ALERT2 Intelligent Network Device Application Program Interface Specification

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1 Introduction

This specification defines the information exchange between an ALERT2 (A2) Application Protocol Device (APD) and an ALERT2 Intelligent Network Device (IND) providing both MANT and AirLink Protocol services. The APD provides the Application Layer Protocol services, including the Self-Reporting Protocol services. The Application Layer Concentration Protocol service may be provided by either the APD or the IND.

The IND provides the MANT and AirLink protocol services defined by the ALERT2 Protocol Specification Documents. Current services include Application Layer payload time stamping, network services such as echo suppression and reliable datagram service; media access services including time division multiple access, bit and frame synchronization, forward error correction coding gain and radio hardware control.

This version defines two different interfaces, a result of implementing the first ALERT2 hardware as an upgrade to the legacy one-way ALERT system. A future API release shall combine these two interfaces into a single API interface. The first interface defines the exchange of information for an IND implementing only the encoding and transmitting protocol services utilized at sensing sites and ALERT2 concentrating ALERT2 repeater sites. The second defines a uni-directional output from an IND implementing only the receiving and decoding protocol services utilized at base stations and ALERT2 repeaters. The separation of the interfaces is manageable initially since most current A2 network architectures are connectionless and unidirectional.

An IND that only encodes and transmits is referred to in this specification as an A2 Encoder & Modulator. Its primary function is to accept application protocol data units (PDUs), provide the MANT services requested, create a MANT header and MANT PDU, aggregate multiple MANT PDUs and create an AirLink frame and transmit the frame on an A2 architecture radio network.

An IND that only receives and decodes AirLink frames from an A2 architecture radio network is named an A2 Demodulator & Decoder in this specification. Its function is to receive AirLink radio frames, provide the AirLink and MANT protocol demodulation and decoding services requested or necessary, and present any application layer PDUs to the appropriate protocol port of a receiving APD.

When used in ALERT2 repeater devices, an A2 Encoder & Decoder will accept complete MANT PDUs provided by a separate A2 Demodulator & Decoder in the repeater. In this case the A2 Encoder & Modulator's primary function is to inspect the received MANT header fields, provide the MANT protocol services requested, revise the MANT PDU if necessary, aggregate multiple MANT PDUs, then create and transmit an AirLink frame on an A2 architecture radio network.

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1.1 API Specification Structure and Definitions

This API document is divided into five parts:

1. the specification of the content (i.e. information) for an IND implementing A2 Encoding & Modulating functionality;
2. the specification for one physical interface method of implementing this A2 Encoder & Modulator content exchange (a serial interface);
3. the specification of the content for an IND implementing A2 Demodulating & Decoding functionality;
4. the specification for the A2 Demodulator & Decoder ASCII serial physical interface (the Legacy interface); and
5. the specification of the binary serial asynchronous interface for an IND implementing Demodulation & Decoding functionality.

All content is exchanged in a Type, Length and Value format (except for the Legacy interface). The content specification defines the type values for each exchange of information.

The content the APD exchanges with the IND includes:

1. exchange of Application Layer Protocol Data Units (PDUs);
2. exchange of the MANT Layer header information for the Application Layer PDU;
3. configuration information for the protocol services provided by the IND; and
4. configuration information for IND hardware, including the ports used for the API.

Much of the configuration information will be static, such as the source address and media access parameters. It is recommended every IND contain non-volatile memory storage where this static information can be saved.

Dynamic, per Application PDU, configuration parameter changes are allowed. Absent any dynamic configuration parameter change the IND must create a MANT header and Payload in accordance with the configuration parameter values stored in the non-volatile storage.

Each content specification is defined herein as mandatory, recommended or optional. The meanings for these three qualifiers are:

- Mandatory (M): An A2 IND device must implement and functionally execute the process of the content specification;
- Recommended (R): An A2 IND device should implement and functionally execute the process of the content specification, but it is not required; and
- Optional (O): An A2 IND device may implement and functionally execute the process of the content specification to provide extra IND services.

This version specifies one physical interface method of implementing the content exchange between an APD sensing device and an A2 Encoder & Modulator. This serial port specification is only one of many methods that may be used for content exchange. It is therefore a mandatory specification only in cases where an asynchronous serial implementation is provided by the IND hardware.

Other methods to exchange the content are expected to be defined in the future. For example, an integrated APD & IND sharing a common processing space may define an interface to be a "named pipe", shared memory, or a data structure. Additionally, for example, an ALERT2 repeater may receive configuration content from a transmitted ALERT2 frame.

Note that future API specification version will integrate the current Demodulator & Decoder content and physical interface specification (parts 3, 4 and 5 above) into the A2 Encoder & Modulator API specification (parts 1 and 2) to form a unified IND API specification. Backward compatibility will be provided by including a version number after the "ALERT2" header string, and a configuration command to revert the output to mimic this version's ASCII string output.

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2 ALERT2 Encoder & Modulator Content

The following tables list the information, its value range and whether an IND must support (M), is recommended to support (R), or may optionally (O) support the information element to meet this API specification.

Application layer protocol PDUs	**Support Level**
ALERT2 Self Reporting Protocol	M
ALERT Concentration Protocol	R
MANT Configuration & Control Protocol	R
forward MANT PDU (recursive TLV structures are required, below)	O
MANT header	R
MANT payload	R
decoder time stamp	O

Protocol Services configuration	**Support Level**	**Default Value**	**Range**
Addressing			
set Source Address	M	1	1 – 65,534
set Destination Address	R	1	1 – 65,534
enable Add Path Service	R	0 = not enabled	0 = not enabled; or 1 = enabled. (Append current IND SA in header path list).
enable Add Destination Address in Header	R	0 = not enabled	0 = not enabled; or 1 = enabled. (Insert DA in MANT header).
force "Test Bit" in Application Layer Header	R	0 = not enabled	0 = not enabled; or 1 = enabled. (set the "Test Bit" in the Application Protocol Header).

Application Layer Protocol Service: Concentration Protocol Configuration	**Support Level**	**Default Value**	**Range**
set "Test Flag" in Concentration App Layer Header	O	0 = not enabled	0 = not enabled; or 1 = enabled. (set the "Test Flag" in the Application Protocol Header).
set "Extra Header Flag" in Concentration App Layer Header	O	0 = not enabled	0 = not enabled; or 1 = enabled. (set the "Extra Header Flag" in the Application Protocol Header).
set "Enable PDU ID Flag" in Concentration App Layer Header	O	0 = not enabled	0 = not enabled; or 1 = enabled. (set the "Enable PDU ID Flag" in the Application Protocol Header).

Time Services	**Support Level**	**Default Value**	**Range**
enable IND time stamp service	R	1 = enabled	0 = not enabled; or 1 enabled. (IND inserts the current time into the Application Layer PDU header).
enable NMEA time string output	R	0 = not enabled	0 = not enabled; or 1 = enabled. (Send NMEA string on serial port).

