

AB5362C

Audio Player Microcontroller

Versions: 0.0.1

2020/08/15

Declaration

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Revision History

Date	Version	Comments	Revised by
2020-08-15	0.0.1	First draft	Leo

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1 Product Features

CPU and Flexible IO

- ✚ 32bit High performance CPU with DSP instruction
- ✚ Program memory: internal 4M bit flash
- ✚ Flexible GPIO pins with Programmable pull-up and pull-down resistors;
- ✚ Support GPIO wakeup or interrupt;

Bluetooth Radio

- ✚ Compliant to Bluetooth 5.0 ;
- ✚ TX output power +2dBm in typical;
- ✚ RX Sensitivity with -90.5dBm @Basic Rate;

FM Tuner

- ✚ Support frequency band 76~108MHz;
- ✚ Auto search tuning;
- ✚ Programmable de-emphasis(50/75uS);
- ✚ Receive signal strength indicator (RSSI);

Audio Interface

- ✚ Audio codec with 16bit stereo DAC and 16bit mono ADC;
- ✚ Support flexible audio EQ adjust;
- ✚ Support Sample rate 8, 11.025, 12, 16, 22.05, 32, 44.1 and 48KHz;
- ✚ 4 channel Analog MUX;
- ✚ One channel MIC amplifier input;
- ✚ High performance mono audio ADC with 90dB SNR;

- ✚ High performance audio DAC with 96dB SNR, with headphone amplifier output;

Peripheral and Interfaces

- ✚ Three 32-bit timers;
- ✚ Three multi-function 32-bit timers, support Capture and PWM mode;
- ✚ WatchDog;
- ✚ Three full-duplex UART;
- ✚ SPI;
- ✚ IR controller;
- ✚ SD Card Host controller;
- ✚ Full speed USB 2.0 HOST/DEVICE controller;
- ✚ Sixteen Channels 10-bit SARADC;
- ✚ Build in PMU, such as LDO;

Package

- ✚ QFN32L;

Temperature

- ✚ Operating temperature: -40℃ to +85℃;
- ✚ Storage temperature: -65℃ to +150℃ ;

