Interference analysis with respect to compliance with Rules of Procedure No. 9.27

1. Comparison between Original parameters and Modified parameters

Table 1 below gives basic characteristics used in analysis of potential increase of characteristics.

Table 1. Comparison between modified parameters and originally filed parameters

Parameter	Originally filed	Proposed for modification
Orbit altitude, km	2000	650
Orbit inclination, degrees	89	96
Number of satellites	28 in 4 orbital planes	28 in 7 orbital planes
Maximum power spectral density in 1 Hz averaged over 4 kHz, dBW/Hz		
1980-2025 MHz	-19 for earth station RTU 1	No change
	-24.8 for earth station RTU 2	No change
		-36.3 for new earth station RTU 3
2170-2200 MHz	-15	-19
5150-5250 MHz	No change	No change
7025-7075 MHz	-57.8	-74.8
Earth station antenna maximum gain in uplink beams, dBi		
1980-2025 MHz	-2.8 for earth station RTU 1 (Non-directional)	No change
	3 for earth station RTU 2 (Non-directional)	No change
		14 for new earth station RTU 3 (AP8)
5150-5250 MHz	No change	No change
Space station antenna maximum gain downlink beams, dBi		
2170-2200 MHz	17.8	11
7025-7075 MHz	7	14

New transmitting space station antenna pattern could be presented in numerical formula format as follows:

Space station antenna pattern	
2170-2200 MHz	REC1528, LEO type

7025-7075 MHz	$G = -\frac{10}{19^2}\,\varphi^2 + 14$	$for \;\; 0 \le \varphi \le 22$
	$G = 0$	$for \;\; 22 < \varphi < 80$
	$G = -\frac{16}{30^2}\,(\varphi - 110)^2 - 16$	$for \;\; 80 \le \varphi < 110$
	$G = -16$	$for \;\; 110 \le \varphi \le 180$

To allow better antenna performance, both satellite antenna patterns and earth station antenna patterns were modified. Figures below show satellite antenna patterns.

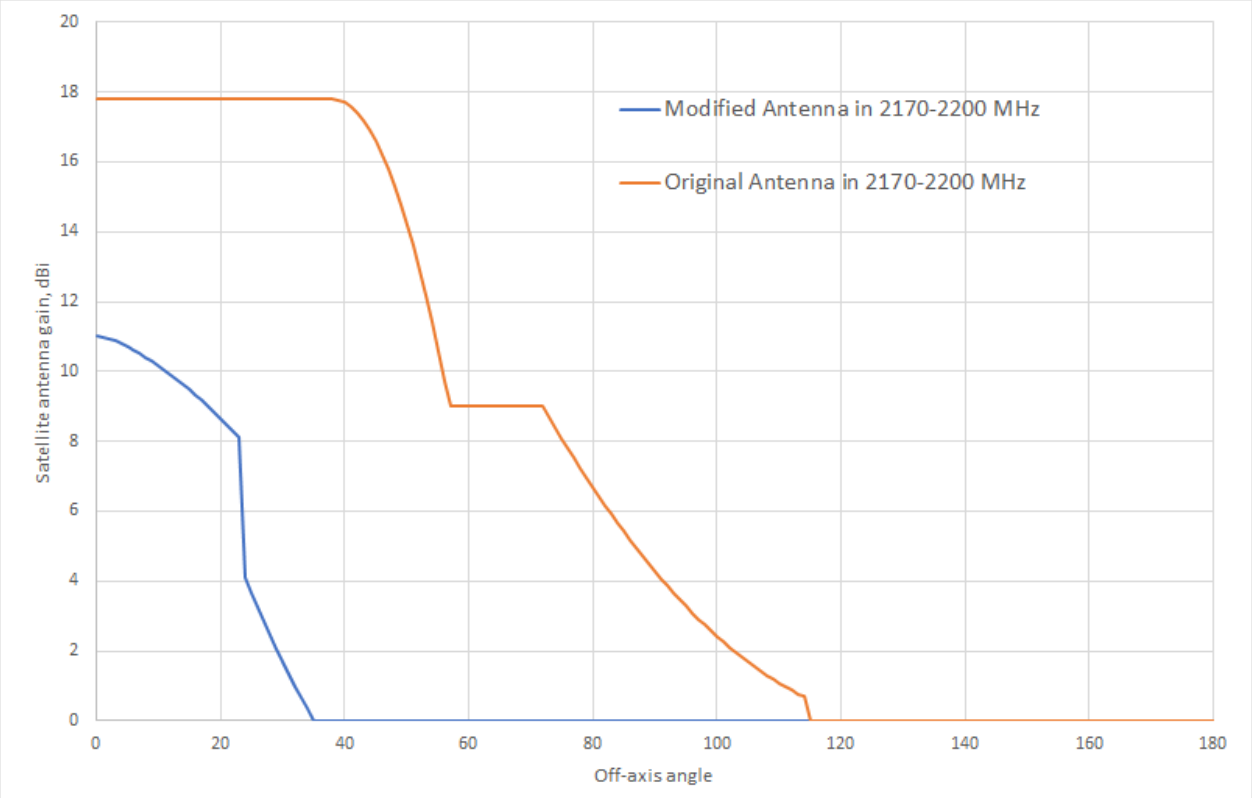

Fig. 1

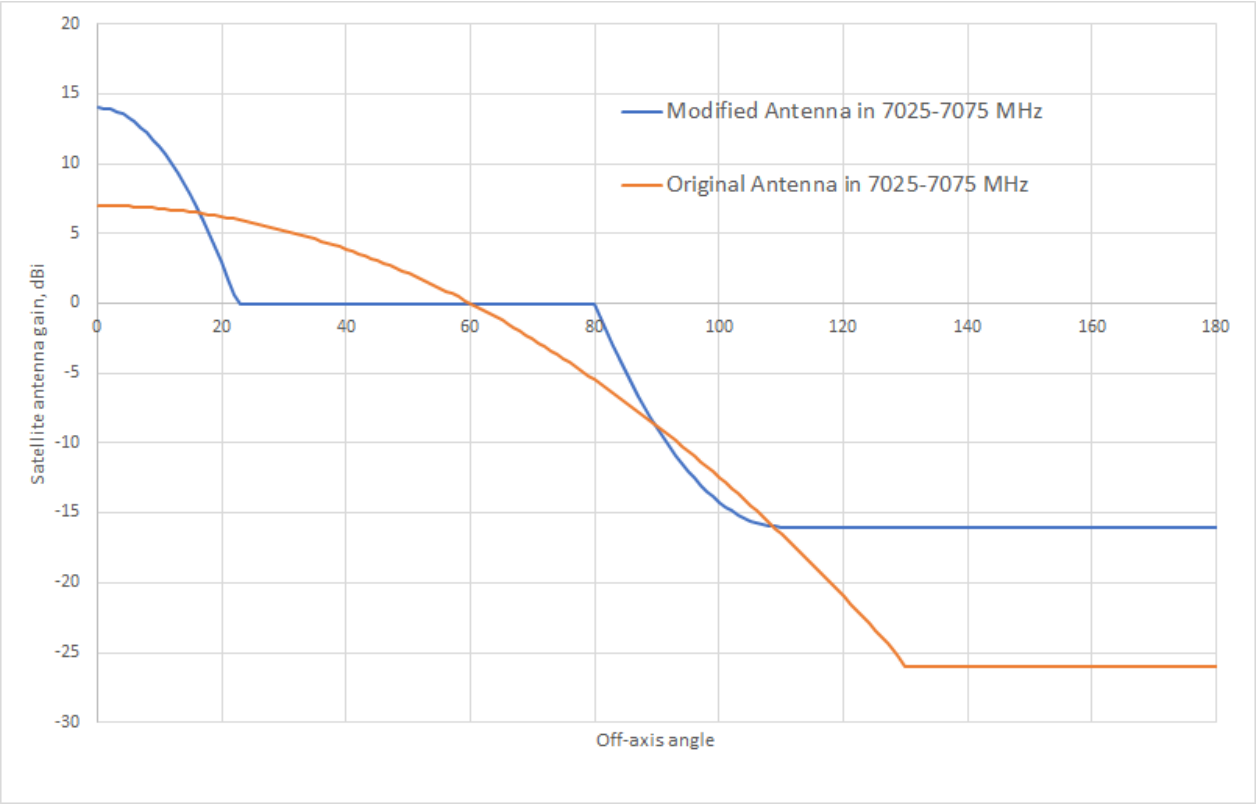

Fig. 2

Resulting EIRP Mask are produced below for analysis.

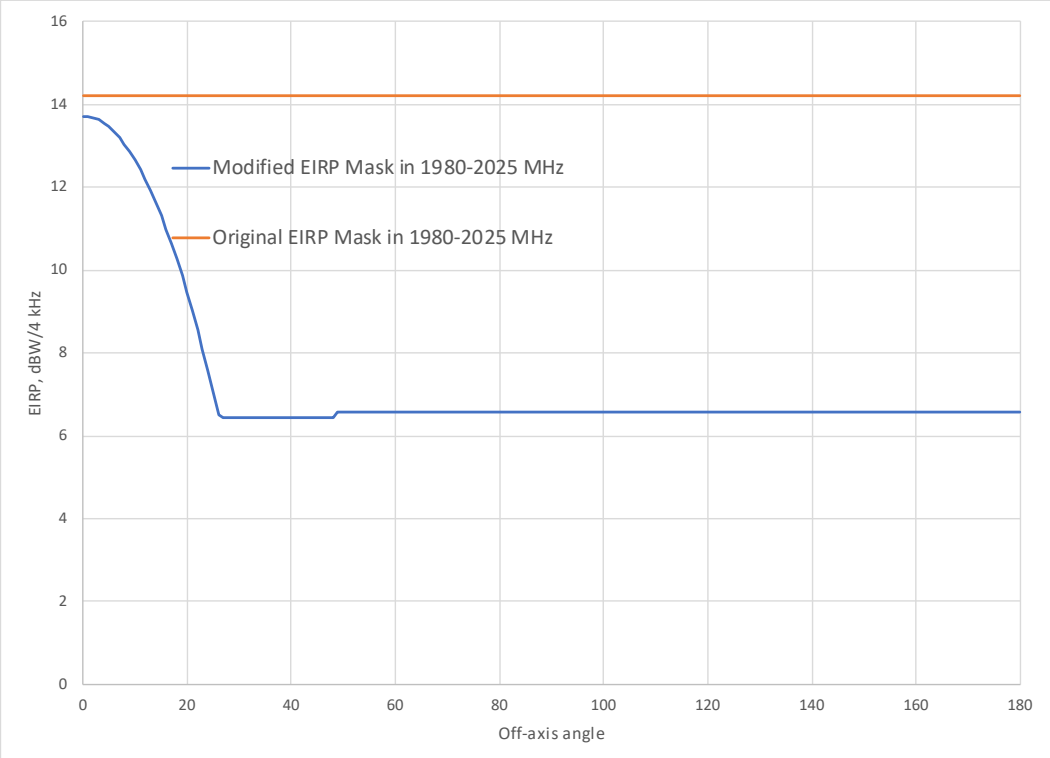

Fig. 3

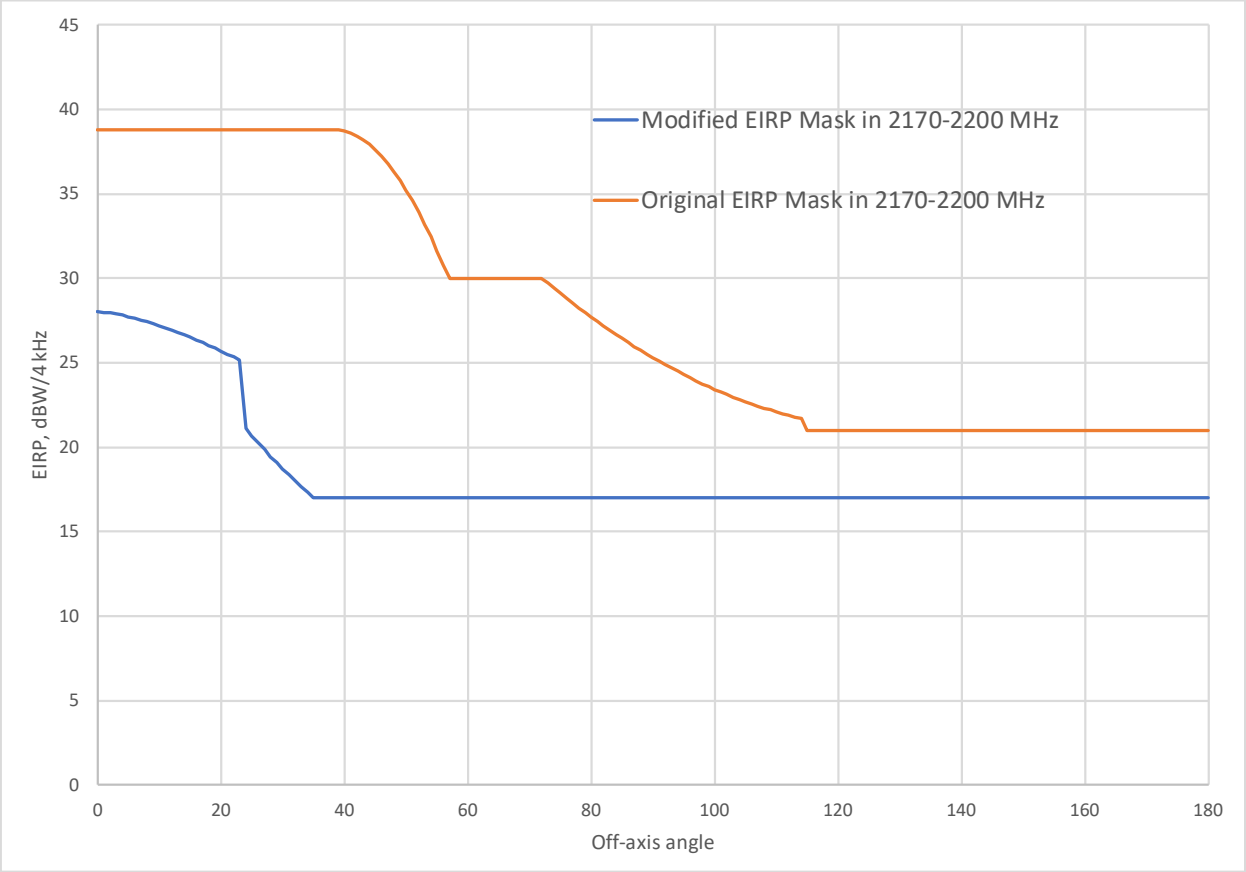
45
40
35
30
25
20
15
10
5
0
EIRP, dBW/4 kHz
0
20
40
60
80
100
120
140
160
180
Off-axis angle
Modified EIRP Mask in 2170-2200 MHz
Original EIRP Mask in 2170-2200 MHz

Fig. 4

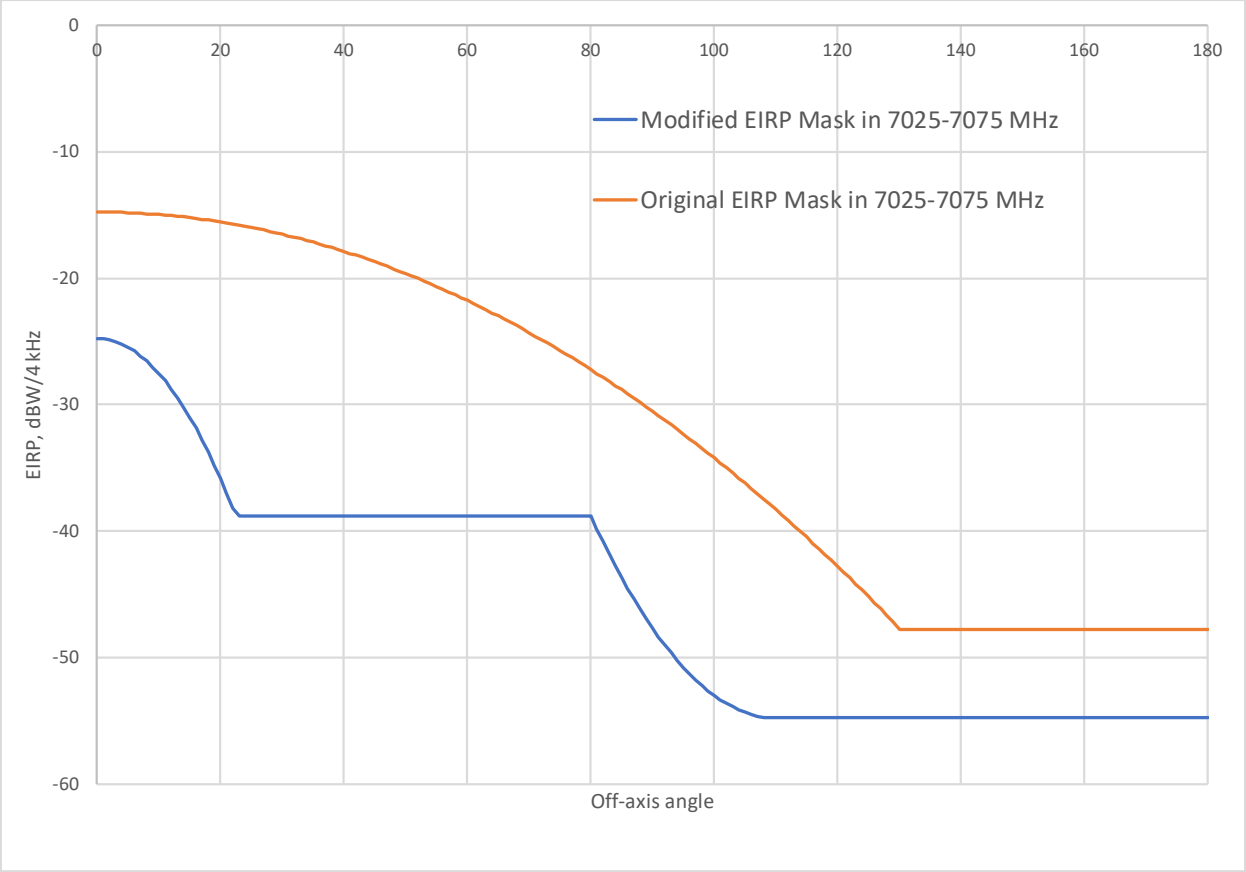
0
-10
-20
-30
-40
-50
-60
EIRP, dBW/4 kHz
0
20
40
60
80
100
120
140
160
180
Off-axis angle
Modified EIRP Mask in 7025-7075 MHz
Original EIRP Mask in 7025-7075 MHz

Fig. 5

As it could be seen from the figures above, modified parameters provide significant decrease over uplink and downlink EIRP. Modified uplink EIRP is maintained at the lower level everywhere in orbit between 0 and 35786 km altitude.

2. Analysis

Frequency assignments of SIRION-1 are subject to coordination under Nos. 9.12, 9.12A and 9.14.

According to the Rules of Procedures under No. 9.27, taking into account that for these coordination provisions only frequency overlap is used to trigger coordination, the modified part of the network will need to effect coordination with respect to space networks that are to be taken into account for coordination:

a) networks with "2D-Date"[2] before D1 [3];

b) networks with "2D-Date" between D1 and D2 [4], where the nature of the change is such as to increase the interference to or from, as the case may be, the assignments of these networks.

According to paragraph 2.3.1 where the coordination requirements of the modification involve any network under *b)* above, the modified assignments will have D2 as their "2D-Date". Otherwise, they will retain D1 as their "2D-Date".

To fulfill these with a view of maintaining original date of receipt the following principles are applied in analysis:

1. SIRION-1 is coordinating with the list of networks with "2D-Date" before D1.
2. With respect to GSO networks worst-case EPFD analysis is provided to demonstrate that modification would not increase interference to GSO networks between D1 and D2.
3. With respect to non-GSO networks dynamic I/N analysis is provided to demonstrate that modification would not increase interference to other non-GSO systems between D1 and D2.
4. Dynamic downlink PFD analysis is carried out in order to demonstrate that downlink transmission would be significantly lower in modification to provide further assurance that there is no increase of interference to all potentially affected services, including those for which no coordination requirement is established.
5. With regards to interference received from networks and systems between D1 and D2, as stipulated in Section 6 of Radiocommunication Bureau Director's Report to Radio Regulations Board (Doc. RRB17-2/3 rev.1), this Administration wish to commit to not requiring any more protection from other non-GSO systems or GSO networks than that required for the original parameters.

Provided analysis follows the guidance given in Section 6 of Radiocommunication Bureau Director's Report to Radio Regulations Board (Doc. RRB17-2/3 rev.1). That is *in the absence of appropriate criteria or calculation methods to verify that there is no increase of interference or protection, the Bureau will thoroughly study the technical justifications provided by the notifying administration to make its finding and publish them to ensure the transparency of the process. Such justifications may be based on static and dynamic interference assessments. For the later one, calculation may be e.g. in the form of a cumulative distribution function of the interference level, expressed as an interference-to-noise (I/N) ratio for varying percentages of time and locations into the subsequently filed non-GSO FSS systems.*

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[2] The "2D-Date" is the date from which an assignment is taken into account as defined in § 1 *e)* of Appendix **5**.

[3] D1 is the original "2D-Date" of the network undergoing modification.

[4] D2 is the date of receipt of request for modification. Concerning the date of receipt, see the Rule of Procedure on Receivability.

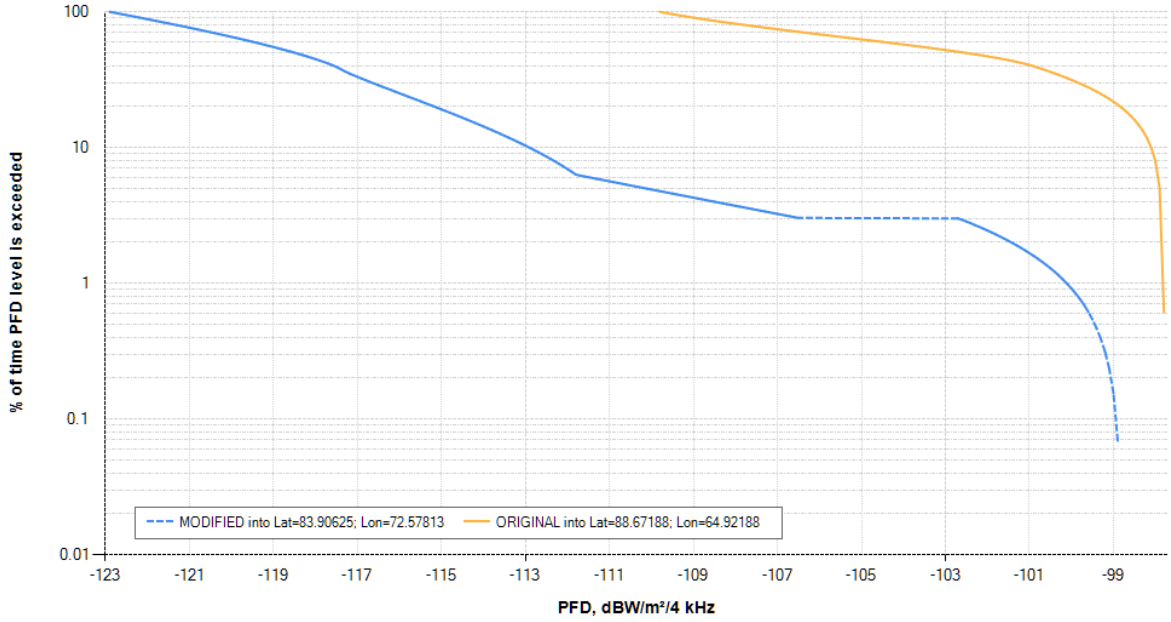
At the same time, existing tools available to the Bureau such as EPFD Validation Software was used to provide description of results of analysis.

3. Dynamic PFD analysis

The purpose of this analysis is to provide statistical envelope of PFD-level produced by modification.

Following assumptions are used:

1. PFD calculated for worst-case location on earth.
2. Each satellite is constantly transmitting.



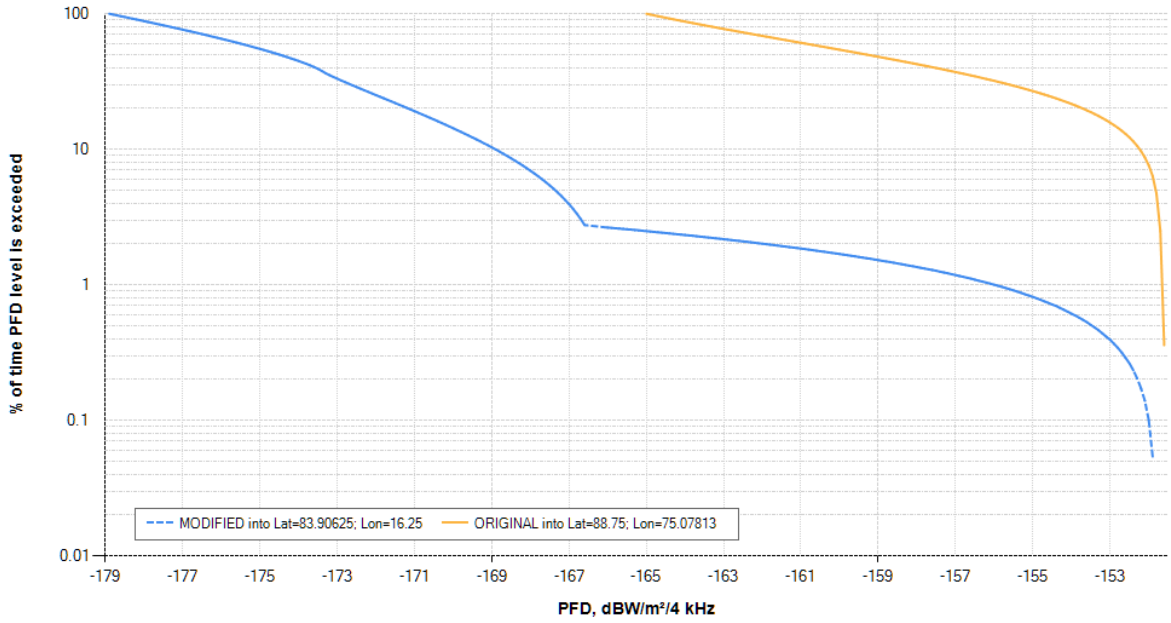
Statistics above was generated for worst-case locations:

Modified constellation:

Lat=83.90625 Lon=72.57813

Original constellation:

Lat=88.67188 Lon=64.92188



Statistics above was generated for worst-case locations:

Modified constellation:
Lat=83.90625 Lon=16.25

Original constellation:
Lat=88.75 Lon=75.07813

It could be seen that modified constellation provides more than 15 dB advantage in a long-term, while keeping maximum PFD level below the one produced by original constellation.

Dynamic range of interference level is improved significantly which would help to establish sharing conditions universally with any service involved.

4. Assessment of modification with respect to GSO networks

4.1. Theoretical consideration

Decrease of orbit attitude would affect downlink interference, unless it is compensated by decrease of EIRP mask of downlink transmission.

Consideration of static interference defines that such decrease should correspond to:

$$20 \log\left(\frac{2000}{650}\right) = 9.7\ dB$$

EIRP masks as presented in Figures 5 and 6 at least 10 dB decrease in satellite transmit EIRP.

