Statutory Instrument No. 77 of 2022

CIVIL AVIATION ACT
(Cap. 71:01)

CIVIL AVIATION (COMMUNICATION SYSTEMS) REGULATIONS, 2022

(Published on 21st June, 2022)

ARRANGEMENT OF REGULATIONS

REGULATION

IN EXERCISE of the powers conferred on the Minister of Transport and Public Works by section 89 of the Civil Aviation Act, and on the recommendation of the Civil Aviation Authority, the following Regulations are hereby made —

PART I — Preliminary Provisions

Citation

1. These Regulations may be cited as the Civil Aviation (Communication Systems) Regulations, 2022.

2. In these Regulations, unless the context otherwise requires — Interpretation

"Aerodrome" means a defined area on land or water including any buildings, installations and equipment intended to be used either wholly or in part for the arrival, departure and surface movement of aircraft;

"AeroMACS downlink (DL)" means the transmission direction from the base station (BS) to the mobile station (MS);

"AeroMACS handover" means the process in which a mobile station (MS) migrates from the air-interface provided by one base station (BS) to another air- interface which is provided by another BS;

"AeroMACS uplink (UL)" means the transmission of the direction from the mobile station (MS) to the base station (BS);

"Aeronautical Administrative Communications (AAC)" means communications necessary for the exchange of aeronautical administrative messages;

"Aeronautical Mobile Airport Communications System (AeroMACS)" means a high capacity data link which supports mobile and fixes communications on the aerodrome surface;

"Aeronautical Operational Control (AOC)" means communication required for the exercise of the authority over the initiation, continuation, diversion or termination of the flight for safety, regularity and efficiency purposes;

"Aeronautical Telecommunication Network (ATN)" means a global internetwork architecture that allows ground, air-ground and avionic data sub-networks to exchange digital data for the safety of air navigation and for the regular, efficient and economic operation of the air traffic services;

"air navigation services" includes the following services provided for air navigation:

(*a*) air traffic services;
(*b*) Instrument Flight Procedure Design Services (IFPD);
(*c*) Aeronautical Information services (AIS);
(*d*) aeronautical cartographic services;
(*e*) aeronautical telecommunication services; and
(*f*) search and rescue services;

"air navigation services provider (ANSP)" means an entity which is established for the purpose of providing the above-mentioned services of the air navigation services as provided in these Regulations;

"Air traffic safety electronics personnel (ATSEP)" means a person who is engaged directly with the operations, maintenance and installation activities of the CNS/ATM systems;

"Air traffic service" means a generic term referring to the flight information service including —

(*a*) alerting service;
(*b*) air traffic advisory service;
(*c*) air traffic control service;
(*d*) area control service;
(*e*) approach control service; or
(*f*) aerodrome control service;

"Aircraft address" means a unique combination of 24 bits available for sending communication information to the aircraft for the purpose of air-ground communications, navigation and surveillance;

"Aircraft data circuit-terminating equipment (ADCE)" means an aircraft specific data circuit-terminating equipment that is associated with an airborne data link processor (ADLP), that operates a protocol unique to Mode S data link for data transfer between air and ground;

"aircraft data link processor (ADLP)" means an aircraft-resident processor that is specific for a particular air-ground data link being the Mode S which provides the channel management, segments or reassemble the messages for transfer which is connected to one side of the aircraft elements common to all data link systems and to the other side of the air-ground link itself;

"Aircraft earth station (AES)" means a mobile earth station in the aeronautical mobile-satellite service located on the board of the aircraft;

"aircraft or vehicle" means a machine or the device capable of atmospheric flight, or a vehicle on the airport surface movement area including runways and taxiways;

"air-initiated protocol" means a procedure initiated by a Mode S aircraft installation for delivering a standard length or extended length downlink message to the ground;

"application entity (AE)" means an AE which represents a set of International Organisation for Standardisation or Open System Interconnection communication capabilities of a particular application process;

"Aeronautical Telecommunication Network (ATN) or Internet Protocol Suite" means Aeronautical Telecommunication Network or Internet Protocol Suite;

"Aeronautical Telecommunication Network end-system" means an Aeronautical Telecommunication Network host in the Internet Protocol Suite terminology;

"Aeronautical Telecommunication Network host" means an Aeronautical Telecommunication Network end-system in the Open System Interconnection terminology;

"Aeronautical Telecommunication Network Security services" means a set of information which allows the receiving end system or intermediate system to identify unambiguous security source of the received information and to verify the integrity of that information;

"Aeronautical Telecommunication Services Inter-Facility Data Communication (AIDC)" means an automated data exchange between air traffic services units in the support of the flight notification, coordination, transfer of control and of communication;

"Aeronautical Telecommunication Services Message Handling Service (ATSMHS)" means an Aeronautical Telecommunication Network application consisting of the procedures used to exchange Aeronautical Telecommunication Services messages in store-and-forward mode over the Aeronautical Telecommunication Network such that the transfer of an Aeronautical Telecommunication Services message is in general not correlated with the transfer of another Aeronautical Telecommunication Services message service provider;

"Aeronautical Telecommunication Services Message Handling System (AMHS)" means the set of the computing and communication resources implemented by Aeronautical Telecommunication Services organisations to provide the Aeronautical Telecommunication Services message handling service;

"authorised path" means a communication path suitable for a given message category;

"automatic dependent surveillance-contract (ADS-C)" means a an ADS-C agreement which would be used as an exchange between the ground system and the aircraft, via a data link, specifying under which conditions ADS-C reports would be initiated, and what data would be contained in the reports;

"automatic dependent surveillance-broadcast (ADS- B)" means the way in which the aircraft, aerodrome vehicles and other objects can automatically transmit or receive data such as identification, position and additional data, as appropriate, in a broadcast mode via a data link;

"automatic terminal information service (ATIS)" means the automatic provision of current, routine information to arriving and departing aircraft throughout 24 hours or a specified portion thereof;

"Base station (BS)" means a generalised equipment set providing connectivity, management, and control of the mobile station (MS);

"BDS Comm-B Data Selector" means the eight-bit BDS code that determines the register whose contents are to be transferred in the MB field of a Comm-B reply which is expressed in two groups of four bits each, BDS1 of most significant four bits and BDS2 least significant four bits;

"bit error rate (BER)" means the number of bit errors in a sample divided by the total number of bits in the sample, generally averaged over many such samples;

" break-before-make AeroMACS handover" means where the service with the target base station starts after a disconnection of the service with the previous serving base station;

"broadcast" means a transmission of information relating to air navigation that is not addressed to a specific station or stations;

"burst profile" means a set of parameters that describe the uplink or downlink transmission properties associated with an interval usage code and each profile contains parameters such as modulation type, forward error correction (FEC) type, preamble, length, guard times;

"burst" means a time defined, contiguous set of one or more related signal units which may transfer user information and protocols, signalling any necessary preamble;

"capability report" means information identifying whether the transponder has a data link capability as reported in the capability field of an all-call reply or squitter transmission;

"carrier-to-multipath ratio (C/M)" means the ratio of the carrier power received directly without reflection to the multipath power carrier received via reflection;

"carrier-to-noise density ratio (C/No)" means the ratio of the total carrier power to the average noise power in a 1 Hz bandwidth, usually expressed in dBHz;

"channel rate accuracy" means the relative accuracy of the clock to which the transmitted channel bits are synchronised at a channel rate of 1.2 kbits/s, maximum error of one part in 106 implies the maximum allowed error in the clock is ±1.2 × 10-3Hz;

"channel rate" means the rate at which bits are transmitted over the Radio Frequency channel and these bits include those bits used for framing and error correction, as well as the information bits for burst transmission and the channel rate refers to the instantaneous burst rate over the period of the burst;

"circuit mode" means a configuration of the communications network which gives the appearance to the application of a dedicated transmission path;

"close-out" means a command from Mode S interrogator that terminates Mode S link layer communication transaction;

"cluster of interrogators" means two or more interrogators with the same interrogator identifier (II) code, operating cooperatively to ensure that there is no interference to the required surveillance and data link performance of each of the interrogators in areas of common coverage;

"coded chip" means a "1" or "0" output of the rate ½ or ¼ convolutional code Encoder;

"comm-A" means a 112-bit interrogation containing the 56-bit MA message field which is used by the uplink standard length message (SLM) and the broadcast protocols;

"comm-B" means a 112-bit reply containing the 56-bit MB message field which is used by the downlink SLM, ground-initiated and broadcast protocols;

"comm-C" means a 112-bit interrogation containing the 80-bit MC message field which is used by the uplink extended length message (ELM) protocol;

"comm-D" means a 112-bit reply containing the 80-bit MD message field which is used by the downlink ELM protocol;

"CNS" means Communication, Navigations and Surveillance;

"connection" means a logical association between peer-level entities in a communication system;

"connection establishment delay" means connection establishment delay as defined in ISO 8348 and it includes a component attributable to the subnetwork (SN) service user which is the time between the SN-CONNECT indication and the SN-CONNECT response and this user component is due to work outside the boundaries of the satellite subnetwork and is therefore excluded from the AMS(R) S specifications;

"controller pilot data link communications (CPDLC)" means communication between a controller and the pilot, using data link for ATC communications;

"Convolutional turbo codes (CTC)" means type of forward error correction (FEC) code;

"COSPAS-SARSAT" means Space System for Search of vessels in distress, Search and Rescue Satellite-Aided Tracking;

"current slot" means the slot in which a received transmission begins;

"data circuit-terminating equipment (DCE)" means a DCE network provider equipment used to facilitate communications between DTEs;

"data link capability report" means information in a Comm-B reply which identifies the complete Mode S communications capabilities of the aircraft installation;

"data link entity (DLE)" means a protocol State machine capable of setting up and managing a single data link connection;

"data link flight information services (D-FIS)" means the provision of FIS via data link;

"data link initiation capability (DLIC)" means a data link application that provides the ability to exchange addresses, names and version numbers necessary to initiate data link applications;

"data link service (DLS) sub-layer" means the sub-layer that resides above the MAC sub-layer and the VDL Mode 4 whereby the DLS sub-layer resides above the VSS sub-layer of which the DLS manages to transmit the queue, creates and destroys DLEs for connection oriented communications and provides facilities for the Link Management Entity to manage the DLS and facilities for connectionless communications;

"data link-automatic terminal information service (D-ATIS)" means the provision of ATIS via data link;

"data signalling rate" means data signalling rate referring to the passage of information per unit of time, and is expressed in bits or seconds which is given by the formula:

$$\sum_{i=1}^{i=m} \frac{1}{T_i} \log_2 n_i$$

where m is the number of parallel channels, Ti is the minimum interval for the ith channel expressed in seconds, ni is the number of significant conditions of the modulation in the ith channel;

"data terminal equipment (DTE)" meansan endpoint of a sub-network Connection;

"data transfer delay, 95th percentile" means the statistical distribution of delays for which data transit delay is the average;

"data transit delay" means the average value of the statistical distribution of data delays in accordance with ISO 8348 which delay represents the subnetwork delay and does not include the connection establishment delay;

"degree of standardised test distortion" means the degree of distortion of the restitution measured during a specific period of time when the modulation is perfect and corresponds to a specific text;

"designated operational coverage (DOC) area" means the area in which a particular service is provided and in which the service is afforded frequency protection;

"direct link service" means a data communications service which makes no attempt to automatically correct errors, detected or undetected, at the link layer of the air-ground communications path whereby error control may be effected by end-user systems;

"directory service (DIR)" means a service based on the ITU-T X.500 series of recommendations, providing access to and management of structured information relevant to the operation of the ATN and its users;

"domain" means a set of end systems and intermediate systems that operate according to the same routing procedures and that is wholly contained within a single administrative domain;

"doppler shift" means the frequency shift observed at a receiver due to any relative motion between transmitter and receiver;

"downlink ELM (DELM)" means extended length downlink communications by means of 112-bit Mode S Comm-D replies, each containing the 80-bit Comm-D message field (MD);

"downlink" means a term referring to the transmission of data from an aircraft to the ground of which Mode S air-to-ground signals are transmitted on the 1 090 MHz reply frequency channel;

"effective margin" means that margin of an individual apparatus which could be measured under actual operating conditions;

"end-to-end" means pertaining or relating to an entire communication path, typically from the interface between the —

(*a*) information source and the communication system at the transmitting end to; and (*b*) communication system and the information user or processor or application at the receiving end;

"end-user" means an ultimate source and or consumer of information;

"energy per symbol to noise density ratio (Es/No)" means the ratio of the average energy transmitted per channel symbol to the average noise power in a 1Hz bandwidth, usually expressed in dB and for A-BPSK and A-QPSK, one channel symbol refers to one channel bit;

"equivalent isotropically radiated power (EIRP)" means the product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna, absolute or isotropic gain;

"extended Golay Code" means an error correction code capable of correcting multiple bit errors;

"extended Length message (ELM)" means a series of Comm-C interrogations uplink ELM transmitted without the requirement for intervening replies, or a series of Comm-D replies downlink ELM transmitted without intervening interrogations;

"flight information service (FIS)" means a service provided for the purpose of giving advice and information that is useful for the safe and efficient conduct of the flights;

"forward error correction (FEC)" means the process of adding redundant information to the transmitted signal in a manner which allows correction at the receiver of the errors incurred in the transmission;

"frame" means the link layer frame composed of a sequence of address, control, FCS and information fields and for VDL Mode 2, of which these fields are bracketed by opening and closing flag sequences, and a frame may or may not include a variable-length information field;

"frequency assignment" means a logical assignment of the centre frequency and channel bandwidth programmed to the base station (BS);

"gain-to-noise temperature ratio" means the ratio, usually expressed in dB/K, of the antenna gain to the noise at the receiver output of the antenna subsystem which noise is expressed as the temperature that a 1ohm resistor must be raised to produce the same noise power density;

"gaussian filtered frequency shift keying (GFSK)" means a continuous-phase, frequency shift keying technique using two tones and a Gaussian pulse shape filter;

"general formatter/manager (GFM)" means the aircraft function responsible for —

(*a*) formatting messages to be inserted in the transponder registers; and

(b) detecting and handling error conditions such as the loss of input data;

"global signalling channel (GSC)" means a channel available on a worldwide basis which provides for communication control;

"ground data circuit-terminating equipment (GDCE)" means a ground specific data circuit-terminating equipment associated with a ground data link processor (GDLP) which operates a protocol unique to Mode S data link for data transfer between air and ground;

"ground data link processor (GDLP)" means a ground-resident processor that is specific to a particular air-ground data link for Mode S, which provides channel management and segments or reassembles messages for transfer and is connected on one side by means of its Data Circuit-terminating Equipment to the ground elements common to all data link systems, and on the other side to the air-ground link itself;

"ground earth station (GES)" means an earth station in the fixed satellite service, or, in some cases, in the aeronautical mobile-satellite service, located at a specified fixed point on land to provide a feeder link for the aeronautical mobile satellite service;

"ground-initiated Comm-B (GICB)" means the ground-initiated Comm-B protocol that allows the interrogator to extract Comm-B replies containing data from a defined source in the MB field;

"ground-initiated protocol" means a procedure initiated by a Mode S interrogator for delivering standard length or extended length messages to a Mode S aircraft installation;

"hands-off" means those connections which manages the media access control sub-layer and physical layer of which an aircraft LME tracks how well it can communicate with the ground stations of a single ground system, an aircraft VME instantiates an LME for each ground station that it monitors while the ground VME instantiates an LME for each aircraft that it monitors and an LME is deleted when communication with the peer system is no longer viable;

"HFDL" means High Frequency Data Link;

"high frequency network protocol data unit (HFNPDU)" means user data packet;

"high performance receiver" means a Universal Access Transmitter receiver with enhanced selectivity to improve the rejection of adjacent frequency DME interference;

"link layer" means the layer that lies immediately above the physical layer in the Open Systems Interconnection protocol model that provides for the reliable transfer of information across the physical media and is subdivided into the data link sub-layer and the media access control sub-layer;

"link management entity (LME)" means a protocol State machine capable of acquiring, establishing and maintaining a connection to a single peer system which establishes data link and sub-network connections;

"link protocol data unit (LPDU)" means data unit which encapsulates a segment of an HFNPDU;

"link" means a link that connects an aircraft DLE and a ground DLE and is uniquely specified by the combination of an aircraft DLS address and the ground DLS address and a different subnetwork entity resides above every link Endpoint;

"low modulation rates" means modulation rates up to and including 300 bauds;

"MANSOPS" means manual of air navigation services operations;

"margin" means the maximum degree of distortion of the circuit at the end of which the apparatus is situated and is compatible with the correct translation of all the signals which it may possibly receive;

"M-ary phase shift keying (M-PSK) modulation" means a digital phase modulation that causes the phase of the carrier waveform to take on one of a set of M values;

"M burst" means a management channel data block of bits used in VDL Mode 3 which contains signalling information needed for media access and link status monitoring;

"media access control (MAC)" means the sub-layer that acquires the data path and controls the movement of bits over the data path;

"media access protocol data unit (MPDU)" means data unit which encapsulates one or more LPDUs;

"medium modulation rates" means modulation rates above 300 and up to and including 3 000 bauds;

"Mobile station (MS)" means a station in the mobile service intended to be used while in motion or during halts at unspecified points of which MS is always a subscriber station (SS);

"Mode 2" means a data-only of VDL mode that uses D8PSK modulation and a carrier sense multiple access (CSMA) control scheme;

"Mode 3" means a voice and data VDL mode that uses D8PSK modulation and a TDMA media to access the control scheme;

"Mode 4" means a data-only for VDL mode which is using a GFSK modulation scheme and self-organising time division multiple access (STDMA);

"Mode S air-initiated Comm-B (AICB) protocol" means a procedure initiated by a Mode S transponder for transmitting a single Comm-B segment from aircraft installation;

"Mode S broadcast" means the protocol within the Mode S system that permits uplink messages to be sent to all aircraft in coverage area, and downlink messages to be made available to all interrogators that have the aircraft wishing to send the message under surveillance;

"Mode S broadcast protocols" means procedures allowing standard length uplink or downlink messages to be received by more than one transponder or ground interrogator respectively;

"Mode S frame" means the basic unit of the transfer at the link level of which in the context of Mode S subnetwork, a frame can include from one to four Comm-A or Comm-B segments, from two to sixteen Comm-C segments, or from one to sixteen Comm-D segments;

"Mode S ground-initiated Comm-B (GICB) protocol" means a procedure initiated by a Mode S interrogator for eliciting a single Comm-B segment from a Mode S aircraft installation, incorporating the contents of one of 255 Comm-B registers within the Mode S transponder;

"Mode S multisite-directed protocol" means a procedure to ensure that extraction and close-out of a downlink standard length or extended length message is affected only by the particular Mode S interrogator selected by the aircraft;

"Mode S packet" means a packet conforming to the Mode S sub-network standard, designed to minimise the bandwidth required from the air-ground link where the ISO 8208 packets may be transformed into Mode S packets and vice-versa;

"Mode S specific protocol (MSP)" means a protocol that provides restricted datagram service within the Mode S sub-network;

"Mode S specific services entity (SSE)" means an entity resident within an XDLP that provide access to the Mode S specific services;

"Mode S specific services" means a set of communication services provided by the Mode S system which are not available from other air-ground sub-networks, and therefore not interoperable;

"Mode S sub-network" means performing an interchange of digital data through the use of secondary surveillance radar (SSR) Mode S interrogators and transponders in accordance with defined protocols;

"modulation rate" means the reciprocal of the unit interval measured in seconds and this rate is expressed in bauds;

"M-PSK symbol" means one of the M possible phase shifts of the M-PSK modulated carrier representing a group of log2 M coded chips;

"network (N)" means the word "network" and its abbreviation "N" in ISO 8348 are replaced by the word "subnetwork" and its abbreviation "SN", respectively, wherever they appear in relation to the subnetwork layer packet data performance;

"optimum sampling point" means the optimum sampling point of a received UAT bit stream is at the nominal centre of each bit period, when the frequency offset is either plus or minus 312.5 kHz;

"packet" means the basic unit of data transfer among communication devices within the network layer of an ISO 8208 packet or a Mode S packet;

"partial usage sub-channelisation (PUSC)" means a technique in which the orthogonal frequency division multiplexing (OFDM) symbol subcarriers are divided and permuted among a subset of sub-channels for transmission, providing partial frequency diversity;

"peak envelope power (PEP)" means the peak power of the modulated signal supplied by the transmitter to the antenna transmission line;

"physical layer protocol data unit (PPDU)" means data unit passed to the physical layer for transmission, or decoded by the physical layer after reception;

"physical layer" means the lowest level layer in the Open Systems Interconnection protocol model which is concerned with the transmission of binary information over the physical medium and for VHF radio;

"point-to-point" means pertaining or relating to the interconnection of two devices, particularly end-user instruments and it is a communication path of service intended to connect two discrete end-users as distinguished from broadcast or multipoint service;

"power measurement point (PMP)" means a cable connecting the antenna to the UAT equipment whereby PMP is the end of that cable that attaches to the antenna and all power measurements are considered as being made at the PMP unless otherwise specified, whereas the cable connecting the UAT equipment to the antenna is assumed to have 3 dB of loss;

"pseudo random message data block" means several UAT requirements State that performance will be tested using pseudo random message data blocks whereby pseudo random message data blocks should have statistical properties that are nearly indistinguishable from those of a true random selection of bits, for instance, each bit should have nearly equal probability of being a ONE or a ZERO, independent of its neighbouring bits and there should be a large number of such pseudo random message data blocks for each message type for basic ADS-B, Long ADS-B or Ground uplink to provide sufficient independent data for statistical performance measurements;

"quality of service (QOS)" means the information relating to data transfer characteristics used by various communications protocols to achieve various levels of performance for network users;

"reed-Solomon code" means an error correction code capable of correcting symbol errors and since symbol errors are collections of bits, these codes provide good burst error correction capabilities;

"reliable link service (RLS)" means a data communications service provided by the subnetwork which automatically provides for error control over its link through error detection and requested retransmission of signal units found to be in error;

"required communication performance (RCP)" means a statement of the performance requirements for operational communication in support of specific ATM functions;

"residual error rate" means the ratio of incorrect, lost and duplicate subnetwork service data units SNSDUs to the total number of SNSDUs that were sent;

"segment" means a portion of a message that can be accommodated within a single MA/MB field in the case of a standard length message, or MC/MD field in the case of an extended length message, this term is also applied to the Mode S transmissions containing these fields;

"self-organising time division multiple access (STDMA)" means a multiple access Scheme based on time-shared use of a radio frequency (RF) channel employing —

(*a*) discrete contiguous time slots as the fundamental shared resource; and

(*b*) a set of operating protocols that allows users to mediate access to these time slots without reliance on a master control station;

"Service data unit (SDU)" means a unit of data transferred between adjacent layer entities, which is encapsulated within a protocol data unit (PDU) for transfer to a peer layer;

"Service flow" means a unidirectional flow of media access control layer (MAC) service data units (SDUs) on a connection that is providing a particular quality of service (QoS);

"service volume" means a part of the facility coverage where the facility provides a particular service in accordance with relevant regulations and within which the facility is afforded frequency protection;

"slot" means one of a series of consecutive time intervals of equal duration of which each burst transmission starts at the beginning of a slot;

"slotted aloha" means a random access strategy whereby multiple users access the same communications channel independently, but each communication must be confined to a fixed time slot and the same timing slot structure is known to all users, but there is no other coordination between the users;

"spot beam" means satellite antenna directivity whose main lobe encompasses significantly less than the earth's surface that is within line-of-sight view of the satellite which is designed so as to improve system resource efficiency with respect to geographical distribution of user earth stations;

"squitter protocol data unit (SPDU)" means data packet which is broadcasting every 32 seconds by an HFDL ground station on each of its operating frequencies, and which contains link management information;

"standard length message (SLM)" means an exchange of digital data using selectively addressed Comm-A interrogations and or Comm-B replies;

"standard UAT receiver" means a general purpose UAT receiver satisfying the minimum rejection requirements of interference from adjacent frequency distance measuring equipment (DME);

"subnetwork" means an actual implementation of a data network that employs a homogeneous protocol and addressing plan, and is under the control of a single authority;

"subnetwork service data unit (SNSDU)" means an amount of subnetwork user data and the identity of which is preserved from one end of a sub network connection to the other;

"subnetwork connection" means a long-term association between an aircraft DTE and a ground DTE using successive virtual calls to maintain context across link handoff;

"subnetwork dependent convergence function (SNDCF)" means the matches of the characteristics and services of a particular subnetwork to those characteristics and services required by theinternetwork facility;

"subnetwork entity" means the phrase "ground DCE" which would be used for the subnetwork entity in a ground station communicating with an aircraft and the phrase "ground DTE" would be used for the subnetwork entity in a ground router communicating with an aircraft station and, the phrase "aircraft DTE" would be used for the subnetwork entity in an aircraft communicating with the station, and a subnetwork entity is a packet layer entity as defined in ISO 8208;

"subnetwork entry time" means the time from when the mobile station starts the scanning for BS transmission, until the network link establishes the connection in order for the first network user "protocol data unit" to be sent;

"subnetwork layer" means the layer that establishes, manages and terminates connections across a subnetwork;

"subnetwork management entity (SNME)" means an entity resident within a GDLP that performs subnetwork management and communicates with peer entities in intermediate or end-systems;

"subnetwork service data unit (SNSDU)" means an amount of subnetwork user data and the identity of which is preserved from one end of a subnetwork connection to the other;

"subscriber station (SS)" means a generalised equipment set providing connectivity between subscriber equipment and a base station (BS);

"successful message reception (SMR)" means the function within the UAT receiver for declaring a received message as valid for passing to an application that uses received UAT messages;

"synchronous operation" means operation in which the time interval between code units is constant;

"system" means a VDL-capable entity which is a system comprising of one or more stations and the associated VDL management entity and a system may either be an aircraft system or a ground system;

"time division duplex (TDD)" means a duplex scheme where the uplink and the downlink transmissions occur at different times but may share the same frequency;

"time division multiple access (TDMA)" means a multiple access scheme based on time-shared use of an RF channel employing —

(*a*) discrete contiguous time slots as the fundamental shared resource; and

(*b*) a set of operating protocols that allows users to interact with a master control station to mediate access to the channel;

"time division multiplex (TDM)" means a channel sharing strategy in which packets of information from the same source but with different destinations are sequenced in time on the same channel;

"timeout" means the cancellation of a transaction after one of the participating entities has failed to provide a required response within a pre-defined period of time;

"total voice transfer delay" means the elapsed time commencing at the instant that speech is presented to the AES or GES and concluding at the instant that the speech enters the interconnecting network of the counterpart GES or AES, this delay includes vocoder processing time, physical layer delay, RF propagation delay and any other delays within an AMS(R)S subnetwork;

"transit delay" means in packet data systems, the elapsed time between a request to transmit an assembled data packet and an indication at the receiving end that the corresponding packet has been received and is ready to be used or forwarded;

"UAT ADS-B message" means a message broadcasted once per second by each aircraft to convey State vector and other information and the UAT ADS-B messages can be in one of two forms depending on the amount of information to be transmitted in a given second which is the basic UAT ADS-B message or the long UAT ADS-B message where UAT ground stations can support traffic information service-broadcast (TIS-B) through transmission of individual ADS-B messages in the ADS-B segment of the UAT frame;

"UAT ground uplink message" means a message broadcasted by ground stations, within the ground segment of the UAT frame, to convey flight information such as text and graphical weather data, advisories, and other aeronautical information, to aircraft that are in the service volume of the ground station;

"universal access transceiver (UAT)" means a broadcast data link operating on 978 MHz, with a modulation rate of 1.041667 Mbps;

"uplink ELM (UELM)" means extended length uplink communication by means of 112-bit Mode S Comm-C interrogations, each containing the 80-bit Comm-C message field (MC);

"uplink" means a term referring to the transmission of data from the ground to an aircraft whereby the Mode S ground-to-air signals are transmitted on the 1030 MHz interrogation frequency channel;

"user group" means a group of ground and or aircraft stations which share voice and or data connectivity and for voice communications, all members of a user group can access all communications and data communications include point-to-point connectivity for air-to-ground messages, and point-to-point and broadcast connectivity for ground-to-air messages;

"UTC" means Coordinated Universal Time;

"VHF" means Very High Frequency;

"VHF digital link (VDL)" means a constituent mobile subnetwork of the aeronautical telecommunication network (ATN), operating in the aeronautical mobile VHF frequency band and the VDL may provide non-ATN functions such as, for instance, digitized voice;

"VDL management entity (VME)" means a VDL-specific entity that provides the quality of service requested by the ATN-defined SN_SME whereby AVME uses the LMEs that it creates and destroys, to enquire the quality of service available from peer systems;

"VDL Mode 4 burst" means a VHF digital link (VDL) Mode 4 burst is composed of a sequence of source address, burst ID, information, slot reservation and frame check sequence (FCS) fields,bracketed by opening and closing flag sequences;

"VDL Mode 4 DLS system" means a VDL system that implements the VDL Mode 4 DLS and subnetwork protocols to carry ATN packets or other packets;

"VDL Mode 4 specific services (VSS) sublayer" means the sublayer that resides above the MAC sublayer and provides VDL Mode 4 specific access protocols including reserved, random and fixed protocols;

"VDL station" means an aircraft-based or ground-based physical entity, capable of VDL Mode 2, 3 or 4;

"vocoder" means a low bit rate voice encoder or decoder;

"voice unit" means device that provides a simplex audio and signalling interface between the user and VDL;

"voice-automatic terminal information service (Voice- ATIS)" means the provision of ATIS by means of continuous and repetitive voice broadcasts;

"VSS user" means a user of the VDL Mode 4 specific services and the VSS user could be higher layers in the VDL Mode 4 SARPs or an external application using VDL Mode 4;

"XDCE" means a general term referring to both the ADCE and the GDCE; and

"XDLP" means a general term referring to both the ADLP and the GDLP.

Application

3. (1) These Regulations shall apply to any person who provides communication, navigation and surveillance services within a designated air spaceand at an aerodrome.

(2) These Regulations shall not apply to a person who provides communication, navigation and surveillance services to a state aircraft.

PART II — General Requirements

Requirements for communication facility

4. The minimum requirements for planning, installing, commissioning, training, operating and maintaining communication facility shall conform to these Regulations.

Certification of air navigation service provider Cap. 71:01 (Sub. Leg.)

5. A person who wishes to provide Air Navigation Services Provider (ANSP) or to operate a facility to support an air traffic service shall hold an ANSP certificate issued in accordance with the Civil Aviation (Certification of Air Navigation Services Providers) Regulations.

Approval requirement

6. (1) A person shall not provide ANSP or operate communication, navigation and surveillance facility or system in a designated airspace and aerodrome unless a facility or system has been approved by the Authority.

(2) The ANSP shall notify the Authority of its intention to procure, install, use, decommission, upgrade or relocate any communication, navigation and surveillance facility in a designated airspace and aerodrome for a period not exceeding 30 days prior to the date of the commencement of the process.

(3) The Authority shall approve the installation, use, decommissioning, upgrading or relocation of all the communication, navigation and surveillance facility in a designated airspace and aerodrome.

Inspection and audit

7. (1) The Authority shall carry out the inspection and audit on CNS facilities, documents and the records of the CNS facilities to determine whether they comply with these Regulations.

(2) An inspector of the Authority shall have unrestricted access to the facilities, installations, records and the documents of the ANSP, to determine whether they comply with these Regulations and the required procedures.

Siting and installation

8. (1) The ANSP shall —

(*a*) provide the procedures to ensure that the communication, navigation and surveillance systems —

(i) are operated, maintained, made available and are reliable in accordance with the requirements provided by the Authority,

(ii) are designed to meet the applicable operational specification for that facility,

(iii) are installed and commissioned as provided by the Authority, and

(iv) conform to the applicable system characteristics and specification standards as provided by the Authority,"; and

(*b*) determine the site for the installation of a new facility, based on operational requirements, construction aspects and the maintainability of a facility.

(2) The procedures provided in terms of subregulation (1), shall be installed by a licensed ATSEP with the relevant ratings requirements for the establishment of a facility.

Commissioning requirement

9. (1) The ANSP shall —

(*a*) provide the procedures to ensure that each new facility is commissioned to meet the specifications for that facility; and

(*b*) ensure that the newly established facility is in compliance with the applicable standards of establishing a facility.

(2) The ANSP shall ensure that —

(*a*) the system performance of the new facility has been validated by the necessary tests; and

(*b*) all the parties involved with the operation and maintenance of the facility, including its maintenance contractor has accepted the test and is satisfied with the result of a test.

(3) The ANSP shall ensure that the procedures shall include —

(*a*) documentation of tests conducted on the facility prior to the commissioning; and

(*b*) the test result to see whether there is compliance with the facility requirements and the applicable standards of any flight check required.

Availability and reliability of communication facility

10. (1) The ANSP shall provide for a communication services and a facility to ensure that the telecommunication information and data necessary for the safe, regular and efficient operation of air navigation is available.

(2) The functional specification of each of the air navigation service provider's telecommunication services shall have the following values or characteristics for each service —

(*a*) availability;

(*b*) accuracy;

(*c*) integrity;

(*d*) mean time between failure (MTBF) reliability; and

(*e*) mean time to repair (MTTF).

(3) The values or characteristics referred to in subregulation (2) shall be derived or be measured from either or both of —

(*a*) the configuration of each service; and

(*b*) the known performance of each service.

(4) The ANSP shall describe in the operations manual the method used to calculate each of the values or characteristics of each service.

(5) The integrity values or characteristics of a Radio Navigation Service shall be given for each kind of navigation aid facility that forms part of the service.

(6) The performance of technical facilities shall be monitored, reviewed and reported in accordance of the procedures provided under these Regulations.

(7) The ANSP shall ensure that —

(*a*) each and every facility is installed with the main and the standby power supply; and

(*b*) the adequate air conditioning is continuously operational to the service being provided.

Interface arrangement for support services

11. The ANSP shall, where applicable, make a formal interface arrangements with the external organisations in the form of the service agreements detailing the following —

(*a*) the interface and the functional specifications of the support service;

(*b*) the service level of the support service such as availability, accuracy, integrity and the recovery time of the failure of the service; and

(*c*) the monitoring and reporting of the operational status of the service to the service provider.

Record keeping and documentation

12. (1) The ANSP shall —

(*a*) hold copies of the relevant equipment manuals, technical standards, practices, instructions, maintenance procedures, site logbooks, systems backup data, equipment and test gear inventory and any other documentation that are necessary for the provision and operation of the facility;

(*b*) establish a procedure for the control of the documentation required under these regulations;

(*c*) keep the records under the control of the relevant key personnel; and

(*d*) control access to the records system to ensure appropriate security.

