
BK3432 Bluetooth Dual Mode SoC

Classic and Low Energy



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implementation may differ.*

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1 General Description

1.1 Overview

The BK3432 chip is a highly integrated Bluetooth 4.2 dual mode with 2 Mbps data rate option. It integrates a high-performance RF transceiver, baseband, ARM9E core, rich feature peripheral units, programmable protocol and profile to support BLE application. The Flash program memory makes it suitable for customized applications.

The BK3432 is designed with advanced technology process and integrated with switch DCDC regulator, that it has ultra-low power consumption and ultra-low leakage power. The embedded high order interference suppression filter and fast automatic gain control logic make it work well in high interference environment.

1.2 Block Diagram

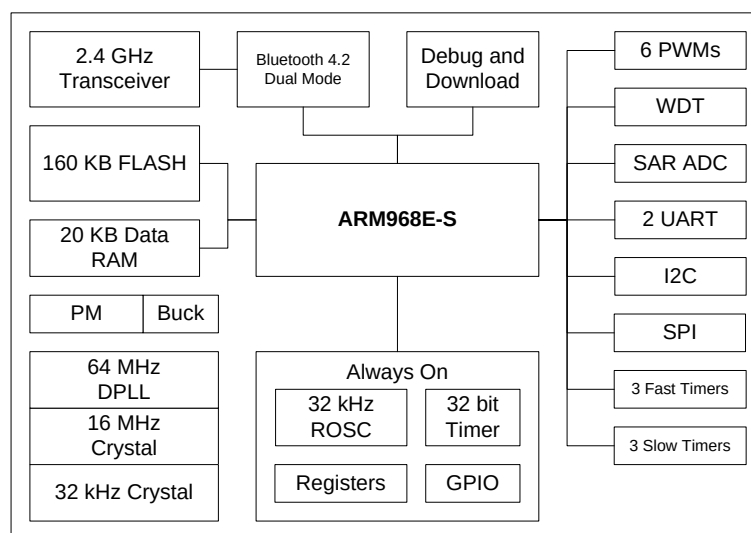


Figure 1 BK3432 Block Diagram

1.3 Features

- Bluetooth® SIG Bluetooth Dual Mode 4.2 compliant
- Low-power 2.4GHz Transceiver
- ARM968E Core Microprocessor integrated
- 160 KB programmable Flash for Program and 20 KB RAM for Data
- Program code read protection
- Operation voltage from 0.9 V to 3.6 V
- Clock
 - 16 MHz crystal reference clock
 - 64 MHz digital PLL clock
 - 32 kHz ring oscillator
 - External 32 kHz crystal oscillator
 - MCU can run with any clock source with internal frequency divider
- Interface and peripheral units
 - JTAG, I2C, SPI interface
 - Two UART interface
 - Multi-channels PWM output
 - On-chip 10 bit general ADC
 - GPIO with multiplexed interface functions
 - True random number generator
- Typical Package Type
 - 32-pin QFN 4x4

