CAREER EPISODE 3

a) Introduction:

3.1 In that career episode, I would like to discuss the "5G MW Integration Project" which was initiated by Huawei-Kuwait to integrate and install the 5G network for the "VIVA" mobile network operator which became "STC". Here, I worked as a microwave and datacom transmission engineer to install, integrate, and prepare the acceptance folders for the newly introduced 5G technology sites for 2000 sites during the 5G technology launching in Kuwait plus upgrading the previous technologies hardware components in all over Kuwait between August 2015 and July 2018.

b) Background:

3.2 Alamanni Industries is part of the Alghanim industries group which is one of the big companies in the Kuwait market working in many fields including air-conditioning, office automation, and technology, which lately included Microwave and datacom (working with data communication, especially with fiber optics communications) and network solutions, Al-Ghanim group is working in 40 countries with more than 100 years heritage working with more than 30 business.

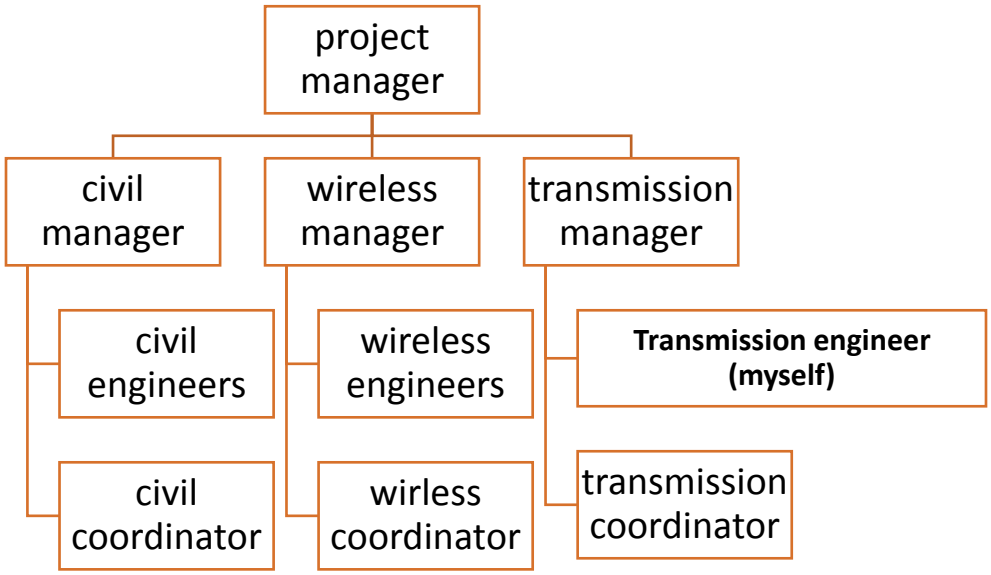
3.3 Huawei is one of the largest telecommunications companies working with all the mobile network operators in Kuwait and with many operators around the world, providing them with the latest versions of equipment for both wireless parts and transmission parts and considered the first company to introduce the 5G technology which signed a contract with "VIVA " operator to provide, install, and integrate 5G network new sites all over Kuwait country plus upgrading the old equipment for the previous technologies (3G and LTE) to the latest ones.

3.4 My job duties as a transmission engineer are as follows:

- Configuring Huawei microwave links such as RTN 380, 310, 980, and 910 for all the technologies including 3G, 4G, and 5G.
- Assure a clear line of sight as per the link budget by managing a team of technicians for the adjustment.
- Configuring Huawei wireless equipment such as BTS 3900 and 5900 through the UMPT card using u2000 Huawei software and WEBLCT for MW during the installation of all site types (FTK, small cells, microcells, and Pico cells).
- Validation summary of newly designed sites to be followed by site engineers including antenna azimuth and link budget.
- Preparing the PAT folder to get the approvals from the customer's acceptance team.