(2) The ANSP shall ensure that data and voice for Air Navigation Service Operational Systems are recorded continuously and the procedures shall be provided for the retention and utilisation of the recordings for purposes of analysis.

(3) The ANSP shall —

(*a*) keep all documents and records which are necessary for the operation and maintenance of the service;

(*b*) make available copies of the documents and records to the authorised personnel when needed.

(4) The documents and records referred to under subregulation (3) shall include —

(*a*) a copy of these Regulations;

(*b*) the ANSP's operations manual;

(*c*) ICAO Annex 10 Aeronautical Telecommunications, Volumes I to V, ICAO Doc 8071-Manual on Testing of Radio Navigation Aids, and other relevant ICAO documents;

(*d*) the records of malfunction and safety incident reports;

(*e*) the records of internal audit reports;

(*f*) the agreements with other organisations;

(*g*) the records of investigation into serious incidents;

(*h*) the records of the staff deployment, duty and leave rosters;

(*i*) the records of equipment spares;

(*j*) the records of job description, training programme and plan of each staff member; and

(*k*) all related air navigation service technical standards and guidance materials developed by the Authority.

(5) A document and records kept for the purposes of these Regulations shall be kept for at least 10 years.

(6) The ANSP shall establish a process for the authorisation and for the amendment of the documents kept for purposes of these Regulations to ensure that they are constantly updated and amended and to ensure that —

(*a*) the currency of the documentation can be readily determined;

(*b*) the amendments to the documentation are controlled in accordance with established quality management principles;

(*c*) only the current versions of the documents shall be made available; and

(*d*) the person authorising the creation and the revision shall be identified.

(7) The ANSP shall ensure that where documents and records are kept as soft copy and are made available, they are subjected to the same control as hard copy documents.

(8) The ANSP shall provide the procedures to identify, collect, index, store, maintain, and dispose records covering —

(*a*) the performance and maintenance history of each facility;

(*b*) the establishment of the periodic test programmes for each facility;

(*c*) each item of test equipment required for the measurement of critical performance parameters;

(*d*) each reported or detected facility malfunction;

(*e*) each internal quality assurance review; and

(*f*) each authorised personnel who is authorised to place facilities into operational service.

Operations manual

13. (1) The ANSP shall develop an operations manual that shall demonstrate the ANSP's compliance with these Regulations.

(2) The contents of the Operations manual shall contain —

(*a*) the information required for the ANSP in accordance with these Regulations;

(*b*) an organisational chart of the ANSP and its maintenance contractors, if any, that shows the position of each personnel and the name, qualifications, experiences, duties and responsibilities of the personnel who is responsible for ensuring the compliance of the organisation with the requirements provided in these Regulations;

(*c*) an overall operation and maintenance plan for the aeronautical telecommunication service for each facility as provided in these Regulations;

(*d*) for each facility, the information on the compliance of the facility with these Regulations and the applicable aeronautical telecommunication standards; and

(*e*) the system performance target of each facility, such as its availability and reliability.

(3) The operations manual shall consist of the main manual covering the main areas that need to be addressed, as well as separate supporting documents and manuals, such as the operation and maintenance plan of each facility that is referred to in the main manual.

(4) The ANSP shall develop an operation and maintenance plan for each facility which shall include —

(*a*) a procedure for the periodic inspection and testing of each facility to verify that the plan meets the operational and performance specifications of that facility;

(*b*) details of flight test, if necessary, such as the standards and procedures to be used and flight test interval, which shall be in compliance with guidelines provided by the Authority;

(*c*) the interval between periodic inspection and flight test and the basis for that interval and whenever the interval is changed, the recording and documentation reasons for such change;

(*d*) the operation and maintenance instructions for each facility;

(*e*) an analysis of the number of personnel required to operate and maintain each facility taking into account the workload required;

(*f*) the corrective plan and procedures for each facility, including whether the repair of modules and component are undertaken in-house or by equipment manufacturers and the spare support plan for each facility; and

(*g*) the maintenance plan or the operating and maintenance instructions for each facility shall specify the test equipment requirements for all levels of operation and maintenance undertaken.

(5) The ANSP shall control the distribution of the operations manual and ensure that it is amended whenever necessary to maintain the accuracy of the information in the operations manual and to keep its contents up to date.

Periodic inspection testing and security of communication facility

14. (1) The ANSP shall establish a procedure for the periodic inspection and testing of the communication, navigation and surveillance systems to verify that each facility meets the applicable operational requirements and performance specifications for that facility.

(2) The ANSP shall ensure —

(*a*) that the appropriate inspection, measuring and testing equipment are available for staff to maintain the operation of each facility; and

(*b*) the control, calibration and maintenance of such equipment so that they have the precision and accuracy necessary for the measurements and tests to be performed.

(3) The periodic inspection under subregulation (1) shall include the —

(*a*) security of the facility and site;

(*b*) adherence to the approved maintenance programme;

(*c*) upkeep of the equipment, building, site and site services; and

(*d*) adequacy of facility records and documentation.

(4) The ANSP shall establish a security programme for the communication, navigation and surveillance facility.

(5) The security programme established under subregulation (4) shall specify the physical security requirements, practices, and procedures to be followed for the purposes of minimising the risk of destruction or damage to, or interference with the operation of communication, navigation and surveillance facility.

(6) The ANSP shall make a test transmission if —

(*a*) the transmission is necessary to test a service, facility or equipment;

(*b*) within a reasonable time before commencing the transmission, the users have been informed about the transmission;

(*c*) at the commencement of the transmission, the service provider identifies the transmission as a test transmission; and

(*d*) the transmission contains information identifying it as a test transmission.

(7) The ANSP shall ensure that —

(*a*) CNS systems and services are protected against cyber threats and attacks to a level consistent with the application service requirements;

(*b*) all end-systems supporting air navigation security services shall be capable of authenticating the identity of peer end- systems, authenticating the source of messages and ensuring the data integrity of the messages;

(*c*) strategies and best practices on the protection of the critical information and communications technology systems used for civil aviation purposes are developed and implemented; and

(*d*) policies are established to ensure that, for critical aviation systems —

(i) architectures are secured by design,

(ii) are resilient,

(iii) methods for data transfer are secured, ensuring integrity and confidentiality of data,

(iv) monitoring and incident detection and reporting, methods are implemented, and

(v) of the forensic analysis of cyber incidents are carried out.

Flight inspection and facility check after accident or incident

15. (1) The ANSP shall ensure that radio navigation aids is available for use by aircraft engaged in air navigation and that the radio navigation aids is subjected to periodic ground and facility flight inspections.

(2) The ANSP shall develop the procedure to check and record the operating condition of any communication, navigation and surveillance facility that may have been used by an aircraft that is involved in an accident or incident.

Radio frequency management and interference reporting

16. The ANSP shall —

(*a*) establish the procedure for the management and protection of aeronautical radio spectrum;

(*b*) designate a responsible person to control any frequency allocation within the aeronautical radio spectrum to ensure that there would be no conflict and interference to any radio stations or facility;

(*c*) ensure that there is no willful transmission of unnecessary or anonymous radio signals, messages or data by any of its radio stations;

(*d*) establish procedures with the communication authority to address occurrence of radio frequency interference;

(*e*) ensure that any frequency interference occurrences are reported, investigated and follow-up actions would be taken to prevent recurrence;

(*f*) keep updated records of all allocated frequencies; and

(*g*) ensure that no facility providing radio signals for the purpose of aviation safety shall be allowed to continue in operation, if there is a suspicion or any cause to suspect that the information being provided by that facility is erroneous.

CNS personnel raining and other requirements

17. (1) The ANSP shall —

(*a*) ensure that the facility employs sufficient number of personnel who possess the skills, qualifications and competencies required in the provision of the aeronautical telecommunication service;

(*b*) provide in the MANSOPS an analysis of the personnel required to perform the communication navigation and surveillance services for each facility taking into account the duties and workload required;

(*c*) develop job descriptions for each of facility staff that would show the job purpose, key responsibilities, and outcome to be achieved by each staff;

(*d*) develop an overall training policy and programme for the organisation;

(*e*) designate an officer in charge of training or on-job training at the operational stations;

(*f*) maintain individual training records for each of the facility staff;

(*g*) conduct a yearly review of the training plan for each staff at the beginning of each year to identify any gaps in competency and changes in training requirement, and prioritise the type of training required for the following year; and

(*h*) ensure that the training requirements of these Regulations are similarly applied to the facility maintenance contractors.

(2) The on-job training officer under subregulation (1) (*e*) above shall have satisfactorily completed the on-job training instructional techniques course.

(3) A person shall not perform a function related to the installation, training, operation or maintenance of any communication, navigation and a surveillance system unless —

(*a*) that person has successfully completed training in the performance of that function in line with the ATSEP competency based training requirements; and

(*b*) the ANSP is satisfied that the technical person is competent in performing that function.

Facility malfunction incident reporting and operational status of communication systems

18. (1) The ANSP shall establish procedures for the reporting, collection and notification of the facility malfunction and safety incidents.

(2) The procedures established in subregulation (1) shall be documented in the MANSOPS.

(3) The ANSP shall compile reports of the incidents and review such reports periodically with the facility maintenance contractors to —

(*a*) determine the cause of the incidents and determine any adverse trends;

(*b*) implement corrective and preventive actions where necessary to prevent recurrence of the incidents; and

(*c*) implement any measures to improve the safety performance of the aeronautical telecommunication service.

(4) The ANSP shall —

(*a*) report any serious service failure or safety incident to the Authority and investigate such incidents in order to establish how and why the incident happened, including possible organisational contributing factors and to recommend actions to prevent a recurrence; and

(*b*) ensure that the information on the operational status of each communication, navigation and surveillance facility that is essential for the enroute, approach, landing, and take-off phases of flight is provided to meet the operational needs of the service being provided.

Safety case, notification of communication facility status and interruption to service

19. (1) The ANSP shall ensure that for safety, critical systems, including automated air traffic control systems, communication systems and instrument landing systems, the commissioning of such systems shall include the conduct of a safety case or equivalent.

(2) The ANSP shall ensure that human factors principles are observed in the design, operations and maintenance of aeronautical telecommunication facilities.

(3) The ANSP shall, as soon as possible —

(*a*) forward to the aeronautical information services —

(i) information on the operational details of any new facility for publication in the aeronautical information publication; and

(ii) information concerning any change in the operational status of any existing facility, for the issue of a notice to airmen; and

(*b*) to ensure that the information forwarded under paragraph (*a*) has been accurately published.

(4) The ANSP shall —

(*a*) establish a procedure to be used in the event of interruption of aeronautical information service to an aircraft or when upgrading communication, navigation and surveillance systems; and

(*b*) specify an acceptable recovery time for each service.

PART III — Aeronautical Telecommunication Network (ATN)

General requirements for the transmission of ATN to operating agencies

20. (1) The ATN shall specifically and exclusively be used to provide digital data communications services to air traffic service provider facility and aircraft operating agencies in support of —

(*a*) air traffic services communications with aircraft;

(*b*) air traffic services communications between air traffic service units;

(*c*) aeronautical operational control communications; and

(*d*) aeronautical administrative communications.

(2) The ATN communication services in subregulation (1) shall support ATN applications.

(3) The ATN shall make arrangement for the implementation of the aeronautical telecommunication network on the basis of the regional air navigation agreements.

(4) The operating agencies referred to in subregulation (1) shall specify the area in which the communication standards for the aeronautical telecommunication network, open system interconnection or the aeronautical telecommunication network and the internet protocol suite are applicable.

General requirements for ATN

21. (1) The ATN shall either use International Organisation for Standardisation (ISO), communication standards for Open Systems Interconnection (OSI) or use the Internet Society communications (ISOC) standards for the internet protocol suite (IPS).

(2) The Aeronautical Fixed Telecommunication Network and Aeronautical Message Handling System (AFTN/AMHS) gateway shall ensure the interoperability of AFTN stations and networks with the ATN.

(3) An authorised path for the AFTN shall be defined on the basis of a predefined routing policy.

(4) The ATN shall transmit, relay and deliver messages in accordance with the priority classifications and without discrimination or undue delay.

(5) The ATN shall provide the —

(*a*) means to define data communications that can be carried only over authorised paths for the traffic type and category specified by the user; and

(*b*) communication in accordance with the provided required communication performance.

(6) The ATN shall operate in accordance with the communication priorities specified in Table 1and Table 2 of Schedule I to these Regulations.

(7) The ATN shall enable —

(*a*) the exchange of the application information when one or more authorised paths exist;

(*b*) an aircraft intermediate system to connect to a ground intermediate system via different subnetworks;

(*c*) an aircraft intermediate system to connect to different ground intermediate systems; and

(*d*) the exchange of address information between applications.

(8) The ATN notify the appropriate application processes when no authorised path exists.

(9) The ANT shall make provision for the efficient use of limited bandwidth subnetworks.

(10) The ATN shall be accurate within one second of the UTC where the absolute time of day is used.

PART IV — ATN Application Requirements

ATN system application requirements

22. (1) During the implementation of air-ground data links, the ATN shall support the data link initiation capability (DLIC) applications.

(2) The ATN/OSI shall, during the implementation of Air Message Handling Services and security protocols, support the retrieval and modification directory services application.

Air-ground applications requirements

23. The ATN shall be capable of supporting one or more of the following applications —

(*a*) Automatic Dependent Surveillance-Contract (ADS– C);

(*b*) Controller Pilot Data Link Communication (CPDLC); and

(*c*) Flight Information Service (FIS) including Automatic Terminal Information Service (ATIS) and Meteorological Reports.

Ground-ground applications requirements

24. The ATN shall be capable of supporting the following applications —

(*a*) Air Traffic Service Interfacility Data Communication (AIDC); and

(*b*) Air Traffic Service Message Handling Services (ATSMHS) applications.

PART V — ATN Communications Service Requirements

ATN/IPS upper layer communications service requirements

25. An ATN host shall be capable of supporting the ATN/Internet Protocol Suite upper layers including an application layer.

ATN/OSI upper layer communications service requirements

26. An ATN/Open Systems Interconnection end-system shall be capable of supporting the OSI upper layer communications service including session, presentation and application layers.

ATN/IPS communications service requirements

27. (1) An ATN host shall be capable of supporting the ATN/IPS including the —

(*a*) transport layer in accordance with Transmission Control Protocols and User Datagram Protocols; and

(*b*) network layer in accordance with Internet Protocol version 6 (IPv6).

(2) An internet protocol suite router shall support the aeronautical telecommunication network layer in accordance with internet protocol version 6 and multiprotocol extensions.

ATN/OSI communications service requirements

28. (1) An ATN or the international organisation for standardisation end-system, shall be capable of supporting the aeronautical telecommunication network including the —

(*a*) transport layer in accordance with international organisation for standardisation transport protocol class 4 and optionally connectionless transport protocol (CLTP); and

(*b*) network layer in accordance with international organisation for standardisation, connectionless network protocol.

(2) An ATN intermediate system shall support the aeronautical telecommunication network layer in accordance with international organisation for standardisation, connectionless network protocol and international organisation for standardisation, inter-domain routing protocol.

ATN naming and addressing requirements

29. (1) The ATN shall make provisions for unambiguous application identification and addressing.

(2) The ATN shall provide provisions for unambiguous addressing.

(3) The ATN shall provide means to unambiguously address all ATN end-systems and intermediate systems.

(4) The ATN addressing and naming plans shall allow the Authority and agencies to assign addresses and names within their own administrative domains.

ATN security requirements

30. (1) The ATN shall make provisions whereby only the controlling ATS unit may provide ATC instructions to aircraft operating in its airspace.

(2) The ATN shall enable the recipient of a message to identify the originator of that message.

(3) The ATN end-systems that supports ATN security services shall be capable of authenticating the —

(*a*) identity of peer end-systems; and

(*b*) source of messages and ensuring the integrity of data messages.

(4) The ATN shall be protected against service attacks to a level consistent with the application service requirements.

PART VI — Aeronautical Mobile-Satellite (Route) Service (AMS(R)S

Aeronautical mobile-satellite route service radio frequency characteristics

31. (1) The mobile-satellite system which provides for AMS(R)S shall conform to the requirements of this part and the AMS(R)S system which shall support packet data service, voice service or both.

(2) The requirements for mandatory carriage of AMS(R)S system equipment shall including the level of system capability made —

(*a*) on the basis of regional air navigation agreements specifying an airspace which is on operation;

(*b*) to implement the timescales for the carriage of equipment; and

(*c*) to include the performance of an aircraft earth station, the satellite and the ground earth station.

(3) The agreements specified in subregulation (2) shall provide at least a notice of two years of mandatory carriage of airborne systems.

(4) The Authority shall coordinate with national authorities and service providers for the implementation aspects of an AMS(R)S system that would permit worldwide interoperability and optimum use, as the appropriate requirements.

PART VII — Aeronautical mobile-satellite route service frequency bands characteristics

Frequency bands

32. An AMS(R)S system shall operate only in frequency bands when providing AMS(R)S communications, which is appropriately allocated to the aeronautical mobile-satellite route service and shall be protected by the International Telecommunications Union Radio Regulations.

Emissions

33. The total emissions of the aircraft earth station necessary to meet designed system performance shall be controlled to avoid harmful interference to other systems necessary to support safety and regularity of air navigation, installed on the same or other aircraft.

34. The emissions from an AMS(R)S system aircraft earth station shall not cause harmful or interfere with an aircraft earth station which provides an aeronautical mobile-satellite route service on a different aircraft.

Interference to other AMS(R)S equipment

35. The aircraft earth station equipment shall operate properly in an interference environment causing a cumulative relative change in its receiver noise temperature (ΔT/T) of 25 per cent.

Susceptibility

36. (1) Every aircraft earth station and ground earth station shall be designed to ensure that messages transmitted in accordance with the Civil Aviation (Communication Procedures) Regulations, including the order of the priority, is not delayed by the transmission and the reception of other types of messages.

Priority and pre-emptive access Cap. 71:01 (Sub. Leg.)

(2) As a means to comply with subregulation(1), the message types not defined under these Regulations, shall be terminated even without warning, in order to allow messages referred to under these Regulations, to be transmitted and received.

(3) All AMS(R)S data packets and voice calls shall be identified as to their associated priority.

(4) The AMS(R)S system shall provide voice communications priority over data communications within the same message category.

37. (1) The aircraft earth station, ground earth station and satellites shall properly acquire and track service link signals when the aircraft is moving at a ground speed of up to 1 500 km/h ,800 knots along any heading.

Signal acquisition and tracking

(2) The aircraft earth station, ground earth station and satellites shall properly acquire and track service link signals when the component of the aircraft acceleration vector in the plane of the satellite orbit is up to 0.6 g.

PART VIII — Performance requirements

38. An AMS(R)S system shall provide air mobile satellite route service throughout the designated operational coverage (DOC).

Designated operational coverage

39. (1) An AMS(R)S system shall provide predictions of the time, location and duration of any resultant outages until full service is restored in the event of a service failure.

Failure notification

(2) The AMS(R)S system shall annunciate a loss of communications capability within 30 seconds of the time when the system detects such a loss.

40. (1) The aircraft earth station shall meet the relevant performance requirements specified in regulation 38 for an aircraft in a straight level flight throughout the designated operational coverage of the satellite system.

AES requirements

(2) The aircraft earth station shall meet the relevant performance requirements specified in regulation 38 for the aircraft for the attitudes of +20/-5 degrees of pitch and +/-25 degrees of roll throughout the designated operational coverage (DOC) of the satellite system.

41. (1) The 95th percentile of the time delayed for a GES to present a call from the original event to the terrestrial network interworking interface after a call origination event has arrived at the AES interface shall not be greater than 20 seconds.

AES and GES origination call processing delay

(2) The 95th percentile of the time delayed for an AES to present a call from the original event at its aircraft interface after a call origination event has arrived at the terrestrial network interworking interface shall not be greater than 20 seconds.

Packet data service interface

42. The GES system that provides AMS(R)S packet data service shall provide - -

(*a*) an interface to the Aeronautical Telecommunication Network; and

(*b*) a connectivity notification function.

Packet data service performance

43. (1) If the aircraft earth station system provides AMS(R)S packet data service, the AMS(R)S system shall meet the standards of regulations 38.

(2) Where an aeronautical mobile-satellite route service system provides packet data service, it shall be capable of operating as a constituent mobile sub-network of the aeronautical telecommunication network.

Delay

44. (1) The subnetwork entry time shall be less than 90 seconds.

(2) The from-MS data transit delay, 95th percentile for the highest priority data service, shall be less than or equal to 1.4 seconds over a window of one hour or 600 SDUs, whichever is longer.

(3) The to-MS data transit delay, 95th percentile for the highest priority data service, shall be less than or equal to 1.4 seconds over a window of one hour or 600 SDUs, whichever is longer.

Delay parameters

45. (1) The delay caused for connecting data from GES to AES, shall not be greater than 70 seconds.

(2) The data transit delay values shall be —

(*a*) based on a fixed sub-network service data unit length of 128 octets in accordance with ISO 8348; and

(*b*) defined as average values.

(3) The data transit delay from aircraft shall not be greater than 40 seconds for the highest priority data service.

(4) The data transit delay from aircraft shall not be greater than 28 seconds for the lowest priority data service.

(5) The data transit delay to aircraft shall not be greater than 12 seconds for the highest priority data service.

(6) The data transit delay to aircraft shall not be greater than 28 seconds for the lowest priority data service.

(7) The data transfer delay, 95th percentile, shall not be greater than 80 seconds for the highest priority data service.

(8) The data transfer delay, 95th percentile, from-aircraft, shall not be greater than 60 seconds for the lowest priority data service.

(9) The data transfer delay, 95th percentile, to-aircraft shall not be greater than 15 seconds for the highest priority data service.

(10) The data transfer delay, 95th percentile, to-aircraft shall not be greater than 30 seconds for the lowest priority data service.

(11) The connection release delay, 95th percentile, shall not be greater than 30 seconds in either direction.

Call processing delay

46. (1) The residual error rate in the from-aircraft direction shall not be greater than 10-4 per subnetwork service data unit.

(2) The residual error rate in the to-aircraft direction shall not be greater than 10-6 per subnetwork service data unit.

(3) The probability of a subnetwork connection provider-invoked subnetwork connection release shall not be greater than 10-4 over any one-hour interval.

(4) The probability of a subnetwork connection provider-invoked reset shall not be greater than 10-1 over any one-hour interval.

Voice service performance

47. The system that provides aeronautical mobile-satellite route voice service shall meet the requirements in regulations 48, 49 and 50.

48. (1) The voice transmission shall provide overall intelligibility performance suitable for the intended operational and ambient noise environment. Voice quality

(2) The total allowable transfer delay within an AMS(R) S subnetwork shall not be greater than 0.485 seconds.

49. The AMS(R)S system shall have sufficient available voice traffic channel resources such that an aircraft earth station- or ground earth station originated AMS(R)S voice call presented to the system shall experience a probability of blockage of not more than 10-2. Voice capacity

50. The AMS(R)S system shall provide features for the protection of the messages in transit from tampering against — AMS(R)S Security requirements

(*a*) the denial of service, degraded performance characteristics, or reduction of system capacity when subjected to external attacks; or

(*b*) unauthorised entry.

51. The AMS(R)S system shall allow subnetwork users to address AMS (R)S communications to specific aircraft by means of the ICAO 24-bit aircraft address. System interfaces

PART IX — Secondary Surveillance Radar Mode S Air-Ground Data Link Communication

52. Where air ground data link communication is used by the Secondary Surveillance Radar Mode S, the following shall be implemented — Mode S Air-ground data link communication

(*a*) the Mode S characteristics shall be as set out in Schedule 2;

(*b*) the DCE and XDCE state tables shall be as set out in Schedule 3; and

(*c*) the Mode S packet formats shall be as set out in Schedule 4.

PART X — Very High Frequency Air-Ground Digital Link (VDL)

53. (1) An Aircraft station radio frequency range shall be capable of tuning to any of the channels in the range as set out in regulation 55 within 100 milliseconds after the receipt of an autotune command. Radio channels and functional channels

(2) An aircraft station for VDL Mode 3 shall be able to tune to any channel in the range set out in regulation 55 within 100 milliseconds after the receipt of any tuning command.

(3) The ground station radio frequency range shall be capable of operating on assigned channel within the radio frequency range set out in regulation 55.

(4) The common signalling channel, the Frequency 136.975MHz shall be reserved as a worldwide common signalling channel for VHF Air-Ground Digital Link Mode 2.

54. (1) The data transparency and the VHF Air-Ground Digital Link system shall provide the code-independent and the byte-independent transfer of data. System capabilities

(2) The VHF Air-Ground Digital Link system shall provide link layer data broadcast services Mode 2 or voice and data broadcast services Mode 3.

(3) The VHF Air-Ground Digital Link Mode 3 and the data broadcast service shall support network multicasting capability originating from the ground.

(4) The VHF Air-Ground Digital Link system shall establish and maintain a reliable communications path between the aircraft and the ground system while allowing but not requiring manual intervention.

(5) The VHF Air-Ground Digital Link -equipped aircraft shall transition from one ground station to another when circumstances dictate.

(6) The VHF Air-Ground Digital Link Mode 3 system shall support a transparent, simplex voice operation based on a "Listen-Before-Push-To-Talk" channel access.

Air-ground VHF digital link communications system characteristics

55. (1) The radio frequencies used for Air-ground VHF digital link communications shall be selected from the radio frequencies in the band 117.975–137 MHz.

(2) The lowest assignable frequency used for Air-ground VHF digital link communications shall be 118.000 MHz, and the highest assignable frequency shall be 136.975 MHz and the separation between assignable frequencies shall be 25 kHz.

(3) The design polarisation of emissions shall be vertical.

System characteristics of ground installations for VHF Air-ground digital link communication

56. The VHF Air ground digital link system characteristics for ground installation shall be as set out in Schedule 5.

System characteristics of aircraft installation

57. The VHF Air ground Digital link system characteristics for aircraft installation shall be as set out in the Schedule 6.

Physical layer protocols and services

58. The VHF Air ground digital link systems physical layer protocols and services shall be as set out in —

(*a*) Schedule 7 for aircraft and ground stations; and

(*b*) Schedule 10 for both mobile and ground stations of Mode 4 unless otherwise stated.

Link layer protocols and services

59. The VHF Air ground digital link systems link layer protocols and services shall be as set out in the Schedule 8.

Subnetwork layer protocols and services

60. The VHF Air ground digital link systems sub-network layer protocols and services shall be as set out in the Schedule 9.

VDL mobile subnetwork dependent convergence function

61. (1) The Very High Frequency Digital Link (VDL) Mode 2 mobile subnetwork dependent convergence function shall be the standard mobile subnetwork dependent convergence function.

(2) The VDL Mode 2 mobile subnetwork dependent convergence function shall —

(*a*) support maintaining context across sub network calls;

(*b*) use the same context across all Switched Virtual Circuits (SVCs) negotiated to a Data Terminal Equipment (DTE), when negotiated with the same parameters; or

(*c*) support at least 2 Switched Virtual Circuits (SVCs) sharing a context.

VDL Mode 3 subnetwork dependent convergence function (SNDCF)

62. The VDL Mode 3 shall support —

(*a*) the standard international organisation for standardisation, ISO 8208 subnetwork dependent convergence function as defined in ICAO Doc 9705; and

(*b*) the denoted frame-based subnetwork dependent convergence function.

Voice Unit for Mode 3 services

63. (1) The voice unit shall provide for a simplex, "push-to-talk" audio and signalling interface between the user and the VDL and two separate mutually exclusive voice circuit types shall be supported.

(2) There shall be two separate mutually exclusive voice circuit types referred to under subregulation (1) which are —

(*a*) dedicated circuits; and

(*b*) demand assigned circuits.

(3) The dedicated circuits under subregulation (2) (*a*) shall provide service to a specific user group on an exclusive basis with no sharing of the circuit with other users outside the group and access shall be based on a "listen-before-push-to-talk" discipline.

(4) The demand assigned circuits under subregulation (2) (*b*) shall provide voice circuit access which is arbitrated by the ground station in response to an access request received from the aircraft station and allow dynamic sharing of the channel resource increasing trunking efficiency.

(5) The voice unit operation shall support a priority override access for authorised ground users.

(6) The voice unit operation shall support notification to the user of the source of a received message.

(7) The voice unit shall support a coded squelch operation that offers some degree of rejection of undesired co-channel voice messages based on the burst time of arrival.

Voice Unit for Mode 3 speech encoding, parameters and procedures

64. The VDL Mode 3 shall use the Advanced Multi-Band Excitation (AMBE), 4.8 kbits/s encoding or decoding algorithm, version number AMBE-ATC-10, developed by Digital Voice Systems, incorporated for voice communications.

VDL Mode 4 radio channels

65. (1) The VDL Mode 4 transmitter or receiver shall be capable of tuning to any of the 25 kHz channels from 112 MHz to 137 MHz.

(2) The VDL Mode 4 station shall be capable of receiving two channels simultaneously.

(3) The VDL Mode 4 stations shall use two assigned frequencies as Global Signalling Channels, to support the user communications and link management functions.

VDL Mode 4 system capabilities

66. (1) The VDL Mode 4 system shall —

(*a*) support ATN/IPS-compliant subnetwork services;

(*b*) provide code-independent and byte-independent transfer of data;

(*c*) provide link layer broadcast services;

(*d*) provide link layer point-to-point services;

(*e*) provide air-air communications, without ground support, as well as air-ground communications;

(*f*) establish and maintain a reliable communications path between the aircraft and the ground system while allowing, but not requiring, manual intervention when supporting air-ground operations; and

(*g*) provide the capability for deriving time from time-of-arrival measurements of received VDL Mode 4 transmissions whenever externally derived estimates of time are unavailable.

(2) The Mobile VDL Mode 4 DLS station shall transition from one ground VDL Mode 4 DLS station to another as required.

(3) The Mobile and ground VDL Mode 4 stations shall access the physical medium operating in simplex mode.

Coordination channel for utilisation

67. The transmissions shall be scheduled relative to UTC, to ensure efficient use of shared channels and to avoid unintentional slot re-use on a regional basis.

Physical layer protocols and services

68. The requirements set out in Schedule 9 shall apply to both mobile and ground stations.

AeroMACS general requirements

69. (1) The AeroMACS shall —

(*a*) conform to the requirements contained in these Regulations;

(*b*) only transmit when on the surface of an aerodrome;

(*c*) support aeronautical mobile (route) service AMS(R)S communications;

(*d*) process messages according to their associated priority;

(*e*) support multiple levels of message priority;

(*f*) support point to point communication;

(*g*) support multicast and broadcast communication services;

(*h*) support internet protocol packet data services;

(*i*) provide mechanisms to transport aeronautical telecommunication network or internet protocol suite and aeronautical telecommunication network open system internet over internet protocol based messaging;

(*j*) support voice services;

(*k*) support multiple service flows simultaneously;

(*l*) support adaptive modulation and coding;

(*m*) support handover between different AeroMACS BSs during aircraft movement or on degradation of connection with current base station;

(*n*) keep total accumulated interference levels with limits defined by the International Telecommunication Union-Radio communication Sector (ITU-R) as required by national or international rules on frequency assignment planning and implementation; and

(*o*) support a flexible implementation architecture to permit link and network layer functions to be located in different or same physical entities.

(2) For purpose of this section, "adaptive modulation" means a system's ability to communicate with another system using multiple burst profiles and a system's ability to subsequently communicate with multiple systems using different burst profiles.

Radio frequency (RF) general characteristics

70. (1) The AeroMACS shall operate —

(*a*) in time division duplex mode;

(*b*) with a 5 MHz channel bandwidth;

(*c*) without guard bands between adjacent AeroMACS channels; and

(*d*) according to the orthogonal frequency division multiple access method.

(2) The AeroMACS MS antenna polarisation shall have a vertical component.

(3) The AeroMACS shall support both segmented partial usage sub-channelisation (PUSC) and PUSC with all carriers as sub-carrier permutation methods.

Radio Frequency (RF) bands

71. (1) The AeroMACS equipment shall operate in the band from 5 030 MHz to 5 150 MHz in channels of 5 MHz bandwidth.

(2) The mobile equipment shall operate at the centre frequencies offset from the preferred frequencies, with an offset of 250 kHz step size.

Radiated power

72. (1) The maximum mobile station equivalent isotropic radiated power (EIRP) shall not exceed 30 dBm.

(2) The maximum base station EIRP in a sector shall not exceed 39.4 dBm.

(3) The total base station EIRP in a sector shall be decreased from that peak, considering the antenna characteristics, at elevations above the horizon, in order to meet the ITU requirements.

Minimum receiver sensitivity

73. The AeroMACS receiver sensitivity shall comply with Table 7-1, set out in Schedule 18 AeroMACS of the receiver sensitivity values.

74. (1) When all active sub-carriers are transmitted in the channel, the power spectral density of the emissions, shall be attenuated below the maximum power spectral density as follows: — Spectral mask and emissions

(*a*) on any frequency removed from the assigned frequency between 50 and 55 per cent of the authorized bandwidth: 26 + 145 log (per cent of BW/50) dB;

(*b*) on any frequency removed from the assigned frequency between 55 and 100 per cent of the authorized bandwidth: 32 + 31 log (per cent of (BW)/55) dB;

(*c*) on any frequency removed from the assigned frequency between 100 and 150 per cent of the authorized bandwidth: 40 +57 log (per cent of (BW)/100) dB; and

(*d*) on any frequency removed from the assigned frequency beyond 150 per cent of the authorised bandwidth: 50 dB.

(2) The AeroMACS shall implement power control.

(3) The AeroMACS minimum rejection for adjacent (+/–5MHz) channel, measured at BER=10-6 level for a victim signal power 3 dB higher than the receiver sensitivity, shall be 10 dB for 16 QAM 3/4.

(4) The AeroMACS minimum rejection for adjacent (+/–5MHz) channel, measured at BER=10-6 level for a victim signal power 3 dB higher than the receiver sensitivity, shall be 4 dB for 64 QAM 3/4.

(5) The AeroMACS minimum rejection for second adjacent (+/–10MHz) channel and beyond, measured at BER=10-6 level for a victim signal power 3 dB higher than the receiver sensitivity, shall be 29 dB for 16 QAM 3/4.

(6) The AeroMACS minimum rejection for second adjacent (+/–10MHz) channel and beyond, measured at BER=10-6 level for a victim signal power 3 dB higher than the receiver sensitivity, shall be 23 dB for 64 QAM 3/4.

