The User Guide

Fiber Pre-distortion Module (OP-DCM)

Optostar optoelectronics Co., Ltd

Address: :14F, building A, Haide Building, the Intersection of Nanxin Road and Haide Second Road Nanshan Distric,shenzhen, P.R.China. P.C.:51805

Tel :+86 (0)755-26400198-612 Fax: :+86 (0)755-26411001

http://www.optostar.com.cn E-mail: sales5@optostar.com.cn

1 Product Overview

At present, 1550nm wavelength high-power analog optical transmission system is the most widely used in HFC cable network. But in the long-distance (≥ 100KM) transmission, the problem of fiber dispersion is very prominent, and the degradation of CSO severely limit the further transmission of the signal. Laser spectral width as well as fiber dispersion (CDI) caused by suppression stimulated Brillouin scattering (SBS) and self-phase modulation (SPM) caused by the fiber nonlinear effect are the most important factors which lead to CSO deterioration.

In order to solve the problems arised from the dispersion and self-phase modulation effect, the most common method is to use dispersion compensation fiber (DCF) and linear chirped fiber grating (CFG) to compensate dispersion, and (DCM) dispersion compensation modules. The compensation techniques such as commercial-oriented DCF and chirped fiber gratings are mostly used in digital transmission systems. For analog HFC transmission systems can not copy them. Such as DCF's ability to compensate dispersion is low, large insertion loss, small diameter of core, strong nonlinear effect, it is not suitable for high-power HFC network transmission. CFG production process is very complicated and can only compensate fixed wavelength, flexibility is not enough. DCM module, as a passive component owe wide spectrum has been successfully used in network and achieved good results.

2 The main technical indicators

Type	compensative fiber length （KM）	Dispersion typical value （ps/nm）	PMD（dB）	Insertion Loss （dB）
OP-DCM-3.5	3.5	-59.5	0.1	1.2
OP-DCM-4.5	4.5	-76.5	0.1	1.2
OP-DCM-5	5	-85.6	1.1	<1.6
OP-DCM-10	10	-170	1.2	<2
OP-DCM-16	16	-270	1.3	<2.5
OP-DCM-20	20	-340	1.5	<3
OP-DCM-25	25	-415	1.8	<2
OP-DCM-30	30	-510	1.9	<3.5
OP-DCM-40	40	-680	2.2	<4
OP-DCM-50	50	-850	2.4	<5
OP-DCM-60	60	-1020	2.6	<6
OP-DCM-70	70	-1160	2.5	<6.5
OP-DCM-80	80	-1360	2.8	<8
OP-DCM-100	100	-1700	3.0	<10

3 DCM dispersion management

Due to the dispersion compensation in analog system is not as simple as the digital

system, in different locations there are different amounts of compensation, the compensation effect is different, and this is the so-called dispersion management. The different dispersion management programs impact the performance of the system differently, we need to research and analyze a variety of situation more in-depth to find optimal dispersion management schemes.

3.1 Distributed and concentrated dispersion compensation

Dispersion compensation is divided into distributed and concentrated dispersion compensation mode generally. In order to repress the impact of the four-wave mixing, generally ,the current DWDM systems also maintain a certain degree of dispersion values on transmission lines, and conduct a one-time dispersion compensation where close to transport terminals to reduce the impact of dispersion, this approach is called concentrated dispersion compensation.

Distributed compensation is not one-time compensation at the circuit terminals ,but in the circuit, compensate dispersedly in accordance with the amount of accumulated amount of dispersion. Each section of transmission fiber and it's dispersion compensation modules form a unit, a complete line is composed by those units. For the ultra-long transmission system, generally ,it is not compensated in the terminal one-time, so it will use the distributed compensation mode.

3.2 The management of location of DCM

According to the different locations that the dispersion compensation modules placed in: it can be divided into pre-compensation,middle-compensation, post-compensation, symmetrical two compensation. Depending on the amount of compensation it can be divided into: complete compensation, a certain degree of over-compensation and a certain degree of less-compensation.