- Managing a team of technicians to collect the required data to prepare the vs and lb by doing surveys

3.5 The organizational chart for the project was as shown below:



c) Personal Engineering Activities:

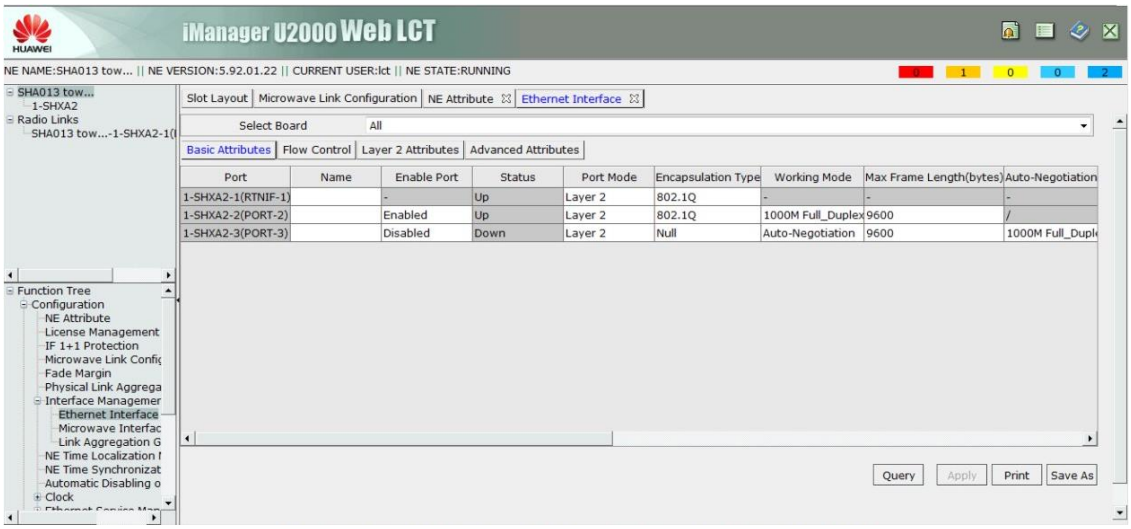
3.6 I first understood the project's goal of covering all Kuwait with the 5G technology, which includes building new sites and upgrading the existing ones. For the implementation of this technology, a collaboration was required among all departments, therefore, I held a meeting with all the coordinators from the other departments (civil and wireless) to discuss how we will perform the technological work. During this meetings, I suggested to complete the civil works first, then the transmission, and lastly connected the wireless system. Hence, it was required to create a proper channel among the three departments so that each member can communicate properly without any hurdle. For this, I arranged the proper reports format which needs to be prepared from each side to explain the work to the other departments.

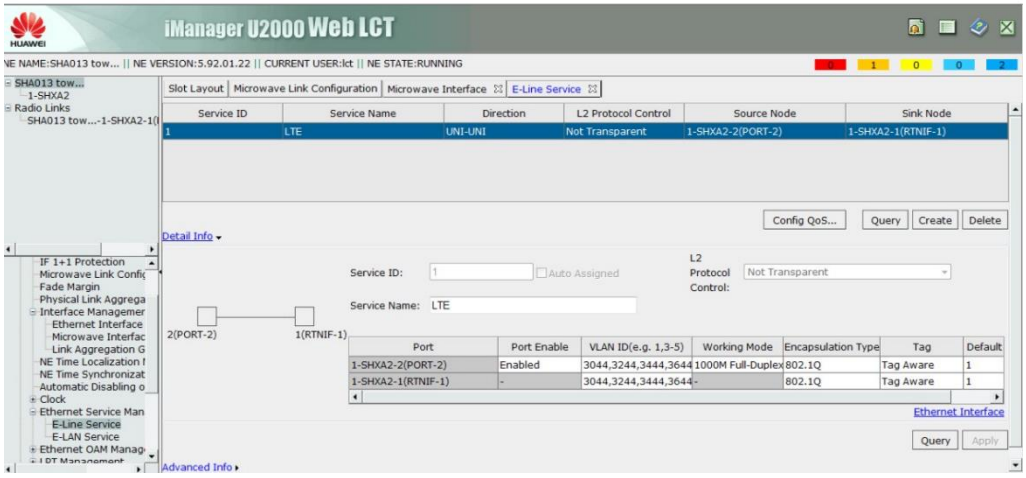
3.7 I performed the configuration of the new microwave links for the newly integrated 5G sites. For this, I first revised the link budget which includes the data to be configured that customer already requested. Then, I checked the devices which needs to be configured because there were four types of the ODU (the outdoor unit) based on the frequency range produced by the unit itself ranging from 6GHZ to 80GHZ, i.e.

