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May 31, 2011

Ruth Milkman
Chief
Wireless Telecommunications Bureau
Federal Communications Commission
Washington, DC 20554

Re: *Amendment of Part 27 of the Commission's Rules to Govern the Operation of Wireless Communications Services in the 2.3 GHz Band* (WT Docket No. 07-293) WRITTEN EX PARTE PRESENTATION

Dear Ms. Milkman:

In its pending petition for reconsideration of the *Report and Order* in the above-referenced proceeding, the WCS Coalition urged the Commission to afford Wireless Communications Service ("WCS") licensees additional time to meet the newly-adopted performance benchmarks set forth in Section 27.14(p) of the Commission's Rules.[1] Recently, representatives of the WCS Coalition engaged in discussions with your staff that highlight the thorny dilemma currently facing WCS licensees that embrace the National Broadband Plan's goal of seeing WCS support mobile broadband offerings. Specifically, we have noted that while there is a diminishing interest among vendors in developing WiMAX mobile products for the 2.3 GHz band as a result of the emerging dominance of Long Term Evolution ("LTE"), due to the unique U.S. regulatory framework for the band it will be some time before standards-based LTE mobile equipment becomes available for use in the 2.3 GHz band in this country.

During a conference call with your staff on May 10, 2011, the WCS Coalition agreed to provide the Commission with a more detailed analysis of the impediments to the development of

[1] *See* Petition of WCS Coalition for Partial Reconsideration, WT Docket No. 07-293, at 1-2 (filed Sept. 1, 2010) ["WCS Coalition Petition"]. Specifically, the Commission has been asked to extend the current March 1, 2014 deadline until July 21, 2017 and the current September 1, 2016 deadline until July 21, 2020. In addition, the WCS Coalition has urged the Commission to replace the current "death penalty" imposed on those that fail to meet. Others sought similar relief. *See* Petition of AT&T Inc. for Partial Reconsideration, WT Docket No. 07-293, at 2, 13 (filed Sept. 1, 2010); Petition of Green Flag Wireless, LLC *et al*. for Reconsideration, WT Docket No. 07-293, at 6 (filed Sept. 1, 2010). And, it has urged the Commission to clarify that while the coverage benchmark of Section 27.14(p)(1) generally applies to point-to-multipoint systems intended to provide ubiquitous broadband service to the general public, Section 27.14(p)(2) applies where a point-to-multipoint system provides a more narrowly focused service that is functionally indistinguishable by an end user from a traditional point-to-point link, the equipment is professionally installed, and the service provider controls both ends of the link. Issuance of this clarification is important as several of the innovative uses that WCS licensees are exploring, such as smart grid and wireless backhaul using point-to-multipoint technology, may not be viable without such a clarification. *See* WCS Coalition Petition at 2 n.2.

LTE mobile equipment suitable for use in the 2.3 GHz band in the United States.[2] The WCS Coalition retained Kurt Schaubach of Conexus Technology Advisors to prepare the attached report that both confirms the diminishing availability of WiMAX equipment for even fixed use in the 2.3 GHz band in the United States and provides a detailed assessment of the standards-setting and related hurdles that will have to be overcome before mobile LTE equipment is available for use in the United States in the 2.3 GHz band. Most significantly, Mr. Schaubach finds that "LTE is the most viable 4G technology for WCS licensees to achieve economics of scale and produce a viable business model." In addition, Mr. Schaubach concludes that "[i]t will be necessary for a new LTE standard to be developed to comply with U.S. regulations and only after that process is complete will commercial equipment be developed." Those findings are fully consistent with the relief being sought on reconsideration.