Situation is different with consideration of statistical nature of interference.

Analysis of GSO networks submitted to ITU after SIRION-1 submission, show that about 50% of different earth station due to nature of service (MSS) would employ non-directional antenna pattern.

For these type of earth stations, in order to maintain the same level of probability of I/N, decreasing EIRP level to the required level would be sufficient. The level of interference would have the same statistical nature as in PFD analysis above, since basically there is no receiving antenna discrimination.

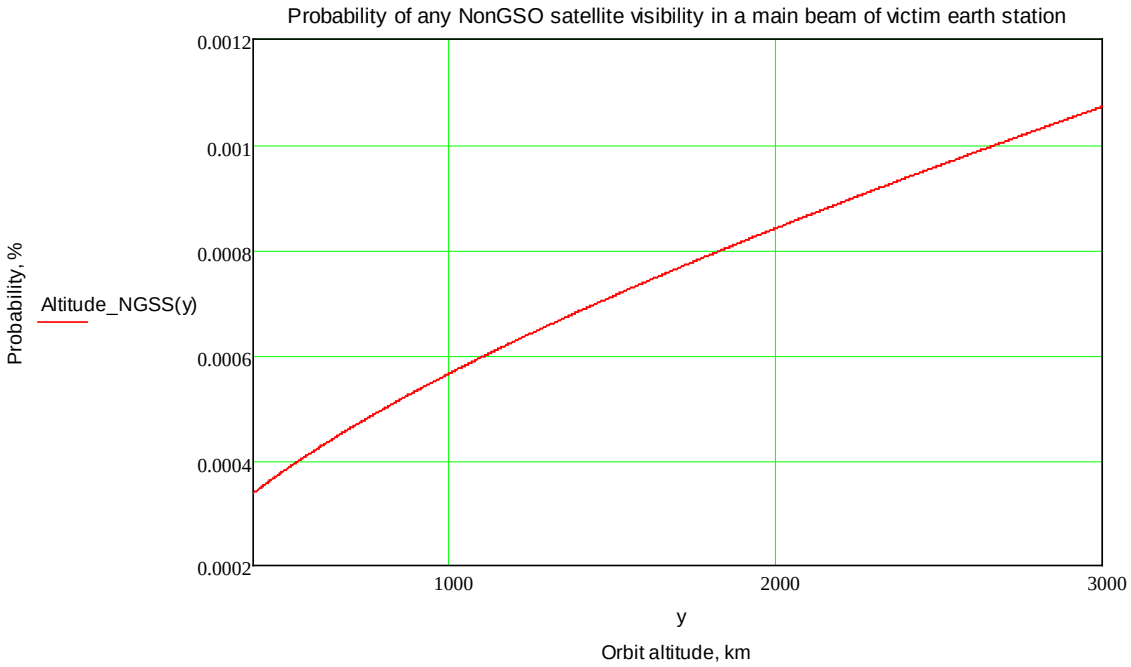
For other earth stations, including those in 7025-7075 MHz which employ directional antenna patterns (most of them being referred to REC-465-5 or REC-580-6) the situation would be changing especially when non-GSO satellite is crossing main beam of receiving antenna.

In this case it is important to assess probability of such events when the satellite is transmitting within the main-lobe of antenna.

It should be noted that while orbit altitude is decreased, the number of satellites is kept unchanged. This would significantly decrease visibility statistics of non-GSO constellation.

Non-GSO visibility statistics could be found using Recommendation ITU-R S. 1257-1. The method in this recommendation is used in calculating the probability to find a satellite of a constellation in a circular or rectangular area (azimuth/elevation or latitude/longitude). A circular area may be satellite earth station antenna main beam or side lobe area.

Calculation conducted in accordance with this recommendation shows the following function of orbit altitude and probability of locating the satellite within the main be of antenna.



For the same number of satellites in constellation the probability of locating satellite in orbit at 650 km is almost two times less that for satellite in orbit at 2000 km.

This would correspond to high level of I/N at much shorter periods.

Statistically, with the given assumption of decreased EIRP, and the number of satellites the interference potential would not be increasing.

This conclusion concurs with the similar conclusion in Recommendation S. 1503-2 which is that a low angular velocity (corresponding to orbit altitude of 2000 km) will result in higher likelihoods of interference. Therefore, lower altitude is increasing angular velocity of the satellites and further provide the benefit for sharing.

For the uplink interference, provided that, due to decrease of altitude, a visibility statistic will be decreasing as well, the total transmission time of single earth station will be shorter and thus the interference duration.

Aggregate effect of transmissions of multiple co-frequency earth stations would not be changing because of the use of FDMA-TDMA transmissions and expectation that the number of earth station would be specific to the market requirements and the system implementation.

4.2. Statistical analysis

Because of the great number of GSO networks submitted in 2013-2017, analysis with respect to each of the networks is quite complicated. Therefore, several representative analyses were used to assess interference.

At the same time, it was felt appropriate to use tools already available to the Bureau, since results could be verified more easily.

For this analysis existing EPFD Validation Software was used. Although, it was created to support EPFD limits verification in FSS bands subject to Article 22 EPFD limits, it provides agreed within ITU-R methodology to calculate interference into GSO.

The purpose of this analysis was a comparison of cumulative distribution function (CDF) of EPFD produced by original filing and modified ones.

To allow calculation of interference into GSO in these frequency bands, following has been done:

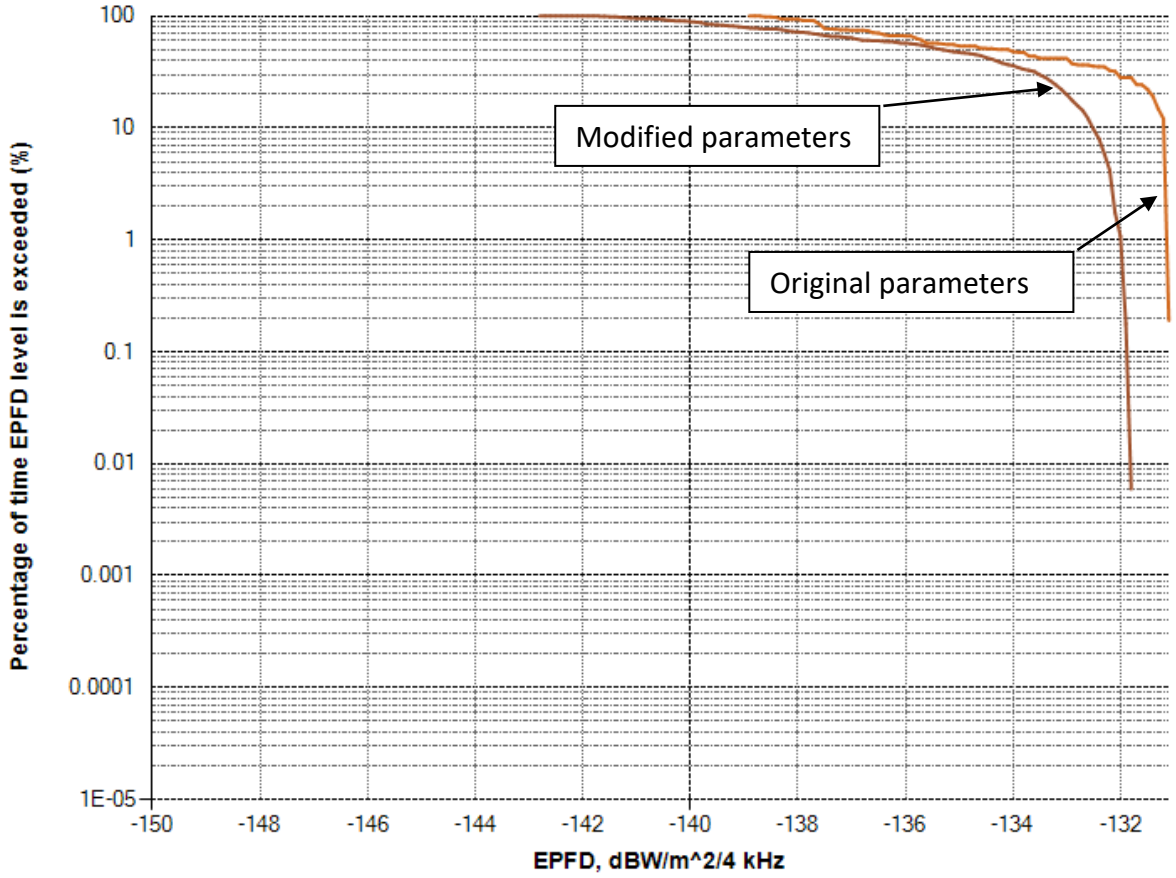
1. The file EPFD_limits_RES85.mdb was modified to include additional frequency bands: 1980-2025 MHz, 2170-2200 MHz, 5150-5250 MHz, 7025-7075 MHz. No specific consideration is given to the limits, since the purpose of the analysis just to produce CDF curves.
2. PFD/EIRP mask has been generated using information in section 1. Worst-case assumptions are taken for consideration of interference from non-GSO, e.g. satellite is always transmitting to single earth station, there are several transmitting earth stations in victim GSO space station service area.
3. Because of worst-case geometry algorithm, the program selects different positions the victim GSO ES receivers for original and modified constellation which makes direct comparison complicated. Therefore, for downlink fixed location were chosen in both calculation corresponding to the option ‘Use test WCG locations’ in S1503_2 Analysis program.
4. Different GSO earth station antenna diameters were chosen from 1 m. to 4.8 meter corresponding to the filed data at ITU.

EPFD uplink in 1980-2025 MHz

This analysis verifies that:

1. For the earth stations RTU 1/RTU 2 which are unchanged, the level of interference and its probability does not increase with the change of orbital parameter.
2. For a new earth station RTU 3 the level of interference and its probability does not increase with the change of orbital parameter as compared to existing earth station RTU 1/2.

1. Comparison of interference produced for the same RTU 1/RTU 2

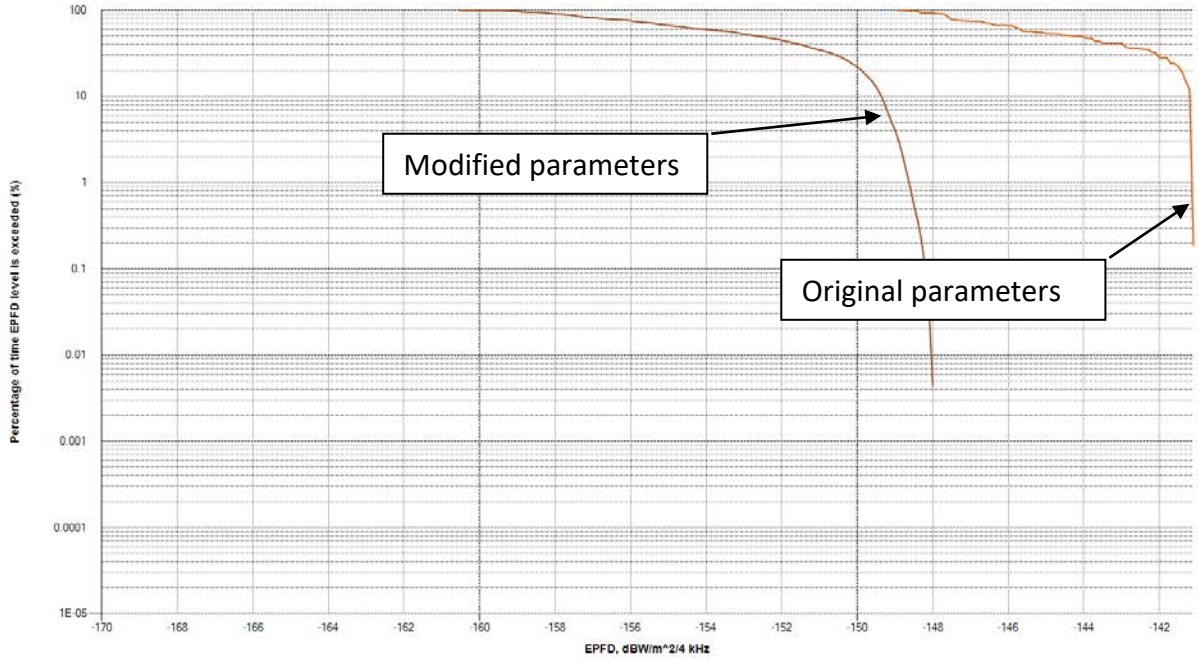


% of time EPFD is exceeded	Modified Parameters	Original parameters	Advantage, dB
100	-142.8	-138.9	3.9
99.99	-142.702478	-138.879151	3.823328
99	-141.535112	-138.640379	2.894733
95	-140.754877	-138.327282	2.427595
90	-140.073657	-137.687919	2.385738
80	-139.066766	-137.536772	1.529994
70	-137.744669	-136.477065	1.267603
60	-136.481904	-135.673479	0.808424
50	-135.30277	-134.083413	1.219357
40	-134.321125	-132.957457	1.363668
30	-133.509247	-132.045812	1.463435

20	-133.005075	-131.423552	1.581523
10	-132.512725	-131.182536	1.330188
5	-132.247887	-131.140468	1.10742
4	-132.192579	-131.132054	1.060525
3	-132.151576	-131.12364	1.027936
2	-132.110574	-131.115226	0.995348
1	-131.991777	-131.106813	0.884964
0.5	-131.935975	-131.102606	0.833369
0.4	-131.924814	-131.101764	0.82305
0.3	-131.913654	-131.100923	0.812731
0.2	-131.902493	-131.100082	0.802412

Decreasing orbit altitude while keeping the number of satellites unchanged would decrease visibility statistics between NGSO earth station and NGSO space station, and therefore, the number of transmission events and their duration during which NGSO earth station may cause interference to GSO would be lower.

2. Comparison of interference produced for a new RTU 3

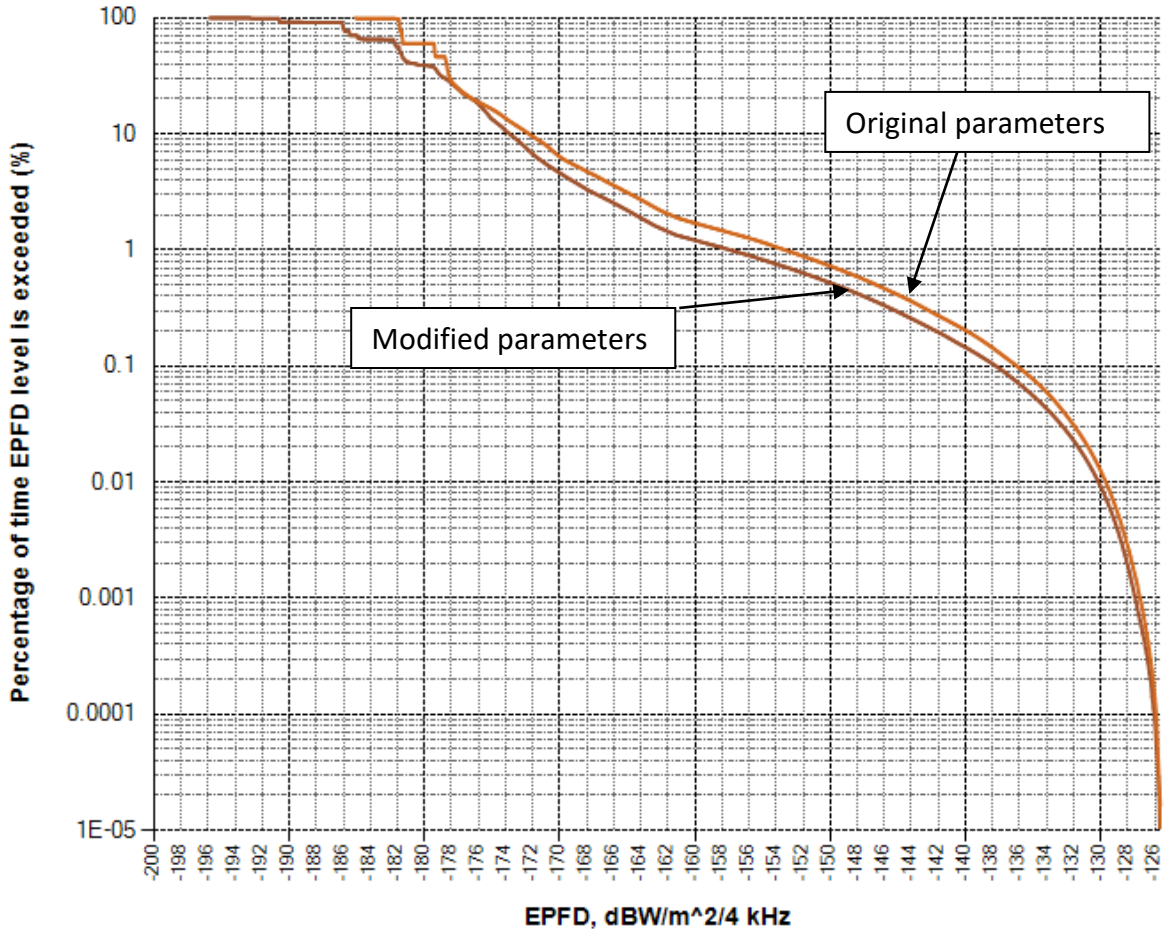


% of time EPFD is exceeded	Original Parameters	Modified parameters	Advantage, dB
100	-148.9	-160.5	11.6
99.99	-148.879151	-160.402478	11.523328
99	-148.640379	-159.23514	10.594761
95	-148.327282	-158.454877	10.127595
90	-147.687919	-157.773533	10.085614
80	-147.536772	-156.750674	9.213902
70	-146.477065	-155.34122	8.864154
60	-145.673479	-153.916694	8.243214
50	-144.083413	-152.61872	8.535307
40	-142.957457	-151.493725	8.536268
30	-142.045812	-150.54158	8.495768
20	-141.423552	-149.880956	8.457404
10	-141.182536	-149.357334	8.174798

5	-141.140468	-149.083645	7.943177
4	-141.132054	-148.992198	7.860145
3	-141.12364	-148.896747	7.773107
2	-141.115226	-148.787046	7.67182
1	-141.106813	-148.623893	7.51708
0.5	-141.102606	-148.47281	7.370204
0.4	-141.101764	-148.418983	7.317219
0.3	-141.100923	-148.357042	7.256119
0.2	-141.100082	-148.287354	7.187272

It should be noted, since original earth station antenna pattern in 1980-2025 MHz is non-directional it has a major impact on the produced level of EPFD. Therefore, even after aligning the level of maximum EIRP in modification with the maximum EIRP of original beam, while at the same time improving the antenna performance, resulting EPFD shows significantly lower level as compared to original one.

EPFD uplink in 5150-5250 MHz

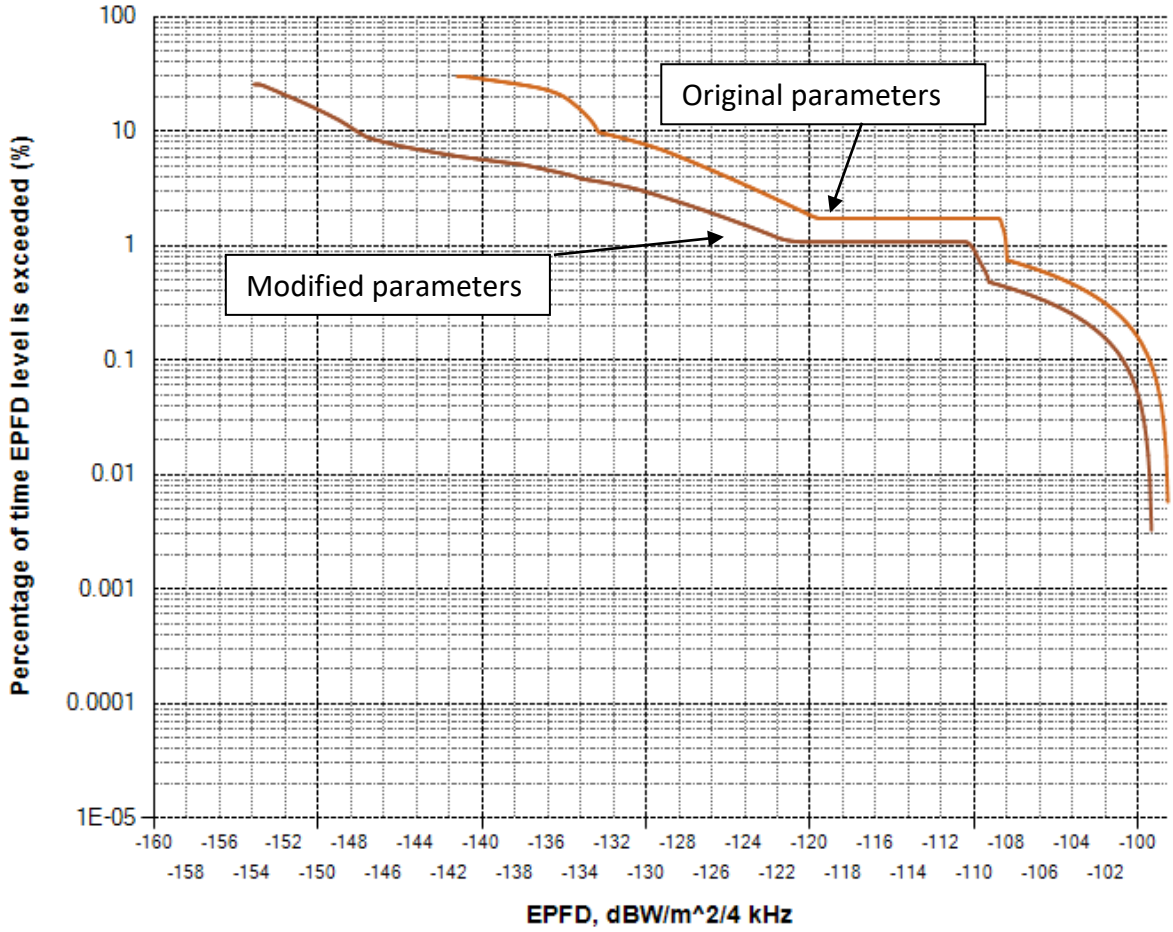


% of time EPFD is exceeded	Modified Parameters	Original parameters	Advantage, dB
100	-195.9	-185.1	10.8
99.99	-192.899721	-185.099114	7.800608
99	-192.832313	-185.011356	7.820958
95	-190.744469	-181.887764	8.856705
90	-186.087674	-181.863097	4.224578

80	-185.975957	-181.813762	4.162195
70	-184.984833	-181.65782	3.327013
60	-182.191144	-179.299259	2.891885
50	-181.800421	-179.22582	2.574601
40	-180.637007	-178.369381	2.267627
30	-178.457005	-178.113393	0.343612
20	-176.496815	-176.427856	0.068959
10	-173.704665	-172.281313	1.423352
5	-170.469491	-168.352723	2.116767
4	-169.148249	-166.761261	2.386988
3	-167.245013	-164.706227	2.538785
2	-164.391492	-161.803244	2.588248
1	-157.408316	-153.344688	4.063628
0.5	-149.604453	-146.580333	3.024119
0.4	-147.544495	-144.777353	2.767142
0.3	-145.191019	-142.698651	2.492367
0.2	-142.169481	-139.894296	2.275186
0.1	-137.755887	-136.20355	1.552337
0.05	-134.5831	-133.407349	1.175751
0.04	-133.745504	-132.722288	1.023215
0.03	-132.796285	-131.909539	0.886746
0.02	-131.661092	-130.925563	0.735529
0.01	-130.167815	-129.620806	0.547009
0.005	-129.084926	-128.648628	0.436298
0.004	-128.795512	-128.392237	0.403275
0.003	-128.4622	-128.074181	0.388019
0.002	-128.051056	-127.678365	0.372691
0.001	-127.450779	-127.090202	0.360578
0.0005	-126.904778	-126.611214	0.293563
0.0004	-126.737213	-126.470961	0.266252
0.0003	-126.53973	-126.316984	0.222747
0.0002	-126.322634	-126.131013	0.191621
0.0001	-126.044577	-125.895599	0.148978
0.00001	-125.617071	-125.522579	0.094492

Downlink analysis was carried out for several types of earth stations both in 2170-2200 MHz and 7025-7075 MHz.

