



Power Increase

Reality in 2010

Gary Liebisch, CPBE

Nautel East Regional Sales Mgr.

Tampa-St. Petersburg SBE
Chapter 39

February 11, 2010

HD Radio is a trademark of iBiquity Digital Corp

Making Digital Radio **Work.**



Power Increase Timeline

- Early 2007 Experimental Period testing of -10 dBc
- 2007 – FCC issues 9 STAs for -10 dBc testing
- June 10, 2008 “Joint Parties” and iBiquity request power increase
- July 18, 2008 – NPR Labs DRCIA Report: 1% inadequate, 10% more than adequate but interference potential identified
- Oct 23, 2008 – FCC issues Public Notice seeking comment on increase
- April, 2009 – NPR Labs develops “metric” for determining interference
- May 22, 2009 – FCC issues 2nd Public Notice – more specific on objectives: defer or not defer until NPR studies done?
- Nov 4, 2009 – NPR Labs submits AICCS Report to FCC – Impact on listeners to interference in the mobile environment
- Nov 5, 2009 –iBiquity and NPR Labs jointly submit 5-point proposal to FCC

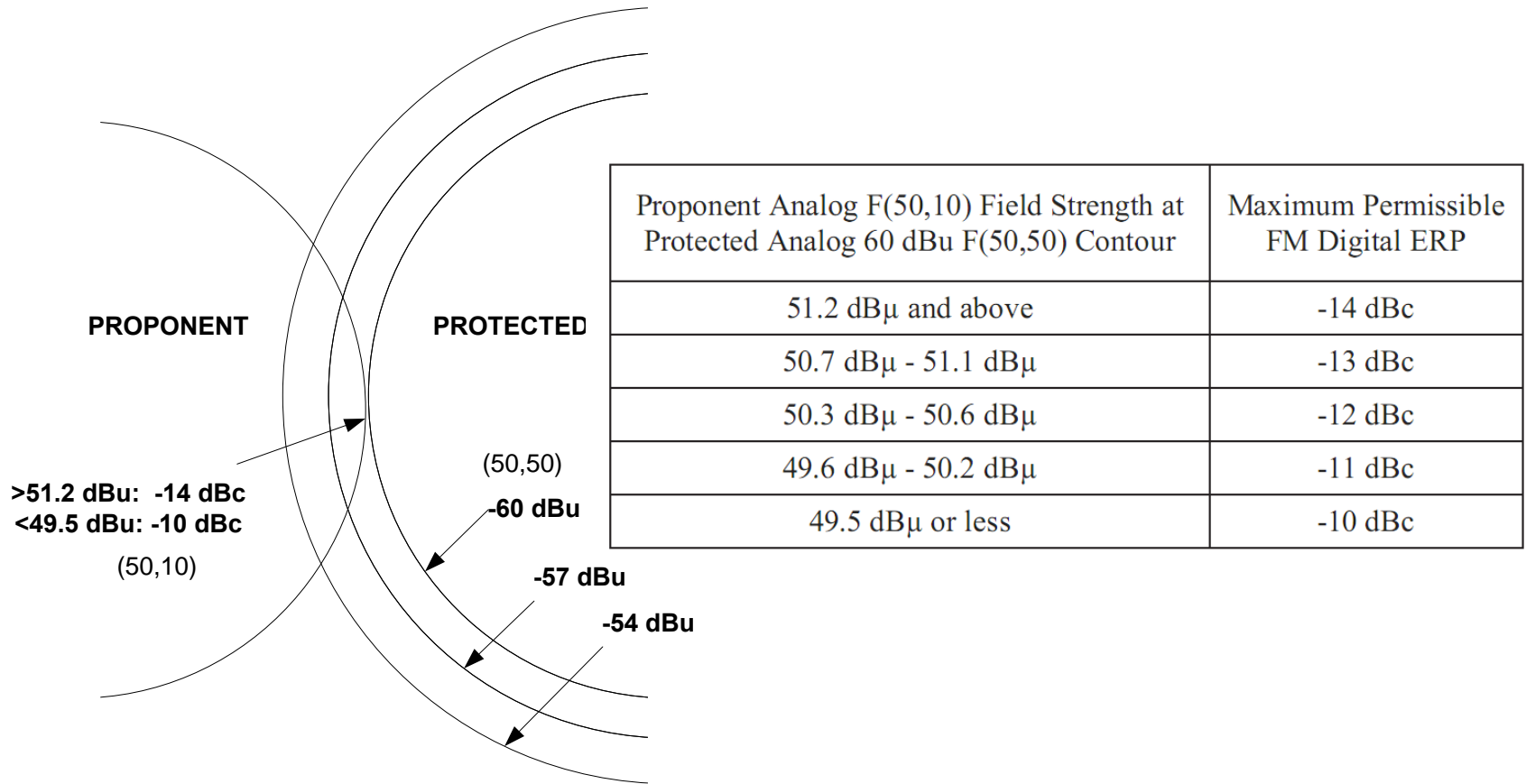


Key Points of Report & Order

- Blanket 6 dB for all stations except “Super B”
- Beyond 6 dB, up to 10 dB, subject to formula developed by NPR Labs
- Established procedures for remediating harmful interference cases above -20 dBc
- FCC may revisit the issue if widespread interference results
- Asymmetrical sidebands not specifically addressed, but it would presumably be compliant with established interference criteria in the R&O.



