



**GE APPLIANCES**

**GE Zoneline: The Quietest PTAC in the  
Industry**

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## **Abstract**

With increasing customer expectations for comfortable and quiet rooms, the Packaged Terminal Air Conditioner (PTAC) plays a vital role in overall guest satisfaction. Additionally, with the advent of 100% satisfaction guarantees, online hotel reviews, and social media, there is an increased sensitivity to the guest experience. This paper will provide an in-depth look at PTAC acoustics and offer comparisons between the new GE Zoneline and other PTACs in the marketplace. Third party testing was conducted at two different laboratories to evaluate the acoustic performance of the PTACs in this study. The results of this study show that the GE Zoneline is the quietest PTAC in the industry.

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## Introduction

With increasing customer expectations for comfortable and quiet rooms, the Packaged Terminal Air Conditioner (PTAC) plays a vital role in overall guest satisfaction. Additionally, with the advent of 100% satisfaction guarantees, online hotel reviews, and social media, there is an increased sensitivity to the guest experience. This white paper will provide an in-depth look at PTAC acoustics and offer comparisons between the new GE Zonline and other PTACs in the marketplace.

## PTAC Acoustics Background

The discussion of PTAC acoustics can be divided into three categories; sound transmission loss, operational sound, and sound quality. Sound transmission loss is a measure of the ability of a barrier to stop sound from passing through. Since the PTAC is a component of the building exterior (envelope), the ability of the PTAC to block sound from outdoors is often specified by architects designing the building. Operational sound is a measure of the sound generated by the PTAC. The PTAC has three sources that generate sound; the indoor fan, the outdoor fan and the compressor. The operational sound level is recorded when all three sources are active, during high cool mode operation. Lastly, sound quality is the subjective evaluation of the sound which the PTAC generates during operation.

## Competitor Testing

The following sections describe the mechanisms of sound transmission and operational sound, while also providing third party results of the GE Zonline vs competitor PTACs. Extensive measures were taken to ensure a fair comparison between the GE Zonline and competitor PTACs. First, all PTACs tested were of the same capacity range (approximately 12,000 BTU) and were all base model heat pumps. Secondly, to account for variation, three of each PTAC was tested. The units were shipped directly to and unboxed at the third party laboratory. All units were installed in the appropriate manufacturer's wall sleeve with the appropriate manufacturer's outdoor grill, and were not modified in any way. Lastly, two separate third party laboratories were utilized to ensure the validity of the results. **The results prove that the GE Zonline offers the best sound performance compared to competitor products tested.**

## Sound Transmission Loss

When the sound from outdoor sources (such as traffic noise) reaches the PTAC, some of the sound is reflected back, some of the sound is absorbed by the unit and the remainder of the sound is transmitted into the room. Sound transmission loss through a PTAC is the measure of sound lost during the transmission of sound from outdoors to indoors. As the sound lost during transmission increases there is less sound remaining to reach the guest. Therefore, high transmission loss is indicative of a good sound barrier.

Transmission loss is measured using ASTM E90: Standard Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions. This method for

determining transmission loss is generally conducted utilizing two adjacent and isolated reverberant rooms, with an opening in the walls between the two rooms (shown in Figure 1).

