

Advantech AE Technical Share Document

Date	2023/11/15	SR#	1-4332494280
Category	■FAQ □SOP	Related OS	N/A
Abstract	What is the definition of system log of wise lora node including WISE-2200-M WISE-2410 WISE-4610		
Keyword	WISE, data format, system log, record, logsys_message		
Related Product	WISE-2410, WISE-4610		

■ Problem Description:

This document explains the data in system log.

■ Brief Solution - Step by Step:

● JSON array name definition:

Field	Abbreviation	Data Type
Array of log messages	LogMsg	Array

● Resource value definitions :

Field	Abbreviation	Data Type	Property	Description
Periodic / Event	PE	Number	R	Recording mode of the storage (Reference System Logging Event Table)
Timestamp	TIM	String	R	Timestamp of the storage ✓ Coordinated Universal Time (UTC) Ex. "1415757750" corresponds to November 12, 2014, 2:02:30 am, Standard Time. (meanwhile, 2014, 10:02:30 am, Taipei Time.) ✓ Local Date/Time according GMT time zone (ISO 8601) Ex. "1994-11-05T08:15:30-05:00" corresponds to November 5, 1994, 8:15:30 am, US Eastern Standard Time.
UUID	UID	String	R	Universally Unique Identifier (UUID) Max. 32 characters
MAC ID	MAC	String	R	MAC address.

(12+5) characters, ex, "00-D0-C9-F0-63-F7"

Recording Record String R
message

System Event Table

Event	Description	Record				
1	Wireless Connection					
2	Reserved					
3	Reserved					
4	Reserved					
5	Reserved					
6	Reserved					
7	Power on/off	1: Power on 2: System restart				
8	Memory full/overwrite in log function	1: IO full 2: IO overwrite 3: System overwrite				
9	Reserved					
10	Reserved					
11	FW upgrade	Version Ex: A1.00 B01→0A100B01				
12	battery	Byte 3	Byte 0~2			
		0	Value	Event		
			1	Low battery		
		1	Battery voltage (mV)			
		2	Internal battery input			
		3	Internal Reference			
		Ex: 00000001 → Low Battery Event Ex: 01000DB5 → Battery voltage 3509 mV				
13	Reserved					
14	Reserved					
15	RF Event	Event	Byte 3	Byte 0~2		
		Join fail	1	0		
		RF initial fail	2	0		
		Connect fail	3	Code		
		Error event	4	Event code		
		MAC Command	5	Command information		
		Fcnt	6	Fcnt information		
		Error	7			
		TX Error	8			
Detail refer to ** RF Event Table .						
16	Reserved					
17	Reserved					
18	HW	Event	Byte 3	Byte 0~2		
		Vibration event	0	Byte 2	Byte 0~1	
				1	ODR error value	
				2	Sensor error	

RF Event Table

<div><div>Byte 2</div><div>Byte 0</div><div>05030502</div><div>Byte 3</div><div>Byte 1</div></div>				
Byte 3		Byte 0~2		
01	Join fail	000000		
02	RF initial fail	000000		
03	Connect fail	Byte 2~0		
		Possible Status Codes		
		-1000(A), -1003, -1010, -1011, -1012, -1014, -1021, -1022, -1024 Refer to RF LoRaWAN Status Code Table		
04	Error event	Event Code	Description	
		000001 (1)	Disconnected	
		000003 (3)	Tx timeout	
		000004 (4)	Tx error - for Class A, in CONFIRMED case, when the MAX number of retries are exhausted.	
		000005 (5)	Crypto error	
		000006 (6)	Tx scheduling error	
		000007 (7)	Rx done	
		000008 (8)	Rx timeout	
		000009 (9)	Rx error	
		00000A (10)	Join failure	
		00000B (11)	Uplink required	
		00000C (12)	Automatic uplink error	
05	MAC Command	02 <u>LinkCheckAns</u>		
		Byte 2	Byte 1	Byte 0
		02	00	00

03 LinkADDRReq

(1) Service not supported:

