# **ConSEL PLUS – Configuration of ConSEL PLUS hardware and software**

# for Capacity Plus Multi-Site operation



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# 0. Basic assumptions for Capacity Plus (Capacity Plus Multi-Site) system design.

- The repeaters operate in **digital mode** (digital channel) in the **DMR** standard **with a purchased licence (for Capacity Plus Multi-Site operation -HKVN4063A).** Setting up the repeaters in analogue or mixed mode does not allow for network connectivity.
- The repeaters are connected to each other via an IP network. The IP network must have stable parameters, i.e. the resulting transmission delays must not exceed **90 ms** and must have a stable character. The manufacturer recommends that network fluctuations be less than 60 ms.
- One of the repeaters is defined as **Master repeater**, the others as **Peer** repeaters. The **Master repeater** requires **a static address in the IP network**. Repeaters defined as Peer can have an IP address assigned from a DHCP server.





# 1. Tasks of devices / applications in the system.

# **1.1.** Capacity Plus Multi-Site (CPMS) system devices.

Master: a repeater responsible for registering new repeaters/applications and notifying other repeaters/applications about changes in the network. After registering Peer devices or applications, the Master repeater distributes information about current participants to all network users. The Master repeater does not verify every transmission from Peers. Disconnecting the Master repeater from the network does not break up the established IPSC system.

# Note: Master repeater requires a STATIC IP ADDRESS.

• **Peer:** a repeater that retransmits audio and signals received from another site.

# 1.2. Applications running on Capacity Plus Single Site system

- RDAC (Repeater Diagnostics and Control): An application for system administration, allowing for monitoring (control) of operation of repeaters in the MOTOTRBO system. The RDAC software is seen as an additional repeater in the IP Site Connect system network.
- MNIS (MOTOTRBO Network Interface Service) is a Windows service application handling data between computer applications and MOTOTRBO radios. It is used on systems where Control Station cannot be used or is not needed. For IP Site Connect operation, repeaters used for data traffic require a NAI Data License.
- **DDMS** Device Discovery and Mobility Service (DDMS) is a Windows application running as a service (i.e. launches automatically on Windows startup and runs in the background). It processes presence and mobility information from radios in the MOTOTRBO radio system. If DDMS is implemented with MNIS, both radio presence (radio is there) and mobility notification (radio is present and where) are supported. The channel and site where the radio transmits the ARS message shall be recorded. MNIS subscribes to DDMS to receive mobility information and uses this information to route data to the radio, wherever it is in the system.
- **ConSEL PLUS** dispatcher application from **Aksel Sp. z o.o**.



SCONSEL PLUS

# 2. Structure of Capacity Plus Multi-Site (Linked Capacity Plus).

For repeaters operating in digital DMR mode, there are two time slots to use, based on which logical communication channels can be created. After uploading a license for CPMS system to repeaters, the repeater can operate with dynamic allocation of logical talk channels (time slots) and allows for connection between different geographical areas. A Capacity Plus Multi-Site system is a combination of IPSC and Capacity Plus Single Site systems.

Before configuring a CPMS system, it is recommended to read the following documents:

- Configuration of ConSEL PLUS hardware and software for IP Site Connect.
- Configuration of ConSEL PLUS hardware and software for Capacity Plus Single Site.

In a Capacity Plus Single Site system it is possible to connect up to 15 devices in one location / site, of which one is of **Master** type and the rest are of **Peer** type.

These 15 connected devices include:

- Disabled repeaters
- Enabled repeaters operating in analogue mode
- Enabled repeaters operating in digital mode
- Maximum of 5 RDAC application connections to the system
- Third-party applications (the application is seen by the

system as Peer)

Repeaters in a Capacity Plus Single Site system operate with a virtual dynamic rest channel. A rest channel is a virtual "token" toggled between available radio resources. After setting up a call for a specific conversation, the virtual "token" informs other radios about the radio channel on which the next radio call will be set up.







Figure 1 Capacity Plus Multi-Site system design.





# 3. Repeater configuration for Capacity Plus Single Site operation.

CPS and RM Configuration Client are Motorola's software applications for configuration of MotoTRBO devices.



Figure 2 CPS – repeater configuration software.

**CPS** is a software that allows you to configure repeaters and upload configurations via USB port. **RM Configuration Client** is a software that allows you to configure repeaters and upload configurations via USB and LAN.