Network Services	**Support Level**	**Default Value**	**Range**
set Communications Service type	R	0 = best efforts	0 = Best Efforts (broadcast); or 1 = End to End Reliable Datagram Service; or others TBD
select Address List for processing (Repeater Only)	R	N/A	0 – N, where N is the identifying number of the address list.
enable or disable selected Address List (Repeater Only)	R	0 = disabled	0 = disabled; or 1 = enabled
set selected Address List for Pass or Reject (Repeater Only)	R	0 = Pass List	0 = Pass List; or 1= Reject List.

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set selected Address List for SA, DA or any address in MANT added Path List (Repeater Only)	R	0 = Source Address List	0 = a Source Address List; 1 = a Destination Address List; or 2 = an added Path List Address List.
add addresses to selected Address List, as list (Repeater Only)	R	N/A	N x 2 byte addresses, (2 – 32,766)
add addresses to selected Address List, as range (Repeater Only)	R	N/A	2 x 2 byte addresses, (4 bytes); lower range address first.
delete addresses in selected Address List, as list (Repeater Only)	R	N/A	N x 2 byte addresses, (2 – 32,766)
delete addresses in selected Address List, as range. (Repeater Only)	R	N/A	2 x 2 byte addresses, (4 bytes); lower range address first.
enable Echo Suppression (forces Add Path Service if enabled) (Repeater Only)	O	0 = not enabled	0 = not enabled; or 1 = enabled. (Test for IND's SA in added Path List, do not repeat MANT if so.)
set Hop Limit	R	7 = not enabled	0 – 6; or 7 = not enabled. (The maximum hops before discarding for a MANT PDU originating at this IND).
enable End to End Reliable Datagram Service (EERDS)	R	0 = not enabled	0 = not enabled; or 1 = enable. (Enabling also sets the IND MANT Protocol ID to 0x01 and enables the Add DA Service.
set EERDS Retransmission Delay Period	R	30	TBD[1],[2] 5 – 255 seconds
set EERDS Maximum Retransmissions	R	3	0 - 10

[1] Seconds is used to accommodate both TDMA and ALOHA media access. With one hop and no transmission errors, the time required to receive an Acknowledgement is dependent on the ordering of the transmitters in frame. The minimum time is 1 frame time + 1 slot time; the maximum is 2 frames. With ALOHA Media Access there are no "frames".

[2] Making this time less than 2 frame times only increases network traffic and does not decrease the time for a site to receive an acknowledgement.

Media Access, TDMA	**Support Level**	**Default Value**	**Range**
set TDMA Frame Length	M[3]	15,000 milliseconds	5,000 – 3,600,000, in milliseconds; also constrained to be 1) an integral multiple of the IND's minimum slot length, and 2) evenly divisible into twelve hours
set TDMA Frame Start Offset	M	0 milliseconds	0 - to a maximum of (3,600,000 minus the current frame length) in milliseconds
set TDMA Slot Length	M	1,000 milliseconds	250 – 10,000 in milliseconds; also constrained to be an integral multiple of the IND's minimum slot size
set TDMA Slot Start Offset	M	0 milliseconds	0 - to a maximum of the current frame length minus the IND's current slot length
set GPS clock Turn On (override) period; (used only if entered value is less than calculated value for hardware clock drift)	O	60 minutes	5 - 1440 minutes
set GPS clock Maximum On time	O	5 minutes	maximum is GPS clock Turn On period minus 1 minute, minimum is 1 minute
set Transmission Delay into Slot (when centered in slot is not enabled; also the minimum time buffer for the slot)	O	25 milliseconds	25 to 250 milliseconds
enable Center Transmission in Slot (use AirLink Frame data length to center in slot)	O	1	1= enable; or 0 = not enabled. (When not enabled, use the fixed "Transmission Delay"
enable TDMA	O	1	1 = enable; or 0 = not enabled.

[3] The TDMA configuration parameters are only Mandatory only for IND devices designed and specified for Time Division Multiple Access media access operation.

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Media Access, Physical Layer Configuration	**Support Level**	**Default Value**	**Range**
set Carrier Only time	R	10 milliseconds	5 – 1000 in milliseconds
set AGC time	R	55 milliseconds	5– 1000 in milliseconds
set RF Tail time	R	5 milliseconds	0 – 100 in milliseconds
set Modulation Inverted	R	0 = normal	0 = normal, 1 = inverted
set FEC Type	R	0 = normal	0 = normal 1 = future, optional AirLink Frame FEC encoding)
enable Radio Transceiver Continuous Power	R	0 = not enabled	0 = not enabled; or 1 enabled.
set Radio Transceiver Power-up time (Time before slot to power radio transceiver.)	R	750 milliseconds	0 – a maximum of the current frame length, in milliseconds
set Audio Preload time (preload radio audio input circuit)	R	100 milliseconds	0 to a maximum of the radio power up time; in milliseconds

IND Configuration	**Support Level**	**Default Value**	**Range**
API Version	M	N/A	0-255
set Decoder Source Address	R	0	0 – 65,534
set Agency Identifier	R	NONE	ASCII string, maximum 64 chars
Save configuration to non-volatile	R	N/A	N/A
Return current configuration	R	N/A	N/A
Reset configuration to defaults	R	N/A	N/A
Recall non-volatile configuration to current	R	N/A	N/A
Display Parameter	R	N/A	All defined configuration type values

enable Display Response (Ack/ Nak on API commands)	R	0 = not enabled	0 = not enabled; or 1 = enabled.

GPS Time Services	**Support Level**	**Default Value**	**Range**
Return GPS time in seconds since 2010	R	0	0-2147483648
Return GPS time valid flag	R	1	0=clock valid 1=never set (started from the 2010-1-1 00:00:00 default value) 2=drifted 3 = never set (started from the 2010-1-1 00:00:00 default value) and drifted
Return GPS NMEA string	R		Variable

Figure 2-1ALERT2 Encoder and Modulator Content

Configuration parameters provided to the IND but not saved into non-volatile storage will apply until 1) it is subsequently changed by an API command, or 2) overwritten by a “Reset configuration to defaults”, or 3) overwritten by a “Recall non-volatile configuration to current”, or 4) overwritten on by the non-volatile configuration on a power cycle.

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3 ALERT2 Encoder & Modulator Asynchronous Binary Serial Interface

One physical interface between the APD and the A2 Encoder & Modulator may be a uni- or bi-directional asynchronous serial connection. If implemented by the IND or the APD, the following specifications apply.

The asynchronous serial port configuration must be:

- TIA RS-232-F standard DCE circuit and signal levels, using either a 3-wire or 5-wire configuration,
- DB9 socket (female) connector,
- 8 data bits, and
- least significant bit sent first.

The initial (power on or reset default) configuration parameters must be:

- 3-wire RS-232 circuit (no hardware handshaking),
- No software handshaking,
- 9600 baud,
- no parity,
- 1 stop bit.

Except for the "ALERT Compatibility Mode Interface" specified below, the form of information exchanged between devices must be a string beginning with the "ALERT2" prefix, a format character (A for ASCII, B for binary), the total length field, the API version number as a TLV element, followed by TLV data. TLV data is 8 bit binary data in the form <type><length><value>, where the value field must be another recursively embedded lower level <type><length><value> structure. The element type field must be 1 or 2 bytes, length field must be 1 or 2 bytes and value field is the number of bytes specified in the length field, as shown below:

Prefix	Format	Total Length
ALERT2	B	
41 4C 45 52 54 32	42	

...

