

The wireless link throughput is lower than expected



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Performance tests

Web interface

The throughput test can be performed with the "Performance Tests" tool built into the web interface, in the section "Device status" → "Link statistics for the rf6.0 interface". This tool generates test traffic between the devices and it allows to obtain data about the real link throughput both in one direction and in a two-way manner. The throughput evaluation is performed using traffic with the specified priority without taking into account the service traffic required to maintain the link operational. To exclude the influence of the data traffic on the test's result, it is recommended to set the highest priority for the test traffic (at least 15). Performance tests are always performed on the highest modulation, the detailed description of the parameters and the performance test settings are available in the "Device Status menu" article.

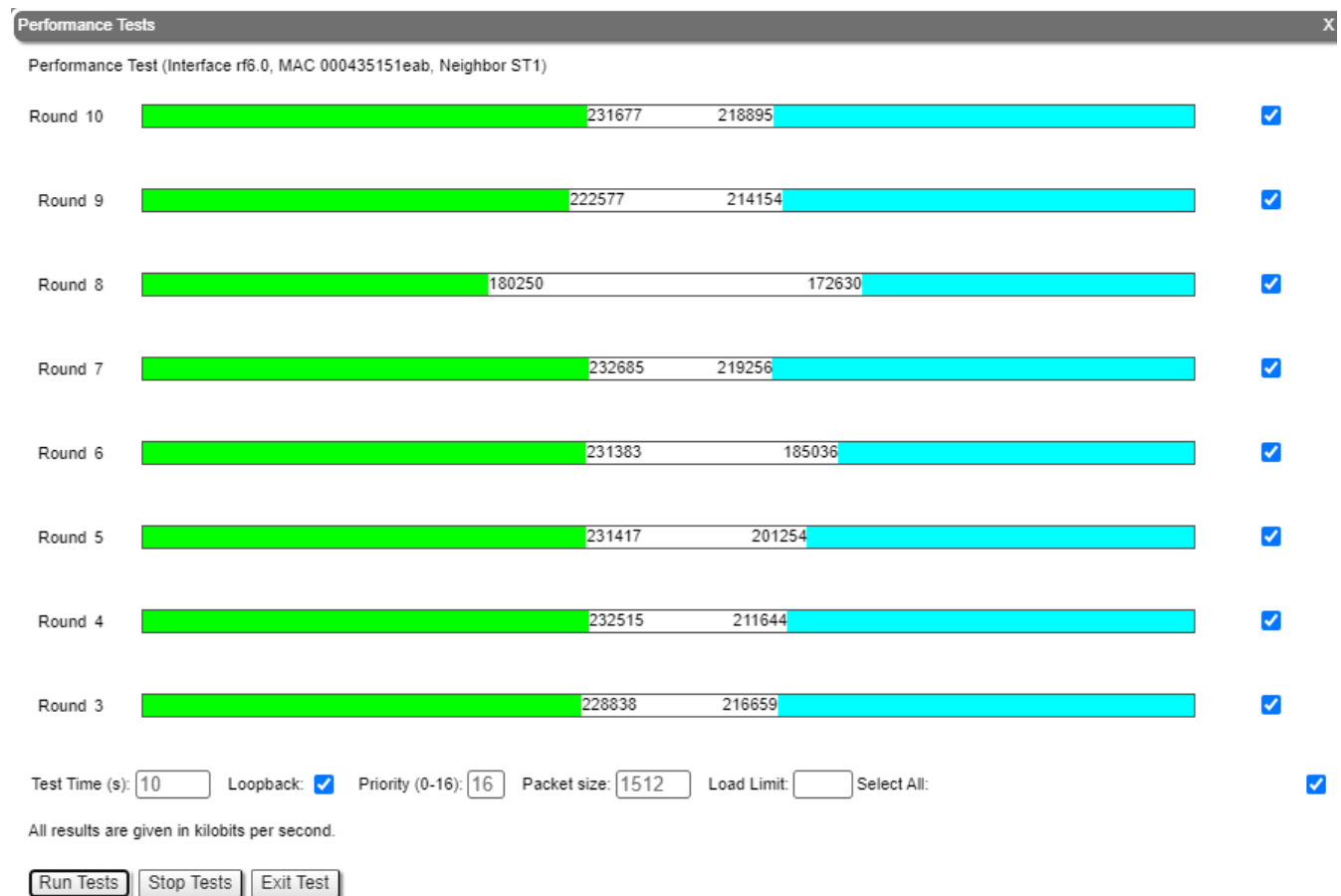


Figure - Performance tests

Command line interface

When using the command line interface to manage the device, it is possible to test the radio link via the "[/test](#)" command.

