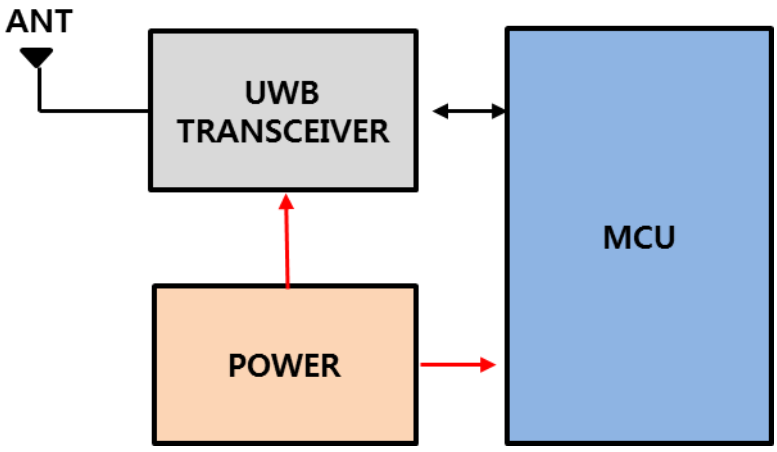
LCU-001 UWB Module
User Manual

1 Module Diagram

1.1 Summary

- This chapter shows the structure of the LCU-001 UWB module separately.

1.2 LCU-001 UWB Module Diagram



Picture LCU-001 UWB Module Block diagram

- The LCU-001 UWB module can be represented by four blocks: MCU, Antenna, UWB Transceiver, and Power.

■ **MCU**

- The MCU IC consists of RF(UWB) IC, debugging block, power supply block and Cortex M0, which acts as a system core.

■ **UWB Transceiver**

- The role of UWB RF Block and Modem is handled by UWB Transceiver. The communication signals are transmitted and received through one antenna

■ **Antenna**

- The antenna is implemented as a pattern on main PCB. The antenna resonance is designed according to 6 ~ 7GHz band.

■ **Power**

- A 3.3V Step-Up DC/DC converter is applied to the module to convert the 2.8V to 3.3V which is a system power. In addition, a 1.8V step-down DC/DC converter is used to increase the efficiency of consumed current in RF operation.

2 Module Specification

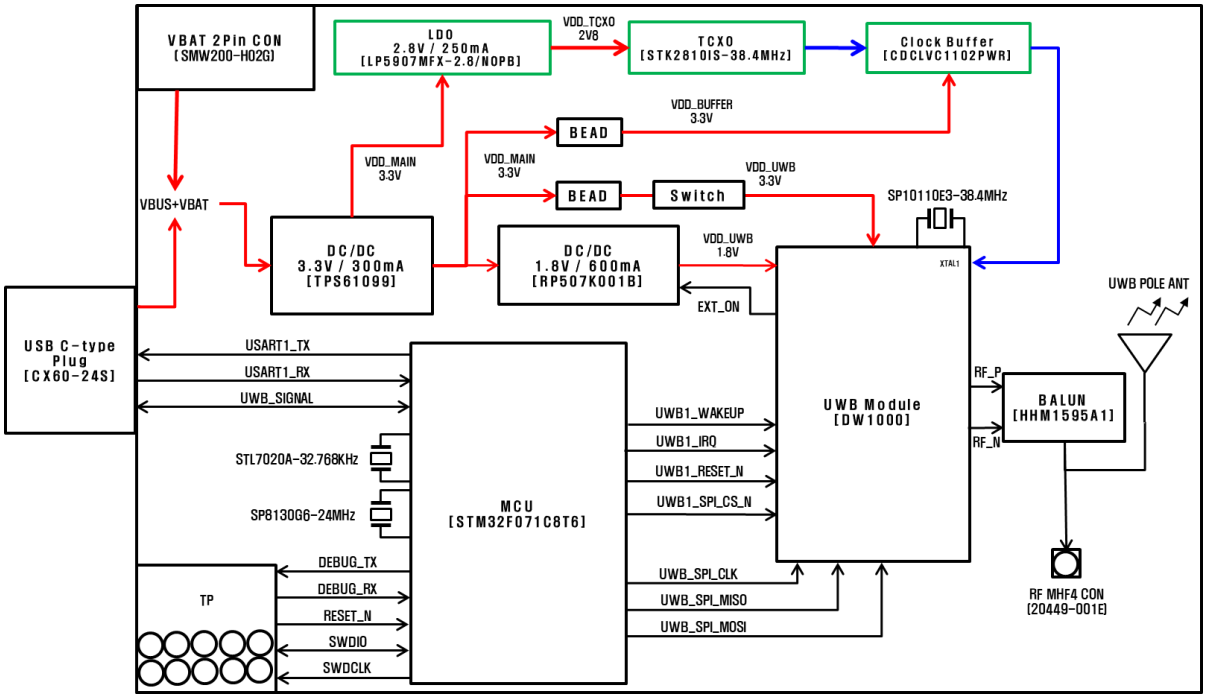
2.1 Summary

- Specifications of the LCU-001 UWB module are defined.

