

# First of its Kind: Global Invacom Optical LNB

## Tested for the first time ever: LNB with optical fiber connection in a real reception test

In the previous issue of **TELE-satellite** we reported exclusively on the development of an LNB with an optical fiber connection by the English manufacturer Global Invacom. At the time the only specimen available was a bulky lab sample. Since then Global Invacom has put together ten prototype optical LNBs so that this new and innovative technology can be tested in real world applications. Global Invacom carried out their first public test at the TELE-satellite Test Center in Austria. Two Global Invacom representatives, project manager Andrew Collar and technician Norman Harris, travelled to Vienna and mounted their optical LNB on an existing 90 cm offset antenna and routed the optical cable from LNB to the lab.

While installing the LNB, Andrew Collar and Norman Harris explained how the new LNB actually works. As it turns out, simplicity is the key to success - a stacker that is built into the LNB distributes the four reception polarizations (vertical low and high band as well as horizontal low and high band) to four distinct frequency ranges.

Next, the RF signal is converted into a digital signal which is then sent through the optical cable via a laser beam. At the other end of the line this

light beam is received by a converter box which reconverts the signal back into a regular satellite signal which can then be processed by any standard digital satellite receiver.

As we watched the Global Invacom staff set up the test system, it became evident that the company intends to introduce the system one step at a time with the aim of keeping everything as simple as possible.

The LNB features two connectors, a standard "F" connec-



Optical LNB by Global Invacom – the 9th of only ten hand-made and fully functional prototype LNBs.

### Comment

Tony Taylor, managing director of Global Invacom, and his team of advisors are in the rare but envious position of making decisions regarding the future of a new technology which will affect the entire satellite industry. They have to look for and find answers to questions such as: Which type of plugs will be used for the optical LNB? Shall we rely on the existing standard even though it has not been conceived for outdoor use? How can we make the plug of an optical cable weather-proof? How durable and water-proof are existing optical cables that are available in stores today?

And then there are those strategic questions which are even more difficult to answer: Should optical LNBs be licensed? Not at all, or can technological details be given to other manufacturers? What about the pricing aspects of the optical LNB and converter box? Too high a price will slow down market penetration of any new technology and at the same time favor the development of less expensive competing products with yet another technology. A mishmash of different standards would then be the result.

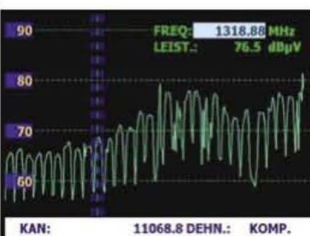
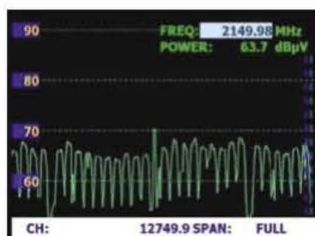
And then there's the mother of all questions: How should the optical LNB be marketed? Is the term 'optical LNB' one that should stay or does it call for the invention of a new name? How about "Laser LNB"? And finally: How can manufacturers of satellite receivers be convinced to add optical LNB inputs to their boxes?

Only one thing is for sure: Global Invacom will find the right answers to all of these questions!

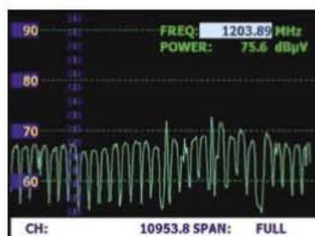
Alexander Wiese



Signal measurement on RAI transponder on HOTBIRD 13° east. Conventional single LNB (left) and Global Invacom optical LNB (right)



Vertical low band (conventional single LNB on the left and Global Invacom optical LNB on the right)



Horizontal low band (conventional single LNB on the left and Global Invacom optical LNB on the right)



tor (like on any typical LNB) and an optical cable connector. As already mentioned in the previous issue of TELE-satellite, the "F" connector is required to provide the LNB with power. Global Invacom is still deciding whether to use a low voltage power connector or this existing "F" connector to supply

wide. Keep in mind though that optical cables should always be used with their pre-attached plugs since special equipment is required along with a great amount of skill as well as a lot of time to change the connectors on optical cables.

