October 5, 2017

***EX PARTE* NOTICE VIA ECFS**

Ms. Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington, DC 20554

RE: Notice of Ex Parte Communication; Authorizing Permissive Use of the "Next Generation" Broadcast Television Standard, and Subsequent Calls for Mandating ATSC 3.0 Receivers in Consumer Devices; GN Docket No. 16-142

Dear Ms. Dortch,

Skyworks Solutions, Inc. ("Skyworks") is an innovator of high performance analog semiconductors. Our products enable connectivity across a broad and diverse set of end markets, including the smartphone market. With our interest and deep understanding of smartphone design impacts, we have followed the recent debate in the ATSC 3.0 docket regarding the engineering trade-offs associated with mandating an ATSC 3.0 tuner capability within today's smartphones. With this letter, we add to the growing record in this proceeding which indicates that adding such capability to a smartphone in its current form would be a non-trivial task and would have many detrimental effects on performance, concluding that an ATSC 3.0 receiver mandate for smartphone and mobile device application is inappropriate.[1]

In evaluating this issue, Skyworks sought to examine the following questions of device implementation:

1. **If broadening a smartphone front end were feasible, could LTE and ATSC 3.0 operate concurrently in the band?**

To implement a smartphone receiver front-end to accommodate both LTE in Band 71 (600 MHz) and ATSC 3.0 in the UHF-TV band would require design changes to add diplexing architecture to the RF

[1] *See*, e.g., ex parte filings from T-Mobile USA, Inc. (filed September 11, 2017); Motorola Mobility (filed September 12, 2017); Ericsson (filed September 15, 2017); Nokia Bell Labs (filed September 15, 2017); Qualcomm (filed September 19, 2017); and Ethertronics, Inc. (filed September 18, 2017 and September 19, 2017).

circuitry. This additional hardware is needed to separate the signals from these two disparate bands for routing to the correct receiver for demodulation. As with adding any filtering technology to a device, there is some degree of associated insertion loss. In this case, we estimate such loss to be approximately 2 dB at the band edge. This in turn could reduce LTE cell edge coverage radius by 20% or more thus requiring the addition of more cell sites or increased power in the smartphone to compensate. Similarly, receive side degradation of ATSC 3.0 signals may require the addition of a low noise amplifier (LNA) to compensate for such loss. Thus, there would be detrimental consequences to attempting concurrent operability of LTE and ATSC 3.0 in the band.

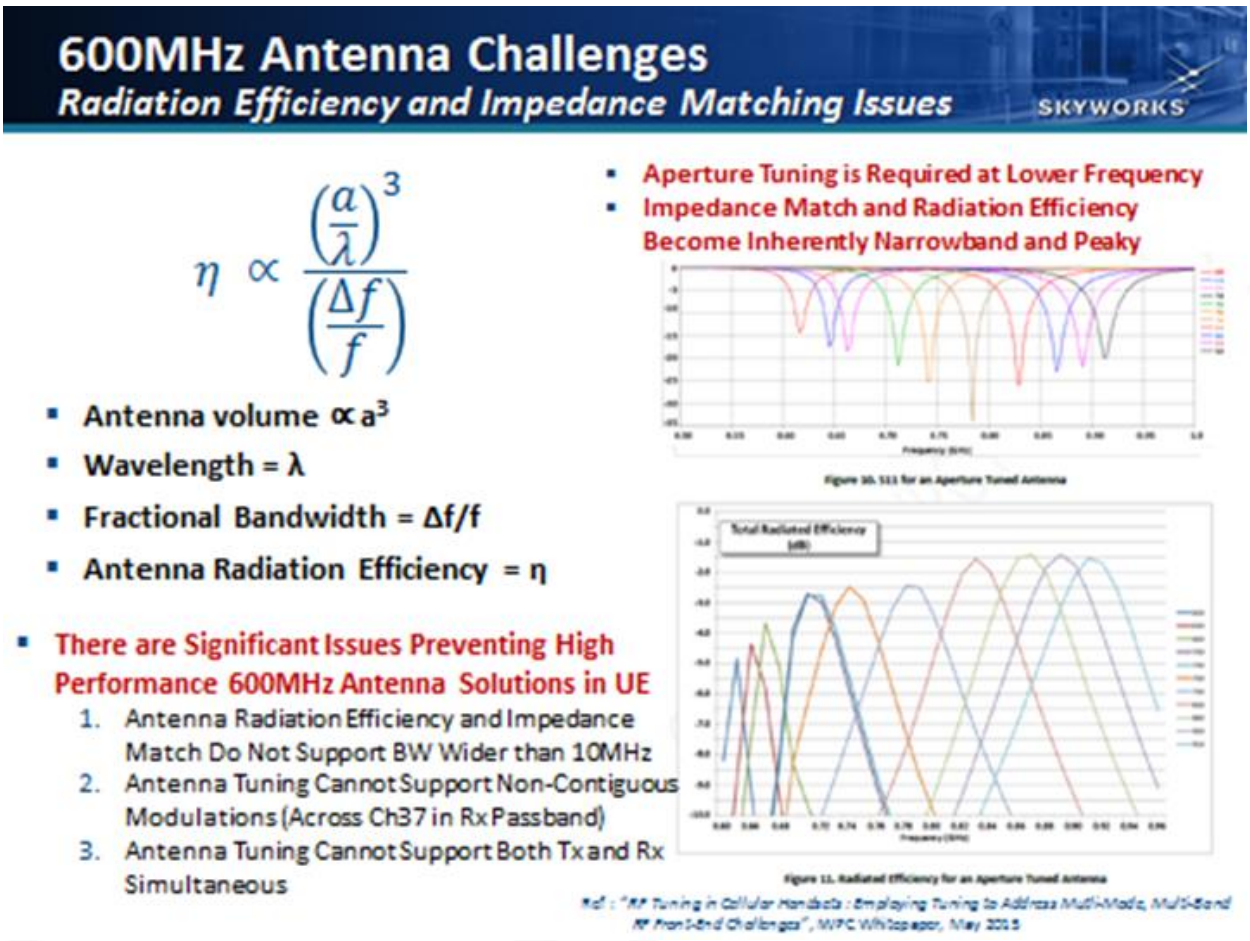
2. If the Band 71 front end was broadened to also support the UHF-TV band (470-608 MHz), what would be the impact in terms of blocking and antenna efficiency?