In addition, during its discussions with your staff, the WCS Coalition has reiterated its belief that a "substantial service" approach is most appropriate for the C and D Blocks because of its inherent flexibility.[3] As noted in the WCS Coalition Petition, the new WCS rules have hamstrung use of those blocks by: a) limiting mobile use of each block to just 2.5 MHz (an amount inadequate to support a consumer-based broadband service); b) imposing more restrictive duty cycle limitations on those blocks; c) restricting use of outdoor antennas with even low-power fixed CPE; and d) capping fixed point-to-point applications to power levels 13 dB lower than those permitted elsewhere in the WCS band.[4] As a result, prior business plans for use of the spectrum have largely been rendered impractical and discarded, and licensees are actively exploring niche applications for this spectrum – niche applications for which the new quantitative performance benchmarks likely are inappropriate. WCS is a flexible use service that should be able to support a wide range of niche services. However, the new quantitative benchmarks presuppose either a transitional point-to-point or a ubiquitous consumer-based broadband business model. Retention of those benchmarks will tend to funnel use of the C and D Blocks in those directions, likely harming the public by discouraging the creativity and innovation a flexible use model otherwise encourages.

In the WCS Coalition's last discussion with your staff, we agreed to consider the possibility of identifying alternative performance requirements that are sufficiently flexible to accommodate the variety of business plans being considered for the C and D Blocks.[5] Although we devoted substantial effort to this undertaking, ultimately we were unsuccessful and forced to conclude that quantitative benchmarks ultimately detract from flexible use and are inferior to the proposed "substantial service" test. Nonetheless, if the Commission is insistent on adopting quantitative benchmarks for C and D Block WCS licensees, we suggest that, in addition to

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[2] *See* Letter from Paul J. Sinderbrand, Counsel to the WCS Coalition, to Marlene H. Dortch, Secretary, Federal Communications Commission, WT Docket No. 07-293, at 1 (filed May 11, 2011) ["WCS Coalition Letter"].

[3] *See* WCS Coalition Petition at 2-4.

[4] *See id.* at 2-3.

[5] WCS Coalition Letter at 1.

adopting our general proposals for modification of the new performance requirements,[6] the Commission reduce the C and D Block quantitative benchmarks to 50% of those applicable to the A and B Blocks. In other words, C and D Block point-to-multipoint deployments should be required to cover 20% of the population at the first benchmark and 37.5% at the second benchmark. Those making point-to-point deployments should be required to demonstrate one link per 33,500 persons at the first benchmark and one link per 16,750 persons at the second benchmark. While this approach is far from perfect, the reduced benchmarks for the C and D Blocks will provide licensees a modicum of additional flexibility to innovate in their use of this challenging spectrum.

Pursuant to Sections 1.1206(b)(1) and 1.49(f) of the Commission's Rules, this letter is being filed electronically with the Commission via the Electronic Comment Filing System. Should you have any questions regarding this presentation, please contact the undersigned.

Respectfully submitted,

Paul J. Sinderbrand
Mary N. O'Connor

Counsel to the WCS Coalition

Attachment

cc: Roger Noel
Linda Chang
Paul Moon
Moslem Sawez

[6] *See supra* note 1.

Standard Setting and Equipment Development Process for the U.S. 2.3 GHz Band

By: Kurt Schaubach
Conexus Technology Advisors
May 31, 2011

I. WCS Performance Requirements Cannot Be Met Without a Viable Mobile Broadband Standard and Commercial Equipment

Now that the FCC has adopted new rules for the 2.3 GHz Wireless Communications Service ("WCS") band that are intended to enable the development of mobile broadband services, standards-based mobile broadband equipment that comports with the FCC's new rules must be developed before WCS licensees can deploy broadband services that meet the new WCS performance requirements. This paper will discuss the standards-setting and equipment development processes that will have to be completed before 2.3 GHz mobile broadband deployments can become a reality in the United States.

The FCC's National Broadband Plan identifies WCS as a band well-suited for the delivery of fourth generation ("4G") mobile broadband services. Access to infrastructure equipment and mobile devices that can take advantage of the economies of scale of standardized 4G technology will be vital for WCS licensees to succeed in meeting the growing public demand for broadband services, much less the FCC's new WCS performance requirements. Without comparable features, functionality, and price for equipment, WCS licensees will not be able to offer services that are competitive to those using other, more globally-harmonized mobile broadband frequencies.

Two critical activities must be completed before WCS licensees will be able to commence deployment of 4G mobile broadband services and meet the newly adopted performance requirements:

1) Adoption of a 4G standard that meets the unique U.S. requirements for the WCS band, including the interference protection provisions for SDARS, AMT, and deep space search; and
2) Development and commercialization of standard-compliant mobile broadband equipment for the WCS band.

