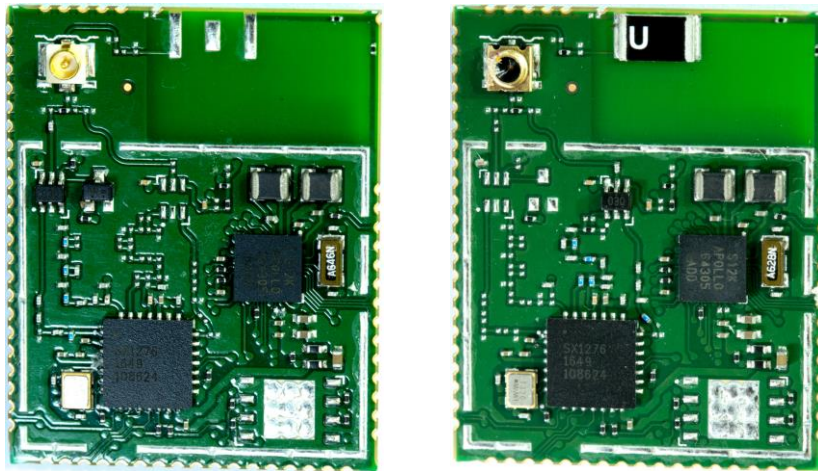


PRODUCT SPECIFICATION

LoRa Module

Model: WSG300A



Model SKU	LITEON P/N	Operation Freq.	Note
WSG300A(915)	AAZ100526D0	915MHz	Chip antenna
WSG300A(868)	AAZ100525D0	868MHz	
WSG300A(470)	AAZ100527D0	470-510MHz	IPEX connector

Version 1.0

Change History:

Revision	Rev	Date	Author	Change List
Version 1.0	V00	2017/12/20	Kaysa Lee	Preliminary

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PRODUCT FEATURES

GENERAL FEATURES:

- General LoRa module for Smart City, Smart Agriculture , Smart Industry, IOT Application
- Compact Form Factor: 25 x 31 x 3 mm
- 58 Pin Stamp Pad for PCB SMT mounting
- I/O port: I2C, SPI, UART
- GPIO configurable 35 pins.
- Temperature range: -40°C to +85°C
- Supply voltage: 3.3V
- Low Power Consumption: 0.553 uA/ 20mA at sleep mode/ standby mode.

RF FEATURE:

- Frequency range: 137-1020 MHz ,ISM and SRD systems.
- IEEE 802.15.4g, Wireless M-Bus and Proprietary Systems
- Maximum 20dBm output power @ power boost mode
- Low-Power Wireless Systems with 7.8-kHz to 500-KHz Bandwidth.
- Support 1 transmission and 1 receiving with 470/868/915MHz bands.
- On board 868/915MHz compatible antenna designed.
- IPEX connector for external antenna (470-510MHz SKU).