2 PIN information

2.1 QFN32

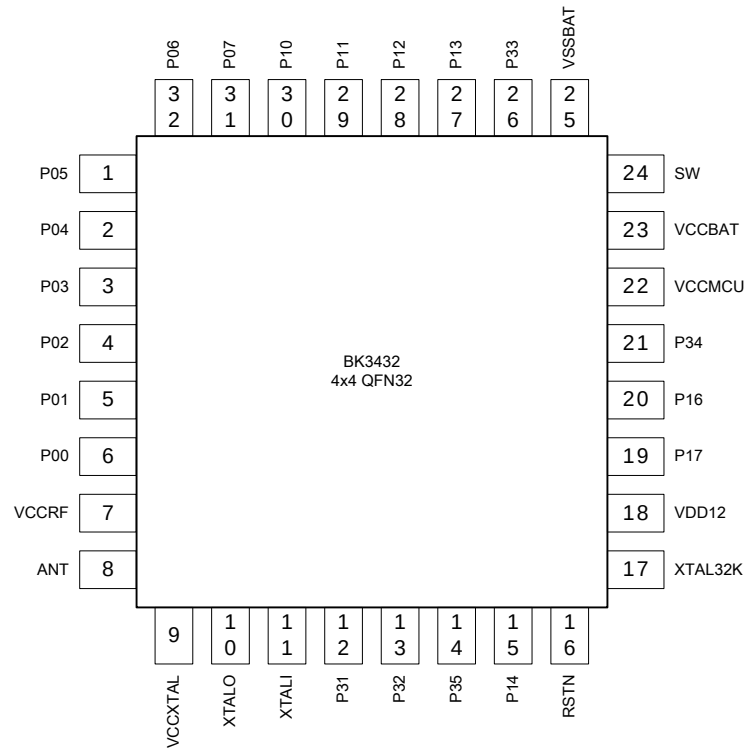


Figure 2 BK3432 QFN32 pin assignment

Table 1 BK3432 QFN32 Pin Description

PIN	Name	Pin Function	Description
1	P05	Digital I/O	General purpose IO
2	P04	Digital I/O	General purpose IO
3	P03	Digital I/O	General purpose IO
4	P02	Digital I/O	General purpose IO
5	P01	Digital I/O	General purpose IO
6	P00	Digital I/O	General purpose IO
7	VCCRF	Power	RF power, 1.5 V
8	ANT	RF	RF signal port

9	VCCXTAL	Power	Crystal power, 1.5 V
10	XTALO	Analog	16 MHz crystal output
11	XTALI	Analog	16 MHz crystal input
12	P31	Digital I/O	General purpose IO
13	P32	Digital I/O	General purpose IO
14	P35	Digital I/O	General purpose IO
15	P14	Digital I/O	General purpose IO
16	RSTN	Analog	Active low pin reset
17	XTAL32K	Analog	32 kHz Crystal input
18	VDD12	Analog	LDO output, 1.5 V
19	P17	Digital I/O	General purpose IO
20	P16	Digital I/O	General purpose IO
21	P34	Digital I/O	General purpose IO
22	VCCMCU	Power	Power, 1.5
23	VCCBAT	Analog	Power, 3 V
24	SW	Analog	Switch regulator pin for two battery mode
25	VSSBAT	Analog	Ground
26	P33	Digital I/O	General purpose IO
27	P13	Digital I/O	General purpose IO
28	P12	Digital I/O	General purpose IO
29	P11	Digital I/O	General purpose IO
30	P10	Digital I/O	General purpose IO
31	P07	Digital I/O	General purpose IO
32	P06	Digital I/O	General purpose IO

3 Functional Description

3.1 GPIO

The BK3432 QFN32 has totally 20 GPIO pins, which can be configured as either input or output. There are secondary functions available for GPIO pins and configurable by firmware.

At the beginning of the chip starts up, the chip will enter programming mode, JTAG mode or normal according received command from Mode Selecting Pin.

Table 2 BK3432 GPIO function mapping

	Description		I/O	PROGRAM Mode	Mode Selection Pin	Jtag mode
P00	UART1	UART_TX	O			
P01		UART_RX	I			
P02	I2C	SCL	I/O			
P03		SDA	I/O			JTAG_NTRST
P04	SPI	SPI_SCK	I/O	SPI_MOSI	SPI_MOSI	JTAG_TDI
P05		SPI_MOSI	I/O	SPI_MISO	SPI_MISO	JTAG_TDO
P06		SPI_MISO/PWM[4]	I/O	SPI_SCK	SPI_SCK	JTAG_TCK
P07		SPI_NSS/PWM[5]	I/O	SPI_CS	SPI_CS	JTAG_TMS
P10	PWM	PWM[0] (20mA)	O			
P11		PWM[1] (20mA)	O			
P12		PWM[2]	O			
P13		PWM[3]	O			
P14		PWM[4]				
P16	UART2	UART2_TX	O			
P17		UART2_RX	O			
P31		Ch1	I			
P32		Ch2	I			
P33		Ch3				
P34		Ch4	I			
P35		Ch5	I			

Each GPIO pin can be the source to wake up MCU from shut down state. In the shutdown state, any voltage level change on the pre-configured GPIO pin will trigger the wake-up procedure.

