

ZigBee Wireless Survey Toolkit for TB7200/TB7300/TB7600 Series Thermostats

USER'S GUIDE



The TB7200, TB7300, and TB7600 Series wireless communicating thermostats are ideal for retrofit applications where the addition of communicating field bus wiring within the building space is prohibitive. These wireless thermostats allow for the use of equipment wiring used by existing electronic thermostats.

The Honeywell wireless thermostats, along with the TB-VWG-APP-1014 wireless communication card and the network driver and device .jar files, are specifically designed to be used by Honeywell WEBs-AX controllers WEB-2xx, WEB-6xx, and WEB-7xx controllers powered by Niagara^{AX}®.

More Information

To learn more about the TB7200, TB7300, and TB7600 thermostats visit <http://customer.honeywell.com>.

- Wireless Installation & Integration Reference Guide for TB7200, TB7300, TB7600 Series Thermostats (Form No. 63-4522)
- TB7600 Series RTU/Heat Pump Communicating Thermostats Specification Data (Form No. 63-2706).
- TB7600 Series RTU Communicating Thermostats with Humidity Control Specification Data (Form No. 63-2707)
- TB7300 Series Communicating Fan Coil Unit Thermostats Specification Data (Form No. 63-2709).
- TB7200 Communicating Zoning Thermostats Specification Data (Form No. 63-2708).
- Sensor Selection Guide (Form No. 63-9285) for a complete listing of compatible sensors.

PRODUCT OVERVIEW

The Honeywell TBST-5014W wireless survey tools are intended to verify and validate the deployment and use of the Honeywell TB7200, TB7300 and TB7600 Series wireless thermostats on a potential job site.

This document provides wireless guidelines and instructions on how to use the wireless survey tools to perform a site survey.

NOTE: Wireless installations require careful consideration of the environment where the wireless devices will be installed. We highly recommend a site survey be performed prior to bidding on or accepting a job.

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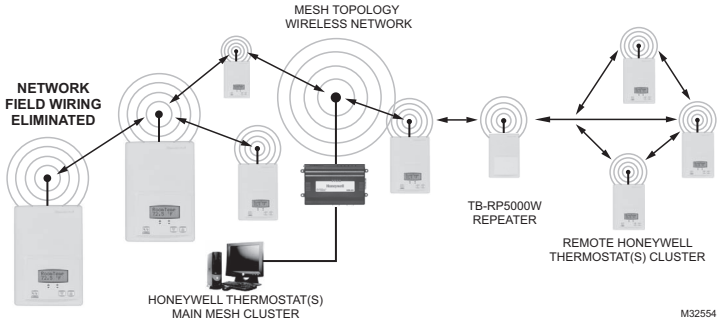


Fig. 1. TB7200, TB7300, TB7600 ZigBee Wireless Network.

GETTING STARTED

Included in the TBST-5014W wireless survey kit, you will find the following items:

- 2 ea. survey tools
- 2 ea. 120 Vac charger for the survey tools

IMPORTANT

Before performing a survey, please insure that both survey tools are fully charged overnight.

The survey tool will display a numerical percentage value on the LCD screen which represents the wireless network ZigBee RSSI dB value (Receiving Signal Strength Indicator).

IMPORTANT

Please note that it is normal for the value to fluctuate slightly (up to 10-20%). The final reading value is representative of the median averaged values displayed.

- Any value from 10 to 100% indicates good ZigBee connectivity.
- Any value below 10% may indicate that a repeater (TB-RP5000W) may need to be installed.

Before you use the wireless survey toolkit to complete a site survey, review this document to learn how to configure the site survey tools and how to perform a site survey using these tools.

About the Wireless Survey Tools

About The Survey Tools

- The survey tools feature an auto-shutdown after 10 minutes. After 10 minutes, 10 quick beeps will sound; if the ON button is not re-pressed, the unit will shutdown to prevent unnecessary battery drainage.
- The minimal expected battery life is at least 50 full charge cycles. The maximum expected battery life is 200 full charge cycles.
- Contact Honeywell for replacement batteries. The survey tools use a custom rechargeable battery type. DO NOT USE regular rechargeable batteries for replacement. Doing so MAY result in critical failure and/or injury.