Wireless link status

Link statistics on the rf6.0 interface

Web interface

To evaluate the quality of the wireless connection with the neighboring device, use the color indication in the "Status" column of the "Link statistics on rf5.0" subsection:

- Red: bad connection.
- Yellow: good connection.
- Green: perfect connection.

The following symbols indicate problems:

- In the wireless connection uptime column:
 - F - the local device has a newer software version than the remote device.
 - E - the Ethernet port of the remote device is flapping.
- In the TX power column:
 - * - hardware device failure.
- In the RSSI column:
 - * - significant difference in the signal power between the vertical and horizontal polarizations.

Make sure that the "TX Power" and "Bitrate" parameters match with the values of the planning phase. In the "Link statistics on rf6.0" of the "Device status" section, pay attention to the wireless connection parameters. The main parameters are the retries number and the bitrate. It is not recommended to use the link with a retries number exceeding 5%. The actual bitrate (modulation level) depends on the SNR parameter - the signal-to-noise ratio. The highest modulations are available at SNR values of 27-50 dB.

For detailed description of the link parameters proceed to the "[Device Status menu](#)" article.

Command line interface

To display information about the wireless link status via the command line interface, use the "[mint rf6.0 map detail](#)" command.

```

mint rf6.0 map detail

=====
Interface rf6.0 TDM (5 ms DL/UL:Auto) (RSSI=-40 Dist=70)
Node 000435252612 "BSE", Id 37426, Nid 0, (Master)
Freq 6020, Band 80, Sid 10101010, autoBitr 780000 (min 58600), Noise -95(+0)

-----
  Id      Name      Node      SNR      Bitrate  Retry  Options
-----
  35531 ST1      000435151EAB 46/43  585/585  1/1  /S/
    load 197749/199768, pps 4091/4255, cost 51
    pwr 12/12, rssi -47/-51, thr 19/15
    dist 0, evm -20/-23
    H22v2.1.26, up 00:00:14, IP=192.168.98.14
  37427 ST2      000435152613 47/44  702/702  0/0  /S/
    load 3/0, pps 1/0, cost 51
    pwr 12/12, rssi -46/-49, thr 15/12
    dist 0, evm -21/-16
    H22v2.1.26, up 00:00:14, IP=192.168.98.15
  37426 BSE      000435052612 join
    load 0/0, pps 0/0, cost 1
-----

2 active neighbors, 1 join
Total load: 197752/199768 (rx/tx), 397520 (sum) Kbps
Total nodes in area: 8
Links fault 4, Routes fault 8
# Optimal tdma distance 2 km

#end

```

Command: `mint rf6.0 map detail`

Figure - The "mint rf6.0 map detail" command output

Pay attention to the indicators in the "Options" column. The following values are possible:

- M - Master device;
- S - Slave device;
- TM - Master device with software having support for the TDMA technology;
- L - the throughput is limited by license;
- F - the software version is older than the one on the local device.

A question mark in front of the remote's device name indicates that it has no password.

Pay attention to the "*" symbol, which can represent the following:

- At the "pwr" column - hardware device failure.
- At the "rssi" column - significant difference between the signal power of the vertical and horizontal polarizations.

Radio statistics

Command line interface

To display statistics via the command line interface, use the ""`rfconfig stat`"" command.

