# LE51-868S Demo-Unit User Guide

1vv0301140 Rev.1 – 2014-05-30

# APPLICABILITY TABLE

| PRODUCT |
| --- |
| LE51-868S |

| SW Version |
| --- |
| GP.S03.00.01-B002 |
| GP.S03.01.00 |

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## Contents

# 1. Introduction

## 1.1. Scope

The aim of this document is to present the functional aspects of the LE51-868S Telit module embedding Telit in house stack and the stand-alone SIGFOX® protocol.

After a short description of the DemoUnit and its installation principles, its functioning will be detailed in more advanced operation modes.

## 1.2. Audience

This document is intended for developers using Telit LE51-868s Module.

## 1.3. Contact Information, Support

For general contact, technical support, to report documentation errors and to order manuals, contact Telit Technical Support Center (TTSC) at:


> TS-SRD@telit.com
> TS-NORTHAMERICA@telit.com
> TS-LATINAMERICA@telit.com
> TS-APAC@telit.com


Alternatively, use:

http://www.telit.com/en/products/technical-support-center/contact.php

For detailed information about where you can buy the Telit modules or for recommendations on accessories and components visit:

http://www.telit.com

To register for product news and announcements or for product questions contact Telit Technical Support Center (TTSC).

Our aim is to make this guide as helpful as possible. Keep us informed of your comments and suggestions for improvements.

Telit appreciates feedback from the users of our information.



## 1.4. Document Organization

This document contains the following chapters

"Chapter 1: "Introduction" provides a scope for this document, target audience, contact and support information, and text conventions.

"Chapter 2: "General description" gives an overview of the Demokit parts.

"Chapter 3: "Detailed equipment description" describes EVK and DIP boards

"Chapter 4: "Installation" describes how to connect different parts of Demokit.

"Chapter 5: "Advanced Operation" gives the reference for the complete use of the Demokit.

"Chapter 6: "Safety Recommendations" describes recommendation for proper usage.

"Chapter 7: "Glossary" shows acronyms used in the document.

"Chapter 8: "Document history" describes the revision history of the document.

## 1.5.   Text Conventions

*Danger – This information MUST be followed or catastrophic equipment failure or bodily injury may occur.*

*Caution or Warning – Alerts the user to important points about integrating the module, if these points are not followed, the module and end user equipment may fail or malfunction.*

**Tip or Information – Provides advice and suggestions that may be useful when integrating the module.**

All dates are in ISO 8601 format, i.e. YYYY-MM-DD.

## 1.6.   Related Documents

- [1] LE51868_S_SW_User_Guid, 1VV0301109
- [2] SR Tool User Guide, 1vv0300899
- [3] LE51-868_S RF module User Guide, 1VV0301131

# 2.    General Description

## 2.1.    DemoKit philosophy

The goal of the DemoUnit is to show to customers the possibilities offered by LE51-868S Telit module embedding the Telit stand-alone SIGFOX® protocol.

## 2.2.    Hardware Considerations

The DemoCase contains an LE51 module.

For detailed HW information on LE51, please refer to the dedicated documentation.

## 2.3.    SIGFOX Considerations

SIGFOX provides an end-to-end solution for your transmission chain, from your equipment through to your information system. With a clear Internet focus and a specifically designed and tailored cloud service, SIGFOX's network uses web communication protocols that make it easy to integrate your applications.

SIGFOX's network is designed around a hierarchical structure:

- UNB modems communicate with base stations, or cells, covering large areas of several hundred square kilometers,

- Base stations route messages to servers,

- Servers check data integrity and route the messages to your information system.

## 2.4.    SR Manager Tool Considerations

SRManagerTool is the PC software to configure and monitor a Star Network.