Note: The first programming of the repeater must be carried out via USB port.

After reading the device, an SLR5000 repeater can be configured in both programs. When choosing to edit the configuration for a selected repeater in RM Configuration Client, a window opens identical to that for CPS configuration.

**3.1.** Reading the radio in CPS.



Figure 3 CPS – radio reading.

#### **3.2.** Reading the radio in RM.

The device you want to read must be added to the database with complete information.

# Figure 4 RM – radio reading.

Once a configuration has been created on the server, the selected configuration can be edited.





# **3.3. Editing the configuration.**



Figure 5 RM – editing configuration for selected device – select from icons



*Figure 6 RM – editing configuration for selected device – right-click selection.* 

When choosing to edit the configuration for a selected device in RM Configuration Client, a window opens identical to that for configuration in CPS.





# 4. Repeater Configuration for Capacity Plus Single Site operation

After reading the device in CPS or editing the configuration in RM, you need to verify that the repeater is enabled for Capacity Plus Single Site operation.



*Figure 7 Repeater settings for Capacity Plus Multi-Site – licence verification.* 

Next you can see the tabs that need to be configured for operation in Capacity Plus Multi-Site.

Set Cate	egorie	5	<b>₽</b>
-	J Co	nfiguration	
	Ħ	Device Information	
		General	
		General Settings	
		Accessories	
		Security	
		Network	
		Link Establishment	
		🗅 Sites	
		Talkgroups	
Ŧ	6	Zone/Channel Assignment	
		🗋 Zone	

*Figure 8 Repeater settings for Capacity Plus Multi-Site – necessary changes.* 





# 4.1. General settings.

	Radio Alias	CPMS Master	)
	Radio ID	1001	
	SIT (ms)	6000	8
	Group Call Hang Time (ms)	3000	
	Private Call Hang Time (ms)	4000	
	Emergency Call Hang Time (ms)	4000	8
	Call Hang Time (sec)	3	
	Repeat Gain (dB)	0.0	
	Antenna Relay Delay Timer (ms)	100	
	Digital/Band 1 TX Low Power (W)	1.0	
	Digital/Band 1 TX High Power (W)	1.0	
	Band 1 DC TX Power (W)	1.0	
	Disable All LEDs		
	Backup Repeater Connected		-
	Codeplug Password		•
○ CWID			
Wating			

*Figure 9 Repeater settings for Capacity Plus Multi Site – general settings.* 

Enter the following:

- Repeater/radio name: any description
- Repeater/Radio ID: to be placed outside the subscriber contact list
- Operating mode: working as a normal repeater.





# 4.2. Network settings.

	Radio IP	192.168.70.1	
	Accessory IP	192.168.70.2	
Radio Network			
	CAI Network	12	
	CAI Group Network	225	A)
Network Setting			
MOTOTREO & MTR3000 Repeater			
MOTOTRBO & MTR3000 Repeater	DHCP		
MOTOTRBO & MTR3000 Repeater	DHCP Ethernet IP	192.168.103.11	
MOTOTRBO & MTR3000 Repeater	DHCP Ethernet IP Gateway IP	192.168.103.11 192.168.103.1	

*Figure 10 Repeater settings for Capacity Plus Multi Site – network settings.* 

Radio's IP address as seen from the PC at the USB port.

It is necessary to define IP addresses for repeaters from the network side.

Master repeaters must have static IP addresses.

Peer repeaters may have DHCP settings.

If repeaters are to be reprogrammed via the IP network, it is necessary to enable the IP Repeater Programming option.





# 4.3. Connection setup

	Network Setting	ite Connect Capacity Plus	
Network Setting			
	Link Type	Master	
	Authentication Key		
	Master IP	192.168.103.11	
	Master UDP Port	50031	
	UDP Port	50031	
	Peer Firewall Open Timer (sec)	6	
IP Site Connect			
	Beacon Duration (ms)	4320	
	Beacon Interval (sec)	60	
Capacity Plus			
	Site ID	1	
	Site Alias	Site 1	
	Beacon Duration (ms)	180	
	Beacon Interval (ms)	1920	
	Rest Channel/Site IP	192.168.103.10	
	Rest Channel/Site UDP Port	55039	

*Figure 11 Settings for Capacity Plus Multi-Site operation – connection setup – settings for Master repeater.* 

Define the repeater's function in the system: Master/Peer.

