

**ENGINEERING REPORT**

**OF**

**TELEVISION TRANSMITTER**

**PERFORMANCE CHARACTERISTICS**

**FOR:**

**WTOV-DT**

**Cox Broadcasting, Inc.**

**CHANNEL 09**

**Steubenville, OH**

Measurements Taken By: Walt Rush

Signature: 

Date Of Measurement: 09/30/2011

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\* = Graphic Included

**FACILITIES NAMED IN LICENSE OR CONSTRUCTION PERMIT:**

Name Of Applicant: **WTOV-DT Cox Broadcasting, Inc.**  
 Call Letters: **WTOV-DT**  
 Channel Assigned: **09**                      Offset: **No**  
 File Number Of License Or CP: **BPCDT-20110308ABN**  
 Passband Center Frequency: **189,000,000.0 Hz**  
 Pilot Frequency: **186,309,440.6 Hz**

**TRANSMITTER LOCATION:**

State: **Ohio**  
 County: **Jefferson**  
 City: **Mingo Junction**  
 Street: **9 Red Donley Plaza**  
 Other: **40° 20' 33" North Latitude**                      **80° 37' 14" West Longitude**

**TRANSMITTER MANUFACTURER:** **HARRIS**                      **EXCITER(s):** **Apex M2X (1)**

Type: **Platinum PTCD20P2-i (Hybrid)**  
 Serial Number: **SR10000017-04**  
 Type Acceptance File Number: **BOI V-PCD-ES5C**

**POWER BUDGET:**

	<b>AVERAGE DIGITAL POWER</b>	
	<b><u>dbK</u></b>	<b><u>kW</u></b>
Transmitter Rated Power	9.03	8.00
Transmitter System Output Power *	8.45	7.00 *
Transmission Line Loss	-0.64db	
Antenna Input Power	7.81	6.04
Antenna Power Gain (Max)	6.96db	
ERP (Average)	14.77	30.00

\* Includes RF System Losses (Data Taken At Mask Filter Output)

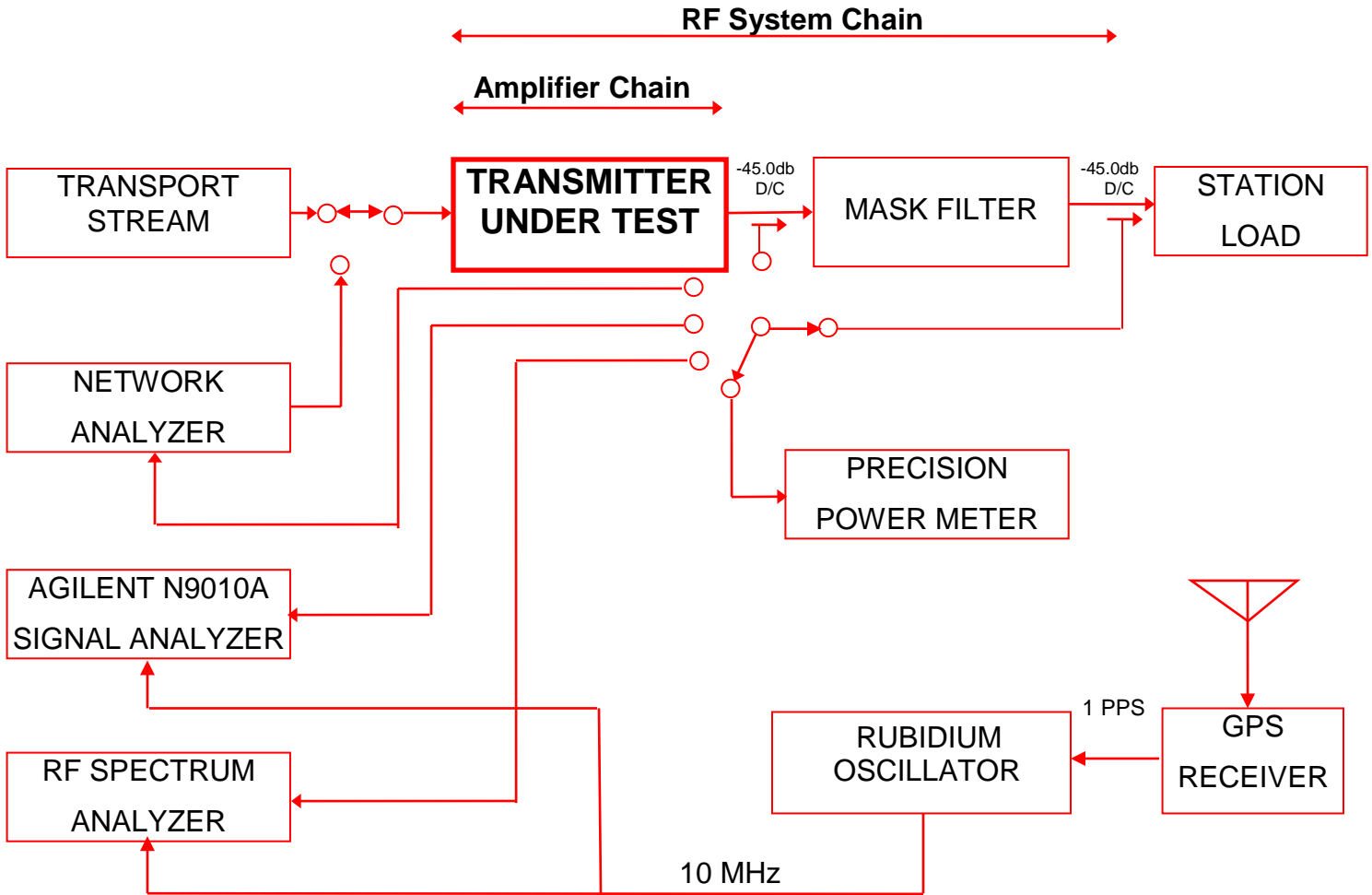
**RF SYSTEM MANUFACTURER:** **Myat**

Type: **Sharp Tuned Filter**                      Serial Number: **1237867**

**ANTENNA MANUFACTURER:** **Dielectric**

Type: **THA-C4-2HV/8-1**                      Serial Number: **N/A**

**TEST AND MEASUREMENT SETUP**



**TEST EQUIPMENT SUMMARY:**

DEVICE	MANUFACTURER	MODEL
Network Analyzer	Agilent	8753ES *
Spectrum Analyzer	Agilent	N9010A *
Power Meter	Agilent	E4418B *
Vector Signal Analyzer	Agilent	N9010A *
Rubidium Oscillator	Stanford Research Systems	PRS-10 *
GPS Reference Receiver	Trimble	Thunderbolt
Tunable Notch Filter	Eagle	TNF-1
Test Cable(s) (50')	Belden	RG-214

\* All Calibrations Valid Thru 05/2012

**METHOD OF DETERMINING OUTPUT POWER USING POWER METER:****TRANSMITTER**

This describes the method for determining Output Power as described in the FCC Rules & Regulations:

With the transmitter adjusted to produce **7.0** kW indicated on the Agilent E4418B Power Meter, the following data was recorded: (The Test Equipment Was Set Up As Illustrated In The Block Diagram On Page 4)

**Equipment Used:** A Calibrated Agilent E4418B Power Meter Connected To A **-45.0db** Precision Directional Coupler Located At The Input To The Station Load.

**Results:** With The Transmitter Operating And The Calibrated Agilent E4418B Power Meter Attached To The Incident Port Of The **-45.0db** Precision Directional Coupler The Transmitter Was Adjusted To Yield The Following:

Power Meter Reading: **221.36 Milliwatts**

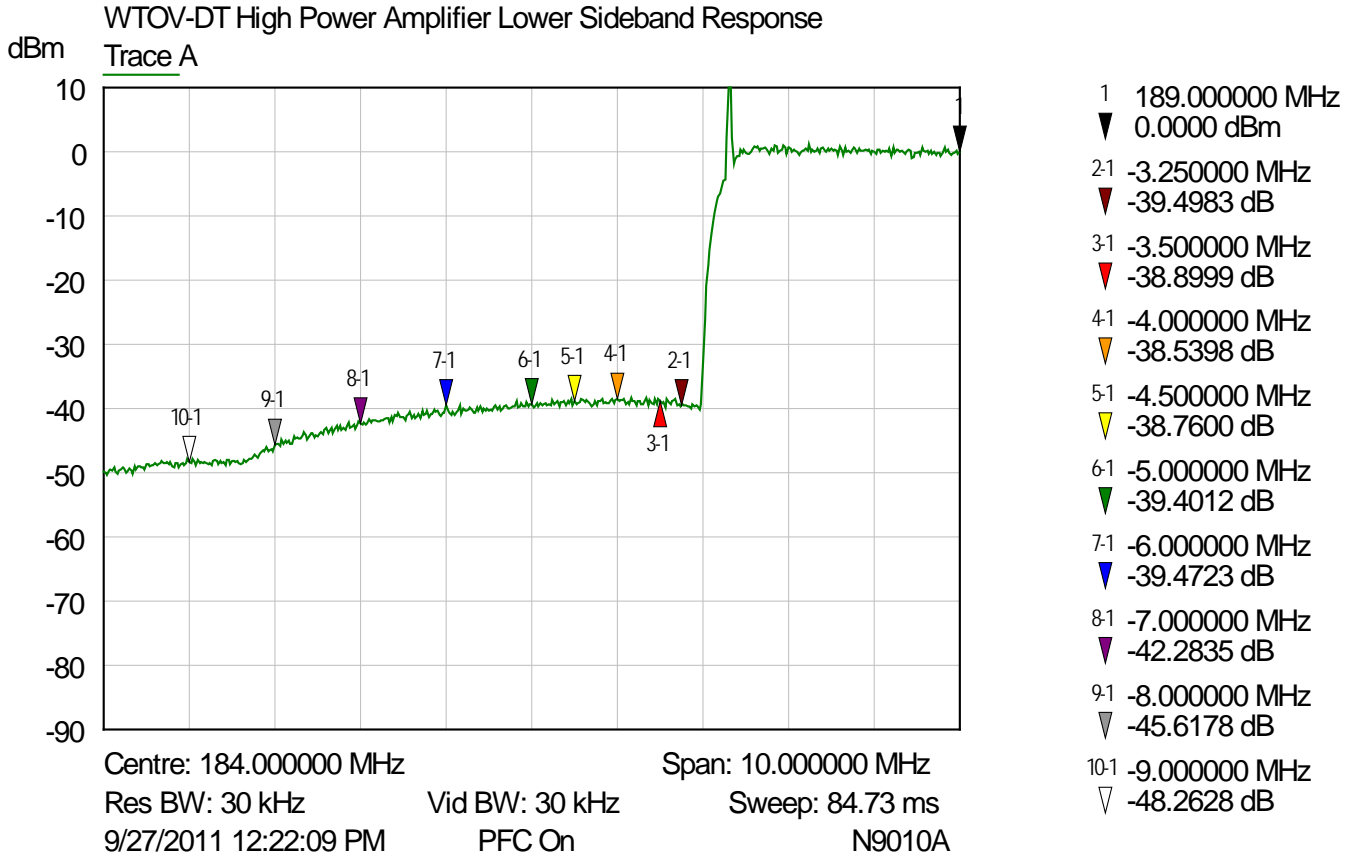
Power In Transmission Line = (Power At Directional Coupler) x  $(10^{(db/10)})$

