International Mobile Telecommunications ("IMT")
Threat to C-band Satellites

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C-Band Satellite Characteristics

- Frequency bands: 5850–6725 MHz (↑) / 3400–4200 MHz (↓)
- Highly directional Earth station antennas
- Wide geographic coverage C-band beams
  - Cover entire continents and oceans, offering an economical way of providing intercontinental and global communications
  - Smaller or hard-to-reach markets and low density regions are covered as easily as metropolitan areas
  - Ideal for point-to-multipoint applications (broadcast, widely-dispersed networks), and remote/rural deployment
- Resistance to rain-fade
  - C-band is less susceptible to signal interruptions from heavy rain than higher frequency bands (Ku-, Ka-band), making it better suited for tropical or high-rain areas and for services with high availabilities

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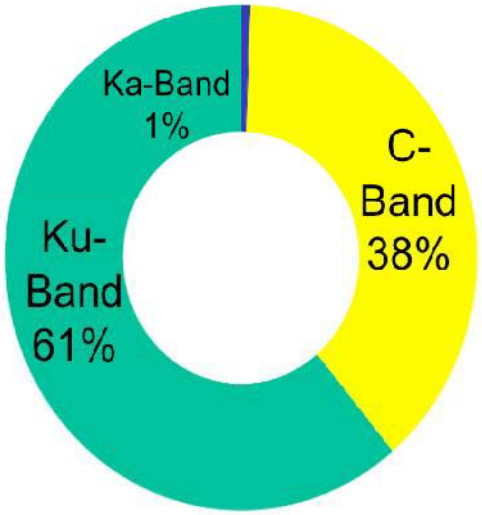
C-Band Satellites in Geostationary Orbit

Global Distribution of 36 MHz Transponder-Equivalents

Total 5,642 TPE in Use



Source: NSR

Note: TPE count does not include multi-spot beam high throughput satellites

- **At least 169 C-band satellites in geostationary orbit today**
  - **Represents about $42-51 billion of in-orbit investment, not including the investments in ground infrastructure**
- **Substantial ongoing investment in C-band satellite capacity worldwide**
  - **At least 52 satellites with C-band payloads have been launched in 2007-2012, representing $12-15 billion in investments**
  - **At least 35 satellites with C-band payloads are under construction and are scheduled to be launched in 2012-2015, representing $9-10 billion in investments**
- **GEOs are long-lived assets; typical operational life is 15 years or more**
  - **Stable, consistent regulatory environment required throughout operational life**

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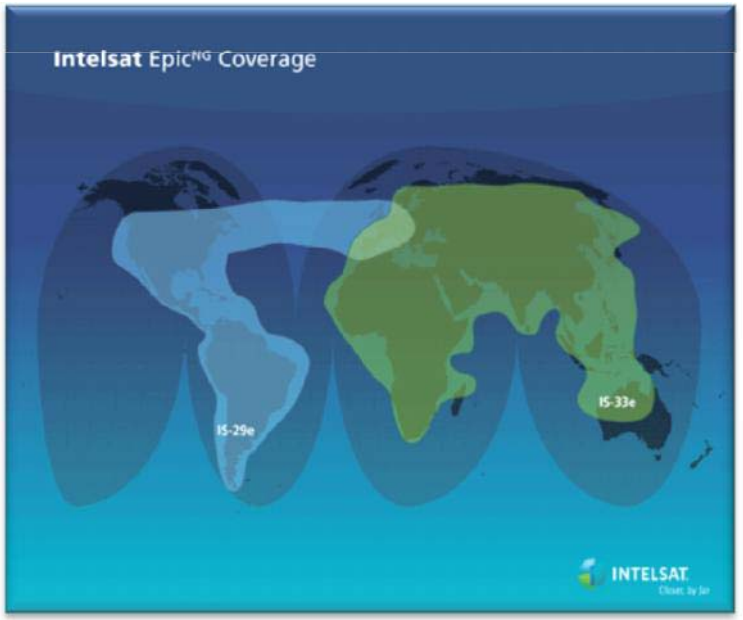
Satellite Innovation in C-band

- **New high-performance satellite platforms will combine C-, Ku- and Ka-bands wide beams, spot beams, and frequency reuse technology to support broadband, media and mobility solutions**
  - **High performance and lower cost per-bit**
  - **Wide beams and spot beams in the same band for broadcast and high-throughput applications**
  - **Frequencies can be aligned to region and application-specific requirements**
  - **Supports open architecture and backward compatibility of network infrastructure**
  - **Forward compatible as ground technology advances**
  - **High throughput, efficiency and reliability enables smaller mobility-friendly terminals and benefits data-centric services like cellular backhaul**



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What Is IMT?

