

*NRSC  
GUIDELINE*

# NATIONAL RADIO SYSTEMS COMMITTEE

**NRSC-G202  
FM IBOC Total Digital Sideband  
Power for Various Configurations  
September, 2010**



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## **FOREWORD**

FM radio broadcasters in the U.S. have been authorized to transmit hybrid IBOC digital radio signals since 2002. Under the initial authorization, and for the first five years of IBOC operations, the sole (total) digital sideband power level authorized was at -20 dBc with respect to the analog FM signal. More recent FCC Orders, in 2007 and 2010, have authorized additional modes of operations and power levels, resulting in a plethora of authorized power levels depending upon the selected configuration.

The purpose of this NRSC Guideline is to give broadcast engineers an easy-to-use, quick method for determining an FM IBOC station's authorized digital sideband power level based upon the station's operational configuration. This document is a companion to another NRSC Guideline, NRSC-G201-A, and in fact expands upon information contained in Annex 1 of that document.

This NRSC Guideline is the work product of the IBOC Standards Development Working Group (ISDWG), a subgroup of the Digital Radio Broadcasting (DRB) Subcommittee of the NRSC. At the time of first adoption of this Guideline, the ISDWG was chaired by Dom Bordonaro, Cox Radio, and the DRB Subcommittee was co-chaired by Mike Bergman, JVC Kenwood Corporation, and Andy Laird, Journal Broadcast Group. The NRSC chairman at the time of first adoption was Milford Smith, Greater Media, Inc.

The NRSC is jointly sponsored by the Consumer Electronics Association and the National Association of Broadcasters. It serves as an industry-wide standards-setting body for technical aspects of terrestrial over-the-air radio broadcasting systems in the United States.

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## FM IBOC TOTAL DIGITAL SIDEBAND POWER FOR VARIOUS CONFIGURATIONS

### 1 SCOPE

This document provides a compilation of total digital sideband power levels for various hybrid and extended hybrid FM IBOC configurations. It also presents a chart relating digital sideband power levels to corresponding spectrum analyzer power spectral density (PSD) values in accordance with NRSC-G201-A. This document is intended as an aid to those who are responsible for or involved with FM IBOC facility design, operation, and compliance monitoring.

### 2 REFERENCES

#### 2.1 Normative References

This is an informative specification. There are no normative references.

#### 2.2 Informative References

The following references contain information that may be useful to those implementing this Guideline document. At the time of publication the editions indicated were valid. All standards are subject to revision, and users of this Guideline document are encouraged to investigate the possibility of applying the most recent editions of the standards listed below.

- [1] *NRSC-5-B, In-band/on-channel Digital Radio Broadcasting Standard*, National Radio Systems Committee, April 2008
- [2] *NRSC-G201-A, NRSC-5 RF Mask Compliance: Measurement Methods and Practice*, National Radio Systems Committee, April 2010
- [3] *Code of Federal Regulations (CFR) 47, Part 73, Subpart C – Digital Audio Broadcasting*, Office of the Federal Register, National Archives and Records Administration
- [4] *FCC DA 10-208, Order* [Permitting FM stations to voluntarily increase FM hybrid digital ERP], Media Bureau, adopted January 27, 2010
- [5] *FCC 07-33, Digital Audio Broadcasting Systems and Their Impact on the Terrestrial Radio Broadcast Service, Second Report and Order, First Order on Reconsideration and Second Further Notice of Proposed Rule Making* [Permitting FM stations to broadcast in extended hybrid modes], adopted March 22, 2007
- [6] *FCC 02-286, Digital Audio Broadcasting Systems and Their Impact on the Terrestrial Radio Broadcast Service, First Report and Order* [Original IBOC authorization], adopted October 10, 2002

#### 2.3 Symbols and abbreviations

In this Guideline the following abbreviations are used:

<b>D-A</b>	Digital-to-Analog
<b>ERP</b>	Effective Radiated Power
<b>FCC</b>	Federal Communications Commission (U.S.)
<b>FM</b>	Frequency Modulation

**IBOC** In-Band/On-Channel

## 2.4 Definitions

In this Guideline the following definitions are used:

<b>Asymmetric sidebands</b>	Refers to an FM hybrid or extended hybrid IBOC configuration in which the upper and lower digital sidebands of the IBOC signal are at different power levels. Asymmetric sidebands are utilized when one sideband must be kept lower than the other sideband in order to protect a radio station on an adjacent frequency.
<b>Digital sideband</b>	The digital portion of an FM hybrid or extended hybrid IBOC signal consists of groups of digitally modulated subcarriers located on either side (in frequency) of the analog portion. These subcarriers are organized into groups called digital sidebands. There are two types of digital sidebands defined for IBOC signals, primary and secondary, however hybrid and extended hybrid IBOC signals only utilize primary (all-digital IBOC signals utilize both primary and secondary digital sidebands). These primary digital sidebands are further subdivided into main and extended portions. Digital sidebands are also distinguished by their relative position (in frequency) to the analog (host) signal—if they are higher in frequency they are called upper digital sidebands, and if lower in frequency, lower digital sidebands.
<b>Digital subcarrier</b>	The digital portion of an FM IBOC signal utilizes orthogonal frequency division multiplexing (OFDM), a digital modulation technique that uses groups of orthogonal digital subcarriers which are transmitted simultaneously. In the IBOC system, the individual digital subcarriers are organized into groups called digital sidebands.
<b>Extended hybrid waveform</b>	A transmitted waveform for modes composed of the analog FM signal plus digitally modulated primary main subcarriers and some or all primary extended subcarriers. This waveform will normally be used by broadcasters requiring additional digital capacity over that provided by the hybrid mode of operation (provides up to approximately 50 kbps additional capacity).
<b>Hybrid waveform</b>	A transmitted waveform for modes composed of the analog-modulated signal, plus digitally modulated primary main subcarriers.
<b>RF mask</b>	The graphical representation of the allowable RF signal power spectral density (relative to a specific bandwidth) versus frequency for an RF transmission. Typically, the power values are indicated relative to the power of an unmodulated signal at the center frequency of the signal.
<b>Service mode</b>	There are four service modes defined for FM hybrid and extended hybrid IBOC transmissions. MP1 (hybrid IBOC) is the base service mode (the one originally authorized by the FCC in 2002) and is characterized by having a 98 kbps throughput and a digital sideband bandwidth of approximately 70 kHz (each). The other three service modes, MP2, MP3, and MP11 (extended hybrid IBOC), have throughputs of 110, 123,

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and 148 kbps, respectively, and digital sideband bandwidths of approximately 76, 83, and 97 kHz (each), respectively. These extended hybrid IBOC service modes were authorized by the FCC in 2007.

### **Spectrum analyzer**

An instrument used to characterize the amplitude (power) versus frequency characteristics of a signal.

### **Symmetric sidebands**

Refers to an FM hybrid or extended hybrid IBOC configuration in which the upper and lower digital sidebands of the IBOC signal are at the same power levels. This is the default (nominal) configuration for all FM IBOC transmissions. In this case, the power of each sideband (*e.g.*, -23 dBc) sums to a total power that is double the power of the individual sidebands (*e.g.*, -20 dBc).

### 3 BACKGROUND

When the FCC first authorized FM IBOC digital radio in October 2002, only the hybrid (MP1) service mode was available, and only at a total digital sideband power level of -20 dBc (*i.e.*, 1% of analog power).<sup>1</sup> As a result, references to FM IBOC digital power in the majority of FCC Rules, Orders, and Notices have pertained only to this -20 dBc level. When the extended hybrid (MP2, MP3, and MP11) service modes were authorized (mid-2007), it became possible to activate additional digital subcarriers (over those available in hybrid IBOC mode), resulting in increased digital signal power over that generated in the MP1 service mode of operation.<sup>2</sup>

Then, in January 2010, the FCC authorized FM IBOC stations to operate digital sidebands at elevated power levels.<sup>3</sup> Further complicating matters is the expected FCC authorization of asymmetric sideband operation for cases where one sideband must be kept lower than the other sideband in order to protect a radio station on an adjacent frequency. One consequence of these actions is that the authorized total digital sideband power for an FM IBOC signal is no longer simply -20 dBc but will vary depending upon the specific configuration in use.

The tables in Section 4 of this Guideline identify the authorized total digital sideband power (ERP) in both dBc and percent (with respect to the analog FM signal) for various hybrid and extended hybrid FM IBOC configurations, with either symmetric or asymmetric sidebands.

The table in Section 5 of this Guideline lists digital sideband power spectral density levels corresponding to digital sideband power ratios for various configurations when observed on a spectrum analyzer in accordance with NRSC-G201-A, *NRSC-5 RF Mask Compliance: Measurement Methods and Practice*.

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<sup>1</sup> See [6].

<sup>2</sup> Details on the FCC authorization of extended hybrid IBOC may be found in [5].

<sup>3</sup> Details on the FCC authorization of elevated digital sideband power levels may be found in [4].



**4 DETERMINING AUTHORIZED TOTAL DIGITAL SIDEBAND POWER**

To determine the authorized total digital sideband Effective Radiated Power (ERP) with respect to the licensed analog ERP for an FM hybrid or extended hybrid IBOC signal, follow these steps:

- 1) Identify the station’s particular digital sideband configuration, specifically;
  - a. service mode (MP1, MP2, MP3, or MP11)
  - b. sideband power levels (utilizing either symmetric or asymmetric configurations)
- 2) Look up the configuration of interest in the tables below and read the nominal total ERP of the digital signal with respect to the licensed analog ERP in either dBc or percent, using the appropriate table:

SIDEBAND CONFIGURATION	SERVICE MODE(S)	TABLE	PAGE
Symmetric	MP1, MP2, MP3, or MP11	Table 1	10
Asymmetric	MP1	Table 2	11
	MP2	Table 3	12
	MP3	Table 4	13
	MP11	Table 5	14

- 3) Further calculations must be made from the dBc values obtained from Tables 1-5 to determine the actual power output of the digital transmitter (in watts), or the total power of the IBOC signal (analog and digital power combined). These calculations will be site-specific and will depend upon the particulars of the IBOC transmission facility.

**Table 1. Symmetric (Equal) Sidebands**

**Total digital sideband ERP (% of Analog)**

Nominal (total) D-A power ratio (dBc), MP1	Service mode				Comments
	MP1	MP2	MP3	MP11	
-20	1.00%	1.10%	1.20%	1.40%	FCC notification required (some exceptions apply)†
-19	1.26%	1.38%	1.51%	1.76%	
-18	1.58%	1.74%	1.90%	2.22%	
-17	2.00%	2.19%	2.39%	2.79%	
-16	2.51%	2.76%	3.01%	3.51%	
-15	3.16%	3.48%	3.79%	4.42%	
-14	3.98%	4.38%	4.77%	5.57%	FCC informal application required†
-13	5.01%	5.51%	6.01%	7.01%	
-12	6.31%	6.94%	7.56%	8.82%	
-11	7.94%	8.73%	9.52%	11.10%	
-10	10.00%	10.99%	11.99%	13.98%	

†See Annex 1

**Total digital sideband ERP (dBc ref. to Analog)**

Nominal (total) D-A power ratio (dBc), MP1	Service mode				Comments
	MP1	MP2	MP3	MP11	
-20	-20.0	-19.6	-19.2	-18.5	FCC notification required (some exceptions apply)†
-19	-19.0	-18.6	-18.2	-17.5	
-18	-18.0	-17.6	-17.2	-16.5	
-17	-17.0	-16.6	-16.2	-15.5	
-16	-16.0	-15.6	-15.2	-14.5	
-15	-15.0	-14.6	-14.2	-13.5	
-14	-14.0	-13.6	-13.2	-12.5	FCC informal application required†
-13	-13.0	-12.6	-12.2	-11.5	
-12	-12.0	-11.6	-11.2	-10.5	
-11	-11.0	-10.6	-10.2	-9.5	
-10	-10.0	-9.6	-9.2	-8.5	

†See Annex 1

**Table 2. Asymmetric Sidebands, Service Mode MP1**

**Note:** as of the date of adoption of this Guideline, operation with asymmetric sidebands requires an experimental authorization from the FCC. This note will be removed from this Guideline should the FCC approve asymmetrical sideband operation.

