Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Amendment of Section 2.106 of the Commission's Rules to Allocate Spectrum for Use by the Mobile Satellite Service	)))	ET Docket No. 95-18
	)	
	)	

To: The Commission

Petition for Reconsideration

The Society of Broadcast Engineers, Incorporated (SBE), the national association of broadcast engineers and technical communications professionals, with more than 5,000 members world wide, hereby respectfully submits its Petition for Reconsideration of the November 10, 2003, Third Report and Order and Third Memorandum Opinion and Order (Third R&O) to ET Docket 95-18. The Third R&O was published in the Federal Register on December 8, 2003, so this Petition for Reconsideration is timely filed.

I. Two Different Band Plans Will Cause Massive Interference and Significant Loss of News Service to the American Public

1. In the Third R&O, the Commission decided that only TV markets 1–30 would be entitled to up-front compensation from the Mobile Satellite Service (MSS) for converting their TV Broadcast Auxiliary Service (BAS) operations from the old 1,990–2,110 MHz band plan, having seven channels spread over 120 MHz, to a new band plan, with just 85 MHz of spectrum. The 2,025–2,110 MHz new band plan consists of seven exactly 12-MHz wide channels, plus two 0.5-MHz wide data return link (DRL) bands. These DRL bands are at the top and bottom edges of the reduced width 2 GHz TV BAS band. Each of the DRL bands have twenty 25-kHz wide channels, which can be used for automatic power control (APC) for TV Pickup station transmitters, and other purposes.

2. Conversely, TV Pickup operations in TV Markets 31-100 would have to wait up to three years for compensation for converting from the old to the new band plan, and TV Markets 101–210 would have to wait for up to five years for compensation. Thus, there would be a transition period of three to five years during which TV Pickup station operations in the top-30

markets would have been converted to digital operation in 12-MHz wide channels, while TV Pickup stations in smaller (and often adjacent) TV markets continued to use conventional FM video analog operations with 17-MHz wide channels.

3. The Commission surmised that broadcasters could make simultaneous operations using two different band plans work by continued use of real-time frequency coordination between electronic news gathering (ENG) operations in the top-30 TV markets versus ENG operations outside of the top-30 TV markets. Whether such an assumption is reasonable depends upon how much interference a digital ENG channel would cause to a conventional 17 MHz-wide analog channel, and vice versa, as the amount of channel overlap increased. As can be seen from the attached Figure 1, this overlap can vary from zero MHz (*i.e.*, no overlap) to 12 MHz (*i.e.*, total overlap). Since broadcasters only learned of the final channel plan with the release of the November 10, 2003, Third R&O, no one had a basis for knowing whether the FCC assumption that broadcasters would some how make different channel plans work was wildly optimistic, or an achievable goal.

II. MRC Study Shows That Different Band Plans Are Unlikely to Work

4. To resolve this uncertainty, SBE asked Microwave Radio Corporation (MRC) if it would be willing to undertake laboratory tests, gauging the interference that a digital signal in a 12 MHz wide new band plan channel would cause to a conventional FM video analog signal still operating on the old band plan with its 17-MHz wide channels, and vice versa. That is, to test in the laboratory the scenario where a major news event occurs in a smaller TV market, where the market is still large enough for TV stations to have their own ENG operations (albeit perhaps just one or two ENG trucks rather than ten trucks plus a news helicopter, such as a top-30 TV market station might employ), but without sufficient financial resources to upgrade their ENG operations to digital absent reimbursement by MSS operators. In that event simultaneous operations in the same area and using both band plans could occur.

5. The question, then, is what sort of additional penalty might simultaneous ENG operations using two different band plans and modulation types in the same area impose on ENG operations? If on the order of 10 or even 20 dB worse, it would be conceivable to SBE that even more heroic real-time frequency coordination between users might still make things work. But, if on the order of 40 to 50 dB worse, there would be no hope of frequency coordinating around such a shortfall, or worsening, of the frequency coordination requirement.

6. Unfortunately, the attached MRC report shows that coded orthogonal frequency division multiplex (COFDM) digital operations would be degraded by analog operations still on the old band plan by around 43 dB, and that conventional FM video analog operations would be degraded by around 47 dB by COFDM operations using the new band plan. SBE does not believe that any amount of improved frequency coordination would be able to withstand a four to five order of magnitude worsening of the frequency coordination requirement.[1]

7. Accordingly, SBE believes that if only the top-30 TV markets are entitled to in-advance conversion to the new band plan, then when a major news event occurs in an adjacent smaller TV market big enough to have its own ENG operations but still operating on the old band plan and with analog radios, either the top-30 market TV stations and major news networks (including cable news networks) will have to refrain from covering the news event, or the smaller TV market stations will have to refrain from covering major news events in their own market. If they do not, then massive interference will result, certainly resulting in greatly diminished real-time news coverage, and perhaps even no real-time news coverage.

8. Based on this new information, which was not possible to obtain until a final band plan had at last been adopted, SBE does not see how the decision reached in the Third R&O can be found to be in the public interest. SBE accordingly asks that the Commission reconsider its decision to only require MSS to reimburse in advance TV BAS operations for the top-30 TV markets, and instead to extend this requirement to all TV markets (*i.e.*, TV markets 1–210). As justification, SBE directs the Commission's attention to the attached Figure 3, which reports the results of a survey undertaken by the SBE's Frequency Coordination Director.

9. While SBE understands that this would increase the start-up costs that MSS would have to bear, SBE does not see why this should be broadcasters' problem, or why broadcasters should be expected to, in effect, subsidize the start up costs of MSS. Further, the broadcasters who would have to bear this burden would be medium to small market broadcasters that have the least amount of capital available to them. TV viewers in those markets should not be expected to suffer degraded news or public service coverage.

[1] See Page 22 of the MRC report, where the penultimate bullet point concludes the loss of 43 dB worth of isolation for COFDM, and the last bullet point concludes a 47 dB net penalty for analog operations (26 dB due to reduced isolation, plus another 21 dB due to reduced video signal-to-noise performance).

III. Clarification Needed

10. The Commission needs to clarify a conflict between the Third R&O and the existing FCC Rules. Section 74.24(c) of the FCC Rules states that a TV BAS station operating pursuant to short-term authority does so on a secondary, non-interference basis to regularly authorized stations. Thus, under Section 74.24(c), a top-30 TV market TV Pickup station that has converted to digital and is operating pursuant to the new band plan, but which is temporarily operating outside its licensed area because it is responding to a major news event, would be secondary to a TV Pickup station where the major news event is occurring. If that TV Pickup station is in a smaller TV market that is still operating analog and using the old band plan, then Section 74.24(c) would require the visiting TV Pickup station to protect the local TV Pickup station. As documented above, this would likely mean no operation by the visiting digital ENG truck, or certainly a vastly reduced number of visiting digital ENG trucks. However, Paragraph 58 of the Third R&O states that

> Because the continued use of the existing channel plan could disrupt BAS licensees that have relocated to the Phase II channel plan and lead to the difficulties in coordination that SBE describers, we will permit continued use of the "old" channel plan only if all BAS licensees in a market will agree to such operation. Moreover, BAS licensees in such markets must operate on a secondary basis to BAS licensees using the Phase II channel plan and must be prepared for the potential disruption associated with secondary operation, such as the interference likely to be caused by a BAS licensee operating on the Phase II channels that enters the market to cover a sporting event or breaking news story.

Thus, a quandary is created: if the visiting TV Pickup station is licensed to a broadcast network entity (BNE) or to a cable network entity (CNE), possibly on a wide-area basis or even over the entire 48 contiguous states (*i.e.*, CONUS), no Section 74.24 authority would be triggered and the visiting operations would simply trump any local, old-band plan analog operations. The local users would see the visiting users as secondary users under Section 74.24(c) while the visiting users, operating under the new band plan, would see the locals as secondary under the above quoted paragraph from the Third R&O. SBE therefore asks, on behalf of its affiliated frequency coordinators, which FCC rule should be applied. That is, does Paragraph 58 of the Third R&O trump Section 74.24(c) of the FCC Rules, or does Section 74.24(c) of the FCC rules trump Paragraph 58 of the Third R&O?

11. A second issue needing clarification is the "if all 2 GHz TV BAS licensees in the market will agree" language. Assuming that a TV market desires to move to the new band plan before MSS reimbursement, does this mean that a single "poor" station in the market can block a smaller TV

market from converting to the new band plan? Does it mean that a single "rich" station in a market may choose to convert to the new band plan, thus forcing other stations in the market to follow suit? Or does it mean a station not converting becomes secondary to their cross town rival who does convert? Part of the success of the SBE frequency coordination program is having clearly defined "priority of use" rules that the volunteer coordinator can use in mediating disputes. The coordinators have always been able to refer to the FCC Rules when dealing with conflicting uses. The present ambiguous situation threatens that ability.

12. Without these clarifications, the Third R&O will cause harm, possibly irreparable, to SBE's voluntary frequency coordination structure. The fruit that SBE started in 1976 and which has taken root and grown strong is called "success." Success in this effort will only continue as long as news directors, engineers, and ENG truck operators believe that frequency coordination will work. The ambiguities created by the Third R&O will place SBE frequency coordinators in a no-win situation where two sides can correctly quote different parts of the Rules that make the "other side" a secondary user and both sides will appear to be correct.

IV. Summary

13. Based on the new information included in the MRC laboratory measurements, simultaneous ENG operations in the same area using differing and incompatible modulation types and different channelizations will conflict and cause irreparable harm. This will result a in major reduction of the capability to cover news events occurring outside of the top-30 TV markets, with ominous implications to Homeland Security and to broadcasters' ability to provide information and reassurance to a concerned population through the rapid and efficient coverage of an emergency situation. This cannot be in the public interest. The Commission should re-consider its decision, and require MSS to convert 2 GHz TV BAS operations for all TV markets, as opposed to just the top-30 TV markets.

14. SBE would like to express its appreciation and gratitude to MRC for undertaking these comprehensive laboratory measurements, as a service to the TV industry, and as a service to the American viewing public.

V. List of Figures and Exhibits

15. The following figures and exhibits are included as part of this SBE Petition for Reconsideration:

1. Old versus new 2 GHz TV BAS band plan
2. Laboratory study by MRC on interference between 12 MHz digital channels using the new band plan and 17 MHz wide analog channels using the old band plan
3. SBE analysis of TV market Adjacencies for ENG purposes.

Respectfully submitted,

Society of Broadcast Engineers, Inc.

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SBE President

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January 7, 2004

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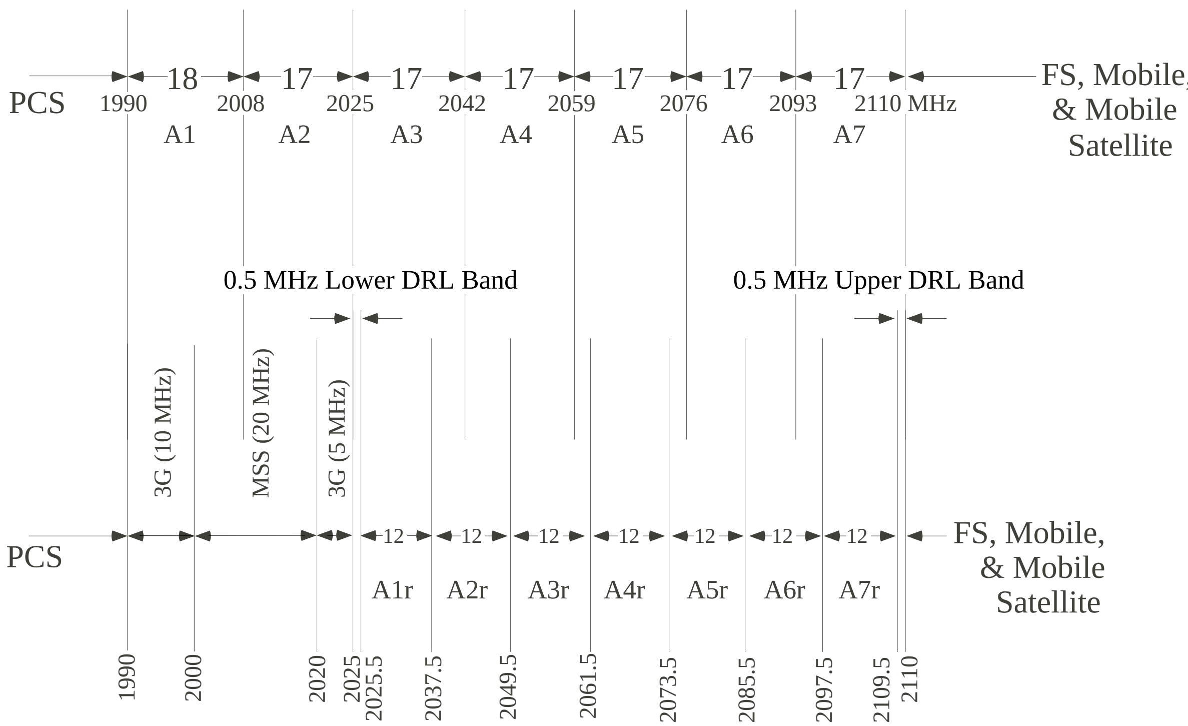
Petition for Reconsideration of the ET Docket 95-18 Third Report & Order

Existing v. Final 2 GHz BAS Band Plan



Final New Band Plan

DRL = Data Return Link

All frequencies and bandwidths are in MHz.