- Technology used in 4G mobile phones (not WiFi)
  - Coverage architecture: Macro/Micro/Pico cells
  - Base stations
    - Macro cells: multiple sectoral antennas (effectively omni-directional)
    - Micro cells: omni-directional antenna
    - Pico cells: omni-directional antenna (assumed)
  - Handheld phones
    - Omni-directional antenna

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WRC-07 and IMT

- **IMT proponents requested 1280-1720 MHz of spectrum by the year 2020 [*source*: Report ITU-R M.2078]**
- **Conducted sharing studies between IMT and incumbent services for a number of candidate bands**
  - **Sharing between IMT and FSS in the 3.4 – 4.2 GHz band is NOT feasible due to large distance separation required between the transmitting IMT (Macro) base station and the receiving FSS Earth stations [Source: ITU-R M.2109]**
    - **51–70 km: protection from long-term co-frequency interference effects**
    - **140–430 km: protection from short-term co-frequency interference effects**
    - **0.4–46 km: protection from out-of-band interference**
    - **10–31 km: protection against FSS Low Noise Block (LNB) overload due to IMT emissions outside FSS band**
- **IMT has access to 1177 MHz of spectrum within the 450 – 3600 MHz band.**

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Exclusion Zone
Long-term Co-frequency Interference

- C-Band Earth stations in southeast England that communicate with Intelsat satellites
- IMT cannot be deployed within the area bounded by the red contour line

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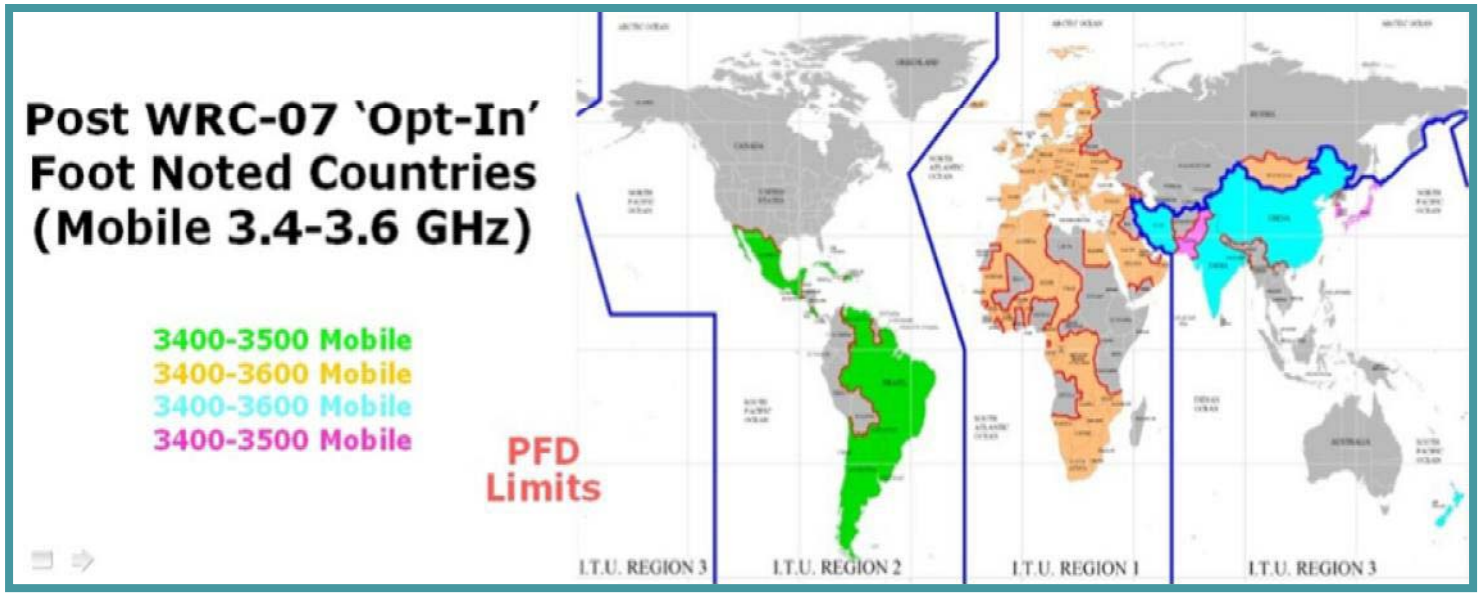
WRC-07 Results