Configuring the Wireless Survey Tools

1. Charge the survey tools overnight.
2. Press the red ON button on the top of each device. The green ON LED will light and the LCD will display **Signal % 254** then display **Signal % 0**. If the devices have already been configured, the signal strength reading will be greater than zero and very likely 99 or 100 since the devices are in close proximity to one another.
3. Press and hold the Override button for five seconds, as shown in Fig. 2, until **Com addr** displays on the LCD.

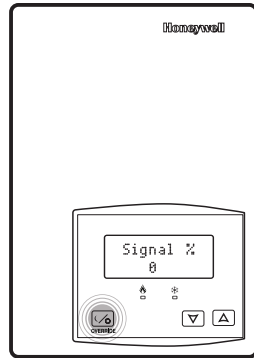


Fig. 2. Press the left (red) button.

4. Press the Override button once and **PAN ID** will display.
5. Assign the PAN ID with the up/down arrows on the right, as shown in Fig. 3. Both devices should be assigned the same PAN ID.

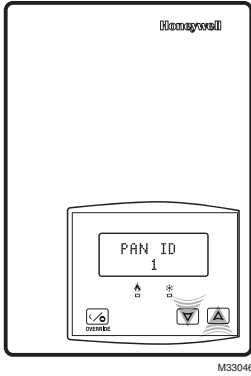


Fig. 3. Assigning PAN ID.

6. Press the Override button once and **Channel** will display.
7. Assign Channel number 15 or 25 with the up/down arrows on the right. Both devices should be assigned the same Channel.

ZIGBEE MESH NETWORK OVERVIEW

ZigBee is a specification for a suite of high level communication protocols using small, low-power digital radios based on the IEEE 802.15.4-2003 standard for wireless personal area networks (WPANs).

Mesh networking is a type of network where each node acts as an independent router. It allows for continuous connections and reconfiguration around broken or blocked paths by “hopping” and “re-meshing” from node to node until the final destination is reached.

General characteristics of the wireless physical communication layer are:

- Uses a wireless physical layer of 2.4GHz with data rates of 250 kbps
- Yields high throughput and low latency
- Automatic topology configuration: star, peer-to-peer, mesh
- Handshake protocol for transfer reliability
- Range: 50 feet (15 meters) typical and up to 100 feet (30 meters) depending on environment

IEEE 802.15.4 along with ZigBee networks and application support layer provide:

- Low cost installation deployment
- Ease of implementation
- Reliable data transfer
- Short range operation
- Very low power consumption

For a successful ZigBee deployment, it is important to understand that the ZigBee wireless network is influenced by the same environmental factors that affect other wireless systems:

- Interference from radio emitters
- Various electronic devices
- Interference caused by solid objects that may slow or stop communication between devices

Even with potential sources of signal interference, the presence of these factors should not result in noticeable network performance degradation. Environmental issues will occur with any wireless network installation.

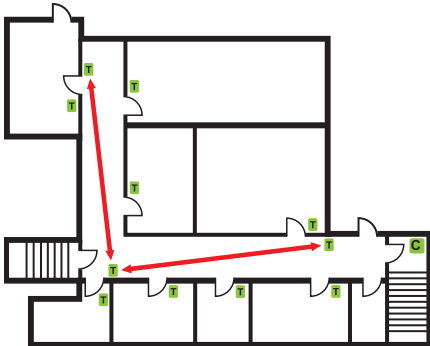
BASIC DESIGN AND DEPLOYMENT CONSIDERATIONS

Proper design considerations need to be addressed prior to any installation of a WEBS-AX controller with a Honeywell wireless communication card and related wireless thermostats.

