Before the

FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the matter of	)	
	)	
Proposal(s) for the Creation of a	)	RM 98-9208
Low-Power FM Broadcast Service	)	RM ~~98~~-9242
	)	

REPLY-COMMENTS OF:

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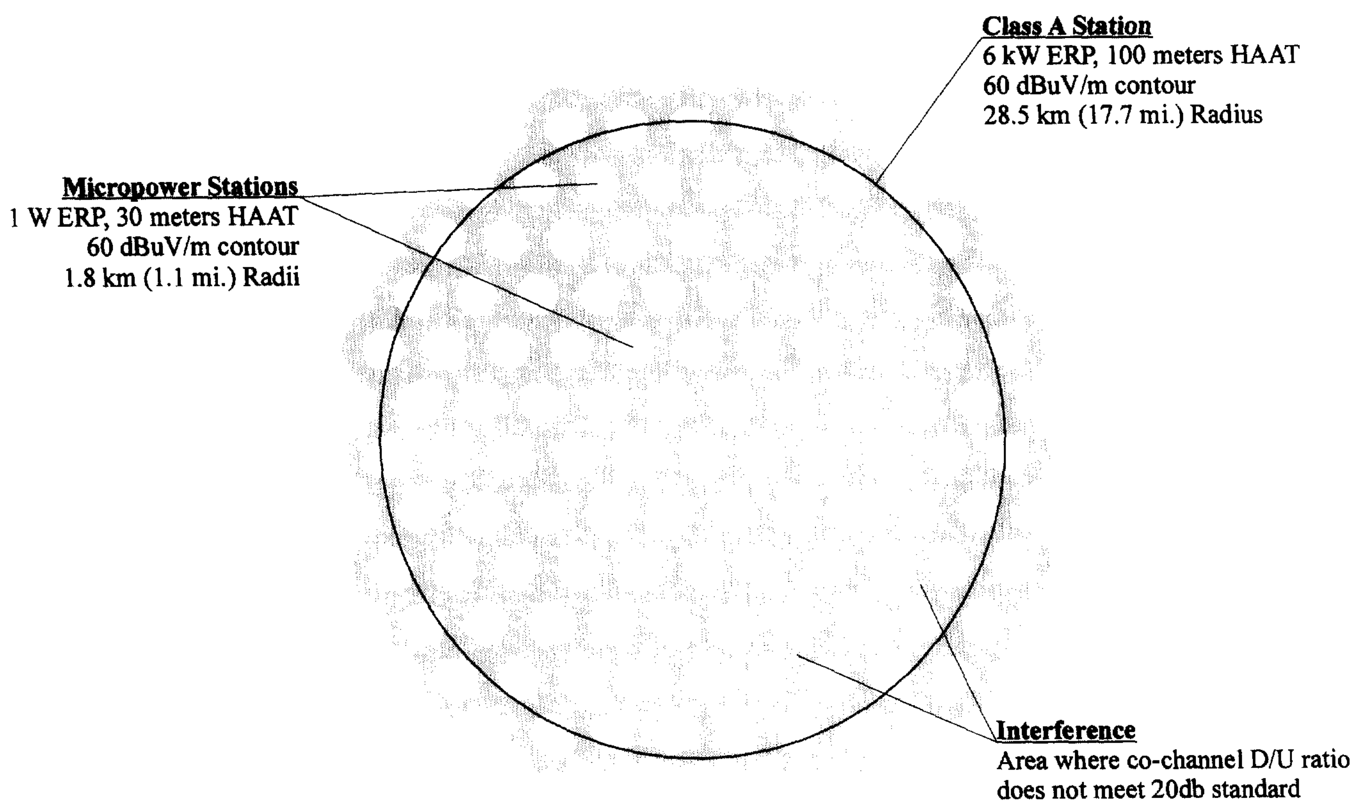
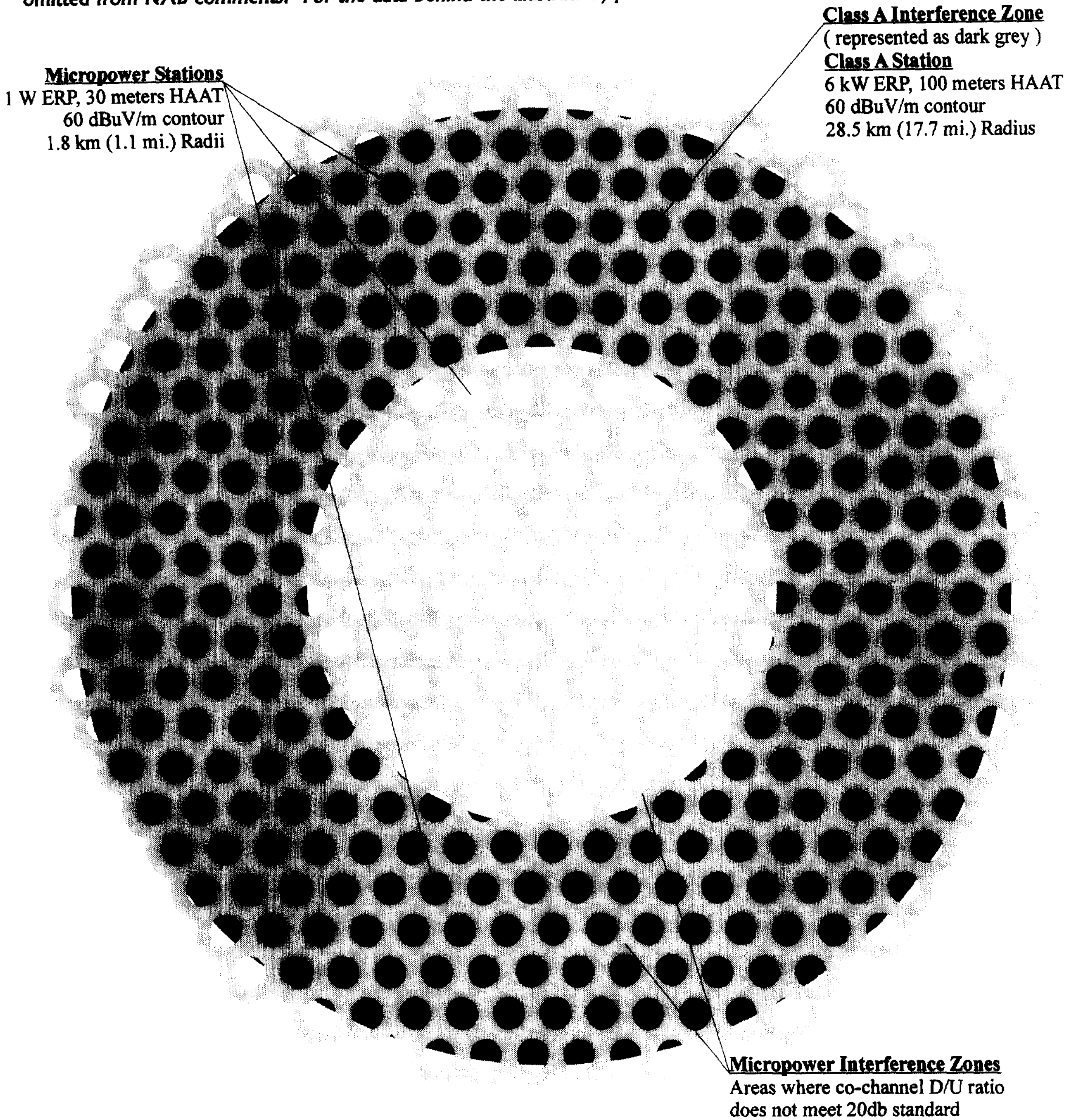
To: The Commission



What's wrong with this picture?

IT'S MISSING SOMETHING!

