



Broadcast RF System Services

ED MURLATT

**41 FOXPOINT WEST
WILLIAMSVILLE, NY 14221**

**PHONE (716) 639-0860
FAX (716) 636-0084
CELL (716) 435-4167**

ed@ema4rf.com

DIGITAL TELEVISION TRANSMITTER

ENGINEERING MEASUREMENTS

AND

PROOF OF PERFORMANCE DATA

FOR THE

Harris Ranger Transmitter

AT

**WBNF-CD, CHANNEL 15,
BUFFALO, NY**

DATA MEASURED BY:

Edward J. Murlatt

Data Recorded on June 12, 2013

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**FACILITIES AUTHORIZED IN LICENSE
PARAMETERS IN FCC DATABASE**

FCC File Number/Type: BLDTA-20111130LWW
Licensee: Faith Broadcasting Network, Inc.
Principal Community: Buffalo, NY
Grant Date: January 12, 2012
Channel: 15
Frequency: 476 – 482 MHz
Maximum ERP: 15 kW
Antenna Make/Model: MCI 955316 in License, ***Jampro JUHD-5/2 (10) on Tower**

***Jampro antenna gain differs from antenna gain in license. Correct value for the antenna gain, as provided by the manufacturer, is used in the calculations below.**

**DETERMINATION OF AS-BUILT OPERATING PARAMETERS
ANTENNA FEEDER LENGTH**

The transmission line length was measured using a Rohde-Schwarz ZVL-6 vector network analyzer. The instrument was operated in the 1601 point mode and the appropriate velocity factor correction was employed to determine the distance to the antenna input tuning section. The distance measurement and manufacturer's transmission line data are shown in the appendices on pages 20 through 22. The line length is 718.83 feet. The loss per hundred feet at 479 MHz is 0.484 dB. The total line loss is $(\frac{718.83}{100}) * 0.484 = 3.48$ dB. The manufacturer's antenna specifications are shown on page 23.

TPO REQUIREMENT CALCULATIONS

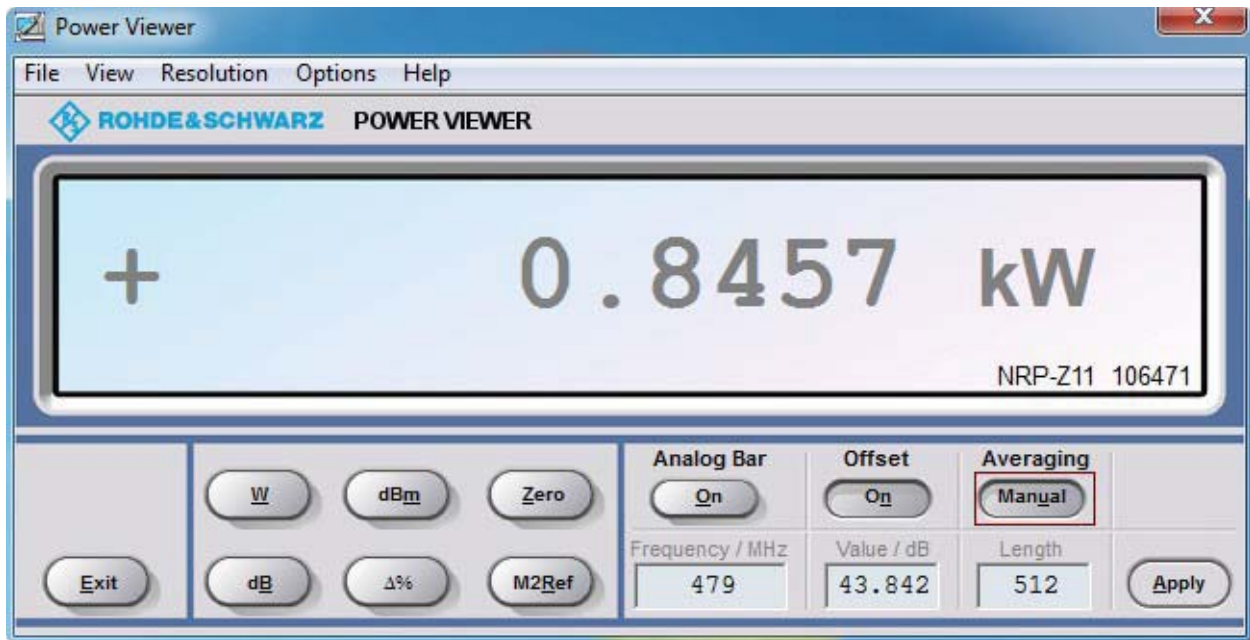
	<u>dB</u>	<u>Power/Gain</u>
Maximum ERP:	11.76 dBk	15 kW
Antenna Gain:	16.0	39.6
Antenna Input Power:	-4.24 dBk	0.38 kW
Transmission Line Loss:	3.48 dB	.45
Combiner/Mask Loss:	Incl	Incl
TPO Requirement:	-0.76 dBk	0.84 kW

POWER AND FREQUENCY MEASUREMENTS

METHOD OF DETERMINING OUTPUT POWER

The transmitter output power was measured using a Rohde-Schwarz NRP-Z11 power probe. The power probe was connected to the system at a directional coupler sample located at the output of the mask filter. The coupler has a fixed coupling value, and as shown on page 19, was measured on site to be -43.842 dB coupling. The transmitter's output power meter reads in watts, and was adjusted to agree with the power meter measurement.

POWER MEASUREMENT



METHOD OF DETERMINING TRANSMITTER FREQUENCY

The transmitter frequency was measured using a Rohde-Schwarz EFA50/53 Analyzer externally locked to a 10 MHz rubidium standard. The accuracy of the measurement is ± 1 Hz. The measurement indicates deviation from assigned frequency.

FREQUENCY MEASUREMENT

ATSC/VSF MEASURE			
CENTER FREQ 479.00 MHz	CHANNEL 15	ATTEN : LOW+P -6.4 dBm	
SET CENTER FREQ	479.0000000 MHz		CONSTELL DIAGRAM...
SET PILOT FREQ	476.3094406 MHz		
CALC PILOT FREQ	476.3094428 MHz		FREQUENCY DOMAIN...
PILOT FREQ OFFSET	2.3 Hz		
SYMBOL RATE OFFSET	-32.0 Hz		
MODULATION		8VSB	TIME DOMAIN...
MER (REAL,RMS)	33.9 dB		
MER (REAL,RMS)	2.01 %		
BER BEFORE RS	1.2E-7	(100/100)	VSF PARA- METERS...
BER AFTER RS	0.0E-8	(268/1K00)	
SEG ERR RATIO	0.0E-6	(268/1K00)	RESET BER
SEG ERR / s	00000		
TS BIT RATE 19.393 Mbit/s			ADD. NOISE OFF
SAW:OFF			

