

ekahau

WIRELESS DESIGN

Fixing Bad Wi-Fi The Easy Way

Have you tried a reboot?

RTFM





No good configuration can fix a bad design.

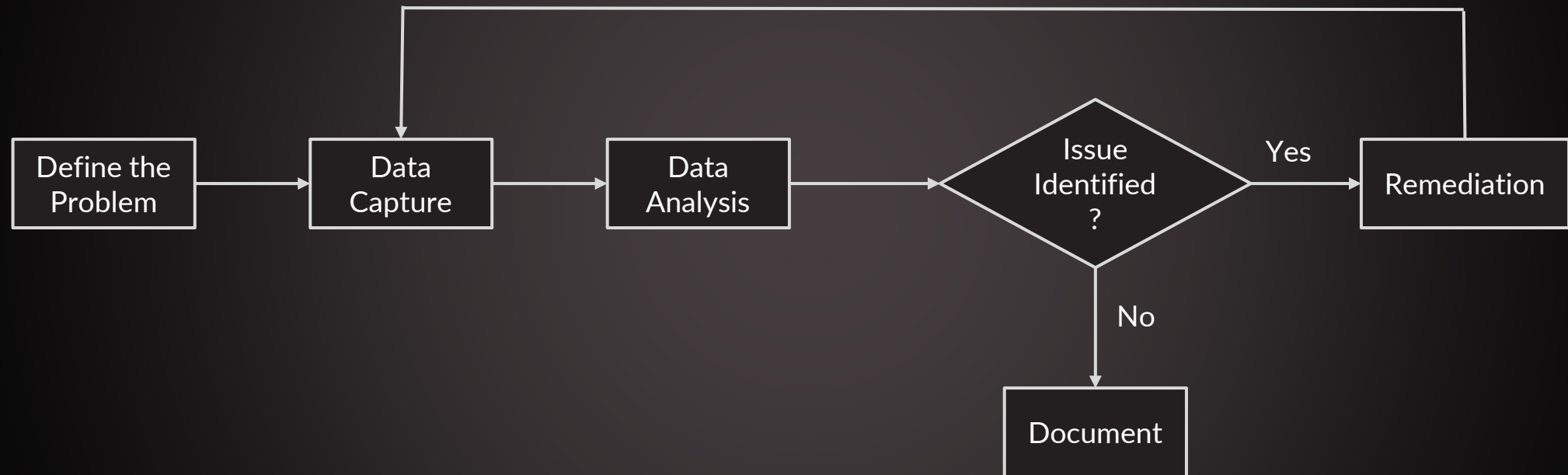
*All
Wireless Engineers*

“

A bad configuration makes a bad design even worse.

Renzo

Troubleshooting Steps



The Four Most Common Configuration Mistakes

And How To Detect Them

- Transmit Power
- Basic Rates
- Bad Channel Plan
- Dual Band SSIDs

Transmit Power

But Not The Way You Might Think

MONITOR WLANs CONTROLLER **WIRELESS** SECURITY MANAGEMENT COMMANDS HELP FEEDBACK Save Con

802.11a > RRM > Tx Power Control(TPC)

TPC Version

Interference Optimal Mode (TPCv2)
 Coverage Optimal Mode (TPCv1)

Tx Power Level Assignment Algorithm

Power Level Assignment Method Automatic Every 600 secs
 On Demand Invoke Power Update Once
 Fixed 1

Maximum Power Level Assignment (-10 to 30 dBm)

Minimum Power Level Assignment (-10 to 30 dBm)

Supported Radio Modes

Maximum Transmit Power 10 - 20 dBm

Transmission Power Floor 2 - 20 dBm

Transmission Power Max Drop 0 - 18 dB

Policy > Smart RF > test

BASIC **CHANNEL AND POWER** SCANNING CONFIGURATION RECOVERY

POWER SETTINGS

5 GHZ MINIMUM POWER **5 GHZ MAXIMUM POWER**

Transmit Power

Dynamic Power Selection & Direct Line Of Sight



Design **Inspect** Survey Live

select access points. X

RADIOS (71)

