

User Manual For
WIFI+BT Combo Module
AP6356S

2x2 Wi-Fi + Bluetooth 4.2 Module AP6356S:



Features

- Lead Free design which is compliant with ROHS requirements.
- 802.11a/b/g/n/ac dual-band radio with virtual-simultaneous dual-band operation
- Dual-stream spatial multiplexing up to 867 Mbps data rate.
- Supports 20, 40, 80 MHz channels with optional SGI(256 QAM modulation)
- Supports IEEE 802.11 ac/n beam forming.
- Supports standard SDIO interfaces.
- BT host digital interface:
 - HCI UART (up to 4 Mbps)
 - PCM for audio data
- Complies with Bluetooth Core Specification Version 4.2 with provisions for supporting future specifications. With Bluetooth Class 1 or Class2 transmitter operation.
- Supports extended synchronous connections (eSCO), for enhanced voice quality by allowing for retransmission of dropped packets.
- Adaptive frequency hopping (AFH) for reducing radio frequency interference.

General Specification

Model Name	AP6356S
Product Description	Support Wi-Fi/Bluetooth functionalities
Dimension	L x W x H: 15 x 13 x 1.5 (typical) mm
WiFi Interface	Support SDIO V3.0
BT Interface	UART / PCM
Operating temperature	-10°C to 65°C
Storage temperature	-40°C to 85°C
Humidity	Operating Humidity 10% to 95% Non-Condensing

Optimal RF performance specified in the data sheet, however, is guaranteed only -10°C to 55°C.

Wi-Fi RF Specification

2.4GHz RF Specification

Conditions: VBAT=3.3V ; VDDIO=3.3V ; Temp:25°C

Feature	Description
WLAN Standard	IEEE 802.11a/b/g/n/ac & Wi-Fi compliant
Frequency Range	2.400 GHz ~ 2.483 GHz (2.4 GHz ISM Band)
Number of Channels	2.4GHz : Ch1 ~ Ch13
Modulation	802.11b : DQPSK, DBPSK, CCK 802.11 g/n : OFDM /64-QAM,16-QAM, QPSK, BPSK
Output Power	802.11b /11Mbps : 16 dBm $\pm$ 1.5 dB @ EVM $\leq$ -9dB
	802.11g /54Mbps : 15 dBm $\pm$ 1.5 dB @ EVM $\leq$ -25dB
	802.11n /MCS7 : 14 dBm $\pm$ 1.5 dB @ EVM $\leq$ -27dB
SISO Receive Sensitivity (11b,20MHz) @8% PER	- 1Mbps PER @ -92 dBm, +/- 2dB
	- 2Mbps PER @ -90 dBm, +/- 2dB
	- 5.5Mbps PER @ -87 dBm, +/- 2dB
	- 11Mbps PER @ -85 dBm, +/- 2dB
SISO Receive Sensitivity (11g,20MHz) @10% PER	- 6Mbps PER @ -89 dBm, +/- 2dB
	- 9Mbps PER @ -88 dBm, +/- 2dB
	- 12Mbps PER @ -87 dBm, +/- 2dB
	- 18Mbps PER @ -84 dBm, +/- 2dB
	- 24Mbps PER @ -81 dBm, +/- 2dB

	- 36Mbps PER @ -78 dBm, +/- 2dB
	- 48Mbps PER @ -73 dBm, +/- 2dB
	- 54Mbps PER @ -71 dBm, +/- 2dB
MIMO Receive Sensitivity (11g,20MHz) @10% PER	- 6Mbps PER @ -91 dBm, +/- 2dB
	- 9Mbps PER @ -90 dBm, +/- 2dB
	- 12Mbps PER @ -89 dBm, +/- 2dB
	- 18Mbps PER @ -87 dBm, +/- 2dB
	- 24Mbps PER @ -84 dBm, +/- 2dB
	- 36Mbps PER @ -81 dBm, +/- 2dB
	- 48Mbps PER @ -76 dBm, +/- 2dB
	- 54Mbps PER @ -74 dBm, +/- 2dB
SISO Receive Sensitivity (11n,20MHz) @10% PER	- MCS=0 PER @ -89 dBm, +/- 2dB
	- MCS=1 PER @ -86 dBm, +/- 2dB
	- MCS=2 PER @ -84 dBm, +/- 2dB
	- MCS=3 PER @ -80 dBm, +/- 2dB
	- MCS=4 PER @ -77 dBm, +/- 2dB
	- MCS=5 PER @ -72 dBm, +/- 2dB
	- MCS=6 PER @ -71 dBm, +/- 2dB
	- MCS=7 PER @ -69 dBm, +/- 2dB
MIMO Receive Sensitivity (11n,20MHz) @10% PER	- MCS=0 PER @ -90 dBm, +/- 2dB
	- MCS=1 PER @ -89 dBm, +/- 2dB
	- MCS=2 PER @ -87 dBm, +/- 2dB
	- MCS=3 PER @ -84 dBm, +/- 2dB
	- MCS=4 PER @ -80 dBm, +/- 2dB
	- MCS=5 PER @ -75 dBm, +/- 2dB
	- MCS=6 PER @ -73 dBm, +/- 2dB
	- MCS=7 PER @ -72 dBm, +/- 2dB
	- MCS=8 PER @ -87 dBm, +/- 2dB
	- MCS=15 PER @ -68 dBm, +/- 2dB
Maximum Input Level	802.11b : -10 dBm
802.11g/n : -20 dBm	
Antenna Reference	Small antennas with 0~2 dBi peak gain

