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ROHDE & SCHWARZ MODEL TMU91

ATSC TRANSMITTER TECHNICAL REPORT

TABLE OF CONTENTS — PAGE

TMU91 TRANSMITTER TECHNICAL REPORT

The following information is provided to support the technical performance of the R & S TMU91 DTV transmitter. The information is supplied for broadcast service according to applicable portions of Part 74 of the FCC Rules.

The information in this report is provided in support of certification that the TMU91 transmitter meets the appropriate requirements identified in the FCC rules and regulations.

Measurements outlined below were recorded of spectrum and other data to demonstrate compliance.

1. Power Output Measurements
2. Frequency stability tests versus AC input voltage and temperature
3. Measurements to demonstrate the transmitter meets the DTV emission mask as specified in FCC Rule 74.794 (a) (2) (ii) and 74.794 (b) (1).
4. Measurement of cabinet radiation for spurs and harmonics as specified in FCC Rule 2.1053 and Rule 2.1057

Measurements for power output and emission mask compliance were conducted at power output levels of both 500 watts and 125 watts. This is the range for which type certification is sought.

The test equipment used for the measurements is listed at the end of this document. All equipment was within its calibration period.

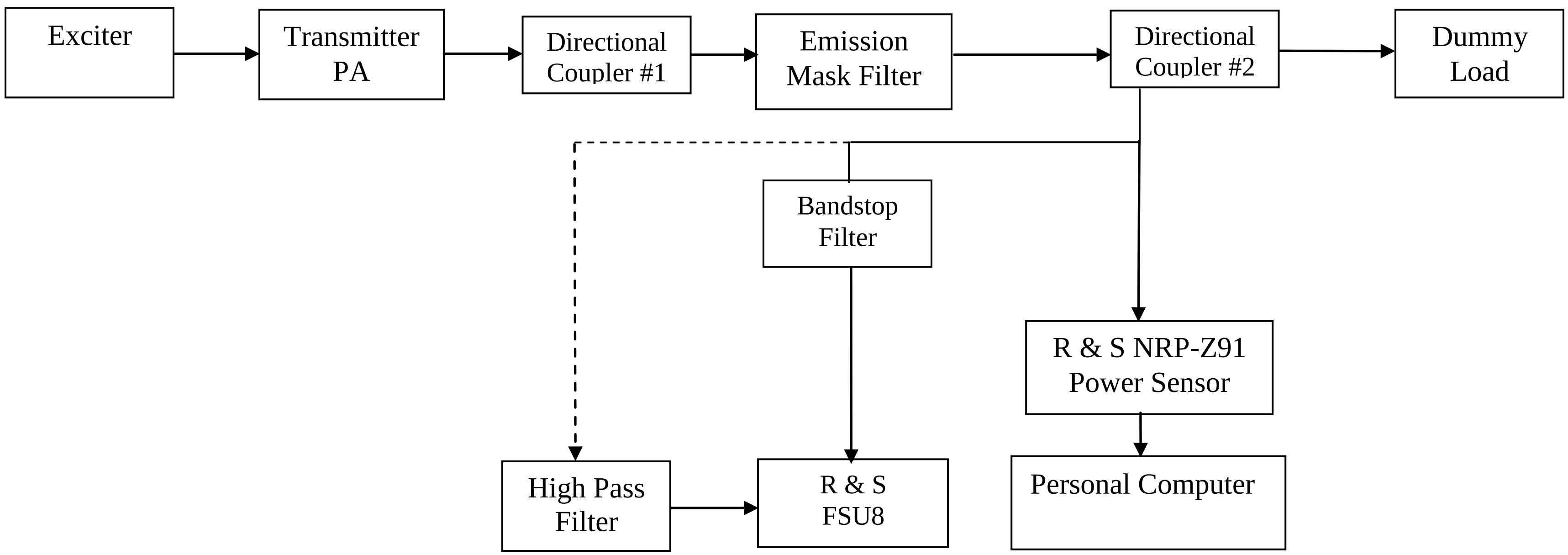


FIGURE 1—TEST EQUIPMENT CONFIGURATION

Note: The coupling factor of directional coupler #2 was determined to be 42.83 dB at channel 36.

RF Power Output Measurements

The equipment was configured as shown in Figure 1. The coupling factor of directional coupler #2 was calibrated at the center frequency of the channel 36 DTV signal of 605 MHz. The coupling value was 42.83 dB. Average power was measured with the R & S NRP-Z91 power sensor connected to the directional coupler and displayed on the personal computer using the Power Viewer program. The indicated reading with the offset from the directional coupler is shown below.

