

- Gatot Wibowo Hamiseno.
- Widyaiswara.
- Pusat Pengembangan & Pemberdayaan Pendidik dan Tenaga Kependidikan Kemendikbud.

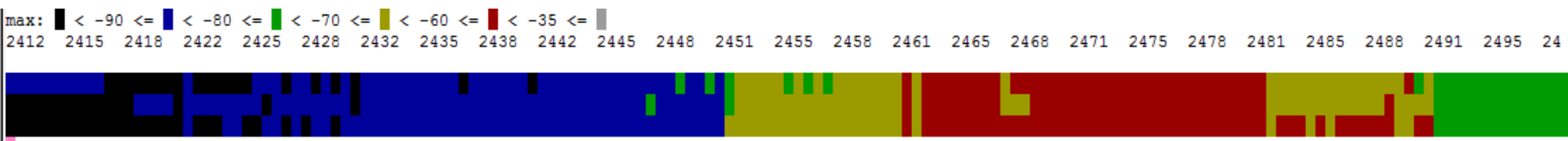
WIRELESS

Tools & Tips

SPECTRAL HISTORY

- Pemetaan berupa spectogram (Atheros 92xx dan 93xx)

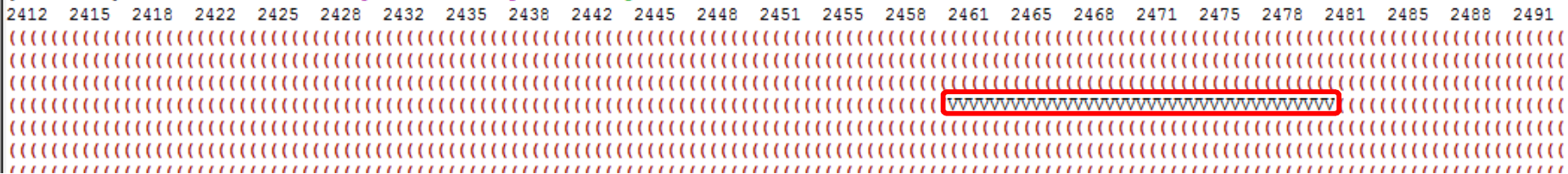
```
[admin@GOR] > interface wireless spectral-history wlan1 range=2432-2480
```



max: █ < -90 <= █ < -80 <= █ < -70 <= █ < -60 <= █ < -35 <= █
2412 2415 2418 2422 2425 2428 2432 2435 2438 2442 2445 2448 2451 2455 2458 2461 2465 2468 2471 2475 2478 2481 2485 2488 2491 2495 2498

- Interference

```
[admin@GOR] > interface wireless spectral-history wlan1 range=2432-2480 value=interference
```



2412 2415 2418 2422 2425 2428 2432 2435 2438 2442 2445 2448 2451 2455 2458 2461 2465 2468 2471 2475 2478 2481 2485 2488 2491

SPECTRAL SCAN

- Monitoring spectrum dengan informasi: frekuensi, power, karakter grafik.

```
[admin@R_Musik] > interface wireless spectral-scan wlan1 range=2432-2461
```

Terminal		
FREQ	DBM	GRAPH
2422	-89	.....
2423	-87	.....
2425	-87	.....
2426	-87	.....
2427	-87	.....
2429	-87	.....
2430	-89	.....
2431	-49	.....
2432	-47	.....
2434	-50	.....
2435	-45	.....
2436	-46	.....
2438	-44	.....
2439	-48	.....
2440	-46	.....
2442	-42	.....
2443	-43	.....
2444	-46	.....
2446	-55	.....
2447	-62	.....
2448	-63	.....
2450	-67	.....
2451	-64	.....
2452	-66	.....
2453	-91	.....
2455	-90	.....

SPECTRAL SCAN

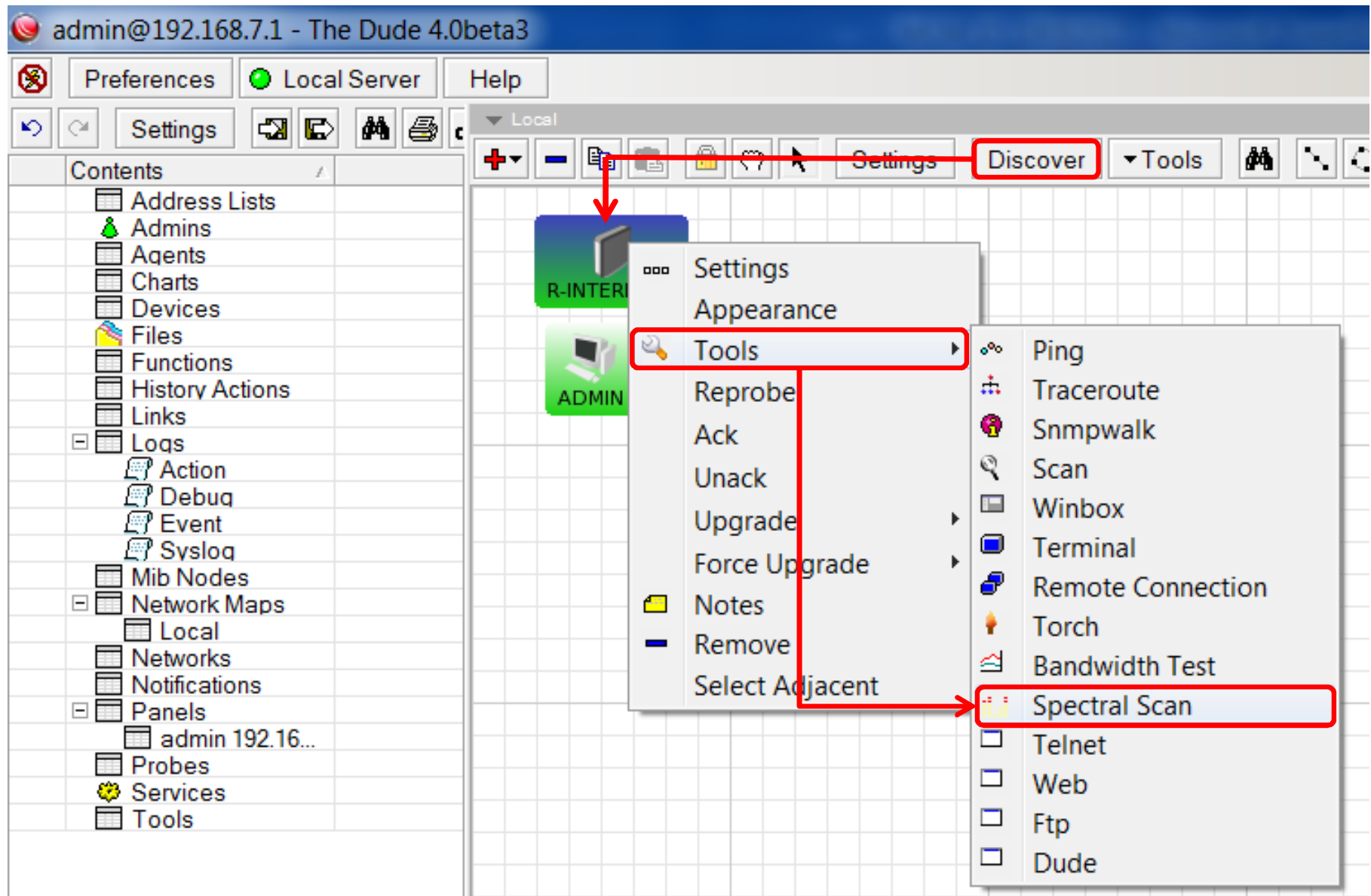
- Menampilkan option interferensi

```
[admin@R_Musik] > interface wireless spectral-scan wlan1 range=2432-2461 show-interference=yes
```

