# Semiconductor Evolution to 4G

## : Mobile WiMAX, LTE, and other 4G Technologies



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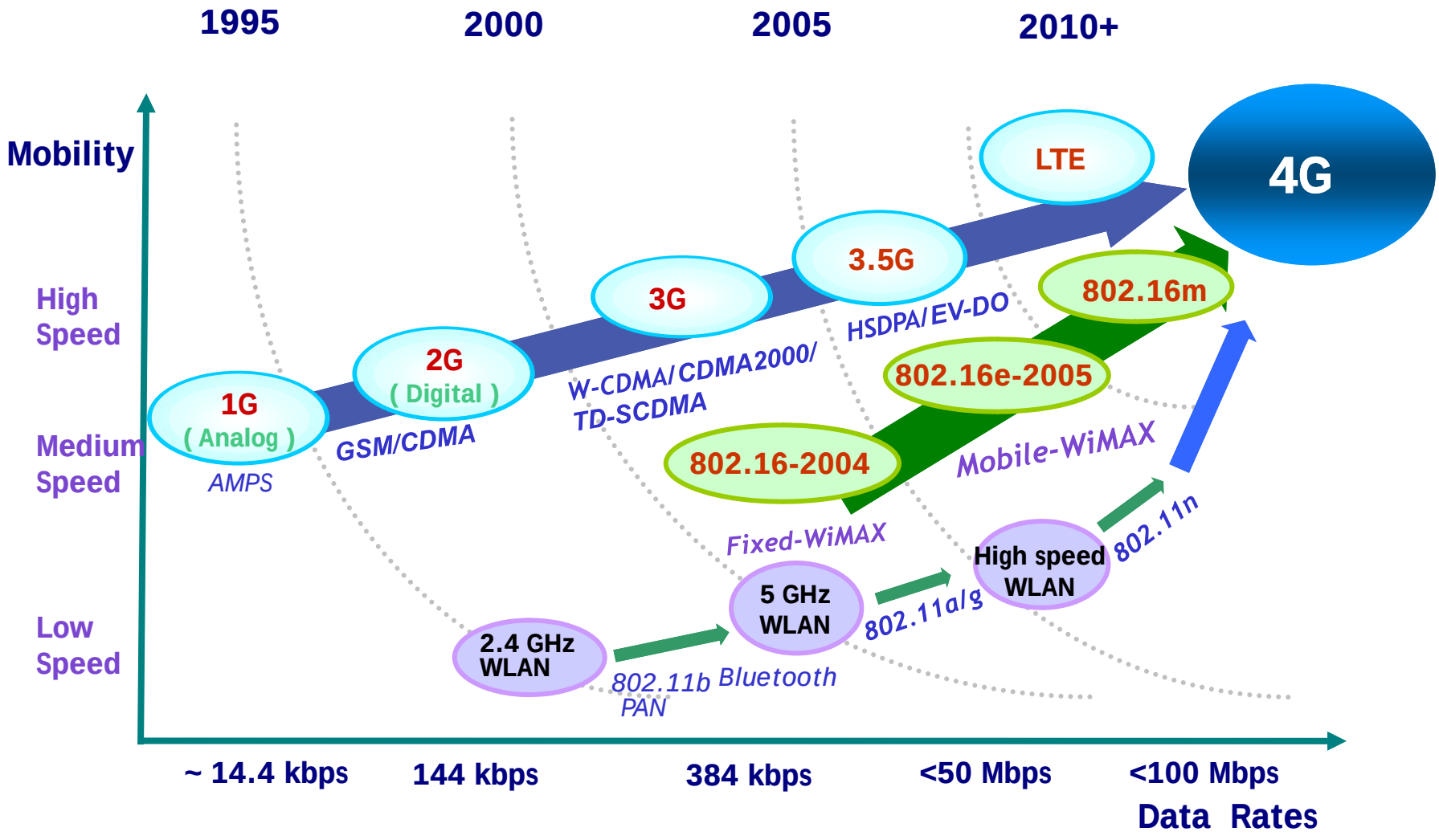
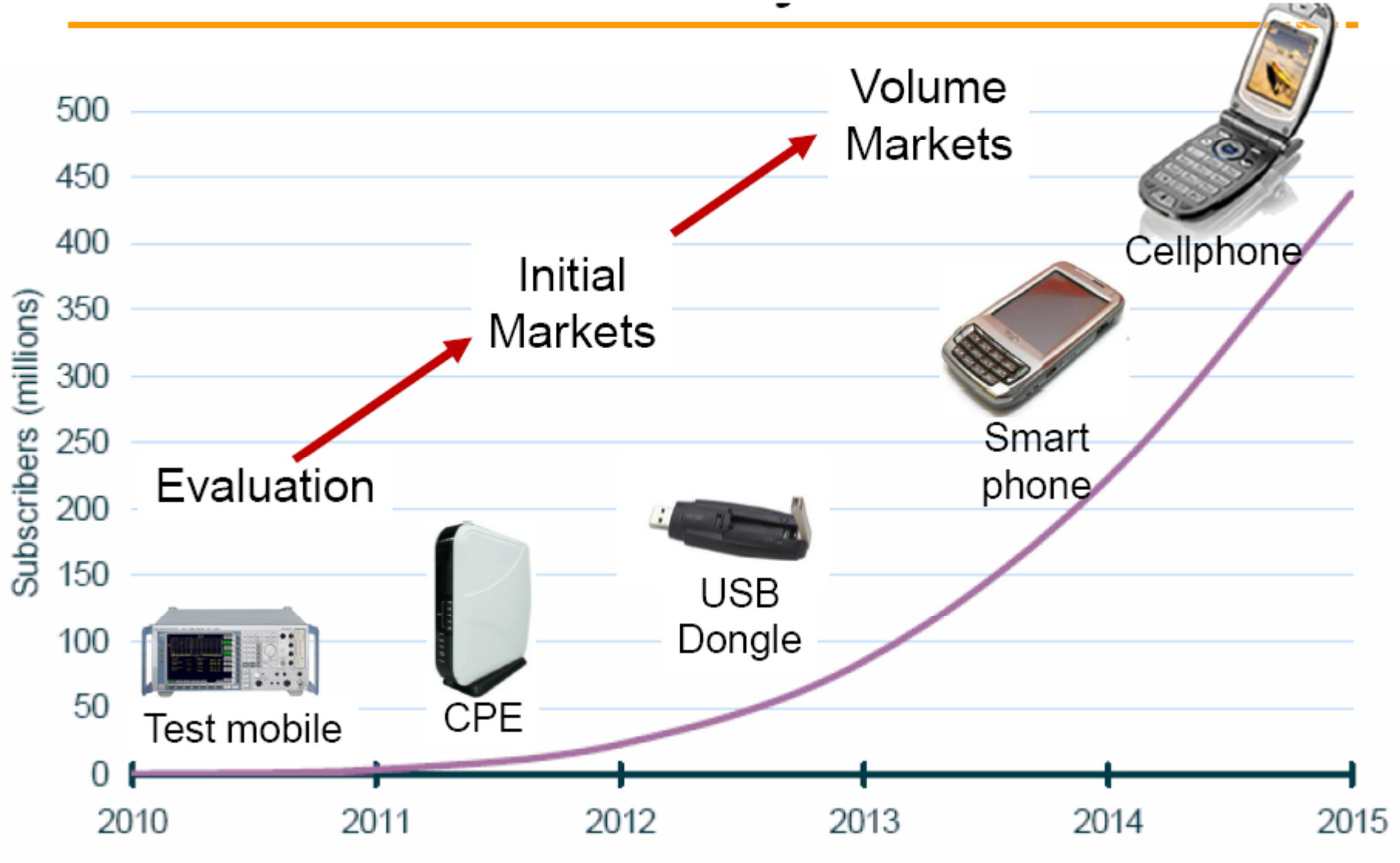
# Trend: Technology Convergence Beyond 3G