75. (1) The AeroMACS BS reference frequency accuracy shall be better than +/- 2 × 10-6 of reference frequency. — Frequency tolerance

(2) The AeroMACS MS reference frequency shall be locked to that of the BS centre frequency with an accuracy better than 2 per cent of the subcarrier spacing.

(3) The AeroMACS MS shall track the frequency of the BS and shall defer any transmission if synchronization is lost or exceeds the tolerances given above.

76. (1) The maximum — — AeroMACS communications service provider

(*a*) unplanned service outage duration on a per aerodrome basis shall be 6 minutes;

(*b*) accumulated unplanned service outage time on a per aerodrome basis shall be 240 minutes year; and

(*c*) number of unplanned service outages shall not exceed 40 per year per aerodrome.

(2) The probability that a transaction will be completed once started shall be at least 0.999 for AeroMACS over every one hour interval.

77. The AeroMACS shall operate with a doppler shift induced by the movement of the main station up to a radial speed of 92.6 km 50 NM per hour, relative to the base station. — Doppler shift

78. (1) The AeroMACS base station and main station shall — — Integrity

(*a*) support mechanisms to detect and correct corrupt SNSDUs; and

(*b*) only process SNSDUs addressed to themselves.

(2) The residual error rate, to or from MS shall be less than or equal to 5 × 10-8 per SNSDU.

(3) The maximum bit error rate shall not exceed 10-6 after CTC-FEC, if the received signal is equal to or greater than the minimum sensitivity level for the modulations scheme used, as given in Table 7-1 set out in Schedule 18.

AeroMACS Security requirements

79. (1) The AeroMACS shall provide —

(*a*) a capability to protect the integrity of messages in transit;

(*b*) a capability to protect the availability of the system;

(*c*) a capability to protect the confidentiality of messages in transit;

(*d*) an authentication capability;

(*e*) a capability to ensure the authenticity of messages in transit; and

(*f*) a capability to authorise the permitted actions of users of the system.

(2) The AeroMACS shall provide capability to prevent intrusion from lower integrity to higher integrity domain, if AeroMACS provide interfaces to multiple domains.

System Interface

80. The AeroMACS shall —

(*a*) provide data service interface to the system users; and

(*b*) support notification of the status of communications.

Application requirements

81. (1) The AeroMACS shall support multiple classes of services to provide appropriate service levels to applications.

(2) The AeroMACS shall pre-empt services with a lower priority, when there is a resource contention than set out under these Regulations or Communication Regulatory Procedures.

PART XII — Aeronautical Fixed Telecommunication Network (AFTN)

Characteristics of Interregional Aeronautical Fixed Service (AFS) circuits

82. The interregional AFS circuits being implemented or upgraded shall —

(*a*) employ the high quality telecommunications service and modulation rate; and

(*b*) take into account traffic volumes expected under both normal and alternate route conditions.

Technical provisions relating to international ground-ground data interchange at medium and higher signalling rates

83. The technical provisions related to international ground-ground data interchange at medium and higher signalling rates for AFTN networks shall be as set out in Schedule 11.

Aircraft addressing system

84. (1) The aircraft address shall be one of 16 777 214 twenty-four-bit aircraft addresses allocated by ICAO to the State of registry or common mark registering authority and assigned as specified under Schedule 12.

(2) The non-aircraft transponders that are installed on aerodrome surface vehicles, obstacles or fixed Mode S target detection devices for surveillance or radar monitoring purposes shall be assigned 24-bit aircraft addresses.

(3) The Mode S transponders used in accordance with subregulation (2) shall not have negative impact on the performance of existing ATS surveillance systems and ACAS.

PART XIII — Point-to-Multipoint Communications

Service via satellite for dissemination of aeronautical information

85. The point-to-multipoint telecommunication service via satellite to support the dissemination of Aeronautical Information shall be based on full-time, and the non-pre-emptible, protected services as defined in the relevant Telecommunication Standardisation Sector of the International Telecommunications Union Recommendations.

Service via satellite for dissemination of World Area Forecast System (WAFS) products

86. The World Area Forecast System (WAFS) characteristics shall include the —

(*a*) frequency-C-band, earth-to-satellite, 6 GHz band, satellite-to-earth, 4 GHz band;

(*b*) capacity with effective signalling rate of not less than 9 600 bits/s;

(*c*) bit error rates — better than 1 in 107;

(*d*) forward error correction; and

(*e*) availability 99.95 per cent.

PART IVX — High Frequency Data Link (HFDL) System

System architecture

87. The High Frequency Data Link (HFDL) system shall —

(*a*) consist of one or more ground and aircraft station subsystems, which implement the High Frequency Data Link protocol set out under regulation 73; and

(*b*) include a ground management subsystem set out under regulation 74.

Aircraft and ground station subsystems

88. The HFDL aircraft station and the HFDL ground station subsystems shall include the following functions —

(*a*) the HF transmission and reception;

(*b*) data modulation and demodulation; and

(*c*) the HFDL protocol implementation and frequency selection.

Operational coverage

89. The frequency assignments for HFDL shall be protected throughout their designated operational coverage area.

Requirements for carriage of HFDL quipment

90. (1) The requirements for mandatory carriage of HFDL equipment shall be made on the basis of regional air navigation agreements that specify the airspace of operation and the implementation timescale.

(2) The agreement in subregulation (1) shall provide advance notice of at least two years for the mandatory carriage of airborne systems.

Ground station networking

91. The HFDL ground station subsystems shall interconnect through a common ground management subsystem.

Ground station synchronisation

92. (1) The Synchronisation of HFDL ground station subsystems shall be to within ±25 ms of UTC.

(2) For any station not operating within ±25 ms of UTC, appropriate notification shall be made to all aircraft and ground station subsystems to allow for continued system operation.

PART XIV — The residual packet error rate.

Quality of service

93. (1) The undetected error rate for a network user packet which contains between 1 and 128 octets of user data shall be equal to or less than 1 in 106.

(2) The transit and transfer delays for network user packets of 128 octets shall not exceed the values of the specifications in Table 11-1 as set out under Schedule 15.

HF data link protocol

94. The HFDL protocol shall consist of a physical layer, a link layer, and a subnetwork layer, as set out under Schedule 13.

Ground management subsystem

95. The ground management subsystem shall —

(*a*) perform the functions necessary to establish and maintain communications channels between the HFDL ground and aircraft station subsystems; and

(*b*) interface with the ground station subsystem in order to exchange control information required for frequency management, system table management, log status management, channel management, and quality of service data collection.

PART VX — Universal Access Transceiver (UAT)

Universal access transceiver system characteristics of aircraft and ground stations

96. The universal access transmitter physical layer and system characteristics of aircraft and ground stations shall be as set out under Schedule 14.

Mandatory carriage requirements

97. The requirements for mandatory carriage of UAT equipment shall be made on the basis of regional air navigation agreements which specify the airspace of operation and the implementation timescales for the carriage of equipment, including the appropriate lead time.

PART XVI — Aeronautical Mobile Service

Air-ground VHF communication system characteristics

98. (1) The characteristics of the air-ground VHF communication system used in the International Aeronautical Mobile Service shall be in conformity with the specifications as set out in Schedule 15.

(2) The Air-Ground VHF Communication systems characteristics for both ground and airborne installation shall conform to the specifications set out in Schedule 15.

Single side band (SSB) HF communication system characteristics

99. The characteristics of the air-ground HF Single Side Band system where used in the Aeronautical Mobile Service, shall be in conformity with the specifications set out in Schedule 15.

Selective Calling System

100. (1) Where a Selective Calling System (SELCAL) is installed, the system characteristics set out in Schedule 16.

(2) The Aeronautical Stations which are required to communicate with SELCAL-equipped aircraft shall have SELCAL encoders in accordance with the red group specified in the table of tone frequencies set out in Schedule 16.

(3) The SELCAL codes using the tones Red P, Red Q, Red R, and Red S shall be assigned after 1 September 1985.

PART XVII — Aeronautical Speech Circuits

Technical provisions relating to International aeronautical speech circuit switching and signalling for ground-ground applications

101. (1) The use of circuit switching and signalling to provide speech circuits to interconnect ATS units not interconnected by dedicated circuits shall be by agreement between the administrations concerned.

(2) The application of aeronautical speech circuit switching and signalling shall be made on the basis of regional air navigation agreements.

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(3) The Air Traffic Control communication requirements defined in the Civil Aviation (Air Traffic Services) Regulations, shall be met by the implementation of one or more of the following basic three call types —

(*a*) instantaneous access;

(*b*) direct access; and

(*c*) indirect access.

(4) Subject to subregulation (3), the following functions shall be provided in order to meet the requirements set out in the Civil Aviation (Air Traffic Services) Regulations by —

(*a*) means of indicating the calling or called party identity;

(*b*) means of initiating urgent or priority calls; and

(*c*) conference capabilities.

(5) The characteristics of the circuits used in aeronautical speech circuit switching and signalling shall conform to the appropriate ISO/IEC international standards and the Telecommunication Standardization Sector of the International Telecommunications Union recommendations.

(6) The Digital signalling system shall be used wherever the use of such system can be justified in terms of any of the following —

(*a*) improved quality of service;

(*b*) improved user facilities; or

(*c*) reduced costs where quality of service is maintained.

(7) The characteristics of supervisory tones to be used such as ringing, busy, number unobtainable shall conform to the appropriate Telecommunication Standardization Sector of the International Telecommunications Union, recommendations.

(8) The international aeronautical telephone network numbering scheme shall be used to take the advantage of the benefits of the interconnecting of the regional and national aeronautical speech networks.

PART XVIII — Emergency Locator Transmitter for search and rescue

Operating frequencies

102. (1) The installations of Emergency Locator Transmitters operating on 406 MHz shall meet the provisions specified in regulation 106.

(2) The installations of Emergency Locator Transmitters operating on 121.5 MHz shall meet the provisions specified in regulation 105.

(3) The Emergency Locator Transmitters shall operate on 406 MHz and 121.5 MHz simultaneously.

(4) The Emergency Locator Transmitters installed on or after 1st January, 2002 shall operate simultaneously on 406 MHz and 121.5 MHz.

(5) The technical characteristics for the 406 MHz component of an integrated ELT shall be in accordance with regulation 106.

(6) The technical characteristics for the 121.5 MHz component of an integrated ELT shall be in accordance with regulation 105.

Emergency locator transmitters register

103. (1) The Authority shall make arrangements to have 406 MHz Emergency Locator transmitters register and to ensure that the register is updated whenever necessary.

(2) The Authority shall make available the registered information regarding the Emergency Locator Transmitters to search and rescue authorities.

(3) The Emergency Locator Transmitters register information shall include the following —

(*a*) transmitter identification expressed in the form of an alphanumerical code of 15 hexadecimal characters;

(*b*) transmitter manufacturer, model and serial number;

(*c*) COSPAS-SARSAT (type approval number);

(*d*) name, address and emergency telephone number of the owner and operator;

(*e*) name, address and telephone number of other emergency contacts to whom the owner or the operator is known;

(*f*) aircraft manufacturer and type; and

(*g*) colour of the aircraft.

Specification for 121.5 MHz component of Emergency Locator Transmitter

104. (1) The Emergency Locator Transmitters shall operate on 121.5 MHz and the frequency tolerance shall not exceed plus or minus 0.005 per cent.

(2) The emission from an Emergency Locator Transmitter under normal conditions and attitudes of the antenna shall be vertically polarized and essentially omni-directional in the horizontal plane.

(3) The Peak Effective Radiated Power shall at no time be less than 50 Mw over a period of 48 hours of continuous operation, at an operating temperature of minus 20°C.

(4) The type of emission shall be A3X and any other type of modulation that meets the requirements of subregulations (5), (6) and (7) shall be used, provided that the emission does not prejudice precise location of the beacon by homing equipment.

(5) The carrier shall be amplitude modulated at a modulation factor of at least 0.85.

(6) The modulation applied to the carrier shall have a minimum duty cycle of 33 per cent.

(7) The emission shall have a distinctive audio characteristic achieved by amplitude modulating the carrier with an audio frequency sweeping downward over a range of not less than 700 Hz within the range 1 600 Hz to 300 Hz and with a sweep repetition rate of between 2 Hz and 4 Hz.

(8) The emission shall include a clearly defined carrier frequency distinct from the modulation sideband components; in particular, at least 30 per cent of the power shall be contained at all times within plus or minus 30 Hz of the carrier frequency on 121.5 MHz.

Specification for 406 MHz component of Emergency Locator Transmitter

105. (1) The Emergency Locator Transmitter shall operate on one of the frequency channels assigned for use in the frequency band 406.0 to 406.1 MHz.

(2) The period between transmissions shall be 50 seconds plus or minus 5 per cent.

(3) The transmitter power output shall be within the limits of 5 W plus or minus 2 Db over a period of 24 hours of continuous operation at an operating temperature of –20°C.

(4) The 406 MHz Emergency Locator Transmitter shall be capable of transmitting a digital message.

Transmitter identification coding

106. (1) The Emergency Locator Transmitter operating on 406 MHz shall be assigned a unique coding for identification of the transmitter or aircraft on which it is carried.

(2) The Emergency Locator Transmitter shall be coded in accordance with either the aviation user protocol or one of the serialized user protocols Set out in Schedule 17 and shall be registered with the appropriate Authority.

PART XIX — Exemptions

Application requirements for exemption

107. The application for an exemption shall be in writing and shall specify the time when the aviation service provider is expected by the Authority to fully comply.

Review and publication of application

108. (1) The Authority shall review the application for exemption made under regulation 107 for accuracy and compliance and if the application is satisfactory, the Authority shall publish a detailed summary of the application for comments, within 14 days, in either —

(*a*) the *Gazette*; or

(*b*) aeronautical information circular; or

(*c*) a newspaper circulating locally.

(2) Where an applicant fails to comply with the requirements under these Regulations, the Authority shall request the applicant in writing, to comply prior to the publication or making of a decision under sub regulation (1).

(3) If the application under these Regulation is for emergency relief, the Authority shall publish the decision as soon as possible after processing the application.

Evaluation of application

109. (1) The Authority shall conduct an evaluation of the application, where the applicant has complied with the requirements under Regulation 107, to include a —

(*a*) determination of whether an exemption would be in the public interest;

(*b*) determination, after a technical evaluation of whether the applicant's proposal would provide a level of safety equivalent to that established by the regulation, although where the Authority decides that a technical evaluation of the request would impose a significant burden on the Authority's technical resources, the Authority may deny the exemption on that basis;

(*c*) determination of whether a grant of the exemption would contravene these Regulations; and

(*d*) recommendation based on the preceding elements, of whether the request should be granted or denied, and of any conditions or limitations that should be part of the exemption.

(2) The Authority shall notify the applicant in writing of the decision to grant or deny the application and shall publish a detailed summary of its evaluation decision in either —

(*a*) the *Gazette*; or

(*b*) aeronautical information circular; or

(*c*) a newspaper circulating locally.

(3) The summary referred to in subregulation (2) shall specify the duration of the exemption and any conditions or limitations of the exemption.

(4) The Authority shall, if the exemption affects a significant population of the aviation community of Botswana, publish the summary in aeronautical information circular.

PART XX — General Provisions

Drug and alcohol testing and reporting

110. (1) Any person who operates as an aircraft whether directly or by contract may be tested for drug or alcohol usage.

(2) Any person who —

(*a*) refuses to undergo a test to show the result of alcohol in the blood; or

(*b*) refuses to undergo a test to show the result of narcotic drugs, marijuana, or depressant or stimulant drugs or substances in the body, when requested by a law enforcement officer or the Authority, or refuses to furnish or to authorise the release of the test results requested by the Authority shall —

(i) be denied any licence, certificate, rating, qualification, or authorisation issued under these Regulations for a period of up to one year from the date of that refusal; or

(ii) have their licence, certificate, rating, qualification, or authorisation issued under these Regulations suspended or revoked.

(3) Any person who is convicted for the violation of any law relating to the growing, processing, manufacturing, sale, disposition, possession, transportation, or importation of narcotic drugs, marijuana, or depressant or stimulant drugs or substances, shall —

(*a*) be denied any license, certificate, rating, qualification, or authorisation issued under these Regulations for a period of up to one year after the date of conviction; or

(*b*) have their licence, certificate, rating, qualification, or authorisation issued under these Regulations suspended or revoked.

Reports of violation

111. (1) Any person who is aware of a violation of the Act, shall report it to the Authority.

(2) The Authority may determine the nature and type of investigation or enforcement action that need to be taken.

Failure to comply with direction

112. Any person who fails to comply with any direction given to him or her by the Authority or by any authorised person under any provision of these Regulations shall be deemed for the purposes of these Regulations to have contravened that provision.

Aeronautical fees

113. (1) The Authority shall notify the applicant in writing of the fees to be charged in connection with the issuance, renewal or variation of any certificate, test, inspection or investigation required by, or for the purpose of these Regulations any orders, notices or proclamations made there under.

(2) The applicant shall be required, before the application is accepted, to pay the fee so chargeable upon an application being made in connection with which any fee is chargeable in accordance with the provisions of sub-regulation (1).

(3) If, after that payment has been made, the application is withdrawn by the applicant or otherwise ceases to have effect or is refused, the Authority shall not refund the payment made.

PART XXI — Offences, Penalties and Appeals

Contravention of Regulations

114. (1) Any person who contravenes any provision of these Regulations may have his certificate or exemption cancelled or suspended.

Offences and penalties

115. (1) Any person who contravenes any provision of these Regulations shall be liable to a fine not exceeding P 100 000 or to imprisonment for a term not exceeding more than six months, or to both.

(2) If it is proved that an act or omission of any person, which would otherwise have been a contravention by that person of a provision of these Regulations, was due to any cause not avoidable by the exercise of reasonable care by that person, the act or omission shall be deemed not to be a contravention by that person of that provision.

Appeals

116. Any person aggrieved by the decision of the Authority under these Regulations may, within 14 days of such decision, appeal to the Tribunal established under the Act.

SCHEDULES

SCHEDULE 1

(regulation 20 (1),(2),(3),(4),21(1),(2),(3),(4),(5),(6),(7), (8),(9),(10),(11),(12),(13),(14), 22(1), (2),23, 24, 25, 26, 27(1), (2), 28(1),(2), 29(1),(2),(3), and 30(1),(2),(3))

1.1 Tables for Aeronautical Telecommunications Network (ATN) Mapping-

1.2 Table 1: Mapping of ATN communication priorities

Message categories	*ATN application*	*Corresponding protocol priority*	
		Transport layer priority	*Network layer priority*
Network/systems management		0	14
Distress communications		1	13
Urgent communications		2	12
High-priority flight safety messages	CPDLC, ADS-C	3	11
Normal-priority flight safety messages	AIDC, ATIS	4	10
Meteorological communications	METAR	5	9
Flight regularity communications	DLIC, ATSMHS	6	8
Aeronautical information service messages		7	7
Network/systems administration	DIR	8	6
Aeronautical administrative messages		9	5
<unassigned>		10	4
Urgent-priority administrative and U.N. Charter communications		11	3
High-priority administrative and State/Government communications		12	2
Normal-priority administrative communications		13	1
Low-priority administrative communications and aeronautical passenger communications		14	0
Note.— The network layer priorities shown in the table apply only to connectionless network priority and do not apply to subnetwork priority.			

Note: The network layer priorities shown in the table apply only to connectionless network priority and do not apply to subnetwork priority.

1.3 Table 2. Mapping of ATN network priority to mobile subnetwork priority

Message categories	*ATN network layer priority*	*Corresponding mobile subnetwork priority (see Note 4)*					
		AMSS	*VDL Mode 2*	*VDL Mode 3*	*VDL Mode 4*	*SSR Mode S*	*HFDL*
Network/systems management	14	14	see Note 1	3	14	high	14
Distress communications	13	14	see Note 1	2	13	high	14
Urgent communications	12	14	see Note 1	2	12	high	14
High-priority flight safety messages	11	11	see Note 1	2	11	high	11
Normal-priority flight safety messages	10	11	see Note 1	2	10	high	11
Meteorological communications	9	8	see Note 1	1	9	low	8
Flight regularity communications	8	7	see Note 1	1	8	low	7
Aeronautical information service messages	7	6	see Note 1	0	7	low	6
Network/systems administration	6	5	see Note 1	0	6	low	5
Aeronautical administrative messages	5	5	not allowed	not allowed	not allowed	not allowed	not allowed
<unassigned>	4	unassigned	unassigned	unassigned	unassigned	unassigned	unassigned
Urgent-priority administrative and U.N. Charter communications	3	3	not allowed	not allowed	not allowed	not allowed	not allowed
High-priority administrative and State/Government communications	2	2	not allowed	not allowed	not allowed	not allowed	not allowed
Normal-priority administrative communications	1	1	not allowed	not allowed	not allowed	not allowed	not allowed
Low-priority administrative communications and aeronautical passenger communications	0	0	not allowed	not allowed	not allowed	not allowed	not allowed

Note 1.— VDL Mode 2 has no specific subnetwork priority mechanisms.
Note 2.— The AMSS SARPs specify mapping of message categories to subnetwork priority without explicitly referencing ATN network layer priority.
Note 3.— The term "not allowed" means that only communications related to safety and regularity of flight are authorized to pass over this subnetwork as defined in the subnetwork SARPs.
Note 4.— Only those mobile subnetworks are listed for which subnetwork SARPs exist and for which explicit support is provided by the ATN boundary intermediate system (BIS) technical provisions.

SCHEDULE 2

(regulation 52)

SSR MODE S AIR GROUND DATA LINK

1. MODE S CHARACTERISTICS

1.1 General provisions

Note 1.— Reference ISO document. When the term "ISO 8208" is referred to in these regulations, it means the ISO Standard "Information technology – Data communications – X.25 Packet Layer Protocol for Data Terminal Equipment, Reference Number ISO/IEC 8208: 1990(E)".

Note 2.— The overall architecture of the Mode S sub-network is presented in the diagram on the following page.

Note 3.— The processing splits into three different paths. The first consists of the processing of switched virtual circuits (SVCs), the second consists of the processing of Mode S specific services, and the third consists of the processing of sub-network management information. SVCs utilize the reformatting process and the ADCE or GDCE function. Mode S specific services utilize the Mode S specific services entity (SSE) function.

1.1.1 Message categories. The Mode S subnetwork shall only carry aeronautical communications classified under categories of flight safety and flight regularity as specified in regulation 39 (*c*) and (*e*) of the Civil Aviation (Communication Procedures) Regulations.

1.1.2 Signals in space. The signal-in-space characteristics of the Mode S subnetwork shall conform to the provisions contained in regulation 45 of the Civil Aviation (Surveillance and Collision Avoidance Systems) Regulations.

1.1.3 Code and byte independency. The Mode S subnetwork shall be capable of code and byte independent transmission of digital data.

1.1.4 Data transfer. Data shall be conveyed over the Mode S data link in segments using either standard length message (SLM) protocols or extended length message (ELM) protocols as defined in regulation 45 of the Civil Aviation (Surveillance and Collision Avoidance Systems) Regulations of Schedule 2 at 1.6.11 and 1.7

Note 1.— An SLM segment is the contents of one 56-bit MA or MB field. An ELM segment is the contents of one 80-bit MC or MD field.

Note 2.— An SLM frame is the contents of up to four linked MA or MB fields. An ELM frame is the contents of 2 to 16 MC or 1 to 16 MD fields.

1.1.5 Bit numbering. In the description of the data exchange fields, the bits shall be numbered in the order of their transmission, beginning with bit 1. Bit numbers shall continue through the second and higher segments of multi-segment frames. Unless otherwise Stated, numerical values encoded by groups (fields) of bits shall be encoded using positive binary notation and the first bit transmitted shall be the most significant bit (MSB) as specified in regulation 45 of the Civil Aviation (Surveillance and Collision Avoidance Systems) Regulations of Schedule 2 at 1.3.2.1.

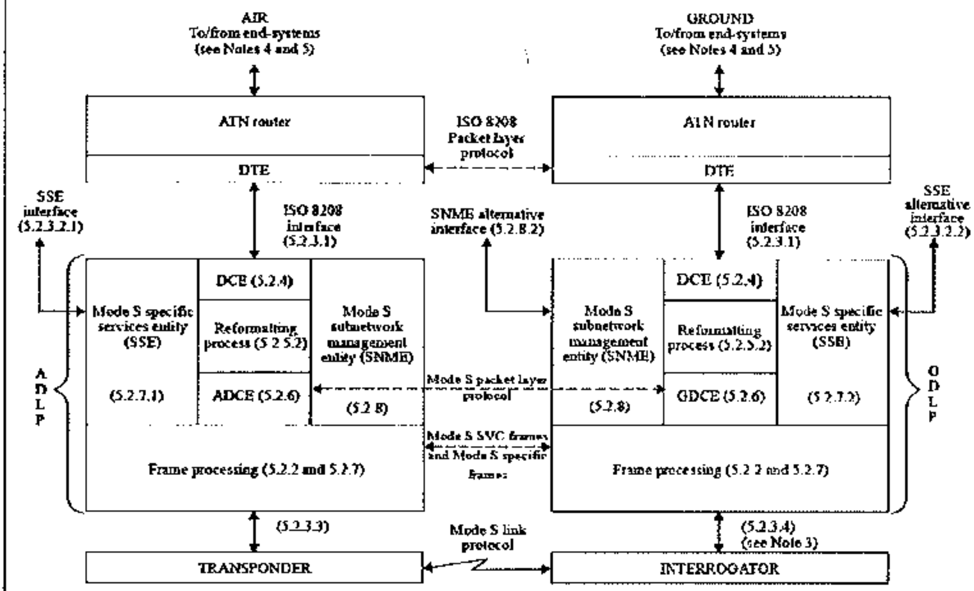
1.1.6 Unassigned bits. When the length of the data is not sufficient to occupy all bit positions within a message field or subfield, the unassigned bit positions shall be set to 0.

1.2 Frames

1.2.1 UPLINK FRAMES

1.2.1.1 SLM frame. An uplink SLM frame shall be composed of up to four selectively addressed Comm-A segments.

Functional elements of the Mode S subnetwork



Key

: physical (RF) connection

: peer level association

: interfaces

Notes:

1. Relevant Mode S subnetwork SARPs paragraph numbers are given in parenthesis.
2. The ADLP/transponder interface is also specified in Annex 10, Volume IV, 3.1.
3. A GDLP may be interfaced to more than one Mode S interrogator.
4. DTEs may be directly associated with end-systems.
5. ATN router access to end-systems may be made via other intermediate systems.

Note1 — Each Comm-A segment (MA field) received by the ADLP is accompanied by the first 32 bits of the interrogation that delivered the segment as specified in regulation 45 of the Civil Aviation (Surveillance and Collision Avoidance Systems) Regulations of Schedule 2 at 1.10.5.2.1.1. Within these 32 bits is the 16-bit special designator (SD) field specified in regulation 45 of the Civil Aviation (Surveillance and Collision Avoidance Systems) Regulations of Schedule 2 at 1.6.1.4.

1.2.1.1.1 IISD field. When the designator identification (DI) field (bits 14-16) has a code value of 1 or 7, the special designator (SD) field (bits 17-32) of each Comm-A interrogation shall be used to obtain the interrogator identifier subfield (IIS, bits 17-20) and the linked Comm-A subfield (LAS, bits 30-32). The action to be taken shall depend on the value of LAS. The contents of LAS and IIS shall be retained and shall be associated with the Comm-A message segment for use in assembling the frame as indicated below. All fields other than the LAS field shall be as defined in regulation 45 of the Civil Aviation (Surveillance and Collision Avoidance Systems) Regulations of Schedule II.

Note: The SD field structure is shown in Figure 5-1 in the Schedule 2 to these Regulations.

1.2.1.1.2 LAS coding. The 3-bit LAS subfield shall be coded as follows:

LAS	*MEANING*
0	single segment
1	linked, 1st segment
2	linked, 2nd but not final segment
3	linked, 3rd but not final segment
4	linked, 4th and final segment
5	linked, 2nd and final segment
6	linked, 3rd and final segment
7	unassigned

1.2.1.1.3 Single segment SLM frame. If LAS = 0, the data in the MA field shall be considered a complete frame and shall be made available for further processing.

1.2.1.1.4 Multiple segment SLM frame. The ADLP shall accept and assemble linked 56-bit Comm-A segments associated with all sixteen possible interrogator identifier (II) codes. Correct linking of Comm-A segments shall be achieved by requiring that all Comm-A segments have the same value of IIS. If LAS = 1 through 6, the frame shall consist of two to four Comm-A segments as specified in the following paragraphs.

1.2.1.1.4.1 Initial segment. If LAS = 1, the MA field shall be assembled as the initial segment of an SLM frame. The initial segment shall be stored until all segments of the frame have been received or the frame is cancelled.

1.2.1.1.4.2 Intermediate segment. If LAS = 2 or 3, the MA field shall be assembled in numerical order as an intermediate segment of the SLM frame. It shall be associated with previous segments containing the same value of IIS.

1.2.1.1.4.3 Final segment. If LAS = 4, 5 or 6, the MA field shall be assembled as the final segment of the SLM frame. It shall be associated with previous segments containing the same value of IIS.

1.2.1.1.4.4 Frame completion. The frame shall be considered complete and shall be made available for further processing as soon as all segments of the frame have been received.

1.2.1.1.4.5 Frame cancellation. An incomplete SLM frame shall be cancelled if one or more of the following conditions apply:

(*a*) a new initial segment (LAS = 1) is received with the same value of IIS. In this case, the new initial segment shall be retained as the initial segment of a new SLM frame;

(*b*) the sequence of received LAS codes (after the elimination of duplicates) is not contained in the following list:

1) *LAS* = 0
2) *LAS* = 1,5
3) *LAS* = 1,2,6
4) *LAS* = 1,6,2
5) *LAS* = 1,2,3,4
6) *LAS* = 1,3,2,4
7) *LAS* = 1,2,4,3
8) *LAS* = 1,3,4,2
9) *LAS* = 1,4,2,3 and
10) *LAS* = 1,4,3,2

(*c*) *Tc* seconds have elapsed since the last Comm-A segment with the same value of IIS was received (Table 5-1).

1.2.1.1.4.6 Segment cancellation. A received segment for an SLM frame shall be discarded if it is an intermediate or final segment and no initial segment has been received with the same value of IIS.

1.2.1.1.4.7 Segment duplication. If a received segment duplicates a currently received segment number with the same value of IIS, the new segment shall replace the currently received segment.

Note.— The action of the Mode S subnetwork protocols may result in the duplicate devery of Comm-A segments.

1.2.1.2 ELM frame. An uplink ELM frame shall consist of from 20 to 160 bytes and shall be transferred from the interrogator to the transponder using the protocol defined in the Civil Aviation (Surveillance and Collision Avoidance Systems) Regulations. The first 4 bits of each uplink ELM segment (MC field) shall contain the interrogator identifier (II) code of the Mode S interrogator transmitting the ELM. The ADLP shall check the II code of each segment of a completed uplink ELM. If all of the segments contain the same II code, the II code in each segment shall be deleted and the remaining message bits retained as user data for further processing. If all of the segments do not contain the same II code, the entire uplink ELM shall be discarded.

Note.— An uplink ELM frame consists of two to sixteen associated Comm-C segments, each of which contains the 4-bit II code. Therefore, the capacity for packet transfer is 19 to 152 bytes per uplink ELM frame.

1.2.2 DOWNLINK FRAMES

1.2.2.1 SLM frame. A downlink SLM frame shall be composed of up to 4 Comm-B segments. The MB field of the first Comm-B segment of the frame shall contain a 2-bit linked Comm-B subfield (LBS, bits 1 and 2 of the MB field). This subfield shall be used to control linking of up to four Comm-B segments.

Note.— The LBS uses the first 2-bit positions in the first segment of a multi or single segment downlink SLM frame. Hence, 54 bits are available for Mode S packet data in the first segment of a downlink SLM frame. The remaining segments of the downlink SLM frame, if any, have 56 bits available.

1.2.2.1.1 LBS coding. Linking shall be indicated by the coding of the LBS subfield of the MB field of the initial Comm-B segment of the SLM frame. The coding of LBS shall be as follows:

LBS	*MEANING*
0	single segment
1	initial segment of a two-segment SLM frame
2	initial segment of a three-segment SLM frame
3	initial segment of a four-segment SLM frame

1.2.2.1.2 Linking protocol

1.2.2.1.2.1 In the Comm-B protocol, the initial segment shall be transmitted using the air-initiated or multisite-directed protocols. The LBS field of the initial segment shall indicate to the ground the number of additional segments to be transferred (if any). Before the transmission of the initial segment to the transponder, the remaining segments of the SLM frame (if any) shall be transferred to the transponder for transmission to the interrogator using the ground-initiated Comm-B protocol. These segments shall be accompanied by control codes that cause the segments to be inserted in ground-initiated Comm-B registers 2, 3 or 4, associated respectively with the second, third, or fourth segment of the frame.

1.2.2.1.2.2 Close-out of the air-initiated segment that initiated the protocol shall not be performed until all segments have been successfully transferred.

Note.— The linking procedure including the use of the ground-initiated Comm-B protocol is performed by the ADLP.

1.2.2.1.3 *Directing SLM frames.* If the SLM frame is to be multisite-directed, the ADLP shall determine the II code of the Mode S interrogator or cluster of interrogators (Schedule 2 at 1.8.1.3) that shall receive the SLM frame.

1.2.2.2 ELM FRAME

Note.— A downlink ELM consists of one to sixteen associated Comm-D segments.

1.2.2.2.1 *Procedure.* Downlink ELM frames shall be used to deliver messages greater than or equal to 28 bytes and shall be formed using the protocol defined in the Civil Aviation (Surveillance and Collision Avoidance Systems) Regulations of Schedule 2 at 1.7

1.2.2.2.2 *Directing ELM frames.* If the ELM frame is to be multisite-directed, the ADLP shall determine the II code of the Mode S interrogator or cluster of interrogators that shall receive the ELM frame.

1.2.3 *XDLP frame processing.* Frame processing shall be performed on all Mode S packets (except for the MSP packet) as specified in 1.2.3 to 1.2.5. Frame processing for Mode S specific services shall be performed as specified in 1.7.

1.2.3.1 *Packet length.* All packets (including a group of packets multiplexed into a single frame) shall be transferred in a frame consisting of the smallest number of segments needed to accommodate the packet. The user data field shall be an integral multiple of bytes in length. A 4-bit parameter (LV) shall be provided in the Mode S DATA, CALL REQUEST, CALL ACCEPT, CLEAR REQUEST and INTERRUPT packet headers so that during unpacking no additional bytes are added to the user data field. The LV field shall define the number of full bytes used in the last segment of a frame. During LV calculations, the 4-bit II code in the last segment of an uplink ELM message shall be (1) ignored for uplink ELM frames with an odd number of Comm-C segments and (2) counted for uplink ELM frames with an even number of Comm-C segments. The value contained in the LV field shall be ignored if the packet is multiplexed.

