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Federal Communications Commission
Office of Secretary

Before the
Federal Communications Commission
Washington, DC 20554

In the Matter of

Satellite CD Radio, Inc.

Application to Modify Authorization to
Launch and Operate a Digital Audio Radio
Satellite Service in the 2320.0-2332.5 MHz
Frequency Band

File No. SAT-MOD-19981211-00099

Satellite CD Radio, Inc.
Consolidated Response to Comments

Satellite CD Radio, Inc. ("CD Radio") files this consolidated response to oppose the comments of XM Satellite Radio, Inc. ("XM") and WCS Radio, Inc. ("WCSR") on the above-captioned proceeding.¹

CD Radio's application to modify its license seeks authority to improve the quality of satellite digital audio radio service ("satellite DARS") that will soon be offered to the public by placing three satellites into inclined and elliptical (non-geostationary) orbits. Neither XM nor WCSR disputes the substantial public benefits of CD Radio's proposed non-geostationary system. Instead, XM and WCSR, in an apparent attempt to obfuscate the advantages of CD Radio's enhanced satellite network, raise irrelevant, and sometimes factually incorrect, assertions regarding

¹ See Application of Satellite CD Radio, Inc. to Modify Authorization to Launch and Operate a Digital Audio Radio Satellite Service, File No. SAT-MOD-19981211-00099 (filed Dec. 11, 1998); see also Satellite CD Radio, Inc., Request for Extension of Time to File a Consolidated Response, File No. SAT-MOD-19981211-00099 (filed Feb. 10, 1999).

the design of an interoperable receiver and interference. XM's and WCSR's *receiver* interoperability comments are irrelevant because they have no relationship to the request by CD Radio—permission to modify its *satellite* system. In any event, CD Radio's use of time division multiplexing ("TDM") for its non-geostationary satellite signals will foster interoperability. Lastly, XM invents a new reading of the statute and rules to assert that CD Radio paid insufficient filing fees.

XM's and WCSR's concerns simply have no bearing on CD Radio's modification request. Most of the issues are already being addressed in other contexts. Because CD Radio's improved satellite network will advance the promise of satellite DARS without any adverse effects, and because CD Radio submitted the appropriate processing fee, the Commission should not hesitate to grant CD Radio's requested modification.

I. GRANT OF CD RADIO'S MODIFICATION WILL SERVE THE PUBLIC INTEREST

CD Radio's modification application demonstrates its commitment to the best possible public service using a high quality, state-of-the-art satellite system. CD Radio has invested hundreds-of-millions of dollars in developing satellite DARS. Through its modification application, CD Radio seeks the Commission's permission to provide superior quality satellite DARS using three satellites in elliptical and inclined (non-geostationary) orbits, rather than two geostationary satellites. Although more expensive than the previously authorized geostationary satellite system, CD Radio is developing its non-geostationary system to meet better the Commission's satellite DARS criteria and fulfill the promise, and realize the full potential, of satellite DARS. Among other advantages, CD Radio's proposed non-geostationary satellite system will provide superior nationwide coverage at higher elevation angles and with fewer terrestrial repeaters, and will allow the transmission of more channels within the same frequency band, as detailed in the Technical

Annex.² Overall, CD Radio's system enhancements will offer dramatically improved service without any adverse effects or public cost.

XM and WCSR do not dispute the substantial public benefits of CD Radio's satellite modification. Instead, XM's and WCSR's comments attempt to obfuscate these benefits by raising irrelevant, and inaccurate, concerns regarding interoperability and interference. As CD Radio demonstrates below, neither XM nor WCSR has raised any issue that would warrant denial of CD Radio's modification request.

