行政院所屬各機關因公出國報告書

（出國類別：考察）

美國廣播電視年會（NAB2003）

考察報告

行政院研考會/省（市）研考會編號欄

服務機關：交通部電信總局

出國人　職　稱：科長

姓　名：鄭詩泱

出國地點：美國

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主辦機關:

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內容摘要: 今年的「美國廣播電視年會（NAB2003）」於四月五日到十日在Las Vegas舉行，開幕儀式則在四月七日。展示會場共分成七個展示區，參展廠商約1200個，研討會部分則分成Keynotes and Special Events及Broadcast Engineering Conference等十四個主題，共約200個場次，大會總共吸引了近九萬名人士參觀。該會議爲全球廣播技術交流與搭配展示設備之世界性會議，會中可瞭解廣播電視之傳播新科技和各國相關業務發展近況，有助於我國推動廣播電視技術數位化之發展。本出國報告則針對美國有線廣播電視數位化推動情形及CATV寬頻網路和電信服務業的競爭簡要介紹。

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一、前言

職奉派參加今年在美國 Las Vegas 舉行的「美國廣播電視年會（NAB2003）」，以瞭解各國最新廣播科技及美國有線廣播電視數位化推動情形。該會議為全球廣播技術交流與搭配展示設備之世界性會議，會中可瞭解廣播電視之傳播新科技和各國相關業務發展近況，有助於我國推動廣播電視技術數位化之發展。

今年的展覽會於四月五日到十日在Las Vegas舉行，開幕儀式則在四月七日。展示會場共分成七個展示區，參展廠商約1200個，研討會部分則分成 Keynotes and Special Events 及 Broadcast Engineering Conference 等十四個主題，共約 200 個場次，大會總共吸引了近九萬名人士參觀，職則針對各國最新廣播科技及美國有線廣播電視數位化推動情形進行了解及探討。

二、行程概要

四月六日　　去程，搭機至美國 Las Vegas

四月七日
至十日　　考察 NAB2003 廣電設備展並參加相關研討會

四月十一日　　回程，由 Las Vegas 返國

四月十二日　　返回台北

三、NAB2003 廣電設備展暨研討會內容

NAB2003 廣電設備展被主辦單位形容成全球最大的電子媒體展，涵蓋面涉及與所有傳播媒體有關的專業影音與聲光內容的研發、傳輸、和管理。NAB 在國際上被視為發表電子媒體新產品和展示最新科技的場地。本年度展示會場共分成 Digital Media Theater、Interactive Living Pavilion、RTNDA@NAB Exhibits、SAN Pavilion Featuring、Network Storage & Security、DTV Drafthouse 及 International Pavilions 等七個展示區，參展廠商約 1200 個，展示最新有線廣播 、無線廣播、衛星廣播、聲音、影像、寬頻傳輸與多媒體視訊等技術及設備，吸引了近九萬名人士參觀，其中來自美國以外世界各地至少有兩萬名人士，包括 137 個不同國家的參觀者，及超過 225 個海外的參展廠商。

今天美國大部分的電視台都已安裝完成基本的數位電視（DTV）設備，主要時段的節目上大約有半數是以高畫質電視（HDTV）方式播出。另外寬頻網路和消費性電子產業也在去年 12 月完成了一項重大協議，同意在零售市場提供隨插即播的數位網路電視。因此在 NAB 的會場上，大部分的公司都宣稱：他們的商品結合了最新的高畫質（HD）技術，在形態上並具有多種彈性。因此在會場上會看到不少能在 HD 和普通畫質（SD）之間做轉換的伺服器及多重形態與多重通訊協定之設備。其他如最先進的控制技術、整體規劃之中央轉播系統、管理與監督軟體工具或硬體設備及多媒體瀏覽器等都有不少的廠家展示。其中新型的光學磁片看來會是未來媒體主要之儲存體，它適用於影、音、多媒體等任何形式的資訊，就像現在儲存文字資料檔一樣容易，光碟業已

取代了現在的錄影帶。

而研討會部分則分成 Keynotes and Special Events、Super Sessions、Leadership Sessions、Broadcast Engineering Conference、Radio Management Conference、RAB Sales & Marketing Conference、Television Management Conference、NAB MultiMedia World Conference、Satellite & Media Forum、Business Law & Regulation Conference、RTNDA@NAB Conference、Digital Video Production Workshop、Digital Cinema Summit 及 Career Fair and Seminar 等十四個主題，共約 200 個場次，分別在不同場地並行舉辦研討，詳如參考資料。

研討內容除探討相關工程技術，對網路傳播所面臨的著作權爭議也進行了熱烈的討論。過去十年來相關的媒體著作權法規，讓一些聽音樂的消費者不需購買錄好的唱片就可由廣播或網路享受美好的音樂，但因此卻造成音樂表演者和唱片公司無法以他們的創作來營生。這種情形現在正威脅著音樂界，很快地也會影響到電影業。法令或許不是促進這個市場成長的最佳方法，但對網路的早期發展卻影響深遠。

由於銷路和收益減少，音樂的授權問題將使唱片業與廣播業及網路傳播業的合作更為密切。另外聯合媒體對於授權給使用者的各項權利將會更小心地精打細算。由於每年花費了數億元來蒐集新聞，當提供新聞服務給個人用戶時，需要有妥善的控制方法回收成本，以便於未來能有足夠的資金繼續去蒐集新聞。

另今年大會首次成立了 NAB 年度媒體發明獎 (AIM)，故與會代表在今年的會展中將票選出最能吸引他們的產品。獎項分為三

個主要的類別，分別是: 內容創作、內容管理及內容傳達，每個類別則會選出五名優勝者。NAB 大會主席兼執行總裁 Edward O. Fritts 表示： NAB 盛會一直被視為創新科技的發源地。而 AIM 活動的設計，旨在表揚運用了尖端科技而能革新通訊技術的產品。

四、美國有線電視系統數位化情形

美國大約需要花上七百億美元左右的資金，才能讓全部的有線電視系統技術升級，大多數的有線電視消費者也才能得到數位服務。Time Warner 有線電視的升級程度已達 98%。Comcast 預估其數位化將於今年年底大幅升級到將近 95%。Mediacom 也搶著更新它先前的 AT&T 寬頻系統，並計畫在六月以前完成達 98%的網路數位化。而 Cablevision 在 2002 年底的數位化程度低於 80%，但計劃在今年能完成全部的數位化工程。

當然現在消費者也須提升自己的接收設備，以配合數位化時代。關於這一點，各家有線電視業者有不同的評估。Kagan World Media 把數位服務的用戶設定為今年年底達兩千零一十萬人，大約佔了市場的 30%。因此仍有很大的成長空間。

雖然業者計畫如期提供最先進的數位服務，而各家情況則不相同。目前 Comcast 籌劃了 30 組隨選視訊播放系統(VOD)，應該在今年年底能針對 MSO (Multiple System Owners) 現有兩千七百萬的半數用戶提供相關服務。但現在廣大的 MSO 用戶最感興趣的是免費的網路即時資訊服務，這有可能會帶動更進一步的數位化成長。Time Warner 也已利用免費的網路資訊服務去刺激用戶對數位服務的興趣，而不只是單獨把 VOD 當做特定的收入來源。而 Mediacom 則抱持不同的看法，它希望透過 VOD 來增加收入，而不是追求最先進的技術。

身為全美最大的 MSO Comcast Corp. 今年首要的目標或許是加強它的基本業務，但仍不放棄數位化的市場。儘管 HDTV 在有限的資源下已於今年開跑，而且數位視訊錄影機 (DVR) 技術測

試也已開始著手，但吸引 C手著a但 目光的最新數位產品卻是 VOD。

而快速的資訊服務是促使 Time Warner Cable 收益成長的最重要因素。它們看到來自於每個用戶的平均收益，和 2000 年的每月 51 美元相比，2002 年底上升到每月 65 美元。目前共有 34 個地區，其中 33 個地區已有 VOD；而 HDTV，以及可連接機上盒 (set-top box) 的 DVR 技術，甚至是網路電話，也在各種不同階段的測試及開發當中。

Cox Communications 則繼續在新服務的推出以及新市場的開發兩方面採取平衡動作，不讓公司侷限在單一模式的框架裡。過去六個月內，Cox 的 VOD 市場已經倍增為四個，並將 DVR 引進兩個沒有 VOD 的市場，以及在其百分之 40 以上版圖推出 HDTV 節目。

經歷長久重大策略調整，Cablevision 的數位影視將在 2003 年積極衝刺。自從去年年初調降數位服務價格，這一有線電視多系統經營者已經拓展數位版圖，並引進低價的 Scientific-Atlanta 視訊轉換器。市場的行銷以及口耳相傳下，已經使得用戶數目出現大幅增長。去年底為止，Cablevision 已經簽下 21 萬 7000 戶數位服務客戶，遠遠超出分析師的預估。

與 Comcast 相似，Mediacom 的最高優先順序為改造購自 AT&T 寬頻部門的低度開發系統。在重新定價與重新包裝數位影視服務之外，整合與升級任務在去年底完成。Mediacom 的數位有線服務在去年 12 月 31 日已經可以為百分之 97 的訂戶接收。大約有百分之 96 的原始網路已經在年底升級到至少 550MHz 頻寬，而且有百分之 91 的家庭具有互動功能。