**Total Digital Sideband ERP (% of Analog): Service Mode MP1**

*Note: numbers in parentheses are corresponding total sideband power in symmetric case*

Lower Power Sideband (dBc)	Higher Power Sideband (dBc)										
	-23 (-20)	-22 (-19)	-21 (-18)	-20 (-17)	-19 (-16)	-18 (-15)	-17 (-14)	-16 (-13)	-15 (-12)	-14 (-11)	-13 (-10)
-23 (-20)	1.00%	1.13%	1.29%	1.50%	1.76%	2.08%	2.49%	3.01%	3.65%	4.47%	5.50%
-22 (-19)		1.26%	1.42%	1.63%	1.89%	2.21%	2.62%	3.14%	3.78%	4.60%	5.63%
-21 (-18)			1.58%	1.79%	2.05%	2.37%	2.78%	3.30%	3.95%	4.76%	5.79%
-20 (-17)				2.00%	2.25%	2.58%	2.99%	3.50%	4.15%	4.97%	6.00%
-19 (-16)					2.51%	2.84%	3.25%	3.76%	4.41%	5.23%	6.26%
-18 (-15)						3.16%	3.57%	4.09%	4.74%	5.55%	6.58%
-17 (-14)							3.98%	4.50%	5.15%	5.96%	6.99%
-16 (-13)								5.01%	5.66%	6.48%	7.51%
-15 (-12)									6.31%	7.13%	8.15%
-14 (-11)										7.94%	8.97%
-13 (-10)											10.00%

**Total Digital Sideband ERP (dBc ref. to Analog): Service Mode MP1**

*Note: numbers in parentheses are corresponding total sideband power in symmetric case*

Lower Power Sideband (dBc)	Higher Power Sideband (dBc)										
	-23 (-20)	-22 (-19)	-21 (-18)	-20 (-17)	-19 (-16)	-18 (-15)	-17 (-14)	-16 (-13)	-15 (-12)	-14 (-11)	-13 (-10)
-23 (-20)	-20.0	-19.5	-18.9	-18.2	-17.6	-16.8	-16.0	-15.2	-14.4	-13.5	-12.6
-22 (-19)		-19.0	-18.5	-17.9	-17.2	-16.6	-15.8	-15.0	-14.2	-13.4	-12.5
-21 (-18)			-18.0	-17.5	-16.9	-16.2	-15.6	-14.8	-14.0	-13.2	-12.4
-20 (-17)				-17.0	-16.5	-15.9	-15.2	-14.6	-13.8	-13.0	-12.2
-19 (-16)					-16.0	-15.5	-14.9	-14.2	-13.6	-12.8	-12.0
-18 (-15)						-15.0	-14.5	-13.9	-13.2	-12.6	-11.8
-17 (-14)							-14.0	-13.5	-12.9	-12.2	-11.6
-16 (-13)								-13.0	-12.5	-11.9	-11.2
-15 (-12)									-12.0	-11.5	-10.9
-14 (-11)										-11.0	-10.5
-13 (-10)											-10.0

**Table 3. Asymmetric Sidebands, Service Mode MP2**

**Note:** as of the date of adoption of this Guideline, operation with asymmetric sidebands requires an experimental authorization from the FCC. This note will be removed from this Guideline should the FCC approve asymmetrical sideband operation.

**Total Digital Sideband ERP (% of Analog): Service Mode MP2**

*Note: numbers in parentheses are corresponding total sideband power in symmetric case*

Lower Power Sideband (dBc)	Higher Power Sideband (dBc)										
	-23 (-20)	-22 (-19)	-21 (-18)	-20 (-17)	-19 (-16)	-18 (-15)	-17 (-14)	-16 (-13)	-15 (-12)	-14 (-11)	-13 (-10)
-23 (-20)	1.10%	1.24%	1.42%	1.65%	1.93%	2.29%	2.74%	3.30%	4.02%	4.92%	6.05%
-22 (-19)		1.38%	1.56%	1.79%	2.07%	2.43%	2.88%	3.45%	4.16%	5.06%	6.19%
-21 (-18)			1.74%	1.97%	2.25%	2.61%	3.06%	3.63%	4.34%	5.24%	6.37%
-20 (-17)				2.19%	2.48%	2.84%	3.29%	3.85%	4.57%	5.46%	6.59%
-19 (-16)					2.76%	3.12%	3.57%	4.14%	4.85%	5.75%	6.88%
-18 (-15)						3.48%	3.93%	4.49%	5.21%	6.11%	7.24%
-17 (-14)							4.38%	4.94%	5.66%	6.56%	7.69%
-16 (-13)								5.51%	6.22%	7.12%	8.25%
-15 (-12)									6.94%	7.84%	8.97%
-14 (-11)										8.73%	9.86%
-13 (-10)											10.99%

**Total Digital Sideband ERP (dBc ref. to Analog): Service Mode MP2**

*Note: numbers in parentheses are corresponding total sideband power in symmetric case*

Lower Power Sideband (dBc)	Higher Power Sideband (dBc)										
	-23 (-20)	-22 (-19)	-21 (-18)	-20 (-17)	-19 (-16)	-18 (-15)	-17 (-14)	-16 (-13)	-15 (-12)	-14 (-11)	-13 (-10)
-23 (-20)	-19.6	-19.1	-18.5	-17.8	-17.1	-16.4	-15.6	-14.8	-14.0	-13.1	-12.2
-22 (-19)		-18.6	-18.1	-17.5	-16.8	-16.1	-15.4	-14.6	-13.8	-13.0	-12.1
-21 (-18)			-17.6	-17.1	-16.5	-15.8	-15.1	-14.4	-13.6	-12.8	-12.0
-20 (-17)				-16.6	-16.1	-15.5	-14.8	-14.1	-13.4	-12.6	-11.8
-19 (-16)					-15.6	-15.1	-14.5	-13.8	-13.1	-12.4	-11.6
-18 (-15)						-14.6	-14.1	-13.5	-12.8	-12.1	-11.4
-17 (-14)							-13.6	-13.1	-12.5	-11.8	-11.1
-16 (-13)								-12.6	-12.1	-11.5	-10.8
-15 (-12)									-11.6	-11.1	-10.5
-14 (-11)										-10.6	-10.1
-13 (-10)											-9.6

**Table 4. Asymmetric Sidebands, Service Mode MP3**

**Note:** as of the date of adoption of this Guideline, operation with asymmetric sidebands requires an experimental authorization from the FCC. This note will be removed from this Guideline should the FCC approve asymmetrical sideband operation.

**Total Digital Sideband ERP (% of Analog): Service Mode MP3**

*Note: numbers in parentheses are corresponding total sideband power in symmetric case*

Lower Power Sideband (dBc)	Higher Power Sideband (dBc)										
	-23 (-20)	-22 (-19)	-21 (-18)	-20 (-17)	-19 (-16)	-18 (-15)	-17 (-14)	-16 (-13)	-15 (-12)	-14 (-11)	-13 (-10)
-23 (-20)	1.20%	1.35%	1.55%	1.80%	2.11%	2.50%	2.99%	3.60%	4.38%	5.36%	6.59%
-22 (-19)		1.51%	1.70%	1.95%	2.26%	2.65%	3.14%	3.76%	4.54%	5.52%	6.75%
-21 (-18)			1.90%	2.15%	2.46%	2.85%	3.34%	3.95%	4.73%	5.71%	6.94%
-20 (-17)				2.39%	2.70%	3.09%	3.58%	4.20%	4.98%	5.96%	7.19%
-19 (-16)					3.01%	3.40%	3.89%	4.51%	5.29%	6.27%	7.50%
-18 (-15)						3.79%	4.28%	4.90%	5.68%	6.66%	7.89%
-17 (-14)							4.77%	5.39%	6.17%	7.15%	8.38%
-16 (-13)								6.01%	6.79%	7.77%	9.00%
-15 (-12)									7.56%	8.54%	9.78%
-14 (-11)										9.52%	10.76%
-13 (-10)											11.99%

**Total Digital Sideband ERP (dBc ref. to Analog): Service Mode MP3**

*Note: numbers in parentheses are corresponding total sideband power in symmetric case*

Lower Power Sideband (dBc)	Higher Power Sideband (dBc)										
	-23 (-20)	-22 (-19)	-21 (-18)	-20 (-17)	-19 (-16)	-18 (-15)	-17 (-14)	-16 (-13)	-15 (-12)	-14 (-11)	-13 (-10)
-23 (-20)	-19.2	-18.7	-18.1	-17.5	-16.8	-16.0	-15.2	-14.4	-13.6	-12.7	-11.8
-22 (-19)		-18.2	-17.7	-17.1	-16.5	-15.8	-15.0	-14.2	-13.4	-12.6	-11.7
-21 (-18)			-17.2	-16.7	-16.1	-15.5	-14.8	-14.0	-13.2	-12.4	-11.6
-20 (-17)				-16.2	-15.7	-15.1	-14.5	-13.8	-13.0	-12.2	-11.4
-19 (-16)					-15.2	-14.7	-14.1	-13.5	-12.8	-12.0	-11.2
-18 (-15)						-14.2	-13.7	-13.1	-12.5	-11.8	-11.0
-17 (-14)							-13.2	-12.7	-12.1	-11.5	-10.8
-16 (-13)								-12.2	-11.7	-11.1	-10.5
-15 (-12)									-11.2	-10.7	-10.1
-14 (-11)										-10.2	-9.7
-13 (-10)											-9.2

**Table 5. Asymmetric Sidebands, Service Mode MP11**

**Note: as of the date of adoption of this Guideline, operation with asymmetric sidebands requires an experimental authorization from the FCC. This note will be removed from this Guideline should the FCC approve asymmetrical sideband operation.**

**Total Digital Sideband ERP (% of Analog): Service Mode MP11**

*Note: numbers in parentheses are corresponding total sideband power in symmetric case*

Lower Power Sideband (dBc)	Higher Power Sideband (dBc)										
	-23 (-20)	-22 (-19)	-21 (-18)	-20 (-17)	-19 (-16)	-18 (-15)	-17 (-14)	-16 (-13)	-15 (-12)	-14 (-11)	-13 (-10)
-23 (-20)	1.40%	1.58%	1.81%	2.09%	2.45%	2.91%	3.48%	4.20%	5.11%	6.25%	7.69%
-22 (-19)		1.76%	1.99%	2.27%	2.64%	3.09%	3.66%	4.38%	5.29%	6.43%	7.87%
-21 (-18)			2.22%	2.50%	2.86%	3.32%	3.89%	4.61%	5.52%	6.66%	8.10%
-20 (-17)				2.79%	3.15%	3.60%	4.18%	4.90%	5.80%	6.95%	8.38%
-19 (-16)					3.51%	3.97%	4.54%	5.26%	6.17%	7.31%	8.75%
-18 (-15)						4.42%	4.99%	5.71%	6.62%	7.76%	9.20%
-17 (-14)							5.57%	6.29%	7.19%	8.33%	9.77%
-16 (-13)								7.01%	7.91%	9.06%	10.49%
-15 (-12)									8.82%	9.96%	11.40%
-14 (-11)										11.10%	12.54%
-13 (-10)											13.98%

**Total Digital Sideband ERP (dBc ref. to Analog): Service Mode MP11**

*Note: numbers in parentheses are corresponding total sideband power in symmetric case*

