



# HiKey970

## User Guide

Issue 01

Date 2018-03-11

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## Change History

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Changes between document issues are cumulative. The latest document issue contains all the changes made in earlier issues.

### **Issue 01 (2018-03-11)**

The first version.



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# User Guide

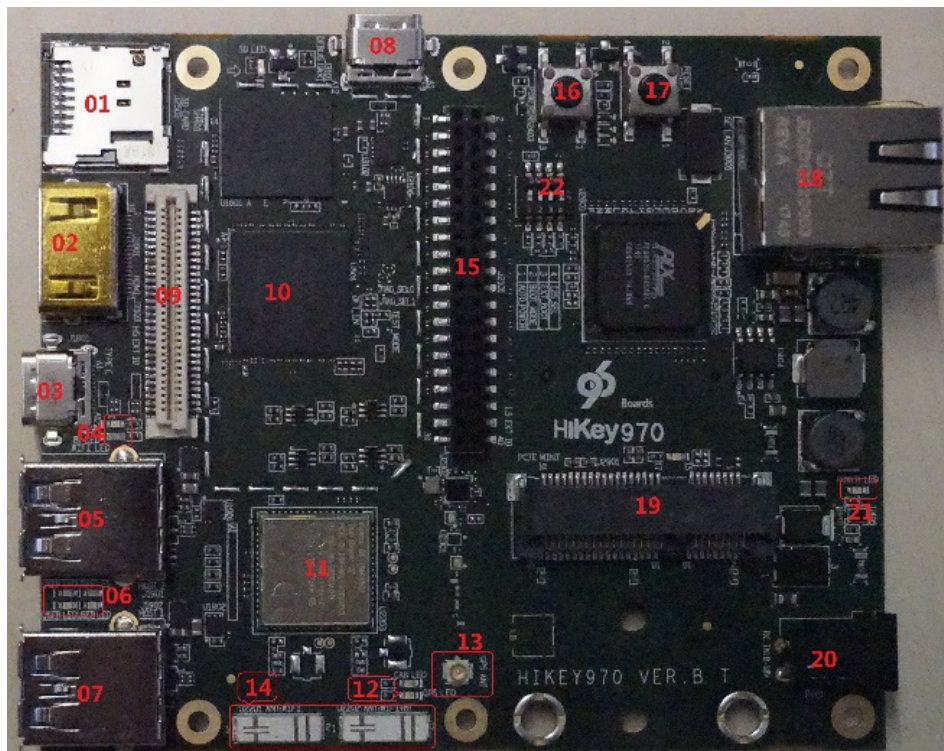
## 1.1 Introduction

The HiKey970 board is a 96Boards compliant community board based on HiSilicon Kirin 970 series of SOC's.

The following table lists its key features:

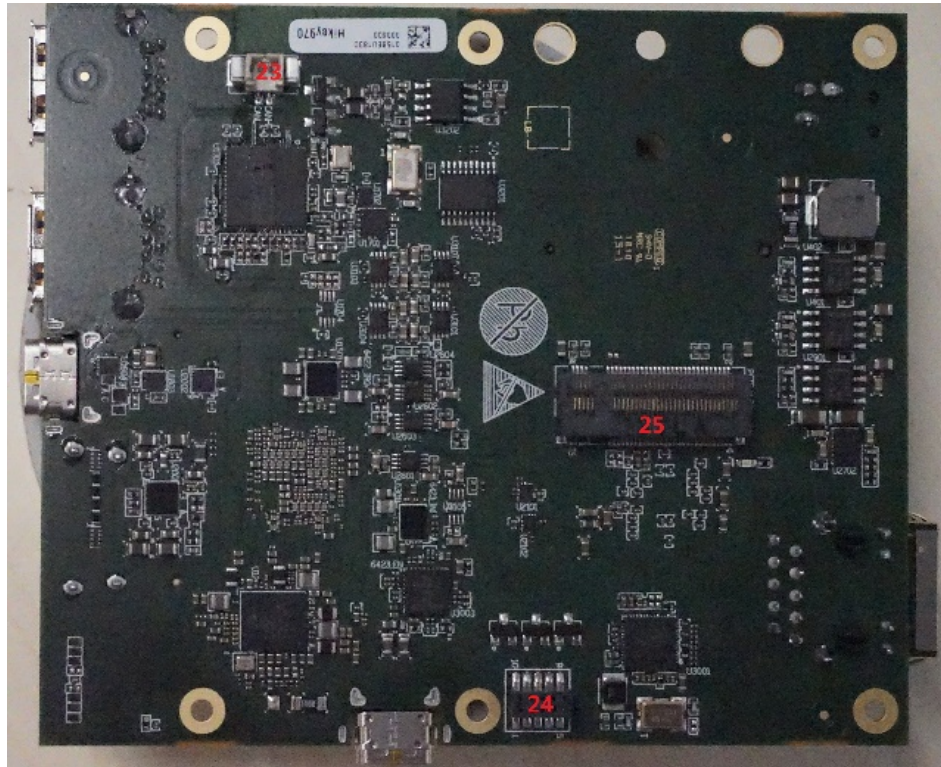
### 1.1.1 Board overview

Figure 1-1 Top side view of the HiKey PCB





**Figure 1-2** Bottom side view of the HiKey PCB



Number	Description
01	(J2502)Micro SD Card Socket
02	(J2001)HDMI Type A Port
03	(J1801)USB Type C
04	(D3305)LED, (D3306) WIFI LED
05	(J1901)USB Type A
06	(D3301~D3304)User LED
07	(J1902) USB Type A
08	(J3101) UART Debug
09	(J2103) High Speed Expansion Connector
10	(U501) Kirin970 Processor
11	(U2203)WLAN
12	(D3307)CAN LED, (D3308)GPS LED
13	(J2301)GPS Antenna Connector
14	(U2201, U2202)WIFI Antenna



Number	Description
15	(J2101)Low Speed Expansion Connector
16	(S2403)Power Button
17	(S2402)Reset Button
18	(J3001) Ethernet Connector
19	(J2901)PCIE MINI Connector
20	(P401)Power Jack
21	(D404)Power LED's
22	(SW2402)Boot Switches
23	(J3201)CAN Connector
24	(J2501)JATG Connector
25	(J2801)PCIE M.2 Connector



## 1.1.2 Key features

<b>Processor</b>	HiSilicon Kirin 970 ARM Cortex-A73 MPCore*4 @up to2.36GHz ARM Cortex-A53 MPCore*4 @up to1.8GHz ARM Mali-G72 MP12 GPU HiAI Architecture Dedicated NPU
<b>Memory</b>	6GB LPDDR4X 1866MHz
<b>Storage</b>	64GB UFS 2.1 Micro SD
<b>Video</b>	1080p@60Hz HDMI 4 line MIPI/LCD port
<b>Camera Support</b>	4 line MIPI port 2 line MIPI port
<b>Connectivity</b>	WIFI(DFS band not support)
<b>I/O Interfaces</b>	One 40-pin Low Speed (LS) expansion connector • UART, SPI, I2S, I2C x2, GPIO x12, DC power One 60-pin High Speed (HS) expansion connector • 4L-MIPI DSI, USB, I2C x2, 2L+4L-MIPI CSI
<b>User Interface</b>	Power/Reset 8 LED indicators • 4 -user controllable • 3 -for radios • 1 – for CAN
<b>OS-support</b>	Android Linux
<b>Power</b>	DC Power: +8V to +18V
<b>Mechanical</b>	Dimensions: 105.26mm by 100mm meeting 96Boards™ Consumer Edition standard dimensions specifications.
<b>Environmental</b>	Operating Temp: 0°C to +70°C RoHS and Reach compliant





## 1.2 Getting started

### 1.2.1 Prerequisites

Before you power up your HiKey970 board for the first time you will need the following:

- HiKey970 board.
- A 96Boards compliant power supply.
- A HDMI LCD Monitor that supports a resolution of 1080P/60Hz.
- HDMI-HDMI cable to connect the board to the Monitor.
- A computer keyboard with USB interface
- A computer mouse with USB interface.