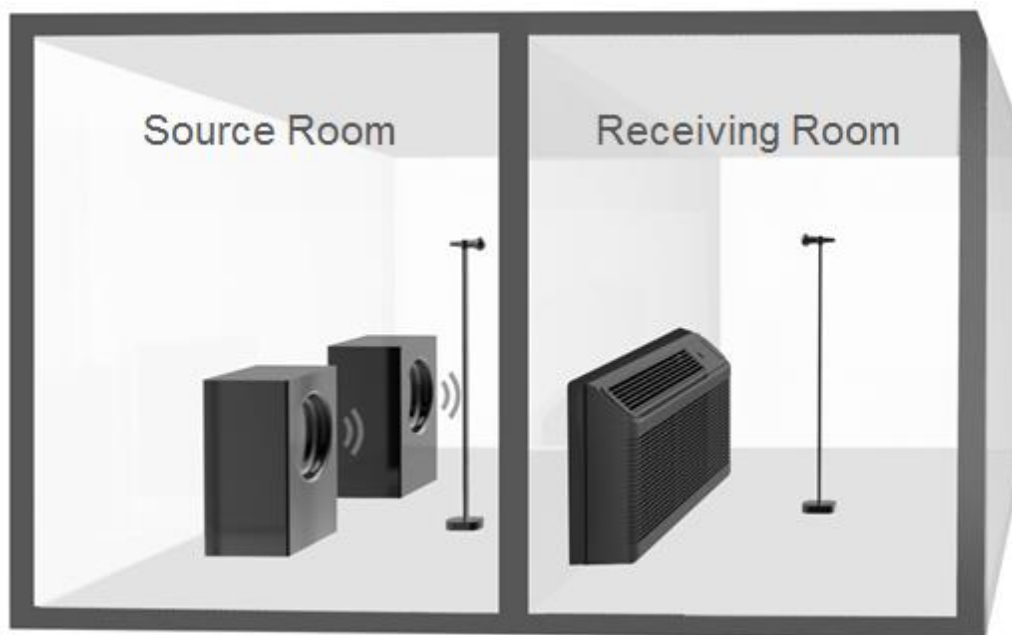


Figure 1: Typical setup for conducting ASTM E90

The PTAC is placed in the opening in the wall between the two rooms (commonly referred to as the filler wall). One of the rooms contains a speaker that produces pink noise that typically ranges from 80 Hz to 10,000 Hz and has amplitude of 100 decibels or higher. This room is appropriately called the source room. Also located in the source room is a rotating microphone that measures the sound in the source room. The adjacent room, named the receiving room, contains a rotating microphone that measures the sound in the receiving room. It is important to note that during this test the PTAC is not operating, as sound transmission loss is simply a measure of how much sound is blocked by the PTAC.

It is very common for the results of ASTM E90 to be presented as single number ratings to make it easier to compare two PTACs. The two most common ratings for sound transmission loss are Sound Transmission Class (STC) and Outdoor Indoor Transmission Class (OITC).

**STC Rating:** The new GE Zoneline has an STC rating of 29. The STC rating indicates the ability for the PTAC to stop sound from transmitting from the outside to the inside. Specifically, the frequency of sound that STC takes into consideration is from 125 Hz to 4000 Hz. A higher STC rating indicates superior performance. STC results were averaged for the three PTACs tested for each manufacturer and rounded down to the nearest class. The STC results generated from the first third party laboratory are shown in Figure 2.