Byte 2	Byte 1	Byte 0
03	0000 Service not supported	

(2) Normal: (4 Events)

Byte 2	Byte 1				Byte 0			
03	<u>DataRate/ TXPower</u>				<u>Redundancy</u>			
	Bits	7:4	3:0		Bits	7	6:4	3:0
		DataRate	TxPower			Reserved	ChMaskCtrl	NoReq
Byte 2	Byte 1 ~ 0							
03	<u>Channel Mask</u>							
Byte 2	Byte 1				Byte 0			
03	<u>DataRate after setting</u>				<u>TxPower after setting</u>			
Byte 2	Byte 1				Byte 0			
03	Bits	7:3	2	1	0	<u>Bytes Passed</u>		
		Reserved	Power ACK	DataRate ACK	Channel Mask ACK			

04 DutyCycleReq

Byte 2	Byte 1	Byte 0
04	<u>Possible Status Codes</u>	
	-1010(0E), 0(00, success)	
	Refer to RF LoRaWAN Status Code Table	

05 RXParamSetupReq (3 Events)

Byte 2		Byte 1			Byte 0	
05		<u>RX1DRoffset</u>			<u>RX2DataRate</u>	
Byte 2 ~ 0						
<u>Frequency</u>						
05	Status (After RXParamSetupReq is completed)				Possible Status Codes	
	Bits	7:3	2	1	0	-1010(0E), 0(00, success) Refer to RF LoRaWAN Status Code Table
		Reserved	Rx1DrOffset range	Data rate	Frequency	

06 DevStatusReq

Byte 2	Byte 1	Byte 0
06	00	00

07 NewChannelReq (3 Events)

Byte 2	Byte 1	Byte 0			
07	ChIndex	DrRange			
Byte 2 ~ 0					
Frequency					
Byte 2	Byte 1	Byte 0			
07	Status (After NewChannelReq is completed)		Possible Status Codes		
	Bits	7:2	1	0	-1010(0E), 0(00, success)
		Reserved	Data rate	Frequency	Refer to RF LoRaWAN Status Code Table

08 RXTimingSetupReq

Byte 2	Byte 1	Byte 0
08	Delay	Possible Status Codes -1010(0E), 0(00, success) Refer to RF LoRaWAN Status Code Table

09 TxParamSetupReq

Byte 2	Byte 1	Byte 0
09	EIRP_DwellTime	Possible Status Codes -1010(0E), 0(00, success) Refer to RF LoRaWAN Status Code Table

0A DiChannelReq (3 Events)

Byte 2	Byte 1	Byte 0		
0A	00	ChIndex		
Byte 2 ~ 0				
Frequency				
0A	Status (After DIChannelReq is completed)		Possible Status Codes	
	Bits	7:2	1	0
		Reserved	Uplink frequency	Frequency
		-1010(0E), 0(00, success)		
		Refer to RF LoRaWAN Status Code Table		

06	Fcnt	Byte 2	Byte 1~0
		01	Uplink frame counter
		02	Downlink frame counter
		03	Downlink counter difference
07	Error	Byte 2	Byte 1~0
		00	Event Code Refer to RF Event Code Table
		01	Initialize Error
			Possible Status Codes
			-1003 Refer to RF LoRaWAN Status Code Table
		02	Add Callbacks Error
			Possible Status Codes
			-1003, -1012 Refer to RF LoRaWAN Status Code Table
		03	Set Confirmed Message and Retries Error
			Possible Status Codes
			-1003, -1012 Refer to RF LoRaWAN Status Code Table
		04	Set Channel Plan Error
			Possible Status Codes
			-1000(B), -1002(A), -1003, -1004, -1005, -1006, -1012 Refer to RF LoRaWAN Status Code Table
		05	Enable/Disable Adaptive Datarate Error
			Possible Status Codes
			-1012 Refer to RF LoRaWAN Status Code Table
		06	Set Datarate Error
			Possible Status Codes
			-1003, -1012 Refer to RF LoRaWAN Status Code Table
		07	Set Device Class Error
			Possible Status Codes
			-1012, -1013 Refer to RF LoRaWAN Status Code Table
		08	Multicast Channel Link Error
			Possible Status Codes
			-1000(B), -1003

