A Solution for Providing an Uninterrupted Transmission on Priority Basis during A Long Power Failure at A Cellular Site

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ABSTRACT

Power failures at cellular sites take place most of the time due to various reasons. For continuous transmission, battery banks are used to operate at such instances. But, if there is a long power failure, capacity of battery banks go down which causes sudden drop of whole GSM transmission. This results in many negative effects for the service provider.

In this research, a system has been proposed for uninterrupted transmission when a power failure occurs at a cellular site. This design is very useful for a site where there is no diesel generator. Basically there are 3 sector (GSM) antennas in a cellular site. When these three antennas are converted into dual band system, it is considered as 6 antennas. These cover the different population densities. Analyzing the usages of each antenna, this system was suggested to save power to operate most important antenna after a power failure occurs. It is done by managing the battery bank; in such a way that power is gradually cut off to each antenna on priority basis.

KEY WORDS: Battery Banks, Cellular Sites, GSM transmission, Power Failures

INTRODUCTION

The company where I had my industrial training has begun with the launch of banking software system to Co-operative Banks in Sri Lanka, over the past few years, it has been engaging in multi-dimensional business activities. It is involving in offering solutions to telecommunication service providers of various networks, especially that of mobile communication. It provides engineering services for planning, developing and managing services to all mobile Telecom operators, Telecommunication vendors and customers, cost effective Engineering purposes and infrastructure development. Further, it is supplies equipments and attends for maintaining services.

Some some of the services offered by the company are

- Site survey for network designing and for the new installation
- Tower supply erection and civil construction work
- Shelter supply installation, with civil work and maintenance
- RF planning and coverage study.
- Preparation of Engineering plans / Drawings
- Network designing and related services
- Installation of Telecommunication system
- Testing and commissioning, certifying of systems
- Manage systems and comprehensive maintenance services

Background and Rationale for the Research

The fast growing world mostly depends on the speed and uninterrupted communication between and among relevant people. To establish fast communication between each other, mostly used method is the wireless communication. Therefore it is needed to keep Base Transmission Station (BTS) alive for uninterrupted communication. There are numerous factors affecting that and among them power management is one of the most important aspect. With the term power management, it is meant about maintaining

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continuous operations at BTS during a power failure. In general, at cellular sites, there are battery banks to get activated at a power interruption and to provide an undisturbed service. The unfortunate thing that occurs is the battery banks are not capable of supplying power for a long term power failure. As such, whole transmission process gets paralyzed. In this research, an automated system was designed to increase the working time of BTS in an effective way when a commercial AC power failure occurs in a cellular base station. With that design, power distribution to antennas will be cut off on priority basis.

The following table shows how the power failures have affected continuous communication for one mobile operator in Sri Lanka.

Table 1: Fault Descriptions

Sub Region	VSWR Alarms	Temp High Alarms	Power Alarms
Kalutara	-	1	38
Galle	-	2	67
Matara	-	1	51
Hambanthota	-	1	36
Ratnapura	1	1	30
Avissawella	2	1	28
Ampara	4	3	78
Batticaloa	3	5	90
Nuwara Eliya	1	2	55

Research Objectives

When a power failure occurs, the existing system will cut off the whole BTS power (when battery level goes down to 47/46 V).This research is aimed at maintaining active time of transmission connections by cutting down power to sector antennas on priority basis.

METHODOLOGY

The equipments of cellular site base on GSM and Microwave transmission are operated with 48DC voltage.
When AC power fails, battery bank will start to provide voltage via rectifier modules.

Basically battery bank provides power only to BTS and MW links. Normally battery bank is discharged from 52 V to 46 V when the system operates with the battery bank.

