

Application Program Interface Supplement  
to the  
Software Communications Architecture Specification

**APPENDIX B**

**Tables of Services**

Revision Summary

2.0	Initial Release
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## **B.1 DESCRIPTION / PURPOSE.**

The services provided by an API at a particular interface include the data transfer, real-time control, and non-real-time control and status that are used at that interface. Services provided at the interfaces defined for APIs in the API Supplement and used by multiple waveform applications are summarized in the following tables.

These tables were generated as a result of analysis of seven JTRS waveforms (LOS, Have Quick, SINGARS, DAMA/DASA, VRC-99, WDW, and HF ALE).

Building Blocks are generalized from these tables. Building Blocks support the services in these tables by way of parameterization. Parameterization of these building blocks will also support many other services that may be needed by other waveforms.



**Table 1. Physical API Control Services**

Group	Subgroup	Primitive	Port Type	Description
Antenna Control	Rx Antenna Control	Rx Antenna	NRT	Connects the receiver to the antenna selected for reception
Antenna Control	Tx Antenna Control	Tx Antenna	NRT	Connects the transmitter to the antenna selected for transmission
Per Hop Rx Control	Data Flow	EndOfStream	RT	Indicates that the last symbol of this hop is an end of stream.
Per Hop Rx Control	Data Flow	NumberOfSymbolsToReceive	RT	Number of symbols to be received in a packet. If the value is -1, there is no limit to the number of symbols to be received. Reception of a packet ends when this number of symbols is received or when a time to end the packet is reached.
Per Hop Rx Control	Data Flow	StartOfStream	RT	Indicates that the first symbol of this hop is a start of stream.
Per Hop Rx Control	Data Flow	SymbolRate	RT	Number of symbols per unit of time to be received.
Per Hop Rx Control	DS Spread Spectrum	PN Code	RT	The pseudo-random code in terms of units or a table index as defined by the documentation for the specific physical radio.
Per Hop Rx Control	DS Spread Spectrum	PN Code Offset	RT	The offset in a pseudo-random code sequence, in terms of units or a table index as defined by the documentation for the specific physical radio.
Per Hop Rx Control	DS Spread Spectrum	PN Code Rate	RT	The pseudo-random code rate (e.g., chips/sec) in terms of units or a table index as defined by the documentation for the specific physical radio.
Per Hop Rx Control	FEC Control	Noise Thresholds		Noise threshold levels to produce soft decisions
Per Hop Rx Control	Frequency	Frequency	RT	Receiver tuning frequency. The frequency at which to tune the receiver for the hop.
Per Hop Rx Control	Modulation	ModulationType	RT	Enumerated value that specifies the type of demodulation to use when receiving the signal. E.g. AM, FM, FSK, etc. This is a setup parameter.

Group	Subgroup	Primitive	Port Type	Description
Per Hop Rx Control	Time	HopTimeOfFirstSymbol	RT	The value of the system time when the starting edge of the first symbol of data was input from the antenna.
Per Hop Rx Control	Time	HopTimeOfLastSymbol	RT	The value of the system time when the starting edge of the last symbol of data will be output to the antenna. This time is used by the component to provide support to timeout the reception.
Per Hop Tx Control/Data	Power	OutputPower	RT	This value sets the RF output power to the antenna.
Per Hop Tx Control/Data	Data Flow	EndOfStream	RT	Indicates the condition that the last symbol of this hop is an end of stream.
Per Hop Tx Control/Data	Data Flow	HopStreamSequenceNumber	RT	Sequence number of the hop within the stream sequence. The waveform application sets this value to zero at every occurrence of a start of stream.
Per Hop Tx Control/Data	Data Flow	NumberOfSymbolsToTransmit	RT	The number of symbols to transmit.
Per Hop Tx Control/Data	Data Flow	StartOfStream	RT	Indicates the condition that the first symbol of this hop is a start of stream.
Per Hop Tx Control/Data	Data Flow	SymbolRate	RT	Number of symbols per unit of time to be transmitted.
Per Hop Tx Control/Data	Data Flow	SymbolsToTransmit	RT	The number of symbols to transmit.
Per Hop Tx Control/Data	DS Spread Spectrum	PN Code	RT	The pseudo-random code in terms of units or a table index as defined by the documentation for the specific physical radio.
Per Hop Tx Control/Data	DS Spread Spectrum	PN Code Offset	RT	The offset in a pseudo-random code sequence, in terms of units or a table index as defined by the documentation for the specific physical radio.
Per Hop Tx Control/Data	DS Spread Spectrum	PN Code Rate	RT	The pseudo-random code rate (e.g., chips/sec) in terms of units or a table index as defined by the documentation for the specific physical radio.
Per Hop Tx Control/Data	Frequency	Frequency	RT	Receiver tuning frequency. Measured actual frequency of received signal.