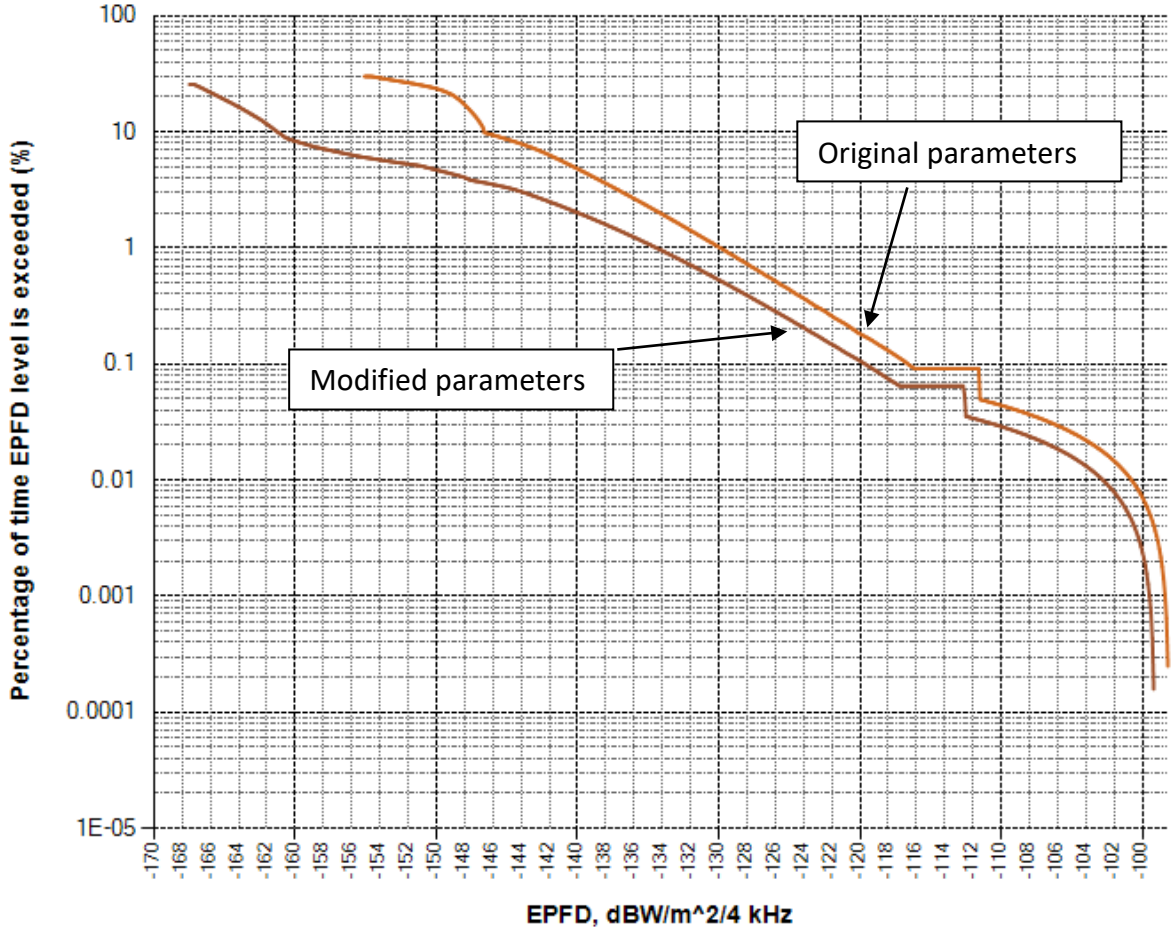
EPFD Downlink in 2170-2200 MHz for 1-meter GSO ES Antenna



% of time EPFD is exceeded	Modified Parameters	Original parameters	Advantage, dB
20	-151.734862	-135.013018	16.721845
10	-147.635642	-132.940866	14.694776
5	-137.211856	-126.649822	10.562034
4	-134.277705	-125.082886	9.19482
3	-130.167775	-123.14126	7.026516
2	-126.320081	-120.515753	5.804328
1	-110.190349	-108.060353	2.129995
0.5	-109.134213	-104.526434	4.60778
0.4	-107.256986	-103.17068	4.086306
0.3	-105.048643	-101.845853	3.20279
0.2	-102.936574	-100.561028	2.375547
0.1	-100.936041	-99.310714	1.625328
0.05	-100.023809	-98.7114	1.312409
0.04	-99.846641	-98.596158	1.250484

0.03	-99.668302	-98.479143	1.189159
0.02	-99.493614	-98.364954	1.128659
0.01	-99.318135	-98.248778	1.069357

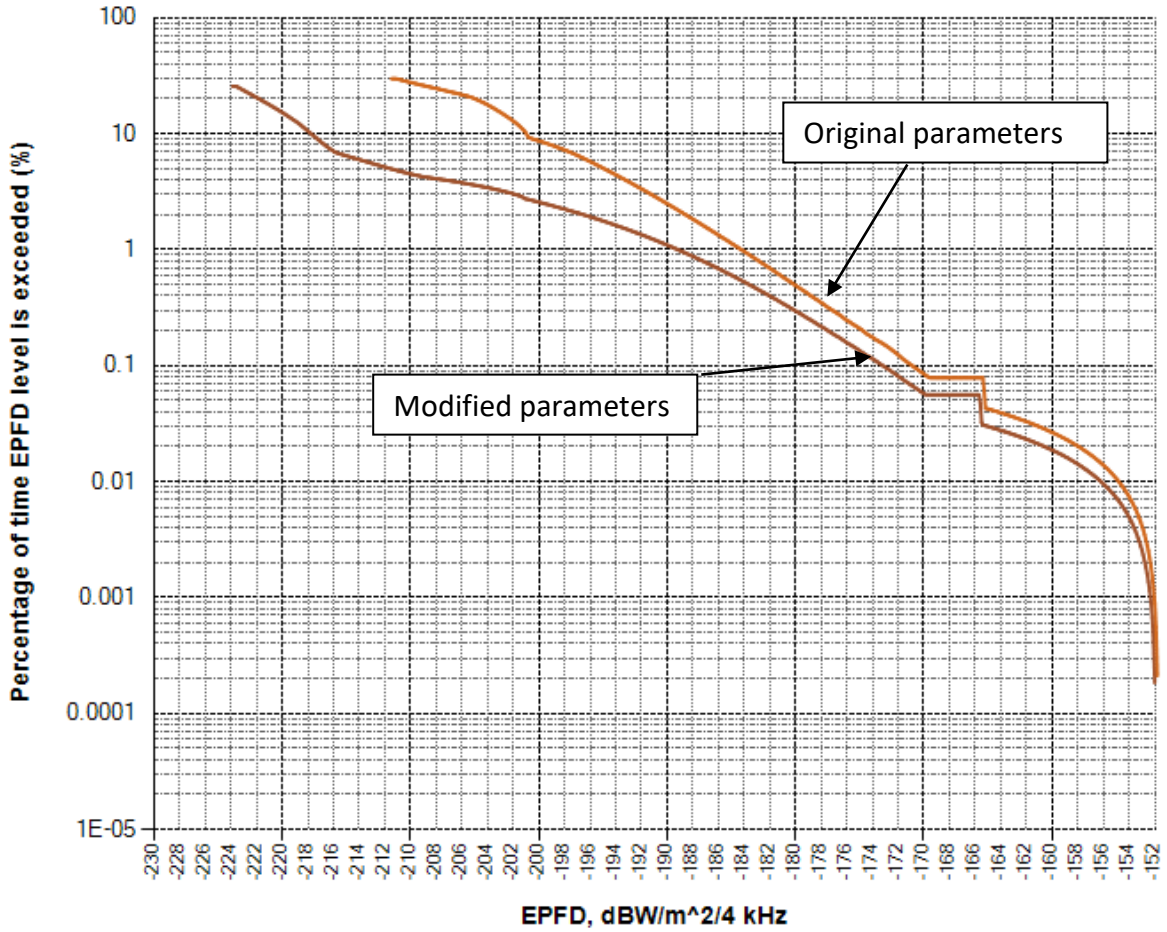
EPFD Downlink in 2170-2200 MHz for 4.8-meter GSO ES Antenna



% of time EPFD is exceeded	Modified Parameters	Original parameters	Advantage, dB
20	-165.362553	-148.642227	16.720325
10	-161.261603	-146.615275	14.646328
5	-150.851003	-140.285963	10.56504
4	-147.900392	-138.720592	9.179799
3	-143.786194	-136.78152	7.004673
2	-139.941815	-134.160542	5.781273
1	-134.4101	-129.888767	4.521333
0.5	-129.609158	-125.789781	3.819377
0.4	-128.15733	-124.516493	3.640837
0.3	-126.333367	-122.813212	3.520154
0.2	-123.828162	-120.5083	3.319862
0.1	-119.655819	-116.612872	3.042947
0.05	-112.575671	-111.501159	1.074512
0.04	-112.523938	-108.883162	3.640776
0.03	-110.403775	-106.157922	4.245853
0.02	-106.558812	-103.455707	3.103106

0.01	-102.794844	-100.770851	2.023993
0.005	-100.946389	-99.451908	1.494482
0.004	-100.58375	-99.181427	1.402323
0.003	-100.22042	-98.916415	1.304005
0.002	-99.85525	-98.656683	1.198568
0.001	-99.500936	-98.393414	1.107522
0.0005	-99.32273	-98.263761	1.058969
0.0004	-99.287869	-98.238359	1.04951
0.0003	-99.251559	-98.212956	1.038603

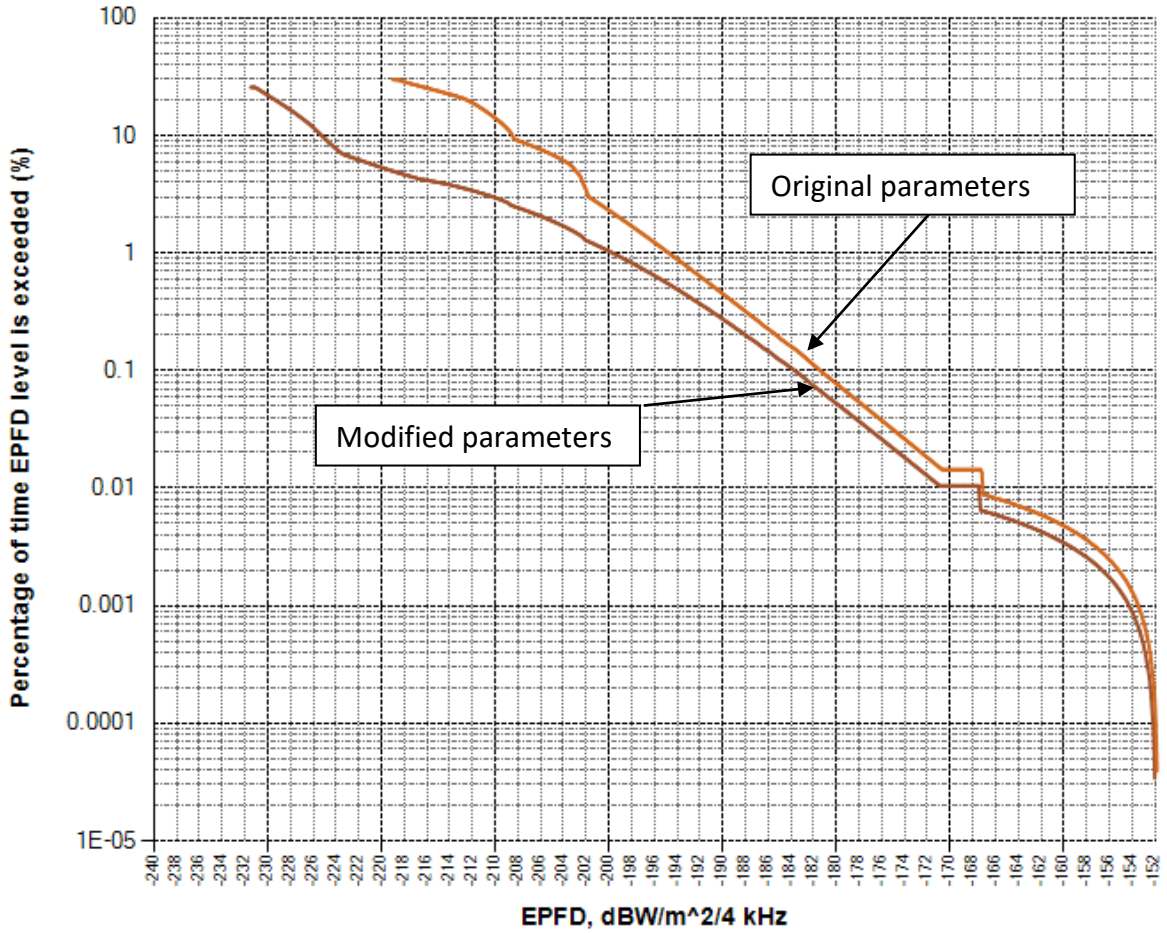
EPFD Downlink in 7025-7075 MHz for 1.6-meter GSO ES Antenna



% of time EPFD is exceeded	Modified Parameters	Original parameters	Advantage, dB
20	-221.817205	-204.966464	16.850741
10	-217.758118	-200.977391	16.780726
5	-211.568408	-194.919907	16.648501
4	-207.376895	-193.268251	14.108644
3	-201.857896	-191.2485	10.609396
2	-196.503088	-188.555764	7.947325
1	-189.166732	-184.22369	4.943042
0.5	-183.618355	-180.090924	3.527431
0.4	-182.032118	-178.805201	3.226917
0.3	-180.088916	-177.125135	2.963781

0.2	-177.457881	-174.757114	2.700767
0.1	-173.203717	-170.916686	2.287031
0.05	-165.630815	-165.239857	0.390958
0.04	-165.551612	-164.259017	1.292594
0.03	-165.042636	-161.086241	3.956395
0.02	-160.582486	-157.93247	2.650016
0.01	-156.201777	-154.809397	1.392379
0.005	-154.036371	-153.263035	0.773336
0.004	-153.616334	-152.957065	0.659269
0.003	-153.189054	-152.650594	0.538459
0.002	-152.772089	-152.342899	0.42919
0.001	-152.336885	-152.036926	0.299959
0.0005	-152.131501	-151.884563	0.246938
0.0004	-152.091819	-151.855273	0.236546
0.0003	-152.049364	-151.825982	0.223382

EPFD Downlink in 7025-7075 MHz for 3.8-meter GSO ES Antenna

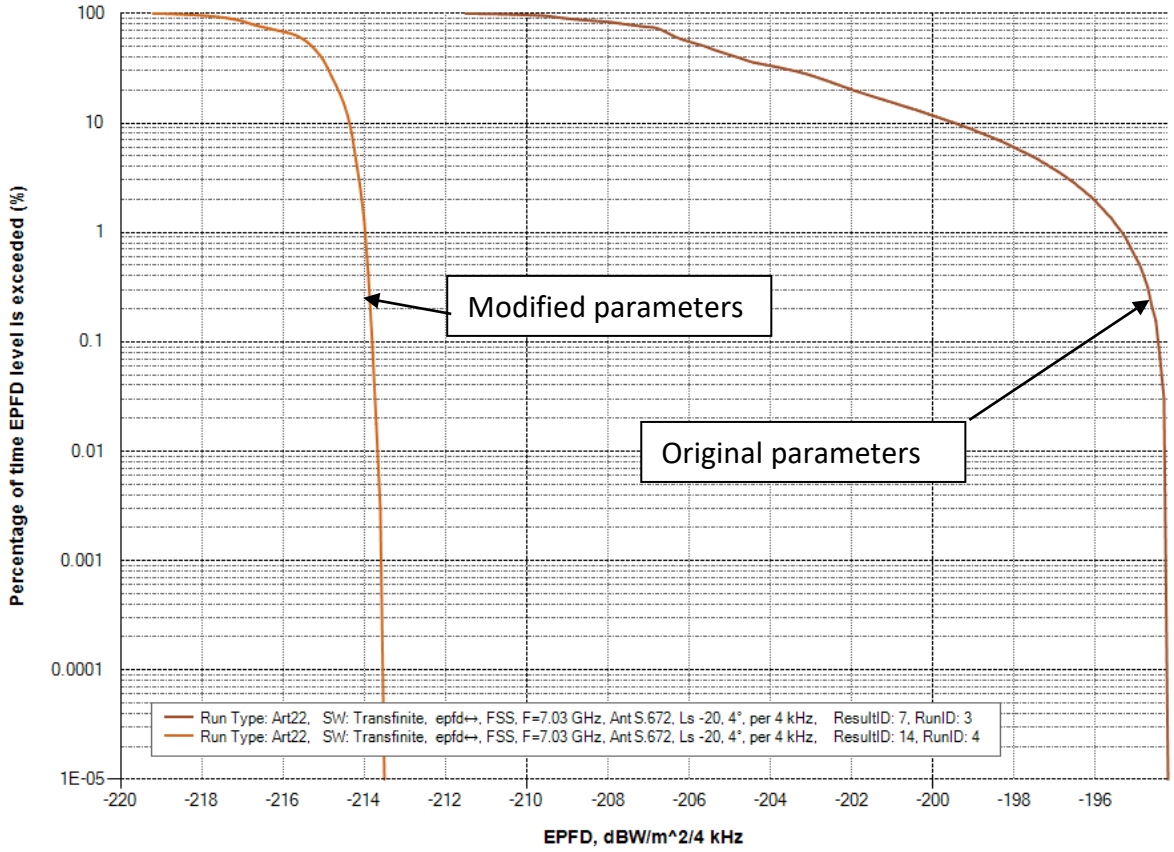


% of time EPFD is exceeded	Modified Parameters	Original parameters	Advantage, dB
20	-229.329099	-212.481923	16.847177
10	-225.270856	-208.490322	16.780534
5	-219.079532	-202.919753	16.159779
4	-215.109556	-202.302947	12.806609

3	-210.208057	-201.76499	8.443067
2	-205.700985	-199.071388	6.629597
1	-199.68138	-194.732179	4.9492
0.5	-194.122352	-190.606481	3.515871
0.4	-192.542706	-189.306285	3.236422
0.3	-190.586667	-187.649581	2.937086
0.2	-187.967562	-185.281407	2.686155
0.1	-183.676676	-181.422925	2.253751
0.05	-179.724102	-177.581543	2.142559
0.04	-178.445531	-176.346881	2.09865
0.03	-176.814743	-174.758781	2.055963
0.02	-174.533884	-172.522064	2.01182
0.01	-167.481876	-167.125743	0.356133
0.005	-163.767678	-160.402319	3.365359
0.004	-161.366597	-158.623789	2.742808
0.003	-158.991203	-156.930702	2.060501
0.002	-156.626787	-155.192732	1.434056
0.001	-154.257082	-153.456307	0.800774
0.0005	-153.084833	-152.587703	0.49713
0.0004	-152.85681	-152.417979	0.438831
0.0003	-152.616562	-152.251427	0.365135
0.0002	-152.381543	-152.077441	0.304102
0.0001	-152.156608	-151.906127	0.250481

Since there is a small number of links operating in Earth-to-Space direction, space-to-space calculation was carried out as well.

EPFD Space-to-Space in 7025-7075 MHz



% of time EPFD is exceeded	Original Parameters	Modified parameters	Advantage, dB
100	-211.5	-219.2	7.7
99.99	-211.467119	-219.132868	7.665749
99	-210.649907	-218.630937	7.98103
95	-209.483496	-217.825426	8.34193
90	-208.9777	-217.292359	8.31466
80	-207.561088	-216.757756	9.196668
70	-206.644865	-216.120761	9.475896
60	-206.268738	-215.558754	9.290016
50	-205.588953	-215.277496	9.688543
40	-204.811765	-215.055496	10.243731
30	-203.412112	-214.864243	11.452131
20	-201.962025	-214.634416	12.672391
10	-199.449405	-214.357518	14.908114
5	-197.563136	-214.212358	16.649223
4	-197.115455	-214.169294	17.05384
3	-196.604216	-214.117334	17.513119
2	-196.025227	-214.050404	18.025176
1	-195.3335	-213.963887	18.630387

0.5	-194.891161	-213.907943	19.016783
0.4	-194.796609	-213.891229	19.09462
0.3	-194.68487	-213.860989	19.176119
0.2	-194.5774	-213.83075	19.25335
0.1	-194.433205	-213.80051	19.367305
0.05	-194.346841	-213.739937	19.393096
0.04	-194.322927	-213.727505	19.404578
0.03	-194.298644	-213.715073	19.41643
0.02	-194.265763	-213.702641	19.436879
0.01	-194.232881	-213.647132	19.414251
0.005	-194.216441	-213.613566	19.397125
0.004	-194.213153	-213.606853	19.3937
0.003	-194.209864	-213.60014	19.390275
0.002	-194.206576	-213.567132	19.360556
0.001	-194.203288	-213.533566	19.330278
0.0005	-194.201644	-213.516783	19.315139
0.0004	-194.201315	-213.513426	19.312111
0.0003	-194.200986	-213.51007	19.309083
0.0002	-194.200658	-213.506713	19.306056
0.0001	-194.200329	-213.503357	19.303028
0.00001	-194.200033	-213.500336	19.300303

In space-to-space direction there is a larger margin. It is understood this is due to different worst-case locations selected for original constellation and modified one. In practice, since the satellites will be flying at lower altitude there will be additional advantage associated with the space-to-space spread loss.

Provided analysis demonstrate that interference to GSO networks is well below the levels produced by original submission of SIRION-1.

Based on this analysis, it is understood that modification would not cause more interference to the GSO Networks received after 21.03.2013.

5. Assessment of modification with respect to non-GSO networks

Following non-GSO networks were filed to ITU after SIRION-1 submission (21.03.2013).

Downlink

ntc_id	adm	sat_name	ntf_rsn	ntc_type	emi_rcp	freq_min	freq_max
113520077	NOR	ARE-2	C	N	E	2199.5	2200
113520188	PNG	OMNISPACE F2	C	N	E	2170	2200
115520048	F	AST-NG-C-1	C	N	E	2170	2200
						7025	7075
115520085	F	ES-SAT-2	C	N	E	7025	7062.5
115520131	NOR	ARE-3	C	N	E	2199.5	2200
115520171	F	AST-NG-C-2	C	N	E	2170	2200
						7025	7075
115520227	CHN	MCSCS	C	N	E	2170	2200
						7025	7075
116520069	LUX	CLEOSAT	C	N	E	7025	7075

116520105	CHN	XINGYUN	C	N	E	7025	7075
116520228	F	AST-NG-C-3	C	N	E	2170	2200
						7025	7075
116520381	G	SSG-CSL	C	N	E	2170	2200
116520443	SLM	SI-SAT-KURUKURU	C	N	E	2170	2200
117520372	F	AST-NG-C-4	C	N	E	2170	2200
						7025	7075
117520071	RUS	IK-NGSO-A10K-2	C	N	E	7025	7075
117520488	RUS	PROGNOZ-N	C	N	E	2170	2200
117520487	F	EB-SAT-LEO-1	C	N	E	2170	2200
						7025	7075
117520492	F	EB-SAT-LEO-1B	C	N	E	2170	2200
						7025	7075
118520082	PNG	MICRONSAT	C	N	E	2170	2200
118520098	CAN	KELYPSIS	C	N	E	2170	2200

Uplink

ntc_id	adm	sat_name	ntf_rsn	ntc_type	emi_rcp	freq_min	freq_max
113520188	PNG	OMNISPACE F2	C	N	R	1980	2025
115520048	F	AST-NG-C-1	C	N	R	1980	2025
						5150	5250
115520085	F	ES-SAT-2	C	N	R	5150	5250
115520171	F	AST-NG-C-2	C	N	R	1980	2025
						5150	5250
115520227	CHN	MCSCS	C	N	R	1980	2010
						5150	5250
115520228	CHN	TXIN	C	N	R	5150	5250
116520069	LUX	CLEOSAT	C	N	R	5150	5250
116520105	CHN	XINGYUN	C	N	R	5150	5250
116520228	F	AST-NG-C-3	C	N	R	1980	2025
						5150	5250
116520381	G	SSG-CSL	C	N	R	1980	2025
116520419	RUS	IK-NGSO-A10K-1	C	N	R	5150	5250
116520442	SLM	SI-SAT-BILIKIKI	C	N	R	5150	5250
						1980	2010
117520071	RUS	IK-NGSO-A10K-2	C	N	R	5150	5250
117520372	F	AST-NG-C-4	C	N	R	1980	2025
						5150	5250
117520183	CHN	DES-LEO	C	N	R	5150	5250
117520487	F	EB-SAT-LEO-1	C	N	R	1980	2025
						5150	5250
117520492	F	EB-SAT-LEO-1B	C	N	R	1980	2025
						5150	5250
117520488	RUS	PROGNOZ-N	C	N	R	1980	2025
118520053	CHN	OKSAT	C	N	R	5216	5250

Space-to-space

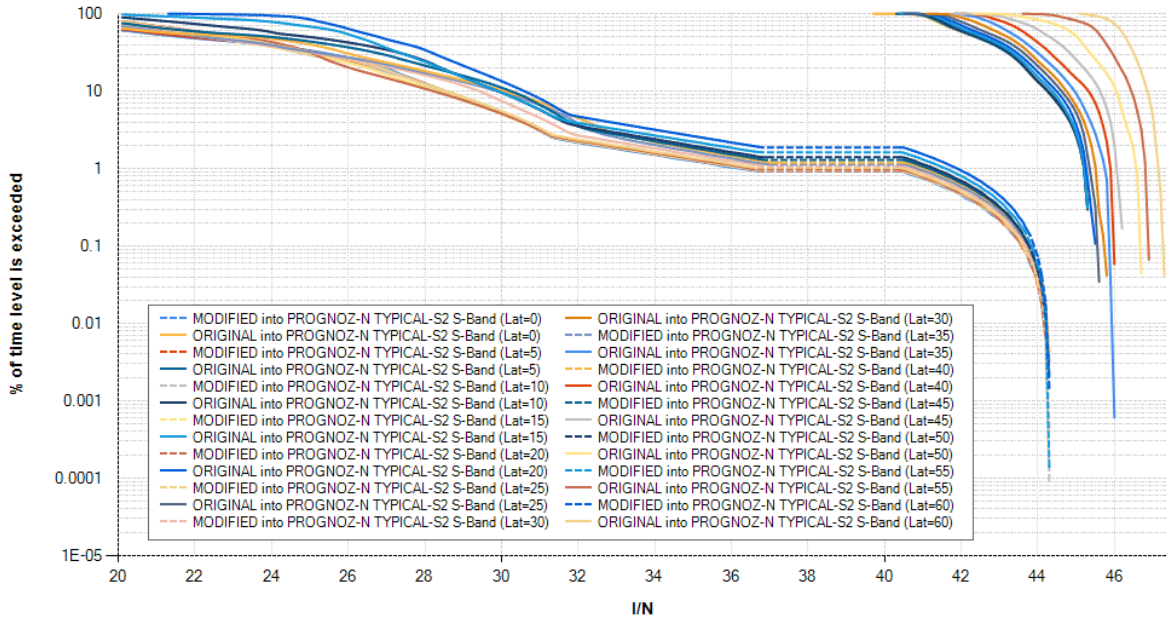
ntc_id	adm	sat_name	ntf_rsn	ntc_type	emi_rcp	freq_min	freq_max
117520071	RUS	IK-NGSO-A10K-2	C	N	R	7025	7075
117520372	F	AST-NG-C-4	C	N	R	7025	7075
317520490	SLM	SI-SAT-BILIKIKI	C	N	R	7025	7075

Dynamic I/N analysis on downlink was carried out for different scenarios of operation of non-GSO networks.

5.1. Downlink analysis

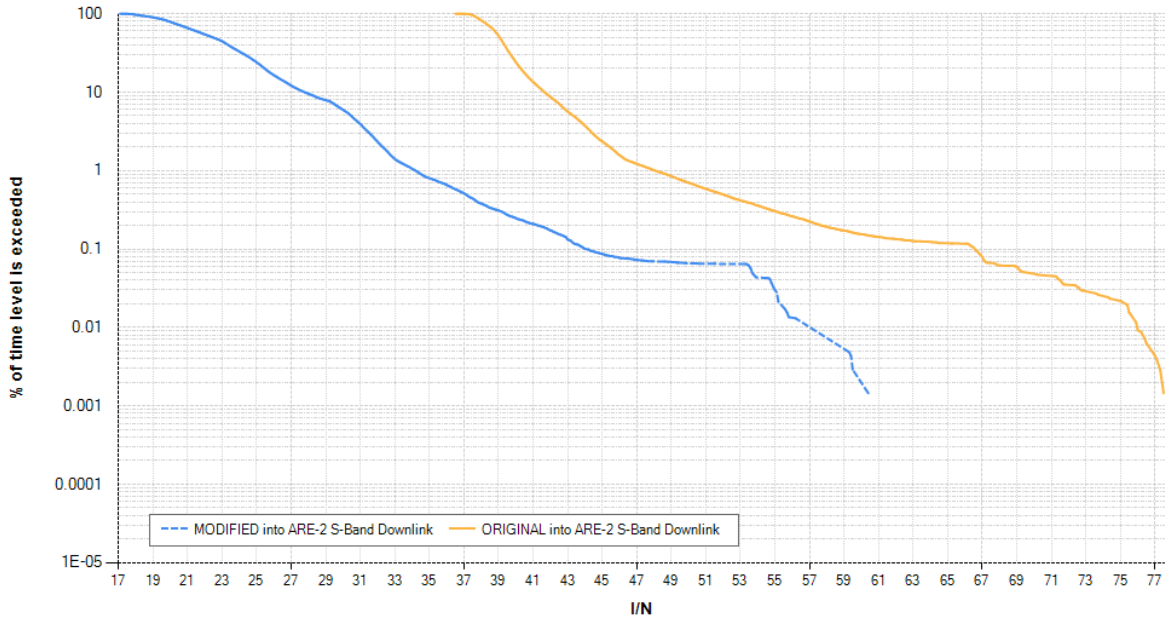
It was assumed that victim non-GSO earth station receiver is tracking its own satellite constellation. For different scenarios different location of victim ES were chosen. In most of the cases it corresponds to worst latitude of 0 degrees. In some other cases, filed geographical coordinates of ES were chosen.