For installation and detailed use, refer to the dedicated documentation [2] available on the Telit web site.
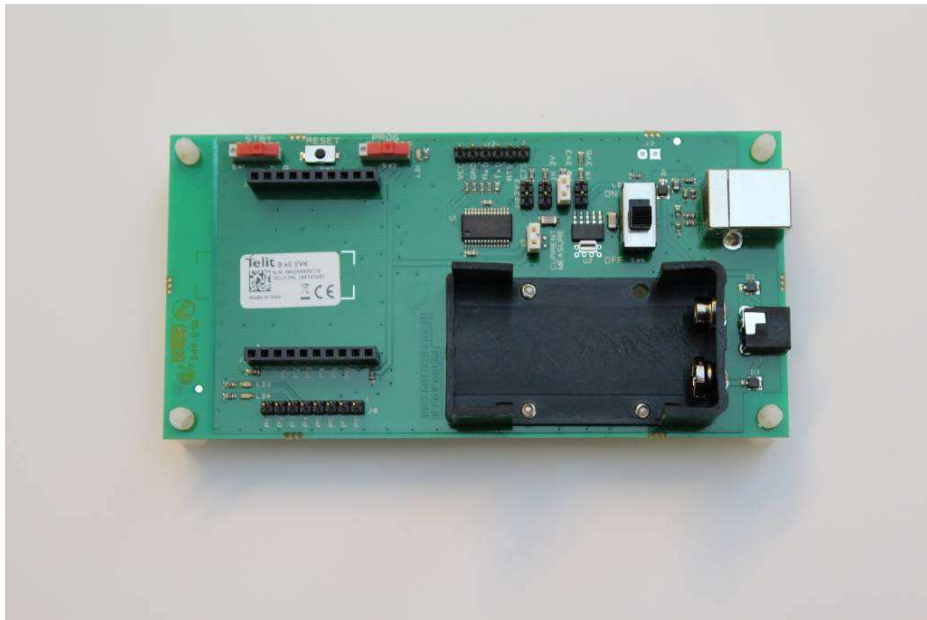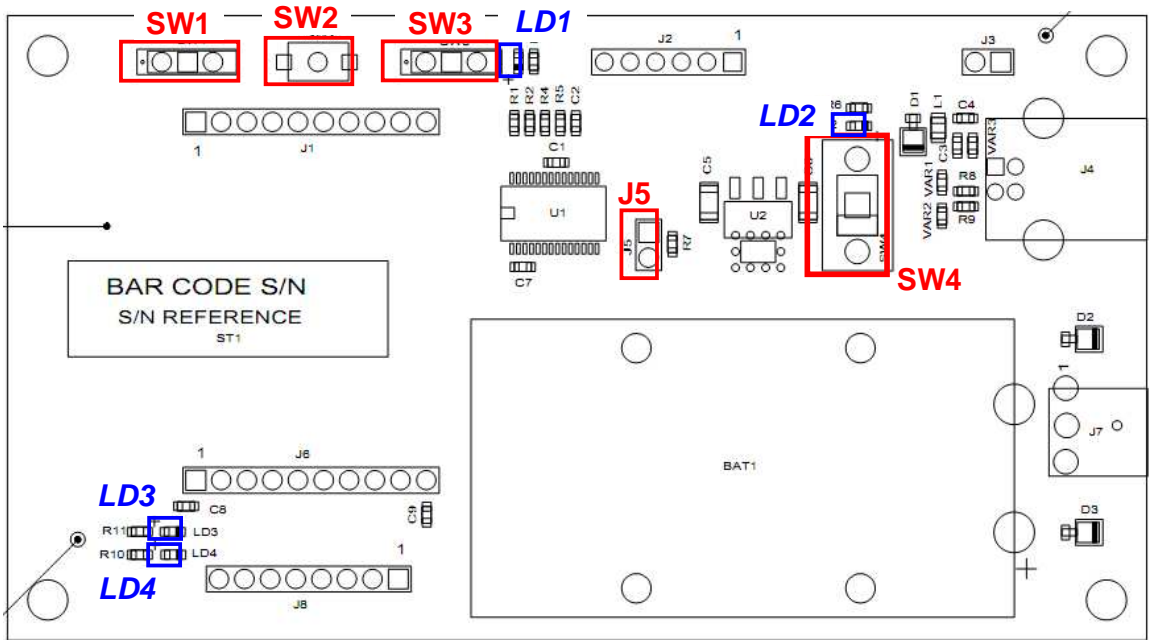
## 2.5.    List of equipment

The DemoUnit is composed by the following items:

- 1 DemoBoard units. (a DemoBoard is composed by: 1 USB EVK board, 1 module on its DIP support, 1 antenna)

- 1 USB cable

- 1 primary batteries (+9V)

- 1 information notice

# 3.    Detailed equipment description

## 3.1.    EVK Description

| Designation | Feature |
|---|---|
| SW1 | Stand-by switch |
| SW3 | Programming switch |
| SW2 | Reset push button |
| SW4 | ON/OFF switch |
| LD1 | PROG Yellow LED |
| LD2 | ON/OFF Yellow LED |
| LD3 | Red LED |
| LD4 | Green LED |