II. CD RADIO'S USE OF NON-GEOSTATIONARY SATELLITES WILL NOT IMPEDE RECEIVER INTEROPERABILITY

A. Grant of CD Radio's Modification Will Facilitate Receiver Interoperability With XM

Nothing in CD Radio's modification request will prevent or delay the design of a receiver that is interoperable with XM. CD Radio has requested the Commission's permission to increase the number of satellites in its DARS network from two to three and to place all three satellites in non-geostationary orbits. The purpose of CD Radio's modification request is to achieve better U.S. service, not to alter interoperability obligations with XM. Nevertheless, XM asserts that CD Radio's modification will make an interoperable design more difficult. XM's assertion is misplaced, as the Technical Annex demonstrates.³ CD Radio's request to modify its in-orbit delivery mechanism for satellite DARS signals has nothing to do with the ability to design an interoperable receiver. Indeed, the only modification requested by CD Radio that affects interoperability is the use of TDM for satellite-to-Earth down-links. This modification will actually facilitate interoperability with XM.

² See attached Technical Annex.

³ *Id.*

The irrelevance of XM's interoperability concerns is demonstrated by its assertion that CD Radio's modified system will prevent interoperability only with XM's fixed site receivers or receivers using directional antennas.⁴ Nothing about CD Radio's requested modification alters XM's ability to deploy interoperable receivers. First, XM's planned mobile antennas are already ideally suited to receive signals from CD Radio's proposed non-geostationary satellite system and would work equally well in fixed sites.⁵ Second, XM could not possibly use only high-gain, single direction antennas without *de facto* violating its obligation to provide interoperability. Very high-gain antennas focus on a single geostationary orbital location and thus preclude interoperability with other satellite DARS systems (geostationary or non-geostationary). Finally, XM could employ fan-shaped or ellipsoidal antenna beams, which might satisfy XM's fixed satellite high-gain requirements while still including CD Radio's enhanced non-geostationary satellite system. As the Technical Annex explains, in light of these alternative antenna options, there is no reason to believe that CD Radio's use of a non-geostationary satellite system would impede the design of an interoperable receiver.⁶

⁴ See Comments of XM Satellite Radio, Inc., In re Application of Satellite CD Radio, Inc. to Modify Authorization to Launch and Operate a Digital Audio Radio Satellite Service, File No. SAT-MOD-19981211-00099, at 6 (filed Feb. 8, 1999); Technical Analysis at 1.

⁵ XM has questioned CD Radio's proposal to mount antennas on south-facing walls. CD Radio agrees with XM.

⁶ XM claims that a recent patent suit by CD Radio affects interoperability. This is simply not true. The patent suit is about whether XM has infringed CD Radio's patents. Interoperability, by contrast, involves whether CD Radio and XM can design receivers capable of receiving signals from each other's systems. An interoperable receiver design is technically possible even were XM not to use CD Radio's patented intellectual property. In any event, the FCC does not adjudicate civil suits in its proceedings. *Cf. Regents of the University System of Georgia v. Carroll*, 338 U.S. 586, 602 (1950) (the Communications Act does not give the Commission authority to litigate civil claims).

In addition to raising fictitious interoperability concerns, XM misrepresents the current state of the interoperability discussions. First, CD Radio has made substantial design concessions to achieve interoperability with XM. For example, CD Radio has agreed on a band segmentation plan that will aid interoperability; both CD Radio and XM will divide their respective bands in thirds. Similarly, CD Radio will use Coded Orthogonal Frequency Division Modulation (“COFDM”) for its terrestrial repeater transmission modulation—the same modulation used by XM. CD Radio also will use the same transmission modulation for spacecraft-to-Earth down-links—TDM. Most recently, CD Radio and XM are nearing agreement on a plan to avoid mutual interference between their systems.⁷ With the adoption of each of these joint solutions, progress has been made toward achieving interoperability with XM.⁸

Both companies were recently required to freeze their separate initial chip designs to accommodate rapidly approaching launch dates—approximately 11 months for CD Radio. This does not mean, however, that CD Radio’s and XM’s receivers will not be interoperable. Radio manufacturers are fully capable of producing receivers that accommodate both chip designs, and will likely do so if demand warrants.⁹

⁷ As noted in the Technical Annex, XM apparently intends to file an application to modify its satellite DARS system. As a result, the exact parameters of XM’s system are not now known; the final XM system will be different than that currently on file with the Commission.

⁸ Further agreement between XM and CD Radio has not been achieved because XM’s insistence on backward compatibility with Worldspace’s existing dual carrier technology hampers its flexibility to design an interoperable receiver.