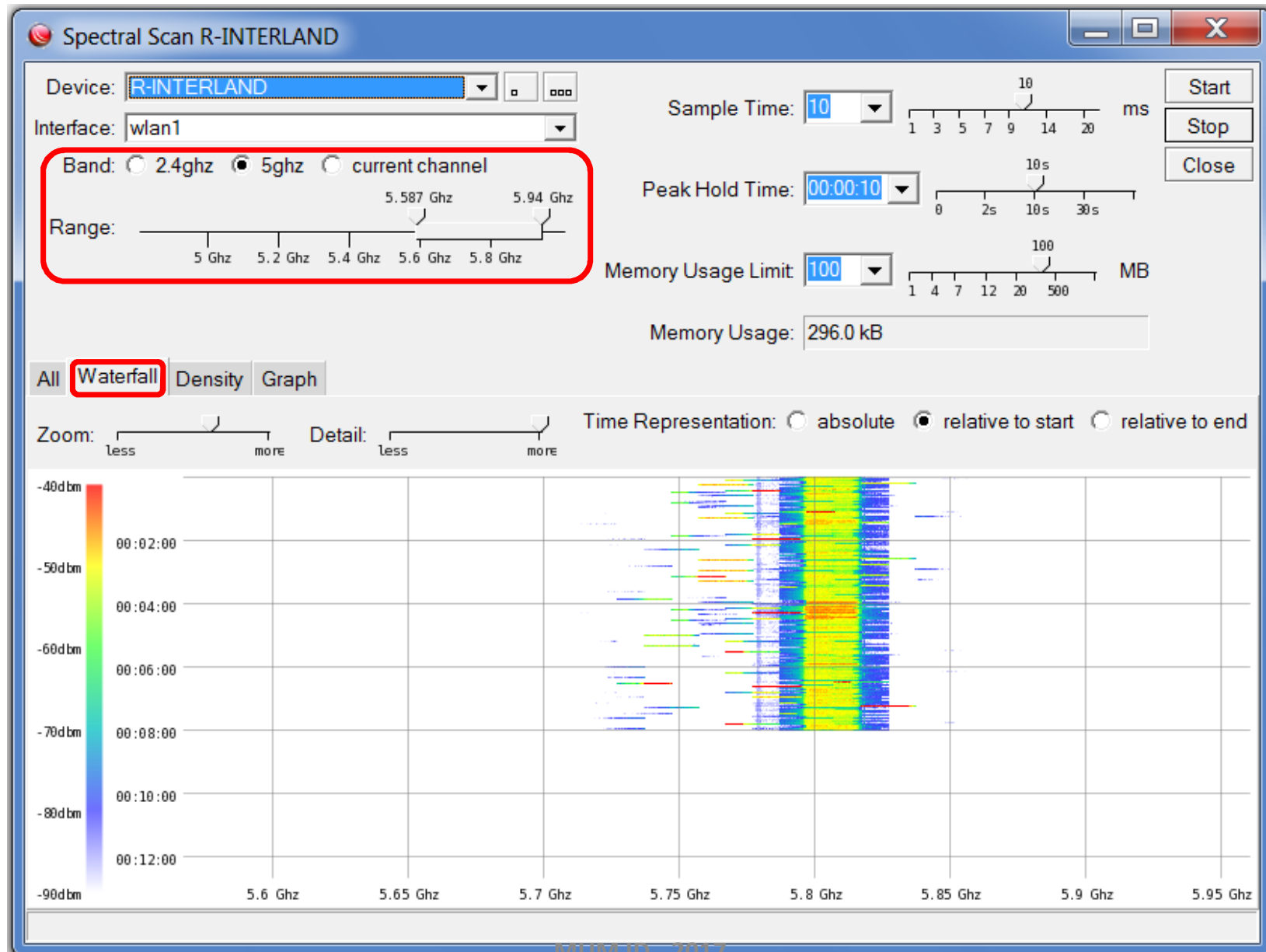
```
Terminal
FREQ INTERFERENCE      DBM GRAPH
2412 none              -67 .....
2414 none              -66 .....
2416 none              -66 .....
2417 none              -65 .....
2419 none              -65 .....
2421 none              -50 .....
2423 none              -55 .....
2425 none              -60 .....
2426 none              -59 .....
2428 none              -40 .....
2430 none              -42 .....
2432 wifi:-72          -38 .....
2433 wifi:-72          -39 .....
2435 wifi:-72          -39 .....
2437 wifi:-72          -37 .....
2439 wifi:-72          -38 .....
2441 wifi:-72          -38 .....
2442 wifi:-72          -37 .....
2444 wifi:-72          -39 .....
2446 wifi:-72          -40 .....
2447 wifi:-72          -49 .....
2449 wifi:-72          -55 .....
2451 wifi:-72          -43 .....
2453 none              -48 .....
2455 none              -59 .....
2456 none              -60 .....
2458 none              -60 .....
2460 none              -61 .....
2462 none              -61 .....
2464 none              -73 .....
2465 none              -72 .....
2467 none              -75 .....
2469 none              -76 .....
2471 none              -75 .....
2472 none              -85 .....
2474 none              -83 .....
2476 none              -84 .....
2478 none              -86 .....
2480 none              -86 .....
┌─ [Q quit|D dump|C-z pause]
```



