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Received Power Problems in 3G and their Impact on Almadar Aljaded Network Performance

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Abstract: In Libya, there are two types of mobile phone networks (Libyana and Almadar Aljaded), and with the development and passage of time, it has become necessary to keep pace with technology smoothly, and on the other hand, the number of network users is increasing, which causes problems that affect the performance of the networks. This study dealt with one of the networks, which is the Almadar Aljaded network for communications and the energy received in the third generation uplink, indicating its values and the factors affecting the studied network, with the development of an algorithm to address the problems that may arise, and this algorithm has proven its effectiveness in addressing three different cases.
Keywords: Received power, AlmadarAljaded, Network, third generation

I. INTRODUCTION

Among the recurring problems facing third generation cellular communication systems are interference in the uplink and the deterioration of (Call Drops), which in turn cause several problems, including increased call interruptions, (Uplink Interference, Quality Degradation) [1, 9].

The interference rate in the third generation in the uplink is measured by an indicator known as Received Total Wideband Power (RTWP) for short, "Received Power"[2].

This study discusses the mechanism for detecting different types of interference and its effects on various performance indicators (which reflect the quality of service to the user) and a number of proposed solutions to these problems, according to studies conducted on the AlmadarAljaded network in the southern region where the communications equipment is owned by Huawei Limited.

II. RECEIVED POWER AND TYPES OF INTERFERENCE

As mentioned earlier, the interference rate is measured by an indicator known as received power in decibel milliwatts (dBm). As shown Figure 1 the value Values below this are considered normal values and above this are considered an indicator, (Threshold) -95 dB is considered a threshold value. There is interference in the uplink [1, 8].

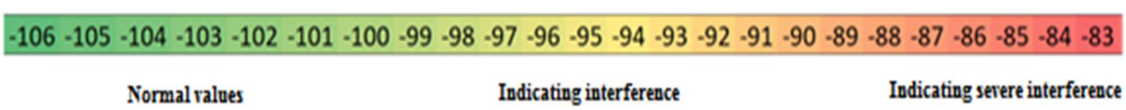

Fig 1: Received power rates

There are several things that cause a negative increase in the received power rates, which can be summarized as follows:

1) Internal interference

This type of interference occurs as a result of a malfunction in the equipment in the stations, which leads to a difference in the received power values measured from the main and sub-inputs (main and miscellaneous ports) of the radio resource unit, where the total value of the received power is affected when the difference exceeds 6 dB [3, 7, 10]. Usually-according to previous experiences in the new orbit network-these malfunctions occur as a result of improper installation of antenna connectors or the presence of bends or holes in the wires resulting from gunshots.

2) External Interference

This type of interference usually occurs when broadcasting on the same frequencies as the NEM, and unauthorized signal boosters usually cause this type of interference. In practice, this type of interference can be confirmed by a spectrum analyzer on the ground. It is worth noting that imprecise frequency planning can also cause external interference.

For example, the NEM uses the 900 MHz frequency band for 2G and 3G operation, and neighboring frequencies can cause interference with each other if the guard distance between frequencies (called guard frequency or guard band) is not taken into account [2, 4]. Another operator can also cause external interference if it uses the NEM frequencies incorrectly.

3) High number of users

Having a large number of users in a cell causes the received power rates to be very high [3, 5, 6]. Figure 2 shows the average number of users versus different values of received power based on data from the Southern Region Network over a period of two weeks.