# Industrial Trends/Facts on 4G

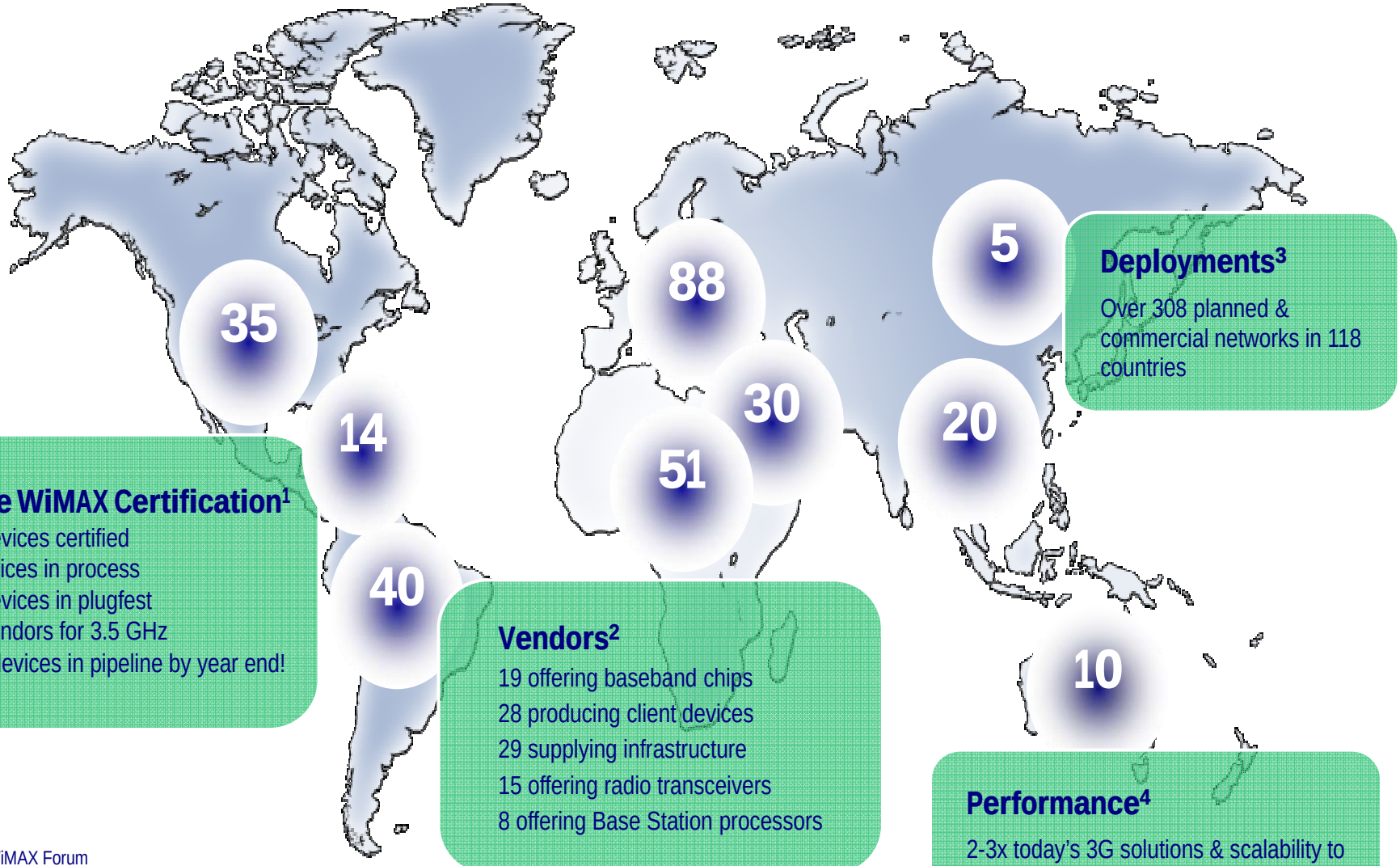
- Most WiMAX operators are ‘green field’ operators characterized by
  - They do NOT own existing cellular networks(with a few exceptions), but in large #s
  - They provide low cost alternatives to higher cost DSL, and high cost 3G services
  - They provide data speed much better than current 3G, and even 3.5G cellular
  - They are serving developed, as well as under-developed countries
  - They are meeting the ‘market hunger’ for high, uninterrupted data speed
  - With Mobile dual mode devices available, it levels the wireless playing field
  - 16m, if it is released in time, will match those higher performances of LTE
- Most cellular operators are lining up in LTE with Verizon, Vodafone, KDDI, DoCoMo, CMCC- an awesome bunch !
  - FDD is ahead of TDD by at least 6 months
  - Just like UMTS, and WiMax, initial device introduction will follow maturation trend, of course with some surprises
    - Data-centric with datacards, dongles
    - Femto APs
    - Finally Embedded devices and handsets