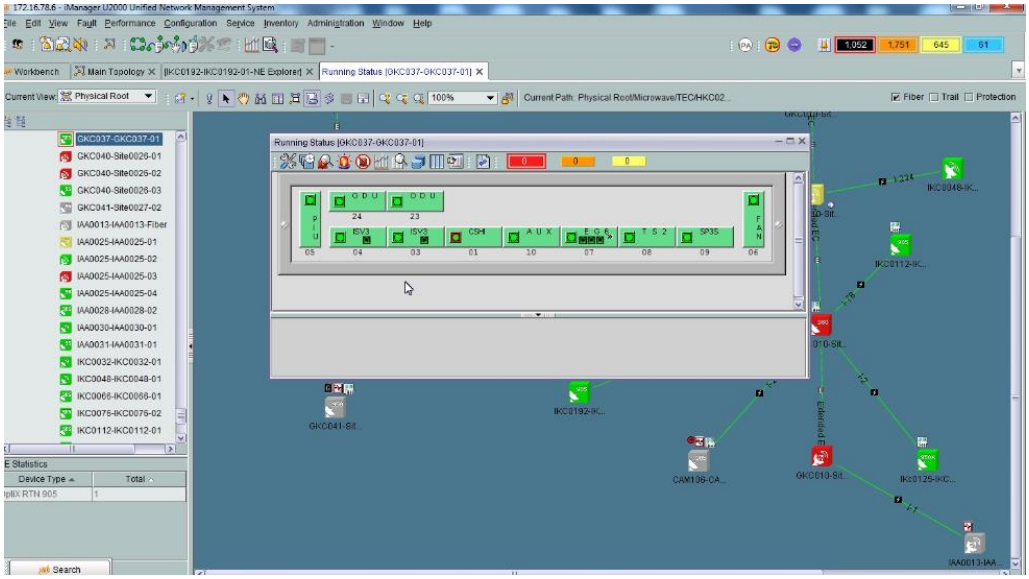
a) 1st type from 6-11GHz
b) 2nd is from 13-23GHz
c) 3rd is from 23-43 GHz
d) 4th is 80GHZ which is usually used for 5G.

3.8 Therefore, based on the hardware datasheet and the planned frequency to be used in the link budget, I decided on the type of device which needs to be used in the system. Furthermore, considering the free space loss equation, I analyzed the required frequency to whether it is suitable or if I had to re-plan the frequency as the equation must fulfill the requirement. After checking the path between the transmitter and receiver, I found out there were no obstacles, therefore, I started the device configuration using the Huawei software WLCT which was to be connected to the device through an Ethernet cable to establish a TCP/IP connection. During this step, I also assumed the required modulation depending on the distance between the transmitter and the receiver as by increasing the distance we should decrease the modulation order (ex:2KM distance we can use 256QAM). Moreover, I also decide the value of the transmitted power (1-20dbm). This power was decided based on two major factors, i.e. range specified by the customer & certified by the regulations of the government and the distance between the two sites.

3.9 Thus, after deciding the values to be used for each parameter, I started the configuration of the link as per the below screenshots from both sides (the near and far end). Here, I instructed the two technicians to climb the towers from both sides to start the link alignment which was to be done using the same Huawei software WLCT. After this activity, I obtained the received power from the far end by the same transmitted value. After that, I developed the Microwave connection and I proceeded with linking the new link with the whole network by adding its ID to the main topology of the network using the u2000 software as per the snaps. Next, I started adding the link to the wireless part of the network by including its VLANS so that all the data traffic coming from the wireless side of the site can be loaded over the newly installed link.