Lower Power Sideband (dBc)	Higher Power Sideband (dBc)										
	-23 (-20)	-22 (-19)	-21 (-18)	-20 (-17)	-19 (-16)	-18 (-15)	-17 (-14)	-16 (-13)	-15 (-12)	-14 (-11)	-13 (-10)
-23 (-20)	-18.5	-18.0	-17.4	-16.8	-16.1	-15.4	-14.6	-13.8	-12.9	-12.0	-11.1
-22 (-19)		-17.5	-17.0	-16.4	-15.8	-15.1	-14.4	-13.6	-12.8	-11.9	-11.0
-21 (-18)			-16.5	-16.0	-15.4	-14.8	-14.1	-13.4	-12.6	-11.8	-10.9
-20 (-17)				-15.5	-15.0	-14.4	-13.8	-13.1	-12.4	-11.6	-10.8
-19 (-16)					-14.5	-14.0	-13.4	-12.8	-12.1	-11.4	-10.6
-18 (-15)						-13.5	-13.0	-12.4	-11.8	-11.1	-10.4
-17 (-14)							-12.5	-12.0	-11.4	-10.8	-10.1
-16 (-13)								-11.5	-11.0	-10.4	-9.8
-15 (-12)									-10.5	-10.0	-9.4
-14 (-11)										-9.5	-9.0
-13 (-10)											-8.5

## 5 EXPECTED DIGITAL SIDEBAND POWER SPECTRAL DENSITY (PSD) FOR VARIOUS CONFIGURATIONS

Broadcasters typically verify the digital sideband levels of an FM IBOC transmission using a spectrum analyzer. Guideline NRSC-G201-A (*NRSC-5 RF Mask Compliance: Measurement Methods and Practice*) provides detailed information on how to make these measurements. Table 6 below lists the expected digital sideband power spectral density (PSD) levels as observed on a spectrum analyzer (using the methods of NRSC-G201-A) for digital sideband power ratios from -20 dBc to -10 dBc.

Note that while, as shown in Table 1 through Table 5 above, the total digital power in the sidebands varies with service mode, the corresponding PSD values for the digital sidebands do not vary as a function of service mode. Consequently, the values in Table 6 apply to all four service modes.

To illustrate this, consider symmetric sideband configurations based upon an MP1 total digital power of -14 dBc. For these configurations, the total digital power varies from -14.0 dBc (MP1), to -13.6 dBc (MP2), to -13.2 dBc (MP3), to -12.5 dBc (MP11), however, in all of these cases the power spectral density of each digital sideband is constant and equal to (from Table 6) -35.4 dBc/kHz. This is because the additional digital power in the extended hybrid service modes (MP2, MP3, and MP11) results from adding additional digital subcarriers (with a resulting increase in digital sideband bandwidth), with the power in each individual digital subcarrier (and thus the power spectral density) remaining constant and equal to that used in the MP1 service mode.

To use Table 6:

- 1) Determine the desired power ratio (relative to analog, in dBc) of the digital sideband to be measured:
  - a) in symmetric sideband cases, simply use the nominal (total) power ratio (typically from -20 dBc to -10 dBc);
  - b) in asymmetric sideband cases, use the corresponding total sideband power in the symmetric case, not the actual sideband power level. Referring to Tables 2-5, this means that the numbers in italics, in parentheses, are the numbers to use here.
- 2) Using Table 6, read the nominal digital sideband PSD relative to analog ERP corresponding to the desired digital sideband power ratio.
- 3) If setting an RF mask value ("limit line") in the spectrum analyzer for this particular configuration, use the "Upper Limit" indicated in the table corresponding to the desired digital sideband power ratio.
- 4) Note that for asymmetric sideband configurations, the expected sideband PSD and RF mask levels will be different for upper and lower digital sidebands.

**Table 6.** Digital Sideband Power Spectral Density (PSD) and Limit Line Values Based on D-A Ratio (MP1, MP2, MP3, MP11)

<b>Digital sideband D-A power ratio relative to analog (dBc)</b>	<b>Nominal digital sideband PSD relative to analog ERP (dBc/kHz)</b>	<b>Upper limit of digital sideband PSD based on original RF mask (dBc/kHz)</b>	<b>Comments</b>
-20	-41.4	-40.0†	Minimum allowed power
-19	-40.4	-39.0	
-18	-39.4	-38.0	
-17	-38.4	-37.0	
-16	-37.4	-36.0	
-15	-36.4	-35.0	
-14	-35.4	-34.0	Blanket authorization power
-13	-34.4	-33.0	
-12	-33.4	-32.0	
-11	-32.4	-31.0	
-10	-31.4	-30.0	Maximum allowed power

†Note that this is the original RF mask level specified in NRSC-5



**ANNEX 1 – FCC Order DA 10-208**

Permitting FM stations to voluntarily increase FM hybrid digital ERP  
(adopted January 27, 2010)

Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of
Digital Audio Broadcasting Systems
And Their Impact on the Terrestrial
Radio Broadcast Service
MM Docket No. 99-325

ORDER

Adopted: January 27, 2010

Released: January 29, 2010

By the Chief, Media Bureau:

I. INTRODUCTION

1. In this Order, the Media Bureau ("Bureau") adopts changes in our digital audio broadcasting ("DAB") technical rules to permit FM stations to voluntarily increase FM hybrid digital effective radiated power ("FM Digital ERP") from the current maximum permissible level of one percent of authorized analog effective radiated power ("FM Analog ERP") up to a maximum of ten percent of authorized FM Analog ERP. In addition, we are simultaneously implementing interference mitigation and remediation procedures to resolve promptly allegations of digital interference to an authorized full-service FM analog facility resulting from an FM Digital ERP power increase undertaken pursuant to the procedures adopted in this Order.

II. BACKGROUND

2. In the First Report and Order, the Commission adopted the FM in-band on-channel ("IBOC") DAB system developed by iBiquity Digital Corporation ("iBiquity") as the de facto standard for FM station digital operations. The iBiquity FM IBOC DAB system was designed to operate as a hybrid digital system (simultaneous transmission of both the analog and digital signals), and also in the extended hybrid digital and all-digital modes. The Commission initially limited digital operations to the hybrid digital mode. This mode permits the simultaneous transmission of both the analog and digital signals within the current spectral emissions mask of a single FM channel, placing the digital information on frequencies immediately adjacent to the analog signal. The digital signals are transmitted using

1 See Digital Audio Broadcasting Systems and Their Impact on the Terrestrial Radio Broadcast Service, Second Report and Order, First Order on Reconsideration and Second Further Notice of Proposed Rule Making, 22 FCC Rcd 10344, 10395 (2007) ("Second Report and Order") (delegating authority to the Media Bureau to amend licensing requirements, generate new forms, establish interference dispute resolution procedures, and update notification procedures for authorizing new in-band, on-channel technical configurations).

2 See Digital Audio Broadcasting Systems and Their Impact on the Terrestrial Radio Broadcast Service, First Report and Order, 17 FCC Rcd 19990 (2002) ("First Report and Order").

3 The extended hybrid mode adds an additional 50 kbps to the 96 kbps digital capacity of the hybrid mode. See Second Report and Order, 22 FCC Rcd at 10352.

4 The Commission subsequently authorized use of the FM IBOC extended hybrid digital mode. See id.

orthogonal frequency division multiplexing. An original goal of the developers of the hybrid FM IBOC DAB system was replication of FM analog coverage without adversely affecting either the host analog signal or adjacent channel analog FM operations.<sup>5</sup> iBiquity and several independent parties conducted extensive field and laboratory tests. Based on the National Radio Systems Committee (“NRSC”)<sup>6</sup> evaluation of those test results, iBiquity requested and the NRSC approved an FM Digital ERP of one percent of FM Analog ERP (20 decibels below carrier (-20 dBc)). Subsequently, the Commission adopted this digital power level for the hybrid digital mode of its FM IBOC DAB system in the DAB *First Report and Order*.<sup>7</sup>

3. Many FM stations promptly commenced hybrid FM IBOC operations. Despite the rigorous testing, it soon became apparent that hybrid FM IBOC digital coverage often did not replicate analog coverage, especially in mobile and indoor environments. Many FM station licensees attributed these reception problems to the extremely low permissible FM Digital ERP. Encouraged by the lack of interference from hybrid FM IBOC operations, a substantial number of early FM licensee adopters and iBiquity concluded that an increase in FM Digital ERP would likely ameliorate, if not completely resolve, reception deficiencies, while still providing adequate protection to the host station and nearby adjacent channel stations. Thereafter, iBiquity embarked on testing to determine the level of FM Digital ERP that would improve FM digital coverage while not adversely affecting existing analog FM operations.

4. In 2007, at the request of individual station licensees, the Commission issued nine authorizations for testing with FM Digital ERP up to 10 dB higher than currently authorized. These experimental authorizations complied with the Commission’s FM emissions mask.<sup>8</sup> The station licensees conducted the testing in concert with iBiquity.<sup>9</sup> The results of the test program convinced the licensees and iBiquity that a 10 dB increase would dramatically improve digital signal coverage without creating a significant risk of harmful interference.

5. Based on the results of the experimental operations with increased FM Digital ERP and other studies, on June 10, 2008, a group consisting of 18 radio group owners that operate over 1,200 commercial and noncommercial educational (“NCE”) FM stations and the four largest broadcast transmission equipment manufacturers, identifying themselves as “Joint Parties,” requested (the “Joint Parties Request”) that the Commission generally increase maximum permissible FM Digital ERP<sup>10</sup> from one percent of a station’s authorized analog ERP (-20 dBc) (1% FM IBOC Power”) to a maximum of ten percent of a station’s authorized analog ERP (-10 dBc) (“10% FM IBOC Power”). The Joint Parties proposed a more restrictive approach for “super-powered” Class B FM stations.<sup>11</sup> Filed concurrently with

<sup>5</sup> See *Petition for Rulemaking*, USA Digital Radio Partners, L.P., RM-9395, filed Oct. 7, 1998, (“USA Digital Petition”) at 41.

<sup>6</sup> The NRSC is an industry group jointly sponsored by the National Association of Broadcasters and the Consumer Electronics Association.

<sup>7</sup> See *First Report and Order*, 17 FCC Rcd at 20004.

<sup>8</sup> 47 C.F.R. § 73.317.

<sup>9</sup> The stations receiving experimental authorizations for increased FM Digital ERP operation in 2007 were: WBEN-FM, Fac. ID No. 22308, Philadelphia, PA; WMGK(FM), Fac. ID No. 25094, Philadelphia, PA; WCSX(FM), Fac. ID No. 25084, Birmingham, MI; WJRZ-FM, Fac. ID No. 31078, Manahawkin, NJ; WKCI-FM, Fac. ID No. 11930, Hamden, CT; KOST(FM), Fac. ID No. 34424, Los Angeles, CA; KROQ-FM, Fac. ID No. 28622, Pasadena, CA; WDHA-FM, Fac. ID No. 49587, Dover, NJ, and WRAT(FM), Fac. ID No. 59530, Point Pleasant, NJ.

<sup>10</sup> The Joint Parties Request refers to FM digital operating power. Since the Commission specifies FM station power as effective radiated power (“ERP”), all references herein will be to FM Digital ERP.

<sup>11</sup> Super-powered FM stations are stations that have effective radiated powers in excess of the maximum permitted for their class, or stations with authorized facilities that produce a reference contour that exceeds the pertinent

(continued....)

and in support of the Joint Parties Request was an iBiquity technical report evaluating its higher digital power field tests. This report examined the impact of a 10 dB increase on digital broadcasting, the compatibility with analog broadcasting, and the potential interference effects.<sup>12</sup> The Joint Parties also requested that the Commission establish a procedure for investigating and resolving reasonably documented allegations of harmful interference resulting from increased FM Digital ERP operation.

