

SIEG®

SIEG Outline

Introduction

Most speakers in the field of car audio are usually sold as a single item, and function as "Speakers" only after they are installed by the specialty store. It is greatly different from the speaker for home audio which is installed in the enclosure from the beginning.

A speaker unit before the installation has its own unique characteristic of material and shape. Therefore, the design of enclosure and the capacity that are able to make the best use of it are necessary. An appropriate installation with understanding the feature of the speaker unit accurately and considering the in-vehicle acoustic characteristic and the back ground noise is the fastest way to bring out the best out of the speaker.

Because there are various restrictions inside the car compared with the listening room, the adjustment in accordance with the in-vehicle acoustic characteristic by the processor is indispensable to create the best sound field.

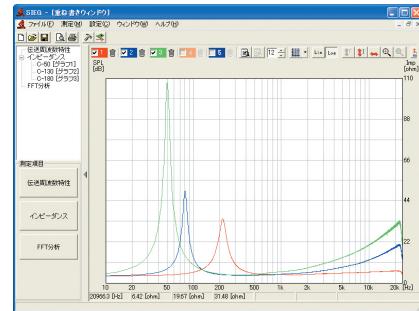
BEWITH's SIEG - Car Audio Analyzer measures the impedance characteristic and in-vehicle transmission frequency characteristic of the speakers easily and accurately. This is indispensable for the dealers to bring out the potential of the speaker units.



Measurement features of SIEG

1. Measurement of impedance frequency characteristic of the speaker unit

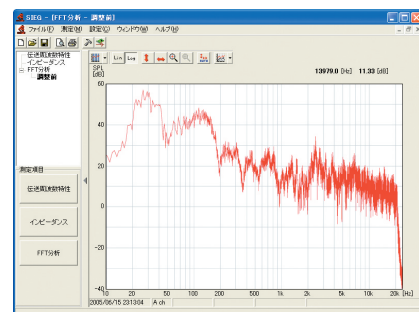
The impedance frequency characteristic shows the resistance of the speakers in frequencies. Low range resonance frequency, nominal impedance, and other conditions can be confirmed in this graph. First, measure the fundamental response of a speaker unit and confirm its capacity and characteristic. Second, analyze the performance of the speaker unit by comparing the response before and after the installation. Understand the necessity of adjustment such as reproduction frequency band, strength of the enclosure, effect of the port, problems of the back pressure, and network adjustment, and take necessary measure efficiently.



2. Measurement of the in-vehicle sound field by FFT (Fast Fourier Transform) analysis

By the FFT analysis, an element of each frequency is displayed as the sound pressure level. Use the following signals for the measurement; Pink noise which has an equal amount of energy per octave; a band noise from only specific band; or standing wave of a specific frequency.

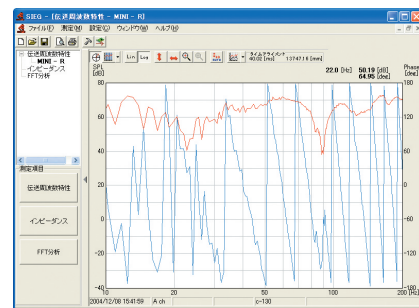
At the final adjustment of the sound after the installation of the speakers, measure the in-vehicle characteristic. Specify the peaks and dips caused by the specific frequency, confirm the cause, and adjust each frequency band after taking measures. Finally, measure the result of the adjustment and again take measures and adjust.



3. Measurement of Transmission frequency characteristic

Transmission frequency characteristic shows the change of the sound pressure level caused by the difference in the frequencies of the vehicle. The pink noise that has an equal amount of energy per octave is also used as a signal for the measurement. SIEG generates the pink noise and then the audio system reproduces it. And SIEG analyzes the frequency and phase of the sound reached to the measuring point. The phase is the time gap of the sound radiated from several sound sources. Even though the frequency and amplitude of the sound is the same, the sound is not the same when there are phase lags.

This measurement provides you the data which the electric characteristic of each equipments and wirings, individual difference of the speaker unit, and all the acoustic characteristics in the vehicle were added to.



By SIEG, because an appropriate installation which matches to the characteristic of the speaker unit is possible, adjustment time will be reduced. Also, it is easy to bring out the best of the speaker unit by appropriate adjustment based on the measurement result. A hearing adjustment will be necessary in the end. However, much time and effort will be reduced.