2 Package Definition

2.1 Pin Assignment

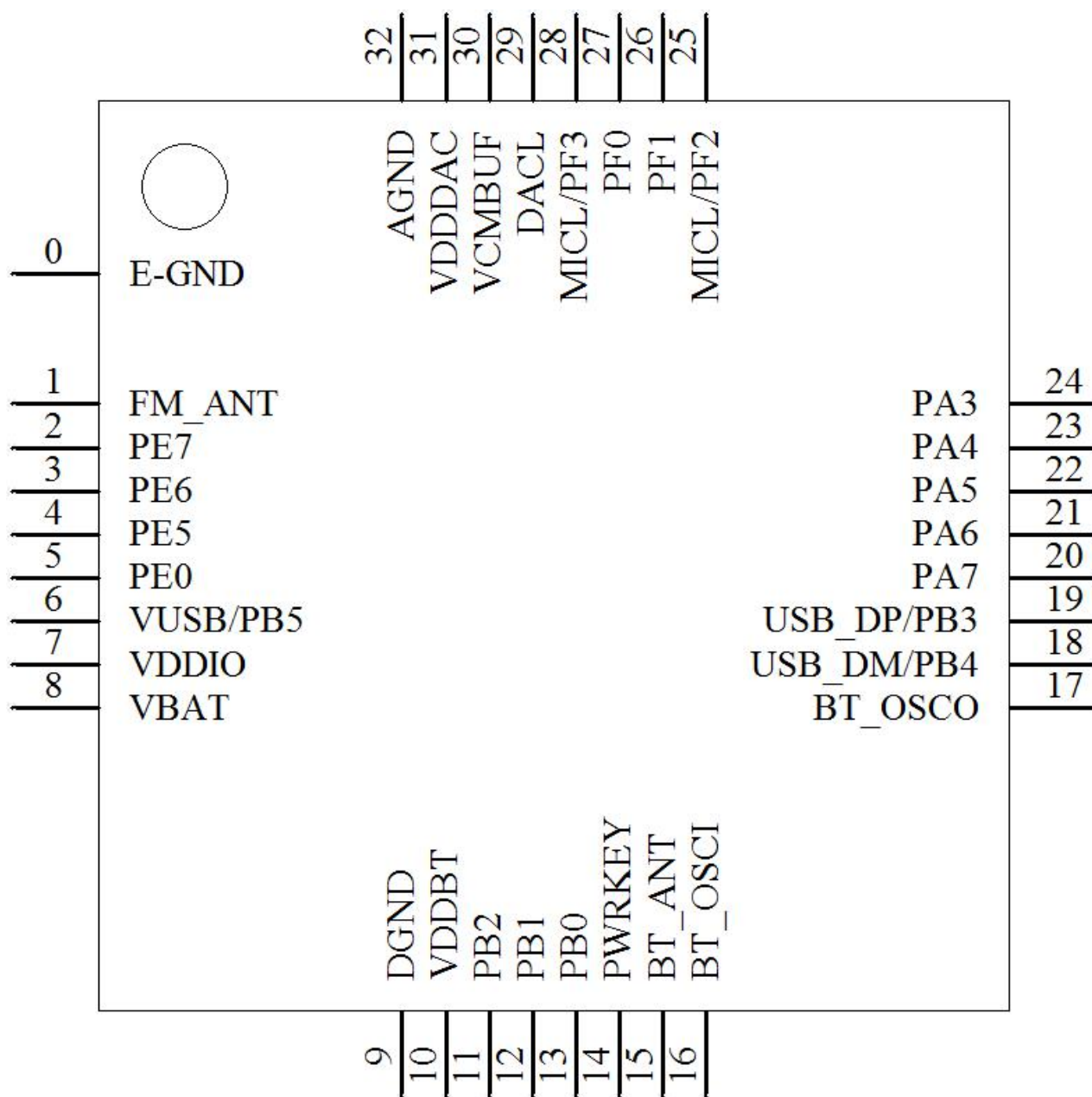


Figure 2- 1 Pin assignment for QFN32L

2.2 Pin Descriptions

Table 2- 1 QFN32L pin description

Pin No.	Name	Type	Function
1	FM_ANT	A	FMRX ANT
2	PE7	I/O	ADC9 AUXR2 SDDAT0-G3 SPI1DO-G4 TX0-G4 HSTRX-G4 PWM2-T4-G1 TMR4CAP-G1/IR-G8 IISMCLK-G2 PE7
3	PE6	I/O	ADC8 AUXL2 SDCLK-G3 SPI1CLK-G4 RX0-G4 HSTRX-G9 FMOSC-G6 PWM1-T4-G1 TMR3CAP-G7/IR-G7 IISLRCLK-G2 PE6
4	PE5	I/O	ADC7 SDCMD-G3 SPI1DI-G4 FMOSC-G5 PWM0-T4-G1 TMR3CAP_G6/IR_G6 IISCLK-G2 PE5
5	PE0	I/O	SPI0DI-G3 TX0-G5(RX) PWM0-T3-G4 TMR3CAP_G5/IR_G5 IISDO/DAT-G2 PE0
6	VUSB/PB5	I/O	TX0-G8(RX) TX1-G3(RX) TX2-G3(RX) HSTRX-G11 PWM2-T3-G2 PB5

7	VDDIO	PWR	VDDIO power output
8	VBAT	PWR	VBAT power input
9	DGND	GND	Digital Ground
10	VDDBT	PWR	BT power
11	PB2	I/O	ADC4 AUXR1 SDDAT0-G2 SPI1DO/SPI1DATA-G3 TX0-G2 TX2-G2(RX) HSTRX-G2 PWM2-T3-G1 PB2
12	PB1	I/O	TOUKEY0 ADC3 AUXL1 SDCLK-G2 SPI1CLK-G3 RX0-G2 RX2-G2 HSTRX-G7 FMOSC-G4 PWM1-T3-G1 TMR3CAP_G4/IR_G4 PB1
13	PB0	I/O	ADC15 SDCMD-G2 SPI1DI-G3 FMOSC-G3 PWM0-T3-G1 TMR3CAP_G3/IR_G3 IISDI-G2 PB0
14	PWRKEY	A	Power key input
15	BT_ANT	A	BT ANT
16	BT_OSCI	A	26M OSC input
17	BT_OSCO	A	26M OSC output
18	USB_DM/PB4	I/O	ADC6 USB DM SDDAT0-G4/ SDDAT0-G6 SPI0CLK-G3 RX0-G3 HSTRX-G8 PWM1-T3-G2 PB4
19	USB_DP/PB3	I/O	ADC5