API Version Number		
Type	Length	Value

...

Type	Length	data	...	data	Type	Length	data	...

Total Length

Figure 3-1 Type and Length field configuration

The <type> and <length> fields are extensible: To encode a value greater than 127 requires a 2-byte field. Bit 7 (the highest bit) of the first byte sent (MSB) is set to 1, and the length value is encoded in the following 15 bits. A value of 127 or less is encoded in a single byte (whose high order bit is 0). On decoding, the MSB is read first, and if the high bit contains a 1, the value is read from the following 15 bits. If the high bit is 0, the value is read as the value of that byte. The one byte field may carry a value of 1 to 127 and the two-byte field may contain a number from 0 to 32,767. The format is shown below:

MSB 7 bits Type	[LSB 8 bits Type]	MSB 7 bits Length	[LSB 8 bits Length]	data	...	data
				Length ←	→	

Figure 3-2 Type and Length field extension

Three categories of content, each with specific type ranges, are defined as follows:

1. Application Layer Protocol or Network Control Protocol data payloads, to be created into MANT datagrams with type range 0 – 20, (where repeated MANT PDU is recursively input as type 20),
2. Serial Interface configuration and commands, type range 4096 – 8191 and
3. Protocol Services configuration parameters, type range 24 - 4095.

The three following tables list the type and length for the TLV interface method on the binary asynchronous serial interface.

Application Layer Protocol or Network Control Protocol	**Type**	**Typical Length (bytes)**
ALERT2 Self Reporting	0	ALERT2 Self-Report PDU length
ALERT Concentration	1	ALERT Concentration PDU length
MANT Configuration & Control Protocol	2	MANT Configuration & Control concatenated TLV structure(s) length
forward MANT PDU (recursive TLV structures are required, below)	20	Sum of the 1024, 1025 and 1026 TLV structures
MANT header (required)	1024	6 – 22; MANT header bytes, first byte received, first.
MANT payload (required)	1025	0 – 32,767; MANT payload bytes, first byte received, first.
MANT decoder time stamp (optional)	1026	4; 32 bit POSIX Time marking the received time

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Protocol Services configuration	**Type**	**Typical Length (bytes)**
Addressing		
set Source Address	24	2
set Destination Address	25	2
enable Add Path Service	26	1
enable Add Destination Address in Header	27	1

IND Application Layer Protocol Service: Concentration Protocol Configuration	**Type**	**Typical Length (bytes)**
set "Test Flag" in Concentration App Layer Header	30	0
set "Extra Header Flag" in Concentration App Layer Header	31	0
set "Enable PDU ID Flag" in Concentration App Layer Header	32	0

Time Services	**Type**	**Typical Length (bytes)**
enable IND time stamp Service	40	1
enable NMEA time string output	41	1

Network Services	**Type**	**Typical Length (bytes)**
set Communications Service type	48	1
select Address List	49	1
enable or disable selected Address List	50	1
set selected Address List for Pass or Reject	51	1
set selected Address List for SA, DA or Path	52	1
add addresses to a selected Address List, as list	53	2-32,767
add addresses to a selected Address List, as range	54	4
delete addresses in a selected Address List, as list	55	2-32,767
delete addresses in a selected Address List, as range	56	4
enable Echo Suppression	63	1
set Hop Limit	64	1
enable End to End Reliable Datagram Service (EERDS)	65	1
set EERDS Retransmission Delay Period	66	1 (TBD)

set EERDS Maximum Retransmissions	67	1

Media Access, TDMA & ALOHA	**Type**	**Typical Length (bytes)**
set TDMA Frame Length	72	3
set TDMA Frame Start Offset	73	3
set TDMA Slot Length	74	3
set Slot Start Offset	75	3
set GPS clock Turn On (override) period	76	1
set GPS clock Maximum On time	77	1
set Transmission Delay into Slot	78	1
enable Center Transmission in Slot	79	1
enable TDMA	80	1

Media Access, Physical Layer Configuration	**Type**	**Typical Length (bytes)**
set Carrier Only time	96	1
set AGC time	97	1
set RF Tail time	98	1
set Modulation Inverted	99	1
set FEC Type	100	1
enable Radio Transceiver Continuous Power	101	1
set Radio Transceiver Power-up time	102	2
set Audio preload time	103	2

IND Configuration	**Type**	**Typical Length (bytes)**
API Version Number	117	1 (Display Only, No Set)
Set Decoder Source Address	118	2
Set Agency Identifier	119	Variable
Save Configuration to Non-Volatile	120	0
Return Current Configuration	121	0
Reset Configuration to Defaults	122	0
Recall Non-Volatile Configuration to Current	123	0
Display Parameter	124	1 or 2
enable Display Response	125	1 or 2

GPS Time Services	**Type**	**Typical Length (bytes)**
Return GPS time in seconds since 2010	126	4
Return GPS time valid flag	127	1
Return GPS NMEA string	128	Variable, maximum 64

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Figure 3-3 Encoder & Modulator protocol services configuration

Notes:

1. The Application Layer PDU format definitions are described in the relevant ALERT2 Application Layer Protocol specification documents.
2. The "Media Access, TDMA" and "Media Access, Control" information and suitable parameter values are defined in the ALERT2 AirLink Protocol specification document.
3. The "Addressing", "Time Services" and "Network Services" information and suitable parameter values are defined in the ALERT2 MANT Protocol specification document.
4. The Display Parameter command's value field contains the Type Number of the parameter to be displayed. The IND shall respond with a recursive TLV structure beginning with the Display Response Type, a total length, then the Type of the requested parameter, the length and the parameter value.

Serial Interface configuration	**Type Value**	**typical length (bytes)**	**Default Value**	**Range**
baud rate	4096	2	9600	1200, 4800, 9600, 19200, 38400, 57600
parity	4097	1	0 = none	0 = none, 1 = even, 2 = odd
stop bits	4098	1	1	1, 2
flow control	4099	1	0 = none	0 = none, 1 = hardware (CTS/RTS), 2 = software (XON/XOFF)
add checksum type on all strings	4100	1	0 = no	1 = yes, add CRC-16 TLV to each string
enable ACK/NAK handshaking	4101	1	0 = no	1 = yes, both entities shall ACK or NAK each string
serial timeout	4102	2	250 milliseconds	1 – 5000 in milliseconds
serial port number to configure	4103	1	0	0 – (N -1), where N is the number of ports available
enable ALERT Compatibility Mode Interface on serial port	4104	1	0 = no	0 = no, API input/output mode 1 = yes, ALERT serial input only

Interface Control Commands	Type Value	typical length (bytes)	Default Value	Range
ACK received string	8187	0	N/A	N/A
NAK received string	8188	0	N/A	N/A
Checksum	8189	2	CCIT CRC-16	N/A

Figure 3-4 Serial interface configuration

- The "Serial Interface configuration" and "Interface Control Commands" are self-explanatory.
- The "Serial Interface Configuration" parameter values are common RS-232 ranges; when enabled the checksum is a CCIT CRC-16 appended as a TLV at the end of each transmitted string, and checked for at the end of each received string. Although not mandatory, enabling ACK/NAK enhances the usefulness of the checksum capability. Serial timeout is the maximum time between received bytes, if exceeded the serial interface clears it's receive buffer.

