



Dear customer

ROHM Co., Ltd. ("ROHM"), on the 1st day of April, 2024,
has absorbed into merger with 100%-owned subsidiary of LAPIS Technology Co., Ltd.

Therefore, all references to "LAPIS Technology Co., Ltd.", "LAPIS Technology"
and/or "LAPIS" in this document shall be replaced with "ROHM Co., Ltd."

Furthermore, there are no changes to the documents relating to our products other than
the company name, the company trademark, logo, etc.

Thank you for your understanding.

ROHM Co., Ltd.
April 1, 2024

ML7404 LPWA/SubG Evaluation Kit Start Guide

Issue Date: Jan 20th, 2022

NOTES

- 1) The information contained herein is subject to change without notice.
- 2) When using LAPIS Technology Products, refer to the latest product information (data sheets, user's manuals, application notes, etc.), and ensure that usage conditions (absolute maximum ratings, recommended operating conditions, etc.) are within the ranges specified. LAPIS Technology disclaims any and all liability for any malfunctions, failure or accident arising out of or in connection with the use of LAPIS Technology Products outside of such usage conditions specified ranges, or without observing precautions. Even if it is used within such usage conditions specified ranges, semiconductors can break down and malfunction due to various factors. Therefore, in order to prevent personal injury, fire or the other damage from break down or malfunction of LAPIS Technology Products, please take safety at your own risk measures such as complying with the derating characteristics, implementing redundant and fire prevention designs, and utilizing backups and fail-safe procedures. You are responsible for evaluating the safety of the final products or systems manufactured by you.
- 3) Descriptions of circuits, software and other related information in this document are provided only to illustrate the standard operation of semiconductor products and application examples. You are fully responsible for the incorporation or any other use of the circuits, software, and information in the design of your product or system. And the peripheral conditions must be taken into account when designing circuits for mass production. LAPIS Technology disclaims any and all liability for any losses and damages incurred by you or third parties arising from the use of these circuits, software, and other related information.
- 4) No license, expressly or implied, is granted hereby under any intellectual property rights or other rights of LAPIS Technology or any third party with respect to LAPIS Technology Products or the information contained in this document (including but not limited to, the Product data, drawings, charts, programs, algorithms, and application examples, etc.). Therefore LAPIS Technology shall have no responsibility whatsoever for any dispute, concerning such rights owned by third parties, arising out of the use of such technical information.
- 5) The Products are intended for use in general electronic equipment (AV/OA devices, communication, consumer systems, gaming/entertainment sets, etc.) as well as the applications indicated in this document. For use of our Products in applications requiring a high degree of reliability (as exemplified below), please be sure to contact a LAPIS Technology representative and must obtain written agreement: transportation equipment (cars, ships, trains, etc.), primary communication equipment, traffic lights, fire/crime prevention, safety equipment, medical systems, servers, solar cells, and power transmission systems, etc. LAPIS Technology disclaims any and all liability for any losses and damages incurred by you or third parties arising by using the Product for purposes not intended by us. Do not use our Products in applications requiring extremely high reliability, such as aerospace equipment, nuclear power control systems, and submarine repeaters, etc.
- 6) The Products specified in this document are not designed to be radiation tolerant.
- 7) LAPIS Technology has used reasonable care to ensure the accuracy of the information contained in this document. However, LAPIS Technology does not warrant that such information is error-free and LAPIS Technology shall have no responsibility for any damages arising from any inaccuracy or misprint of such information.
- 8) Please use the Products in accordance with any applicable environmental laws and regulations, such as the RoHS Directive. LAPIS Technology shall have no responsibility for any damages or losses resulting non-compliance with any applicable laws or regulations.
- 9) When providing our Products and technologies contained in this document to other countries, you must abide by the procedures and provisions stipulated in all applicable export laws and regulations, including without limitation the US Export Administration Regulations and the Foreign Exchange and Foreign Trade Act..
- 10) Please contact a ROHM sales office if you have any questions regarding the information contained in this document or LAPIS Technology's Products.
- 11) This document, in part or in whole, may not be reprinted or reproduced without prior consent of LAPIS Technology.

(Note) "LAPIS Technology" as used in this document means LAPIS Technology Co., Ltd.

LAPIS Technology Co.,Ltd.

2-4-8 Shinyokohama, Kouhoku-ku, Yokohama 222-8575, Japan
<https://www.lapis-tech.com/en/>

Introduction

Thank you very much for purchasing products of our company. Before using this product, please use correctly after reading this “start guide”. Moreover, please keep it carefully even after reading this. This start guide indicates the updating method to Sigfox cloud, procedure, sensor bridge operation with bridge communication and the method to change the operation mode.

Please download the software that is implemented in the evaluation kit, the details of command, the command script, the manual and the evaluation tools from the company support site.