Therefore: **Average Power = (.22136 watts) X  $(10^{(45/10)}) = 7.0 KW$**

**NOTE #1:** After Making These Measurements, The Power Indicating Meters Were Adjusted To Read 100% Power.

**HIGH POWER AMPLIFIER LOWER SIDEBAND PERFORMANCE  
(Exciter "A")**

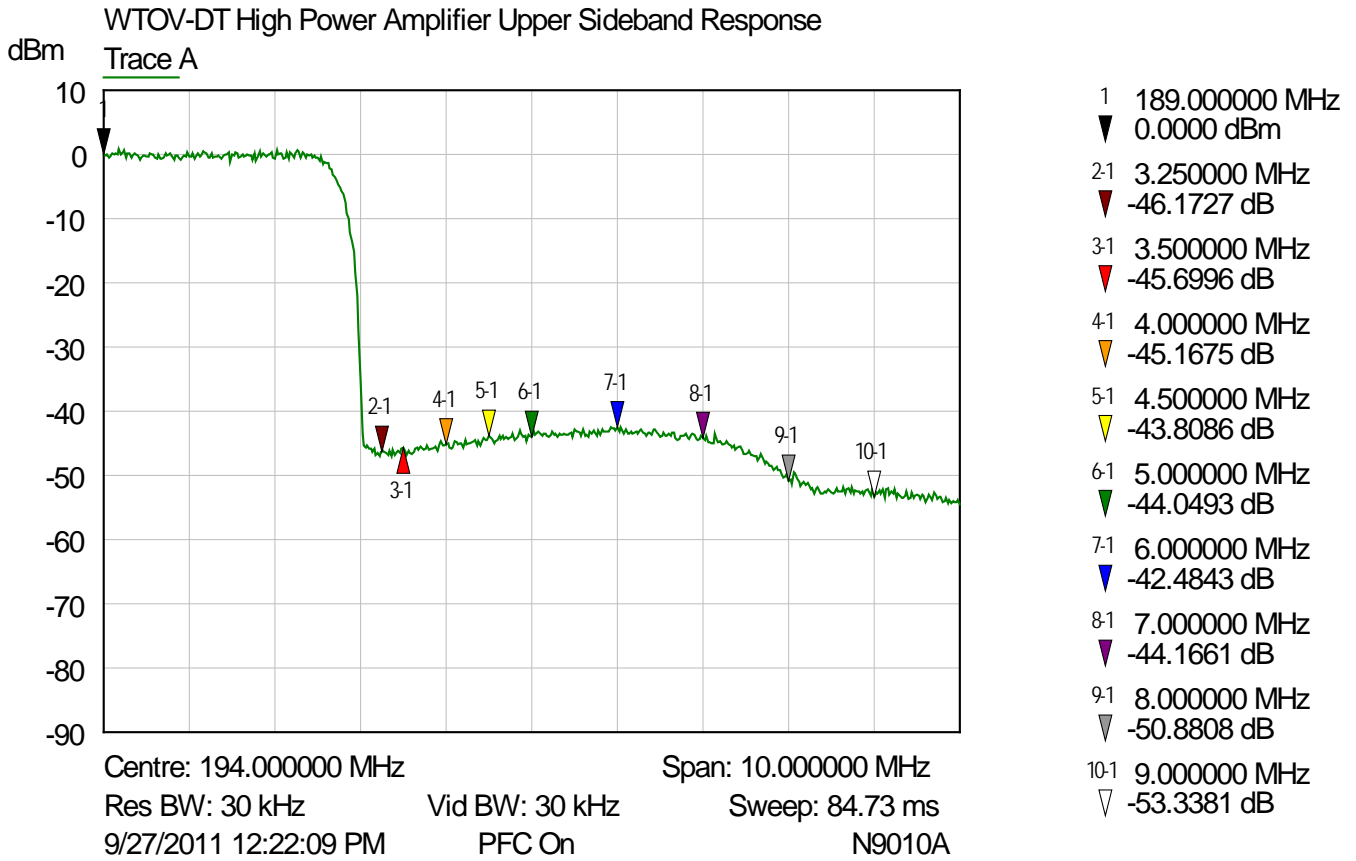
**Cable Type:** RG -214    **Length:** 50 Feet  
**Spectrum Analyzer:** Agilent    **Model:** N9010A



**NOTE:** Markers #2 Thru #10 In The Plot Above Are Referenced To Marker #1

HIGH POWER AMPLIFIER UPPER SIDEBAND PERFORMANCE  
(Exciter "A")

Cable Type: RG -214 Length: 50 Feet  
Spectrum Analyzer: Agilent Model: N9010A



**NOTE:** Markers #2 Thru #10 In The Plot Above Are Referenced To Marker #1

**FCC MASK COMPLIANCE TABULAR DATA**

Frequency	Mask Filter Response			Transmitter Pre-Filter Response			Net Response	FCC Mask Response	RED # Is out of FCC Specification
	Analyzer Reading	Center Freq. Reference	Filter Response	Analyzer Reading	Center Freq. Reference	Transmitter Response			
-9.00MHz	-67.70	0.000	-67.70	-48.26	0.000	-48.26	-115.96	-99.80	16.16
-8.00MHz	-72.65	0.000	-72.65	-45.62	0.000	-45.62	-118.27	-88.30	29.97
-7.00MHz	-69.86	0.000	-69.86	-42.28	0.000	-42.28	-112.14	-76.80	35.34
-6.00MHz	-53.91	0.000	-53.91	-39.47	0.000	-39.47	-93.38	-65.30	28.08
-5.00MHz	-42.36	0.000	-42.36	-39.40	0.000	-39.40	-81.76	-53.80	27.96
-4.50MHz	-36.89	0.000	-36.89	-38.76	0.000	-38.76	-75.65	-48.10	27.55
-4.00MHz	-32.18	0.000	-32.18	-38.54	0.000	-38.54	-70.72	-42.30	28.42
-3.50MHz	-38.05	0.000	-38.05	-38.90	0.000	-38.90	-76.95	-36.60	40.35
-3.25MHz	-21.56	0.000	-21.56	-39.50	0.000	-39.50	-61.06	-36.40	24.66
<b>189 MHz</b>	<b>Center Frequency</b>			<b>EXCITER "A"</b>					
+3.25MHz	-28.42	0.000	-28.42	-46.17	0.000	-46.17	-74.59	-36.40	38.19
+3.50MHz	-24.11	0.000	-24.11	-45.70	0.000	-45.70	-69.81	-36.60	33.21
+4.00MHz	-28.59	0.000	-28.59	-45.17	0.000	-45.17	-73.76	-42.30	31.46
+4.50MHz	-35.38	0.000	-35.38	-43.81	0.000	-43.81	-79.19	-48.10	31.09
+5.00MHz	-42.04	0.000	-42.04	-44.05	0.000	-44.05	-86.09	-53.80	32.29
+6.00MHz	-55.54	0.000	-55.54	-42.48	0.000	-42.48	-98.03	-65.30	32.73
+7.00MHz	-76.82	0.000	-76.82	-44.17	0.000	-44.17	-120.99	-76.80	44.19
+8.00MHz	-72.40	0.000	-72.40	-50.88	0.000	-50.88	-123.28	-88.30	34.98
+9.00MHz	-70.44	0.000	-70.44	-53.34	0.000	-53.34	-123.77	-99.80	23.97

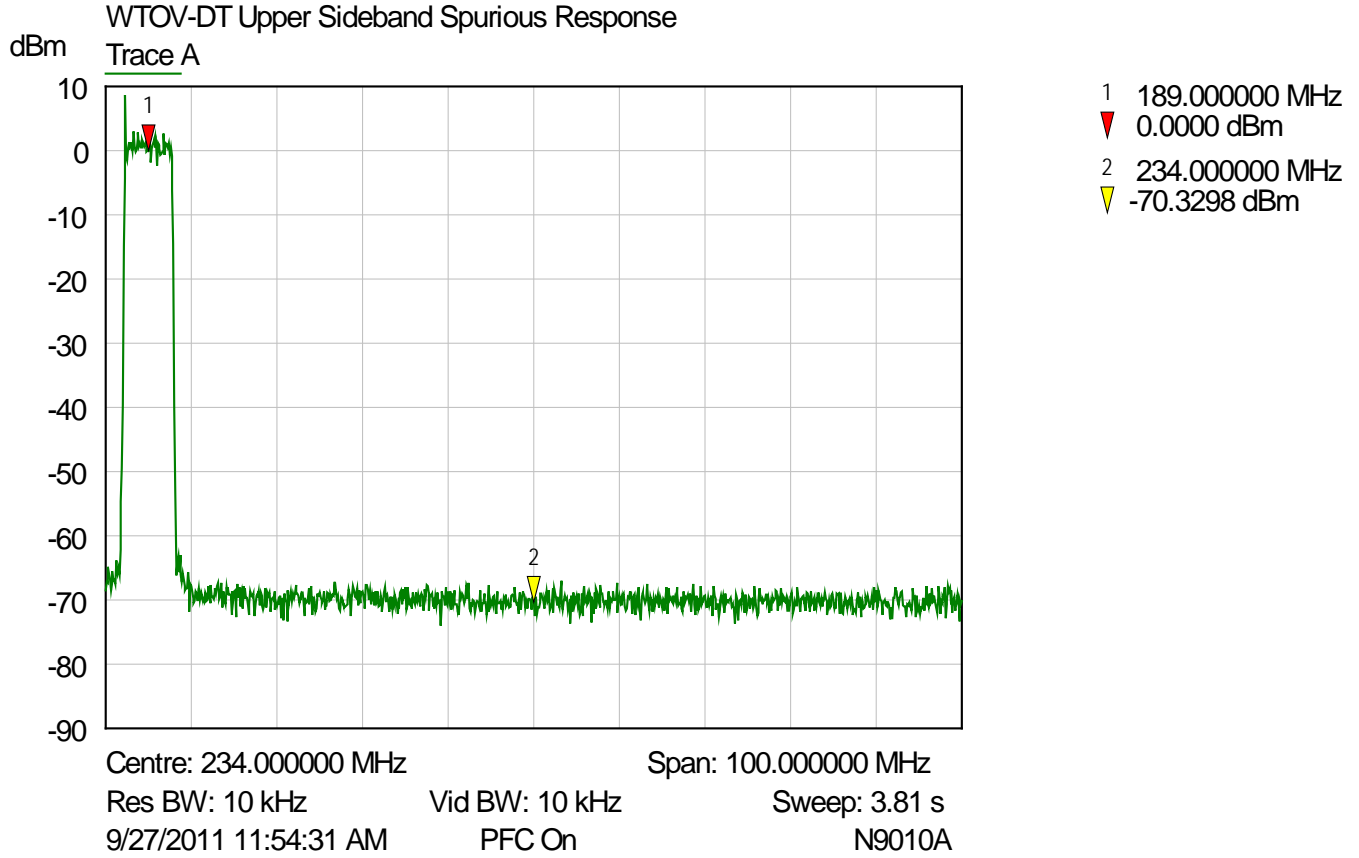
**NOTE 1:** The Transmitter data in the above table is taken from the markers shown in the plots on pages 6 & 7 of this report.

**NOTE 2:** See Notes #1 & #2 on the “Notes & Addenda” page of this report (Pg. 33).



SPURIOUS UPPER SIDEBAND PRODUCTS

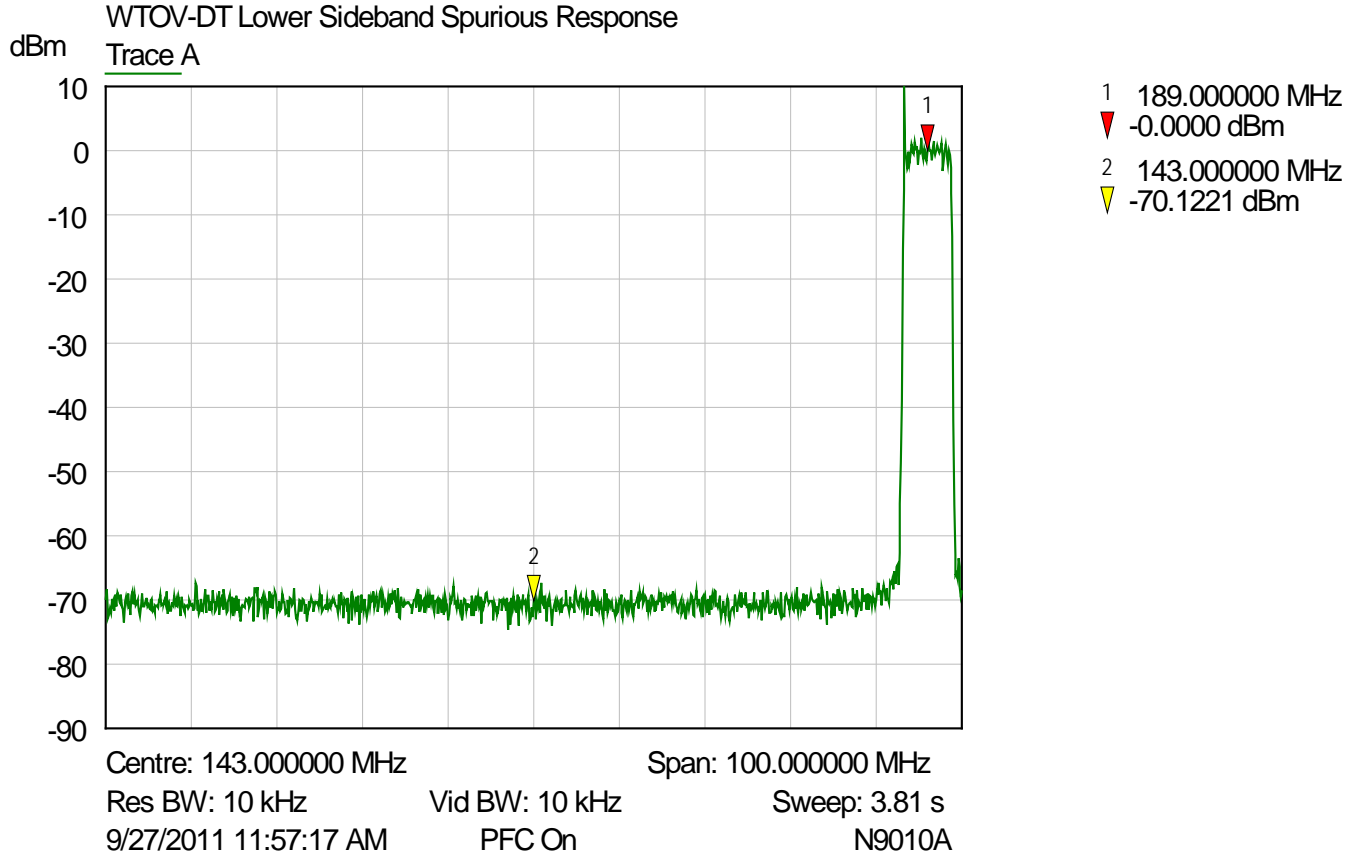
Cable Type: RG -214 Length: 50 Feet  
Spectrum Analyzer: Agilent Model: N9010A



