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COST OPTIMIZED RADIO COMMUNICATION AT THE FMCG SECTOR SUPPORTING THE OBJECT SECURITY

Abstract

At the FMCG sector the operation management might require a stabile and reliable communication at site. Most cases the company pulls in a mobile telephone asset to cover this task. This case the management of the supply chain, the guards and other workers are using cell phones for communication. In the unlike event of any disaster or accidents this communication line might loose its stable connection. Many cases the workers are not allowed to take in mobile phone to the GMP area, but still must stay contactable. To handle the in-house communication one of the options can be an in-house radio system. This article compares the GSM phone and the in-house radio system helping the decision maker to choose the best solution to cover this task.

Az FMCG szektorban a vezetésnek szüksége lehet stabil és megbízható kommunikációra a telephelyein. A legtöbb esetben a cégek mobil telefon állománnyal kezelik a feladatot. Ennél a megoldásnál az ellátási lánc vezetése az őrség és a dolgozók telefonhívással intézik az üzemeltetést. Egy sajnálatos katasztrófánál vagy balesetnél azonban a kommunikációs csatorna eltűnhet. A legtöbb gyári környezetben a dolgozók amúgy sem használhatnak telefont GMP környezetben, de mégis elérhetőnek kell maradniuk. A belső kommunikáció kezelésére történhet rádió rendszerrel is. A cikk összehasonlítja a GSM telefont és a rádió rendszert segítve a döntéshozót a legjobb megoldás kiválasztásában.

Keywords: Object safety, Data safety, RF communication at FMCG sites ~ Objektumvédelem, Adatbiztonság, RF kommunikáció FMCG környezetben

INDUCTION

In-house communication is important due to cost efficiency or Health and Safety purposes at the FMCG (Fast Moving Consumer Goods) sector [1]. FMCG sector uses different kind of manufacturing plants, logistic warehouses, shops and other supply chain elements for its business. Depending on site, the plant might be quiet huge and the site might contain several buildings. Most factories have fence, metal framed windows, boilers – as part of the manufacturing technology – some others might have ammonia based cooling systems built all gears very close to each other. Within this area people should communicate to each other. All of the equipment mentioned above are acting as shield of the communication, managing weak signals in any RF based communication.

As a bundle of contracts, phones might be seen cheap for the Management, so they cover the daily tasks during the manufacturing by cellphones in most cases. If there are overnight maintenance tasks, the phones are also used to handle the in-house communication: like getting permission of suspending the local Fire Alarm System or support many other engineering tasks.

The problem comes if the cellphone supplier's tower is located too far, or the building has several basements. Due to Health and Safety reasons all staff should stay contactable, and none of the Maintenance Engineers should be sent alone to any plant room without any communication device. Losing the connection is a weak point in case of preventing any accidents. The best communication device is essential if we want to reach a better level of in-house security. Nowadays no one is sure about the information safety at site. The company might loose in-house information when using normal cellphones. Actually food and other FMCG manufacturing plants are not as critical like a nuclear plant, but some sales secret might be very sensitive information for the owner. The information is money, even if it is not a classified data [2] by the law.

Internal communication is essential to reach the KPI (Key Production Indicator) [3] goals at an average factory. The old days, daily printed reports where sent around, but nowadays the process efficiency and the speeded customer service expectations require much quicker in-house communication, than a few years before.

Some companies might have tight policies when providing company phones or radios for employees. Actually if the maintenance staff is not allowed so use a mobile at site and even not supplied by any other communication device, might cause absenteeism of work. Basically the local manager and the fire department or the guards cannot reach their staff during working hours. Most cases the serious incident response plan - In Hungary the SKET [4] - describes the minimal required in-house communication protocol.

I specify that an engineering team without communication device is a massive bottleneck within the object security. Shame that the fire alarm procedures and dangerous material recovery actions are effected: such like ammonia or hydrogen recovery or server room cooling safety. Any company having maintenance team without mobile communication device has a high risk of KPI fall. In Hungary traditional service providers like Water or Drain Works are highly affected. In case of fire the maintenance staff is one of the first at site who should actually act. Without the primer action the harm might become much bigger at site in case of technical error.

