

AK-TC-M01Module specification

General Description

AK-TC-M01 module is a BLE wireless turn-key solution that supports multiple peripheral functions (ADC, Timer, Counter, PWM) and Serial Communication Protocol (I2C, UART), Bluetooth 4.2 protocols with up to 34GPIO pins.

Module Description

- size: 20*27.5*2.5
- Half hole process
- Up to 256 KB of flash memory with read accelerator and up to 32KB of SRAM
- Up to 34 GPIO pins
- Single mode module with Bluetooth 4.2
- Operating temperature range: -40°C-85°C
- 48MHz ARM Cortex-M0 CPU with single cycle algorithm
- Internal low-speed oscillator dedicated to watchdog timer
- With SWD protocol burning port

Power consumption

- TX output power range: -18dbm-3dbm
- Received Signal Strength Indicator (RSSI): 1 db resolution
- RX current: 18.7mA
- TX current: 15.6mA (power is 0dbm)
- In low power mode:
 - Active mode: 3MHz flash execution program, current is 1.7mA
 - 1.5 µA deep sleep mode current while monitoring crystal oscillator (WCO) operation
 - Sleep mode: Current is 150 nA when data is retained in RAM
 - Stop mode: 60 nA

Functional performance

- SAR ADC with 12-bit resolution and 1 Msps sample rate includes differential mode, single-ended mode, and channel sequencer with signal averaging
- Two independent and reconfigurable serial communication modules (SCBs) with reconfigurable I2C, UART functionality
- Four 16-bit timer, counter, pulse width modulator (TCPWM) modules
- LCD driver (Com or Seg driver) is supported on all pins
- Capable of operating in deep sleep mode with 4 bits of memory per pin
- I2S host interface

Table of Contents

General Description	1
Module Description.....	1
Power consumption.....	1
Functional performance	1
Table of Contents	2
Overview	3
Module overview	3
Pinouts.....	4
Module schematic	5
Key components.....	5
Antenna Parameters	6
Electrical Specifications	6
Absolute maximum ratings	6
RF specifications.....	7
Device-Level Specifications	7
GPIO Electrical Specifications	9
SAR ADC Electrical Specifications	11
Fixed I2C Electrical Specifications.....	13
Fixed UART Electrical Specifications.....	13
BLE Subsystem Electrical Specifications.....	14

Overview

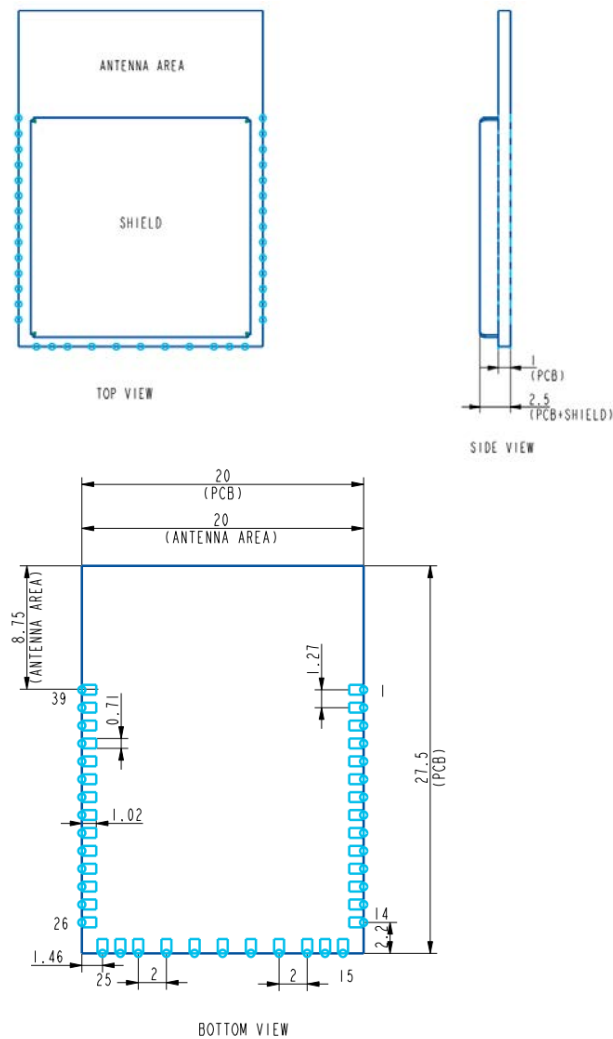
Module overview

AK-TC-M01 is a complete module, designed to be used on an application board. The specific dimensions are shown in Table 1 and Figure 1.