## 3.2.    LE51-868S DIP Pin Out
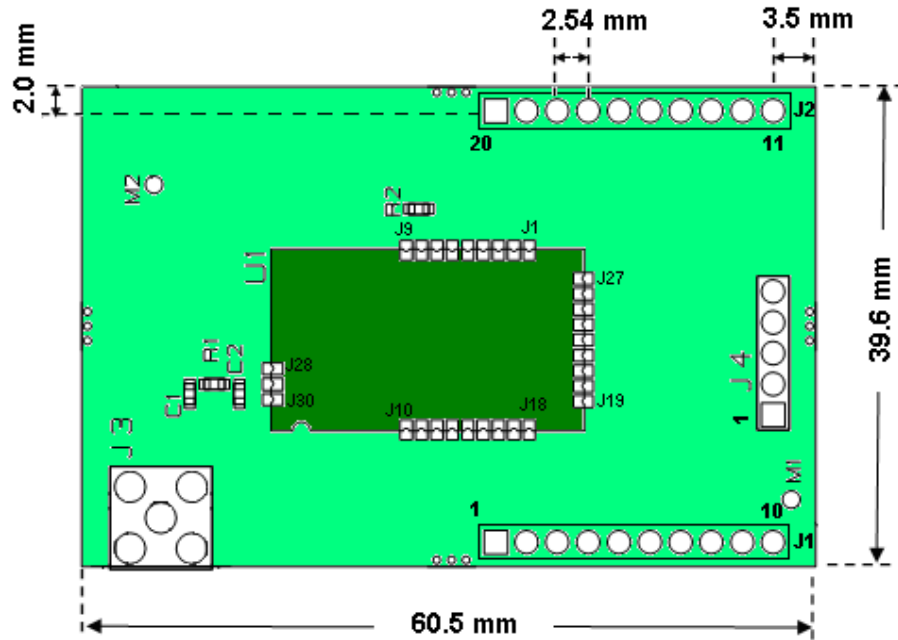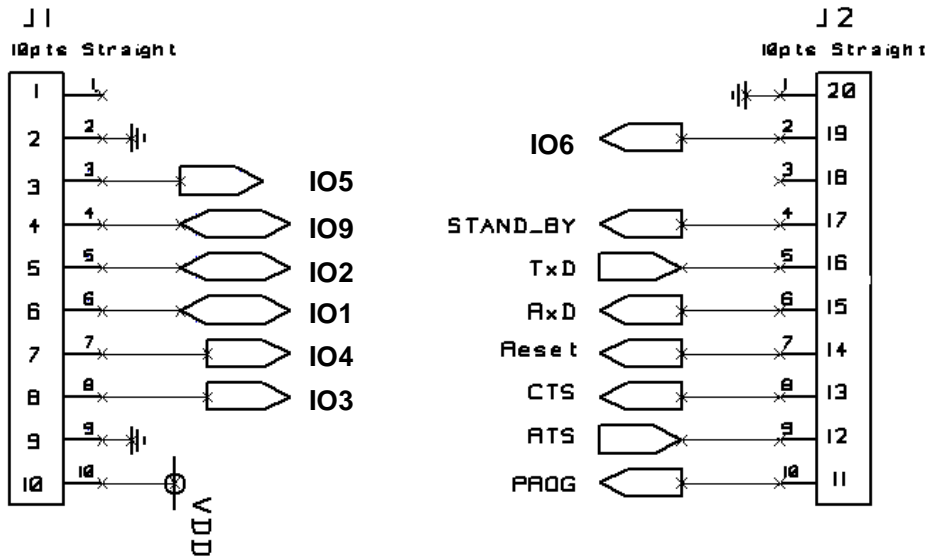
# 4.      Installation

## 4.1.      Demoboard Construction

In order to build each demoboard:

1.      Plug the DIP module on the EVK board.

2.      Screw the SMA antenna on the DIP module.

3.      Plug the USB cable to the EVK board.

4.      Plug a +9B battery if needed

## 4.2.    DemoBoard Connection

In order to connect a demoboard:

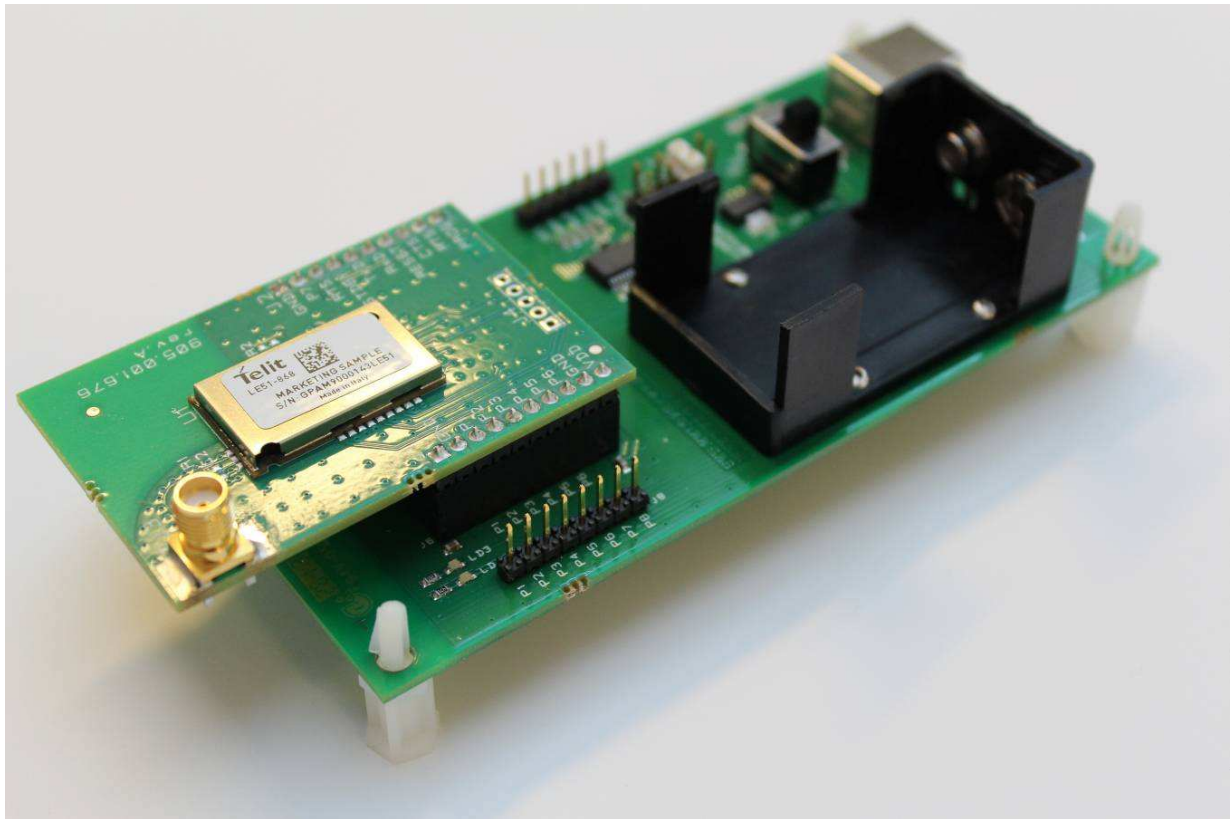1.  Connect the USB cable to the PC.

ⓘ    *The Demoboard is supplied directly through the USB connection. In case of mobility is needed, a +9V battery can be used. When battery is plugged, it has priority on the USB power supply.*

2.  Check that stand-by (STBY, SW1) and programming (PROG, SW3) switches are turned OFF.
3.  Switch the DemoBoard ON (SW4).
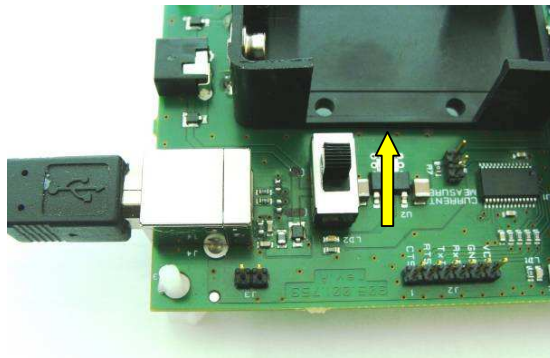
      *OFF*                                                   *ON*
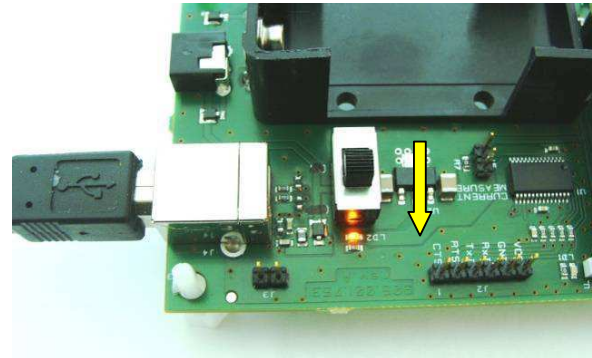
4.  Check that the yellow LED LD2 lights on when power supplying the DemoBoard.