⁹ To the extent XM plans further system modifications, however, a delay in interoperability could result.

B. WCSR's Interoperability Request Is Irrelevant to CD Radio's Modification Request And Inconsistent With Commission Policy

CD Radio seeks to provide a premium quality satellite DARS service. WCSR, as shown by its insistence on interjecting interoperability into this proceeding, seeks to delay CD Radio's provision of satellite DARS so that it may "piggy back" on CD Radio's technical innovations. CD Radio's request to improve its satellite network by using three satellites in inclined and elliptical (non-geostationary) orbits has nothing to do with WCSR's legal ability to demand an interoperable receiver design. As CD Radio has stated previously, the Commission's well-established, interoperability rules do not apply to WCSR,¹⁰ and nothing in CD Radio's modification request alters that fact. The proper forum to resolve WCSR's interoperability request is the current proceeding regarding WCSR's application for authority to provide satellite DARS, where this issue has been raised and briefed and is now ripe for decision.¹¹

III. CD RADIO'S USE OF NON-GEOSTATIONARY SATELLITES WILL NOT CAUSE UNACCEPTABLE INTERFERENCE TO CO-CHANNEL FACILITIES IN CENTRAL AND SOUTH AMERICA

CD Radio's non-geostationary satellite system is designed to maximize the satellites' orbits over the United States and should not cause unacceptable interference to co-channel facilities that might, in the future, be deployed in Central and South America. XM's concern for southern

¹⁰ See Satellite CD Radio, Inc. Petition to Dismiss or Deny, In re Application of WCS Radio, Inc. For Authorization to Construct, Launch, and Operate Two Communications Satellites In the Digital Audio Radio Service, File Nos. SAT-LOA-19981113-00085/86, at 41-45 (filed Jan. 13, 1999); Reply of Satellite CD Radio, Inc., In re Application of WCS Radio, Inc. For Authorization to Construct, Launch, and Operate Two Communications Satellites In the Digital Audio Radio Service, File Nos. SAT-LOA-19981113-00085/86, at 23-25 (filed Feb. 8, 1999).

¹¹ Application of WCS Radio, Inc. for Authorization to Construct, Launch, and Operate Two Communications Satellites In the Digital Audio Radio Service, SAT-LOA-19981113-00085/86 (filed Dec. 13, 1998); *Application of WCS Radio, Inc.*, Public Notice, Report No. SAT-00006 (Dec. 14, 1998).

countries' terrestrial mobile or fixed wireless services, although benevolent, is a smokescreen designed to cloud the consumer benefits of CD Radio's modification request. CD Radio seeks to operate a non-geostationary system because the high elevation angles of satellites operating north of the equator will provide far superior satellite DARS to the northern United States than geostationary satellites. CD Radio is aware that operating a non-geostationary system alters the interference potential to countries in the southern hemisphere. Accordingly, CD Radio is engaged in international coordination and fully anticipates concluding agreements with affected countries on acceptable levels of interference. Thus, XM's concern with this issue is entirely unfounded.

Similarly, XM has fabricated power flux density (pfd) concerns to draw the Commission's focus away from the positive benefits of CD Radio's modification request. As discussed in the Technical Annex, attached hereto, the pfd limit identified by XM, -152 dBW/m²/4 kHz, does not apply to the 2.3 GHz frequency band. Moreover, even in radio frequency bands where this pfd limit applies, it serves only as a threshold for international coordination, not as an interference limit.¹²

IV. CD RADIO PAID THE REQUIRED FILING FEE

CD Radio paid the required filing fee to modify its satellite DARS authorization. Section 1.1107 of the Commission's Rules,¹³ as required by statute,¹⁴ sets forth a schedule of charges for international services applications. CD Radio applied the Commission's Rules to its application

¹² Likewise, CD Radio will secure its provision of satellite DARS on a non-interfering basis during coordination discussions with Mexico—the only country that has indicated an intention to use the 2.3 GHz satellite DARS frequency band for a geostationary system. Similarly, the United States Government is already implementing the International Telecommunication Union's ("ITU") notification and registration procedures for CD Radio's satellites.

