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October 7, 2016

VIA ELECTRONIC FILING IN IBFS

Ms. Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Re: ViaSat, Inc., IBFS File No. SAT-MOD-20160527-00053, Call Sign S2902

Dear Ms. Dortch:

ViaSat, Inc. ("ViaSat") submits the attached amended and restated response to the Commission's request dated August 15, 2016 for additional information regarding the above-referenced application seeking to modify its grant of U.S. market access for the ViaSat-2 satellite at the 69.9º W.L. orbital location to add the 27.5-28.1 GHz and 17.7-18.3 GHz frequencies. The attached Amended and Restated Attachment A provides the technical information and analyses requested.

In addition, Attachment B includes revised antenna gain pattern information referenced in the Amended and Restated Attachment A. The requirement for such information set forth in Section 25.264(a) specifies that antenna gain measurements for the 17.3-17.8 GHz band be made at three frequencies, including at 5 MHz within the band edges. ViaSat requests a waiver of this requirement to the extent necessary to allow a demonstration at a single frequency (17,700 MHz), which is representative of the antenna's performance throughout the 17.7-17.8 GHz frequency range for which ViaSat seeks authority. Notably, the type of demonstration provided by Section 25.264(a)—three measurements at the top, middle and bottom of 500 MHz—effectively would provide representative antenna gain information for a range of spectrum that is 125 MHz above and below the measurement frequency. Thus, ViaSat's representative measurement for 100 MHz of spectrum is consistent with the data required to be provided under Section 25.264(a).

If you have any questions regarding this submission, please contact the undersigned.

Respectfully submitted,

/s/

John P. Janka
Elizabeth R. Park

Attachments

cc: Jose Albuquerque
Stephen Duall
Alyssa Roberts
Chip Fleming

AMENDED AND RESTATED ATTACHMENT A

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

Engineering Analysis and Supporting Technical Information

REQUEST ONE: *For the frequency band 17.7-17.8 GHz (space-to-Earth) please provide the predicted transmitting antenna off-axis gain information specified in Section 25.264(a) of the Commission's rules, 47 CFR § 25.264(a). In addition, please perform the power flux-density (pfd) calculations based upon this off-axis antenna gain information as specified in Section 25.264(b) and identify each prior-filed U.S. Direct Broadcast Satellite (DBS) space station at whose location the coordination threshold pfd level of -117 dBW/m^2/100 kHz is exceeded. Although ViaSat considers the 61.5º W.L. ITU Region 2 Broadcasting-Satellite Service (BSS) Plan location in its application, its pfd calculations must take into account all prior-filed U.S. DBS space stations as defined in Section 25.264(b)(1).*

The Figures in Attachment B provide the requested transmitting off-axis gain information for the A type and B type spot beams. The gain patterns were generated at the 17.7 GHz frequency. Because the satellite will operate using only 100 MHz of the 500 MHz at 17.3-17.8 GHz that is the subject of Section 25.264(a) of the Commission's rules, ViaSat provides the gain patterns at a single frequency. The antenna gain information provided in Attachment B for 17,700 MHz is representative of the antenna performance across of the entire 17.7-17.8 GHz band segment, because the gain does not vary materially within a 100 MHz range.

In addition to the 61.7° W.L. orbital position considered in ViaSat's technical annex, two other DBS networks that use the 17.7-17.8 GHz band segment and that have U.S. market access are operated within the vicinity of the nominal 70° W.L. orbital location: NIMIQ 5 at 71.7° W.L., and Quetsat at 77.0° W.L. The geocentric angle between ViaSat-2 at 69.9° W.L. and each of the former locations is 8.1°, 1.9°, and 7.2° respectively. In the X axis, the off-axis angle toward each of the potential victim satellites is in the range of 85.95° to 89.05°.

Examining the Figures in Attachment B it can be seen that the highest gain for any of the pattern cuts in the +X direction is 10.9 dBi and the highest gain in the –X direction is 0.1 dBi. The associated EIRP densities are -4.8 dBW/MHz and -15.3 dBW/MHz respectively.

Table 1 shows the distance between ViaSat-2 and each of the potential victim satellites as well as the associated spreading loss values. The highest EIRP density in the +X direction or in the –X direction is then added to the spreading loss for each of the potential victim satellites as appropriate, along with power density bandwidth adjustment from 1 MHz to 100 kHz, to determine the worst case pfd at any of the potential victim satellite locations, with the results as shown in Table 1 below.

Given the large margin for the requested cases, ViaSat also considered the case of a satellite located at 69.7° W.L., which is only 0.2° away from 69.9° W.L. in the +X direction (the +X direction has the worst case EIRP density of either X direction). At 0.2° away, the spreading loss drops to 114.3 dB and the resulting pfd at the victim is -129.1 dB(W/(m^2*100 kHz)), which is still 12.1 dB below the -117 dB(W/(m^2*100 kHz)) limit.