Group	Subgroup	Primitive	Port Type	Description
Per Hop Tx Control/Data	Modulation	ModulationType	RT	Enumerated value that specifies the type of demodulation to use when receiving the signal. E.g. AM, FM, FSK, etc. This is a setup parameter.
Per Hop Tx Control/Data	Time	HopTimeOfFirstSymbol	RT	The value of the system time when the starting edge of the first symbol of data will be output to the antenna.
Per Modulation Rx Control	Auto Reacquisition	LocalReacquireEnable	NRT	Resets all the state variables in a receiver to allow for a new acquisition.
Per Modulation Rx Control	Data Flow	CarrierThreshold	NRT	Sets the value that the signal has to be in relation to the noise level measurement to declare bit sync.
Per Modulation Rx Control	Data Flow	SymbolsPerPacket_FirstPacket	NRT	Sets the number of symbols contained in the first packet of a sequence of packets.
Per Modulation Rx Control	Data Flow	SymbolsPerPacket_RemainingPackets	NRT	Sets the number of symbols contained the rest of the packets in the sequence.
Per Modulation Rx Control	Doppler	DopplerBandwidth	NRT	Set the bandwidth of the receiver filters to accommodate the frequency offset due to Doppler
Per Modulation Rx Control	FEC Control	numberOfSoftBits	NRT	Number of bits output by the demodulator with each symbol to aid in the FEC decoding.
Per Modulation Rx Control	Modulation	BitsPerSymbol	NRT	Number of data bits represented by each symbol of modulation.
Per Modulation Rx Control	Modulation	ModulationType	NRT	Enumerated value that specifies the type of demodulation to use when receiving the signal. E.g. AM, FM, FSK, etc. This is a setup parameter.
Per Modulation Rx Control	Squelch	Squelch Attack Time	NRT	The time that it takes the squelch audio attenuator to reach 95% of its maximum value after the squelch indicator falls below threshold.
Per Modulation Rx Control	Squelch	Squelch Decay Time	NRT	The time that it takes the squelch audio attenuator to decay to 5% of its maximum value after the squelch indicator rises above the threshold.
Per Modulation Rx Control	Squelch	SquelchLevelOffToOn	NRT	Sets the threshold that squelch indicator needs to go below to initiate the squelch circuit.

