Listen

Transforming Sound into Knowledge

Sequence Note

Splice Near Field and Far Field Sequence

Introduction

This sequence measures the anechoic response of a loudspeaker in an ordinary room using both a near field and time-windowed far field measurement “spliced” together to cover the full bandwidth of the loudspeaker’s response from 20 Hz to 40 kHz. This sequence package contains a master sequence and three sub-sequences that cover the individual measurements that make up the complete test. Typically, you will run the Master Sequence.

- Splice NF+FF (Master Sequence)
- Near Field Woofer (Sub-sequence)
- Near Field Ported(Sub-sequence)
- Far Field (Sub-sequence)

First, the microphone is placed very close to the low frequency driver (less than an inch from the woofer), and the near field frequency response measured using a 1/12th octave stepped sine). Next, the microphone is placed in the far field and the frequency response is measured using a continuous log sweep with the Time Selective Response analysis algorithm. An option is available for measuring a ported loudspeaker

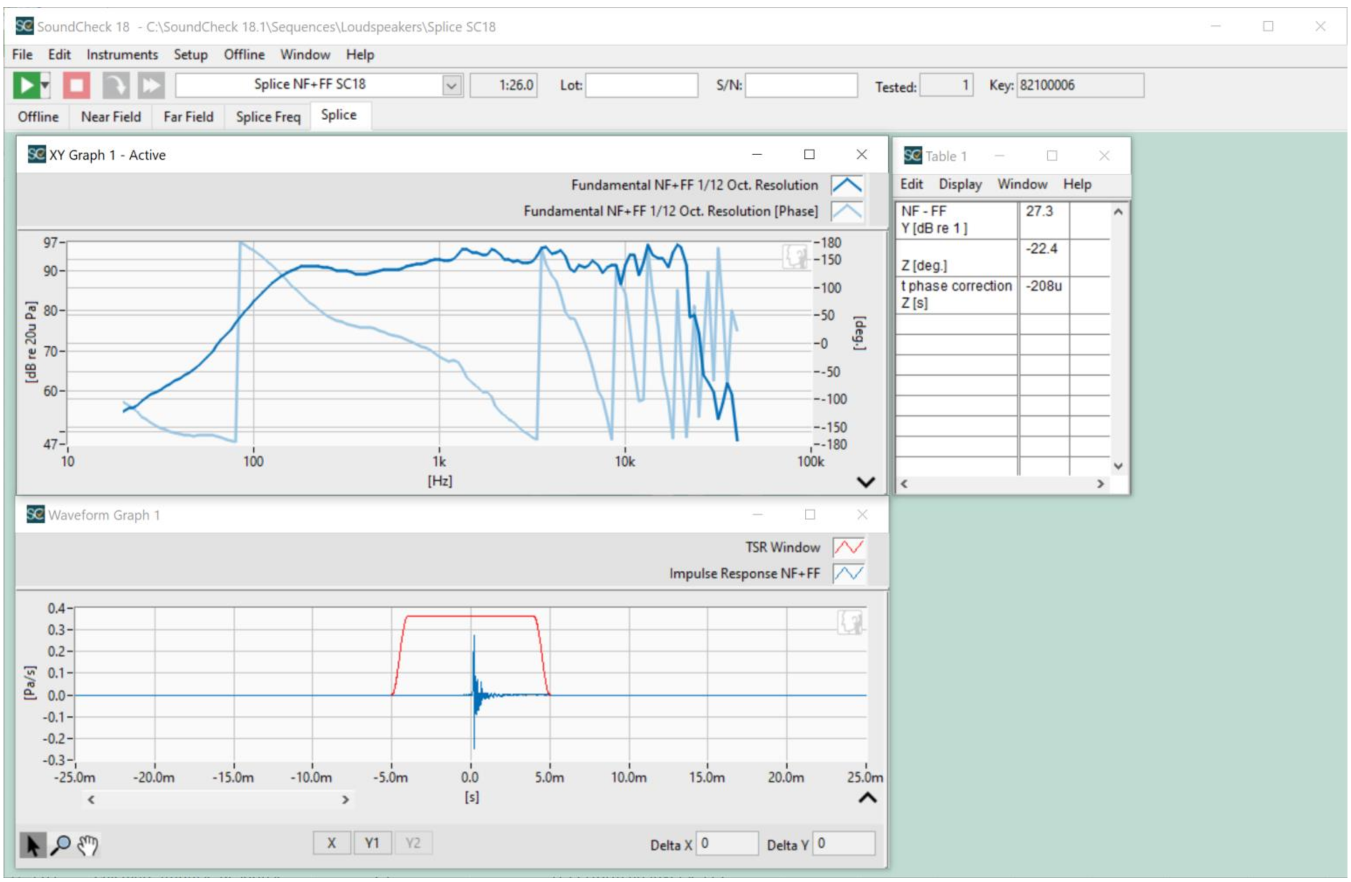

Figure 1 – Splice Sequence Final Display

The near field measurement is unaffected by room reflections, but does not represent the free field response at high frequencies. The far field, time-windowed measurement is not affected by room reflections, but at low frequencies the room size limits the width of the time window and corresponding frequency resolution.

The sequence displays both measurements on a graph, showing the overlap range where the measurements are equal. From this, the user selects the precise frequency at which to splice the two halves of the measurements together to obtain the full range free field response of the loudspeaker. This is done in several post-processing steps including the inverse FFT of the final frequency response back to the time domain to calculate the impulse response. Differences in amplitude or phase are automatically corrected, and this information is displayed in the table on the final display step.