5GHz RF Specification

Conditions: VBAT=3.3V ; VDDIO=3.3V ; Temp:25°C

Feature	Description
WLAN Standard	IEEE 802.11a/b/g/n/ac & Wi-Fi compliant
Frequency Range	5.15 GHz ~ 5.845 GHz (5.0 GHz ISM Band)
Number of Channels	5.0GHz : Please see the table1
Modulation	802.11a : OFDM /64-QAM,16-QAM, QPSK, BPSK 802.11n : OFDM /64-QAM,16-QAM, QPSK, BPSK 802.11ac : OFDM /256-QAM
Output Power	802.11a /54Mbps : 13 dBm $\pm$ 1.5 dB @ EVM $\leq$ -25dB
	802.11n /MCS7 : 12 dBm $\pm$ 1.5 dB @ EVM $\leq$ -27dB
	802.11ac /MCS9 : 10 dBm $\pm$ 1.5 dB @ EVM $\leq$ -32dB
SISO Receive Sensitivity (11a,20MHz) @10% PER	- 6Mbps PER @ -88 dBm, +/- 2dB
	- 9Mbps PER @ -87 dBm, +/- 2dB
	- 12Mbps PER @ -86 dBm, +/- 2dB
	- 18Mbps PER @ -83 dBm, +/- 2dB
	- 24Mbps PER @ -80 dBm, +/- 2dB
	- 36Mbps PER @ -77 dBm, +/- 2dB
	- 48Mbps PER @ -72 dBm, +/- 2dB
	- 54Mbps PER @ -70 dBm, +/- 2dB
MIMO Receive Sensitivity (11a,20MHz) @10% PER	- 6Mbps PER @ -90 dBm, +/- 2dB
	- 9Mbps PER @ -89 dBm, +/- 2dB
	- 12Mbps PER @ -88 dBm, +/- 2dB

