Wireless Smart Audio Module (A98D)

User Manual

Revision 0.2

Mar 07, 2024

HISTORY

Version	Date	Description
0.1	01/31/2024	Initial Version Release
0.2	03/07/2024	Change some descriptions

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1. Overview

Linkplay Wireless Smart Audio module A98D, is our 3rd generation smart audio modules developed to be used in the connected speaker, sound bar and other connected audio devices. It integrates the low power AMPAK AP6611SDV Wi-Fi/BT module and amlogic A113X application processor. A113X is an advanced application processor designed for connected audio applications. It integrates a powerful CPU subsystem, advanced multi-format audio processing unit, a secured running environment and all major peripherals to form the low power audio AP.

The main system CPU is a quad-core ARM Cortex-A53 CPU with L1 instruction/data cache for each core and a large unified L2 cache to improve system performance. Each Cortex-A53 CPU can run up to 1.5GHz (DVFS + hot plug) and has a wide bus connecting to the memory sub-system. When the system is suspended, the main CPU can be powered off and the cortex-M3 in the always-on power domain can resume the system from multiple interrupt sources.

The audio processing engine (APE) is based on ARM® NEONTM general-purpose SIMD architecture which works seamlessly with main CPU to accelerate the multimedia processing algorithms, enhancing the user experience. It is able to decode all major high resolution audio formats including MP3, AAC, WMA, RM, FLAC, Ogg, etc and with the flexibility to support future audio standards.

A113X integrates all standard audio input/output interfaces including multiple TDM, PCM, I2S and SPDIF digital audio input/output interfaces, and 8 channel far-field PDM digital microphone (DMIC) inputs. Audio input has power detector to wake up from low activity states and hardware assisted synchronization blocks for multiple room audio applications. Audio input data can be restricted to trusted memory space to protect always-on audio privacy.

A98D module supports IEEE 802.11 a/b/g/n/ac/ax 2.4GHz, 5GHz and 6GHz. It also supports BT5.3 with EDR and BLE.

A98D module also provides USB, I2S, I2C, PDM, SPI, UART etc. interfaces.

The firmware is fully compatible with Apple AirPlay and digital living network alliance (DLNA) streaming standards. It supports Hi-Fi audio up to 192KHz, 24-bit with most popular audio formats. It supports multi-room and multi-channel audio streaming with perfect synchronization.

With this module, you can play the music on your speaker wirelessly from iPhone, iPad , iPod touch, Android devices or PC. More important, it enables the traditional speaker system to become the Internet enabled device through the wired or wireless connection provided by the module. Thus, you could freely playback any Internet audio contents such as music, podcast, radio or either the accompany audio in the movie directly from the Internet.

Features

- amlogic A113X application processor
- 512MB DDR3 DRAM
- 512MB NAND FLASH
- Support IEEE 802.11 a/b/g/n/ac/ax 1T1R antenna diversity tri band
- Support BT5.3

Application

- Connected speaker, sound bar

- Connected audio devices

1.1. Parameter

Type	Items	Performance
Wi-Fi	Certification	Wi-Fi Alliance
	WLAN Standard	IEEE 802.11 a/b/g/n/ac/ax Wi-Fi compliant
Wi-Fi (2.4G)	Frequency Range	2.400 GHz ~ 2.4835 GHz (2.4 GHz ISM Band)
	Number of Channels	Ch1 ~ Ch13
	Modulation	802.11b : DQPSK, DBPSK, CCK
		802.11g/n : OFDM /64-QAM,16-QAM, QPSK, BPSK
		802.11ax : OFDMA /256-QAM,64-QAM,16-QAM, QPSK,BPSK
	Output Power (Tolerance ± 1.5 dB The transmit EVM quality & spectrum mask are compliant with IEEE 802.11 standard)	802.11b 1/2/5.5/11Mbps : 19 dB
		802.11g 6/9/12/18Mbps : 19 dB
		802.11g 24/36Mbps : 18 dB
		802.11g 48/54Mbps : 17 dB
		802.11n 20MHz MCS0-3 : 18.5 dB
		802.11n 20MHz MCS4 : 18 dB
		802.11n 20MHz MCS5 : 17 dB
		802.11n 20MHz MCS6/MCS7 : 16 dB
		802.11ax 20MHz HE0-3 : 18.5 dB
		802.11ax 20MHz HE4 : 18 dB
		802.11ax 20MHz HE5 : 17 dB
		802.11ax 20MHz HE6-7 : 16 dB
		802.11ax 20MHz HE8 : 15.5 dB
		802.11ax 20MHz HE9 : 15 dB
	Receive Sensitivity (Tolerance ± 2 dB CCK modulation PER ≦ 8%、OFDM modulation PER ≦ 10%)	802.11b 1Mbps -96 dBm
		802.11b 2Mbps -90 dBm
		802.11b 5.5Mbps -88 dBm
		802.11b 11Mbps -87 dBm
		802.11g 6Mbps -91 dBm
		802.11g 9Mbps -88 dBm
		802.11g 12Mbps -87 dBm
		802.11g 18Mbps -85 dBm
		802.11g 24Mbps -83 dBm
		802.11g 36Mbps -80 dBm
		802.11g 48Mbps -76 dBm
		802.11g 54Mbps -73 dBm
		802.11n 20MHz MCS0 -90 dBm

		802.11n 20MHz MCS1 -87 dBm
		802.11n 20MHz MCS2 -84 dBm
		802.11n 20MHz MCS3 -80 dBm
		802.11n 20MHz MCS4 -77 dBm
		802.11n 20MHz MCS5 -75 dBm
		802.11n 20MHz MCS6 -73 dBm
		802.11n 20MHz MCS7 -72 dBm
		802.11ax 20MHz HE0 -90 dBm
		802.11ax 20MHz HE1 -87 dBm
		802.11ax 20MHz HE2 -84 dBm
		802.11ax 20MHz HE3 -80 dBm
		802.11ax 20MHz HE4 -77 dBm
		802.11ax 20MHz HE5 -75 dBm
		802.11ax 20MHz HE6 -72 dBm
		802.11ax 20MHz HE7 -71 dBm
		802.11ax 20MHz HE8 -69 dBm
		802.11ax 20MHz HE9 -68 dBm
	Maximum Input Level	802.11b : -10 dBm
		802.11g/n/ax : -20 dBm
	Antenna Interface	N/A
Wi-Fi (5G)	WLAN Standard	IEEE 802.11a/n/ac/ax & Wi-Fi compliant
	Frequency Range	5.15 ~ 5.35GHz、5.47 ~ 5.725GHz、5.725 ~ 5.85GHz (5GHz UNII Band)
	Number of Channels	5.15~5.35GHz：Ch36 ~ Ch64 5.47~5.725GHz：Ch100 ~ Ch144 5.725~5.85GHz：Ch149 ~ Ch165
	Modulation	802.11a : OFDM /64-QAM、16-QAM、QPSK、BPSK
		802.11n : OFDM /64-QAM、16-QAM、QPSK、BPSK
		802.11ac : OFDM /256-QAM、64-QAM、16-QAM、QPSK、BPSK
		802.11ax : OFDMA /1024-QAM、256-QAM、64-QAM、16-QAM、QPSK、BPSK
	Output Power (Tolerance ± 2 dB The transmit EVM quality & spectrum mask are compliant with IEEE 802.11 standard)	802.11a 5150~5350MHz 6-9Mbps、12-18Mbps、24Mbps、36Mbps、48Mbps: 15.5 dB
		802.11a 5150~5350MHz 54Mbps : 15 dB
		802.11a 5470~5725MHz 6-9Mbps、12-18Mbps、24Mbps、36Mbps、48Mbps: 15.5 dB
		802.11a 5470~5725MHz 54Mbps : 15 dB
		802.11a 5725~5850MHz 6-9Mbps、12-18Mbps、24Mbps、36Mbps、48Mbps: 15.5 dB
		802.11a 5725~5850MHz 54Mbps : 15 dB

		802.11n 20MHz 5150~5350MHz MCS0~5 : 15.5 dB
		802.11n 20MHz 5150~5350MHz MCS6 : 15 dB
		802.11n 20MHz 5150~5350MHz MCS7 : 14 dB
		802.11n 20MHz 5470~5725MHz MCS0~5 : 15.5 dB
		802.11n 20MHz 5470~5725MHz MCS6 : 15 dB
		802.11n 20MHz 5470~5725MHz MCS7 : 14 dB
		802.11n 20MHz 5725~5850MHz MCS0~5 : 15.5 dB
		802.11n 20MHz 5725~5850MHz MCS6 : 15 dB
		802.11n 20MHz 5725~5850MHz MCS7 : 14 dB
		802.11n 40MHz 5150~5350MHz MCS0~6 : 15 dB
		802.11n 40MHz 5150~5350MHz MC7 : 14 dB
		802.11n 40MHz 5470~5725MHz MCS0~6 : 15 dB
		802.11n 40MHz 5470~5725MHz MC7 : 14 dB
		802.11n 40MHz 5725~5850MHz MCS0~6 : 15 dB
		802.11n 40MHz 5725~5850MHz MC7 : 14 dB
		802.11ac 20MHz 5150~5350MHz MCS0~5 : 15.5 dB
		802.11ac 20MHz 5150~5350MHz MCS6 : 15 dB
		802.11ac 20MHz 5150~5350MHz MCS7 : 14.5 dB
		802.11ac 20MHz 5150~5350MHz MCS8 : 12.5 dB
		802.11ac 20MHz 5470~5725MHz MCS0~5 : 15.5 dB
		802.11ac 20MHz 5470~5725MHz MCS6 : 15 dB
		802.11ac 20MHz 5470~5725MHz MCS7 : 14.5 dB
		802.11ac 20MHz 5470~5725MHz MCS8 : 12.5 dB
		802.11ac 20MHz 5725~5850MHz MCS0~5 : 15.5 dB
		802.11ac 20MHz 5725~5850MHz MCS6 : 15 dB
		802.11ac 20MHz 5725~5850MHz MCS7 : 14.5 dB
		802.11ac 20MHz 5725~5850MHz MCS8 : 12.5 dB
		802.11ac 40MHz 5150~5350MHz MCS0~6 : 15 dB
		802.11ac 40MHz 5150~5350MHz MCS7 : 14 dB
		802.11ac 40MHz 5150~5350MHz MCS8 : 12 dB
		802.11ac 40MHz 5150~5350MHz MCS9 : 11 dB
		802.11ac 40MHz 5470~5725MHz MCS0~6 : 15 dB
		802.11ac 40MHz 5470~5725MHz MCS7 : 14 dB
		802.11ac 40MHz 5470~5725MHz MCS8 : 12 dB
		802.11ac 40MHz 5470~5725MHz MCS9 : 11 dB
		802.11ac 40MHz 5725~5850MHz MCS0~6 : 15 dB
		802.11ac 40MHz 5725~5850MHz MCS7 : 14 dB
		802.11ac 40MHz 5725~5850MHz MCS8 : 12 dB
		802.11ac 40MHz 5725~5850MHz MCS9 : 11 dB
		802.11ac 80MHz 5150~5350MHz MCS0~6 : 15 dB
		802.11ac 80MHz 5150~5350MHz MCS7 : 13.5 dB
		802.11ac 80MHz 5150~5350MHz MCS8 : 12 dB