Group	Subgroup	Primitive	Port Type	Description
Per Modulation Rx Control	Squelch	SquelchLevelOnToOff	NRT	Sets the threshold that the squelch indicator needs to go above to turn off the squelch circuit.
Per Modulation Rx Control	Squelch	SquelchType	NRT	Sets the type of squelch circuit to use at this time.
Per Modulation Rx Control		OffRampTime	NRT	The time for the RF signal to decrease from 90% to 10% power when the signal drops off.
Per Modulation Rx Control		OnRampTime	NRT	The time for the RF signal to increase from 10% to 90% power when the signal starts up.
Radio Mode	Mode Select	Mode	NRT	Sets the mode(s) of the radio. Modes: OFF, STANDBY, OPERATE, TEST
Radio Mode	Silent Mode Select	SilentMode	NRT	Set the SilentMode to TRUE (on) or FALSE (off). If SilentMode is TRUE the transmitter will remain inactive even if TxActive is TRUE.
Rx Data	Data Flow	EndOfStream	RT	Indicates that the received packet of data is at the end of a stream.
Rx Data	Data Flow	HopStreamSequenceNumber	RT	Sequence number of the hop within the stream sequence. This number is reset to zero at every occurrence of a detected Start Of Stream.
Rx Data	Data Flow	NumberOfSymbolsReceived	RT	Number of symbols in the received packet.
Rx Data	Data Flow	StartOfStream	RT	Indicates that the received packet of data is at the beginning of a stream.
Rx Data	Data Flow	SymbolRate	RT	Expected number of symbols per unit of time to the demodulator. Measured number of symbols per unit of time from symbol tracker.
Rx Data	Data Flow	SymbolsReceived	RT	The actual received data
Rx Data	DS Spread Spectrum	PN Code	RT	The pseudo-random code in terms of units or a table index as defined by the documentation for the specific physical radio.
Rx Data	DS Spread Spectrum	PN Offset	RT	The offset in a pseudo-random code sequence, in terms of units or a table index as defined by the documentation for the specific physical radio.

Group	Subgroup	Primitive	Port Type	Description
Rx Data	Frequency	Frequency	RT	Receiver tuning frequency. Measured actual frequency of received signal.
Rx Data	Modulation	ModulationType	RT	Enumerated value that specifies the type of demodulation to use when receiving the signal. E.g. AM, FM, FSK, etc. This is a setup parameter.
Rx Data	Signal Quality	noiseLevel	RT	Returns the physical layer measurement of the noise level
Rx Data	Signal Quality	signalLevel	RT	Returns the physical layer measurement of the signal level
Rx Data	Time	HopTimeOfFirstSymbol	RT	Time the first symbol of a message or hop is expected to be received. Measured actual time of the first symbol at the receiver.
Rx Setup	Modulation	FrequencyDeviationForLogicalOne_FskReceive	NRT	Represents the frequency deviation for a logical "one" for FSK modulation format.
Rx Setup	Modulation	FrequencyDeviationForLogicalZero_FskReceive	NRT	Represents the frequency deviation for a logical "zero" for FSK modulation format.
Rx Setup	Modulation	FrequencyDeviationFullScale_FmReceive	NRT	The full scale FM deviation (single-ended) for FM modulation.
Rx Setup	Modulation	ModulationPercent_AmReceive	NRT	AM modulation index.
Rx Setup	Time	ReceiveInputPathDelay	NRT	The delay of the system reception line prior to the input of the component. The component will use this value to compute the time-of-arrival of the first symbol.
Rx Terminate	Rx Terminate	Abort Rx	NRT	Shut off the receive operation.
Rx Terminate	Rx Terminate	Drop Capture	NRT, RT	Zeros all state variables relating to signal capture and demodulation. Returns to the Acquiring Acquisition State.
Tx Setup	Modulation	FrequencyDeviationForLogicalOne_FskTransmit	NRT	Represents the frequency deviation for a logical "one" for FSK modulation format.
Tx Setup	Modulation	FrequencyDeviationForLogicalZero_FskTransmit	NRT	Represents the frequency deviation for a logical "zero" for FSK modulation format.

Group	Subgroup	Primitive	Port Type	Description
Tx Setup	Modulation	FrequencyDeviationFullScale_FmTransmit	NRT	The full scale FM deviation (single-ended) for FM modulation.
Tx Setup	Modulation	ModulationPercent_AmTransmit	NRT	AM modulation index.
Tx Setup	Power	OutputPower	NRT	This value sets the RF output power to the antenna.
Tx Setup	Time	TransmitOutputPathDelay	NRT	The delay of the system transmission line following the output of the component. The component will use this value to compensate the time-of-transmission of the first symbol.
Tx Setup		OffRampTime	NRT	The time interval for the transmitted RF to decrease from yy% power to xx% power when transmitter turns off. This parameter may have to be changed to indicate a power down profile for certain waveforms.
Tx Setup		OnRampTime	NRT	The time interval for the transmitted RF to increase from xx% power to yy% power when transmitter turns on. This parameter may have to be changed to indicate a power up profile for certain waveforms.