## 4.3.    SR Tool Installation

Refer to SR Tool user guide ([2]) for a detail description of SR tool installation

# 5.      Advanced operations

## 5.1.      Flashing operation

In order to reflash a demoboard:

1. Switch the DemoBoard OFF (SW2).

2. Turn programming switch (PROG, SW4) to ON.

3. Switch the DemoBoard ON (SW2).

4. Reflash the demoboard using SR Tool (Refer to SR Tool user guide ([2]) for a detail description of flashing procedure)

5. Switch the DemoBoard OFF (SW2).

6. Turn programming switch (PROG, SW4) back to OFF.

## 5.2.      Functional operation

Refer to SR Tool user guide ([2]) and SIGFOX stand-alone module user guide ([1]) for a detailed description of usage.

## 5.3.      Send a Frame to the SigFox BackEnd

TELIT demo unit includes 1 year SIGFOX connectivity*.
*The included connectivity corresponds to the Platinum subscription level, namely 140 messages/day/kit.

TELIT will have no responsibility of any kind on the connectivity itself and will not be in charge of the customer's on-boarding process.


Process:
Send an email to SIGFOX subscribes email address subscribe@sigfox.com to ask for the activation of the connectivity, and provides (mandatory):

- ID & PAC of the TELIT demo unit module
- Fill-in SIGFOX on-boarding form (provided by Sigfox)

SIGFOX Sales team will acknowledge receipt of the customer's activation request explaining what will be the next steps for him

SIGFOX will set up the customer's account, register the demo-unit ID & PAC so that the customers can start using Telit's module with SIGFOX connectivity within 48 hours following customer's subscription request.

The LE51-868S is preconfigured to be able to send data to the SIGFOX Network.

The sent data will be displayed on the SigFox BackEnd at the address http://backend.sigfox.com


In order to perform a transmission test the following steps shall be followed:

- Start a serial terminal on your PC

- Connect to the COM port associated to the USB connection between your PC and the LE51-868 (default serial port configuration is the following speed: 19200 bps, 8N1)

- Type the following hexadecimal values A5 05 01 25 48 65 6C 6C 6F 1F 02 5A (see next paragraph for serial protocol description).

- Connect to the SIGFOX Backend

- The message you have just sent should be reported (hexadecimal values) in the SIGFOX BACKEND (48 65 6C 6C 6F)

## 5.3.1.  Serial protocol interface

In order to avoid data loss or data error, we provide a serial protocol interface. The Serial protocol described in this chapter shall be used only when the module is in DATA mode.

Please note that this protocol must be used in conjunction with hardware flow control.

Frame format:

| FIELD | LENGTH (bytes) | Possible values | Comments |
|---|---|---|---|
| Header | 1 | 0xA5 | |
| Length | 1 | 0x00 – 0xFF | It's the payload length |
| Type | 1 | DATA - 0x01 <br> KEEP - 0x02 <br> BIT - 0x03 <br> CONFIRM - 0x10 | DATA: simple data <br> KEEP: used to send a keep alive message as described in the SIGFOX standard; it's in charge to the user to send the keep alive message every 24 hours <br> BIT: send a status bit following the SIGFOX protocol |
| Sequence Number | 1 | 0x01 – 0xFF | It's in charge to user to put a valid value to recognize the association packet send – |

| | | | confirm received |
|---|---|---|---|
| Payload | 0x00 – 0xFF | Up to customer | DATA: up to 255 bytes<br>KEEP: must be omitted<br>BIT: one byte with value 0 or 1 |
| CRC | 2 | Up to customer | It's the sum of all bytes except header and tailer (lsb first) |
| Tailer | 1 | 0x5A | |

After receiving a packet on the serial, the firmware sends a confirm packet on the serial port to inform the user about success or packet error.

