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Federal Communications Commission
Office of the Secretary

VIA HAND DELIVERY

Ms. Marlene H. Dortch
Secretary
Federal Communications Commission
445 Twelfth Street, SW
Washington, DC 20554

Re: **MM Docket No. 99-325**
Experimental Report – BDSTA-20070125ADV
FM IBOC Building Penetration Tests At Elevated Digital Subcarrier Levels

Dear Ms. Dortch:

CBS Radio Inc., by its attorneys, hereby submits the attached FM IBOC Building Penetration Tests at Elevated Digital Subcarrier Levels Report (the "Report") for inclusion in MM Docket No. 99-325.

The Report provides the results of building penetration tests that were conducted by station KROQ-FM, Pasadena, California (Facility ID No. 28622) operating with In-Band On-Channel digital power levels up to 10 dB above the currently authorized level pursuant to experimental authorization BDSTA-20070125ADV, as extended.

Should there be any questions regarding this matter, please contact the undersigned.

Very truly yours,

Steven A. Lerman
Counsel for CBS Radio Inc.

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Enclosure

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CBS RADIO

BROADCAST HD STREAMING ON-DEMAND

ESTABLISHED 1928

FM IBOC Building Penetration Tests

At

Elevated Digital Subcarrier Levels

Los Angeles, CA

May 29, 2008

CBS Radio
1515 Broadway
46th Floor
New York, NY 10036

Overview:

This report documents the performance of indoor reception of conventional FM analog signals and the digital component of iBiquity's hybrid IBOC FM system. Primarily, these tests document improvements in indoor reception with the IBOC Radio System operating with the digital subcarrier power level increased to -10 dBc vs. the authorized -20 dBc power level.

The IBOC Signal:

The authorized FM IBOC hybrid transmission mode consists of IBOC digital subcarriers inserted on both sides of the host analog FM signal. On each sideband there are 191subcarriers each at a power level of -41.4 dBc, reference a 1 kHz bandwidth. The total power of the 382 digital carriers is 20 dBc below the total power in the analog host. Building penetration tests were conducted in the Los Angeles metropolitan area on KROQ FM with the digital signal operating at the authorized power of -41.4 dBc per carrier level (total digital power -20 dBc) and with the digital power elevated to –31.4 dBc per carrier (total digital power -10 dBc).

KROQ-FM Transmission Facility:

The tests of elevated digital IBOC power tests were conducted using KROQ-FM (FCC ID 28622), licensed to CBS Radio, Pasadena California. KROQ-FM, Class B FM commercial radio station has been continuously operating as an IBOC station on 106.7 MHz since 09/27/02. The transmitter is located at 34-11-49.0 N latitude 118-15-30.0 W longitude. KROQ broadcasts with 5.6 kW Effective Radiated Power ("ERP") at a Height Above Average Terrain ("HAAT") of 423 m. The KROQ transmitter operates at 4.3 kW of Transmitter Power Output ("TPO") to produce its licensed Effective Radiated Power (ERP).

The IBOC -20 dBc and -10 dBc IBOC signals were generated using a Harris FlexStar exciter amplified by a Harris Z-16 Plus transmitter employing common amplification. The transmitter was connected to a 3 bay antenna resulting in 5.6 kWs of analog ERP and a digital ERP of either 56 W. at -20 dBc, or 560 W, at -10 dBc. Figure 1 depicts a spectral representation of the FM hybrid mode operating with total digital power of -20 dBc and Figure 2 shows the same spectrum with the total digital power elevated to -10 dBc. The rectangular areas contain the digital subcarriers, and the triangular area represents the analog host FM signal.

