Digital Mixer Testing Methods and Solutions

------ Based on the GYT 274-2013 Standard

Doewe Technologies Application Notes-030-V1.0

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1. Overview

This article, based on the testing procedures outlined in "GYT 274-2013 Technical Specifications and Measurement Methods for Digital Mixers," will introduce how to use an audio analyzer to test the analog input to analog output interface specifications of a digital mixer.

序号	项目		频率范围	技术指标等级		测量方法
				I 级	II 级	
1	最大输出电平		997Hz	24dBu	22dBu	见 6.14
2	最大输入电平		997Hz	24dBu	22dBu	见 6.15
3	等效输入噪声（话筒输入）		997Hz	≤-125dBu	≤-110dBu	见 6.7
4	信噪比（线路输入）		997Hz	≥70dB	≥65dB	见 6.8
5	幅频特性	话筒输入	20Hz～20kHz	±0.5dB 内	±1.0dB 内	见 6.9
		线路输入		±0.2dB 内	±0.5dB 内	
6	总谐波失真加噪声		20Hz～20kHz	≤0.05%	≤0.10%	见 6.10
7	通道间电平差		20Hz～20kHz	±0.5dB 内	±1.0dB 内	见 6.11
8	通道间隔离度		20Hz～20kHz	≥80dB	≥70dB	见 6.12
9	通道间相位差		20Hz～20kHz	≤0.5°	≤1.0°	见 6.13

Figure 1

Figure 1 shows all the test specifications and their requirements for the analog input to analog output interface as stipulated by the standard, including: Maximum Output Level, Maximum Input Level, Equivalent Input Noise (Mic Input), Signal-to-Noise Ratio (Line Input), Amplitude-Frequency Response, Total Harmonic Distortion plus Noise (THD+N), Level Difference Between Channels, Crosstalk (Isolation) Between Channels, and Phase Difference Between Channels. The following sections will primarily focus on how to use an audio analyzer to test Signal-to-Noise Ratio (S/N), Amplitude-Frequency Response, and Total Harmonic Distortion plus Noise (THD+N).

2. Test Preparation

2.1 Connection Setup

2.2 Mixer Test State Configuration

3. Measurement Methods

3.1 Signal-to-Noise Ratio (S/N) - Line Input

Standard Measurement Method:

1) Enable the 20 Hz ~ 20 kHz bandpass filter on the test instrument's input.
2) Apply a sine wave test signal at 997 Hz with the reference measurement level to the input of the DUT digital mixer. Read the output level value U1 using the test instrument.
3) Remove the test signal and connect an equivalent matching resistor to the input.
4) Record the noise level value U2 at the output.
5) The Signal-to-Noise Ratio S/N is calculated as S/N = U1 - U2.

Using Audio Analyzer: The audio analyzer's built-in S/N measurement function allows one-click testing while adhering to the standard's principles. Figure 3 shows the S/N test interface. After setting the filter, output signal frequency, and level according to the standard requirements, click Start to obtain the S/N measurement value (e.g., S/N = 80.954 dB), meeting Grade I requirements.

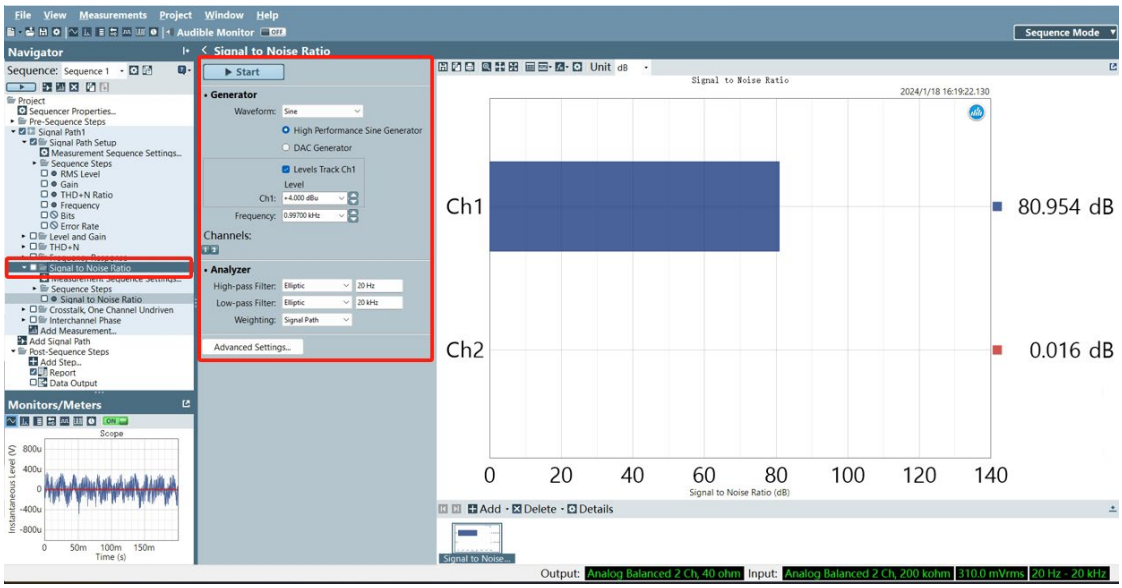

Figure 3

3.2 Amplitude-Frequency Response

Standard Measurement Method:

1. Enable the 20 Hz ~ 20 kHz bandpass filter on the test instrument's input.
2. Apply a sine wave test signal at 997 Hz with the reference measurement level to the input of the DUT digital mixer. Record the output level U0 as the reference level.
3. Change the test signal frequency. The frequency sampling points are specified in standard section 6.1. Record the output level U at each frequency sampling point.

Using Audio Analyzer: Use the Stepped Frequency Sweep function in the audio analyzer to complete this test. As shown in Figure 4, set the parameters according to the method requirements and click **Start** to obtain the curve showing level versus frequency.。

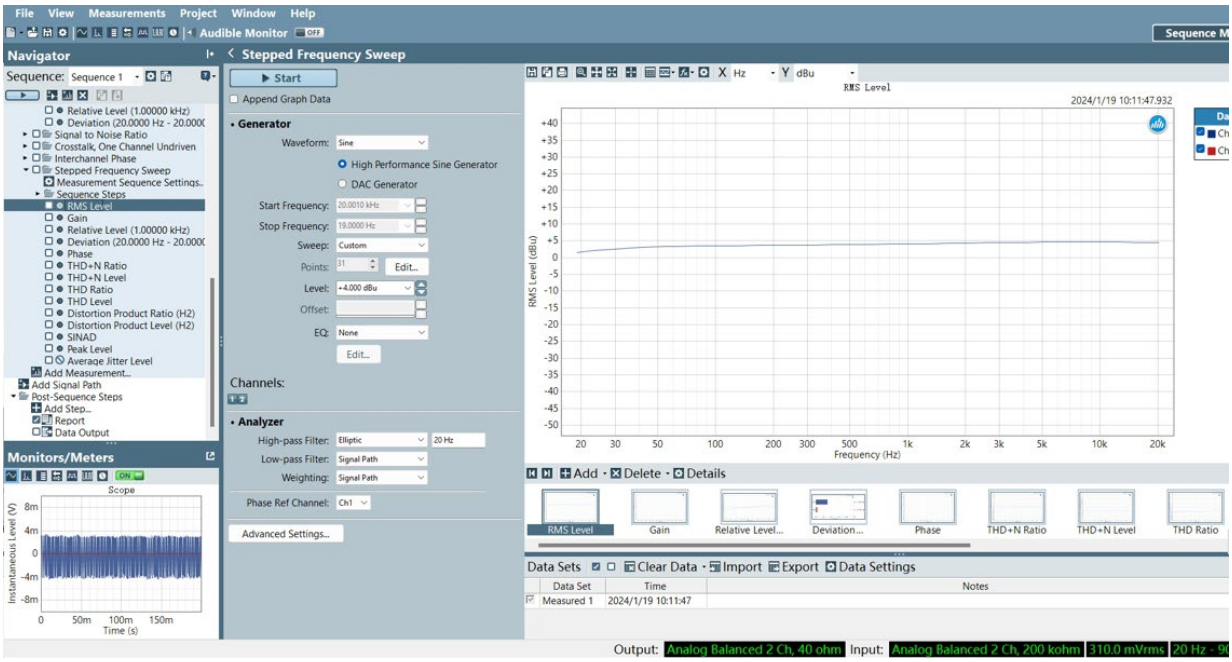

Figure 4

As shown in Figure 5, you can view a table of specific level values at different frequency points and also export the data.