《LAPIS Technology., Co.Ltd support site》

https://www.lapis-semi.com/cgi-bin/MyLAPIS/regi/login_J.cgi

Wireless communication LSI ⇒ Specified small power wireless communication documents/software ⇒ ML7404 ⇒ LPWA bridge communication for ML7404, download from Sigfox communication software

(X indicates version number)

●Manual

FEXK74Q410_startguide-XX.pdf (This document)

LWCSP_System_VXXX.chm

WCT3.X.X User Guide

●Software (Command Script)

ML7416S 用 LWCSP lwesp_VersionX.XX_XXXXXXXXX.zip

ML7416S SDK ML7416S_SDK_VXXX.zip

●Evaluation Tool

WCT3 WCT3XX.zip

Notation

Classification	Notation	Description
□ Numeric value	<i>0xnm</i>	Represents a hexadecimal number.
	<i>0bnnnn</i>	Represents a binary number.
□ Address	<i>0xnnnn_nnnn</i>	Represents a hexadecimal number. (indicates 0xnnnnnnnn)
□ Unit	word, W	1 word = 32 bits
	byte, B	1 byte = 8 bits
	Mega, M	10^6
	Kilo, K (uppercase)	$2^{10}=1024$
	Kilo, k (lowercase)	$10^3=1000$
	Milli, m	10^{-3}
	Micro, μ	10^{-6}
	Nano, n	10^{-9}
Second, s (lowercase)	Second	
□ Terminology	"H" level	Signal level on the high voltage side; indicates the voltage level of V_{IH} and V_{OH} as defined in electrical characteristics.
	"L" level	Signal level on the low voltage side; indicates the voltage level of V_{IL} and V_{OL} as defined in electrical characteristics.
□ Register description		<p>Read/write attribute: R indicates read-enabled; W indicates write-enabled.</p> <p>MSB: Most significant bit in an 8-bit register (memory)</p> <p>LSB: Least significant bit in an 8-bit register (memory)</p>

Table of Contents

NOTES	2
Introduction	4
Notation	5
Table of Contents.....	6
1. Precautions of handling this product.....	7
2. Overview	8
3. Package Contents Confirmation	9
4. Board Explanation	10
5. Customer Preparation.....	11
5.1. Reading method of ID,PAC	12
5.2. How to register the evaluation kit	14
6. Switching Operation Mode	15
7. Sigfox Communication	17
7.1. Data Transmission Method to Sigfox cloud	17
7.2. Confirmation method of Sigfox cloud.....	17
8. IEEE802.15.4k-Sigfox Bridge Communication	18
8.1. Setting up of Sensor Node's side.....	18
8.2. Setting up of Bridge Server side.....	19
9. Antenna Setting	20
10. Support Site.....	21
Revision History	22

1. Precautions of handling this product

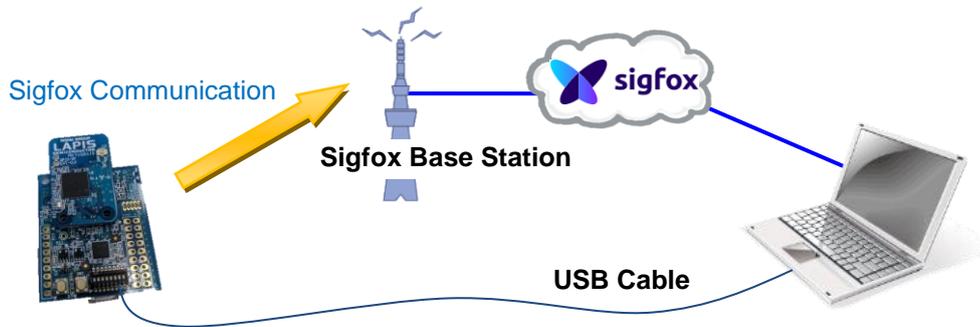
- This product is the evaluation kit. This is used for only evaluation.
- Use the application software of this product on the PC that installs the Japanese version Windows10.
- Refer the software license, then use the application software for PC and the software for MCU relating to this product.
- LAPIS Technology shall have no responsibility for remodeling and any illegal usages of our product.
- If this product emits harmful radio waves, change the frequency or stop the radio wave emission immediately, then avoid interference.

2. Overview

ML7404LPWA/SubG evaluation kit (Hereafter it is written as Evaluation Kit) can executes some evaluation, demonstration. This chapter explains three modes, 1)Sigfox communication, 2) IEEE802.15.4k-Sigfox bridge communication, 3)RF evaluation with WCT3. Other sample software is prepared, please refer to (LWCSP_System_VXXX.chm) in detail.