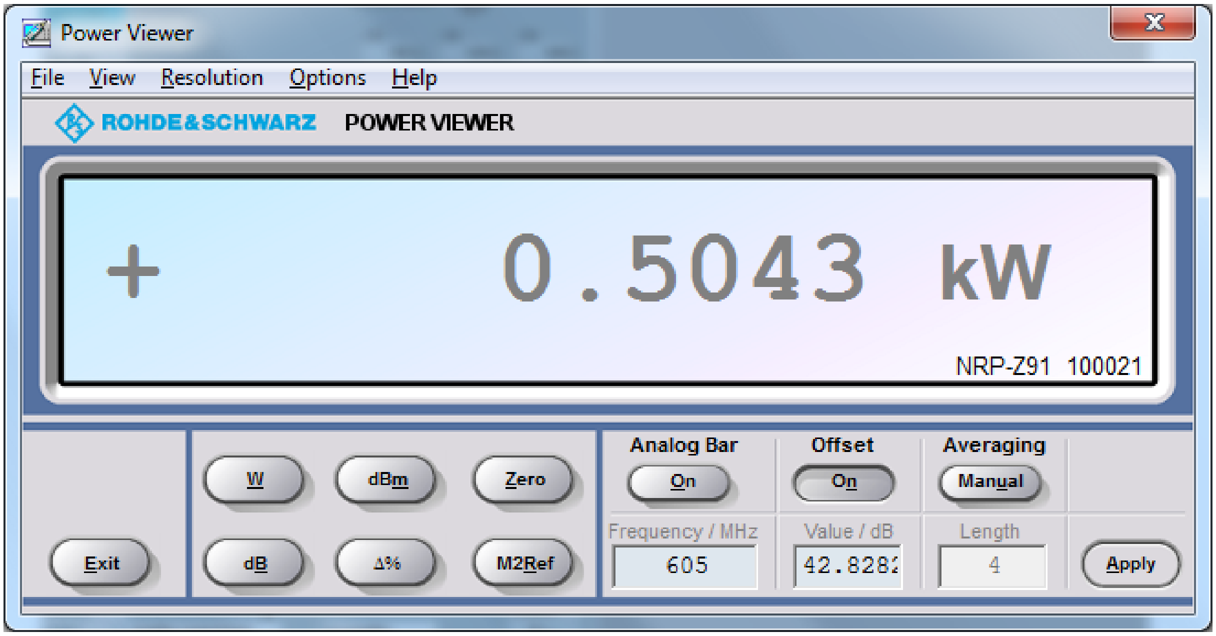


Figure 2—Power Meter Reading at Nominal Transmitter Power

Calculation of Output Power: An offset of 42.828 dB from the directional coupler was added to the reading on the Power Viewer program. The actual value of 14.17 dBm was measured using the NRP-Z91 power sensor and the offset value of 42.83 dB was added to the directional coupler coupling value to display the correct value of 57.0 dBm or 500 watts. With this operating state, measured transmitter final amplifier voltage was 29.7 VDC and final amplifier current was 55.7 Amps. The power supply voltage for each amplifier was multiplied by the current for each amplifier to obtain the total DC power of 1654 W for the final amplifier stage.

Emission Mask Compliance

To determine conducted radiation emission mask compliance, the test equipment configuration shown on Figure 1 was used. For adjacent channel and harmonic energy measurements, the R & S FSU8 spectrum analyzer was used. The transmitter was tested for compliance with the stringent emission mask as specified in FCC rule 74.794 (a) (2) (ii). The IEEE 2008-1631 Recommended Practice On 8-VSB Digital Television Transmission Compliance Measurement was used as the test measurement methodology. The first part of the emission mask compliance tests measured the adjacent channel emission and the second part of the tests measured the harmonic and spurious energy.

The transmitter was energized at 500 watts on Channel 36 (center frequency of 605 MHz) as measured at the output of Directional coupler #2 using the R & S NRP-Z91 power sensor and a reference was established on the FSU8 spectrum analyzer (using the channel power measurement mode). The bandstop filter insertion loss (including input and output cables loss) versus frequency response was previously determined using the FSU8 spectrum analyzer and tracking generator combination. The insertion loss at the center of each of the twelve 500 kHz segments either side of the main channel was tabulated. The bandstop filter response is shown as Figure 3. The tabulated attenuation versus frequency has been indicated in the next section with the table of measured emission values.

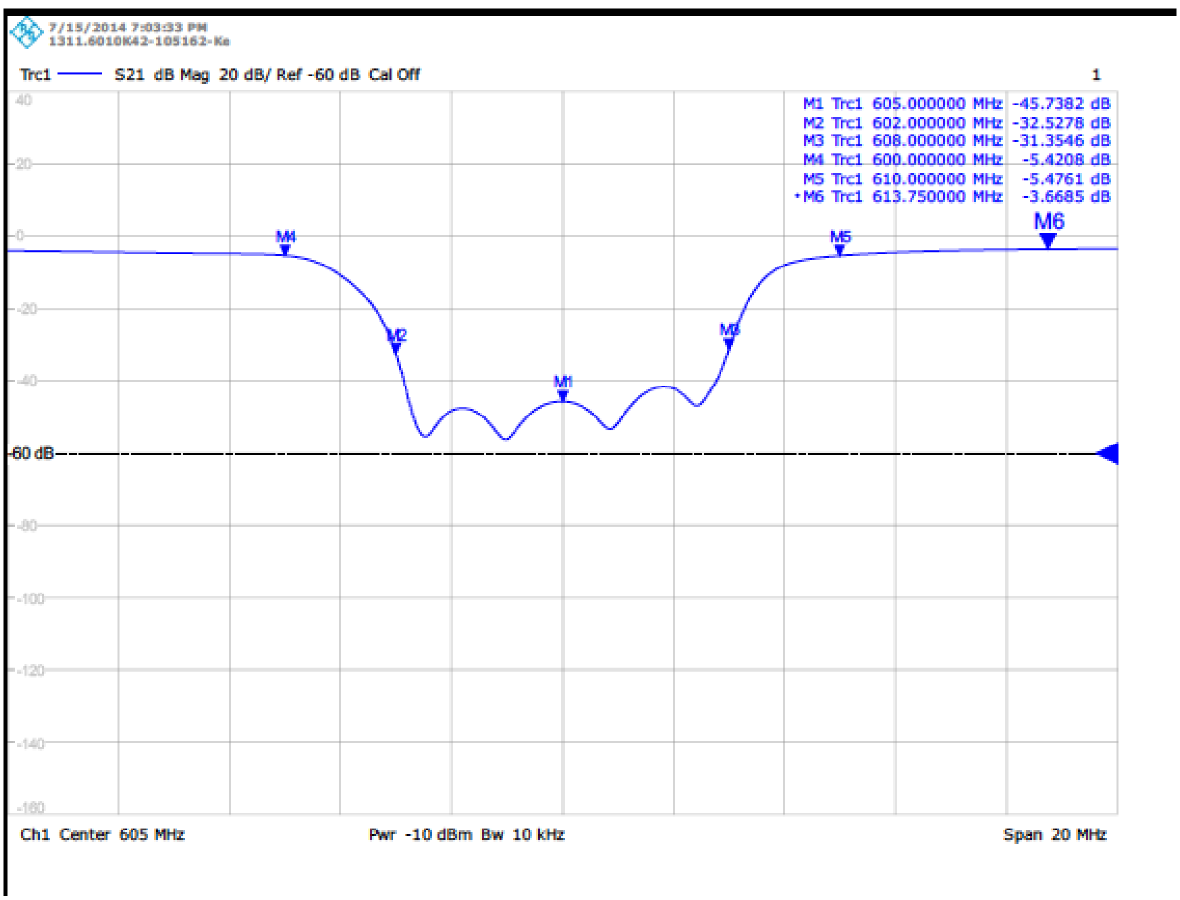


Figure 3 Bandstop Filter Response

The noise floor of the spectrum analyzer in the adjacent channels was found and from that value, the minimum RF sample level was determined (assuming the transmitter exactly met the emission mask requirements identified in the FCC rules). The actual RF sample level was well above the required minimum RF sample so plenty of margin was available with the test configuration used. The minimum RF sample value and actual RF sample values are contained in the emission mask measurement table on the following page

The transmitter was energized at 500 W and optimized for linearity. The 6 MHz DTV channel power was first measured for the channel 36 signal. This data was recorded in the table on the following page. Then the twelve 500 kHz segments on both sides of the channel 36 signal were measured. Leaving the spectrum analyzer attenuator set at the same value as the 6 MHz channel power measurement, the closest four 500 kHz segments on either side of the channel 36 signal were measured without the use of the bandstop filter because those signals were above the noise floor of the FSU8 spectrum analyzer with the existing attenuator setting. Spectrum analyzer screen captures were made for the upper and lower sidebands for reference. The bandstop filter was then inserted in the path as shown in Figure 1. The attenuation of the spectrum analyzer was reduced to the minimum without overloading spectrum analyzer. The remaining 500 kHz segments on each side of channel 36 were measured and the data was recorded in the emission mask table provided on the next page.

