

Date & Time Filed: Jul 12 2005 7:15:15:810PM  
File Number: SAT-STA-20050712-00145  
Callsign:

FEDERAL COMMUNICATIONS COMMISSION  
APPLICATION FOR SPACE STATION SPECIAL TEMPORARY AUTHORITY

FOR OFFICIAL USE ONLY

APPLICANT INFORMATION

Enter a description of this application to identify it on the main menu:  
Request for STA to operate indoor boosters

1. Applicant

<b>Name:</b>	XM Radio Inc.	<b>Phone Number:</b>	202-380-4000
<b>DBA Name:</b>		<b>Fax Number:</b>	202-380-4500
<b>Street:</b>	1500 Eckington Place, NE	<b>E-Mail:</b>	bill.bailey@xmradio.com
<b>City:</b>	Washington	<b>State:</b>	DC
<b>Country:</b>	USA	<b>Zipcode:</b>	20002
<b>Attention:</b>	William J. Bailey		

File # SAT-STA-20050712-00145  
Callsign: \_\_\_\_\_ Grant Date: 1/18/07  
(or other identifier)  
Term Dates  
From: 1/18/07 To: + 180 days  
Approved: [Signature] Policy Branch Chief  
w/conventions.

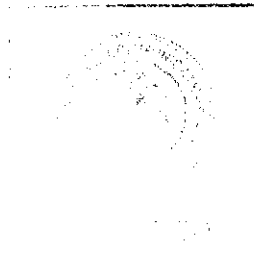
**Application of XM Radio Inc. for Special Temporary Authority**  
**IBFS File No. SAT-STA-20050712-00145**

Special temporary authority (STA) IS GRANTED to XM Radio Inc. (XM Radio) for a period of 180 days to operate up to 5,000 indoor terrestrial repeaters with an Effective Isotropically Radiated Power (EIRP) of 0.0001 watts at stores and other commercial establishments within the United States where satellite radio receivers are displayed or used, but where signals may be attenuated due to blockage from walls and ceilings, subject to the following conditions:

1. XM Radio shall operate the indoor terrestrial repeaters at its own risk and such operation shall not prejudice the outcome of the final rules adopted by the Commission in IB Docket 95-91;
2. XM Radio shall operate the indoor terrestrial repeaters on a non-interference basis with respect to all permanently authorized radiocommunication facilities;
3. The indoor terrestrial repeaters are restricted to the simultaneous retransmission of the complete programming, and only that programming, transmitted by the satellite directly to SDARS receivers;
4. Where applicable, coordination of the indoor terrestrial repeaters shall be completed with all affected Administrations prior to operation, in accordance with all applicable international agreements including those with Canada and Mexico;
5. The indoor terrestrial repeaters shall comply with Part 17 of the Commission's rules - Construction, Marking, and Lighting of Antenna Structures;
6. The indoor terrestrial repeaters shall comply with Part 1 of the Commission's rules, Subpart I - Procedures Implementing the National Environmental Policy Act of 1969, including the guidelines for human exposure to radio frequency electromagnetic fields as defined in Sections 1.1307(b) and 1.1310 of the Commission's rules;
7. The out-of-band emissions of the indoor terrestrial repeaters shall be limited to  $75 + \log(\text{EIRP})$  dB less than the transmitter EIRP;
8. XM Radio shall operate the indoor terrestrial repeaters according to the technical parameters provided in its application for special temporary authority to operate such indoor terrestrial repeaters;
9. The indoor terrestrial repeaters shall be professionally installed pursuant to written instructions provided by XM Radio and shall be labeled with contact telephone numbers for XM Radio to be called in the event that an indoor terrestrial repeater causes interference;
10. XM Radio shall immediately shut down any, or all, indoor terrestrial repeaters upon a complaint of interference, upon direction from the Commission, or upon finding that an indoor terrestrial repeater has not been properly installed;

**Application of XM Radio Inc. for Special Temporary Authority  
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11. XM Radio is granted 30 days from the date of the release of this authorization to decline the authorization as conditioned. Failure to respond within that period will constitute formal acceptance of the authorization as conditioned.
12. This action is issued pursuant to Section 0.261 of the Commission's rules on delegated authority, 47 C.F.R. § 0.261, and is effective immediately. Petitions for reconsideration under Section 1.106 or applications for review under Section 1.115 of the Commission's rules, 47 C.F.R. §§ 1.106, 1.115, may be filed within 30 days of the date of the public notice indicating that this action was taken.



