SNIFFER & TREEVIEW

Monitoring and analyzing
RF G5 SYSTEMS
Quick User manual

GOLDTEC
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1 INTRODUCTION:

The Treeview is a PC software that enables analyzing and monitoring RF G5 Systems. The Treeview can read, display, and record the communication between the Master and RTUs over the air.

The Treeview software describes the arrangement of the RTUs in the RF G5 system, their Address, and the association between the RTUs to Routers or to the Master unit.

The arrangement is described as a hierarchical view of information with branches and nodes visualized by a list.

The Treeview PC software can run on a Sniffer hardware, on a Master unit, or on any RTU RF G5 in the field such as RTU RF G5 ECO, RTU RF G5 Modular, RTU RF G5 4 ANA, and RTU RF G5 SDI).

During the installation, the Treeview can be used to find the best location of an RTU to receive maximum RSSI.

Also, it can be used in an existing radio system for troubleshooting.

Read on for detailed descriptions and examples.

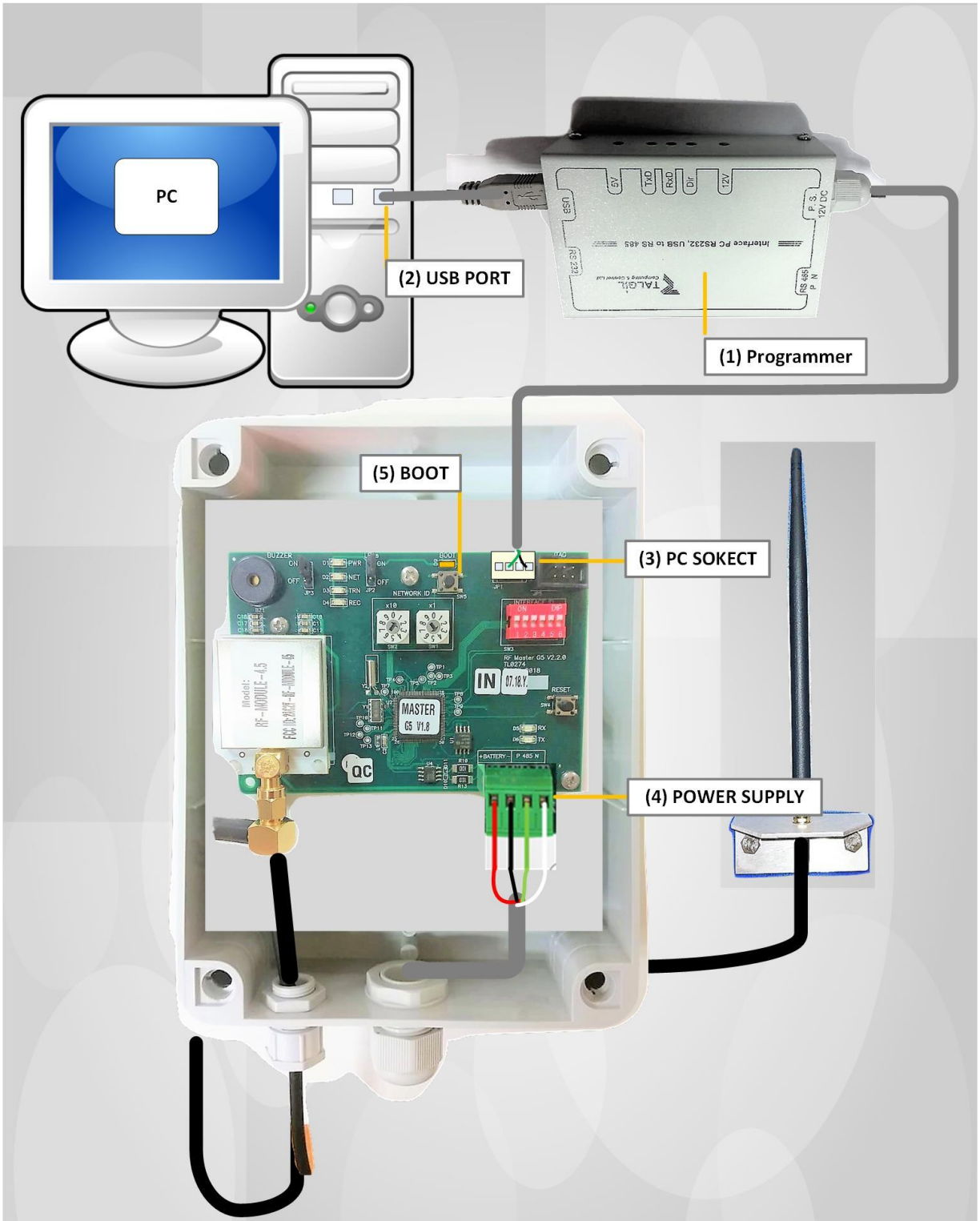


Image 1- Running the TREEVIEW PC software on the MASTER unit

2 RUN THE TREEVIEW PC SOFTWARE ON THE MASTER UNIT.

1. To start, Connect a **Programmer** device **(Pointer 1 Image 1)** to a **USB PORT (2)** on your PC and to the **PC Socket (3)** on the **Master unit** board.
2. Connect the **Power supply (4)** plug to the **Master unit** board.
3. Press and hold the **BOOT (5)** button for 2 seconds. The BOOT led should turn on.
4. Start the **TREEVIEW** software. If you do not have it, download it here:
   (https://drive.google.com/drive/folders/1OUWf04dw7EEsFPFOAmfFBZ1EJExaMkrT?usp=sharing)
   On the **DATA source**, select **Use Realtime data (Pointer 1 image 2)**. Select the **Communication Method: RS232 (2)**, Select the **Communication port (3).**
   Select and **Baud rate 115200 (4).**

To identify the **USB SERIAL PORT,** right-click on **My PC** and select **Properties->Device manager->Ports (Com & LPT).**

5. To start monitoring a specific Radio system, click **Start connection**.
6. The results will appear in the **Topology** screen as described in **Image 3**.

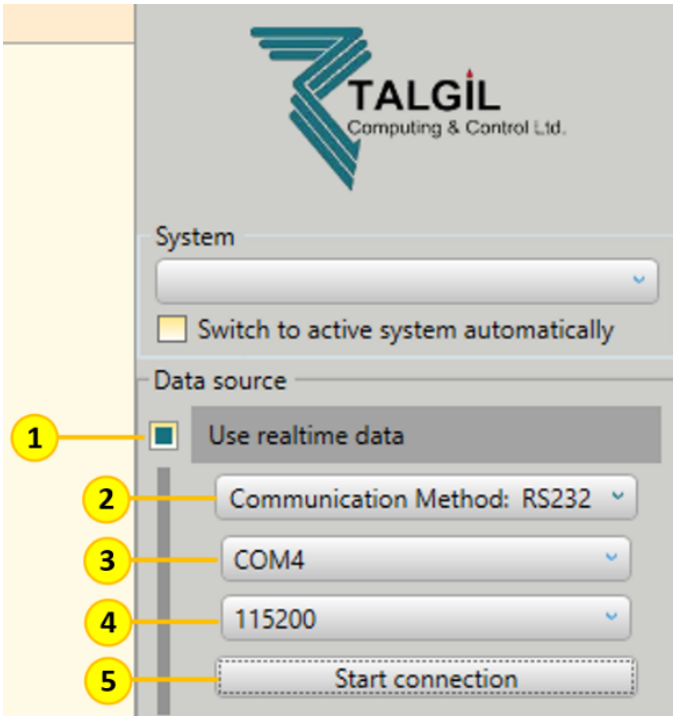
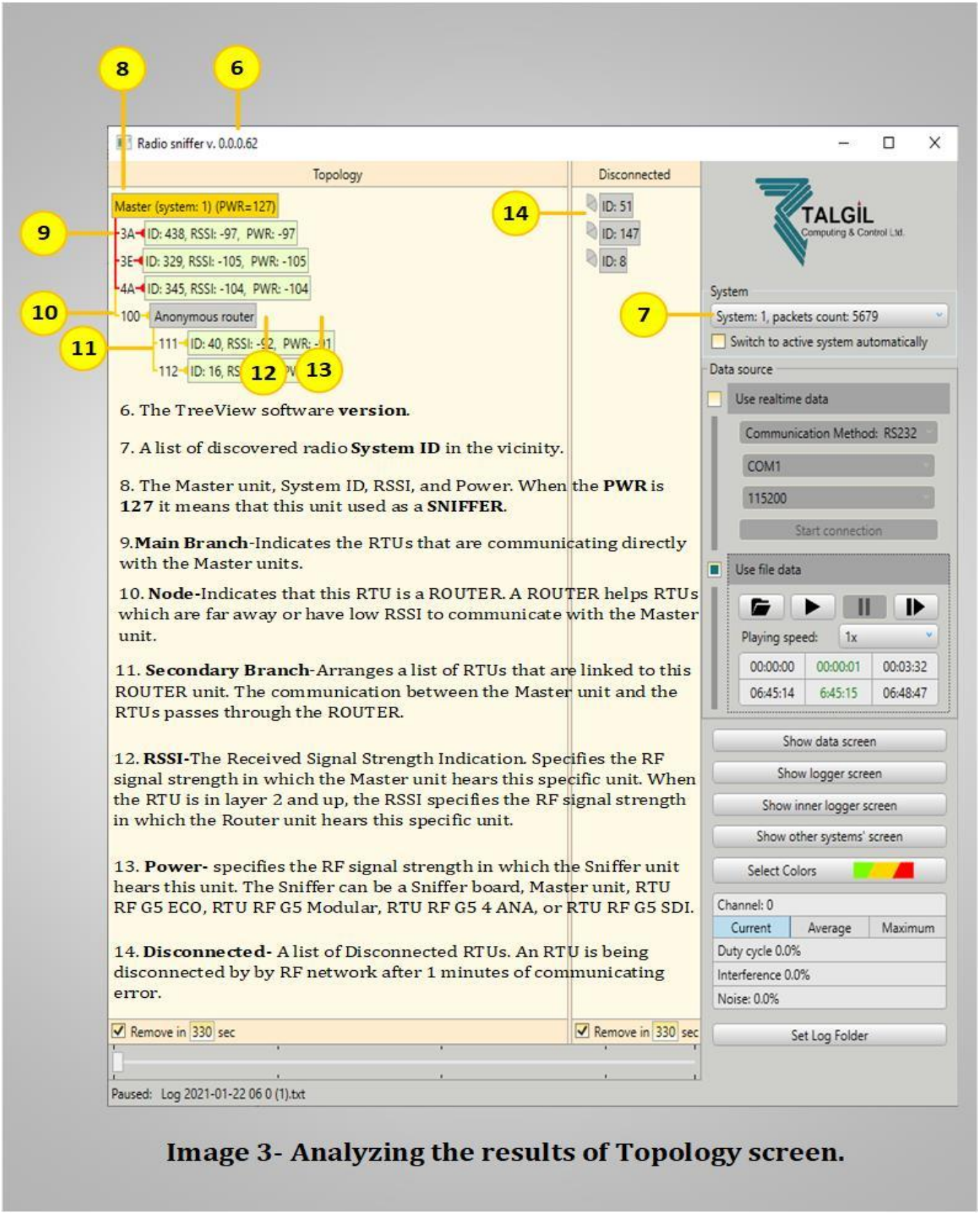


Image 2- DATA source in the Treeview software



6. The TreeView software **version**.

7. A list of discovered radio **System ID** in the vicinity.

8. The Master unit, System ID, RSSI, and Power. When the **PWR** is **127** it means that this unit used as a **SNIFFER**.

