

# 3G Embedded Notebook Products: Industry Update

FCC OET Meeting

Washington DC

April 18<sup>th</sup> 2007

# Agenda

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- Introduction
  - Recap on Previous FCC Meetings
- Update on 3G embedded notebook market
  - 3G Broadband Networks
  - Embedded Notebook Proliferation
- RF Exposure requirements for 3G embedded notebook products
  - Guidance to TCB's
  - End-User Upgrades or New install
- FCC requirements for Co-located transmitters

# Introduction

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- QUALCOMM originally filed comments to FCC NPRM 03-137 in support of WWAN approvals
  - Presenting a roadmap for the emerging 3G networks and a forward looking assessment of the demand for wireless data and the subsequent proliferation of embedded WWAN notebooks
  - Formalize FCC Part 22/24 module approval process
    - Currently FCC informally uses WLAN module definitions per DA 00-1407
  - Streamline FCC Test Requirements for embedded WWAN notebooks

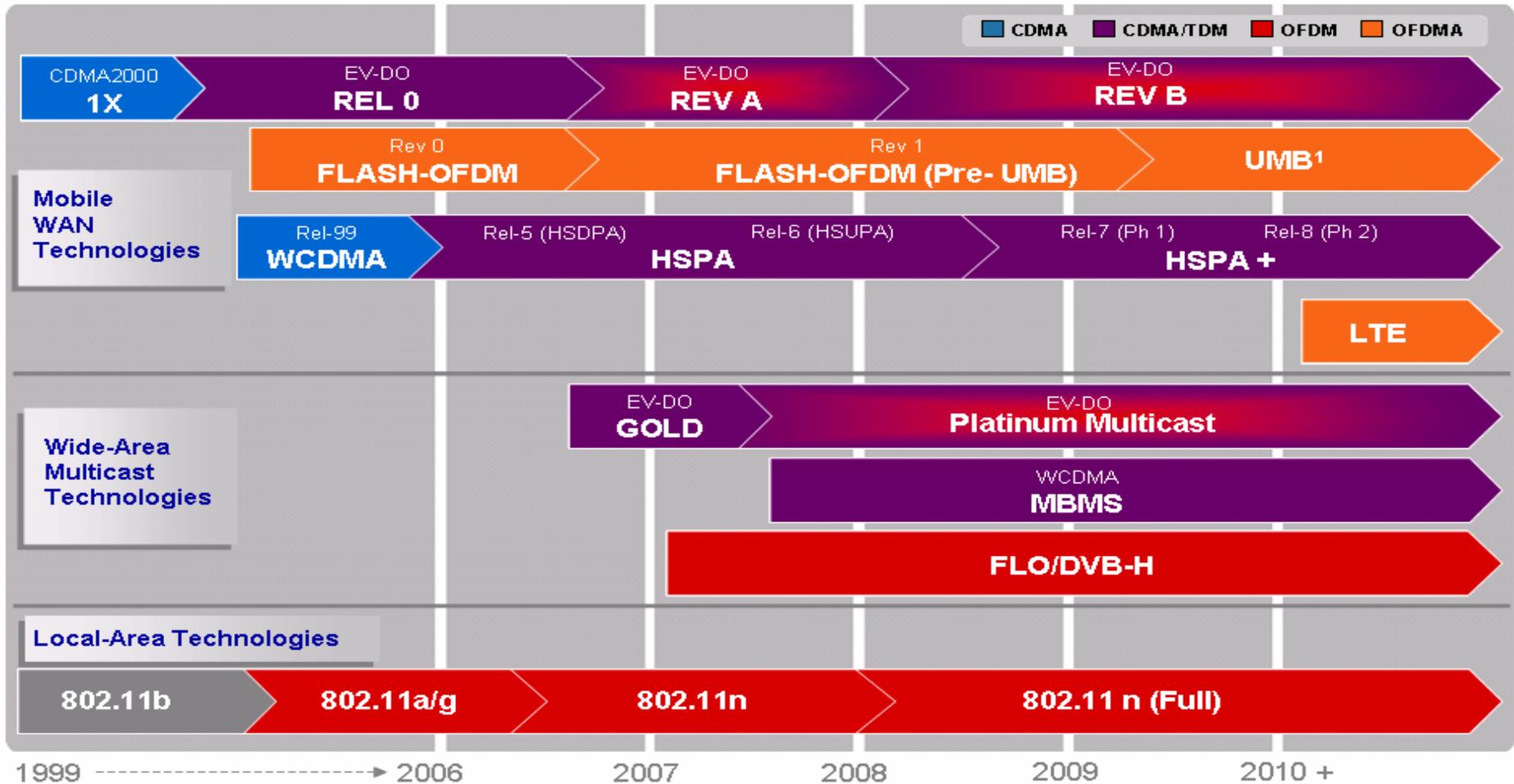
## Introduction (continued)

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- Recommendations made to the FCC during May 2004 meeting with OET and through additional filing made August 16<sup>th</sup> 2005.
  - Recommended minimum separation distance of 10cm as a distance at which valid MPE measurements can be made at the frequencies used by WWAN licensed devices
  - QCOMM also proposed that the FCC allow the installation by customers and retailers of Part 22 and 24 approved modules into notebooks
    - Just as the FCC today permits unlicensed modules to be installed by end-users into notebooks.
    - This would permit notebook vendors to sell WWAN-ready notebook, with the WWAN antennas and other necessary components built in, but in which the end-user could install an approved module and enable WWAN connectivity for their notebook device.