在美國，有線電視業者對於他們如何提供數位服務並沒有相

同的看法，值得我國業者密切注意與觀察。我國有線電視數位化才剛起步，距離真正的數位競賽還有一段路要走。

五、美國有線電視寬頻網路和電信服務業的競爭

寬頻上網技術將決定有線電視寬頻網路和電信服務業者間競爭的成敗。電信業者以數位用戶服務技術 (xDSL)來傳送雙向的寬頻服務。同時也提供比撥接式數據機快十倍的高速服務，有些 xDSL 可提供 1.5Mbps 的傳輸速度，相較之下極為快速。除了偏遠的鄉村之外，xDSL 電話上網服務至今幾乎在全美各地都很普及。

相反地，寬頻網路數據機又比最好的高速 xDSL 技術快上好幾倍，它夠快速而完整的傳輸影像、資訊和聲音，但是寬頻網路數據機的市場佔有率在美國已逐漸衰退。主要的兩個因素是技術和價格。經過實證，當太多使用者都同時蜂擁上網的時候，鄰近地區的處理器就會跟著停頓，這個問題迄今未能獲得妥善解決。在價格方面，xDSL 數據機則勝過網路數據。一般家庭或小公司能以每月平均定價 40 美元或更低價來購買 xDSL 的相關服務，而寬頻網路服務的平均價格每月約 70 美元。基於 xDSL 顯而易見的優勢，有些人會覺得許多寬頻網路的服務業者，例如 High Speed Access，在經濟衰退的情況下已呈現捉襟見肘的現象。還有隱私的問題，寬頻網路數據機因無法保障私人隱私而一直為人所詬病。

另外，美國有線電視寬頻網路尚面臨來自於有線電視產業內部的困境，如會計與收費的作業無法妥善配合，客服系統不佳與區域產業壟斷一直難以獲得改善。美國有線電視寬頻網路可能可以克服衛星和電信兩個產業之間競爭白熱化的問題，但網路業務之發展是否能夠站穩自己的腳步才是產業成敗的關鍵。

五、結論與建議

（一）數位化是有線電視產業的必然趨勢：

有線電視業者未來將不只扮演節目提供者的角色，隨著雙向互動的落實、寬頻環境的建立，有線電視業、行動通訊服務業及ISP 業的界限漸模糊，用戶或使用者對寬頻通訊的服務需求則愈趨多樣化，收費下降且提供通信和廣播等多方位的服務，將對有線電視業者形成新的挑戰和機會。

如何以有限的頻道資源提供許多先進的服務，是有線電視系統數位化追求的目標。數位電視應用不只對STB 等產品帶來新的需求，增加頻道使用效率及具備雙向互動傳輸功能，對系統業者而言，數位化後不但可提供一個更安全且更獲利的來源，還可仔細研究用戶喜愛的節目類型，並從用戶分析中找出更多的商機。而對收視戶而言，有更多更精彩的服務選擇，如高畫質電視(HDTV)、節目計次付費(PPV)、隨選視訊(VOD)、電子節目單 (EPG)及上網。

（二）引進競爭機制可加速有線電視數位化

美國有線電視數位化主要的動力來自政府的強勢作為和衛星電視的激烈競爭。FCC 除要求 2006 年 12 月 31 日要停止無線電視台類比信號廣播外還訂定電視機加裝數位解調器時程及確認各地區之電視台播送 HDTV 節目之日程表。另外數位衛星電視節目正式服務已有五年以上的歷史，而近期更要推出雙向 Ka 頻段光束衛星系統。例如 EchoStar 計畫在 2003（今）年五月將新的人造衛星發射升空將對有線電視造成很大的衝擊。反觀我國有線電視由於是分區獨占或寡占性質，業者對網路數位化之著眼點僅在於利潤的

增加，如新增收費頻道與降低私接戶以增加營收。今天我國衛星廣播電視產業已難以和有線電視產業競爭，若能引進中華電信經營 MOD 業務，再加上相關配套措施如對推廣使用符合本局規範之數位機上盒之業者給於補助、修法鼓勵較小之業者合併以改善其企業體質等，以刺激我國有線電視之發展朝向正面的競爭。

（三）有線電視應提供高畫質電視節目以強化其競爭力

數位化及高畫質節目從本次 NAB 展覽會場上可以確認是未來廣電技術及服務之主流，有線電視若能引進高畫質電視（HDTV）應可使其在與中華電信之 MOD 業務競賽中，取得局部優勢地位。傳送 HDTV 節目所須之傳輸速率約近 20M Bps ，以今天成熟之技術或設備，有線電視一個 6M Hz 頻寬之頻道可傳送一至兩個 HDTV 節目，而今天 MOD 系統則僅具傳送 3M Bps 之傳輸能力，要達到傳送 HDTV 節目 20Mbs 能力，須對整體網路設備重新建設，將是一大難題與考驗。另外在技術上頻寬變寬傳輸距離將縮短，服務範圍的變小應非短期內所能克服。

（四）建議 DRM 與 IBOC 均納入 AM 頻段數位廣播試播之項目

雖然 AM 短、中、長波段之 Digital Radio Mondiale(DRM) 系統已於 2001 年為 ITU 所接受，但本次會場上卻看到不少已商品化的美規 AM IBOC 發射機，惟經現場了解 AM IBOC 廣播系統之夜間廣播干擾問題尚待解決。前者為國際所認定之規格，後者則於市場上展現先機，故建議我國在近期做相關試播或實驗測試時，DRM 與 IBOC 系統均可納入試播實驗的選項，詳如參考資料。

The Conferences and Events...

BEC = Broadcast Engineering
BLR = Business, Law & Regulation
DCS = Digital Cinema Summit
DVP = Digital Video Production Wrkshp
GI = General Interest Events
IS = InfoSession
MMW = NAB MultiMedia World
R/TV = Radio & TV Management
SS = Super Sessions
SMF = Satellite Media Forum

The Venues...

LVCC = Las Vegas Convention Center
LVH = Las Vegas Hilton Hotel

Attend these sessions and events If your Interest Is...

Conf.	Event	Time	For complete description, see page...	Room	Venue	Digital	Engineering	International	Internet	Legal	Multi Media	Production/Post	Radio Mgmt.	Radio Sales/Mktg.	Satellite	Streaming	Telecom	TV Mgmt.	TV Sales/Mktg.	Video
	Saturday																			
DVP	Digital Video Production Workshop ▲	8:30am - 4:30pm	60	S220-22	LVCC	●		●			●	●								●
DCS	Digital Cinema Summit *Keynote: Kurt Hall* ▲	9:00am - 5:00pm	58	N245	LVCC	●	●	●			●	●								●
BEC	IEEE/BTS Tutorial - 8 VSB Enhancements	9:00am - 1:00pm	42	N109	LVCC	●	●													
BEC	SBE Ennes Workshop	9:00am - 6:00pm	42	N111	LVCC	●	●													●
BEC	HDTV Codecs: How Much Bandwidth Does It Take?	2:00-4:00pm	43	N109	LVCC	●	●													
GI	NAB Research Grant Recipient Summaries	3:00 - 4:15pm	36	N225	LVCC								●	●			●	●		
	Sunday																			
DVP	Digital Video Production Workshop ▲	8:30am - 5:30pm	62	S220-22	LVCC	●		●			●	●								●
DCS	Digital Cinema Summit ▲	9:00am - 5:00pm	59	N245	LVCC	●		●			●	●								●
BEC	Broadcast Engineering Conference Opening *Keynote: Leonardo Chiariglione*	9:00-9:30am	43	N109	LVCC	●	●	●												
BEC	DTV Conversion Issues & Solutions - Part I	9:30am - Noon	43	N109	LVCC	●	●													
BEC	IBOC DAB - Ready for Prime Time - Part I	9:30am - Noon	44	N111	LVCC	●	●													
MMW	Producing Video, DVD and Websites for Profit	10:00 - 11:00am	68	N115	LVCCv	●		●	●		●	●								●
GI	NAB/BEA/RTNDA Career Seminar	10:30 - 11:45am	36	N242	LVCC								●	●						
MMW	Web Designing for Dollars	11:15am-12:15pm	68	N115	LVCC	●		●	●			●				●				
GI	NAB/BEA/RTNDA Career Fair	Noon - 4:45 pm	36	N252	LVCC								●	●						
BEC	IBOC DAB - Ready for Prime Time - Part II	1:00 - 5:00pm	45	N111	LVCC	●	●													
BEC	DTV Conversion Issues & Solutions - Part II	1:00 - 5:30pm	44	N109	LVCC	●	●													
MMW	Internet Broadcasting Legal Review	2:00 - 3:15pm	68	N115	LVCC	●			●	●	●					●				
R/TV	The Digital Landscape	2:00 - 4:00pm	71		LVCC	●	●			●			●	●				●	●	
	The Business of DTV: Revenue Opportunities			N237	LVCC															
	Digital AM & FM Radio: The Future Begins Now			N241	LVCC															
	Digital Reception and Table Top Exhibits	4:00 - 5:00pm	71	N238	LVCC															
GI	RTNDA@NAB Exhibit Preview	2:00 - 6:00pm	36	Pavilion	LVH	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
MMW	Streaming Media Business Models That Work	3:30 - 4:45pm	68	N115	LVCC			●								●				