TABLE 1 MODULE SIZE

Size name		Specifications
Module size	Length	20mm+-0.15mm
	Width	27.5mm+-0.15mm
Antenna size	Length	12.8mm+-0.15
	Width	7.8+-0.15
PCB thickness	Thickness	1mm+-0.1mm
Shield thickness	Thickness	1.5+-0.1mm

FIGURE 1 MODULE MECHANICAL DIMENSION DRAWING



Pinouts

TABLE 2 AK-TC-M01 PIN LIST

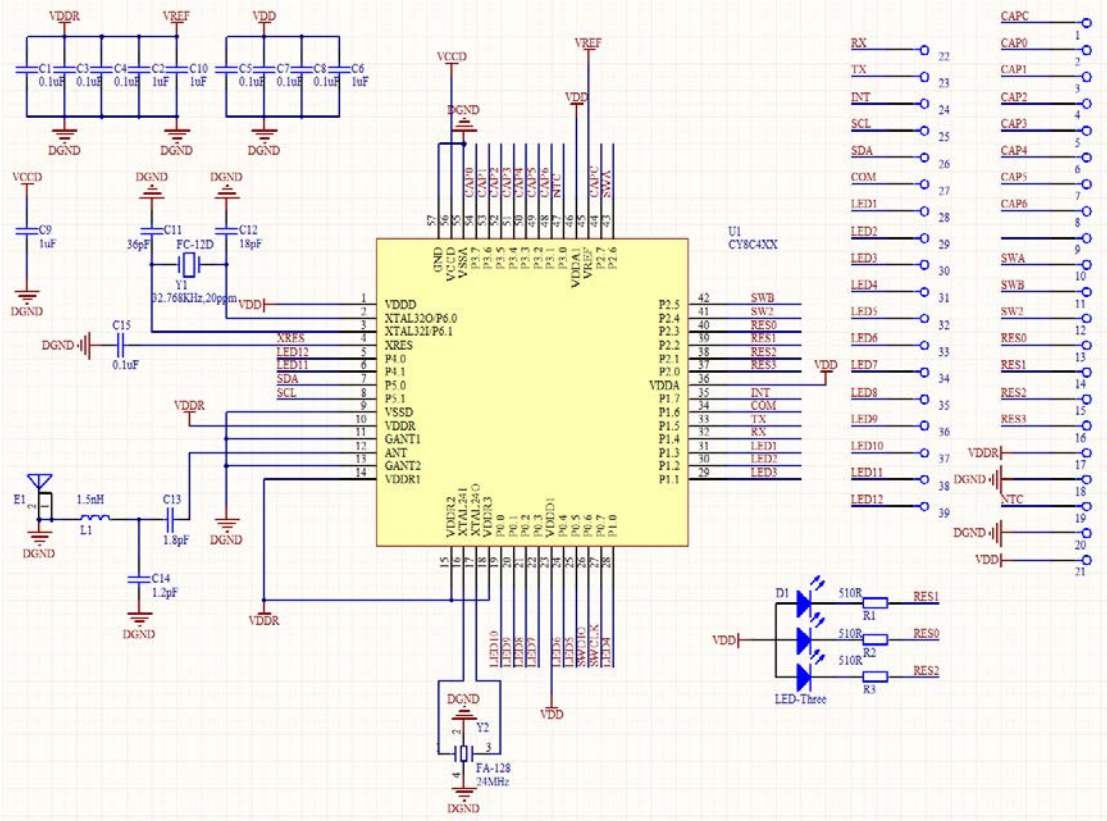
Pin	Name	Type	Description
1	CAPC	GPIO	IO
2	CAP1	GPIO	IO
3	CAP2	GPIO	IO
4	CAP3	GPIO	IO
5	CAP4	GPIO	IO
6	CAP5	GPIO	IO
7	CAP6	GPIO	IO
8	CAP7	GPIO	IO
9	CAP8	NC	Do not connect
10	SWA	GPIO	IO
11	SWB	GPIO	IO
12	SW2	GPIO	IO
13	RES1	GPIO	IO
14	RES2	GPIO	IO
15	RES3	GPIO	IO
16	RES4	GPIO	IO
17	VDDR	POWER	1.9 V to 5.5 Vradio supply
18	DGND	DGND	Ground
19	NTC	GPIO	ADC
20	DGND	DGND	Ground
21	VDD	DGND	1.71 Vto 5.5 Vdigital supply
22	RX	GPIO	UARTrx, I2C SDA
23	TX	GPIO	UART tx, I2CSCL
24	INT	GPIO	External interrupt
25	SCL	GPIO	UART tx、I2CSCL
26	SDA	GPIO	UART rx、I2C SDA
27	COM	GPIO	PWM
28	LED1	GPIO	IO