		802.11ac 80MHz 5150~5350MHz MCS9 : 11 dB
		802.11ac 80MHz 5470~5725MHz MCS0~6 : 15 dB
		802.11ac 80MHz 5470~5725MHz MCS7 : 13.5 dB
		802.11ac 80MHz 5470~5725MHz MCS8 : 12 dB
		802.11ac 80MHz 5470~5725MHz MCS9 : 11 dB
		802.11ac 80MHz 5725~5850MHz MCS0~6 : 15 dB
		802.11ac 80MHz 5725~5850MHz MCS7 : 13.5 dB
		802.11ac 80MHz 5725~5850MHz MCS8 : 12 dB
		802.11ac 80MHz 5725~5850MHz MCS9 : 11 dB
		802.11ax 20MHz 5150~5350MHz HE0~5 : 15.5 dB
		802.11ax 20MHz 5150~5350MHz HE6 : 15 dB
		802.11ax 20MHz 5150~5350MHz HE7 : 14.5 dB
		802.11ax 20MHz 5150~5350MHz HE8 : 12.5 dB
		802.11ax 20MHz 5150~5350MHz HE9 : 12 dB
		802.11ax 20MHz 5150~5350MHz HE10/11 : 9.5 dB
		802.11ax 20MHz 5470~5725MHz HE0~5 : 15.5 dB
		802.11ax 20MHz 5470~5725MHz HE6 : 15 dB
		802.11ax 20MHz 5470~5725MHz HE7 : 14.5 dB
		802.11ax 20MHz 5470~5725MHz HE8 : 12.5 dB
		802.11ax 20MHz 5470~5725MHz HE9 : 12 dB
		802.11ax 20MHz 5470~5725MHz HE10/11 : 9.5 dB
		802.11ax 20MHz 5725~5850MHz HE0~5 : 15.5 dB
		802.11ax 20MHz 5725~5850MHz HE6 : 15 dB
		802.11ax 20MHz 5725~5850MHz HE7 : 14.5 dB
		802.11ax 20MHz 5725~5850MHz HE8 : 12.5 dB
		802.11ax 20MHz 5725~5850MHz HE9 : 12 dB
		802.11ax 20MHz 5725~5850MHz HE10/11 : 9.5 dB
		802.11ax 40MHz 5150~5350MHz HE0~6 : 15 dB
		802.11ax 40MHz 5150~5350MHz HE7 : 14 dB
		802.11ax 40MHz 5150~5350MHz HE8 : 12 dB
		802.11ax 40MHz 5150~5350MHz HE9 : 11 dB
		802.11ax 40MHz 5150~5350MHz HE10/11 : 9 dB
		802.11ax 40MHz 5470~5725MHz HE0~6 : 15 dB
		802.11ax 40MHz 5470~5725MHz HE7 : 14 dB
		802.11ax 40MHz 5470~5725MHz HE8 : 12 dB
		802.11ax 40MHz 5470~5725MHz HE9 : 11 dB
		802.11ax 40MHz 5470~5725MHz HE10/11 : 9 dB
		802.11ax 40MHz 5725~5850MHz HE0~6 : 15 dB
		802.11ax 40MHz 5725~5850MHz HE7 : 14 dB
		802.11ax 40MHz 5725~5850MHz HE8 : 12 dB
		802.11ax 40MHz 5725~5850MHz HE9 : 11 dB
		802.11ax 40MHz 5725~5850MHz HE10/11 : 9 dB

		802.11ax 80MHz 5150~5350MHz HE0~6 : 15 dB
		802.11ax 80MHz 5150~5350MHz HE7 : 13.5 dB
		802.11ax 80MHz 5150~5350MHz HE8 : 12 dB
		802.11ax 80MHz 5150~5350MHz HE9 : 11 dB
		802.11ax 80MHz 5150~5350MHz HE10/11 : 8 dB
		802.11ax 80MHz 5470~5725MHz HE0~6 : 15 dB
		802.11ax 80MHz 5470~5725MHz HE7 : 13.5 dB
		802.11ax 80MHz 5470~5725MHz HE8 : 12 dB
		802.11ax 80MHz 5470~5725MHz HE9 : 11 dB
		802.11ax 80MHz 5470~5725MHz HE10/11 : 8 dB
		802.11ax 80MHz 5725~5850MHz HE0~6 : 15 dB
		802.11ax 80MHz 5725~5850MHz HE7 : 13.5 dB
		802.11ax 80MHz 5725~5850MHz HE8 : 12 dB
		802.11ax 80MHz 5725~5850MHz HE9 : 11 dB
		802.11ax 80MHz 5725~5850MHz HE10/11 : 8 dB
	Receive Sensitivity (Tolerance ± 2 dB CCK modulation PER ≦ 8%、OFDM modulation PER ≦ 10%)	802.11a 6Mbps -90 dBm
		802.11a 9Mbps -90 dBm
		802.11a 12Mbps -88 dBm
		802.11a 18Mbps -86 dBm
		802.11a 24Mbps -83 dBm
		802.11a 36Mbps -80 dBm
		802.11a 48Mbps -75 dBm
		802.11a 54Mbps -73 dBm
		802.11n 20MHz MCS0 -90 dBm
		802.11n 20MHz MCS1 -88 dBm
		802.11n 20MHz MCS2 -86 dBm
		802.11n 20MHz MCS3 -83 dBm
		802.11n 20MHz MCS4 -79 dBm
		802.11n 20MHz MCS5 -76 dBm
		802.11n 20MHz MCS6 -73 dBm
		802.11n 20MHz MCS7 -72 dBm
		802.11n 40MHz MCS0 -88 dBm
		802.11n 40MHz MCS1 -86 dBm
		802.11n 40MHz MCS2 -83 dBm
		802.11n 40MHz MCS3 -80 dBm
		802.11n 40MHz MCS4 -77 dBm
		802.11n 40MHz MCS5 -72 dBm
		802.11n 40MHz MCS6 -70 dBm
		802.11n 40MHz MCS7 -69 dBm
		802.11ac 20MHz MCS0 -90 dBm
		802.11ac 20MHz MCS1 -88 dBm
		802.11ac 20MHz MCS2 -86 dBm

		802.11ac 20MHz MCS3 -83 dBm
		802.11ac 20MHz MCS4 -79 dBm
		802.11ac 20MHz MCS5 -75 dBm
		802.11ac 20MHz MCS6 -73 dBm
		802.11ac 20MHz MCS7 -70 dBm
		802.11ac 20MHz MCS8 -68 dBm
		802.11ac 40MHz MCS0 -88 dBm
		802.11ac 40MHz MCS1 -86 dBm
		802.11ac 40MHz MCS2 -83 dBm
		802.11ac 40MHz MCS3 -80 dBm
		802.11ac 40MHz MCS4 -76 dBm
		802.11ac 40MHz MCS5 -72 dBm
		802.11ac 40MHz MCS6 -70 dBm
		802.11ac 40MHz MCS7 -69 dBm
		802.11ac 40MHz MCS8 -65 dBm
		802.11ac 40MHz MCS9 -64 dBm
		802.11ac 80MHz MCS0 -85 dBm
		802.11ac 80MHz MCS1 -82 dBm
		802.11ac 80MHz MCS2 -79 dBm
		802.11ac 80MHz MCS3 -76 dBm
		802.11ac 80MHz MCS4 -73 dBm
		802.11ac 80MHz MCS5 -68 dBm
		802.11ac 80MHz MCS6 -67 dBm
		802.11ac 80MHz MCS7 -65 dBm
		802.11ac 80MHz MCS8 -62 dBm
		802.11ac 80MHz MCS9 -61 dBm
		802.11ax 20MHz HE0 -90 dBm
		802.11ax 20MHz HE1 -88 dBm
		802.11ax 20MHz HE2 -86 dBm
		802.11ax 20MHz HE3 -83 dBm
		802.11ax 20MHz HE4 -79 dBm
		802.11ax 20MHz HE5 -75 dBm
		802.11ax 20MHz HE6 -73 dBm
		802.11ax 20MHz HE7 -70 dBm
		802.11ax 20MHz HE8 -68 dBm
		802.11ax 20MHz HE9 -64 dBm
		802.11ax 20MHz HE10 -59 dBm
		802.11ax 20MHz HE11 -57 dBm
		802.11ax 40MHz HE0 -88 dBm
		802.11ax 40MHz HE1 -86 dBm
		802.11ax 40MHz HE2 -83 dBm
		802.11ax 40MHz HE3 -80 dBm

