DESIGN OF THE STATIONS COMMUNICATION SYSTEM IN EMAPA-I AND PROPOSED MIGRATION OF RADIANT SYSTEM TECHNOLOGY USING THE IEEE 802.11ac STANDARD

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Abstract — This project consists of the design certification of the communications system of pumping stations EMAPA (Ibarra), complying with the recommendations issued by the ANSI and other organizations responsible for standardizing and regulating the telecommunications sector; additionally reengineering and migration of wireless system technology in accordance with the guidelines established by the IEEE 802.11ac. The work comprises four chapters where safety requirements and availability required in transmission and data processing functions that perform the heating system and the communication system respectively arise.

Índice de Términos — SCADA, ANSI, 802.11ac, Fresnel.

I. Introduction

The importance of full and truthful information establishes as a precedent that the structure that supports this flow of information must have adequate planning, molding it into a physical area designed specifically for this purpose, where effective protection of computer assets is ensured Ie data and hardware, obeying local, regional and international standards.

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A telecommunications room is not only focused on protecting the computer equipment and information, but also the life of the personnel who operate it, highlighting criteria such as: preparation, safety standards, recovery procedures in case of infrastructure failure.

EMAPA-I is a public company of the city of Ibarra, whose purpose is to capture, process, distribute and sell potable water and, in parallel, the provision of sewerage services and sanitary infrastructure to the Ibarreña community and its rural parishes; The constant flow of clean and consumable drinking water to each household represents a social commitment for EMAPA-I, with the population of the different sectors of the city of Ibarra; For it has been located different stations throughout the city that allow you to store, treat and pump the vital liquid.

Inside the pumping stations of the vital liquid, the pressure levels in the valves are monitored through a SCADA system, this system extracts information through sensors that inform the state of the keys, concentrating this data in a server located in a room of equipment The same that has little lighting, has no ventilation system or electrical redundancy, physical security is minimal, low level of ducting and ductile, poor electrical dimensioning; Factors that prevent the teams from reaching their maximum performance in data processing.

The information processed by the SCADA system is destined to the repeater station located in the sector of

San Miguel Arcángel, and then sent to the headquarters office located in the "Francisco Calderón" Plazoleta, by wireless communication is here where there are drawbacks since the Design of a radiant system must have a planning regarding calculation of losses in the links, calculations of Fresnel zones, line of sight and addressing, among other parameters; With the objective of determining the feasibility of the link, which has not been carried out in the radiant system that EMAPA-I possesses in the points mentioned above.

II. Theorical basis

Next, the theoretical basis for the development of the present project is established, starting with the consideration of different recommendations issued by the ANSI, then a review of the IEEE 802.11ac standard and finally the explanation of the SCADA systems.

A. Infrastructure standards

The ANSI / EIA / TIA-568, ANSI / EIA / TIA-569, ANSI / EIA / TIA-568, ANSI / EIA / 607 and ANSI / EIA / TIA-942. In them it is mentioned that a room of equipment is a space destined for specific use of telecommunications equipment and several or all the functions of a room of telecommunications can be provided by a room of equipment, with the difference that a room of equipment also includes Work space for telecommunication personnel, in the process of structuring a quarter of equipment are considered key aspects such as: planning of the physical area, study of energy capacity, verification of computational capacity, adequate temperature and humidity among other engineering details .

A.1. Civil work

The equipment room requires dedicated spaces to support only the telecommunications infrastructure ie to support the wiring and telecommunications equipment itself.

The telecommunications equipment room should be a closed space ie no windows to avoid dust and it is proposed to install over floor or technical floor, as well as false ceiling or false ceiling [1]

A.2. Communications system

At this point, some estimations will be made with respect to the supports on which the transmission means travels in a room of telecommunications equipment and its main elements.