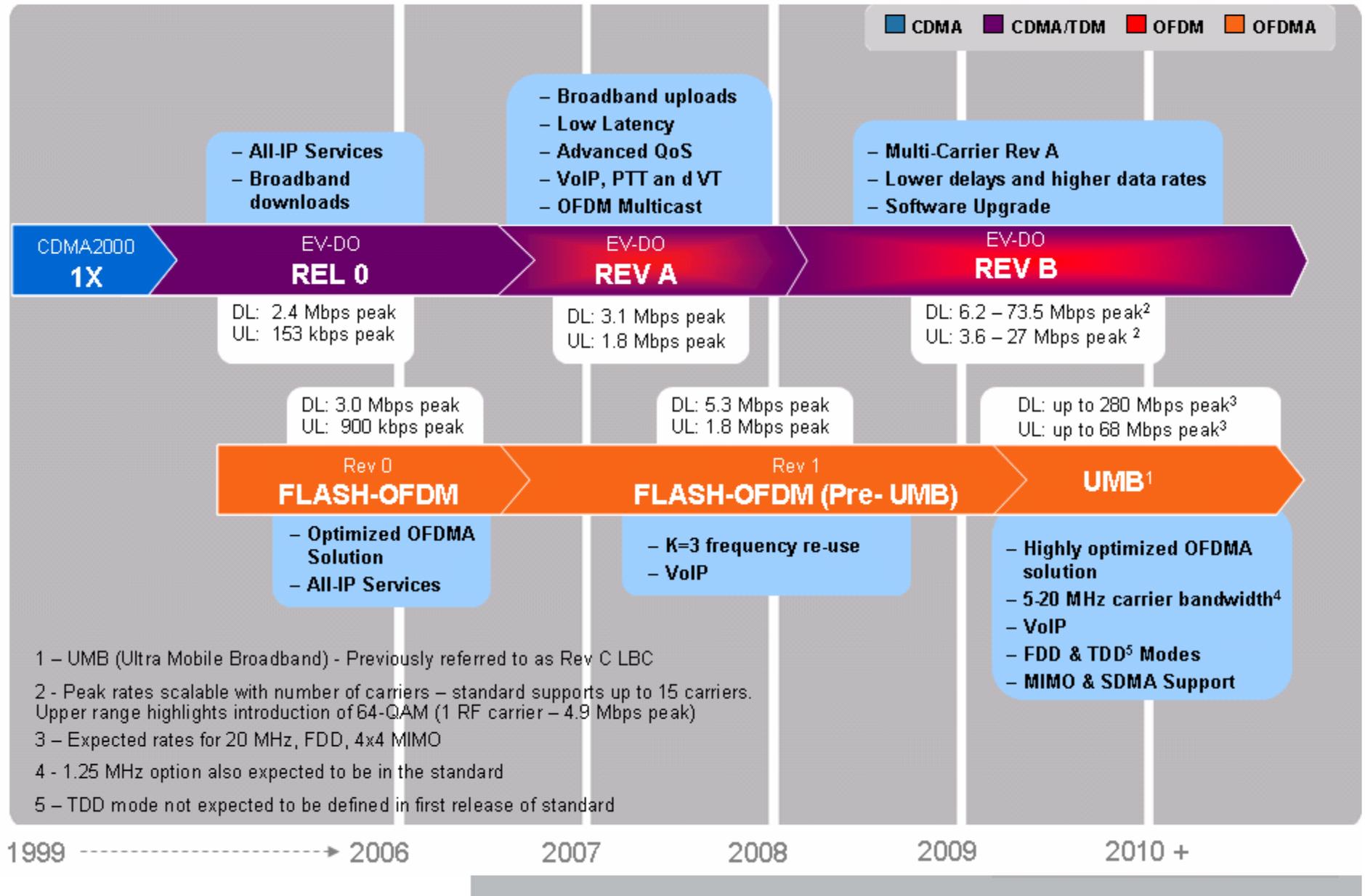
# Wireless Evolution Update

## Wireless Evolution: The Right Technology for the Right Application

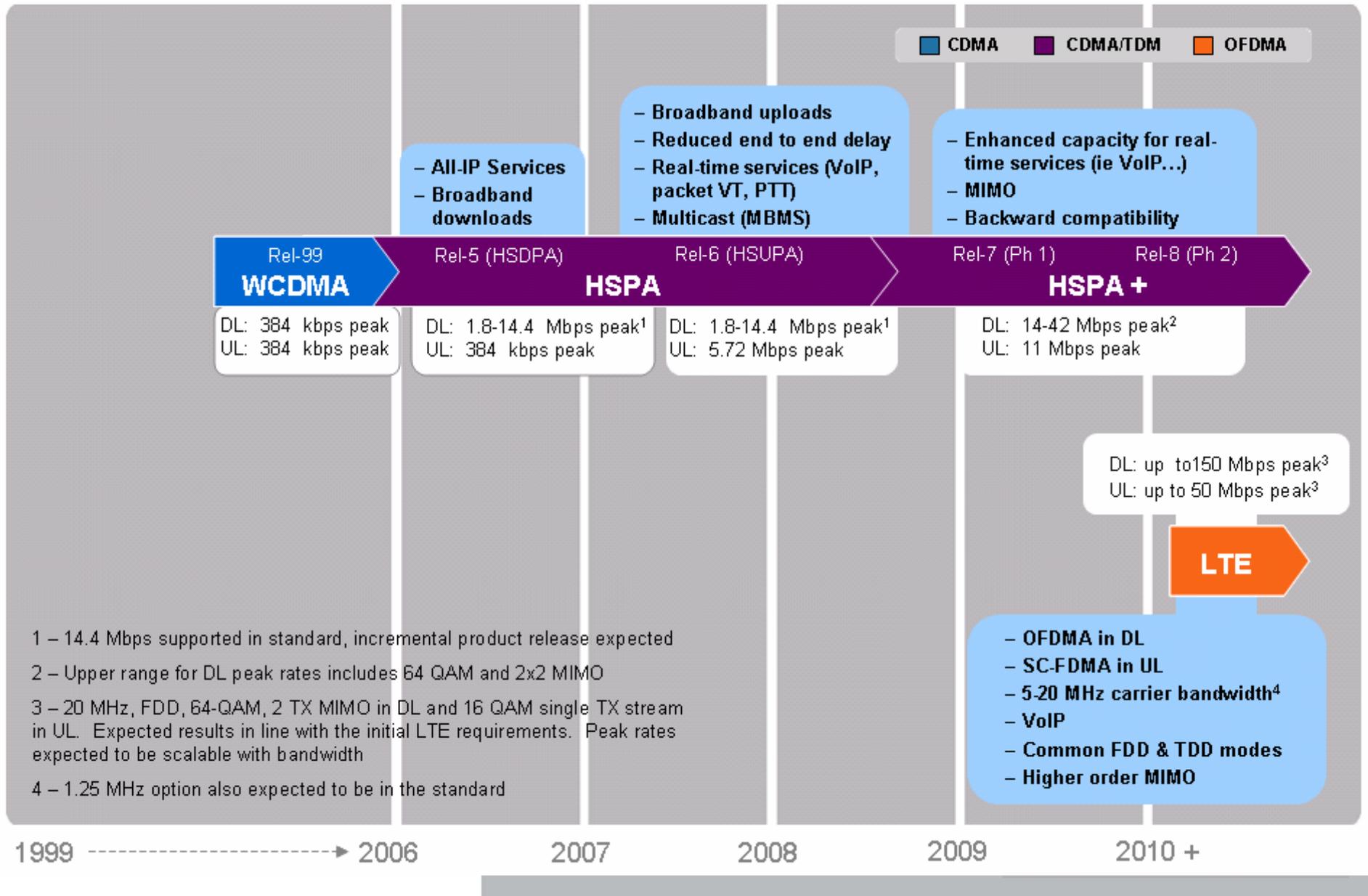


1-UMB (Ultra Mobile Broadband), previously