Interference would not change significantly with the latitude, this is since all systems are operating with the low circular orbits. Figure below illustrates that interference produced by modified characteristics would generally stay below interference produced by original assignments for all the latitudes.

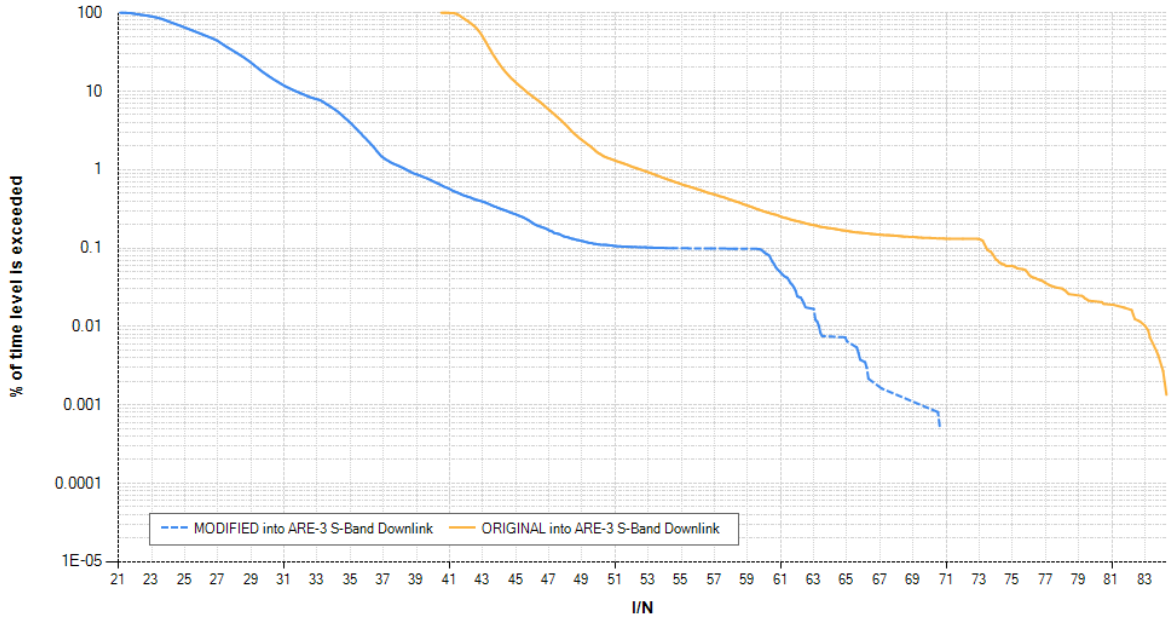


It should be noted that the most earth stations operating in 2170-2200 are mobile earth stations having non-directional antenna patterns.

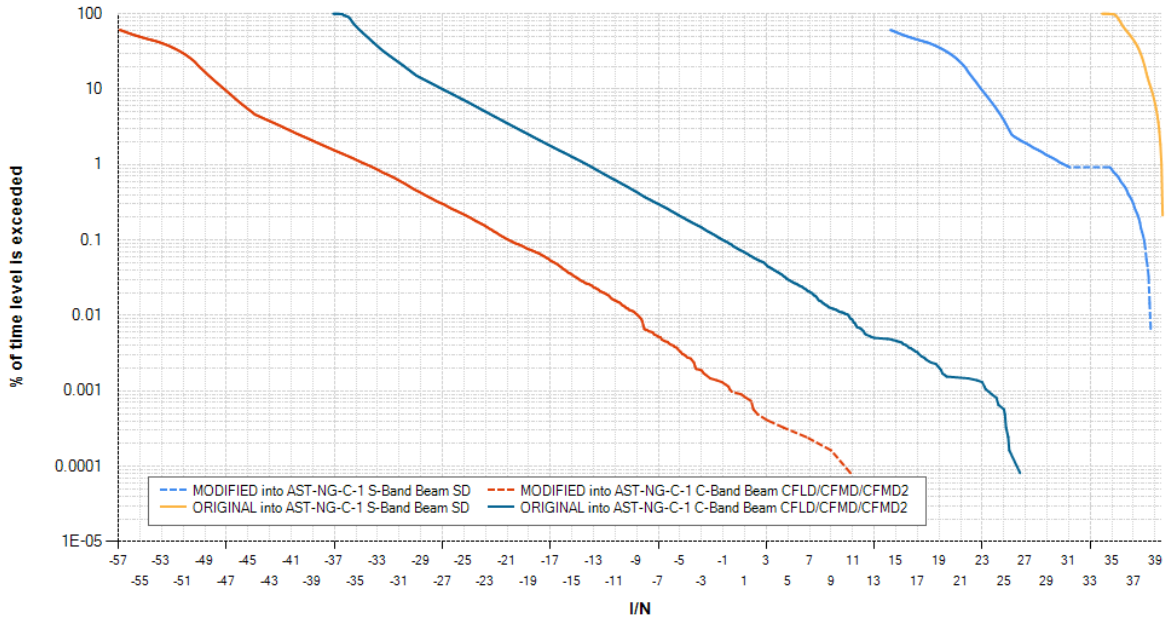
In the figures below CDF curves of interference to noise ratio are provided comparing the level of produced I/N for each of the system.



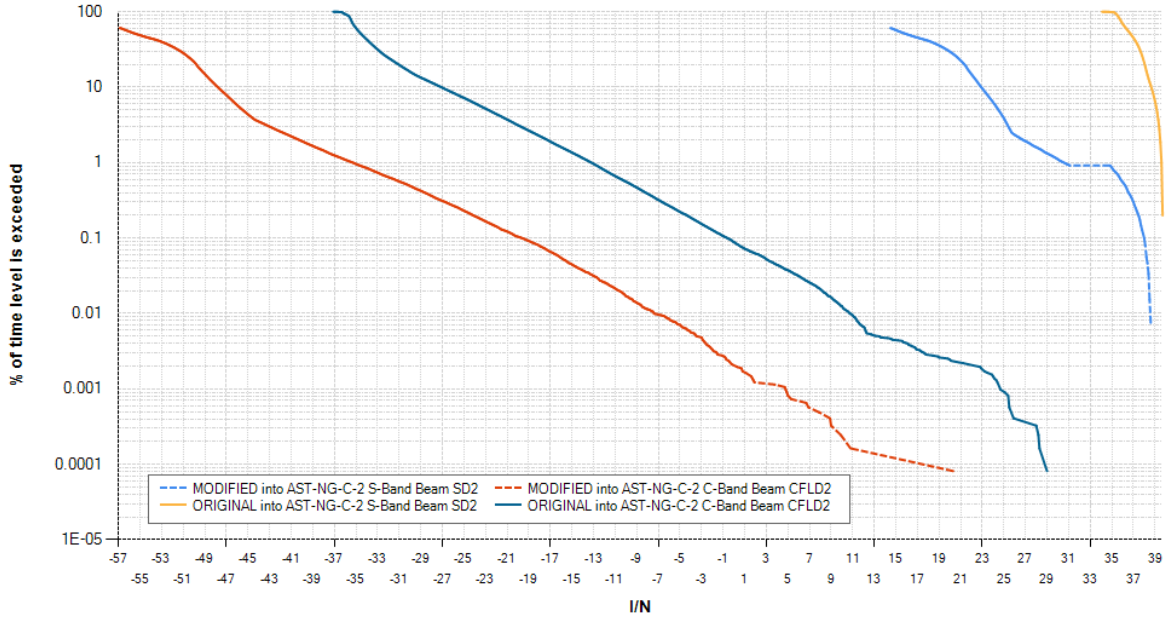
Earth station location (latitude 78.2167) is based on the coordinates of specific earth station in the filing.



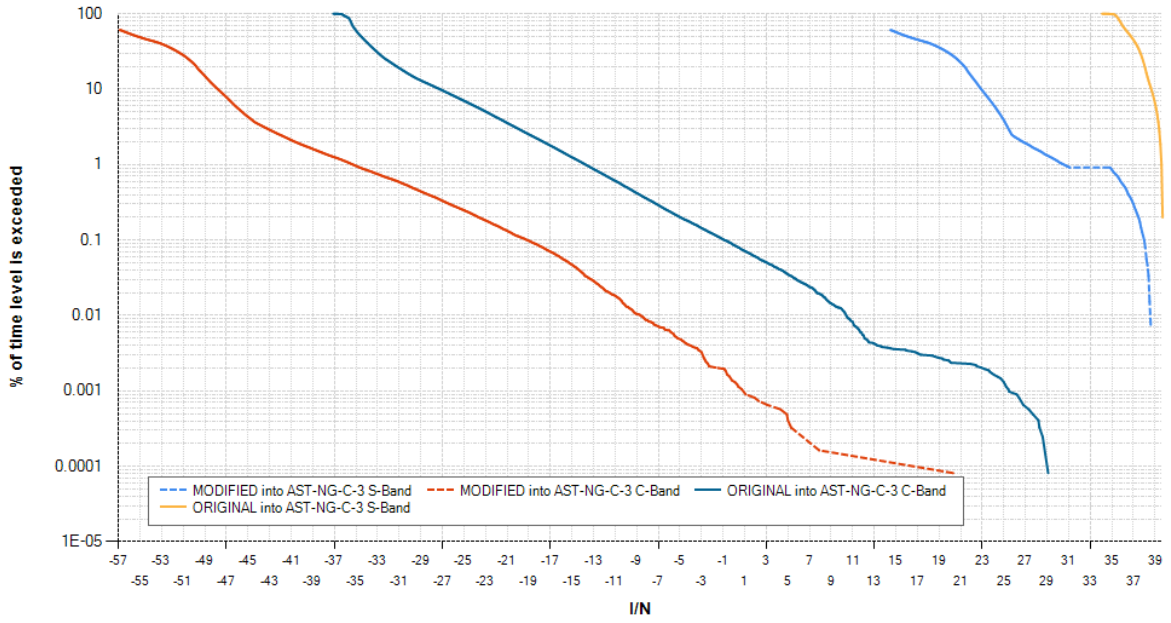
Earth station location (latitude 78.2167) is based on the coordinates of specific earth station in the filing.



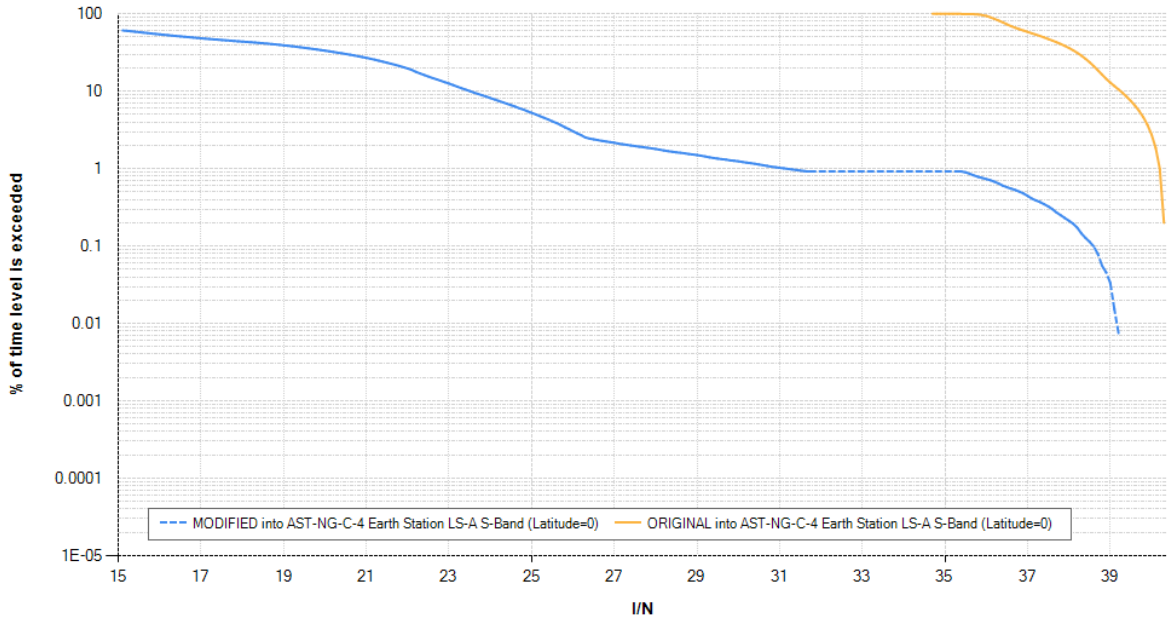
Worst-case latitude is 0 degrees.

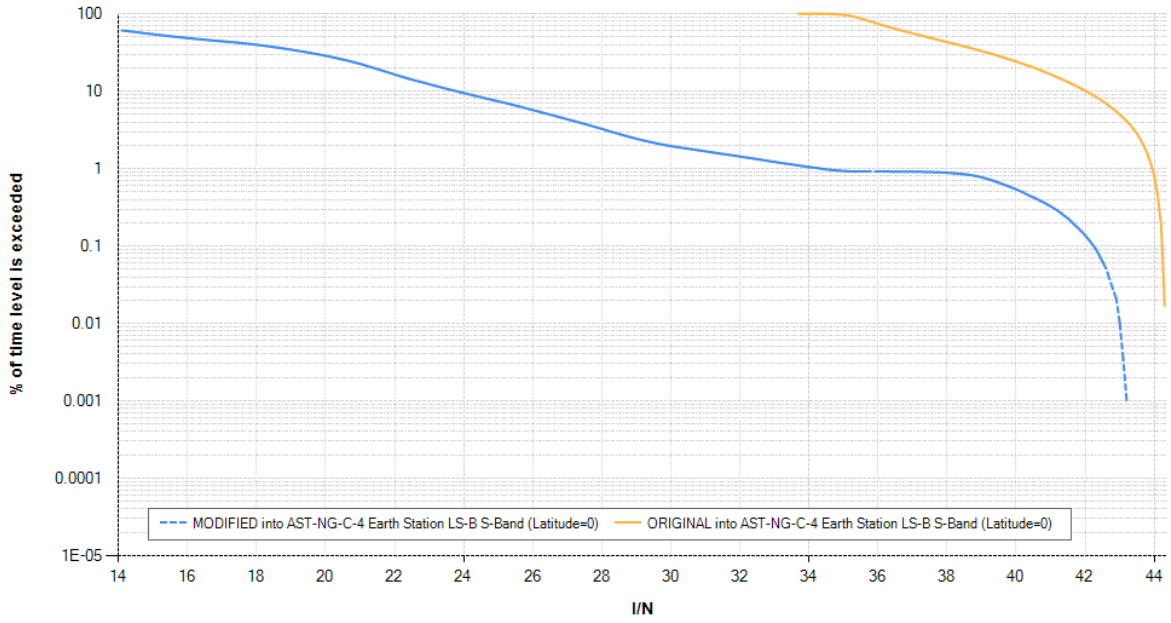


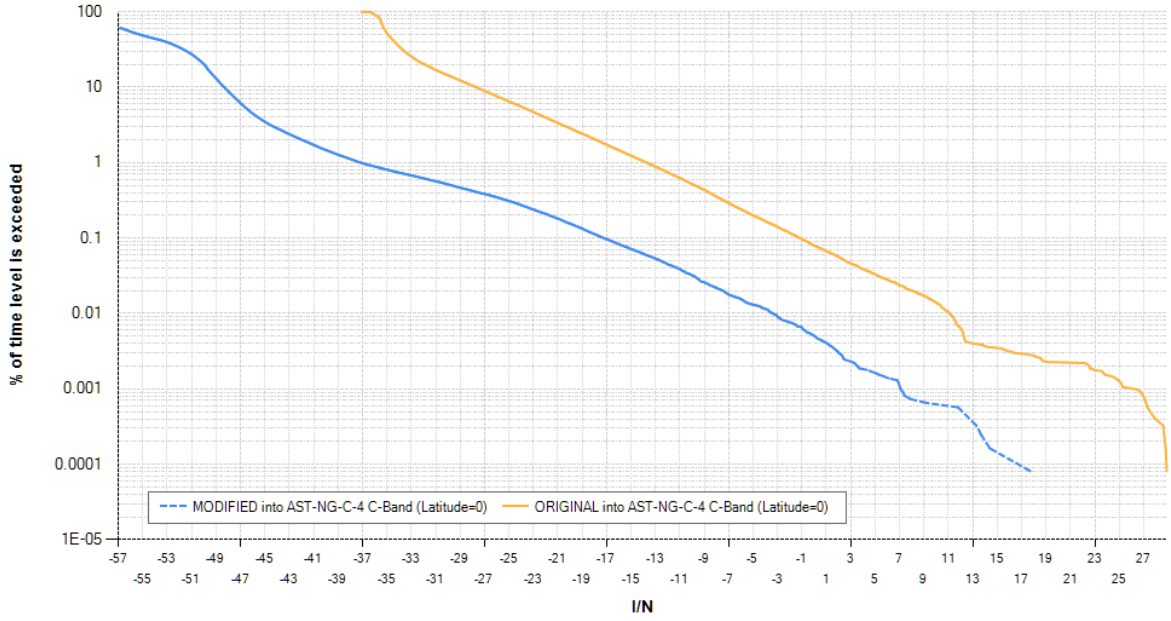
Worst-case latitude is 0 degrees.

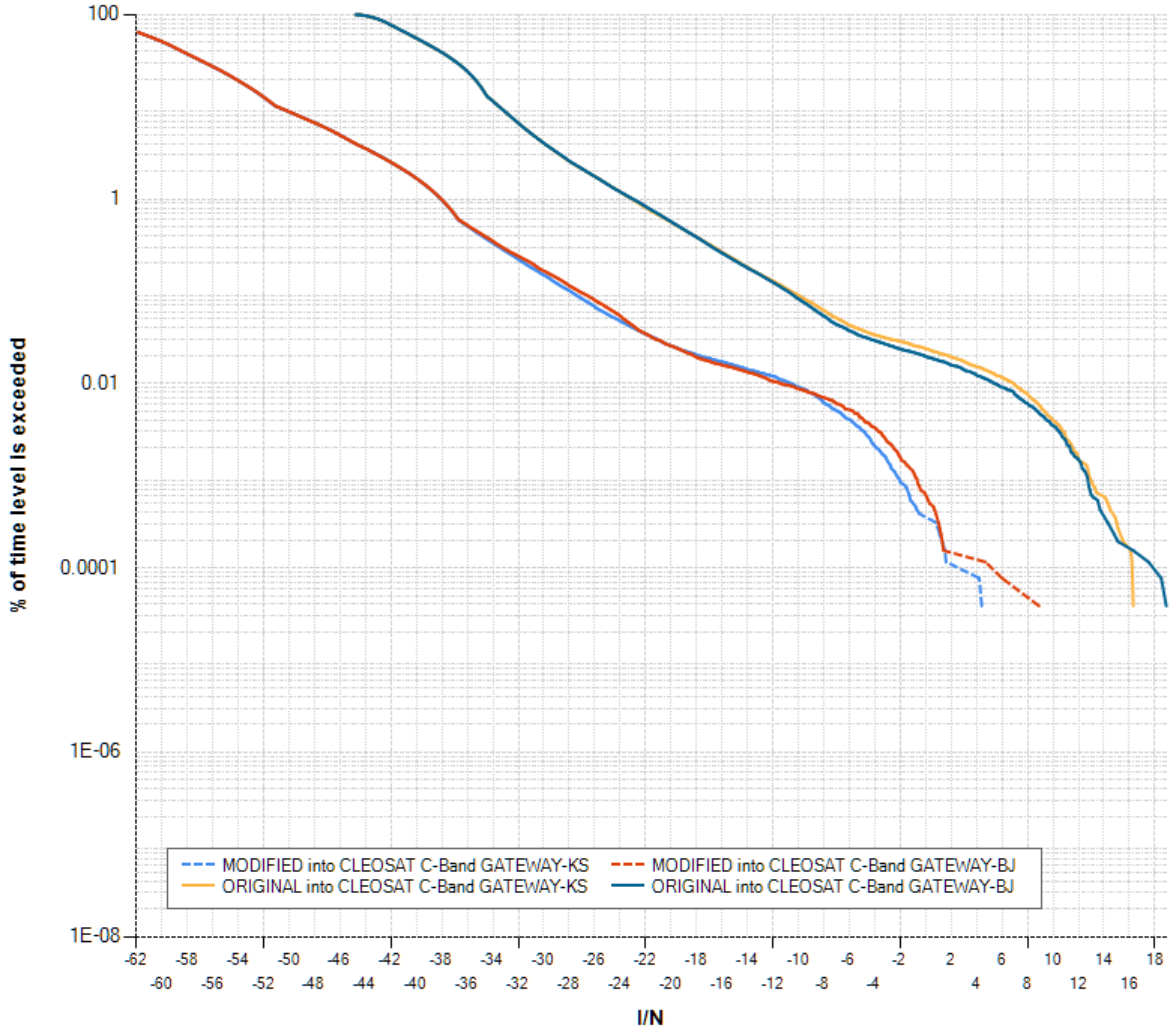


Worst-case latitude is 0 degrees.



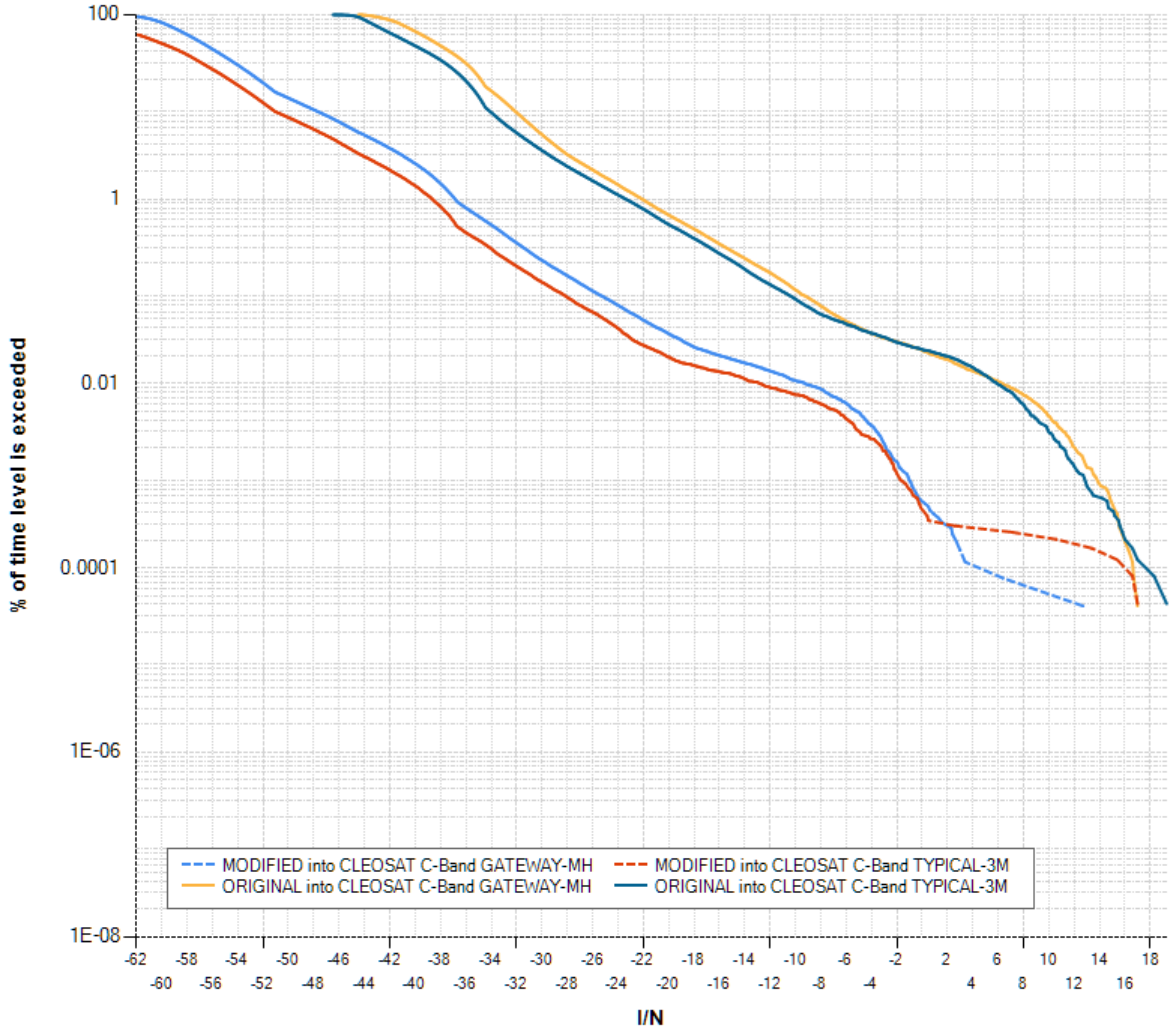

100
10
1
0.1
0.01
0.001
0.0001
1E-05
% of time level is exceeded
14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44
I/N
MODIFIED into AST-NG-C-4 Earth Station LS-B S-Band (Latitude=0)
ORIGINAL into AST-NG-C-4 Earth Station LS-B S-Band (Latitude=0)


100
10
1
0.1
0.01
0.001
0.0001
1E-05
% of time level is exceeded
-57 -53 -49 -45 -41 -37 -33 -29 -25 -21 -17 -13 -9 -5 -1 3 7 11 15 19 23 27
-55 -51 -47 -43 -39 -35 -31 -27 -23 -19 -15 -11 -7 -3 1 5 9 13 17 21 25
I/N
MODIFIED into AST-NG-C-4 C-Band (Latitude=0)
ORIGINAL into AST-NG-C-4 C-Band (Latitude=0)

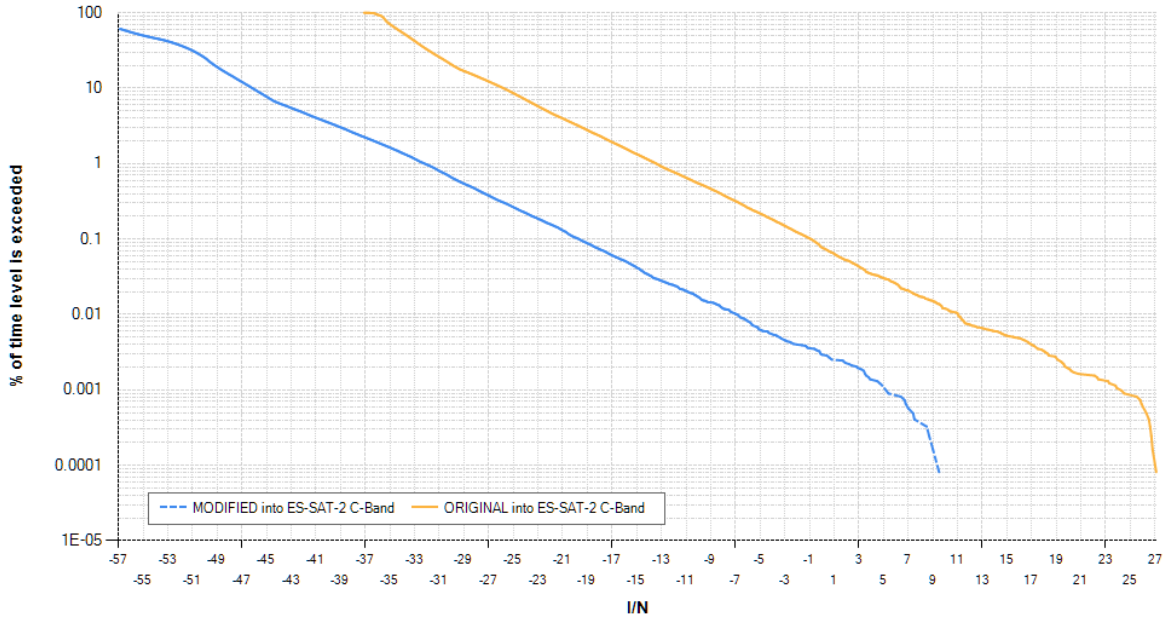


GATEWAY-BJ Earth station location (latitude 39.68) is based on the coordinates of specific earth station in the filing.

