

# ARTIK 7 User Manual

**Model: SIP007AFS00**

## 1. ARTIK 7 RF PART Circuit Description

### 1.1 ZIGBEE : EM3587(U10)

The Ember EM3587 is a fully integrated System-on-Chip that integrates a 2.4 GHz, IEEE 802.15.4-2003-compliant transceiver, 64-bit ARM® Cortex-A53 microprocessor, flash and RAM memory, and peripherals of use to designers of ZigBee-based systems.

- 64-bit ARM® Cortex-A53 processors
- 2.4 GHz IEEE 802.15.4-2003 transceiver & lower MAC
- 256 or 512 kB flash, with optional read protection
- 32 or 64 kB RAM memory
- AES128 encryption accelerator
- Flexible ADC, UART/SPI/TWI serial communications, and general purpose timers
- Optional USB serial communications
- 24 highly configurable GPIOs with Schmitt trigger inputs

### 1.2 WLAN/BT : BCM43455(U8)

BCM43455 is the combo module for IEEE 802.11 a/b/g/n/ac Wireless LAN and Bluetooth 4.1 + LE at embedded and mobile applications. Wireless local area network (WLAN) compliant with the IEEE 802.11 b/g/n specification

- WLAN - IEEE 802.11ac Draft compliant
- Single-stream spatial multiplexing up to 433.3Mbps data rate
- Supports 20, 40, and 80MHz channels with optional SGI (256 QAM modulation)
- Full IEEE 802.11 a/b/g/n legacy compatibility with enhanced performance
- Tx/Rx low-density parity check (LDPC) support for improved range and power efficiency
- Bluetooth – Bluetooth 4.1 + Low Energy
- Bluetooth Class 1 or Class 2 transmitter operation
- Supports extended synchronous connections(eSCO), for enhanced voice quality by allowing for retransmission of dropped packets
- FM unit supports HCI for communication.

- FM receiver : 65MHz to 108 MHz FM band; supports the European radio data systems(RDS) and the North American radio broadcast data system(RBDS) standards.

(1) Description for 2.4GHz

Description	
Frequency	● 2412 ~ 2472 MHz
DFS attestations	● Client without radar detection capability
Frequency tolerance	● 802.11 b / g / n : ± 20 ppm
IEEE802.11 mode	● b / g / n
Data rate	● up to 300 Mbps defined by the IEEE 802.11 b/g/n
Channel Bandwidth	● 20MHz, 40MHz
DFS channel	Not Support
Ad-hoc/WiFi direct	● Not Support
WiFi display	● Not Support
Data Modulation	● DSSS : CCK, BPSK, QPSK for 802.11b ● OFDM : BPSK, QPSK, 16QAM, 64QAM for 802.11g/n

(2) Description for 5GHz

Description	
Frequency	● 5150 ~ 5350MHz, 5470~5825MHz
DFS attestations	● Client without radar detection capability
Frequency tolerance	● 802.11 a / n /ac : ± 20 ppm
IEEE802.11 mode	● a / n / ac
Data rate	● up to 867 Mbps defined by the IEEE 802.11 a/n/ac
Channel Bandwidth	● 20MHz, 40MHz, 80MHz
Scan behavior	● Not mentioned
DFS channel	● Use DFS range, No ability of radar detection
Ad-hoc/WiFi direct	● Not Support
WiFi display	● Not Support
Data Modulation	● OFDM : BPSK, QPSK, 16QAM, 64QAM, 256QAM for 802.11a/n/ac

### (3) Description for Bluetooth

Description	
Frequency	● 2402~2480
Power Class	● Class 1 or 2
Bluetooth Standard	● Bluetooth 4.1 + EDR
Data rate	● up to 3Mbps defined by the Enhanced Data Rate
Data Modulation	● FHSS : GFSK, OQPSK, 8DPSK, $\pi$ /4DPSK for Bluetooth

## 2. ARTIK 7 Baseband Circuit Description

### 2.1 AP : S5P6818(U1)

Nexell S5P6818 is a system-on-a-chip (SoC) based on the 64-bit RISC processor for Smartphone tablet, laptop, and desktop PCs. Designed with the 28 nm low power process, Nexell S5P6818 provides the best performance features such as CORTEX-A53 Octa core CPU, highest memory bandwidth, Full HD display, 1080p 60 fps (frames per second) video decoding and 1080p 30 frame encoding hardware, 3D graphics hardware and high-speed interfaces such as eMMC4.5, and USB 2.0.

- ARM Cortex-A53 Octa CPU as high performance processor
  - 64KB RAM, 20KB ROM and 512KB L2 Cache
- Supports ARM TrustZone technology
- Supports Security functions (AES, DES/TDES, SHA-1, MD5 and PRNG) and Secure JTAG
- High Performance 3D Graphic Accelerator
- Supports Dual Display up to 1920x1080, TFT-LCD, LVDS, HDMI 1.4a, MIPI-DSI and CVBS output
- Supports various boot modes including NAND (with ECC detection and correction), SPI Flash/EEPROM, NOR, SD(eMMC), USB and UART

### 2.2 Memory : KLM4G1FEPD-B031 (U2)

The Samsung KLM4G1FEPD-B031 is a 4 GB eMMC flash memory

- embedded MultiMediaCard Ver. 5.0 compatible. Detail description is referenced by JEDEC Standard
- SAMSUNG eMMC supports features of eMMC5.0 which are defined in JEDEC Standard
  - Supported Features : Packed command, Cache, Discard, Sanitize, Power Off Notification, Data Tag, Partition types, Context ID, Real Time Clock, Dynamic Device Capacity, HS200, HS400, Field Firmware Update

