[ ]

INTEROPERABILITY REPORT

Ascom i62

Meru Networks AP320, AP332 and AP1000

System manager version 5.3-50

i62 OEM derivatives version 4.1.12

Ascom, Gothenburg

February 2013

TABLE OF CONTENT:

INTRODUCTION

This document describes necessary steps and guidelines to optimally configure the Meru Networks WLAN platform with Ascom i62 VoWiFi handsets.

The guide should be used in conjunction with both Meru Networks and Ascoms configuration guide(s).

About Ascom

Ascom Wireless Solutions (www.ascom.com/ws) is a leading provider of on-site wireless communications for key segments such as hospitals, manufacturing industries, retail and hotels. More than 75,000 systems are installed at major companies all over the world. The company offers a broad range of voice and professional messaging solutions, creating value for customers by supporting and optimizing their Mission-Critical processes. The solutions are based on VoWiFi, IP-DECT, DECT, Nurse Call and paging technologies, smartly integrated into existing enterprise systems. The company has subsidiaries in 10 countries and 1,200 employees worldwide. Founded in the 1950s and based in Göteborg, Sweden, Ascom Wireless Solutions is part of the Ascom Group, listed on the Swiss Stock Exchange.

About Meru Networks

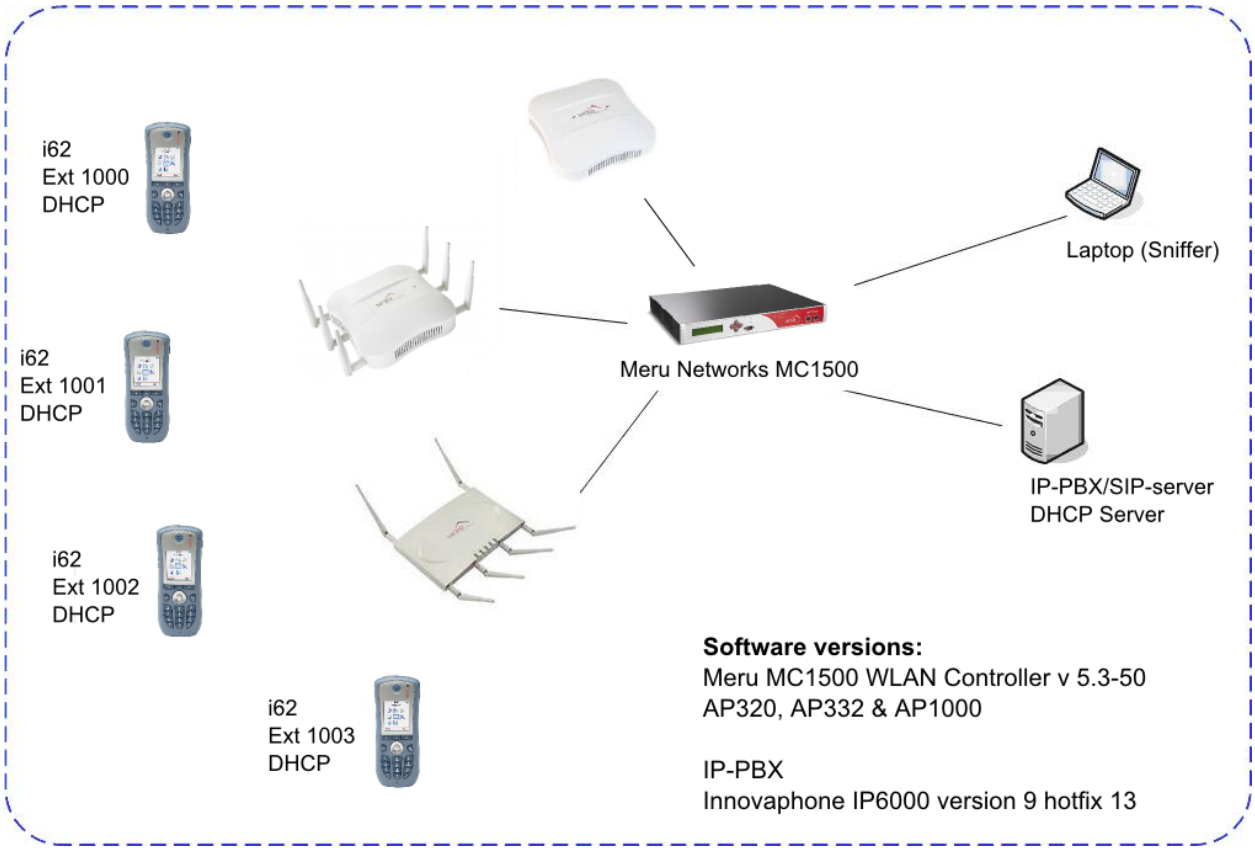
Founded in 2002, Meru Networks provides a virtualized wireless LAN solution that cost-effectively optimizes the enterprise network to deliver the performance, reliability, predictability and operational simplicity of a wired network, with the advantages of mobility. Meru's solution represents an innovative approach to wireless networking that utilizes virtualization technology to create an intelligent and self-monitoring wireless network, and enables enterprises to migrate their business-critical applications from wired networks to wireless networks, and become all-wireless enterprises. Meru's solutions have been adopted in all major industry vertical markets, including Fortune 500 enterprises, healthcare, education, retail, manufacturing, hospitality and government. Meru is headquartered in Sunnyvale, Calif., and has operations in the Americas, Europe, the Middle East and Asia Pacific. For more information, visit www.merunetworks.com or call (408) 215-5300.

SITE INFORMATION

Test Site:
Morrisville
598 Airport blvd, NC 27560
USA

Participants:
Karl-Magnus Olsson, Ascom HQ

TEST TOPOLOGY



SUMMARY

Please refer to Appendix B for detailed results.

WLAN Controller Features

High Level Functionality	Result
Association, Open with No Encryption	OK
Association, WPA-PSK, TKIP	OK
Association, WPA2-PSK, TKIP / AES Encryption	OK
Association, PEAP-MSCHAPv2 Auth., TKIP Encryption	Not tested
Association, PEAP-MSCHAPv2 Auth., AES Encryption	OK
Association, Multiple ESSIDs	OK
Beacon Interval and DTIM Period	OK
PMKSA Caching	Roam transparent to handset*
WPA2-opportunistic/proactive Key Caching	Roam transparent to handset*
WMM Prioritization	OK
Active Mode (load test)	OK**
802.11 Power-save mode	OK**
802.11 Power-save mode (load test)	OK
802.11e U-APSD	OK
802.11e U-APSD (load test)	OK

*) Not applicable due to the Meru system architecture (Virtual Cell).
**) i62 must be configured to use U-APSD to work with AP320.

Roaming

High Level Functionality	Result
Roaming, Open with No Encryption	OK*
Roaming, WPA-PSK, TKIP Encryption	OK*
Roaming, WPA2-PSK, AES Encryption	OK*
Roaming, PEAP-MSCHAPv2 Auth, AES Encryption	OK*

*) Roaming is transparent to the handset. Therefore no roaming times presented.