¹³ 47 C.F.R. § 1.1107.

¹⁴ 47 U.S.C. § 158.

and paid the required fee. XM suggests that CD Radio should have paid a filing fee unrelated to its application. XM's assertion that CD Radio failed to submit the correct filing fee with its application must be rejected because it ignores the Commission's Rules.

The Commission's Rules clearly require CD Radio to pay a "modification" fee. Under the Rules, there are two separate fee tracks for space station applications. The first is for "applications for authority to launch and operate."¹⁵ The second is for "modification" applications.¹⁶ CD Radio filed an application to "Modify Authorization" and paid a "modification" fee. Despite the clarity of the Commission's Rules, XM asserts that CD Radio should have paid a fee for "applications for authority to launch and operate." However, no degree of wordsmithing by XM can alter the fact that CD Radio is not required by the Commission's Rules to submit the fee for "applications for authority to launch and operate" because it already holds authority to launch and operate a satellite DARS system.

The Commission's Rules are, however, unclear with respect to which "modification" fee CD Radio's application requires. Again, the Commission has two separate fee tracks. One "modification" fee applies to "Space Stations (Geostationary)."¹⁷ A second "modification" fee applies to "Space Stations (Low-Earth Orbit Satellite Systems)."¹⁸ CD Radio seeks a modification for space stations in elliptical and inclined (non-geostationary) orbits, which does not fit clearly within either of the two fee categories.

¹⁵ 47 C.F.R. § 1.1107(9)(a) and (10)(a).

¹⁶ 47 C.F.R. § 1.1107(9)(c) and (10)(c).

¹⁷ 47 C.F.R. § 1.1107(9)(c).

¹⁸ 47 C.F.R. § 1.1107(10)(c).

CD Radio paid the “modification” fee for “Space Stations (Low-Earth Orbit Satellite Systems)” because this was the most directly applicable fee. It was also the more expensive fee. Because the orbit of its proposed non-geostationary satellite system more closely resembles the orbits of low-earth orbit satellites than geostationary satellites, CD Radio paid the “modification” fee for “Space Stations (Low-Earth Orbit Satellite Systems).”¹⁹ Arguably, however, CD Radio could have paid the lesser “modification” fee for “Space Stations (Geostationary)” if it based its fee choice on the coverage pattern of its proposed satellite network. The U.S. coverage from CD Radio’s satellites in elliptical and inclined (non-geostationary) orbits more closely corresponds to that of geostationary satellites than to that of low-earth-orbit satellites which circle the globe.

The fee CD Radio submitted for its modification was entirely appropriate under the Commission’s Rules. Nevertheless, CD Radio will comply with any reasonable “modification” fee that the Commission decides to impose.

V. CONCLUSION

This proceeding addresses whether CD Radio should be permitted to improve the quality of satellite DARS service that will soon be available to customers by placing three satellites into inclined and elliptical (non-geostationary) orbits. Neither XM nor WCSR disputes the substantial public benefits of CD Radio’s proposed non-geostationary system. Rather, they raise questions of

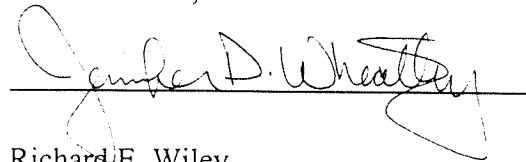
¹⁹ *Id.* CD Radio’s payment of the “modification” fee for “Space Stations (Low-Earth Orbit Satellite Systems)” also conforms to Commission policy because it adequately compensates the Commission for its analysis of issues relating to CD Radio’s modification request. The majority of issues evaluated by the Commission in the course of CD Radio’s original “application for authority to launch and operate” space stations remain unchanged. CD Radio’s modification only seeks to alter the number and orbital configuration of satellites in its pre-approved satellite DARS network. Thus, the extent of analysis required by CD Radio’s modification nowhere near approaches the level of scrutiny applied to initial “applications for authority to launch and operate.”

interoperability and interference that have nothing to do with CD Radio's modification request.
Accordingly, CD Radio respectfully requests that the Commission grant its application.