Adjacent Channel Protection





NPR Labs Calculator Example

IBOC Candidate Station				
Call Sign	FCC Status	Channel	IBOC Power Limit (dBc)	
WWRM <i>TAMPA, FL</i>	LIC	235C	<i>lower</i> -10.0	<i>upper</i> -13.0

Sideband of WWRM	Protected Station	Status	Class	FCC App ID	Bearing to Protected from WWRM (deg. T)	IBOC WWRM F (50,10) (dBu)	D/U Ratio (dB)	IBOC Power Relative to Protected (dBc)
L	WSYR-FM <i>GIFFORD, FL</i>	LIC	C2	693987	99	49.1	10.9	-10.0
U	WBVD <i>MELBOURNE, FL</i>	LIC	A	1167773	77	50.9	9.1	-13.0

IBOC Protected Station				
Call Sign	FCC Status	Channel	IBOC Power Limit (dBc)	
WWRM <i>TAMPA, FL</i>	LIC	235C	<i>lower</i> -10.0	<i>upper</i> -13.0

IBOC Candidate Channel	Candidate Station	Status	Class	FCC App ID	Bearing to Candidate from WWRM (deg. T)	IBOC Candidate F(50,10) (dBu)	D/U Ratio (dB)	IBOC Power Relative to Protected (dBc)
234	WSYR-FM <i>GIFFORD, FL</i>	LIC	C2	693987	279	44.7	15.3	-10.0
236	WAPE-FM <i>JACKSONVILLE, FL</i>	LIC	C	1056965	192	35.0	25	-10.0
236	WBVD <i>MELBOURNE, FL</i>	LIC	A	1167773	257	37.2	22.8	-10.0



TAMPA-ST. PETERSBURG MARKET

-10 dBc (both SB)	Asymmetrical	-14 dBc (both SB)
WYUU	WDUV	WMNF
WMTX	WBVM	
WFLZ	WXTB	
WBTP	WRBQ	
WLLD	WSJT	
WPOI	WHPT	
WSUN	WFUS	
WXGL	WUSF	
WQYK*	WWRM	

* -10.3 and -10

Making Digital Radio **Work.**

Interference Complaint Remediation

First Step: Reliance on voluntary reductions and mutual resolution between parties

Escalation step: 6 documented complaints required for filing with FCC:

- Must submit maps showing ongoing interference inside protected contour
- Must document tests and equipment used for tests
- FCC to resolve within 90 days
- In absence of FCC action, must reduce to -14 dBc
- LPFM and Translators excluded from protection

Notification Procedure

For -14 dBc operation: Notify FCC within 10 days after commencing operation, using the Digital Notification Form, online at CDBS.

For above -14 dBc operation: File informal request with showing of calculation of proponent (50,10) contour on protected station's 60 dBu (50,50) contour. *This is essentially the NPR Labs online calculator.*

Super-powered FMs must file an informal application for any proposed increase in digital power.

Changes in Implementation Methods

20 dBc Combining Options	-14 / -10 dBc Combining Options
High Level/Split Level*	Change or remove combiner
Space Combined	Space Combined (improved interleaved, and dual input)
Common Amp/Low Level	Common Amp/ Low Level with headroom/de-rating factors
	Low Loss Combining (sharp tuned filters)

