Exhibit A. Experiment Objectives & Operations

XM Satellite Radio intends to utilize a System Validation Single Frequency Network (SV-SFN) of three (3) fixed locations and up to thirty (30) portable locations to optimize a terrestrial repeater system that will be used to augment the satellite Digital Audio Radio Service (DARS) system. Satellite signals at S-Band do not fully provide coverage to urban areas due to the severe blockage from buildings. Consequently, a terrestrial network will retransmit the satellite service signal to provide coverage in those urban areas where the satellite signal is blocked. To optimize the network planning, XM Satellite Radio plans to conduct a series of tests beginning in April 1999 using a limited number of transmitters.

Testing of the SV-SFN transmitter system will be for the purpose of channel characterization, including signal power and multi-path characteristics, to assist in establishing and validating propagation and channel models for a single frequency network. Consequently, on any given field testing day, one transmitter may be operating or several of the transmitters may be emitting RF energy simultaneously. These measurements will help verify techniques and equipment.

To allow the field collection to proceed efficiently and to ensure the accuracy of the data, the testing team will be able to remotely control and monitor the three fixed transmitters via a phone connection. The portable transmitters will each be controlled and monitored locally. Figures A-1 and A-2 illustrate the test architectures for the fixed and portable transmitters, respectively..

Testing is planned during the period of April 1999 through September 2000. XM Satellite Radio will conduct tests during normal working hours; non-working hour testing is not planned. The transmitters will only emit RF energy when tests are being conducted—the transmitters will be turned off at all other times.