PRODUCT SPECIFICATIONS**MAIN CHIPSET**

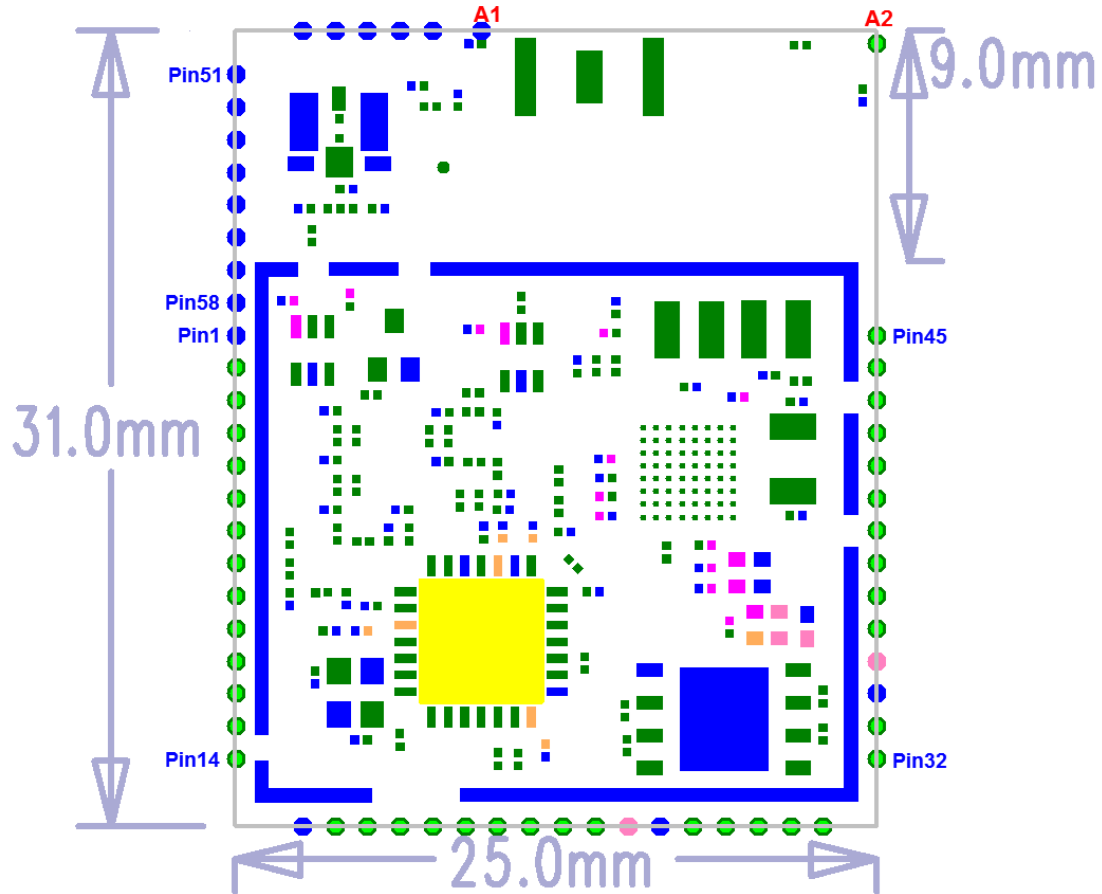
RF Transceiver : SEMTECH SX1276

MCU: AMBIQMICRO Apollo

FUNCTIONAL SPECIFICATIONS

RF Function	
Standard	IEEE 802.15.4g
Interface	I2C/SPI/ UART
Transmit Output Power	19dBm +/- 1dBm
Data Rate	0.018 - 37.5 kbps
Modulation Techniques	Multilevel (G)FSK and MSK
Frequency bands	137~1020 MHz
Operating Voltage	3.3 V +/- 10% I/O supply voltage