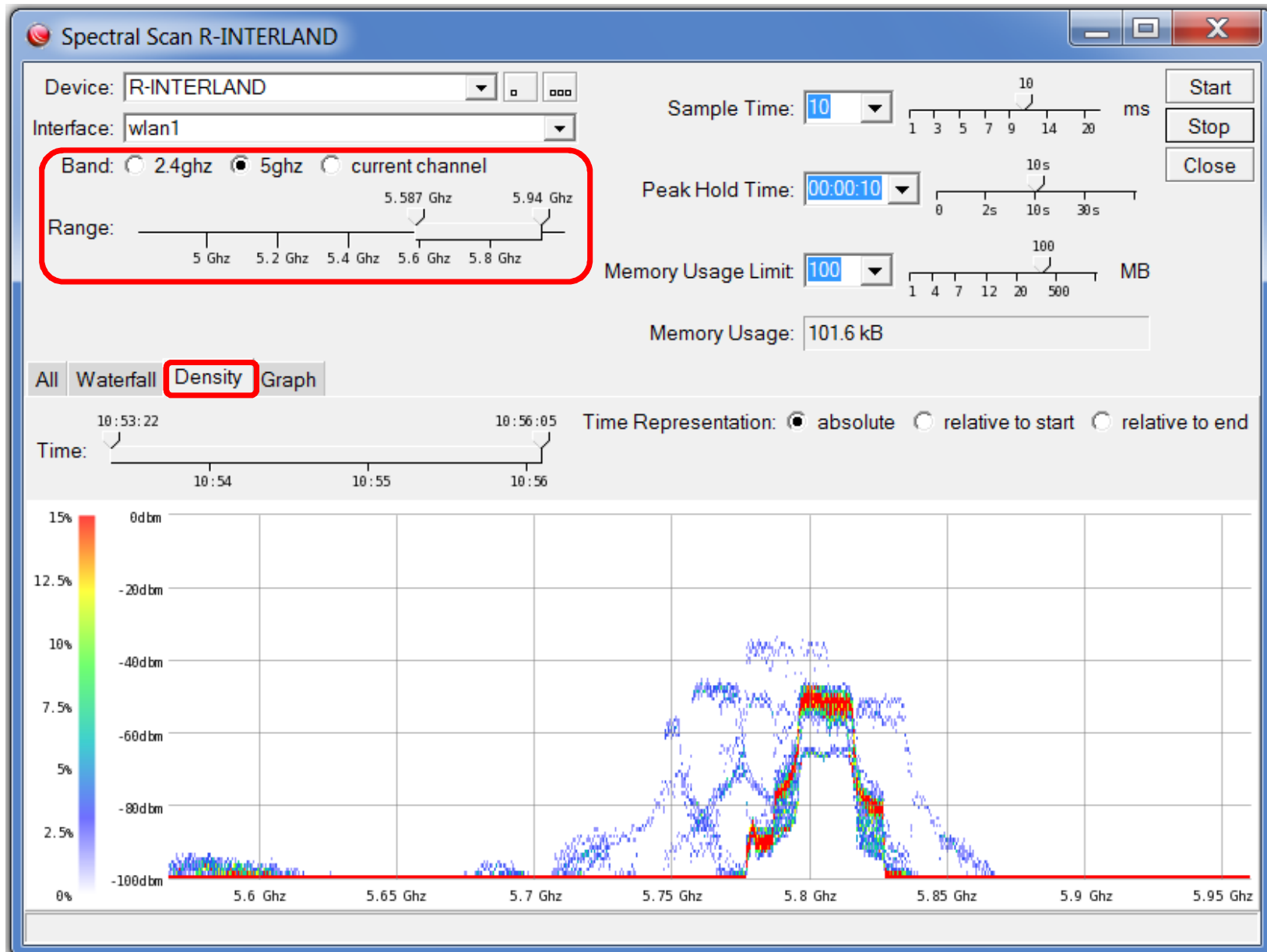
THE DUDE SPECTRAL SCAN



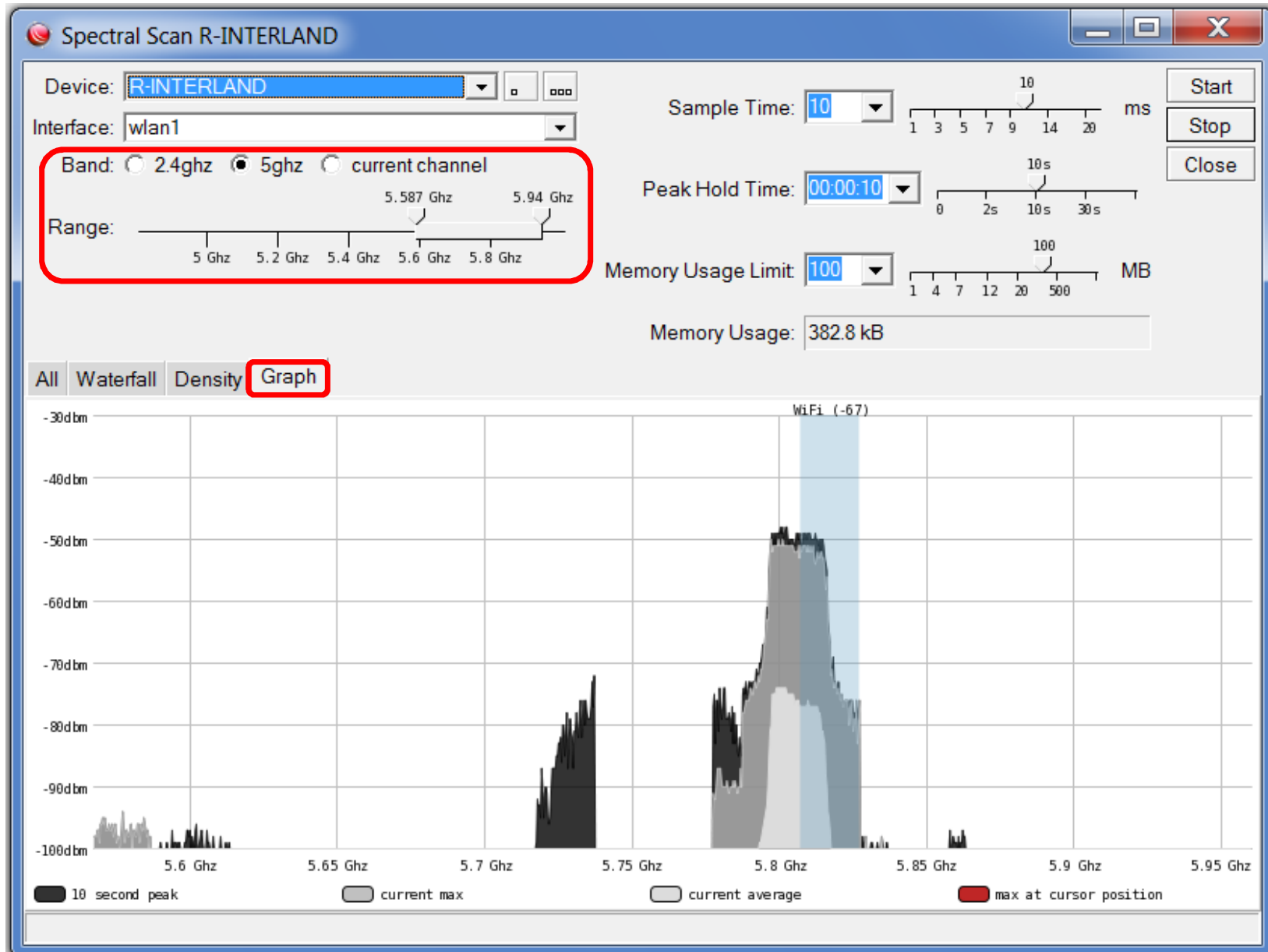
THE DUDE SPECTRAL SCAN



THE DUDE SPECTRAL SCAN

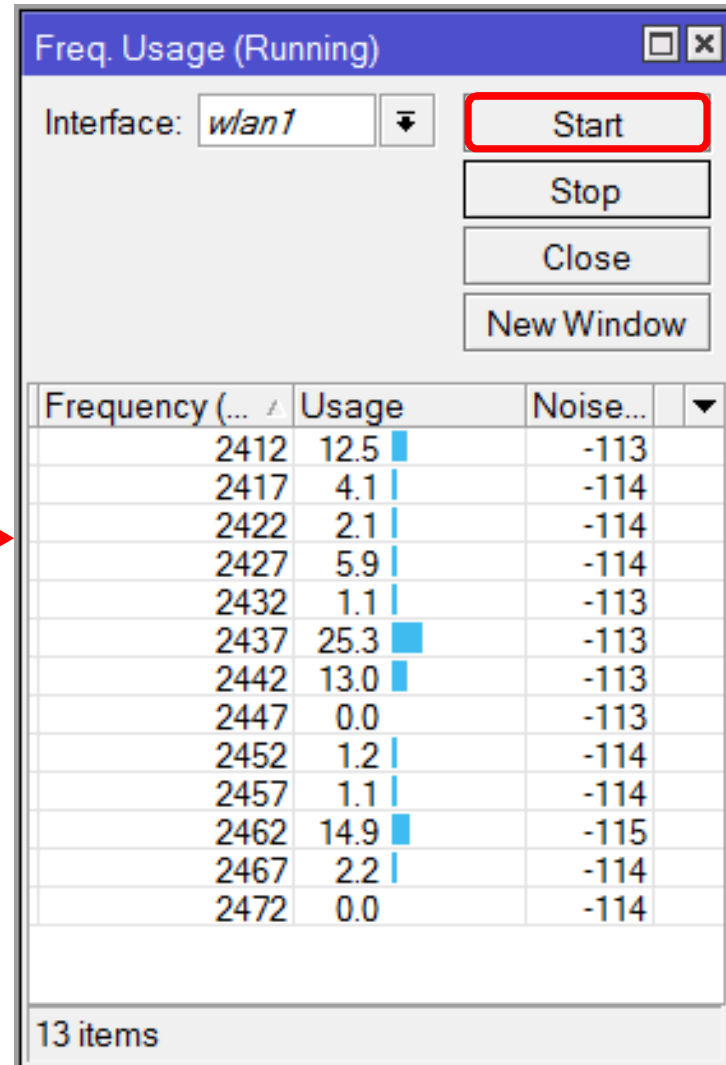
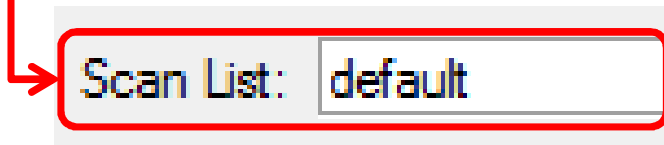
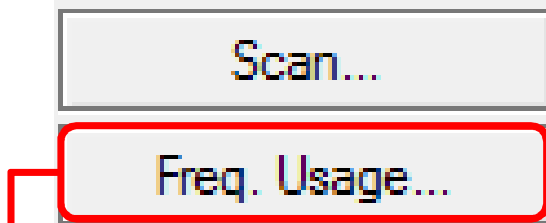


THE DUDE SPECTRAL SCAN



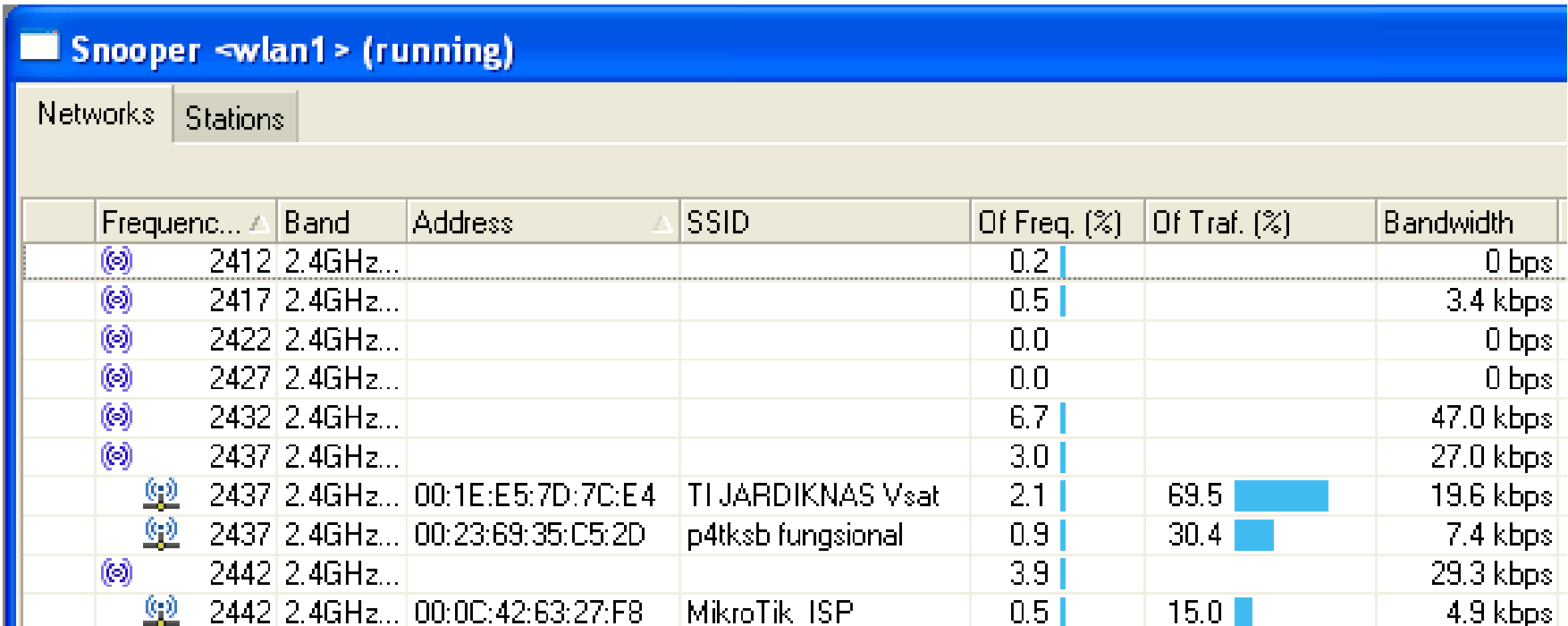
Freq. Usage

- Melihat penggunaan frekuensi sesuai Scan List.



Snooper

- Melihat beban bandwidth di setiap frekuensi serta jumlah station yang terkoneksi AP.



