AWA4959
Speech Intelligibility Measurement System

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Definition and Importance

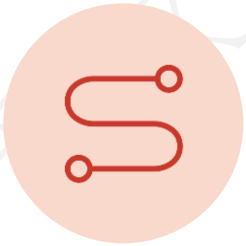
01 What is Speech Intelligibility?

Scientific Definition · Standard

Speech Intelligibility is the percentage of speech units that can be recognized by a listener after being transmitted through a communication system.

Popular understanding · Perception

Simply put, it's about "whether you can hear clearly and understand what you hear." In a high-definition acoustic environment, listeners can easily distinguish every word of the speaker without much effort.



Core Value · Value

Whether the information is conveyed correctly.

02 How to Measure Speech Intelligibility

Evolution of Testing Methods: From "Subjective Manual" to "Objective Quantification"

Early Methods: Subjective Evaluation System

Implementation Standards

GB/T 15508—1995 Acoustic Speech Intelligibility Test Methods

Manual Testing Process

A professional speaker reads standard syllables aloud, multiple listeners record and count the number of sounds heard clearly, and the final score is manually calculated.

Significant limitations

The results are affected by the level of listening/pronunciation (not objective); Data cannot be duplicated; The efficiency of the fully manual process is extremely low.

Modern Method: Objective Quantitative Evaluation

International General Standards

IEC 60268-16:2020 Sound System Equipment - Part 16: Objective evaluation of speech intelligibility by Speech Transmission Index

GB/T 12060.16—2017 Acoustic System Equipment Part 16: Objective Evaluation of Speech Intelligibility by Speech Transmission Index

Automated Analysis Based on STI Algorithm

Using professional testing equipment to send test signals, automatically collect and analyze data, and output objectively quantified intelligibility results through the Speech Transmission Index (STI).

Core technological advantages

The data results are completely objective and neutral; When the testing conditions are consistent, the verification can be repeated; Automated processes significantly improve testing efficiency.

03 What is STI?

Simply put, STI stands for Speech Transmission Index. It has a good consistency with Speech Intelligence and can reflect and predict actual speech intelligibility well.

Language clarity

Core Perception Objectives
Decided to 'not hear clearly'

Consonant Comprehensibility

The degree to which consonants are correctly accepted and understood

Fidelity of speech modulation envelope

Voice signal integrity
Determine the recognition of consonants

MTF (Modulation Transfer Function)

Characterization of signal transmission
Quantify envelope fidelity

STI (Speech Transmission Index)

STI = Weighted integral of MTF at key modulation frequencies

💡 **Core Conclusion: STI is a standard quantitative concept that transforms the subjective human perception of "speech intelligibility" into an objective, measurable, and comparable concept through scientific experiments and mathematical calculations.**

03 What is STIPA?

Core concepts and relationships

STI (Speech Transmission Index)

The most comprehensive and accurate objective evaluation index for language transmission, covering all key acoustic parameters from low to high frequency (7 octave bands x 14 modulation frequencies=98 measurement frequencies).

STIPA (Speech Transmission Index for Public Address)

A simplified solution designed specifically for public broadcasting systems, which significantly reduces measurement time and is more practical by optimizing test signals (7 octave bands x 2 modulation frequencies=14 measurement frequencies).

The preferred solution for on-site acceptance of engineering projects

STIPA is highly correlated with STI, and the measurement can be completed in only about 15 seconds, making it extremely efficient.

STI Numerical Rating Standard (0~1.0)

< 0.30	Bad	Completely unable to understand the voice content
0.30～0.45	Poor	Understanding is extremely difficult and requires great attention
0.45～0.60	Fair	Basic understanding, but requires focused attention
0.60～0.75	Good	Clear and easy to understand, with a relaxed auditory experience
> 0.75	Excellent	The voice is very clear and perfectly understood

04 The Role of Speech Intelligibility Measurement

Ensuring public safety

Clear emergency announcements are the lifeline for guiding crowds and avoiding panic in public places such as airports, train stations, and shopping malls.
GB/T 50526-2021 "Technical Standard for Public Broadcasting System Engineering", Level 1 Emergency Broadcasting System requires Speech Transmission Index (STI) ≥ 0.55