MODULE PINOUT

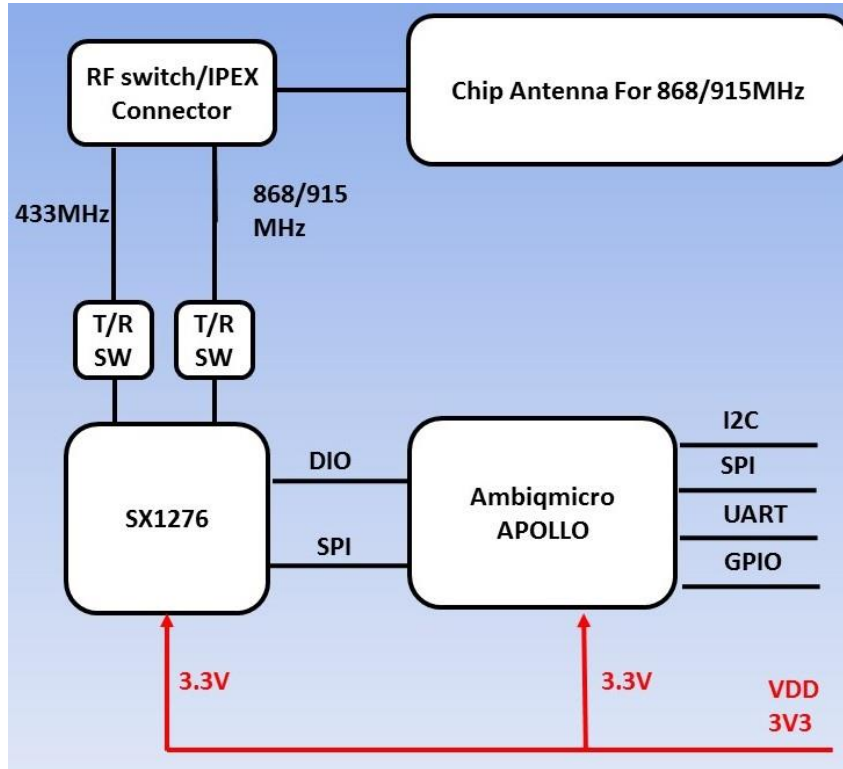


* Total 58 pins

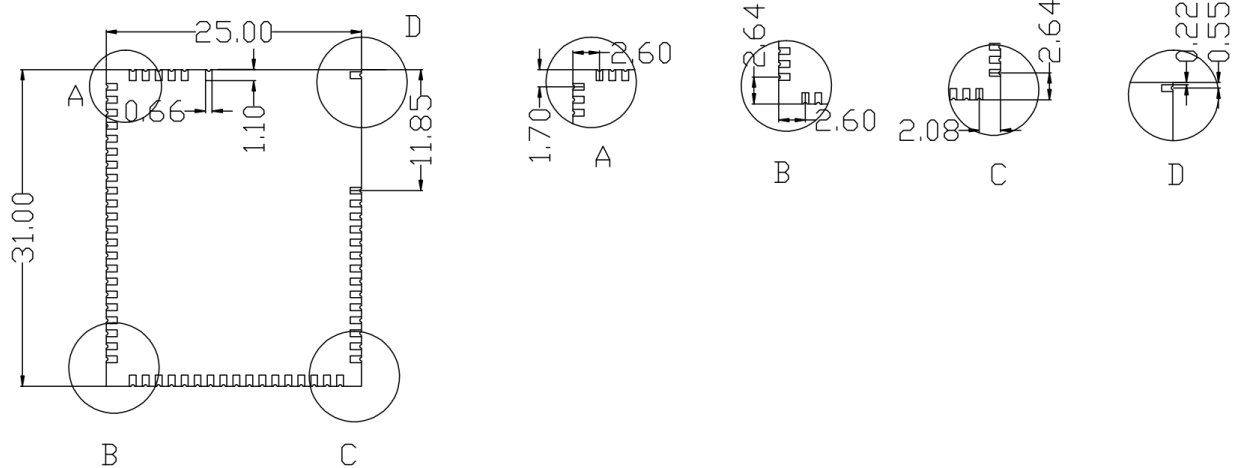
Pin number	Description	Function
1	Ground	
2	GPIO 45	
3	GPIO 43	
4	GPIO 42	
5	GPIO 21	
6	GPIO 20	
7	GPIO 8	SPI SCLK
8	GPIO 9	SPI MISO
9	GPIO 10	SPI MOSI
10	GPIO 28	
11	GPIO 3	SPI NSS
12	GPIO 35	UART TX
13	GPIO 15	
14	GPIO 6	I2C SCL
15	Ground	
16	GPIO 38	
17	GPIO 37	

18	GPIO 36	UART RX
19	RST (reserved)	Security Element reset pin, for Gemalto IC
20	GPIO 44	
21	CLK (reserved)	Security Element clock pin, for Gemalto IC
22	GPIO 5	I2C SDK
23	GPIO 1	
24	GPIO 0	
25	VDD 3.3V	Power Input
26	Ground	
27	GPIO 16	
28	NRST	MCU External Reset Input pin, for Apollo MCU
29	GPIO 11	
30	IO (reserved)	Security Element input & output pin, for Gemalto IC
31	SWP (reserved)	Security Element, Unused to be left unconnected pin, for Gemalto IC
32	GPIO 19	
33	GPIO 32	
34	Ground	
35	VDD 3.3V	
36	GPIO 29	
37	GPIO 33	
38	GPIO 13	
39	GPIO 14	
40	GPIO 12	
41	GPIO 31	
42	GPIO 39	
43	GPIO 41	
44	GPIO 30	
45	GPIO 40	
46	Ground	
47	Ground	
48	Ground	
49	Ground	
50	Ground	
51	Ground	
52	Ground	
53	Ground	
54	Ground	
55	Ground	
56	Ground	
57	Ground	
58	Ground	
A1	Antenna 2 nd tuning	Please reserve a Capacity on Host Board.
A2	Antenna 2 nd tuning	Please reserve a Capacity on Host Board.

