Extract High Bit Rate Modulated Channels from DWDM Networks

XTRACT
Optical Channel Drop Unit

Introduction

On WDM links, several channels are transmitted on one fiber. These channels have different optical frequencies, centered on the ITU-T grid. Each channel, characterized by its central frequency (or wavelength), carries a modulated signal, with high bit rate, representing the transmitted data.
The challenge in communication networks is still to increase bandwidth, to fulfill the demanding needs for triple and quadruple play services. Therefore, Network Equipment Manufacturers now commercialize DWDM solutions, with high numbers of narrow-spaced channels, modulated at high bit rates, up to 40 Gbps.
To test the transmission quality, it may be necessary to isolate a single channel, to run Bit Error Rate Testing (BERT), SONET/SDH analysis... on individual channels. Because of the high traffic density on networks, this operation is not straightforward.
The objective of this application note is to help in selecting the best filter for a clean extraction of DWDM modulated channels.

Isolate one channel

The first characteristic of a filter is its spectral profile. The ideal spectral shape of a band-pass filter is a rectangular function, providing a perfect transmission, without distortion, of the whole signal within the filter bandwidth, and cutting undesired signals out of the band.

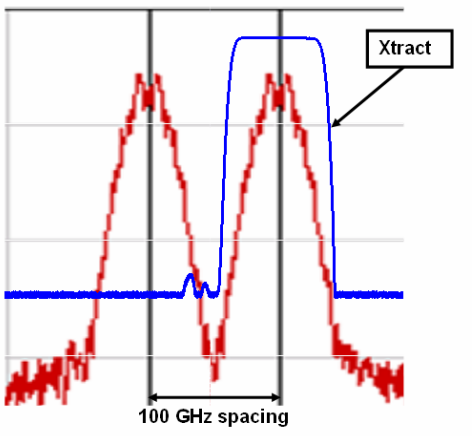

Fig 1. typical 40 Gbps duobinary channels optical spectrum and Xtract filter shape

With flat top and sharp edges, Anritsu Xtract tunable filter is very close to the ideal rectangular shape and allows a clean extraction of DWDM channels without any corruption of data.

Also, as we can deduce from the figure 1 above, the filter must have a large enough bandwidth to transmit the whole signal of the modulated channel. On figure 1, the spectral width of the modulated signal is about 600 pm at -20 dB. But this width depends on the modulation format. See, on figures 2, examples of different modulation types, and, superimposed, the spectral profile of a Xtract at 3 different bandwidths (250 pm, 560 pm and 750 pm at – 3 dB).

