02291 PROTOCOL DESCRIPTION

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Frame Structure

The 02291 transfer data using a frame structure as follows:

Preamble	SOF	Factory ID	Packet ID	PN	DA	Message Type	Payload	CRC	EOF

Type	Purpose	Length (bytes)
Preamble	Calibrate Radio Circuits	12
SOF	Start Of Frame	1
Factory ID	UART Frame Sync	1
Packet ID	Packet ID	2
Packet No	Sequence Number	1
Message Type	Type of message	1
DA	Destination Address	1
Payload	Data	0 to 200
CRC	Payload CRC Checksum	2
EOF	End Of Frame	1

Table 1: Packet Fields

Frame Description

- **Preamble**
  The Preamble is an alternating sequence of 0s and 1s. It's purpose is to eliminate DC offsets within the radio and to allow time for the power amplifier power to ramp up. 02291 also use this to read the RSSI output.

- **Start Of Frame**
  The SOF is a byte synchronization that the upcoming data are aligned.

- **Factory ID**
  The Factory ID is used to prevent noise from different model or product using similar system

- **Packet ID**
  The packet ID is a Unique ID (16bit) to used prevent RF noise.

- **Message Type**

  Sync Type: Include LINK REQ, LINK ACK and other link establishment.
  Data Type: Data Request Packet, Data Packet
  Audio Type: Audio Request Packet, Audio Packet

- **Destination Address**
  Destination address indicate where packet is to be received.

- **Payload**
  Data to be sent

- **Checksum**
  CRC 16bit checksum make sure the data is corrected.

- **EOF**
  EOF identifies end of the frame.

Link Establishment

After power up, the 02291 starts to search the peer by sending a LINK REQ packet at all frequencies under its pseudo random frequencies pattern. The peer will issue a LINK ACK packet to confirm the link and a point to point link is established.

To avoid dead link in case of one end is powered off or out of range, 02291 continue to synchronize with the other end using the REQ and ACK packet.

Data Transfer Mechanism

The 02291 continue to transfer or receive data by issuing Data request and Audio request packet.

If a data packet request is sent, the peer will check the destination address, if the address is matched, it either send data or null data packet (if no data to sent)

If an audio packet request is sent, the peer will check the destination address, if the address is matched, it either send data or null data packet (if no data to sent).

If an audio packet is sent, the peer will check the destination address, if the address is matched, it transmit the ACK packet to complete data transfer.

Audio data request will be sent in fix period depending on audio data rate in order to meet audio requirement.

Frequency Hopping Scheme

Hopping Frequency

The Hopping frequency is about 1100 times per seconds. The packet length is ranging from 80us (SNYC packet) to 660us (DATA packet)

Pseudo Random Hopping Sequence Generation

Physical hopping frequency used are :

Channel	Frequency
1	2407.5MHz
2	2412.0MHz
3	2416.5MHz
4	2421.0MHz
5	2405.5MHz
6	2430.0MHz
7	2434.5MHz
8	2439.0MHz
9	2443.5MHz
10	2448.0MHz
11	2452.5MHz
12	2457.0MHz
13	2461.5MHz
14	2466.0MHz
15	2470.5MHz
16	2475.0MHz

The sequences are generated by C++ rand function in which calculate uniformly distributed random numbers. The 16 channels are grouped into sequence 1. Sequence 2 is generated by the same function with only the same 16 channels are selected.

Example Sequence 1	Example Sequence 2
Channel=9	Channel=10
Channel=13	Channel=13
Channel=5	Channel=3
Channel=16	Channel=1
Channel=4	Channel=9
Channel=14	Channel=11
Channel=7	Channel=5
Channel=14	Channel=2
Channel=1	Channel=13
Channel=3	Channel=8
Channel=12	Channel=15
Channel=1	Channel=6

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Channel=15          Channel=7
Channel=12          Channel=12
Channel=3           Channel=16
Channel=4           Channel=9
Channel=15          Channel=11
Channel=6           Channel=4
Channel=10          Channel=5
Channel=2           Channel=14
Channel=6           Channel=14
Channel=8           Channel=1
Channel=16          Channel=15
Channel=11          Channel=8
Channel=9           Channel=12
Channel=13          Channel=6
Channel=11          Channel=2
Channel=2           Channel=16
Channel=8           Channel=3
Channel=5           Channel=10
Channel=7           Channel=7
Channel=10          Channel=4
```

Equal Hopping Frequency Use

All channel of frequency are continue to use as the example hopping sequence, In summary, all channels are used equally.

System Receiver Input Bandwidth

The system receiver bandwidth is 4.5MHz, which is equal to the bandwidth of the 16 hopping channel.

System Receiver Hopping Capability

The PN number is the state of hopping sequence which is transmitted by the 02291, which is transmitted in all type of packets. It is incremented after transmission. The receiver will capture the PN number, and synchronize with the transmitter using this PN number, such that the next hopping channel are known.

Correlation with other FHSS system

The 02291 use a unique factory ID (8bit) and Packet ID (16bit) to avoid receiving and transmitting signals to other FHSS system.