

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554**

In the Matter of

Expanding the Economic and Innovation
Opportunities of Spectrum Through Incentive
Auctions

GN Docket No. 12-268

**REPLY COMMENTS OF QUALCOMM INCORPORATED ON PUBLIC NOTICE
TO SUPPLEMENT THE RECORD ON THE 600 MHZ BAND PLAN**

QUALCOMM Incorporated (“Qualcomm”) hereby files brief reply comments in response to the Wireless Telecommunications Bureau’s Public Notice¹ seeking to supplement the record on the 600 MHz band plan. The record before the FCC demonstrates that both band plan variations on which the WTB PN specifically seeks comment — the “Down from 51 Reversed” (“DF51 Reversed”) Frequency Division Duplex (“FDD”) band plan, which places downlink operations in the upper portion of the 600 MHz band, and a TDD band plan comprised of unpaired Time Division Duplex (“TDD”) blocks — would be a poor fit for the 600 MHz band for a number of technical reasons and should not be adopted.

Indeed, many commenters explained that the DF51 Reversed and TDD band plans would be technically inferior to other plans² because each of these plans: (i) wastes prime mobile

¹ See FCC Public Notice DA 13-1157, *Wireless Telecommunications Bureau Seeks To Supplement The Record On The 600 MHz Band Plan* (May 17, 2013) (“WTB PN”); see also *Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, GN Docket No. 12-268, *Notice of Proposed Rulemaking*, FCC 12-118 (rel. Oct. 2, 2012) (“NPRM”).

² See generally Comments of AT&T Inc.; Comments of the Consumer Electronics Association; Comments of Qualcomm Inc.; Comments of Research In Motion Corp.; Comments of T-Mobile USA, Inc.; Comments of Motorola Mobility LLC; and Comments of Verizon and

broadband spectrum at the top end of the 600 MHz band on a guard band, which would be needed to avoid interference from Lower 700 MHz A block operations; (ii) introduces harmonics and spurious products that would interfere with operations in other bands that will be simultaneously active within the mobile device; (iii) increases the potential for interference to TV receivers and incumbent operations in Channel 37; and (iv) would thwart the Commission's goal of enabling market variation.

In contrast, a straight "Down from 51" ("DF51") FDD band plan in which a 25 MHz-wide uplink portion of the band is placed directly adjacent to the Lower 700 MHz A block, followed by a 10 to 12 MHz duplex gap and then a 25 MHz-wide downlink portion, with the remaining spectrum allocated for Supplemental Downlink ("SDL"), avoids the crippling technical problems that the DF51 Reversed and the TDD band plans create, as summarized below.

I. The DF51 Reversed And TDD Band Plans Suffer From Crippling Technical Problems

Both plans would waste 10 MHz of prime 600 MHz uplink spectrum on a guard band.

Both the DF51 Reversed band plan and the TDD band plan require the placement of a guard band at the upper end of the 600 MHz band, which wastes forty percent of the 600 MHz spectrum that is best suited for uplink operations. Given that it is uncertain how much spectrum the incentive auction will recover, consigning a major swath of prime recovered spectrum to a guard band is inefficient and wasteful. Qualcomm believes that at least a 10 MHz-wide guard band at the uppermost end of the 600 MHz band would be needed to protect 600 MHz downlink operations from the Lower 700 MHz A block uplink operations.

Verizon Wireless (all in response to WTB PN and filed June 14, 2013). *See also* Supplemental Comments of CIT Group, Inc., (filed June 14, 2013).

Both plans would jam higher frequency bands that can be simultaneously active within the mobile device. Both the DF51 Reversed band plan and the TDD band plan would jam many higher frequency bands that could be simultaneously operating within the device; this includes critically important global positioning bands, the 2.4 GHz unlicensed Wi-Fi band, and licensed mobile bands such as PCS, WCS, and the BRS/EBS bands.³ Qualcomm has explained in lengthy detail the extensive degree to which harmonics and spurious products from 600 MHz uplink operations below 673 MHz would create crippling intra-device interference and should be avoided.⁴

Both plans would increase the potential to interference to WMTS, radio astronomy, and TV receivers as compared to a straight DF51 plan. Both the DF51 Reversed band plan and the TDD band plan place uplink operations closer in frequency to broadcast TV receivers, and directly adjacent to Wireless Medical Telemetry Services (“WMTS”) and radio astronomy operations in Channel 37, and thus increase the potential for harmful interference to these services when compared to the straight DF51 plan, which places downlink operations adjacent to these three services.

In fact, both plans likely would require the implementation of guard bands around Channel 37 in order to adequately protect incumbent WMTS and radio astronomy operations, because they place uplink in adjacent spectrum. Placing mobile uplink operations in the lower portion of the 600 MHz band also increases the potential for interference from mobile devices to

³ Indeed, the DF51 Reversed band plan also introduces the possibility of intermodulation products interfering with the mobile uplink because this plan places mobile uplink operations in between TV stations and mobile downlink operations.