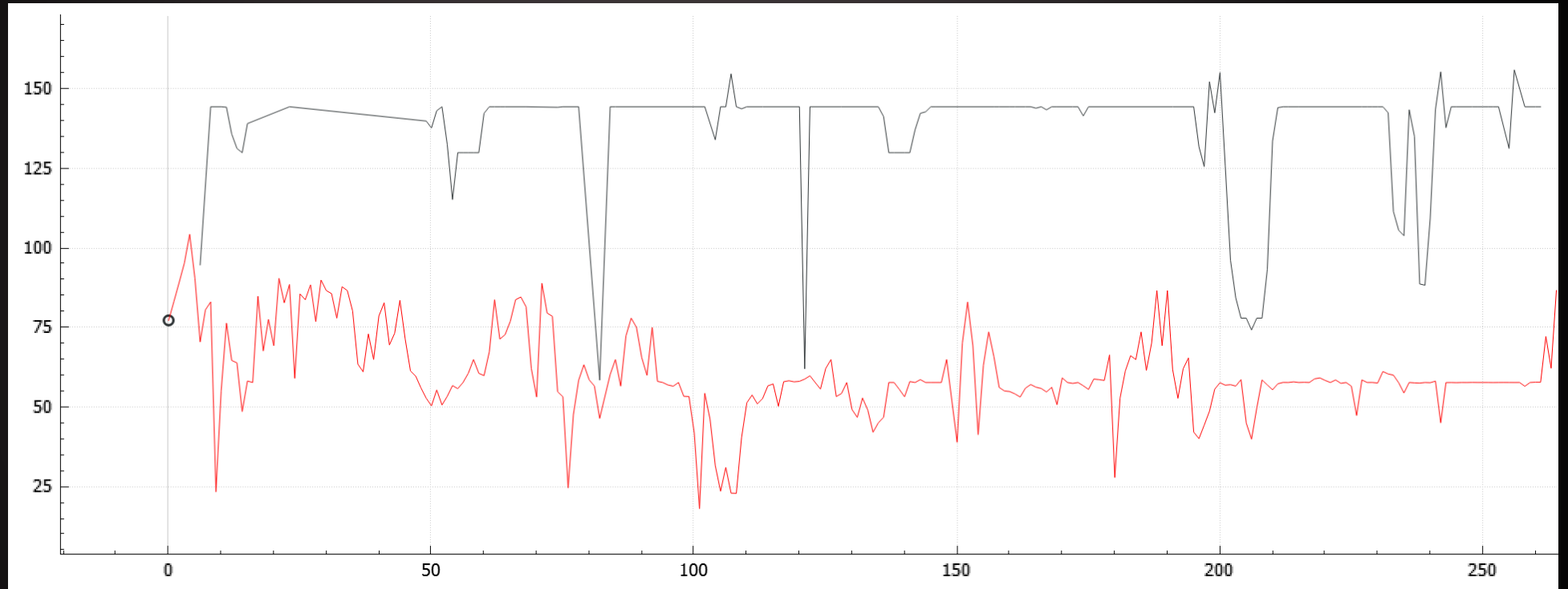
TECHNOLOGY	802.11ac
SSID / BSSID	
SPATIAL STREAMS	3
SUPPORTED RATES	9, 12(B), 18, 24(B), 36, 48, 54
ENCRYPTION	WPA2, Open
MAX DATA RATE	289 Mbps
POWER	5 dBm
TAGS	

```
> IEEE 802.11 Beacon frame, Flags: .....C
v IEEE 802.11 Wireless Management
  > Fixed parameters (12 bytes)
  v Tagged parameters (258 bytes)
    > Tag: SSID parameter set: "HI_OFFICE"
    > Tag: Supported Rates 9, 12(B), 18, 24(B), 36, 48, 54, [Mbit/sec]
    > Tag: Traffic Indication Map (TIM): DTIM 0 of 1 bitmap
    > Tag: Country Information: Country Code CH, Environment All
    > Tag: QBSS Load Element 802.11e CCA Version
    > Tag: HT Capabilities (802.11n D1.10)
    > Tag: RSN Information
    > Tag: HT Information (802.11n D1.10)
    > Tag: Extended Capabilities (8 octets)
    > Tag: Cisco CCX1 CKIP + Device Name
  v Tag: Vendor Specific: Cisco Systems, Inc: Aironet DTCP Powerlevel 5dBm
    Tag Number: Vendor Specific (150)
    Tag length: 6
    OUI: 00:40:96 (Cisco Systems, Inc)
    Vendor Specific OUI Type: 0
    Aironet IE type: DTCP (0)
    Aironet IE CCX DTCP: 5 dBm
    Aironet IE CCX DTCP Unknown: 00
```

$$5\text{dBm} = 3.16\text{mW}$$

Transmit Power

Link Imbalance

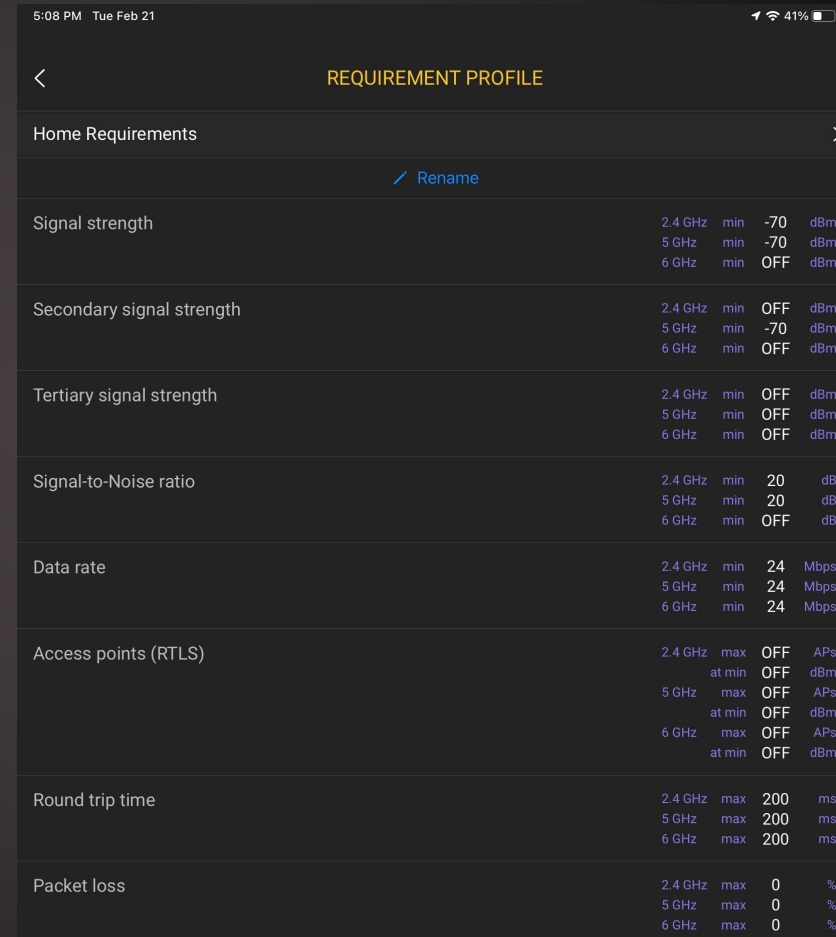
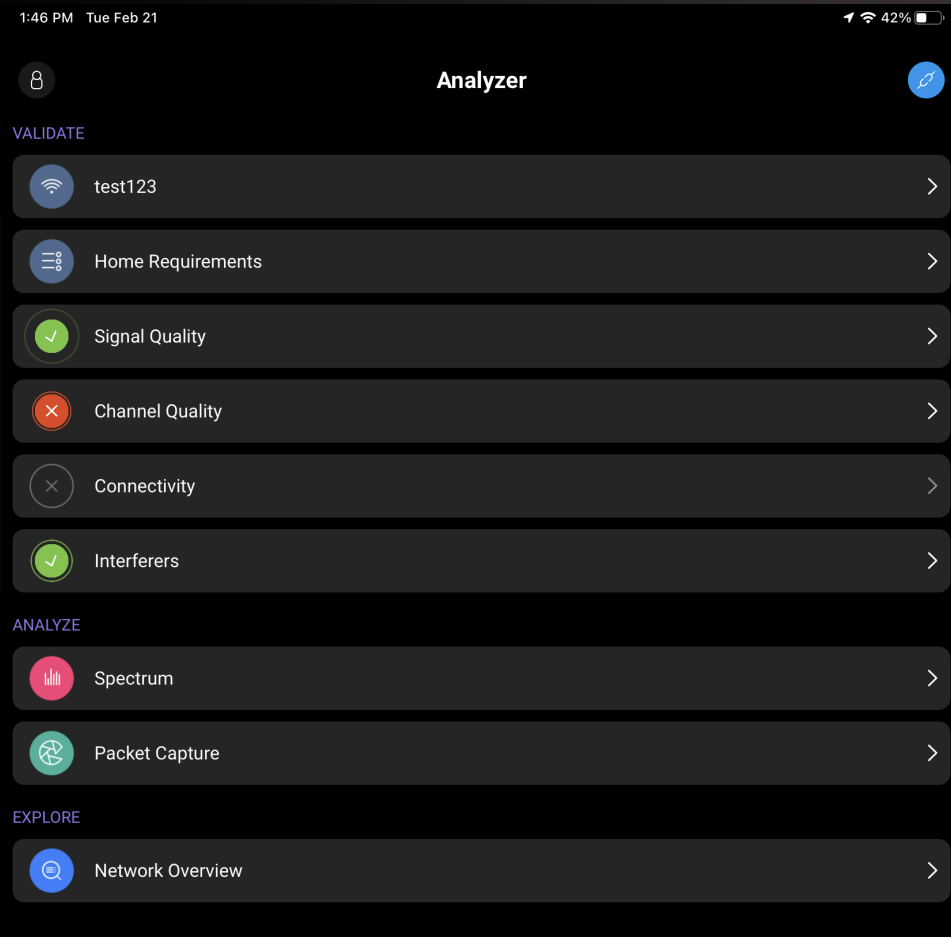