# LTE Roll-out like UMTS,WiMax ? Or Faster?




Forecast LTE Subscribers, 2010~12015 [Source: Analysis Research, 2007]

# WiMAX Global Momentum Continues to Build




**Mobile WiMAX Certification[1]**

- 18 devices certified
- 8 devices in process
- 49 devices in plugfest
- 12 vendors for 3.5 GHz
- 100 devices in pipeline by year end!

**Vendors[2]**

- 19 offering baseband chips
- 28 producing client devices
- 29 supplying infrastructure
- 15 offering radio transceivers
- 8 offering Base Station processors

**Deployments[3]**

Over 308 planned & commercial networks in 118 countries

**Performance[4]**

2-3x today's 3G solutions & scalability to 10x in the future

1: WiMAX Forum
2: Forward Concepts, 2008
3: Informa Telecoms & Media, 2008
4. 2-3x based upon actual network performance in Korea and U.S.; 10x per IEEE 802.16m Systems Requirements Document

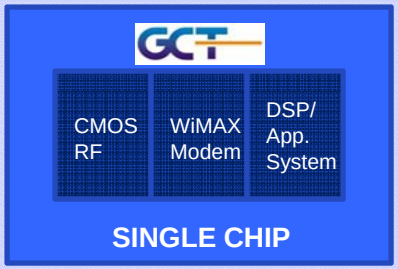
# GCT is WiMax Focused

- GCT has 3 product lines
  1. Mobile WiMax PL - WiMax only, WiMax+Wifi, Femto APs
  2. Mobile Digital TV PL – Satellite DMB, T-DMB, ISDB-T
  3. RF Transceivers PL – WiMax RF, CDMA2000/EVDO RF and others
  - Balanced Portfolio, Re-use key IPs for Fast-time-to-Market.
  - In-house 'Cellular RF capability' enables GCT to be the industry's first in RF+BB single chips to serve multiple suitable markets as required
- WiMax Design Philosophy
  - GCT's design philosophy is to squeeze every bit out of cost and performance by using 'special design techniques' to lower down power consumption and size in a given process node, thus avoiding pitfalls to use more expensive process of less desirable cost/performance.
  - GCT will continue to roll-out more dual-mode integrated designs as well with smaller process nodes
  - GCT will continue to shrink die size and reduce cost to meet future market needs

# WiMAX Single Chip Offerings

## Monolithic (RF & BB) Single Chip (GDM7205 &GDM7213)

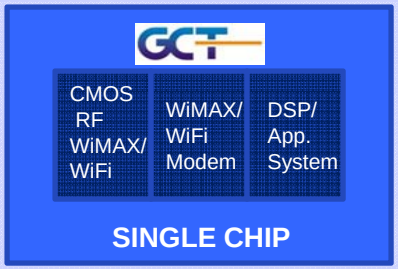
- Lowest power consumption
- Smallest form factor design
- Lowest system cost
- Market/ field proven solution