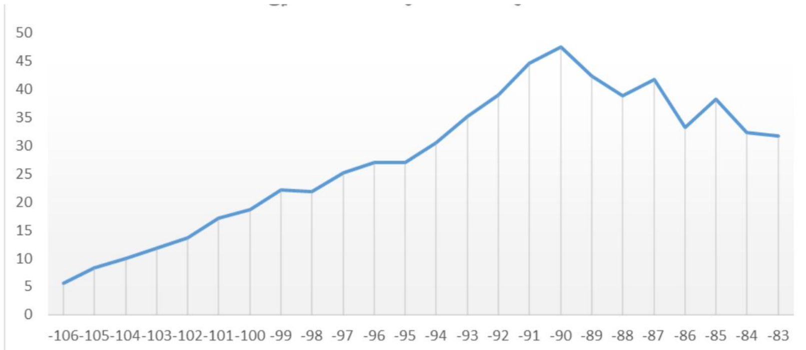

Fig 2: Received power and number of users

In general, it is noted from the figure above that when the number of users is approximately 25 users, the value of the received power reaches the aforementioned threshold value (95 dBm). It can also be noted that the number of users is not always directly proportional (or at least. does not have an explicit linear relationship) to the received power, and this appears at the values of the received power from 88 dBm to 83 dBm. This is due to the presence of other influencing factors such as external interference and internal interference.

III. ANALYSIS AND STUDY OF DIFFERENT CASES IN THE NETWORK

In this section, a number of cases will be classified according to the classification of the three types of interference mentioned above, where they were worked on according to the algorithm shown in Figure 3.

A. Case of Internal Interference

A case of a difference between the main and sub-entries found in the SAB34 station was studied through the PRS platform, the indicators were extracted:

VS MeanRTWP

VS MeanRTWP Locell Sectorfigm Ant0

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Following the algorithm in Figure 3 and using the above indicators (which were extracted over a week, with each day representing a traffic rush hour) and showing a difference between the main and sub-inputs (indicated by the performance indicators between the difference between the main and sub-inputs (indicated by the last two performance indicators), noting that the RX channel imbalance alarm of the RTWP/RSSI RF unit can be relied upon as an indicator of a difference between the main and sub-inputs and in collaboration with colleagues in the Radio and Communications Unit it was shown that the relevant connectors were not installed correctly (the DTF test feature to detect fault locations played a role in this). Figure 4 shows the noticeable improvement after colleagues in the Radio Unit and correspondence with the installation of the connections where the difference decreased from 10 dB to less than 1 dB (an improvement of 85%), which was positively reflected in several performance indicators, including an initial improvement of approximately 6 times in the data transfer rate in the uplink rate per user (HSUPA User Throughput), as shown in Figure 5.

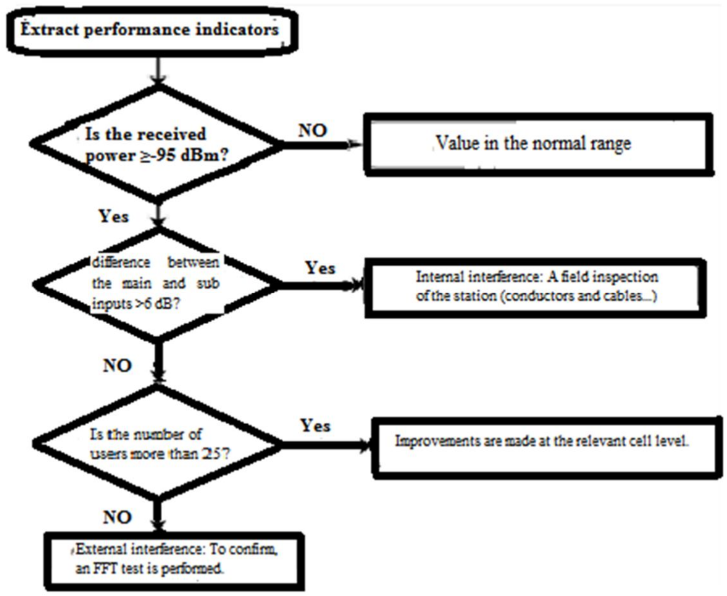

Fig 3: Algorithm for detecting and solving received power problems

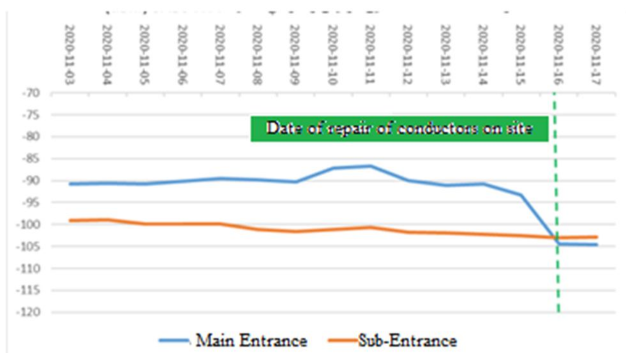

Fig 4: Received power measured at the main and sub inputs of the SAB34WY cell.

