INFRARED-THE REAL FUTURE PROOF ITS COMMUNICATION MEDIUM

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1. The Basic Achievement

Efkon electronics has achieved a major technical breakthrough in infrared communication technology. The introduction of zero power standby technology and the possibility to extract data from any kind of background noise has made this medium a basis for superior solutions.

Since 1995, the applications have grown, and some of the largest ITS communication systems in the world are using infrared as the most preferred solution. While still a most modern technology, there are numerous references and applications are rapidly spreading all over the world.

2. Advantages of the medium Infrared

2.1. No radio License required

Infrared is free from any radio licensing procedures and can therefore be implemented and put up in very short time without special permission.

2.2. No Interference

The incoherent medium infrared does not have problems with interference, phase shifts and /or reflections in comparison to a RF-and microwave carrier based coherent medium. While microwaves may create dead communication zones, this will never happen with IR based systems.

2.3. No Electrosmog

There is ample evidence that transmitting devices on every corner are more and more becoming a public concern. In Austria, property prices are falling around GSM transmitters because of perceived health risk for the population. Microwave devices are therefore not a future proof ITS DSRC (dedicated short range communication) medium for dense city applications.

2.4. All Weather Conditions

During the tests of UEM Malaysia and Taiwan Telecom (Chunghwa Telecom) all kinds of weather conditions were tested and it was possible to show that the IS® (Infrared Communication Systems) DSRC interface is not affected by heavy rain, dirt, dust, etc.

Efkon Austria operates a test site which has about the most severe weather conditions in Austria. The overhead mounted infrared equipment has not been touched in four years and is performing well in extreme conditions (ice sickles, sprays of salt from road de-icing, dirt, fog, thunderstorms with heavy rain, snow fall, etc.).

2.5. Dark Windscreens

Tests have shown that darkened windscreens can absorb up to 40db of microwave signals. The loss of infrared in comparable setups is below 7db.

In addition, CEN 5.8 GHz and other backscatter technologies lose 40db on the way in PLUS 40 db on the way out which adds up to 80db loss and is not sufficient to communicate. Since all new vehicles are soon equipped with this type of windshield, there will be no communication possible.

2.6. Unlimited Data Rate

For long term ITS projections, high data rates should be a concern. All major car makers are already setting up mobile internet access prototypes and vast amounts of data need to be transmitted to the moving vehicle. With the very limited data rates and bandwidth available to radio frequency users, the targets may not be achievable.

Infrared is so far only limited by the physical properties of the electronic components, i.e. data rates of 100 Mbytes/second or even 1GByte/second can be achieved.

2.7. Precisely adjustable communication zones

The edge precision of the beam is +/- 2 degrees. (the beam opening can be adjusted from 10 to 60 degrees). EFKON can provide a portable device which can be used to define and measure the exact position of the communication zone. (IS®-IZI 100, Infrared Zone Indicator). The incoherent infrared light is not a laser, it is rather like a torch or lamp.

2.8. Long communication zones

More than 100 meters. IS® currently only utilizes 13 Watt peak (0.4 Watt average) of max. 100 Watts permitted according to IEC 825-1. For ETC, a communication zone of 8-12 m is sufficient. (Depends on transaction time and speed of vehicle)

2.9. Short re-use distance and Easy Multilane Free flow solutions

Because of its clear direct ability, reuse of IS® transceivers can take place within a few meters. This is also important in dense cities with many potential ITS applications.

In multilane free flow the transceivers are dedicated to one lane and overlap with the neighboring transceiver. The solution for free flow requires only a software solution. No channel hopping , band switching or the like are required. An ant collision algorithm scans all OBUs (Efkon's tags are called On Board Units) and activates/silences them as required.

2.10. No Cross-Talk with other RF applications

Due to the different medium, there is no problem with other systems like mobile phones, military frequencies, pager services, industrial broadcasting, satellite receivers (at 11-30 GHz), radar devices (at 1-35 GHz), etc.

2.11. Easy to mount

The skills required to mount the IS® overhead transceiver can be compared to the skills required to mount a lamp. The IS® transceiver can be compared to a torch rather than an antenna. Non-stop tolling and ITS applications are very easy to implement and it is possible to provide of the shelve equipment for self mounting.