**Table 2. MAC API Control Services**

Group	Subgroup	Primitive	Port Type	Description
Forward error correction		FEC Parameters	NRT	This command sets the FEC type, the rate, the constraint length, the number of soft decisions per symbol, the threshold levels to produce the soft decisions, the code taps, the puncture points, and the traceback length. The information that the Physical layer needs to set up the FEC input is passed in the setFECPassthrough call.
Addressing		Own Address	NRT	MAC Address of this node. This for link layer protocols that have MAC addresses
Addressing		Distant Address(es)	NRT	MAC Address of the destination. This for link layer protocols that have MAC addresses.
Synchronization		Network synchronization time	NRT	Used to synchronize or initialize external network time. E.g. TODs and net TODs.
Addressing		Net ID	NRT	MAC layer attribute that identifies a radio net. The net id translates into a multiple access identifier such as a hopset, Slot ID, PN Code or PN Offset at the Physical layer.
Synchronization		dropCapture	NRT, RT	Zeros all state variables relating to signal capture and demodulation. Returns to the Acquiring Acquisition State.
Interleaver	Interleaver Control	interleaver type	NRT	Enumerated value that includes interleaver types (interleaver algorithm and parameters) that are supported by the interface.
Synchronization		WOD	NRT	Word of the Day which is input to the randomizer to create pseudo random number codes. Selects Hopping frequencies.
Access		Slot time	RT	Start time of a TDMA slot.
Fill		Fill	NRT	COMSEC variables, TRANSEC variables, Net times, etc.
Access		Start transmit/end transmit (PTT)	RT	Signals the start and end of transmitter operation.
Control		Flow control	RT	Control the flow of data units into and out of MAC layer.

Group	Subgroup	Primitive	Port Type	Description
Control		Waveform type and mode	NRT	Selects the waveform processing to be performed in the MAC.
QOS		Quality of service	RT	E.g. throughput, transit delay, priority, residual error rate, resilience, SNR, SINAD, RSSI, acknowledgement.
Access		Waveform-specific parameters	NRT	E.g. slot assignments, 188-220 RNAD parameters, etc.
Synchronization		Frame synchronization	NRT	Algorithm to use to indicate start of message.
Fill		Zeroize	NRT, RT	Clear all security-related variables.
Control		User data bit rate	NRT	Number of bits per unit time for transmit and receive.
Synchronization		TOD	RT	Time of Day which is input to the randomizer to create pseudo random number codes. Selects Hopping frequencies.

**Table 3. LLC API Control Services**

Group	Subgroup	Primitive	Port Type	Description
(See Copyright notice on the last page of this spreadsheet.)				
Local Management	Information Reporting	DL_INFO_REQ	NRT	Used to query the DLSP (Data Link Service Provider) to find out what version of DLPI and which parts of DLPI does the DLSP support. Describes: maximum/minimum number of bytes that may be transmitted in a DLSDU, current state, MAC type supported (i.e. CMSA-8802/3,Token-8802/4,Token Ring 8802/5 ethernet,...) , service modes supported (DL_CODLS, DL_CLDLS, DL_ACLDLS), negotiated/default values for QOS, PPA style, and address info.
Local Management	Information Reporting	DL_INFO_ACK	NRT	Used to respond to a query from the DLSP user (i.e. DL_INFO_REQ) to the DLSP (Data Link Service Provider) to provide the following: maximum/minimum number of bytes that may be transmitted in a DLSDU, current state, MAC type supported (i.e. CMSA-8802/3,Token-8802/4,Token Ring 8802/5 ethernet,...) , service modes supported (DL_CODLS, DL_CLDLS, DL_ACLDLS), negotiated/default values for QOS, PPA style, and address info.
Local Management	Information Reporting	DL_ERROR_ACK	NRT	Informs the DLS user that a previous issued request was invalid. It conveys the identity of the primitive in error.
Local Management	Attach	DL_ATTACH_REQ	NRT	The attach service assigns a physical point of attachment (PPA) to specify the physical medium over which communication will occur. The DLS provider indicates success with a DL_OK_ACK: failure with a DL_ERROR_ACK. This is used when a link layer can support more than one physical medium or for a physical layer that supports multiplexing. In STREAMS a PPA is associated with a stream. A PPA can be used to identify channel or slot in TDMA.