Improving the quality of education

In the classroom, ensuring that every row of students can clearly hear the teacher's explanation is the foundation for ensuring learning effectiveness and educational equity.
T/JYBZ 030—2024 "Technical Specification for Acoustic System in Primary and Secondary School Campuses", Level 1 Teaching Space requires Speech Transmission Index (STI) ≥ 0.60

Improve communication efficiency

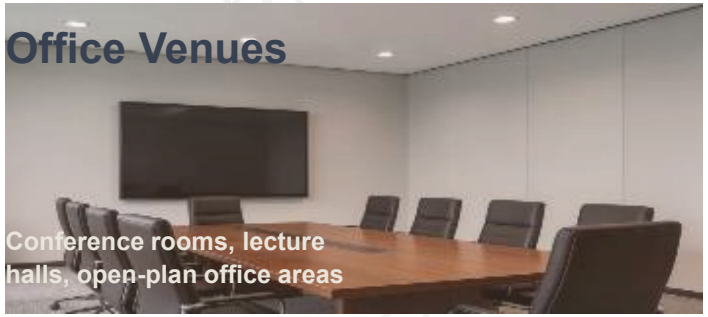
In conference rooms and lecture halls, clear speech ensures accurate information transmission, reduces misunderstandings, and significantly improves team decision-making efficiency.

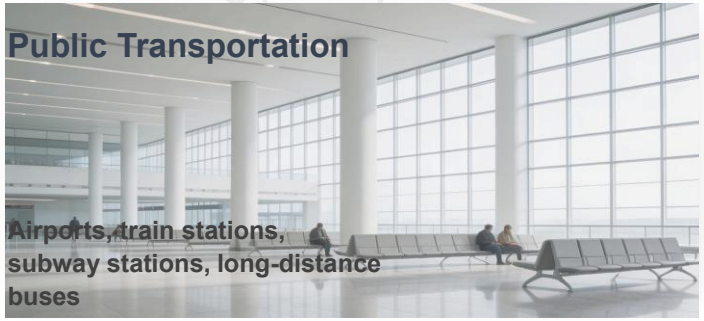
Optimize user experience

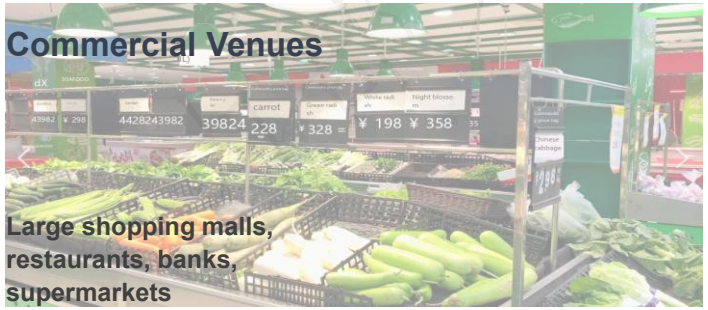
Good language clarity is an important component of immersive atmosphere and high-quality audio-visual experience in entertainment venues such as cinemas and theaters.

05 Typical Application Scenarios of Speech Intelligibility

In any public place where it is necessary to hear people clearly, speech clarity needs to be considered. Scientific acoustic measurement and design can significantly improve the auditory experience.







PART.02

AWA4959 Model Detailed Explanation of Speech Intelligibility Measurement System

01 Test Basis

IEC 60268-16:2020

"Sound System Equipment Part 16: Objective Evaluation of Speech Intelligibility by Speech Transmission Index"

Defines the calculation method, test signal, and measurement procedure for STI/STIPA, and is a core international standard for objectively evaluating speech intelligibility.

GB/T 50356—2005

"Code for Acoustic Design of Theaters, Cinemas, and Multipurpose Halls"

This document specifies the core requirements for acoustic design of professional performance venues such as theaters, cinemas, and lecture halls, including reverberation time and background noise.

GB/T 12060.16—2017

"Sound System Equipment Part 16: Objective Evaluation of Speech Intelligibility by Speech Transmission Index"

Equivalent to the IEC 60268-16 international standard, it serves as the direct basis for STI/STIPA measurement and acceptance in domestic engineering projects.

