QXDM
1. enable diag port cmd: setprop sys.usb.config diag,adb
2. file -> manage configuration
3. connect diag port
4. play or record
5. disconnect diag port
5. file -> save item

QCAT
1. file -> open file
1. view -> vocoder playback -> process

latency calculator
ref: 80-pp949-4_b_measure_pcm_data_path_delay_in_adsp.pdf

ADSP AFE TDM ports: can check the number from acdb cfg file
TDM1 (0x9100-0x0x910F)
TDM2 (0x9110-0x0x911F)
TDM3 (0x9120-0x0x912F)
TDM4 (0x9130-0x0x913F)
TDM5 (0x9140-0x0x914F)

adsp capture latency
= abs ((ASM_tx_wav – AFE_tx_wav) + (ASM_tx_Label – AFE_tx_Label)) //(0x1536) - (0x1586)
= -2 + (379-324)
= 53

= -175 +55
= -120

adsp playback latency(12-08.20-52-49-665.hdf)
= abs ((AFE_rx_wav – ASM_rx_wav) + (AFE_rx_Label – ASM_rx_Label)) //(0x1586) - (0x152E)
= 55 + (915-925)
= 45

device tree
80-p2310-9_b_s820m_linux_android_automotive_audio_customization_guide.pdf page:22
kernel/msm-5.4/Documentation/devicetree/bindings/sound/qcom-audio-dev.txt
vendor/qcom/proprietary/devicetree/qcom/sa6155-audio.dtsi
vendor/qcom/proprietary/devicetree/qcom/sa6155-tml-gen3-audio.dtsi
1. SND card information
2. GPIO configuration
3. Group device configuration
4. TDM format definition

3和4大部分的配置都可以在QACT中进行配置，Tools > Device Designer
Group device definition
Group device ID
qcom,msm-cpudai-tdm-group-id = <37168>;

Table 9-1 Available group device IDs

Name	Group device ID
AFE_GROUP_DEVICE_ID_PRIMARY_TDM_RX	0x9100
AFE_GROUP_DEVICE_ID_PRIMARY_TDM_TX	0x9101
AFE_GROUP_DEVICE_ID_SECONDARY_TDM_RX	0x9110
AFE_GROUP_DEVICE_ID_SECONDARY_TDM_TX	0x9111
AFE_GROUP_DEVICE_ID_TERTIARY_TDM_RX	0x9120
AFE_GROUP_DEVICE_ID_TERTIARY_TDM_TX	0x9121
AFE_GROUP_DEVICE_ID_QUATERNARY_TDM_RX	0x9130
AFE_GROUP_DEVICE_ID_QUATERNARY_TDM_TX	0x9131

AFE port ID
qcom,msm-cpudai-tdm-group-port-id = <36912 36914 36916 36918>;

Table 9-2 Available AFE port IDs

Name	AFE port ID
AFE_PORT_ID_PRIMARY_TDM_RX	0x9000
AFE_PORT_ID_PRIMARY_TDM_RX_1	0x9002
AFE_PORT_ID_PRIMARY_TDM_RX_2	0x9004
AFE_PORT_ID_PRIMARY_TDM_RX_3	0x9006
AFE_PORT_ID_PRIMARY_TDM_RX_4	0x9008
AFE_PORT_ID_PRIMARY_TDM_RX_5	0x900A
AFE_PORT_ID_PRIMARY_TDM_RX_6	0x900C
AFE_PORT_ID_PRIMARY_TDM_RX_7	0x900E
AFE_PORT_ID_PRIMARY_TDM_TX	0x9001
AFE_PORT_ID_PRIMARY_TDM_TX_1	0x9003
AFE_PORT_ID_PRIMARY_TDM_TX_2	0x9005
AFE_PORT_ID_PRIMARY_TDM_TX_3	0x9007
AFE_PORT_ID_PRIMARY_TDM_TX_4	0x9009
AFE_PORT_ID_PRIMARY_TDM_TX_5	0x900B
AFE_PORT_ID_PRIMARY_TDM_TX_6	0x900D
AFE_PORT_ID_PRIMARY_TDM_TX_7	0x900F
AFE_PORT_ID_SECONDARY_TDM_RX	0x9010

```
AFE clock rate
qcom,msm-cpudai-tdm-clk-rate = <12288000>;

Data lane config
tdm_quat_rx中：
qcom,msm-cpudai-tdm-lane-mask = /bits/ 16 <10>;
10=b1010: 表示data1和data3为tdm_quat_rx，output引脚
tdm_quat_tx中：
qcom,msm-cpudai-tdm-lane-mask = /bits/ 16 <5>;
5=b0101: 表示data0和data2为tdm_quat_tx，input引脚


AFE port format configuration (TDM format)
AFE port ID
qcom,msm-cpudai-tdm-dev-id = <36912>;

Sync mode
qcom,msm-cpudai-tdm-sync-mode = <1>;
```

Table 9-3 Available sync modes

Sync mode	Value
AFE_PORT_TDM_SHORT_SYNC_BIT_MODE	0
AFE_PORT_TDM_LONG_SYNC_MODE	1
AFE_PORT_TDM_SHORT_SYNC_MODE	2

```
Sync source
qcom,msm-cpudai-tdm-sync-src = <0>;
```