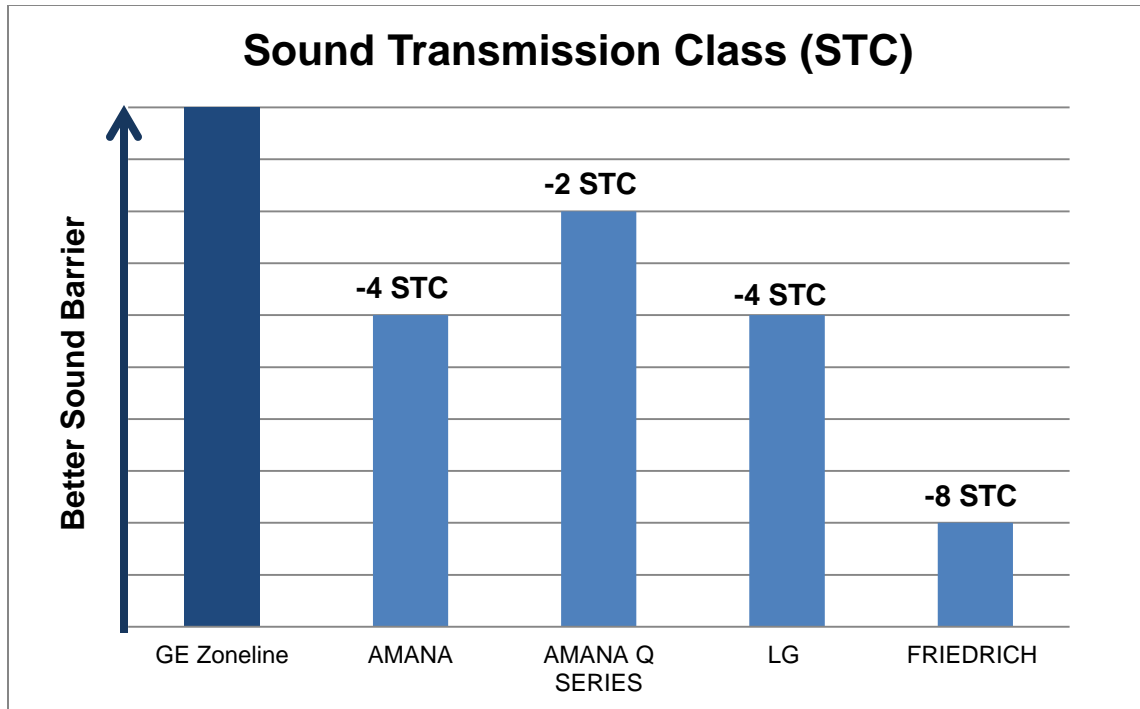


Figure 2: STC results from the first third party laboratory

The results show that the GE Zoneline has the highest STC when compared to the competitors tested, even when compared to the Amana Q Series product which is specifically marketed for acoustic performance. This means that the GE Zoneline will block more outdoor sound from reaching the hotel guest when compared to the competitors tested. The two highest performing PTACs (GE Zoneline and Amana Q Series) were tested at a second third party, to confirm GE Zoneline superior STC performance.

