
BEST PRACTICES GUIDE

TC5X/TC7X MOBILE COMPUTERS

VOICE DEPLOYMENT OPTIMIZATION WITH
ARUBA INFRASTRUCTURE



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ABOUT THIS GUIDE

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 Settings 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.

Related Documents

For the latest version of this guide and all documentation sets for the TC51, TC51HC, TC56, TC70x, and TC75x, go to:

[zebra.com/support](https://support.zebra.com). Refer to the following link for specific details about Aruba infrastructure: <https://community.arubanetworks.com/t5/Validated-Reference-Design/RF-and-Roaming-Optimization-for-Aruba-802-11ac-Networks/ta-p/432994>

DEVICE SETTINGS

Introduction

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

Default, Supported, and Recommended for Voice Device Settings

Table 1 in this chapter points out some 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 ones which would need the careful examination, most of the Device's Default Settings is 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 which for whichever reason 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 same SSID), then it 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. This holds true 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 be also 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 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 FOR VOICE SETTINGS

Feature	Default Configuration	Supported Configuration	Recommended Configuration 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_2.4GHz See ChannelMask Note above table.	All channels enabled subjected to regulatory	Per regulatory	1, 6, 11, if WLAN SSID is enabled on 2.4G
ChannelMask_5.0GHz See ChannelMask Note above table.	All non DFS channels enabled, subjected to regulatory	<p>All non DFS channels enabled (default)</p> <ul style="list-style-type: none"> • 36 to 48 • 149 to 165 <p>All DFS channels can be enabled</p> <ul style="list-style-type: none"> • 52 to 64 • 100 to 140 <p>Note: Channel 144 is not supported</p>	As default
Band Selection	Auto (Both 2.4GHz and 5GHz bands enabled)	<ul style="list-style-type: none"> • Auto (Both bands enabled) • 2.4 GHz • 5 GHz 	5GHz
Band Preference	Disabled	<ul style="list-style-type: none"> • Enable for 5 GHz • Enable for 2.4 GHz • Disable 	Enable for 5GHz, 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
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

TABLE 1: DEFAULT, SUPPORTED, AND RECOMMENDED FOR VOICE SETTINGS (CONTINUED)

Feature	Default Configuration	Supported Configuration	Recommended Configuration for Voice
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	2.4Ghz – 20MHz 5Ghz - 20MHz, 40MHz and 80MHz	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
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 recommendation for balanced environmental RF characteristics which shall be considered as a baseline environment to support Voice deployment.

Recommended Environment

Note the following:

- A Voice Grade Site Survey is required and should insure 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.

Additional explanations and rationale of recommended network settings can be found in documents referred from the “Related Documents” chapter.

TABLE 2: NETWORK RECOMMENDATIONS

Setting	Value
Latency	< 100 ms end-to-end
Jitter	< 100 ms
Packet Loss	< 1%
Minimum AP Coverage	-65dBm
Minimum SNR	25dB
Minimum Same-Channel Separation	19dB
Radio Channel Utilization	< 50%
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 <ul style="list-style-type: none"> • If you are using DFS channels, broadcast the SSID in beacons <p>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.</p>

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	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 configuration, rather – they are the ones that are called-out as required verification, to accomplish successful interoperability between Zebra devices and Aruba WLAN Network.

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

Additional information to supplement the two parts of this chapter can be found in documents referred from the “Related Documents” chapter.

Recommendations

Table 4 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 to 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 -65dBm). 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, 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 co-exist. The Zebra device automatically prioritizes its method selection.
- It is a general best practice to limit the amount of SSID per AP to only the required ones. There is no hard 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	5GHz only
Encryption	AES Note: Do not use WEP and TKIP.
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, to accomplish balanced “AP Minimum Coverage” as specified in the Recommended Environment section.
Fast Roam Methods (See the Fast Roam Methods note above this table.)	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: 20MHz 5 GHz: 20MHz
WMM	Enable
802.11k	Enable only Neighbor Report. Do not enable any 11k measurements.
802.11w	Disable
802.11v	Enable
AMPDU	Enable. Note: There could be local environmental/RF situations, such as high interference level, collisions, obstructions and alike – yielding local high retries ratio, delays, and packet-drops – in which 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		
Parameter	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 (5Ghz/2.4Ghz).	✓	
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 80MHz support	✓	

Further Notes for Table 5

With respect to Aruba's Client Match and Band Steering features, it is recommended to Disable both of them (as specified in the table above) 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 re-test. Only then decide if the Client Match and Band Steering are necessary on top of that.

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