2.2 LCU-001 UWB Module Hardware Specification

- The UWB module consists of MCU and UWB transceiver.
- The system power is suppied from the main board

2.2.1 H/W Block Diagram



Picture LCU-001 UWB Module Block Diagram

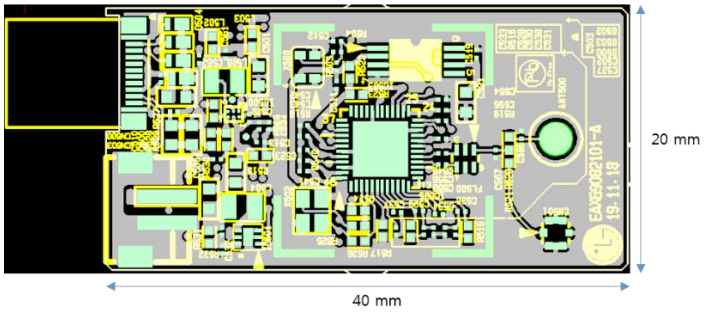
- Programming interface
- The firmware download is done by connecting SWDIO, SWDCLK port and J-LINK, and the module debugging is performed by UART connection

2.2.2 Module Specifications

Function	Spec
MCU	32bit Cortex-M0, 16KB SRAM, 128KB Flash
RF	Metal Monopole type ANTENNA (Peak gain : 3.64dBi) Average TX Power : under -41.3dBm/MHz (Domestic) Max Tx power : under 0dBm/50MHz (Domestic) Frequency range : 6 ~ 7 GHz
Power	Operating Voltage : 1.8 ~ 3.6V Main Power : 3.3V Step Up Converter (Input Voltage typ. 2.8V) RF Transceiver Power : 1.8V Step Down Converter (Input Voltage typ. 3.3V)
Others	Using 2.8V VBUS and UART by USB C type connector

2.2.3 Dimension

- The PCB Dimension is 40mm x 20mm and it is equipped with RF IC, MCU and DC/DC Converter.
- PCB specification is 0.8mm 4 layer rigid PCB and through via



Picture Module PCB Dimension

Picture. Module actual photo with Shield-Can (Left: TOP, Right: BOTTOM)

ANTENNA

Picture. Module actual photo without Shield-Can (Left: TOP, Right: BOTTOM)

2.3 Pin Map

Pin Number	Pin Name	Pin Type	I/O Structure	STM32F071C8T6	Additional Functions
1	VBAT	S	-	VDD_MAIN_3V3	POWER
2	PC13	I/O	TC	-	-
3	PC14-OSC32_IN	I/O	TC	XTAL_32.768K_IN	OSC32_IN
4	PC15-OSC32_OUT	I/O	TC	XTAL_32.768K_OUT	OSC32_OUT
5	PF0-OSC_IN	I/O	FT	XTAL_24M_IN	OSC_IN
6	PF1-OSC_OUT	I/O	FT	XTAL_24M_OUT	OSC_OUT
7	NRST	I/O	RST	MCU_RESET_N (TP)	RESET
8	VSSA	S	-	GND	POWER
9	VDDA	S	-	VDD_MAIN_3V3	POWER
10	PA0	I/O	TTa	UWB_WAKEUP	WKUP1
11	PA1	I/O	TTa	UWB_IRQ	ADC_IN1, COMP1_INP
12	PA2	I/O	TTa	UWB_SIGNAL (TP)	ADC_IN2, COMP2_INM6,
13	PA3	I/O	TTa	UWB_RESET_N	ADC_IN3, COMP2_INP
14	PA4	I/O	TTa	UWB_SPI_CS_N	SPI_CS
15	PA5	I/O	TTa	UWB_SPI_CLK	SPI_CLK
16	PA6	I/O	TTa	UWB_SPI_MISO	SPI_MISO
17	PA7	I/O	TTa	UWB_SPI_MOSI	SPI_MOSI
18	PB0	I/O	TTa	BAT_ADC	-
19	PB1	I/O	TTa	TCXO_PW_EN	-
20	PB2	I/O	FT	UWB_PWR_EN	-
21	PB10	I/O	FT	MCU_DEBUG_TX (TP)	DEBUG Uart TX
22	PB11	I/O	FT	MCU_DEBUG_RX (TP)	DEBUG Uart RX
23	VSS	S	-	GND	POWER
24	VDD	S	-	VDD_MAIN_3V3	POWER
25	PB12	I/O	FT	ADC_GND_CTL_N	-
26	PB13	I/O	FTf	-	-
27	PB14	I/O	FTf	-	-
28	PB15	I/O	FT	-	-
29	PA8	I/O	FT	-	-
30	PA9	I/O	FT	USART_TX (TP)	PCB Uart TX
31	PA10	I/O	FT	USART_RX (TP)	PCB Uart RX
32	PA11	I/O	FT	-	-
33	PA12	I/O	FT	-	-
34	PA13	I/O	FT	MCU_SWDIO (TP)	SWD JTAG DEBUG
35	VSS	S	-	GND	POWER
36	VDDIO2	S	-	VDD_MAIN_3V3	POWER
37	PA14	I/O	FT	MCU_SWDCLK (TP)	SWD JTAG DEBUG
38	PA15	I/O	FT	-	-
39	PB3	I/O	FT	-	-
40	PB4	I/O	FT	-	-
41	PB5	I/O	FT	TP	WKUP6
42	PB6	I/O	FTf	-	-
43	PB7	I/O	FTf	-	-
44	BOOT0	I	B	PULL DOWN (TP)	
45	PB8	I/O	FTf	-	-
46	PB9	I/O	FTf	-	-
47	VSS	S	-	GND	POWER
48	VDD	S	-	VDD_MAIN_3V3	POWER