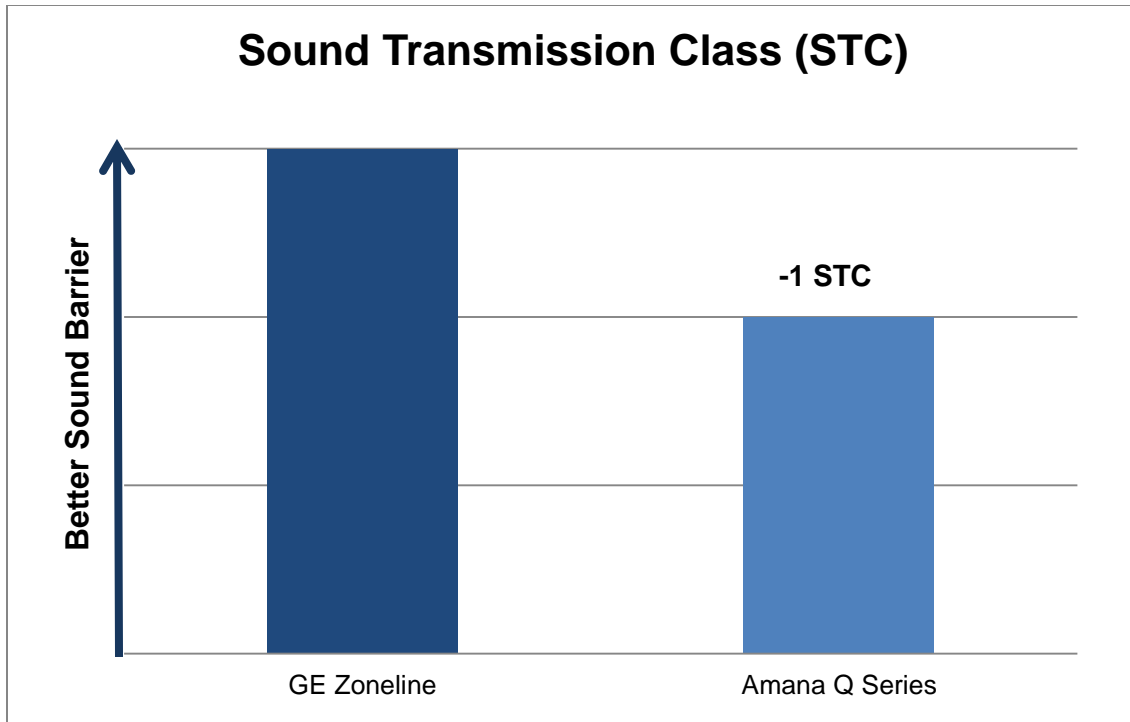


Figure 3: STC results at second third party laboratory

In the tests performed by the second third party laboratory, the GE Zoneline outperforms the Amana Q Series (shown in Figure 3). Small differences in STC between labs are not uncommon and can be attributed to differences in laboratory setup and filler wall variation. There was no work done to correlate the two third party labs, but both labs are accredited to run ASTM E90 and confirm that the GE Zoneline is superior in STC to the Amana Q Series PTAC.

**OITC Rating:** The new GE Zoneline has an OITC rating of 21. OITC, like STC, is determined using ASTM E90. However, the rating weighs heavily towards the lower frequencies. Since most of the traffic noise is dominated by the lower frequencies, **OITC is considered a better indicator of PTAC's ability to block sound from being transmitted from outside to inside in most hospitality installations.** Like STC, a higher OITC rating indicates superior performance. OITC results were averaged for the three PTACs tested for each manufacturer and rounded down to the nearest class. The results from the third party lab testing are shown in Figure 4.

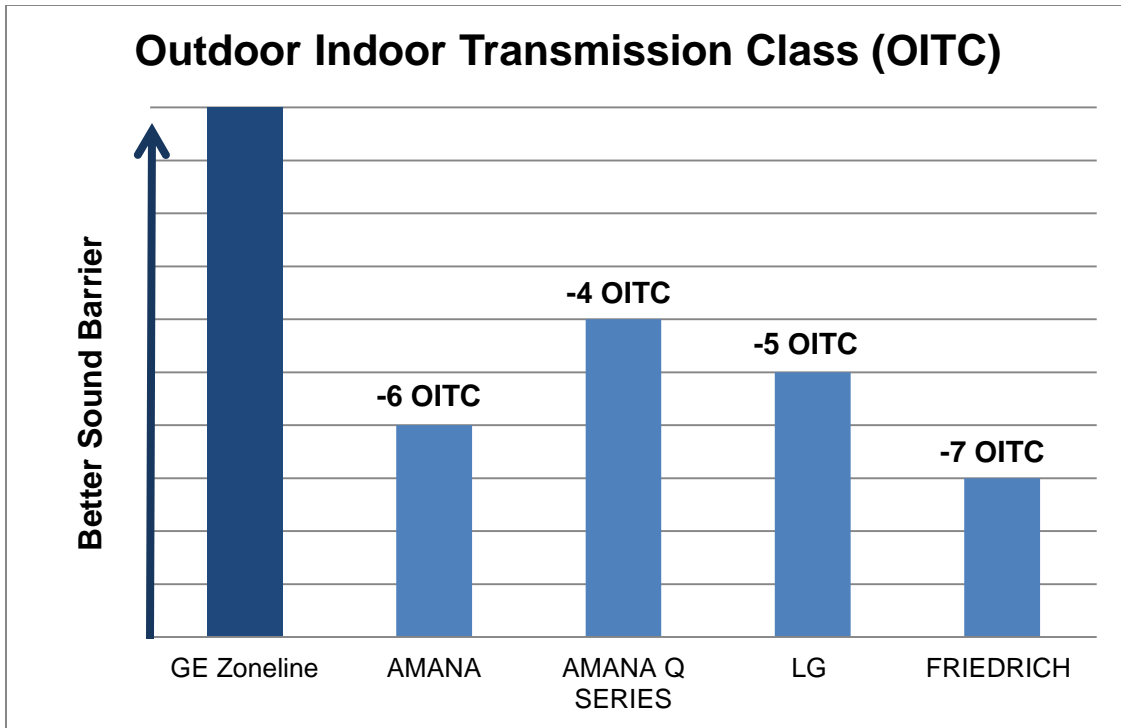


Figure 4: OITC results at the first third party laboratory

The results show that the GE Zonline has the highest OITC when compared to the competitors tested, even when compared to the Amana Q Series. This means that the GE Zonline will block more outdoor sound (traffic noise, etc.) from reaching the hotel guest when compared to the competitors tested. Again, the two highest performing brands (GE Zonline and the Amana Q Series) were tested at the second third party lab to verify the GE Zonline is the superior PTAC in terms of OITC. The results from the second third party lab are offered in Figure 5.