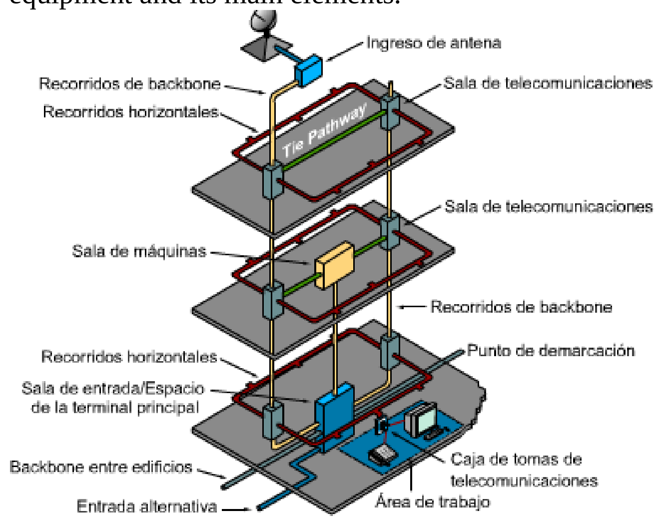

Fig. 1 Parts of a telecommunications room

A.3. Air conditioning system

The appearance of the temperature and humidity inside a room of equipment influences the performance of the artifacts that it contains, precisely this point focuses on giving continuity to the computer process, defining ranges of the factors of air conditioning.

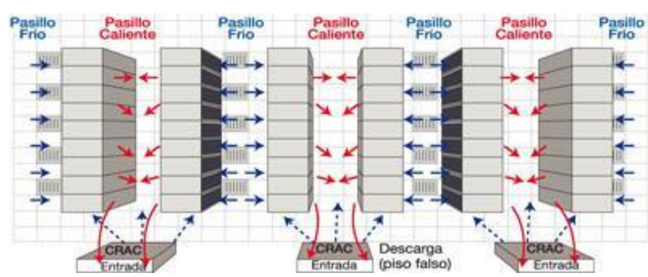

Fig. 2 Cabinet technical location in hot and cold walkways

In the "hot aisle / cold aisle" configuration cabinets and equipment racks are arranged in alternating rows of hot and cold aisles; In the cold corridor there are perforated plates, then the cabinets of the equipment are placed front and front so that the cold air reaches the front of the equipment, instead that in the hot corridors the cabinets are placed rear with back, allowing That the hot air is expelled into the hot aisle, obviously there are no perforated plates in the hot aisle. [2]

A.4. Security installations

This phase of the design contemplates technical specifications of those systems that will maintain the physical integrity of the people, information and the equipment that are in the room of telecommunications equipment.

Fig. 3 Biometric Access Control

This system will also have an electromagnetic lock that will be embedded in the main access door to the room, this in turn will be controlled by the biometric, allowing in this way to open or close the door respectively.

A.5. Electric system

This is the most important aspect to take into account in the current design of telecommunications since this depends on the correct operation of the equipment, only a fraction of a second is enough time to cause a failure in servers, communications, transactions that is why A reliable power supply must be guaranteed. Or in the present case that at least the administrator has time to back up the information.

The electrical system for the equipment room must be kept independent of any other load that is in the building, starting from the main connection, but with a cut in the power supply, the uninterrupted power system (UPS) will assume Charge momentarily.

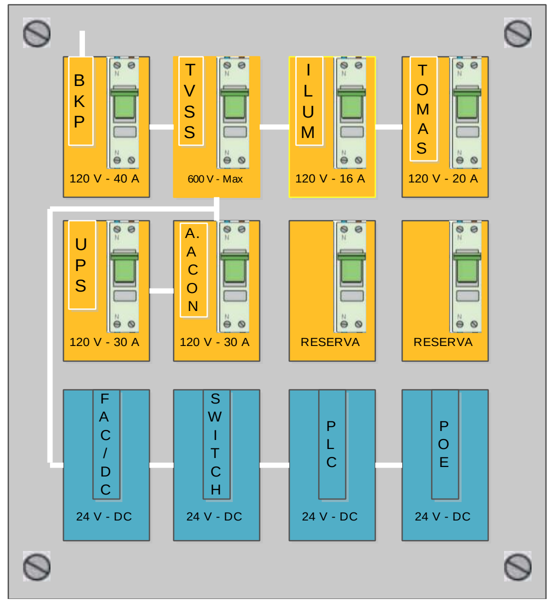

Fig. 4 Distribution of the electrical board

The ANSI / TIA 942 standard states that the level of lighting required for a telecommunications area is 500 lux horizontally and that the walls, ceiling and floor must be of such color as to aid the illumination of the equipment room. The luminaires can be of the fluorescent type or led type, that adapt to the level of illumination that is required in the area.

