

WAVELENGTH PLAN ANALYSIS

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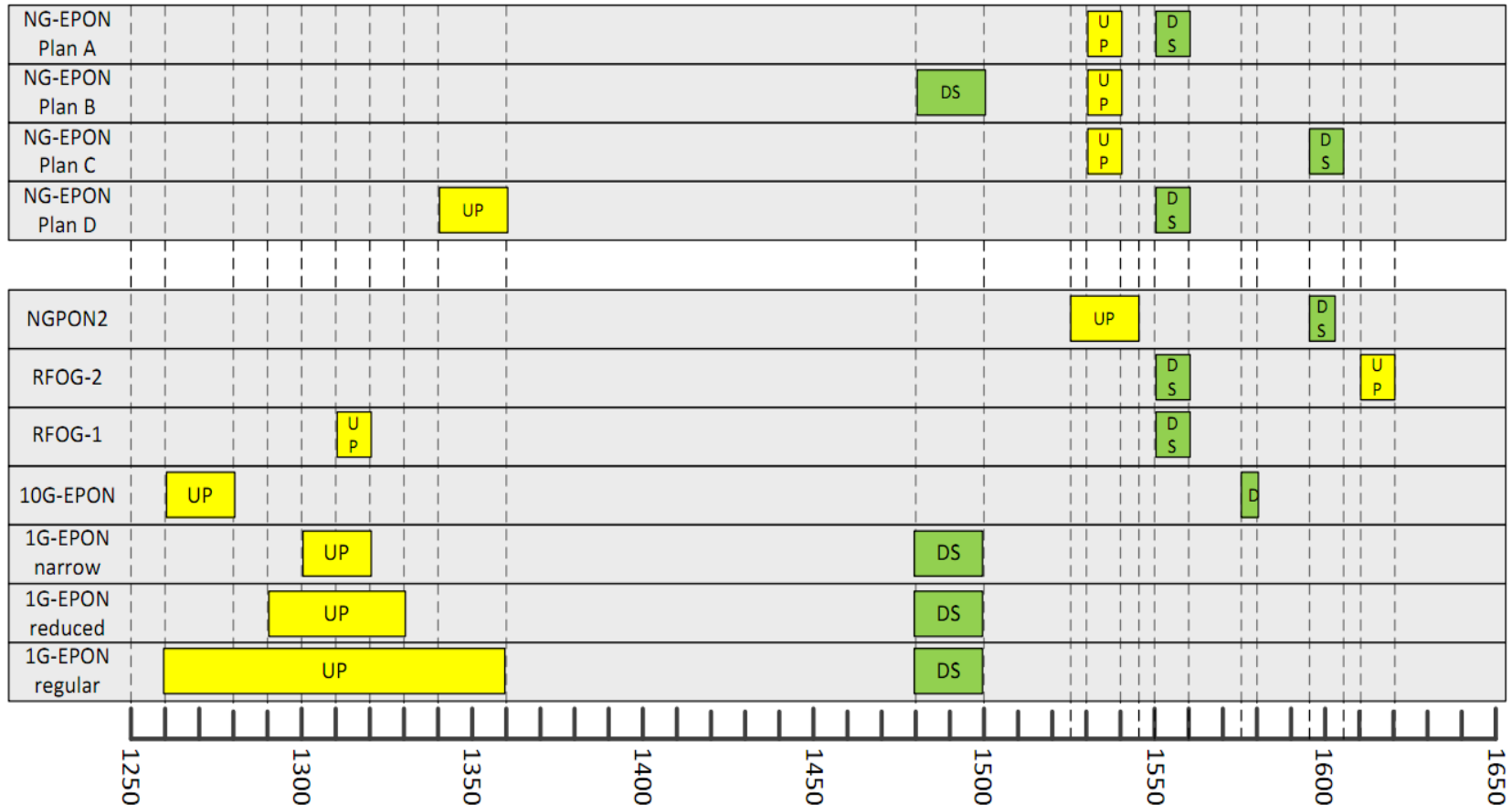
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OUTLINE

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NGEPON WAVELENGTH PLANS PROPOSAL



* Optional NGPON2 PtP WDM Expanded Spectrum (US/DS 1524-1625 nm) is also allowed subject to spectrum otherwise being used

Wavelength allocation plans for 1G-EPON, 10G-EPON, ITU-T PON, SCTE RFOG, and NG-EPON

NGEPON WAVELENGTH PLAN PROPOSALS

(CONT.)

Wavelength Plan		Plan A	Plan B	Plan C	Plan D	Plan E (NGPON2)
DS band(nm)		1550-1560	1480-1500	1595-1605	1555-1560	1596-1603
US band(nm)		1530-1540	1530-1540	1530-1540	1340-1360	1524-1544
Coexistence	1G-EPON	Y	NO	Y	Y	Y
	10G-EPON	Y	Y	Y	Y	Y
	RFoG US	NO	Y	Y	NO	Y
	RFoG DS	NO	Y	Y	NO	Y
	NGPON2	NO	NO	Close	Y	Y

Some concerns:

- Coexistence with RFoG.
- Coexistence with 1G EPON.
- Use of O band for NGEPON US.
 - Will regular 1G-EPON gradually disappear in industry?
 - Can NGEPON US use the same compatibility mechanism as 10G-EPON with 1G-EPON (i.e., TDM in single wavelength)?