iManager U2000 Web LCT
NE NAME:SHA013 tow... || NE VERSION:5.92.01.22 || CURRENT USER:lct || NE STATE:RUNNING
Slot Layout | Microwave Link Configuration | NE Attribute | Ethernet Interface
Select Board All
Basic Attributes | Flow Control | Layer 2 Attributes | Advanced Attributes
Port | Name | Enable Port | Status | Port Mode | Encapsulation Type | Working Mode | Max Frame Length(bytes) | Auto-Negotiation
1-SHXA2-1(RTNIF-1) | | - | Up | Layer 2 | 802.1Q | - | - | -
1-SHXA2-2(PORT-2) | | Enabled | Up | Layer 2 | 802.1Q | 1000M Full_Duplex | 9600 | /
1-SHXA2-3(PORT-3) | | Disabled | Down | Layer 2 | Null | Auto-Negotiation | 9600 | 1000M Full_Dupl
Query | Apply | Print | Save As
Function Tree
Configuration
NE Attribute
License Management
IF 1+1 Protection
Microwave Link Config
Fade Margin
Physical Link Aggrega
Interface Managemer
Ethernet Interface
Microwave Interfac
Link Aggregation G
NE Time Localization f
NE Time Synchronizat
Automatic Disabling o
Clock


iManager U2000 Web LCT
NE NAME:SHA013 tow... || NE VERSION:5.92.01.22 || CURRENT USER:lct || NE STATE:RUNNING
Slot Layout | Microwave Link Configuration | Microwave Interface | E-Line Service
Service ID | Service Name | Direction | L2 Protocol Control | Source Node | Sink Node
1 | LTE | UNI-UNI | Not Transparent | 1-SHXA2-2(PORT-2) | 1-SHXA2-1(RTNIF-1)
Config QoS... | Query | Create | Delete
Detail Info
Service ID: 1 Auto Assigned
L2 Protocol Control: Not Transparent
Service Name: LTE
2(PORT-2) 1(RTNIF-1)
Port | Port Enable | VLAN ID(e.g. 1,3-5) | Working Mode | Encapsulation Type | Tag | Default
1-SHXA2-2(PORT-2) | Enabled | 3044,3244,3444,3644 | 1000M Full-Duplex | 802.1Q | Tag Aware | 1
1-SHXA2-1(RTNIF-1) | - | 3044,3244,3444,3644 | - | 802.1Q | Tag Aware | 1
Ethernet Interface
Query | Apply
Advanced Info
Ethernet Service Man
E-Line Service
E-LAN Service
Ethernet OAM Manag


Running Status [GKC037-GKC037-01]
GKC037-GKC037-01
GKC040-Site0026-01
GKC040-Site0026-02
GKC040-Site0026-03
GKC041-Site0027-02
IAA0013-IAA0013-Fiber
IAA0025-IAA0025-01
IAA0025-IAA0025-02
IAA0025-IAA0025-03
IAA0025-IAA0025-04
IAA0028-IAA0028-02
IAA0030-IAA0030-01
IAA0031-IAA0031-01
IKC0032-IKC0032-01
IKC0048-IKC0048-01
IKC0066-IKC0066-01
IKC0076-IKC0076-02
IKC0112-IKC0112-01
E Statistics
Device Type
Total
Search

3.10 After finishing all the required configurations, I started preparing the acceptance folder which is a folder including all the photos collected from the field as the device serial numbers, specifications (site design from the wireless side), and all the configurations with their values and all the quality of the work done in the site which too is submitted to the acceptance team of the customer to get the acceptance.