Victim satellites	SOMESAT	NIMIQ 5	QUETSAT	
Orbital location	61.7	71.7	77.0	deg
Orbital spacing from VS-2	8.1	-1.9	-7.2	deg
Separation distance	5954.8	-1397.9	-5294.1	km
Spreading loss for distance	146.5	133.9	145.5	dB(m^2)
Worst Case EIRP Density +X	-4.8			dBW/MHz
Worst Case EIRP Density -X	-15.3			dBW/MHz
pfd at victim orbital loc	-161.3	-159.2	-170.8	dBW/(m^2*100 kHz)
25.264 Requirement	-117.0			dBW/(m^2*100 kHz)
Margin above requirement	44.3	42.2	53.8	dB

Table 1 RDBS PFD Calculation Results

REQUEST TWO: *Please provide an interference analysis as described in Section 25.140(b)(4)(iii) of the Commission's rules, 47 CFR § 25.140(b)(4)(iii), demonstrating that ViaSat's proposed operations in the 17.7-17.8 GHz (space-to-Earth) band will not cause more interference to any current or future 17/24 GHz BSS satellite networks than if the applicant were located at the precise Appendix F orbital location from which it seeks to offset. ViaSat's orbital location, 69.9º W.L., is offset 1.1 degrees from the 71º W.L. Appendix F orbital location. Accordingly, ViaSat's operations from this location must be at pfd levels that are reduced from those specified in Section 25.208(c) in accordance with the following calculation methodology:*

For a given location on the surface of the Earth at which the required pfd reduction value needs to be determined, calculate the topocentric angular separation 'ϕ' of the 71º W.L. and 67º W.L. geostationary orbital locations, and the corresponding off-axis gain GCO1(ϕ) of the antenna specified in Section 25.224(a)(1) of the Commission's rules at that angular separation. For the same location on the surface of the Earth, also calculate the topocentric angular separation of the 67º W.L. and 69.9 º W.L. geostationary orbital locations, and the gain of the antenna GCO2(ϕ) specified in Section 25.224(a)(1) of the Commission's rules at that angular separation. Then, perform the subtraction GCO2(ϕ) – GCO1(ϕ). The result is the required reduction in pfd from the value specified in Section 25.208(c).

Please demonstrate that under all atmospheric conditions, and for all angles of arrival, the pfd levels at the Earth's surface from ViaSat's transmissions in the 17.7-17.8 GHz (space-to-Earth) band will not exceed these calculated levels anywhere within the United States and its Territories.

The following interference analysis demonstrates that ViaSat's proposed operations in the 17.7-17.8 GHz (space-to-Earth) band will not cause more interference to any current or future 17/24 GHz BSS satellite networks than if the applicant were located at the precise Appendix F orbital location from which it seeks to offset. ViaSat's orbital location of 69.9° W.L. is 1.1° offset from the 71.0° W.L. and accordingly that much closer to the 67.0° W.L. orbital location.

Table 2 below identifies the topocentric separation angle ϕ between the 71° W.L. and 67° W.L. orbital locations and the topocentric separation angle ϕ' between the 67° W.L. and 69.9° W.L. orbital locations. Table 2 also includes the corresponding off-axis co-polar pattern gain values GC01(ϕ) and GC02(ϕ') calculated for the reference antenna for each of the two topocentric angles. The difference in the two gain values is shown and is the amount by which ViaSat's pfd at that location of interest must be reduced from the value specified in Section 25.208(c).

ViaSat calculated the above values for various locations within CONUS, as well as Puerto Rico

and determined that the worst case location was the north-west corner of the US near Seattle. This is due to the lower angle of arrival at this location of 13.9° and the accordingly reduced pfd limit. In Table 2, the resulting values are shown, demonstrating that the pfd levels from ViaSat-2 at the 69.9° W.L. meets the required pfd limit (as reduced to account for the relevant topocentric angles) at all locations within the United States and territories for both type spot beams. The calculations are based on free space path loss conditions with no rain fade or atmospheric loss assumed. Because downlink power control is not used, this represents the highest possible interfering power, i.e., lowest loss scenario.