		802.11ax 40MHz HE4 -76 dBm
		802.11ax 40MHz HE5 -72 dBm
		802.11ax 40MHz HE6 -70 dBm
		802.11ax 40MHz HE7 -69 dBm
		802.11ax 40MHz HE8 -65 dBm
		802.11ax 40MHz HE9 -64 dBm
		802.11ax 40MHz HE10 -60 dBm
		802.11ax 40MHz HE11 -55 dBm
		802.11ax 80MHz HE0 -85 dBm
		802.11ax 80MHz HE1 -82 dBm
		802.11ax 80MHz HE2 -79 dBm
		802.11ax 80MHz HE3 -76 dBm
		802.11ax 80MHz HE4 -73 dBm
		802.11ax 80MHz HE5 -68 dBm
		802.11ax 80MHz HE6 -67 dBm
		802.11ax 80MHz HE7 -65 dBm
		802.11ax 80MHz HE8 -62 dBm
		802.11ax 80MHz HE9 -61 dBm
		802.11ax 80MHz HE10 -57 dBm
		802.11ax 80MHz HE11 -53 dBm
	Maximum Input Level	802.11a/n/ac/ax : -30 dBm
	Antenna Reference	N/A
Wi-Fi (6G)	WLAN Standard	IEEE 802.11ax & Wi-Fi compliant
	Frequency Range	5.925 ~ 7.125GHz (6GHz U-NII5, U-NII6, U-NII-7, U-NII-8 Band)
	Number of Channels	5.925~6.425GHz：6G1 ~ 6G93 6.425~6.525GHz：6G97 ~ 6G113 6.525~6.875GHz：6G117 ~ 6G181 6.875~7.125GHz：6G185 ~ 6G233
	Modulation	802.11ax : OFDMA /1024-QAM、256-QAM、64-QAM、16-QAM、QPSK、BPSK
	Output Power (Tolerance ± 2.5 dB The transmit EVM quality & spectrum mask are compliant with IEEE 802.11 standard)	802.11ax 20MHz 5925~6425MHz HE0-2 : 14.5 dB
		802.11ax 20MHz 5925~6425MHz HE3/4/5/6 : 14 dB
		802.11ax 20MHz 5925~6425MHz HE7 : 13 dB
		802.11ax 20MHz 5925~6425MHz HE8 : 11.5 dB
		802.11ax 20MHz 5925~6425MHz HE9 : 10.5 dB
		802.11ax 20MHz 5925~6425MHz HE10/11 : 9 dB
		802.11ax 20MHz 6425~6525MHz HE0-2 : 14.5 dB
		802.11ax 20MHz 6425~6525MHz HE3/4/5/6 : 14 dB
		802.11ax 20MHz 6425~6525MHz HE7 : 13 dB
		802.11ax 20MHz 6425~6525MHz HE8 : 11.5 dB
		802.11ax 20MHz 6425~6525MHz HE9 : 10.5 dB

		802.11ax 20MHz 6425~6525MHz HE10/11 : 9 dB
		802.11ax 20MHz 6525~6875MHz HE0~6 : 14 dB
		802.11ax 20MHz 6525~6875MHz HE7 : 13 dB
		802.11ax 20MHz 6525~6875MHz HE8 : 11.5 dB
		802.11ax 20MHz 6525~6875MHz HE9 : 10.5 dB
		802.11ax 20MHz 6525~6875MHz HE10/11 : 9 dB
		802.11ax 20MHz 6875~7125MHz HE0~5 : 13.5 dB
		802.11ax 20MHz 6875~7125MHz HE6 : 13 dB
		802.11ax 20MHz 6875~7125MHz HE7 : 11 dB
		802.11ax 20MHz 6875~7125MHz HE8 : 10.5 dB
		802.11ax 20MHz 6875~7125MHz HE9 : 9.5 dB
		802.11ax 20MHz 6875~7125MHz HE10/11 : 8 dB
		802.11ax 40MHz 5925~6425MHz HE0-2 : 14.5 dB
		802.11ax 40MHz 5925~6425MHz HE3/4/5 : 14 dB
		802.11ax 40MHz 5925~6425MHz HE6 : 13.5 dB
		802.11ax 40MHz 5925~6425MHz HE7 : 12.5 dB
		802.11ax 40MHz 5925~6425MHz HE8 : 10.5 dB
		802.11ax 40MHz 5925~6425MHz HE9 : 9 dB
		802.11ax 40MHz 5925~6425MHz HE10/11 : 8 dB
		802.11ax 40MHz 6425~6525MHz HE0-2 : 14.5 dB
		802.11ax 40MHz 6425~6525MHz HE3/4/5 : 14 dB
		802.11ax 40MHz 6425~6525MHz HE6 : 13.5 dB
		802.11ax 40MHz 6425~6525MHz HE7 : 12.5 dB
		802.11ax 40MHz 6425~6525MHz HE8 : 10.5 dB
		802.11ax 40MHz 6425~6525MHz HE9 : 9.5 dB
		802.11ax 40MHz 6425~6525MHz HE10/11 : 8.5 dB
		802.11ax 40MHz 6525~6875MHz HE0~5 : 14 dB
		802.11ax 40MHz 6525~6875MHz HE6 : 13.5 dB
		802.11ax 40MHz 6525~6875MHz HE7 : 12.5 dB
		802.11ax 40MHz 6525~6875MHz HE8 : 10.5 dB
		802.11ax 40MHz 6525~6875MHz HE9 : 9.5 dB
		802.11ax 40MHz 6525~6875MHz HE10/11 : 8.5 dB
		802.11ax 40MHz 6875~7125MHz HE0-2 : 14 dB
		802.11ax 40MHz 6875~7125MHz HE3/4/5 : 13.5 dB
		802.11ax 40MHz 6875~7125MHz HE6 : 13 dB
		802.11ax 40MHz 6875~7125MHz HE7 : 11.5 dB
		802.11ax 40MHz 6875~7125MHz HE8 : 9.5 dB
		802.11ax 40MHz 6875~7125MHz HE9 : 8.5 dB
		802.11ax 40MHz 6875~7125MHz HE10/11 : 7.5 dB
		802.11ax 80MHz 5925~6425MHz HE0-2 : 14.5 dB
		802.11ax 80MHz 5925~6425MHz HE3/4/5 : 14 dB
		802.11ax 80MHz 5925~6425MHz HE6 : 13.5 dB

		802.11ax 80MHz 5925~6425MHz HE7 : 12.5 dB
		802.11ax 80MHz 5925~6425MHz HE8 : 10.5 dB
		802.11ax 80MHz 5925~6425MHz HE9 : 9.5 dB
		802.11ax 80MHz 5925~6425MHz HE10/11 : 8.5 dB
		802.11ax 80MHz 6425~6525MHz HE0-2 : 14.5 dB
		802.11ax 80MHz 6425~6525MHz HE3/4/5 : 14 dB
		802.11ax 80MHz 6425~6525MHz HE6 : 13.5 dB
		802.11ax 80MHz 6425~6525MHz HE7 : 12.5 dB
		802.11ax 80MHz 6425~6525MHz HE8 : 10.5 dB
		802.11ax 80MHz 6425~6525MHz HE9 : 9.5 dB
		802.11ax 80MHz 6425~6525MHz HE10/11 : 8.5 dB
		802.11ax 80MHz 6525~6875MHz HE0~5 : 14 dB
		802.11ax 80MHz 6525~6875MHz HE6 : 13.5 dB
		802.11ax 80MHz 6525~6875MHz HE7 : 12.5 dB
		802.11ax 80MHz 6525~6875MHz HE8 : 10.5 dB
		802.11ax 80MHz 6525~6875MHz HE9 : 9.5 dB
		802.11ax 80MHz 6525~6875MHz HE10/11 : 8.5 dB
		802.11ax 80MHz 6875~7125MHz HE0-2 : 14 dB
		802.11ax 80MHz 6875~7125MHz HE3/4/5 : 13.5 dB
		802.11ax 80MHz 6875~7125MHz HE6 : 13 dB
		802.11ax 80MHz 6875~7125MHz HE7 : 11.5 dB
		802.11ax 80MHz 6875~7125MHz HE8 : 9.5 dB
		802.11ax 80MHz 6875~7125MHz HE9 : 8.5 dB
		802.11ax 80MHz 6875~7125MHz HE10/11 : 7.5 dB
	Receive Sensitivity (Tolerance ± 2 dB OFDM modulation PER ≦ 10%)	802.11ax 20MHz SISO HE0 -88 dBm
		802.11ax 20MHz SISO HE1 -86 dBm
		802.11ax 20MHz SISO HE2 -84 dBm
		802.11ax 20MHz SISO HE3 -83 dBm
		802.11ax 20MHz SISO HE4 -77 dBm
		802.11ax 20MHz SISO HE5 -73 dBm
		802.11ax 20MHz SISO HE6 -71 dBm
		802.11ax 20MHz SISO HE7 -68 dBm
		802.11ax 20MHz SISO HE8 -66 dBm
		802.11ax 20MHz SISO HE9 -62 dBm
		802.11ax 20MHz SISO HE10 -57 dBm
		802.11ax 20MHz SISO HE11 -55 dBm
		802.11ax 20MHz MIMO HE0 -88 dBm
		802.11ax 20MHz MIMO HE1 -86 dBm
		802.11ax 20MHz MIMO HE2 -84 dBm
		802.11ax 20MHz MIMO HE3 -81 dBm
		802.11ax 20MHz MIMO HE4 -77 dBm
		802.11ax 20MHz MIMO HE5 -73 dBm

