

# Field Trial of Alien Wavelengths on GARR Optical Network

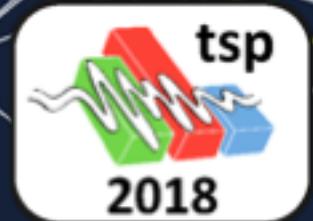
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Athens, 2018-07-04

TSP2018



# GARR Network community

About 1000 connected sites belonging to several organisations

-  100 Universities
-  350 Research Institutes and Laboratories
-  60 Biomedical Research Institutes
-  65 Music Conservatories, Art Academies, Libraries, Museums & other Cultural Institutions
-  500 Schools
-  100 PoPs

IRU fiber footprint **15000 km**

**~9.000 Km** of backbone

**~6.000 Km** of access links

**IP/MPLS based Network over DWDM**

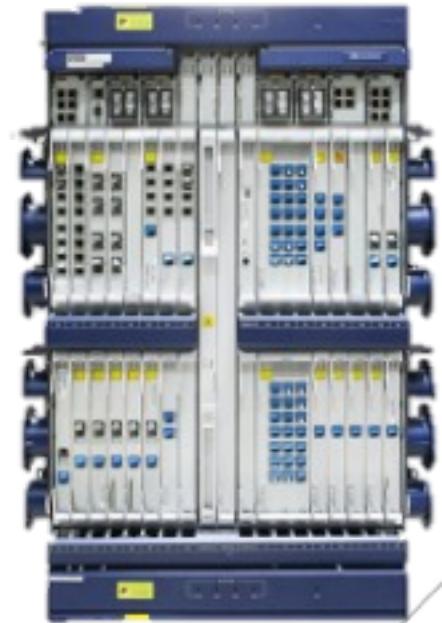


# GARR-X: since 2011

## Huawei OptiX OSN 8800 (6800 on OLA)

### Key properties:

- DCM compensated
- 80 channels @50GHz spacing
- $\lambda$ s: 10G and 40G IM-DD OOK
- Max capacity: 3.2 Tbps
- Client: 1G, 10G
- ROADM:
  - core nodes: colorless & directionless
  - colored & directionless
- WSON control plane: preset restoration
- MUX and WSS: equipped with VOA
- Integrated OSA Board in each node
- OTN Matrix: 1.28Tbps

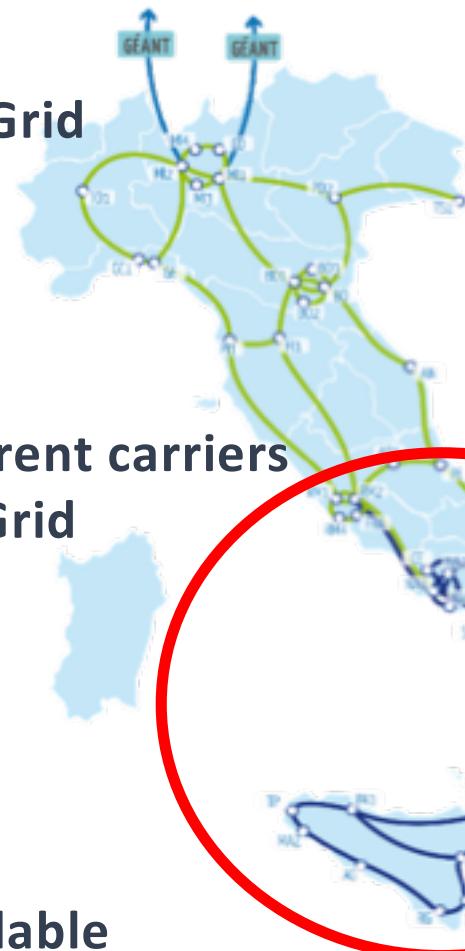


# GARR-X Progress: since 2015

## Infinera DTN-X Intelligent transport network

### Key properties:

- 16 superchannels@500G Fixed Grid
- Max capacity: 8 Tbps
- Client: 10G, 40G, 100G
- SD-FEC (reach up to ULH)
- For each superchannel: 10 coherent carriers spaced at 200GHz on a 25GHz Grid
- PM-QPSK, PM-BPSK
- NO WSS
- OTN Matrix: 5Tbps or 2Tbps
- GMPLS control plane
- Restoration and protection available



