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SUBJECTIVE EVALUATION OF THE EFFECT OF NOISE AND INTERFERENCE ON FREQUENCY MODULATED NTSC TELEVISION SIGNALS

by

M. Bouchard and G. Chouinard
and
R. Trenholm

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M. Bouchard and G. Chouinard
(Space Technology and Application Branch)
and
R. Trenholm
(Canadian Radio-Television and Telecommunications Commission)

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ABSTRACT

The future environment of broadcasting satellites may well be governed by the limiting factor of interference between television signals from neighbouring satellites. A program of tests was performed to evaluate subjectively the effect of aggregate interference and/or noise on the impairment of television pictures. Up to four interfering channels were added in an environment resembling that of future broadcasting satellite systems including up to two co-frequency channels and up to two adjacent channels. Also results of just-perceptible interference tests due to adjacent channel interferer at various intercarrier spacings and for different receive filter characteristics on the wanted signal path are presented. The results of these tests are considered valuable in the study of the quality standard for the RARC-83 for the planning of the broadcasting-satellite service.

1. INTRODUCTION

In 1983, a Regional Administrative Radio Conference, RARC-83, was convened for the planning of the broadcasting-satellite service at 12 GHz and the associated feeder links at 17 GHz in ITU Region 2 (the Americas). A similar Conference, the World Administration Radio Conference, was held in 1977 for the planning of the service in the rest of the world.

The conference established a plan based on values for key system parameters selected to achieve a given service quality. Intensive subjective measurement programs were conducted before this conference. The results of the Canadian measurement program presented in this report were used at the conference in the establishment of the system parameters to potentially allow for an appropriate picture quality. The required values for protection against the effect of noise and interference on frequency modulated NTSC television signals can best be determined from the subjective assessment of their effect on picture quality in an environment which resembles that expected for multiple broadcasting satellites sharing the orbit.

A series of tests were performed in Canada to determine the effect of noise and/or interference on television signals. Related tests were made previously in Canada using a different methodology and are reported by Loo [1]. The present tests in a similar context for satellite broadcasting as the TASO[2] tests were conducted in the late 1950's for terrestrial broadcasting. Results from tests conducted in the USA relating to interference between FM/TV signals were reported lately[3]. CCIR Report 634[4] summarizes the results of different studies related to interference from different types of transmission into frequency modulated television signals.

The goals of the tests reported here were:

- to assess the effect of thermal noise on picture quality
- to assess the effect of single-entry co-channel interference on picture quality
- to assess the effect of adjacent channel interference on picture quality
- to assess the effect of picture content and motion on observer's subjective grading
- to assess the level of just-perceptible interference due to non co-channel interferers as a function of frequency offset, wanted signal deviation, and receive filter characteristics.

The results reported here are part of a wider program concerned with the subjective assessment of the quality of television signals. In these tests, NTSC coded signals were used to frequency modulate the carriers. In future tests, the effect of noise and interference on time-multiplexed colour and luminance signals will be subjectively evaluated.

The subjective assessment tests were conducted using 4 groups of observers presented with different test conditions.

2. EQUIPMENT SET-UP

The equipment set-up is outlined in Figure 1. It is basically constructed around a wanted signal path to which thermal noise and up to four interfering signals can be added. The frequency of each interfering signal can be adjusted to correspond to co-channel or adjacent channel interference. The frequency conversion from the first Intermediate Frequency (IF) of 70 MHz to a second IF around 500 MHz facilitated this frequency change.

For the purposes of the tests, the frequency adjustment as well as the level of each interferer had to be set within 15 seconds. The frequency change was performed by connecting different local oscillators to the first frequency converters (mixers) in the interfering signal paths. This connection was made using a patch panel. The levels of insertion of noise and interference were adjusted with calibrated attenuators.

The NTSC video signal of the wanted path was obtained from a telecine chain for the test slides and a 1" type "C" video-tape recorder for the moving scenes. The weighted* signal-to-noise ratio (S/N_w) measured from the telecine chain was 56 dB, and from the video-tape recorder, it was 51 dB. The video signals of the interfering paths were off-air signals obtained from four professional AM-VSB demodulators and had no synchronization relationship with the wanted signal or with each other.

The receiver pre-detection filter was a non-equalized 4-pole Chebychev type filter at 70 MHz having an equivalent noise bandwidth of 22.7 MHz. The amplitude response and group-delay characteristic of this filter are shown in Figure 2. A peak-to-peak carrier deviation of 9.52 MHz for a 1V peak-to-peak composite video signal was used to obtain a 30 dB FM improvement including weighting and pre-emphasis such that a S/N_w= 42 dB was available for a carrier-to-noise ratio of 12 dB. The standard pre-emphasis, as specified in CCIR Recommendation 405[6] for System M/NTSC, was used.

Two unmodulated sound sub-carriers, at 5.41 MHz and 5.79 MHz, were added to the video signal in both the wanted and interfering paths. The deviation of the main carrier by each sound sub-carrier was adjusted to 2 MHz peak-to-peak. Considering 5.79 MHz as the top baseband frequency, the Carson bandwidth is 21.1 MHz resulting in a 7.6% extra bandwidth in the receive filter for sound sub-carriers. An equalized video filter was inserted after demodulation to reject these two sound sub-carriers. No artificial energy dispersal was used.

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* The CCIR unified weighting for 525-line systems and 4.2 MHz video bandwidth was assumed [5]

The video synchronization was re-inserted before being sent to the picture monitor to allow for possible recording of the test sequences. This synchronization re-insertion was found to have no effect on picture quality.

All pieces of equipment used in this set-up had been aligned for best performance giving the following nominal overall performance for the wanted video path of the set-up alone:

S/N_W	$\geq$	60 dB
Differential Gain	$<$	3%
Differential Phase	$<$	3°
2T K-factor	$<$	2%

A calibration routine was performed every morning before the start of the tests.

Special attention was paid to the viewing room set-up where a standard resolution professional picture monitor was placed in front of a white wall illuminated at 15% of the monitor maximum brightness (20 foot lamberts or 68.5 cd/m^2) with a white lamp of proper colour temperature. Steps were taken in the setting up of the viewing room to remove any shadow or reflection on the screen. The colour rendition as well as the brightness of the picture monitor were calibrated using a D6500K reference colour comparator.

3. TEST PROCEDURES

The test method and procedures were based on those given in CCIR Report 405-4 [7] and in CCIR Recommendations 500-2 [8] and 600 [9]. The test using slides was composed of three 30 minute sessions separated by a 10 to 20 minute rest period and the test using scenes with motion was composed of two 30 minute sessions separated by the same rest period. Except for one case to be discussed later, a maximum of four viewers were allowed to take the test simultaneously. The viewers were seated at a distance 5 times the picture height from the screen and the viewing angle was no greater than 30 degrees. Although no pre-selection had been applied, most of the viewers had a technical background. In one case only, using expert viewers (broadcasters), 14 viewers were seated in three rows in front of the picture monitor. In this case, the distance from the screen ranged from 4 to 7 times the picture height and the viewing angle exceeded 30°.

At the start of the test, each group was given a verbal introduction describing the purpose of the test, and the full range of impairments to be expected was shown for the 3 types of impairment: noise, co-channel interference and adjacent channel interference. The text of this verbal introduction appears in Appendix A. The test slide "Make-up scene" (Philips #14) was used for the introduction. The verbal introduction was followed by 10 presentations of the "Make up scene" at various levels of impairment. Observers were asked to grade these 10 pictures but were told that the scores would not be included in the analysis of the results. The introduction was only given at the start of the first session. The visual acuity of each observer was recorded and was used to help explain possible inconsistencies in the results.

It was found later that, within a reasonable range of visual acuity (20/30 or better), visual acuity does not seem to have a direct relationship to the viewer's consistency in rating the level of picture impairment.

The population of observers comprised 3 groups of "concerned" viewers and 1 group of "expert" viewers. The "concerned" viewers, as opposed to the "average" viewers, were considered to have a relatively broad knowledge of communication satellite systems and realize the purpose of these tests. The "expert" viewers were broadcasters whose work involves evaluation of television picture quality. These groups were:

Group "A" = Group consisted of "concerned" viewers who assessed the level of picture impairment caused by noise in the range of weighted signal-to-noise ratio (S/N_W) between 38 dB and 56 dB and interference in the range of co-channel carrier-to-interference ratio (C/I) between 3 dB and 30 dB using three still pictures as the wanted signal.

Group "B" = Group consisted of "concerned" viewers who assessed the level of picture impairment caused by noise in the same range as above and interference in the range of co-channel C/I between 13 dB and 40 dB using three still pictures as the wanted signal, i.e. this group was presented with levels of interference 10 dB lower than the previous group.

Group "C" = Group consisted of "concerned" viewers who assessed the level of picture impairment caused by noise and interfernce using two moving scenes as the wanted signal. The same levels of interference as Group "A" were presented (i.e. C/I between 3 to 30 dB).

Group "D" = Group consisted of "expert" viewers from the broadcasting industry, taking the test simultaneously, presented with three still slides as the wanted signal and using levels of noise and interference as in Group B (i.e. C/I between 13 to 40 dB).

Table 1 gives, for each group, the number of viewers who participated in the test, the number of viewers for whom the results were found to be inconsistent using the checking procedure outlined in the following section, the number of viewers considered in the data analysis and finally the overall mean score which gives an idea of the quality of the television pictures that were presented to the viewers during the test sessions evaluated on the CCIR 5-grade scale (see Table 2).

	Group A	Group B	Group C	Group D
Total number of viewers	27	27	22	14
Inconsistent viewers	2	4	1	2
Viewers considered	25	23	21	12
Overall mean score	3.69	4.05	3.51	3.99

Table 1: Viewer population and overall results

The pictures used for the wanted signal on which the level of impairment was assessed are as follows:

Still pictures

Slide 1: Girl in green dress (SMPTE #14)
Slide 2: Basket of fruit (Philips #8)
Slide 3: Beach scene (SMPTE #1)

Moving scenes

Scene with motion 1: Theatre Play
Scene with motion 2: Singer on red background

In the "Theatre Play", actors move on a stage with dimmed lighting while the camera pans. In the "Singer on red background", the camera zooms in on the singer's face.

The pictures and impairments were introduced at random and there were three different random sequences for each test. In each random sequence, care was taken to ensure that consecutive presentations would not show the same picture or the same type of impairment. Each presentation consisted of 15 seconds of viewing time followed by 15 seconds of 50 IRE grey display for changes in equipment setting and for scoring.

Both direct and indirect anchoring were used. First, during the introduction, the viewers were shown the best and the worst pictures to be encountered during the test using the slide "Make up scene" (direct anchoring). Indirect anchoring, which refers to the presentation of the best pictures and the worst pictures without telling the observers, was presented throughout the test at the rate of one anchor in every seven pictures on the average. Top and bottom anchors were interleaved and bottom anchors were alternately impaired by noise (S/N_w = 25 dB) and by co-channel interference (C/I = 3 dB for Group A and C, and C/I = 13 dB for Groups B and D). The relatively high level of FM triangular noise needed for the bottom anchor was obtained by reducing the deviation by a factor close to 1/10 and keeping the carrier-to-noise ratio (C/N) above the FM threshold.

The five grade impairment scale of the CCIR shown in Table 2 was used throughout the test.

Grade	Opinion Rating
5	Imperceptible
4	Perceptible but not annoying
3	Slightly annoying
2	Annoying
1	Very annoying

Table 2: CCIR five-grade impairment scale

An example of the score sheet used during these tests is given in Appendix B. The first page is for general information and scoring during the introduction session. The second page starts with the first scores to be considered in the data analysis. The still picture sessions had a total of 178 presentations and the moving scene sessions had 140 presentations. The presentation number was announced at each presentation. The numerical equivalent of the opinion rating was not used for scoring, however it was extensively used for the statistical analysis of the results. Scoring using a fraction of a grade was not permitted.

Seven carrier arrangements were studied. They can be represented by a three digit number giving respectively the number of interferers on the lower adjacent channel, on the co-frequency channel and on the upper adjacent channel. These seven arrangements are:

000 for impairment caused by noise only
010 for single-entry co-channel interference
020 for aggregate co-channel interference
030 for aggregate co-channel interference
101 for aggregate adjacent-channel interference
111 for aggregate adjacent and co-channel interference
121 for aggregate adjacent and co-channel interference

The range of S/N and C/I covered during these tests by different groups of viewers is given in Table 3. It should be noted that for arrangements "111" and "121" where both co-channel and adjacent channel interference were presented, the ratio between individual carrier power for these two types of interfering carriers was kept constant at 17 dB throughout the full range of the C/I tested.

	Groups A & C	Groups B & D
Top anchor S/N_w	56	56
Bottom anchor S/N_w	25	25
S/N_w	38 to 53	38 to 53
Top anchor C/I	$\propto$	$\propto$
Bottom anchor C/I	3	13
Co-channel C/I	10 to 30	20 to 40
Adjacent channel C/I	0 to 16	3 to 23

Table 3: Ranges of S/N_w and C/I values in dB presented to the viewers

At the end of the test session with Group "D", the broadcasters were asked to indicate the level of "just perceptible" impairment caused by triangular noise and co-channel single-entry interference for each still picture. This test was done by decreasing the level of noise or interference in 1 dB steps and asking whether any impairment could still be seen between each setting. The impairment was switched in and out to see any variation in picture quality. The value was recorded when less than 15% of the viewers indicated that they could still detect the presence of impairment.

Additional tests were performed by seven concerned viewers using the "just-perceptible" level. The attenuation on the interference level was set by the observer while he was watching the picture monitor. These tests were done for co-channel and adjacent channel single-entry interference cases with the three still pictures mentioned above plus the introductory slide: "Make-up scene".

4. TREATMENT OF THE TEST RESULT

The data were entered into computer files and re-arranged from the random sequences to facilitate the verification of viewer consistency and the validity of each presentation. The data were first checked for wrong equipment setting during any presentation by comparing the results of the same presentation from the three random sequences. Results from erroneous presentations were discarded. The viewer consistency was then evaluated based on three criteria: visual acuity, number of wrong ratings given to the top and bottom indirect anchors and number of ratings differing by two or more grades from the mean. A composite function of these three factors was used to determine the level of viewer inconsistency. Results from inconsistent viewers were discarded. The number of discarded viewers for each group is indicated in Table 1. The number of data points thus discarded corresponds to 10% of the total.

The filtered data were structured with a comprehensive keying system based on information relative to each presentation (i.e.: wanted picture, interferer arrangement, carrier spacing, S/N_W and C/I) such that automatic scanning for given test conditions was facilitated. This scanning was performed and an opinion score histogram was obtained giving the population of scores for each impairment grade and for each test case. The opinion mean score, the standard deviation, the 95% confidence range of the mean and the median were then calculated for each test case. The results reduced under this format can be found in Appendix C.

5. ASSESSMENT OF STILL PICTURES BY CONCERNED VIEWERS

This section deals with the results of the tests made with still pictures presented to the concerned viewers of Groups A and B. The main conclusions on required signal-to-noise ratio and interference protection ratio will be deduced from these two Groups. Since there is a 10 dB difference in C/I presented to these two groups, a discussion on the effect of this difference will also be included.

5.1 IMPAIRMENT DUE TO TRIANGULAR NOISE

The mean opinion rating of each scene as a function of the weighted signal-to-noise ratio is presented in Figure 3 for Group A and in Figure 5 for Group B. It is found that the subjective grade given to the unimpaired picture (top anchor) varies in the range of 4.84 to 4.95 with an average of 4.90 for the two Groups.

It can be seen that the picture content has a major effect on the susceptibility to impairment. Among the three test slides used, the "Beach scene" was found to be the most robust when assessing degradation due to noise and the "Basket of fruit" was consistently the most sensitive. The difference in S/N_W between these two scenes is about 6 dB at grade 4.5. The main reason for the higher susceptibility to noise impairment of the "Basket of fruit" is the presence of saturated red colour. The susceptibility of NTSC signals to chrominance noise produced by FM triangular noise is well known and shows up very clearly in these results.

The slope of the curves between grades 3 and 4.5 is different depending on whether the degradation is mainly due to chrominance noise or luminance noise. For the "Basket of fruit" where the degradation is mainly due to chrominance noise, the slope is found to be around 8 dB/grade, whereas in the case of the two other slides where there is a better balance between chrominance and luminance noise, the slope is around 4 dB/grade.

The scores for the three slides were merged and the mean, the 95% confidence range of the mean and the median were calculated. These are given in Figures 4 and 6 for Groups A and B respectively. It can be seen that the median is very close to the mean indicating that the skewness of the population of scores was minimal. The median curve crosses the mean curve around grade 3 which indicates that the non-linearity created by the limitation of impairment scale at grades 1 and 5 seems to cancel out at mid scale. One could conclude that, assuming a non-skewed population of scores, the impairment scale has relatively small non-linearities at the two extremes and that these non-linearities are symmetrical approximating an "S" shaped curve.

A comparison of Figures 4 and 6 indicates that Group B is slightly more critical than Group A (by 0.15 grade around grade 4 and 0.4 grade around grade 2.5). Although the same values of S/N_W were tested with the two groups, Group B became more critical because it was exposed to C/I's 10 dB higher than those for Group A, and this transpired into the S/N_W results. A secondary effect is that the consistency in scoring decreased slightly for the viewers exposed to higher C/I's. This effect is evidenced by the slightly larger 95% confidence range of the means in Figure 6.

This drift in subjective evaluation indicates that the observer is influenced by the overall range in quality of the pictures presented in the test session. This drift is relatively small and falls well within the 95% confidence range of each Group. In terms of dB's, it is found to be less than 1 dB for most impairment grades larger than 3.5.

Table 4 summarises the results in S/N_W in terms of the mean score for each slide and the mean of the concatenated scores of the 3 slides for some typical impairment grades.

Group	Grade	Slide #1	Slide #2	Slide #3	3 Slides
A	4.3	43.8	49.3	42.6	45.2
	4.5	45.2	51.2	43.9	47.3
	4.7	47.0	53.1	45.8	50.4
	4.8	49.2	54.2	50.0	53.0
B	4.3	45.0	50.1	43.8	45.2
	4.5	46.7	52.1	45.1	48.2
	4.7	49.3	54.4	46.9	52.0
	4.8	51.5	56.7	49.0	54.4

Table 4: Weighted S/N_w in dB required for given impairment grade

5.2 IMPAIRMENT DUE TO CO-CHANNEL INTERFERENCE

Single-entry interference was tested and the results for each slide appear on Figures 7 and 9 for Groups A and B respectively. The subjective level of unimpaired picture was not reached for slide #2 with Group A using a C/I of 30 dB. All other cases showed evidence of saturation especially for Group B where C/I as high as 40 dB were tested. This saturation which should occur at the same level of quality as the top anchors as indicated in Figure 9 seems to be reached at about 33 dB for slide #2 and 27 dB for slide #3. Slide #1 falls in between at 29 dB.

The picture content has a strong influence on the assessment or C/I impairment. The difference in C/I between slides for a given quality depends on the quality grade with a maximum difference of 9 dB between slides #2 and #3. It was found, as in the case of impairment due to triangular noise, that slide #3 is very tolerant whereas slide #2 which has highly saturated colours is very sensitive to interference.

The population of scores for the 3 slides were merged and the mean, the 95% confidence range of the mean and the median were calculated for the two Groups and were plotted in Figures 8 and 10 for Groups A and B respectively. Similarly to what was found in the previous section in the case of impairment due to triangular noise, the median reaches higher grades than the mean at high C/I and lower grades at low C/I. The cross-over of the two curves is close to grade 3. Between grades 2 and 4, the slope of the curves is about 5 dB/grade for all slides.

An interesting effect seems to show up at C/I = 33 dB and beyond as illustrated in Figure 10. The subjective quality at 33 dB C/I is very close to the saturation point (top anchors); beyond this point it slightly decreases and then goes back to its maximum for extremely low levels of interference. This effect, showing a peak of quality at 33 dB, seems to come from the fact that NTSC imperfections due to cross-colour, cross-luminance and interlace scanning seem to be masked by a low level of co-channel interference. This effect can be related to the dithering process used in data transmissions, particularly in the digital encoding of video signals. As in the case of noise degradation, Group B was found to be more critical for pictures impaired by co-channel interference than Group A. This shows up from a comparison of Figures 8 and 10.

A summary of the results is given in Table 5 for some specific impairment grades. Also indicated are the results of "just-perceptible" tests performed by 7 "concerned" viewers. It is interesting to note that, in most cases, the "just perceptible" level corresponds approximately to grade 4.8 for Group A and grade 4.7 for Group B.

Group	Grade	Slide #1	Slide #2	Slide #3	3 Slides
A	4.3	21.3	25.8	18.0	22.2
	4.5	23.2	27.4	19.6	24.2
	4.7	26.3	29.4	21.6	27.0
	4.8	27.5	30.5	23.5	29.0
B	4.3	24.2	25.9	21.8	23.8
	4.5	25.6	27.3	23.7	25.2
	4.7	27.8	29.7	26.0	28.0
	4.8	27.6	32.0	28.0	31.0
Just-perceptible 7 viewers		27.9	30.5	23.4	

Table 5: C/I required for given impairment grades (dB)

5.3 IMPAIRMENT DUE TO ADJACENT CHANNEL INTERFERENCE

The effect of interference from adjacent channels was studied for intercarrier spacings of 13 MHz and 15 MHz. One lower and one upper adjacent channel interferers were always present at the same level of C/I. The 13 MHz results for each slide are given in Figures 11 and 13 for Groups A and B respectively and the 15 MHz results are given in Figures 12 and 14 for Groups A and B respectively.

Unlike the co-channel interference and noise cases where the picture degradation occurs progressively with an increase in levels of noise or interference, the degradation due to adjacent channel interference occurs suddenly and results in an abrupt degradation of picture quality. An imperceptible impairment (grade = 4.9) can become annoying (grade = 2) within only a 5 dB decrease in C/I as can be seen in Figures 11 and 14. Both upper and lower adjacent channels are present, and their effect on picture quality is different (the upper adjacent channel shows up in a television picture as a vertical line drifting slowly in the horizontal direction, the lower adjacent channel shows up mainly as image contours from the high frequency content of the video signal during its large amplitude transitions, titles in particular are very objectionable). It was found that one of the two interferers was always predominant.

From what can be seen in the four figures mentioned above, this abrupt degradation seems to occur practically at the same level of C/I for all 3 slides for the same intercarrier spacing. The transition seems to be sharper for slide #1 ("Girl in the green dress") because of its grey background where this correlated type of interference shows up easily. Slide #3 gives a smoother transition due to the "business" of its picture content.

5.4 IMPAIRMENT DUE TO MULTIPLE CO-CHANNEL INTERFERERS

The picture quality assessments performed with two and three co-channel interferers gave results reasonably similar to the single entry case as far as the slope and the shape of the curves were concerned except that these curves are shifted toward higher values of C/I by a few dB's as can be seen in Figures 15, 16 and 17 for slides #1, #2 and #3 respectively for the Group A and Figures 19, 20 and 21 for the same 3 slides for Group B.

Figures 18 and 22 show the mean score of the three slides for 1, 2 and 3 co-channel interferers as graded by Groups A and B respectively. Figure 18 shows that the level of the unimpaired picture was not reached for Group A in the presence of aggregate interference whereas Figure 22 shows that this level was reached for Group B.

From this data, it is possible to evaluate the effect of multiple equal level interferers compared to a single interferer on the picture impairment. In the case of 3 interferers, the multiple interferers would need to be decreased by 3 to 5 dB to have the same level of picture impairment as a reference single entry interferer. It was found, after a close examination of the eight figures, that the value which relates two equal power co-channel interferers to a reference single-entry interferer in the range of grade 4 to 4.8 is close to 2.4 dB and in the case of 3 interferers, it tends to be close to 3.8 dB. Note that this is less than the normally assumed power-addition law which would result in 3 dB for two carriers and 4.8 dB for three carriers.

5.5 IMPAIRMENT DUE TO MULTIPLE CO-CHANNEL AND ADJACENT CHANNEL INTERFERERS

Test were performed with the aggregate of a co-channel interferer and upper and lower adjacent channel interferers (111). The arrangement 121 was also tested where two co-channel interferers were added to the two adjacent channel interferers. In all the cases tested, the difference between the level of the co-channel interferers and the adjacent channel interferers was kept at 17 dB and the intercarrier spacing was kept at 15 MHz.

The second arrangement (121) relates to a more practical and worse situation where the system interference would be due to the two adjacent channels transmitted cross-polarized to the desired signal from the same satellite and the two co-polarized channels transmitted from the two adjacent satellites. The first arrangement implies that only one adjacent satellite is interfering.

Figure 23 shows the results for the three interferer arrangements 020, 101 and 121. It shows how the co-channel and adjacent channel interferers, individually and combined, affect the picture quality using the means from the concatenated results of the 3 slides from Group A.

5.6 IMPAIRMENT DUE TO CO-CHANNEL INTERFERENCE AND TRIANGULAR NOISE

Some tests were performed with different levels of co-channel interference added to a fixed level of FM triangular noise. This level was chosen at 42 dB weighted S/N as suggested in the CCIR texts (Report 215-5 [10]). It was found afterward that the implied noise level was too high and the results were found to be of limited practical value. Figure 24 shows the difference between the 010 interferer arrangement and this same arrangement with FM triangular noise (S/N_w = 42 dB). The curves shown are based on the mean score for each slide and the mean of the concatenated scores of the 3 slides for the two cases, with and without noise, for the viewer Group B.

It can easily be seen that the major effect is the saturation on the impairment scale due to the presence of noise. Here, this saturation occurs at about grade 3.8 for the average of the 3 slides. This actually corresponds to the grade given to pictures degraded by noise only. The results obtained from the case where both noise and co-channel interference were present correspond very closely to the theoretical results obtained by adding the picture degradation due to noise to the degradation due to co-channel interference using the law of addition of impairments [7].

No evidence of masking of co-channel interference by noise was observed for this level of noise (i.e. the opinion grade of pictures impaired by noise and interference was always lower than that of pictures impaired by interference only).

6. ASSESSMENT OF MOVING SCENES BY CONCERNED VIEWERS

A total of 22 "concerned" viewers were presented with three random sequences of pictures impaired by noise and interference. (Group C). Although many interference cases were studied, only the most conclusive will be reported here.

6.1 IMPAIRMENT DUE TO TRIANGULAR NOISE

As can be seen in Figure 25, the subjective grading of moving scenes is very much the same as for still pictures. The "Theatre Play" gives results similar to the "Beach scene" whereas the "Singer with red background" gives results very similar to the "Basket of Fruit". The first moving scene is very robust with respect to noise degradation and the saturated colours of the second scene increase the picture susceptibility to noise degradation. It can be concluded that the picture content has a greater impact on opinion score than the fact that there is a certain level of motion. This can be explained by the fact that the viewers become accustomed to seeing the same scene and, as they do for still pictures, they learn where to look for picture degradation. Moving scenes are not standard in subjective assessment of picture quality and are likely to give different results only for the first few presentations at the beginning of the test session.

The results for moving scenes were found to saturate at lower values of opinion score than for the still pictures. This was due to the presence of residual noise on the video tape recorder. It showed up mainly in the "Singer with red background".

6.2 IMPAIRMENT DUE TO CO-CHANNEL INTERFERENCE

Figure 26 shows the mean opinion score of the two moving scenes impaired by co-channel single-entry interference. Curves are drawn for the mean score of each scene and the mean of the concatenated scores of the two scenes. The 95% of confidence ranges of the means are also indicated for the concatenated scores of the two scenes. For comparison, the mean of the three still pictures is also shown. In a manner similar to the effect of noise, the picture content overides the effect of motion.

6.3 EFFECT OF THE CARRIER DEVIATION

Some tests were done at twice the carrier deviation in order to verify the relationship between carrier deviation and required protection ratio. CCIR Report 634-2[4] suggests the following equation for co-channel single-entry protection ratio for system M/NTSC:

$$PR_o = 13.5 - 20 \log (D_v/12) - Q + 1.1 \, Q^2$$

where:
- PR_o is the co-channel protection ratio in dB
- D_v is the peak-to-peak carrier deviation in MHz
- Q is the quality factor

The term "$-20 \log (D_v/12)$" predicts a decrease of 6 dB in the required protection ratio when the deviation of the wanted carrier is doubled. The pre-detection filter was removed to avoid overmodulation (truncation) defects. Figure 27 shows a close relationship to within 1 dB between the theory and results for the 010 case.

7. ASSESSMENT OF STILL PICTURES BY EXPERT VIEWERS (Group D)

7.1 IMPAIRMENT DUE TO TRIANGULAR NOISE

Figure 28 shows the opinion score of pictures impaired by triangular noise. The curves are very similar to those of Group B shown in Figure 5. Figure 29 shows the mean of the scores for the three slides as well as the 95% confidence range of the mean and the median. The 95% confidence ranges tend to indicate that these results are less consistant than those of Group B, mainly because of the smaller number of observers. The slightly larger difference between the mean and the median curves tends to indicate that the population of scores are slightly more skewed than for Group B. The results indicate that the expert viewers were slightly more severe (by 0.2 of a grade) than the concerned viewers. Table 6 gives the required S/N_W for a range of impairment grades and the tests on the just-perceptible level.

Group	Grade	Slide #1	Slide #2	Slide #3	3 Slides
B Concerned Viewers	4.3	45.4	50.0	44.2	46.0
	4.5	47.0	52.7	45.5	48.0
	4.7	49.7	55.0	46.7	52.0
	4.8	51.0	56.0	49.0	53.5
D Expert Viewers	4.3	46.5	50.5	44.0	47.4
	4.5	50.0	51.8	45.0	49.5
	4.7	55.0	53.5	46.5	52.7
	4.8	-	55.0	52.5	-
Just perceptible test (Expert Viewers)		50.0	56.0	49.0	-

Table 6: S/N_W in dB required for specific values of impairment grade for the 3 still pictures as given by Groups B and D

7.2 IMPAIRMENT DUE TO CO-CHANNEL INTERFERENCE

Figure 30 gives the results of the assessment of co-channel interference by Group D. These results resemble those of Group B given in Figure 9. The expert viewers seemed to be more critical to interference than Group B on slide #1 but slightly less critical on the other two slides. Figure 31 gives the mean, median and 95% confidence range of the mean for the concatenated scores of the 3 slides. It is very similar to Figure 10 which shows the corresponding data for Group B.

Table 7 summarizes the comparison between Groups B and D for C/I in the range of impairment grades of interest and also contains the "just perceptible" values obtained from the expert viewers and by seven concerned viewers.

Group	Grade	Slide #1	Slide #2	Slide #3	3 Slides
B Concerned Viewers	4.3	23.7	25.9	21.6	23.6
	4.5	25.0	27.3	23.4	25.2
	4.7	27.0	30.0	25.8	27.8
	4.8	28.8	32.0	28.0	30.0
D Expert Viewers	4.3	24.3	24.0	19.0	23.0
	4.5	27.0	25.3	22.0	24.6
	4.7	33.0	26.8	24.5	27.5
	4.8	-	32.0	26.0	-
Just-perceptible test (7 Concerned Viewers)		27.9	30.5	23.4	-
Just-perceptible test (Expert Viewers)		28.0	34.0	29.0	-

Table 7: C/I in dB required for specific values of impairment grade for the 3 still pictures as given by Group B and D

8. JUST-PERCEPTIBLE INTERFERENCE TESTS

8.1 INTRODUCTION

A second set of carrier-to-interference tests was conducted based on measuring the "just-perceptible" threshold level of interference for both co-channel and adjacent channel interference cases.

The main objective of these tests was to verify the method of specifying the adjacent channel protection ratio template as now proposed in the CPM Report[11]. Also it was found desirable to provide data for determining the effect of varying the following parameters on the adjacent channel protection ratio:

- carrier frequency offset
- video deviation of the FM carrier
- receive filter bandwidth and out-of-band rejection characteristics.

This section reports on and summarizes the results of the just-perceptible tests that were performed.

8.2 JUST-PERCEPTIBLE TEST METHOD

The equipment set-up and viewing conditions for the just perceptible tests were as reported for the subjective tests in section 2.

The test procedure employed was different from that used for the subjective tests, specifically:

- A single interferer was used for all the tests.

- The test was performed separately by each observer. For each test case, two sets of independent adjacent channel sweeps were done. In the first case, referred to as the (C/I) sweep, the viewer pre-set the interfering carrier to a specified frequency offset and then adjusted the level of the interfering signal using an adjustable potentiometer until the threshold of the just perceptible interference was reached (i.e. when a slight change in the wanted picture was perceived). In the other method, referred to as the frequency sweep method, the observer pre-set the interfering signal level to a specified value and then adjusted the interfering carrier frequency offset until just-perceptible interference level was noticed. Both tests were performed for positive and negative frequency offsets. These two independent methods of measuring the adjacent channel protection ratio complemented each other and helped to prevent missing any critical values of carrier offsets.

- A total of eight viewers participated in the just-perceptible tests except for two of the frequency sweep tests only cases (Case A and B discussed in section 8.3) where seven viewers participated. All the viewers were classified as "concerned" viewers as defined in chapter 3. However, for the just-perceptible tests this classification of viewers is probably less significant than for the case of subjective impairment tests.

- The wanted picture consisted of four test slides as defined in chapter 3 as well as the "Make-up scene" slide (Philips #14).

- The interfering FM signal consisted of a split-screen colour bar test signal. (Off-air programming was initially attempted but this resulted in inconsistant results due to the critical nature of the just-perceptible level on the type of interfering image.)

8.3 JUST-PERCEPTIBLE TEST CASES

Co-channel and adjacent channel just-perceptible tests were performed for three cases. The difference between the test cases was the wanted signal modulation parameters used and the characteristics of the receiver filter. These three cases are defined as follows:

<u>Case A (18 MHz filter)</u>

Receiver filter (see Figure 2)

4-pole Chebychev
1 dB bandwidth: 18 MHz
Noise bandwidth: 22.7 MHz

Modulation parameters (wanted signal)

Video peak-to-peak carrier deviation: 9.52 MHz
Sound sub-carriers (unmodulated): 5.41 and 5.79 MHz
Sub-carrier modulation of main carrier: 2 MHz (p-p) (each)
Carson's bandwidth: 21.1 MHz. Comparing the filter noise bandwidth to Carson's bandwidth, the wanted signal was under-modulated by 7.6% or, in terms of carrier deviation, was under-deviated by 16%).

<u>Case B (14 MHz filter)</u>

Receive filter (see Figure 36)

4-pole Chebychev
1 dB bandwidth: 14 MHz
Noise bandwidth: 18 MHz

Modulation parameters (wanted signal)

Same as for Case A. Comparing the filter noise bandwidth to Carson's bandwidth, the wanted signal is being overmodulated by 17.2% or, in terms of carrier deviation, over-deviated by 48.2%.

<u>Case C (26 MHz filter)</u>

Receive filter (see Figure 37)

5-pole Chebychev
1 dB bandwidth: 26 MHz
Noise bandwidth: 30 MHz

Modulation parameters (wanted signal)

Video peak-to-peak carrier deviation: 16.3 MHz
Carson's bandwidth: 27.9 MHz

Other modulation parameters, same as Case A.
This case again represents an under-modulation of 7.6% as in Case A or, in terms of video carrier deviation, an under-deviation of 13%.

There were also some tests done with no receive filter using the modulation parameters given for Case A. However, a complete data set was not obtained for this case although the available data, which is presented in Case B results, is sufficient to indicate, for extreme case, the impact of receiver filtering on the adjacent channel protection ratio requirement.

8.4 JUST PERCEPTIBLE TEST RESULTS

This section presents a summary of the just-perceptible measurement results for the three test cases described in section 8.3. A listing of the statistical results of the test for the three cases is given in Appendix D.

8.4.1 Case A (18 MHz filter, low deviation)

Figures 38-41 present the results of the just-perceptible measurements in a graphical form corresponding to the four test slides used for the wanted signal. The figures show the mean and the corresponding upper and lower 95% confidence levels for the mean of the C/I sweep data (vertical bars) and the frequency sweep data (horizontal bars). Very good agreement was obtained between the two sets of measurements.

The most sensitive slide giving the highest adjacent channel protection ratio requirement was the "Basket of fruit", however the "Girl in green dress" test slide was nearly as critical for carrier offsets greater than approximately 10 MHz.

The least sensitive slide was the "Beach scene" which is similar to the results obtained in the co-channel subjective tests.

The analysis of the figures indicates that the adjacent channel protection ratio is not symmetrical with respect to the carrier frequency offset. This non-symmetrical characteristic is easily seen in Figure 42 which overlays the negative and positive carrier offset data for two test cases. In most cases for carrier offsets less than approximately 10 MHz, the positive carrier offset protection ratios are higher whereas for offset values greater than 10 MHz, negative carrier offsets results in the most critical protection ratios in all cases.

8.4.2 CASE B (14 MHz filter, low deviation)

The primary purpose of these particular tests was to determine the impact of using a receiver filter with narrower bandwith on the just-perceptible adjacent channel protection ratio.

Both frequency sweep and C/I sweep tests were performed using the four test slides and a narrower receive filter (i.e. 18 MHz equivalent noise bandwidth). The condition introduces an overmodulation of the wanted signal by 17.2% with respect to the Carson's rule bandwidth.

Figures 43 through 46 show the results of these tests for the four test slides including the results of the 22.7 MHz filter (Case A) for comparison. Also shown on the figures are the results of limited test data for the test case with no receive filter.

As expected, the tests indicate that the receive filter has no effect on the co-channel protection ratio. However, the results also indicate that, within the limits of measurement error, the receive filter does not impact significantly on the adjacent channel protection for carrier offsets less than approximately one half of the Carson's bandwidth. This conclusion is best observed by comparing the case of no receive filter with that of the 14 MHz and 18 MHz filters. As indicated by these results, the just-perceptible adjacent channel protection ratio for the no filter case differs only appreciably from that of the 14 MHz and 18 MHz filters for offsets greater than approximately one half of the Carson's bandwidth.

8.4.3 Case C (26 MHz filter, high deviation)

Figures 47-50 present the results for the high deviation case using a 26 MHz filter (1 dB bandwidth). Figure 51 shows the average results for the four test slides. Again very good agreement was reached between the frequency sweep data and the C/I sweep data for all slides and for all values of carrier offset.

The effect of varying the carrier deviation of the wanted signal on the co-channel and adjacent channel protection ratios is evident by comparing Figures 38-41 for the low deviation test with Figures 47-50 corresponding to the high deviation tests. Using the normal procedure for adjusting the protection ratio results to take into consideration the differences in carrier deviation [i.e. 20 $\log_{10}$ (ratio of the carrier deviations)], the factor for adjusting Case C results to that of Case A results would be 20 $\log_{10}(16.3/9.52)$ = 4.7 dB. The following Table 8 compares the actual measured results and indicates that the average reduction in just-perceptible protection ratio is 1 dB more than predicted by the formula (5.7 dB compared to 4.7 dB).

Slide	Co-channel Protection Ratio (PRco) (Just-perceptible) (dB)		Difference in PRo (dB)
	Case A	Case C	Case A - Case C)
Girl in green dress	28.1	21.5	6.6
Basket of fruit	29.9	23.4	6.5
Beach scene	23.1	19.1	4.0
Make-up scene	24.6	18.7	5.9
Average	26.4	20.7	5.7

Table 8: Comparison of the co-channel protection ratios for two different carrier deviations

As the value of the interfering carrier frequency offset increases, the advantage in adjacent channel protection ratio obtained from the larger carrier deviation is partly offset by the increased spectrum spreading that occurs due to the higher carrier deviation. Thus for large carrier offset values, the protection ratio requirement for the high deviation case is relatively more critical than for the low deviation case. This is one of the reasons why the adjacent channel protection ratio should not be made relative to the co-channel case.

The non-symmetrical nature of the adjacent channel just-perceptible protection ratio is even more apparent for the high deviation case as illustrated in Figure 52. This figure shows, for the average results of the four slides, the negative offset (C/I) sweep data superimposed on the positive offset (C/I) data. However, unlike the low deviation test results, the negative carrier offset protection ratio is more critical than the positive carrier offset for all values of frequency offset.

9. ANALYSIS OF THE RESULTS

The analysis is performed on the basis of the tests with concerned viewers and the still pictures. Similar analysis can be performed with the results of expert viewers or the results of the moving scenes. As for the results dealing with the adjacent channel protection ratio template, results of the just-perceptible tests will be considered.

9.1 SIGNAL-TO-NOISE RATIO

The study has shown that the opinion score for any given signal-to-noise ratio is a strong function of picture content. Table 4 indicates that for the concerned viewers, the weighted signal-to-noise ratio for an opinion score of 4.5 varies in the range of 43.9 dB for the non-critical slide (Beach scene) to 52.1 dB for the most critical slide (Basket of fruit). The mean values for the three slides are 47.3 dB for Group A and 48.2 for Group B. The average for these two groups is 47.7 dB.

The opinion score of the unimpaired pictures varies in the range of 4.84 to 4.95. These high values of opinion score for the unimpaired pictures indicate that the slide tests were not limited by equipment noise other than the camera noise estimated to be approximately 56 dB.

The above value of signal-to-noise ratio were obtained using a peak-to-peak deviation of 9.52 MHz and a top baseband frequency of 5.79 MHz. The corresponding Carson bandwidth is 21.1 MHz. The peak-to-peak deviation was chosen to give an FM improvement factor of 30 dB between C/N and S/N_w. Hence, these modulation parameters resulted in a S/N_w of 42 dB for a C/N of 12 dB.

Table 9 gives the peak-to-peak deviation and the weighted (unified [5]) signal-to-noise ratios which can be obtained in 22.7 MHz, 24 MHz and 27 MHz noise bandwidth filters without overmodulation using a top baseband frequency of 5.79 MHz. This actually corresponds to a state of slight under-deviation 16%. 100% modulation would produce an improvement of 1.1 dB in the weighted S/N for given C/N. Overmodulation was not covered in these tests. It is usually avoided in practical systems for the following reasons:

- it causes an increase in threshold C/N,
- it causes an increase in truncation noise and
- it increases the channel non-linearities and causes intermodulation.

In addition, overmodulation at the receiver requires a larger transmit RF bandwidth and may therefore reduce plan capacity.

Channel Bandwidth (MHz)	Peak-to-Peak deviation (MHz)	S/N_w for C/N = 12 dB (dB)	S/N_w for C/N = 14 dB (dB)
22.7	9.52	42	44
24	12.42	44.4	46.4
27	15.42	46.2	48.2

Table 9: Peak-to-peak deviation and corresponding weighted signal-to-noise ratio for the test conditions and extrapolation for 24 MHz and 27 MHz noise bandwidth without overmodulation.

The use of a component coding scheme is known to improve the chrominance signal-to-noise ratio by 1 to 4 dB (depending on the chrominance filter bandwidth) over that achievable with composite coding schemes [12, 13]. This is due to the absence of a colour sub-carrier in the high frequency portion of the video baseband signal of the component coding scheme. Correspondingly, the luminance signal-to-noise ratio of the component coding scheme is known to be about 1 dB less than that of the composite signals. This is due to the time compression of component coding scheme (usually 1.5:1 compression ratio) which results in a corresponding expansion in the frequency domain of the video baseband signal.

However, it has been reported [13] that the 4 dB increase in chrominance signal-to-noise ratio outweights the 1 dB decrease of luminance signal-to-noise ratio of the component coding scheme relative to PAL. A comparative subjective test of the impairment due to noise on component and composite signals has shown that on the average, and over a large range of opinion scores, the opinion score of component signals was about 1/2 grade (on a quality scale) higher than that of composite signal.

The above reported results suggest that the picture quality of component signals is governed mostly by chrominance noise and that the overall quality assessment of component signals is equivalent to an increase of weighted signal-to-noise ratio of between 1 and 4 dB over that of composite signals.

If we now apply this apparent S/N_w improvement due to component coding to the signal-to-noise ratio achievable using composite signals (see Table 8), we find that at C/N = 12 dB, the use of component coding would be equivalent to a weighted signal-to-noise in the range of 45.4 dB to 48.4 dB in 24 MHz and in the range of 47.2 dB to 50.2 dB in 27 MHz depending on chrominance noise bandwidth. An additional 1.1 dB is also available if the full 100% modulation is used as compared to the state of slight under-modulation used in these tests.

Thus a picture quality equivalent to S/N_W of 48 dB is achievable using:

- a C/N ratio of 14 dB
- a 27 MHz receive filter bandwidth
- a NTSC signal and
- no overmodulation

A S/N_W of 48 dB can also be achieved using:

- a C/N ratio of 12 dB
- a 24 MHz receive filter bandwidth
- a component coding scheme
- no overmodulation

A picture quality equivalent to S/N_W of around 50 dB is achievable using:

- a C/N ratio of 12 dB
- a 27 MHz receive filter bandwidth
- a component coding scheme
- no overmodulation

The opinion score of the concerned viewers corresponding to S/N_W of 50 dB is around 4.6 when considering the average of the three slides and around 4.3 for the most critical picture containing highly saturated red colours (Basket of fruit).

Increasing the channel bandwidth from 24 MHz to 27 MHz may decrease the number of channels available in the 500 MHz total bandwidth allocated to BSS by as many as 4 channels. This increase in bandwidth corresponds to an increase of 0.5 dB in satellite power for a given C/N. The co-channel protection ratio requirement also decreases with increasing deviation. An increase in peak-to-peak deviation from 12.42 MHz to 15.42 MHz corresponds to a 2 dB decrease in the co-channel protection ratio requirement for any subjective level of impairment (see section 9.2.3).

9.2 CO-CHANNEL CARRIER TO INTERFERENCE RATIO

9.2.1 SINGLE ENTRY INTERFERENCE

The results of section 9.1 have shown that noise is a major contributor to the impairment of picture quality. In this kind of environment, any perceptible level of impairment due to interference will further degrade the overall picture quality. Ideally, the level of impairment due to interference should be imperceptible so as to retain the maximum overall image quality. However, this approach is neither realistic nor feasible. It is therefore proposed to maximize the overall picture quality by adding a low level of impairment due to interference to the impairment due to noise.

In a broadcasting satellite downlink plan, the level of interference is determined primarily by antenna discrimination considerations. Therefore, interference is present for 100% of the time at the selected test points under study. It can therefore be argued that the desirable level of interference should be compared to the S/N_W ratio obtained during clear-sky conditions rather than to the S/N_W ratio not exceeded for less than 1% of the worst month. The relationship between clear sky S/N_W and faded S/N_W depends of course on rain climatic zone and on elevation angle. A maximum value of 2 dB will be used for the purpose of illustration. Therefore, at the edge of the service area, the clear-sky S/N_W ratios using a 24 MHz filter bandwidth are around 46.4 dB and 48.4 dB for clear-sky C/N values of 14 and 16 dB respectively. These values of S/N_W correspond to clear-sky opinion score of 4.35 and 4.55 respectively for the mean of the three slides and for the average of the two groups of concerned viewers.

The values of single-entry co-channel C/I corresponding to opinion scores of 4.35 and 4.55 are 23.6 dB and 25.4 dB respectively for the mean of the three slides and for the average of the two groups of viewers. At these levels of impairment, the impairment due to noise is equal to the impairment due to interference for nearly to 99% of the worst month (99.7% of the time) at the edge of the service area. This situation is not desirable since the service is limited by interference throughout the service area. A C/I value of 4 to 5 dB higher would make the service noise-limited throughout the service area and nearly 99% of the worst month. This is considered a desirable feature since the clear-sky impairment due to noise is more under the control of the satellite operator than the clear-sky impairment due to interference. Under these conditions, the required C/I value is around 28.5 dB for a faded C/N ratio of 12 dB and 30.5 dB for a faded C/N ratio of 14 dB.