w/conditions

File # SAT-STA-20050712-00145

Call Sign \_\_\_\_\_ Grant Date 1/18/07  
(or other identifier)

Term Dates  
From 1/18/07 To + 180 days

John L. Keagy  
Policy Branch Chief

<b>2. Contact</b>	
<b>Name:</b> Bruce D. Jacobs	<b>Phone Number:</b> 202-663-8077
<b>Company:</b> Pillsbury Winthrop Shaw Pittman LLP	<b>Fax Number:</b> 202-663-8007
<b>Street:</b> 2300 N Street, NW	<b>E-Mail:</b> bruce.jacobs@pillsburylaw.com
<b>City:</b> Washington	<b>State:</b> DC
<b>Country:</b> USA	<b>Zipcode:</b> 20037 -1128
<b>Attention:</b>	<b>Relationship:</b> Legal Counsel
(If your application is related to an application filed with the Commission, enter the file number below.)	
<b>3. Reference File Number</b>	
<b>4a. Is a fee submitted with this application?</b>	
<input checked="" type="radio"/> If Yes, complete and attach FCC Form 159. If No, indicate reason for fee exemption (see 47 C.F.R. Section 1.1114).	
<input type="radio"/> Governmental Entity <input type="radio"/> Noncommercial educational licensee	
<input type="radio"/> Other (please explain):	
<b>4b. Fee Classification</b> CRY - Space Station (Geostationary)	
<b>5. Type Request</b>	
<input type="radio"/> Change Station Location	<input type="radio"/> Extend Expiration Date
	<input checked="" type="radio"/> Other
<b>6. Temporary Orbit Location</b>	
	<b>7. Requested Extended Expiration Date</b>

8. Description (If the complete description does not appear in this box, please go to the end of the form to view it in its entirety.)

XM Radio Inc. requests Special Temporary Authority to operate up to 5000 indoor signal boosters in its licensed frequency band (2332.5-2345 MHz) with an Effective Isotropically Radiated Power (EIRP) of 0.0001 watts.

9. By checking Yes, the undersigned certifies that neither applicant nor any other party to the application is subject to a denial of Federal benefits that includes FCC benefits pursuant to Section 5301 of the Anti-Drug Act of 1988, 21 U.S.C. Section 862, because of a conviction for possession or distribution of a controlled substance. See 47 CFR 1.2002(b) for the meaning of "party to the application"; for these purposes.

Yes  No

10. Name of Person Signing  
William J. Bailey

11. Title of Person Signing  
Senior Vice President

12. Please supply any need attachments.

Attachment 1: Letter

Attachment 2:

Attachment 3:

WILLFUL FALSE STATEMENTS MADE ON THIS FORM ARE PUNISHABLE BY FINE AND / OR IMPRISONMENT  
(U.S. Code, Title 18, Section 1001), AND/OR REVOCATION OF ANY STATION AUTHORIZATION  
(U.S. Code, Title 47, Section 312(a)(1)), AND/OR FORFEITURE (U.S. Code, Title 47, Section 503).

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**THE FOREGOING NOTICE IS REQUIRED BY THE PAPERWORK REDUCTION ACT OF 1995, PUBLIC LAW 104-13, OCTOBER 1, 1995, 44 U.S.C. SECTION 3507.**



July 12, 2005

**VIA ELECTRONIC FILING**

Ms. Marlene H. Dortch, Secretary  
Federal Communications Commission  
445 12th Street, S.W.  
Washington, D.C. 20554

**Re: XM Radio Inc.  
Request for Special Temporary Authority to Operate Indoor Signal Boosters  
in the Satellite Digital Audio Radio Service**

Dear Ms. Dortch:

XM Radio Inc. ("XM"), pursuant to 47 C.F.R. § 25.120,<sup>1</sup> hereby requests Special Temporary Authority ("STA") to operate up to 5,000 indoor signal boosters manufactured by Translight Video Systems, Inc. with an Effective Isotropically Radiated Power ("EIRP") of 0.0001 watts in its licensed frequency band (2332.5-2345 MHz). This STA is requested for a period of 180 days or until the date on which permanent rules become effective for the operation of Satellite Digital Audio Radio Service ("SDARS") terrestrial repeaters, whichever occurs first. Grant of this STA will serve the public interest because the boosters will allow for adequate reception of XM's satellite radio service inside of stores and other establishments where satellite radio receivers are displayed or used but where signals may be attenuated due to blockage from walls and ceilings. Because these boosters will transmit at an extremely low power, there is no potential for interference to other communications services.<sup>2</sup>