**GARR**  
NETWORK



# Network Harmonization

## Idea:

- Share of the optical spectrum among Huawei and Infinera signals

**How:** Field trial on production network

## why:

- Increase P2P capacity
- Make 100GE client services available in the northern network
- the Infinera node needed only where the 100GE service ends
- Extend the lifetime of the Huawei technology
- All terminal nodes are kept to deliver the native 10 Gbps services. Amps serve both platforms



**Goal:** To measure performances/penalties of the Infinera superchannel alongside native lambdas over Huawei line system

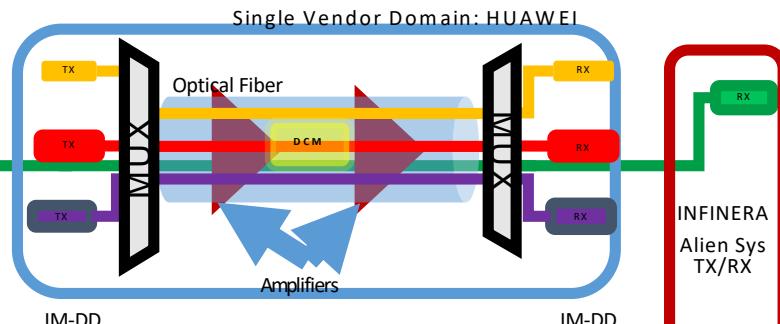
# Field Trail on production network

Where

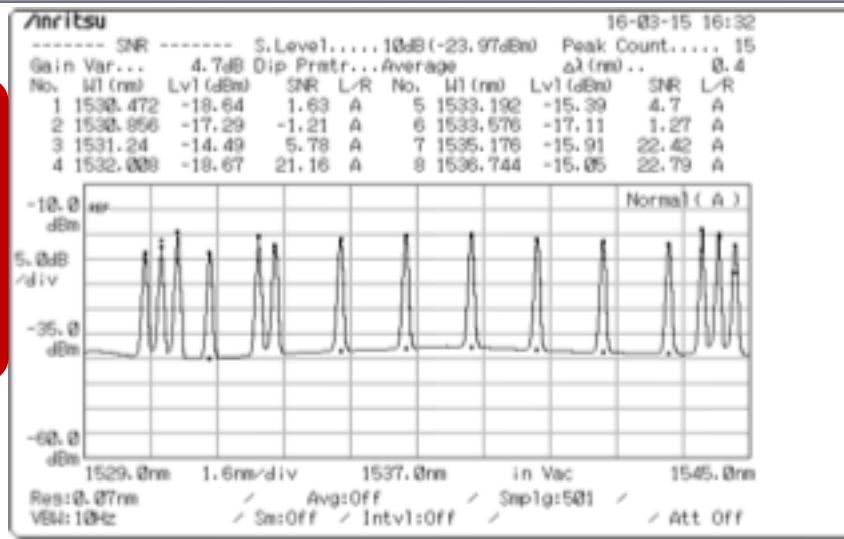
	Test 1	Test 2
Path	RM2-NA1	RM2-AQ-PE-BA1-MT-NA1
Distance (km)	<b>345</b>	<b>1181</b>
Line Attenuation (dB)	<b>93</b>	<b>314</b>
# ROADM	<b>2</b>	<b>6</b>
# Raman Span	<b>1</b>	<b>3</b>