The measured values were corrected for proximity to the noise floor first and then for the bandstop filter insertion loss. The transmitter emissions met the requirements as indicated by comparison with the FCC Emission Mask from FCC Rule 74.794 (a) (2) (ii).

ATSC TRANSMITTER
TEST REPORT 500 W

Spectrum Analyzer 10kHz RBW Noise Floor [dBm]	-115.0
Spectrum Analyzer 500kHz RBW Noise Floor [dBm]	-98.0
Noise floor proximity upper threshold [dBm]	-88.0
Noise floor proximity lower threshold [dBm]	-95.0

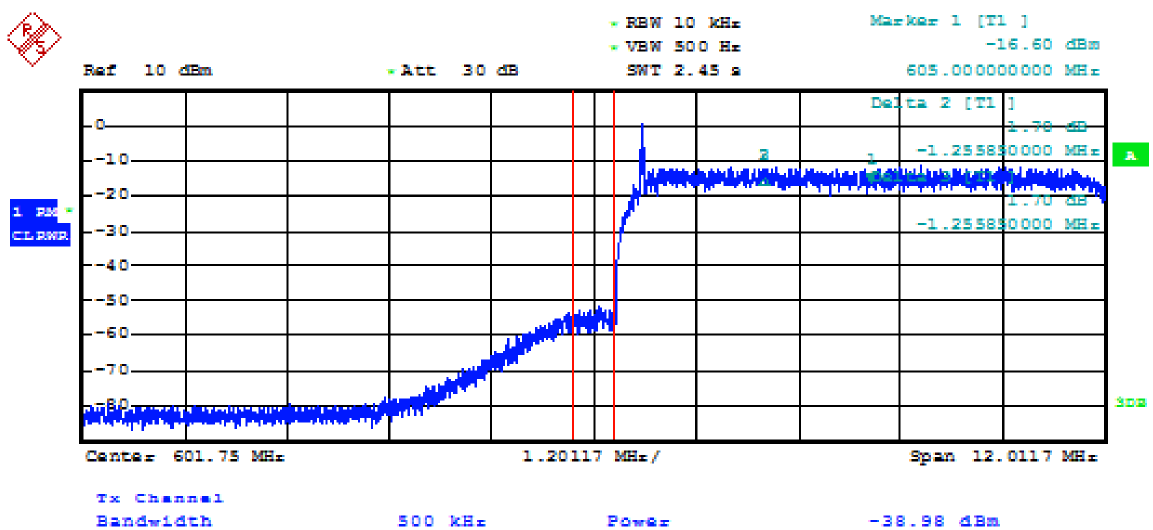
Min. Sample Level [dBm]	-21.8
Actual Sample Level [dBm]	11.8

ATSC TRANSMISSION MASK COMPLIANCE TEST
Stringent Mask

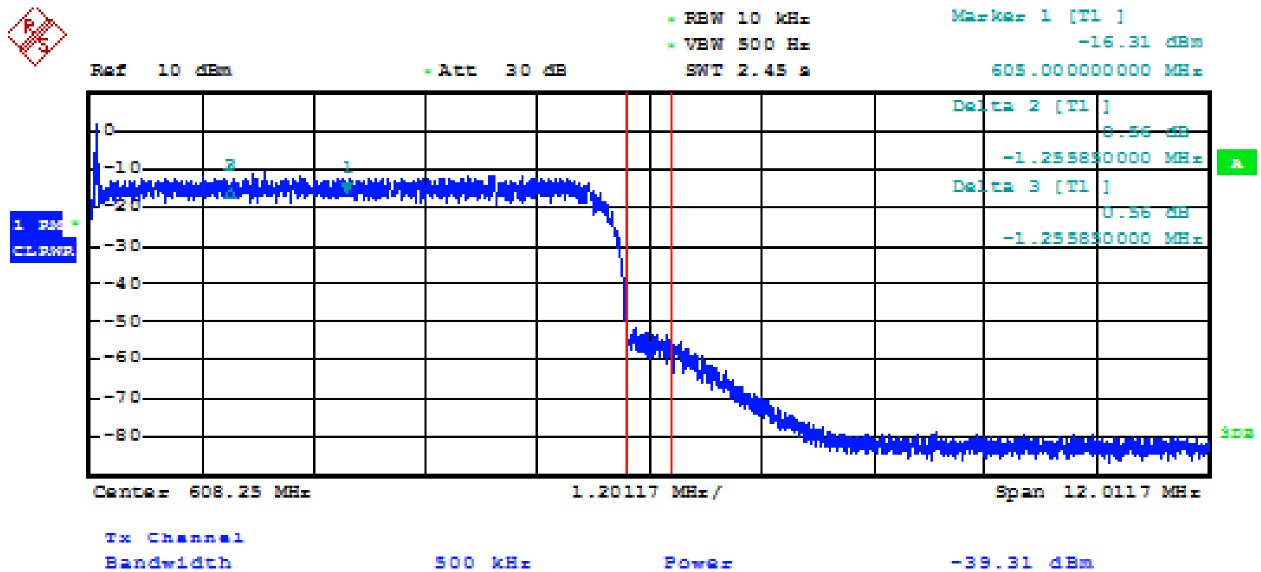
Channel Power [dBm]	11.8
Channel Number	36
Center Frequency [MHz]	605