Note.— A specific length field is used to define the length of each element of a multiplexed packet. Therefore the LV field value is not used. LV field error handling is described in Schedule 3 at Tables 5-16 and 5-19.

1.2.3.2 *Multiplexing.* When multiplexing multiple Mode S packets into single SLM on ELM frame, the following procedures shall be used. Multiplexing of the packets within the ADLP shall not be applied to packets associated with SVCs of different priorities.

Note.— Multiplexing is not performed on MSP packets.

1.2.3.2.1 Multiplexing optimization

When multiple packets are awaiting transfer to the same XDLP, they shall be multiplexed into a single frame in order to optimize throughput, provided that packets associated with SVCs of different priorities are not multiplexed together.

1.2.3.2.2 *Structure.* The structure of the multiplexed packets shall be as follows:

HEADER: 6 or 8	LENGTH:8	1ST PACKET:v	LENGTH:8	2ND PSCKET:v

Note.— A number in the field signifies the field length in bits; "v" signifies that the field is of variable length.

1.2.3.2.2.1 *Multiplexing header.* The header for the multiplexed packets shall be as follows:

DP:1	MP:1	SP:2	ST:2	FILL2:0 or 2

Where,
Data packet type (DP) = 0
MSP packet type (MP) = 1
Supervisory packet (SP) = 3
Supervisory type (ST) = 2

1.2.3.2.2.2 Length. This field shall contain the length of the following packet in bytes. Any error detected in a multiplexed DATA packet, such as inconsistency between length as indicated in the LENGTH field and the length of the frame hosting that packet, shall result in the discarding of the packet unless the error can be determined to be limited to the LENGTH field, in which case a REJECT packet with the expected PS value can be sent.

1.2.3.2.2.2.1 For multiplex packets, if the entire packet cannot be de-multiplexed, then the first constituent packet shall be treated as a format error, and the remainder should be discarded.

1.2.3.2.2.3 Termination. The end of a frame containing a sequence of multiplexed packets shall be determined by one of the following events:

(*a*) a length field of all zeros; or

(*b*) less than eight bits left in the frame.

1.2.3.3 MODE S CHANNEL SEQUENCE PRESERVATION

1.2.3.3.1 Application. In the event that multiple Mode S frames from the same SVC are awaiting transfer to the same XDLP, the following procedure shall be used.

1.2.3.3.2 Procedure

1.2.3.3.2.1 *SLM frames.* SLM frames awaiting transfer shall be transmitted in the order received.

1.2.3.3.2.2 *ELM frames.* ELM frames awaiting transfer shall be transmitted in the order received.

1.2.4 GDLP FRAME PROCESSING

1.2.4.1 GENERAL PROVISIONS

1.2.4.1.1 The GDLP shall determine the data link capability of the ADLP/transponder installation from the data link capability report before performing any data link activity with that ADLP.

1.2.4.1.2 GDLP frame processing shall provide to the interrogator all data for the uplink transmission that are not provided directly by the interrogator.

1.2.4.2 *Delivery status.* GDLP frame processing shall accept an indication from the interrogator function that a specified uplink frame that was previously transferred to the interrogator has been successfully delivered over the ground-to air link.

1.2.4.3 *Aircraft address.* GDLP frame processing shall receive from the interrogator along with the data in each downlink SLM or ELM frame, the 24-bit address of the aircraft that transmitted the frame. GDLP frame processing shall be capable of transferring to the interrogator the 24-bit address of the aircraft that is to receive an uplink SLM or ELM frame.

1.2.4.4 *Mode S protocol type identification.* GDLP frame processing shall indicate to the interrogator the protocol to be used to transfer the frame: standard length message protocol, extended length message protocol or broadcast protocol.

1.2.4.5 *Frame determination.* A Mode S packet (including multiplexed packets but excluding MSP packets) intended for uplink and less than or equal to 28 bytes shall be sent as an SLM frame. A Mode S packet greater than 28 bytes shall be sent as an uplink ELM frame for transponders with ELM capability, using M-bit processing as necessary at 1.5.1.4.1. If the transponder does not have ELM capability, packets greater than 28 bytes shall be sent using the M-bit or S-bit at 1.5.1.4.2 assembly procedures as necessary and multiple SLM frames.

Note.— The Mode S DATA, CALL REQUEST, CALL ACCEPT, CLEAR REQUEST and INTERRUPT packets are the only Mode S packets that use M-bit or S-bit sequencing.

1.2.5 ADLP FRAME PROCESSING

1.2.5.1 *General provisions.* With the possible exception of the last 24 bits (address/parity), ADLP frame processing shall accept from the transponder the entire content of both 56-bit and 112-bit received uplink transmissions, excluding all call and ACAS interrogations. ADLP frame processing shall provide to the transponder all data for the downlink transmission that is not provided directly by the transponder.

1.2.5.2 *Delivery status.* ADLP frame processing shall accept an indication from the transponder that a specified downlink frame that was previously transferred to the transponder has been closed out.

1.2.5.3 *Interrogator identifier.* ADLP frame processing shall accept from the transponder, along with the data in each uplink SLM and ELM, the interrogator identifier (II) code of the interrogator that transmitted the frame. ADLP frame processing shall transfer to the transponder the II code of the interrogator or cluster of interrogators that shall receive a multisite-directed frame.

1.2.5.4 *Mode S protocol type identification.* ADLP frame processing shall indicate to the transponder the protocol to be used to transfer the frame: ground-initiated, air-initiated, broadcast, multisite-directed, standard length or extended length.

1.2.5.5 *Frame cancellation.* ADLP frame processing shall be capable of cancelling downlink frames previously transferred to the transponder for transmission but for which a close-out has not been indicated. If more than one frame is stored within the transponder, the cancellation procedure shall be capable of cancelling the stored frames selectively.

1.2.5.6 *Frame determination.* A Mode S packet (including multiplexed packets but excluding MSP packets) intended for downlink and less than or equal to 222 bits shall be sent as an SLM frame. A Mode S packet greater than 222 bits shall be sent as a downlink ELM frame for transponders with ELM capability using M-bit processing as necessary. When M-bit processing is used, all ELM frames containing M = 1 shall contain the maximum number of ELM segments that the transponder is capable of transmitting in response to one requesting interrogation (UF = 24). If the transponder does not have ELM capability, packets greater than 222 bits shall be sent using the M-bit or S-bit assembly procedures and multiple SLM frames.

1.2.6 PRIORITY MANAGEMENT

1.2.6.1 *ADLP priority management.* Frames shall be transferred from the ADLP to the transponder in the following order of priority (highest first):
(*a*) Mode S specific services;
(*b*) search requests;
(*c*) frames containing only high priority SVC packets; and
(*d*) frames containing only low priority SVC packets.

1.2.6.2 GDLP PRIORITY MANAGEMENT

Uplink frames shall be transferred in the following order of priority (highest first):

(*a*) Mode S specific services;

(*b*) frames containing at least one Mode S ROUTE packet;

(*c*) frames containing at least one high priority SVC packet; and

(*d*) frames containing only low priority SVC packets.

1.3 Data exchange interfaces

1.3.1 THE DTE ISO 8208 INTERFACE

1.3.1.1 *General provisions.* The interface between the XDLP and the DTE(s) shall conform to ISO 8208 packet layer protocol (PLP). The XDLP shall support the procedures of the DTE as specified in ISO 8208. As such, the XDLP shall contain a DCE.

1.3.1.2 *Physical and link layer requirements for the DTE/DCE interface. The requirements are:*

(*a*) the interface shall be code and byte independent and shall not impose restrictions on the sequence, order, or pattern of the bits transferred within a packet; and

(*b*) the interface shall support the transfer of variable length network layer packets.

1.3.1.3 DTE ADDRESS

1.3.1.3.1 Ground DTE address. The ground DTE address shall have a total length of 3 binary coded decimal (BCD) digits, as follows:

$X_0X_1X_2$

X_0 shall be the most significant digit. Ground DTE addresses shall be decimal numbers in the range of 0 through 255 coded in BCD. Assignment of the DTE address shall be a local issue. All DTEs connected to GDLPs having overlapping coverage shall have unique addresses. GDLPs which have a flying time less than Tr (Table 5-1) between their coverage areas shall be regarded as having overlapping coverage.

1.3.1.3.2 Mobile DTE address. The mobile DTE address shall have a total length of 10 BCD digits, as follows:

$X_0X_1X_2X_3X_4X_5X_6X_7X_8X_9$

X_0 shall be the most significant digit. The digits X_0 to X_7 shall contain the octal representation of the aircraft address coded in BCD. The digits X_8X_9 shall identify a sub-address for specific DTEs on board an aircraft. This sub-address shall be a decimal number in the range of 0 and 15 coded in BCD. The following sub-address assignments shall be used:

00	ATN router
01 to 15	Unassigned

1.3.1.3.3 Illegal DTE addresses. DTE addresses outside of the defined ranges or not conforming to the formats for the ground and mobile DTE addresses specified in 1.3.1.3.1 and 1.3.1.3.2 shall be defined to be illegal DTE addresses. The detection of an illegal DTE address in a CALL REQUEST packet shall lead to a rejection of the call as specified in 1.5.1.5.

1.3.1.3.4 PACKET LAYER PROTOCOL REQUIREMENTS OF THE DTE/DCE INTERFACE

1.3.1.4.1 Capabilities. The interface between the DTE and the DCE shall conform to ISO 8208 with the following capabilities:

(*a*) expedited data delivery, i.e. the use of INTERRUPT packets with a user data field of up to 32 bytes;
(*b*) priority facility (with two levels);
(*c*) fast select; and
(*d*) Called/calling address extension facility, if required by local conditions (i.e. the XDLP is connected to the DTE via a network protocol that is unable to contain the Mode S address as defined). Other ISO 8208 facilities and the D-bit and the Q-bit shall not be invoked for transfer over the Mode S packet layer protocol.

1.3.1.4.2 Parameter values. The timer and counter parameters for the DTE/DCE interface shall conform to the default ISO 8208 values.

1.3.2 MODE S SPECIFIC SERVICES INTERFACE

Note.— Mode S specific services consist of the broadcast Comm-A and Comm-B, GICB and MSP.

1.3.2.1 ADLP

1.3.2.1.1 General provisions. The ADLP shall support the accessing of Mode S specific services through the provision of one or more separate ADLP interfaces for this purpose.

1.3.2.1.2 Functional capability. Message and control coding via this interface shall support all of the capabilities specified in 1.7.1.

1.3.2.2 GDLP

1.3.2.2.1 General provisions. The GDLP shall support the accessing of Mode S specific services through the provision of a separate GDLP interface for this purpose and/or by providing access to these services through the DTE/DCE interface.

1.3.2.2.2 Functional capability. Message and control coding via this interface shall support all of the capabilities specified in 1.7.2.

1.3.1 ADLP/TRANSPONDER INTERFACE

1.3.1.1 TRANSPONDER TO ADLP

1.3.1.1.1 The ADLP shall accept an indication of protocol type from the transponder in connection with data transferred from the transponder to the ADLP. This shall include the following types of protocols:

(*a*) surveillance interrogation;
(*b*) Comm-A interrogation;
(*c*) Comm-A broadcast interrogation; and
(*d*) Comm-A broadcast interrogation; and
(*e*) uplink ELM.

The ADLP shall also accept the II code of the interrogator used to transmit the surveillance, Comm-A or uplink ELM.

Note.— Transponders will not output all-call and ACAS information on this interface.

1.3.1.1.2 The ADLP shall accept control information from the transponder indicating the status of downlink transfers. This shall include:

(*a*) Comm-B close-out;
(*b*) Comm-B broadcast timeout; and
(*c*) downlink ELM close-out.

1.3.1.1.3 The ADLP shall have access to current information defining the communication capability of the Mode S transponder with which it is operating. This information shall be used to generate the data link capability report.

1.3.1.2 ADLP TO TRANSPONDER

1.3.1.2.1 The ADLP shall provide an indication of protocol type to the transponder in connection with data transferred from the ADLP to the transponder. This shall include the following types of protocols:

(*a*) ground-initiated Comm-B;
(*b*) air-initiated Comm-B;
(*c*) multisite-directed Comm-B;
(*d*) Comm-B broadcast;
(*e*) downlink ELM; and
(*f*) multisite-directed downlink ELM.

The ADLP shall also provide the II code for transfer of a multisite-directed Comm-B or downlink ELM and the Comm-B data selector (BDS) code in the Civil Aviation (Surveillance and Collision Avoidance Systems) Regulations for a ground-initiated Comm-B.

1.3.1.2.2 The ADLP shall be able to perform frame cancellation as specified in 1.2.5.5.

1.3.2 GDLP/MODE S INTERROGATOR INTERFACE

1.3.2.1 INTERROGATOR TO GDLP

1.3.2.1.1 The GDLP shall accept an indication of protocol type from the interrogator in connection with data transferred from the interrogator to the GDLP. This shall include the following types of protocols:

(*a*) ground-initiated Comm-B;
(*b*) air-initiated Comm-B;
(*c*) air-initiated Comm-B broadcast; and
(*d*) downlink ELM.

The GDLP shall also accept the BDS code used to identify the ground-initiated Comm-B segment.

1.3.2.1.2 The GDLP shall accept control information from the interrogator indicating the status of uplink transfers and the status of the addressed Mode S aircraft.

1.3.2.2 GDLP to interrogator. The GDLP shall provide an indication of protocol type to the interrogator in connection with data transferred from the GDLP to the interrogator. This shall include the following types of protocols:

(*a*) Comm-A interrogation;
(*b*) Comm-A broadcast interrogation;
(*c*) uplink ELM; and
(*d*) ground-initiated Comm-B request.

The GDLP shall also provide the BDS code for the ground-initiated Comm-B protocol.

1.4 DCE operation

Note.— The DCE process within the XDLP acts as a peer process to the DTE. The DCE supports the operations of the DTE with the capability specified in 1.3.1.4. The following requirements do not specify format definitions and flow control on the DTE/DCE interface. The specifications and definitions in ISO 8208 apply for these cases.

1.4.1 *State transitions.* The DCE shall operate as a State machine. Upon entering a State, the DCE shall perform the actions specified in Table 5-2. State transitions and additional action(s) shall be as specified in Table 5-3 through Table 5-12.

Note.— The next State transition (if any) that occurs when the DCE receives a packet from the DTE is specified by Table 5-3 through Table 5-8. These tables are organized according to the hierarchy illustrated in Figure 5-2. The same transitions are defined in Table 5-9 through Table 5-12 when the DCE receives a packet from the XDCE (via the reformatting process).

1.4.2 DISPOSITION OF PACKETS

1.4.2.1 Upon receipt of a packet from the DTE, the packet shall be forwarded or not forwarded to the XDCE (via the reformatting process) according to the parenthetical instructions contained in Tables 5-3 to 5-8. If no parenthetical instruction is listed or if the parenthetical instruction indicates "do not forward", the packet shall be discarded.

1.4.2.2 Upon receipt of a packet from the XDCE (via the reformatting process), the packet shall be forwarded or not forwarded to the DTE according to the parenthetical instructions contained in Tables 5-9 to 5-12. If no parenthetical instruction is listed or if the parenthetical instruction indicates "do not forward", the packet shall be discarded.

1.5 Mode S packet layer processing

1.5.1 GENERAL REQUIREMENTS

1.5.1.1 *BUFFER REQUIREMENTS*

1.5.1.1.1 *ADLP buffer requirements*

1.5.1.1.1.1 The following requirements apply to the entire ADLP and shall be interpreted as necessary for each of the main processes (DCE, reformatting, ADCE, frame processing and SSE).

1.5.1.1.1.2 The ADLP shall be capable of maintaining sufficient buffer space for fifteen SVCs:

(*a*) maintain sufficient buffer space to hold fifteen Mode S subnetwork packets of 152 bytes each in the uplink direction per SVC for a transponder with uplink ELM capability or 28 bytes otherwise;

(*b*) maintain sufficient buffer space to hold fifteen Mode S subnetwork packets of 160 bytes each in the downlink direction per SVC for a transponder with downlink ELM capability or 28 bytes otherwise;

(*c*) maintain sufficient buffer space for two Mode S subnetwork INTERRUPT packets of 35 bytes each (user data field plus control information), one in each direction, for each SVC;

(*d*) maintain sufficient resequencing buffer space for storing thirty-one Mode S subnetwork packets of 152 bytes each in the uplink direction per SVC for a transponder with uplink ELM capability or 28 bytes otherwise; and

(*e*) maintain sufficient buffer space for the temporary storage of at least one Mode S packet of 160 bytes undergoing M-bit or S-bit processing in each direction per SVC.

1.5.1.1.1.3 The ADLP shall be capable of maintaining a buffer of 1 600 bytes in each direction to be shared among all MSPs.

1.5.1.1.2 GDLP buffer requirements

1.5.1.1.2.1 The GDLP shall be capable of maintaining sufficient buffer space for an average of 4 SVCs for each Mode S aircraft in the coverage area of the interrogators connected to it, assuming all aircraft have ELM capability.

1.5.1.2 CHANNEL NUMBER POOLS

1.5.1.2.1 The XDLP shall maintain several SVC channel number pools; the DTE/DCE (ISO 8208) interface uses one set. Its organization, structure and use shall be as defined in the ISO 8208 standard. The other channel pools shall be used on the ADCE/GDCE interface.

1.5.1.2.2 The GDLP shall manage a pool of temporary channel numbers in the range of 1 to 3, for each ground DTE/ADLP pair. Mode S CALL REQUEST packets generated by the GDLP shall contain the ground DTE address and a temporary channel number allocated from the pool of that ground DTE. The GDLP shall not reuse a temporary channel number allocated to an SVC that is still in the CALL REQUEST State.

Note 1.— The use of temporary channel numbers allows the GDLP to have up to three call requests in process at the same time for a particular ground DTE and ADLP combination. It also allows the GDLP or ADLP to clear a channel before the permanent channel number is assigned.

Note 2.— The ADLP may be in contact with multiple ground DTEs at any one time. All the ground DTEs use temporary channel numbers ranging from 1 to 3.

1.5.1.2.3 The ADLP shall use the ground DTE address to distinguish the temporary channel numbers used by the various ground DTEs. The ADLP shall assign a permanent channel number (in the range of 1 to 15) to all SVCs and shall inform the GDLP of the assigned number by including it in the Mode S CALL REQUEST by ADLP or Mode S CALL ACCEPT by ADLP packets. The temporary channel number shall be included in the Mode S CALL ACCEPT by ADLP together with the permanent channel number in order to define the association of these channel numbers. The ADLP shall continue to associate the temporary channel number with the permanent channel number of an SVC until the SVC is returned to the READY (p1) State, or else, while in the DATA TRANSFER (*p*4) State, a Mode S CALL REQUEST by GDLP packet is received bearing the same temporary channel number. A non-zero permanent channel number in the Mode S CLEAR REQUEST by ADLP, CLEAR REQUEST by GDLP, CLEAR CONFIRMATION by ADLP or CLEAR CONFIRMATION by GDLP packet shall indicate that the permanent channel number shall be used and the temporary channel number shall be ignored. In the event that an XDLP is required to send one of these packets in the absence of a permanent channel number, the permanent channel number shall be set to zero, which shall indicate to the peer XDLP that the temporary channel number is to be used.

1.5.1.2.4 The channel number used by the DTE/DCE interface and that used by the ADCE/GDCE interface shall be assigned independently. The reformatting process shall maintain an association table between the DTE/DCE and the ADCE/GDCE channel numbers.

1.5.1.3 *Receive ready and receive not ready conditions.* The ISO 8208 interface and the ADCE/GDCE interface management procedures shall be independent operations since each system must be able to respond to separate receive ready and receive not ready indications.

1.5.1.4 PROCESSING OF M-BIT AND S-BIT SEQUENCE

Note.— M-bit processing applies to the sequencing of the DATA packet. S-bit processing applies to the sequencing of Mode S CALL REQUEST, CALL ACCEPT, CLEAR REQUEST and INTERRUPT packets.

1.5.1.4.1 M-bit processing

Note.— The packet size used on the DTE/DCE interface can be different from that used on the ADCE/GDCE interface.

1.5.1.4.1.1 M-bit processing shall be used when DATA packets are reformatted. M-bit processing shall utilize the specifications contained in the ISO 8208 standard. The M-bit sequence processing shall apply on a per channel basis. The M-bit set to 1 shall indicate that a user data field continues in the subsequent DATA packet.

Subsequent packets in an M-bit sequence shall use the same header format (i.e. the packet format excluding the user data field).

1.5.1.4.1.2 If the packet size for the XDCE interface is larger than that used on the DTE/DCE interface, packets shall be combined to the extent possible as dictated by the M-bit, when transmitting a Mode S DATA packet. If the packet size is smaller on the XDCE interface than that defined on the DTE/DCE interface, packets shall be fragmented to fit into the smaller Mode S packet using M-bit assembly.

1.5.1.4.1.3 A packet shall be combined with subsequent packets if the packet is filled and more packets exist in the M-bit sequence (M-bit = 1).

A packet smaller than the maximum packet size defined for this SVC (partial packet) shall only be allowed when the M-bit indicates the end of an M-bit sequence. A received packet smaller than the maximum packet size with M-bit equal to 1 shall cause a reset to be generated as specified in ISO 8208 and the remainder of the sequence should be discarded.

1.5.1.4.1.4 In order to decrease delivery delay, reformatting shall be performed on the partial receipt of an M-bit sequence, rather than delay reformatting until the complete M-bit sequence is received.

1.5.1.4.2 *S-bit processing.* S-bit processing shall apply only to Mode S CALL REQUEST, CALL ACCEPT, CLEAR REQUEST and INTERRUPT packets. This processing shall be performed as specified for M-bit processing (1.5.1.4.1) except that the packets associated with any S-bit sequence whose reassembly is not completed in Tq seconds (Tables 5-1 and 5-13) shall be discarded (1.6.3.6, 1.6.4.5 and 1.6.9) and receipt of a packet shorter than the maximum packet size with S = 1 shall cause the entire S-bit sequence to be treated as a format error in accordance with Table 2.2-16.

1.5.1.5 MODE S SUBNETWORK ERROR PROCESSING FOR ISO 8208 PACKETS

1.5.1.5.1 *D-bit.* If the XDLP receives a DATA packet with the D-bit set to 1, the XDLP shall send a RESET REQUEST packet to the originating DTE containing a cause code (CC) = 133 and a diagnostic code (DC) = 166. If the D-bit is set to 1 in a CALL REQUEST packet, the D-bit shall be ignored by the XDLP. The D-bit of the corresponding CALL ACCEPT packet shall always be set to 0. The use of CC is optional.

1.5.1.5.2 *Q-bit.* If the XDLP receives a DATA packet with the Q-bit set to 1, the XDLP shall send a RESET REQUEST packet to the originating DTE containing CC = 133 and DC = 83. The use of CC is optional.

1.5.1.5.3 *Invalid priority.* If the XDLP receives a call request with a connection priority value equal to 2 through 254, the XDLP shall clear the virtual circuit using DC = 66 and CC = 131. The use of CC is optional.

1.5.1.5.4 *Unsupported facility.* If the XDLP receives a call request with a request for a facility that it cannot support, the XDLP shall clear the virtual circuit using DC = 65 and C = 131. The use of CC is optional.

1.5.1.5.5 *Illegal calling DTE address.* If the XDLP receives a call request with an illegal calling DTE address, the XDLP shall clear the virtual circuit using DC = 68 and CC = 141. The use of CC is optional.

1.5.1.5.6 *Illegal called DTE address.* If the XDLP receives a call request with an illegal called DTE address, the XDLP shall clear the virtual circuit using DC = 67 and CC = 141. The use of CC is optional.

1.5.2 REFORMATTING PROCESS

Note.— The reformatting process is divided into two subprocesses: uplink formatting and downlink formatting. For the ADLP, the uplink process reformats Mode S packets into ISO 8208 packets and the downlink process reformats ISO 8208 packets into Mode S packets. For the GDLP, the uplink process reformats ISO 8208 packets into Mode S packets and the downlink process reformats Mode S packets into ISO 8208 packets.

1.5.2.1 CALL REQUEST BY ADLP

1.5.2.1.1 *Translation into Mode S packets*

1.5.2.1.1.1 Translated packet format. Reception by the ADLP reformatting process of an ISO 8208 CALL REQUEST packet from the local DCE shall result in the generation of corresponding Mode S CALL REQUEST by ADLP packet(s) (as determined by S-bit processing (1.5.1.4.2)) as follows:

DP:1	MP:1	SP:2	ST:2	FILL2:0 or 2	P:1	FILL:1	SN:6	CH:4	AM:4	AG:8	S:1	FS:2	F:1	LV:4	UD:v

1.5.2.1.1.2 *Data packet type (DP).* This field shall be set to 0.

1.5.2.1.1.3 *MSP packet type (MP).* This field shall be set to 1.

1.5.2.1.1.4 *Supervisory packet (SP).* This field shall be set to 1.

1.5.2.1.1.5 *Supervisory type (ST).* This field shall be set to 0.

1.5.2.1.1.6 *Priority (P).* This field shall be set to 0 for a low priority SVC and to 1 for a high priority SVC. The value for this field shall be obtained from the data transfer field of the priority facility of the ISO 8208 packet, and shall be set to 0 if the ISO 8208 packet does not contain the priority facility or if a priority of 255 is specified. The other fields of the priority facility shall be ignored.

1.5.2.1.1.7 *Sequence number (SN).* For a particular SVC, each packet shall be numbered.

1.5.2.1.1.8 *Channel number (CH).* The channel number shall be chosen from the pool of SVC channel numbers available to the ADLP. The pool shall consist of 15 values from 1 through 15. The highest available channel number shall be chosen from the pool. An available channel shall be defined as one in State p1. The correspondence between the channel number used by the Mode S subnetwork and the number used by the DTE/DCE interface shall be maintained while the channel is active.

1.5.2.1.1.9 *Address, mobile (AM).* This address shall be the mobile DTE sub-address in the range of 0 to 15. The address shall be extracted from the two least significant digits of the calling DTE address contained in the ISO 8208 packet and converted to binary representation.

1.5.2.1.1.10 *Address, ground (AG).* This address shall be the ground DTE address in the range of 0 to 255. The address shall be extracted from the called DTE address contained in the ISO 8208 packet and converted to binary representation.

1.5.2.1.1.11 *Fill field.* The fill field shall be used to align subsequent data fields on byte boundaries. When indicated as "FILL:n", the fill field shall be set to a length of "n" bits. When indicated as "FILL1: 0 or 6", the fill field shall be set to a length of 6 bits for a non-multiplexed packet in a downlink SLM frame and 0 bit for all other cases. When indicated as "FILL2: 0 or 2", the fill field shall be set to a length of 0 bit for a non-multiplexed packet in a downlink SLM frame or for a multiplexing header and 2 bits for all other cases.

1.5.2.1.1.12 *S field (S).* A value of 1 shall indicate that the packet is part of an S-bit sequence with more packets in the sequence to follow. A value of 0 shall indicate that the sequence ends with this packet. This field shall be set as specified in 1.5.1.4.2

1.5.2.1.1.13 *FS field (FS).* A value of 0 shall indicate that the packet does not contain fast select data. A value of 2 or 3 shall indicate that the packet contains fast select data. A value of 2 shall indicate normal fast select operation. A value of 3 shall indicate fast select with restricted response. An FS value of 1 shall be undefined.

1.5.2.1.1.14 *First packet flag (F).* This field shall be set to 0 in the first packet of an S-bit sequence and in a packet that is not part of an S-bit sequence. Otherwise it shall be set to 1.

1.5.2.1.1.15 *User data length (LV).* This field shall indicate the number of full bytes used in the last SLM or ELM segment.

1.5.2.1.1.16 *User data field (UD).* This field shall only be present if optional CALL REQUEST user data (maximum 16 bytes) or fast select user data (maximum 128 bytes) is contained in the ISO 8208 packet. The user data field shall be transferred from ISO 8208 packet unchanged using S-bit processing as specified in 1.5.1.4.2

1.5.2.1.2 *Translation into ISO 8208 packets*

1.5.2.1.2.1 *Translation.* Reception by the GDLP reformatting process of a Mode S CALL REQUEST by ADLP packet (or an S-bit sequence of packets) from the GDCE shall result in the generation of a corresponding ISO 8208 CALL REQUEST packet to the local DCE. The translation from the Mode S packet to the ISO 8208 packet shall be the inverse of the processing defined in 1.5.2.1.1 with the exceptions as specified in 1.5.2.1.2.2

1.5.2.1.2.2 *Called DTE, calling DTE address and length fields.* The calling DTE address shall be composed of the aircraft address and the value contained in the AM field of the Mode S packet, converted to BCD. The called DTE address shall be the ground DTE address contained in the AG field of the Mode S packet, converted to BCD. The length field shall be as defined in ISO 8208.

1.5.2.2 *CALL REQUEST BY GDLP*

1.5.2.2.1 *Translation into Mode S packets*

1.5.2.2.1.1 General. Reception by the GDLP reformatting process of an ISO 8208 CALL REQUEST packet from the local DCE shall result in the generation of corresponding Mode S CALL REQUEST by GDLP packet(s) (as determined by S-bit processing (1.5.1.4.2)) as follows:

DP:1	MP:1	SP:2	ST:2	FILL2:0	P:1	FILL:1	SN:6	FILL:2	TC:2	AM:4	AG:8	S:1	FS:2	F:1	LV:4	UD:v

Fields shown in the packet format and not specified in the following paragraphs shall be set as specified in 1.5.2.1.1.

1.5.2.2.1.2 *Data packet type (DP).* This field shall be set to 0.

1.5.2.2.1.3 *MSP packet type (MP).* This field shall be set to 1.

1.5.2.2.1.4 *Supervisory packet (SP).* This field shall be set to 1.

1.5.2.2.1.5 *Supervisory type (ST).* This field shall be set to 0.

1.5.2.2.1.6 *Temporary channel number field (TC).* This field shall be used to distinguish multiple call requests from a GDLP. The ADLP reformatting process, upon receipt of a temporary channel number, shall assign a channel number from those presently in the READY State, *p*1.

1.5.2.2.1.7 *Address, ground (AG).* This address shall be the ground DTE address (in the range of 0 to 255. The address shall be extracted from the calling DTE address contained in the ISO 8208 packet and converted to binary representation.

1.5.2.2.1.8 *Address, mobile (AM).* This address shall be the mobile DTE sub-address in the range of 0 to 15. The address shall be extracted from the two least significant digits of the called DTE address contained in the ISO 8208 packet and converted to binary representation.

1.5.2.2.2 *Translation into ISO 8208 packets*

1.5.2.2.2.1 *Translation.* Reception by the ADLP reformatting process of a Mode S CALL REQUEST by GDLP packet (or an S-bit sequence of packets) from the ADCE shall result in the generation of a corresponding ISO 8208 CALL REQUEST packet to the local DCE. The translation from the Mode S packet to the ISO 8208 packet shall be the inverse of the processing defined in 1.5.2.2.1 with the exceptions as specified in 1.5.2.2.2.2.

1.5.2.2.2.2 *Called DTE, calling DTE address and length fields.* The called DTE address shall be composed of the aircraft address and the value contained in the AM field of the Mode S packet, converted to BCD. The calling DTE address shall be the ground DTE address contained in the AG field of the Mode S packet, converted to BCD. The length field shall be as defined in ISO 8208.

1.5.2.3 *CALL ACCEPT BY ADLP*

1.5.2.3.1 *Translation into Mode S packets*

1.5.2.3.1.1 *Translated packet format.* Reception by the ADLP reformatting process of an ISO 8208 CALL ACCEPT packet from the local DCE shall result in the generation of corresponding Mode S CALL ACCEPT by ADLP packet(s) (as determined by S-bit processing (1.5.1.4.2)) as follows:

DP:1	MP:1	SP:2	ST:2	FILL2:0 or 2	TC:2	SN:6	CH:4	AM:4	AG:8	S:1	FILL:2	F:1	LV:4	UD:v

Fields shown in the packet format and not specified in the following paragraphs shall be set as specified in 1.5.2.1

1.5.2.3.1.2 *Data packet type (DP).* This field shall be set to 0.

1.5.2.3.1.3 *MSP packet type (MP).* This field shall be set to 1.

1.5.2.3.1.4 *Supervisory packet (SP).* This field shall be set to 1.

1.5.2.3.1.5 *Supervisory type (ST).* This field shall be set to 1.

1.5.2.3.1.6 *Temporary channel number (TC).* The TC value in the originating Mode S CALL REQUEST by GDLP packet shall be returned to the GDLP along with the channel number (CH) assigned by the ADLP.

1.5.2.3.1.7 *Channel number (CH).* The field shall be set equal to the channel number assigned by the ADLP as determined during the CALL REQUEST procedures for the Mode S connection.

1.5.2.3.1.8 *Address, mobile and address, ground.* The AM and AG values in the originating Mode S CALL REQUEST by GDLP packet shall be returned in these fields. When present, DTE addresses in the ISO 8208 CALL ACCEPT packet shall be ignored.

1.5.2.3.2 *Translation into ISO 8208 packets*

1.5.2.3.2.1 *Translation.* Reception by the GDLP reformatting process of a Mode S CALL ACCEPT by ADLP packet (or an S-bit sequence of packets) from the GDCE shall result in the generation of a corresponding ISO 8208 CALL ACCEPT packet to the local DCE. The translation from the Mode S packet to the ISO 8208 packet shall be the inverse of the processing defined in 1.5.2.3.1 with the exceptions as specified in 1.5.2.3.2.2.

Called DTE, calling DTE address and length fields. Where present, the called DTE address shall be composed of the aircraft address and the value contained in the AM field of the Mode S packet, converted to BCD. Where present, the calling DTE address shall be the ground DTE address contained in the AG field of the Mode S packet, converted to BCD. The length field shall be as defined in ISO 8208.

1.5.2.4 CALL ACCEPT BY GDLP

1.5.2.4.1 *Translation into Mode S packets*

1.5.2.4.1.1 *Translated packet format.* Reception by the GDLP reformatting process of an ISO 8208 CALL ACCEPT packet from the local DCE shall result in the generation of corresponding Mode S CALL ACCEPT by GDLP packet(s) (as determined by S-bit processing (1.5.1.4.2)) as follows:

DP:1	MP:1	SP:2	ST:2	FILL:2	FILL:2	SN:6	CH:4	AM:4	AG:8	S:1	FILL:2	F:1	LV:4	UD:v

Fields shown in the packet format and not specified in the following paragraphs shall be set as specified in 2.2.2.1.