- Honeywell recommends using a per floor horizontal architecture vs. a vertical one. Transmitting from one floor to the other may be possible in certain applications (such as going through stairways), but the design and optimization of the thermostat antenna is designed for optimal horizontal distance penetration and not a vertical one. As such, be prepared to use AT LEAST ONE WEBS-AX controller and wireless communication card per floor.
- Please note that radio transmissions CANNOT travel through steel. If floors are constructed with steel joists or other steel materials it is highly unlikely that the wireless thermostat transmissions will be successful between floors.

Clear line of sight deployment

- To avoid network interference with 802.11 Wi-Fi devices in the 2.4GHz spectrum, Honeywell recommends the use of 802.15.4 channels 15 and 25 ONLY. 802.11 Wi-Fi transmissions overlap and may interfere with other channel selections allowed by 802.15.4 (Channels 11 to 26).
- With clear line of sight deployment (no physical obstacles between 2 communicating thermostats), the maximum distance between each thermostat is 100 feet (30 meters). See Fig. 4 .

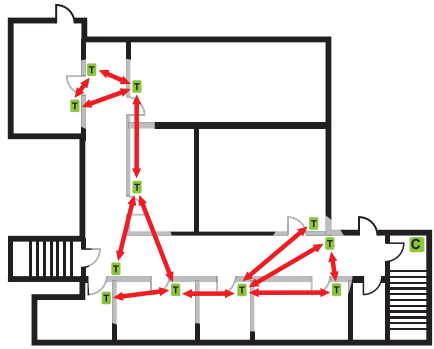


NOTE: LINE OF SIGHT DISTANCE BETWEEN TWO NODES IS A MAXIMUM OF 100 FEET (30 M). MCR32614

Fig. 4. Line of sight distance between two nodes is a maximum of 100 feet (30 M).

Non-clear line of sight deployment

- The maximum non-clear line of sight distance between thermostats for gypsum wall partitions which may include metal stud framing is a maximum of 50 feet (15 meters). See Fig. 5.



NOTE: MAXIMUM 50 FEET (15 M) BETWEEN 2 THERMOSTAT NODES. MCR32615

Fig. 5. Non-clear line of sight distance between two thermostat nodes is a maximum of 50 feet (15 M).

- In order to avoid interference from other wireless devices, such as wireless routers, wireless adapters or laptops using wireless networks, etc., ensure that a minimum distance of 3 feet (1 meter) is maintained between any Honeywell wireless device and any Wi-Fi devices. A distance of 10 feet (3 meters) or more is preferred when possible (Fig. 6).

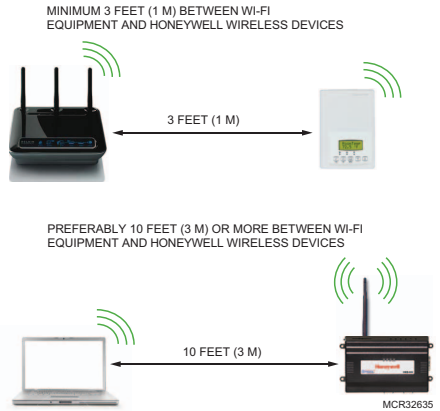


Fig. 6. Minimum 3 feet (1 M) between Wi-Fi equipment and Honeywell wireless devices. Preferably 10 feet (3 M) or more between Wi-Fi equipment and Honeywell wireless devices

- Ensure that at least one thermostat is within 50 feet (15 M) of the controller with wireless card for every cluster of 10 thermostats installed. WEB-2xx controllers have a recommended max of 30 wireless thermostats per controller. If 30 thermostats are installed, three thermostats should be installed within 50 feet of the controller with wireless card. WEB-6xx and WEB-7xx controllers have a recommended max of 50 wireless thermostats per controller. If 50 thermostats are installed, five thermostats should be within 50 feet of the controller with wireless card. (Fig. 5 and Fig. 6)
- Always install the controller with wireless card closest to the center of all associated wireless thermostats.

