REQUEST FOR SPECIAL TEMPORARY AUTHORITY

By this application, SES Government Solutions, Inc., formerly known as Americom Government Services, Inc. ("SES-GS") respectfully requests special temporary authority ("STA") for a period of 180 days to operate an earth station in Bristow, VA that will communicate with the O3b Ka-band non-geostationary orbit ("NGSO") satellite fleet. As discussed below, grant of the requested authority is in the public interest as it will allow SES-GS to test and evaluate O3b services that may be of interest to U.S. government customers. SES-GS does not seek to provide commercial services to end users.

Background: SES-GS provides reliable and secure commercial satellite services to U.S. Government, Intelligence and Civilian agencies. SES-GS believes that adding access to the O3b network may be an attractive option for such customers. Because of its lower NGSO orbit, the O3b fleet can offer service with reduced latency at affordable rates. In order to introduce prospective customers to the capabilities of the O3b network, SES-GS has procured a set of antennas that can communicate with the O3b constellation and can be used to evaluate and demonstrate the O3b services. SES-GS initially seeks to locate these antennas at a location in Bristow, VA that is in close proximity to the site where O3b has a pending earth station application.[1] Under the requested STA, SES-GS seeks to operate the antennas only for testing and providing demonstrations and will not be offering service to customers for a fee.

Protection of Authorized Stations: SES-GS proposes to communicate with O3b in a subset of the Ka-band spectrum that O3b has been licensed to use for its existing U.S. earth stations.[2] Specifically, O3b has assigned spectrum to SES-GS in

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[1] *See* O3b Limited, Call Sign E130107, File No. SES-LIC-20130618-00516 ("O3b Bristow Application"). Pending action on this application, the Commission has granted O3b temporary authority for operations at the Bristow location. *See* O3b Limited, Call Sign E130107, File No. SES-STA-20130617-00497, grant-stamped Aug. 27, 2013 ("O3b Bristow STA").

[2] *See* O3b Limited, Call Sign E130021, File No. SES-LIC-20130124-00089, granted June 20, 2013 ("O3b Texas License"), Section C (authorizing operations in the 17.8-18.6 GHz, 18.8-19.3 GHz, 27.6-28.4 GHz, and 28.6-29.1 GHz bands); O3b Limited, Call Sign E100088, File No. SES-LIC-20100723-00952 ("O3b Hawaii Application"), granted Sept. 25, 201 ("O3b Hawaii License"), Section C (same).

O3b's beam 3, with uplink spectrum at 28.172-28.388 GHz and downlink spectrum at 18.372-18.558 GHz. NGSO fixed-satellite service ("FSS") does not have a primary U.S. allocation in this spectrum. However, SES-GS demonstrates herein that its proposed communications with the O3b network will not cause interference to primary operations in the spectrum, and SES-GS will not claim interference protection from such operations.

LMDS in the 28.172-28.350 GHz Band: In most of the uplink spectrum O3b has assigned to SES-GS, terrestrial local multipoint distribution service ("LMDS") systems are primary, and FSS has a secondary allocation. In order to ensure that its proposed secondary operations would not cause interference to LMDS operations, SES-GS asked Comsearch to identify all existing and proposed terrestrial networks in the vicinity of the Bristow, VA site. Comsearch notified each of these operators of the technical parameters of the planned SES-GS transmissions. In the attached report, Comsearch confirms that it did not receive any objections to the proposed operations from any of the potentially affected terrestrial systems.

GSO FSS in the 28.350-28.388 GHz and 18.372-18.558 GHz Bands: In the remaining segment of the uplink spectrum assigned to SES-GS, the spectrum is allocated to GSO FSS uplinks on a primary basis, with a secondary allocation for NGSO FSS uplinks. GSO FSS downlinks are primary throughout the downlink spectrum O3b assigned to SES-GS, and there is no NGSO FSS allocation in this segment.

Uplink transmissions from the proposed SES-GS earth station will not cause harmful interference to primary GSO FSS networks. In support of its Bristow application, O3b demonstrated that its proposed operations at that site would comply with ITU uplink EPFD limits applicable to the 28.35-28.4 GHz band.[3] This showing was based on the power levels of the earth station and the angular separation between the O3b and geostationary orbits as viewed from the Earth.[4] The SES-GS and O3b Bristow antennas are effectively co-located, so the angular separation between the O3b and

[3] O3b Bristow Application, Narrative at 4-5.

[4] *Id*., Narrative at 5 (cross-referencing the O3b Hawaii Application and demonstrating that because the Bristow site is further north than the Hawaii location, the angular separation is greater).

GSO orbits is the same, but the SES-GS antennas will operate at lower power levels than the O3b Bristow antennas.[5] Accordingly, for the reasons set forth in the O3b Bristow Application, the proposed SES-GS operations will comply with the applicable ITU $EPFD_{up}$ limits. As a result, grant of STA for use of the 28.35-28.4 GHz band on a secondary basis to communicate with the O3b constellation is consistent with Commission precedent.[6]

SES-GS proposes to use the 18.372-18.588 GHz band on a non-conforming basis. SES-GS acknowledges that it is not entitled to protection from interference caused by primary GSO FSS operations in this spectrum. Furthermore, O3b has demonstrated that transmissions from its space stations will comply with the limits developed by the ITU to protect GSO FSS networks from unacceptable interference.[7] Because SES-GS seeks authority here for operations in close vicinity to the proposed O3b earth station site, the analysis provided in the O3b Bristow Application is directly applicable here, and SES-GS incorporates it by reference.

Earth Station Technical Parameters: SES-GS is attaching the following documents to provide the technical details of the operations proposed under the requested STA:

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[5] Specifically, the maximum earth station EIRP density transmitted by the proposed SES-GS 1.8 meter Bristow earth station for a 216 MHz signal is 21.5 dBW/4kHz, which is equivalent to 31.5 dBW/40kHz. This results in an input power spectral density of -31.5 dBW/4kHz. Assuming a 32 - 25 log(Θ) gain mask, the off-axis gain of the transmitting earth station for an off-axis angle of 7.4° is 2.8 dBi, resulting in a worst-case off-axis EIRP density towards the GSO of -28.7 dBW/4kHz or -18.7 dBW/40kHz.

[6] *See, e.g.,* O3b Texas License, Provisions 90086 and 90087 (specifying that transmissions from the earth station are secondary in the 27.6-28.4 GHz band and must comply with ITU EPFD requirements); O3b Hawaii License, Provisions 90039 and 90040 (same); *Northrop Grumman Space & Missions Systems Corp.,* 24 FCC Rcd 2330, 2354 at ¶¶ 72-73 (Int'l Bur. 2009) (authorizing NGSO uplink operations on a secondary basis in primary GSO spectrum conditioned on compliance with ITU EPFD limits); *contactMEO Communications, LLC,* 21 FCC Rcd 4035, 4043-44 at ¶¶ 23-24, (Int'l Bur. 2006) (same).

[7] *See* O3b Bristow Application, Exhibit 1 at 6-7 (noting that "O3b is able to satisfy the [$EPFD_{down}$] limits by taking advantage of the inherent angular separation of the O3b and the GSO orbits when viewed from the surface of the Earth at latitudes away from the equator").

1. Schedule B. Although SES-GS is not seeking a permanent license for the O3b station, SES-GS is providing as Annex 1 hereto a Schedule B with the applicable technical parameters for the Commission's convenience.

2. Comsearch report. As discussed above, Comsearch identified and notified the 28 GHz terrestrial networks in the vicinity of the Bristow site. Attached as Annex 2 is the report confirming that no terrestrial licensee objected to the proposed operations of SES-GS.

3. Antenna patterns. General Dynamics SATCOM Technologies, manufacturer of the 1.8 meter antennas SES-GS will use to communicate with the O3b fleet, has provided antenna patterns that are attached as Annex 3.

4. Link budgets. Representative link budgets for the Bristow earth station are provided in Annex 4.

5. Radiation hazard study. SES-GS has performed an analysis of the maximum radiofrequency levels emitted from the satellite communications antenna, and it is attached as Annex 5.

In addition, SES-GS incorporates by reference herein technical materials provided by O3b:

1. Schedule S. O3b submitted a Schedule S describing the satellite fleet's technical characteristics as an attachment to O3b's application for a gateway earth station in Hawaii. *See* O3b Limited, Call Sign E100088, File No. SES-LIC-20100723-00952, Completed Schedule S. The operational characteristics of the proposed SES-GS Bristow terminal are within all aspects of the envelope defined for user terminals in O3b's Schedule S.

2. Service area definition. The SES-GS Bristow location falls within the "U" service area identified in the O3b Schedule S, which includes all locations on Earth with elevation angles to the operational O3b satellites greater than 3 degrees.

3. Beam contour maps. In a supplement to the O3b Bristow Application, O3b provided antenna gain contours for the O3b satellite receive and transmit beams when directed towards the O3b Bristow earth station site. *See* Technical Supplement to O3b Bristow Application filed July 24, 2013 ("O3b Bristow Technical Supplement") at 1-5, Figures A.2-1, A.2-2, and A.2-3. Given the close proximity of the SES-GS and O3b Bristow sites, the gain contours submitted by O3b accurately depict the contours of the beans when directed towards the SES-GS Bristow location.

4. U.S. government coordination. As explained in the O3b Hawaii Application, coordination of the O3b NGSO satellite system has been completed, and the coordination agreement has been provided confidentially to the Commission. *See* O3b Hawaii Application, Attachment A at 33, Section A.12. O3b has advised SES-GS that the agreement contemplates the operation of U.S. earth stations.

5. Compliance with PFD limits. O3b has shown that the power flux density ("PFD") of the O3b system complies with all applicable FCC limits. *See* O3b Bristow Technical Supplement at 6-8. This showing is based on a worst-case methodology to calculate the maximum EIRP density produced by the O3b downlinks. The proposed SES-GS Bristow earth station will be operated with O3b downlink signals that are below this maximum EIRP density level.

U.S. Market Access: The O3b Hawaii Application included a showing that allowing U.S. earth stations to communicate with the foreign-licensed O3b NGSO constellation is consistent with U.S. market access policies,[8] as those policies are set forth in the *DISCO II* framework[9] and codified in Section 25.137.[10] The Commission granted the application, thereby authorizing communication between the Hawaii earth station and the O3b satellite fleet.[11] Subsequent to that grant, no change has occurred in the O3b satellite network's operating parameters or the services that the network will be used to provide. Under these circumstances, no additional showing is needed to allow SES-GS to use its proposed Bristow antennas to communicate with the O3b satellite constellation.[12]

In any event, the SES-GS Bristow antennas will be used for evaluation and demonstration purposes only, and not for commercial services. As a result, grant of the requested authority to communicate with the O3b constellation will have no effect on competition within the U.S.

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[8] *See* O3b Hawaii Application, Legal Narrative at 10-24.

[9] *See Amendment of the Commission's Policies to Allow Non-U.S. Licensed Space Stations providing Domestic and International Service in the United States,* Report & Order, 12 FCC Rcd 24094 (1997) ("*DISCO II*").

[10] 47 C.F.R. § 25.137.

[11] *See* O3b Hawaii License, Section D (authorizing communications with the U.K.-licensed O3b NGSO satellite system).

[12] *See DISCO II,* 12 FCC Rcd at 24176, ¶ 192.

Waiver Requests: SES-GS requests grant of any necessary waiver of the Commission's rules in connection with the instant STA request. Such waiver is consistent with Commission policy:

> The Commission may waive a rule for good cause shown. Waiver is appropriate if special circumstances warrant a deviation from the general rule and such deviation would better serve the public interest than would strict adherence to the general rule. Generally, the Commission may grant a waiver of its rules in a particular case if the relief requested would not undermine the policy objective of the rule in question and would otherwise serve the public interest.[13]

Section 25.145(c): Section 25.145(c) of the Commission's rules requires Ka-band NGSO systems to meet global and U.S. service coverage requirements.[14] O3b has explained that its network, which was designed with a focus on providing service to emerging markets and areas without significant terrestrial broadband infrastructure, cannot meet these requirements.[15] O3b argued that granting a waiver of the coverage requirements to allow access to the O3b network would further, not undermine, achievement of the rule's purpose – fostering seamless global communications.[16] The Commission granted a waiver of the rule for both the O3b Hawaii and Texas gateway and TT&C earth stations, but stated that the grant was without prejudice to action on any waiver request to provide additional U.S. services.[17]

SES-GS seeks grant of any necessary waiver of Section 25.145(c) in connection with the instant STA request. As with the O3b Hawaii and Texas stations, the proposed SES-GS Bristow antennas will not provide commercial services to end

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[13] *PanAmSat Licensee Corp*., 17 FCC Rcd 10483, 10492 (Sat. Div. 2002) (footnotes omitted).

[14] 47 C.F.R. § 25.145(c).

[15] *See* O3b Limited, Call Sign E100088, File No. SES-LIC-20100723-00952 ("O3b Hawaii Application"), Legal Narrative at 21-22.

[16] *Id.* at 22.

[17] *See* O3b Hawaii License, Provision 90044; O3b Texas License, Provision 90044.

users. Instead, the antennas will be operated only for purposes of evaluating the capabilities of the O3b network and demonstrating those capabilities to prospective customers interested in using O3b capacity for their communications needs, whether outside or inside the U.S. No fees will be charged to customers for these demonstrations, and accordingly the proposed operations will have no effect on competition in the U.S. In these circumstances, preventing SES-GS from communicating with the operational O3b global satellite network because that network does not comply with Commission coverage requirements would serve no conceivable public interest objective.

Section 25.210(i)(1): O3b has also explained that its satellite constellation does not comply with the minimum cross-polarization isolation requirement for FSS systems in Section 25.210(i)(1).[18] The Commission granted a waiver of this rule in the O3b Hawaii and Texas Licenses.[19] For the same reasons, SES-GS requests that the Commission grant any necessary waiver of Section 25.210(i)(1) in connection with the instant STA request.[20]

Conclusion: The requested STA will allow SES-GS to evaluate and demonstrate the O3b network's operational capabilities and will not result in harmful interference to other authorized spectrum users. Thus, grant of the STA will serve the public interest.

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[18] *See* O3b Hawaii Application, Legal Narrative at 22-23.

[19] *See* O3b Hawaii License, Provision 90041; O3b Texas License, Provision 90041.

[20] SES-GS notes that the bond requirements of Section 25.165 are inapplicable to this STA request, as O3b has already posted a bond payable in the event the O3b constellation does not meet operational milestones. *See* O3b Texas License, Provision 90041. *See also Telesat Canada*, Order, 22 FCC Rcd 588, 593 (Sat. Div. 2007) ("it is not necessary to have more than one bond posted" with respect to a satellite network in order to fulfill the bond requirement's purpose).

Annex 1

Approved by OMB
3060-0678

Date & Time Filed:
File Number: ---
Callsign/Satellite ID:

APPLICATION FOR EARTH STATION AUTHORIZATIONS FCC 312 MAIN FORM FOR OFFICIAL USE ONLY	FCC Use Only

APPLICANT INFORMATION

Enter a description of this application to identify it on the main menu:
Attachment to STA for Bristow O3b Demo 1.8m

1-8. Legal Name of Applicant

Name:	SES Government Solutions, Inc.	Phone Number:	703-610-0906
DBA Name:		Fax Number:	703-610-1030
Street:	2010 Corporate Ridge, Suite 550	E-Mail:	joe.oloughlin@ses-gs.com
City:	McLean	State:	VA
Country:	USA	Zipcode:	22102 -
Attention:	Mr Joseph A O'Loughlin		

9-16. Name of Contact Representative

Name:	Maurice Najarian	Phone Number:	703-610-0985
Company:	SES Government Solutions, Inc.	Fax Number:	703-610-1030
Street:	2010 Corporate Ridge Suite 550	E-Mail:	
City:	McLean	State:	VA
Country:	USA	Zipcode:	22102-
Attention:		Relationship:	

CLASSIFICATION OF FILING

17. Choose the button next to the classification that applies to this filing for both questions a. and b. Choose only one for 17a and only one for 17b.

a.
◉ a1. Earth Station
(N/A) a2. Space Station

b.
◉ b1. Application for License of New Station
○ b2. Application for Registration of New Domestic Receive-Only Station
(N/A) b3. Amendment to a Pending Application
(N/A) b4. Modification of License or Registration
(N/A) b5. Assignment of License or Registration
(N/A) b6. Transfer of Control of License or Registration
(N/A) b7. Notification of Minor Modification
(N/A) b8. Application for License of New Receive-Only Station Using Non-U.S. Licensed Satellite
(N/A) b9. Letter of Intent to Use Non-U.S. Licensed Satellite to Provide Service in the United States
○ b10. Other (Please specify)
○ b11. Application for Earth Station to Access a Non-U.S.satellite Not Currently

	Authorized to Provide the Proposed Service in the Proposed Frequencies in the United States.

17c. Is a fee submitted with this application?
◉ If Yes, complete and attach FCC Form 159.

If No, indicate reason for fee exemption (see 47 C.F.R.Section 1.1114).
○ Governmental Entity ○ Noncommercial educational licensee
○ Other(please explain):

17d.
Fee Classification BAX - Fixed Satellite Transmit/Receive Earth Station

18. If this filing is in reference to an existing station, enter:	19. If this filing is an amendment to a pending application enter:	
(a) Call sign of station:	(a) Date pending application was filed:	(b) File number of pending application:
Not Applicable	Not Applicable	Not Applicable

TYPE OF SERVICE

20. NATURE OF SERVICE: This filing is for an authorization to provide or use the following type(s) of service(s): Select all that apply:

☒ a. Fixed Satellite
☐ b. Mobile Satellite
☐ c. Radiodetermination Satellite
☐ d. Earth Exploration Satellite
☐ e. Direct to Home Fixed Satellite
☐ f. Digital Audio Radio Service
☐ g. Other (please specify)

21. STATUS: Choose the button next to the applicable status. Choose only one.	22. If earth station applicant, check all that apply.
○ Common Carrier ◉ Non-Common Carrier	☐ Using U.S. licensed satellites ☒ Using Non-U.S. licensed satellites

23. If applicant is providng INTERNATIONAL COMMON CARRIER service, see instructions regarding Sec. 214 filings. Choose one. Are these facilities:
○ Connected to a Public Switched Network ○ Not connected to a Public Switched Network ◉ N/A

24. FREQUENCY BAND(S): Place an "X" in the box(es) next to all applicable frequency band(s).
☐ a. C-Band (4/6 GHz) ☐ b. Ku-Band (12/14 GHz)
☒ c.Other (Please specify upper and lower frequencies in MHz.)
Frequency Lower: 18372 Frequency Upper: 28388

TYPE OF STATION

25. CLASS OF STATION: Choose the button next to the class of station that applies. Choose only one.
◉ a. Fixed Earth Station
○ b. Temporary-Fixed Earth Station
○ c. 12/14 GHz VSAT Network
○ d. Mobile Earth Station
(N/A) e. Geostationary Space Station
(N/A) f. Non-Geostationary Space Station
○ g. Other (please specify)

26. TYPE OF EARTH STATION FACILITY: Choose only one.
◉ Transmit/Receive ○ Transmit-Only ○ Receive-Only ○ N/A

PURPOSE OF MODIFICATION

27. The purpose of this proposed modification is to: (Place an 'X' in the box(es) next to all that apply.) Not Applicable

ENVIRONMENTAL POLICY

28. Would a Commission grant of any proposal in this application or amendment have a significant environmental impact as defined by 47 CFR 1.1307? If YES, submit the statement as required by Sections 1.1308 and 1.1311 of the Commission's rules, 47 C.F.R. §§ 1.1308 and 1.1311, as an exhibit to this application.A Radiation Hazard Study must accompany all applications for new transmitting facilities, major modifications, or major amendments.	○ Yes ◉ No

ALIEN OWNERSHIP Earth station applicants not proposing to provide broadcast, common carrier, aeronautical en route or aeronautical fixed radio station services are not required to respond to Items 30-34.

29. Is the applicant a foreign government or the representative of any foreign government?	○ Yes ◉ No
30. Is the applicant an alien or the representative of an alien?	○ Yes ○ No ◉ N/A
31. Is the applicant a corporation organized under the laws of any foreign government?	○ Yes ○ No ◉ N/A
32. Is the applicant a corporation of which more than one-fifth of the capital stock is owned of record or voted by aliens or their representatives or by a foreign government or representative thereof or by any corporation organized under the laws of a foreign country?	○ Yes ○ No ◉ N/A
33. Is the applicant a corporation directly or indirectly controlled by any other corporation of which more than one-fourth of the capital stock is owned of record or voted by aliens, their representatives, or by a foreign government or representative thereof or by any corporation organized under the laws of a foreign country?	○ Yes ○ No ◉ N/A
34. If any answer to questions 29, 30, 31, 32 and/or 33 is Yes, attach as an exhibit an identification of the aliens or foreign entities, their nationality, their relationship to the applicant, and the percentage of stock they own or vote.	

BASIC QUALIFICATIONS

35. Does the Applicant request any waivers or exemptions from any of the Commission's Rules? If Yes, attach as an exhibit, copies of the requests for waivers or exceptions with supporting documents.	◉ Yes ○ No
36. Has the applicant or any party to this application or amendment had any FCC station authorization or license revoked or had any application for an initial, modification or renewal of FCC station authorization, license, or construction permit denied by the Commission? If Yes, attach as an exhibit, an explination of circumstances.	○ Yes ◉ No
37. Has the applicant, or any party to this application or amendment, or any party directly or indirectly controlling the applicant ever been convicted of a felony by any state or federal court? If Yes, attach as an exhibit, an explination of circumstances.	○ Yes ◉ No
38. Has any court finally adjudged the applicant, or any person directly or indirectly controlling the applicant, guilty of unlawfully monopolizing or attemptiing unlawfully to monopolize radio communication, directly or indirectly, through control of manufacture or sale of radio apparatus, exclusive traffic arrangement or any other means or unfair methods of competition? If Yes, attach as an exhibit, an explanation of circumstances	○ Yes ◉ No
39. Is the applicant, or any person directly or indirectly controlling the applicant, currently a party in any pending matter referred to in the preceding two items? If yes, attach as an exhinit, an explanation of the circumstances.	○ Yes ◉ No
40. If the applicant is a corporation and is applying for a space station license, attach as an exhibit the names, address, and citizenship of those stockholders owning a record and/or voting	

10 percent or more of the Filer's voting stock and the percentages so held. In the case of fiduciary control, indicate the beneficiary(ies) or class of beneficiaries. Also list the names and addresses of the officers and directors of the Filer.

41. 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**

42a. Does the applicant intend to use a non-U.S. licensed satellite to provide service in the United States? If Yes, answer 42b and attach an exhibit providing the information specified in *47 C.F.R. 25.137, as appropriate*. If No, proceed to question 43. (●) **Yes** ( ) **No**

42b. What administration has licensed or is in the process of licensing the space station? If no license will be issued, what administration has coordinated or is in the process of coordinating the space station? United Kingdom

43. Description. (Summarize the nature of the application and the services to be provided). SES Government Solutions seeks FCC authority to operate an earth station in Bristow, Virginia, with the O3b U.K.-licensed non-geostationary Ka-band satellite system for testing and demonstration purposes only.

43a. Geographic Service Rule Certification

By selecting A, the undersigned certifies that the applicant is not subject to the geographic service or geographic coverage requirements specified in 47 C.F.R. Part 25. ( ) **A**

By selecting B, the undersigned certifies that the applicant is subject to the geographic service or geographic coverage requirements specified in 47 C.F.R. Part 25 and will comply with such requirements. ( ) **B**

By selecting C, the undersigned certifies that the applicant is subject to the geographic service or geographic coverage requirements specified in 47 C.F.R. Part 25 and will not comply with such requirements because it is not feasible as a technical matter to do so, or that, while technically feasible, such services would require so many compromises in satellite design and operation as to make it economically unreasonable. A narrative description and technical analysis demonstrating this claim are attached. (●) **C**

CERTIFICATION

The Applicant waives any claim to the use of any particular frequency or of the electromagnetic spectrum as against the regulatory power of the United States because of the previous use of the same, whether by license or otherwise, and requests an authorization in accordance with this application. The applicant certifies that grant of this application would not cause the applicant to be in violation of the spectrum aggregation limit in 47 CFR Part 20. All statements made in exhibits are a material part hereof and are incorporated herein as if set out in full in this application. The undersigned, individually and for the applicant, hereby certifies that all statements made in this application and in all attached exhibits are true, complete and correct to the best of his or her knowledge and belief, and are made in good faith.

44. Applicant is a (an): (Choose the button next to applicable response.)

- ( ) Individual
- ( ) Unincorporated Association
- ( ) Partnership
- (●) Corporation
- ( ) Governmental Entity
- ( ) Other (please specify)

45. Name of Person Signing	46. Title of Person Signing
Joseph O'Loughlin	CTO

47. Please supply any need attachments.

Attachment 1:	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).

SATELLITE EARTH STATION AUTHORIZATIONS
FCC Form 312 - Schedule B:(Technical and Operational Description)

FOR OFFICIAL USE ONLY

Location of Earth Station Site

E1: Site Identifier:	WMP 1.8m Ka	E5. Call Sign:	
E2: Contact Name	Tim Kavanaugh	E6. Phone Number:	703-350-8665
E3. Street:	8000 Gainsford Ct	E7. City:	Bristow
		E8. County:	Prince William
E4. State	VA	E9. Zip Code	20136
E10. Area of Operation:		Fixed	
E11. Latitude:	38 ° 47 ' 0.25 " N		
E12. Longitude:	77 ° 34 ' 24.5 " W		
E13. Lat/Lon Coordinates are:		○ NAD-27	◉ NAD-83 ○ N/A
E14. Site Elevation (AMSL):		86.56 meters	

E15. If the proposed antenna(s) operate in the Fixed Satellite Service (FSS) with geostationary satellites, do(es) the proposed antenna(s) comply with the antenna gain patterns specified in Section 25.209(a) and (b) as demonstrated by the manufacturer's qualification measurement? If NO, provide asa technical analysis showing compliance with two-degree spacing policy.	○ Yes ○ No ◉ N/A
E16. If the proposed antenna(s) do not operate in the Fixed Satellite Service (FSS), or if they operate in the Fixed Satellite Service (FSS) with non-geostationary satellites, do(es) the proposed antenna(s) comply with the antenna gain patterns specified in Section 25.209(a2) and (b) as demonstrated by the manufacturer's qualification measurements?	◉ Yes ○ No ○ N/A
E17. Is the facility operated by remote control? If YES, provide the location and telephone number of the control point.	○ Yes ◉ No
E18. Is frequency coordination required? If YES, attach a frequency coordination report as	◉ Yes ○ No
E19. Is coordination with another country required? If YES, attach the name of the country(ies) and plot of coordination contours as	○ Yes ◉ No
E20. FAA Notification - (See 47 CFR Part 17 and 47 CFR part 25.113(c)) Where FAA notification is required, have you attached a copy of a completed FCC Form 854 and or the FAA's study regarding the potential hazard of the structure to aviation? FAILURE TO COMPLY WITH 47 CFR PARTS 17 AND 25 WILL RESULT IN THE RETURN OF THIS APPLICATION.	○ Yes ◉ No

POINTS OF COMMUNICATION

Satellite Name:O3B-A | O3B-A | Eq. NGSO If you selected OTHER, please enter the following:	
E21. Common Name:	E22. ITU Name:
E23. Orbit Location:	E24. Country:

POINTS OF COMMUNICATION (Destination Points)

E25. Site Identifier:	
E26. Common Name:	E27. Country:

ANTENNA

Site ID	E28. Antenna Id	E29. Quantity	E30. Manufacturer	E31. Model	E32. Antenna Size	E41/42. Antenna GainTransmint and/or Recieve(____dBi at _____GHz)
WMP 1.8m Ka	Ant 1-2	2	GD/Prodelin	GDST-1.8M	1.8	49.1 dBi at 18.562
						52.8 dBi at 28.362

E28. Antenna Id	E33/34. Diameter Minor/Major (meters)	E35. Above Ground Level (meters)	E36. Above Sea Level (meters)	E37. Building Height Above Ground Level (meters)	E38. Total Input Power at antenna flange (Watts)	E39. Maximum Antenna Height Above Rooftop (meters)	E40. Total EIRP for al carriers (dBW)
Ant 1-2	0.0/0.0	2.4	89.0	0.0	40.0	0.0	68.8

FREQUENCY

E28. Antenna Id	E43/44. Frequency Bands(MHz)	E45. T/R Mode	E46. Antenna Polarization (H,V,L,R)	E47. Emission Designator	E48. Maximum EIRP per Carrier(dBW)	E49. Maximum ERIP Density per Carrier (dBW/4kHz)
Ant 1-2	18372 18588	R	Left Hand Circular	1M00G7D	0.0	0.0
E50. Modulation and Services Digital Data						
Ant 1-2	18372 18588	R	Left Hand Circular	216MG7D	0.0	0.0
E50. Modulation and Services Digital Data						
Ant 1-2	28172 28388	T	Right Hand Circular	1M00G7D	48.6	24.6
E50. Modulation and Services Digital Data						
Ant 1-2	28172 28388	T	Right Hand Circular	216MG7D	68.8	38.8
E50. Modulation and Services Digital Data						

FREQUENCY COORDINATION

E28. Antenna Id	E51. Satellite Orbit Type	E52/53. Frequency	E54/55. Range of	E56. Earth Station	E57. Antenna Elevation	E58. Earth Station	E59. Antenna Elevation	E60. Maximum EIRP

		Limits (MHz)	Satellite Arc E/W Limit	Azimuth Angle Eastern Limit	Angle Eastern Limit	Azimuth Angle Western Limit	Angle Western Limit	Density toward the Horizon (dBW/4kHz)
Ant 1-2	Non-Geostationary	18372 18588	0.0/ 0.0	122.4	7.6	238.3	7.0	0.0
	Non-Geostationary	28172 28388	0.0/ 0.0	122.4	7.6	238.3	7.0	38.8

REMOTE CONTROL POINT LOCATION
REMOTE CONTROL POINT LOCATION

E61. Call Sign NOTE: Please enter the callsign of the controlling station, not the callsign for which this application is being filed.			E65. Phone Number
E62. Street Address			
E63. City	E67. County	E64/68. State/Country /	E66. Zip Code

FCC NOTICE REQUIRED BY THE PAPERWORK REDUCTION ACT

The public reporting for this collection of information is estimated to average 0.25 - 24 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the required data, and completing and reviewing the collection of information. If you have any comments on this burden estimate, or how we can improve the collection and reduce the burden it causes you, please write to the Federal Communications Commission, AMD-PERM, Paperwork Reduction Project (3060-0678), Washington, DC 20554. We will also accept your comments regarding the Paperwork Reduction Act aspects of this collection via the Internet if you send them to PRA@fcc.gov. PLEASE DO NOT SEND COMPLETED FORMS TO THIS ADDRESS.

Remember - You are not required to respond to a collection of information sponsored by the Federal government, and the government may not conduct or sponsor this collection, unless it displays a currently valid OMB control number or if we fail to provide you with this notice. This collection has been assigned an OMB control number of 3060-0678.

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.

Ka-Band Earth Station – Bristow, VA

Frequency Coordination Report

28 GHz

Prepared on Behalf of
SES Government
Solutions, Inc.

September 19, 2013

COMSEARCH®
A CommScope Company

Table of Contents

1. Summary of Results

On behalf of SES Government Solutions', Inc. proposed earth station transmitting at 28 GHz[1], Comsearch performed a coordination notice for all existing and proposed terrestrial licenses within the coordination contours of the Ka-Band station in Bristow, VA. Prior notification letters were sent to the licensees and a copy of the notification data is provided in section four of this report. The earth station coordination was finalized on September 10, 2013.

No objections were received from any of the incumbent 28 GHz licensees. Our notification to the LMDS incumbents was performed under the assumption that the earth station would be operating on a secondary basis to LMDS Block A operations and a contact at SES Government Solutions has been provided in case any concerns may arise in the future.

2. 28 GHz Common Carrier and LTTS Coordination

In accordance with FCC Rules and Regulations, a Ka-Band earth station in Bristow, VA was prior coordinated by Comsearch. The notification letters and datasheet for this earth station were sent to the following 28 GHz common carrier fixed microwave licensees on August 9, 2013. These licensees are authorized to operate temporary fixed operations from 27.5 – 29.5 GHz on a statewide or nationwide basis.

Licensee	Authorized Geographic Area
GTE Southwest Inc. dba Verizon	Continental US
Verizon	Statewide: VA, MD, and DC

A notification letter and datasheet for the Ka-Band earth station in Bristow, VA was also sent to the following 28 GHz local television transmission licensee on August 9, 2013. This licensee is authorized to operate temporary fixed operations from 27.5 – 29.5 GHz on a nationwide basis.

Licensee	Authorized Geographic Area
Information Super Station, LLC	Continental US

No objections were received from the common carrier or local television transmission service incumbents.

[1] The proposed earth station will operate in the 28.1 – 28.4 GHz portion of the Ka-Band.

3. 28 GHz LMDS Coordination

Notification letters were sent to the following 28 GHz LMDS licensees on August 9, 2013. The proposed earth station will operate on frequencies that overlap Block A of the LMDS service. The total frequency allocation for Block A of the LMDS spectrum appears below.

Block A: 27.500-28.350 GHz
29.100-29.250 GHz
31.075-31.225 GHz

Licensee	Market	Market Name
Nextlink Wireless / XO	BTA029	Baltimore, MD
Nextlink Wireless / XO	BTA374	Richmond-Petersburg, VA
Verizon	BTA398	Salisbury, MD
Nextlink Wireless / XO	BTA461[2]	Washington, DC

No objections were received from the LMDS incumbents.

[2] The proposed Bristow,VA earth station will be located inside BTA461.

4. Earth Station Coordination Data

This section presents the data pertinent to the proposed Ka-Band earth station in Bristow, VA. This data was circulated to all incumbent licensees in the 28 GHz shared frequency ranges.

