Your appliance may be smart, but can it connect?

How connectivity issues are making life harder for manufacturers and consumers alike.

UL
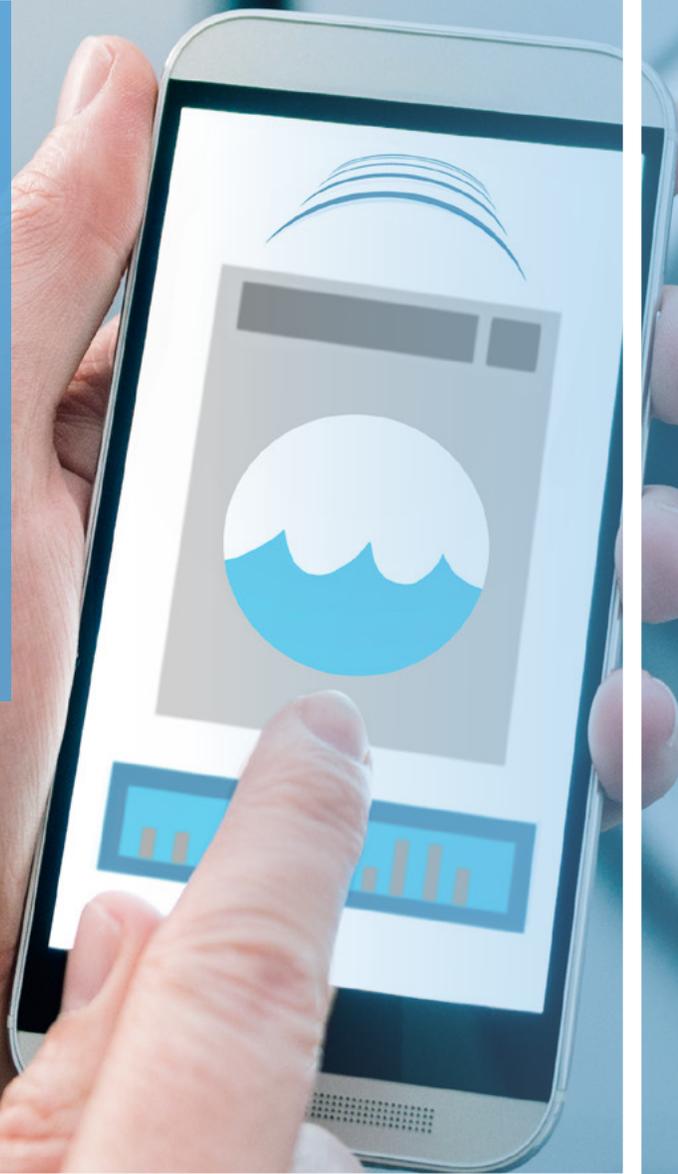
Empowering Trust™

Executive Summary

As the smart home and automation trend continues to heat up so does the need for innovative design of smart home devices, the technologies that power them and the flow of data between them. New consumer technologies, which have given rise to interconnected, easy-to-control environments themed smart homes, are doing just that.

These residences, in which several smart appliances are connected to the internet, enables occupants to monitor and manage their entire home from the convenience of a smartphone or device. A simple voice command or click of a button can start a load of laundry, brew a cup of coffee or schedule a maintenance appointment — tasks that essentially improve the overall efficiency of everyday life.

The time and money-saving benefits that these technologies can offer has piqued consumer interest — a lot of interest. By the end of 2018, more than 45 million smart home devices were installed in the U.S.[1] and the global smart home market is forecasted to reach a value of more than $53 billion (USD) by 2022.[2] This type of demand is fueling a digital revolution, especially in the world of Internet of Things (IoT), and the home automation industry is struggling to keep pace with the evolving technology.