GB/T 4959—2011

"Methods for Measuring Acoustic Characteristics of Halls and Sound Reinforcement Systems"

This document specifies the general technical methods for acoustic measurement in various types of halls, including the principles for arranging key measurement points and the testing procedures for basic signals.

02 Detailed Measurement Method (Based on GB/T 4959-2011 Measurement Method for Hall Sound Reinforcement Characteristics)

Test signal input via microphone

Sound source location specifications

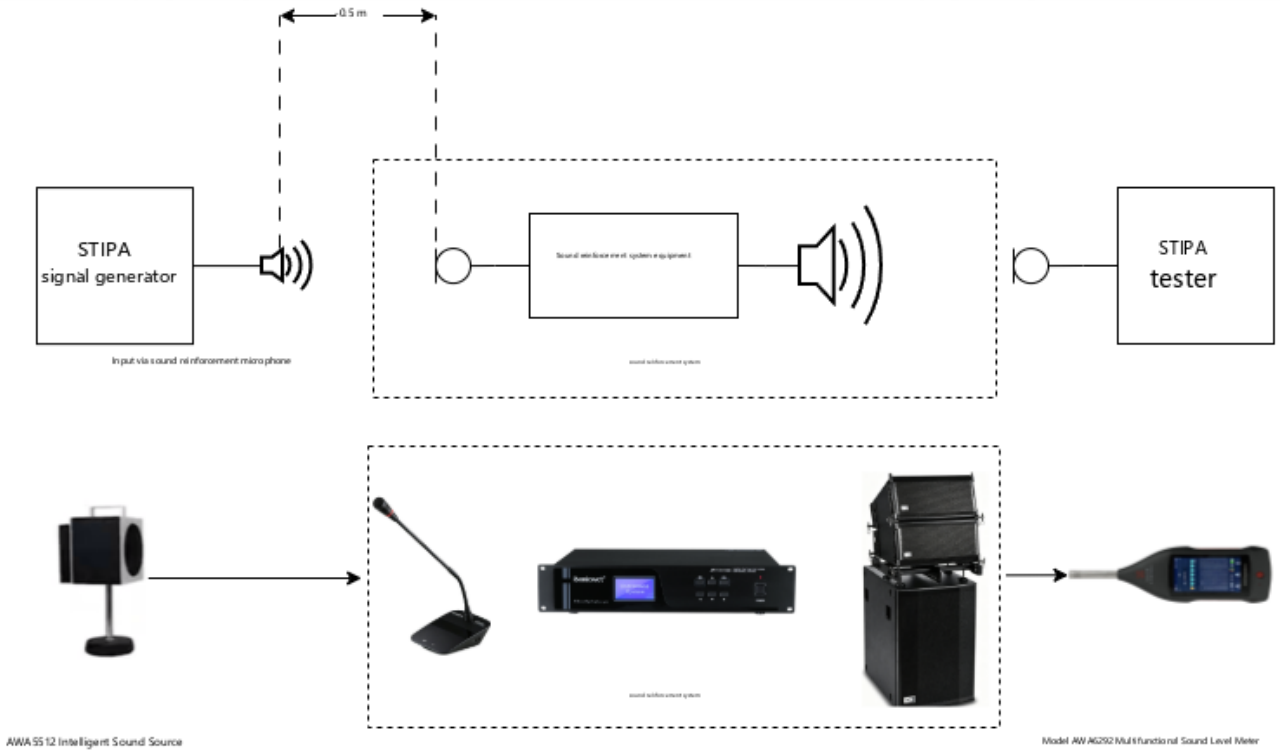
The microphone should be placed at normal speaking distance, with its axis strictly pointing in the normal speaking direction of the sound source, simulating a real-world scenario.

Signal sound pressure level standards

The test level must be equivalent to the sound pressure level of normal speech, or a sound pressure level of 66 dB measured at a distance of 0.5 m from the speaker during calibration.

Simply playing any piece of music or human voice is not sufficient to objectively measure the speech transmission index.