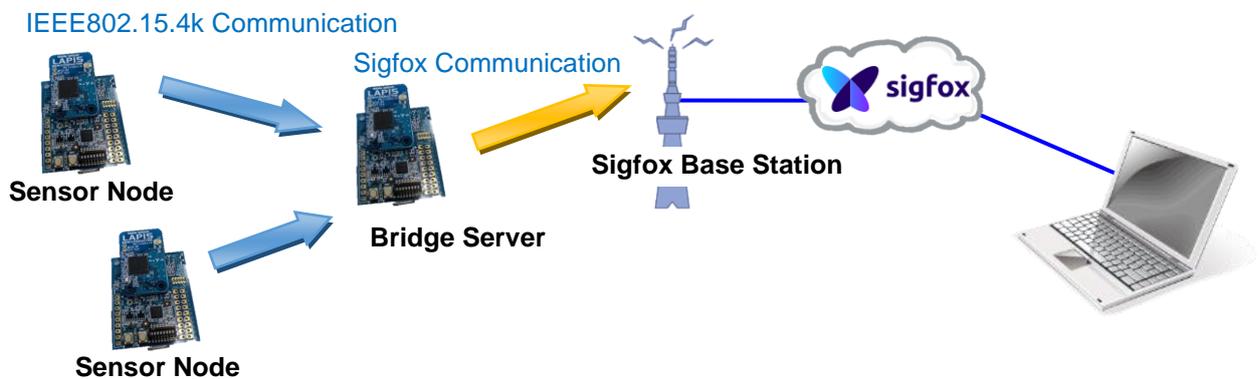
1) Sigfox Communication

Sigfox certified reference module (MK74Q0410) can transmits data(fixed data) from PC to Sigfox cloud. PC can read the data on the cloud easily.



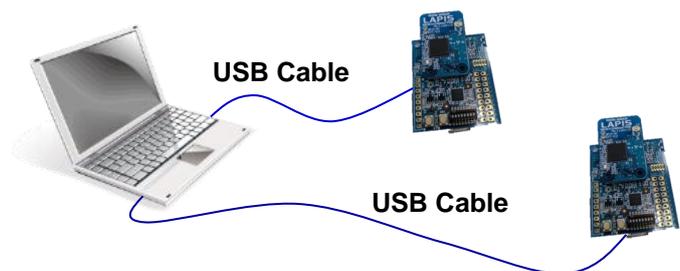
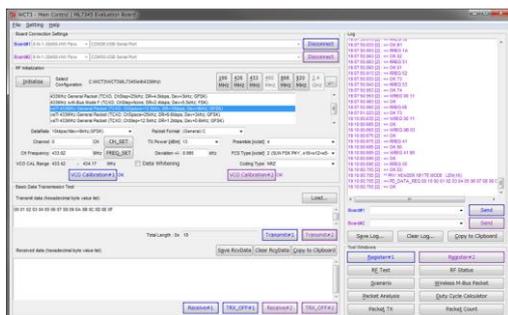
2) IEEE802.15.4k-Sigfox Bridge Communication

Sensor nodes sense the sensor devices and transmit data to bridge server with IEEE802.15.4k communication, bridge server that receives data from sensor nodes and transmits the data to Sigfox base station periodically, they execute standalone operation each other. PC can read the data on the Sigfox cloud easily.



3) RF Evaluation with WCT3

It is possible to evaluate RF that is read/written to some registers with Windows GUI tool WCT3. Two boards that connects to PC with USB can communicate each other.



3. Package Contents Confirmation

Please confirm the following contents are in the box.
If some contents are short or broken, inform the purchase shop.

*Depending on the shipping period, the implemented parts may be different from the photo.

*Please prepare the PC.

Configuration Part	Quantity
(1) MK74Q0410(ML7404/ML7416S is implemented)	1
(2) Interface Board	1
(3) RF Cable + Antenna	1
(4) USB Cable (TypeA-micro B)	1