9.**Main Branch**-Indicates the RTUs that are communicating directly with the Master units.

10. **Node-**Indicates that this RTU is a ROUTER. A ROUTER helps RTUs which are far away or have low RSSI to communicate with the Master unit.

11. **Secondary Branch**-Arranges a list of RTUs that are linked to this ROUTER unit. The communication between the Master unit and the RTUs passes through the ROUTER.

12. **RSSI-**The Received Signal Strength Indication. Specifies the RF signal strength in which the Master unit hears this specific unit. When the RTU is in layer 2 and up, the RSSI specifies the RF signal strength in which the Router unit hears this specific unit.

13. **Power-** specifies the RF signal strength in which the Sniffer unit hears this unit. The Sniffer can be a Sniffer board, Master unit, RTU RF G5 ECO, RTU RF G5 Modular, RTU RF G5 4 ANA, or RTU RF G5 SDI.

14. **Disconnected-** A list of Disconnected RTUs. An RTU is being disconnected by by RF network after 1 minutes of communicating error.

Image 3- Analyzing the results of Topology screen.

Run the Treeview PC software on RTU RF ECO G5

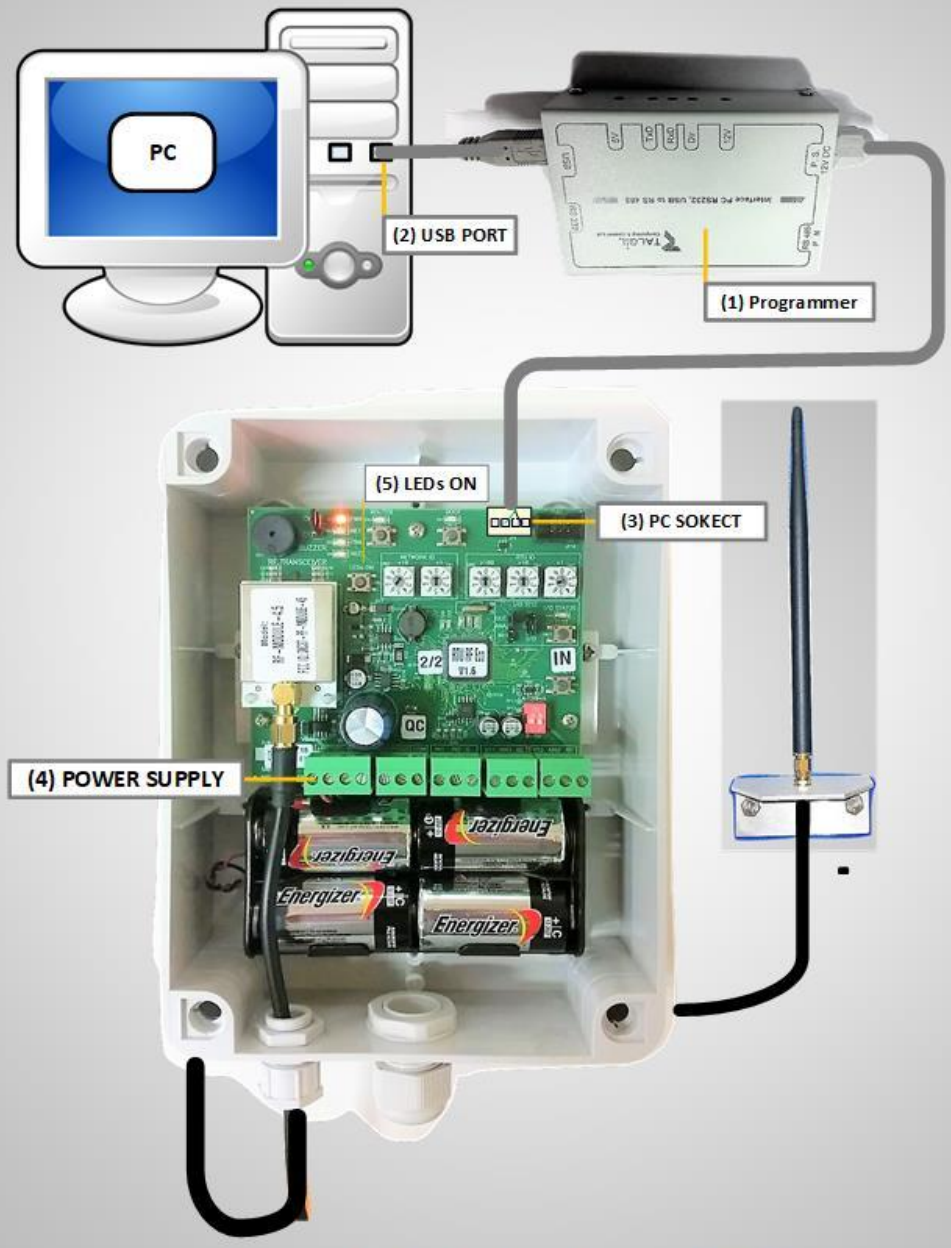


Image 4- Running the TreeView PC software on RTU RF G5 ECO

3 RUN THE TREEVIEW PC SOFTWARE ON RTU RF G5 ECO.

To run the **Treeview** PC software on **RTU RF G5 ECO**, follow the instructions below:

1. Connect a **Programmer** device **(Pointer 1 Image 4)** to a **USB PORT (2)** on your **PC** and to the **PC Socket (3)** on the **RTU RF ECO** board.
2. Connect the **Power supply (4)** plug to the **RTU RF ECO** board.
3. Press the **LEDs ON** button. The **POWER** and **NET** LEDs will turn on.
4. Turn on the **ROUTER** mode. To identify if the RTU mode is RTU or ROUTER, Press the LEDs ON button (Step 3) If the **ROUTER LED is** on, the RTU mode is ROUTER.

IF the ROUTER LED is OFF, the RTU mode is RTU. To turn ON or to Turn OFF a ROUTER mode, press the LEDs ON button then press the ROUTER button.

5. Start the **TREEVIEW** software. If you do not have it, download it here: https://drive.google.com/drive/folders/1OUWf04dw7EEsFPFOAmfFBZ1EJExaMkrT?usp=sharing
6. On the **DATA source**, select **Use Realtime data (Pointer 1 image 2)**. Select the **Communication Method: RS232 (2)**, Select the **Communication port (3),** and **Baud rate 115200 (4).**

To identify the **USB SERIAL PORT,** right-click on **My PC** and select **Properties->Device manager->Ports (Com & LPT).**

7. To start monitoring a specific Radio system, click **Start connection**.
8. The results will appear in the **Topology** screen as described in **Image 3**.

Run the Treeview on RTU RF G5 Modular

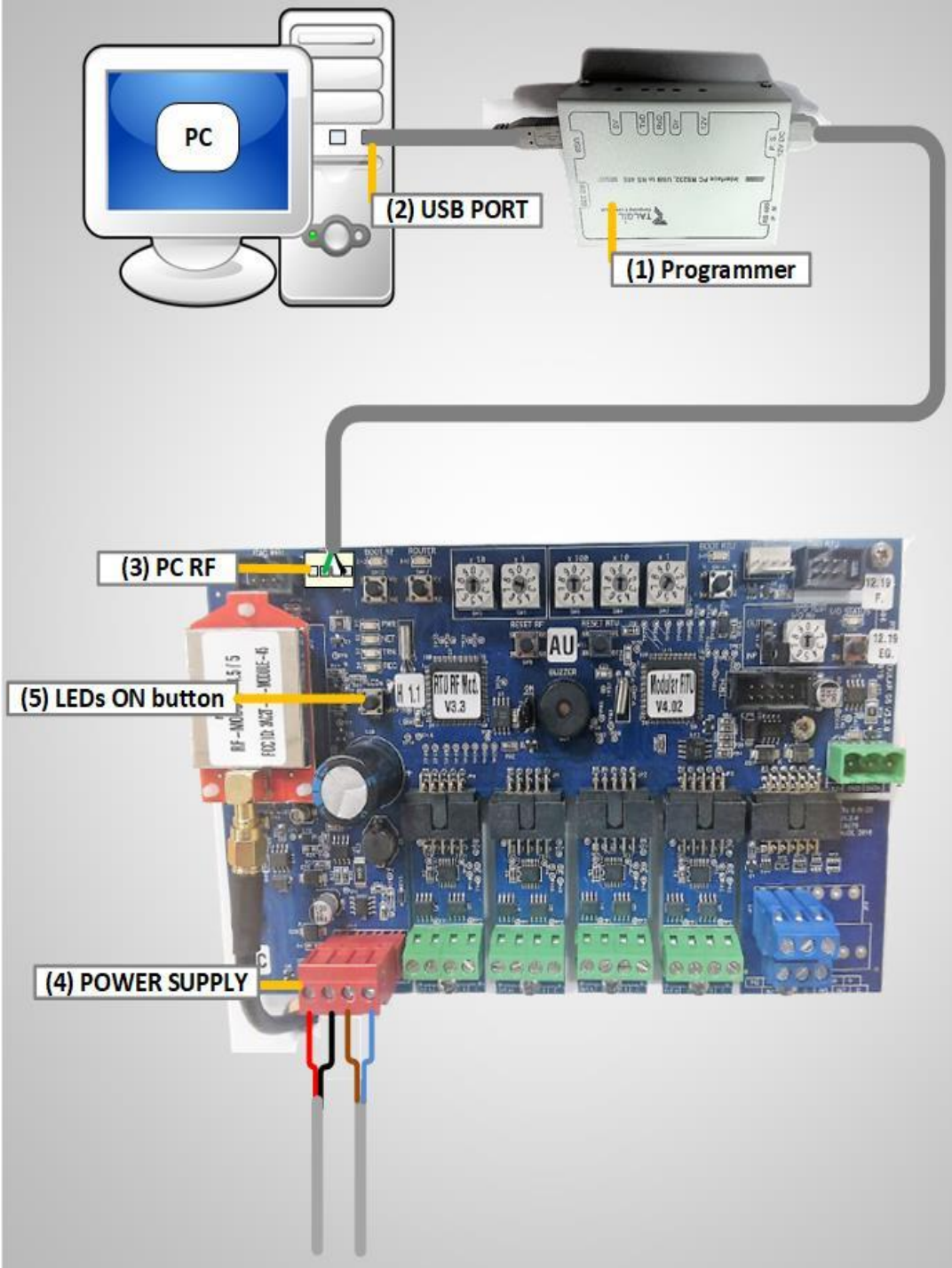


Image 5- Running the TreeView PC software on RTU RF G5 Modular

4

5 RUN THE TREEVIEW PC SOFTWARE ON RTU RF G5 MODULAR.

To run the Treeview PC software on RTU RF G5 Modular, follow the instructions below:

1. Connect a **Programmer** device **(Pointer 1 Image 5)** to a **USB PORT (2)** on your PC and the **PC RF Socket (3)** on the **RF unit** of the **RTU RF G5 Modular** board.
2. Connect the **Power supply (4)** plug to the **RTU RF G5 Modular** board.
3. Press **LEDs ON (5)** button. The **POWER** and **NET** LEDs will turn on.
4. Turn on the **ROUTER** mode. To identify if the RTU mode is RTU or ROUTER, Press the LEDs ON button (Step 3) If the **ROUTER LED is** on, the RTU mode is ROUTER.
   IF the ROUTER LED is OFF, the RTU mode is RTU. To turn ON or to Turn OFF a ROUTER mode, press the LEDs ON button then press the ROUTER button.
5. Start the **TREEVIEW** software. If you do not have it, download it here: https://drive.google.com/drive/folders/1OUWf04dw7EEsFPFOAmfFBZ1EJExaMkrT?usp=sharing
6. On the **DATA source**, select **Use Realtime data (Pointer 1 image 2)**. Select the **Communication Method: RS232 (2)**, Select the **Communication port (3),** and **Baud rate 115200 (4).**

To identify the **USB SERIAL PORT,** right-click on **My PC** and select **Properties->Device manager->Ports (Com & LPT).**

7. To start monitoring a specific Radio system, click **Start connection**.
8. The results will appear in the **Topology** screen as described in **Image 3**.