TABLE 2 AK-TC-M01 PIN LIST

29	LED2	GPIO	IO
30	LED3	GPIO	IO
31	LED4	GPIO	IO
32	LED5	GPIO	IO
33	LED6	GPIO	IO
34	LED7	GPIO	IO
35	LED8	GPIO	IO
36	LED9	GPIO	IO
37	LED10	GPIO	IO
38	LED11	GPIO	IO
39	LED12	GPIO	IO

Module schematic

FIGURE 2 AK-TC-M01 MODULE SCHEMATIC



Key components

TABLE 3 KEY COMPONENTS LIST

Component	Designator	Description
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TABLE 3 KEY COMPONENTS LIST

MCU	U1	BLEQFNPSOC with 56 pins
Crystal oscillator	Y2	24MHz, 12pF
Crystal oscillator	Y1	32. 768KHz, 12. 5pF

Antenna Parameters

TABLE 4 ANTENNA PARAMETERS

Parameter	Value
Frequency range	2400–2500MHz
Peak gain	1. 5dbm
Average gain	0. 5dbm
Return loss	minimum at -10db

Electrical Specifications

Absolute maximum ratings

TABLE 5 ABSOLUTE MAXIMUM RATINGS

Parameter	Description	Min	Typ	Max	Units	Details/Condi tions
VDDD_ABS	Analog, digital, or radio supply relative to VSS(VSSD=VSSA)	-0. 5	-	6	V	Absolute max
VCCD_ABS	Direct digital core voltage input relative to VSSD	-0. 5	-	1. 95	V	Absolute max
VDD_RIPPLE	Supply voltage ripple with maximum input voltage VDD and VDDR	-	-	100	mV	Ripple frequency 100KHz-750KHz when the supply voltage is 3V
VGPIO_ABS	GPIO voltage	-0. 5	-	VDD+0 . 5	V	Absolute max
IGPIO_ABS	Maximum current per GPIO	-25	-	25	mA	Absolute max

TABLE 5 ABSOLUTE MAXIMUM RATINGS

IGPIO_injection	GPIO injection current, Max for $V_{IH} > V_{DD}$, and Min for $V_{IL} < V_{SS}$	-0.5	-	0.5	mA	Absolute max, current injection per pin
LU	Pin current for latch-up	-200	-	200	mA	-

RF specifications

TABLE 6 RF SPECIFICATIONS

Parameter	Description	Min	Typ	Max	Units	Details/Conditions
RF _o	RF output power	-18	0	3	dBm	Adjust by register
RX _s	RF sensitivity	-	-87	-	dBm	-
F _R	RF operating frequency	2400	-	2480	MHz	-
G _P	Peak gain	-	1.5	-	dBi	-
G _{Av}	Average gain	-	0.5	-	dBi	-
RL	Return loss	-	-10.5	-	dB	-

Device-Level Specifications

TABLE 7 DC SPECIFICATION

Parameter	Description	Min	Typ	Max	Units	Details/Conditions
V _{DD1}	power supply input voltage	1.8	-	5.5	V	With regulator enabled
V _{DD2}	power supply input voltage unregulated	1.71	1.8	1.89	V	Internally unregulated Supply
V _{DDR1}	Radio supply voltage (Radio ON)	1.9	-	5.5	V	-
V _{DDR2}	Radio supply voltage (Radio OFF)	1.71	-	5.5	V	-
Active mode, VDD= 1.71 V to 5.5 V						
I _{DD3}	Execute from flash; CPU at 3 MHz	-	1.7	-	mA	T = 25 ° C, VDD= 3.3 V