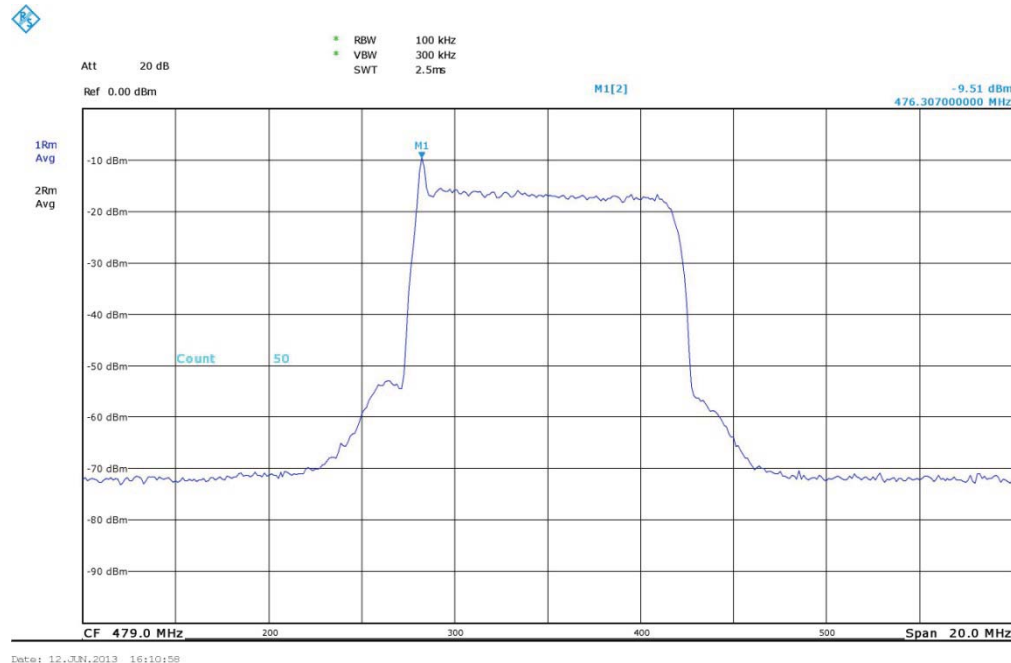
SPECTRUM MEASUREMENTS
HARMONIC EMISSIONS MEASUREMENTS

The directional coupler sample was connected to the spectrum analyzer through two Eagle model TFN-230 notch filters tuned to reduce the carrier to prevent overloading the spectrum analyzer. The notch provided over 60 dB of attenuation. Coupler correction is 6 dB per octave, and cable attenuation is -1.04 dB at the 2nd harmonic and -0.29 dB at the 3rd. Cable and notch characteristics were measured using the Rhode and Schwarz ZVL-6 vector network analyzer, and are shown in the appendix on page 24. 20 dB of input attenuation is removed for the harmonic measurement. The harmonics were attenuated below the noise floor of the instrument, or more than 110 dB (-90 dB noise floor, minus 20 dB of input attenuation).

HARMONIC CALCULATIONS

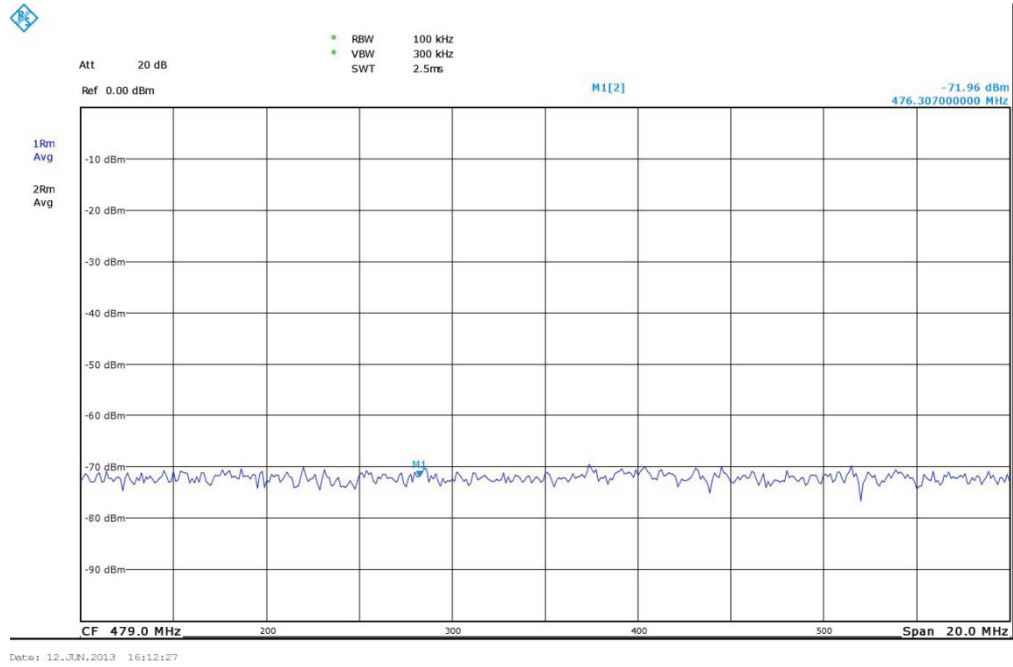
Measurement	Normalized Attenuation (dBm)	Coupler Correction (dB)	Cable Correction (dB)	Net
2nd Harmonic	110.00	6	-1.04	114.96
3rd Harmonic	110.00	9	-0.29	118.71