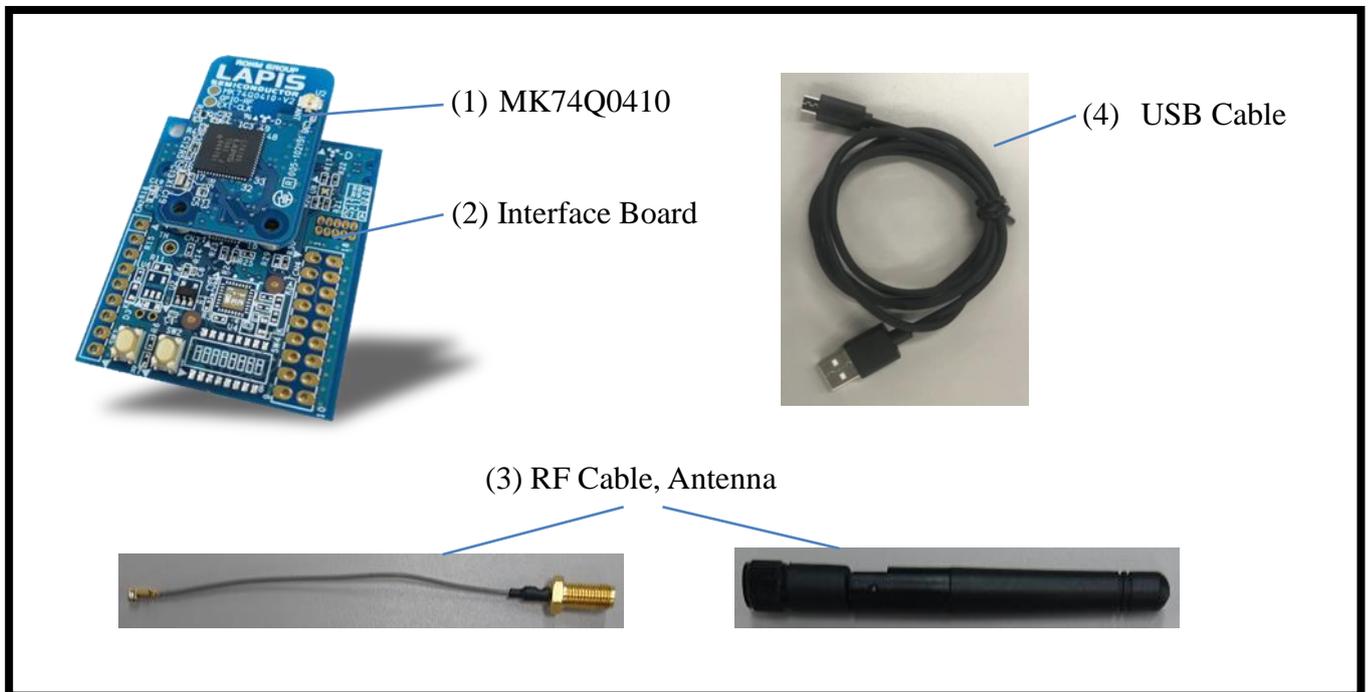


Figure 1: Evaluation Kit

4. Board Explanation

At the time of delivery, microcontroller (ML7416S) is set to boot the internal program at the initial state.

When board setting is changed, turn power off.

Connect USB connector that is surrounded by yellow thick line in the Back Side figure to USB cable.

[Note] If USB cable is connected diagonally, the connector may be broken.

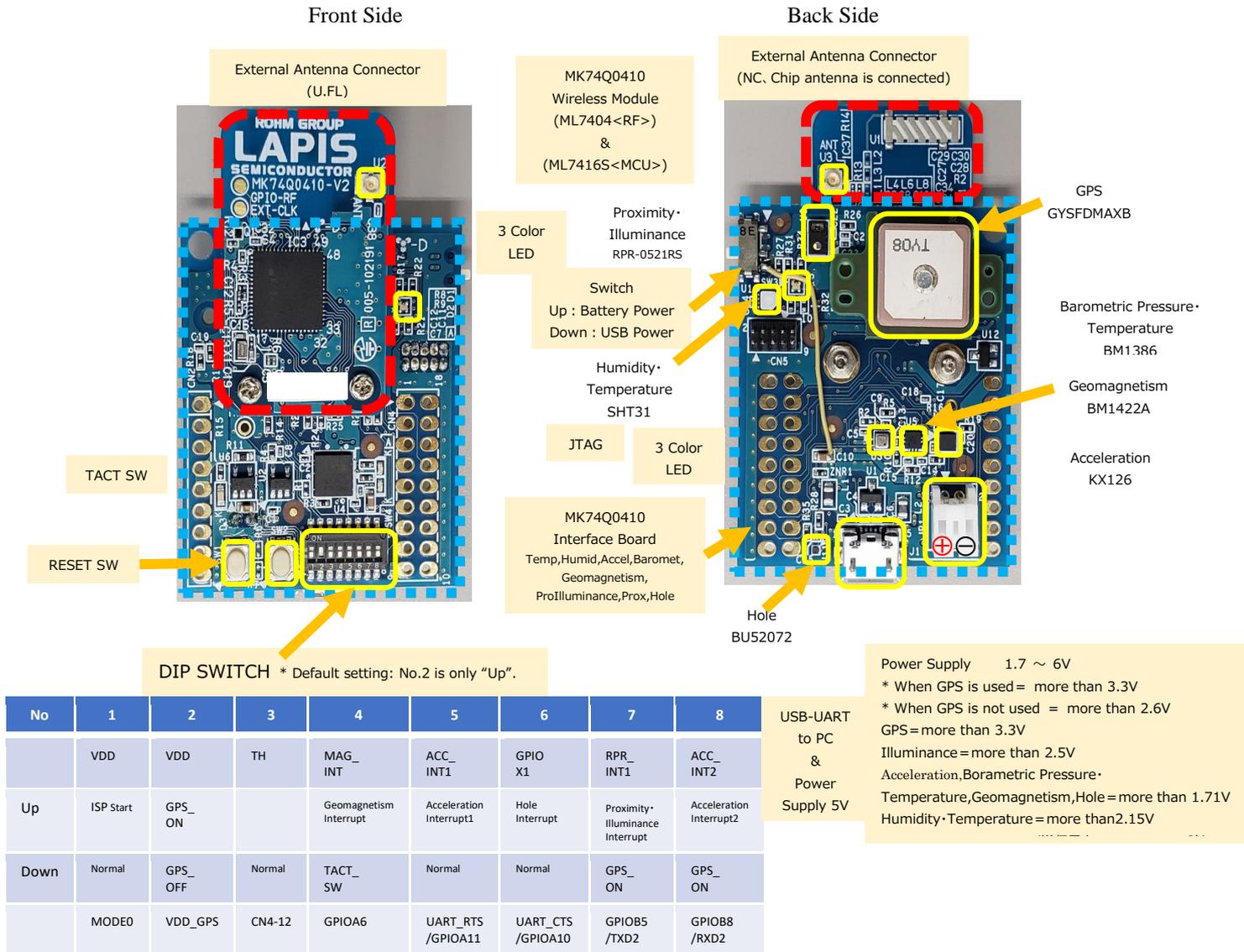


Figure 2: Evaluation Board

*Refer to the following about the evaluation board schematic and the parts list. (XX indicates version number)

MK74Q0410 wireless module : Schematic_ML7404_ML7416S_vXX_connector.pdf

: PartsList_ML7404_ML7416S_vXX.pdf

MK74Q0410 Interface Board : Schematic_MK74Q04xx_IF_vXX.pdf

: PartsList_MK74Q04xx_IF_vXX.pdf

5. Customer Preparation

- Confirmation of device ID information

Before Sigfox communication, it is necessary to register the device(MK74Q0410) that customer purchased to Sigfox WEB site. Please confirm device ID and PAC information.