TABLE 7 DC SPECIFICATION

IDD4	Execute from flash; CPU at 3 MHz	–	–	–	mA	T = – 40 °C to 85 °C
IDD5	Execute from flash; CPU at 6 MHz	–	2.5	–	mA	T = 25 °C, VDD= 3.3 V
IDD6	Execute from flash; CPU at 6 MHz	–		–	mA	T = – 40 °C to 85 °C
IDD7	Execute from flash; CPU at 12 MHz	–	4	–	mA	T = 25 °C, VDD= 3.3 V
IDD8	Execute from flash; CPU at 12 MHz	–	–	–	mA	T = – 40 °C to 85 °C
IDD9	Execute from flash; CPU at 24 MHz	–	7.1	–	mA	T = 25 °C, VDD= 3.3 V
IDD10	Execute from flash; CPU at 24 MHz	–	–		mA	T = – 40 °C to 85 °C
IDD11	Execute from flash; CPU at 48 MHz	–	13.4	–	mA	T = 25 °C, VDD= 3.3 V
IDD12	Execute from flash; CPU at 48 MHz	–	–	–	mA	T = – 40 °C to 85 °C
Sleep Mode, VDD= 1.8 V to 5.5 V						
IDD13	IM0on	–	–	–	mA	T = 25 °C, VDD = 3.3 V, SYSCLK = 3MHz
Sleep Mode, VDD and VDDR= 1.9 V to 5.5 V						
IDD14	EC0on	–	–	–	mA	T = 25 °C, VDD = 3.3 V, SYSCLK = 3MHz
Deep Sleep Mode, VDD= 1.8 V to 3.6 V						
IDD15	WDT with WC0on	–	1.3	–	μA	T = 25 °C, VDD= 3.3 V
IDD16	WDT with WC0on	–	–	–	μA	T = – 40 °C to 85 °C
Deep Sleep Mode, VDD= 3.6 V to 5.5 V						
IDD17	WDT with WC0on	–	–	–	μA	T = 25 °C, VDD= 5 V
IDD18	WDT with WC0on	–	–	–	μA	T = – 40 °C to 85 °C

TABLE 7 DC SPECIFICATION

Deep Sleep Mode, VDD= 1.71 V to 1.89 V (Regulator Bypassed)						
I _{DD19}	WDT with WCOon	-	-	-	μA	T = 25 °C
I _{DD20}	WDT with WCOon	-	-	-	μA	T = -40 °C to 85 °C
Hibernate Mode, VDD = 1.8 V to 3.6 V						
I _{DD21}	GPIOand reset active	-	150	-	nA	T = 25 °C, VDD= 3.3 V
I _{DD22}	GPIOand reset active	-	-	-	nA	T = -40 °C to 85 °C
Stop Mode, VDD= 1.8 to 3.6 V						
I _{DD23}	Stop mode current (VDD)	-	20	-	nA	T = 25 °C, VDD= 3.3 V
I _{DD24}	Stop mode current (VDDR)	-	40	-	nA	T = 25 °C, VDDR= 3.3 V

TABLE 8 AC SPECIFICATIONS

Parameter	Description	Min	Typ	Max	Units	Details/Condi tions
F _{CPU}	CPU frequency	DC	-	48	MHz	VDD=1.71V to 5.5V
T _{SLEEP}	Wakeup from Sleep mode		0		μs	Guaranteed by characterizatio n
T _{DEEPSLEEP}	Wakeup from Deep Sleep mode	-	-	25	μs	24 MHz IM. Guaranteed by characterizatio n
T _{HIBERNATE}	Wakeup from Hibernate mode	-	-	2	ms	Guaranteed by characterizatio n
T _{STOP}	Wakeup from Stop mode	-	-	2	ms	Guaranteed by characterizatio n

GPIO Electrical Specifications

TABLE 9 GPIO DC SPECIFICATIONS

Parameter	Description	Min	Typ	Max	Units	Details/Condi tions
V _{IH}	Input voltage HIGH threshold	0.7* VDD	-	-	V	CMOS input