9.2.2 THE EFFECT OF DEVIATION

The values of C/I ratio given in section 9.2.1 are based on a peak-to-peak deviation of 9.52 MHz and a Carson bandwidth of 21.1 MHz. A series of tests using a peak-to-peak deviation of 19.04 MHz (section 6.3) has shown that over a large range of opinion scores, the co-channel protection ratio requirement decreases approximately as the square of the peak-to-peak deviation as reported in CCIR Report 634-2. The corresponding values of the required single-entry C/I ratio adjusted for a peak-to-peak deviation of 12.42 MHz and a Carson bandwidth of 24 MHz are 26 dB and 28 dB for faded C/N ratios of 12 and 14 dB respectively.

9.2.3 AGGREGATE INTERFERENCE

The subjective test on aggregate co-channel interference (section 5.4) has shown that the law of power addition of interferers is observed in certain cases but not all. It was found that the opinion score of three equal-power interferers is equivalent to that of a single interfering carrier having a power level 3 to 5 dB higher than that of each of the equal power interfering carriers. However, the law of power addition is believed to be representative of the worst case interference for non-correlated carriers and is considered appropriate for the calculation of aggregate co-channel interference in planning the BSS or coordinating between systems.

9.2.4 COMPONENT CODED SIGNALS

Tests were performed by the European Broadcasting Union on the just-perceptible interference of component coded signals and of composite coded signals (PAL and SECAM). The results indicated, in general, that the co-channel protection ratio requirements for the component coded signals are less than those required for the composite coded signals.

9.3 ADJACENT CHANNEL INTERFERENCE

Subjective tests (section 5.3) were performed in the presence of two adjacent channel interferers; one lower channel and one upper channel. These tests were repeated with 13 MHz and 15 MHz intercarrier spacings.

The tests have shown that the opinion score remains close to the unimpaired level for high values of C/I but decreases rapidly once the C/I is reduced below a certain "threshold" level. This behaviour is quite different than that of the co-channel interference where the opinion score gradually approaches the level of the unimpaired picture with increasing C/I. This sudden decrease in opinion score indicates the necessity of retaining a carrier-to-interference ratio above the "cliff-edge" value . This may be achieved by selecting a C/I margin of a few dB above the threshold value.

The protection ratio requirement corresponding to a 3 dB margin above the cliff edge is around 10.5 dB at 15 MHz and 13.5 dB at 13 MHz and appears to be independent of the picture content. These values refer to the two groups of viewers A and B and to a peak-to-peak deviation of 9.52 MHz with a receive filter characteristic as illustrated in Figure 2. However the number of data points in the reported tests is considered insufficient to fully characterize the shape of the curve.

Under clear-sky conditions, the adjacent channel interference is governed by the downlink but the feeder link contribution to the overall adjacent channel interference is between 10% and 50%. However, during rain fall at the wanted feeder link station, the adjacent channel interference is gradually governed by the feeder link contribution and under worst case conditions, the 13.5 dB aggregate protection ratio is not met at a rain fade on the feeder link in the range of 5 to 15 dB depending on the elevation angle of the transmitting earth stations and on the number of interfering adjacent channels.

9.4 AGGREGATE CO-CHANNEL AND ADJACENT CHANNEL INTERFERENCE

Figures 32 and 33 show the effect of the aggregate interference from one co-channel interferer, one lower adjacent channel interferer and one upper adjacent channel interferer (111) using slide 1 (Girl in green dress) and using slide 2 (Basket of fruit) respectively. Slide 1 is considered representative of an average picture content whereas slide 2 is considered representative of a more critical picture content.

Figures 34 and 35 show the effect of aggregate interference from two co-channel interferers, one lower adjacent channel interferer and one upper adjacent channel interferer (121) using slides 1 and 2 respectively.

The figures also show the adjacent channel interference only and the co-channel interference only for comparison purpose. The arrows in the figures indicate the following values of protection ratios:

- 28 to 30.5 dB for aggregate co-channel interference and
- 10.5 dB for single-entry adjacent channel interference

In all figures, the carrier offset is 15 MHz and the ratio of co-channel to adjacent channel interference power is constant at 17 dB throughout the C/I range.

The figures show that at a high carrier-to-interference ratio, the opinion score is mostly governed by the co-channel interference and that at low carrier-to-interference ratio, the opinion score is mostly governed by the adjacent channel interference. The change-over occurs near the "cliff edge" of adjacent channel interference, i.e. 6 to 8 dB for slides 1 and 2. Under the test conditions, this is equivalent to 23 to 25 dB co-channel carrier-to-interference ratio. One data point in Figure 34 is considered abnormal and has been discarded for the curve fitting.

The figures show that for the value of co-channel to adjacent channel power ratio used, the service quality is governed by co-channel interference and that the adjacent channel interference is less than perceptible and has little effect on opinion score. This is considered highly desirable because of the rapid decline of opinion score at lower values of adjacent channel C/I.

However, in a constellation of satellites, the mechanisms of interference for the co-channels and for the adjacent channels may be quite independent of each other unlike the case under study where the ratio of power of the co-channel interferers to the power of the adjacent channels was kept constant at 17 dB throughout the full range of opinion scores. In the broadcasting-satellite service, the adjacent channel interference may originate from the feeder links or the downlinks of the same or other networks whereas the co-channel interference originates from the satellite links of other networks. Under these conditions, the power ratio of co-channel interference to adjacent channel interference is unlikely to be constant. It is therefore recommended that the co-channel interference and the adjacent channel interference be independently assessed. The co-channel interference is best assessed relative to the aggregate co-channel protection ratio and the adjacent interference is best assessed relative to the aggregate protection ratio for adjacent channel interference. The time statistics of the two types of interference are also very different in a satellite system.

9.5 ADDITION OF IMPAIRMENT UNITS

The data of Figure 24 on the impairment due to noise and interference was used to determine the validity of the law of addition of impairment units as given in CCIR Report 405-4. The results on the mean of the three slides are given in Table 9 and indicate that the law of addition of impairment units is pessimistic, giving lower calculated values of opinion scores than those observed.

The discrepancy between the calculated and the observed values varies with impairment level. The difference between the calculated and the observed values of opinion score reaches a maximum of about 0.3 at an opinion score of 2.5 and decreases to less than 0.1 at opinion scores approaching 1 and 5. It should be noted also that the above calculation did not remove or account for the residual impairment that was in the system. This most likely explains the somewhat pessimistic calculated values.

C/I (dB)	Calculated opinion score	Observed opinion score
10	1.91	2.15
17	2.98	3.12
23	3.42	3.62
27	3.65	3.77
30	3.70	3.83

Table 9 - Calculated and observed opinion score for the mean of three slides impaired by noise at a carrier-to-noise ratio of 12 dB and by interference in the range of 10 to 30 dB. The observed data is extracted from Figure 24.

9.6 JUST PERCEPTIBLE TESTS

This section discusses the results of the just-perceptible tests as pertaining to the adjacent channel protection ratio requirements and provides the method used to arrive at the proposed adjacent channel protection ratio.

9.6.1 PROPOSED ADJACENT CHANNEL PROTECTION RATIO TEMPLATE (FMTV/FMTV)

Based on the results of protection ratio tests reported in section 8, the proposed adjacent channel protection ratio template for the case of FMTV interfering with FMTV is shown in Figure 53. This normalized template is described by the following set of equations:

For negative carrier offsets (i.e. $X_n < 0$)

$$\text{Pr in dB} = \begin{cases} 46\ X_n + 39.9 & X_n > -0.52 \text{ (see note 1)} \\ 27.7\ X_n + 30.4 & -0.52 > X_n > -0.882 \\ 48.05\ X_n + 48.38 & -0.882 > X_n \end{cases}$$

For positive carrier offsets (i.e. $X_n > 0$)

$$\text{Pr in dB} = \begin{cases} -66.29\ X_n + 51.09 & X_n < 0.669 \text{ (see note 1)} \\ -24.67\ X_n + 23.23 & 0.669 < X_n < 0.96 \\ -46.96\ X_n + 44.67 & 0.96 < X_n \end{cases}$$

X_n = normalized carrier offset

$$X_n = \frac{F_I - F_w}{\text{Carson's BW}}$$

Carson's BW = $(\Delta F_v + 2 F_t)$

where:

ΔF_v = peak-to-peak carrier deviation due to video signal

F_t = top baseband frequency including sub-carriers

$F_I - F_w$ = carrier offset

Note 1: The template is extended towards zero frequency offset (i.e. co-channel) until the adjacent channel protection ratio value equals the co-channel protection ratio and remains at that value into zero offset

Also, the following conditions should be observed regarding the template;

- the values of adjacent channel protection ratio given by the template should be considered as absolute (i.e. they should not be adjusted relative to the co-channel protection ratio value);

- the template should not be adjusted according to the value chosen for the peak-to-peak deviation of the video signal (i.e. not normalized to 12 MHz peak-to-peak deviation as is the case for the co-channel protection ratio);

- based on limited just-perceptible tests, it appears that the method of power summing the respective adjacent channel interference margins (upper and lower) with that of the co-channel (C/I) margin to obtain an overall interference margin is valid provided that:

  i) the adjacent channel (C/I) margins are derived using the actual non-symmetrical template, and

  ii) that the co-channel protection ratio margin corresponds approximately to the "just-perceptible" level of interference on which the adjacent channel template is based. (i.e. the subjective impairment of the co-channel interference is approximately equivalent to that of the adjacent channel interference).

9.6.2 Method for Deriving the Adjacent Channel Protection Ratio Template

One of the interesting findings of the subjective tests that are reported in sections 5, 6 and 7 using a combination of adjacent channel and co-channel interferers was that the impact of the adjacent channel interference on subjective picture impairment is substantially different from that for the co-channel case.

Whereas the co-channel interferers typically exhibit a sensitivity of 1 impairment unit per 5 to 6 dB change in C/I over the linear part of the curve (i.e. impairments in the range of 2 to 4.5), the adjacent channel interference exhibits a considerably greater sensitivity of approximately 1 impairment grade per 1.6 dB change in C/I. The "cliff edge" effect, which is apparent in all of the adjacent channel subjective test results, suggests that the basis for deriving the adjacent channel interference objectives for planning should be different from that of the co-channel case. It also suggests that the adjacent channel protection ratio template should not be specified relative to the co-channel protection ratio selected for planning but rather considered in absolute terms.

Thus to ensure that the objectives set for the adjacent channel interference will result in values for C/I that are sufficiently beyond the point where a rapid decline in opinion score occurs, it is considered desirable to base the adjacent channel protection ratio template on the worst case test results, specifically:

- on the results of the just-perceptible tests (there are also considerably more data available from the just-perceptible tests), and
- the template should enclose the just-perceptible levels of C/I corresponding to the upper 95% confidence limits of the mean for the most critical test slide considered.

10. CONCLUSIONS AND RECOMMENDATIONS

The tests have shown that the effect of noise and interference depends strongly on picture content. The effect of picture content on quality overides the effect of motion.

It is considered a normal practice to establish the overall quality of the service on the basis of an opinion score as close as possible to 4.5 for the average of all slides presented in the subjective test.

10.1 SIGNAL-TO-NOISE RATIO

A weighted signal-to-noise ratio of 47.7 dB corresponds to an opinion score of 4.5 for the average of all slides. A S/N_W of 48 dB can be achieved without over-modulation by using a carrier-to-noise ratio of 14 dB and a channel bandwidth of 27 MHz. A quality equivalent to this can also be achieved using a component coded system and employing a carrier-to-noise ratio of 12 dB and a channel bandwidth of 24 MHz. Overmodulation was not considered in these tests and should be considered with caution due to its side effects like threshold increase and appearance of truncation noise. The increase in channel bandwidth from 24 MHz to 27 MHz requires, for the same C/N a 0.5 dB increase in satellite power; may reduce the capacity of orbit/spectrum plans by up to four channels per 500 MHz of bandwidth due to the required larger intercarrier spacing between adjacent channels, and reduces co-channel protection ratio requirement by about 2 dB.

10.2 CO-CHANNEL PROTECTION RATIO

The co-channel protection ratio is determined on the basis of a peak-to-peak deviation of 9.52 MHz and may need to be adjusted for the modulation parameters used in the orbit/spectrum plans.

The carrier-to-interference ratio for the mean of the three slides and for the average of the two groups is found to be 23.7, 26, 27 and 30 dB respectively for grades 4.4, 4.6, 4.7 and 4.8. Protection ratios of 28.5 dB and 30.5 dB are found to be necessary for satellite systems which are limited by noise for 99% of the worst month and throughout the service area when the clear sky carrier-to-noise ratio is 14 and 16 dB respectively.

10.3 ADJACENT CHANNEL PROTECTION RATIO

Subjective tests of adjacent channel interference have shown that the opinion score decreases very rapidly when the carrier-to-interference level is decreased below the level of just-perceptible interference. The effect of adjacent channel interference depends on the picture content of the wanted and the interfering signals but the onset of the rapid decline of opinion score does not. A suitable margin is needed to guard against the onset of the rapid decline of opinion score. Assuming a 3 dB margin above this threshold level, a single entry protection ratio of 13.5 dB for 13 MHz carrier offset, and 10.5 dB for 15 MHz carrier offset is required. These values are applicable for a peak-to-peak deviation of 9.52 MHz and a 4 pole receive filter having a noise bandwidth of 22.7 MHz.

Considering the sensitivity of the subjective impairment level to the adjacent channel interference once this threshold limit is reached, it was concluded that the adjacent channel protection ratio requirements (i.e. template) be based on the more critical and extensive "just-perceptible" tests reported in sections 8 and 9. The results of these tests indicate that;

- the adjacent channel template should not be made relative to the co-channel protection ratio value.
- for a given value of normalized offset, (especially for offsets greater than 0.5), the protection ratio does not vary according to the square of the carrier deviation as is the case for the co-channel protection ratio
- the protection ratio template is non-symmetrical with the more sensitive offsets generally corresponding to negative offsets (for positive sense modulation)".

11. REFERENCES

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4. CCIR Report 634-2, Volume X & XI Part 2, XVth Plenary Assembly, GENEVA, 1982.

5. CCIR Report 637-2, Volume XII, XVth Plenary Assembly, Geneva, 1982

6. CCIR Recommendation 405, Volume XI, XVth Plenary Assembly, GENEVA, 1982.

7. CCIR Report 405-4, Volume XI, XVth Plenary Assembly, GENEVA, 1982.

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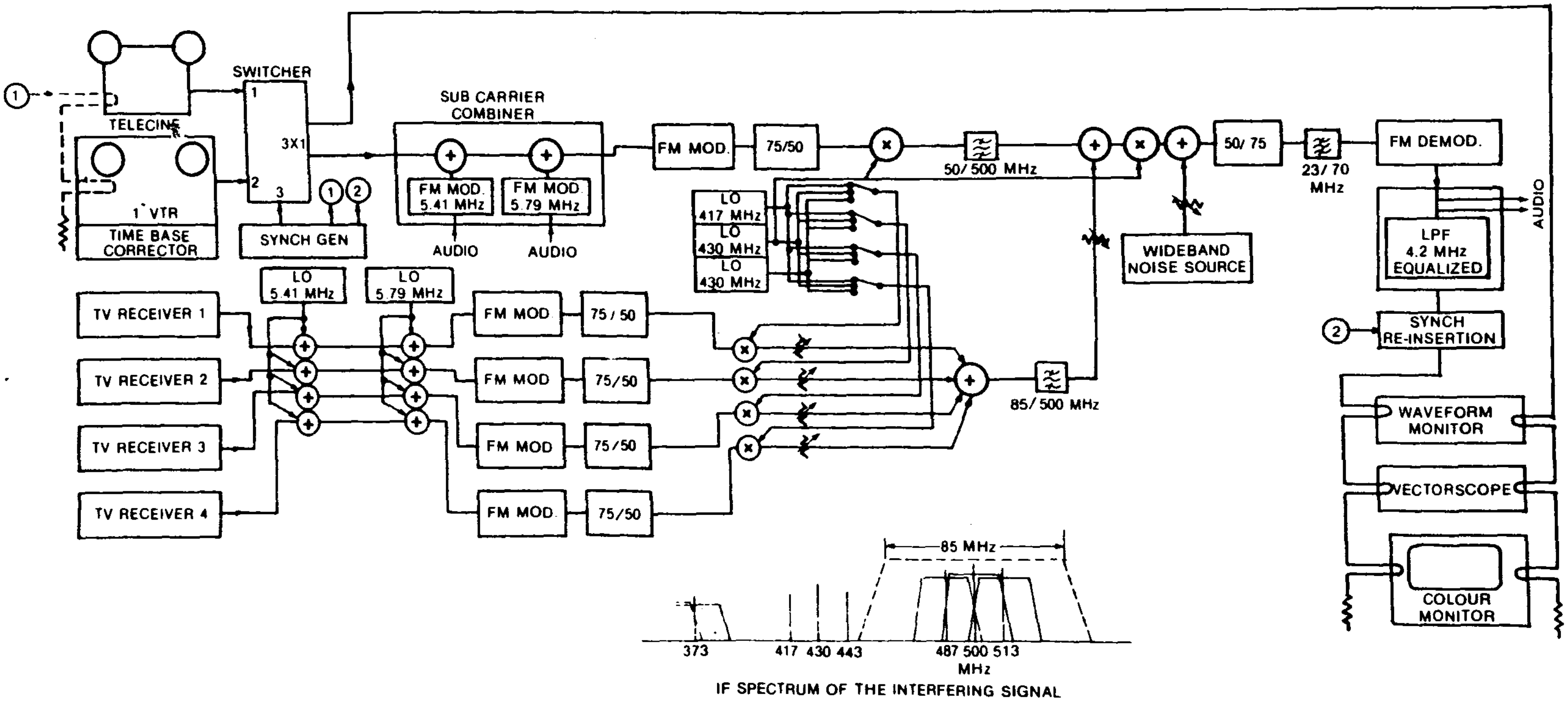


Figure 1: Test set-up circuit Diagram

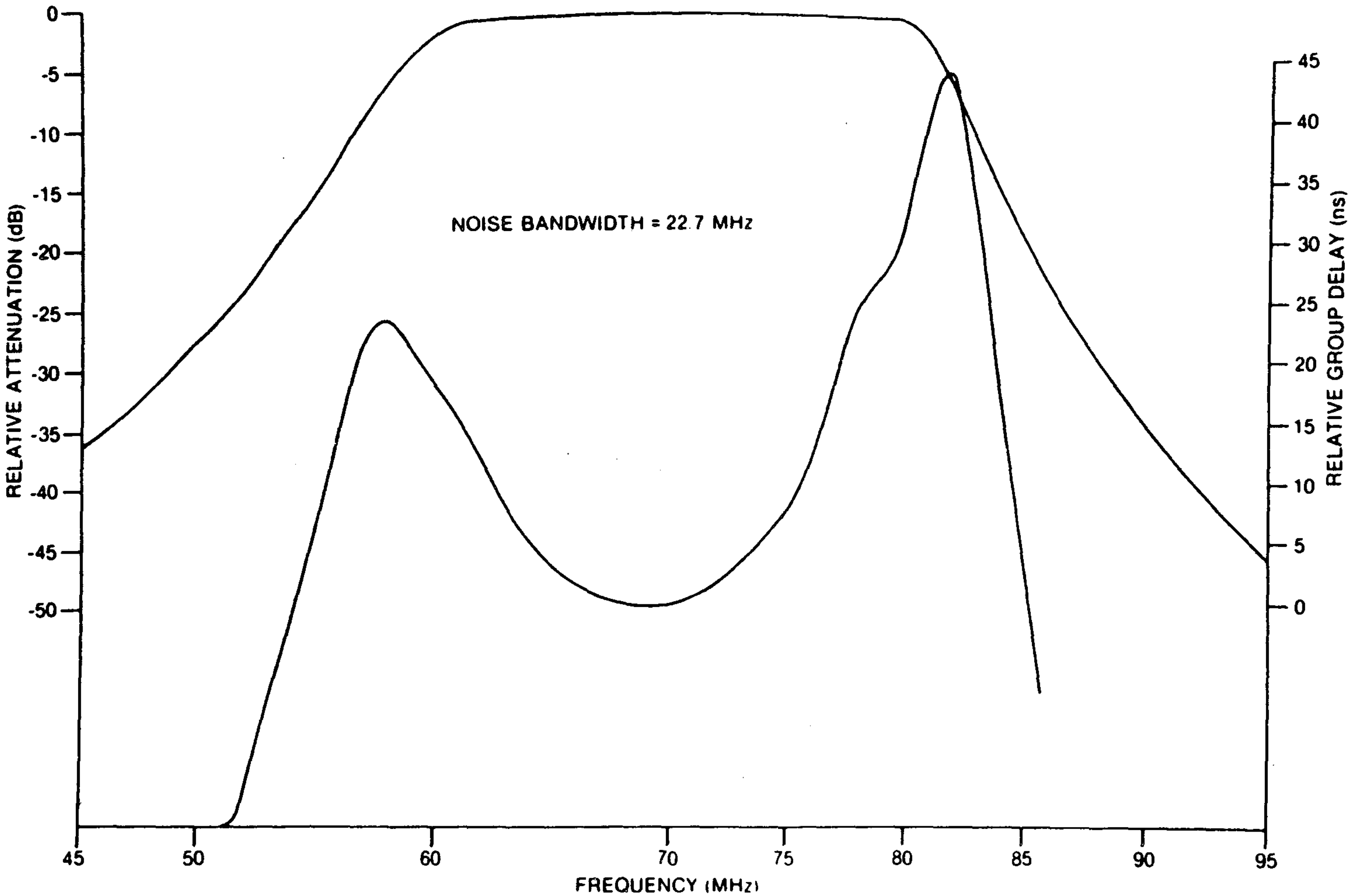


Figure 2: Frequency response of the 4-pole/18 MHz IF pre-detection filter.

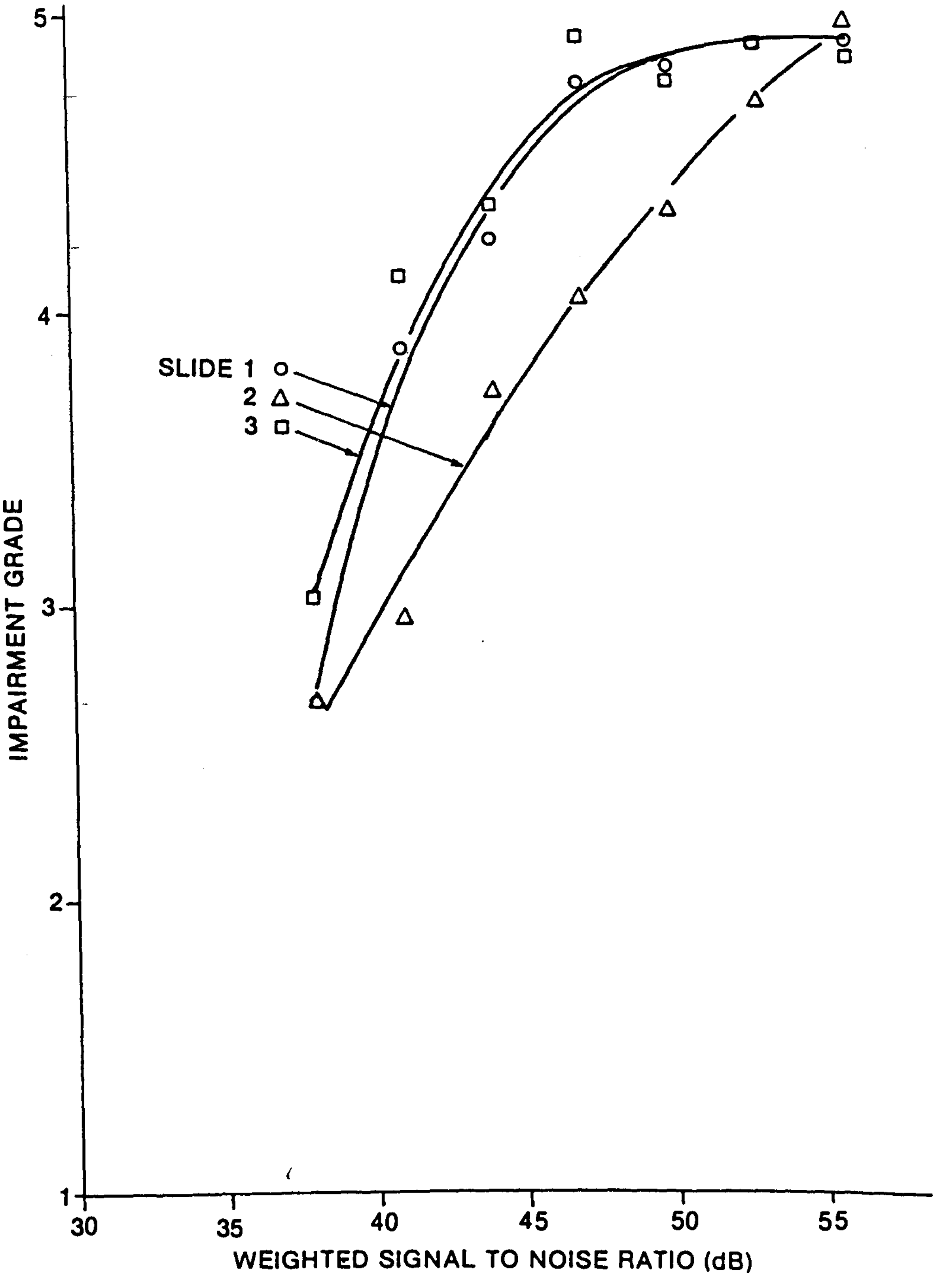


Figure 3: Picture degradation due to triangular noise
(3 still pictures, Viewers Group A)

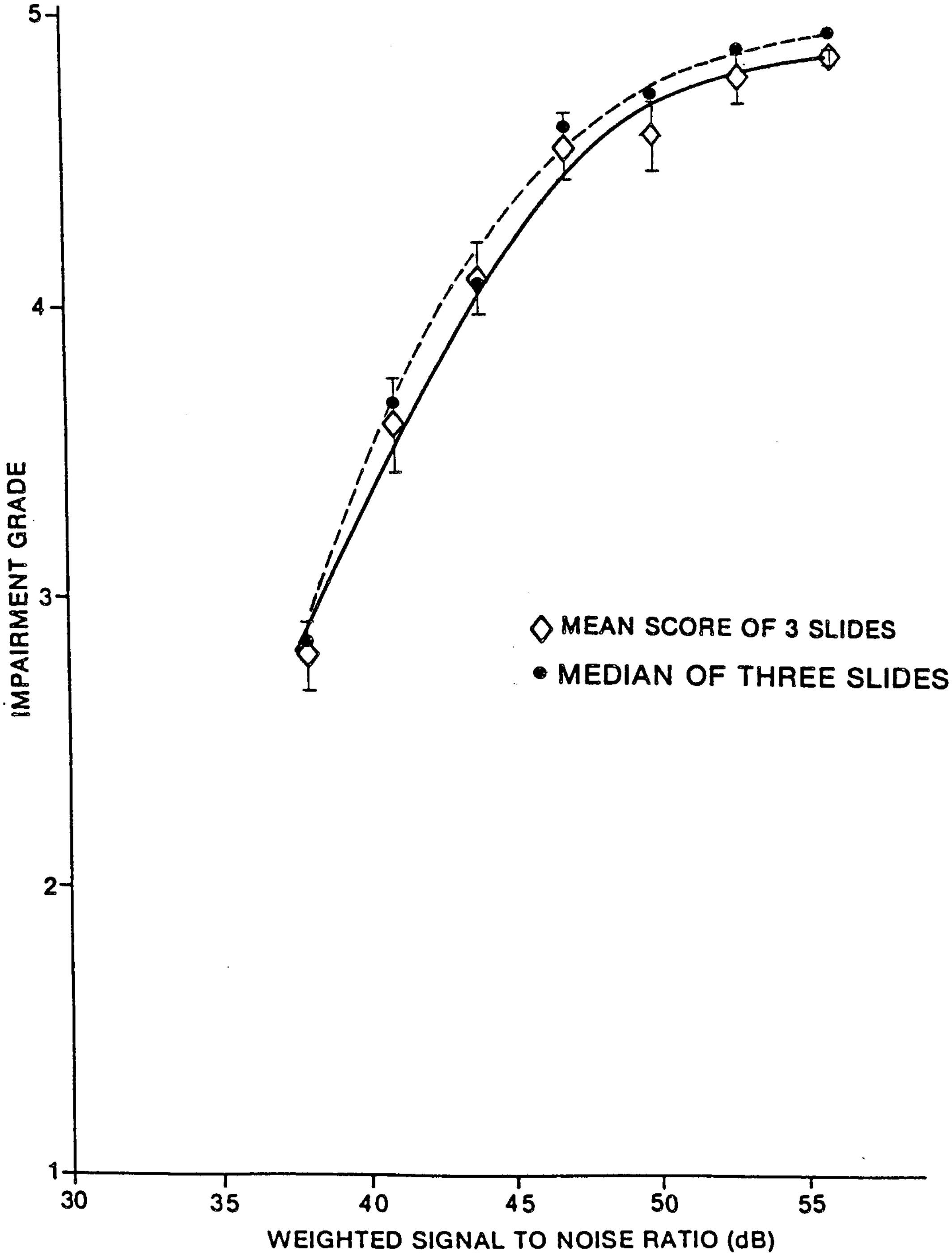


Figure 4: Picture degradation due to triangular noise (average of 3 still pictures, Viewer Group A)

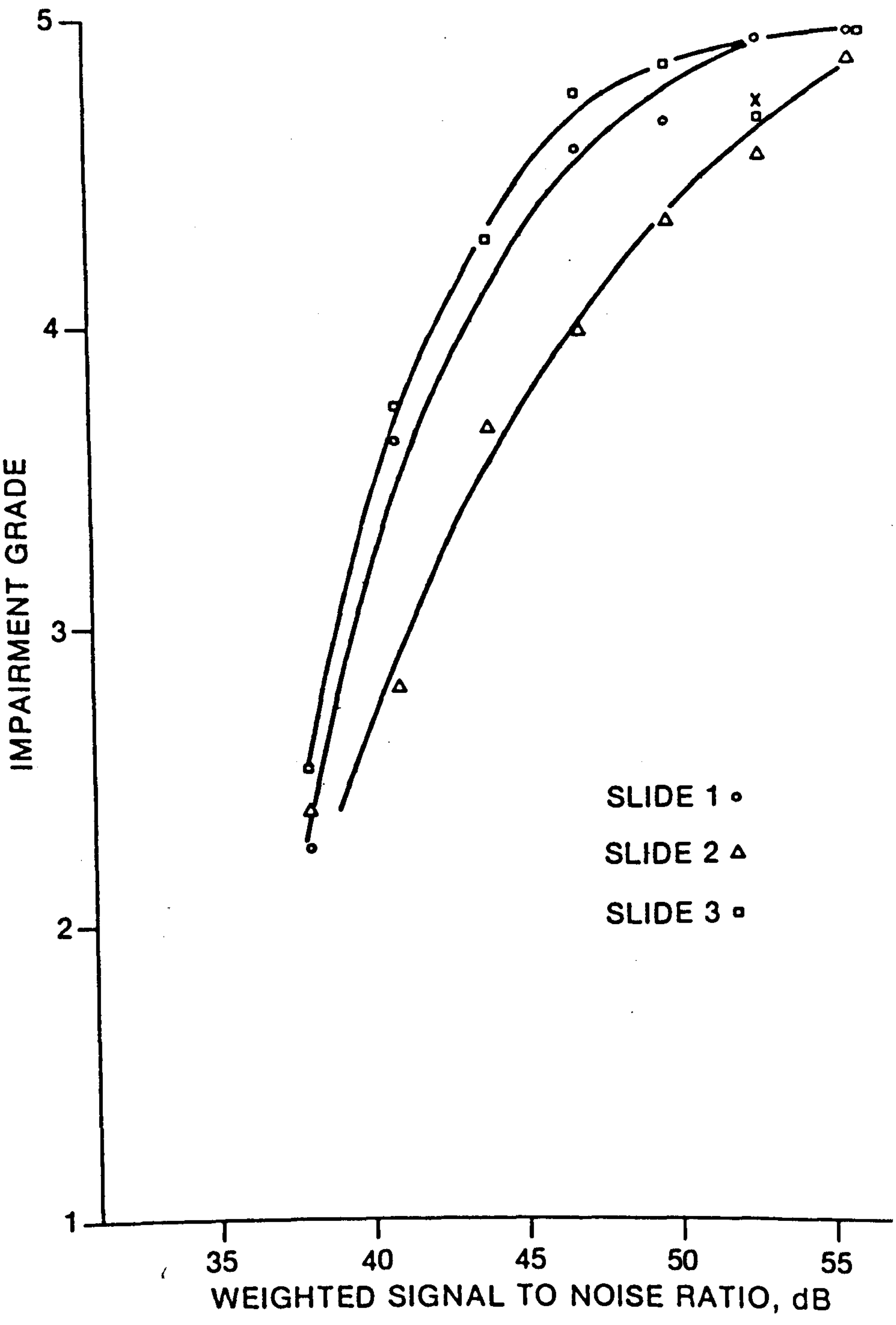


Figure 5: Picture degradation due to triangular noise (3 still pictures, Viewer Group B)

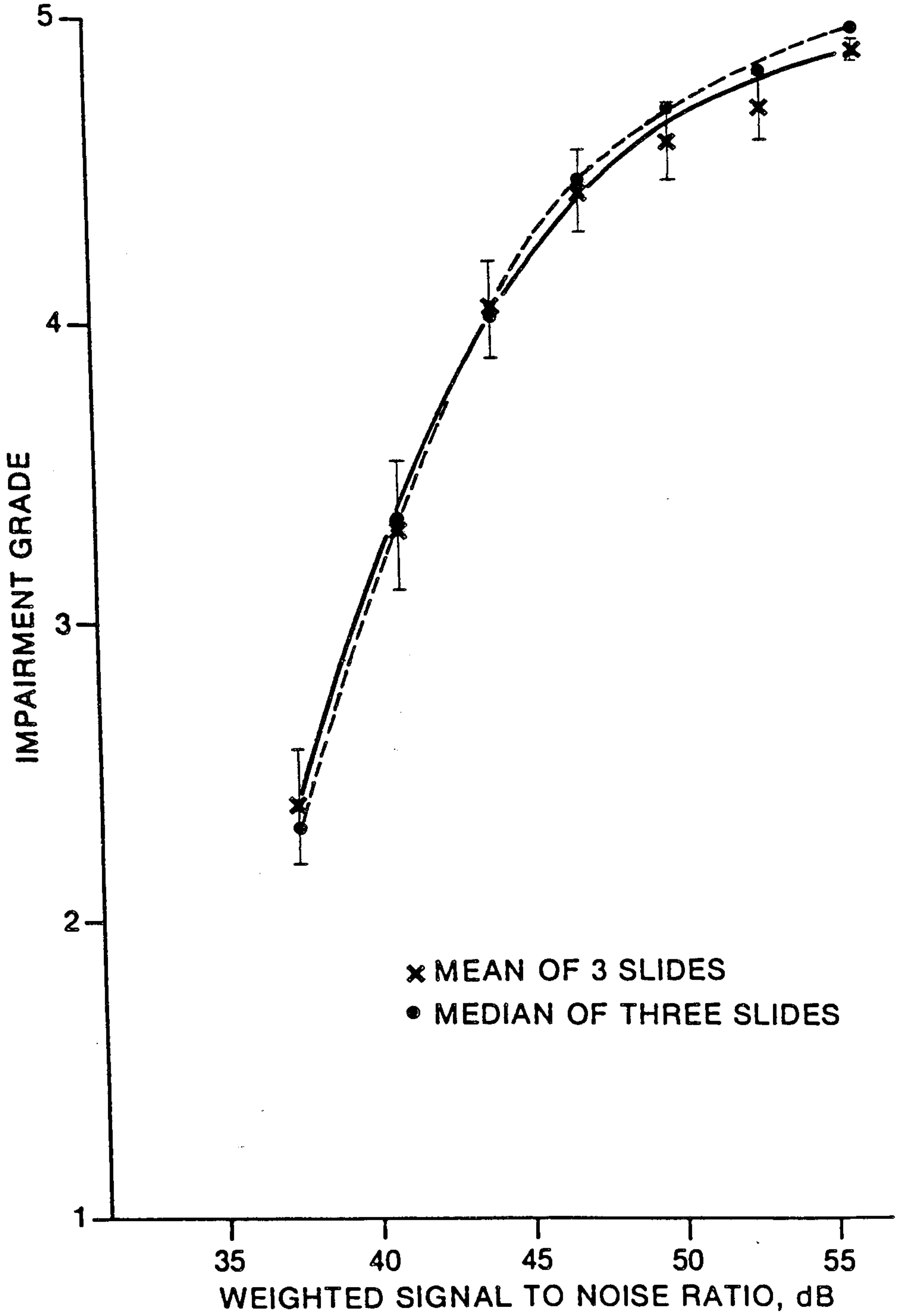


Figure 6: Picture degradation due to triangular noise (average of 3 still pictures, Viewer Group B)

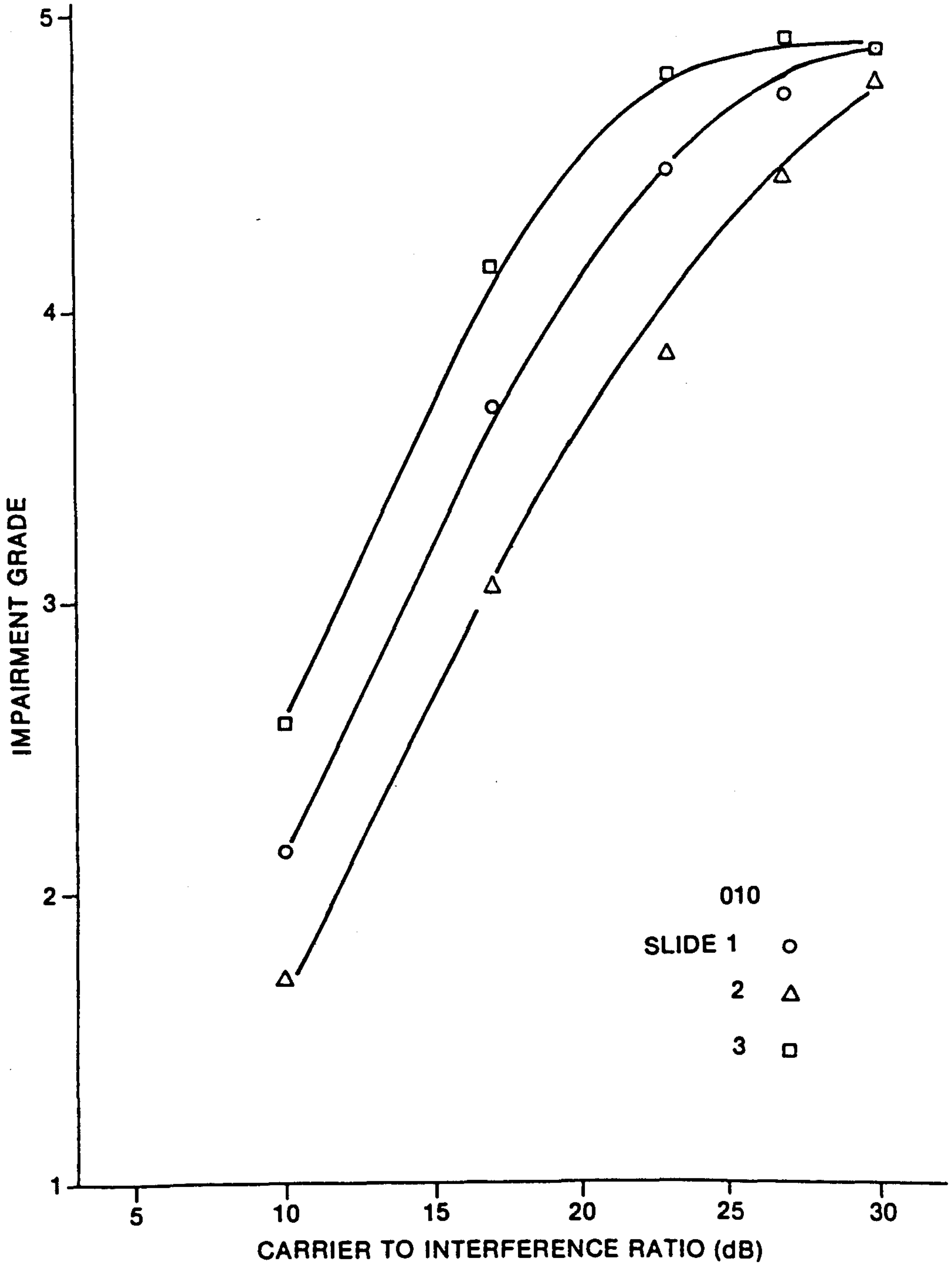


Figure 7: Picture degradation due to co-channel interference (3 still pictures, Viewer Group A)

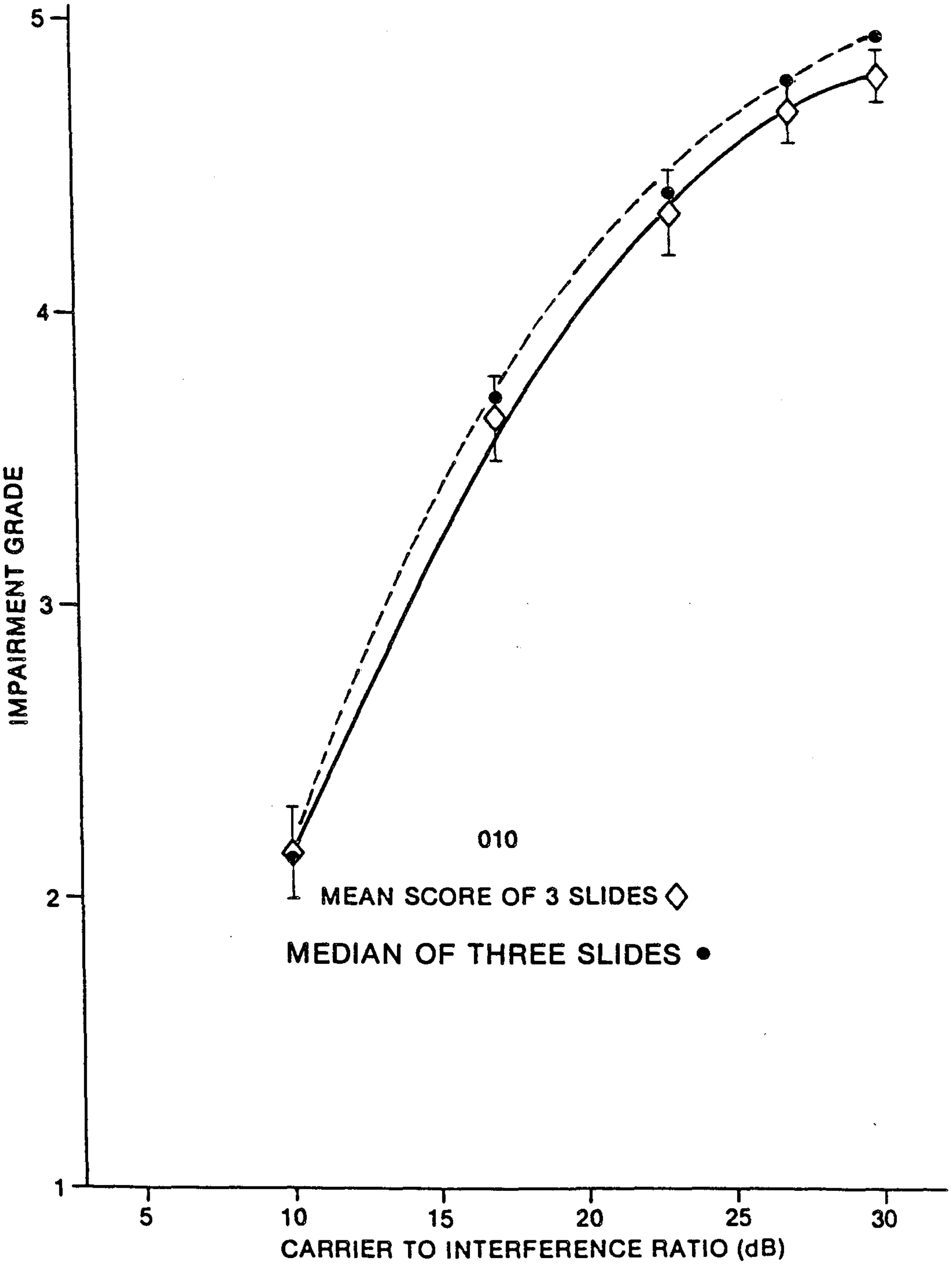


Figure 8: Picture degradation due to co-channel interference (average of 3 still pictures, Viewer Group A)

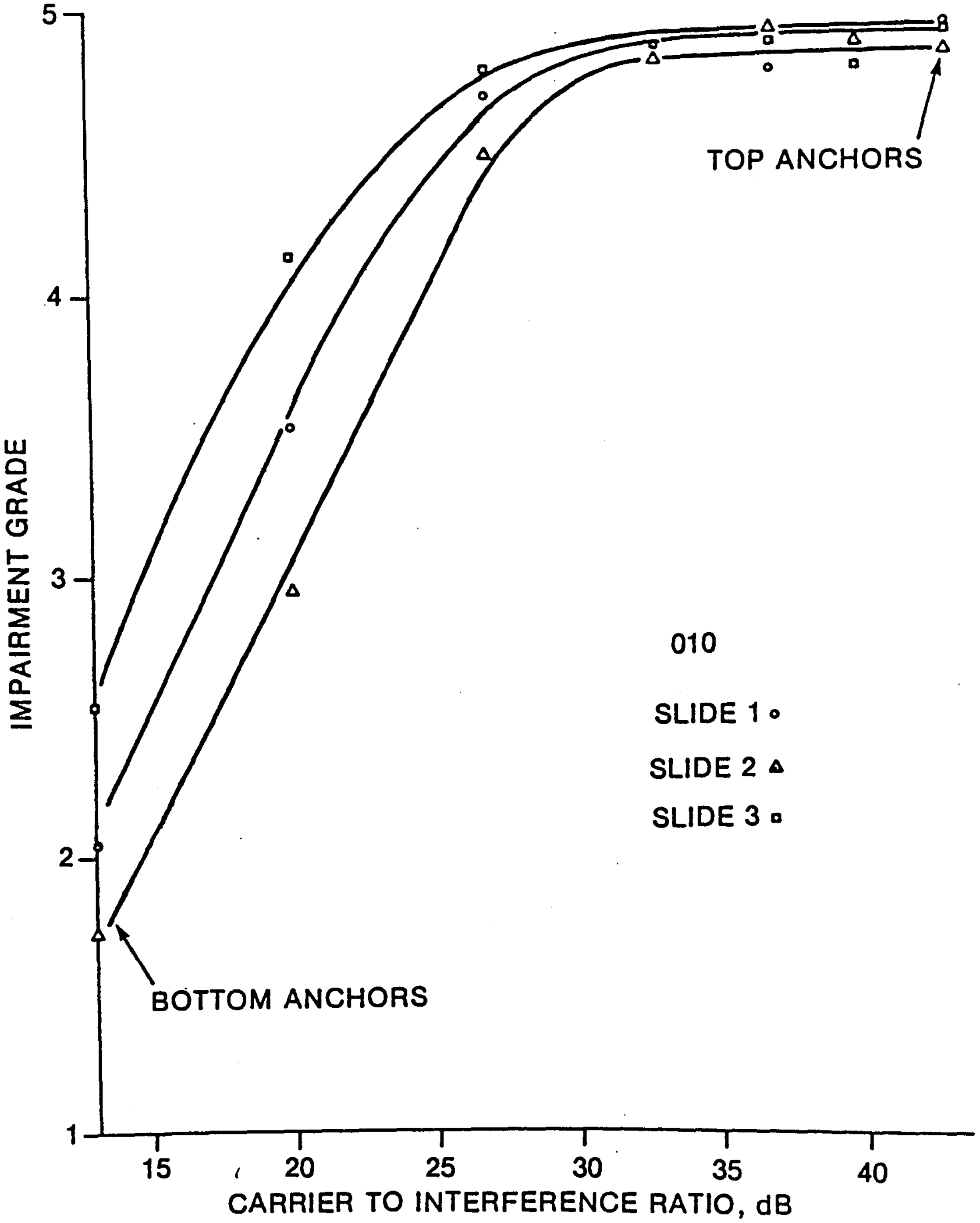


Figure 9: Picture degradation due to co-channel interference (3 still pictures, Viewer Group B)