Known issues and limitations

- Inter controller roaming. Scenarios were an i62 roams from controller A to controller B and back to controller A results in one way speech.
  Workaround: Disable "Fastpath" in the controller. Please consult Ascom or Meru technical support for assistance.

- The handset and system must be configured to use U-APSD with the AP320 and is recommended for all deployment configurations.

- In 5.3-50 Silent Client Polling is disabled by default and has to be enabled with a CLI command. Silent client polling will send QoS null data frames to a passive client. This helps the controller to keep track of "silent" devices such as a handset in power save.
  Please consult Ascom or Meru technical support for assistance.

For additional information regarding known issues please contact support@ascom.se or interop@ascom.se

Compatibility information

All tests were performed on a MC1500 controller running version 5.3-50. However, we guarantee interoperability with below listed controllers running software version 5.3-50. Analogously, all tests were performed with AP320, AP332 and AP1020 but variants of these access points stated below are also supported.

i62 version 4.1.12 is using WLAN driver version 2.3.c.

Supported controllers.
MC1500
MC1550
MC3200
MC4200
MC5000
MC6000

Compatible access points
AP 301/302/310/311
AP 332i/332e
AP1010/1014/1020

General Conclusions

The result of the verified test areas, such as authentication, association, handover and call stability tests, produced in general very good test result. Due to Meru's single channel architecture, no traditional roaming is made which makes the roaming seamless.

The Meru controller and the Ascom i62 MUST be configured to use U-APSD to work with AP320

Note. Unless the parameter "Expedited Forwarding Override" is used the i62 have to mark voice packets with DSCP 48 in order for appropriate mapping in the "air" (Access Category 6).

Please refer to Meru's documentation for information regarding co-existence and between different access point models within the same wireless network.

Ascom WLAN Infrastructure Verification – VoWiFi

Software Versions:

- Meru Networks MC3000 WLAN Controller, version 5.3-50
- AP320/AP332/AP1000 Access Points
- Ascom i62, v 4.1.12 (WLAN version 2.3.c)

Signaling Protocol:

- SIP, Innovaphone IP6000 used as SIP server

Configuration of WLAN System:

- Beacon Interval: 100ms
- DTIM Period: 5
- Silent Client Polling enabled
- 802.11bgn
- 802.11an
- WMM/ U-APSD Enabled (See appendix A for QoS profiles)

Ascom i62 Configuration:

- World Mode Regulatory Domain set to World mode.
- IP DSCP for Voice: 0xC0 (48) – Class Selector 6
- IP DSCP for Signaling: 0x68 (26) – Assured Forwarding 31
- Roaming Methodology: System-aided roaming
- Transmit Gratuitous ARP: Enable

.

Keep in mind that security options and power save modes were adjusted according to requirements in individual test cases. Please refer to appendix A for information regarding device configuration.

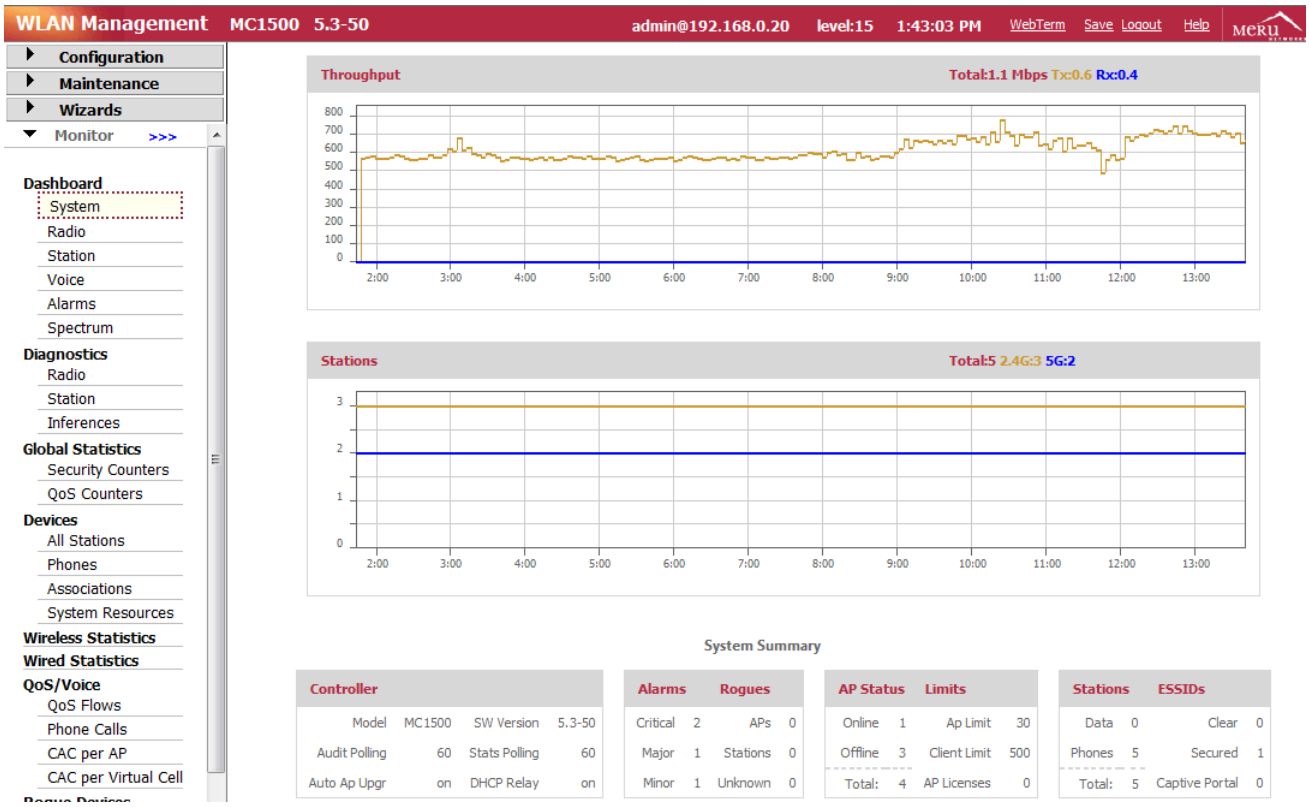
APPENDIX A: TEST CONFIGURATIONS

Meru Networks MC3000 WLAN Controller and AP320//332/1000 Access Points. Version 5.3-50

In the following chapter you will find screenshots and explanations of basic settings in order to get a Meru WLAN system to operate with an Ascom i62. Please note that security settings were modified according to requirements in individual test cases.