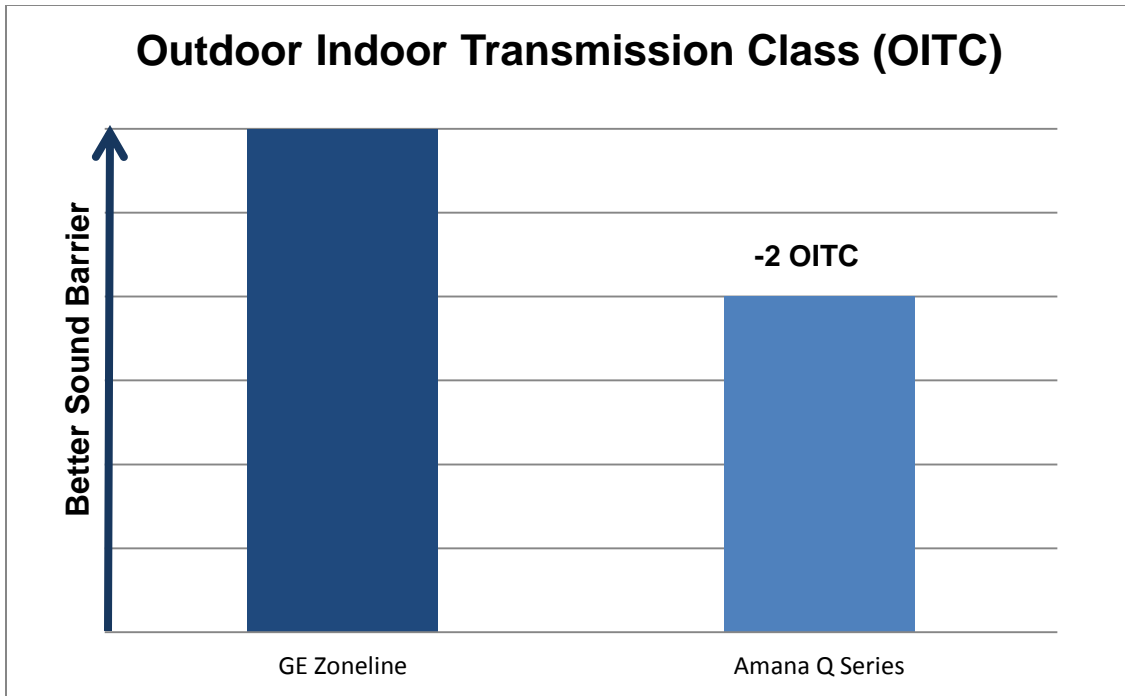


Figure 5: OITC results at second third party laboratory

Again, the GE Zonline outperforms the Amana Q Series. Differences in OITC between labs are not uncommon and can be attributed to differences in laboratory setup and filler wall variation. There was no work done to correlate the two third party labs, but both labs are accredited to run ASTM E90 and confirm that the GE Zonline is superior in OITC.

### Operational Sound Level

PTAC operational sound is measured using AHRI 350 Standard for Sound Performance Rating of Non-ducted Indoor Air Conditioning and Heat Pump Equipment. Operational sound levels can be expressed in either sound pressure level or sound power level. There is a distinct difference between sound pressure and sound power. Sound pressure level is dependent on many factors including the distance in which the measurement is taken from the PTAC and the specific environment in which the measurement is taken (room construction materials, carpets, furniture, etc). On the contrary, sound power level does not depend on the location of the microphone or acoustic treatments in the room. It is dependent on the unit itself, which therefore makes sound power the preferred method of comparing PTAC sound levels. Figure 6 offers a common analogy to help understand the difference between sound pressure and sound power.