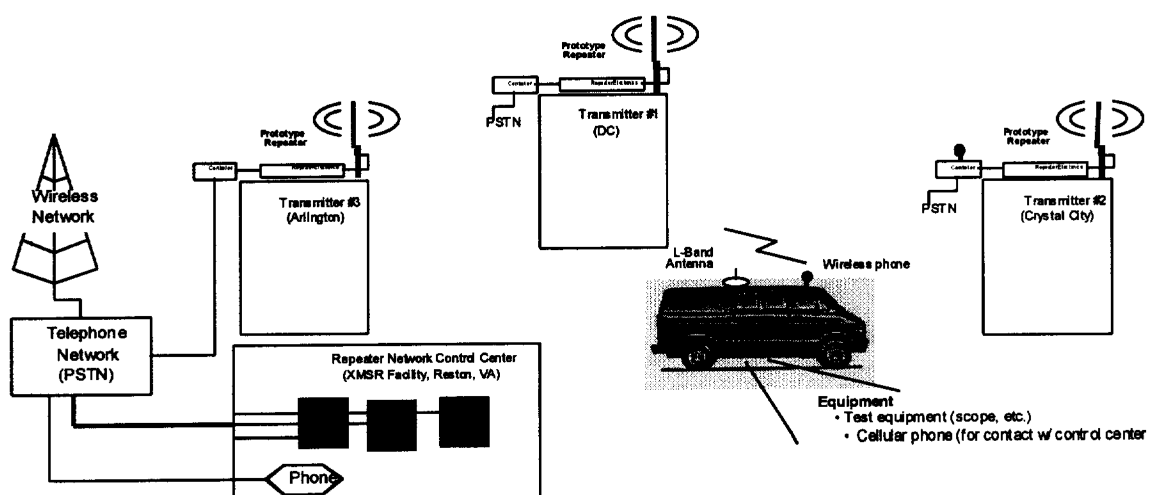

Figure A-1. Experiment Configuration - Fixed Transmitter Sites

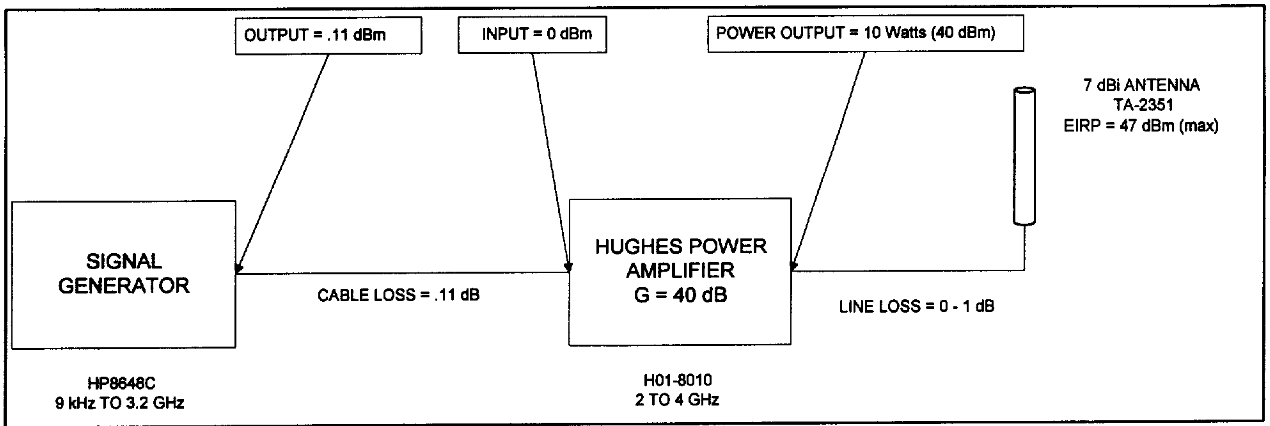

Figure A-2 Portable Test Transmitter

Exhibit B. Transmitter Locations

The System Validation Single Frequency Network (SV-SFN) will consist of three (3) fixed transmitters located in metropolitan Washington, DC and approximately 30 portable transmitters. The specific geographical and site parameters of the transmitters are listed in Table B-1 and shown in Figures B-1 and B-2. The portable transmitter locations will be distributed throughout the Washington D.C. metropolitan area within a 20 mile radius of 38-52-58N / 77-02-53W. Technical characteristics for the fixed transmitters and portable transmitters are provided in Exhibit C. The antennas for the transmitters will be located on controlled access roof-tops of buildings while the electronic equipment may be placed on the roof-tops or in top floor equipment rooms. When necessary, the antennas for the portable transmitters may be located on cranes. The antennas will not extend more than 6 m above the building height. The antennas will be mounted < 4 m above the building height.

Table B-1. Fixed Transmitter Site Parameters

Transmitter	Latitude (North)	Longitude (West)	Building Height above ground	Ground Elevation
SV-SFN Tx1	38 ° 54' 25"	77 ° 03' 08"	30.5 m*	15.9 m
SV-SFN Tx2	38 ° 51' 13"	77 ° 03' 06"	53.4 m*	13.1 m
SV-SFN Tx3	38 ° 53' 14"	77 ° 05' 46"	36.6 m*	79.9 m

* The antennas will be mounted < 4 m above the building height; they will not extend more than 6 m

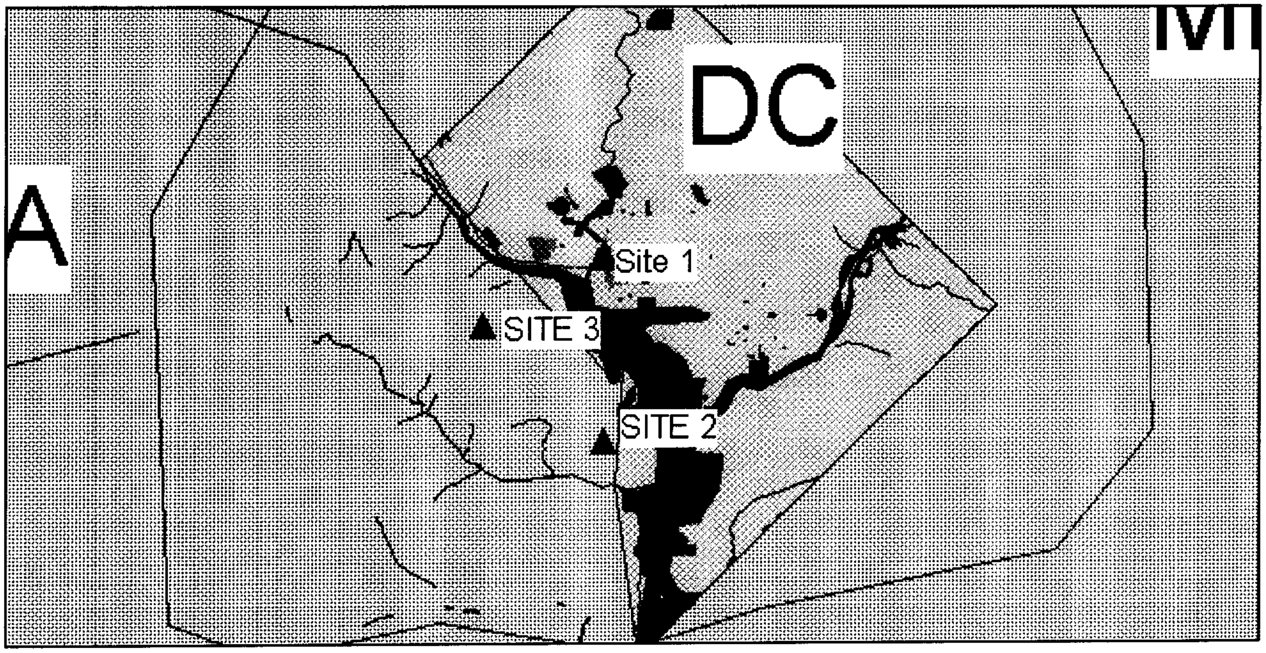

Figure B-1. System Validation Single Frequency Network Fixed Transmitter Locations