		802.11ax 20MHz MIMO HE6 -71 dBm
		802.11ax 20MHz MIMO HE7 -68 dBm
		802.11ax 20MHz MIMO HE8 -66 dBm
		802.11ax 20MHz MIMO HE9 -62 dBm
		802.11ax 20MHz MIMO HE10 -57 dBm
		802.11ax 20MHz MIMO HE11 -54 dBm
		802.11ax 40MHz SISO HE0 -86 dBm
		802.11ax 40MHz SISO HE1 -84 dBm
		802.11ax 40MHz SISO HE2 -81 dBm
		802.11ax 40MHz SISO HE3 -78 dBm
		802.11ax 40MHz SISO HE4 -74 dBm
		802.11ax 40MHz SISO HE5 -70 dBm
		802.11ax 40MHz SISO HE6 -68 dBm
		802.11ax 40MHz SISO HE7 -67 dBm
		802.11ax 40MHz SISO HE8 -63 dBm
		802.11ax 40MHz SISO HE9 -62 dBm
		802.11ax 40MHz SISO HE10 -58 dBm
		802.11ax 40MHz SISO HE11 -53 dBm
		802.11ax 40MHz MIMO HE0 -85 dBm
		802.11ax 40MHz MIMO HE1 -84 dBm
		802.11ax 40MHz MIMO HE2 -81 dBm
		802.11ax 40MHz MIMO HE3 -78 dBm
		802.11ax 40MHz MIMO HE4 -74 dBm
		802.11ax 40MHz MIMO HE5 -70 dBm
		802.11ax 40MHz MIMO HE6 -68 dBm
		802.11ax 40MHz MIMO HE7 -67 dBm
		802.11ax 40MHz MIMO HE8 -63 dBm
		802.11ax 40MHz MIMO HE9 -62 dBm
		802.11ax 40MHz MIMO HE10 -58 dBm
		802.11ax 40MHz MIMO HE11 -53 dBm
		802.11ax 80MHz SISO HE0 -83 dBm
		802.11ax 80MHz SISO HE1 -80 dBm
		802.11ax 80MHz SISO HE2 -77 dBm
		802.11ax 80MHz SISO HE3 -74 dBm
		802.11ax 80MHz SISO HE4 -71 dBm
		802.11ax 80MHz SISO HE5 -66 dBm
		802.11ax 80MHz SISO HE6 -65 dBm
		802.11ax 80MHz SISO HE7 -63 dBm
		802.11ax 80MHz SISO HE8 -60 dBm
		802.11ax 80MHz SISO HE9 -59 dBm
		802.11ax 80MHz SISO HE10 -55 dBm
		802.11ax 80MHz SISO HE11 -51 dBm

		802.11ax 80MHz MIMO HE0 -82 dBm
		802.11ax 80MHz MIMO HE1 -80 dBm
		802.11ax 80MHz MIMO HE2 -77 dBm
		802.11ax 80MHz MIMO HE3 -74 dBm
		802.11ax 80MHz MIMO HE4 -71 dBm
		802.11ax 80MHz MIMO HE5 -66 dBm
		802.11ax 80MHz MIMO HE6 -65 dBm
		802.11ax 80MHz MIMO HE7 -63 dBm
		802.11ax 80MHz MIMO HE8 -60 dBm
		802.11ax 80MHz MIMO HE9 -59 dBm
		802.11ax 80MHz MIMO HE10 -55 dBm
		802.11ax 80MHz MIMO HE11 -50 dBm
	Maximum Input Level	802.11ax : -30 dBm
	Antenna Reference	N/A
Bluetooth	Certification	QDID
	Bluetooth Standard	BDR、EDR(1Mbps & 2Mbps)、LE(1Mbps)、2LE(2Mbps)
	Antenna Interface	N/A
	Frequency Band	2402 MHz ~ 2480 MHz
	Number of Channels	79 channels for classic、40 channels for BLE
	Modulation	GFSK, π/4-DQPSK,8DPSK
	BDR Output Power	CL1: 7dBm
	EDR Output Power	CL1: 6dBm
	BLE Output Power	CL1: 7dBm
	Sensitivity @ BER=0.1% for GFSK (1Mbps)	-87 dBm, Typical
	Sensitivity @ BER=0.01% for π/4-DQPSK (2Mbps)	-89 dBm, Typical
	Sensitivity @ BER=0.01% for 8DPSK (3Mbps)	-84 dBm, Typical
	Sensitivity @ PER=30.8% for LE (1Mbps)	-90 dBm, Typical
	Sensitivity @ BER=30.8% for 2LE (2Mbps)	-90 dBm, Typical
	Maximum Input Level	GFSK (1Mbps): -20dBm
		π/4-DQPSK (2Mbps) : -20dBm
		8DPSK (3Mbps) : -20dBm
Hardware	Work voltage	3.5-5.5V
	Work current	200 ~ 240mA (STA mode)
	Standby current	5mA
	Operating ambient temperature	0℃ ~ 40℃
	Storage temperature	-5℃ ~ 45℃

	Wi-Fi work distance	2.4G 80 meters/5G 200meters
	IO Extension	USB, I2S, I2C, PWM, SPI, UART
	Dimension	NGFF golden finger 67PIN

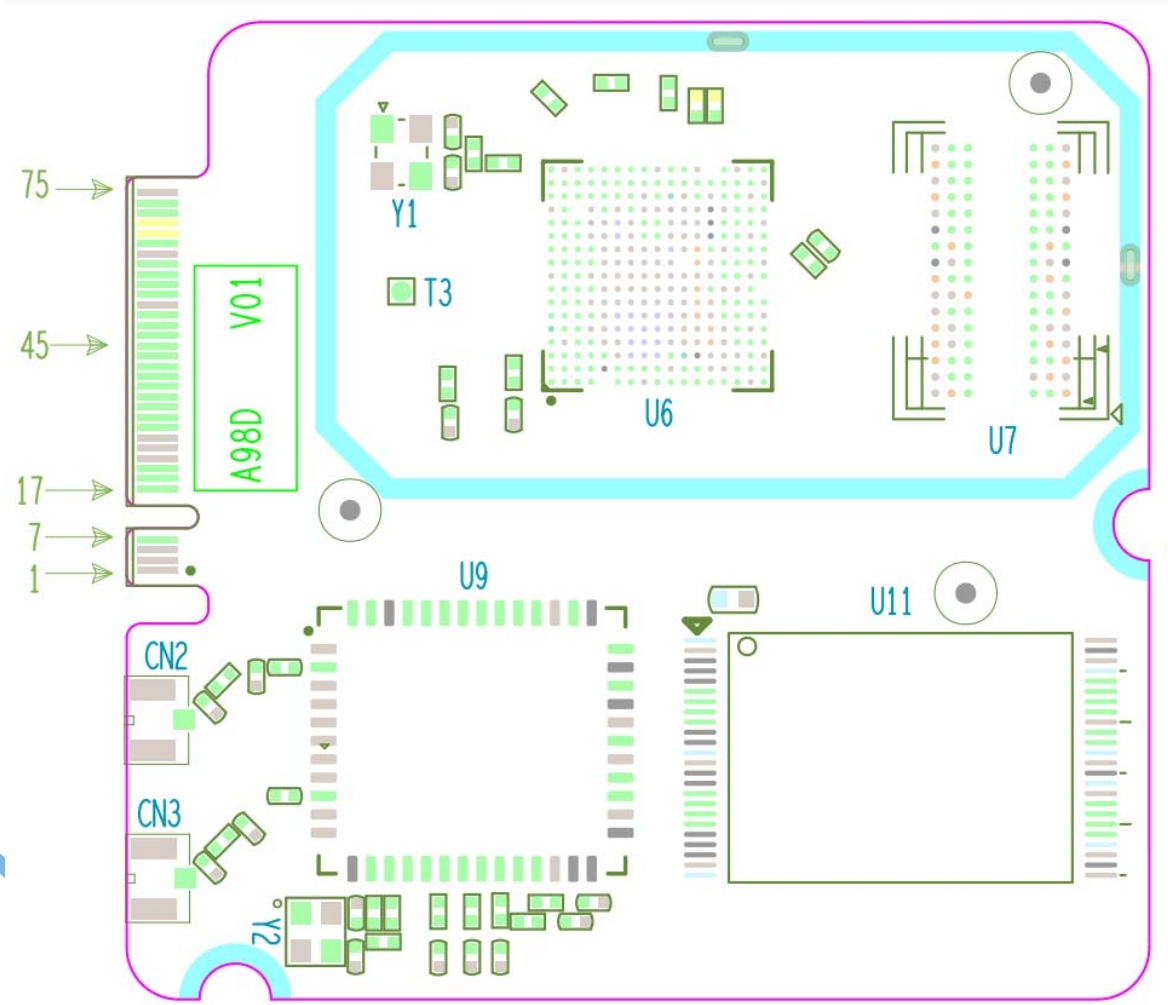
Table1- 1 Linkplay A98D module parameters

Note: The Bluetooth output power is able to be configured by firmware (hcd file).

2. Hardware Description

2.1. Description of Hardware Interface

A98D provides the option to connect with customer board through its 67-pins NGFF golden finger. The detail is as follows.