*Background.* The Commission has recognized that terrestrial repeaters are critical to satellite radio to overcome the effects of signal blockage and multipath interference.<sup>3</sup> Consistent with this policy, the International Bureau ("Bureau") in September 2001 granted XM an STA to operate terrestrial repeaters while the Commission concludes its rulemaking proceeding

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<sup>1</sup> XM has filed this STA request electronically via the International Bureau Filing System. An FCC Form 159 and the accompanying \$735.00 filing fee are being submitted under separate cover.

<sup>2</sup> XM has notified Sirius Satellite Radio Inc. of this request, and it does not object.

<sup>3</sup> See *Establishment of Rules and Policies for the Digital Audio Radio Satellite Service in the 2310-2360 MHz Frequency Band, Report and Order, Memorandum Opinion and Order, and Further Notice of Proposed Rulemaking*, 12 FCC Rcd 5754 (1997) ("DARS Order and FNPRM").

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regarding final technical rules.<sup>4</sup> In granting this STA, the Bureau noted that XM “needs to employ terrestrial repeaters to provide adequate service.” See *XM Radio STA Order* ¶ 7. Soon after grant of this STA, XM began commercial service. Since that time, satellite radio has proven to be an unmitigated success, confirming the Commission’s vision in establishing the satellite radio service.

In June 2003, the Bureau granted XM and Sirius Satellite Radio Inc. (“Sirius”) STAs to jointly own and operate in-store signal boosters in their licensed frequency band.<sup>5</sup> These boosters are S-band radio frequency amplifiers.<sup>6</sup> XM uses these signal boosters to receive and amplify satellite and terrestrial signals inside of retail outlets, where such transmissions are attenuated, to demonstrate the capability of satellite radio. To date, XM has not received any complaints of interference resulting from its operation of these signal boosters. In June 2005, XM filed a request for an STA to operate an additional 5000 of these boosters.<sup>7</sup>

*STA Request.* With this application, XM requests an STA to operate 5000 indoor signal boosters manufactured by Translight Video Systems, Inc. with an EIRP of 0.0001 watts in its licensed frequency band (2332.5-2345 MHz). The technical parameters and configuration of these boosters will be similar to XM’s currently authorized boosters. An antenna will be located on the roof or mounted on the outside walls of a store or other structure to receive the XM satellite signal and, where available, terrestrial signal. The signal will then be fed via coaxial cable to an inline amplifier and subsequently to an antenna inside an establishment which will amplify the signal. The transmitted carriers have a center frequency and frequency stability identical to the received satellite and terrestrial carriers.

These boosters, like the previously approved signal boosters, are essentially S-band radio frequency amplifiers. They are ideally suited for supplementing satellite radio coverage indoors, such as inside stores and other establishments where satellite radio receivers are displayed or used.

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<sup>4</sup> *XM Radio, Inc., Application for Special Temporary Authority to Operate Satellite Digital Audio Radio Service Complimentary Terrestrial Repeaters, Order and Authorization*, DA 01-2172, at ¶ 18 (rel. September 17, 2001) (“*XM Radio STA Order*”).

<sup>5</sup> XM Radio Inc., Request for Special Temporary Authority, File No. SAT-STA-20030409-00076 (granted June 23, 2003) (“*XM Booster STA*”).

<sup>6</sup> Unlike boosters, repeaters perform a change in modulation and operate at EIRPs over ten million times higher than boosters.

<sup>7</sup> XM Radio Inc., Request for Special Temporary Authority, File No. SAT-STA-20050601-00113 (filed June 1, 2005).