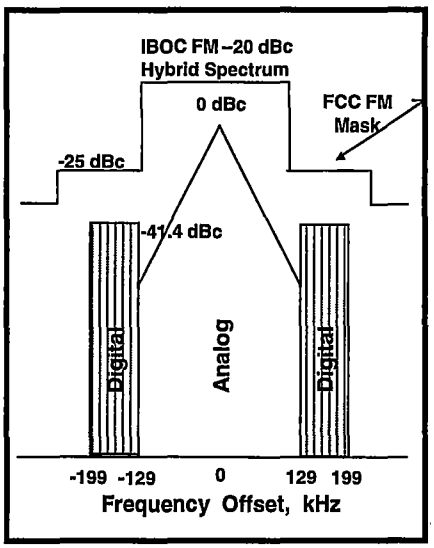

Figure 1 - FM Hybrid -20 dBc Spectrum

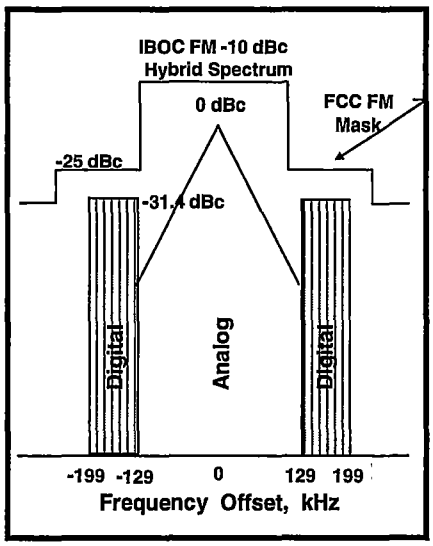

Figure 2 - FM Hybrid-10 dBc Spectrum

Station Configuration:

KROQ-FM's transmission setup is shown in Figure 3. As part of these tests a new Harris FlexStar Analog / Digital signal generator was installed and programmed to generate a combined analog and digital signal. In addition KROQ-FM's Harris Z-16 HD transmitter was upgraded to a Z16-HD-Plus w/ options transmitter. The upgraded transmitter provides for a higher degree of linearity and enables the transmitter to operate with 10 dB higher digital power level while maintaining the Out of Band Emissions ("OBE") within the iBiquity suggested mask for operation at the -20 dBc level.

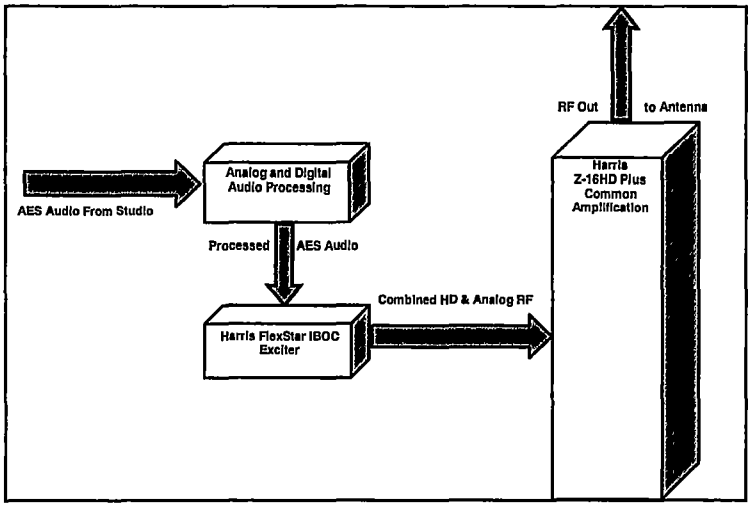

Figure 3 - Diagram of KROQ-FM IBOC Common Amplification FM Transmitter Setup

Operating Power:

Pursuant to KROQ-FM's license and Experimental Authorization, Granted by letter from the FCC dated Feb. 16, 2007, KROQ-FM was operated at its licensed analog power with total digital ERP of - 20 dBc, 56 watts, or -10 dBc, 560 watts.

Building Selection:

The CBS Engineering Team identified 10 buildings differing in construction type and usage. The buildings ranged from a residential dwelling to an office building in downtown Los Angeles. The sites are further described in Table 1 and the locations noted on the map shown in Figure 4.