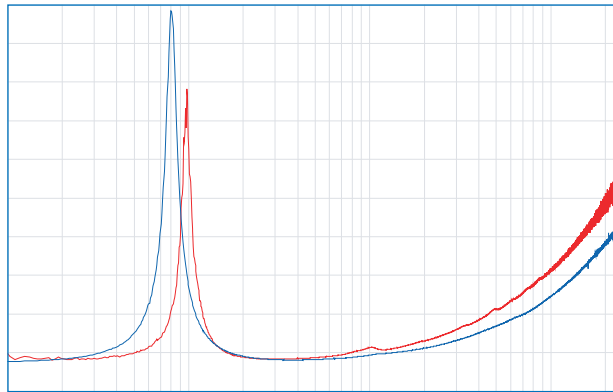
Effective use of SIEG

Please refer to the owner's manual for the operation of this equipment and software.

1. Measurement of the impedance frequency characteristic of the speaker

Measures the impedance frequency characteristic of the speaker and checks the lowest resonance frequency (f_0), the nominal impedance (Z_0), and Q factor.

- Check the difference of the left and right. If needed, match both.
- Understand the interference of the edge and the resonance at high frequency range.
- Set the frequency band according to the characteristics.
- Consider the level adjustment according to the impedance frequency characteristic at high frequency range.



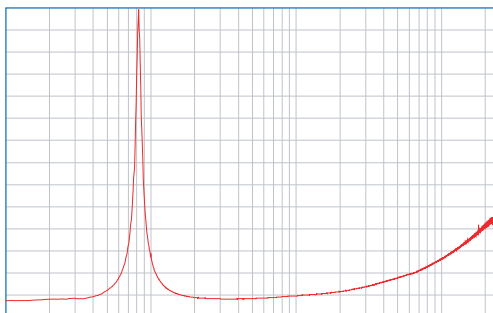
2. Consideration of the installation, the design of the enclosure

Consider the installation, the design and capacity of the enclosure, according to the characteristic of the speaker unit.

2-1. Example of the characteristic with sealed enclosure

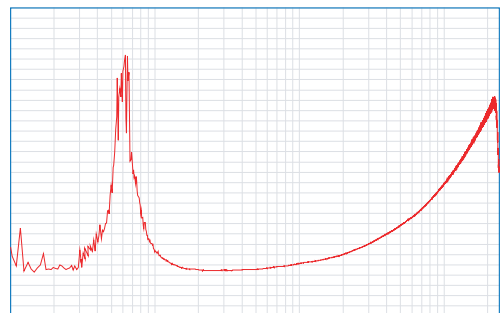
When installing the speaker unit to the sealed enclosure which is airtight, the characteristic of the speaker becomes similar characteristic to the fundamental response. Though it depends on the size and sound absorption material inside the enclosure, the lowest resonance frequency shifts to high range a little and the Q factor becomes large. When the enclosure is not rigid enough, the enclosure itself expands by the sound pressure and appropriate Q factor would not be obtained.

