April 5, 2006

Subject: Advanced Wireless Services (AWS) – FCC ET Docket No. 00-258

Micronet Communication was asked to review and provide recommendations on the assertions of Sprint Nextel in the subject comments, specifically regarding the assertion by Sprint Nextel that "*Sharing between the type of upstream BRS (Broadband Radio Service) transmissions that Sprint Nextel and other BRS licensees operate in the 2150-2162 MHz band and the downstream transmissions that future advanced wireless services (AWS) licensees plan to implement is impossible*."[1]

The comments describe a system whereby BRS base stations are located at high altitude sites, and operate on a line-of-sight basis. At issue is whether or not AWS equipment in adjacent bands could operate within reasonable geographic distances from BRS equipment that has not yet been transitioned to other frequency bands from the 2150 – 2162 MHz band.

The first question relates to how much interference power can be reasonably injected into the Sprint CPE – Base Station link without degrading their stated performance objectives.

Micronet modeled a typical uplink between a Sprint Customer Premises Unit (CPE) transmitting to the BRS base station in order to ascertain the actual performance requirements of this link. Since several data rates and bandwidths are available, the 200 KHz bandwidth was taken as the reference for this analysis. The Hybrid Series 2000 equipment manual provided a 13 db S/N link requirement as corresponding to a bit error rate of 10^{-9}.

[1] *See* Comments of Sprint Nextel Corporation, In the Matter of Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, including Third Generation Wireless Systems, ET Docket No. 00-258, (November 25, 2005) at page 14.

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Those calculations are provided here (as well as in the attached spreadsheet), and show that the injection of a C/I of 15 db still allows the Sprint link to function acceptably over a thirty mile path, and with a 10 db fade margin. The system temperature was estimated based on the performance of typical antennas, LNAs and preampliers available on the market.

CPE Output Power (dbm)	23.4
CPE Transmit EIRP (dbm)	39.9
Frequency (MHz)	2156.0
Link Margin (db)	10.0
Path Length (Miles)	30.0
Free Space Loss (db)	132.8
Data Rate (KBps)	224.0
Bandwidth (KHz)	200.0
Receive Antenna Gain (db)	19.0
Carrier Power at LNA Input (db)	-83.9
System Temperature (db-K)	27.6
Thermal Noise Power (dbm)	-117.9
Thermal C/N (db)	34.1
Assigned C/I (db)	15.0
System C/N (db)	14.9
C/N Requirement	13.0
Margin	1.9
Total Interference Power (dbm)	-98.9

These calculations lead to the conclusion that a C/I of 15 db will allow acceptable performance on the Sprint Nextel base station, or that the BRS base station can survive with –98.9 dbm of interference power.

Once the 15 db C/I ratio was established as a viable threshold, a calculation of the resulting co-channel interference was made by parametrically evaluating multiple emitters located various distances from the BRS base station.

There are effectively two ways of isolating interference, namely geographic separation and frequency separation. The use of both is preferred.

Using geographic separation alone, Micronet concluded that if five (5) emitters were located 2.2 Km away from a BRS base station on the average, the BRS would remain totally functional and meeting its quality performance objectives if each of these emitters transmit a maximum of –33 dbm in a 200 KHz bandwidth.

This is roughly consistent with the out-of-band emission levels of PCS base station equipment produced by vendors such as Lucent for example. Clearly, fewer emitters located further from the BRS base station would be even less of a problem.

In additional comments to the FCC[2] Sprint Nextel makes the assertion that the mere presence of line-of-sight between an AWS base station and a BRS base station is sufficient for the presence of disabling interference to BRS. If this were true, then any existing BRS base stations that had a line-of-sight path to other BRS base stations would be providing disabling interference into one another.

In the KGA attachment to these comments, footnote 4 discusses the lower edge of the 2150-2162 MDS band and the assumption of a 5 MHz guard band coming from the upper 5MHz AWS channel, because operation in that 5 MHz would clearly cause interference to BRS1. This footnote brings the focus of the discussion to the subject of filtering and adjacent channel interference rejection as it should.

KBA provides a BRS filter characteristic showing a flat 15 MHz bandwidth that would extend from 2148.5 MHz to 2163.5 MHz if it were tuned to the center of the band at 2156 as implied in the additional comments with the filter data sheet. Clearly there is little adjacent channel rejection from this receive filter, so it becomes important to look at the transmit filtering.

For UMTS equipment, Adjacent Channel Leakage power Ratio (ACLR) [3] defines the ratio of the average power centered on the assigned channel to the average power centered on an adjacent channel frequency. For a 5 MHz channel, the ratio is 45 db.

Assuming a maximum base station power of 30 watts per carrier results in adjacent channel power level of –14.2 dbm in a 200 KHz bandwidth. This value is 19 db above the levels derived from the earlier C/I analyses, so the remaining 19 db must be obtained from geographic separation. This implies separation distances of roughly 20 km between base stations.

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[2] Sprint Nextel Letter dtd April 3, 2006 and including the Engineering Statement of Robert Gehman, Jr. P.E. of Kessler and Gehman Associates (KGA)

[3] 3GPP TS 25.104 V4.1.0 (2001-06) Technical Specification entitled 3rd Generation Partnership Project; Technical Specification Group Radio Access Networks; UTRA(BS) FDD; Radio transmission and Reception (Release 4)

Validation Through the Concept of Reciprocity

In the event that theoretical calculations are deemed inadequate to resolve questions of mutual interference in the AWS bands, a simple on-site measurement can be made using the concept of reciprocity.

In short, the measurement is made at the site of the proposed AWS facility, to see if a carrier from a nearby BRS can be seen and measured. Adjusting for the differences in transmit power between the planned AWS site and the existing BRS base station allows a rapid estimation of whether or not the planned site is likely to interfere into the BRS base station.

The bottom line is rather straightforward. From the calculations made by Micronet, there is little doubt that AWS equipment can begin using bands adjacent to those occupied by existing BRS base stations so long as adequate geographic separations are maintained. If the parties cannot agree on specific calculations, the use of on-site measurements, based on reciprocity, can be used to resolve the disagreement.

For Micronet Communications, Inc.

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Attachment