Site Number	Description	Address	Height, Stories	Floor Measured
00	KROQ Main Transmitter Site	1250 Beaudry Blvd., Glendale	N/A	N/A
01	KROQ Studio/Office Conference Room	5901 Venice Blvd., Los Angeles	2	1
02	Chubb Insurance Building	801 South Figueroa St., Los Angeles	31	17
03	8-Unit apartment building	4127 East 1st St., Long Beach	2	2
04	5670 Wilshire high-rise office building	5670 Wilshire Blvd., Los Angeles	30	2
05	"SBS" medium-rise office building	10281 W. Pico Blvd., Los Angeles	4	1
06	"Hollywood/Highland" entertainment complex	6801 Hollywood Blvd., Los Angeles	3	3
07	single-family residence	1313 35th St. San Pedro	1	1
08	32-unit apartment complex	4616 Cahuenga Blvd., Toluca Lake	2	2
09	Underground Parking "Studio City Place"	11239 Ventura Blvd., Studio City	2	2 below ground
10	Underground Parking Ralphs Shopping Center	211 N. Glendale Ave., Glendale	2	2 below ground

Table 1 – Buildings Used For Testing

4616 Cahuenga Blvd, Toluca Lake #08
N34° 09.274'
W118° 21.677'
KROQ Tr #00
N34° 11.809'
W118° 14.398'
Underground Parking Lot #09
N34° 08.597'
W118° 22.492'
6801 Hollywood Blvd #06
N34° 06.283'
W118° 20.326'
Ralph's Shopping Ctr #10
211 N Glendale Ave., Glendale
N34° 08.897'
W118° 14.769'
CBS HQ
5670 Wilshire Blvd #04
N34° 03.754'
W118° 21.132'
The 801 Tower #02
N34° 03.910'
W118° 14.774'
KROQ Studio #01
N34° 02.382'
W118° 22.116'
10281 W. Pico Blvd #05
N34° 02.578'
W118° 16.374'
4127 East 1st St.
Long Beach, CA
N33° 45.630'
W118° 08.673'
1313 35th St #07
N33° 42.973'
W118° 18.351'
Apartment Bldg #03
Canoga Park
Van Nuys
Glendale
Pasadena
Sierra Madre
Monrovia
Arcadia
Temple City
San Gabriel
Rosemead
El Monte
Baldwin Park
Bassett
Monterey Park
South El Monte
Montebello
Commerce
Whittier
La Habra
Santa Fe Springs
La Mirada
Downey
Norwalk
Bellflower
Paramount
Compton
Lakewood
Cerritos
La Palma
Hawaiian Gardens
Cypress
Los Alamitos
Stanton
Long Beach
Garden
Westminster
Seal Beach
Sunset Beach
Huntington Beach
Torrance
Carson
Lomita
Palos Verdes Estates
Rolling Hills Estates
San Pedro
Wilmington
Harbor City
Redondo Beach
Hermosa Beach
Manhattan Beach
El Segundo
Playa del Rey
Marina del Rey
Venice
Inglewood
Lennox
Lawndale
Gardena
Hawthorne
Lynwood
Willow Brook
Florence
Maywood
Bell
Bell Gardens
Cudahy
Huntington Park
Vernon
Pico Rivera
Los Angeles
Pacific Palisades
Beverly Hills
West Hollywood
Hollywood
Burbank
Glendale
Altadena
Pasadena
Sierra Madre
Monrovia
Arcadia
Duarte
Topanga
Tarzana
Encino
Van Nuys
Sylmar
Canoga Park
Woodland Hills
Malibu
Santa Monica
Venice
Marina del Rey
Playa del Rey
El Segundo
Manhattan Beach
Hermosa Beach
Redondo Beach
Torrance
Palos Verdes Estates
Rolling Hills Estates
San Pedro
Wilmington
Harbor City
Long Beach
Seal Beach
Sunset Beach
Huntington Beach
Westminster
Garden Grove
Cypress
Los Alamitos
Stanton
Hawaiian Gardens
Lakewood
Cerritos
La Palma
Norwalk
Downey
Santa Fe Springs
La Mirada
Whittier
La Habra
Montebello
Commerce
Monterey Park
South El Monte
Bassett
El Monte
Baldwin Park
Rosemead
San Gabriel
Temple City
Sierra Madre
Monrovia
Arcadia
Duarte
Pasadena
Glendale
Burbank
Hollywood
Beverly Hills
West Hollywood
Pacific Palisades
Topanga
Woodland Hills
Sylmar
Tarzana
Encino
Van Nuys
Canoga Park
Malibu
Santa Monica
Venice
Marina del Rey
Playa del Rey
El Segundo
Manhattan Beach
Hermosa Beach
Redondo Beach
Torrance
Carson
Lomita