The first, adoption of a 4G standard that meets the U.S. requirements for the WCS band, is anticipated to take anywhere from 18-24 months from now. This length of time is necessary to: a) assess the changes that are required because the U.S. rules deviate from those applicable to markets for which standards have already been developed; b) develop industry support (and most importantly, vendor support) for the proposed changes; and c) work through the standardization process – all while competing for the time and attention of the standards body that is already taxed with a substantial workload for the modification of the existing standard and development of new standards.

The second, the development and commercialization of compliant equipment, is estimated to take an additional 12-24 months - potentially as long as 30 months - after achieving certain key

milestones in the standardization process. This length of time is necessary for vendors to modify existing 4G network infrastructure and device designs to comply with the new standards. The extent to which modifications are necessary to meet a new U.S.-centric standard will determine the total time required to design, implement, validate, and commercialize the new equipment. If design changes are necessary that impact key building blocks of network equipment or devices, for example changes to the RF ASIC utilized in a mobile device, more time will be required.

II. 4G Mobile Broadband Technology Development

The two primary 4G mobile broadband technologies that are recognized on a global basis are Long Term Evolution ("LTE") and IEEE 802.16e WiMAX. LTE is considered the most viable 4G technology to meet the new WCS performance requirements through greenfield deployments given dwindling support in the industry for 2.3 GHz band WiMAX and the adoption of LTE by most carriers operating in the United States.[1]

A. WiMAX at 2.3 GHz

Throughout much of the rulemaking proceeding establishing the new WCS rules, WiMAX technology appeared to be the most likely alternative for WCS. WiMAX is a standards based technology developed by the IEEE 802.16 committee. WCS licensee, NextWave, and several other companies invested significantly in the development of WiMAX technology and its use in the WCS band. However, today only two vendors are actively marketing and supporting 802.16 WiMAX equipment for the WCS band,[2] which has been deployed on a limited basis for fixed broadband services, while no vendor is known to have developed a mobile 802.16e WiMAX solution for the U.S. 2.3 GHz band.

In early 2005, the 3G Partnership Project ("3GPP") began work on a next generation wireless broadband technology, called LTE. Over the past 12 months, LTE has overtaken WiMAX as the global technology of choice for future 4G deployments. Around the globe, WiMAX original

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[1] A recent GSA report indicates that 208 operators in 80 countries are investing in LTE (http://www.gsacom.com/gsm_3g/info_papers.php4). Both China Mobile and Biharti Airtel have announced plans to deploy LTE in the 2.3 GHz band. SK Telecom, which operates perhaps the largest mobile WiMAX network in the 2.3 GHz band, recently opted to abandon WiMAX for LTE ("SK Telecom to Launch LTE in July, Dropping Mobile WiMAX", Light Reading, January 13, 2011).

[2] Alvarion Ltd and Airspan Networks Inc. are currently the only known original equipment manufacturers ("OEMs") supplying WiMAX technology and deployments for the U.S. 2.3 GHz band. Further complicating the outlook for WiMAX in the 2.3 GHz band is that these vendors rely on device OEM partnerships in their end-to-end solutions, meaning they outsource the manufacture of WiMAX compliant user devices or baseband ASICs.

equipment manufacturers ("OEMs"), original design manufacturers ("ODMs"), and network operators have decided to abandon further development of WiMAX in lieu of LTE.[3]

While existing fixed WCS WiMAX deployments serving niche applications may remain viable in the near term, they are generally insufficient to meet the new WCS performance requirements. Although fixed offerings may be the most appropriate use for the C and D Blocks, given the limitation on mobile transmissions in those blocks, it is unlikely they will sustain long term business plans for ubiquitous broadband offerings. Without OEM support for WiMAX network equipment and devices it is impossible to economically expand the existing fixed deployments. In essence, WiMAX in the 2.3 GHz band has been relegated to a 'proprietary' standard in that it does not have an evolving technology base or multiple vendors supporting interoperable equipment.