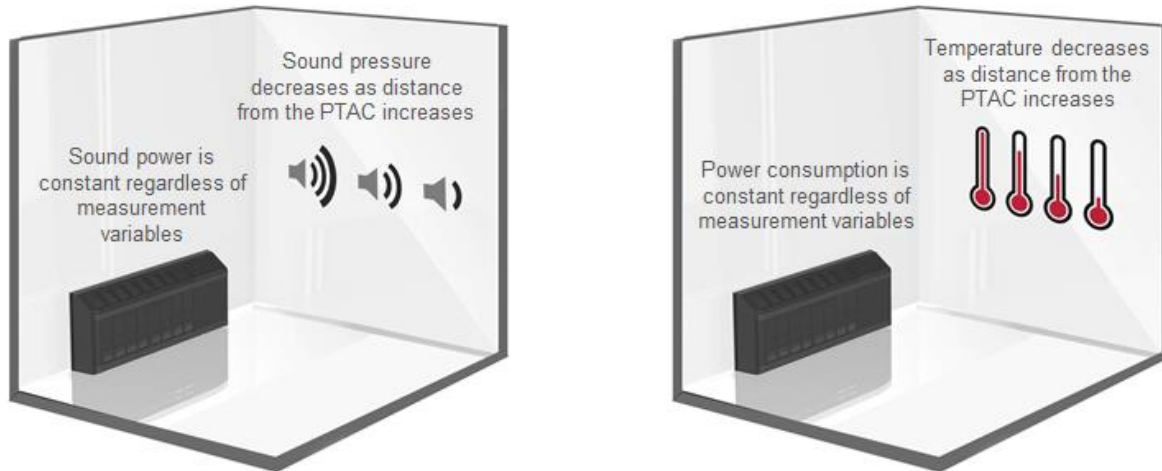


Figure 6: Analogy of sound pressure to temperature and sound power to electrical power

Using the analogy offered in Figure 6, the sound pressure in the room due to the PTAC operation is much like the temperature in the room, it will vary depending on where the measuring device (microphone or thermometer) is located. In this particular example, the PTAC is in heating mode, so the temperature will increase as you approach the PTAC, much like how the sound pressure will increase as you approach the PTAC. On the contrary, the sound power of the PTAC and the electrical power of the PTAC remain the same regardless of the measurement location. For this reason, it is ideal to compare two sound power levels, not sound pressure levels when comparing PTACs.

Sound power is typically expressed in units of decibels or dB. It is common to weigh the operational sound data to reflect how loud it would be for human hearing using a method called A-weighting. When a sound level is A-weighted it is called a dBA level. Lower dBA indicates that the human ear will perceive the sound as quieter. As stated earlier, AHRI 350 was conducted at the third party laboratory. During this test, the PTAC is installed in a filler wall much like in ASTM E90. Sound power results were averaged for the three PTACs tested for each manufacturer and rounded up to the nearest tenth. Figure 7 offers the results for operational sound power measured on the indoor side of the PTAC.

