Before the
Federal Communications Commission
Washington, DC 20554

In the Matter of	)	
	)	IB Docket No. 11-109;
Ligado's Modification Application	)	IB Docket No. 12-340
	)	
	)	

Comments of Greenwood Telecommunications Consultants LLC

May 23, 2016

Introduction

The Commission requests comments on Ligado's modified application including specific proposed operating parameters and conditions in Ligado's recent proposal to operate up- and down- links in adjacent bands to L1 band GPS/GNSS operating between 1559-1610 MHz.

Comments

Ligado recently proposed significant modifications affecting compatibility based on new operating parameters (reduced downlink EIRP, new downlink frequencies offering greater frequency separation, much lower mobile and fixed station OOBE). These are substantial improvements over the successor company's 2010-2011 plan and proposal. In particular, Ligado proposes adopting lower OOBE for terminal (UE) equipment which based on the FCC ordered 2011 TWG tests would amply conform to GPS/GNSS operations – which this commenter analyzes offers an improved separation distance between equipment of 1 meter or less. Notably, existing MSS UE equipment OOBE specifications are much higher than levels proposed by Ligado. Ligado now proposes a mobile OOBE limit of -105 dBW/MHz thus provides 35 dB more OOBE interference suppression than current neighboring MSS uplink specifications offer. The low OOBE also removes aggregate interference concerns since more than one active device would have to be within 1 meter of a victim receiver operate at full power, and on the lowest uplink transmit channel simultaneously. The existing MSS profile is far more lethal to GPS operations in either single device or aggregate interference cases. The MSS and Ligado UE's operate in the same band and MSS is growing in installations. Ligado uplinks would operate in bands currently dedicated exclusively to GEO-MSS uplinks and are the farthest from the GPS/GNSS band. Ligado UE EIRP specifications, 23dBm, operate at 15-200 times less radiant power than prevailing MSS. Ligado has addressed use of close-in receiver operation; it also bases specifications on use of modern solid state low cost commercial filter components following characteristic requirements to operate across other LTE bands.

Ligado also proposes reduced downlink power in the original "Lower 10 MHz", 1525-1536 MHz, that has transmission power that conforms to certified aviation receiver requirements including close-in, "corner case" (such as helicopter landings near roadside towers) interference scenarios. Certified aviation

has the most stringent receiver adjacent band rejection characteristics among all receivers. Ligado also re-commits to abandoning an earlier downlink band between 1545-1555MHz. Ligado further proposes downlink operation in an under-used bands between 1670-1680 MHz, which is about 100MHz offset from GPS center frequency, 1575.42 MHz. Ligado proposes fixed station downlink bands operate at -95 dBW/MHz OOBE which is sufficiently low to not raise the noise floor. These parameters substantially improves fielded receiver resistance from adjacent band interference of past proposals due to greater separation from existing GPS and new GPS and GNSS services. As the Commission notes, the Department of Transportation (DOT) is in the process of analyzing adjacent band test data collected from its recent tests of about 80 receivers undergoing tests following its protocol to survey all regions of the neighboring band. The DOT test could shed needed light on neighboring services' impact, not just Ligado LTE, and thus serve future needed policy decisions with an aim to protect GPS/GNSS.

The primary receiver categories most challenged by adjacent operations are wideband precision and certified aviation. Aviation appears to be addressed by Ligado's offer to drop power in the 1525-36 MHz downlink to conform to current and future receiver specifications related to adjacent band rejection performance, including aggregate interference which must be analyzed for en-route flight phases. This also requires adapting and upgrading a known set of helicopters fitted with Terrain Avoidance (TAWS) to reject multiple sources of interference potentially present at close distance including but not limited to future Ligado bases stations. Precision receivers, based on results from comprehensive TWG measurements from 2011, may require adaptation of the receiver front end to avoid interference to MSS and its GNSS passband characteristics. New designs can accommodate both based on mutually informed coordination between the receiver and MSS providers that carry MSS augmentation data to terrestrial precision receivers.

Spectrum management imperatives seek best and highest use of scarce spectrum. In this commenter's view, the first priority should be unconditional protection of GPS and GNSS. GNSS suppliers are simultaneously augmenting and "toughening" receiver performance. These services are critical to safety of life navigation, positioning, high reliability commercial timing, and finally emerging services. All categories rely on acquiring then continuous tracking relatively weak signal that should only be bounded by thermally limited channels based on path budgets and transmissions from distant MEO or in certain cases GEO satellites. Innovative use of GPS can also solve broadband spectrum shortages. For instance, in the 3.5 GHz shared spectrum allocations (Docket 12-354), GPS provides critical 3D positioning and can also be used to sense in-building RF containment loss to permit 100X more spectrum sharing by intelligent re-use at 3.5GHz, which portends the same eventually across other sub-6 GHz bands. The same solution addresses Indoor E911 and commercial grade services. GPS based synchronization also increases spectrum efficiency and network quality. In short, GPS offers a way to increase spectrum use but it must be protected.

Ligado's proposed modifications deserve serious attention. It offers a new view of how to fit future terrestrial compatibly into the L-band. To hasten progress and certainty and voice L-band issues robustly, it now seems appropriate to find a more efficient process to resolve remaining compatibility issues.

Conclusion

We urge the Commission adopt orders that implement a multi-stakeholder forum (MSF) to conduct and finalize detailed L-band compatibility analysis and solutions in a timely fashion. An MSF best serves needed technical scrutiny and technical solutions based on many subtle cross-service intricacies. Durable compatibility between GPS/GNSS and terrestrial broadband services is possible. 1559-1610 MHz ARNSS mask should also maintain alignment with internationally recognized spectrum and services. MSF can also best address this need and should open the MSF to participants globally.