REFERENCE SWEEP ACROSS 20 MHz – ATTENUATION 20 dBM

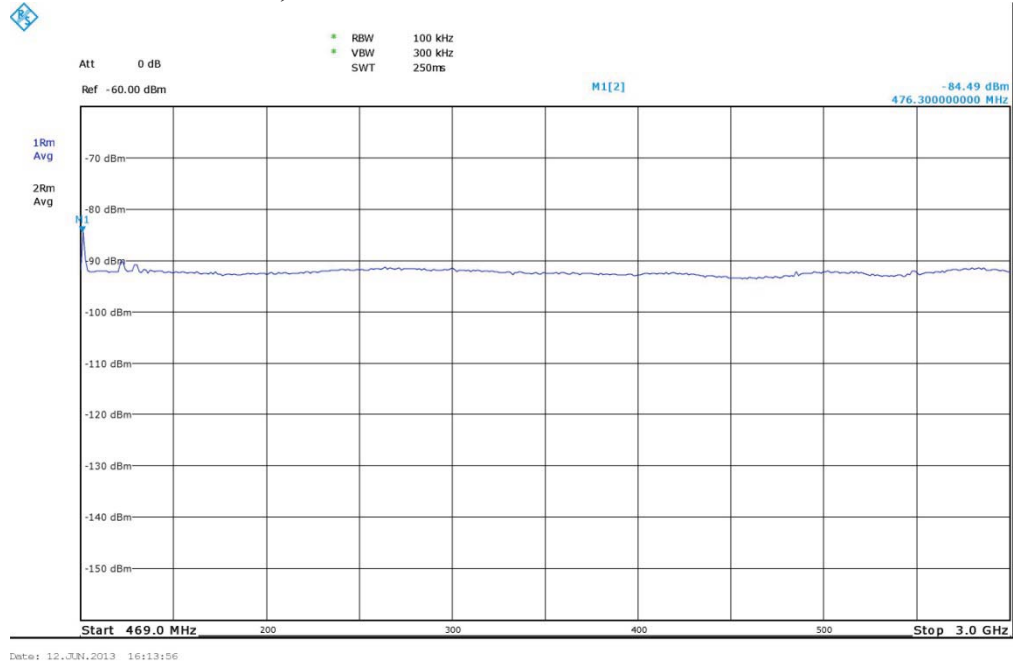


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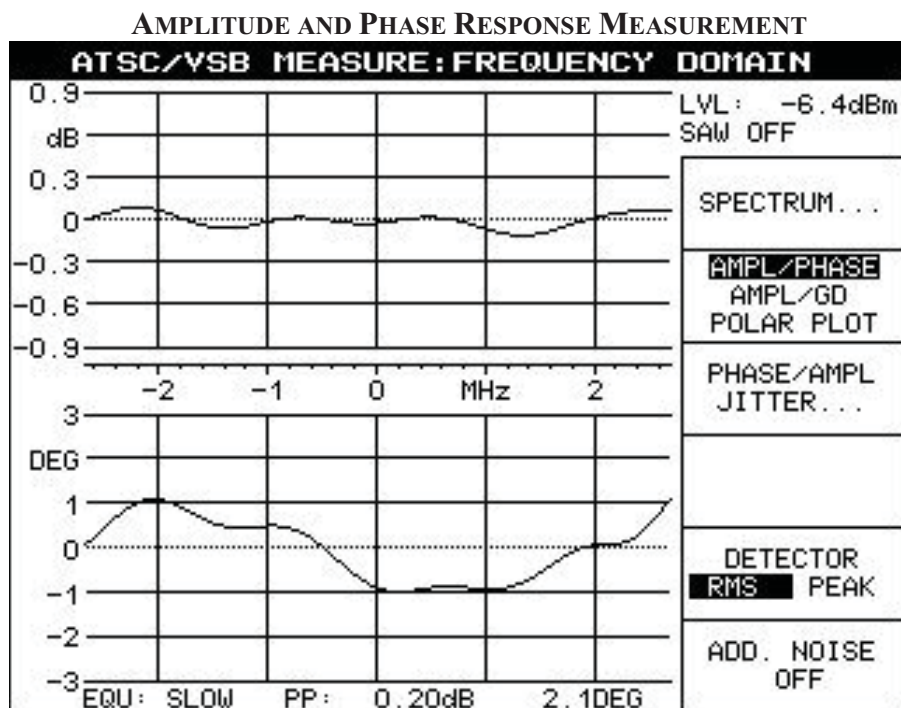
NOTCH SUPPRESSION - ATTENUATION 20 dB



SPECTRUM TO 3 GHz; FUNDAMENTAL SUPPRESSION >70 dB ATTENUATION 0 dB



CHANNEL RESPONSE MEASUREMENTS:



TRANSMITTER AMPLITUDE RESPONSE MEASUREMENTS

The transmitter amplitude response measurements demonstrated below were made using the Rohde-Schwarz ZVL6 analyzer in the spectrum analyzer mode. The analyzer was connected to a forward directional coupler located on the output of the amplifier combiner, and prior to the mask filter. The analyzer was operated in the 401 point mode and averaging across 100 sweeps was employed to reduce the impact of noise and subtle changes in the system output power. The data was exported to an Excel file along with the Filter Response data discussed below. The aggregate data is shown on pages 10 and 11.

MASK FILTER AMPLITUDE RESPONSE MEASUREMENTS

The WBNF-CD transmitter employs a Dielectric mask filter to comply with the FCC mask requirements. The filter's amplitude response was measured using the Rohde-Schwarz ZVL-6 in the vector network analyzer mode. Trace data is exported directly to an Excel file and summed with the transmitter amplitude data to produce the aggregate data shown on pages 10 and 11.

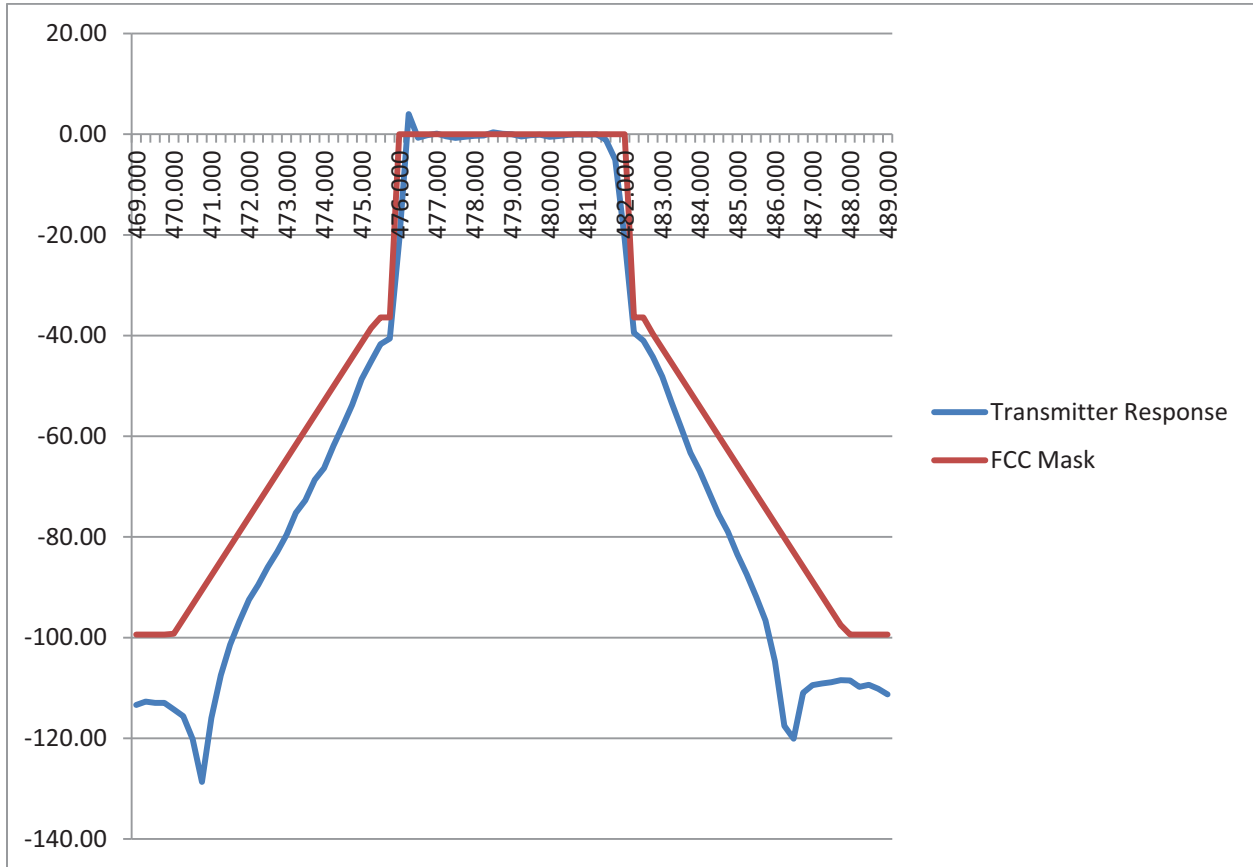
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JUNE 12, 2013

FCC MASK COMPLIANCE – TABULAR DATA

The table below uses the data collected from the transmitter amplitude response measurements and the filter amplitude response measurements to verify compliance with the FCC mask requirements. The two responses are added and compared to the FCC response in the chart on the following page.

