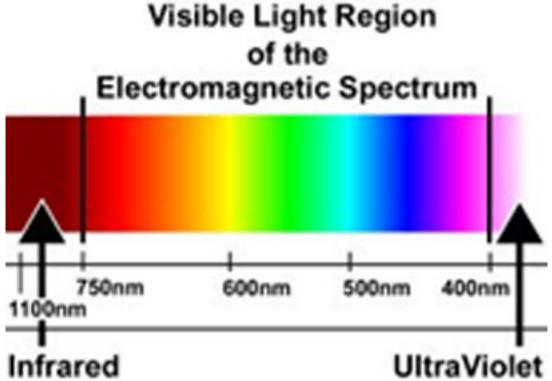# Diffused Infrared is Lightening Infrared Future

By Uri Kanonich, Infra-Com Ltd.
&quotHey dad, can you do me a favor and turn on the TV?&quot
This was the kick-off for the first 'killer application' in the short-range wireless communication market &#151 the TV Infrared remote control.
About 20 years later, an installed base of almost 500 million IrDA ports are enabling Infrared short-range wireless communication between laptops, PDAs and cellular phones. This huge number doesn't include the standard Infrared remote control, which became an integrated part of all consumer electronic audio-video devices.
But, for the last 3 years it seems that the glory days of Infrared (IR) are over, and Radio Frequency (RF) protocols are about to conquer the short-range wireless arena. RF protocols such as Bluetooth, Wireless LAN and HomeRF had become the promise for the future short-range wireless communication market.
But IR isn't dead yet. It is back in business with Infra-Com's new emerging Diffuse Infrared (DIR&#153) technology. The DIR(tm) technology enables the use of Infrared without the need for line-of-sight and can create communication links for a distance of 8 meters. Together with the qualities of the traditional Infrared: low cost, minimum interference and inherent security, Infra-Com promises to keep Infrared ahead in the short-range communication race.

When you 'shoot' your TV with the good old TV remote control, a beam of invisible red light is being transmitted straight forward. This light beam is transmitted in the near infrared spectrum band, the nearest spectrum band to visible light, usually

using the 950 nanometer wavelength.

But, infrared light can enable you to transmit much more than only the TV channel number. Infrared standards developed during the last decade mainly by the Infrared Data Association (IrDA).

The IrDA is a non-profit organization, which was founded in 1993, and is the leading standardization organization for Infrared technologies. All of its standards are using baseband modulation techniques that support low power consumption. They use the 850-nanometer wavelength optical carrier, which better supports their high rate capability.

Since the publishing of its first standard - Serial IR (SIR), several more advanced standards have been introduced, presenting radical evolvement in the communication rates.

&#149 **Serial IR (SIR) -** The first standard, SIR, was intended to replace the serial cable connection with a wireless IR connection. As such it allows a communication rate of 125Kbps similar to the standard serial cable.

&#149 **Control IR (CIR) -** CIR aimed to connect cordless human input devices, i.e. mice, keyboards, joysticks and game pads. It enables wider connectivity angel and larger distance between the input device and the receiver.

&#149 **Fast IR (FIR) -** The present leading standard is FIR, which defines up to 4Mbps communication rate. It has a backward compatibility with SIR lower rate. SIR components can be found embedded in almost every laptop worldwide.

&#149 **VFIR -** The latest standard that comes out to the market these days enables 16Mbps communication rate. Its rate emphasizes the infrared high bit rate achievement potential.

Back to the remote control &#151 low rate was only one of its problems. All IrDA standards still require line-of-sight between the transmitter and the receiver and still works for short-range only. These IrDA standards started the facto the short-range wireless communication market. They are sometimes being called &quotthe successful failure&quot as the standards succeeded in becoming an integral part of every laptop in the world, while only few of the users ever used it. In fact the Palm Pilot PDA was the first product, where this communication capability was actually used in large scales.

A dramatic change happened three years ago: Radio Frequency (RF) standards evolved and took the glory from the IR 'old' technology, threatening to dispossess IR from its place as the leading short-range wireless communication standard. As in Infrared, few standards took the lead in the RF arena:

&#149 **Bluetooth -** Back in the happy days of the Hi-Tech hype, Bluetooth was the hottest buzzword in the market. The standard is using a TDMA modulation scheme, hopping over a carrier in the 2.4 MHz frequency band. It supports a rate of up to 730Kbps for 30 feet range. With a promise for very low cost solution and interoperability with every possible device, Bluetooth hoped to concurred the market and sale hundred million units per year.