referred to as Rev C LBC

# PP2: A Well Established Mobile Broadband Evolution Path

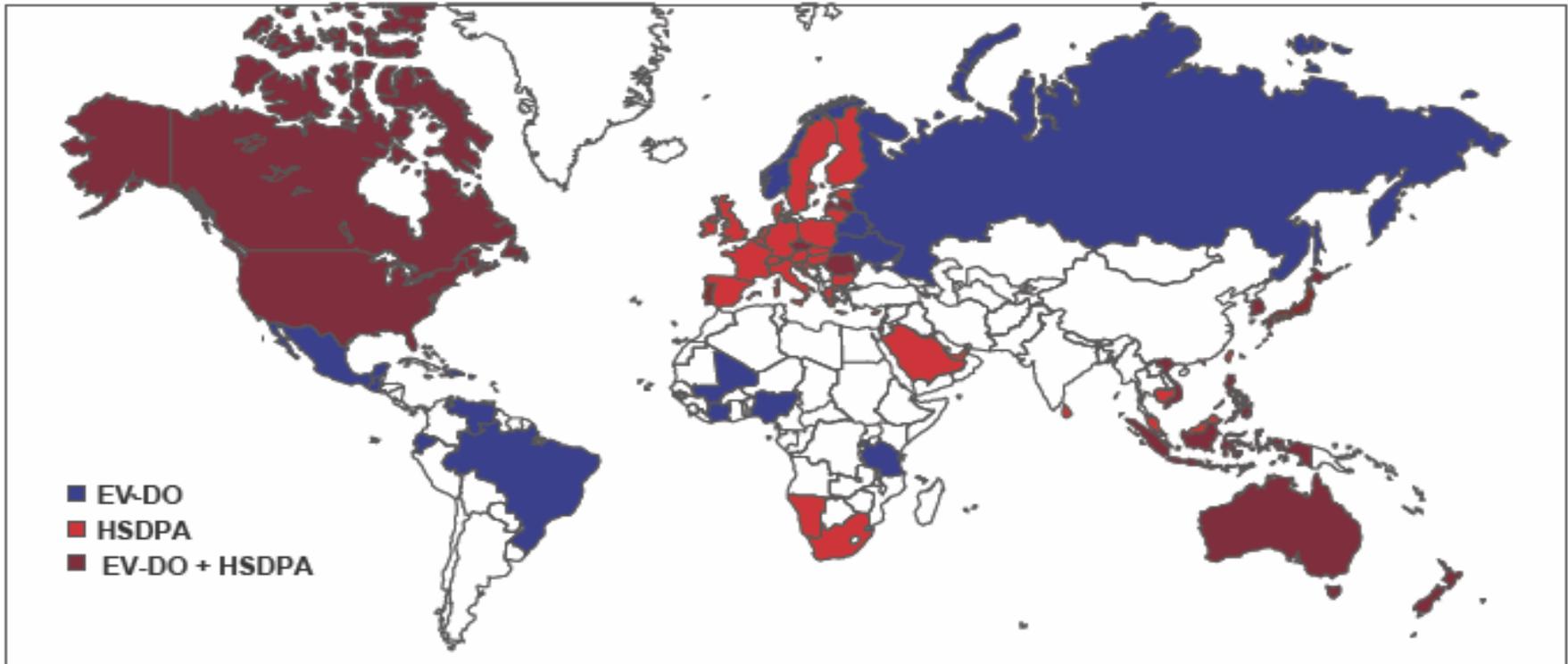


# PP: A Well Established Mobile Broadband Evolution Path



# Worldwide 3G