Respectfully submitted,

SATELLITE CD RADIO, INC.

By:

A handwritten signature in cursive script, appearing to read "Jennifer D. Wheatley", is written over a horizontal line.

Richard E. Wiley
Michael Yourshaw
Carl R. Frank
Jennifer D. Wheatley
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Its Attorneys

February 23, 1999

TECHNICAL ANNEX

TECHNICAL ANNEX

This replies to the technical portions of the two filings opposing the proposed CD Radio satellite DARS license modification. The proposed CD Radio license modification does not materially affect frequency coordination nor interoperability, the two issues raised by the opposed filings. It does significantly increase the cost of the space segment and, consequently, the modification was proposed only after careful and detailed consideration of its benefits to the public as recapitulated in the next paragraph.

BENEFITS TO PUBLIC OF CD RADIO'S MODIFICATION

The benefits of the modified system to the public are increased capacity and improved service. Increased capacity is not a technical issue and its importance has been described elsewhere.¹ The improved service results from higher satellite elevation angles to users, particularly mobile users,² in the northern third of the country. These higher elevation angles provide major reduction in potential service outages from blockage, multipath and foliage attenuation as well as reduce the number of required terrestrial repeaters. Two specific examples follow:

(1) Worst Case Blockage

An automobile with an antenna 5 foot above the roadway cannot be blocked by a 20 foot high building until the vehicle is closer than 8 feet for a typical satellite elevation

¹ See *Digital Audio Radio Satellite Service Rules and Policies*, 12 F.C.C. Rcd 5754, 5774-76 (1997) (Report and Order, Memorandum Opinion and Order and Further Notice of Proposed Rulemaking).

² CD Radio believes the technical challenge is to provide excellent service quality to mobile users. Although some fixed service will be provided, a similar radio service is currently available to fixed locations by cable and by the major DBS operators.

angle with the proposed license modification of 60°. For the previous geostationary orbit, the typical satellite elevation angle in the northeast is 30° resulting in blockage from a 20 foot high building when the vehicle is closer than 24 feet. This reduction in potential blockage by a factor of 3 is extremely large and important because this blockage potential occurs pervasively in all populated environments, particularly suburban areas. This reduction in potential blockage will reduce the number of required terrestrial repeaters.

(2) Foliage Attenuation

Attachment One³ is the Empirical Roadside Shadowing (ERS) model which shows the fade margin required to overcome service outages as a function of satellite elevation angle for various service outage time probabilities. For a 1% of the time probability of outage (i.e., 99% of the time continuity), a fade margin of 24 dB is required with a 30° satellite elevation angle whereas only 7 dB fade margin is required with a 60° satellite elevation angle, typical with the proposed license modification for the northern portion of the United States. This factor of over 20 (i.e., 14 dB) is extremely important when one considers the expense of satellite radiated power.

OBJECTIONS OF XM AND WCSR

The previous discussion establishes the public interest desirability of the proposed CD Radio satellite DARS license modification from a technical standpoint. The objections of the two opposing filers are now addressed:

(1) Interference to Central and South America

XM points out that potential interference of the CD Radio satellites' S-band transmissions with co-frequency services in Central and South America is possible. XM

³ See Attachment One.

implies there is a satellite power flux density limit of $-152\text{dBW}/\text{m}^2/4\text{kHz}$ when no such limit exists. Even using the XM “typical $-152\text{dBW}/\text{m}^2/4\text{kHz}$ limit,” the previous satellite DARS filings show that this limit is exceeded by the original CD Radio geostationary satellites and, according to our calculations, by XM’s geostationary satellites.