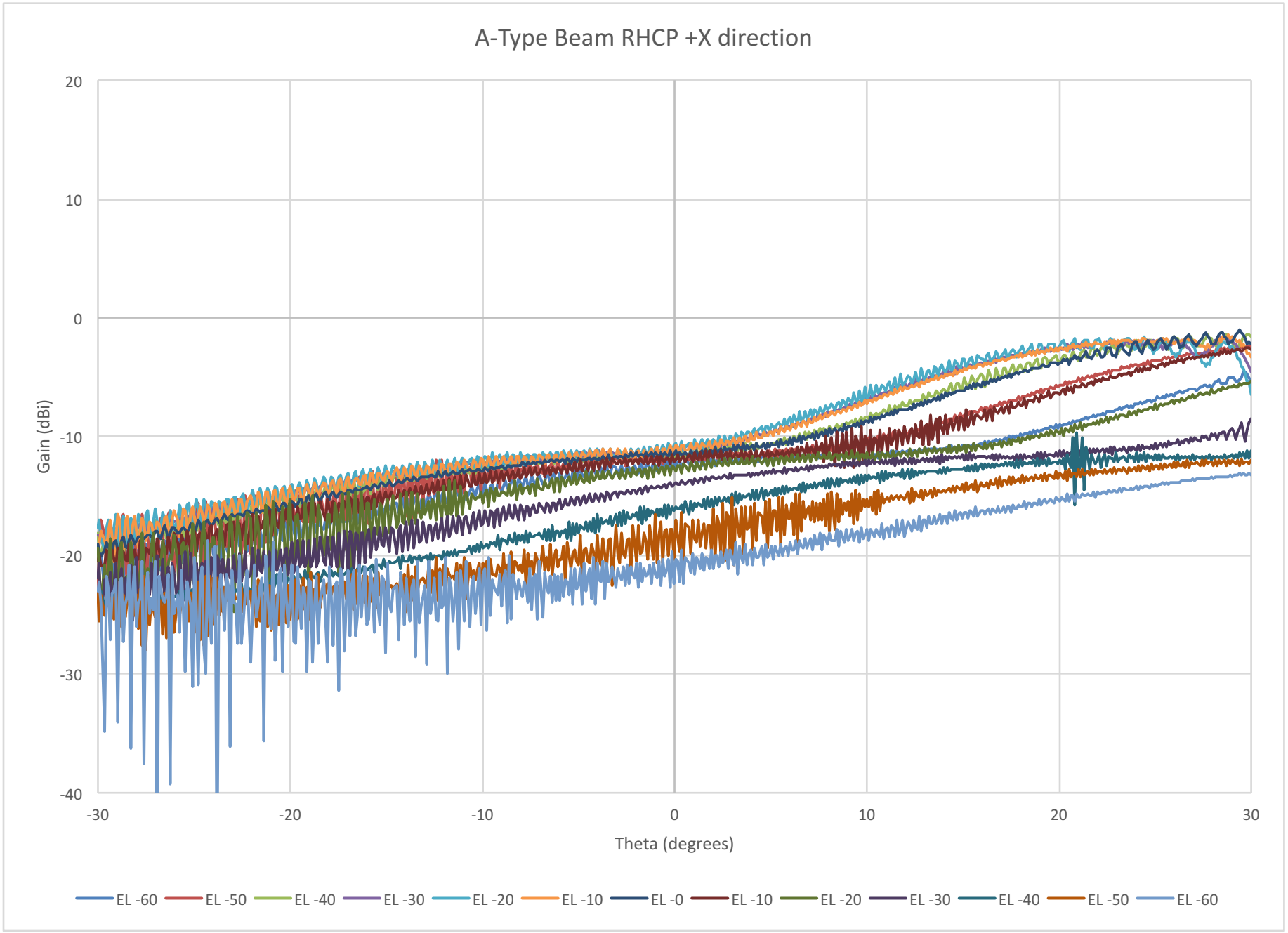
Therefore, operations of ViaSat-2 in the 17.7-17.8 GHz band segment at the 69.9° W.L. orbital location will not cause more interference to any current or future 17/24 GHz BSS satellite networks than if the satellite were located at the 71° W.L. orbital location.

Topo sep	Topo sep			
67 - 71	67 - 69.9			
4.18	3.02	deg		
GCO1	GCO2		GC02-GC01	
13.48	20.30	dBi	6.81	dB
Default pfd for Seattle		-110.56	dBW/(m^2*MHz)	
Adjusted pfd for Seattle		-117.37	dBW/(m^2*MHz)	
ViaSat-2 pfd in Seattle		-123.59	dBW/(m^2*MHz)	
Margin above limit		6.23	dB	