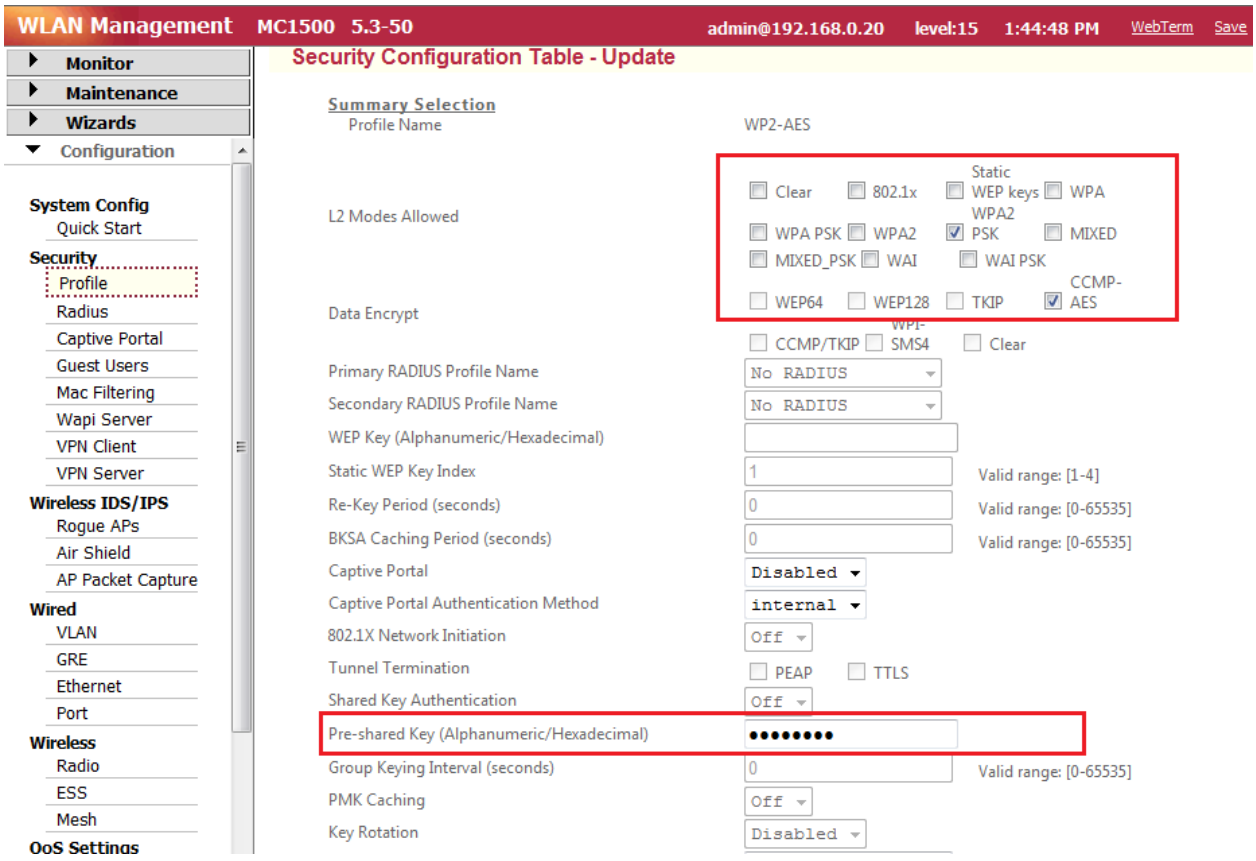
The configuration file is found at the bottom of this chapter.