Actually if the communication protocol is well set up, the data can be logged well and the job can be tracked. This information is handy for the mid management to make action plan to cover minor faults and carry out surveys within the plant. If the minor faults are well managed all faults are handled at a higher level and the payback is a much higher object security as well with less integrity fail.

IN-HOUSE COMMUNICATION ALTERNATIVES

Verbal and written communication

Good option for communication, but the information is slow and not trustable, especially if report comes from the night shift. Actually written report can make a better quality of logging, but still slow and the logging procedure cannot be centralized. Written reports like Survey Reports and Maintenance Sheets are nowadays the standard method of work. Most maintenance task might be handled this way, but in case of any accident paperwork is usually made after the case itself. I specify, that this is a bottleneck of the object security.

Email

Email might work in office to office communication, but at the field, usually at GMP (Good Manufacturing Practice) area normal computers keyboards are not permitted due to hygienic and safety reasons. [5] Due to legal employment and EHS (Environment Health and Safety) [6] specs lone working is not allowed during maintenance procedures at Hungary. Actually one guard and one competent person together in the engineering sector can be even a pair, by the law. Most cases companies are updating the original hand operated plant rooms after a while to semiautomatic type. This plants do not require daily maintenance attendance, only some visits. This case one person is allowed to have regular checks ordered by HR due to the force of reducing costs. I specify that HR should not force lone working, as it is one of the root cause of accidents. In case of any problem the best practice is not the email for communication. Much better way to report a fault is a PDA device or a hand held radio as they are much quicker, well logged and all tasks are human controlled instantly. Basically the guard at the Security Office can log the fault, and the Engineering Manager can call out the contractor to repair the fault. This type of outsourcing can reduce the local costs as special companies can handle special faults quicker.

GSM cellphone

As widely used and well known commercial product [7], the mobile phone is a good solution for communication, if the service provider guaranties the service. Actually the problem is rather data safety and hygiene risk. Most IFS (International Food Standard) [8] regulations do not allow foreign objects at the manufacturing area, and most phones can fall easily into the product. If the company controls the food quality with additives, this information might be handled as special secrets and it is not good, if a competitor uses the mobile phone as a spying tool. GSM cellphone is good gear to reach the customer, but is not the best solution for a factory even widely used everywhere today.

PMR handheld radio

PMR (Personal Mobile Radio) [9] is available on the market at a very reasonable price. The frequency is free to use, but anyone might listen the conversation. Cheap PMR solutions are not safe and reliable for industrial use at all. Actually the power of an average unit is well too weak to support an average sized factory. Also the equipment's lifetime is too short to support a team. We can expect at least 3 years of lifecycle in case of any industrial set up. Actually the PMR radios are available for commercial use are designed really like toys. 3 cell NiCd batteries are unable to handle an output power better than 300 mW. This power is not enough at a noisy field, which is usually full with interference. Licence free PMR solution has no coding in the modulation. Basically anyone picks up the signal might listen the sender as the

modulation is standard narrow FM. The information might go away a few miles in good propagation conditions.

Civil TETRA solution

Civil Tetra system is an industrial solution allowing encryption in communication. Actually a whole bunch of radios are available on the market, and their usage become close to mobile phones. This communication systems are used in 55 countries [10]. It still has a centralized station, but the data is much more isolated and the communication protocol allows to reach just the authorized equipment as seen on Fig1. Even the product has a good quality the communication still relies on the central station.
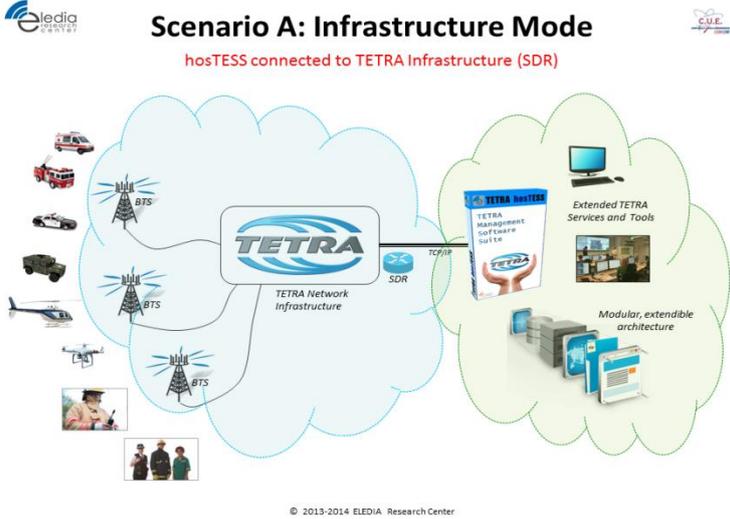