## Monolithic WiMAX+WiFi Single Chip (GDM7215)

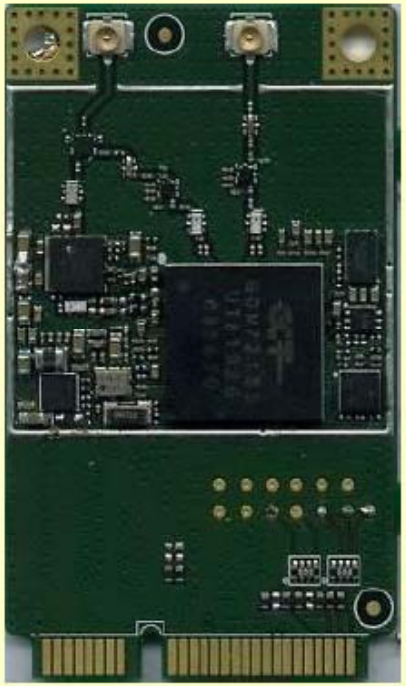
- Enhanced access coverage
- Wide embedded application
- Lowest system cost
- Smallest form factor design




# Embedded Reference Design Offerings

Full Mini Card

Top View



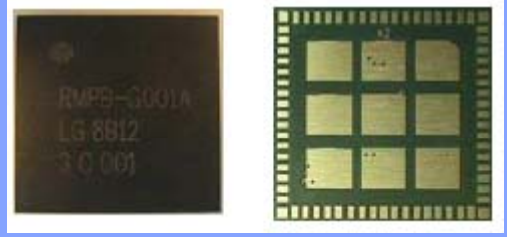
Half Mini Card

Top View


Bot
Vi

Enables MID, Netbook, PDA, Smartphones and other gadgets !

**15mm x 15mm**
**World's Smallest Module**



# Commercialized Products

Myungmin
WiMAX

Modacom
WiMAX+T-DMB

Samsung
WiMAX+SDCard

LG
WiMAX+MP3

KTFT
WiMAX

Modacom
WiMAX +Storage

Posdata
WiMAX

LG
WiMAX NB

LG
WiMAX
Smartphone

Raon
WiMAX UMPC

Sodiff
WiMAX PMP

Modacom
WiMAX

Myungmin
WiMAX

KT

Infomark
SuperMAX
WiMAX CPE

Seowon
Huawei-WW
WiMAX Router

Infomark
Saudi
WiMAX / WiFi CPE

Commercialized Products

# Commercial Launch CY09 and Beyond

## CPE/Terminals


WiMAX / WiFi AP
Portable Router

WiMAX / WiFi
AP Router

World Wide
WiMAX CPE,
CPE+Vocie,
CPE+WiFi AP


Sensei(Moda)
WiMAX Dongle
Express Card


Gemtek
P1 (Wiggy)
WiMAX USB

Wide World
WiMAX USB

USB Dongle for S.E. Asia

## Handhelds


Yukyung
WiMAX
MID

Sambo
WiMAX
MID

WiMAX / WiFi / HSDPA
Smart Phone

WiMAX
VOIP Phone

WiMAX / WiFi
VOIP Phone

## Femto APs

WiMAX
Femto
Repeater


IB-Cell
WiMAX Femto AP

WiMAX
Femto
AP

More Design-Wins
and Operator
will be announced
Quarterly !

Commercial Launch on CY09

# Conclusion

- WiMax is a growing into a very large world market, certainly not a niche. It will pay off handsomely for all those who has invested and persisted in this market. 16m will prove itself to be a strong competitor for LTE.
- LTE is lagging behind WiMax by two years, and has quite a catch-up to do in a hurry, and is intended to surpass WiMax.
- WiMax, LTE, both are OFDMA based, could be complimentary regardless, and could even converge ☺
- Strong eco-system build-up in WiMax will benefit GCT moving forward
- GCT is keeping a close eye on the industrial trend and its developments.

Thank You !