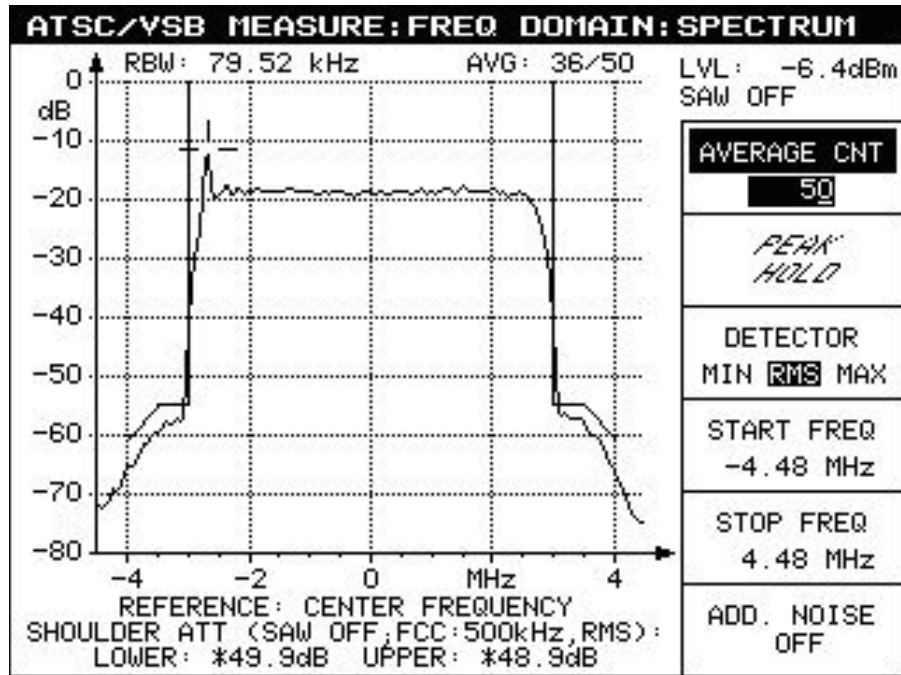
Frequency in MHz	Mask Filter Response			Transmitter Pre-Filter Response			Net Response FCC Response	
	NWA Reading	Center Freq Reference	Normalized Response	Spec An Reading	Center Freq Reference	Normalized Response		
469.000	-69.58	-0.32	-69.26	-58.64	-14.54	-44.10	-113.36	-99.4
470.000	-71.57	-0.32	-71.25	-57.55	-14.54	-43.01	-114.26	-99.2
471.000	-75.08	-0.32	-74.76	-55.75	-14.54	-41.21	-115.96	-87.7
472.000	-53.74	-0.32	-53.42	-53.59	-14.54	-39.05	-92.46	-76.1
473.000	-40.06	-0.32	-39.74	-54.36	-14.54	-39.82	-79.56	-64.5
474.000	-26.04	-0.32	-25.72	-55.15	-14.54	-40.61	-66.33	-53.0
474.500	-18.08	-0.32	-17.76	-54.65	-14.54	-40.11	-57.87	-47.2
475.000	-9.18	-0.32	-8.86	-54.34	-14.54	-39.80	-48.65	-41.4
475.500	-2.06	-0.32	-1.73	-54.52	-14.54	-39.98	-41.71	-36.4
475.750	-0.85	-0.32	-0.53	-54.61	-14.54	-40.06	-40.59	-36.4
476.000	-0.55	-0.32	-0.22	-35.44	-14.54	-20.90	-21.12	0.0
477.000	-0.38	-0.32	-0.05	-14.36	-14.54	0.18	0.13	0.0
478.000	-0.33	-0.32	-0.01	-14.86	-14.54	-0.32	-0.33	0.0
479.000	-0.32	-0.32	0.00	-14.54	-14.54	0.00	0.00	0.0
480.000	-0.32	-0.32	0.00	-15.07	-14.54	-0.53	-0.53	0.0
480.500	-0.34	-0.32	-0.02	-14.65	-14.54	-0.11	-0.12	0.0
481.000	-0.36	-0.32	-0.04	-14.60	-14.54	-0.06	-0.10	0.0
482.000	-0.52	-0.32	-0.20	-35.19	-14.54	-20.65	-20.85	0.0
482.250	-0.86	-0.32	-0.54	-53.46	-14.54	-38.92	-39.46	-36.4
482.500	-2.22	-0.32	-1.90	-53.64	-14.54	-39.09	-40.99	-36.4
483.000	-9.70	-0.32	-9.37	-53.33	-14.54	-38.79	-48.16	-42.6
483.500	-18.81	-0.32	-18.48	-54.29	-14.54	-39.74	-58.22	-48.4
484.000	-27.19	-0.32	-26.87	-54.55	-14.54	-40.00	-66.87	-54.1
485.000	-42.62	-0.32	-42.29	-55.72	-14.54	-41.18	-83.47	-65.7
486.000	-62.35	-0.32	-62.03	-57.23	-14.54	-42.69	-104.71	-77.3
487.000	-64.87	-0.32	-64.54	-59.45	-14.54	-44.91	-109.45	-88.8
488.000	-62.41	-0.32	-62.09	-60.98	-14.54	-46.44	-108.53	-99.4
489.000	-63.39	-0.32	-63.07	-62.74	-14.54	-48.20	-111.27	-99.4

MASK COMPLIANCE PLOT



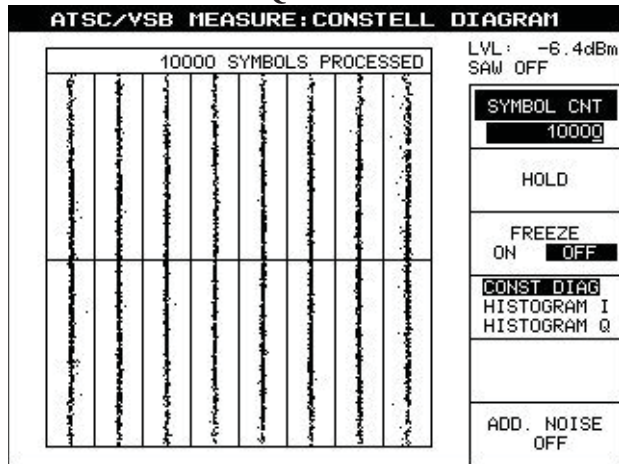
SHOULDER ATTENUATION

The Rohde-Schwarz EFA50/53 was used to verify shoulder compliance.