	- 18Mbps PER @ -86 dBm, +/- 2dB
	- 24Mbps PER @ -83 dBm, +/- 2dB
	- 36Mbps PER @ -80 dBm, +/- 2dB
	- 48Mbps PER @ -75 dBm, +/- 2dB
	- 54Mbps PER @ -71 dBm, +/- 2dB
SISO Receive Sensitivity (11n,20MHz) @10% PER	- MCS=0 PER @ -88 dBm, +/- 2dB
	- MCS=1 PER @ -85 dBm, +/- 2dB
	- MCS=2 PER @ -83 dBm, +/- 2dB
	- MCS=3 PER @ -80 dBm, +/- 2dB
	- MCS=4 PER @ -76 dBm, +/- 2dB
	- MCS=5 PER @ -71 dBm, +/- 2dB
	- MCS=6 PER @ -70 dBm, +/- 2dB
	- MCS=7 PER @ -68 dBm, +/- 2dB
MIMO Receive Sensitivity (11n,20MHz) @10% PER	- MCS=0 PER @ -89 dBm, +/- 2dB
	- MCS=1 PER @ -88 dBm, +/- 2dB
	- MCS=2 PER @ -86 dBm, +/- 2dB
	- MCS=3 PER @ -83 dBm, +/- 2dB
	- MCS=4 PER @ -79 dBm, +/- 2dB
	- MCS=5 PER @ -74 dBm, +/- 2dB
	- MCS=6 PER @ -73 dBm, +/- 2dB
	- MCS=7 PER @ -71 dBm, +/- 2dB
	- MCS=8 PER @ -68 dBm, +/- 2dB
	- MCS=15 PER @ -68 dBm, +/- 2dB
SISO Receive Sensitivity (11n,40MHz) @10% PER	- MCS=0 PER @ -85 dBm, +/- 2dB
	- MCS=1 PER @ -82 dBm, +/- 2dB
	- MCS=2 PER @ -80 dBm, +/- 2dB
	- MCS=3 PER @ -77 dBm, +/- 2dB
	- MCS=4 PER @ -73 dBm, +/- 2dB
	- MCS=5 PER @ -69 dBm, +/- 2dB
	- MCS=6 PER @ -67 dBm, +/- 2dB
	- MCS=7 PER @ -66 dBm, +/- 2dB
MIMO Receive Sensitivity (11n,40MHz) @10% PER	- MCS=0 PER @ -87 dBm, +/- 2dB
	- MCS=1 PER @ -85 dBm, +/- 2dB
	- MCS=2 PER @ -83 dBm, +/- 2dB
	- MCS=3 PER @ -80 dBm, +/- 2dB
	- MCS=4 PER @ -76 dBm, +/- 2dB
	- MCS=5 PER @ -72 dBm, +/- 2dB
	- MCS=6 PER @ -70 dBm, +/- 2dB
	- MCS=7 PER @ -69 dBm, +/- 2dB
	- MCS=8 PER @ -85 dBm, +/- 2dB
	- MCS=15 PER @ -66 dBm, +/- 2dB
SISO Receive Sensitivity (11ac,20MHz) @10% PER	- MCS=0, NSS1 PER @ -86 dBm, +/- 2dB
	- MCS=1, NSS1 PER @ -84 dBm, +/- 2dB
	- MCS=2, NSS1 PER @ -82 dBm, +/- 2dB
	- MCS=3, NSS1 PER @ -79 dBm, +/- 2dB
	- MCS=4, NSS1 PER @ -75 dBm, +/- 2dB
	- MCS=5, NSS1 PER @ -70 dBm, +/- 2dB
	- MCS=6, NSS1 PER @ -69 dBm, +/- 2dB
	- MCS=7, NSS1 PER @ -68 dBm, +/- 2dB
	- MCS=8, NSS1 PER @ -64 dBm, +/- 2dB
MIMO Receive Sensitivity (11ac,20MHz) @10% PER	- MCS=0, NSS1 PER @ -88 dBm, +/- 2dB
	- MCS=1, NSS1 PER @ -87 dBm, +/- 2dB
	- MCS=2, NSS1 PER @ -85 dBm, +/- 2dB
	- MCS=3, NSS1 PER @ -82 dBm, +/- 2dB
	- MCS=4, NSS1 PER @ -78 dBm, +/- 2dB
	- MCS=5, NSS1 PER @ -73 dBm, +/- 2dB
	- MCS=6, NSS1 PER @ -72 dBm, +/- 2dB

