

TC5X/TC7X

Mobile Computers



ZEBRA

Best Practices Guide

Voice Deployment
Optimization with ARUBA
Infrastructure

VOICE DEPLOYMENT OPTIMIZATION WITH ARUBA INFRASTRUCTURE

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Revision History

Changes to the original guide are listed below:

Change	Date	Description
-01 Rev A	04/2019	Initial Release
-02EN Rev. A	07/2020	Added Additional Configurations for Voice Multicast Applications.

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About This Document

Introduction

This guide provides recommendations for voice deployment using the following mobile computers and their accessories with ARUBA Wireless Network:

- TC51
- TC51HC
- TC56
- TC70x
- TC75x.

Chapter Descriptions

Topics covered in this guide are as follows:

- [Device Setting](#) provides device settings: default, supported, and recommendations for voice traffic.
- [Network Settings and Device RF Characteristics](#) provides device settings for the recommended environment and device RF parameters.
- [Infrastructure and Vendor Model Recommendations](#) provides Zebra recommendations for common vendor infrastructures and specific recommendations by vendor.

For details about configurations and parameters, refer to vendor documentation.

Notational Conventions

The following conventions are used in this document:

- "Device" refers to all configurations of the Zebra TC51, TC51HC, TC56, TC70x, and TC75x.
- **Bold** text is used to highlight the following:
 - Dialog box, window and screen names
 - Drop-down list and list box names
 - Check box and radio button names
 - Icons on a screen

- Key names on a keypad
- Button names on a screen.

- Bullets (•) indicate:
 - Action items
 - Lists of alternatives
 - Lists of required steps that are not necessarily sequential.
- Sequential lists (e.g., those that describe step-by-step procedures) appear as numbered lists.

Icon Conventions

The documentation set is designed to give the reader more visual clues. The following graphic icons are used throughout the documentation set. These icons and their associated meanings are described below.



NOTE: The text here indicates information that is supplemental for the user to know and that is not required to complete a task.

Related Documents

For the latest version of this guide and all documentation sets for the TC51, TC51HC, TC56, TC70x, and TC75x, go to: www.zebra.com/support.

Refer to the Aruba's RF and Roaming Optimization documentation for more details about Aruba infrastructure.

Feedback

If you have comments, questions, or suggestions about this guide, send an email to EVM-techdocs@zebra.com.

Device Setting

Introduction

This chapter includes device settings for default, supported, and voice traffic recommendations.

Default, Supported, and Recommended for Voice Device Settings

[Table 1 on page 11](#) in this chapter points out specific recommendations for Voice which are not set as the Default out-of-the-box configuration. It is generically advised to examine those specific settings in alignment with the WLAN Network needs and compatibilities. Making blind changes to the defaults in some cases could harm generic connectivity performance.

Besides those specific recommendations which would need careful examination, most of the device's default settings are already an optimized configuration for Voice, optimized together with generic connectivity subjects. For that, it is recommended to keep the defaults as is, letting it dynamically adjust to the WLAN network dynamic feature-selection levels. Device configuration should change only if there are WLAN network (WLC, AP) features which mandate respective changes on the device side to allow proper inter-operation.

Note the following:

- Most infrastructures/APs deployments that cannot configure support of Fast Transition (11r) for the SSID, have the default support of OKC (Opportunistic Key Caching). Under that situation of non-11r support, if there is a necessity to explicitly disable the default OKC on the controller and support only PMKID method (for example - due to other non-Zebra old devices compatibility issues on the same SSID), then it is necessary to enable PMKID and disable the OKC configuration on the Zebra device side as well.
- The Subnet Roam feature allows you to change the network IP of the WLAN interface when the network is configured for a different subnet on the same ESSID.
- ChannelMask
 - It is strongly recommended to enforce (configure as necessary) an exact match between the device ChannelMask and the infrastructure operating channels providing the WLAN coverage. That match should be examined for each Band 2.4G and 5.0G separately.
 - In any case, changes applied to channels are verified with regulatory compliance per the country settings (whether set manually or by the 11d country setting). Changes are effective for allowed channels only even when the UI or configuration-file attempts to configure non-allowed channels.
- 11v / Wireless Network Management (WNM) standard is supported beginning with Android Nougat releases and later.

- A change to the setting can be accomplished via MDM Agents. A subset of the parameters can also be changed via UI.
- Android Battery Optimization feature
 - For voice applications, and for any highly-dependent client-server communication apps, it is recommended not to be subjected to the Android Battery Optimization feature (also known as Doze Mode) in the device management tools.
 - When an app is subjected to Battery Optimization, it may cause interruptions in communication between dependent endpoints and servers.

