

**Before the  
Federal Communications Commission, Washington, D.C. 20554**

In the Matter of	)	
	)	
Unlicensed Use of the 6 GHz Band	)	ET Docket No. 18-295
ET Docket No. 18-295	)	
	)	
Expanding Flexible Use in Mid-Band Spectrum	)	GN Docket No. 17-183
Between 3.7 and 24 GHz	)	

**Zebra Technologies, Inc. Reply Comments in response to  
Notice of Proposed Rule Making (FCC 18-147)**

Zebra Technologies, Inc. is pleased to submit these reply comments in response to the Federal Communications Commission's Notice of Proposed Rule Making<sup>1</sup> (NPRM) in the above referenced docket.

**1. Regarding comments of UWB Alliance, iRobot, Alteros, Decawave**

The comments of UWB Alliance<sup>2</sup> and Decawave<sup>3</sup> regarding the applicability of ultrawideband (UWB) to enable IoT technologies as well as its role as a means for fostering innovation are accurate and relevant. Zebra, originally as Multispectral Solutions, Inc., has been living in that world of innovative development of UWB technology since the beginning. The applications of UWB already in deployments are numerous, diverse and often essential.

The fundamental concern is that, due to the extremely low spectral density constraints required by Part 15 Subpart F and 15.250, UWB systems operate very successfully with little margin over a very wideband noise floor. To date, this has been very practical due to the protections afforded to and the predictability of high-value licensees in this band. Any unpredictable disruption to the RF environment at levels comparable to that noise floor will have a severe negative impact to UWB operation.

We agree with comments of UWB Alliance, iRobot<sup>4</sup> and Alteros<sup>5</sup> regarding a coexistence strategy allowing UWB systems to continue to operate alongside Wi-Fi. In particular, permitting standard power levels between 5925 and 6100 MHz will satisfy requirements of the Mobile Now Act, while incurring minimal impact to UWB systems. We also agree that, in the event that Wi-Fi operation is allowed above 6100 MHz, there needs to be a mechanism by which critical UWB deployments can participate in any AFC database which may be created and that it should apply across all new U-NII bands. Furthermore, we agree that a "beacon fence" requirement should be added in order to mitigate against errors or failures in the AFC system.

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<sup>1</sup> FCC 18-147

<sup>2</sup> Comments of UWB Alliance, GN 17-183 ET 18-295 (filed Feb. 15, 2019).

<sup>3</sup> Comments of Decawave, GN 17-183 ET 18-295 (filed Feb. 15, 2019).

<sup>4</sup> Comments of iRobot Corp., GN 17-183 ET 18-295 (filed Feb. 15, 2019).

<sup>5</sup> Comments of Alteros, Inc., GN 17-183 ET 18-295 (filed Feb. 15, 2019).

## 2. Regarding comments of RLAN Group, Apple, HPE, Wi-Fi Alliance

RLAN Group<sup>6</sup> suggests allowing an increase of 10dB to the power spectral density (PSD) limits proposed in the NPRM, as well as a change to the boundary between U-NII-7 and U-NII-8 in order to accommodate “modern modulation techniques”. We feel that the original PSD levels already require some justification particularly since efficient spatial re-use should be a goal of any new allocation intended to relieve congestion.

RLAN Group also proposes allowing client devices to operate at the same power level as its associated Access Point (AP) in order to prevent “unbalanced links”. As anticipated in the NPRM<sup>7</sup>, a client device can easily be outdoors while its associated AP is indoors, creating a greater likelihood of harmful interference. For this reason, Zebra objects to this proposal.

RLAN Group also suggest essentially moving the boundary between U-NII-7 and U-NII-8 in order to be more compatible with a pending IEEE standard. In fact, many of the same members had earlier suggested exactly the boundaries proposed in the NPRM. Zebra objects to any provision allowing for more high-power outdoor Wi-Fi as it only increases the likelihood for more unpredictable increases in the effective noise floor.