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XM will distribute the signal boosters along with an Installation Manual. An illustrative Installation Manual is attached as Exhibit A. The signal boosters will be required to be installed pursuant to the Installation Manual. Other than a mechanical swivel which permits the user to align the booster transmit antenna with the indoor receiving antenna, the boosters have no operator controls and are not adjustable by the user. Pursuant to contractual arrangements, XM will maintain ownership and operational control of each of these indoor signal boosters and will retain the right to shut down any signal booster upon a complaint of interference, upon direction of the Commission, or upon finding that a booster has not been installed in accordance with the Installation Manual. Each booster will be labeled with the phone number of XM's repeater operations center (202-529-7012) in the event that a booster causes interference. XM's repeater operations center is staffed 24 hours per day, 7 days per week.<sup>8</sup>

In Exhibit B, XM provides a list of technical parameters for the indoor signal boosters it seeks to operate pursuant to this STA. XM has included the following information: (1) antenna type; (2) antenna beamwidth; (3) total EIRP; and (4) approximate maximum height Above Ground Level (AGL).<sup>9</sup>

The location of each indoor signal booster does not constitute part of the "full particulars of the proposed operation" which must be submitted with an application for STA.<sup>10</sup> Because the indoor signal boosters will operate at such a low EIRP that they will not cause blanketing interference to any Wireless Communications Service ("WCS") receivers, even ones operated very close to the signal boosters, there is no need to identify the location of the boosters in this application. Furthermore, it would be impractical for XM to list the establishments nationwide at which it plans to deploy these indoor signal boosters or to modify this STA every time XM were to operate an indoor booster at a new retail establishment. To the extent that the Commission determines that location information is required, XM respectfully requests that the Commission waive this requirement.<sup>11</sup>

*Interference Considerations.* The indoor signal boosters will not cause harmful interference to other radio services. Because XM has exclusive use of its licensed frequency band,<sup>12</sup> there is no potential for in-band interference. Moreover, these additional indoor signal

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<sup>8</sup> XM Radio's point of contact for Commission inquiries regarding operation of the boosters is Craig Wadin (phone: 561-226-1218; fax: 561-883-5642; e-mail: [craig.wadin@xmradio.com](mailto:craig.wadin@xmradio.com)).

<sup>9</sup> XM notes that the manufacturers of these boosters may change, but the specifications will remain the same.

<sup>10</sup> 47 C.F.R. § 25.120(a).

<sup>11</sup> 47 C.F.R. § 1.3.

<sup>12</sup> 47 C.F.R. § 25.202(a)(6) (stating the 2320-2345 MHz band is allocated exclusively for SDARS).

boosters, like the current boosters, will not cause adjacent band interference to WCS licensees in the 2305-2320 MHz and 2345-2360 MHz bands.

As set forth in Exhibit C, assuming the worst case scenario for interference to WCS operations (*i.e.*, WCS equipment operating on a frequency adjacent to the upper edge of XM's licensed frequency band and operating within 5.3 feet of the signal booster), WCS licensees will have a margin of 19 dB, which is sufficient for any digital fixed wireless or mobile use. Moreover, where WCS equipment operates outside of the structure where the booster is located, the margin will increase by another 9 dB as a result of wall or ceiling attenuation, providing additional protection to any possible outdoor WCS receivers. And, as required by the Installation Manual, both the SDARS roof or wall-mounted receive antenna and the signal booster antenna will be installed with sufficient isolation to avoid reflection. Moreover, the booster will filter any WCS signals to avoid unintentionally boosting WCS signals along with the SDARS signal.

*Public Interest Considerations.* Prompt grant of this STA will promote the continued success of satellite radio and thereby serve the public interest. This STA will allow for clear reception of satellite radio inside of stores and other establishments where satellite radio receivers are used or displayed. Due to blockage from walls and ceilings, it is often difficult to provide quality reception of satellite and even terrestrial signals inside of certain structures. Grant of this request is particularly critical given the display and use of portable, hand-held satellite radio receivers inside of retail and other establishments nationwide. Many such establishments are located in areas that receive only a satellite signal or a weak repeater signal, thereby limiting the potential for indoor reception. By operating an indoor signal booster, XM will be able to provide indoor reception without the need for a hard wire connection to the receiver. As XM explained in its original booster STA request, a hard wire connection misleads consumers to believe that satellite radio is not a mobile service. In addition, grant of the requested STA will enable XM to deploy advanced technology, which will support the continued growth and development of satellite radio service.