➤ -70 dbm

SPURIOUS LOWER SIDEBAND PRODUCTS

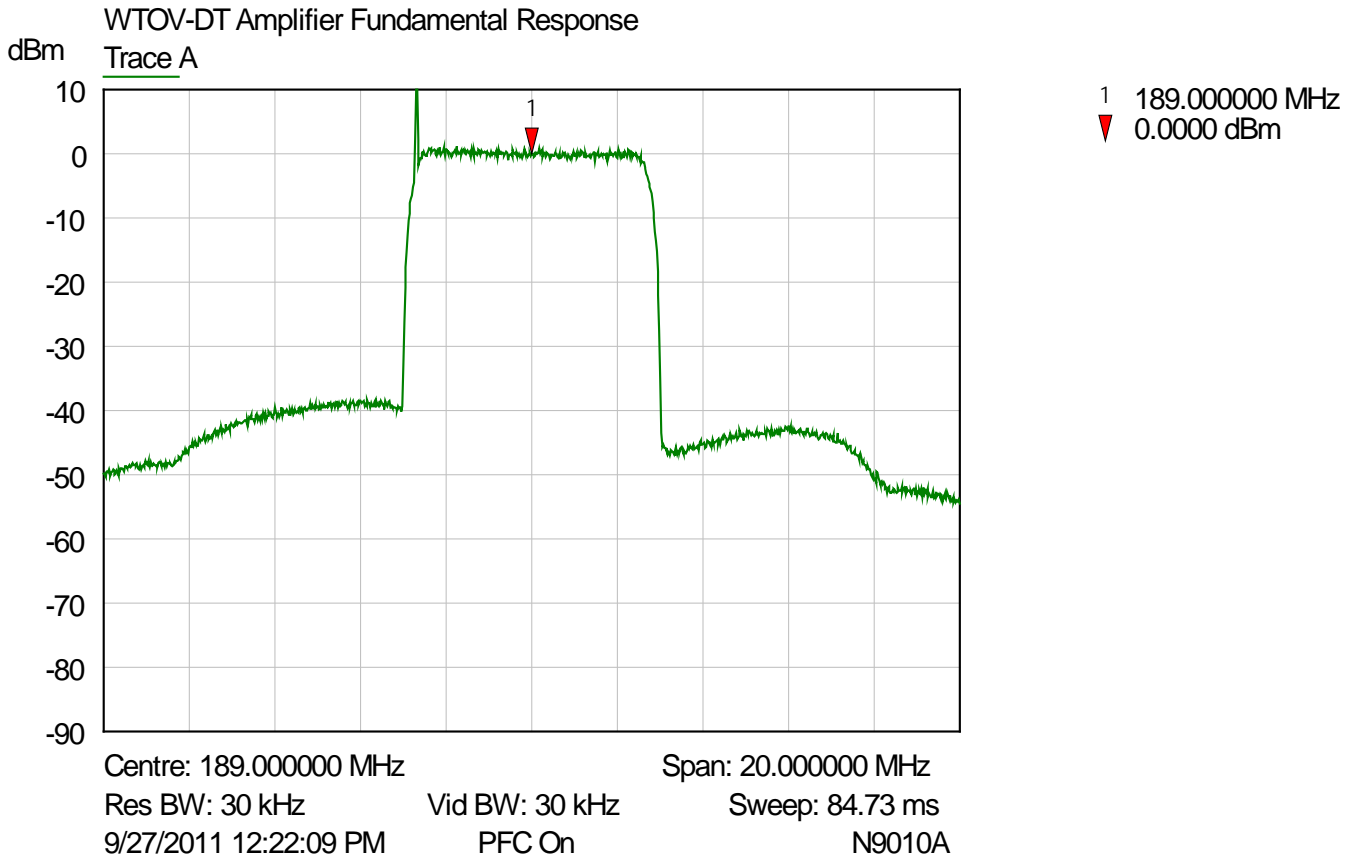
Cable Type: RG -214 Length: 50 Feet  
Spectrum Analyzer: Agilent Model: N9010A



➤ -70 dbm

### HIGH POWER AMPLIFIER FUNDAMENTAL RESPONSE (Exciter "A")

**Cable Type:** RG -214    **Length:** 50 Feet  
**Spectrum Analyzer:** Agilent    **Model:** N9010A



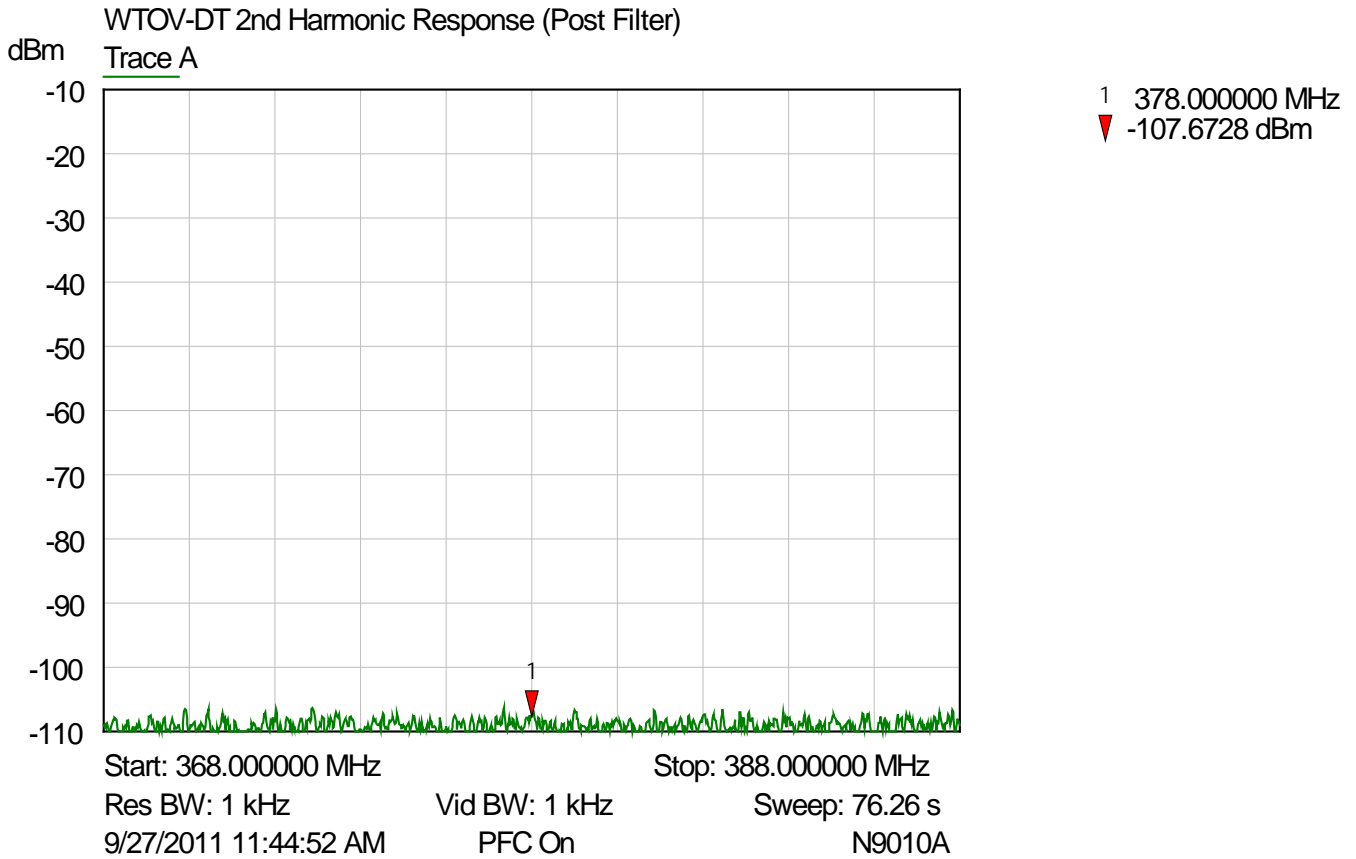
### HIGH POWER AMPLIFIER NOTCHED FUNDAMENTAL RESPONSE (Exciter "A")

Cable Type: RG -214    Length: 50 Feet  
Spectrum Analyzer: Agilent    Model: N9010A    Eagle Notch Filter: TNF-1



**HIGH POWER AMPLIFIER 2<sup>ND</sup> HARMONIC MEASUREMENT (Post-Filter)  
(Exciter "A")**

**Cable Type:** RG -214    **Length:** 50 Feet  
**Spectrum Analyzer:** Agilent    **Model:** N9010A    **Eagle Notch Filter:** TNF-1



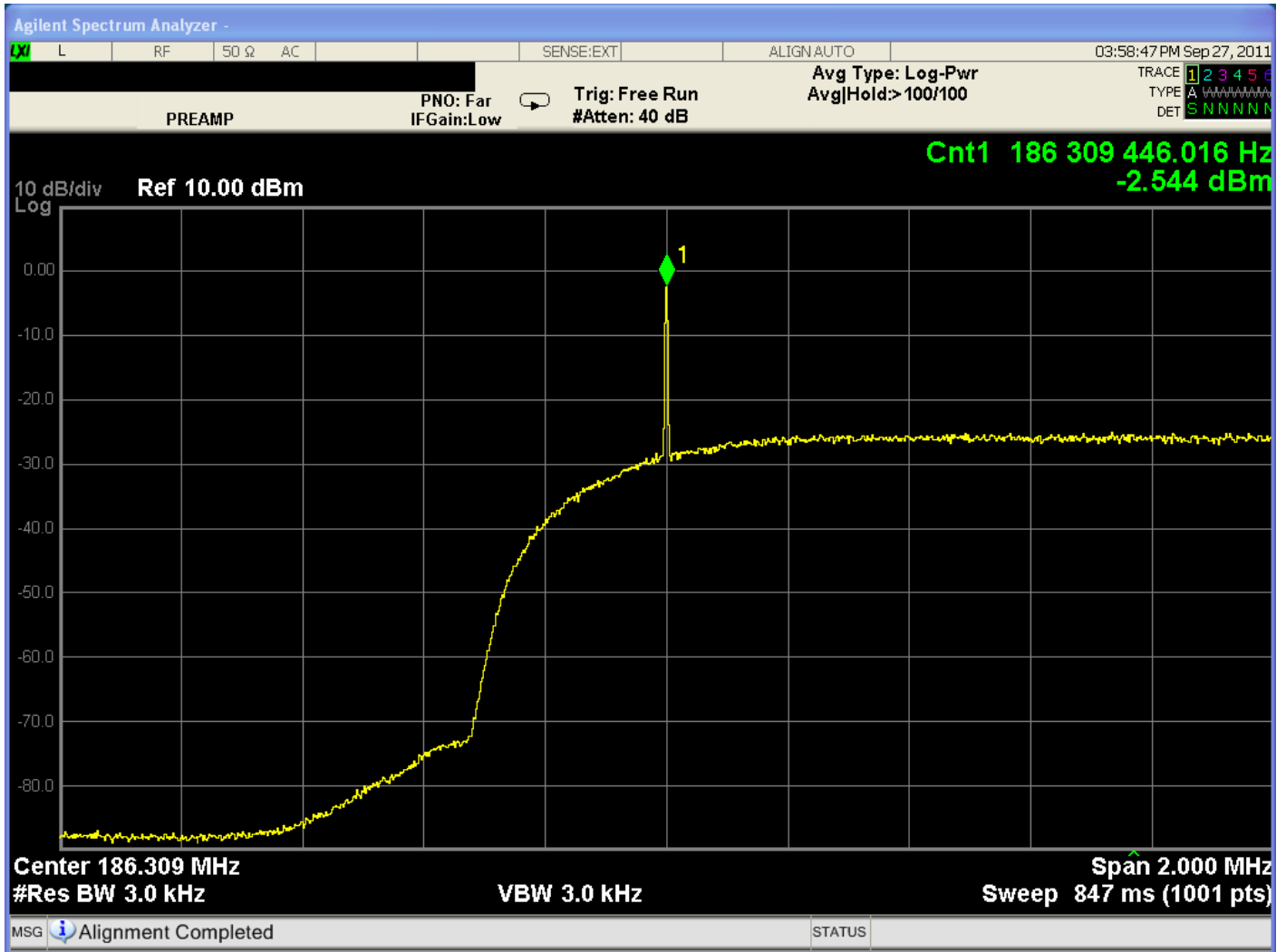
Capacitive Samples Were Connected To The Spectrum Analyzer Through A Tunable Notch Filter Tuned To The Fundamental Frequency To Prevent Overloading The Spectrum Analyzer Front End. A 6 db/Octave Correction Factor Was Applied For Coupler Frequency Response.