# Alienwave - Field Trail

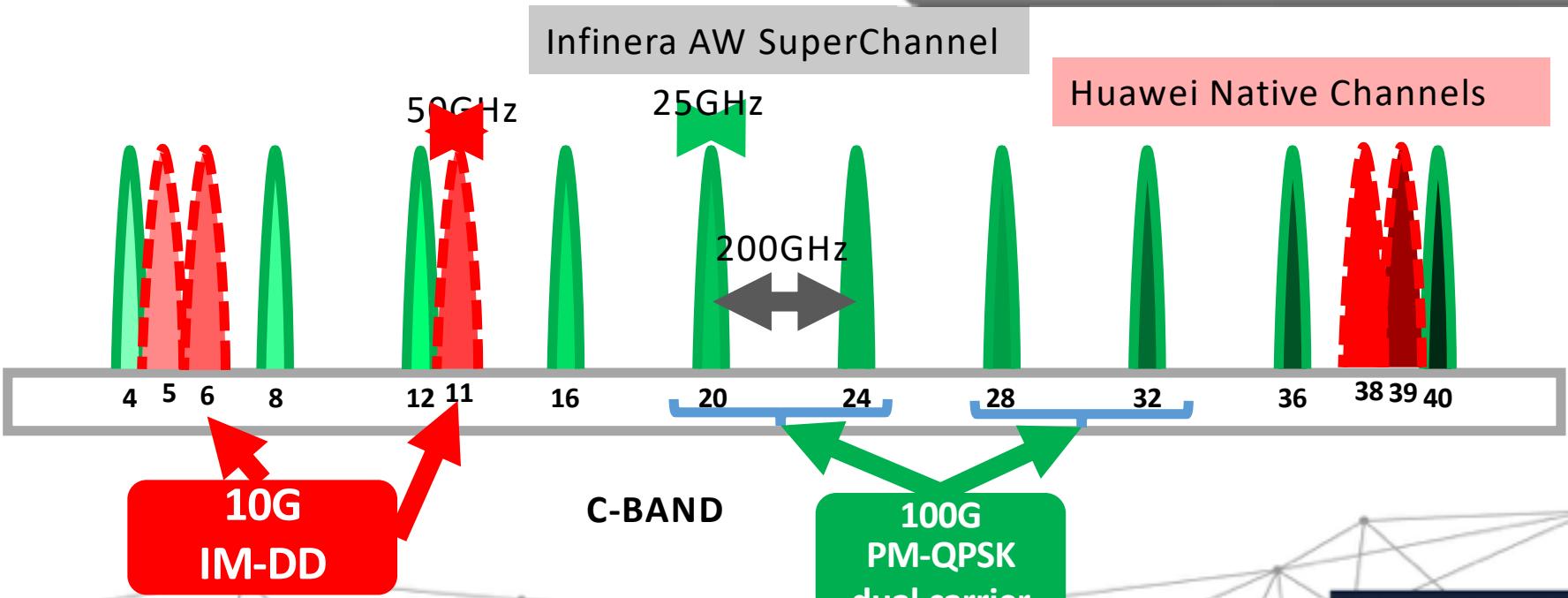


Coherent



Infinera AW SuperChannel

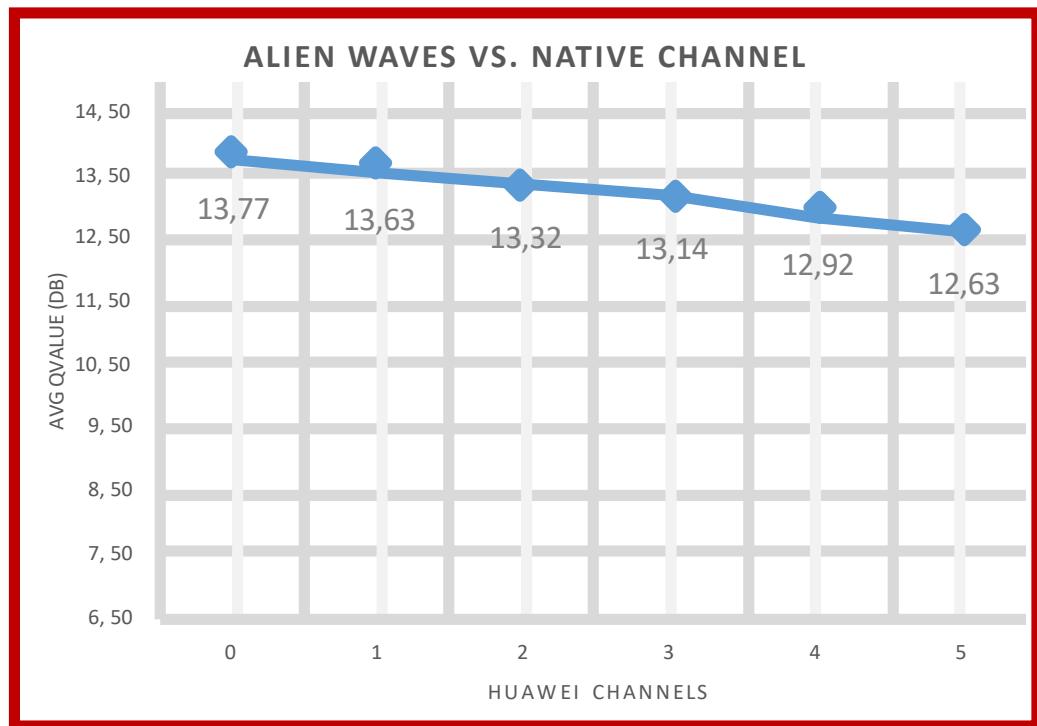
Huawei Native Channels



# Alienwaves vs Native Waves



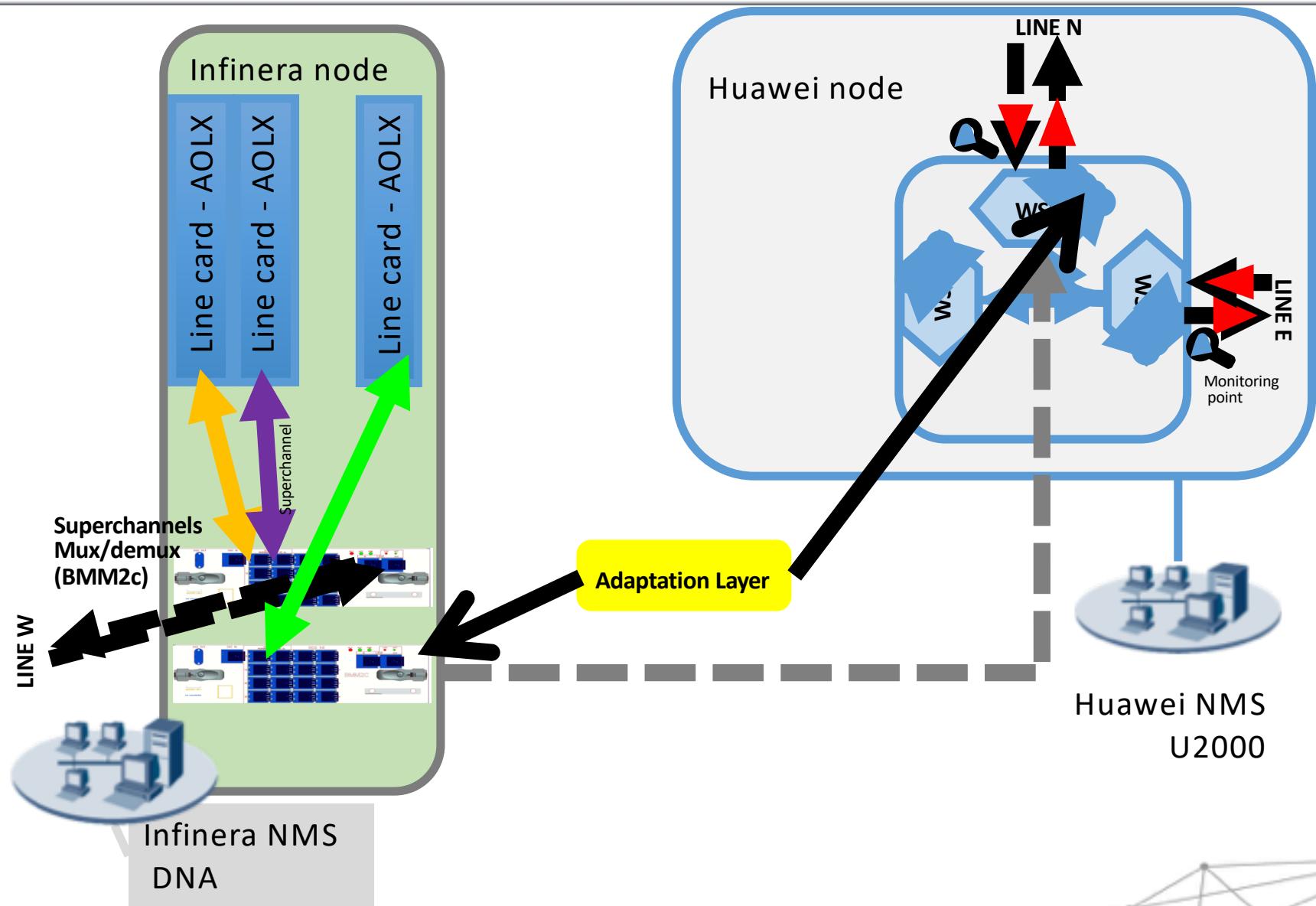
**Alien Waves perspective:**



**Native Waves perspective:**

No relevant interaction on native channels caused by Alien Waves transmission

# Alienwave - GARR Technique



# Alienwaves - Network Evolution

	BO1-MI1	RM2-BO1	BA1-BO1	RM2-MI2
Path	BO1-MI1	RM2-FI1-BO1	BA1-PE-AN-BO-BO1	RM2-RM1-PI1-GE-MI2
Distance (km)	277	495	813	1131
Attenuation (dB)	78	105	232	325
# OLA	2	4	10	12
# ROADM	2	3	6	5
# Raman Span	1	3	2	3