In the National Association of Broadcasters comments, Figure 1, page 10, they illustrate their assertion that lower power transmission facilities are less spectrally efficient than higher power facilities. The graphic below more accurately depicts the real efficiencies of use. It includes the interference area of a class A facility, disingenuously omitted from NAB comments. For the data behind the illustration, please refer to Exhibit C.



Approximately 235 "Micropower" facilities can be accomodated within the total area occupied by a single class A facility. The aggregate protected coverage of these "Micropower" facilities is 2502 km^2 compared to protected coverage of 2515 km^2 for the class A facility - a negligible difference.

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COMMENTARY

I. Perspective

The outstanding feature of this comment process has been the absolute refusal of the established broadcast media to address public concerns in a meaningful way. Comments from the National Association of Broadcasters (NAB), National Public Radio (NPR), and individual broadcasters, almost without exception, seek to marginalize Low Power FM (LPFM) proponents and the service. Obstructive, diversionary, hysterical and baseless arguments abound.

Although we find the LPFM petitions themselves fail to address some of the practical issues involved in implementing the new service they propose, that is no defect in and of itself. These omissions certainly do not invalidate the larger issues of diversity and access in broadcast. The debate that these petitions have sparked is a much needed contribution to establishing responsible policies to address public concerns.

Our position is that expanded access needs to be provided to the broadcast airwaves, especially in the wake of liberalized ownership limits, lax regulation (so-called industry "self-regulation") and technological advances. Whether LPFM can contribute to this goal is largely a function of the course of its development and institution. LPFM doesn't have to be the only solution, but improved diversity and access are important to a democratic society. The Commission can accomplish many of the goals of the LPFM petitioners by simple modernization of existing regulations.

II. Erecting New Barriers

Historically, barriers to access in FM broadcast media have been regulatory, economic and technological in nature. Technical limitations have been greatly diminished due to continuing improvement in receiver sensitivity and selectivity (see <u>Exhibit B, Receiver Selectivity</u>). There is an accelerating decrease in the costs of technically advanced components for transmission and reception equipment. Conversely, broadcast license auctions, Congressional removal of the Commission's authority to conduct license lotteries, and continuing regulations that ignore improvements in FM transmission and reception technology result in exclusionary policies that virtually eliminate new entry into broadcasting.

In past decades, the major barrier to entry was the practical aspect of construction and operation of an FM broadcast facility. In the 1940's, '50's, and '60's, lack of FM receivers in the hands of the public turned an FM broadcaster into a pioneer in a new medium. In the '70's FM receivers appeared in clock and automotive radios. This period saw FM broadcast move into the American mainstream. In recent times[1], regulation and public policy have become the principal barriers to entry. The broadcast provisions of the Telecommunications Act of 1996 and their implementations to date have served to dramatically reduce opportunity in broadcasting. Despite Congressional mandates for de-regulation, the FCC continues to maintain and, incredibly, reinforce indefensible regulations that serve to reduce competition. We can't believe Congress intended the FCC to act to reduce competition.

At the same time that FM transmitting and studio equipment has become less costly, new public policy has encouraged existing large broadcast companies occupancy of every available FM channel via multiple ownership and Joint Sales Agreements. Meanwhile, archaic FCC FM broadcast rules regarding adjacent channel operation, unchanged since the 1940's, further limit competition in FM broadcasting.

Nothing bears our arguments and the reality of the marketplace out more than the proliferation of unlicensed broadcast outlets. The technologies and economies of operation of broadcast facilities have shifted in favor of inclusion. Regulation and public policy have taken up an adversarial role in response. The question is: who or what is driving this response? Market forces and the public interest - or the established broadcast industry?

III. IBOC – An Industry Stalking Horse?

The centerpiece of broadcast industry objections to LPFM is the proposed implementation of another new service, In-Band On-Channel (IBOC) Digital Audio Broadcasting (DAB). A large portion of comments in opposition to LPFM are devoted to supporting the NAB contention that updated adjacent channel FM rules will prevent the implementation of FM band IBOC DAB. In these Reply-Comments, we will present a rather more balanced and inclusive approach to FM band IBOC DAB.