FCC Statements

FCC Part 15.19 Statements

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

FCC Part 15.105 statement (Class B)

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules.
These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Part 15.21 statement

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

Regulatory notice to host manufacturer according to KDB 996369 D03 OEM Manual

List of applicable FCC rules
This module has been granted modular approval as below listed FCC rule parts.
- FCC Rule parts 15F(15.519)

Summarize the specific operational use conditions
The OEM integrator should use equivalent antennas which is the same type and equal or less gain then an antenna listed in this instruction manual.

RF exposure considerations
The module has been certified for integration into products only by OEM integrators under the following condition:
- The antenna(s) must be installed such that a minimum separation distance of at least 20 cm is maintained between the radiator (antenna) and all persons at all times.
- The transmitter module must not be co-located or operating in conjunction with any other antenna or transmitter except in accordance with FCC multi-transmitter product procedures.
- Mobile use

As long as the three conditions above are met, further transmitter testing will not be required. OEM integrators should provide the minimum separation distance to end users in their end-product manuals.

Antennas list
This module is certified with the following integrated antenna.
- Type: Metal Monopole type ANTENNA

	6200	6300	6400	6500	6600	6700	6800
Peak [dBi]	5.5	2.85	-0.09	2.34	3.29	3.64	5.45

Any new antenna type, higher gain than listed antenna should be met the requirements of FCC rule 15.203 and 2.1043 as permissive change procedure.

End Product Labeling
The module is labeled with its own FCC ID and IC Certification Number. If the FCC ID and IC Certification Number are not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. In that case, the final end product must be labeled in a visible area with the following:
“Contains FCC ID: BEJ-LCU001”
“Contains IC: 2703N-LCU001”

Information on test modes and additional testing requirements
-OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, additional transmitter in the host, etc.).

Additional testing, Part 15 Subpart B disclaimer
-The final host product also requires Part 15 subpart B compliance testing with the modular transmitter installed to be properly authorized for operation as a Part 15 digital device.

ISED Statements

RSS-GEN, Sec. 7.1.3– (licence-exempt radio apparatus)

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions:
(1) this device may not cause interference, and
(2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :
(1) l'appareil ne doit pas produire de brouillage, et
(2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

RF Exposure

The antenna (or antennas) must be installed so as to maintain at all times a distance minimum of at least 20 cm between the radiation source (antenna) and any individual. This device may not be installed or used in conjunction with any other antenna or transmitter.

l'exposition aux RF
L'antenne (ou les antennes) doit être installée de façon à maintenir à tout instant une distance minimum de au moins 20 cm entre la source de radiation (l'antenne) et toute personne physique.

Caution

Any changes or modifications to this device not explicitly approved by manufacturer could void your authority to operate this equipment.

Les changements ou modifications de cet appareil non expressément approuvé par le fabricant peuvent annuler votre droit à utiliser cet équipement.

É tiquetage du produit final (IC)

Le module LCU-001 est étiqueté avec sa propre identification FCC et son propre numéro de certification IC. Si l'identification FCC et le numéro de certification IC ne sont pas visibles lorsque le module est installé à l'intérieur d'un autre dispositif, la partie externe du dispositif dans lequel le module est installé devra également présenter une étiquette faisant référence au module inclus. Dans ce cas, le produit final devra être étiqueté sur une zone visible avec les informations suivantes :
- Contient module émetteur identification FCC ID: BEJ-LCU001
- Contient module émetteur IC : 2703N-LCU001