While this explosion in the retail market presents huge opportunities for many companies, it also presents major challenges, which Forbes Magazine recently called out, stating, "Key barriers to mass adoption include cost, security threats, the technological fragmentation present in the smart home industry (due to the plethora of devices, standards and networks in the ecosystem) and the difficulties inherent in linking and integrating the numerous and disparate smart home devices and systems."[3]

While working with a well-known manufacturer of household appliances, UL's team of experts discovered that technical fragmentation was, in fact, the biggest obstacle that the industry would face. By tapping into our history of innovation, methodological expertise and technical resources, we were not only able to identify the issues that prevent smart appliances from working properly, but in most cases we were able to identify ways to solve them.

This white paper will:

- Provide an overview of the smart appliance market and current purchasing trends
- Explain the challenges that smart appliance manufacturers face, especially as it relates to the customer experience
- Outline the risks you will face if your smart appliances do not work as intended
- Demonstrate how our end-to-end Smart Device Interoperability (IOP) Solutions Testing can help mitigate these risks

Introduction

We live in a world that is ruled by convenience and technology. Consumers expect to access almost everything in their lives with a simple voice command, touch of a button or swipe of a screen. It shouldn't come as a surprise that smart homes are the latest trend to dominate the market, with current statistics showing that the industry will approach $40 billion (USD) in the U.S. alone by 2024.[4]

What's the reason for this drastic increase? It's simple. People want to make their lives easier. Considering that smart technology can be integrated into almost any home furnishing, it just makes sense that consumers would want to connect the things that they use most — their appliances. By linking their refrigerators, laundry machines, dishwashers and ovens to the internet, homeowners can easily monitor, control and track everything from the convenience of their smartphones and, more recently, their smart speakers. Sounds easy, right?

Except in most cases, it's not.

Smart home devices are only as good as their ability to get connected, stay connected and deliver on their intended features. That means that the products don't just have to work, but they have to work properly within a customer's existing ecosystem. Delivering on this promise is proving to be harder than anticipated. Many of these features simply don't function properly once the appliance is in a real-world setting.

These issues can be attributed to the fact that the technology used in these appliances has not been tested from an end-user perspective. Many of the main players in the appliance manufacturing industry — companies that have been around for decades — have never before incorporated smart technology into their products. While these companies are making huge strides, they may not fully understand the technical intricacies involved in linking smart appliances with the numerous and disparate consumer devices that are in the market today.

Purchasing trends: Who's buying your products?

Trends show that retailers should pay attention to what millennials are purchasing and how they are making their purchasing decisions. In 2017, they made up the largest group of homebuyers[5] (34% of the total buying pool) and statistics suggest that they will remain the most dominant buyers in 2019.

With so many millennials becoming homeowners, smart appliances will be invading homes at an unparalleled rate. Not only does this generation rely on technology to be integrated into every part of their daily lives, they expect it to be simple, intuitive and frictionless. In fact, 47% of millennials already own one smart product for their home and 70% of them are planning to buy another one.[6] This is expected to catapult household penetration to 28.2% by 2020.[7]

How does all of this information convert into dollars and cents for manufacturers? Within two years, the smart appliance market will be worth $37.2 billion (USD).[8]

By **2020**, the smart appliance shares *will be as follows:*

37%, air conditioners

refrigerators **28%,**

washing machines **27%,**

clothes dryers **2%,**

dishwashers **4%,** *and*

large cooking appliances **2%.**

The challenge: Avoiding real-world customer frustration

With a larger number of IoT devices in operation powered by different mobile applications, customers want products that are easy to set up, reliable and compatible with their existing high-functioning electronic devices. The last thing a customer wants to do is buy a smart appliance, have it not work, call customer service and get told they need to buy a newer router or mobile phone that is compatible. Not only was the appliance impossible to set up, but also it is now going to cost more money than expected.

Customers are becoming increasingly frustrated with the entire experience: Something that was supposed to make their lives easier is actually causing one big headache. Smart appliances need to work with their existing home networks. Consumers should be able to open the box, follow the quick-start guide and get connected in a few easy-to-follow steps. So, therein lies the challenge: How do you deliver a seamless experience to every customer, every time?

When working to find a solution, we knew we had to listen to real-world customers first.

Here's what we heard:

"After many attempts, I have given up connecting my smart appliance to my home Wi-Fi router."

"When I got a new router, I was unable to get my appliances reconnected."