B. LTE at 2.3 GHz

Development of LTE equipment for the 2.3 GHz band is underway given the ITU-R identification of the band for IMT-2000 and IMT-Advanced services at WRC-07 and the announcements by operators in China, India and Russia to deploy LTE in the band. The current LTE standard, however, does not support the specific technical requirements adopted by the FCC for the U.S. WCS band.

3GPP is the standards body responsible for the development of LTE standards. LTE standards development within 3GPP involves the development of the LTE Specification (consistent with open systems interconnection ("OSI") reference model) in addition to the associated Band Classes, which define the specific RF standards, specifications, and conformance testing for a specific frequency band of operation. Currently available LTE standard Release 9 encompasses both FDD and TDD technology variants and is approved for a several different frequency bands.[4]

3GPP is scheduled to complete the development of the LTE Release 10 standard, which is designed to meet the ITU's IMT-Advanced specifications with the freezing of the ASN.1, in early June 2011 paving the way for the cycle towards commercial equipment embodying the Release 10 enhancements to begin in earnest.

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[3] Clearwire has been testing LTE since 2010 and plans to switch from WiMAX to LTE as the ecosystem continues to mature (eWeek.com, "Clearwire 4G to Transition from WiMax to LTE: Report", May 23, 2011) and last May, Russian network operator Yota announced it would abandon WiMAX in favor of LTE ("Top WiMAX operator Yota chooses LTE over WiMAX for new market rollouts", Fierce Wireless, May 23, 2010. Vendor commitment has shifted in favor of LTE as well ("LTE claims its final vendor victim", Connected Planet, July 13, 2010).

[4] 3GPP Release 8 was finalized in December 2008 and has been the basis for commercial development of LTE equipment and devices (see www.3gpp/lte.org). Forty-three band classes are defined within 3GPP for TDD and FDD operation covering key bands designated for mobile wireless around the world. Band Class 40 covers the 2300–2400 MHz band.

While in the United States the 2.3 GHz band is allocated as a combination of paired and unpaired spectrum, in most other regions it is allocated strictly as unpaired spectrum in which TDD technology will be deployed. An approved 3GPP specification for TD-LTE currently exists. Band Class 40 covers the broad 2300-2400 MHz band but, as discussed below, is inapplicable to the U.S. market. While most mobile broadband networks in the United States are FDD and the license assignment scheme for the WCS band could support FDD technology, there is currently no development for an FDD LTE specification for 2.3 GHz.[5]

China and India are leading the commercial development[6] of TD-LTE in the 2.3 GHz band. China Mobile has initiated a seven-city, 1000 site trial of TD-LTE at 2.3 GHz that is expected to continue through 2012. Bharti Airtel, one of the 2.3 GHz licensees in India, has commenced its efforts to deploy TD-LTE at 2.3 GHz and anticipates turning on its trial network in Q4 of 2011.

While 2.3 GHz LTE development is underway, it is not focused on the unique requirements of the U.S.-only WCS band requirements. As mentioned above, the WCS frequencies are a subset of the 2300-2400 MHz band covered by 3GPP Band Class 40, but the Band Class specifications do not account for the unique interference protection conditions of the WCS band adopted by the FCC to address uses outside the 2305-2320/2345-2360 MHz WCS band, including:

- Out-of-band Emission ("OOBE") specifications adopted for the protection of adjacent SDARS, AMT and deep space research services; and
- Adjacent channel selection ("ACS") protection that may be required to protect receivers from adjacent high power SDARS repeater operations.

Further, and potentially more troubling, are the newly adopted WCS regulations that run counter to the fundamental design of the underlying LTE technology, specifically those new FCC regulations on duty cycle and power density. Unless modified on reconsideration, these new U.S.-only regulations may have more far reaching consequences on equipment and device design and will further impede commercialization of LTE in the WCS band.[7]

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[5] It should be noted that the C and D Blocks are not paired, and that in several instances licensees of the A and B Blocks in a given market have engaged in spectrum swaps so that each has 10 MHz of contiguous spectrum rather than unpaired 5 MHz channels.