Table 1 Default, Supported, and Recommended Voice Device Settings

Feature	Default Configuration	Supported Configuration	Recommended for Voice
Auto Time Config	Disabled	<ul style="list-style-type: none"> • Enable (works only on Extreme infrastructure) • Disable 	As default
State11d	Country selection set to Auto	<ul style="list-style-type: none"> • Country selection set to Auto • Country selection set to Manual 	As default
ChannelMask_2.4 GHz See ChannelMask .	All channels enabled subjected to regulatory	Per regulatory	1, 6, 11, if WLAN SSID is enabled on 2.4G
ChannelMask_5.0 GHz See ChannelMask .	All non DFS channels enabled, subjected to regulatory	All non DFS channels enabled (default) <ul style="list-style-type: none"> • 36 to 48 • 149 to 165 All DFS channels can be enabled <ul style="list-style-type: none"> • 52 to 64 • 100 to 140 Note: channel 144 is not supported	As default
Band Selection	Auto (Both 2.4 GHz and 5 GHz bands enabled)	Auto (Both bands enabled) <ul style="list-style-type: none"> • 2.4 GHz • 5 GHz 	5 GHz
Band Preference	Disabled	Enable for 5 GHz <ul style="list-style-type: none"> • Enable for 2.4 GHz • Disable 	Enable for 5 GHz, if WLAN SSID is on both bands
Wi-Fi Sleep Policy	Never	<ul style="list-style-type: none"> • Always On • Never On 	As default
Open Network Notification	Disabled	<ul style="list-style-type: none"> • Enable • Disable 	As default
Advanced Logging	Disabled	<ul style="list-style-type: none"> • Enable • Disable 	As default

Table 1 Default, Supported, and Recommended Voice Device Settings (Continued)

Feature	Default Configuration	Supported Configuration	Recommended for Voice
User Type	Non-Restricted	<ul style="list-style-type: none"> • Enable • Disable 	As default
CCKM	Enabled	<ul style="list-style-type: none"> • Enable • Disable 	As default
FT	Enabled	<ul style="list-style-type: none"> • Enable • Disable 	As default
FT Over The DS	Enabled	<ul style="list-style-type: none"> • Enable • Disable 	As default
OKC	Enabled	<ul style="list-style-type: none"> • Enable • Disable 	As default
PMKID	Disabled	<ul style="list-style-type: none"> • Enable • Disable 	As default
Power Save Note: The default PS of the device side does not require PS config change on the network side.	NDP (Null data power save)	<ul style="list-style-type: none"> • NDP • PS-POLL • WMM-PS 	As default
11k	Enabled	<ul style="list-style-type: none"> • Enable • Disable 	As default
Subnet Roam	Disabled	<ul style="list-style-type: none"> • Enable • Disable 	As default
11w	Disabled	<ul style="list-style-type: none"> • Enable and 11W set to Required • Enable and 11W set to Optional • Disable 	As default
Channel Width	2.4 GHz - 20 MHz 5 GHz - 20 MHz, 40 MHz and 80 MHz	Not configurable	As default
11n	Enabled	<ul style="list-style-type: none"> • Enable • Disable <p>Note: If disabled, 11ac is also forced to disabled</p>	As default

Table 1 Default, Supported, and Recommended Voice Device Settings (Continued)

Feature	Default Configuration	Supported Configuration	Recommended for Voice
11ac	Enabled	<ul style="list-style-type: none"> • Enable • Disable 	As default
11v (Android Nougat support only)	Disabled	<ul style="list-style-type: none"> • Enable • Disable 	Enable

Network Settings and Device RF Characteristics

Introduction

This chapter describes Network recommendations for balanced environmental RF characteristics which are considered a baseline environment to support Voice deployment.

Recommended Environment

Note the following:

- A Voice Grade Site Survey is required and should ensure the requirements in [Table 2](#) are met.
- Signal to Noise Ratio (SNR), measured in dB, is the delta between the noise in dBm and the coverage RSSI in dBm. The minimum value for that delta is mentioned in [Table 2](#). Ideally, the raw noise floor should be approximately -90 dBm or weaker.
- Same-Channel Separation: in floor level, wherever two or more APs with the same-channel are in RF-sight of a scanning device in given location. The value mentioned in [Table 2](#) specifies the minimum RSSI delta between those same-channel APs.

See [Related Documents](#) for additional explanations and rationale of recommended network settings.