Group	Subgroup	Primitive	Port Type	Description
Local Management	Attach	DL_DETACH_REQ	NRT	The detach requests the DLS provider detach a PPA that was previously set up via the DL_ATTACH_REQ.
Local Management	Attach	DL_OK_ACK	NRT	Informs the DLS user that a previous issued request was valid and was received successfully. It is only initiated for those primitives that require a positive acknowledgement.
Local Management	Attach	DL_ERROR_ACK	NRT	Informs the DLS user that a previous issued request was invalid. It conveys the identity of the primitive in error.
Local Management	Bind	DL_BIND_REQ	NRT	Used to assign your local link address. Associates a data link address to a PPA/stream. Conveys mode of service(DL_CODLS, DL_DLDLS, DL_ACLDLS) for this connection. DL_BIND_REQ allows service user to request automatic response to XID or TEST on this stream/PPA.
Local Management	Bind	DL_BIND_ACK	NRT	Reports the successful bind of a DLSAP address to a stream and returns the bound DLSAP address to the DLS user. This primitive is generated in response to a DL_BIND_REQ.
Local Management	Bind	DL_SUBS_BIND_REQ	NRT	Requests the DLS provider bind a subsequent DLSAP address to the same JTRS port.
Local Management	Bind	DL_SUBS_BIND_ACK	NRT	Reports the successful bind of a subsequence DLSAP to a JTRS Port and returns the bound DLSAP address to the DLS user. This primitive is generated in response to a DL_SUBS_BIND_REQ.
Local Management	Bind	DL_UNBIND_REQ	NRT	Requests the DLS Provider to unbind the DLSAP address that had been bound by a previous DL_BIND_REQ from this JTRS port.
Local Management	Bind	DL_SUBS_UNBIND_REQ	NRT	Request the DLS Provider to unbind the DLSAP address, that had been bound by a previous DL_SUBS_BIND_REQ on this port.

Group	Subgroup	Primitive	Port Type	Description
Local Management	Bind	DL_OK_ACK	NRT	Informs the DLS user that a previous issued request was valid and was received successfully. It is only initiated for those primitives that require a positive acknowledgement.
Local Management	Bind	DL_ERROR_ACK	NRT	Informs the DLS user that a previous issued request was invalid. It conveys the identity of the primitive in error.
Local Management	Other	DL_ENABMULTI_REQ	NRT	Requests the DLS Provider to enable specific multicast address on a JTRS port.
Local Management	Other	DL_DISABMULTI_REQ	NRT	Requests the DLS Provider to disable multicast address on a JTRS port.
Local Management	Other	DL_PROMISCON_REQ	NRT	Requests the DLS provider to enable promiscuous mode (ignores address and accepts all messages) either at the physical or SAP level.
Local Management	Other	DL_PROMISCOFF_REQ	NRT	Requests the DLS provider to disable promiscuous mode on a JTRS port, either at the physical or SAP level.
Local Management	Other	DL_OK_ACK	NRT	Informs the DLS user that a previous issued request was valid and was received successfully. It is only initiated for those primitives that require a positive acknowledgement.
Local Management	Other	DL_ERROR_ACK	NRT	Informs the DLS user that a previous issued request was invalid. I conveys the identity of the primitive in error.
Connection Establishment	Connection Establishment	DL_CONNECT_REQ	RT	Requests the DLS provider to establish a data link connection between a local DLS user and a remote DLS user for the purpose of sending data. The request contains the DLSAP address for the remote (called) DLS user and the QOS parameters to be negotiate during establishment.