[6] Commercial development is a multi-stage process that involves standards setting, research and development, equipment prototyping, and system test and validation before it can be considered 'commercial ready'. The process can typically require 12–24 months from the point at which the standard is complete to infrastructure and devices available for commercial use. For example, the first "freeze" of the 3GPP standard for Release 8 was completed in March 2008 and the first commercial launch of LTE followed 18 months later, after intensive industry development to realize the first release of the technology ("TeliaSonera launches first commercial LTE network", Fierce Wireless, December 19, 2009).

[7] Declaration of Douglas Duet, AT&T Petition for Partial Reconsideration, WT Docket No. 07-293, September 1, 2010.

Therefore, given the unique requirements adopted by the FCC for the 2.3 GHz band in the United States, a new or modified 3GPP LTE standard will be required before commercial development of solutions for the U.S. WCS band can occur.

III. Seeking Support of U.S. 2.3 GHz Requirements within the 3GPP Process

Development of an LTE solution for the WCS band will, at minimum, require either the creation of a new Band Class or a Sub-Band Class within the existing Band Class 40 to cover the U.S. requirements. Furthermore, if the changes requested by the WCS Coalition in its petition for reconsideration of the new WCS rules are not adopted, modification of the LTE standard to encompass other unique U.S. WCS requirements, such as duty cycle and power spectral density limitations, will also be necessary.

While the process is virtually identical, the creation of a new 3GPP Band Class, rather than modification of existing Band Class 40, appears to be the more straightforward approach for developing LTE solutions for the U.S. WCS band. Given that 3GPP is a consensus based organization composed primarily of operators, network and device OEMs, the success of any initiative within 3GPP requires member support. Modification of Band Class 40 to accommodate the U.S. requirements, while possible, appears more problematic as it has the potential (real or perceived) to slow down the commercial development of other 2.3 GHz systems.

On the other hand, developing a new LTE standard to support FDD in 2.3 GHz and/or to accommodate the most problematic unique requirements that FCC has adopted for the WCS band, such as the duty cycle and power spectral density limitations, could further complicate the development of a standard as compared with leveraging what currently exists with TD-LTE at 2.3 GHz. At minimum, retention of the current duty cycle and power spectral density regulations, both of which will dramatically affect the performance of LTE in the WCS band, may slow operator and vendor interest in developing a new standard.[8]

Additionally, if a new specification is not sufficiently close to the current and planned variants of LTE and LTE-Advanced, infrastructure and mobile devices for the U.S. 2.3 GHz band may not attain sufficient market share necessary to drive the requisite economy of scales demanded by the wireless marketplace. Equipment manufacturers might also opt to forgo such a small market slice thereby limiting availability of the critical infrastructure, including the base station

[8] Declaration of Douglas Duet, AT&T Petition for Partial Reconsideration, WT Docket No. 07-293, September 1, 2010.

equipment and latest consumer and enterprise mobile devices, leading to a replication of the WiMAX scenario mentioned previously.

IV. The 3GPP Process for Creation of a New Band Class for the U.S. WCS Will Take a Minimum of 18-24 Months

Even under the best case scenario it is expected to take 18-24 months from now to develop a new Band Class for the U.S. WCS requirements.[9] Key issues that affect timing include:

- The standards organizations will generally not take up an issue that is not yet ripe for consideration. Given that the U.S. WCS regulations are still subject to considerable uncertainty with several critical issues raised in pending petitions for reconsideration, vendors are loath to devote substantial resources to work on technical requirements that may change in the near future. While the WCS community is actively laying the groundwork for a 3GPP submission, the current uncertainty, particularly with respect to the duty cycle and power density issues, is limiting progress.

- A harmonized regional band plan does not yet exist. Canadian regulators have only recently taken action to review and potentially revise their 2.3 GHz WCS rules.

- The primary focus for 3GPP currently has now turned to addressing fine tuning updates to Release 10 as the commercial equipment under that Release is being engineered. Attention in 3GPP and the industry is also focused as a high priority on the key elements of Release 11 that have been demanded by the operators including developing the performance specifications necessary to move to the rollout of the operator specific Carrier Aggregation scenarios that were teed up in the Release 10 capability. The 3GPP group handling issues relating to radio frequency already has a very full work program, which currently encompasses 51 Feature or Study Items (http://www.3gpp.org/ftp/Specs/html-info/TSG-WG--R4--wis.htm).