Table 2 DBS PFD Calculation Results

ATTACHMENT B

BEAM PATTERNS


A-Type Beam RHCP +X direction
20
10
0
-10
-20
-30
-40
Gain (dBi)
-30
-20
-10
0
10
20
30
Theta (degrees)
EL -60
EL -50
EL -40
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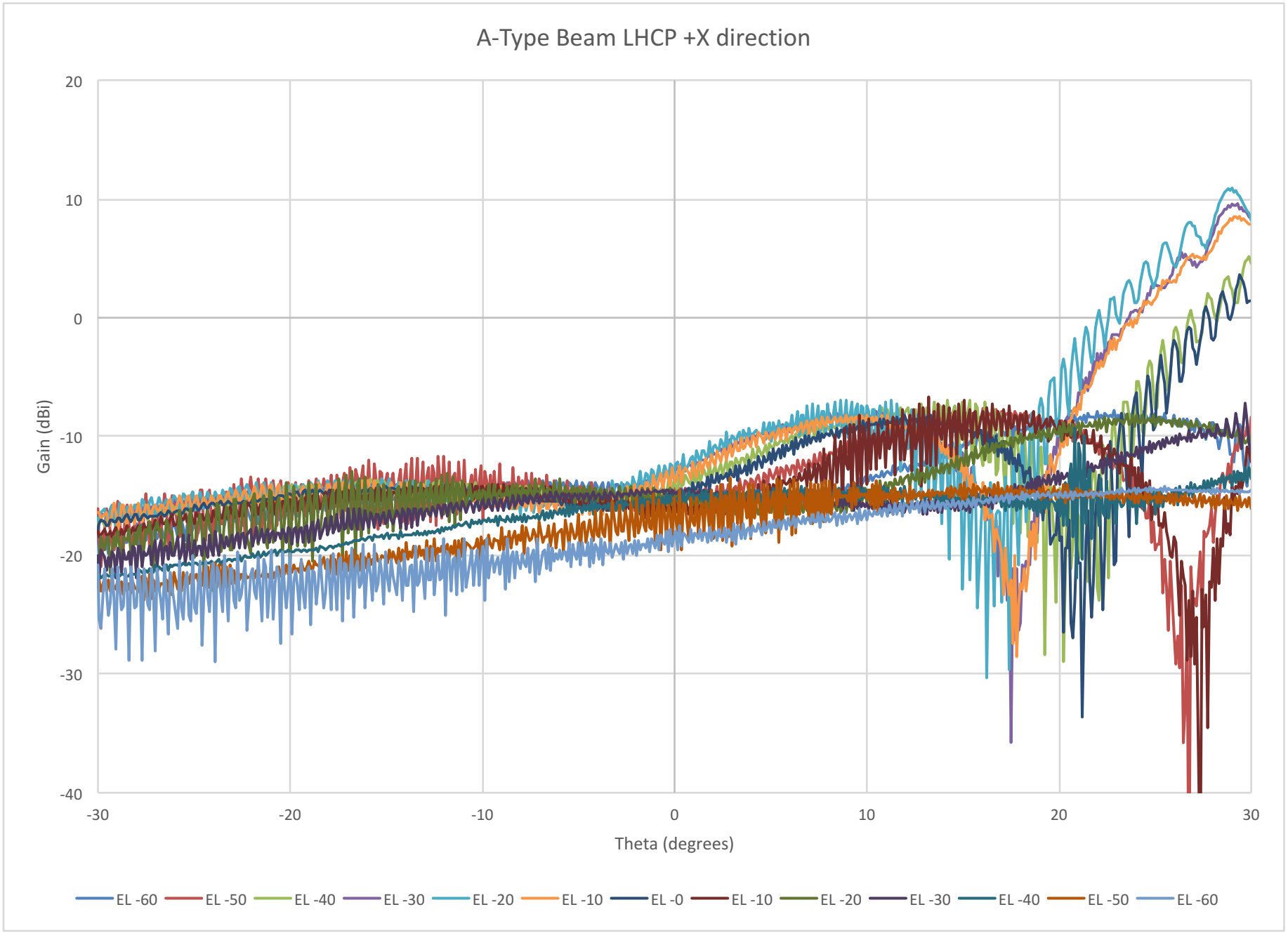
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-20
-30
-40
Gain (dBi)
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Theta (degrees)