3.2 Timers

3.2.1 PWM Timers

There are six 16 bits PWM timers. The clock of PWM timers can be selected as 32 KHz clock or 16 MHz clock by register.

There are two modes of PWM timers. One is timer mode and another is PWM mode. The timer mode can generate interrupt to MCU. The PWM mode can generate PWM waveform and output to GPIO pins to drive external device such as LED. Six GPIO pins can be used to output PWM waveform separately.

3.2.2 Watch dog timer and RTC timer

The watch dog timer and RTC timer run on the always on power domain, whose clock source is 32 kHz clock.

The 16 bits watch dog timer runs with 4 kHz frequency that its period can be up to 16 second. After watch dog timer is expired, it will reset the whole chip.

The 32 bits RTC timer in always on power domain run with ROSC frequency that its period can be up to one day. After RTC timer is expired, it will wake up the MCU.

3.3 ADC

A 10-bit generic ADC is integrated in BK3432. Total five external channels and one internal channel can be selected for ADC transfer. It supports both single and continuous mode.

ADC Channel Number	ADC Source
Channel 1	GPIO31
Channel 2	GPIO32
Channel 3	GPIO33
Channel 4	GPIO34
Channel 5	GPIO35
Channel 7	VCCBAT-pin

3.4 UART, I2C and SPI

There are two set UARTs, one set I2C and one set SPI interface, which support both master and slave mode.

The UART baud rate can be up to 3.2 MHz, and the SPI clock speed can be up to 4 MHz.

3.5 Security

There is a true random number generator to make system get better security communcation.

The FLASH content will be protected (not readable, but erasable) as long as the LSB bit 3 or bit 5 of the last 32-bit word of last address 0x9FFF is write to zero.

4 Electrical Specifications

Table 3 BK3432 RF Characteristics

Name	Parameter (Condition)	Min	Typical	Max	Unit	Comment
Operating Condition						
VCC	Voltage	0.9	3.0	3.6	V	
TEMP	Temperature	-40	+27	+125	°C	
Digital input Pin						
VIH	High level	VCC-0.3		VCC+0.3	V	
VIL	Low level	VSS		VSS+0.3	V	
Digital output Pin						
VOH	High level (IOH=-0.25mA)	VCC- 0.3		VCC	V	
VOL	Low level(IOL=0.25mA)	VSS		VSS+0.3	V	
Normal condition						
IVDD	Deep sleep		0.5		uA	
IVDD	Sleep current (RF OFF, 32 kHz clock, DIG Retention)		1.8		uA	
IVDD	Active RX (3.3 V)		5.1		mA	With DCDC regulator
IVDD	Active TX @ -1 dBm (3.3 V)		4.8		mA	With DCDC regulator
Normal RF condition						
FOP	Operating frequency	2400		2480	MHz	
FXTAL	Crystal frequency		16		MHz	
RFSK	Air data rate		1	2	Mbps	
Transmitter (1 Mbps mode)						
PRF	Output power	-20	-1	+4	dBm	
PBW	Modulation 20 dB bandwidth			1	MHz	
PRF1	Out of band emission 2 MHz		-20		dB	