Delta Frequency [MHz]	Frequency [MHz]	Measured Amplitude [dBm]	Corrected for Noise Floor [dBm]	Bandstop Filter (dB)	Corrected Amplitude [dBm]	Amplitude below Channel Power [dB]	FCC Limit [dB]	Pass/Fail
3.25	608.25	-39.4	-39.4		-39.4	51.2	47.0	**Pass**
3.75	608.75	-43.9	-43.9		-43.9	55.7	49.9	**Pass**
4.25	609.25	-52.4	-52.4		-52.4	64.2	55.6	**Pass**
4.75	609.75	-60.0	-60.0		-60.0	71.8	61.4	**Pass**
5.25	610.25	-72.9	-72.9	5.2	-67.7	79.5	67.1	**Pass**
5.75	610.75	-79.9	-79.9	4.8	-75.2	87.0	71.9	**Pass**
6.25	611.25	-86.3	-86.3	4.4	-81.9	93.7	76.0	**Pass**
6.75	611.75	-92.5	-93.9	4.2	-89.8	101.6	76.0	**Pass**

7.25	612.25	-96.9	-98.0	4.0	-94.0	105.8	76.0	**Pass**
7.75	612.75	-98.6	-98.0	3.8	-94.2	106.0	76.0	**Pass**
8.25	613.25	-99.0	-98.0	3.7	-94.3	106.1	76.0	**Pass**
8.75	613.75	-99.0	-98.0	3.7	-94.3	106.1	76.0	**Pass**
-3.25	601.75	-39.2	-39.2		-39.2	51.0	47.0	**Pass**
-3.75	601.25	-41.9	-41.9		-41.9	53.7	49.9	**Pass**
-4.25	600.75	-48.5	-48.5		-48.5	60.3	55.6	**Pass**
-4.75	600.25	-55.6	-55.6		-55.6	67.4	61.4	**Pass**
-5.25	599.75	-66.4	-66.4	5.2	-61.3	73.1	67.1	**Pass**
-5.75	599.25	-74.2	-74.2	5.0	-69.2	81.0	71.9	**Pass**
-6.25	598.75	-81.2	-81.2	4.9	-76.3	88.1	76.0	**Pass**
-6.75	598.25	-87.9	-87.9	4.8	-83.1	94.9	76.0	**Pass**
-7.25	597.75	-94.2	-96.5	4.7	-91.8	103.6	76.0	**Pass**
-7.75	597.25	-97.6	-98.0	4.6	-93.4	105.2	76.0	**Pass**
-8.25	596.75	-98.8	-98.0	4.5	-93.5	105.3	76.0	**Pass**
-8.75	596.25	-99.2	-98.0	4.4	-93.7	105.5	76.0	**Pass**