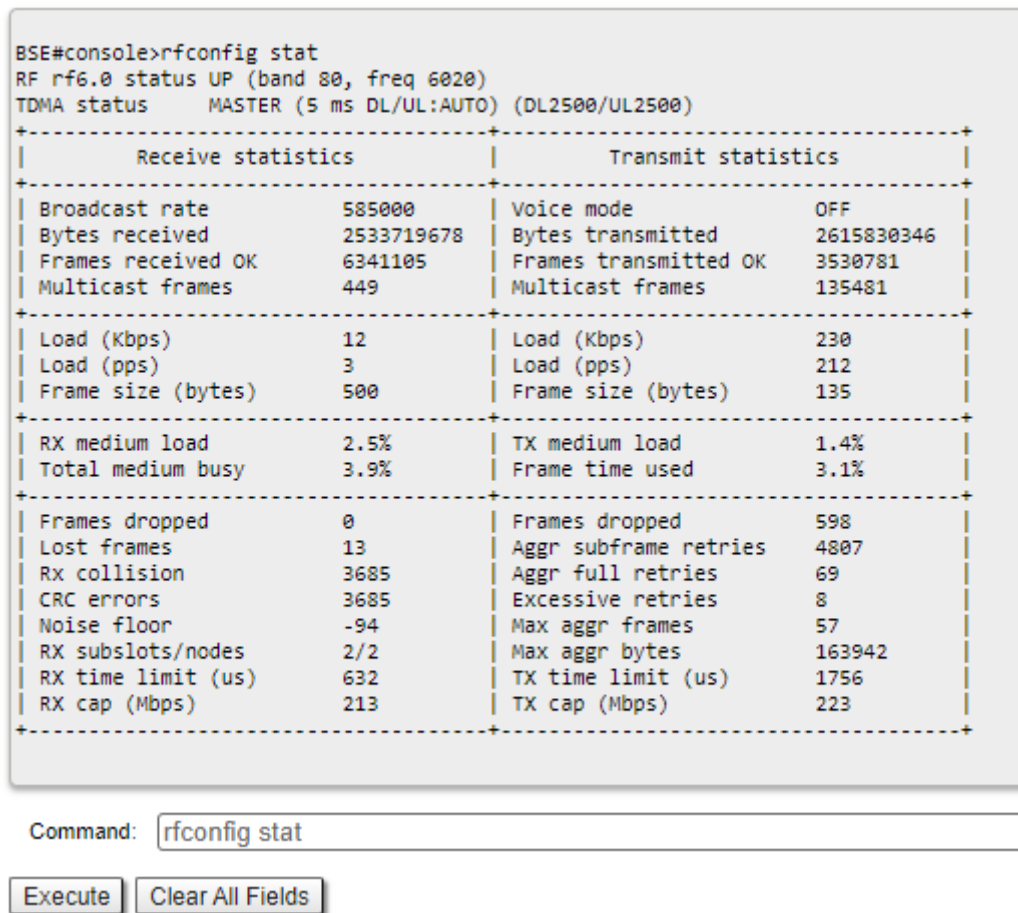


Figure - General statistics

Pay attention to the following indicators:

- "Lost Frames" - the number of frames that were not received by the device, even after retrying.
- "Aggr Subframe Retries" and "Aggr Full Retries" - the number of frames that the device has sent several times because the other side did not acknowledge the receipt.
- "Excessive Retries" - the number of frames that failed to be sent after all the retry attempts.

QoS statistics

Web interface

The "QoS statistics" section provides information about the transmitted and dropped packets in each priority queue configured on the device. Drops present in the traffic processing queues indicate that the throughput threshold has been exceeded. Losses in queue q00 (P16) are acceptable because this queue contains performance test data.