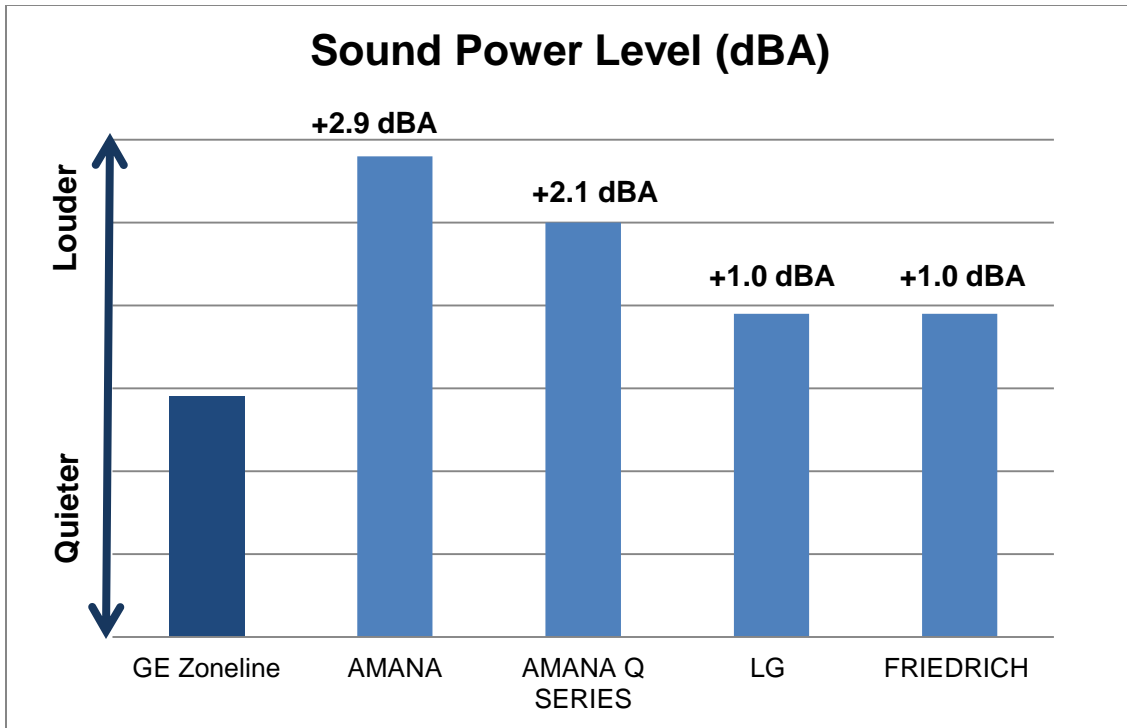


Figure 7: Operational sound power level results at the first third party laboratory

The results show that the GE Zoneline has a lower A-weighted sound power level than the competitors tested. This means that while in High Cool operation, the GE Zoneline will sound quieter to the hotel guest. As with the transmission loss testing, additional testing at a second third party was conducted comparing the GE Zoneline sound power to the Amana Q Series. The results are shown in Figure 8.

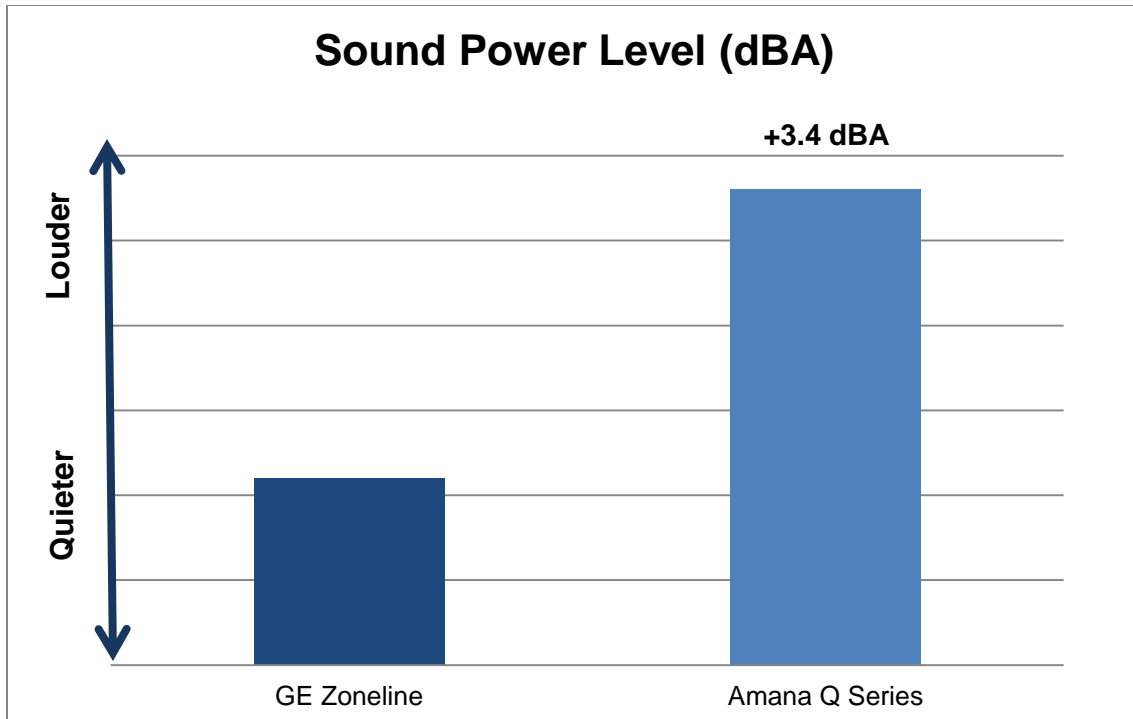


Figure 8: Operational sound power level results at the second third party laboratory