Table 2 Network Recommendations

Setting	Value
Latency	< 100 ms end-to-end
Jitter	Country selection set to Auto
Packet Loss	< 1%
Minimum AP Coverage	-65 dBm
Minimum SNR	25 dB
Minimum Same-Channel Separation	19 dB
Radio Channel Utilization	< 50%

Table 2 Network Recommendations (Continued)

Setting	Value
Coverage Overlap	20% in critical environments
Channel Plan	2.4 GHz: 1, 6, 11 <ul style="list-style-type: none"> • No adjacent channels (overlapping) • Overlapping APs must be on different channels 5 GHz: 36, 40, 44, 48, 149, 153, 157, 161, 165 • If you are using DFS channels, broadcast the SSID in beacons Note: U-NII-2 (DFS channels, 52 to 140) and U-NII-3 (channels 149 to 165) are subjected to the Regulatory for the specific country.

Device RF Capabilities

The RF capabilities listed in [Table 3](#) are provided by the Zebra device. These are not configurable but are documented here for visibility.

Table 3 RF Capabilities

Setting	Value
Roam Threshold	-65dbm (cannot be modified)
Device-specific Antenna Configuration	<ol style="list-style-type: none"> 1. TC51: 2x2 MIMO 2. TC51 HC: 2x2 MIMO 3. TC56: 1x1 SISO 4. TC70x: 2x2 MIMO 5. TC75x: 2x2 MIMO
11n Capabilities	A-MPDU Tx/Rx, A-MSDU Rx, STBC, SGI 20/40 etc.
11ac Capabilities	Rx MCS 8-9 (256-QAM) and Rx A-MPDU of A-MSDU

Infrastructure and Vendor Model Recommendations

Introduction

This chapter includes recommendations for Aruba Infrastructure settings, divided into two parts:

The first part describes generic WLAN practices for enabling Voice. The second part describes more specific Aruba infrastructure recommendations to handle Voice traffic and maintain expected Voice quality.

Listed items in this chapter do not make up a full-list of Aruba configurations. They are the ones that are called-out as required verification, to accomplish successful interoperability between Zebra devices and Aruba WLAN Network.

The listed items may or may not be default settings of given Aruba controller version (i.e. in any case the verification is advised).

See [Related Documents](#) for additional explanations and rationale of recommended network settings.

Recommendations

[Table 4 on page 17](#) lists the recommendations for WLAN to support Voice deployment.

Note the following:

- For best results, Wi-Fi Certified (Voice Enterprise certification from Wi-Fi Alliance) AP models should be used.
- If SSID for Voice is enabled on 2.4G band, it is recommended not to enable the 11b-legacy data rates on that band unless there is specific justification for it by some restricted coverage planning or there is a need to support old legacy devices.
- The device determines to roam or connect to an AP depending on the infrastructure settings in effect and on many underlying dynamics of the RF ecosystem. Generically, the device scans for other available APs at certain trigger points (for example, in normal scenarios if the connected AP gets weaker than -65 dBm). If it finds a better AP than it is already connected to, the device then moves to that AP.
- It is recommended to disable non-used Fast Roam Methods from the SSID. However, occasionally this is not possible due to older devices on the same SSID which support a different method. In this case, it is acceptable that two or more methods remain enabled if they can coexist. The Zebra device automatically prioritizes its method selection.

- It is a general best practice to limit the amount of SSID per AP to only those required. There is no set recommendation on the number of SSIDs per AP as this would be a function of multiple RF environmental factors which are specific to each deployment. The major impact of a high number of SSIDs is on Channel Utilization which comprises not only users/apps traffic, but also beacons traffic of all the SSIDs on the channel (even from SSIDs which are not in use).

Table 4 Recommendations for WLAN Infrastructure Settings to support Voice

Setting	Value
Infra type	Controller based
Security	WPA2
Voice WLAN	5 GHz only
Encryption	AES
Authentication: Server Based (Radius)	802.1X EAP-TLS/PEAP-MSCHAPv2
Authentication: Pre-Shared Key (PSK) Based, if necessary.	Enable both PSK and FT-PSK Note: Device automatically picks FT-PSK. PSK is necessary to support legacy/non-11r devices on same SSID.
Operational Data Rates	2.4 GHz: <ul style="list-style-type: none"> • G: 12, 18, 24, 36, 48, 54 (disable all lower rates, including 11b-legacy) • N: MCS 0 -15 5 GHz: <ul style="list-style-type: none"> • A:12, 18, 24, 36, 48, 54 (disable all lower rates) • AN: MCS 0 -15 • AC: MCS 0 - 7, 8 Note: Rates settings might need to change per environmental characteristics, see Recommended Environment on page 14 to accomplish balanced AP Minimum Coverage.
Fast Roam Methods (See the note in Recommendations on page 16.)	If supported by infrastructure: <ul style="list-style-type: none"> • FT (802.11R) • OKC or PMK Cache Note: Device priority order from the top.
Beacon Interval	100
Channel Width	2.4 GHz: 20 MHz 5 GHz: 20 MHz
WMM	Enable
802.11k	Enable only Neighbor Report. Do not enable any 11k measurements.
802.11w	Disable