Date:	08/12/2013
Job Number:	<PCNJobCode>
Administrative Information	
Status	ENGINEER PROPOSAL
Call Sign	<PCNCallSign>
Licensee Code	AMGOSE
Licensee Name	SES Government Solutions
Site Information	**BRISTOW, VA**
Venue Name	
Latitude (NAD 83)	38° 47' 0.2" N
Longitude (NAD 83)	77° 34' 24.5" W
Climate Zone	A
Rain Zone	2
Ground Elevation (AMSL)	86.56 m / 284.0 ft
Link Information	
Satellite Type	Medium Earth Orbit
Mode	TR - Transmit-Receive
Modulation	Digital
Minimum Elevation Angle	7.0°
Azimuth Range	0.0° to 360°
Antenna Centerline (AGL)	1.83 m / 6.0 ft

Antenna Information		**Receive - FCC32**		**Transmit - FCC32**
Manufacturer		GD/Prodelin		GD/Prodelin
Model		GDST-1.8M		GDST-1.8M
Gain / Diameter		49.1 dBi / 1.8 m		52.8 dBi / 1.8 m
3-dB / 15-dB Beamwidth		0.23° / 0.60°		0.14° / 0.32°
Max Available RF Power	(dBW/4 kHz)			-14.0
	(dBW/MHz)			10.0
Maximum EIRP	(dBW/4 kHz)			38.8
	(dBW/MHz)			62.8
Interference Objectives:	Long Term	-156.0 dBW/MHz	20%	-151.0 dBW/4 kHz 20%
	Short Term	-146.0 dBW/MHz	0.01%	-128.0 dBW/4 kHz 0.0025%

Frequency Information	**Receive 18.0 GHz**	**Transmit 28.0 GHz**
Emission / Frequency Range (MHz)	1M00G7D - 216MG7D / 18372.0 - 18588.0	1M00G7D - 216MG7D / 28172.0 - 28388.0
Max Great Circle Coordination Distance	198.5 km / 123.3 mi	124.7 km / 77.5 mi
Precipitation Scatter Contour Radius	100.0 km / 62.1 mi	100.0 km / 62.1 mi

Coordination Values	**BRISTOW, VA**			
Licensee Name	SES Government Solutions			
Latitude (NAD 83)	38° 47' 0.2" N			
Longitude (NAD 83)	77° 34' 24.5" W			
Ground Elevation (AMSL)	86.56 m / 284.0 ft			
Antenna Centerline (AGL)	1.83 m / 6.0 ft			
Antenna Model	GD/Prodelin 1.8 Meter			
Antenna Mode	Receive 18.0 GHz		Transmit 28.0 GHz	
Interference Objectives: Long Term	-156.0 dBW/MHz	20%	-151.0 dBW/4 kHz	20%
Short Term	-146.0 dBW/MHz	0.01%	-128.0 dBW/4 kHz	0.0025%
Max Available RF Power		-14.0 (dBW/4 kHz)		

			Receive 18.0 GHz		Transmit 28.0 GHz	
Azimuth (°)	Horizon Elevation (°)	Antenna Discrimination (°)	Horizon Gain (dBi)	Coordination Distance (km)	Horizon Gain (dBi)	Coordination Distance (km)
0	0.00	97.86	-10.00	100.00	-10.00	100.00
5	0.00	92.86	-10.00	100.00	-10.00	100.00
10	0.00	87.86	-10.00	100.00	-10.00	100.00
15	0.00	82.86	-10.00	100.00	-10.00	100.00
20	0.00	77.86	-10.00	100.00	-10.00	100.00
25	0.00	72.86	-10.00	102.20	-10.00	100.00
30	0.00	67.86	-10.00	103.10	-10.00	100.00
35	0.00	62.86	-10.00	108.30	-10.00	100.00
40	0.00	57.87	-10.00	111.90	-10.00	100.00
45	0.00	52.87	-10.00	107.60	-10.00	100.00
50	0.00	47.87	-10.00	112.00	-10.00	100.00
55	0.00	42.87	-10.00	116.00	-10.00	100.00
60	0.00	37.87	-8.98	138.00	-8.98	100.00
65	0.00	32.87	-7.69	142.70	-7.69	102.20
70	0.00	27.88	-6.23	147.10	-6.23	105.80
75	0.00	22.88	-4.54	152.30	-4.54	109.80
80	0.00	17.89	-2.58	159.20	-2.58	114.50
85	0.00	12.90	-0.16	153.40	-0.16	109.50
90	0.00	7.92	2.89	139.80	2.89	100.00
95	0.00	3.02	6.69	147.40	6.69	100.50
100	0.00	2.34	10.98	158.20	10.98	106.50
105	0.00	7.20	11.99	185.10	11.99	124.70
110	0.00	12.18	7.90	144.30	7.89	100.00
115	0.00	17.17	4.32	127.60	4.33	100.00
120	0.00	22.16	1.61	118.50	1.61	100.00
125	0.00	27.15	-0.49	110.90	-0.49	100.00
130	0.00	32.15	-2.17	102.30	-2.17	100.00
135	0.00	37.15	-3.58	100.00	-3.58	100.00
140	0.00	42.15	-4.79	100.00	-4.79	100.00
145	0.00	47.15	-5.83	100.00	-5.83	100.00
150	0.00	52.15	-6.84	104.50	-6.84	100.00
155	0.00	57.14	-7.55	103.10	-7.55	100.00
160	0.00	62.14	-8.18	110.70	-8.18	100.00
165	0.00	67.14	-8.62	110.30	-8.62	100.00
170	0.00	72.14	-8.94	110.00	-8.94	100.00
175	0.00	77.14	-9.13	109.10	-9.13	100.00
180	0.00	82.14	-9.22	114.60	-9.22	100.00
185	0.00	87.14	-9.11	106.60	-9.11	100.00

Coordination Values	**BRISTOW, VA**			
Licensee Name	SES Government Solutions			
Latitude (NAD 83)	38° 47' 0.2" N			
Longitude (NAD 83)	77° 34' 24.5" W			
Ground Elevation (AMSL)	86.56 m / 284.0 ft			
Antenna Centerline (AGL)	1.83 m / 6.0 ft			
Antenna Model	GD/Prodelin 1.8 Meter			
Antenna Mode	Receive 18.0 GHz		Transmit 28.0 GHz	
Interference Objectives: Long Term	-156.0 dBW/MHz	20%	-151.0 dBW/4 kHz	20%
Short Term	-146.0 dBW/MHz	0.01%	-128.0 dBW/4 kHz	0.0025%
Max Available RF Power		-14.0 (dBW/4 kHz)		

			Receive 18.0 GHz		Transmit 28.0 GHz	
Azimuth (°)	Horizon Elevation (°)	Antenna Discrimination (°)	Horizon Gain (dBi)	Coordination Distance (km)	Horizon Gain (dBi)	Coordination Distance (km)
190	0.00	92.14	-8.93	107.10	-8.92	100.00
195	0.00	97.14	-8.70	129.70	-8.70	100.00
200	0.00	102.14	-8.36	130.90	-8.26	100.00
205	0.00	107.14	-7.77	142.50	-7.77	100.00
210	0.00	112.14	-7.01	143.00	-7.01	100.00
215	0.00	117.14	-6.15	139.70	-6.15	100.00
220	0.00	122.13	-5.13	138.80	-5.13	100.00
225	0.00	127.13	-3.95	142.30	-3.95	100.00
230	0.00	132.13	-2.55	148.90	-2.55	100.00
235	0.00	137.13	-0.84	147.30	-0.84	100.00
240	0.00	142.13	1.29	144.40	1.29	100.00
245	0.00	147.13	3.94	152.30	3.94	100.00
250	0.00	152.12	7.53	166.60	7.53	100.00
255	0.00	157.12	10.91	198.50	10.91	100.00
260	0.00	162.11	10.18	175.90	10.18	100.00
265	0.00	167.10	6.38	158.70	6.38	100.00
270	0.00	172.08	2.76	143.10	2.76	100.00
275	0.00	176.98	-0.17	133.50	-0.17	100.00
280	0.00	177.66	-2.56	128.90	-2.56	100.00
285	0.00	172.80	-4.52	113.50	-4.52	100.00
290	0.00	167.82	-6.22	112.80	-6.22	100.00
295	0.00	162.83	-7.69	109.00	-7.69	100.00
300	0.00	157.84	-8.98	100.00	-7.95	100.00
305	0.00	152.85	-10.00	100.00	-9.24	100.00
310	0.00	147.85	-10.00	100.00	-10.00	100.00
315	0.00	142.85	-10.00	100.00	-10.00	100.00
320	0.00	137.85	-10.00	100.00	-10.00	100.00
325	0.00	132.85	-10.00	100.00	-10.00	100.00
330	0.00	127.85	-10.00	100.00	-10.00	100.00
335	0.00	122.86	-10.00	100.00	-10.00	100.00
340	0.00	117.86	-10.00	100.00	-10.00	100.00
345	0.00	112.86	-10.00	100.00	-10.00	100.00
350	0.00	107.86	-10.00	100.00	-10.00	100.00
355	0.00	102.86	-10.00	100.00	-10.00	100.00

5. Contact Information

For questions or information regarding the 28 GHz Frequency Coordination Report, please contact:

Contact person:	Joanna Lynch
Title:	Manager, Spectrum & Data Solutions
Company:	Comsearch
Address:	19700 Janelia Farm Blvd., Ashburn, VA 20147
Telephone:	703-726-5711
Fax:	703-726-5599
Email:	jlynch@comsearch.com
Web site:	www.comsearch.com

FREQUENCY COORDINATION AND INTERFERENCE ANALYSIS REPORT

Prepared for
SES Government Solutions, Inc.
BRISTOW, VA
(18 GHz Receive)
Satellite Earth Station

Prepared By:
COMSEARCH
19700 Janelia Farm Boulevard
Ashburn, VA 20147
September 19, 2013

TABLE OF CONTENTS

1. CONCLUSIONS

An interference study considering all existing, proposed and prior coordinated microwave facilities within the coordination contours of the proposed earth station demonstrates that this site will operate satisfactorily with the 18 GHz common carrier microwave environment. Further, there will be no restrictions of its operation due to interference considerations.

2. SUMMARY OF RESULTS

A number of great circle interference cases were identified during the interference study of the proposed earth station. Each of the cases, which exceeded the interference objective on a line-of-sight basis, was profiled and the propagation losses estimated using NBS TN101 (Revised) techniques. The losses were found to be sufficient to reduce the signal levels to acceptable magnitudes in every case.

3. SUPPLEMENTAL SHOWING

Pursuant to Part 25.203(c) of the FCC Rules and Regulations, the satellite earth station proposed in this application was coordinated by Comsearch using computer techniques and in accordance with Part 25 of the FCC Rules and Regulations.

Coordination data for this earth station was sent to the below listed carriers with a letter dated 08/12/2013.

Company
APC Realty and Equipment CO LLC
Airband Communications Inc
Arlington County Emergency Comm Ctr
B.F. SAUL COMPANY
Believe Wireless, LLC
Blaze Broadband
Blue Ridge Carriers
CBS Broadcasting Inc
CBS Communications Services Inc.
Calvert County Government
Clearwire Spectrum Holdings III, LLC
Commissioners of Caroline County
ECW Wireless, LLC
Eduro Networks LLC
Enoch Pratt Free Library
George Washington University
Loudoun Wireless LLC
Loudoun, County of
Maryland Port Administration
Maryland, State Of - MDOT - MTA
NBC TELEMUNDO LICENSE LLC
New Cingular Wireless PCS LLC - DC
Old Dominion LLC
PEG Bandwidth
Prince William, County of
Radio One Inc, LLC
RapidDSL & Wireless, Inc.
Red Zebra Broadcasting Licensee, LLC
Roadstar Internet, Inc.
SALISBURY UNIVERSITY FOUNDATION, INC
Shenandoah Personal Communications, LLC
Sprint Spectrum L.P
Virginia Cellular LLC
Virginia Electric & Power Company
Virginia PCS Alliance, L.C.
WASHINGTON CABLE SYSTEMS INC
WICOMICO BOARD OF EDUCATION
WKYSFM, INC
Washington Metro Area Transit Police Dep
Wicomico County
Wor-Wic Community College
World Class Wireless LLC

4. EARTH STATION COORDINATION DATA

This section presents the data pertinent to frequency coordination of the proposed earth station that was circulated to all carriers within its coordination contours.

COMSEARCH

Earth Station Data Sheet

19700 Janelia Farm Boulevard, Ashburn, VA 20147
(703)726-5500 http://www.comsearch.com

Date:	09/19/2013
Job Number:	130812COMSGE01

Administrative Information

Status	ENGINEER PROPOSAL
Call Sign	
Licensee Code	AMGOSE
Licensee Name	SES Government Solutions, Inc.

Site Information — BRISTOW, VA

Venue Name	
Latitude (NAD 83)	38° 47' 0.2" N
Longitude (NAD 83)	77° 34' 24.5" W
Climate Zone	A
Rain Zone	2
Ground Elevation (AMSL)	86.56 m / 284.0 ft

Link Information

Satellite Type	Medium Earth Orbit
Mode	TR - Transmit-Receive
Modulation	Digital
Minimum Elevation Angle	7.0°
Azimuth Range	0.0° to 360°
Antenna Centerline (AGL)	1.83 m / 6.0 ft

Antenna Information		Receive - FCC32		Transmit - FCC32	
Manufacturer		GD/Prodelin		GD/Prodelin	
Model		GDST-1.8M		GDST-1.8M	
Gain / Diameter		49.1 dBi / 1.8 m		52.8 dBi / 1.8 m	
3-dB / 15-dB Beamwidth		0.23° / 0.60°		0.14° / 0.32°	
Max Available RF Power	(dBW/4 kHz)			-14.0	
	(dBW/MHz)			10.0	
Maximum EIRP	(dBW/4 kHz)			38.8	
	(dBW/MHz)			62.8	
Interference Objectives:	Long Term	-156.0 dBW/MHz	20%	-151.0 dBW/4 kHz	20%
	Short Term	-146.0 dBW/MHz	0.01%	-128.0 dBW/4 kHz	0.0025%

Frequency Information	Receive 18.0 GHz	Transmit 28.0 GHz
Emission / Frequency Range (MHz)	1M00G7D - 216MG7D / 18372.0 - 18588.0	1M00G7D - 216MG7D / 28172.0 - 28388.0
Max Great Circle Coordination Distance	198.5 km / 123.3 mi	124.7 km / 77.5 mi
Precipitation Scatter Contour Radius	100.0 km / 62.1 mi	100.0 km / 62.1 mi

COMSEARCH

Earth Station Data Sheet

19700 Janelia Farm Boulevard, Ashburn, VA 20147
(703)726-5500 http://www.comsearch.com

Coordination Values	**BRISTOW, VA**			
Licensee Name	SES Government Solutions			
Latitude (NAD 83)	38° 47' 0.2" N			
Longitude (NAD 83)	77° 34' 24.5" W			
Ground Elevation (AMSL)	86.56 m / 284.0 ft			
Antenna Centerline (AGL)	1.83 m / 6.0 ft			
Antenna Model	GD/Prodelin 1.8 Meter			
Antenna Mode	Receive 18.0 GHz		Transmit 28.0 GHz	
Interference Objectives: Long Term	-156.0 dBW/MHz	20%	-151.0 dBW/4 kHz	20%
Short Term	-146.0 dBW/MHz	0.01%	-128.0 dBW/4 kHz	0.0025%
Max Available RF Power		-14.0 (dBW/4 kHz)		

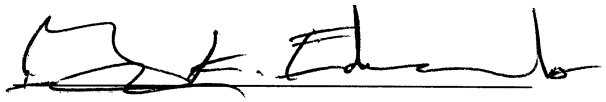
			Receive 18.0 GHz		Transmit 28.0 GHz	
Azimuth (°)	Horizon Elevation (°)	Antenna Discrimination (°)	Horizon Gain (dBi)	Coordination Distance (km)	Horizon Gain (dBi)	Coordination Distance (km)
0	0.00	97.86	-10.00	100.00	-10.00	100.00
5	0.00	92.86	-10.00	100.00	-10.00	100.00
10	0.00	87.86	-10.00	100.00	-10.00	100.00
15	0.00	82.86	-10.00	100.00	-10.00	100.00
20	0.00	77.86	-10.00	100.00	-10.00	100.00
25	0.00	72.86	-10.00	102.20	-10.00	100.00
30	0.00	67.86	-10.00	103.10	-10.00	100.00
35	0.00	62.86	-10.00	108.30	-10.00	100.00
40	0.00	57.87	-10.00	111.90	-10.00	100.00
45	0.00	52.87	-10.00	107.60	-10.00	100.00
50	0.00	47.87	-10.00	112.00	-10.00	100.00
55	0.00	42.87	-10.00	116.00	-10.00	100.00
60	0.00	37.87	-8.98	138.00	-8.98	100.00
65	0.00	32.87	-7.69	142.70	-7.69	102.20
70	0.00	27.88	-6.23	147.10	-6.23	105.80
75	0.00	22.88	-4.54	152.30	-4.54	109.80
80	0.00	17.89	-2.58	159.20	-2.58	114.50
85	0.00	12.90	-0.16	153.40	-0.16	109.50
90	0.00	7.92	2.89	139.80	2.89	100.00
95	0.00	3.02	6.69	147.40	6.69	100.50
100	0.00	2.34	10.98	158.20	10.98	106.50
105	0.00	7.20	11.99	185.10	11.99	124.70
110	0.00	12.18	7.90	144.30	7.89	100.00
115	0.00	17.17	4.32	127.60	4.33	100.00
120	0.00	22.16	1.61	118.50	1.61	100.00
125	0.00	27.15	-0.49	110.90	-0.49	100.00
130	0.00	32.15	-2.17	102.30	-2.17	100.00
135	0.00	37.15	-3.58	100.00	-3.58	100.00
140	0.00	42.15	-4.79	100.00	-4.79	100.00
145	0.00	47.15	-5.83	100.00	-5.83	100.00
150	0.00	52.15	-6.84	104.50	-6.84	100.00
155	0.00	57.14	-7.55	103.10	-7.55	100.00
160	0.00	62.14	-8.18	110.70	-8.18	100.00
165	0.00	67.14	-8.62	110.30	-8.62	100.00
170	0.00	72.14	-8.94	110.00	-8.94	100.00
175	0.00	77.14	-9.13	109.10	-9.13	100.00
180	0.00	82.14	-9.22	114.60	-9.22	100.00
185	0.00	87.14	-9.11	106.60	-9.11	100.00

Coordination Values	**BRISTOW, VA**			
Licensee Name	SES Government Solutions			
Latitude (NAD 83)	38° 47' 0.2" N			
Longitude (NAD 83)	77° 34' 24.5" W			
Ground Elevation (AMSL)	86.56 m / 284.0 ft			
Antenna Centerline (AGL)	1.83 m / 6.0 ft			
Antenna Model	GD/Prodelin 1.8 Meter			
Antenna Mode	Receive 18.0 GHz		Transmit 28.0 GHz	
Interference Objectives: Long Term	-156.0 dBW/MHz	20%	-151.0 dBW/4 kHz	20%
Short Term	-146.0 dBW/MHz	0.01%	-128.0 dBW/4 kHz	0.0025%
Max Available RF Power		-14.0 (dBW/4 kHz)		

			Receive 18.0 GHz		Transmit 28.0 GHz	
Azimuth (°)	Horizon Elevation (°)	Antenna Discrimination (°)	Horizon Gain (dBi)	Coordination Distance (km)	Horizon Gain (dBi)	Coordination Distance (km)
190	0.00	92.14	-8.93	107.10	-8.92	100.00
195	0.00	97.14	-8.70	129.70	-8.70	100.00
200	0.00	102.14	-8.36	130.90	-8.26	100.00
205	0.00	107.14	-7.77	142.50	-7.77	100.00
210	0.00	112.14	-7.01	143.00	-7.01	100.00
215	0.00	117.14	-6.15	139.70	-6.15	100.00
220	0.00	122.13	-5.13	138.80	-5.13	100.00
225	0.00	127.13	-3.95	142.30	-3.95	100.00
230	0.00	132.13	-2.55	148.90	-2.55	100.00
235	0.00	137.13	-0.84	147.30	-0.84	100.00
240	0.00	142.13	1.29	144.40	1.29	100.00
245	0.00	147.13	3.94	152.30	3.94	100.00
250	0.00	152.12	7.53	166.60	7.53	100.00
255	0.00	157.12	10.91	198.50	10.91	100.00
260	0.00	162.11	10.18	175.90	10.18	100.00
265	0.00	167.10	6.38	158.70	6.38	100.00
270	0.00	172.08	2.76	143.10	2.76	100.00
275	0.00	176.98	-0.17	133.50	-0.17	100.00
280	0.00	177.66	-2.56	128.90	-2.56	100.00
285	0.00	172.80	-4.52	113.50	-4.52	100.00
290	0.00	167.82	-6.22	112.80	-6.22	100.00
295	0.00	162.83	-7.69	109.00	-7.69	100.00
300	0.00	157.84	-8.98	100.00	-7.95	100.00
305	0.00	152.85	-10.00	100.00	-9.24	100.00
310	0.00	147.85	-10.00	100.00	-10.00	100.00
315	0.00	142.85	-10.00	100.00	-10.00	100.00
320	0.00	137.85	-10.00	100.00	-10.00	100.00
325	0.00	132.85	-10.00	100.00	-10.00	100.00
330	0.00	127.85	-10.00	100.00	-10.00	100.00
335	0.00	122.86	-10.00	100.00	-10.00	100.00
340	0.00	117.86	-10.00	100.00	-10.00	100.00
345	0.00	112.86	-10.00	100.00	-10.00	100.00
350	0.00	107.86	-10.00	100.00	-10.00	100.00
355	0.00	102.86	-10.00	100.00	-10.00	100.00

5. CERTIFICATION

I HEREBY CERTIFY THAT I AM THE TECHNICALLY QUALIFIED PERSON RESPONSIBLE FOR THE PREPARATION OF THE FREQUENCY COORDINATION DATA CONTAINED IN THIS APPLICATION, THAT I AM FAMILIAR WITH PARTS 101 AND 25 OF THE FCC RULES AND REGULATIONS, THAT I HAVE EITHER PREPARED OR REVIEWED THE FREQUENCY COORDINATION DATA SUBMITTED WITH THIS APPLICATION, AND THAT IT IS COMPLETE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF.

BY: 

Gary K. Edwards
Senior Manager
COMSEARCH
19700 Janelia Farm Boulevard
Ashburn, VA 20147

DATED: September 19, 2013

GENERAL DYNAMICS
SATCOM Technologies

1.8m Ka-Band CP Rx/Tx Antenna

O3b Antenna System

2241 RevB Test Report / FCC Format

East Maiden Antenna Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650
828-428-1485 / 828-428-1488 fax

GENERAL DYNAMICS
SATCOM Technologies

GENERAL DYNAMICS
SATCOM Technologies

Test No. 2241 RevB

Antenna: 1.8M Ka-Band CP Rx/Tx O3b Antenna System

Report Notes:
This report is to show antenna compliance to FCC 47 CFR Ch. 1, 10-01-10 Edition, Section 25.209 and 25.138.

In the plane of the geostationary satellite orbit the following RPE is shown on patterns.
29-25log theta dBi for 1.5° = theta = 7°
+8 dBi for 7° < theta = 9.2°
32-25log theta dBi for9.2° < theta = 48°
-10 dBi for 48° < theta = 85°
0 dBi for 85° < theta = 180°

In all other directions or in the plane of the horizon, the following RPE is shown on patterns.
32-25log theta dBi for 3° < theta = 48°
-10 dBi for 48° < theta = 85°
0 dBi for 85° < theta = 180°

The Cross-Polarization in the plane of the geostationary satellite orbit and/or in all other directions the following RPE is shown on patterns.
19-25log theta dBi for 1.8° < theta = 7°
-2 dBi for 7° < theta = 9.2°

Test Location:
General Dynamics SATCOM Technologies
Antenna Test Facility
4488 Lawing Chapel Church Rd
Maiden, NC 28650

Test Operator(s):
Dwight B. Lutz
Jonathan Hartness

828-428-1485 office
dwight.lutz@gdsatcom.com

1.8M Ka-Band CP Rx/Tx Antenna System

O3b

Contents

Gain

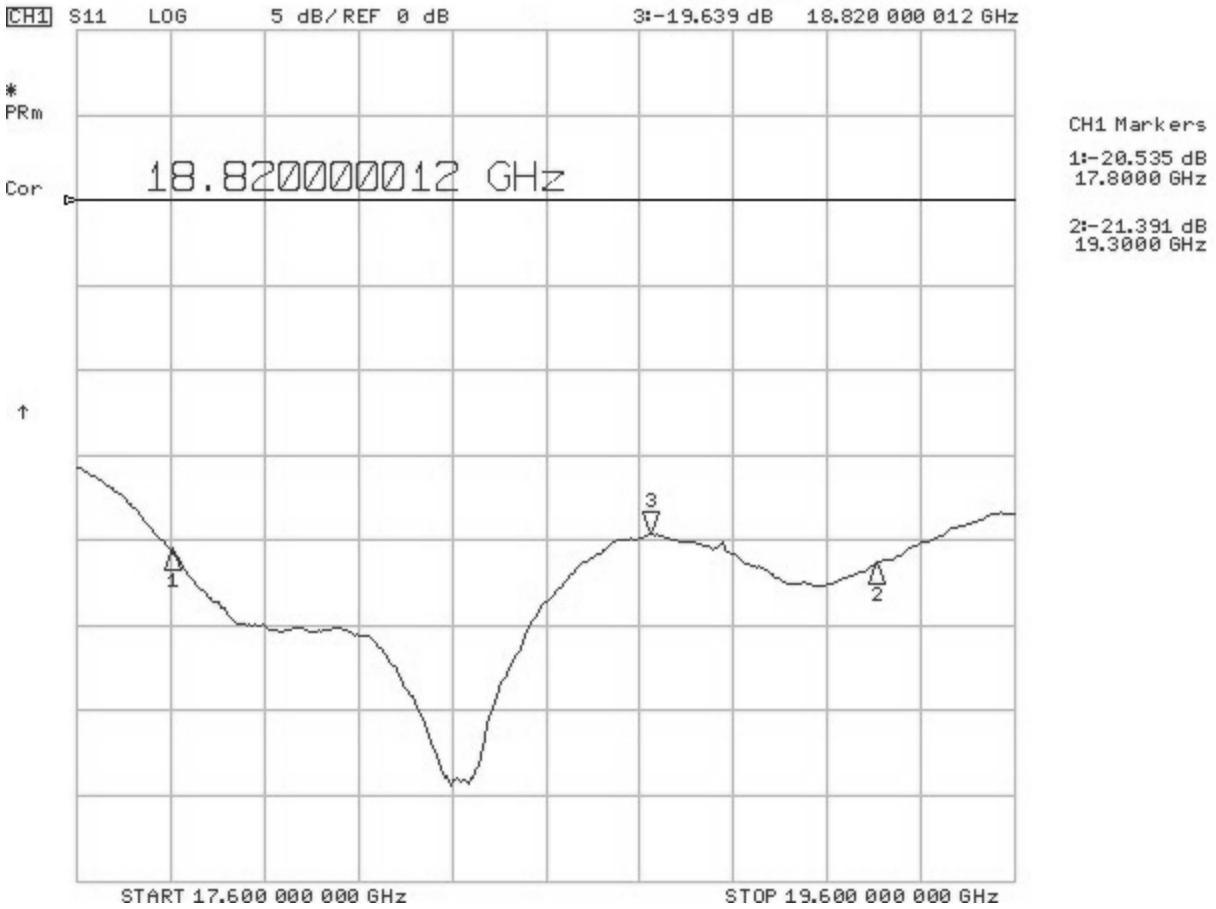
Gain Analysis

Frequency (GHz)	Gain (dB) LHCP	Gain (dB) RHCP
27.60	52.7	52.6
28.35	52.9	52.8
29.10	53.0	53.0
17.80	49.1	49.0
18.55	49.4	49.4
19.30	49.7	49.7

Feed Data

Compliance to Return Loss, Port to Port Isolation & Axial Ratio

Rx LH Return Loss

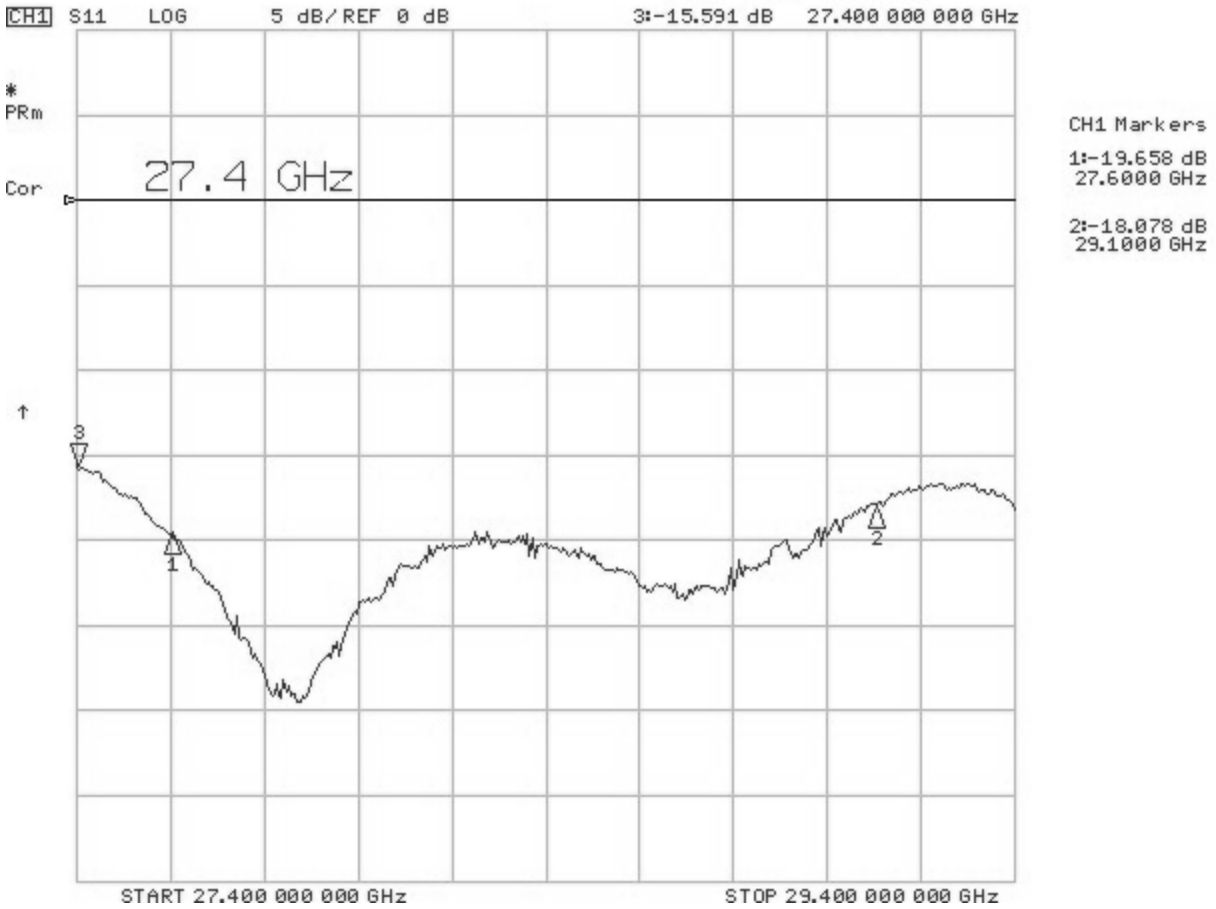


General Dynamics SATCOM Technologies
Antenna Test Facility
Maiden, North Carolina 28650

Rx RH Return Loss

General Dynamics SATCOM Technologies
Antenna Test Facility
Maiden, North Carolina 28650

Tx LH Return Loss



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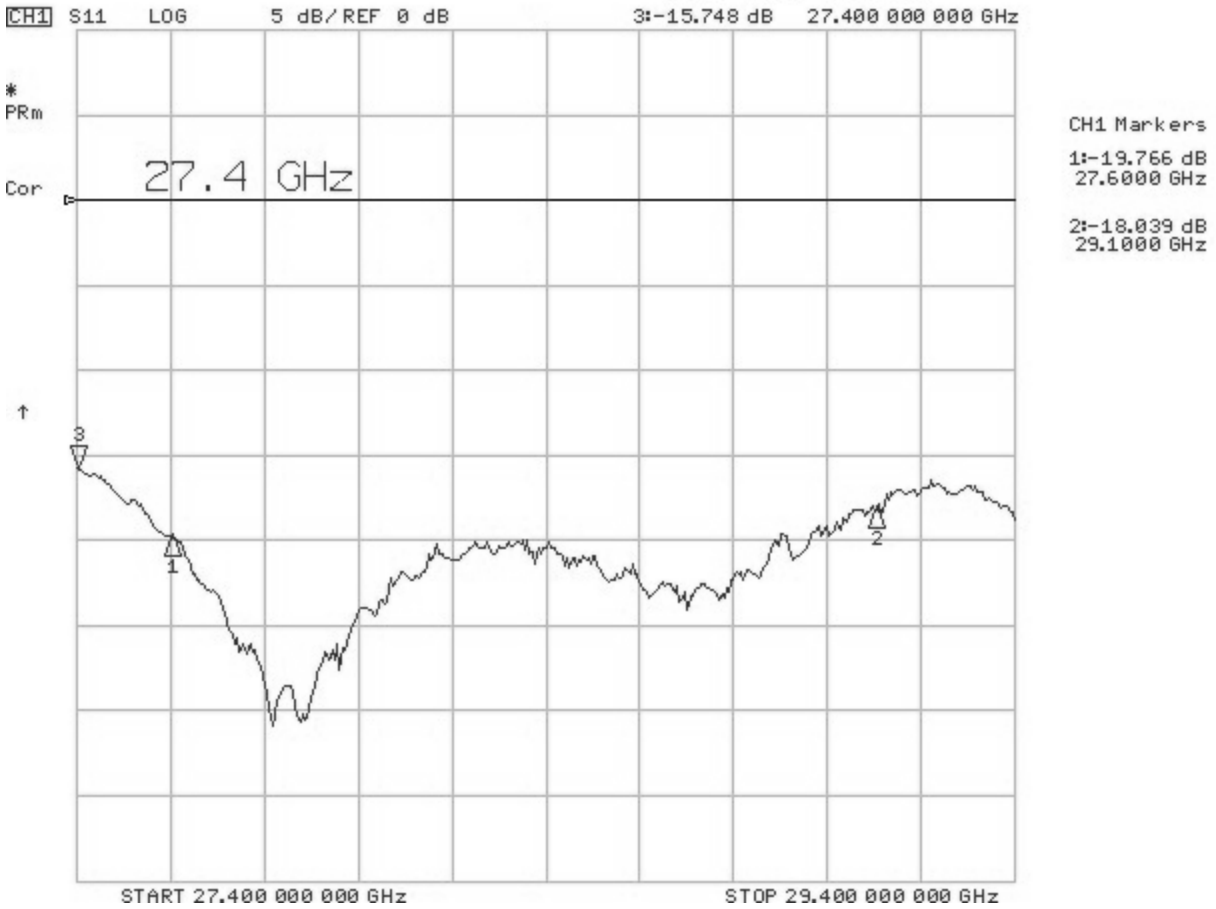
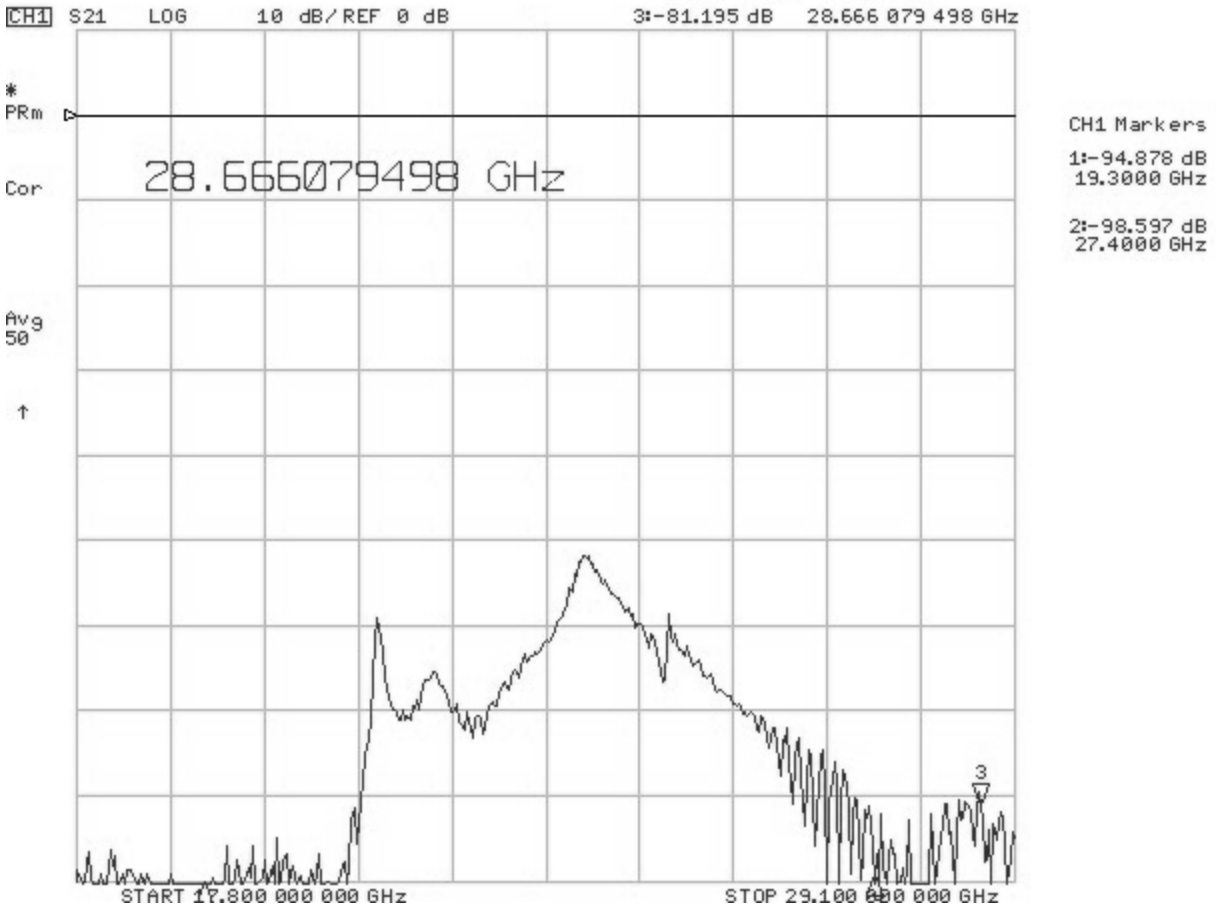
Maiden, North Carolina 28650

Tx RH Return Loss



General Dynamics SATCOM Technologies
Antenna Test Facility
Maiden, North Carolina 28650

Port to Port Isolation



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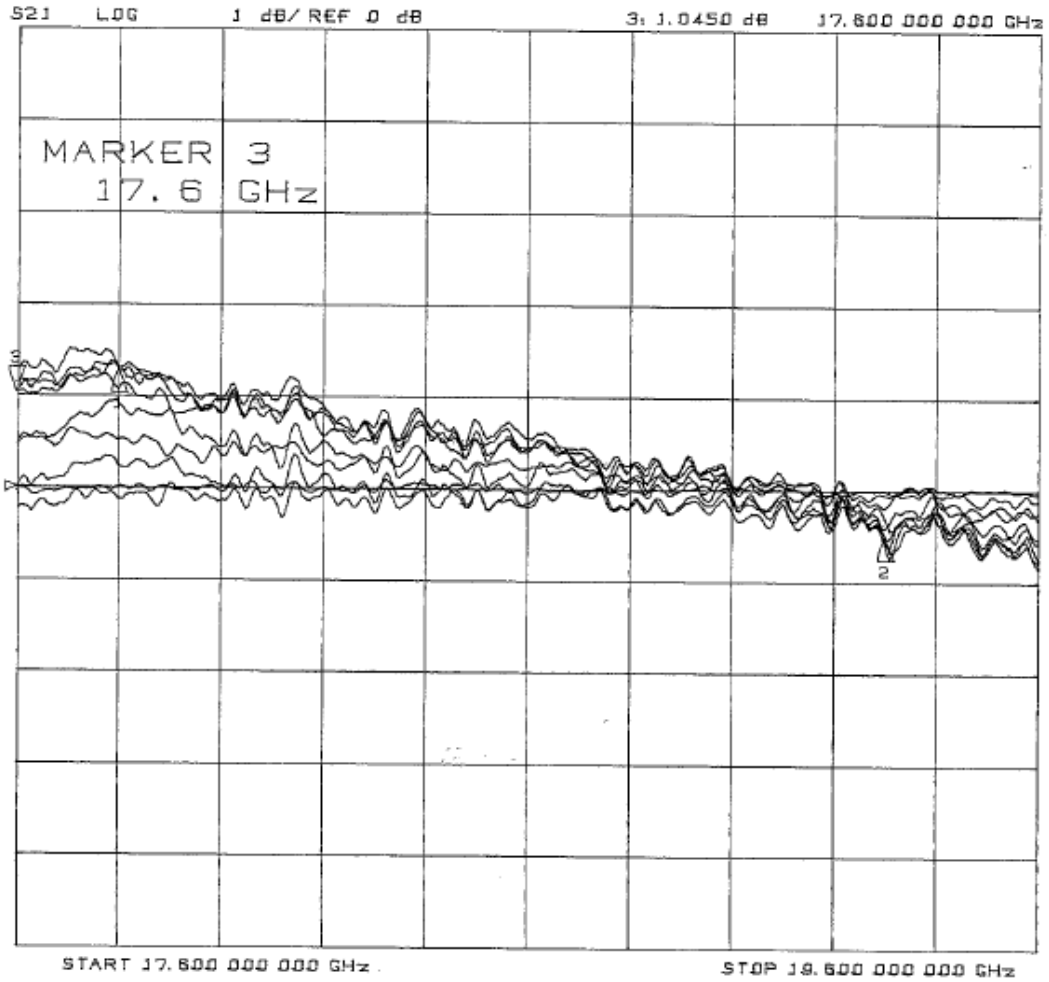
Maiden, North Carolina 28650