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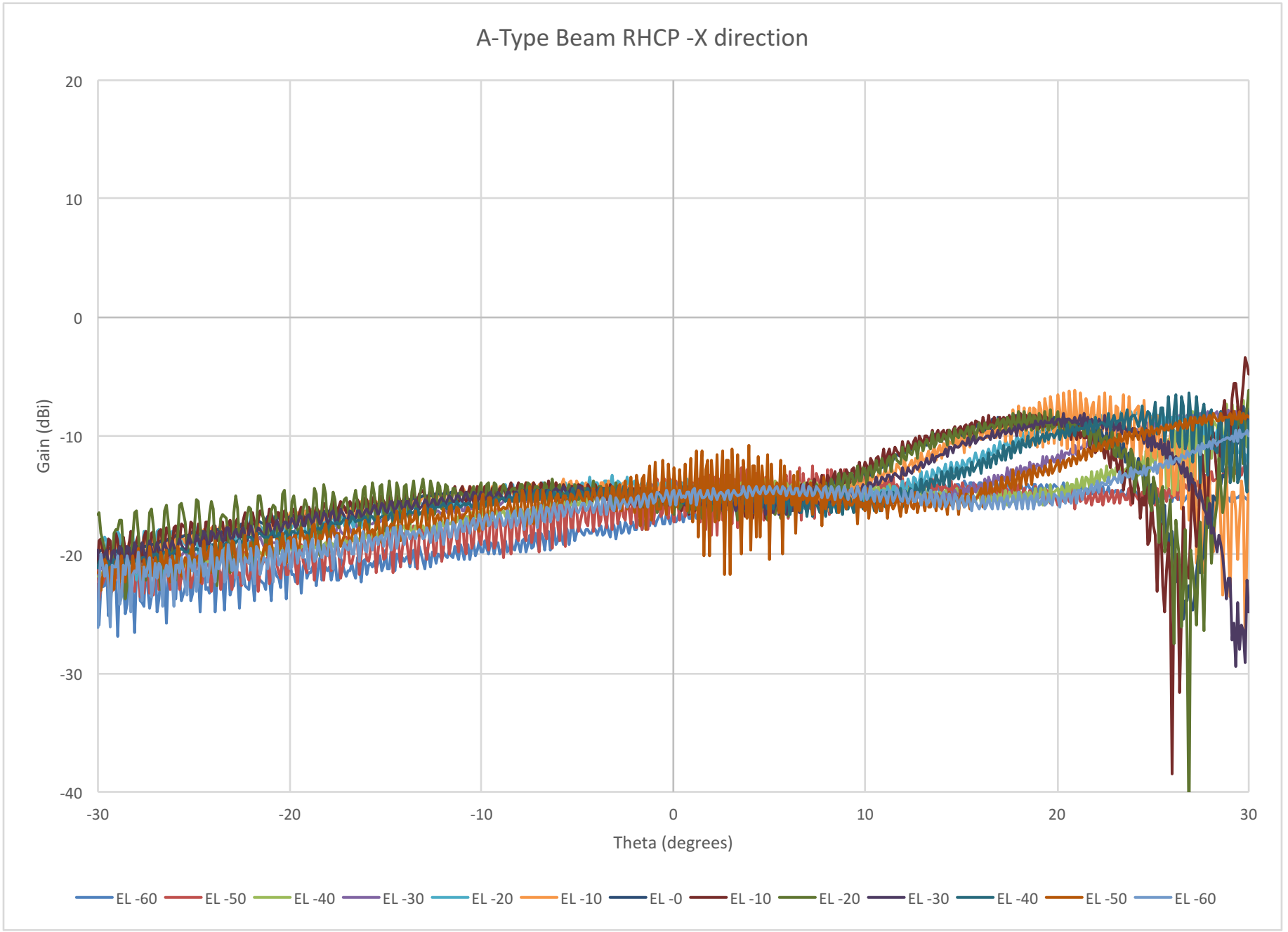
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20
10
0
-10
-20
-30
-40
Gain (dBi)
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-20
-10
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Theta (degrees)
EL -60
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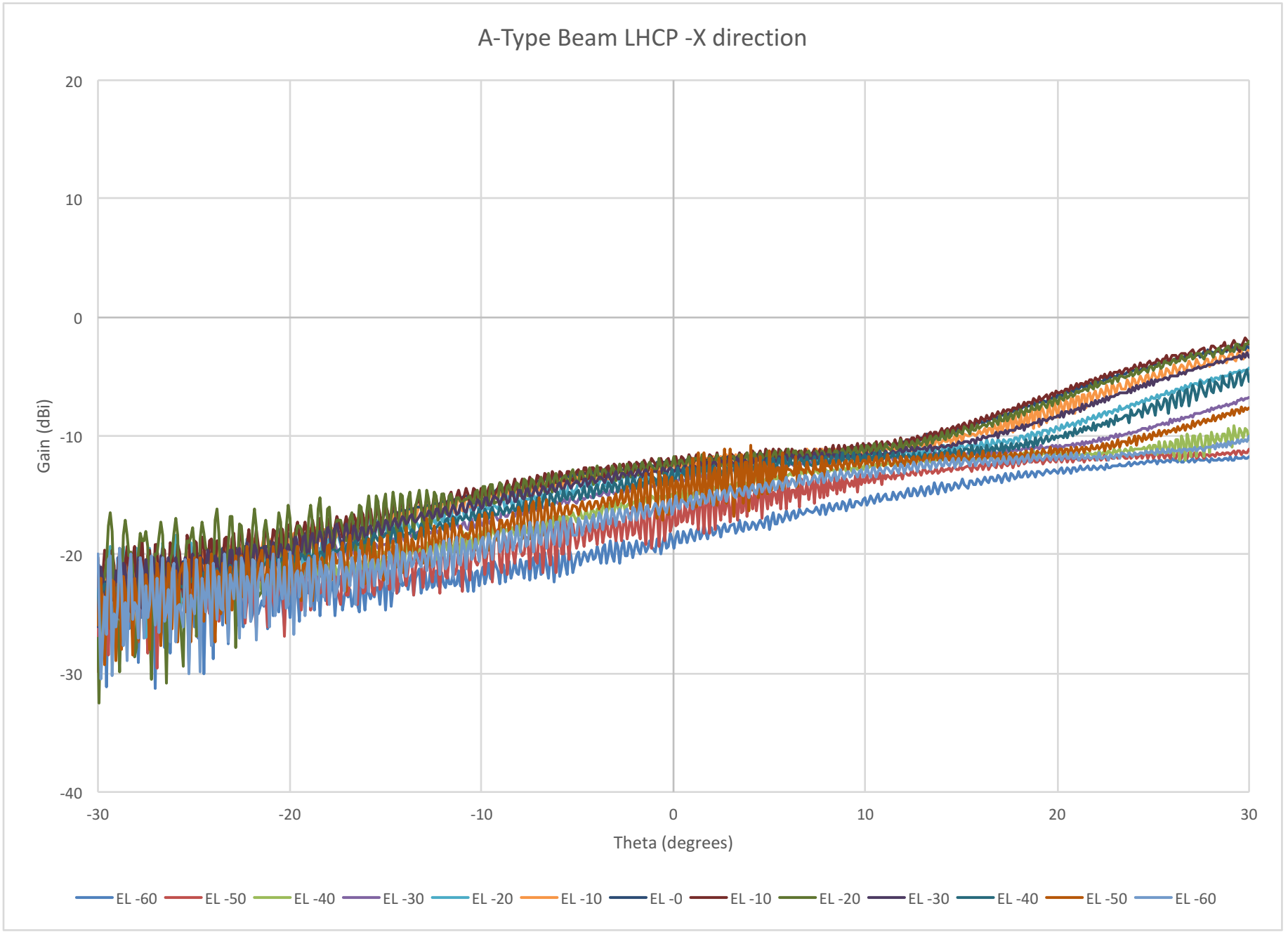
A-Type Beam LHCP -X direction
20