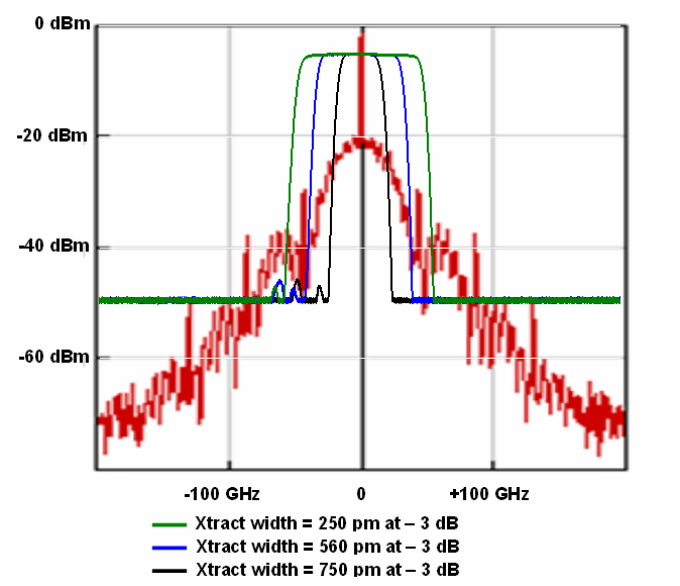

Fig 2a. typical 40 Gbps NRZ channel optical spectrum and Xtract filter shape

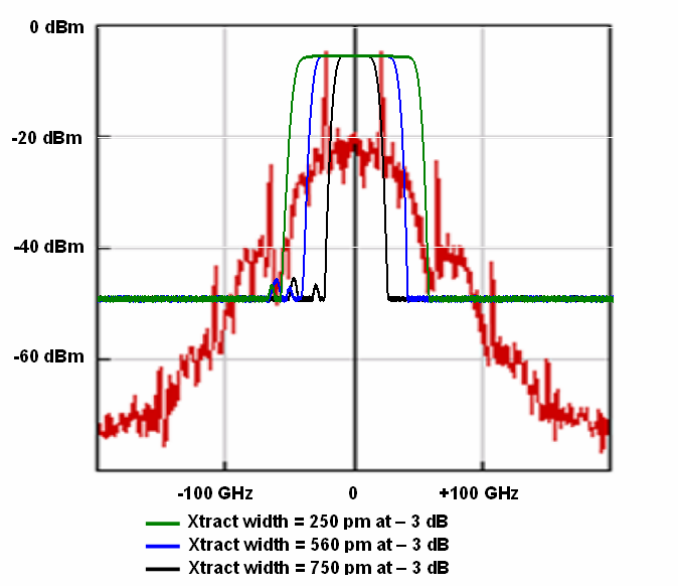

Fig 2b. typical 40 Gbps CS-RZ channel optical spectrum and Xtract filter shape

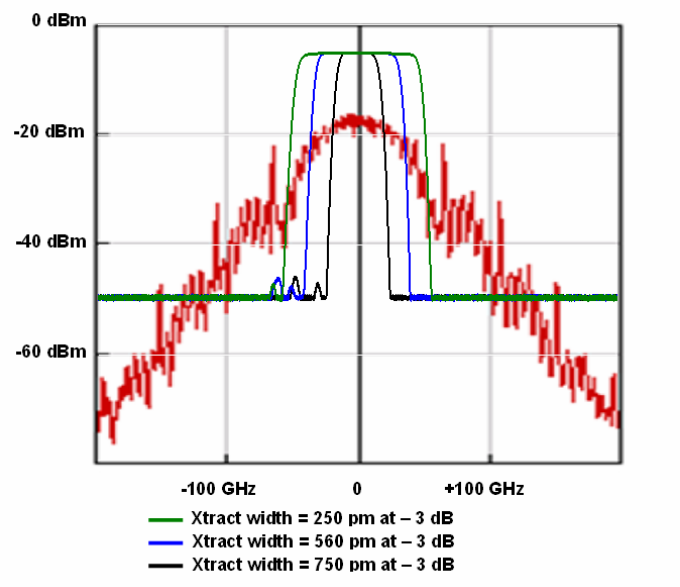

Fig 2c. typical 40 Gbps RZ-DPSK channel optical spectrum and Xtract filter shape

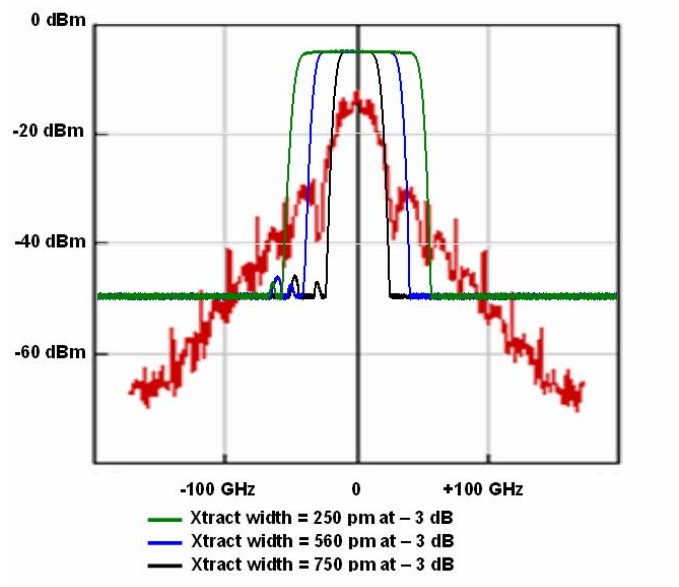

Fig 2d. typical 40 Gbps RZ-DQPSK channel optical spectrum and Xtract filter shape

Consequently, a filter with an adjustable bandwidth is mandatory when testing different modulation formats. The Xtract has a continuously variable bandwidth option, which allows a perfect adaptation to any kind of modulation, from 2.5 to 40 Gbps, and beyond.

This adjustable bandwidth of Xtract can also be used to simulate OADM concatenation. In a WDM network, the data pass through multiple OADMs. Due to the uncertainties and tolerances on the central wavelength and bandwidth of these components, the cumulative transmission window, seen by modulated signals, becomes narrower when the number of crossed OADM increases. By slightly changing the Xtract spectral width, the effect of the accumulation of OADMs can be tested accurately.