6 RUN THE TREEVIEW PC SOFTWARE ON RTU RF G5 4 ANA OR SDI.

To run the Treeview PC software on **RTU RF G5 4 Ana** or **RTU RF G5 SDI**, use the instructions above. On step 1, connect the **Programmer** device to the **PC RF** socket on the **RTU RF G5 4 Ana** or **RTU RF G5 SDI** boards. Continue to steps 2 to 7.

7 THE SNIFFER UNIT.

The SNIFFER unit enables Analyzing and Monitoring the Radio communication without using any RTU unit. For example, if you need to identify the RSSI of the Master unit at some point at the site, and there is no RTU in the vicinity, you can use the **SNIFFER** unit to Analyze and Monitor the Radio communication, the RSSI, the Power, and he radio stability.

This action is recommended when the Installer would like to know where is the best location for an RTU unit to achieve the maximum RSSI and the best performances.

To examine the RSSI at a specific point at the site, Install the Master unit close to the Irrigation controller in a high place to improve the radio communication. Make sure that the Master unit has a Line of sight to the RTUs or the ROUTERs.

Go to the desired place, Install the SNIFFER unit on the testing site, make sure that you are using the same Variant of the radio system you are going to test.

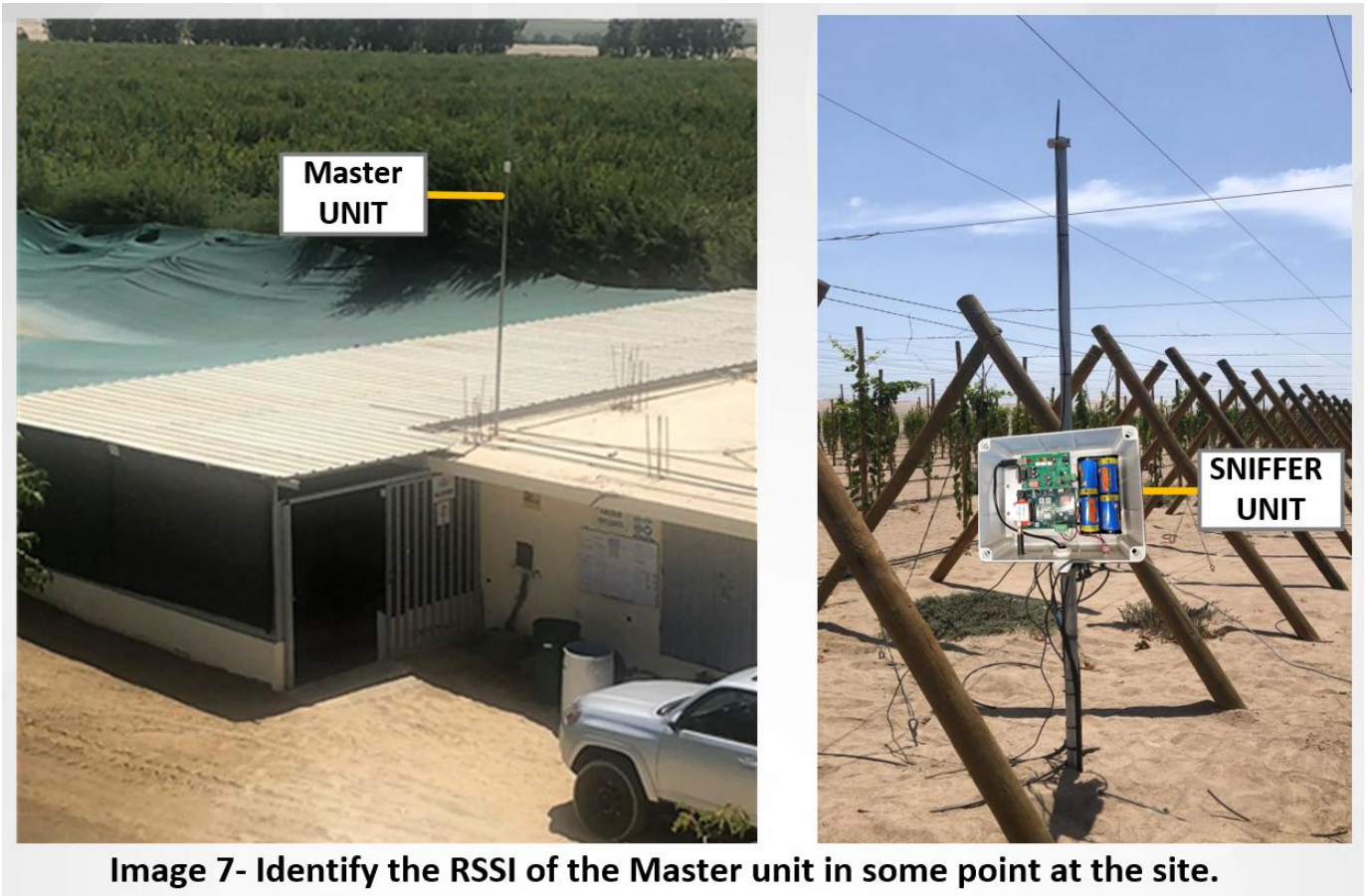


Image 7- Identify the RSSI of the Master unit in some point at the site.