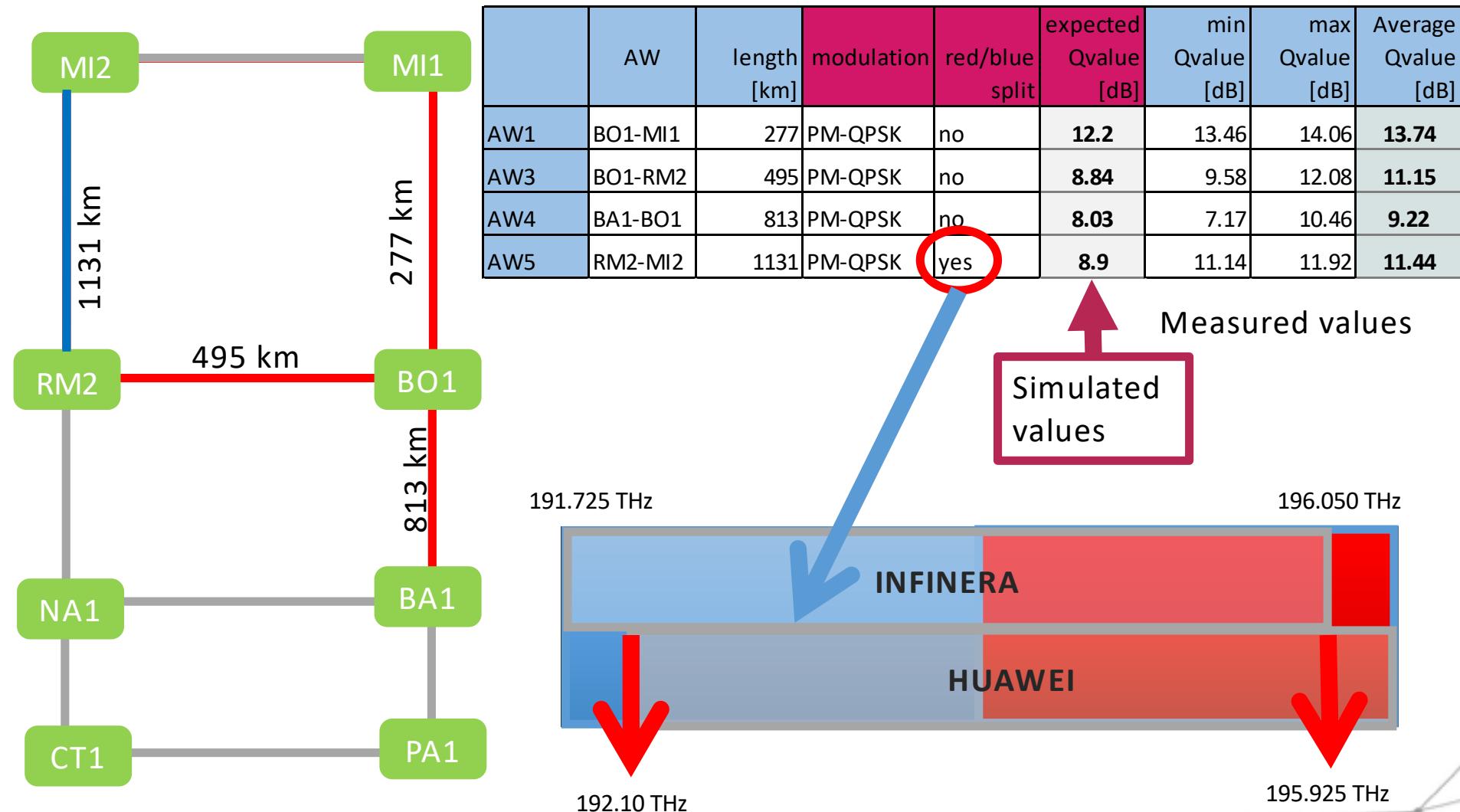


This span is the more challenging.