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Indianapolis, Indiana

040105
Figure 1

BAS Band Plan Testing
17 MHz and 12 MHz Channel Plans

3rd Report & Order
SBE Comments
January 7h, 2004

REVISION HISTORY

REV	Change Description	By	Approved	Release Date
A	Original draft	John Wood		December 2003
B	Update frequency list and documentation	John Wood		January 5th, 2004
C	Documentation Update	John Wood		January 7th, 2004
D	Documentation Update	John Wood		January 7th, 2004

I. Introduction:

Section 58 of the latest Report & Order alludes to some of the potential band plan conflicts between market segments.

> *" We also believe that BAS licenses should have the ability to continue to operate on channels 3 –7 under the "old" channel plan, if they so elect. As SBE notes, there are many reasons why licensees would choose to adopt the new channel plan. However, we will not prohibit BAS licensees from continuing to use the existing channel plan, so long as they restrict their use to the 2025-2110 MHz band when they are no longer permitted to use the 1990 – 2025 MHz band segment. Because the continued use of the existing channel plan could disrupt BAS licensees that have relocated to the Phase II channel plan and lead to the difficulties in coordination that SBE describes, we will permit continued use of the "old" channel plan only if all BAS licensees in a market will agree to such operation. …"*

The fundamental issue being the harmonization of channel plans and operating bandwidths across all the market segments. The incorporation of two channel plans – one in support of an existing 17 MHz channel plan and a second in support of a Phase II 12 MHz channel has the potential to cause frequency co-ordination issues with in those adjacent market segments affected.

Microwave Radio Communications (MRC) intent is to, help to clarify some of the adjacent and co channel operational equipment requirements in support of the industries two band plans.

MRC has performed the following tests in their laboratory facilities to develop the necessary D/U ratios:

- Desired (COFDM) – 12 MHz / Undesired (analog) – 17 MHz - in 1 MHz frequency steps.
- Desired (analog) – 17 MHz/ Undesired (COFDM) – 12 MHz – for 1 MHz frequency steps.
- Desired (COFDM) – 12 MHz/ Undesired (COFDM) – 17 MHz – for 1 MHz frequency steps

II. Band Plan Considerations

The following is a list of the channel frequency assignments for the two segments that would exist. Note, ENG channels 8 thru 10 are not shown.

Channel #	Top 30 markets	Markets – 31 and below
1	2031.5 MHz	
2	2043.5 MHz	
3	2055.5 MHz	2033.5 MHz
4	2067.5 MHz	2050.5 MHz
5	2079.5 MHz	2067.5 MHz
6	2091.5 MHz	2084.5 MHz
7	2103.5 MHz	2101.5 MHz
	Phase II Plan 12 MHz centers	**Existing "old" Channel Plan 17 MHz centers**

2.1 Bandwidth Considerations

Currently, there are two techniques used to support microwave ENG applications, traditional FM analog techniques and digital applications using COFDM techniques.

Traditional analog ENG FM radios have used a 4 MHz peak deviation to meet the required 17 MHz channel bandwidth occupancy with a one-volt peak-peak video input.

A brief history lesson will show that the 17 MHz channel bandwidths was derived using Carson's rule for spectral occupancy for FM techniques and still allowing for maximum FM video signal/noise (S/N) performance in the channel.

A generic overview of Carson's rule stated the following[1]:

Bn = 2(M) + 2 (D) where: Bn = necessary bandwidth (Hz)
M = maximum modulation frequency (Hz)
D = peak deviation (Hz)

Note, this does not consider total FM sideband energy.

[1] Reference Data for Radio Engineers, 8th edition,

Related to current analog FM video ENG applications gives the following:

Bn = 2 (4.2 MHz) + 2 (4 MHz) = 16.4 MHz (17 MHz ENG Channel)

Inside that occupied bandwidth, two sub-carriers are supported for the transport of audio information. These audio sub-carriers are usually spaced at 4.83 MHz from the center carrier frequency and at 6.2 MHz from the center, dependent on the application.

The following plot shows a typical analog link centered on "old" channel plan 4 (2050.5 MHz).

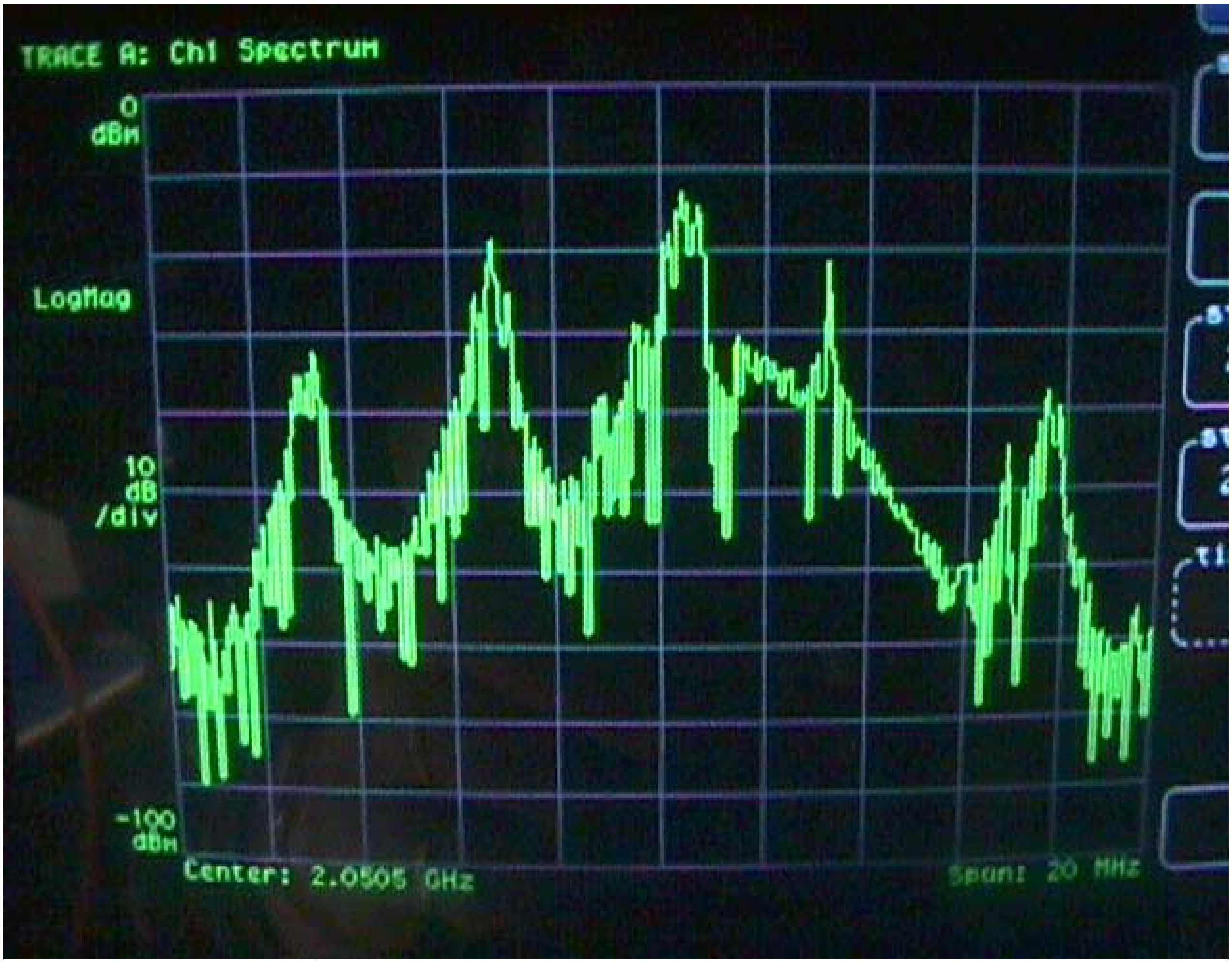

Fig. 1 – Analog FM radio output – 2GHz

Along with analog techniques, COFDM techniques are supported. For current applications, a 7.61[2] MHz COFDM pedestal is used. Figure 2 shows a compliant COFDM pedestal that would be used to support 12 MHz Phase II channel plan applications. The COFDM pedestal is centered on Phase II – channel A3r – 2055.5 MHz.

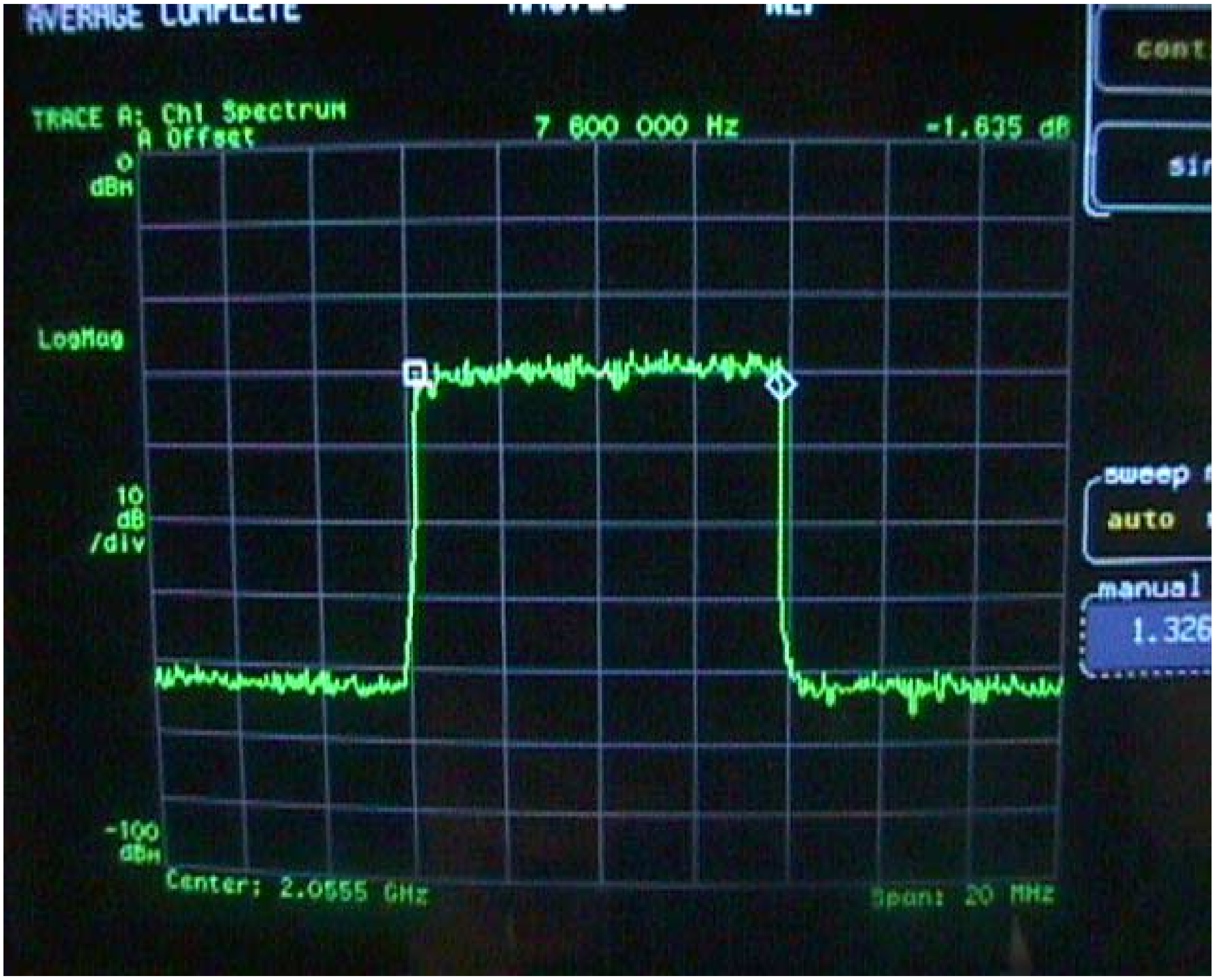

Fig. 2 – 2 GHz COFDM Output

2 The derivation of the 7.61 MHz bandwidth point can be referenced in ETSI specification EN 300-744.

2.2 Channel Bandwidth Overlap

The following plot is an overlay of the two compliant signals for their respective channel plans. The plot shows a significant amount of energy crossing over into each channel. In the upcoming tests, MRC will determine the amount of isolation needed for each signal.