The potential interference to other countries will be handled through the normal international coordination process. This process has been started and a copy of the Federal Communications Commission (FCC) submission to the International Telecommunication Union (ITU) for the modified CD Radio system has previously been supplied to XM. It is pointed out that the “limit” noted by XM above does not apply in satellite DARS bands. Although this “limit” has been used in other satellite radio frequency bands as a threshold for coordination, it never has been used as an interference limit. Although XM is correct concerning the higher sensitivity with lower interference elevation angles, coordination of Iridium, Globalstar and other non-geostationary satellite systems has been accomplished under much more difficult technical challenges. It is further noted that coordination has been successfully completed with Canada for both the XM geostationary orbit and for CD Radio’s geosynchronous orbits at a pfd of $-119\text{dBW}/\text{m}^2/4\text{kHz}$. In fact, the Canadian coordination allows for higher satellite DARS flux densities than CD Radio satellites provide and is applicable to low angles of interference arrival. Consequently, coordination of the proposed CD Radio modified system with other countries should not be difficult. In response to WCSR, the procedures for registering and coordinating non-geostationary orbit systems are well known and are being followed by CD Radio.

2. Interoperability

XM's allegations on interoperability are incomplete and misleading.

Considerable progress has been made by the parties in designing their systems to improve the degree of interoperability.

The considerable efforts of CD Radio and XM on interoperability have accomplished much if one compares the original XM and CD Radio FCC technical applications with CD Radio's current and XM's recent publications and filings. Specifically, the companies have agreed to divide their licensed radio frequency bandwidths so satellite transmissions use two-thirds of the spectrum with Time Division Modulation and the remaining one-third is used for terrestrial repeaters with Coded Orthogonal Frequency Division Modulation (COFDM). XM refers to their COFDM terrestrial transmissions as MultiCarrier Modulation (MCM) which originally was proposed to be Time Division Modulation. These three matters of joint agreement (band segmentation, satellite modulation and terrestrial modulation) have contributed significantly to achievement of a realistic level of interoperability.

CD Radio intends to submit to the FCC a design of an interoperable receiver after the subsequent XM filing describing their modifications (in order to confirm the details in the previous paragraph) and after further discussions with chip and radio makers. Discussions of further interoperability have been temporarily suspended. The main reason for this suspension is the need to freeze first generation chip design since CD Radio's initial satellite launch is only 11 months away. CD Radio's chipmaker (Lucent Microelectronics) has already been delayed⁴ due in part to the changes made for better

⁴ See Form 8-K of CD Radio Inc. at 2-3 (filed Feb. 2, 1999).

interoperability. Likewise, XM has chosen ST Microelectronics as its chipmaker⁵ which must be in final design of its chipset if XM's system operational date is to be met. It must be recognized that an interoperable receiver will generally be more expensive than a single system receiver, since the operating bandwidth and its segmentations are doubled and additional circuitry is required in the chipset. The radio makers must decide if the increased market for interoperable receivers is sufficient to justify the cost. CD Radio intends to continue interoperability discussions with XM. In any event, CD Radio expects to have greater opportunity to ensure that second generation chip sets will have a higher degree of interoperability.

XM makes incorrect allegations on CD Radio's "unwillingness" to change. For instance, at a June 5th meeting in 1998, which was confirmed in writing, CD Radio's adoption of COFDM for terrestrial transmission and the use of band segmentation was detailed. Also, XM was provided advance knowledge of CD Radio's modified satellite DARS system and of CD Radio's opinion that it does not affect interoperability. XM has never previously disputed the fact that CD Radio's proposed satellite DARS system would affect interoperability from a technical viewpoint until the subject opposing filing where it singles out a potential problem with fixed receivers, especially those requiring directional antenna. As earlier described, the major market is for mobile receivers, but the CD Radio design for fixed receivers does not affect interoperability as described below.

⁵ See *XM Satellite Radio*, Comments, File No. SAT-MOD-19981211-00099 (filed Feb. 8, 1999).

The fixed site receivers consist of three types. For those in urban core areas covered by terrestrial repeaters, any outside antenna siting will provide excellent signal reception with a single branch receiver since the antenna is near omni-directional. Interoperable reception is possible, dependent on XM's terrestrial repeater coverage. The second receiver type would be employed in rural areas where antenna siting is generally possible so that obstructions are below 20° elevation. Again, the antenna is near omni-directional so geostationary XM satellites and two geosynchronous CD Radio satellites would be simultaneously viewed and only a single branch receiver is required. The third type would be used where obstructed viewing of the satellites occurs and will require a dual branch receiver.