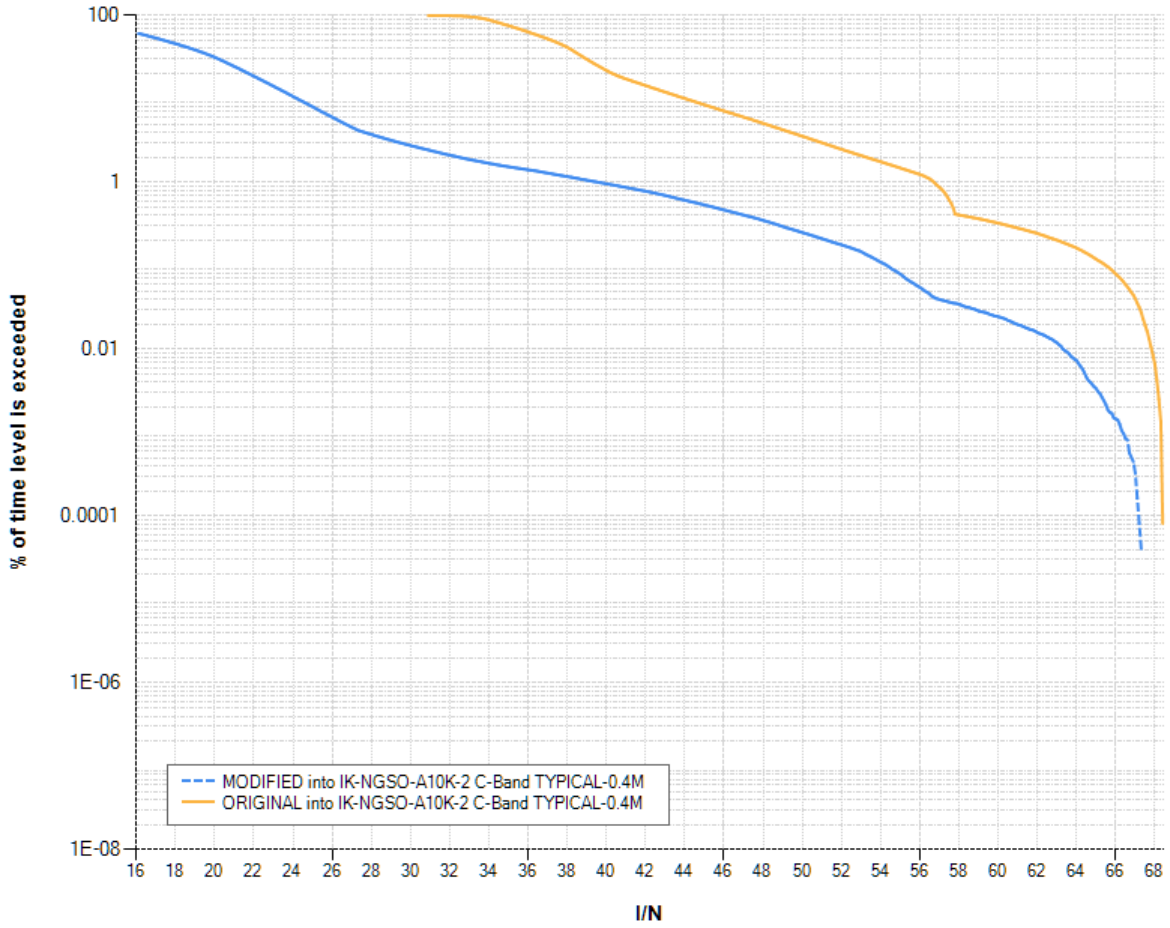
GATEWAY-KS Earth station location (latitude 39.56) is based on the coordinates of specific earth station in the filing.



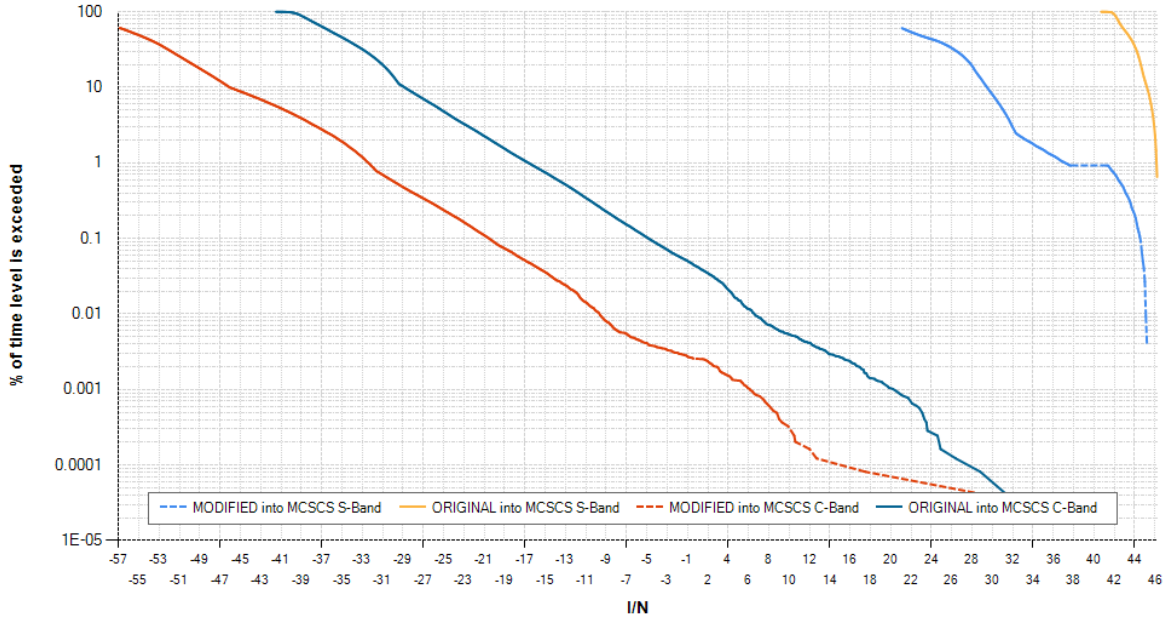
GATEWAY-MH Earth station location (latitude 53.55) is based on the coordinates of specific earth station in the filing.



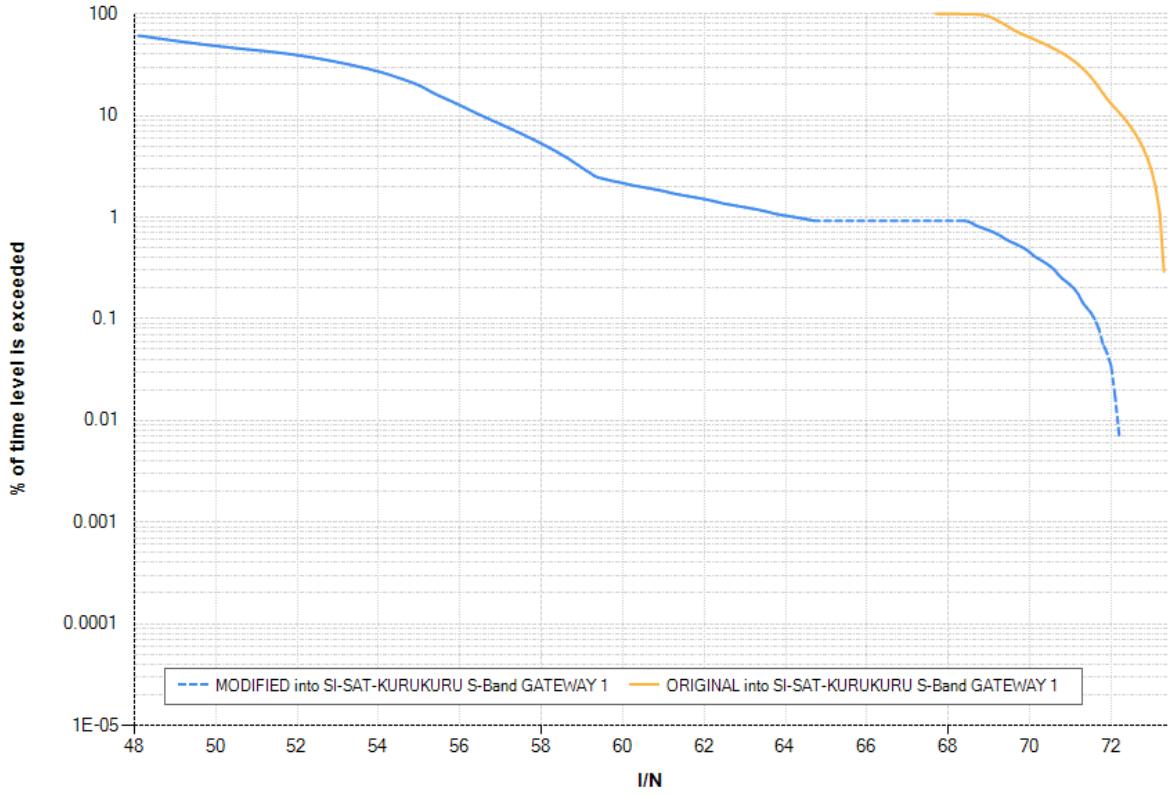
For TYPICAL-3M worst-case latitude is 0 degrees.



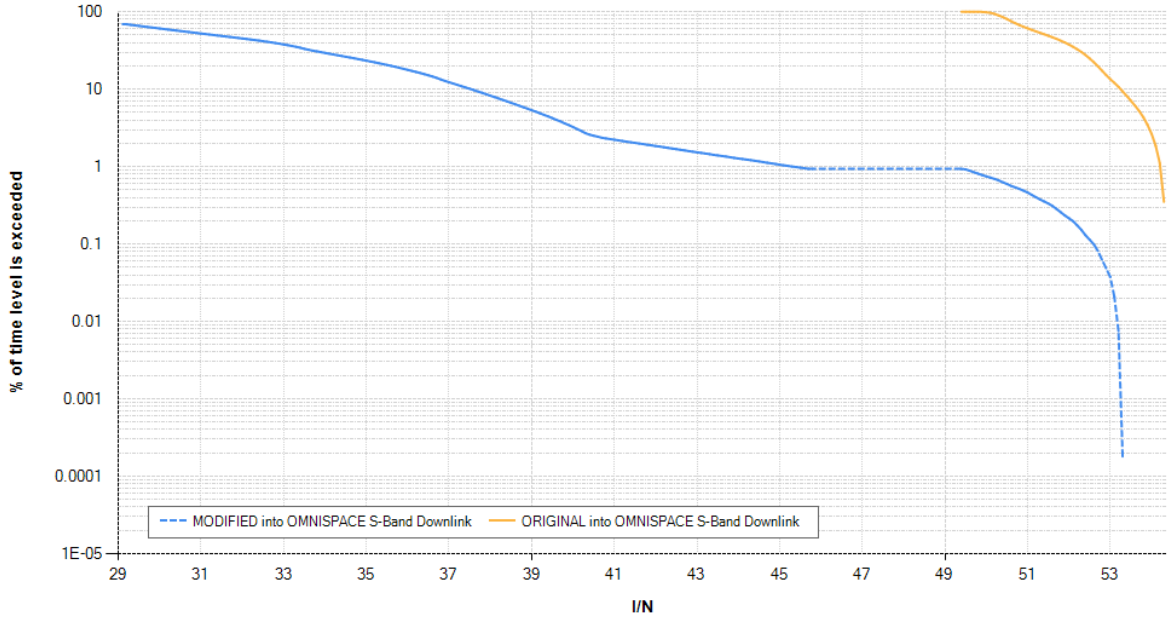
Worst-case latitude is 0 degrees.



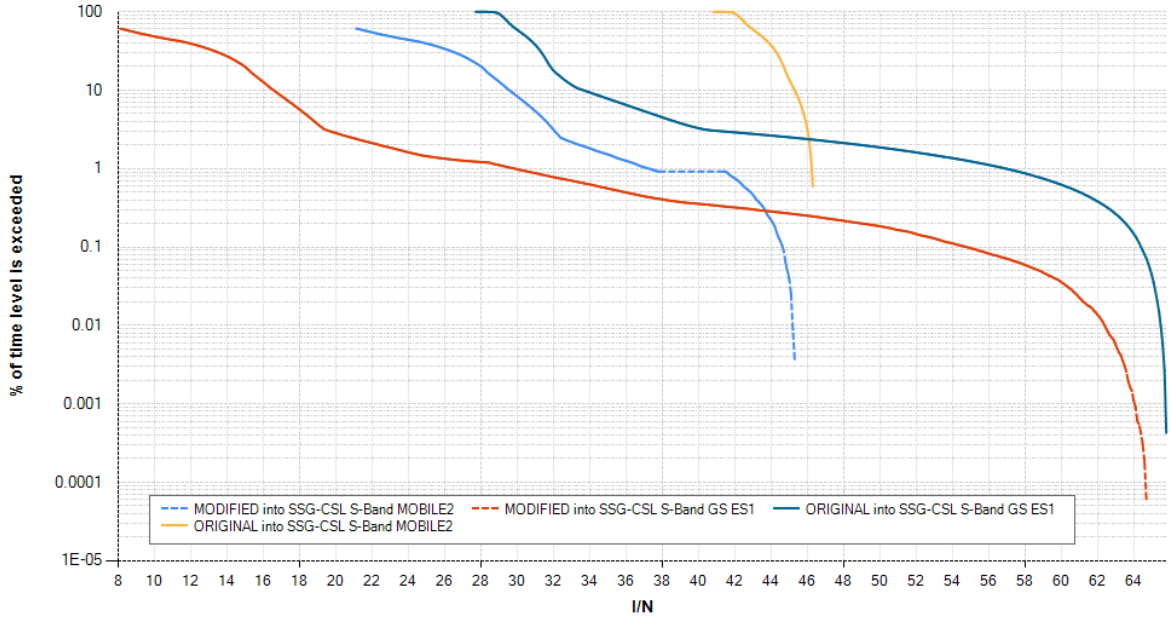
Worst-case latitude is 0 degrees.



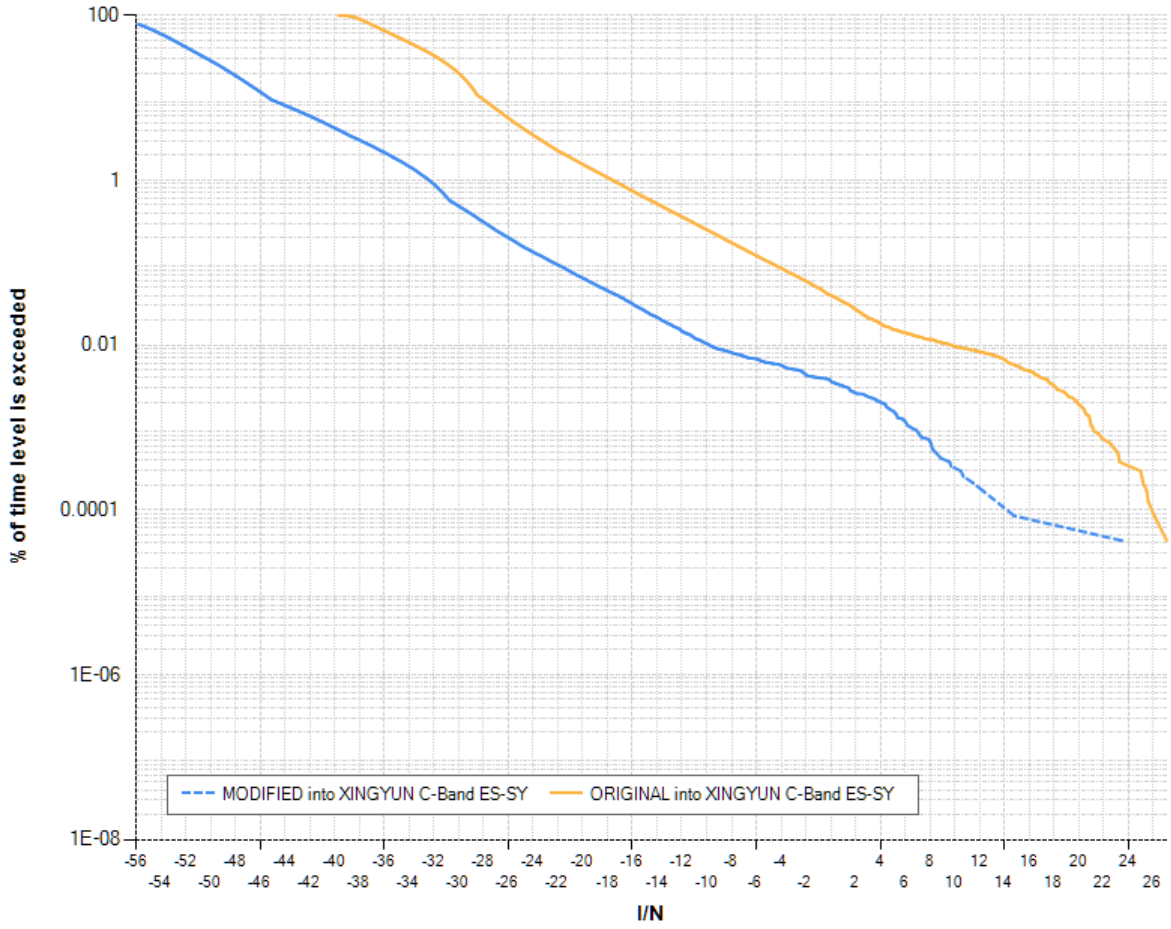
Worst-case latitude is 0 degrees.



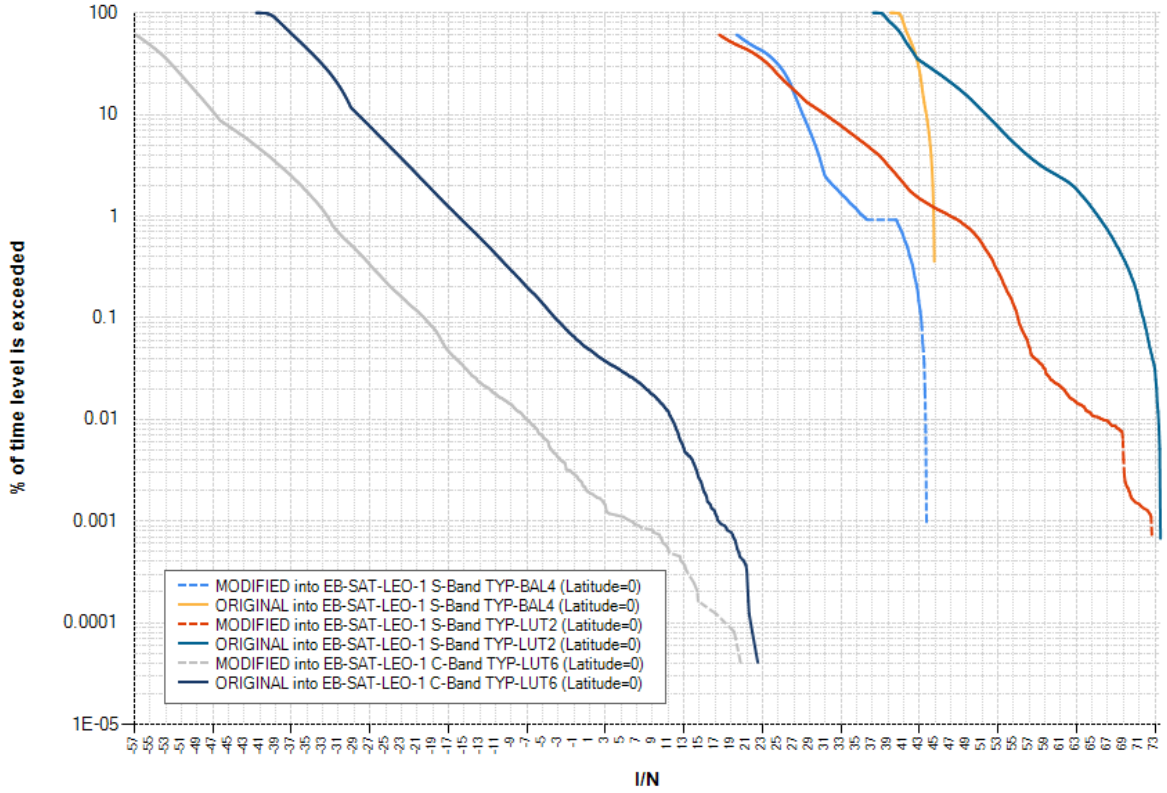
Worst-case latitude is 10 degrees.

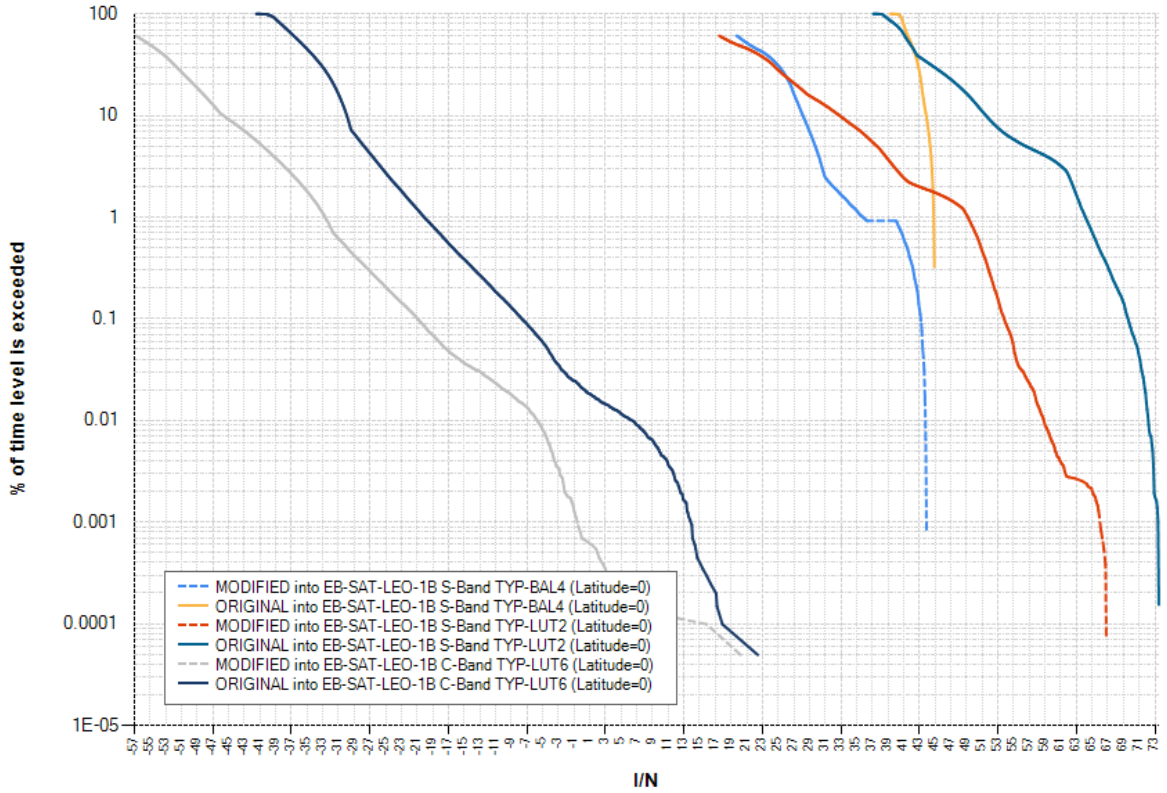


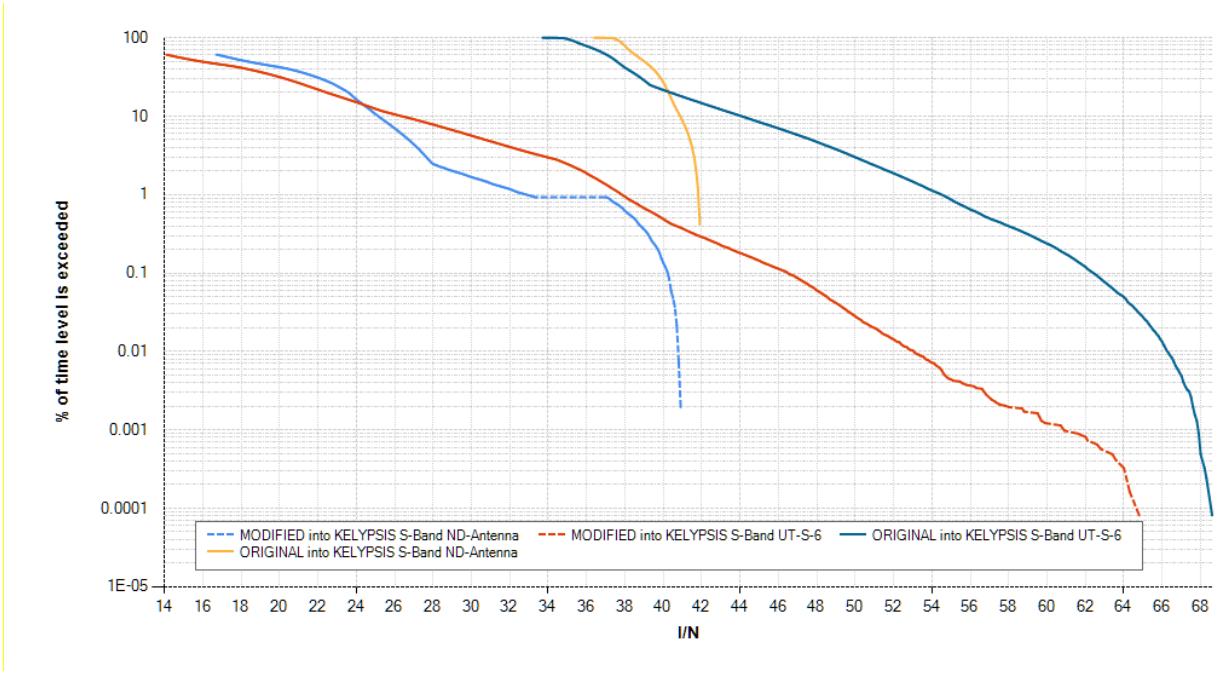
Worst-case latitude is 0 degrees.