Fig1. Civil Tetra System. source: [10]

Tetra solution is much more secure than free PMR. The radio might be used in local mode and also in distance mode. The second solution requires the centralised station, but the communication can be encrypted meeting TEA2 level as part of the contract. The overall solution the TETRA is an excellent choice for industrial users - such like power stations - but the system is relative pricy for the FMCG sector. As per my research the TEA2 coded communication is available for Private Customers, but the service provider must agree prior to any coding. The communication encryption deepness cannot be the same like used in the public services.

Landline

Landline is still a safe way of communication in meaning of reliability, but the equipment is locked in position. Actually landline wires are easy to reach by unauthorized person. Analog landline is out of date nowadays.

CHOOSING THE BEST SOLUTION FOR AN AVERAGE FACTORY

Engineering Manager usually provides calculation and estimating for the decision maker. The decision maker can believe he/she is in charge, but he/she usually deals with the options already in the forecast plan. If there seems another solution, which is really missed by the decision maker, the forecast plan must be extended. The decision is usually down to cost and payback. Payback could be the customer satisfaction well, but usually the actual costs are compared.

If any payback comes within year it should be invested with no argues, especially if no other policies are affected. If the payback comes in about 3 years, it is still a value. When the company's finance is stable, the solution should be pulled in. If the payback is over 10 years it is not the best option to choose at all.

Some cases to keep the fleet of mobile phones is a bonus for the staff as they can use it for private calls and they stay contactable after working hours. Engineering managers might find the best technical solution, most of the time the cost must be kept as low as possible. Mobile phones are quiet cheap and their service providers can offer a contract for low price if the customer chooses a contract of a bundle. The problem comes if the building is built of metal sheet based panels, which work like a screen, especially if they are well grounded.[11] In case of a well grounded metal frame like commonly used in server rooms as soon as the user enters into the room there is no proper signal. If the people really want to reach someone there they must use a landline or a powerful radio. Actually the cost of the radio system can be about 5 times more compare to a cell phone in a bundle. Actually the radio has several advantages:

- Much more RF power. Even a hand based Vertex Standard VX-231 can reach 5 Watts [12]. This power is enough to cover a 20 floor building including the subbasement also.
- No cost of minutes
- Hand held radios cannot take pictures. Might be handy if client wants to save the know-how. Some factories have a procedure to tape up the cameras on the client's mobile phones due to integrity policies.
- Depending on its frequency it can see trough the iron-concrete structure.
- Civil tetra might use encryption.
- Investigating the data safety

When the management chooses a communication protocol, the security and integrity officer should provide at least a quick description of risks. The know-how is part of the asset such like a part or a product a material or a tool. The easiest way to loose the know-how, if the staff is taking it out from the factory. If they loose a job, they are able to take the know-how with them and next day are able to sell the information for the concurrence. Some other method might be if the camera system is hacked and provides information for someone else. Food manufacturing is mostly not so high-tech, so no point to do it in this way but actually the sales forecast plan is a valuable document for the concurrence. The market is so small, that obviously easier to make some phone calls and have some details from the competitors management as a favour if pre sales data is required.

