

# A Review of industry standard WDM channel maps and recommendation to IEEE

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# Contents

- Review of WDM standard channel maps
- Review of EDFA tradeoffs
- Recommendation on channel map

# Relevant Standards:

- ITU-T, [G.698.2](#), (11/2018)
- ITU-T, [G.694.1](#), (02/2012) [Defines the DWDM grid]
- IA # OIF-400ZR-0.10 Draft
- Cablelabs, [P2PCO-SP-PHYv1.0-I01-180629](#)

# ITU-T, G.698.2, (11/2018) definitions

- Table 7-1, Min/Max Central Frequency 7.2.1

**Table 7-1 – Parameters for DWDM applications using the "black link" approach with amplifiers**

Parameter	Units	Defined in
Minimum central frequency	THz	7.2.2
Maximum central frequency	THz	7.2.2

- 7.2.2, “lie on the frequency grid for the minimum ....”

## **7.2.2 Minimum and maximum central frequency**

The central frequency is the nominal single-channel frequency on which the digital coded information of the particular optical channel is modulated by use of the NRZ line code.

The central frequencies of all channels within an application lie on the frequency grid for the minimum channel spacing of the application given in [ITU-T G.694.1].

While the specific central frequencies used within each application are not specified in this Recommendation, the nominal central frequencies of all channels within an application should be greater than or equal to the minimum central frequency and less than or equal to the maximum central frequency.

# ITU-T, G.698.2, (11/2018) requirements

- Table 8-8 DP-DQPSK 100G [~80 km] applications

**Table 8-8 – Physical layer parameters and values for class DP-DQPSK 100G, wide spectral excursion applications**

Parameter	Units	DW50U-8A2(C)F	DW50U-8A3(L)F	DW50U-8A5(C)F	DW100U-8A2(C)F	DW100U-8A3(L)F	DW100U-8A5(C)F
Minimum central frequency	THz		191.5 for (C) 186.0 for (L)				
Maximum central frequency	THz		196.2 for (C) 191.5 for (L)				

# ITU-T, G.694.1, (02/2012)

- Table 1, Example nominal central frequencies

Table 1 – Example nominal central frequencies of the DWDM grid

Nominal central frequencies (THz) for spacings of:				Approximate nominal central wavelengths (nm) (Note)
12.5 GHz	25 GHz	50 GHz	100 GHz and above	
•	•	•	•	•
•	•	•	•	•
•	•	•	•	•
195.9375	–	–	–	1530.0413
195.9250	195.925	–	–	1530.1389
195.9125	–	–	–	1530.2365
195.9000	195.900	195.90	195.9	1530.3341

- Page 2 states “ Endpoints shown are illustrative, not normative”

Table 1 illustrates some nominal central frequencies within the C and L bands based on the 12.5 GHz minimum channel spacing anchored to the 193.1 THz reference. Table 1 also illustrates the 25, 50 and 100 GHz grid frequencies within the same region. The endpoints shown are illustrative, not normative.

# IA # OIF-400ZR-0.10 Draft

- Table 13.1.1 Optical channel specifications

Ref.	Parameter	Default	Min	Max	Unit	Conditions/Comments
13.1.100	Channel frequency	193.7	191.3	196.1	THz	ITU-T grid

- 16 Annex A, Normative 48 x 100 GHz DWDM Application Channels,
  - 191.4 through 196.1 THz

1	191.3	25	193.7
2	191.4	26	193.8
3	191.5	27	193.9
4	191.6	28	194.0
5	191.7	29	194.1
6	191.8	30	194.2
7	191.9	31	194.3
8	192.0	32	194.4
9	192.1	33	194.5
10	192.2	34	194.6
11	192.3	35	194.7
12	192.4	36	194.8
13	192.5	37	194.9
14	192.6	38	195.0
15	192.7	39	195.1
16	192.8	40	195.2
17	192.9	41	195.3
18	193.0	42	195.4
19	193.1	43	195.5
20	193.2	44	195.6
21	193.3	45	195.7
22	193.4	46	195.8
23	193.5	47	195.9
24	193.6	48	196.0
		49	196.1



# Cablelabs , P2PCO-SP-PHYv1.0-I01-180629

- Table 2, channel 13 (191.3 THz) to channel 62 (196.2 THz)

## 7.2.6 DWDM Frequency Grid

In order to enable interoperability between transceivers operating in Dense Wavelength Division Multiplexing (DWDM) environments, and to interoperate with existing cable operator DWDM systems and equipment, the specification has adopted a subset of the channels identified in [ITU G.694.1] using a 100 GHz spacing. Specifically, Table 2 lists the specific DWDM wavelengths, frequencies, and associated channel numbers on which compliant transceivers can operate.

In order to enable low cost implementations, transceivers are only required to support one channel from the Table 2. However, in order to support greater flexibility, devices are also permitted to support multiple channels from that list, and may comprise the entire list or just portions of it.

# Summary of channel ranges:

	OIF 400ZR	ITU-T G.698.2	CableLabs
Spacing (GHz)	100	100	100
Min ch (THz)	191.3 (191.4)	191.5	191.3
Max ch (THz)	196.1	196.2	196.2
Channel count	49 (48)	48	50

# Impact with lower channel count

- Slight reduction of pump power for EDFA
- Slight reduction in ripple across the channels for EDFA
- Slight reduction in noise figure for EDFA
- Slight change in optical amplifier gain flattening filter for a reduced channel count for EDFA
- AWG designs would be slightly easier to build, see:

[http://www.ieee802.org/3/cn/public/18\\_11/deandrea\\_3cn\\_01c\\_1118.pdf](http://www.ieee802.org/3/cn/public/18_11/deandrea_3cn_01c_1118.pdf)

# Proposal on Channel Plan for 100 and 400G options:

- Recommend IEEE adopt start channel at 191.5 THz
- Recommend IEEE adopt end channel at 196.1 THz
  - 47 channels
  - 4.7 Tb/s total aggregate rate for 100G option
  - 18.8 Tb/s total aggregate rate for 400G option