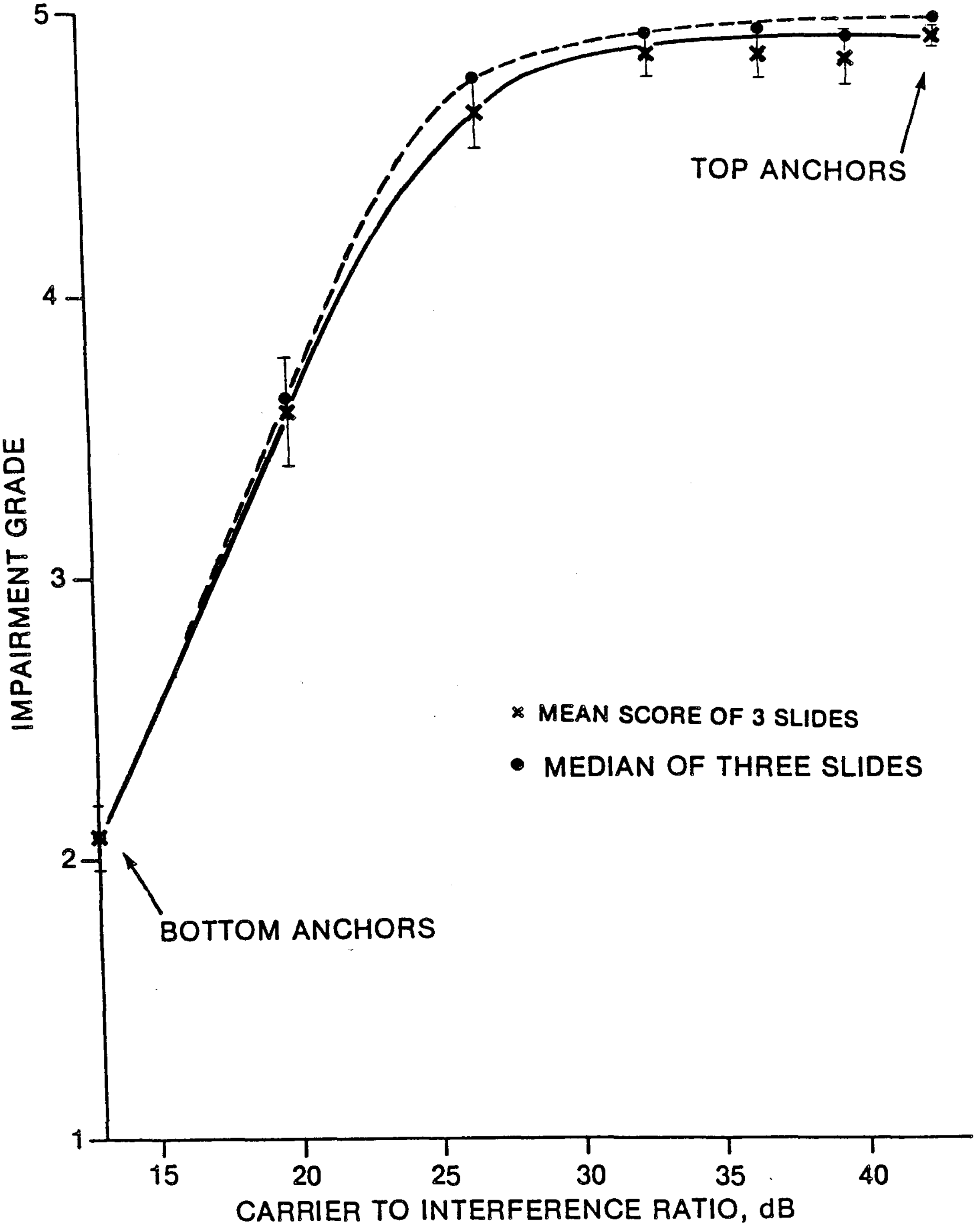


Figure 10: Picture degradation due to co-channel interference (Average of 3 still pictures, Viewer Group B)

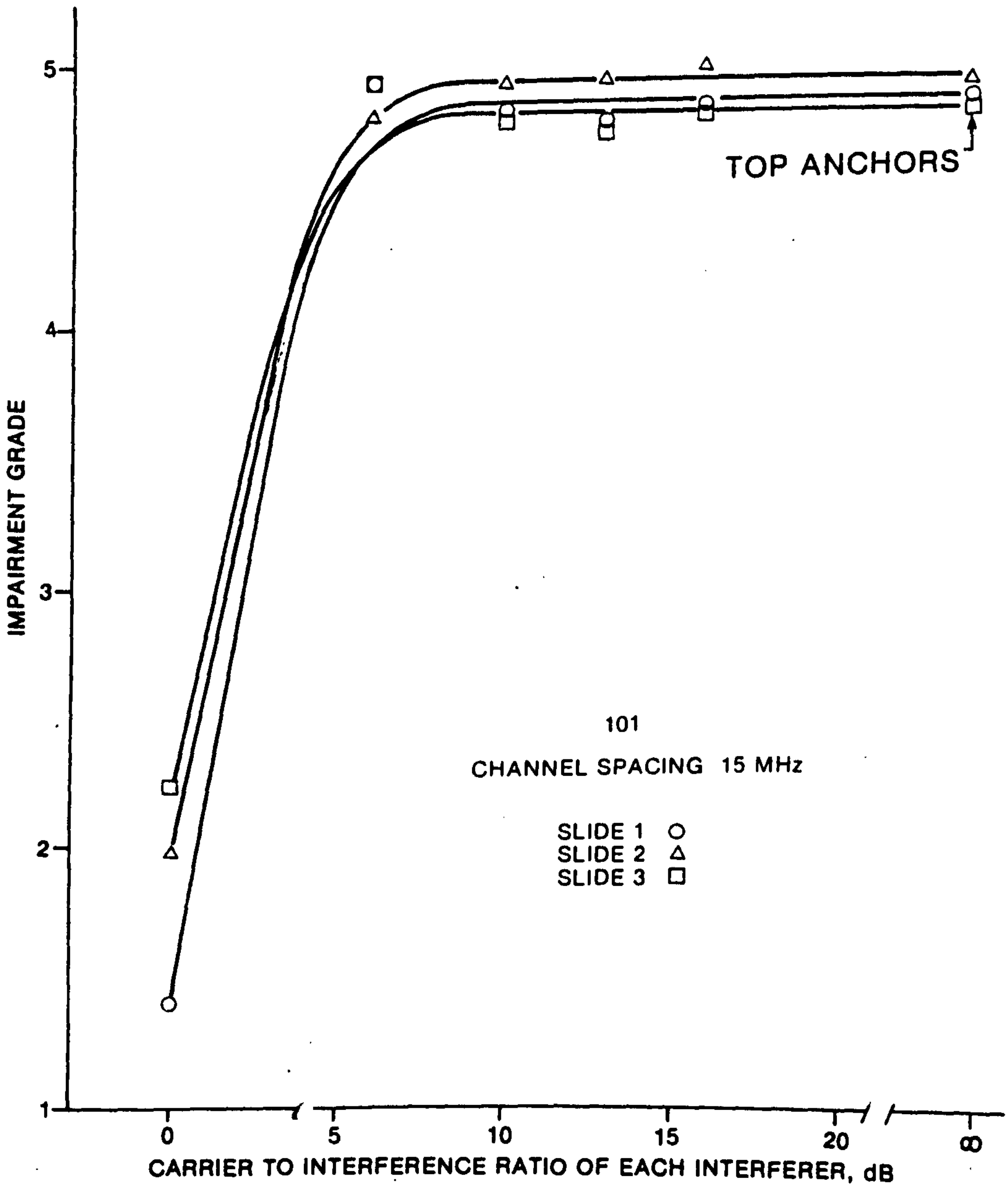


Figure 11: Picture degradation due to adjacent channel interference (3 still pictures, 15 MHz intercarrier spacing, Viewer Group A)

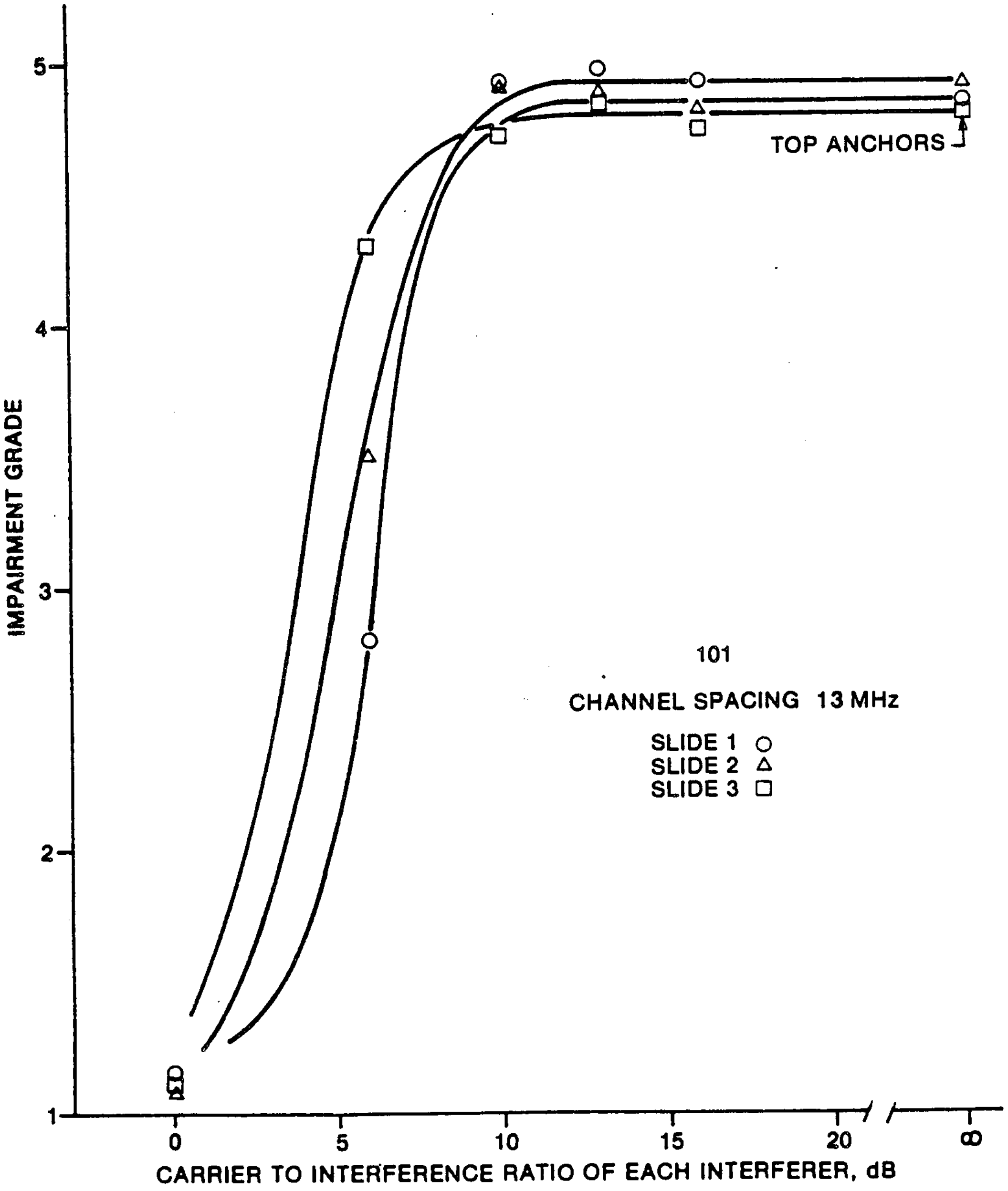


Figure 12: Picture degradation due to adjacent channel interference (3 still pictures, 13 MHz intercarrier spacing, Viewer Group A)

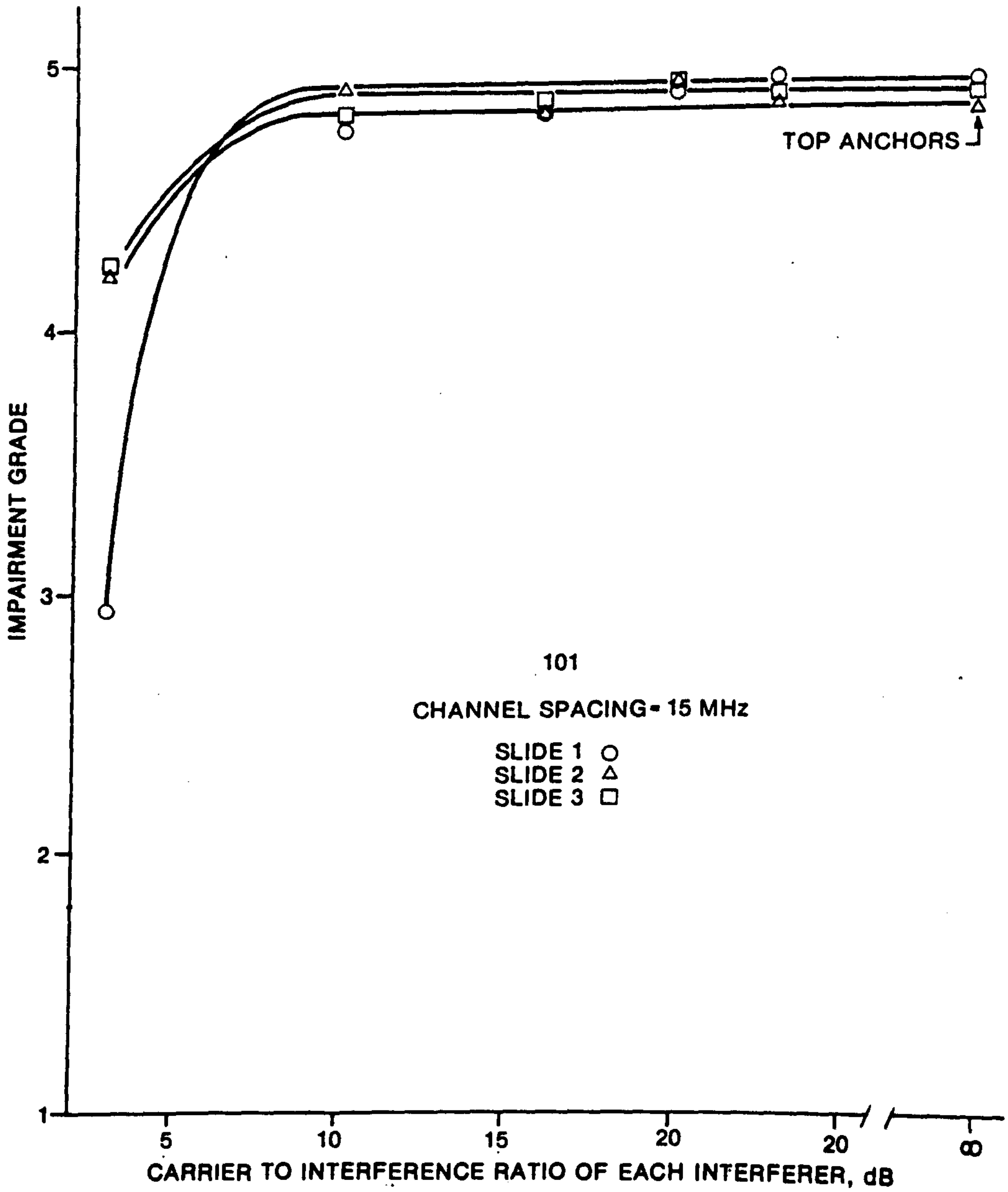


Figure 13: Picture degradation due to adjacent channel interference (3 still pictures, 15 MHz intercarrier spacing, Viewer Group B)

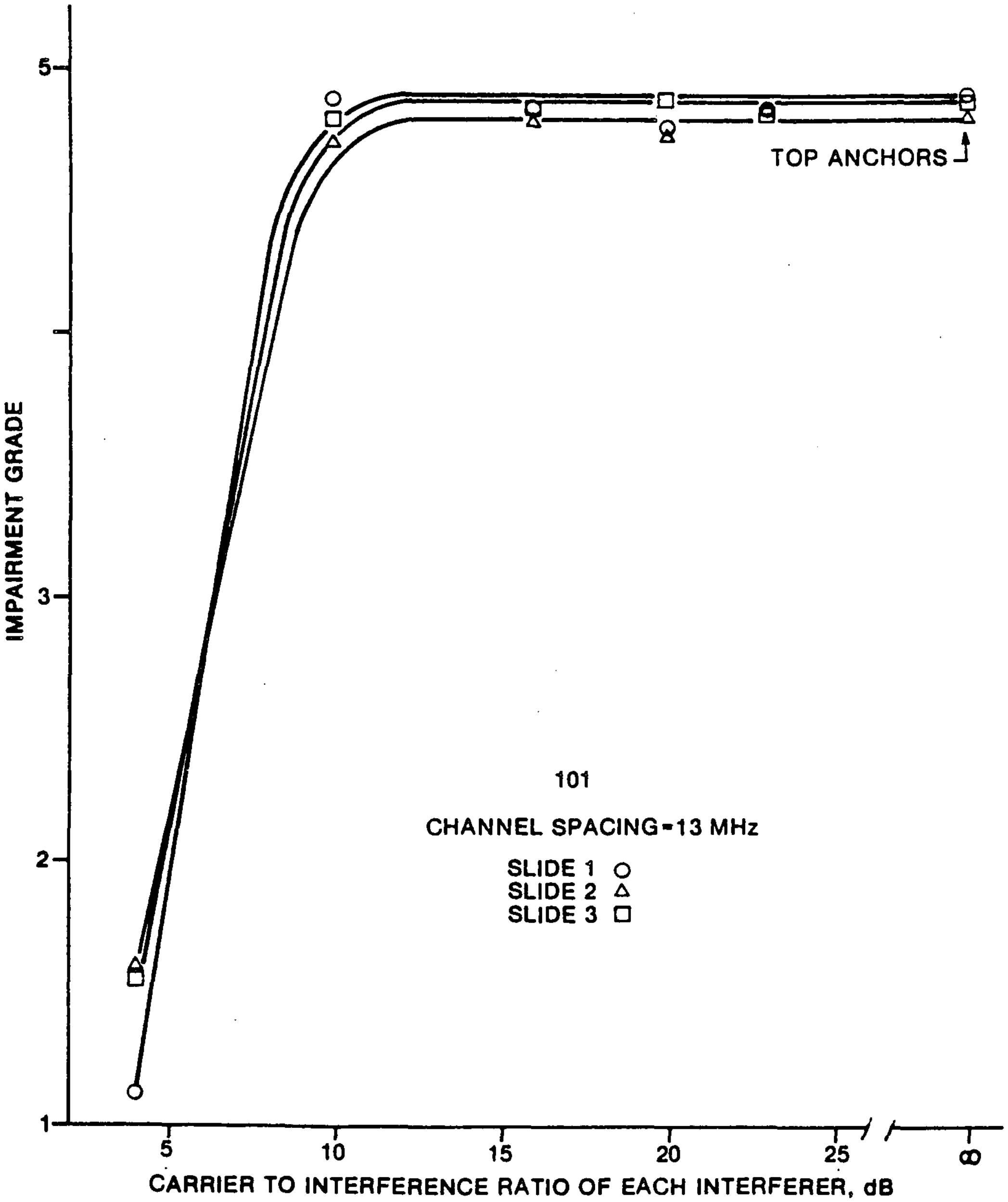


Figure 14: Picture degradation due to adjacent channel interference (3 still pictures, 13 MHz intercarrier spacing, Viewer Group B)

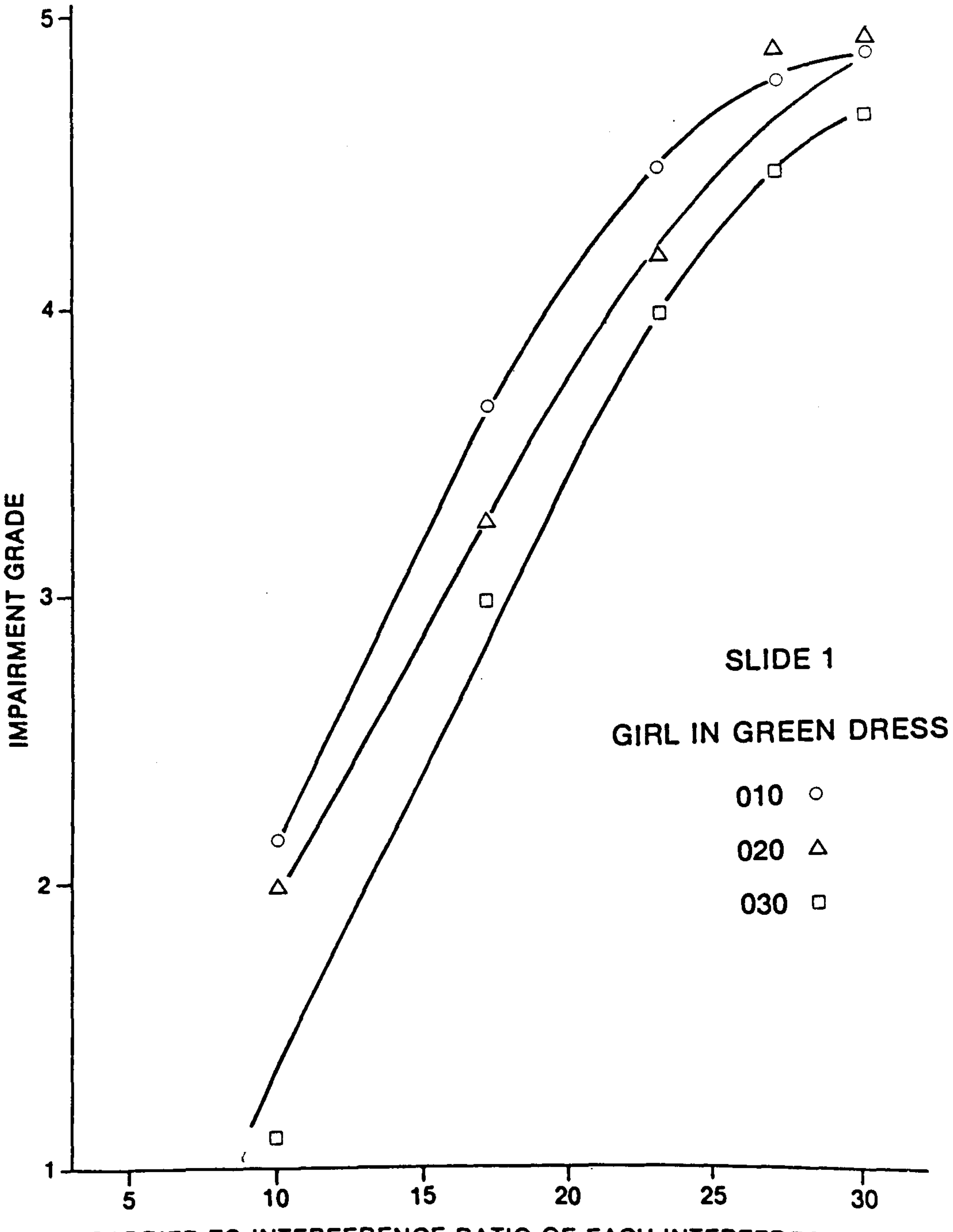


Figure 15: Picture degradation due to aggregate co-channel interference (Still picture #1, Viewer Group A)

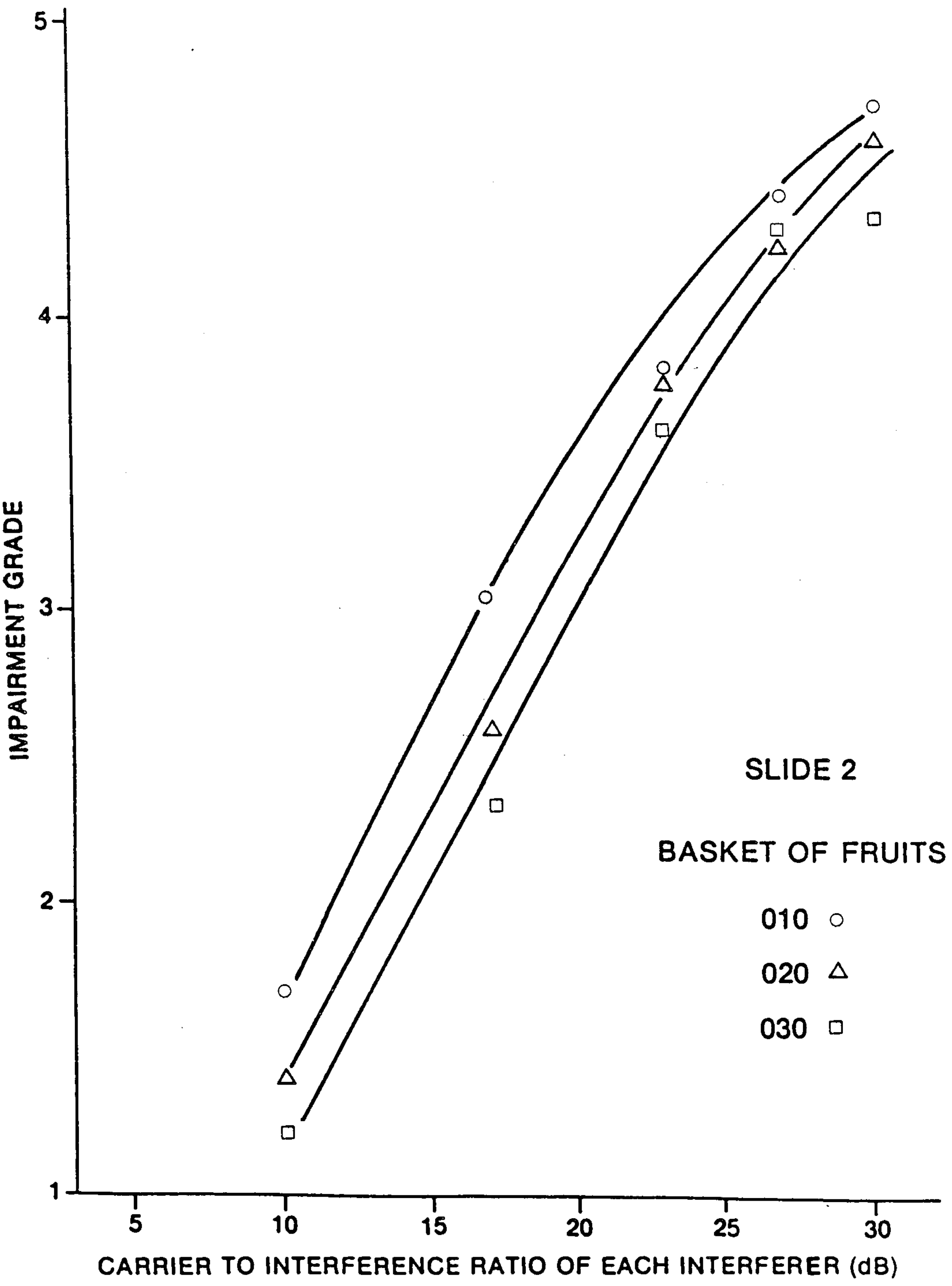


Figure 16: Picture degradation due to aggregate co-channel interference (Still picture #2, Viewer Group A)

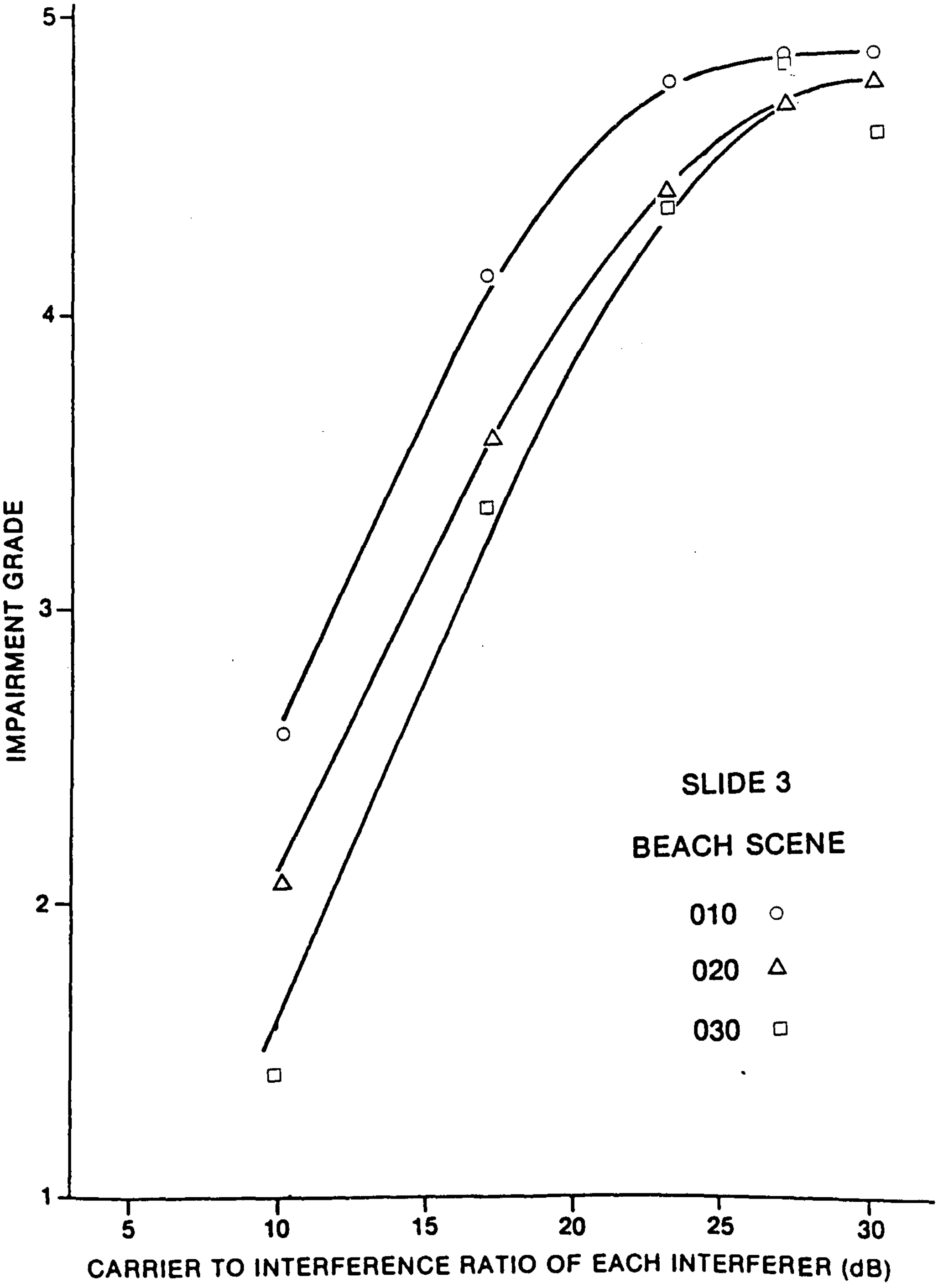


Figure 17: Picture degradation due to aggregate co-channel interference
(Still picture #3, Viewer Group A)

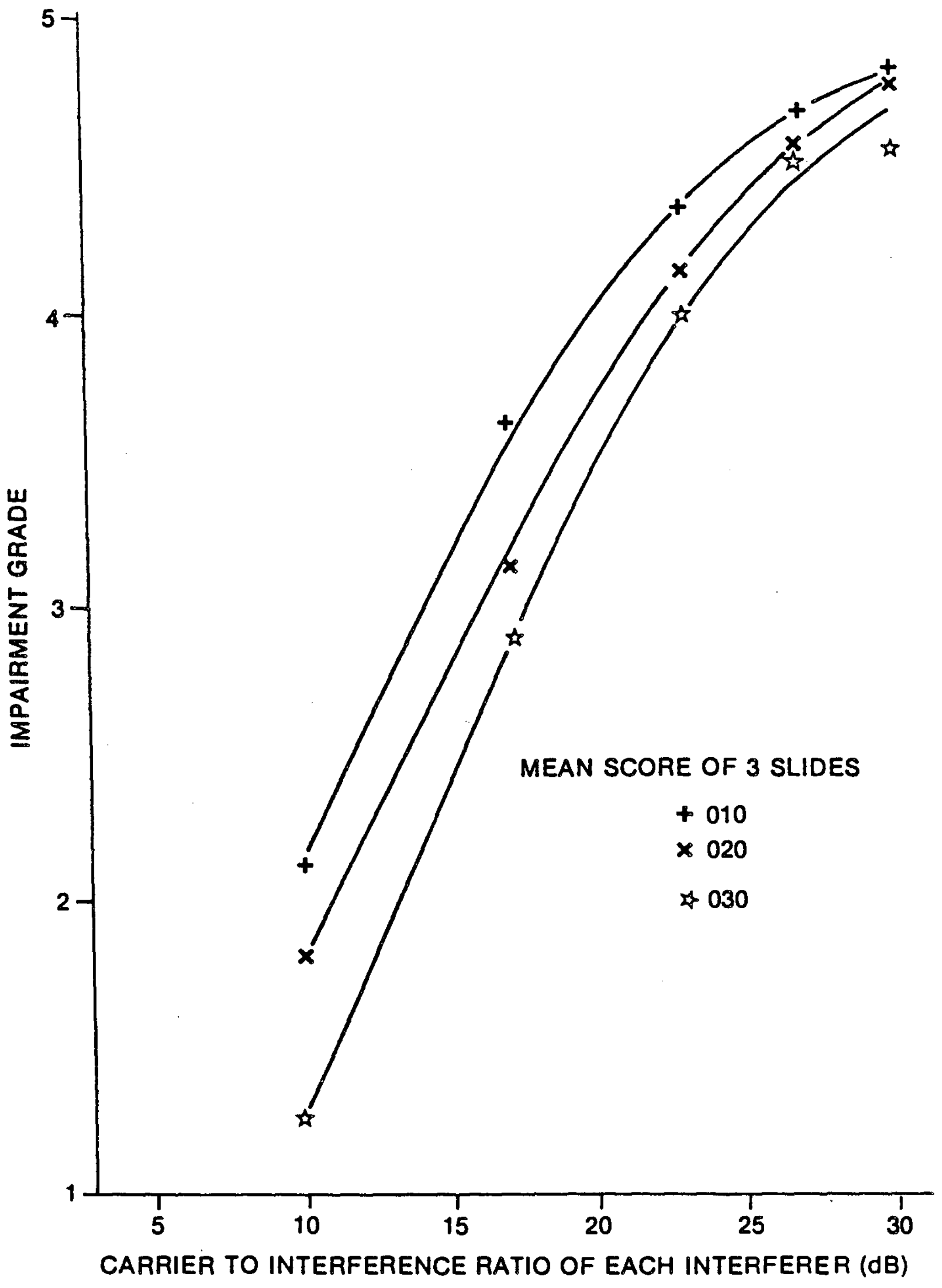


Figure 18: Picture degradation due to aggregate co-channel interference
(All 3 slides, Viewer Group A)

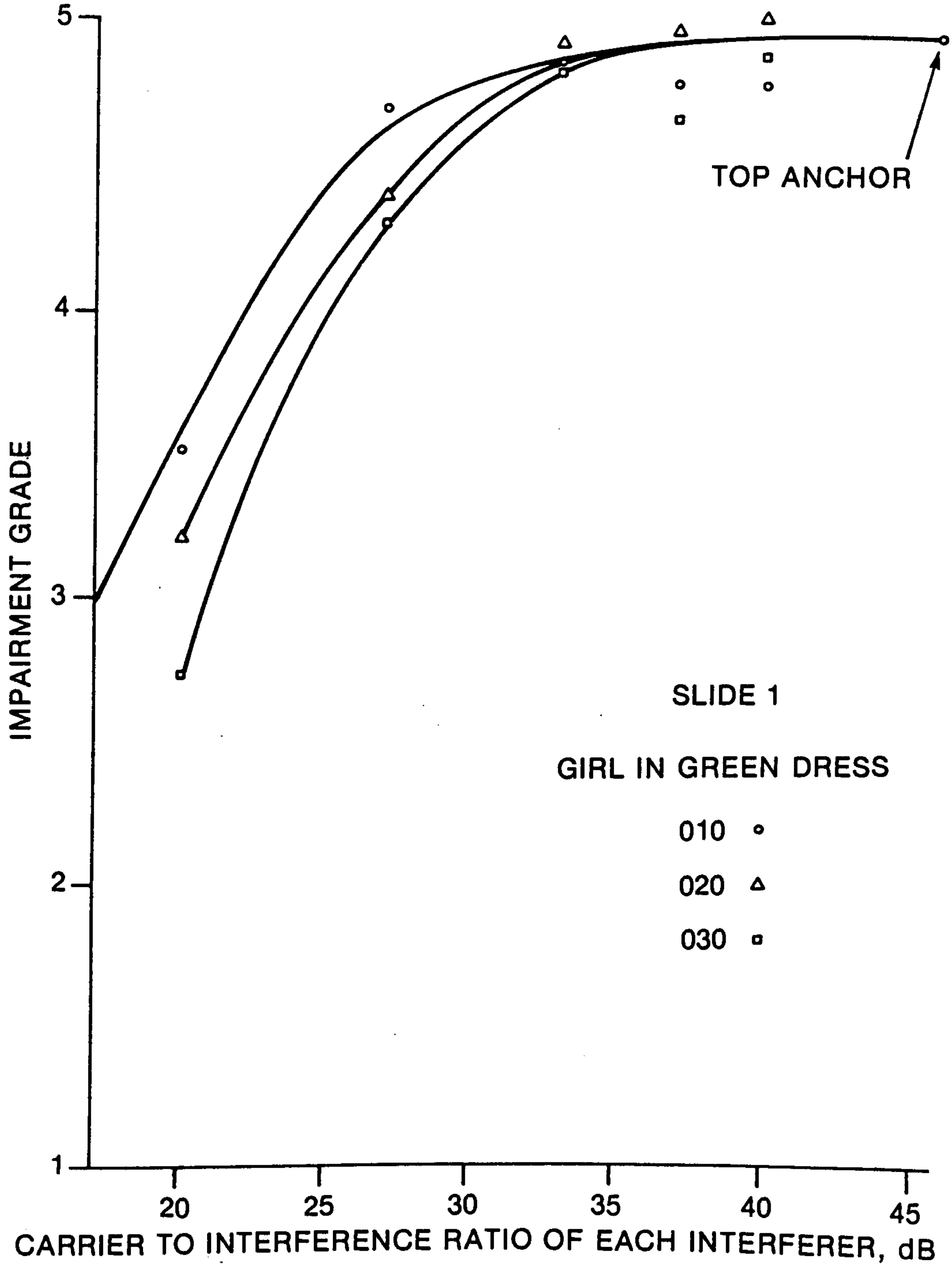


Figure 19: Picture degradation due to aggregate co-channel interference (Still picture #1, Viewer Group B)

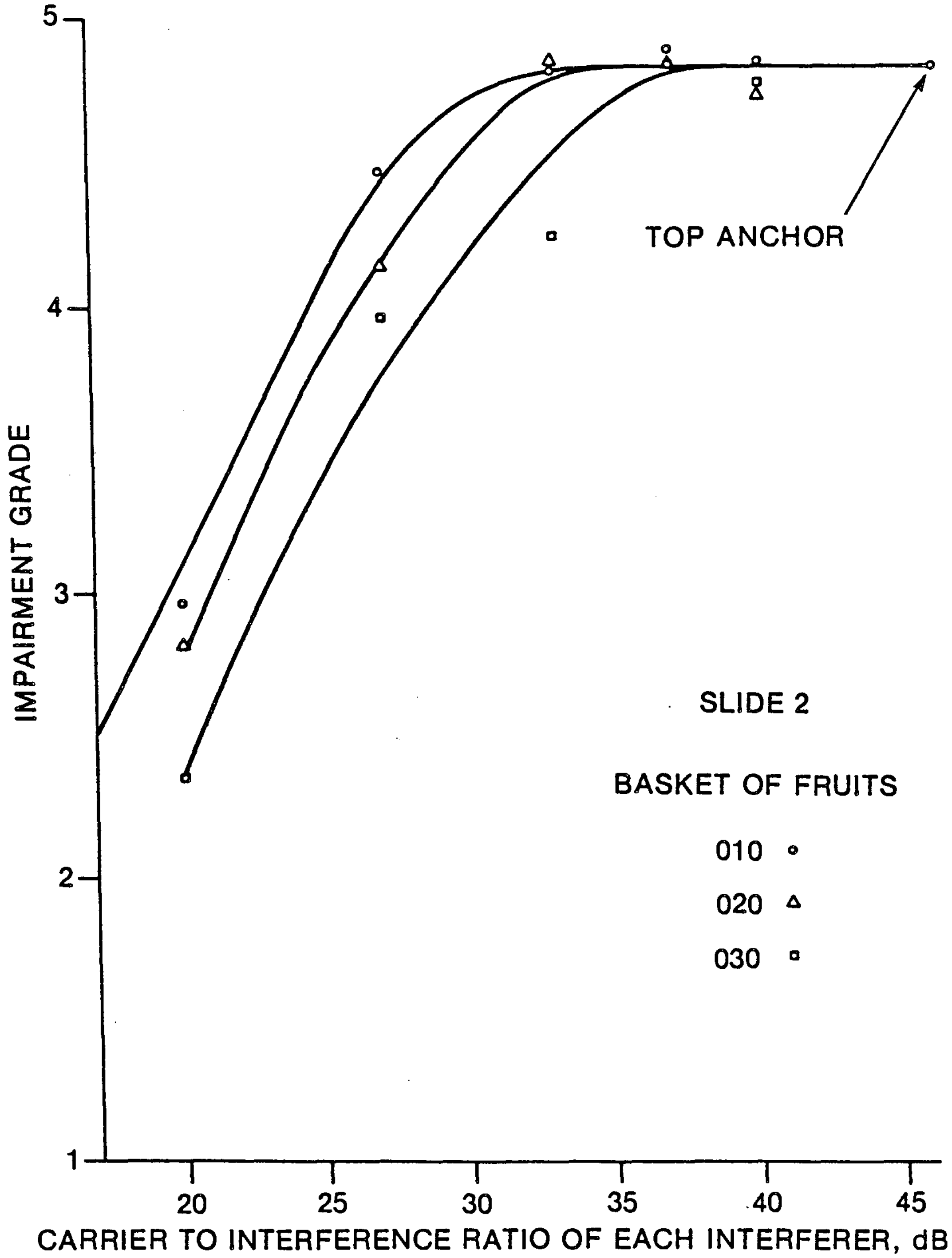


Figure 20: Picture degradation due to aggregate co-channel interference (Still picture #2, Viewer Group B)

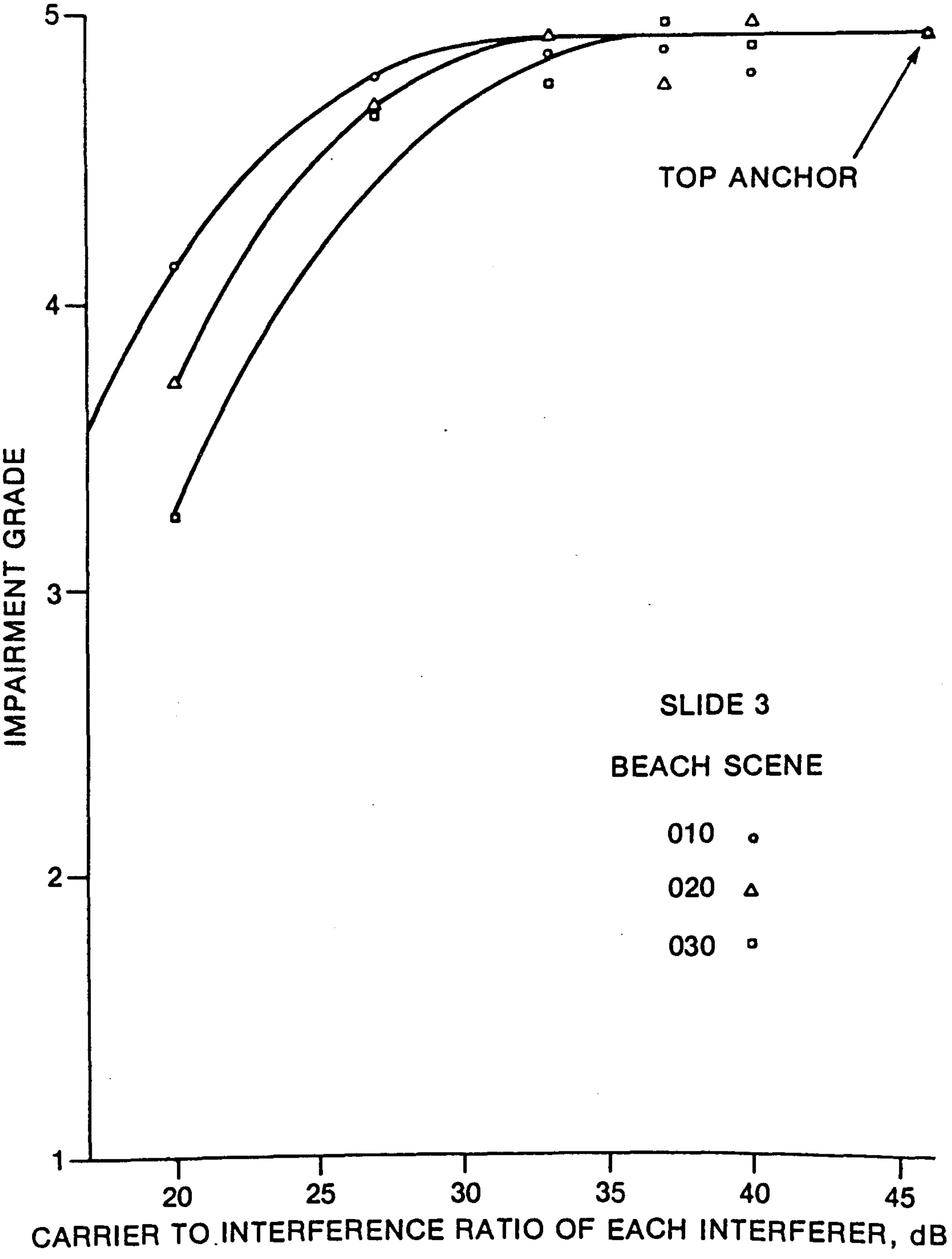


Figure 21: Picture degradation due to aggregate co-channel interference (Still Picture #3, Viewer Group B)