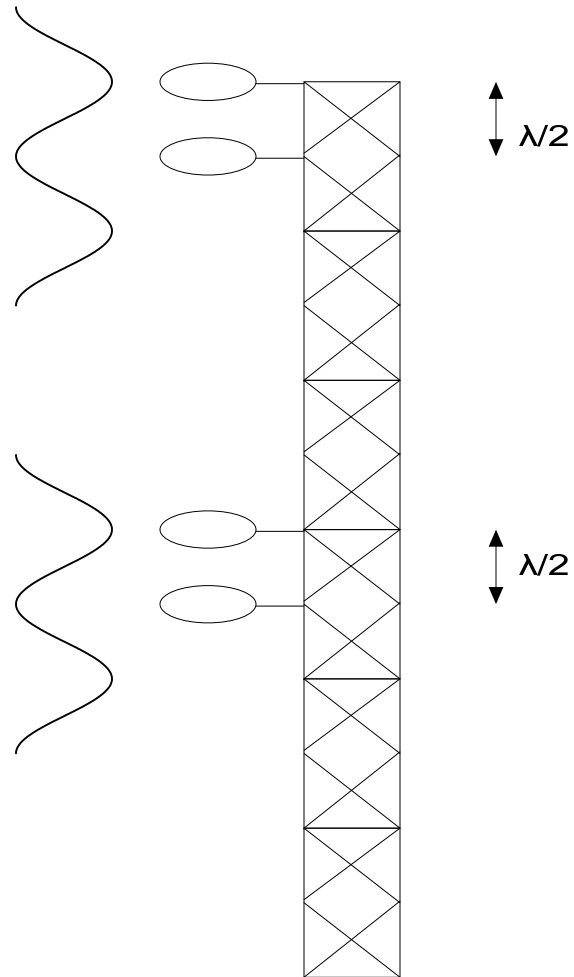
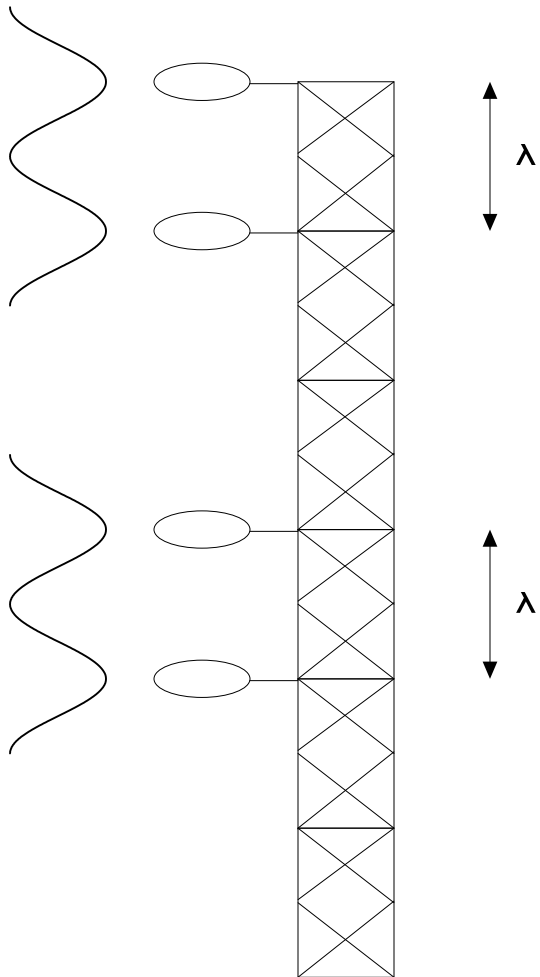
High Level Combining Modification

Powering	Licensed TPO	Total Analog Power Required	Digital Power Total	New Digital Power	Boost in dB	Total Reject Power
0	100.00	111.00	10.00	1.00	0	20.00
	100.00	114.17	10.00	1.26	1	22.92
	100.00	118.36	10.00	1.58	2	26.78
	100.00	123.93	10.00	2.00	3	31.94
	100.00	131.43	10.00	2.51	4	38.92
	100.00	141.62	10.00	3.16	5	48.46
	100.00	155.66	10.00	3.98	6	61.68

Space Combining Considerations

Loss-Coupling Calculation Example	-20 dBc typical	-10 dBc Best	-10 dBc Worst	
Digital Tx (db relative Digital)	20	10	10	
Antenna Loss Coupling	-20	-30	-20	10 to 20 dB or more depending on antennas/spacing, etc.
Isolator	-27	-30	-25	Ferrite circulators, typical -25 to -30 dB isolation
Digital TX Turnaround loss	-17	-20	-5	tube tx, typical -6 dB, solid state tx, typical -14 to -20 dB
Digital TX Output	-44	-70	-40	SHOULD BE > -40 DB
Analog Tx (dB relative analog)	-20	-10	-10	
Antenna Loss Coupling	-20	-30	-20	10 to 20 dB or more depending on antennas/spacing, etc.
Isolator	0	0	0	Ferrite circulators, typical -25 to -30 dB isolation
Digital Tx Turnaround Loss	-17	-17	-6	tube tx, typical -6 dB, solid state tx, typical -14 to -20 dB
Digital TX Output	-57	-57	-36	SHOULD BE > -40 DB