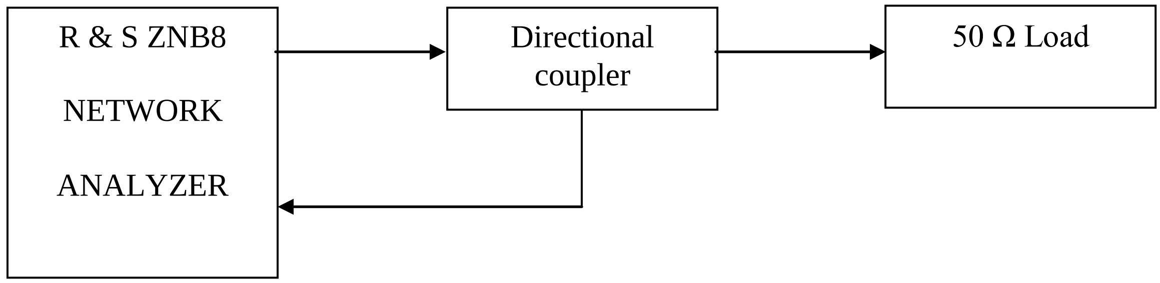
LOWER SIDEBAND MEASUREMENT



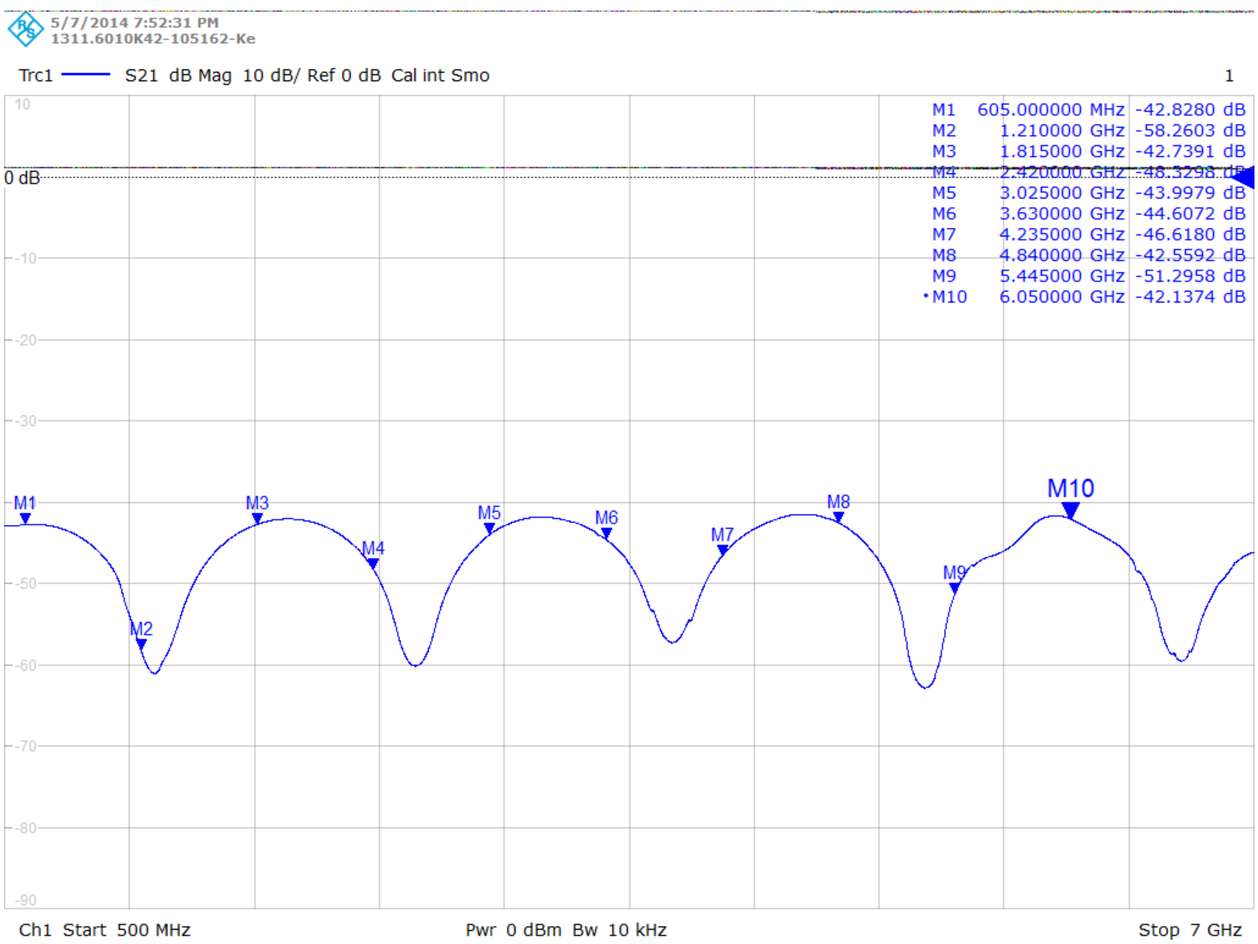
UPPER SIDEBAND MEASUREMENT

HARMONIC AND SPURIOUS ENERGY

The next set of tests provided measurements of conducted harmonic and spurious energy from the transmitter. The frequency spectrum up to the 10th harmonic was investigated for harmonic and spurious energy. The test setup of Figure 1 was used with the RF sample feeding the high pass filter and then the spectrum analyzer. A highpass filter was used to keep the total energy applied to the FSU8 spectrum analyzer low enough to prevent harmonic energy from being created in the spectrum analyzer itself. The highpass filter and cables to and from the unit under test were characterized using a network analyzer. The directional coupler was also calibrated at each of the harmonic frequency ranges of the transmitter using a network analyzer. These results are shown below and the tabulated values are included in the harmonic results table.



CALIBRATION OF DIRECTIONAL COUPLER

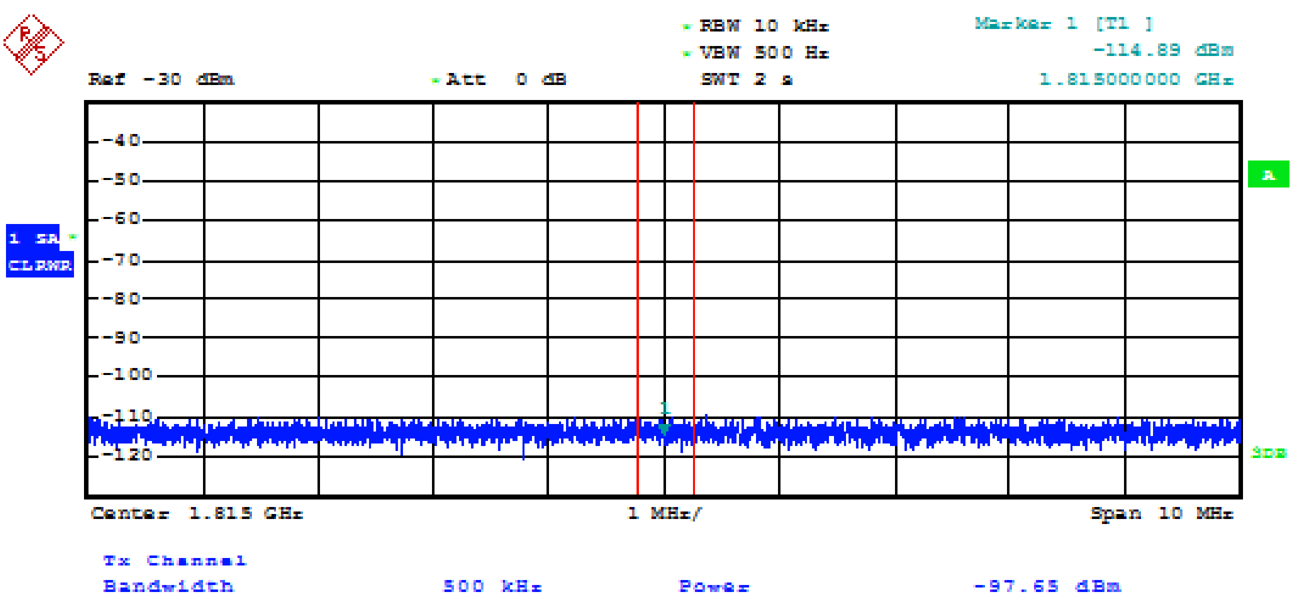


DIRECTIONAL COUPLER COUPLING VALUE VERSUS FREQUENCY PLOT WITH MARKERS

Frequency (MHz)	HPF + Cable Loss (dB)
605	41
1210	2.0
1815	2.5
2420	2.9
3025	3.3
3630	3.7
4235	4.0
4840	4.3
5445	4.7
6050	5.0

TABULATED COUPLING VALUE VERSUS FREQUENCY
(INCLUDES HIGH PASS FILTER)

The only energy coming from the transmitter was found to be harmonics. Channel power measurements using a 500 kHz channel power bandwidth were taken at harmonics up to the 10th and the largest signal level in any 500 kHz segment of the energy was recorded in the table following on the next page. The measured values were converted back to an equivalent power at the transmitter output using the directional coupler factor and compared with the total power of the channel 36 power. A screen capture was made of the conducted harmonic energy at the worst case condition. In this case, no harmonic power above the spectrum analyzer noise floor was observed.