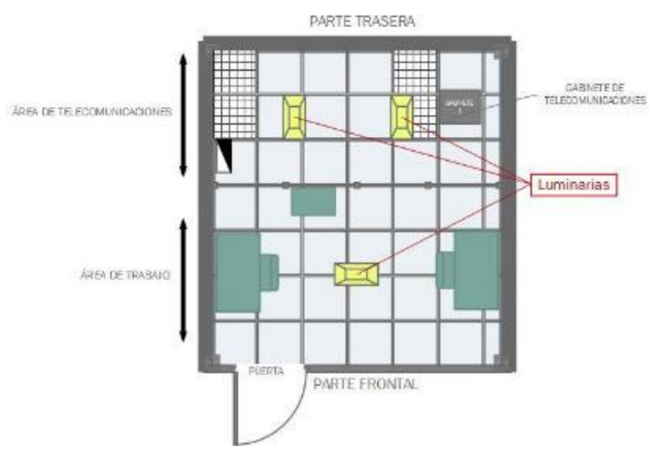

Fig. 5 Distribution of luminaires in the equipment room

B. Wireless System

To begin with the final phase of the project is presented a table of the geographical location of the points involved in the communication process.

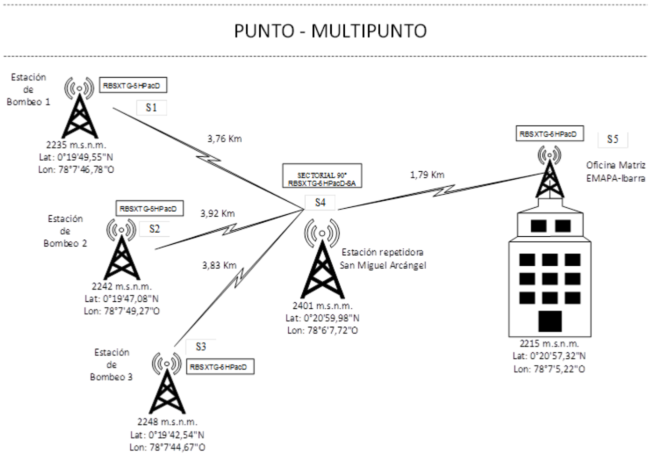

Fig. 6 Wireless System Architecture

Next, the Fresnel zones are planned for clearing so that each station has a strip suitable for effective wireless transmission, this will be achieved by calculating how much the antennas should be lifted in order to be able to perform the broadcast.

B.1. Pumping station to repeater station

A scheme is made to identify the variable to be calculated in this section which is the height at which the antennas should be placed in the pumping stations.

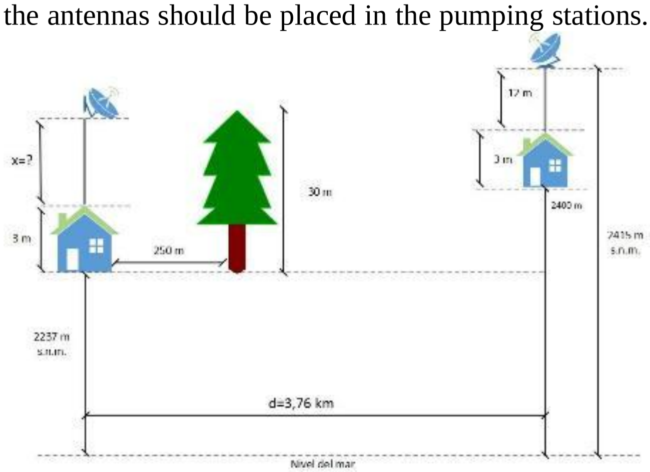

Fig. 6 Scheme prior to the Fresnel zone clearing design

B.2. Equipment used in the radiant system

The selection of equipment should be made taking into account the needs in terms of technical characteristics of the devices that will be employed in the design.