	- MCS=7, NSS1 PER @ -71 dBm, +/- 2dB
	- MCS=8, NSS1 PER @ -67 dBm, +/- 2dB
	- MCS=0, NSS2 PER @ -87 dBm, +/- 2dB
	- MCS=8, NSS2 PER @ -63 dBm, +/- 2dB
SISO Receive Sensitivity (11ac,40MHz) @10% PER	- MCS=0, NSS1 PER @ -84 dBm, +/- 2dB
	- MCS=1, NSS1 PER @ -81 dBm, +/- 2dB
	- MCS=2, NSS1 PER @ -79 dBm, +/- 2dB
	- MCS=3, NSS1 PER @ -76 dBm, +/- 2dB
	- MCS=4, NSS1 PER @ -73 dBm, +/- 2dB
	- MCS=5, NSS1 PER @ -68 dBm, +/- 2dB
	- MCS=6, NSS1 PER @ -67 dBm, +/- 2dB
	- MCS=7, NSS1 PER @ -66 dBm, +/- 2dB
	- MCS=8, NSS1 PER @ -61 dBm, +/- 2dB
	- MCS=9, NSS1 PER @ -60 dBm, +/- 2dB
	- MCS=0, NSS1 PER @ -86 dBm, +/- 2dB
MIMO Receive Sensitivity (11ac,40MHz) @10% PER	- MCS=1, NSS1 PER @ -84 dBm, +/- 2dB
	- MCS=2, NSS1 PER @ -82 dBm, +/- 2dB
	- MCS=3, NSS1 PER @ -79 dBm, +/- 2dB
	- MCS=4, NSS1 PER @ -76 dBm, +/- 2dB
	- MCS=5, NSS1 PER @ -71 dBm, +/- 2dB
	- MCS=6, NSS1 PER @ -70 dBm, +/- 2dB
	- MCS=7, NSS1 PER @ -69 dBm, +/- 2dB
	- MCS=8, NSS1 PER @ -64 dBm, +/- 2dB
	- MCS=9, NSS1 PER @ -63 dBm, +/- 2dB
	- MCS=0, NSS2 PER @ -84 dBm, +/- 2dB
	- MCS=9, NSS2 PER @ -60 dBm, +/- 2dB
	- MCS=0, NSS1 PER @ -81 dBm, +/- 2dB
	- MCS=1, NSS1 PER @ -78 dBm, +/- 2dB
	- MCS=2, NSS1 PER @ -76 dBm, +/- 2dB
SISO Receive Sensitivity (11ac,80MHz) @10% PER	- MCS=3, NSS1 PER @ -72 dBm, +/- 2dB
	- MCS=4, NSS1 PER @ -69 dBm, +/- 2dB
	- MCS=5, NSS1 PER @ -66 dBm, +/- 2dB
	- MCS=6, NSS1 PER @ -64 dBm, +/- 2dB
	- MCS=7, NSS1 PER @ -62 dBm, +/- 2dB
	- MCS=8, NSS1 PER @ -58 dBm, +/- 2dB
	- MCS=9, NSS1 PER @ -56 dBm, +/- 2dB
	- MCS=0, NSS1 PER @ -82 dBm, +/- 2dB
	- MCS=1, NSS1 PER @ -81 dBm, +/- 2dB
	- MCS=2, NSS1 PER @ -79 dBm, +/- 2dB
MIMO Receive Sensitivity (11ac,80MHz) @10% PER	- MCS=3, NSS1 PER @ -75 dBm, +/- 2dB
	- MCS=4, NSS1 PER @ -72 dBm, +/- 2dB
	- MCS=5, NSS1 PER @ -69 dBm, +/- 2dB
	- MCS=6, NSS1 PER @ -67 dBm, +/- 2dB
	- MCS=7, NSS1 PER @ -65 dBm, +/- 2dB
	- MCS=8, NSS1 PER @ -61 dBm, +/- 2dB
	- MCS=9, NSS1 PER @ -60 dBm, +/- 2dB
	- MCS=0, NSS2 PER @ -80 dBm, +/- 2dB
	- MCS=9, NSS2 PER @ -56 dBm, +/- 2dB
Maximum Input Level	802.11a/n : -30 dBm
Antenna Reference	Small antennas with 0~2 dBi peak gain

5GHz(20MHz) Channel table

Band (GHz)	Operating Channel Numbers	Channel center frequencies(MHz)
5.15GHz~5.25GHz	36	5180
40	5200	
44	5220	

48	5240	
5.25GHz~5.35GHz	52	5260
56	5280	
60	5300	
64	5320	
5.5GHz~5.7GHz	100	5500
104	5520	
108	5540	
112	5560	
116	5580	
120	5600	
124	5620	
128	5640	
132	5660	
136	5680	
140	5700	
5.725GHz~5.845GHz	149	5745
153	5765	
157	5785	
161	5805	
165	5825	

Bluetooth Specification

Conditions : VBAT=3.3V ; VDDIO=3.3V ; Temp:25°C

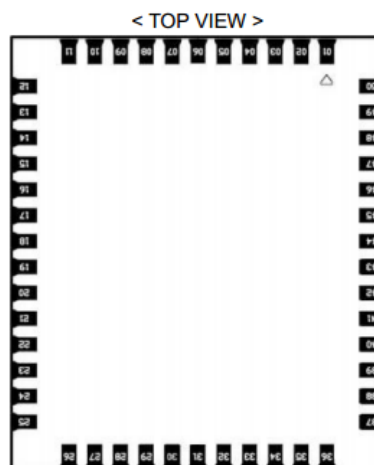
General Specification	
Feature	Description
Bluetooth Standard	Bluetooth V4.2 of 1, 2 and 3 Mbps.
Host Interface	UART
Antenna Reference	Small antennas with 0~2 dBi peak gain
Frequency Band	2402 MHz ~ 2480 MHz
Number of Channels	79 channels
Modulation	FHSS, GFSK, DPSK, DQPSK