### 1.2.2 Starting the board for the first time

To start the board, follow these simple steps:

Step 1. Connect the HDMI cable to the HiKey970 HDMI connector (marked J2001) and to the LCD Monitor.

Step 2. Connect the keyboard to the boards USB connector marked J1901(or J1902) and the mouse to the USB connector marked J1902(or J1901).

**Step 3. Ensure that the boot switches SW2402 are set to '1000', on/off/off/off position.**

Step 4. Connect the power supply to power connector J401.

Once you plug the power supply into a power outlet the board will start the booting process, and you should see Android boot up.

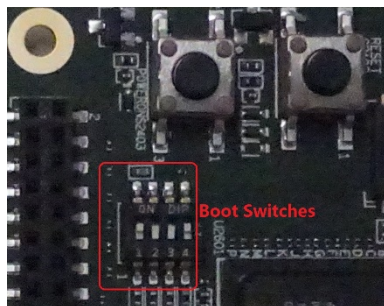
Please note that the first boot takes several minutes due to Androids initialization. Subsequent boot times should be faster.

## 1.3 HiKey970 Overview

### 1.3.1 Boot switches and UART debug

The HiKey board has multiple boot options that are user selectable in hardware which can be set via Switch SW2402.

**Figure 1-3** Boot switches





	SW2402
1	AUTO_POWER
2	BOOT_MODE
3	EXT_BOOT
4	I2S_SEL

- Auto Power Switch

ON: system will boot up automatically when the power supply is applied.

OFF : Pressing the power switch is required to boot up the system.

- Boot Setting Switch

ON: the will attempt to program the UFS flash from USB OTG source. This should ONLY be used if the first stage bootloader is corrupted or needs to be replaced.

OFF : the unit boots from the first stage bootloader installed in the onboard UFS device.

- User Jumper

Connected to GPIO\_055 on the SoC and UEFI mode

ON : GPIO\_055 will be pulled low, the board will boot up UEFI mode

OFF: GPIO\_055 will be pulled High, the board will boot up the system

- I2S SEL

ON: I2S0 will connect Low Speed Expansion Connector

OFF: I2S0 will connect other channel.

The HiKey board also has an option for a Debug UART Type C J3101. This is normally used by the first stage bootloader developers, and is connected to the UART6 port of the SoC.

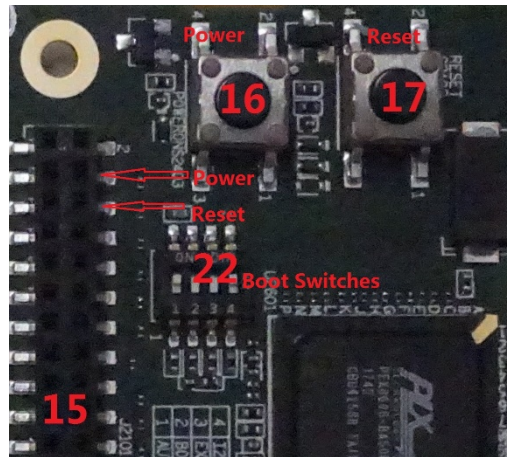
## 1.3.2 POWER on button /reset button

The power button S2403 can be used to power up, power down the system.

- A simple press and release powers ON the board provided the Auto Power Jumper is not installed.
- A press and release will then power OFF the board

The Reset button S2402 can be used to reset the system.

**Figure 1-4 Powr/Reset**



It is also possible to connect external switches for power on/off . This is implemented by routing the specific power signals to the low speed bus connector J2101.4(PWRON\_N) and J2401.6(EXP\_RSTOUT\_N).

### 1.3.3 DC in jack

DC Power is provided via the DC jack at P401. This is a CUI PJ-041H connector with a center pin diameter of 1.65mm configured with positive polarity (center +). An 8V up to 18V power supply at a minimum of 2A rating can be used to provide sufficient board power for on system requirements as well as external devices. Additional current rating may be required for mezzanine boards or modules. DC Power can also be supplied via the SYS\_DCIN pins on the low speed expansion J2101.