① Examples of the characteristic measurement with sealed enclosure



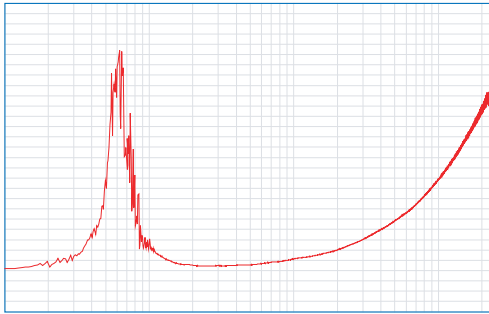
Using an appropriate enclosure

② Examples of the characteristic measurement with sealed enclosure



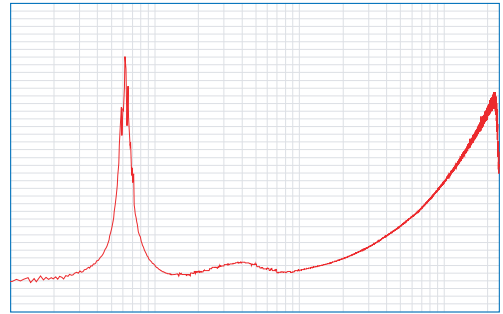
Resonance of the back of the enclosure

③ Examples of the characteristic measurement with sealed enclosure



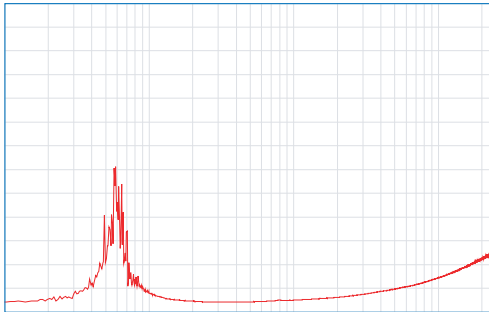
Resonance of the back of the enclosure, machinery resonance, and a resonance caused by the first backpressure radiation

④ Examples of the characteristic measurement with sealed enclosure



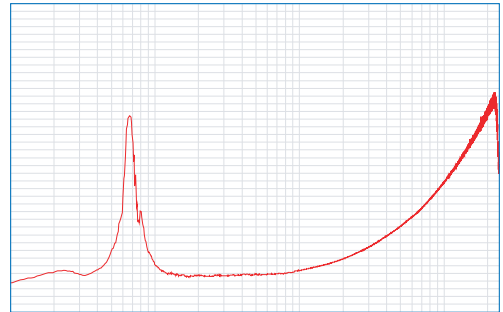
Resonance of the back of the enclosure, machinery resonance, and a resonance caused by the first backpressure radiation and a standing wave

⑤ Examples of the characteristic measurement with sealed enclosure



The back of the enclosure is narrow and also other resonances occur

⑥ Examples of the characteristic measurement with sealed enclosure

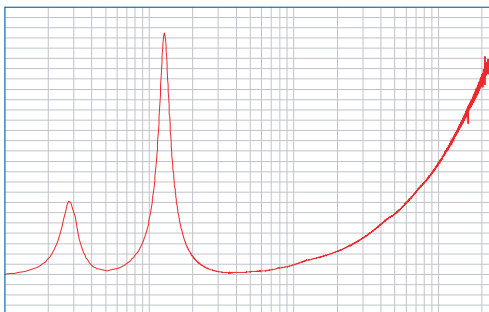


Inappropriate shield and the air leak

2-2. Example of the characteristic with bass-reflex enclosure

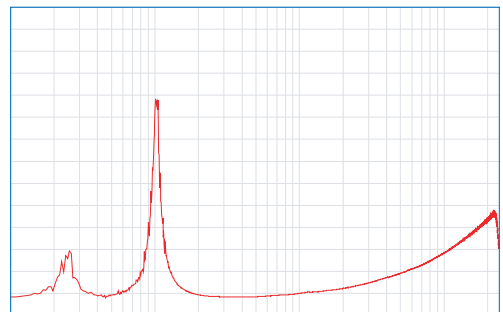
The bass-reflex enclosure is a speaker cabinet enclosure in which a portion of the radiation from the rear of the cone is channeled to reinforce the bass tones. With this enclosure, 2 peaks arise at the lowest resonance frequency (f_0) and anti-resonance frequency (f_r) on the impedance characteristic. As well as the sealed enclosure, the air leakage from the places except the duct causes inappropriate characteristic. Conversely, the airtightness can be confirmed on the impedance characteristic.

① Example of the characteristic with bass-reflex enclosure



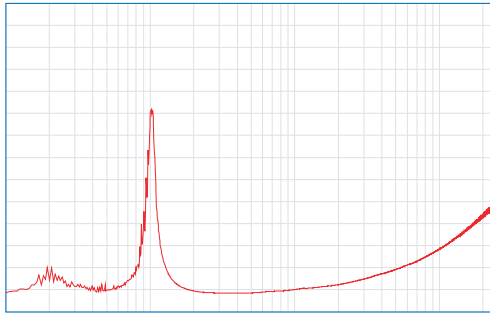
An appropriate duct and a speaker unit's movement