Full Wave vs. Half Wave Antennas

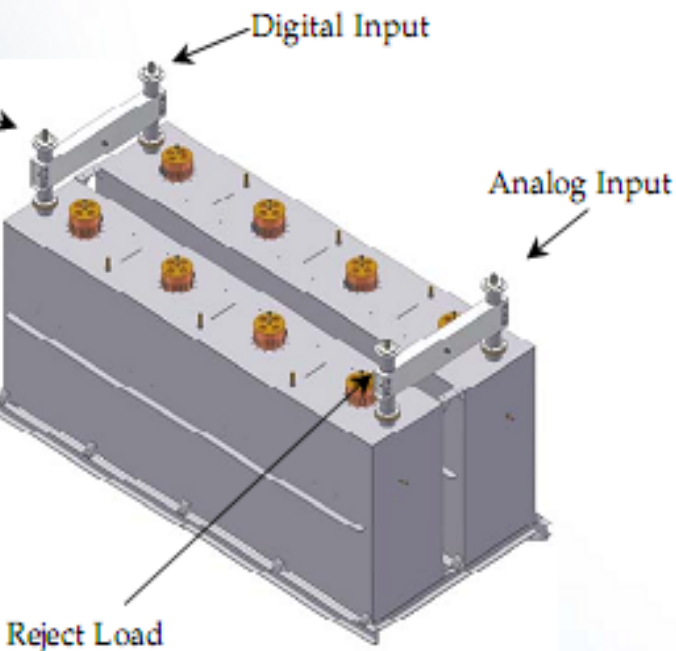


Myat *“LO-LOSS SOLUTION”*

PATENT PENDING



EVANESCENT COUPLED TECHNOLOGY



- Attractive solution for combining FM + HD Radio signals at powers above 20KW
- Efficient high level combining technique
- Ideal for the proposed 10dB digital sideband increase
- Allows existing Tx facilities to go from 20dB_c to 10dB_c
- Lower operating cost, less waste
- Evanescent Coupled Technology for superior efficiency
- Compact design suitable for floor, or ceiling mount





HD Radio Injection Level Analysis Tool

Enter analog TPO here in watts → **23,000**

HD Injection Level / Analog TPO

<u>Model</u>	<u>-20dB</u>	<u>-18dB</u>	<u>-16dB</u>	<u>-14db</u>	<u>-12dB</u>	<u>-10dB</u>
NV3.5	3,375	3,206	3,038	2,700	2,312	1,941
NV5	4,500	4,275	4,050	3,600	3,083	2,588
NV7.5	6,750	6,413	6,075	5,400	4,624	3,881
NV10	9,000	8,550	8,100	7,200	6,165	5,175
NV15	13,500	12,825	12,150	10,800	9,248	7,763
NV20	18,000	17,100	16,200	14,400	12,330	10,350
NV30	27,000	25,650	24,300	21,600	18,495	15,525
NV40	36,000	34,200	32,400	28,800	24,660	20,700
NV60	54,000	51,300	48,600	43,200	36,990	31,050
NV80	72,000	68,400	64,800	57,600	49,320	41,400

Capable of meeting injection level at that Analog TPO

Capable of meeting injection level at that Analog TPO with HD PowerBoost

Capable of meeting injection level at that Analog TPO with in-cabinet upgrade

All specifications subject to change. Rev 11/26/09 CWK

All estimates based on VSWR < 1.05:1, 3dB headroom to HD mask, and current NRSC measurement recommendations.

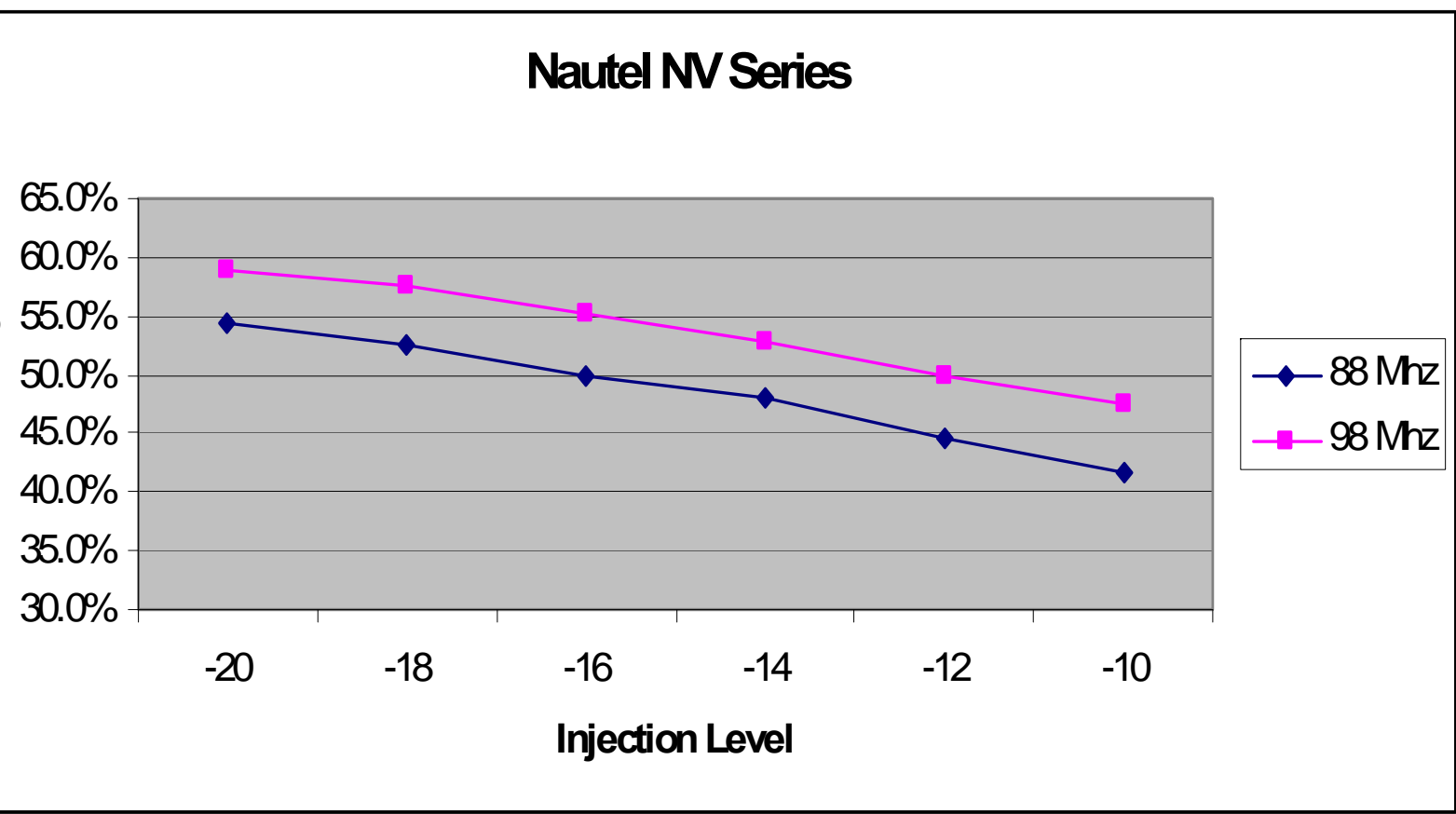
For example, if you enter 11,000 as the Analog TPO, the cells highlighted in Green indicate the Transmitter Model / Injection level combinations that are possible with the standard transmitter. Blue cells indicate combinations which requires the use of HD PowerBoost and Yellow cells indicate the need to upgrade the transmitter via an in-cabinet upgrade.