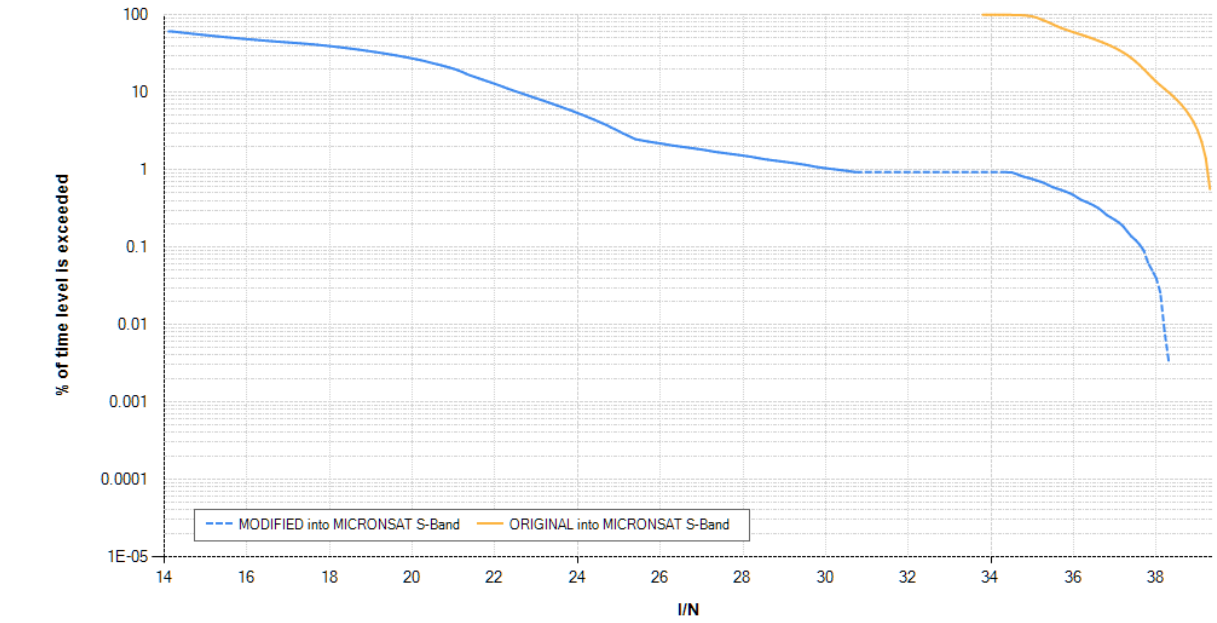
Earth station location (latitude 18.2339) is based on the coordinates of specific earth station in the filing.


% of time level is exceeded
100
10
1
0.1
0.01
0.001
0.0001
1E-05
I/N
MODIFIED into EB-SAT-LEO-1 S-Band TYP-BAL4 (Latitude=0)
ORIGINAL into EB-SAT-LEO-1 S-Band TYP-BAL4 (Latitude=0)
MODIFIED into EB-SAT-LEO-1 S-Band TYP-LUT2 (Latitude=0)
ORIGINAL into EB-SAT-LEO-1 S-Band TYP-LUT2 (Latitude=0)
MODIFIED into EB-SAT-LEO-1 C-Band TYP-LUT6 (Latitude=0)
ORIGINAL into EB-SAT-LEO-1 C-Band TYP-LUT6 (Latitude=0)


% of time level is exceeded
100
10
1
0.1
0.01
0.001
0.0001
1E-05
I/N
MODIFIED into EB-SAT-LEO-1B S-Band TYP-BAL4 (Latitude=0)
ORIGINAL into EB-SAT-LEO-1B S-Band TYP-BAL4 (Latitude=0)
MODIFIED into EB-SAT-LEO-1B S-Band TYP-LUT2 (Latitude=0)
ORIGINAL into EB-SAT-LEO-1B S-Band TYP-LUT2 (Latitude=0)
MODIFIED into EB-SAT-LEO-1B C-Band TYP-LUT6 (Latitude=0)
ORIGINAL into EB-SAT-LEO-1B C-Band TYP-LUT6 (Latitude=0)



For UT-S-6 antenna approximation close to earth station AP8 antenna pattern was used.

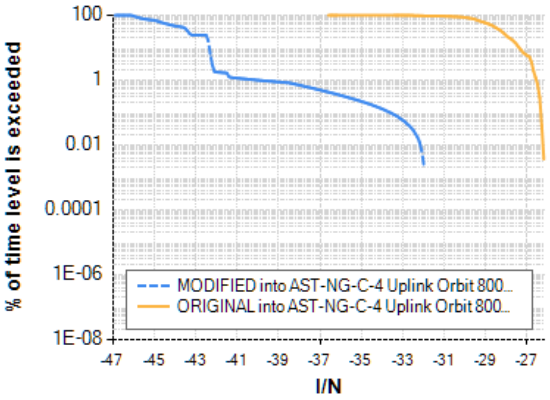


Dynamic simulation demonstrates that the level of I/N in modified parameters filing is well below the level of I/N produced by system with unmodified parameters. The worst-case is when I/N is calculated into 2170-2200 MHz receiving earth station having non-directional antenna pattern. In this case the difference between maximum I/N could be as less as 1 dB.

5.2. Space-to-space analysis

Normally interference in space-to-space direction would be negligible due to orbit separation and receiving or interfering transmitting antenna discrimination.

Included Space-to-Space analysis considers interference into 3 systems. However, because some systems like AST-NG-C-4 use several type of orbits (up-to 60) calculation was required to each type of orbit distinguished by orbit inclination and altitude.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ORIGINAL into AST-NG-C-4 Uplink Orbit 800...
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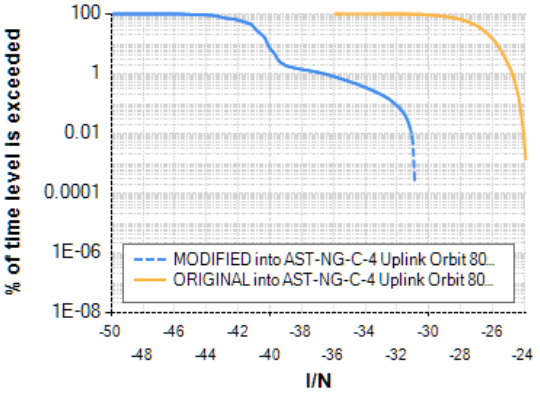
I/N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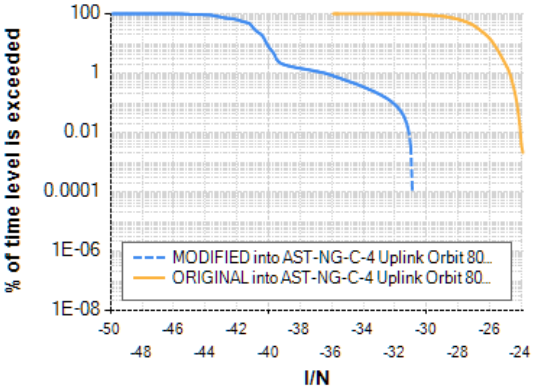
I/N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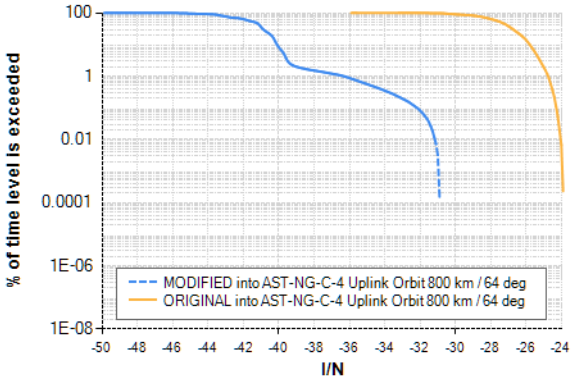
I/N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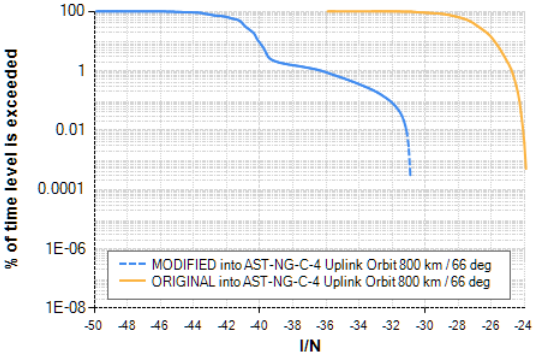
I/N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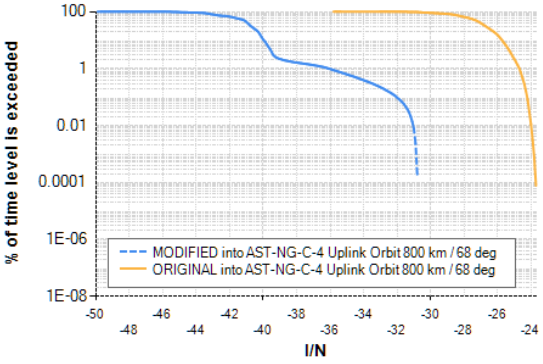
I/N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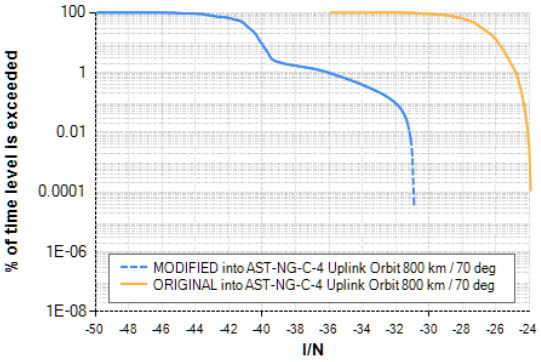
-48 -44 -40 -36 -32 -28 -24
I/N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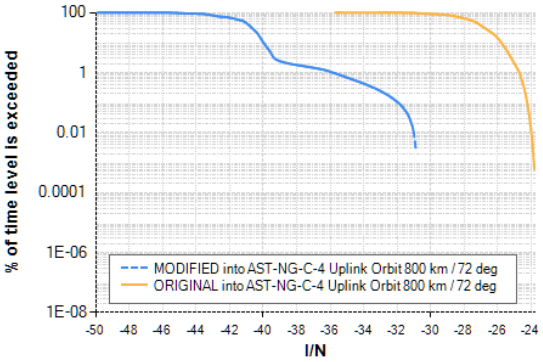
I/N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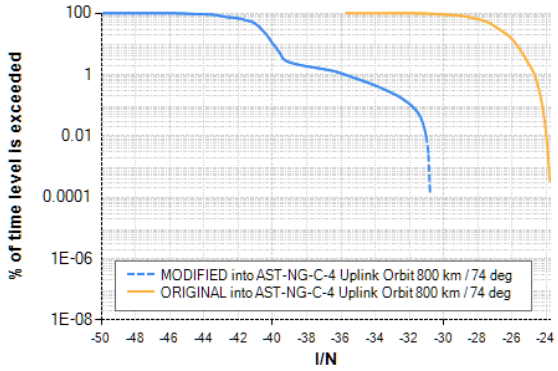
I/N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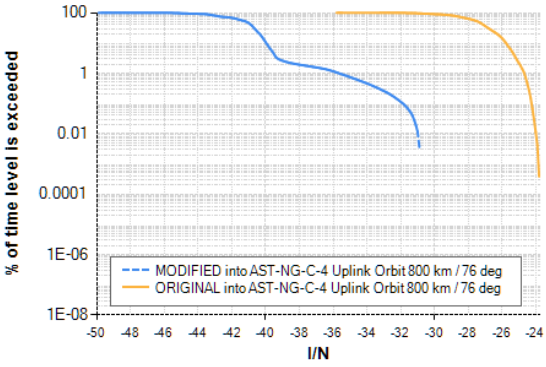
ORIGINAL into AST-NG-C-4 Uplink Orbit 800 km / 74 deg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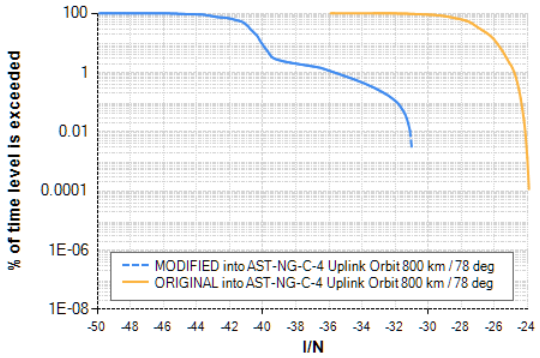
ORIGINAL into AST-NG-C-4 Uplink Orbit 800 km / 76 deg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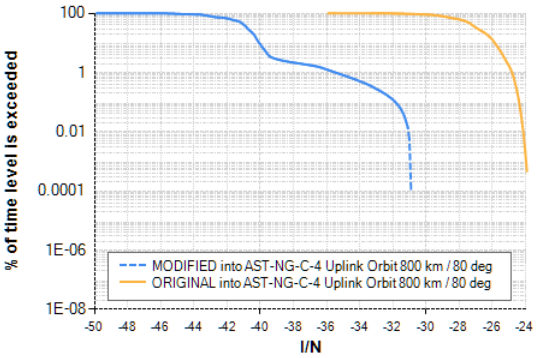
ORIGINAL into AST-NG-C-4 Uplink Orbit 800 km / 78 deg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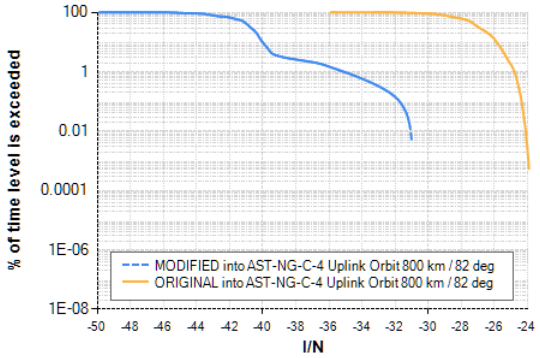
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I/N
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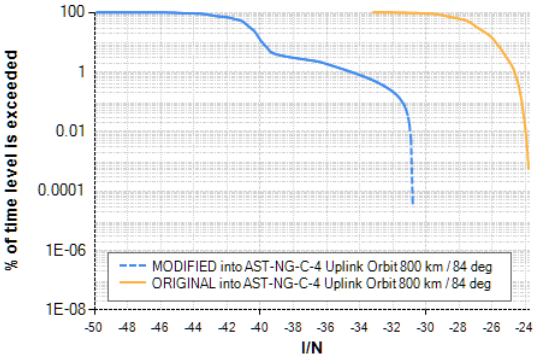
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I/N
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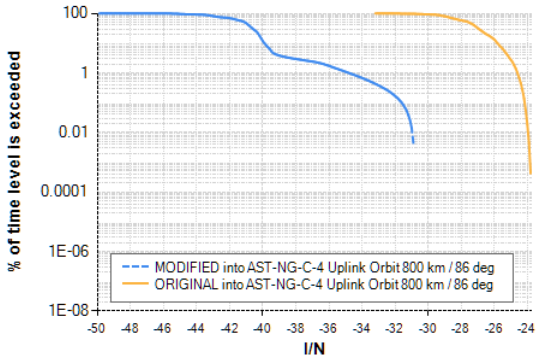
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I/N
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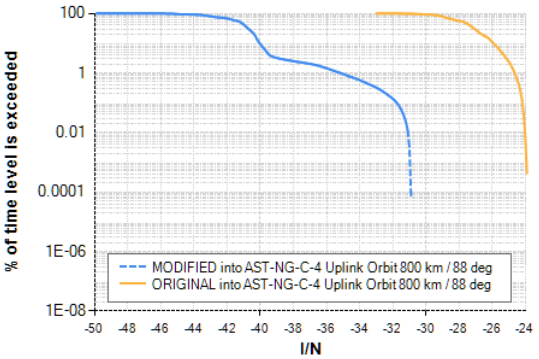
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I/N
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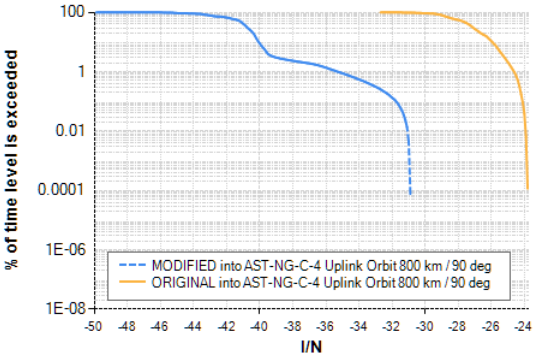
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I/N
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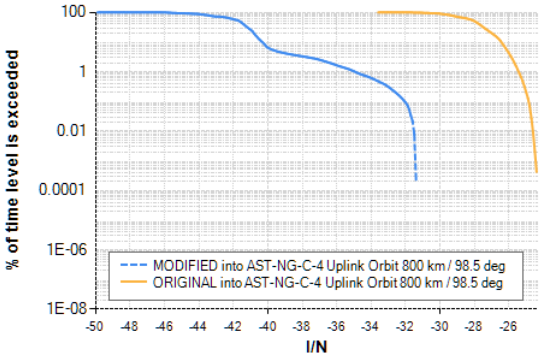
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1E-08
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I/N
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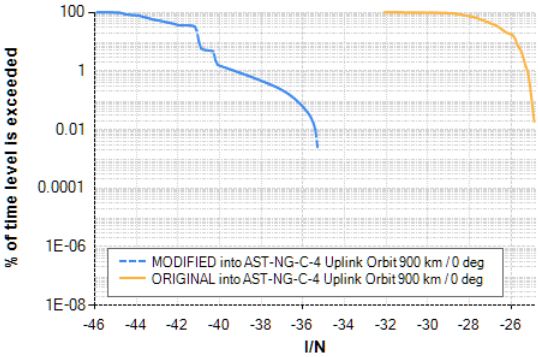
ORIGINAL into AST-NG-C-4 Uplink Orbit 800 km / 98.5 deg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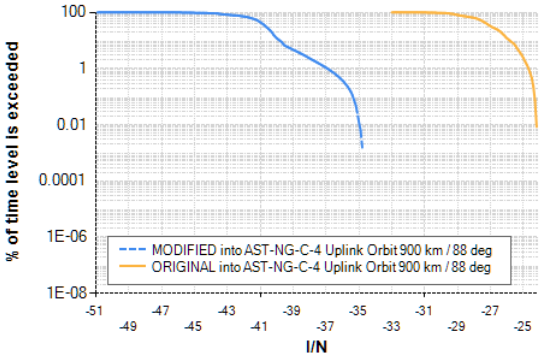
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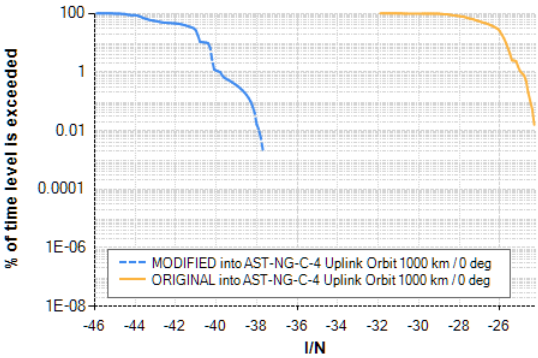
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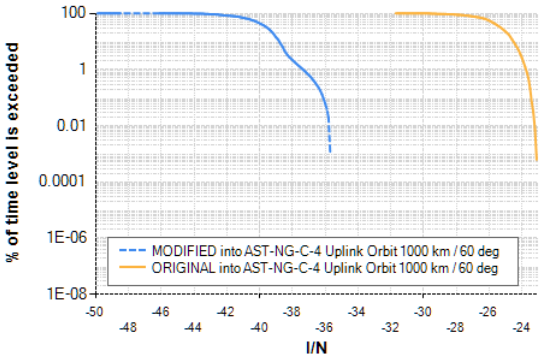
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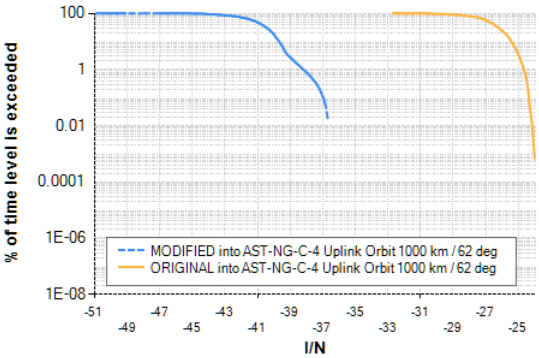
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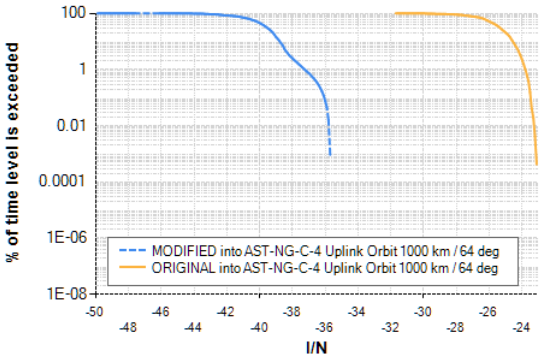
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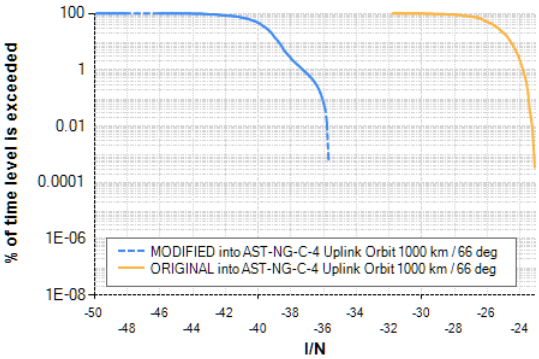
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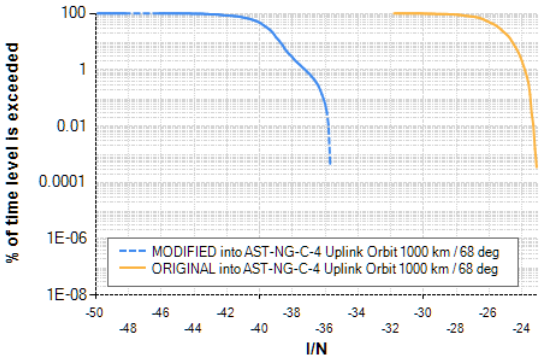
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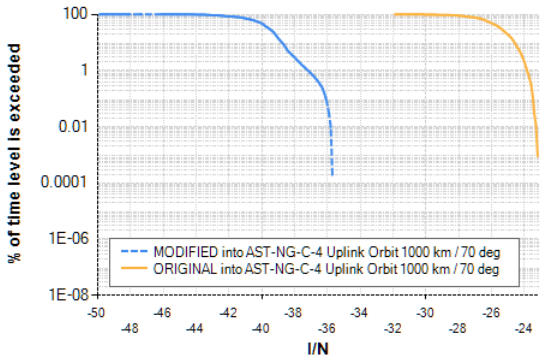
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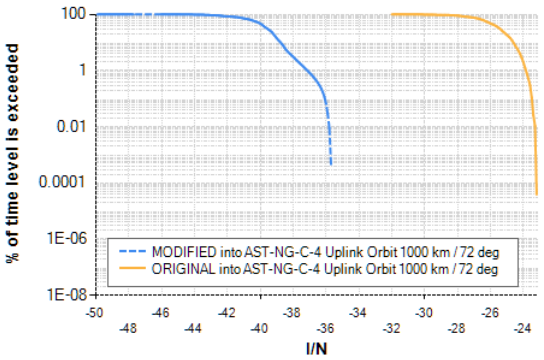
MODIFIED into AST-NG-C-4 Uplink Orbit 1000 km / 70 deg
ORIGINAL into AST-NG-C-4 Uplink Orbit 1000 km / 70 deg
-50 -48 -46 -44 -42 -40 -38 -36 -34 -32 -30 -28 -26 -24
I/N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MODIFIED into AST-NG-C-4 Uplink Orbit 1000 km / 72 deg
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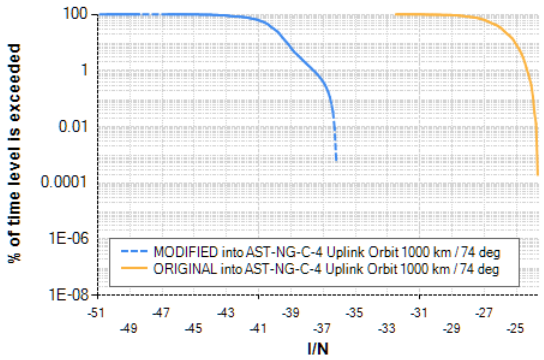
-50 -48 -46 -44 -42 -40 -38 -36 -34 -32 -30 -28 -26 -24
I/N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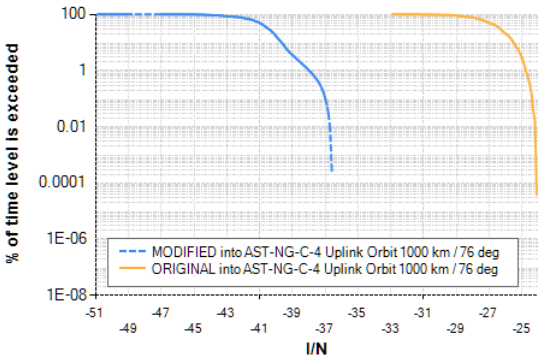
MODIFIED into AST-NG-C-4 Uplink Orbit 1000 km / 74 deg
ORIGINAL into AST-NG-C-4 Uplink Orbit 1000 km / 74 deg
-51 -49 -47 -45 -43 -41 -39 -37 -35 -33 -31 -29 -27 -25
I/N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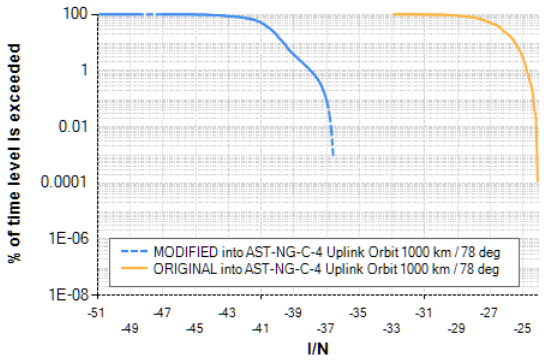
ORIGINAL into AST-NG-C-4 Uplink Orbit 1000 km / 76 deg
-51 -49 -47 -45 -43 -41 -39 -37 -35 -33 -31 -29 -27 -25
I/N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-51 -49 -47 -45 -43 -41 -39 -37 -35 -33 -31 -29 -27 -25
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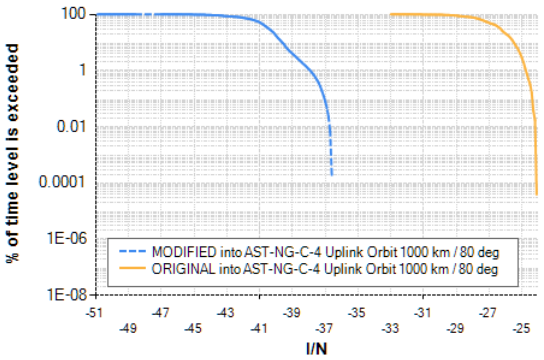
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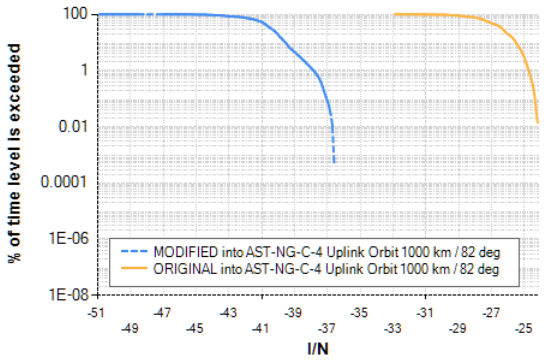
I/N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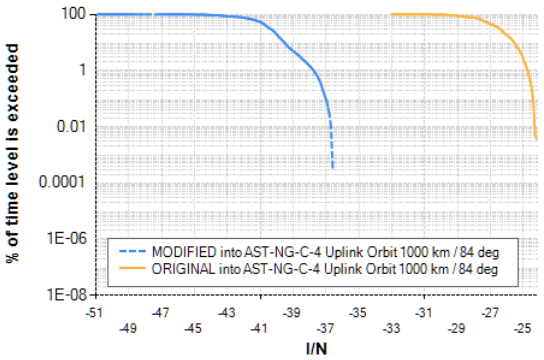
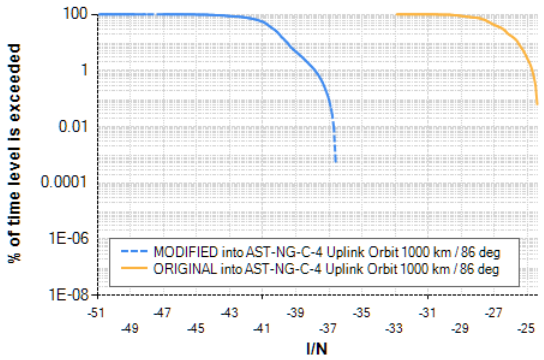
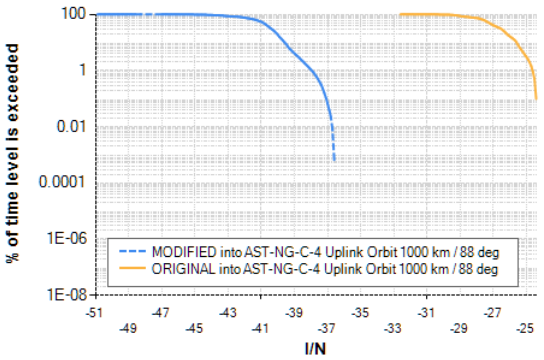
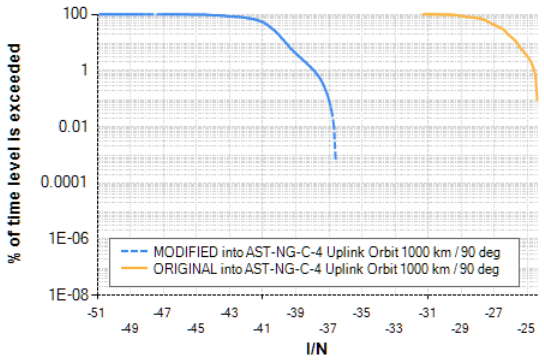
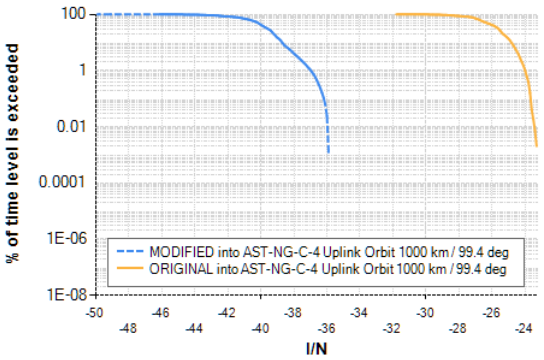
1E-08
MODIFIED into AST-NG-C-4 Uplink Orbit 1000 km / 82 deg
ORIGINAL into AST-NG-C-4 Uplink Orbit 1000 km / 82 deg
-51 -49 -47 -45 -43 -41 -39 -37 -35 -33 -31 -29 -27 -25
I/N