Black Line = Uplink => MCS7 (144.4Mbps)

Red Line = Downlink => MCS3 (57.8Mbps)

Setting Up Ekahau Analyzer

Select SSID To Validate And Define RF Requirements



Basic Rates

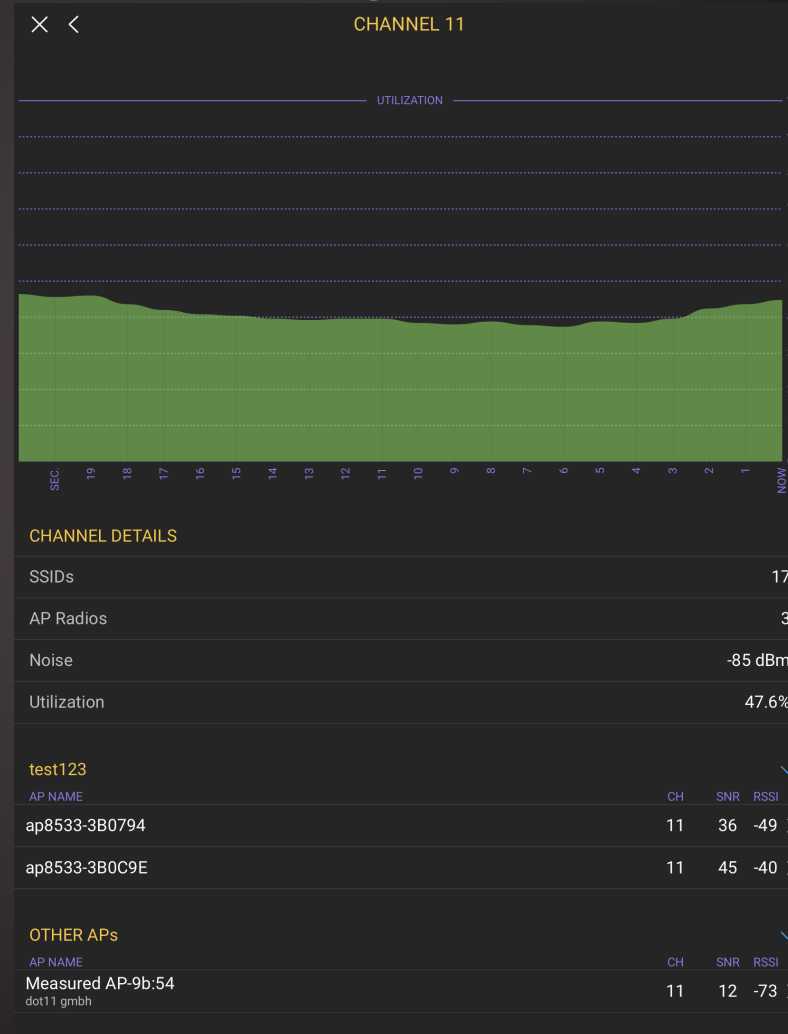
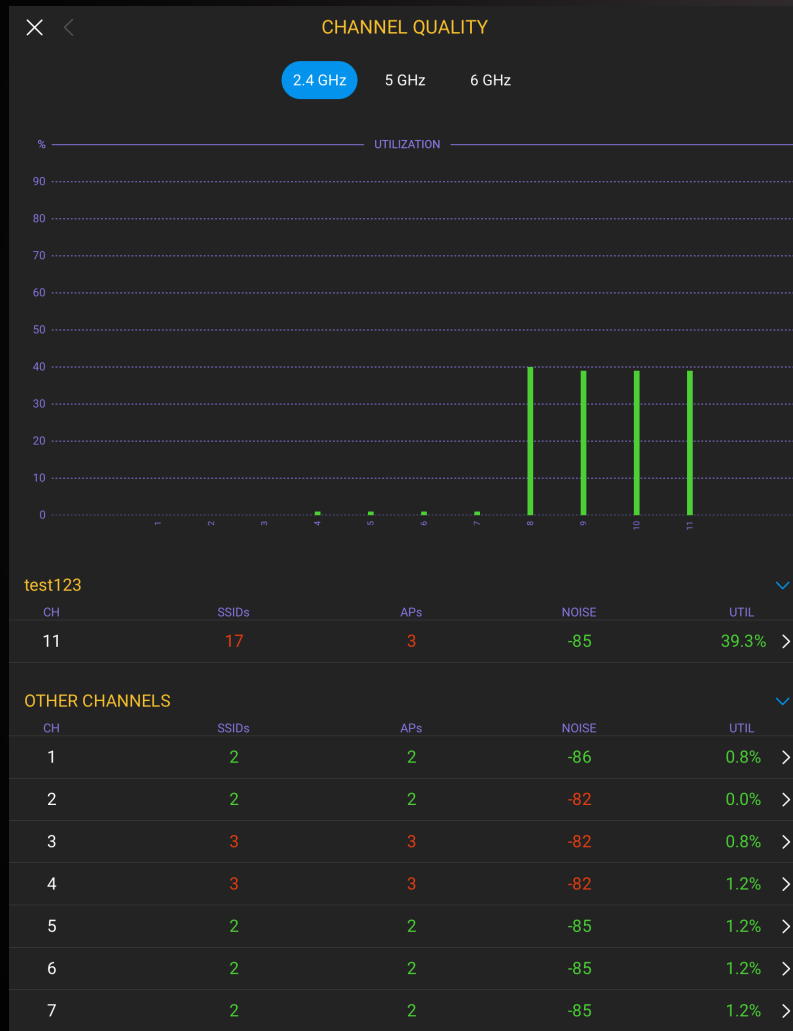
Beacon Overhead