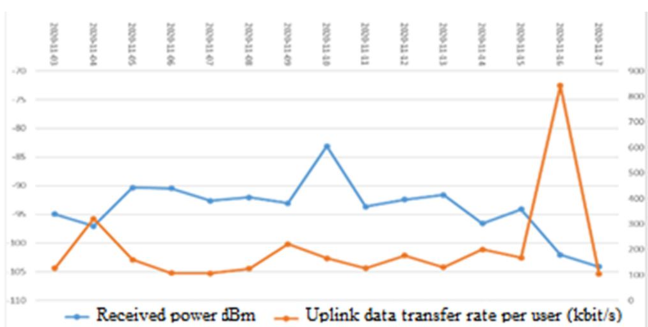

Fig 5: Received power and data transfer rate in the uplink per user for cell SAB34WY

B. External interference case

In this section, an external interference case found at station RSG19W will be studied. After applying the algorithm shown in Figure 3, it was found that there was a possibility of external interference. Accordingly, the received power index data was extracted, with the value for each day being the average of the hours from 3:00 AM to 6:00 AM (non-peak hours). It was found - as shown in Figure 6 - that the value exceeds the threshold value for cells RSG19WY and RSG19WZ, which increases the possibility of external interference.

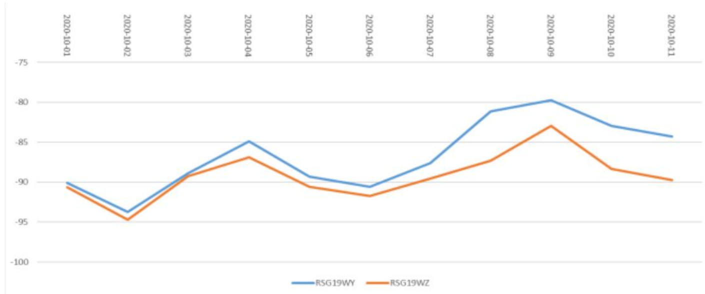

Fig 6: Received power of two cells of RSG19W

Then, for confirmation, an FFT Offline Scan test was performed through the WebLMT platform to confirm the presence of interference and identify the frequencies involved. After analyzing the test results, it was found that the frequency range between 894.6 MHz and 897.4 MHz was affected, as shown in Figure 7.

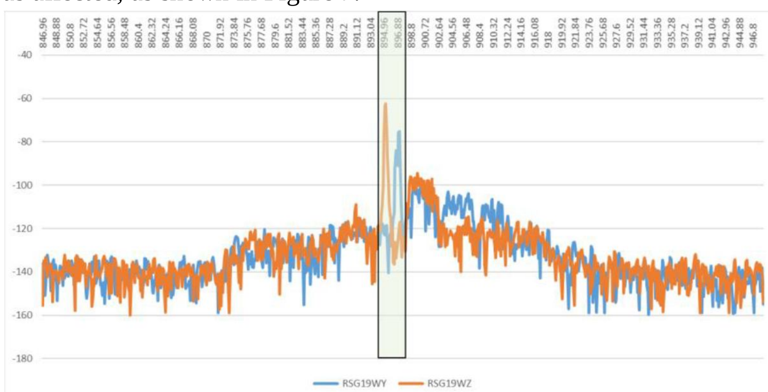

Fig 7: FFT Office Scan result between received power vs frequency

Then using an approximate map of the station coverage in the third generation extracted by a series of performance indicators, it was possible to approximate the location of the source of interference within a circle as shown in Figure 8. After communicating with several parties, the location of the source of interference became largely known and work is underway to address it until the date of writing these lines.