General settings

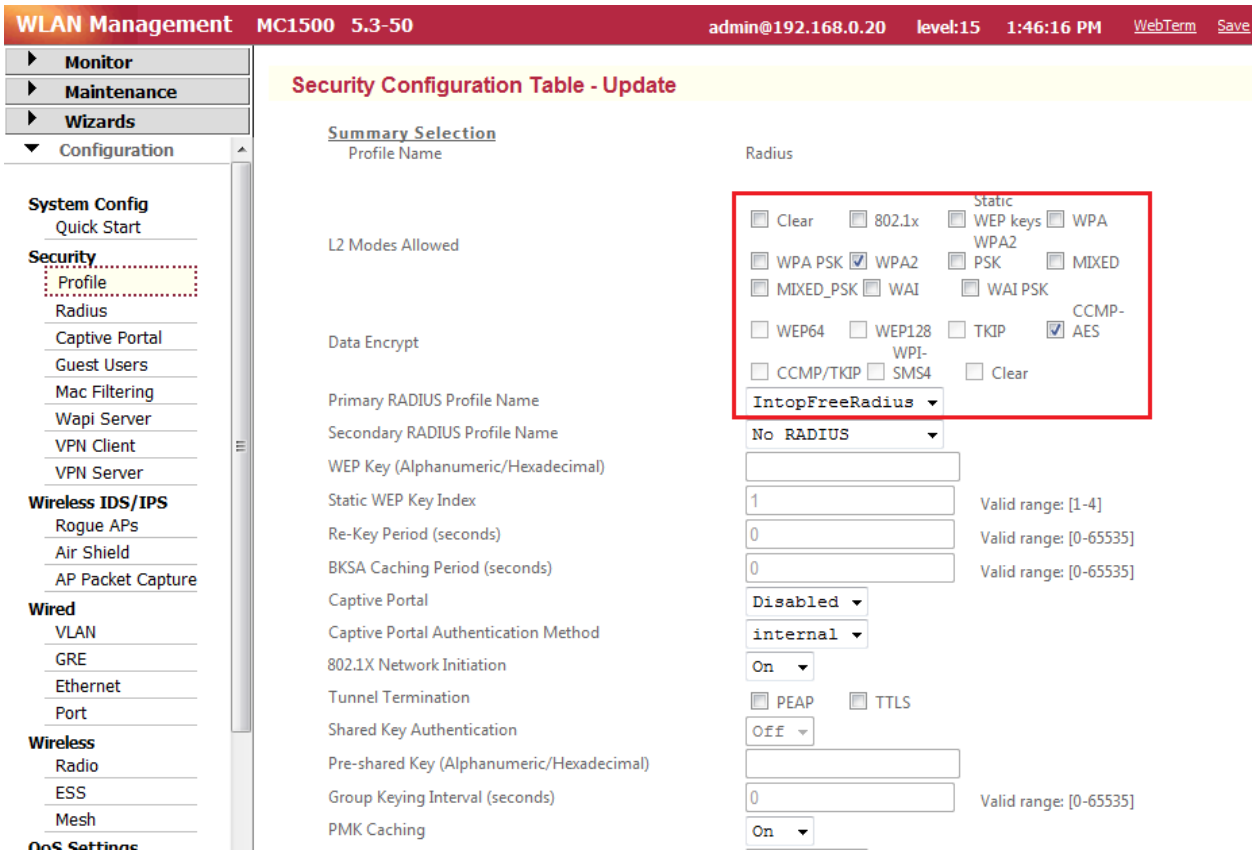


System overview

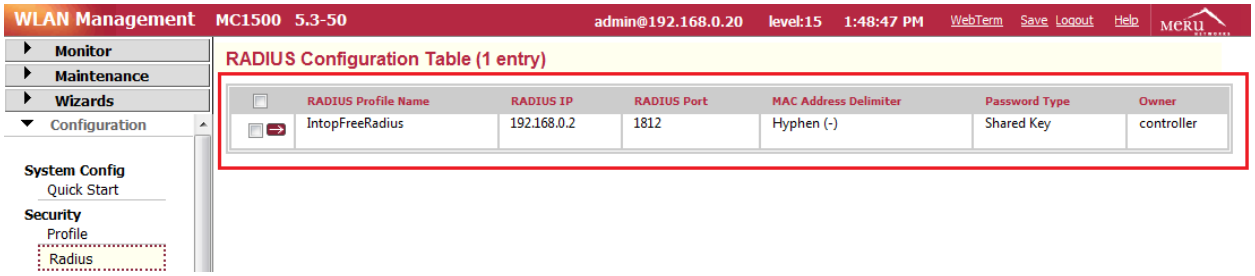
Security settings



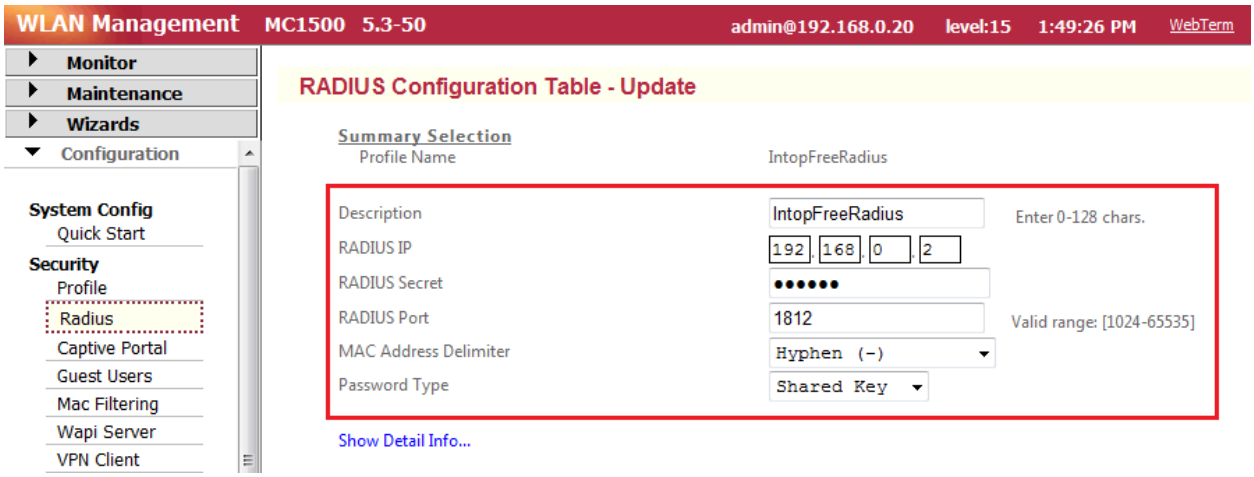
Security profile WPA2-PSK, AES/CCMP encryption. TKIP encryption is supported in WPA-PSK or “mixed mode”.



Security profile WPA2-Enterprise, AES-CCMP encryption Primary RADIUS Profile Name “IntopFreeRadius” refers to the Radius profile set up in the controller. See radius profile below for additional details.

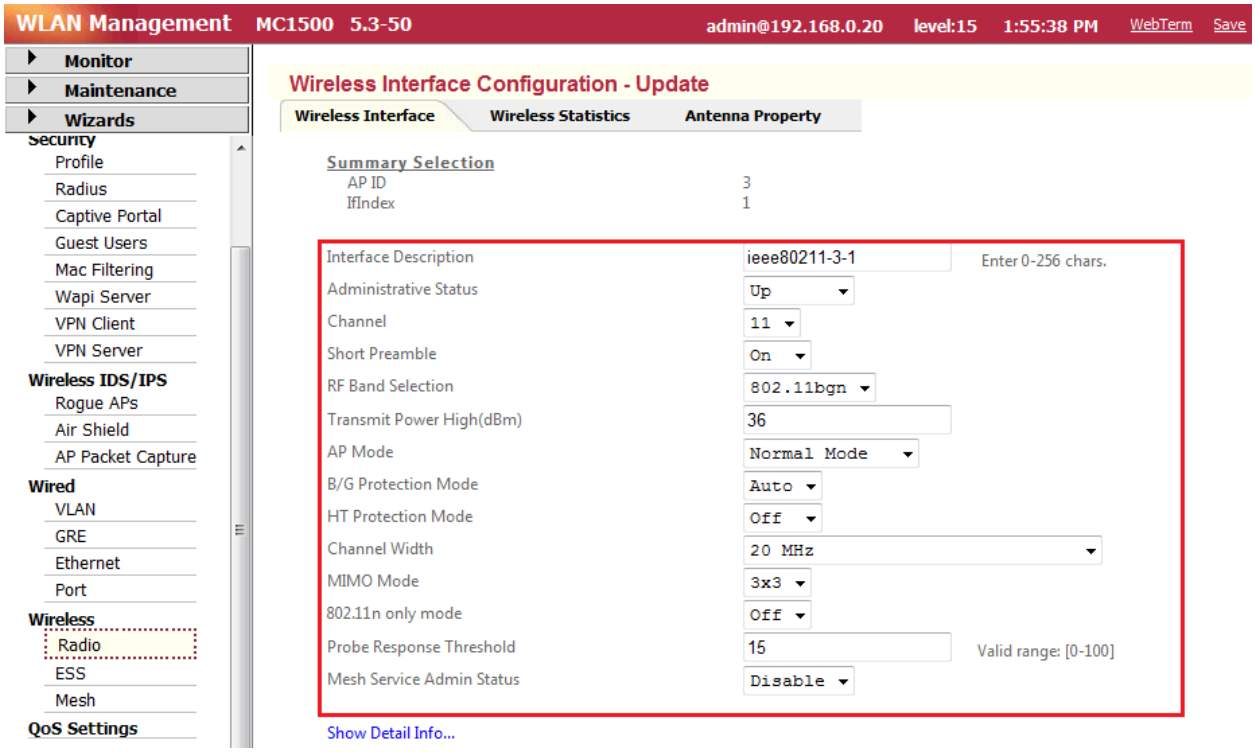


Configuration of Radius profile.



Radius profile configuration . Note that the profile “intop”, the RADIUS IP and the secret must correspond to the authentication server running in the network.

