App Note - SENSO8 LoRaWAN Network Rejoining Mechanism

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1. What is network rejoining mechanism?

In case the LoRaWAN network connection between SENSO8 sensor and its network server is lost, the network rejoining mechanism helps to recover it.

2. How does SENSO8 LoRaWAN sensor know its network connection is lost?

SENSO8 sensor schedules to send a confirmed message with ACK request every 24 hours. If the SENSO8 sensor and the network server are connected, the network server will respond to the ACK request. Otherwise, the SENSO8 sensor will find that its connection to the network server is lost and start the network rejoining mechanism.

SENSO8 sensor has implemented a re-transmission back-off mechanism when sending a confirmed message with ACK request. If there is no response from the network server, the SENSO8 sensor will re-transmit the confirmed message 7 more times. Data rate and TX power in retransmissions will progressively decrease and increase respectively with the number of re-transmissions. So, when a confirmed message with ACK request is reporting failure, the SENSO8 sensor has already attempted 8 times.

3. What does network rejoining actually do?

3.1. OTAA

1. TX power and data rate are restored to its default region configuration.
2. Uplink frame counters are reset.
3. Send Join Request to network server.

4. Wait for Join Accept response from network server.

3.2. ABP

1. TX power and data rate are restored to its default region configuration.
2. Uplink frame counters are reset.
3. Assume the network connection is recovered.

For ABP mode, the network connection is assumed to be recovered after rejoining procedure. No Join Request is sent.

For OTAA mode, the SENSO8 sensor will continue to send the Join Request until a Join Accept response is received.

After network connection is recovered by either a Join Accept response is received in OTAA mode or rejoining procedure has run in ABP mode, the SENSO8 sensor will schedule to send a confirmed message with ACK request every 24 hours. If another confirmed message has been sent within this 24-hour period, the next confirmed message will be scheduled to 24 hours later.

If the network connection cannot be recovered, the SENSO8 sensor will send another Join Request again after a certain time interval. This time interval will increase progressively according to the number of rejoining attempts as listed in the table below.

Rejoining Frequency

Rejoining Counter	Timeline	Next rejoin interval
1	0 min	15 min
2	15 min	15 min
3	30 min	15 min
4	45 min	15 min
5	60 min	6 hours
6	7 hours	6 hours
7	13 hours	6 hours
8	19 hours	6 hours
9	25 hours	1 day
10	1 day 25 hours	1 day
11	2 day 25 hours	1 day
...	...	1 day
N	(N-9) day 25 hours	1 day

4. Firmware Default Setting

Activation Mode	Re-join	Limitation/Potential Issue
OTAA	Enabled	• The connection would be lost if the downlink transmission is unreliable. It could be due to: ◦ RF reception, the RSSI is too low and packet loss is frequent. ◦ Improper network configuration, downlink packet is not transmitted from gateway with good RSSI. ◦ The latency from the gateway to network server is too high such that the downlink does not arrive gateway on time. ◦ Other devices on the network keep sending downlinks and occupy the downlink channel (join request and join accept uses default frequencies only).
ABP	Disabled	• If the sensor does not have additional frequencies pre-set, it will not receive the additional frequencies via MAC commands unless it is restarted manually (for some network servers).

5. Pros and Cons of OTAA and ABP

	Pros	Cons
OTAA	Higher security as NwkSKey and AppSKey are generated on joining each time.	Difficult to deploy in locations where the reception is marginal as it requires more network handshake on network joining.
	Frame counter is reset to 0 on joining. Better security as it does not need to disable frame-counter validation on network server.	
	LoRaWAN settings like additional channel frequencies, RX1 delay are sent to sensor on joining.	

	Pros	Cons
ABP	Able to work in locations where reception is very poor. Still able to upload data despite the packet losses.	Relatively lower security as NwkSKey and AppSKey are pre-stored on the sensor and will not be changed.
		It might need to disable frame-counter validation on network server if the frame-counter is not stored on the sensor.
		LoRaWAN settings like additional channel frequencies, RX1 delay may not be sent to sensor (depends on network server). These settings must be pre-stored on the sensor.

6. Revision History

Revision	*Description*	*Date*
1.0	Initial Release.	8 Feb 2024
2.0	First release on docs.senso8.com	Oct 2026