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ZTE Suggestions for TD-LTE Spectrum Usage in EU

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1 Background

From the first investment wave in 2009, LTE has achieved global success thanks to the contributions from each link of the entire industry chain. More carriers revised their view from LTE island coverage at hotspot areas to nationwide coverage and turned LTE into a key differentiator with other WCDMA operators.

GSA reported that 360 commercial LTE networks launched in 124 countries by 2014, which including 48 LTE TDD networks in 30 countries, there are 17 operators deploying both LTE FDD and TDD networks among the 48 LTE TDD networks.

To meet the huge demand for mobile data, more spectrum resources are required. However, paired spectrum resources used for LTE FDD are increasingly scarce, and operators often reform their 2G and 3G spectrum for 4G services. In contrast, asymmetric TD-LTE spectrum resources are more abundant. As TD-LTE is mature and the industrial chain gradually improves, there will be more and more networks operating in TD-LTE and LTE FDD dual mode.

In China, TD-LTE is allocated with 190 MHz in the 2.6G band while LTE FDD is allocated with 2 × 30 M in the 1.8G and 2.1G bands. To cope with the flood of data, hybrid TD/FDD LTE is the trend to maximize spectrum use.

In Europe, Hi3G Sweden's hybrid TD/FDD LTE network, built exclusively by ZTE, is the world's first commercial dual-mode 4G network. Compared to single LTE FDD, dual-mode TD-LTE/FDD increases costs by 25–35%, but total network capacity doubled.

2 TDD-LTE Benefits

2.1 Complementary capacity with TDD/FDD-LTE

Using TD-LTE as a complement to LTE FDD offers the following benefits:

Higher capacity

- All TDD bands are above 1900 MHz and offer more bandwidth, typically released in blocks of 40-100MHz , compared to FD-LTE, limited to 10-20MHz blocks.

Additional coverage:

- 3.5GHz/3.6 GHz spectrum is best suited for small cell deployments in limited coverage areas (urban hot zones)

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Faster speeds:

- TD-LTE offers faster downlink speeds than FD-LTE (+30% higher measured by Softbank)
- More downlink capacity to support video streaming and downloading

Higher Revenues:

- Higher capacity & speeds favor more services consumption

Better matches user behaviour

- TDD offers flexibility in the adjustment of the DL/UL ratios according to traffic demand since its spectrum is asymmetric, which is not the case with FDD.

Dual Mode
FDD/TDD Network



Use of TD-LTE as a complement to LTE FDD

Benefits**■ Additional coverage**

- Offer Small cells coverage
- 3.5GHz/3.6 GHz spectrum is best suited for small cell deployments in limited coverage areas (urban hot zones)

■ Faster speeds

- TD-LTE offers faster downlink speeds than FD-LTE (+30% higher measured by Softbank)
- More downlink capacity to support video streaming and downloading

■ Higher Revenues

- Higher capacity & speeds favor more services consumption

■ Higher capacity

- All TDD bands are above 1900 MHz and offer more bandwidth, typically released in blocks of 40-100MHz, compared to FD-LTE, limited to 10-20MHz blocks.

■ Better matches user behaviour

- TDD offers flexibility in the adjustment of the DL/UL ratios according to traffic demand

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Since TDD benefits from higher spectrum range and in higher bands compared to FDD, it better suits to urban coverage than rural coverage.

Based on ZTE's experience with one operator in EU, we could demonstrate that TDD can assign more downlink capacity:

	FDD LTE UL: 10MHz DL: 10MHz	TDD LTE UL&DL: 20MHz SA=2	TDD UL&DL: 20MHz SA=5
DL Max. Cell Throughput	71Mb/s	108Mb/s	124Mb/s
UL Max. Cell Throughput	21Mbps	11Mb/s	5.5Mb/s
Total Cell Throughput	91Mbps	119Mbps	130.4Mb/s

Where:

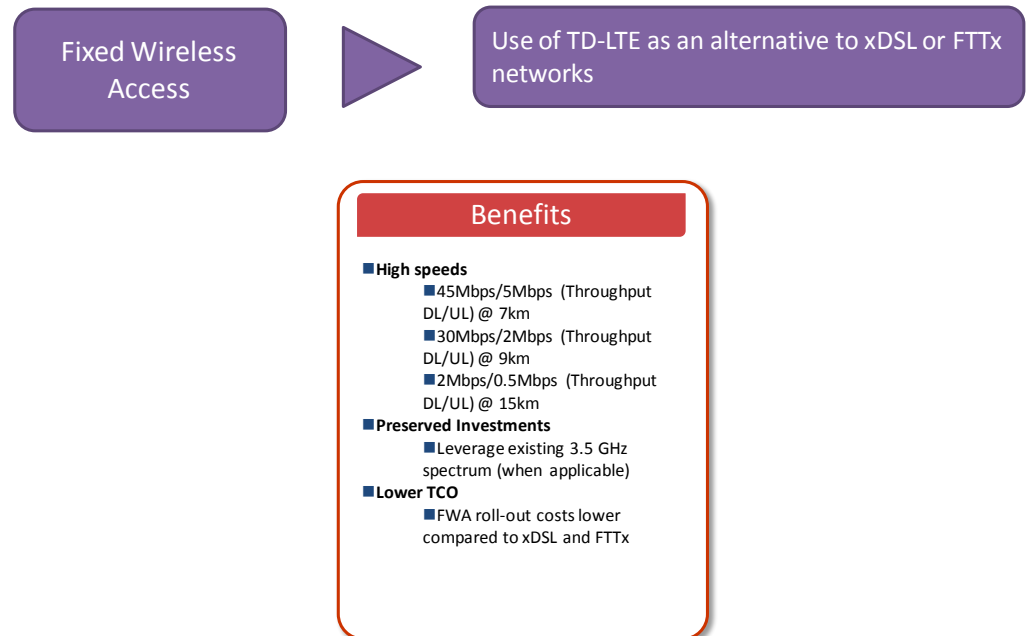
- D is a subframe for downlink transmission
- S is a "special" subframe used for a guard time
- U is a subframe for uplink transmission

This operator obtained 50MHz TDD spectrum at 2.6GHz band from 2570-2620MHz and 2*9MHz FDD spectrum at 1800MHz band for LTE (1720.1-1729.1, 1815.1-1824.1).

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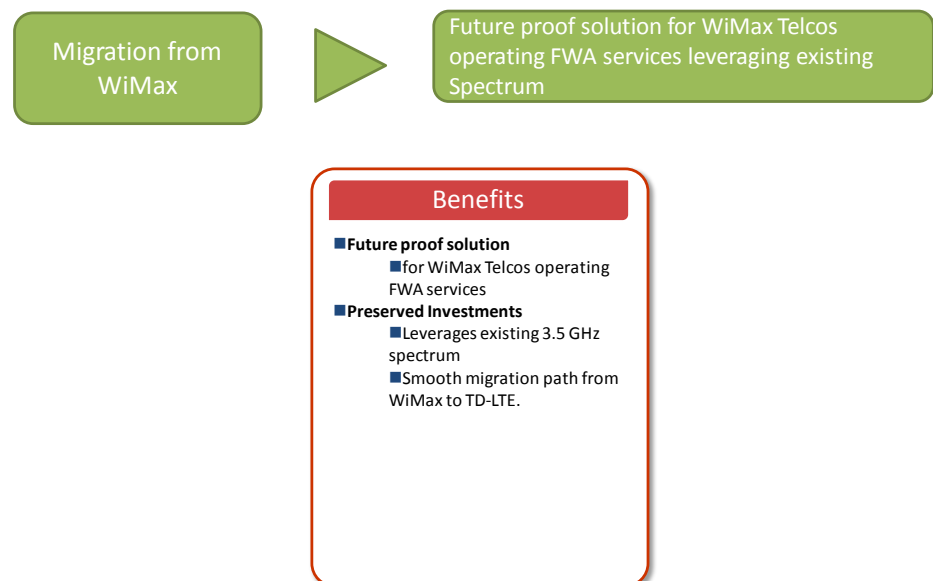
2.2 Fixed Wireless Access Alternative