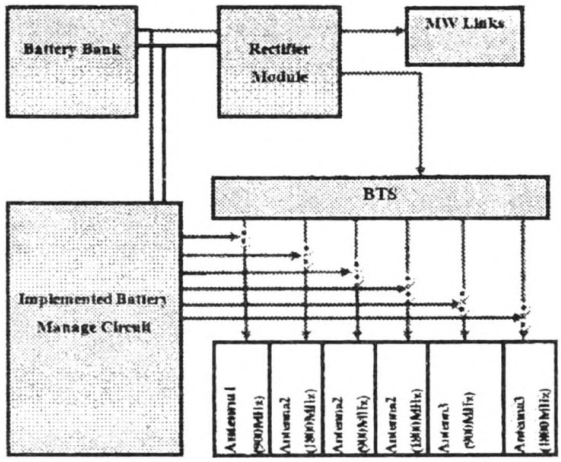

Figure 1: Block diagram of proposed system.

The output of battery bank is connected to the voltage divider circuit and it takes out 1/10 of battery bank voltage. Then it varies between 5.2 V and 4.6 V and it is easy to connect as a inverting input for all LD741 OpAmps.

All 6 op-amps are operating in12 V and 0 V as supply voltage (V+ Supply and V- Supply). To get outputs from op-amps in 49 V, 48.5 V, 48 V, 47.5 V, 47.25 V, 47 V relative to battery bank, 4.9 V, 4.85 V, 4.8 V, 4.75 V, 4.7 V, 4.65 V are connected to the non inverting input of op-amp as shown in circuit diagram.

When the battery voltage level goes down to the reference voltage, the op-amp produces +12 V as output. If not output becomes 0 V. After output becomes 12 V by using B313 NPN transistor, next output of op-amp

connected to driver circuit, switches on the relay that is shown in block diagram.
The next part of the circuit was designed to switch on/off the power cables which are going to sector antennas separately. Cutting off power to each sector antenna depends on the voltage level of battery bank.

The block diagram shows the way of cut off the power to one sector antenna using one op-amp and full circuit included with six op-amps for six sector antennas.

IMPLEMENTING THE CIRCUIT

Mainly a voltage comparator was used for this circuit development as following circuit.

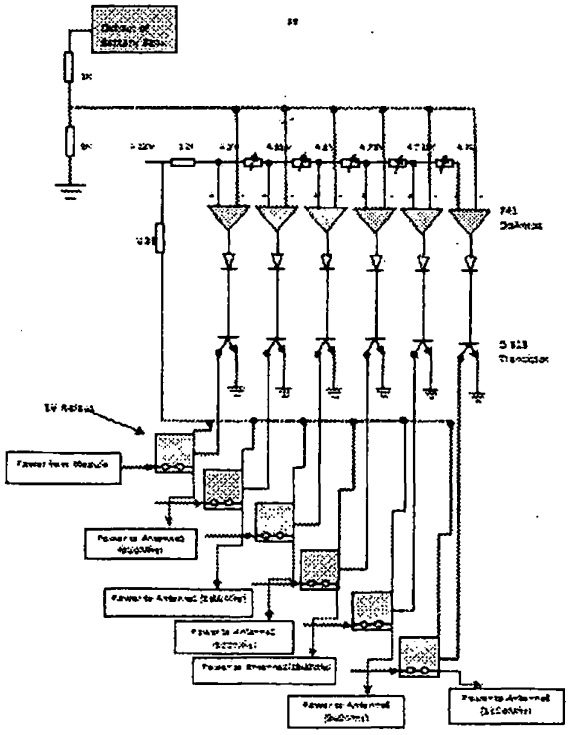

Figure 2: Implemented circuit for power management

DISCUSSION

Due to security reasons, it was not allowed to use a cellular site for checking the design. Hence, design could not be checked under real world application.
But, the objective was to indicate the availability of necessary power during a long term power failure. For that LEDs were used as indications of availability of required power in sector antennas.

CONCLUSION

In this research project, the final objective is a power management system for the cellular sites by dropping the power in separate antennas on priority basis. As a further implementation, this system can be developed to decrease the power of sector antenna gradually without switching off their whole power.

Output of this research will be more important for all mobile operators as they can continue their GSM transmission for longer time when power failures occur at cellular sites.

Designing cost is also not high for this circuit and therefore from the point of economical aspects, it will be an ideal set up to use at any site.

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