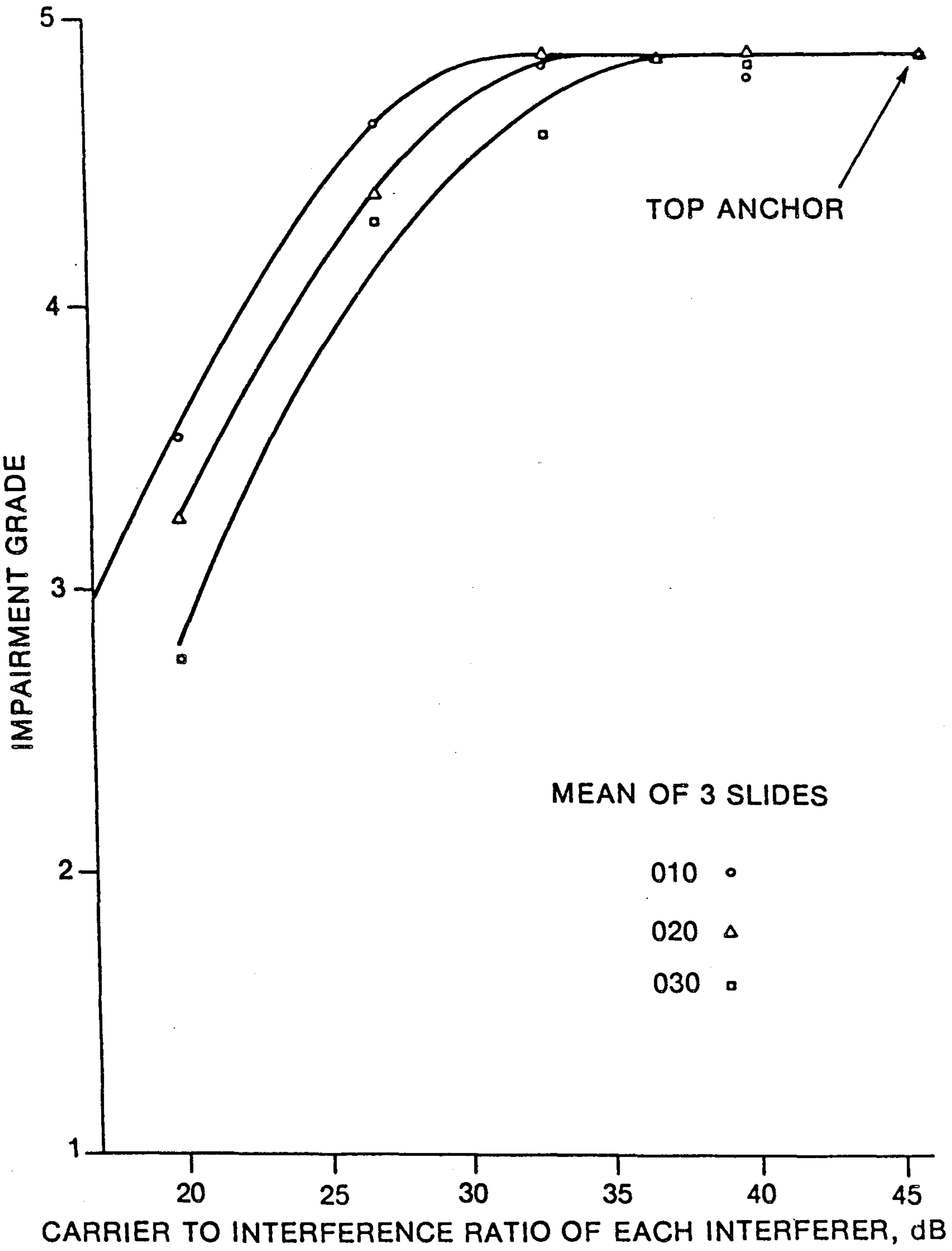
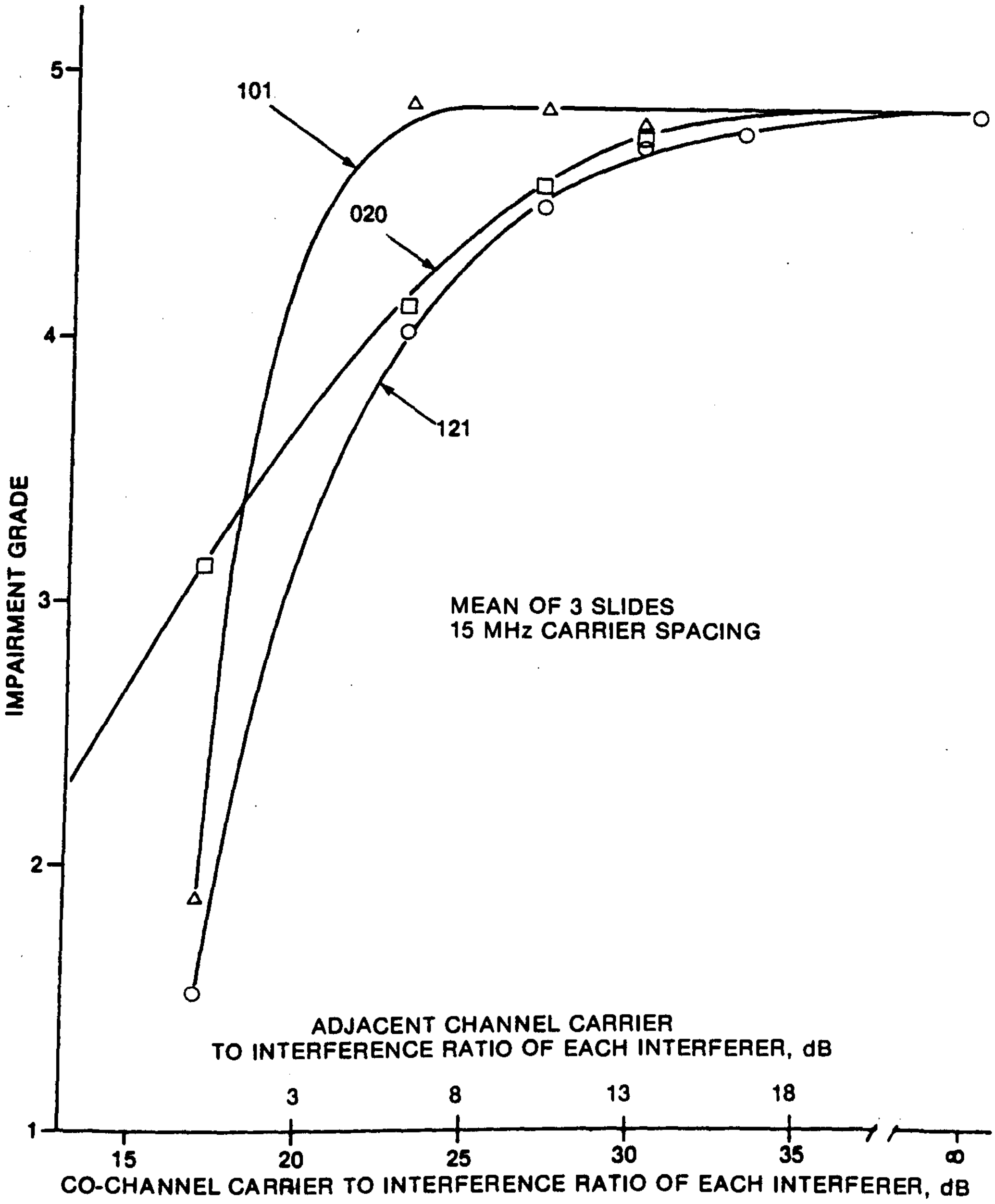


Figure 22: Picture degradation due to aggregate co-channel interference (All 3 slides, Viewer Group B)



Picture 23: Picture degradation due to aggregate co-channel and adjacent channel interference
(All 3 slides, Viewer Group B)

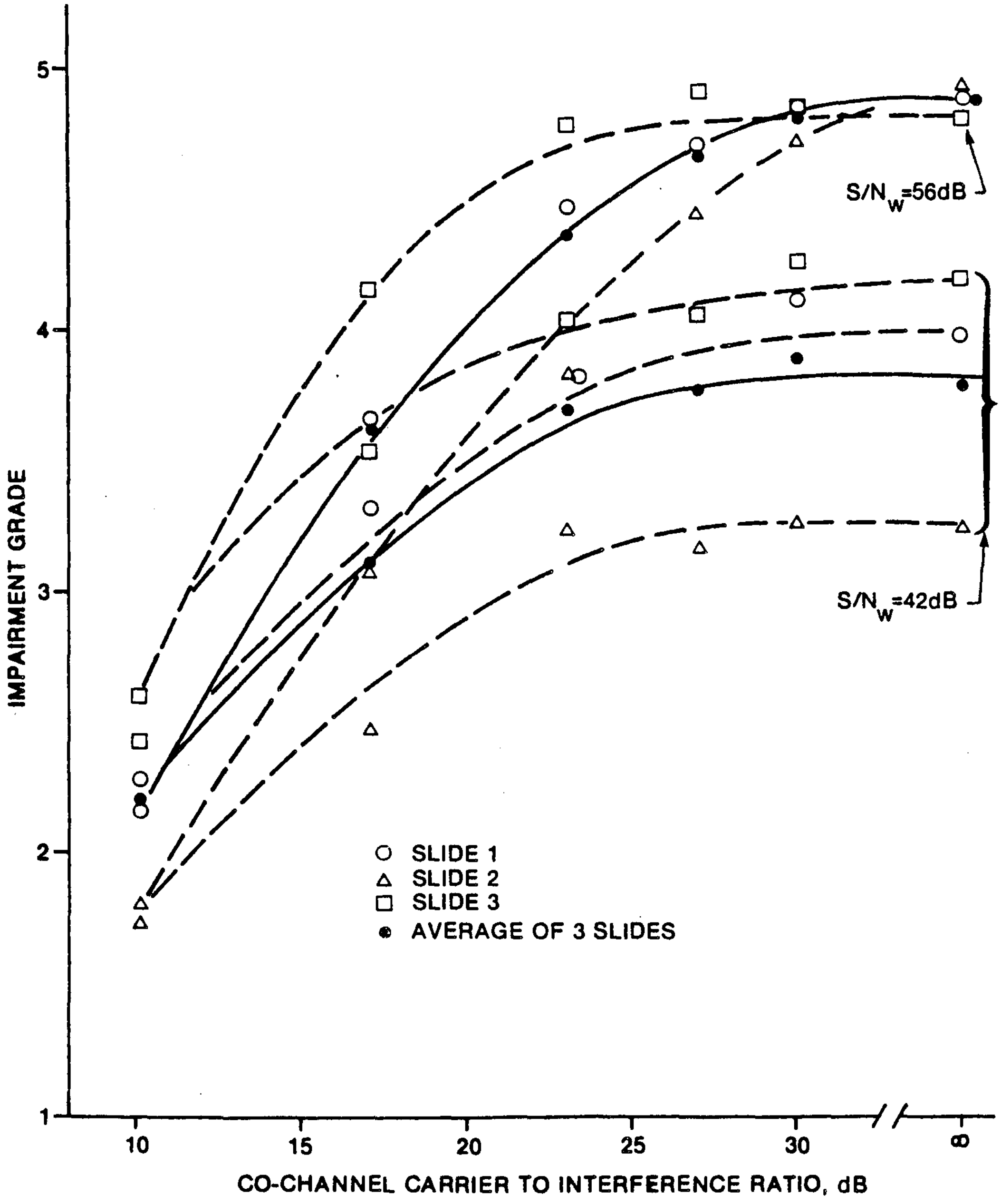


Figure 24: Picture degradation due to the aggregate of noise and interference (All 3 slides, Viewer Group B)

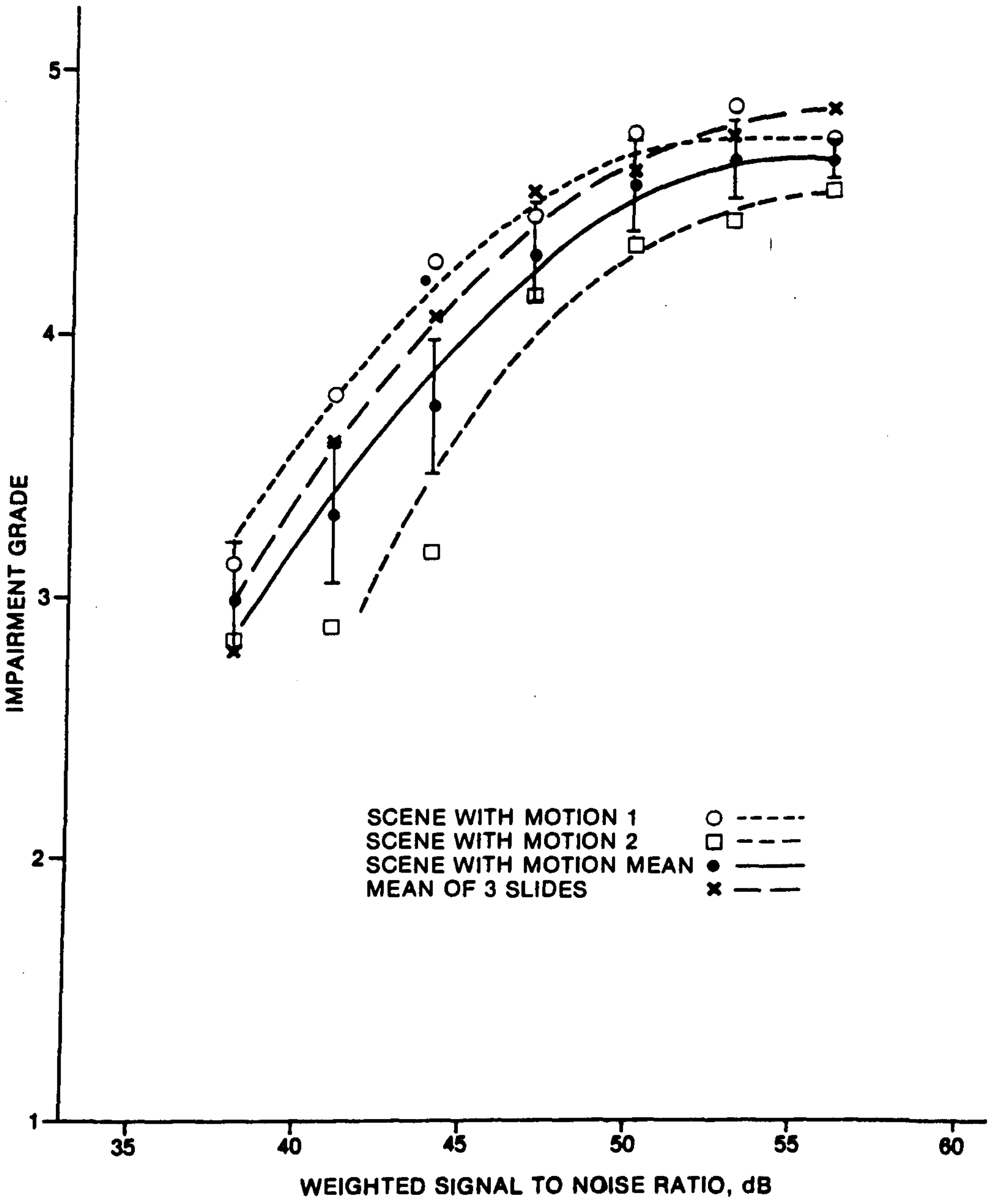


Figure 25: Picture degradation due to triangular noise (2 moving scenes, viewer Group C)

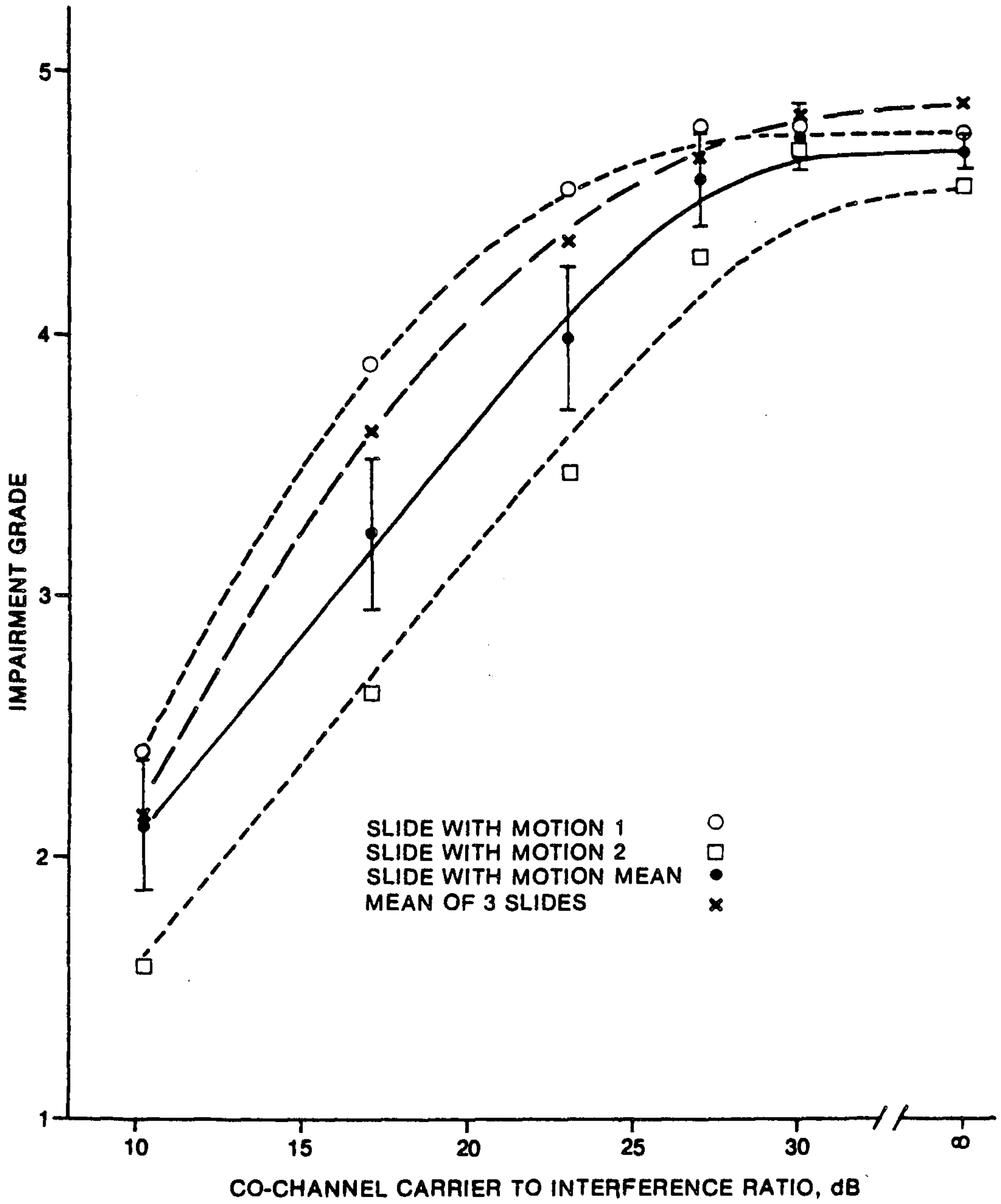


Figure 26: Picture degradation due to co-channel interference (2 moving scenes, viewer Group C)

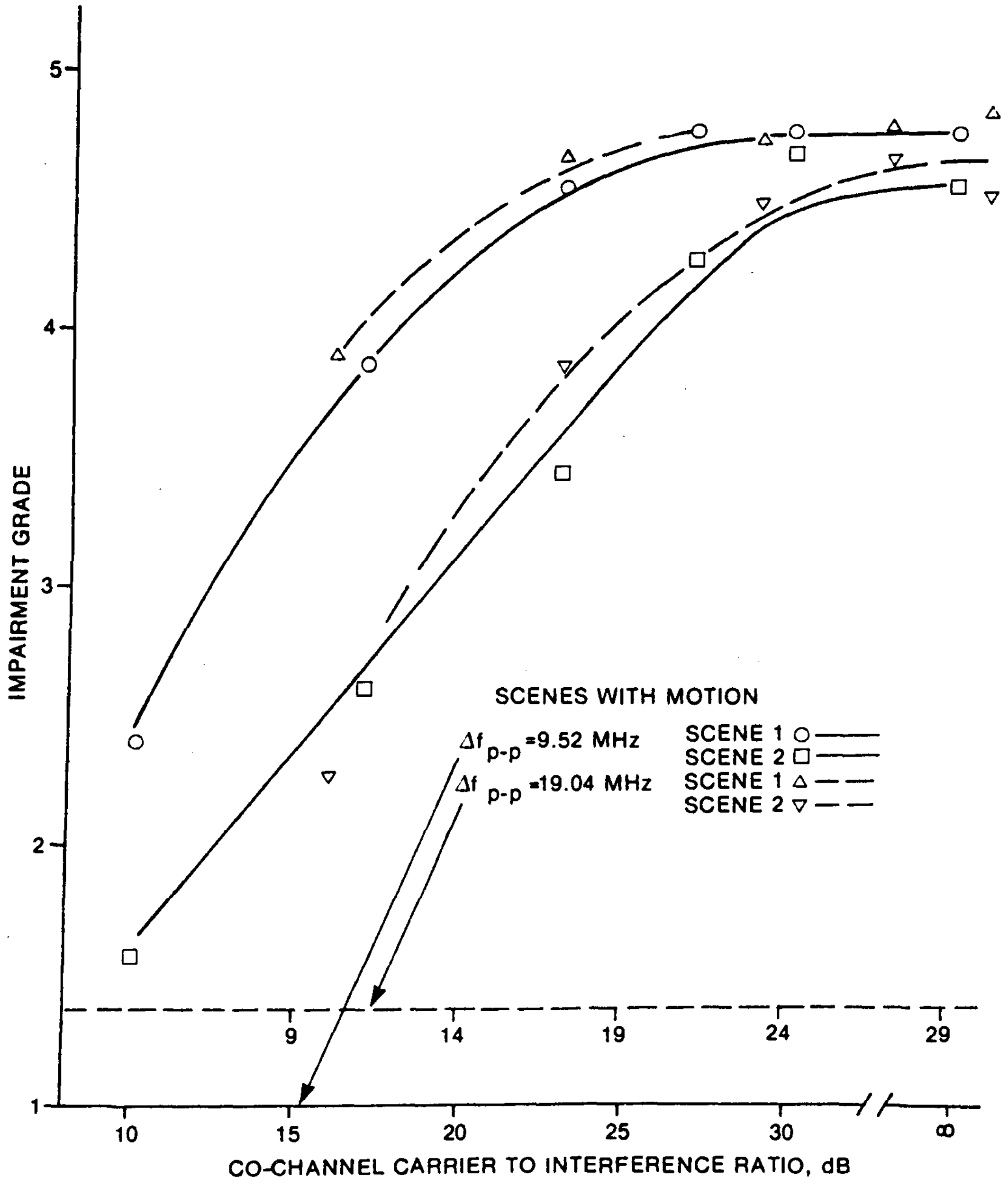


Figure 27: Effect of doubling the carrier deviation
(2 moving scenes, viewer Group C)

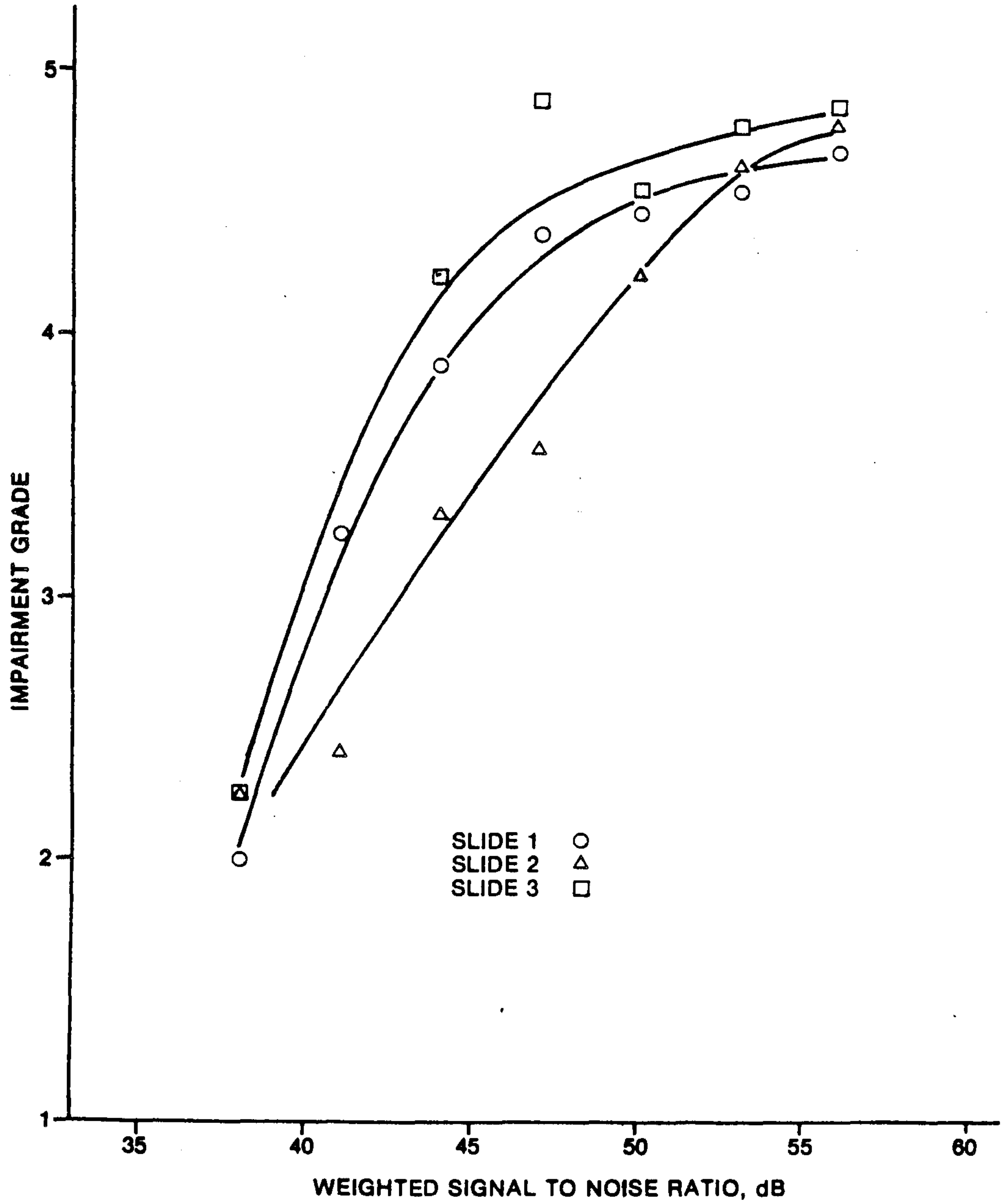


Figure 28: Picture degradation due to triangular noise (3 still pictures, viewer Group D)

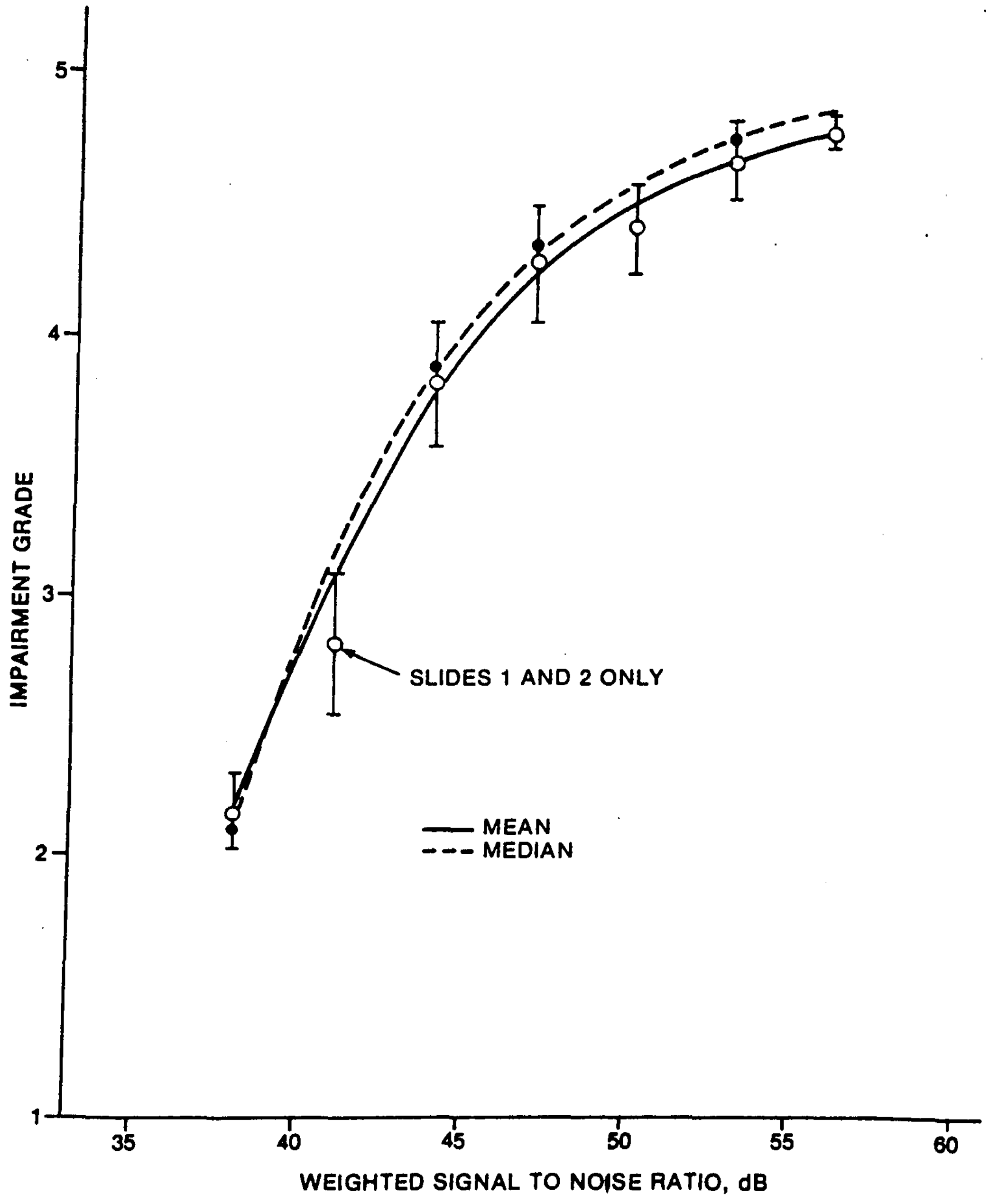


Figure 29: Picture degradation due to triangular noise (average of 3 still pictures)

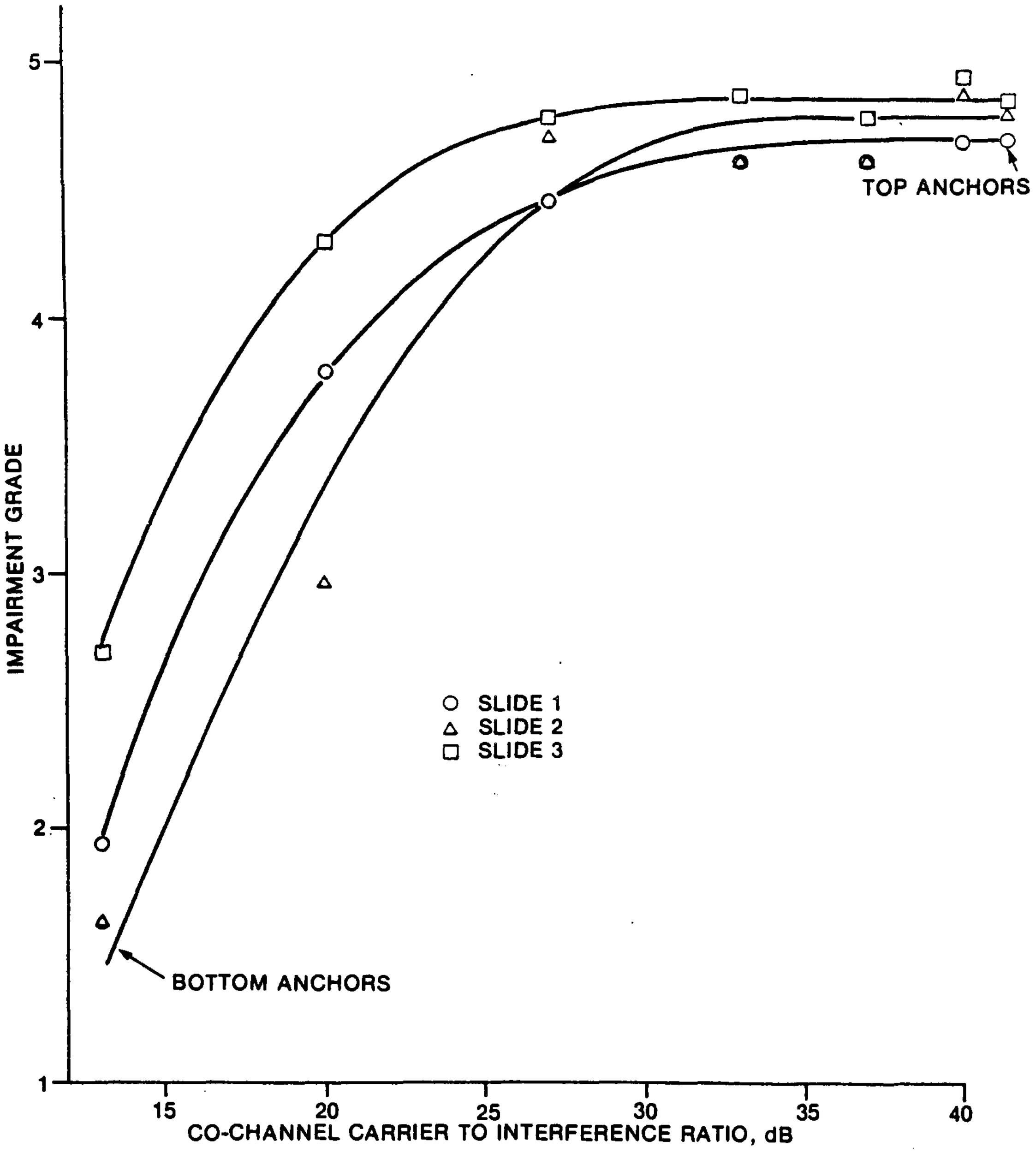


Figure 30: Picture degradation due to co-channel interference (3 still pictures, viewer Group D)

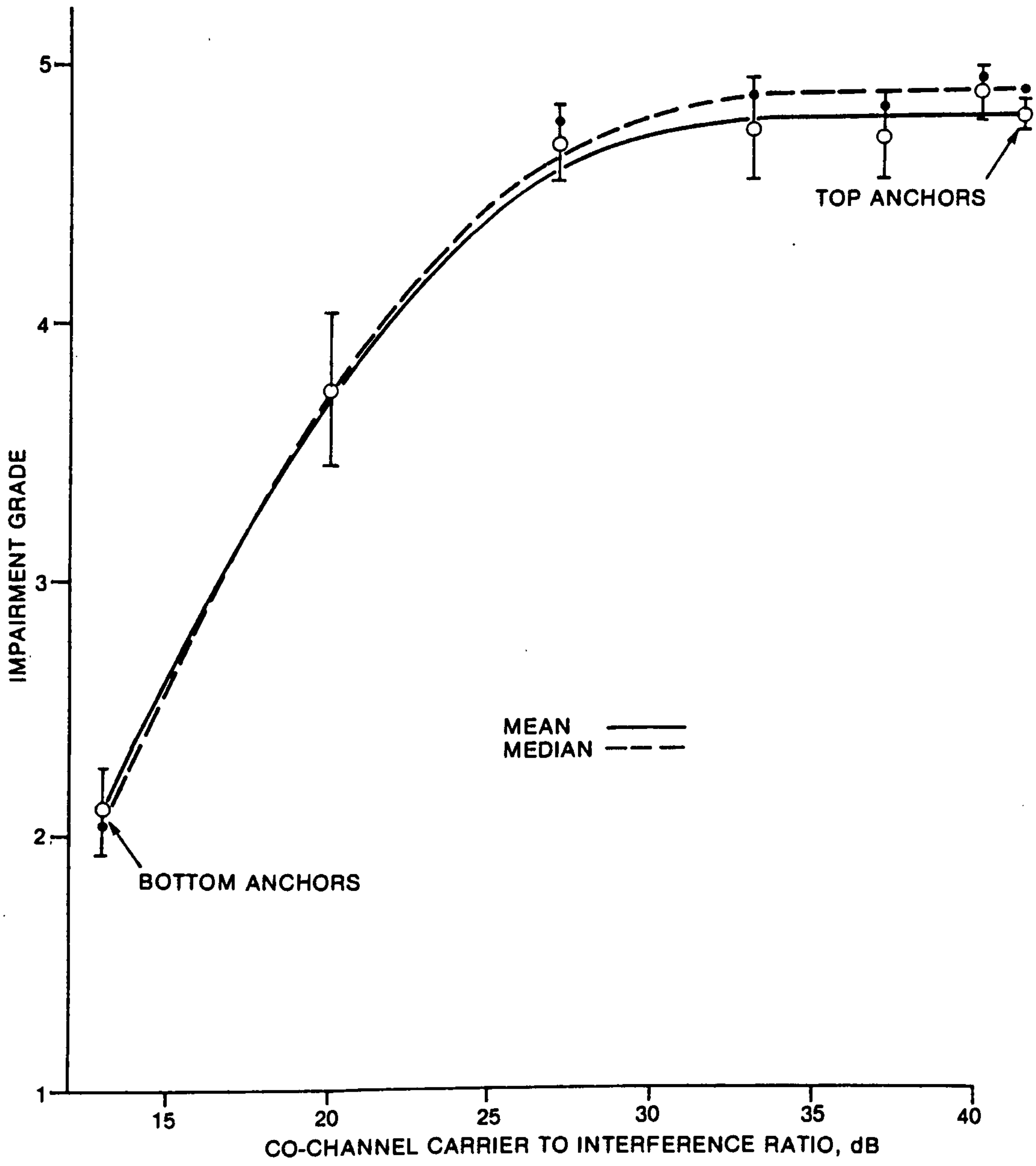


Figure 31: Picture degradation due to co-channel interference (average of 3 still pictures, viewer Group D)

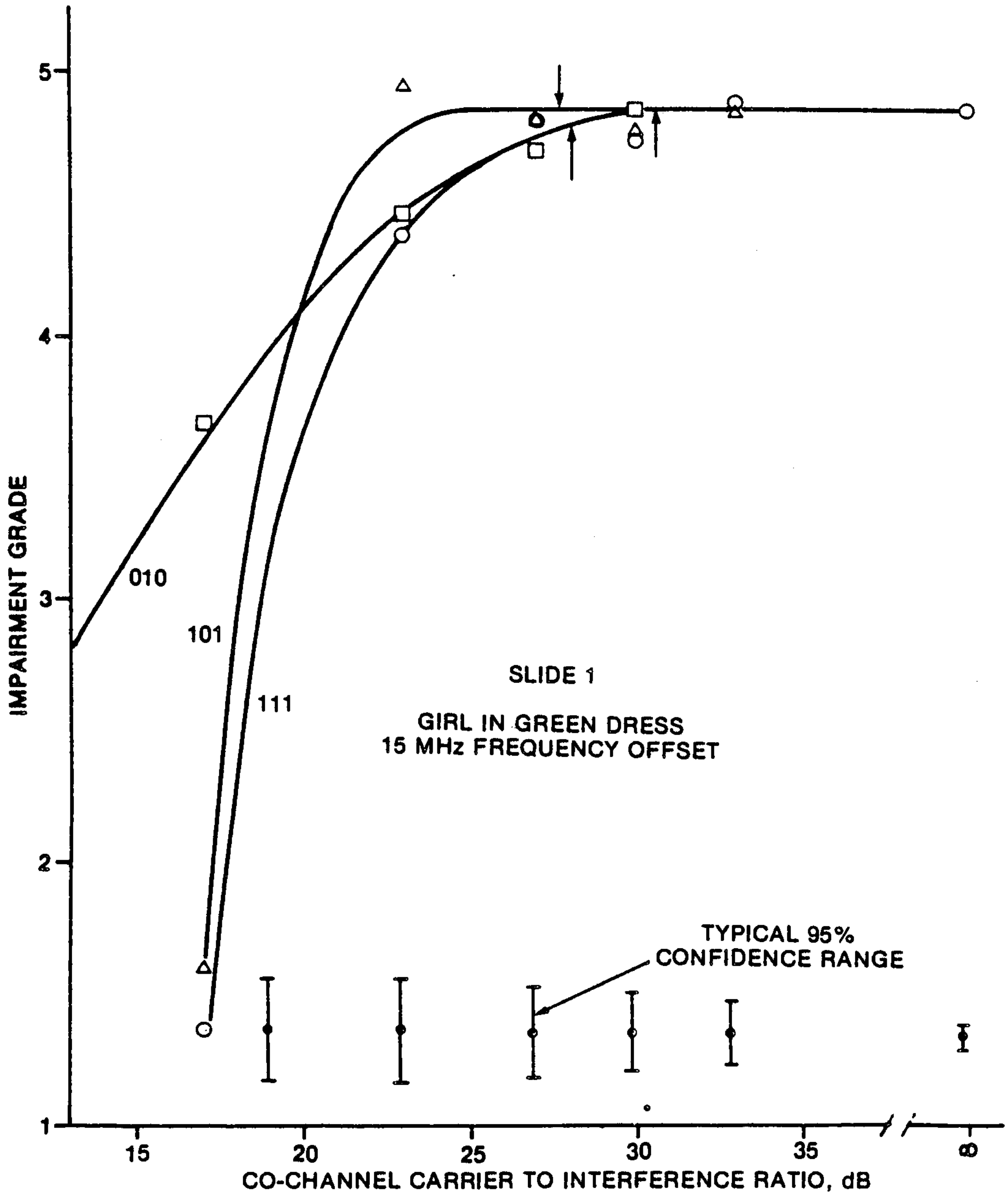


Figure 32: Picture degradation due to aggregate co-channel and adjacent channel interference (111) (still picture 1, viewer Group A)

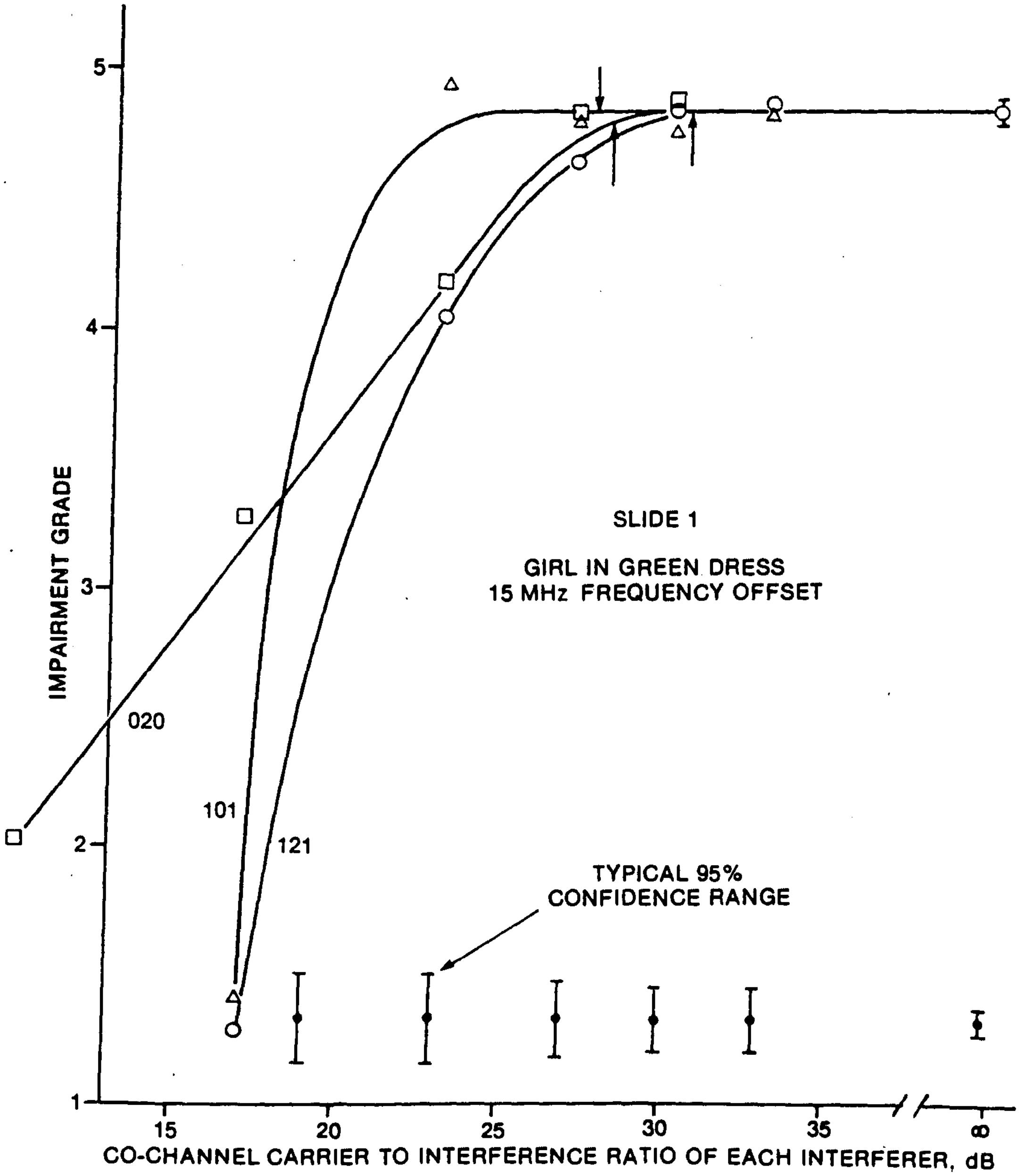


Figure 33: Picture degradation due to aggregate co-channel and adjacent channel interference (121) (still picture 1, viewer Group A)