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GI	Global Matchmaking Reception	6:00 - 8:00pm	36	Blrm B	LVH	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
GI	Opening Celebration Featuring Bill Cosby ✖ *Sponsored by EMC*	8:00 - 10:pm	36	Grnd Blrm	Bellagio	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	Monday																			
GI	Congressional Breakfast	7:30 - 8:45am	38	Blrm A	LHV					●			●	●						
GI	All Industry Opening Ceremony ■ *Keynote: Barry Diller; State of Industry: Eddie Fritts; DSA Recipient: Cokie Roberts*	9:00 - 10:30am	38	Barron Rm	LVH	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
GI	Exhibits Open	9:00am - 6:00pm	87	Exh. Halls	LVCC	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
SMF	Global Opportunities: Satellite Industry & Media Sector *Keynote: Joan Byrnes*	10:30 - 11:00am	80	N115	LVCC	●		●							●		●			
BLR	The New EEO Rules: Making Lemonade	10:30 - 11:45am	53	N240	LVCC					●			●					●		
BLR	Copyright/SHVIA - A Broadcaster Update	10:30 - 11:45am	53	N233	LVCC					●			●					●		
BLR	Legislating the Airwaves: Congress & Broadcasting	10:30 - 11:45am	53	N241	LVCC					●			●					●		
R/TV	Radio: Power of Performance: Require. for Excellence	10:30 - 11:45am	72	N232	LVCC			●						●						
R/TV	TV Digital Operations Exchange	10:30 - 11:45am	72	N237	LVCC	●	●		●									●	●	
R/TV	Radio & TV Idea Swap	10 :30 - 11:45am	72	N236	LVCC								●	●				●	●	
SS	The Future of Desktop Digital Video *Keynote: Bryan Lamkin Sponsored by Adobe*	10:30am - Noon	39	S222	LVCC	●		●			●	●								●
BEC	Digital Television Around the World	10:30am - Noon	45	N109	LVCC	●	●	●												
BEC	International Broadcast Developments	10:30am - Noon	45	N111	LVCC	●	●	●												
SMF	What's Hot, What's Not in Satellite Services	11am - 12:30pm	80	N115	LVCC	●		●							●		●			
R/TV	Television All Industry Luncheon ✖ ■ *Hall of Fame Induction: Disney Anthology Series accepted by Michael Eisner; Spirit of Broadcasting Recipient and Keynote: Don Hewitt*	12:30 - 2:15pm	72	Barron Rm	LVH			●										●	●	
R/TV	Radio: 10 Steps to Bigger Local Direct Sales	1:00 - 2:15pm	74	N232	LVCC			●						●						
R/TV	Radio: What Makes Your Employees Tick?	1:00 - 2:15pm	74	N241	LVCC			●					●							
BEC	Digital Storage & Asset Mgmt. for Content	1:00 - 5:30pm	46	N111	LVCC	●	●	●												

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BEC	MPEG-Enabling Broadcast and Media Convergence	1:00 - 6:00pm	46	N109	LVCC	●	●	●												
SMF	Satellite & Media Forum *Keynote: Scott Davis*	1:30 - 1:45pm	80	N115	LVCC			●							●		●			
SMF	From SNG to CDN: Outsourcing Media	1:45 - 2:55pm	80	N115	LVCC	●	●								●		●			
BLR	The FCC Legal Advisors	2:00 - 3:15pm	53	N240	LVCC			●		●			●					●		
BLR	Future of Music Performance Licenses for Radio	2:00 - 3:15pm	53	N233	LVCC					●			●							
MMW	New Media Research Study Forum	2:00 - 5:00pm	68	S220	LVCC	●		●			●									
MMW	The PVR: Shifting Time and Paradigm	2:00 - 5:00pm	69	S221	LVCC	●		●			●									
R/TV	Leadership Session: When Group Executives Talk...	2:30 - 3:45pm	74	N245	LVCC					●			●	●				●		
SMF	Roundtable: The Times They Are a Changin'	2:55 - 3:40pm	81	N115	LVCC	●		●							●		●			
BLR	Radio Licenses: Renew Them or Lose Them	3:30 - 4:45pm	54	N240	LVCC					●			●							
BLR	DTV: New Rule Proposals Abound	3:30 - 4:45pm	54	N233	LVCC					●								●		
SMF	What Content Providers Need Most	3:55 - 5:05pm	81	N115	LVCC	●		●							●		●			
R/TV	Digital TV Operations Tour	4:00pm	74	N236	LVCC	●												●		
MMW	NAB MultiMedia World Keynote: *Mike Volpi* *Sponsored by IBM*	5:00 - 6:00pm	69	S222	LVCC	●		●			●									
SMF	Creating New Customers in B'casting & Satellite	5:05 - 5:50pm	81	N115	LVCC										●		●			
GI	International Reception *Sponsored by HBO Latin America*	5:30 - 7:00pm	38	Blrm B	LVH	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
R/TV	RTNDA Paul White Award Reception & Dinner ✖	7:00pm - 10:00pm	39	Barron Rm	LVH								●							
BLR	**Tuesday** FCC Chairman's Breakfast ■ *Intro & Welcome: Eddie Fritts; One-on-One:* *The Honorable Michael Powell and Sam Donaldson* *Sponsored by AG Edwards & Sons, Inc.*	7:30 - 8:45am	54	Blrm A/B	LVH	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
IS	PanAmSat Info Session – Global Satellite Update	8:30 - 10:30am	79	N250	LVCC		●	●							●	●				
GI	Exhibits Open	9:00am - 6:00pm	87	Exh. Halls	LVCC	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
BLR	Broadcast Ownership Regulation: Times Are a Changin'	9:00 - 10:15am	54	N240	LVCC					●			●					●		
R/TV	Influential Marketing: 2003 and Beyond	9:00 - 10:15am	75	N245	LVCC	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

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R/TV	Radio: Stealing Ad Budgets from Newspapers	9:00 - 10:15am	75	N232	LVCC			●					●							
SS	Broadband Digital and Wireless Media *Keynote: Kari-Pekka Wilska*	9:00am - Noon	40	S222	LVCC	●		●				●					●			
BEC	Implementing PSIP and Metadata	9:00am - Noon	48	N109	LVCC	●	●													
BEC	Radio Transmission Forum	9:00am - Noon	48	N111	LVCC	●	●													
MMW	B'cast Quality Production for Internet & DVD - Part I	9:00am - Noon	69	S220	LVCC	●		●	●		●	●								
BLR	Spectrum: Can We Keep It?	10:30 - 11:45am	56	N233	LVCC					●			●					●		
R/TV	Leadership Session: Business 2004: New Agenda	10:30 - 11:45am	75	N245	LVCC			●					●	●						
R/TV	The Digital TV Transition: Let Viewers Be Your Guide	10:30 - 11:45am	75	N241	LVCC	●		●		●								●	●	
R/TV	Radio Luncheon ✖ ■ *Keynote: Bob Schieffer; Hall of Fame Radio Inductee: Scott Shannon Sponsored by ASCAP*	12:15 - 1:45pm	76	Barron Rm	LVH	●		●	●		●		●	●		●				
BEC	DTV Reception and Enhancements	1:00 - 5:00pm	49	N109	LVCC	●	●													
BEC	Radio Audio Forum	1:00 - 5:30pm	49	N111	LVCC	●	●													
BLR	FCC Enforcement: Don't Bet the Ranch Against It	2:00 - 3:15pm	56	N240	LVCC					●			●					●		
BLR	Television Music Licensing - Bridge to Fairness	2:00 - 3:15pm	56	N233	LVCC					●								●		
R/TV	David & Goliath: Selling Strength of Your Cluster	2:00 - 3:15pm	76	N232	LVCC			●						●						
R/TV	Leadership During Tough & Demanding Times	2:00 - 3:15pm	76	Birm A/B	LVH	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
MMW	B'cast Quality Production for Internet & DVD - Part II	2:00 - 4:00pm	70	S220	LVCC	●		●	●			●				●				
SS	Ready for Primetime: Interactive TV *Keynote: Jeff Shell*	2:00-4:15pm	40	S222	LVCC	●		●	●							●				
IS	ISMA Info Session - The Future of Streaming Media	3:00 - 5:00pm	67	N252	LVCC	●		●	●		●					●				●
BLR	Regulatory Face-off Coffee Break	3:15 - 3:30pm	56	N245	LVCC				●				●	●				●	●	
BLR	The Regulatory Face-off *Moderator: John Cochran; Panelists: Kathleen Abernathy; Michael Copps; Kevin Martin; Jonathan Adelstein; Nancy Victory*	3:30 - 4:30pm	56	N245	LVCC				●				●	●				●	●	
MMW	Walking the Line Between Rights and Revenue	4:15 - 5:30pm	70	S221	LVCC	●				●	●									
MMW	Distributing Media for Consumer-Based Services	4:15 - 5:30pm	70	S220	LVCC	●		●			●									