Global Invacom will also offer



Norman Harris (left), Global Invacom technician, and Andrew Collar, Global Invacom project manager, install the new Global Invacom optical LNB on a 90 cm dish at the TELE-satellite Test Center Austria in Vienna.

power in the production version - a decision will be made in the next couple of months. An advantage to keeping the "F" connector would be that customers wanting to upgrade to an optical LNB would only need to run the new optical cable; the existing coax cable would simply be used along with a power pack to supply power to the LNB.

A standard optical cable can be used to carry the signal between the LNB and converter box. Since this kind of cable has become the norm in modern telecom networks, the price has come down significantly over the past several years and is now about 1€ per meter.

So, price is one advantage of this new technology; the cost of standard coax cables keeps rising consistently due to rising copper prices world-

wide. Keep in mind though that optical cables should always be used with their pre-attached plugs since special equipment is required along with a great amount of skill as well as a lot of time to change the connectors on optical cables.

Once the signal is converted to optical format, it is carried through the optical cable either to the first node or directly to the receiver. The thin optical cable is capable of carrying the full frequency range of a complete satellite and can thus be perfectly split using passive taps. Distribution switches, as used in most MDU networks today are no longer required with this system.

When this system reaches the store shelves, it will support

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splitting the signal into as many as 16 optical cables. Over time this number will be increased almost endlessly since it only depends on the optical power output of the laser beam which can be increased by the manufacturer according to the application in which it will be used. Initially two LNB's with different fixed output powers are expected to support: small up to 16 node or large up to 96 node MDU networks.

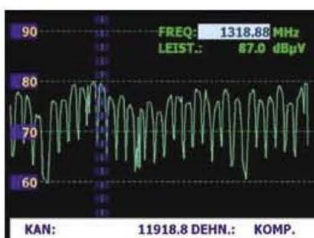
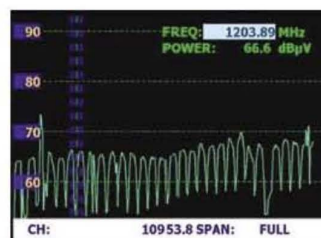
For an average home this means the signal is carried from the LNB through an optical cable to one or more central nodes from which it is then distributed to individual rooms

using additional thin optical cables. Unlike much thicker coax cables, these thin optical cables can more easily be added to existing ducts, even if these ducts are already occupied with other cables. In addition, optical cables are resistant to any kind of interference. If necessary, optical cables can even be routed around the strongest electrical motor without any adverse effects.

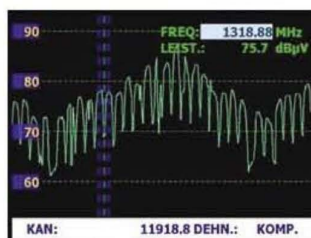
In the individual rooms, the optical signal cable is fed into a converter box which in turn provides two (in later stages up to four) individual connections for standard multiple tuner satellite receivers.



**A word of caution to all installers: Never simply plug in optical cables – the connections of the cables need to be perfectly clean before they are put together. Various methods can be used to achieve this; the most practical is using the device shown here: the connector of a fibre optical cable is inserted and a lever is then operated to clean the connector with an extremely fine-grain abrasive paper that is only used once. This is the only way to guarantee a plugged connection is established without any signal attenuation.**



Vertical high band (conventional single LNB on the left and Global Invacom optical LNB on the right)



Horizontal high band (conventional single LNB on the left and Global Invacom optical LNB on the right)





Global Invacom highly recommends using only pre-assembled optical cables. If two such cables need to be connected to increase the overall cable length, the connector pieces shown here should be used. This way any number of pre-assembled rolls can be added together to create overall cable lengths of several hundred meters or even kilometers. The picture illustrates the thinness of optical cables with a diameter of only three millimeters.

The converter box design shown in the picture is a prototype and does not represent the final design. The actual box will be smaller so that it can be buried or installed like a regular satellite IF splitter socket or electrical socket. In this way it

can be concealed completely. Thanks to the optical cabling a single thin line can be used to connect up to four individual satellite receiver tuners. In addition, Global Invacom is planning an option to feed DVB-T signals into the line as well.

This will allow you to connect two or four satellite receivers as well as a TV with integrated DVB-T tuner or a DVB-T set-top box. In this way a single thin cable becomes a universal means of transportation for all types of digital media content.