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Group	Subgroup	Primitive	Port Type	Description
Connection Establishment	Connection Establishment	DL_CONNECT_IND	RT	Conveys to the local DLS user that a remote (calling) DLS user wishes to establish a data link connection. The indication contains the DLSAP address of the calling and called DLS user, and the QOS parameters as specified by the calling DLS user and negotiated by the DLS provider.
Connection Establishment	Connection Establishment	DL_CONNECT_RES	RT	Directs the DLS provider to accept a connect request from a remote (calling) DLS user on a designated JTRS port. The DLS user may accept the connection on the same JTRS Port where the connection indication arrived, or on a new JTRS PORT. (?? Not sure how to do this in JTRS). The response contains the correlation number from the corresponding DL_CONNECT_IND.
Connection Establishment	Connection Establishment	DL_CONNECT_CON	RT	Informs the local DLS user that the requested data link connection has been established. The primitive contains the DLSAP address of the responding DLS user and the quality of service parameters as selected by the responding DLS user.
Connection Establishment	Connection Establishment	DL_TOKEN_REQ	RT	Requests that a connection response token be assigned to the JTRS port and returned to the DLS user. This token can be supplied in the DL_CONNECT_RES primitive to indicate the JTRS port on which a connection will be established
Connection Establishment	Connection Establishment	DL_TOKEN_ACK	RT	This message is sent in response to DL_TOKEN_REQ: it conveys the connection response token assignment to the JTRS port
Connection Establishment	Connection Establishment	DL_OK_ACK	RT	Informs the DLS user that a previous issued request was valid and was received successfully. It is only initiated for those primitives that require a positive acknowledgement.
Connection Establishment	Connection Establishment	DL_ERROR_ACK	RT	Informs the DLS user that a previous issued request was invalid. It conveys the identity of the primitive in error.

Group	Subgroup	Primitive	Port Type	Description
Connection-Mode Data Transfer	Data Transfer	DL_DATA_REQ	RT	Provides for transfer of connection oriented user data transmit: Guaranteed to delivery in the same order as transmitted to DLS user peer. If order can not be maintained user will receive a DL_RESET_IND or DL_DISCONNECT_IND (if connection lost).
Connection-Mode Data Transfer	Data Transfer	DL_DATA_IND	RT	Conveys a DLSDU from the DLS provider to the DLS user. Guaranteed to delivery in the same order as transmitted from DLS user peer. If order can not be maintained user will receive a DL_RESET_IND or DL_DISCONNECT_IND (if connection lost).
Connection-Mode Data Transfer	Reset	DL_RESET_REQ	RT	Requests that the DLS provider initiate the resynchronization of a data link connection. This service is abortive, so no guarantee of delivery can be assumed about data that is in transit.
Connection-Mode Data Transfer	Reset	DL_RESET_IND	RT	Informs the DLS user that either the remote DLS user is resynchronizing or the DLS provider is reporting loss of data for which it can not recover. The indication convey the reason for the reset.
Connection-Mode Data Transfer	Reset	DL_RESET_RES	RT	Directs the DLS provider to complete resynchronizing the data link connection.
Connection-Mode Data Transfer	Reset	DL_RESET_CON	RT	Informs the reset-initiating DLS user that the reset has completed
Connection-Mode Data Transfer	Reset	DL_OK_ACK	RT	Informs the DLS user that a previous issued request was valid and was received successfully. It is only initiated for those primitives that require a positive acknowledgement.
Connection-Mode Data Transfer	Reset	DL_ERROR_ACK	RT	Informs the DLS user that a previous issued request was invalid. It conveys the identity of the primitive in error.