At each location the following measurements were made:

1. At an outside location the antenna was placed in a position where a visual observation indicated the signal was being received with minimal multipath[1]. Spectrum analyzer data and signal level were recorded to establish the unattended RF signal level being received from KROQ-FM.
2. The antenna, receiver and spectrum analyzer were moved into an indoor location near a window where the engineer attempted to receive the digital broadcast while transmitting with the IBOC carriers operating at -20 dBc[2]. Spectrum Analyzer data and signal level was recorded to establish the indoor signal level being received from KROQ-FM.
3. The antenna was moved to a more interior point within the building in an attempt to find a point where the digital signal failed, Point of Failure (POF)[3]. The distance in meters form the "window" location was recorded along with the analog audio and the spectrum analyzer measurements.
4. The digital power at the KROQ transmitter was increased and the antenna moved further into the interior of the building to a point where the digital signal failed, POF, -10 dBc. As above the distance in meters from the "window" location was recorded along with the analog audio and the spectrum analyzer measurements.
5. The building attenuation was calculated by subtracting the inside measurement from the outside measurement[4].

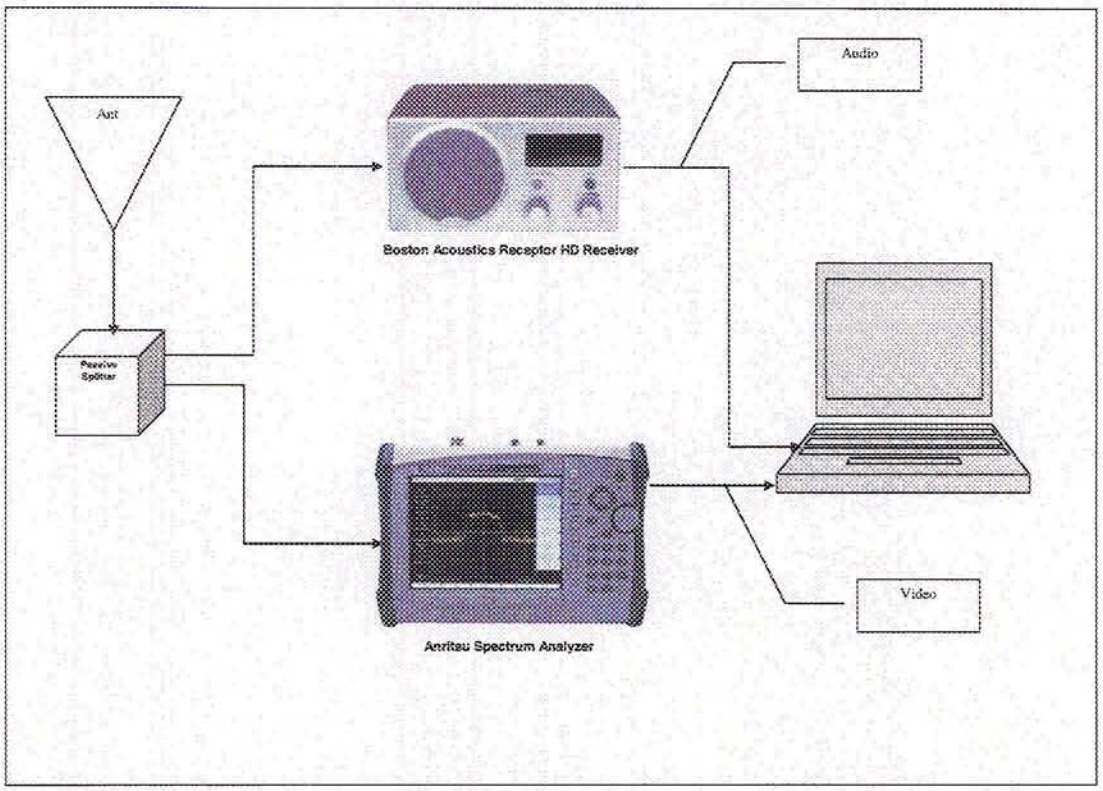

Figure 5 - Diagram of Field Measurements and Recording Setup

[1] The antenna was moved around until a location could be found where the IBOC sidebands were symmetrical in level.
[2] In many locations it was not possible to receive the digital signal at the -20 dB transmission level.
[3] -20 dBc POF location
[4] The absolute field intensity read off the spectrum analyzer in dBm was converted to dBu by adding 116dB. 3dB was added to the resultant number to account for the loss in the attenuation of the splitter.

Results:

The results of the tests are summarized in Table 2, below. In 75% of the buildings tested the analog reception was described as non-existent, noisy or poor and there was no digital reception when the IBOC power levels were operating at the -20 dBc level.