Snooper <wlan1 > (running)

Networks Stations

	Frequenc... ▲	Band	Address ▲	SSID	Of Freq. (%)	Of Traf. (%)	Bandwidth
	2412	2.4GHz...			0.2		0 bps
	2417	2.4GHz...			0.5		3.4 kbps
	2422	2.4GHz...			0.0		0 bps
	2427	2.4GHz...			0.0		0 bps
	2432	2.4GHz...			6.7		47.0 kbps
	2437	2.4GHz...			3.0		27.0 kbps
	2437	2.4GHz...	00:1E:E5:7D:7C:E4	TI JARDIKNAS Vsat	2.1	69.5	19.6 kbps
	2437	2.4GHz...	00:23:69:35:C5:2D	p4tksb fungsional	0.9	30.4	7.4 kbps
	2442	2.4GHz...			3.9		29.3 kbps
	2442	2.4GHz...	00:0C:42:63:27:F8	MikroTik_ISP	0.5	15.0	4.9 kbps

Band & Channel Width

Interface <wlan1>

General Wireless Data Rates Advanced

Mode: ap bridge

Band: 2GHz-G/N

- 2GHz-B
- 2GHz-only-G
- 2GHz-B/G
- 2GHz-only-N
- 2GHz-B/G/N
- 2GHz-G/N

Interface <wlan1>

General Wireless Data Rates Advanced

Mode: ap bridge

Band: 2GHz-G/N

Channel Width: 20MHz

- 5MHz
- 10MHz
- 20/40MHz Ce
- 20/40MHz eC
- 20MHz

5MHz, throughput $\frac{1}{4}$
10MHz, throughput $\frac{1}{2}$
20MHz, standard
40MHz, throughput 2x

Data Rates

Interface <wlan1>

General Wireless **Data Rates** Advanced

Mode: ap bridge

Band: 5GHz-A

Channel Width: 20MHz

Frequency: 5785

SSID: AP_SXT

Interface <wlan1>

Wireless **Data Rates** Advanced HT WDS Nstreme NV2 ...

- Rate

default configured

Supported Rates A/G: 6Mbps 9Mbps 12Mbps 18Mbps
 24Mbps 36Mbps 48Mbps 54Mbps

Basic Rates A/G: 6Mbps 9Mbps 12Mbps 18Mbps
 24Mbps 36Mbps 48Mbps 54Mbps

	Tx (dBm)	Rx (dBm)
6Mbit/s	31	-96
54MBit/s	28	-81
MCS0	30	-96
MCS7	27	-77
MCS9	22	-72

Data Rates

Interface <wlan1>

General Wireless Data Rates Advanced

Mode: ap bridge

Band: 5GHz-only-N

Channel Width: 20MHz

Frequency: 5765

Interface <wlan1>

HT HT MCS WDS Nstreme NV2 Tx P

HT Supported MCS: MCS 0 MCS 1
 MCS 2 MCS 3
 MCS 4 MCS 5
 MCS 6 MCS 7
 MCS 8 MCS 9
 MCS 10 MCS 11
 MCS 12 MCS 13
 MCS 14 MCS 15
 MCS 16 MCS 17
 MCS 18 MCS 19
 MCS 20 MCS 21
 MCS 22 MCS 23

HT Basic MCS: MCS 0 MCS 1
 MCS 2 MCS 3
 MCS 4 MCS 5
 MCS 6 MCS 7
 MCS 8 MCS 9
 MCS 10 MCS 11
 MCS 12 MCS 13

	Tx (dBm)	Rx (dBm)
6Mbit/s	31	-96
54MBit/s	28	-81
MCS0	30	-96
MCS7	27	-77
MCS9	22	-72

Data Rates

Modulation and coding schemes

MCS index	Spatial streams	Modulation type	Coding rate	Data rate (in Mbit/s) ^[a]			
				20 MHz channel		40 MHz channel	
				800 ns GI	400 ns GI	800 ns GI	400 ns GI
0	1	BPSK	1/2	6.5	7.2	13.5	15
1	1	QPSK	1/2	13	14.4	27	30
2	1	QPSK	3/4	19.5	21.7	40.5	45
3	1	16-QAM	1/2	26	28.9	54	60
4	1	16-QAM	3/4	39	43.3	81	90
5	1	64-QAM	2/3	52	57.8	108	120
6	1	64-QAM	3/4	58.5	65	121.5	135
7	1	64-QAM	5/6	65	72.2	135	150
8	2	BPSK	1/2	13	14.4	27	30
9	2	QPSK	1/2	26	28.9	54	60
10	2	QPSK	3/4	39	43.3	81	90

Country

- Memilih negara yang akan diaplikasikan regulasinya

Frequency Mode:

Country:

Frequency:

2412
2417
2422
2427
2432
2437
2442
2447
2452
2457
2462

Frequency Mode:

Country:

Frequency:

2412
2417
2422
2427
2432
2437
2442
2447
2452
2457
2462
2467
2472

Scan

- **Scan**, digunakan untuk melihat informasi AP yang sedang memancarkan sinyal.

Scanner (Running)

Interface: *wlan1*

Background Scan

Start

Stop

Close

Connect

New Window

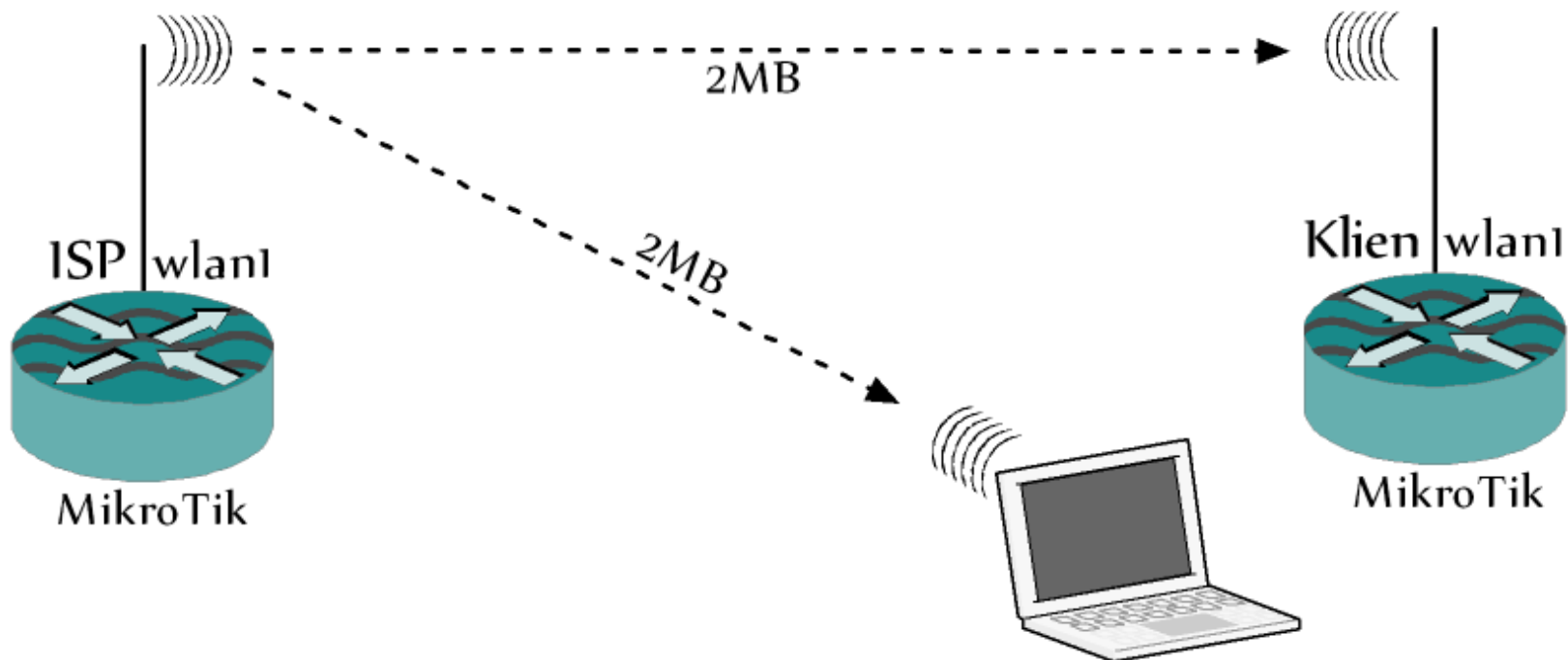
Address	SSID	Channel	Signal S...	Noise...	Signal To N...	Radio N...	RouterO...
00:0C:4...	MikroTik ISP	2437/20/gn	-25	-109		84 radio1-isp	6.38

Default AP Tx Rate

- **Default AP Tx Rate**, limitasi trafik dari AP ke setiap klien (MikroTik maupun non MikroTik).