CONFIGURATION	# APs ON CHANNEL	# SSIDs PER AP					
		1	2	3	4	5	6
Beacon Data Rate: 1 Mbps Beacon Size: 380 bytes Beacon Interval: 102.4 ms	1	3.22%	6.45%	9.67%	12.90%	16.12%	19.35%
	2	6.45%	12.90%	19.35%	25.80%	32.25%	38.70%
	3	9.67%	19.35%	29.02%	38.70%	48.37%	58.04%
	4	12.90%	25.80%	38.70%	51.59%	64.49%	77.39%
	5	16.12%	32.25%	48.37%	64.49%	80.62%	96.74%
Beacon Data Rate: 5.5 Mbps Beacon Size: 380 bytes Beacon Interval: 102.4 ms	1	0.70%	1.40%	2.11%	2.81%	3.51%	4.21%
	2	1.40%	2.81%	4.21%	5.62%	7.02%	8.42%
	3	2.11%	4.21%	6.32%	8.42%	10.53%	12.63%
	4	2.81%	5.62%	8.42%	11.23%	14.04%	16.85%
	5	3.51%	7.02%	10.53%	14.04%	17.55%	21.06%
Beacon Data Rate: 12 Mbps Beacon Size: 380 bytes Beacon Interval: 102.4 ms	1	0.31%	0.61%	0.92%	1.22%	1.53%	1.83%
	2	0.61%	1.22%	1.83%	2.45%	3.06%	3.67%
	3	0.92%	1.83%	2.75%	3.67%	4.58%	5.50%
	4	1.22%	2.45%	3.67%	4.89%	6.11%	7.34%
	5	1.53%	3.06%	4.58%	6.11%	7.64%	9.17%

Data generated using Andrew von Nagy's [Beacon Overhead calculator](#)

Basic Rates

Verify Utilization In Analyzer – Channel Quality



Basic Rates

Verify Basic Rates & Utilization In Analyzer – Network Overview

11:51 AM Tue Feb 21 60%

Scanning My Network 2.4 5 6 All Open Secure

SSID	CH	AP NAME	BAND	RSSI	MIN RATE	BASIC RATES	BSS UTIL	UTIL	...
test123 B8:50:01:6D:8D:60	11	...8533-3B0C9E	2.4 GHz ISM	-39 dBm	1 Mbps	1, 2, 5.5, 11 M...	43.9%	46.7%	ⓘ
test123 B8:50:01:6D:43:90	11	ap8533-3B0794	2.4 GHz ISM	-44 dBm	1 Mbps	1, 2, 5.5, 11 M...	43.5%	46.7%	ⓘ

SSID	CH	AP NAME	BAND	RSSI	MIN RATE	BASIC RATES	BSS UTIL	UTIL	..
test123 B8:50:01:6D:43:90	11	ap8533-3B0794	2.4 GHz ISM	-39 dBm	6 Mbps	24 Mbps	7.8%	7.6%	ⓘ
test123 B8:50:01:6D:8D:60	11	...8533-3B0C9E	2.4 GHz ISM	-33 dBm	6 Mbps	24 Mbps	9.0%	7.6%	ⓘ

SSID	CH	AP NAME	BAND	RSSI	MIN RATE	BASIC RATES	BSS UTIL	UTIL	...
test123 B8:50:01:6D:43:90	11	ap8533-3B0794	2.4 GHz ISM	-38 dBm	6 Mbps	54 Mbps	7.5%	1.6%	ⓘ
test123 B8:50:01:6D:8D:60	11	...8533-3B0C9E	2.4 GHz ISM	-30 dBm	6 Mbps	54 Mbps	7.5%	1.6%	ⓘ

Basic Rates

1Mbps



vs.

24Mbps



vs.

54Mbps



Basic Rates

Smooth

vs.