- **Did NOT identify any portion of the 3400–4200 MHz band to IMT on a regional or global basis**
  - **Through footnotes, a number of countries permitted IMT in various segments of the 3400–3600 MHz band**



***Source*: Electromagnetic Mission Assurance Center**

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WRC-15 and IMT

- Under Agenda Item 1.1, ITU is tasked with identifying additional frequency bands for IMT
- Working Party 5D (WP 5D) is to identify suitable IMT frequency ranges
  - Consider only the technical feasibility of operating IMT in the specified frequency range. Will NOT consider impact to/from other incumbent services
  - Update IMT bandwidth requirements – Complete work by July 31, 2013
  - Provide/Update IMT parameters – Complete work by July 31, 2013
- Joint Task Group 4-5-6-7 (JTG 4-5-6-7)
  - Perform sharing studies
  - Generate Conference Preparatory Meeting (CPM) Report
  - Identify candidate frequency bands for IMT from the frequency ranges provided by WP 5D
    - Administrations can propose IMT frequency bands – separate from the frequency ranges proposed by WP 5D

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Suitable IMT Frequency Ranges Proposed by Working Party 5D

Frequency as reflected in input contributions to WP 5D (MHz)	Number of Contributions Submitted to WP 5D in Support of The Frequency Band	Frequency as reflected in input contributions to WP 5D (MHz)	Number of Contributions Submitted to WP 5D in Support of The Frequency Band	Frequency as reflected in input contributions to WP 5D (MHz)	Number of Contributions Submitted to WP 5D in Support of The Frequency Band
470-598	7	1 525-1 559	6	3 300-3 400	2
598-608	8	1 559-1 610	4	3 400-3 492.5	7
608-614	7	1 610-1 660.5	6	3 492.5-3 542.5	8
614-694	8	1 660.5-1 668	4	3 542.5-3 575	7
694-790[2]	7	1 668-1 675	6	3 575-3 600	8
1 000-1 300	2	1 675-1 700	4	3 600-3 800	11
1 300-1 375	6	2 025-2 090	4	3 800-4 200	11
1 375-1 400	9	2 090-2 110	5	4 200-4 400	1
1 400-1 427/1 427.9	6	2170 – 2200	6	4 400-4 900	3
1 427/1 427.9-1 452	14	2 200-2 215	5	4 900-5 000	2
1 452-1 462.9	15	2 215-2 290	3	5 350-5 470	1
1 462.9-1 475.9	14	2 700-2 900	7	5 850-5 925	1
1 475.9-1 492	15	2 900–2 930	5	5 925-6 425	2
1 492-1 510/1 510.9	11	2 930-3 100	3	Above 6 000	2
1 510/1 510.9-1 518	8	3 100-3 200	2	13250 - 13750	1
1 518-1 525	8	3 200-3 300	1	24250 - 29500	1

- **WP 5D is currently considering revision of IMT spectrum requirements by the year 2020 that range from 1065 to 2100 MHz**
- **All the above frequency bands from 470-6425 MHz are proposed by WP 5D for further studies**

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Satellite Industry Concerns

- **Renewed efforts to identify the 3400–4200 MHz band for IMT**
  - **WRC-07 studies demonstrated incompatibility of satellite services with IMT**
    - **Interference from IMT transmissions into FSS receive stations**
    - **Requires large distance separations between IMT stations and FSS earth stations**
  - **No technology developments that change the compatibility analysis since 2007 to warrant different outcome at WRC-15**
- **New effort to identify the 5850–6725 MHz band for IMT**
  - **ITU has not conducted sharing studies for this band**
  - **Receiving IMT stations are susceptible to interference from transmitting FSS Earth stations**
    - **It is likely that large distance separations will be required**
  - **Severely restrict placement of new FSS Earth stations**
  - **Limits on the size of FSS Earth station antennas**
    - **Restrictions on FSS applications**