1.5.2.4.1.2 *Data packet type (DP).* This field shall be set to 0.

1.5.2.4.1.3 *MSP packet type (MP).* This field shall be set to 1.

1.5.2.4.1.4 *Supervisory packet (SP).* This field shall be set to 1.

1.5.2.4.1.5 *Supervisory type (ST).* This field shall be set to 1.

1.5.2.4.1.6 *Address, mobile and address, ground.* The AM and AG values in the originating Mode S CALL REQUEST by ADLP packet shall be returned in these fields. When present, DTE addresses in the ISO 8208 CALL ACCEPT packet shall be ignored.

1.5.2.4.2 *Translation into ISO 8208 packets*

1.5.2.4.2.1 *Translation.* Reception by the ADLP reformatting process of a Mode S CALL ACCEPT by GDLP packet (or an S-bit sequence of packets) from the ADCE shall result in the generation of a corresponding ISO 8208 CALL ACCEPT packet to the local DCE. The translation from the Mode S packet to the ISO 8208 packet shall be the inverse of the processing defined in 2.2.2.4.1 with the exceptions as specified in 2.2.4.2.2.

1.5.2.4.2.2 *Called DTE, calling DTE address and length fields.* Where present, the calling DTE address shall be composed of the aircraft address and the value contained in the AM field of the Mode S packet, converted to BCD. Where present, the called DTE address shall be the ground DTE address contained in the AG field of the Mode S packet, converted to BCD. The length field shall be as defined in ISO 8208.

1.5.2.5 *CLEAR REQUEST BY ADLP*

1.5.2.5.1 *Translation into Mode S packets*

1.5.2.5.1.1 *Translated packet format.* Reception by the ADLP reformatting process of an ISO 8208 CLEAR REQUEST packet from the local DCE shall result in the generation of a corresponding Mode S CLEAR REQUEST by ADLP packet(s) (as determined by S-bit processing (1.5.1.4.2)) as follows:

DP:1	MP:1	SP:2	ST:2	FILL2:0 or 2	TC:2	SN:6	CH:4	AM:4	AG:8	CC:8	DC:8	S:1	FILL:2	P:1	LV:4	UD:v

1.5.2.5.1.2 *Data packet type (DP).* This field shall be set to 0.

1.5.2.5.1.3 *MSP packet type (MP).* This field shall be set to 1.

1.5.2.5.1.4 *Supervisory packet (SP).* This field shall be set to 1.

1.5.2.5.1.5 *Channel number (CH)*: If a channel number has been allocated during the call acceptance phase, then CH shall be set to that value, otherwise it shall be set to zero.

1.5.2.5.1.6 *Temporary channel (TC)*: If a channel number has been allocated during the call acceptance phase, then TC shall be set to zero, otherwise it shall be set to the value used in the CALL REQUEST by GDLP.

1.5.2.5.1.7 *Supervisory type (ST).* This field shall be set to 2.

1.5.2.5.1.8 *Address, ground or address, mobile.* The AG and AM values in the originating Mode S CALL REQUEST by ADLP or CALL REQUEST by GDLP packets shall be returned in these fields. When present, DTE addresses in the ISO 8208 CLEAR REQUEST packet shall be ignored.

1.5.2.5.1.9 *Clearing cause (CC) and diagnostic code (DC) fields.* These fields shall be transferred without modification from the ISO 8208 packet to the Mode S packet when the DTE has initiated the clear procedure. If the XDLP has initiated the clear procedure, the clearing cause field and diagnostic field shall be as defined in the State tables for the DCE and XDCE -The coding and definition of these fields shall be as specified in ISO 8208.

1.5.2.5.2 *Translation into ISO 8208 packets*

1.5.2.5.2.1 *Translation.* Reception by the GDLP reformatting process of a Mode S CLEAR REQUEST by ADLP packet (or an S-bit sequence of packets) from the local GDCE shall result in the generation of a corresponding ISO 8208 CLEAR REQUEST packet to the local DCE. The translation from the Mode S packet to the ISO 8208 packet shall be the inverse of the processing defined in 1.5.2.5.1 with the exceptions specified in 1.5.2.5.2.2 and 1.5.2.5.2.3.

1.5.2.5.2.2 *Called DTE, calling DTE and length fields.* These fields shall be omitted in the ISO 8208 CLEAR REQUEST packet.

1.5.2.5.2.3 *Clearing cause field.* This field shall be set taking account of 2.3.3.3.

1.5.2.6 *CLEAR REQUEST BY GDLP*

1.5.2.6.1 *Translation into Mode S packets*

1.5.2.6.1.1 *Translated packet format.* Reception by the GDLP reformatting process of an ISO 8208 CLEAR REQUEST packet from the local DCE shall result in the generation of corresponding Mode S CLEAR REQUEST by GDLP packet(s) (as determined by S-bit processing (1.5.1.4.2)) as follows:

DP:1	MP:1	SP:2	ST:2	FILL2:0	TC:2	SN:6	CH:4	AM:4	AG:8	CC:8	DC:8	S:1	FILL:2	F:1	LV:4	UD:v

Fields shown in the packet format and not specified in the following paragraphs shall be set as specified in 1.5.2.1, 1.5.2.2 and 1.5.2.5.

1.5.2.6.1.2 *Data packet type (DP).* This field shall be set to 0.

1.5.2.6.1.3 *MSP packet type (MP).* This field shall be set to 1.

1.5.2.6.1.4 *Supervisory packet (SP).* This field shall be set to 1.

1.5.2.6.1.5 *Channel number (CH): If a channel number has been allocated during the call acceptance phase, then CH shall be set to that value, otherwise it shall be set to zero.*

1.5.2.6.1.6 *Temporary channel (TC):* If a channel number has been allocated during the call acceptance phase, then TC shall be set to zero, otherwise it shall be set to the value used in the CALL REQUEST by GDLP.

1.5.2.6.1.7 *Supervisory type (ST).* This field shall be set to 2.

1.5.2.6.2 *Translation into ISO 8208 packets*

1.5.2.6.2.1 *Translation.* Reception by the ADLP reformatting process of a Mode S CLEAR REQUEST by GDLP packet (or an S-bit sequence of packets) from the local ADCE shall result in the generation of a corresponding ISO 8208 CLEAR REQUEST packet to the local DCE. The translation from the Mode S packet to the ISO 8208 packet shall be the inverse of the processing defined in 1.5.2.6.1.

1.5.2.6.2.2 *Called DTE, calling DTE and length fields.* These fields shall be omitted in the ISO 8208 CLEAR REQUEST packet.

1.5.2.7 *DATA*

1.5.2.7.1 *Translation into Mode S packets*

1.5.2.7.1.1 *Translated packet format.* Reception by the XDLP reformatting process of ISO 8208 DATA packet(s) from the local DCE shall result in the generation of corresponding Mode S DATA packet(s) as determined by M-bit processing (1.5.1.4.1), as follows:

DP:1	M:1	SN:6	FILL1:0 or 6	PS:4	PR:4	CH:4	LV:4	UD:v

1.5.2.7.1.2 *Data packet type (DP).* This field shall be set to 1.

1.5.2.7.1.3 *M field (M).* A value of 1 shall indicate that the packet is part of an M-bit sequence with more packets in the sequence to follow. A value of 0 shall indicate that the sequence ends with this packet. The appropriate value shall be placed in the M-bit field of the Mode S packet.

1.5.2.7.1.4 *Sequence number (SN).* The sequence number field shall be set as specified in 1.5.2.1.1.7

1.5.2.7.1.5 *Packet send sequence number (PS).* The packet send sequence number field shall be set as specified in.2.3.4.4.

1.5.2.7.1.6 *Packet receive sequence number (PR).* The packet receive sequence number field shall be set as specified in 2.3.4.4.

1.5.2.7.1.7 *Channel number (CH).* The channel number field shall contain the Mode S channel number that corresponds to the incoming ISO 8208 DATA packet channel number.

1.5.2.7.1.8 *User data length (LV).* This field shall indicate the number of full bytes used in the last SLM or ELM segment as defined in 1.2.3.1.

1.5.2.7.1.9 *Fill (FILL1).* This field shall be set as specified in 1.5.2.1.1.11

1.5.2.7.1.10 *User data (UD).* The user data shall be transferred from the ISO 8208 packet to the Mode S packet utilizing the M-bit packet assembly processing as required.

1.5.2.7.2 *Translation into ISO 8208 packets.* Reception by the XDLP reformatting process of Mode S DATA packet(s) from the local XDCE shall result in the generation of corresponding ISO 8208 DATA packet(s) to the local DCE. The translation from Mode S packet(s) to the ISO 8208 packet(s) shall be the inverse of the processing defined in 1.5.2.7.1

1.5.2.8 *INTERRUPT*

1.5.2.8.1 *Translation into Mode S packets*

1.5.2.8.1.1 *Translated packet format.* Reception by the XDLP reformatting process of an ISO 8208 INTERRUPT packet from the local DCE shall result in the generation of corresponding Mode S INTERRUPT packet(s) (as determined by S-bit processing (1.5.1.4.2)) as follows:

DP:1	MP:1	SP:2	ST:2	FILL2:0 or 2	S:1	F:4	SN:6	CH:4	LV:4	UD:v

Fields shown in the packet format and not specified in the following paragraphs shall be set as specified in 1.5.2.1.

1.5.2.8.1.2 *Data packet type (DP).* This field shall be set to 0.

1.5.2.8.1.3 *MSP packet type (MP).* This field shall be set to 1.

1.5.2.8.1.4 *Supervisory packet (SP).* This field shall be set to 3.

1.5.2.8.1.5 *Supervisory type (ST).* This field shall be set to 1.

1.5.2.8.1.6 *User data length (LV).* This field shall be set as specified in 1.2.3.1

1.5.2.8.1.7 *User data (UD).* The user data shall be transferred from the ISO 8208 packet to the Mode S packet using the S-bit packet reassembly processing as required. The maximum size of the user data field for an INTERRUPT packet shall be 32 bytes.

1.5.2.8.2 *Translation into ISO 8208 packets.* Reception by the XDLP reformatting process of Mode S INTERRUPT packet(s) from the local XDCE shall result in the generation of a corresponding ISO 8208 INTERRUPT packet to the local DCE. The translation from the Mode S packet(s) to the ISO 8208 packet shall be the inverse of the processing defined in 1.5.2.8.1.

1.5.2.9 *INTERRUPT CONFIRMATION*

1.5.2.9.1 *Translation into Mode S packets*

1.5.2.9.1.1 *Translated packet format.* Reception by the XDLP reformatting process of an ISO 8208 INTERRUPT CONFIRMATION packet from the local DCE shall result in the generation of a corresponding Mode S INTERRUPT CONFIRMATION packet as follows:

DP:1	MP:1	SP:2	ST:2	SS:2	FILL2:0 or 2	SN:6	SN:6	CH:4	FILL:4

Fields shown in the packet format and not specified in the following paragraphs shall be set as specified in 1.5.2.1.

1.5.2.9.1.2 *Data packet type (DP).* This field shall be set to 0.

1.5.2.9.1.3 *MSP packet type (MP).* This field shall be set to 1.

1.5.2.9.1.4 *Supervisory packet (SP).* This field shall be set to 3.

1.5.2.9.1.5 *Supervisory type (ST).* This field shall be set to 3.

1.5.2.9.1.6 *Supervisory subset (SS).* This field shall be set to 0.

1.5.2.9.1.7 *Translation into ISO 8208 packets.* Reception by the XDLP reformatting process of a Mode S INTERRUPT CONFIRMATION packet from the local XDCE shall result in the generation of a corresponding ISO 8208 INTERRUPT CONFIRMATION packet to the local DCE. The translation from the Mode S packet to the ISO 8208 packet shall be the inverse of the processing defined in 1.5.2.9.1

1.5.2.10 *RESET REQUEST*

1.5.2.10.1 *Translation into Mode S packets*

1.5.2.10.1.1 *Translated packet format*. Reception by the XDLP reformatting process of an ISO 8208 RESET REQUEST packet from the local DCE shall result in the generation of a corresponding Mode S RESET REQUEST packet as follows:

DP:1	MP:1	SP:2	ST:2	FILL2:0 or 2	FILL:2	SN:6	CH:4	FILL:4	RC:8	DC:8

Fields shown in the packet format and not specified in the following paragraphs shall be set as specified in 1.5.2.1

1.5.2.10.1.2 *Data packet type (DP)*. This field shall be set to 0.

1.5.2.10.1.3 *MSP packet type (MP)*. This field shall be set to 1.

1.5.2.10.1.4 *Supervisory packet (SP)*. This field shall be set to 2.

1.5.2.10.1.5 *Supervisory type (ST)*. This field shall be set to 2.

1.5.2.10.1.6 *Reset cause code (RC) and diagnostic code (DC)*. The reset cause and diagnostic codes used in the Mode S RESET REQUEST packet shall be as specified in the ISO 8208 packet when the reset procedure is initiated by the DTE. If the reset procedure originates with the DCE, the DCE State tables shall specify the diagnostic fields coding. In this case, bit 8 of the reset cause field shall be set to 0.

1.5.2.10.2 *Translation into ISO 8208 packets*. Reception by the XDLP reformatting process of a Mode S RESET packet from the local XDCE shall result in the generation of a corresponding ISO 8208 RESET packet to the local DCE. The translation from the Mode S packet to the ISO 8208 packet shall be the inverse of the processing defined in 1.5.2.10.1

1.5.2.11 *ISO 8208 RESTART REQUEST to Mode S CLEAR REQUEST*. The receipt of an ISO 8208 RESTART REQUEST from the local DCE shall result in the reformatting process generating a Mode S CLEAR REQUEST by ADLP or Mode S CLEAR REQUEST by GDLP for all SVCs associated with the requesting DTE. The fields of the Mode S CLEAR REQUEST packets shall be set as specified in 1.5.2.5 and 1.5.2.6.

1.5.3 *PACKETS LOCAL TO THE MODE S SUBNETWORK*

1.5.3.1 *MODE S RECEIVE READY*

1.5.3.1.1 *Packet format.* The Mode S RECEIVE READY packet arriving from an XDLP is not related to the control of the DTE/DCE interface and shall not cause the generation of an ISO 8208 packet. The format of the packet shall be as follows:

DP:1	MP:1	SP:2	ST:2	FILL2:0 or 2	FILL:2	SN:6	CH:4	PR:4

1.5.3.1.2 *Data packet type (DP). This field shall be set to 0.*

1.5.3.1.3 *MSP packet type (MP). This field shall be set to 1.*

1.5.3.1.4 *Supervisory packet (SP). This field shall be set to 2.*

1.5.3.1.5 *Supervisory type (ST). This field shall be set to 0.*

1.5.3.1.6 *Packet receive sequence number (PR). This field shall be set as specified in 3.3.4.4.*

1.5.3.2 *MODE S RECEIVE NOT READY*

1.5.3.2.1 *Packet format.* The Mode S RECEIVE NOT READY packet arriving from an XDLP is not related to the control of the DTE/DCE interface and shall not cause the generation of an ISO 8208 packet. The format of the packet shall be as follows:

DP:1	MP:1	SP:2	ST:2	FILL2:0 or 2	FILL:2	SN:6	CH:4	PR:4

Fields shown in the packet format and not specified in the following paragraphs shall be set as specified in 1.5.2.1. The packet shall be processed as specified in 3.3.6.

1.5.3.2.2 *Data packet type (DP). This field shall be set to 0.*

1.5.3.2.3 *MSP packet type (MP). This field shall be set to 1.*

1.5.3.2.4 *Supervisory packet (SP). This field shall be set to 2.*

1.5.3.2.5 *Supervisory type (ST). This field shall be set to 1.*

1.5.3.2.6 *Packet receive sequence number (PR). This field shall be set as specified in 3.3.4.4.*

1.5.3.3 *MODE S ROUTE*

1.5.3.3.1 *Packet format.* The format for the packet shall be as follows:

DP:1	MP:1	SP:2	ST:2	OF:1	IN:1	RTL:8	RT:v	ODL:0 or 8	OD:v

Fields shown in the packet format and not specified in the following paragraphs shall be set as specified in 1.5.2.1. The packet shall only be generated by the GDLP. It shall be processed by the ADLP as specified in 1.8.1.2 and shall have a maximum size as specified in 2.3.4.2.1.

1.5.3.3.2 *Data packet type (DP). This field shall be set to 0.*

1.5.3.3.3 *MSP packet type (MP). This field shall be set to 1.*

1.5.3.3.4 *Supervisory packet (SP). This field shall be set to 3.*

1.5.3.3.5 *Supervisory type (ST). This field shall be set to 0.*

1.5.3.3.6 *Option flag (OF). This field shall indicate the presence of the optional data length (ODL) and optional data (OD) fields. OF shall be set to 1 if ODL and OD are present. Otherwise it shall be set to 0.*

1.5.3.3.7 *Initialization bit (IN).* This field shall indicate the requirement for subnetwork initialization. It shall be set by the GDLP as specified in 1.8.1.2(d).

1.5.3.3.8 *Route table length (RTL).* This field shall indicate the size of the route table, expressed in bytes.

1.5.3.3.9 Route table (RT)

1.5.3.3.9.1 *Contents.* This table shall consist of a variable number of entries each containing information specifying the addition or deletion of entries in the II code-DTE cross-reference table (5.2.8.1.1).

1.5.3.3.9.2 *Entries.* Each entry in the route table shall consist of the II code, a list of up to 8 ground DTE addresses, and a flag indicating whether the resulting II code-DTE pairs shall be added or deleted from the II code-DTE cross-reference table. A route table entry shall be coded as follows:

II:4	AD:1	ND:3	DAL:v

1.5.3.3.9.3 *Interrogator identifier (II).* This field shall contain the 4-bit II code.

1.5.3.3.9.4 *Add/delete flag (AD).* This field shall indicate whether the II code-DTE pairs shall be added (AD = 1) or deleted (AD = 0) from the II code-DTE cross-reference table.

1.5.3.3.9.5 *Number of DTE addresses (ND).* This field shall be expressed in binary in the range from 0 to 7 and shall indicate the number of DTE addresses present in DAL minus 1 (in order to allow from 1 to 8 DTE addresses).

1.5.3.3.9.6 *DTE address list (DAL).* This list shall consist of up to 8 DTE addresses, expressed in 8-bit binary representation.

1.5.3.3.10 *Optional data length (ODL).* This field shall contain the length in bytes of the following OD field.

1.5.3.3.11 *Optional data (OD).* This variable length field shall contain optional data.

1.5.3.4 *MODE S CLEAR CONFIRMATION BY ADLP*

1.5.3.4.1 *Packet format.* The format for this packet shall be as follows:

DP:1	MP:1	SP:2	ST:2	FILL2:0 or 2	TC:2	SN:6	CH:4	AM:4	AG:8

Fields shown in the packet format and not specified in the following paragraphs shall be set as specified in 1.5.2.1 and 1.5.2.5. This packet shall be processed as specified in 2.3.3.

1.5.3.4.2 *Data packet type (DP). This field shall be set to 0.*

1.5.3.4.3 *MSP packet type (MP). This field shall be set to 1.*

1.5.3.4.4 *Supervisory packet (SP). This field shall be set to 1.*

1.5.3.4.5 *Channel number (CH): If a channel number has been allocated during the call acceptance phase, then CH shall be set to that value, otherwise it shall be set to zero.*

1.5.3.4.6 *Temporary channel (TC):* If a channel number has been allocated during the call acceptance phase, then TC shall be set to zero, otherwise it shall be set to the value used in the CALL REQUEST by GDLP.

1.5.3.4.7 *Supervisory type (ST).* This field shall be set to 3.

1.5.3.5 *MODE S CLEAR CONFIRMATION BY GDLP*

1.5.3.5.1 *Packet format.* The format for this packet shall be as follows:

DP:1	MP:1	SP:2	ST:2	FILL:2	TC:2	SN:6	CH:4	AM:4	AG:8

Fields shown in the packet format and not specified in the following paragraphs shall be set as specified in 1.5.2.1 and 1.5.2.6. This packet shall be processed as specified in 2.3.3.

1.5.3.5.2 *Data packet type (DP). This field shall be set to 0.*

1.5.3.5.3 *MSP packet type (MP). This field shall be set to 1.*

1.5.3.5.4 *Supervisory packet (SP). This field shall be set to 1.*

1.5.3.5.5 *Channel number (CH): If a channel number has been allocated during the call acceptance phase, then CH shall be set to that value, otherwise it shall be set to zero.*

1.5.3.5.6 *Temporary channel (TC): If a channel number has been allocated during the call acceptance phase, then TC shall be set to zero, otherwise it shall be set to the value used in the CALL REQUEST by GDLP.*

1.5.3.5.7 *Supervisory type (ST). This field shall be set to 3.*

1.5.3.6 *MODE S RESET CONFIRMATION*

1.5.3.6.1 *Packet format.* The format for this packet shall be as follows:

DP:1	MP:1	SP:2	ST:2	FILL2:0 or 2	FILL:2	SN:6	CH:4	FILL:4

Fields shown in the packet format and not specified in the following paragraphs shall be set as specified in 1.5.2.1. This packet shall be processed as specified in Table 5-14.

1.5.3.6.2 *Data packet type (DP). This field shall be set to 0.*

1.5.3.6.3 *MSP packet type (MP). This field shall be set to 1.*

1.5.3.6.4 *Supervisory packet (SP). This field shall be set to 2.*

1.5.3.6.5 *Supervisory type (ST). This field shall be set to 3.*

1.5.3.7 *MODE S REJECT*

1.5.3.7.1 *Packet format.* The format for this packet shall be as follows:

DP:1	MP:1	SP:2	ST:2	SS:2	FILL2:0 or 2	SN:6	CH:4	PR:4

Fields shown in the packet format and not specified in the following paragraphs shall be set as specified in 1.5.2.1. This packet shall be processed as specified in 2.3.6.8.

1.5.3.7.2 *Data packet type (DP). This field shall be set to 0.*

1.5.3.7.3 *MSP packet type (MP). This field shall be set to 1.*

1.5.3.7.4 *Supervisory packet (SP). This field shall be set to 3.*

1.5.3.7.5 *Supervisory type (ST). This field shall be set to 3.*

1.5.3.7.6 *Supervisory subset (SS). This field shall be set to 1.*

1.5.3.7.7 *Packet receive sequence number (PR).* This field shall be set as specified in 2.3.4.4.

1.6 XDCE operation

Note.— The ADCE process within the ADLP acts as a peer process to the GDCE process in the GDLP.

1.6.1 *State transitions.* The XDCE shall operate as a State machine. Upon entering a State, the XDCE shall perform the actions specified in Table 5-14. State transition and additional action(s) shall be as specified in Table 5-15 through Table 5-22.

Note 1.— The next State transition (if any) that occurs when the XDCE receives a packet from the peer XDCE is specified by Table 5-15 through Table 5-19. The same transitions are defined in Table 5-20 through Table 5-22 when the XDCE receives a packet from the DCE (via the reformatting process).

Note 2.— The XDCE State hierarchy is the same as for the DCE as presented in Figure 5-2, except that States r2, r3 *and* p5 *are omitted*

1.6.2 DISPOSITION OF PACKETS

1.6.2.1 Upon receipt of a packet from the peer XDCE, the packet shall be forwarded or not forwarded to the DCE (via the reformatting process) according to the parenthetical instructions contained in Tables 5-15 to 5-19. If no parenthetical instruction is listed or if the parenthetical instruction indicates "do not forward" the packet shall be discarded.

1.6.2.2 Upon receipt of a packet from the DCE (via the reformatting process), the packet shall be forwarded or not forwarded to the peer XDCE according to the parenthetical instructions contained in Tables 5 - 20 to 5 - 22. If no parenthetical instruction is listed or if the parenthetical instruction indicates "do not forward" the packet shall be discarded.

1.6.3 SVC CALL SETUP AND CLEAR PROCEDURE

1.6.3.1 *Setup procedures.* Upon receipt of a CALL REQUEST from the DCE or peer XDCE, the XDLP shall determine if sufficient resources exist to operate the SVC. This shall include: sufficient buffer space (refer to 2.2.1.1 for buffer requirements) and an available *p*1 State SVC. Upon acceptance of the CALL REQUEST from the DCE (via the reformatting process), the Mode S CALL REQUEST packet shall be forwarded to frame processing. Upon acceptance of a Mode S CALL REQUEST from the peer XDCE (via frame processing), the Mode S CALL REQUEST shall be sent to the *reformatting process.*

1.6.3.2 *Aborting a call request.* If the DTE and/or the peer XDCE abort a call before they have received a CALL ACCEPT packet, they shall indicate this condition by issuing a CLEAR REQUEST packet. Procedures for handling these cases shall be as specified in Table 2.4-16 and Table 2.4-20.

1.6.3.3 *VIRTUAL CALL CLEARING*

1.6.3.3.1 If the XDCE receives a Mode S CALL REQUEST from the reformatting process that it cannot support, it shall initiate a Mode S CLEAR REQUEST packet that is sent to the DCE (via the reformatting process) for transfer to the DTE (the DCE thus enters the DCE CLEAR REQUEST to DTE State, *p*7).

1.6.3.3.2 If the XDCE receives a Mode S CALL REQUEST packet from the peer XDCE (via frame processing) which it cannot support, it shall enter the State p7.

1.6.3.3.3 A means shall be provided to advise the DTE whether an SVC has been cleared due to the action of the peer DTE or due to a problem within the sub network itself.

1.6.3.3.4 The requirement of 1.6.3.3.3 shall be satisfied by setting bit 8 of the cause field to 1 to indicate that the problem originated in the Mode S sub network and not in the DTE. The diagnostic and cause codes shall be set as follows:

(a) no channel number available, DC = 71, CC = 133;
(b) buffer space not available, DC = 71, CC = 133;
(c) DTE not operational, DC = 162, CC = 141; and
(d) link failure, DC = 225, CC = 137.

1.6.3.3.5 If the ADLP receives a Mode S ROUTE packet with the IN bit set to ONE, the ADLP shall perform local initialization by clearing Mode S SVCs associated with the DTE addresses contained in the ROUTE packet. If the GDLP receives a search request (Table 5-23) from an ADLP, the GDLP shall perform local initialization by clearing Mode S SVCs associated with that ADLP. Local initialization shall be accomplished by:

(a) releasing all allocated resources associated with these SVCs (including the resequencing buffers);
(b) returning these SVCs to the ADCE ready State (*p*1); and
(c) sending Mode S CLEAR REQUEST packets for these SVCs to the DCE (via the reformatting process) for transfer to the DTE.

1.6.3.4 *Clear confirmation.* When the XDCE receives a Mode S CLEAR CONFIRMATION packet, the remaining allocated resources to manage the SVC shall be released (including the resequencing buffers) and the SVC shall be returned to the *p*1 State. Mode S CLEAR CONFIRMATION packets shall not be transferred to the reformatting process.

1.6.3.5 *Clear collision.* A clear collision occurs at the XDCE when it receives a Mode S CLEAR REQUEST packet from the DCE (via the reformatting process) and then receives a Mode S CLEAR REQUEST packet from the peer XDCE (or vice versa). In this event, the XDCE does not expect to receive a Mode S CLEAR CONFIRMATION packet for this SVC and shall consider the clearing complete.

1.6.3.6 *Packet processing.* The XDCE shall treat an S-bit sequence of Mode S CALL REQUEST, CALL ACCEPT and CLEAR REQUEST packets as a single entity.

1.6.4 DATA TRANSFER AND INTERRUPT PROCEDURES

1.6.4.1 *GENERAL PROVISIONS*

1.6.4.1.1 Data transfer and interrupt procedures shall apply independently to each SVC. The contents of the user data field shall be passed transparently to the DCE or to the peer XDCE. Data shall be transferred in the order dictated by the sequence numbers assigned to the data packets.

1.6.4.1.2 To transfer DATA packets, the SVC shall be in a FLOW CONTROL READY State (*d*1).

1.6.4.2 *MODE S PACKET SIZE*

1.6.4.2.1 The maximum size of Mode S packets shall be 152 bytes in the uplink direction and 160 bytes in the downlink direction for installations that have full uplink and downlink ELM capability. The maximum downlink packet size for level four transponders with less than 16 segment downlink ELM capability shall be 10 bytes times the maximum number of downlink ELM segments that the transponder specifies in its data link capability report. If there is no ELM capability, the maximum Mode S packet size shall be 28 bytes.

1.6.4.2.2 The Mode S sub network shall allow packets of less than the maximum size to be transferred.

1.6.4.3 *FLOW CONTROL WINDOW SIZE*

1.6.4.3.1 The flow control window size of the Mode S sub network shall be independent of that used on the DTE/DCE interface. The Mode S sub network window size shall be 15 packets in the uplink and downlink directions.

1.6.4.4 *SVC FLOW CONTROL*

1.6.4.4.1 Flow control shall be managed by means of a sequence number for received packets (PR) and one for packets that have been sent (PS). A sequence number (PS) shall be assigned for each Mode S DATA packet generated by the XDLP for each SVC. The first Mode S DATA packet transferred by the XDCE to frame processing when the SVC has just entered the flow control ready State shall be numbered zero. The first Mode S packet received from the peer XDCE after an SVC has just entered the flow control ready State shall be numbered zero. Subsequent packets shall be numbered consecutively.

1.6.4.4.2 A source of Mode S DATA packets (the ADCE or GDCE) shall not send (without permission from the receiver) more Mode S DATA packets than would fill the flow control window. The receiver shall give explicit permission to send more packets.

1.6.4.4.3 The permission information shall be in the form of the next expected packet sequence number and shall be denoted PR. If a receiver wishes to update the window and it has data to transmit to the sender, a Mode S DATA packet shall be used for information transfer. If the window must be updated and no data are to be sent, a Mode S RECEIVE READY (RR) or Mode S RECEIVE NOT READY (RNR) packet shall be sent. At this point, the "sliding window" shall be moved to begin at the new PR value. The XDCE shall now be authorized to transfer more packets without acknowledgement up to the window limit.

1.6.4.4.4 When the sequence number (PS) of the next Mode S DATA packet to be sent is in the range $PR \leq PS \leq PR + 14$ (modulo 16), the sequence number shall be defined to be "in the window" and the XDCE shall be authorized to transmit the packet. Otherwise, the sequence number (PS) of the packet shall be defined to be "outside the window" and the XDCE shall not transmit the packet to the peer XDCE.

1.6.4.4.5 When the sequence number (PS) of the packet received is next in sequence and within the window, the XDCE shall accept this packet. Receipt of a packet with a PS:

(a) outside the window; or
(b) out of sequence; or
(c) not equal to 0 for the first data packet after entering FLOW CONTROL READY State (d1); shall be considered an error (1.6.8).

1.6.4.4.6 The receipt of a Mode S DATA packet with a valid PS number (i.e. the next PS in sequence) shall cause the lower window PR to be changed to that PS value plus 1. The packet receive sequence number (PR) shall be conveyed to the originating XDLP by a Mode S DATA, RECEIVE READY, RECEIVE NOT READY, or REJECT packet. A valid PR value shall be transmitted by the XDCE to the peer XDCE after the receipt of 8 packets provided that sufficient buffer space exists to store 15 packets. Incrementing the PR and PS fields shall be performed using modulo 16 arithmetic.

1.6.4.4.7 A copy of a packet shall be retained until the user data has been successfully transferred. Following successful transfer, the PS value shall be updated.

1.6.4.4.8 The PR value for user data shall be updated as soon as the required buffer space for the window (as determined by flow control management) is available within the DCE.

1.6.4.4.9 Flow control management shall be provided between the DCE and XDCE.

1.6.4.5 *INTERRUPT PROCEDURES FOR SWITCHED VIRTUAL CIRCUITS*

1.6.4.5.1 If user data is to be sent via the Mode S subnetwork without following the flow control procedures, the interrupt procedures shall be used. The interrupt procedure shall have no effect on the normal data packet and flow control procedures. An interrupt packet shall be delivered to the DTE (or the transponder or interrogator interface) at or before the point in the stream of data at which the interrupt was generated. The processing of a Mode S INTERRUPT packet shall occur as soon as it is received by the XDCE.

1.6.4.5.2 The XDCE shall treat an S-bit sequence of Mode S INTERRUPT packets as a single entity.

1.6.4.5.3 Interrupt processing shall have precedence over any other processing for the SVC occurring at the time of the interrupt.

1.6.4.5.4 The reception of a Mode S INTERRUPT packet before the previous interrupt of the SVC has been confirmed (by the receipt of a Mode S INTERRUPT CONFIRMATION packet) shall be defined as an error. The error results in a reset (see Table 5-18).

1.6.5 RECEIVE READY PROCEDURE

1.6.5.1 The Mode S RECEIVE READY packet shall be sent if no Mode S DATA packets (that normally contain the updated PR value) are available for transmittal and it is necessary to transfer the latest PR value. It also shall be sent to terminate a receiver not ready condition.

1.6.5.2 Receipt of the Mode S RECEIVE READY packet by the XDCE shall cause the XDCE to update its value of PR for the outgoing SVC. It shall not be taken as a demand for retransmission of packets that have already been transmitted and are still in the window.

1.6.5.3 Upon receipt of the Mode S RECEIVE READY packet, the XDCE shall go into the ADLP (GDLP) RECEIVE READY State (*g*1).

1.6.6 RECEIVE NOT READY PROCEDURE

1.6.6.1 The Mode S RECEIVE NOT READY packet shall be used to indicate a temporary inability to accept additional DATA packets for the given SVC. The Mode S RNR condition shall be cleared by the receipt of a Mode S RR packet or a Mode S REJECT packet.

1.6.6.2 When the XDCE receives a Mode S RECEIVE NOT READY packet from the peer XDCE, it shall update its value of PR for the SVC and stop transmitting Mode S DATA packets on the SVC to the XDLP. The XDCE shall go into the ADLP(GDLP) RECEIVE NOT READY State (*g2*).

1.6.6.3 The XDCE shall transmit a Mode S RECEIVE NOT READY packet to the peer XDCE if it is unable to receive from the peer XDCE any more Mode S DATA packets on the indicated SVC. Under these conditions, the XDCE shall go into the ADCE(GDCE) RECEIVE NOT READY State (*f2*).