In each repeater to operate in the Capacity Plus Single Site system, you can enter the authentication key for logging on to the Master device (the key provides a type of device authentication).

By default, Peer devices communicate with the Master via port **50000**. In the IPSC system, the Master's UDP port number is port **50000** for connection setup – notification to the Master and registration.

The operating port of the Master repeater can have any number; when changing it, remember to enter the port number correctly in Peer devices.

In the Capacity Plus tab, define the rest channel ("virtual token") parameters as IP / port for Site. For all repeaters in the system, enter the same parameters for the rest channel at a given Site. (Different parameters for different Sites).

Note: The IP of the rest channel must be from the same subnet as the physical repeater interface from the network side.





	Network Setting IP Sit	e Connect Capacity Plus	
Network Setting			
	Link Type	Peer	
	Authentication Key		
	Master IP	192.168.103.11	
	Master UDP Port	50031	8
	UDP Port	50041	
	Peer Firewall Open Timer (sec)	6	
IP Site Connect			
	Beacon Duration (ms)	4320	
	Beacon Interval (sec)	60	
Capacity Plus			
	Site ID	2	
	Site Alias	Site 2	
	Beacon Duration (ms)	180	
	Beacon interval (ms)	4800	
	Rest Channel/Site IP	192.168.104.10	
	Rest Channel/Site UDP Port	50049	0
			U

*Figure 12 Settings for Capacity Plus Multi-Site operation – connection setup – settings for Peer repeater.* 





# 4.4. Channel zone assignment.

Under Zone / Channel Assignment tab, add a channel working in Capacity Plus Multi Site system and edit it.



Figure 13 Repeater settings for Capacity Plus Multi Site – zone – representation of channels in a table.

Once a zone is selected, you can add (+) a channel: Audio Capacity Plus (Linked)

Specify the Preference Level (1 is the highest preference level) to determine channel priority.

Specify the channel ID of the slot, reflecting the number of repeaters in the sites, with subsequent odd values up to: 2\*(number of repeaters) -1.

For the radio channel, specify the RX/TX operating frequencies and the colour code.





# 4.5. Locations / Sites

				G	eneral				
General									
			Max	Number of Sites	15				
Sites	List Items								
1	$\bullet \circ \circ$								
	Site ID	Reserved Wide Area Channels	Neighbor 1	Neighbor 2	Neighbor 3	Neighbor 4	Neighbor 5	Neighbor 6	
	Site ID 1	Reserved Wide Area Channels 0	Neighbor 1 2	Neighbor 2 3	Neighbor 3 Non	Neighbor 4 None	Neighbor 5 None	Neighbor 6 None	
	Site ID 1 2	Reserved Wide Area Channels 0 0	Neighbor 1 2 1	Neighbor 2 3 3	Neighbor 3 Non Non	Neighbor 4 None None	Neighbor 5 None None	Neighbor 6 None None	
	Site ID 1 2 3	Reserved Wide Area Channels 0 0 0 0	Neighbor 1 2 1	Neighbor 2 3 3 2	Neighbor 3 Non Non	Neighbor 4 None None None	Neighbor 5 None None	Neighbor 6 None None None	

*Figure 14 Repeater settings for Capacity Plus Multi Site – locations/sites.* 

Depending on the number of sites in the Capacity Plus Multi-Site system, a map of adjacent sites should be defined in the Master repeater.

When Capacity Plus Multi-Site requires retransmission of talkgroups in a wide area, a number of channels can be reserved for the wide area.

# 4.6. Talkgroups.

			All Wide Are	a Talkgroups 🗌			
Talkg	roups List Items						
	⊕ ⊝ ⊙	)					
	Call ID	Site 1	Site 2	Site 3	S c 4	Site 5	Site 6
2	10	<b>v</b>	<b>v</b>	~			
			<ul> <li>Image: A set of the set of the</li></ul>				
P.	20	*					
	20 30		✓	<b>~</b>			

Figure 15 Repeater settings for Capacity Plus Multi Site – Talkgroups.

In the Talkgroups tab, you can define which talkgroups are to be retransmitted to which sites.

You can select to have all talkgroups retransmitted by all sites.





# 5. Configuration of subscriber radios for Capacity Plus Multi Site

In CPS, in the General/General settings tab, enter the subscriber radio ID according to the acquired contact list.

In CPS under the General/Network tab, set the network parameters and communication ports for the service.