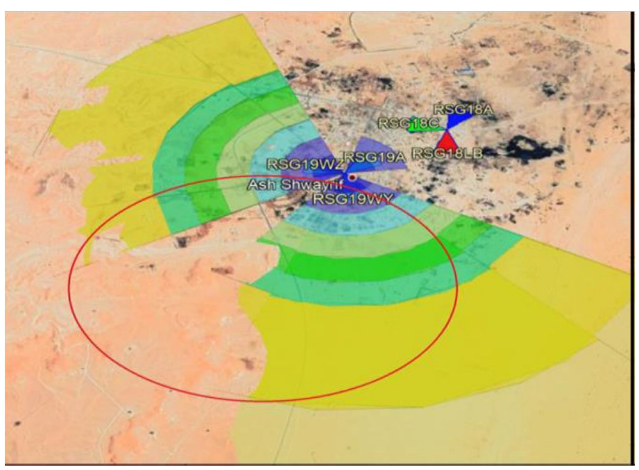

Fig 8: Approximation of the location of the interference source on the station. RSG19W

C. Case of a large number of users

As shown in Figure 2, when the number of users reaches 25 in the cell, the received power value reaches the threshold value. In this section, the case of the NSA37 WB cell will be studied, which has been processed with a number of improvements that will be detailed in succession.

In general, when the number of data users in the downlink exceeds 15(SDPA Users), this increase causes a decrease in the data transfer rate in the downlink. Therefore, taking into account other factors (such as the rate of consumption of the transmitted signal power or TCP Utilization Rate), it is recommended to carry out an expansion if the work cannot be reduced by transferring it to the 4G or neighboring stations and cells.

Returning to cell NSA37B and observing Figure 9, it is clear that the received power increases with the increase in the number of users, and it exceeded the value of the box. However, by applying the improvements shown in Table 1, our text has been reduced to below the threshold value from 93dBm to 98dBm, or approximately 5 dBm.

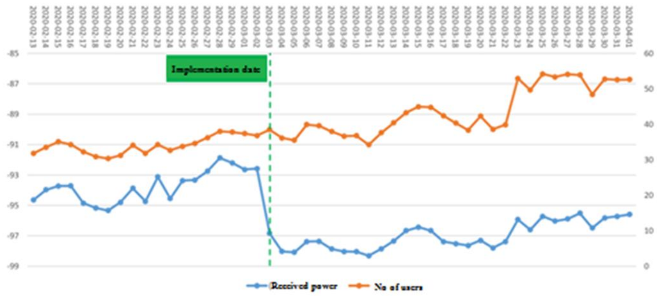

Fig 9: Received power and number of users for cell NSA37B and the effect of applying improvements

TABLE I

SET OF IMPROVEMENTS MADE TO CELL NSA37B TO IMPROVE RECEIVED POWER RATES

Parameter	Effect
E-Tilt (0 to 3)	Limiting Overshooting
CCPIC Phase2 Switch (OFF to CCPIC_PHASE2_COORDINATING_RL_SWITCH-1)	The control center (RNC) performs the interference elimination (IC) process.To reduce interference that may result from neighboring cells
CCPIC Phase4 Switch (DEFAULT to CCPICPHASE4)	Reduce user load on the uplink and improve overall data transfer rate.
RTWPMEAOPTIMSW (OFF to ON)	Increase the number of users getting high traffic at the same time.
NBIS (OFF to ON)	Reduces narrowband interference, improving overall cell performance.

IV. CONCLUSIONS

For internal interference, the RF Unit RX Channel RTWP/RSS Unbalanced alarm can be relied upon as an indicator of the presence of a difference between the main and sub-entries. It is also recommended to use the DTF Test feature to locate faults. As for external interference, it is recommended to use FFT Offline Scan (which requires stopping the service when performing it) to give more accurate results. A Spectrum Analyzer can also be used in the event of a field inspection to identify the source of interference. When there are a large number of users, it is recommended to reduce the load on the cells concerned by either transferring the traffic to the fourth generation or neighboring cells or expanding it if possible. If the above is not possible, several improvements are made to reduce the impact of increasing the received power.