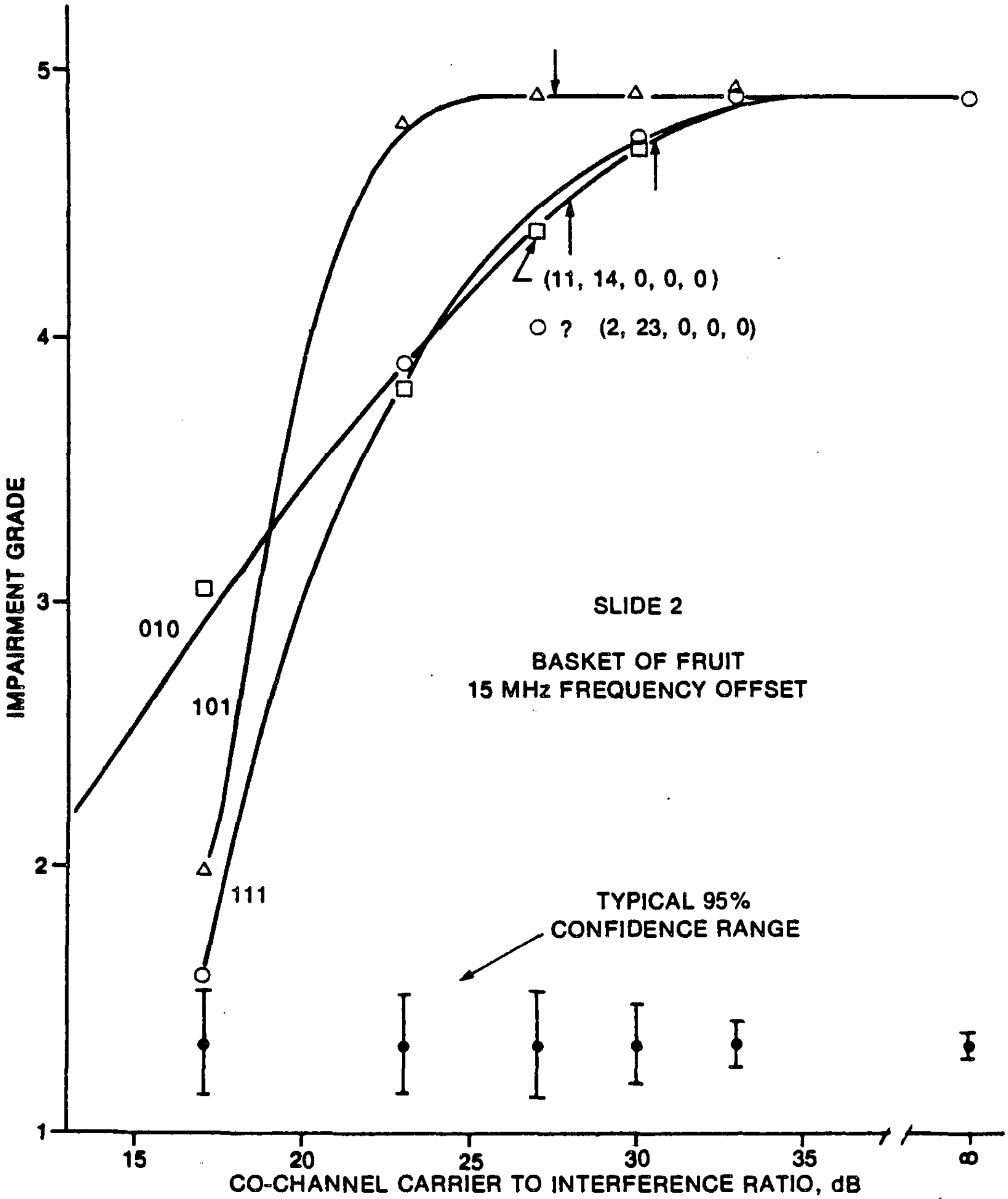


Figure 34: Picture degradation due to aggregate co-channel and adjacent channel interference (111) (still picture 4, viewer Group A)

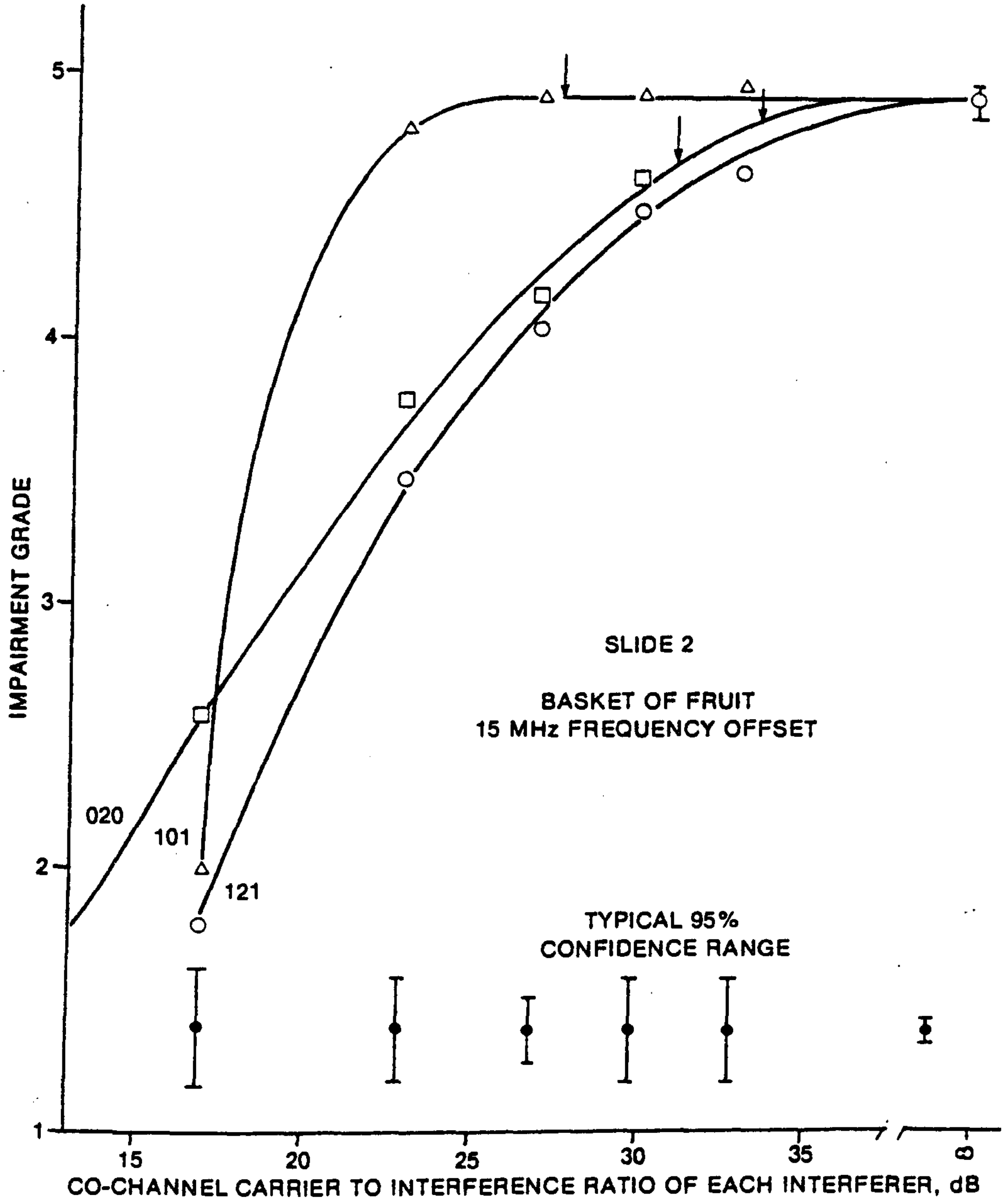


Figure 35: Picture degradation due to aggregate co-channel and adjacent channel interference (121)

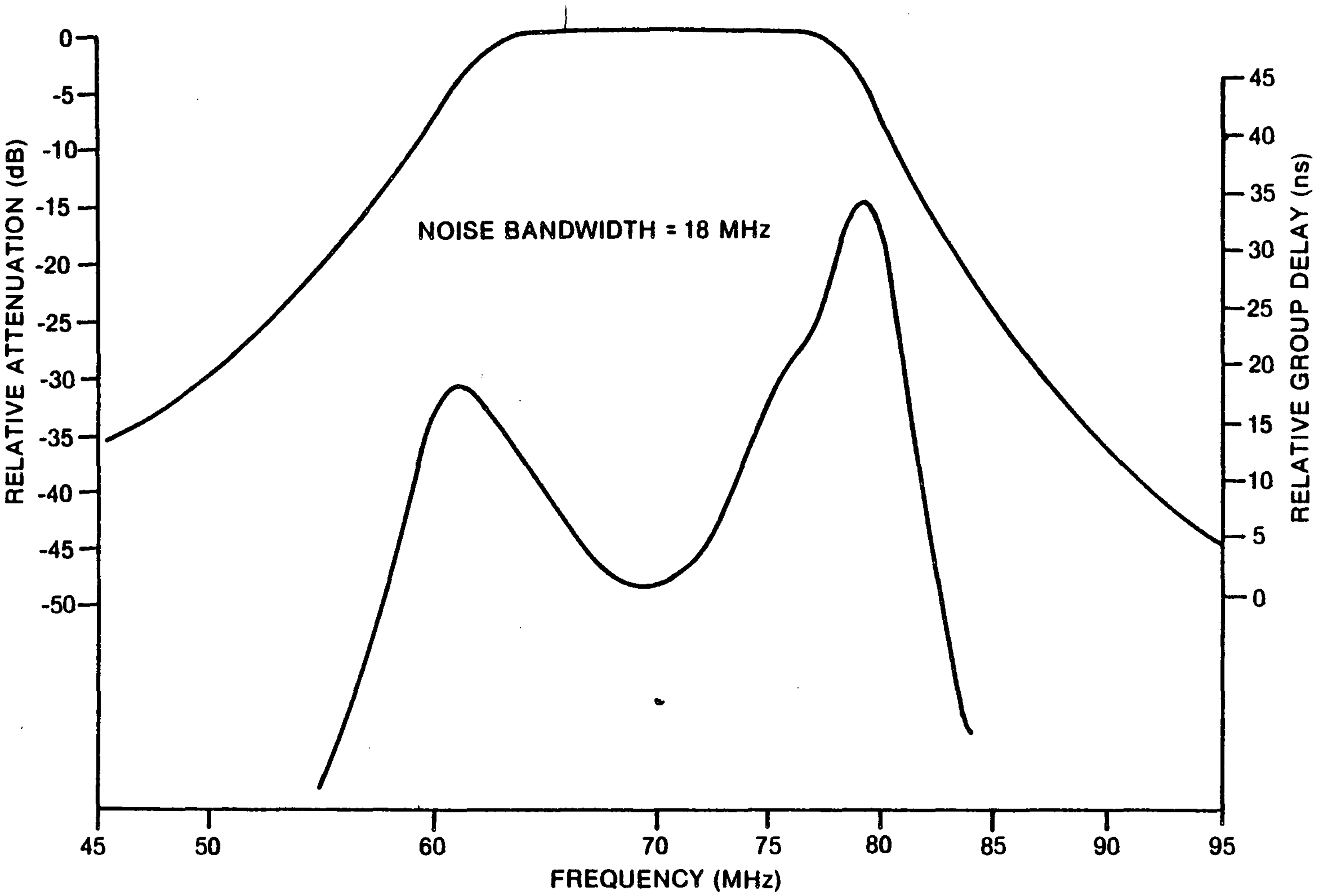


Figure 36: Frequency response of the 4-pole/14 MHz IF pre-detection filter.

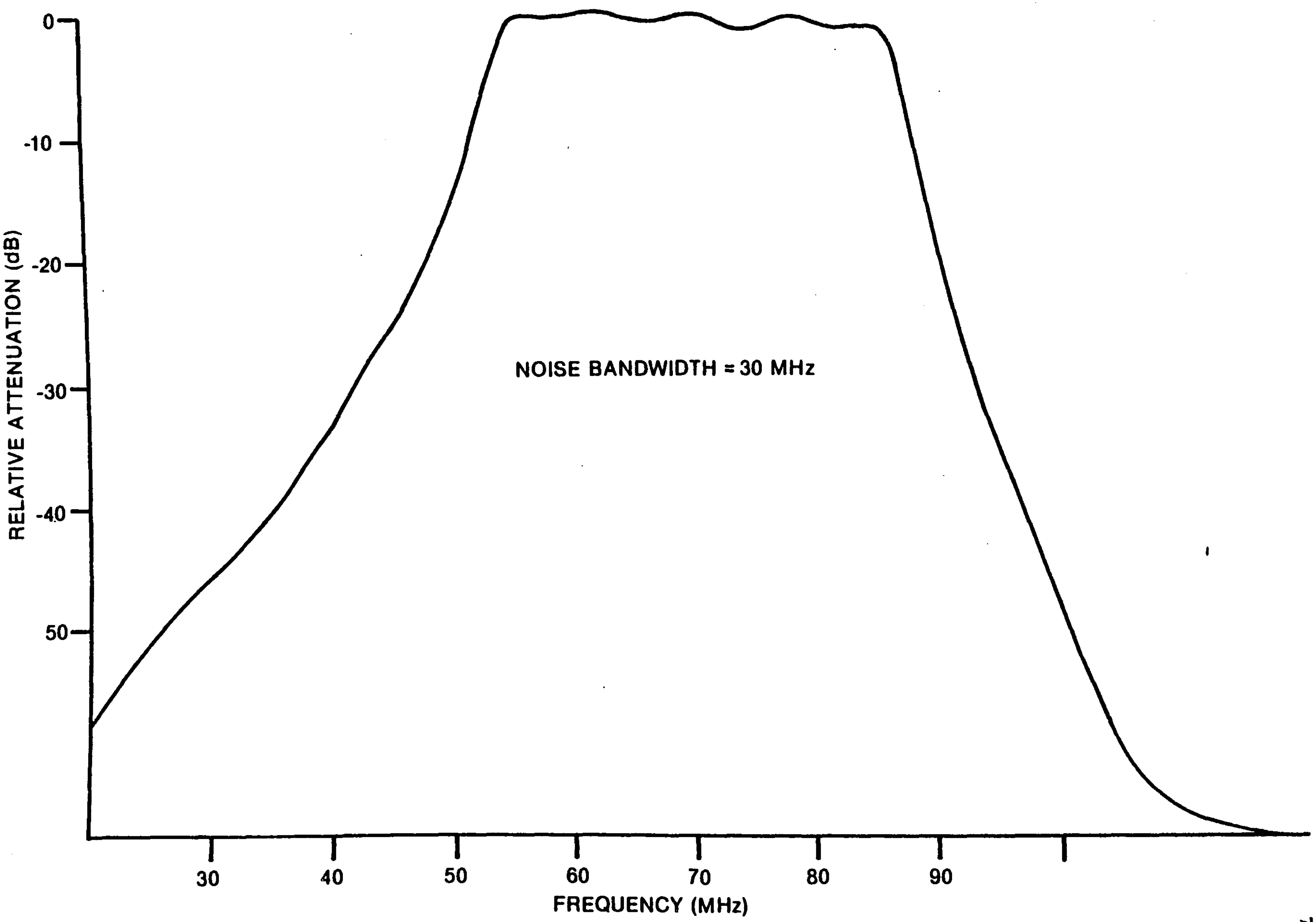


Figure 37: Frequency response of the 5-pole/26 MHz IF pre-detection filter.

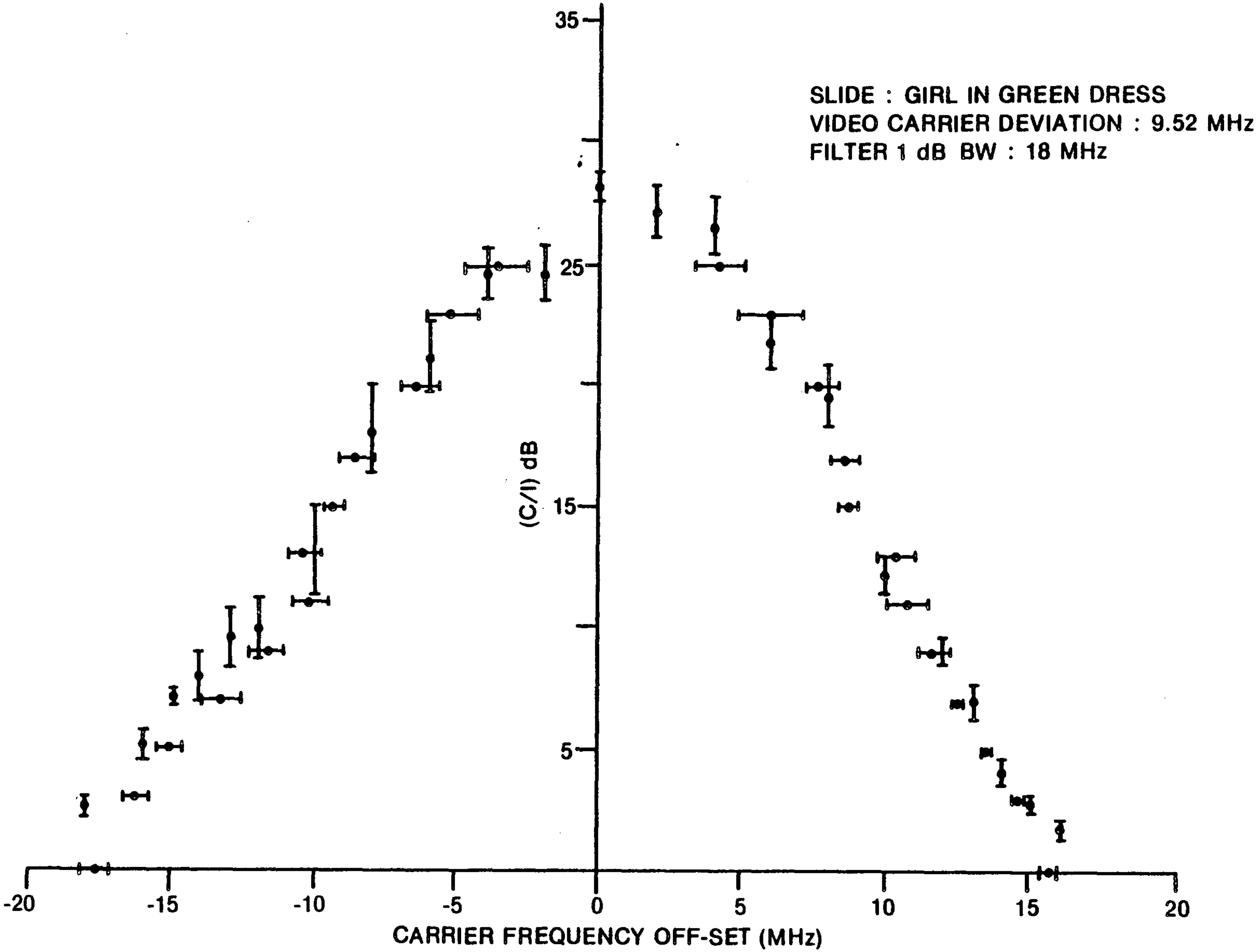


Figure 38: Results of the just-perceptible tests (mean and 95% confidence range) for the frequency sweep and the C/I sweep for normal test conditions and slide #1.

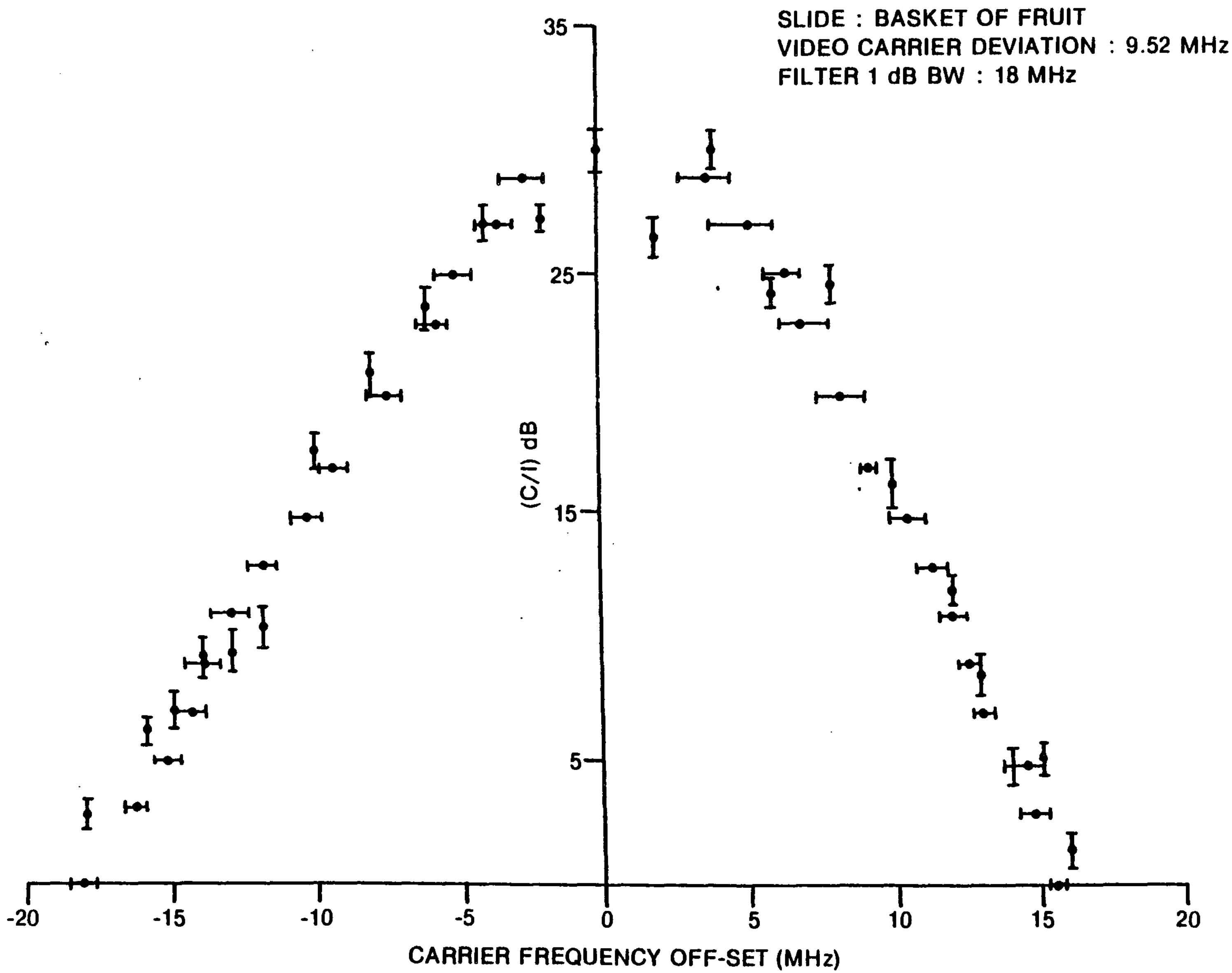


Figure 39: Results of the just-perceptible tests (mean and 95% confidence range) for the frequency sweep and the C/I sweep for normal test conditions and slide #2.

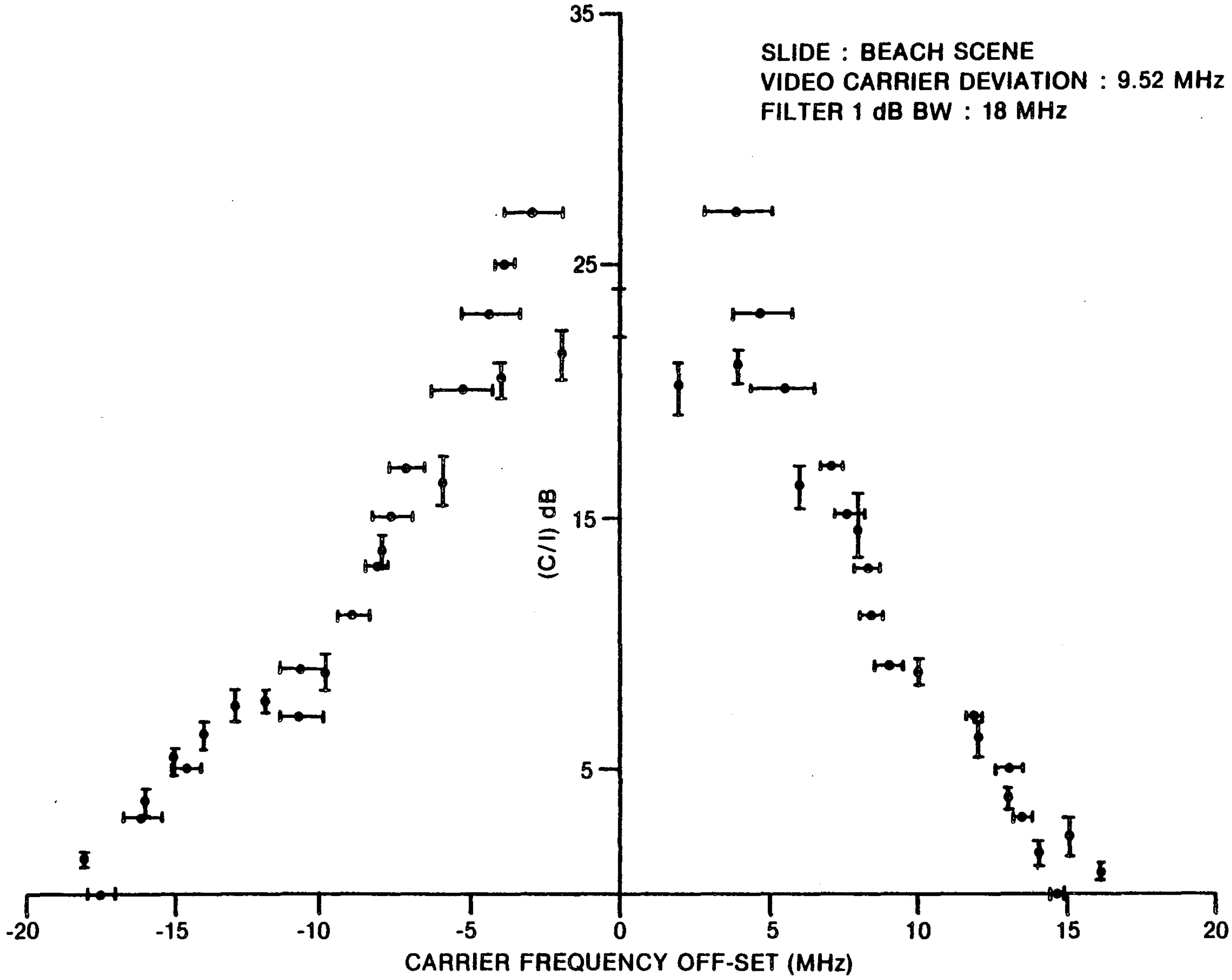


Figure 40: Results of the just-perceptible tests (mean and 95% confidence range) for the frequency sweep and the C/I sweep for normal test conditions and slide #3.

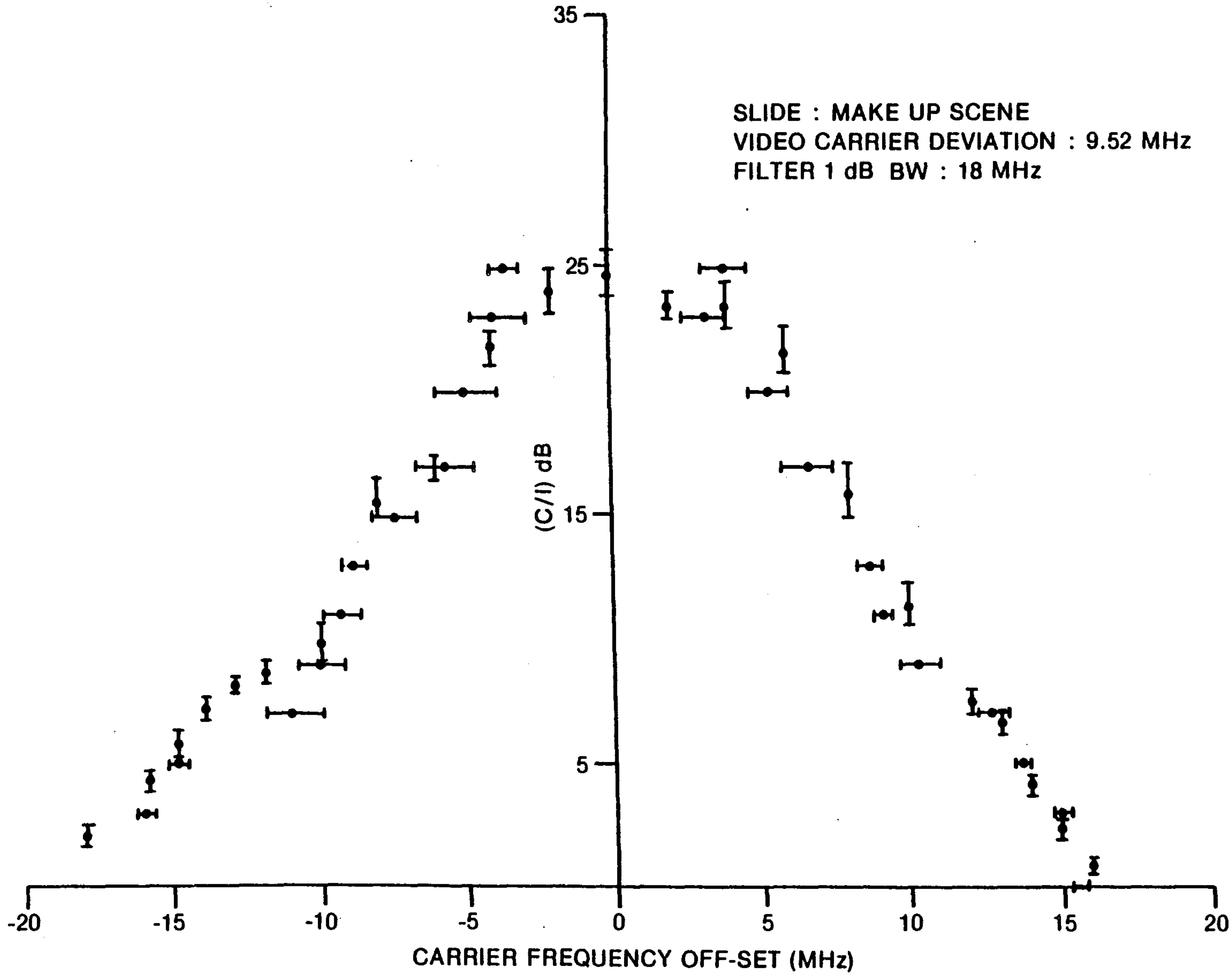


Figure 41: Results of the just-perceptible tests (mean and 95% confidence range) for the frequency sweep and the C/I sweep for normal test conditions and slide #4.

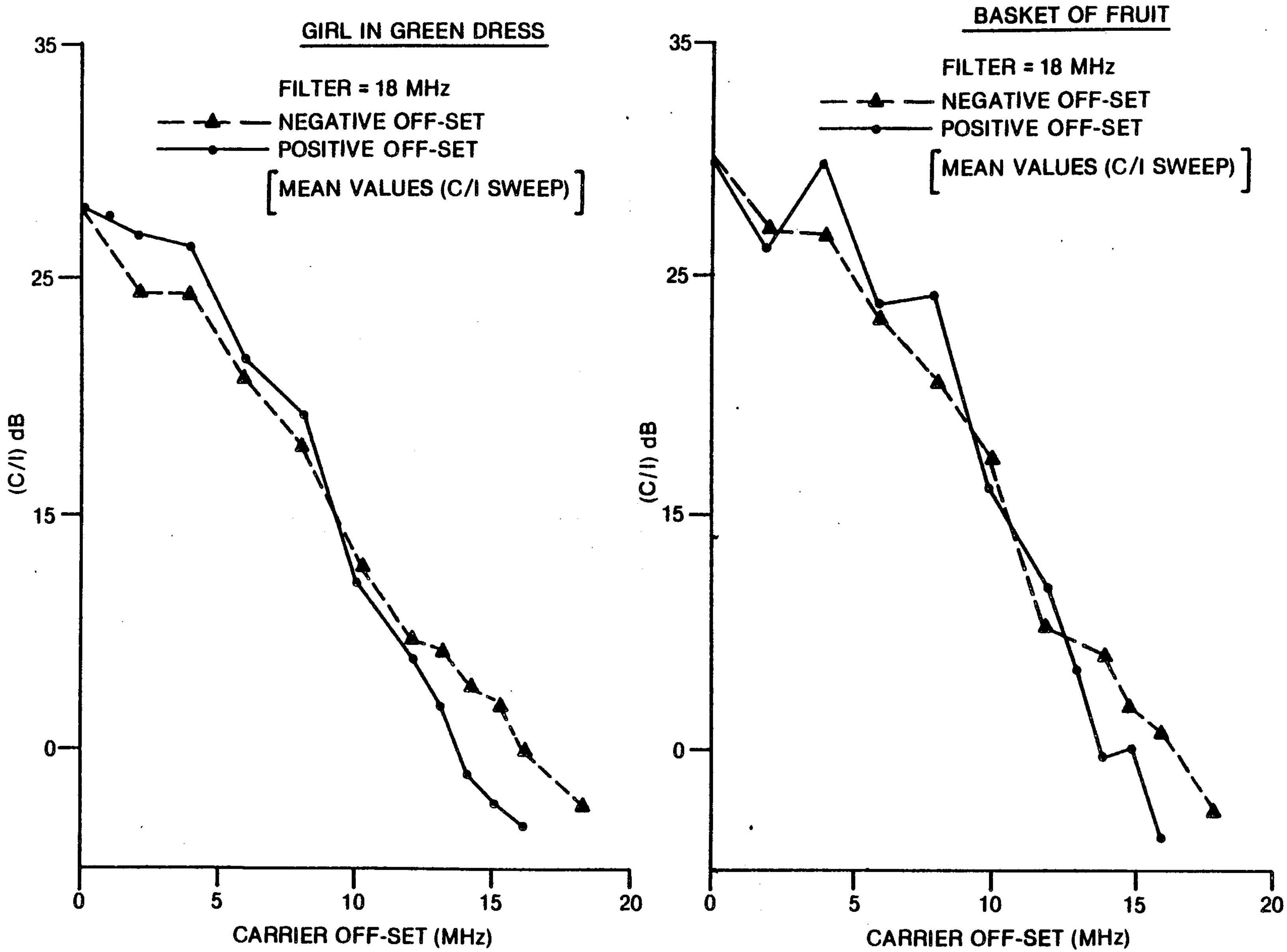


Figure 42: Symmetry of the results of the just-perceptible tests with respect to the positive and negative offsets from the co-channel case for slides #1 and #2.

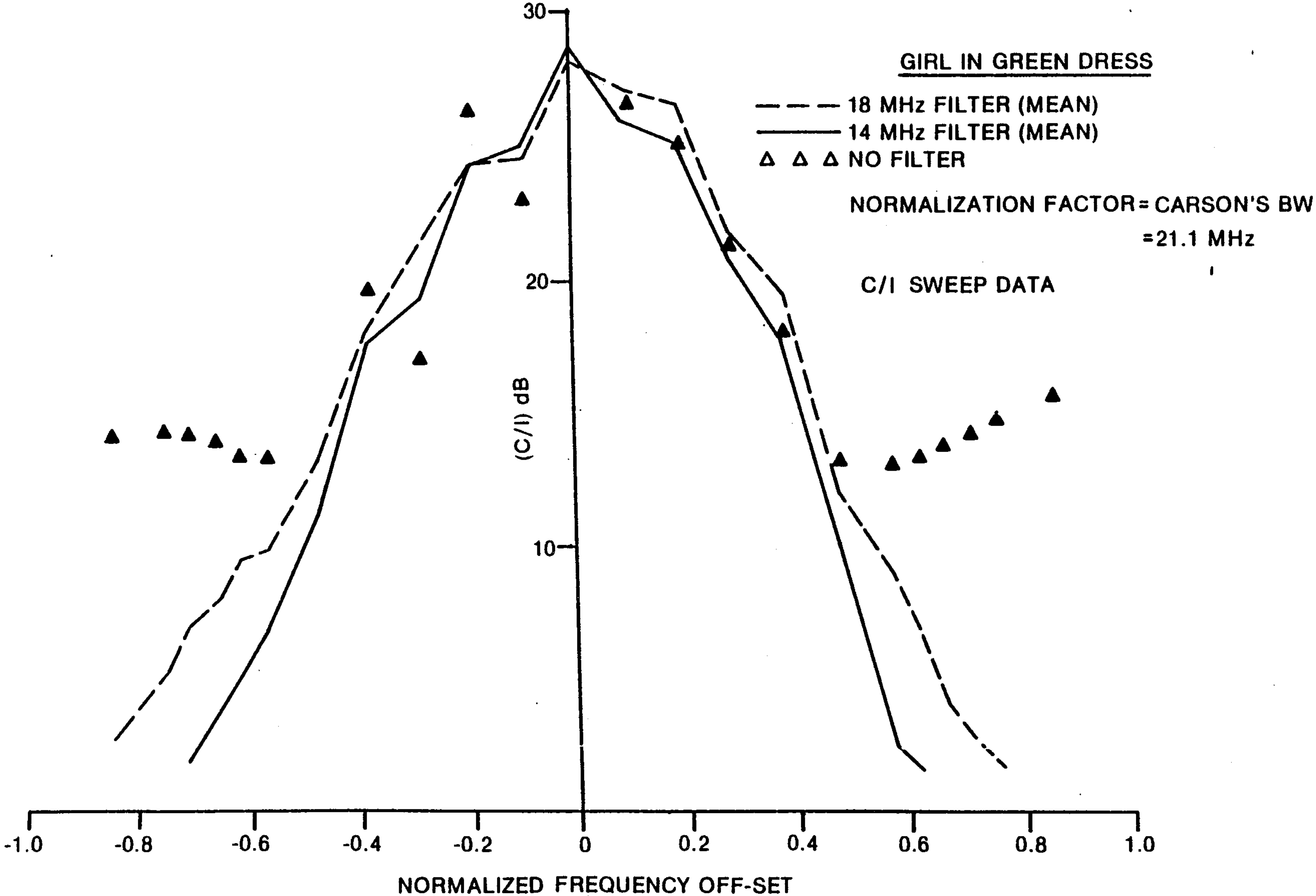


Figure 43: Comparison of the results of the just-perceptible interference tests for three different filter bandwidths for slide #1.

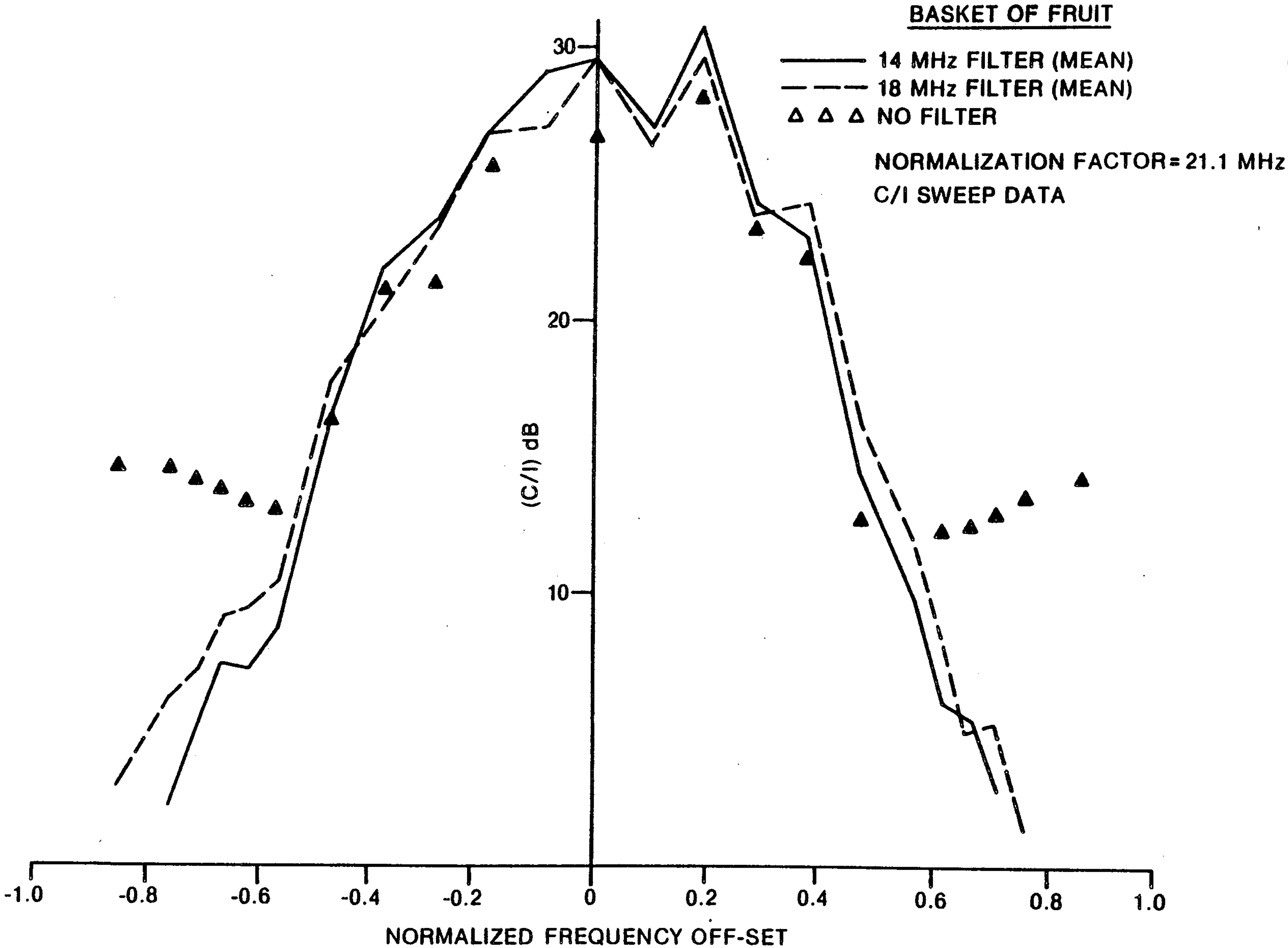


Figure 44: Comparison of the results of the just-perceptible interference tests for three different filter bandwidths for slide #2.

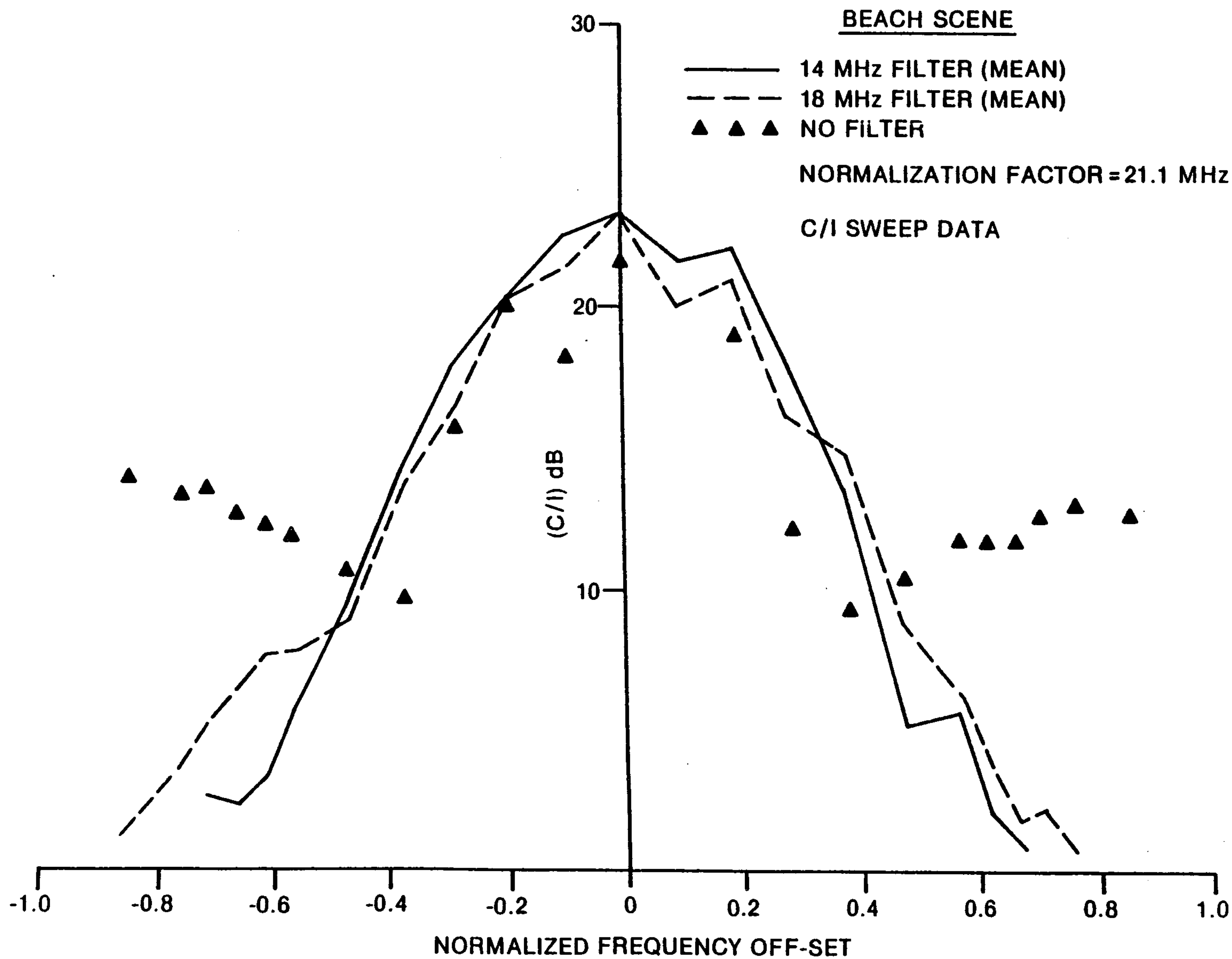


Figure 45: Comparison of the results of the just-perceptible interference tests for three different filter bandwidths for slide #3.

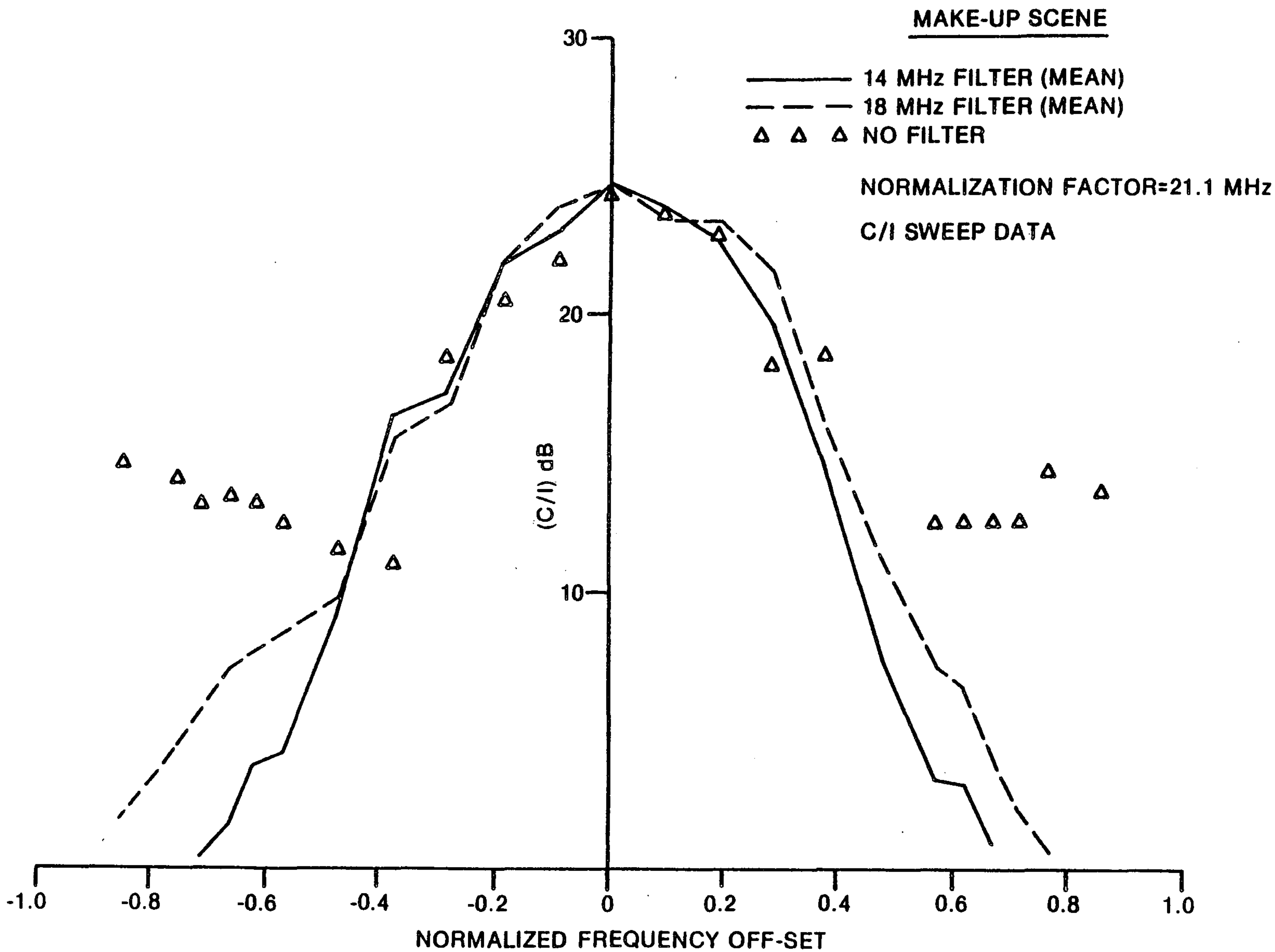


Figure 46: Comparison of the results of the just-perceptible interference tests for three different filter bandwidths for slide #4.