Group	Subgroup	Primitive	Port Type	Description
Connection Release	Connection Release	DL_DISCONNECT_REQ	RT	Requests the DLS provider to disconnect an active data link connection or one that was in the process of activation, either outgoing or incoming, as a result of an earlier DL_CONNECT_IND or DL_CONNECT_REQ. If an incoming DL_CONNECT_IND is being refused, the correlation number associate with that connection indication must be supplied. This message indicates the reason for the disconnect.
Connection Release	Connection Release	DL_DISCONNECT_IND	RT	Informs the DLS user that the data link connection on the JTRS port has been disconnected, or that a pending connection (either DL_CONNECT_REQ or DL_CONNECT_IND) has been aborted.
Connection Release	Connection Release	DL_OK_ACK	RT	Informs the DLS user that a previous issued request was valid and was received successfully. It is only initiated for those primitives that require a positive acknowledgement.
Connection Release	Connection Release	DL_ERROR_ACK	RT	Informs the DLS user that a previous issued request was invalid. I conveys the identity of the primitive in error.
Connectionless-Mode Data Transfer	Data Transfer	DL_UNITDATA_REQ	RT	The Connectionless-mode service enable data transfer to peer DLS users without incurring the overhead of establishing a connection.
Connectionless-Mode Data Transfer	Data Transfer	DL_UNITDATA_IND	RT	Conveys one DLSDU from the DLS provider to the DLS user.
Connectionless-Mode Data Transfer	QOS	DL_UDQOS_REQ	RT	Set/change QOS on the following packets.
Connectionless-Mode Data Transfer	QOS	DL_OK_ACK	RT	Acknowledges to the DLS user that a previously issued request primitive was received successfully. It is only initiated for those primitives that require a positive acknowledgement.
Connectionless-Mode Data Transfer	QOS	DL_ERROR_ACK	RT	Informs the DLS user that a previously issued request or response was invalid. It conveys the identity of the primitive in error.

Group	Subgroup	Primitive	Port Type	Description
Connectionless-Mode Data Transfer	Error Reporting	DL_UDERROR_IND	RT	Informs the DLS user that a previously sent DL_UNITDATA_REQ produced an error or could not be delivered. The primitive indicates the destination DLSAP address and conveys an error value. This service does not guarantee that an error indication will be issued for every undelivered data unit.
Acknowledged Connectionless-mode Data Transfer	QOS	DL_UDQOS_REQ	NRT	QOS (transit delay [end-to-end], priority [local], protection [local], residual error rate) service enables a DLS user to specify the quality of service it can expect for each invocation of the connectionless service.
Acknowledged Connectionless-mode Data Transfer	QOS	DL_OK_ACK	RT	Acknowledges to the DLS user that a previously issued request primitive was received successfully. It is only initiated for those primitives that require a positive acknowledgement.
Acknowledged Connectionless-mode Data Transfer	QOS	DL_ERROR_ACK	RT	Informs the DLS user that a previously issued request or response was invalid. It conveys the identity of the primitive in error.
Acknowledged Connectionless-mode Data Transfer	Error Reporting	DL_UDERROR_IND	RT	Informs the DLS user that a previously sent DL_UNITDATA_REQ produced an error or could not be delivered. The primitive indicates the destination DLSAP address and conveys an error value. This service does not guarantee that an error indication will be issued for every undelivered data unit.
XID/TEST	XID	DL_XID_REQ	RT	Conveys one XID DLSDU from the DLS User to the DLS Provider for transmission to a peer DLS User.
XID/TEST	XID	DL_XID_IND	RT	Conveys an XID DLSDU from the DLS Provider to DLS User.
XID/TEST	XID	DL_XID_RES	RT	Conveys an XID DLSDU from the DLS User to the DLS Provider in response to a DL_XID_IND.
XID/TEST	XID	DL_XID_CON	RT	Conveys an XID DLSDU from the DLS Provider to the DLS User in response to a DL_XID_REQ.