BLOCK DIAGRAM

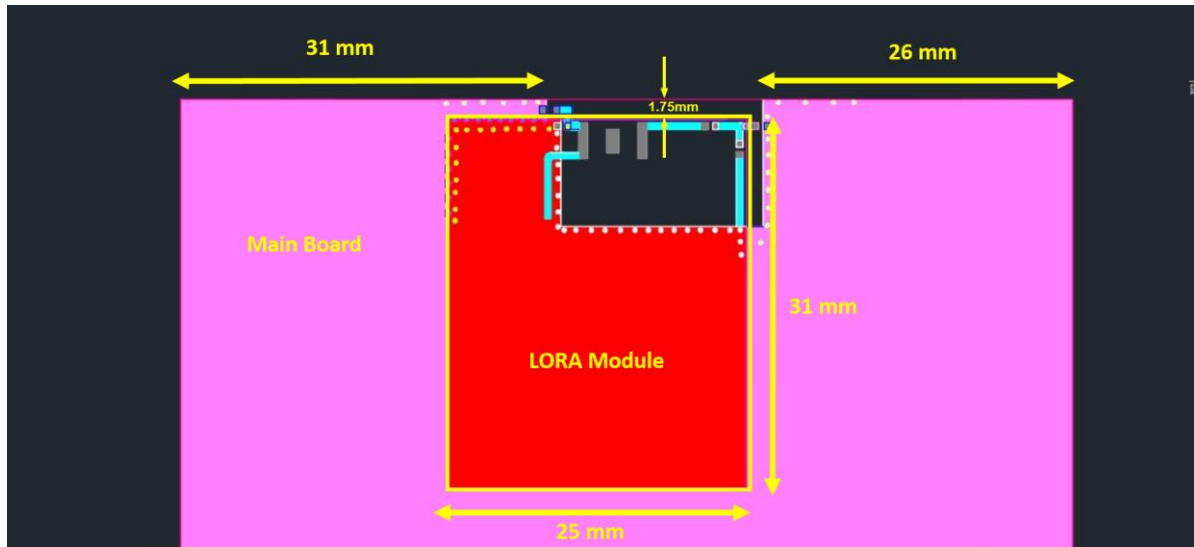


MODULE DIMENSION



MODULE RECOMMENDATION FOOTPRINT FOR CHIP ANTENNA

Module Placement & Host Board GND Size Dimension

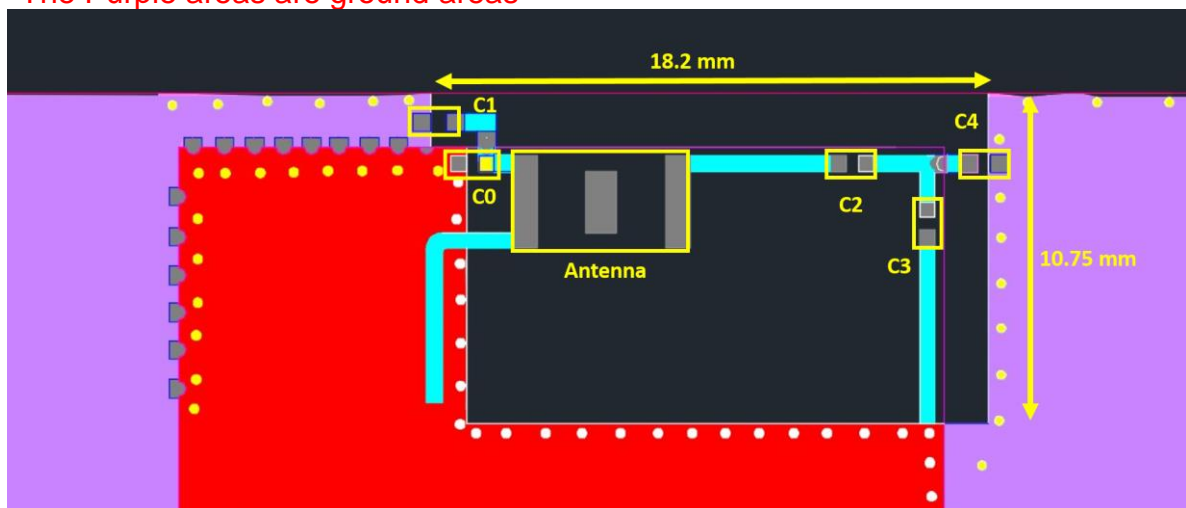


RF Matching Circuit for Antenna 2nd Tuning on Host Board:

Reserve **C1/C4** as below circuit / layout design on Host Board.

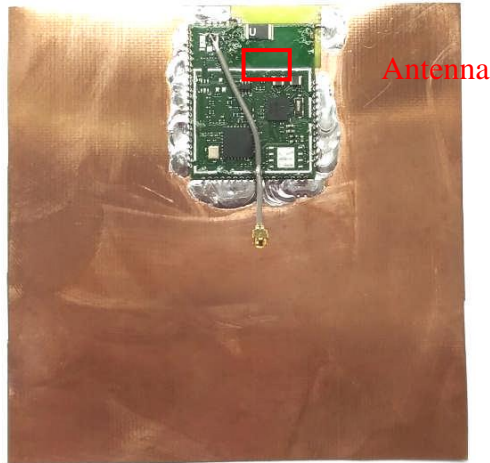
*The Dark areas are ground clearance areas