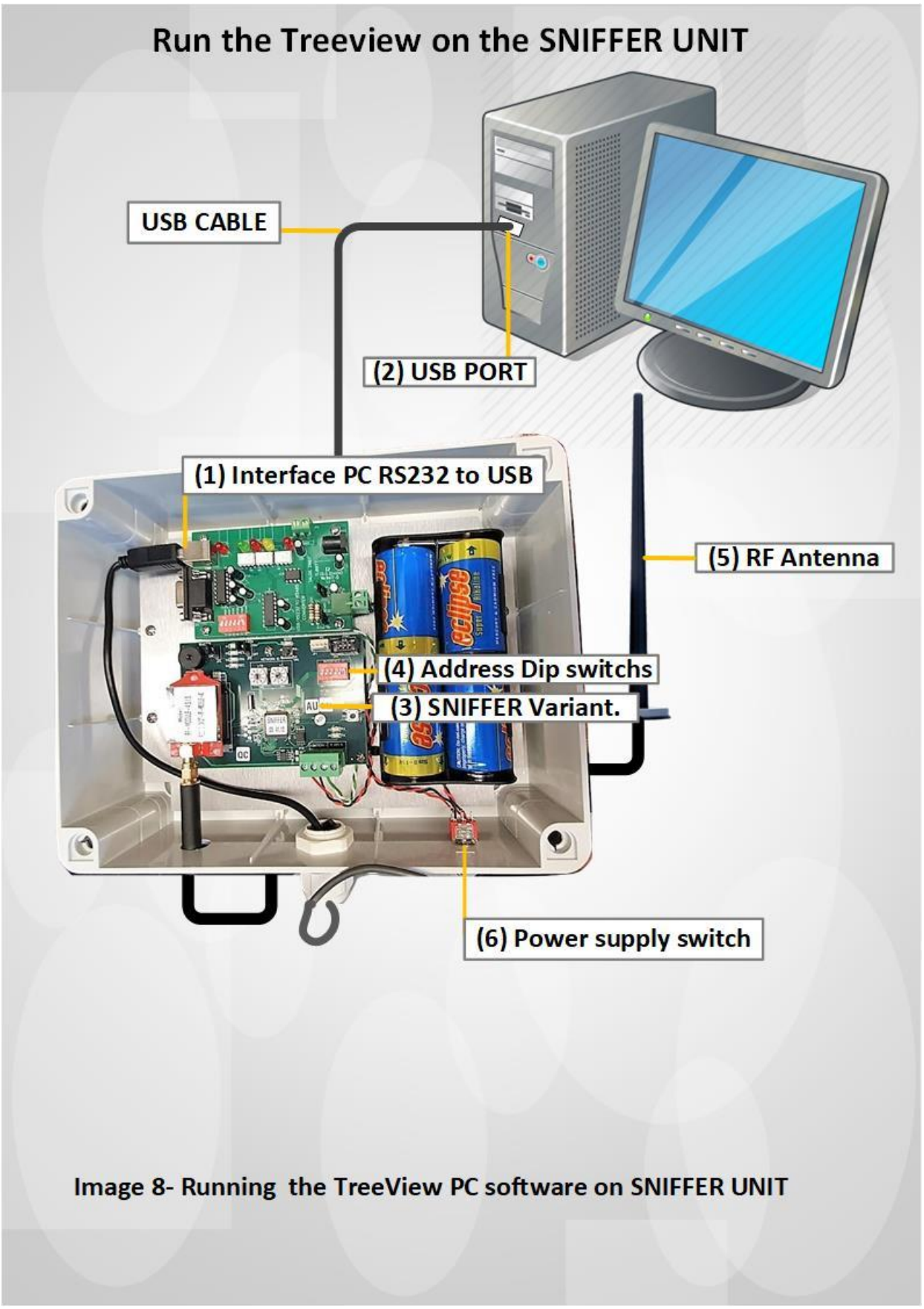


Image 8- Running the TreeView PC software on SNIFFER UNIT

8 RUN THE TREEVIEW PC SOFTWARE ON SNIFFER UNIT.

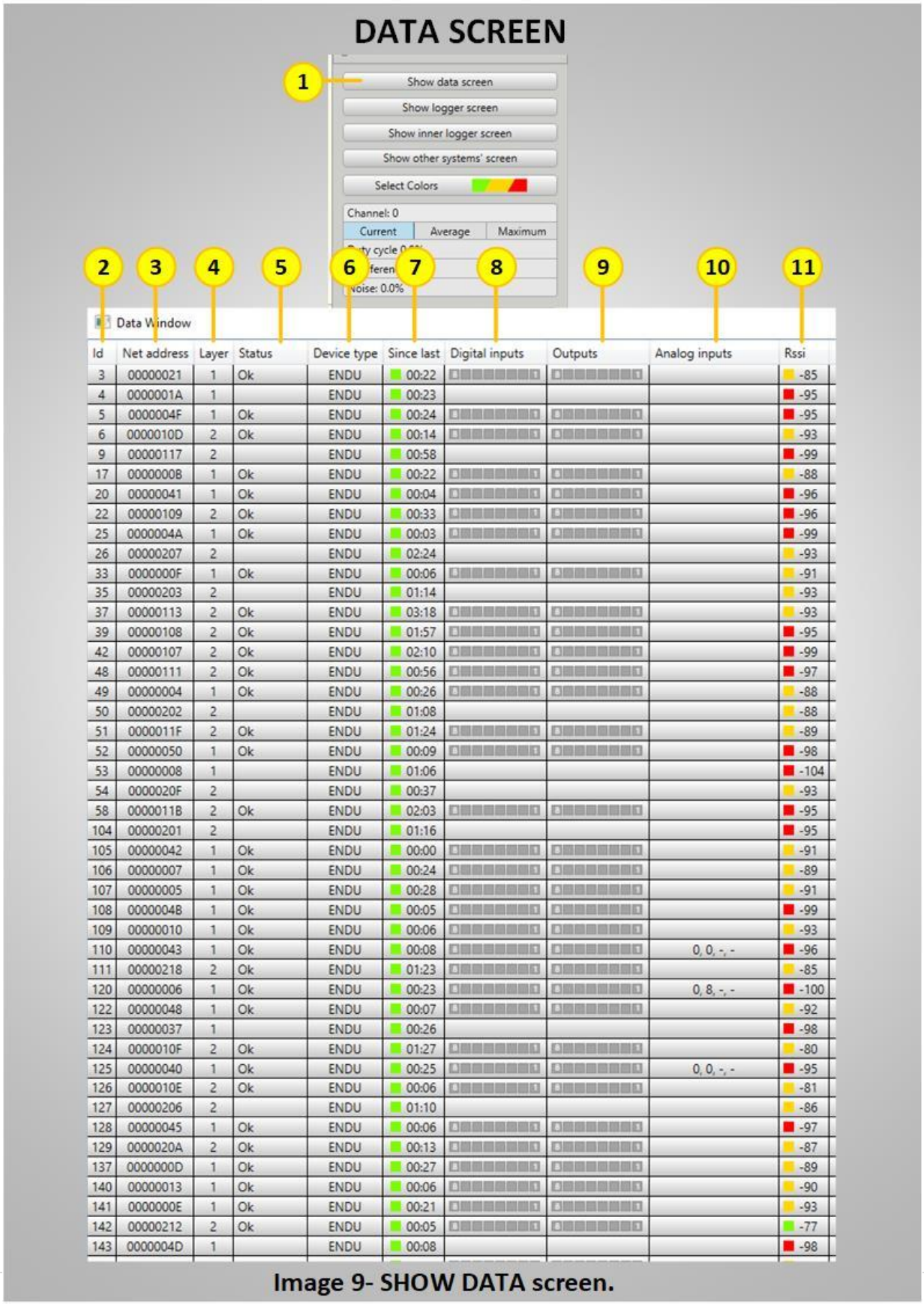
To run the **Treeview** PC software on **RF G5 SNIFFER**, follow the instructions below:

1. Connect the **USB** cable of the **Interface PC RS232 to USB** device **(Pointer 1 Image 8)** to a **USB PORT (2)** on your **PC**.
2. Make sure that the **SNIFFER VARIANT** is defined to the **RF Variant** you are going to Monitor. The **VARIANT** appears on the **SNIFFER** board **(3).**
3. Turn ON all the **Dip Switches** of the **SNIFFER ADDRESS (4)**. This action allows the **SNIFFER** to Monitor the Radio communication in all frequency of this specific Variant.
4. Make sure that the **RF Antenna (5)** is located in a high place to improve the RF reception and to enable the **Line of SIGHT** between the **Master unit**, **ROUTERs**, and RF testing site.
5. Turn ON the **Power supply (6)** switch. The **Power supply switch** is located in the lower right corner of the **SNIFFER** box.
6. Start the **TREEVIEW** software. If you do not have it, download it here: https://drive.google.com/drive/folders/1OUWf04dw7EEsFPFOAmfFBZ1EJExaMkrT?usp=sharing
7. On the **DATA source**, select **Use Realtime data (Pointer 1 image 2)**. Select the **Communication Method: RS232 (2)**, Select the **Communication port (3),** and **Baud rate 115200 (4).**

To identify the **USB SERIAL PORT,** right-click on **My PC** and select **Properties->Device manager->Ports (Com & LPT).**

8. To start monitoring a specific Radio system, click **Start connection**.
9. The results will appear in the **Topology** screen as described in **Image 3**.

DATA SCREEN



Id	Net address	Layer	Status	Device type	Since last	Digital inputs	Outputs	Analog inputs	Rssi
3	00000021	1	Ok	ENDU	00:22				-85
4	0000001A	1		ENDU	00:23				-95
5	0000004F	1	Ok	ENDU	00:24				-95
6	0000010D	2	Ok	ENDU	00:14				-93
9	00000117	2		ENDU	00:58				-99
17	0000000B	1	Ok	ENDU	00:22				-88
20	00000041	1	Ok	ENDU	00:04				-96
22	00000109	2	Ok	ENDU	00:33				-96
25	0000004A	1	Ok	ENDU	00:03				-99
26	00000207	2		ENDU	02:24				-93
33	0000000F	1	Ok	ENDU	00:06				-91
35	00000203	2		ENDU	01:14				-93
37	00000113	2	Ok	ENDU	03:18				-93
39	00000108	2	Ok	ENDU	01:57				-95
42	00000107	2	Ok	ENDU	02:10				-99
48	00000111	2	Ok	ENDU	00:56				-97
49	00000004	1	Ok	ENDU	00:26				-88
50	00000202	2		ENDU	01:08				-88
51	0000011F	2	Ok	ENDU	01:24				-89
52	00000050	1	Ok	ENDU	00:09				-98
53	00000008	1		ENDU	01:06				-104
54	0000020F	2		ENDU	00:37				-93
58	0000011B	2	Ok	ENDU	02:03				-95
104	00000201	2		ENDU	01:16				-95
105	00000042	1	Ok	ENDU	00:00				-91
106	00000007	1	Ok	ENDU	00:24				-89
107	00000005	1	Ok	ENDU	00:28				-91
108	0000004B	1	Ok	ENDU	00:05				-99
109	00000010	1	Ok	ENDU	00:06				-93
110	00000043	1	Ok	ENDU	00:08			0, 0, -, -	-96
111	00000218	2	Ok	ENDU	01:23				-85
120	00000006	1	Ok	ENDU	00:23			0, 8, -, -	-100
122	00000048	1	Ok	ENDU	00:07				-92
123	00000037	1		ENDU	00:26				-98
124	0000010F	2	Ok	ENDU	01:27				-80
125	00000040	1	Ok	ENDU	00:25			0, 0, -, -	-95
126	0000010E	2	Ok	ENDU	00:06				-81
127	00000206	2		ENDU	01:10				-86
128	00000045	1	Ok	ENDU	00:06				-97
129	0000020A	2	Ok	ENDU	00:13				-87
137	0000000D	1	Ok	ENDU	00:27				-89
140	00000013	1	Ok	ENDU	00:06				-90
141	0000000E	1	Ok	ENDU	00:21				-93
142	00000212	2	Ok	ENDU	00:05				-77
143	0000004D	1		ENDU	00:08				-98

Image 9- SHOW DATA screen.

9 DATA SCREEN

The **DATA screen** getting the whole received information together. To display the **DATA screen**, click the **Show data screen** button (**Pointer 1 Image 9**).

The received information described below:

2. **ID-**The RTU address.

3. **NET ADDRESS-**The network address given to the RTU by the RF Network.

4**. LAYER-**The location of a specific RTU or ROUTER in the RF network. An RTU which communicating directly with the Master unit is being located on the first layer called layer one. When an RTU use only one ROUTER to communicate with the Master unit, the RTU is located on layer two, the ROUTER is located on layer one, and so on.

5.**STATUS-**The communication status of a specific RTU. The status changed to **OK** when the RTU sends sanity (Status of Hardware, Inputs, Outputs, RSSI, and Power).

6. **DEVICE TYPE-**Specifies the RTU type. There are two types. RTU and ROUTER.

7. **Since Last-**Indicates the time duration a specific RTU is connected to the RF network.

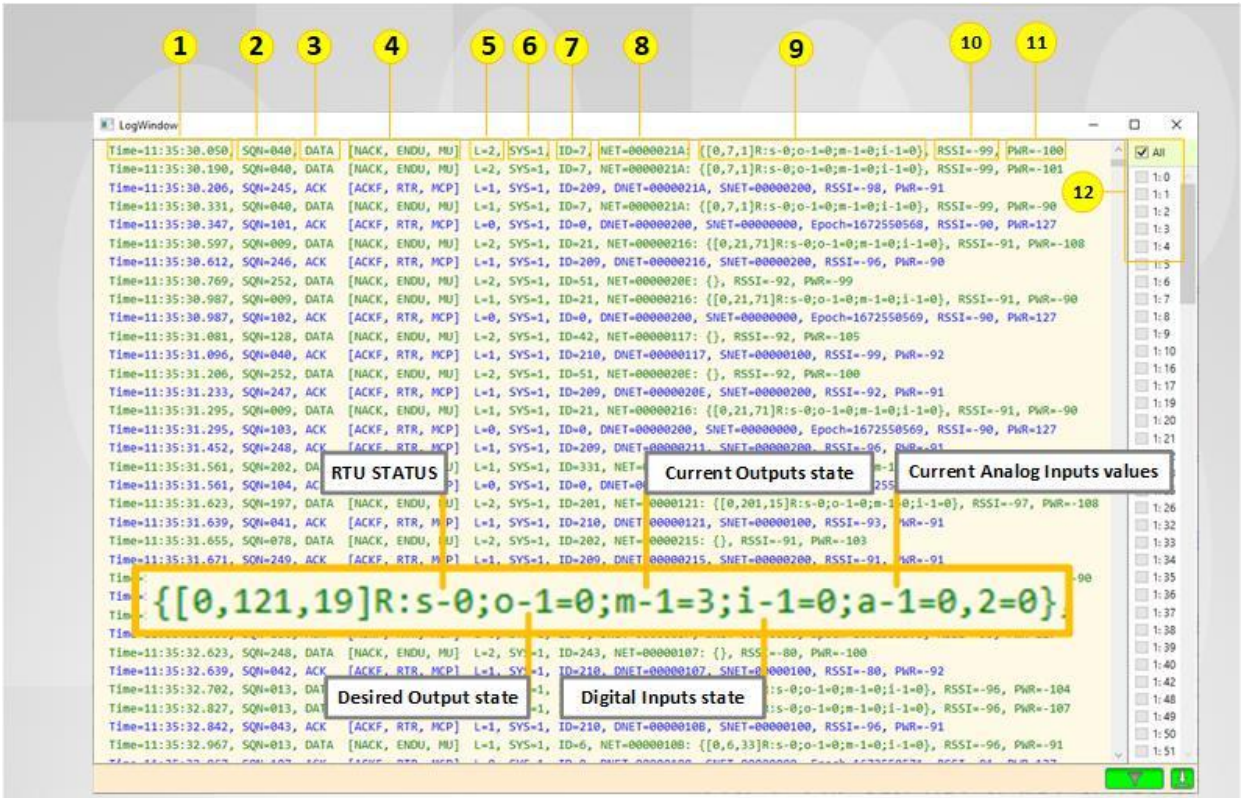
Specifies how long time the RTU communication state is OK.

8. Digital inputs-The current state of Digital inputs on a specific RTU. There are two states, ON (Close contact) and OFF (Open contact). A closed digital input is colored in light Blue.

9. Outputs- The current state of the Outputs on a specific RTU. There are two states, OPEN and CLOSED. The opened output is colored in light Blue.

10. Analog Inputs-The current analog values of the Analog INPUTS.

11. RSSI- The Received Signal Strength Indication. Specifies the RF signal strength in which the Master unit hears this specific RTU.



1. Packet receiving time.
2. Packet ID.
3. Packet Data type.
4. Packet direction.
5. RTU Layer.
6. RTU System ID.
7. RTU Address.
8. RTU Network ID.
9. The Packet Data.
10. RSSI.
11. Power.
12. Add RTUs to the logger screen.

Image 10- Logger screen

10 LOGGER SCREEN

The Logger screen displays the received information on the air. Read on for detailed descriptions and Packets structure.