Actually some of the data is good for the supplier, who wants to sell machinery or some other contractors who might want to cover their fault by making another fault somewhere else within the firm. This situation is very hardly provable. Just like an example in the FMCG sector the cleaners can pressure wash everything including the ceiling and the power switch panels also and then blame the Maintenance staff for bad maintenance. If the fire alarm system is pressure washed it is straight away affect the object security and the root cause could have been easily tracked by a modern PDA solution.

Let's say one of the machine fails due to cheated cleaning procedure. If the maintenance contractor is allowed to make pictures at site, he is able to prove the moisture in the panel, which obviously makes straight forward, that his bill will be paid or at least covered by the Insurance. As soon as is not allowed to make a picture at site, only with the attendance on any technical staff, this picture becomes a valuable data and should be saved and kept as one of the Critical Control Points (CCP). One of the solution is, if there is not allowed to take in smart phones at all. If only authorised people are allowed to take pictures at site, the maintenance procedures are much more controlled. Basically taking out the phones from a factory nowadays can make the staff mourning. HR must have a full understanding about the better Supply Chain integrity without phones otherwise they will not support the idea.

As we can see the communication of the mobile phones are not secure at all. Even the iPhone is easily hacked by the Israeli government [13] the Android has many weak points also. Actually the government might reach the data easily.

CASE STUDY

Infrastructure investigation

Some cases the factory has a basement, which is full with machinery, like air handlers, motors and drivers. They might make additional RF noise. Also if the plant has many buildings the other weak point is the distance. The draft version of the investigation (forecast data only) does not require site attendance. The week points can be estimated by checking the factory layout only. On Fig.2. as a sample project there is map about the biggest yoghurt manufacturers site located at Budapest. The author never been to this site, only Google map was used to provide data to fill the Estimation Sheet. The resolution of the map is limited, but still usable and free of charge. Using AutoCAD we are able to draw draft plan about the layout, which can be seen of Fig.3. The drawing is a simplified map, showing only the required depth of the site for designing.
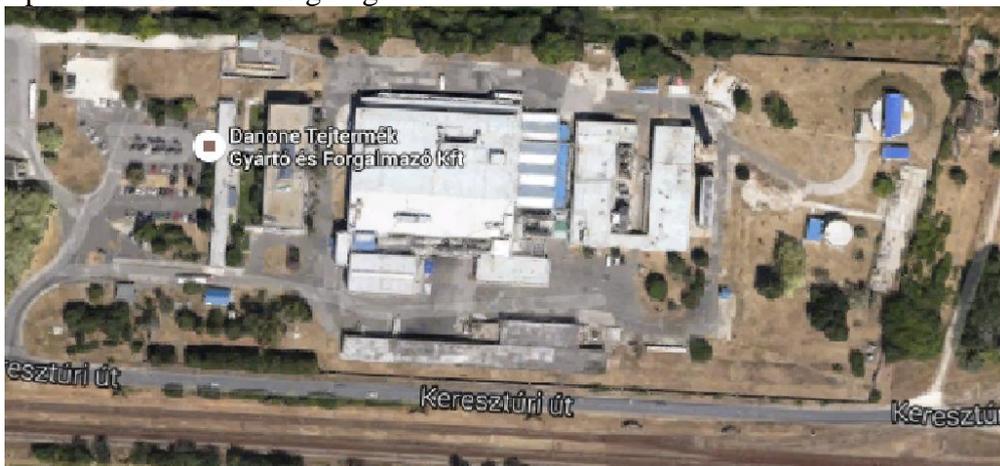
Fig2. Map for the sample project. Source: (using [14] edited by the Author)