Group	Subgroup	Primitive	Port Type	Description
XID/TEST	TEST	DL_XID_REQ	RT	Conveys one TEST command DLSDU from the DLS User to the DLS Provider for transmission to a peer DLS Provider.
XID/TEST	TEST	DL_XID_IND	RT	Conveys the TEST response/indication DLSDU from the DLS Provider to DLS User.
XID/TEST	TEST	DL_XID_RES	RT	Conveys the TEST response DLSDU from the DLS User to the DLS Provider in response to a DL_TEST_IND.
XID/TEST	TEST	DL_XID_CON	RT	Conveys the TEST response DLSDU from the DLS Provider to the DLS User in response to a DL_TEST_REQ.
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**Table 4. I/O API Control Services**

Group	Subgroup	Primitive	Port Type	Description
Data, Audio	Alerts and alarms	TxActive	RT	Reflects whether or not the port is actively sending data to the IO server.
Audio	Audio output	Audio output enable	NRT	Gates output to the user on and off regardless of the active operating state.
Audio	Audio output	SideTone enable	NRT	Turns the sidetone on and off.
Audio	Audio input, Audio output	Compression	NRT	Determines the type of compression used to format the audio.
Audio	Audio input, Audio output	SampleRate	NRT	Determines the sample rate of the audio.
Audio	Audio input, Audio output	Vocoder	NRT	Determines the Vocoder used to generate the data.
Audio	Audio input, Audio output	BitRate	NRT	Determines the rate of the Vcoded Data.
Audio	Audio input, Audio output	Sample quantization	NRT	Determines the size of the samples. (i.e.- 12 bit)
Audio	Audio output	Output gain	NRT	Controls the gain setting used to generate output to the user.
Audio	Alerts and alarms	CreateTone	NRT	Creates a tone that can be turned on and off as required. Returns a Tone_ID
Audio	Alerts and alarms	StartTone	RT	Starts generating the requested tone to the user.
Audio	Alerts and alarms	StopTone	RT	Stops generating the requested tone to the user.
Audio	Alerts and alarms	StopAllTones	RT	Turns all tones off.
Audio	Alerts and alarms	CreateBeep	NRT	Creates a beep of the requested Freq and Duration. Returns an ID.
Audio	Alerts and alarms	SendBeep	RT	Generates the selected beep to the user.
Data	Data input, data output	Hardware port flow control method	NRT	Identifies method used to control the flow of data between the radio and the external device. E.g. Xon/Xoff, RTS/CTS, etc.
Data		Hardware port settings	NRT	Identifies settings of the data port between the radio and the external device. E.g. synchronous/asynchronous, clock source, parity, etc.
Audio	Audio input	Microphone gain	NRT	Controls the gain setting of the incoming audio.
Data	Data input	Transmit data	RT	User data from external device.
Data	Data output	Receive data	RT	User data to external device.

<b>Group</b>	<b>Subgroup</b>	<b>Primitive</b>	<b>Port Type</b>	<b>Description</b>
Audio	Audio input	Transmit audio	RT	User audio samples from external device.
Audio	Audio output	Receive audio	RT	User audio samples to external device.

**Table 5. Data Services for APIs**

Group	Subgroup	Primitive	Port Type	Description
		setLowWaterMark		Signals that the Queue occupancy is above the low water mark. Note: The value of the low water mark needs to be set.
		setHighWaterMark		Signals that the Queue occupancy is above the high water mark. Note: The value of the high water mark needs to be set.
		setEmptySignal		Signals that the Queue is empty.
		allocateCapacity		Allocates Queue Size
		deallocateCapacity		Deallocates the queue
		Space Available		Return the queue space available
		NumberOfPriorityQueues		The number of priority queues in the MAC layer
Error Control	Error Control	getErrorControl	NRT	This query lists the actions that the radio will take if any of the listed errors occur and lists any errors that have occurred.
Error Control	Error Control	setErrorControl	NRT	This command lists the actions that the radio should take if any of the listed errors occur
Event Control	Event Control	getEventControl	NRT	This query lists the actions that the radio will take if any of the listed events occur and lists any events that have occurred.
Event Control	Event Control	setEventControl	NRT	This command lists the actions that the radio should take if any of the listed events occur.
Per Hop Rx Control	Data Flow	EndOfStream	RT	Indicates that the last symbol of this hop is and end of stream.
Per Hop Rx Control	Data Flow	StartOfStream	RT	Indicates that the first symbol of this hop is a start of stream.
		pushPacket		Data transfer operation. This is the operation that transfers data between the layers.