- Always locate the controller with wireless card near or in the direct line of sight to as many wireless thermostats as possible.
- Avoid metal, brick walls or concrete obstructions between wireless devices as much as possible.
- Make sure the antenna on the wireless card is perpendicular to the floor.
- Avoid placing the controller with wireless card and the thermostats near metal or enclosing the controller with wireless card in a metal box. If the controller needs to be installed inside a metal cabinet, use the remote antenna accessory (TB-RA-1014).

SITE SURVEY OVERVIEW

If available, it is best to have a floor plan layout showing the location of all the proposed thermostats to be installed (Fig. 7).

If possible, perform the survey during occupied hours when other electronic devices such as (computers, wireless laptop, cell phones, PDA's, wireless telephones, microwave ovens, light ballasts, etc.) would be in use as

to generate as much interference as possible. Some of these devices can generate interference up to 20 feet (6.8 meters) away during normal operation. Even with possible sources of signal interference, the presence of these wireless devices will most probably not result in any network performance degradation.

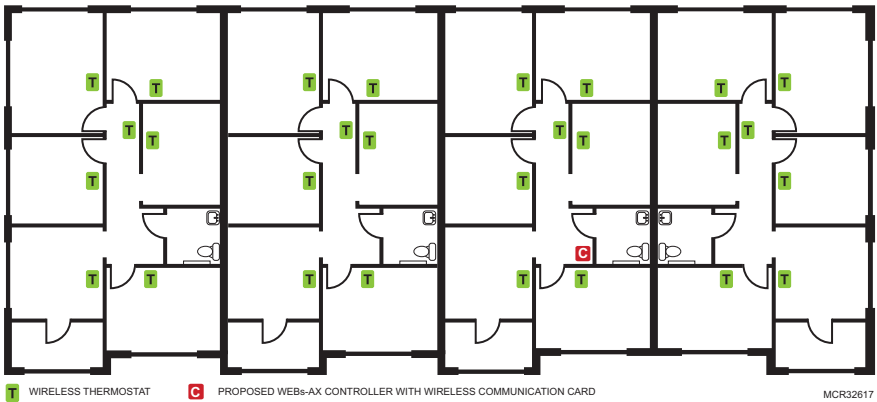


Fig. 7. Floor plan with proposed thermostats to be installed.

It is important to understand that the survey values recorded are provided as a worst case scenario of a point to point application. Once the whole network is deployed with a WEBs-AX controller and wireless communication card and all wireless thermostats are present and functioning as routers, the ability of the network to

efficiently route wireless signals cannot be compared to this simple survey analysis method (Fig. 8). Thus, it is important to remember that the displayed percent signal ONLY represents the signal strength from point A to point B. As other devices join the network mesh, the route taken from device A to device B will most likely change.

A dense cluster of wireless thermostats will allow your network to recover from temporary disturbances more swiftly.

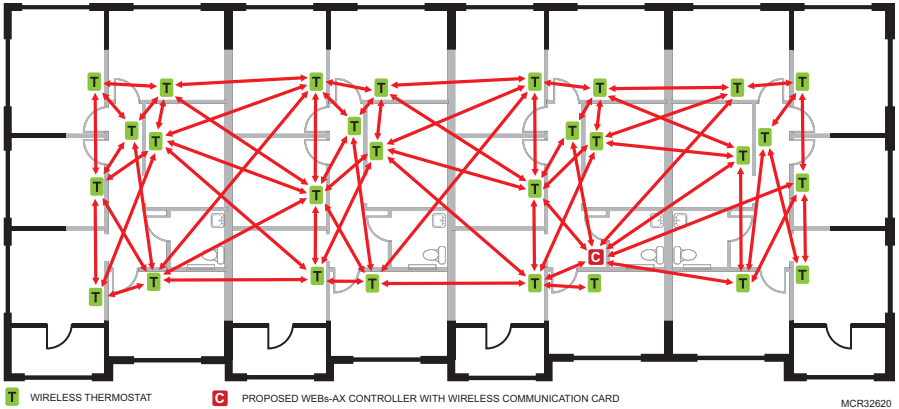


Fig. 8. A fully deployed wireless network will outperform the point-to-point wireless survey.