**Measured 2<sup>nd</sup> Harmonic Response = -113.67**

**FCC Requirement:** At Least -110 db Below Average Carrier.

**PILOT FREQUENCY MEASUREMENT  
(Exciter "A")**

**Cable Type:** RG -214    **Length:** 50 Feet  
**Vector Signal Analyzer:** Agilent    **Model:** N9010A

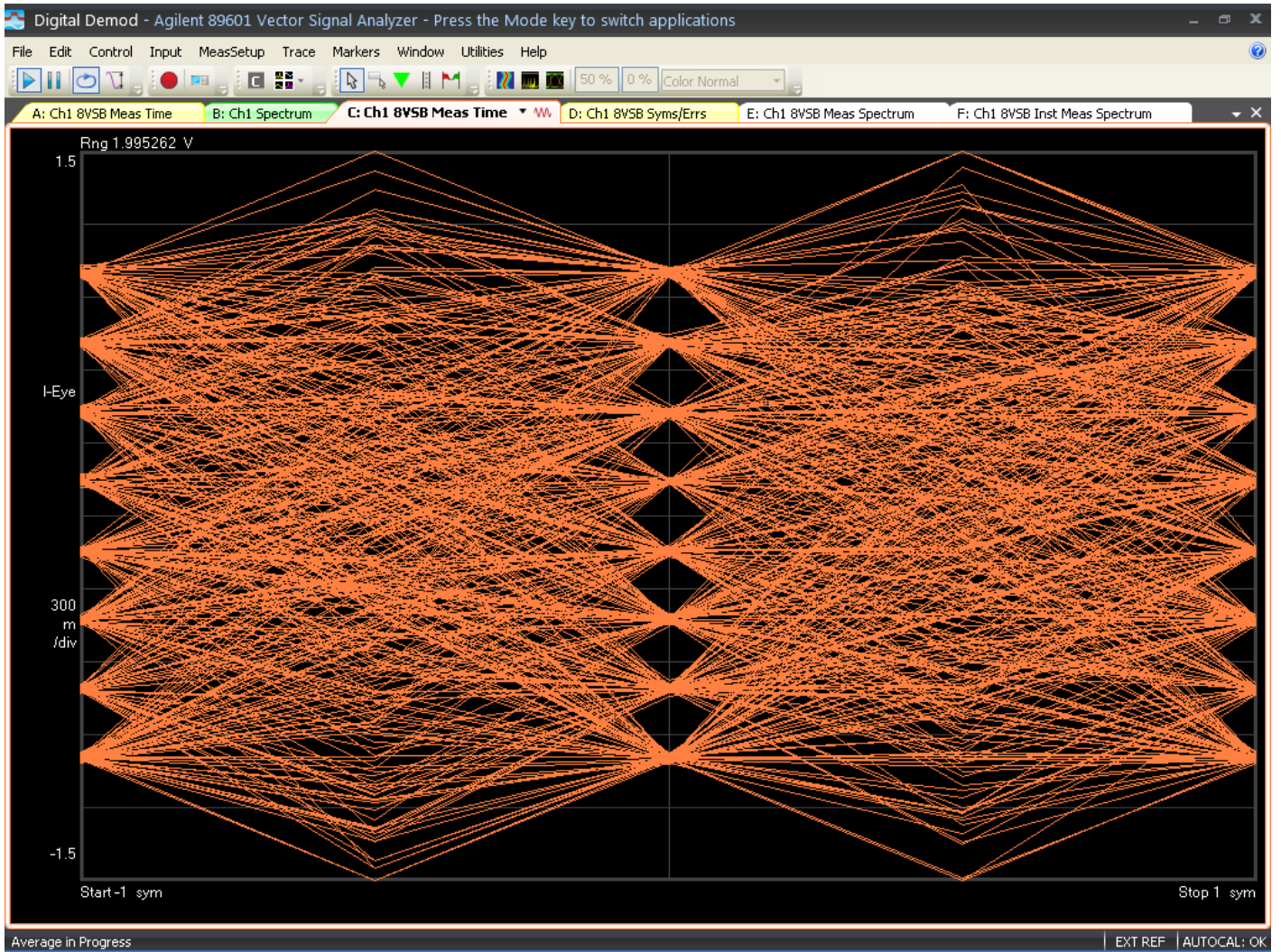


	<u>Center Frequency</u>	<u>Pilot Signal</u>
Assigned	189,000,000.0 Hz	186,309,440.6 Hz
Actual	189,000,000.0 Hz	186,309,446.016 Hz *
* Error: +5.416 Hz      FCC Tolerance = +/- 1000.0 Hz		

**NOTE: Frequency Measurement Taken With GPS Disciplined Rubidium Oscillator Being Used As Frequency Reference Input To The Agilent N9010A**

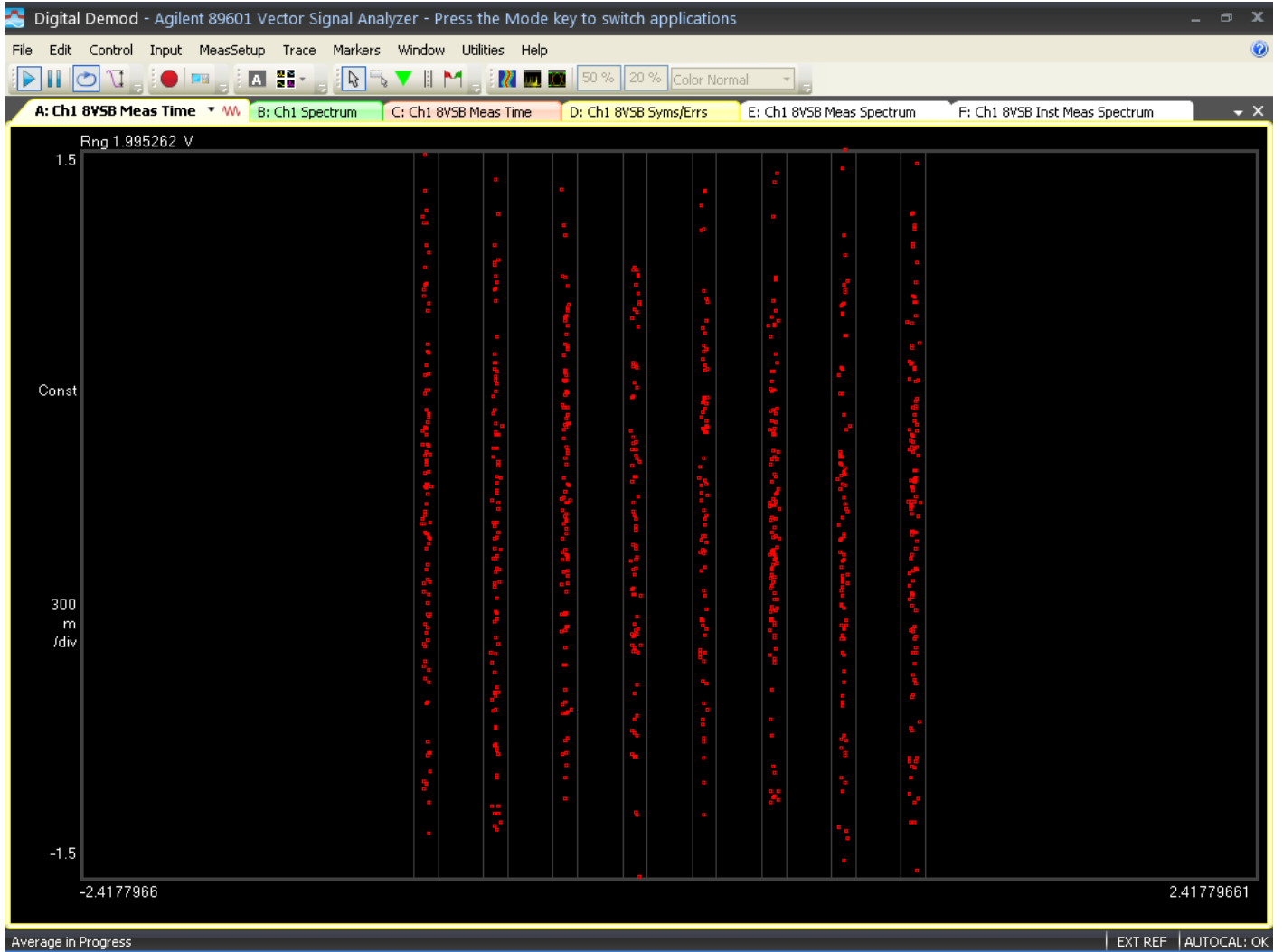
### EYE PATTERN (Exciter "A")

**Cable Type:** RG -214    **Length:** 50 Feet  
**Vector Signal Analyzer:** Agilent    **Model:** N9010A



### CONSTITUTION PATTERN (Exciter "A")

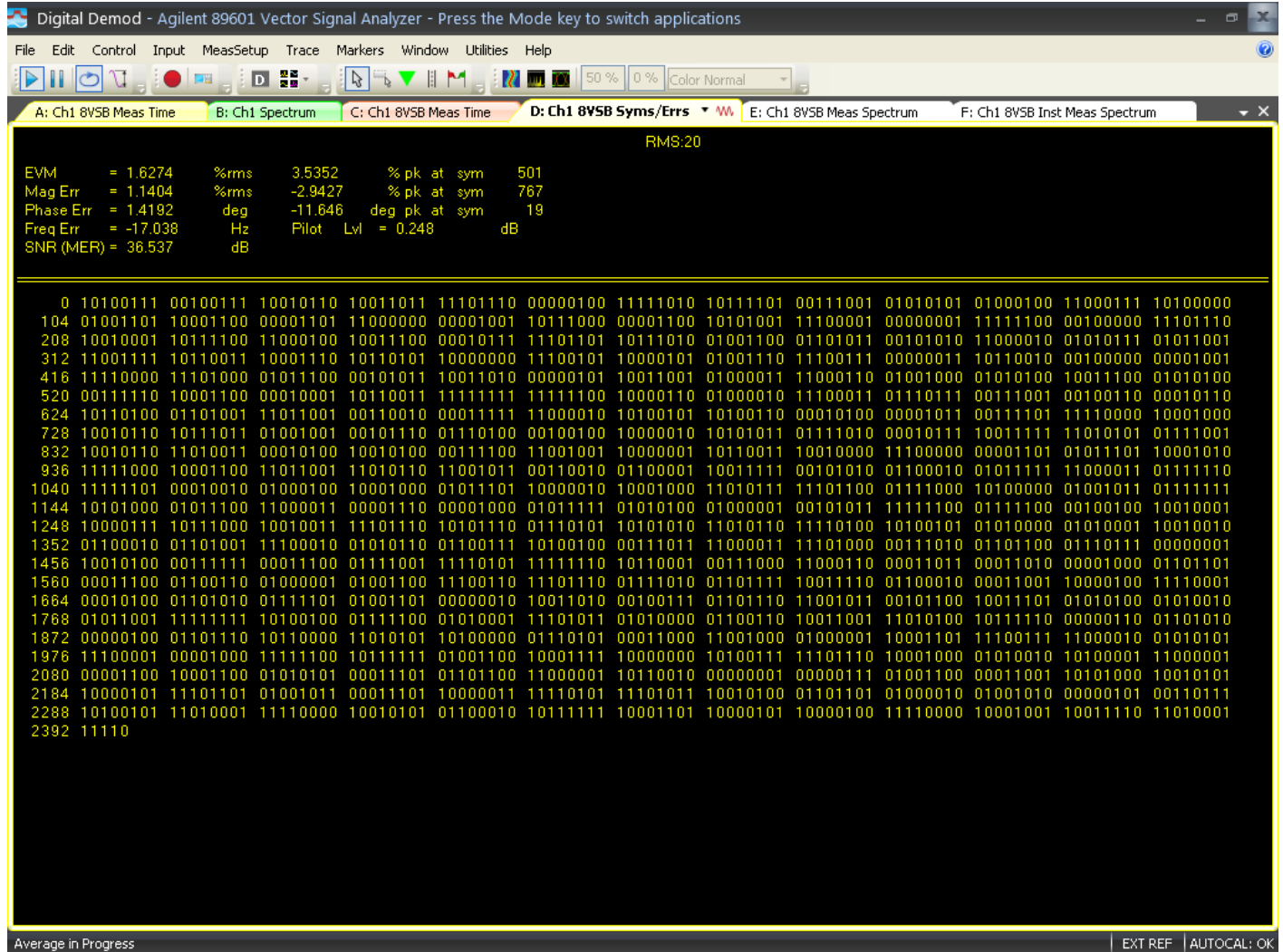
Cable Type: RG -214 Length: 50 Feet  
Vector Signal Analyzer: Agilent Model: N9010A