Default AP Tx Rate: ▲ bps

Default Client Tx Rate: ▼ bps



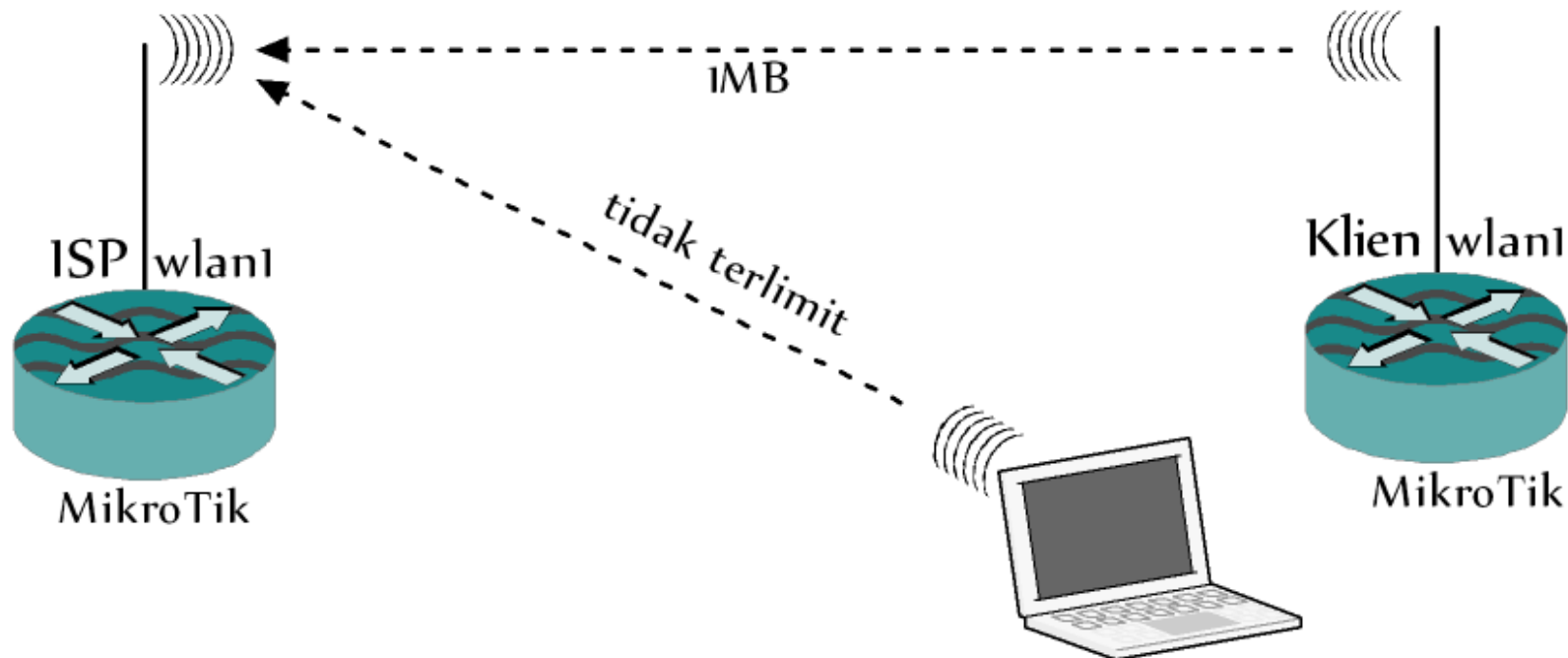
Default Client Tx Rate

- **Default Client Tx Rate**, limitasi trafik dari klien MikroTik ke AP MikroTik.

Default AP Tx Rate:

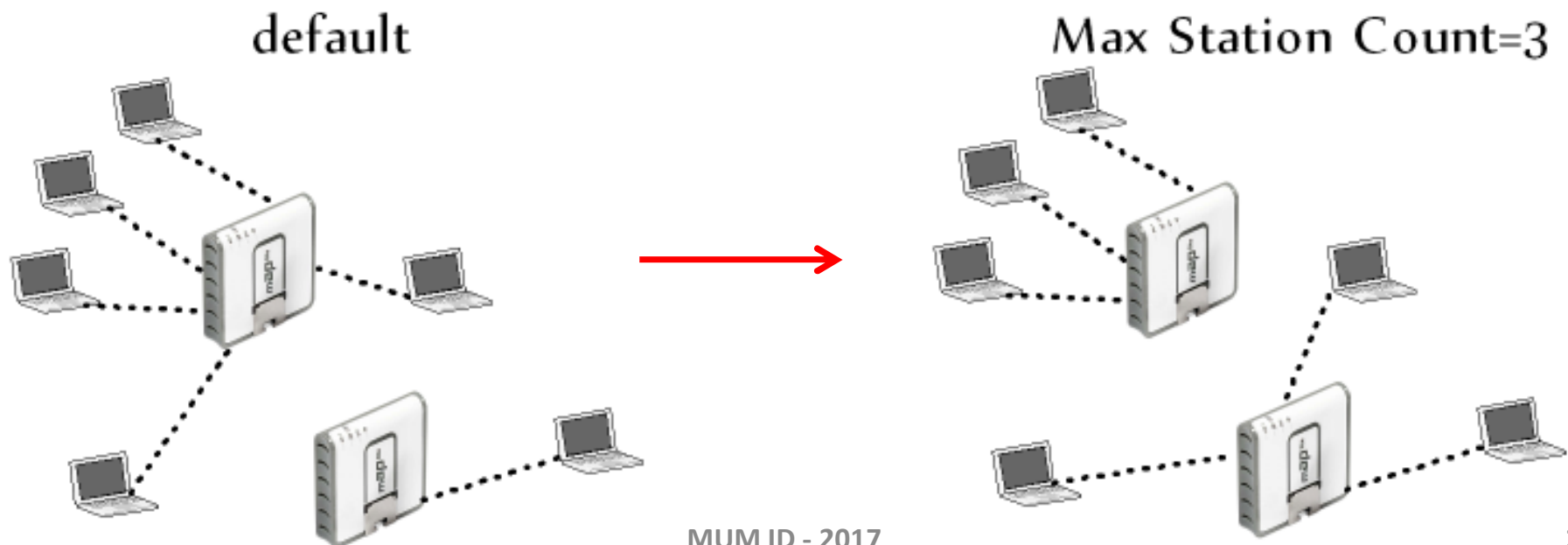
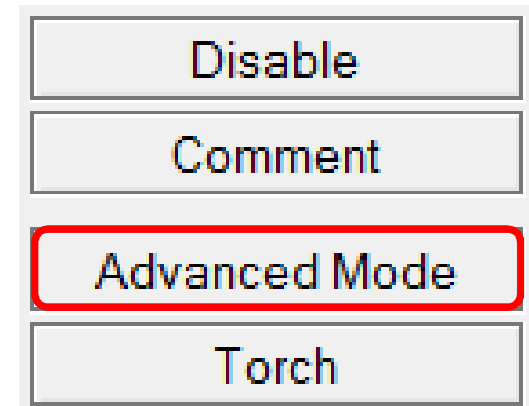
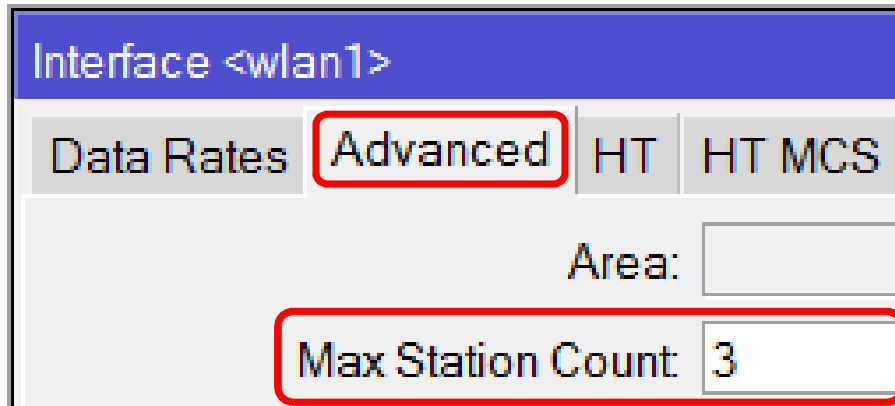
Default Client Tx Rate:

Pengaturan Default AP Tx Rate & Default Client Tx Rate hanya berfungsi di **Router AP**.



AP LOAD BALANCE

- **Max Station Count**, membatasi jumlah klien.



REGISTRATION

- Registration digunakan untuk menganalisa kualitas koneksi wireless.