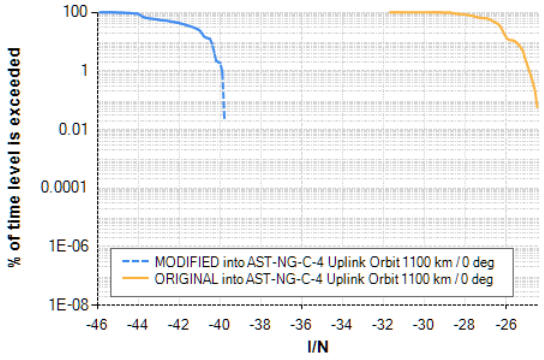

% of time level is exceeded
100
1
0.01
0.0001
1E-06
1E-08
MODIFIED into AST-NG-C-4 Uplink Orbit 1000 km / 84 deg
ORIGINAL into AST-NG-C-4 Uplink Orbit 1000 km / 84 deg
-51 -49 -47 -45 -43 -41 -39 -37 -35 -33 -31 -29 -27 -25
I/N

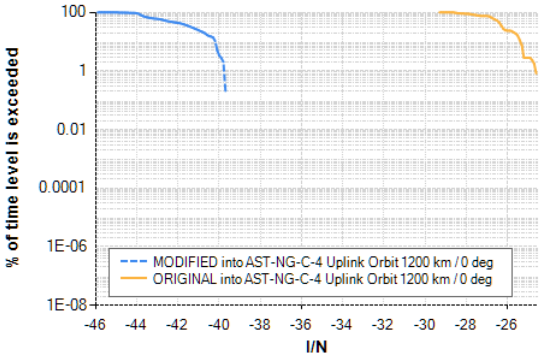

% of time level is exceeded
100
1
0.01
0.0001
1E-06
1E-08
MODIFIED into AST-NG-C-4 Uplink Orbit 1000 km / 86 deg
ORIGINAL into AST-NG-C-4 Uplink Orbit 1000 km / 86 deg
-51 -49 -47 -45 -43 -41 -39 -37 -35 -33 -31 -29 -27 -25
I/N

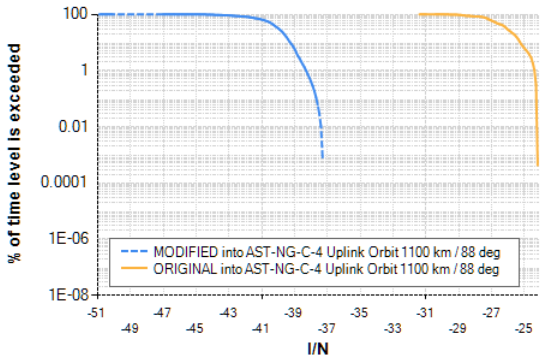

% of time level is exceeded
100
1
0.01
0.0001
1E-06
1E-08
MODIFIED into AST-NG-C-4 Uplink Orbit 1000 km / 88 deg
ORIGINAL into AST-NG-C-4 Uplink Orbit 1000 km / 88 deg
-51 -49 -47 -45 -43 -41 -39 -37 -35 -33 -31 -29 -27 -25
I/N

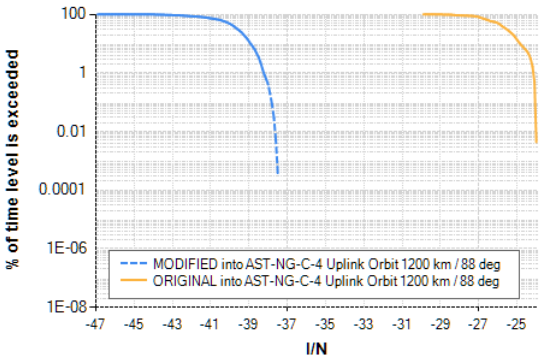

% of time level is exceeded
100
1
0.01
0.0001
1E-06
1E-08
MODIFIED into AST-NG-C-4 Uplink Orbit 1000 km / 90 deg
ORIGINAL into AST-NG-C-4 Uplink Orbit 1000 km / 90 deg
-51 -49 -47 -45 -43 -41 -39 -37 -35 -33 -31 -29 -27 -25
I/N

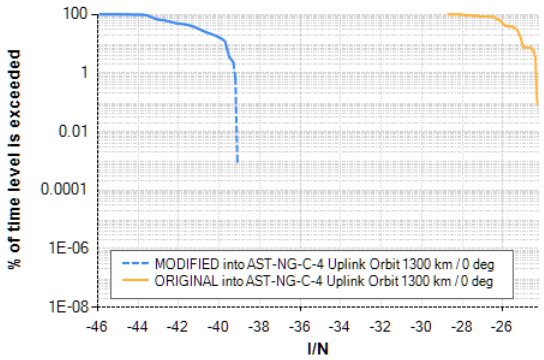

% of time level is exceeded
100
1
0.01
0.0001
1E-06
1E-08
MODIFIED into AST-NG-C-4 Uplink Orbit 1000 km / 99.4 deg
ORIGINAL into AST-NG-C-4 Uplink Orbit 1000 km / 99.4 deg
-50 -48 -46 -44 -42 -40 -38 -36 -34 -32 -30 -28 -26 -24
I/N

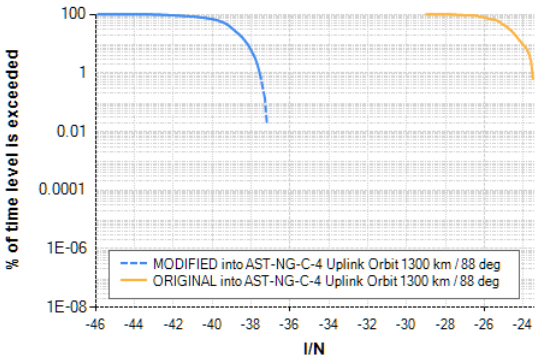

% of time level is exceeded
100
1
0.01
0.0001
1E-06
1E-08
MODIFIED into AST-NG-C-4 Uplink Orbit 1100 km / 0 deg
ORIGINAL into AST-NG-C-4 Uplink Orbit 1100 km / 0 deg
-46 -44 -42 -40 -38 -36 -34 -32 -30 -28 -26
I/N

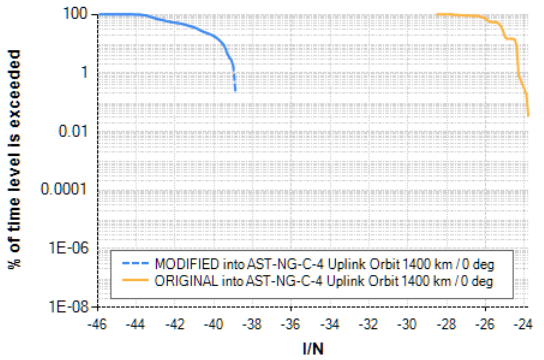

% of time level is exceeded
100
1
0.01
0.0001
1E-06
1E-08
MODIFIED into AST-NG-C-4 Uplink Orbit 1200 km / 0 deg
ORIGINAL into AST-NG-C-4 Uplink Orbit 1200 km / 0 deg
-46 -44 -42 -40 -38 -36 -34 -32 -30 -28 -26
I/N

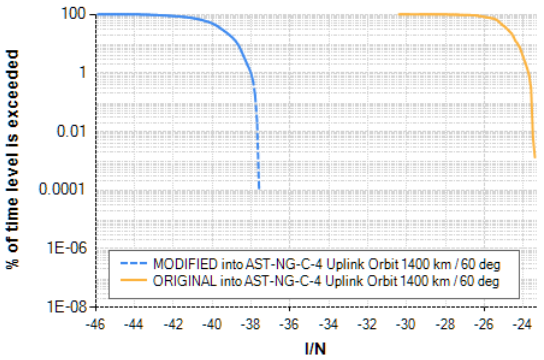

% of time level is exceeded
100
1
0.01
0.0001
1E-06
1E-08
-51 -49 -47 -45 -43 -41 -39 -37 -35 -33 -31 -29 -27 -25
I/N
MODIFIED into AST-NG-C-4 Uplink Orbit 1100 km / 88 deg
ORIGINAL into AST-NG-C-4 Uplink Orbit 1100 km / 88 deg

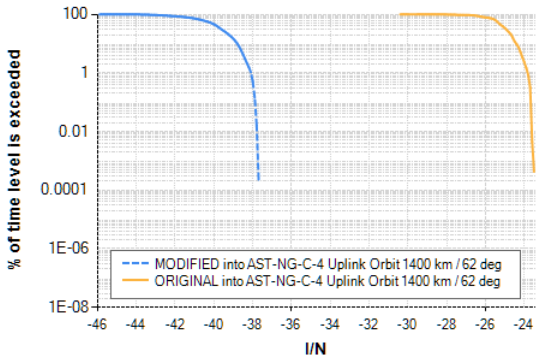

% of time level is exceeded
100
1
0.01
0.0001
1E-06
1E-08
-47 -45 -43 -41 -39 -37 -35 -33 -31 -29 -27 -25
I/N
MODIFIED into AST-NG-C-4 Uplink Orbit 1200 km / 88 deg
ORIGINAL into AST-NG-C-4 Uplink Orbit 1200 km / 88 deg

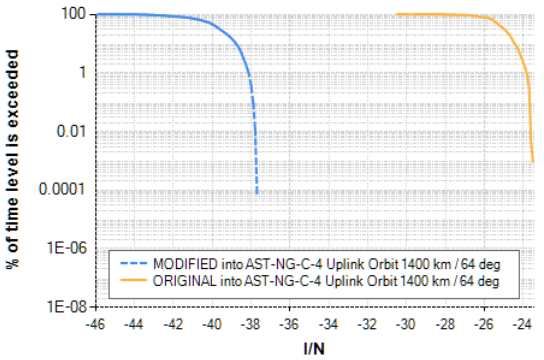

% of time level is exceeded
100
1
0.01
0.0001
1E-06
1E-08
-46 -44 -42 -40 -38 -36 -34 -32 -30 -28 -26
I/N
MODIFIED into AST-NG-C-4 Uplink Orbit 1300 km / 0 deg
ORIGINAL into AST-NG-C-4 Uplink Orbit 1300 km / 0 deg

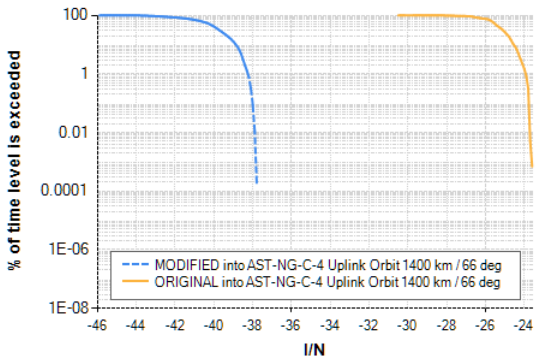

% of time level is exceeded
100
1
0.01
0.0001
1E-06
1E-08
-46 -44 -42 -40 -38 -36 -34 -32 -30 -28 -26 -24
I/N
MODIFIED into AST-NG-C-4 Uplink Orbit 1300 km / 88 deg
ORIGINAL into AST-NG-C-4 Uplink Orbit 1300 km / 88 deg

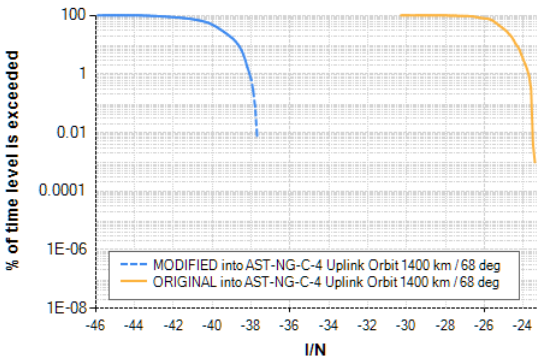

% of time level is exceeded
100
1
0.01
0.0001
1E-06
1E-08
-46 -44 -42 -40 -38 -36 -34 -32 -30 -28 -26 -24
I/N
MODIFIED into AST-NG-C-4 Uplink Orbit 1400 km / 0 deg
ORIGINAL into AST-NG-C-4 Uplink Orbit 1400 km / 0 deg

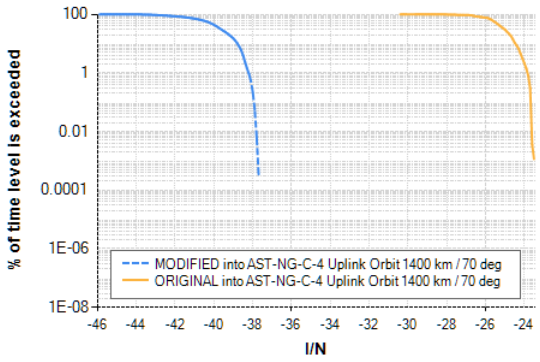

% of time level is exceeded
100
1
0.01
0.0001
1E-06
1E-08
-46 -44 -42 -40 -38 -36 -34 -32 -30 -28 -26 -24
I/N
MODIFIED into AST-NG-C-4 Uplink Orbit 1400 km / 60 deg
ORIGINAL into AST-NG-C-4 Uplink Orbit 1400 km / 60 deg

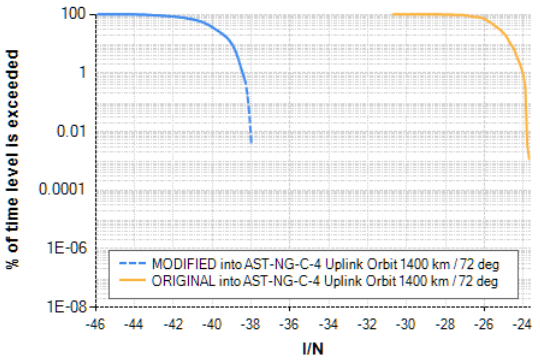

% of time level is exceeded
100
1
0.01
0.0001
1E-06
1E-08
-46 -44 -42 -40 -38 -36 -34 -32 -30 -28 -26 -24
I/N
MODIFIED into AST-NG-C-4 Uplink Orbit 1400 km / 62 deg
ORIGINAL into AST-NG-C-4 Uplink Orbit 1400 km / 62 deg

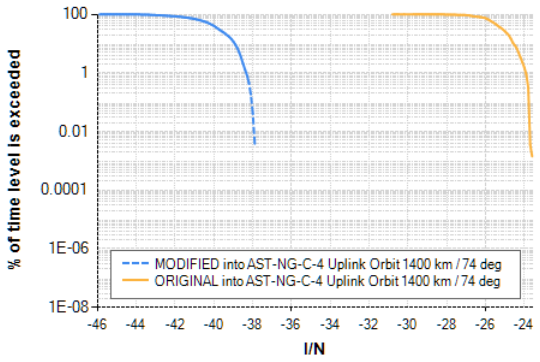

% of time level is exceeded
100
1
0.01
0.0001
1E-06
1E-08
-46 -44 -42 -40 -38 -36 -34 -32 -30 -28 -26 -24
I/N
MODIFIED into AST-NG-C-4 Uplink Orbit 1400 km / 64 deg
ORIGINAL into AST-NG-C-4 Uplink Orbit 1400 km / 64 deg

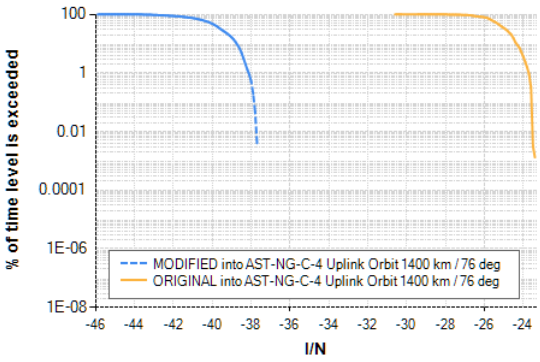

% of time level is exceeded
100
1
0.01
0.0001
1E-06
1E-08
-46 -44 -42 -40 -38 -36 -34 -32 -30 -28 -26 -24
I/N
MODIFIED into AST-NG-C-4 Uplink Orbit 1400 km / 66 deg
ORIGINAL into AST-NG-C-4 Uplink Orbit 1400 km / 66 deg

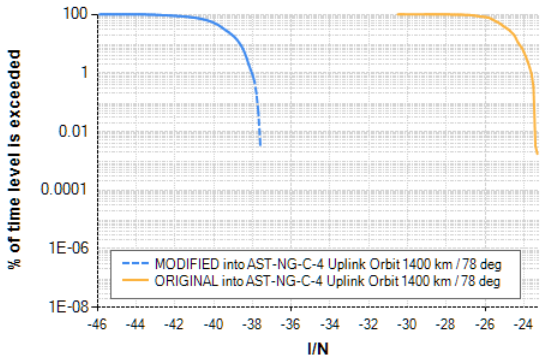

% of time level is exceeded
100
1
0.01
0.0001
1E-06
1E-08
-46 -44 -42 -40 -38 -36 -34 -32 -30 -28 -26 -24
I/N
MODIFIED into AST-NG-C-4 Uplink Orbit 1400 km / 68 deg
ORIGINAL into AST-NG-C-4 Uplink Orbit 1400 km / 68 deg

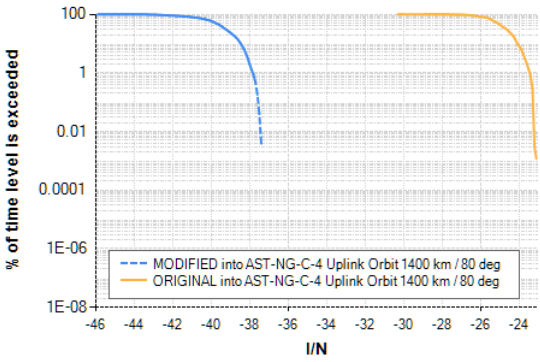

% of time level is exceeded
100
1
0.01
0.0001
1E-06
1E-08
-46 -44 -42 -40 -38 -36 -34 -32 -30 -28 -26 -24
I/N
MODIFIED into AST-NG-C-4 Uplink Orbit 1400 km / 70 deg
ORIGINAL into AST-NG-C-4 Uplink Orbit 1400 km / 70 deg

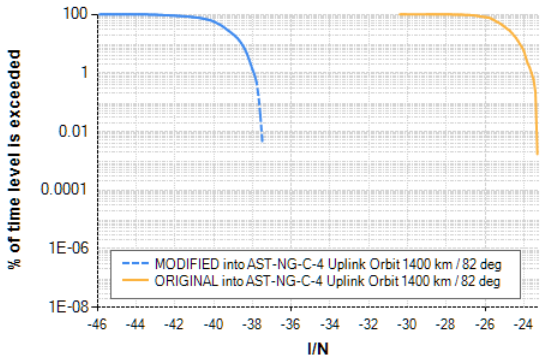

% of time level is exceeded
100
1
0.01
0.0001
1E-06
1E-08
-46 -44 -42 -40 -38 -36 -34 -32 -30 -28 -26 -24
I/N
MODIFIED into AST-NG-C-4 Uplink Orbit 1400 km / 72 deg
ORIGINAL into AST-NG-C-4 Uplink Orbit 1400 km / 72 deg

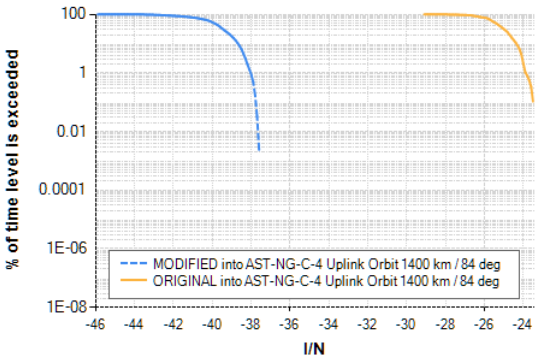

% of time level is exceeded
100
1
0.01
0.0001
1E-06
1E-08
-46 -44 -42 -40 -38 -36 -34 -32 -30 -28 -26 -24
I/N
MODIFIED into AST-NG-C-4 Uplink Orbit 1400 km / 74 deg
ORIGINAL into AST-NG-C-4 Uplink Orbit 1400 km / 74 deg

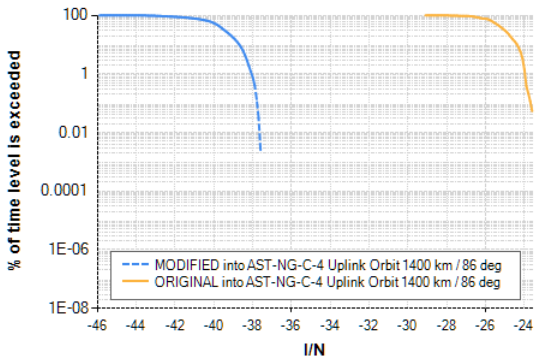

% of time level is exceeded
100
1
0.01
0.0001
1E-06
1E-08
-46 -44 -42 -40 -38 -36 -34 -32 -30 -28 -26 -24
I/N
MODIFIED into AST-NG-C-4 Uplink Orbit 1400 km / 76 deg
ORIGINAL into AST-NG-C-4 Uplink Orbit 1400 km / 76 deg

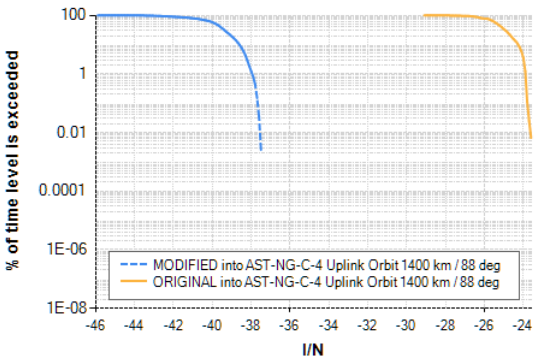

% of time level is exceeded
100
1
0.01
0.0001
1E-06
1E-08
-46 -44 -42 -40 -38 -36 -34 -32 -30 -28 -26 -24
I/N
MODIFIED into AST-NG-C-4 Uplink Orbit 1400 km / 78 deg
ORIGINAL into AST-NG-C-4 Uplink Orbit 1400 km / 78 deg