*The Purple areas are ground areas

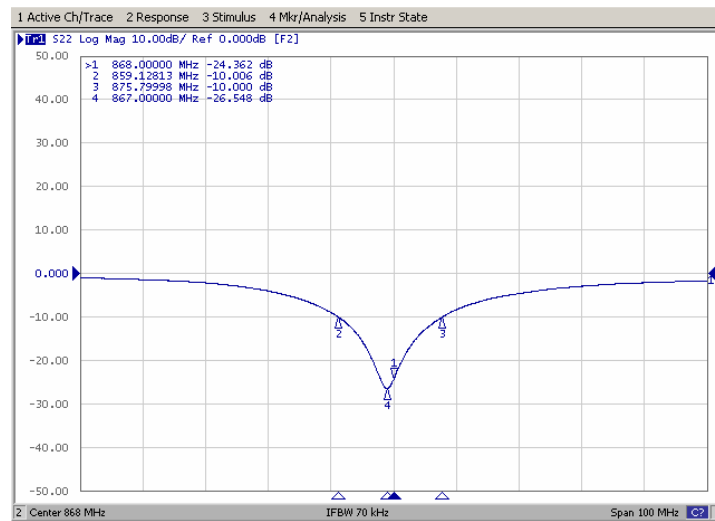


ANTENNA TEST REPORT

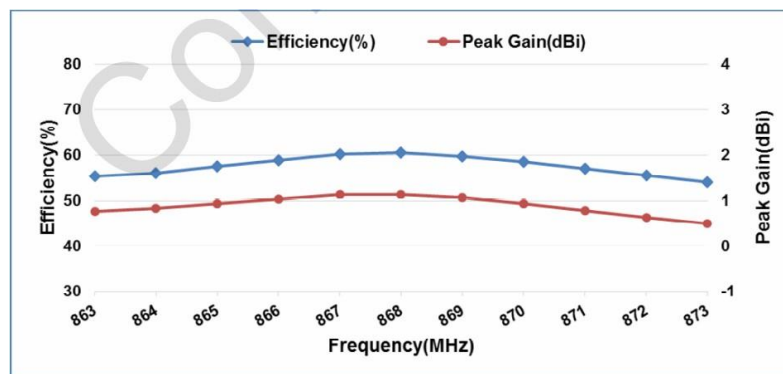
868MHz



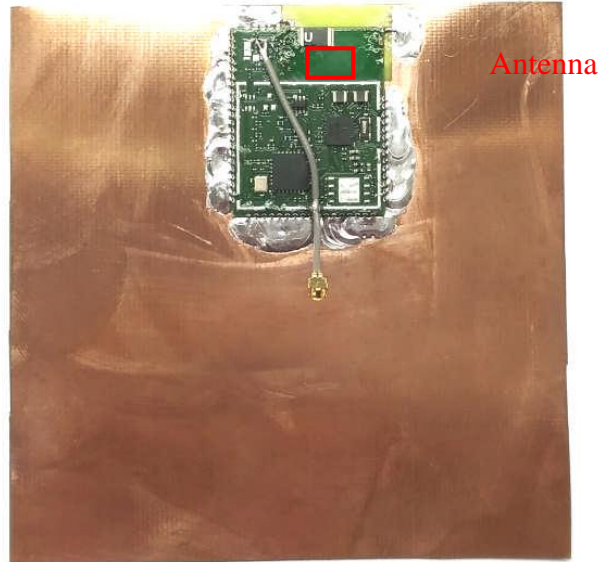
Return Loss



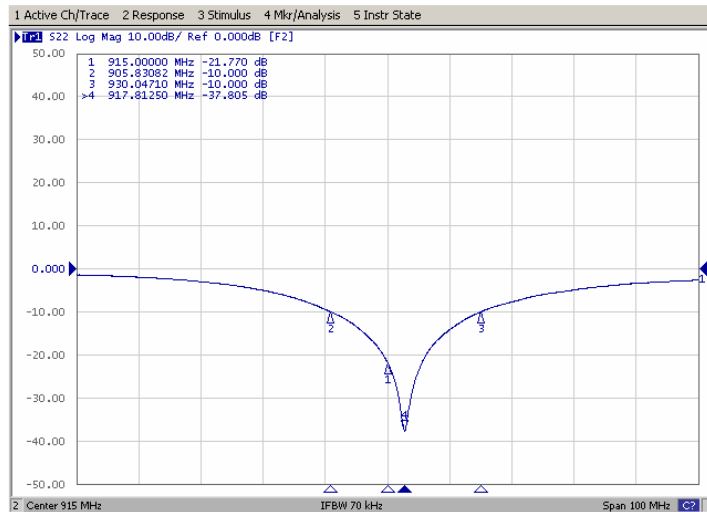
Efficiency vs. Frequency



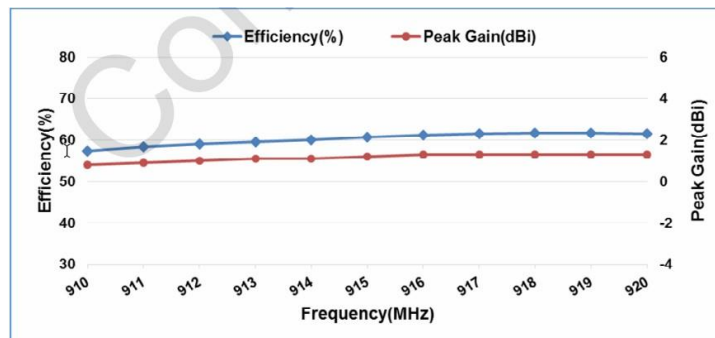
915MHz



Return Loss



Efficiency vs. Frequency



AT COMMAND LIST:

All the AT commands have a standard format as “AT+XXX”, with XXX denoting the command. There are four available command behaviors:

- AT+XXX? provides a short help of the given command, for example AT+DEUI?
- AT+XXX is used to run a command, such as AT+JOIN
- AT+XXX=? is used to get the value of a given command, for example AT+CFS=?
- AT+XXX=<value> is used to provide a value to a command, for example

AT+SEND=2:Hello

1Keys, IDs and EUIs management

1.1AT+APPEUI: application identifier

This command allows the user to access the global application identifier.

ommand	Input parameter	Return value	Return code
AT+APPEUI?	-	AT+APPEUI: get or set the application EUI	OK
AT+APPEUI=?	-	<8 hexa separated by:>	OK
AT+APPEUI= <Param>	<8 hexa separated by:>	-	AT_PARAM_ERROR OK / (1)
Example AT+APPEUI=	01:2:a:FB:A1:CD:4D:20:01: :02:30:40:5a:6b:7f:88	-	OK
Example AT+APPEUI=	01:2:a:FB:A1:CD:4D:20:01: :02:30:40:5a:6b:7f	-	AT_PARAM_ERROR(1)
Example AT+APPEUI=?	-	01:02:03:04:05:06:07:08	OK

(1). AT_PARAM_ERROR is returned when setting a wrong or malformed value.