The sequence can be run with stored data as well and experimentation with the time window can be performed without having to re-measure data. The curve data and time waveforms (e.g. impulse response) can be analyzed in SoundMap, SoundCheck's time-frequency analysis module, or exported for further analysis.

Required Hardware

- Reference Microphone - Listen SCM-3 PN 4004 or similar
- Audio Interface/Microphone Power Supply - Listen AudioConnect PN 4050 or similar
- Audio Power Amplifier - Listen SCAmp PN 4060 or similar

Required Software

- SoundCheck Plus, version 18.0 or later
- Module 2006 - Time Selective Response

Setup & Calibration

1. Calibrate the reference microphone as described in the SoundCheck user manual
2. Calibrate the audio power amplifier as described in the SoundCheck Manual;
3. Connect the hardware as shown in the schematic diagram below
4. Place both the loudspeaker and microphone on stands so that they are roughly in the middle of the test room both horizontally and vertically. This will optimize the minimum permissible low frequency cut-off for time-windowed free field measurements.

You are ready to start the sequence.

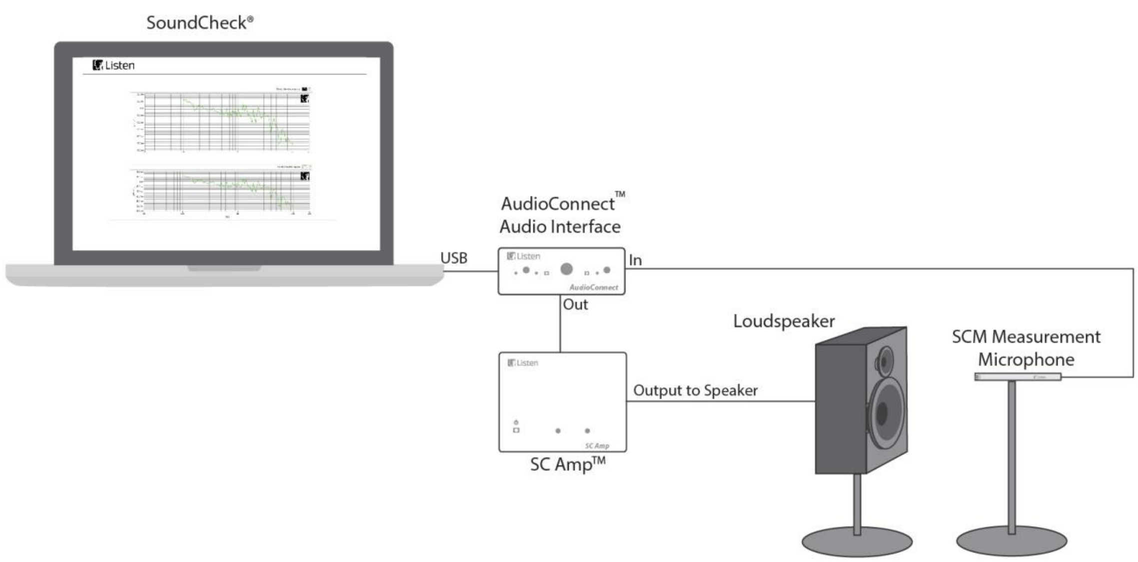

Figure 2 – Hardware Setup

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Running the Sequence – Recall Data

If you just want to look at stored measurement data, run the sequence, click "Yes" when asked if the speaker is ported and then recall the appropriate near field and far field files when prompted. The default values in all numeric message steps are appropriate to use with the recall data.

Sequence Logic (Master Sequence)

Type	Step Name	#	Out	In	
Mes	Ported Speaker	1			// Is the speaker ported?
Dis	Near Field	2			
Seq	Near Field Ported SC18	3			// Ported Sub-sequence
Com	comment	4			// Near Field
Mes	dummy jump	5			
Seq	Near Field Woofer	6			// Near Field Woofer Sub-sequence
Dis	Far Field	7			
Seq	Far Field SC18	8			// Far Field Sub-sequence
Dis	Splice Freq	9			
Pos	Curve Subtraction	10			// Find difference in level between NF & FF
Com	comment	11			// Far Field
Mes	Splice Freq	12			// Choose Splice Frequency (300Hz is default)
Pos	Curve Average	13			
Pos	Curve multiplied by constant	14			
Pos	Phase correction	15			// Calculate delay between NF & FF
Pos	Phase correction FF	16			// Calculate phase correction@300Hz (t=angle/360° x f)
Ana	FF	17			// Correct for time delay between NF & FF
Pos	NF to FF level correction	18			// Correct for level difference between NF & FF
Mes	Operator Message	19			
Pos	Frequency Window	20			// Near field from 20Hz - Splice Freq
Pos	Splice Freq+1	21			
Pos	Frequency Window	22			// Far field from (Splice Freq+1) - 40kHz
Pos	Splice NF+FF	23			// Add level and phase corrected NF to FF
Pos	Calculate Impulse Response	24			// Perform an inverse FFT
Pos	Convert To ISO R40	25			// Convert Response to Standard ISO 1/12 octave response
Dis	Splice	26			
Mes	Save data	27			
Aut	Save to Wfm	28			
Aut	Save to Dat	29			
Mes	End Seq	30			

Further sequence development

This sequence has been designed for testing a small bookshelf loudspeaker in a reasonably small room (e.g. 10' x 10' x 10'). Ways in which you could modify or further develop the sequence include:

- Splice the harmonic Near and Far field distortion curves together
- Measure impedance at the same time as the Near Field response using an impedance box on another hardware input

References:

C. Struck and S. Temme, "Simulated Free Field Measurements", JAES, Vol. 42, No 6, 1994 June