② Example of the characteristic with bass-reflex enclosure



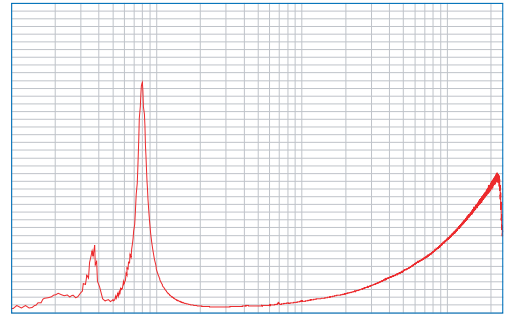
A diffraction and resonance occurred inside the duct and a resonance caused by the speaker unit's backpressure

③ Example of the characteristic with bass-reflex enclosure



A narrow (long) duct and a resonance of the back of the enclosure

④ Example of the characteristic with bass-reflex enclosure



Short duct, duct leak, enclosure leak, or a resonance of the back of the enclosure

2-3. Notes to the bass-reflex enclosure

In home audio, the bass-reflex enclosure is designed to divide the work load equally between the speaker unit and the port to reproduce lower frequency band well. In this case, 2 same height peaks arise on the impedance characteristic. Inside a vehicle, because the capacity of the space is small, a peak arises at around 100 to 125 Hz. Therefore, if the design of the enclosure is the same as the home-use, low frequency sound becomes too loud.

In car audio bass-reflex enclosure, an anti-resonance frequency of the port is set in low frequency band for wider reproduction band. Also, the sound radiated out of the port is reduced intentionally for flat frequency response.

In the frequency band below the anti-resonance frequency of the port, control of speaker cone becomes inappropriate and it causes malfunction of the speaker. It is important to design the port and the enclosure for appropriate speaker operation.

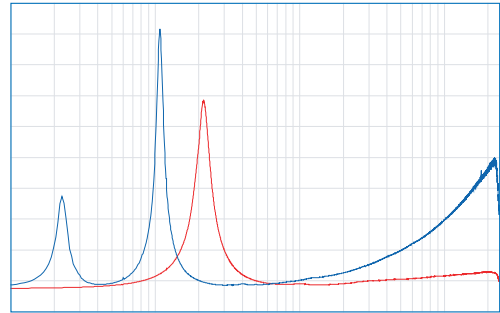
3. Confirmation of the installation

3-1. Impedance measurement

Measures the final impedance of the speakers which have been installed to the vehicle. Take off the speaker cables from the network (when using multi-system, take them off from the amplifier), connect them to SIEG and measure.

Check the result of the measurement and improve the installation if needed.

- Condition of the speaker installation.
- Condition of the enclosure and the baffle board.
- Condition of the backpressure treatment of the speaker unit.
- Condition of the vibration absorption and deadening.

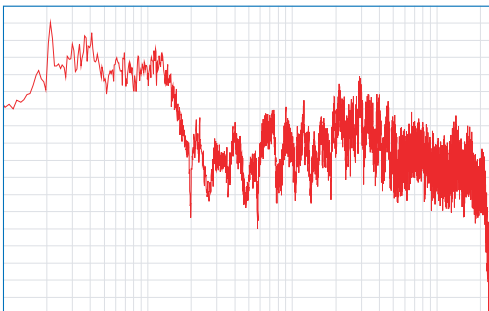


Example of measurement when using an enclosure

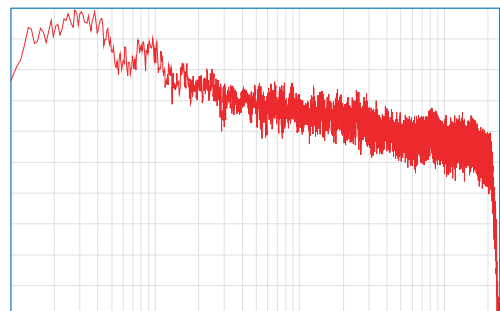
3-2. FFT measurement

Check the characteristics of the audio equipment and condition of the speaker installation, in addition to the in-vehicle acoustic characteristics. FFT analysis measures the frequency characteristics by reproducing the pink noise and taking the sound reached to the listening point with microphone.

It also shows the condition of the installation such as the frequency band that resonates with the capacity in vehicle and the resonance of the door trim in high frequency band. This data is useful not only for the level adjustment between the speakers and the adjustment with equalizer, but also for many other adjustment and cuts down the workload.



Example of FFT measurement



Example of FFT measurement after the adjustment