NOTE: Power should not be supplied simultaneously from multiple sources

### 1.3.4 Low speed expansion connector

The HiKey board features two expansion connectors: one low speed expansion connector and one high speed. The low speed expansion connector carries GPIO and other low speed interfaces. The connector is a low profile 40 pin female 2mm receptacle (20x2) of a specified height of 4.5mm height.

The low speed expansion brings out 1.8V level SoC signals such as UART2 and UART3, I2C0 and I2C1, GPIO signals as well as SPI, Audio, Reset, 1.8V and Ground. The complete list of SoC signals is shown in Table 1 below:

96Boards Signals	HiKey970 Signals	Pin	Pin	HiKey970 Signals	96Boards Signals
GND	GND	1	2	GND	GND
UART0_CTS	UART2_CTS_N	3	4	PWRON_N	PWR_BTN_N
UART0_TxD	UART2_RXD	5	6	EXP_RSTOUT_N	RST_BTN_N
UART0_RxD	UART2_RXD	7	8	SPI2_CLK	SPI0_SCLK
UART0_RTS	UART2_RTS_N	9	10	SPI2_DI	SPI0_DIN



96Boards Signals	HiKey970 Signals	Pin	Pin	HiKey970 Signals	96Boards Signals
UART1_TxD	DEBUG_UART6_TX D	11	12	SPI2_CS0_N	SPI0_CS
UART1_RxD	DEBUG_UART6_RX D	13	14	SPI2_DO	SPI0_DOUT
I2C0_SCL	I2C0_SCL	15	16	EXT_I2S0_XFS	PCM_FS
I2C0_SDA	I2C0_SDA	17	18	EXT_I2S0_XCLK	PCM_CLK
I2C1_SCL	I2C2_SCL	19	20	EXT_I2S0_DO	PCM_DO
I2C1_SDA	I2C2_SDA	21	22	EXT_I2S0_DI	PCM_DI
GPIO-A	GPIO_208_WAKEU P_SOC	23	24	GPIO_171	GPIO-B
GPIO-C	GPIO_169	25	26	GPIO_052	GPIO-D
GPIO-E	GPIO_170	27	28	LCD_BL_PWM	GPIO-F
GPIO-G	LCD_TE0	29	30	GPIO_029_LCD_RS T_N	GPIO-H
GPIO-I	GPIO_013_CAM0_R ST_N	31	32	GPIO_053	GPIO-J
GPIO-K	GPIO_032_CAM1_R ST_N	33	34	GPIO_031	GPIO-L
+1V8	VOUT4_1V8	35	36	SYSDC_IN	SYS_DCIN
+5V	SYS_5V	37	38	SYSDC_IN	SYC_DCIN
GND	GND	39	40	GND	GND

The HiKey board can also drive 5V or 12V cooling fans. The power for these is available on the low speed Expansion connector and can be supplied through a 2-pin 2mm male header inserted at pins J2101.37-J2101.39 or J2101.38-J2101.40, respectively

### 1.3.5 High speed expansion connector

The HS Expansion connector is a board to board low profile 60 pin receptacle TE part.

96Boards Signals	HiKey970 Signals	Pin	Pin	HiKey970 Signals	96Boards Signals
SD_DAT0/SPI1_DOUT	SPI3_DO	1	2	CSI0_CLK_P	CSI0_C+
SD_DAT1	UART0_RXD	3	4	CSI0_CLK_N	CSI0_C-
SD_DAT2	UART0_TXD	5	6	GND	GND
SD_DAT3/SPI1_CS	SPI3_CS0_N	7	8	CSI0_DATA0_P	CSI0_D0+
SD_SCLK/SPI1_SCLK	SPI3_CLK	9	10	CSI0_DATA0_N	CSI0_D0-