Table 4 Recommendations for WLAN Infrastructure Settings to support Voice (Continued)

Setting	Value
802.11v	Enable
AMPDU	Enable Note: There could be local environmental/RF situations (such as high interference level, collisions, obstructions, etc.) yielding local high retries ratio, delays, and packet-drops. The AMPDU feature can worsen the Voice performance in addition to the already challenging RF. In those cases, it is recommended to disable the AMPDU.

Table 5 lists the more specific Aruba infrastructure recommendations to handle Voice traffic and maintain expected Voice Quality.

Table 5 Recommendations for Aruba Infrastructure to Handle and Maintain Voice Quality

Recommendation	Required	Recommended But Not Required
DTIM Interval set to value of 1. Note: DTIM value of 2 is also acceptable for deployments in some scenarios. Whether 1 or 2 is better, depends on the Voice Application deployed (and other Voice related such as Push-to-Talk), and depends on the potentially mixed types of devices sharing the same SSID, Battery Life of the different types, and if each Client Product is configured to different Power Save method.	√	
Create a dedicated user role on Aruba for Voice devices, according to application deployment needs. Create a session ACL and place the Voice protocols in prioritized high queue.	√	
Broadcast Filtering set to All or ARP.	√	
Make sure Dot1x Termination is Disabled.	√	
Make sure Probe Retry is set to its default Enable.		√
Make sure to Max Tx Failure is set to its default Disable (max-tx-fail=0).	√	
Disable Legacy only (5 GHz/2.4 GHz).	√	
Enable 802.11d/h.	√	
Enable Mcast-rate-opt (needed for multicast to go at highest rate).		√
Beacon-rate set with a rate that is also basic-rate.		√
Make sure Local Probe Request Threshold is set to its default of 0 (disable).	√	
Disable Client Match.	√	
Disable Band Steering.	√	
Make sure Voice Aware Scan is enabled and voice traffic of the given ACL definition (of the deployed App) is detected on the controller.	√	
Disable 80 MHz support.	√	

Further Notes for Table 5

For Aruba's Client Match and Band Steering features, it is recommended to disable both of them (as specified in [Table 5](#)) in good balance RF deployments. In some situations of very challenging RF environments where Clients cannot roam to stronger AP (due to the poor RF environment), such that they have to remain sticky with weak AP or sticky with non-preferred Band, then the Client Match and Band Steering features can be enabled and configured (relative to the problem) to see if the poor RF condition can be mitigated. It is imperative to consider that sticky client conditions without those settings is typically a result of a bigger environmental problem or non-optimal RF design, in which it is recommended to first examine those aspects, correct them if necessary, and retest. Only then decide if the Client Match and Band Steering are necessary.

Additional Configurations for Voice Multicast Applications

Zebra's PTT Express Deployment

[Table 6](#) lists the recommended configurations to support the PTT Express deployment.



NOTE: The settings in [Table 6](#) are recommended by Zebra but they are not default in the Aruba controller releases. Validate these settings if they provide quality improvement in the production environment before configuring.

Table 6 Zebra Recommendations of Additional Aruba Infrastructure Settings to Support PTT Express.

Recommendation	Recommended
dynamic-multicast-optimization (Converts Multicast to Unicast. Higher data rate)	√
dmo-channel-utilization-threshold 90 (Falls back to Multicast traffic from Unicast if the channel utilization reaches 90%)	√
wmm-background-share 60 (Limits Background bandwidth usage to 60%)	√

Recommended WLC and AP Models



NOTE: Model recommendations are based on satisfactory test results.

Aruba 72xx series

- Software Version: 8.2.2.0 or later
- Aruba 70xx series
- Software Version: 8.2.2.0
- AP Models: 303H, 303 series, 300 series, 310 series, 320 series, 330 series, 340 series
- IAP 300 series, 310 series, s20 series, 330 series, 340 series
- Software Version: 6.5.4.8