1. **The packet receiving Time-** The time at which the Treeview/Sniffer received the information.
2. **Packet ID-**Packet numbering.
3. **Packet data Type-**Describes the kind of the Packet. The Types are Data, Acknowledge, Test, Response, Link, Network address, Join, Disconnect, and Beacon.
4. **Packet direction-**Describes who is sending the packet and who is the information for. In Image 10, The **End unit** sends the information to the **Master unit**.
5. **Layer-**Specifies the **End unit** layer. Layer 0 represents packets coming from the **Master unit**. Layer 1 represents **End unit** or **Router** which communicating directly with the **Master unit.** Layer 2 means that there is a **Router** in layer 1 which helps the **End unit** on layer 2.
6. **System ID-** Specifies the RF G5 System ID.
7. **Unit ID-** Represent the RTU address.
8. **Network address-** Specifies the address was given to the RTU by the RF network.
9. **Packet Data-** The Packet data includes the Hardware status, Desired Outputs State**,** For example:
   0= '00'- Two outputs are closed.
   1= '10'- Output 1 is open.
   2= '01'-Output 2 is open.
   3='11'-Outputs 1 and 2 are open.

Current Outputs state- Specifies the current outputs state.

Digital Inputs State- The current Inputs state of the **End unit**. The value represents a decimal conversion of two bits. For example:

0= '00'- the two Inputs are opened.
1= '10'- Input 1 is closed.
2= '01'- Input 2 is closed.
3= '11'- the two Inputs are closed.

Current Analog inputs values- Specifies the values of the analog input measurements. A-1 =Analog input 1. A-2=Analog input 2.

10. **RSSI-** The Received signal strength indication in which the Master unit hears RTU 7.
    The **RSSI** of RTU which is located very close to the Master unit is close to zero.
    The minimum **RSSI** value to connect to the RF network is -96.
    When the current RSSI is lower than -96, try to improve the RF reception by:
    - Change the RF Antenna location to a high place.
    - Improve the Line of sight between the RTU and Master unit.
    - Use a ROUTER between the RTU and the Master unit.

11. **Power**- The Received signal strength indication in which the Sniffer unit hears RTU 7.

11 LOG FILES

The Treeview PC software generates log files. The Log files include the received information that has been recorded during the connection. The user can replay the record or send the log file to the support team.

Replay a log file: To replay a log file, select **Use file data**, browse to the folder include the log file, and select the log file to play.
The Treeview software will show the recorded communication, the Data screen, and the log screen.

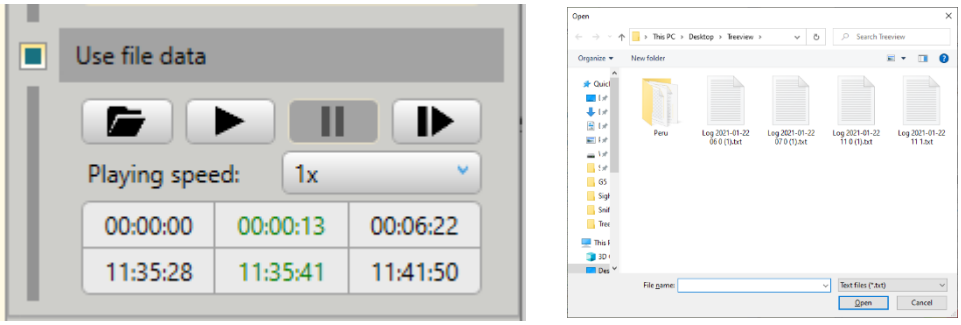


Image 11- Replay Log file

Send a log file to the Support team: To send a log file to the support team, navigate to the Treeview folder and copy the log files inside. The log file name includes the Date and Time and log file number.

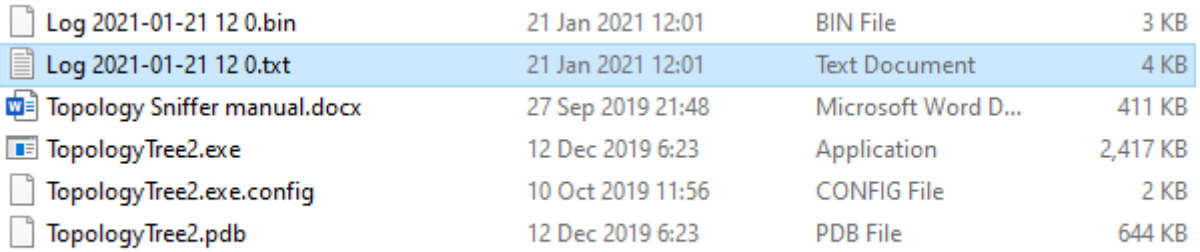
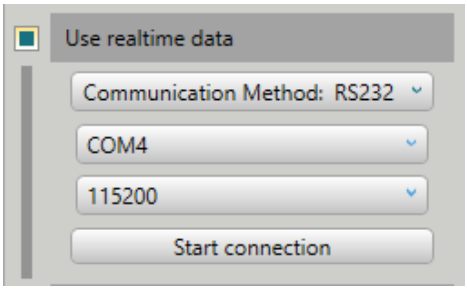


Image 12- Send log file to the Support team

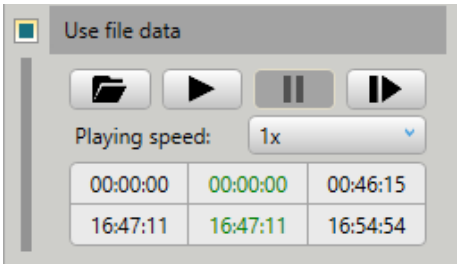
12 FILES ANALYZE

The TreeView has 2 modes of operation:

1. **Use Realtime data** – This is the mode at which the recording takes place. The minimal recording time should not be shorter than 5 minutes, the longer the better. Before starting the recording, the com port at which the programmer is connected, should be specified.

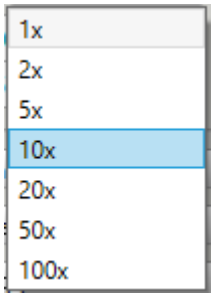


2. **Use File data** – This is the mode at which recorded log–files are analyzed. The user may select one or more files to be analyzed.



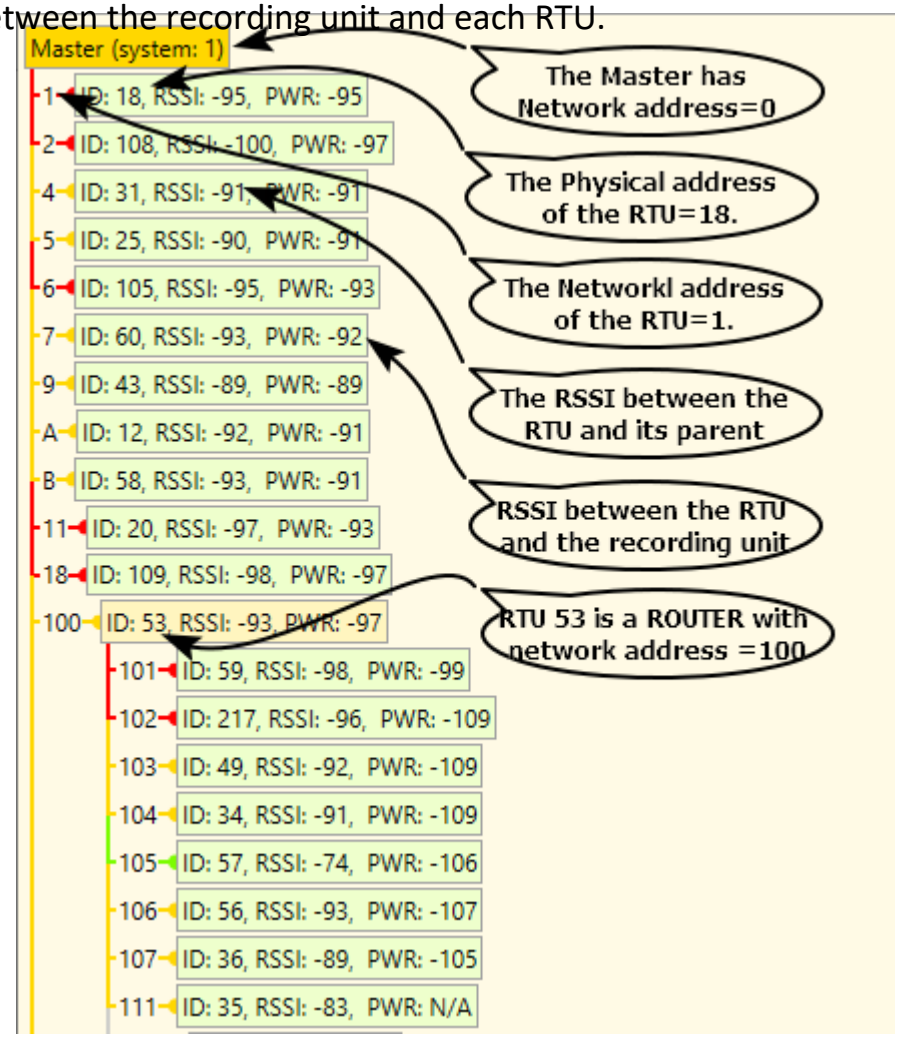
When the system is large, recording at one point, unless made at the MASTER, may not give a full picture of the network and since recording at the MASTER may sometimes be problematic, we need to be able to do the recording at various points and then enable loading several log-files at once. Hold down the SHIFT key to select a range of log-files or use the CTRL key to select individual files to be loaded.

The recorded data can be replayed at various playing speeds.



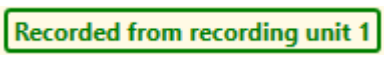
What information can be obtained from the log file?

1. The main screen shows a hierarchical structure of the network. Including the signal strength (RSSI) between each RTU and its parent, and the signal strength (PWR) between the recording unit and each RTU.



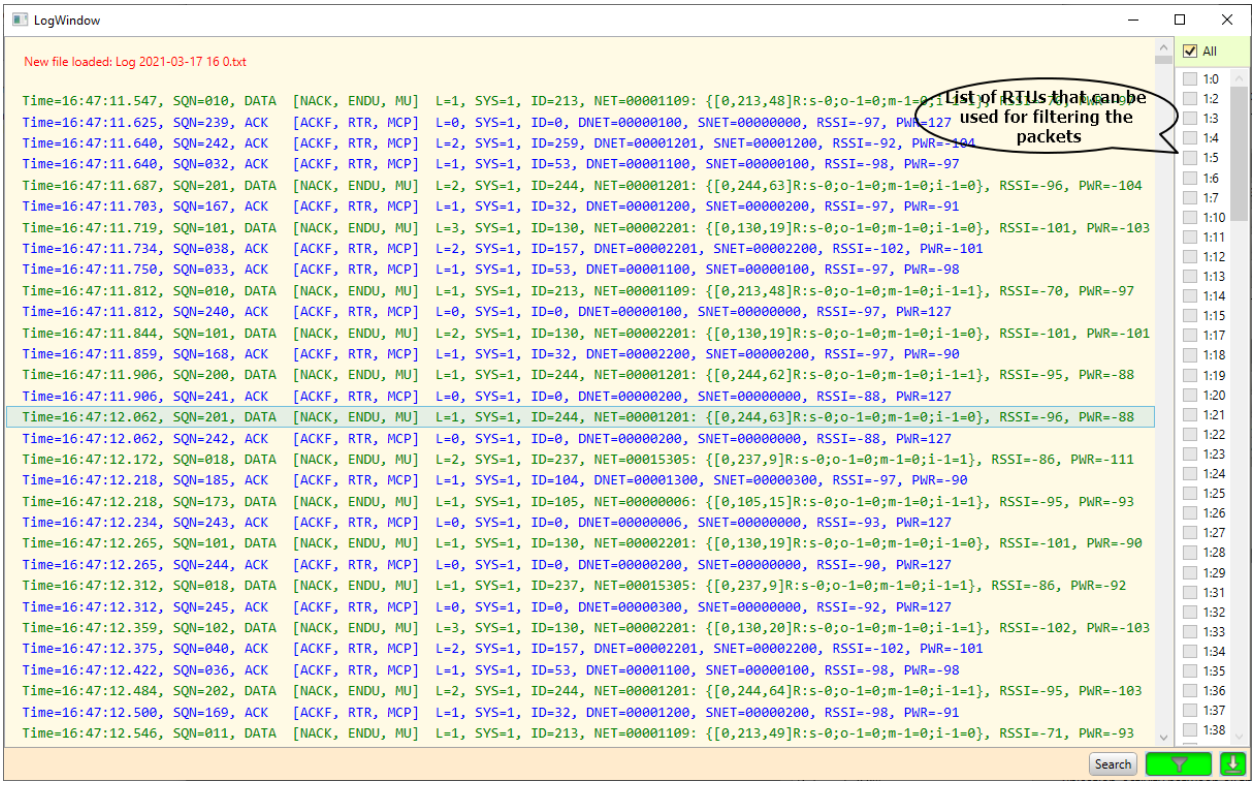
   The RSSI is presented by a negative number. The value -97 is the limit between stable and unstable communication. Anything less negative than -97 (for example -96,-95,-94…) indicates better signal strength.