First of all, DCM module should be placed in the output of the erbium-doped fiber amplifier (EDFA). This is because the DCM module will introduce additional loss 2~6dB. If placed in the input port of optical amplifier, that will reduce the input-driven optical power of fiber amplifier, thus deteriorate the C / N indicators. Placed in the output port, can increase the fiber amplifier's output optical power to make up the additional loss of DCM modules.

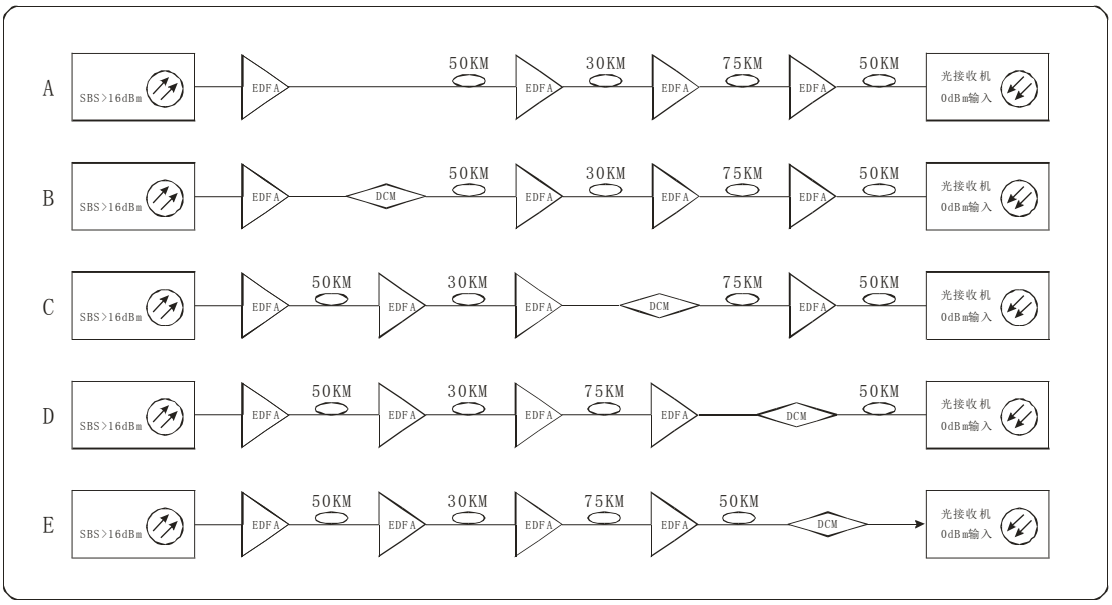
Secondly, generally, the non-linear effect of fiber needs strict phase-matching conditions, so the existence of a certain amount of dispersion can make some delay in different wavelengths, will cause walk-off effect. This undermines the phase-matching conditions, and inhibit the production of non-linear effect. For example, dispersion can inhibit the four-wave mixing certainly, walk-off caused by dispersion will weaken XPM effect. Therefore, in a distributed compensation, generally do not completely compensate for each segment, but rather a certain degree of over-compensation or less-compensation, which not only can reduce the accumulation of dispersion, but also inhibit the non-linear effects. Especially for multi-wavelength systems that maintain a certain amount of dispersion can reduce the crosstalk between wavelengths.

Finally, when relay multi-level optical amplifiers, research results show that the compensation module is best placed in the middle of several stages. On the top level, the system is less-compensation, placed in the final level, the system is

over-compensation, will reduce the ability to compensate.

4 DCM dispersion compensation management and experiment report

The figure is the DCM modules in different locations to compensate. In the figure ,the amount of compensation in the module is 1360PS, can compensate for 80KM common G625 fiber dispersion. Figure A is the uncompensated transmission structure; B is the pre-compensation structure; C is the middle-level compensation structure; D is the post-compensation structure; E is compensation structure at the receiver. In order to ensure the five kinds of test conditions is the same, 75KM fiber and DCM act as a whole unit ,and are put in the beginning, middle and end of the system separately.