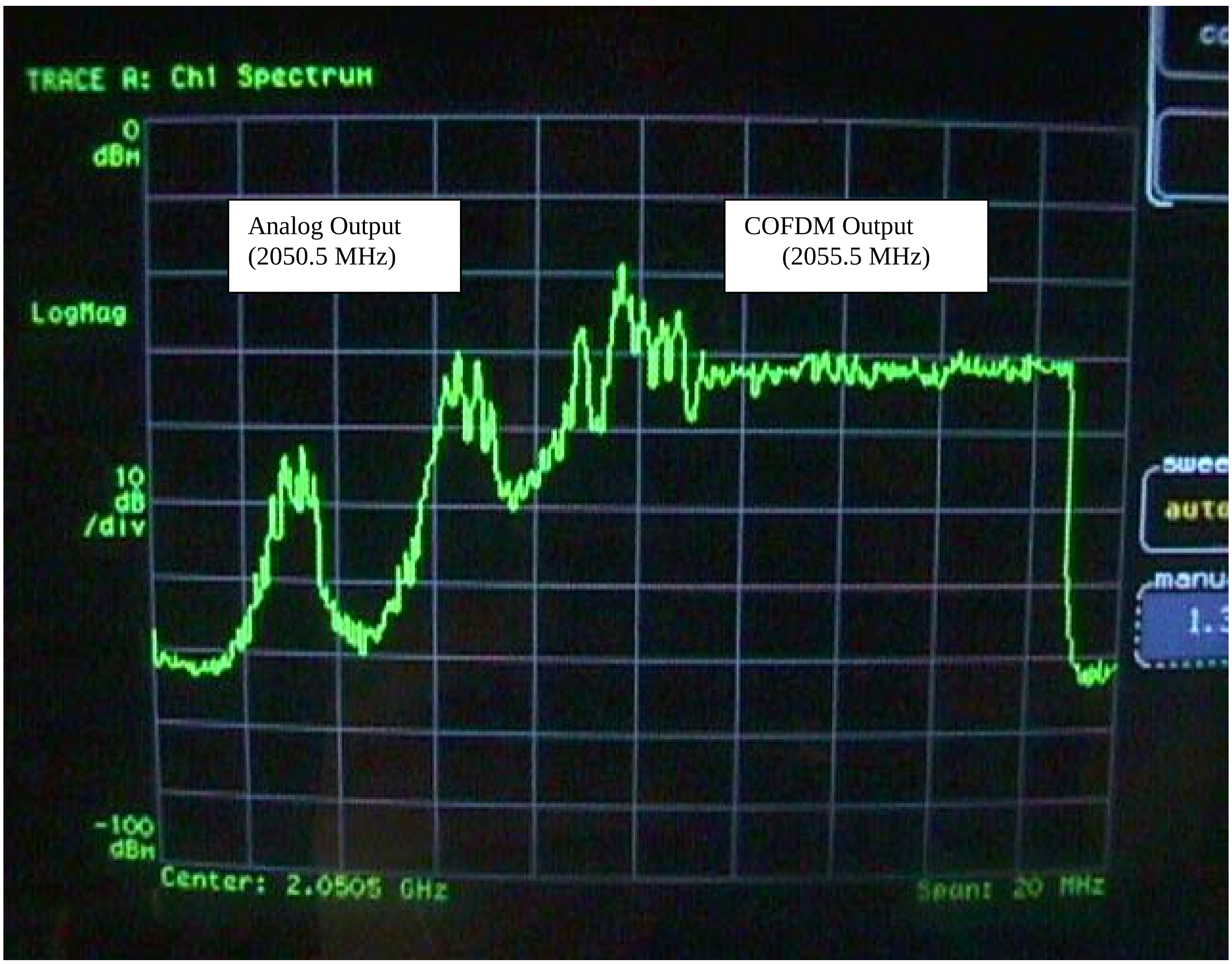

Fig. 3 – Potential Interference Condition

Channel #	Top 30 markets	Markets – 31 and below	Closest Frequency Delta
1	2031.5 MHz		
2	2043.5 MHz		
3	2055.5 MHz	2033.5 MHz	2.0 MHz
4	2067.5 MHz	2050.5 MHz	5.0 MHz
5	2079.5 MHz	2067.5 MHz	0.0 MHz
6	2091.5 MHz	2084.5 MHz	5.0 MHz
7	2103.5 MHz	2101.5 MHz	2.0 MHz
	Phase II Plan 12 MHz centers	**Existing "old" Channel Plan 17 MHz centers**	

2.3 Interference Considerations – D/U (desired/undesired) ratio – analog operation

Due to the significant amount of percentage bandwidth overlap for each channel, no longer is the interference condition considered to be more a function of adjacent channel requirements rather it becomes more co-channel dependent.

In the past, MRC has made a number of adjacent/co-channel performance curves on their equipment in support of the BAS reallocation; some of these curves are displayed in section 6 of this document. The D/U ratio is developed in order to define the appropriate operating conditions for the desired signal vs. the interfering energy or the undesired signal at the appropriate receive carrier level of the receiver.

A positive D/U ratio indicates that the desired signal has to be higher in receive signal level vs. the undesired signal.

In an analog domain, the threshold of the receiver is a function of the drop off in the video signal to noise performance due to distortion or available voltage swing in the discriminator. A typical analog FM demodulator has a video threshold rating of 37db video S/N.

2.4 Interference Considerations – D/U ratio – digital –COFDM operation

The expected D/U ratio requirements for COFDM co-channel operation are a function of the mode of operation with in the ETSI 300 –744 tables. The ETSI table allows for adjustable data thru puts based upon modulation, forward error correction (FEC) and the required guard interval that is used. Table 1 below shows a typical distribution of data thru put versus the given parameters.

Digital Video Broadcasting (DVB-T)
Data Thruput Settings (8 Mhz)

	1/4 Guard			1/8 Guard			1/16 Guard			1/32 Guard		
Code Rate	QPSK	16 QAM	64 QAM	QPSK	16 QAM	64 QAM	QPSK	16 QAM	64 QAM	QPSK	16 QAM	64 QAM
1/2	4.98	9.95	14.93	5.53	11.06	16.59	5.85	11.71	17.56	6.03	12.06	18.10
2/3	6.64	13.27	19.91	7.37	14.75	22.12	7.81	15.61	23.42	8.04	16.09	24.13
3/4	7.46	14.93	22.39	8.29	16.59	24.88	8.78	17.56	26.35	9.05	18.10	27.14
5/6	8.29	16.59	24.88	9.22	18.43	27.65	9.76	19.52	29.27	10.05	20.11	30.16
7/8	8.71	17.42	26.13	9.68	19.35	29.03	10.25	20.49	30.74	10.56	21.11	31.67
	56 usec			28 usec			14 usec			7 usec		

Note: Data Thruput is scaled down by 1/4 for 6 Mhz system and 7/8 for 7 Mhz system

COFDM Overview 1

Table 1

But as the data rate grows so does the C/N requirements for each mode of operation. This C/N requirement now impacts the required D/U ratio for proper operation.

The following is a C/N versus modulation and FEC requirements for a typical COFDM demodulator for a Rayleigh channel requirement. These numbers assume that the interfering energy is Gaussian in nature.

Modulation	QPSK					16 QAM					64 QAM				
FEC Code	1/2	2/3	3/4	5/6	7/8	1/2	2/3	3/4	5/6	7/8	1/2	2/3	3/4	5/6	7/8
C/N	7.4	10.4	12.7	15.1	18.3	13.2	16.2	18.7	21.3	24.8	18.0	21.3	24.	27.3	29.9

For current DENG operations in the US, the mode of operation that has been used most often is QPSK, ½ FEC, 1/8th guard interval. This mode has the lowest C/N requirement on the table.

This would relate the receiver thermal noise threshold to an approximate –94 dbm. As such, any interfering energy should be down below this level given the C/N requirement, thus not to degrade the acceptable coverage area for the ENG shot.

In the future, it is foreseen that this bit rate allocation will grow, to support higher data thru put applications, as such so will the C/N requirement.

Given this, any co-channel requirement should take into consideration the maximum possible bit rate along with the maximum C/N requirement for any future potential application requirements with in the BAS band. That would mean that an approximate +30 db D/U ratio would have to be used for any interference calculation as seen from above. It should be noted; that the +7.4 to +30 D/U ratio is operational mode dependent and overall is an improvement from analog operation.

Once again, these numbers will vary a bit due to the power spectral density of the interfering waveform which is a function of frequency separation and percentage bandwidth overlap.

The exact numbers will be quantified with the laboratory experiments.

This D/U ratio is dependent on the random nature of the energy across the channel estimation pilots and static pilots used for demodulator synchronization internal to the COFDM digital waveform.

III. MRC Laboratory Tests

As previously noted, MRC has conducted tests at their facilities in the month of December to quantify some of the adjacent/co-channel energy requirements for proper operation due to the latest FCC Report & Order. The objective of the tests was to determine the D/U ratio as a function of frequency offset for each channel plan operation.

3.1 Required Tests

3.1.1 Test #1 - Desired (COFDM) – 12 MHz / Undesired (analog) – 17 MHz - in 1 MHz frequency steps.

For this test, an 8 MHz COFDM pedestal was used as the desired transmitter simulating a top 30-market transmitter with a frequency of 2055.5 MHz (Ch.3). A COFDM mode of 16 QAM and ½ FEC was used along with a 1/8th guard interval.

An analog transmitter was used as the undesired transmitter, simulating a lower market transmitter with a frequency of 2050.5 MHz (Ch.4). The undesired transmitter frequency was then increased in 1 MHz steps until it reached the desired frequency of 2055.5 MHz.

The D/U ratios were recorded at each of the frequency points at which the post viterbi BER achieved 1 x10 –5 or better and a TASO rating of 2 to 3 was achieved. The S/N degradation was also recorded at each of the points to show the amount of degradation to the wanted signal.
The ratios were recorded at receive carrier levels of –40, -50, -70, -89 dbm (1 db above the threshold point).

3.1.2 Test #2 - Desired (analog) – 17 MHz/ Undesired (COFDM) – 12 MHz – in 1 MHz frequency steps.

For this test, a 4 MHz FM deviated analog transmitter was used as the desired transmitter simulating a lower market with a frequency of 2050.5 MHz (Ch.2). An 8 MHz COFDM pedestal was then used as the undesired transmitter with a frequency of 2055.5, simulating a top 30-market transmitter. The undesired transmitter frequency was then decreased in 1 MHz steps until it reached the desired frequency of 2050.5 MHz.