1.6.7 RESET PROCEDURE

1.6.7.1 When the XDCE receives a Mode S RESET REQUEST packet from either the peer XDCE or the DCE (via the reformatting process) or due to an error condition performs its own reset, the following actions shall be taken:

(*a*) those Mode S DATA packets that have been transmitted to the peer XDCE shall be removed from the window;
(*b*) those Mode S DATA packets that are not transmitted to the peer XDCE but are contained in an M-bit sequence for which some packets have been transmitted shall be deleted from the queue of DATA packets awaiting transmission;
(*c*) those Mode S DATA packets received from the peer XDCE that are part of an incomplete M-bit sequence shall be discarded;
(*d*) the lower window edge shall be set to 0 and the next packet sent shall have a sequence number (PS) of 0;
(*e*) any outstanding Mode S INTERRUPT packets to or from the peer XDCE shall be left unconfirmed;
(*f*) any Mode S INTERRUPT packet awaiting transfer shall be discarded;
(*g*) data packets awaiting transfer shall not be discarded (unless they are part of a partially transferred M-bit sequence); and
(*h*) the transition to d1 shall also include a transition to i1, j1, f 1 and g1.

1.6.7.2 The reset procedure shall apply to the DATA TRANSFER State (p4). The error procedure in Table 5-16 shall be followed. In any other State the reset procedure shall be abandoned.

1.6.8 REJECT PROCEDURE

1.6.8.1 When the XDCE receives a Mode S DATA packet from the peer XDCE with incorrect format or whose packet sequence number (PS) is not within the defined window (Table 5-19) or is out of sequence, it shall discard the received packet and send a Mode S REJECT packet to the peer XDCE via frame processing. The Mode S REJECT packet shall indicate a value of PR for which retransmission of the Mode S DATA packets is to begin. The XDCE shall discard subsequent out-of-sequence Mode S DATA packets whose receipt occurs while the Mode S REJECT packet response is still outstanding.

1.6.8.2 When the XDCE receives a Mode S REJECT packet from the peer XDCE, it shall update its lower window value with the new value of PR and begin to (re)transmit packets with a sequence number of PR.

1.6.8.3 Reject indications shall not be transferred to the DCE. If the ISO 8208 interface supports the reject procedures, the reject indications occurring on the ISO 8208 interface shall not be transferred between the DCE and the XDCE.

1.6.9 PACKET RESEQUENCING AND DUPLICATE SUPPRESSION

1.6.9.1 Resequencing. Resequencing shall be performed independently for the uplink and downlink transfers of each Mode S SVC. The following variables and parameters shall be used:

SNR	A 6-bit variable indicating the sequence number of a received packet on a specific SVC. It is contained in the SN field of the packet (1.5.2.1.1.7).
NESN	The next expected sequence number following a series of consecutive sequence numbers.
HSNR	The highest value of SNR in the resequencing window.
Tq	Resequencing timers (see Tables 5-1 and 5-13) associated with a specific SVC.

All operations involving the sequence number (SN) shall be performed modulo 64.

1.6.9.2 *Duplication window.* The range of SNR values between NESN – 32 and NESN – 1 inclusive shall be denoted the duplication window.

1.6.9.3 *Resequencing window.* The range of SNR values between NESN + 1 and NESN + 31 inclusive shall be denoted the resequencing window. Received packets with a sequence number value in this range shall be stored in the resequencing window in sequence number order.

1.6.9.4 TRANSMISSION FUNCTIONS

1.6.9.4.1 For each SVC, the first packet sent to establish a connection (the first Mode S CALL REQUEST or first Mode S CALL ACCEPT packet) shall cause the value of the SN field to be initialized to zero. The value of the SN field shall be incremented after the transmission (or retransmission) of each packet.

1.6.9.4.2 The maximum number of unacknowledged sequence numbers shall be 32 consecutive SN numbers. Should this condition be reached, then it shall be treated as an error and the channel cleared.

1.6.9.5 RECEIVE FUNCTIONS

1.6.9.5.1 *Resequencing.* The resequencing algorithm shall maintain the variables HSNR and NESN for each SVC. NESN shall be initialized to 0 for all SVCs and shall be reset to 0 when the SVC re-enters the channel number pool (1.5.1.2).

1.6.9.5.2 *Processing of packets within the duplication window.* If a packet is received with a sequence number value within the duplication window, the packet shall be discarded.

1.6.9.5.3 *Processing of packets within the resequencing window.* If a packet is received with a sequence number within the resequencing window, it shall be discarded as a duplicate if a packet with the same sequence number has already been received and stored in the resequencing window. Otherwise, the packet shall be stored in the resequencing window. Then, if no Tq timers are running, HSNR shall be set to the value of SNR for this packet and a Tq timer shall be started with its initial value (Tables 5-1 and 5-13). If at least one Tq timer is running, and SNR is not in the window between NESN and HSNR + 1 inclusive, a new Tq timer shall be started and the value of HSNR shall be updated. If at least one Tq timer is running, and SNR for this packet is equal to HSNR + 1, the value of HSNR shall be updated.

1.6.9.5.4 *Release of packets to the XDCE.* If a packet is received with a sequence number equal to NESN, the following procedure shall be applied:

(*a*) the packet and any packets already stored in the resequencing window up to the next missing sequence number shall be passed to the XDCE;

(*b*) NESN shall be set to 1 + the value of the sequence number of the last packet passed to the XDCE; and

(*c*) the Tq timer associated with any of the released packets shall be stopped.

1.6.9.6 *Tq timer expiration.* If a Tq timer expires, the following procedure shall be applied:

(*a*) NESN shall be incremented until the next missing sequence number is detected after that of the packet associated with the Tq timer that has expired;

(*b*) any stored packets with sequence numbers that are no longer in the resequencing window shall be forwarded to the XDCE except that an incomplete S-bit sequence shall be discarded; and

(*c*) the Tq timer associated with any released packets shall be stopped.

1.7 Mode S specific services processing

Mode S specific services shall be processed by an entity in the XDLP termed the Mode S specific services entity (SSE). Transponder registers shall be used to convey the information specified in Table 5-24. The data structuring of the registers in Table 5-24 shall be implemented in such a way that interoperability is ensured.

Note 1.— The data formats and protocols for messages transferred via Mode S specific services are specified in the Technical Provisions for Mode S Services and Extended Squitter (Doc 9871) (in preparation).

Note 2.— Uniform implementation of the data formats and protocols for messages transferred via Mode S specific services will ensure interoperability.

Note 3.— This section describes the processing of control and message data received from the Mode S specific services interface.

Note 4.— Control data consists of information permitting the determination of, for example, message length, BDS code used to access the data format for a particular register, and aircraft address.

1.7.1 ADLP PROCESSING

1.7.1.1 DOWNLINK PROCESSING

1.7.1.1.1 Specific services capability. The ADLP shall be capable of receiving control and message data from the Mode S specific services interface(s) and sending delivery notices to this interface. The control data shall be processed to determine the protocol type and the length of the message data. When the message or control data provided at this interface are erroneous (i.e. incomplete, invalid or inconsistent), the ADLP shall discard the message and deliver an error report at the interface.

Note. — The diagnostic content and error reporting mechanism are a local issue.

1.7.1.1.2 Broadcast processing. The control and message data shall be used to format the Comm-B broadcast message as specified in 1.7.5 and transferred to the transponder.

1.7.1.1.3 GICB processing. The 8-bit BDS code shall be determined from the control data. The 7-byte register content shall be extracted from the received message data. The register content shall be transferred to the transponder, along with an indication of the specified register number. A request to address one of the air-initiated Comm-B registers or the airborne collision avoidance system (ACAS) active resolution advisories register shall be discarded. The assignment of registers shall be as specified in Table 5-24.

1.7.1.1.4 MSP processing

1.7.1.1.4.1 The MSP message length, channel number (M/CH) (1.7.3.1.3) and optionally the interrogator identifier (II) code shall be determined from the control data. The MSP message content shall be extracted from the received message data. If the message length is 26 bytes or less, the SSE shall format an air-initiated Comm-B message (1.7.1.1.4.2) for transfer to the transponder using the short form MSP packet (1.7.3.1). If the message length is 27 to 159 bytes and the transponder has adequate downlink ELM capability, the SSE shall format an ELM message for transfer using the short form MSP packet. If the message length is 27 to 159 bytes and the transponder has a limited downlink ELM capability, the SSE shall format multiple long form MSP packets (1.7.3.2) using ELM messages, as required utilizing the L-bit and M/SN fields for association of the packets. If the message length is 27 to 159 bytes and the transponder does not have downlink ELM capability, the SSE shall format multiple long form MSP packets (1.7.3.2) using air initiated Comm-B messages, as required utilizing the L-bit and M/SN fields for association of the packets. Different frame types shall never be used in the delivery of an MSP message. Messages longer than 159 bytes shall be discarded. The assignment of downlink MSP channel numbers shall be as specified in Table 5-25.

1.7.1.1.4.2 For an MSP, a request to send a packet shall cause the packet to be multisite-directed to the interrogator which II code is specified in control data. If no II code is specified, the packet shall be downlinked using the air-initiated protocol. A message delivery notice for this packet shall be provided to the Mode S specific interface when the corresponding close-out(s) have been received from the transponder. If a close-out has not been received from the transponder in Tz seconds, as specified in Table 5-1, the MSP packet shall be discarded. This shall include the cancellation in the transponder of any frames associated with this packet. A delivery failure notice for this message shall be provided to the Mode S specific services interface.

1.7.1.2 UPLINK PROCESSING

Note.— This section describes the processing of Mode S specific services messages received from the transponder.

1.7.1.2.1 *Specific services capability.* The ADLP shall be capable of receiving Mode S specific services messages from the transponder via frame processing. The ADLP shall be capable of delivering the messages and the associated control data at the specific services interface. When the resources allocated at this interface are insufficient to accommodate the output data, the ADLP shall discard the message and deliver an error report at this interface.

Note.— The diagnostic content and the error reporting mechanism are a local issue.

1.7.1.2.2 *Broadcast processing.* If the received message is a broadcast Comm-A, as indicated by control data received over the transponder/ADLP interface, the broadcast ID and user data (1.7.5) shall be forwarded to the Mode S specific services interface (1.3.2.1) along with the control data that identifies this as a broadcast message. The assignment of uplink broadcast identifier numbers shall be as specified in Table 5-23.

1.7.1.2.3 *MSP processing.* If the received message is an MSP, as indicated by the packet format header (1.7.3), the user data field of the received MSP packet shall be forwarded to the Mode S specific services interface (1.3.2.1) together with the MSP channel number (M/CH), the IIS subfield (1.2.1.1.1) together with control data that identifies this as an MSP message. L-bit processing shall be performed as specified in 1.7.4. The assignment of uplink MSP channel numbers shall be as specified in Table 5-25.

1.7.2 GDLP PROCESSING

1.7.2.1 UPLINK PROCESSING

1.7.2.1.1 *Specific services capability.* The GDLP shall be capable of receiving control and message data from the Mode S specific services interface(s) (1.3.2.2) and sending delivery notices to the interface(s). The control data shall be processed to determine the protocol type and the length of the message data.

1.7.2.1.2 *Broadcast processing.* The GDLP shall determine the interrogator(s), broadcast azimuths and scan times from the control data and format the broadcast message for transfer to the interrogator(s) as specified in 1.7.5.

1.7.2.1.3 *GICB processing.* The GDLP shall determine the register number and the aircraft address from the control data. The aircraft address and BDS code shall be passed to the interrogator as a request for a ground-initiated Comm-B.

1.7.2.1.4 *MSP processing.* The GDLP shall extract from the control data the message length, the MSP channel number (M/CH) and the aircraft address, and obtain the message content from the message data. If the message length is 27 bytes or less, the SSE shall format a Comm-A message for transfer to the interrogator using the short form MSP packet (1.7.3.1). If the message length is 28 to 151 bytes and the transponder has uplink ELM capability, the SSE shall format an ELM message for transfer to the interrogator using the short form MSP packet. If the message length is 28 to 151 bytes and the transponder does not have uplink ELM capability, the SSE shall format multiple long form MSP packets (1.7.3.2) utilizing the L-bit and the M/SN fields for association of the packets. Messages longer than 151 bytes shall be discarded. The interrogator shall provide a delivery notice to the Mode S specific services interface(s) indicating successful or unsuccessful delivery, for each uplinked packet.

1.7.2.2 DOWNLINK PROCESSING

1.7.2.2.1 Specific services capability. The GDLP shall be capable of receiving Mode S specific services messages from the interrogator via frame processing.

1.7.2.2.2 Broadcast processing. If the received message is a broadcast Comm-B, as indicated by the interrogator/GDLP interface, the GDLP shall:

(*a*) generate control data indicating the presence of a broadcast message and the 24-bit address of the aircraft from which the message was received;

(*b*) append the 7-byte MB field of the broadcast Comm-B; and

(*c*) forward this data to the Mode S specific services interface(s) (1.3.2.2).

1.7.2.2.3 GICB processing. If the received message is a GICB, as indicated by the interrogator/ GDLP interface, the GDLP shall:

(*a*) generate control data indicating the presence of a GICB message, the register number and the 24-bit address of the aircraft from which the message was received;

(*b*) append the 7-byte MB field of the GICB; and

(*c*) forward this data to the Mode S specific services interface(s) (1.3.2.2).

1.7.2.2.4 MSP processing. If the received message is an MSP as indicated by the packet format header (1.7.3), the GDLP shall:

(*a*) generate control data indicating the transfer of an MSP, the length of the message, the MSP channel number (M/CH) and the 24-bit address of the aircraft fro which the message was received;

(*b*) append the user data field of the received MSP packet; and

(*c*) forward this data to the Mode S specific services interface(s) (1.3.2.2). L-bit processing shall be performed as specified in 1.7.4.

1.7.3 MSP PACKET FORMATS

1.7.3.1 Short form MSP packet. The format for this packet shall be as follows:

DP:1	MP:1	M/CH:6	FILL1:0 or 6	UD:v

1.7.3.1.1 Data packet type (DP). This field shall be set to 0.

1.7.3.1.2 MSP packet type (MP). This field shall be set to 0.

1.7.3.1.3 MSP channel number (M/CH). The field shall be set to the channel number derived from the SSE control data.

1.7.3.1.4 Fill field (FILL1:0 or 6). The fill length shall be 6 bits for a downlink SLM frame. Otherwise the fill length shall be 0.

1.7.3.1.5 User data (UD). The user data field shall contain message data received from the Mode S specific services interface (1.3.2.2).

1.7.3.2 Long form MSP packet. The format for this packet shall be as follows:

DP:1	MP:1	SP:1	L:1	M/SN:3	FILL2:0 OR 2	M/CH:6	UD:v

Fields shown in the packet format and not specified in the following paragraphs shall be set as specified in 1.5.2.1 and 1.7.3.1

1.7.3.3 Data packet type (DP). This field shall be set to 0.

1.7.3.3.1 *MSP packet type (MP). This field shall be set to 1.*

1.7.3.3.2 *Supervisory packet (SP). This field shall be set to 0.*

1.7.3.3.3 *L field (L).* A value of 1 shall indicate that the packet is part of an L-bit sequence with more packets in the sequence to follow. A value of 0 shall indicate that the sequence ends with this packet.

1.7.3.3.4 *MSP sequence number field (M/SN).* This field shall be used to detect duplication in the delivery of L-bit sequences. The first packet in an L-bit sequence shall be assigned a sequence number of 0. Subsequent packets shall be numbered sequentially. A packet received with the same sequence number as the previously received packet shall be discarded.

1.7.4 *L-bit processing.* L-bit processing shall be performed only on the long form MSP packet and shall be performed as specified for M-bit processing (1.5.1.4.1) except as specified in the following paragraphs.

1.7.4.1 Upon receipt of a long form MSP packet, the XDLP shall construct the user data field by:

(*a*) verifying that the packet order is correct using the M/SN field (1.7.3.2);

(*b*) assuming that the user data field in the MSP packet is the largest number of integral bytes that is contained within the frame;

(*c*) associating each user data field in an MSP packet received with a previous user data field in an MSP packet that has an L-bit value of 1; and

Note.— Truncation of the user data field is not permitted as this is treated as an error condition.

(*d*) if an error is detected in the processing of an MSP packet, the packet shall be discarded.

1.7.4.2 In the processing of an L-bit sequence, the XDLP shall discard any MSP packets that have duplicate M/SN values. The XDLP shall discard the entire L-bit sequence if a long form MSP packet is determined to be missing by use of the M/SN field.

1.7.4.3 The packets associated with any L-bit sequence whose reassembly is not completed in Tm seconds (Tables 5-1 and 5-13) shall be discarded.

1.7.5 BROADCAST FORMAT

1.7.5.1 Uplink broadcast. The format of the broadcast Comm-A shall be as follows: The 83-bit uplink broadcast shall be inserted in an uplink Comm-A frame. The MA field of the Comm-A frame shall contain the broadcast identifier specified in Table 5-23 in the first 8 bits, followed by the first 48 user data bits of the broadcast message. The last 27 user data bits of the broadcast message shall be placed in the 27 bits immediately following the UF field of the Comm-A frame.

1.7.5.2 Downlink broadcast. The format of broadcast Comm-B shall be as follows: The 56-bit downlink broadcast message shall be inserted in the MB field of the broadcast Comm-B. The MB field shall contain the broadcast identifier specified in Table 5-23 in the first 8 bits, followed by the 48 user data bits.

1.8 Mode S sub-network management

1.8.1 INTERROGATOR LINK DETERMINATION FUNCTION

Note.— The ADLP interrogator link determination function selects the II code of the Mode S interrogator through which a Mode S sub-network packet may be routed to the desired destination ground DTE.

1.8.1.1 *II code-DTE address correlation.* The ADLP shall construct and manage a Mode S interrogator-data terminal equipment (DTE) cross-reference table whose entries are Mode S interrogator identifier (II) codes and ground DTE addresses associated with the ground ATN routers or other ground DTEs. Each entry of the II code-DTE cross-reference table shall consist of the 4-bit Mode S II code and the 8-bit binary representation of the ground DTE.

Note 1— Due to the requirement for non-ambiguous addresses, a DTE address also uniquely identifies a GDLP.

Note 2— An ATN router may have more than one ground DTE address.

1.8.1.2 *Protocol.* The following procedures shall be used:

(*a*) when the GDLP initially detects the presence of an aircraft, or detects contact with a currently acquired aircraft through an interrogator with a new II code, the appropriate fields of the DATA LINK CAPABILITY report shall be examined to determine if, and to what level, the aircraft has the capability to participate in a data exchange. After positive determination of data link capability, the GDLP shall uplink one or more Mode S ROUTE packets as specified in 1.5.3.3. This information shall relate the Mode S II code with the ground DTE addresses accessible through that interrogator. The ADLP shall update the II code-DTE cross-reference table and then discard the Mode S ROUTE packet(s);

(*b*) a II code-DTE cross-reference table entry shall be deleted when commanded by a Mode S ROUTE packet or when the ADLP recognizes that the transponder has not been selectively interrogated by a Mode S interrogator with a given II code for Ts seconds by monitoring the IIS subfield in Mode S surveillance or Comm-A interrogations (Table 5-1);

(*c*) when the GDLP determines that modification is required to the Mode S interrogator assignment, it shall transfer one or more Mode S ROUTE packets to the ADLP. The update information contained in the Mode S ROUTE packet shall be used by the ADLP to modify its cross-reference table. Additions shall be processed before deletions;

(*d*) when the GDLP sends the initial ROUTE packet after acquisition of a Mode S data link-equipped aircraft, the IN bit shall be set to ONE. This value shall cause the ADLP to perform the procedures as specified in 1.6.3.3.3. Otherwise, the IN bit shall be set to ZERO;

(*e*) when the ADLP is initialized (e.g. after a power-up procedure), the ADLP shall issue a search request by sending a broadcast Comm-B message with broadcast identifier equal to 255 (FF16, as specified in Table 5-23) and the remaining 6 bytes unused. On receipt of a search request, a GDLP shall respond with one or more Mode S ROUTE packets, clear all SVCs associated with the ADLP, as specified in 1.6.3.3, and discard the search request. This shall cause the ADLP to initialize the II code-DTE cross-reference table; and (*f*) on receipt of an update request (Table 5-23), a GDLP shall respond with one or more Mode S ROUTE packets and discard the update request. This shall cause the ADLP to update the II code-DTE cross-reference table.

Note.— The update request may be used by the ADLP under exceptional circumstances (e.g. changeover to standby unit) to verify the contents of its II code DTE cross reference table.

1.8.1.3 PROCEDURES FOR DOWNLINKING MODE S PACKETS

1.8.1.3.1 When the ADLP has a packet to downlink, the following procedures shall apply:

(a) CALL REQUEST packet. If the packet to be transferred is a Mode S CALL REQUEST, the ground DTE address field shall be examined and shall be associated with a connected Mode S interrogator using the II code-DTE cross reference table. The packet shall be downlinked using the multisite-directed protocol. A request to transfer a packet to a DTE address not in the cross-reference table shall result in the action specified in 1.6.3.3.1; and

(b) Other SVC packets. For an SVC, a request to send a packet to a ground DTE shall cause the packet to be multisite directed to the last Mode S interrogator used to successfully transfer (uplink or downlink) a packet to that DTE, provided that this Mode S interrogator is currently in the II code-DTE cross-reference table. Otherwise, an SVC packet shall be downlinked using the multisite-directed protocol to any other Mode S interrogator associated with the specified ground DTE address. Level 5 transponders shall be permitted to use additional interrogators for downlink transfer as indicated in the II code-DTE cross-reference table.

1.8.1.3.2 A downlink frame transfer shall be defined to be successful if its Comm-B or ELM close-out is received from the transponder within Tz seconds as specified in Table 5-1. If the attempt is not successful and an SVC packet is to be sent, the II code-DTE cross-reference table shall be examined for another entry with the same called ground DTE address and a different Mode S II code. The procedure shall be retried using the multisite-directed protocol with the new Mode S interrogator. If there are no entries for the required called DTE, or all entries result in a failed attempt, a link failure shall be declared (1.8.3.1).

1.8.2 SUPPORT FOR THE DTE(S)

1.8.2.1 GDLP connectivity reporting. The GDLP shall notify the ground DTE(s) of the availability of a Mode S data link-equipped aircraft ("join event"). The GDLP shall also inform the ground DTEs when such an aircraft is no longer in contact via that GDLP ("leave event"). The GDLP shall provide for notification (on request) of all Mode S data link equipped aircraft currently in contact with that GDLP. The notifications shall provide the ground ATN router with the sub-network point of attachment (SNPA) address of the mobile ATN router, with the position of the aircraft and quality of service as optional parameters. The SNPA of the mobile ATN router shall be the DTE address formed by the aircraft address and a sub-address of 0 (1.3.1.3.2).

1.8.2.2 ADLP connectivity reporting. The ADLP shall notify all aircraft DTEs whenever the last remaining entry for a ground DTE is deleted from the II code-DTE cross-reference table (1.8.1.1). This notification shall include the address of this DTE.

1.8.2.3 Communications requirements. The mechanism for communication of changes in subnetwork connectivity shall be a confirmed service, such as the join/leave events that allow notification of the connectivity status.

1.8.3 ERROR PROCEDURES

1.8.3.1 *Link failure*. The failure to deliver a packet to the referenced XDLP after an attempt has been made to deliver this packet via all available interrogators shall be declared to be a link level failure. For an SVC, the XDCE shall enter the State p1 and release all resources associated with that channel. This shall include the cancellation in the transponder of any frames associated with this SVC. A Mode S CLEAR REQUEST packet shall be sent to the DCE via the reformatting process and shall be forwarded by the DCE as an ISO 8208 packet to the local DTE as described in 1.6.3.3. On the aircraft side, the channel shall not be returned to the ADCE channel pool, i.e. does not return to the State p1, until Tr seconds after the link failure has been declared (Table 5-1).

1.8.3.2 *ACTIVE CHANNEL DETERMINATION*

1.8.3.2.1 *Procedure for d1 State*. The XDLP shall monitor the activity of all SVCs, not in a READY State (p1). If an SVC is in the (XDCE) FLOW CONTROL READY State (d1) for more than Tx seconds (the active channel timer, Tables 5-1 and 5-13) without sending a Mode S RR, RNR, DATA, or REJECT packet, then:

(*a*) if the last packet sent was a Mode S REJECT packet to which a response has not been received, then the XDLP shall resend that packet; and
(*b*) otherwise, the XDLP shall send a Mode S RR or RNR packet as appropriate to the peer XDLP.

1.8.3.2.2 *Procedure for other States*. If an XDCE SVC is in the p2, p3, p6, p7, d2 or d3 State for more than Tx seconds, the link failure procedure of 1.8.3.1 shall be performed.

1.8.3.2.3 Link failure shall be declared if either a failure to deliver, or a failure to receive, keep-alive packets has occurred. In which case the channel shall be cleared.

1.9 The data link capability report

The data link capability report shall be as specified in the Civil Aviation (surveillance and collision avoidance system) Regulations.

1.10 System timers

1.10.1 The values for timers shall conform to the values given in Tables 5-1 and 5-13.

1.10.2 Tolerance for all timers shall be plus or minus one per cent.

1.10.3 Resolution for all timers shall be one second.

1.11 System requirements

1.11.1 *Data integrity.* The maximum bit error rates for data presented at the ADLP/transponder interface or the GDLP/interrogator interface measured at the local DTE/XDLP interface (and vice versa) shall not exceed 10-9 for undetected errors and 10-7 for detected errors.

Note.— The maximum error rate includes all errors resulting from data transfers across the interfaces and from XDLP internal operation.

1.11.2 TIMING

1.11.2.1 ADLP timing. ADLP operations shall not take longer than 0.25 seconds for regular traffic and 0.125 seconds for interrupt traffic. This interval shall be defined as follows:

(*a*) *Transponders with downlink ELM capability.* The time that the final bit of a 128-byte data packet is presented to the DCE for downlink transfer to the time that the final bit of the first encapsulating frame is available for delivery to the transponder;

(*b*) *Transponders with Comm-B capability.* The time that the final bit of a user data field of 24 bytes is presented to the DCE for downlink transfer to the time that the final bit of the last of the four Comm-B segments that forms the frame encapsulating the user data is available for delivery to the transponder;

(*c*) *Transponders with uplink ELM capability.* The time that the final bit of the last segment of an ELM of 14 Comm-C segments that contains a user data field of 128 bytes is received by the ADLP to the time that the final bit of the corresponding packet is available for delivery to the DTE; and

(*d*) *Transponders with Comm-A capability.* The time that the final bit of the last segment of four linked Comm-A segments that contains a user data field of 25 bytes is received by the ADLP to the time that the final bit of the corresponding packet is available for delivery to the DTE.

1.11.2.2 GDLP TIMING

The total time delay across the GDLP, exclusive of transmission delay, shall not be greater than 0.125 seconds.

1.11.2.3 Interface rate. The physical interface between the ADLP and the transponder shall have a minimum bit rate of 100 kilobits per second.

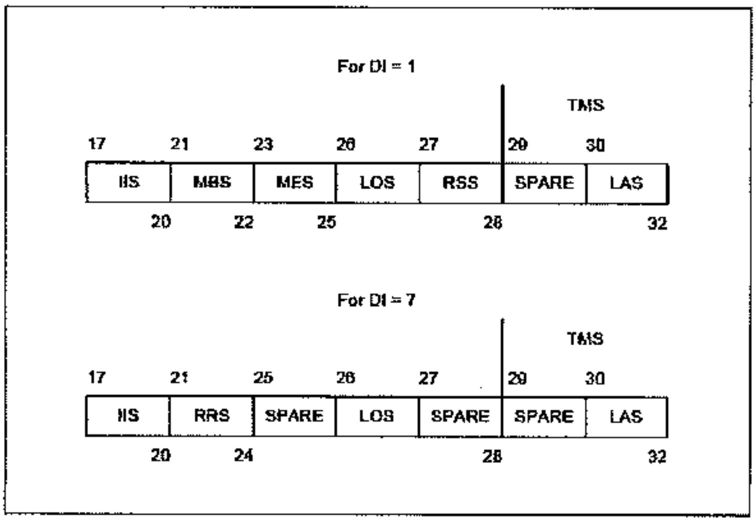
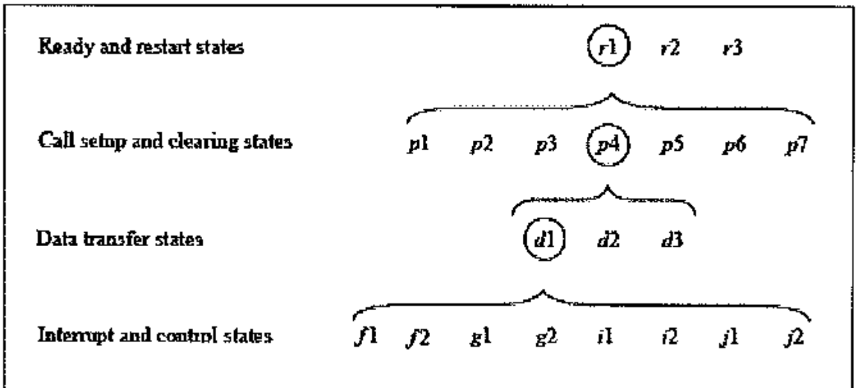


Figure 5-1. The SD field structure



Note.— States r1, p4 and d1 (shown circled) are states that provide access to the lower levels of the DCE substate hierarchy.

Figure 5-2. DCE substate hierarchy

TABLES

Timer name	*Timer label*	*Nominal value*
Channel retirement	*Tr*	600 s
Active channel-ADLP	*Tx*	420 s
Interrogator interrogation	*Ts*	60 s
Interrogator link	*Tz*	30 s
Link frame cancellation	*Tc*	60 s
L-bit delivery-ADLP	*Tm*	120 s
Packet resequencing and S-bit delivery	*Tq*	60 s

Table 5-1. ADLP Mode S subnetwork timers

DCE state	*State definition*	*Action that shall be taken when entering the state*
r1	PACKET LEVEL READY	Return all SVCs to the *p1* state (see *p1* state explanation).
r2	DTE RESTART REQUEST	Return each SVC to the *p1* state (see *p1* state explanation). Issue a RESTART CONFIRMATION to the DTE.
r3	DCE RESTART REQUEST	Issue a RESTART REQUEST to the DTE. Unless entered via the *r2* state, send a RESTART REQUEST to the reformatting process.
p1	READY	Release all resources assigned to SVC. Break the correspondence between the DTE/DCE SVC and the ADCE/GDCE SVC (the ADCE/GDCE SVC may not yet be in the *p1* state).
p2	DTE CALL REQUEST	Determine if sufficient resources exist to support request; if so, allocate resources and forward CALL REQUEST packet to reformatting process; if not, enter DCE CLEAR REQUEST to DTE state (*p7*). Determination of resources and allocation is as defined in ISO 8208.
p3	DCE CALL REQUEST	Determine if sufficient resources exist to support request; if so allocate resources and forward CALL REQUEST packet to DTE; if not, send a CLEAR REQUEST packet to the reformatting process. Determination of resources and allocation is as defined in ISO 8208.
p4	DATA TRANSFER	No action.
p5	CALL COLLISION	Reassign outgoing call to another SVC (the DTE in its call collision state ignores the incoming call) and enter the DCE CALL REQUEST state (*p3*) for that new SVC. Enter the *p2* state to process the CALL REQUEST from the DTE.
p6	DTE CLEAR REQUEST	Release all resources assigned to SVC, send a CLEAR CONFIRMATION packet to the DTE and enter *p1* state.
p7	DCE CLEAR REQUEST to DTE	Forward CLEAR REQUEST packet to DTE.
d1	FLOW CONTROL READY	No action.
d2	DTE RESET REQUEST	Remove DATA packets transmitted to DTE from window; discard any DATA packets that represent partially transmitted M-bit sequences and discard any INTERRUPT packet awaiting transfer to the DTE; reset all window counters to 0; set any timers and retransmission parameters relating to DATA and INTERRUPT transfer to their initial value. Send RESET CONFIRMATION packet to DTE. Return SVC to *d1* state.
d3	DCE RESET REQUEST to DTE	Remove DATA packets transmitted to DTE from window; discard any DATA packets that represent partially transmitted M-bit sequences and discard any INTERRUPT packet awaiting transfer to the DTE; reset all window counters to 0; set any timers and retransmission parameters relating to DATA and INTERRUPT transfer to their initial value. Forward RESET REQUEST packet to DTE.

DCE state	State definition	Action that shall be taken when entering the state
i1	DTE INTERRUPT READY	No action.
i2	DTE INTERRUPT SENT	Forward INTERRUPT packet received from DTE to reformatting process.
j1	DCE INTERRUPT READY	No action.
j2	DCE INTERRUPT SENT	Forward INTERRUPT packet received from reformatting process to DTE.
f1	DCE RECEIVE READY	No action.
f2	DCE RECEIVE NOT READY	No action.
g1	DTE RECEIVE READY	No action.
g2	DTE RECEIVE NOT READY	No action.

Table 5-2. DCE actions at state transition

SCHEDULE 3

(Regulation 51(b))

1. DCE AND XDCE STATE TABLES

1.1 Civil Aviation Authority of Botswana (CAAB) table requirements. The DCE and XDCE shall function as specified in Tables 5-3 to 5-22. CAA-U Tables 5-15 through 5-22 shall be applied to:

(a) ADLP CAA-U transitions when the XDCE or XDLP terms in parenthesis are omitted; and

(b) GDLP State transitions when the terms in parenthesis are used and the XDCE or XDLP preceding them are omitted.

1.2 Diagnostic and cause codes. The table entries for certain conditions indicate a diagnostic code that shall be included in the packet generated when entering the State indicated. The term, "*D* =," shall define the diagnostic code. When "*A* = *DIAG,* ", the action taken shall be to generate an ISO 8208 DIAGNOSTIC packet and transfer it to the DTE; the diagnostic code indicated shall define the entry in the diagnostic field of the packet. The cause field shall be set as specified in 1.6.3.3. The reset cause field shall be set as specified in ISO 8208.