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Gain (dBi)
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Theta (degrees)
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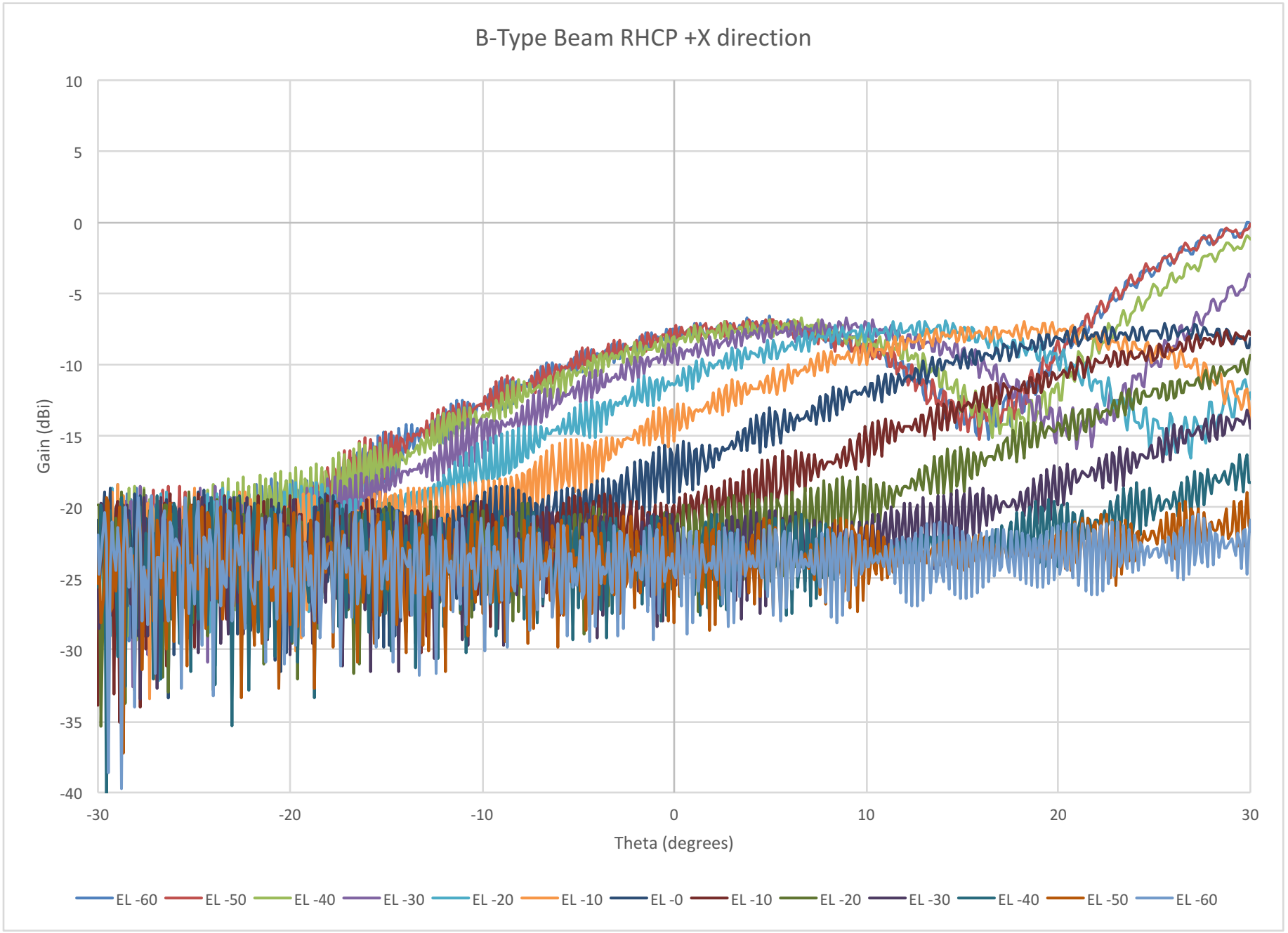
B-Type Beam RHCP +X direction
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
Gain (dBi)
-30
-20
-10
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Theta (degrees)
EL -60
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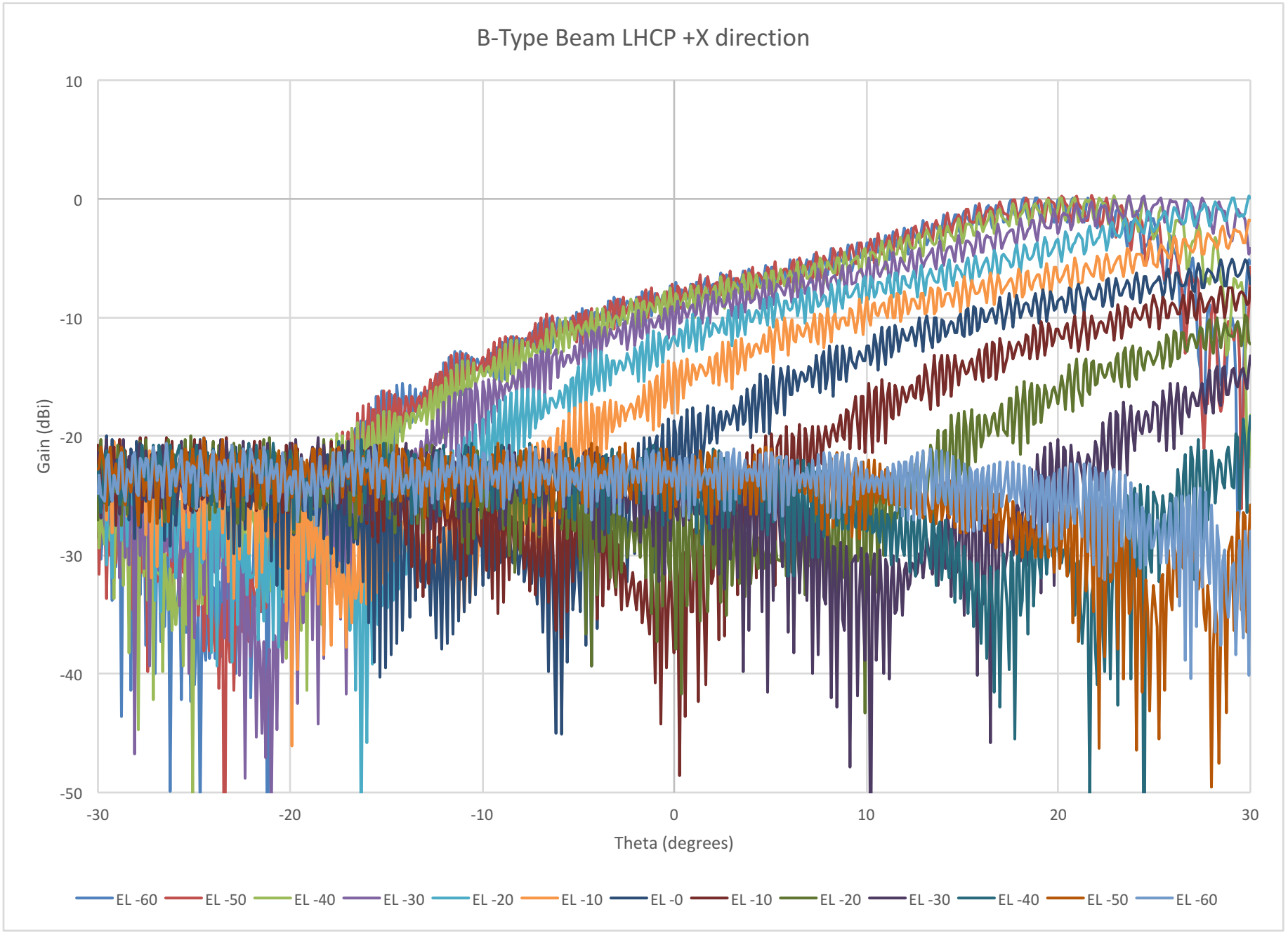
