uAvionix SkyLink Interface Control Document

UAV-100????-001

Rev A

July 05, 2019

1. Revision History

Revision	Date	Comments
A	07/05/2019	Initial release.

2. GDL90 Public Specification

The *GDL 90 Data Interface Specification* can be found here: https://www.faa.gov/nextgen/programs/adsb/Archival/media/GDL90_Public_ICD_RevA.PDF

3. Physical Interfaces

3.1. Direct to device over Serial

Communication to a uAvionix SkyLink device is accomplished through a full duplex asynchronous serial interface with 3.3v TTL physical layer drivers. The serial data interface is configured with the following characteristics:

- Default Data bit rate: 115200bps
- Data Length: 8 bits
- Parity: None
- Stop Bits: 1 bit
- Flow Control: None

3.2. Direct to SkyStation over Network

Communication to a uAvionix SkyStation is accomplished over a IP network interface using either the UDP or TCP protocol. In the case of UDP, the SkyStation will default to a broadcast IP address with the port below. While for the TCP protocol, the SkyStation will default to accept connections upon power up at the port number below.

- UDP Control Data Port: 30012
- TCP Control Data Port: 30013

4. Packet Format

5. The SkyLink device packets follow the Revision History

Revision	Date	Comments
A	07/05/2019	Initial release.

GDL90 Public Specification for framing, byte stuffing, control escape, and frame check sequencing. The standard flag byte of 0x7E and escape byte of 0x7D are used, see section 2.2.1 of the public specification for additional details.

Frame Flag (0x7E)	Msg ID 1 byte	Payload N bytes	Frame Check Sequence 2 bytes	Frame Flag (0x7E)

6. SkyLink Packet Format

All messages pertaining to the control and configuration of SkyLink will contain a GDL90 MsgID of 49_{10} and shall follow the format below

Frame Flag (0x7E)	Msg ID (0x31)	Msg ID SubType 1 byte	Payload N bytes	Frame Check Sequence 2 bytes	Frame Flag (0x7E)

7. Message Sub Packet Types

uAvionix GDL90 Skylink supported packets are broken down into two categories related to the purpose of the packet. The first category is Configuration, this category relates to the initial setup of the SkyLink device to the system or aircraft it's being installed into. The second category is Operational, which relates to the ongoing operation of the SkyLink device once it's been installed into the aircraft and has been configured.

7.1. Configuration Packets

Message ID SubType & Name	I/O	Section

02_{10} (0x02) – Configuration Request	In	***7.1.1***
03_{10} (0x03) – Configuration Report	In/Out	***7.1.2***
04_{10} (0x04) – Hop Table Request	In/Out	***7.1.3***
05_{10} (0x05) – Hop Table Report	In/Out	***7.1.4***

7.1.1. Configuration Request (Msg ID SubType = 02_{10})

When a configuration request message is sent to the SkyLink device, the device will reply with a Configuration Report (Msg ID SubType = 03_{10}) message in response. This allows a method for the host to retrieve the current configuration for initialization and verification purposes.

Offset	Type/Width	Value	Description
0	uint8_t	0x31	Message ID
1	uint8_t	0x02	Skylink Message ID SubType

7.1.2. Configuration Report (Msg ID SubType = 03_{10})

The configuration message should be sent only as required to set or update the device's version of the information fields contained within this message. Valid receipt of this message will cause the device to write the new data into non-volatile memory and all data will persist through a power cycle. If a confirmation of reception is desired, simply send a Configuration Request (Msg ID SubType = 02_{10}) message after sending the configuration message and verify field data match.