6. On July 18, 2008, National Public Radio, Inc. (“NPR”) submitted its *Report to the Corporation for Public Broadcasting, Digital Radio Coverage & Interference Analysis (DRCIA) Research Project* (the “DRCIA Project Report”), a research report and findings on digital radio coverage and interference. As stated in the DRCIA Project Report, CPB created the DRCIA Project with three primary goals: 1) to determine the coverage capabilities of legacy analog FM service; 2) to determine the coverage capabilities of IBOC DAB service; and 3) to evaluate the impact of the digital transmissions on reception of analog FM service.<sup>13</sup> The DRCIA Project Report included a “worst case” analysis of the coverage and interference that would result if every currently authorized FM station operated hybrid FM IBOC facilities at 1% FM IBOC Power and at 10% FM IBOC Power. NPR concluded that at 1% FM IBOC Power, the mobile, indoor and portable digital coverage achieved by most FM stations would not replicate analog coverage, but that at 10% FM IBOC Power most FM stations could achieve digital mobile, portable and indoor coverage levels which either met or exceeded comparable analog coverage levels. However, based on the results of its study, NPR opposed an unqualified 10 dB increase because the DRCIA Project Report predicted substantial interference to analog reception of first-adjacent and second-adjacent channel analog FM stations. Based on these findings, NPR recommended that further studies should be undertaken relating to the viability of single frequency networks, FM boosters, asymmetrical sideband power levels and improved radio receivers before any Commission action on an increase in FM Digital ERP.

7. In response to the Joint Parties and NPR filings, on October 23, 2008, the Bureau released a Public Notice<sup>14</sup> seeking comment on the FM Digital ERP increase request and the associated technical studies. The Bureau received comments and reply comments from over 60 parties. Some commenters expressed unqualified support for<sup>15</sup> and others unqualified opposition to<sup>16</sup> the proposed digital power

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maximum class contour distance, as specified in § 73.211. For these stations, the Joint Parties recommend permitting an increase in FM Digital ERP to the greater of either 1) 20 dB below the station’s currently authorized analog power (the currently permissible hybrid FM IBOC digital ERP level); or 2) at least 10 dB below the maximum analog power for the station class adjusted for height.

<sup>12</sup> See *HD Radio™ System Test Report, Compatibility and Performance Tests at Elevated FM Digital Power Level*, MM Docket No. 99-325.

<sup>13</sup> See *DRCIA Project Report* at 4.

<sup>14</sup> *Comment Sought on Joint Parties Request for FM Digital Power Increase and Associated Studies*, Public Notice, DA 08-2340 (MB rel. Oct. 23, 2008) (“October 2008 Public Notice”).

<sup>15</sup> See, e.g., Comments of William Cordell at 1, John W. Haralson at 2, Seton Hall University at 1, Brian Kirby at 4, Julian H. Booker at 1, Ford Motor Company at 2, BMW of North America at 2, iBiquity at 2, Backyard Broadcasting, LLC et al (Joint Parties) at 1, Consumer Electronics Association at 3, National Association of Broadcasters at 4, and Mt. Wilson FM Broadcasters, Inc. at 1.

<sup>16</sup> See, e.g., Comments of Brian Gregory at 1, Chris Kantack at 1, Robert D. Young at 1, Tim Houser at 1, Ann Lynch at 1, James S. Bumpous at 1, Barry D. McLarnon at 7, Brian J. Henry at 1, Bernard Wise at 1, Jeff Johnson at 1, Robert M. Fiocchi at 1, Jonathan E. Hardis at 13, Marshfield Broadcasting Company, Inc. at 3, Leigh Robartes at 1, Edgar C. Reihl, P.E. at 2, Paul Dean Ford, P.E. at 1, Brown Broadcasting Service, Inc. at 3, Stephen Shultis at 1, Association of Public Radio Engineers, Inc. at 3, Prometheus Radio Project *et al* at 1, Talley Broadcasting Corporation at 5, and Rhode Island Public Radio at 1.

increase. Some commenters favored either a limited or incremental approach.<sup>17</sup> Several commenters supported the adoption of a processing policy to permit FM Digital ERP increases only on a case-by-case basis,<sup>18</sup> while others suggested that the Commission use minimum distance separation or contour protection standards.<sup>19</sup> Concerns about the impact of the proposed FM Digital ERP increase on the analog operations of full-service FM stations,<sup>20</sup> as well as on the analog operations of low power FM (“LPFM”) and FM translator stations<sup>21</sup> were received. Numerous commenters who discussed interference concerns urged the Commission to adopt FM digital interference mitigation and remediation procedures in connection with any decision to permit an FM Digital ERP increase.<sup>22</sup> Some discussed the potential of asymmetrical sideband power levels to limit interference to closely spaced first-adjacent channel analog stations and single frequency networks and synchronous boosters to improve FM digital coverage in lieu of an increase in FM Digital ERP.<sup>23</sup> A list of parties submitting comments and reply comments in response to the *October 2008 Public Notice* is included as Appendix A.

8. In April 2009, NPR commenced additional testing to develop metrics for assessing the potential for interference from higher-powered FM digital operations. When this testing commenced, NPR estimated that the tests would be completed in late summer 2009, and that the test results would be submitted to the Commission in September 2009.

9. As of May 2009, the *October 2008 Public Notice* had helped generate an extensive record on the requested digital power increase. Also on file were both the Joint Parties Request seeking an expeditious increase in FM Digital ERP and NPR’s conflicting request to withhold action pending completion of its additional tests. On May 22, 2009, the Media Bureau released a second Public Notice<sup>24</sup> specifically requesting public comment on the following four issues:

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<sup>17</sup> See, e.g., Comments of Seton Hall University at 1, Hampton Roads Educational at 1 and Houston Christian Broadcasters, Inc. at 4.

<sup>18</sup> See, e.g., Comments of Radio Training Network, Inc. at 2, Lehigh Valley Community Broadcasters Association at 1, International Association of Audio Information Services at 2 and Educational Media Foundation at 9.

<sup>19</sup> See, e.g., Comments of Douglas L. Vernier, V-Soft Communications LLC at 5, The Moody Bible Institute of Chicago at 3, Augusta Radio Fellowship Institute, Inc. at 4, Houston Christian Broadcasters, Inc. at 3 and National Public Radio at 14.

<sup>20</sup> See, e.g., Comments of James S. Bumpous at 2, H. Donald Messer at 3, Simmons Media Group, LLC at 1, Robert M. Fiocchi at 1, Douglas L. Vernier, V-Soft Communications LLC at 3, WOLF Radio, Inc. at 1, Jonathan E. Hardis at 2, Marshfield Broadcasting Company, Inc. at 1, Educational Information Corporation at 2, The Moody Bible Institute of Chicago at 3, Educational Media Foundation at 3, Brown Broadcasting Service, Inc. at 1, Association of Public Radio Engineers, Inc. at 3, Talley Broadcasting Corporation at 5 and National Public Radio at 4.

<sup>21</sup> See, e.g., Comments of James S. Bumpous at 2, H. Donald Messer at 3, Leigh Robartes at 1, Educational Information Corporation at 5, Mullaney Engineering, Inc. at 2 and National Translator Association at 3, Mark D. Humphrey at 5 and Prometheus Radio Project at 4.

<sup>22</sup> See, e.g., Comments of Simmons Media Group, LLC at 2, Paul S. Lotsof at 2, Consumer Electronics Association at 5 and Mt. Wilson FM Broadcasters, Inc. at 7.

<sup>23</sup> See, e.g., Comments of Seton Hall University at 1, Brian Kirby at 2, Jonathan E. Hardis at 8, The Moody Bible Institute of Chicago at 4, Augusta Radio Fellowship Institute, Inc. at 5, Houston Christian Broadcasters, Inc. at 4, Mark D. Humphrey at 6, Association of Public Radio Engineers, Inc. at 4 and Mt. Wilson FM Broadcasters, Inc. at 5.

<sup>24</sup> *Comment Sought on Specific Issues Regarding Joint Parties Request for FM Digital Power Increase and Associated Technical Studies*, Public Notice, 24 FCC Red 5818 (MB 2009) (“*May 2009 Public Notice*”).

A. Whether the Bureau should defer consideration of the Joint Parties' requested power increase until the completion of and comment on the further NPR studies?<sup>25</sup>

B. Whether the record in this proceeding, the real-world experience gained from over 1,500 FM stations operating for several years in the hybrid mode and the record of experimental authorizations at higher digital ERP levels warrant an increase in maximum digital ERP as proposed by the Joint Parties or support a provisional power increase of some lesser extent than that requested by the Joint Parties?

C. If the Commission does adopt a power increase, whether it should also establish standards to ensure the lack of interference to the analog signals of stations operating on first adjacent channels? Should such standards apply to, i.e., require the protection of LPFM stations operating on first adjacent channels?

D. Finally, if the Commission does adopt a power increase, whether it should also establish more explicit procedures to resolve digital-into-analog interference complaints?

10. The Commission received approximately the same number of comments in response to the *May 2009 Public Notice* as it had to the *October 2008 Public Notice*. A list of parties submitting comments and reply comments in response to the May 2009 Public Notice is included as Appendix B.

11. On November 4, 2009, NPR submitted to the Commission the results of its further evaluation of operations at higher digital power levels, a study titled "Report to the FCC on the Advanced IBOC Coverage and Compatibility Study" ("AICCS Project Report"). NPR stated in the AICCS Project Report that "the main test goal of this study is to understand consumers' reactions to analog radio broadcasts in a mobile environment when digital ERP is increased."<sup>26</sup> As part of its test procedures, NPR assembled a Working Group and a Peer Review Group, consisting of NPR and Corporation for Public Broadcasting participants, as well as members representing the Joint Parties, iBiquity, the National Association of Broadcasters ("NAB"), the Consumer Electronics Association ("CEA") and others with an interest in terrestrial FM digital broadcasting. A full listing of the Working Group and Peer Review Group participants is contained in the AICCS Project Report.<sup>27</sup>

12. Based on its AICCS Project findings, NPR concluded that a blanket 6 dB increase in FM Digital ERP (from -20 dBc to -14 dBc) was acceptable for most FM stations, and that using a formula it developed based on its testing,<sup>28</sup> certain FM stations could increase FM Digital ERP up to a maximum of 10 dB (from -20 dBc to -10 dBc).<sup>29</sup> Subsequently, NPR reached an agreement (the "Agreement") with iBiquity modeled on the AICCS Project Report findings. iBiquity and NPR jointly submitted a proposal to the Commission on November 5, 2009, in which they:

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<sup>25</sup> As discussed *infra*, NPR recently submitted its further test results. Accordingly, this issue is moot.

<sup>26</sup> See AICCS Project Report at 3.

<sup>27</sup> *Id* at 7 and 40.

<sup>28</sup> See AICCS Project Report at Appendix J.