2. Indicating at which unit was the recording made. This information becomes very important especially when we want to decide which RTUs can serve as ROUTERs that can improve the connection of a problematic RTU.



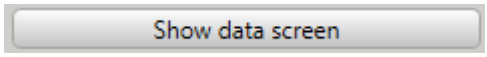
3. Listing of all the communication activity between the network members. Select

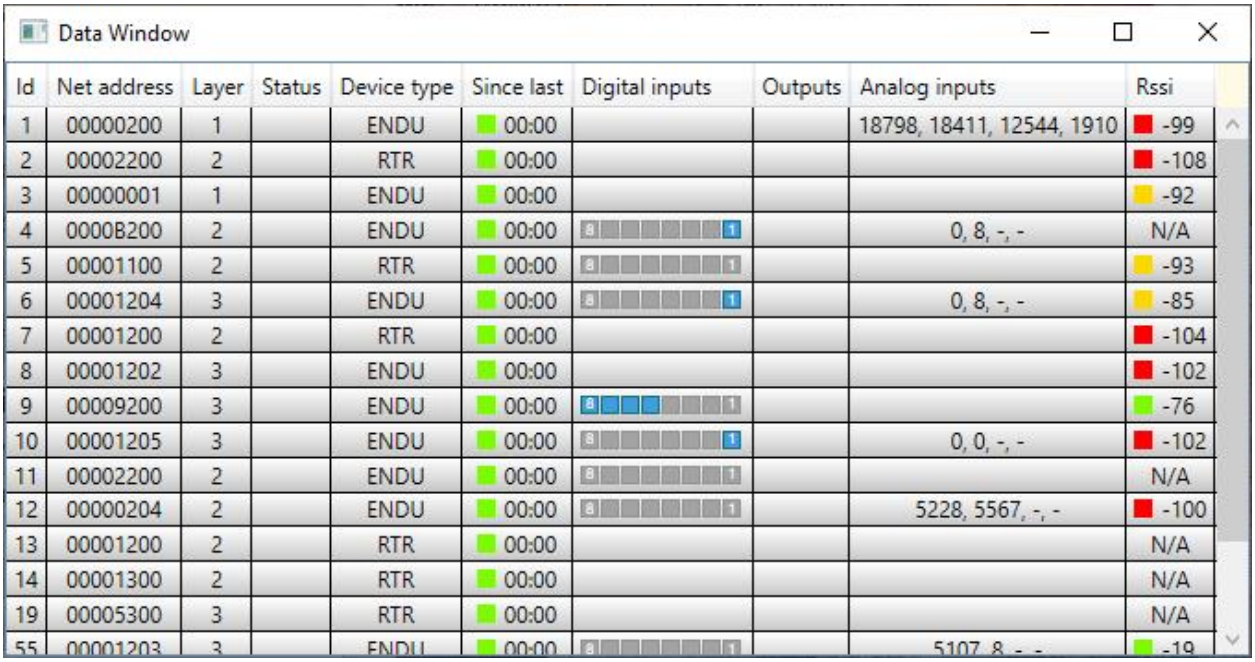
The information can be filtered per selected RTUs .



Actually this list of packets is the base of all the information presented by the TreeView tool.

4. Showing the status of the outputs and the inputs of all the RTUs. Select

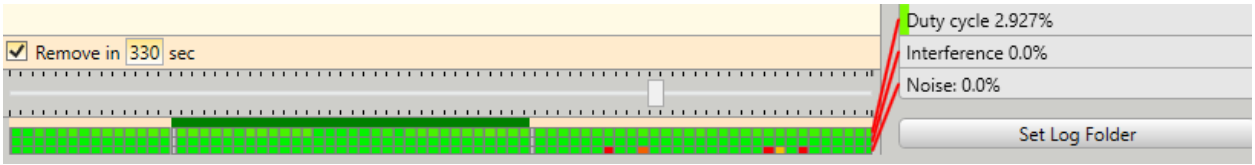




Id	Net address	Layer	Status	Device type	Since last	Digital inputs	Outputs	Analog inputs	Rssi
1	00000200	1		ENDU	00:00			18798, 18411, 12544, 1910	-99
2	00002200	2		RTR	00:00				-108
3	00000001	1		ENDU	00:00				-92
4	0000B200	2		ENDU	00:00			0, 8, -, -	N/A
5	00001100	2		RTR	00:00				-93
6	00001204	3		ENDU	00:00			0, 8, -, -	-85
7	00001200	2		RTR	00:00				-104
8	00001202	3		ENDU	00:00				-102
9	00009200	3		ENDU	00:00				-76
10	00001205	3		ENDU	00:00			0, 0, -, -	-102
11	00002200	2		ENDU	00:00				N/A
12	00000204	2		ENDU	00:00			5228, 5567, -, -	-100
13	00001200	2		RTR	00:00				N/A
14	00001300	2		RTR	00:00				N/A
19	00005300	3		RTR	00:00				N/A
55	00001203	3		ENDU	00:00			5107, 8, -, -	-19

Notice that the information described at the entries above depends on the position of the CURSOR at the timeline. At the beginning of the timeline there is no available information.

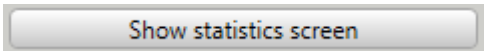
5. Showing the DUTY CYCLE, the INTERFERENCE and NOISE levels in % along the timeline

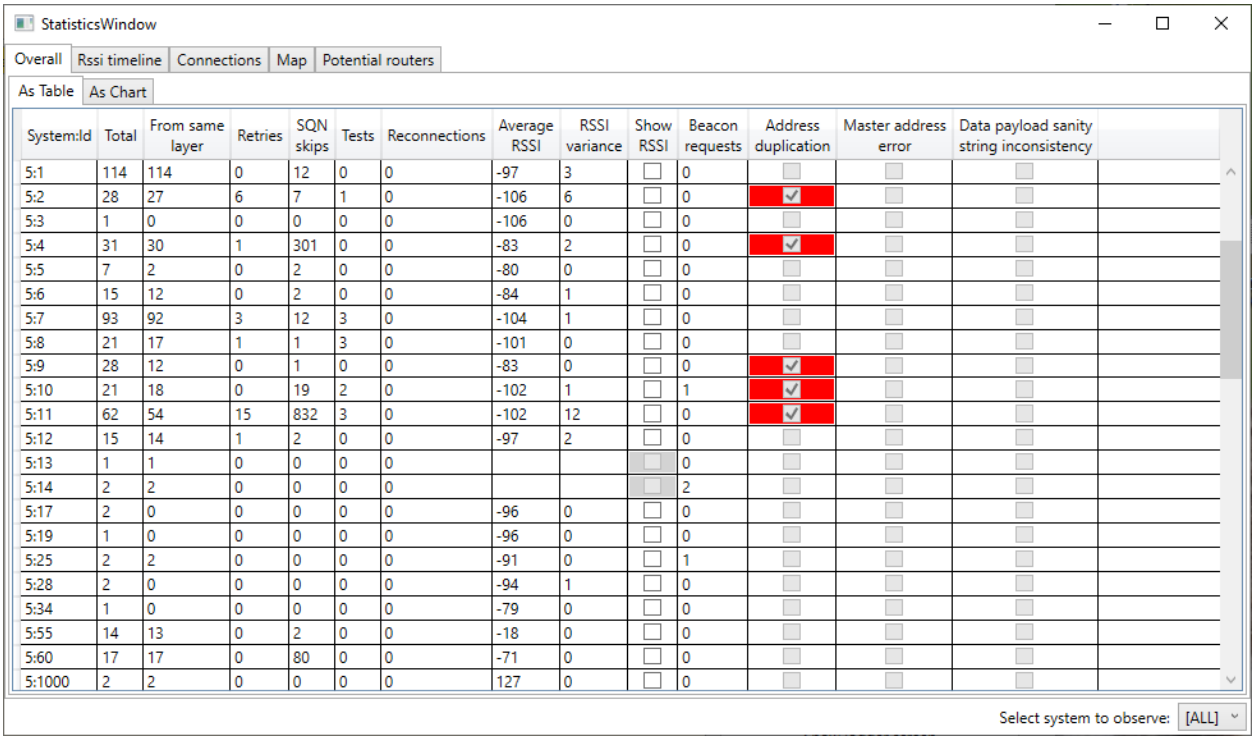


The DUTY CYCLE should not exceed 25%.

Below 15% it will be green, and above it will start getting yellow up to 25% at which it will become red.

The INTERFERENCE and the NOISE will be green up to 2.5% growing to yellow and becoming red above 5%.