			Refer to RF LoRaWAN Status Code Table		
		09	Send Error		
			Possible Status Codes		
			-1000(B), -1001(A), -1002(B), -1003, -1009, -1010, -1011, -1012, -1014, -1015, -1017, -1021, -1022		
			Refer to RF LoRaWAN Status Code Table		
		0A	Receive Error		
			Possible Status Codes		
			-1001(B), -1003, -1012, -1017		
			Refer to RF LoRaWAN Status Code Table		
		0B	Disconnect Error		
			Possible Status Codes		
			-1011, -1012		
			Refer to RF LoRaWAN Status Code Table		
		0C	Frequency Out of Range Error when set channel during LoRaWAN initialization.		
		0D	Downlink frame parsed errors / Result after downlink processing		
			Possible Error Codes (Downlink frame parsed errors)		
			Byte 1	Byte 0	Description
		FF		FF (-1)	Invalid I/O type
				FE (-2)	Invalid address mode
				FD (-3)	Wrong frame length
				FC (-4)	Wrong frame CRC
				FB (-5)	Incomplete frame
				FA (-6)	Invalid frame version
				F9 (-7)	Reserved check
				F8 (-8)	Decrypt failed
				F7 (-9)	Duplicate sequence number
			Possible Result (Result after downlink processing)		
			Byte 1	Byte 0	Description
			I/O type	Result	I/O type and Result Code refer to I/O Type & Result Code Table
08	Send error	Same with 7 Error above			
		Byte 3	Byte 2	Byte 1~0	
		7	09	Send Error	
		(Error)		Possible Status Codes	
				-1000(B), -1001(A), -1002(B), -1003, -1009, -1010, -1011, -1012, -1014, -1015, -1017, -1021, -1022	
				Refer to ORF LoRaWAN Status Code Table	
		(Reserved for WISE-2410)			

09	Downlink Frame	<p>WISE data header (WHDR) of the received frame</p> <table> <tr> <th>Byte 2</th><th>Byte 1</th><th>Byte 0</th></tr> <tr> <td>Frame Control</td><td>Frame Sequence Number</td><td>Total Length (L)</td></tr> </table> <p>Payload (WPayload):</p> <table> <tr> <th>Byte 2</th><th>Byte 1</th><th>Byte 0</th></tr> <tr> <td>WPayload[0]</td><td>WPayload[1]</td><td>WPayload[2]</td></tr> <tr> <td>WPayload[3]</td><td>...</td><td></td></tr> <tr> <td></td><td>WPayload[L-1]</td><td>0x00 (invalid data)</td></tr> </table> <p>*if I/O type is Application Raw Data (Transparent), only the first 3 bytes ("A0", Len, Len) of payload are recorded</p>	Byte 2	Byte 1	Byte 0	Frame Control	Frame Sequence Number	Total Length (L)	Byte 2	Byte 1	Byte 0	WPayload[0]	WPayload[1]	WPayload[2]	WPayload[3]	...			WPayload[L-1]	0x00 (invalid data)
Byte 2	Byte 1	Byte 0																		
Frame Control	Frame Sequence Number	Total Length (L)																		
Byte 2	Byte 1	Byte 0																		
WPayload[0]	WPayload[1]	WPayload[2]																		
WPayload[3]	...																			
	WPayload[L-1]	0x00 (invalid data)																		
0A	LoRaWAN network data rate	<p>data rate (DR0 ~ DR6) changed information.</p> <table> <tr> <th>Byte 2</th><th>Byte 1</th><th>Byte 0</th></tr> <tr> <td>TX: 0x00</td><td> Original Data Rate (DR) 0 ~ 6: by regions (link) -1: invalid </td><td> New Data Rate (DR) 0 ~ 6: by regions (link) </td></tr> </table>	Byte 2	Byte 1	Byte 0	TX: 0x00	Original Data Rate (DR) 0 ~ 6: by regions (link) -1: invalid	New Data Rate (DR) 0 ~ 6: by regions (link)												
Byte 2	Byte 1	Byte 0																		
TX: 0x00	Original Data Rate (DR) 0 ~ 6: by regions (link) -1: invalid	New Data Rate (DR) 0 ~ 6: by regions (link)																		