It is noted that XM's statement dealing with the potential cost differential between dual and single branch receivers may be incorrect. The basic CD Radio chipset is a three branch receiver for the very large United States mobile market. Its low cost is achieved through volume production. Although a one branch chipset would be less expensive in similar volumes, CD Radio believes the very high volume production would be for mobile users (i.e., three branch receivers), and the number of fixed site users would be modest. In such a case it will be more economical to use a three branch chipset for fixed users as well, rather than designing and producing a one branch chipset with low volume.

Lastly, the XM matter of directive antenna use is not understood. A directive antenna which would have just encompassed one XM and one CD Radio geostationary satellite would have an antenna diameter of approximately 10 feet. CD Radio did not plan and does not plan in its proposed modified system to use such highly directive antennas. CD Radio does plan to use antennas with some directivity. These antennas

produce receiving beams shaped as a rectangular sector (i.e., a so-called fan beam antenna) and as an ellipsoid. Such antennas are well known in the industry, are of modest size and low cost.⁶ The width of the beamwidth is such that the XM satellite geostationary orbital locations are included so services may be received from both CD Radio and XM. The antennas are sited so the beams are approximately vertical.

It is concluded that the proposed CD Radio satellite DARS license modification does not materially affect receiver interoperability.

⁶ See Attachment Two. Letter from Seavey Engineering Associates, Inc. to Robert D. Briskman (Feb. 18, 1999).



**CERTIFICATION OF PERSON RESPONSIBLE
FOR TECHNICAL INFORMATION**

I am the Executive Vice President, Engineering and Operations, of CD Radio Inc., the parent company of Satellite CD Radio, Inc. I certify that I am qualified to review the technical information contained in this Consolidated Response to Comments, that I am familiar with Part 25 of the Commission's Rules, that I have prepared and reviewed the technical information submitted in this document, and that it is complete and accurate to the best of my knowledge.

My technical qualifications comprise over 40 years of direct experience in satellite systems engineering including 22 years at COMSAT and its subsidiaries. I hold a B.S.E. degree from Princeton University and a M.S.E.E. degree from the University of Maryland. I am a Fellow of IEEE, AIAA, and WAS and have received the APOLLO Achievement Award from NASA for development of the Unified S-Band System, the Army Commendation Medal, and the IEEE Centennial Medal. I hold six United States patents and have authored over 50 technical papers.

By: Robert D. Briskman Dated: February 22, 1999
Robert D. Briskman
Executive Vice President, Engineering and Operations
CD Radio Inc.