Priority queues statistics			
Software Priority Queues rf6.0 (count / drops)			
q00 (P16) (cos1)	0 / 0	q16	0 / 0
q01 (P15) (cos0)	0 / 0	q17 (P06)	0 / 0
q02	0 / 0	q18 (P05) (cos3)	8 / 0
q03 (P14)	0 / 0	q19	0 / 0
q04 (P13)	0 / 0	q20	0 / 0
q05 (P12)	0 / 0	q21 (P04) (cos4)	0 / 0
q06	0 / 0	q22 (P03)	10 / 0
q07 (P11)	0 / 0	q23	0 / 0
q08	0 / 0	q24 (P02) (cos5)	0 / 0
q09 (P10)	0 / 0	q25	0 / 0
q10 (P09) (cos2)	0 / 0	q26 (P01) (cos6)	0 / 0
q11	0 / 0	q27	0 / 0
q12	0 / 0	q28 (P00) (cos7)	2233 / 0
q13 (P08)	0 / 0	q29	8715 / 0
q14 (P07)	0 / 0	q30	247 / 0
q15	0 / 0	q31	51521 / 0

Auto Refresh: ☒

Figure - QoS statistics

Command line interface

To display statistic via the command line interface, use the "*rfconfig rf6.0 stat qos*" command. The number of dropped packets for each configured queue can be displayed by the "*qm stat*" command.

Statistics graphs

If the link has deteriorated during its operation, having the initial parameters corresponding to the calculated ones, it is necessary to find out when the problem has occurred. Use the "Statistics graphs" tool to determine when or how often the problem occurs by changing the display options.

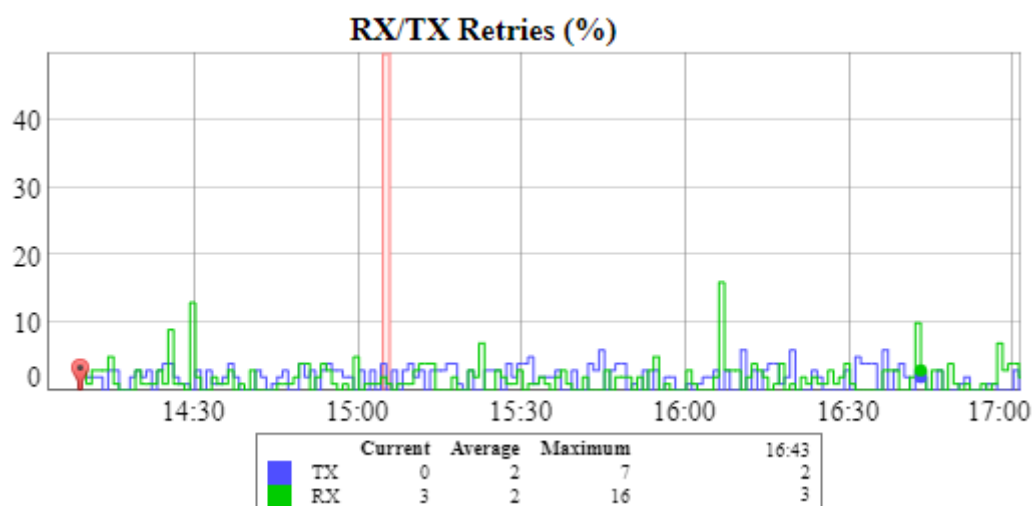


Figure - Statistics graphs

Device status

Title

Pay attention to the CPU and memory usage indicators in the "[Device status](#)" section. Excessive processes running on a device can overflow the volatile memory and overload the CPU (over 95% usage), leading to a deterioration in the wireless link's quality. The CPU load can be displayed using the "[system cpu](#)" command and information about the device's memory state can be shown using the "[mem](#)" command.

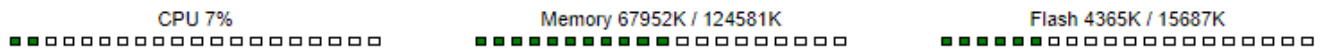


Figure - CPU and memory usage

Last reboot reason

Disruptions in the wireless link may be caused by the reboot of the device. In the "[Maintenance](#)" section or in the "[system uptime](#)" command output pay attention to the last device reboot reason. The following values are possible:

- "Software fault".
- "Unexpected restart".
- "Manual restart".
- "Manual delayed restart".
- "Firmware upgrade".
- "SNMP managed restart".
- "Test firmware loaded".
- "Power-on reset".