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Conf.	Event	Time	For complete description, see page...
	Wednesday		
BEC	Technology Based Broadcast Services	8:00 - 11:30am	50
GI	Exhibits Open	9:00am - 6:00pm	87
SS	Technologies & Media on Wall Street *Keynote: Greg Estes*	9:00 - 10:30am	41
R/TV	Radio: Mgmt. Lessons from Around the World	9:30 - 10:45am	78
R/TV	Leadership Session: Customer of the 21st Century	9:30 - 10:45am	78
MMW	Next Generation Technologies, Future of Comm.	10:45am - Noon	70
R/TV	Breakout Session: The Teenage Marketplace	11:00 am - 12:15pm	78
R/TV	Breakout Session: The Hispanic Marketplace	11:00 am - 12:15pm	78
R/TV	Radio: Are You & Clients Speaking the Same Language?	11:00 am - 12:15pm	78
BEC	Technology Luncheon ✖ ■ *Keynote: George Gilder; Presentation of Radio & TV Engineering Achievement Awards* *Sponsored by Thales Broadcast & Multimedia*	Noon - 1:45pm	50
GI	AIM Awards Presentation	Noon - 1:45pm	41
R/TV	Broadcast/Print/Online Partnerships	1:30 - 2:45pm	78
SS	Internet Broadcasting & Webcasting *Keynote: Rob Glaser*	2:00-4:00pm	41
BEC	Facilities Management for Radio and Television	2:00 - 5:00pm	52
GI	RTNDA@NAB Closing Reception	4:15 - 6:00pm	41
BEC	Amateur Radio Operators Reception *Sponsored by CQ Communications & Kenwood Communications Corporation*	6:00 - 8:00pm	52
	Thursday		
MMW	The Future of Streaming & Internet Broadcasting	9:00 - 10:30am	70
BEC	Workbench Tips From Radio World's John Bisset	9:00am - Noon	52
BEC	Television Production and Operations	9:00am - Noon	52
GI	Exhibits Open	9:00am - 4:00pm	87
MMW	Effective New Media Marketing Strategies	10:45am - Noon	70

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N109	LVCC	●	●													
Exh. Halls	LVCC	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
S222	LVCC	●		●			●		●					●		
N232	LVCC			●						●						
N237	LVCC	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
S220	LVCC	●		●	●		●									
N241	LVCC			●					●	●				●	●	
N240	LVCC								●	●				●	●	
N232	LVCC			●						●						
Barron Rm	LVH	●	●	●			●									
Barron Rm	LVH								●							
N237	LVCC				●				●	●				●	●	
S222	LVCC	●		●	●		●		●			●				
N109	LVCC	●	●													
Pavilion	LVH								●							
Blrm B	LVH		●	●					●							
S220	LVCC	●		●	●		●					●				
N111	LVCC	●	●													
N109	LVCC	●	●				●							)		
Exh. Halls	LVCC	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
S220	LVCC	●		●	●		●					●				

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RTNDA@NAB

Air Radio & TV News Directors Association events take place at the Las Vegas Hilton and the Hilton Center.

Event	Time • Room
Monday at RTNDA	
RTNDA Educator Breakfast - Making Choices	7:30 - 8:45am • Blrm B
RTNDA Opening Session and Business Meeting	10:20 - 11:10am • Blrms A&B
Why My News Should Be "Branded"	11:15am - 12:30pm • Pavilion 9
Managing Your Boss	11:15am - 12:30pm • Pavilion 10
When News Breaks	11:15am - 12:30pm • Blrm F
Covering Politics On-Air and Online	11:15am - 12:30pm • Blrm D
Stations and Colleges Working Together	11:15am - 12:30pm • Blrm E
Powerful Airchecking That Works!	2:15 - 3:30pm • Blrm G
Writing Workshop With Bob Dotson	2:15 - 3:30pm • Pavilion 9
Winning the Weather Wars	2:15 - 3:30pm • Blrm F
Making Convergence Work	2:15 - 3:30pm • Blrm D
Producing Producers	2:15 - 3:30pm • Blrm E
Working With Other Department Heads	2:15 - 3:30pm • Pavilion 10
Your Newsroom Leadership Style	3:45 - 5:00pm • Pavilion 10
One-On-One with Bob Schieffer	3:45 - 5:00pm • Pavilion 9
Do the Du(opoly)	3:45 - 5:00pm • Blrm E
How the Media Treated Me	3:45 - 5:00pm • Blrm F
One-Man Bands: How Do They Do It?	3:45 - 5:00pm • Blrm D
What Makes a Great News Music Theme?	3:45 - 5:00pm • Blrm G
Paul White Award Reception & Dinner	7:00 - 10:00pm • Barron Rm
Tuesday at RTNDA	
Design a Better Desk	9:00 - 10:15am • Blrm E
Intl Viewpoint: One-On-One With BBC News Head	9:00 - 10:15am • Blrm F
Caviar Websites on a Cheeseburger Budget, Take II	9:00 - 10:15am • Blrm D
Changing Audiences, Shifting Demographics	9:00 - 10:15am • Conf Rm 1-3
Proven Tools for Better On-Air Delivery	9:00 - 10:15am • Blrm G
Creating a Positive Newsroom Culture	9:00 - 10:15am • Conrad Rm

Event	Time • Room
Super Session: Leadership During Tough Times	2:00 - 3:30pm • Blrms A&B
Child Abduction Alerts	3:45 - 5:00pm • Blrm F
Graphic Trends: Finding a Look That Works	3:45 - 5:00pm • Blrm E
Basics of a Well-Written Newscast	3:45 - 5:00pm • Blrm G
Serving Your Spanish Speaking Audience	3:45 - 5:00pm • Blrm D
How *Not* to Get a Job	3:45 - 5:00pm • Conf Rm 1-3
Conducting Difficult Conversations	3:45 - 5:00pm • Pavilion 10
14th Annual RTNDF Live Auction & Reception	5:00 - 6:30pm • Ctr Foyer
Wednesday at RTNDA	
International Journalism Opportunities	9:00 - 10:15am • Blrm F
Making Your Mark with Enterprising Stories	9:00 - 10:15am • Pavilion 9
Converting to a Tapeless Newsroom	9:00 - 10:15am • Blrm D
Make Sure Your News Dept Isn't Expendable	9:00 - 10:15am • Blrm G
Secrets of Great Coaching	9:00 - 10:15am • Pavilion 10
Covering Native America	9:00 - 10:15am • Blrm E
24 Hour News Channels: Impact on Local News	10:30 - 11:45am • Blrm D
Covering Bioterrorism at Home	10:30 - 11:45am • Pavilion 9
Audience Grabbing Teasing Techniques	10:30 - 11:45am • Blrm G
Interviewing and Hiring the Best and the Brightest	10:30 - 11:45am • Pavilion 10
How To Win an RTNDF Scholarship	10:30 - 11:45am • Blrm E
RTNDF Luncheon	Noon - 1:45pm • Blrm A
Live Shot Training Camp	1:45-4:15pm • Pavilion 1-8
Time Management for You and Your Staff	3:00 - 4:15pm • Pavilion 10
Diversity in Newsroom Management	3:00 - 4:15pm • Blrm F
Talent Coaching: 60 Tips in 60 Minutes	3:00 - 4:15pm • Pavilion 9
High Sch. & You: Partnering with Next Generation	3:00 - 4:15pm • Blrm E
Interviewing Tech: Asking the Right Questions	3:00 - 4:15pm • Blrm D
Closing Reception in the RTNDA@NAB Exhibit Hall	4:15-6:00pm • Pavilion 1-8

PRACTICAL CONSIDERATIONS FOR THE IMPLEMENTATION OF AM IBOC

THOMAS R. RAY, III, CSRE
Corporate Director of Engineering
Buckley Broadcasting/WOR Radio
New York City, New York

INTRODUCTION

After many years of development, the time to begin implementation of In-Band On-Channel (IBOC) digital transmission on the AM band has arrived. For some, it will be an expensive proposition.

WOR-AM in New York City was approached by iBiquity Digital Corporation in regards to becoming a test station for IBOC-AM. We agreed and, while the final software load for the exciter was not yet ready, WOR turned IBOC on and committed to it on a permanent basis on October 11, 2002, the day after the FCC approved the use of IBOC. On this day, WOR became New York's First Digital AM Radio Station.

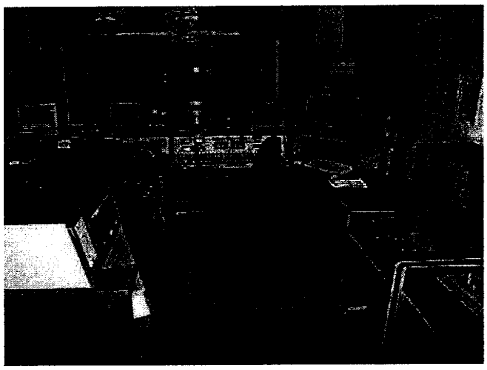
This paper serves to inform you of some of the practical considerations for implementing AM IBOC at your facility. We will discuss what WOR did and did not do to implement IBOC, and we will discuss some of our findings that you might not have thought of.

WHAT YOUR STATION NEEDS TO IMPLEMENT IBOC

Unfortunately, there has not been a plethora of information available on the implementation of IBOC. If you go by the information in ads in the trade publications, it appears that you need to have digital studio sources feeding a digital console, which feeds a digital STL, which feeds a digital processor, which feeds an IBOC exciter and your transmitter. About the only thing I haven't seen in the ads is that you should also have a digital announcer.

When WOR implemented IBOC, we were using original, 1978 vintage Pacific Recorders and Engineering System One consoles. And they were mono. And they still sounded pretty good. While 2003 was going to herald a reconfiguration of the WOR facility, WOR was still using the System One consoles in October 2002. And if you look around the typical WOR control room, you find a rather eclectic mix of older technology and new technology. Everything from turntables which are used during the Joe Franklin program on Saturday night (and Joe still brings 78RPM records in to play), to an ENCO system. I would think that the WOR studio situation is fairly typical of most stations in the United States.