Table 9-4 Available sync sources

Sync Source	Value
AFE_PORT_TDM_SYNC_SRC_EXTERNAL	0
AFE_PORT_TDM_SYNC_SRC_INTERNAL	1

```
Data out
qcom,msm-cpudai-tdm-data-out = <0>;
```

Table 9-6 Available Invert Sync Values

Invert sync	Value
AFE_PORT_TDM_SYNC_NORMAL	0
AFE_PORT_TDM_SYNC_INVERT	1

```
Data delay
qcom,msm-cpudai-tdm-data-delay = <0>;
```

Table 9-7 Available data delay values

Data delay	Value
AFE_PORT_TDM_DATA_DELAY_0_BCLK_CYCLE	0
AFE_PORT_TDM_DATA_DELAY_1_BCLK_CYCLE	1
AFE_PORT_TDM_DATA_DELAY_2_BCLK_CYCLE	2

```
Data align
qcom,msm-cpudai-tdm-data-align = <0>;
```

Table 9-8 Available data align values

Data Align	Value
AFE_SLOT_MAPPING_DATA_ALIGN_MSB	0
AFE_SLOT_MAPPING_DATA_ALIGN_LSB	1

qualcomm doc ref
ref: 80-pp949-4_b_measure_pcm_data_path_delay_in_adsp.pdf

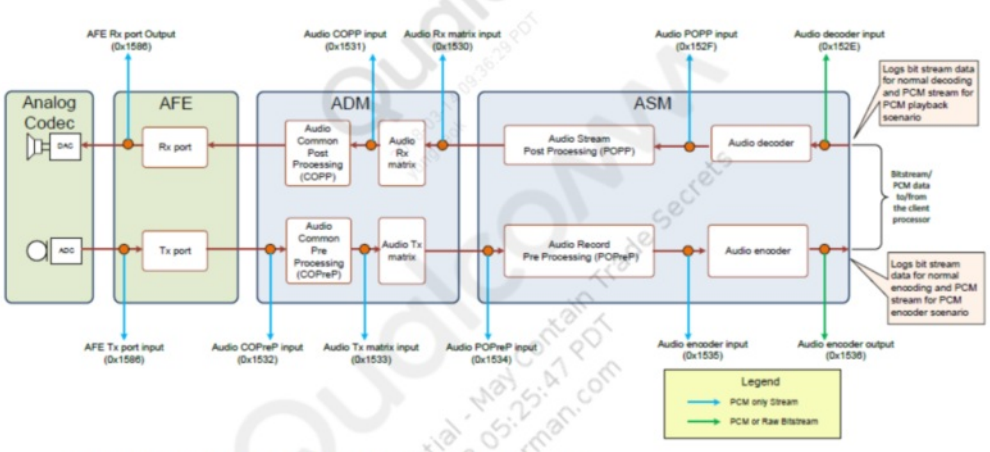

Figure 2-1 Audio PCM logging point diagram

ref: 80-nf775-1_b_qualcomm_hexagon_access_audio_api_reference_for_avs.adsp.2.9.pdf
4.2.6