The D/U ratios were recorded at each of the frequency points at which the video output achieved a TASO rating of 3 to 4 and the 2nd audio sub carrier achieved a 0.5 % THD distortion reading.

The ratios were recorded at receive carrier levels of –40, -50, -70, -86 dbm (1 db above the analog +37 db video S/N threshold point).

The video S/N degradation was also recorded at each of the points to show the amount of degradation to the wanted video signal.

3.1.2 Test #3 – Desired (COFDM) – 12 MHz/ Undesired (COFDM) – 17 MHz – in 1 MHz frequency steps.

For this test, a 8 MHz COFDM pedestal was used as the desired transmitter simulating a top 30-market transmitter with a frequency of 2055.5 MHz (Ch.3). An 8 MHz COFDM pedestal was used as the undesired transmitter, simulating a lower market transmitter with a frequency of 2050.5 MHz (Ch.4). The undesired transmitter frequency was then increased in1 MHz steps until it reached the desired frequency of 2055.5 MHz.

The D/U ratios were recorded at each of the frequency points at which a post viterbi BER of 1 x10 –5 was achieved along with a TASO of 2-3. The S/N degradation was also recorded at each of the points to show the amount of degradation to the wanted signal.

The ratios were recorded at receive carrier levels of –40, -50, -70,-89dbm (1 db above the threshold point).

3.2 Laboratory Test Set Up

The following is a block diagram (figure 4) of the functional set up that was used to measure and develop the required D/U ratios for the tests.

The diagram shows that two 2Ghz microwave transmitters were used for the tests. Transmitter #1 was a Strata TCU/TXU/HPU combination that allowed for easy access to switch back and forth between analog and digital (COFDM) operation, to simulate the appropriate desired or undesired signal. Transmitter #2 was a Reporter radio system that used a COFDM waveform system.

For the Receiver, the Code Runner 4 product was used in conjunction with a COFDM IRD.

In line step attenuators (#1 & #2), were used to simulate the D/U ratio or power level difference between the two transmit conditions while a variable attenuator (#3) was used to simulate the receive carrier level requirement.

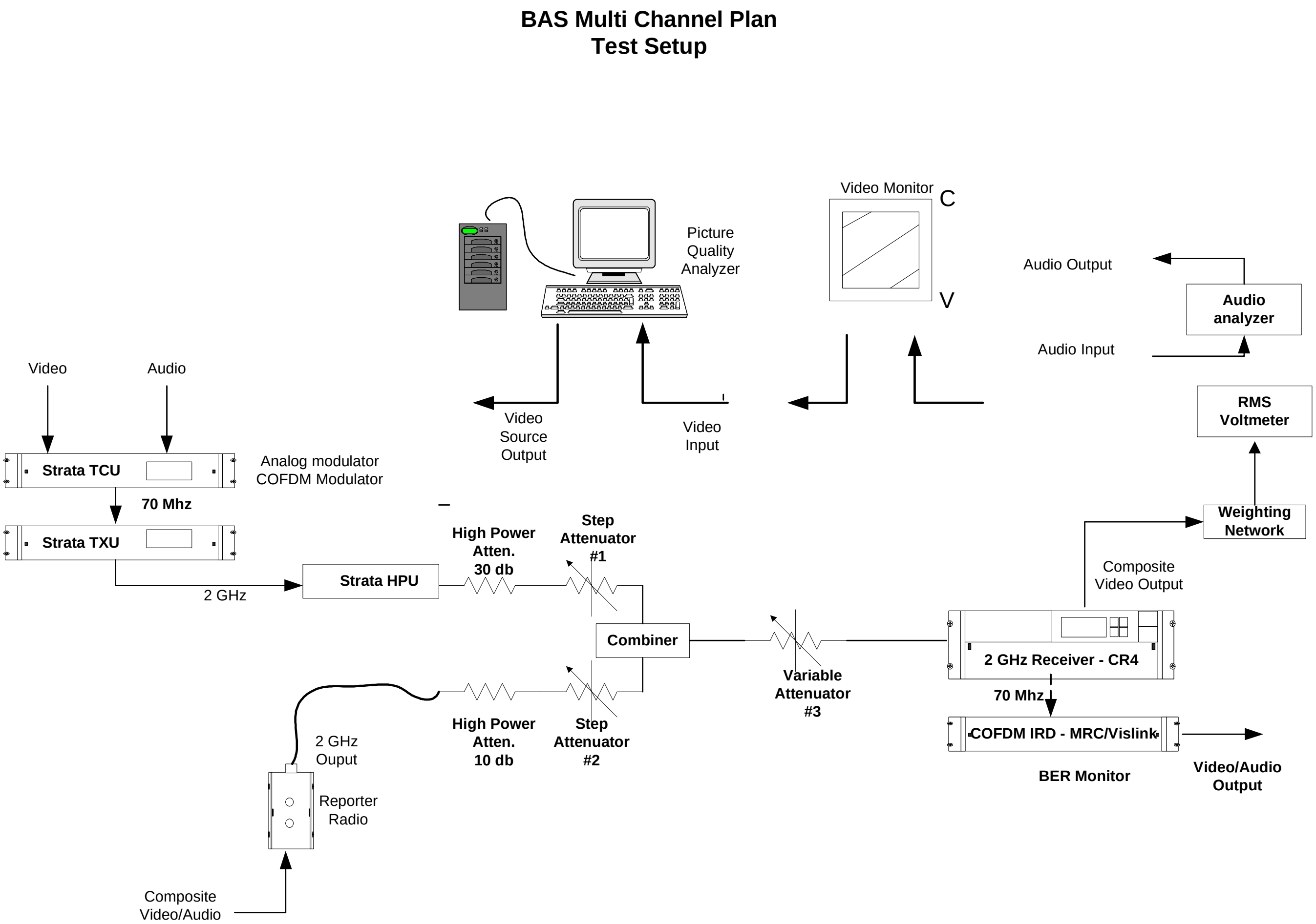

Fig. 4 Lab Test Set Up

3.3 Measurement Objectives

The objectives of the measurements were to quantify the D/U ratios for each band plan along with the expected video and audio performance under each condition. To quantify the D/U ratio, we took the difference in power levels between the two stimuli transmitters.

For a desired COFDM signal, it was a point where the post viterbi BER across the channel was less than 1 x10-5 and a TASO subjective video rating of 2 to 3 was achieved along with the marginal degradation in the peak signal noise ratio of the video signal.

For a desired analog signal, it was a point where the TASO video subjective rating of 3 to 4 was achieved.

3.4 Television Signal Rating Scale (TASO)

Analog Measurement Threshold Criteria
Subjective Video Rating Scale

TASO #1 -Excellent viewing	the picture is of extremely high quality as good as you could desire.
TASO #2 – Fine viewing	the picture is of high quality providing enjoyable viewing. Interference is perceptible.
TASO #3 – Passable viewing	the picture is of acceptable quality. Interference is not Objectionable.
TASO #4- Marginal viewing	the picture is poor in quality and you wish you could improve it. Interference is somewhat objectionable.
TASO #5- Inferior viewing	the picture is very poor but you could watch it. Definitely objectionable interference is present.
TASO #6 –Unusable viewing	the picture is so bad that you could not watch it.

A TASO rating of 2 – 3 is recommended as the minimum subjective viewing threshold.

3.5 Audio threshold

A total harmonic distortion (THD+N) reading of 0.5% per channel was used as the minimum audio threshold per RS-250C.

3.6 Peak Signal Noise Ratio (PSNR)

PSNR Measurement:

Peak signal to noise ratio is a raw, non –human vision system picture difference measurement which is the ratio of the peak signal to rms noise, observed between the reference video signal and the captured video signal.

For compression systems, the PSNR values can range from 23 to 43 all dependent on the bit rate of use. The higher the number, the better the quality of the picture.
For our tests, we noted the values to show that there was or was not a major difference with and with out the interfering signals present.

IV. MRC Laboratory Test Results

4.1 Test #1 – Digital (desired) 12 MHz/ Analog (un desired) 17 MHz

Test #1 - Digital to Analog

COFDM Desired (12 MHz) - Analog un desired (17 MHz)

COFDM Mode - 16 QAM 1/2 FEC, 1/8th guard interval - 11.058 Mbits

TX Desired Frequency - 2055.5 MHz - Channel #3 - top 30 market

TX Undesired Frequency - analog content - lower markets -4 MHz deviation

Undesired Freq.	Receive Carrier Level	D/U Ratio	TASO #	PSNR	Post BER	S/N DEG.
2050.5 MHz (#4)	-40 dbm	4	2	34.76	4.9 e-6	6.8
2050.5 MHz (#4)	-50 dbm	4	2	34.84	4.9 e -6	6.8
2050.5 MHz (#4)	-70 dbm	4	2	34.37	1.7 e -5	7
2050.5 MHz (#4)	- 89 dbm (1 db point)	4	2	34.33	6.5 e-6	0.6
2051.5 MHz	-40 dbm	7	2	34.77	7.2 e -6	8.6
2051.5 MHz	-50 dbm	7	2	34.73	7.1 e -6	8.2
2051.5 MHz	-70 dbm	7	2	34.77	1.6 e -6	8
2051.5 MHz	- 89 dbm (1 db point)	7	2	34.83	1.6 e -6	1.1
2052.5 MHz	-40 dbm	11	2	34.35	1.76 e -5	7.6
2052.5 MHz	-50 dbm	12	2	34.29	7.2 e -6	7.3
2052.5 MHz	-70 dbm	12	2	34.33	8.6 e -6	6.8
2052.5 MHz	- 89 dbm (1 db point)	12	2	34.35	9.7 e -6	0.8
2053.5 MHz	-40 dbm	11	2	34.33	1.11 e -5	6.6
2053.5 MHz	-50 dbm	11	2	34.34	1.37 e -5	6.9
2053.5 MHz	-70 dbm	11	2	34.42	1.44 e -5	6.6
2053.5 MHz	- 89 dbm (1 db point)	13	2	34.35	3.41 e -5	0.5
2054.5 MHz	-40 dbm	11	2	34.42	1.17 e -5	5.6
2054.5 MHz	-50 dbm	11	2	34.81	8.5 e -6	5.6
2054.5 MHz	-70 dbm	12	2	34.37	7.0 e -6	5.5
2054.5 MHz	- 89 dbm (1 db point)	12	2	34.85	2.35 e -6	1.8
2055.5 MHz	-40 dbm	12	2	34.45	7.1 e -6	7.7
2055.5 MHz	-50 dbm	12	2	34.41	7.5 e -6	7.6
2055.5 MHz	-70 dbm	12	2	34.34	8.8 e -6	7.9
2055.5 MHz	- 89 dbm (1 db point)	14	2	34.88	4.2 e -6	1.5

