Experimental License Application for 6.925 GHz – 7.325 GHz Massive MIMO Testing

Introduction

To evaluate next-generation cellular equipment, Samsung Research America (SRA) requests an experimental license to perform multi-user-multiple-input, multiple-output (MU-MIMO) tests between 6.925 and 7.325 GHz band. The tests will have a single prototype base station and up to 16 mobile radios.

Samsung leads the way in wireless innovation, setting new standards for connectivity, speed, and reliability. With cutting-edge technology and unparalleled expertise, we are redefining the future of mobile communication. Our commitment to research and development ensures that our products stay ahead of the curve, delivering unparalleled experiences to our customers. Experimental licenses such as this help us in pursuit of this mission.

Experiment Description

MU-MIMO operation enables several spatial streams to be used simultaneously to beamform to multiple users on the same time and frequency resources, increasing network capacity. A maximum average EIRP of 85 dBm in 200 MHz will be divided among all the spatial streams. At each test site, SRA will set up mobile test terminals within a radius of 4 kilometer.

The full antenna is made up of 128 sub-arrays, each consisting of 4 dual-polarized patch antennas. Each subarray operates with an antenna gain of approximately 10 dBi with a 3 dB beam width of approximately 100 degrees. The radiation pattern of an example subarray is shown in Figure 1. Finer beam patterns are achieved for MU-MIMO via precoding the signals across the subarrays/elements. In the case of beamforming to a single user, the minimum 3 dB beam width is 9°. The antennas are prototypes developed internally for this purpose.

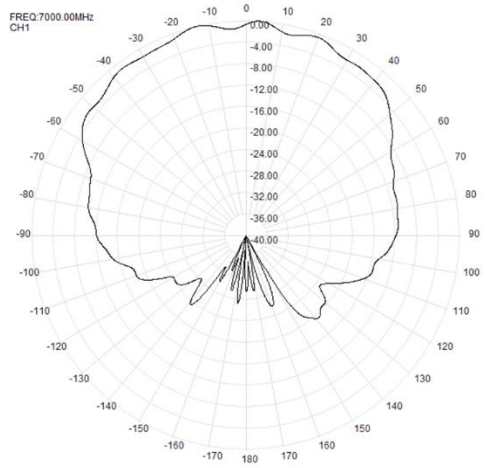

Figure 1. Example radiation pattern measurement from antenna subarray at 7 GHz

The final antenna panel is expected to have over 1000 individual elements arranged in a rectangular grid. We will operate our antenna panel no higher than 64 m, 40 m, and 45 m off the ground for each of the three test sites. The corresponding AGL and AMSL are in Table 1 for each test site.

Table 2. Site Location Overview

Site Name	Longitude/Latitude	Azimuth	Antenna Height (m)	Mean EIRP / 200 MHz	Signal Bandwidth	Mean EIRP / MHz	Antenna 3 dB beam width (degrees)
CROSSROADS	N 33° 13’ 23” W 96° 58’ 11”	0°, 120°, and 240°	64	85 dBm	200 MHz	62 dBm	9
NAVO ROAD	N 33° 13’ 32” W 96° 55’ 36”	60°, 180°, and 300°	40	85 dBm	200 MHz	62 dBm	9
LITTLE ELM NORTH	N 33° 12’ 24” W 96° 55’ 50”	30°, 150°, and 270°	45	85 dBm	200 MHz	62 dBm	9

Figure 2: Denton Test Sites. From left to right in the figures above, the CROSSROADS, NAVO ROAD, and LITTLE ELM NORTH sites are shown. For each site, the MU-MIMO stations will be placed at the marked location. Mobile test terminals (UE devices) will be distributed within a 4 km radius of each station. Each site will have multiple azimuths at which we will perform testing, listed in table 1, with potential beam envelope described in Figure 1.

Interference Coordination

For a worst-case engineering analysis, we consider the case of a single user. We operate with an EIRP of 85 dBm/100 MHz and a beamwidth of 9°. We can use the 3GPP 38.901 RMa NLOS channel model to evaluate the range our transmission will potentially cause interference. Using the thermal noise floor of -90 dBm in 200 MHz, the signal must suffer 175 dB of loss before it is sufficiently attenuated. This distance corresponds to ~4 km using the above-mentioned 3GPP channel model, which can be considered the effective spectral footprint of our peak power transmissions.

To the best of our knowledge, there are no licensed users within range of our proposed spectral footprint, as defined by each test site, test azimuth, EIRP, and anticipated path loss. To ensure no harm to incumbent operation, we will operate for the minimum amount of time to perform each test. We will reduce power whenever feasible and maintain a physical downtilt on the antenna panel to limit the range. We will also monitor spectrum usage before operating to verify no spectral activity by incumbents.

Samsung is committed to avoiding harmful interference to the spectrum incumbents. Tests will take place only as needed under direct supervision and monitoring. In the unlikely event that harmful interference occurs, immediate requests to end transmissions can be directed to Chance Tarver, via email at c.tarver@samsung.com or phone at 325-301-8992.