"My phone got updated, and now I don't get any appliance notifications."

"Everything was working great until the app was updated and now my favorite feature does not work anymore."

"I have stopped using my smart appliance features because the app crashes at the most critical time."

"The appliance features work fine on my wife's iOS phone but not on my Android phone."

"I don't understand what this error message means."

Overwhelmed call centers

The key to both maintaining and growing customers boils down to how satisfied they are with your service, which is why your customer service call center is one of the most critical components of your business. If customers experience long wait times or ineffective agents, customers will quickly become frustrated and may start to look for other solutions. Even more concerning is that studies suggest more than 91% of customers are unlikely to recommend your company after a bad customer service incident[9] — a number too big to ignore.

Additionally, overwhelmed and underperforming call centers can quickly and irreversibly damage your reputation and break consumer trust. Consumer trust is the hallmark of any successful business and once it's been broken, it's hard to

gain back. In such a competitive industry, chances are that another manufacturer will always be willing and waiting to fill the role of America's "most trusted brand."

The takeaway: You don't need to work on improving your customer service call centers, you need to work on improving your products so that customers don't need to call them in the first place.

Overwhelmed call centers pose a major financial risk to your business. Each call can cost upward of $13 (USD).

Negative online reviews

Millennials, who are more likely to be buy a smart appliance than any other demographic, rely heavily on online customer reviews when making a purchasing decision. In fact, eight out of 10 millennials never buy anything without first reading a

review,[10] taking the research phase of their purchases more seriously than any previous generation.

With that said, it's important to realize that all consumers are likely checking online reviews before making a purchasing decision. A study conducted in 2017 by the Better Business Bureau and Nielsen found that more than half of U.S. internet users said they used ratings and online reviews "always" or "often" to inform purchasing decisions.[11] Also, the majority of respondents find product reviews to be at least somewhat reliable when shopping because there's a certain level of trust inherently established within them. A further study suggests that two-thirds of consumers are willing to pay up to 15% more for the same product or service if they are assured they will have a better experience.[12]

There's no doubt that online reviews are one of the biggest influencers in today's digital shopping era. Reviews enable you to create a positive online footprint and, in turn, help build your brand and increase sales. Negative reviews, on the other hand, are the quickest and most efficient way to damage your reputation and drive away potential customers.

The takeaway: You need to ensure that your products are performing in a way that will garner positive online reviews.

Kitchen Appliances
★☆☆☆☆

Laundry Appliances
★⯪☆☆☆

Comfort Appliances
★★☆☆☆

90% of consumers
READ ONLINE REVIEWS
before visiting a business

88% of consumers
TRUST ONLINE REVIEWS
★ *as much as*
personal recommendations

86% of people
WILL HESITATE TO
make a purchase from
a business that has
negative online reviews

Star rating is the ★★★★☆
number one factor
used by consumers
TO JUDGE A BUSINESS

A NEGATIVE REVIEW
can drive away
40% *of* *potential*
customers

The good news

Many of the issues that lead to customer frustration, overwhelmed customer support centers and negative online reviews are well within your control — our team of experts found that there is always a workaround or fix to the problem. If you mitigate these problems before your products ever launch, you will not only preserve your reputation, you will help secure your place as a leader in the home automation industry.

Introducing UL's end-to-end Smart Device IOP Testing solutions

Our team has created a one-of-a-kind solution, which isn't available anywhere else in the market. Our end-to-end Interoperability (IOP) Solutions Testing is designed to:

- Identify and help mitigate problems in connectivity and interoperability across a broad range of commercially available Wi-Fi routers and Wi-Fi chipsets
- Verify the Android and iOS mobile apps operate correctly across many different mobile phone manufacturers and models along with their respective OS configurations
- Help companies maintain the highest rating of customer experience in the market

We curated our Smart Device IOP Solutions Testing program to enable you to deliver the out-of-box-experience that consumers expect — a service that has never before been offered in the smart appliance industry. To do that, we had to use a reality-based approach that was rooted in solving real-world frustration. In order to help meet customer demands for easy-to-use products, we created our own specifications, we created our own, surpassing the standard protocols in order to take a much deeper dive into the problems that are affecting smart appliance performance. By testing a variety of smart devices against your mobile apps, along with conducting in-depth quality tests, we can help your customers have the experience they were hoping for.