Offset	Type/Width	Value	Description
0	Uint8_t	0x31	Message ID
1	Uint8_t	0x03	SkyLink Message ID SubType
2	Uint8_t		Station Type
3	Uint8_t		UTC Pulse Polarity
4	Uint32_t		User Port Baud Rate in bps
8	Uint32_t		Position Port Baud Rate in bps
12	Uint32_t		Control Port Baud Rate in bps
16	Uint8_t(7:7)		Uart Idle Framing Enabled
16	Uint8_t(6:6)		Stale Data Framing Enabled

16	Uint8_t (5:0)	0	Spare Bits (Set to 0's)
17	Uint8_t		Maximum Transmission Unit (MTU)

7.1.3. Hop Table Request (Msg ID SubType = 03_{10})

When a hop table request message is sent to the SkyLink device, the device will reply with a

Hop Table Report (Msg ID SubType = 0410) message containing the requested section of the hop table in response. This allows a method for the host to retrieve a particular section of a hop table for initialization and verification purposes. A hop table request message can also be sent by the device to request additional hop channels as part of an entire hop table transfer. If a hop table request message containing a "First Hop Channel Requested" greater than the size of the Hop Table, the message should be considered invalid and ignored.

Offset	Type/Width	Value	Description
0	Uint8_t	0x31	Message ID
1	Uint8_t	0x03	SkyLink Message ID SubType
2	Uint8_t(7:6)		Hop Table ID (RFU, set to 0)
2	Uint8_t(5:0)		Spare bits (Set to 0's)
3	Uint8_t		First Hop Channel Requested

7.1.4. Hop Table Report (Msg ID SubType = 04_{10})

The hop table message should be sent only as required to set or update the device's version of the hop table contained within this message. If a confirmation of reception is desired, the host should simply send a Hop Table Request (Msg ID SubType = 03_{10}) message after sending the Hop Table Report (Msg ID SubType = 04_{10}) message and verify the data matches. The maximum number of Hop Channels in any Hop Table Report message is 25 to maintain a maximum message size of 204 bytes.

Offset	Type/Width	Value	Description
0	Uint8_t	0x31	Message ID
1	Uint8_t	0x04	SkyLink Message ID SubType
2	Uint8_t(7:6)		Hop Table ID (RFU, set to 0)

<table>
<tr><td>2</td><td>Uint8_t(5:0)</td><td></td><td>Spare bits (Set to 0’s)</td></tr>
<tr><td>3</td><td>Uint8_t</td><td></td><td>Total number of Hop Channels</td></tr>
<tr><td>4</td><td>Uint8_t</td><td></td><td>First Hop Channel Index</td></tr>
<tr><td>5</td><td>
<h5>7.1.4.1. Hop Channel:</h5>
<table>
<tr><th>Offset</th><th>Type/Width</th><th>Description</th></tr>
<tr><td>0</td><td>Uint32_t</td><td>Frequency in Hz</td></tr>
<tr><td>4</td><td>Uint32_t</td><td>Channel Code Word</td></tr>
</table>
<h4>7.1.5. Hop Table Transfer Sequence Example</h4>
This is an example sequence of how the Hop Table Request (Msg ID SubType = 03_{10}) and Hop Table Report (Msg ID SubType = 04_{10}) messages are used to transfer an entirely new hop table to a SkyLink device.
</td><td></td><td>HopChannel[First Hop Channel Index + 0]</td></tr>
<tr><td>13</td><td>
<h5>7.1.5.1. Hop Channel:</h5>
<table>
<tr><th>Offset</th><th>Type/Width</th><th>Description</th></tr>
<tr><td>0</td><td>Uint32_t</td><td>Frequency in Hz</td></tr>
<tr><td>4</td><td>Uint32_t</td><td>Channel Code Word</td></tr>
</table>
<h4>7.1.6. Hop Table Transfer Sequence Example</h4>
This is an example sequence of how the Hop Table Request (Msg ID SubType = 03_{10}) and Hop Table Report (Msg ID SubType = 04_{10}) messages are used to transfer an entirely new hop table to a SkyLink device.
</td><td></td><td>HopChannel[First Hop Channel Index + 1]</td></tr>
<tr><td>…</td><td></td><td></td><td>…</td></tr>
</table>

197	Hop Channel		HopChannel[First Hop Channel Index + 24]

7.1.6.1. Hop Channel:

Offset	Type/Width	Description
0	Uint32_t	Frequency in Hz
4	Uint32_t	Channel Code Word

7.1.7. Hop Table Transfer Sequence Example

This is an example sequence of how the Hop Table Request (Msg ID SubType = 03_{10}) and Hop Table Report (Msg ID SubType = 04_{10}) messages are used to transfer an entirely new hop table to a SkyLink device.