3rd Harmonic Spectrum

ATSC TRANSMISSION MASK COMPLIANCE TEST

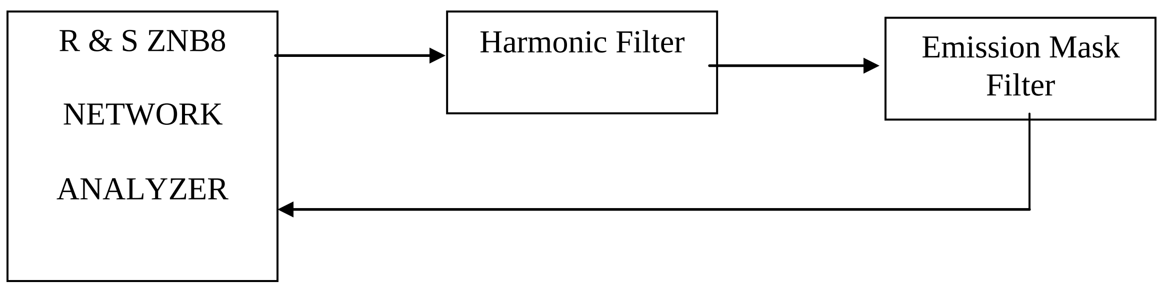
HARMONICS

Channel Power [dBm]	57.0
Channel Number	36
Center Frequency [MHz]	605

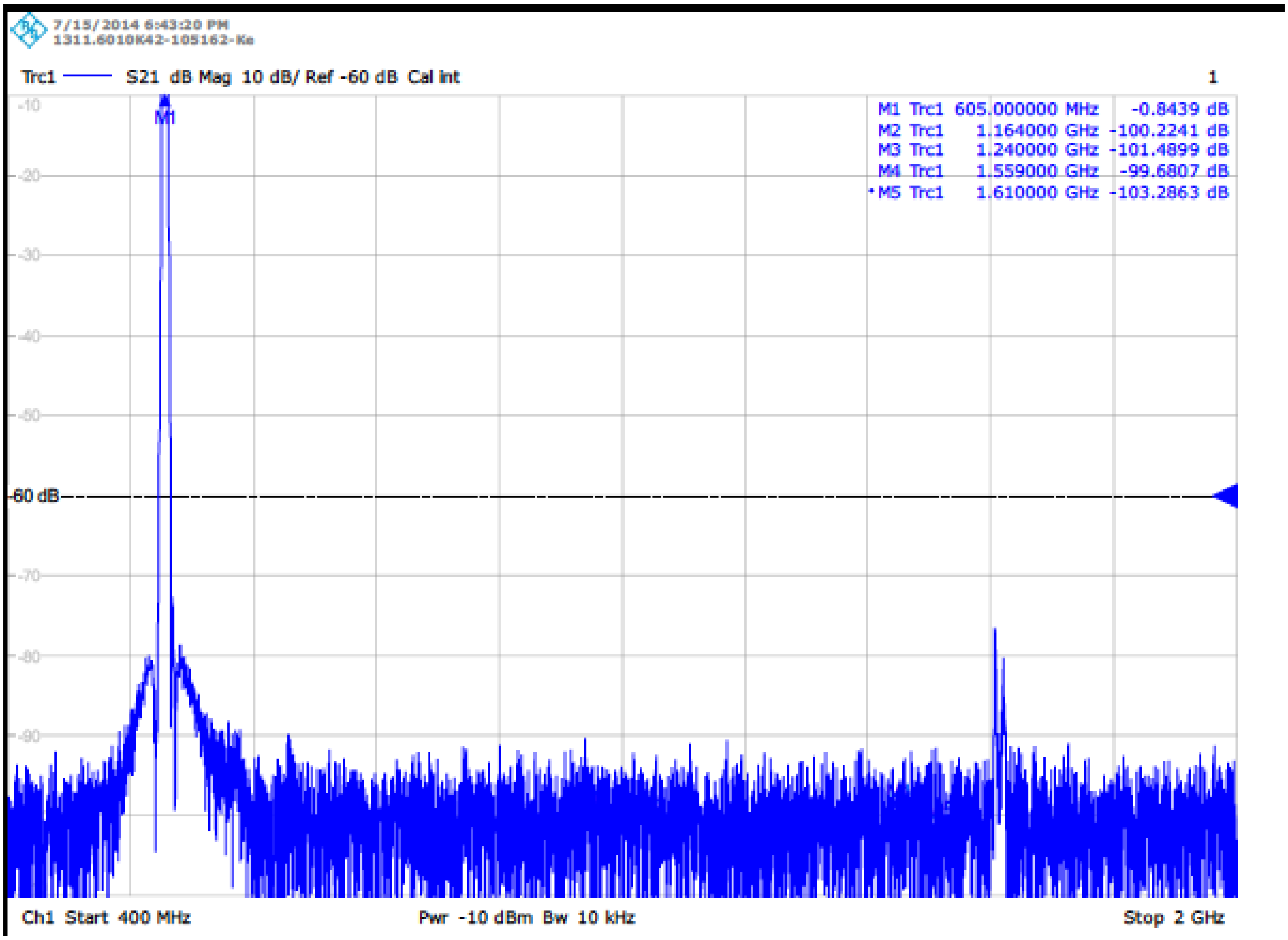
Harmonic	Frequency [MHz]	Measured Amplitude [dBm]	HPF & Cable Loss [dB]	Coupling Value [dB]	Corrected Amplitude [dBm]	Amplitude below Channel Power[dB]	FCC Limit [dB]	Pass/Fail
2nd	1210.00	-98.7	2.0	58.3	-38.4	95.4	76.0	**Pass**
3rd	1815.00	-97.2	2.5	42.7	-52.0	109.0	76.0	**Pass**
4th	2420.00	-95.7	2.9	48.3	-44.5	101.5	76.0	**Pass**
5th	3025.00	-96.0	3.3	44.0	-48.7	105.7	76.0	**Pass**
6th	3630.00	-95.6	3.7	44.6	-47.3	104.3	76.0	**Pass**
7th	4235.00	-94.3	4.0	46.6	-43.7	100.7	76.0	**Pass**
8th	4840.00	-94.9	4.3	42.6	-48.0	105.0	76.0	**Pass**
9th	5445.00	-95.5	4.7	51.3	-39.5	96.5	76.0	**Pass**
10th	6050.00	-95.6	5.0	42.1	-48.5	105.5	76.0	**Pass**

Filter Attenuation to GPS Band Frequencies

The plot on the following page indicates the amount of attenuation provided by the combination of the harmonic filter and emission mask filter for the TMU91 transmitter from 400 MHz to 2 GHz. The test setup to measure the attenuation is shown below. Markers are provided on the plot to indicate the attenuation present in the GPS bands from 1.1 GHz to 1.61 GHz. As can be seen by the plot on the following page, the attenuation by the harmonic filter combined with the emission mask attenuation is equal to or greater than 85 dB as specified by FCC Rule 74.794 (b) (1). Therefore compliance to the rule is demonstrated.



FILTER ATTENUATION AT GPS BAND FREQUENCIES


7/15/2014 6:43:20 PM
1311.6010K42-105162-Ke
Trc1 S21 dB Mag 10 dB/ Ref -60 dB Cal int
1
M1 Trc1 605.000000 MHz -0.8439 dB
M2 Trc1 1.164000 GHz -100.2241 dB
M3 Trc1 1.240000 GHz -101.4899 dB
M4 Trc1 1.559000 GHz -99.6807 dB
M5 Trc1 1.610000 GHz -103.2863 dB
M1
-10
-20
-30
-40
-50
-60 dB
-70
-80
-90
Ch1 Start 400 MHz
Pwr -10 dBm Bw 10 kHz
Stop 2 GHz

FREQUENCY STABILITY

For temperature stability measurements, the exciter only was placed inside a Tenney T10C temperature chamber equipped with a digital thermometer. The frequency stability of the transmitter is determined solely by the exciter used so no additional power amplifiers were used for this test. The frequency stability was measured versus temperature and versus line voltage. The temperature range was measured from 0 °C to 45 °C in steps of 5 or 10 °C. The exciter was tested on channel 36. For the test, the exciter was operated in the chamber without input signal. The channel 36 pilot signal of the exciter was measured with an R&S ETL receiver and spectrum analyzer with a 0.1 PPM stability reference oscillator and the signal counter was activated to provide a resolution of 0.1 Hz. The exciter synthesizer board was working in internal mode, so it was not locked to an external reference. The exciter was switched on at 0 °C and allowed to stabilize from 15:05 to 15:20. The temperature was raised during the period between 15:20 and 17:20. The temperature was stabilized at each measurement increment for a minimum of 15 minutes.