PERFORMING A SITE SURVEY

This section provides information to complete a site survey.

Tools Needed

- One TBST-5014W ZigBee Wireless Survey Toolkit
- Site floor plan drawing

Preparing for the Site Survey

Prepare the following prior to going to the job site to do a site survey.

1. Create a site drawing of proposed locations for all wireless devices like the floor plan shown in Fig. 7.
2. Charge the wireless survey tools overnight.
3. Ensure the wireless survey tools are working by powering them up and verifying that they both display a signal strength very near 100% when in close proximity to each other. If a 0% signal strength displays, see "Getting Started" on page 2.

NOTE: To ensure a proper survey, Honeywell recommends using **ONLY** channels 15 or 25 to avoid network interference with 802.11 Wi-Fi devices in the 2.4GHz spectrum range.

Best Practices When Performing the Site Survey

- Always hold the wireless survey tools vertically to ensure proper measurements. The wireless survey tool antenna is designed for optimal horizontal distance penetration. Holding the device horizontally will dramatically lower the range of connectivity.

- Hold the wireless survey tool at the location where you would like to install the thermostat. The closer the device is to the actual installation location of the thermostat, the more accurate the survey results will be.
- Do NOT stand directly in between the wireless survey tools while measuring. Your body will interfere with transmission signals. Always stand out of line of sight to avoid interfering with the signal readings.
- To ensure accurate readings, ALWAYS hold the wireless survey tool near the bottom. Do not hold it up higher, as you may cover the antenna (Fig. 9).

NOTE: Always place the wireless survey tool as close as possible to the final installation location of the wireless thermostat.

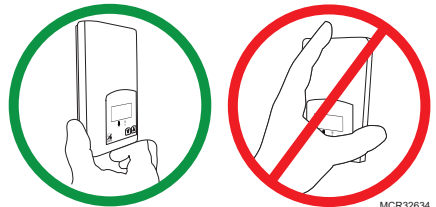


Fig. 9. Hold the wireless survey tool, as shown in the left image, when doing a site survey.

At the Job Site

1. Begin by positioning one of the wireless survey tools in the proposed location for the WEBS-AX controller.
2. Find the coverage radius for the controller at its proposed location. This coverage radius is the first hop from the controller. Any thermostat or repeater should be installed NO FARTHER than 5 hops to and from the WEBS-AX controller with the wireless communication card. This is due to the nature of the ZigBee stack in the wireless controllers. Walk about
3. Move to another cluster of thermostats at different points to determine the radius. This represents the maximum radius of the first hop where connectivity is possible based on the building environment and partition construction. Please note that this distance can be anywhere from 0 to hundreds of feet (Fig. 10). It's possible that another location may improve your network performance or that you may require an additional controller with a wireless communication card or additional wireless repeaters.

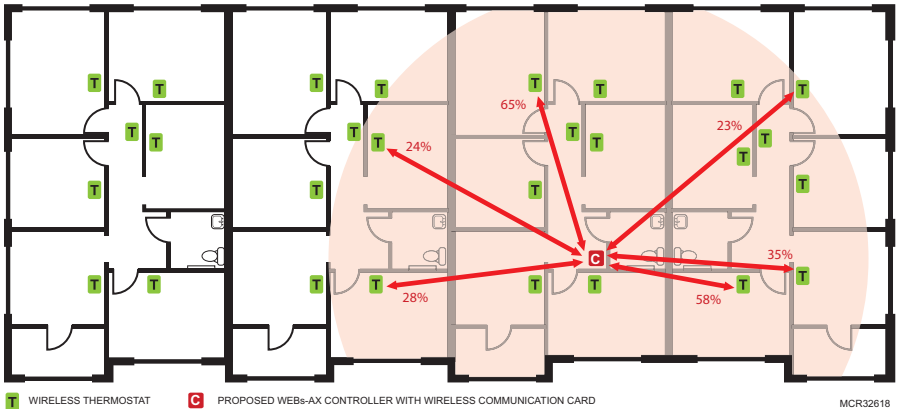


Fig. 10. Measuring the radius of the first hop.