<sup>29</sup> On January 4, 2010, Media Access Project, on behalf of Prometheus Radio Project, filed an *Ex Parte Notice* ("MAP 2010 *Ex Parte*") questioning the AICCS Project test methodology and alleging that the results of the AICCS Project are insufficient to justify a blanket increase in FM Digital ERP. On January 6, 2010, Alan W. Jurison ("Jurison") filed *Ex Parte Comments* ("*Jurison Comments*") also questioning the AICCS Project test methodology and alleging that the results of the AICCS Project show that the proposed blanket 10 dB increase in FM Digital ERP would not cause objectionable interference to first-adjacent channel analog FM operations in most, if not all, cases.

i) endorsed a blanket 6 dB increase in FM Digital ERP above the currently maximum permissible level of -20 dBc for all FM stations except grandfathered, super-powered Class B stations, which would be limited to the higher of -20 dB relative to their analog carrier as is currently permitted, or at least 10 dB below the maximum analog power authorized for this class of station as adjusted for height, absent any grandfathered super power;

ii) agreed that additional FM Digital ERP increases in excess of 6 dB are possible depending on conditions that limit harmful interference to analog FM operations, and that allowable FM Digital ERP for such increases should be determined using the following formula with regard to first-adjacent channel stations:

$$\text{Allowable IBOC power} = [2.27 * (60 - \text{IBOC station F}(50,10) \text{ dB}\mu) - 33.6];$$

iii) requested that the Commission adopt specific procedures to remediate harmful interference from any station increasing FM Digital ERP above the current -20 dBc level;

iv) suggested that the Commission reserve the right to revisit the matter of FM Digital ERP in the future if widespread instances of harmful interference results from increased FM Digital ERP operations; and

v) stated iBiquity's and NPR's commitment to undertake additional research on FM IBOC DAB single frequency network system design and to develop software to permit asymmetrical digital sideband power levels. They also agreed to collaborate on low bit rate codecs and conditional access for radio reading services.<sup>30</sup>

### III. DISCUSSION

#### A. FM Digital ERP Increase

13. *Voluntary Increases Up to 6 dB.* Virtually all of the licensees of the nearly 1,500 commercial and NCE FM stations currently operating hybrid FM digital facilities have concluded that the coverage resulting from their operations at maximum permissible FM Digital ERP levels does not replicate analog coverage, and that indoor and portable coverage are particularly and significantly diminished.<sup>31</sup> Both the iBiquity and NPR studies confirm these service limitations. Moreover, the number of notifications of the commencement of hybrid FM digital operations has dropped significantly over the past two years.<sup>32</sup> Based on these findings, we conclude that it is important to increase FM Digital ERP to improve FM digital coverage and to eliminate regulatory impediments to FM digital radio's ability to meet its full potential and deliver its promised benefits.

14. Since the commencement of 1% FM IBOC Power operations in 2004, the Bureau has not received any well documented complaints of interference to analog FM stations from digital signals. Since May 2006, the Media Bureau issued a total of 15 experimental authorizations to permit operations at up to 10% FM IBOC Power, including authorizations for ten grandfathered short-spaced stations with as many as four first-adjacent channel short spacings.<sup>33</sup> Some of these short spacings are severe. These

<sup>30</sup> See November 5, 2009, iBiquity/NPR letter to the Secretary, MM Docket No. 99-325.

<sup>31</sup> See Comments of iBiquity at 2, NAB at 2, Joint Commenters at 2.

<sup>32</sup> In 2003-2004, the Bureau received approximately 180 notifications; in 2005, 301 notifications; in 2006, 327 notifications; in 2007, 354 notifications; in 2008, 210 notifications; and in 2009, 128 notifications.

<sup>33</sup> The stations receiving experimental authorizations for increased FM Digital ERP were: WBEN-FM, Fac. ID No. 22308, Philadelphia, PA; WMGK(FM), Fac. ID No. 25094, Philadelphia, PA; WCSX(FM), Fac. ID No. 25084,

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stations operated their FM digital facilities with different levels of increased FM Digital ERP throughout the experimental period, with the preponderance of the time spent operating with the maximum permissible FM Digital ERP of -10 dBc. The Bureau did not receive any complaints of interference to analog FM stations from licensees of analog FM stations or the listening public as a result of the experimental operations.<sup>34</sup>

15. In the *MAP 2010 Ex Parte*, Prometheus asserts that the results of the AICCS Project do not support a blanket FM Digital ERP increase, and that “the Commission should only consider the increase after the NPR Labs Study can provide results of interference levels within the protected contours of stations, since, given the magnitude of the results as currently reported, it is likely that the interference inside the protected contours also will be significant.”<sup>35</sup> Although opining that the AICCS Project testing is flawed, Jurison asserts that the data submitted in the AICCS Project Report “suggests that all stations should be allowed a blanket -10 dBc.”<sup>36</sup> He also states that the structured increase in FM Digital ERP specified in the Agreement is cumbersome; that the AICCS Project interference analysis is flawed; that grandfathered, super-powered Class B stations should not be excluded from any blanket digital power increase; and that digital interference complaints should be resolved using the procedures set forth in the Agreement.<sup>37</sup> We have reviewed the AICCS Project Report, the Agreement submitted by NPR and iBiquity, the *MAP 2010 Ex Parte* and the *Jurison Comments*. Based on our analysis of these documents and data, as well as five years of interference-free FM hybrid digital operations by approximately 1500 stations, we are convinced that an immediate voluntary 6 dB increase in FM Digital ERP is appropriate for all FM stations except super-powered FM stations.<sup>38</sup> The Agreement would restrict the maximum permissible FM Digital ERP for super-powered Class B stations only. The technical concerns which support this restriction, however, are equally applicable to all super-powered stations. Accordingly, we are extending the limitation of FM Digital ERP to all classes of super-powered FM stations.<sup>39</sup> The maximum permissible FM Digital ERP for these stations will be limited initially to the higher of either the currently permitted -20 dBc level or 10 dB below the maximum analog power that would be authorized for the class of the super-powered FM station adjusted for the station’s antenna height above average terrain (“HAAT”), predicted in accordance with Section 73.211(b).<sup>40</sup> In order for a licensee to determine if its FM station is, by definition, a super-powered FM station, the Bureau will provide an FM Super-Powered Maximum Digital ERP Calculator (the “Calculator”) on the Bureau’s Audio Division web

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Birmingham, MI; WJRZ-FM, Fac. ID No. 31078, Manahawkin, NJ; WKCI-FM, Fac. ID No. 11930, Hamden, CT; KOST(FM), Fac. ID No. 34424, Los Angeles, CA; KROQ-FM, Fac. ID No. 28622, Pasadena, CA; WDHA-FM, Fac. ID No. 49587, Dover, NJ; WRAT(FM), Fac. ID No. 59530, Point Pleasant, NJ; WKLB-FM, Fac. ID No. 10542, Waltham, MA; WMGQ(FM), Fac. ID No. 55179, New Brunswick, NJ; KJAQ(FM), Fac. ID No. 1091, Seattle, WA; KCRB-FM, Fac. ID. No. 42970, Bemidji, MN; KUHF(FM), Fac. ID No. 69150, Houston, TX, and KUVO(FM), Fac. ID No. 16687, Denver, CO.

<sup>34</sup> We note that Rhode Island Public Radio reported interference from the experimental increased FM Digital ERP facilities of WKLB-FM, Fac. ID No. 10542, Waltham, MA, to analog FM station WRNI-FM, Fac. Id No. 22874, Narragansett Pier, RI, in its Comments filed in MM Docket No. 99-325 on January 12, 2009, but did not file an interference complaint with the Commission.

<sup>35</sup> See *MAP 2010 Ex Parte* at 2.

<sup>36</sup> See *Jurison Comments* at 16.

<sup>37</sup> See *Jurison Comments*, *passim*.

<sup>38</sup> We disagree with the *MAP 2010 Ex Parte* conclusion that further testing is necessary. In particular, we note that the complaint procedures discussed *infra* will provide a reliable mechanism for identifying and promptly resolving instances of interference to analog signals.

<sup>39</sup> Less than two percent of the approximately 9,600 licensed FM stations are super-powered.

<sup>40</sup> 47 C.F.R. § 73.211(b).



page (<http://www.fcc.gov/mb/audio/digitalFMpower.html>). The Calculator will require the licensee to enter the FM station's call sign and Facility ID Number. Based on the station's authorized facilities, the Calculator will compare the station's reference contour with the appropriate class contour to determine if the station is a super-powered FM station. If it is, the Calculator will then determine maximum permissible FM Digital ERP for the station. The licensee of a super-powered FM station must file an application, in the form of an informal request, for any increase in the station's FM Digital ERP.

16. Consistent with the IBOC notification procedures that the Commission adopted in the *First and Second Reports and Orders*, and with the Bureau's delegated authority to implement new IBOC notification procedures to authorize new IBOC technical configurations,<sup>41</sup> beginning on the effective date of this *Order*, eligible FM stations may commence operation with FM digital operating power up to -14 dBc (that is, up to a 6 dB increase), and must electronically notify the Media Bureau of increased power FM digital operation within 10 days of commencement using the Digital Notification form available in the Media Bureau's Consolidated Database System ("CDBS") Electronic Filing System ([https://licensing.fcc.gov/prod/cdbs/forms/prod/cdbs\\_ef.htm](https://licensing.fcc.gov/prod/cdbs/forms/prod/cdbs_ef.htm)). Eligible FM stations wishing to commence increased power FM digital operation before the effective date of this *Order* may file a request for Special Temporary Authorization ("STA").<sup>42</sup>

17. *Increases Over 6 dB*. In the Agreement, iBiquity and NPR recommended that the Commission permit, by application, additional FM Digital ERP increases beyond the blanket 6 dB increase, up to a maximum increase of 10 dB. They also proposed a formula to set maximum allowable FM Digital ERP. The formula is based on the highest value of the field strength of the "interfering" FM station's analog signal along the protected 60 dB $\mu$  service contour of a potentially affected first-adjacent channel FM station. In Appendix J of the AICCS Project Report, NPR outlines the procedure to follow to determine a station's allowable FM operating power using the formula in the Agreement. NPR notes that this procedure assumes that the FM station is using the same transmitting site and antenna for both the analog and digital operations, and that use of a different digital transmitter site and/or antenna must be considered separately.

18. The Agreement specifies that FM station eligibility for digital ERP increases beyond 6 dB is based upon protection of an analog station's 60 dB $\mu$  contour. We recognize that the Commission's Rules specify different protected contours for Class A, C3, C2, C1, C0 and C FM stations (60 dB $\mu$ ) than for Class B1 FM stations (57 dB $\mu$ ) and Class B FM stations (54 dB $\mu$ ) in the non-reserved band. However, for the limited purpose of determining maximum permissible FM Digital ERP greater than -14 dBc, we will base all predictions of maximum permissible FM Digital ERP on calculations at the potentially affected analog FM station's 60 dB $\mu$  contour. However, the mitigation and remediation procedures set forth below will apply to all instances of alleged interference within the protected service contours of potentially affected stations.

19. As NPR and iBiquity have proposed, we will require a licensee to submit an application to the Bureau, in the form of an informal request, for any increase in FM Digital ERP beyond 6 dB. The Bureau's experience with higher powered digital experimental authorizations suggests that the formula developed by NPR and endorsed by iBiquity in the Agreement is over-predictive of the potential for interference. Nevertheless, we believe that the protection this methodology provides to first-adjacent channel stations can be used to establish an expeditious "go-no go" mechanism for many FM stations to obtain significant digital power in excess of the 6 dB for which most stations will qualify.

<sup>41</sup> See *Second Report and Order*, 22 FCC Rcd at 10383, 10395.

<sup>42</sup> See 47 C.F.R... § 73.1635.

20. A licensee desiring FM Digital ERP in excess of -14 dBc is required to calculate the station's analog F(50,10) field strength at all points on the protected 60 dBu F(50,50) contour of a potentially affected first-adjacent channel analog FM station. This calculation must be done using the station's licensed analog facilities<sup>43</sup> and the standard FCC contour prediction methodology.<sup>44</sup> Once the most restrictive analog F(50,10) field strength of the proponent station has been determined, the licensee will use the following table to determine the proponent station's maximum permissible FM Digital ERP:

Proponent Analog F(50,10) Field Strength at Protected Analog 60 dBu F(50,50) Contour	Maximum Permissible FM Digital ERP
51.2 dB $\mu$ and above	-14 dBc
50.7 dB $\mu$ - 51.1 dB $\mu$	-13 dBc
50.3 dB $\mu$ - 50.6 dB $\mu$	-12 dBc
49.6 dB $\mu$ - 50.2 dB $\mu$	-11 dBc
49.5 dB $\mu$ or less	-10 dBc

The maximum permissible FM Digital ERP levels shown in this chart were calculated using the procedure in Appendix J of the AICCS Project Study and the formula set forth therein. In situations in which the simplified method above is not applicable due to unusual terrain, environmental or technical considerations, or when it produces anomalous FM Digital ERP results, the Bureau will accept applications for FM Digital ERP in excess of -14 dBc. These applications must include a detailed showing containing a complete explanation of the prediction methodology used as well as data, maps and sample calculations. The Bureau will evaluate these applications on a case-by-case basis.