Attention to Specifications

Model #	-10		
	Comb	FM (TPO)	IBOC
NV 3.75	2,184	1,985	199
NV 5	2,912	2,647	265
NV 7.5	4,368	3,971	397
NV 10	5,824	5,294	529
NV 15	8,736	7,941	794
NV 20	11,647	10,589	1,059
NV 30	17,471	15,883	1,588
NV 40	23,295	21,177	2,118

- Keep in mind the relationship between ***combined total RMS power***, and ***available analog FM TPO***.

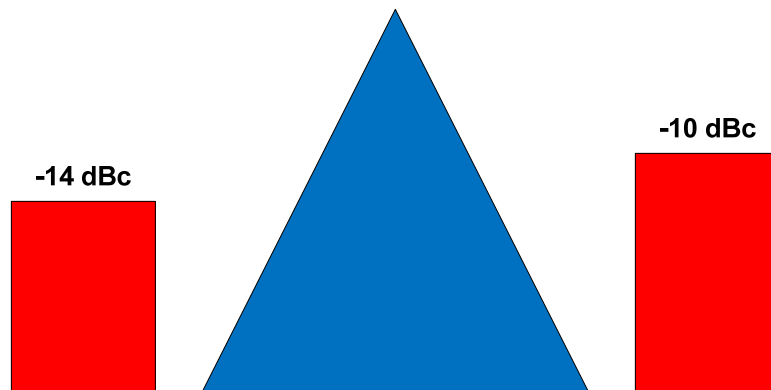
Efficiency vs. Injection Level for Common Amp (Low Level)