4. Next test the signal strength at each location where a thermostat is to be installed. The signal strength at each location can be anywhere from 10% to 100%. Testing each proposed thermostat location ensures no unexpected obstacles or unforeseen sources of interference will affect each wireless thermostat at the time of installation.
5. Once all thermostats within the radius have been tested, place one of the wireless survey tools at the first cluster of thermostats tested, go to another cluster of thermostats extending outward from the radius of the first hop. Locate the boundary where the signal strength is about 20%. This represents
- the maximum radius of the second hop where connectivity is possible based on the building environment and partition construction.
6. Next test the signal strength at each location where a thermostat is to be installed. The signal strength at each location can be anywhere from 10% to 100%. Testing each proposed thermostat location ensures no unexpected obstacles or unforeseen sources of interference will affect each wireless thermostat at the time of installation. Fig. 11 shows the Proposed Site Floor Plan Example with three hops as indicated by the gray arc (hop 1), the dashed line arc (hop 2) and the dotted line (hop 3).

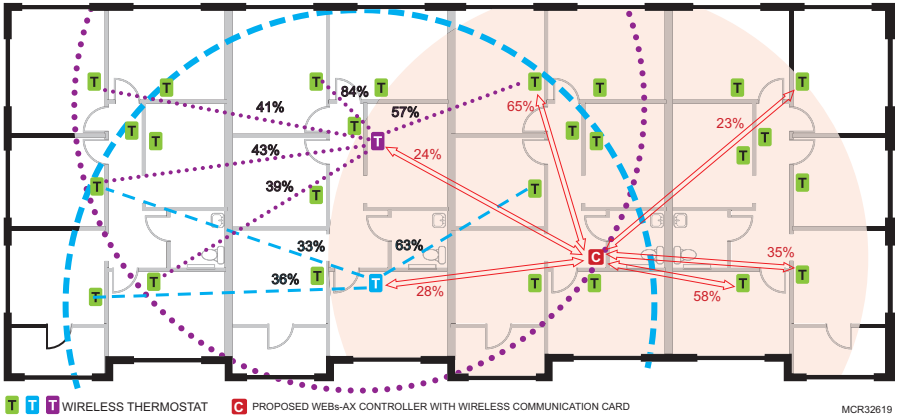


Fig. 11. Proposed floor plan with three hop radiuses.

- Repeat steps 2-5 until you establish the maximum range covered by 5 hops where the last position recorded represents the safest furthest position that can be covered by a single controller (Fig. 12) and

each thermostat location has been confirmed to have a signal strength of 10% or greater.

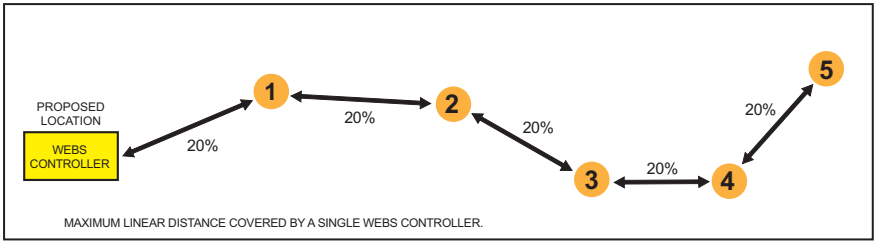


Fig. 12. Maximum of 5 hops from controller.

If more than 5 hops could be required by any device, we recommend adding another controller with wireless communication card. (Fig. 13). Please note that a hop in this case is defined as the maximum linear connectivity between 2 devices independently of other devices being

present in between. If adding another network, use a different PAN ID and Channel on the second network. If additional networks, alternate between Channel 15 and Channel 25 for each level.