Examples are shown in Appendix A.

3.1 ALERT Compatibility Mode Interface

To support legacy ALERT network architectures, it is recommended that an IND provide the Application layer Concentration Protocol service and support an asynchronous serial port configurable to accept ALERT decoder output. It is recommended that this port accept standard binary format, enhanced IFLOWS format and legacy ASCII format (see the Application Layer Protocol specification document). When supported, this is named the ALERT Compatibility Mode Interface.

When in this mode, the asynchronous serial port is uni-directional and shall only accept ALERT 4 byte messages with no other framing than asynchronous start and stop bits on each binary byte. There shall be no timing constraint; one or more ALERT 4 byte binary messages may be received at the serial communications speed, or the bytes may be spaced with delays between bytes. This input byte format that shall be accepted is shown below:

byte 0	...	byte 1	...	byte 2	...	byte 3

The asynchronous serial port configuration parameters that shall be configurable in this mode are baud rate, parity, number of stop bits, flow control, and serial port to configure. The "add Checksum" and "enable ACK/NAK" are ignored in this mode.

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Once configured into the ALERT Compatibility Mode Interface all serial asynchronous bytes shall be parsed, if possible, into ALERT serial binary information. Some other mechanism (e.g. reconfiguration of the serial port from a different serial port) is necessary to reset the port.

When configured into the ALERT Compatibility Mode Interface, the IND must provide the application layer Concentration Protocol services for the ALERT messages. (See the ALERT2 Application Layer Protocols Specification Document.)

Examples are shown in Appendix B.

4 ALERT2 Demodulator & Decoder Content

The IND implementing only AirLink and MANT demodulation and decoding protocol services must provide the 3 mandatory services and may include optional services, as shown below:

1. AirLink physical demodulation, forward error correction and frame decoding;
2. Error detection derived from the FEC;
3. MANT header parsing;
4. Time Stamping (optional);
5. Statistical Network information (optional); and
6. ALERT Concentration Protocol (Application Layer) decoding (optional).

The output content of the Demodulator & Decoder interface shall be separately exported as follows:

1. AirLink PDU, consisting of header information, payload (MANT PDU) and meta data;
2. MANT PDU, consisting of header information, payload and metadata;
3. Optional decoded Concentration Protocol data;
4. Optional error message data; and
5. Optional periodic network operational statistical data.

The following tables list the information, its value range and whether it is mandatory (M), recommended (R) or optional (O) to meet this API specification.

Protocol Services configuration	**Support Level**	**Default Value**	**Range**
MANT PDU (the data structure elements are shown below)	M	N/A	up to 65,535, number of bytes in all subfields
MANT PDU (data elements)			
MANT header	M	N/A	the MANT header bytes, first byte received, first.
MANT payload	M	N/A	the MANT payload bytes, first byte received, first.
IND time stamp	O	N/A	32 bit POSIX Time optionally marking a received time
AirLink PDU (the data structure elements are shown below)	M	N/A	up to 65,535 number of bytes in all subfields
AirLink PDU (data elements)			
AirLink header	M	N/A	2 (3 in version 0)
AirLink payload, first block	M	N/A	24 (17 in version 0)
AirLink first block, FEC field	M	N/A	1
AirLink payload, follow on block	M	N/A	up to 32

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AirLink follow on block, FEC field	M	N/A	1
IND time stamp	O	N/A	32 bit POSIX Time marking a received time
Error and IND Statistics (data structure elements TBD by TWG)	O	N/A	up to 65,535

Figure 4-1 Demodulator & Decoder protocol configuration services

5 ALERT2 Demodulator & Decoder ASCII Asynchronous Serial Interface

One physical interface between the APD and the A2 Demodulator and Decoder may be a uni- or bi-directional ASCII asynchronous serial connection. If implemented by the IND, the following specifications apply.

The asynchronous serial port configuration must be:

- TIA RS-232-F standard DCE circuit and signal levels, using either a 3-wire or 5-wire configuration,
- DB9 socket (female) connector,
- 8 data bits, and
- least significant bit sent first.

The initial (power on or reset default) configuration parameters must be:

- 3-wire RS-232 circuit (no hardware handshaking),
- No software handshaking,
- 9600 baud,
- no parity,
- 1 stop bit.

Typically used to interface to legacy ALERT "base station" hosts, this interface must provide content as ASCII strings prefaced by the ALERT2A prefix, the application header identification, a single type character. The ASCII strings are terminated by a 'CRLF' character sequence and all fields except the last must be delimited by the comma character. The form is shown below:

ALERT2A	,	Version	,	Decoder Source Address	,	Agency Identifier	,

type char	,	field char(s)	,	field char(s)	,	…	'CR' char	'LF' char

Figure 5-1 ASCII string format

Unless specified differently below, the following specifications apply:

1. All numeric data are in decimal integer format. Alpha-numeric and decimal integer fields are not of fixed length, are not space padded and, for positive numeric values, are not prefaced with the '+' character.
2. No numeric fields are empty; numeric fields of value 0 are output as the '0' ASCII character.
3. Numeric fields output with hexadecimal encoding represent 8 bits and are zero padded, 2 character fixed width, with no "0x" pre-pended.
4. The strings are not necessarily fixed length.

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The ASCII “type char” for each output content shall be

AirLink PDU string	‘P’
MANT packet string	‘N’
Optional decoded Concentration Protocol strings	‘C’ and ‘A’
Optional error message string	‘S’
Optional periodic statistical string	‘S’

Figure 5-2 Output type characters

5.1 AirLink Protocol Data Unit string

ALERT2A	,API Version	,Decoder Source Address	,Agency Identifier

,P	, AirLink version	,time tag	,payload length	…

,first block length	,first block payload	,first block error field	…

[,next block length	,next block payload	,next block error field]	…

[,first calc time	[,last calc time]	CRLF

Figure 5-3 AirLink PDU string

The content and fields in the AirLink PDU string are:

1. AirLink Spec version.
2. Time tag; time of frame arrival (time measured at the start of the header); the time fields are not allowed to be empty. If an appropriate system time is not available to time tag the frame, the fields are zero filled. The Time tag contains 6 fields:
   2.1. Five fields; year (4 digit), month, day, hour and minute, and
   2.2. One decimal fixed point field: seconds (including a decimal point) with resolution to the millisecond as a minimum, optionally up to the microsecond.
3. Payload length; the size of MANT PDU in bytes.

These fields are followed by the forward error corrected payload data. The AirLink Specification states that payload is divided into forward error corrected blocks. The number of blocks and the number of the fields output in each block depends on the payload size. At a minimum one block, the “first block”,exists. This first block is fixed length and contains the AirLink and typically all of the MANT header information. When the header plus the MANT PDU is less than the first block fixed length the AirLink payload is padded with 0x55.