Wireless Tables

Interfaces Nstreme Dual Access List **Registration** Connect List Security Profiles Channels

[-] [Filter] [Reset]

R...	MAC Address	Interface	Uptime	AP	W...	Tx/Rx Sign...	Tx Rate	Rx Rate
🔗	58:00:E3:89:BE:8D	wlan1	00:11:38	no	no	-64	72.2Mbps-20MHz/1S/SGL	72.2Mbps-20MHz/1S/SGL
🔗	94:E9:79:DE:74:DF	wlan1	00:10:53	no	no	-47	65Mbps-20MHz/1S	19.5Mbps-20MHz/1S
🔗	74:C6:3B:7F:E0:95	wlan1	00:10:38	no	no	-31	72.2Mbps-20MHz/1S/SGL	72.2Mbps-20MHz/1S/SGL
🔗	58:00:E3:89:C3:F5	wlan1	00:06:37	no	no	-38	72.2Mbps-20MHz/1S/SGL	19.5Mbps-20MHz/1S
🔗	58:00:E3:89:C3:6F	wlan1	00:06:20	no	no	-43	72.2Mbps-20MHz/1S/SGL	72.2Mbps-20MHz/1S/SGL
🔗	58:00:E3:89:BE:89	wlan1	00:06:15	no	no	-58	65Mbps-20MHz/1S/SGL	58.5Mbps-20MHz/1S
🔗	94:E9:79:DE:29:FD	wlan1	00:06:12	no	no	-41	72.2Mbps-20MHz/1S/SGL	52Mbps-20MHz/1S
🔗	58:00:E3:89:C3:CD	wlan1	00:06:06	no	no	-56	65Mbps-20MHz/1S/SGL	72.2Mbps-20MHz/1S/SGL
🔗	58:00:E3:89:BE:6F	wlan1	00:06:03	no	no	-49	65Mbps-20MHz/1S/SGL	72.2Mbps-20MHz/1S/SGL
🔗	58:00:E3:89:C3:E9	wlan1	00:06:01	no	no	-57	58.5Mbps-20MHz/1S	58.5Mbps-20MHz/1S
🔗	58:00:E3:89:BE:DF	wlan1	00:05:57	no	no	-53	65Mbps-20MHz/1S/SGL	72.2Mbps-20MHz/1S/SGL
🔗	94:E9:79:DE:2E:1D	wlan1	00:05:50	no	no	-52	72.2Mbps-20MHz/1S/SGL	72.2Mbps-20MHz/1S/SGL
🔗	58:00:E3:89:E0:A5	wlan1	00:05:41	no	no	-55	65Mbps-20MHz/1S/SGL	19.5Mbps-20MHz/1S
🔗	58:00:E3:89:C3:7D	wlan1	00:05:32	no	no	-53	65Mbps-20MHz/1S/SGL	52Mbps-20MHz/1S
🔗	58:00:E3:89:BE:5F	wlan1	00:05:25	no	no	-53	65Mbps-20MHz/1S/SGL	72.2Mbps-20MHz/1S/SGL
🔗	58:00:E3:89:BE:5D	wlan1	00:05:18	no	no	-59	72.2Mbps-20MHz/1S/SGL	52Mbps-20MHz/1S
🔗	58:00:E3:89:B6:03	wlan1	00:05:12	no	no	-53	72.2Mbps-20MHz/1S/SGL	52Mbps-20MHz/1S
🔗	58:00:E3:89:C9:29	wlan1	00:05:05	no	no	-48	72.2Mbps-20MHz/1S/SGL	72.2Mbps-20MHz/1S/SGL
🔗	58:00:E3:89:C3:9F	wlan1	00:04:53	no	no	-63	6Mbps	72.2Mbps-20MHz/1S/SGL
🔗	58:00:E3:89:C3:D7	wlan1	00:04:16	no	no	-46	72.2Mbps-20MHz/1S/SGL	72.2Mbps-20MHz/1S/SGL
🔗	34:36:3B:9F:12:39	wlan1	00:04:08	no	no	-57	65Mbps-20MHz/1S	65Mbps-20MHz/1S
🔗	94:E9:79:DE:2E:21	wlan1	00:03:29	no	no	-54	72.2Mbps-20MHz/1S/SGL	72.2Mbps-20MHz/1S/SGL
🔗	94:E9:79:DE:FB:7D	wlan1	00:03:12	no	no	-70	57.7Mbps-20MHz/1S/SGL	72.2Mbps-20MHz/1S/SGL
🔗	58:00:E3:89:C9:37	wlan1	00:01:30	no	no	-52	54Mbps	58.5Mbps-20MHz/1S
🔗	58:00:E3:89:C9:27	wlan1	00:01:21	no	no	-50	54Mbps	72.2Mbps-20MHz/1S/SGL
🔗	58:00:E3:89:C9:3B	wlan1	00:00:48	no	no	-52	72.2Mbps-20MHz/1S/SGL	52Mbps-20MHz/1S
🔗	58:00:E3:89:BE:57	wlan1	00:00:41	no	no	-58	48Mbps	39Mbps-20MHz/1S

REGISTRATION - SIGNAL TAB

- **TX Signal Strength**, sinyal yang diterima dari AP/Klien.
- **TX Signal Strength Ch0**, chain0 aktif
- **TX Signal Strength Ch1**, chain1 aktif
- **Signal to Noise**, signal - noise

AP Client <6C:3B:6B:FE:B5:31>

General 802.1x **Signal** Nstreme NV2

Last Activity: 1.020 s

Tx/Rx Signal Strength: -58/-61 dBm

Tx/Rx Signal Strength Ch0: -64/-68 dBm

Tx/Rx Signal Strength Ch1: -59/-62 dBm

Tx/Rx Signal Strength Ch2:

Signal To Noise: 40 dB

Tx/Rx CCQ: 80/82 %

The screenshot shows a network management interface for an AP Client. The 'Signal' tab is selected and highlighted with a red box. The interface displays various signal strength and quality metrics. A red box highlights the 'Signal To Noise' value of 40 dB, and another red box highlights the 'Tx/Rx Signal Strength' values for the main signal and channels 0, 1, and 2.

REGISTRATION - SIGNAL TAB

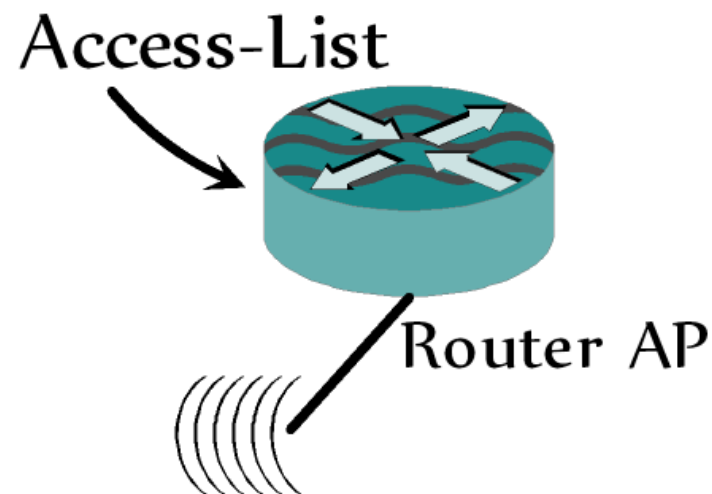
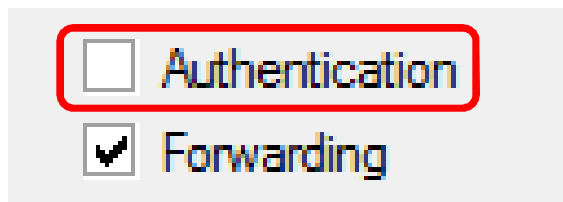
- **Client Connection Quality (CCQ), T Min / T Real,**
 - Tmin: waktu yang seharusnya untuk mentransmit
 - Treal: waktu senyatanya mentransmit

AP Client <6C:3B:6B:FE:B5:31>

General	802.1x	Signal	Nstreme	NV2
Last Activity:		1.020 s		
Tx/Rx Signal Strength:		-58/-61 dBm		
Tx/Rx Signal Strength Ch0:		-64/-68 dBm		
Tx/Rx Signal Strength Ch1:		-59/-62 dBm		
Tx/Rx Signal Strength Ch2:				
Signal To Noise:		40 dB		
Tx/Rx CCQ:		80/82 %		

Access List

- **Access-list**, digunakan Router AP untuk **menolak/ menerima** koneksi dari Router Klien/PC berdasarkan MAC Address.
- Jika MAC Address klien tidak terdaftar di Access-List, koneksi dari klien akan ditolak, atau meskipun terdaftar namun disable **Authentication**, koneksi dari klien tersebut ditolak.



Access List

Wireless Tables

Interfaces | Nstreme Dual | **Access List** | Regis

+ [] [] [] [] [] []

#	MAC Ad...	Interf...	Signal...	Authe...	Forwa
0	↔	wlan1	-75..120	yes	yes

AP Access Rule <00:00:00:00:00:00>

MAC Address: []

Interface: wlan1

Signal Strength Range: -75..120

MAC Address, MAC Address klien yang terdaftar.

Signal Strength Range, batas rentang sinyal yang boleh terkoneksi, jika ada diluar rentang sinyal maka koneksi tidak akan terjadi.

Default Authenticate

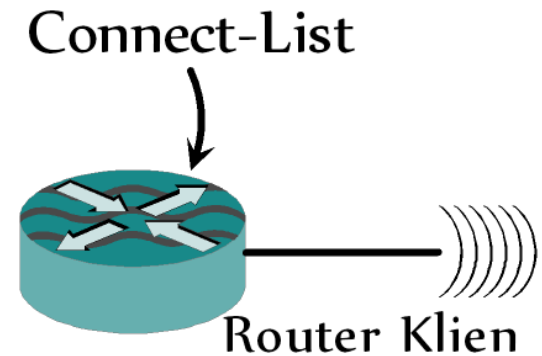
Default Forward

Hide SSID

Disable Default Authenticate di Interface wireless AP.

Connect List

- **Connect-List**, digunakan Router Klien untuk **mengijinkan/ melarang** koneksi ke Router AP berdasarkan MAC Address.
- Jika MAC Address Router AP tidak terdaftar di Connect-List, koneksi ke Router AP tidak diijinkan, atau meskipun terdaftar namun disable **Connect**, koneksi ke AP Router juga tidak diijinkan.