⇒Please refer to [5.1. Reading method of ID, PAC] in detail.

- Activation of the evaluation kit

It is necessary to purchase Sigfox communication line contract from Japan communication line service provider. When using the evaluation kit of Lapis Technology, it is possible to use the line free of charge for one year.

⇒Please refer to [5.2. How to register the evaluation kit] in detail.

*In case of renting the evaluation kit, purchasing communication line and device registration is unnecessary.

5.1. Reading method of ID,PAC

ID, PAC informations *1 are necessary to register device to Sigfox Portal *2.

Read ID, PAC informations as following procedure.

[Procedure]

(1) It uses PowerShell*3 on the Windows PC.

The preparation*4 is necessary on the PowerShell.

*1: Sigfox network assigns the fixed identification number to identify the terminal that is authenticated by Sigfox communication. They are the DEVICE ID (Abbreviation: ID), Portable Authentication Code (Abbreviation: PAC)

*2: Sigfox Portal is a Sigfox site to register, control Sigfox device and confirm data arrived at Sigfox cloud.

(<https://backend.sigfox.com/auth/login>)

*3: PowerShell is the extensible command line interface (CLI) and shell script language, scripting environment that is supported by Windows7 or later.

*4: PowerShell scrips are supplied without PowerShell signature to edit the execution policy for users. Initila value is set to “Restricted” that prohibits script execution. It is necessary to edit the execution policy to execute the supplied script at first.

(2) PowerShell Preparation (Changing method of execution policy)

1) Right click [Windows PowerShell] icon of start menu and direct [Click run as administrator(A)].



2) Set the following command in the PowerShell console display.

```
PS C:\Windows\system32> Set-ExecutionPolicy RemoteSigned
```

Scripts that are stored on the Local are set to executable. Only signed scripts (downloaded from Internet) that are stored on the Unlocal are set to executable.



- (3) Connect Evaluation Kit and Windows PC with USB.
- (4) Download the command script files (ML7416S LWCSP, ML7416S SDK) from the Support Site that is described at “Introduction” (Page 4) then store them at the arbitrary folder.
- (5) Set the following command to enable PowerShell*5 with WCT3*6.

SET_SAL 00 0C 03 10<CR>

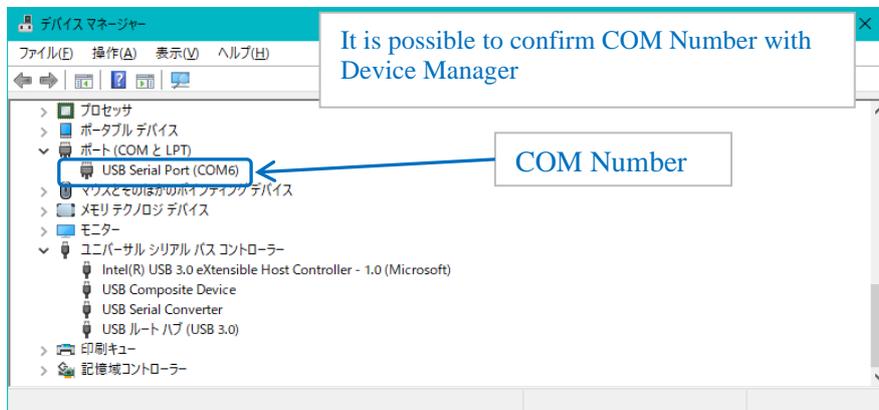
*5: Sigfox Evaluation Kit includes some sample application. The shipping initial state is [WCT_IF application] executable. Application is necessary to switch the mode to enable PowerShell.

*6: Refer to [WCT3.5.3 User Guide] about usage of WCT3(GUI Tool for LAPIS Technology SubG LSI Evaluation Board).

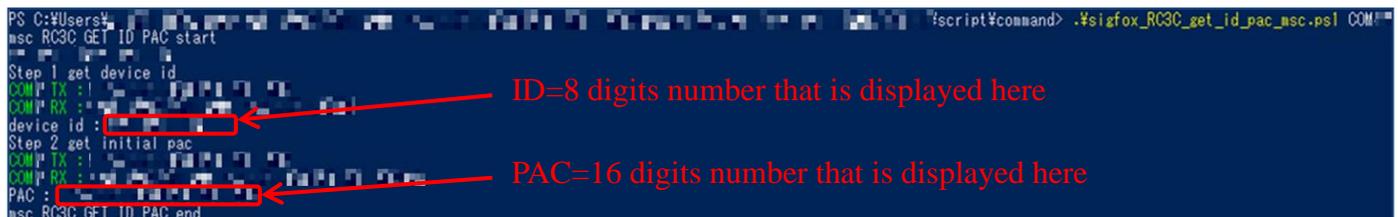
- (6) Move to the folder that stores command script on the PowerShell.
 PS C:\windows\system32>cd C:******\LWCSP_VXXX_MLYYYY\script\command
 (Change, adjust *** and the folder hierarchy to the location of the files that customer download)
- (7) Execute the command script “sigfox_RC3C_get_id_pac_msc.ps1” on the PowerShell.
 Files with [.PS1] extension are PowerShell script files. It is necessary to direct path expressly for PowerShell to execute script file. Script execution on the PowerShell need to direct absolute path or attach .\ on the top of current directory file.