By the way, don't be fooled by the yellow optical cable you see in our pictures; these are also lab samples. The final cables that will be available for sale will come in more subdued colors such as grey or white but will include colors for every

taste and if you insist on having a bright green cable, for example, you could get that too.

## Everyday use

For our test setup at the Austrian TELE-satellite Test Center in Vienna we chose to use a 90 cm dish with a 40 mm feed adaptor. In the first step, we mounted a standard single LNB to align the dish to HOTBIRD 13° east using the Promax TV Explorer II (a test report of this device will appear in the next issue of TELE-satellite). For comparison later on, we saved the spectrum analyzer results of all four HOTBIRD polarizations before the Global Invacom professionals went about installing their optical LNB.

Once they finished with the installation, we stared in awe at the signal analyzer and realized at first glance that the results appeared quite different - and by that we mean better. We compared all four polarizations and found out that in each instance the optical LNB delivered better results. The signal level of the optical LNB was remarkably better and delivered a more accentuated result for individual transponders while the initially installed single LNB left a consistently weaker impression.

The reasons for this are two-fold: first, the optical LNB is a state-of-the art high-quality product, and second, there is almost no signal attenuation with optical signal transmission - the actual value is approximately 0.3 dB per kilometer!

At first we used a 2 way splitter in our test configuration, but once we experienced first hand how beautifully this new system worked, we decided to go for the max and asked the Global Invacom representatives to distribute the output signal of the LNB to the currently maximum possible 16 individual optical outputs. That is a maximum of 64 Satellite Tuner inputs.

The measurements supported what we had expected right from the start: there was no deviation in the results; all was still next to perfect according to the TV Explorer II.

We can just imagine the smiles that this system will put on the installer's faces who, up



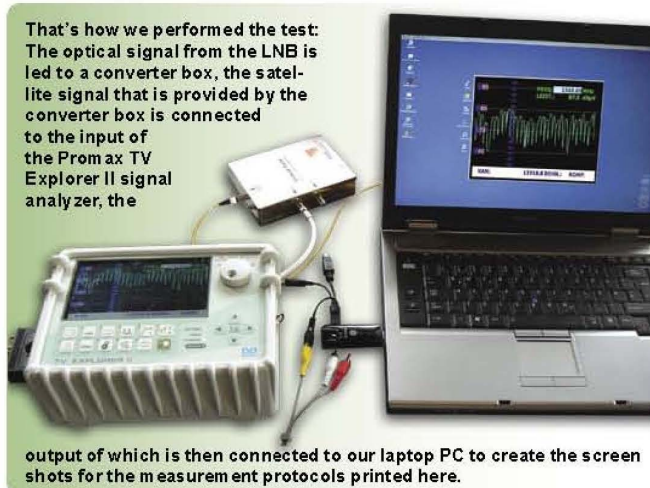
This is what our test setup looked like: the two boxes to the left are converters which split optical signals into two identical satellite signals. In this way, two satellite receivers can be connected and operated completely independently from each other. On page 46 of the previous TELE-satellite issue, the same device can be seen as a lab specimen. Global Invacom was able to reduce the size significantly; the

actual devices that will officially be introduced will be even smaller.

In the center of the picture you can see an optical 1-to-4 splitter (above) and 1-to-2 splitter (below), both of which already are available for the distribution of telecom signals with optical cables. To the right there is the hand made optical prototype LNB which was used for this test.



**That's how we performed the test:** The optical signal from the LNB is led to a converter box, the satellite signal that is provided by the converter box is connected to the input of the Promax TV Explorer II signal analyzer, the



output of which is then connected to our laptop PC to create the screen shots for the measurement protocols printed here.

until now, have always had to take into account attenuation, interference, tap or switch gain flatness and so on when distributing satellite signals to multiple outlets.

To sum up, we were totally impressed with how well this new technology performed in a real word setup. As if that wasn't enough, the third signal measurement we performed on the 11804V transponder used by the Italian public broadcaster RAI, cast away any remaining doubts that we might have had. At 86.7 dBµV, the signal level delivered by the optical LNB was significantly higher than what we had received from the single LNB (75.3 dBµV).