6. The more useful analytical tool is the statistical table that can be reached by the following key 



System:Id	Total	From same layer	Retries	SQN skips	Tests	Reconnections	Average RSSI	RSSI variance	Show RSSI	Beacon requests	Address duplication	Master address error	Data payload sanity string inconsistency
5:1	114	114	0	12	0	0	-97	3	☐	0	☐	☐	☐
5:2	28	27	6	7	1	0	-106	6	☐	0	☑	☐	☐
5:3	1	0	0	0	0	0	-106	0	☐	0	☐	☐	☐
5:4	31	30	1	301	0	0	-83	2	☐	0	☑	☐	☐
5:5	7	2	0	2	0	0	-80	0	☐	0	☐	☐	☐
5:6	15	12	0	2	0	0	-84	1	☐	0	☐	☐	☐
5:7	93	92	3	12	3	0	-104	1	☐	0	☐	☐	☐
5:8	21	17	1	1	3	0	-101	0	☐	0	☐	☐	☐
5:9	28	12	0	1	0	0	-83	0	☐	0	☑	☐	☐
5:10	21	18	0	19	2	0	-102	1	☐	1	☑	☐	☐
5:11	62	54	15	832	3	0	-102	12	☐	0	☑	☐	☐
5:12	15	14	1	2	0	0	-97	2	☐	0	☐	☐	☐
5:13	1	1	0	0	0	0			☐	0	☐	☐	☐
5:14	2	2	0	0	0	0			☐	2	☐	☐	☐
5:17	2	0	0	0	0	0	-96	0	☐	0	☐	☐	☐
5:19	1	0	0	0	0	0	-96	0	☐	0	☐	☐	☐
5:25	2	2	0	0	0	0	-91	0	☐	1	☐	☐	☐
5:28	2	0	0	0	0	0	-94	1	☐	0	☐	☐	☐
5:34	1	0	0	0	0	0	-79	0	☐	0	☐	☐	☐
5:55	14	13	0	2	0	0	-18	0	☐	0	☐	☐	☐
5:60	17	17	0	80	0	0	-71	0	☐	0	☐	☐	☐
5:1000	2	2	0	0	0	0	127	0	☐	0	☐	☐	☐

The statistical table consists of several tabs. The main tab is the “Overall” tab that enables viewing the statistics “As Table” or “As Charts”. The statistics contains per each RTU the following data:

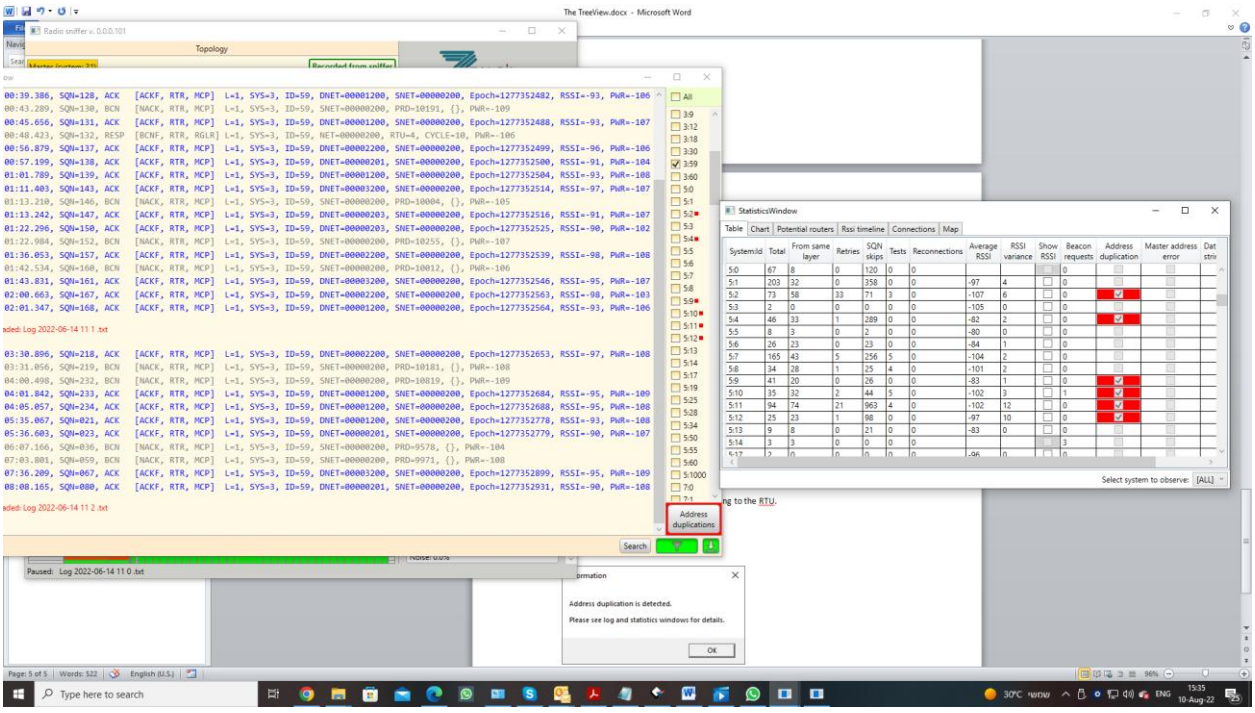
a. **Total** – the total number of packets belonging to the RTU. This will indicate how much data we rely on in the analysis of a particular RTU.
b. **From same layer** – The number of packets directly picked up from the RTU itself and not from ROUTERS transferring its packets.
c. **Retries** – how many packets were forced to be sent repeatedly because of no response received to the previous transmission.
d. **SQN skips** – how many times there were gaps in the numeration of the sequences. In other words, how many packets were lost.
e. **Tests** – how many times the RTU was sending “Test” packets, looking for connection. The RTU will send 3 “Test” packets while trying to reconnect after losing connection, or it will send single “Test” packets when trying to improve its connection when its RSSI is worse than the requested “RSSI LINK”. In both cases large numbers of “Test” packets indicate poor connection.
f. **Reconnections** – How many times the RTU lost connection to its parent and had to reconnect.

g. **Average RSSI** – the average value of the RSSI by which the RTU is connected to its parent. A value of RSSI=-97 will usually supply a stable connection, but RSSI= -98,-99,-100 and more negative values will usually result in unstable connections.

h. **RSSI Variance** – how unstable is the RSSI itself, how much it is varying around the average. The higher the RSSI VARIANCE value, the higher is the instability.

i. **Beacon Requests** – In beacon mode, when an RTU fails to receive the BEACON sent from its parent, it has to ask for retransmission of the BEACON in order to remain synchronized. So large number of BEACON REQUESTS indicate a problem with the reception from the parent.

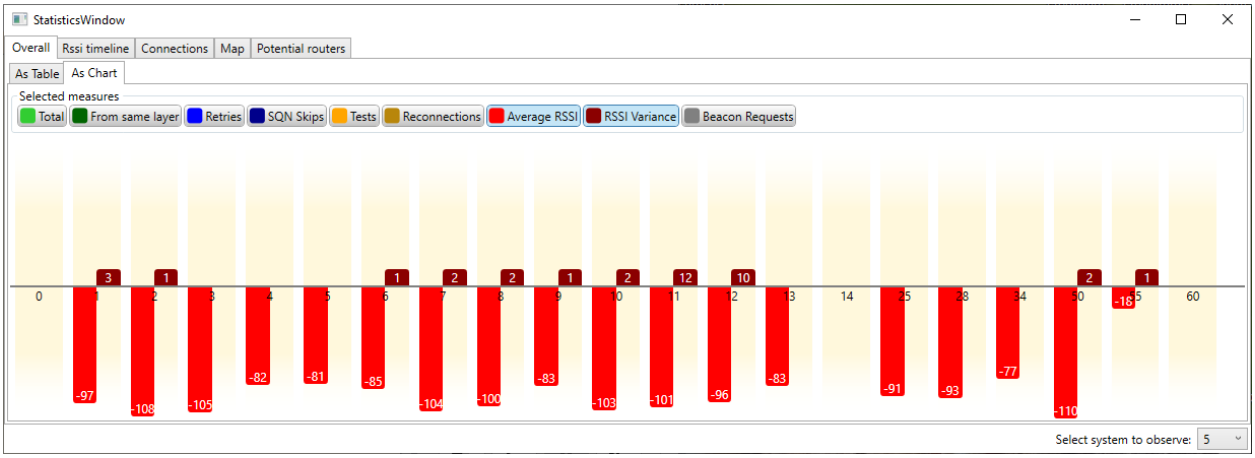
j. **Address duplications** - the system detects and reports of having RTUs with the same address. This is a severe problem, difficult to detect. If there are multiple duplication cases, it may indicate having a neighbor system with identical NETWORK ID. The duplication is indicated in several places as in the screenshot below.



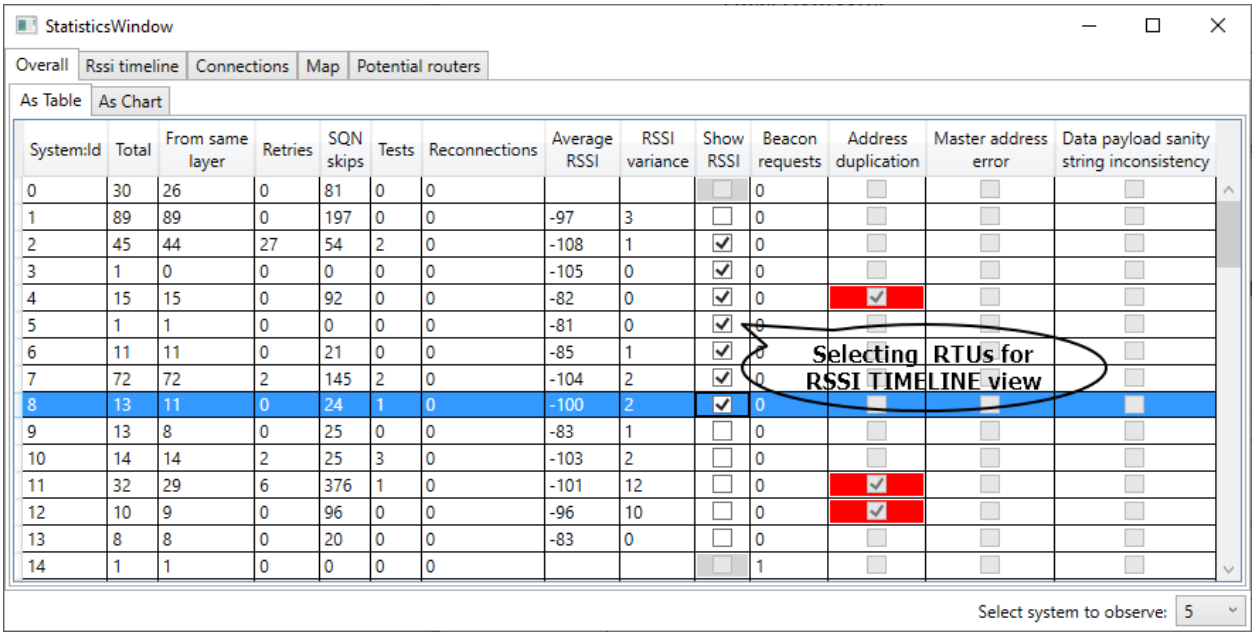
k. **Master address error** – This is a rare error in which the network address of an RTU as registered at the MASTER is different from the actual network address known to the RTU. This may happen when for some reason the MASTER has not been updated after reconnection of the RTU. The result will be commands execution failures, when commands of the MASTER will not arrive to the correct address.

l. **Data payload sanity string inconsistency** – In G5-4 the maximal number of analog values per a single RTU is 4. If by mistake more analog inputs are defined (for example THD and pH/EC LIN supply 6 analog values) this will result in inconsistency with the SANITY STRINGs transmitted by the RTU.

7. When selecting the “As charts” tab, the data included in the statistical table will be presented as graphical charts. For example the following screenshot shows the charts of the AVERAGE RSSI and RSSI VARIANCE.