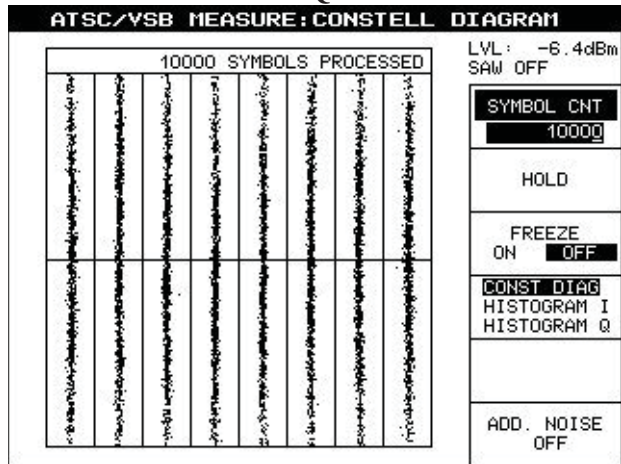


ATSC SYSTEM PERFORMANCE MEASUREMENTS
CONSTELLATION DISPLAY

EQ On



EQ Off



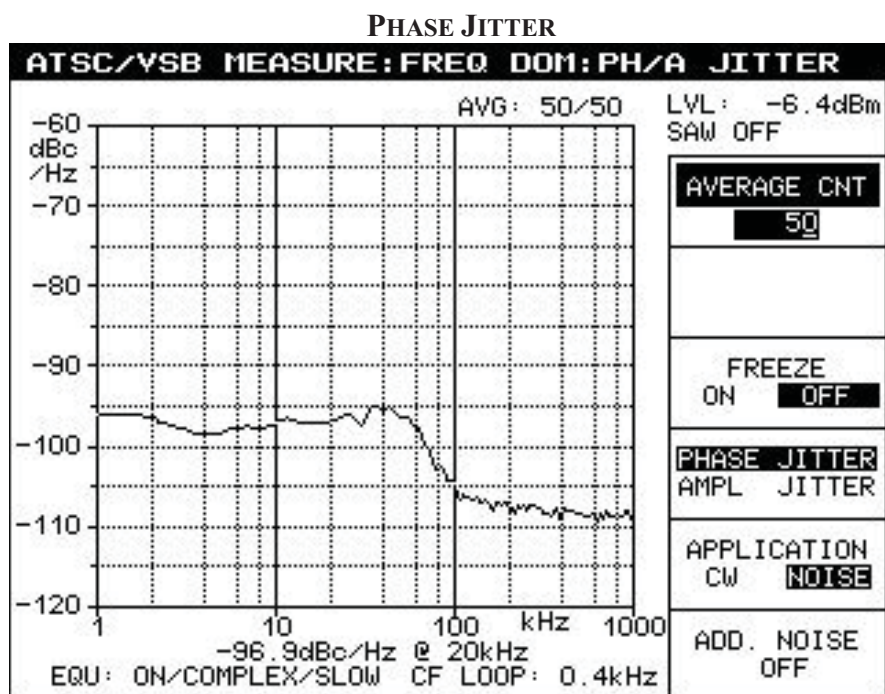
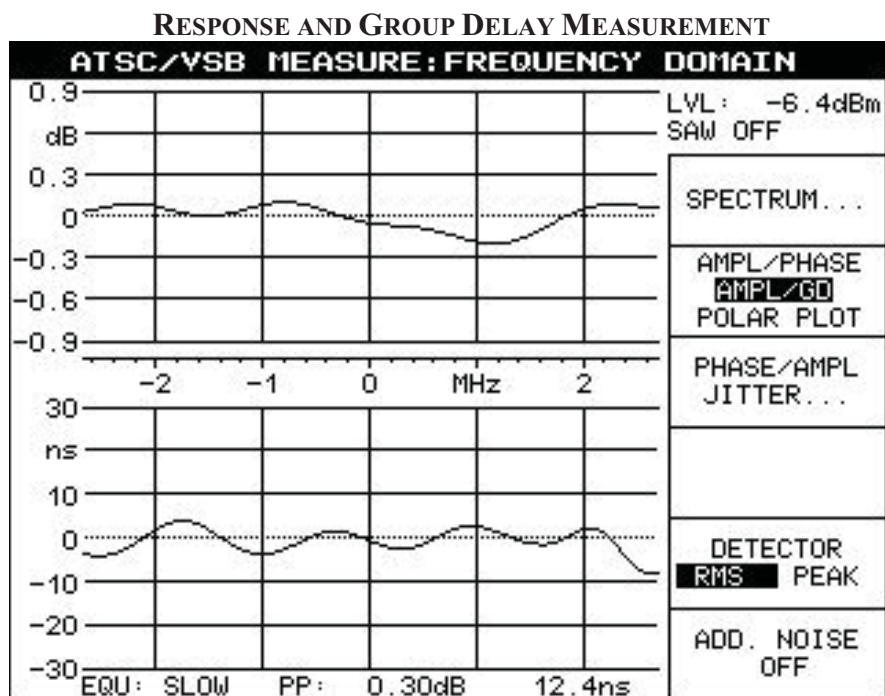
8VSB PARAMETERS

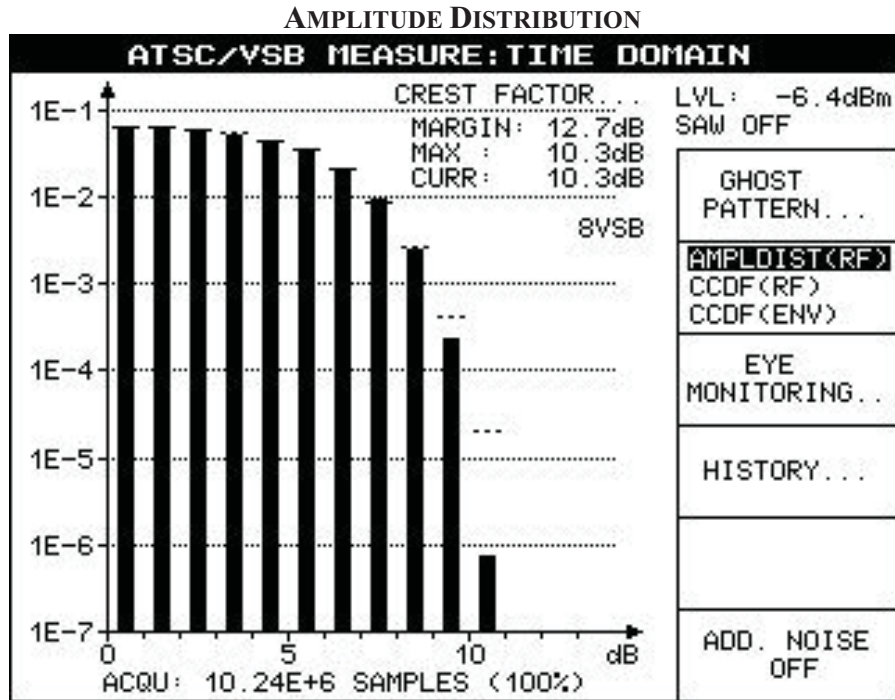
EQ On

ATSC/VSB MEASURE: VSB PARAMETERS			
CENTER FREQ 479.00 MHz	CHANNEL 15	ATTEN : LOW+P -6.4 dBm	
TRANSMISSION:			CONSTELL DIAGRAM...
PHASE JITTER (RMS)			0.25 °
SIGNAL/NOISE (LOW Q)			39.6 dB
SUMMARY:			FREQUENCY DOMAIN...
MER (REAL,RMS)			38.0 dB
MER (REAL,MIN)			14.9 dB
MER (REAL,RMS)			1.26 %
MER (REAL,MAX)			17.90 %
			VSB PARA PILOT VALUE.
			ADD. NOISE OFF