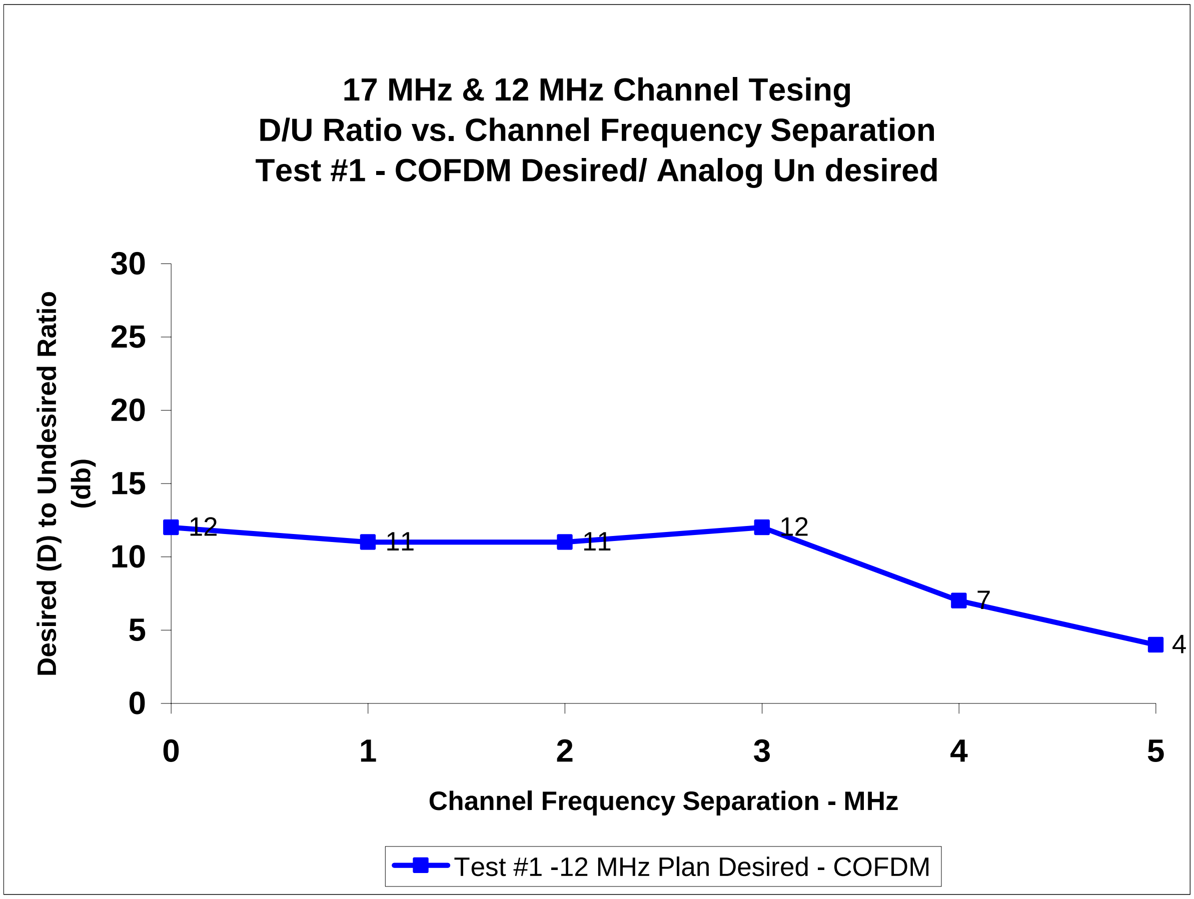

Fig. 5 Test #1 D/U @ -50 dbm

- 0 D/U ratios cannot be measured due to lack of COFDM lock condition from analog interfere.
- For co – channel operation, the D/U ratio is with in 1.5 db of the C/N requirement for the COFDM demodulator – 12 db vs. 13.2 db for 16 QAM ½ FEC operation, the improvement a function of analog energy content.
- The COFDM S/N degradation varies from 5 to 9 db, dependent on the random energy across the channel estimation pilots of the COFDM demodulator.
- PSNR somewhat constant when COFDM locked, digital cliff effect.

4.2 Test #2 – Analog (desired) 17 MHz/COFDM (un desired) 17 MHz

Test #2 - Analog to Digital

Analog Desired (17 MHz) - COFDM un desired (12 MHz)

TX Desired Frequency - 2050.5 MHz - Channel #4 - lower markets

TX Undesired Frequency - digital COFDM 8 MHz content - top 30 market

Undesired Freq.	Receive Carrier Level	D/U Ratio	TASO#	PSNR	Vid. S/N	S/N DEG.	Audio D/U
2055.5 MHz (#3)	-40 dbm	15	3	24.23	41	25	19
2055.5 MHz (#3)	-50 dbm	15	3	24.23	41	21.5	19
2055.5 MHz (#3)	-70 dbm	15	3	24.23	41.5	4	19
2055.5 MHz (#3)	- 86 dbm (1 db point)	20	4	23.29	37	2	N/A
2054.5 MHz	-40 dbm	15	3	24.11	40.5	25.5	19
2054.5 MHz	-50 dbm	15	3	24.22	41	21.5	19
2054.5 MHz	-70 dbm	15	3	24.31	41	4.5	19
2054.5 MHz	- 86 dbm (1 db point)	20	4	23.17	37.5	1.5	N/A
2053.5 MHz	-40 dbm	16	3	24.6	42	24	19
2053.5 MHz	-50 dbm	16	3	24.43	41.5	22.5	19
2053.5 MHz	-70 dbm	16	3	24.47	41	4.5	19
2053.5 MHz	- 86 dbm (1 db point)	21	4	23.42	37	2	N/A
2052.5 MHz	-40 dbm	15	3	23.18	41.5	24.5	16
2052.5 MHz	-50 dbm	15	3	24.29	40.5	22	16
2052.5 MHz	-70 dbm	15	3	24.38	40.5	5	16
2052.5 MHz	- 86 dbm (1 db point)	20	4	23.48	38	1	N/A
2051.5 MHz	-40 dbm	17	3	24.52	41	25	17
2051.5 MHz	-50 dbm	17	3	24.57	41	21.5	17
2051.5 MHz	-70 dbm	17	3	24.5	41	5.5	17
2051.5 MHz	- 86 dbm (1 db point)	22	4	23.06	38	1	N/A
2050.5 MHz	-40 dbm	17	3	24.78	42	24	17
2050.5 MHz	-50 dbm	17	3	24.8	42	20.5	17
2050.5 MHz	-70 dbm	17	3	24.54	42	3.5	17
2050.5 MHz	- 86 dbm (1 db point)	22	4	23.37	37.5	1.5	N/A

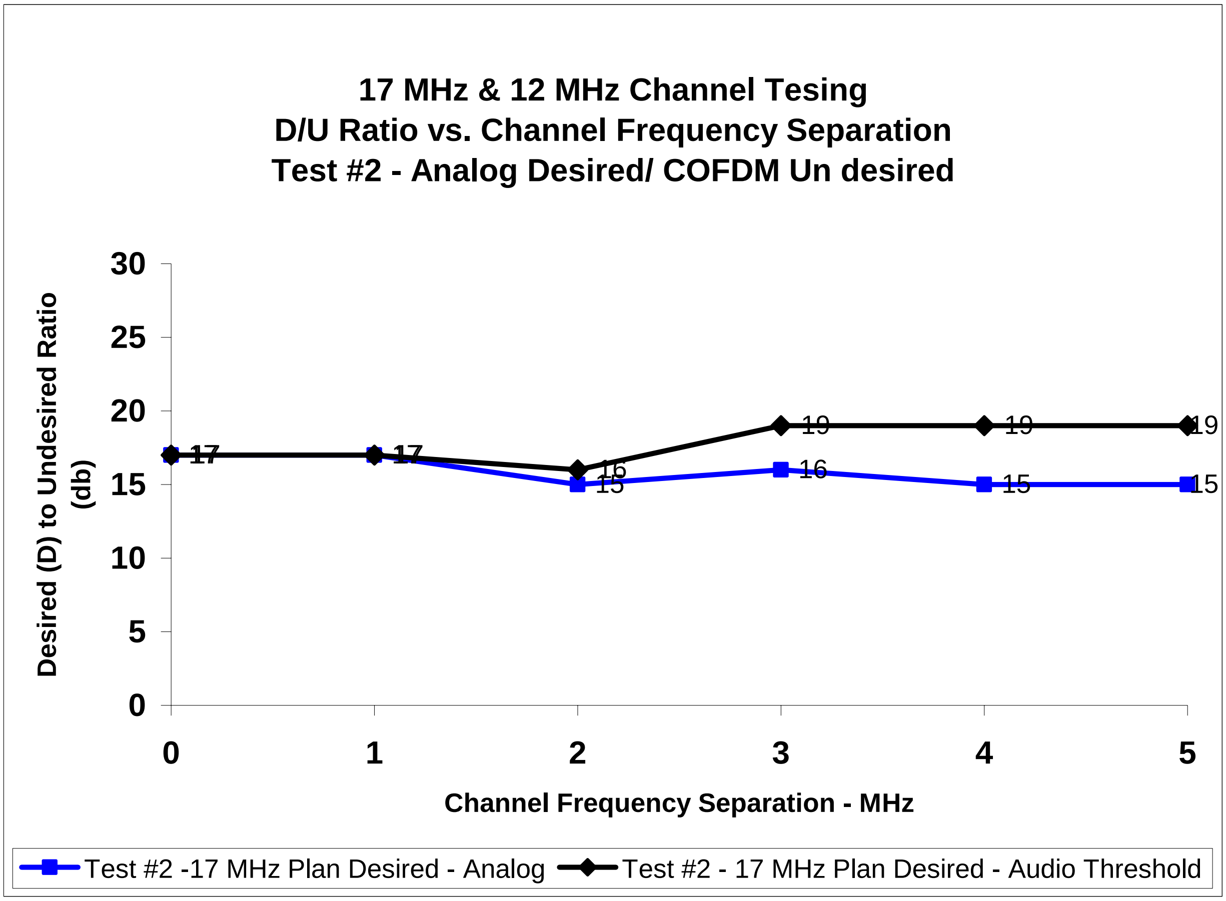

Fig. 6 Test #2 D/U @- 50 dbm

- A 15 to 17 db D/U ratio will be required for analog operation to achieve a TASO 3 to 4 operations. This includes an approximate 22db hit in video S/N performance.
- An additional 2db D/U ratio will be required for proper audio operation.
- Due to the slow degradation of the analog signal, significant PSNR degradation can be seen as a function of the minimum viewing quality achieved from the TASO rating.
- A 0 D/U ratio was not achievable due to severe interference and below the minimum video S/N rating.

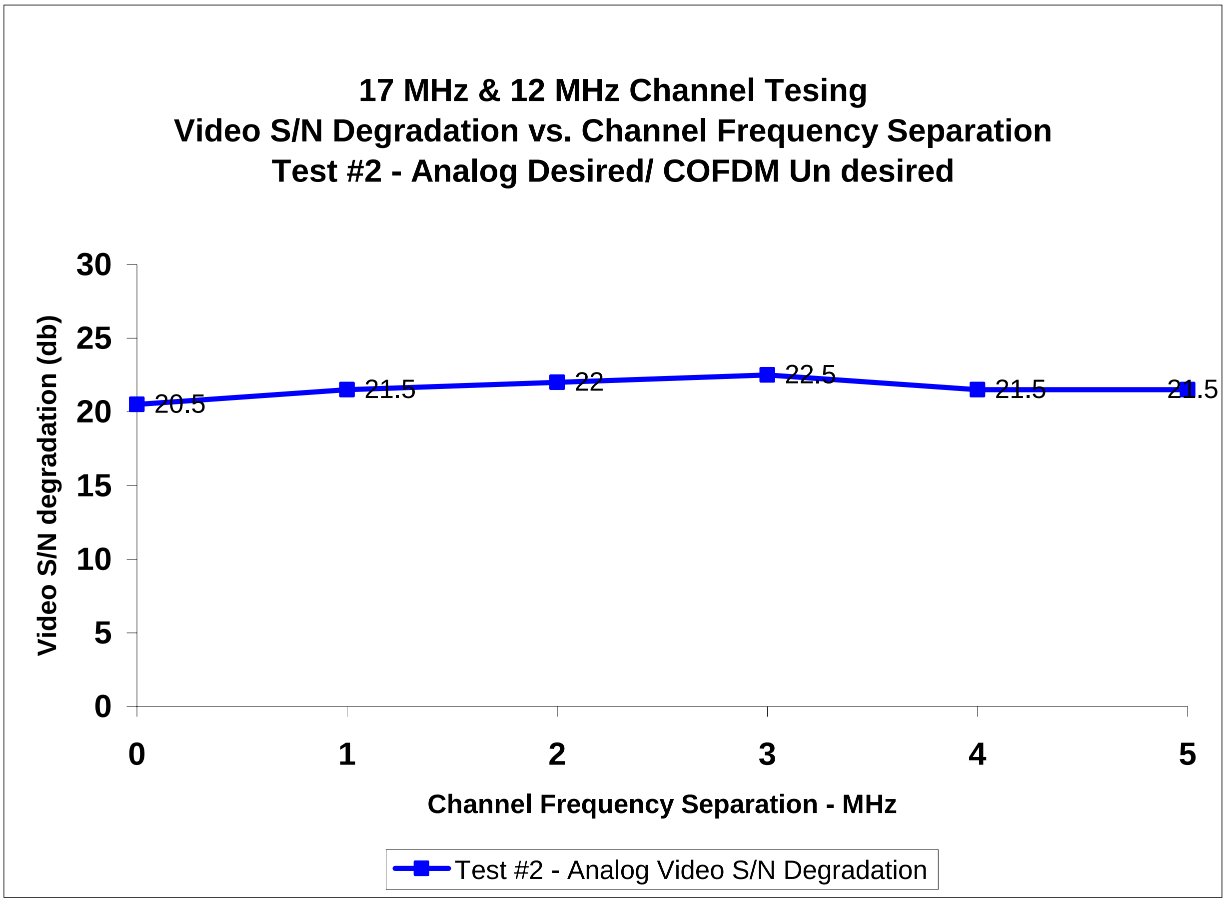

Fig. 7 Video S/N Degradation @ -50 dbm

- Video S/N reading at (–50dbm) with out interfering energy - (62.5 db)
- The graph shows a pretty much constant degradation in S/N of about 22 db
- Previous tests have a measured D/U ratios at 1db degradation point, 21db difference – refer to appendix at the back of the document.