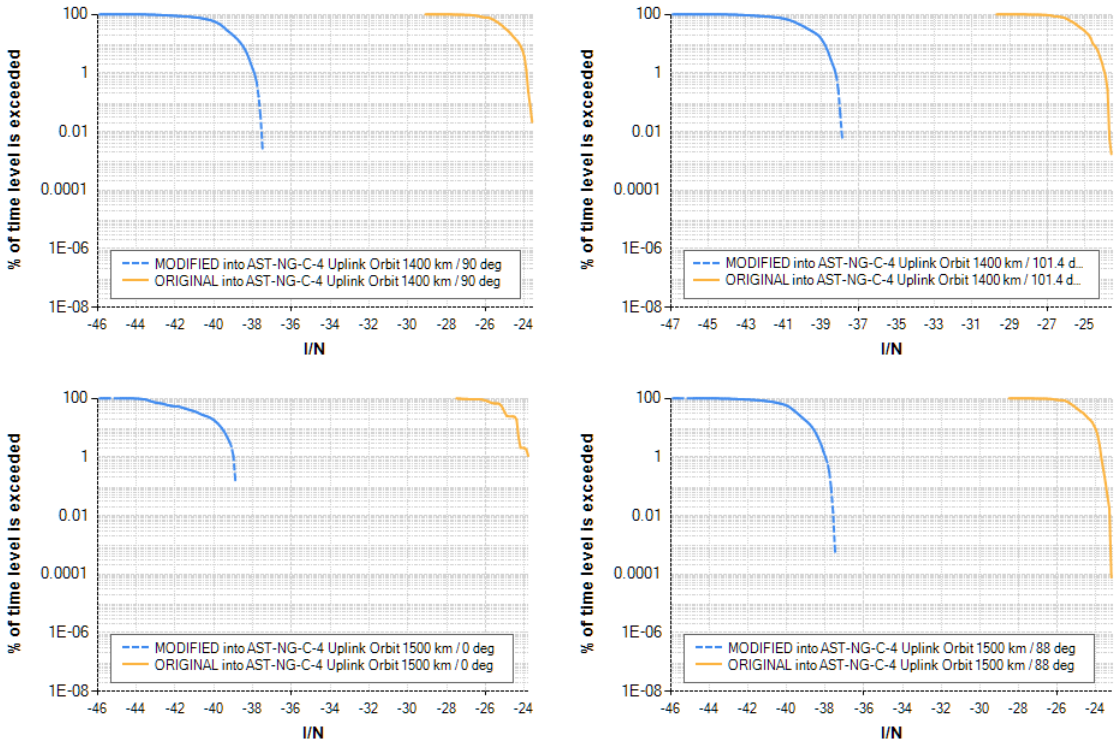

% of time level is exceeded
100
1
0.01
0.0001
1E-06
1E-08
-46 -44 -42 -40 -38 -36 -34 -32 -30 -28 -26 -24
I/N
MODIFIED into AST-NG-C-4 Uplink Orbit 1400 km / 80 deg
ORIGINAL into AST-NG-C-4 Uplink Orbit 1400 km / 80 deg


% of time level is exceeded
100
1
0.01
0.0001
1E-06
1E-08
-46 -44 -42 -40 -38 -36 -34 -32 -30 -28 -26 -24
I/N
MODIFIED into AST-NG-C-4 Uplink Orbit 1400 km / 82 deg
ORIGINAL into AST-NG-C-4 Uplink Orbit 1400 km / 82 deg


% of time level is exceeded
100
1
0.01
0.0001
1E-06
1E-08
-46 -44 -42 -40 -38 -36 -34 -32 -30 -28 -26 -24
I/N
MODIFIED into AST-NG-C-4 Uplink Orbit 1400 km / 84 deg
ORIGINAL into AST-NG-C-4 Uplink Orbit 1400 km / 84 deg

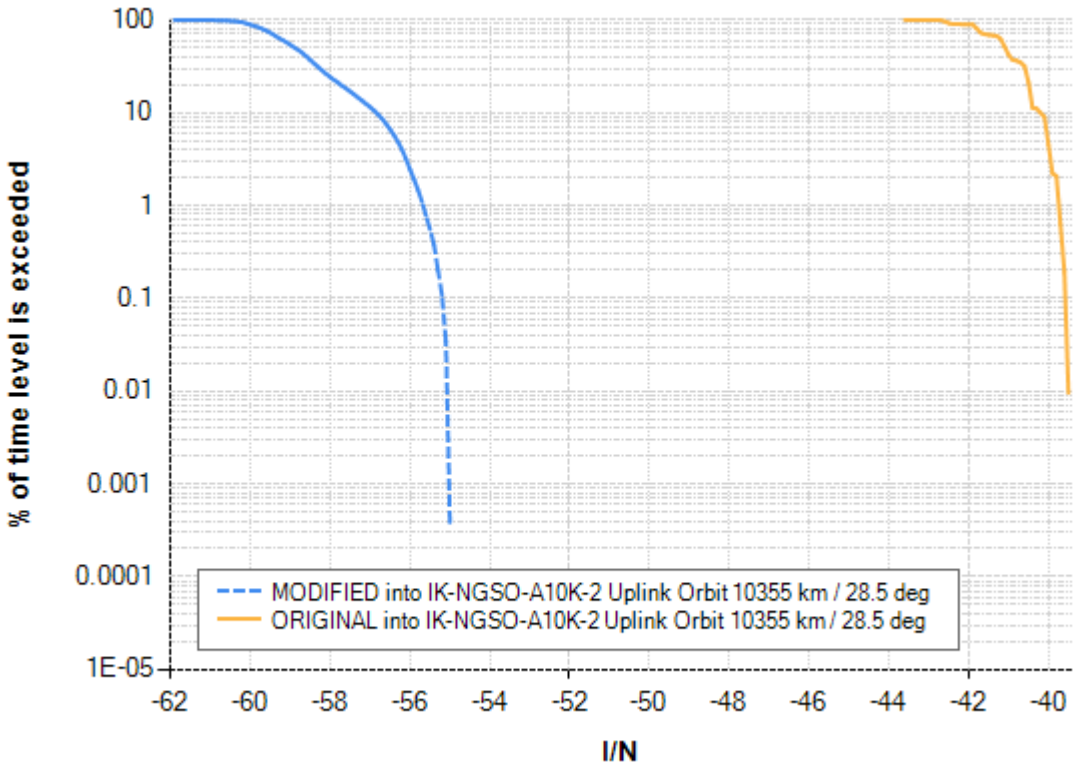

% of time level is exceeded
100
1
0.01
0.0001
1E-06
1E-08
-46 -44 -42 -40 -38 -36 -34 -32 -30 -28 -26 -24
I/N
MODIFIED into AST-NG-C-4 Uplink Orbit 1400 km / 86 deg
ORIGINAL into AST-NG-C-4 Uplink Orbit 1400 km / 86 deg

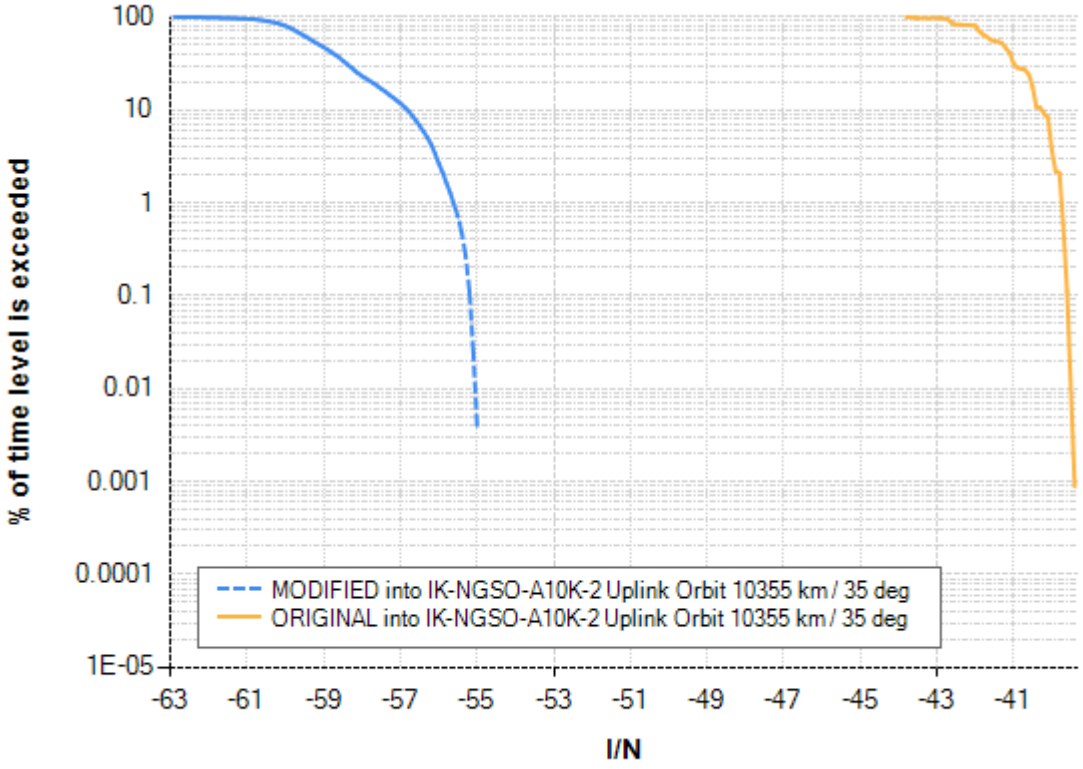

% of time level is exceeded
100
1
0.01
0.0001
1E-06
1E-08
-46 -44 -42 -40 -38 -36 -34 -32 -30 -28 -26 -24
I/N
MODIFIED into AST-NG-C-4 Uplink Orbit 1400 km / 88 deg
ORIGINAL into AST-NG-C-4 Uplink Orbit 1400 km / 88 deg

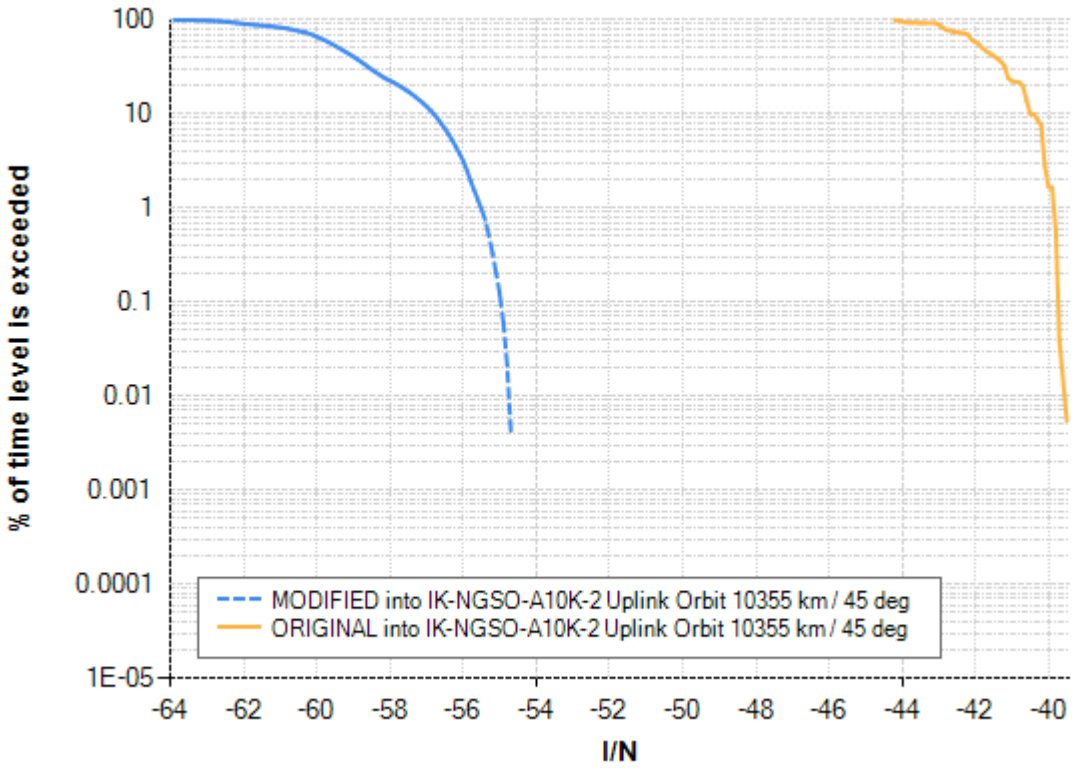


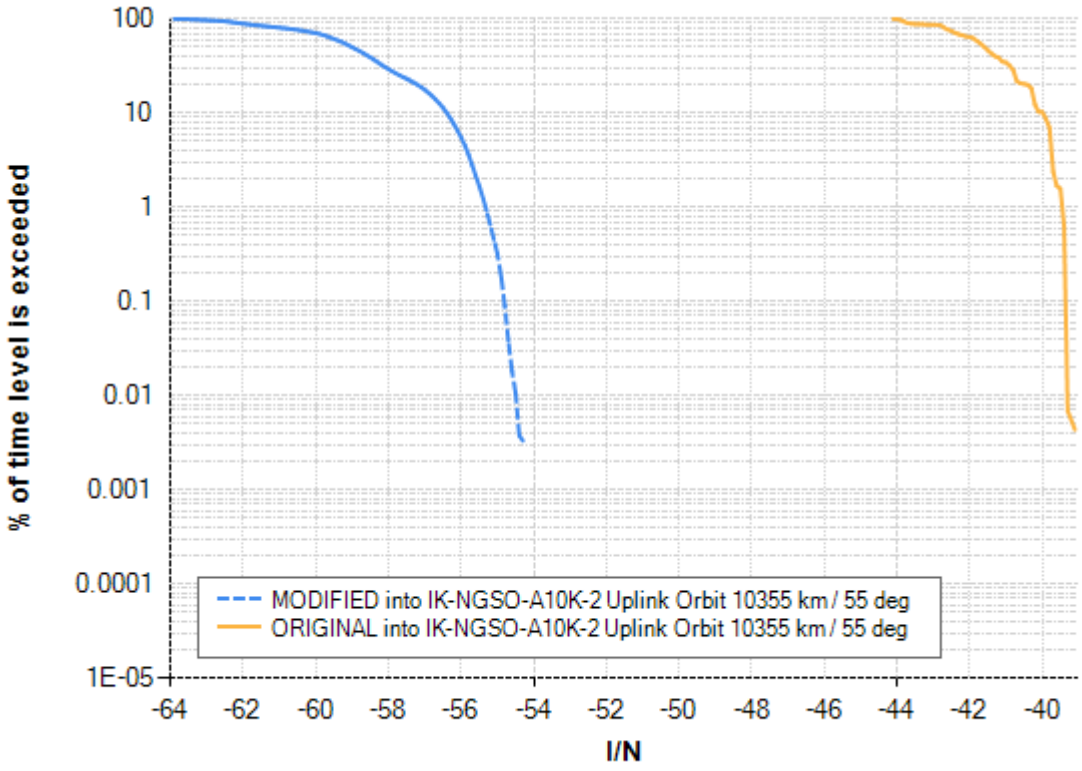
These results demonstrate very low level of I/N.

Results for IK-NGSO-A10K-2 are provided for different orbit inclinations of IK-NGSO-A10K-2.

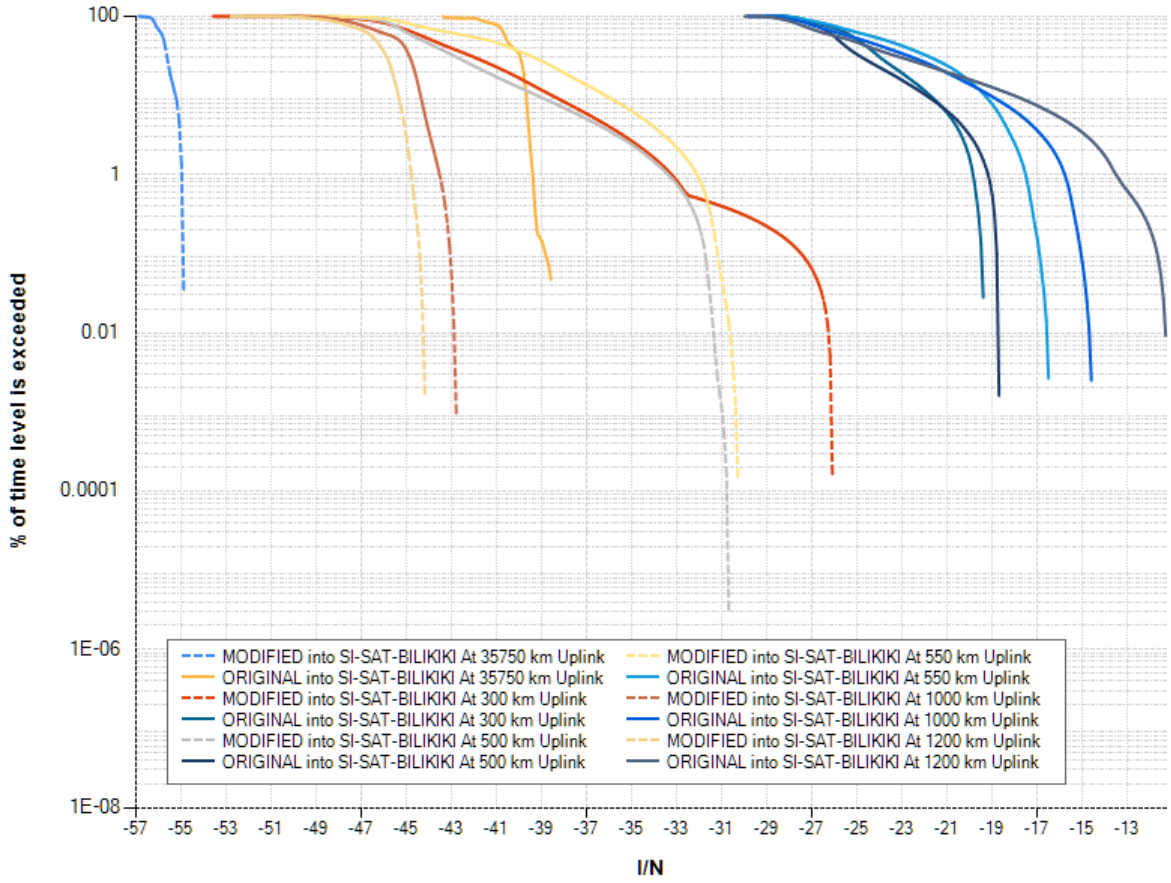

100
10
1
0.1
0.01
0.001
0.0001
1E-05
% of time level is exceeded
-62
-60
-58
-56
-54
-52
-50
-48
-46
-44
-42
-40
I/N
MODIFIED into IK-NGSO-A10K-2 Uplink Orbit 10355 km / 28.5 deg
ORIGINAL into IK-NGSO-A10K-2 Uplink Orbit 10355 km / 28.5 deg


100
10
1
0.1
0.01
0.001
0.0001
1E-05
% of time level is exceeded
-63
-61
-59
-57
-55
-53
-51
-49
-47
-45
-43
-41
I/N
MODIFIED into IK-NGSO-A10K-2 Uplink Orbit 10355 km / 35 deg
ORIGINAL into IK-NGSO-A10K-2 Uplink Orbit 10355 km / 35 deg





Medium earth orbit used in IK-NGSO-A10K-2 is significantly more susceptible to interference from SIRION-1 2000 km orbit.



5.3. Uplink analysis

For the uplink analysis decreased visibility statistics for SIRION-1 constellation would generally decrease the number and duration of earth station transmissions, this would mean that for same level of produced I/N, the probability of this level of I/N would be lower.

Also, modified uplink EIRP in 1980-2025 MHz provided in section 1 demonstrates the decreased level of potential interference, whether SIRION-1 earth station could have tracking or fixed pointing antenna.

Dynamic analysis is confirmed by analysis carried out in section for GSO networks, which demonstrated that dynamic EPFD calculation follows EIRP mask pattern.

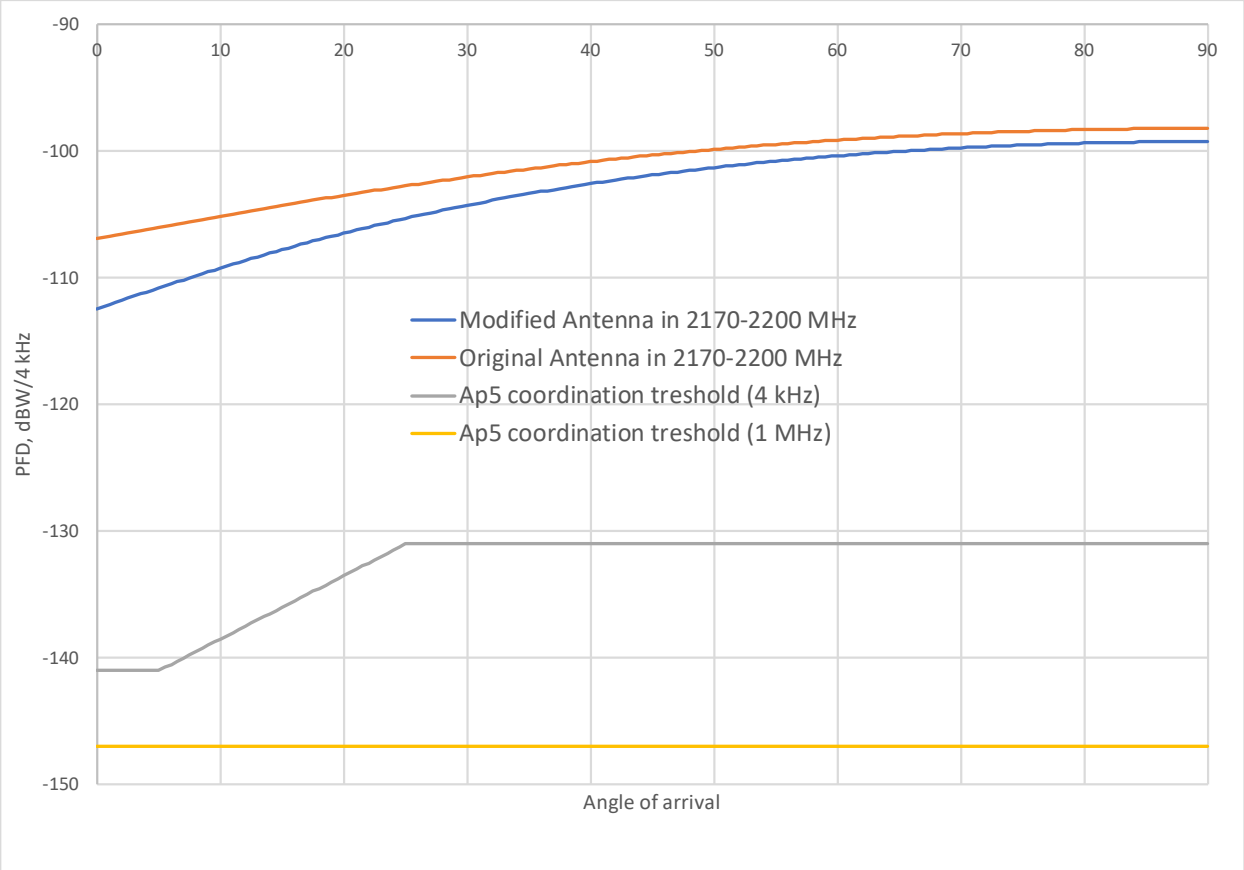
According to Recommendation S. 1503-2, a low angular velocity (corresponding to orbit altitude of 2000 km) will result in higher likelihoods of interference. Therefore, lower altitude is increasing angular velocity of the satellites and further provide the benefit for sharing.

5.4. Downlink analysis under No. 9.14

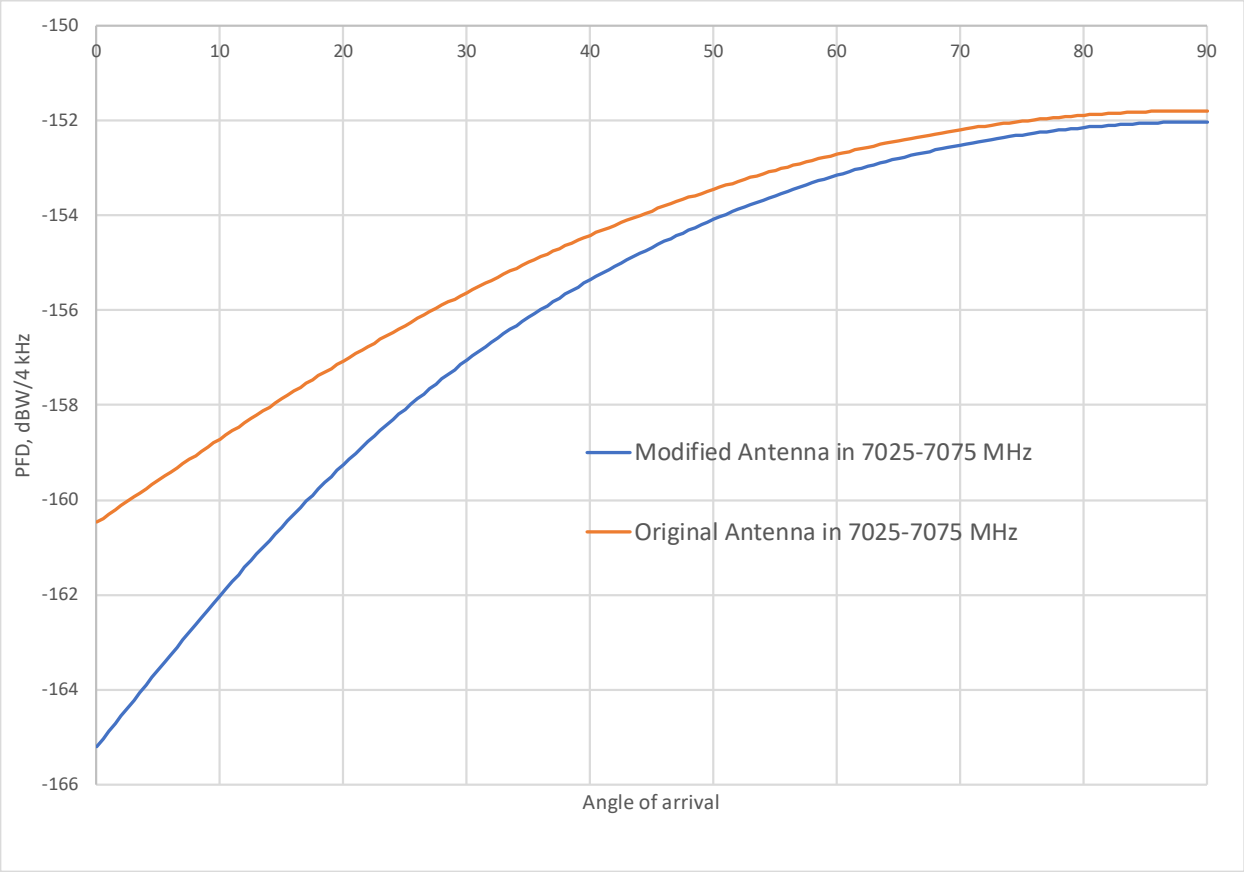
For 2170-2200 MHz where coordination threshold exists in Appendix 5, Annex 1 both original publication and modified one will exceed coordination thresholds. Produced PFD masks below are based on fixed beam orientation with maximum pointing at nadir.

Purpose of the dynamic PFD analysis provided in section 3 is to demonstrate that even while exceeding coordination thresholds, all terrestrial stations notified after original publication of

SIRION-1 would not receive more interference from modified SIRION-1 as compared to original one. Thus, condition of paragraph 2.3.1 of the Rules of procedures for No. 9.27 is met.



In the band 7025-7075 MHz, the document provides similar analysis even though there is no requirement to coordinate with terrestrial services and they are protected through hard-limit in Article 21.



6. Conclusion

The aim of provided analysis was to demonstrate that modification of parameters to SIRION-1 filing would improve interference environment involving co-frequency sharing with terrestrial services, GSO networks and non-GSO systems.

In each of the case, the level of interference produced by this modification is lower as compared to originally filed parameters.

Moreover, coordination requirements are not affected following the guidance of Rules of Procedures under No. 9.27.