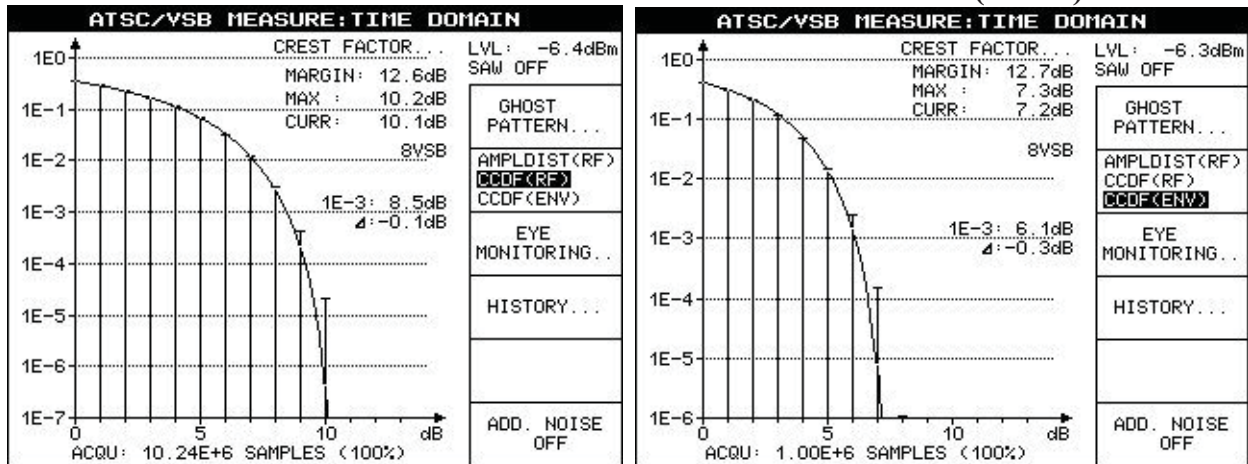
EQ Off

ATSC/VSB MEASURE: VSB PARAMETERS			
CENTER FREQ 479.00 MHz	CHANNEL 15	ATTEN : LOW+P -6.4 dBm	
TRANSMISSION:			CONSTELL DIAGRAM...
PHASE JITTER (RMS)			--- °
SIGNAL/NOISE (LOW Q)			36.7 dB
SUMMARY:			FREQUENCY DOMAIN...
MER (REAL,RMS)			35.7 dB
MER (REAL,MIN)			13.7 dB
MER (REAL,RMS)			1.63 %
MER (REAL,MAX)			20.63 %
			VSB PARA PILOT VALUE.
			ADD. NOISE OFF





COMPLIMENTARY CUMULATIVE DISTRIBUTION FUNCTION (CCDF)



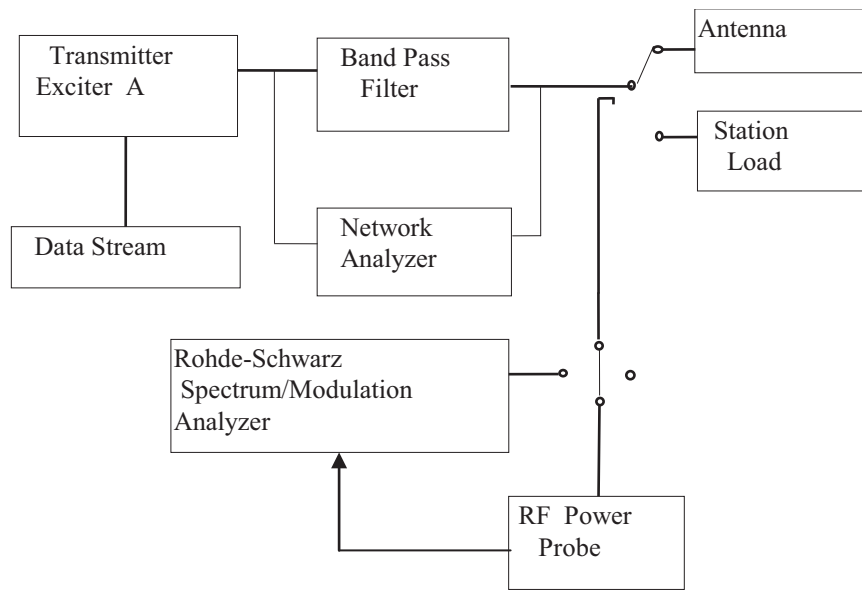
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APPENDIX

TEST EQUIPMENT LIST

	Make	Model	Serial
Power Probe	Rohde-Schwarz	NRP-Z11	106471
Spectrum Analyzer	Rohde-Schwarz	ZVL6-K1	100429
Modulation Analyzer	Rohde-Schwarz	EFA50/53	100296053
Rubidium Reference	Stanford Research Systems	FS725/2	65717
Vector Network Analyzer	Rohde-Schwarz	ZVL6	100429
Notch Filters	Eagle	TFN-230	N/A

TEST CONFIGURATION BLOCK DIAGRAM



APPENDIX
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FCC AUTHORIZATION



United States of America
FEDERAL COMMUNICATIONS COMMISSION
DIGITAL CLASS A
BROADCAST STATION LICENSE

Authorizing Official:

Official Mailing Address:

FAITH BROADCASTING NETWORK, INC.
P. O. BOX 1010
MARION IL 62959

Hossein Hashemzadeh
Deputy Chief
Video Division
Media Bureau

Facility Id: 14326

Grant Date: January 12, 2012

Analog TSID: 8372

This license expires 3:00 a.m.
local time, June 01, 2015.