Networks

**More Than 1 Billion People Have Access to 150 3G Mobile Broadband Networks Today**

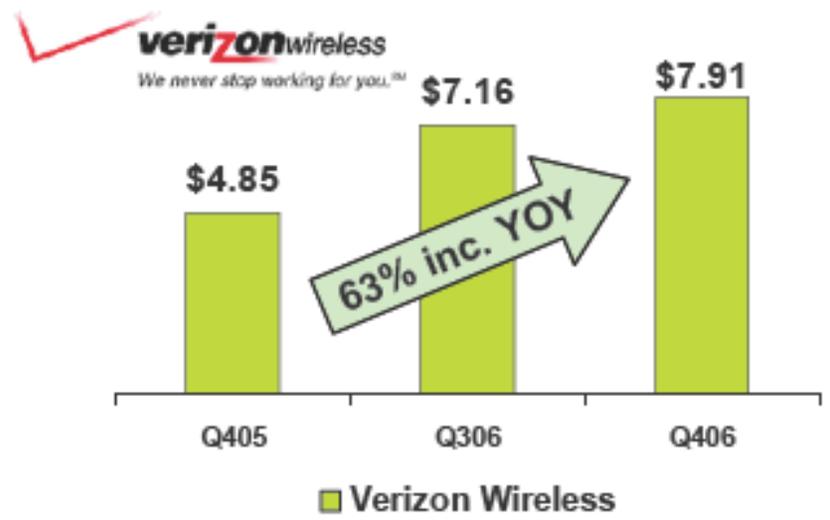
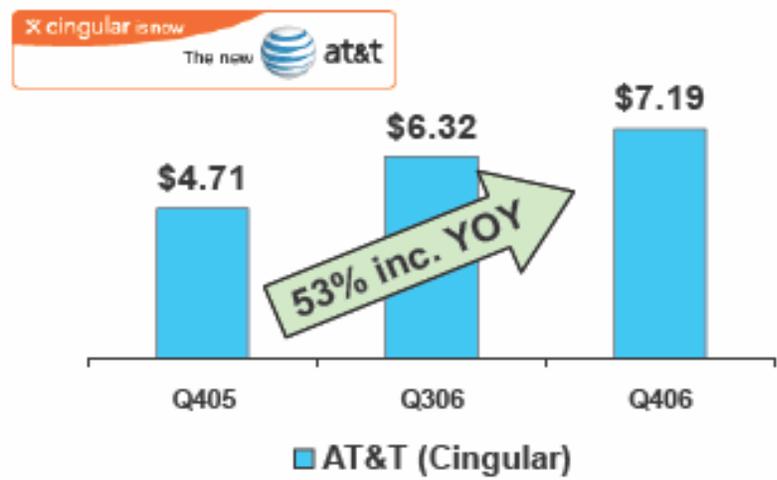
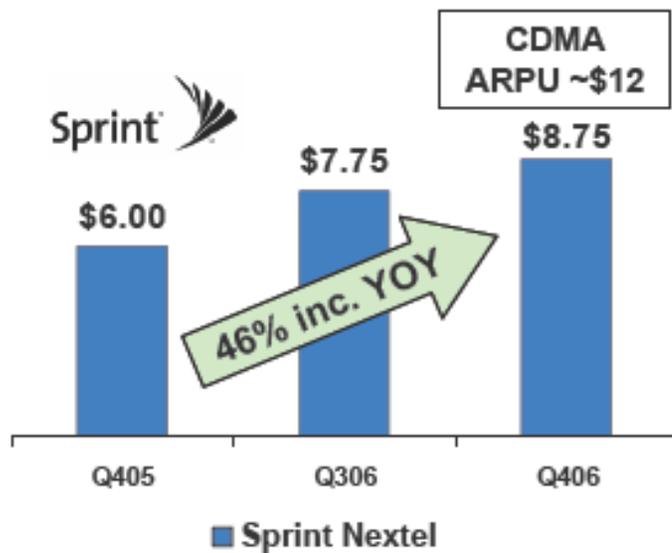