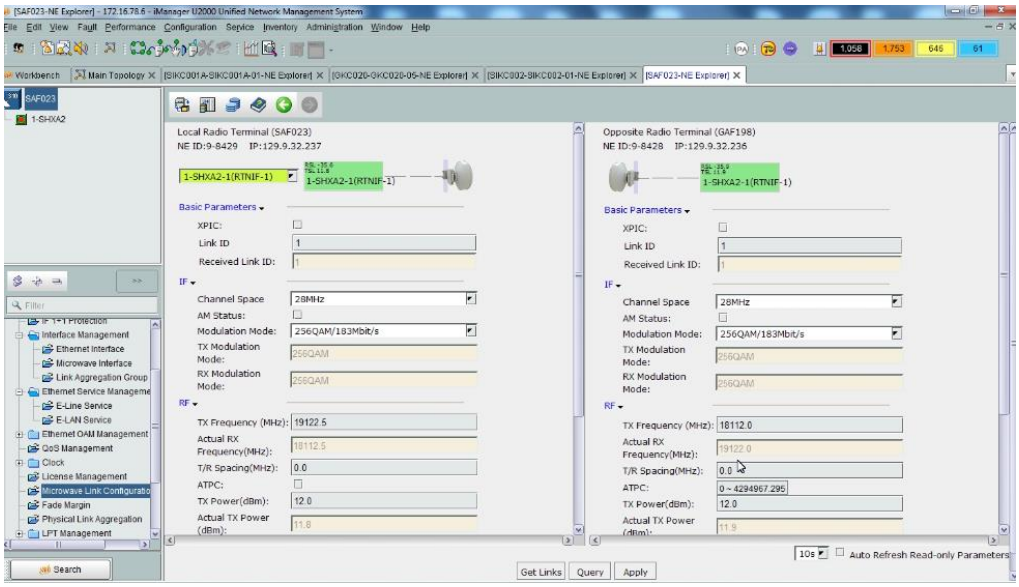
$$FSL=36.6+20logF+20logD$$

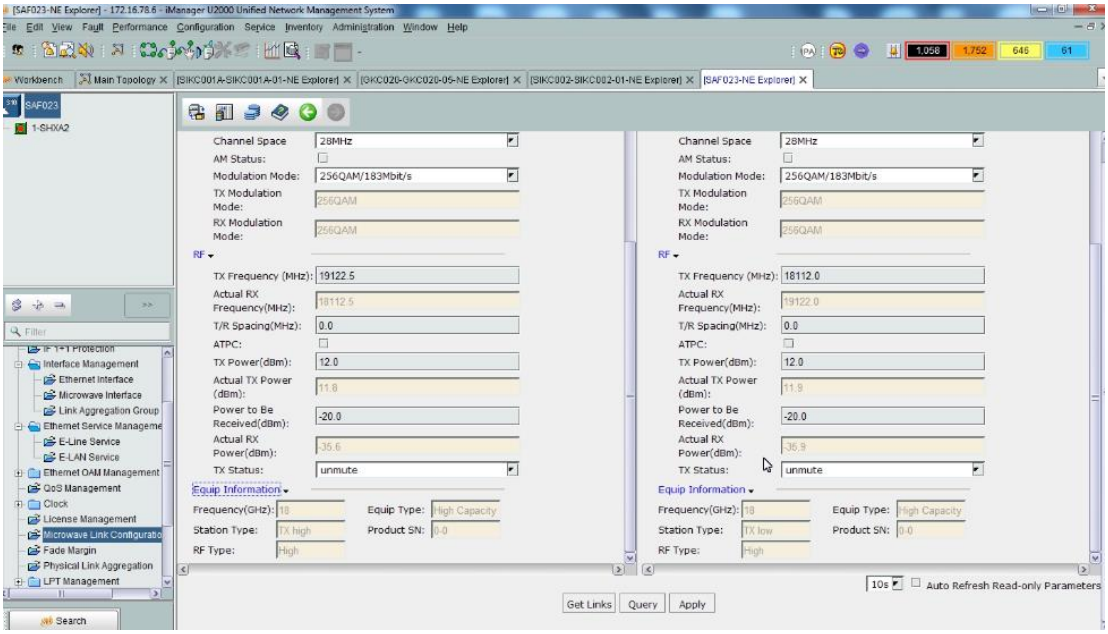
Where F is the used frequency in MHZ and D is the real distance in miles between the transmitter and the receiver and FSL must not exceed a specific range for each frequency band.