1.2AT+APPKEY: application key

This command allows the user to access the application session key.

Command	Input parameter	Return value	Return code
AT+APPKEY?	-	AT+APPKEY: get or set the application key	OK
AT+APPKEY=?	-	<16 hexa separated by:>	OK
AT+APPKEY= <Param>	<16 hexa separated by:>	void	AT_PARAM_ERROR OK / (1)

(1). AT_PARAM_ERROR is returned when setting a wrong or malformed value.

1.3AT+APPSKEY: application session key

This command allows the user to access the application session key

Command	Input parameter	Return value	Return code
AT+APPSKEY?	-	AT+APPSKEY: get or set the application session key	OK
AT+APPSKEY=?	-	<16 hexa separated by:>	OK
AT+APPSKEY= <Param>	<16 hexa separated by:>	void	OK / AT_PARAM_ERROR(1)
Example AT+APPSKEY=	01:2:a:FB:A1:CD:4D:20:01: 02:30:40:5a:6b:7f:88	-	OK
Example AT+APPSKEY=	01:2:a:FB:A1:CD:4D:20:01: 02:30:40:5a:6b:7f:	-	AT_PARAM_ERROR(1)
Example	-	df:bb:02:df:30:eb:7e:07:52:c5:6d:8f:	OK

AT+APPSKEY=?		1d:e4:3f:37	
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(1). AT_PARAM_ERROR is returned when setting a wrong or malformed value.

1.4 AT+DADDR: device address

This command allows the user to access the device address

Command	Input parameter	Return value	Return code
AT+DADDR?	-	AT+DADDR: get or set the device address	OK
AT+DADDR=?	-	<4 hexa separated by:>	OK
AT+DADDR=<Param>	<4 hexa separated by:>	-	OK / AT_PARAM_ERROR(1)
Example AT+DADDR=	01:2:a:FB:A1:CD:4D:20:01:02:30:40:5a:6b:7f:88	-	OK
Example AT+DADDR=?	11:22:33:44	11:22:33:44	OK

(1). AT_PARAM_ERROR is returned when setting a wrong or malformed value.

1.5 AT+DEUI: device EUI

This command allows the user to access the global end-device ID.

Command	Input parameter	Return value	Return code
AT+DEUI?	-	AT+DEUI: get or set the device EUI	OK
AT+DEUI=?	-	<8 hexa separated by:>	OK
AT+DEUI=<Param>	<8 hexa separated by:>	-	OK / AT_PARAM_ERROR(1)
Example AT+DEUI=?	-	11:22:33:44:55:66:77:88	OK
Example AT+DEUI=	11:22:33:44:55:66:77:88	-	OK

(1). AT_PARAM_ERROR is returned when setting a wrong or malformed value.

1.6 AT+NWKID: network ID

This command allows the user to access the network identifier.

Command	Input parameter	Return value	Return code
AT+NWKID?	-	AT+NWKID: get or set the network ID	OK
AT+NWKID=?	-	<4 hexa separated by:>	OK
AT+DEUI=<Param>	<4 hexa separated by:>	-	OK / AT_PARAM_ERROR(1)
Example AT+DEUI=?	-	11:22:33:44:55:66:77:88	OK
Example AT+DEUI=	11:22:33:44:55:66:77:88	-	OK

(1). AT_PARAM_ERROR is returned when setting a wrong or malformed value.

1.7 AT+NWKSKEY: network session key

This command allows the user to access the network session key.