Stepped Frequency Sweep

Import Export X Unit Hz Y Unit dBu Points Same as Graph Data Set Measured 1 Clear Data

	Ch1		Ch2	
	X	Y	X	Y
1	20.0010k	+4.375	20.0010k	-98.159
2	16.0010k	+4.455	16.0010k	-98.239
3	12.5030k	+4.502	12.5030k	-98.392
4	10.0070k	+4.522	10.0070k	-98.299
5	7.99300k	+4.525	7.99300k	-98.212
6	6.30100k	+4.511	6.30100k	-98.303
7	4.99900k	+4.479	4.99900k	-98.028
8	4.00100k	+4.432	4.00100k	-98.321
9	3.16300k	+4.365	3.16300k	-98.332
10	2.50300k	+4.286	2.50300k	-98.341
11	1.99900k	+4.202	1.99900k	-98.070
12	1.60100k	+4.120	1.60100k	-98.180
13	1.24900k	+4.034	1.24900k	-98.161
14	0.99700k	+3.963	0.99700k	-98.180
15	797.000	+3.900	797.000	-98.289
16	631.000	+3.837	631.000	-98.232
17	499.000	+3.775	499.000	-98.269
18	401.000	+3.716	401.000	-98.191
19	317.000	+3.653	317.000	-98.286
20	251.000	+3.593	251.000	-98.296
21	199.000	+3.539	199.000	-98.268
22	163.000	+3.490	163.000	-98.325
23	127.000	+3.431	127.000	-98.237
24	101.000	+3.372	101.000	-98.224
25	79.0000	+3.294	79.0000	-98.293
26	61.0000	+3.181	61.0000	-98.275
27	53.0000	+3.100	53.0000	-98.284
28	41.0000	+2.898	41.0000	-98.143
29	33.0000	+2.643	33.0000	-98.223
30	23.0000	+1.950	23.0000	-98.211
31	19.0000	+1.344	19.0000	-98.244

Figure 5

As shown in Figure 6, the flatness result, representing the DUT's amplitude-frequency response, can be viewed directly within this function, eliminating the need for manual calculation.

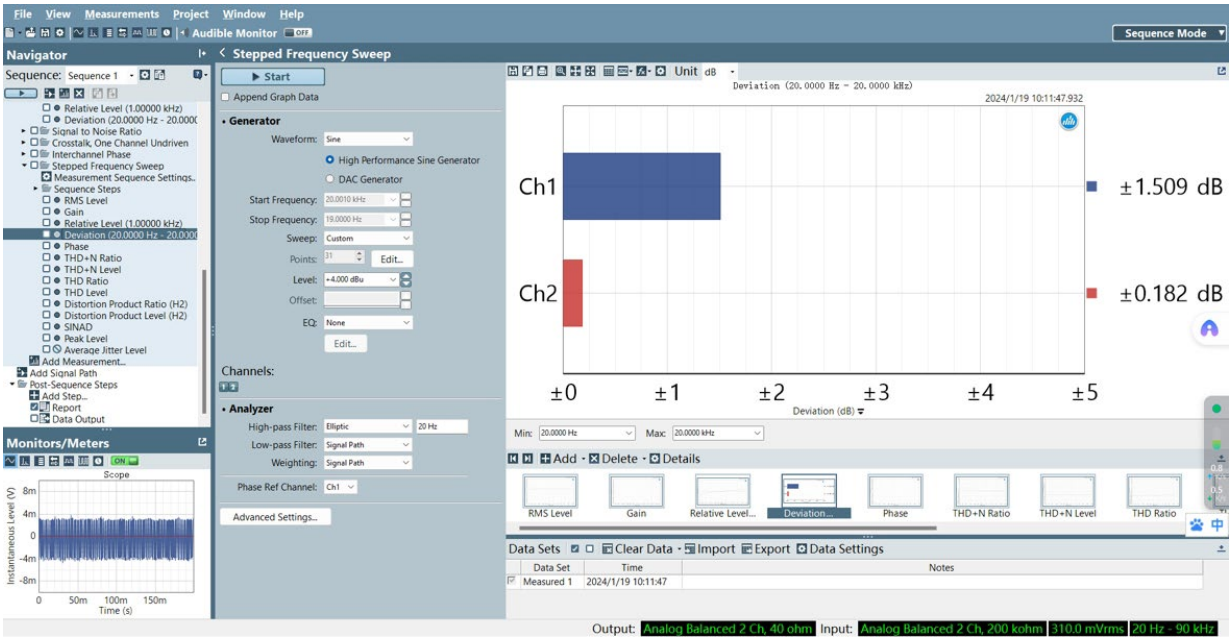

Figure 6

3.3 Total Harmonic Distortion plus Noise (THD+N)

Standard Measurement Method:

1) Enable the 20 Hz ~ 20 kHz bandpass filter on the test instrument's input.
2) Apply the reference measurement level to the input of the DUT digital mixer. The test signal frequency sampling points are specified in section 6.1. Record the output THD+N value at each frequency sampling point.

Using Audio Analyzer: THD+N can also be tested using the Stepped Frequency Sweep function. As shown in Figure 7, select THD+N Ratio in the result display. Configure the parameters according to the test method and click Start to obtain the curve showing THD+N versus frequency.