**EV-DO: 55 Commercial Operators**

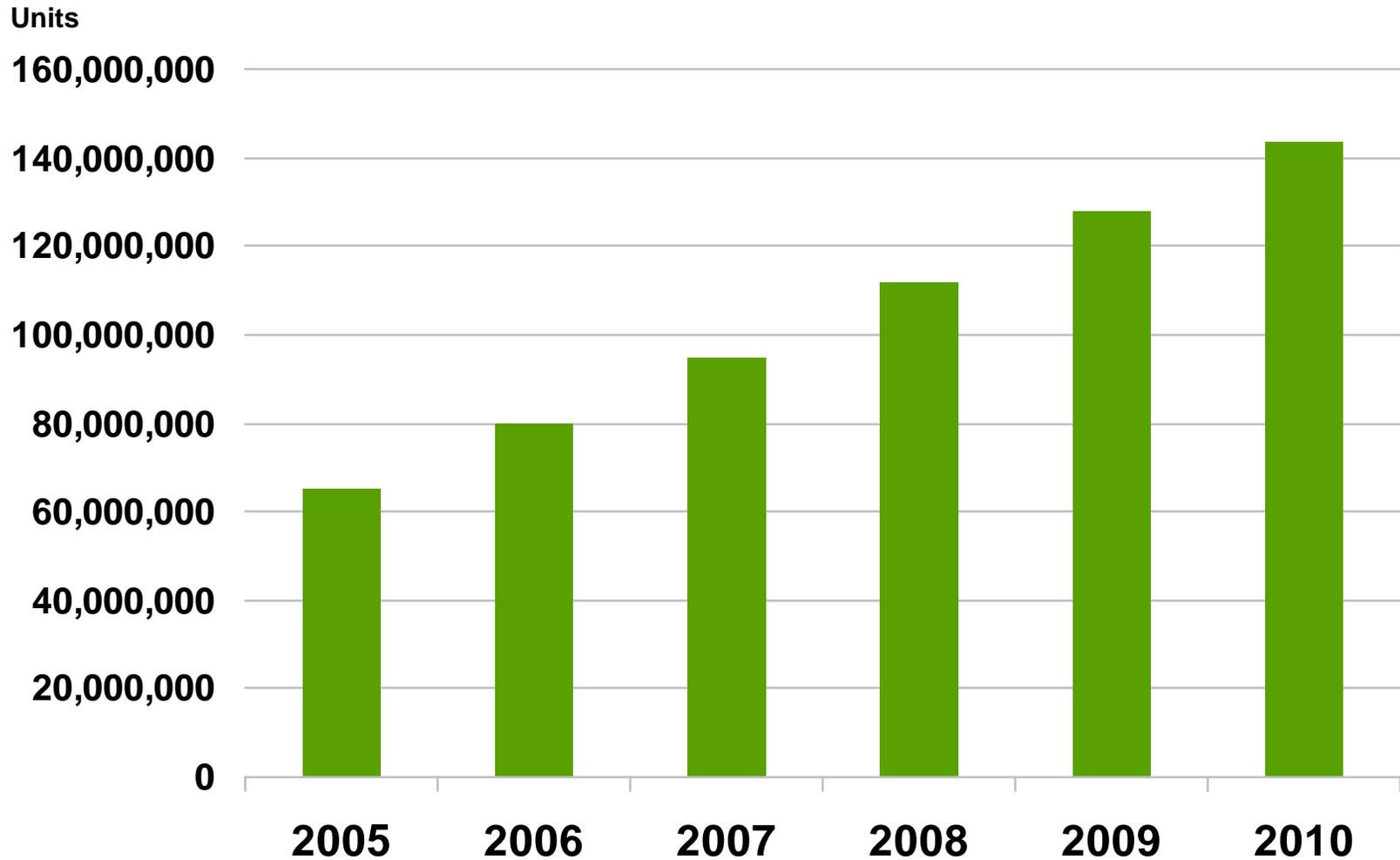
**HSDPA: 95 Commercial Operators**

• Source: CDG and 3G Americas (February 16, 2007); 1 billion refers to combined estimated POPs coverage.

# 3G Drives Data ARPU



# Worldwide Notebooks Shipment Forecast



Source: IDC, In-Stat - August, 2006

# Benefits of Embedded 3G Notebook Computers

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- Embedded WWAN provides:
  - Ubiquitous service
- Better coverage than WiFi hotspots
  - High Speed connectivity
    - Cellular data rates and performance continue to trend upward over time
    - 3G wireless data performance enables desktop applications to work over wireless
  - Ease of Use
    - Embedding wireless WAN enables an out-of-box, immediate experience
    - No need for add-ons such as PC cards
    - Connection managers and network interface (NDIS) are enablers
  - Improved Quality
    - Close cooperation between WWAN module manufacturer and PC OEM improves technical integrity

# Many Embedded Mobile Broadband Solutions Today

March 2006	March 2007
21	98*
Launched NB Offerings	
11	45
Launched NB Models	
5	16
Notebook Manufacturers	
4	17
3G Embedded Carriers	