Note 1.— The tables provided below specify State requirements in the following order:

5-3	*DCE special cases*
5-4	*DTE effect on DCE restart States*
5-5	*DTE effect on DCE call setup and clearing States*
5-6	*DTE effect on DCE reset States*
5-7	*DTE effect on DCE interrupt transfer States*
5-8	*DTE effect on DCE flow control transfer States*
5-9	*XDCE effect on DCE restart States*
5-10	*XDCE effect on DCE call setup and clearing States*
5-11	*XDCE effect on DCE reset States*
5-12	*XDCE effect on DCE interrupt transfer States*
5-15	*GDLP (ADLP) effect on ADCE (GDCE) packet layer ready States*
5-16	*GDLP (ADLP) effect on ADCE (GDCE) call setup and clearing States*
5-17	*GDLP (ADLP) effect on ADCE (GDCE) reset States*
5-18	*GDLP (ADLP) effect on ADCE (GDCE) interrupt transfer States*
5-19	*GDLP (ADLP) effect on ADCE (GDCE) flow control transfer States*
5-20	*DCE effect on ADCE (GDCE) call setup and clearing States*
5-21	*DCE effect on ADCE (GDCE) reset States*
5-22	*DCE effect on ADCE (GDCE) interrupt transfer States*

Note 2.— All tables specify both ADLP and GDLP actions.

Note 3. — Within the Mode S subnetwork, States p6 and d2 are transient States.

Note 4. — References to "notes" in the State tables refer to table-specific notes that follow each State table.

Note 5. — All diagnostic and cause codes are interpreted as decimal numbers.

Note 6. — An SVC between an ADCE and a GDCE may be identified by a temporary and/or permanent channel number, as defined in 1.5.1.2.

Table 5-3. DCE special cases

Received from DTE	*DCE special cases* *Any state*
Any packet less than 2 bytes in length (including a valid data link level frame containing no packet)	A=DIAG D=38
Any packet with an invalid general format identifier	A=DIAG D=40
Any packet with a valid general format identifier and an assigned logical channel identifier (includes a logical channel identifier of 0)	See Table 5-4

Table 5-4. DTE effect on DCE restart states

Packet received from DTE	DCE restart states (see Note 5) PACKET LEVEL READY (see Note 1) *r1*	DTE RESTART REQUEST *r2*	DCE RESTART REQUEST *r3*
Packets having a packet type identifier shorter than 1 byte and logical channel identifier not equal to 0	See Table 5-5	*A=ERROR* *S=r3* *D=38* (see Note 4)	*A=DISCARD*
Any packet, except RESTART, REGISTRATION (if supported) with a logical channel identifier of 0	*A=DIAG* *D=36*	*A=DIAG* *D=36*	*A=DIAG* *D=36*
Packet with a packet type identifier which is undefined or not supported by DCE	See Table 5-5	*A=ERROR* *S=r3* *D=33* (see Note 4)	*A=DISCARD*
RESTART REQUEST, RESTART CONFIRMATION, or REGISTRATION (if supported) packet with a logical channel identifier unequal to 0	See Table 5-5	*A=ERROR* *S=r3* *D=41* (see Note 4)	*A=DISCARD*
RESTART REQUEST	*A=NORMAL* (forward) *S=r2*	*A=DISCARD*	*A=NORMAL* *S=p1* or *d1* (see Note 2)
RESTART CONFIRMATION	*A=ERROR* *S=r3* *D=17* (see Note 6)	*A=ERROR* *S=r3* *D=18* (see Note 4)	*A=NORMAL* *S=p1* or *d1* (see Note 2)
RESTART REQUEST OR RESTART CONFIRMATION packet with a format error	*A=DIAG* *D=38, 39, 81 or 82*	*A=DISCARD*	*A=ERROR* *D=38, 39, 81 or 82*
REGISTRATION REQUEST or REGISTRATION CONFIRMATION packets (see Note 3)	*A=NORMAL*	*A=NORMAL*	*A=NORMAL*
REGISTRATION REQUEST or REGISTRATION CONFIRMATION packet with a format error (see Note 3)	*A=DIAG* *D=38, 39, 81 or 82*	*A=ERROR* *S=r3* *D=38, 39, 81 or 82* (see Note 4)	*A=ERROR* *D=38, 39, 81 or 82*
Call setup, call clearing, DATA, interrupt, flow control, or reset packet	See Table 5-5	*A=ERROR* *S=r3* *D=18*	*A=DISCARD*

NOTES:

1. *The Mode S subnetwork has no restart states. Receipt of a RESTART REQUEST causes the DCE to respond with a RESTART CONFIRMATION. The RESTART REQUEST packet is forwarded to the reformatting process, which issues clear requests for all SVCs associated with the DTE. The DCE enters the r3 state only as a result of an error detected on the DTE/DCE interface.*
2. *The SVC channels are returned to state* **p1**, *the permanent virtual circuits (PVC) channels are returned to state* **d1**.
3. *The use of the registration facility is optional on the DTE/DCE interface.*
4. *No action is taken within the Mode S subnetwork.*
5. *Table entries are defined as follows:* A = *action to be taken,* S = *the state to be entered,* D = *the diagnostic code to be used in packets generated as a result of this action,* DISCARD *indicates that the received packet is to be cleared for the XDLP buffers, and* INVALID *indicates that the packet/state combination cannot occur.*
6. *The error procedure consists of entering the r3 state, and sending a RESTART REQUEST to the reformatting process.*

Table 5-4. DTE effect on DCE restart states

Packet received from DTE	DCE call setup and clearing states (see Note 5)						
	READY p1	DTE CALL REQUEST p2	DCE CALL REQUEST p3	DATA TRANSFER p4	CALL COLLISION p5 (see Notes 1 and 4)	DTE CLEAR REQUEST p6	DCE CLEAR REQUEST to DTE p7
Packets having a packet type identifier shorter than 1 byte	A=ERROR S=p7 D=38	A=ERROR S=p7 D=38 (see Note 2)	A=ERROR S=p7 D=38 (see Note 2)	See Table 5-6	A=ERROR S=p7 D=38 (see Note 2)	A=ERROR S=p7 D=38 (see Note 2)	A=DISCARD
Packets having a packet type identifier which is undefined or not supported by DCE	A=ERROR S=p7 D=33	A=ERROR S=p7 D=33 (see Note 2)	A=ERROR S=p7 D=33 (see Note 2)	See Table 5-6	A=ERROR S=p7 D=33 (see Note 2)	A=ERROR S=p7 D=33 (see Note 2)	A=DISCARD
RESTART REQUEST, RESTART CONFIRMATION or REGISTRATION packet with logical channel identifier unequal to 0	A=ERROR S=p7 D=41	A=ERROR S=p7 D=41 (see Note 2)	A=ERROR S=p7 D=41 (see Note 2)	See Table 5-6	A=ERROR S=p7 D=41 (see Note 2)	A=ERROR S=p7 D=41 (see Note 2)	A=DISCARD
CALL REQUEST	A=NORMAL S=p2 (forward)	A=ERROR S=p7 D=21 (see Note 2)	A=NORMAL S=p5	A=ERROR S=p7 D=23 (see Note 2)	A=ERROR S=p7 D=24 (see Note 2)	A=ERROR S=p7 D=25 (see Note 2)	A=DISCARD
CALL ACCEPT	A=ERROR S=p7 D=20	A=ERROR S=p7 D=21 (see Note 2)	A=NORMAL S=p4 (Forward) or A=ERROR S=p7 D=42 (see Notes 2 and 3)	A=ERROR S=p7 D=23 (see Note 2)	A=ERROR S=p7 D=24 (see Notes 2 and 4)	A=ERROR S=p7 D=25 (see Note 2)	A=DISCARD
CLEAR REQUEST	A=NORMAL S=p6	A=NORMAL S=p6 (forward)	A=NORMAL S=p6 (forward)	A=NORMAL S=p6 (forward)	A=NORMAL S=p6 (forward)	A=DISCARD	A=NORMAL S=p1 (do not forward)
CLEAR CONFIRMATION	A=ERROR S=p7 D=20	A=ERROR S=p7 D=21 (see Note 2)	A=ERROR S=p7 D=22 (see Note 2)	A=ERROR S=p7 D=23 (see Note 2)	A=ERROR S=p7 D=24 (see Note 2)	A=ERROR S=p7 D=25 (see Note 2)	A=NORMAL S=p1 (do not forward)
DATA, interrupt, flow control or reset packets	A=ERROR S=p7 D=20	A=ERROR S=p7 D=21 (see Note 2)	A=ERROR S=p7 D=22 (see Note 2)	See Table 5-6	A=ERROR S=p7 D=24 (see Note 2)	A=ERROR S=p7 D=25 (see Note 2)	A=DISCARD

Packet received from DTE	DCE call setup and clearing states (see Note 5)						
	READY *p1*	DTE CALL REQUEST *p2*	DCE CALL REQUEST *p3*	DATA TRANSFER *p4*	CALL COLLISION *p5* (see Notes 1 and 4)	DTE CLEAR REQUEST *p6*	DCE CLEAR REQUEST to DTE *p7*

NOTES:

1. *On entering the* p5 *state, the DCE reassigns the outgoing call to the DTE to another channel (no CLEAR REQUEST is issued) and responds to incoming DTE call as appropriate with a CLEAR REQUEST or CALL ACCEPT packet.*
2. *The error procedure consists of performing the actions specified when entering the* p7 *state (including sending a CLEAR REQUEST packet to the DTE) and additionally sending a CLEAR REQUEST packet to the XDCE (via the reformatting process).*
3. *The use of the fast select facility with a restriction on the response prohibits the DTE from sending a CALL ACCEPT packet.*
4. *The DTE in the event of a call collision must discard the CALL REQUEST packet received from the DCE.*
5. *Table entries are defined as follows:* A = *action to be taken,* S = *the state to be entered,* D = *the diagnostic code to be used in packets generated as a result of this action,* DISCARD *indicates that the received packet is to be cleared from the XDLP buffers, and* INVALID *indicates that the packet/state combination cannot occur.*

Table 5-5. DTE effect on DCE call setup and clearing states

Packet received from DTE	DCE call setup and clearing states (see Note 5)						
	READY *p1*	DTE CALL REQUEST *p2*	DCE CALL REQUEST *p3*	DATA TRANSFER *p4*	CALL COLLISION *p5* (see Notes 1 and 4)	DTE CLEAR REQUEST *p6*	DCE CLEAR REQUEST to DTE *p7*
Packets having a packet type identifier shorter than 1 byte	*A=ERROR* *S=p7* *D=38*	*A=ERROR* *S=p7* *D=38* (see Note 2)	*A=ERROR* *S=p7* *D=38* (see Note 2)	See Table 5-6	*A=ERROR* *S=p7* *D=38* (see Note 2)	*A=ERROR* *S=p7* *D=38* (see Note 2)	*A=DISCARD*
Packets having a packet type identifier which is undefined or not supported by DCE	*A=ERROR* *S=p7* *D=33*	*A=ERROR* *S=p7* *D=33* (see Note 2)	*A=ERROR* *S=p7* *D=33* (see Note 2)	See Table 5-6	*A=ERROR* *S=p7* *D=33* (see Note 2)	*A=ERROR* *S=p7* *D=33* (see Note 2)	*A=DISCARD*
RESTART REQUEST, RESTART CONFIRMATION or REGISTRATION packet with logical channel identifier unequal to 0	*A=ERROR* *S=p7* *D=41*	*A=ERROR* *S=p7* *D=41* (see Note 2)	*A=ERROR* *S=p7* *D=41* (see Note 2)	See Table 5-6	*A=ERROR* *S=p7* *D=41* (see Note 2)	*A=ERROR* *S=p7* *D=41* (see Note 2)	*A=DISCARD*
CALL REQUEST	*A=NORMAL* *S=p2* (forward)	*A=ERROR* *S=p7* *D=21* (see Note 2)	*A=NORMAL* *S=p5*	*A=ERROR* *S=p7* *D=23* (see Note 2)	*A=ERROR* *S=p7* *D=24* (see Note 2)	*A=ERROR* *S=p7* *D=25* (see Note 2)	*A=DISCARD*
CALL ACCEPT	*A=ERROR* *S=p7* *D=20*	*A=ERROR* *S=p7* *D=21* (see Note 2)	*A=NORMAL* *S=p4* (Forward) or *A=ERROR* *S=p7* *D=42* (see Notes 2 and 3)	*A=ERROR* *S=p7* *D=23* (see Note 2)	*A=ERROR* *S=p7* *D=24* (see Notes 2 and 4)	*A=ERROR* *S=p7* *D=25* (see Note 2)	*A=DISCARD*
CLEAR REQUEST	*A=NORMAL* *S=p6*	*A=NORMAL* *S=p6* (forward)	*A=NORMAL* *S=p6* (forward)	*A=NORMAL* *S=p6* (forward)	*A=NORMAL* *S=p6* (forward)	*A=DISCARD*	*A=NORMAL* *S=p1* (do not forward)
CLEAR CONFIRMATION	*A=ERROR* *S=p7* *D=20*	*A=ERROR* *S=p7* *D=21* (see Note 2)	*A=ERROR* *S=p7* *D=22* (see Note 2)	*A=ERROR* *S=p7* *D=23* (see Note 2)	*A=ERROR* *S=p7* *D=24* (see Note 2)	*A=ERROR* *S=p7* *D=25* (see Note 2)	*A=NORMAL* *S=p1* (do not forward)
DATA, interrupt, flow control or reset packets	*A=ERROR* *S=p7* *D=20*	*A=ERROR* *S=p7* *D=21* (see Note 2)	*A=ERROR* *S=p7* *D=22* (see Note 2)	See Table 5-6	*A=ERROR* *S=p7* *D=24* (see Note 2)	*A=ERROR* *S=p7* *D=25* (see Note 2)	*A=DISCARD*

Packet received from DTE	DCE call setup and clearing states (see Note 5)						
	READY *p1*	DTE CALL REQUEST *p2*	DCE CALL REQUEST *p3*	DATA TRANSFER *p4*	CALL COLLISION *p5* (see Notes 1 and 4)	DTE CLEAR REQUEST *p6*	DCE CLEAR REQUEST to DTE *p7*

NOTES:

1. *On entering the* p5 *state, the DCE reassigns the outgoing call to the DTE to another channel (no CLEAR REQUEST is issued) and responds to incoming DTE call as appropriate with a CLEAR REQUEST or CALL ACCEPT packet.*
2. *The error procedure consists of performing the actions specified when entering the* p7 *state (including sending a CLEAR REQUEST packet to the DTE) and additionally sending a CLEAR REQUEST packet to the XDCE (via the reformatting process).*
3. *The use of the fast select facility with a restriction on the response prohibits the DTE from sending a CALL ACCEPT packet.*
4. *The DTE in the event of a call collision must discard the CALL REQUEST packet received from the DCE.*
5. *Table entries are defined as follows:* A = *action to be taken,* S = *the state to be entered,* D = *the diagnostic code to be used in packets generated as a result of this action,* DISCARD *indicates that the received packet is to be cleared from the XDLP buffers, and INVALID indicates that the packet/state combination cannot occur.*

Table 5-6 DTE effect on DCE reset states

	DCE reset states (see Note 2)		
Packet received from DTE	FLOW CONTROL READY *d1*	RESET REQUEST by DTE *d2*	DCE RESET REQUEST to DTE *d3*
Packet with a packet type identifier shorter than 1 byte	*A=ERROR* *S=d3* *D=38* (see Note 1)	*A=ERROR* *S=d3* *D=38* (see Note 1)	*A=DISCARD*
Packet with a packet type identifier which is undefined or not supported by DCE	*A=ERROR* *S=d3* *D=33* (see Note 1)	*A=ERROR* *S=d3* *D=33* (see Note 1)	*A=DISCARD*
RESTART REQUEST, RESTART CONFIRMATION, or REGISTRATION (if supported) packet with logical channel identifier unequal to 0	*A=ERROR* *S=d3* *D=41* (see Note 1)	*A=ERROR* *S=d3* *D=41* (see Note 1)	*A=DISCARD*
RESET REQUEST	*A=NORMAL* *S=d2* (forward)	*A=DISCARD*	*A=NORMAL* *S=d1* (do not forward)
RESET CONFIRMATION	*A=ERROR* *S=d3* *D=27* (see Note 1)	*A=ERROR* *S=d3* *D=28* (see Note 1)	*A=NORMAL* *S=d1* (do not forward)
INTERRUPT packet	See Table 5-7	*A=ERROR* *S=d3* *D=28* (see Note 1)	*A=DISCARD*
INTERRUPT CONFIRMATION packet	See Table 5-7	*A=ERROR* *S=d3* *D=28* (see Note 1)	*A=DISCARD*
DATA or flow control packet	See Table 5-8	*A=ERROR* *S=d3* *D=28* (see Note 1)	*A=DISCARD*
REJECT supported but not subscribed to	*A=ERROR* *S=d3* *D=37* (see Note 1)	*A=ERROR* *S=d3* *D=37* (see Note 1)	*A=DISCARD*

NOTES:

1. *The error procedure consists of performing the specified actions when entering the d3 state (which includes forwarding a RESET REQUEST packet to the DTE) and sending a RESET REQUEST packet to the XDCE (via the formatting function).*
2. *Table entries are defined as follows:* A = *action to be taken,* S = *the state to be entered,* D = *the diagnostic code to be used in packets generated as a result of this action,* DISCARD *indicates that the received packet is to be cleared for the XDLP buffers, and* INVALID *indicates that the packet/state combination cannot occur.*

Table 5-7. DTE effect on DCE interrupt transfer states

Packet received from DTE	DTE/DCE interrupt transfer states (see Note 2) DTE INTERRUPT READY i1	 DTE INTERRUPT SENT i2
INTERRUPT (see Note 1)	*A=NORMAL* *S=i2* (forward)	*A=ERROR* *S=d3* *D=44* (see Note 3)
Packet received from DTE	**DTE/DCE interrupt transfer states (see Note 2) DCE INTERRUPT READY j1**	** DCE INTERRUPT SENT j2**
INTERRUPT CONFIRMATION (see Note 1)	*A=ERROR* *S=d3* *D=43* (see Note 3)	*A=NORMAL* *S=j1* (forward)

NOTES:

1. *If the packet has a format error, then the error procedure applies (see Note 3). Interrupt packets with user data greater than 32 bytes should be treated as a format error.*
2. *Table entries are defined as follows:* A = *action to be taken,* S = *the state to be entered,* D = *the diagnostic code to be used in packets generated as a result of this action,* DISCARD *indicates that the received packet is to be cleared from the XDLP buffers, and* INVALID *indicates that the packet/state combination cannot occur.*
3. *The error procedure consists of performing the specified actions when entering the* d3 *state (which includes forwarding a RESET REQUEST packet to the DTE) and sending a RESET REQUEST packet to the XDCE (via the reformatting process).*

Table 5-8. DTE effect on DCE flow control transfer states

Packet received from DTE	DCE flow control transfer states (see Notes 2 and 3) DCE RECEIVE READY *f1*	DCE RECEIVE NOT READY *f2*
DATA packet with less than 4 bytes when using modulo 128 numbering	*A=ERROR* *S=d3* *D=38* (see Note 4)	*A=DISCARD*
DATA packet with invalid PR	*A=ERROR* *S=d3* *D=2* (see Note 4)	*A=ERROR* *S=d3* *D=2* (see Note 4)
DATA packet with valid PR but invalid PS or user data field with improper format	*A=ERROR* *S=d3* *D*=1 (invalid PS) *D*=39 (UD > max negotiated length) *D*=82 (UD unaligned) (see Note 4)	*A=DISCARD* (process PR data)
DATA packet with valid PR with M-bit set to 1 when the user data field is partially full	*A=ERROR* *S=d3* *D=165* (see Note 4)	*A=DISCARD* (process PR data)
DATA packet with valid PR, PS and user data field format	*A=NORMAL* (forward)	*A=DISCARD* (process PR data)
Packet received from DTE	**DCE flow control transfer states (see Notes 2 and 3) DTE RECEIVE READY *g1***	**DTE RECEIVE NOT READY *g2***
RR, RNR, or REJECT packet with less than 3 bytes when using modulo 128 numbering (see Note 1)	*A=DISCARD*	*A=DISCARD*
RR, RNR, or REJECT packet with an invalid PR	*A=ERROR* *S=d3* *D=2* (see Note 4)	*A=ERROR* *S=d3* *D=2* (see Note 4)
RR packet with a valid PR	*A=NORMAL*	*A=NORMAL* *S=g1*
RNR packet with a valid PR	*A=NORMAL* *S=g2*	*A=NORMAL*
REJECT packet with a valid PR	*A=NORMAL*	*A=NORMAL* *S=g1*

NOTES:

1. *The reject procedures are not required.*
2. *The RR, RNR and REJECT procedures are a local DTE/DCE matter and the corresponding packets are not forwarded to the XDCE.*
3. *Table entries are defined as follows:* A = *action to be taken,* S = *the state to be entered,* D = *the diagnostic code to be used in packets generated as a result of this action,* DISCARD *indicates that the received packet is to be cleared from the XDLP buffers, and INVALID indicates that the packet/state combination cannot occur.*
4. *The error procedure consists of performing the specified actions when entering the* d3 *state (which includes forwarding a RESET REQUEST packet to the DTE) and sending a RESET REQUEST packet to the XDCE (via the reformatting process).*

Table 5-9. XDCE effect on DCE restart states

Packet received from XDCE	DCE restart states (see Note) PACKET LEVEL READY *r1*	DTE RESTART REQUEST *r2*	DCE RESTART REQUEST *r3*
CALL REQUEST	See Table 5-10	Send CLEAR REQUEST to reformatting process with *D*=244	Send CLEAR REQUEST to reformatting process with *D*=244
CALL ACCEPT, CLEAR REQUEST, DATA, INTERRUPT, INTERRUPT CONFIRMATION, RESET REQUEST	See Table 5-10	*A*=*DISCARD*	*A*=*DISCARD*

Note.— Table entries are defined as follows: A = *action to be taken,* S = *the state to be entered,* D = *the diagnostic code to be used in packets generated as a result of this action,* DISCARD *indicates that the received packet is to be cleared from the XDLP buffers, and* INVALID *indicates that the packet/state combination cannot occur.*

Table 5-10. XDCE effect on DCE call setup and clearing states

Packet received from XDCE	DCE call setup and clearing states (see Note) READY *p1*	DTE CALL REQUEST *p2*	DCE CALL REQUEST *p3*	DATA TRANSFER *p4*	CALL COLLISION *p5*	DTE CLEAR REQUEST *p6*	DCE CLEAR REQUEST to DTE *p7*
CALL REQUEST	*A*=*NORMAL* *S*=*p3* (forward)	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID
CALL ACCEPT	*A*=*DISCARD*	*A*=*NORMAL* *S*=*p4* (forward)	INVALID	INVALID	INVALID	*A*=*DISCARD*	*A*=*DISCARD*
CLEAR REQUEST	*A*=*DISCARD*	*A*=*NORMAL* *S*=*p7* (forward)	*A*=*NORMAL* *S*=*p7* (forward)	*A*=*NORMAL* *S*=*p7* (forward)	INVALID	*A*=*DISCARD*	*A*=*DISCARD*
DATA, INTERRUPT, INTERRUPT CONFIRMATION, or RESET REQUEST	*A*=*DISCARD*	INVALID	INVALID	See Table 5-11	INVALID	*A*=*DISCARD*	*A*=*DISCARD*

Note.— Table entries are defined as follows: A = *action to be taken,* S = *the state to be entered,* D = *the diagnostic code to be used in packets generated as a result of this action,* DISCARD *indicates that the received packet is to be cleared from the XDLP buffers, and* INVALID *indicates that the packet/state combination cannot occur.*

Table 5-11. XDCE effect on DCE reset states

Packet received from XDCE	DCE reset states (see Note) FLOW CONTROL READY *d1*	DTE RESET REQUEST *d2*	DCE RESET REQUEST to DTE *d3*
RESET REQUEST	*A=NORMAL* *S=d3* (forward)	*A=NORMAL* *S=d1* (forward)	*A=DISCARD*
INTERRUPT	See Table 5-12	*A=DISCARD*	*A=DISCARD*
INTERRUPT CONFIRMATION	See Table 5-12	*A=DISCARD*	INVALID
DATA	*A=NORMAL* (forward)	*A=DISCARD*	*A=DISCARD*

Note.— Table entries are defined as follows: A = *action to be taken,* S = *the state to be entered,* D = *the diagnostic code to be used in packets generated as a result of this action,* DISCARD *indicates that the received packet is to be cleared from the XDLP buffers, and* INVALID *indicates that the packet/state combination cannot occur.*

Table 5-12. XDCE effect on DCE interrupt transfer states

Packet received from XDCE	DCE interrupt transfer states (see Note) DTE INTERRUPT READY *i1*	DTE INTERRUPT SENT *i2*
INTERRUPT CONFIRMATION	INVALID	*A=NORMAL* *S=i1* (forward)
Packet received from XDCE	**DCE interrupt transfer states (see Note) DCE INTERRUPT READY *j1***	**DCE INTERRUPT SENT *j2***
INTERRUPT	*A=NORMAL* *S=j2* (forward)	INVALID

Note.— Table entries are defined as follows: A = *action to be taken,* S = *the state to be entered,* D = *the diagnostic code to be used in packets generated as a result of this action,* DISCARD *indicates that the received packet is to be cleared from the XDLP buffers, and* INVALID *indicates that the packet/state combination cannot occur.*

Table 5-13. GDLP Mode S subnetwork timers

Timer name	*Timer label*	*Nominal value*
Active channel-GDLP	*Tx*	300 s
L-bit delivery-GDLP	*Tm*	120 s
Packet resequencing and S-bit delivery	*Tq*	60 s

Table 5-14. XDCE actions at state transition

XDCE state	*State definition*	*Action that shall be taken when entering the state*
r1	PACKET LEVEL READY	Return all SVCs to the *p1* state.
p1	READY	Release all resources assigned to the SVC. Break the correspondence between the ADCE/GDCE SVC and the DTE/DCE SVC (the DTE/DCE SVC may not yet be in a *p1* state).
p2	GDLP(ADLP) CALL REQUEST	Determine if sufficient resources exist to support request; if so allocate resources and forward Mode S CALL REQUEST packet to reformatting process; if not, enter ADCE(GDCE) CLEAR REQUEST to GDLP(ADLP) state (*p7*).
p3	ADCE(GDCE) CALL REQUEST	Determine if sufficient resources exist to support request; if so, allocate resources and forward Mode S CALL REQUEST packet to frame processing; if not, send Mode S CLEAR REQUEST to reformatting process and go to state *p1*. Do not forward the Mode S CALL REQUEST to the peer XDCE.
p4	DATA TRANSFER	No action.
p6	GDLP(ADLP) CLEAR REQUEST	Release all resources, send a Mode S CLEAR CONFIRMATION packet to the peer XDCE and enter the *p1* state.
p7	ADCE(GDCE) CLEAR REQUEST to GDLP(ADLP)	Forward Mode S CLEAR REQUEST packet to the peer XDCE via frame processing.
d1	FLOW CONTROL READY	No action.
d2	GDLP(ADLP) RESET REQUEST	Remove Mode S DATA packets transmitted to peer XDCE from window; discard any DATA packets that represent partially transmitted M-bit sequences and discard any Mode S INTERRUPT packets awaiting transfer to the peer XDCE; reset all flow control window counters to 0 (5.2.6.7.1). Send Mode S RESET CONFIRMATION packet to the peer XDCE. Return SVC to *d1* state. Forward Mode S RESET REQUEST packet to reformatting process.
d3	ADCE(GDCE) RESET REQUEST to GDLP(ADLP)	Remove Mode S DATA packets transmitted to peer XDCE from window; discard any DATA packets that represent partially transmitted M-bit sequences and discard any Mode S INTERRUPT packets awaiting transfer to the peer XDCE; reset all flow control window counters to 0 (5.2.6.7.1). Forward Mode S RESET REQUEST packet to peer XDCE via frame processing
i1	GDLP(ADLP) INTERRUPT READY	No action.
i2	GDLP(ADLP) INTERRUPT SENT	Forward Mode S INTERRUPT packet received from peer XDCE to the reformatting process.
j1	ADCE(GDCE) INTERRUPT READY	No action.
j2	ADCE(GDCE) INTERRUPT SENT	Forward Mode S INTERRUPT packet received from the reformatting process.
f1	ADCE(GDCE) RECEIVE READY	No action.
f2	ADCE(GDCE) RECEIVE NOT READY	No action.
g1	GDLP(ADLP) RECEIVE READY	No action.
g2	GDLP(ADLP) RECEIVE NOT READY	No action.

Table 5-15. GDLP (ADLP) effect on ADCE (GDCE) packet layer ready states

Packet received from GDLP (ADLP) (see Note 2)	ADCE (GDCE) states (see Notes 1 and 3) PACKET LEVEL READY r1
CH=0 with no TC present (see Note 4) or CH=0 in a CALL ACCEPT by ADLP packet	*A=DISCARD*
Unassigned packet header	*A=DISCARD*
Call setup, call clearing, DATA, interrupt, flow control, or reset	See Table 5-16

NOTES:

1. *The XDCE state is not necessarily the same state as the DTE/DCE interface.*
2. *All packets from the peer XDLP have been checked for duplication before evaluation as represented by this table.*
3. *Table entries are defined as follows:* A *= action to be taken,* S *= the state to be entered,* D *= the diagnostic code to be used in packets generated as a result of this action,* DISCARD *indicates that the received packet is to be cleared from the XDLP buffers, and* INVALID *indicates that the packet/state combination cannot occur.*
4. *Where CH=0 and a valid TC is present in a CLEAR REQUEST by ADLP or GDLP packet or a CLEAR CONFIRMATION by ADLP or GDLP packet, it is handled as described in 5.2.5.1.2.3 and Table 5-16.*

Table 5-16. GDLP (ADLP) effect on ADCE (GDCE) call setup and clearing states

Packet received from GDLP (ADLP) (see Note 2)	ADCE (GDCE) call setup and clearing States (See Notes 1, 7 and 8) READY p1	GDLP (ADLP) CALL REQUEST p2	ADCE (GDCE) CALL REQUEST p3	DATA TRANSFER p4	GDLP (ADLP) CLEAR REQUEST p6	ADCE (GDCE) CLEAR REQUEST to GDLP (ADLP) p7
Format error (see Note 3)	*A=ERROR* (see Note 10) *S=p7* *D*=33 (see Note 9)	*A=ERROR* *S=p7* *D*=33 (see Note 6)	*A=ERROR* *S=p7* *D*=33 (see Notes 6 and 9)	See Table 5-17	*A=ERROR* *S=p7* *D*=25 (see Note 6)	*A=DISCARD*
CALL REQUEST	*A=NORMAL* (5.2.6.3.1) *S=p2* (forward request to DCE)	*A=ERROR* *S=p7* *D*=21 (see Note 6)	Not applicable (see Note 4)	Not applicable (see Note 4)	*A=ERROR* *S=p7* *D*=25 (see Note 6)	*A=DISCARD*
CALL ACCEPT	*A=ERROR* *S=p7* *D*=20 (see Note 10)	*A=ERROR* *S=p7* *D*=21 (see Note 6)	*A=NORMAL* (5.2.6.3.1) *S=p4* (forward to DCE), or *A=ERROR* *S=p7* *D*=42 (see Note 6)	*A=ERROR* *S=p1* *D*=23 (see Note 6)	*A=ERROR* *S=p7* *D*=25 (see Note 6)	*A=DISCARD*

Packet received from GDLP (ADLP) (see Note 2)	ADCE (GDCE) call setup and clearing States (See Notes 1, 7 and 8) READY *p1*	GDLP (ADLP) CALL REQUEST *p2*	ADCE (GDCE) CALL REQUEST *p3*	DATA TRANSFER *p4*	GDLP (ADLP) CLEAR REQUEST *p6*	ADCE (GDCE) CLEAR REQUEST to GDLP (ADLP) *p7*
CLEAR REQUEST	*A=NORMAL* (5.2.6.3.3) *S=p6* (do not forward)	*A=NORMAL* (5.2.6.3.3) *S=p6* (forward to DCE)	*A=NORMAL* (5.2.6.3.3) *S=p6* (forward to DCE)	*A=NORMAL* (5.2.6.3.3) *S=p6* (forward to DCE)	*A=DISCARD*	*A=NORMAL* (5.2.6.3.3) *S=p1* (do not forward)
CLEAR CONFIRMATION	*A=ERROR* *S=p7* *D=20* (see Note 10)	*A=ERROR* *S=p7* *D=21* (see Note 6)	*A=ERROR* *S=p7* *D=22* (see Note 6)	*A=ERROR* *S=p7* *D=23* (see Note 6)	*A=ERROR* *S=p7* *D=25* (see Note 6)	*A=NORMAL* (5.2.6.3.3) *S=p1* (do not forward)
DATA, interrupt, flow control or reset packets	*A=ERROR* *S=p7* *D=20* (see Note 10)	*A=ERROR* *S=p7* *D=21* (see Notes 6 and 9)	*A=ERROR* *S=p7* *D=22* (see Notes 5 and 6)	See Table 5-17	*A=ERROR* *S=p7* *D=25* (see Note 6)	*A=DISCARD*

NOTES:

1. *The XDCE is not necessarily in the same state as the DTE/DCE interface.*
2. *All packets from the peer XDLP have been checked for duplication before evaluation as represented by this table.*
3. *A format error may result from an S-bit sequence having a first or intermediate packet shorter than the maximum length, or else from an invalid LV field in a CALL REQUEST, CALL ACCEPT, CLEAR REQUEST or INTERRUPT packet. There are no other detectable Mode S format errors.*
4. *The ADCE assigns all channel numbers used between the ADLP and GDLP, hence call collisions are not possible. When a CALL REQUEST by GDLP packet is received bearing a temporary channel number associated with an SVC in the* p4 *state, the association of the temporary to permanent channel number is broken (5.2.5.1.2.3).*
5. *Not applicable to the GDLP.*
6. *The error procedure consists of performing the actions specified when entering the* p7 *state (including sending a CLEAR REQUEST packet to the peer XDLP) and additionally sending a CLEAR REQUEST packet to the DCE (via the reformatting process).*
7. *Table entries are defined as follows:* A = *action to be taken,* S = *the state to be entered,* D = *the diagnostic code to be used in packets generated as a result of this action,* DISCARD *indicates that the received packet is to be cleared from the XDLP buffers, and INVALID indicates that the packet/state combination cannot occur.*
8. *The number in parentheses below an* "A = NORMAL" *table entry is the paragraph number in this document that defines the actions to be taken to perform normal processing on the received packet. If no paragraph number is referenced, the normal processing is defined in the table entry.*
9. *An error condition is declared and transfer to the* p7 *state is possible only if the ground DTE address is known unambiguously. Otherwise the action is to discard the packet.*
10. *The error procedure consists of performing the action when entering the* p7 *state (including sending a CLEAR REQUEST packet to the XDLP) but without sending a CLEAR REQUEST packet to the local DCE.*