Inspector

SHARED VISUALIZATION OPTIONS

Visualization Mode: **Smooth** (Selected), Detailed, Inspector

Accuracy: 12 m, 8 m, 5 m, **3 m** (Selected), 2 m

Opacity: 30%, 40%, 50%, 60%, **70%** (Selected), 80%, 90%, 100%

Signal Prediction: Off, Current ..., **+ - 1 floor** (Selected), + - 2 floors, All floors

View as Mobile Device: Off

Automatic Refresh: On

Color Scheme: 4

Legend Range: -100, -85, **-70** (Selected), -30

SHARED VISUALIZATION OPTIONS

Visualization Mode: Smooth, Detailed, **Inspector** (Selected)

Accuracy: 12 m, 8 m, 5 m, **3 m** (Selected), 2 m

Opacity: 30%, 40%, 50%, 60%, **70%** (Selected), 80%, 90%, 100%

Signal Prediction: Off, Current ..., **+ - 1 floor** (Selected), + - 2 floors, All floors

View as Mobile Device: Off

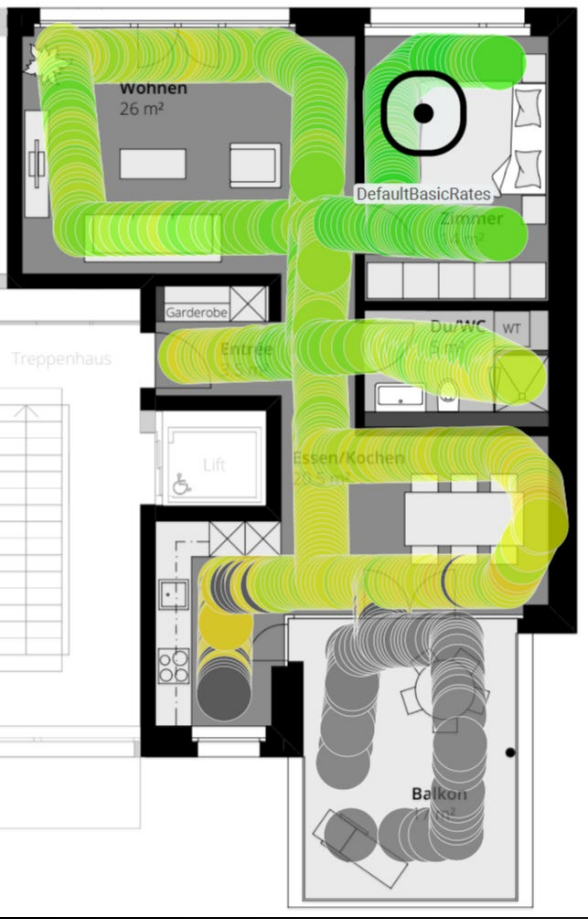
Automatic Refresh: On

Color Scheme: 4

Legend Range: -100, -85, **-70** (Selected), -30

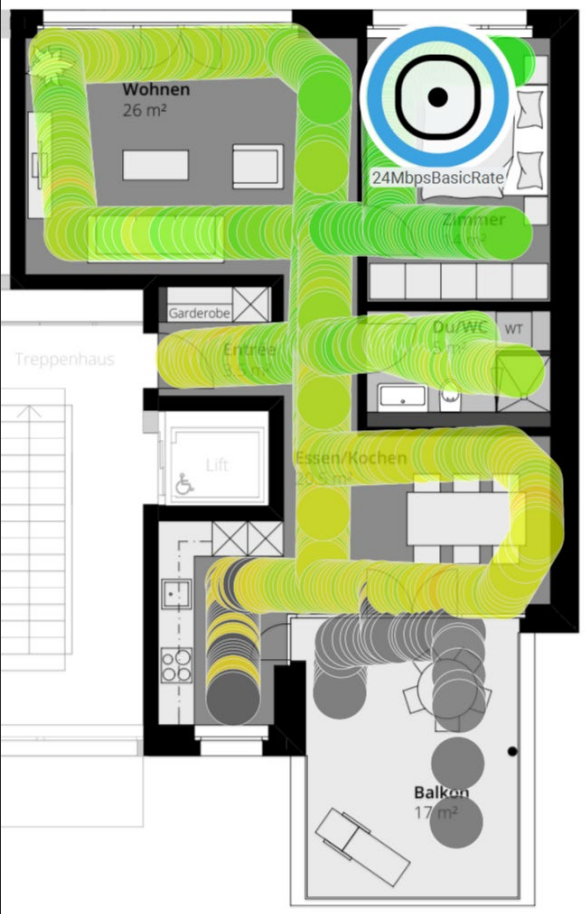
Basic Rates

1Mbps



vs.

24Mbps



vs.

54Mbps



Basic Rates

1Mbps



vs.

24Mbps



vs.

54Mbps



Basic Rates

1Mbps

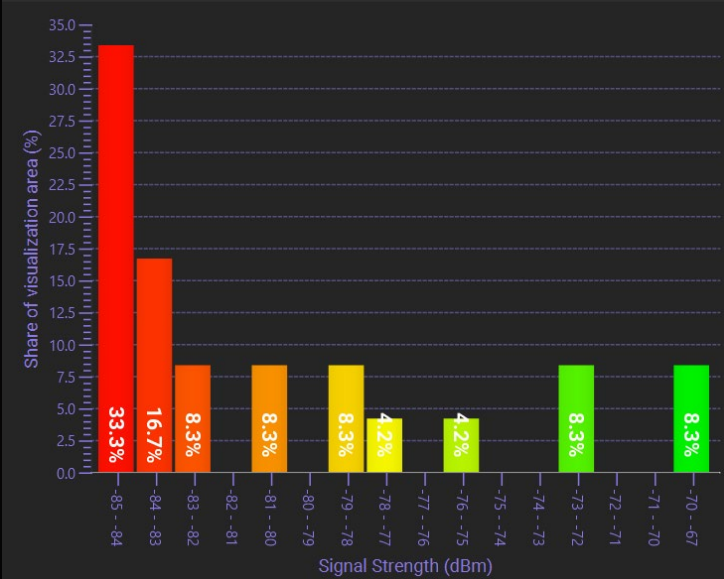
vs.

24Mbps

vs.