With the digital subcarriers elevated to -10 dBc, the digital radio signal could be received reliably in 75% of the building and at selected locations in the remaining 25% of the buildings. The goals of the test plan were not entirely met as the ability to receive the digital part of the broadcast when operating at an IBOC power level of -20 dBc was only possible in one building and when operating at -10 dBc the signal was available uniformly throughout the structure except in two of the buildings. While the tests did not yield the desired quantitative numbers the qualitative information shows that increasing the digital power by 10 dB results in very robust indoor reception. It is important to note that the improvements in digital reception did not change the quality or reception of the host analog signal.

Testing was conducted in two underground parking garages to determine the POF, when the receiver is located in very obstructed and attenuated spaces. In this test, CBS Radio engineers drove a test van outfitted with the Boston Acoustics Receptor HD receiver into underground parking garages to demonstrate how much deeper into a building that IBOC signals could be received when the power was increased to the -10 dBc digital power level. In building 9, at -20 dBc, the digital signal failed at the bottom of the ramp even though the analog reception was good. With the power increased to -10 dBc digital reception was available at most of the locations in the building while analog reception in these same locations was reported to be noisy. In building 10, the digital reception with the IBOC carriers at –20 dBc was available to about 30 feet into the building. With the IBOC carriers elevated to -10 dBc the digital signal was received to 165 feet within the building. At the point of digital failure, the analog signal had deteriorated to the point that would not be acceptable to most listeners. The results are summarized in *"Table 2, and 3 Test Results"* with a detailed description of the results following in appendixes 00 -10.