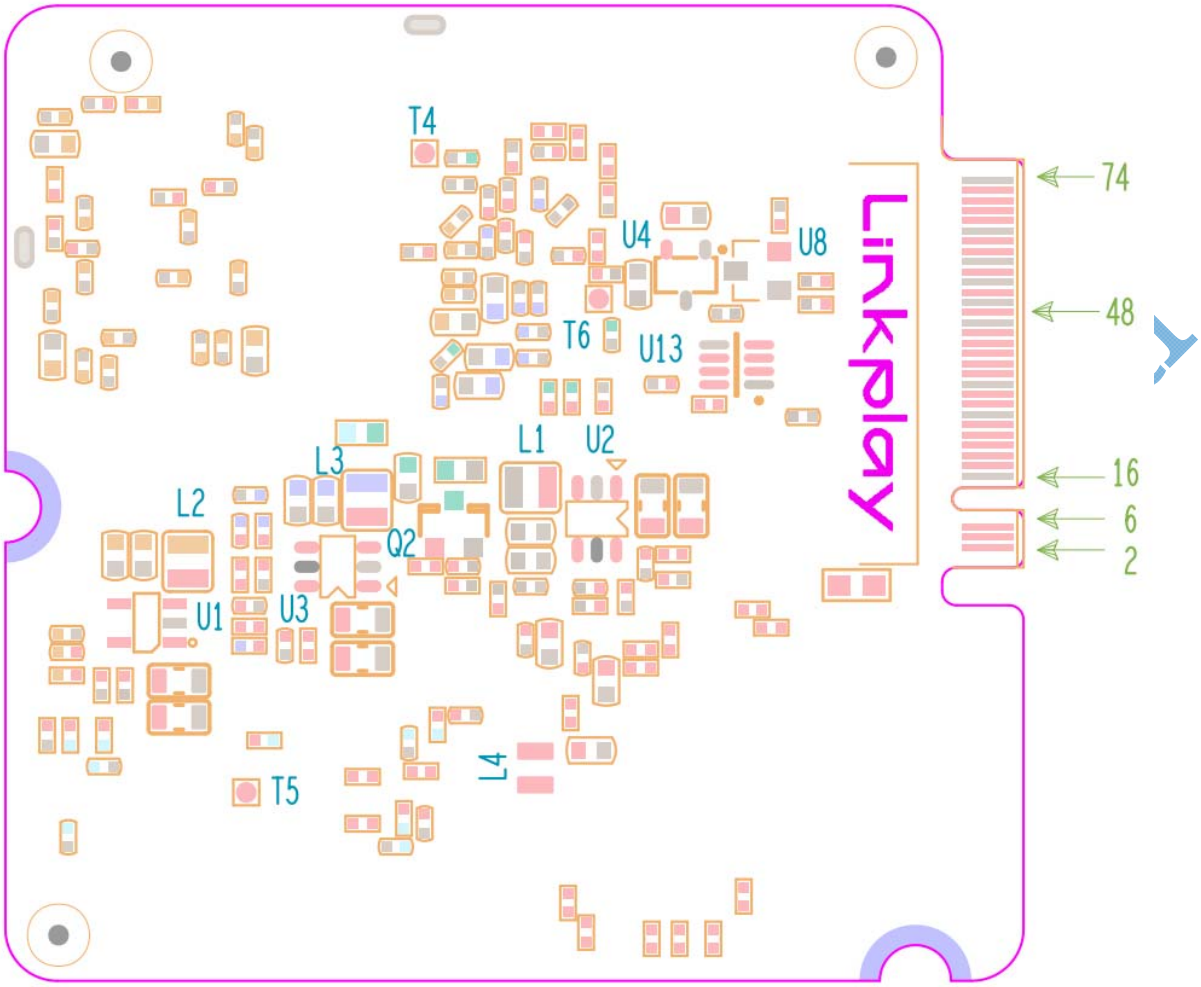


Figure 2- 1 A98D Interface Pins

Pin Description:

Pin No.	Pin Name	Type	Function0	Function1
1, 3, 5, 16, 23, 25, 27, 28, 34, 46, 50, 53, 54, 58, 63, 64, 74, 75	GND	Supply	Digital ground	
2，4，6	VDD_5V	Power I	Power supply input > 500mA	
7	GPIOZ_7	I/O	General purpose input output	
17	I2C1_SCL	I/O	I2C bus1 clock	
19	I2C1_SDA	I/O	I2C bus1 data	

21	GPIOZ_3	I/O	General purpose input output	
29	GPIOZ_6	I/O	General purpose input output	
31	PWM_B	O	Pulse Width Modulation B	
33	PWM_D	O	Pulse Width Modulation C	
35	PWMAO_C	O	Pulse Width Modulation AO_C	
37	PWMAO_D	O	Pulse Width Modulation AO_D	
39	UART0_RXD	I	UART0 receive	
41	UART0_TXD	O	UART0 transmit	
43	GPIOAO_7	I/O	General purpose input output	
45	GPIOAO_6	I/O	General purpose input output	
47	PWMAO_A	O	Pulse Width Modulation AO_A	
49	I2C0_SDA	I/O	I2C0 bus data	
51	I2C0_SCL	I/O	I2C0 bus clock	
55	GPIOA_19	I/O	General purpose input output	
57	ADC_CH0	I	ADC input	
59	MCLK_C	O	Master clock C	
61	GPIOAO_13	I/O	General purpose input output	
65	GPIOA_20	I/O	General purpose input output	
67	USB_DM	I/O	USB data minus	
69	USB_DP	I/O	USB data plus	
71	USB_VBUS	I	USB voltage detection	
73	USB_ID	I	USB ID	
18	GPIOZ_5	I/O	General purpose input output	
20	GPIOZ_1	I/O	General purpose input output	
22	GPIOZ_0	I/O	General purpose input output	
24	PWM_C	I/O	Pulse Width Modulation C	
26	GPIOZ_2	I/O	General purpose input output	
30	UART1_RXD	I	UART1 receive	
32	UART1_TXD	O	UART1 transmit	
36	PDM_DIN3	I	PDM input data 3 signal	
38	PDM_DIN1	I	PDM input data 1 signal	
40	PDM_DIN2	I	PDM input data 2 signal	
42	PDM_DCLK	O	PDM output clock	
44	PDM_DIN0	I	PDM input data 0 signal	
48	TDMB_DIO1	I/O	TDM B input and output data1	
52	TDMB_SCLK	I/O	TDM B bit clock	
56	TDMB_DIO0	I/O	TDM B input and output data0	
60	TDMB_FS	I/O	TDM B L/R clock	
62	TDMC_DIO1	I/O	TDM C input and output data1	
66	TDMC_DIO0	I/O	TDM C input and output data0	
68	TDMC_FS	I/O	TDM C L/R clock	

70	TDMC_SCLK	I/O	TDM C bit clock	
72	MCLK_B	O	Master clock B	

Table 2- 1 Linkplay A98D module pin description

Notes:

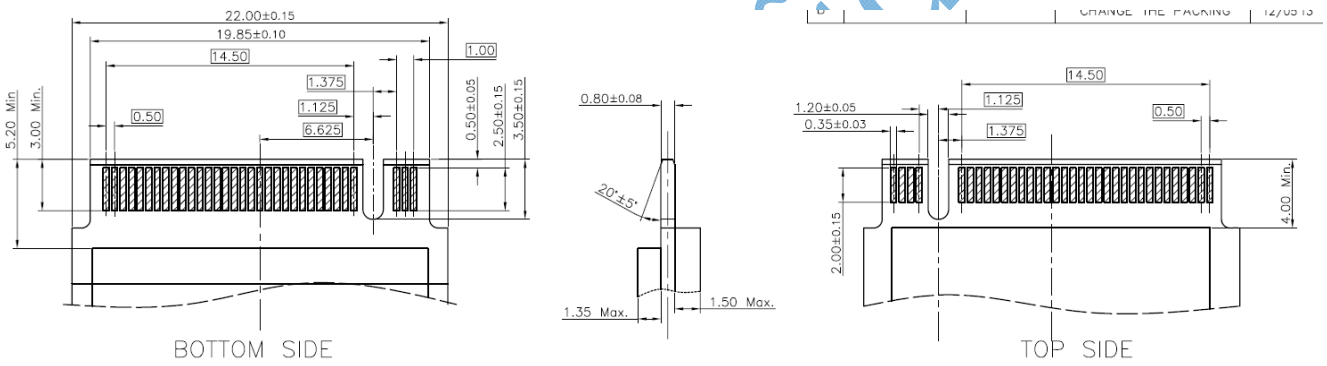
1. I：Input
2. O：Output
3. P：Power
4. PU：Internal Pull Up
5. PD：Internal Pull Down

2.2. Mechanical Dimension

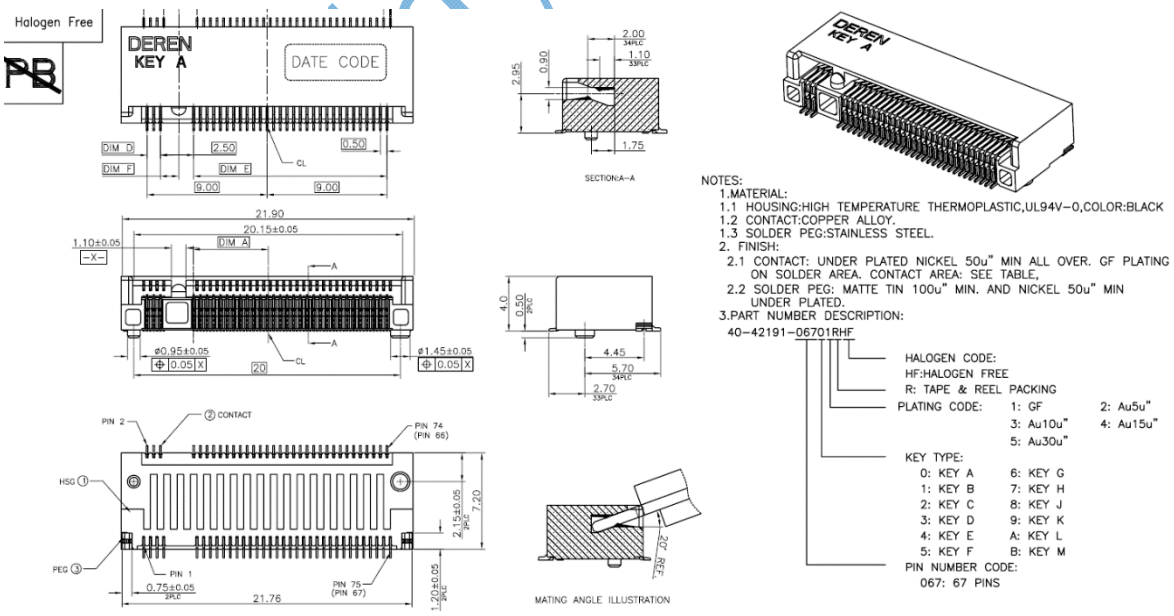
Linkplay A98D module has the dimension of 50mm x 47.83mm. The detailed layout will be given shortly below.