			USB DP SDDAT0-G5/ SDCMD-G6 SPI0DO-G3 TX0-G3 HSTRX-G3 PWM0-T3-G2 PB3
20	PA7	I/O	ADC2 AUXR0 SDDAT0-G1 SPI1DO-G2 TX0-G1(RX) TX1-G1(RX) HSTRX-G1 PWM2-T5-G1 IISDI-G1 PA7
21	PA6	I/O	ADC1 AUXL0 SDCLK-G1/ SDCLK-G4/ SDCLK-G5/ SDCLK-G6 SPI1CLK-G2 RX0-G1 RX1-G1 HSTRX-G6 FMOSC-G2 PWM1-T5-G1 TMR3CAP-G2/IR-G2 IISDO/DAT-G1 PA6
22	PA5	I/O	ADC0 SDCMD-G1/SDCMD-G4/SDCMD-G5 SPI1DI-G2 FMOSC-G1 PWM0-T5-G1 TMR3CAP-G1/IR-G1 IISCLK-G1 PA5
23	PA4	I/O	SPI1DO/SPI1DATA-G1 TX1-G2(RX) PWM2-T3-G3 IISLRCLK-G1 PA4
24	PA3	I/O	SPI1CLK-G1 RX1-G2 PWM1-T3-G3 IISMCLK-G1

			PA3
25	MICL/PF2	I/O	ADC10 MICL SPI1DO-G5 TX0-G7 PWM0-T3-G3 TMR5CAP-G1/IR-G9 PF2
26	PF1	I/O	AUXR3 SPI1CLK-G5 RX0-G6 PWM2-T4-G2 PF1
27	PF0	I/O	SPI1DI-G5 TX0-G6 PWM1-T4-G2 PF0
28	MICL/PF3	I/O	PWM0-T4-G2 MICL PF3
29	DACL	A	DACL
30	VCMBUF	A	VCM buffer output
31	VDDDAC	PWR	DAC power
32	AGND	GND	DAC Ground

Note: I/O: Digital input/output; I : Digital input; A : Analog Pin; PWR: Power Pin; GND: Ground.

3 Characteristics

3.1 PMU Parameters

Table 3- 1 PMU voltage input Parameters

Sym	Characteristics	Min	Typ	Max	Unit	Conditions
VUSB	Charger Voltage input	3.0	5.0	5.5	V	
VBAT	Voltage input	3.0	3.7	5.0	V	

Table 3- 2 3.3V LDO Parameters

Sym	Characteristics	Min	Typ	Max	Unit	Conditions
VDDIO	3.3V LDO voltage output	-	3.3	-	V	Light Loading condition
Δ VVDDIO	Output Mismatch 1-sigma	-	56	-	mV	VDDIO=3.3v
ILOAD	Maximum output current	-	-	150	mA	@VBAT=3.6v
ISC	Short Circuit Current Limit	-	-	300	mA	@VBAT=3.8v

Table 3- 3 1.6V LDO Parameters

Sym	Characteristics	Min	Typ	Max	Unit	Conditions
VDDBT	1.6V LDO voltage output	-	1.6	-	V	Light Loading condition
Δ VVDDBT	Output Mismatch 1-sigma	-	27	-	mV	VDDBT=1.6v
ILOAD	Maximum output current	-	-	100	mA	@VBAT=3.0v
ISC	Short Circuit Current Limit	-	-	200	mA	@VBAT=3.8v

Table 3- 4 1.2V LDO Parameters

Sym	Characteristics	Min	Typ	Max	Unit	Conditions
VDDCORE	1.2V LDO voltage output	-	1.2	-	V	Light Loading condition
Δ VVDDCORE	Output Mismatch 1-sigma	-	20	-	mV	VDDCORE=1.2v
ILOAD	Maximum output current	-	-	80	mA	@VBAT=3.6v
ISC	Short Circuit Current Limit	-	-	120	mA	@VBAT=3.8v

3.2 IO Parameters

Table 3- 5 I/O Parameters

GPIO—Electrical Characteristics							
Symbol	Description	Related GPIO	Min	Typical	Max	Units	Conditions
V _{IL}	Low-level input voltage		-0.3		1.27	V	VDDIO=3.3V
V _{IH}	High-level input voltage		2.03		3.6	V	VDDIO=3.3V
Driver Ability 1	Output Driver Ability 1			32		mA	VDDIO=3.3V
Driver Ability 0	Output Driver Ability 0			8		mA	VDDIO=3.3V
R _{PUP0}	Internal pull-up resistor 0		8	10	12	K Ω	
R _{PUP1}	Internal pull-up resistor 1		0.24	0.3	0.36	K Ω	
R _{PUP2}	Internal pull-up resistor 2		160	200	240	K Ω	
R _{PDN0}	Internal pull-down resistor 0		8	10	12	K Ω	
R _{PDN1}	Internal pull-down resistor 1		0.24	0.3	0.36	K Ω	
R _{PDN2}	Internal pull-down resistor 2		160	200	240	K Ω	