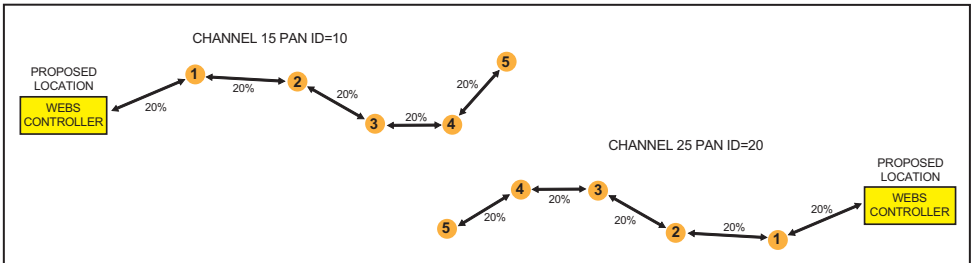


Fig. 13. Two wireless networks covering a maximum of 5 hops each.

Once the network is deployed and all wireless thermostats are present and functioning as routers, the ability of the network to efficiently route wireless signals cannot be compared to this simple survey analysis method.

Site Survey Summary

- Always write your transmission results on a site floor plan when possible.
- Use TB-RP5000W repeaters if remote devices are too far to bridge or the signal is too weak.
- You can move the proposed location of the WEBS-AX controller with wireless card to a new location if it helps create better clusters of thermostats.
- Always plan for a floor by floor horizontal architecture vs. a vertical one.
- Additional controllers with wireless card can be used when clusters become too far apart in an installation.
- Contact your Honeywell sales representative for recommendations if you have a floor plan layout available for review.

DISCLAIMER

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Electronic controls are static sensitive devices. Discharge yourself properly before manipulation and installing the Honeywell wireless gateway.

All Honeywell wireless gateways and related wireless thermostats are to be used only as operating controls. Whenever a control failure could lead to personal injury and/or loss of property, it becomes the responsibility of the user to add safety devices and/or alarm system to protect against such catastrophic failures.

All Honeywell Series wireless thermostats and associated components have been rigorously tested to ensure reliable operation in most building applications using the latest 2.4 ZigBee technologies. Honeywell cannot guarantee against potential network interference should additional wireless systems be deployed sharing close proximity.

Best practices covered in this manual and all related Honeywell documents should be considered as a guide to apply Honeywell Wireless Network devices only. The instructions included in this manual are based upon Honeywell in house testing and should be referred to as a guide only.

Honeywell Inc. may not be held liable for continued reliable or robust operation of any and all wireless based devices. Although Honeywell has taken many precautions in assuring the robustness of the TB7000 series wireless thermostat product line and associated network access point (WEBs-AX controller's with wireless option card) please note; future application of additional wireless devices utilizing the same or similar channels and / or frequencies may degrade performance of overall system and / or reliability.

Non-approved modifications or changes made to the communication card, the wireless thermostat driver or wireless thermostats may void the FCC compliance of the wireless card and wireless thermostats.

Ferrites supplied with the power supply and controller with wireless card MUST be installed according to instructions. Failure to do so may void the FCC compliance of the wireless card and wireless thermostats.

THIS DEVICE COMPLIES WITH PART 15 OF THE FCC RULES. OPERATION IS SUBJECT TO THE FOLLOWING TWO CONDITIONS: (1) THIS DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE, AND (2) THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING INTERFERENCE THAT MAY CAUSE UNDESIRABLE OPERATION.

Honeywell may not be held liable for continued reliable or robust operation of any and all wireless based devices. Although Honeywell has taken many precautions in assuring the robustness of the TB7200, TB7300 and TB7600 Series wireless thermostat product line and associated network access point. Please note future application of additional wireless devices utilizing the same or similar channels and / or frequencies may degrade performance of overall system and / or reliability.

Non-approved modifications or changes made to the Wireless Communication Card TB-VWG-APP-1014 or wireless thermostats may void the FCC compliance of the TB-VWG-APP-1014 and wireless thermostats.

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