XM certifies that its operation of the boosters will comply with the same conditions the Commission imposed on XM in granting its original repeater STA. *See XM Radio STA Order* ¶ 18. Specifically, XM Radio certifies the following:

- (a) Any actions taken as a result of this STA are solely at XM Radio's own risk. This STA will not prejudice the outcome of the final rules adopted by the Commission in GEN Docket 95-91;
- (b) Operation of the boosters authorized pursuant to this STA is on a non-interference basis with respect to all permanently authorized radiocommunication facilities;

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- (c) The booster is restricted to the simultaneous retransmission of the complete programming, and only that programming, transmitted by the satellite directly to SDARS receivers;
- (d) Where applicable, coordination of the booster shall be completed with all affected Administrations prior to operation, in accordance with all applicable international agreements including those with Canada and Mexico;
- (e) The booster will comply with Part 17 of the Commission's rules regarding antenna structures;
- (f) The booster will comply with Part 1 of the Commission's rules, Subpart I - Procedures Implementing the National Environmental Policy Act of 1969, including the guidelines for human exposure to radio frequency electromagnetic fields as defined in Sections 1.1307(b) and 1.1310 of the Commission's rules;
- (g) The out-of-band emissions of the booster will be limited to  $75 + \log(\text{EIRP})$  dB less than the transmitter EIRP.

One of the conditions imposed in the original STA grant was the requirement that XM pre-coordinate with WCS licensees any repeater affecting an operational WCS base station. See *XM Radio STA Order* ¶ 14. XM is not aware of any operational WCS base stations. Moreover, as required with XM's currently authorized boosters, the boosters will be professionally installed pursuant to written instructions provided by XM and will be labeled with the contact telephone number for XM to be called in the event that a booster causes interference. *XM Booster STA*, Condition #12.

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Please direct any questions regarding this matter to the undersigned.

Very truly yours,

/s/William J. Bailey  
William J. Bailey  
Senior Vice President, Regulatory and  
Government Affairs

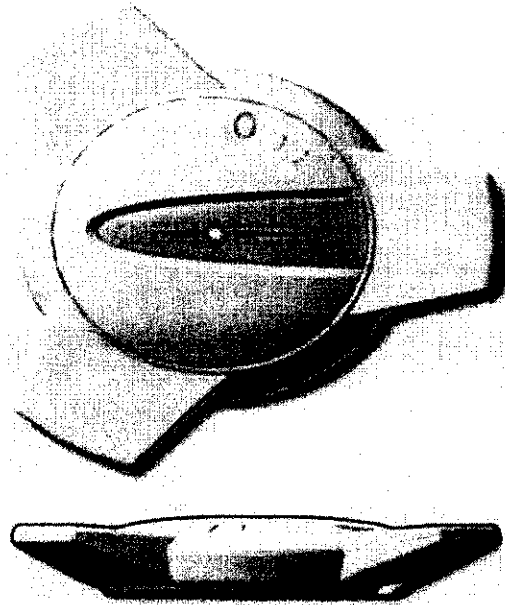
cc: Stephen Duall

**EXHIBIT A**

**Illustrative Installation Manual**

**ILLUSTRATIVE USERS MANUAL**

**TRANSLIGHT IN-BUILDING BOOSTERS**



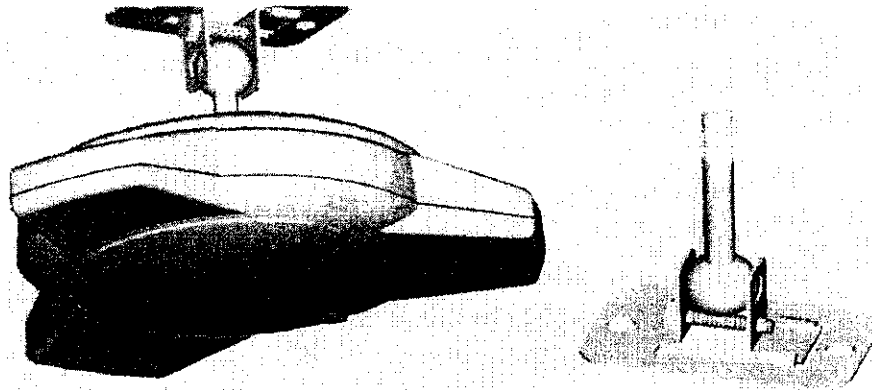
**TRANSLIGHT VIDEO SYSTEMS INC.**

**LA JOLLA CA 92037**

## 1.0 System Overview and Indoor Booster Description

Wireless systems frequently suffer from insufficient RF coverage particularly in enclosed areas such as residential homes, apartment buildings, office buildings, or shopping mall areas (to mention a few). Those weak coverage areas can be eliminated by installing active RF boosters which amplify filter and redirects the stronger available outdoor signal indoor with a properly selected indoor coverage antennae.