To sum up our studio situation with the implementation of IBOC, WOR feeds analog audio into an older analog console. The consoles were in reasonable shape and had reasonable specifications which were still being met. There was no immediate need to go out and immediately purchase 5 brand new completely digital consoles. If your consoles are still in reasonable shape and sound good, there should be no need to replace your consoles to implement IBOC. The reason WOR is reconfiguring our studios, which will include new consoles, is that most of the semiconductors and switches used in these consoles are no longer available. If they were not next to impossible to repair, we would most likely be keeping the PR&E consoles for another few years.



WOR's Studio 2, October 2002. This studio has been witness to much history, from John A. and John R. Gambling and comedians Bob and Ray, to originating all programming the day terrorists stuck The World Trade Center.

Our Master Control room contains passive relay studio switchers which are stereo. Presently, the right channel is used to switch paths for the cue tones used for The WOR Radio Networks. As part of taking WOR stereo over the next few months, these switchers will be added onto so that we have a different path that will follow the main switchers for the cue tones. At the present time, there is no need to change a set of studio switchers that still work fine and that we can obtain parts for.

One reason that the reconfiguration of the WOR facility will maintain analog audio is our top-hour time tone. I have yet to find anyone who makes a small, rack mountable, AES audio mixer so that we can maintain

the automatic insertion of our time tone. Deleting the time tone is not an option, as it has been on WOR for decades, and is actually constructed using a middle-C oscillator module from a Hammond organ. Many times during the day WOR is automated, sometimes we are live, and automatic insertion of the time tone is a must. So for this aspect, WOR must maintain analog audio through the studio switchers.

Once the audio passes through an Orban 8200ST processor, it is fed through a distribution amplifier to feed our STL paths. WOR maintains 5 STL paths to our transmitter in New Jersey. The first is an Intraplex STL/TSL unit that transmits bi-directionally on a Harris Aurora 5.8GHz spread spectrum radio. This allows us to bring our ten satellite channels back from the transmitter in New Jersey, gives us a 15kHz non data reduced path to the transmitter in stereo, plus allows for 5 data channels and two telco paths between the transmitter and studio. Because the Intraplex rack is utilizing all the time slots on the T1 created with the Aurora, we could not put Intraplex's "IBOC" card into the unit and maintain our data and telco channels. This means that the WOR audio goes into and comes out of the Intraplex analog, and is 15kHz bandwidth. We did not see a reason to increase the bandwidth to 20kHz, as AM IBOC will pass up to 15kHz.

Our second STL is a 950 band Moseley DSP-6000 that is stereo. While this uses data reduction, it is perfectly adequate as a second stereo backup for WOR.

Our third STL is a 950-band mono Moseley PCL-6010 transmitter and 6020 receiver. Once again, as a third backup, this STL is perfectly adequate and did not need to be replaced.

Our fourth path is an 8kHz equalized phone line that, at times, has been known to hum or whistle quietly. Once again, if we need to resort to the phone line, it is better than the alternatives (i.e., the sounds of silence), and this STL path will be adequate even with IBOC.

Our final STL path is a G.722 ISDN codec that is intended for extreme emergency use, such as if we need to abandon the Manhattan studios and broadcast from elsewhere. Under these circumstances, this path would be more than adequate even with IBOC.

Bottom line, I saw no good reason to replace our studio switchers or STL's with a completely digital path. What we are using sounds good, is reliable, and is perfectly adequate with our IBOC installation. If your analog audio path to the transmitter sounds good and is reliable, there should be no immediate need to go through the expense of replacing your STL's. And while stereo would be nice, if they're mono, so what? Your present signal is mono. Aim for stereo STL's sometime down the road.

At the transmitter by necessity, due to our need to feed analog audio to our auxiliary transmitter chain, the audio that comes out of our various STL paths is analog and goes through a passive Broadcast Tools switcher. The WOR transmitter site was rewired in 1997, and I wired it with stereo in mind. The output of the switcher feeds a distribution amplifier, which feeds the auxiliary transmitter chain, still feeds the main chain with an analog signal, and now also feeds an analog to digital converter. The IBOC equipment requires an AES digital signal. The A/D takes the analog audio from the STL switcher and converts it to an AES signal before the EASU unit of the IBOC exciter. If you intend to keep your STL path analog, you will need to purchase an A/D converter. Ours is from Radio Systems.

In addition to certain control aspects it has over the IBOC exciter, the EASU also acts as an AES distribution amplifier. It feeds our Optimod 9200 an AES signal for the analog processing of our signal, and feeds our Optimod 6200 an AES signal for the IBOC portion of our signal. The processor for your analog signal should have AES in and out, as the IBOC exciter accepts AES in only for either the analog or digital signals. And you will need to purchase a separate processor for the IBOC audio. The processor you choose should have digital broadcasting in mind, though an FM processor with the pre-emphasis defeated should work fine. This processor also needs to be AES in and out. If you wish to utilize your present audio processor and it does not have AES in and out, you will use an A to D converter.

The little blue relay shown above the circuit board will switch the excitation to WOR's Harris DX-50 from the external excitation provided by the IBOC exciter to the transmitter's internal oscillator in the event of a failure of the IBOC exciter. This helps prevent lost air time in the event of exciter failure

There are a few paths to take when connecting the IBOC exciter to your transmitter. One is to simply connect the exciter and turn it on. The one chosen by WOR was to connect a relay to the IBOC transmitter to exciter interface unit, in addition to the analog output of

the Optimod 9200. If the IBOC exciter were to fail, the relay drops out and switches the RF input to our DX-50 transmitter back to the internal oscillator.

Having our analog Optimod output available through the interface box, which contains an audio relay, would cause the transmitter's audio input to change from the IBOC exciter's output to the standard output from the Optimod. This would keep WOR on the air in the event of an exciter failure, and it proved to be the correct decision one morning when, after running a special program on the exciter to switch the IBOC carriers on and off for testing, the exciter spontaneously rebooted when I attempted to kill the toggling program. The DX-50 simply dumped when the RF input dropped, and came right back up after about 1 second. No issues, no lost time.

Now that you know that the exciter is a computer, running the IBOC program under Linux, how is the power at your site? You should put the exciter, the D/A converter, and the processors, as a minimum, on a good Uninterruptable Power Supply that is the type that is always on line and has surge protection. This will help prevent the Linux computer from locking up with power hits, and prevent the station from being off the air if a momentary power failure causes the exciter to reboot.

Another consideration with the exciter is the interconnection to the transmitter. The RF and audio or, as they are known in IBOC lingo, the phase and magnitude signals, exit the exciter on RJ-45 connectors. The connection between the exciter and the interface box in your transmitter should be shielded Cat-5 cable. The connection between the interface box and the transmitter should be an RG-58 cable terminated in BNC connectors for the RF, and regular single pair shielded audio cable for the magnitude connection, terminated in spade lugs for the transmitter, and bare wires for the Phoenix-type connectors on the interface box. You will need to determine how your transmitter will accept the external RF input and plan a relay accordingly if you intend to add the failsafe switching described earlier. In the WOR installation, we discovered during installation that our supplier shipped non-shielded RJ-45 connectors in a package marked that they were shielded. We simply took the shield wires on the Cat-5, crimped spade lugs on the ends, and attached them to the nearest screw with a ground connection. Whatever works in a pinch.

One final consideration for the exciter is rack space. WOR has an iBiquity exciter that is 4 rack units high. The EASU unit is two rack units high, and should have one rack unit of space above, below and between the units. Additionally, the units are fairly deep. If you have shallow racks and intend to keep the back door closed, you will need to modify the exciter and EASU mounting to provide airflow behind the exciter. Don't forget, it's a computer, and the power supply exhaust is on the rear of the unit. Not leaving enough space for airflow will cause the exciter to overheat and fail.

Your transmitter is going to be a big consideration. IBOC will not work with a plate-modulated transmitter. It is questionable if it will work with a tube Pulse Duration Modulated transmitter, and will not work with a Doherty modulated transmitter. The Harris DX series of transmitter, of which WOR has a DX-50, is pretty much plug and play for IBOC. Broadcast Electronics and Nautel transmitters are likewise.

If you have a PDM transmitter that is solid state, you will need to check with the manufacturer to see if the transmitter will pass IBOC. Most have a modification kit available, as the audio pass band must be 50kHz through the PDM modulator. Most likely the PDM frequency and the PDM filtering sections will need to be changed out. Your transmitter needs to have a pretty flat audio response that is 50kHz wide, and the RF section needs to have a fairly low amount of phase noise, or, as we know it from AM stereo days, IQM or IPM. You should check with the manufacturer and make a decision as to whether you should purchase a new transmitter.

Your antenna is the other big consideration. WOR employs a three-tower dogleg directional array. There are detuning skirts, two on each tower, for 1010kHz (WINS) and 1190kHz (WLIB) to electrically shorten the WOR towers at these frequencies. The tuning houses have detuning networks for 1010kHz, 1190kHz, and 620kHz (WJWR), in addition to traps for 1010kHz, 1190kHz, and 620kHz. To say that our array is "challenging" for a fairly flat path at and about 710kHz is an understatement.