System log

Proceed to the System Log tool in the "Device status" section or by using the "[system log](#)" command. Using the log entries, check if the link degradation was caused by a configuration change ("system reconfiguration" message). Restore the previous version of the configuration if necessary. Detailed information about saving and uploading the configuration is available in the "[General Purpose Command Set](#)" article.

Refresh

Auto Refresh: ☒

Auto Refresh Time (sec):

Hide System Log

Clear System Log

CfgU: ftp connection failed
CfgU result code: 2
rf6.0: Link DOWN "ST1" (000435151EAB), no signal, SNR <47/43>, EVM -25
rf6.0: Link DOWN "ST2" (000435152613), no signal, SNR <47/44>, EVM -17
rf6.0: Link UP "ST2" (000435152613), SNR <45/43>, EVM -24
rf6.0: Link UP "ST1" (000435151EAB), SNR <46/42>, EVM -22
rf6.0: Link DOWN "ST2" (000435152613), no signal, SNR <46/44>, EVM -18
rf6.0: Link DOWN "ST1" (000435151EAB), link reconnecting, SNR <47/43>, EVM -20
rf6.0: Link UP "ST2" (000435152613), SNR <43/43>, EVM -20
rf6.0: Link UP "ST1" (000435151EAB), SNR <45/42>, EVM -23
SNMP: using operative ftp account 'bDczbWQidw:bupyrPK4CByHobcFhHKprAzPqWLAhkO@127.0.0.10:2121'
CfgU: uploading config to bDczbWQidw:bupyrPK4CByHobcFhHKprAzPqWLAhkO@127.0.0.10:2121/TgbihLdDu313tebe/SN-337426.

Figure - System log

Pay attention to the following messages:

Messages in the log	Description
Link DOWN	The wireless link has disconnected. The reason for the disconnection is indicated in the same entry.
"too many transmit errors"	The wireless link was interrupted due to transmission errors.
"link reconnecting"	The wireless link is reestablished.
"no signal from the remote side detected"	There is no signal received, check the remote device.
Scrambling engine overflow	The hardware capabilities of the scrambling module are exceeded. To connect more subscribers (more than 62) scrambling should be disabled.

Warning: Abnormal transmit power disbalance!	May indicate a hardware problem.
--	----------------------------------

Frequent changes in the status of the Ethernet interface ("Up" and "Down") may indicate problems with the Ethernet interface, the cable connected to it, with the power supply, or with the switch.

Antenna alignment

Web interface

The link degradation can be caused by antenna misalignment or by the appearance of obstacles along the signal's propagation path. Use the built-in "Antenna Alignment Tool". The recommended parameters are shown in the table below. If the parameters differ significantly from the calculated ones, check the alignment accuracy on both link sides.

RSSI (dBm)	
-90 ... -80	The value is close to the receiver sensitivity level, only lower modulations are available
-80 ... -60	Low level. Average modulations are available
-60 ... -40	The recommended value for maximum performance
>-40	The received signal level is too high
Absolute value EVM (dB)	
>21	Recommended value
CINR (dB)	
>28	Higher modulations are available
Absolute value Crosstalk (dB)	
>20	Recommended value

If the value of the RSSI parameter remains high while the CINR value decreases, it may indicate high interference levels near one of the devices. The deterioration of both the RSSI and the CINR parameters can indicate a misalignment of the devices. A detailed description of the "Antenna Alignment" tool is available in the ["Device status menu"](#) article.

Command line interface

When using the command line to manage the device, fine antenna alignment can be performed using the `"ltest rf6.0 MAC ADDRESS -align"` command. The command output will show the average CINR for the local and the remote devices.

```
BSE#console>ltest rf6.0 000435151EAB -align
```

```
Unicast test to 000435151EAB via rf6.0 with priority 0  
packet size 64, reply size 64, align, tx antennas: local(all), remote(all)
```

local ant.amps dB	remote ant.amps dB	est. rtt ms
36:38:00	32:35:00	12
36:38:00	32:35:00	15
36:38:00	32:35:00	17
36:38:00	32:35:00	14
35:38:00	32:35:00	16
35:38:00	32:35:00	13

Command:

Figure - "ltest - align" command output