Host	SkyLink Device
Hop Table Report containing 25 hop channels with "First hop channel index" = 0 →	
	← Hop Table Request with "First Hop Channel Requested" = 25
Hop Table Report containing 25 hop channels with "First hop channel index" = 25 →	
	← Hop Table Request with "First Hop Channel Requested" = 50
End of transfer sequence	

7.2. Operational Packets

Message ID & Name	I/O	Section
01_{10} (0x01) – Status Msg	Out	***7.2.1***

7.2.1. Status Message (Msg ID SubType = 01_{10})

The Status message packet contains all data to represent the immediate status of the local and remote SkyLink. Status messages are sent with a 1/2 second period only when the SkyLink is operational. Once powered on the SkyLink does not become operational until Position data and UTC pulse is supplied.

Offset	Type/Width	Value	Description
0	tint8_t	0x31	Message ID
1	tint8_t	0x01	SkyLink Message ID SubType
2	SkyLink Status		Local SkyLink Status
84	SkyLink Status		Remote SkyLink Status

SkyLink Status Structure:

Offset	Type/Width	Description
0	Int32_t	Latitude in Decimal Degree with 1x10^7 units
4	Int32_t	Longitude in Decimal Degree with 1x10^7 units
8	Int32_t	GNSS Altitude in mm units
12	Uint32_t	Horizontal Accuracy in mm units
16	Uint32_t	Vertical Accuracy in mm units
20	Uint32_t	Velocity Accuracy in mm/s units
24	Int32_t	Vertical Velocity in mm/s units
28	Int32_t	North Velocity in mm/s units
32	Int32_t	East Velocity in mm/s units
36	Uint8_t	GPS Fix Type
37	Uint8_t	Number of GPS Satellites in solution
38	Uint16_t	Transmitted Frames
40	Uint16_t	Received Frames
42	Uint16_t	Dropped Frames
44	Uint16_t(15:15)	Primary Radio Link Status 0 = No Link, 1 = Link Ok
44	Uint16_t(14:14)	Secondary Radio Link Status 0 = No Link, 1 = Link Ok
44	Uint16_t(13:0)	Spare bits (Set to 0’s)
46	Uint32_t	Transmitted Bytes Total
50	Uint32_t	Received Bytes Total
54	Uint16_t	Transmitted Frame Rate in Frames/second

56	Uint16_t	Receive Frame Rate in Frames/Second
58	Uint16_t	Transmitted Data Rate in bytes/second units
60	Uint16_t	Received Data Rate in bytes/second units
62	Uint8_t	Receive Frame Queue Depth
63	Uint8_t	Receiver Max Queue Depth
64	Uint8_t	Transmitter Queue Depth
65	Uint8_t	Transmitter Max Queue Depth
66	Int16_t	Primary RSSI in dBm with 1x10^2 units
68	Uint16_t	Primary Beacon Frame Count
70	Uint16_t	Primary Data Frame Count
72	Uint16_t	Primary Dropped Frame Count
74	Int16_t	Secondary RSSI in dBm with 1x10^2 units
76	Uint16_t	Secondary Beacon Frame Count
78	Uint16_t	Secondary Data Frame Count
80	Uint16_t	Secondary Dropped Frame Count

8. Field Definitions

8.1. Station Type

Station Type	Value
Ground	0
Airborne	1

8.2. UTC Pulse Polarity

Pulse Polarity	Value
Pulse Positive (Rising edge Captured)	0
Pulse Negative (Falling edge Captured)	1

8.3. GPS Fix Type

Fix Type	Value
None	0
No Fix	1
2D Fix	2
3D Fix	3
3D Fix with Differential	4
3D Fix with RTK	5