ESS, Radio and QoS settings



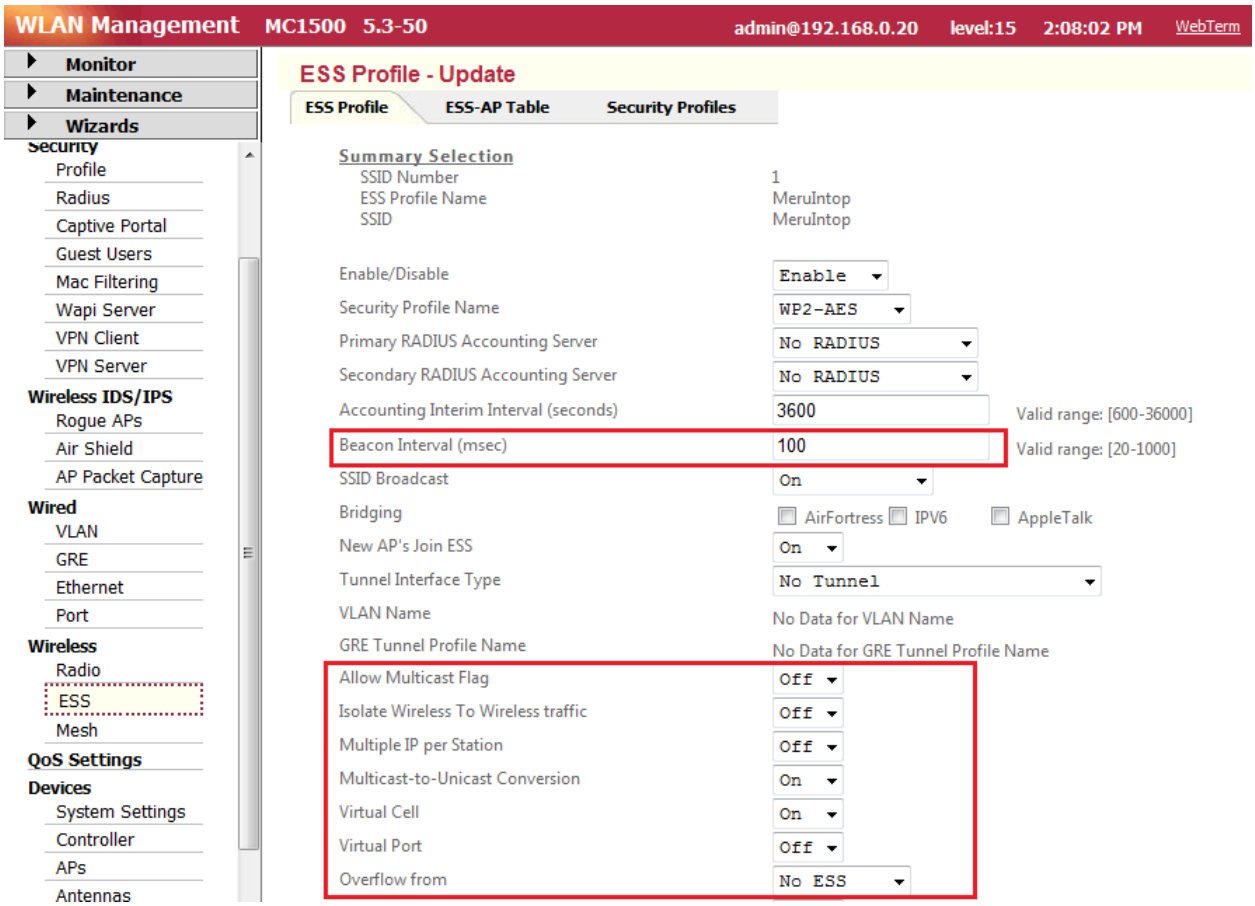
Ascom recommended settings for 802.11bgn are to only use channel 1, 6 or 11. For 802.11an, use channels according to the infrastructure manufacturer and country regulations.

1. Enabling more than 8 channels will degrade roaming performance. Ascom strongly recommends against going above this limit.

2. Using 40 MHz channels (or "channel-bonding") will reduce the number of non-DFS* channels to two in ETSI regions (Europe). In FCC regions (North America), 40MHz is a more viable option because of the availability of additional non-DFS channels. The handset can co-exist with 40MHz stations in the same ESS.

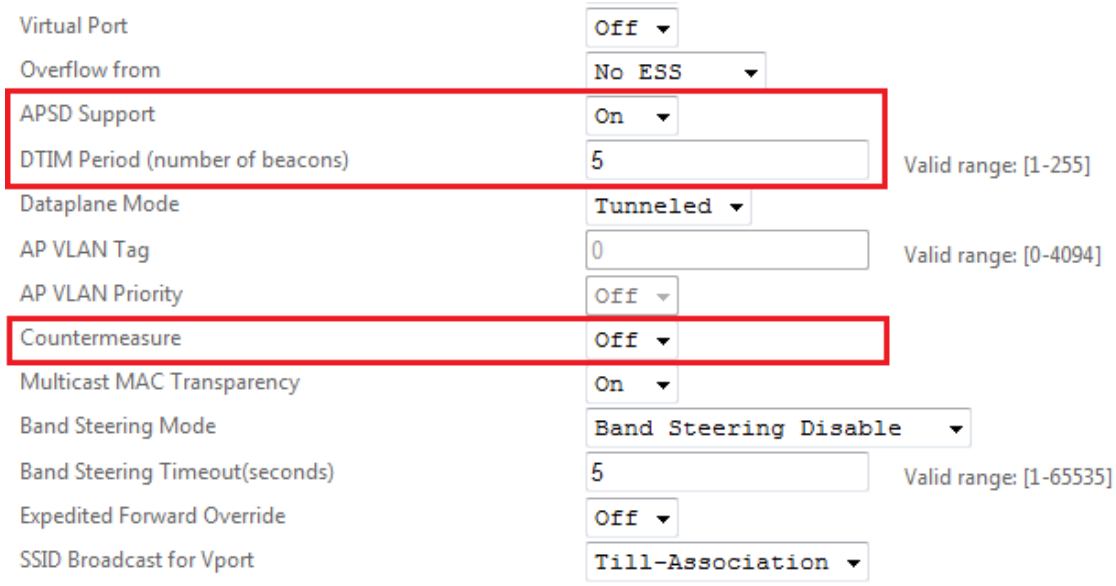
3. Make sure that all non-DFS channel are taken before resorting to DFS channels. The handset can cope in mixed non-DFS and DFS environments; however, due to "unpredictability" introduced by radar detection protocols, voice quality may become distorted and roaming delayed. Hence Ascom recommends avoiding the use of DFS channels in VoWIFI deployments.

***) Dynamic Frequency Selection (radar detection)**



ESS settings. Since multicast applications are usually not expected in WLANs, where Ascom VoWIFI handsets are deployed, the “Allow Multicast Flag” should be set to “OFF”.

Note. Ascom and Meru recommend Virtual Cell ON/Virtual Port OFF for AP332/AP1000. For AP320 Deployments use Virtual Cell ON/Virtual Port ON.