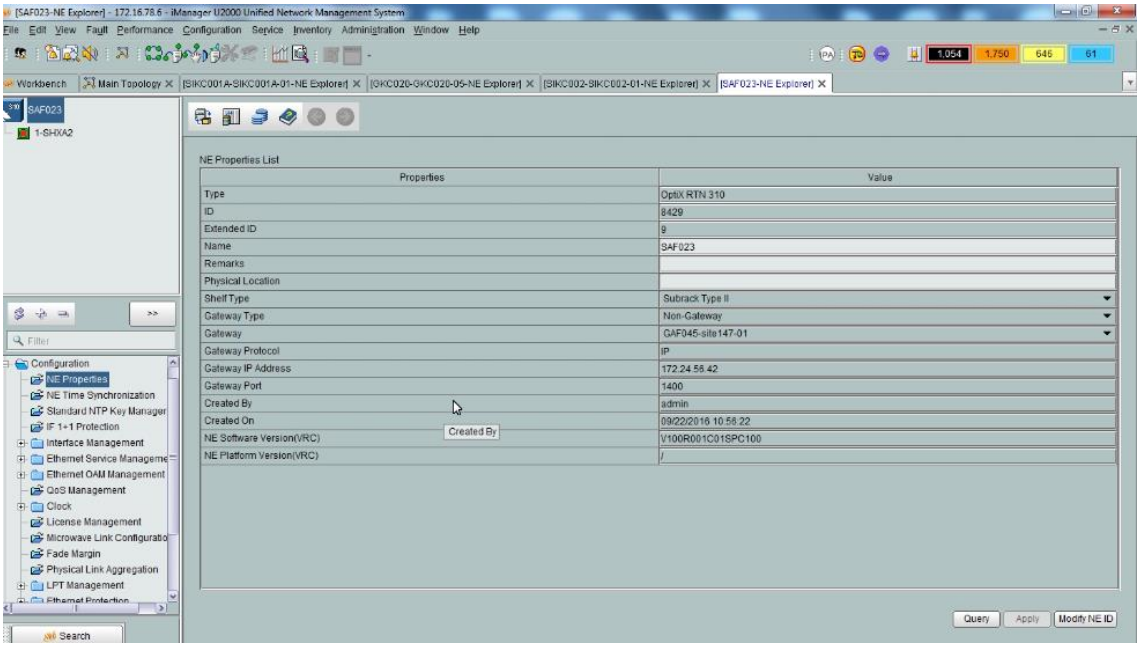
3.11 My next task was to obtain the best LOS (line of sight) alignment for the microwave link by managing a team of technicians who were to be distributed between the transmitter site and the receiver site. In this case, I first ensured that all the data, such as antenna azimuth and tilt are in the correct position installed by the technicians by using some simple tools (compass). Then, I instructed the technicians to start aligning the dishes using millimeters while I was observing the received power in dBm to stop them once it reach the required value. During this process, I also encountered big challenges regarding changing the link configurations of the transmitted frequency because the existing interference was obtained from unknown sources. Therefore, instead of getting 20dbm, I used random values, for example, 6dbm or 15dbm, etc. to get the desired value.

3.12 Another challenge was related to link polarization. I had to ensure the wave would act in the air either horizontal or vertical during the implementation of a new 5G site and setting of the link design with the polarization in the vertical direction. So, after starting the implementation by doing the link alignment, I found that the link was not able to establish any connection. Considering this issue, I revised the link design and the device specifications and I found that the antenna is supporting the band 18GHZ as per the snapshot which is to be used with horizontal polarization, therefore, after 18GHZ the signal got scattered so the horizontal polarization helps to decrease this scattering. I reported the case to the customer and I edited the design which got approved by the customer to be horizontal finally I got the required received power and proceeded to the other link configurations.

3.13 Next, I implemented the launching of the 5G and configured the wireless part of the new 5G site. Also, after completing the installation of all the equipment, I started adding each device to the network using the Huawei U2000 software by its ID and add the VLANs for each service (3G, 4G, and 5G), and configured the operating mode for each card in the BTS 3900 such as UBBP as it can operate with 4 modes. I ensured that each network was used for making it operate for one or more technologies (2G,3G,4G,5G)and checked for any existing alarms to clear and after making sure the site is clear of alarms I send to the customer to make it ONAIR (available for the end users).


[SAF023-NE Explorer] - 172.16.78.6 - iManager U2000 Unified Network Management System
File Edit View Fault Performance Configuration Service Inventory Administration Window Help
Workbench
Main Topology
[SIKC001A-SIKC001A-01-NE Explorer]
[GKC020-GKC020-05-NE Explorer]
[SIKC002-SIKC002-01-NE Explorer]
[SAF023-NE Explorer]
SAF023
1-SHXA2
Local Radio Terminal (SAF023)
NE ID:9-8429 IP:129.9.32.237
1-SHXA2-1(RTNIF-1)
Opposite Radio Terminal (GAF198)
NE ID:9-8428 IP:129.9.32.236
Basic Parameters
XPIC:
Link ID
Received Link ID:
IF
Channel Space
28MHz
AM Status:
Modulation Mode:
256QAM/183Mbit/s
TX Modulation Mode:
RX Modulation Mode:
256QAM
RF
TX Frequency (MHz):
19122.5
18112.0
Actual RX Frequency(MHz):
18112.5
19122.0
T/R Spacing(MHz):
0.0
ATPC:
TX Power(dBm):
12.0
Actual TX Power (dBm):
11.8
11.9
0 ~ 4294967.295
Auto Refresh Read-only Parameters
Get Links
Query
Apply
Search