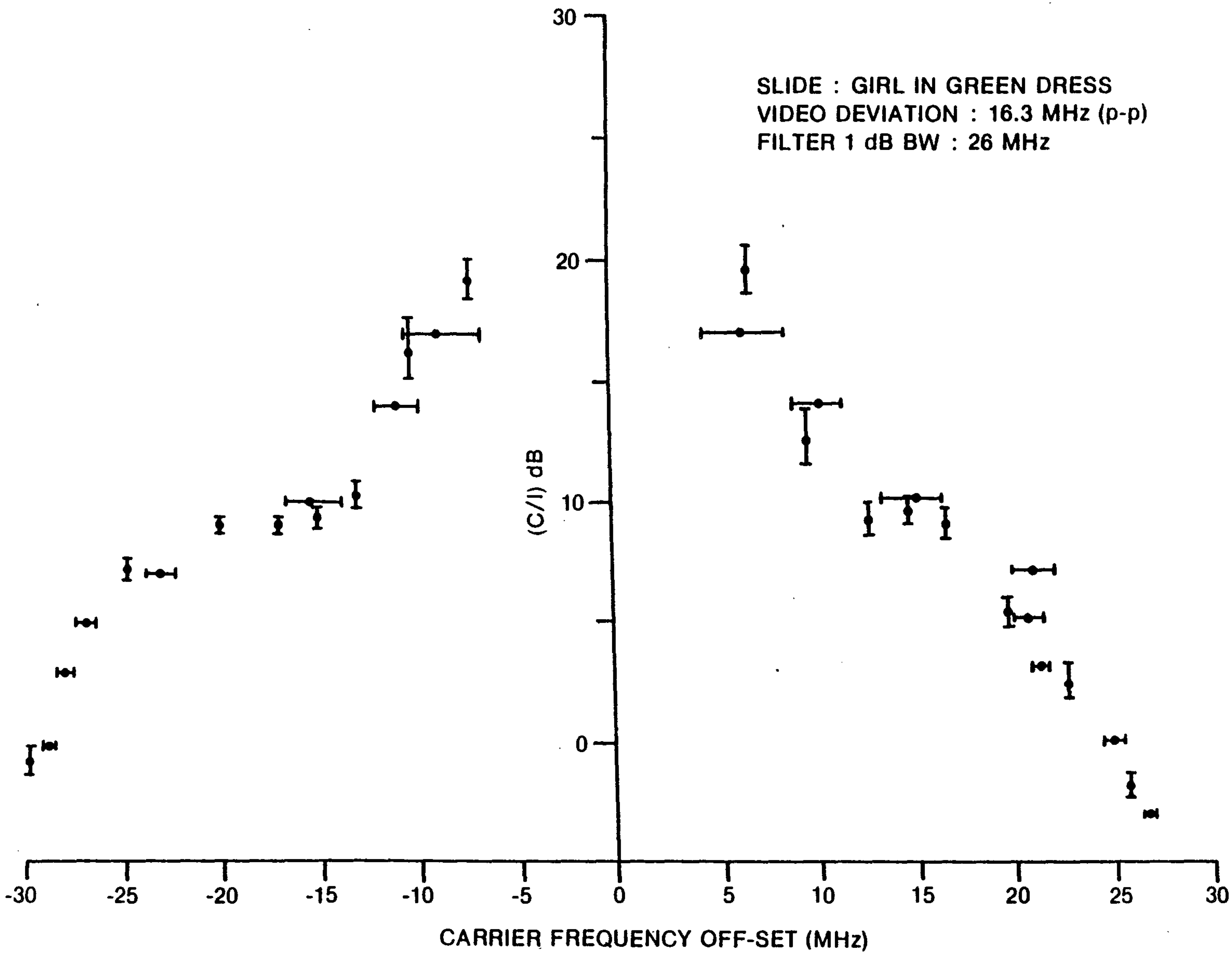


Figure 47: Results of the just-perceptible tests (mean and 95% confidence range) for the frequency sweep and C/I sweep for wider deviation (16.3 MHz) and using a filter of wider bandwidth for slide #1.

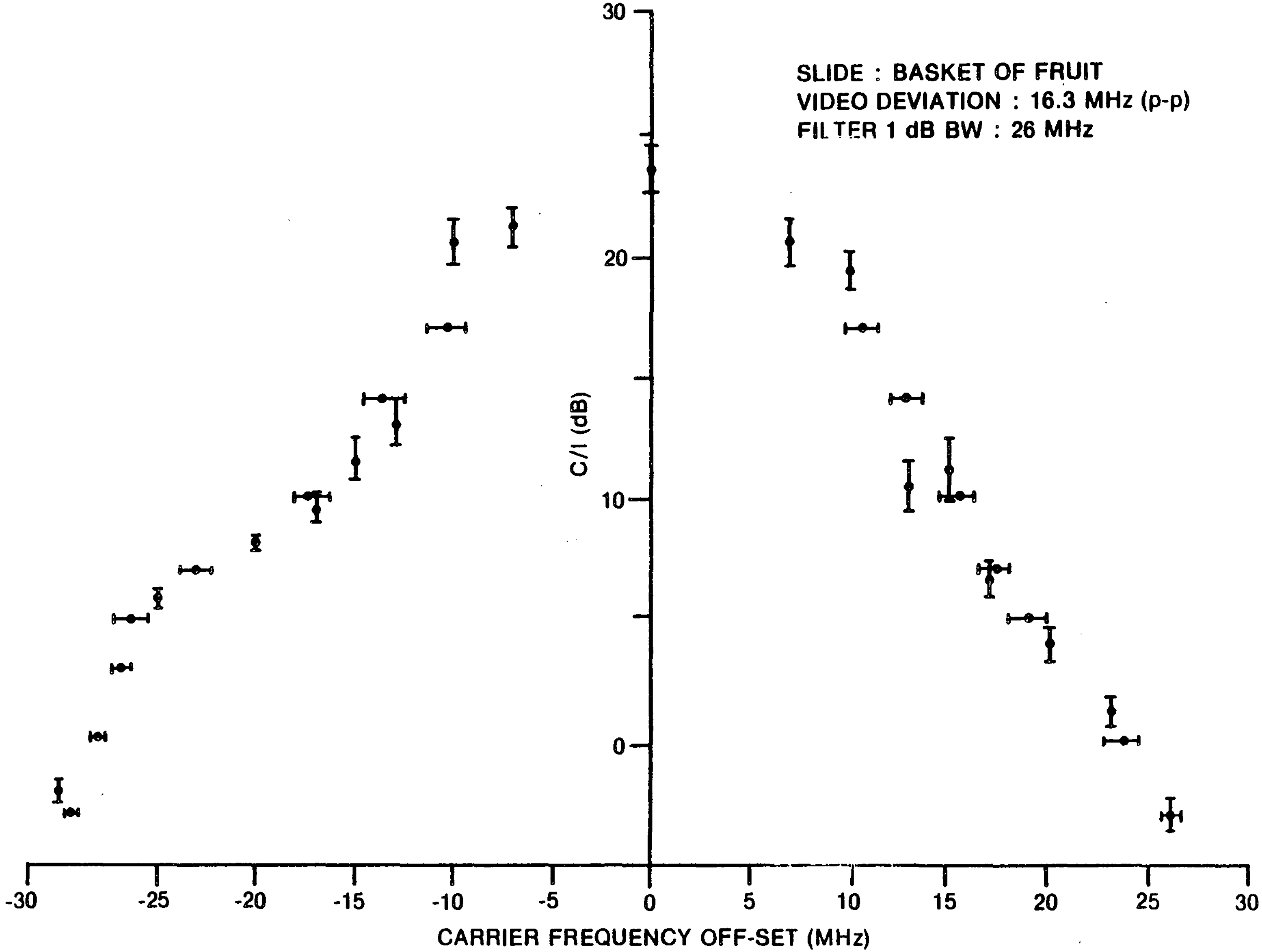


Figure 48: Results of the just-perceptible tests (mean and 95% confidence range) for the frequency sweep and C/I sweep for wider deviation (16.3 MHz) and using a filter of wider bandwidth for slide #2.

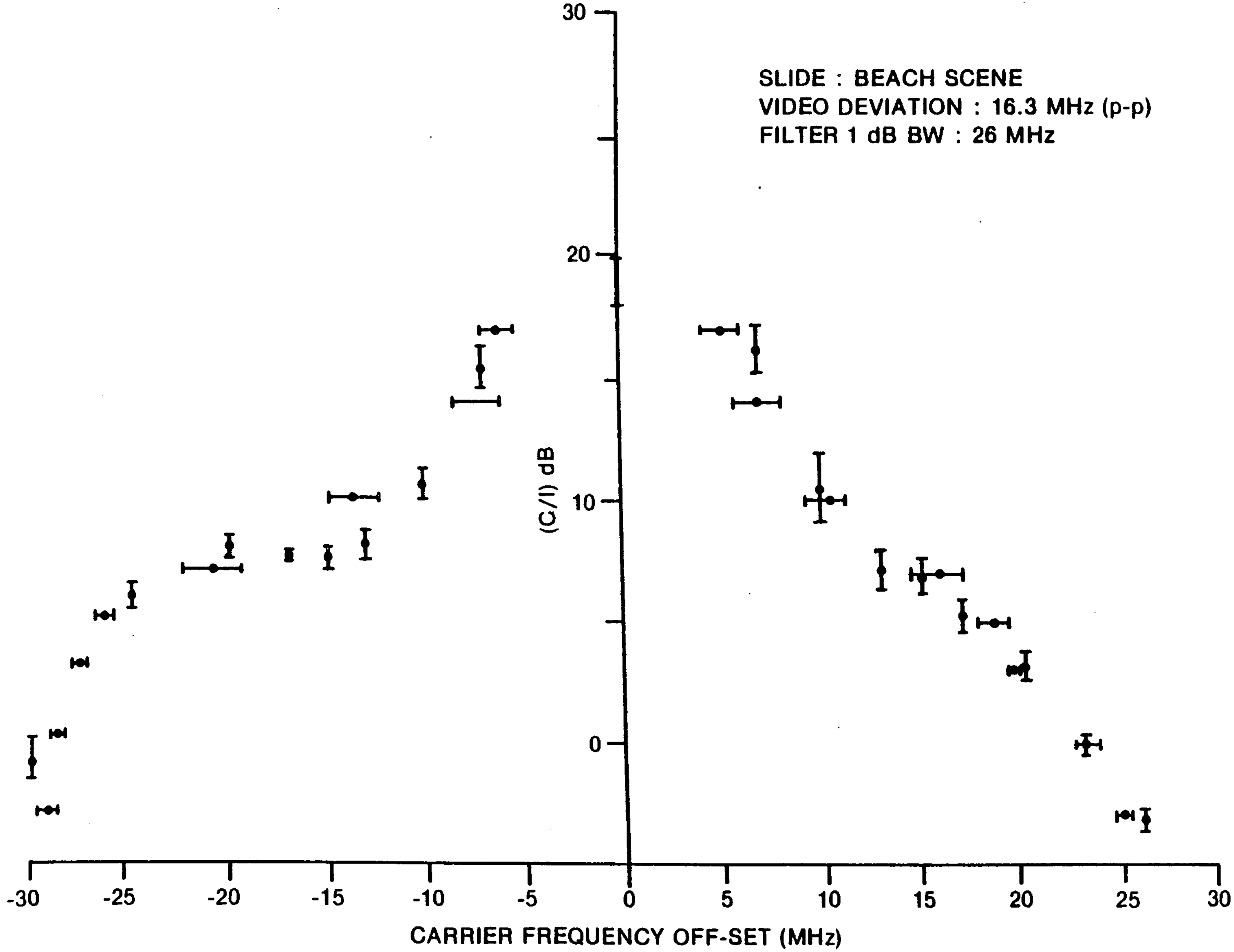


Figure 49: Results of the just-perceptible tests (mean and 95% confidence range) for the frequency sweep and C/I sweep for wider deviation (16.3 MHz) and using a filter of wider bandwidth for slide #3.

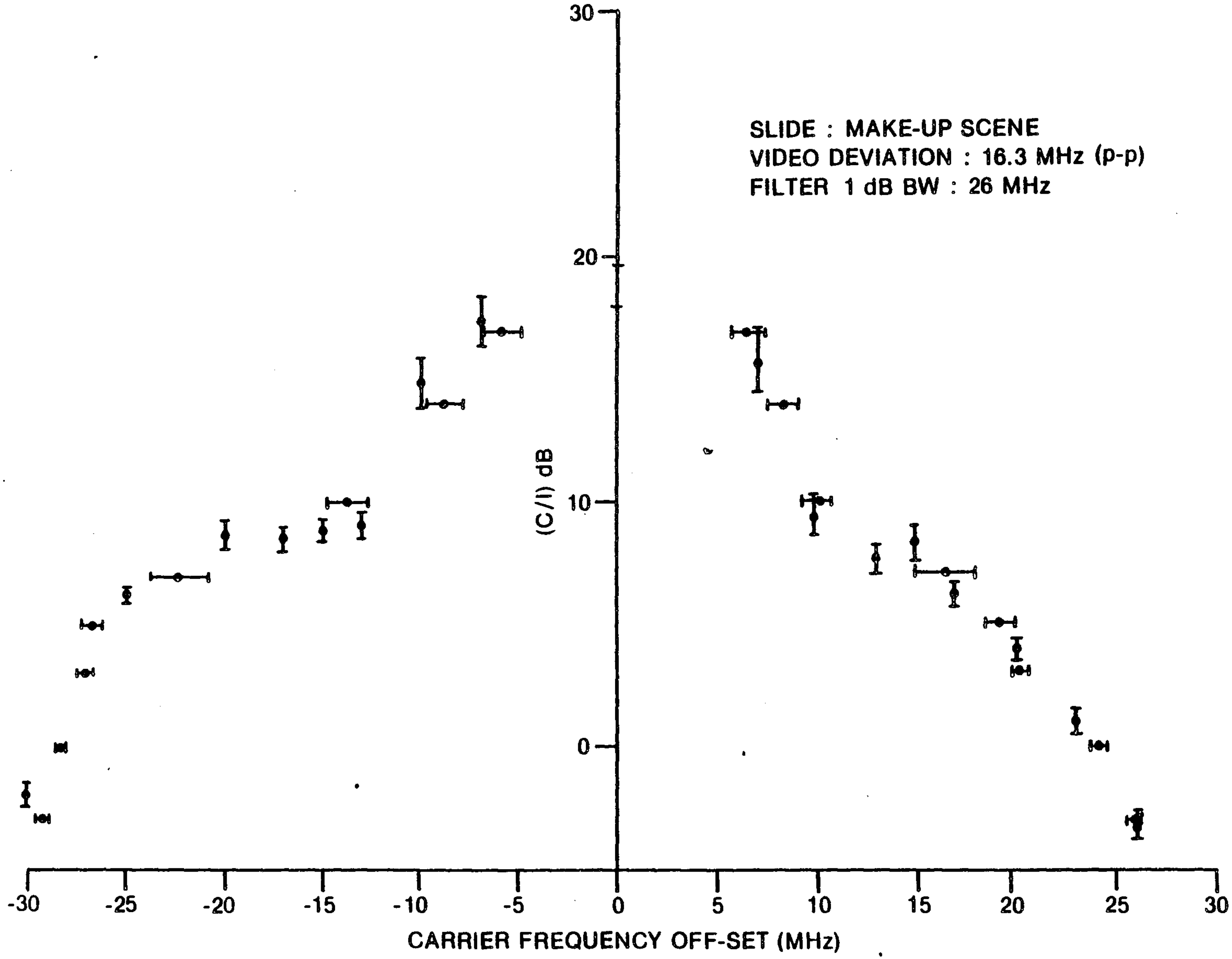


Figure 50: Results of the just-perceptible tests (mean and 95% confidence range) for the frequency sweep and C/I sweep for wider deviation (16.3 MHz) and using a filter of wider bandwidth for slide #4.

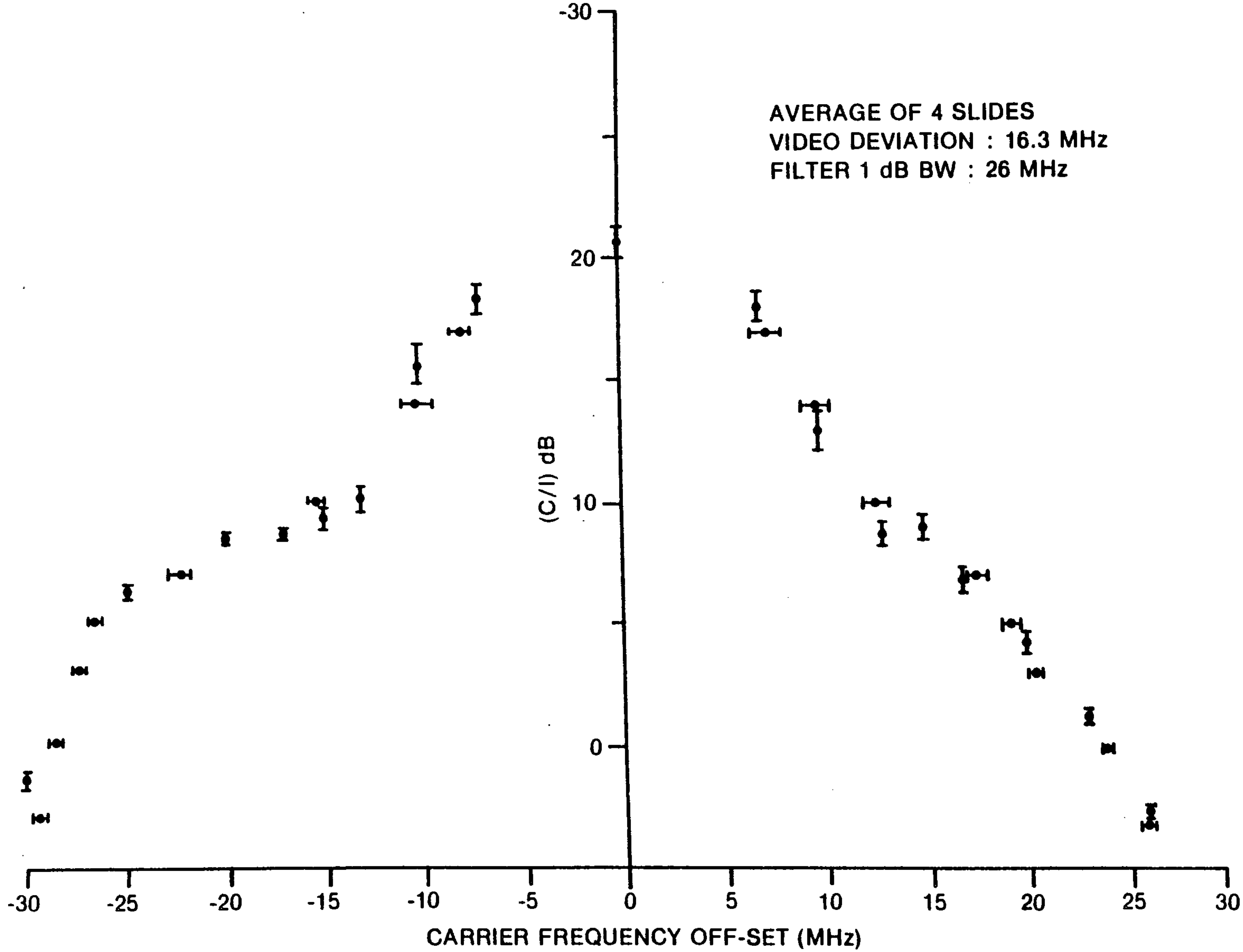


Figure 51: Results of the just-perceptible tests (mean and 95% confidence range) for the frequency sweep and C/I sweep for wider deviation (16.3 MHz) and using a filter of wider bandwidth for the average of the four slides.

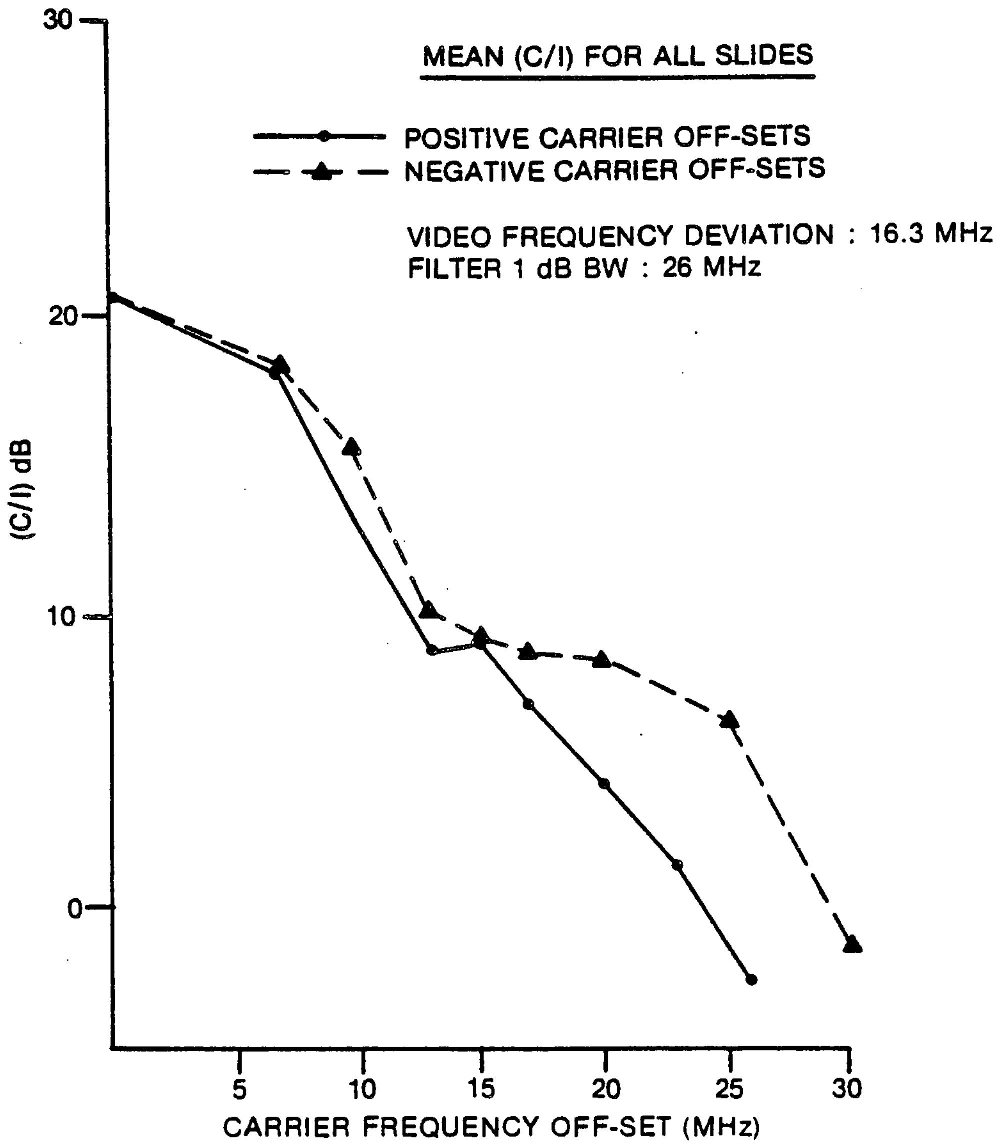


Figure 52: Symmetry of the results of the just-perceptible tests with respect to the positive and negative offsets from the co-channel case using the average for the four slides.

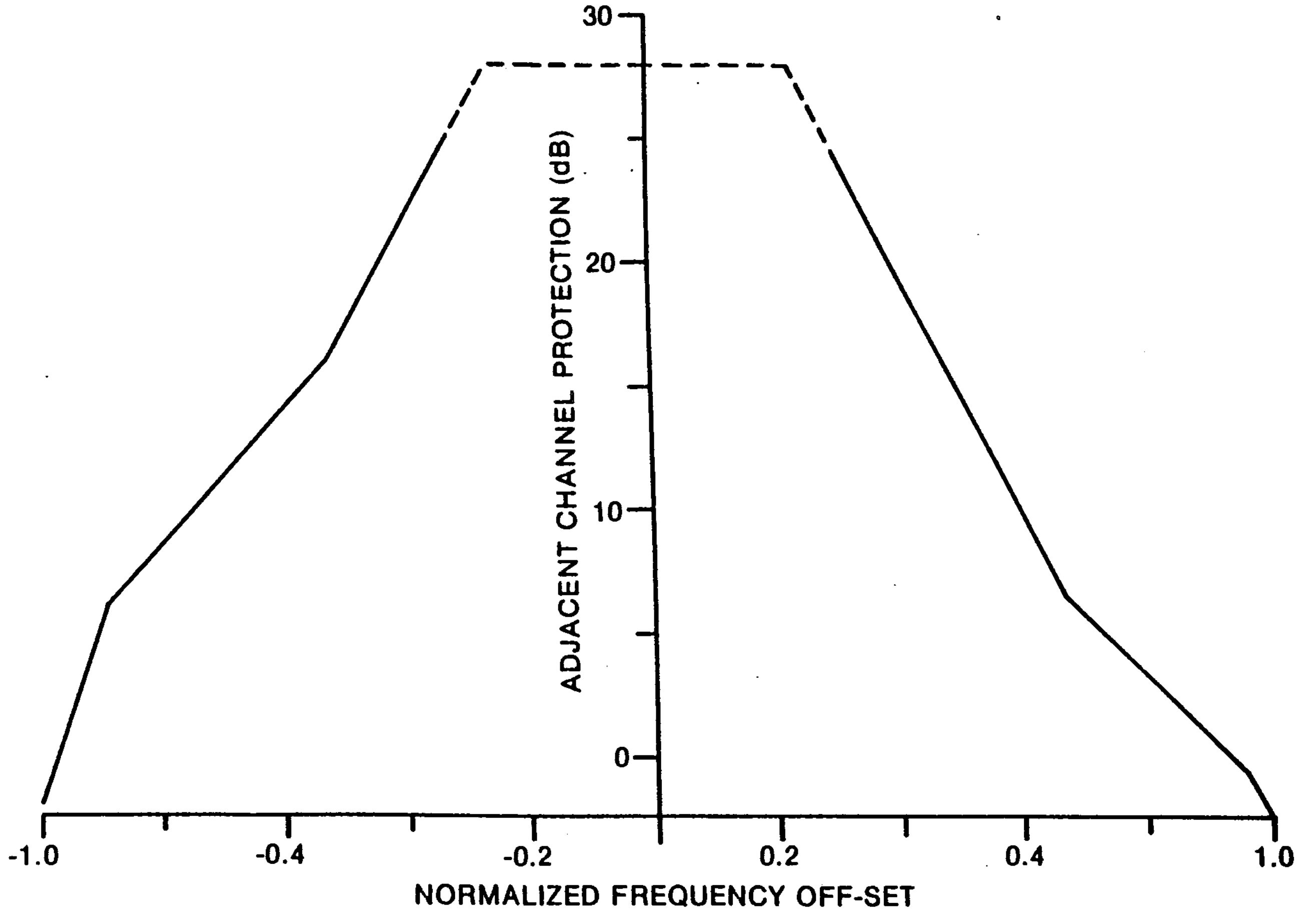


Figure 53: Proposed adjacent channel protection ratio template (FMTV/FMTV)

APPENDIX A

INTRODUCTION TO SUBJECTIVE TESTS FOR THE ESTABLISHMENT OF AN INTERFERENCE PROTECTION RATIO FOR THE BROADCASTING SATELLITE SERVICE

You have been invited to participate in this series of subjective evaluations of television pictures as concerned* viewers. You will be asked to judge the level of impairment caused by factors like noise and interference expected to affect a real life broadcasting satellite system.

The purpose of these tests is mainly to establish a reasonable isolation factor between satellite systems such that these future satellite systems can provide the quality that the viewers require. This is done in preparation for the Regional Conference that will plan the Broadcasting Satellite Service for the American Continents next June in Geneva (RARC-83). This new measurement program is to give us new fresh data on the viewer's expectation of what the level of television picture quality should be.

Using the sheets that you received when you came in, you will be asked to score the level of picture impairment that will be presented to you by indicating which of the 5 grades corresponds more closely to the level of impairment that you see. You will be asked to score as concerned viewers which means that you are expected to have a minimum knowledge of the impact that the level of system isolation has on the overall system capacity. To highlight this, a range can be established where, at one extremity, a very good isolation would be available but the number of television channels would be limited, say at 12, at the other extremity, only a poor isolation would be available leading to a poor picture quality, however, the system capacity would be much higher, say 36 channels. One should try to find a point in this range which corresponds to his expectations for a broadcasting satellite system in the 1990's in terms of quantity and quality of service.

As you can see, an impairment grading scale is used for this test. Firstly, it permits the viewer to more easily make an abstraction of the picture quality that he usually receives at home (we want to avoid one scoring all 5's because all that he has seen is better than that which he receives at home). Secondly, this grading scale permits the viewer to concentrate on the impairment caused by noise and interference rather than the overall subjective picture quality therefore disregarding any impairment caused by the high quality picture source.

NOTE:* A concerned viewer is considered to be someone that, without having any previous experience in subjective assessment of television picture quality, has a relatively broad knowledge of broadcasting satellite systems and realizes the purpose and the impact of these tests. An expert viewer is considered, for the purpose of these tests, as someone for which subjective evaluation of picture quality is part of his normal day to day work whereas an average viewer is someone who is expected to score the picture quality based only on his viewing experience at home.

This test lasts half a day, it is made of 3 sessions of 35 minutes separated by 15 min. breaks. Each presentation will last 15 seconds separated by 10 sec. of flat grey for scoring time. Four test slides will be used during these tests. This one ("Make-up scene" shown with no impairment) for introduction purposes and these 3 during the test sequence (show perfect pictures with "Girl with green dress", "Basket of fruit" and "Beach scene"). It should be pointed out that the beating effect on the pants of the gentleman in the center of the "Beach scene" slide should not be considered since it is due to a cross-colour effect, a limitation of the NTSC system rather than an effect of noise or interference.

The range of impairment that will be covered through this test sequence is presented using the "Make-up scene" slide:

FM triangular noise	=	56 dB → 25 dB → 56 dB
Co-channel interference	=	∞ → 3 dB → ∞
Upper adjacent channel	=	∞ → -3 dB → ∞
Lower adjacent channel	=	∞ → -3 dB → ∞

These different impairments will be aggregated and presented in a random sequence.

The 10 first presentations made with the "Make-up scene" should be evaluated but will not be considered in the analysis of results.

Your present distance from the screen is 5 times picture height which is the recommended practice, make sure that this distance is kept throughout the test.

I will ask you to write your name, date and session number of the first page on the form before we start and I would like to thank you in advance for your time.

APPENDIX B

SCORE SHEET USED DURING THE SUBJECTIVE ASSESSMENT TESTS

SUBJECTIVE EVALUATION OF TELEVISION PICTURES

NAME OF OBSERVER ______________________

SESSION ______________________

DATE ______________________

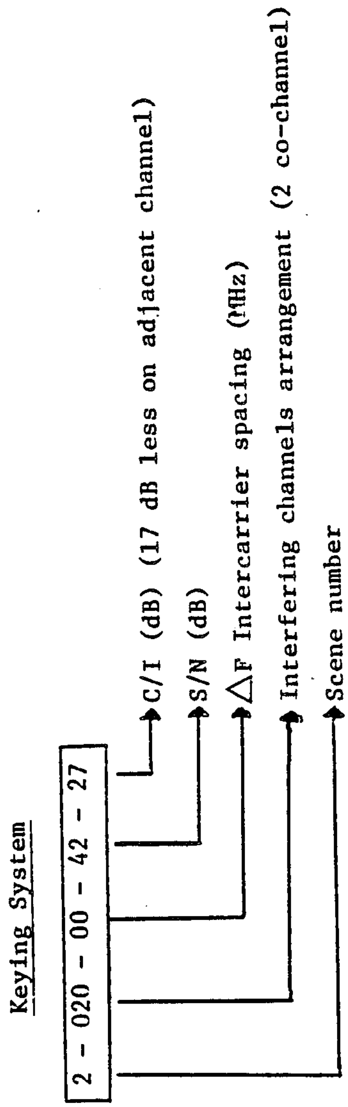
INTRODUCTION

PICTURE	IMPAIRMENT GRADE				
	IMPERCEPTIBLE	PERCEPTIBLE BUT NOT ANNOYING	SLIGHTLY ANNOYING	ANNOYING	VERY ANNOYING
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

PICTURE	IMPAIRMENT GRADE				
	IMPERCEPTIBLE	PERCEPTIBLE BUT NOT ANNOYING	SLIGHTLY ANNOYING	ANNOYING	VERY ANNOYING
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

APPENDIX C

TABULATED RESULTS OF THE SUBJECTIVE ASSESSMENT OF TELEVISION PICTURE IMPAIRED BY FM NOISE AND INTERFERENCE



1.000	-000-00-00-00	Top anchor
2.000	-000-00-00-00	
3.000	-000-00-25-00	Bottom anchor (S/N)
4.000	-010-00-00-03	Bottom anchor (C/I)
5.000	-000-00-53-00	
6.000	-000-00-50-00	
7.000	-000-00-47-00	S/N
8.000	-000-00-44-00	
9.000	-000-00-41-00	
10.000	-000-00-38-00	
11.000	-010-00-00-30	
12.000	-010-00-00-27	
13.000	-010-00-00-23	010
14.000	-010-00-00-17	
15.000	-010-00-00-10	
16.000	-010-00-42-30	
17.000	-010-00-42-27	
18.000	-010-00-42-23	010 + S/N
19.000	-010-00-42-17	
20.000	-010-00-42-10	
21.000	-020-00-00-30	
22.000	-020-00-00-27	
23.000	-020-00-00-23	020
24.000	-020-00-00-17	
25.000	-020-00-00-10	
26.000	-030-00-00-30	
27.000	-030-00-00-27	
28.000	-030-00-00-23	030
29.000	-030-00-00-17	
30.000	-030-00-00-10	
31.000	-101-15-00-30	
32.000	-101-15-00-27	
33.000	-101-15-00-23	$101_{(15)}$
34.000	-101-15-00-17	
35.000	-101-15-00-33	
36.000	-101-15-42-30	
37.000	-101-15-42-27	
38.000	-101-15-42-23	$101_{(15)}$ + S/N
39.000	-101-15-42-17	
40.000	-101-15-42-33	
41.000	-111-15-00-30	
42.000	-111-15-00-27	
43.000	-111-15-00-23	111
44.000	-111-15-00-17	
45.000	-111-15-00-33	
46.000	-121-15-00-30	
47.000	-121-15-00-27	
48.000	-121-15-00-23	121
49.000	-121-15-00-17	
50.000	-121-15-00-33	
51.000	-101-13-00-30	
52.000	-101-13-00-27	
53.000	-101-13-00-23	$101_{(13)}$
54.000	-101-13-00-17	
55.000	-101-13-00-33	
56.000	-101-13-42-30	
57.000	-101-13-42-27	
58.000	-101-13-42-23	$101_{(13)}$ + S/N
59.000	-101-13-42-17	
60.000	-101-13-42-33	
61.000	-010-00-56-30	
62.000	-010-00-56-27	
63.000	-010-00-56-23	2 x Dev
64.000	-010-00-56-17	
65.000	-010-00-56-10	

Viewer Group "A"

SCENE	KEY	5	4	3	2	1	POP	MOS	SIGMOS	R95	MEDIAN
1	-000-00-00-00	103	14	0	0	0	117	4.880	.325	.059	4.932
2	-000-00-00-00	110	6	0	0	0	116	4.948	.221	.041	4.973
3	-000-00-00-00	77	15	0	0	0	92	4.837	.369	.076	4.903
1	-000-00-25-00	0	0	0	4	54	58	1.069	.253	.066	1.037
2	-000-00-25-00	0	0	0	0	50	50	1.000	.000	.000	1.000
3	-000-00-25-00	0	0	0	0	58	58	1.000	.000	.000	1.000
1	-010-00-00-03	0	0	0	0	42	42	1.000	.000	.000	1.000
2	-010-00-00-03	0	0	0	0	50	50	1.000	.000	.000	1.000
3	-010-00-00-03	0	0	0	11	39	50	1.220	.414	.116	1.141
1	-000-00-53-00	22	3	0	0	0	25	4.880	.325	.129	4.932
2	-000-00-53-00	17	8	0	0	0	25	4.680	.466	.185	4.765
3	-000-00-53-00	22	3	0	0	0	25	4.880	.325	.129	4.932
1	-000-00-50-00	20	5	0	0	0	25	4.800	.400	.158	4.875
2	-000-00-50-00	9	15	1	0	0	25	4.320	.546	.216	4.267
3	-000-00-50-00	19	6	0	0	0	25	4.760	.427	.169	4.842
1	-000-00-47-00	19	6	0	0	0	25	4.760	.427	.169	4.842
2	-000-00-47-00	1	24	0	0	0	25	4.040	.196	.078	4.021
3	-000-00-47-00	23	2	0	0	0	25	4.920	.271	.107	4.957
1	-000-00-44-00	7	17	1	0	0	25	4.240	.512	.203	4.176
2	-000-00-44-00	0	18	7	0	0	25	3.720	.449	.178	3.806
3	-000-00-44-00	9	16	0	0	0	25	4.360	.480	.190	4.281
1	-000-00-41-00	1	20	4	0	0	25	3.880	.431	.171	3.925
2	-000-00-41-00	0	3	18	4	0	25	2.960	.528	.209	2.972
3	-000-00-41-00	3	14	1	0	0	18	4.111	.458	.214	4.071
1	-000-00-38-00	0	1	15	9	0	25	2.680	.546	.216	2.733
2	-000-00-38-00	0	0	17	8	0	25	2.680	.466	.185	2.765
3	-000-00-38-00	0	4	18	3	0	25	3.040	.528	.209	3.028
1	-010-00-00-30	22	3	0	0	0	25	4.880	.325	.129	4.932
2	-010-00-00-30	19	6	0	0	0	25	4.760	.427	.169	4.842
3	-010-00-00-30	23	1	1	0	0	25	4.880	.431	.171	4.957
1	-010-00-00-27	18	7	0	0	0	25	4.720	.449	.178	4.806
2	-010-00-00-27	11	14	0	0	0	25	4.440	.496	.197	4.393
3	-010-00-00-27	23	2	0	0	0	25	4.920	.271	.107	4.957
1	-010-00-00-23	12	13	0	0	0	25	4.480	.500	.198	4.462
2	-010-00-00-23	1	19	5	0	0	25	3.840	.463	.183	3.895
3	-010-00-00-23	21	3	1	0	0	25	4.800	.490	.194	4.905
1	-010-00-00-17	0	17	8	0	0	25	3.680	.466	.185	3.765
2	-010-00-00-17	0	4	19	2	0	25	3.080	.483	.191	3.053
3	-010-00-00-17	4	21	0	0	0	25	4.160	.367	.145	4.095
1	-010-00-00-10	0	0	8	13	4	25	2.160	.674	.267	2.154
2	-010-00-00-10	0	0	1	16	8	25	1.720	.531	.210	1.781
3	-010-00-00-10	0	1	13	11	0	25	2.600	.566	.224	2.615
1	-010-00-42-30	6	16	3	0	0	25	4.120	.588	.233	4.094
2	-010-00-42-30	0	8	16	1	0	25	3.280	.531	.210	3.219
3	-010-00-42-30	7	18	0	0	0	25	4.280	.449	.178	4.194
1	-010-00-42-27	4	19	2	0	0	25	4.080	.483	.191	4.053
2	-010-00-42-27	0	5	19	1	0	25	3.160	.463	.183	3.105
3	-010-00-42-27	4	19	2	0	0	25	4.080	.483	.191	4.053
1	-010-00-42-23	0	22	2	1	0	25	3.840	.463	.183	3.932
2	-010-00-42-23	0	8	15	2	0	25	3.240	.585	.232	3.200
3	-010-00-42-23	4	18	3	0	0	25	4.040	.528	.209	4.028
1	-010-00-42-17	0	11	11	3	0	25	3.320	.676	.268	3.364
2	-010-00-42-17	0	0	13	11	1	25	2.480	.574	.227	2.538
3	-010-00-42-17	1	11	9	1	0	22	3.545	.656	.277	3.591
1	-010-00-42-10	0	0	7	18	0	25	2.280	.449	.178	2.194
2	-010-00-42-10	0	0	1	18	6	25	1.800	.490	.194	1.861
3	-010-00-42-10	0	1	9	15	0	25	2.440	.571	.226	2.333

SCENE	KEY	5	4	3	2	1	POP	MOS	SIGMOS	R95	MEDIAN
1	-020-00-00-30	23	2	0	0	0	25	4.920	.271	.107	4.957
2	-020-00-00-30	16	9	0	0	0	25	4.640	.480	.190	4.719
3	-020-00-00-30	20	5	0	0	0	25	4.800	.400	.158	4.875
1	-020-00-00-27	21	4	0	0	0	25	4.840	.367	.145	4.905
2	-020-00-00-27	5	20	0	0	0	25	4.200	.400	.158	4.125
3	-020-00-00-27	18	7	0	0	0	25	4.720	.449	.178	4.806
1	-020-00-00-23	6	18	1	0	0	25	4.200	.490	.194	4.139
2	-020-00-00-23	1	18	6	0	0	25	3.800	.490	.194	3.861
3	-020-00-00-23	12	13	0	0	0	25	4.480	.500	.198	4.462
1	-020-00-00-17	0	9	14	2	0	25	3.280	.601	.238	3.250
2	-020-00-00-17	0	1	13	11	0	25	2.600	.566	.224	2.615
3	-020-00-00-17	0	15	10	0	0	25	3.600	.490	.194	3.667
1	-020-00-00-10	0	0	3	19	3	25	2.000	.490	.194	2.000
2	-020-00-00-10	0	0	0	10	15	25	1.400	.490	.194	1.333
3	-020-00-00-10	0	1	2	18	2	23	2.087	.583	.241	2.028
1	-030-00-00-30	17	8	0	0	0	25	4.680	.466	.185	4.765
2	-030-00-00-30	10	14	1	0	0	25	4.360	.557	.221	4.321
3	-030-00-00-30	20	4	0	0	1	25	4.680	.835	.331	4.875
1	-030-00-00-27	12	13	0	0	0	25	4.480	.500	.198	4.462
2	-030-00-00-27	7	18	0	0	0	25	4.280	.449	.178	4.194
3	-030-00-00-27	22	3	0	0	0	25	4.880	.325	.129	4.932
1	-030-00-00-23	3	19	3	0	0	25	4.000	.490	.194	4.000
2	-030-00-00-23	0	16	9	0	0	25	3.640	.480	.190	3.719
3	-030-00-00-23	10	15	0	0	0	25	4.400	.490	.194	4.333
1	-030-00-00-17	0	5	15	5	0	25	3.000	.632	.250	3.000
2	-030-00-00-17	0	0	9	16	0	25	2.360	.480	.190	2.281
3	-030-00-00-17	0	10	14	1	0	25	3.360	.557	.221	3.321
1	-030-00-00-10	0	0	0	3	22	25	1.120	.325	.129	1.068
2	-030-00-00-10	0	0	0	6	19	25	1.240	.427	.169	1.158
3	-030-00-00-10	0	0	0	11	14	25	1.440	.496	.197	1.393
1	-101-15-00-30	20	5	0	0	0	25	4.800	.400	.158	4.875
2	-101-15-00-30	24	1	0	0	0	25	4.960	.196	.078	4.979
3	-101-15-00-30	19	6	0	0	0	25	4.760	.427	.169	4.842
1	-101-15-00-27	21	4	0	0	0	25	4.840	.367	.145	4.905
2	-101-15-00-27	24	1	0	0	0	25	4.960	.196	.078	4.979
3	-101-15-00-27	22	1	2	0	0	25	4.800	.566	.224	4.932
1	-101-15-00-23	24	1	0	0	0	25	4.960	.196	.078	4.979
2	-101-15-00-23	21	4	0	0	0	25	4.840	.367	.145	4.905
3	-101-15-00-23	24	1	0	0	0	25	4.960	.196	.078	4.979
1	-101-15-00-17	0	0	0	10	15	25	1.400	.490	.194	1.333
2	-101-15-00-17	0	0	4	17	4	25	2.000	.566	.224	2.000
3	-101-15-00-17	0	1	6	16	2	25	2.240	.650	.257	2.156
1	-101-15-00-33	19	3	0	0	0	22	4.864	.343	.145	4.921
2	-101-15-00-33	22	0	0	0	0	22	5.000	-.000	.000	5.000
3	-101-15-00-33	18	4	0	0	0	22	4.818	.386	.163	4.889
1	-101-15-42-30	5	18	2	0	0	25	4.120	.515	.204	4.083
2	-101-15-42-30	0	10	13	2	0	25	3.320	.614	.243	3.308
3	-101-15-42-30	5	20	0	0	0	25	4.200	.400	.158	4.125
1	-101-15-42-27	3	19	3	0	0	25	4.000	.490	.194	4.000
2	-101-15-42-27	0	10	15	0	0	25	3.400	.490	.194	3.333
3	-101-15-42-27	7	18	0	0	0	25	4.280	.449	.178	4.194
1	-101-15-42-23	5	17	3	0	0	25	4.080	.560	.222	4.059
2	-101-15-42-23	0	8	16	1	0	25	3.280	.531	.210	3.219
3	-101-15-42-23	3	19	3	0	0	25	4.000	.490	.194	4.000
1	-101-15-42-17	0	0	0	9	16	25	1.360	.480	.190	1.281
2	-101-15-42-17	0	0	0	18	7	25	1.720	.449	.178	1.806
3	-101-15-42-17	0	0	2	12	11	25	1.640	.625	.247	1.625
1	-101-15-42-33	3	18	1	0	0	22	4.091	.417	.176	4.056
2	-101-15-42-33	0	9	13	0	0	22	3.409	.492	.208	3.346
3	-101-15-42-33	5	17	0	0	0	22	4.227	.419	.177	4.147