FREQUENCY STABILITY VERSUS TEMPERATURE RESULTS

Date	Time	Nominal Temperature °C	Measured Frequency (Hz)	Difference (Hz)
1/13/2014	15:05	0	602,309,488.8	Reference (Start of Test)
1/13/2014	15:20	0	602,309,486.9	1.9
1/13/2014	15:40	10	602,309,484.8	4.0
1/13/2014	16:05	20	602,309,482.2	6.6
1/13/2014	16:25	25	602,309,480.4	8.4
1/13/2014	16:40	30	602,309,479.2	9.6
1/13/2014	17:00	40	602,309,477.7	11.1
1/13/2014	17:20	45	602,309,475.8	13.0

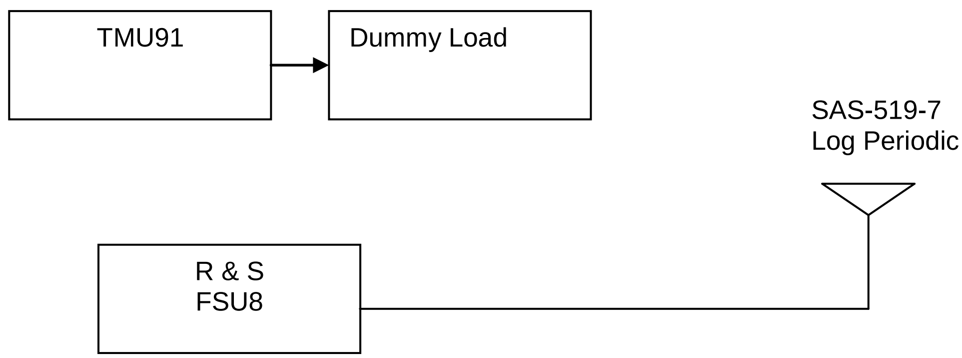
The line voltage was adjusted for nominal voltage and the frequency was recorded. Then the line voltage was adjusted to 85% and 115% of the nominal voltage and the frequency was recorded at each voltage level. The results are tabulated below:

Line Voltage (Volts)	Frequency (MHz)	Difference (Hz)
103 (85%)	602,309,488.7	0.1
121 (Nominal)	602,309,488.8	0.0
139 (115%)	602,309,488.6	0.2

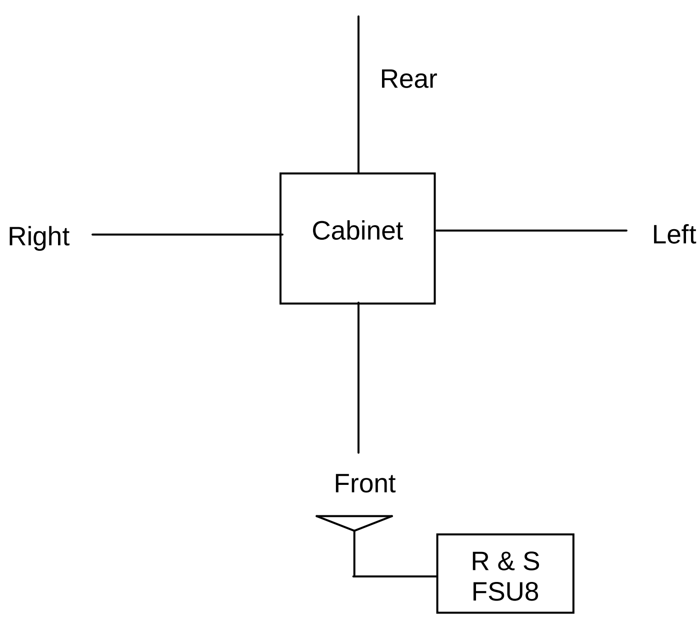
CABINET RADIATION

The transmitter and test equipment were configured as shown below including the angles of measurement with respect to the transmitter cabinet. The transmitter was operated at 500 W average power. The free space path loss, cable loss and antenna gain characteristics were obtained at the center of the channel of operation and at each of the harmonics of DTV channel 36 in order to accurately assess the level of the signal radiated from the cabinet. Radiation from the cabinet was measured at a distance of 10 meters in 4 different physical rotation angles: 0° (front), 90° (right), 180° (Rear), and 270° (Left). The transmitter was measured, rotated 90 degrees, and measured after each 90 degree rotation, so that the transmitter radiation in four directions 90 degrees apart was evaluated. The measured value for each spectrum emission emanating from the cabinet was recorded in the tables beginning on the next page following the photos of the test setup.

Test Equipment Configuration for Cabinet Radiation Measurements



Block diagram of Test Setup



Physical setup of the equipment Configuration
(Photo Shown on Following Page)

500 Watt Xmtr

Cabinet RadiationTest Setup Photo #1

SAS519-7
Receiving
Antenna

FSU8
Spectrum
Analyzer

Cabinet Radiation Test Setup Photo #2

Cabinet Radiation Test Results

Although radiation from other systems was measureable, no radiation from the transmitter cabinet was observed. Thus, only the noise floor of the spectrum analyzer was seen at the harmonic ranges of the transmitter. This data is indicated on the table data on the following pages, the worst case measurement was -94.2 dBm using a 500 kHz bandwidth compared to the total DTV channel power. The measurement tables for the corresponding view angles of the transmitter are shown on the following pages.