Station Connect Rule <00:0C:42:61:B8:08>

Interface: wlan1

MAC Address: 00:0C:42:61:B8:08

Connect

Interface <wlan1>

General Wireless Data Rates Advanc


Mode: station bridge

Default Authenticate

WPA

Wireless Tables

Interfaces | Nstreme Dual | Access List | Registration | Connect List | **Security Profiles** | Channels

+ 

Name	Mode	Authenticat...	Unicast Ci...	Group Ciph...	WPA Pre-Shar...	WPA2 Pre-Sh...
* default	none					
wpa_mikrotik	dynamic.k...	WPA PSK...	aes.ccm	aes.ccm	1234abcd	5678efgh

Security Profile <wpa_mikrotik>

General | RADIUS | EAP | Static Keys

Name: wpa_mikrotik

Mode: dynamic keys

Authentication Types: WPA PSK WPA2 PSK
 WPA EAP WPA2 EAP

Unicast Ciphers: aes.ccm tkip

Group Ciphers: aes.ccm tkip

WPA Pre-Shared Key: 1234abcd

WPA2 Pre-Shared Key: 5678efgh

Interface <wlan1>

General | **Wireless** | HT | HT MCS | WDS

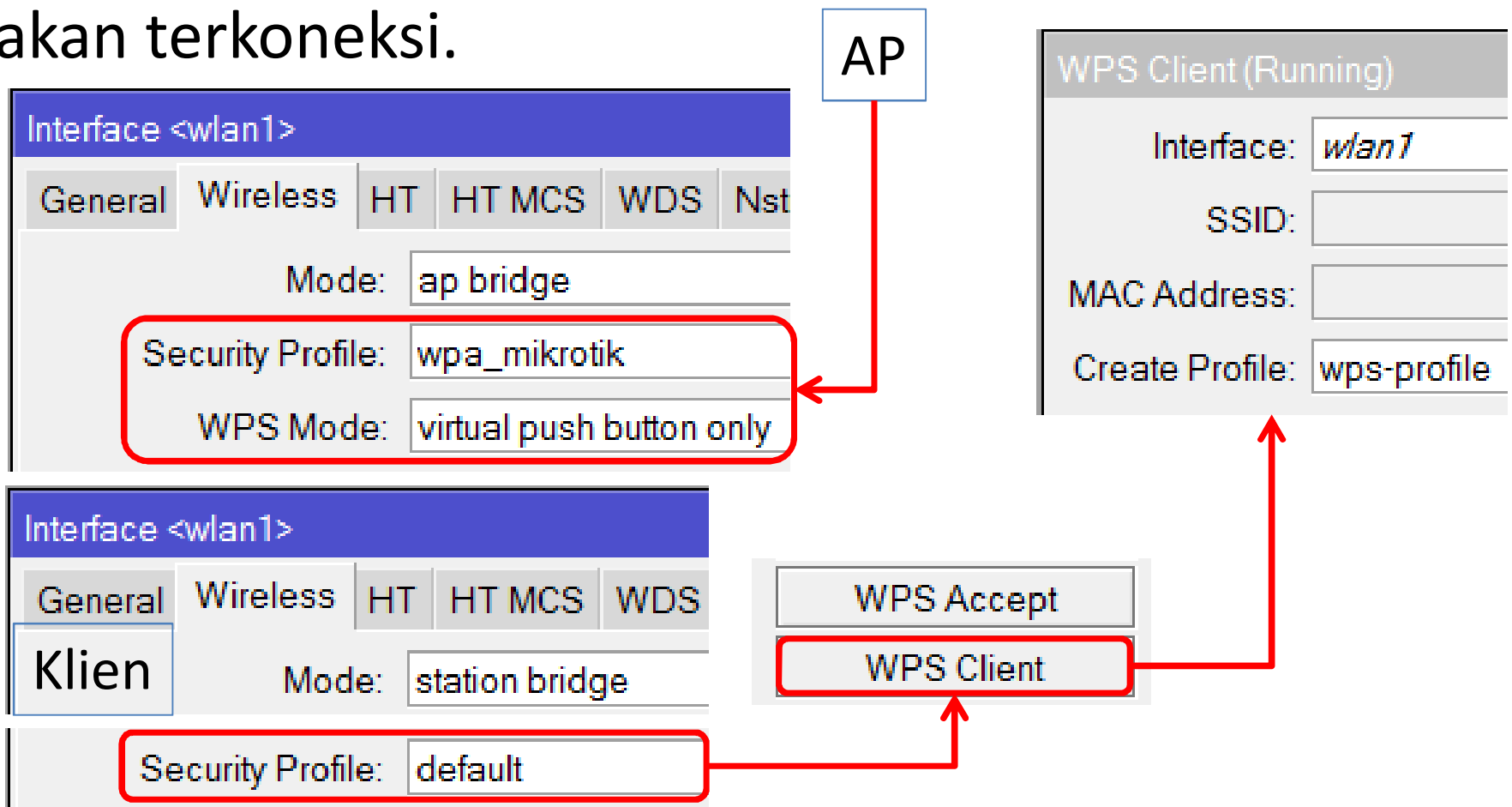
Mode: ap bridge

Security Profile: wpa_mikrotik

Default Authenticate
 Default Forward
 Hide SSID

WPS

- MikroTik mendukung pengamanan dengan WPS, WPS Accept di sisi AP ditekan setiap ada klien yang akan terkoneksi.



Wireless Repeater

- Satu interface wireless dapat digunakan sebagai:
 - a) Station dan virtual station.
 - b) Station dan virtual AP.
 - c) AP dan virtual station.
 - d) AP dan virtual AP (legacy).
- Band, Channel Width, Frekuensi & Wireless Protocol di interface virtual harus sama dengan interface induknya.

Wireless Repeater

- Background Scan, scan AP tanpa terputus

Scanner (Running)

Interface:

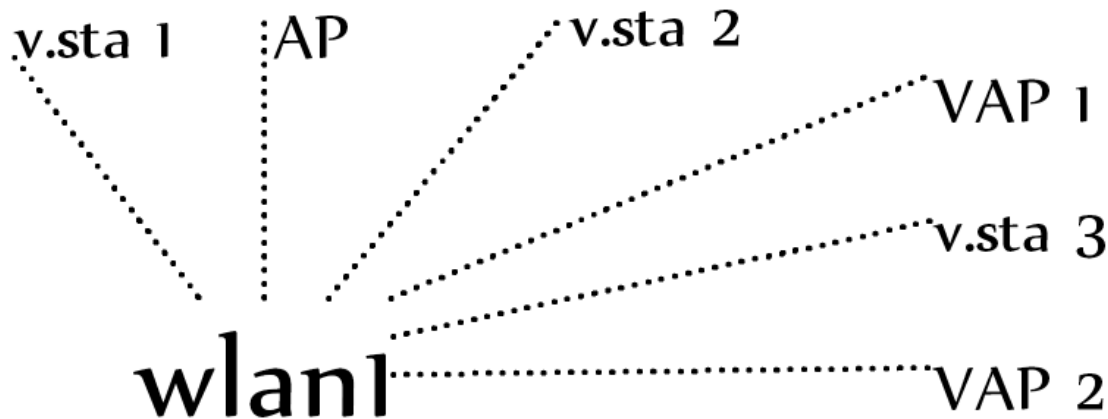
Background Scan

	Address	SSID	Chan...	Sign...	Noi...	Sign...	Radio Name	RouterOS Version
APRB	4C:5E:0C:6F:4...	MikroLine	2412/...	-61	0	0	4C5E0C6F4...	6.32.2

Terminal

```
84 74.125.130.100          56 45 56ms
85 74.125.130.100          56 45 57ms
86 74.125.130.100          56 45 57ms
87 74.125.130.100          56 45 57ms
88 74.125.130.100          56 45 57ms
89 74.125.130.100          56 45 57ms
90 74.125.130.100          56 45 56ms
91 74.125.130.100          56 45 57ms
92 74.125.130.100          56 45 56ms
93 74.125.130.100          56 45 56ms
94 74.125.130.100          56 45 57ms
```

Wireless Repeater



Wireless Tables

Wireless Tables											
Interfaces	Nstreme Dual	Access List	Registration	Connect List	Security Profiles	Channels					
+	-	✓	✗	📄	🔍	CAP	WPS Client	Scanner	Freq. Usage	Alignment	Wireless
	Name	Type	MAC Address	Mode	Band	Channel...	Freq...	SSID			
R	🔗 wlan1	Wireless...	4C:5E:0C:EE:AF:0B	ap bridge	2GHz-B/G/N	20MHz	2412	AP MikroLine			
R	🔗 wlan2	Virtual	4E:5E:0C:EE:AF:0C	station bridge				ISP1			
R	🔗 wlan3	Virtual	4E:5E:0C:EE:AF:0B	station bridge				ISP2			
R	🔗 wlan4	Virtual	4E:5E:0C:EE:AF:0D	station bridge				ISP3			
R	🔗 wlan5	Virtual	4E:5E:0C:EE:AF:0E	ap bridge				AP MikroTik			
R	🔗 wlan6	Virtual	4E:5E:0C:EE:AF:0F	ap bridge				AP Training			

Station & Virtual Station

Wireless Tables

Interfaces | Nstreme Dual | Ac

+ - ✓ ✗ ☰ 🔍

Virtual

WDS

Nstreme Dual

Wireless Tables

Interfaces | Nstreme Dual | Access List | Registration | Connect Lis

+ - ✓ ✗ ☰ 🔍 CAP WPS Client Setup Re

	Name	Mode	Band	Cha...	Fre...	SSID
R	wlan1	station brid...	2GHz-G/N	20M...	2442	AP-MM-A
R	wlan2	station brid...				AP-MM-B