Yet, the more important C/N and MER values were also better with the optical LNB. To be fair, we also have to mention that the single LNB was tested in dry weather conditions while the optical LNB had to prove its worth during rain that set in soon after the LNB had been mounted. We can safely assume that both the C/N and MER values of the optical LNB would have been even better in dry conditions.

## Areas of Application

In the truest sense of the word, Global Invacom has developed this new system with all customers in mind. Apart from individual users and households, this technology is also particularly suited for apartment buildings and multi-family homes. Originating from the optical LNB, the signal is fed to central nodes where it

is split until each apartment is equipped with enough outlets.

Spinning this idea even further, remote or rural areas can establish small-scale local cable networks since the satellite signal needs to only be received at one central location and then fed into the fiber optical network. Global Invacom tests with cable lengths of up to 12 km achieved positive results without a significant loss of signal strength (apart from the 0.3 dB per kilometer attenuation this technology brings with it).

Considering the fact that optical cables can easily be integrated into virtually any existing duct system, this is a viable alternative to setting up a coaxial cable network which is troublesome to establish and prone to signal attenuation and interference.

## Future Perspectives

It's not only Global Invacom that is convinced a turning point in satellite signal distribution has been reached; we at TELE-satellite also believe the path Global Invacom has taken with its optical LNB might become a superhighway in the future. Just try to imagine a satellite receiver which does not pick up the signal from a standard coax cable but is instead directly connected to the LNB by means of a fiber optical cable! And that's not all - PCs, TVs, DVD players and so on can all become members of such a network and exchange data via a super-thin, hardly visible cable with all the content and signals made available to all of the components

all of the time regardless of whether it's DVB-S, DVB-T or Internet access.

With the introduction of its optical LNB, Global Invacom has created a true milestone en route to this perfect scenario. We hope that many component manufacturers will jump on the bandwagon on the way to forever changing the way we experience multimedia content today and even more so in the coming years.

Unfortunately, Global Invacom was not ready to reveal any pricing information; the final details will only become available shortly before the official market launch. Initially, the optical LNB will be designed to receive signals from one satellite only, but Global Invacom is working on expanding the

system and plans to offer cables consisting of more than one optical cable at a later stage. Looking like any other standard cable, this new development will allow the reception of signals from two, three or four satellites simultaneously and splitting them so that each end device will be able to access any signal from any of these satellites at any time.

Another Global Invacom plan involves putting the laser unit in a separate box outside the LNB so that the size of the optical LNB can be reduced with the laser box then being placed inconspicuously on the antenna mast. Official sale of the optical LNB will start in June/July 2008 and as soon as the first units hit the stores, TELE-satellite will take a closer look at the final product.

## Expert Opinion

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The major plus of the optical LNB is that all four signal levels of a satellite can be transmitted simultaneously via a single cable and virtually loss-free. Thanks to this, the signal can be split almost endlessly and each outlet is provided with all the signals that can be accessed completely independently.

Another advantage is that this system can bridge large distances without compromising signal quality. Fibre optical cables are extremely thin and flexible; they will fit into any existing duct system. The very low signal attenuation results in a considerable gain when large distances need to be covered (like in our test setup, for example, that added up to some 50 meters from antenna to signal analyzer) compared with coax cables. This gain in combination with the higher C/N value may be the decisive factor in taking a weak signal and putting it on a TV screen or not. The low material costs (approx. 1€ per meter for the fibre optical cable, 25€ for a splitter for two connections, 60 to 70€ for four connections) are another convincing argument in favor of this innovative system.



**Thomas Haring**  
TELE-satellite  
Test Center  
Austria

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Practically none, apart from the fact that - from a strictly mechanical point of view - fibre optical cables require more care than standard coax cables. In addition, it is important to set up the system very diligently so that the cables are able to carry signals without any obstruction so as to make sure that users can enjoy this new technology to its fullest.

## TECHNIC DATA

Manufacturer	Global Invacom, Essex, UK
Website	www.global-invacom.com
E-Mail	sales@invacom.com
Tel	+44-1621-743440
Model	Optical LNB Handmade Evaluation Prototype
Function	Universal single LNB with optical output and stacked frequency ranges
Reception range	10.7-11.7 GHz/11.7-12.75 GHz
Power supply	13/18V over "F" connector
Optical connection	FCPC