96Boards Signals	HiKey970 Signals	Pin	Pin	HiKey970 Signals	96Boards Signals
SD_CMD/SPI1_DIN	SPI3_DI	11	12	GND	GND
GND	GND	13	14	CSI0_DATA1_P	CSI0_D1+
CLK0/CSI0_MCLK	ISP_CCLK0_MCAM	15	16	CSI0_DATA1_N	CSI0_D1-
CLK1/CSI1_MCLK	ISP_CCLK1_SCAM	17	18	GND	GND
GND	GND	19	20	CSI0_DATA2_P	CSI0_D2+
DSI_CLK+	DSI2_CLK_P	21	22	CSI0_DATA2_N	CSI0_D2-
DSI_CLK-	DSI2_CLK_N	23	24	GND	GND
GND	GND	25	26	CSI0_DATA3_P	CSI0_D3+
DSI_D0+	DSI2_DATA0_P	27	28	CSI0_DATA3_N	CSI0_D3-
DSI_D0-	DSI2_DATA0_N	29	30	GND	GND
GND	GND	31	32	ISP_SCL0	I2C2_SCL
DSI_D1+	DSI2_DATA1_P	33	34	ISP_SDA0	I2C2_SDA
DSI_D1-	DSI2_DATA1_N	35	36	ISP_SCL1	I2C3_SCLL
GND	GND	37	38	ISP_SDA1	I2C3_SDA
DSI_D2+	DSI2_DATA2_P	39	40	GND	GND
DSI_D2-	DSI2_DATA2_N	41	42	CSI1_DATA0_P	CSI1_D0+
GND	GND	43	44	CSI1_DATA0_N	CSI1_D0-
DSI_D3+	DSI3_DATA3_P	45	46	GND	GND
DSI_D3-	DSI3_DATA3_N	47	48	CSI1_DATA1_P	CSI1_D1+
GND	GND	49	50	CSI1_DATA1_N	CSI1_D1-
USB_D+	USB_DP_HUB_DN4_CON	51	52	GND	GND
USB_D-	USB_DM_HUB_DN4_CON	53	54	CSI1_CLK_P	CSI1_C+
GND	GND	55	56	CSI1_CLK_N	CSI1_C-
HSIC_STR	NA	57	58	GND	GND
HSIC_DATA	NA	59	60	VOUT4_1V8	RESERVED

## 1.3.6 Antenna connector

The HiKey board is equipped with a TI WL1835MOD WLAN Baseband Processor and RF Transceiver which supports IEEE 802.11a, 802.11b, 802.11g and 802.11n WiFi.

A PCB chip antenna is available onboard by default but also an external antenna socket option is provided via J201&J2202 footprint. A Hirose U.FL-R-SMT connector can be soldered at J2201&J2202 location.

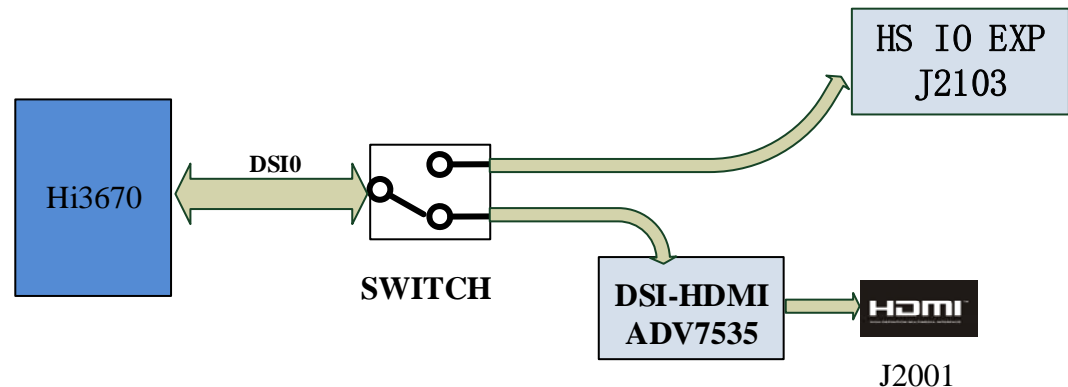
The HiKey board is equipped with a Broadcom BCM4753 GPS Baseband Processor and RF Transceiver. A Hirose U.FL-R-SMT connector can be soldered at J2301 location.

### 1.3.7 Display interfaces

The on board HDMI is provided via the Analog Devices ADV7535 multifunction video interface chip is available on the Type A HDMI connector mounted at J2001. This connector is ESD protected with TI protection diodes.