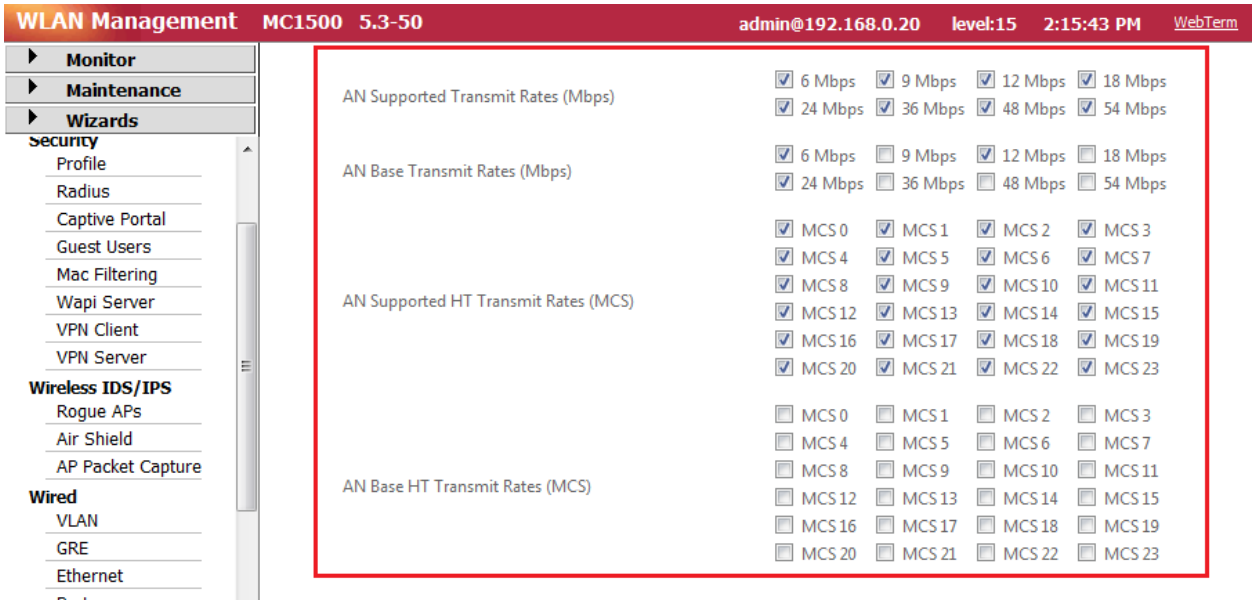


ESS settings (continued).

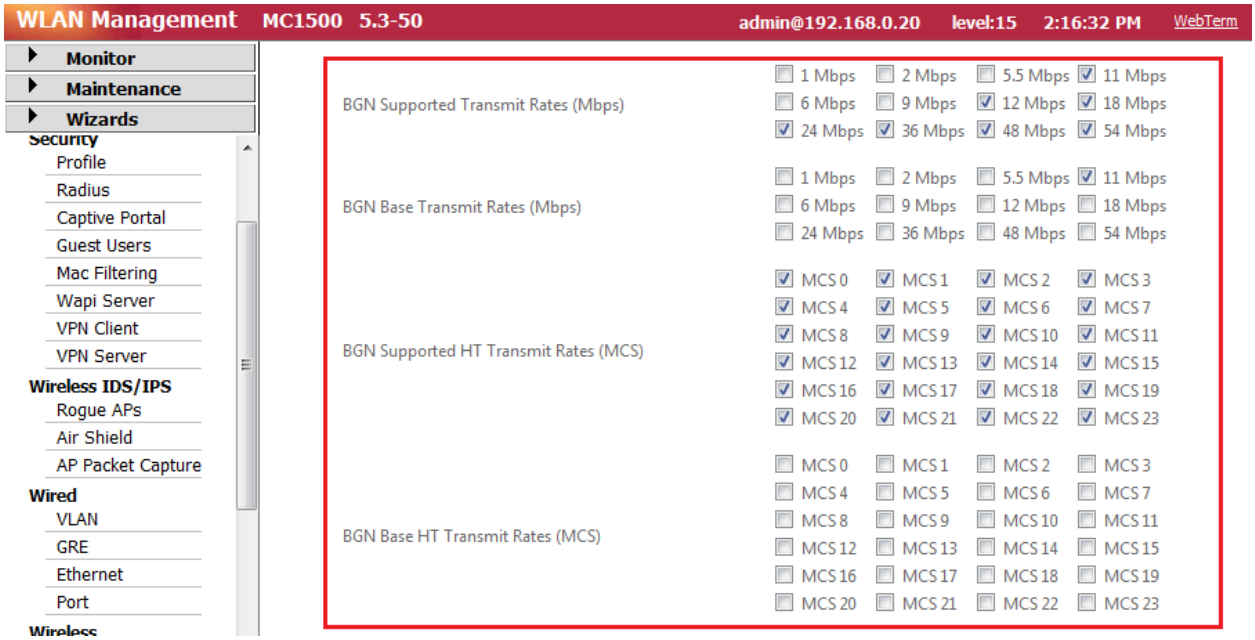
U-APSD should be turned on for optimal performance. Set DTIM Period of 5 and a DTIM interval of 100ms. These values are recommended in order to allow maximum battery conservation without impacting the quality. Lower DTIM values are possible but will decrease the standby time.

Ascom also recommends, especially as a precaution in WPA-PSK/TKIP environments, that “Enable Countermeasure” should be turned OFF.

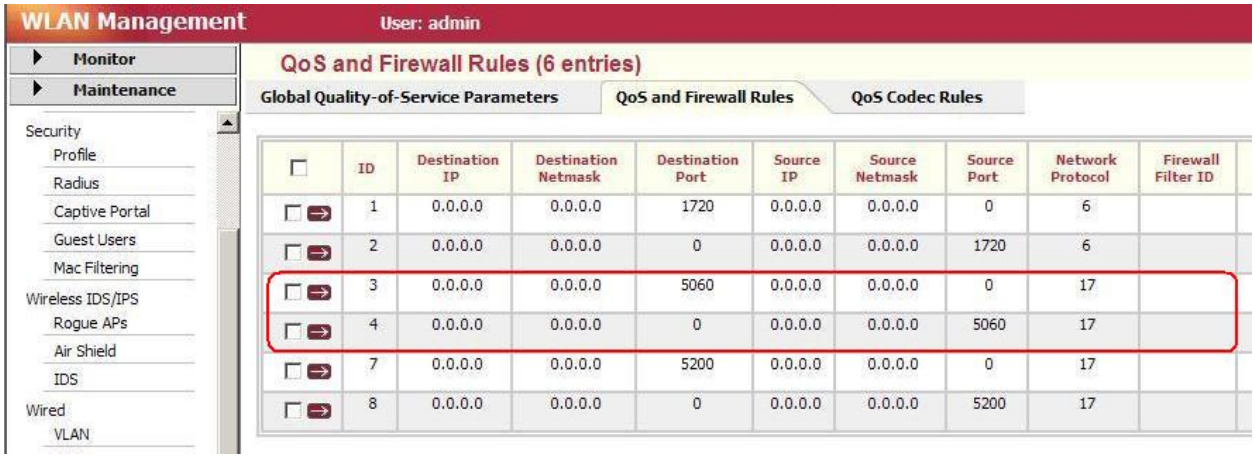
Note. Expedited Forwarding Override will map DSCP 46 (EF) to the AC_VO. If turned off, IP DSCP for Voice has to be set to 0x30 (48) in the Phone. See i62 settings further down.