RLAN Group, HPE<sup>8</sup>, and Apple propose permitting Very-Low-Power (VLP) portable devices at 14 dBm to operate indoors or outdoors without AFC. Zebra objects to the portable aspect of this proposal as it creates the potential for more unpredictable interference. As the NPRM already proposes restrictions on vehicular operation, the potential for dynamic and unpredictable interference is clearly appreciated. Unmitigated portable operation would be moving further in that direction and should be not permitted. Furthermore, this sort of uncontrolled low power operation in 5925-7125 MHz has been previously addressed by the Commission during the establishment of Part 15.250.

Without the mitigation effects of AFC or an indoor-only requirement, there is no basis for allowing higher average (75 nW/MHz) or peak (1 mW/50MHz) power levels than already permitted by 15.250. For comparison, a hypothetical wideband signal taking up the entire 5925-7125 MHz band with an average PSD of 75 nW/MHz would have an average power of only 90  $\mu$ W (–10.5 dBm). The concerns surrounding unconstrained mobile operation across 5925-7125 MHz remain as valid today as in 2005 when the current PSD limits were established<sup>9</sup>.

RLAN Group and Wi-Fi Alliance<sup>10</sup> make the case that an expanded Wi-Fi allocation is essential for Internet of Things (IoT) and innovation. Although Wi-Fi is certainly one component of a technology ecosystem, other technologies can provide functionality which is not possible with Wi-Fi. UWB continues to contribute to the public benefit with unique capabilities, including:

- Compatibility with incumbents: Due to the low PSD and high bandwidth disparity, interference to incumbents is nonexistent. There has never been any need for AFC, and outdoor operation has been allowed since 2005.
- Small, micro-power transmit only devices: Zebra’s tags deployed in NFL footballs weigh less than 4 g and last for the life of the football.

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<sup>6</sup> Comments of Apple Inc., Broadcom Inc., et al (RLAN Group), GN 17-183 ET 18-295 (filed Feb. 15, 2019).

<sup>7</sup> NPRM ¶169

<sup>8</sup> Comments of Hewlett Packard Enterprise Company (HPE), GN 17-183 ET 18-295 (filed Feb. 15, 2019).

<sup>9</sup> FCC 04-285, 47 CFR 15.250

<sup>10</sup> Comments of Wi-Fi Alliance, GN 17-183 ET 18-295 (filed Feb. 15, 2019).

- High instantaneous time resolution: Raw time-of flight measurements are accurate enough to allow motion (velocity, acceleration) to be derived from location measurements.
- Low latency: Without network overhead, real-time applications are possible such as live RTLS in sports, production audio, robotic motion control, worker safety.

Wi-Fi Alliance offers a unique interpretation of the NPRM ¶ 72 by suggesting that the Commission anticipates no need for rule changes in order to ensure coexistence with UWB and new U-NII operation. Rather, ¶ 72 merely states that no rule changes are currently planned, and clearly asks for input on coexistence and mitigation strategies. Furthermore, Wi-Fi Alliance suggests that the “sufferance” clause in FCC 05-58 should somehow apply to a new rulemaking instead of only to existing regulations. In fact, the Commission is clearly considering the public benefit by inquiring about the potential impact to UWB, and furthermore has a history of considering the benefits of existing Part 15 systems when considering new rulemaking for both unlicensed<sup>11</sup> and even licensed<sup>12</sup> services. Furthermore, by being well organized and compartmentalized, Part 15 has generally minimized the likelihood of interference among unlicensed devices.

Wi-Fi Alliance further suggests that unlicensed applications will likely be confined to locations under the control of a single entity and can be managed accordingly. While this will sometimes be the case, it would not be uncommon, especially under the proposed power levels, where that control will not be available either due to an extreme interference range or due to unconstrained mobile operation. The Commission has previously expressed a policy “to protect neighbors from causing interference to each other”.<sup>13</sup> The primary reason for Zebra’s concerns about the proposed U-NII allocations are for those uncontrollable situations.