**TABULAR DATA  
(Exciter "A")**

**Cable Type:** RG -214    **Length:** 50 Feet  
**Vector Signal Analyzer:** Agilent    **Model:** N9010A



**Error Vector Magnitude = 1.16274**  
**Signal To Noise Ratio (MER) = 36.537db**

**GROUP DELAY & RESPONSE MEASUREMENT  
(Exciter "A")**

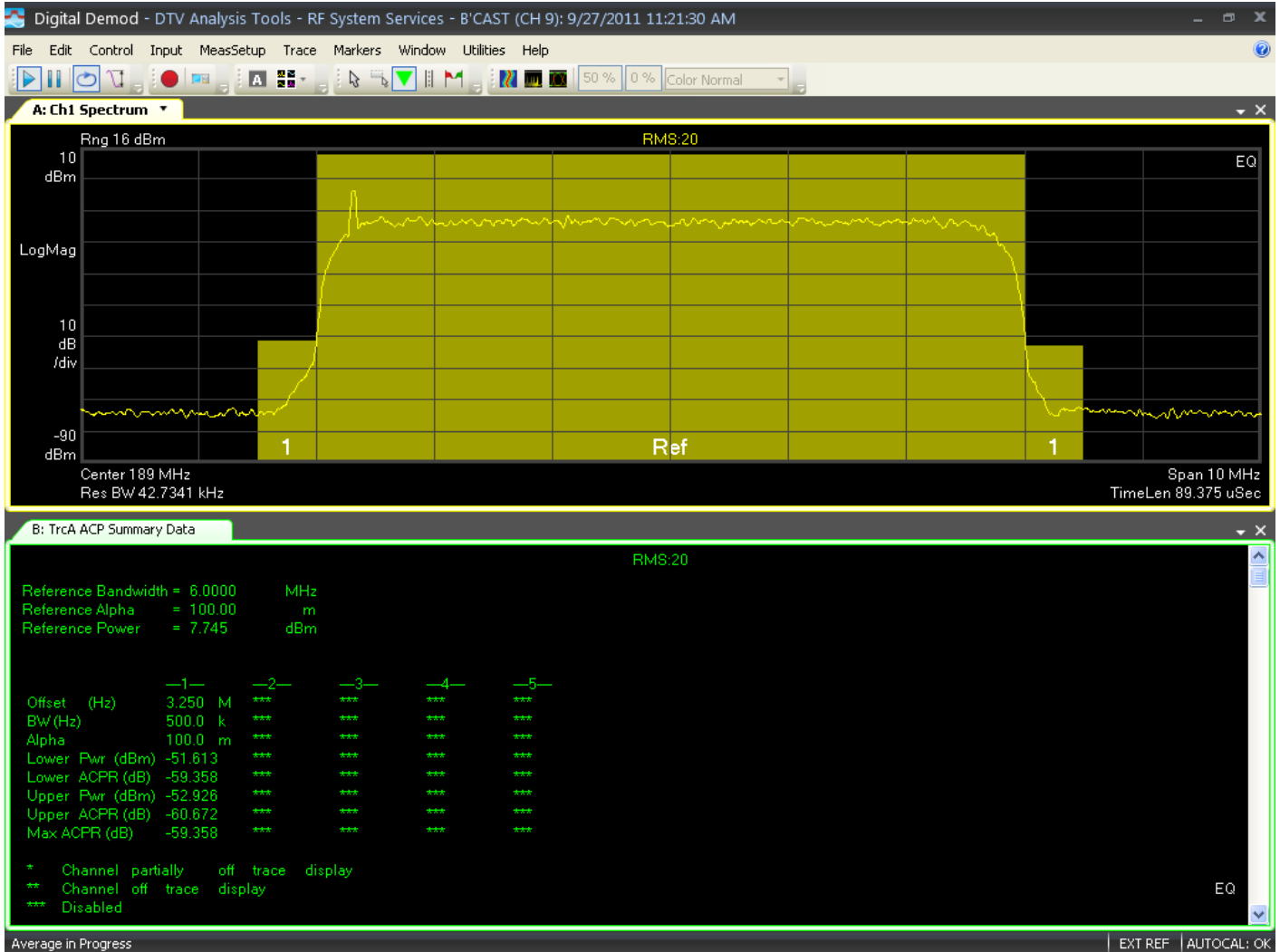
**Cable Type:** RG -214    **Length:** 50 Feet  
**Vector Signal Analyzer:** Agilent    **Model:** N9010A



**Maximum Group Delay = -1.9146 nSec.**  
**Maximum Response Error = -0.103db**

**ADJACENT CHANNEL POWER MEASUREMENT  
(Exciter "A")**

**Cable Type:** RG -214    **Length:** 50 Feet  
**Vector Signal Analyzer:** Agilent    **Model:** N9010A



**Main Channel Power:**                      7.745 dbm                      7.745 dbm

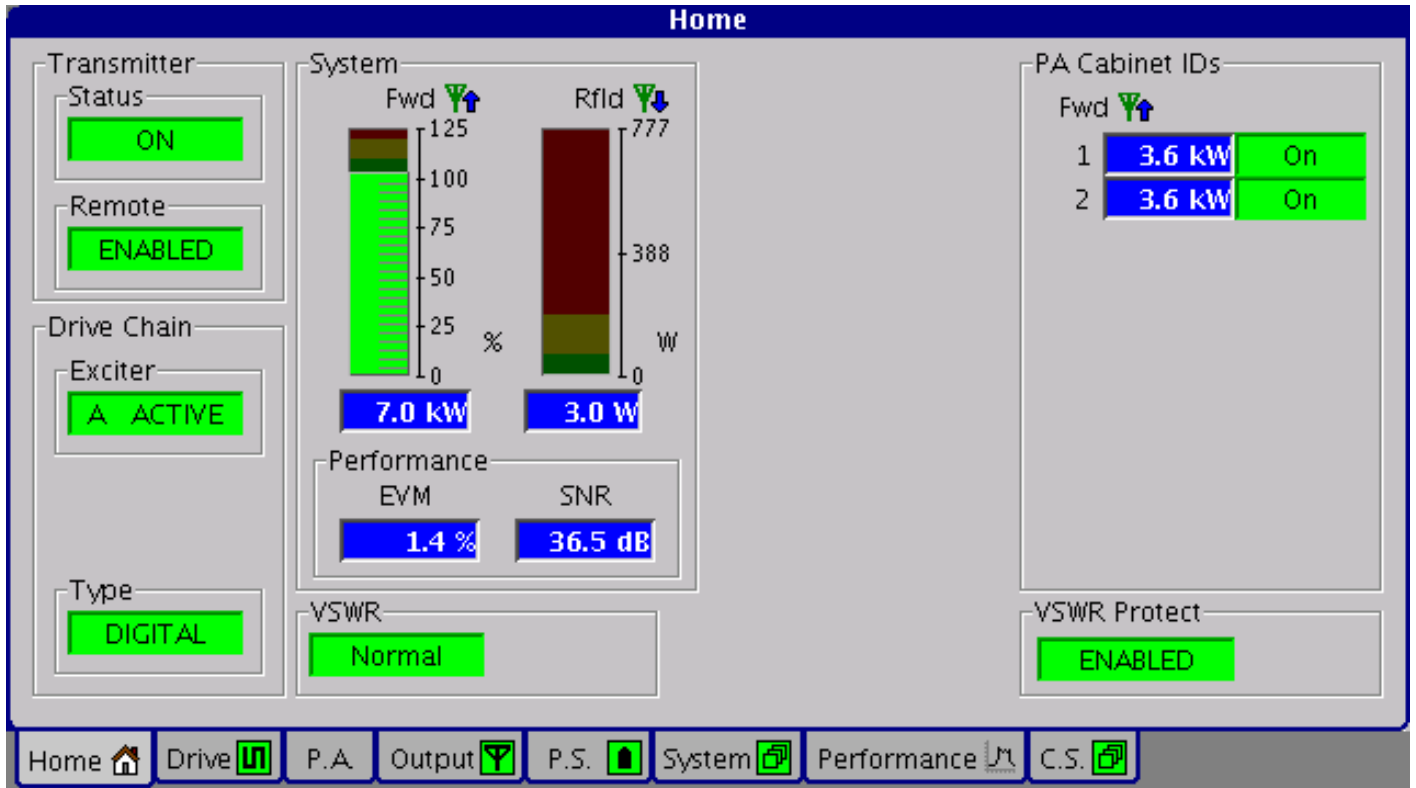
**Lower Sideband Power:**                      -59.358 dbm

**Upper Sideband Power:**                      -60.672 dbm

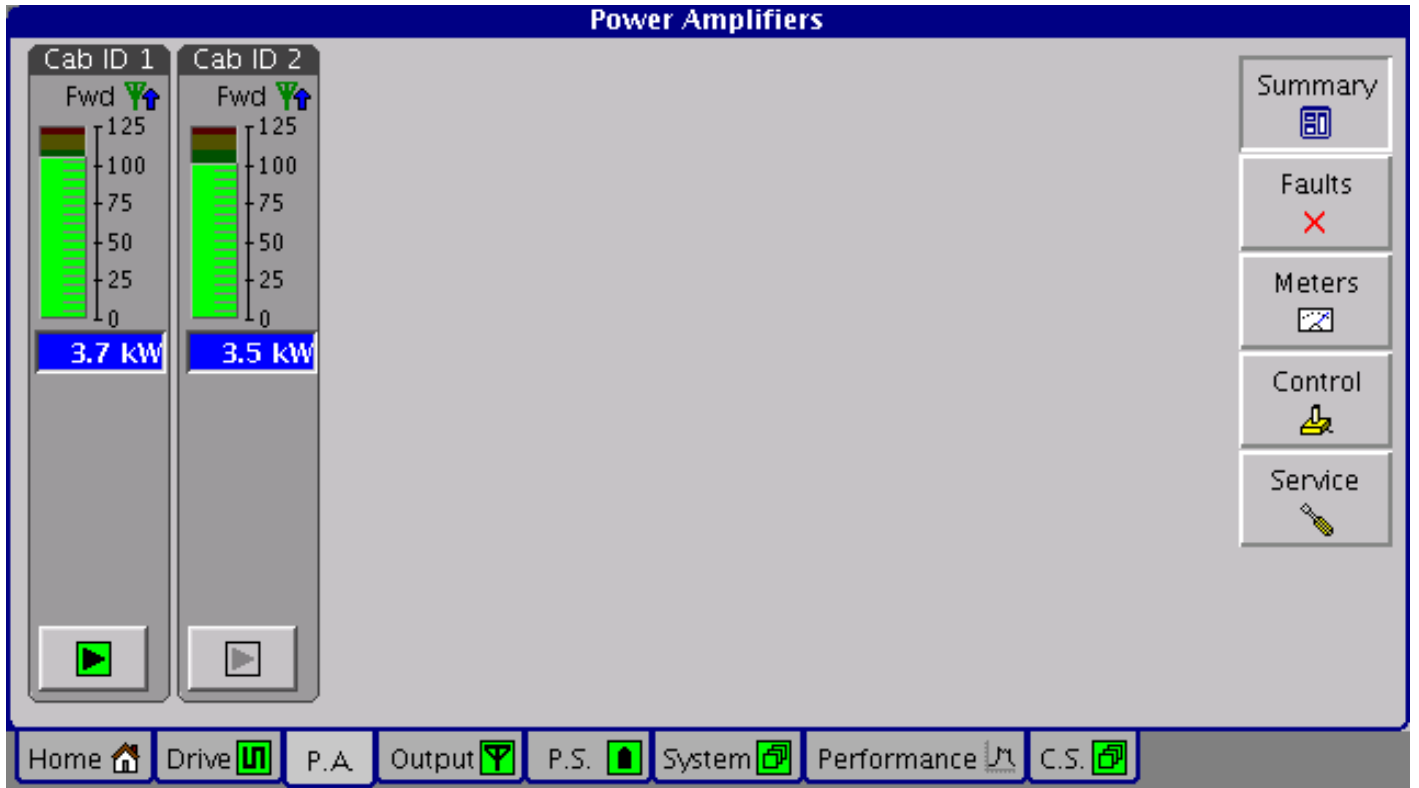
**Out Of Channel Power:**                      -67.103 dbC \*                      -68.417dbC \*