In a Meru environment, we recommended that the data rates are advertised within the ESS per above for 802.11an (default).

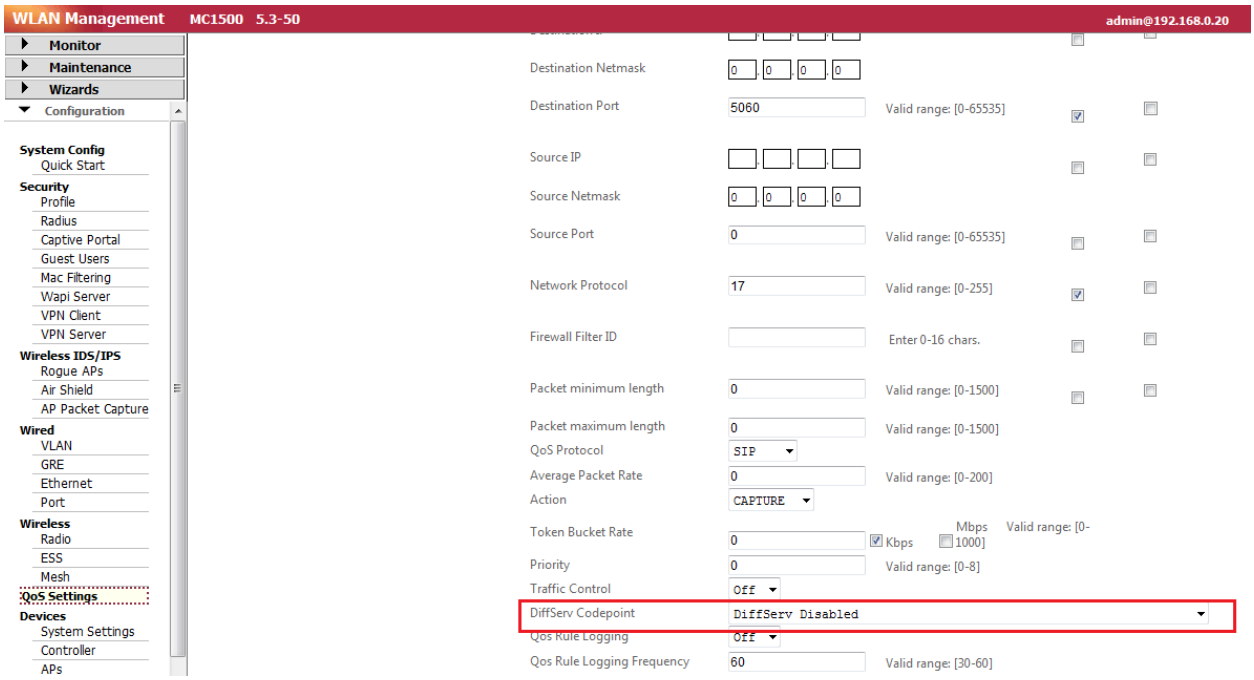


In a Meru environment, it is recommended that the data rates are advertised within the ESS per above (802.11bgn). To further optimize performance it is recommended to disallow 802.11b clients to associate by setting 12Mbps rate to mandatory in the 802.11bgn data rate set.



Quality of Service rules for SIP.

These are the default rules for SIP flow detection and Quality of Service on the Meru controller.

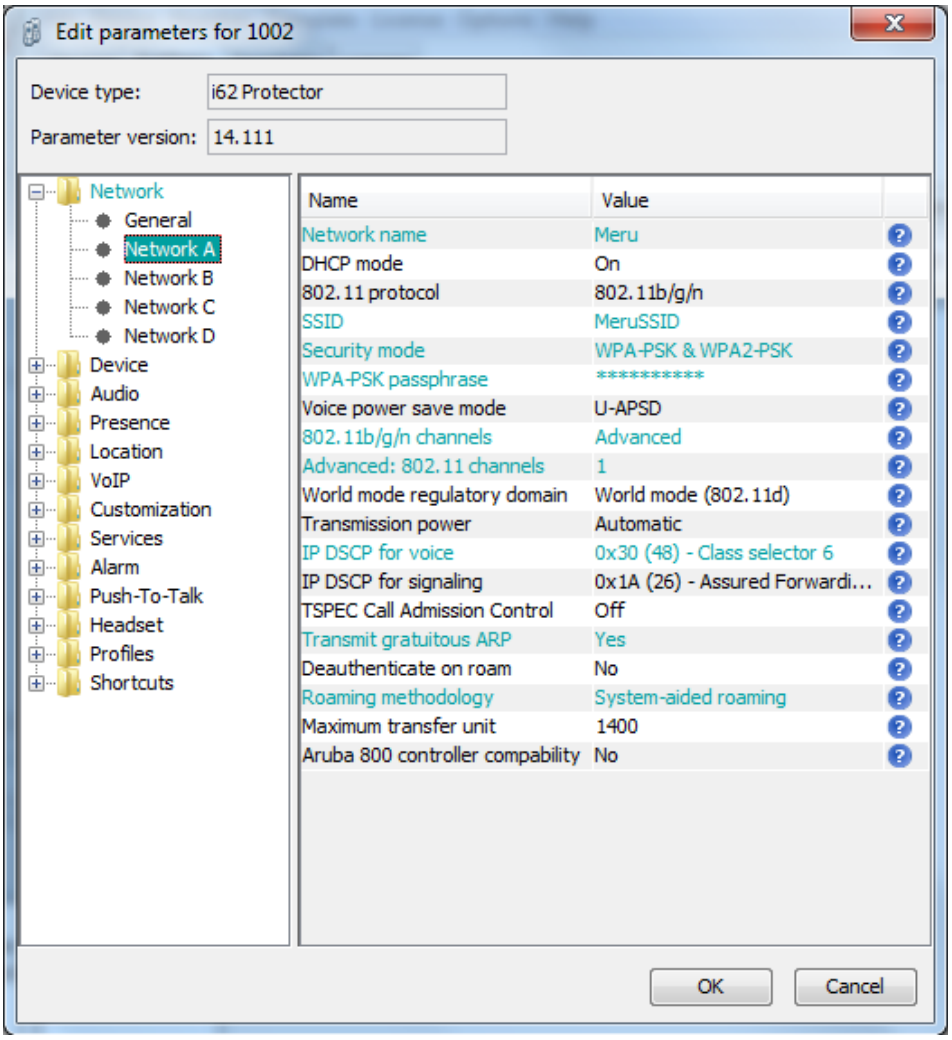


Configuration of “Diffserv Codepoint” (DSCP). Leaving “DiffServ Codepoint” disabled in an environment, where U-APSD has been implemented, implies that all Ascom VoIP devices must mark voice packets with DSCP 0xc0/48 (CS6). Similarly, signaling has to be DSCP 0x68/26 (AF31) or DSCP 0x00/00 (BE).