Using TD-LTE as an alternative to xDSL or FTTx networks offers the following benefits:



2.3 Smooth Migration from WiMax

TD-LTE is a future proof solution for WiMax Telcos operating FWA services leveraging existing spectrum. It preserves initial Investments by leveraging existing 3.5 GHz spectrum and offers a smooth migration path from WiMax to TD-LTE.

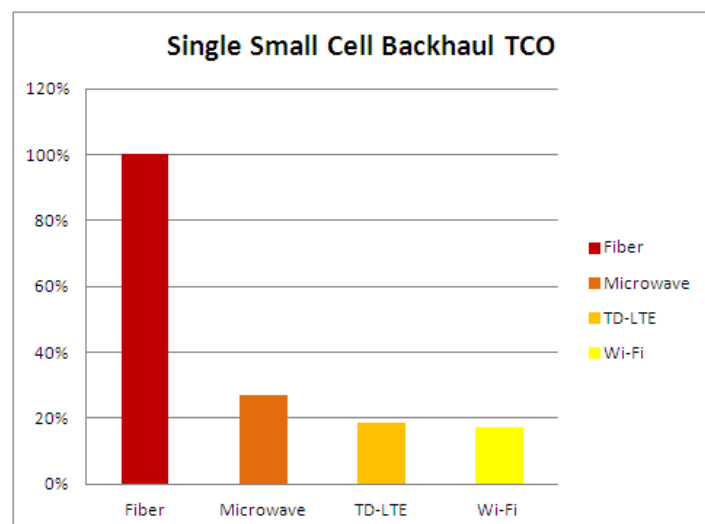
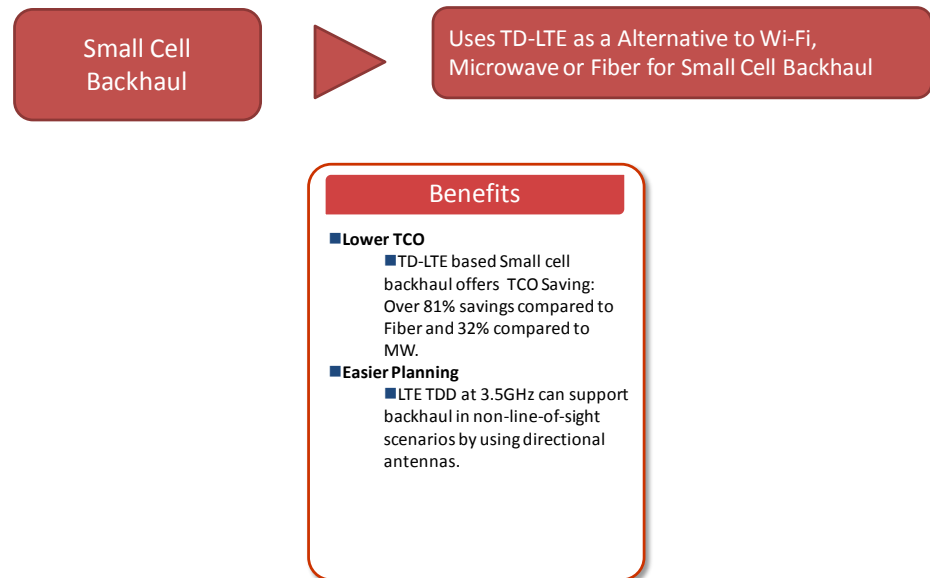


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2.4 Lower Small cell backhaul cost

According to Senza Fili consulting, in a business case study for backhaul for small cells, small-cell backhaul represents around 37-45% of the overall small cell TCO. And TD-LTE based single small cell backhaul offers 81% TCO savings compared to Fiber and 32% TCO savings compared to MW over a 5 year period.