Script execution example :

PS C:\Users\XXXX\XXXX\XXXX\script\command>.\sigfox_RC3C_get_id_pac_msc.ps1 COM*
 (Set “*” to COM number of Evaluation Kit)



Execution example)



5.2. How to register the evaluation kit

Communication line contract is necessary with KYOCERA Communication Systems (KCCS) to transmit data from Sigfox device to Sigfox cloud in Japan. When using the evaluation kit of Lapis Technology, it is possible to use the line free of charge for one year. Please refer to "Registering the device as a development kit (DevKit)" on the KCCS technology blog site below and follow the device registration procedure.

<https://qiita.com/organizations/sigfox>

In addition, if you apply for a line contract other than the above, it will be posted on the following site of KCCS, so please apply and register as appropriate according to the posted contents..

<https://www.kccs-iot.jp/buy/flow/>

Note: Rough indication of 1 communication line fee ¥700 - ¥1,200 Device/Year (at January, 2020)

The communication line fee depends on the number of communication per 1 day and Sigfox Atlas (Location-based service)

6. Switching Operation Mode

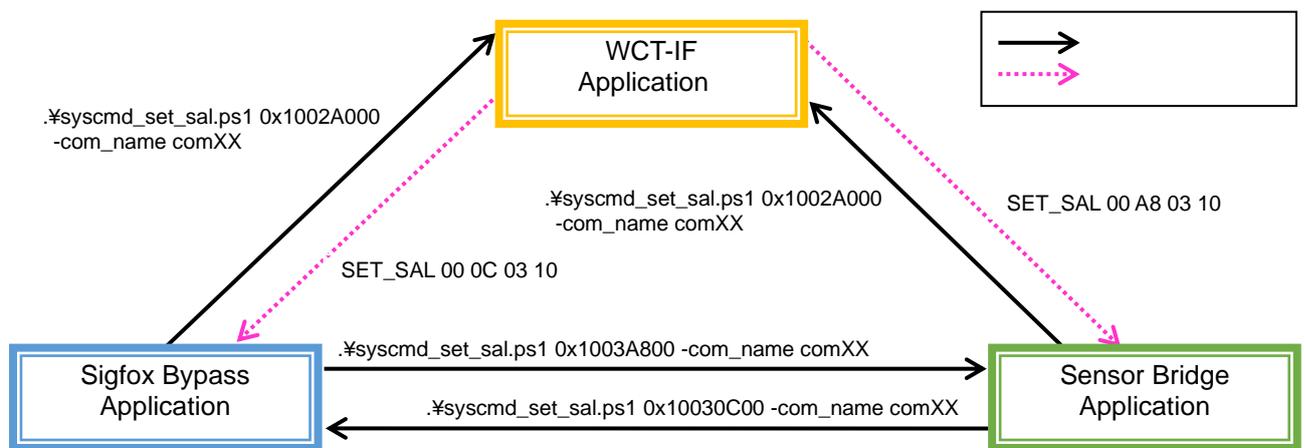
This chapter explains switching method of 3 modes that are 1)Sigfox communication, 2)IEEE802.15.4k-Sigfox bridge communication, 3)RF evaluation with WCT3. These operation modes can be set to switch the following sample application as Boot software.

- | | |
|--|---------------------------|
| 1) Sigfox communication | Sigfox Bypass Application |
| 2) IEEE802.15.4k-Sigfox bridge communication | Sensor Bridge Application |
| 3) RF evaluation with WCT3 | WCT-IF Application |

Boot software can be set with rewriting SAL(Start Address List). After rewriting SAL, program starts at the directed address with power on reset. Rewriting method depends on the current execution software. When WCT-IF is executed, issue “SET_SAL” command on WCT3 tool. When other application software is executed, issue syscmd_set_sal.ps1 script on the PowerShell. Execute hardware reset after rewriting SAL.

The following figure shows the relationship between the execution software and SAL rewriting command.

*Factory default setting is WCT-IF application.



■ Switching method with PowerShell Command

- (1) Move to the folder that stores command script on the PowerShell.
- (2) Execute command script “`.\syscmd_set_sal.ps1 0xXXXXXXXX -com_name comXX`” on the PowerShell.