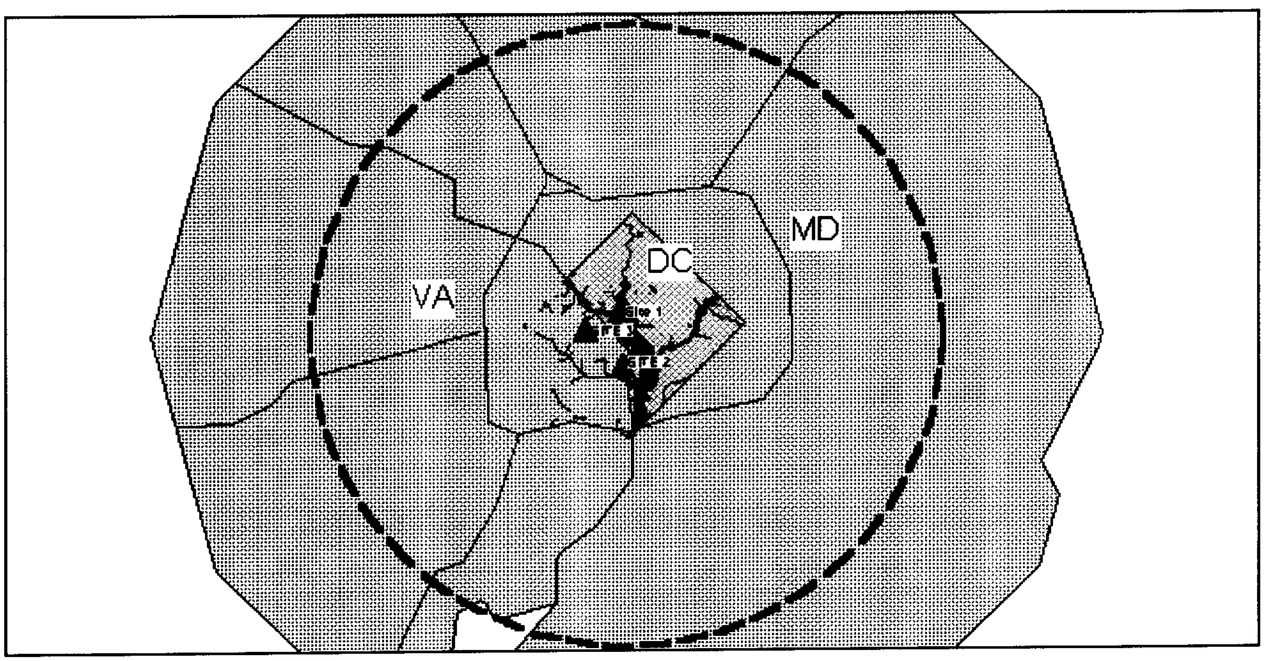

Figure B-2 Area of Testing, including Portable Transmitters

Exhibit C. Transmitter Technical Parameters

The three (3) fixed transmitters of the System Validation Single Frequency Network (SV-SFN) will be identical. The prototype design incorporated into each transmitter will not only verify the basic design but will also allow XM Satellite Radio to investigate various components.

Table C-1 summarizes the technical parameters of the fixed transmitters.

Table C-1. Transmitter Characteristics (Fixed Sites)

Component/Parameter	Value	Notes
Transmit Frequency	2332.5 - 2345 MHz	• Adjustable center frequency within range
EIRP Maximum Nominal	 1.2 kW 800 W	• Measured at antenna boresight • Referenced to isotropic antenna • Power will be adjustable (nominal EIRP = 800 W ± 200 W)
CW Tone Emission designator	 N0N	This signal will be used for propagation measurements.

The portable transmitters will use Continuous Wave transmissions and will be mainly used to characterize the propagation channel

Table C-2. Transmitter Characteristics of Portable sites

Component/Parameter	Value	Notes
Transmit Frequency	2332.5 - 2345 MHz	• Adjustable center frequency within range
EIRP		• Measured at antenna boresight
Maximum	50 W	• Referenced to isotropic antenna
Nominal	40 W	
Signal & Modulation	CW	Continuous wave transmissions

Table C-3. Transmitter Equipment Fixed Sites

Component/Parameter	Value	Notes
RF High Power Amplifiers: S-Band HPAs		Manufacturer: Unique Systems
Rated output power	100 W	
Spectral shoulder regrowth	30 dBc	
Back-off	>6 dB	Measured from 1 dB compression point
Antenna		Manufacturer: TIL-TEK
Model number	TA-2350	See data sheets later in this section for complete antenna pattern and other details
Gain at boresight	10 dBi	
Polarization	Vertical	
Electronic downtilt	0°	