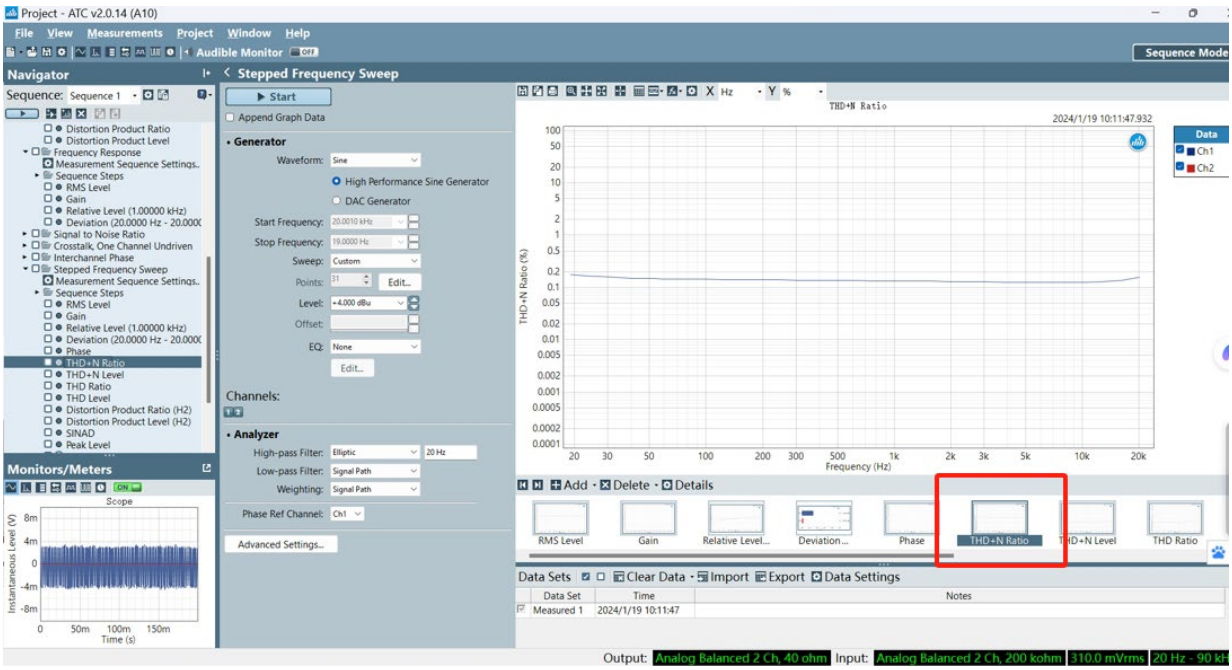

Figure 7

As shown in Figure 8, you can view a table of specific THD+N values at different frequency points and also export the data.

Stepped Frequency Sweep

Import Export X Unit Hz Y Unit % Points Same as Graph Data Set Measured 1 Clear Data

	Ch1		Ch2	
	X	Y	X	Y
1	20.0010k	0.156617	20.0010k	----
2	16.0010k	0.133710	16.0010k	----
3	12.5030k	0.126463	12.5030k	----
4	10.0070k	0.124147	10.0070k	----
5	7.99300k	0.122779	7.99300k	----
6	6.30100k	0.125052	6.30100k	----
7	4.99900k	0.124320	4.99900k	----
8	4.00100k	0.124489	4.00100k	----
9	3.16300k	0.126284	3.16300k	----
10	2.50300k	0.126575	2.50300k	----
11	1.99900k	0.128058	1.99900k	----
12	1.60100k	0.129393	1.60100k	----
13	1.24900k	0.131873	1.24900k	----
14	0.99700k	0.132210	0.99700k	----
15	797.000	0.131413	797.000	----
16	631.000	0.132465	631.000	----
17	499.000	0.134700	499.000	----
18	401.000	0.134889	401.000	----
19	317.000	0.135547	317.000	----
20	251.000	0.136609	251.000	----
21	199.000	0.138040	199.000	----
22	163.000	0.138581	163.000	----
23	127.000	0.139561	127.000	----
24	101.000	0.141375	101.000	----
25	79.0000	0.142451	79.0000	----
26	61.0000	0.143600	61.0000	----
27	53.0000	0.144634	53.0000	----
28	41.0000	0.147796	41.0000	----
29	33.0000	0.152969	33.0000	----
30	23.0000	0.165735	23.0000	----
31	19.0000	0.175732	19.0000	----

Figure 8

Signal-to-Noise Ratio (S/N), Amplitude-Frequency Response, and Total Harmonic

Distortion plus Noise (THD+N) are three common test indicators. The audio analyzer can also be used to test other indicators specified in the standard. For detailed test methods, please consult Beijing Doewe Technologies Co., Ltd.