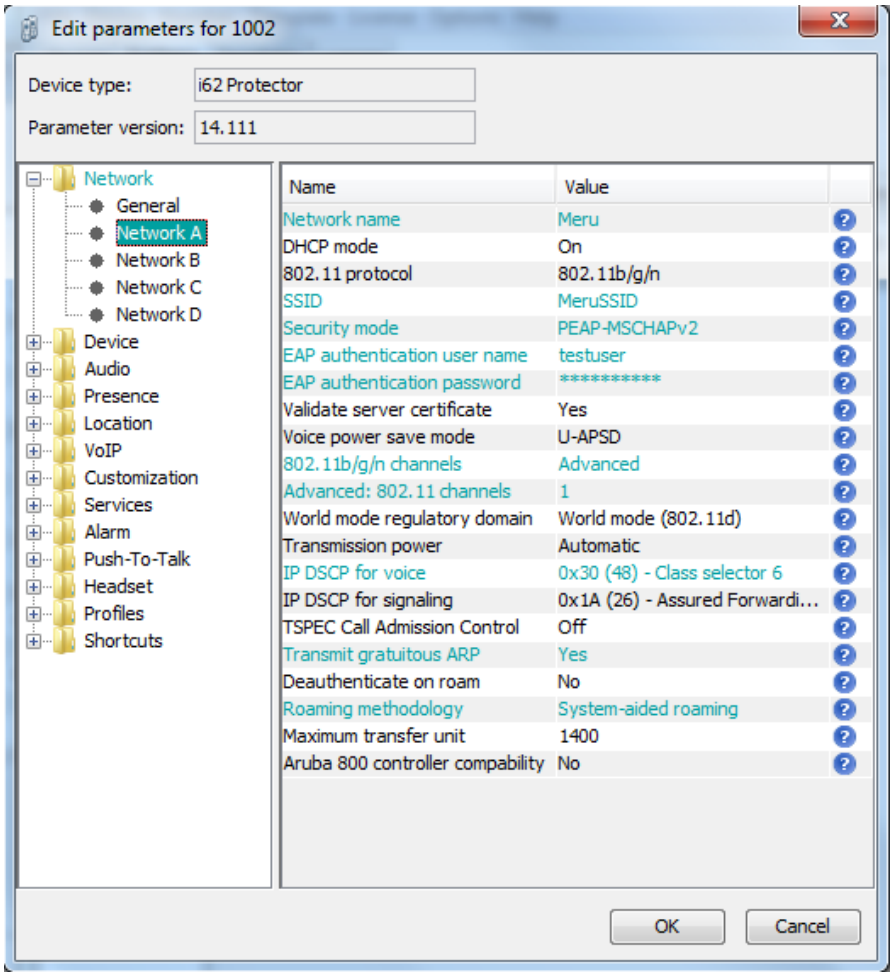
Configuration:

See attached file (merucfg.txt) for Meru MC1500 configuration.

Ascom i62

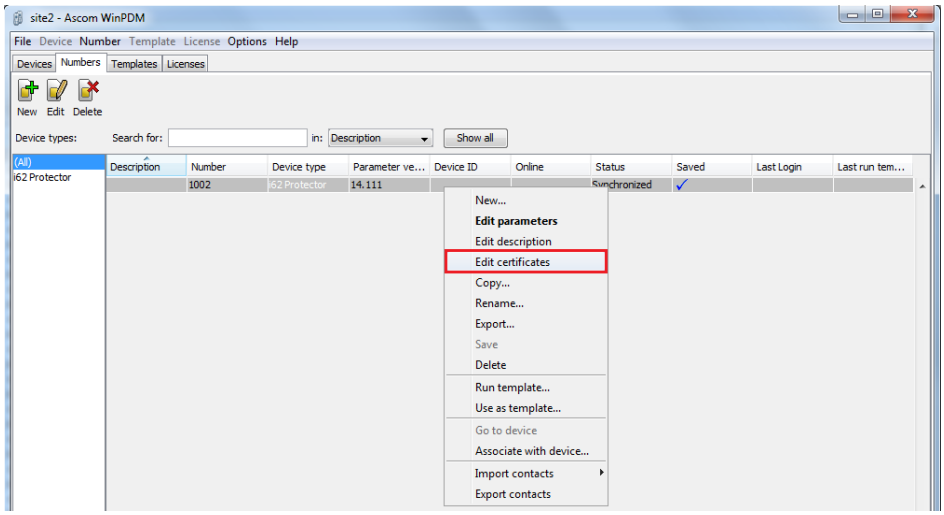


Recommended i62 system settings. Security mode, encryption type and Voice power save mode may vary depending on site. Due to the “one channel” architecture it is possible to set “802.11b/g/n or a/n channels” to advanced and specify the channel that’s being used.
It is recommended to set Roaming methodology to “System-aided roaming”.



i62 network settings for 802.1X authentication (PEAP-MSCHAPv2).

Note that depending on which Authentication method used it might be necessary to add a certificate into the i62. PEAP-MSCHAPv2 requires a Root certificate and EAP-TLS requires both a Root certificate and a client certificate. Server certificate validation can however be overridden in version 4.1.12 and above per handset setting.



If 802.1X Authentication is used a root certificate has to be uploaded to the phone by “right clicking” - > Edit certificates. EAP-TLS will require both a root and a client certificate.

Innovaphone IP6000 (IP PBX & DHCP server)

The Innovaphone IP6000 was configured with a static IP address. Signaling is less relevant here since testing homes in on interoperability in relation to the WLAN infrastructure and not features of the IP PBX. During the tests the IP6000 also was used as DHCP server.

IP6000 configuration:

See attached file (complete-IP6000-08-03-a6.txt) for IP6000 configuration.

APPENDIX B: DETAILED TEST RECORDS

A full test round was performed with AP332 due to the fact that it is a new platform. The well-known AP320 and AP1000 series were given a spot check including a less extensive number of tests.

AP332

Pass	24
Fail	0
Comments	3
Untested	6
Total	33

See attached file (WLANinteroperabilityTestReport_Meru_5_3_AP332.xls) for detailed test results.

MISCELLANEOUS

Please refer to the test specification for WLAN systems on Ascom's interoperability web page for explicit information regarding each test case.

See URL (requires login):
https://www.ascom-ws.com/AscomPartnerWeb/en/startpage/Sales-tools/Interoperability

Document History

Rev	Date	Author	Description
PA	2012-12-10	SEKMO	Draft1
PB	2012-12-13	SEKMO	Update after Meru feedback
R1	2012-12-20	SEKMO	Update after internal feedback. R1 state
R2	2013-01-18	SEKMO	Correction to attached test record R2
R3	2013-02-11	SEKMO	Added info to Known Issues section (inter controller roaming)
R4	2013-02-12	SEKMO	Minor corrections
R5	2013-05-17	SEKMO	Minor corrections