Figure 16 Subscriber radio settings (Capacity Plus Multi-Site) – network settings.

In the Radio Networks tab, disable computer data transfer.

In the ARS ID Services tab, enter the ID of the managed base radio.

For the subscriber radio in the CPS, similarly to the managed base radio, enter the parameters for: contacts, receive lists, Capacity Plus System Lists according to the template presented earlier.

In the Capacity Plus Personality tab, modify the setting for ARS sending.



Figure 17 Subscriber radio settings (Capacity Plus Multi-Site) – personality settings.



# 6. SCK Client configuration – working with NAI protocols.

The use of NAI protocols in ConSEL PLUS software requires the purchase of a licence in the form of a HASP hardware key.

It is necessary to activate the licence in the repeaters:

NAI Voice HKVN4211A

NAI Data HKVN4212A

Radioserver configuration - registry	Х
Status General Modules Advanced Remote License	
List of modules:	
Linked Capacity + (04) V Remove module Add new Disable mo	dule
Module type:	
MotoTRBO NAI Module 🗸	
Module options:	
Basic Features Advanced Privacy Rep.pos. Rec. outside	
Radio system Master IP Address Port Local port	
O IPSC 192.168.103.11 50031	
CP Peer ID Authent Key	
CP MultiSite     9998	
MNIS mode: O direct connection	
ARS mode: 🔿 Auto 💿 Manual	
Port Host Port	
Lexiting 14001	
Location 14001	1
GOB 4004/4444 O independer	1
Telemetry 14008 14007	
Inter-module settings:  Turn on routing Routing configuration	
Shared resource settings for NAI modules (MNIS tunnel type)	_
Text port 4007 AMBE ports auto	
Save configuration	

Figure 18 ConSEL PLUS settings – radio server for NAI (Capacity Plus Multi-Site).

In the Modules tab, add a new module under a new name (Linked Capacity Plus) or use the default basic module.

Once the module has been added, set the module type as MotoTRBO NAI.

Specify in which radio system the module will work – select CP Multi Site.

For the selected system, enter:

- address of the Master repeater working in Capacity Plus.
- port on which the Master communicates
- ID with which the SCK Client is to work
- authenticate the key





The ConSEL PLUS SCK Client software is based on AMBE software audio codecs.

After entering these parameters, Save the settings and restart the service.

After restarting the service, the Status tab shows successful connection of the service to the Master repeater.

Radioserver configuration - registry		×
Status General Modules Advanced	Remote License	
Status from: 08:53:43	Error console	Client stopping
Configuration server		
ok ok		
Maps server		
🔵 ok 📃 Maps: ok		
Events server		
ok ok		
Modules		
Linked Capacity + (mod04) - MotoTRBC	D NAI Module (CPM)	
Connected to the system, site:2 - 1	peer(s), site:1 - 1 peer	r(s), 3 apps
Save	configuration	

Figure 19 ConSEL PLUS Status – radio server for NAI (Capacity Plus Multi-Site).





# 7. ConSEL PLUS console configuration – operation with NAI protocols.

When using NAI protocols and direct connection of the radio server to the repeater. A software defined (virtual) radio can be connected to a single repeater in the ConSEL PLUS system client. In the ConSEL PLUS system client, select: Side menu/Administration/Radio Consoles Configuration Select Add Radio Module to create the first virtual radio.

Select the module operation as console.

- Enter:
  - Radio server address network address of the computer on which the radio server is running (local address 127.0.0.1 in case of installation of radio server and console on the same computer).
  - SckClient module number use the α icon to read the available radio server modules and select the module for the configured radio network from the list of radio communication modules running on the radio server – the basic module is selected by default.
  - Playback device from the list of available devices in the system, select the device that will play back the voice communications on the console.
  - Recording device select the device to act as a microphone from the list of available devices in the system
  - Module Type: NAI CP(M)





Basic configuration:	Radio console	Add a radioserver module
Linked Cap+ GR20	Module name:	
172.30.5.127	Radioserver address	Remove the radioserver module
4 ~	SckClient module No. ರ	Remove all modules
Speakers (Realtek High Definiti 🛛 🗸	Playing device	Import from CSV/
Stereo Mix (Realtek High Defini 🛛 🗸	Recording device	import nom cov
~	External PTT	Export to CSV
~	Pressing PTT	Save changes
	Exclusion modules	Save thanges
Module type:		
○ MotoTRBO ○ NAI IPSite ●	NAI CP (M) ONAI SFR OIPSite	
○ Analog ○ RActivity ○	Tetra	
Requests handling:		
Voice call	Module with outputs control	
Position reporting, diagnostics and	telemetry Global intercom recorder	
Sending message		Channel dictionaries editors
Disable contacts activity from online		External PTTs config

Figure 20 ConSEL PLUS radio console settings for NAI (Capacity Plus Multi-Site).