[SAF023-NE Explorer] - 172.16.78.6 - iManager U2000 Unified Network Management System
Channel Space
28MHz
AM Status:
Modulation Mode:
256QAM/183Mbit/s
TX Modulation Mode:
RX Modulation Mode:
256QAM
RF
TX Frequency (MHz):
19122.5
18112.0
Actual RX Frequency(MHz):
18112.5
19122.0
T/R Spacing(MHz):
0.0
ATPC:
TX Power(dBm):
12.0
Actual TX Power (dBm):
11.8
11.9
Power to Be Received(dBm):
-20.0
Actual RX Power(dBm):
-35.6
-36.9
TX Status:
unmute
Equip Information
Frequency(GHz):
18
Equip Type:
High Capacity
Station Type:
TX high
TX low
Product SN:
RF Type:
High
Auto Refresh Read-only Parameters
Get Links
Query
Apply



3.14 After configuration, I supervised the site to ensure that the field team is following the safety roles as they must use the proper Personal protective equipment (PPE) during working on heights which were stated in a training that was held by Huawei EHS teams, such as the safety helmet, full body harness, safety shoe, safety vest, and gloves and make sure that all the instructive labels are labeled in the site. Later, I uploaded the safety supervision details for all the workers in the Huawei ISDP application. Moreover, I also developed a PAT folder (including serial numbers for all the installed equipment, photos for all the installed equipment showing also the quality of installation, safety assurance snaps, and site design, that folder is to be submitted to the customer for the acceptance of the site). I ensured that nobody is working on heights from 11 AM till 4 PM as instructed by the Kuwaiti government as the temperature can exceed 50” during that time.

3.15 I faced a challenge while installing and configuring one of the first 5G patch sites in Kuwait which were built inside the Kuwait international expedition and it was the launching site for the 5G in Kuwait in a big event held there to show the usage of the 5G technology in the virtual reality. I had to connect this temporary site network with a microwave link, but no near site was having the free capacity to include the traffic coming from my new site. Therefore, I decided to increase the capacity of the microwave transmission link of the far end site by replacing the normal link 1+1 which uses only one polarization with the XPIC link which uses double polarization instead of one. This doubled the data rate of the transmitted data. Also, I requested approval from the customer side to do the required action and proceeded with the installation which was done within the same day to match the target as the launching ceremony was by the evening and then I got appreciated by my team from the CTO of VIVA company Kuwait (the mobile network operator company).

3.16 Meanwhile, I arranged meetings with subcontractors to give brief descriptions of the tools required for the project. I remained in contact with them to check the availability of some materials required frequently on the site, especially during the installment and alignment of the microwave links such as calibrated millimeters and calibrated compasses. Also, I arranged a required number of technicians and laborers for the site installation works as the 5G equipment is much heavier than the other technologies and it's so sensitive during the link alignment for the microwave links. I discussed with the team the total number of technicians required for the installation of each type of site (FTK, small cells, Pico cells, and site upgrades).

3.17 I also did self-study to quickly understand the 5G transmission concepts such as MIMO (multi input multi output) which is used even in the wireless part of the 5G, but here in the transmission, we are using it to double the capacity of the data to be transmitted over the microwave link with a very high data correction rate.

d) Summary:

3.18 I learned from that project how to deal with new technologies such as 5G which was an added value to my career in telecommunications plus managing a big team of technicians and dealing with the safety rules. Furthermore, I increased my knowledge of using Hawaii software for linking the new link with the whole network and developing the network connections. I worked along with the site installation team and I got the chance to learn from their field experiences.