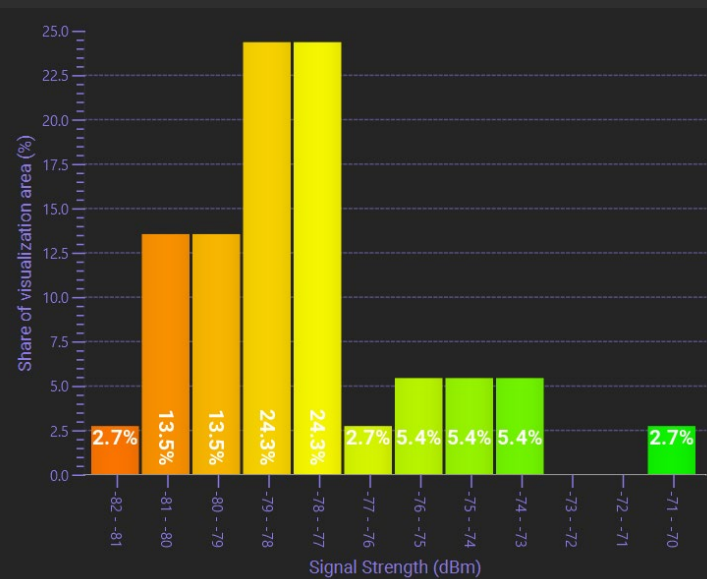
54Mbps

SIGNAL STRENGTH FOR OUTDOOR AT 2.4 GHZ



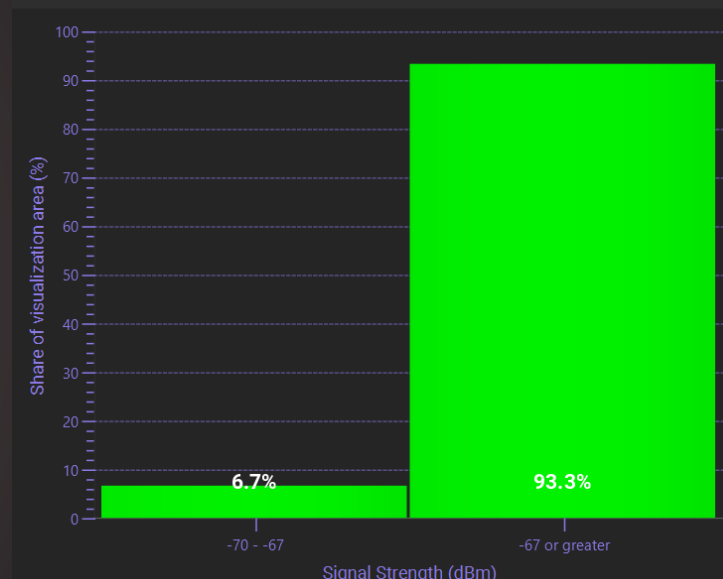
Decoding Beacons to <-85dBm

SIGNAL STRENGTH FOR OUTDOOR AT 2.4 GHZ



Decoding Beacons to -82dBm