Even if it is important to have a large bandwidth for the integrity of the transmitted channel, the filter bandwidth should not be too large in order to stop the other channels. In the example shown on figure 1, a filter width superior to 600 pm (around 75 GHz) at -20 dB is necessary to extract a channel on two 40 Gbps channels with a 100 GHz spacing. But to stop the other channel, a good isolation is needed for wavelengths at + or – 400 pm (about 50 GHz) from the center of the filter.
The sharp edges of the Xtract are perfect for that purpose: typically on the Xtract, when the width at -3 dB is 550 pm, the width at -20 dB is around 650 pm and the width at - 40 dB is around 700 pm.
In comparison, a Gaussian filter with a 500 pm width at -3 dB will have a 950 pm width at -20 dB, providing a far less efficient isolation than the Xtract, as we can see on figure 3.

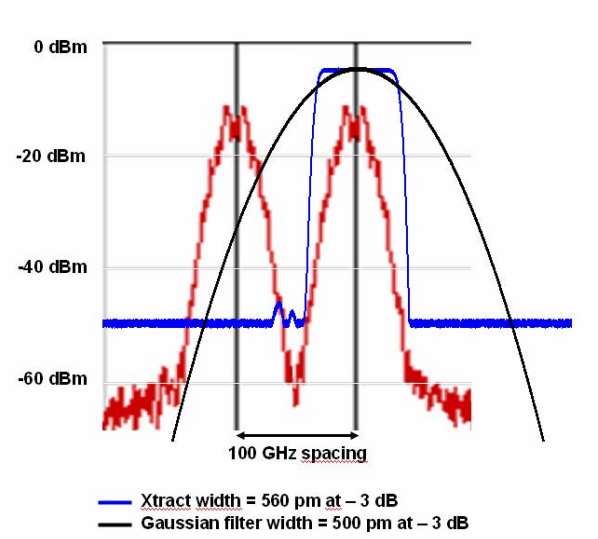

Fig 3. typical 40 Gbps duobinary channel optical spectrum with Xtract and Gaussian filter shapes

Besides, the spectral shape of a Gaussian filter may degrade the transmitted signal, altering results on tests performed after the filter, while the wide flat top profile of the Xtract on its pass-band region prevents distortions of the extracted channel.

Another essential parameter of a filter is its centering on the signal to be extracted. The position of the filter has to be adjusted regarding the signal harmonics. A high accuracy is required. The Auto-positioning feature of the Xtract allows a centering accuracy better than 15 pm (< 2 GHz), sufficient to dramatically minimize the influence of the filter in test results on the extracted channel.

Conclusion

To test DWDM systems, during the design phase, the manufacturing, the final qualification or the commissioning, it is necessary to use an optical band-pass filter, to extract a single channel and test the transmission quality on this individual carrier. Because the trend in DWDM networks is to tighten the channel spacing and to increase the modulation rate, isolating one channel without altering data is not straightforward.
Thanks to its patented squared spectral shape, with flat top and sharp edges, the Xtract Optical Channel Drop Unit provides a clean extraction of DWDM signal, without degradation of the transmitted data.
With a continuously adjustable bandwidth, it can be adapted to any high bit rate modulation format, from 2.5 Gbps to 40 Gbps, and beyond.
The automatic channel detection, allowing a fast and accurate centering on the channel to extract, enriches the Xtract features and makes it the ideal filter to isolate high bit rate modulated channels from a DWDM networks.

More Information

Visit the Xtract Product Page at www.anritsu.com

Anritsu

Specifications are subject to change without notice.

Anritsu Corporation
5-1-1 Onna, Atsugi-shi, Kanagawa, 243-8555 Japan
Phone: +81-46-223-1111
Fax: +81-46-296-1264

• **U.S.A.**
Anritsu Company
1155 East Collins Blvd., Suite 100, Richardson,
TX 75081, U.S.A.
Toll Free: 1-800-267-4878
Phone: +1-972-644-1777
Fax: +1-972-671-1877

• **Canada**
Anritsu Electronics Ltd.
700 Silver Seven Road, Suite 120, Kanata,
Ontario K2V 1C3, Canada
Phone: +1-613-591-2003
Fax: +1-613-591-1006