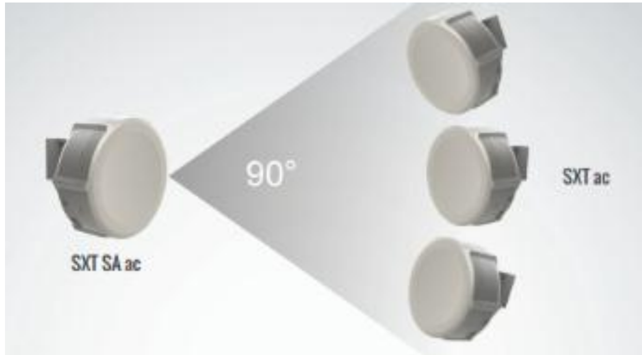

Fig. 7 Devices for the point-multipoint link with sector SXT SA ac

The manufacturer's recommendation to maximize the performance of the wireless system is to work with the above-mentioned sector antenna along with the SXT antennas as a function of stations.

B.3. Simulation of the radiant system

The first step is to set the stations, at this point the geographical coordinates must be delivered at each station ie its latitude and longitude.

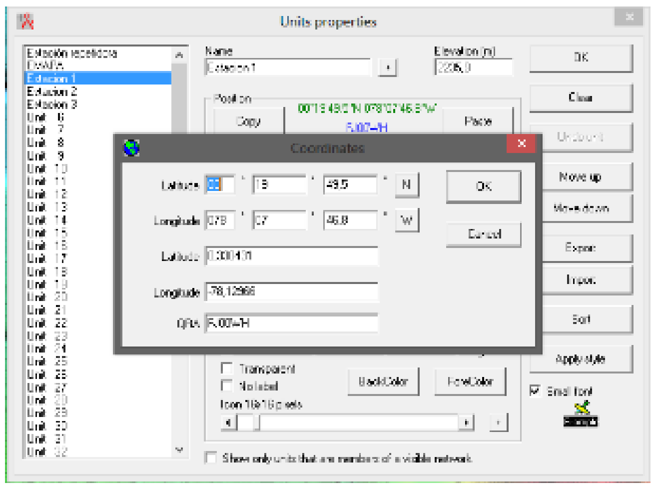

Fig. 8 Fixing stations

When the stations have already been fixed, a screen will be displayed showing the stations and the topography of the terrain.

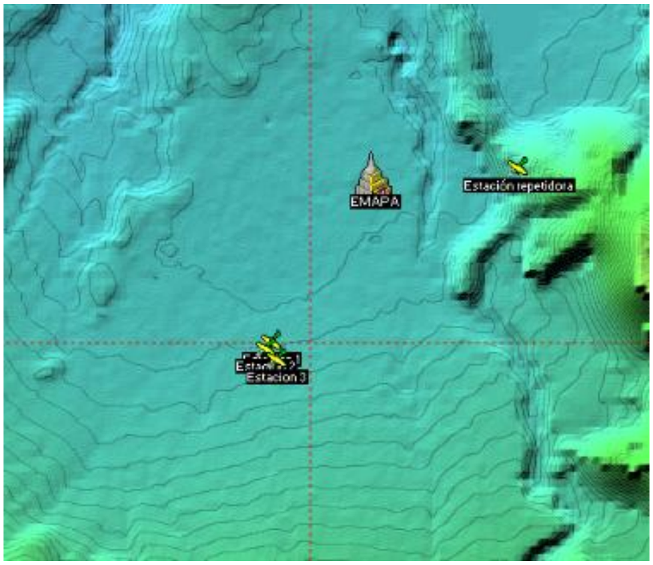

Fig. 9 Map location of the sites

B.4. Set up the link

This option allows you to define each link and its characteristics, such as the maximum and minimum frequency.

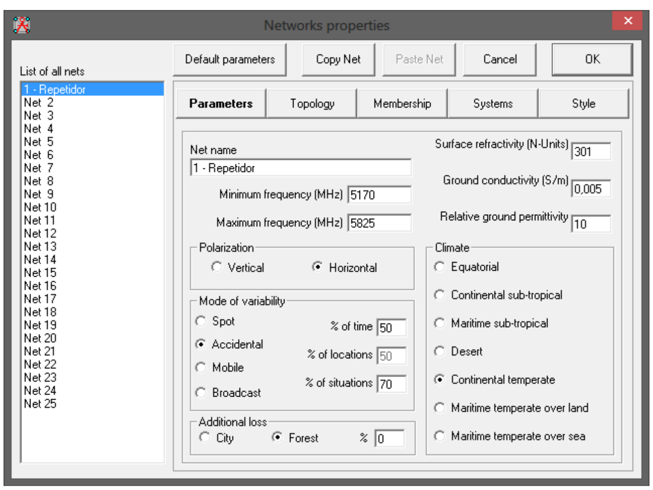

Fig. 10 Link Characteristics Definition

A 90° sectoral antenna configured in repeater mode would be sufficient to transport traffic from the pumping stations.