The confirm format is the same shown above, and the fields will be filled as follow:

**Length**: it's the payload length, usually 1

**Type**: it is the same type sent by the host ORed with CONFIRM value.

**Sequence number**: it's the same sent by the host

**Payload**: is the error code returned by the firmware

```
enum Ack
{
  NO_ERROR = 0,
  SERIAL_LENGTH_ERROR,
  SERIAL_CRC_ERROR,
  SERIAL_TAILER_MISS_ERROR,
  SERIAL_TIMEOUT_ERROR,
  SERIAL_GENERIC_ERROR,
  SFX_INIT_ERROR,
  SFX_SEND_ERROR,
  SFX_CLOSE_ERROR
}
```

## 5.3.2.   Examples of serial stream

In order to send data with payload (0x70, 0x69, 0x70, 0x70, 0x6F), the corresponding serial stream is: (A5 05 01 25 48 65 6C 6C 6F 1F 02 5A). Where length is 0x05, type is 0x01, sequence number is 0x25 and CRC is 0x021F.

In order to send a Keep-Alive message the corresponding serial stream is: (A5 00 02 15 17 00 5A). Where length is 0x00, type is 0x02, sequence number is 0x15 and CRC is 0x0017.

# 6.    Safety Recommendations

**READ CAREFULLY**

Be sure the use of this product is allowed in the country and in the environment required. The use of this product may be dangerous and has to be avoided in the following areas:

- Where it can interfere with other electronic devices in environments such as hospitals, airports, aircrafts, etc.
- Where there is risk of explosion such as gasoline stations, oil refineries, etc. It is responsibility of the user to enforce the country regulation and the specific environment regulation.

Do not disassemble the product; any mark of tampering will compromise the warranty validity. We recommend following the instructions of the hardware user guides for a correct wiring of the product.

The product has to be supplied with a stabilized voltage source, Safety Extra Low Voltage, with no energy hazard. The wiring has to be conforming to the security and fire prevention regulations. The product has to be handled with care, avoiding any contact with the pins because electrostatic discharges may damage the product itself.

The system integrator is responsible of the functioning of the final product; therefore, care has to be taken to the external components of the module, as well as of any project or installation issue, because the risk of disturbing external devices or having impact on the security. Should there be any doubt, please refer to the technical documentation and the regulations in force. When installed in final product, a fire protection enclosure must be provided. Every module has to be equipped with a proper antenna with specific characteristics. The antenna has to be installed with care in order to avoid any interference with other electronic devices and has to guarantee a minimum distance from the body (20 cm).

The European Community provides some Directives for the electronic equipments introduced on the market. All the relevant information's are available on the European Community website:

http://ec.europa.eu/enterprise/sectors/rtte/documents/

The text of the Directive 99/05 regarding telecommunication equipments is available, while the applicable Directives (Low Voltage and EMC) are available at:

http://ec.europa.eu/enterprise/sectors/electrical/

# 7. Glossary

| | |
|---|---|
| **ACP** | Adjacent Channel Power |
| **BER** | Bit Error Rate |
| **Bits/s** | Bits per second (1000 bits/s = 1Kbps) |
| **CER** | Character Error Rate |
| **dBm** | Power level in decibel milliwatt (10 log (P/1mW)) |
| **EMC** | Electro Magnetic Compatibility |
| **EPROM** | Electrical Programmable Read Only Memory |
| **ETR** | ETSI Technical Report |
| **ETSI** | European Telecommunication Standard Institute |
| **FM** | Frequency Modulation |
| **FSK** | Audio Frequency Shift Keying |
| **GFSK** | Gaussian Frequency Shift Keying |
| **GMSK** | Gaussian Minimum Shift Keying |
| **IF** | Intermediary Frequency |
| **ISM** | Industrial, Scientific and Medical |
| **kbps** | kilobits/s |
| **LBT** | Listen Before Talk |
| **LNA** | Low Noise Amplifier |
| **MHz** | Mega Hertz (1 MHz = 1000 kHz) |
| **PLL** | Phase Lock Loop |
| **PROM** | Programmable Read Only Memory |
| **NRZ** | Non return to Zero |
| **RF** | Radio Frequency |
| **RoHS** | Restriction of Hazardous Substances |
| **RSSI** | Receive Strength Signal Indicator |
| **Rx** | Reception |
| **SRD** | Short Range Device |
| **Tx** | Transmission |
| **SMD** | Surface Mounted Device |
| **VCO** | Voltage Controlled Oscillator |
| **VCTCXO** | Voltage Controlled and Temperature Compensated Crystal Oscillator |

# 8.    Document History

| Revision | Date | Changes |
|----------|------|---------|
| 0 | 2014-02-12 | First Release |
| 1 | 2014-05-30 | Applicability table update & Advanced operation |