Figure 1: TransLight Indoor Booster



The TransLight Booster to be installed at a customer location consists of a booster housing, swivel to align the transmitting and receiving antenna fields, a wallwart-type power supply providing 9v to the booster system, and sufficient amount of coax to connect the indoor booster with the outdoor receiving antenna.

The booster housing consists of front and back covers. On the front cover, one can find the ON/OFF push button and a green LED power on indicator. On the back cover, access is provided to the power connector and to the RF input connector of the booster. In addition, a threaded insert is molded in the back cover for the swivel arm to be attached to it during installation.

In addition, a distribution amplifier is provided to compensate for cable losses and to ensure the booster has the necessary input signal level needed for proper operation.

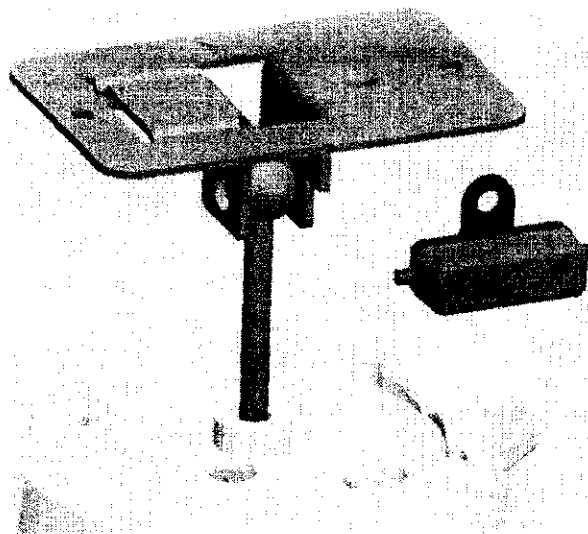
## 2.0 Installation Procedures

Installation of a booster consists of finding a suitable location for the housing to be mounted. Ideally, the booster will be located at the highest point with direct view of the area to be covered. At that location, one first mounts the base of the swivel, then mounts the booster with its attached swivel arm, and then tightens the screws to install the swivel arm on to the base. Now the swivel can be rotated to left and right, and up and down.

Once the booster is mounted onto the swivel base, one can proceed with the installation of the RF and the power cables to the booster. Make sure that a proper power supply (and connector) is used to supply the power to the booster (and the other serially-connected components on the RF cable) which are powered by it.

### **3.0 Distribution Amplifier Installation Instructions**

The distribution amplifier is an essential component of the booster system and will most likely be included in a large number of booster installations. Its purpose is to compensate for the cable losses and to make sure that the signal level at the input of the booster is in its proper range. The distribution amplifier when installed is powered by the booster, and the installation consists simply of serially inserting a SMB male to male amplifier at the cable extension point between two sections of coax cable properly connected (SMB female to female in this case). The distribution amplifier has to drive a minimum length of 16 feet of coax cable, and a max of 150 feet.



**Figure 2: Booster on a swivel and the associated distribution amplifier**



#### **4.0 Other Installed Components of An Indoor Booster System**

The other components of the system include outdoor amplified antenna and a home satellite radio receiver with its indoor amplified antenna.

SDARS roof or wall-mounted receive antenna and the signal booster antenna must be installed with sufficient isolation to avoid reflection. During installation, special attention must be paid to minimizing multipath and reflection effects. Each antenna location selection must be made to minimize the multipath and maximize the isolation between different antenna, thus minimizing the reflections and avoiding dead spots at their different locations.

Input amplified antenna feeds the indoor satellite receiver with signal received from the booster and thus its location also has to be selected judiciously. Ideally, it has to be mounted as high as possible to prevent people walking to affect the quality of the reception and away from places that can cause reflections and multipath.

#### **5.0 Completion of Installation - Final Test**

Once the outdoor/indoor amplified antennae, receiver, and the booster components have been installed, one can now align and test the system for proper operation by observing the RSSI and BER at the receiver.

### Specifications

Electrical	Satellite Radio
Frequency band	2320-2345 MHz
Gain (Center frequency)	36 db min
Gain Flatness (full band)	+!- 0.5 db
Noise figure	3.9 db
Input Impedance	50 ohms
Input VSWR	1.6
Time delay	< 0.1 nsec
Output IP <sub>3</sub> (db)	25 dbm
Output P <sub>1</sub> (db)	15 dbm
Supply Voltage (From external wall wart)	9v(-1+0.3)v
Supply current	<150 ma
Spectral Mask	Meets FCC-specified mask
Operating temperature	-20 to +55°C
storage	-40 to +85°C
On-board indoor antenna	1/4 wave brass PCB mount patch
Antenna impedance	50 Ohms
Antenna gain (omni-hor)	0 dbi
Environmental	in/outdoor environment
Mechanical	
Input RF connector	SMB Male
Connector voltage to outdoor antenna	9V +1- 0.3V
Power "on" indicator LED	Green
Dimensions	6" DIA, 1" Thick
Weight	< 6 oz
Fastening /Alignment	Swivel mount

## EXHIBIT B

Attached is the following information for each of the indoor signal boosters XM seeks to operate pursuant to this STA.