4. For each block in the AirLink PDU:
   4.1. Block length; the number of bytes included in this block.[4]
   4.2. Payload bytes; each byte is a separate fixed 2 character length, zero padded, hexadecimal encoded field having a value 0 – FF.
   4.3. Reed-Solomon FEC check field; a signed decimal integer encoded field; the number of errors corrected by the Reed-Solomon decoder. A zero or positive number means that the block data is (statistically) error free. A negative value means the Reed-Solomon decoder could not correct all the symbol errors and therefore the block likely contains at least one byte with at least one bit error.[5]

After all the data blocks are output, there are two optional output fields. If the fields are not present the string will be terminated early with a 'CRLF' character sequence:

5. First block processing time; the number of microseconds required to process AirLink first block.
6. Remaining processing time; the number of microseconds required to process the remaining AirLink frame following the first block; only output if there is more than one block in the frame.

Examples are shown in Appendix C.

5.2 MANT Protocol Data Unit string

ALERT2A	,API Version	,Decoder Source Address	,Agency Identifier

,N	,time tag	,MANT Spec Ver	,Protocol ID	,Time Stamp Request	,Add Path Request	,DA in Hdr	,Service /Port	,Resrved Bits	,ACK bit	,Added Hdr	,Hop Limit

…	,Payload length	, SA	[,DA]	[,MANT PDU ID]	[,number of SAs appended]	[,first SA[,...][,last SA]	,payload bytes…	CRLF

Figure 5-4 MANT PDU String

---

[4]The MANT PDU length (field 3) does not include the number of AirLink header bytes embedded in the first block. Yet the Block data length field 4.1 is the total bytes in the block and includes the count for the header in the first block. Therefore, the sum of the Block length fields will exceed the payload length field by the length of the AirLink header (currently defined as 2 bytes.) Currently AirLink Specification states the first block has a fixed AirLink payload length of 24 bytes. Regardless of the MANT PDU length, the first block length will always be 24.
[5] In field trials, it's been observed, although extremely rarely, that the RS decoder flags a block as containing an error even though an embedded 16 bit CCIT standard CRC check on the same block does not flag the block as errored.

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The content and fields contained in the 'N' string are (unless otherwise stated, all fields are decimal integer encoded):

1. Time tag - time of frame arrival (time measured at the start of the header), copied from the P string; the time fields are not allowed to be empty. If an appropriate system time is not available to time tag the frame, the fields are zero filled. The Time tag contains 6 fields:
   a. Five fields are: year (4 digit), month, day, hour and minute, and
   b. One decimal fixed point field: seconds (including a decimal point) with resolution to the millisecond as a minimum, optionally up to the microsecond.
2. MANT Version; 2 bit field.
3. Protocol ID; 3 bit field.
4. Time Stamp Protocol Service Request; 1 bit field.
5. Add Path Service Request flag; 1 bit field.
6. Destination Address in Header; 1 bit field.
7. Service/Port field; 4 bit field.
8. Reserved Bit Field; 3 bit field.
9. EERDS Acknowledge Bit (ACK); 1 bit field.
10. Added Header field; 1 bit field.
11. Hop Limit Field; 3 bit field.
12. Payload length; 12 bit field.
13. Source Address field; 16 bit field.
14. [Optional – Destination Address field; 16 bit field.]
15. [Optional – MANT PDU ID; 8 bit field.]
16. [Optional – Number of SAs appended; 8 bit field.]
17. [Optional – appended SAs; zero or more 16 bit field, each is a separate delimited field.]
18. MANT PDU Payload; each byte is a separate fixed 2 character length, zero padded, hexadecimal encoded field having a value 0 – FF.

Examples are shown in Appendix C.

5.3 Concentration Protocol Data Unit strings ('C' and 'A')

ALERT2A	,API Version	,Decoder Source Address	,Agency Identifier

,C	,# of SAs	,SA1	[,SA2…,SAn]	,time tag	,ALERT ID	,ALERT Data	[,…]	[,time tag]	[,ALERT ID]	[,ALERT Data]	CRLF

Figure 5-5 Concentration PDU string

The content and fields contained in the 'C' string are[6]:

1. Number of Source Addresses; this is 1 unless the Add Path Service is requested by a node in the transited path.
2. Source Address field(s); the 16 bit address fields, beginning with the origination IND. If Add Path Service is requested, the last SA is that of the IND providing the output.
3. ALERT message sub-string(s); one or more sets of fields that are the ALERT transmissions embedded by the Concentration Protocol. The ordering of the ALERT sub-strings within the "C" string is not specified. Each ALERT message sub-string contains the following fields:
   3.1. Time tag; the time of original ALERT transmission[7]calculated from Concentration Protocol Time Stamp and the receiving IND system time. Six decimal integer data fields: year (4 digits or a single '0' digit), month, day, hour, minute and seconds. The time fields are always output; if the Time Stamp is not available, the ALERT sub-string time tag is zero except for the seconds' field. The seconds field then carries a negative decimal integer which is the time offset embedded in the Concentration Protocol.
   3.2. ALERT ID; embedded ALERT message ID, range 0-8195.
   3.3. ALERT Data; embedded ALERT message data, range 0-2047.

The content and fields contained in the 'A' string are the ALERT sub-strings contained in the 'C' string field 3; each ALERT sub-string contained in a 'C' string is prefaced with the 'A' character and terminated by a CRLF. This is shown below:

ALERT2A	,API Version	,Decoder Source Address	,Agency Identifier

,A	,time tag	,ALERT ID	,ALERT Data	CRLF

…

[ALERT2A	,API Version	,Decoder Source Address	,Agency Identifier

[,A	,time tag	,ALERT ID	,ALERT Data	CRLF]

Figure 5-6 ALERT output string

Examples are shown in Appendix C.

[6] The field ordering in the 'C' and 'A' strings maintains backward compatibility with older versions on base station software.

[7]The decoder uses the Concentration Protocol header16 bit time stamp (if available), the Concentration Protocol time offset value(s) and receiving IND's receipt time tag (if available) to calculate and time tag the original time of ALERT transmission. See the Concentration Protocol application layer specification.

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5.4 Error and Statistics strings ('S')

ALERT2A	,API Version	,Decoder Source Address	,Agency Identifier

,S	,Type	,Field1	[,...]	CRLF

Figure 5-7 Error and statistics output string

These ASCII output strings generated by the IND or Demodulator & Decoder do not present network traffic, but contain information on the status of the IND, the network and other operations information. Status messages are always prefaced by the 'S' character immediately followed by a decimal integer numeric type field which is the Type field. At this time the Types are vendor specific(coordination of the 65,535 S type numbers is by the ALERT2 TWG). The Type field is used to identify the number and encoding of the fields that are included in the 'S' string. The fields contained in the 'S' string are:

1. Type - a numeric field defining the number, encoding and content in the following Data fields
2. Data fields - as defined by the vendor.

6 ALERT2 Demodulator & Decoder Binary Asynchronous Serial Interface

A second physical interface for the A2 Demodulator & Decoder may be a uni- or bi-directional asynchronous serial connection providing binary data in a TLV format. If implemented by the IND, the following specifications apply.