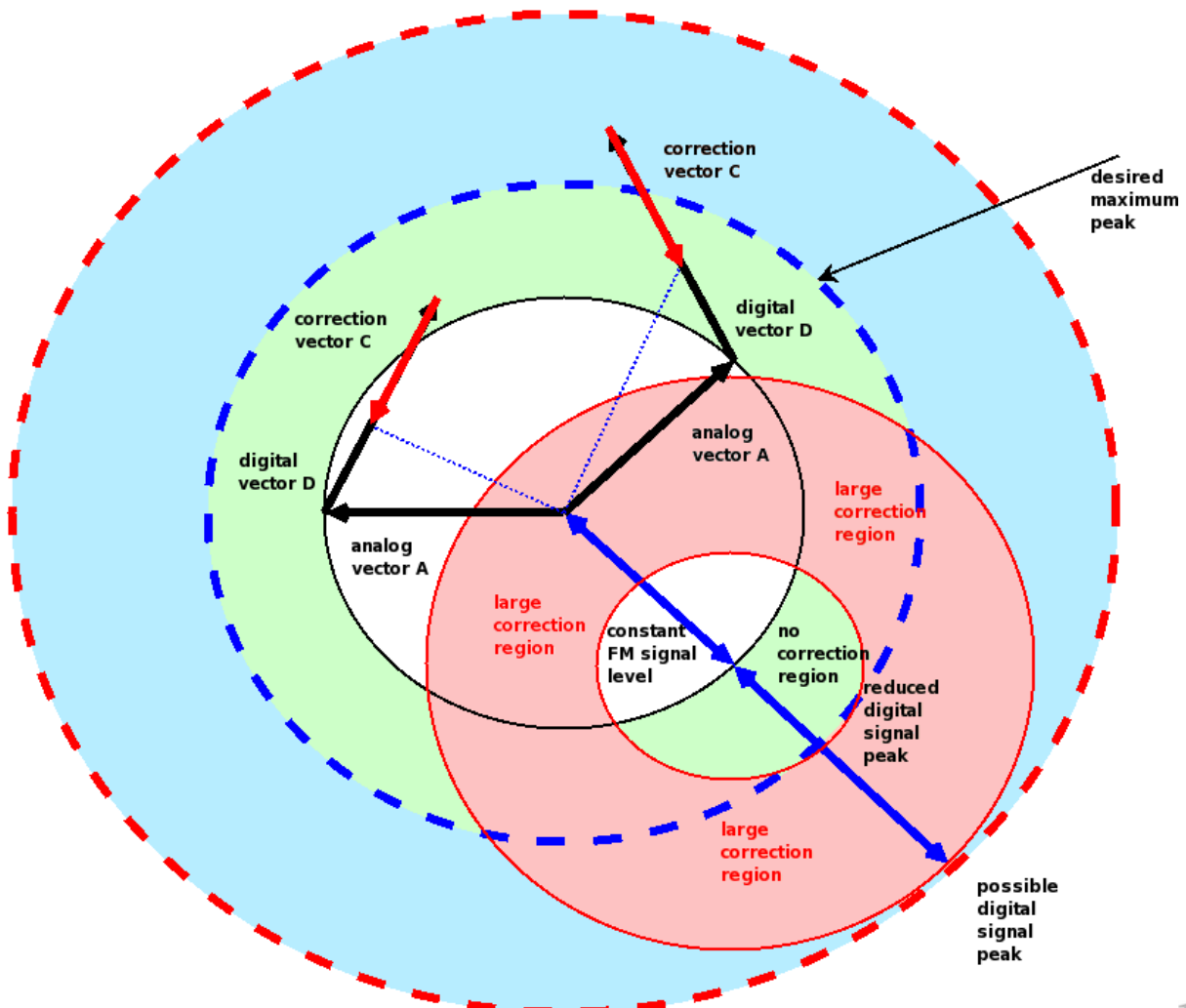
Factors That Can Improve De-rating

Peak-to-Average Power Ratio Reduction (PAPR) such as Nautel PowerBoost™, can yield an addition 1 to 1.3 dB in available analog power

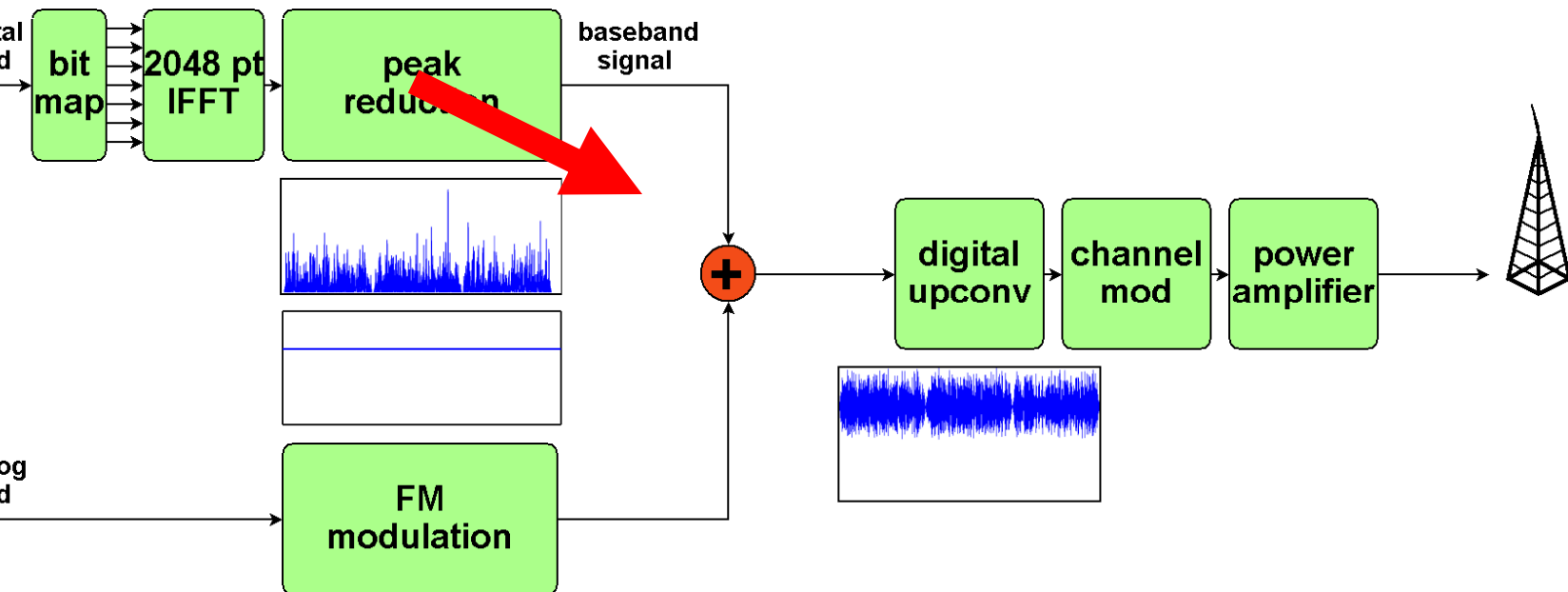
Asymmetrical sideband technology – optimizes power in upper and lower sidebands.