We had Tom Jones from the firm of Carl T. Jones Corporation redesign our coupling networks and phasor in 1997. By putting line stretchers in each tuning house, making all the tuning networks phase lead (there had been one phase lag previously), and changing a few components in the phasor, as well as changing the common point from 75 ohms to 50 ohms, the WOR common point is now fairly flat, both resistance and reactance, from 690 to 730, ideal for IBOC. The lower sideband is favored slightly, and this can be seen in the lower IBOC sideband being about 1.5dB higher than the upper IBOC sideband.

The load presented to your transmitter needs to be fairly flat +/-15kHz from carrier in both resistance and reactance. At the very least, if asymmetry is present, the impedance needs to be asymmetric equally and opposite on both sides of carrier. You should sweep your system to see what the transmitter is actually looking into. You may need to hire a consultant to

flatten things out. If WOR's system could be flattened, there is indeed hope for your system.

OTHER CONSIDERATIONS

In addition to the technical considerations mentioned previously, there are a few other considerations that we learned with our foray into IBOC. The first revolves around the inherent approximate 8.5-second delay introduced into the analog audio once you have converted to IBOC. The reason for this delay is that the radios are designed to blend back to analog should the digital signal encounter a problem. This prevents the audio from going away rather abruptly. Obviously, if you do not delay the analog 8.5 seconds, this blend will be choppy at best.

WOR is a talk station and, consequently, operates with a profanity delay most of the time. The exceptions are the top of the hour newscasts and portions of The WOR Morning Show. Obviously, the talent cannot monitor air when air is delayed by 8.5 seconds. To counter this, we changed the air monitoring position in all studios to a feed off the DA that feeds the STL's. This gave the talent a real time audio feed of the audio before it left for Jersey.

The problem with this is that they were used to hearing the signal all "pumped up" and heavily processed. Some had trouble adjusting to the cleaner, flatter signal. To correct this, we took an old CRL AM system we had occupying rack space at the transmitter and inserted it into the feed the studios were getting. This gave the talent their pumped up audio and made them happy.

The next problem to resolve was: if you can't listen to air (even in the Master Control room), how do you know if you're on the air? Oh, you'll know if the transmitter is on the air. WOR has computer monitors in each control room that displays the transmitter status at a glance. But what about an audio failure?

We installed two silence sensors. One on the feed into the STL transmitters, the other on the analog modulation monitor. They are set for 10 seconds. If either the feed to the STL quits (i.e., somebody switches to a dead studio) or the transmitter audio quits (i.e., STL failure or processor failure), the thing screams. We should bless Radio Shack for having loud, obnoxious piezo beepers available. There are also silence sensors at the transmitter site feeding status lights on the remote control. If the silence sensor goes off, a simple glance at the transmitter screen will show if it's at the transmitter site or studio. If the problem is at the transmitter site, the screen will show if it is the active STL receiver or the transmitter where the audio has quit.

Another issue: program on hold on the office phone system. It had been fed off the same DA that feeds the studio monitors. Rick Buckley, our President, observed that the hold audio was 8.5 seconds ahead of what he was hearing on his office radio in Greenwich, CT, and thought it was rather confusing. The program on hold feed now comes from the modulation monitor directly.

What about the time tone? We have people who literally set their watch by the WOR time tone. The switchboard floods with complaints if we patch the time tone out briefly for maintenance. I could just imagine what would happen if it were 8.5 seconds off. Can you say complaints to the FCC for giving erroneous time information? WOR utilizes a programmable timer made by ESE to fire off various things, like the backup feed mini disk machines for The WOR Radio Networks. We programmed a position on this timer to fire the time tone at :59:51.5, so it hits air at exactly straight up on the hour. We have had no complaints.

Live sports? This is an issue that is being worked on by iBiquity. Your station can ramp in and out of the 8.5-second delay but, as mentioned previously, this may cause blend problems between analog and digital signals on radios. iBiquity has told us they are working on setting a bit in the data stream to inform listeners that the analog feed is real time for a live sporting event, and the listener can choose to listen to the digital or analog feed. This will allow persons listening in the stands or watching the game on TV and listening to WOR to hear the game in real time.

One thing that no one considered at WOR was the effect the 8.5-second delay would have on our top hour newscasts. We are formatted to hit the ID/news sounder on top of the hour. At the time IBOC was implemented, the ID cut was 24 seconds long. We normally have a 10 second "brought to you by" announcement at the top of the cast, meaning that we didn't get to the actual lead story until 34 seconds past the hour. Add the 8.5-second delay to the mix, and we now did not get into the lead story until almost 43 seconds past the hour. While WOR is not a news station, this problem came to light on one particularly busy news day, when every station in New York City had already hit the lead story, gone to the outside reporter, and was into the second story before our announcer was even out of the sponsor announcement.

Our solution was to shorten the ID to under 15 seconds, and advance the clocks in the studio complex so that everything would happen 8.5 seconds early. If we were 8.5 seconds early, it would hit air on time. But there were two problems. First, the digital clocks were locked to our GPS receiver and that couldn't be changed. Our ENCO system was also locked to the GPS receiver, meaning that all automation timed events would need to be reprogrammed. Finally, what would

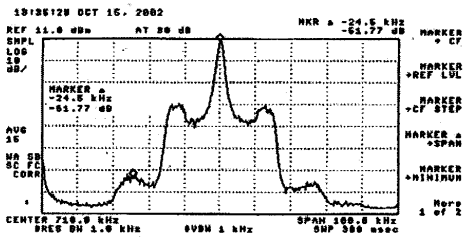
we do about The WOR Radio Networks? They need to feed on a real time basis. If we advanced the clocks, and an operator made a mistake, we would go up at 06:32 rather than 06:40, or come out at 58:42 rather than :58:50, fouling up hundreds of stations around the country.

The solution came in a product manufactured by Symetrix under the AirTools name. The AirTools digital delay units delay audio, TC-89 time code, and contact closures! By setting an 8.5 second delay on the AirTools unit, the TC-89 time code would advance by a corresponding 8.5 seconds. This would make the digital clocks and the ENCO system correspond to the 8.5-second advance of the analog clocks. This meant that, in real time, the network would start at :06:32, but hit the satellite channel at :06:40 as it should. The only time WOR hits an outside source is with Mutual News from 9PM through 4AM. Only a handful of automation commands would need to be changed. None of the automated records for the network would need to be changed. And WOR would now be on time.

HARRASSMENT

One of the things that no one considered was the reaction of a certain small segment of the community. These people are DXers. Some belong to an AM Stereo club.

My Chief Engineer, Kerry Richards, and myself were verbally attacked on a personal level on at least two very public message boards. We have been harassed via email and on the telephone. I have had people trying to get me to "admit" that I am operating WOR illegally. I am not. WOR's operation is perfectly legal under FCC regulations.



Good record keeping will help prove that the operation of your station is legal. The IBOC signal fits nicely under the NRSC mask, and this spectrum photo shows that WOR's IBOC carriers are perfectly legal, residing at –28dBc.

We have had to have the phone number changed at the transmitter site. If we turned the IBOC on after sunset, even after midnight, the phone has rung, we have been met with a stream of obscenities and hung up on. The caller ID was blocked and I have no idea how someone got a non-listed non-published phone number. It's nice to know that some people have nothing better to do than call radio station transmitter sites, at all hours of the day and night, and harass the engineers.

I have been accused of splattering the AM band from 540kHz to 1030kHz. I have had people tell me that I must protect skywave signals coming into the New York Metro area at night: incidentally, there is nothing in the FCC regulations requiring me to do so once outside protected contours.

I haven't been physically threatened at this point, nor has anyone attempted to gain access to the WOR facility. I have, however, filed information with the police department in the community where the WOR transmitter is located, and they have the names and addresses of the people doing the harassing should threats begin.

In short, your station should brace not only for the positive aspects of what IBOC will bring you, but also for some negativity. Your promotion department, if you have one, should have a way to handle these situations. Bottom line, in my opinion, is that IBOC helps AM, and that is why you are considering installing IBOC on your AM facility.

CONCLUSION

These are the things that we at WOR needed to take under consideration in our facility when we committed to IBOC. While these items are by no means a complete list, it should help you to see items that will need consideration before you take your AM station IBOC. Each station and set of circumstances is different, and only you can decide what is the best way to handle the issues that may crop up with IBOC implementation.

With well thought out implementation, and the ability to react to issues as they pop up, your transition to IBOC will be smooth and fairly uneventful.

Digital Radio Mondiale: Features and Requirements from a Broadcaster's Perspective

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ABSTRACT

The year 2003 sees the official launch of Digital Radio Mondiale (DRM), the new broadcast system for short-wave, medium-wave and long-wave. As with many digital broadcasting systems that replace their analogue predecessor, DRM offers a long list of enhancements and new features that broadcasters should be aware of.

The paper presents DRM from the perspective of broadcasters who are considering introducing DRM services or switching their analogue transmissions to digital technology. What is the trade-off between audio quality and signal robustness? What is the impact on the production of radio programmes in the studio? What issues need to be considered on the transmitter side? What features are available to increase the radio listening experience? These and other questions will be considered in the paper.

INTRODUCTION

In 1998, the DRM consortium was formed to define a new digital radio system aimed to replace AM radio on long-wave, medium-wave and short-wave. Three years later, the International Telecommunications Union (ITU) recommended the system for worldwide use. As soon as the first prototype modulators were available at the beginning of the year 2000, a series of field trials was started, which, partitioned into several phases, aimed at

- evaluating the developing standard by assessing its capabilities and limits
- demonstrating the system
- exploring new possibilities, such as the transmission of multimedia content and electronic programme guides.