To study the dispersion and the effects of DCM compensation, the transmission distance of experiment system is up to 205KM, so intends to highlight the impact of dispersion. At the same time adjustment each piece of EDFA output power, so that the optical power of each segment into the fiber are controlled below 16dBm, to reduce deterioration caused by self-phase modulation (SPM). Theoretically, when the DCM fully compensate 80KM dispersion, the CSO indicators would improve 6.2dB.

The results show that:

When the system A is in the absence of DCM compensation, the system CSO value is -34dBc (60CH);

The system B is a over-compensation. At first, the transmited signal is changed -1360ps , and then put it into the fiber to transport. The tested CSO value is -36.5dBc (60CH), 2.5dB improvement, the difference with the theoretical calculated value is 3.7dB;

The system C, after the signal transmit 80KM, at the 80th KM compensate -1360ps. The system CSO value is -40dBc (60CH), a 6dB improvement. The improvement is the best and approach with the theoretical calculated value;

The system D , after the signal transmit 130KM, compensate -1360ps. System CSO value is -39.1dBc (60CH), a 5.1dB improvement, the difference with the theoretical calculated value is1.1dB.

The system E place the same DCM Dispersion Compensation Module in the end of receiver. System CSO value is -33.6dBc (60CH), compared with the without DCM there is a degradation of 0.4dB. Compensation effective is the worst.

If connect a compensation module at the back of each section, so that the dispersion of each section is basically compensated, the compensation effect will be better.

DCM Dispersion Compensation Module have advantages,a strong ability to compensate, broadband compensation, insertion loss, reasonable price, and so on. A rational dispersion management, can well compensate the issue of dispersion brought from long-distance transmission, it is suitable for long-distance broadcast analog HFC network transmission.

5 The notes about optical connection

Before you connect them, carefully clean all the fiber optic connectors and connectors

Cleaning Guide:

5.1)Fiber Optic jumper

Removal the dust cap of fiber optic connector, pay attention to confirm the optical connector is a APC surface;

The tips of cleaning fiber optic connector is to use a dedicated and dry cloth without velveteen (the company 5Kimwipes ®'s fine cloth); In addition, preferably adopt special microscope (at 100 times, 200 times) to check the cleanliness of fiber optic connector surface or blemish.

pay attention to maintaining the fiber optic connectors is clean;

fiber optic connectors (flange) is clean

you can use a dedicated compressed gas to clean the surface of fiber optic connector;

you can remove the dust which is less than 0.2 microns, better without residue;

hold the tank of compressed air from the connector about 6 inches, alignment flange, and press the nozzle switch shortly times,so you can clean the connector completely;

if there is no dedicated compressed air, the 2.5 mm cotton swab for cleaning can also be used to clean the optical transmitter connectors, or remove the flange and clean the optical fiber jumper connector of the other side directly ;

Note: When handling fiber optic connectors must be very careful to avoid damage.

6 other notes

6.1) The machine should be set up in anti-hot, anti-cold, anti-wet environment, so as to avoid excessive temperature and humidity affect the use life of machine.

6.2) To ensure the optical return loss ≥ 45dB, this machine's optical connectors adopt FC / APC, other models (such as FC / PC) could not be picked. The connector should be installed to keep clean. you should use ethanol and defatted cotton wool to wipe after plug repeatedly.

Shenzhen Optostar Optoelectronics Co., Ltd.
Address:14F,Building A,Haide Building,the Intersection of Nanxin Road and Haide Second Road Nanshan District,Shenzhen,P.R.China
Tel:0086-755-26400288 Fax:0086-755-26411001
E-mail:info@optostar.com.cn Http://www.optostar.com.cn