Table 5-17. GDLP (ADLP) effect on ADCE (GDCE) reset states

Packet received from GDLP (ADLP) (see Note 2)	ADCE (GDCE) reset states (see Notes 1, 4 and 5)		
	FLOW CONTROL READY *d1*	GDLP (ADLP) RESET REQUEST *d2*	ADCE (GDCE) RESET REQUEST to GDLP (ADLP) *d3*
RESET REQUEST	*A=NORMAL* (5.2.6.7) *S=d2* (forward to DCE)	*A=DISCARD*	*A=NORMAL* (5.2.6.7) *S=d1* (do not forward)
RESET CONFIRMATION	*A=ERROR* *S=d3* *D=27* (see Note 3)	*A=ERROR* *S=d3* *D=28* (see Note 3)	*A=NORMAL* (5.2.6.7) *S=d1* (do not forward)
INTERRUPT	See Table 5-18	*A=ERROR* *S=d3* *D=28* (see Note 3)	*A=DISCARD*
INTERRUPT CONFIRMATION	See Table 5-18	*A=ERROR* *S=d3* *D=28* (see Note 3)	*A=DISCARD*
DATA or flow control packet	See Table 5-19	*A=ERROR* *S=d3* *D=28* (see Note 3)	*A=DISCARD*
Format error (see Note 6)	*A=ERROR* *S=d3* *D=33* (see Note 3)	*A=ERROR* *S=d3* *D=33* (see Note 3)	*A=DISCARD*

NOTES:

1. *The XDCE is not necessarily in the same state as the DTE/DCE interface.*
2. *All packets from the peer XDLP have been checked for duplication before evaluation as represented by this table.*
3. *The error procedure consists of performing the specified actions when entering the d3 state (which includes forwarding a RESET REQUEST packet to the peer XDLP) and sending a RESET REQUEST packet to the DCE (via the formatting function).*
4. *Table entries are defined as follows:* A = *action to be taken,* S = *the state to be entered,* D = *the diagnostic code to be used in packets generated as a result of this action,* DISCARD *indicates that the received packet is to be cleared for the XDLP buffers, and INVALID indicates that the packet/state combination cannot occur.*
5. *The number in parentheses below an* "A = NORMAL" *table entry is the paragraph number in this document that defines the actions to be taken to perform normal processing on the received packet. If no paragraph number is referenced, the normal processing is defined in the table entry.*
6. *A format error may result from an S-bit sequence having a first or intermediate packet shorter than the maximum length, or else from an invalid LV field in a CALL REQUEST, CALL ACCEPT, CLEAR REQUEST, or INTERRUPT packet. There are no other detectable Mode S format errors.*

Table 5-18. GDLP (ADLP) effect on ADCE (GDCE) interrupt transfer states

Packet received from GDLP (ADLP) (see Note 2)	ADCE/GDCE interrupt transfer states (see Notes 1, 3 and 4) GDLP (ADLP) INTERRUPT READY *i1*	GDLP (ADLP) INTERRUPT SENT *i2*
INTERRUPT (see Note 6)	*A=NORMAL* (5.2.6.4.5) *S=i2* (forward to DCE)	*A=ERROR* *S=d3* *D=44* (see Note 5)
Packet received from GDLP (ADLP) (see Note 2)	**ADCE (GDCE) interrupt transfer states (see Notes 1, 3 and 4) ADCE (GDCE) INTERRUPT READY *j1***	**ADCE (GDCE) INTERRUPT SENT *j2***
INTERRUPT CONFIRMATION	*A=ERROR* *S=d3* *D=43* (see Note 5)	*A=NORMAL* (5.2.6.4.5) *S=j1* (forward confirmation to DCE)

NOTES:

1. *The XDCE is not necessarily in the same state as the DTE/DCE interface.*
2. *All packets from the peer XDLP have been checked for duplication before evaluation as represented by this table.*
3. *Table entries are defined as follows:* A = *action to be taken,* S = *the state to be entered,* D = *the diagnostic code to be used in packets generated as a result of this action,* DISCARD *indicates that the received packet is to be cleared for the XDLP buffers, and INVALID indicates that the packet/state combination cannot occur.*
4. *The number in parentheses below an "*A = NORMAL*" table entry is the paragraph number in this document that defines the actions to be taken to perform normal processing on the received packet. If no paragraph number is referenced, the normal processing is defined in the table entry.*
5. *The error procedure consists of performing the specified actions when entering the d3 state (which includes forwarding a RESET REQUEST packet to the peer XDLP) and sending a RESET REQUEST packet to the DCE (via the reformatting process).*
6. *User data length for INTERRUPT packets greater than 32 bytes, or an out of sequence INTERRUPT packet, are considered as errors.*

Table 5-19. GDLP (ADLP) effect on ADCE (GDCE) flow control transfer states

Packet received from GDLP (ADLP) (see Note 2)	ADCE (GDCE) flow control transfer states (see Notes 1, 6 and 7) ADCE (GDCE) RECEIVE READY *f1*	ADCE (GDCE) RECEIVE NOT READY *f2*
DATA packet with invalid PR (see Note 3)	*A=ERROR* *S=d3* *D=2* (see Note 8)	*A=ERROR* *S=d3* *D=2* (see Note 8)
DATA packet with valid PR, invalid PS or LV subfield (see Notes 4 and 5)	*A=DISCARD*, but process the PR value and send REJECT packet containing the expected PS value (see Note 5)	*A=DISCARD*, but process the PR value and send REJECT packet containing the expected PS value when busy condition ends

DATA packet with valid PR, PS and LV subfield	*A=NORMAL* (5.2.6.4.4) (forward)	*A=PROCESS*, if possible; or *A=DISCARD*, but process the PR value and send REJECT containing the expected PS value when busy condition ends

	ADCE (GDCE) flow control transfer states (see Notes 1, 6 and 7)	
Packet received from GDLP (ADLP) (see Note 2)	GDLP (ADLP) RECEIVE READY *g1*	GDLP (ADLP) RECEIVE NOT READY *g2*
RR, RNR, REJECT packet with invalid PR (see Note 3)	*A=ERROR* *S=d3* *D=2* (see Note 8)	*A=ERROR* *S=d3* *D=2* (see Note 8)
RR with valid PR field (see Note 9)	*A=NORMAL* (5.2.6.5)	*A=NORMAL* (5.2.6.6) *S=g1*
RNR with valid PR value (see Note 9)	*A=NORMAL* (5.2.6.5) *S=g2*	*A=NORMAL* (5.2.6.6)
REJECT with valid PR (see Note 9)	*A=NORMAL* (5.2.6.5)	*A=NORMAL* (5.2.6.6) *S=g1*

NOTES:

1. *The XDCE is not necessarily in the same state as the DTE/DCE interface.*
2. *All packets from the peer XDLP have been checked for duplication before evaluation as represented by this table.*
3. *An invalid PR value is one which is less than the PR value (modulo 16) of the last packet sent by the peer XDLP, or greater than the PS value of the next data packet to be transmitted by the XDLP.*
4. *An invalid PS value is one which is different from the next expected value for PS.*
5. *An invalid LV subfield is one which represents a value that is too large for the size of the segment received. In the event of an LV field error which gives rise to a loss of confidence in the correctness of the other fields in the packet, the packet is discarded without any further action.*
6. *Table entries are defined as follows:* A = *action to be taken,* S = *the state to be entered,* D = *the diagnostic code to be used in packets generated as a result of this action,* DISCARD *indicates that the received packet is to be cleared from the XDLP buffers, and INVALID indicates that the packet/state combination cannot occur.*
7. *The number in parentheses below an "*A = NORMAL*" table entry is the paragraph number in this document that defines the actions to be taken to perform normal processing on the received packet. If no paragraph number is referenced, the normal processing is defined in the table entry.*
8. *The error procedure consists of performing the specified actions when entering the d3 state (which includes forwarding a RESET REQUEST packet to the peer XDLP) and sending a RESET REQUEST packet to the DCE (via the reformatting process).*
9. *RR, RNR, and REJECT packets have no end-to-end significance and are not forwarded to the DCE.*
10. *The receipt of a packet smaller than the maximum packet size with M-bit = 1 will cause a reset to be generated and the remainder of the sequence be discarded.*

Table 5-20. DCE effect on ADCE (GDCE) call setup and clearing states

Packet received from DCE (see Notes 2 and 4)	ADCE (GDCE) call setup and clearing states (see Notes 1, 7 and 8)					
	READY *p1*	GDLP (ADLP) CALL REQUEST *p2*	ADCE (GDCE) CALL REQUEST *p3*	DATA TRANSFER *p4*	GDLP (ADLP) CLEAR REQUEST *p6*	ADCE (GDCE) to GDLP (ADLP) CLEAR REQUEST *p7*
CALL REQUEST (see Note 6)	*A=NORMAL* (5.2.6.3.1) *S=p3* (forward)	INVALID (see Note 5)	INVALID (see Note 3)	INVALID (see Note 3)	INVALID (see Note 3)	INVALID (see Note 3)
CALL ACCEPT (see Note 4)	*A=DISCARD*	*A=NORMAL* *S=P4* (forward)	INVALID (see Note 3)	INVALID (see Note 3)	*A=DISCARD*	*A=DISCARD*
CLEAR REQUEST (see Note 4)	*A=DISCARD*	*A=NORMAL* (5.2.6.3.3) *S=p7* (forward)	*A=NORMAL* (5.2.6.3.3) *S=p7* (forward)	*A=NORMAL* (5.2.6.3.3) *S=p7* (forward)	*A=DISCARD*	*A=DISCARD*
DATA, INTERRUPT or RESET packets (see Note 4)	*A=DISCARD*	INVALID (see Note 3)	INVALID (see Note 3)	See Table 5-21	*A=DISCARD*	*A=DISCARD*

NOTES:

1. *The XDCE is not necessarily in the same state as the DTE/DCE interface.*
2. *This is the DTE packet received via the DCE after all DTE/DCE processing has occurred. Procedures local to the DTE/DCE interface (such as RR, RNR, and REJECT if in effect), do not affect the XDCE directly. All error procedures as documented in ISO 8208 have been performed. Hence certain packets are rejected by the interface and are not represented in this table.*
3. *The DCE in its protocol operation with the DTE will detect this error condition, hence the erroneous packet can be said never to "reach" the XDCE; see also Note 2.*
4. *The channel number for the DTE/DCE need not be the same channel number used for the ADCE/GDCE; a packet from the DTE which contains a channel number is associated with an air/ground channel by means of a previously established cross-reference table. If none exists then the DTE/DCE channel by definition references an air/ground channel in the p1 state.*
5. *The ADCE assigns all channel numbers used between the ADLP and GDLP; hence call collisions (denoted p5 ISO 8208) are not possible; see also Note 4.*
6. *A CALL REQUEST from the DTE can never be associated with an XDCE channel number which is not in the p1 state.*
7. *Table entries are defined as follows:* A = *action to be taken,* S = *the state to be entered,* D = *the diagnostic code to be used in packets generated as a result of this action,* DISCARD *indicates that the received packet is to be cleared from the XDLP buffers, and INVALID indicates that the packet/state combination cannot occur.*
8. *The number in parentheses below an "*A = NORMAL*" table entry is the paragraph number in this document that defines the actions to be taken to perform normal processing on the received packet. If no paragraph number is referenced, the normal processing is defined in the table entry.*

Table 5-21. DCE effect on ADCE (GDCE) reset states

Packet received from DCE	ADCE (GDCE) reset states (see Notes 1, 4 and 5)		
	FLOW CONTROL READY *d1*	GDLP (ADLP) RESET REQUEST *d2*	ADCE (GDCE) RESET REQUEST to GDLP (ADLP) *d3*
RESET REQUEST	*A=NORMAL* (5.2.6.7) *S=d3* (forward)	*A=NORMAL* (5.2.6.7) *S=d1* (forward)	*A=DISCARD*
RESET CONFIRMATION	INVALID (see Note 3)	INVALID (see Note 3)	INVALID (see Note 3)
INTERRUPT	See Table 5-21	*A=DISCARD*	Hold interrupt until Mode S reset complete
INTERRUPT CONFIRMATION	See Table 5-22	*A=DISCARD*	INVALID (see Note 3)
DATA (see Note 2)	*A=NORMAL* (5.2.6.4) (forward)	*A=DISCARD*	Hold data until Mode S reset complete

NOTES:

1. *The XDCE is not necessarily in the same state as the DTE/DCE interface.*
2. *This is the DTE packet received via the DCE after all DTE/DCE processing has occurred. Procedures local to the DTE/DCE interface (such as RR, RNR, and REJECT if in effect), do not affect the XDCE directly. All error procedures as documented in ISO 8208 have been performed. Hence certain packets are rejected by the interface and are not represented in this table.*
3. *The DCE in its protocol operation with the DTE will detect this error condition, hence the erroneous packet can be said never to "reach" the XDCE; see also Note 2.*
4. *Table entries are defined as follows:* A = *action to be taken,* S = *the state to be entered,* D = *the diagnostic code to be used in packets generated as a result of this action,* DISCARD *indicates that the received packet is to be cleared from the XDLP buffers, and INVALID indicates that the packet/state combination cannot occur.*
5. *The number in parentheses below an* "A = NORMAL" *table entry is the paragraph number in this document that defines the actions to be taken to perform normal processing on the received packet. If no paragraph number is referenced, the normal processing is defined in the table entry.*

Table 5-22. DCE effect on ADCE (GDCE) interrupt transfer states

Packet received from DCE (see Note 2)	ADCE (GDCE) interrupt transfer state (see Notes 1, 4 and 5)	
	GDLP (ADLP) INTERRUPT READY i1	GDLP (ADLP) INTERRUPT SENT i2
INTERRUPT CONFIRMATION	INVALID (See Note 3)	*A=NORMAL* (5.2.6.4.5) *S=i1* (forward)

Packet received from DCE (see Note 2)	ADCE (GDCE) interrupt transfer states (see Notes 1, 4 and 5)	
	ADCE (GDCE) INTERRUPT READY j1	ADCE (GDCE) INTERRUPT SENT j2
INTERRUPT	*A=NORMAL* (5.2.6.4.5) *S=j2* (forward)	INVALID (see Note 3)

NOTES:

1. *The XDCE is not necessarily in the same state as the DTE/DCE interface.*
2. *This is the DTE packet received via the DCE after all DTE/DCE processing has occurred. Procedures local to the DTE/DCE interface (such as RR, RNR, and REJECT if in effect), do not affect the XDCE directly. All error procedures as documented in ISO 8208 have been performed. Hence certain packets are rejected by the interface and are not represented in this state.*
3. *The DCE in its protocol operation with the DTE will detect this error condition, hence the erroneous packet can be said never to "reach" the XDCE; see also Note 2.*
4. *Table entries are defined as follows:* A = *action to be taken,* S = *the state to be entered,* D = *the diagnostic code to be used in packets generated as a result of this action,* DISCARD *indicates that the received packet is to be cleared from the XDLP buffers, and INVALID indicates that the packet/state combination cannot occur.*
5. *The number in parentheses below an* "A = NORMAL" *table entry is the paragraph number in this document that defines the actions to be taken to perform normal processing on the received packet. If no paragraph number is referenced, the normal processing is defined in the table entry.*

Table 5-23. Broadcast identifier number assignments

Uplink broadcast identifier	*Assignment*
00_{16}	Not valid
01_{16}	Reserved (differential GNSS correction)
30_{16}	Not valid
31_{16}	Reserved for ACAS (RA broadcast)
32_{16}	Reserved for ACAS (ACAS broadcast)
Others	Unassigned
Downlink broadcast identifier	*Assignment*
00_{16}	Not valid
02_{16}	Reserved (traffic information service)
10_{16}	Data link capability report
20_{16}	Aircraft identification
FE_{16}	Update request
FF_{16}	Search request
Others	Unassigned

Table 5-24. Register number assignments

Transponder register No.	*Assignment*
00_{16}	Not valid
01_{16}	Unassigned
02_{16}	Linked Comm-B, segment 2
03_{16}	Linked Comm-B, segment 3
04_{16}	Linked Comm-B, segment 4
05_{16}	Extended squitter airborne position
06_{16}	Extended squitter surface position
07_{16}	Extended squitter status
08_{16}	Extended squitter identification and type
09_{16}	Extended squitter airborne velocity
$0A_{16}$	Extended squitter event-driven information
$0B_{16}$	Air/air information 1 (aircraft state)
$0C_{16}$	Air/air information 2 (aircraft intent)
$0D_{16}$-$0E_{16}$	Reserved for air/air state information
$0F_{16}$	Reserved for ACAS
10_{16}	Data link capability report
11_{16}-16_{16}	Reserved for extension to data link capability reports
17_{16}	Common usage GICB capability report
18_{16}-$1F_{16}$	Mode S specific services capability reports
20_{16}	Aircraft identification
21_{16}	Aircraft and airline registration markings
22_{16}	Antenna positions
23_{16}	Reserved for antenna position
24_{16}	Reserved for aircraft parameters
25_{16}	Aircraft type
26_{16}-$2F_{16}$	Unassigned
30_{16}	ACAS active resolution advisory
31_{16}-$3F_{16}$	Unassigned
40_{16}	Selected vertical intention
41_{16}	Next waypoint identifier
42_{16}	Next waypoint position
43_{16}	Next waypoint information
44_{16}	Meteorological routine air report

Transponder register No.	*Assignment*
45_{16}	Meteorological hazard report
46_{16}	Reserved for flight management system Mode 1
47_{16}	Reserved for flight management system Mode 2
48_{16}	VHF channel report
49_{16}-$4F_{16}$	Unassigned
50_{16}	Track and turn report
51_{16}	Position report coarse
52_{16}	Position report fine
53_{16}	Air-referenced state vector
54_{16}	Waypoint 1
55_{16}	Waypoint 2
56_{16}	Waypoint 3
57_{16}-$5E_{16}$	Unassigned
$5F_{16}$	Quasi-static parameter monitoring
60_{16}	Heading and speed report
61_{16}	Extended squitter emergency/priority status
62_{16}	Reserved for target state and status information
63_{16}	Reserved for extended squitter
64_{16}	Reserved for extended squitter
65_{16}	Aircraft operational status
66_{16}-$6F_{16}$	Reserved for extended squitter
70_{16}-75_{16}	Reserved for future aircraft downlink parameters
76_{16}-$E0_{16}$	Unassigned
$E1_{16}$-$E2_{16}$	Reserved for Mode S BITE
$E3_{16}$	Transponder type/part number
$E4_{16}$	Transponder software revision number
$E5_{16}$	ACAS unit part number
$E6_{16}$	ACAS unit software revision number
$E7_{16}$-$F0_{16}$	Unassigned
$F1_{16}$	Military applications
$F2_{16}$	Military applications
$F3_{16}$-FF_{16}	Unassigned

Note.— In the context of Table 5-24, the term "aircraft" can be understood as "transponder carrying aircraft", "pseudo-aircraft (e.g. an obstacle)" or "vehicle".

Table 5-25. MSP channel number assignments

Uplink channel number	*Assignment*
0	Not valid
1	Reserved (specific services management)
2	Reserved (traffic information service)
3	Reserved (ground-to-air alert)
4	Reserved (ground derived position)
5	ACAS sensitivity level control
6	Reserved (ground-to-air service request)
7	Reserved (air-to-ground service response)
8–63	Unassigned
Downlink channel number	*Assignment*
0	Not valid
1	Reserved (specific services management)
2	Unassigned
3	Reserved (data flash)
4	Reserved (position request)
5	Unassigned
6	Reserved (ground-to-air service response)
7	Reserved (air-to-ground service request)
8–63	Unassigned

SCHEDULE 4

(Regulation 51 (c))

1. MODE S PACKET FORMATS

1.1. Formats. The Mode S packet formats shall be as specified in Figures 5-3 to 5-22 as contained in this schedule.

1.2. Significance of control fields. The structure of the format control fields used in Mode S packets shall be as specified in Figure 5-23. The significance of all control fields used in these packet formats shall be as follows:

Field	*Symbol Definition*
AG	Address, Ground; the 8-bit binary representation of the ground DTE address
AM	Address, Mobile; the 4-bit binary representation of the last two BCD digits of the mobile DTE address
CC	Clearing cause as defined in ISO 8208
CH	Channel number (1 to 15)
DC	Diagnostic code as defined in ISO 8208
DP	Data packet type (Figure 5-23)
F	S-bit sequence, first packet flag
FILL	Fill field
FILL1	Has a length of 6 bits for a non-multiplexed packet in a downlink SLM frame; otherwise it is 0 bit
FILL2	Has a length of 0 bit for a non-multiplexed packet in a downlink SLM frame and for a multiplexing header; otherwise it is 2 bits
FIRST PACKET	The contents of the first of the multiplexed packets
FS	Fast select present
IN	Initialization bit
L	"More bit" for long-form MSP packets
LAST PACKET	The contents of the last of the multiplexed packets
LENGTH	The length of a multiplexed packet in bytes expressed as an unsigned binary number
LV	User data field length; number of user bytes M "More bit" for SVC DATA packets
M/CH	MSP channel number
MP	MSP packet type (Figure 5-23)
M/SN	Sequence number; the sequence number for the long form MSP packet
OD	Optional data
ODL	Optional data length
OF	Option flag

P	Priority field
PR	Packet receive sequence number
PS	Packet send sequence number
RC	Resetting cause code as defined in ISO 8208
RT	Route table
RTL	Route table length expressed in bytes
S	"More bit" for CALL REQUEST, CALL ACCEPT, CLEAR REQUEST and INTERRUPT packets
SN	Sequence number; the sequence number for this packet type
SP	Supervisory packet (Figure 5-23)
SS	Supervisory subset number (Figure 5-23)
ST	Supervisory type (Figure 5-23)
TC	Temporary channel number (1 to 3)
UD	User data field

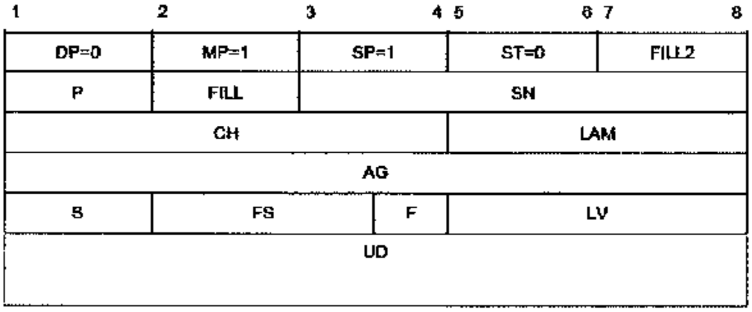


Figure 5-3. CALL REQUEST by ADLP packet

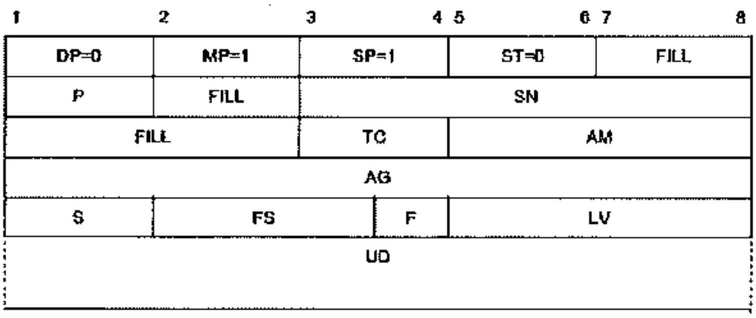


Figure 5-4. CALL REQUEST by GDLP packet

1 2 3 4 5 6 7 8

<table>
<tr><td colspan="2">DP=0</td><td colspan="2">MP=1</td><td colspan="2">SP=1</td><td colspan="2">ST=1</td><td colspan="2">FILL2</td></tr>
<tr><td colspan="4">TC</td><td colspan="6">SN</td></tr>
<tr><td colspan="6">CH</td><td colspan="4">AM</td></tr>
<tr><td colspan="10">AG</td></tr>
<tr><td colspan="2">S</td><td colspan="3">FILL</td><td colspan="1">F</td><td colspan="4">LV</td></tr>
<tr><td colspan="10">UD</td></tr>
</table>

Figure 5-5. CALL ACCEPT by ADLP packet

1 2 3 4 5 6 7 8

<table>
<tr><td colspan="2">DP=0</td><td colspan="2">MP=1</td><td colspan="2">SP=1</td><td colspan="2">ST=1</td><td colspan="2">FILL</td></tr>
<tr><td colspan="4">FILL</td><td colspan="6">SN</td></tr>
<tr><td colspan="6">CH</td><td colspan="4">AM</td></tr>
<tr><td colspan="10">AG</td></tr>
<tr><td colspan="2">S</td><td colspan="3">FILL</td><td colspan="1">F</td><td colspan="4">LV</td></tr>
<tr><td colspan="10">UD</td></tr>
</table>

Figure 5-6. CALL ACCEPT by GDLP packet

1 2 3 4 5 6 7 8

<table>
<tr><td colspan="2">DP=0</td><td colspan="2">MP=1</td><td colspan="2">SP=1</td><td colspan="2">ST=2</td><td colspan="2">FILL2</td></tr>
<tr><td colspan="4">TC</td><td colspan="6">SN</td></tr>
<tr><td colspan="6">CH</td><td colspan="4">AM</td></tr>
<tr><td colspan="10">AG</td></tr>
<tr><td colspan="10">CC</td></tr>
<tr><td colspan="10">DC</td></tr>
<tr><td colspan="2">S</td><td colspan="3">FILL</td><td colspan="1">F</td><td colspan="4">LV</td></tr>
<tr><td colspan="10">UD</td></tr>
</table>

Figure 5-7. CLEAR REQUEST by ADLP packet

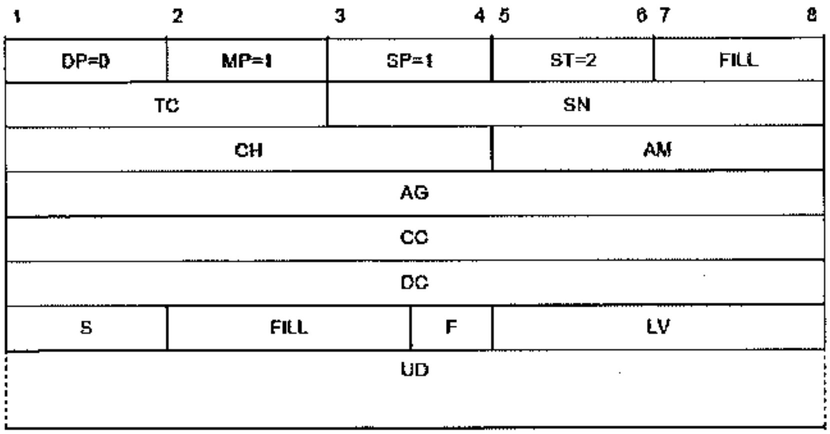


Figure 5-8. CLEAR REQUEST by GDLP packet

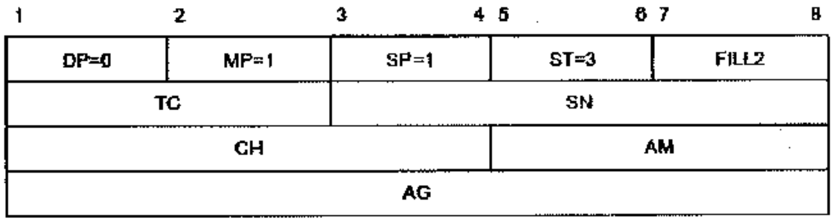


Figure 5-9. CLEAR CONFIRMATION by ADLP packet

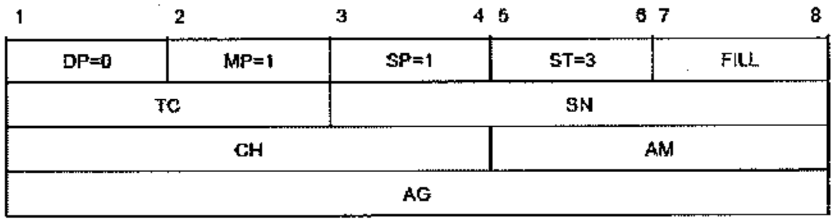


Figure 5-10. CLEAR CONFIRMATION by GDLP packet

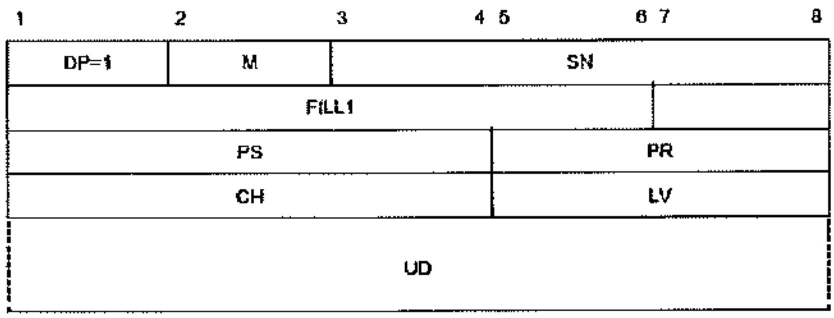


Figure 5-11. DATA packet

1 2 3 4 5 6 7 8

DP=0	MP=1	SP=3	ST=1	FILL2
S	F	SN		
CH			LV	
UD				

Figure 5-12. INTERRUPT packet

1 2 3 4 5 6 7 8

DP=0	MP=1	SP=3	ST=3	SS=0
FILL2		SN		
CH			FILL	

Figure 5-13. INTERRUPT CONFIRMATION packet

1 2 3 4 5 6 7 8

DP=0	MP=1	SP=3	ST=3	SS=1
FILL2		SN		
CH			PR	

Figure 5-13. INTERRUPT CONFIRMATION packet

1 2 3 4 5 6 7 8

DP=0	MP=1	SP=3	ST=3	SS=1
FILL2		SN		
CH			PR	

Figure 5-14. REJECT packet

1 2 3 4 5 6 7 8

DP=0	MP=1	SP=2	ST=0	FILL2
FILL		SN		
CH			PR	

Figure 5-15. RECEIVE READY packet

1 2 3 4 5 6 7 8

<table>
<tr><td>DP=0</td><td>MP=1</td><td>SP=2</td><td>ST=1</td><td>FILL2</td></tr>
<tr><td colspan="2">FILL</td><td colspan="3">SN</td></tr>
<tr><td colspan="3">CH</td><td colspan="2">PR</td></tr>
</table>

Figure 5-16. RECEIVE NOT READY packet

1 2 3 4 5 6 7 8

<table>
<tr><td>DP=0</td><td>MP=1</td><td>SP=2</td><td>ST=2</td><td>FILL2</td></tr>
<tr><td colspan="2">FILL</td><td colspan="3">SN</td></tr>
<tr><td colspan="3">CH</td><td colspan="2">FILL</td></tr>
<tr><td colspan="5">RC</td></tr>
<tr><td colspan="5">DC</td></tr>
</table>

Figure 5-17. RESET REQUEST packet

1 2 3 4 5 6 7 8

<table>
<tr><td>DP=0</td><td>MP=1</td><td>SP=2</td><td>ST=3</td><td>FILL2</td></tr>
<tr><td colspan="2">FILL</td><td colspan="3">SN</td></tr>
<tr><td colspan="3">CH</td><td colspan="2">FILL</td></tr>
</table>

Figure 5-18. RESET CONFIRMATION packet

1 2 3 4 5 6 7 8

<table>
<tr><td>DP=0</td><td>MP=1</td><td>SP=3</td><td>ST=0</td><td>OF</td><td>IN</td></tr>
<tr><td colspan="6">RTL</td></tr>
<tr><td colspan="6">RT</td></tr>
<tr><td colspan="6">ODL</td></tr>
<tr><td colspan="6">OD</td></tr>
</table>

Figure 5-19. ROUTE packet

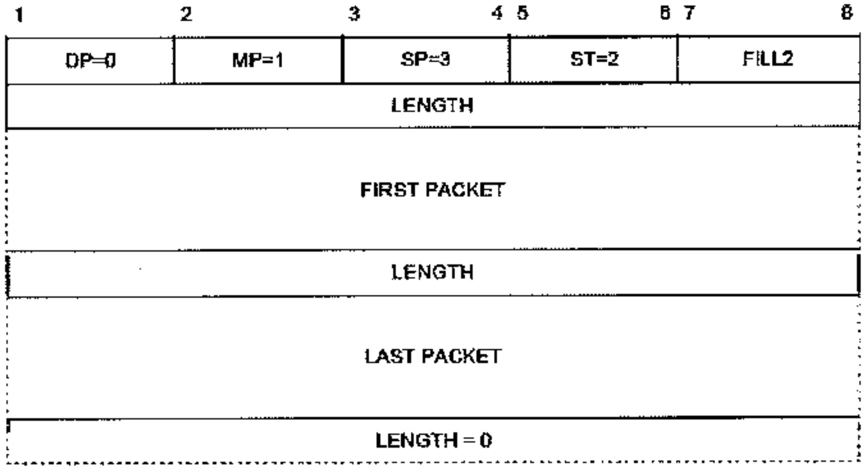


Figure 5-20. MULTIPLEX packet

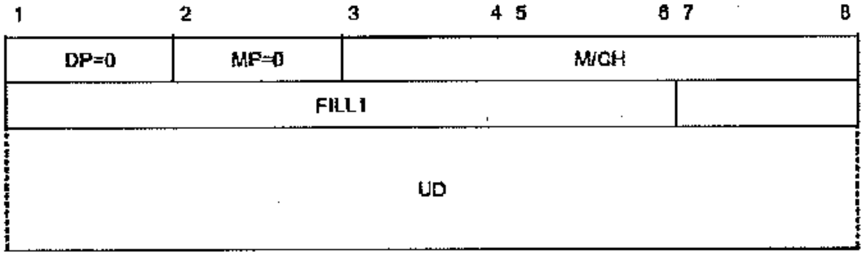


Figure 5-21. SHORT FORM MSP packet

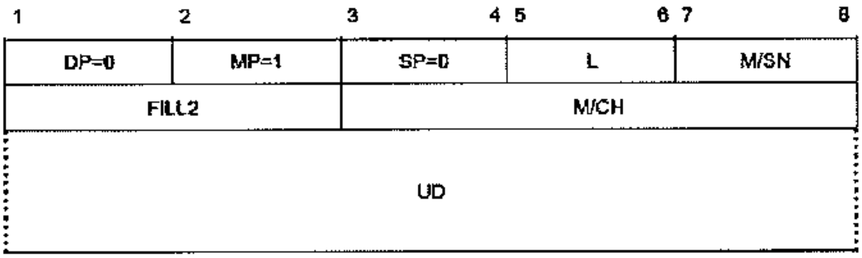


Figure 5-22. LONG FORM MSP packet