Some of the experience gained during these tests is summarised in the following sections of this paper. As with any kind of new broadcast system, the introduction of DRM is not a trivial exercise. From a broadcaster's point of view it is beneficial to consider potential impacts on the whole production process of a radio programme. Recording raw material in- or outside the studio, editing the material to transform it into a final programme, distributing material to transmitter sites followed by the transmission itself, and, last but not least, monitoring of the transmitted signal in the coverage area.

PROGRAMME CONSIDERATIONS

DRM will provide a wide range of opportunities for broadcasters, both those concerned with national and international broadcasting. Additionally there will be opportunities for new services from both current and new broadcasters.

The question is, will the services provided just be "more of the same" or should broadcasters be considering what DRM has to offer and tailor their DRM offer accordingly.

For example, the BBC, as an international broadcaster, could just take its existing network output and feed it to the DRM transmitters. Although in the short term this may be the most attractive way of getting a service on the air, the longer term needs for DRM broadcasts should be considered – many of the changes required will need integration into the existing infrastructures and will not be done overnight. So the need to start planning what will be required starts now.

Let us consider the evolution of international broadcasters such as the BBC over the last few decades. Twenty years ago the majority of the international output of the BBC was fed to listeners via conventional shortwave services along with some medium wave outlets. Quality was and still is poor over shortwave – that is one of the fundamental needs for developments such as DRM. On the plus side – geographical coverage was wide, a number of countries could be covered with a single transmission and indeed this advantage stays with us in the DRM era.

Poor audio quality brought with it a certain style of presentation and programme content. For example news was read in a slow and considered manner, music output was low because over shortwave and with a narrow bandwidth a lot was lost. Widespread geographical coverage also meant that news content was presented from the global or at least the continental perspective. All of this lead to a "one size fits all" approach to programming and led to complaints from the listeners from one area that they didn't want to hear about news from another area.

With the advent of deregulation in the FM spectrum considerable opportunities were presented. Local FM for cities were available, programming could become more targeted and became more competitive against local FM operators.

Without careful consideration of what programmes are carried on DRM and what are covered on FM, there is a potential that the service may decline from being inappropriately targeted at audiences and a unique position may be lost.

RECORDING AND EDITING

After having been planned and commissioned, a programme needs to be recorded and edited. For this purpose, broadcasters make increasing use of computer-based, non-linear editing systems. For cost reasons, the latter keep hard-disk space to a minimum and therefore compress the sound using a variety of compression systems. Bearing in mind that the final programme will be compressed again in order to fit the corresponding DRM signal into a long-wave, medium-wave or short-wave channel, it is vitally important to use a low compression rate (i.e. high bit rate) for the editing processes (for example 384 kbit/s MPEG Layer-3). This reduces the detrimental effects of cascaded audio coding.

DISTRIBUTION

The same considerations as described for the recording and editing process are true for the signal distribution. The effects of cascaded coding should be avoided, or at least reduced.

The DRM Multiplex Distribution Interface (MDI) offers the possibility to encode the programme at the studio output, thus producing a bit stream containing the compressed audio (using one of the audio encoders built into the DRM system) as well as information describing the service such as the station label, 128-character text message and a list of alternative frequencies. Note that a DRM multiplex can contain up to four different audio and/or data services, under the condition of course that they share the available bit rate.

The extra information as well as the additional protection add about 20%-25% to the useful programme bit rate, with the result that a typical MDI stream will fit into a transmission channel offering a capacity in the range of 32 kbit/s to 64 kbit/s (the exact value obviously depends on the various DRM audio encoder and modulator settings).

However, this distribution method assumes that all transmitters that are fed with the same MDI stream transmit the same content, using the same modulator settings. If a broadcaster intends to transmit the same audio programme from different transmitters, but not necessarily using the same signal robustness, the "mother" signal needs to be distributed at a much higher bit rate. Coding Technologies, the inventor of the spectral extension technique SBR (which is part of the DRM specification) suggest the following bit rates for commonly used audio codecs (see Table 1). Note that the values are only estimates and probably need further research into transcoding effects.

Table 1 Distribution Bit Rates

Codec	Bit rate
MPEG Layer-2	256 kbit/s
MPEG Layer-3	192 kbit/s
MPEG-2 AAC	128 kbit/s
aacPlus	96 kbit/s

TRANSMISSION

In difference to conventional AM transmissions, DRM requires the transmitter operator to specify a large number of modulation parameters, thus shaping the signal to specific needs:

The RF bandwidth can be chosen between 4.5, 5, 9, 10, 18 and 20 kHz. This leaves enough flexibility to simulcast alongside an analogue SSB signal in a single channel, or, in the other extreme, to use two adjacent 9 or 10 kHz RF channels together.

Four different robustness modes adapt the signal to fundamentally different propagation scenarios: medium-wave (mode A), benign short-wave (mode B) and challenging short-wave (as found with spread-F conditions after sunset in areas served by tropical broadcasting), for which modes C or D would be used.

Six different combinations of code rates and constellations are allowed. They determine the robustness with respect to interference and low signal strength. In descending order of robustness, the combinations are: 16-QAM

with code rate 0.5, 16-QAM/0.62, 64-QAM/0.5, 64-QAM/0.6, 64-QAM/0.71 and 64-QAM/0.78

The choice of the parameters depicted above determines the useful bit rate. As a result, the latter ranges from 4.8 kbit/s (bandwidth 4.5 kHz, mode B, constellation 16-QAM, code rate 0.5) up to 72 kbit/s (bandwidth 20 kHz, mode A, constellation 64-QAM, code rate 0.78). Neither of these extreme values is likely to be used very often though. Typical bit rates that are currently being employed for DRM tests are between 14 kbit/s and 34 kbit/s.

Naturally, the available bit rate has an important impact on the achievable audio quality. The broadcaster needs to decide which audio quality is acceptable for a given content. If the programme only contains speech, then one of the two DRM speech encoders (HVXC or CELP) might be suitable to do the necessary compression. As soon as music is present, AAC or aacPlus (the latter extends AAC by adding treble information through a technique called 'Spectral Bandwidth Replication', or SBR) should be the coder of choice. Table 2 intends to give an idea about the bit rates that are covered by the individual audio coders. Note that the recommended bit rate ranges overlap, thus further stressing the point that the choice is not straight-forward and will require each broadcaster to assess individually which codec and bit rate fits a given programme best.

Table 2 DRM Audio Codecs

Codec	Content	Possible bit rates	Recommended bit rates
HVXC	Speech	2-8 kbit/s	2-8 kbit/s
CELP	Speech	4-16 kbit/s	8-16 kbit/s
AAC	Speech/Music	8-72 kbit/s	12-20 kbit/s
aacPlus	Speech/Music	20-72 kbit/s	16-72 kbit/s

In the end, the choice of bit rate will always be a trade-off between signal robustness and audio quality. The signal robustness (and therefore usually the coverage area) can be increased at the expense of audio quality. Normally, a broadcaster will want to achieve the highest possible coverage at the lowest acceptable audio quality. But care needs to be taken to make sure that this choice does not compromise one of the big advantages of DRM over AM: the superior audio quality.

The modulator settings given in Table 3 seem to be a good starting point (the 'Constellation' column designates the constellation used for the Main Service Channel and the bit rates are given in bits per second).

For those broadcasters who are able to use several transmitters simultaneously, DRM opens up another exciting field: the synchronised transmission of the same programme from different transmitters. Depending on the choice of frequencies, this transmission technique is referred to as Single Frequency Network (SFN) or Multiple Frequency Network (MFN). Both networks can be set-up from a single transmission site or, alternatively, from different transmission sites, thus suiting a multitude of needs.

Both network options should increase the reception reliability, either by reducing the risk of flat-fading over the entire channel bandwidth (SFNs), or by offering the same signal on a different frequency which is subject to different fading statistics (MFNs). DRM receivers supporting the Alternative Frequency Switching (AFS) mechanism will then have the opportunity to tune themselves automatically to the strongest frequency and reduce the occurrence of audio dropouts considerably. For 2003, a series of MFN/SFN tests is planned and the results are hoped to give broadcasters guidance as to which combination of transmission sites and frequencies give the best reliable coverage for a given target area.

MONITORING

Monitoring plays an important role in the world of AM broadcasting and this remains true for DRM. There is a big difference though: whereas monitoring of AM transmissions usually requires the ear of a professionally trained person, the errors of a received digital audio stream can be evaluated automatically by calculating audio checksums.

The audio stream is transmitted in the form of audio frames. Each audio frame contains a checksum that allows the associated information to be checked for correctness. Single audio frame errors are usually concealed, but the audio decoder is forced to mute the audio output as soon as too many audio frames are lost (approximately the equivalent of 400 milliseconds or more). Automatic evaluation software can easily count the number of corrupted audio frames and compile an audio dropout distribution for each reception hour.

Assuming that several monitoring receivers are placed into the target area, several dropout distributions will be available. Current research is looking into combining these distributions into a compact format (ideally a single number) that makes it easy to assess how acceptable a transmission was.