- While the U.S. WCS licensees have been actively engaged OEMs and others to develop a consensus-based proposal to 3GPP that will accommodate the U.S.-only regulatory regime, because of the factors noted above no formal industry support yet exists for a consensus-based proposal to meet the U.S. WCS requirements.

[9] As discussed later, this timeframe is inclusive of the technical work and industry coalition building that is necessary even before the standards development itself can commence.

A. Developing Industry Support for a New Band Class

Any attempt to develop a new Band Class for WCS will be fruitless until broader support for such an effort is generated. To build industry interest and support, WCS licensees have solicited proposals from vendors to conduct a more detailed engineering analysis of the impact of the newly-adopted WCS technical rules on the existing standard as well as on LTE equipment and device designs. This engineering analysis is anticipated to require 2-3 months once contracting is complete, which WCS licensees anticipate will occur in Q3 2011.

Such foundational work is critical to the process as a new Work Item in 3GPP requires support from at least four member companies and a strong level of overall support by the meeting to achieve the consensus to be scheduled into the official workplan. Building in advance a support coalition, along with understanding and delineating the specific efforts required, aids 3GPP in understanding how this work can be slotted into the heavy workload already known for Release 11. Completing an engineering study, as a first step, is necessary to address technical questions or concerns that are likely to arise in the early stages of the standardization process. Subsequent to this external industry effort, interested WCS licensees can than collaborate from a knowledgeable position with international 2.3 GHz band operators, equipment vendors, and device vendors to garner the necessary support for adding the WCS band requirements into the LTE standard.

B. 3GPP Structure

The 3GPP structure consists of a Project Coordination Group ("PCG") and Technical Specifications Groups ("TSGs"). The TSGs develop the 3GPP work program and organize Working Groups ("WGs") as needed in such development.

TSGs and WGs have elected a Chairman and one or more Vice Chairmen. The TSG Chairman is responsible for the overall management of the technical work within the TSG and its Working Groups. The TSG or WG Chairman is responsible for the overall management of the technical work within the Group and its subgroups.

TSGs and WGs attempt to reach consensus on proposals and this is the usual method of work. . When full consensus is not possible the Groups exceptionally vote on items. A proposal shall be deemed approved if it receives 71% of votes in favor.

There are currently a total of 4 TSGs and 17 WGs within 3GPP. The creation of a new Band Class is a matter for the Radio Access Network ("RAN") TSG. Specifically, the Working Group RAN4, which deals with radio performance and protocol aspects, is responsible for Band Class development. Working Group RAN5, which sets standards for mobile terminal conformance

testing, also has a role in the development of a Band Class and its work typically follows that of RAN4. The RAN TSG Plenary ultimately agrees on the work of the RAN Working Groups under its purview to produce the approved 3GPP specifications.

The process for developing a new Band Class begins with the creation of a Work Item and, if there is sufficient support by the membership at large, the attainment of agreement by 3GPP to take the Work Item onboard. After the Work Item is created, resources are allocated by the WG to begin work. Agreement of the WG RAN4 and the RAN TSG Plenary is required to turn the details developed under the Work Item into a standard.

C. 3GPP Process for Establishing a New Band Class

1. To create and submit a Work Item within RAN4 TSG, a submission needs to include at minimum:

    a) The intended output;
    b) Impact on specifications;
    c) Impact on other 3GPP work items;
    d) Schedule for tasks; and
    e) Sponsor and support from three additional 3GPP members.

2. The Work Item must be proposed and approved at a RAN Plenary meeting. Generally this happens at the first RAN Plenary in which the Work Item is submitted, but it could be delayed if there is no consensus (hence, the importance of the work U.S. WCS licensees are doing now to develop a consensus). RAN Plenary meetings occur roughly every 3 months (schedule at: http://webapp.etsi.org/MeetingCalendar/ViewMeetings.asp?qTB=373&qINCLUDE_SUB_TB=TRUE&qSTART_DATE=TODAY&qDISPLAY_TYPE=SHORT).