See Exhibit A for an analysis of the technical and regulatory aspects of IBOC. Therein we agree that IBOC does, indeed, required greater bandwidth than plain old FM broadcasting. The industry presents the FCC with an interesting new question. Should we, at no cost, allow all existing analog FM stations sufficiently greater bandwidth to permit digital broadcasting, while incidentally suffocating new competition? We hope the answer will be a resounding NO!

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1 In 1978 the Commission decided to prevent formation of new class D stations, principally as a result of FCC policies that failed to enforce class D secondary status during a period of great FM non-commercial growth.

IV. Procedural Subversion

IBOC is certainly not the only obvious candidate to provide DAB services. Other ideas and systems could be proposed. That an industry research project not even part of the public policy making process should be used in arguments against a duly submitted proposal for a new service is unfortunate. It is a betrayal of the public trust to accept petitions for new services submitted in good faith, if these proposals are to be turned aside in favor of arguments rooted outside the public process.

V. Spectrum Efficiency and the NAB

The NAB has argued that LPFM results in an inefficient service. They say spectrum is wasted that would not be using higher power. In Exhibit C we lay that nonsense to rest. We are inclined to believe that the NAB has been disingenuous in presenting its argument that one watt FM stations will leave islands of service amidst oceans of interference[2], while suggesting higher powered stations are different. It is difficult to understand how such a prestigious organization as the NAB could have failed to calculate the spectrum efficiency of low powered versus higher power stations.

VI. *Competition is Good*

Some of the barriers to access in the FM broadcast band are artificial and serve no purpose other than to protect existing licensees from competition and support the value of their investment. Many of the opposing comments say as much. Rest assured that there'll be a very long line of those be willing to broadcast in a competitive marketplace the day existing broadcasters decide to quit the business because of the unbearable competition from low power FM. The suitability of new services and would-be competitors should be judged by the marketplace and not through subjective arguments by parties driven by self-interest. The FCC should no attempt to assure the economic well being of commercial broadcasters.

SUMMARY

We respectfully request that the Commission:

1) Significantly reduce 2nd and eliminate 3rd and IF spacing requirements outside of a minimal blanketing contour and apply this to all FM broadcast license classes, not specifically to a LPFM service;

2 We don't intend here to propose any particular LPFM power level, only to show that the lowest power proposed, one (1) Watt, is not particularly inefficient.

2) Re-establish class A stations as a community service and implement community based ownership and origination rules;

3) Re-establish the existing class D originating regulations for all 50 states, but as a primary service with allowance for commercial and non-commercial allotments.

4) If the Commission allows IBOC DAB it should not be a protected service other than that protection that would be incidental to the primary analog FM license.

5) Request Congress to re-instate license lotteries for Class A and D community licenses;

6) Establish 1 day filing windows for Class A and D allotments.

7) Request proposals for out-of-band digital audio broadcasting solutions.

Respectfully submitted,

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EXHIBIT A

IBOC – AN ANALYSIS

USA Digital FM Band IBOC DAB

It is most ironic that in denying the validity of a proposed new service and its incumbent regulatory "overhead", the NAB has sidestepped the same issues related to its own proposals. In their lengthy rejection of the LPFM proposals, the NAB comments neglect to discuss the ramifications of the additional spectrum requirements for the USA Digital IBOC DAB proposal.

Also notable in its absence, is any discussion on the benefits to be realized through the implementation of FM band IBOC DAB. A tradeoff defined by substantial financial benefit to existing licensees at a significant cost to the public interest and the Commission's stated goal of promoting diversity through expanded access to the FM broadcast band.

The NAB favored USA IBOC DAB scheme suggests the use of an existing core analog FM carrier with upper and lower digital sidebands extending from 130kHz to 199kHz from the center of an existing FM allotment. This amounts to an occupied channel 398 kHz wide with additional guard band requirements.