TABLE 9 GPIO DC SPECIFICATIONS

V _{IL}	Input voltage LOW threshold		–	0.3* VDD	V	CMOS input
V _{IH}	LVTTL input, VDD < 2.7 V	0.7* VDD	–	–	V	–
V _{IL}	LVTTL input, VDD < 2.7 V		–	0.3* VDD	V	–
V _{IH}	LVTTL input, VDD ≥ 2.7 V	2.0	–	–	V	–
V _{IL}	LVTTL input, VDD ≥ 2.7 V		–	0.8	V	–
V _{OH}	Output voltage HIGH level	VDD–0.6	–	–	V	I _{oh} = 4 mA at VDD = 3.3
V _{OH}	Output voltage HIGH level	VDD–0.5	–	–	V	I _{oh} = 1 mA at VDD = 1.8
V _{OL}	Output voltage LOW level	–	–	0.6	V	I _{oh} = 8 mA at VDD = 3.3
V _{OL}	Output voltage LOW level	–	–	0.6	V	I _{oh} = 4 mA at VDD = 1.8
V _{OL}	Output voltage LOW level	–	–	0.4	V	I _{oh} = 3 mA at VDD = 3.3
R _{pullup}	Pull-up resistor	3.5	5.6	8.5	k Ω	–
R _{pulldown}	Pull-down resistor	3.5	5.6	8.5	k Ω	–
I _{IL}	Input leakage current (absolute value)	–	–	2	nA	25 ° C, VDD = 3.3 V
I _{IL_CTBm}	Input leakage on CTBm input	–	–	4	nA	–
C _{IN}	Input capacitance	–	–	7	pF	–
V _{hysttl}	Input hysteresis LVTTL	25	40		mV	VDD > 2.7 V
V _{hyscmos}	Input hysteresis CMOS	0.05* VDD	–	–	mV	–
I _{diode}	Current through protection diode to VDD/VSS	–	–	100	μA	–
I _{TOT_GPIO}	Maximum total source or sink chip current	–	–	200	mA	–

TABLE 10 GPIO AC SPECIFICATIONS

Parameter	Description	Min	Typ	Max	Units	Details/Conditions
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TABLE 9 GPIO DC SPECIFICATIONS

TRISET	Rise time in Fast-Strong mode	2		12	ns	3.3 V VDDD, CLOAD= 25 pF
TFALLF	Fall time in Fast-Strong mode	2		12	ns	3.3 V VDDD, CLOAD= 25 pF
TRISES	Rise time in Slow-Strong mode	10		60	ns	3.3 V VDDD, CLOAD= 25 pF
TFALLS	Fall time in Slow-Strong mode	10		60	ns	3.3 V VDDD, CLOAD= 25 pF
FGPIOUT1	GPIO Fout; 3.3 V=<VDD <=5.5 V. Fast-Strong mode	–	–	33	MHz	90/10%, 25-pF load, 60/40 duty cycle
FGPIOUT2	GPIO Fout; 1.7 V=<VDD <=3.3 V. Fast-Strong mode	–	–	16.7	MHz	90/10%, 25-pF load, 60/40 duty cycle
FGPIOUT3	GPIO Fout; 3.3 V=<VDD <=5.5 V. Slow-Strong mode	–	–	7	MHz	90/10%, 25-pF load, 60/40 duty cycle
FGPIOUT4	GPIO Fout; 1.7 V=<VDD <=3.3 V. Slow-Strong mode	–	–	3.5	MHz	90/10%, 25-pF load, 60/40 duty cycle
FGPIOIN	GPIO input operating frequency; 1.71 V=<VDD<=5.5 V	–	–	48	MHz	90/10% VIO

SAR ADC Electrical Specifications

TABLE 11 SAR ADC DC SPECIFICATIONS

Parameter	Description	Min	Typ	Max	Units	Details/Conditions
A_RES	Resolution	–	–	12	位	
A_CHNIS_S	Number of channels – single-ended	–	–	8		8 full-speed
A-CHNKS_D	Number of channels – differential	–	–	4		Diff inputs use neighboring I/O
A-MONO	Monotonicity	–	–	–		Yes
A_GAINERR	Gain error		–	±0.1	%	With external reference

TABLE 11 SAR ADC DC SPECIFICATIONS

A_OFFSET	Input offset voltage	–	–	2	mV	Measured with 1-V VREF
A_ISAR	Current consumption	–	–	1	mA	–
A_VINS	Input voltage range – single-ended	VSS	–	VDDA	V	–
A_VIND	Input voltage range – differential	VSS	–	VDDA	V	–
A_INRES	Input resistance	–	–	2.2	k Ω	–
A_INCAP	Input capacitance	–	–	10	pF	–
VREFSAR	Trimmed internal reference to SAR	–1	–	1	%	Percentage of Vbg(1.024-V)