BK3432 Datasheet

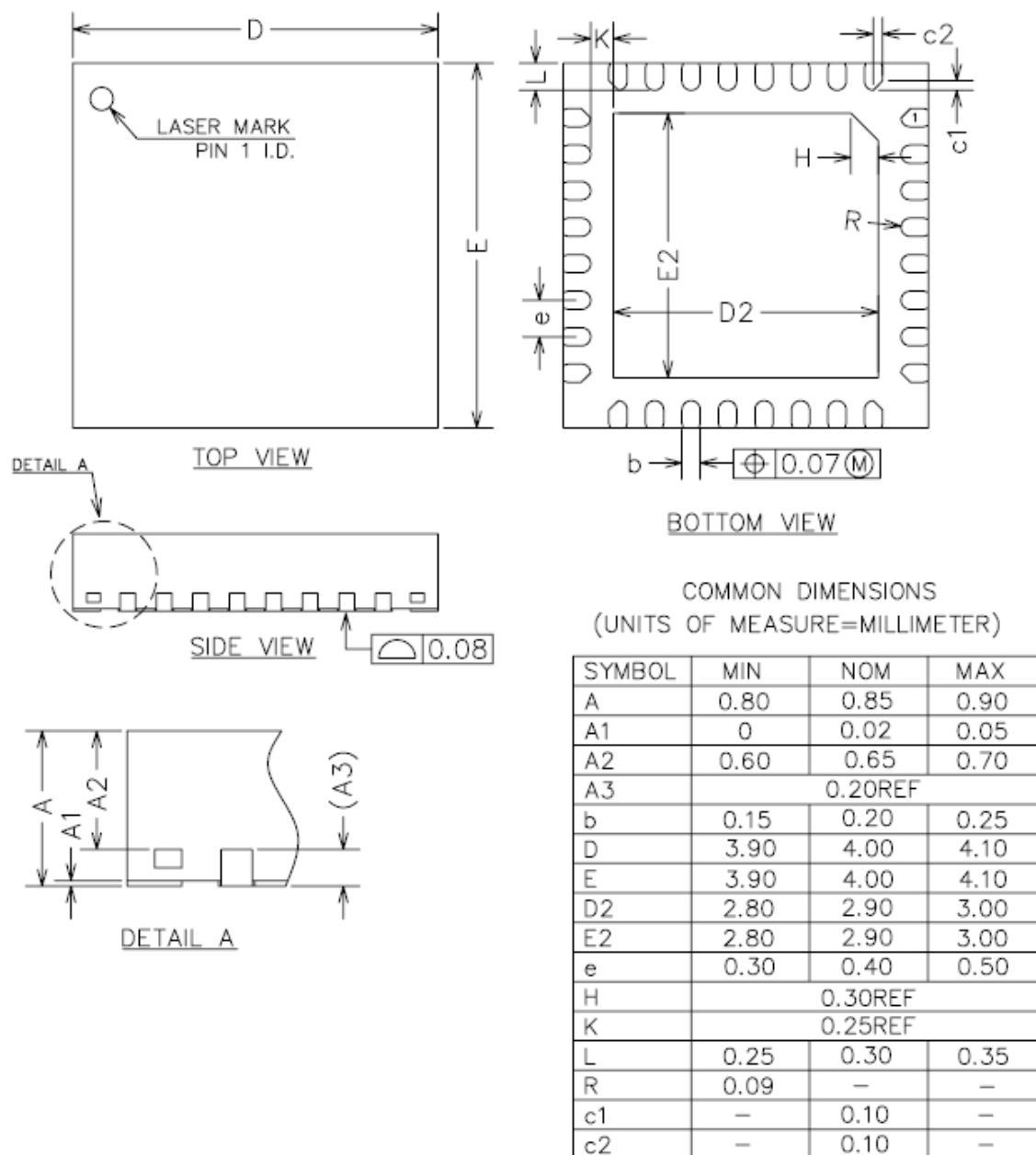
V 0.1

PRF2	Out of band emission 3 MHz		-58		dB	
Dev	Transmit FM deviation	115	250	300	kHz	
Drift	Transmit drift in any position			400	Hz/us	
Receiver BLE Mode (Classic Mode is to be provided)						
Max Input	1 E-3 BER		-10		dBm	
RXSENS	1 E-3 BER sensitivity		-96	-97	dBm	
Intermodulation	Pin=-64 dBm; Punwant=-50 dBm; f0=2f1-f2, f2-f1=3 MHz or 4 MHz or 5 MHz		-25	-22	dBm	
C/ICO	Co-channel C/I		7		dB	
C/I1ST	ACS C/I 1MHz	-9		-6	dB	
C/I2ND	ACS C/I 2MHz		-44		dB	
C/I3RD	ACS C/I 3MHz		-50		dB	
C/I1STI	ACS C/I Image channel		-25		dB	
C/I2NDI	ACS C/I 1 MHz □adjacent to image channel		-35		dB	
Block	Block @ 2399,and 2484		-15		dBm	
Block	Block @ 2 GHz and 3 GHz		-15		dBm	
Leakage	Leakage @ < 1GHz		-71		dBm	
Leakage	Leakage @ >1GHz		-56		dBm	

5 Package Information

5.1 QFN 4x4 32-Pin

The BK3432 32-Pin uses the 4mmx4mm QFN package.