We are able to find the fence on the picture as well. This part, specially the North and West side can be marked as maximal distance from the entrance. The fence should be checked on a regular basis by the Guards. Having good connection is essential for human safety and object safety. Most of the time the Security Office is close to the entrance. The maximal distance is about 300 meters which is not too much for a hand held industrial RF radio, but PMR solution would be too week to cover the communication.
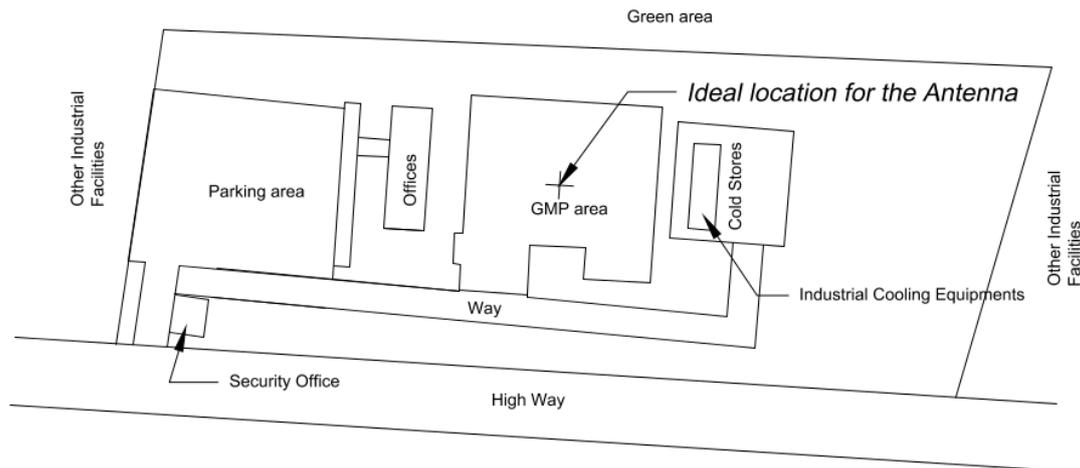
Fig3. Schematics form the plant. Drawn by the Author.

Actually the main building and all the small buildings are acting as shields [11], specially the metal roofs (blue on the picture). Even the main building is much closer to the Security Office the signal strength might be much weaker compared to the fence. If there is a basement, the weakest point might be there.

There is a huge plant room providing cooling energy. This place is mostly very noisy meaning the normal noise and the RF noise as well. In case of maintenance the Engineer should reach the Security Office for Security Officer's permission. The main reason is that most of the time to local fire alarm system or gas detector system should be suspended until the end of the maintenance task.

Install the units

The distance in radio to radio communication as a worst case is at least double distance, than when using a relay station. The relay should be installed to the centre of the plant to as high as possible. One of the best option is an industrial chimney is the architect agrees. Alternatives are the water tower or a standalone beams. If the building has an area which is really screened, like a server room or x-ray room it can be controlled with an extra substation or cover by an extra rule. If everybody agrees that the server room it is not contactable through a radio device, it can be handled as an exception in the policy.

Earthing

Lightning protection equipment is helpful during installation. Prior to any install the lightning protection certificates should be checked or renewed in case of need. During the survey any corrosions on the Earthing cables might show a sign of weak earthing. Lindab based halls are earthed, and they act up as screen for the signal.

Antenna and cabling

To cover an average site 3-4 element Yagi antenna is a good option, especially if vertically installed. The vertical polarisation is better for handheld devices. Most cases the user holds the radio in vertical position. As the Yagi has about 4 dB gain [15] to one direction, the signal is focused to the site. Basically it means that the main station can pick up signal easier from the main direction, and less power is enough for the communication. The station uses coaxial

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cables most cases to connect the station to the antenna. The cable must be specified for the used frequency, the impedance must meet with the specs. The cable has more attenuation if narrower. In normal conditions coaxial cables should be shorter than 15 meters, otherwise the most power disappears in the line and not transmitted out. Should the install conditions require longer cabling -as a last result-longer cable might be used, but its diameter should be extended to keep the overall loss below 3dB. [16]

CONCLUSION

Within FMCG sector the in-house RF communication is essential. One of the best and reliable solution is the Civil TETRA, but a shared service of GSM phone and PMR service is a cheaper but still reliable solution. GSM service might be used in this case for office communication. Industrial PMR solution might be used for the in-house services and engineering. In confined spaces, such like industrial tanks, server rooms the landline and the high power PMR might be a good option. The decision is usually made by the management (board) who are comparing the costs and the payback based on the Engineering Managers forecast. Even cost are important the Civil TETRA has an added encryption package which is useful for integrity.

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