\* FCC Specification: > -47dbC

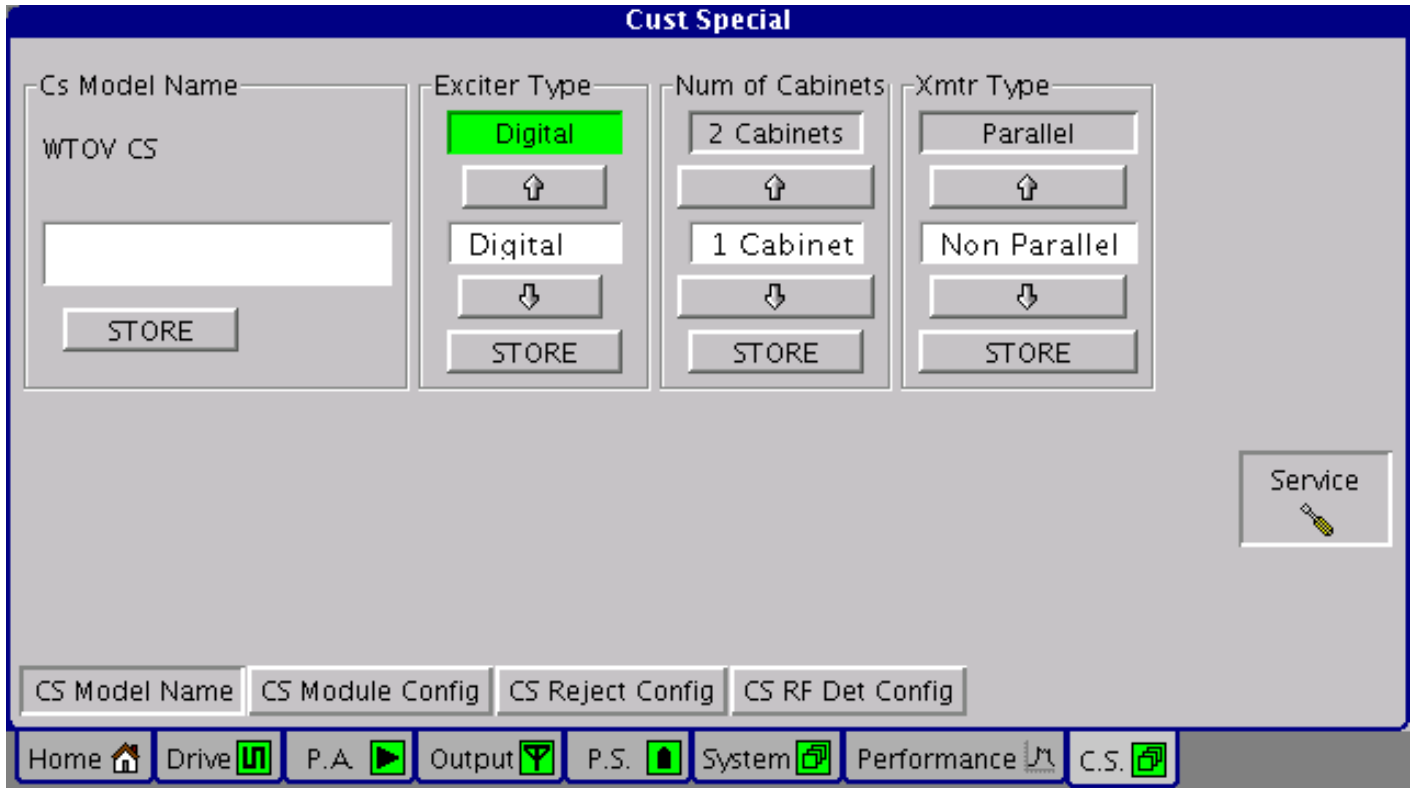
CONTROL CABINET GRAPHICAL USER INTERFACE SCREENS AT 100% POWER



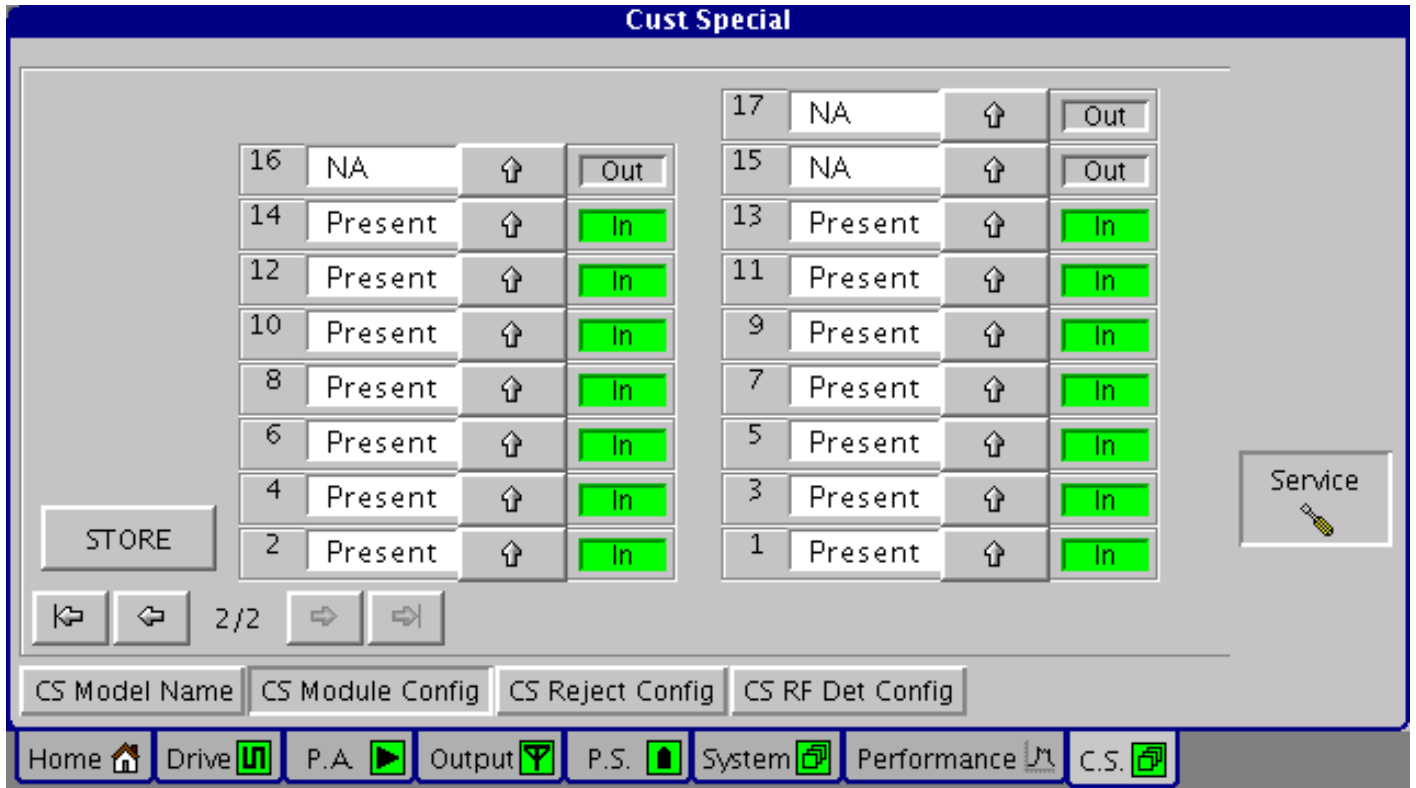
CONTROL CABINET GRAPHICAL USER INTERFACE SCREENS AT 100% POWER



CONTROL CABINET GRAPHICAL USER INTERFACE SCREENS AT 100% POWER




CONTROL CABINET GRAPHICAL USER INTERFACE SCREENS AT 100% POWER



CONTROL CABINET GRAPHICAL USER INTERFACE SCREENS AT 100% POWER









**Cust Special**

1	AB	↑	↓	AB	
2	NULL	↑	↓	NULL	
3	NULL	↑	↓	NULL	
4	NULL	↑	↓	NULL	
5	NULL	↑	↓	NULL	
6	NULL	↑	↓	NULL	
7	NULL	↑	↓	NULL	
8	NULL	↑	↓	NULL	
9	NULL	↑	↓	NULL	
10	NULL	↑	↓	NULL	
11	NULL	↑	↓	NULL	
12	NULL	↑	↓	NULL	
13	NULL	↑	↓	NULL	