Write system logs in the order of MAC commands

For underlined words, please refer to [lorawan_specification_v1_0_2-20161012_1398_1.pdf](#)

RF Event Code Table

Code	Description
0000	MIC error
0001	LaRaWAN timeout reset

RF LoRaWAN Status Code Table

Code	Description	Detail
FC18 (-1000)	LoRaWAN Busy	(A) if the previous JoinRequest for connection is still underway (B) if TX currently ongoing (state is not idle) (C) if the send cannot be canceled
FC17 (-1001)	LoRaWAN would block	(A) if another TX is ongoing (B) if there is nothing available to read at the moment
FC16 (-1002)	Service unknown	(A) if custom channel plans are disabled (channels cannot be customized in some region) (B) Unknown message type (not confirmed/unconfirmed)
FC15 (-1003)	Invalid parameter	if NULL data, out of range or parameters are invalid
FC14 (-1004)	Invalid frequency	if invalid frequency is given
FC13 (-1005)	Invalid data rate	if invalid data rate is given
FC12 (-1006)	Invalid frequency and data rate	if invalid data rate and frequency are given
FC0F (-1009)	The device is not in a LoRaWAN	not joined the network
FC0E (-1010)	Payload length error	payload buffer full
FC0D (-1011)	The device is switched off	device is in shut down state
FC0C (-1012)	Stack not initialized	if system is not initialized
FC0B (-1013)	Service not supported	if requested class is not supported (class B)
FC0A (-1014)	Crypto failure	frame MIC calculation or payload encryption failed
FC09 (-1015)	Invalid port	if trying to send to an invalid port (e.g. to 0)
FC08 (-1016)	Connection in progress	Wait for JoinAccept after sending JoinRequest (only OTAA)
FC07 (-1017)	No active session	if connection is not open (not connected)
FC06 (-1018)	Idle at the moment	
FC05 (-1019)	Cannot perform requested operation	if the operation cannot be completed (nothing to cancel)

FC04 (-1020)	Transmission will continue after duty cycle back-off	duty cycle restriction
FC03 (-1021)	None of the channels is enabled at the moment	no valid channel found
FC02 (-1022)	None of the enabled channels is ready for another TX (duty cycle limited)	found valid channels, but channels are not free (due to LBT mechanism)
FC01 (-1023)	Meta-data after an RX or TX is stale	if the meta-data is not available
FC00 (-1024)	The device has already joined a network	if a network was already joined successfully

I/O Type & Result Code Table

Byte 1			Byte 0
I/O Type (4 bits)	Attributes (4 bits)	Description	Possible Result Codes
0x0	0x0	DI Data	
0x1	0x0	DO Data	
0x3	0x0	AI Data	
0x5	0x0~0x2	Sensor Data - Temperature	
	0x3	Sensor Data - Humidity	
	0x4~0x5	Sensor Data - Accelerometer	
	0x6	Sensor Data - Stacklights	
0x6	0x1	Device Data - General	
	0x2	Device Data - LPWAN Application	
	0x3	Device Data - LPWAN Network	
0x7	0x0	Coil Data	Modbus/RTU Status code
0x8	0x0	Register Data	
0x9	0x0	Meter Data	
0xA	0x0	Application Raw Data (Transparent)	Transparent Status Code

Transparent Status Code

Event Value	Description
0 (0x00)	No error
1 (0x01)	Minimum length not reached
2 (0x02)	out of memory
17 (0x11)	Server response timeout
20 (0x14)	Send request fail
24 (0x18)	Invalid Protocol