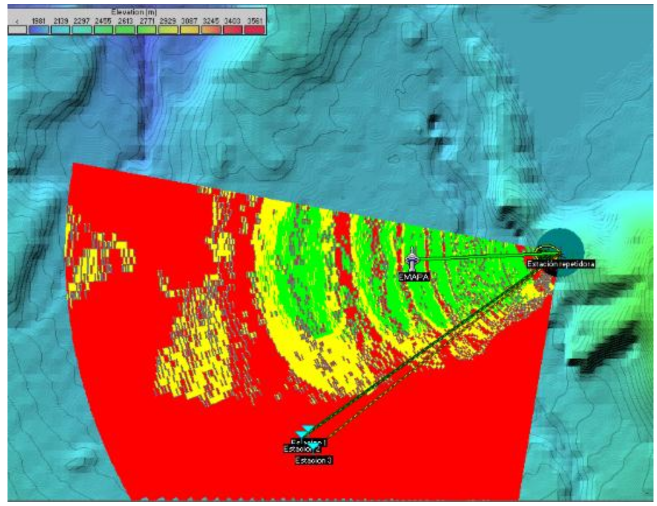

Fig. 11 Area covered by sector antenna 90°

III. CONCLUSIONS

- ICREA-Std-131-2013 and EIA / TIA standards were analyzed, from which it can be concluded that the ICREA standard has considerations that are better adapted in data processing centers and management of information technology areas (ATI) At the level of Latin America, in what refers to civil works, communications system, security, electrical system and environment system.

- Through the analysis of the current situation it was possible to identify different shortcomings that affect the processing and transmission of the information, as for example the communications system does not have the due system of canalizations, as far as the electrical system is not due the protections To earth, as far as the ventilation system does not exist the necessary atmosphere system, lastly as regards the security system there is no access control equipment and stage of fire detection / extinguishing; It is possible to emphasize that this design delivers a series of well-organized steps so that the technical staff can identify with precision the mentioned aspects in order that they are solved at the moment of implementation.

- This design took into account considerations inside the room of telecommunications equipment, such as clearing the area where IT equipment will be set up, providing a good distribution of the SCE, forming a robust electrical system and an adequate ventilation system ; Once the site or room to accommodate the equipment is adequate, the wireless system reengineering, ie its entire structure, such as antennas, routing, power budget, profit and loss, is re-engineered.
- The factors that influenced the choice of the components of the communications network in each pumping station are the transmission speed, this should be higher than 1000 Mbps, this does not generate bottlenecks in the information processing and the second Is that they are compatible with the data transmission devices in the LAN of EMAPA-I, which allows to establish stable bases for the technological scalability.
- The reasons for using the IEEE 802.11ac standard for wireless system reengineering were the following: transmission speed (1.3Gbps), which helps to implement applications that require a greater flow of information, handling of MIMO technology , Increase of the bandwidth, compatibility with previous versions, thus giving greater adaptability to the ever greater demands of the technological environment.
- The economic analysis of the project included not only the financial factor or the costs that are equivalent to the implementation of the project, but also the benefits that will be obtained in the future by the departments of the company and the population to which the service is being delivered, Where the study of results should be focused.
- Being a public company that provides drinking water services to citizens and water the essential liquid for life, EMAPA must manage a concept of excellence in terms of water management in its different stations and carry out a project of this type , The cost that has been estimated to execute the project is not considered as an expense but as an investment.

IV. Bibliographic references

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V. Biography

Danny F. Melo G. Was born in Quito, Ecuador, on February 23, 1989. His primary education was at the "24 de Mayo" Mixed Tax School. He obtained a bachelor's degree in Physical and Mathematical Sciences at the "Los Shyris" Technological Institute of Quito and studied Electronics and Communication Networks at the Faculty of Engineering in Applied Sciences (FICA) at Universidad Tecnica del Norte in Ibarra - Ecuador.