2.12. Not affected by lightning

Infrared devices are not affected by lightning as they can be properly shielded and grounded. EFKON's installation in Malaysia is in one of the countries with the highest lightning rates and has not had a single problem since over two years of tests and operation.

3. Standardization Discussions

There are some participants in the market. Since a number of companies have invested a lot of effort in creation of CEN, ASTM or ISO standards. There is for example a CEN Pre-Standard proposal for 5.8 GHz microwave. Logically, these parties try to protect their investment by all means. Such a standard would keep others conveniently out even if it is not in the interest of the final user. But what if it turns out that microwave based systems are a future roadblock to many ITS applications....?

The history of DSRC standardization started in 1993. There were a number of companies in the market. Coming from quite different directions they tried to create an interoperable and uniform CEN document. The document is still under discussion and countries like Italy have officially announced that they will deviate from the CEN requirements. The reason: Italy's exisitng 5.8 GHz system is not interoperable and can not even coexist with CEN compliant solutions.

There is also a lack of procedures to determine compliance of a given system.

The ISO group has clearly decided to leave discussions on layer 1 (physical layer) and 2 (medium access layer) up to what is available and is now only taking decisions about layer 7 (application layer) in order to provide a standard system software interface.

4. Interoperability:

Interoperability between products which refer back to a common origin is very easy to achieve.

Currently, there are two active sources for the CEN-Compliant Infrared Efkon IS® System. two more sources for the IS® OBU will be available by the end of 2000. At that time, there will be more manufacturers for IS® OBUs than for any other technology in the world, and they will be 100% interoperable.

The CEN documents for infrared communication allow local companies to capture as much of the value added as they want and to create their own Infrared ITS communication systems.

5. Examples of Current Systems

Malaysia: Around 100,000 of 1 million OBUs have already been shipped to Malaysian customers. The chip card is the same as the one used in the existing Touch & Go system. There is a plan to implement the OBU in all cars produced in Malaysia in the factory.

Taiwan: 3 million units will be shipped to Taiwanese motorists during 2000-2002. There is an announcement by the Ministry of Transport that all cars produced in Taiwan after 2002 will have the device already built in from the factory.

Japan: Japan is also one of the drivers for infrared ITS . There is already a system installed, which uses infrared beacons for the communication between cars, trucks, pedestrians and roadside installations. The system has grown to 20,000 units at current and another 10,000 units are under installation (VICS System installed by National Police Agency of Japan, Sumitomo). This system is 10 times larger than any other DSRC ITS communication system in the world.

6. Possible applications in RSA

6.1 Introduction of a most flexible and upgradable Infrared and Contactless Smart Cards Payment System for Road Toll Payment:

1. a touch & go reader which is installed in the lane works with the contactless chip card
2. an OBU (On-Board-Unit, a small ”box” mounted in the windscreen) reads the chip card data and sends them out to an overhead infrared terminal.
3. multilane free flow installations which use the same data format and backend software as (1) and (2), together with automatic vehicle classification, identification and enforcement.

Typically, operators start with the touch & go solution and upgrade to non-stop tolling if traffic increases.

6.2 Introduction of an Infrared and Contactless Smart Cards Payment System for Public Transport in South Africa:

1. buses use smart card readers for fare payment
2. infrared transceivers along the route determine bus location, timing and switching of zones (e.g. "Central Pretoria" to "Western Pretoria")
3. the bus returns to the hub in the evening and communicates its data via the infrared link to the clearing house

Cash is removed from the system and drivers are safer. Zone switching and data transmission is fully automatism and does not distract the drivers.

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<u>CV of Max Staudinger (Speaker):</u>

Max Staudinger holds an Engineering Degree from Graz University of technology and an MBA Degree from Webster University Vienna.

After various international assignments, Max Staudinger has been a major contributor in developing the contactless smart card market as Marketing Manager Asia/Pacific for Mikron Company and Philips Semiconductors Identification group.

Director Sales/Marketing of EFKON since 1999.