The asynchronous serial port configuration must be:

- TIA RS-232-F standard DCE circuit and signal levels, using either a 3-wire or 5-wire configuration,
- DB9 socket (female) connector,
- 8 data bits, and
- least significant bit sent first.

The initial (power on or reset default) configuration parameters must be:

- 3-wire RS-232 circuit (no hardware handshaking),
- No software handshaking,
- 9600 baud,
- no parity,
- 1 stop bit.

The form of information exchanged between devices must be a string beginning with the ALERT2 prefix and B format character, the length field, and then the version number, decoder source address, and agency identifier as TLV data, followed by TLV data. TLV data is 8 bit binary data in the form <type><length><value>, where the value field must be another recursively embedded lower level <type><length><value> structure. The element type field must be 1 or 2 bytes, length field must be 1 or 2 bytes and value field is the number of bytes specified in the length field, as shown below:

Prefix	Format	Total Length
ALERT2	B	
41 4C 45 52 54 32	42	

...

Version Number			Decoder Source Address			Agency Identifier		
Type	Length	Value	Type	Length	Value	Type	Length	Value

...

Type	Length	data	...	data	Type	Length	data	...

Total Length

Figure 6-1 Binary T-L-V structure

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The <type> and <length> fields are extensible: To encode a value greater than 127 requires a 2-byte field. Bit 7 (the highest bit) of the first byte sent (MSB) is set to 1, and the length value is encoded in the following 15 bits. A value of 127 or less is encoded in a single byte (whose high order bit is 0). On decoding, the MSB is read first, and if the high bit contains a 1, the value is read from the following 15 bits. If the high bit is 0, the value is read as the value of that byte. The one byte field may carry a value of 1 to 127 and the two-byte field may contain a number from 0 to 32,767. The format is shown below:

MSB 7 bits Type	[LSB 8 bits Type]	MSB 7 bits Length	[LSB 8 bits Length]	data	...	data
				←	Length	→

Figure 6-2 Type and Length field extensibility

The following tables list the content type and length when using a TLV interface method on the binary asynchronous serial interface. Some of the sub-TLV fields in the MANT PDU <value> or AirLink PDU <value> fields are mandatory, although some are optional. The ordering is not specified.

Protocol Services configuration	**Type**	**Length (bytes)**
MANT PDU (data structure elements are shown below)	20	2
MANT PDU (data elements)		
MANT header	1024	
MANT payload	1025	
decoder time stamp	1026	4
AirLink PDU (data structure elements are shown below)	21	2
AirLink PDU (data elements: the payload blocks must be sent in received order and each payload block data structure element must be sent in the following order.)		
AirLink header	1040	2 (3 in version 0.01)
AirLink payload, first block	1041	24 (17 in version 0.01)
AirLink first block, FEC field	1042	1
AirLink payload, follow on block	1043	1 – 32
AirLink follow on block, FEC field	1044	1
decoder time stamp	1026	4

Figure 6-3 Binary Content Type and Length

Examples are shown in Appendix D.

7 Appendix A – Examples of the Encoder & Modulator serial interface

1)

Prefix	Format	Length
ALERT2	B	43
41 4C 45 52 54 32	42	2B

...

Version Number		
Type	Length	Value
117	1	1
75	01	01

...

Set Source Address		
Type	Length	Value
24	2	4403
18	02	11 33

...

Self Reporting Protocol		
Type	Length	Value
0	23	n/a
00	17	70 02 0A 01 14 00 00 00 68 14 0F 0A 02 01 08 12 12 03 24 13 22 02 76

Figure 7-1 Example 1: Application Program Device string

This example shows the APD string sent to the IND in binary format, using version 1, to send a Self-Reporting Protocol Data Unit with Source Address 4403. All other IND configuration parameters are as previously saved in non-volatile storage. The Application Layer PDU is (as shown as an example in the Application Layer Specification) has the following fields embedded:

Control = 112, formatted as a one- byte value (where App Layer PDU ID not used set to ‘111’, time stamp and test transmission set at ‘0’).
Type = 2, Tipping Bucket Rain Gage Report
Length = 10, single byte sum of sizes of all fields following the Length field
Tipping Bucket ID = 1, Format/Length = 20, Accum = 104, Time offsets = 20, 15, 10, 2
Type = 1, General Sensor Report, formatted as a single byte.
Length = 8, single byte sum of sizes of all fields following the Length field
pH Sensor ID = 18, Format/Length = 18, Current pH value = 804
Water Temperature Sensor ID = 19, Format/Length = 34, Current temperature value = 630

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Field	C	T	L	Tipping Bucket Rain Gage							T	L	Sensor			Sensor		
Decimal	112	2	10	1	20	104	20	15	10	2	1	8	18	18	804	19	34	630
Hex	70	02	0A	01	14	00 00 00 68	14	0F	0A	02	01	08	12	12	03 24	13	22	02 76

Figure 7-2 Application layer PDU

2)

Prefix	Format	Length
ALERT2	B	31
41 4C 45 52 54 32	42	1F

...

Version Number		
Type	Length	Value
117	1	1
75	01	01

...

Frame Start			Frame Length		
Type	Length	Value	Type	Length	Value
72	3	60000	73	3	30000
48	03	00 EA 60	49	03	00 75 30

...

Slot Length			Save Configuration	
Type	Length	Value	Type	Length
74	3	1000	120	0
4A	03	00 03 E8	78	00

Figure 7-3 Example 2: Application Protocol Device String

This example shows the APD string sent to the IND in binary format, using version 1, to configure the IND with TDMA parameters of Frame Start at 1 minute after top of the hour (60,000 in milliseconds), with a Frame Length of 30 seconds (30,000 in milliseconds) and a Slot Time of 1 second (1,000 in milliseconds. The configuration is saved to non-volatile configuration storage in the IND; until changed either temporarily or again into non-volatile storage, the IND uses these TDMA parameters for all communications.

8 Appendix B – Examples of the "ALERT Compatibility Mode" interface

(See also the examples in the Application Layer Specifications.)

1)

byte 0	...	byte 1	...	byte 2	...	byte 3
7B		6F		FC		FF

This is the 4 byte binary for an ALERT message with ID 3067 and data value 1022, sent in the "standard" binary format, e.g. using the encoding:

ALERT Byte 1	0	1	A5	A4	A3	A2	A1	A0
ALERT Byte 2	0	1	A11	A10	A9	A8	A7	A6
ALERT Byte 3	1	1	D4	D3	D2	D1	D0	A12
ALERT Byte 4	1	1	D10	D9	D8	D7	D6	D5

Figure 8-1 ALERT Binary format

2)

byte 0	...	byte 1	...	byte 2	...	byte 3
35		33		35		36

This is the 4 byte binary for an ALERT message with ID 35 and data value 65, sent in the "ALERT ASCII" format, e.g. using the encoding:

ALERT Byte 1	0	0	1	1	AU3	AU2	AU1	AU0
ALERT Byte 2	0	0	1	1	AT3	AT2	AT1	AT0
ALERT Byte 3	0	0	1	1	DU3	DU2	DU1	DU0
ALERT Byte 4	0	0	1	1	DT3	DT2	DT1	DT0

Figure 8-2 ALERT ASCII format

3)

byte 0	...	byte 1	...	byte 2	...	byte 3
FB		2F		FF		per EIF

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This is the 4 byte binary for an ALERT message with ID 3067 and data value 1022, sent in the "Enhanced IFLOWS Format", e.g. using the encoding:

ALERT Byte 1	1	1	A5	A4	A3	A2	A1	A0
ALERT Byte 2	D0	A12	A11	A10	A9	A8	A7	A6
ALERT Byte 3	D8	D7	D6	D5	D4	D3	D2	D1
ALERT Byte 4	C0	C1	C2	C3	C4	C5	D10	D9

Figure 8-3 ALERT EIF Format

Where (C0-C5) are the EIFS Frame Check Sequence bits.