The results at the second third party laboratory, again, confirm that the GE Zoneline is quieter than the competition tested.

## Sound Quality

In addition to quantifiable acoustics performance parameters like STC, OITC and dBA, a principal component of acoustic performance is sound quality. Sound quality refers to the subjective evaluation of the sound of the PTAC. To evaluate sound quality, the GE Zoneline and an Amana PTAC were placed in neighboring hotel rooms of comparable layout in a SpringHill Suites (10101 Forest Green Blvd, Louisville, KY 40223). A sound jury was conducted in which approximately 200 people of varying ages were asked to evaluate the PTAC for acoustics. The sound jury was conducted as a blind study to eliminate any bias. During the sound jury, the units went through a series of operating modes including start-up, high-cool, low-cool, high-heat pump and low heat pump. Participants rated the sounds and were asked questions like “Do you find any of these sounds displeasing?” and “Would you be happy with your stay at this hotel?” The study was conducted on all 4 capacities offered by GE (7,000 BTU, 9,000 BTU, 12,000 BTU, and 15,000 BTU) on both air conditioners and heat pump models. To ensure fair comparison, the juries were conducted such that equal capacity units were compared to one another. GE Zoneline was rated better for sound quality when compared to the Amana PTAC in 63% of tests. On the contrary, the Amana PTAC was only preferred over the GE Zoneline in 8% of tests. It is clear from the results that the GE Zoneline has preferable sound quality when compared to the Amana PTAC.

## **Conclusion**

Sound is a vital characteristic when evaluating PTAC performance and plays a major role in the guest experience in a hotel setting. The third party results prove that the GE Zoneline is superior in both transmission loss and operational sound level when compared to competitor PTACs in the marketplace. This means that the GE Zoneline will block more outdoor noise and operate quieter than the competitor PTACs tested. In addition, a blind jury of approximately 200 individuals chose the GE Zoneline to have preferable sound when compared to the Amana brand PTAC. The results from this extensive study prove that the GE Zoneline offers the best acoustic performance compared to the leading competition.

## Additional Resources

ASTM E90-09 Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

(<https://www.astm.org/Standards/E90.htm>)

AHRI Standard 350 – 2015 Standard for Sound Performance Rating of Non-ducted Indoor Air-conditioning and Heat Pump Equipment

([http://www.ahrinet.org/App\\_Content/ahri/files/STANDARDS/AHRI/AHRI\\_Standard\\_350\\_2015.pdf](http://www.ahrinet.org/App_Content/ahri/files/STANDARDS/AHRI/AHRI_Standard_350_2015.pdf))

Wilson, Charles E. Noise Control: Measurement, Analysis, and Control of Sound and Vibration. Second ed. Malabar, Florida: Krieger Publishing Company, 1994. Print.

The following tables offer additional information regarding the PTACs tested for this study.

Laboratory 1		
Brand	Model	Date Tested
Amana	PTH123G35AXXXAA	March 26, 2015 – April 3, 2015
Amana	PTH123G35QXXXAA	March 26, 2015 – April 3, 2015
Friedrich	PDH12K3SG-A	March 26, 2015 – April 3, 2015
LG	LP123HD3B	March 26, 2015 – April 3, 2015
GE	AZ65H12DABW1	October 13, 2015 – October 14, 2015

Laboratory 2		
Brand	Model	Date Tested
Amana	PTH123G35QXXXAA	February 22, 2016 – February 24, 2016
GE	AZ65H12DABW1	February 22, 2016 – February 24, 2016

## FOR MORE INFORMATION

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