A dedicated test signal must be used for STI/STIPA measurement. It is a random noise synthesis signal based on a bandwidth-limited male speech spectrum, and must be played at the specified distance and volume during measurement.



AWA4959 Speech Intelligibility Measurement System

02 Detailed Measurement Method (Based on GB/T 4959-2011 Measurement Method for Hall Sound Reinforcement Characteristics)

Direct input test signal method

System operating status

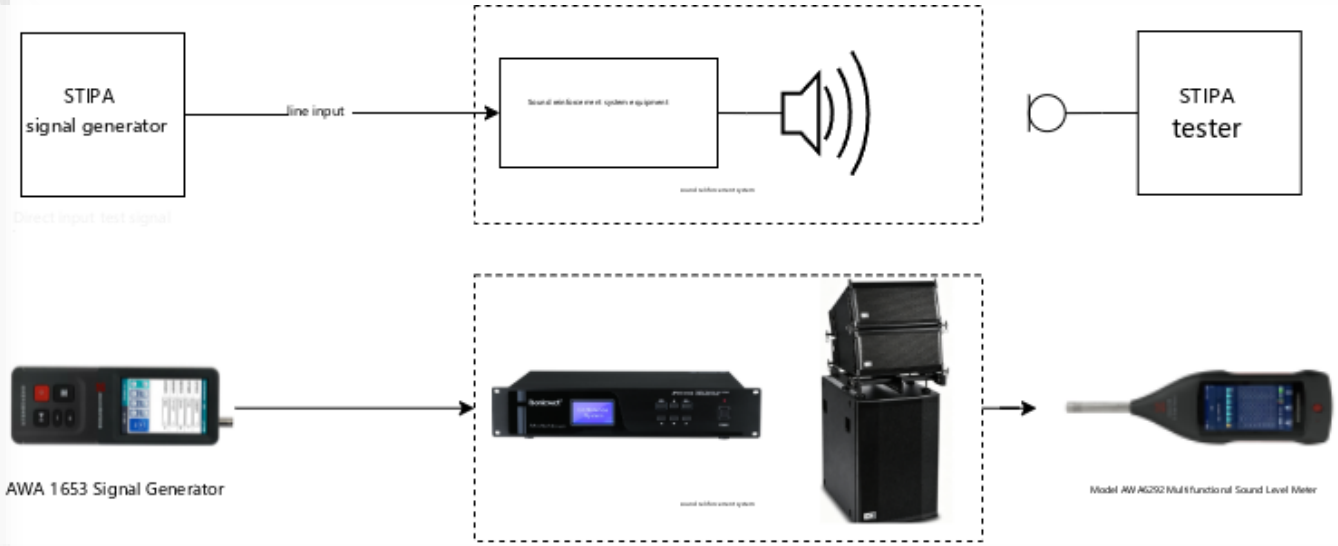
The sound reinforcement system must be operating at its highest available gain and in a stable state, with the signal directly connected to the mixing console's line input.

Guarantee of result accuracy

Multiple measurements must be taken under the same conditions, and the arithmetic mean must be calculated as the final result.

Not all devices are suitable for playing test signals

Its accuracy must reach ±200ppm (e.g., when playing a 9kHz sine wave signal, its electrical output frequency should be between 8998Hz and 9002Hz), so it is recommended to use a professional signal generator.



System physical display

Figure 1: AWA4959 Speech Intelligibility Measurement System Kit

Figure 2: System component detail display

AWA4959 Speech Intelligibility Measurement System

03 Selection of On-site Measurement Points (Based on GB/T 50526—2021 "Technical Standard for Public Broadcasting System Engineering" and GB/T 4959-2011 "Measurement Method for Hall Sound Reinforcement Characteristics")