TABLE 12 SAR AC SPECIFICATIONS

Parameter	Description	Min	Typ	Max	Units	Details/Conditions
A_PSRR	Power supply rejection ratio	70	–	–	dB	Measured at 1-V reference
A_CMRR	Common mode rejection ratio	66	–	–	dB	–
A_samp	Sample rate	–	–	1	Msp/s	Sample rate at 806 Ksp/s
Fsarintref	SAR operating speed without external ref. Bypass	–	–	100	Ksp/s	12-bit resolution
A_snr	Signal-to-noise ratio (SNR)	65	–	–	dB	F _{in} = 10 kHz
A_bw	Input bandwidth without aliasing	–	–	A_samp/2	kHz	
A_inl	Integral non linearity. V _{DD} = 1.71 to 5.5 V, 1 Msp/s	–1.7	–	2	LSB	V _{ref} = 1 V to V _{DD}
A_INL	Integral non linearity. V _{DDD} = 1.71 to 3.6 V, 1 Msp/s	–1.5	–	1.7	LSB	V _{ref} = 1.71 V to V _{DD}
A_INL	Integral non linearity. V _{DD} = 1.71 to 5.5 V, 500 Ksp/s	–1.5	–	1.7	LSB	V _{ref} = 1 V to V _{DD}

TABLE 11 SAR ADC DC SPECIFICATIONS

A_DNL	Differential non linearity. $V_{DD} = 1.71$ to 5.5 V, 1 Msps	-1	-	2.2	LSB	$V_{ref} = 1 \text{ V}$ to VDD
A_DNL	Differential non linearity. $V_{DD} = 1.71$ to 3.6 V, 1 Msps	-1	-	2	LSB	$V_{ref} = 1.71 \text{ V}$ to VDD
A_DNL	Differential non linearity. $V_{DD} = 1.71$ to 5.5 V, 500 Ksps	-1	-	2.2	LSB	$V_{ref} = 1 \text{ V}$ to VDD
A_thd	Total harmonic distortion	-	-	-65	dB	$F_{in} = 10 \text{ kHz}$

Fixed I2C Electrical Specifications

TABLE 13 FIXED I2C DC SPECIFICATIONS

Parameter	Description	Min	Typ	Max	Units	Details/Conditions
I _{I2C1}	Block current consumption at 100 kHz	-	-	50	μA	-
I _{I2C2}	Block current consumption at 400 kHz	-	-	155	μA	-
I _{I2C3}	Block current consumption at 1 Mbps	-	-	390	μA	-
I _{I2C4}	I ² C enabled in Deep Sleep mode	-	-	1.4	μA	-

TABLE 14 FIXED I2C AC SPECIFICATIONS

Parameter	Description	Min	Typ	Max	Units	Details/Conditions
F _{I2C1}	Bit rate	-	-	1	Mbps	-

Fixed UART Electrical Specifications

TABLE 15 FIXED UART DC SPECIFICATIONS

Parameter	Description	Min	Typ	Max	Units	Details/Conditions
I _{UART1}	Block current consumption at 100 kbps	-	-	55	μA	-
I _{UART2}	Block current consumption at 1000 kbps	-	-	312	μA	-

TABLE 16 FIXED UART AC SPECIFICATIONS

Parameter	Description	Min	Typ	Max	Units	Details/Conditions
FUART	Bit rate	–	–	1	Mbps	–

BLE Subsystem Electrical Specifications

TABLE 17 BLE SUBSYSTEM ELECTRICAL SPECIFICATIONS

Parameter	Description	Min	Typ	Max	Units	Details/Conditions
RXS、IDLE	RX sensitivity with idle transmitter	–	–89	–	dBm	–
	RX sensitivity with idle transmitter excluding Balun loss	–	–91	–	dBm	Guaranteed by design simulation
RXS、DIRTY	RX sensitivity with dirty transmitter	–	–87	–70	dBm	RF-PHY Specification (RCV-LE/CA/01/C)
RXS、HIGHGAIN	RX sensitivity in high-gain mode with idle transmitter	–	–91	–	dBm	–
PRXMAX	Maximum input power	–10	–1	–	dBm	RF-PHY Specification (RCV-LE/CA/06/C)
CI1	Co-channel interference, Wanted signal at –67 dBm and Inter-ferer at FRX	–	9	21	dB	RF-PHY Specification (RCV-LE/CA/03/C)
CI2	Adjacent channel interference Wanted signal at –67 dBm and Inter-ferer at FRX ± 1 MHz	–	3	15	dB	RF-PHY Specification (RCV-LE/CA/03/C)
CI3	Adjacent channel interference Wanted signal at –67 dBm and Inter-ferer at FRX ± 2 MHz	–	–29	–	dB	RF-PHY Specification (RCV-LE/CA/03/C)