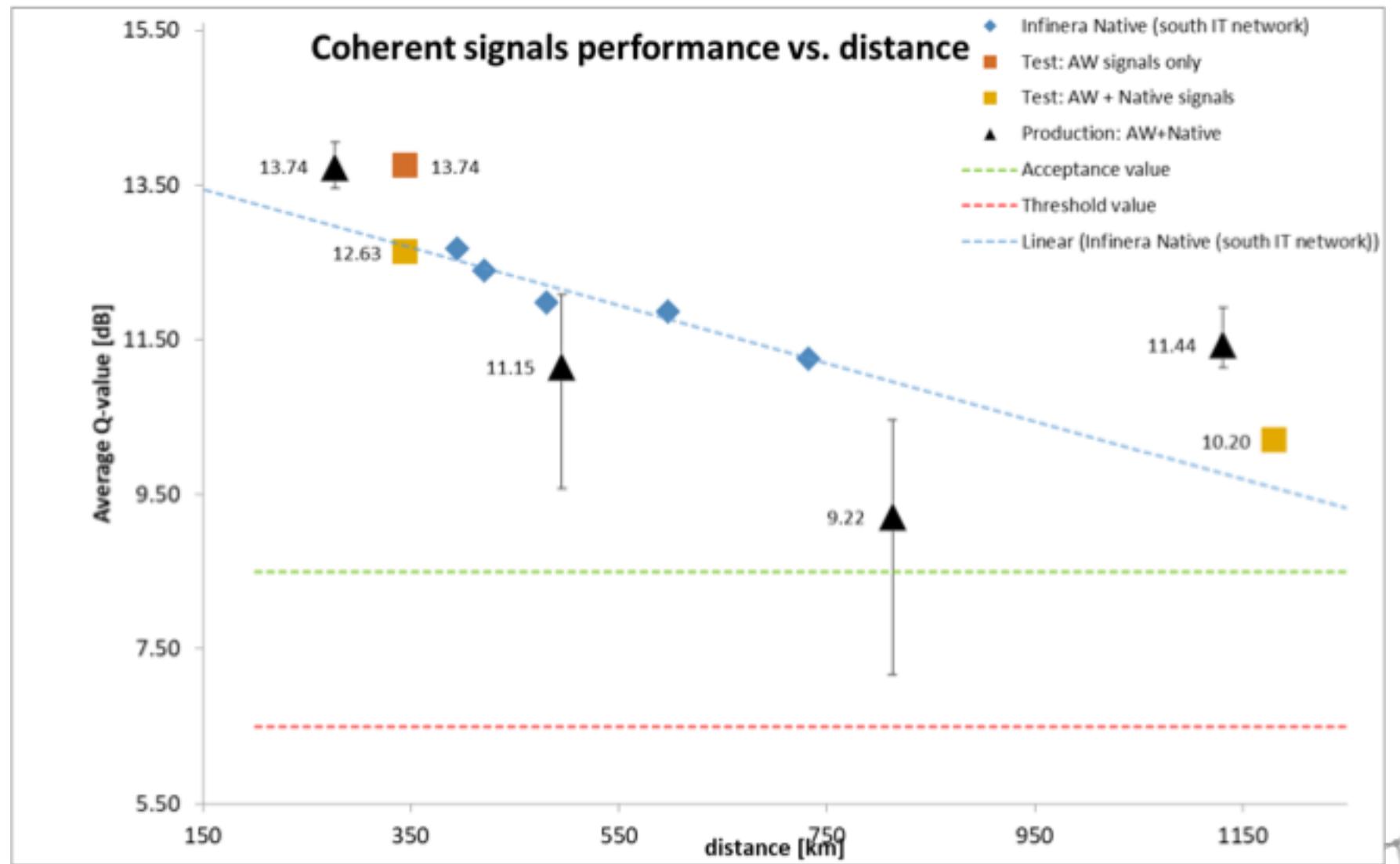
Possible solutions:

- BPSK (250Gbps)
- QPSK on dedicated spectrum space(450Gbps!).

# Alienwaves Performances



# Alienwaves Performances



# GARR Network 2018 - Conclusions

- Alien Wave successfully deployed in production network
- High capacity interconnections implemented in an effective way
- Integration of optical networks
- First step forward to an open approach in optical networking





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