\*Sum of individual notebooks certified per carrier network



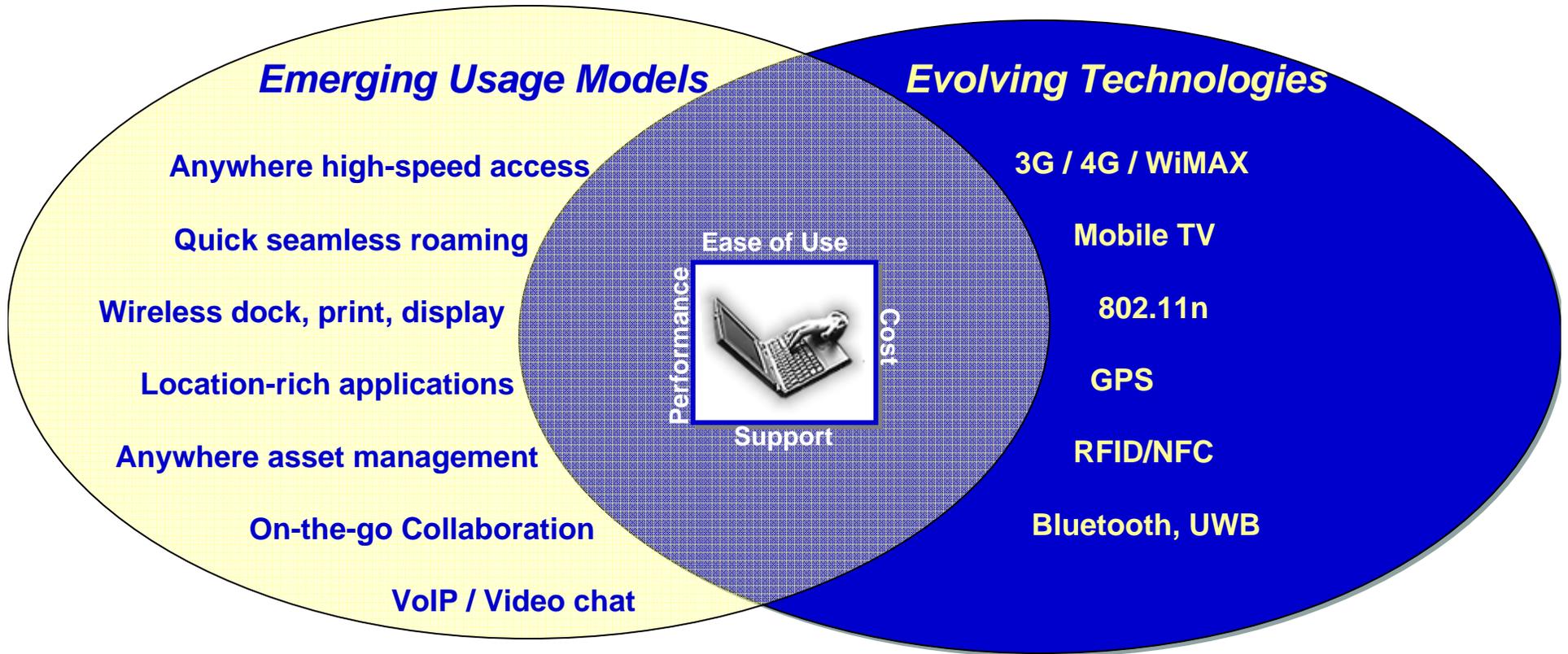
# Federal Communications Commission

April 18, 2007

Keith Hendrickson  
Office of the CTO

# Future Wireless Drivers

*wireless connectivity will be the norm not the exception....*



- Commitment to launch additional models
- Trend towards smaller form factors (i.e. <20cm between lid and base)
- Multiple Radio technologies
  - 3G WWAN {EvDo, HSPA}, DVB-H/T, GPS, Wi-MAX, 802.11b, g, a, n, UWB, Bluetooth
- WWAN enabled/ready platforms
- Customer replaceable units/Field replaceable units {CRU/FRU}
- Today's challenges with TCB/FCC test and authorization process
  - SAR, co-location/co-existence testing

# Wireless Trends & Regulatory Challenges

Robin Castell  
Dir. Communications Technology  
Notebook GBU

April 2007



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# Wireless Trends

- Wireless Broadband Support:
  - Support for both HSDPA and 1xEVDO. HSUPA and EVDO rev A will follow.
  - Notebooks: NC6140, NC6310, NC6400, NC6320, NC6315b, NC6715b
  - WWAN will appear on models in all three product segments: Ultra light, Balanced Mobility, and Performance
  - Notebook models that will support WWAN will continue to increase throughout 2007 and into 2008.
- Antenna spacing from the base are trending to less than 20 cm driven by:
  - smaller form factors in the Ultra light notebook segment
  - the proliferation of radios/antennas within the notebook and the limited space available. For example 802.11, 3G WWAN, UWB, Bluetooth, GPS, DVB-H/T.
  - impact of MIMO
  - entry of new small form factor product categories that include wireless devices e.g. UMPC.
- End user upgrades - Customers want to have the flexibility to defer the wireless decision and have the flexibility to upgrade wireless device without needing to replace the notebook or return the unit.
  - Use of BIOS lock ensure only approved cards will function in the notebook

# Today's challenges with FCC test and authorization process

- Collocation complexity resulting from Multiple Radio technologies and multiple suppliers.
  - Technologies:
    - WLAN 802.11 b, g, a, n
    - WWAN GSM, GPRS, EDGE, HSDPA, 1xRTT, 1xEVDO
    - UWB
    - BT
    - WI-MAX
  - Multiple sourcing of the above technologies can further increase the complexity.
  - This complexity requires significant resources and time to execute and manage.

# A example Notebook Collocation Matrix

	Vendor A HSDPA	Vendor B 1xEVDO Rev 0	Vendor B 1xEVDO rev A
Vendor C	802.11g	802.11g	802.11g
	802.11a/g	802.11a/g	802.11a/g
	802.11 a/g/n 2x2	802.11 a/g/n 2x2	802.11 a/g/n 2x2
	802.11a/g/n 2x3	802.11a/g/n 2x3	802.11a/g/n 2x3
Vendor D	802.11g	802.11g	802.11g
	802.11a/g	802.11a/g	802.11a/g
	802.11 a/g/n 2x2	802.11 a/g/n 2x2	802.11 a/g/n 2x2
	802.11a/g/n 2x3	802.11a/g/n 2x3	802.11a/g/n 2x3

# Tablet/Convertible Notebook Challenges

For the first time we have Tablet and Convertible Notebooks where both WWAN and WLAN SAR testing may be required.

