



# Acoustic Verification System (AVS)



## Fast, Reliable Acoustic Analysis

The hidden costs of ‘no fault found’ device returns. Every year, millions of mobile devices are returned by customers. Often the root cause is a mystery: the customer is dissatisfied, but the cause could be the device, network or the service. With no good way to identify defective devices vs. other causes, many defective devices are tagged as “no fault found”. Reliably identifying which devices are truly defective reduces device costs by millions and ensures these devices don’t get refurbished and sent back to customers.

**Public enemy #1: poor audio quality.** One of the most common return issues is poor voice quality. The root cause could be a defect or configuration issue with a device component such as the microphone, receiver, or baseband DSP. Alternately, the root cause could be related to network, coverage or service issues that have nothing to do with the device.

**Wanted: a better way.** The good news is that the techniques to reliably detect defects have existed for years. The bad news is that traditional approaches require skilled technicians, large expensive acoustic labs and several hours of test time. The industry needs a new, better way to reduce “no fault found” device returns.

**Benchmark acoustic analysis: fast, reliable, easy-to-use.** The solution is to enable fast and reliable identification of defective devices in an easy-to-use and compact form factor. That’s why we invented the Acoustic Verification System (AVS). AVS enables anyone to perform pass/fail evaluation of acoustic speech quality in minutes – reducing no fault found returns significantly. AVS also accelerates device R&D by allowing fast, iterative testing of speech quality.

## HIGHLIGHTS

Significantly reduce “no fault found” device returns related to poor voice/audio quality

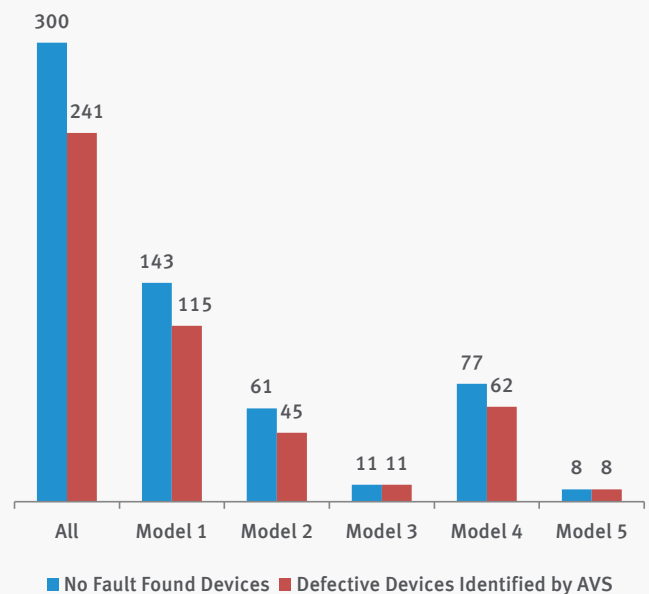
Accurately determine which in-warranty returned devices have acoustic speech quality defects

Improve customer experience and lower costs by reducing the number of defective devices sent for refurbishment

Identify faulty devices before they are sold to consumers

Accelerate mobile device R&D and reduce costs by fixing acoustic speech quality issues faster and earlier in the development cycle

### AVS Showed 80% of No Fault Found Devices Were Actually Defective



In a test of 300 “no fault found” devices returned due to “poor audio quality”, AVS determined that 80% of the devices were actually defective.



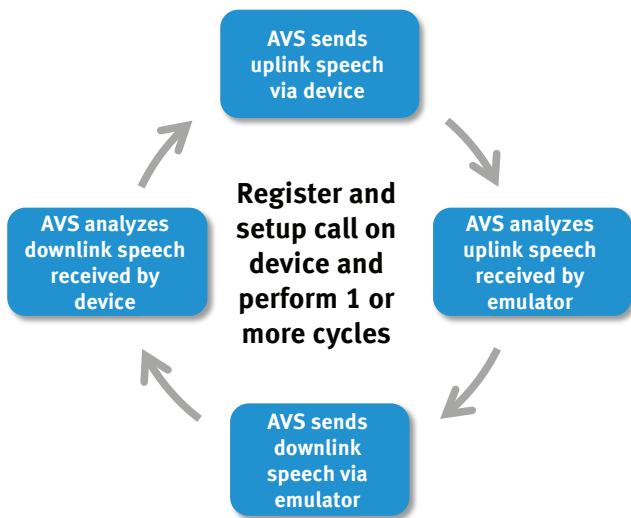
# AVS: Acoustic Speech Quality Evaluation on the Benchtop

**Fast Results.** Using AVS is quick and easy:

1. Apply the AVS alignment sticker to the device and initiate a call between the device and network emulator
2. Place the device onto the mount inside the AVS chamber and close the door
3. Press start on the AVS control software
4. Pass/fail results are ready in minutes – it's that easy.