• **Brazil**
Anritsu Eletrônica Ltda.
Praca Amadeu Amaral, 27 - 1 Andar
01327-010-Paraiso-São Paulo-Brazil
Phone: +55-11-3283-2511
Fax: +55-11-3288-6940

• **Mexico**
Anritsu Company, S.A. de C.V.
Av. Ejèrcito Nacional No. 579 Piso 9, Col. Granada
11520 Mèxico, D.F., Mèxico
Phone: +52-55-1101-2370
Fax: +52-55-5254-3147

• **U.K.**
Anritsu EMEA Ltd.
200 Capability Green, Luton, Bedfordshire, LU1 3LU, U.K.
Phone: +44-1582-433200
Fax: +44-1582-731303

• **France**
Anritsu S.A.
16/18 avenue du Québec-SILIC 720
91961 COURTABOEUF CEDEX, France
Phone: +33-1-60-92-15-50
Fax: +33-1-64-46-10-65

• **Germany**
Anritsu GmbH
Nemetschek Haus, Konrad-Zuse-Platz 1
81829 München, Germany
Phone: +49-89-442308-0
Fax: +49-89-442308-55

• **Italy**
Anritsu S.p.A.
Via Elio Vittorini 129, 00144 Roma, Italy
Phone: +39-6-509-9711
Fax: +39-6-502-2425

• **Sweden**
Anritsu AB
Borgafjordsgatan 13, 164 40 KISTA, Sweden
Phone: +46-8-534-707-00
Fax: +46-8-534-707-30

• **Finland**
Anritsu AB
Teknobulevardi 3-5, FI-01530 VANTAA, Finland
Phone: +358-20-741-8100
Fax: +358-20-741-8111

• **Denmark**
Anritsu A/S
Kirkebjerg Allé 90, DK-2605 Brøndby, Denmark
Phone: +45-72112200
Fax: +45-72112210

• **Spain**
Anritsu EMEA Ltd.
Oficina de Representación en España
Edificio Veganova
Avda de la Vega, n° 1 (edf 8, pl 1, of 8)
28108 ALCOBENDAS - Madrid, Spain
Phone: +34-914905761
Fax: +34-914905762

• **United Arab Emirates**
Anritsu EMEA Ltd.
Dubai Liaison Office
P O Box 500413 - Dubai Internet City
Al Thuraya Building, Tower 1, Suit 701, 7th Floor
Dubai, United Arab Emirates
Phone: +971-4-3670352
Fax: +971-4-3688460

• **Singapore**
Anritsu Pte. Ltd.
60 Alexandra Terrace, #02-08, The Comtech (Lobby A)
Singapore 118502
Phone: +65-6282-2400
Fax: +65-6282-2533

• **India**
Anritsu Pte. Ltd.
India Branch Office
Unit No. S-3, Second Floor, Esteem Red Cross Bhavan,
No. 26, Race Course Road, Bangalore 560 001, India
Phone: +91-80-32944707
Fax: +91-80-22356648

• **P.R. China (Hong Kong)**
Anritsu Company Ltd.
Units 4 & 5, 28th Floor, Greenfield Tower, Concordia Plaza,
No. 1 Science Museum Road, Tsim Sha Tsui East,
Kowloon, Hong Kong
Phone: +852-2301-4980
Fax: +852-2301-3545

• **P.R. China (Beijing)**
Anritsu Company Ltd.
Beijing Representative Office
Room 1515, Beijing Fortune Building,
No. 5, Dong-San-Huan Bei Road,
Chao-Yang District, Beijing 10004, P.R. China
Phone: +86-10-6590-9230
Fax: +86-10-6590-9235

• **Korea**
Anritsu Corporation, Ltd.
8F Hyunjuk Building, 832-41, Yeoksam Dong,
Kangnam-ku, Seoul, 135-080, Korea
Phone: +82-2-553-6603
Fax: +82-2-553-6604

• **Australia**
Anritsu Pty. Ltd.
Unit 21/270 Ferntree Gully Road, Notting Hill,
Victoria 3168, Australia
Phone: +61-3-9558-8177
Fax: +61-3-9558-8255

• **Taiwan**
Anritsu Company Inc.
7F, No. 316, Sec. 1, Neihu Rd., Taipei 114, Taiwan
Phone: +886-2-8751-1816
Fax: +886-2-8751-1817

ISO 9001:2000 certified. Application Note: MBXTRACT-AN-01-0801-A4