- Non-supported Features : Large Sector Size (4KB)
- Full backward compatibility with previous MultiMediaCard system specification (1bit data bus, multi-eMMC systems)
- Data bus width : 1bit (Default), 4bit and 8bit
- MMC I/F Clock Frequency : 0 ~ 200MHz  
MMC I/F Boot Frequency : 0 ~ 52MHz
- Temperature : Operation (-25 °C ~ 85 °C), Storage without operation (-40 °C ~ 85 °C)
- Power : Interface power → VDD(VCCQ) (1.70V ~ 1.95V or 2.7V ~ 3.6V) , Memory power → VDDF(VCC) (2.7V ~ 3.6V)

### **2.3 PMIC : S2MPS11B02(S2MPS11B2) (U4)**

S2MPS11 is an advanced Power Management IC (PMIC) designed for mobile applications. S2MPS11, coupled with Multi Core Samsung Application Processors (Exynos5410), is used in a wide variety of mobile applications such as smart phones and tablet PCs.

- I2C-Bus interface @3.4MHz and 400kHz
- High Efficiency Step-down DC/DC Converters
- Low Drop Voltage Regulators
- USB External device interface
- 5ch-GPIO
- Real-Time Clock (RTC)
- Package CSP0606-85(0.5mm pitch) or CSP0608-80(0.65mm pitch)
- Process CMOS

## 2. ARTIK 7 Antenna Description

The antennas supplied with the ARTIK developer kit are of the following specifications.

<b>Antenna type</b>	Dipole Antenna
<b>Antenna peak gain</b>	+1.43dBi(2484MHz) / +0.91(5320MHz)
<b>Frequency</b>	2.4GHz, 5GHz (for Wi-Fi, BT, ZigBee)
<b>Connector type</b>	SMA-M

### ***FCC (United States) Compliance Statement***

Replacement antennas must be of the same type, must be of equal or less gain than an antenna previously authorized under the same grant of certification (A3LATKM052000 for ARTIK 5), and must have similar in-band and out-of-band characteristics (consult specification sheet for cutoff frequencies). Any new antenna type, or higher gain antenna, approved under Part 15 requires a Class II permissive change, and the requirements of § 15.203 must be met.

### ***IC (Canada) Compliance Statement***

This radio transmitter (649E-ATKM052000 for ARTIK 5) has been approved by Industry Canada to operate with the antenna types listed above with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device. (RSS-GEN clause 8.3)

## MODULE DISCLOSURES – QUICK START GUIDE

### FCC REGULATORY DISCLOSURES

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This device complies with Part 15 of the FCC's 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 undesirable operation

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.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20cm between the transmitter's radiating structure(s) and the body of the user or nearby persons.

This module is intended for OEM integration. The OEM integrator is responsible for FCC compliance and compliance with all applicable regulations including those for modular transmitters 47 C.F.R. 15.212. The OEM product must comply with all applicable labeling requirements including those contained in 15 C.F.R. 15.19. The OEM is solely responsible for certification and testing and labeling of its own products. In addition to any independently required labels, the OEM shall also affix to the outside of a device into which the module is installed a label referring to the enclosed module. This exterior label should be prepared in a legible font and permanently affixed and using the wording "Contains Transmitter Module FCCID: [A3LSIP007AFS00]

The OEM is required to ensure that the end product integrates this module so as to maintain a minimum distance of 20 cm between the equipment's radiating structure(s) and the body of the user or nearby persons. The OEM shall also advise its end user of this requirement as required by applicable rules.

The OEM shall require that the end user of its product be informed that the FCC radio frequency exposure guidelines for an uncontrolled environment can be satisfied. The OEM shall further inform its

end user that any change or modifications to this module not expressly approved by the manufacturer will void the warranty and the users' authority to operate the equipment.

## INDUSTRY CANADA REGULATORY DISCLOSURES

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### INDUSTRY CANADA STATEMENT

This device complies with Industry Canada license-exempt RSS standard(s). 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.

Cet appareil est conforme avec Industrie Canada exempts de licence standard RSS (s). L'opération est soumise aux deux conditions suivantes:(1) cet appareil ne peut causer d'interférences, et (2) cet appareil doit accepter toute interférence, y compris les interférences qui peuvent causer un mauvais fonctionnement de l'appareil.

### INDUSTRY CANADA RADIATION EXPOSURE STATEMENT AND LIMITATIONS ON USE

This equipment complies with IC RSS-102 radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator and your body. This equipment should be installed and must not be co-located or operating in conjunction with any other antenna or transmitter.

This equipment is restricted to indoor use in the 5.15-5.25 GHz range. This equipment is not able to be operated at 5600-5650. In the United States and Canada, only Channel 1~11 can be operated and these channel assignments deal only with the 2.4 GHz range.

The end product must be labeled to display the Industry Canada certification number of the module.

**“Contains transmitter module IC: 649E-SIP007AFS00”**

*Le dispositif d'accueil doivent être étiquetés pour afficher le numéro de certification d'Industrie Canada du module.*

*Contient module émetteur IC : 649E- SIP007AFS00*

## EU REGULATORY DISCLOSURES

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### CE STATEMENT \*

*The following statement must be supplied with each product but can be printed in the user manual, the packaging, or provided as a separated leaflet.*

Hereby, Samsung declares that this IoT Module is in compliance with the essential requirements and other relevant provisions of Article 3 of the R&TTE Directive 1999/5/EC, 2004/108/EC and RoHS directive 2011/65/EU.

“The declaration of conformity may be consulted at [[www.artik.io/](http://www.artik.io/)]”