Digital TSID: 8373

Call Sign: WBNF-CD

License File Number: BLDTA-20111130LWW

This license covers permit no.: BDFCDTA-20090507ABL

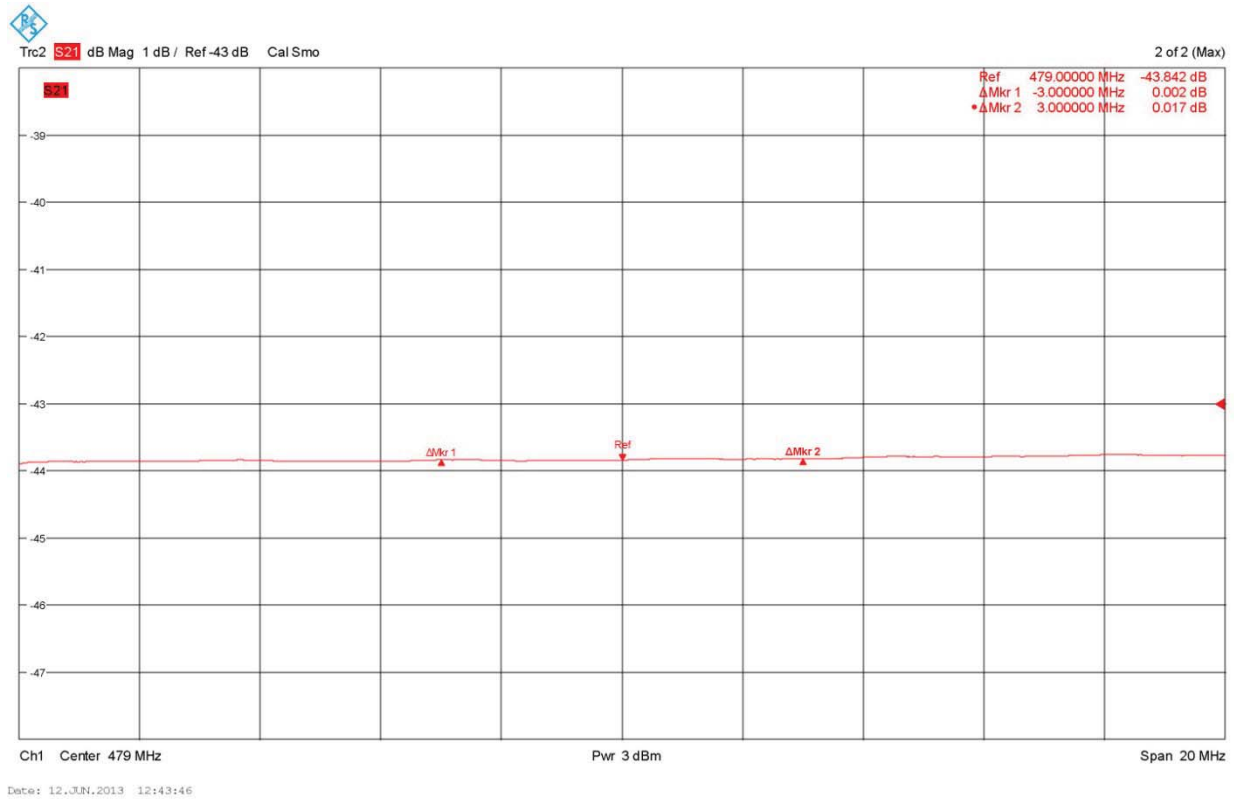
Subject to the provisions of the Communications Act of 1934, subsequent acts and treaties, and all regulations heretofore or hereafter made by this Commission, and further subject to the conditions set forth in this license, the licensee is hereby authorized to use and operate the radio transmitting apparatus herein described.

This license is issued on the licensee's representation that the statements contained in licensee's application are true and that the undertakings therein contained so far as they are consistent herewith, will be carried out in good faith. The licensee shall, during the term of this license, render such broadcasting service as will serve the public interest, convenience, or necessity to the full extent of the privileges herein conferred.

This license shall not vest in the licensee any right to operate the station nor any right in the use of the frequency designated in the license beyond the term hereof, nor in any other manner than authorized herein. Neither the license nor the right granted hereunder shall be assigned or otherwise transferred in violation of the Communications Act of 1934. This license is subject to the right of use or control by the Government of the United States conferred by Section 606 of the Communications Act of 1934.

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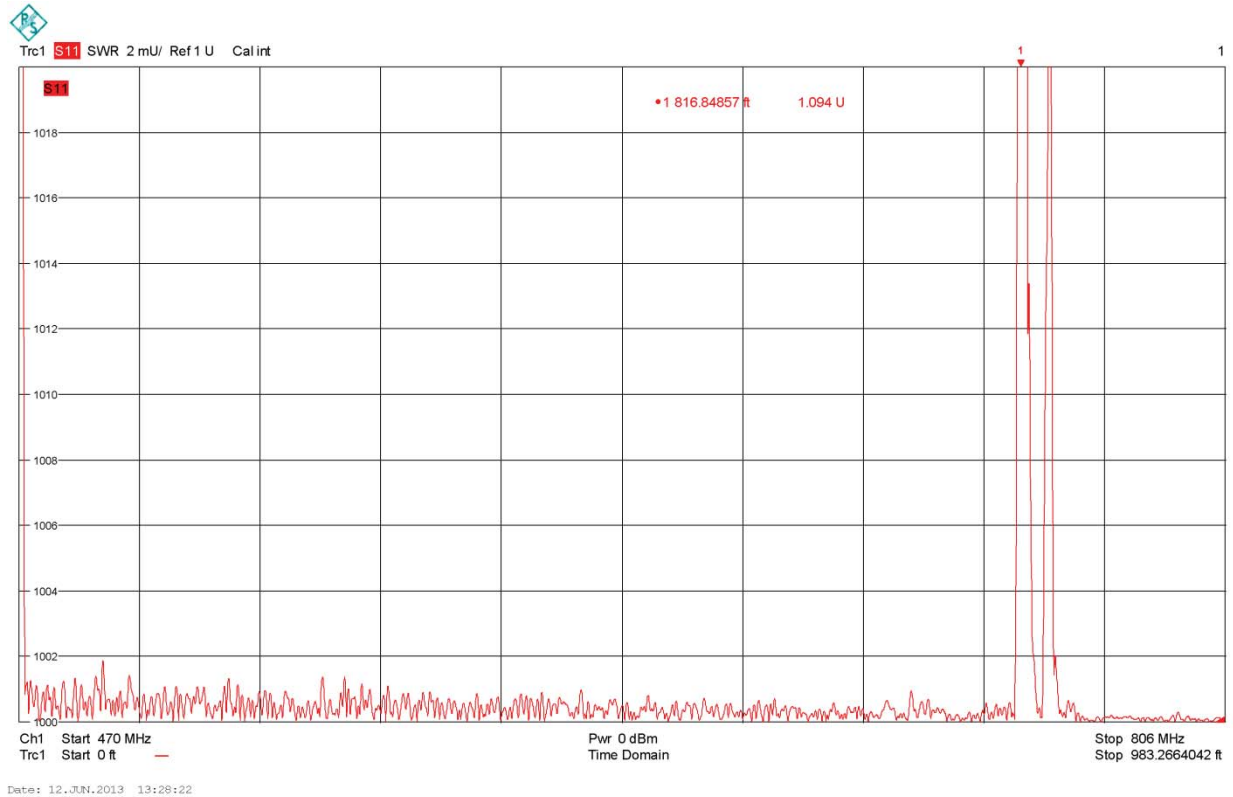
DIRECTIONAL COUPLER MEASUREMENT



The coupling value of the directional coupler used to calibrate the power meter was measured using the Rohde & Schwarz vector network analyzer. The analyzer was operated in the 1601 point mode.

APPENDIX
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TRANSMISSION LINE LENGTH MEASUREMENT



Marker 1 shows the location of the antenna input. The measurement was made from the input of the power meter sample section to the antenna. The distance shown in the plot uses a velocity factor of 1. The manufacturer's specifications state the velocity factor is 0.88, making the actual distance to the antenna 816.85×0.88 or 718.83 feet. The network analyzer was operated in the 1601 point mode.