&#149 **IEEE 802.1b WLAN -** This standard emerged as an extension to the office Ethernet LAN. Using a Code Division Multiple Access - Collision Avoidance (CDMA\CA) technique, it enables 1,2, 5 & 11 Mbps rates for a range of up to 100 feet.

&#149 **HomeRF -** This standard intended to present a wireless home solution. It seems that marketing problems and a late react to the need for higher communication rate than the initial 2 Mbps, made it loose the market to IEEE 802.11b WLAN.

&#149 **IEEE 801.11a & HyperLan 2 -** The last developments in the RF area operate in the 5GHz frequency band. More available frequency to use, and mainly less interference forced these two standards toward it. IEEE 802.11a is an evaluation in rate to its older successful brother IEEE 802.11b, while HyperLAN 2 emerged after an unsuccessful marketing attempt by its slower version HyperLAN 1. Both 802.11a & HyperLan 2, promise communication rate of up to 54Mbps using Orthogonal Frequency Division Multiplexing (OFDM), which is a Multi carrier CDMA (MC-CDMA) modulation technique.

These RF protocols, which were backed by many large companies worldwide offered the big advantage of the RF medium compare to IR &#151 it can go through walls. Except that after more than 3 years of promising hundred of millions of wireless

devices, people started to understand that the fact that RF can go through wall creates RF biggest disadvantage - interferences.

This interference problem issue is often described by 'The Popcorn Syndrome': Lets say your kid is watching a DVD movie using your new RF wireless surround speakers. If you try to make him popcorn in the microwave oven in your kitchen, the wireless speakers would stop working because of the created interferences

Your microwave oven, and most RF wireless standards mentioned above are using exactly the same 2.4 GHz band frequency. The reason is that there is only very few RF frequency bands which are, free for use, and don't require purchase of a government usage license. These bands are called ISM bands (Industrial, Scientific, Medical bands), and were reserved all over the world for license free use.

The trivial solution for the interference problem is of course moving from this crowded frequency band to the next ISM free band in the 5 GHz frequencies, and in fact it is being done in newer RF standards. Both IEEE 802.11a & HiperLAN are claiming to solve the problem by using this frequency band.

But, this 'Cat and Mouse' game with the interferences was tried before in the home cordless phone arena: The first cordless phones used the 48 MHz frequency band, but the interferences from your neighbors phones became so bad, that they moved to the 900 MHz band, and than to 2.4 GHz &#151 the same crowded band of 'The Popcorn Syndrome'. Just two month ago a cordless phone working in the 5 GHz frequency band was introduced, promising again &quotno more interferences&quot.

Despite this problem the hi-tech industry spotlights had continued to be focused on the RF short-range wireless industry rather than on IR solutions. Eventually, after two years of combating the RF hype unsuccessfully, it seems that the infrared market found the right way to continue and increase sales.

Diffuse Infrared is a known term for years: You beam infrared light to the room space, and the reflections from the walls, ceiling, furniture and even people walking around the room reach the other side of the room. No need for line-of-sight, no need for directionality &#151 the perfect solution for IR old limitation.

But for many years a diffuse IR system would typically include two large boxes with many IR LEDs and a very large detector. The price was naturally high, and no company could even dream of embedding such a device into a final product as an internal component.

Infra-Com changes the status: Leveraging the major evolvement in LED and detectors technology during the last decade, it uses in its chipset standard of-the-shelf LEDs and standard small detectors. The result is that what was achievable with large boxes ten years ago can be achieved by using the IrGT801A small chipset, opening the huge market for embedding the technology into various consumer electronic products.

IrGate technology is using a proprietary baseband modulation scheme over an optical carrier in the 850-nanometer wavelength, just like the IrDA technology. The chipset's advanced analog & digital signal processing allows to transmit high bit rate, up to 10 Mbps, rate, for about 8 meter distance, with no line-of-sight between the transmitter and the receiver.

So who is going to win the mass market? The last years showed many technological achievements followed by fast changes in the markets: IrDA sold last year around 150 Million components, while Bluetooth continued to promise a breakthrough without much success. Wireless LAN is showing fast growth in sales compared to last year, but its market is still limited mainly to the corporate and PC oriented

market. Diffuse Infrared redefines the market battle, by suggesting advanced technical solution for an old problem.
It could be that the answer is hidden in the market itself.
The short-range wireless market is changing fast from an early adapters market to the market majority, creating opportunity for sales in large quantities over various market segments. As any such segment has different technological emphasis, it opens an opportunity for few technologies to succeed together.

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