For the virtual radio created in the NAI tabs, you need to enter:

- ID of virtual base radio
- Default receive and transmit talkgroups

# Figure 21 ConSEL PLUS radio console settings for NAI (Capacity Plus Multi-Site).

Select Add Radio Module to create another virtual radio and enter the same data as for the first virtual radio.

In the ConSEL PLUS software for Capacity Plus Multi Site you can create the required number of call groups for local and global calls.





🏈 Ko	nfiguracja modułów radioserwerów		- 🗆 X			
vowe	Konfiguracja podstawowa: 3	Konsola Rejestrator Dane	Dodaj moduł radioserwera			
dstav	Capacity Plus Multi Site GR30	Nazwa modułu				
Pod	172.30.5.127	Adres radioserwera	Usuń moduł radioserwera			
NA	1	v Nr modułu SckClient ت	Usuń wszystkie moduły			
tkowe	Speakers (Realtek High Definiti	Urządzenie odtwarzające				
	Microphone Array (Realtek High	Urządzenie nagrywające	Importuj z CSV			
Doda		Zewnętrzny PTT	Exportuj do CSV			
		Sygnalizacja naciśnięcia PTT	Zapisz zmiany			
		Moduły wykluczające				
	Typ modułu:					
	O MotoTRBO O NAI IPSite	NAI CP(M) ONAI SFR OIPSite				
	○ Analog ○ RActivity ○	) Tetra				
	Obsługa żądań:					
	Połączenie głosowe	Moduł z obsługą sterowania				
	🗌 Raportowanie pozycji, diagnostyka	i telemetria 🗌 Rejestrator globalnego interkomu				
	Wysyłanie wiadomości		Konfiguracja słowników kanałów			
	Wyłącz aktywność kontaktów z onli	Konfiguracja zewn. PTT				
Ē	1 2 3					

Figure 22 Multiple ConSEL PLUS radio consoles settings for NAI (Capacity Plus Multi-Site).

adio window Link ap + GR 10	ed Radio window Linked Cap+ GR20	Radio window Linked Cap+ GR 30							
NAI CP (M)	NAI CP (M)	NALCP (M)							
Radio panel			- 1	X Radio panel		* E X	Radio panel		
342 2	🎾 🌒 🔰 Linked Cap	p + GR 10 🥘	)	<b>342</b>	Linked Cap+ GR20	•	142 2	2	
100 Serwis	id.999			100 Serwis	n ist 999		100 Serwis	id:999	
102 Serwis	Group: 10		PTT	102 Serwis	Group: 20	PTT	102 Serwis	Group: 30	
104 Serwis 110011	Group. To			104 Serwis	Group: 20		104 Serwis	Group. St	
200 Dyspozytor				200 Dyspozytor			200 Dyspozytor		
283 Autobus				283 Autobus			283 Autobus		
284 Autobus				284 Autobus			284 Autobus		
285 Autobus	Ste 1 Ste 2 Apps			285 Autobus	Site 1 Site 2 Apps		285 Autobus	Ste 1 Ste 2 A	
286 Autobus				286 Autobus		<u> </u>	286 Autobus	-	
293 Autobus	See Call P	history		293 Autobus	and Call history		293 Autobus	88	
297 Autobus				297 Autobus		<u></u>	297 Autobus		
299 Autobus				299 Autobus			299 Autobus		
300 Autobus				300 Autobus			300 Autobus		
301 Autobus				301 Autobus			301 Autobus		
302 Autobus				302 Autobus			302 Autobus		
303 Autobus				303 Autobus			303 Autobus		
304 Autobus				304 Autobus			304 Autobus		
305 Autobus				305 Autobus			305 Autobus		
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307 Autobus				307 Autobus			307 Autobus		
308 Autobus				308 Autobus			308 Autobus		
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Figure 23 Multiple ConSEL PLUS radio consoles settings for NAI (Capacity Plus Multi-Site).