3. Once a Work Item is approved, the Work Item is entered into the 3GPP work program.

4. The Work Item then enters the "drafting phase" and RAN4 members begin submitting technical submissions and debating the topic.

5. The drafting process will culminate into the development of a Technical Report ("TR") that will include the technical specifications for the new Band Class and identify all of the technical standards that are affected by the creation of the new Band Class. In the case of Band Class creation, there are a significant number of standards that are affected. In total, the drafting phase and development and approval of the TR can take 3-6 months, depending on how politics among the members affects the process.

6. The TR is finalized and approved at a RAN Plenary. Approval will generally be reached through consensus, assuming that all of the issues have been resolved within the Working Group, but it is possible that this could require a vote.

7. Once the TR is approved, work can begin on any Change Requests ("CRs"). The CRs are redline edits to the standards. It will take another 2-4 months for the redline edits to be developed with politics affecting the timing.

8. The final CRs are submitted for approval at a RAN Plenary. If approved through consensus or vote, the Band Class is created. Combining the timeframes described above, along with some additional time to account for scheduling of submissions to RAN4 meetings, the complete RAN process will require 7–12 months to complete

9. This process effectively repeats again for RAN5 to set the standards for conformance testing, etc. of the Band Class. While many of the more difficult technical issues will be resolved in RAN4, the work process for standardization within RAN5 is identical to that of RAN4, and so will require an additional 7–12 months to complete.

10. Once both the RAN4 and RAN5 processes are complete, the vendors should have everything they need to build equipment for the new Band Class.

V. Once Standardization is Complete, Commercial Equipment Development Must Commence

Due to substantial differences between the U.S. regulations and the 3GPP technical specifications adopted for Band Class 40 it will necessary to modify commercially available 2.3 GHz LTE equipment for operation in the United States. While initial work to modify existing equipment designs can commence while the standards process is still underway, such as evaluating the design impact, the majority of the development work cannot not occur until the standard is approved in 3GPP.[10]

While a detailed engineering analysis is needed to understand the full extent of the modifications necessary to adapt equipment for operation in the WCS band, potential considerations include:

[10] At minimum, it is unlikely that commercial equipment development work would commence before the RAN4 process is complete. It is, however, reasonable to assume that early in the process of RAN5 standardization, perhaps within the first 2-3 months, OEMs and ODMs would have sufficient visibility as to the likely timing and outcome of the standards process to commence work.

Base Station Modifications

- At a minimum, a more robust front end filter will be needed to provide additional OOBE attenuation as well as rejection of adjacent channel SDARS repeater signals.
- Base station receiver design may need to be modified to provide additional protection from SDARS repeaters (note that to date analysis of SDARS repeater overload to LTE systems has not been conducted).

Mobile Device Modifications

- A re-design of the front end module ("FEM") used in 2.3 GHz devices will be necessary to provide additional attenuation of OOBE. This will include the design, prototype, testing, and production of a surface mount filter – most likely based on Bulk Acoustic Wave technology.
- Development of signal processing techniques, such as power amplifier power linearization, predistortion, and peak to average power reduction, may also be necessary to further reduce OOBE.
- Redesign of the RF and Baseband ASICs, which can take 6- 9 months to develop initial samples, may also be required.

Such modifications are estimated to take 3-5 months for the base stations and 6-12 months for mobile devices. These estimates do not account for the modifications needed to comply with the duty cycle and power density regulations, which may impose additional design impacts.

Following this detailed engineering phase, development of commercial prototypes will need to occur. As new modules are introduced into existing equipment form factors, further module design iterations may be necessary. For example, the new base station filters, which are anticipated to be larger, may need further modifications to be easily integrated into existing base station form factors. Similarly, power dissipation and current drain for the new mobile device modem may need to be optimized. The development of commercial prototypes is estimated to require 3–5 months to complete.