Table C-4. Portable Transmitter Equipment

Component/Parameter	Value	Notes
Signal Generator		HP Signal Generator 8648C or equivalent
Power Amplifier	10 Watts	Hughes H01-8010 or equivalent
Antenna	7 dBi Omni	TA-2351 or equivalent

Enclosed Product Sheets:

- TIL-TEK TA-2350
- HP 8648C Signal Generator

Exhibit D. Radio-frequency Exposure Compliance

The transmitter antennas will be located on controlled access building roof-tops, so the exposure to humans will be limited. The transmitters can be turned off when roof-top activities close to the antennas are required by maintenance or other workers. In addition, the antennas will be situated such that the distance to near-by buildings will be greater than that indicated by the calculations listed below. Consequently, the FCC radio-frequency field exposure limits will not be exceeded.

For the purposes of predicting RF field strength and power density levels, the following equations from the OET Bulletin 65* are used:

$$S = \frac{\text{EIRP}}{4\pi R^2}$$

where: S = Power Density (mW/ sq cm)
EIRP = Transmit Power (mW) x Antenna Gain (relative it isotropic radiator)
R = distance to the center of radiation of the antenna (m)

As a worst case prediction, 100% reflection of the incoming radiation is assumed. This is representative of a roof top environment. This results in a four fold increase in power density giving:

$$S = \frac{\text{EIRP}}{\pi R^2}$$

Based on the FCC limits outlined in OET Bulletin 65 for maximum permissible exposure (MPE) for a frequency of 2340 MHz, the maximum allowable power density is calculated to be:

General Population Exposure =	1.0 mW/ sq cm
Occupational Exposure =	5.0 mW/ sq cm

* *Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields*, FCC OET Bulletin 65, Ed. 97-01, August 1997

Using these limits, the minimum separation distance required to receive this power density is calculated as a function of the antenna discrimination (see TIL-TEK TA-2350 antenna data sheet) and shown in Table D-1.

Table D-1. RF Exposure Limit Ranges

Angle Below Main Beam (Deg)	Antenna Gain (dBi)	Occupational (m)	General Pop (m)
0	10	2.52	5.64
5	6	1.59	3.56
10	-6	0.40	0.89
15	-2	0.63	1.42
20	-6	0.40	0.89
25	-3	0.56	1.26
30	-8	0.32	0.71
35	-5	0.45	1.00
40	-9	0.28	0.63
45	-5	0.45	1.00
50	-14	0.16	0.36
55	-8	0.32	0.71
60	-9	0.28	0.63
65	-18	0.10	0.22
70	-9	0.28	0.63
75	-8	0.32	0.71
80	-9	0.28	0.63
85	-10	0.25	0.56
90	-13	0.18	0.40

This is a worse case RF Exposure calculation. The field strengths for the portable transmitters will be lower in all cases.

Exhibit E. Emission Isolation to Existing Systems

XM Satellite Radio recognizes that the experimental transmitters are not allowed to cause harmful interference to nearby stations including systems operating in adjacent bands. In addition, XM Satellite Radio understands that space communications (Deep Space Network (DSN) in the 2290 - 2300 MHz band) and Radioastronomy (ARECIBO, 2370 - 2380 MHz) as well as aeronautical telemetry systems (> 2360 MHz) operate in nearby bands. As noted in the Wireless Communications Service (WCS) FCC reports, some existing multipoint distribution service and the instructional television fixed service (MDS/ITFS) systems have a poor front-end design with limited frequency selectivity and are thus susceptible to out-of-band operations in the 2.3 GHz band. XM Satellite Radio analysis, however, indicates that there is a very low probability for causing interference to existing systems both at the frequency of operation and in adjacent bands.

Because the experimental transmitters will be located on roof-tops, they may be situated near base stations for systems, such as MDS/ITFS. Preliminary measurements of the high power amplifier indicate that harmonics will be - 55 dBc and spurious emissions less than - 60 dBc. This combined with other reductions to out-of-band emissions (e.g., filtering at input to HPA, coupling loss to antenna) will dramatically reduce any emission outside the 2320 - 2345 MHz band. In addition, XM Satellite Radio will situate the antennas on the roof-tops to ensure that no existing basestation receives excessive RF energy.

Finally, the location of the transmitters in Washington, DC precludes any interference to the sensitive systems operated by the DSN or ARECIBO. Also, the transmitter 1.2 kW maximum EIRP is also below the maximum authorized (2 kW) for WCS systems operating in adjacent bands, so MDS/ITFS systems will be protected from interference.

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