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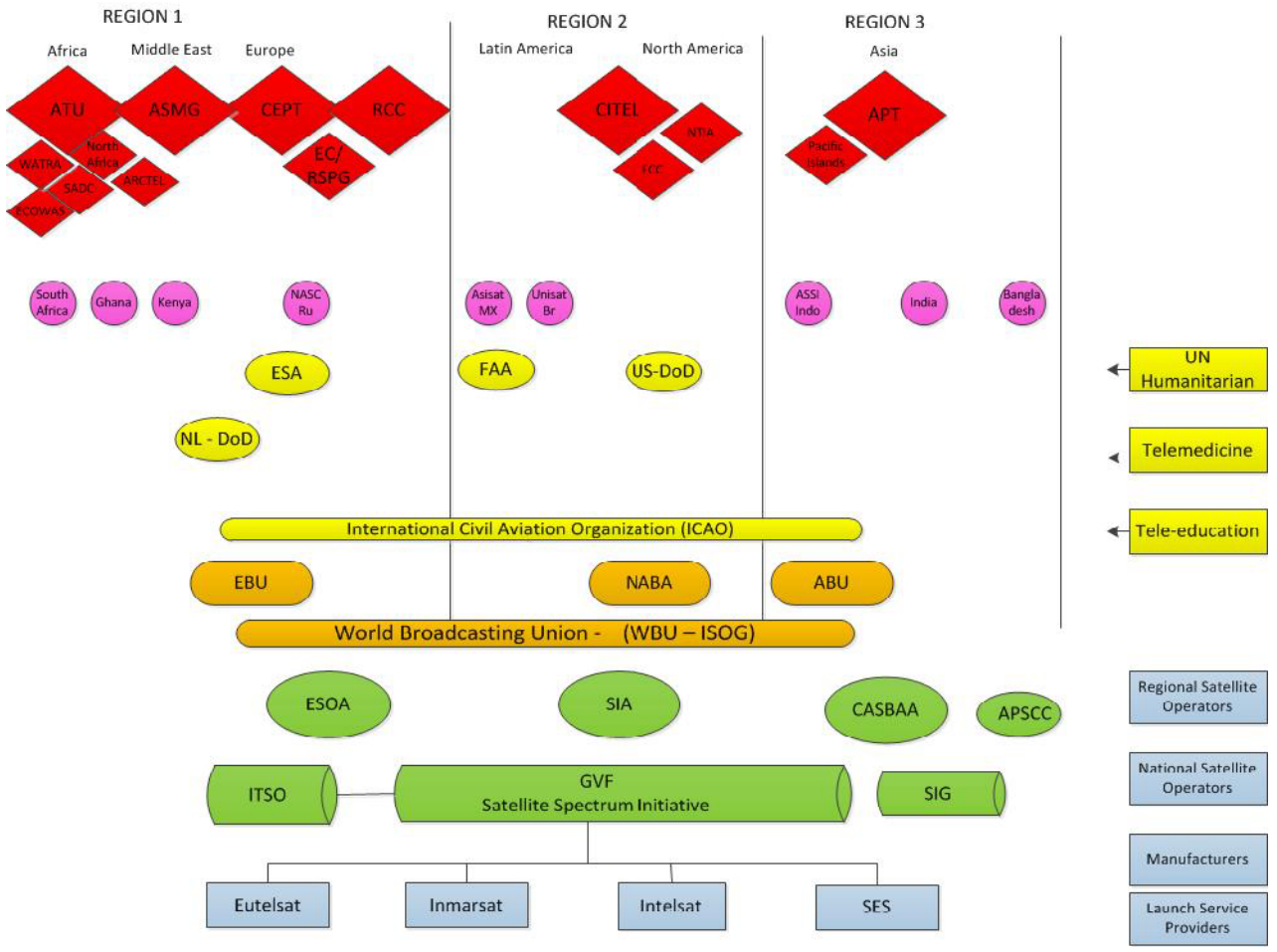
Global C-band Spectrum Campaign



Action Plan

- **Lobby regulators worldwide to oppose change in the ITU Table of Frequency Allocations in C-band frequencies (3400-4200 MHz and 5850-6725 MHz) for IMT (or broadband wireless access systems)**
- **Attend JTG meetings**
- **Participate/attend your government's preparatory meetings for the JTG.**
  - **Submit contributions!**
    - **Technical studies**
    - **Earth station deployments in your country**

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Action Plan (continued)

- **Highlight the importance of C-band satellite communications to your business**
  - Gives added choice in how your content is transmitted
  - Allows your business to expand to rural and underserved areas as well as urban areas
  - Costs of changing equipment and architecture
    - Cost to customers
- **Register your Earth station with your regulator!**
  - Forces IMT operators to place their base stations far away from you
  - IMT operators and regulators cannot ignore you!
- **Report cases of interference to your regulator!**

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Action Plan (continued)

- **Don't let regulators only hear one message from IMT proponents!**
  - **Visit regulators often to get your message across – The IMT proponents are!**
  - **Encourage your partners and customers to contact their regulators**

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