3.3 Audio DAC Parameters

Table 3- 6 Audio DAC Parameters

Sym	Characteristics	Min	Typ	Max	Unit	Conditions
SNR		-	96	-	dB	VCM cap=1uF VDDDAC cap=1uF with A-wt filter Output -3dBV Fin=1KHz
THD+N		-	-86	-	dB	VCM cap=1uF VDDDAC cap=1uF with A-wt filter Output -3dBV with 10K loading Fin=1KHz
Output Range	Maximum output voltage	-	2.6		V _{peak-peak}	32ohm Loading

3.4 Audio ADC Parameters

Table 3- 7 Audio ADC Parameters

Sym	Characteristics	Min	Typ	Max	Unit	Conditions
SNR		-	90	-	dB	VCM cap=1uF VDDDAC cap=1uF with A-wt filter Input sine amplitude, 850mV RMS Fin=1KHz
THD+N		-	-87	-	dB	VCM cap=1uF VDDDAC cap=1uF with A-wt filter Input sine amplitude, 850mV RMS Fin=1KHz.
Input Range	Input sine wave peak amplitude	0		VCM	V	From aux input, aux 0db gain, VCM represent VCM voltage.

3.5 BT Parameters

Table 3- 8 BT Parameters

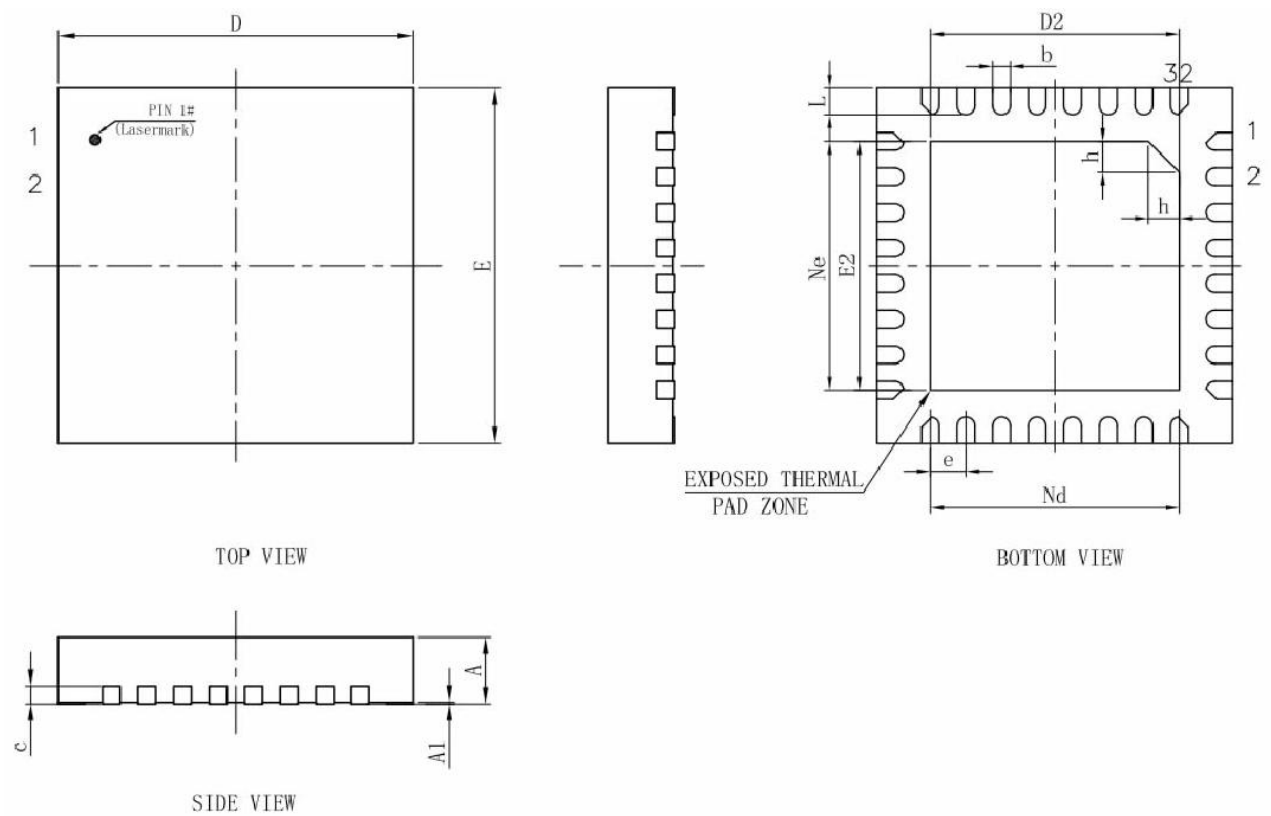
Characteristics	Min	Typical	Max	Unit	Conditions
Maximum Transmit Power	-	-	7	dBm	
RMS DEVM	-	5.5	-	%	Maximum TX power 2-DH5 packet
Peak DEVM	-	12.5		%	
EDR Relative Transmit Power		-0.2		dB	
Sensitivity @ Basic Rate		-90.5		dBm	BER=0.1%, using DH5 packet
Sensitivity @ EDR		-89.5		dBm	BER=0.01%, using 2-DH5 packet