TABLE 17 BLE SUBSYSTEM ELECTRICAL SPECIFICATIONS

CI4	Adjacent channel interference Wanted signal at -67 dBm and Inter-ferer at FRX ± 3 MHz	-	-39	-	dB	RF-PHY Specification (RCV-LE/CA/03/C)
CI5	Adjacent channel interference Wanted Signal at -67 dBm and Inter-ferer at Image frequency (F_{IMAGE})	-	-20	-	dB	RF-PHY Specification (RCV-LE/CA/03/C)
CI6	Adjacent channel interference Wanted signal at -67 dBm and Inter-ferer at Image frequency ($F_{\text{IMAGE}} \pm 1$ MHz)	-	-30	-	dB	RF-PHY Specification (RCV-LE/CA/03/C)
OBB1	Out-of-band blocking, Wanted signal at -67 dBm and Inter-ferer at $F = 30 - 2000$ MHz	-30	-27	-	dBm	RF-PHY Specification (RCV-LE/CA/04/C)
OBB2	Out-of-band blocking, Wanted signal at -67 dBm and Inter-ferer at $F = 2003 - 2399$ MHz	-35	-27	-	dBm	RF-PHY Specification (RCV-LE/CA/04/C)
OBB3	Out-of-band blocking, Wanted signal at -67 dBm and Inter-ferer at $F = 2484 - 2997$ MHz	-35	-27	-	dBm	RF-PHY Specification (RCV-LE/CA/04/C)
OBB4	Out-of-band blocking, Wanted signal a -67 dBm and Inter-ferer at $F = 3000 - 12750$ MHz	-30	-27	-	dBm	RF-PHY Specification (RCV-LE/CA/04/C)
IMD	Intermodulation performance Wanted signal at -64 dBm and 1-Mbps BLE, third, fourth, and fifth offset channel	-50	-	-	dBm	RF-PHY Specification (RCV-LE/CA/04/C)

TABLE 17 BLE SUBSYSTEM ELECTRICAL SPECIFICATIONS

RXSE1	Receiver spurious emission 30 MHz to 1.0 GHz	–	–	–57	dBm	100-kHz measurement bandwidth ETSI EN300 328 V1.8.1
RXSE2	Receiver spurious emission 1.0 GHz to 12.75 GHz	–	–	–47	dBm	100-kHz measurement bandwidth ETSI EN300 328 V1.8.1
RF Transmitter Specifications						
TXP、ACC	RF power accuracy	–	–	± 4	dB	
TXP、RANGE	RF power control range	–	20	–	dB	–
TXP, 0dBm	Output power, 0-dB Gain setting (PA7)	– 4	0	3	dBm	–
TXP、MAX	Output power, maximum power setting (PA10)	–1	3	6	dBm	–
TXP, MIN	Output power, minimum power setting (PA1)	–	–18	–	dBm	–
F2AVG	Average frequency deviation for 10101010 pattern	185	–	–	kHz	RF-PHY Specification (TRM-LE/CA/05/C)
F1AVG	Average frequency deviation for 11110000 pattern	225	250	275	kHz	RF-PHY Specification (TRM-LE/CA/05/C)
E0	Eye opening = $\Delta F_{2AVG} \Delta F_{1AVG}$	0.8	–	–		RF-PHY Specification (TRM-LE/CA/05/C)
FTX, ACC	Frequency accuracy	–150	–	150	kHz	RF-PHY Specification (TRM-LE/CA/06/C)
FTX、MAXDR	Maximum frequency drift	–50	–	50	kHz	RF-PHY Specification (TRM-LE/CA/06/C)