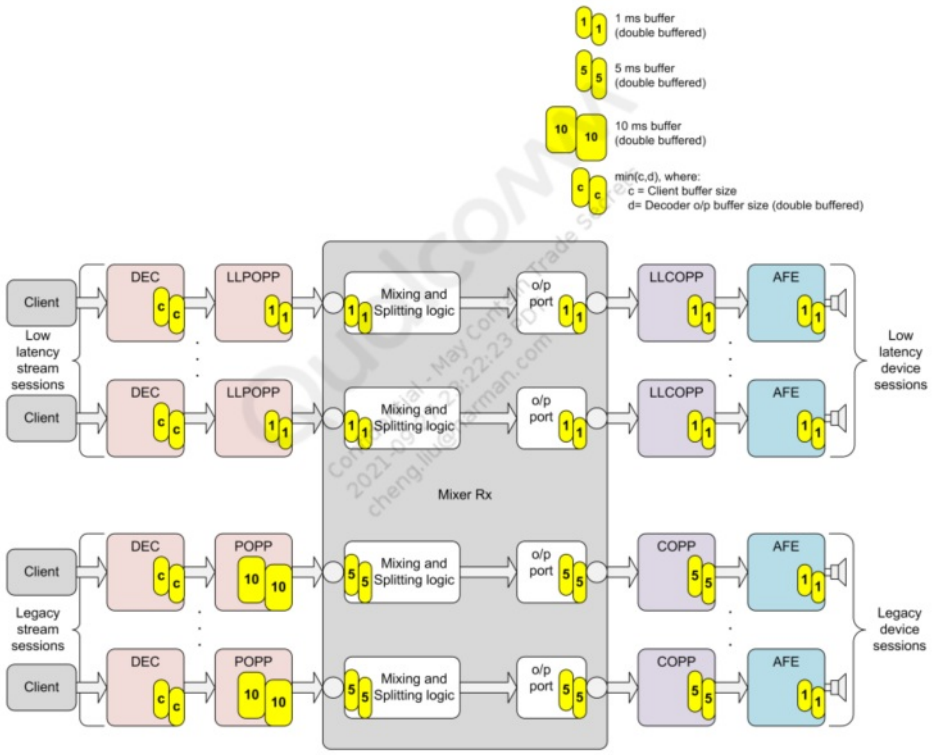

Figure 4-61 Low latency and legacy playback sessions

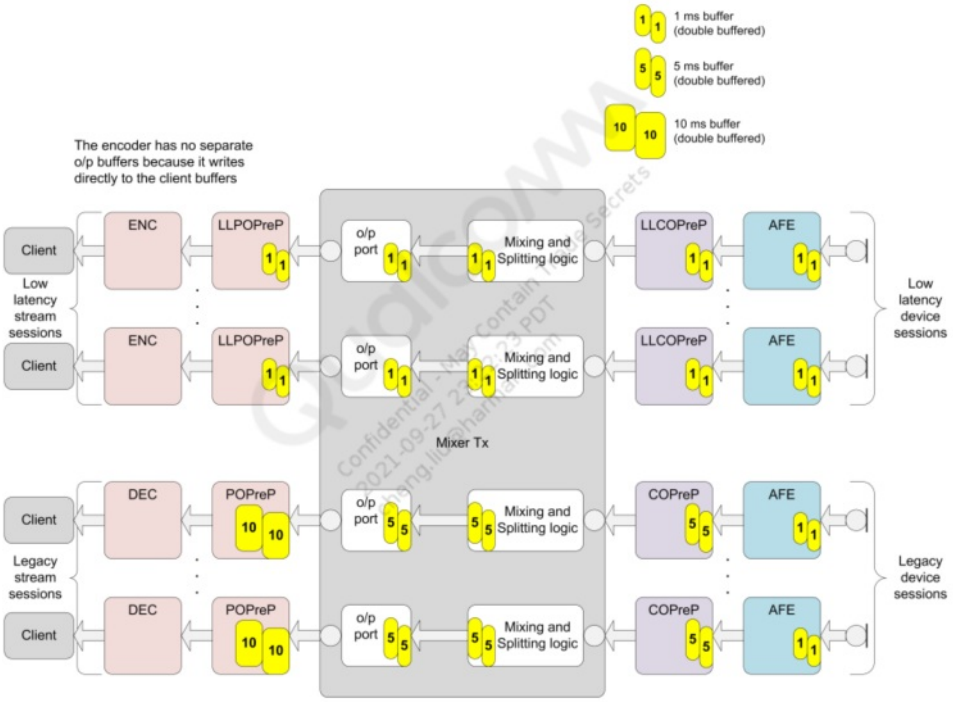

Figure 4-62 Low latency and legacy record sessions

Audio Interfaces

Interface	Description	Hardware capabilities

MI2S	Used for the PCM data transfer from LPASS to the external codec and vice versa	▪ Sample rate
		  ▪ MSM in Master mode – 8, 16, 48, 96, 192 kHz
		  ▪ MSM in Slave mode – 8, 16, 44.1, 48, 88.2, 96, 176, 4, 192 kHz
		▪ Data formats – Up to 24 bit
		▪ Maximum bit clock supported – 12.288 MHz
		▪ Maximum channels – Up to 8

HDMI	High-definition multimedia interface that is capable of transferring multichannel audio data in compressed and PCM format	▪ Sample rate – Up to 192 kHz ▪ Bit width – Up to 24 bit ▪ Channels – Up to 8 ▪ HBR mode supported bit rate is increased to 1536 Mbps from 768 Mbps (as part of HDMI 2.0 changes)
USB	In USB audio, all audio data is transferred over isochronous transfers. Interrupt transfers are used to relay information regarding the availability of audio clocks. Control transfers are used to set volume, request sample rates, etc.	▪ Sample rate in kHz – Up to 192 kHz ▪ Bit width – Up to 24 bit ▪ Channels – Up to 5.1
UART	Playback over Bluetooth devices using an A2DP profile involves transferring SBC encoded packets over a high-speed UART interface to the Bluetooth chip to be sent over the air to the Bluetooth headset.	▪ Sample rate – 44.1 kHz or 48 kHz ▪ Bit width – 16 bit ▪ Channels – Up to 2

Interface	Description	Hardware capabilities

TDM	Up to 16 channel per data line in Master mode and 32 channels per data line in Slave mode	▪ Rx sample rate – Up to 48 kHz
		▪ Tx sample rate – Up to 48 kHz
		▪ Bit width – Up to 24 bit
		▪ Slot width – Up to 32 bit
		▪ Max supported clock
		  ▪ Slave – 24.576 MHz
		  ▪ Master – 24.576 MHz

PCM	Up to 4 channels (slots) per data line	▪ Rx sample rate – Up to 48 kHz
		▪ Tx sample rate – Up to 48 kHz
		▪ Bit width – 16 bit
		▪ Max supported clock
		  ▪ Slave – 24.576 MHz
		  ▪ Master – 24.576 MHz