Service 

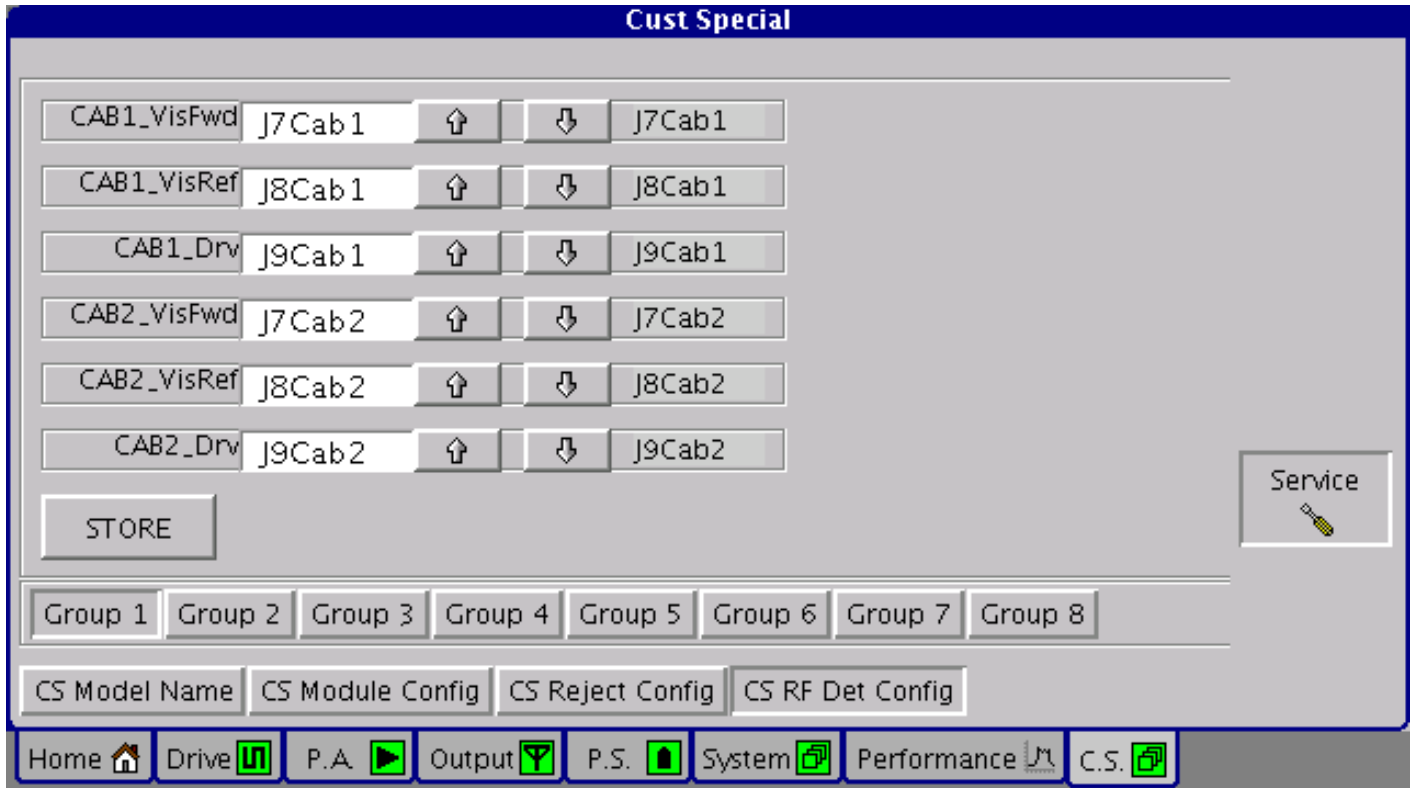
STORE

CS Model Name CS Module Config CS Reject Config CS RF Det Config

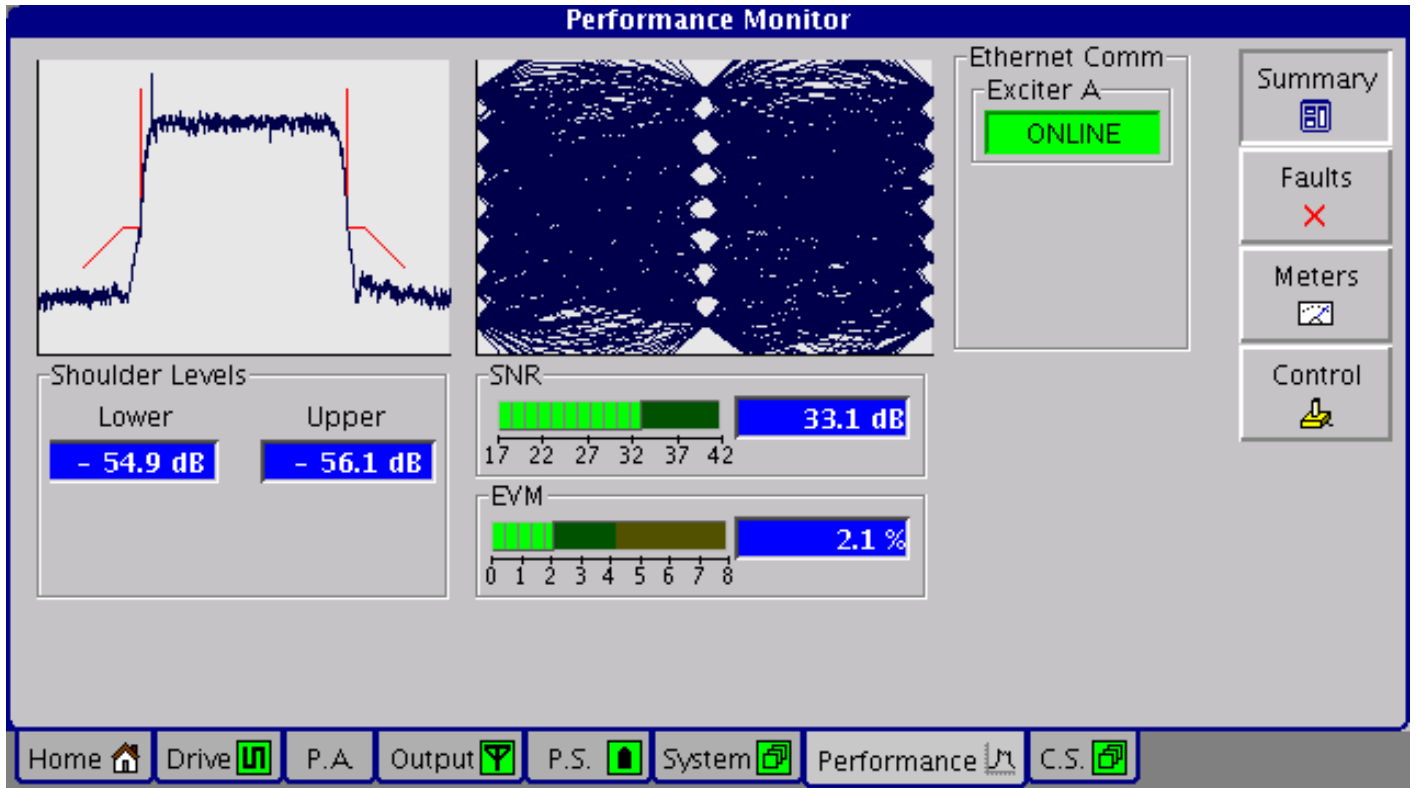
Home  Drive  P.A.  Output  P.S.  System  Performance  C.S. 