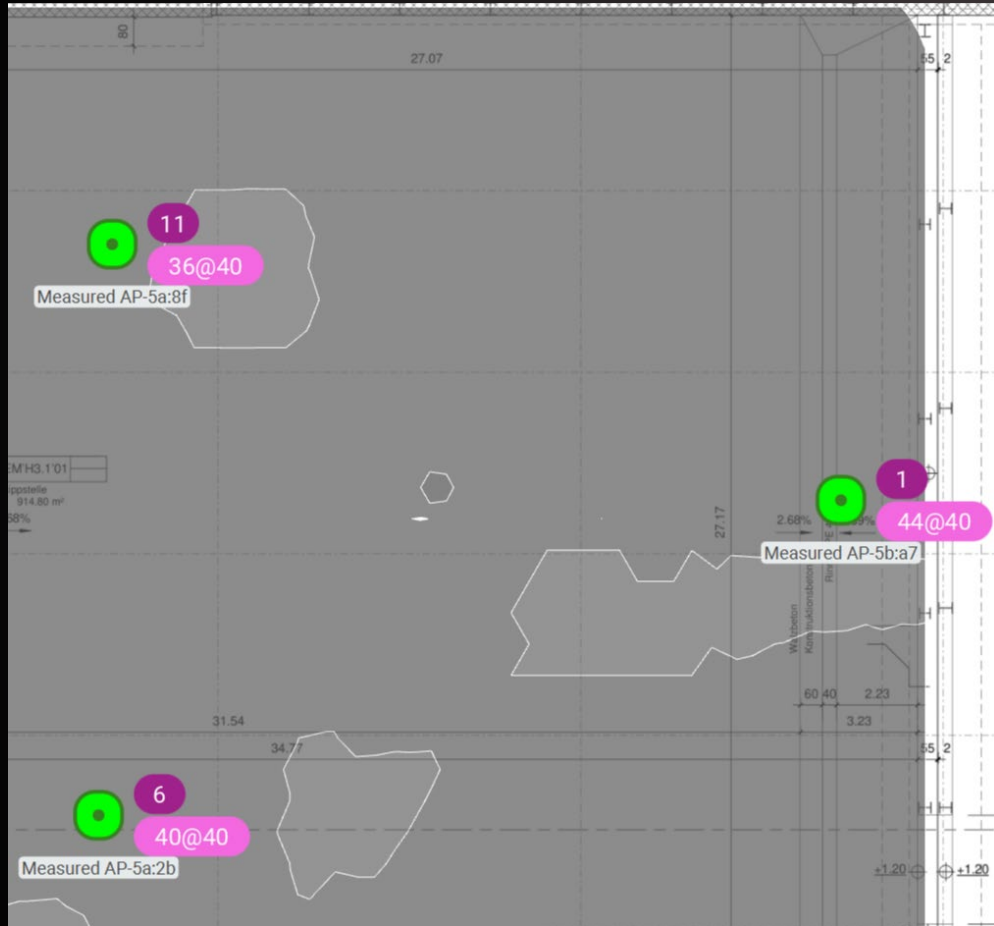
SIGNAL STRENGTH FOR OUTDOOR AT 2.4 GHZ



Decoding Beacons to -70dBm

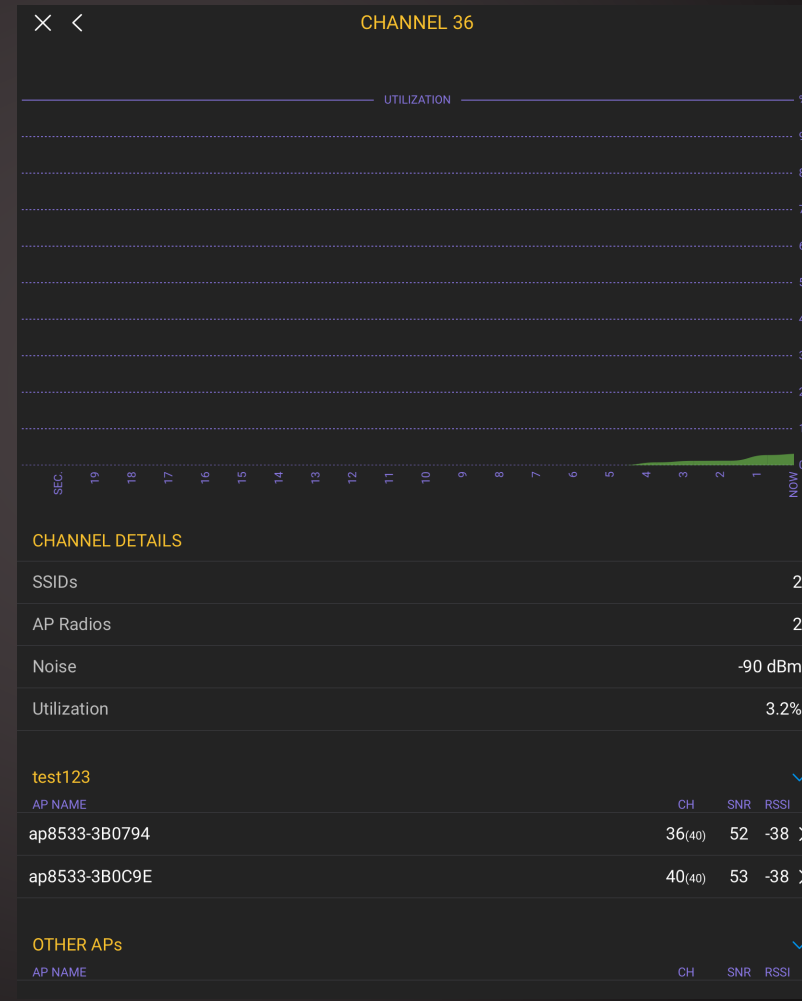
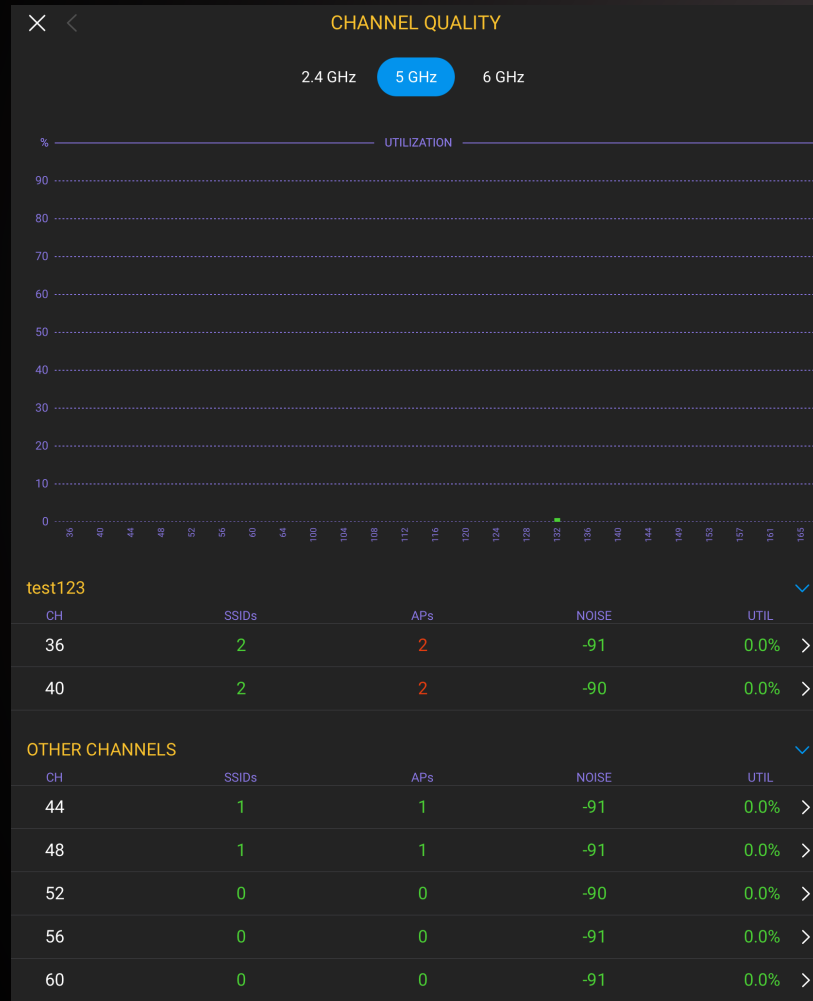
Bad Channel Plan