Axial Ratio Rx LH



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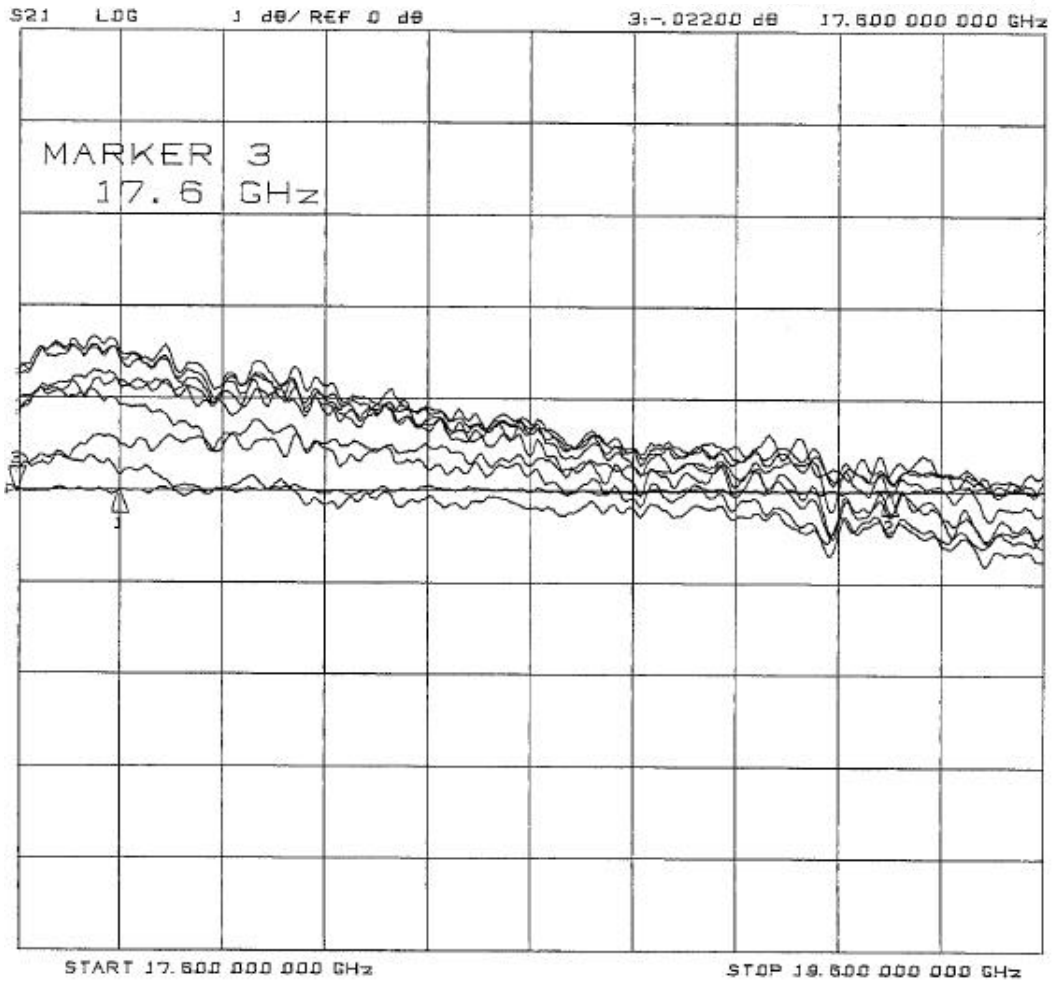
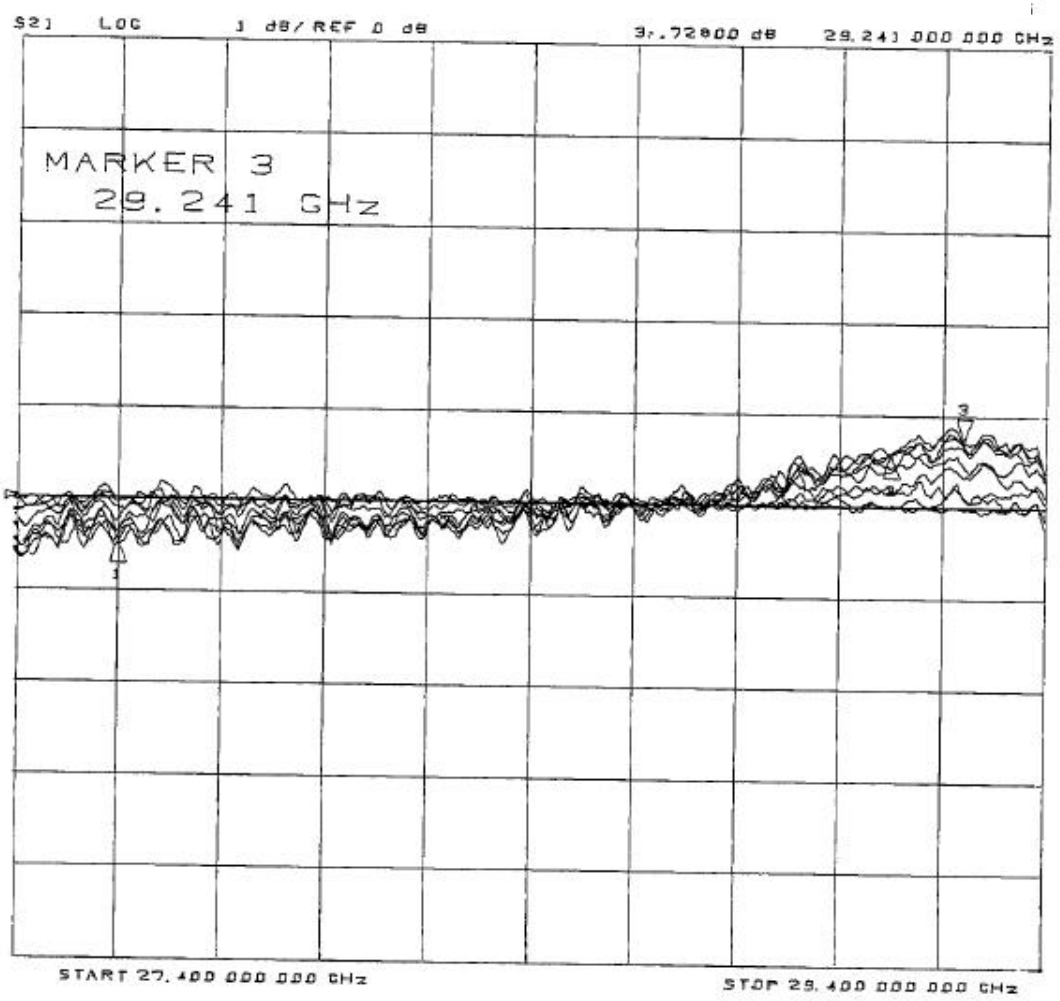
Antenna Test Facility
Maiden, North Carolina 28650

Axial Ratio Rx RH



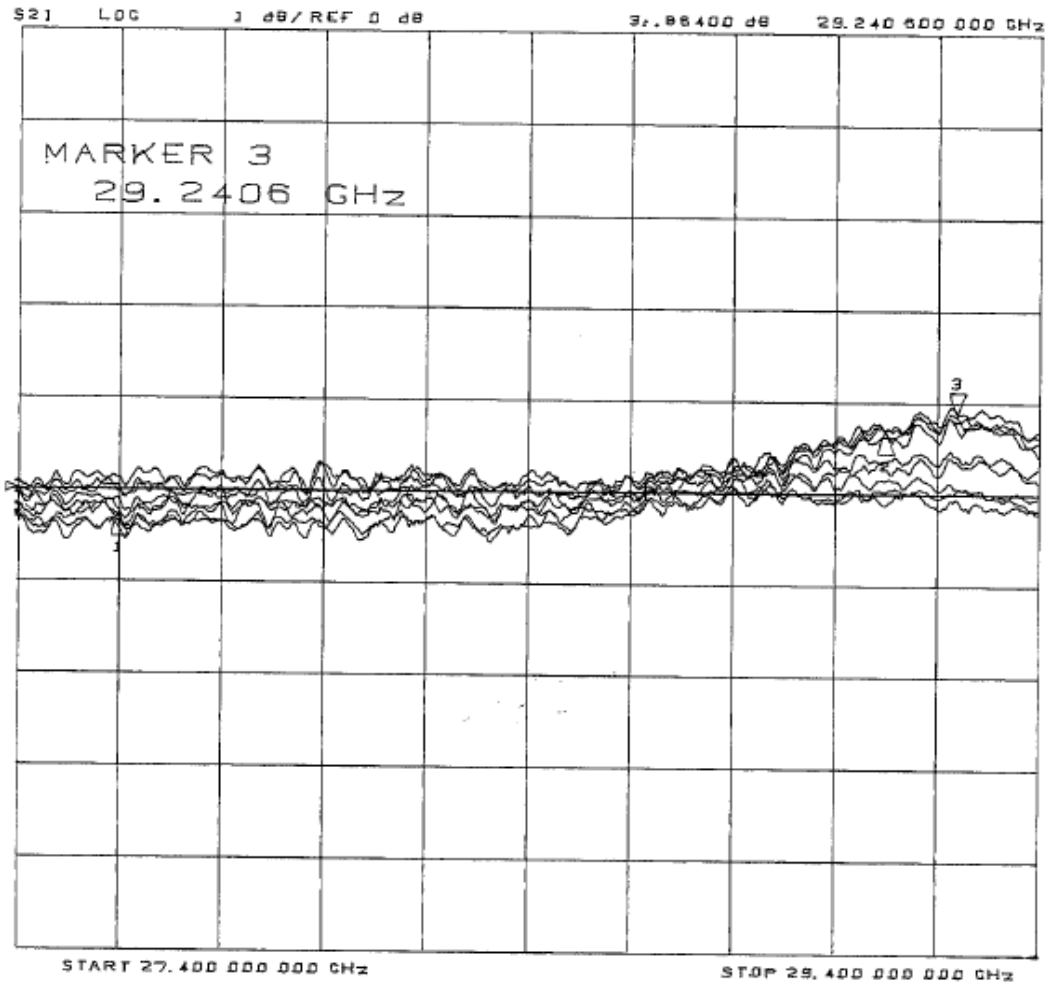
General Dynamics SATCOM Technologies
Antenna Test Facility
Maiden, North Carolina 28650

Axial Ratio Tx LH



General Dynamics SATCOM Technologies
Antenna Test Facility
Maiden, North Carolina 28650

Axial Ratio Tx RH



General Dynamics SATCOM Technologies
Antenna Test Facility
Maiden, North Carolina 28650

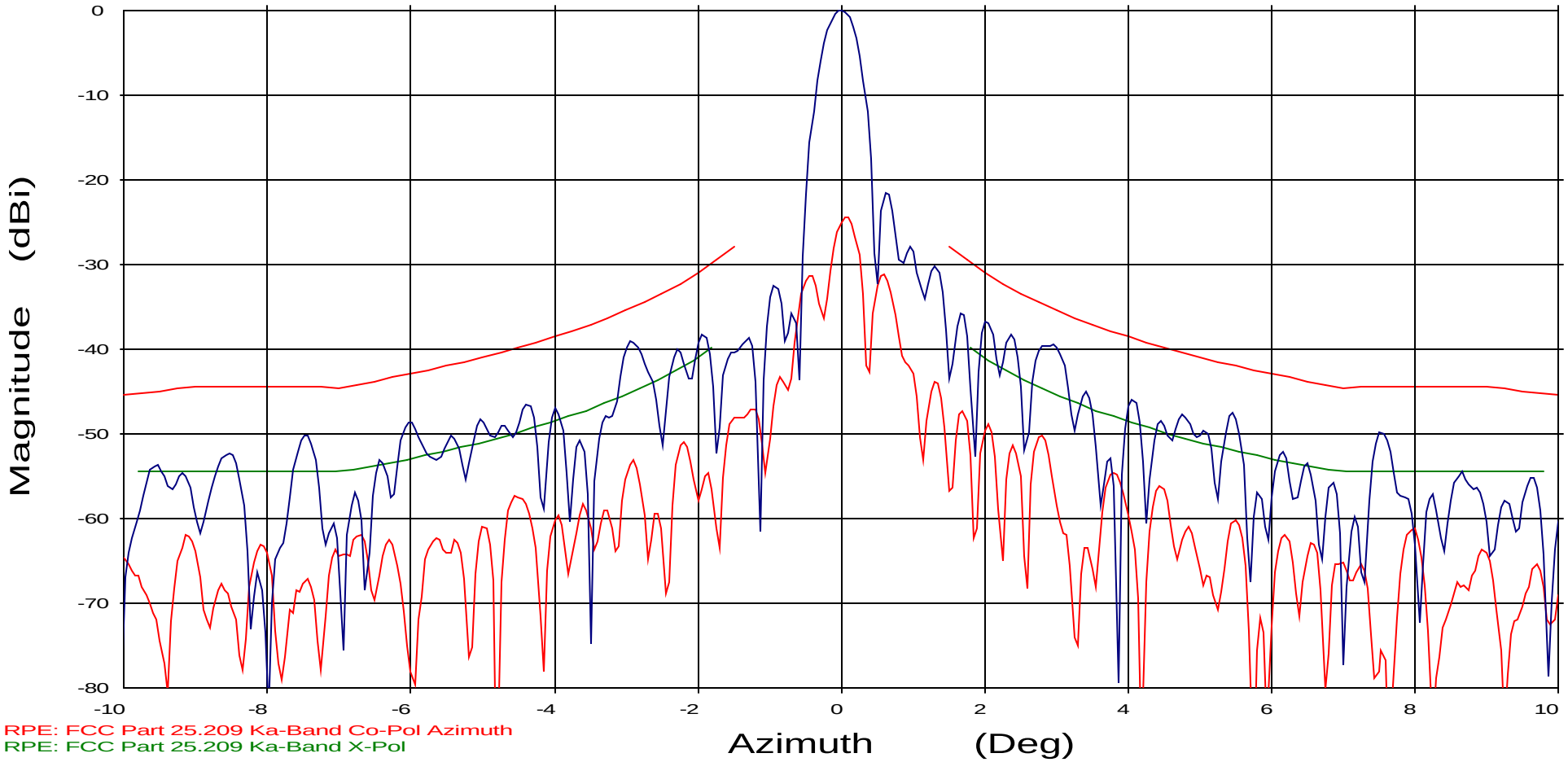
LHCP Radiation Patterns

Transmit Frequencies

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 27.600 GHz

Operator: J Hartness
Ser. no.: 013012-1
Channel: AUT Tx pol: LHCP Rx pol: LHCP



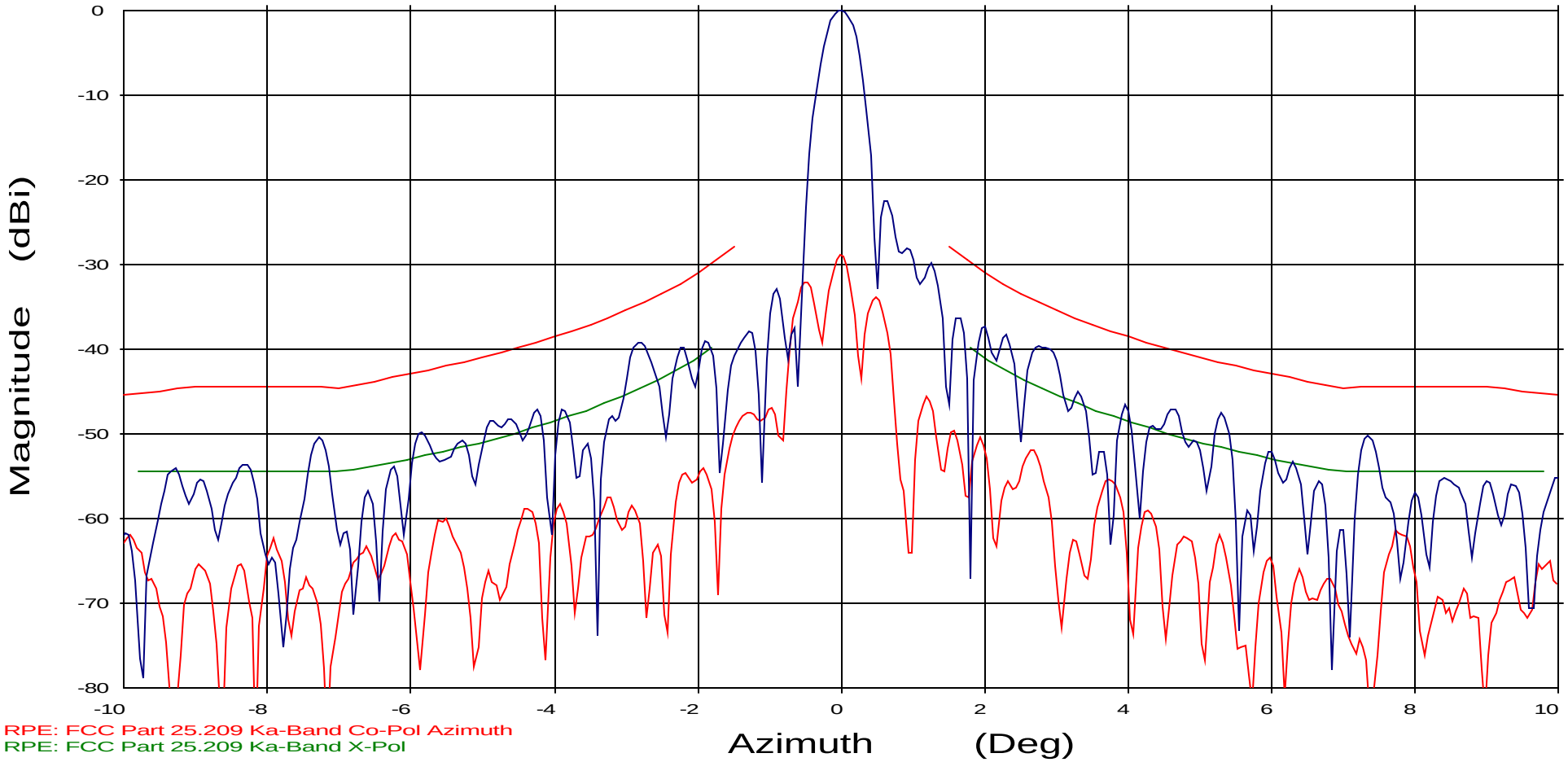
Overlays	Cal. file	table	channel	units
2241 05.dat-ant_under_test	2241 05.dat	Reference	AUT	dBi
2241 08.dat-ant_under_test	2241 08.dat	Reference	AUT	dBi

General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 28.350 GHz

Operator: J Hartness
Ser. no.: 013012-1
Channel: AUT Tx pol: LHCP Rx pol: LHCP



RPE: FCC Part 25.209 Ka-Band Co-Pol Azimuth
RPE: FCC Part 25.209 Ka-Band X-Pol

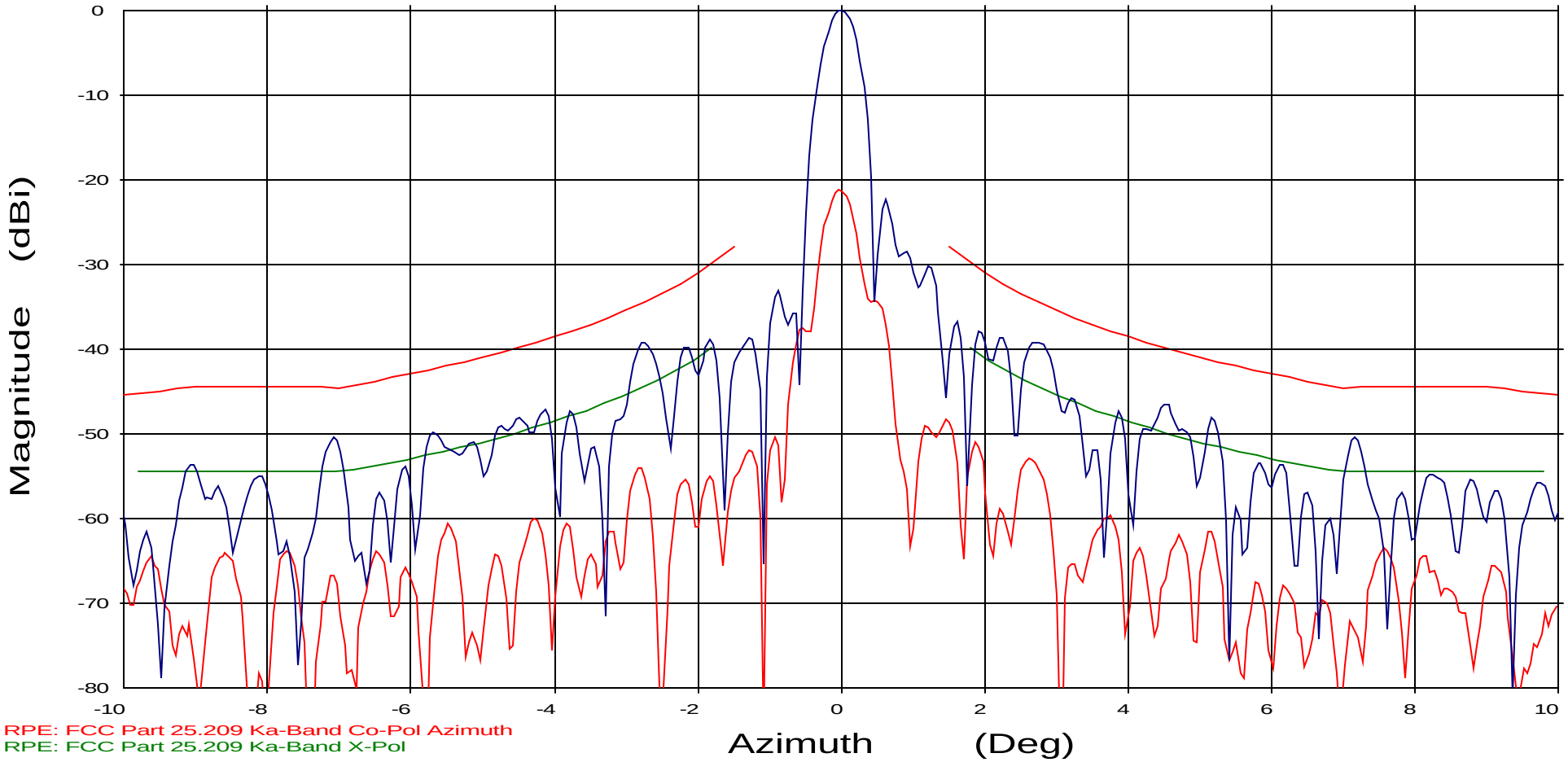
Overlays	Cal. file	table	channel	units
2241 05.dat-ant_under_test	2241 05.dat	Reference	AUT	dBi
2241 08.dat-ant_under_test	2241 08.dat	Reference	AUT	dBi

General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 29.100 GHz

Operator: J Hartness
Ser. no.: 013012-1
Channel: AUT Tx pol: LHCP Rx pol: LHCP



RPE: FCC Part 25.209 Ka-Band Co-Pol Azimuth
RPE: FCC Part 25.209 Ka-Band X-Pol

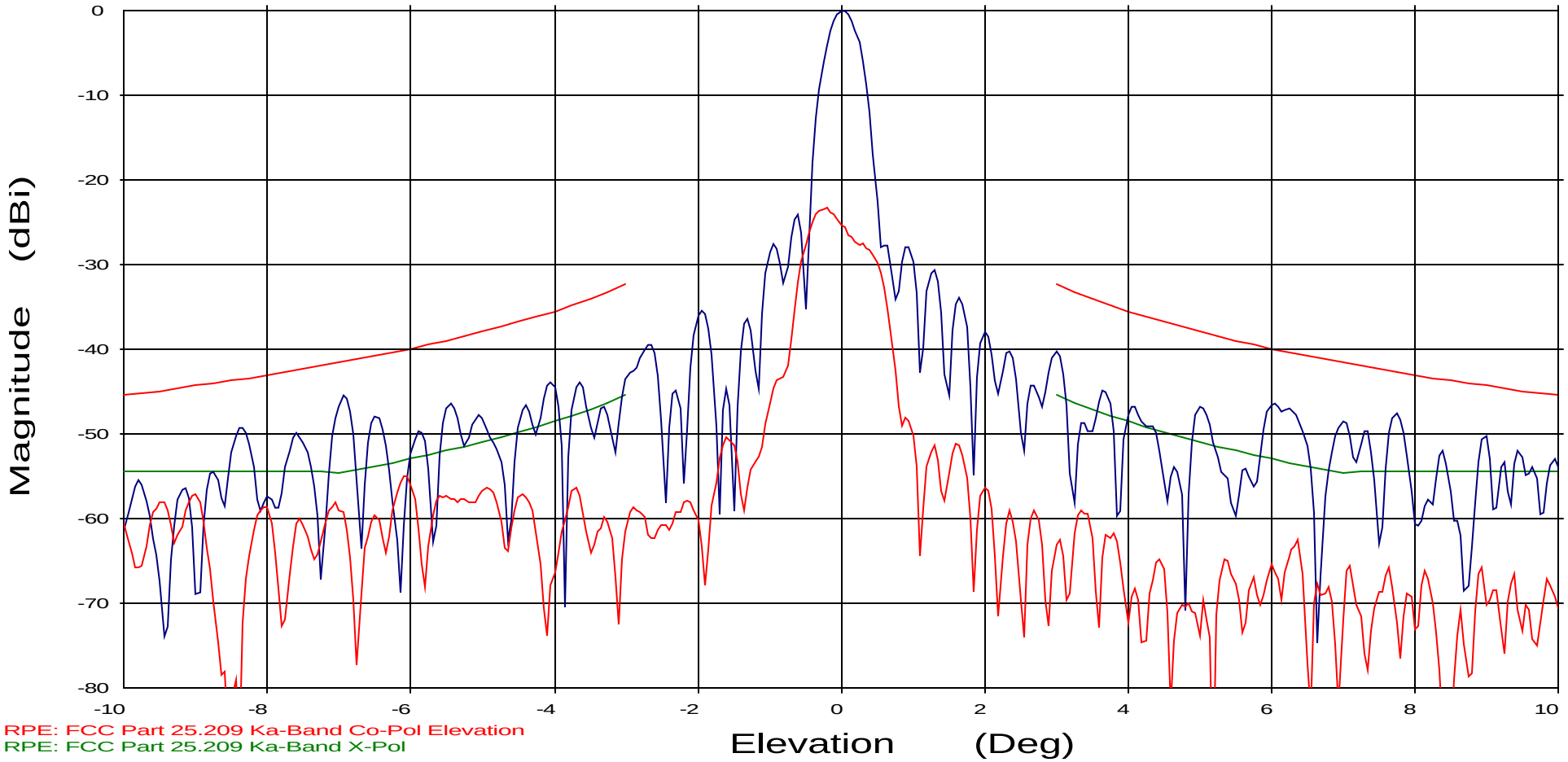
Overlays	Cal. file	table	channel	units
2241 05.dat-ant_under_test	2241 05.dat	Reference	AUT	dBi
2241 08.dat-ant_under_test	2241 08.dat	Reference	AUT	dBi

General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 27.600 GHz

Operator: J Hartness
Ser. no.: 013012-1
Channel: AUT Tx pol: LHCP Rx pol: LHCP



RPE: FCC Part 25.209 Ka-Band Co-Pol Elevation
RPE: FCC Part 25.209 Ka-Band X-Pol

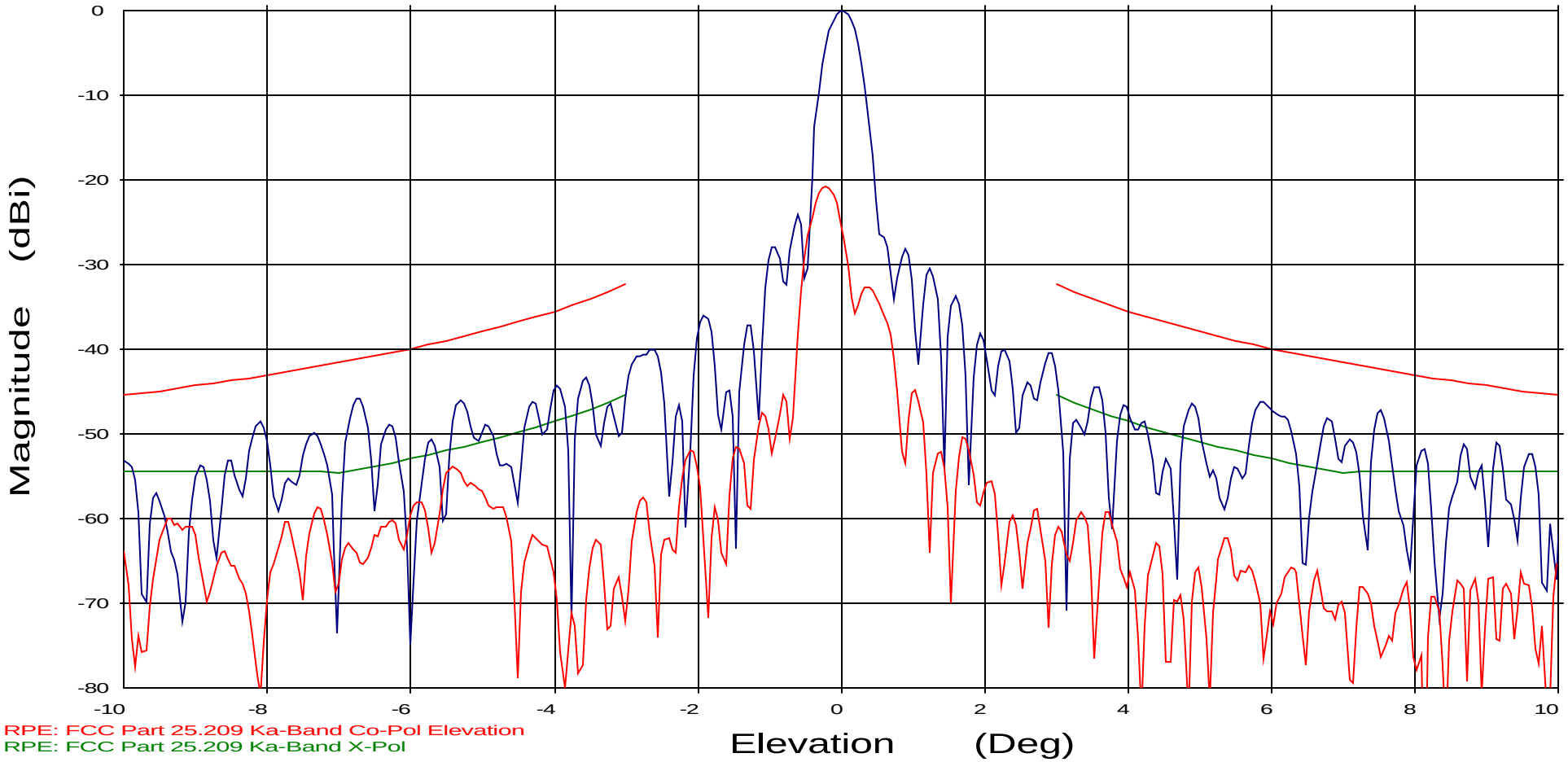
Overlays	Cal. file	table	channel	units
2241 07.dat-ant_under_test	2241 07.dat	Reference	AUT	dBi
2241 10.dat-ant_under_test	2241 10.dat	Reference	AUT	dBi

General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 28.350 GHz

Operator: J Hartness
Ser. no.: 013012-1
Channel: AUT Tx pol: LHCP Rx pol: LHCP



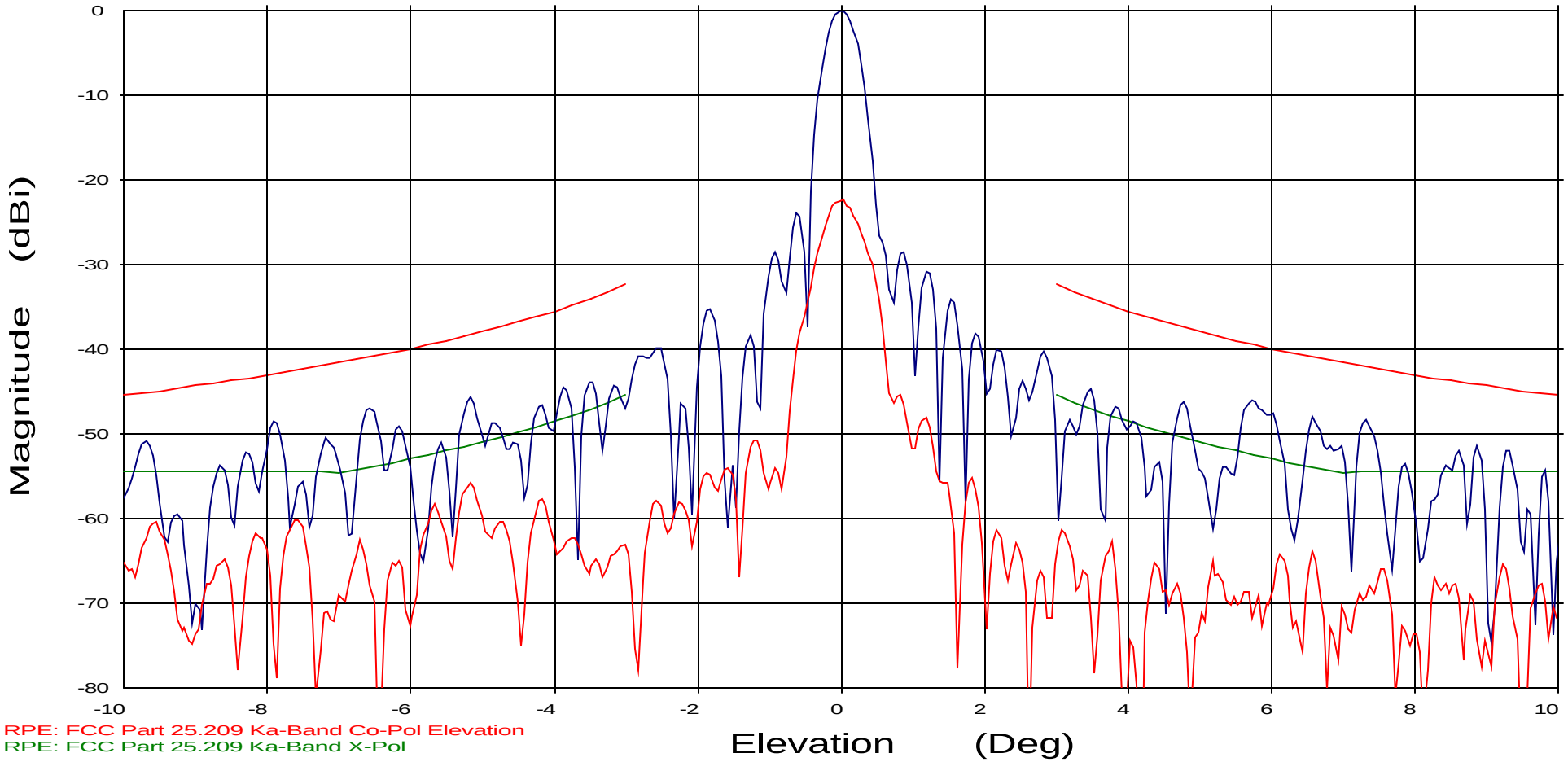
Overlays	Cal. file	table	channel	units
2241 07.dat-ant_under_test	2241 07.dat	Reference	AUT	dBi
2241 10.dat-ant_under_test	2241 10.dat	Reference	AUT	dBi

General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 29.100 GHz

Operator: J Hartness
Ser. no.: 013012-1
Channel: AUT Tx pol: LHCP Rx pol: LHCP



RPE: FCC Part 25.209 Ka-Band Co-Pol Elevation
RPE: FCC Part 25.209 Ka-Band X-Pol

Overlays	Cal. file	table	channel	units
2241 07.dat-ant_under_test	2241 07.dat	Reference	AUT	dBi
2241 10.dat-ant_under_test	2241 10.dat	Reference	AUT	dBi

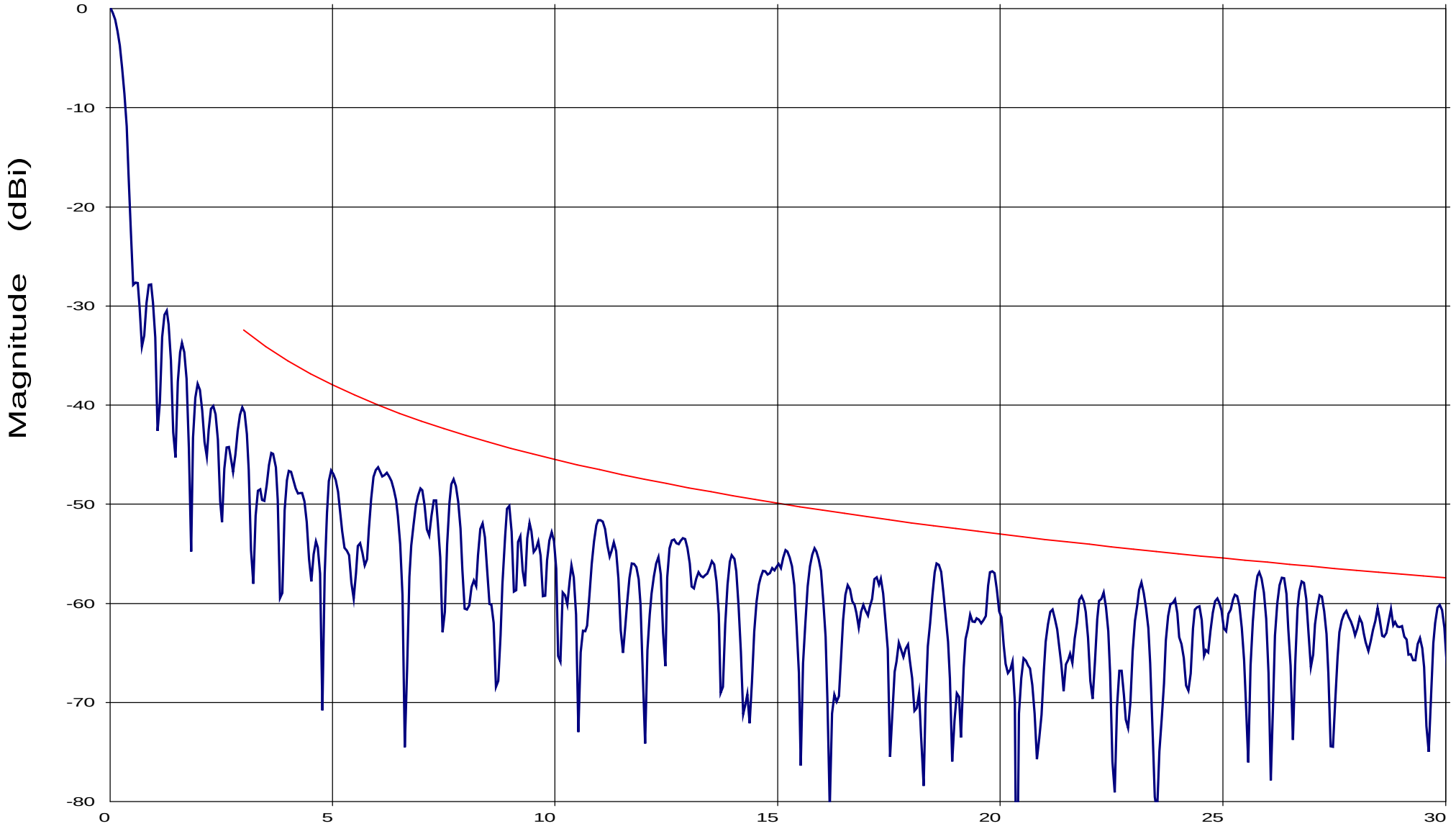
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: 2241 07.dat