Rules regarding spectrum occupancy of an FM broadcast signal are found at §73.317. This rule limits emission outside of an occupied bandwidth of 240 kHz. This rule is supposed to define how much unintended incidental radiation outside of this occupied bandwidth is allowed. IBOC proponents intend to create a new digital signal as intentional radiation outside of the occupied bandwidth, but at a low enough power to fit within the incidental radiation limits. By converting incidental radiation to intentional radiation, IBOC will be, in a sense, utilizing new spectrum for digital broadcasting.

§73.317 does not in any way guarantee an FM station us of spectrum outside of the 240 kHz channel, even as incidental radiation. In fact, the rule says, that in spite of the limits allowed in this rule that "... should harmful interference to other authorized stations occur, the licensee shall correct the problem promptly or cease operation."

Since FM band IBOC DAB as proposed by USA Digital takes place, by definition, outside of the protected occupied bandwidth, NAB and USA Digital should address the regulatory changes required to protect their proposed new service.

The following is a litany of the defects and misrepresentations found in the USA Digital FM band IBOC proposal:

1) it suggests that the additional spectrum and its corresponding additional capacity, including multiple digital services, be provided to existing licensees, free of charge, when others have to pay for additional spectrum;

2) it occupies more spectrum without providing a means of releasing the original analog allotment for re-use. Apparently the unspoken intention is to expand the licensee's digital capacity into the core analog channel after phasing out analog FM;

3) it occupies more spectrum, obstructing new services and eliminating access to new licensees thereby limiting competition;

4) it adds expense to consumer receivers through the complexity and the proprietary nature of the design;

5) the benefits of near CD audio quality and multipath resistance in the FM band have yet to be extensively field tested and are open to debate. Especially questionable given the loss of audio quality inherent in lossy digital compression techniques are qualitative improvements <u>over</u> existing analog FM service;

6) IBOC proposes OFDM modulation. OFDM is a system that can be spectrally efficient through the use of on-channel non-interfering booster transmitters. IBOC defeats this by requiring use of a single digital transmitter co-located with an analog transmitter.

Most notably, the NAB uses the additional spectrum requirements for the USA Digital IBOC system as an argument against expansion of FM Band service, including LPFM. We believe there are several workable options. For example, new digital OFDM signals could be placed as separate signals in the existing FM band, or in other bands, such as vacant UHF TV spectrum. Alternatively, the new DTV service could broadcast many channels of digital audio when not broadcasting 1080 I HDTV.

EXHIBIT B

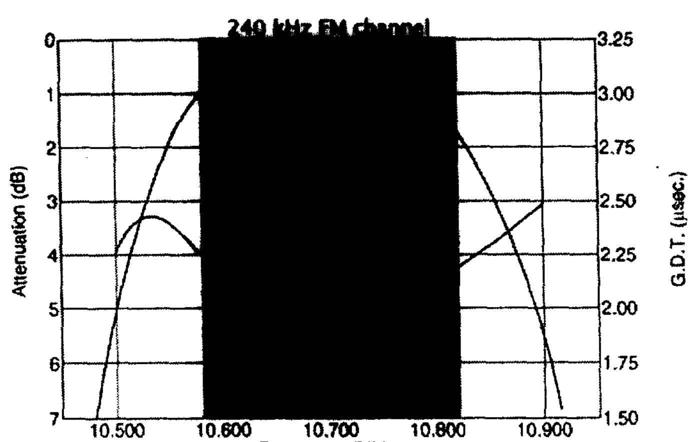
FM Receiver Selectivity

Selectivity in FM receivers

Selectivity is a receiver quality describing the ability of a FM radio to reject stations that are not on the desired frequency. Selectivity is determined, for the most part, by filters used in the IF section of the receiver. Most receivers made today use two ceramic filters of equal quality for this purpose. Thus, the quality of ceramic IF filters more than anything else define the ability of an FM radio to accept the desired bandwidth without distortion or attenuation and to reject signals outside of the desired bandwidth.

FCC rules define Analog FM channel widths are 240 kHz[3]. A radio IF filter section must be able to pass this 240 kHz wide signal while rejecting neighboring emissions. The ideal filter would pass a signal 240 kHz wide, while completely rejecting signals beyond the channel edges. In reality, the signal the desired signal suffers some attenuation and time delay distortion, while some out of band energy still gets through. The closer to perfection one gets, the more expensive the filter devices.