9 Appendix C – Example Demodulator & Decoder ASCII Output strings

9.1 AirLink PDU string

1)

ALERT2A,1,8000,SACCO,P,0,2009,11,25,13,45,04.076567,35,24,00,08,3F,03,A3,08,3B,03,A5,28,0A,04,99,85,A6,08,84,04,9F,08,02,05,A0,08,0,13,CA,05,F4,06,11,12,13,14,15,16,17,0,1196,1550<CR><LF>

This is the ASCII format from a demodulator-decoder, using version 1, with decoder source address 8000 and agency identifier SACCO, for an AirLink frame that arrived on November 25, 2009 at 13:45:04.076567 containing the AirLink header version 0and a 35 byte MANT PDU divided into two payloads, the first is 24 bytes, the second is 13 bytes, as shown below (in hex bytes, with the first byte transmitted at the left):

0x00083F03 A3083B03 A5280A04 9985A608 84049F08 0205A008
CA05F406 11121314 151617

Each payload is decoded without errors. The first block was FEC decoded in 1.196 milliseconds and the remaining frame was FEC decoded in 1.550 milliseconds.

2)

ALERT2A,1,8000,SACCO,P,0,2009,12,02,23,28,59.979351,14,24,00,0E,00,DA,04,D0,A4,0C,04,D0,A5,0A,04,D0,A6,09,55,55,55,55,55,55,55,55,4,1003<CR><LF>

This is the ASCII format from a demodulator-decoder, using version 1, with decoder source address 8000 and agency identifier SACCO, for an AirLink frame that arrived on December 2, 2009 at 23:28:59.979351 containing an AirLink version 0 and a 14 byte MANT PDU as shown below (in hex bytes, with the first by transmitted at the left):

0x00DA04D0 A40C04D0 A50A04D0 A609

And it is decoded with the Reed-Solomon decoder correcting 4 symbol errors in the first block, and where the first block was decoded in 1.003 milliseconds.

3)

ALERT2A,1,8000,SACCO,P,0,2009,11,25,13,45,04.076567,35,24,00,23,00,08,3F,03,A3,08,3B,03,A5,28,0A,04,99,85,A6,08,84,04,9F,08,02,05,2,13,A0,A1,BB,05,F4,06,CC,AB,99,10,10,10,1F,-1, 1196,2999<CR><LF>

This is the ASCII format from a demodulator-decoder, using version 1, with decoder source address 8000 and agency identifier SACCO, for an AirLink frame that arrived on November 25,

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2009 at 13:45:04.076567 containing a 35 byte MANT PDU divided into two payloads, the first is 24 bytes, the second is 13 bytes, as shown below (in hex bytes, with the first byte transmitted at the left):

0x00083F03 A3083B03 A5280A04 9985A608 84049F08 0205A008
CA05F406 11121314 151617

And it is decoded with the Reed –Solomon decoder correcting 2 errors on the first block and where the second block had more than 8 symbol errors, therefore the second block could not be corrected. The first block was FEC decoded in 1.196 milliseconds and the remaining frame was FEC decoded in 2.999 milliseconds.

9.2 MANT Protocol Data Unit string

1)

ALERT2A,1,8000,SACCO,N,2009,11,25,13,45,04.076567,0,0,0,0,0,0,0,0,0,7,13,4403,70,08,3F,03,A3,08,3B,03,A5,28,0A,04,99<CR><LF>

This is the ASCII format from a demodulator-decoder, using version 1, with decoder source address 8000 and agency identifier SACCO, for an AirLink frame that arrived on November 25, 2009 at 13:45:04.076567 containing a 13 byte ALERT2Self Reporting Application Layer PDU as shown below (in hex bytes, with the first byte transmitted at the left):

0x70083F03 A3083B03 A5280A04 99

The MANT Version is ‘0’ and the Protocol ID is ‘0’. There is no Time Stamp Service Request or Add Path Service Request, and there is no Destination Address appended to the header. The Service/Port is ‘0’ and the Reserved Bits field is ‘0’. The EERDS ACK bit is ‘0’ and the Added Header field is ‘0’. The Hop Limit is ‘7 and the Source Address is decimal 4403.

2)

ALERT2A,1,8000,SACCO,N,2009,11,25,13,45,04.076567,0,0,0,1,0,0,0,0,0,0,7,13,4403,2,3303,3304,70,08,3F,03,A3,08,3B,03,A5,28,0A,04,99<CR><LF>

This is the output given the same conditions as example 1 above, except that the APD requested that an Add Path Service from the MANT. The MANT PDU has been repeated by 2 IND nodes, the first with source address 3303 and the second with source address 3304.

3)

ALERT2A,1,8000,SACCO,N,2009,11,25,13,45,04.076567,0,0,1,0,0,0,0,0,0,0,7,13,4403,70,08,3F,03,A3,08,3B,03,A5,28,0A,04,99<CR><LF>

This is the output given the same conditions as example 1 above, except the Time Service Request bit is set. The Demodulator & Decoder does not provide a Time Service. Since the Demodulator & Decoder output still includes the Time Service Request field set, no node in this MANT PDUs path had an accurate clock to add the time tag in the Application Layer payload (unlikely). If this MANT PDU had been repeated by an IND with an accurate clock, the Time Service Request would have been processed, and the Time Service Request field would have been ‘0’ on receipt.

9.3 Concentration Protocol Data Unit strings

1)

ALERT2A,1,8000,SACCO,C,2,8002,9003,2008,10,17,09,53,36,2192,80,2008,10,17,09,53,38,21
91,42,2008,10,17,09,53,37,2187,51

This is the ”C” string output generated from ALERT messages received at an ALERT2IND with a Source Address of 9003 and with Add Path Service requested. This MANT PDU was received and forwarded by an ALERT2repeater with a Source Address of 8002. The Concentration Protocol message embedded three ALERT messages (“2192, 80”, “2191, 42” and “2187, 51”) with arrival time offsets (“-4”, “-2” and “-3” seconds, respectively). The Concentration Protocol embedded a time stamp representing 9:53:40 AM UTC and the MANT PDU was received in the AM on 10/17/2008 UTC.

2)

ALERT2A,1,8000,SACCO,C,2,8002,9003,0,0,0,0,0,-12,2192,80,0,0,0,0,0,-10,2191,42,0,0,0,0,0,
-11,2187,51

Same as example 1 above, except no IND device had an accurate time clock.