⁴ See Qualcomm Comments on WTB PN at 9-11 (filed June 14, 2013). See also Comments of Qualcomm Inc. (Jan. 25, 2013) (“Qualcomm Comments”) at 7-13; Reply Comments of Qualcomm Inc. (Mar. 12, 2013, re-filed on Apr. 3, 2013, with corrected page numbers) (“Qualcomm Reply Comments”) at 19-23.

TV receivers operating in the remaining TV spectrum and may require a larger guard band to protect TV receivers than what is necessary with the straight DF51 band plan.

Both plans are less amenable to accommodate market variation than the straight DF51 band plan. Both the DF51 Reversed band plan and the TDD band plan would be considerably less able to accommodate market variation than the straight DF51 plan. To be clear, the two plans would vary the uplink spectrum in regions of the country in which the auction recovers less spectrum from TV broadcasters,⁵ and Qualcomm has calculated that full power TV broadcast stations can cause interference to mobile base station receivers (*i.e.*, uplink operations) located more than 310 miles (or 500 km) away. This not only would substantially limit market variation in those areas of the country where it will be needed the most, such as up and down the eastern coast of the continental U.S., but it also would complicate coordination with Canada and Mexico.

In contrast, mobile downlink operations could avoid interference from TV broadcast operations located just slightly more than 100 km away, which means that to the extent the FCC is seeking a plan that supports market variation, the FCC should vary the downlink portion of the band rather than the uplink portion of the band. This is why Qualcomm has recommended that the FCC allocate any additional spectrum recovered (above and beyond the 72 MHz swath of spectrum needed to support a 2 x 25 MHz FDD band plan with a 10-12 MHz duplex gap and 10 MHz guard band at the low end of the band) for SDL usage.

⁵ See generally WTB PN.

II. While Qualcomm Does Build Chipsets That Support TDD Operations in Other Frequency Bands, The Foregoing Technical Issues Compel Allocation Of The 600 MHz Band For FDD Operations

Two commenting parties who favor a TDD band plan rely upon a September 2011 Qualcomm presentation that describes the general benefits of TDD operations, and they suggest incorrectly that Qualcomm also supports TDD operations for the 600 MHz band.⁶ The presentation was prepared before Congress even passed the legislation authorizing the voluntary incentive auction, and it obviously has nothing to do with 600 MHz. Qualcomm strongly supports the straight DF51 FDD band plan at 600 MHz for the reasons summarized above and detailed in its earlier filings in this proceeding.⁷

In fact, a TDD band plan makes inefficient use of the limited portion of the band that is best suited for uplink operations, *i.e.*, the top 25 MHz, because it combines uplink and downlink operations in each TDD spectrum block. After wasting approximately 10 MHz on a guard band at the uppermost end of the 600 MHz band, a TDD band plan would mix downlink with uplink operations in the remaining 15 MHz, which further limits utilization of the most desirable uplink spectrum. Moreover, because uplink operations are in every block of spectrum, the number of spectrum blocks that need to be coordinated to limit interference between the blocks is maximized by the use of TDD. The fact that a TDD plan may (depending on how it is constructed) be supported by a narrower antenna bandwidth is heavily outweighed by the many technical problems highlighted above and detailed herein.

⁶ See Supp. Comments of Cellular South, Inc. Regarding the 600 MHz Band Plan (filed June 14, 2013) at 5-6; Comments of Sinclair Broadcast Group, Inc. (filed June 14, 2013) at 6-7.

⁷ See generally Qualcomm Comments on WTB PN.

III. The FCC Should Implement A Straight “Down From Channel 51” FDD Band Plan, Specifically A 2 x 25 MHz Plan With A 10 MHz Gap And Any Remainder For SDL

Qualcomm is very confident about the technical feasibility of using the 600 MHz band for FDD operations, that is, with 2 x 25 MHz situated in the uppermost portion of the band along with a 10 MHz duplex gap, with any additional spectrum allocated for SDL operations.

Qualcomm has conducted extensive and multi-faceted technical studies of the 600 MHz band to determine how best to incorporate the band into today’s smartphones and other mobile devices that consumers love. These studies have confirmed and re-confirmed what Qualcomm originally proposed, *i.e.*, the superior use for this band is the straight DF51 FDD band plan, as described above. To the extent the forward auction permits the FCC to repurpose for mobile broadband operations more than 12 TV broadcast channels (*i.e.*, the amount of spectrum necessary to support a 2 x 25 MHz plan with a 10-12 MHz duplex gap and 10 MHz guard band at the low end), the additional spectrum should be allocated and auctioned for SDL use.⁸

⁸ See Qualcomm Comments on WTB PN at 9-11.

CONCLUSION

As the opening comments filed on the WTB PN make abundantly clear, the Commission should not implement a DF51 Reversed or TDD band plan because neither plan is technically efficient, and both plans create problems that the straight DF51 2 x 25 MHz FDD band plan that Qualcomm recommends was designed to avoid.

Qualcomm looks forward to continuing to work with the Commission and the wireless and broadcast industry stakeholders towards defining a band plan that will raise the greatest amount of money and can be readily incorporated into mobile devices that are comparable in size to those being used today.

Respectfully submitted,

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