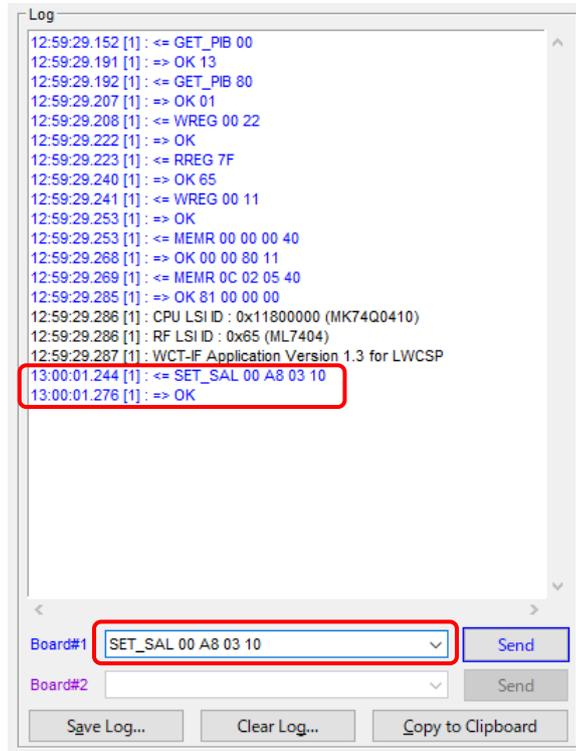
[Execution example]

```
PS C:\LWCSP\script\command> .\syscmd_set_sal.ps1 0x10030C00 -com_name com5
System Command SET_SAL
com5 : 01FF080001000100000C031003
com5 : 02FF0500010001000003
10
```

■ Switching method with WCT command

- (1) Start WCT3 tool.
- (2) Put [Connect] button of WCT3, then connect to evaluation kit.
- (3) Input SET_SAL command from the right input field.

[Execution Example]



The start addresses of each application programs are following.

Sample Application	Program start address
WCT-IF Application	0x1003A800
Sigfox Bypass Application	0x1002A000
Sensor Bridge Application	0x10030C00

7. Sigfox Communication

This chapter explains the method to transmit data to Sigfox base station. Confirm and set the procedure of [5. Customer Preparation] previously.

7.1. Data Transmission Method to Sigfox cloud

Execute the command script “sigfox_RC3C_send_frame_msc.ps1” on the PowerShell.

Script execution example : PS C:\Users\XXXX\script\command>. sigfox_RC3C_send_frame_msc.ps1 COM*

(Please set COM number of connected device of evaluation kit to “*”)

Execution example)

```
PS C:\> #Bridge_System_Version1.20\MK7400410\script\command> .sigfox_RC3C_send_frame_msc.ps1 COM*
msc RC3C SEND FRAME start
Step 1 open
COM9 TX : [Hex data]
COM9 RX : [Hex data]
Step 2 set std config
COM9 TX : [Hex data]
COM9 RX : [Hex data]
Step 3 get version
COM9 TX : [Hex data]
COM9 RX : [Hex data]
Sigfox Library Version : V2.3.1_FDL
Step 4 send frame
COM9 TX : [Hex data]
COM9 RX : [Hex data]
Step 5 get info
COM9 TX : [Hex data]
COM9 RX : [Hex data]
Information : DB
Step 6 close
COM9 TX : [Hex data]
COM9 RX : [Hex data]
msc RC3C SEND FRAME end
```

7.2. Confirmation method of Sigfox cloud

Device management and data confirmation that is registered to Sigfox service is done on the Sigfox Portal (<https://backend.sigfox.com/auth/login>)*6. Please complete device registration that is introduced at the previous page, transmit data, then confirm the data on it.



*6: Sigfox ID is necessary to login the Sigfox Portal. It can be produced in the procedure of KCCS line contract.

8. IEEE802.15.4k-Sigfox Bridge Communication

This chapter explains the sensor bridge application of IEEE802.15.4k-Sigfox. Sensor bridge application executes the process that the Sensor (Humidity, Temperature, Accelation, Barometric pressure, Geomagnetism, ProIlluminance, Proximity, Hole, GPS) Nodes get data, transmit the data with IEEE802.15.4k communication to Bridge Server then the Bridge Server transmits the data to Sigfox base station.

Please refer to the item [Sample Application (Sensor Bridge Application)] of the manual (LWCSP_System_VXXX.chm) in detail.



8.1. Setting up of Sensor Node's side

- (1) When the Sigfox ID and PAC are written, the sensor node operates as a Sigfox device, so the Sigfox ID and PAC information are deleted. To do this, unprotect the boot program area of the ML7416S. For details on how to unprotect, refer to the "Write Sigfox Credentials" section of the "Sigfox Firmware Framework" tab in the manual (LWCSP_System_VXXX.chm).
- (2) Edit "settings.xml" in the folder that stores command script as following.

```

<config>
  <id>0xFFFFFFFF</id>
  <pac_l>0xFFFFFFFF</pac_l>
  <pac_h>0xFFFFFFFF</pac_h>
  <key_ll>0xFFFFFFFF</key_ll>
  <key_lh>0xFFFFFFFF</key_lh>
  <key_hl>0xFFFFFFFF</key_hl>
  <key_hh>0xFFFFFFFF</key_hh>
</config>
  
```

- (3) Move to the folder that stores command script on the PowerShell.
- (4) Execute the command script ".\sigfox_write_credential.ps1 -com_name comXX" on the PowerShell. This script writes ID,PAC,KEY that is edited in the "settings.xml" previously to the device.