### **3. Regarding comments of NAB, SBE and Boeing**

As pointed out by NAB<sup>14</sup> and SBE<sup>15</sup>, many UWB systems are currently deployed in real-time, live, highly visible production environments which may be well within range of other entities. Examples are Zebra’s live player and ball tracking as currently deployed in all NFL venues, and Alteros’ wireless microphones used in live broadcast production audio.

Although the number of such deployments may be small by comparison with that of consumer devices, they are often directly in the critical path of live production audio and video streams distributed to many millions of consumers. We agree with NAB and SBE that these deployments are particularly vulnerable to an increase in the ambient noise level and that such an increase, especially with aggregation, is likely for these live, time-critical applications. Restricting a new U-NII allocation to operate below 6100 MHz and/or implementation of a beacon fence are possible remedies.

Boeing<sup>16</sup> expressed similar concerns for UWB systems used for real-time tracking thousands of items at its large fabrication facilities. Zebra agrees with Boeing’s assertion that the low power levels allowed for UWB under Part 15 also make UWB receivers highly susceptible to harmful interference from new Wi-Fi devices sharing the same spectrum. We also agree that the Commission should take

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<sup>11</sup> See discussion of unlicensed wireless microphones, 75 FR 75814 ¶12-16, and 47 CFR 15.713(h)(9)

<sup>12</sup> See, for example, FCC 95-41 ¶11, FCC 96-115

<sup>13</sup> FCC 00-163 ¶39

<sup>14</sup> Comments of National Association of Broadcasters (NAB), GN 17-183 ET 18-295 (filed Feb. 15, 2019).

<sup>15</sup> Comments of Society of Broadcast Engineers, Inc. (SBE), GN 17-183 ET 18-295 (filed Feb. 15, 2019).

<sup>16</sup> Comments of The Boeing Company, GN 17-183 ET 18-295 (filed Feb. 15, 2019).

steps to ensure the continued viability of these time-critical industrial deployments when considering new Wi-Fi allocations.

#### 4. Summary

UWB systems, as low-power devices and especially when based on time-of-arrival, are particularly vulnerable to changes in the ambient RF environment. With a 400 MHz instantaneous bandwidth, the effective thermal noise floor for a UWB receiver is about -88 dBm. An interference-to-noise (I/N) ratio of 0 dB would raise this noise floor and negatively impact the UWB performance by 3 dB. At the short ranges utilized by UWB, a free-space propagation model is not a bad baseline, particularly since mitigation becomes less likely at shorter range. However, even allowing for 20 dB of mitigation, even a VLP transmitter at 25mW will have a 3dB impact on the effective noise floor for an isotropic receive antenna at a range of 45 meters. The impact range will be correspondingly greater with more typical antenna gains of 6 to 15 dBi, as it will for the higher power modes (250 mW and 1 W). These ranges will often put uncontrollable entities well within range.

It is for these reasons that Zebra is interested in all possible mitigation strategies, particularly confining the spectral extent of Standard Power Wi-Fi to 5925-6100 MHz as previously suggested. For any allocation above 6100 MHz, participation in AFC, beacon fence, and reduced power levels will reduce but not eliminate the potential for degraded performance.

Due to the radical departure from established power and PSD limits for unlicensed operation in this band, Zebra requests that the Commission take a cautious and gradual approach to any new allocation, which should include robust studies and testing. This is the approach previously taken by the Commission during the introduction of UWB rules<sup>17</sup> into this same band. There are many interested and potentially impacted parties. New and expanded U-NII rules must strive to allow for coexistence with existing unlicensed uses, while ensuring that licensed users continue to be protected from harmful interference.

Respectfully submitted,  
Zebra Technologies, Inc.

By:



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Edward A. Richley



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Carl S. Mower

March 18, 2019

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<sup>17</sup> First Report and Order, FCC 02-48, ¶15 and, Second Report and Order and Second Memorandum Opinion and Order, FCC 04-285, ¶1.