- Concerned if each device requires an individual SAR test in addition to all shippable combinations
- Testing of all combinations would likely take up to 2 weeks, but the processing time is the biggest time element and is a major concern.
- Is it possible to ship while a class 2 permissive change is being processed?
- Can a family approval approach be used to reduce or eliminate redundant testing of similar models?

**Think**

# Lenovo Presentation to the FCC

## April 18<sup>th</sup> 2007

Barry Pate

Lenovo EMC Standards

**lenovo**



WORLDWIDE PARTNER

[www.thinkpad.com](http://www.thinkpad.com)

**lenovo**

## Lenovo Outlook

- Increased demand for notebook models
- Trend towards more antennas in notebook lid (i.e. <20cm between lid and base)
- Increased use of multiple radio technologies
  - 802.11, 3G WWAN, UWB, Bluetooth
- WWAN-ready models/User upgrades
  - Backward certifications on legacy systems with new WANN upgrade modules
- Need to Simplify FCC test and authorization process where possible (e.g., redundant SAR evaluations)

**lenovo**



**lenovo**

## Benefits of Reduced Testing to the Consumer

- Bring new technology to the consumer faster
- Offer the customers more choices for the new technology
  - Reduced SAR testing would allow more mechanical form factor and Wireless WAN/LAN choices
- Offer products cheaper due to lower development and testing costs

**lenovo**



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# RF Exposure requirements for embedded notebook

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- Guidance to TCB's

- The FCC presented the following bullets at a TCB meeting in October 2006
  - FCC Lab is preparing general procedure under which SAR tested for one configuration can be used to support operation of the combination of WWAN and WLAN transmitters in other notebook computers having similar configurations
  - For original then subsequent applications within an FCC ID, this procedure applies to minimize the number of routine evaluation SAR tests required for a licensed module-like transmitter used in notebook configuration groups
- When is the FCC planning to release this procedure?
- Is there an opportunity for further relaxation using the 10cm minimum separation by which MPE remains a valid assessment?
  - SAR concerns not supported by existing data for embedded WWAN notebooks

# SAR Results from FCC Database

PC OEM	Model / Specs	Module FCC ID	Technology	Band	Seperation Distance	TX Conducted Power (dBm)	SAR (mW/g 1g)
Lenovo	<a href="#">Thinkpad R60</a>	N7N-MC5720	EV-DO	Cell	6.7cm	24.3	0.043
Lenovo	<a href="#">Thinkpad R60</a>	N7N-MC5720	EV-DO	PCS	6.7cm	24.6	0.162
Lenovo	<a href="#">Thinkpad T60</a>	N7N-MC5720	EV-DO	Cell	6.1cm	24.3	0.0851
Lenovo	<a href="#">Thinkpad T60</a>	N7N-MC5720	EV-DO	PCS	6.1cm	24.6	0.0881
Lenovo	<a href="#">Thinkpad T60p</a>	ACJ9TGCF-192	HSDPA	Cell	6.5cm	23.94	0.047
Lenovo	<a href="#">Thinkpad T60p</a>	ACJ9TGCF-192	HSDPA	PCS	6.5cm	23.19	0.054
Lenovo	<a href="#">Thinkpad X60</a>	CJ6UPA3490G3	HSDPA	Cell	1.5cm	23.94	0.096
Lenovo	<a href="#">Thinkpad X60</a>	N7N-MC5720	HSDPA	PCS	1.5cm	23.19	0.296
Lenovo	<a href="#">Thinkpad Z61t</a>	ACJ9TGCF-192	EV-DO	Cell	4.6cm	24.3	0.064
Lenovo	<a href="#">Thinkpad Z61t</a>	N7N-MC5720	EV-DO	PCS	4.6cm	24.3	0.072
Panasonic	MK4	CJ6UPA3490G3	HSDPA	Cell	0cm	20.43	0.216
Panasonic	MK4	CJ6UPA3490G3	HSDPA	PCS	0cm	21.27	0.228
Panasonic	<a href="#">Toughbook CF-19</a>	ACJ9TGCF-194	EV-DO	Cell	0cm	25.05	0.417
Panasonic	<a href="#">Toughbook CF-19</a>	ACJ9TGCF-194	EV-DO	PCS	0cm	25.2	0.775
Panasonic	<a href="#">Toughbook CF-19 (Tablet)</a>	N7NMC8765	HSDPA	Cell	0cm	20.86	0.146
Panasonic	<a href="#">Toughbook CF-19 (Tablet)</a>	ACJ9TGCF-189A	HSDPA	PCS	0cm	21.18	0.22
Sony	<a href="#">VAIO VGN-TXN10</a>	ACJ9TGCF-194	EV-DO	Cell	2cm	14	0.05
Sony	<a href="#">VAIO VGN-TXN10</a>	ACJ9TGCF-194	EV-DO	PCS	2cm	25.55	0.192
Toshiba	<a href="#">Portégé R400</a>	N7NMC8765	EV-DO	Cell	>5cm	25.1	0.124
Toshiba	<a href="#">Portégé R400</a>	ACJ9TGCF-189A	EV-DO	PCS	>5cm	24.4	0.27
Average Reported SAR Value							0.182
Max Reported SAR							0.775
Min Reported SAR							0.043

- All data is as reported in respective FCC SAR report. SAR data is not scaled to transmit power.
- Only mid channel SAR value reported for given notebook and associated bands.
- If multiple notebook physical configuration reported for a given mode, only the highest SAR configuration reported
- SAR data for WWAN mode only. WLAN was not transmitting.