IBOC Building Penetration Test Results, KROQ, Los Angeles, CA.															
#	Description	Dwelling Type	Longitude (DMS)	Latitude (DMS)	Distance From Tx (km)	Predicted dBµ	Rx Ht. m	dBµ Out	dBµ In	Bld. Atten. dB	dBµ @ -20 dBc POF	dBµ @ -10 dBc POF	Analog Reception	IBOC @ -20 dBc	IBOC @ -10 dBc
00	KROQ Transmitter	Concrete Block	118-14-23.9 W	34-11-36.5 N	KROQ Transmitter Site – Calibration Only										
01	KROQ Studios	Concrete Block	118-22-07.0 W	34-02-22.9 N	20.19	63	2	65.7	47.3	18.4			Noisy	None	Solid
02	801 Tower	Concrete & Steel	118-14-46.4 W	34-03-54.6 N	14.66	67	17	70.7	58.9	11.8			Good w/ Multipat	Intermittent	Solid
03	Long Beach Apts.	Wood Frame Stucco	118-08-40.4 W	34-45-37.8 N	45.59	56	2	46.3	43.1	3.2		41.6	Poor	None	Intermittent
04	CBS Radio Hdq..	Concrete & Steel	118-21-07.9 W	34-03-45.2 N	17.24	44	2	62.0	66.7	-4.7		44.0	None	None	Solid
05	SBS Office Building	Concrete & Steel	118-16-22.4 W	34-02-34.7 N	17.13	64	2	61.8	33.1	28.7			None	None	Solid
06	Hollywood Highland	Concrete & Steel	118-20-20.2 W	34-06-05.6 N	12.93	53	3	63.8	51.0	12.8			Poor	None	Solid
07	San Pedro Residence	Wood Frame Stucco	118-18-21.1 W	34-42-58.4 N	53.5	34	2	44.4	41.6	2.8		41.6	Poor	None	Intermittent
08	Toluca Lake Apts.	Wood Frame Stucco	118-21-40.6 W	34-09-16.4 N	10.59	69	2	68.1	73.6	-5.5			Good	Solid	Solid
09	Studio City Pk. Garage	Concrete & Steel	118-22-29.6 W	34-08-30.4 N	12.37	68	2	82.6	55.7	26.9		39.3	Point of Failure Tests Only		
10	Ralph's Pk. Garage	Concrete & Steel	118-14-46.1 W	34-08-52.7 N	5.55	75	2	68.2	49.4	18.9	49.4	41.2	Point of Failure Tests Only		

Measurement notes, the measurement made outside location 04 CBS Radio Hdq were made at ground level therefore the inside signal levels on the 3rd floor are higher, likewise the measurement made outside location 08 were higher than inside. The negative attenuation numbers from these two buildings are not included in the attenuation calculations.

Table 2 – Test Results Summary

Structure	Attenuation
Concrete Block	18.4 dB
Concrete & Steel	19.8dB
Wood Frame	3.0 dB
All Structures (Average)	17.5 dB

Table 3 – Test Results Summary

Conclusions:

When operating at a digital power of -20 dBc, hybrid IBOC signals are difficult to receive inside most structures except when they are located close to the transmission site. This report shows that by elevating the IBOC carrier levels to -10 dBc that the hybrid IBOC system can provide equivalent indoor reception with better quality than analog while providing additional digital channels and services. The power increase will promote the widespread adoption of digital radio.

Appendixes

Site 00 - KROQ Transmitter Site / 1250 Beaudry Blvd, Glendale, CA ..... Appendix 00

Site 01 – KROQ Studios / 5901 Venice Blvd., LA..... Appendix 01

Site 02 – The 801 Tower / 801 South Figueroa St., LA..... Appendix 02

Site 03 – 8 Unit Apt. Building 4127 East 1st St., Long Beach..... Appendix 03

Site 04 – CBS Radio / 5670 Wilshire Blvd, LA..... Appendix 04

Site 05 – SBS Office Building /10281 W. Pico Blvd, LA..... Appendix 05

Site 06 – Hollywood Highland Entertainment Complex 6801 Hollywood Blvd, LA..... Appendix 06

Site 07 – Single Residence 1313 35th St, San Pedro, CA..... Appendix 07

Site 08 – 36 Unit Apt. Complex 4646 Cahuenga Blvd, Toluca Lake..... Appendix 08

Site 09 – Parking Garage 11239 Ventura Blvd., Studio City, CA..... Appendix 09

Site 10 – Parking Garage 211 N. Glendale Ave., Glendale, CA..... Appendix 10

Table of Audio Cuts..... Appendix 11