Work With What You Can – But Do It Right



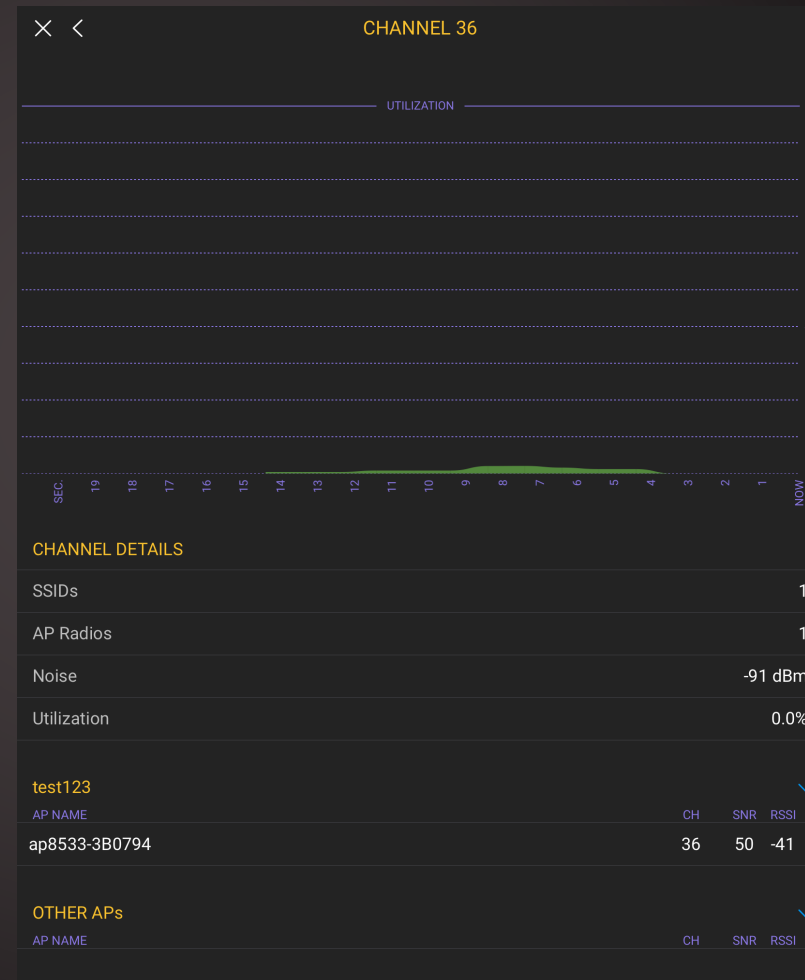
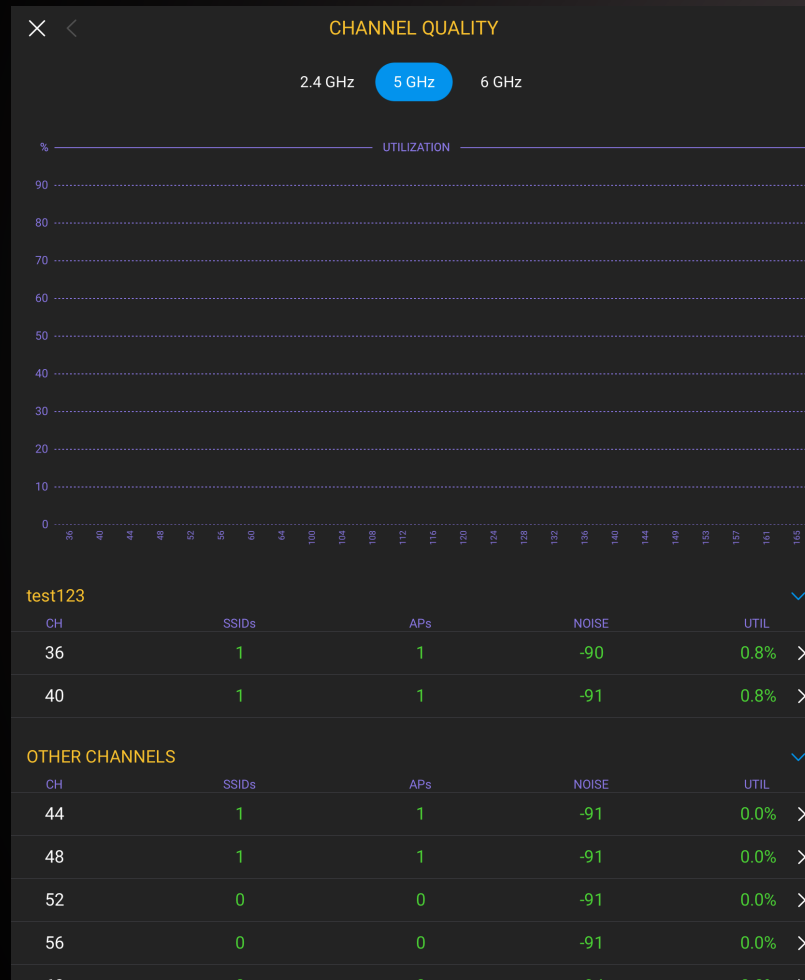
Bad Channel Plan

Verify In Ekahau Analyzer – Channel Quality



Bad Channel Plan

Verify In Ekahau Analyzer – Channel Quality



Dual Band SSIDs

You'll Never Know What Your Client Is Up To

∨ Issues (1)

P4 Connected
Dual Band capable client prefers 2.4 GHz over 5 GHz
Instance Count: 1

Dual Band SSIDs

Verify In Ekahau Analyzer – Signal Quality

1:45 PM Tue Feb 21 📶 42%

X < SIGNAL QUALITY

2.4 GHz 5 GHz 6 GHz All

test123 ▼

AP NAME	CH	SNR	RSSI
ap8533-3B0C9E	40(40)	59	-32 >
ap8533-3B0C9E	11	46	-39 >
ap8533-3B0794	36(40)	48	-42 >
ap8533-3B0794	11	40	-45 >

OTHER APs ▼

AP NAME	CH	SNR	RSSI
Measured AP-ef:94 dot11 gmbh	6	49	-36 >
Measured AP-ef:94 dot11 gmbh	132(40)	52	-39 >
Measured AP-9b:54 dot11 gmbh	11	16	-69 >
Measured AP-60:44 Sunrise_2.4GHz_516040	1	10	-75 >
Measured AP-56:a1 FRITZ!Box 5490 KA	1(40)	10	-75 >
Measured AP-9b:54 dot11 gmbh	44(40)	15	-76 >

Dual Band SSIDs

Verify In Ekahau Analyzer – Network Overview

12:59 PM Tue Feb 21 51%

Scanning My Network 2.4 5 6 All Open Secure

SSID	AP NAME	CH	BAND	MODE	GEN	RSSI	
test123 B8:50:01:6D:8D:60	ap8533-3B0C9E	11	2.4 GHz ISM	11g, 11n	4	-28 dBm	i
test123 B8:50:01:6C:53:00	ap8533-3B0C9E	40(40)	5 GHz UNII-1	11a, 11n, 11ac	5	-35 dBm	i
test123 B8:50:01:6C:C6:D0	ap8533-3B0794	36(40)	5 GHz UNII-1	11a, 11n, 11ac	5	-40 dBm	i
test123 B8:50:01:6D:43:90	ap8533-3B0794	11	2.4 GHz ISM	11g, 11n	4	-37 dBm	i

The Four Most Common Configuration Mistakes

And How To Detect Them

- Transmit Power
- Basic Rates
- Bad Channel Plan
- Dual Band SSIDs