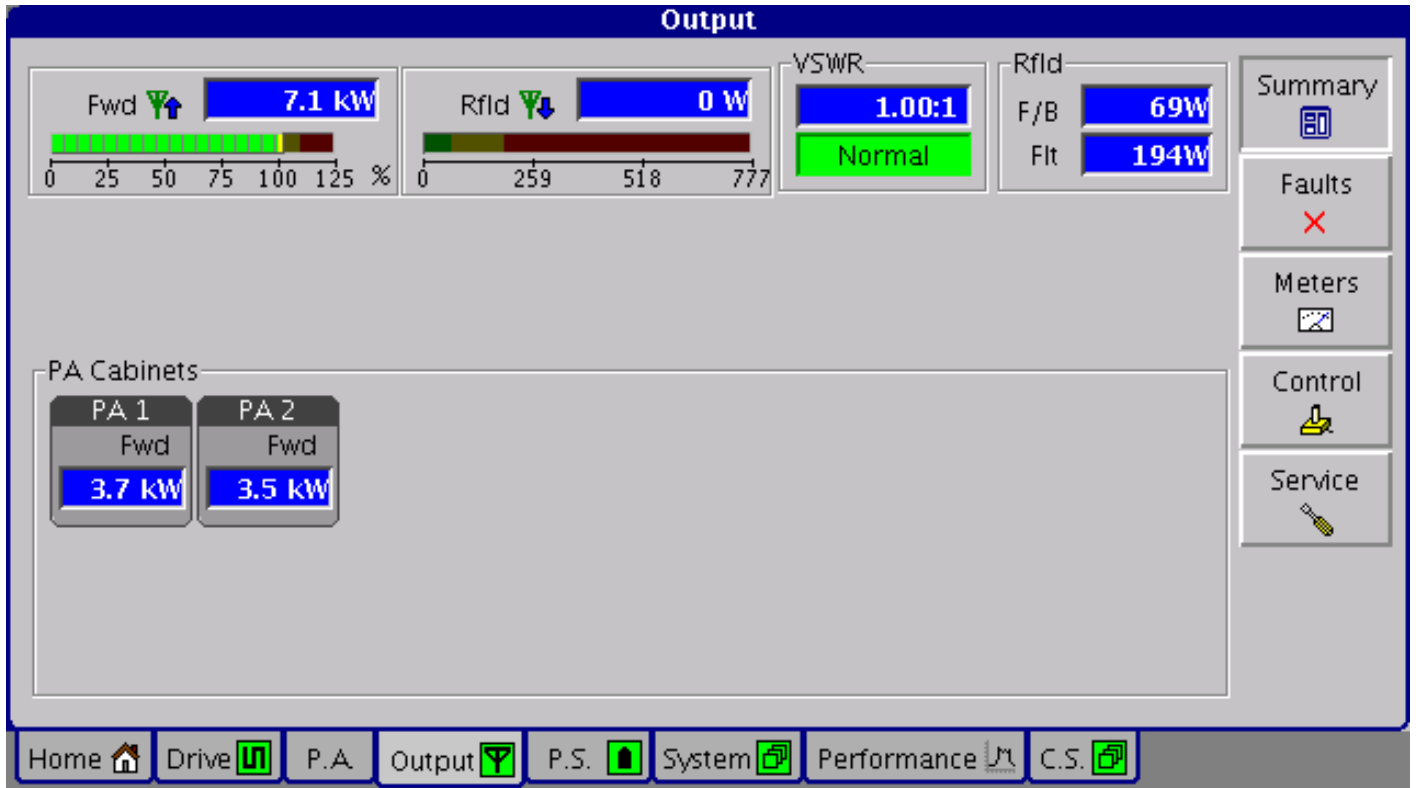
CONTROL CABINET GRAPHICAL USER INTERFACE SCREENS AT 100% POWER



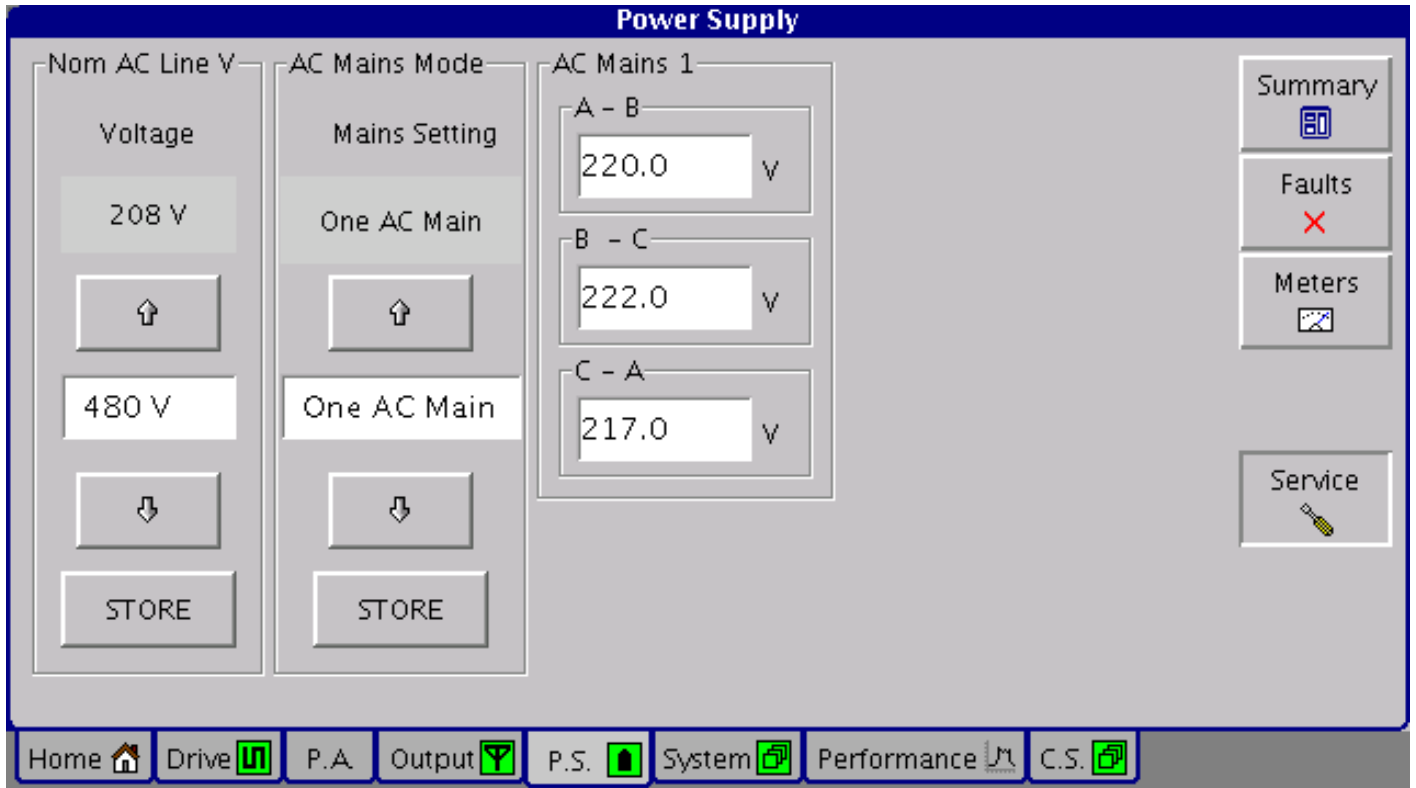
CONTROL CABINET GRAPHICAL USER INTERFACE SCREENS AT 100% POWER



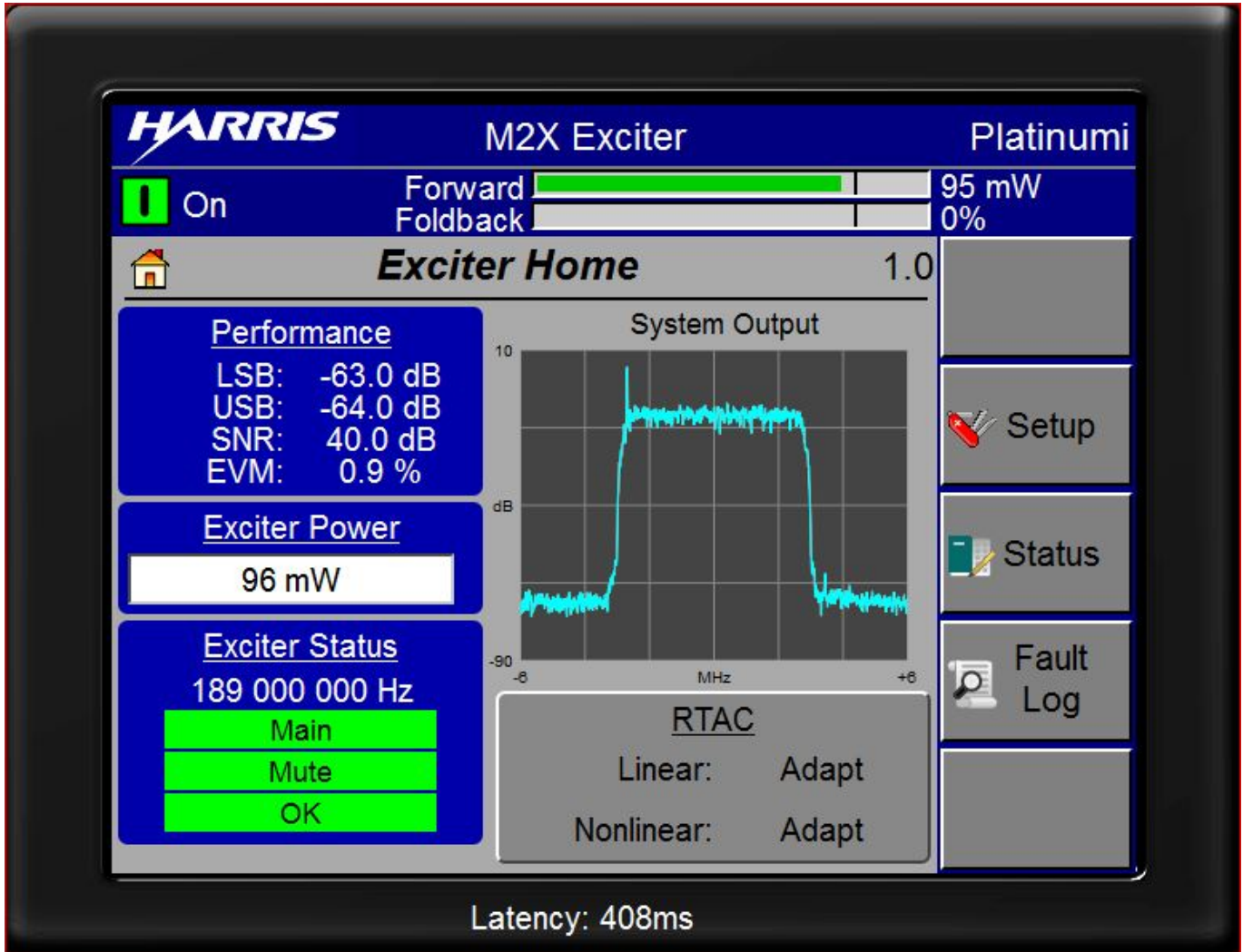
CONTROL CABINET GRAPHICAL USER INTERFACE SCREENS AT 100% POWER



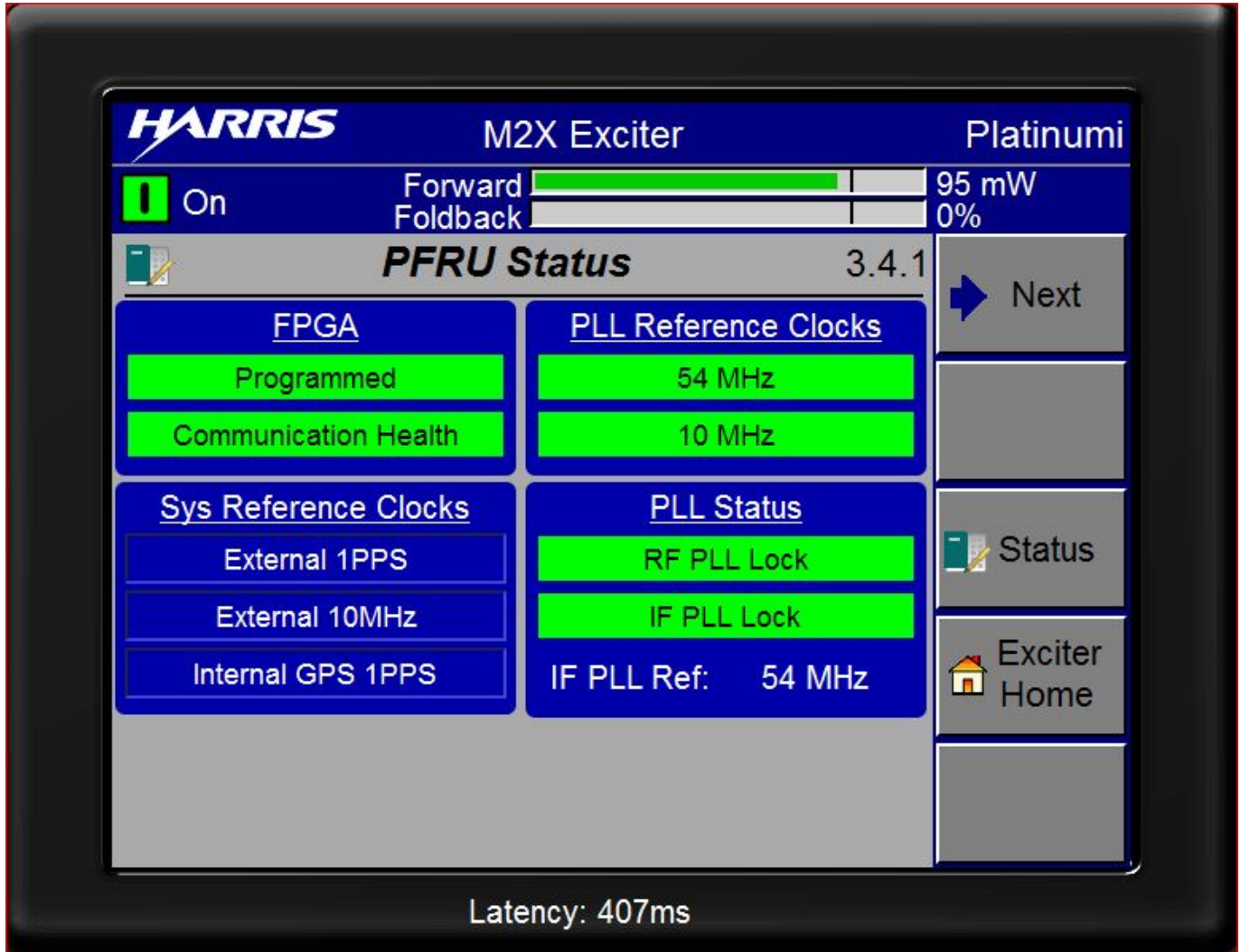
CONTROL CABINET GRAPHICAL USER INTERFACE SCREENS AT 100% POWER



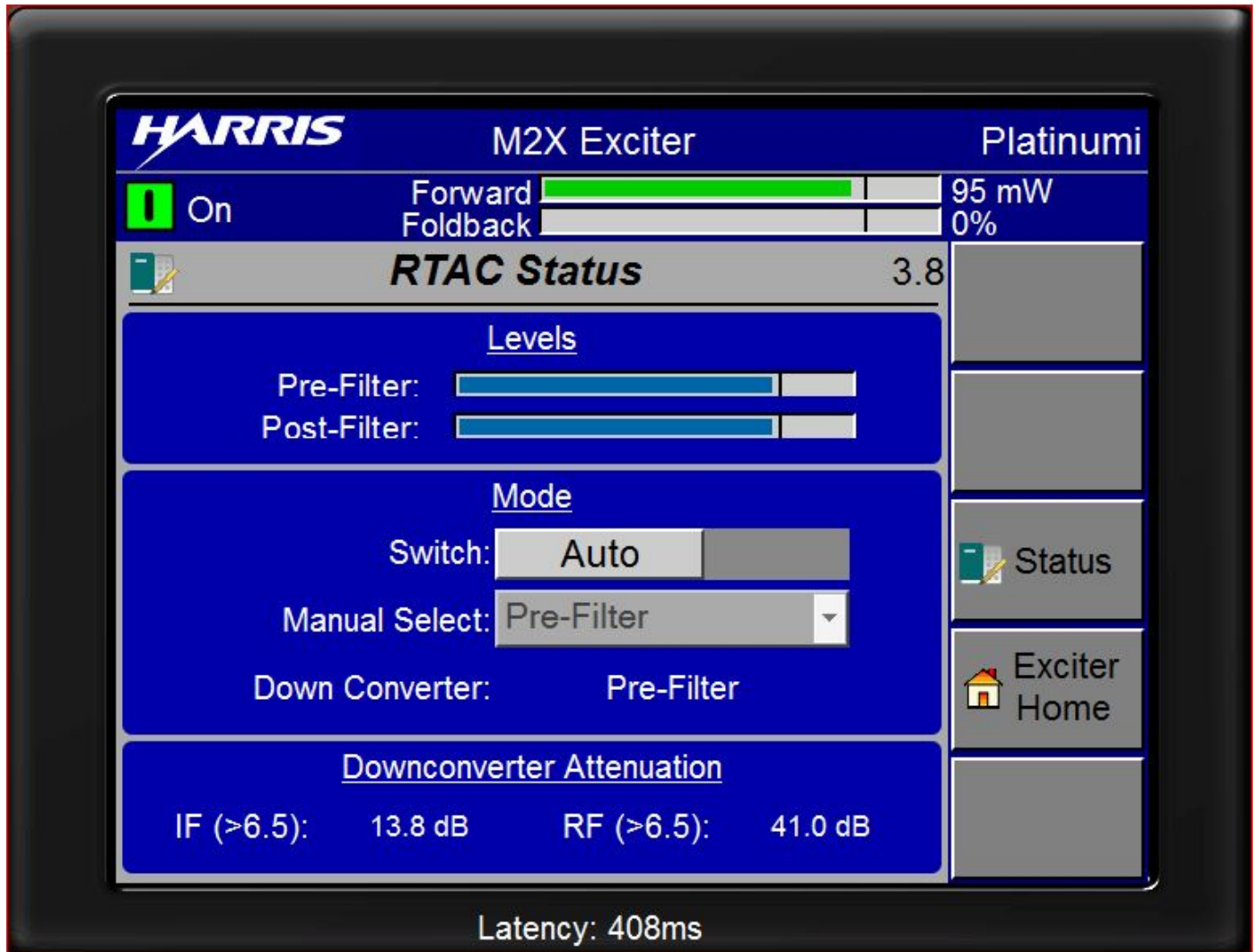
EXCITER GRAPHICAL USER INTERFACE SCREENS AT 100% POWER



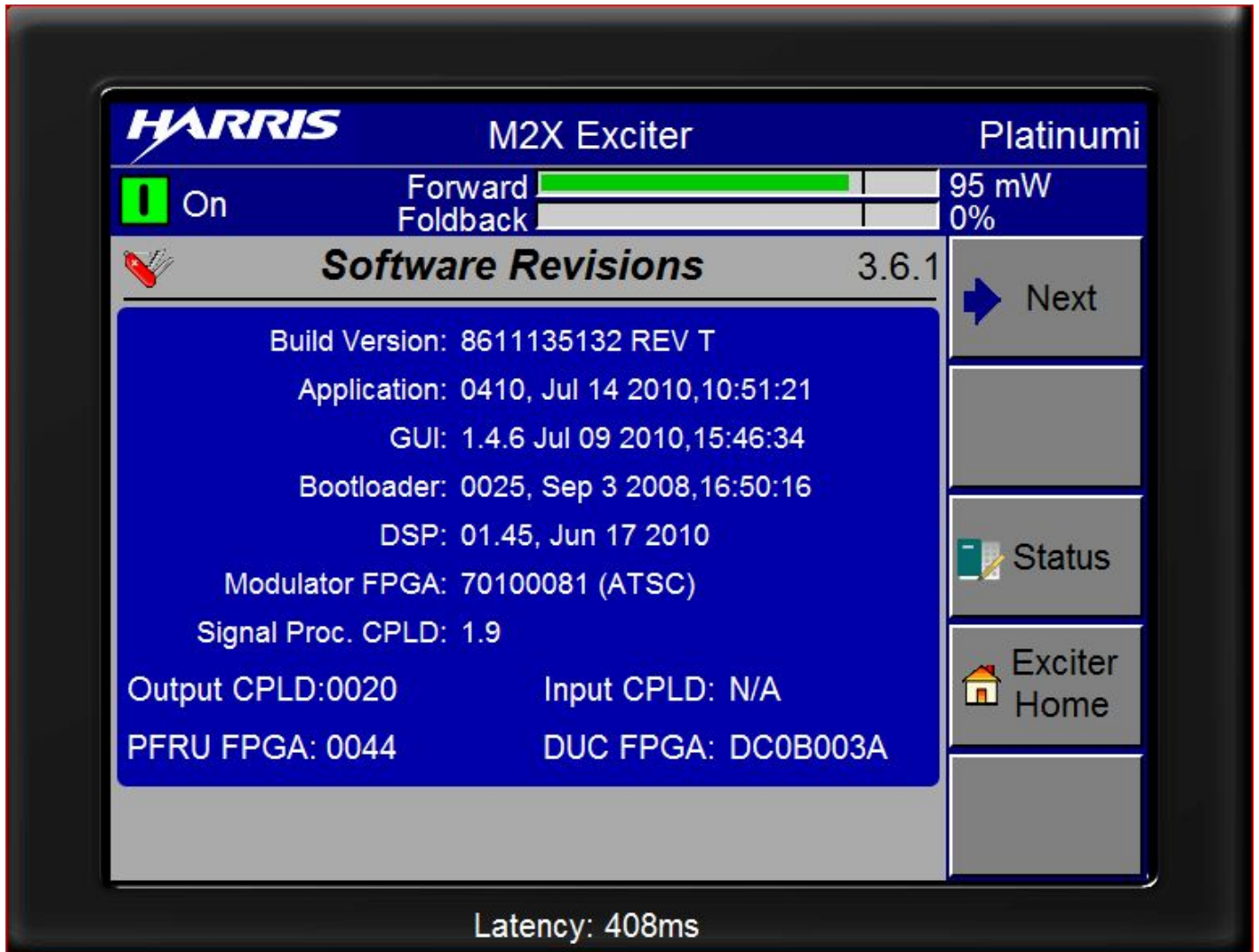
EXCITER GRAPHICAL USER INTERFACE SCREENS AT 100% POWER



EXCITER GRAPHICAL USER INTERFACE SCREENS AT 100% POWER



EXCITER GRAPHICAL USER INTERFACE SCREENS AT 100% POWER





## NOTES AND ADDENDA

1. The data shown in the table on Page #8 of this report under the heading **“Filter Response, Analyzer Reading”** is taken from the raw Network Analyzer data which is on file at the WTOV-DT Transmitter site.
2. The data shown in the table on Page #10 of this report under the heading **“Transmitter Response Before Filter”** is taken from the plots shown on pages 6 and 7 of this report.
3. The system meets or exceeds all manufacturers and FCC specifications.