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 27.600 GHz

Operator: J Hartness
Ser. no.: 013012-1
Channel: AUT Tx pol: LHCP Rx pol: LHCP



RPE: FCC Part 25.209 Ka-Band Co-Pol Elevation

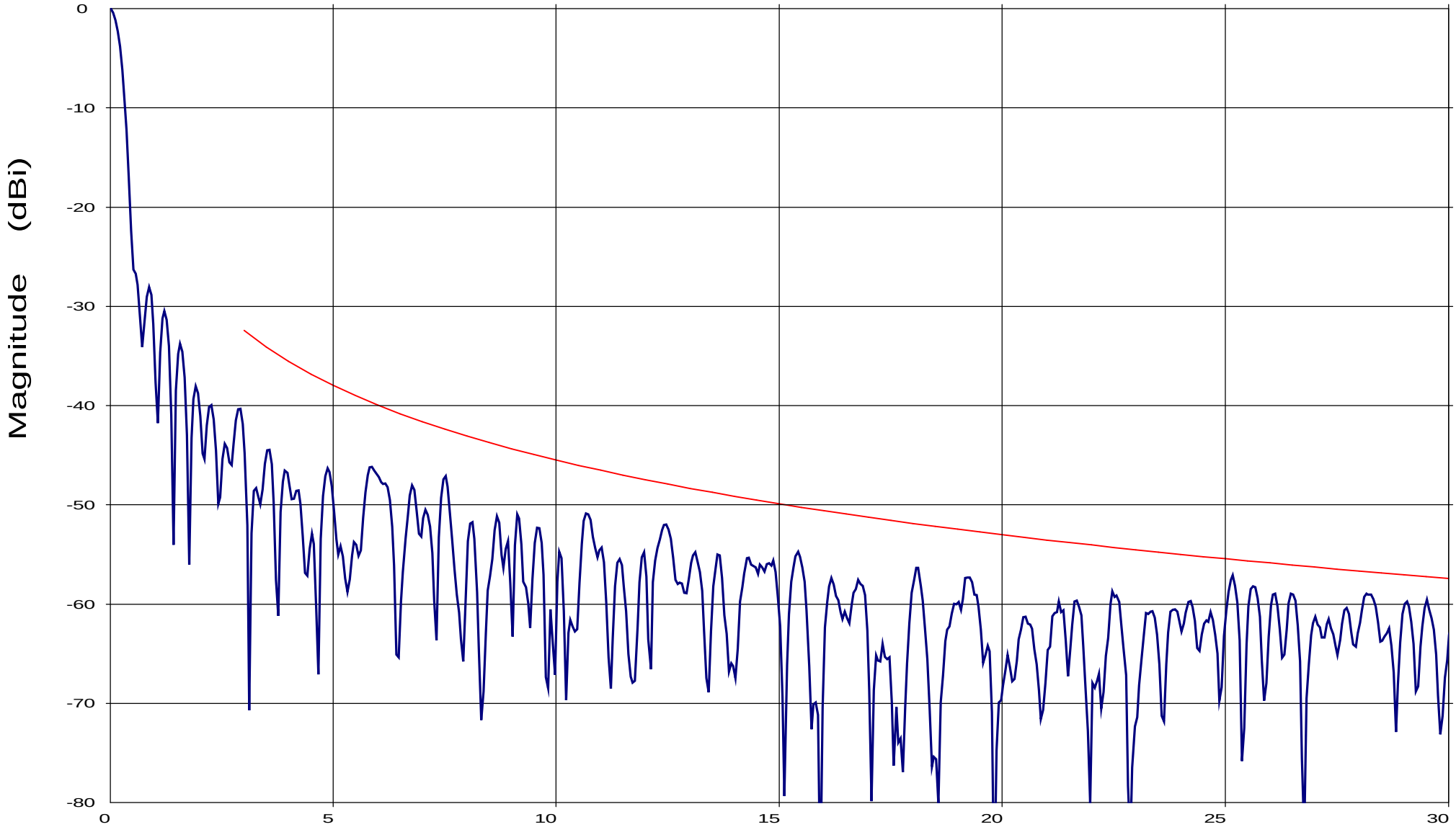
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: 2241 07.dat

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 28.350 GHz

Operator: J Hartness
Ser. no.: 013012-1
Channel: AUT Tx pol: LHCP Rx pol: LHCP



RPE: FCC Part 25.209 Ka-Band Co-Pol Elevation

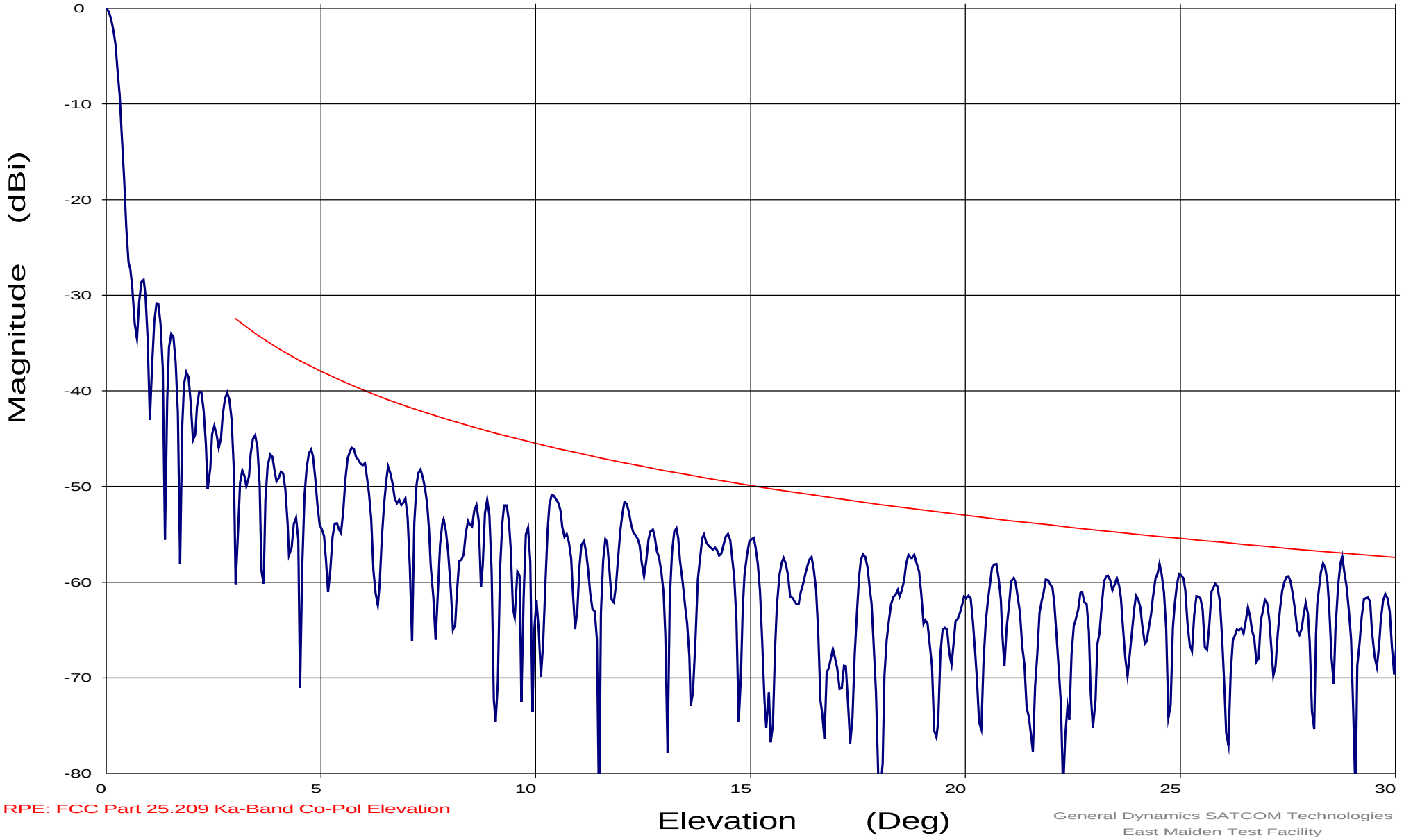
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: 2241 07.dat

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 29.100 GHz

Operator: J Hartness
Ser. no.: 013012-1
Channel: AUT Tx pol: LHCP Rx pol: LHCP



RPE: FCC Part 25.209 Ka-Band Co-Pol Elevation

General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: 2241 05.dat

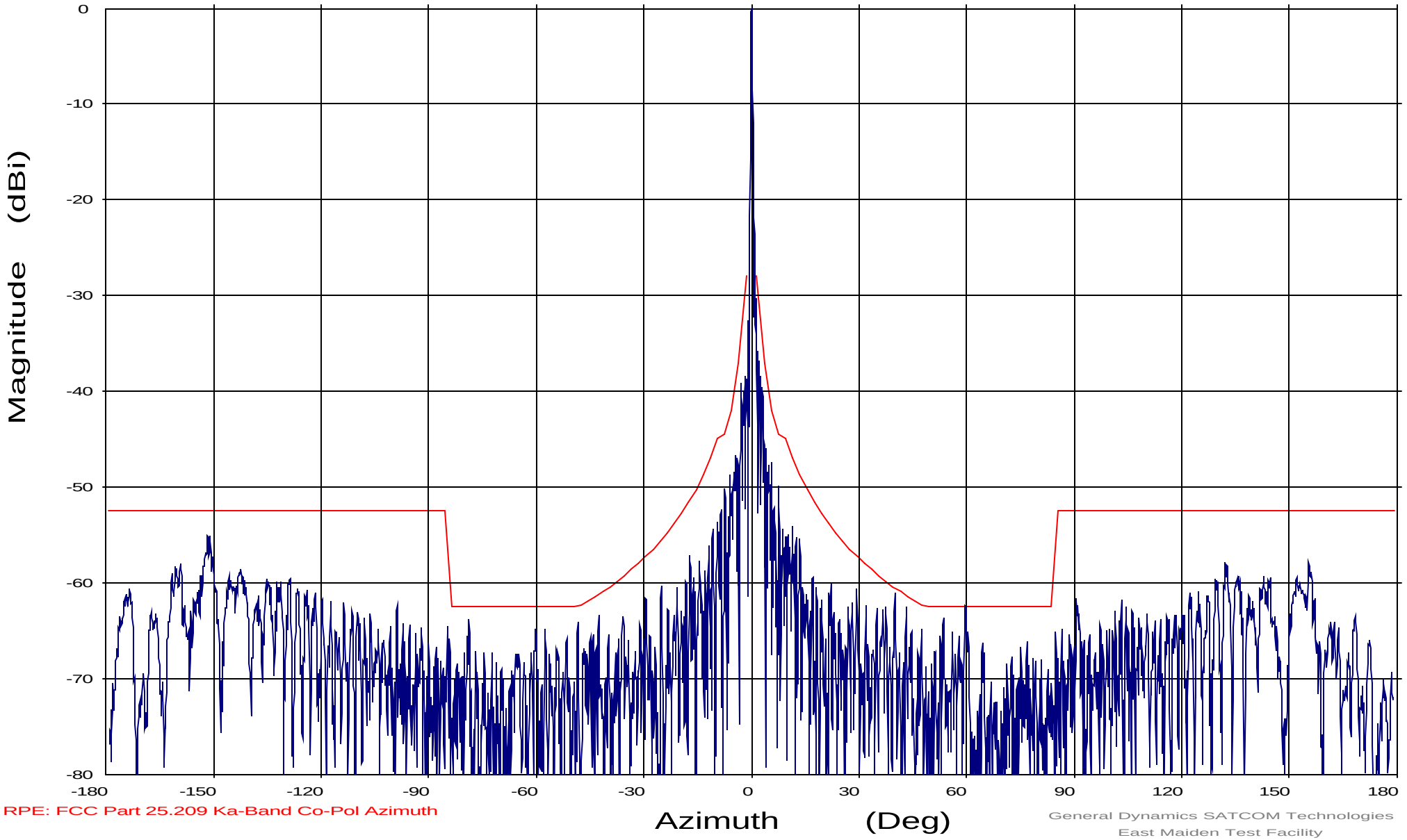
1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 27.600 GHz

Operator: J Hartness
Ser. no.: 013012-1
Channel: AUT

Tx pol: LHCP

Rx pol: LHCP



RPE: FCC Part 25.209 Ka-Band Co-Pol Azimuth

General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: 2241 05.dat

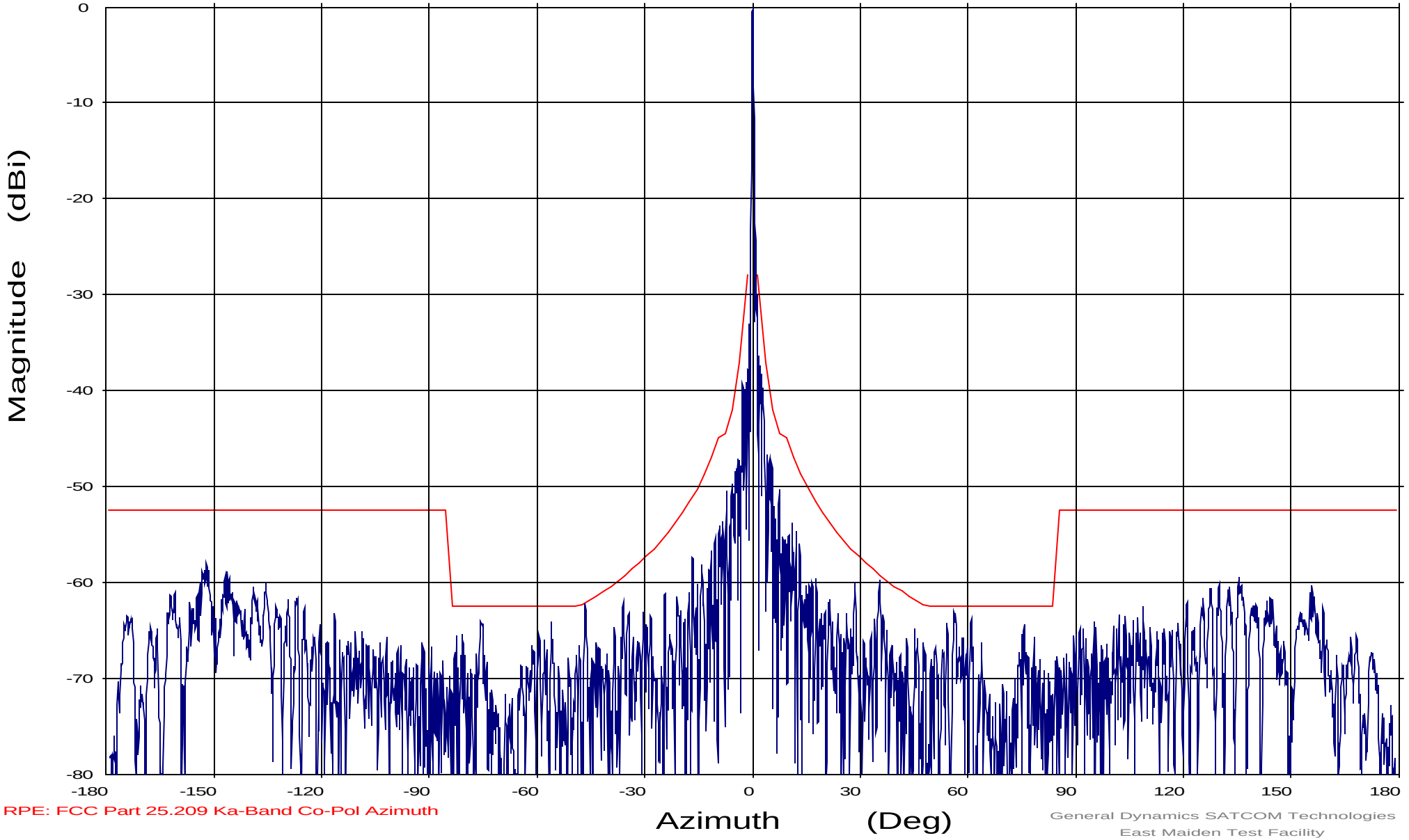
1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 28.350 GHz

Operator: J Hartness
Ser. no.: 013012-1
Channel: AUT

Tx pol: LHCP

Rx pol: LHCP



RPE: FCC Part 25.209 Ka-Band Co-Pol Azimuth

General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: 2241 05.dat

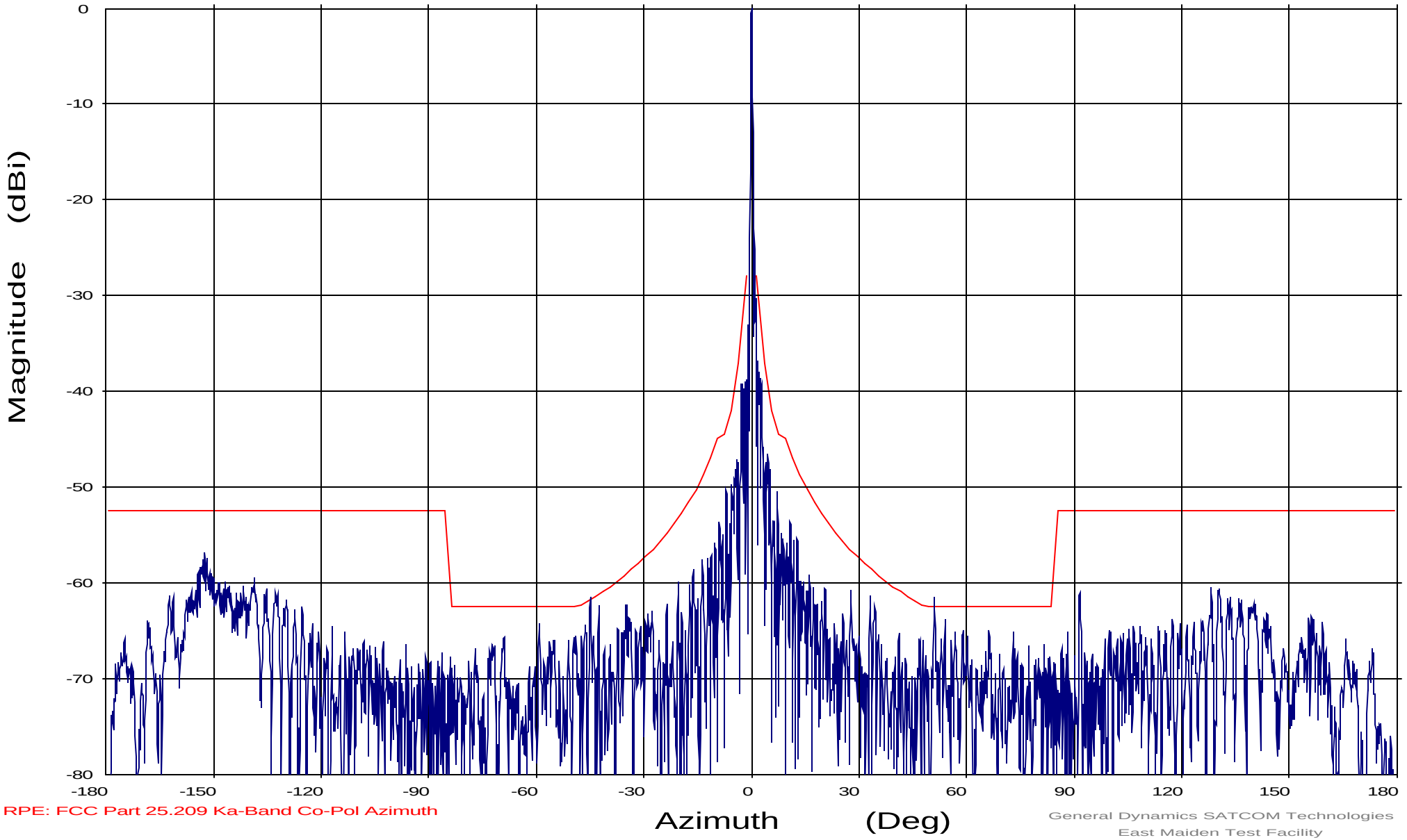
1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 29.100 GHz

Operator: J Hartness
Ser. no.: 013012-1
Channel: AUT

Tx pol: LHCP

Rx pol: LHCP



RPE: FCC Part 25.209 Ka-Band Co-Pol Azimuth

General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

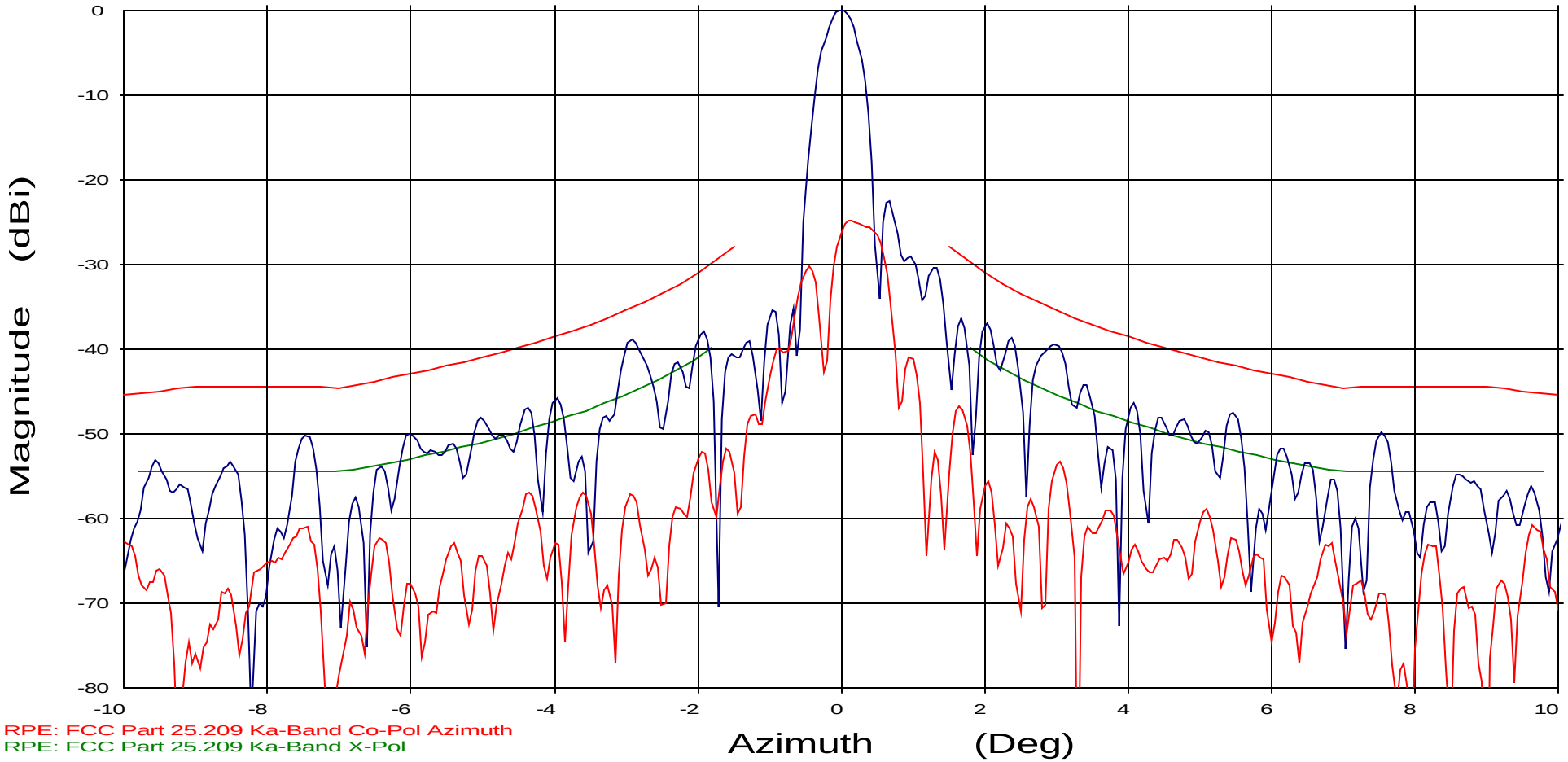
RHCP Radiation Patterns

Transmit Frequencies

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 27.600 GHz

Operator: Dwight B. Lutz
Ser. no.: 013012-1
Channel: AUT Tx pol: RHCP Rx pol: RHCP



RPE: FCC Part 25.209 Ka-Band Co-Pol Azimuth
RPE: FCC Part 25.209 Ka-Band X-Pol

Overlays	Cal. file	table	channel	units
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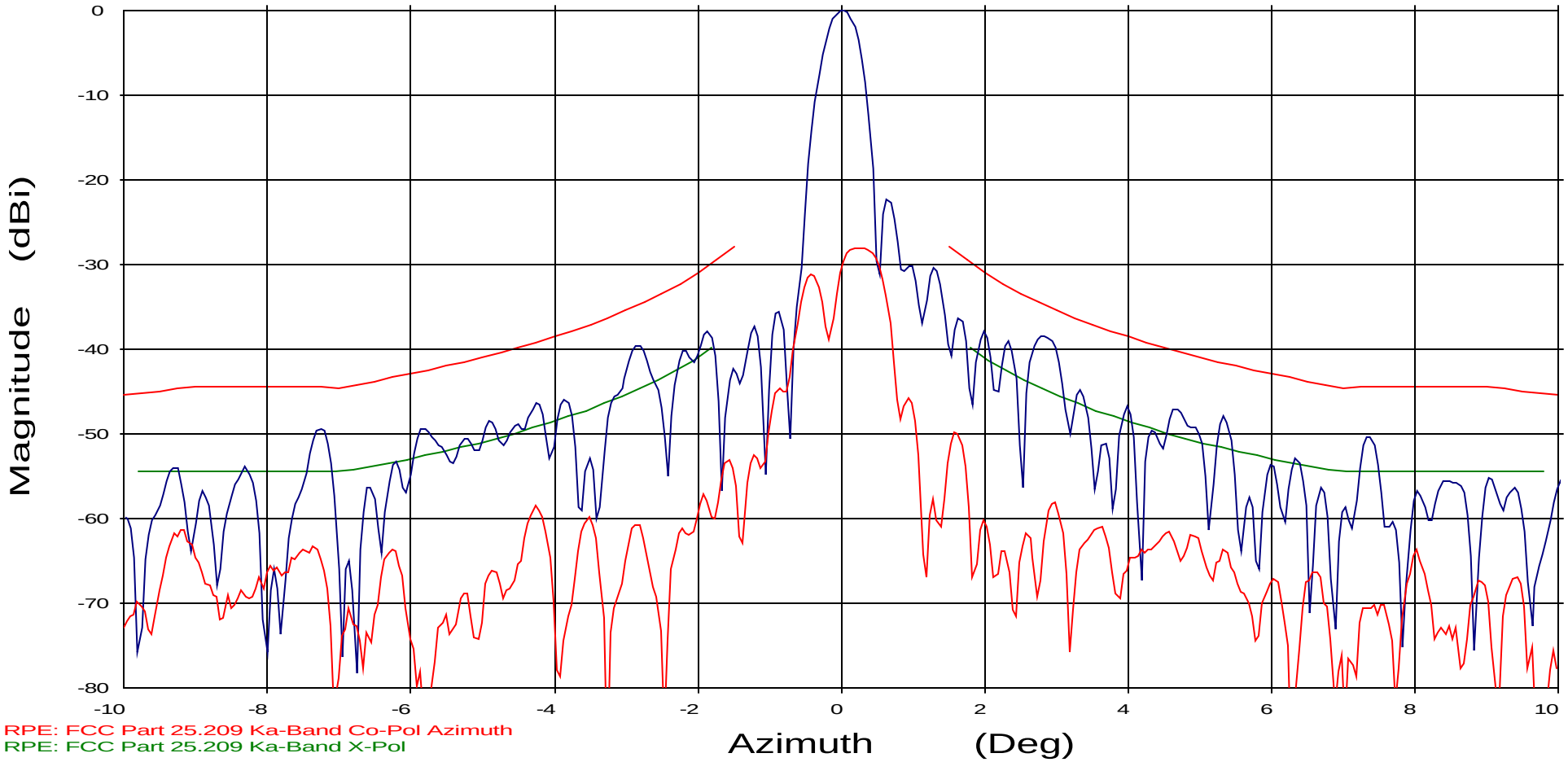
2241 16.dat-ant_under_test	2241 16.dat	Reference	AUT	dBi

General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 28.350 GHz

Operator: Dwight B. Lutz
Ser. no.: 013012-1
Channel: AUT Tx pol: RHCP Rx pol: RHCP



Overlays	Cal. file	table	channel	units
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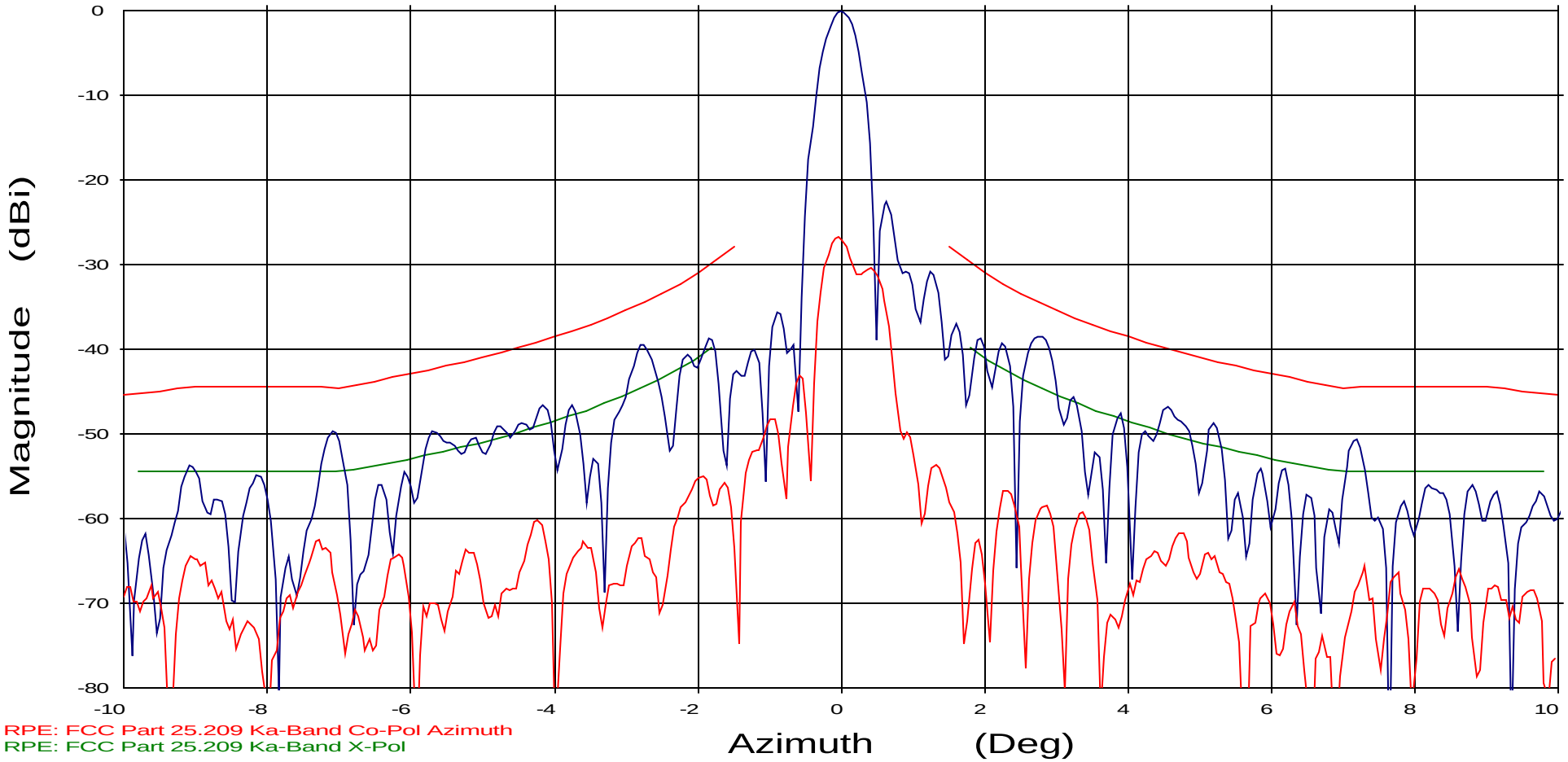
2241 16.dat-ant_under_test	2241 16.dat	Reference	AUT	dBi

General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 29.100 GHz

Operator: Dwight B. Lutz
Ser. no.: 013012-1
Channel: AUT Tx pol: RHCP Rx pol: RHCP



RPE: FCC Part 25.209 Ka-Band Co-Pol Azimuth
RPE: FCC Part 25.209 Ka-Band X-Pol

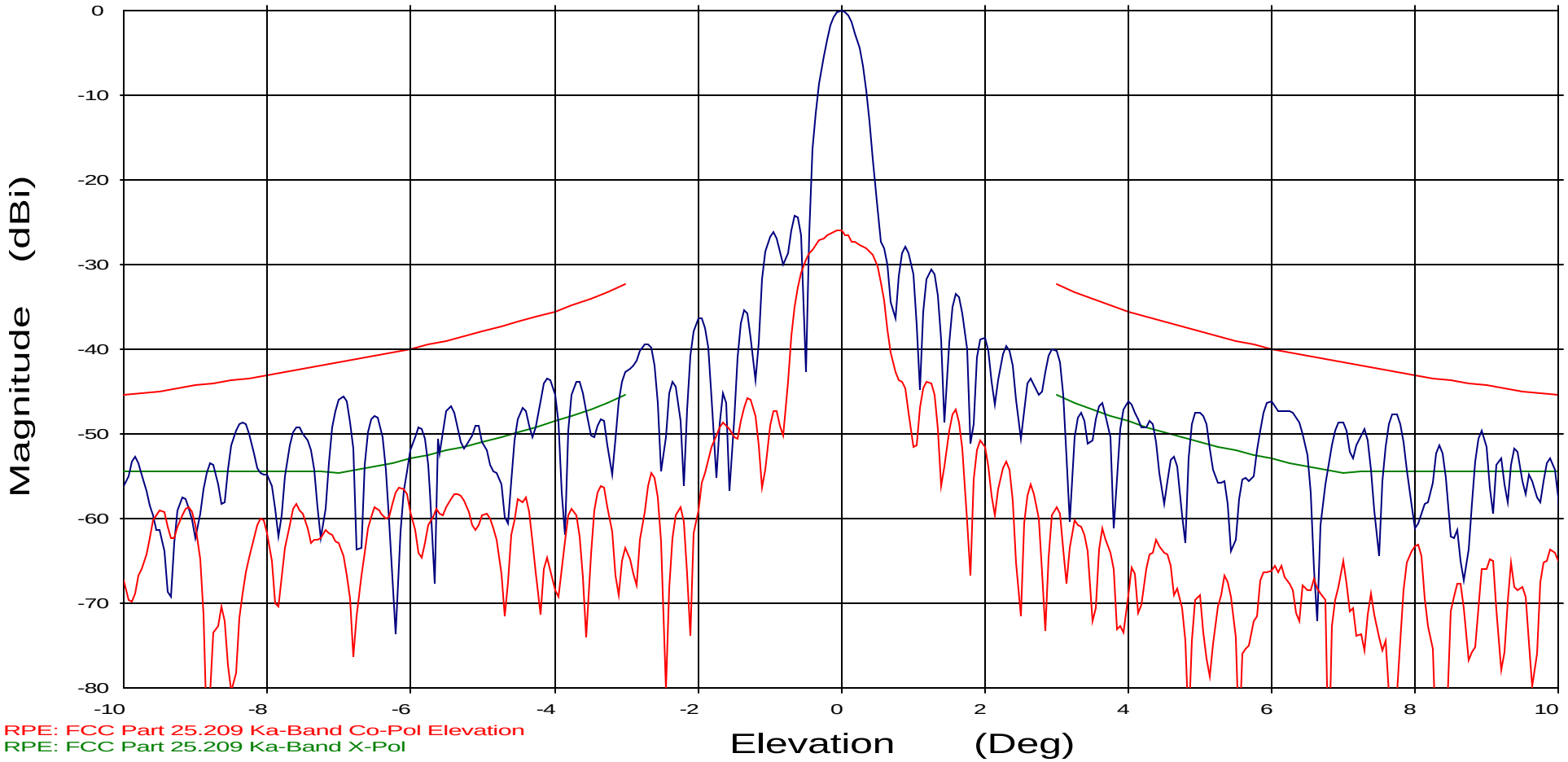
Overlays	Cal. file	table	channel	units
2241 13.dat-ant_under_test	2241 13.dat	Reference	AUT	dBi
2241 16.dat-ant_under_test	2241 16.dat	Reference	AUT	dBi