**Clear Pass/Fail Indicators.** As the test is being performed, mean opinion score (MOS) and other test results will display in real-time for both the uplink and downlink. When the test completes, speech quality results and pass/fail status are clearly indicated.

**True End-to-End Voice Quality.** Evaluate the end-to-end voice quality for both the uplink and downlink of the device under test. Use a network emulator (sold separately) to establish wireless calls to the device under test for any air-interface technology supported by the device and emulator. The artificial mouth and ear emulate an actual user speaking into the device and listening to the device earpiece to enable a complete end-to-end assessment of voice quality over both links.



Each AVS test cycle alternates between measurements of uplink and downlink speech quality

**Reliable, Repeatable Metrics.** AVS voice quality is measured based on the industry-standard ITU-T P.862 PESQ or P.863 POLQA algorithms. Furthermore, the patent-pending AVS device mount ensures low-loss acoustic coupling between device, ear and mouth is consistently achieved. This consistent coupling ensures highly repeatable results from test to test.

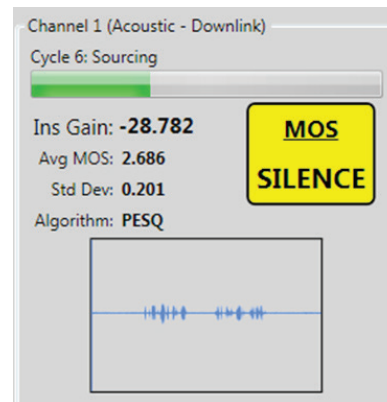
**Customize to Your Process.** Configure pass/fail thresholds and enter metadata such as production line, tester name/station and failure code to enable reporting based on specific process needs.

## APPLICATIONS

Reverse logistics: fast identification of defective devices for “poor voice quality” returns

R&D: Rapid, iterative evaluation of end-to-end voice quality for bug fixes and performance improvements







Forward logistics: pre-shipment sampling of device quality before devices reach consumers for purchase



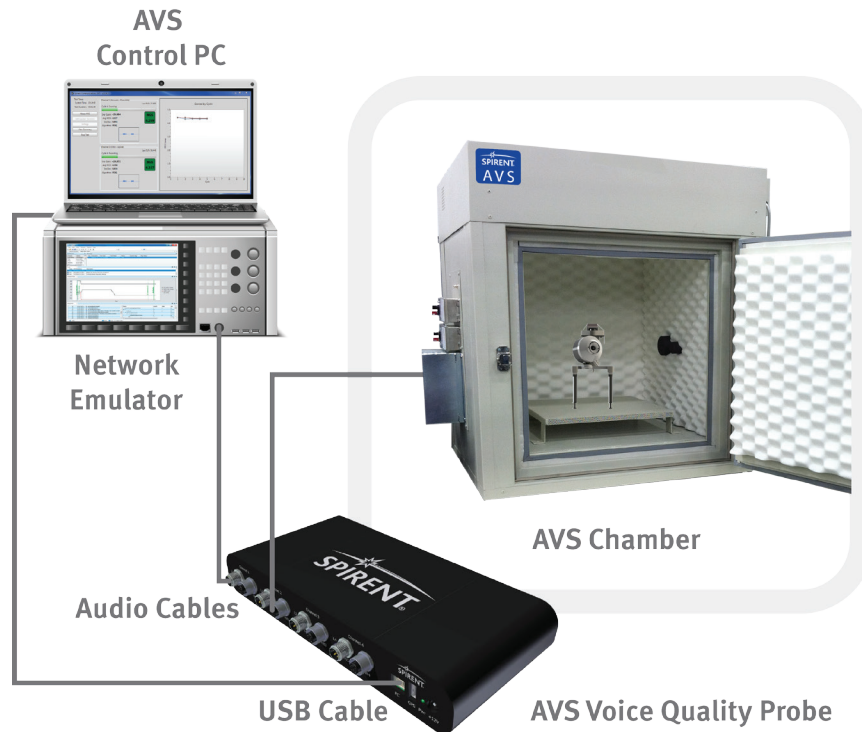
Quickly detect defective devices. The device in this figure delivered poor speech with abnormal periods of complete silence.