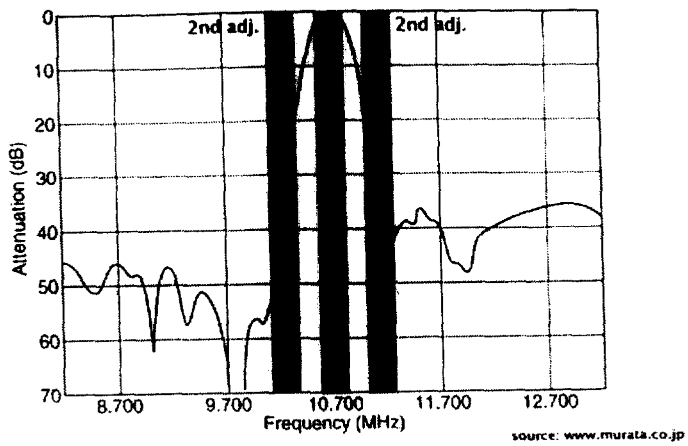
Originally IF filters were made from coils of wire, ferrite slugs for tuning, and capacitors placed in a small tin can. One could tune the device by sliding the ferrite slug up and down inside a little plastic tube on which the coil was wound. Tuning would change over time, or if bumped. Modern filters are inexpensive ceramic resonators, smaller than a fingernail, having fixed and stable qualities.



source: www.murata.co.jp

The figure to the left is a graph of just such a Ceramic Resonator. In this model, attenuation at the desired channel edge is from 1 or 1.9 db down. We have added to this manufacturers graph a band indicating the desired FM channel. IF center frequency is normally 10.7 MHz.

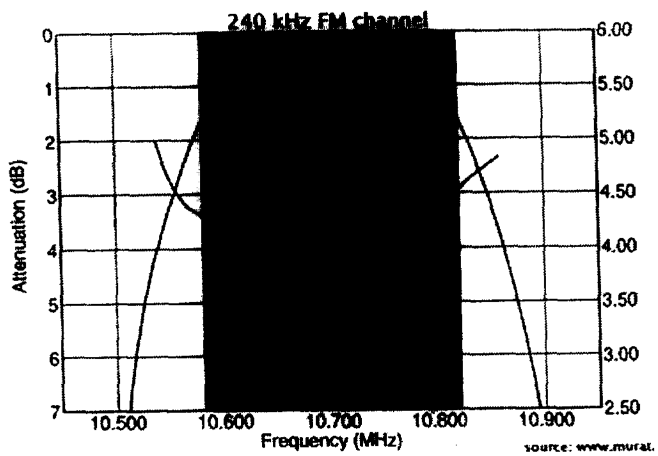
3 One rule of thumb used to determine occupied FM bandwidth is to multiply the highest modulation frequency by 2, plus FM deviation times 2, plus frequency stability. Stereo greatly increased FM broadcast bandwidth. The suppressed stereo sub carrier is 19*2=38 kHz. We add the highest audio frequency of 15 kHz to 38 for a highest modulating frequency of 53kHz. FCC frequency stability required of an FM station is +/- 1kHz. If the peak deviation is 75 kHz, and the station is stereo highest modulation frequency caused by stereo multiplexing is 53 kHz. Thus (2*75)+(2*53)+(2*1)= 258 kHz occupied bandwidth.