21. Some commenters advocated that the Commission establish protection rights for LPFM stations from digital FM interference.<sup>45</sup> Both Prometheus Radio Project ("Prometheus") and V-Soft Communications, LLC contend that low ERP LPFM stations are more likely than full-service FM stations to be affected by a first-adjacent channel station operating with increased FM Digital ERP. During a recent meeting with Bureau staff, Prometheus asked that the Commission reject the Joint Parties Request, stating that the recently submitted AICCS Project results do not support a blanket FM Digital ERP increase, and that the testing submitted by both the Joint Parties and NPR failed to assess the impact of the proposed FM Digital ERP increase on LPFM stations.<sup>46</sup> Prometheus reiterated these concerns in the *MAP 2010 Ex Parte* and again requested that LPFM and FM translator stations be granted protection from digital FM interference within their protected contours.<sup>47</sup>

<sup>43</sup> Since the Commission's rules permit only a limited differential in the location of separate FM analog and digital transmitting facilities and there will be very little difference in the predicted maximum permissible FM Digital ERP for an eligible FM station if calculated from either of the two locations, we are requiring use of the licensed analog facilities for this calculation.

<sup>44</sup> See 47 C.F.R. § 73.313.

<sup>45</sup> See Comments of James M. Wilhelm at 1, Positive Alternative Radio, Inc. at 6, Entravision Holdings, LLC at 5, V-Soft Communications, LLC at 3, Educational Information Corporation at 9, and Prometheus Radio Project at 4.

<sup>46</sup> See *Ex Parte* Presentation Letter, Media Access Project, filed Nov. 20, 2009.

<sup>47</sup> See *MAP 2010 Ex Parte* at 4.

22. As a general matter, adoption of these recommendations would constitute a dramatic change in LPFM licensing rules and the relationship between LPFM and full-service stations. Analog LPFM and FM translator stations are secondary services, and, as such, are not currently entitled to protection from existing full-service analog FM stations. Moreover, this digital audio broadcasting proceeding has not created any additional rights for these secondary services *vis a vis* digital hybrid operations by full-service stations. In addition, one aspect of secondary service licensing would make this change particularly problematic. In contrast to full-service stations, our technical rules permit LPFM stations to operate at locations at which they may receive interference from other stations. The ability to “accept” received interference is enormously beneficial to the LPFM service, providing greater flexibility in choosing transmitter sites and, in many instances, permitting the licensing of stations that would not be possible under full-service rules. Thus, to the extent that LPFM stations are operating at substandard spacings, it is generally the result of voluntary decisions by LPFM licensees to accept interference from nearby full-service stations. In these circumstances, it seems both unfair and at odds with secondary service licensing principles to deny a full-service station additional digital power based on the potential of increased interference to an LPFM station. In any event, only the Commission has the authority for such fundamental modifications in the digital protection scheme. Accordingly, we decline to establish new protection rights for secondary services from first-adjacent channel full-service analog FM stations commencing new or higher power digital operations within the narrow scope of this *Order*. Licensees will not be required to take into account nearby LPFM stations in calculating permissible digital power levels in excess of -14 dBc.

### **B. Digital/Analog Protection Standards**

23. We believe that our existing FM technical protection scheme has proven its efficacy and robustness over time. The analog FM predicted interference methodology promotes full spectrum utilization, permitting stations to maximize service within protected coverage areas while generating extremely few interference complaints. A digital-into-analog predicted interference methodology would provide similar benefits to broadcasters and listeners. The present record does not support the establishment of protection standards.<sup>48</sup> Such standards, however, are unnecessary in light of the digital power limits and interference dispute procedures adopted herein.<sup>49</sup> The Bureau anticipates that widespread implementation of FM Digital ERP increases will provide valuable coverage and interference data that will be useful in developing a prediction methodology. Neither the general 6 dB power increase nor the standards we adopt for additional FM Digital ERP is intended to prejudge future standard setting efforts. We are convinced that it is imperative for us to implement a power increase promptly and that the record establishes that the digital power limits set forth in this order will provide the necessary protection to analog FM stations. However, out of an abundance of caution, we are adopting interference remediation procedures, discussed below, to address instances of loss of analog service within a full-service FM station’s protected contour.

### **C. Interference Protection and Complaint Remediation**

24. Our longstanding FM technical regulatory scheme is designed to protect the reception of analog FM signals within an area where those signals meet or exceed a specified minimum signal strength.<sup>50</sup> In the reserved band, for all classes of FM stations, this protected area is the area within the

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<sup>48</sup> The *MAP 2010 Ex Parte* urges the Commission require each station that seeks a digital power increase to “document the potential for interference” to analog signals. Absent agreement on a predicted interference methodology, it is unclear to us how a station could “document” the potential for interference. We reject this proposal as unworkable and excessively burdensome on licensees seeking to increase digital power levels.

<sup>49</sup> The Commission’s delegation of authority to the Bureau in the *Second Report and Order* does not appear to encompass the establishment of analog protection standards.

<sup>50</sup> See *First Report and Order*, 17 FCC Rcd at 19995.

predicted 60 dB $\mu$  F(50,50) field strength contour. In the non-reserved FM band, for Class A, C3, C2, C1, C0 and C stations, the predicted 60 dB $\mu$  F(50,50) field strength contour defines this area; for Class B1 and B stations, the predicted 57 dB $\mu$  F(50,50) and 54 dB $\mu$  F(50,50) field strength contours, respectively, define this area. The locations of all protected FM contours are predicted using the FM station's authorized facilities and the standard FCC contour prediction methodology.<sup>51</sup> This methodology does not ensure reception at every location within these protected contours, and treats interference outside these protected contours as not objectionable. Reception of an analog FM station outside the station's protected contour may be diminished or completely eliminated at any time by the addition of new or modified, rule-conforming analog FM stations.

25. In the *May 2009 Public Notice*, we asked if we should adopt explicit procedures to resolve digital-into-analog interference complaints. Twenty-four commenters responded affirmatively,<sup>52</sup> and offered suggestions on procedures that could be employed. Many commenters<sup>53</sup> expressed their belief that new interference protection standards for full-service analog FM stations should be adopted before any increase in FM Digital ERP is permitted, while others<sup>54</sup> stated that our current standards are adequate for protecting full-service analog FM operations from digital FM interference. Aaron Read suggested that the Commission permit negotiated agreements for interference resolution among affected parties. Henry Ruhwiedel recommended FM Digital ERP reduction and termination of digital operation to eliminate interference. Educational Information Corporation suggested creation of an FCC website for filing FM IBOC interference complaints. Klein Broadcast Engineering, L.L.C. and Talley Broadcasting Corporation urged the Commission to require advance notification of commencement of new or increased FM Digital ERP operation to potentially affected analog FM stations. Cohen, Dippell and Everist, P.C. recommended updating the FCC *Interference Handbook* to include information on the nature and effects of FM digital interference for consumers. Prometheus suggested that complaint-driven interference mitigation should include notification of an FM Digital ERP increase by the station licensee to all potentially affected analog stations.<sup>55</sup>

26. In the Agreement, iBiquity and NPR requested that the Commission adopt specific procedures to remediate harmful interference to full-service analog FM stations from any station increasing FM Digital ERP above the current -20 dBc level. We agree that adoption of explicit digital FM into analog FM interference resolution procedures for full-service FM stations must accompany this

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<sup>51</sup> See 47 C.F.R. § 73.313.

<sup>52</sup> See Comments of John A. Buffalo at 2, James M. Wilhelm at 1, Daniel Houg at 2, Simmons Media Group at 2, Creative Educational Media Corp., Inc. at 5, Positive Alternative Radio, Inc. at 6, Calvary Chapel of Twin Falls, Inc. at 6, Barry D. McLarnon at 2, Aaron Read at 2, Henry Ruhwiedel at 2, Wisconsin Public Radio at 2, Entravision Holdings, LLC at 5, V-Soft Communications, LLC at 3, Charles Keiler at 4, Cohen, Dippell and Everist, P.C. at 3; Leroy C. Granlund at 3, Mullaney Engineering, Inc. at 3, Educational Information Corporation at 9, Prometheus Radio Project at 4, Talley Broadcasting Corporation at 4, Press Communications, LLC at 4, Klein Broadcast Engineering, L.L.C. at 8, National Public Radio at 11, and Educational Media Foundation at 5.

<sup>53</sup> See Comments of John A. Buffalo at 1, James M. Wilhelm at 1, Daniel Houg at 2, Simmons Media Group at 2, Creative Educational Media Corp., Inc. at 4, Positive Alternative Radio, Inc. at 5, Calvary Chapel of Twin Falls, Inc. at 5, Barry D. McLarnon at 2, Aaron Read at 1, Henry Ruhwiedel at 2, Wisconsin Public Radio at 2, Entravision Holdings, LLC at 5, V-Soft Communications, LLC at 3, Charles Keiler at 3, Cavell, Mertz & Associates, Inc. at 2, Cohen, Dippell and Everist, P.C. at 2; Leroy C. Granlund at 3, Mullaney Engineering, Inc. at 3, Educational Information Corporation at 8, Prometheus Radio Project at 4, Talley Broadcasting Corporation at 3, Press Communications, LLC at 4, Klein Broadcast Engineering, L.L.C. at 8, National Public Radio at 11, and Educational Media Foundation at 5.

<sup>54</sup> See Comments of iBiquity Digital Corporation at 8, Joint Commenters at 14, National Association of Broadcasters at 9.

<sup>55</sup> See *MAP 2010 Ex Parte* at 4.

FM Digital ERP increase and we herein adopt the procedures specified in the Agreement with only one modification that is discussed below. For the reasons discussed earlier, as secondary services, LPFM and FM translator stations are not eligible for the interference remediation procedures that we are adopting herein.

27. If a full-service analog FM station is receiving verifiable listener complaints of interference within its protected contour from FM digital facilities operating with FM Digital ERP in excess of -20 dBc, the licensee of the affected analog FM station must contact the licensee of the station operating the FM digital facilities. We will require the stations to work cooperatively to confirm the instances of interference and to attempt to eliminate the interference using voluntary tiered FM Digital ERP reductions. If the stations resolve the interference by voluntarily reduction of FM Digital ERP, then the licensee operating the digital facilities must maintain its FM Digital ERP at the jointly agreed upon reduced level, and notify the Commission electronically of its reduced FM Digital ERP value.

28. If the stations fail to reach agreement on appropriate interference remediation measures, the licensee of the affected analog FM station may file an interference complaint with the Bureau. The Agreement specified that a minimum of three interference reports should be required for an affected analog station to file an interference complaint with the Commission. Due to the effects of varying terrain, tall buildings and other FM stations throughout many FM stations coverage areas, we believe that this number should be increased. Thus, in order to be considered by the Bureau, the complaint must contain at least six reports of ongoing (rather than transitory) objectionable interference. For each report of interference, the affected FM licensee must submit a map showing the location of the reported interference and a detailed description of the nature and extent of the interference being experienced at that location. Interference reports at locations outside a station's protected analog contour will not be considered. The complaint must also contain a complete description of the tests and equipment used to identify the alleged interference and the scope of the unsuccessful efforts to resolve the interference.