We conclude that the Band 71 front end cannot be broadened to also support the UHF-TV band for multiple reasons. To begin with, the rejection required to encompass the additional UHF-TV bandwidth cannot be practically implemented using conventional acoustic duplexer technology. Such an effort would severely impact Band 71 and result in a maximum power sensitivity degradation of approximately 20 dB. Additionally, extending the bandwidth would create a situation where out of band blocker amplitudes become in band blockers with amplitudes 30 dB higher than Band 71 standalone implementation. The requirement for concurrency in the same filter/antenna structure, would render Band usage impossible. Further, we estimate that widening the LNA bandwidth to support ATSC 3.0 would degrade the receiver noise figure by at least 2 dB. Finally, the antenna tuning challenge for lower frequencies with the electrically small antenna already in development to support B71 would require enlargement for extension down to 470MHz such that the ever more narrowband radiation efficiency (as shown in the figure below) as frequencies decrease would prevent any reasonable concurrency just from an antenna response perspective. If the B71 is selected for tuned response to salvage remaining performance there, the ATSC3.0 performance suffers significantly, and vice-versa. The concurrent performance support would impair coverage and essential e911 services on the B71 LTE service as a result.

3. What would be the impact if separate antennas for Band 71 and ATSC 3.0 were installed?

Present LTE operation requires two low band antennas to support the 617MHz to 960MHz frequencies of low band cellular services for both primary and diversity, with requirement for lo envelope correlation coefficient and reasonable radiation efficiency on each for TRP/TIS performance. The limited

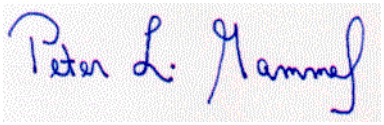
volume within a smartphone to accommodate an additional/separate ATSC3.0 antenna down to even lower frequency would have severe consequences on performance. As shown in the graph below which shows radiation efficiency as a function of frequency and antenna volume, the impact of placing two low band antennas in such a limited volume would be to severely reduce the radiation performance which in turn would degrade cellular performance to such a point that it would be rendered useless.



Skyworks has concluded that adding an ATSC 3.0 tuner capability would have adverse impacts to the normal operation of a smartphone using 600 MHz LTE technology, and such action is not recommended. As described above, there are very real and considerable consequences associated with adding an ATSC 3.0 receive capability into a smartphone to coexist with 600 MHz Band 71 operations. Current smartphone form factors, which are popular with the public, cannot simply be modified to add such capability, and the significant impact on user experience for both general cellular services as well as e911 on LTE cannot be recovered through other architecture/design/technology changes in the radio

front-end solution. Thus, we recommend that the Commission refrain from considering such a requirement sought by the broadcasters seeking an ATSC 3.0 receiver mandate.

Respectfully submitted,



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