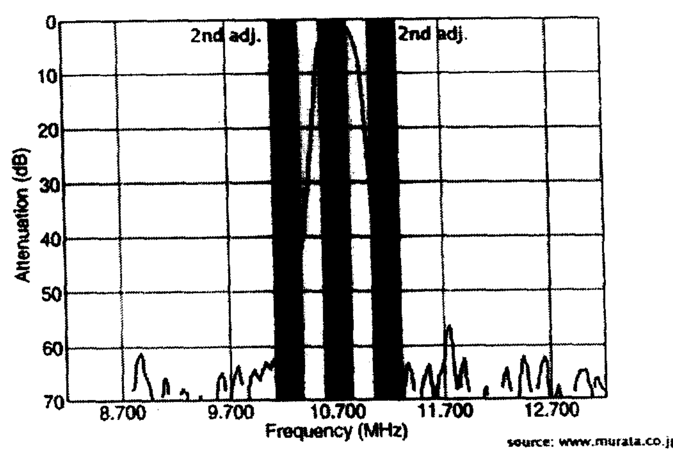


The chart is a graph of the same part showing a wider frequency range. It shows how at 400 khz (2nd adjacent) from the center of the desired channel, spurious signals will be at least 25db down at 10.580 mHz and over 30db down at 10.820 mHz.

For a few cents more cost, an FM receiver manufacturer might chose a better part such as the Murata SFT10.7MA5-A[4] shown below. This higher quality IF ceramic filter provides much better rejection of adjacent channel signals.

Here, 2nd adjacent signal rejection is over 55db down below the desired channel and over 45db down above the channel. In most FM receivers two ceramic filters are employed, effectively doubling the adjacent channel rejection figures in both examples shown above.





[4] Murata is one of the major consumer filter suppliers. Their parts catalog is on line. To find this one go to the Murata search engine at http://www.murata.co.jp/search/pn-e.html, type in sft10.7ma5-a. Charts shown here are Spurious Response and Frequency Characteristics.

EXHIBIT C

Spectrum Efficiency

§ 307 (b) of the Communications Act of 1934 call on the Commission "...to provide a fair, efficient, and equitable distribution of radio" ... licenses. Below we have tabulations showing the "efficiency" of current FM allocations. Efficiency is defined herein as that area over which FM stations provide service, divided by the area the same station, or class of stations preclude service by other stations.

The NAB and others claim that low power FM stations make less efficient use of the spectrum than higher power stations.

Where one signal might cause interference to another, there will be areas of service and interference. If the new signal is well within the existing service area of the existing signal, then there will be a certain area of new service provided by the new signal, and reduction in service area provided by the existing signal due to interference. For the sake of analysis we can call the new signal Undesired, and the existing signal Desired. Service is defined to be provided where the desired signal is strong enough to overcome natural background noise (noise limited service) in the absence of interference, and strong enough to overcome any interfering signals (interference limited service). Where service is limited by interference, we can define the ratio of desired signal strength over undesired signal strength required to provide service.

Spectrum efficiency is highly correlated to the desired/undesired ratio (D/U radio) required to provide service. For example, imagine that the ratio is 1/1,[5] and you propose to place a new 10 watt station two kilometers from a 100 kilowatt station. Your little station would punch a hole in the service area of the existing station, and both stations would have interference limited coverage, especially the little station. However, because the D/U ratio is 1/1, your new 10 watt signal provides new service to that exact area the big station is caused destructive interference. Net service, or spectrum efficiency, remains the same.

If we could figure out a modulation method that results in a 1/1 D/U ratio, and if all stations were interference limited, spectrum efficiency would be 100%[6]. This would be so because in every place a radio would pick up the one station providing the strongest signal, and ignore all weaker signals.

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5 A one to one D/U ratio is not impossible. Some types of modulation can have better co-channel efficiency than one to one! For example, spread spectrum modulation can allow several signals to be heard by the same radio, even though all are on exactly the same frequency and equally strong. Spread spectrum radio channels are, by definition, much wider, so overall resulting spectrum efficiency might be not be better than conventional narrow band communication.

6 A properly coded digital signal might result in a D/U ratio of 1/1 in the bandwidth now occupied by an FM broadcast station. But that is another issue for another petition on another day.