Interface <wlan2>

General | **Wireless** | WDS | Status | Traffic

Mode: station bridge

SSID: AP-MM-B

Master Interface: wlan1

Security Profile: default

Station & Virtual AP

Wireless Tables

Interfaces Nstreme Dual Ac

+ - ✓ ✗ ☰ 🔍

Virtual

WDS

Nstreme Dual

Wireless Tables

Interfaces Nstreme Dual Access List Registration Connect List

+ - ✓ ✗ ☰ 🔍 CAP WPS Client Setup Re

	Name	Mode	Band	Cha...	Fre...	SSID
R	wlan1	station brid...	2GHz-B/...	20M...	2412	AP-Pusat
R	wlan2	ap bridge				AP-UKS

Interface <wlan2>

General Wireless WDS Status Traffic

Mode: ap bridge

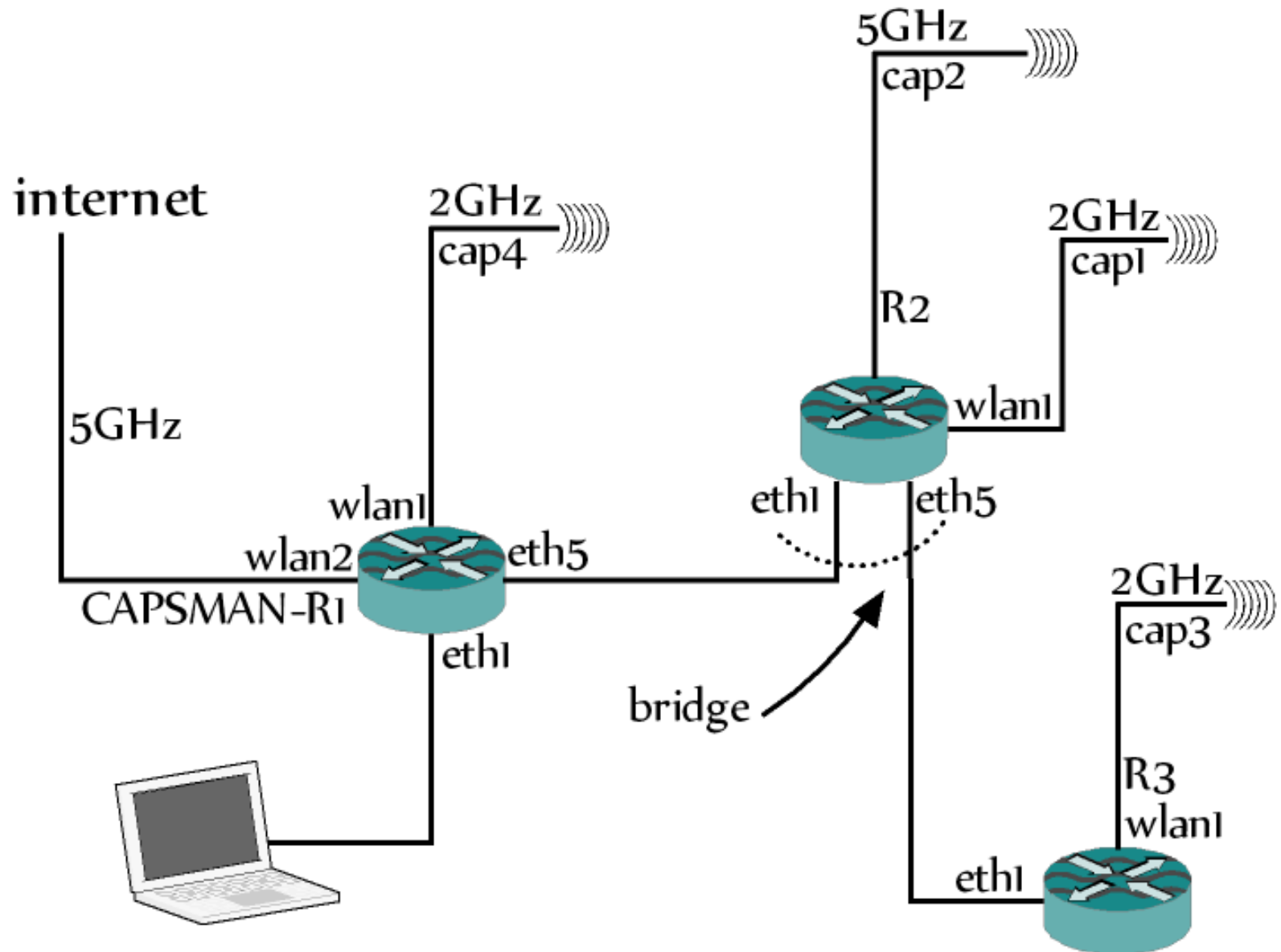
SSID: AP-UKS

Master Interface: wlan1

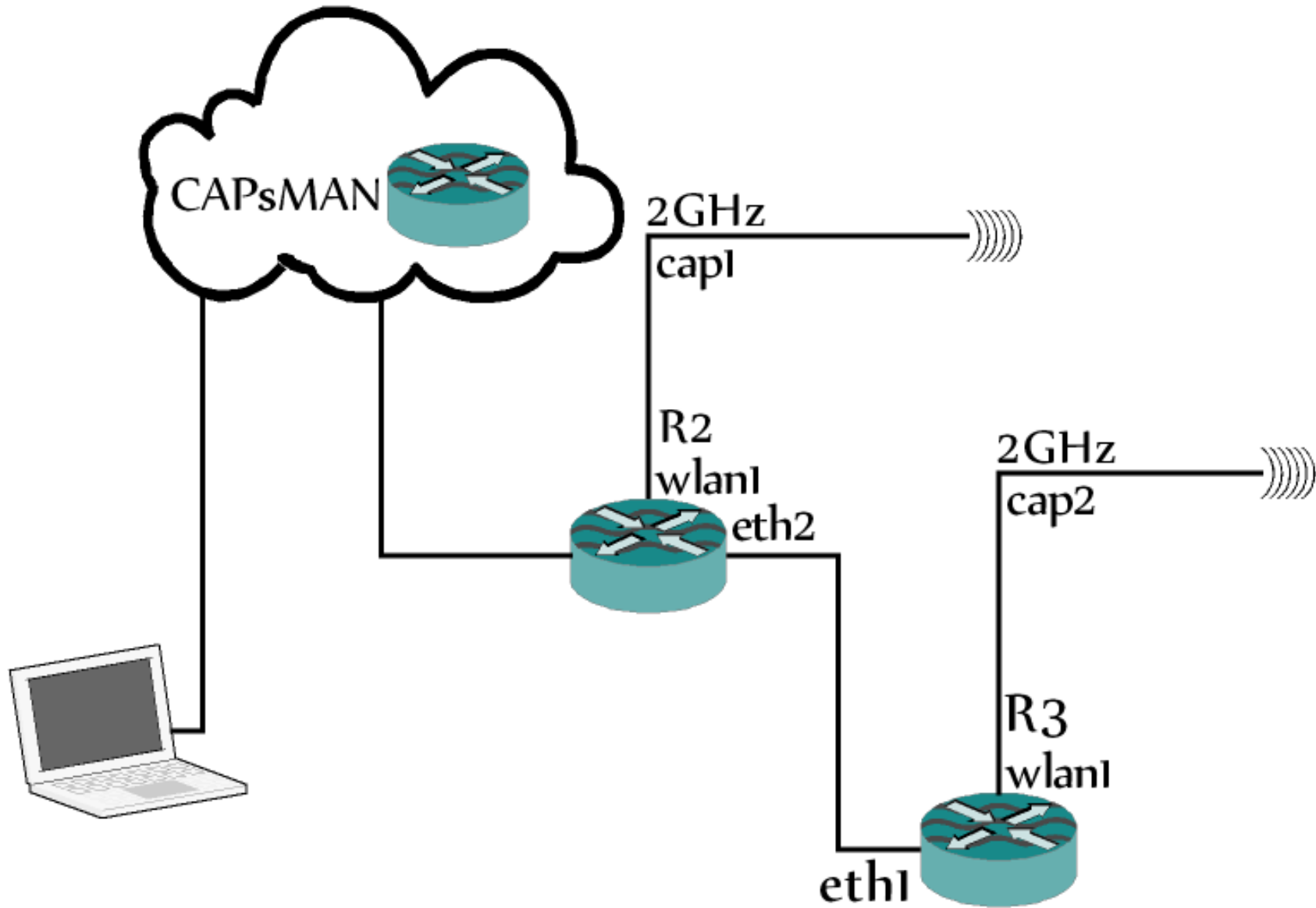
CAPsMAN

- CAPsMAN memungkinkan pengelolaan jaringan wireless (AP) yang terpusat, terdiri dari "CAP Manager" (CAPsMAN) dan sejumlah 'Controlled Access Points' (CAP).
- Koneksi CAP ke CAPsMAN dapat dilakukan dengan Layer 2 atau Layer 3

CAPsMAN (L2)



CAPsMAN (L3)



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