In case that a transmission is found to be unacceptable, the automatic evaluation software should be able to decide what the cause of the

unacceptable dropouts was. There are several potential causes:

Low signal strength

High levels of RF noise

Co-channel or adjacent channel interference

High fading rates (Doppler spread) and/or multipath (high Delay spread)

The signal strength is relatively easy to measure, but requires a calibrated receiver. If fed with a signal received on a calibrated antenna, it is even possible to derive the field strength (in dBµV/m), thus allowing for a comparison with coverage predictions.

DRM receivers are also able to estimate the signal-to-noise ratio on the reception frequency, which, in combination with the field strength measurements, can reveal high noise levels at the reception site. Note that the choice of the monitoring locations has a strong influence on the results, and it is therefore crucial to select these sites carefully in order to reflect typical reception conditions.

AM interference can also be assessed automatically and tests are being carried out to evaluate different ideas, most of them looking at the degradation of the signal-to-noise ratio of specific carriers in the multi-carrier signal. Each DRM receiver also needs to estimate the channel impulse response, which can be used to get an indication on Doppler and Delay spreads.

All of the necessary information is provided by the current generation of field trial receivers at an update rate of 400 milliseconds. The corresponding data format was agreed within DRM and it is envisaged to standardise it through the International Telecommunications Union (ITU).

In January 2002, DRM members started to transmit several hours of daily DRM programmes. Since then, an increasing network of DRM receivers (16 in December 2002) collected a large amount of reception data, which is regularly sent to a central database via email (typically 100 kbyte per day and receiver). The data is processed automatically and daily reception reports are generated and sent to a list of interested people. Figure 1 shows an extract of such a report for a transmission from Jülich (Germany) to receivers in England, Germany, Norway and The Netherlands.

The experience gained with these long-term tests is very likely to help DRM broadcasters to set-up their own monitoring network (or, more often, share a monitoring network with other broadcasters) in the near future. It will allow transmitter operators and broadcasters to take a daily decision about which modulation parameters should be chosen to serve the target in the best possible way. It would even be imaginable to take the decision on an hourly basis by feeding back the reception data in real-time. Research is currently underway to investigate this concept (the EU-funded QoSAM project for example).

SUMMARY

As a new digital radio system, DRM offers many possibilities to transmit audio and data in a form that significantly improves upon the listener's experience with AM radio. Alongside the increased attractiveness of radio reception over long distances for the listener comes the broadcaster's and network operator's challenge to produce, distribute and transmit radio programmes suitable for the DRM medium in a way that reaches the listeners in an optimum way.

Extra care needs to be taken to ensure that the effects of cascaded audio compression are minimised throughout the production chain, and the right signal distribution method needs to be chosen in order to achieve high reception reliability. This could involve multiple transmission sites operating on the same or on different frequencies and/or continuous feedback from monitoring receivers allowing the modulator parameters to be adjusted dynamically.

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Giefer, A., "Digital Radio Mondiale – A suitable System for broadcasting in Africa?", paper presented at Africast 2002, Abuja, Nigeria, October 2002

Thomas Ziegler, Martin Dietz, Jonas Rödén, Stefan Meltzer, "aacPlus – Highest Efficient Audio Coding for Broadcast Applications", NAB2003 Broadcast Engineering Conference, Las Vegas, April 5-10, 2003

DRM: http://www.drm.org

DRM software radio: http://www.drmrx.org

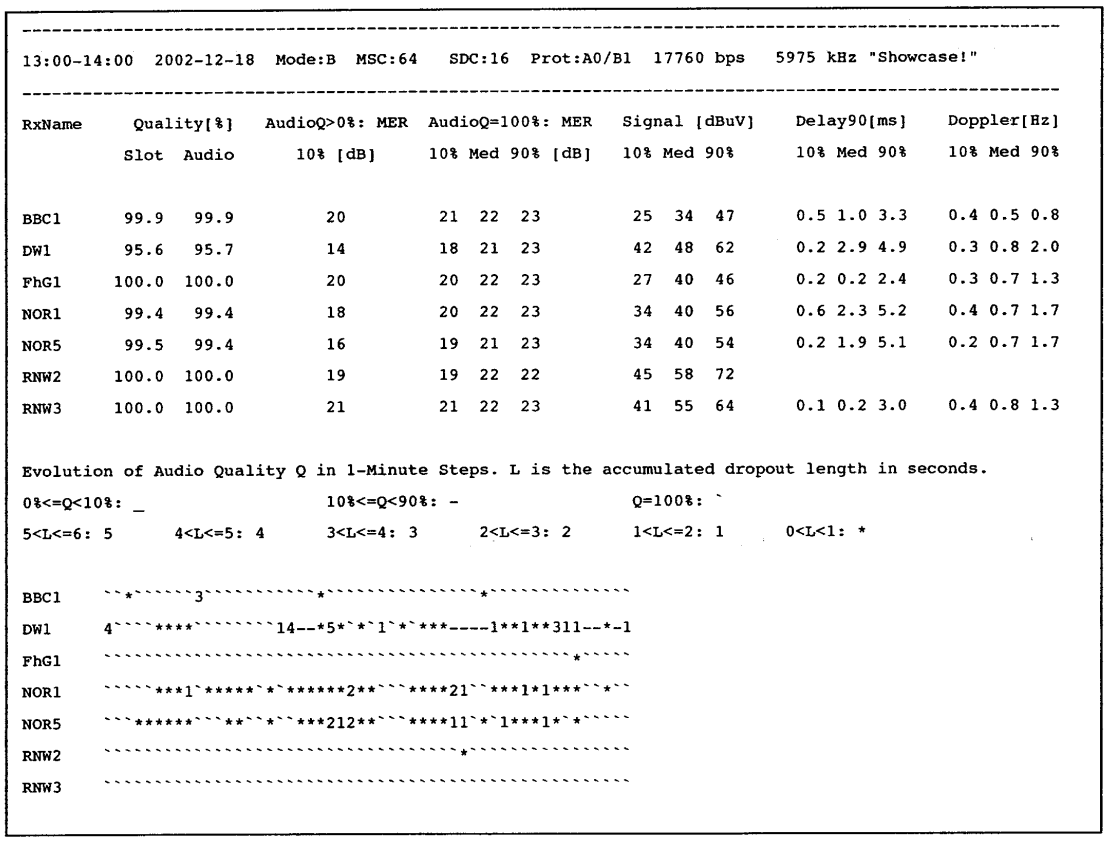
QoSAM: http://www.ist-qosam.com

BBC: http://www.bbc.co.uk

Table 3 Useful Modulator settings to start from

	Bandwidth	Mode	Constellation	Code rate	Interleaver	Bitrate	Audio coder
MF	9 kHz	A	64-QAM	0.6	Short	23620 bit/s	aacPlus mono
MF	10 kHz	A	64-QAM	0.6	Short	27880 bit/s	aacPlus mono aacPlus stereo
MF	18 kHz	A	16-QAM	0.62	Short	34100 bit/s	aacPlus stereo
MF	20 kHz	A	16-QAM	0.5	Short	30540 bit/s	aacPlus stereo
HF	10 kHz	B	64-QAM	0.6	Long	20960 bit/s	aacPlus mono
HF	20 kHz	B	16-QAM	0.62	Long	29800 bit/s	aacPlus stereo

Figure 1 Daily Field Trials Report



```
-------------------------------------------------------------------------------------------------------
13:00-14:00  2002-12-18  Mode:B  MSC:64   SDC:16  Prot:A0/B1  17760 bps   5975 kHz "Showcase!"
-------------------------------------------------------------------------------------------------------
RxName     Quality[%]   AudioQ>0%: MER  AudioQ=100%: MER   Signal [dBuV]    Delay90[ms]    Doppler[Hz]
         Slot  Audio      10% [dB]     10% Med 90% [dB]   10% Med 90%      10% Med 90%    10% Med 90%

BBC1      99.9   99.9         20          21  22  23         25  34  47      0.5 1.0 3.3    0.4 0.5 0.8
DW1       95.6   95.7         14          18  21  23         42  48  62      0.2 2.9 4.9    0.3 0.8 2.0
FhG1     100.0  100.0         20          20  22  23         27  40  46      0.2 0.2 2.4    0.3 0.7 1.3
NOR1      99.4   99.4         18          20  22  23         34  40  56      0.6 2.3 5.2    0.4 0.7 1.7
NOR5      99.5   99.4         16          19  21  23         34  40  54      0.2 1.9 5.1    0.2 0.7 1.7
RNW2     100.0  100.0         19          19  22  22         45  58  72
RNW3     100.0  100.0         21          21  22  23         41  55  64      0.1 0.2 3.0    0.4 0.8 1.3

Evolution of Audio Quality Q in 1-Minute Steps. L is the accumulated dropout length in seconds.
0%<=Q<10%: _                  10%<=Q<90%: -                 Q=100%: `
5<L<=6: 5      4<L<=5: 4      3<L<=4: 3      2<L<=3: 2      1<L<=2: 1      0<L<1: *

BBC1    ``*``````3``````````*````````````````*```````````````
DW1     4````****````````14--*5*`*`1`*`***----1**1**311--*-1
FhG1    ``````````````````````````````````````````````*`````
NOR1    `````***1`*****`*`******2**```****21``***1*1***``*``
NOR5    ```******```**``*``***212**```****11`*`1***1*`*`````
RNW2    ````````````````````````````````````*````````````````
RNW3    ````````````````````````````````````````````````````
```