TABLE 17 BLE SUBSYSTEM ELECTRICAL SPECIFICATIONS

FTX、INITDR	Initial frequency drift	-20	-	20	kHz	RF-PHY Specification (TRM-LE/CA/06/C)
FTX, DR	Maximum drift rate	-20	-	20	kHz/ 50μs	RF-PHY Specification (TRM-LE/CA/06/C)
IBSE1	In-band spurious emission at 2-MHz offset	-	-	-20	dBm	RF-PHY Specification (TRM-LE/CA/03/C)
IBSE2	In-band spurious emission at ≥ 3 -MHz offset	-	-	± 3	dBm	RF-PHY Specification (TRM-LE/CA/03/C)
TXSE1	Transmitter spurious emissions (average), <1.0 GHz	-	-	-55.5	dBm	FCC-15.247
TXSE2	Transmitter spurious emissions (average), <1.0 GHz	-	-	-41.5	dBm	FCC-15.247
RF Current Specifications						
IRX	Receive current in normal mode	-	18.7	-	mA	-
IRX_RF	Radio receive current in normal mode	-	16.4	-	mA	Measured at V_{DDR}
IRX、HIGHGAIN	Receive current in high-gain mode	-	21.5	-	mA	-
ITX, 3dBm	TX current at 3-dBm setting (PA10)	-	20	-	mA	-
ITX, 0dBm	TX current at 0-dBm setting (PA7)	-	16.5	-	mA	-
ITX_RF, 0dBm	Radio TX current at 0 dBm setting (PA7)	-	15.6	-	mA	Measured at V_{DDR}
ITX_RF, 0dBm	Radio TX current at 0 dBm excluding Balun loss	-	14.2	-	mA	Guaranteed by design simulation
ITX, -3dBm	TX current at -3-dBm setting (PA4)	-	15.5	-	mA	-

TABLE 17 BLE SUBSYSTEM ELECTRICAL SPECIFICATIONS

ITX, -6dBm	TX current at -6-dBm setting (PA3)	-	14.5	-	mA	-
ITX, -12dBm	TX current at -12-dBm setting (PA2)	-	13.2	-	mA	-
ITX, -18dBm	TX current at -18-dBm setting (PA1)	-	12.5	-	mA	-
Iavg_1sec, 0dBm	Average current at 1-second BLE connection interval	-	18.9	-	μA	TXP: 0 dBm; ±20-ppm master and slave clock accuracy.
Iavg_4sec, 0dBm	Average current at 4-second BLE connection interval	-	6.25	-	μA	TXP: 0 dBm; ±20-ppm master and slave clock accuracy.
General RF Specifications						
FREQ	RF operating frequency	2400	-	2482	MHz	-
CHBW	Channel spacing	-	2	-	MHz	-
DR	On-air data rate	-	1000	-	kbps	-
IDLE2TX	BLE. IDLE to BLE. TX transition time	-	120	140	μs	-
IDLE2RX	BLE. IDLE to BLE. RX transition time	-	75	120	μs	-
RSSI Specifications						
RSSI、ACC	RSSI accuracy	-	±5	-	dB	-
RSSI、RES	RSSI resolution	-	1	-	dB	-
RSSI、PER	RSSI sample period	-	6	-	μs	-

FCC WARNING

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.

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

NOTE: 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.

To maintain compliance with FCC's RF Exposure guidelines, This equipment should be installed and operated with minimum distance between 20cm the radiator your body: Use only the supplied antenna.

This module meets the requirements of FCC part 15C(15.247).it specifically establish the 6dB Bandwidth, Peak Output Power, Radiated Spurious Emission, Power Spectral Density, Restricted Band of Operation and Band Edge ,Out of Band Emissions. It is a single module. PCB antenna, The antenna cannot be removed , Unconventional interface, The module with trace antenna designs, and This manual has been shown the layout of trace design,, antenna, connectors, and isolation requirements.

This module is Mobile device, It's complies with FCC RF radiation exposure limits set forth for an uncontrolled environment, This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body." This module is designed to comply with the FCC statement, FCC ID is: 2AUCD-AKTCM01.

The host system using this module, should have label in a visible area indicated the following texts: "Contains FCC ID: 2AUCD-AKTCM01.

Hangzhou Qi Chu Intelligent Technology Co., Ltd can increase the utility of our modular transmitters by providing instructions that simulates or characterizes a connection by enabling a transmitter.

The module without unintentional-radiator digital circuitry, so the module does not require an evaluation by FCC Part 15 Subpart B. The host shoule be evaluated by the FCC Subpart B.