Data Rate

WISE Link v1

	Region					
"RT":	US	EU	JP	TW	AU	CN470
0	DR4– SF8/500KHz	DR0– SF12/125KHz	DR0– SF12/125KHz	DR4– SF8/500KHz	DR4– SF8/500KHz	DR0– SF12/125KHz
1	DR8– SF12/500KHz	DR1– SF11/125KHz	DR1– SF11/125KHz	DR8– SF12/500KHz	DR8– SF12/500KHz	DR1– SF11/125KHz
2	DR9– SF11/500KHz	DR2– SF10/125KHz	DR2– SF10/125KHz	DR9– SF11/500KHz	DR9– SF11/500KHz	DR2– SF10/125KHz
3	DR10– SF10/500KHz	DR3– SF9/125KHz	DR3– SF9/125KHz	DR10– SF10/500KHz	DR10– SF10/500KHz	DR3– SF9/125KHz
4	DR11– SF9/500KHz	DR4– SF8/125KHz	DR4– SF8/125KHz	DR11– SF9/500KHz	DR11– SF9/500KHz	DR4– SF8/125KHz
5	DR12– SF8/500KHz	DR5 – SF7/125KHz	DR5 – SF7/125KHz	DR12– SF8/500KHz	DR12– SF8/500KHz	DR5 – SF7/125KHz
6	DR13– SF7/500KHz	DR6– SF7/250KHz		DR13– SF7/500KHz	DR13– SF7/500KHz	
7		DR7 – FSK				

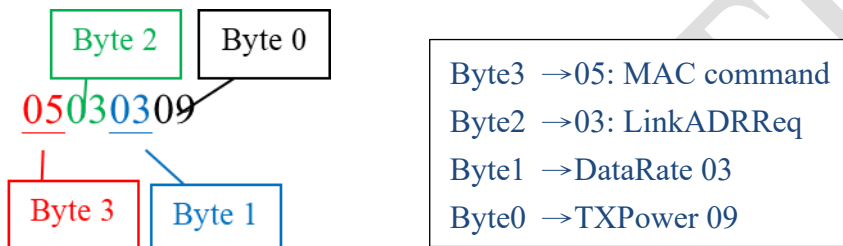
For example: Event type: 15, Value: 05030309 (WISE-2410 FW: NA version)

Important information is event type 15, record: 05xxxxxx (MAC Command) that could help to understand whether the MAC command for WISE-2410 was successfully received.

Event Type	Time	Device Name	Value
15	2020-10-27T13:47:00+08:00	WISE-2410_FF45D737	05060000
15	2020-10-27T13:49:31+08:00	WISE-2410_FF45D737	05030309
15	2020-10-27T13:49:31+08:00	WISE-2410_FF45D737	0503070A
15	2020-10-27T13:49:32+08:00	WISE-2410_FF45D737	05060000
15	2020-10-27T13:50:03+08:00	WISE-2410_FF45D737	05030309

Figure 1. System log captured from WISE-2410.

According to this format and parsing, we can parse the content of MAC command (05030309).



According to each FW version and national regulations, please refer to the LoRaWAN specification of each country, there is definition of “Data Rate 03” and “TX Power 09”.

DataRate	Configuration	Indicative physical bit rate [bit/sec]
0	LoRa: SF10 / 125 kHz	980
1	LoRa: SF9 / 125 kHz	1760
2	LoRa: SF8 / 125 kHz	3125
3	LoRa: SF7 / 125 kHz	5470
4	LoRa: SF8 / 500 kHz	12500
5..7	RFU	
8	LoRa: SF12 / 500 kHz	980
9	LoRa: SF11 / 500 kHz	1760
10	LoRa: SF10 / 500 kHz	3900
11	LoRa: SF9 / 500 kHz	7000
12	LoRa: SF8 / 500 kHz	12500
13	LoRa: SF7 / 500 kHz	21900
14..15	RFU	

US902-928 TX Data rate table

TXPower	Configuration (conducted power)
0	30 dBm – 2*TXpower
1	28 dBm
2	26 dBm
3..13
14	2 dBm
15	RFU

US902-928 TX power table

Figure 2. LoRa definition from LoRaWAN specification v1.0.2.

The result of data rate is changed to DR3-SF7/125K Hz, Tx Power 12 dBm.