SCENE	KEY	5	4	3	2	1	POP	MOS	SIGMOS	R95	MEDIAN
1	-111-15-00-30	19	6	0	0	0	25	4.760	.427	.169	4.842
2	-111-15-00-30	20	5	0	0	0	25	4.800	.400	.158	4.875
3	-111-15-00-30	22	3	0	0	0	25	4.880	.325	.129	4.932
1	-111-15-00-27	21	4	0	0	0	25	4.840	.367	.145	4.905
2	-111-15-00-27	2	23	0	0	0	25	4.080	.271	.107	4.043
3	-111-15-00-27	14	8	0	0	0	22	4.636	.481	.203	4.714
1	-111-15-00-23	10	15	0	0	0	25	4.400	.490	.194	4.333
2	-111-15-00-23	1	15	2	0	0	18	3.944	.404	.189	3.967
3	-111-15-00-23	17	8	0	0	0	25	4.680	.466	.185	4.765
1	-111-15-00-17	0	0	0	9	16	25	1.360	.480	.190	1.281
2	-111-15-00-17	0	0	1	13	11	25	1.600	.566	.224	1.615
3	-111-15-00-17	0	0	3	16	6	25	1.880	.588	.233	1.906
1	-111-15-00-33	20	2	0	0	0	22	4.909	.287	.121	4.950
2	-111-15-00-33	21	1	0	0	0	22	4.955	.208	.088	4.976
3	-111-15-00-33	17	4	1	0	0	22	4.727	.538	.227	4.853
1	-121-15-00-30	22	3	0	0	0	25	4.880	.325	.129	4.932
2	-121-15-00-30	13	12	0	0	0	25	4.520	.500	.198	4.538
3	-121-15-00-30	22	3	0	0	0	25	4.880	.325	.129	4.932
1	-121-15-00-27	17	8	0	0	0	25	4.680	.466	.185	4.765
2	-121-15-00-27	2	23	0	0	0	25	4.080	.271	.107	4.043
3	-121-15-00-27	20	5	0	0	0	25	4.800	.400	.158	4.875
1	-121-15-00-23	3	21	1	0	0	25	4.080	.392	.155	4.048
2	-121-15-00-23	0	11	11	0	0	22	3.500	.500	.211	3.500
3	-121-15-00-23	14	11	0	0	0	25	4.560	.496	.197	4.607
1	-121-15-00-17	0	0	0	7	18	25	1.280	.449	.178	1.194
2	-121-15-00-17	0	0	2	16	7	25	1.800	.566	.224	1.844
3	-121-15-00-17	0	0	2	8	15	25	1.480	.640	.253	1.333
1	-121-15-00-33	20	2	0	0	0	22	4.909	.287	.121	4.950
2	-121-15-00-33	15	7	0	0	0	22	4.682	.466	.197	4.767
3	-121-15-00-33	17	5	0	0	0	22	4.773	.419	.177	4.853
1	-101-13-00-30	25	0	0	0	0	25	5.000	.000	.000	5.000
2	-101-13-00-30	23	2	0	0	0	25	4.920	.271	.107	4.957
3	-101-13-00-30	22	3	0	0	0	25	4.880	.325	.129	4.932
1	-101-13-00-27	24	1	0	0	0	25	4.960	.196	.078	4.979
2	-101-13-00-27	23	2	0	0	0	25	4.920	.271	.107	4.957
3	-101-13-00-27	19	6	0	0	0	25	4.760	.427	.169	4.842
1	-101-13-00-23	0	3	13	7	0	23	2.826	.636	.263	2.846
2	-101-13-00-23	1	14	7	3	0	25	3.520	.755	.299	3.679
3	-101-13-00-23	9	11	2	0	0	22	4.318	.631	.267	4.318
1	-101-13-00-17	1	0	0	0	24	25	1.160	.784	.310	1.021
2	-101-13-00-17	0	0	0	2	23	25	1.080	.271	.107	1.043
3	-101-13-00-17	0	1	0	0	24	25	1.120	.588	.233	1.021
1	-101-13-00-33	21	1	0	0	0	22	4.955	.208	.088	4.976
2	-101-13-00-33	19	3	0	0	0	22	4.864	.343	.145	4.921
3	-101-13-00-33	17	5	0	0	0	22	4.773	.419	.177	4.853

Viewer Group "A"

SCENE	KEY	5	4	3	2	1	POP	MOS	SIGMOS	R95	MEDIAN
ALL	-000-00-00-00	290	35	0	0	0	325	4.892	.310	.034	4.940
ALL	-000-00-25-00	0	0	0	4	154	158	1.025	.157	.025	1.013
ALL	-010-00-00-03	0	0	0	11	131	142	1.077	.267	.044	1.042
ALL	-000-00-53-00	61	14	0	0	0	75	4.813	.390	.089	4.885
ALL	-000-00-50-00	48	26	1	0	0	75	4.627	.511	.117	4.719
ALL	-000-00-47-00	43	32	0	0	0	75	4.573	.495	.113	4.628
ALL	-000-00-44-00	16	51	8	0	0	75	4.107	.556	.127	4.078
ALL	-000-00-41-00	4	37	23	4	0	68	3.603	.689	.165	3.689
ALL	-000-00-38-00	0	5	50	20	0	75	2.800	.542	.124	2.850
ALL	-010-00-00-30	64	10	1	0	0	75	4.840	.401	.092	4.914
ALL	-010-00-00-27	52	23	0	0	0	75	4.693	.461	.105	4.779
ALL	-010-00-00-23	34	35	6	0	0	75	4.373	.628	.144	4.400
ALL	-010-00-00-17	4	42	27	2	0	75	3.640	.625	.143	3.702
ALL	-010-00-00-10	0	1	22	40	12	75	2.160	.694	.159	2.137
ALL	-010-00-42-30	13	42	19	1	0	75	3.893	.685	.157	3.917
ALL	-010-00-42-27	8	43	23	1	0	75	3.773	.644	.147	3.814
ALL	-010-00-42-23	4	48	20	3	0	75	3.707	.628	.144	3.802
ALL	-010-00-42-17	1	22	33	15	1	72	3.097	.785	.183	3.106
ALL	-010-00-42-10	0	1	17	51	6	75	2.173	.574	.131	2.118
ALL	-020-00-00-30	59	16	0	0	0	75	4.787	.410	.094	4.864
ALL	-020-00-00-27	44	31	0	0	0	75	4.587	.492	.113	4.648
ALL	-020-00-00-23	19	49	7	0	0	75	4.160	.567	.130	4.122
ALL	-020-00-00-17	0	25	37	13	0	75	3.160	.694	.159	3.162
ALL	-020-00-00-10	0	1	5	47	20	73	1.822	.605	.140	1.851
ALL	-030-00-00-30	47	26	1	0	1	75	4.573	.657	.150	4.702
ALL	-030-00-00-27	41	34	0	0	0	75	4.547	.498	.114	4.585
ALL	-030-00-00-23	13	50	12	0	0	75	4.013	.577	.132	4.010
ALL	-030-00-00-17	0	15	38	22	0	75	2.907	.696	.159	2.908
ALL	-030-00-00-10	0	0	0	20	55	75	1.267	.442	.101	1.182
ALL	-101-15-00-30	63	12	0	0	0.	75	4.840	.367	.084	4.905
ALL	-101-15-00-27	67	6	2	0	0	75	4.867	.411	.094	4.940
ALL	-101-15-00-23	69	6	0	0	0	75	4.920	.271	.062	4.957
ALL	-101-15-00-17	0	1	10	43	21	75	1.880	.673	.154	1.884
ALL	-101-15-00-33	59	7	0	0	0	66	4.894	.308	.075	4.941
ALL	-101-15-42-30	10	48	15	2	0	75	3.880	.652	.149	3.927
ALL	-101-15-42-27	10	47	18	0	0	75	3.893	.602	.138	3.915
ALL	-101-15-42-23	8	44	22	1	0	75	3.787	.639	.146	3.830
ALL	-101-15-42-17	0	0	2	39	34	75	1.573	.546	.125	1.590
ALL	-101-15-42-33	8	44	14	0	0	66	3.909	.570	.139	3.932
ALL	-111-15-00-30	61	14	0	0	0	75	4.813	.390	.089	4.885
ALL	-111-15-00-27	37	35	0	0	0	72	4.514	.500	.117	4.527
ALL	-111-15-00-23	28	38	2	0	0	68	4.382	.543	.130	4.342
ALL	-111-15-00-17	0	0	4	38	33	75	1.613	.586	.134	1.618
ALL	-111-15-00-33	58	7	1	0	0	66	4.864	.385	.094	4.931
ALL	-121-15-00-30	57	18	0	0	0	75	4.760	.427	.098	4.842
ALL	-121-15-00-27	39	36	0	0	0	75	4.520	.500	.114	4.538
ALL	-121-15-00-23	17	43	12	0	0	72	4.069	.631	.147	4.058
ALL	-121-15-00-17	0	0	4	31	40	75	1.520	.597	.136	1.438
ALL	-121-15-00-33	52	14	0	0	0	66	4.788	.409	.100	4.865
ALL	-101-13-00-30	70	5	0	0	0	75	4.933	.249	.057	4.964
ALL	-101-13-00-27	66	9	0	0	0	75	4.880	.325	.074	4.932
ALL	-101-13-00-23	10	28	22	10	0	70	3.543	.905	.214	3.607
ALL	-101-13-00-17	1	1	0	2	71	75	1.120	.588	.134	1.028
ALL	-101-13-00-33	57	9	0	0	0	66	4.864	.343	.084	4.921

SCENE	KEY	5	4	3	2	1	POP	MOS	SIGMOS	R95	MEDIAN
ALL	ALL	1712	1186	478	420	579	4375	3.693	1.408	.042	4.099

Viewer Group "B"

SCENE	KEY	5	4	3	2	1	POP	MOS	SIGMOS	R95	MEDIAN
1	-000-00-00-00	99	7	0	0	0	106	4.934	.248	.048	4.965
2	-000-00-00-00	92	18	0	0	0	110	4.836	.370	.070	4.902
3	-000-00-00-00	75	8	0	0	0	83	4.904	.295	.064	4.947
1	-000-00-25-00	0	0	0	2	52	54	1.037	.189	.051	1.019
2	-000-00-25-00	0	0	0	1	42	43	1.023	.151	.046	1.012
3	-000-00-25-00	0	0	0	2	43	45	1.044	.206	.061	1.023
1	-010-00-00-13	0	0	6	27	4	37	2.054	.517	.168	2.037
2	-010-00-00-13	0	0	5	23	18	46	1.717	.648	.189	1.717
3	-010-00-00-13	0	1	21	21	0	43	2.535	.543	.164	2.524
1	-000-00-53-00	21	2	0	0	0	23	4.913	.282	.116	4.952
2	-000-00-53-00	12	11	0	0	0	23	4.522	.500	.206	4.542
3	-000-00-53-00	15	8	0	0	0	23	4.652	.476	.197	4.733
1	-000-00-50-00	15	8	0	0	0	23	4.652	.476	.197	4.733
2	-000-00-50-00	9	12	2	0	0	23	4.304	.621	.256	4.292
3	-000-00-50-00	19	4	0	0	0	23	4.826	.379	.156	4.895
1	-000-00-47-00	13	10	0	0	0	23	4.565	.496	.205	4.615
2	-000-00-47-00	3	16	4	0	0	23	3.957	.550	.227	3.969
3	-000-00-47-00	17	6	0	0	0	23	4.739	.439	.181	4.824
1	-000-00-44-00	3	17	3	0	0	23	4.000	.511	.211	4.000
2	-000-00-44-00	2	5	7	0	0	14	3.643	.718	.380	3.500
3	-000-00-44-00	7	15	1	0	0	23	4.261	.529	.218	4.200
1	-000-00-41-00	0	15	7	1	0	23	3.609	.570	.235	3.733
2	-000-00-41-00	1	3	9	10	0	23	2.783	.832	.343	2.667
3	-000-00-41-00	2	6	6	0	0	14	3.714	.700	.370	3.667
1	-000-00-38-00	1	1	3	16	2	23	2.261	.845	.349	2.094
2	-000-00-38-00	0	1	10	9	3	23	2.391	.766	.316	2.444
3	-000-00-38-00	0	2	10	9	2	23	2.522	.773	.319	2.550
1	-010-00-00-40	18	5	0	0	0	23	4.783	.412	.170	4.861
2	-010-00-00-40	20	3	0	0	0	23	4.870	.337	.139	4.925
3	-010-00-00-40	18	5	0	0	0	23	4.783	.412	.170	4.861
1	-010-00-00-37	18	5	0	0	0	23	4.783	.412	.170	4.861
2	-010-00-00-37	21	2	0	0	0	23	4.913	.282	.116	4.952
3	-010-00-00-37	20	3	0	0	0	23	4.870	.337	.139	4.925
1	-010-00-00-33	20	3	0	0	0	23	4.870	.337	.139	4.925
2	-010-00-00-33	19	4	0	0	0	23	4.826	.379	.156	4.895
3	-010-00-00-33	20	3	0	0	0	23	4.870	.337	.139	4.925
1	-010-00-00-27	16	7	0	0	0	23	4.696	.460	.190	4.781
2	-010-00-00-27	12	10	1	0	0	23	4.478	.580	.239	4.542
3	-010-00-00-27	18	5	0	0	0	23	4.783	.412	.170	4.861
1	-010-00-00-20	0	14	7	2	0	23	3.522	.651	.269	3.679
2	-010-00-00-20	0	5	12	6	0	23	2.957	.690	.285	2.958
3	-010-00-00-20	6	14	3	0	0	23	4.130	.612	.253	4.107
1	-010-00-42-40	0	15	8	0	0	23	3.652	.476	.197	3.733
2	-010-00-42-40	1	7	8	7	0	23	3.087	.880	.363	3.063
3	-010-00-42-40	7	12	4	0	0	23	4.130	.679	.280	4.125
1	-010-00-42-37	2	18	3	0	0	23	3.957	.464	.192	3.972
2	-010-00-42-37	0	9	7	7	0	23	3.087	.830	.342	3.143
3	-010-00-42-37	3	14	6	0	0	23	3.870	.612	.253	3.893
1	-010-00-42-33	0	19	4	0	0	23	3.826	.379	.156	3.895
2	-010-00-42-33	0	5	10	5	0	20	3.000	.707	.313	3.000
3	-010-00-42-33	4	15	4	0	0	23	4.000	.590	.243	4.000
1	-010-00-42-27	2	14	7	0	0	23	3.783	.587	.242	3.821
2	-010-00-42-27	1	4	9	9	0	23	2.870	.850	.351	2.778
3	-010-00-42-27	3	15	5	0	0	23	3.913	.583	.241	3.933
1	-010-00-42-20	0	5	13	5	0	23	3.000	.659	.272	3.000
2	-010-00-42-20	0	6	7	9	1	23	2.783	.883	.364	2.714
3	-010-00-42-20	0	15	7	1	0	23	3.609	.570	.235	3.733

SCENE	KEY	5	4	3	2	1	POP	MOS	SIGMOS	R95	MEDIAN
1	-020-00-00-40	23	0	0	0	0	23	5.000	.000	.000	5.000
2	-020-00-00-40	17	6	0	0	0	23	4.739	.439	.181	4.824
3	-020-00-00-40	22	1	0	0	0	23	4.957	.204	.084	4.977
1	-020-00-00-37	22	1	0	0	0	23	4.957	.204	.084	4.977
2	-020-00-00-37	20	3	0	0	0	23	4.870	.337	.139	4.925
3	-020-00-00-37	17	6	0	0	0	23	4.739	.439	.181	4.824
1	-020-00-00-33	21	2	0	0	0	23	4.913	.282	.116	4.952
2	-020-00-00-33	20	3	0	0	0	23	4.870	.337	.139	4.925
3	-020-00-00-33	21	2	0	0	0	23	4.913	.282	.116	4.952
1	-020-00-00-27	9	14	0	0	0	23	4.391	.488	.201	4.321
2	-020-00-00-27	7	12	4	0	0	23	4.130	.679	.280	4.125
3	-020-00-00-27	17	5	1	0	0	23	4.696	.547	.226	4.824
1	-020-00-00-20	0	7	14	2	0	23	3.217	.587	.242	3.179
2	-020-00-00-20	1	3	10	9	0	23	2.826	.816	.337	2.750
3	-020-00-00-20	2	14	6	1	0	23	3.739	.674	.278	3.821
1	-030-00-00-40	20	3	0	0	0	23	4.870	.337	.139	4.925
2	-030-00-00-40	18	5	0	0	0	23	4.783	.412	.170	4.861
3	-030-00-00-40	20	3	0	0	0	23	4.870	.337	.139	4.925
1	-030-00-00-37	16	6	1	0	0	23	4.652	.560	.231	4.781
2	-030-00-00-37	20	3	0	0	0	23	4.870	.337	.139	4.925
3	-030-00-00-37	22	1	0	0	0	23	4.957	.204	.084	4.977
1	-030-00-00-33	19	4	0	0	0	23	4.826	.379	.156	4.895
2	-030-00-00-33	9	9	2	1	0	21	4.238	.811	.350	4.333
3	-030-00-00-33	17	6	0	0	0	23	4.739	.439	.181	4.824
1	-030-00-00-27	9	12	2	0	0	23	4.304	.621	.256	4.292
2	-030-00-00-27	5	12	6	0	0	23	3.957	.690	.285	3.958
3	-030-00-00-27	15	8	0	0	0	23	4.652	.476	.197	4.733
1	-030-00-00-20	0	5	8	9	1	23	2.739	.845	.349	2.688
2	-030-00-00-20	0	1	8	12	2	23	2.348	.698	.288	2.292
3	-030-00-00-20	0	7	11	2	0	20	3.250	.622	.276	3.227
1	-101-15-00-40	22	1	0	0	0	23	4.957	.204	.084	4.977
2	-101-15-00-40	20	3	0	0	0	23	4.870	.337	.139	4.925
3	-101-15-00-40	21	2	0	0	0	23	4.913	.282	.116	4.952
1	-101-15-00-37	18	2	0	0	0	20	4.900	.300	.133	4.944
2	-101-15-00-37	21	2	0	0	0	23	4.913	.282	.116	4.952
3	-101-15-00-37	21	2	0	0	0	23	4.913	.282	.116	4.952
1	-101-15-00-33	19	4	0	0	0	23	4.826	.379	.156	4.895
2	-101-15-00-33	19	4	0	0	0	23	4.826	.379	.156	4.895
3	-101-15-00-33	21	1	1	0	0	23	4.870	.448	.185	4.952
1	-101-15-00-27	18	5	0	0	0	23	4.783	.412	.170	4.861
2	-101-15-00-27	21	2	0	0	0	23	4.913	.282	.116	4.952
3	-101-15-00-27	19	4	0	0	0	23	4.826	.379	.156	4.895
1	-101-15-00-20	3	5	2	8	2	20	2.950	1.284	.568	2.500
2	-101-15-00-20	5	11	1	0	0	17	4.235	.546	.262	4.182
3	-101-15-00-20	12	7	2	2	0	23	4.261	.943	.389	4.542
1	-101-15-42-40	0	15	8	0	0	23	3.652	.476	.197	3.733
2	-101-15-42-40	0	8	7	8	0	23	3.000	.834	.344	3.000
3	-101-15-42-40	2	16	5	0	0	23	3.870	.536	.221	3.906
1	-101-15-42-37	0	14	9	0	0	23	3.609	.488	.201	3.679
2	-101-15-42-37	2	7	6	5	0	20	3.300	.954	.422	3.333
3	-101-15-42-37	5	12	3	0	0	20	4.100	.624	.276	4.083
1	-101-15-42-33	2	12	9	0	0	23	3.696	.621	.256	3.708
2	-101-15-42-33	1	8	9	5	0	23	3.217	.832	.343	3.222
3	-101-15-42-33	1	16	5	1	0	23	3.739	.606	.250	3.844
1	-101-15-42-27	1	12	7	0	0	20	3.700	.557	.247	3.750
2	-101-15-42-27	1	4	10	8	0	23	2.913	.830	.342	2.850
3	-101-15-42-27	5	14	4	0	0	23	4.043	.624	.258	4.036
1	-101-15-42-20	0	6	2	5	6	19	2.421	1.228	.558	2.200
2	-101-15-42-20	0	5	7	11	0	23	2.739	.792	.327	2.571
3	-101-15-42-20	1	5	11	5	0	22	3.091	.793	.335	3.045

SCENE	KEY	5	4	3	2	1	POP	MOS	SIGMOS	R95	MEDIAN
1	-111-15-00-40	20	3	0	0	0	23	4.870	.357	.139	4.925
2	-111-15-00-40	22	1	0	0	0	23	4.957	.204	.084	4.977
3	-111-15-00-40	17	6	0	0	0	23	4.739	.439	.181	4.824
1	-111-15-00-37	18	5	0	0	0	23	4.783	.412	.170	4.861
2	-111-15-00-37	20	3	0	0	0	23	4.870	.337	.139	4.925
3	-111-15-00-37	19	4	0	0	0	23	4.826	.379	.156	4.895
1	-111-15-00-33	21	2	0	0	0	23	4.913	.282	.116	4.952
2	-111-15-00-33	9	5	0	0	0	14	4.643	.479	.254	4.722
3	-111-15-00-33	17	6	0	0	0	23	4.739	.439	.181	4.824
1	-111-15-00-27	11	12	0	0	0	23	4.478	.500	.206	4.458
2	-111-15-00-27	9	12	2	0	0	23	4.304	.621	.256	4.292
3	-111-15-00-27	17	3	0	0	0	20	4.850	.357	.158	4.912
1	-111-15-00-20	0	5	12	6	0	23	2.957	.690	.285	2.958
2	-111-15-00-20	1	6	9	7	0	23	3.043	.859	.354	3.000
3	-111-15-00-20	2	15	4	2	0	23	3.739	.735	.304	3.867
1	-121-15-00-40	20	3	0	0	0	23	4.870	.337	.139	4.925
2	-121-15-00-40	21	2	0	0	0	23	4.913	.282	.116	4.952
3	-121-15-00-40	20	3	0	0	0	23	4.870	.337	.139	4.925
1	-121-15-00-37	21	2	0	0	0	23	4.913	.282	.116	4.952
2	-121-15-00-37	17	6	0	0	0	23	4.739	.439	.181	4.824
3	-121-15-00-37	20	2	0	0	0	22	4.909	.287	.121	4.950
1	-121-15-00-33	21	2	0	0	0	23	4.913	.282	.116	4.952
2	-121-15-00-33	14	6	0	0	0	20	4.700	.458	.203	4.786
3	-121-15-00-33	20	3	0	0	0	23	4.870	.337	.139	4.925
1	-121-15-00-27	8	14	1	0	0	23	4.304	.547	.226	4.250
2	-121-15-00-27	3	13	7	0	0	23	3.826	.636	.263	3.846
3	-121-15-00-27	18	5	0	0	0	23	4.783	.412	.170	4.861
1	-121-15-00-20	0	4	10	9	0	23	2.783	.720	.297	2.750
2	-121-15-00-20	0	2	8	10	3	23	2.391	.820	.339	2.350
3	-121-15-00-20	0	10	9	4	0	23	3.261	.735	.304	3.333
1	-101-13-00-40	20	3	0	0	0	23	4.870	.337	.139	4.925
2	-101-13-00-40	17	3	0	0	0	20	4.850	.357	.158	4.912
3	-101-13-00-40	20	3	0	0	0	23	4.870	.337	.139	4.925
1	-101-13-00-37	17	4	0	0	0	21	4.810	.393	.170	4.882
2	-101-13-00-37	18	5	0	0	0	23	4.783	.412	.170	4.861
3	-101-13-00-37	21	2	0	0	0	23	4.913	.282	.116	4.952
1	-101-13-00-33	20	3	0	0	0	23	4.870	.337	.139	4.925
2	-101-13-00-33	19	4	0	0	0	23	4.826	.379	.156	4.895
3	-101-13-00-33	20	3	0	0	0	23	4.870	.337	.139	4.925
1	-101-13-00-27	21	2	0	0	0	23	4.913	.282	.116	4.952
2	-101-13-00-27	17	6	0	0	0	23	4.739	.439	.181	4.824
3	-101-13-00-27	19	4	0	0	0	23	4.826	.379	.156	4.895
1	-101-13-00-20	0	0	0	3	20	23	1.130	.337	.139	1.075
2	-101-13-00-20	0	0	1	9	8	18	1.611	.591	.276	1.611
3	-101-13-00-20	0	0	3	7	13	23	1.565	.712	.294	1.385

Viewer Group "B"

SCENE	KEY	5	4	3	2	1	POP	MOS	SIGMOS	R95	MEDIAN
ALL	-000-00-00-00	266	33	0	0	0	299	4.890	.313	.036	4.938
ALL	-000-00-25-00	0	0	0	5	137	142	1.035	.184	.031	1.018
ALL	-010-00-00-13	0	1	32	71	22	126	2.095	.672	.118	2.077
ALL	-000-00-53-00	48	21	0	0	0	69	4.696	.460	.110	4.781
ALL	-000-00-50-00	43	24	2	0	0	69	4.594	.547	.130	4.698
ALL	-000-00-47-00	33	32	4	0	0	69	4.420	.600	.143	4.453
ALL	-000-00-44-00	12	37	11	0	0	60	4.017	.619	.158	4.014
ALL	-000-00-41-00	3	24	22	11	0	60	3.317	.826	.211	3.364
ALL	-000-00-38-00	1	4	23	34	7	69	2.391	.802	.191	2.309
ALL	-010-00-00-40	56	13	0	0	0	69	4.812	.391	.093	4.884
ALL	-010-00-00-37	59	10	0	0	0	69	4.855	.352	.084	4.915
ALL	-010-00-00-33	59	10	0	0	0	69	4.855	.352	.084	4.915
ALL	-010-00-00-27	46	22	1	0	0	69	4.652	.506	.121	4.750
ALL	-010-00-00-20	6	33	22	8	0	69	3.546	.809	.193	3.636
ALL	-010-00-42-40	8	34	20	7	0	69	3.623	.818	.195	3.721
ALL	-010-00-42-37	5	41	16	7	0	69	3.638	.761	.181	3.780
ALL	-010-00-42-33	4	39	18	5	0	66	3.636	.710	.173	3.756
ALL	-010-00-42-27	6	33	21	9	0	69	3.522	.827	.197	3.636
ALL	-010-00-42-20	0	26	27	15	1	69	3.130	.797	.190	3.185
ALL	-020-00-00-40	62	7	0	0	0	69	4.899	.302	.072	4.944
ALL	-020-00-00-37	59	10	0	0	0	69	4.855	.352	.084	4.915
ALL	-020-00-00-33	62	7	0	0	0	69	4.899	.302	.072	4.944
ALL	-020-00-00-27	33	31	5	0	0	69	4.406	.621	.148	4.452
ALL	-020-00-00-20	3	24	30	12	0	69	3.261	.792	.189	3.250
ALL	-030-00-00-40	58	11	0	0	0	69	4.841	.366	.087	4.905
ALL	-030-00-00-37	58	10	1	0	0	69	4.826	.416	.099	4.905
ALL	-030-00-00-33	45	19	2	1	0	67	4.612	.622	.150	4.756
ALL	-030-00-00-27	29	32	8	0	0	69	4.304	.666	.159	4.328
ALL	-030-00-00-20	0	13	27	23	3	66	2.758	.818	.199	2.759
ALL	-101-15-00-40	63	6	0	0	0	69	4.913	.282	.067	4.952
ALL	-101-15-00-37	60	6	0	0	0	66	4.909	.287	.070	4.950
ALL	-101-15-00-33	59	9	1	0	0	69	4.841	.404	.096	4.915
ALL	-101-15-00-27	58	11	0	0	0	69	4.841	.366	.087	4.905
ALL	-101-15-00-20	20	23	5	10	2	60	3.817	1.162	.297	4.065
ALL	-101-15-42-40	2	39	20	8	0	69	3.507	.735	.175	3.667
ALL	-101-15-42-37	7	33	18	5	0	63	3.667	.777	.194	3.758
ALL	-101-15-42-33	4	36	23	6	0	69	3.551	.733	.175	3.653
ALL	-101-15-42-27	7	30	21	8	0	66	3.545	.838	.204	3.633
ALL	-101-15-42-20	1	16	20	21	6	64	2.766	.980	.243	2.750
ALL	-111-15-00-40	59	10	0	0	0	69	4.855	.352	.084	4.915
ALL	-111-15-00-37	57	12	0	0	0	69	4.826	.379	.090	4.895
ALL	-111-15-00-33	47	13	0	0	0	60	4.783	.412	.105	4.862
ALL	-111-15-00-27	37	27	2	0	0	66	4.530	.556	.136	4.608
ALL	-111-15-00-20	3	26	25	15	0	69	3.246	.841	.200	3.280
ALL	-121-15-00-40	61	8	0	0	0	69	4.884	.320	.076	4.934
ALL	-121-15-00-37	58	10	0	0	0	68	4.853	.354	.085	4.914
ALL	-121-15-00-33	55	11	0	0	0	66	4.833	.373	.091	4.900
ALL	-121-15-00-27	29	32	8	0	0	69	4.304	.666	.159	4.328
ALL	-121-15-00-20	0	16	27	23	3	69	2.812	.839	.200	2.815
ALL	-101-13-00-40	57	9	0	0	0	66	4.864	.343	.084	4.921
ALL	-101-13-00-37	56	11	0	0	0	67	4.836	.370	.090	4.902
ALL	-101-13-00-33	59	10	0	0	0	69	4.855	.352	.084	4.915
ALL	-101-13-00-27	57	12	0	0	0	69	4.826	.379	.090	4.895
ALL	-101-13-00-20	0	0	4	19	41	64	1.422	.607	.150	1.280

SCENE	KEY	5	4	3	2	1	POP	MOS	SIGMOS	R95	MEDIAN
ALL	ALL	1930	1017	466	323	222	4008	4.050	1.195	.037	4.476

Viewer Group "C"

SCENE	KEY	5	4	3	2	1	POP	MOS	SIGMOS	R95	MEDIAN
1	-000-00-00-00	84	23	0	0	0	107	4.785	.411	.079	4.863
2	-000-00-00-00	47	32	1	0	0	80	4.575	.519	.115	4.649
1	-000-00-25-00	0	0	0	5	49	54	1.093	.290	.078	1.051
2	-000-00-25-00	0	0	0	2	40	42	1.048	.213	.065	1.025
1	-010-00-00-03	0	0	0	1	41	42	1.024	.152	.047	1.012
2	-010-00-00-03	0	0	0	0	42	42	1.000	.000	.000	1.000
1	-000-00-53-00	19	2	0	0	0	21	4.905	.294	.127	4.947
2	-000-00-53-00	11	9	1	0	0	21	4.476	.587	.254	4.545
1	-000-00-50-00	17	4	0	0	0	21	4.810	.393	.170	4.882
2	-000-00-50-00	10	9	2	0	0	21	4.381	.653	.282	4.444
1	-000-00-47-00	11	9	1	0	0	21	4.476	.587	.254	4.545
2	-000-00-47-00	5	11	2	0	0	18	4.167	.601	.280	4.136
1	-000-00-44-00	8	10	2	0	0	20	4.300	.640	.283	4.300
2	-000-00-44-00	0	7	11	3	0	21	3.190	.663	.287	3.182
1	-000-00-41-00	1	13	3	0	0	17	3.882	.471	.226	3.923
2	-000-00-41-00	0	5	10	5	1	21	2.905	.811	.350	2.950
1	-000-00-38-00	0	6	12	3	0	21	3.143	.639	.276	3.125
2	-000-00-38-00	1	4	8	7	0	20	2.950	.865	.383	2.875
1	-010-00-00-30	17	4	0	0	0	21	4.810	.393	.170	4.882
2	-010-00-00-30	13	5	0	0	0	18	4.722	.448	.209	4.808
1	-010-00-00-27	17	4	0	0	0	21	4.810	.393	.170	4.882
2	-010-00-00-27	6	9	1	0	0	16	4.313	.583	.289	4.278
1	-010-00-00-23	13	7	1	0	0	21	4.571	.583	.252	4.692
2	-010-00-00-23	1	10	8	2	0	21	3.476	.732	.316	3.550
1	-010-00-00-17	2	15	4	0	0	21	3.905	.526	.227	3.933
2	-010-00-00-17	0	2	11	6	2	21	2.619	.785	.339	2.727
1	-010-00-00-10	1	2	11	13	3	30	2.500	.885	.320	2.423
2	-010-00-00-10	0	0	1	10	10	21	1.571	.583	.252	1.550
1	-010-00-42-30	8	10	2	1	0	21	4.190	.794	.343	4.250
2	-010-00-42-30	0	3	13	5	0	21	2.905	.610	.263	2.923
1	-010-00-42-27	2	10	8	1	0	21	3.619	.722	.312	3.650
2	-010-00-42-27	0	5	12	3	1	21	3.000	.756	.327	3.042
1	-010-00-42-23	7	9	5	0	0	21	4.095	.750	.324	4.111
2	-010-00-42-23	0	3	10	7	1	21	2.714	.765	.330	2.750
1	-010-00-42-17	4	7	6	0	0	17	3.882	.758	.364	3.857
2	-010-00-42-17	0	0	4	14	3	21	2.048	.575	.249	2.036
1	-010-00-42-10	0	4	6	9	2	21	2.571	.904	.390	2.444
2	-010-00-42-10	0	0	1	10	10	21	1.571	.583	.252	1.550
1	-020-00-00-30	17	4	0	0	0	21	4.810	.393	.170	4.882
2	-020-00-00-30	7	11	2	0	0	20	4.250	.622	.276	4.227
1	-020-00-00-27	16	5	0	0	0	21	4.762	.426	.184	4.844
2	-020-00-00-27	8	10	2	0	0	20	4.300	.640	.283	4.300
1	-020-00-00-23	14	5	2	0	0	21	4.571	.660	.285	4.750
2	-020-00-00-23	0	9	11	1	0	21	3.381	.575	.249	3.364
1	-020-00-00-17	0	11	6	4	0	21	3.333	.777	.336	3.545
2	-020-00-00-17	0	0	3	11	3	17	2.000	.594	.285	2.000
1	-020-00-00-10	0	0	4	13	4	21	2.000	.617	.267	2.000
2	-020-00-00-10	0	0	0	5	16	21	1.238	.426	.184	1.156
1	-030-00-00-30	17	4	0	0	0	21	4.810	.393	.170	4.882
2	-030-00-00-30	8	12	1	0	0	21	4.333	.563	.243	4.292
1	-030-00-00-27	15	5	0	0	0	20	4.750	.433	.192	4.833
2	-030-00-00-27	3	16	1	1	0	21	4.000	.617	.267	4.031
1	-030-00-00-23	10	8	3	0	0	21	4.333	.713	.308	4.438
2	-030-00-00-23	0	6	14	1	0	21	3.238	.526	.227	3.179
1	-030-00-00-17	2	7	10	2	0	21	3.429	.791	.342	3.550
2	-030-00-00-17	0	0	7	10	4	21	2.143	.710	.307	2.150
1	-030-00-00-10	0	0	1	5	6	12	1.583	.640	.366	1.500
2	-030-00-00-10	0	0	0	8	22	30	1.267	.442	.160	1.182

SCENE	KEY	5	4	3	2	1	POP	MOS	SIGMOS	R95	MEDIAN
1	-101-15-00-30	16	5	0	0	0	21	4.762	.426	.184	4.844
2	-101-15-00-30	8	10	3	0	0	21	4.238	.683	.295	4.250
1	-101-15-00-27	13	8	0	0	0	21	4.619	.486	.210	4.692
2	-101-15-00-27	11	9	1	0	0	21	4.476	.587	.254	4.545
1	-101-15-00-23	18	2	1	0	0	21	4.810	.499	.216	4.917
2	-101-15-00-23	8	11	1	0	0	20	4.350	.572	.253	4.318
1	-101-15-00-17	0	1	0	8	3	12	1.917	.759	.434	1.875
2	-101-15-00-17	0	0	0	12	9	21	1.571	.495	.214	1.625
1	-101-15-00-33	17	4	0	0	0	21	4.810	.393	.170	4.882
2	-101-15-00-33	13	8	0	0	0	21	4.619	.486	.210	4.692
1	-101-15-42-30	7	13	1	0	0	21	4.286	.547	.236	4.231
2	-101-15-42-30	0	9	7	5	0	21	3.190	.794	.343	3.286
1	-101-15-42-27	6	13	2	0	0	21	4.190	.587	.254	4.154
2	-101-15-42-27	0	4	10	4	0	18	3.000	.667	.311	3.000
1	-101-15-42-23	2	13	6	0	0	21	3.810	.587	.254	3.846
2	-101-15-42-23	0	3	10	4	1	18	2.833	.764	.356	2.900
1	-101-15-42-17	0	0	3	7	11	21	1.619	.722	.312	1.455
2	-101-15-42-17	0	0	0	10	11	21	1.476	.499	.216	1.455
1	-101-15-42-33	8	11	2	0	0	21	4.286	.628	.271	4.273
2	-101-15-42-33	0	4	13	4	0	21	3.000	.617	.267	3.000
1	-111-15-00-30	17	1	0	0	0	18	4.944	.229	.107	4.971
2	-111-15-00-30	12	8	1	0	0	21	4.524	.587	.254	4.625
1	-111-15-00-27	19	2	0	0	0	21	4.905	.294	.127	4.947
2	-111-15-00-27	10	8	2	1	0	21	4.286	.825	.356	4.438
1	-111-15-00-23	14	6	1	0	0	21	4.619	.575	.249	4.750
2	-111-15-00-23	3	6	10	2	0	21	3.476	.852	.368	3.350
1	-111-15-00-17	0	0	2	8	11	21	1.571	.660	.285	1.455
2	-111-15-00-17	0	0	0	6	14	20	1.300	.458	.203	1.214
1	-111-15-00-33	15	5	0	0	0	20	4.750	.433	.192	4.833
2	-111-15-00-33	12	9	0	0	0	21	4.571	.495	.214	4.625
1	-121-15-00-30	17	4	0	0	0	21	4.810	.393	.170	4.882
2	-121-15-00-30	7	10	3	1	0	21	4.095	.811	.350	4.150
1	-121-15-00-27	21	9	0	0	0	30	4.700	.458	.166	4.786
2	-121-15-00-27	4	12	4	0	0	20	4.000	.632	.280	4.000
1	-121-15-00-23	9	10	2	0	0	21	4.333	.642	.278	4.350
2	-121-15-00-23	0	6	12	3	0	21	3.143	.639	.276	3.125
1	-121-15-00-17	0	0	2	3	15	20	1.350	.654	.289	1.167
2	-121-15-00-17	0	0	0	6	15	21	1.286	.452	.195	1.200
1	-121-15-00-33	19	2	0	0	0	21	4.905	.294	.127	4.947
2	-121-15-00-33	10	10	1	0	0	21	4.429	.583	.252	4.450
1	-101-13-00-30	16	5	0	0	0	21	4.762	.426	.184	4.844
2	-101-13-00-30	11	9	1	0	0	21	4.476	.587	.254	4.545
1	-101-13-00-27	8	4	0	0	0	12	4.667	.471	.269	4.750
2	-101-13-00-27	15	14	1	0	0	30	4.467	.562	.203	4.500
1	-101-13-00-23	4	2	7	6	0	19	3.211	1.104	.501	3.000
2	-101-13-00-23	0	7	7	2	2	18	3.056	.970	.453	3.214
1	-101-13-00-17	0	0	0	0	21	21	1.000	.000	.000	1.000
2	-101-13-00-17	0	0	0	0	21	21	1.000	.000	.000	1.000
1	-101-13-00-33	17	3	0	0	0	20	4.850	.357	.158	4.912
2	-101-13-00-33	10	9	2	0	0	21	4.381	.653	.282	4.444
1	-101-13-42-30	7	11	3	0	0	21	4.190	.663	.287	4.182
2	-101-13-42-30	0	6	10	5	0	21	3.048	.722	.312	3.050
1	-101-13-42-27	2	8	2	0	0	12	4.000	.577	.330	4.000
2	-101-13-42-27	0	6	7	5	1	19	2.947	.887	.403	3.000
1	-101-13-42-23	0	3	9	7	2	21	2.619	.844	.365	2.667
2	-101-13-42-23	0	0	4	10	0	14	2.286	.452	.239	2.200
1	-101-13-42-17	0	0	0	0	30	30	1.000	.000	.000	1.000
2	-101-13-42-17	0	0	0	0	21	21	1.000	.000	.000	1.000
1	-101-13-42-33	8	10	3	0	0	21	4.238	.683	.295	4.250
2	-101-13-42-33	0	4	12	5	0	21	2.952	.653	.282	2.958

SCENE	KEY	5	4	3	2	1	POP	MOS	SIGMOS	R95	MEDIAN
1	-010-00-56-30	18	3	0	0	0	21	4.857	.350	.151	4.917
2	-010-00-56-30	11	10	0	0	0	21	4.524	.499	.216	4.545
1	-010-00-56-27	17	4	0	0	0	21	4.810	.393	.170	4.882
2	-010-00-56-27	11	5	0	0	0	16	4.688	.464	.229	4.773
1	-010-00-56-23	16	5	0	0	0	21	4.762	.426	.184	4.844
2	-010-00-56-23	11	10	0	0	0	21	4.524	.499	.216	4.545
1	-010-00-56-17	15	4	1	0	0	20	4.700	.557	.247	4.833
2	-010-00-56-17	1	17	3	0	0	21	3.905	.426	.184	3.941
1	-010-00-56-10	3	5	4	0	0	12	3.917	.759	.434	3.900
2	-010-00-56-10	0	0	5	8	1	14	2.286	.589	.312	2.250

Viewer Group "C"

SCENE	KEY	5	4	3	2	1	POP	MOS	SIGMOS	R95	MEDIAN
ALL	-000-00-00-00	131	55	1	0	0	187	4.695	.472	.068	4.786
ALL	-000-00-25-00	0	0	0	7	89	96	1.073	.260	.053	1.039
ALL	-010-00-00-03	0	0	0	1	83	84	1.012	.108	.023	1.006
ALL	-000-00-53-00	30	11	1	0	0	42	4.690	.511	.156	4.800
ALL	-000-00-50-00	27	13	2	0	0	42	4.595	.580	.177	4.722
ALL	-000-00-47-00	16	20	3	0	0	39	4.333	.613	.194	4.325
ALL	-000-00-44-00	8	17	13	3	0	41	3.732	.856	.265	3.765
ALL	-000-00-41-00	1	18	13	5	1	38	3.342	.836	.268	3.500
ALL	-000-00-38-00	1	10	20	10	0	41	3.049	.764	.236	3.025
ALL	-010-00-00-30	30	9	0	0	0	39	4.769	.421	.134	4.850
ALL	-010-00-00-27	23	13	1	0	0	37	4.595	.543	.177	4.696
ALL	-010-00-00-23	14	17	9	2	0	42	4.024	.859	.262	4.088
ALL	-010-00-00-17	2	17	15	6	2	42	3.262	.927	.283	3.367
ALL	-010-00-00-10	1	2	12	23	13	51	2.118	.900	.249	2.043
ALL	-010-00-42-30	8	13	15	6	0	42	3.548	.956	.292	3.500
ALL	-010-00-42-27	2	15	20	4	1	42	3.310	.801	.245	3.300
ALL	-010-00-42-23	7	12	15	7	1	42	3.405	1.025	.313	3.367
ALL	-010-00-42-17	4	7	10	14	3	38	2.868	1.128	.362	2.700
ALL	-010-00-42-10	0	4	7	19	12	42	2.071	.910	.278	1.974
ALL	-020-00-00-30	24	15	2	0	0	41	4.537	.588	.182	4.646
ALL	-020-00-00-27	24	15	2	0	0	41	4.537	.588	.182	4.646
ALL	-020-00-00-23	14	14	13	1	0	42	3.976	.859	.262	4.000
ALL	-020-00-00-17	0	11	9	15	3	38	2.737	.965	.310	2.611
ALL	-020-00-00-10	0	0	4	18	20	42	1.619	.653	.199	1.556
ALL	-030-00-00-30	25	16	1	0	0	42	4.571	.541	.165	4.660
ALL	-030-00-00-27	18	21	1	1	0	41	4.366	.654	.202	4.381
ALL	-030-00-00-23	10	14	17	1	0	42	3.786	.832	.254	3.714
ALL	-030-00-00-17	2	7	17	12	4	42	2.786	.989	.302	2.794
ALL	-030-00-00-10	0	0	1	13	28	42	1.357	.527	.161	1.250
ALL	-101-15-00-30	24	15	3	0	0	42	4.500	.627	.191	4.625
ALL	-101-15-00-27	24	17	1	0	0	42	4.548	.543	.166	4.625
ALL	-101-15-00-23	26	13	2	0	0	41	4.585	.583	.180	4.712
ALL	-101-15-00-17	0	1	0	20	12	33	1.697	.627	.216	1.725
ALL	-101-15-00-33	30	12	0	0	0	42	4.714	.452	.138	4.800
ALL	-101-15-42-30	7	22	8	5	0	42	3.738	.874	.267	3.864
ALL	-101-15-42-27	6	17	12	4	0	39	3.641	.862	.273	3.706
ALL	-101-15-42-23	2	16	16	4	1	39	3.359	.832	.264	3.406
ALL	-101-15-42-17	0	0	3	17	22	42	1.548	.625	.191	1.455
ALL	-101-15-42-33	8	15	15	4	0	42	3.643	.895	.273	3.633
ALL	-111-15-00-30	29	9	1	0	0	39	4.718	.504	.160	4.828
ALL	-111-15-00-27	29	10	2	1	0	42	4.595	.692	.211	4.776
ALL	-111-15-00-23	17	12	11	2	0	42	4.048	.925	.282	4.167
ALL	-111-15-00-17	0	0	2	14	25	41	1.439	.586	.181	1.320
ALL	-111-15-00-33	27	14	0	0	0	41	4.659	.474	.147	4.741
ALL	-121-15-00-30	24	14	3	1	0	42	4.452	.730	.223	4.625
ALL	-121-15-00-27	25	21	4	0	0	50	4.420	.635	.178	4.500
ALL	-121-15-00-23	9	16	14	3	0	42	3.738	.874	.267	3.750
ALL	-121-15-00-17	0	0	2	9	30	41	1.317	.560	.173	1.183
ALL	-121-15-00-33	29	12	1	0	0	42	4.667	.519	.159	4.776
ALL	-101-13-00-30	27	14	1	0	0	42	4.619	.532	.163	4.722
ALL	-101-13-00-27	23	18	1	0	0	42	4.524	.545	.167	4.587
ALL	-101-13-00-23	4	9	14	8	2	37	3.135	1.044	.340	3.107
ALL	-101-13-00-17	0	0	0	0	42	42	1.000	.000	.000	1.000
ALL	-101-13-00-33	27	12	2	0	0	41	4.610	.579	.179	4.741
ALL	-101-13-42-30	7	17	13	5	0	42	3.619	.898	.275	3.676
ALL	-101-13-42-27	2	14	9	5	1	31	3.355	.935	.332	3.536
ALL	-101-13-42-23	0	3	13	17	2	35	2.486	.732	.245	2.412
ALL	-101-13-42-17	0	0	0	0	51	51	1.000	.000	.000	1.000
ALL	-101-13-42-33	8	14	15	5	0	42	3.595	.927	.283	3.571
ALL	-010-00-56-30	29	13	0	0	0	42	4.690	.462	.141	4.776
ALL	-010-00-56-27	28	9	0	0	0	37	4.757	.429	.140	4.839
ALL	-010-00-56-23	27	15	0	0	0	42	4.643	.479	.146	4.722
ALL	-010-00-56-17	16	21	4	0	0	41	4.293	.634	.196	4.286
ALL	-010-00-56-10	3	5	9	8	1	26	3.038	1.055	.410	2.944

SCENE	KEY	5	4	3	2	1	POP	MOS	SIGMOS	R95	MEDIAN
ALL	ALL	939	766	405	300	449	2859	3.506	1.435	.053	3.860

Viewer Group "D"