Defined D/U ratios in FM broadcast service are far less than 100% efficient.[7] §73.509 (b) show the values used to build the commercial table of allotments. In millivolts per meter, Co-channel FM D/U ratios are 10/1, 1st adjacent is 2/1, 2nd adjacent is 1/10 and third adjacent is 1/100.[8]

As you can see, using the quality of service as defined in FCC rules, FM broadcast co-channel and second adjacent D/U ratios result in much less than 100% spectrum efficiency. However 2nd and 3rd adjacent ratios, which allow both desired and undesired signals to provide service to some of the same area are more than 100% efficient.

Table of Co-Channel Efficiencies

We have computed the efficiency of the present allocation scheme. We have used the FCC FM engineering database to analyze all commercial band licenses. We looked at the ERP and HAAT of each, and computed the relevant distance to service contour using the FCC distance to contour algorithm, TVFMFS. We compared the actual service contour to the contour for a station of the same class running at maximum facilities for the class.

```
                    count: Total number of licensed stations
         average ERP (kW): Average ERP for all stations of that class.
     average HAAT (meters): Average HAAT for all stations of that class.
average Coverage area (sq kM): Sum of the area within the protected contour/#stations.
 class protected area (sq kM): Area with protected contour for maximum facility station.
efficiency of protected usage: Average coverage area/class protected area
     class table area (sq kM): Area within circle of 1/2 separation distance same class.4
               efficiency: Protected-service area/preclusion area
```

	A	B	B1	C	C1	C2	C3	Micropower
count	2403	903	137	857	729	512	463	n/a
average ERP (kW)	3.20	32.61	10.62	84.39	86.18	35.93	14.65	0.001
average HAAT (meters)	121.54	257.98	192.33	452.57	213.91	188.26	142.15	30.00
average Coverage area (sq kM)	1,899.05	9,002.34	4,274.21	19,773.78	11,904.91	7,621.02	4,257.61	10.64
class protected area (sq kM)	2,515.29	8,558.89	4,798.32	26,485.37	16,424.51	8,558.89	4,798.32	10.64
efficiency of protected usage	75.50%	105.18%	89.08%	74.66%	72.48%	89.04%	88.73%	n/a
class table area (sq kM)	10,386.89	45,616.71	24,052.82	66,051.99	47,143.52	28,352.87	18,385.39	44.18
efficiency of separated usage	18.28%	19.73%	17.77%	29.94%	25.25%	26.88%	23.16%	24.00%

base data: fcc fm database 7/22/1998

In general , we can expect higher efficiency where the reach of an interfering signal is limited by a distant radio horizon. The horizon can still forward scatter some signal, so it helps efficiency if the signal is weakened by the time it reaches the horizon. This case is exemplified by class C service, where efficiency is

7 In fact, defined service contour values and interference values are administrative maters that attempt to guarantee a consistent quality of service to the radio spectrum user based upon some engineering criteria and propagation models.

8 Normally broadcast engineers use dbu or millivolts per meter (mV/m) to describe field strength. These different units of measurements should be converted to power to fully grasp what is being described. A real radio responds to power. To convert to power, ratios expressed in mV/m must be squared. Thus FM co-channel field density D/U power ratios are co channel= 100/1, first adjacent= 4/1, second adjacent= 1/100, and third adjacent= 1/10,000. In other words, using FCC rules as a guide, interference is caused a desired station when an undesired third adjacent signal is ten thousand times more powerful.

higher. Note that class A service is already such a low power that no efficiency can be provided by the radio horizon. Lowering the power to less than class A would not reduce efficiency.

For purposes of comparison we have assumed a fully packed LPFM Micropower service at one watt ERP and 30.48 meters HAAT (100 feet). 1 mV/m F50/50 service distance is 1.84 km, while the interference .1 mV/m F50/10 distance would be 5.68 km. Using the same techniques to determine efficiency, such an LPFM service would be 24% efficient, not very different from existing low powered classes.

CERTIFICATION OF SERVICE

I, Wolfgang V Kurtz, do hereby certify that a true and correct copy of the foregoing "Reply-Comments on Proposals for the Creation of a Low-Power FM Broadcast Service, RM-9208 and RM-9242" was sent via first class mail, this 23nd day of July, 1998, to the following parties:

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