- (1) antenna type;
- (2) antenna beamwidth;
- (3) total EIRP; and
- (4) approximate height Above Ground Level (AGL)

City	Antenna Type	Antenna Beamwidth	EIRP Total in Watts	Height AGL
Various	Integrated patch	160 degrees	.0001	< 50 feet

The transmitted carriers have a center frequency and frequency stability identical to the received SDARS satellite or terrestrial carriers. Frequency accuracy is controlled by the satellite or terrestrial repeater and not by the booster.

## EXHIBIT C

### Calculation of Free-Space Loss

$$\begin{aligned}\alpha(\text{in dB}) &= 36.6 + 20 \log (f) + 20 \log (d) \\ f &= \text{transmission frequency in MHz} \\ d &= \text{separation distance in miles}\end{aligned}$$

Assuming the *worst case* frequency (*i.e.*, 2345 MHz) and 0.001 miles (*i.e.*, 5.3 feet) separation:

$$\begin{aligned}\alpha(\text{in dB}) &= 36.6 + 20 \log (2345) + 20 \log (0.001) \\ &= 36.6 + 67.4 - 60.0 \\ &= 44 \text{ dB}\end{aligned}$$

### Calculation of Signal Power Received ( $P_R$ ) By WCS Receiver Assuming It Has Omni-Directional (0 dBi) Antenna

$$P_R(\text{in dBW}) = \text{EIRP}_{MP} - \alpha$$

$\text{EIRP}_{MP}$  is the output of the booster at beampeak (*i.e.*, 0.0001 watts or -40 dBW) (antenna beamwidth at 3 dB pattern points is 75°).

$$\begin{aligned}P_R(\text{in dBW}) &= -40 \text{ dBW} - 44 \text{ dB} \\ &= -84 \text{ dBW}\end{aligned}$$

### Calculation of Margin at WCS Receiver (Assuming A Well-Designed Unit Operates Unimpaired With OOB Interference Of -65 dBW)

$$\begin{aligned}\text{Margin} &= -65 \text{ dBW} - (-84 \text{ dBW}) \\ &= 19 \text{ dB}\end{aligned}$$

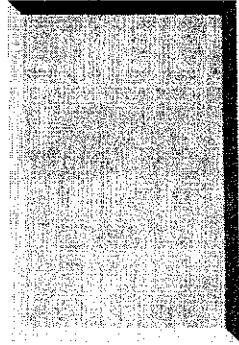
#### Notes:

- (1) The calculation is done on a line-of-sight (*i.e.*, 5.3 feet) co-polarized basis.
- (2) The booster is for indoor operation and no wall/ceiling attenuation, which would normally exist, has been added to the margin. Where WCS equipment operates outside of the building where the booster is located, the margin will increase by another 9 dB as a result of wall or ceiling attenuation, providing additional protection to any possible outdoor WCS receivers.
- (3) Near field effects should be negligible. Locations at other than beampeak receive even lower  $P_R$  levels.

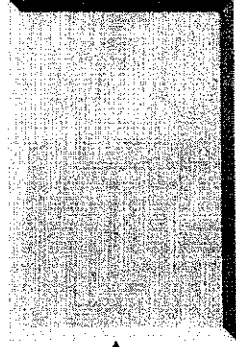
**EXHIBIT D**

Block Diagram

ROOFTOP  
ANTENNA



A 2-pole filter has 6 dB  
attenuation at WCS frequency



BOOSTER  
ANTENNA

A 4-pole filter has 12 dB attenuation  
at WCS frequency

THUS:

With a 2-pole filter at the rooftop and a 4-pole filter  
at the booster, the total attenuation of the WCS  
frequency will be 18 dB.

With -30 dBm maximum SDARS EIRP, the  
maximum SDARS EIRP at the nearest WCS  
frequency will be -48 dBm.