General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 27.600 GHz

Operator: Dwight B. Lutz
Ser. no.: 013012-1
Channel: AUT Tx pol: RHCP Rx pol: RHCP



RPE: FCC Part 25.209 Ka-Band Co-Pol Elevation
RPE: FCC Part 25.209 Ka-Band X-Pol

Overlays	Cal. file	table	channel	units
2241 15.dat-ant_under_test	2241 15.dat	Reference	AUT	dBi
2241 18.dat-ant_under_test	2241 18.dat	Reference	AUT	dBi

General Dynamics SATCOM Technologies
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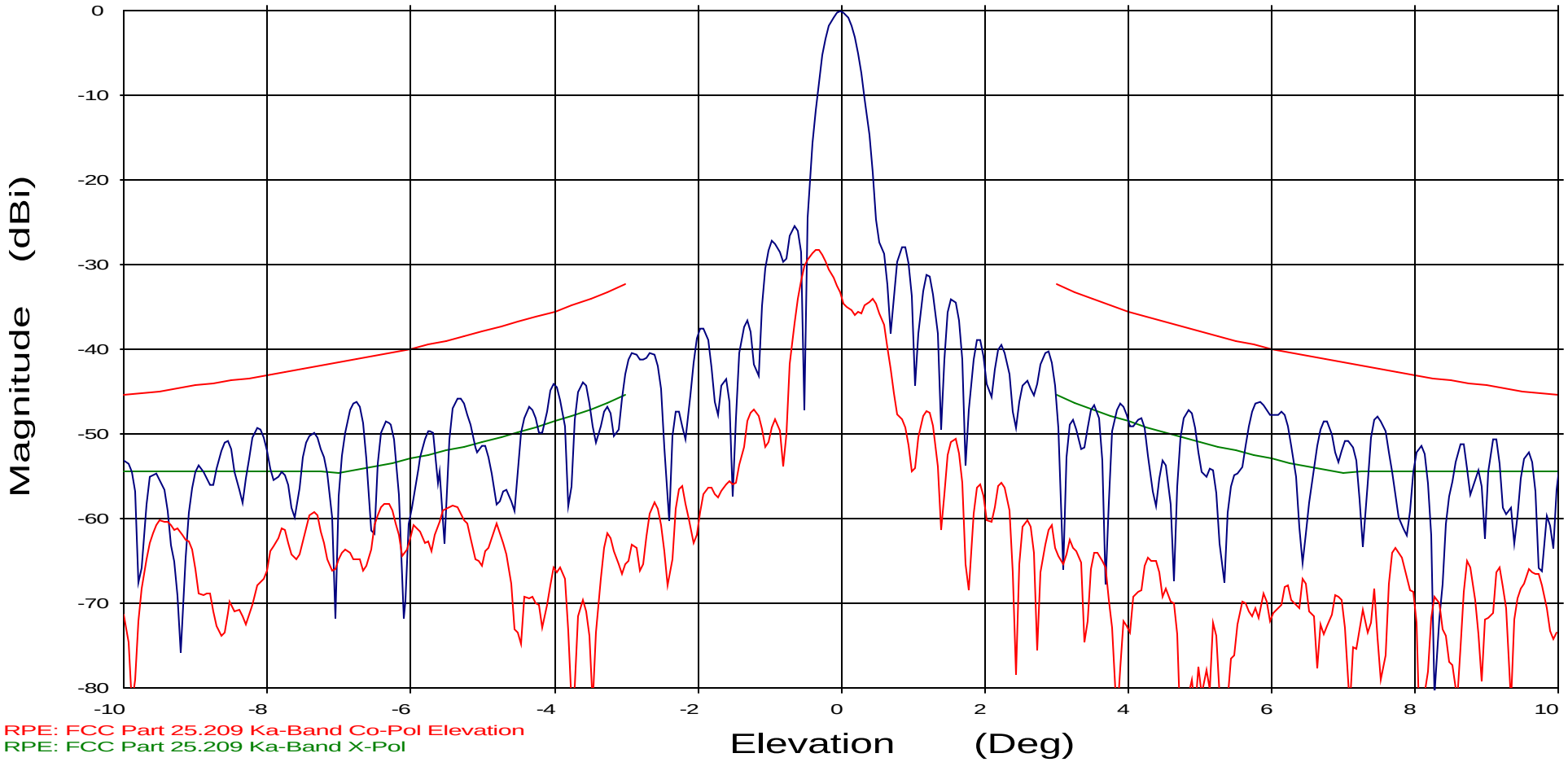
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 28.350 GHz

Operator: Dwight B. Lutz
Ser. no.: 013012-1
Channel: AUT Tx pol: RHCP Rx pol: RHCP



RPE: FCC Part 25.209 Ka-Band Co-Pol Elevation
RPE: FCC Part 25.209 Ka-Band X-Pol

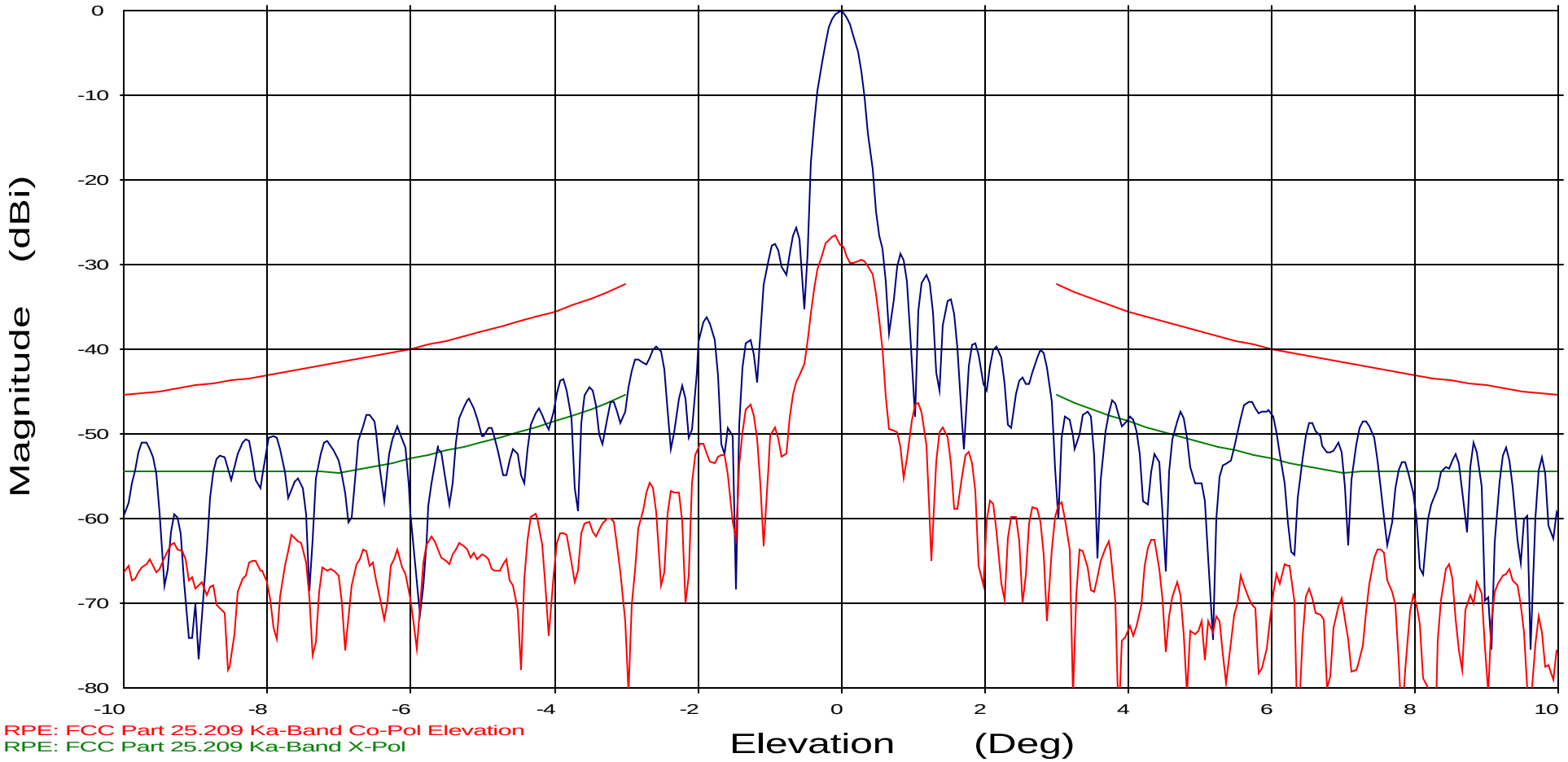
Overlays	Cal. file	table	channel	units
2241 15.dat-ant_under_test	2241 15.dat	Reference	AUT	dBi
2241 18.dat-ant_under_test	2241 18.dat	Reference	AUT	dBi

General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 29.100 GHz

Operator: Dwight B. Lutz
Ser. no.: 013012-1
Channel: AUT Tx pol: RHCP Rx pol: RHCP



RPE: FCC Part 25.209 Ka-Band Co-Pol Elevation
RPE: FCC Part 25.209 Ka-Band X-Pol

Overlays	Cal. file	table	channel	units
2241 15.dat-ant_under_test	2241 15.dat	Reference	AUT	dBi
2241 18.dat-ant_under_test	2241 18.dat	Reference	AUT	dBi

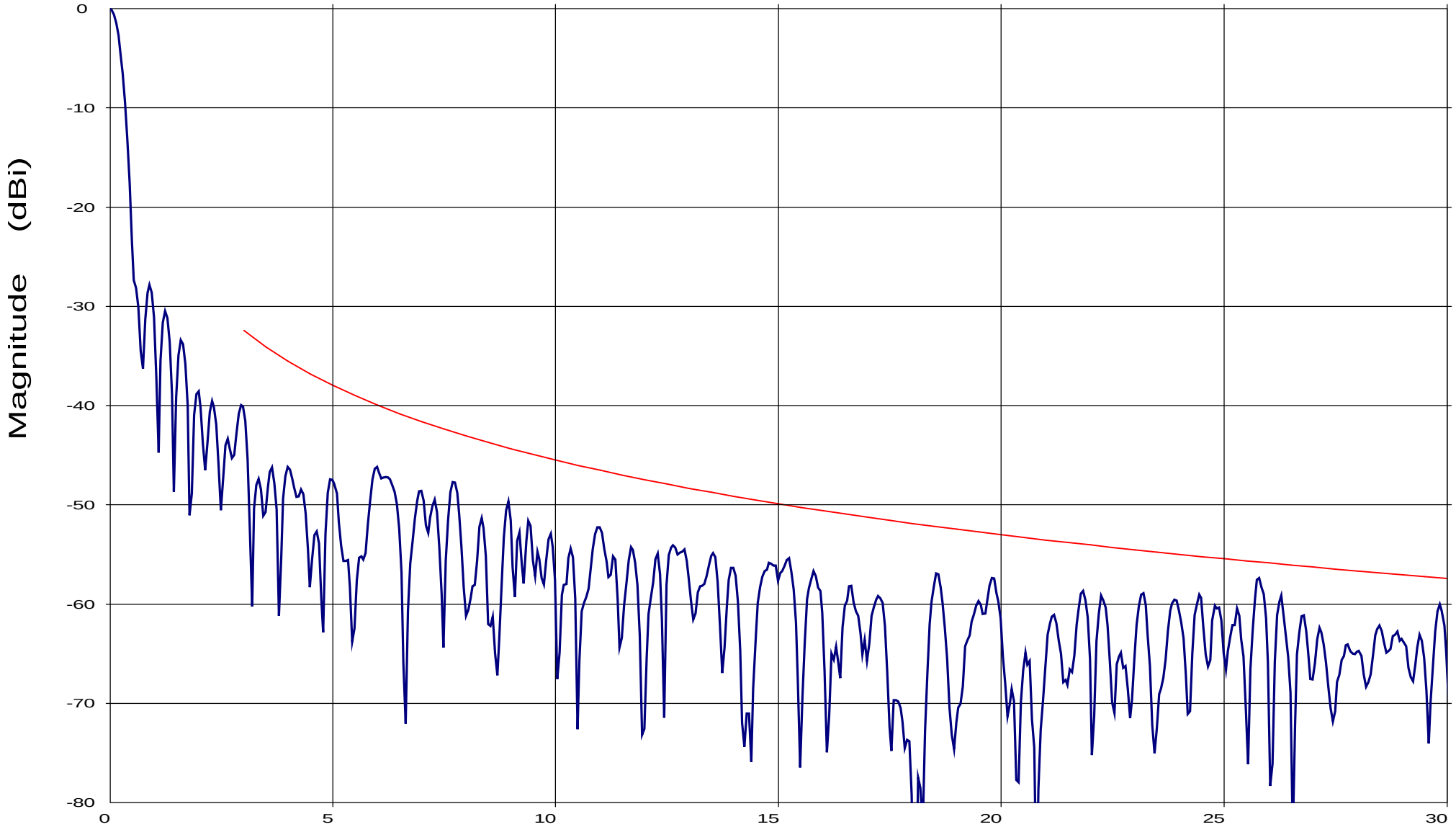
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: 2241 15.dat

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 27.600 GHz

Operator: Dwight B. Lutz
Ser. no.: 013012-1
Channel: AUT Tx pol: RHCP Rx pol: RHCP



RPE: FCC Part 25.209 Ka-Band Co-Pol Elevation

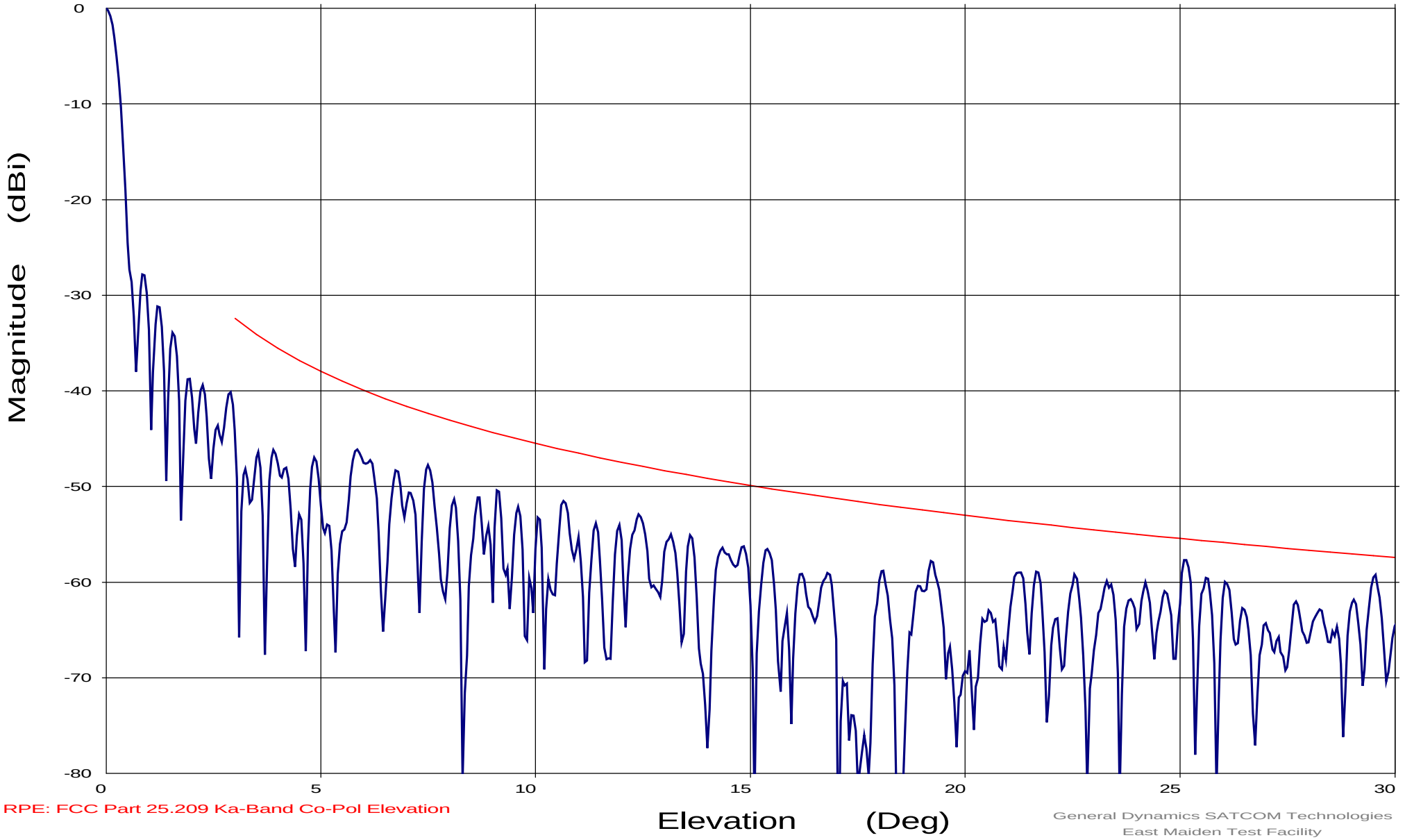
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: 2241 15.dat

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 28.350 GHz

Operator: Dwight B. Lutz
Ser. no.: 013012-1
Channel: AUT Tx pol: RHCP Rx pol: RHCP



RPE: FCC Part 25.209 Ka-Band Co-Pol Elevation

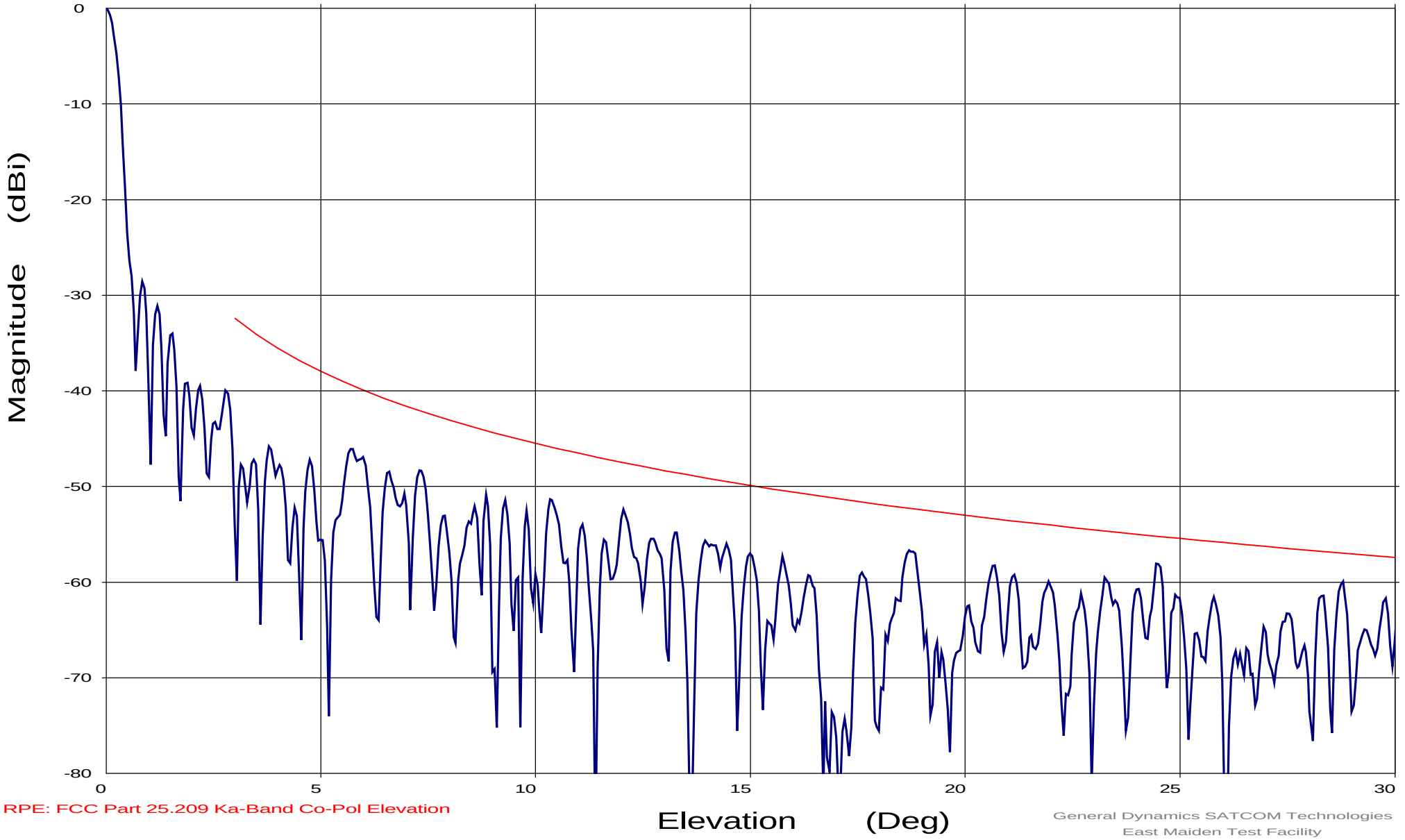
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: 2241 15.dat

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 29.100 GHz

Operator: Dwight B. Lutz
Ser. no.: 013012-1
Channel: AUT Tx pol: RHCP Rx pol: RHCP



RPE: FCC Part 25.209 Ka-Band Co-Pol Elevation

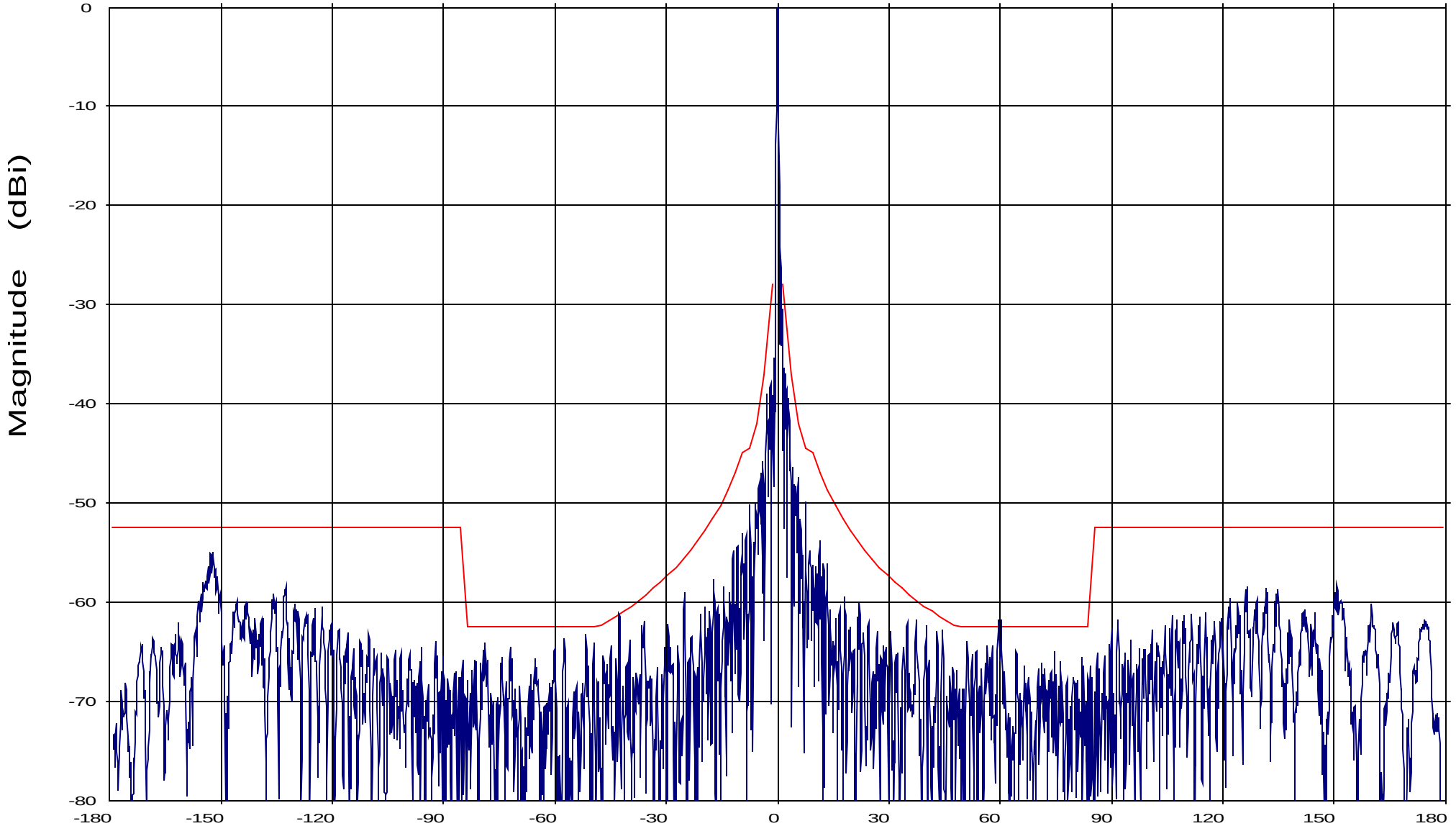
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: 2241 13.dat

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 27.600 GHz

Operator: Dwight B. Lutz
Ser. no.: 013012-1
Channel: AUT Tx pol: RHCP Rx pol: RHCP



RPE: FCC Part 25.209 Ka-Band Co-Pol Azimuth

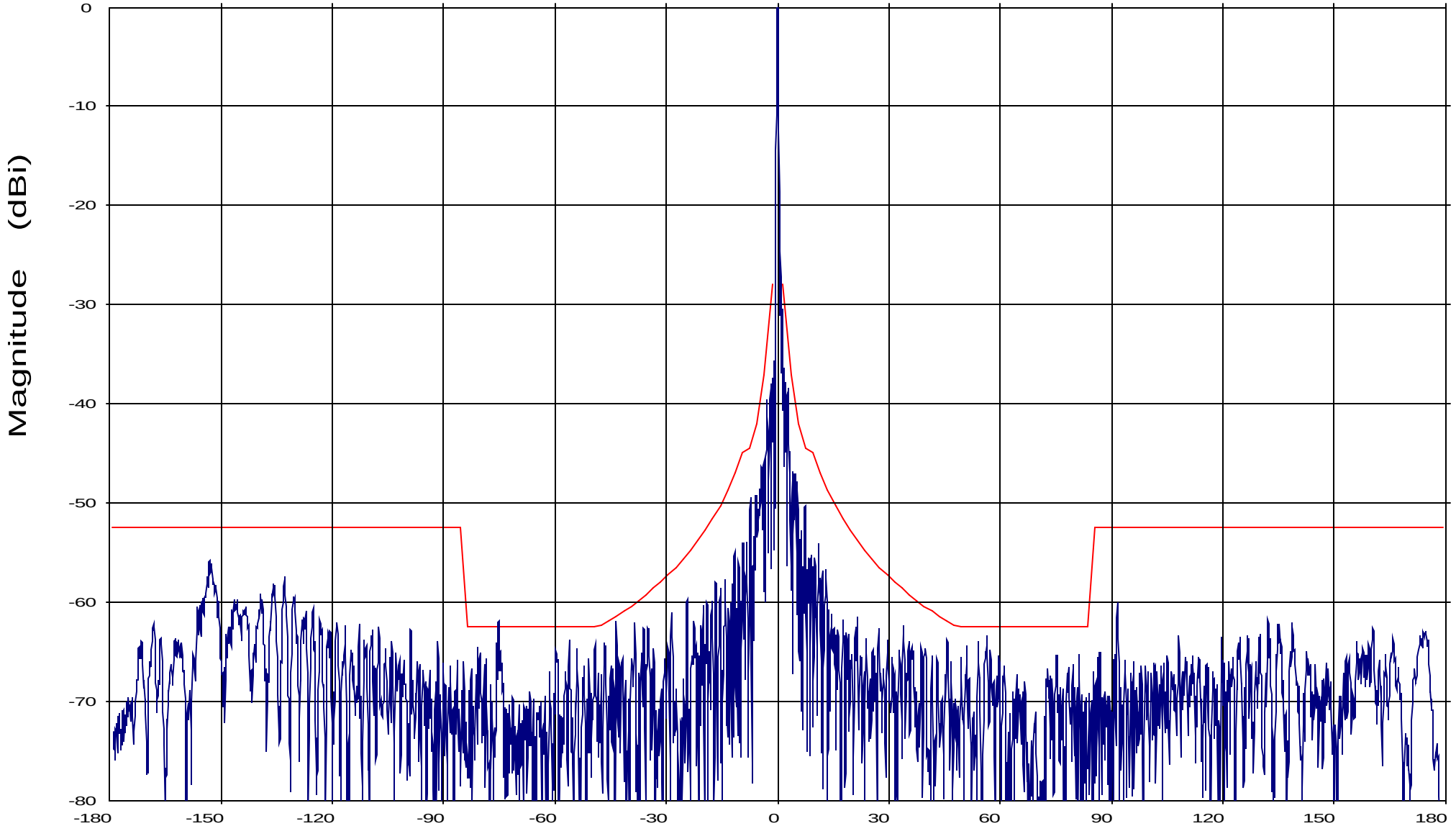
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: 2241 13.dat

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 28.350 GHz

Operator: Dwight B. Lutz
Ser. no.: 013012-1
Channel: AUT Tx pol: RHCP Rx pol: RHCP



RPE: FCC Part 25.209 Ka-Band Co-Pol Azimuth

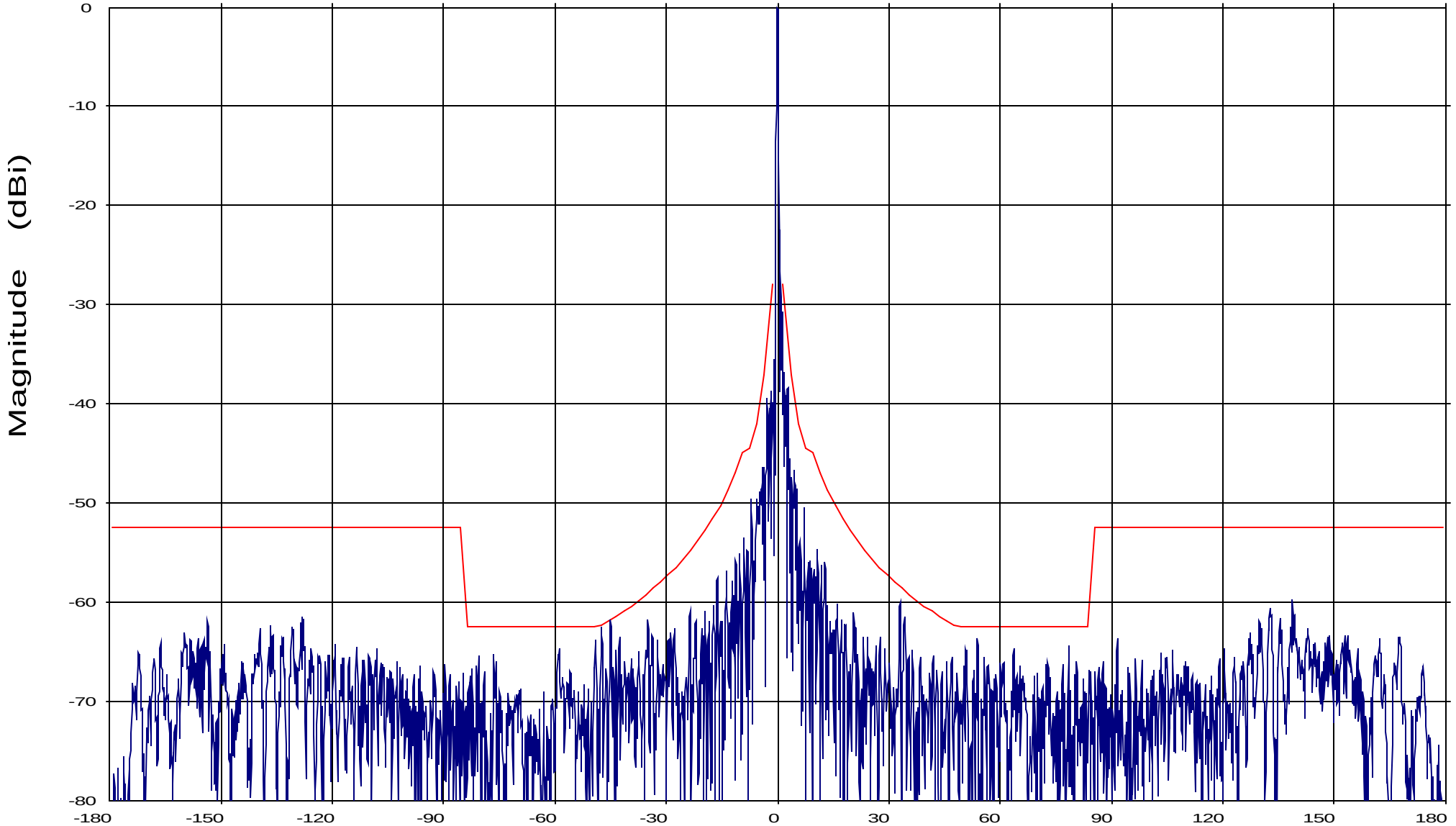
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: 2241 13.dat

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 29.100 GHz

Operator: Dwight B. Lutz
Ser. no.: 013012-1
Channel: AUT Tx pol: RHCP Rx pol: RHCP



RPE: FCC Part 25.209 Ka-Band Co-Pol Azimuth

General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

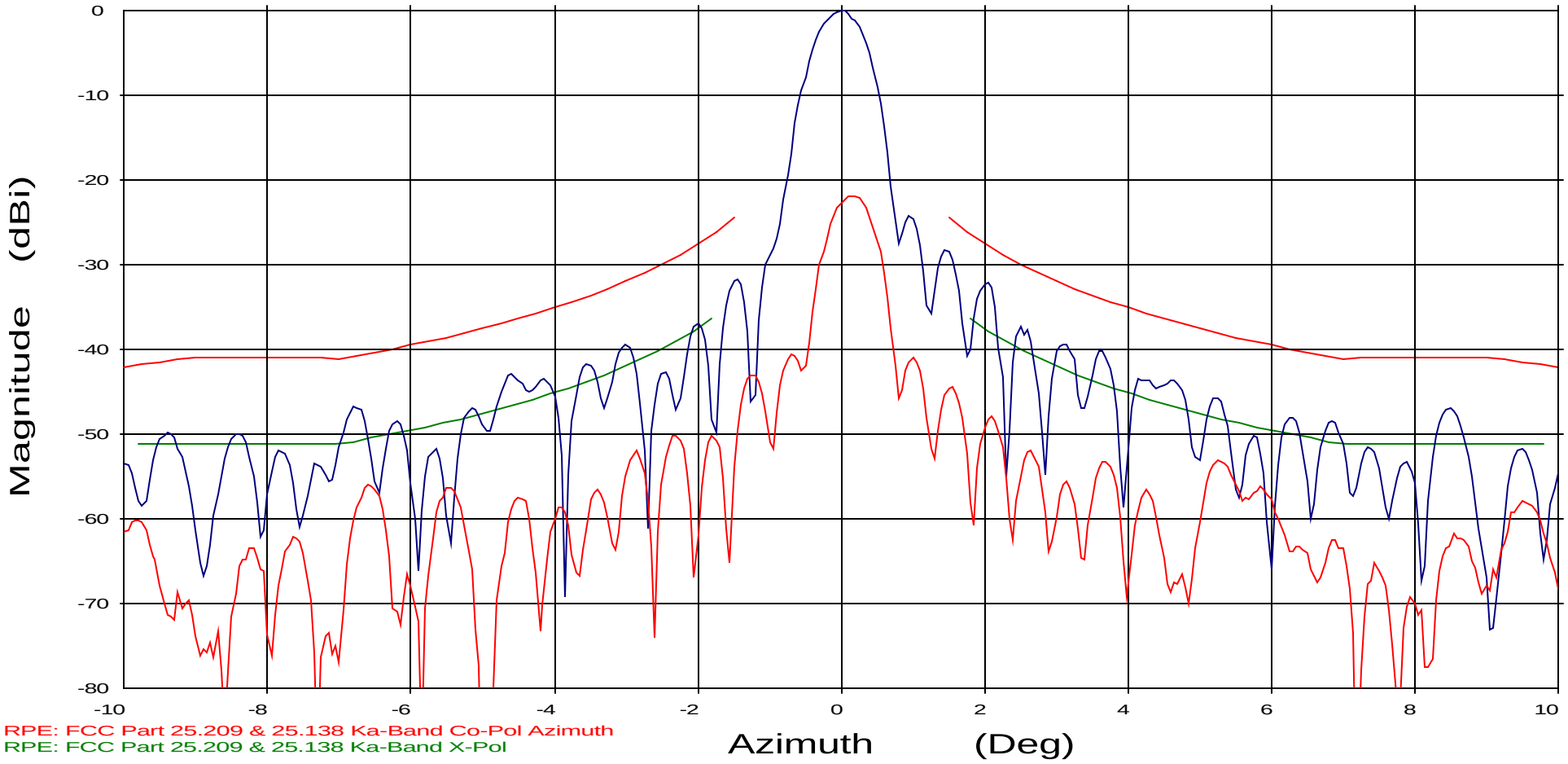
LHCP Radiation Patterns

Receive Frequencies

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 17.800 GHz

Operator: Dwight B. Lutz
Ser. no.: 013012-1
Channel: AUT Tx pol: LHCP Rx pol: LHCP



RPE: FCC Part 25.209 & 25.138 Ka-Band Co-Pol Azimuth
RPE: FCC Part 25.209 & 25.138 Ka-Band X-Pol