Standard PAPR Reduction

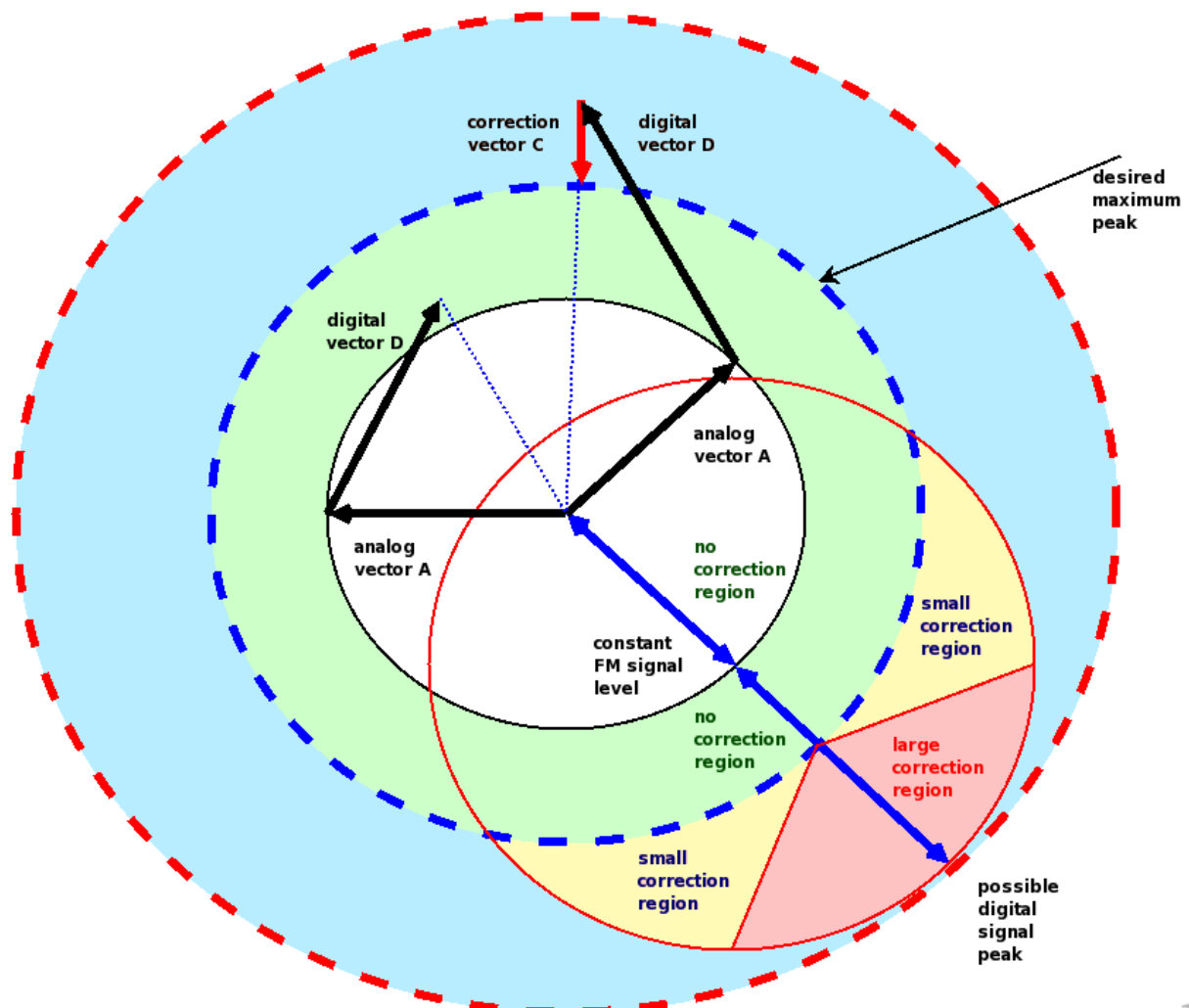


The “new” PAPR Reduction



... what if we considered both the analog and digital signals together?