RF Specification			
	Min.	Typical.	Max.
Output Power ¹	0	-	10
Sensitivity @ BER=0.1% for GFSK (1Mbps)		-89 dBm	
Sensitivity @ BER=0.01% for $\pi/4$ -DQPSK (2Mbps)		-90 dBm	
Sensitivity @ BER=0.01% for 8DPSK (3Mbps)		-86 dBm	
Maximum Input Level	GFSK (1Mbps):-20dBm		
	$\pi/4$ -DQPSK (2Mbps) :-20dBm		
	8DPSK (3Mbps) :-20dBm		

NOTE¹ : Output power can be configured by HCD firmware.

Pin

Outline



Pin Definition

NO	Name	Type	Description
1	GND	-	Ground connections
2	WL/BT_ANT0	I/O	RF I/O port0
3	GND	-	Ground connections
4	GND	-	Ground connections

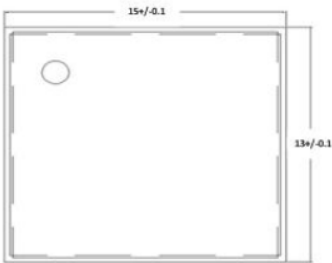
5	GND	-	Ground connections
6	GND	-	Ground connections
7	GND	-	Ground connections
8	GND	-	Ground connections
9	WL_ANT1	I/O	RF I/O port1
10	GND	-	Ground connections
11	GND	-	Ground connections
12	NC	-	No connect
13	XTAL_OUT	O	External Crystal out
14	XTAL_IN	I	External Crystal in/ Single clock source in
15	WL_REG_ON	I	Low asserting reset for WiFi core
16	WL_HOST_WAKE	O	WLAN to wake-up HOST
17	SDIO_DATA_CMD	I/O	SDIO command line
18	SDIO_DATA_CLK	I/O	SDIO clock line
19	SDIO_DATA_3	I/O	SDIO data line 3
20	SDIO_DATA_2	I/O	SDIO data line 2
21	SDIO_DATA_0	I/O	SDIO data line 0
22	SDIO_DATA_1	I/O	SDIO data line 1
23	GND	-	Ground connections
24	NC	-	No connect
25	VIN_LDO	P	Internal Buck voltage generation pin
26	VIN_LDO_OUT	P	Internal Buck voltage generation pin
27	PCM_SYNC	I/O	PCM sync signal
28	PCM_IN	I	PCM data input
29	PCM_OUT	O	PCM Data output
30	PCM_CLK	I/O	PCM clock
31	LPO	I	External Low Power Clock input (32.768KHz)
32	GND	-	Ground connections
33	NC	-	No connect
34	VDDIO	P	I/O Voltage supply input
35	NC	-	No connect
36	VBAT	P	Main power voltage source input
37	NC	-	No connect
38	BT_REG_ON	I	Low asserting reset for Bluetooth core
39	GND	-	Ground connections
40	UART_TXD	O	Bluetooth UART interface
41	UART_RXD	I	Bluetooth UART interface
42	UART_RTS_N	O	Bluetooth UART interface
43	UART_CTS_N	I	Bluetooth UART interface
44	NC	-	No connect
45	NC	-	No connect
46	NC	-	No connect
47	NC	-	No connect
48	NC	-	No connect

49	BT_WAKE	I	HOST wake-up Bluetooth device
50	BT_HOST_WAKE	O	Bluetooth device to wake-up HOST

Dimensions

(Unit: mm)