[Execution example]

```

PS C:\LWCSP\script\command> .\sigfox_write_credential.ps1 -com_name com3
com3 : 01FF0A00010101FF00000040040003
com3 : 02FF0E00010101FF000000400400000801103
System Command SCTR_ERASE
com3 : 01FF0A00030101FF00FE0314010003
com3 : 02FF0500030101FF0003
10
com3 : 01FF2A00020101FFE0FF03142000FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF03
com3 : 02FF0500020101FF0003
10
  
```

- (5) Refer to [6. Switching Operation Mode] and set [Sensor Bridge Application] to the Boot software.
- (6) Set No.5 and No.6 of DIP switch to ON. If GPS is used, set No.2 to ON too.
- (7) Sensor Nodes start to transmit the sensed data to Bridge Server periodically after hardware reset. If Bridge Server is not waked up, LED emits red light to mean transmission failure.

* Please contact the address of [10. Portal Site] if resetting to Sigfox Communication status is necessary after setting Sensor Node status.

8.2. Setting up of Bridge Server side

- (1) Refer to [6. Switching Operation Mode] and set [Sensor Bridge Application] to the Boot software.
- (2) Move to the folder that stores scripts of Sensor Bridge on the PowerShell.
- (3) At the default setting, the device is operated as a sensor node. Execute the script `”.$snsr_br_set_testmode.ps1 1 -com_name comXX”` of sensor bridge to stop the operation.

[Execution Example]

```
PS C:\LWCSP\script\sensor_bridge> .\$snsr_br_set_testmode.ps1 1 -com_name com3
Sensor Bridge Get Application Parameter
com3 : 01400500000400000103
com3 : 02400500000400000003
10
```

- (4) Execute the script `”.$snsr_br_smpmac_set_eepem.ps1 -device 1 -com_name comXX”` to operate as Bridge Server. Set the argument of `-device` to “0” to operate as Sensor Node.

[Execution Example]

```
PS C:\LWCSP\script\sensor_bridge> .\$snsr_br_smpmac_set_eepem.ps1 -device 1 -com_name com5
Set SimpleMAC Parameter
com5 : 01FF0600020201FF062803
com5 : 02FF2800020201FF06280100000008080403000104060A00F40134120110FFFFFFFFFFFFFFFFFFFFFFFF03
com5 : 01FF2800010201FF062820000100000008080403000104060A00F40134120110FFFFFFFFFFFFFFFFFFFFFFFF03
com5 : 02FF0500010201FF0003
10
```

- (5) Bridge Server becomes the status to wait for receiving data from Sensor Node after hardware reset.

9. Antenna Setting

This evaluation board can select the external antenna (front side of evaluation board) or chip antenna (back side of evaluation board). Chip antenna is selected at the initial status. If customer uses the external antenna, switch the setting as following procedure.

- (1) Move to the folder that stores LWCSP command script on the PowerShell.
 PS C:\windows\system32>**cd C:*****\LWCSP_VXXX_MLYYYY\script\command**
 (Change, adjust *** and the folder hierarchy to the location of the files that customer download)
- (2) Execute the command script “**syscmd_set_antsw.ps1**” on the PowerShell.

Antenna	Setting Value
External Antenna (Front)	0x02
Internal Antenna (Back)	0x06(Initial state)

Script execution example: PS C:\Users\XXX\XXX\XXX\script\command>.syscmd_set_antsw.ps1 -com_name COM* -set_dat 0x02

(Set COM number of connected device of evaluation kit to “*”)

The following message is displayed when script is executed. (This example is the case of setting 0x02)

```
System Command SET_EEPEM
COM18 : 01FF0C00010201FF000E04000200000003
COM18 : 02FF0500010201FF0003
10
```

10. Support Site

LAPIS Technology asks customers to register user information at [LAPIS Technology Support Site] to provide good quality products and services. Registration to this Support Site allows to download the latest documents and evaluation tools. Please take this opportunity to register.

■Registration Method

1. Access to [Support Site] of LAPIS Technology's Top Page.

<https://www.lapis-tech.com/en/>

Top Page [Support Site]

Or refer to the following address directly.

<https://www.lapis-semi.com/cgi-bin/MyLAPIS/regi/login.cgi>

2. Click [Sign up/Reregistration] button, then register as following the display direction.

*At first, do [Temporary Registration], then complete [Main Registration] to register this Support Site.

*When do [Main Registration], set [Wireless LSI] to [Product Fields], [Bluetooth / Sub-GHz•LPWA Evaluation Kit] to [Development/Evaluation Tool] and [Serial Number of development Tool]. [Serial Number of Development Tool] is provided from LAPIS Technology when customer purchases the evaluation kit.

[Note]

Customer receives [Notification of registration completion] after completing registration. Please wait for a while. Even if registration is completed and it is impossible to download files, login to Support Site, and register [Serial Number of Development Tool] of “Modification of Access Permission” again.

■Contact

Please contact the following address about this Support Site, or fill the [Contact] form in this Support Site.

[Contact Address]

E-mail: telecom-support@lapis-tech.com