6 Order Information

Part number	Package	Packing	Minimum Order Quantity
BK3432QN32B	QFN 4mmx4mm 32-Pin	Tape Reel	3K

Revision History

Version	Date	Author(s)	Description
0.1	12/Mar/2017	WF	Initial

Host Product Manufacturer You need to evaluate the host as Part 15B

NOTICE:

- ◆ please keep this product and accessories attached to the places which children can't touch;
- ◆ do not splash water or other liquid onto this product, otherwise it may cause damage;
- ◆ do not put this product near the heat source or direct sunlight, otherwise it may cause deformation or malfunction;
- ◆ please keep this product away from flammable or naked flame;
- ◆ please do not repair this product by yourself. Only qualified personnel can be repaired.

FCC WARNING

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

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.

This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.

15.105 Information to the user.

(b) For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

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.

This equipment complies with FCC 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.

Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

The availability of some specific channels and/or operational frequency bands are country dependent and are firmware programmed at the factory to match the intended destination.

The firmware setting is not accessible by the end user.

The final end product must be labelled in a visible area with the following:

“Contains Transmitter Module FCC ID: REY-BK3432”

Requirement per KDB996369 D03**2.2 List of applicable FCC rules**

List the FCC rules that are applicable to the modular transmitter. These are the rules that specifically establish the bands of operation, the power, spurious emissions, and operating fundamental frequencies.

DO NOT list compliance to unintentional-radiator rules (Part 15 Subpart B) since that is not a condition of a module grant that is extended to a host manufacturer. See also Section 2.10 below concerning the need to notify host manufacturers that further testing is required.³

Explanation: This module meets the requirements of FCC part 15C(15.247).

2.3 Summarize the specific operational use conditions

Describe use conditions that are applicable to the modular transmitter, including for example any limits on antennas, etc. For example, if point-to-point antennas are used that require reduction in power or compensation for cable loss, then this information must be in the instructions. If the use condition limitations extend to professional users, then instructions must state that this information also extends to the host manufacturer's instruction manual. In addition, certain information may also be needed, such as peak gain per frequency band and minimum gain.

Explanation: The module has a PCB antenna with an antenna gain of 3.29 dBi, and is used mainly in socket conditions.

2.4 Limited module procedures

If a modular transmitter is approved as a “limited module,” then the module manufacturer is responsible for approving the host environment that the limited module is used with. The manufacturer of a limited module must describe, both in the filing and in the installation instructions, the alternative means that the limited module manufacturer uses to verify that the host meets the necessary requirements to satisfy the module limiting conditions.

A limited module manufacturer has the flexibility to define its alternative method to address the conditions that limit the initial approval, such as: shielding, minimum signaling amplitude, buffered modulation/data inputs, or power supply regulation. The alternative method could include that the limited module manufacturer reviews detailed test data or host designs prior to giving the host manufacturer approval.

This limited module procedure is also applicable for RF exposure evaluation when it is necessary to demonstrate compliance in a specific host. The module manufacturer must state how control of the product into which the modular transmitter will be installed will be maintained such that full compliance of the product is always ensured. For additional hosts other than the specific host originally granted with a limited module, a Class II permissive change is required on the module grant to register the additional host as a specific host also approved with the module.

Explanation: The module is not a limited module. It’s a single(full) module.

2.5 Trace antenna designs

For a modular transmitter with trace antenna designs, see the guidance in Question 11 of KDB Publication 996369 D02 FAQ – Modules for Micro-Strip Antennas and traces. The integration information shall include for the TCB review the integration instructions for the following aspects: layout of trace design, parts list (BOM), antenna, connectors, and isolation requirements.