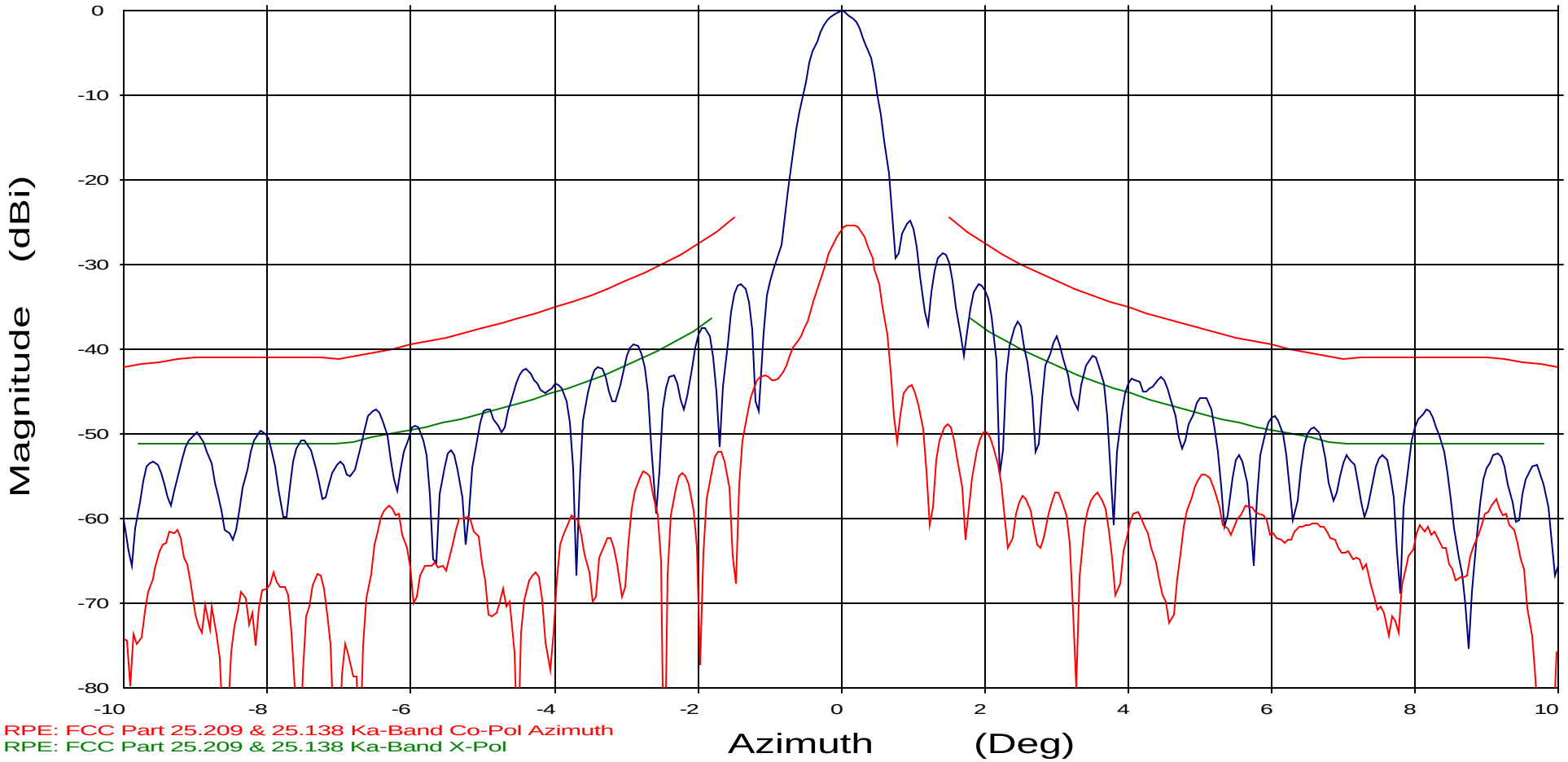
Overlays	Cal. file	table	channel	units
2241 21.dat-ant_under_test	2241 21.dat	Reference	AUT	dBi
2241 25.dat-ant_under_test	2241 25.dat	Reference	AUT	dBi

General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 18.550 GHz

Operator: Dwight B. Lutz
Ser. no.: 013012-1
Channel: AUT Tx pol: LHCP Rx pol: LHCP



RPE: FCC Part 25.209 & 25.138 Ka-Band Co-Pol Azimuth
RPE: FCC Part 25.209 & 25.138 Ka-Band X-Pol

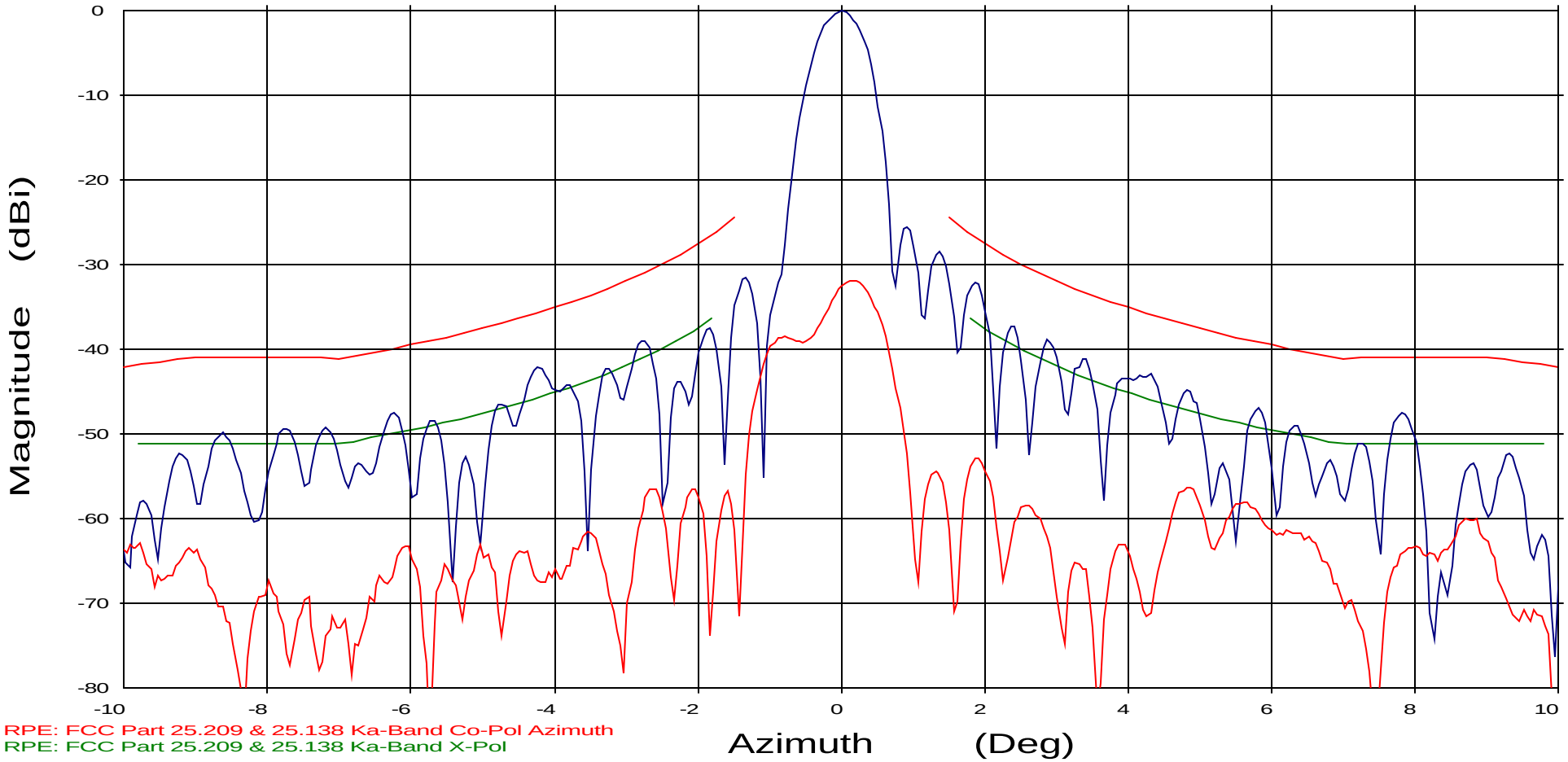
Overlays	Cal. file	table	channel	units
2241 21.dat-ant_under_test	2241 21.dat	Reference	AUT	dBi
2241 25.dat-ant_under_test	2241 25.dat	Reference	AUT	dBi

General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 19.300 GHz

Operator: Dwight B. Lutz
Ser. no.: 013012-1
Channel: AUT Tx pol: LHCP Rx pol: LHCP



RPE: FCC Part 25.209 & 25.138 Ka-Band Co-Pol Azimuth
RPE: FCC Part 25.209 & 25.138 Ka-Band X-Pol

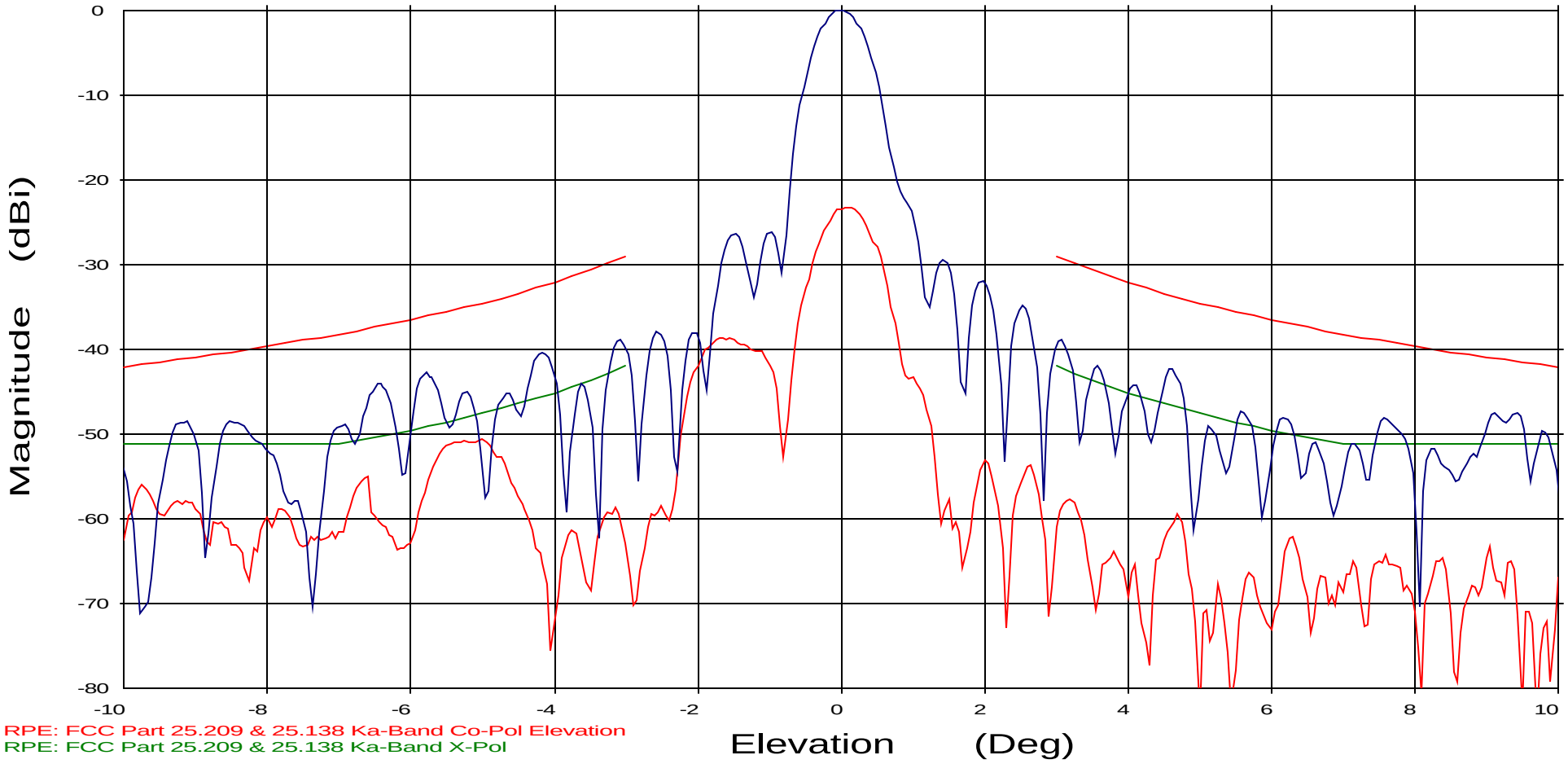
Overlays	Cal. file	table	channel	units
2241 21.dat-ant_under_test	2241 21.dat	Reference	AUT	dBi
2241 25.dat-ant_under_test	2241 25.dat	Reference	AUT	dBi

General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 17.800 GHz

Operator: Dwight B. Lutz
Ser. no.: 013012-1
Channel: AUT Tx pol: LHCP Rx pol: LHCP



RPE: FCC Part 25.209 & 25.138 Ka-Band Co-Pol Elevation
RPE: FCC Part 25.209 & 25.138 Ka-Band X-Pol

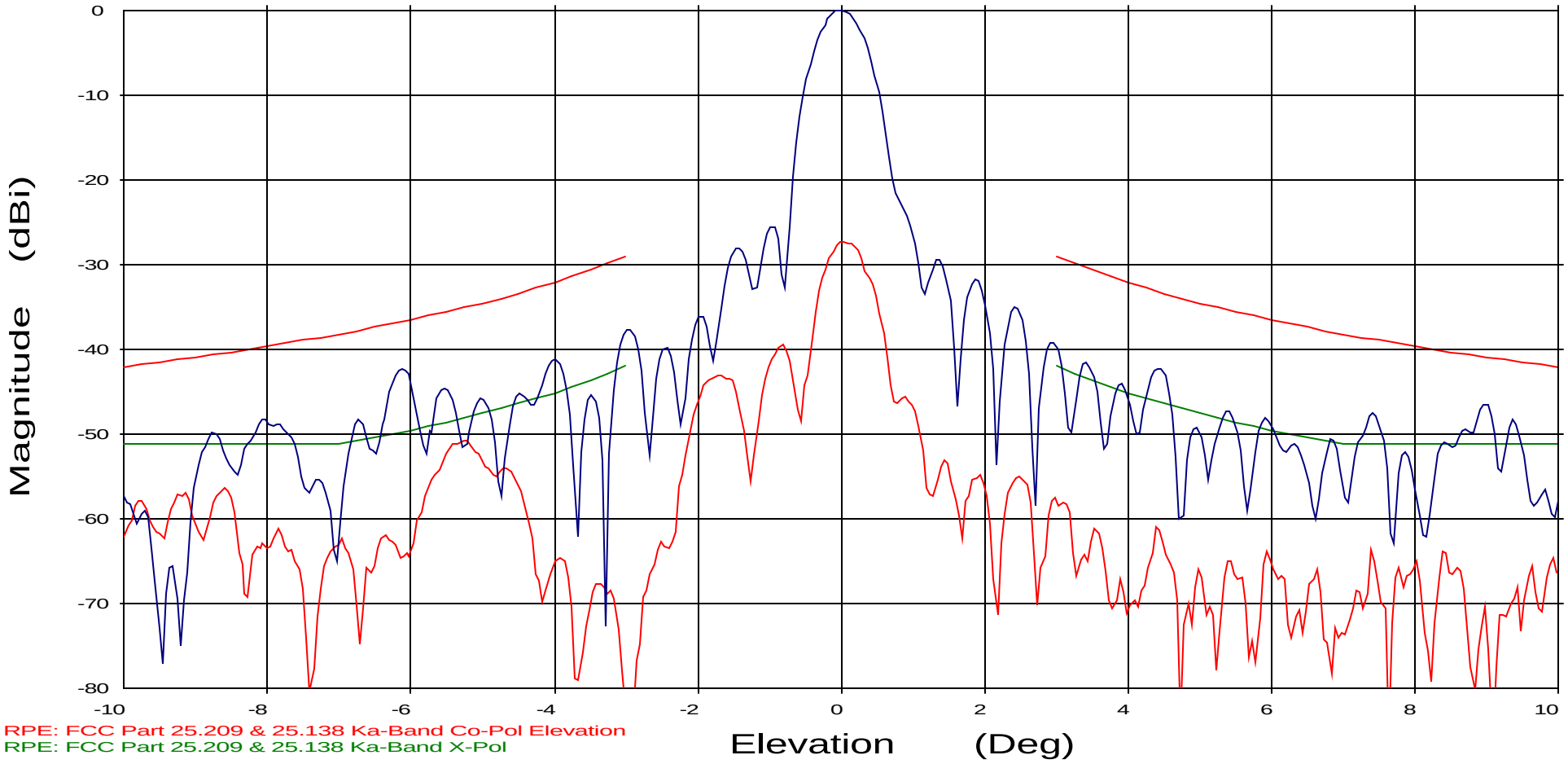
Overlays	Cal. file	table	channel	units
2241 23.dat-ant_under_test	2241 23.dat	Reference	AUT	dBi
2241 28.dat-ant_under_test	2241 28.dat	Reference	AUT	dBi

General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 18.550 GHz

Operator: Dwight B. Lutz
Ser. no.: 013012-1
Channel: AUT Tx pol: LHCP Rx pol: LHCP



RPE: FCC Part 25.209 & 25.138 Ka-Band Co-Pol Elevation
RPE: FCC Part 25.209 & 25.138 Ka-Band X-Pol

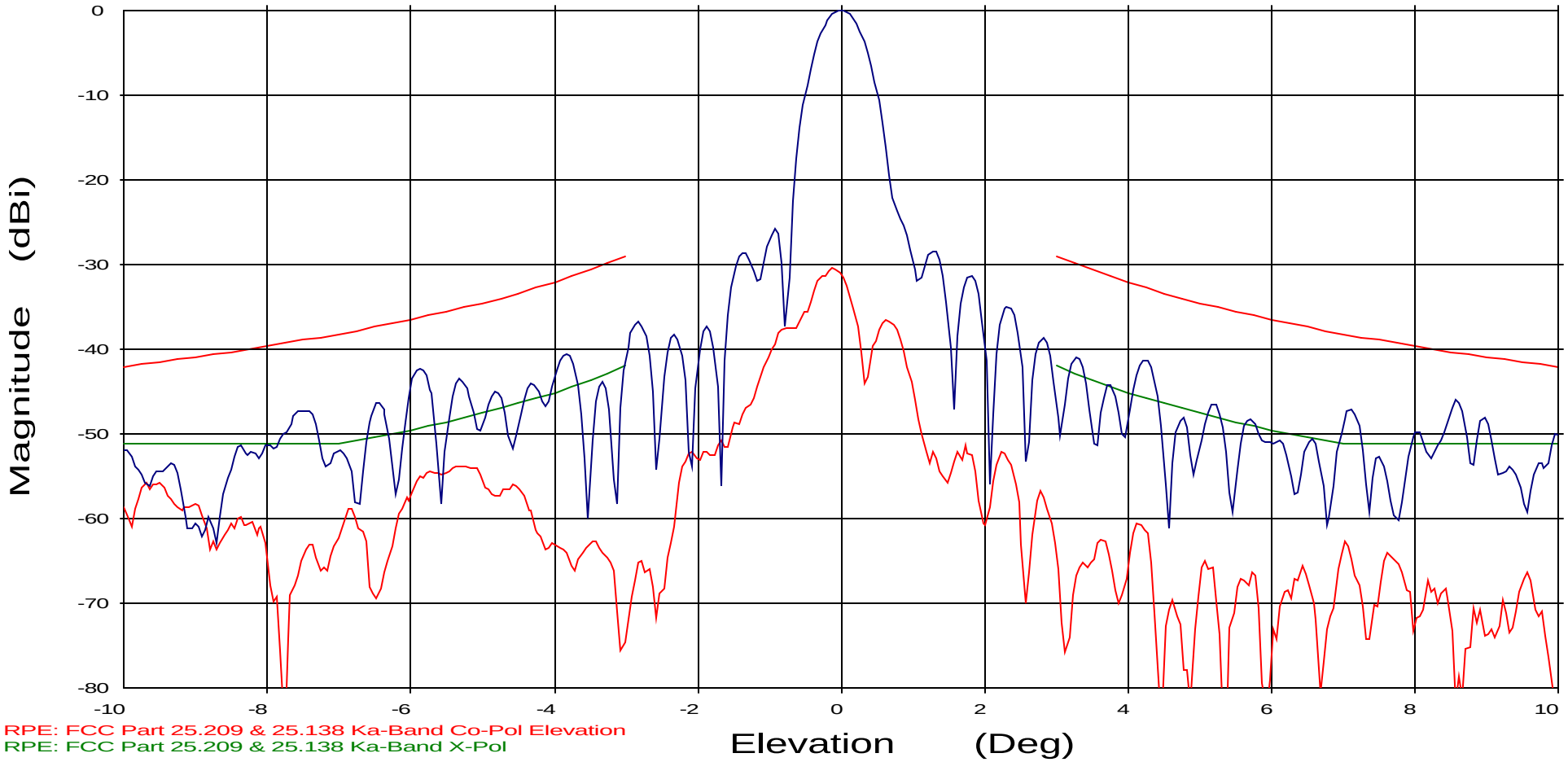
Overlays	Cal. file	table	channel	units
2241 23.dat-ant_under_test	2241 23.dat	Reference	AUT	dBi
2241 28.dat-ant_under_test	2241 28.dat	Reference	AUT	dBi

General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 19.300 GHz

Operator: Dwight B. Lutz
Ser. no.: 013012-1
Channel: AUT Tx pol: LHCP Rx pol: LHCP



RPE: FCC Part 25.209 & 25.138 Ka-Band Co-Pol Elevation
RPE: FCC Part 25.209 & 25.138 Ka-Band X-Pol

Overlays	Cal. file	table	channel	units
2241 23.dat-ant_under_test	2241 23.dat	Reference	AUT	dBi
2241 28.dat-ant_under_test	2241 28.dat	Reference	AUT	dBi

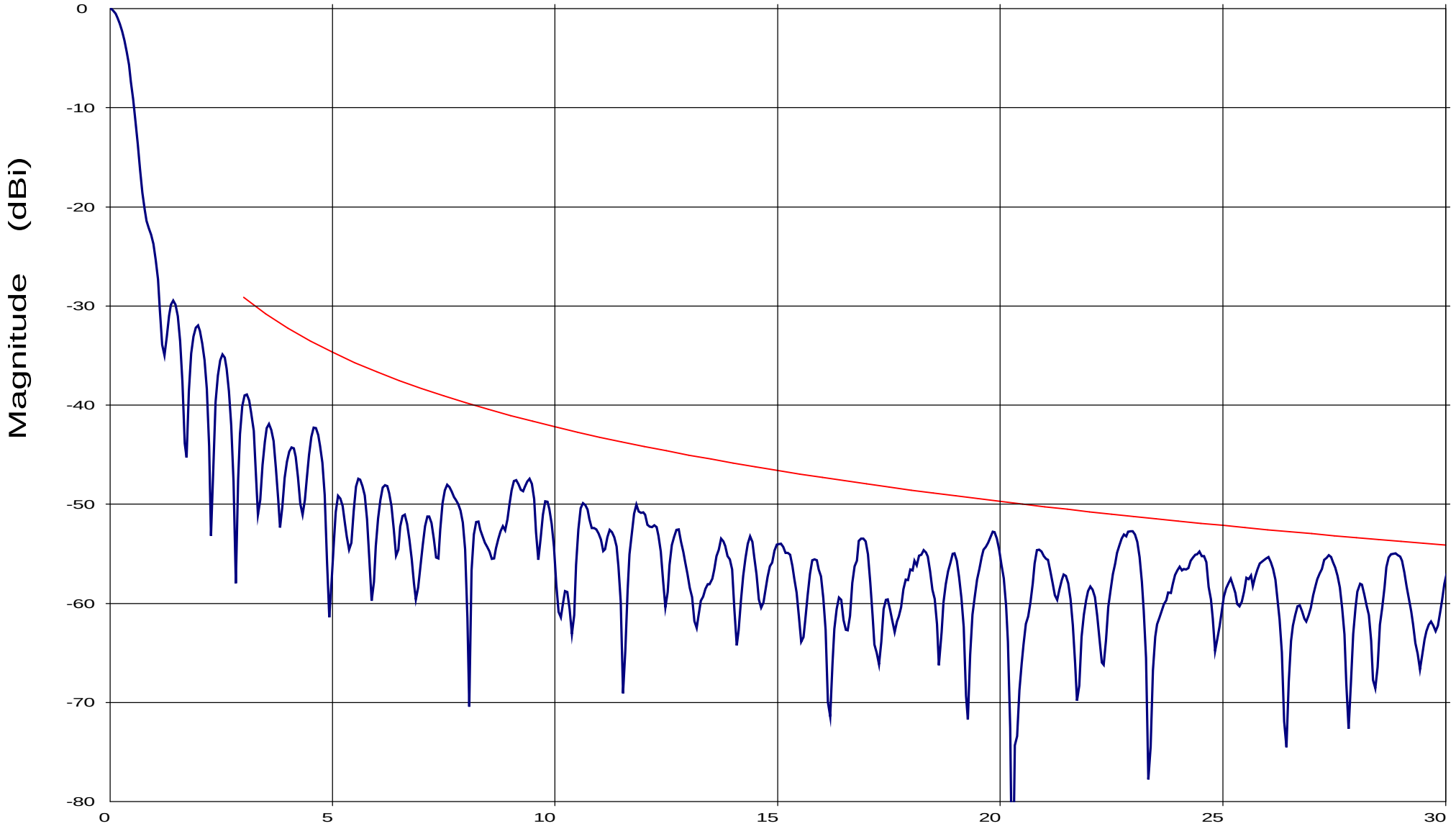
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: 2241 23.dat

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 17.800 GHz

Operator: Dwight B. Lutz
Ser. no.: 013012-1
Channel: AUT Tx pol: LHCP Rx pol: LHCP



RPE: FCC Part 25.209 & Part 25.138 Ka-Band Co-Pol Elevation

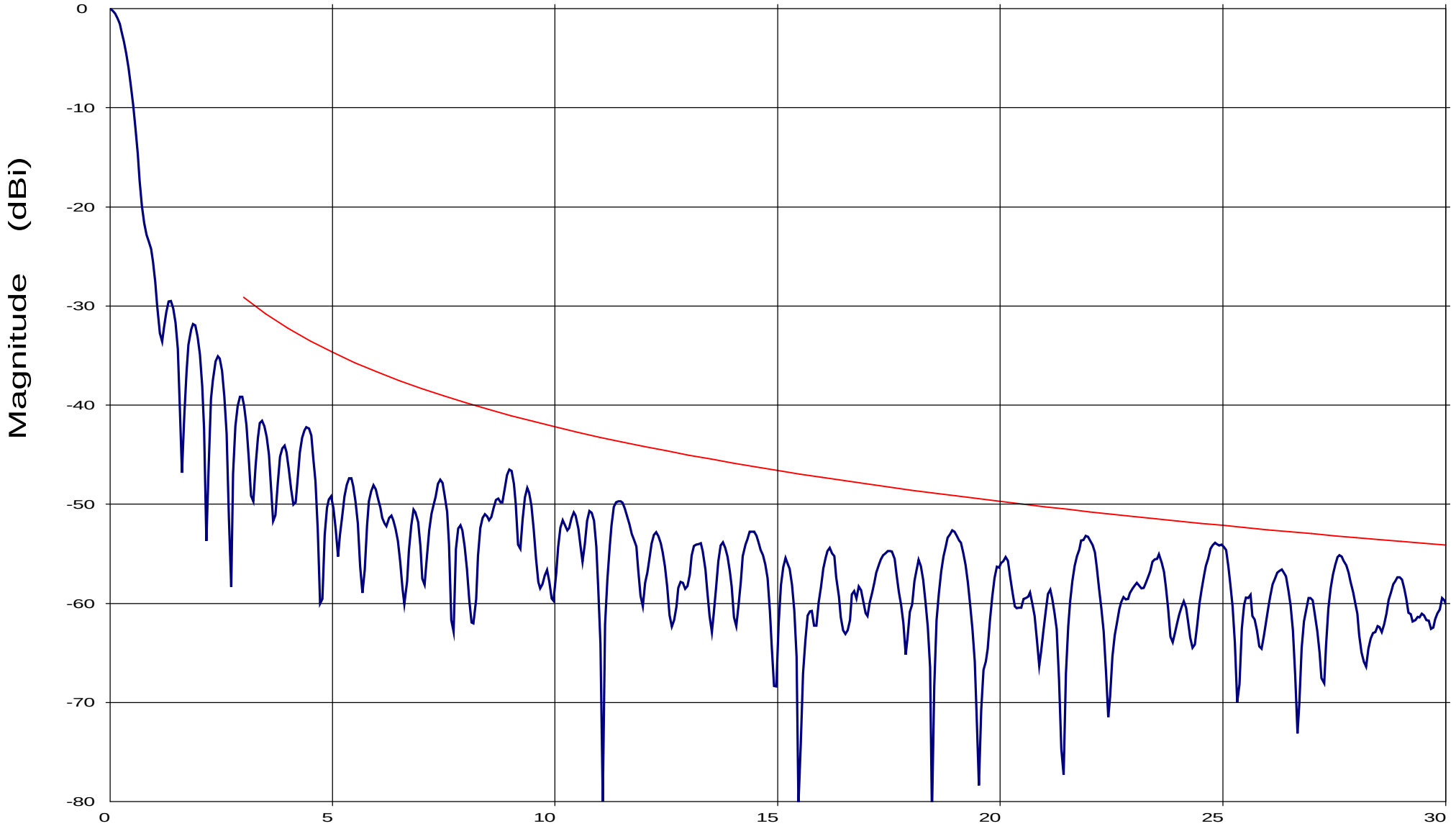
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: 2241 23.dat

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 18.550 GHz

Operator: Dwight B. Lutz
Ser. no.: 013012-1
Channel: AUT Tx pol: LHCP Rx pol: LHCP



RPE: FCC Part 25.209 & Part 25.138 Ka-Band Co-Pol Elevation

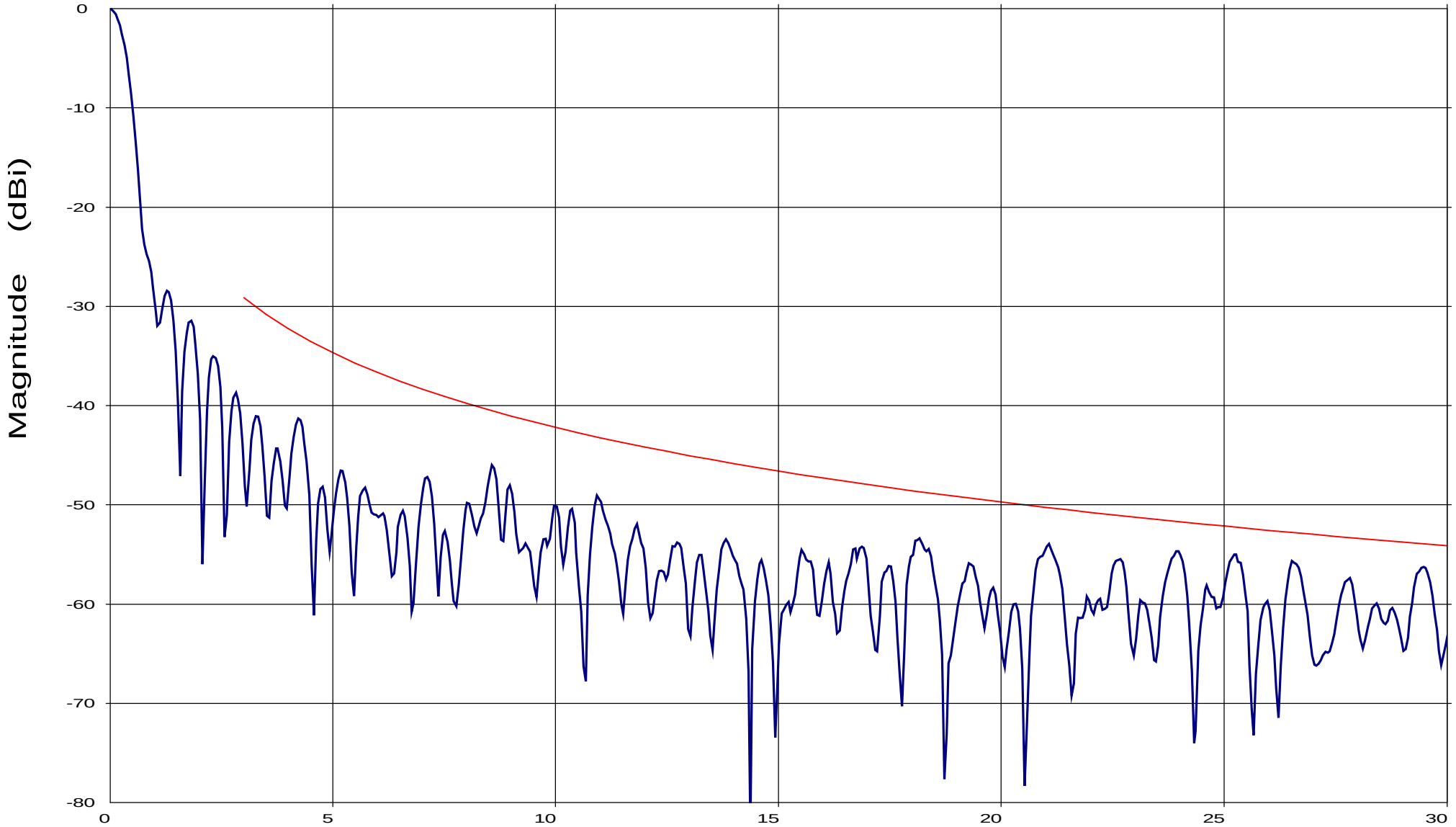
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: 2241 23.dat

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 19.300 GHz

Operator: Dwight B. Lutz
Ser. no.: 013012-1
Channel: AUT Tx pol: LHCP Rx pol: LHCP



RPE: FCC Part 25.209 & Part 25.138 Ka-Band Co-Pol Elevation

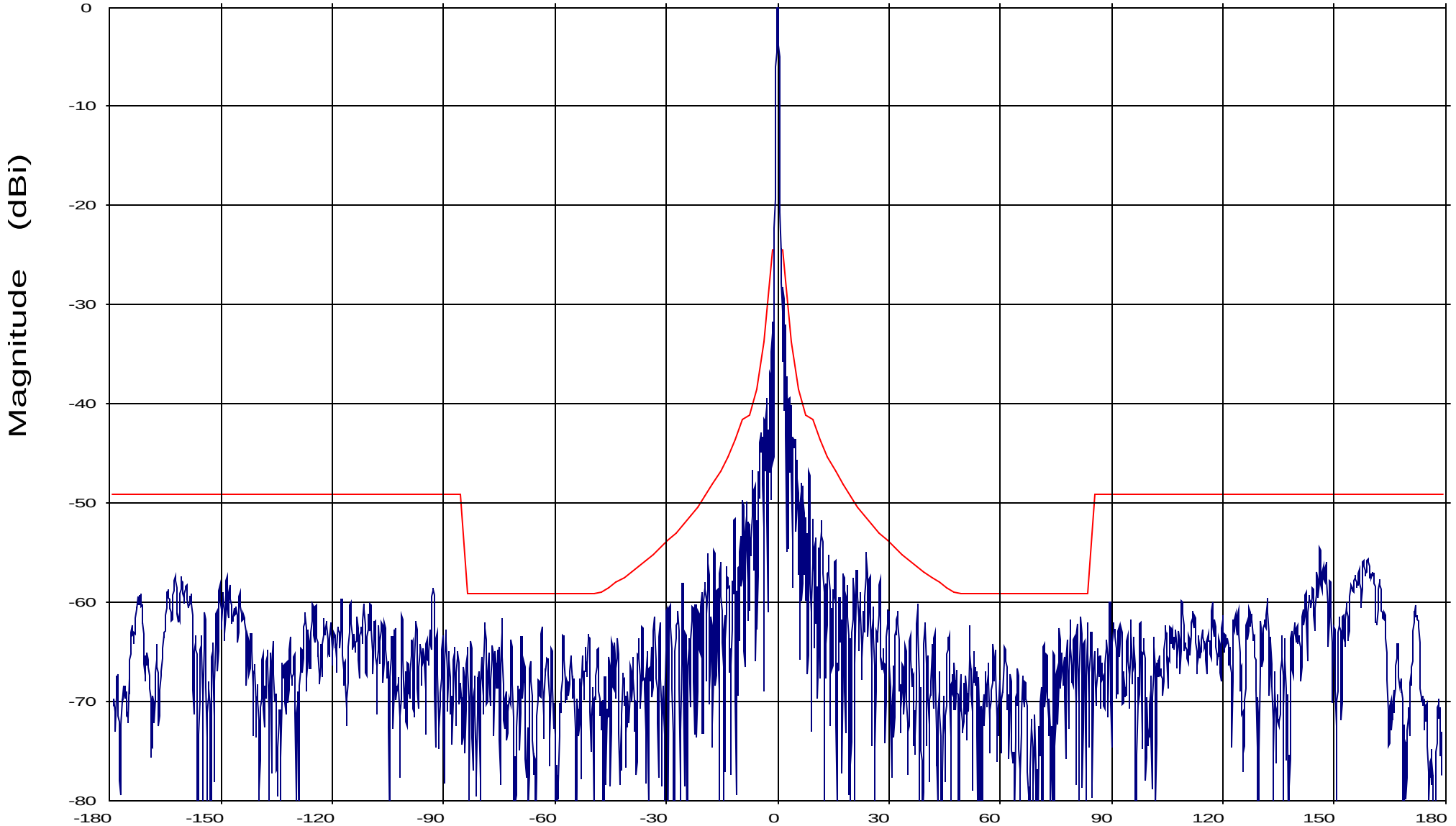
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: 2241 21.dat

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 17.800 GHz

Operator: Dwight B. Lutz
Ser. no.: 013012-1
Channel: AUT Tx pol: LHCP Rx pol: LHCP