9.4 ALERT message string

If the “A” string output is turned on, every 'C' string is followed by one 'A' sting for each ALERT message. The time tag, ALERT ID and ALERT Data fields are identical to the fields in the 'C' string. The example “C” strings from above would be immediately followed by these “A” strings:

1) The example 1 'C' sting:

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ALERT2A,1,8000,SACCO,A,2008,10,17,09,53,36,2192,80
ALERT2A,1,8000,SACCO,A,2008,10,17,09,53,38,2191,42
ALERT2A,1,8000,SACCO,A,2008,10,17,09,53,37,2187,51

2) The example 2 'C':

ALERT2A,1,8000,SACCO,A,0,0,0,0,0,-4,2192,80
ALERT2A,1,8000,SACCO,A,0,0,0,0,0,-2,2191,42
ALERT2A,1,8000,SACCO,A,0,0,0,0,0,-3,2187,51

9.5 S strings

1) (TBD by TWG – proposed S subtype number'1").

This example "S" string is from Blue Water Design LLC's Model B2010 Decoder & Demodulator. This example string is output from the AirLink protocol decoder when the "first block" is flagged in error. Since the AirLink PDU length is embedded in the first block, no further processing is possible for the received AirLink, if it in fact was an AirLink frame.

ALERT2A,1,8000,SACCO,S,1,139,46,2010,09,01,00,08,16.674973,469,17,B9,D5,8B,3C,D2,8A,49,E6,67,95,96,B2,B6,5F,41,95,81,-1,*Bad First Block, uncorrectable bit errors; discarding packet

2) (TBD by TWG – proposed S subtype number'10').

This example "S" string is from Blue Water Design LLC's Model B2010 Decoder & Demodulator. This example string is hourly statistics output.

ALERT2A,1,8000,SACCO,S,10,2010,9,1,1,0,1,tpackts = 201, talertm = 411, tcrblks = 243, tRSsymc = 8635, tncblks = 0, tbfblks = 1, dcdperr = 0, fecperr = 0

It includes:
Time tag: 2010,9,1,1,0,1
Total packets (AirLink frames): tpackts = 201
Total Concentration Protocol ALERT messages received: talertm = 411
Total R-S corrected blocks: tcrblks = 243
Total R-S symbols corrected: tRSsymc = 8635
Total blocks not correctable: tncblks = 0
Total first block errors: tbfblks = 1
Total decoder processing errors: dcdperr = 0
Total FED decoder processing errors: fecperr = 0

10 Appendix D – Example Demodulator & Decoder Binary Output

In these examples, the fields are shown in three lines, the field TLV labels, the decimal values and the equivalent hex bytes sent down the wire.

10.1 MANT PDU

1)

Prefix	Format	Length
ALERT2	B	48
41 4C 45 52 54 32	42	30

...

Version Number			Decoder Source Address			Agency Identifier		
Type	Length	Value	Type	Length	Value	Type	Length	Value
117	1	1	118	2	8000	119	5	SACCO
75	01	01	76	02	1F 40	77	05	53 41 43 43 4F

...

MANT PDU	
Type	Length
20	32
36	20

...

Header		
Type	Length	Value
1024	6	n/a
84 00	06	00 00 70 0D 11 33

...

Payload		
Type	Length	Value
1025	13	n/a
84 01	0D	A4 08 3F 03 A3 08 3B 03 A5 28 0A 04 99

...

Decoder time stamp		
Type	Length	Value
1026	4	1293699600
84 02	04	4D 1C 4A 10

Figure 10-1 Example Binary output

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Where here the MANT Protocol header fields are:

Field length bits	Description	Value
2	Version	00
3	Protocol ID	000
1	Time Stamp Protocol Service Request	0
1	Add Path Service Request	0
1	Destination Address in Header	0
4	Service/Port	0000
3	Reserved Bits field	000
1	EERDS ACK bit	0
1	Added Header	0
3	Hop Limit	111
12	Payload Length	0000 0000 1101
16	Source Address	0x1133
[16]	[Destination Address in Header]	none
[8]	[MANT PDU ID]	none
[8]	[Number of SAs appended]	none
[N*16]	[path list]	none

Figure 10-2 MANT protocol header fields

And the MANT payload is an Application Layer Self Reporting Protocol with contents:
0xA4083F03 A3083B03 A5280A04 99
It was received by the IND on December 30, 2010 at 9:00:00 AM, from Source Address 4403.

10.2 AirLink PDU

1)

Prefix	Format	Length
ALERT2	B	46
41 4C 45 52 54 32	42	2E

...

Version Number			Decoder Source Address			Agency Identifier		
Type	Length	Value	Type	Length	Value	Type	Length	Value
117	1	1	118	2	8000	119	5	SACCO
75	01	01	76	02	1F 40	77	05	53 41 43 43 4F

...

AirLink PDU	
Type	Length
21	39
37	27

...

Header		
Type	Length	Value
1040	2	19
84 10	02	00 13

...

First Block		
Type	Length	Value
1041	24	n/a
84 11	18	00 13 00 0D 11 33 A4 08 3F 03 A3 08 3B 03 A5 28 0A 04 99 55 55 55 55 55

...

First Block FEC		
Type	Length	Value
1042	1	0
84 12	01	00

...

Decoder time stamp		
Type	Length	Value
1026	4	
84 02	04	56 44 33 11

Figure 10-3 Example AirLink PDU

Where here the AirLink Protocol header fields are:

Field	Description	Value
2 bits	Version	00
4 bits	Reserved bit field	0000
10 bits	Payload Length	0000 0000 11

Figure 10-4 AirLink header fields

And the AirLink (data) payload is:
0x0000000D 1133A408 3F03A3083B 03A5280A 0499
It was received by the IND on December 30, 2010 at 9:00:00 AM.

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11 Glossary

Abbreviation	Description
APD	Application Protocol Device – a device that implements the application layer protocols
API	Application Program Interface – the means and specifications for communication between programs; in this document it refers to the interface with an Intelligent Network Device
APSR	Add Path Service Request – a 1-bit field in the MANT header used to request that each IND add its source address as it forwards a frame
DA	Destination Address – the Source Address of the IND to which a PDU is directed
DAI	Destination Address included in header – a 1-bit MANT header field used to indicate that the destination address is added to the header
EERDS	End-to-End Reliable Datagram Service – a MANT protocol used to confirm delivery of application PDUs
IND	Intelligent Network Device – A device that implements both the AirLink and MANT protocols, e.g., a modulator/encoder or a demodulator/decoder
MANT	The middle layer of the ALERT2 3-layer protocol stack. It is responsible for network and transport services
PDU	Protocol Data Unit – a unit of data containing a control header and a data payload that is exchanged between peer layers
SA	Source Address – the 16 bit identifier of the originating IND
TSSR	Time Stamp Service Request - a 1-bit MANT header field used to request that the receiving IND add a timestamp to certain MANT PDUs
UTC	Universal Coordinated Time, also known as Greenwich Mean Time (GMT)

The ALERT Version 2 protocol would not have been possible without the dedication, time and energy of members of ALERT2 Protocol Technical Working Group. The NHWC would like to thank the member organizations that allowed their people to provide their time.

For more information
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