Unit: mm

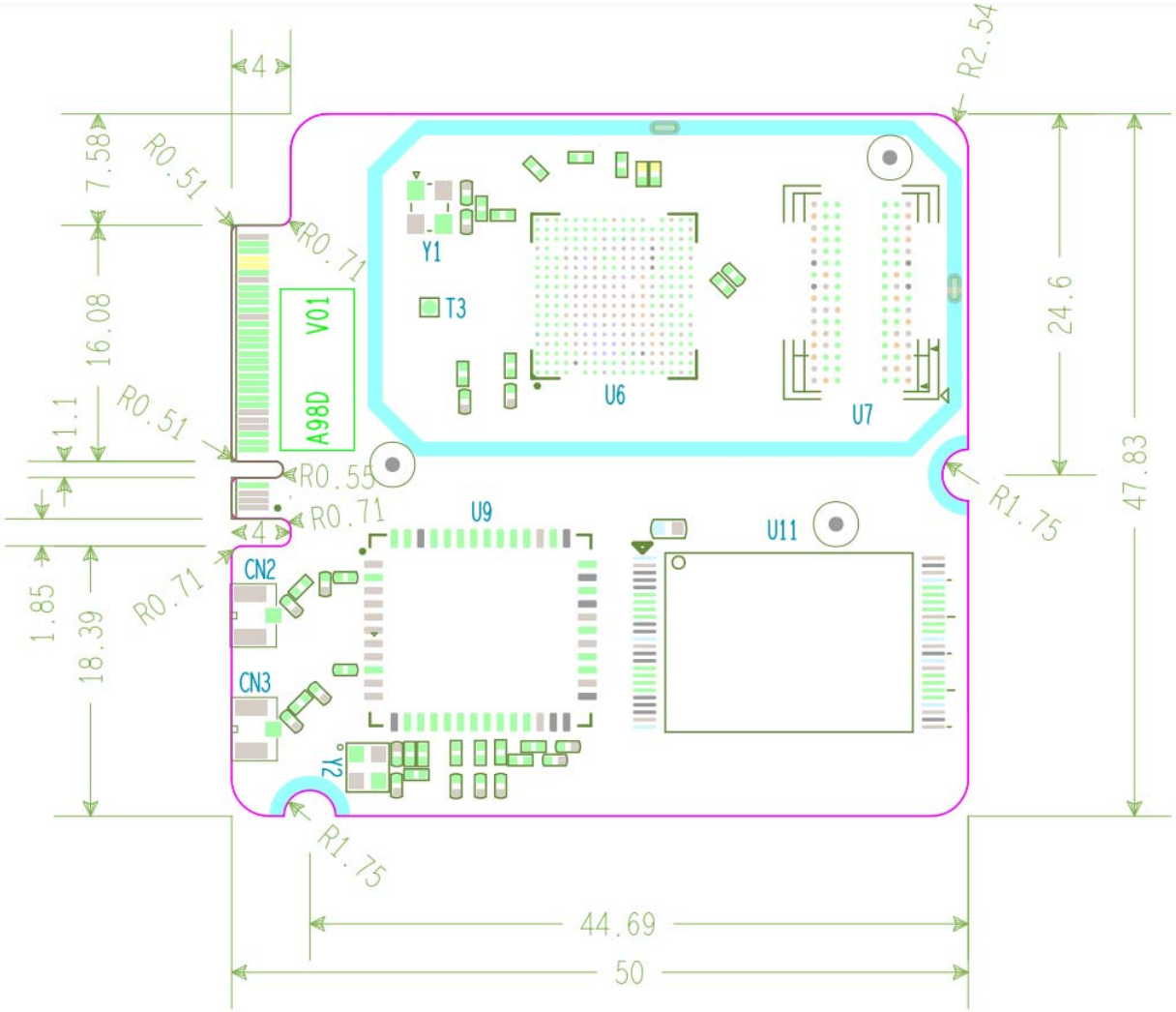
PLUG PCB dimensions:



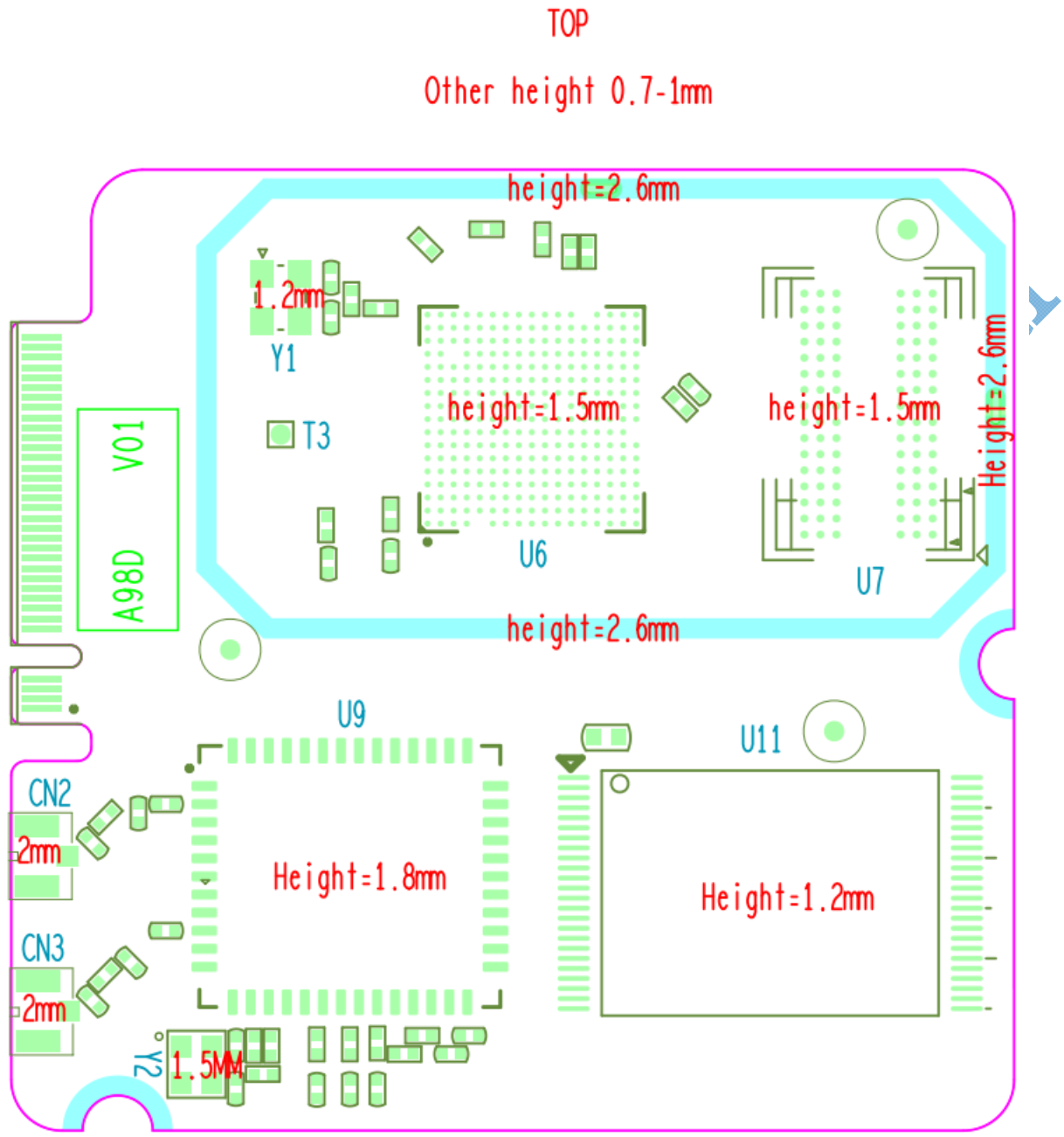
NGFF connector dimensions:



Top View



TOP Components Height Limit



Bottom Components Height Limit

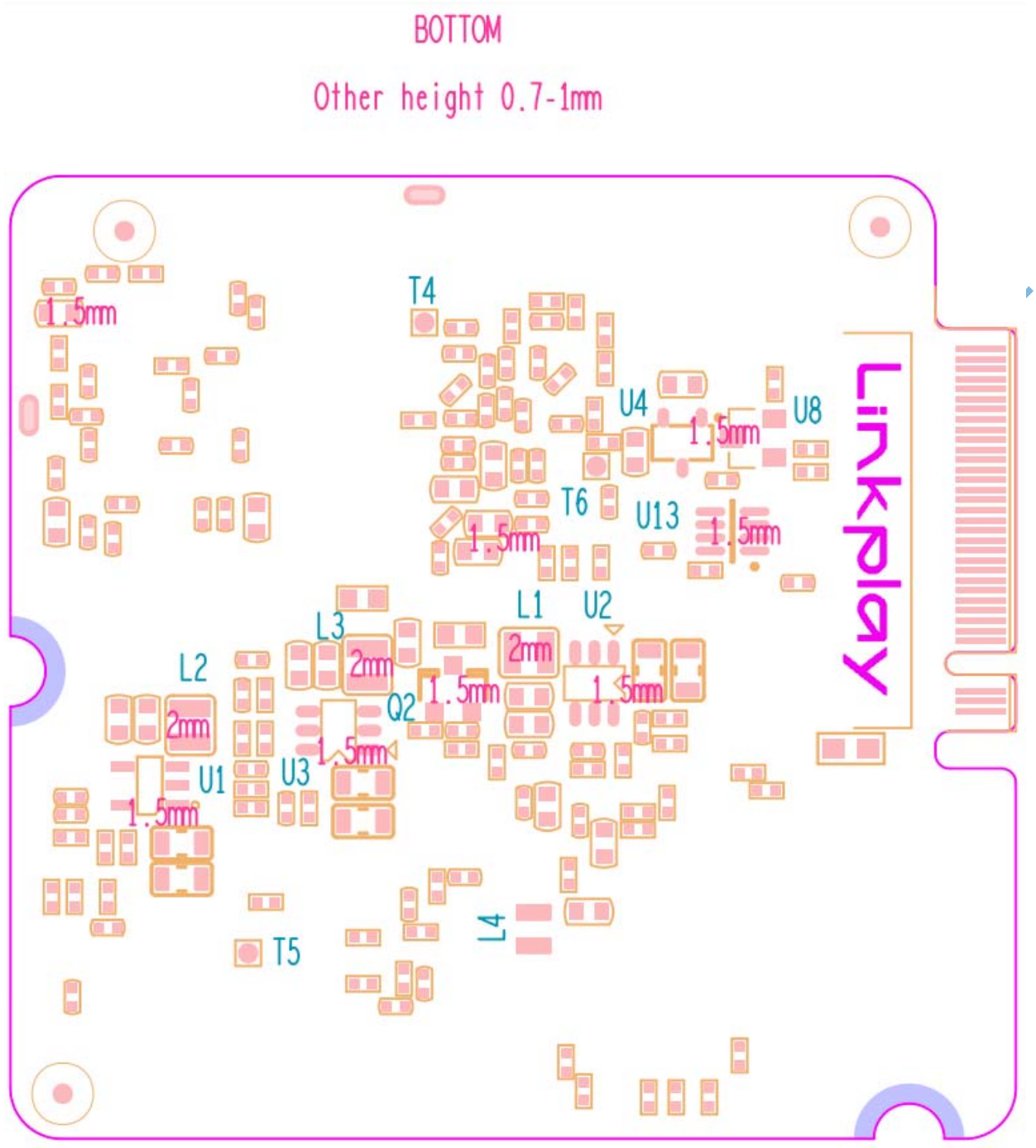


Figure 2- 2: Linkplay A98D physical dimension

2.3. External Antenna

A98D uses the external antenna for the best Wi-Fi performance. To use external antenna, please choose the antenna type that meets the requirement of IEEE 802.11a/b/g/n/ac/ax Wi-Fi standard running at 2.4GHz/5GHz/6GHz frequency. The detailed parameters are shown in the table below.

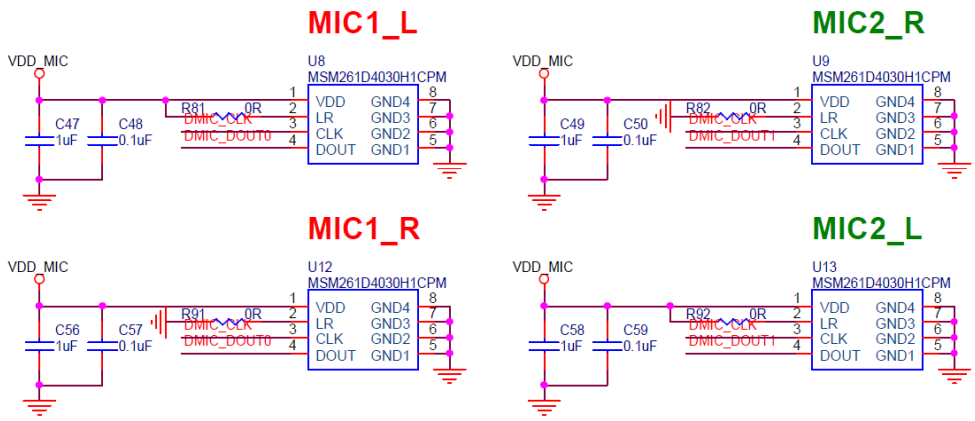
Item	Parameter
Frequency range	2.4 ~ 2.5GHz/4.9 ~ 5.8GHz/5.9 ~ 7.1GHz
Impedance	50 Ohm
VSWR	2 (Max.)
Reflection loss	-10dB (Max.)
Connector	I-PEX or populate directly

Table 2- 5 External antenna parameters for A98D

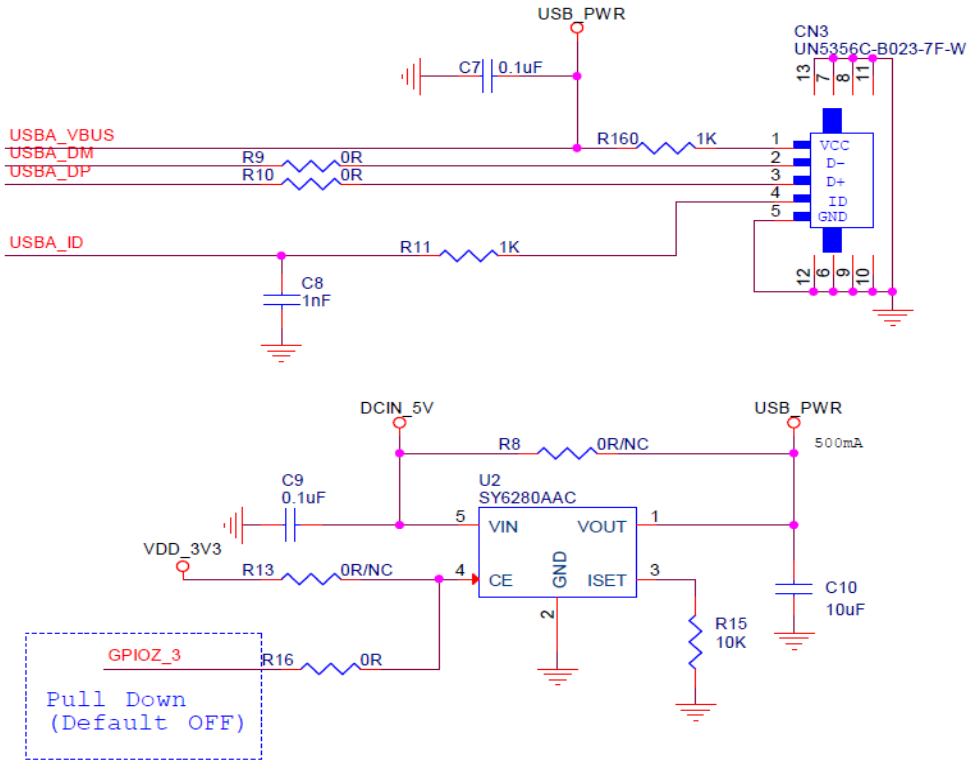
2.4. Typical Application

WiFiAudio-A98D's typical reference design:

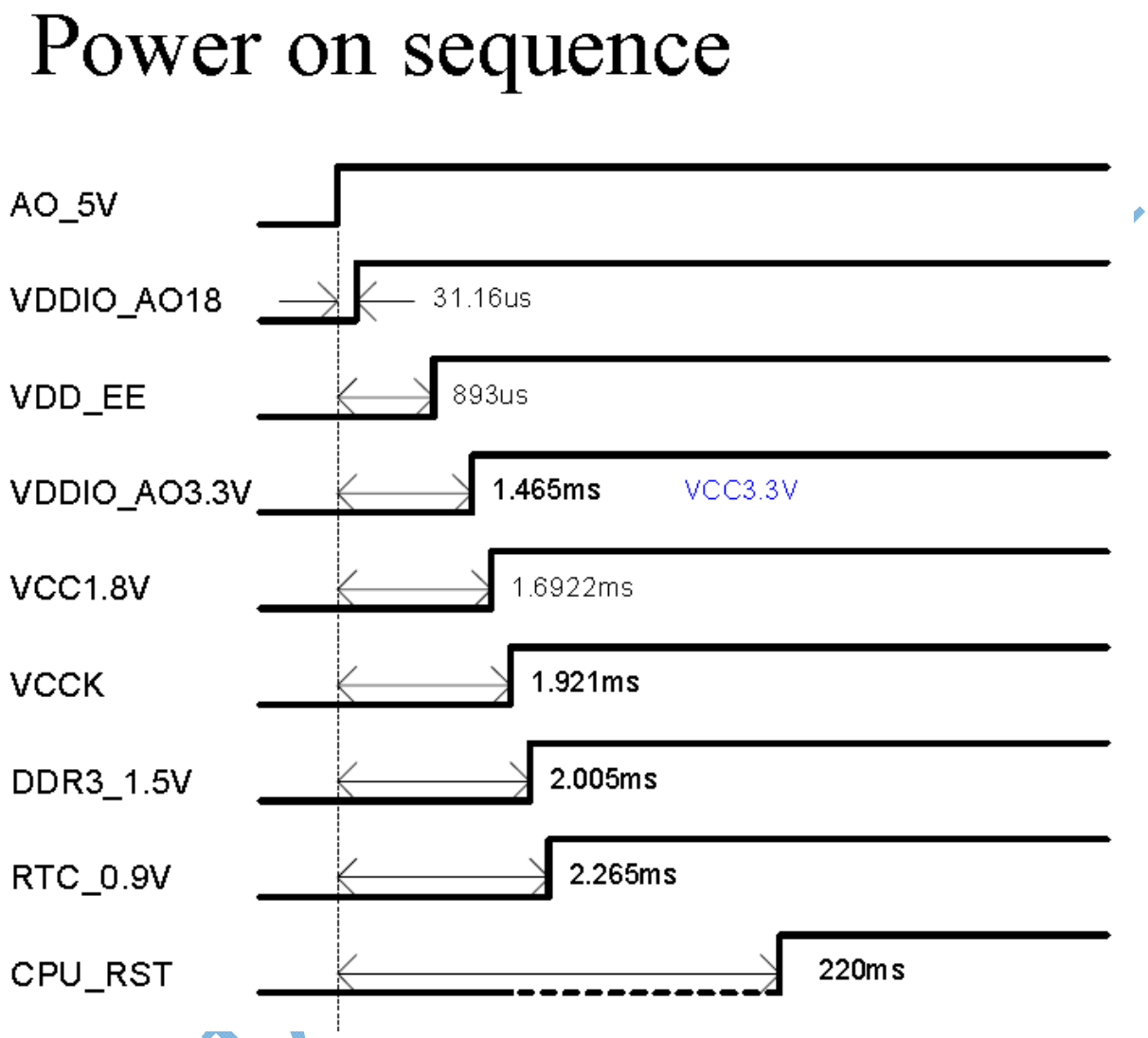
2-MIC or 4-MIC Far-Field



Power and OTG



2.5. Power on Sequence



2.6 USB OTG Port

Please follow the design rule below to populate the USB host interface:

Item	Parameter
Signal Group	USB
Topology	Differential Pair Point-to-Point
Reference Plane	Ground Referenced
Characteristic Trace Impedance (Zo)	90 Ω ±10%
Trace Width	4 mils
Serpentine Spacing (center to center)	8.5 mils

Minimum Isolation Spacing to Clock Signals	50 mils
Minimum Isolation Spacing to Low-Speed Signals	20 mils
Minimum Isolation Spacing to other USB Pair	20 mils
Total Length (with package length)	< 8000 mils
Maximum Recommended Via Count	2 (per side)
DM to DP Length Matching (with package length)	Match total length to within ±10 mils

Table 2- 2 A98D USB design rule

3. Software Introduction

3.1. Feature list

- "Easy Setup" to setup your network, with the help of one button of your device, you can connect the device to your home router quickly.
- Music stream protocol
  Support Spotify Connect, Airplay, DLNA and QPlay protocol
- Amazon Alexa
- Google Voice Assistant and Google Cast for Audio
- Music content
  Support iHeartRadio, Napster/Rhapsody, Tidal, Deezer, vTune, Qobuz, Audible, Radio.de, NPR， Ximalaya，Qingting FM, QQ FM, Douban FM inside, with the help of App, you can search, stream, playback and preset the musics of the above music services.
- Multiroom
  Support multiroom.
  Support Airplay, Spotify, Bluetooth, Aux-in multiroom playback.
- Music format
  HTTP/HTTPS/RTSP/MMS/TS protocol
  HLS/ASX/M3U playlist format
  MP3/AAC/FLAC/ALAC/WMA/APE/OGG codec
- BT
  Support 4.2： A2DP, AVRCP, HFP, HID profiles
  Support BLE
  Support EDR
- Preset
  With the help of App, you can store the music account token and playlist in the A98D. Then the end user can play the playlist by the button/voice or timer even without the App.

3.2. APP support

- iOS App

≥ iOS6.1， suggest iOS10 and above

- Android APP
  ≥ Android 4.3.3
- Quick Customization
  With the help of the Linkplay compile server, you can change the brand and some strings, change the logo and some pictures to get a customization App.

3.3. Certifications

Linkplay can help you to finish follow certifications:

- Wi-Fi Alliance
- BQB
- Amazon Alexa
- MFi
- Spotify Connect
- DLNA
- QPlay

4. CE/FCC/IC Statements

FCC/IC Statement:

RF Exposure Information: The equipment complies with FCC/IC RSS-102 radiation exposure limits set forth for an uncontrolled environment. The equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

This device complies with Part 15 of the FCC Rules and contains license-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS standard(s). 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.

NOTE: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications or changes to this equipment. Such modifications or changes 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.

For radio equipment operates in 5150-5850MHz

High power radars are allocated as primary users of the 5.25 to 5.35 GHz and 5.65 to 5.85 GHz bands. These radar stations can cause interference with and/or damage to LE LAN (Licence-Exempt Local Area Network) devices. No configuration controls are provided for this wireless equipment allowing any change in the frequency of operations outside the FCC grant of authorization for US operation according to Part 15.407 of the FCC rules.

The device for operation in the band 5150-5250 MHz is only for indoor use to reduce the potential for harmful interference to co-channel mobile satellite systems; for devices with detachable antenna(s), the maximum antenna gain permitted for devices in the bands 5250-5350 MHz and 5470-5725 MHz shall be such that the equipment still complies with the e.i.r.p. limit; for devices with detachable antenna(s), the maximum antenna

gain permitted for devices in the band 5725-5850 MHz shall be such that the equipment still complies with the e.i.r.p. limits specified for point-to-point and non-point-to-point operation as appropriate.

Transmitters in the 5.925-7.125 GHz band are prohibited from operating to control or communicate with unmanned aircraft systems.

This device is intended only for OEM integrators under the following conditions:

1. The antenna must be installed such that 20 cm is maintained between the antenna and users.
2. The transmitter module may not be co-located with any other transmitter or antenna. As long as the two conditions above are met, additional transmitter testing will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required for the installed module.

Important Note:

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the Federal Communications Commission of the U.S. Government (FCC) and the Canadian Government authorizations are no longer considered valid and the FCC ID and IC ID cannot be used on the final product. In these circumstances, the OEM integrator shall be responsible for re-evaluating the end-product (including the transmitter) and obtaining a separate FCC and IC authorization in the U.S. and Canada.

OEM Integrators - End Product Labeling Considerations:

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: “Contains, FCC ID: 2BABF-A98D or IC:30828-A98D. The grantee's FCC ID can be used only when all FCC compliance requirements are met.

OEM Integrators - End Product Manual Provided to the End User:

The OEM integrator shall not provide information to the end user regarding how to install or remove this RF module in end product user manual. The end user manual must include all required regulatory information and warnings as outlined in this document.

Énoncé d'exposition aux rayonnements FCC/IC
L'équipement est conforme aux limites d'exposition aux rayonnements FCC/IC RSS-102 établies pour un environnement non contrôlé. L'équipement doit être installé et utilisé avec une distance minimale de 20cm entre le radiateur et votre corps.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique 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, et
(2) l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Les radars de puissance élevée sont attribués comme utilisateurs principaux des fréquences de 5,25 à 5,35 GHz et Bandes de 5,65 à 5,85 GHz. Ces stations radar peuvent causer des interférences avec
Et/ou dommages aux périphériques LE LAN (réseau Local exempté de licence). Non non
Des contrôles de configuration sont fournis pour cet équipement sans fil permettant toute
Modification de la fréquence des opérations en dehors du FCC octroi d'autorisation
Pour les opérations américaines conformément à la partie 15.407 des règles de la FCC.

les dispositifs fonctionnant dans la bande 5150-5250 MHz sont réservés uniquement pour une utilisation à l'intérieur afin de réduire les risques de brouillage préjudiciable aux systèmes de satellites mobiles utilisant les mêmes canaux;
le gain maximal d'antenne permis pour les dispositifs utilisant les bandes 5250-5350 MHz et 5470-5725 MHz doit se conformer à la limite de p.i.r.e.;
le gain maximal d'antenne permis (pour les dispositifs utilisant la bande 5725-5850 MHz) doit se conformer à la limite de p.i.r.e. spécifiée pour l'exploitation point à point et non point à point, selon le cas.

Il est interdit d'utiliser les émetteurs de la bande de 5,925 à 7,125 GHz pour contrôler les systèmes d'aéronef sans pilote ou communiquer avec eux.

CAN ICES-003(B)/NMB-003(B)

IC: 30828-A98D
FCC ID: 2BABF-A98D

CE Statement:

RF exposure information: The Maximum Permissible Exposure (MPE) level has been calculated based on a distance of d=20 cm between the device and the human body. To maintain compliance with RF exposure requirement, use product that maintain a 20cm distance between the device and the human body.

Do not use the device in the environment at too high or too low temperature,
never expose the device under strong sunshine or too wet environment.
The suitable temperature for the product and accessories is 0℃-40℃.

Operating frequency range and maximum transmit power

Bluetooth: 2402MHz ~ 2480MHz, <10.0 dBm(EIRP)
WLAN 2.4GHz: 2412MHz ~ 2472MHz, <20 dBm(EIRP)
WLAN 5GHz: 5150MHz ~ 5825MHz, <20 dBm(EIRP)
WLAN 6GHz: 5955MHz ~ 6415MHz, <20 dBm(EIRP)

The device for operation in the band 5150-5350 MHz and 5955-6415MHz are only for indoor use to reduce the potential for harmful interference to co-channel mobile satellite systems.

AT	BE	BG	CH	CY	CZ	DE	DK
EE	EL	ES	FI	FR	HR	HU	IE
IS	IT	LI	LT	LU	LV	MT	NL
PL	PT	RO	SE	SI	SK	TR	UK(NI)
UK							

This product can be used across EU member states.

EU Regulatory Conformance

Hereby, Linkplay Technology Inc. Corporation declares that this device is in compliance with the essential requirements and other relevant provisions of Directive 2014/53/EU.
For the declaration of conformity, visit the Web site https://www.wiimhome.com/certificaton.

CE