RPE: FCC Part 25.209 & 25.138 Ka-Band Co-Pol Azimuth

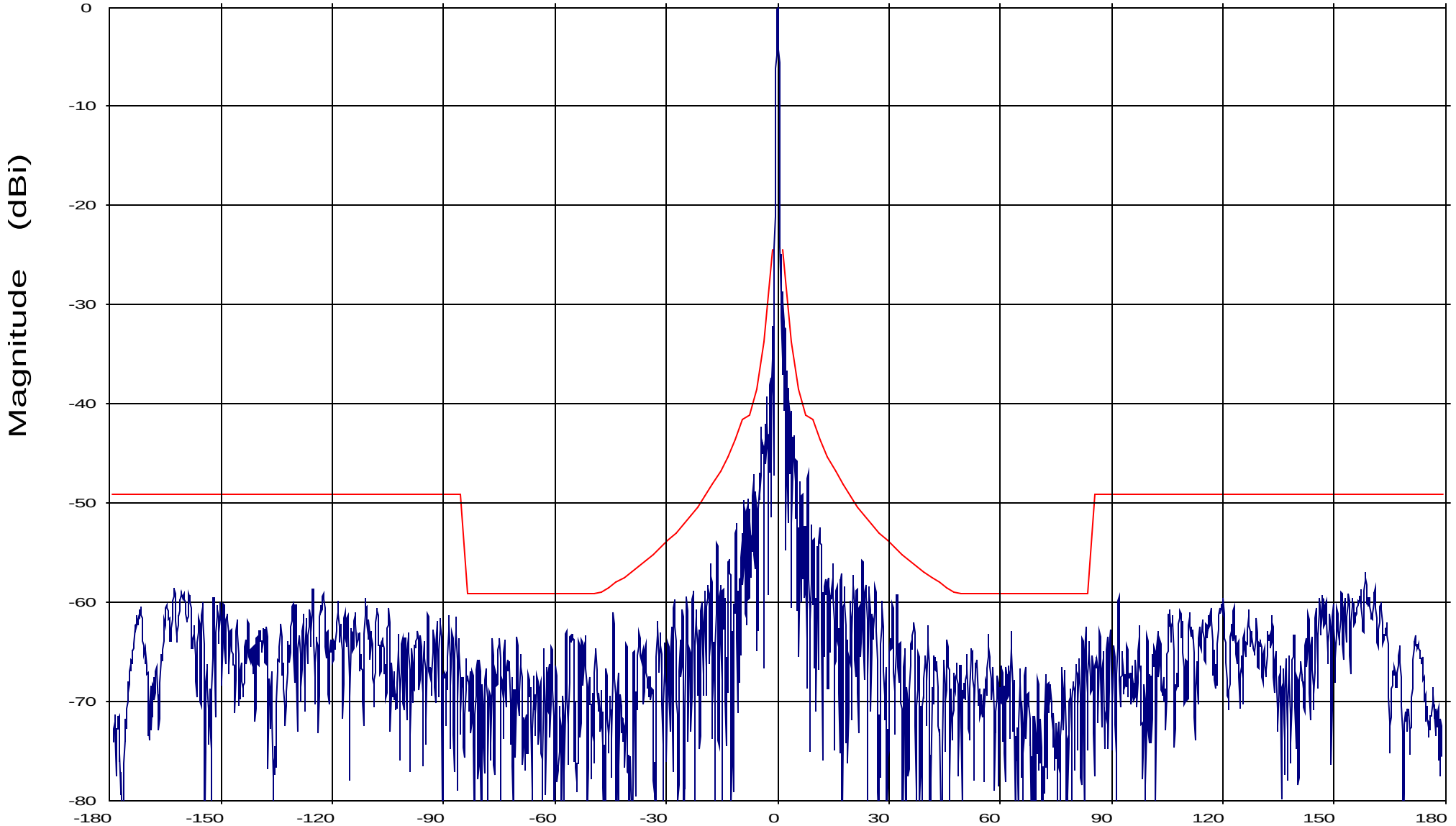
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: 2241 21.dat

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 18.550 GHz

Operator: Dwight B. Lutz
Ser. no.: 013012-1
Channel: AUT Tx pol: LHCP Rx pol: LHCP



RPE: FCC Part 25.209 & 25.138 Ka-Band Co-Pol Azimuth

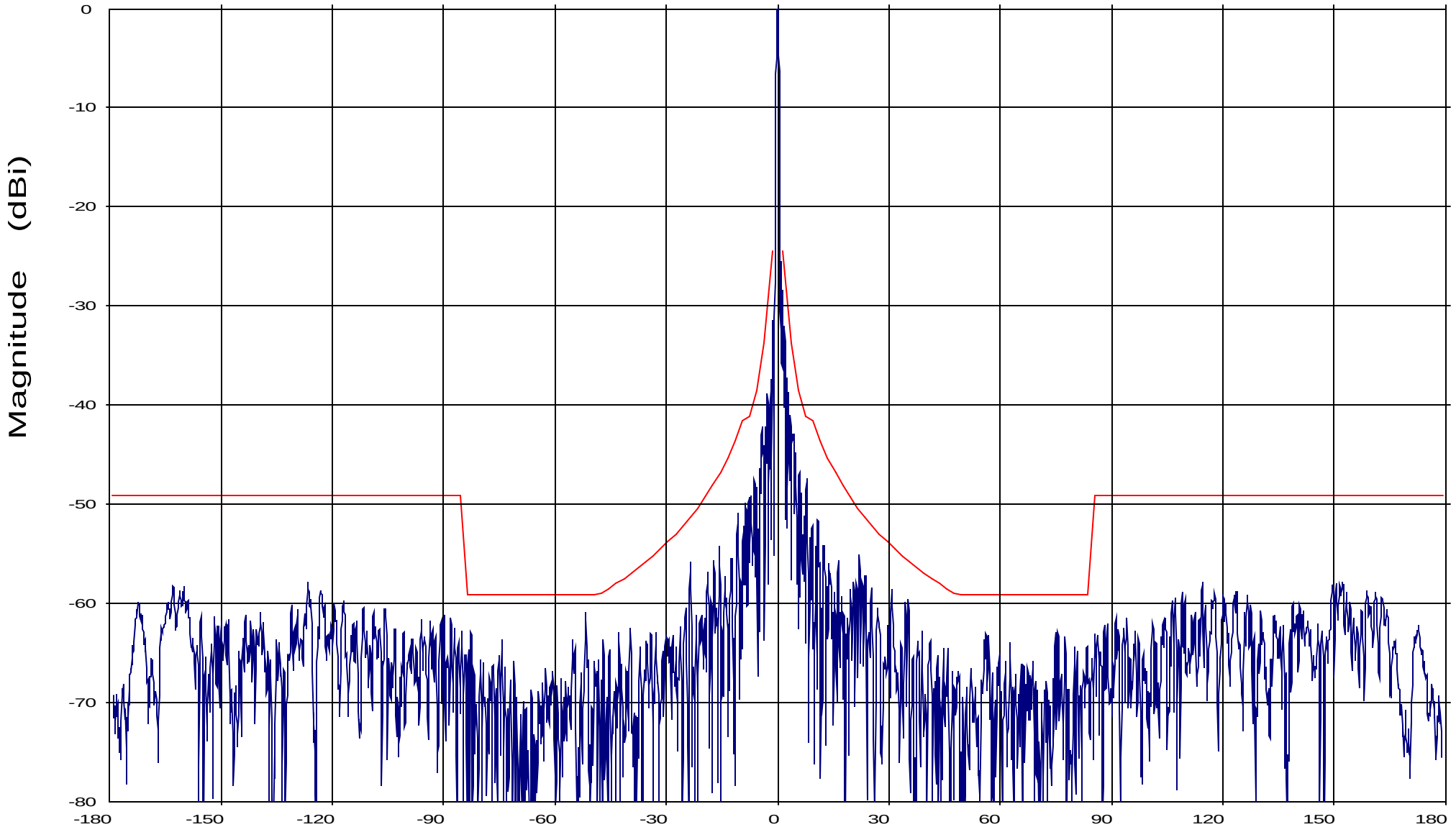
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: 2241 21.dat

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 19.300 GHz

Operator: Dwight B. Lutz
Ser. no.: 013012-1
Channel: AUT Tx pol: LHCP Rx pol: LHCP



RPE: FCC Part 25.209 & 25.138 Ka-Band Co-Pol Azimuth

General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

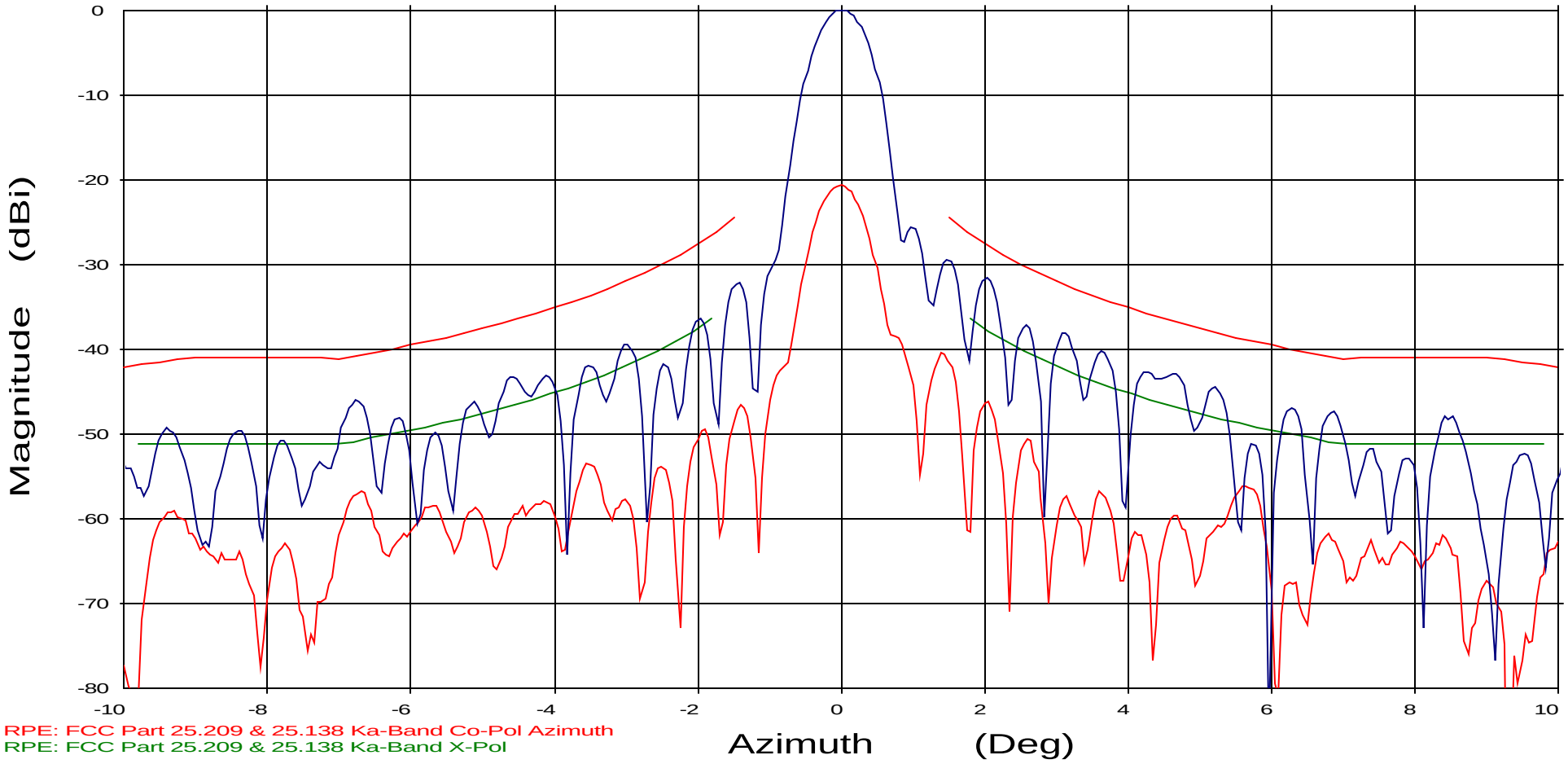
RHCP Radiation Patterns

Receive Frequencies

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 17.800 GHz

Operator: Dwight B. Lutz
Ser. no.: 013012-1
Channel: AUT Tx pol: RHCP Rx pol: RHCP



RPE: FCC Part 25.209 & 25.138 Ka-Band Co-Pol Azimuth
RPE: FCC Part 25.209 & 25.138 Ka-Band X-Pol

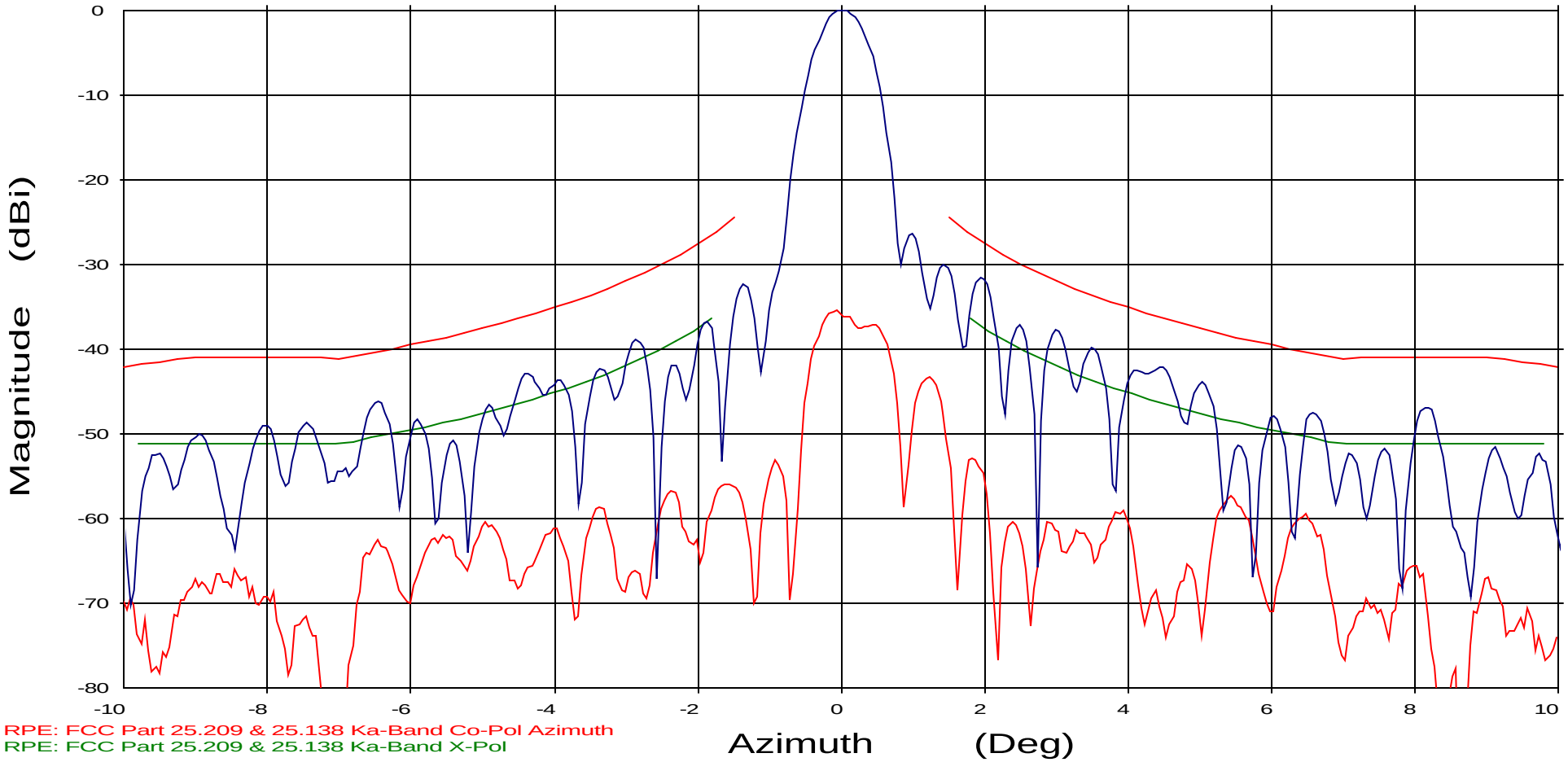
Overlays	Cal. file	table	channel	units
2241 31.dat-ant_under_test	2241 31.dat	Reference	AUT	dBi
2241 34.dat-ant_under_test	2241 34.dat	Reference	AUT	dBi

General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 18.550 GHz

Operator: Dwight B. Lutz
Ser. no.: 013012-1
Channel: AUT Tx pol: RHCP Rx pol: RHCP



RPE: FCC Part 25.209 & 25.138 Ka-Band Co-Pol Azimuth
RPE: FCC Part 25.209 & 25.138 Ka-Band X-Pol

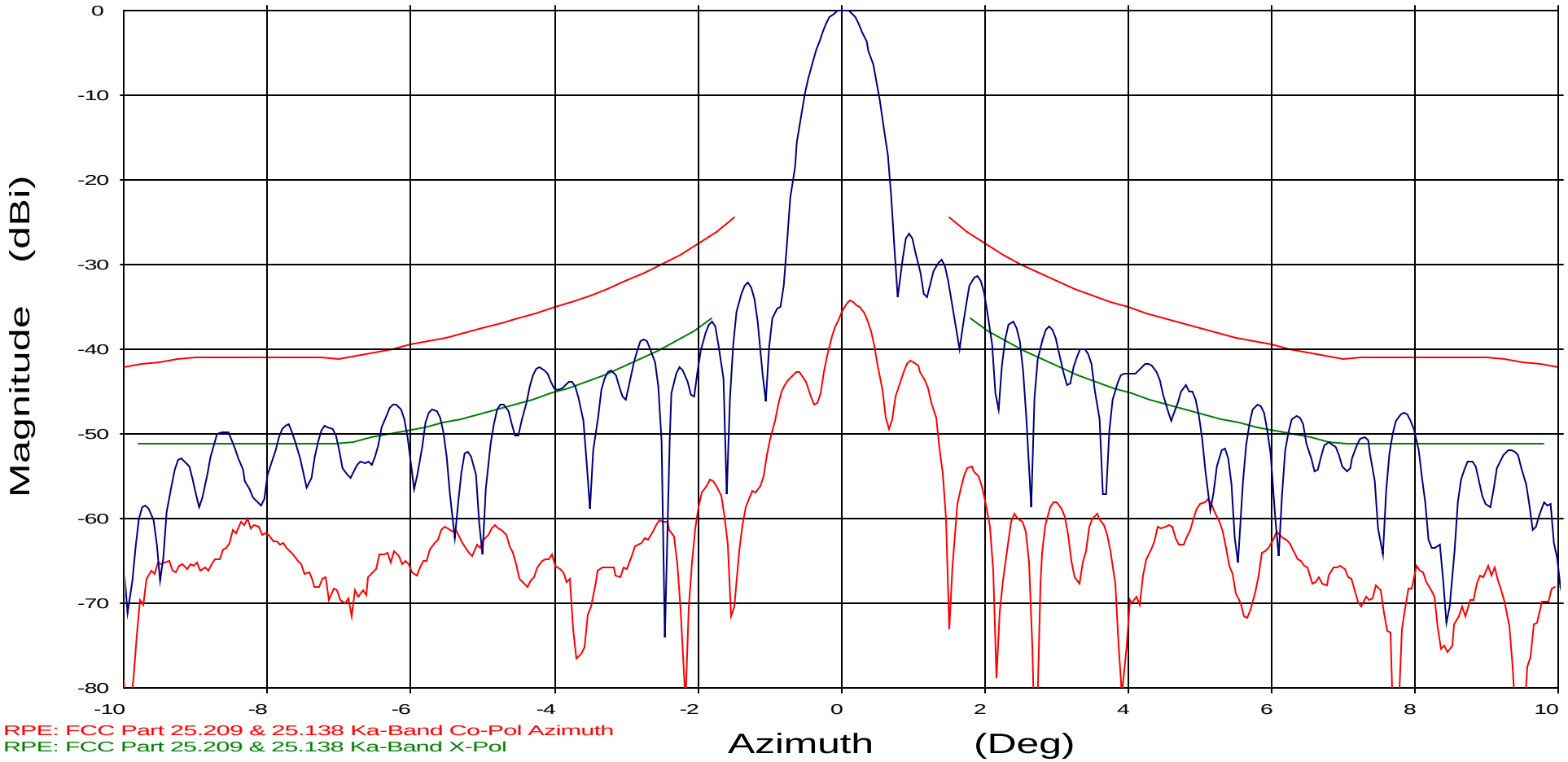
Overlays	Cal. file	table	channel	units
2241 31.dat-ant_under_test	2241 31.dat	Reference	AUT	dBi
2241 34.dat-ant_under_test	2241 34.dat	Reference	AUT	dBi

General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 19.300 GHz

Operator: Dwight B. Lutz
Ser. no.: 013012-1
Channel: AUT Tx pol: RHCP Rx pol: RHCP



RPE: FCC Part 25.209 & 25.138 Ka-Band Co-Pol Azimuth
RPE: FCC Part 25.209 & 25.138 Ka-Band X-Pol

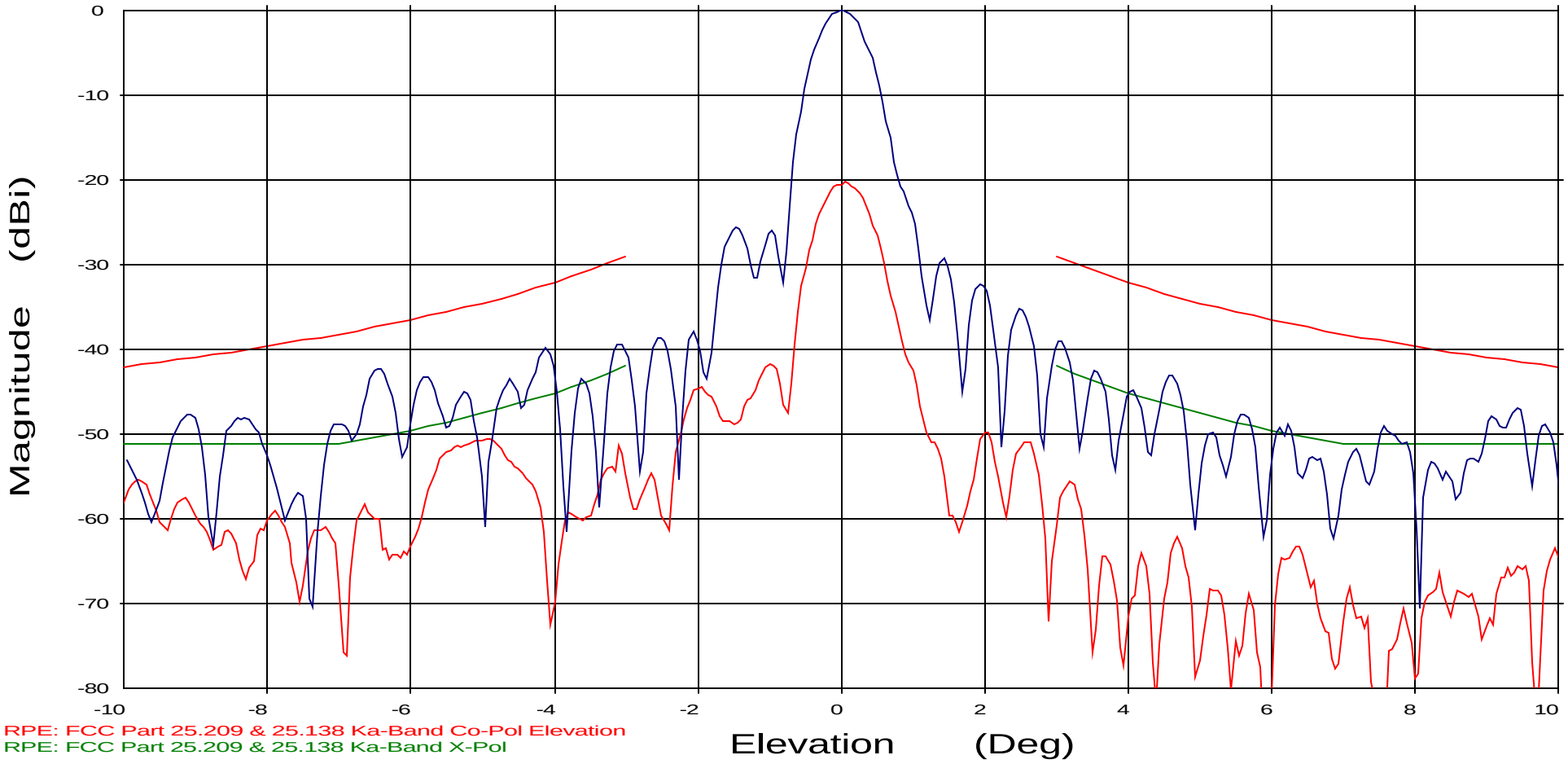
Overlays	Cal. file	table	channel	units
2241 31.dat-ant_under_test	2241 31.dat	Reference	AUT	dBi
2241 34.dat-ant_under_test	2241 34.dat	Reference	AUT	dBi

General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 17.800 GHz

Operator: Dwight B. Lutz
Ser. no.: 013012-1
Channel: AUT Tx pol: RHCP Rx pol: RHCP



RPE: FCC Part 25.209 & 25.138 Ka-Band Co-Pol Elevation
RPE: FCC Part 25.209 & 25.138 Ka-Band X-Pol

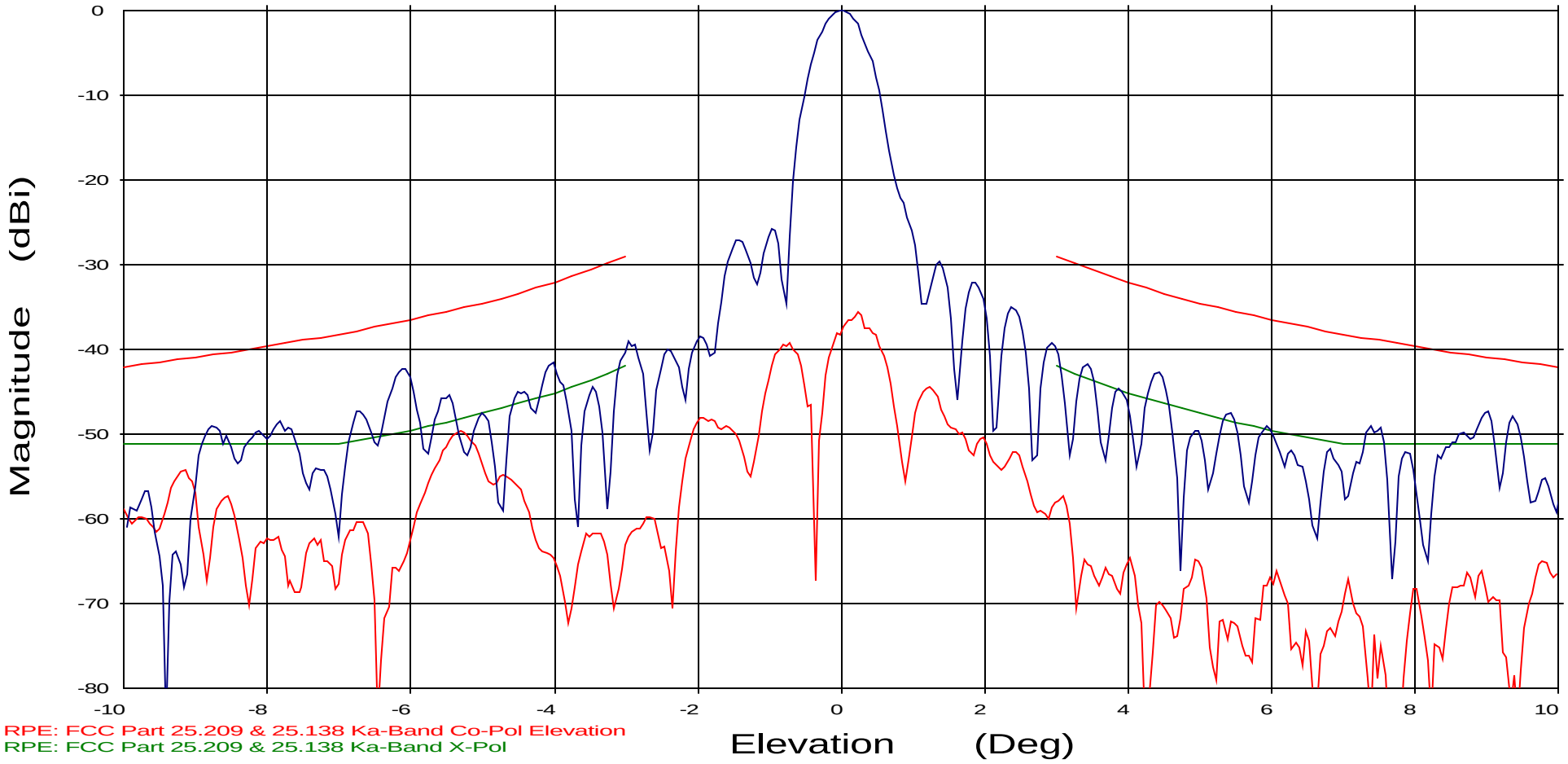
Overlays	Cal. file	table	channel	units
2241 32.dat-ant_under_test	2241 32.dat	Reference	AUT	dBi
2241 35.dat-ant_under_test	2241 35.dat	Reference	AUT	dBi

General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 18.550 GHz

Operator: Dwight B. Lutz
Ser. no.: 013012-1
Channel: AUT Tx pol: RHCP Rx pol: RHCP



RPE: FCC Part 25.209 & 25.138 Ka-Band Co-Pol Elevation
RPE: FCC Part 25.209 & 25.138 Ka-Band X-Pol

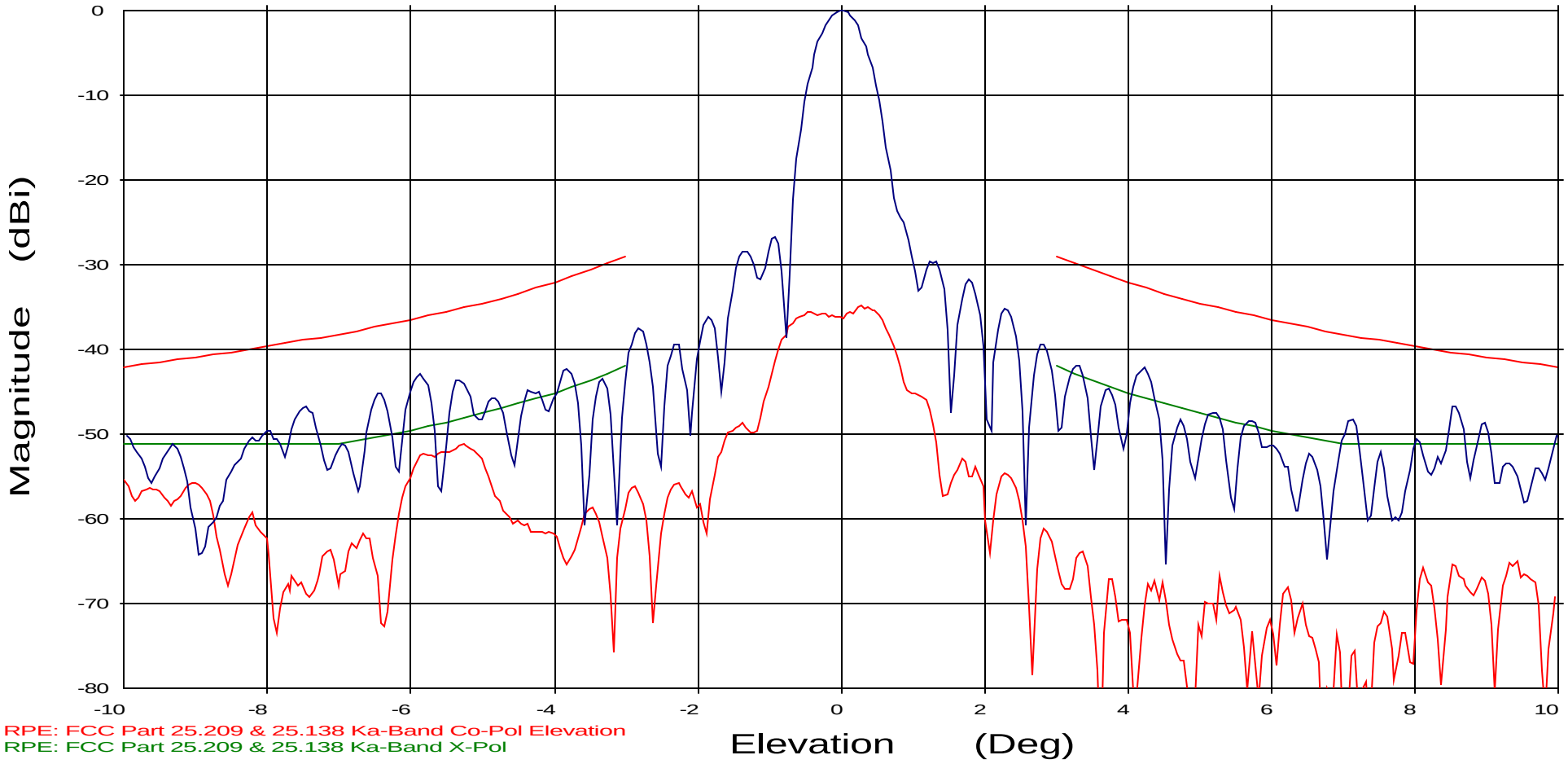
Overlays	Cal. file	table	channel	units
2241 32.dat-ant_under_test	2241 32.dat	Reference	AUT	dBi
2241 35.dat-ant_under_test	2241 35.dat	Reference	AUT	dBi

General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 19.300 GHz

Operator: Dwight B. Lutz
Ser. no.: 013012-1
Channel: AUT Tx pol: RHCP Rx pol: RHCP



RPE: FCC Part 25.209 & 25.138 Ka-Band Co-Pol Elevation
RPE: FCC Part 25.209 & 25.138 Ka-Band X-Pol

Overlays	Cal. file	table	channel	units
2241 32.dat-ant_under_test	2241 32.dat	Reference	AUT	dBi
2241 35.dat-ant_under_test	2241 35.dat	Reference	AUT	dBi

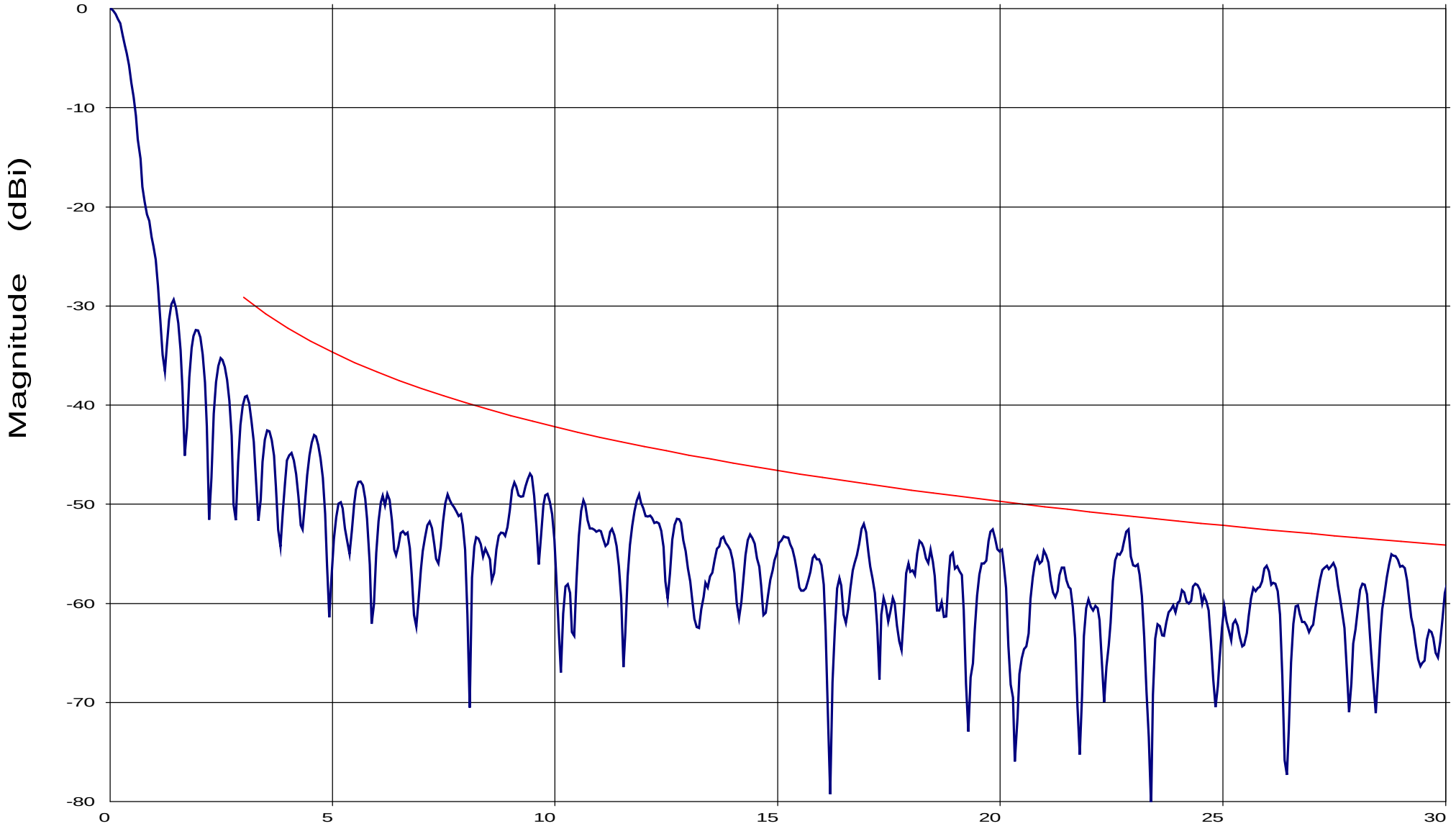
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: 2241 32.dat

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 17.800 GHz

Operator: Dwight B. Lutz
Ser. no.: 013012-1
Channel: AUT Tx pol: RHCP Rx pol: RHCP