29. The Bureau staff will review each FM digital interference complaint and order appropriate action by the licensee of the interfering FM digital facilities within 90 days of the date on which a complete and sufficient complaint has been filed. As set forth in the Agreement, if the Bureau fails to act within the allowable 90-day period, the interfering station must immediately reduce its FM Digital ERP. Stations operating with FM Digital ERP in excess of -14 dBc must immediately reduce FM Digital ERP to -14 dBc. If ongoing complaints of objectionable interference from the FM digital facilities persist, the Bureau may require subsequent 3 dB reductions in FM Digital ERP to -17 dBc and -20 dBc, respectively, until it acts on the pending interference complaint. Stations operating with FM Digital ERP of -14 dBc or less must immediately reduce FM Digital ERP to -17 dBc. If interference complaints persist after this initial reduction, the Bureau will order the station to reduce FM Digital ERP to the currently permitted maximum of -20 dBc and require it to remain at that level until the Bureau acts on the pending FM digital interference complaint.

30. We believe that the FM Digital ERP increase and the FM digital interference remediation procedures that we are adopting will not result in numerous or non-resolvable cases of objectionable interference to analog FM stations. Nonetheless, if implementation of the adopted increases in FM Digital ERP results in a widespread level of interference to existing analog FM stations that we deem unacceptable, we will promptly revisit the maximum permissible FM Digital ERP values in the future.<sup>56</sup>

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<sup>56</sup> The *MAP 2010 Ex Parte* request to first resolve the public interest obligations of digital radio licensees is both beyond the scope of this proceeding and seeks action which exceeds the Bureau's delegated authority.

#### IV. PROCEDURAL MATTERS

##### Final Regulatory Flexibility Act Analysis

31. The Final Regulatory Flexibility Analysis is attached to this *Order* as Appendix D.

##### Final Paperwork Reduction Act Analysis.

32. This *Order* adopts a new or revised information collection requirement(s) subject to the Paperwork Reduction Act of 1995 (“PRA”), Public Law 104-13 (44 U.S.C. 3501-3520). The requirement will be submitted to the Office of Management and Budget (“OMB”) for review under Section 3507 of the PRA. The Commission will publish a separate notice in the Federal Register inviting comment on the new or revised information collection requirement(s) adopted in this document. The requirement(s) will not go into effect until OMB has approved it and the Commission has published a notice announcing the effective date of the information collection requirement(s). In addition, we note that pursuant to the Small Business Paperwork Relief Act of 2002, Public Law 107-198, see 44 U.S.C. 3506(c)(4), we previously sought specific comment on how the Commission might “further reduce the information collection burden for small business concerns with fewer than 25 employees.” We find that the modified information collection requirements must apply fully to small entities (as well as to others) to ensure compliance with our FM rules, as described in the Report and Order.

##### A. Congressional Review Act.

33. The Commission will send a copy of this *Order* in a report to be sent to Congress and the Government Accountability Office, pursuant to the Congressional Review Act.

##### B. Additional Information.

34. For additional information on this proceeding, contact Peter H. Doyle, [Peter.Doyle@fcc.gov](mailto:Peter.Doyle@fcc.gov), or Susan N. Crawford, [Susan.Crawford@fcc.gov](mailto:Susan.Crawford@fcc.gov), of the Media Bureau, (202) 418-2700.

#### V. ORDERING CLAUSES

35. Accordingly, IT IS ORDERED that pursuant to the authority contained in Sections 1, 4(i), 301, 302, 303, 307, 308, 309, 319, and 324 of the Communications Act of 1934, as amended, 47 U.S.C §§ 151, 154(i), 301, 302, 303, 307, 308, 309, 319, and 324, as well as the authority delegated to the Media Bureau by the Commission in the *Second Report and Order* in this proceeding, this *Order* and the rule modifications attached hereto as Appendix C ARE ADOPTED, effective upon the later of: (a) thirty (30) days after publication of the text or a summary thereof in the Federal Register; or (b) announcement in the Federal Register of OMB approval of those rules and requirements involving PRA burdens.

36. IT IS FURTHER ORDERED the Joint Parties Request IS GRANTED TO THE EXTENT INDICATED HEREIN and OTHERWISE DENIED.

FEDERAL COMMUNICATIONS COMMISSION

William T. Lake, Chief  
Media Bureau

## APPENDIX A

**List of Commenters and Reply Commenters to October 23, 2008, *Public Notice***

Educational Information Corporation  
National Association of Broadcasters  
Cohen, Dippell and Everist, P.C.  
Prometheus Radio Project  
National Federation of Community Broadcasters  
New America Foundation  
iBiquity Digital Corporation  
Backyard Broadcasting, LLC  
Beasley Broadcast Group, Inc.  
Black Crow Media Group, L.L.C.  
Bonneville International Corp.  
Broadcast Electronics, Inc.  
CBS Radio Inc.  
Clear Channel Communications, Inc.  
Commonwealth Broadcasting Corporation  
Commonwealth Public Broadcasting Corporation  
Continental Electronics Corp.  
Cox Radio, Inc.  
Emmis Communications Corporation  
Entercom Communications Corp.  
Greater Media, Inc.  
Harris Corporation  
Journal Broadcast Corporation  
Lincoln Financial Media Company  
Nassau Broadcasting Partners, L.P.  
Nautel Maine Inc.  
NRG Media, LLC  
Sacred Heart University, Inc.  
Rhode Island Public Radio  
Marshfield Broadcasting Company, Inc. (WATD-FM)  
Nevada City Community Broadcast Group, Inc.  
Augusta Radio Fellowship Institute, Inc.  
Paul Dean Ford, P.E.  
Houston Christian Broadcasters, Inc.  
International Association of Audio Information Services  
National Public Radio, Inc.  
Communication Center of Minnesota State Services for the Blind  
Talley Broadcasting Corporation  
Association of Public Radio Engineers, Inc.  
National Translator Association  
Consumer Electronics Association  
Stephen Shultis WNYC Radio  
Brown Broadcasting Service, Inc.  
Mark D. Humphrey  
The Livingston Radio, Co. (WHMI-FM)  
Educational Media Foundation  
Mullaney Engineering, Inc.  
Charles Keiler

Minnesota Public Radio  
The Moody Bible Institute of Chicago  
BMW of North America  
Mt. Wilson FM Broadcasters, Inc.  
Ford Motor Company  
Paul S. Lotsof  
Lehigh Valley Community Broadcasters Association (WDIY-FM)  
Julian H. Booker  
Jonathan E. Hardis  
WOLF Radio, Inc.  
Douglas L. Vernier, V-Soft Communications LLC  
Edgar C. Reihl, P.E.  
Leigh Robartes  
Radio Training Network, Inc.  
Hampton Roads Educational  
Brian Kirby  
Robert M. Fiocchi  
Jeff Johnson  
Bernard Wise  
Carlson Communications, International  
Brian J. Henry  
John W. Haralson  
William Cordell  
Seton Hall University (WSOU-FM)  
Simmons Media Group, LLC  
Mars Hill Broadcasting Co., Inc.  
Barry D. McLarnon  
H. Donald Messer  
Aaron Read  
James S. Bumpous  
Tim Houser  
Robert D. Young, Jr.  
Ann Lynch  
Chris Kantack  
Brian Gregory



## APPENDIX B

List of Commenters and Reply Commenters to May 22, 2009, *Public Notice*

Jonathan E. Hardis  
Brown Broadcasting Service, Inc.  
Givens and Bell, Inc.  
Robert R. Hawkins  
Barry D. McLarnon  
iBiquity Digital Corporation  
Prometheus Radio Project  
Backyard Broadcasting, LLC  
Beasley Broadcast Group, Inc.  
Black Crow Media Group, L.L.C.  
Bonneville International Corp.  
Broadcast Electronics, Inc.  
Broadcaster Traffic Consortium LLC  
CBS Radio Inc.  
Clear Channel Communications, Inc.  
Commonwealth Broadcasting Corporation  
Continental Electronics Corp.  
Cox Radio, Inc.  
Emmis Communications Corporation  
Entercom Communications Corp.  
Greater Media, Inc.  
Harris Corporation  
Journal Broadcast Corporation  
Lincoln Financial Media Company  
Nassau Broadcasting Partners, L.P.  
Nautel Maine Inc.  
NRG Media, LLC  
Sacred Heart University, Inc.  
Good Shepherd Radio Incorporated  
National Association of Broadcasters  
Michael Gehring  
Rhode Island Public Radio  
WFCR, Amherst, Massachusetts  
Press Communications, LLC  
National Public Radio, Inc.  
Educational Information Corporation (WCPE)  
Edward Czelada  
Edgar C. Reihl, P.E.  
James K. Davis  
Leroy C. Granlund  
Brian Gregory  
James M. Wilhelm  
V-Soft Communications, LLC  
American University (WAMU)  
Public Radio Regional Organizations  
Charles River Broadcasting Company, a subsidiary of Greater Media  
Inc. (WKLB-FM)  
Educational Media Foundation

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Cohen, Dippell and Everist, P.C.  
Klein Broadcast Engineering, L.L.C.  
Talley Broadcasting Corporation  
American Public Media Group  
Mullaney Engineering, Inc.  
Cavell, Mertz & Associates, Inc.  
Charles Keiler  
WUKY Public Radio  
Entravision Holdings, LLC  
Seton Hall University (WSOU-FM)  
University Station Alliance (Craig Beeby)  
James W. Anderson  
Wisconsin Public Radio  
Henry Ruhwiedel  
Delmarva Broadcasting Company  
Aaron Read  
Positive Alternative Radio, Inc.  
Creative Educational Media Corp., Inc.  
Calvary Chapel of Twin Falls, Inc.  
Brian J. Kirby  
The Livingston Radio Co. (WHMI)  
Daniel Houg  
G. Craig Hanson, Simmons Media Group, LLC  
Steven Glenn Daniel  
Roy H Fisk  
Kevin Redding  
John A. Buffaloe  
Gregory Smith

## APPENDIX C

## Final Rule Changes

Part 73 of the Code of Federal Regulations is amended as follows:

## PART 73 – RADIO BROADCAST SERVICES

1. Section 73.404 is amended by revising paragraphs (a) and (e) as follows:

**§ 73.404 Interim Hybrid IBOC DAB Operation.**

(a) The licensee of an AM or FM station, or the permittee of a new AM or FM station which has commenced program test operation pursuant to § 73.1620, may commence interim hybrid IBOC DAB operation with digital facilities which conform to the technical specifications specified for hybrid DAB operation in the *First Report and Order* in MM Docket No. 99-325, **as revised in the Media Bureau's subsequent Order in MM Docket No. 99-325. AM stations are permitted to operate with hybrid digital nominal power equal to one percent of authorized analog nominal power (20 decibels below carrier (-20 dBc)). FM stations are permitted to operate with hybrid digital effective radiated power equal to one percent (-20 dBc) of authorized analog effective radiated power and may operate with up to ten percent (-10 dBc) of authorized analog effective radiated power in accordance with the procedures set forth in the Media Bureau's Order in MM Docket No 99-325. An AM or FM station may transmit IBOC signals during all hours for which the station is licensed to broadcast.**

\* \* \* \* \*

(e) \* \* \* \* \*

(5) **FM digital effective radiated power used and certification that the FM analog effective radiated power remains as authorized;**

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## APPENDIX D

### Final Regulatory Flexibility Act Analysis

1. As required by the Regulatory Flexibility Act (“RFA”),<sup>1</sup> as amended, an Initial Regulatory Flexibility Analysis (“IRFA”) was incorporated in the FM Digital Power Increase and Associated Technical Studies Notice of Proposed Rules,<sup>2</sup> in this proceeding. The Commission sought written public comment on the proposals in the Notice of Proposed Rules section, including comment on the IRFA. The Commission received no comments specifically on the IRFA. This Final Regulatory Flexibility Analysis (“FRFA”) conforms to the RFA.