## User Experience Analytics by Spirent

AVS is part of a suite of systems that provide an unmatched range of user experience analytics including:

-  Speech
-  Call
-  Web Browsing
-  File Transfer
-  Video
-  Battery Life

## System Overview



**AVS Control PC & Software.** The control software enables configuration of the network emulator and measurement of voice quality using the AVS Voice Quality Probe. The software calculates perceptual voice quality using the ITU-T P.862 PESQ or ITU-T P.863 POLQA algorithms.

**AVS Voice Quality Probe.** The probe plays ITU standard speech samples over the uplink and downlink of the emulated end-to-end mobile network. On downlink, the probe inserts speech samples into the network emulator and captures received speech at the device earpiece via the artificial ear. On the uplink, the probe plays speech into the artificial mouth and captures received speech from the network emulator.

**AVS Chamber.** The chamber provides an RF-shielded, sound-dampened environment with a compact 4'x4' footprint. The device under test, device mount, artificial ear, artificial mouth and microphone amplifier are placed inside the chamber during voice quality evaluation.

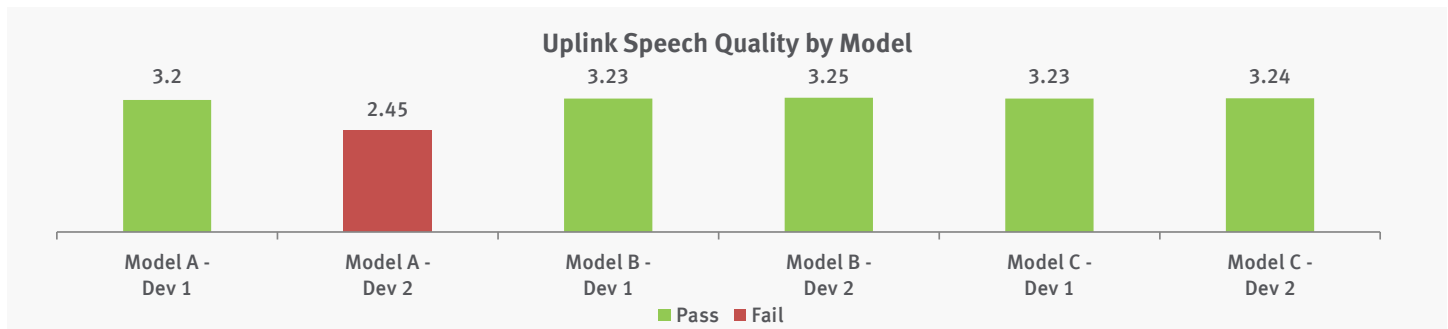
**AVS Device Mount, Artificial Ear and Mouth & Microphone Amplifier.** The device mount enables devices to be quickly and accurately positioned relative to the artificial ear and mouth to ensure a low-loss acoustic coupling.

**Network Emulator (sold separately).** The network emulator simulates an end-to-end wireless network, passing speech samples to and from the device under test over the air-interface inside the RF-shielded AVS chamber.

## Example Outputs

User Activity	MEID	Model	Production Line	Insertion Gain	Insertion	PESQU	PESQU Status	PESQD	PESQD Status	Fail Code
					Gain Status					
John D.	9000012345678	Model A - Dev 1	East	-10.1	Fail	3.2	Pass	3.5	Pass	1A
John D.	90000123456790	Model A - Dev 2	East	-7.44	Pass	2.45	Fail	2.98	Fail	2A
John D.	90000123456792	Model B - Dev 1	East	-8.74	Fail	3.23	Pass	2.2	Fail	1C
John D.	90000123456793	Model B - Dev 2	East	-5.7	Pass	3.25	Pass	3.25	Pass	1B
John D.	90000123456789	Model C - Dev 1	East	-6.96	Pass	3.23	Pass	3.3	Pass	1B
John D.	90000123456794	Model C - Dev 2	East	-5.49	Pass	3.24	Pass	3.3	Pass	1B

Export test results into CSV format for additional analysis or integration with other systems.



## Technical Specifications

Component	Specifications
Acoustic Speech Quality Metrics	MOS (instantaneous, average, standard deviation), insertion gain for uplink and downlink
Perceptual Voice Quality Algorithms	ITU-T P.862 PESQ ITU-T P.863 POLQA
Artificial Ear	ITU-T P.57 Type 3.2 high leak ear simulator
Artificial Mouth	ITU-T P.51 Artificial mouth with built in amplifier
Microphone Power Amplifier	1 channel with 200V polarization voltage
AVS Chamber	Chamber dimensions: 34" x 36" x 36" Included chamber stand: 44 3/4" x 44 3/4" x 31" Height of chamber on stand: 68 3/8"
Network Emulator (purchased separately)	Please contact your Spirent sales manager for a list of supported network emulators

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