RPE: FCC Part 25.209 & Part 25.138 Ka-Band Co-Pol Elevation

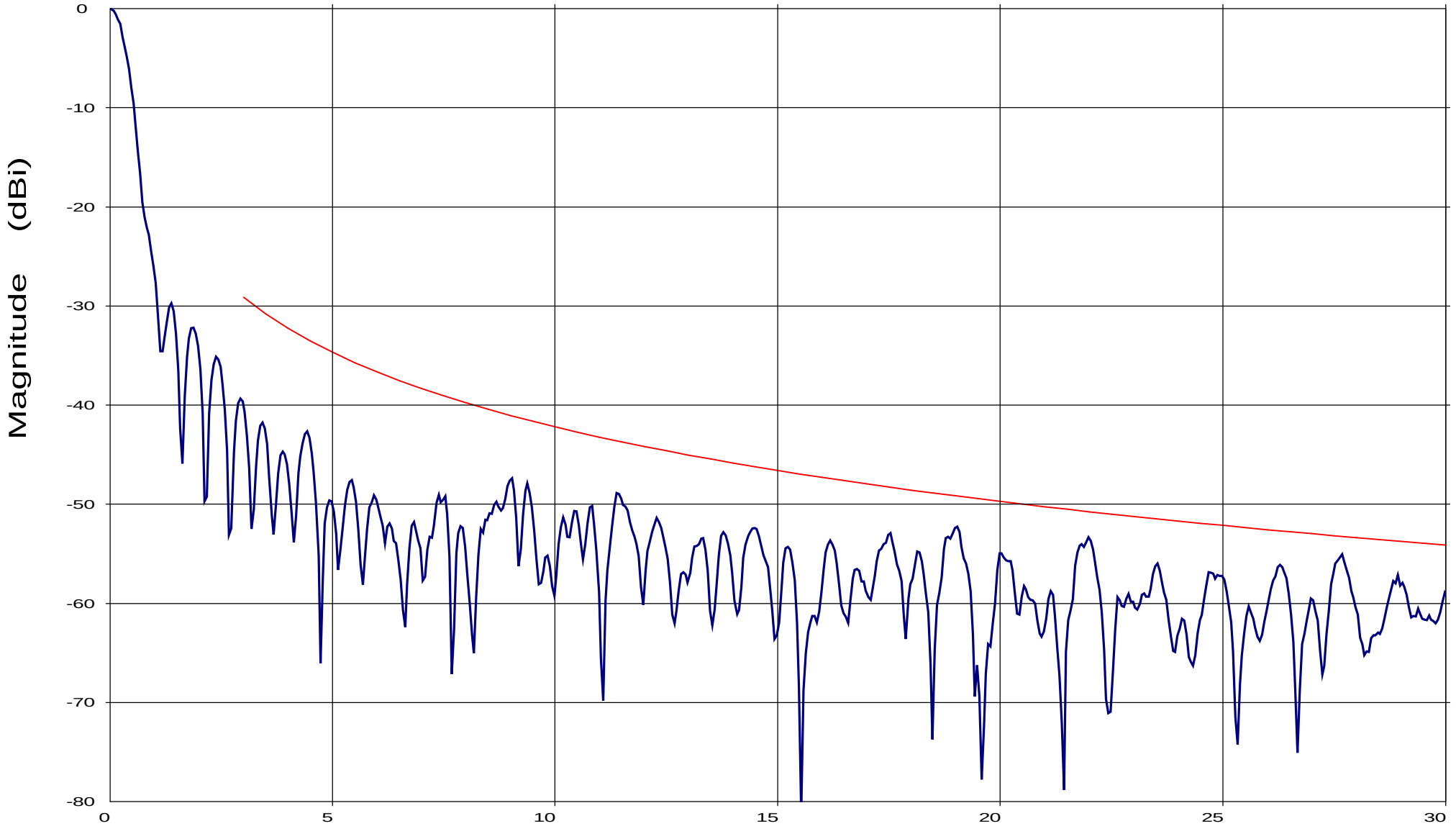
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: 2241 32.dat

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 18.550 GHz

Operator: Dwight B. Lutz
Ser. no.: 013012-1
Channel: AUT Tx pol: RHCP Rx pol: RHCP



RPE: FCC Part 25.209 & Part 25.138 Ka-Band Co-Pol Elevation

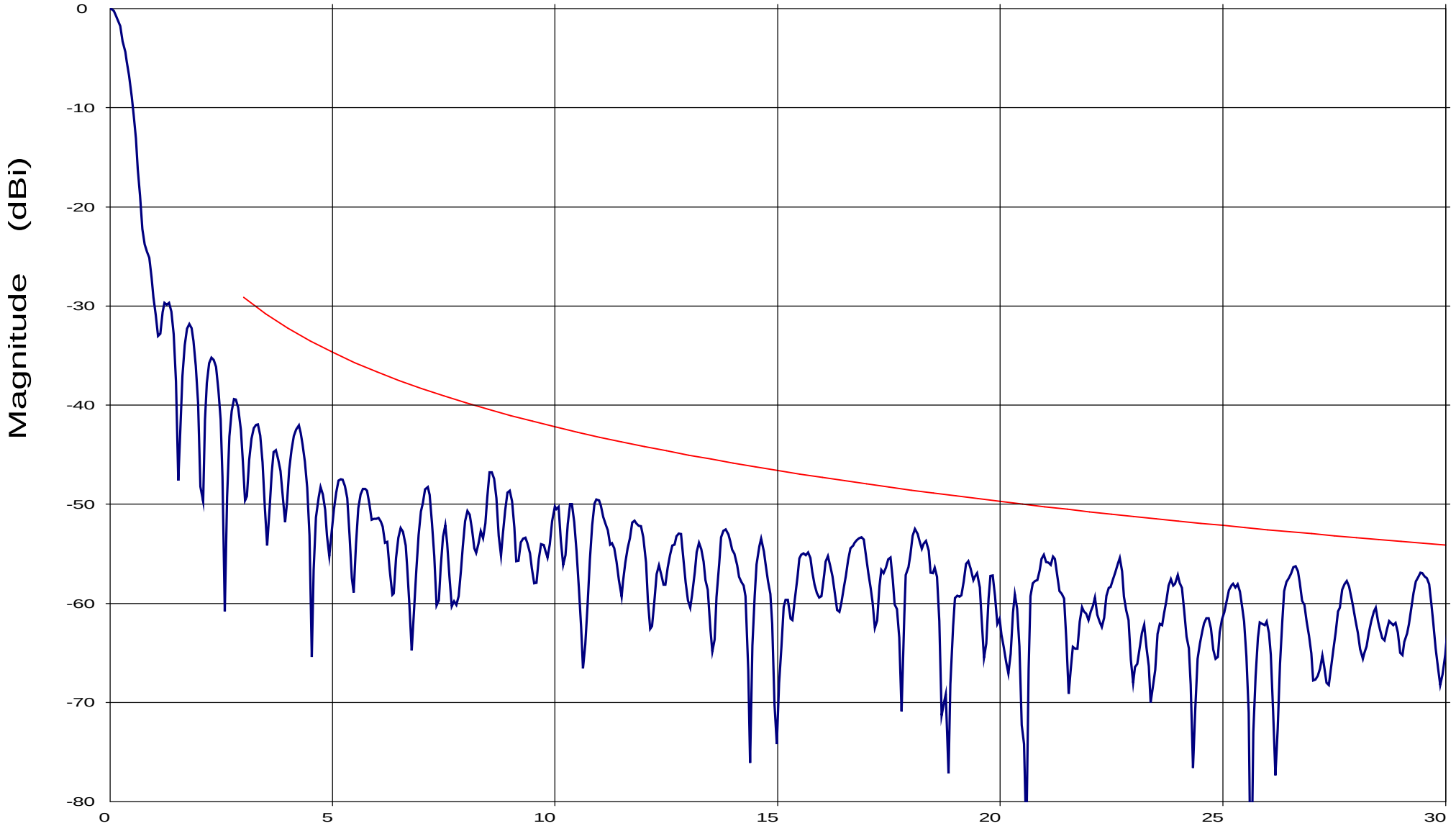
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: 2241 32.dat

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 19.300 GHz

Operator: Dwight B. Lutz
Ser. no.: 013012-1
Channel: AUT Tx pol: RHCP Rx pol: RHCP



RPE: FCC Part 25.209 & Part 25.138 Ka-Band Co-Pol Elevation

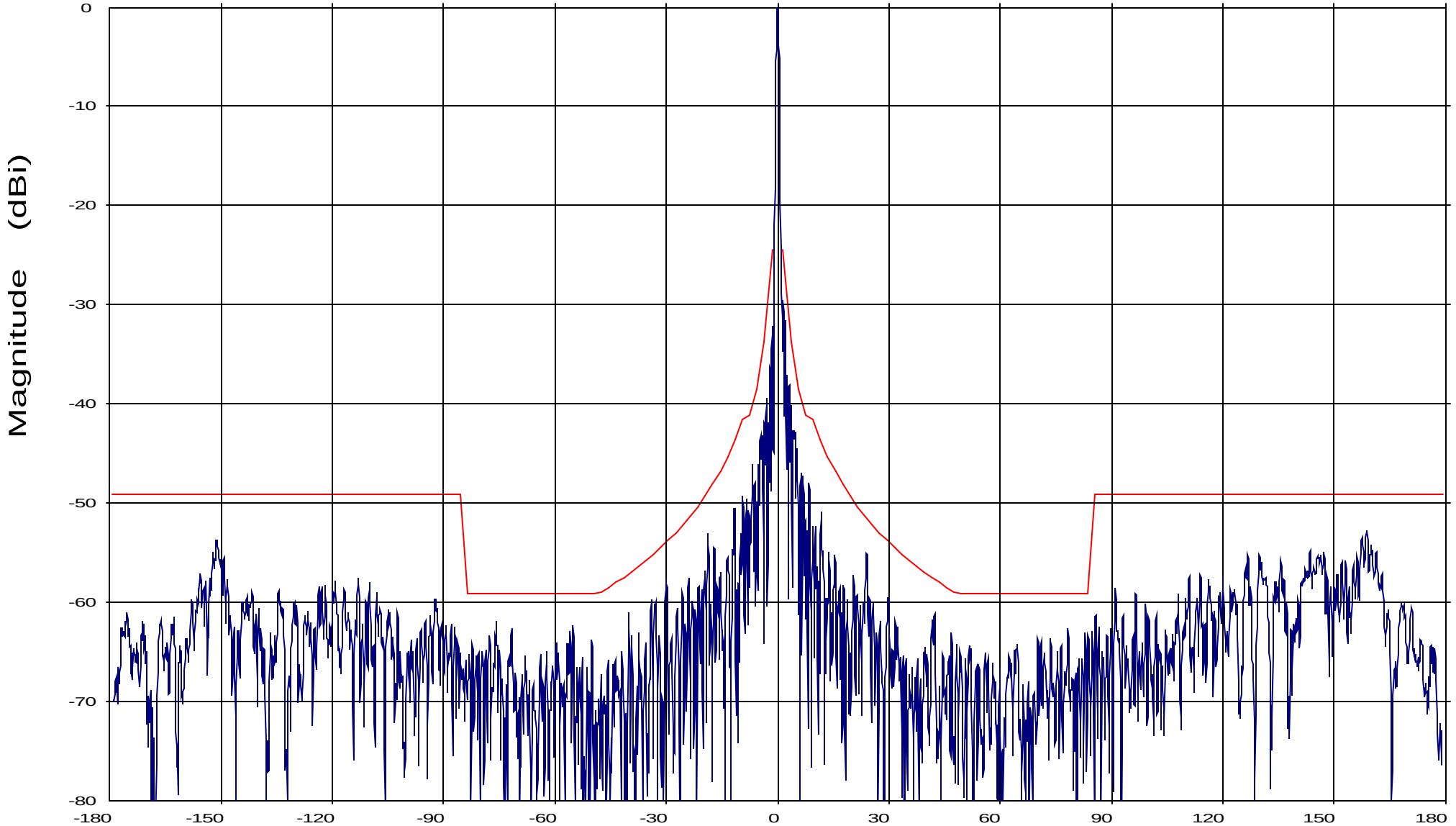
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: 2241 31.dat

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 17.800 GHz

Operator: Dwight B. Lutz
Ser. no.: 013012-1
Channel: AUT Tx pol: RHCP Rx pol: RHCP



RPE: FCC Part 25.209 & 25.138 Ka-Band Co-Pol Azimuth

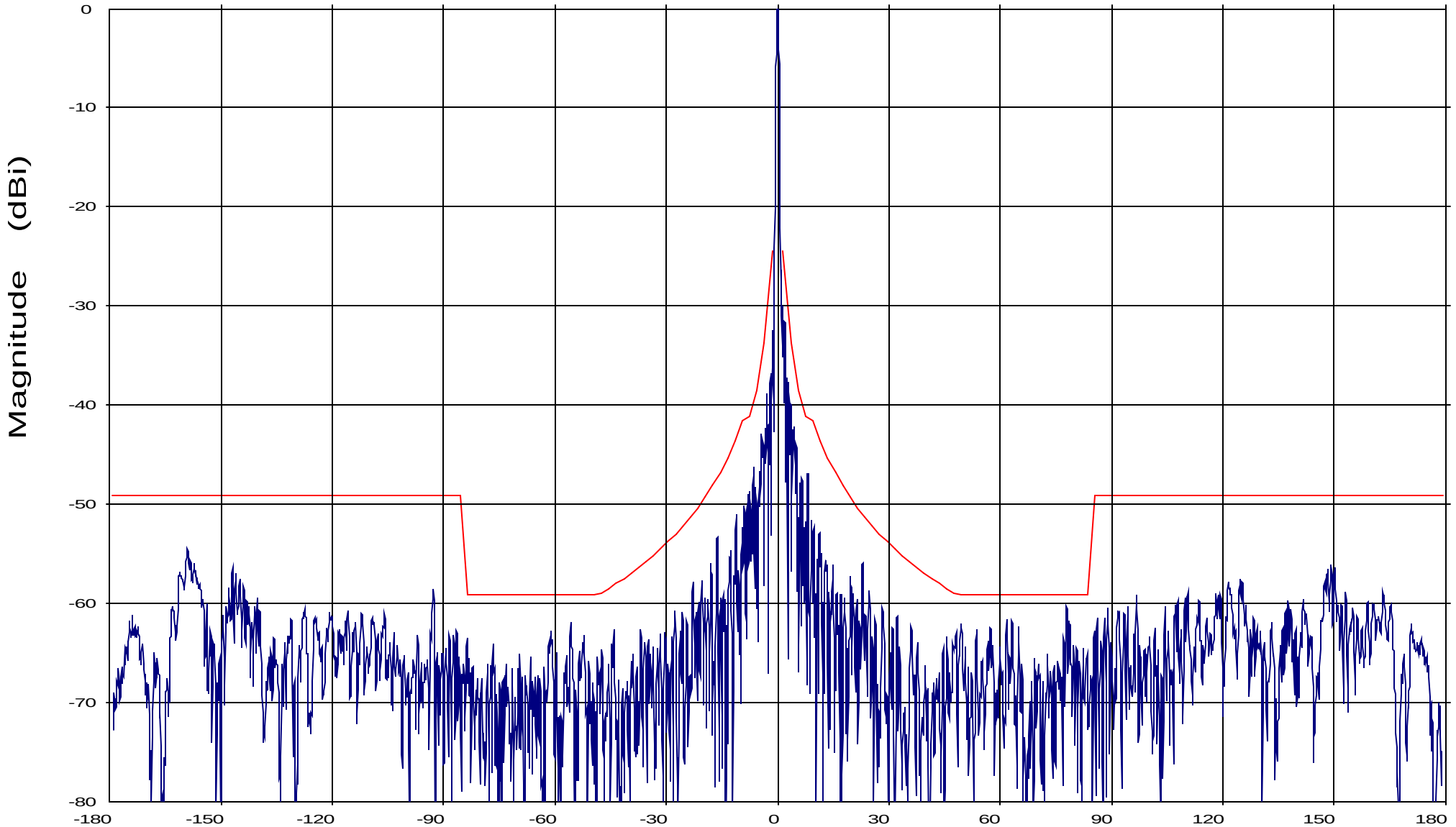
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: 2241 31.dat

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 18.550 GHz

Operator: Dwight B. Lutz
Ser. no.: 013012-1
Channel: AUT Tx pol: RHCP Rx pol: RHCP



RPE: FCC Part 25.209 & 25.138 Ka-Band Co-Pol Azimuth

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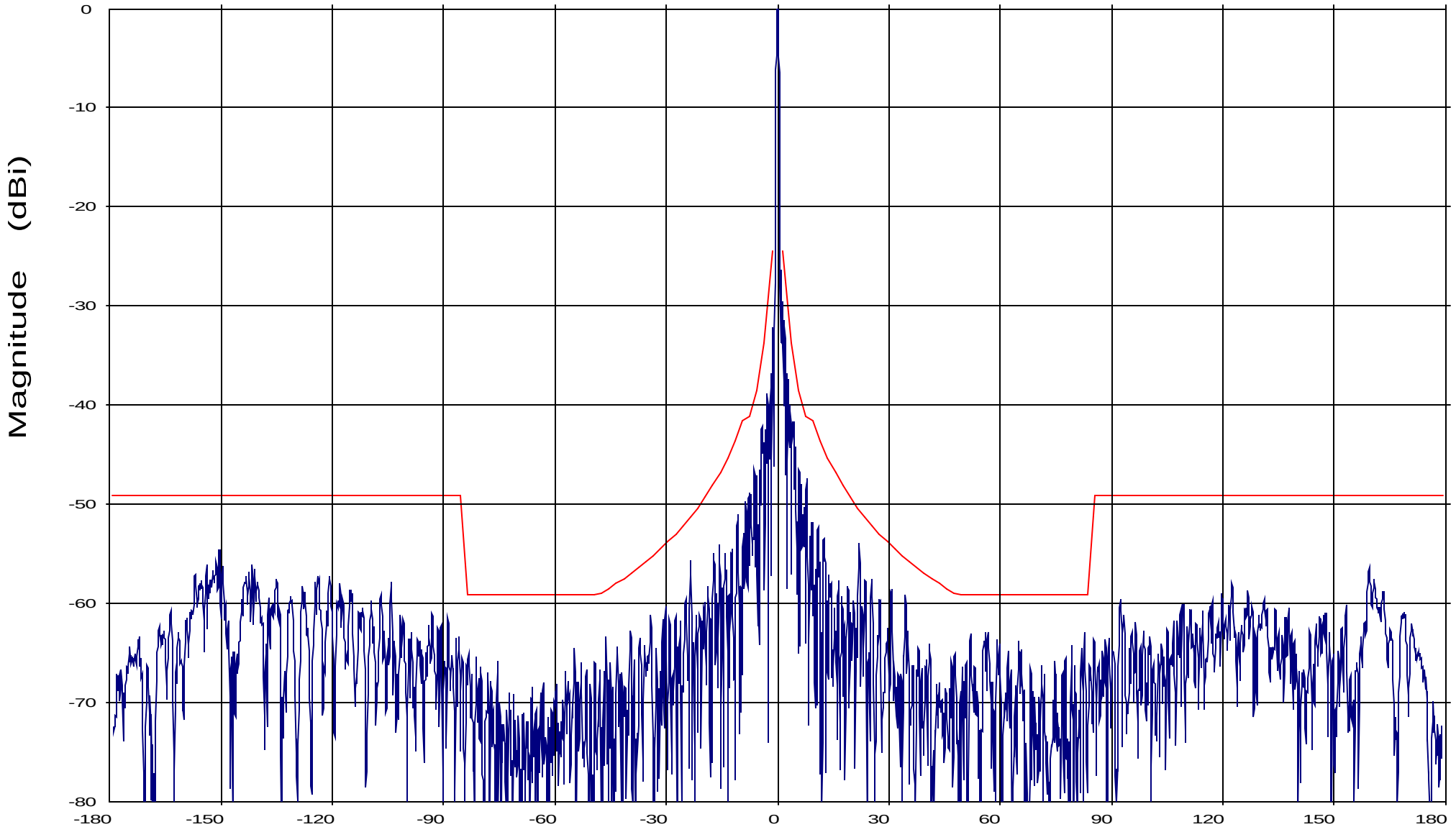
Maiden, North Carolina 28650

File: 2241 31.dat

1.8M Ka-Band CP Rx/Tx
O3b Antenna System

Frequency : 19.300 GHz

Operator: Dwight B. Lutz
Ser. no.: 013012-1
Channel: AUT Tx pol: RHCP Rx pol: RHCP



RPE: FCC Part 25.209 & 25.138 Ka-Band Co-Pol Azimuth

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Test Photos

End of Report

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Annex 4: Link Budgets

O3b Network Link Analysis - Tier 2 Service For Washington, United States			
Link Budget Creator - Rev 3.2.12: September 09, 2013		**Tier 2**	**Tier 2**
Parameters:	**Unit**	**71.8 km Diameter Beam**	
Ground Parameter		**Teleport**	**Telco**
Location		Vernon (East), United States	Washington, United States
Latitude	(°)	34.2	38.9
Longitude (East)	(°)	260.7	283.0
E/S Maximum Range to SV	(km)	9861.7	10613.2
E/S Minimmum Elevation to SV	(°)	34.1	24.1
E/S Altitude	(km)	0.3	0.0
SV Beam Identifier	(#)	23	
Minutes Into Pass (Sample #31)	(Min)	14:31	
Telco Spot Beam Off-Angle	(°)	0.20	
Telco Spot Beam Diameter	(km)	71.80	
Telco Spot Beam Coverage Area	(km^2)	4048.92	
Maximum Roundtrip Latency	(msec)	136.59	
Modulation Parameters		**Forward**	**Return**
Enter Receiver	Type	DVB-S2	DVB-S2
Modem Overhead	(%)	1.0%	1.0%
Percentage of Bandwidth	(%)	100.00	100.00
Number of Carriers per Channel	(#)	1	1
Available Bandwidth	(Hz)	216,000,000	216,000,000
Available Throughput	(bps)	400,950,000	237,600,000
Aggregate Throughput (100% / 100% of Full Rate)	(bps)	400,950,000	237,600,000
Channel Symbol Rate	(sps)	180,000,000	180,000,000
Channel Modulation Type		8PSK	QPSK
Channel FEC Rate		0.75	0.67
Channel Spectral Efficiency	(bits/Sym)	2.25	1.33
Channel Throughput (100% / 100% of Full Rate)	(bps)	400,950,000.00	237,600,000.00
Uplink		**Forward**	**Return**
E/S Tx Channels per HPA	(#)	5	1
E/S Tx Carrier Frequency	(MHz)	28,280	28,280
E/S Tx Wavelength	(m)	0.010601	0.010601
E/S Tx HPA Power Percentage	(%)	100.00	100.00
E/S Tx HPA Power Level	(W)	500	40
E/S Tx OBO	(dB)	-4.00	-1.50
E/S Tx Post-HPA Losses	(dB)	-2.38	-0.69
E/S Tx Antenna Gain (7.3 m / 1.8 m)	(dB)	65.15	52.67
E/S Tx EIRP Per Channel	(dBW)	78.77	66.50
E/S Tx Pointing Loss	(dB)	-0.50	-0.50
E/S Tx RF Link Availability	(%)	75.000	99.000
E/S Tx Atmospheric Losses	(dB)	-1.16	-10.89
E/S Tx Diversity Gain	(dB)	0.00	0.00
E/S Tx Free Space Loss	(dB)	-201.36	-201.99
E/S Tx Spreading Loss	(dB)	-150.87	-151.51
Satellite		**Forward**	**Return**
SV Number of Channels per HPA	(#)	1	5
SV Rx G/T	(dB/K)	5.36	5.40
SV Rx Power Per Tier	(dBW)	-118.88	-141.48
SV Rx Flux Density Per Tier	(dBW/m^2)	-73.75	-96.40
SV Rx Pointing Loss (0.2° Pointing Error)	(dB)	0.00	0.00
SV Tx TWTA Power Percentage	(%)	100.00	100.00
SV Tx TWTA Power Per Tier	(W)	65	65
SV Tx OBO (ALC / ALC)	(dB)	-3.80	-5.80
SV Tx Post-TWTA Losses	(dB)	-1.50	-1.50
SV Tx Antenna Gain	(dBi)	31.82	31.87
SV Tx EIRP Per Channel/Carrier	(dBW)	44.65	35.71
SV Tx Pointing Loss	(dB)	0.00	0.00
Downlink		**Forward**	**Return**
E/S Rx Carrier Frequency	(MHz)	18,480	18,480
E/S Rx Wavelength	(m)	0.016223	0.016223
E/S Rx Free Space Loss	(dB)	-198.30	-197.66
E/S Rx Spreading Loss	(dB)	-151.51	-150.87
E/S Rx RF Link Availability	(%)	99.150	75.000
E/S Rx Atmospheric Losses	(dB)	-5.64	-0.67
E/S Rx Diversity Gain	(dB)	0.00	0.00
E/S Rx Pointing Loss	(dB)	-0.50	-0.50
E/S Rx Antenna Gain (1.8 m / 7.3 m)	(dBi)	47.84	62.04
E/S Rx Effective G/T	(dB/K)	23.14	38.97
E/S Rx Power Per Channel	(dBW)	-111.95	-101.08
E/S Rx Flux Density Per Channel	(dBW/m^2)	-113.00	-116.33
Total Link		**Forward**	**Return**
Carrier / Noise Bandwidth	(dB)	82.55	82.55
Carrier / Noise Uplink	(dB)	27.17	4.56
Carrier / Noise Downlink	(dB)	9.40	21.90
Carrier / Interference Uplink (XPD)	(dB)	18.43	38.58
Carrier / Interference Downlink (XPD)	(dB)	36.95	20.45
Carrier / Interference Uplink (CoPol)	(dB)	30.70	15.36
Carrier / Interference Downlink (CoPol)	(dB)	31.30	20.74
Carrier / Intermodulation Im (C/Im)	(dB)	23.53	19.20
(C/N) - Total Actual	(dB)	8.53	3.79
(C/N) - Total Required	(dB)	8.50	3.70
(E_b/N_o) - Total Actual	(dB)	5.00	2.54
(E_b/N_o) - Total Required	(dB)	4.98	2.45
Excess Margin	**(dB)**	**0.03**	**0.09**
Fade Margin	**(dB)**	**11.13**	**6.39**

O3b Network Link Analysis - Tier 2 Service For Washington, United States

Link Budget Creator - Rev 3.2.12: September 09, 2013		Tier 2	Tier 2
Parameters:	**Unit**	**71.8 km Diameter Beam**	
Ground Parameter		**Teleport**	**Telco**
Location		Vernon (East), United States	Washington, United States
Latitude	(°)	34.2	38.9
Longitude (East)	(°)	260.7	283.0
E/S Maximum Range to SV	(km)	9999.8	10403.3
E/S Minimmum Elevation to SV	(°)	32.1	26.7
E/S Altitude	(km)	0.3	0.0
SV Beam Identifier	(#)	23	
Minutes Into Pass (Sample #46)	(Min)	21:46	
Telco Spot Beam Off-Angle	(°)	0.20	
Telco Spot Beam Diameter	(km)	71.80	
Telco Spot Beam Coverage Area	(km^2)	4048.92	
Maximum Roundtrip Latency	(msec)	136.12	
Modulation Parameters		**Forward**	**Return**
Enter Receiver	Type	DVB-S2	DVB-S2
Modem Overhead	(%)	1.0%	1.0%
Percentage of Bandwidth	(%)	100.00	100.00
Number of Carriers per Channel	(#)	1	1
Available Bandwidth	(Hz)	216,000,000	216,000,000
Available Throughput	(bps)	400,950,000	178,200,000
Aggregate Throughput (100% / 100% of Full Rate)	(bps)	400,950,000	178,200,000
Channel Symbol Rate	(sps)	180,000,000	180,000,000
Channel Modulation Type		8PSK	QPSK
Channel FEC Rate		0.75	0.50
Channel Spectral Efficiency	(bits/Sym)	2.25	1.00
Channel Throughput (100% / 100% of Full Rate)	(bps)	400,950,000.00	178,200,000.00
Uplink		**Forward**	**Return**
E/S Tx Channels per HPA	(#)	5	1
E/S Tx Carrier Frequency	(MHz)	28,280	28,280
E/S Tx Wavelength	(m)	0.010601	0.010601
E/S Tx HPA Power Percentage	(%)	100.00	100.00
E/S Tx HPA Power Level	(W)	500	20
E/S Tx OBO	(dB)	-4.00	-1.50
E/S Tx Post-HPA Losses	(dB)	-2.38	-0.69
E/S Tx Antenna Gain (7.3 m / 1.8 m)	(dB)	65.15	52.67
E/S Tx EIRP Per Channel	(dBW)	78.77	63.49
E/S Tx Pointing Loss	(dB)	-0.50	-0.50
E/S Tx RF Link Availability	(%)	75.000	99.000
E/S Tx Atmospheric Losses	(dB)	-1.21	-10.11
E/S Tx Diversity Gain	(dB)	0.00	0.00
E/S Tx Free Space Loss	(dB)	-201.48	-201.82
E/S Tx Spreading Loss	(dB)	-150.99	-151.34
Satellite		**Forward**	**Return**
SV Number of Channels per HPA	(#)	1	5
SV Rx G/T	(dB/K)	5.36	5.32
SV Rx Power Per Tier	(dBW)	-119.05	-143.62
SV Rx Flux Density Per Tier	(dBW/m^2)	-73.93	-98.46
SV Rx Pointing Loss (0.2° Pointing Error)	(dB)	0.00	0.00
SV Tx TWTA Power Percentage	(%)	100.00	100.00
SV Tx TWTA Power Per Tier	(W)	65	65
SV Tx OBO (ALC / ALC)	(dB)	-3.80	-5.80
SV Tx Post-TWTA Losses	(dB)	-1.50	-1.50
SV Tx Antenna Gain	(dBi)	31.80	31.87
SV Tx EIRP Per Channel/Carrier	(dBW)	44.63	35.71
SV Tx Pointing Loss	(dB)	0.00	0.00
Downlink		**Forward**	**Return**
E/S Rx Carrier Frequency	(MHz)	18,480	18,480
E/S Rx Wavelength	(m)	0.016223	0.016223
E/S Rx Free Space Loss	(dB)	-198.13	-197.78
E/S Rx Spreading Loss	(dB)	-151.34	-150.99
E/S Rx RF Link Availability	(%)	99.300	75.000
E/S Rx Atmospheric Losses	(dB)	-5.66	-0.70
E/S Rx Diversity Gain	(dB)	0.00	0.00
E/S Rx Pointing Loss	(dB)	-0.50	-0.50
E/S Rx Antenna Gain (1.8 m / 7.3 m)	(dBi)	47.84	62.04
E/S Rx Effective G/T	(dB/K)	23.07	38.96
E/S Rx Power Per Channel	(dBW)	-111.83	-101.24
E/S Rx Flux Density Per Channel	(dBW/m^2)	-112.87	-116.49
Total Link		**Forward**	**Return**
Carrier / Noise Bandwidth	(dB)	82.55	82.55
Carrier / Noise Uplink	(dB)	27.00	2.43
Carrier / Noise Downlink	(dB)	9.45	21.74
Carrier / Interference Uplink (XPD)	(dB)	18.43	37.90
Carrier / Interference Downlink (XPD)	(dB)	36.71	20.45
Carrier / Interference Uplink (CoPol)	(dB)	30.14	12.77
Carrier / Interference Downlink (CoPol)	(dB)	31.55	20.25
Carrier / Intermodulation Im (C/Im)	(dB)	23.53	19.20
(C/N) - Total Actual	(dB)	8.56	1.77
(C/N) - Total Required	(dB)	8.50	1.60
(E_b/N_o) - Total Actual	(dB)	5.04	1.77
(E_b/N_o) - Total Required	(dB)	4.98	1.60
Excess Margin	**(dB)**	**0.06**	**0.17**
Fade Margin	**(dB)**	**11.16**	**4.37**

Annex 5

Radiation Hazard Study

RADIATION HAZARD STUDY

When applying for a license to construct and operate, modify, or renew an earth station, it is understood that licensees must certify whether grant of the application will have significant environmental impact as defined in the Federal Communications Commission's (FCC) rules, 47 C.F.R., Section 1.1307.

In this report SES Government Solutions, Inc. ("SES-GS") analyzes the maximum radiofrequency (RF) levels emitted from the satellite communications antenna described below. The reference document for this study is OET Bulletin No. 65, Edition 97-01, *Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields*, August 1997.

I. Antenna Near-Field Power Density Calculation

The extent of the near-field is defined by the following equation:

$$R_{near} = (D_{ant})^2 / (4\lambda)$$

where: R_{near} = extent of the near-field (in meters)
D_{ant} = diameter of the antenna main reflector (in meters)
λ = wavelength of the RF transmit frequency (in meters)

The maximum on-axis power density within near-field is defined by the following equation:

$$S_{near} = \{(16\eta P_{feed}) / [\pi(D_{ant})^2]\} / 10$$

where: S_{near} = maximum on-axis power density within the near-field (in milliwatts per square centimeter)
η = antenna aperature efficiency
P_{feed} = maximum power into antenna feed flange (in watts)
D_{ant} = diameter of the antenna main reflector (in meters)

II. Antenna Far-Field Power Density Calculation

The distance to the beginning of the far-field region is defined by the following equation:

$$R_{far} = [0.6(D_{ant})^2] \ / \ \lambda$$

where: R_{far} = distance to beginning of far-field (in meters)
D_{ant} = diameter of the antenna main reflector (in meters)
λ = wavelength of the RF transmit frequency in (meters)

The maximum on-axis power density within the far-field is defined by the following equation:

$$S_{far} = [(P_{feed} \ G_{ant}) \ / \ 4\pi(R_{far})^2] \ / \ 10$$

where: S_{far} = maximum on-axis power density in the far-field (in milliwatts per square centimeter)
P_{feed} = maximum power into antenna feed flange (in watts)
G_{ant} = antenna main beam gain at RF transmit frequency (in watts)
R_{far} = distance to beginning of far-field (in meters)

III. Antenna Transition Region Power Density Calculation

By definition, the maximum on-axis power densitiy in the transition region will never be greater than the maximum on-axis power densities in the near-field:

$$S_{tr} \leq S_{near}$$

where: S_{tr} = maximum on-axis power density in the transition region (in milliwatts per square centimeter)
S_{near} = maximum on-axis power density in the near-field (in milliwatts per square centimeter)

IV. Antenna Feed-Flange (or Subreflector) Power Density Calculation

The maximum power density at the antenna feed-flange (or subreflector surface) is defined by the following equation:

$$S_{feed(sub)} = 1000 \ \{[4(P_{feed})] \ / \ \{[\pi(D_{feed(sub)})^2 \ ] \ / \ 4\}\}$$

where: $S_{feed(sub)}$ = maximum power density at the antenna feed-flange or subreflector surface (in milliwatts per square centimeter)
P_{feed} = maximum power into antenna feed flange (in watts)
$D_{feed(sub)}$ = diameter of the antenna feed-flange or subreflector (in centimeters)

V. Antenna Main Reflector Power Density Calculation

The maximum power density in the main reflector region of the antenna is defined by the following equation:

$$S_{ant} = \{[2(P_{feed})] / \{[\pi(D_{ant})^2] / 4\}\} / 10$$

where: S_{ant} = maximum power density in the antenna main reflector region (in milliwatts per square centimeter)
P_{feed} = maximum power into antenna feed flange (in watts)
D_{ant} = diameter of the antenna main reflector (in meters)

VI. Power Density Calculation between the Antenna Main Reflector and the Ground

The maximum power density between the antenna main reflector and the ground is defined by the following equation:

$$S_{ground} = \{P_{feed} / \{[\pi(D_{ant})^2] / 4\}\} / 10$$

where: S_{ground} = maximum power density between the antenna main reflector and the ground (in milliwatts per square centimeter)
P_{feed} = maximum power into antenna feed flange (in watts)
D_{ant} = diameter of the antenna main reflector (in meters)

VII. Summary of Calculated Radiation Levels

SES-GS understands the licensee must ensure people are not exposed to harmful levels of radiation.

Maximum permissible exposure (MPE) limits for general population/uncontrolled exposure were not considered in this analysis for several reasons. The main-beam orientation and height above ground of this highly directional antenna significantly limit exposure to the general population. Furthermore, access to SES-GS stations is limited to authorized personnel who have been appropriately briefed and advised.

MPE limits for occupational/controlled exposure, however, were considered in this analysis. It is standard practice for our technical staff to cease transmissions whenever maintenance is performed in close proximity to antenna reflector regions with potentially hazardous power density levels. Based on the results (see next page entitled "Radiation Hazard Calculations") and our standard practices within our controlled antenna environment, the earth station operators / technicians should not be exposed to radiation levels exceeding 5 mW/cm^2 power density over a six minute averaging time.

VIII. Certification

I hereby certify that I am the technically qualified person responsible for preparation of the engineering information contained in this radiation hazard assessment, that I have reviewed the engineering information submitted, and that it is complete and accurate to the best of my knowledge.

Maurice Najarian
Senior Member Technical Staff

Antenna main reflector diameter	1.8	m	
Feed flange (or subreflector) diameter	4.4500	cm	
RF transmit frequency	28.388	GHz	
Maximum power into antenna feed-flange	40.00	W	
Main-beam gain of antenna (at RF transmit frequency)	52.8	dBi	
	190546.1	W	
Antenna aperature efficiency	0.65		
Antenna main reflector surface area	2.54	m^2	
Feed flange (or subreflector) surface area	15.553	cm^2	
Wavelength of the RF transmit frequency	0.011	m	
Distance to beginning of far-field region	184.08	m	
Distance to extent of near-field region	76.70	m	
Max. on-axis power density [far-field]	**1.790**	**mW/cm^2**	**SATISFIES MPE LIMITS**
Max. on-axis power density [near-field]	**4.087**	**mW/cm^2**	**SATISFIES MPE LIMITS**
Max. on-axis power density [transition region]	**4.087**	**mW/cm^2**	**SATISFIES MPE LIMITS**
Max. power density [feed-flange or subreflector]	**10287.505**	**mW/cm^2**	**POTENTIAL HAZARD**
Max. power density [main reflector region]	**6.288**	**mW/cm^2**	**POTENTIAL HAZARD**
Max. power density [between main reflector and ground]	**1.572**	**mW/cm^2**	**SATISFIES MPE LIMITS**