#### A. Need For and Objectives of the Proposed Rules:

2. The Commission’s current rules limit the maximum permissible digital effective radiated power for FM stations (“FM Digital ERP”) to 1 percent of a station’s authorized analog effective radiated power (“Analog ERP”) (20 decibels below carrier (-20 dBc)). Operating pursuant to that limitation, many stations have observed deficiencies in their digital signal coverage as compared to the coverage of their analog signal, particularly with regard to portable and indoor listening. A group consisting of 18 broadcasters that operate over 1200 commercial and noncommercial educational (“NCE”) FM radio stations throughout the United States and the 4 largest manufacturers of broadcast transmission equipment, collectively identifying themselves as the “Joint Parties,” filed with the Commission a request that the maximum permissible FM Digital ERP be increased to 10 percent of a station’s authorized Analog ERP (-10 dBc) to allow stations to improve their digital coverage (“Joint Parties’ Request”). Filed concurrently with and in support of the Joint Parties’ Request was a technical report on the proposed increase, prepared by iBiquity Digital Corporation (“iBiquity”). National Public Radio (“NPR”) subsequently submitted its Corporation for Public Broadcasting (“CPB”)-supported research on FM digital radio coverage and interference at higher power levels and expressed its opposition to the Joint Parties’ Request, citing interference concerns. The Media Bureau (“Bureau”) issued a public notice seeking comment on the Joint Parties’ Request and the iBiquity and NPR technical studies.<sup>3</sup>

3. NPR subsequently announced that it would complete additional studies on FM DAB at higher power levels, which it stated would be released in September 2009. The Bureau thereafter issued a second public notice in which it specifically asked whether an increase in maximum authorized FM digital operating power is warranted, and whether it should defer consideration of a power increase until completion of and comment on the further NPR studies.<sup>4</sup> In response, the majority of commenters stated that improvements to FM digital coverage are necessary for the successful consumer adoption of FM DAB technology. Some commenters stated, however, that the Bureau should delay any increase until completion of and comment on the further NPR studies, in order to ensure that higher-powered digital operation does not cause unacceptable interference to first adjacent analog stations.

4. On November 4, 2009, NPR submitted the results of its additional FM Digital ERP increase studies, “Report to the FCC on the Advanced IBOC Coverage and Compatibility Study” (“AICCS Project Report”), to the Commission. Based on its AICCS Project Report findings, NPR concluded that a blanket

<sup>1</sup> See 5 U.S.C. § 603. The RFA, *see* 5 U.S.C. § 601 *et seq.*, has been amended by the Contract With America Advancement Act of 1996, Pub. L. No. 104-121, 110 Stat. 847 (1996) (CWAAA). Title II of the CWAAA is the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA).

<sup>2</sup> 74 FR 27985, June 12, 2009.

<sup>3</sup> *Comment Sought on Joint Parties Request for FM Digital Power Increase and Associated Technical Studies*, Public Notice, DA 08-2340 (MB rel. Oct. 23, 2008).

<sup>4</sup> *Comment Sought on Specific Issues Regarding Joint Parties’ Request for FM Digital Power Increase and Associated Technical Studies*, Public Notice, 24 FCC Red (MB 2009) (DA 09-1127).

6 dB increase in FM Digital ERP (from -20 dBc to -14 dBc) was acceptable for most FM stations, and that using a formula it developed based on its testing, certain FM stations could increase FM Digital ERP up to a maximum of 10 dB (from -20 dBc to -10 dBc).

5. Based on the results of the AICCS Project Report and the five years of generally interference-free FM hybrid digital operations by approximately 1500 stations, the *Order* adopts rule changes to allow eligible authorized FM stations to commence operation of FM digital facilities with operating power up to -14 dBc upon notice to the Commission (licensees of a super-powered FM station must file an informal request for *any* increase in the station's FM Digital ERP). The rule changes will further allow licensees to submit an application to the Media Bureau, in the form of an informal request, for any increase in FM Digital ERP beyond 6 dB. Licensees submitting such a request must use a simplified method set forth in the *Order* to determine the proponent station's maximum permissible FM Digital ERP. In situations where the simplified method is not applicable due to unusual terrain or other environmental or technical considerations or when it produces anomalous FM Digital ERP results, the Bureau will accept applications for FM Digital ERP in excess of -14 dBc. Such an application must be accompanied by a detailed showing containing a complete explanation of the prediction methodology used as well as data, maps and sample calculations. The Media Bureau will evaluate these applications on a case-by-case basis. Finally, the *Order* implements interference mitigation and remediation procedures to resolve promptly allegations of digital interference to an authorized FM analog facility resulting from an FM Digital ERP power increase undertaken pursuant to the procedures adopted in the *Order*. Specifically, if an analog FM station is receiving verifiable listener complaints of interference within its protected contour from FM digital facilities operating with FM Digital ERP in excess of -20 dBc, the licensee of the affected analog FM station must contact the licensee of the station operating the FM digital facilities. Stations are required to work cooperatively to confirm the instances of interference. If the stations fail to reach agreement on appropriate interference remediation measures, the licensee of the affected analog FM station may file an interference complaint with the Bureau.

6. The rule changes adopted in the *Order* balance the pressing need for improved FM digital coverage with the continued need to limit interference to first-adjacent analog stations. The rules will allow an FM station's digital signal to more closely approximate the coverage of their analog signal, improving service to listeners, and provide a detailed mechanism for resolving interference complaints, thus providing regulatory certainty as this relatively new service continues to develop.

**B. Summary of Significant Issues Raised by Public Comments in Response to the IRFA:**

7. In the IRFA, the Bureau sought comment regarding how small entities would be affected if the Commission were to adopt an increase in maximum digital operating power, whether such adoption could result in the disparate treatment of small entities with limited financial and/or technical resources, and any information on alternative approaches to alleviate any potential burdens on small entities. The Commission received no comments specifically in response to the IRFA.

**C. Description and Estimate of the Number of Small Entities to Which the Proposed Rules Will Apply:**

8. The RFA directs the Commission to provide a description of and, where feasible, an estimate of the number of small entities that will be affected by the proposed rules.<sup>5</sup> The RFA generally defines the term "small entity" as encompassing the terms "small business," "small organization," and "small governmental entity."<sup>6</sup> In addition, the term "small business" has the same meaning as the term "small

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<sup>5</sup> 5 U.S.C. § 603(b)(3).

<sup>6</sup> 5 U.S.C. § 601(6).

business concern” under the Small Business Act.<sup>7</sup> A small business concern is one which: (1) is independently owned and operated; (2) is not dominant in its field of operation; and (3) satisfies any additional criteria established by the Small Business Administration (“SBA”).<sup>8</sup> The proposed rules and policies potentially will apply to all FM radio broadcasting licensees and potential licensees.

9. The SBA defines a radio broadcasting station that has \$7 million or less in annual receipts as a small business.<sup>9</sup> A radio broadcasting station is an establishment primarily engaged in broadcasting aural programs by radio to the public.<sup>10</sup> Included in this industry are commercial, religious, educational, and other radio stations.<sup>11</sup> Radio broadcasting stations which primarily are engaged in radio broadcasting and which produce radio program materials are similarly included.<sup>12</sup> According to Commission staff review of the BIA Financial Network, Inc. Media Access Radio Analyzer Database as of February 19, 2009, about 10,600 (96 percent) of 11,050 commercial radio stations in the United States have revenues of \$7 million or less. We note that many radio stations are affiliated with much larger corporations having much higher revenue. Our estimate, therefore, likely overstates the number of small entities that might be affected by our action.

**D. Description of Projected Reporting, Recordkeeping and Other Compliance Requirements:**

10. The increase of FM Digital ERP as authorized in the *Order* is at the option of the licensee. As noted above, a broadcast licensee may opt not to increase its power and will thus incur no costs. To the extent that a licensee chooses to increase its digital operating power, the associated burdens and costs depend on the nature of the increase. The rule changes will allow eligible authorized FM stations to commence operation of FM digital facilities with operating power up to -14 dBc upon notice to the Commission. The rule changes will further allow licensees to submit an application to the Media Bureau, in the form of an informal request, for any increase in FM Digital ERP beyond 6 dB (or, in the case of super-powered stations, any increase in its Digital ERP). Licensees submitting such a request must use a simplified method set forth in the *Order* to determine the proponent station’s maximum permissible FM Digital ERP. In situations where the simplified method is not applicable due to unusual terrain or other environmental or technical considerations or when it produces anomalous FM Digital ERP results, the Bureau will accept applications for FM Digital ERP in excess of -14 dBc on a case-by-case basis when accompanied by a detailed showing containing a complete explanation of the prediction methodology used as well as data, maps and sample calculations.

**E. Steps Taken to Minimize Significant Impact on Small Entities, and Significant Alternatives Considered:**

11. The RFA requires an agency to describe any significant alternatives that it has considered in reaching its proposed approach, which may include the following four alternatives (among others): (1) the establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities; (2) the clarification, consolidation, or simplification of compliance or

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<sup>7</sup> 5 U.S.C. § 601(3) (incorporating by reference the definition of “small business concern” in the Small Business Act, 15 U.S.C. § 632). Pursuant to 5 U.S.C. § 601(3), the statutory definition of a small business applies “unless an agency, after consultation with the Office of Advocacy of the Small Business Administration and after opportunity for public comment, establishes one or more definitions of such term which are appropriate to the activities of the agency and publishes such definition(s) in the Federal Register.”

<sup>8</sup> 15 U.S.C. § 632.

<sup>9</sup> See 13 C.F.R. 121.201, NAICS Code 515112 (changed from 513112 in October 2002).

<sup>10</sup> *Id.*

<sup>11</sup> *Id.*

<sup>12</sup> *Id.*

reporting requirements under the rule for small entities; (3) the use of performance, rather than design, standards; and (4) an exemption from coverage of the rule, or any part thereof, for small entities.<sup>13</sup>

12. In the *Order*, we take actions that may affect FM stations that are small entities by providing them the opportunity to operate at higher digital power levels. Prior to the instant rule changes, broadcasting in digital was optional for FM stations, and it will remain optional for FM stations following the rule changes. As a result, FM radio stations of all sizes may choose to take no action in response to the rule changes. In addition, FM radio stations already broadcasting in digital will not be required to take any action under the new rule if they continue operation at one percent of their Analog ERP levels, the maximum FM Digital ERP previously authorized, because the authorized increases in FM Digital ERP adopted in the *Order* are voluntary. In other words, small entities may continue to operate as authorized prior to today's rule changes if they lack, for instance, the resources to make investments in equipment necessary to implement a digital power increase. We acknowledge that an argument could be made by smaller entities that they could face an unacceptable disproportionate burden because of a comparative lack of capital and other resources. This argument suggests that the adopted rule changes places smaller entities at a resultant disadvantage in relation to larger entities. However, we reject such an argument because allowing such voluntary upgrades will ultimately provide: (1) improved digital coverage; (2) the advancement of digital radio technology; (3) increased listenership; (4) greater regulatory certainty; (5) flexibility to licensees in the timing and scope of the rollout of their digital radio services; and (6) the facilitation of informed decisions regarding equipment purchases that will best serve licensees' needs. Allowing licensees to voluntarily increase their Digital ERP will, in the long run, prove to impose a lesser burden on smaller entities than alternative measures, such as making digital power increases compulsory or prohibiting increases altogether. In light of these considerations, the Bureau has determined that the rule changes will not have a significant disproportionate impact on small entities.

#### **F. Report to Congress:**

13. The Commission will send a copy of the *Order*, including this FRFA, in a report to be sent to Congress pursuant to the SBREFA.<sup>14</sup> In addition, the Commission will send a copy of the *Order*, including the FRFA, to the Chief Counsel for Advocacy of the SBA. A copy of the *Order* and the FRFA (or summaries thereof) will also be published in the Federal Register.<sup>15</sup>

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<sup>13</sup> 5 U.S.C. § 603(b).

<sup>14</sup> See 5 U.S.C. § 801(a)(1)(A).

<sup>15</sup> See 5 U.S.C. § 604(b).

**NRSC-G202**

**NRSC Document Improvement Proposal**

If in the review or use of this document a potential change appears needed for safety, health or technical reasons, please fill in the appropriate information below and email, mail or fax to:

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