Nautel PowerBoost™ PAPR

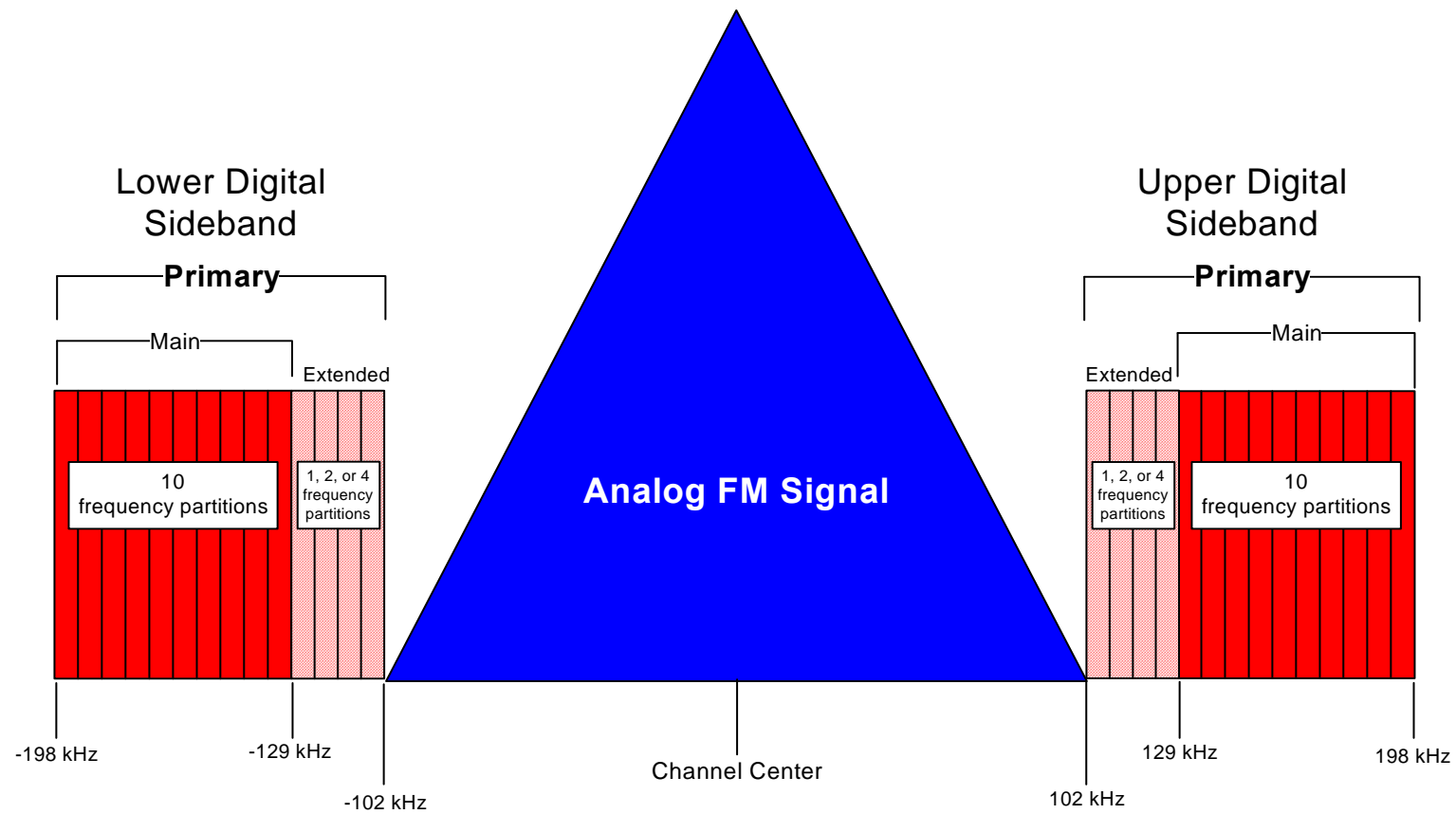


Factors That Can Degrade De-rating

Tube vs. Solid State – Tubes generally de-rate faster as injection approaches -10 dBc

Extended hybrid modes – Depending on the Mode (MP2, MP3, MP11, etc.), may require 10% to 40% additional DIGITAL power due to additional carriers

Extended Hybrid Modes



Considerations for Extended Hybrid Modes

- MP2 uses 10% more carriers than MP1 (1 additional pair of partitions), and adds 12.4 kbps.
- MP3 uses 20% more carriers than MP1 (2 additional pairs of partitions), and adds 24.8 kbps.
- Additional carriers further de-rate analog capability.

NV Series Transmitter



Single Cabinet, solid state solutions from 3.5 to 40 kW

Multiple levels of redundancy: PA, IPA, all power supplies, & cooling

Available of PowerBoost (PAPR) for 1 to 1.3 dB additional analog power

Support asymmetrical sideband capability



Thank You!

Gary Liebisch

NAUTEL

Eastern Regional Sales Mgr.

Milford, OH

gary.liebisch@nautel.com

(513) 576-6400