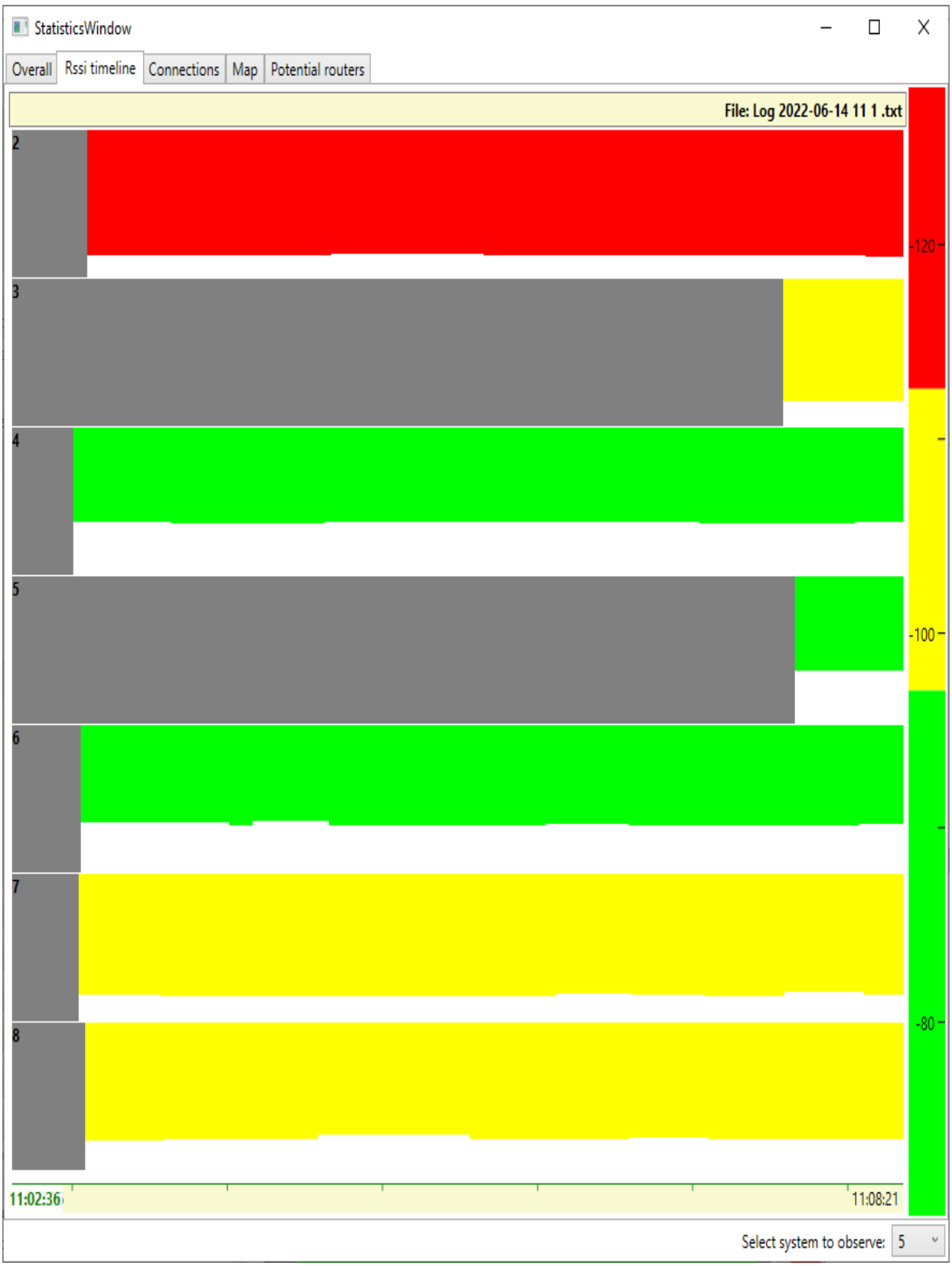


8. Selecting the tab of “Rssi timeline” supplies a tool that enables presenting the behavior of the RSSI of selected RTUs along the timeline. The selection of the desired RTUs is done in the statistical table as below.

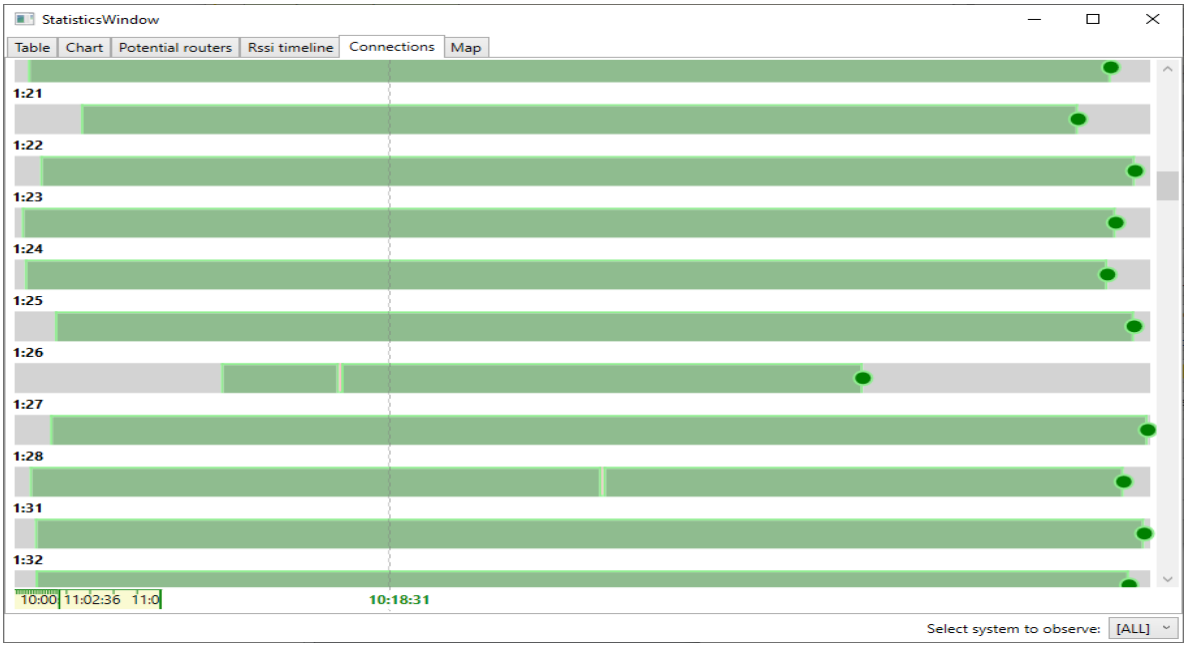


System:Id	Total	From same layer	Retries	SQN skips	Tests	Reconnections	Average RSSI	RSSI variance	Show RSSI	Beacon requests	Address duplication	Master address error	Data payload sanity string inconsistency
0	30	26	0	81	0	0				0			
1	89	89	0	197	0	0	-97	3		0			
2	45	44	27	54	2	0	-108	1	☑	0			
3	1	0	0	0	0	0	-105	0	☑	0			
4	15	15	0	92	0	0	-82	0	☑	0	☑		
5	1	1	0	0	0	0	-81	0	☑	0			
6	11	11	0	21	0	0	-85	1	☑	0			
7	72	72	2	145	2	0	-104	2	☑	0			
8	13	11	0	24	1	0	-100	2	☑	0			
9	13	8	0	25	0	0	-83	1		0			
10	14	14	2	25	3	0	-103	2		0			
11	32	29	6	376	1	0	-101	12		0	☑		
12	10	9	0	96	0	0	-96	10		0	☑		
13	8	8	0	20	0	0	-83	0		0			
14	1	1	0	0	0	0				1			

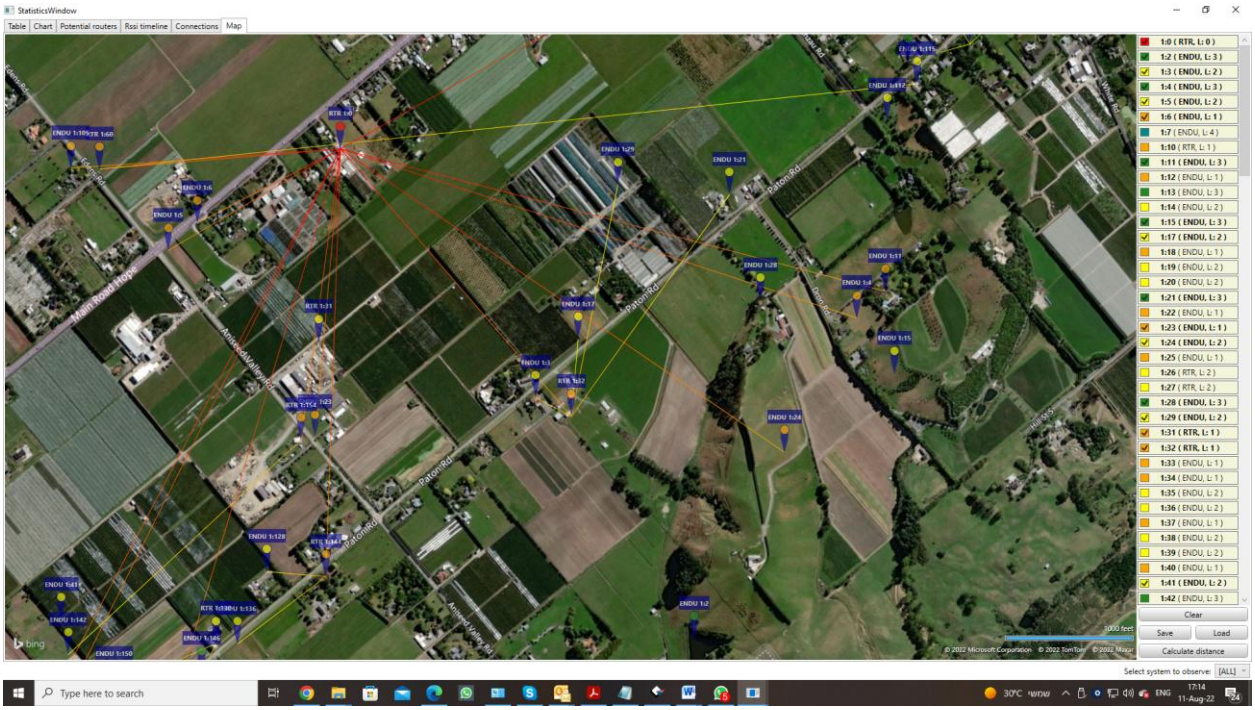
The RSSI behavior of the selected RTUs along the timeline is presented in the following charts. The values are indicated both by the color and by the thickness of the lines


StatisticsWindow
Overall
Rssi timeline
Connections
Map
Potential routers
File: Log 2022-06-14 11 1 .txt
2
3
4
5
6
7
8
-120
-100
-80
11:02:36
11:08:21
Select system to observe:
5

9. The next tool shows when each RTU was connected/disconnected into the network.



10. The following tool enables placing the MASTER and the RTUs on a geographical map and thus obtaining a clear picture of the locations of the network members including the connection lines between each RTU and its parent. This can be a very helpful tool when trying to think how the connections can be improved. The colors of the RTUs indicate the layer to which the RTU belongs. The resulting map with the RTUs and the MASTER can be saved in a file with the extension “pins”.



The map includes the ability to measure distances between the system members.

11. The last but not least tool helps to decide which RTUs can best serve as ROUTERs to an RTU with communication difficulties. The user has to connect the PROGRAMMER to the problematic RTU and use it as RECORDING UNIT. The resulting log-file should then be analyzed by the POTENTIAL ROUTERS tool. RTUs in green can be considered as potential ROUTERS.

StatisticsWindow

Overall | Rssi timeline | Connections | Map | Potential routers

Potential routers to: **5:1,** recorded from: **recording unit 1**
From file: **Log 2022-07-31 11 0 .txt**

	5:2	5:4	5:7	5:9	5:11	5:13	5:14	5:17	5:18	5:19	5:20	5:21	5:22	5:24	5:27	5:28	5:29	5:31	5:34	5:40	5:41	5:42	5:43	5:44	5:60
PWR to	-83	-100			-109	-103	-100	-112	-107					-107				-112	-111					-108	-89
RSSI to parent	-82	-88				-85	-92							-98					-79					-75	-72
Rating	■■	■□				■□	■□							□□					■□					■□	■■