COEXISTENCE WITH RFOG

- ⦿ Answer is definitely YES.
- ⦿ Evidence indicates that RF overlay will provide services for many subscribers in the foreseeable future.
- ⦿ “Coexistence with current 1G-EPON and RF overlay will be necessary” is from KDDI’s view. “agata_ngepon_01_0314.pdf”
- ⦿ It is recommended that NGEPON group adopt this requirement, at least for DS video.

COEXISTENCE WITH 1G EPON

- ◉ 1G EPON will still play a big role in residential applications in future.
- ◉ This coexistence requirement should be adopted.

USE OF O BAND FOR NGEPON US

- ◉ EPON's main deployment areas are Asia and Americas. In China, Japan and Korea, FP lasers are largely deployed which occupy O band from 1260nm to 1360nm.
- ◉ Driven by cost, manufacturers will produce more standard 1G EPON devices. So, disappearance of standard 1G EPON is unlikely.
- ◉ If NGEPON upstream only has a single wavelength, it can TDM-coexistence with 1G EPON and 10G EPON. But if NGEPON upstream uses multi-wavelength aggregation mode, it will not work. This prohibits expanding capacity, a stated requirement for business subscribers.
- ◉ The above observations suggest that use of O band for NGEPON US is ill advised.

MATURITY AND INDUSTRY CHAIN

- ◉ O band optics devices are mature, disadvantages are described on the previous page.
- ◉ If NGEPON use ITU's wavelength plan, it will benefit from:
 - Shared industry chain: for 1G and 10G, EPON and GPON wavelength plans are basically the same. The main reason is to promote development of optical components and cost lower. NGEPON and NGPON2 will also see this benefit.
 - NGPON2's upstream devices are already commercially available in Japan, German and Korea. In China, Accelink has already begun to develop NGPON2's devices.
 - NGPON2 downstream lasers have been successfully used.
- ◉ So the benefits from NGEPON using NGPON2's wavelength plan are clear.

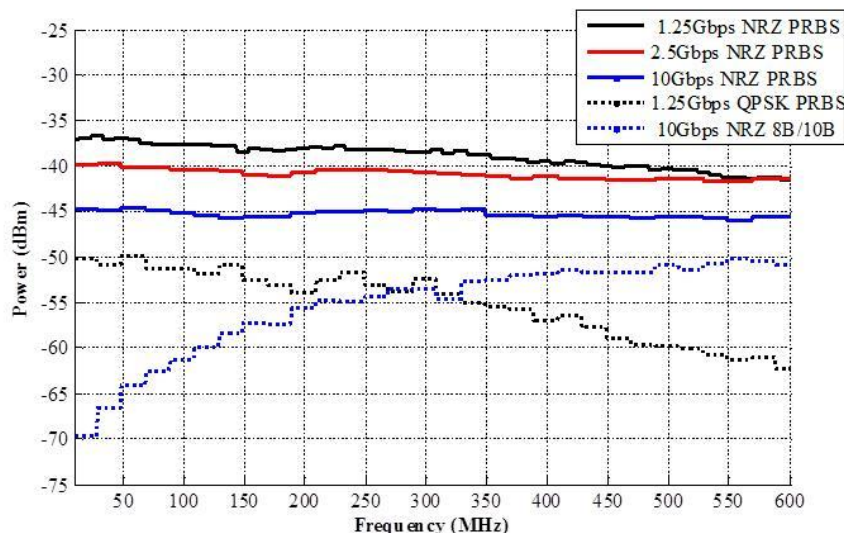
SUMMARY

- ⦿ Require Coexistence with RFoG (downstream at minimum) and 1G EPON.
- ⦿ If NGEPON adopts the same wavelength plan as NGPON2 it will promote optical devices and industry chain's maturity, and from the survey of availability of NGPON2 devices, Plan E (NGPON2) is a better solution.

THANK YOU

RAMAN MITIGATION

- ◉ Mitigation techniques for nonlinear raman interactions in optical fiber (from G.989.2 Appendix VI)
- ◉ High Pass RF filtering of data signals prior to transmission (HighPassRF). Up to a 12 dB reduction in Raman crosstalk might be achievable.
- ◉ Zero Composite DoP Interferer Launch (DoP0).
- ◉ Dedicated Raman Crosstalk Mitigation Optical Transmitter (DedicatedTx).
- ◉ Power Spectrum Density Shaping (PSD-S).



So Raman effects are not a problem.

Measured RF spectrum of several data rates, modulation formats and codings