- a) Information that includes permitted variances (e.g., trace boundary limits, thickness, length, width, shape(s), dielectric constant, and impedance as applicable for each type of antenna);
- b) Each design shall be considered a different type (e.g., antenna length in multiple(s) of frequency, the wavelength, and antenna shape (traces in phase) can affect antenna gain and must be considered);
- c) The parameters shall be provided in a manner permitting host manufacturers to design the printed circuit (PC) board layout;
- d) Appropriate parts by manufacturer and specifications;
- e) Test procedures for design verification; and
- f) Production test procedures for ensuring compliance.

The module grantee shall provide a notice that any deviation(s) from the defined parameters of the antenna trace, as described by the instructions, require that the host product manufacturer must notify the module grantee that they wish to change the antenna trace design. In this case, a Class II permissive change application is required to be filed by the grantee, or the host manufacturer can take responsibility through the change in FCC ID (new application) procedure followed by a Class II permissive change application.

Explanation: No, The module has no tracking antenna design, is PCB antenna.

2.6 RF exposure considerations

It is essential for module grantees to clearly and explicitly state the RF exposure conditions that permit a host product manufacturer to use the module. Two types of instructions are required for RF exposure information: (1) to the host product manufacturer, to define the application conditions (mobile, portable – xx cm from a person's body); and (2) additional text needed for the host product manufacturer to provide to end users in their end-product manuals. If RF exposure statements and use conditions are not provided, then the host product manufacturer is required to take responsibility of the module through a change in FCC ID (new application)

Explanation: This module 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: REY-BK3432

2.7 Antennas

A list of antennas included in the application for certification must be provided in the instructions. For modular transmitters approved as limited modules, all applicable professional installer instructions must be included as part of the information to the host product manufacturer. The antenna list shall also identify the antenna types (monopole, PIFA, dipole, etc. (note that for example an "omni-directional antenna" is not considered to be a specific "antenna type")).

For situations where the host product manufacturer is responsible for an external connector, for example with an RF pin and antenna trace design, the integration instructions shall inform the installer that unique antenna connector must be used on the Part 15 authorized transmitters used in the host product. The module manufacturers shall provide a list of acceptable unique connectors.

Explanation: The module has a PCB antenna with an antenna gain of 3.29 dBi.

2.8 Label and compliance information

Grantees are responsible for the continued compliance of their modules to the FCC rules. This includes advising host product manufacturers that they need to provide a physical or

e-label stating "Contains FCC ID" with their finished product. See Guidelines for Labeling and User Information for RF Devices – KDB Publication 784748.

Explanation: The host system using this module, should have label in a visible area indicated the following texts: "Contains FCC ID: REY-BK3432"

2.9 Information on test modes and additional testing requirements

Additional guidance for testing host products is given in KDB Publication 996369 D04 Module Integration Guide. Test modes should take into consideration different operational conditions for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product.

The grantee should provide information on how to configure test modes for host product evaluation for different operational conditions for a stand-alone modular transmitter in a host, versus with multiple, simultaneously transmitting modules or other transmitters in a host.

Grantees can increase the utility of their modular transmitters by providing special means, modes, or instructions that simulates or characterizes a connection by enabling a transmitter. This can greatly simplify a host manufacturer's determination that a module as installed in a host complies with FCC requirements.

Explanation: This testing is performed with the host product configured in typical operational modes to check the fundamental-frequency and spurious emissions for compliance with all the applicable rules. The transmitters can be enabled by using publicly-available drivers and turned on, so the transmitters are active. In certain conditions it might be appropriate to use a technology-specific call box (test set) where accessory devices or drivers are not available. When testing for emissions from the unintentional radiator, the transmitter shall be placed in the receive mode or idle mode, if possible. If receive mode only is not possible then, the radio shall be passive (preferred) and/or active scanning. In these cases, this would need to enable activity on the communication BUS (i.e., PCIe, SDIO, USB) to ensure the unintentional radiator circuitry is enabled.

2.10 Additional testing, Part 15 Subpart B disclaimer

The grantee should include a statement that the modular transmitter is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuitry), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

Explanation: Yes , Warns any Host Product Manufacture that uses this module that Part 15B evaluation of the finished product is still required