Measurement point selection requirements

1. Microphone Height: 1.2m~1.5m
   Simulated human ear sitting posture / standing posture height

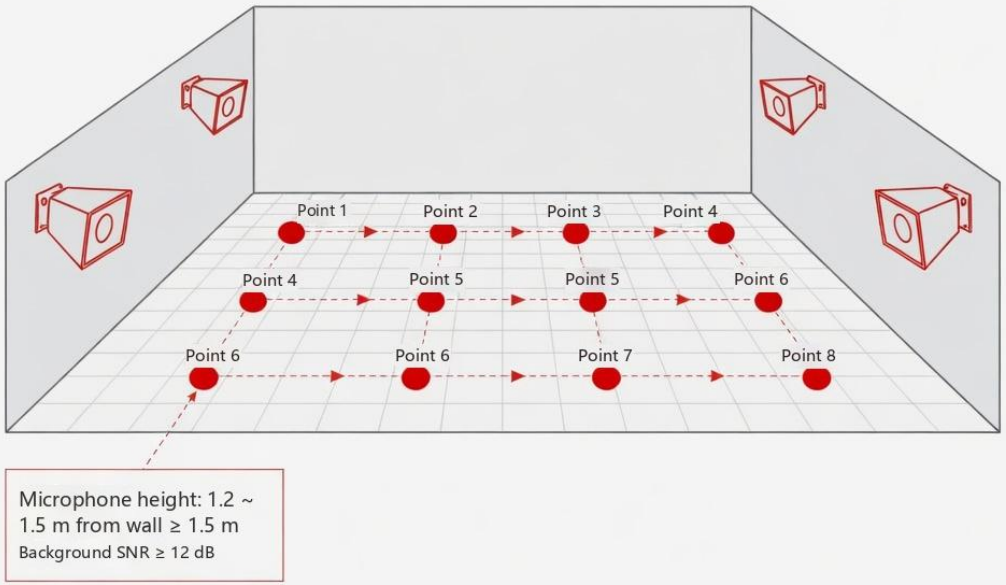
2. Distance from Reflector Surface: **≥ 1.5m**

   Keep away from walls, curtains, and other obstructions; background signal-to-noise ratio ≥ 12dB

3. Typical listening area coverage: **multiple**

   At least 1 per 50㎡, not less than 3

   When measuring in a square, at least one microphone per 20m × 20m area
   One measurement point, not less than 3



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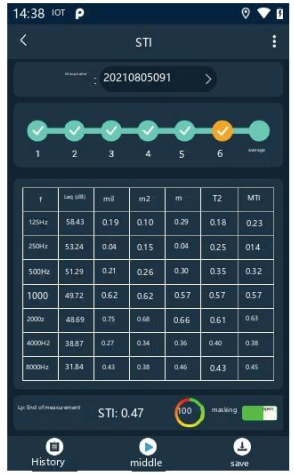
04 Detailed Explanation of AWA6292 Speech Intelligibility Measurement System Measurement Interface and Acoustic Rating Standard Guide

AWA6292 Real-time Measurement Interface



Core data display:

• STI Value: The final measurement result (e.g., 0.36) is directly output below the display screen.
• Masking switch: The masking and weakening effect of ambient background noise on speech signals, controls whether background noise is superimposed in the calculation, practical test recommends turning it on.
• MTF Data: The modulation transfer function for different frequency bands is listed on the left to aid analysis.

STI Rating Standards and Application Scenarios

class	STI range	Typical occasion
A +	> 0.76	Recording studio
A	0.72-0.76	Theatres, lecture halls, councils,
B	0.68-0.72	Theatres, lecture halls, councils,
C	0.64-0.68	Teleconference, Theatre
D	0.60-0.64	Classrooms, concert halls;
E	0.56-0.60	Concert halls, modern churches;
F	0.52-0.56	Shopping mall broadcast system, public offices, churches;
G	0.48-0.52	Shopping mall broadcast system, public office
H	0.44-0.48	Poor acoustical broadcasting system
I	0.40-0.44	A poorly acoustically broadcast system
J	0.36-0.40	N/A Broadcasting system
U	< 0.36	N/A Broadcasting system

Classification and application scenario definition:

• Grading: STI (0-1) is quantified into 13 levels from A+ to U for intuitive rating.
•Scenario benchmarking: A+ grade is used for recording studios; D grade (0.60-0.64) meets the needs of ordinary classrooms.
• Engineering significance: Provides an objective and unified reference basis for acoustic decoration acceptance and optimization.

Thank you
for watching