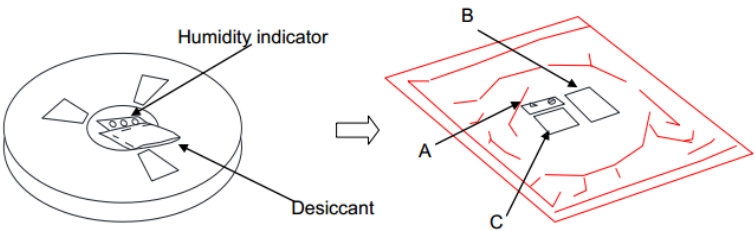
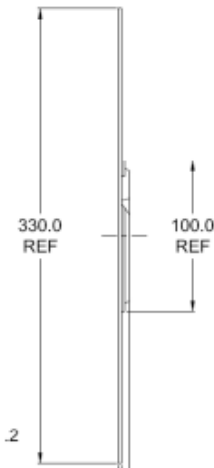
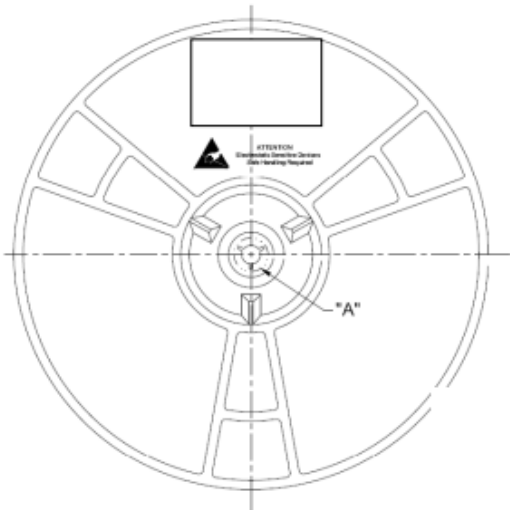
< TOP VIEW >

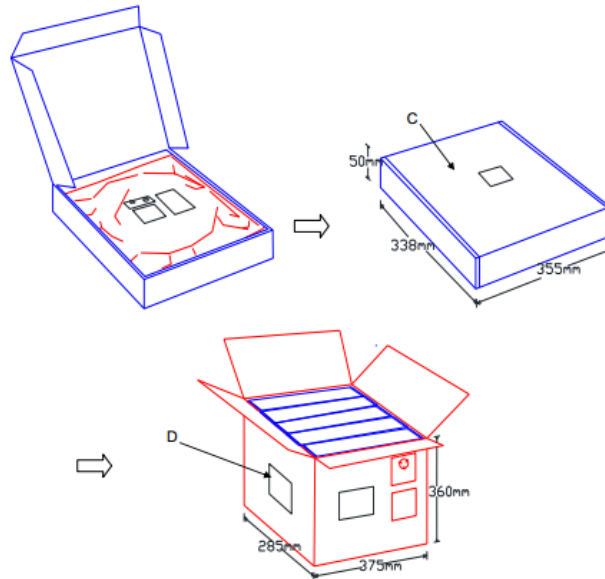


< Side View >



Package





MSL Level / Storage Condition

	Caution This bag contains MOISTURE-SENSITIVE DEVICES	LEVEL 4
		If blank, see adjacent bar code label
1. Calculated shelf life in sealed bag: 12 months at $<40^{\circ}\text{C}$ and $<90\%$ relative humidity (RH)		
2. Peak package body temperature: <u>250</u> $^{\circ}\text{C}$ If blank, see adjacent bar code label		
3. After bag is opened, devices that will be subjected to reflow solder or other high temperature process must be		
a) Mounted within: <u>72</u> hours of factory conditions If blank, see adjacent bar code label		
$\leq 30^{\circ}\text{C}/60\% \text{ RH}$, or		
b) Stored per J-STD-033		
4. Devices require bake, before mounting, if:		
a) Humidity Indicator Card reads $>10\%$ for level 2a-5a devices or $>60\%$ for level 2 devices when read at $23 \pm 5^{\circ}\text{C}$		
b) 3a or 3b are not met.		
5. If baking is required, refer to IPC/JEDEC J-STD-033 for bake procedure.		
Bag Seal Date: _____ If blank, see adjacent bar code label		
Note: Level and body temperature defined by IPC/JEDEC J-STD-020		

FCC Compliance Statement

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 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.
- 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: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. Such modifications could void the user's authority to operate the equipment.

FCC RF Radiation Exposure Statement:

This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment.

This device and its antenna must not be co-located or operating in conjunction with any other antenna or

transmitter.

“To comply with FCC RF exposure compliance requirements, this grant is applicable to only Mobile Configurations. The antennas used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.”

Canadian Compliance Statement

This device complies with Industry Canada license-exempt RSSs. 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;
- (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.)

Radiation Exposure Statement:

This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment.

This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

Déclaration d'exposition aux radiations:

Cet équipement est conforme aux limites d'exposition aux rayonnements IC établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 20 cm de distance entre la source de rayonnement et votre corps.