The solution: Smart device + mobile apps + quality testing

Smart device
- Helps ensure setup and connectivity to Wi-Fi router
- Checks compatibility across a wide range of Wi-Fi routers
- Confirms user inactivity doesn't affect connectivity
- Verifies various nonstandard Wi-Fi configurations supported by Wi-Fi router manufacturers

Mobile app
- Helps ensure proper control of the device
- Confirms proper layout on different size displays and orientations
- Strengthens stability to avoid crashes
- Verifies functionality across multiple phones and accounts
- Validates links, FAQs and error messages
- Highlights nonintuitive functionality

Quality testing
- Reports on server availability
- Reviews of the user guide, packaging, Quick Start Guide and FAQs
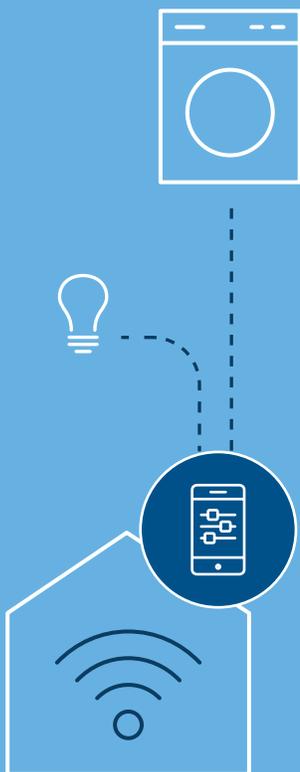
The process

The wide-range of Wi-Fi routers and diversity of mobile phones, i.e., different manufacturers, models and carriers, presents the biggest challenge that smart appliance manufacturers have to face. The technology programmed into these appliances needs to be capable of linking and integrating with numerous and disparate consumer products. With so many possible configurations, how can you possibly ensure connectivity with every customer, every time?

Simply meeting the standard industry specifications isn't going to solve that potential issue. That's why we've gone beyond the typical testing procedures to present a solution that's never before been offered. Our testing process enables us to:

- Evaluate how your product performs with a lineup of common consumer products
- Document and diagnoses failures with proper tools, e.g., Wi-Fi capture, phone system logs, screenshots and videos
- Narrow down the information in a way that enables your engineers to fix the problems

We're able to offer this one-of-a-kind solution, because we have one-of-a-kind resources. Our team has access to nearly every type of product that a consumer would have in their home, which gives us a well-rounded dataset. Whether it's different routers' brands or bands, IOS or Android, we've accounted for everybody's setup to be a little bit different and can simulate almost any configuration. We perform all of our tests in a standard environment — one that mimics a consumer's home — and we don't use special software. This ensures that we are verifying functionality in a real-world setting, rather than a laboratory.

Capturing failures:
The difference-maker

Many times, engineers encounter a problem but cannot duplicate it. That's a real issue, because in the world of IoT, you need to replicate a problem in order to fix it. Fortunately, our in-house developers created a unique software solution. By providing video, screenshots and failure logs, which can all be matched to a time stamp, your coders and IT developers will be able to identify the reason an app failed much more quickly.

This is a more efficient solution than using a traditional test market approach, i.e., consumers testing devices in their homes, which can be a lengthy process. We shorten that cycle so that test time is a lot quicker and a lot less expensive, helping you get to market faster.

That's the UL difference and that's what sets our service apart from the competition.

The results
- Improved out-of-box experience
- Minimized calls into customer support
- Reduced product returns
- Improved product and app reviews
- Increased sales
- Reinforced trust in your brand

Why UL: Our experience sets us apart

As a forward-thinking company, we have a rich history of helping innovators decrease time-to-market. As the world of IoT continues to evolve at a rapid pace, changing the way consumers use and interact with everyday products, we've made it our mission to stay at the forefront of technology.