SCENE	KEY	5	4	3	2	1	POP	MOS	SIGMOS	R95	MEDIAN
1	-000-00-00-00	45	14	1	0	0	60	4.733	.478	.122	4.833
2	-000-00-00-00	40	8	0	0	0	48	4.833	.373	.107	4.900
3	-000-00-00-00	43	5	0	0	0	48	4.896	.305	.087	4.942
1	-000-00-25-00	0	0	0	0	24	24	1.000	.000	.000	1.000
2	-000-00-25-00	0	0	0	0	24	24	1.000	.000	.000	1.000
3	-000-00-25-00	0	0	0	0	24	24	1.000	.000	.000	1.000
1	-010-00-00-13	0	0	3	17	4	24	1.958	.538	.218	1.971
2	-010-00-00-13	0	0	2	11	11	24	1.625	.633	.256	1.591
3	-010-00-00-13	0	3	12	8	1	24	2.708	.735	.297	2.750
1	-000-00-53-00	7	5	0	0	0	12	4.583	.493	.282	4.643
2	-000-00-53-00	8	4	0	0	0	12	4.667	.471	.269	4.750
3	-000-00-53-00	10	2	0	0	0	12	4.833	.373	.213	4.900
1	-000-00-50-00	6	6	0	0	0	12	4.500	.500	.286	4.500
2	-000-00-50-00	4	7	1	0	0	12	4.250	.595	.340	4.214
3	-000-00-50-00	7	5	0	0	0	12	4.583	.493	.282	4.643
1	-000-00-47-00	5	7	0	0	0	12	4.417	.493	.282	4.357
2	-000-00-47-00	0	7	5	0	0	12	3.583	.493	.282	3.643
3	-000-00-47-00	11	1	0	0	0	12	4.917	.276	.158	4.955
1	-000-00-44-00	2	7	3	0	0	12	3.917	.640	.366	3.929
2	-000-00-44-00	0	6	4	2	0	12	3.333	.745	.426	3.500
3	-000-00-44-00	4	7	1	0	0	12	4.250	.595	.340	4.214
1	-000-00-41-00	0	4	7	1	0	12	3.250	.595	.340	3.214
2	-000-00-41-00	0	0	5	7	0	12	2.417	.493	.282	2.357
1	-000-00-38-00	0	0	0	12	0	12	2.000	.000	.000	2.000
2	-000-00-38-00	0	0	3	9	0	12	2.250	.433	.247	2.167
3	-000-00-38-00	0	0	4	7	1	12	2.250	.595	.340	2.214
1	-010-00-00-40	9	3	0	0	0	12	4.750	.433	.247	4.833
2	-010-00-00-40	11	1	0	0	0	12	4.917	.276	.158	4.955
3	-010-00-00-40	12	0	0	0	0	12	5.000	.000	.000	5.000
1	-010-00-00-37	9	2	1	0	0	12	4.667	.624	.356	4.833
2	-010-00-00-37	8	4	0	0	0	12	4.667	.471	.269	4.750
3	-010-00-00-37	10	2	0	0	0	12	4.833	.373	.213	4.900
1	-010-00-00-33	10	1	0	1	0	12	4.667	.850	.486	4.900
2	-010-00-00-33	8	4	0	0	0	12	4.667	.471	.269	4.750
3	-010-00-00-33	11	1	0	0	0	12	4.917	.276	.158	4.955
1	-010-00-00-27	6	6	0	0	0	12	4.500	.500	.286	4.500
2	-010-00-00-27	9	3	0	0	0	12	4.750	.433	.247	4.833
3	-010-00-00-27	10	2	0	0	0	12	4.833	.373	.213	4.900
1	-010-00-00-20	3	5	3	1	0	12	3.833	.898	.513	3.900
2	-010-00-00-20	0	2	8	2	0	12	3.000	.577	.330	3.000
3	-010-00-00-20	5	6	1	0	0	12	4.333	.624	.356	4.333
1	-010-00-42-40	0	7	5	0	0	12	3.583	.493	.282	3.643
2	-010-00-42-40	0	1	6	5	0	12	2.667	.624	.356	2.667
3	-010-00-42-40	2	8	2	0	0	12	4.000	.577	.330	4.000
1	-010-00-42-37	4	7	1	0	0	12	4.250	.595	.340	4.214
2	-010-00-42-37	0	1	5	6	0	12	2.583	.640	.366	2.500
3	-010-00-42-37	4	6	2	0	0	12	4.167	.687	.393	4.167
1	-010-00-42-33	1	7	4	0	0	12	3.750	.595	.340	3.786
2	-010-00-42-33	0	1	6	4	1	12	2.583	.759	.434	2.667
3	-010-00-42-33	3	7	2	0	0	12	4.083	.640	.366	4.071
1	-010-00-42-27	0	6	6	0	0	12	3.500	.500	.286	3.500
2	-010-00-42-27	0	2	6	4	0	12	2.833	.687	.393	2.833
3	-010-00-42-27	1	7	4	0	0	12	3.750	.595	.340	3.786
1	-010-00-42-20	0	1	7	4	0	12	2.750	.595	.340	2.786
2	-010-00-42-20	0	0	7	5	0	12	2.583	.493	.282	2.643

SCENE	KEY	5	4	3	2	1	POP	MOS	SIGMOS	R95	MEDIAN
3	-010-00-42-20	0	8	2	2	0	12	3.500	.764	.437	3.750
1	-020-00-00-40	10	2	0	0	0	12	4.833	.373	.213	4.900
2	-020-00-00-40	8	4	0	0	0	12	4.667	.471	.269	4.750
3	-020-00-00-40	10	2	0	0	0	12	4.833	.373	.213	4.900
1	-020-00-00-37	11	1	0	0	0	12	4.917	.276	.158	4.955
2	-020-00-00-37	11	1	0	0	0	12	4.917	.276	.158	4.955
3	-020-00-00-37	10	2	0	0	0	12	4.833	.373	.213	4.900
1	-020-00-00-33	11	1	0	0	0	12	4.917	.276	.158	4.955
2	-020-00-00-33	3	9	0	0	0	12	4.250	.433	.247	4.167
3	-020-00-00-33	10	2	0	0	0	12	4.833	.373	.213	4.900
1	-020-00-00-27	7	4	1	0	0	12	4.500	.645	.369	4.643
2	-020-00-00-27	0	10	2	0	0	12	3.833	.373	.213	3.900
3	-020-00-00-27	9	3	0	0	0	12	4.750	.433	.247	4.833
1	-020-00-00-20	0	3	7	2	0	12	3.083	.640	.366	3.071
2	-020-00-00-20	0	0	6	6	0	12	2.500	.500	.286	2.500
3	-020-00-00-20	2	6	4	0	0	12	3.833	.687	.393	3.833
1	-030-00-00-40	11	1	0	0	0	12	4.917	.276	.158	4.955
2	-030-00-00-40	12	0	0	0	0	12	5.000	.000	.000	5.000
3	-030-00-00-40	10	2	0	0	0	12	4.833	.373	.213	4.900
1	-030-00-00-37	10	2	0	0	0	12	4.833	.373	.213	4.900
2	-030-00-00-37	11	1	0	0	0	12	4.917	.276	.158	4.955
3	-030-00-00-37	10	2	0	0	0	12	4.833	.373	.213	4.900
1	-030-00-00-33	10	2	0	0	0	12	4.833	.373	.213	4.900
2	-030-00-00-33	1	8	3	0	0	12	3.833	.553	.316	3.875
3	-030-00-00-33	8	4	0	0	0	12	4.667	.471	.269	4.750
1	-030-00-00-27	1	10	1	0	0	12	4.000	.408	.233	4.000
2	-030-00-00-27	0	7	4	1	0	12	3.500	.645	.369	3.643
3	-030-00-00-27	6	5	1	0	0	12	4.417	.640	.366	4.500
1	-030-00-00-20	0	1	7	4	0	12	2.750	.595	.340	2.786
2	-030-00-00-20	0	0	4	6	1	11	2.273	.617	.368	2.250
3	-030-00-00-20	1	4	5	2	0	12	3.333	.850	.486	3.300
1	-101-15-00-40	7	5	0	0	0	12	4.583	.493	.282	4.643
2	-101-15-00-40	11	1	0	0	0	12	4.917	.276	.158	4.955
3	-101-15-00-40	9	3	0	0	0	12	4.750	.433	.247	4.833
1	-101-15-00-37	9	3	0	0	0	12	4.750	.433	.247	4.833
2	-101-15-00-37	12	0	0	0	0	12	5.000	.000	.000	5.000
3	-101-15-00-37	10	2	0	0	0	12	4.833	.373	.213	4.900
1	-101-15-00-33	9	3	0	0	0	12	4.750	.433	.247	4.833
2	-101-15-00-33	11	1	0	0	0	12	4.917	.276	.158	4.955
3	-101-15-00-33	12	0	0	0	0	12	5.000	.000	.000	5.000
1	-101-15-00-27	12	0	0	0	0	12	5.000	.000	.000	5.000
2	-101-15-00-27	11	1	0	0	0	12	4.917	.276	.158	4.955
3	-101-15-00-27	11	1	0	0	0	12	4.917	.276	.158	4.955
1	-101-15-00-20	5	5	2	0	0	12	4.250	.722	.412	4.300
2	-101-15-00-20	8	4	0	0	0	12	4.667	.471	.269	4.750
3	-101-15-00-20	9	3	0	0	0	12	4.750	.433	.247	4.833
1	-101-15-42-40	0	7	5	0	0	12	3.583	.493	.282	3.643
2	-101-15-42-40	0	0	5	6	1	12	2.333	.624	.356	2.333
3	-101-15-42-40	4	7	1	0	0	12	4.250	.595	.340	4.214
1	-101-15-42-37	1	9	2	0	0	12	3.917	.493	.282	3.944
2	-101-15-42-37	0	1	7	4	0	12	2.750	.595	.340	2.786
3	-101-15-42-37	1	8	3	0	0	12	3.833	.553	.316	3.875
1	-101-15-42-33	2	7	3	0	0	12	3.917	.640	.366	3.929
2	-101-15-42-33	0	4	6	2	0	12	3.167	.687	.393	3.167
3	-101-15-42-33	4	6	2	0	0	12	4.167	.687	.393	4.167
1	-101-15-42-27	0	9	2	1	0	12	3.667	.624	.356	3.833
2	-101-15-42-27	0	1	7	4	0	12	2.750	.595	.340	2.786
3	-101-15-42-27	4	6	2	0	0	12	4.167	.687	.393	4.167
1	-101-15-42-20	0	1	3	6	2	12	2.250	.829	.474	2.167
2	-101-15-42-20	0	0	2	10	0	12	2.167	.373	.213	2.100
3	-101-15-42-20	0	4	8	0	0	12	3.333	.471	.269	3.250

SCENE	KEY	5	4	3	2	1	POP	MOS	SIGMOS	R95	MEDIAN
1	-111-15-00-40	10	2	0	0	0	12	4.833	.373	.213	4.900
2	-111-15-00-40	10	2	0	0	0	12	4.833	.373	.213	4.900
3	-111-15-00-40	10	2	0	0	0	12	4.833	.373	.213	4.900
1	-111-15-00-37	7	5	0	0	0	12	4.583	.493	.282	4.643
2	-111-15-00-37	10	2	0	0	0	12	4.833	.373	.213	4.900
3	-111-15-00-37	10	2	0	0	0	12	4.833	.373	.213	4.900
1	-111-15-00-33	9	3	0	0	0	12	4.750	.433	.247	4.833
2	-111-15-00-33	9	3	0	0	0	12	4.750	.433	.247	4.833
3	-111-15-00-33	11	1	0	0	0	12	4.917	.276	.158	4.955
1	-111-15-00-27	7	4	1	0	0	12	4.500	.645	.369	4.643
2	-111-15-00-27	1	8	3	0	0	12	3.833	.553	.316	3.875
3	-111-15-00-27	12	0	0	0	0	12	5.000	.000	.000	5.000
1	-111-15-00-20	1	4	5	2	0	12	3.333	.850	.486	3.300
2	-111-15-00-20	0	0	9	3	0	12	2.750	.433	.247	2.833
3	-111-15-00-20	5	5	2	0	0	12	4.250	.722	.412	4.300
1	-121-15-00-40	9	3	0	0	0	12	4.750	.433	.247	4.833
2	-121-15-00-40	8	4	0	0	0	12	4.667	.471	.269	4.750
3	-121-15-00-40	10	2	0	0	0	12	4.833	.373	.213	4.900
1	-121-15-00-37	8	4	0	0	0	12	4.667	.471	.269	4.750
2	-121-15-00-37	6	6	0	0	0	12	4.500	.500	.286	4.500
3	-121-15-00-37	11	1	0	0	0	12	4.917	.276	.158	4.955
1	-121-15-00-33	9	3	0	0	0	12	4.750	.433	.247	4.833
2	-121-15-00-33	1	11	0	0	0	12	4.083	.276	.158	4.045
3	-121-15-00-33	7	5	0	0	0	12	4.583	.493	.282	4.643
1	-121-15-00-27	5	7	0	0	0	12	4.417	.493	.282	4.357
2	-121-15-00-27	1	9	2	0	0	12	3.917	.493	.282	3.944
3	-121-15-00-27	8	4	0	0	0	12	4.667	.471	.269	4.750
1	-121-15-00-20	0	1	7	4	0	12	2.750	.595	.340	2.786
2	-121-15-00-20	0	0	3	8	1	12	2.167	.553	.316	2.125
3	-121-15-00-20	0	6	5	1	0	12	3.417	.640	.366	3.500
1	-101-13-00-40	4	8	0	0	0	12	4.333	.471	.269	4.250
2	-101-13-00-40	10	2	0	0	0	12	4.833	.373	.213	4.900
3	-101-13-00-40	11	1	0	0	0	12	4.917	.276	.158	4.955
1	-101-13-00-37	6	5	1	0	0	12	4.417	.640	.366	4.500
2	-101-13-00-37	10	2	0	0	0	12	4.833	.373	.213	4.900
3	-101-13-00-37	12	0	0	0	0	12	5.000	.000	.000	5.000
1	-101-13-00-33	7	5	0	0	0	12	4.583	.493	.282	4.643
2	-101-13-00-33	9	3	0	0	0	12	4.750	.433	.247	4.833
3	-101-13-00-33	9	3	0	0	0	12	4.750	.433	.247	4.833
1	-101-13-00-27	8	4	0	0	0	12	4.667	.471	.269	4.750
2	-101-13-00-27	7	5	0	0	0	12	4.583	.493	.282	4.643
3	-101-13-00-27	9	3	0	0	0	12	4.750	.433	.247	4.833
1	-101-13-00-20	0	0	0	3	9	12	1.250	.433	.247	1.167
2	-101-13-00-20	0	0	1	5	6	12	1.583	.640	.366	1.500
3	-101-13-00-20	0	0	0	7	5	12	1.583	.493	.282	1.643

Viewer Group "D"

SCENE	KEY	5	4	3	2	1	POP	MOS	SIGMOS	R95	MEDIAN
ALL	-000-00-00-00	128	27	1	0	0	156	4.814	.405	.064	4.891
ALL	-000-00-25-00	0	0	0	0	72	72	1.000	.000	.000	1.000
ALL	-010-00-00-13	0	3	17	36	16	72	2.097	.785	.183	2.056
ALL	-000-00-53-00	25	11	0	0	0	36	4.694	.461	.152	4.780
ALL	-000-00-50-00	17	18	1	0	0	36	4.444	.550	.181	4.444
ALL	-000-00-47-00	16	15	5	0	0	36	4.306	.700	.231	4.367
ALL	-000-00-44-00	6	20	8	2	0	36	3.833	.764	.252	3.900
12	-000-00-41-00	0	4	12	8	0	24	2.833	.687	.278	2.833
ALL	-000-00-38-00	0	0	7	28	1	36	2.167	.441	.146	2.107
ALL	-010-00-00-40	32	4	0	0	0	36	4.889	.314	.104	4.938
ALL	-010-00-00-37	27	8	1	0	0	36	4.722	.506	.167	4.833
ALL	-010-00-00-33	29	6	0	1	0	36	4.750	.595	.196	4.879
ALL	-010-00-00-27	25	11	0	0	0	36	4.694	.461	.152	4.780
ALL	-010-00-00-20	8	13	12	3	0	36	3.722	.901	.297	3.731
ALL	-010-00-42-40	2	16	13	5	0	36	3.417	.795	.262	3.500
ALL	-010-00-42-37	8	14	8	6	0	36	3.667	1.000	.330	3.786
ALL	-010-00-42-33	4	15	12	4	1	36	3.472	.928	.306	3.567
ALL	-010-00-42-27	1	15	16	4	0	36	3.361	.713	.235	3.375
ALL	-010-00-42-20	0	9	16	11	0	36	2.944	.743	.245	2.938
ALL	-020-00-00-40	28	8	0	0	0	36	4.778	.416	.137	4.857
ALL	-020-00-00-37	32	4	0	0	0	36	4.889	.314	.104	4.938
ALL	-020-00-00-33	24	12	0	0	0	36	4.667	.471	.156	4.750
ALL	-020-00-00-27	16	17	3	0	0	36	4.361	.630	.208	4.382
ALL	-020-00-00-20	2	9	17	8	0	36	3.139	.822	.271	3.088
ALL	-030-00-00-40	33	3	0	0	0	36	4.917	.276	.091	4.955
ALL	-030-00-00-37	31	5	0	0	0	36	4.861	.346	.114	4.919
ALL	-030-00-00-33	19	14	3	0	0	36	4.444	.643	.212	4.553
ALL	-030-00-00-27	7	22	6	1	0	36	3.972	.687	.227	4.000
ALL	-030-00-00-20	1	5	16	12	1	35	2.800	.821	.275	2.781
ALL	-101-15-00-40	27	9	0	0	0	36	4.750	.433	.143	4.833
ALL	-101-15-00-37	31	5	0	0	0	36	4.861	.346	.114	4.919
ALL	-101-15-00-33	32	4	0	0	0	36	4.889	.314	.104	4.938
ALL	-101-15-00-27	34	2	0	0	0	36	4.944	.229	.076	4.971
ALL	-101-15-00-20	22	12	2	0	0	36	4.556	.598	.197	4.682
ALL	-101-15-42-40	4	14	11	6	1	36	3.389	.980	.323	3.500
ALL	-101-15-42-37	2	18	12	4	0	36	3.500	.764	.252	3.611
ALL	-101-15-42-33	6	17	11	2	0	36	3.750	.795	.262	3.794
ALL	-101-15-42-27	4	16	11	5	0	36	3.528	.866	.286	3.625
ALL	-101-15-42-20	0	5	13	16	2	36	2.583	.795	.262	2.500
ALL	-111-15-00-40	30	6	0	0	0	36	4.833	.373	.123	4.900
ALL	-111-15-00-37	27	9	0	0	0	36	4.750	.433	.143	4.833
ALL	-111-15-00-33	29	7	0	0	0	36	4.806	.396	.131	4.879
ALL	-111-15-00-27	20	12	4	0	0	36	4.444	.685	.226	4.600
ALL	-111-15-00-20	6	9	16	5	0	36	3.444	.926	.306	3.313
ALL	-121-15-00-40	27	9	0	0	0	36	4.750	.433	.143	4.833
ALL	-121-15-00-37	25	11	0	0	0	36	4.694	.461	.152	4.780
ALL	-121-15-00-33	17	19	0	0	0	36	4.472	.499	.165	4.447
ALL	-121-15-00-27	14	20	2	0	0	36	4.333	.577	.191	4.300
ALL	-121-15-00-20	0	7	15	13	1	36	2.778	.786	.259	2.767
ALL	-101-13-00-40	25	11	0	0	0	36	4.694	.461	.152	4.780
ALL	-101-13-00-37	28	7	1	0	0	36	4.750	.493	.163	4.857
ALL	-101-13-00-33	25	11	0	0	0	36	4.694	.461	.152	4.780
ALL	-101-13-00-27	24	12	0	0	0	36	4.667	.471	.156	4.750
ALL	-101-13-00-20	0	0	1	15	20	36	1.472	.552	.182	1.400

SCENE	KEY	5	4	3	2	1	POP	MOS	SIGMOS	R95	MEDIAN
ALL	ALL	980	560	273	195	115	2123	3.987	1.202	.052	4.354

APPENDIX D

JUST-PERCEPTIBLE TESTS RESULTS FOR ADJACENT CHANNEL INTERFERENCE

Just-perceptible Tests Results

for Adjacent Channel Interference

FREQUENCY SWEEP TABLE (FILTER = 14 MHZ)

F (MHz)	MEAN (C/I) (dB) #1	#2	#3	#4	ALL	STD. DEV. (C/I) (dB) #1	#2	#3	#4	ALL	95% CONF. LIMIT (dB) #1	#2	#3	#4	ALL
-18	.00	3.10	.00	.00	3.10	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
-16	2.60	2.05	.00	.00	2.16	.00	2.53	.00	.00	2.27	.00	2.50	.00	.00	2.01
-15	1.83	4.58	2.55	.35	2.98	1.91	1.73	.05	.05	2.19	2.19	1.40	.07	.07	1.20
-14	3.59	7.25	2.32	1.47	4.05	2.39	2.66	1.34	.73	3.11	1.79	1.86	1.33	.59	1.23
-13	5.31	7.07	3.17	3.68	4.81	2.80	2.11	2.22	1.56	2.69	1.96	1.47	1.56	1.09	.94
-12	6.74	8.51	5.69	4.17	6.28	4.09	2.20	1.84	1.07	3.01	2.87	1.54	1.29	.75	1.05
-10	11.13	16.29	9.30	9.22	11.48	4.40	3.30	2.54	2.82	4.41	3.08	2.31	1.78	1.97	1.54
-8	17.63	21.92	14.11	16.32	17.49	2.69	2.77	1.78	2.33	3.74	1.89	1.94	1.24	1.63	1.31
-6	19.26	23.58	17.82	17.23	19.47	2.81	2.04	2.96	1.73	3.48	1.97	1.43	2.07	1.21	1.22
-4	24.29	26.99	21.20	21.86	23.59	2.41	2.27	2.95	2.41	3.40	1.69	1.59	2.06	1.69	1.19
-2	24.92	29.19	22.46	23.07	24.91	2.37	2.06	2.77	3.09	3.70	1.66	1.44	1.94	2.16	1.30
0	28.80	29.69	23.36	24.66	26.63	3.25	2.16	3.34	3.03	4.00	2.27	1.51	2.33	2.12	1.40
2	25.95	26.74	21.53	23.87	24.52	3.18	2.78	3.74	2.70	3.72	2.23	1.94	2.62	1.89	1.30
4	25.19	30.81	22.05	22.54	25.15	3.54	2.50	3.31	3.01	4.67	2.48	1.75	2.32	2.11	1.64
6	20.75	24.51	17.72	19.73	20.68	2.20	2.06	2.00	2.91	3.38	1.54	1.44	1.40	2.04	1.18
8	17.74	23.19	13.37	14.81	17.28	3.85	2.53	2.84	3.17	4.89	2.69	1.77	1.99	2.22	1.71
10	10.06	14.40	5.10	7.58	9.28	2.99	2.52	2.83	2.95	4.45	2.09	1.77	1.98	2.07	1.56
12	2.52	9.74	5.73	3.22	5.77	1.38	3.20	1.46	1.29	3.85	1.22	2.24	1.67	1.05	1.62
13	1.66	5.98	2.20	3.10	3.74	1.45	3.71	1.28	.00	3.32	1.29	2.77	1.47	.00	1.64
14	.00	5.25	1.10	1.00	4.20	.00	3.49	.00	.00	3.55	.00	2.82	.00	.00	2.47
15	.00	2.86	.00	.00	2.86	.00	1.99	.00	.00	1.99	.00	1.61	.00	.00	1.61
16	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
18	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

C/I SWEEP TABLE (FILTER = 14 MHZ)

C/I (dB)	MEAN (F) (MHz) #1	#2	#3	#4	ALL	STD. DEV. (F) (MHz) #1	#2	#3	#4	ALL	95% CONF. LIMIT (MHz) #1	#2	#3	#4	ALL
-3	-15.61	-16.52	-15.03	-15.71	-15.74	.90	.96	.60	1.11	1.08	.67	.67	.45	.83	.40
0	-14.19	-15.42	-13.38	-14.42	-14.39	.95	.85	1.02	.84	1.19	.71	.59	.77	.63	.44
3	-12.92	-15.21	-11.99	-12.98	-13.34	.75	1.19	1.61	.88	1.71	.56	.83	1.21	.65	.63
5	-12.38	-15.08	-11.13	-11.51	-12.61	1.15	1.44	1.47	1.27	2.11	.86	1.01	1.10	.95	.78
7	-11.71	-14.15	-10.41	-10.55	-11.79	1.46	1.52	1.52	1.55	2.19	1.09	1.07	1.13	1.16	.80
9	-10.60	-12.87	-9.73	-9.86	-10.84	1.60	1.93	1.32	1.34	2.08	1.20	1.35	.99	1.00	.76
11	-9.59	-12.20	-8.79	-9.29	-10.04	1.32	.98	1.56	1.28	1.90	.99	.68	1.16	.96	.70
13	-9.44	-12.08	-8.05	-9.08	-9.75	1.42	1.18	1.65	1.49	2.11	1.06	.82	1.23	1.11	.78
15	-8.62	-10.74	-7.09	-7.50	-8.57	.85	2.33	2.25	1.66	2.39	.63	1.63	1.68	1.24	.88
17	-7.39	-9.34	-5.86	-6.37	-7.24	1.60	1.82	2.01	1.81	2.28	1.20	1.36	1.50	1.35	.85
20	-6.21	-7.66	-5.25	-4.60	-6.10	1.98	2.77	2.29	1.99	2.62	1.48	1.94	2.03	1.61	1.02
23	-4.73	-6.19	-5.22	-3.30	-4.97	2.94	1.95	2.09	2.50	2.63	2.60	1.46	2.07	2.22	1.14
25	-3.52	-4.79	-4.33	-3.40	-4.29	.89	2.41	2.42	.90	2.14	1.01	1.68	2.76	1.26	1.06
27	-3.11	-4.36	-3.60	-2.50	-3.76	.76	.58	.49	.00	.90	.87	.47	.69	.00	.51
29	-1.99	-3.73	-3.75	-2.50	-3.30	.30	.85	.64	.00	.99	.42	.69	.90	.00	.59
31	-2.30	-4.35	-3.10	-2.50	-3.32	.00	.65	.00	.00	.99	.00	.91	.00	.00	.87
33	-2.30	-3.85	-3.10	-2.50	-3.12	.00	.14	.00	.00	.69	.00	.19	.00	.00	.62
35	-2.30	-3.70	-3.10	-2.50	-2.90	.00	.00	.00	.00	.56	.00	.00	.00	.00	.55
37	-2.30	-3.70	-3.10	-2.50	-2.90	.00	.00	.00	.00	.56	.00	.00	.00	.00	.55
37	-.10	5.30	5.20	5.80	4.05	.00	.00	.00	.00	2.41	.00	.00	.00	.00	2.39
35	-.10	5.30	5.20	5.80	4.05	.00	.00	.00	.00	2.41	.00	.00	.00	.00	2.39
33	-.10	3.65	5.20	5.80	3.64	.00	1.65	.00	.00	2.31	.00	2.31	.00	.00	2.05
31	-.10	3.65	5.20	5.80	3.64	.00	1.65	.00	.00	2.31	.00	2.31	.00	.00	2.05
29	.88	4.43	5.20	5.80	3.88	.97	1.57	.00	.00	2.10	1.36	1.39	.00	.00	1.38
27	2.44	5.19	5.20	2.00	3.97	2.09	1.46	.00	3.80	2.59	2.39	1.18	.00	5.32	1.48
25	2.79	5.57	3.96	3.87	4.50	2.20	2.52	1.04	2.60	2.54	2.51	1.77	1.19	2.97	1.22
23	3.40	6.41	6.05	4.02	5.06	2.58	1.64	1.52	2.74	2.55	2.29	1.23	1.50	2.43	1.10
20	5.38	8.06	5.51	5.60	6.28	1.52	1.96	2.70	2.31	2.42	1.14	1.37	2.39	1.87	.94
17	7.17	8.80	6.43	6.49	7.22	1.57	1.58	1.37	1.30	1.77	1.17	1.19	1.02	.97	.66
15	7.76	9.96	6.57	7.51	8.02	.99	2.20	.76	1.15	1.93	.74	1.54	.57	.86	.71
13	8.90	10.54	7.46	7.51	8.67	.84	1.50	1.16	.94	1.75	.63	1.05	.87	.70	.64
11	8.74	11.27	8.22	8.54	9.26	.80	1.97	1.38	.70	1.85	.60	1.38	1.03	.52	.68
9	9.68	12.42	8.97	9.22	10.15	1.20	1.43	1.24	.96	1.89	.90	1.00	.93	.72	.69
7	10.52	12.78	9.55	9.67	10.71	1.29	1.12	1.23	1.27	1.83	.97	.78	.92	.95	.67
5	11.18	12.72	10.77	10.90	11.44	.90	.77	1.34	1.33	1.38	.68	.54	1.00	.99	.51
3	12.02	13.78	11.22	11.79	12.26	1.42	1.72	1.02	.82	1.63	1.06	1.20	.77	.61	.60
0	12.51	15.12	12.25	12.37	13.13	.85	1.66	1.21	.60	1.71	.63	1.16	.91	.45	.63
-3	13.93	15.66	13.00	13.78	14.14	1.07	1.65	.97	.86	1.55	.80	1.16	.73	.65	.57

FREQUENCY SWEEP TABLE (FILTER = 18 MHZ)

F (MHz)	MEAN (C/I) (dB) #1	#2	#3	#4	ALL	STD. DEV. (C/I) (dB) #1	#2	#3	#4	ALL	95% CONF. LIMIT (dB) #1	#2	#3	#4	ALL
-18	2.59	2.72	1.37	1.87	2.18	.97	1.67	.72	.90	1.27	.73	1.25	.58	.73	.49
-16	5.04	6.07	3.70	4.17	4.70	1.84	1.49	1.42	1.49	1.80	1.29	1.11	.99	1.05	.64
-15	7.06	7.06	5.24	5.62	6.22	.82	2.32	1.63	1.55	1.88	.62	1.63	1.14	1.08	.67
-14	7.87	9.14	6.30	7.04	7.59	2.82	2.59	1.43	1.23	2.38	1.97	1.81	1.00	.86	.83
-13	9.46	9.34	7.50	7.94	8.56	3.51	2.62	1.68	.96	2.54	2.46	1.83	1.17	.67	.89
-12	9.88	10.39	7.57	8.49	9.08	3.55	2.66	1.33	1.30	2.65	2.48	1.86	.93	.91	.93
-10	13.07	17.49	8.81	9.80	12.29	5.55	2.32	1.99	2.30	4.78	3.88	1.62	1.39	1.61	1.67
-8	18.10	20.75	13.66	15.53	17.01	5.27	2.59	1.99	2.48	4.28	3.69	1.81	1.39	1.74	1.50
-6	21.09	23.45	16.42	16.80	19.44	4.28	2.58	2.87	1.59	4.20	3.00	1.80	2.01	1.11	1.47
-4	24.50	26.97	20.36	21.64	23.37	3.16	2.10	2.09	2.18	3.53	2.21	1.47	1.46	1.53	1.24
-2	24.58	27.18	21.44	23.88	24.27	3.21	1.65	2.84	2.80	3.38	2.24	1.16	1.99	1.96	1.18
0	28.19	29.94	23.10	24.64	26.47	1.64	2.51	2.68	2.61	3.63	1.15	1.76	1.88	1.82	1.27
2	27.07	26.38	20.04	23.32	24.20	3.10	2.28	3.08	1.57	3.80	2.17	1.60	2.16	1.10	1.33
4	26.52	29.94	20.94	23.36	25.19	3.39	2.25	2.00	3.24	4.38	2.37	1.57	1.40	2.27	1.53
6	21.71	24.05	16.06	21.53	20.84	3.38	1.73	2.46	2.72	3.95	2.37	1.21	1.72	1.90	1.38
8	19.43	24.42	14.63	15.86	18.59	3.74	2.44	3.69	3.17	5.04	2.62	1.71	2.58	2.22	1.76
10	12.07	16.27	8.77	11.27	12.10	2.13	2.78	1.46	2.61	3.55	1.49	1.94	1.02	1.83	1.24
12	8.92	11.92	6.13	7.34	8.58	1.71	1.73	1.93	1.50	2.77	1.20	1.21	1.35	1.05	.97
13	6.87	8.48	3.79	6.56	6.43	1.97	2.49	1.31	1.48	2.52	1.38	1.74	.92	1.03	.88
14	3.97	4.82	1.58	4.02	3.73	1.59	2.43	1.17	1.16	2.04	1.11	1.70	.94	.82	.74
15	2.70	5.10	2.20	2.12	3.13	.94	1.84	1.20	.91	1.77	.70	1.49	1.68	.68	.75
16	1.66	1.40	.80	.73	1.27	1.14	1.49	.30	.49	1.17	1.01	1.32	.42	.56	.60
18	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

C/I SWEEP TABLE (FILTER = 18 MHZ)

C/I (dB)	MEAN (F) (MHz)					STD. DEV. (F) (MHz)					95% CONF. LIMIT (MHz)				
	#1	#2	#3	#4	ALL	#1	#2	#3	#4	ALL	#1	#2	#3	#4	ALL
-3	-18.27	-19.48	-18.92	-19.19	-19.01	1.42	.41	.71	.45	.89	1.62	.40	.63	.40	.43
0	-17.72	-18.18	-17.46	-18.25	-17.89	1.34	.96	1.09	.90	1.15	1.01	.77	.82	.67	.44
3	-16.33	-16.59	-16.32	-16.32	-16.39	1.30	.89	1.29	.87	1.15	.97	.67	.96	.65	.43
5	-15.13	-15.30	-14.69	-15.19	-15.08	1.41	1.13	1.18	.88	1.20	1.05	.85	.88	.66	.45
7	-13.32	-14.62	-10.99	-11.32	-12.56	1.99	1.56	1.89	2.45	2.50	1.49	1.17	1.42	1.83	.94
9	-11.74	-14.15	-10.81	-10.28	-11.75	1.76	1.59	2.08	2.21	2.45	1.31	1.19	1.56	1.65	.92
11	-10.20	-13.18	-9.07	-9.48	-10.48	1.78	2.02	1.67	1.73	2.44	1.33	1.51	1.25	1.30	.91
13	-10.39	-11.98	-8.33	-9.02	-9.93	1.70	1.37	1.03	1.21	1.98	1.27	1.03	.77	.91	.74
15	-9.44	-10.39	-7.76	-7.66	-8.81	1.14	1.43	1.72	2.04	2.03	.85	1.07	1.29	1.52	.76
17	-8.61	-9.39	-7.27	-5.86	-7.78	1.73	1.32	1.58	2.74	2.36	1.29	.98	1.18	2.05	.88
20	-6.41	-7.54	-5.42	-5.04	-6.13	1.82	1.57	2.66	2.99	2.53	1.37	1.18	2.15	2.23	.97
23	-5.29	-5.91	-4.44	-3.89	-4.99	2.40	1.64	2.38	2.22	2.30	1.94	1.23	2.11	1.96	.95
25	-3.78	-5.19	-3.98	-3.71	-4.34	2.76	1.88	.43	.79	2.13	2.23	1.41	.60	.90	.99
27	-3.68	-3.61	-3.01	-3.36	-3.51	1.85	1.81	1.39	.10	1.66	1.83	1.46	1.95	.14	.88
29	-2.71	-2.68	-4.40	-3.30	-2.90	2.21	1.77	.00	.00	1.86	2.19	1.57	.00	.00	1.11
31	-2.61	-2.90	-4.40	-3.30	-2.98	2.15	1.88	.00	.00	1.88	2.13	2.15	.00	.00	1.24
33	-2.90	-4.90	-4.40	-3.30	-3.68	2.50	.00	.00	.00	1.78	3.50	.00	.00	.00	1.58
35	-2.77	-4.90	-4.40	-3.30	-3.63	2.63	.00	.00	.00	1.88	3.68	.00	.00	.00	1.66
37	-2.70	-4.90	-4.40	-3.30	-3.60	2.70	.00	.00	.00	1.93	3.78	.00	.00	.00	1.71
37	3.84	5.30	5.60	1.90	4.10	3.84	.00	.00	.00	2.77	5.38	.00	.00	.00	2.45
35	3.86	5.30	5.60	1.90	4.11	3.81	.00	.00	.00	2.75	5.34	.00	.00	.00	2.44
33	3.90	4.58	5.60	1.90	4.08	3.78	.72	.00	.00	2.50	5.29	1.00	.00	.00	2.02
31	3.04	3.79	5.60	1.90	3.50	3.30	1.65	.00	.00	2.46	3.77	1.89	.00	.00	1.73
29	3.06	3.69	5.60	-.42	2.94	3.27	2.04	.00	2.31	2.96	3.74	1.81	.00	3.24	1.77
27	3.43	4.95	3.92	3.77	4.20	2.63	3.00	1.68	1.87	2.69	2.60	2.43	2.35	2.62	1.42
25	4.16	6.36	5.65	3.85	5.13	2.40	1.57	.00	1.44	2.12	1.94	1.17	.00	1.65	.99
23	6.00	7.13	4.71	3.31	5.48	2.87	2.24	2.37	2.15	2.84	2.32	1.68	2.10	1.91	1.17
20	7.80	8.36	5.47	5.33	6.79	1.72	2.20	2.76	1.90	2.56	1.29	1.65	2.23	1.42	.98
17	8.70	9.27	7.10	6.62	7.92	1.47	.66	1.06	2.29	1.87	1.10	.49	.79	1.71	.70
15	8.76	10.49	7.77	8.02	8.76	.76	1.35	1.37	.98	1.58	.57	1.01	1.03	.73	.59
13	10.47	11.40	8.31	8.49	9.67	1.80	1.33	1.21	.96	1.90	1.35	.99	.90	.72	.71
11	10.86	12.06	8.47	9.09	10.12	1.87	.96	.94	.87	1.91	1.40	.72	.71	.65	.71
9	11.72	12.68	9.07	10.27	10.93	1.48	.88	1.31	1.91	2.02	1.11	.66	.98	1.43	.76
7	12.58	13.12	11.82	12.31	12.46	.52	.80	.63	1.01	.94	.39	.60	.47	.76	.35
5	13.63	14.56	12.99	13.63	13.70	.52	1.95	1.21	.82	1.40	.39	1.46	.91	.61	.52
3	14.81	14.77	13.43	14.94	14.48	.80	1.20	.57	.86	1.12	.60	.90	.42	.64	.42
0	15.60	15.56	14.62	15.57	15.34	.56	.67	.48	.63	.76	.42	.50	.36	.48	.29
-3	17.04	16.80	15.66	16.62	16.53	.68	.84	.50	.53	.90	.51	.63	.37	.40	.34

FREQUENCY SWEEP TABLE (NO FILTER)

F (MHz)	MEAN (C/I) (dB) #1	#2	#3	#4	ALL	STD. DEV. (C/I) (dB) #1	#2	#3	#4	ALL	95% CONF. LIMIT (dB) #1	#2	#3	#4	ALL
-18	14.10	14.60	13.80	14.70	14.26	.10	.00	.00	.00	.34	.14	.00	.00	.00	.30
-16	14.35	14.60	13.20	14.20	14.14	.35	.00	.00	.00	.54	.49	.00	.00	.00	.47
-15	14.25	14.10	13.60	13.30	13.90	.45	.00	.00	.00	.48	.63	.00	.00	.00	.42
-14	14.05	13.80	12.60	13.60	13.62	.55	.00	.00	.00	.64	.77	.00	.00	.00	.57
-13	13.50	13.30	12.30	13.30	13.18	.10	.00	.00	.00	.45	.14	.00	.00	.00	.40
-12	13.40	13.10	11.80	12.50	12.84	.20	.00	.00	.00	.63	.28	.00	.00	.00	.56
-10	13.40	16.70	10.60	11.60	13.14	.40	.00	.00	.00	2.10	.56	.00	.00	.00	1.86
-8	19.70	20.70	9.70	11.20	16.20	1.10	.00	.00	.00	4.78	1.54	.00	.00	.00	4.24
-6	17.15	21.50	15.70	18.50	18.00	1.35	.00	.00	.00	2.14	1.89	.00	.00	.00	1.89
-4	26.55	25.70	20.40	20.50	23.94	.25	.00	.00	.00	2.87	.35	.00	.00	.00	2.54
-2	23.20	26.70	18.30	21.80	22.64	3.20	.00	.00	.00	3.38	4.48	.00	.00	.00	2.99
0	28.40	26.70	21.70	23.80	25.80	2.40	.00	.00	.00	3.05	3.36	.00	.00	.00	2.71
2	26.70	26.40	17.20	23.70	24.14	1.90	.00	.00	.00	3.84	2.66	.00	.00	.00	3.40
4	25.15	28.40	19.10	22.90	24.14	1.45	.00	.00	.00	3.20	2.03	.00	.00	.00	2.84
6	21.50	23.50	12.20	18.20	19.38	.60	.00	.00	.00	3.99	.84	.00	.00	.00	3.53
8	18.30	22.60	9.20	18.70	17.42	.50	.00	.00	.00	4.43	.70	.00	.00	.00	3.92
10	12.90	12.90	10.50	12.10	12.26	1.50	.00	.00	.00	1.33	2.10	.00	.00	.00	1.18
12	13.05	12.40	11.80	12.60	12.58	.35	.00	.00	.00	.52	.49	.00	.00	.00	.46
13	13.40	12.40	11.70	12.70	12.72	.10	.00	.00	.00	.65	.14	.00	.00	.00	.57
14	13.75	12.70	11.80	12.70	12.94	.05	.00	.00	.00	.74	.07	.00	.00	.00	.65
15	14.35	13.10	12.80	12.70	13.46	.15	.00	.00	.00	.74	.21	.00	.00	.00	.66
16	14.95	13.70	13.20	14.60	14.28	.25	.00	.00	.00	.72	.35	.00	.00	.00	.64
18	15.85	14.40	12.70	13.70	14.50	.75	.00	.00	.00	1.32	1.05	.00	.00	.00	1.17

FREQUENCY SWEEP TABLE (FILTER = 26 MHZ)

F (MHz)	MEAN (C/I) (dB)					STD. DEV. (C/I) (dB)					95% CONF. LIMIT (dB)				
	#1	#2	#3	#4	ALL	#1	#2	#3	#4	ALL	#1	#2	#3	#4	ALL
-30	-.95	-1.94	-1.94	-2.66	-1.84	1.84	1.48	2.57	1.65	2.02	1.29	1.11	1.92	1.23	.74
-25	6.92	5.97	5.99	6.07	6.24	1.01	1.35	1.58	.87	1.30	.71	.94	1.11	.61	.45
-20	8.75	8.14	8.03	8.54	8.36	1.28	.59	1.27	1.44	1.23	.90	.41	.89	1.01	.43
-17	8.63	9.77	7.77	8.30	8.62	.97	1.72	.61	1.25	1.41	.68	1.20	.43	.88	.49
-15	9.07	11.77	7.64	8.71	9.30	1.36	2.57	1.23	1.08	2.26	.95	1.80	.86	.75	.79
-13	9.94	13.25	8.16	8.96	10.08	1.99	3.09	1.75	1.63	2.92	1.39	2.16	1.23	1.14	1.02
-10	16.11	20.66	10.62	14.86	15.57	3.79	3.01	1.51	2.89	4.62	2.65	2.11	1.06	2.02	1.62
-7	20.35	21.28	15.59	17.34	18.64	4.46	2.59	2.61	2.82	3.95	3.12	1.82	1.83	1.97	1.38
0	21.49	23.40	19.09	18.75	20.68	3.04	2.68	2.80	2.35	3.32	2.13	1.88	1.96	1.64	1.16
7	19.39	20.52	16.21	15.75	17.97	2.93	2.77	2.84	3.65	3.68	2.05	1.94	1.99	2.55	1.29
10	12.41	19.36	10.44	9.44	12.91	3.43	2.24	4.16	2.48	5.01	2.40	1.57	2.91	1.73	1.75
13	9.02	10.44	7.03	7.57	8.52	1.92	3.04	2.33	1.91	2.69	1.34	2.13	1.63	1.33	.94
15	9.37	11.04	6.81	8.19	8.85	1.73	3.43	2.28	2.36	2.97	1.21	2.40	1.60	1.65	1.04
17	8.86	6.59	5.17	6.11	6.68	1.85	2.37	1.64	1.54	2.32	1.30	1.66	1.15	1.08	.81
20	5.17	3.82	3.26	3.80	4.01	1.86	1.94	1.54	1.52	1.86	1.30	1.36	1.08	1.07	.65
23	2.21	1.07	-.19	.94	1.01	2.22	1.42	1.24	1.67	1.88	1.56	.99	.87	1.17	.66
26	-2.03	-3.30	-3.99	-3.41	-3.18	1.53	1.49	1.31	1.43	1.61	1.07	1.04	.92	1.00	.56

C/I SWEEP TABLE (FILTER = 26 MHZ)

C/I (dB)	MEAN (F) (MHz)					STD. DEV. (F) (MHz)					95% CONF. LIMIT (MHz)				
	#1	#2	#3	#4	ALL	#1	#2	#3	#4	ALL	#1	#2	#3	#4	ALL
-3	-31.85	-30.80	-30.43	-30.61	-30.92	1.97	1.78	1.83	1.02	1.77	1.38	1.24	1.28	.71	.62
0	-30.26	-28.99	-28.93	-29.28	-29.36	2.05	1.70	1.39	1.16	1.71	1.44	1.19	.97	.81	.60
3	-28.57	-28.35	-27.44	-27.67	-28.00	1.45	2.74	1.19	1.40	1.86	1.01	1.92	.83	.98	.65
5	-27.02	-26.37	-26.18	-26.74	-26.58	1.43	2.40	1.52	1.47	1.79	1.00	1.68	1.07	1.03	.63
7	-23.14	-23.12	-20.80	-23.43	-22.62	2.07	2.48	4.49	4.92	3.85	1.45	1.74	3.14	3.44	1.35
10	-15.24	-17.32	-13.49	-13.86	-15.01	4.21	2.74	4.07	3.11	3.92	2.95	1.91	2.85	2.33	1.39
14	-10.85	-13.41	-7.29	-8.88	-10.22	3.18	3.20	3.46	2.55	3.90	2.38	2.24	2.59	1.91	1.43
17	-8.52	-10.43	-6.21	-5.89	-7.84	4.41	2.67	2.38	2.20	3.53	3.90	2.00	1.92	1.78	1.43
17	6.72	10.65	5.16	6.52	7.40	5.33	2.09	2.40	2.29	3.90	4.31	1.56	1.94	1.85	1.55
14	10.45	12.81	7.07	8.33	9.77	3.42	2.35	3.28	2.01	3.60	2.56	1.65	2.46	1.50	1.32
10	15.03	15.35	10.40	9.99	12.78	4.35	2.68	3.36	2.16	4.12	3.04	1.87	2.35	1.61	1.47
7	20.97	17.16	15.80	16.34	17.57	3.41	2.47	4.11	4.36	4.19	2.39	1.73	2.88	3.05	1.46
5	20.83	18.86	18.57	19.02	19.32	2.23	2.83	2.30	2.08	2.54	1.56	1.98	1.61	1.46	.89
3	21.29	20.69	19.82	20.07	20.47	1.10	2.25	1.04	1.20	1.61	.77	1.57	.73	.84	.56
0	24.78	23.45	23.18	24.01	23.86	1.21	2.27	1.59	1.43	1.80	.85	1.59	1.11	1.00	.63
-3	26.58	25.98	25.05	25.66	25.82	.83	1.31	.81	.85	1.14	.58	.92	.57	.59	.40

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LOWE-MARTIN No. 1137