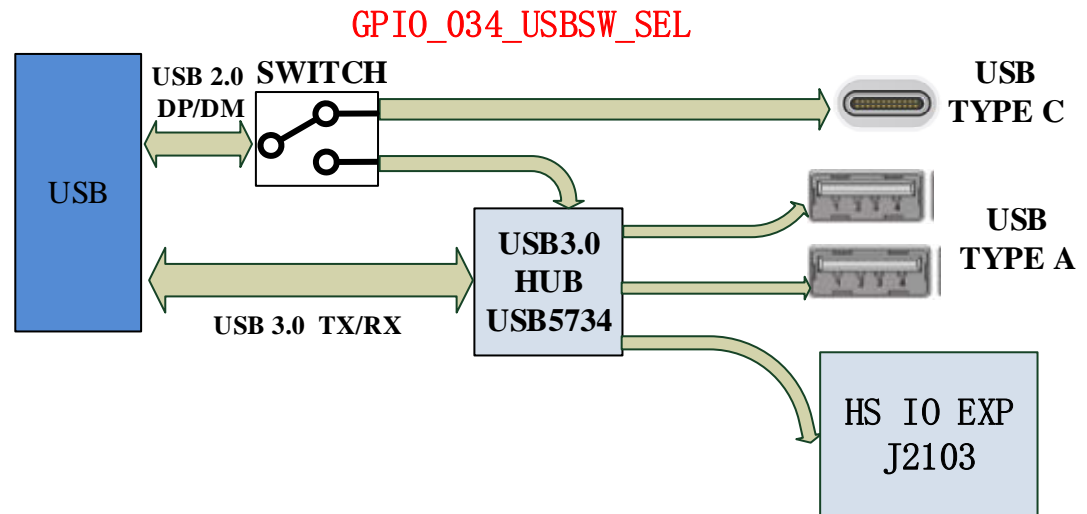
A 4 lane MIPI/DSI port is provided on the HS Expansion bus interface. Below is a block diagram of the HiKey implementation.

Figure 1-5 HDMI&LCD



### 1.3.8 USB interfaces

There are a total of 4 USB ports on the HiKey board. Two Type-A USB 3.0 host ports at J1901 and J1902, one type C 2.0 host/slave port at P1801 and one USB host port available on the High Speed Expansion bus.

**Figure 1-6 USB**

The HiKey board utilizes a single SoC USB interface without USB protocol hardware split transfer support. The USB interfaces are therefore subject to the following restrictions:

- The type C or the Type A/Mezzanine board interfaces may be used depending on the state of GPIO\_034\_USBSW\_SEL. Both interfaces may not be used at the same time.
- The type C port supports a single attached device with USB slave operations or USB host high speed, full speed or low speed operations.
- The Type A/Mezzanine board interfaces cannot support mixed speed devices. All attached devices must be of the same type – high speed, full speed or low speed. Furthermore, the HiKey board must be configured in software to support either full speed/low speed devices (default) or high/super speed devices on these ports.

### 1.3.9 System and user LEDs

There are four status LEDs and four User LEDs on the HiKey board. The user LEDs can be programmed by the SoC directly.

- D3305 – WiFi LED

The WiFi activity LED is a Yellow type surface mount 0603 LED.

- D3306- LED

The activity LED is a Blue Type surface mount 0603 LED .

- D3301-D3304 – USER LEDs

The four user LEDs are surface mount Green Type 0603 LED .

- D3308-GPS LED
- D3307-CAN LED

### 1.3.10 JTAG header

The HiKey board includes the option for soldering a 10 pin header that brings out the SoC signals for JTAG debug. A FTSH-105-01-F-DV header can be populated at J2501.



### 1.3.11 Ethernet

Hikey970 board reserved an Ethernet connector, but Ethernet function is not supported by current software.

## 1.4 FCC Regulations:

- 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 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.
- Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

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## FCC RF Radiation Exposure Statement

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This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. To comply with FCC RF Exposure compliance requirements, this grant is applicable to only Mobile Configurations. The antennas used for the transmitter must be installed to provide a separation distance of at least 20cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.