As a scientific leader at the forefront of technological developments, we have a lot of experience working with IoT systems and devices, focusing much of our attention on smart products, such as light bulbs, switches, cameras, door locks, televisions, appliances, medical devices and wearables. In doing so, our team has gained an in-depth understanding of the mechanisms that are necessary to integrate these products with consumer devices like smartphones. We have the resources and technical know-how to get your products working together so that your brand will become synonymous with quality, ease-of-use and superior functionality. With so much competition in this space, these attributes will help you become the smart appliance manufacturer of choice — now and in the future.

Looking toward the future

Manufacturers are looking to smart devices as the business models of the future, because the technology presents unlimited opportunities for growth, specifically as it relates to the reoccurring revenue stream. Take, for instance, a refrigerator that can automatically reorder new water filters when needed or a washing machine that charges $0.25 (USD) per load instead of $1,000 upfront. Not only do these types of functions benefit you, they also benefit consumers who are looking to make their lives easier and more efficient — the No. 1 reason why smart appliances are taking off in the first place.

It's obvious that the benefits of having your smart appliance in someone's home grows exponentially every year. That's why it's more important than ever to become the brand that people trust — the brand that people will continue purchasing.

Wi-Fi interoperability testing

Wi-Fi IOP testing	Tests performed
Protocol	Testing security, SSID, power management, etc.
2.4 GHz and 5 GHz (if applicable)	Testing the RF portion of product such as channel, overlap, etc.
AP function	To help ensure the most common mobile devices can connect to the device to share the Wi-Fi credentials
Long-term	Document the connectivitiy and functionality over a set period of time
Wi-Fi Router Compatibility - mesh and non-mesh technologies	Test Wi-Fi routers to help ensure connectivity

Mobile app testing

App testing	Tests performed
Application, in-depth testing with iOS and Android phones	Verify application setup, login, features, notifications, functionality, stability and proper control of end devices
Mobile application compatibility	Subset test cases of application in-depth. Performed across multiple smartphones

Summary + Conclusion
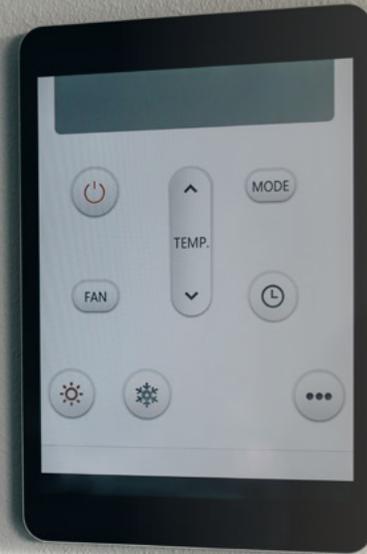
The smart appliance market is about to see an incredible surge in sales as more millennials become homeowners. With the global market forecasted to be worth $53 billion (USD) by 2022, it's in your best interest to help ensure that the technology in your devices meets the compatibility requirements necessary to take advantage of this growing trend.

By producing top quality appliances for decades, you've worked hard to build your brand and the consumer trust that goes along with it. The last thing you want to do is let the complexities of IoT integration jeopardize that trust. And you don't want consumers to be your product testers. As the technology in smart appliances stands today, however, that is very likely to happen.

Problems with setup, connectivity and functionality are causing a lot of customer frustration, and that frustration is leading to overwhelmed call centers and poor product reviews. As evidenced by the research, insufficient customer service and negative online reviews can be extremely detrimental to your brand — a few key strokes can literally sabotage your reputation.

As the industry's leader in smart appliance IOP testing, we can help you avoid those pitfalls. By helping ensure that your products are working the way they are supposed to, in a real-world environment with real-world devices, we can help you deliver the out-of-box experience that your customers expect. By taking advantage of our Smart Device IOP Solutions Testing, you are one step closer to solidifying your reputation as a leading producer of quality, top-of-the-line smart appliances.

For more information on UL's Smart Solutions Quality Testing Services for smart appliances, contact our team at Applianceinfo@UL.com. Or visit us at UL.com/SmartSolutions.

End Notes

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