4.3 Test #3 – COFDM (desired) 17 MHz/COFDM (un desired) 12 MHz

Test #3 - Digital to Digital

Digital Desired (17 MHz) - COFDM un desired (17 MHz)

COFDM Mode - 16 QAM 1/2 FEC, 1/8 th guard interval - 11.02568 Mbits

TX Desired Frequency - 2050.5 MHz - Channel #4 - lower markets

TX Undesired Frequency - digital COFDM 8 MHz content - top 30 market

Undesired Freq.	**Receive Carrier Level**	**D/U Ratio**	**Taso #**	**PSNR**	**Post BER**	**S/N Deg.**
2055.5 MHz (#3)	-40 dbm	8	2	34.52	7.4 e -6	7.3
2055.5 MHz (#3)	-50 dbm	8	2	34.33	7.8 e -6	7.7
2055.5 MHz (#3)	-70 dbm	8	2	34.37	8.4 e -6	8.1
2055.5 MHz (#3)	- 89 dbm (+1 db point)	9	2	34.32	9.6 e -6	0.3
2054.5 MHz	-40 dbm	9	2	34.68	8.8 e -6	9.7
2054.5 MHz	-50 dbm	9	2	34.71	7.7 e -6	9.5
2054.5 MHz	-70 dbm	9	2	34.73	9.8 e -6	9.8
2054.5 MHz	- 89 dbm (+1 db point)	12	2	34.69	0.9 e -6	0.2
2053.5 MHz	-40 dbm	11	2	34.82	3.8 e -6	10.6
2053.5 MHz	-50 dbm	11	2	34.75	2.5 e -6	10.1
2053.5 MHz	-70 dbm	11	2	34.67	2 e -6	10
2053.5 MHz	- 89 dbm (+1 db point)	12	2	34.78	6.8 e-6	0.1
2052.5 MHz	-40 dbm	12	2	34.87	3.9 e -6	10.8
2052.5 MHz	-50 dbm	12	2	34.65	3.5 e -6	9.9
2052.5 MHz	-70 dbm	12	2	34.67	3.34 e -6	9.1
2052.5 MHz	- 89 dbm (+1 db point)	13	2	34.54	0.7 e -6	0.1
2051.5 MHz	-40 dbm	13	2	34.65	5.8 e -6	10.7
2051.5 MHz	-50 dbm	13	2	34.52	3.8 e -6	10.2
2051.5 MHz	-70 dbm	13	2	34.89	2.4 e -6	9.5
2051.5 MHz	- 89 dbm (+1 db point)	14	2	34.53	1.6 e -5	0.7
2050.5 MHz	-40 dbm	13	2	34.71	4.8 e-6	11.1
2050.5 MHz	-50 dbm	13	2	34.83	5.9 e -6	11.8
2050.5 MHz	-70 dbm	13	2	34.55	3.4 e -6	11
2050.5 MHz	- 89 dbm (+1 db point)	14	2	34.53	7.1e -5	0.5

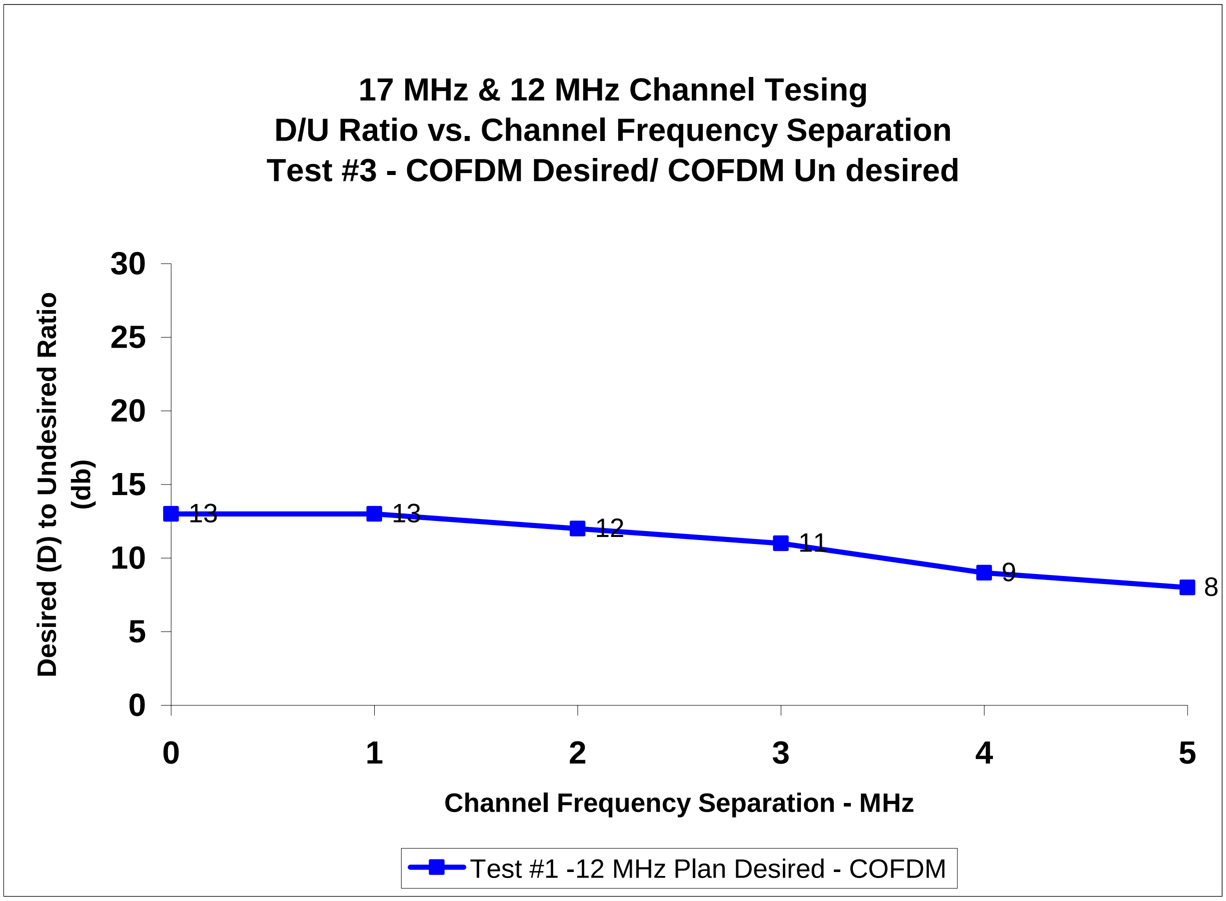

Fig. 8 -Test #3 D/U @ -50 dbm

- D/U ratio varies from 8 to 13 db as a function of channel frequency separation.
- Graph shows a consistent measurement with expected C/N requirements (13.2 db)
- TASO #2 achieved consistently with the appropriate D/U ratio

V. Results Summary & Comparison:

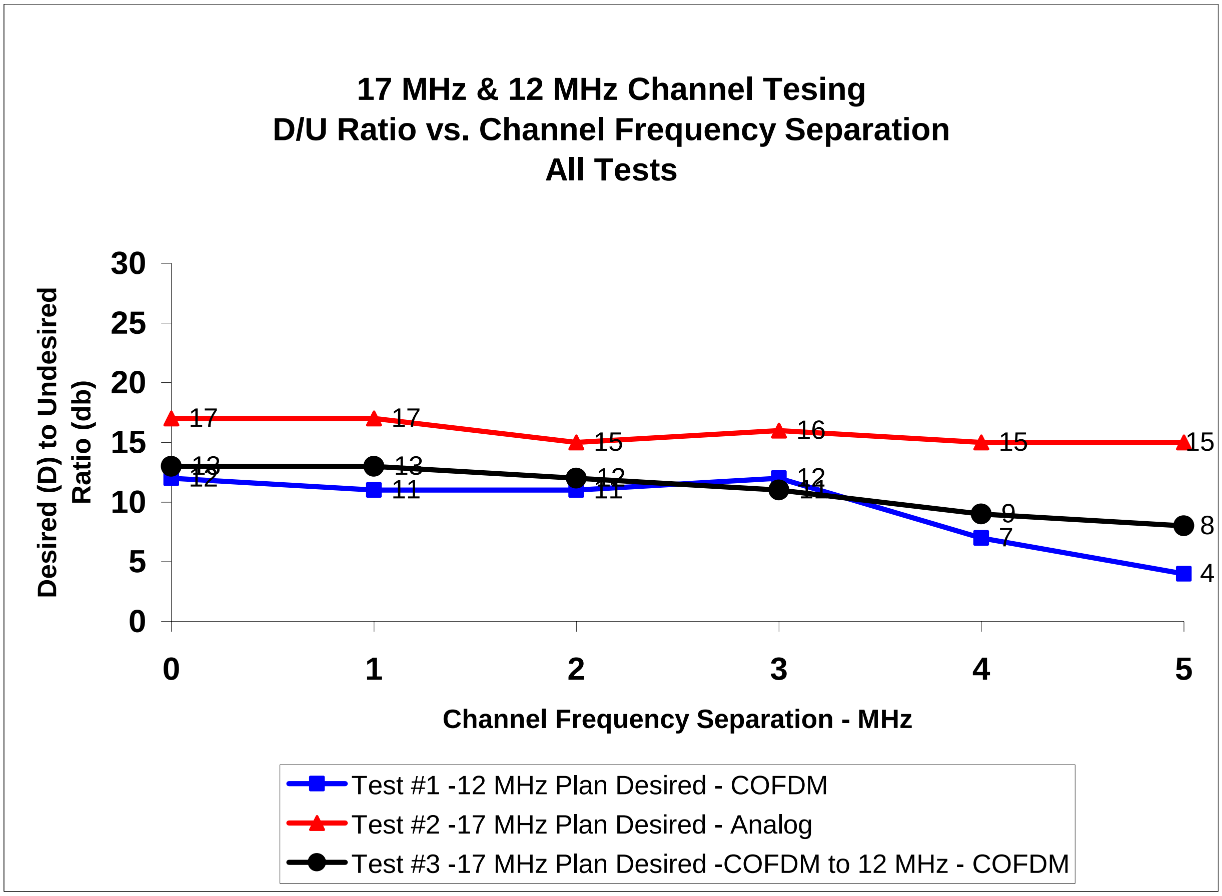

Fig. 9 –All tests D/U @ -50 dbm

- Test #1 achieved the best D/U ratios from an operational standpoint
- A top 30 market will lose approximately 43 db of isolation from existing 17 MHz channel applications when comparing test #1 results curves from above with previous 17 MHz channel curves per figure 13 in the appendix for mixed signal digital/analog operation. (D/U ratio - +12 db to –31 db = 43 db).
- A lower 30 market will lose approximately 26 db of isolation for analog operation when comparing test #2 above with previous 17 MHz channel testing curves per figure 13 in the appendix for mixed signal operation. (D/U ratio - +17 db to –9 db = 26 db). Note, this includes 22db degradation in the video S/N as a measurement threshold point for the tests above while a 1db degradation point was used as a threshold point for the previous tests. Which would increase the 26db loss in isolation another 21 db in practice.