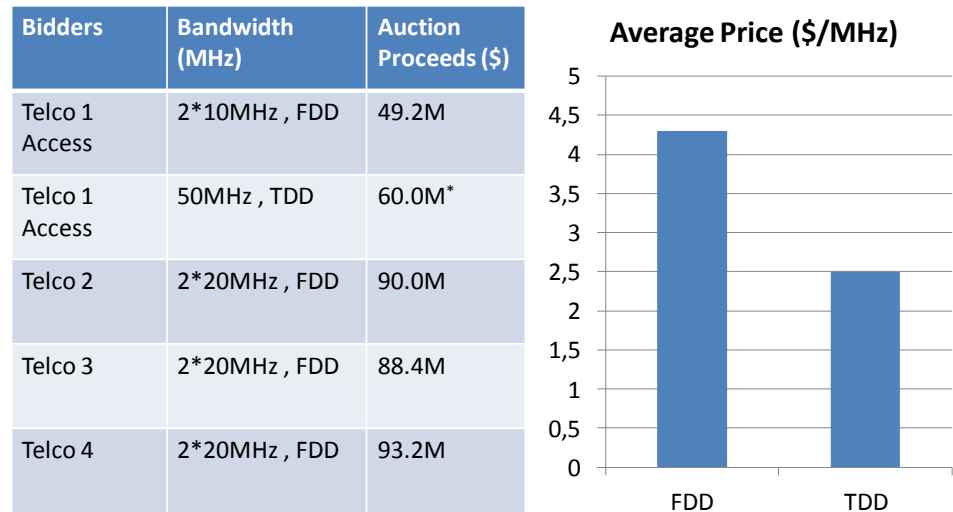
Also easier Planning can be achieved since LTE TDD at 3.5GHz can support backhaul in non-line-of-sight scenarios by using directional antennas.



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2.5 Lower Spectrum cost

Based on ZTE's experience with another operator in EU, TDD spectrum was cheaper compared to FDD spectrum:



This cost advantage was also backed by industry analysts: according to ABI research, for the 2.xGHz spectrum, TDD is about 2.3 times cheaper:

Spectrum bands	FDD	TDD
For the 2.xGHz spectrum	\$0.119/(MHz*Population)	\$0.052/(MHz*Population)
For the 3.xGHz spectrum	N/A	\$0.009/(MHz*Population)

As a result, the hardware and Operation cost for TDD and FDD LTE will be similar, the TCO for FDD LTE would be about 30% higher than TDD LTE due to higher spectrum cost.

2.6 Evolution path towards 5G

Full-duplex and Carrier Aggregation will encourage further TDD/FDD convergence toward 5G.

According to GTI Group, 3.5GHz band, with its abundant bandwidth, has been regarded as the next gold band for TD-LTE. This band not only offers a great opportunity for the global development of TD-LTE, but also builds a crucial spectrum anchor for 5G development around the world.

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On the evolution path to 5G, ZTE could demonstrate that TD based Massive MIMO could achieve 3 times higher peak data rate in a test completed with a chinese operator, compared to legacy TD-LTE.

At MWC Barcelona 2015, ZTE made a live demonstration of M-MIMO delivering a total of more than 400 Mb/s to 12 commercial 4G handsets using a single 20 MHz TDD carrier at 2.6GHz.

Further trials are planned with Softbank in Japan, with KT Corporation in Korea and with U Mobile in Malaysia.

3 ZTE Recommendation

Based on the challenges faced by current FDD-LTE networks, ZTE recommends European regulators to consider introducing more spectrum compatible for TD-LTE usage.

TD-LTE would offer:

- Complementary capacity with TDD/FDD-LTE
- A Fixed Wireless Access Alternative
- Smooth migration from WiMax
- Lower Small cell backhaul cost
- Lower Spectrum cost
- Evolution path towards 5G