Professional Engineer
DC License # 749008279

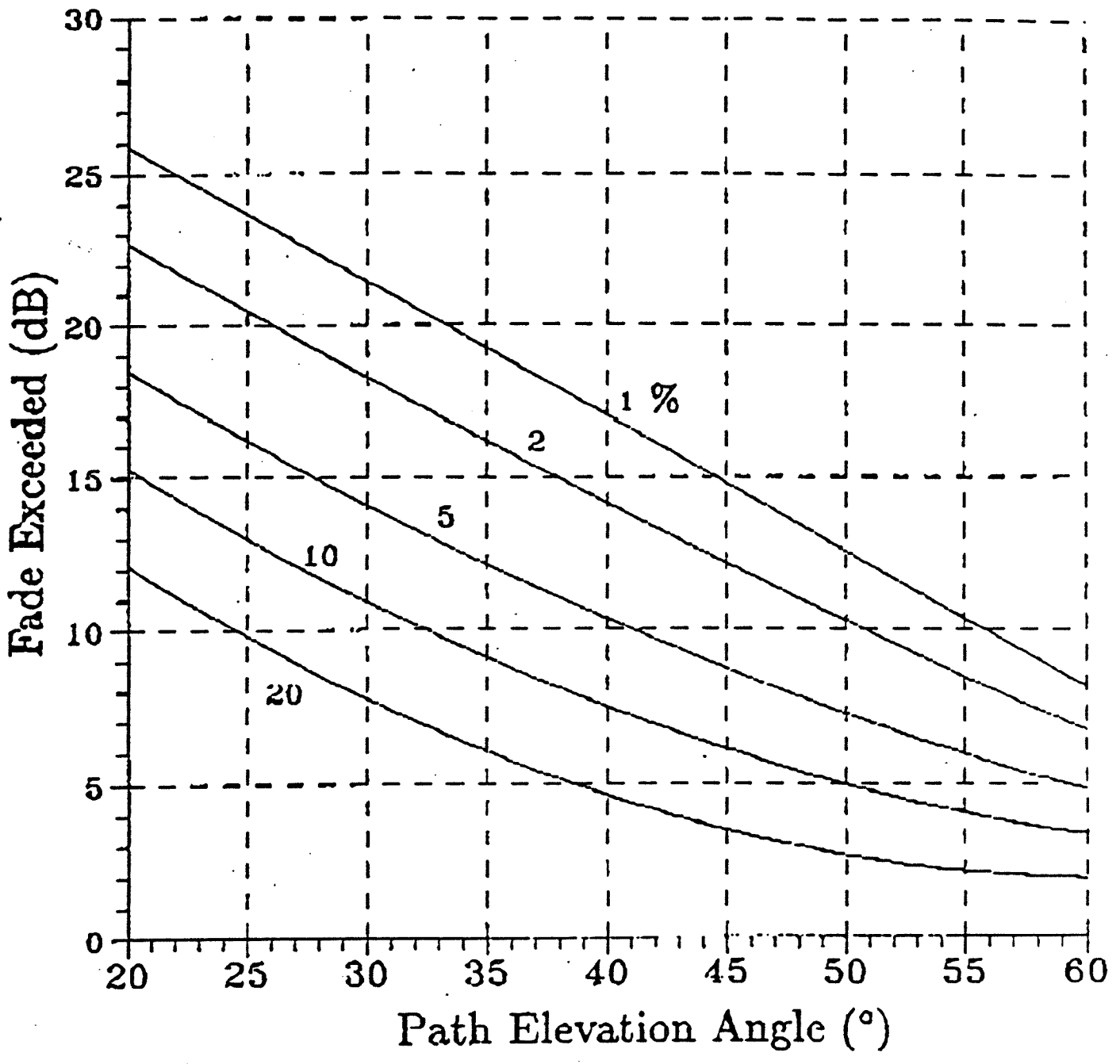
Sworn and subscribed to before me
this 22nd day of February, 1999.

Roberta P. Barber
Notary Public

My Commission Expires: 1-31-03

ATTACHMENT ONE

Empirical Roadside Shadowing (ERS)



ATTACHMENT TWO

Letter from Seavey Engineering Associates, Inc.



SEAVEY ENGINEERING ASSOCIATES, INC.

ANTENNA DESIGN AND DEVELOPMENT

February 18, 1999

Mr. Robert D. Briskman
Executive V.P. for Engineering and Operations
CD Radio, Inc.
3 Bethesda Metro Center Suite 700
Bethesda, MD 20814

Subject: Fan Beam Antenna Systems

Dear Rob:

During your recent visit you inquired if it is feasible to produce a low cost circularly polarized antenna which has a fan beam or an elliptically-shaped beam.

The answer is "yes, indeed".

This type of antenna is widely used in a variety of applications and our company has completed many designs.

There is no technical, product or economic risk associated with such an antenna for your application.

I trust that this answers your questions.

Best Regards:



John M. Seavey
President
JMS:zak

also FAXed to: Mr. Robert. D. Briskman
CD Radio, Inc.
1180 Avenue of the Americas
New York, NY 10036

CERTIFICATE OF SERVICE

I hereby certify that on this 23rd day of February, 1999, I caused copies of the foregoing document to be mailed via first-class mail, postage prepaid, to the following:

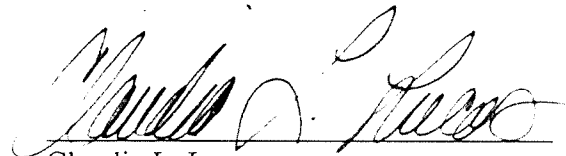
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