Previous Testing Measurement Results

Appendix

VI. Previous Testing Measurement Results

Current Channel Conditions – (17 MHz channel spacing)

6.1 Analog Operation – adjacent channel Testing - 17 MHz Operation:

The following graph shows the current adjacent channel D/U performance of two analog radios operated together with 17 MHz center channel spacing.

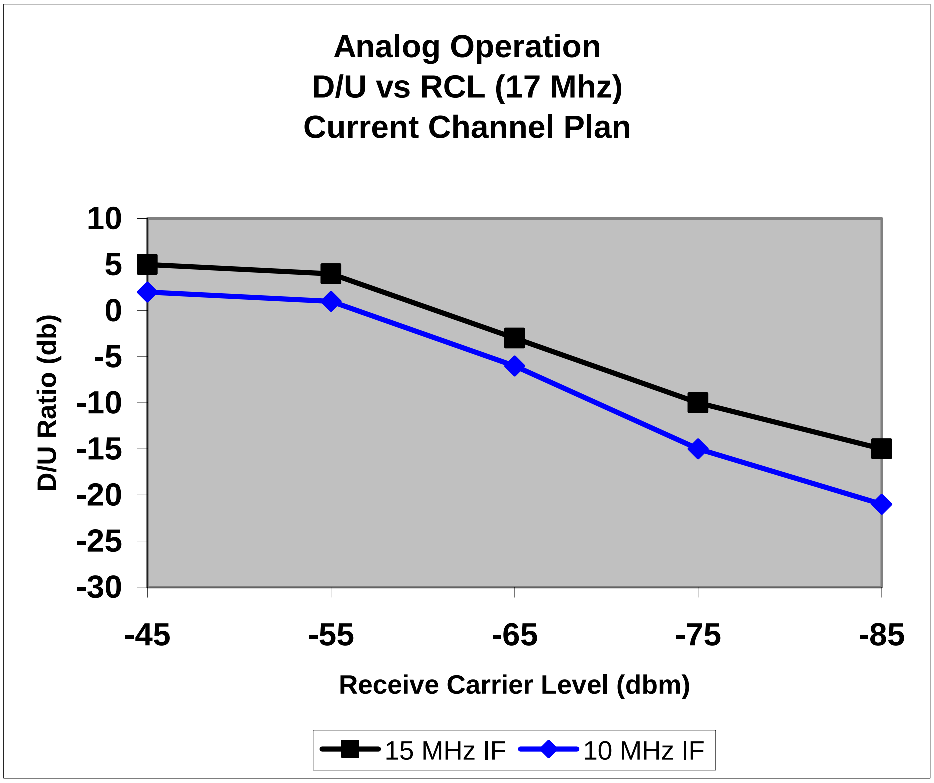

Fig. 10 -Analog 17 MHz Adjacent Channel

6.2 Analog Operation – co-channel - 17 MHz channels:

The following graph shows the current co-channel requirements of two analog radios operated together on the same 17 MHz channel.

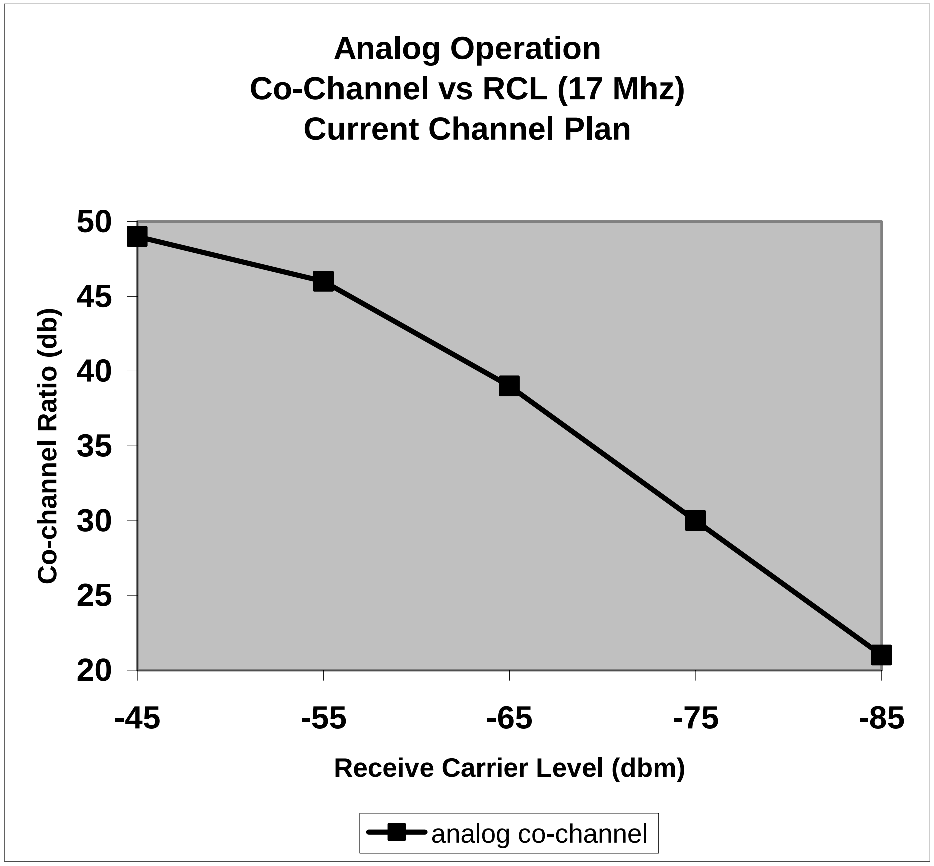

Fig. 11 -Analog 17 MHz Co - Channel

D/U Measurement Threshold (Analog):

The D/U number was recorded when 1db degradation in the video S/N is established. A positive number will denote that the desired carrier (D) has to be "X" amount larger than the undesired carrier (U) to meet the measurement threshold. A negative number will denote that the undesired (U) is "X" amount larger than the desired (D) to meet the measurement threshold.
Note, the 1db degradation point for the video S/N is used as a baseline point. The 1db degradation in video S/N does not create a noticeable degradation in the subjective video quality.

6.3 Analog Operation/Digital Operation – adjacent channel - 17 MHz:

The following spectrum plot shows an adjacent channel baseline spectrum of 8 MHz COFDM pedestal long with an analog FM carrier.

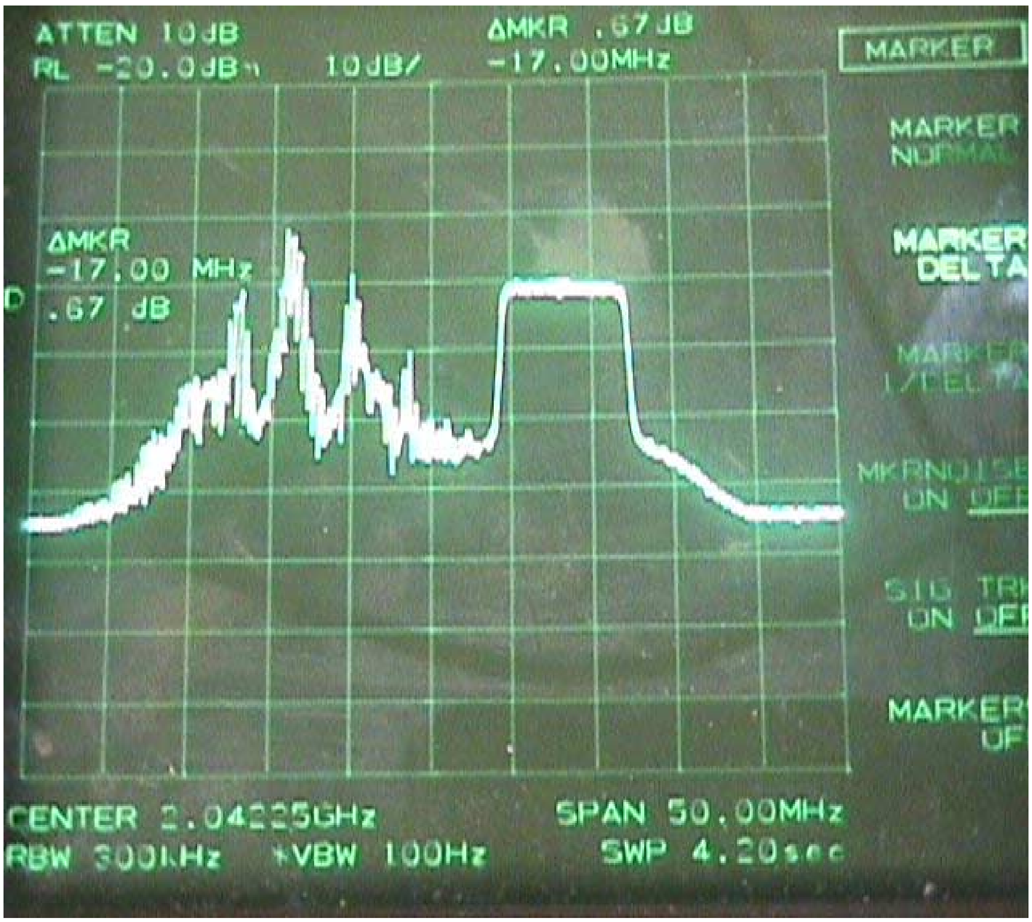

Figure 12 – 17 MHz channels – analog/digital operation

6.3 Analog Operation/Digital Operation – adjacent channel - 17 Mhz:

The following graph shows the adjacent channel D/U requirements for the co-existence of an analog channel and a digital channel.

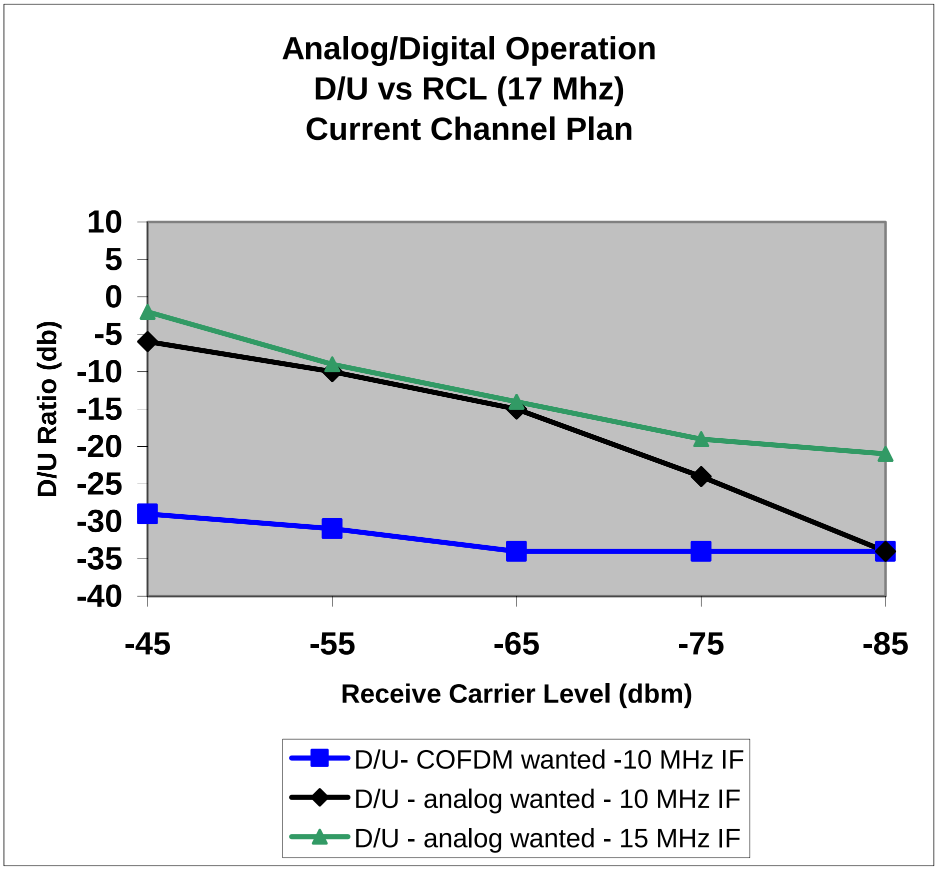

Fig. 13 D/U ratio 17 MHz channels –analog/digital

- A -9 dB D/U ratio was achieved for analog operation for the desired with a COFDM digital pedestal as the undesired at a receive carrier level of –55 dbm.
- A -31 db D/U ratio was achieved for digital COFDM operation for the desired signal with a analog FM waveform used as the un desired at a receive carrier level of –55 dbm.