Design verification and interoperability testing ("IOT") will begin once prototype equipment is available. This test phase, estimated to take 3-4 months, will verify conformance with 3GPP standards and FCC rules. Ramp up of full commercial production of equipment and devices over a 2-3 month period can occur following the completion of the testing phase.

VI. Summary

Now that the FCC has adopted new rules for the 2.3 GHz WCS band, WCS licensees need standards-based mobile broadband equipment before they can deploy broadband services that meet the new WCS performance requirements. Given current market trends, LTE is the most viable 4G technology for WCS licensees to achieve economies of scale and produce a viable business model. While global development of LTE standards in the 2.3 GHz band is underway – with operators in China and India leading efforts – it is not focused on the unique requirements of the U.S. WCS band. It will be necessary for a new LTE standard to be adopted to comply with U.S. regulations and only after that process is complete will commercial equipment be developed.

Based on the analysis provided above, it is estimated that the development of a new LTE Band Class supporting the WCS band requirements will be an 18–24 month process from start to finish. Once the majority of standardization work is complete, an additional 12–24 months will be required for commercial equipment to be developed. This process and timeframes associated with the various stages are illustrated in the attached Figure 1.
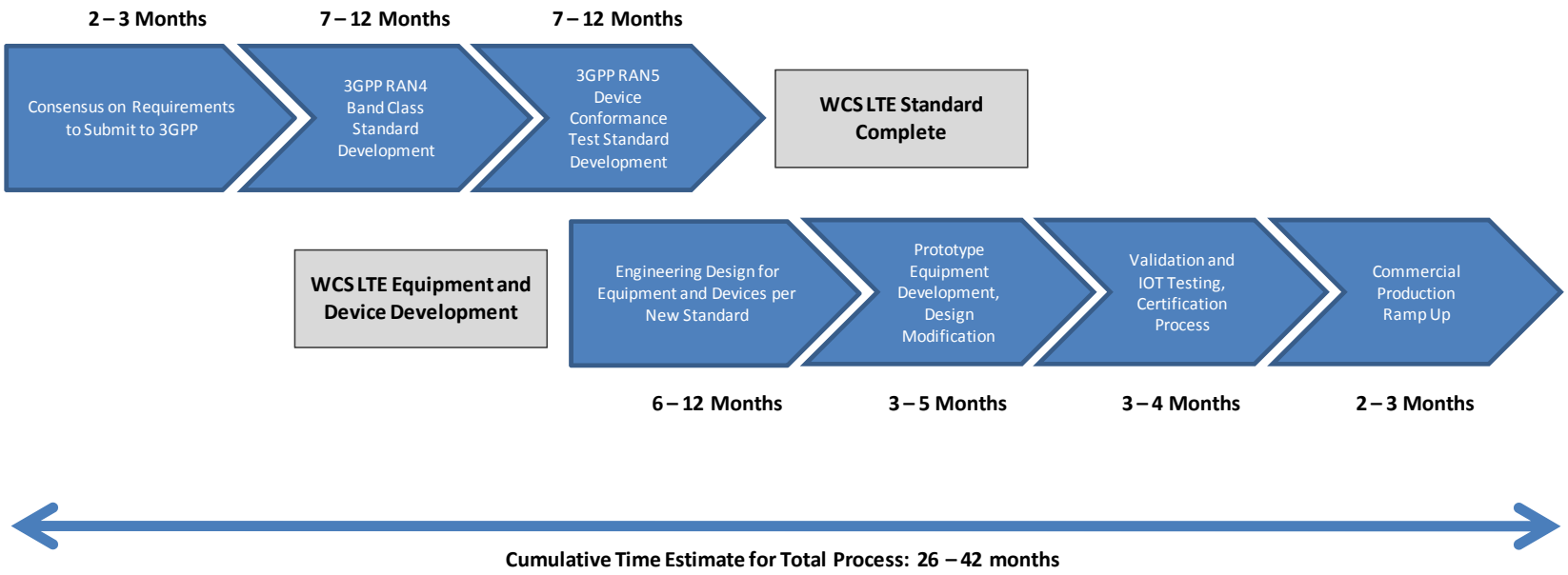
Figure 1: Process for LTE Standard and Equipment Development for the WCS Band