MANUFACTURER'S TRANSMISSION LINE SPECIFICATION

Product Specifications

COMMSCOPE®



LDF7-50A

LDF7-50A, HELIAX® Low Density Foam Coaxial Cable, corrugated copper, 1-5/8 in, black PE jacket



OBSOLETE

Construction Materials

Jacket Material	PE
Outer Conductor Material	Corrugated copper
Dielectric Material	Foam PE
Flexibility	Standard
Inner Conductor Material	Corrugated copper tube
Jacket Color	Black

Dimensions

Nominal Size	1-5/8 in
Cable Weight	0.82 lb/ft 1.22 kg/m
Diameter Over Dielectric	44.196 mm 1.740 in
Diameter Over Jacket	49.784 mm 1.960 in
Inner Conductor OD	17.2720 mm 0.6800 in
Outer Conductor OD	46.482 mm 1.830 in

Electrical Specifications

Cable Impedance	50 ohm \pm 1 ohm
Capacitance	23.1 pF/ft 75.8 pF/m
dc Resistance, Inner Conductor	0.250 ohms/kft 0.820 ohms/km
dc Resistance, Outer Conductor	0.160 ohms/kft 0.525 ohms/km
dc Test Voltage	11000 V
Inductance	0.190 μ H/m 0.058 μ H/ft
Insulation Resistance	100000 Mohms•km
Jacket Spark Test Voltage (rms)	10000 V
Operating Frequency Band	1 – 2700 MHz
Peak Power	315.0 kW
Pulse Reflection	0.5%
Velocity	88%

Environmental Specifications

Installation Temperature	-40 °C to +60 °C (-40 °F to +140 °F)
Operating Temperature	-55 °C to +85 °C (-67 °F to +185 °F)
Storage Temperature	-70 °C to +60 °C (-94 °F to +140 °F)

General Specifications

Brand	HELIAX®
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Product Specifications

COMMScope®

LDF7-50A



Attenuation

Frequency (MHz)	Attenuation (dB/100 m)	Attenuation (dB/100 ft)	Average Power (kW)
479	1.587	0.484	6.92

Attenuation

Frequency (MHz)	Attenuation (dB/100 m)	Attenuation (dB/100 ft)	Average Power (kW)
0.5	0.044	0.014	247.25
1	0.063	0.019	174.46
1.5	0.077	0.024	142.22
2	0.089	0.027	122.99
10	0.202	0.062	54.32
20	0.289	0.088	38.05
30	0.356	0.109	30.85
50	0.465	0.142	23.63
88	0.627	0.191	17.53
100	0.671	0.205	16.38
108	0.699	0.213	15.72
150	0.834	0.254	13.17
174	0.904	0.276	12.15
200	0.976	0.297	11.26
300	1.22	0.372	9.01
400	1.433	0.437	7.67
450	1.532	0.467	7.17
500	1.627	0.496	6.76
512	1.649	0.503	6.67
600	1.806	0.55	6.09
700	1.974	0.602	5.57
800	2.134	0.65	5.15
824	2.171	0.662	5.06
894	2.278	0.694	4.83
960	2.376	0.724	4.63
1000	2.434	0.742	4.52
1250	2.781	0.848	3.95
1500	3.106	0.947	3.54
1700	3.354	1.022	3.28
1800	3.474	1.059	3.16
2000	3.709	1.131	2.96
2100	3.824	1.165	2.87
2200	3.937	1.2	2.79
2300	4.049	1.234	2.71
2500	4.267	1.301	2.58
2700	4.481	1.366	2.45

* Values typical, guaranteed within 5%

Regulatory Compliance/Certifications

Agency	Classification
RoHS 2011/65/EU	Compliant
China RoHS SJ/T 11364-2006	Below Maximum Concentration Value (MCV)



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MANUFACTURER'S ANTENNA SPECIFICATIONS



6340 Sky Creek Drive, Sacramento, California 95828
P.O. Box 292880, Sacramento, California 95829-2880

(916) 383-1177 FAX (916) 383-1182

ANTENNA SPECIFICATIONS

MODEL: JUHD-5/2 (10)

SERIAL NO: 16730

ELECTRICAL SPECIFICATIONS

FREQUENCY: 476-482 MHz

POLARIZATION: Horizontal

AZIMUTH PATTERN: Directional

PEAK GAIN: 39.6x (16.0 dBd)

BEAM TILT: 0.5°

NULL FILL: 0%

INPUT POWER: 1 kW

INPUT IMPEDANCE: 50 ohms, nominal

MAXIMUM VSWR: 1.1:1

ELECTRICAL DE-ICER: none

INPUT CONNECTION: 1-5/8" EIA

MECHANICAL/ENVIRONMENTAL SPECIFICATIONS

WEIGHT: 1037 lbs. (470 kg), no ice

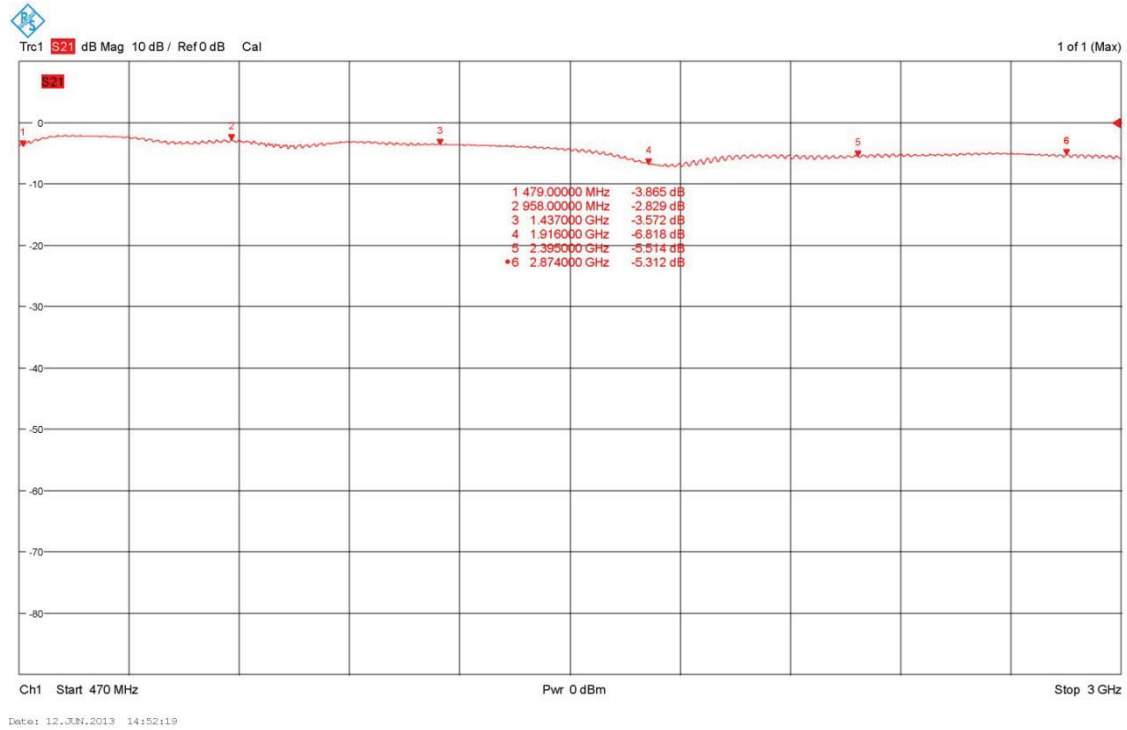
EFFECTIVE PROJECTED AREA (EPA): 83 ft² (7.7 m²), no ice, per TIA-222-G

PRESSURIZATION: 10 psi max, 3–5 psi operating

ANTI-ICING PROTECTION: Radomes

APPENDIX
WBNF – JUNE 12, 2013, 2013

MEASUREMENT OF TEST CABLE AND NOTCH RESPONSE



APPENDIX
WBNF – JUNE 12, 2013, 2013

STATEMENT OF AUTHENTICITY

The preceding statements and data contained herein were prepared by me and/or under my direct supervision, and are true and accurate to the best of my knowledge and belief.



Edward J. Murlatt

June 14, 2013

Date