3.6 Current Parameters

Table 3- 9 Current Parameters

Sym	Characteristics	Min	Typ	Max	Unit	Conditions
IRTC	RTC mode current	-	4	-	uA	4.2V input, room temp.
Sleep	Sleep current	-	500	2000	uA	3.3V input, room temp

4 Package Information



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	0	0.02	0.05
b	0.15	0.20	0.25
c	0.18	0.20	0.25
D	3.90	4.00	4.10
D2	2.70	2.80	2.90
e	0.40BSC		
Ne	2.80BSC		
Nd	2.80BSC		
E	3.90	4.00	4.10
E2	2.70	2.80	2.90
L	0.25	0.30	0.35
h	0.30	0.35	0.40
L/F载体尺寸	122X122		

FCC Statement

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.

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 important announcement

Important Note:

Radiation Exposure Statement

This device complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. The device is installed and operated without restriction.

The transmitter module may not be co-located with any other transmitter or antenna

End Product Labeling

The final end product must be labeled in a visible area with the following"

Contains FCC ID:**2BWIAAB5362C** "

Manual Information to the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

The end user manual shall include all required regulatory information/warning as show in this manual.

Integration instructions for host product manufacturers according to KDB 996369 D03 OEM Manual v01r01

2.2 List of applicable FCC rules

CFR 47 FCC PART 15 SUBPART C 15.247 & 15.207 & 15.209 has been investigated. It is applicable to the modular transmitter

2.3 Specific operational use conditions

This module is stand-alone modular. If the end product will involve the Multiple simultaneously transmitting condition or different operational conditions for a stand-alone modular transmitter in a host, host manufacturer have to consult with module manufacturer for the installation method in end system.

2.4 Limited module procedures

Not applicable

2.5 Trace antenna designs

Not applicable

2.6 RF exposure considerations

This device complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. The device is installed and operated without restriction.

The transmitter module may not be co-located with any other transmitter or antenna

2.7 Antennas

This radio transmitter **FCC ID:2BWIAAB5362C** has been approved by Federal Communications Commission to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Antenna No.	Model No. of antenna:	Type of antenna:	Gain of the antenna (Max.)	Frequency range:
Bluetooth	/	PCB Antenna	-0.58dBi	2402-2480MHz

2.8 Label and compliance information

The final end product must be labeled in a visible area with the following "Contains FCC ID:2BWIAAB5362C".

2.9 Information on test modes and additional testing requirements

Operation Frequency: 2402-2480MHz

Number of Channel: 79

Modulation: GFSK, $\pi/4$ DQPSK, 8DPSK

Host manufacturer must perform test of radiated & conducted emission and spurious emission, etc. according to the actual test modes for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product. Only when all the test results of test modes comply with FCC requirements, then the end product can be sold legally.

2.10 Additional testing, Part 15 Subpart B disclaimer

Host manufacturer is responsible for compliance of the host system with module installed with all other applicable requirements for the system such as Part 15 B.

2.11 Note EMI Considerations

Host manufacture is recommended to use D04 Module Integration Guide recommending as "best practice" RF design engineering testing and evaluation in case non-linear interactions generate additional non-compliant limits due to module placement to host components or properties.

2.12 How to make changes

This module is stand-alone modular. If the end product will involve the Multiple simultaneously transmitting condition or different operational conditions for a stand-alone modular transmitter in a host, host manufacturer have to consult with module manufacturer for the installation method in end system. According to the KDB 996369 D02 Q&A Q12, For EMC/radio-parameter compliance purposes, when an evaluation is done by the grantee or host provider and there are no additional emissions generated due to simultaneous-transmission operations compared to single transmitter operations testing (i.e., not transmitting simultaneously), it is not necessary to file the additional simultaneous transmission test data. The host manufacturer is responsible for ensuring compliance with the applicable FCC rules for the transmitters operating individually and simultaneously. This includes compliance for the summation of all emissions from all outputs occupying the same or overlapping frequency ranges, as defined by the applicable rules.

Important Note:

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.