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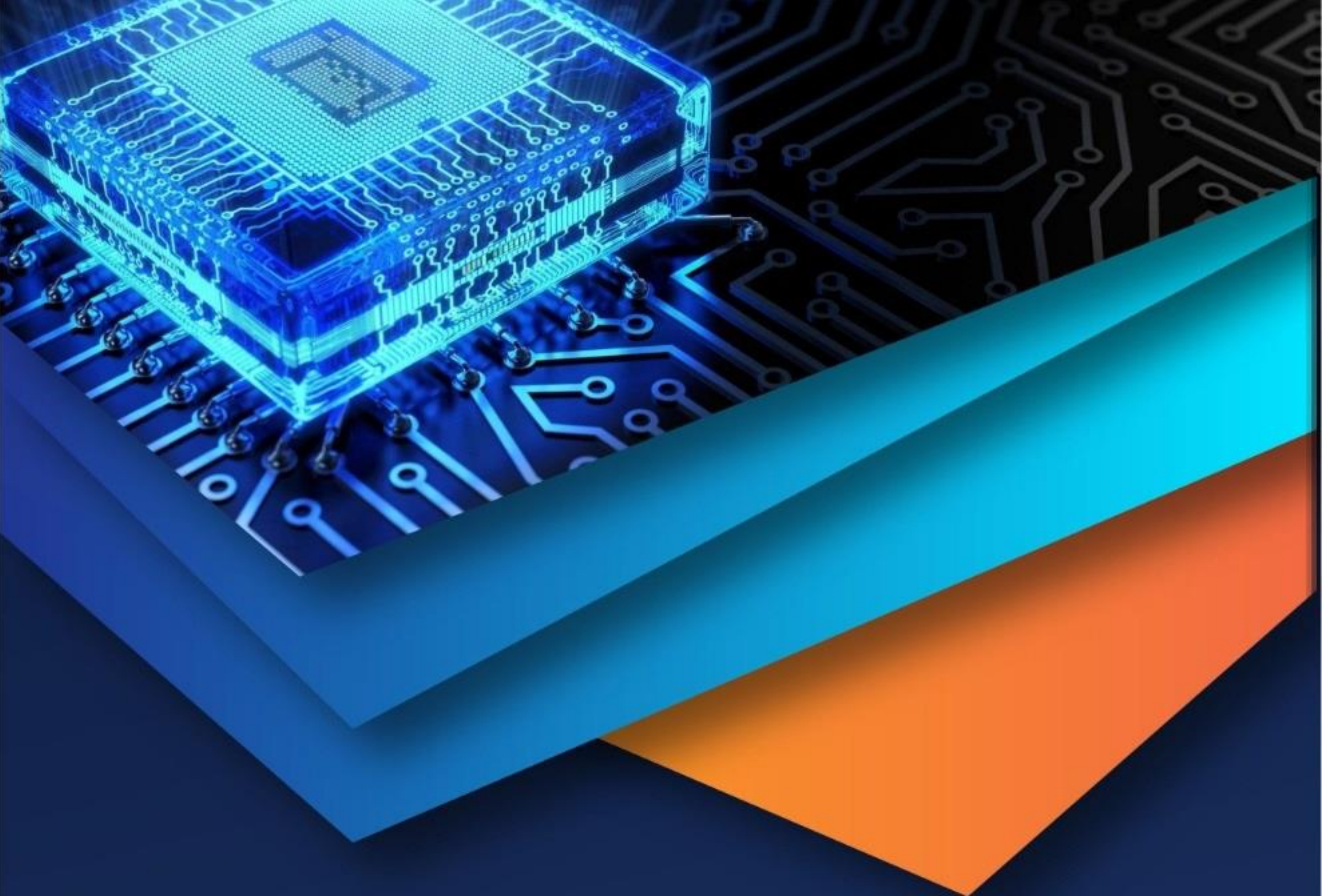

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