Optical Splitters of Global Invacom

- splits optical signals nearly as good as theoretically possible
- gives even better terrestrial signal levels than by using standard equipment
- proofs that a optical system is nearly noiseless
- splitting optic signal into 50+ outlets without noticeable loss
Can 3% Be As Good As 100%?

When you need to distribute satellite and terrestrial signals to a large number of apartments, a fibre optics system comes first to mind. Even with very long optical cables there is hardly any signal quality loss. Also signal strength suffers only insignificantly for practical cable lengths. But what is the impact of optical splitters? You need them to distribute the input signal to many terminal devices like TV-sets or satellite receivers. And every passive splitter will attenuate the signal. The larger the number of its output the weaker the signal you get. So you can not split the signal without an end. Where is the limit?

We had the opportunity to find an answer to this question. We got two models of multi-output optical splitters made by GlobalInvacom: GISplit16pro and GISplit32pro. As you can easily deduce, these are 16-way and 32-way splitters respectively. Both are contained in the same sized metal enclosures but while GISplit16pro has one input and 16 outputs located on the same side panel, the other model has an additional 16 outputs on the opposite side. All connectors are of the FC-PC type.

There are four holes in the corners of the top and bottom panels. So how are you supposed to install the device on the wall? You do need to have long and rather thin screws to pass them through the whole device before entering the wall, or else you need to partly disassemble the device. After unscrewing four small screws on the side panels, the bottom panel can be detached from the splitter enclosure. Then, you can attach the bottom panel to the wall with standard screws and reassemble the device.

Ideally, the GISplit16pro splits the input to 16 equal...
outputs each carrying 6.25% of the input light. That’s because 100% / 16 = 6.25%. Should we convert it to dB, it would be -12 dB. Of course, real performance must be somewhat worse due to unavoidable coupling losses. And indeed, GlobalInvacom specify their GISplit-16pro as having a typical insertion loss of 13.3 dB.

Similarly, the GISplit32pro should ideally split the input to 3.125% and have -15 dB of insertion loss but GlobalInvacom specify the loss as 16.8 dB typically. The manufacturer’s specifications are explicitly provided on the labels attached to the splitters as you can see on the photographs.

And that was the first performance parameter we wanted to measure in our test. For that, we used a GlobalInvacom Optical LNB and their Fibre@S ODU32 optical transmitter as signal source. Additionally, we fed the ODU32 with a terrestrial signal to create the most realistic test conditions. We connected the output of the ODU32 with the input of the splitters. Then we measured the optical power at the input and at every output of the splitters at 1490 nm wavelength.

The first to go was GISplit16pro. As you can see in the graph 1, the maximum insertion loss was 13.8 dB and minimum only 13.15 dB. The average loss (green line) was 13.4 – so very close to the typical value specified by the manufacturer. The next splitter – GISplit32pro was even better. You can see its results in the graph 2. The average loss (blue line) was only 16.2 dB and all outputs had a lower insertion loss than the specified typical value 16.8 dB! Output number 23 was the best – only 15.99 dB. Impressive!

The insertion loss for both optical splitters was really very small – very close to the theoretical limit. But to be fully convinced that the optical systems built with GISplit-16pro and GISplit32pro are really that perfect, we decided to compare the results we got with the results we could achieve in a classical way – in purely RF systems.

For the satellite test, we used the same dish but this time with a classical high performance LNB. Table 1 presents the outcome.

<table>
<thead>
<tr>
<th>Output #</th>
<th>Channel Power [dB]</th>
<th>MER [dB]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>61.2</td>
<td>28.0</td>
</tr>
<tr>
<td>3-4</td>
<td>61.2</td>
<td>28.0</td>
</tr>
</tbody>
</table>

For the satellite test, we used transponder 10720 V from HOTBIRD on 13° East as our test signal. Please note that we measured the RF signal directly at the LNB output without any RF splitters or multiswitches. Despite the fact that the optical signal was split to 16 or 32 outputs, the results were only slightly inferior to the top class single LNB system with a very short cable! We did a similar test with a terrestrial antenna and this time we were even more surprised. See our results in Table 2.

<table>
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<th>MER [dB]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>49.3</td>
<td>25.4</td>
</tr>
<tr>
<td>3-4</td>
<td>49.3</td>
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</tr>
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</table>

The output signal in both cases of optical setup was better than a classical installation! Not only was the signal stronger but its MER was also better! And remember that we used only 3.125% of the light power entering the system in case of the GISplit-32pro. Evidently, we were working with very good signals with so small amount of noise that it was comparable with the noise threshold of our signal analyzer. This last test was a crowning evidence that the whole optical system is almost noiseless and signal quality does not suffer at all.

And how much splitting can you get in real life? Well, the optical LNB by GlobalInvacom generates about 7 dBm of optical power. The GISplit32pro has a specified insertion loss of 16.8. This means that its output we can expect -9.8 dBm. And the light-to-RF converter that we used in our test (GTU QUAD) is specified for -15 through 0 dBm. It means that we still have a 5 dB margin. Enough to use 2-way optical splitter at every one of 32 outputs of GISplit-32pro to get more than 50 optical outputs in total. The theoretical limit would be 64 outputs, but it is recommended to leave sufficient margin to allow for ageing of the laser and the odd output going to maximum loss.

Both GISplit16pro and GISplit32pro are really excellent building blocks you can rely on when building fiber optics distribution systems.