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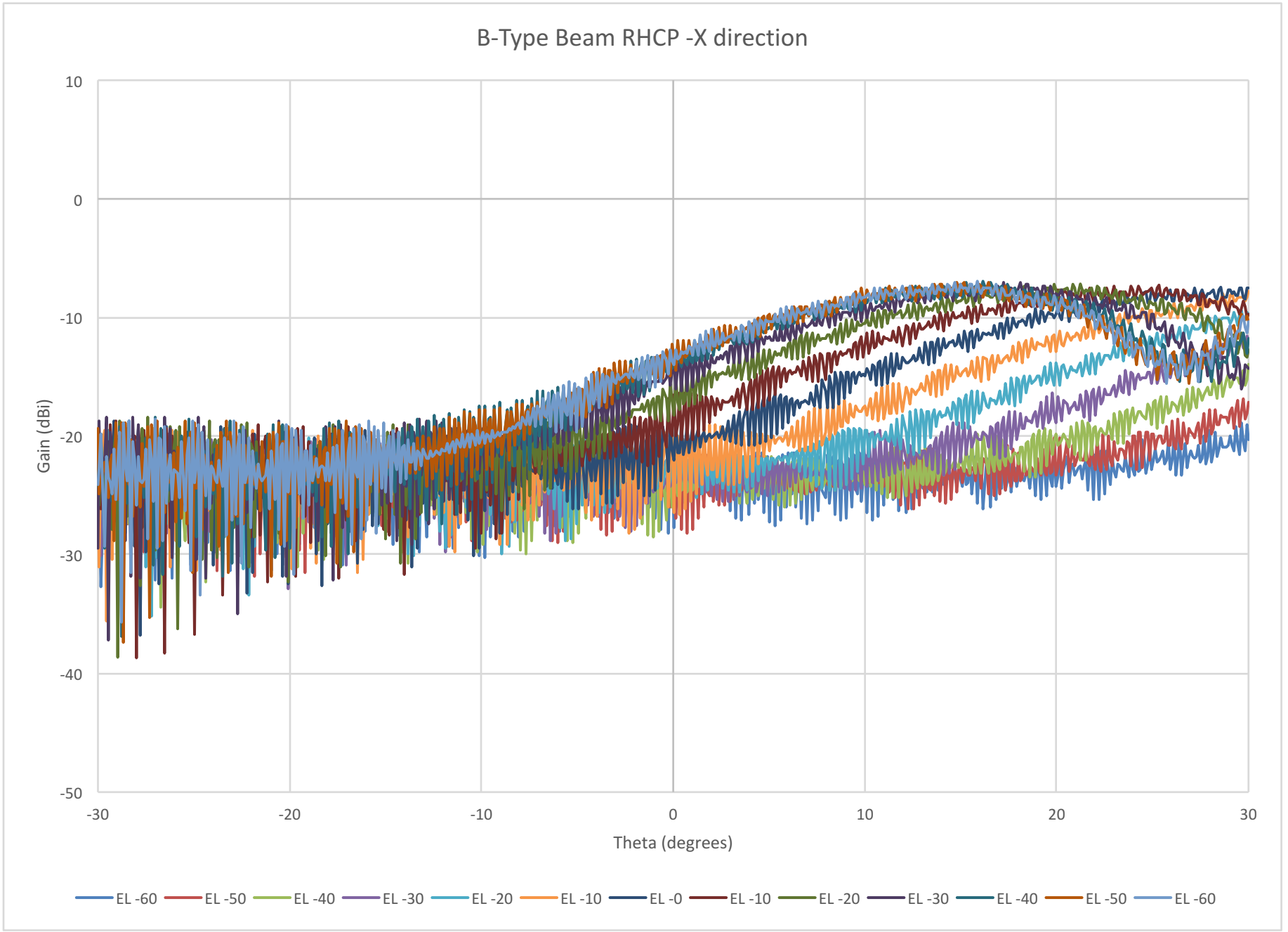
B-Type Beam RHCP -X direction
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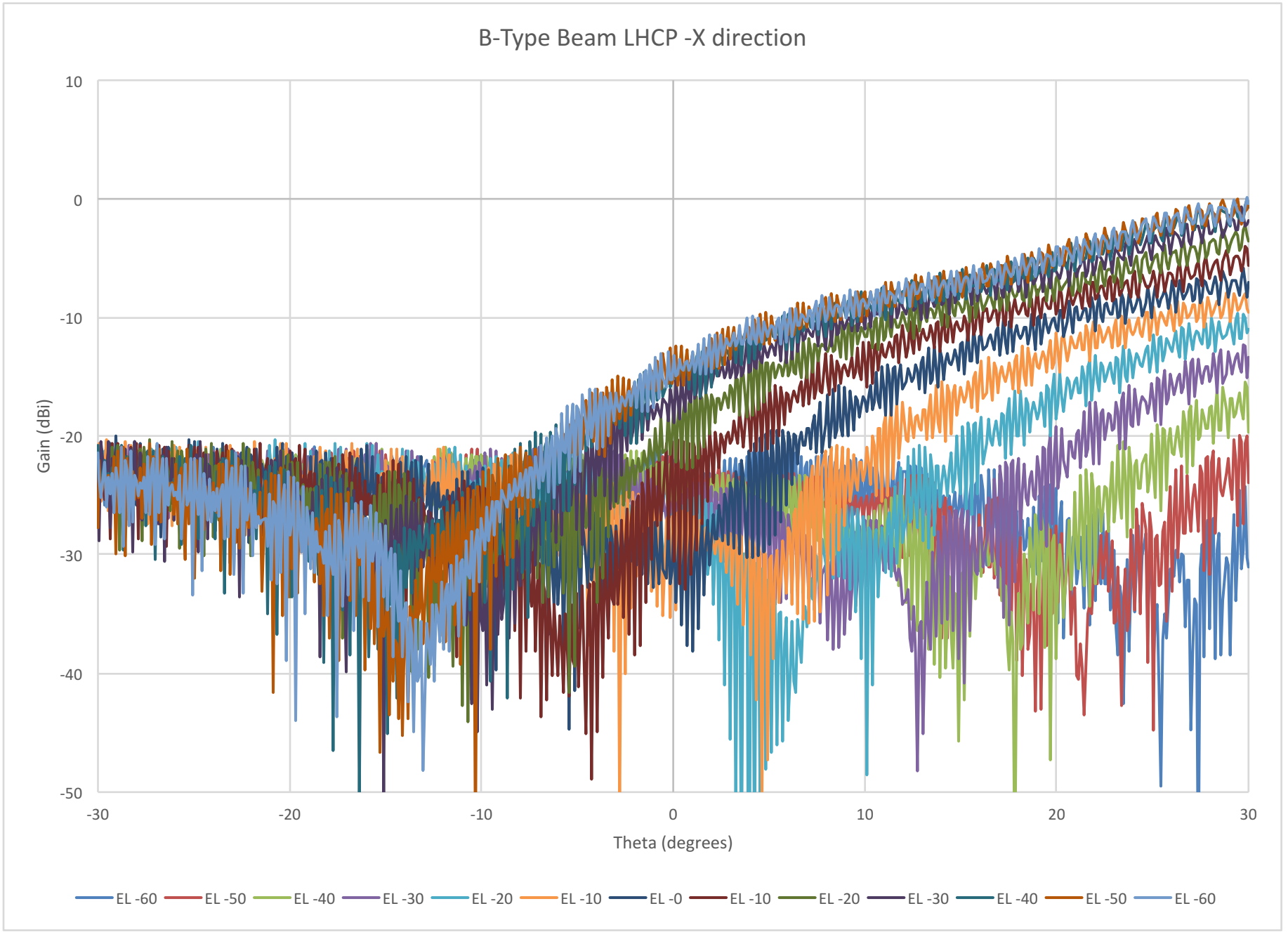
B-Type Beam LHCP -X direction
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EL -60

DECLARATION

I, Daryl T. Hunter, hereby make the following declarations under penalty of perjury. I understand that this Declaration will be submitted to the Federal Communications Commission.

1. I am Senior Director, Regulatory Affairs of ViaSat, Inc.

2. I have reviewed the foregoing Amended and Restated Attachment A, Response to Request for Additional Information, and the accompanying Attachment B, and they are true and correct to the best of my knowledge, information and belief.

Daryl T. Hunter, P.E.

Executed October 7, 2016