6.4 Digital Operation Only – adjacent channel - 17 MHz:

The following plot shows the D/U requirements of two 8 MHz COFDM pedestals with a 17 MHz channel spacing.

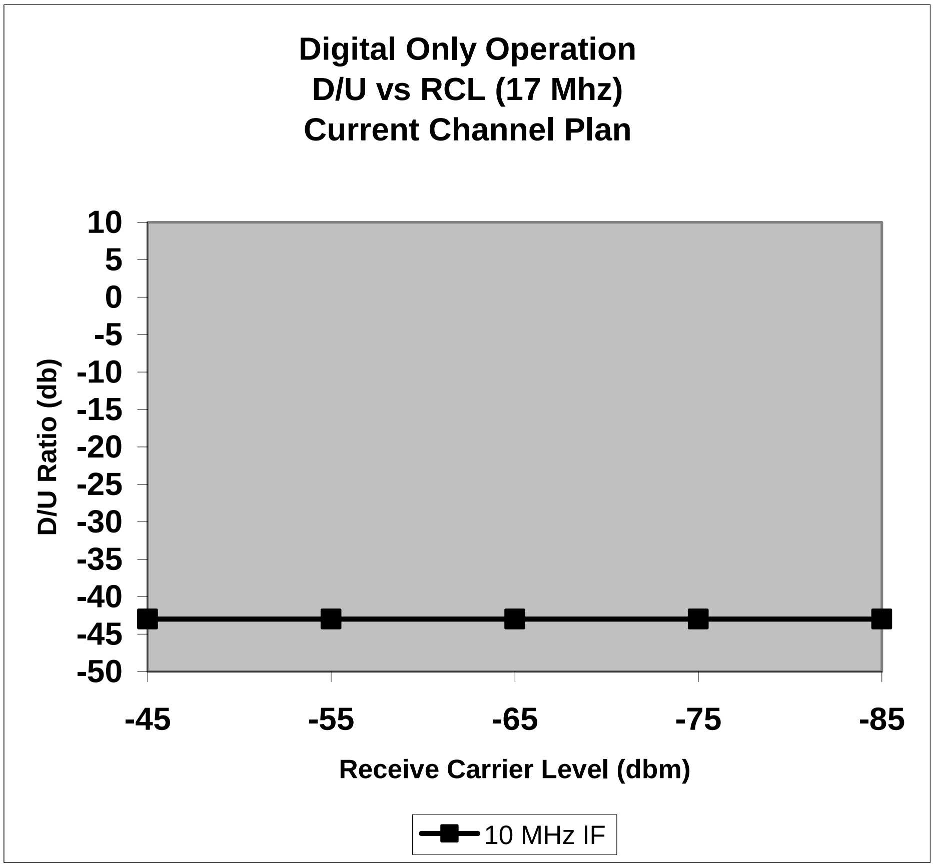

Fig. 14 D/U ratio 17 MHz channels –digital/digital

- A –43 db D/U ratio was achieved at –55 dbm for COFDM operation using QPSK ¾ 1/8th operation.

SBE Analysis of TV Market Adjacencies for ENG Purposes

Because the reasoning by which the FCC dismissed SBE's previously stated concerns over the use of incompatible BAS band plans in large and small markets is based on SBE's record of success in encouraging and facilitating market-based BAS frequency coordination, the Society tasked one of its staff members (David P. Otey, Frequency Coordination Director) with ascertaining specifically what additional frequency coordination burden could be anticipated under the market-differentiated plan, and whether such burdens could reasonably be accommodated using known coordination procedures. To ascertain these facts, the SBE Frequency Coordination Director polled the Society's roughly 200 volunteer frequency coordinators, and followed said poll with additional interviews by phone and e-mail. This report is based on the information thus collected from engineers who are perhaps the best qualified in the entire country to speak to the issue of coordinating users of incompatible band plans.

The explanatory statements by the FCC in the ET Docket Third R&O raise multiple concerns. To begin with, one must note the assumption explicit in the qualifying statement, "To the extent that such interference is similar to interference that small market stations have previously received…". While it is true that edge-of-market or overlapping-market issues already exist and are dealt with routinely (which is not to say with 100% success), it has been shown that the interference resulting from mismatched band plans in such regions is not at all similar to existing interference cases. Research into this issue has shown that the limiting factor in determining whether a given ENG shot (that is, one set of transmissions from a mobile BAS transmitter to a fixed receiver) will be successful is rarely co-channel interference, but is almost always adjacent-channel interference due to the presence of many ENG users crowding a market. It is that problem which local frequency coordination has been most successful in mitigating.

As shown in the accompanying research by Microwave Radio Corporation, the existence of both old and new band plans, with the new channels being occupied by digital transmissions, changes the coordination landscape completely. What previously might have been adjacent-channel interference cases will become co-channel cases, to the tune of a 43-dB to 47-dB worsening of the isolation between users. This could hardly be considered similar to the status quo.

The effects of such a change in the landscape are borne out in comments received from local coordinators. From the Monterey/Salinas market in northern California comes the observation that stations in that market (currently #121) rely on a mountaintop receive site in the Coastal Range separating the Monterey Bay region from the San Francisco Bay metro area. Likewise, numerous stations in the San Jose/San Francisco/Oakland market (#5) rely on a mountaintop site located only two miles away in the same range. When the large-market stations fly their helicopters or drive their ENG vans to the coast to provide their audience information about a breaking news story or natural disaster, coordination between the large-market and small-market stations will be virtually impossible, as each Salinas/Monterey user of the legacy band plan will necessarily receive on-axis, co-channel interference from up to three users of the new band plan.

Similar examples can be found in Boston and Providence; Phoenix and Tucson; and Chicago and Milwaukee. Each of these cases pairs a top-30 market with a lower-ranked market nearby which stands to be severely affected by the market-differentiated transition plan. Coordinators in all of these markets have examined their current coordination plans and voiced extreme concern over their markets' respective ability to absorb the impact of this period of disparity, which the FCC dismisses as "temporary."

A second concern raised by the FCC's reasoning has to do with the assumption that markets below number 30 should be able to make do with only five of the original seven 2-GHz channels, for a period of up to five years. (The alternative to such a reduction in channel capacity is of course for licensees in those markets to subsidize the early entry of new MSS or AWS licensees by absorbing the cost of converting to digital equipment capable of operating in 12-MHz, instead of 17-MHz, channel bandwidth.) It should be noted that according to data taken from the Nielsen Media web site, approximately 46% —almost half—of the U.S. population is found in markets 31 through 210.

What is more important, though, is the extent to which many of the smaller markets demonstrate a demand for newsgathering bandwidth which is out of proportion to their audience size. The most obvious example of this situation is provided by state capitals. For historic reasons, many states have capitals which are not those states' largest cities. In a number of such cases, capital cities not only encompass relatively small media markets, but are found in areas dominated by larger markets with an understandable interest in news from the capital. Austin, Texas, for example, while currently TV market number 54, is located within a triangle bounded by San Antonio (#37), Houston (#11) and Dallas-Fort Worth (#7). Stations from each of these larger markets operate or have operated capital bureaus in Austin, some of them equipped with ENG receive facilities linked to backhauls (hard line or microwave) to their main studios. Furthermore, Dallas stations have been known to relay live coverage of spot news from Austin all the way back to Dallas via helicopter.

The same situation exists in Florida, where Tallahassee (#111) attracts news coverage from stations in Tampa-St. Petersburg (#13), Orlando (#20), and Miami-Ft. Lauderdale (#17). Because of the relative proximity of Tampa to Tallahassee, Tampa stations often send their ENG trucks to the capital to cover important stories, according to the Tampa frequency coordinator.

Even more noteworthy examples can be found in states where the capitals are still smaller, and the dominating markets even larger and closer. Perhaps the most extreme example is Lansing, Michigan (#110), located only an hour's drive from both Detroit (#10) and Grand Rapids (#38) . At periods of peak demand for BAS bandwidth—notably election days, for example—the Lansing frequency coordinator reports that demand already outstrips supply in the 2-GHz band. To meet the needs of both the local and the visiting media requires not only time-shared use of 2-GHz channels, but the use of portable 7-GHz and 13-GHz equipment as well. Because Detroit stations maintain a 2-GHz fixed receive site in Lansing, linked to Detroit studios by terrestrial microwave, they will continue to send ENG trucks for capital coverage, competing with local stations for scarce 2-GHz channels. However, since local news broadcasts are not the profit centers for small-market stations that they are in larger markets, the Lansing stations will be hard-pressed to convert to digital ENG equipment in order to conform their band plan with Detroit's; so what alternative do they have but to reduce their live coverage in times of peak interest? Clearly, the assumption that smaller markets can make do with fewer BAS channels and operate on a secondary basis is flawed.

Besides Michigan, similar situations with respect to capital coverage can be described in Oregon, Wyoming (where TV market #196, Cheyenne. is in the shadow of Colorado's capital, and TV market #18, Denver), and Wisconsin. Madison, in fact, is faced with not only the dominance of nearby Chicago, but also the need to maintain compatibility with a statewide BAS newsgathering infrastructure linking it with Milwaukee and Green Bay. Coordinators in these Wisconsin markets have already opened discussions on how best to implement their transition. In the interest of serving their audiences, it appears (from the coordinator's observations) that stations in these markets are likely to choose the more expensive option of converting to digital ENG three to five years ahead of any possible reimbursement, in effect subsidizing the newcomers rather than sacrificing public service.

Finally, an observation is in order regarding the FCC's belief that large-market itinerants can avoid creating problems for their small-market hosts by temporarily switching to a compatible center-frequency plan (Third R&O, at footnote 103). It has been noted that the limiting factor in ENG microwave shots is usually adjacent-channel interference. Because this is so, stations in congested markets have adopted as standard practice the use of tight-skirted channel filters ahead of their fixed ENG receivers. Therefore, although the receivers themselves are frequency-agile, the stations are in effect locked into their market's "home channel plan" by which frequency coordination is implemented. The FCC's suggestions in footnote 103 assume complete agility, even between the old and new band plans. In actual practice, such agility is rarely possible.

Conclusion: In its zeal to protect the economic interests of the new entrants to the spectrum at 1,990-2,025 MHz, the FCC has issued a decision which will force television stations serving an aggregate of 46% of the American public to make a Hobson's choice: either subsidize the newcomers by absorbing substantial conversion costs up-front, in hopes of reimbursement three to five years hence, or provide their audiences reduced news coverage, and therefore inferior service, so spectrum can be given away to a new technology which offers no equivalent information-disseminating service to the public. How odd that the FCC would take a step which so obviously undercuts the ability of local broadcasters to serve the public, while at the same time pursuing a public inquiry into Localism in the Media. The uniquely local program content which only local broadcasters can provide—including live coverage of breaking news, threatening weather, natural disasters, or threats to public safety—depend for their existence on the BAS spectrum that is the subject of this rulemaking, and which SBE and others have so carefully coordinated for years, to the benefit of local audiences nationwide.

Respectfully submitted,

David P. Otey, CSTE
SBE Frequency Coordination Director