## Considerations for End User Upgrades & New Install

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- Notebook OEMs are shipping WWAN ready notebooks today
  - WWAN antennas and other necessary components built-in
- 3G data network service costs and the cost of the WWAN modules are decreasing while consumer 3G awareness is increasing
- Enterprise notebooks are replaced every 3-5 years
- Customers who did not order the WWAN feature at time of original notebook purchase or have an old WWAN version will want to purchase the latest version of WWAN technology
- What is the process by which the notebook OEM can provide the end user with the latest WWAN modules without re-certification of legacy WWAN enabled notebooks?
  - e.g. if the new module maximum transmit power (conducted) is equal to or less than the conducted transmit power of the module used in the initial notebook authorization then no re-cert required

# FCC requirements for Co-located transmitters

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- Notebook OEMs would welcome the opportunity for collaborative discussions with the FCC OET on exploring further optimization of the process associated with the assessment of complex co-located radio technologies (WWAN+WLAN+WPAN) in the notebook platform
- Existing SAR data for embedded notebooks with complex co-located radio combinations present significant margin to the FCC SAR limits
  - Review of existing filings suggest that a number of tests were unnecessary
    - It's not clear if redundant tests were requested or undertaken voluntarily by the applicant
    - Additional guidance may be required

# Co-Located Transmitter Data

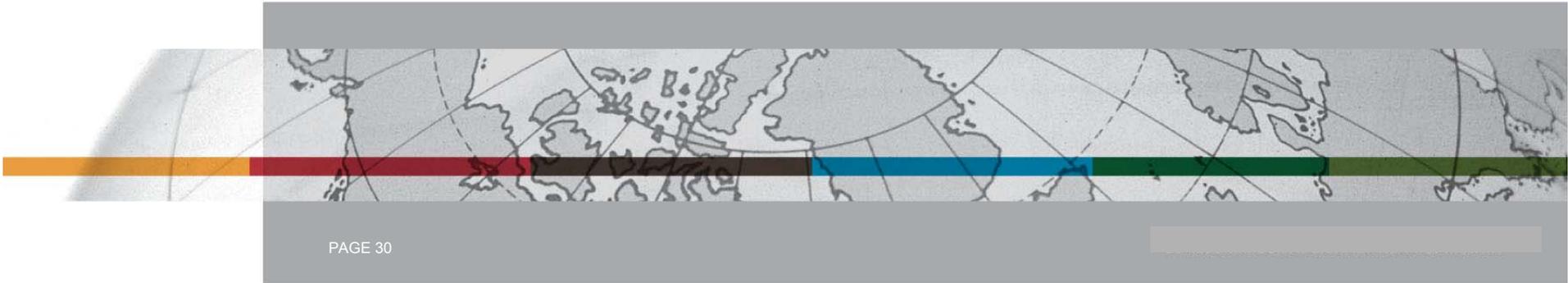
Cell Band SAR results for Lenovo Z62 FCC ID N7N-MC5720, permissive change 10/12/06			
Channel	SAR (1g)	WWAN Mode	Transmitter Configuration
384	0.064	1x	WWAN Only
1013	0.054	DO	WWAN Only
384	0.069	DO	WWAN Only
777	0.07	DO	WWAN Only
777	0.073	DO	Collocation with Bluetooth and WLAN 802.11b legacy mode
777	0.067	DO	Collocation with Bluetooth and WLAN 802.11g legacy mode
777	0.065	DO	Collocation with Bluetooth and WLAN 802.11g HT20 MIMO mode
777	0.068	DO	Collocation with Bluetooth and WLAN 802.11g HT40 MIMO mode
777	0.069	DO	Collocation with Bluetooth and WLAN 802.11a 5.2GHz legacy mode
777	0.071	DO	Collocation with Bluetooth and WLAN 802.11a 5.2GHz HT20 MIMO mode
777	0.066	DO	Collocation with Bluetooth and WLAN 802.11a 5.2GHz HT40 MIMO mode
777	0.067	DO	Collocation with Bluetooth and WLAN 802.11a 5.8GHz legacy mode
777	0.066	DO	Collocation with Bluetooth and WLAN 802.11a 5.8GHz HT20 MIMO mode
777	0.067	DO	Collocation with Bluetooth and WLAN 802.11a 5.8GHz HT40 MIMO mode
<b>Average</b>	0.068		
<b>Stdev</b>	0.002		

- Configuration 1: WWAN only. 4 SAR scans total. High/mid/low for DO, one channel for 1x
- Configuration2: Co-located WWAN/WLAN. 10 additional scans for 802.11 modes. The average was 0.0679 mW/g with a stdev of 0.00247. The low standard deviation suggests the additional WLAN tests were unnecessary given the WLAN antenna location and that the WLAN transmit power is comparable for different modes.

# Conclusions

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- QUALCOMM and the notebook OEMs ask
  - That the FCC consider the market update, empirical evidence and documented rationale and allow MPE assessment for 3G embedded notebook computers where a 10 cm or greater separation distance can be maintained between the user and the transmitting antenna (including co-located WLAN)
  - That the FCC provide specific guidance to TCB's for WWAN notebook authorization
  - That the FCC provide specific guidance on module upgrades/new install
- QUALCOMM and the notebook OEMs would also propose collaborating on opportunities for further optimization resulting in
  - Increased number of WWAN enabled notebooks offered
  - Reduced product time to market
  - Lower cost to the consumer



Thank You