Command	Input parameter	Return value	Return code
AT+NWKSKEY?	-	AT+NWKSKEY: get or set the network session key	OK
AT+NWKSKEY=?	-	<16 hexa separated by:>	OK
AT+NWKSKEY=	<16 hexa separated by:>	-	OK /

< Param >			AT_PARAM _ ERROR(1)
Example AT+NWKSKEY=	0:1:2:3:4:5:6:7:8:9:A:B:C:D: E:F	-	OK
Example AT+NWKSKEY=?	-	00:01:02:03:04:05:06:07:08:09:A: 0B:0C:0D:0E:0F	OK

(1). AT_PARAM_ERROR is returned when setting a wrong or malformed value.

2 Joining and sending data on LoRa® network

2.1 AT+CFM: confirm mode

This command allows the user to access to the notification on received data coming from network

Command	Input parameter or Parameter	Return value	Return code
AT+CFM?	-	AT+CFM: get or set the confirm mode (0-1)	OK
AT+CFM=?	-	0 or 1	OK
AT+CFM=<Param>	0 or 1	-	OK / AT_PARAM_ERROR(1)
Example AT+CFM=	1	-	OK
Example AT+CFM=? (2)	-	1	OK

(1). AT_PARAM_ERROR is returned when setting a wrong or malformed value.

(2). When the confirmation mode is 1, each sent message must be confirmed. AT+CFS=? allows to know whether the last sent message has been confirmed or not.

2.2 AT+CFS: confirm status

This command allows the user to access to the status of the last "SEND" command

Command	Input parameter	Return value	Return code
AT+CFS?	-	AT+CFS: get the confirmation status of the last AT+SEND (0-1)	OK
AT+CFS=?	-	0 or 1	OK
Example AT+CFS=?	-	0	OK

2.3 AT+JOIN: join LoRa® network

This command does a join request to the network

Command	Input parameter	Return value	Return code
AT+JOIN?	-	AT+JOIN: join network	OK
AT+JOIN	Void	Void	OK/ AT_BUSY_ERROR(1)
Example AT+JOIN	-	-	OK

(1). AT_BUSY_ERROR is returned when a joining process is already running.

2.4 AT+NJM: LoRa® network join mode

This command allows the user to access to the network join mode

Command	Input parameter	Return value	Return code
AT+NJM?	-	AT+NJM: get or set the network join mode (0: ABP, 1: OTAA)	OK
AT+NJM	-	OK/	

AT+NJM=<Input>	0 or 1	-	OK/ AT_PARAM_ERROR(1)
Example AT+NJM=?	-	0	OK
Example AT+NJM=	1	-	OK
Example AT+NJM=	2	-	AT_PARAM_ERROR

(1). AT_PARAM_ERROR is returned when setting a wrong or malformed value.

2.5AT+NJS: LoRa® network join status

This command allows the user to access to the current status of the LoRa® link

Command	Input parameter	Return value	Return code
AT+NJS?	-	AT+NJS: get the join status	OK
AT+NJS=?	-	0 or 1	OK
Example AT+NJS=?	-	0 (network not joined)	OK
Example AT+NJS=?	-	1 (network joined)	OK

2.6AT+RECV: last received text data

This command allows the user to access to the last received text data in raw format.

Command	Input parameter	Return value	Return code
AT+RECV?	-	AT+RECV: print the last received data in raw format	OK
AT+RECV=?	-	raw (string format)	OK
Example AT+RECV=?	-	45: hello world	OK

2.7AT+SEND: send text data

This command provides the way to send text data on a dedicated port number.

Command	Input parameter	Return value	Return code
AT+SEND?	-	AT+SEND: send text data along with the application port	OK
AT+SEND=<input>	port text	-	OK/ AT_PARAM_ERROR(1)/ AT_BUSY_ERROR(2)/ AT_NO_NETWORK_JOINED(3)
Example AT+SEND=	12: hello world	-	OK

(1). AT_PARAM_ERROR is returned when the setting does not have the correct format <port>:<text>, with <port> being a decimal value.

(2). AT_BUSY_ERROR is returned when the previous send is not complete (send waiting for duty cycle, rx window not consumed...).

(3). AT_NO_NETWORK_JOINED is returned when the network is not yet joined.