TEST INPUTS	***CONDITIONS & PARAMETERS***		
TEST DATE:	**7/16/14**		
TEST ENGINEER:	**Greg Best**		
TRASMITTER MODEL NO:	**TMU91**		
OPERATING POWER OUTPUT LEVEL	**57.0 dBm**	**500**	**Power in Watts**
OPERATING FREQUENCY IN GHz	**0.605 GHz**	**36**	**Channel**
ANTENNA MODEL NUMBER	**SAS-519-7**		
SPECTRUM ANALYZER MODEL	**FSU-8**		
DISTANCE TO TRANSMITTER IN METERS	**10**		

Power levels were measured in 500 kHz segments between the lower frequency edge and the upper frequency edge of the spectrum associated with each harmonic. Center frequency of highest amplitude signal in the 500 kHz band segment is recorded below. Data is not recorded for the fundamental frequency due to the fact that in normal operation the transmit antenna will be the dominant radiator. The measured value was corrected for the cable loss from the antenna to the spectrum analyzer, the antenna gain, and the path loss from the transmitter to the antenna. The corrected value is shown in the ADJ LEVEL column and compared to the allowable maximum level. As can be seen, all cabinet radiation is well below the maximum level.

0 DEGREE VIEW

Harmonic	Frequency GHz	SIGNAL LEVEL dBm	CABLE LOSS dB dB	ANTENNA GAIN dB dB	PATH LOSS dB dB	ADJ LEVEL dBm	MAXIMUM LEVEL dBm	STATUS
Fundamental	0.605	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2	1.21	-98.3	2.0	7.6	54.16	-49.7	-3.0	P
3	1.815	-97.7	2.5	6.7	57.68	-44.2	-3.0	P
4	2.42	-95.4	2.9	7.0	60.18	-39.3	-3.0	P
5	3.025	-95.8	3.3	4.9	62.11	-35.3	-3.0	P
6	3.63	-95.1	3.7	6.2	63.70	-33.9	-3.0	P
7	4.235	-94.4	4.0	6.8	65.04	-32.2	-3.0	P
8	4.84	-94.2	4.3	7.7	66.20	-31.4	-3.0	P
9	5.445	-94.5	4.7	8.0	67.22	-30.6	-3.0	P
10	6.05	-95.2	5.0	5.9	68.14	-28.0	-3.0	P

90 DEGREE VIEW

Harmonic	Frequency GHz	SIGNAL LEVEL dBm	CABLE LOSS dB dB	ANTENNA GAIN dB dB	PATH LOSS dB dB	ADJ LEVEL dBm	MAXIMUM LEVEL dBm	STATUS
Fundamental	0.605	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2	1.21	-98.3	2.0	7.6	54.16	-49.7	-3.0	P
3	1.815	-97.7	2.5	6.7	57.68	-44.2	-3.0	P
4	2.42	-95.4	2.9	7.0	60.18	-39.3	-3.0	P
5	3.025	-95.8	3.3	4.9	62.11	-35.3	-3.0	P
6	3.63	-95.1	3.7	6.2	63.70	-33.9	-3.0	P
7	4.235	-94.4	4.0	6.8	65.04	-32.2	-3.0	P
8	4.84	-94.2	4.3	7.7	66.20	-31.4	-3.0	P
9	5.445	-94.5	4.7	8.0	67.22	-30.6	-3.0	P
10	6.05	-95.2	5.0	5.9	68.14	-28.0	-3.0	P

180 DEGREE VIEW

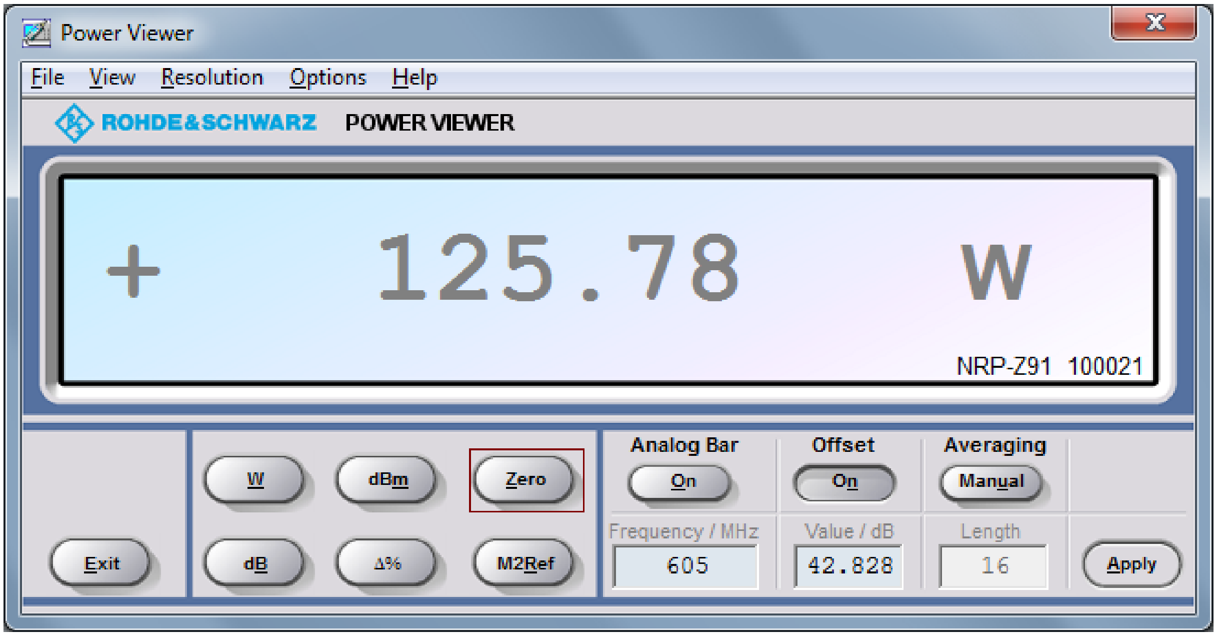
Harmonic	Frequency GHz	SIGNAL LEVEL dBm	CABLE LOSS dB dB	ANTENNA GAIN dB dB	PATH LOSS dB dB	ADJ LEVEL dBm	MAXIMUM LEVEL dBm	STATUS
Fundamental	0.605	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2	1.21	-98	2.0	7.6	54.16	-49.4	-3.0	P
3	1.815	-97.3	2.5	6.7	57.68	-43.8	-3.0	P
4	2.42	-95.2	2.9	7.0	60.18	-39.1	-3.0	P
5	3.025	-95.5	3.3	4.9	62.11	-35.0	-3.0	P
6	3.63	-94.8	3.7	6.2	63.70	-33.6	-3.0	P
7	4.235	-94.2	4.0	6.8	65.04	-32.0	-3.0	P
8	4.84	-94.7	4.3	7.7	66.20	-31.9	-3.0	P
9	5.445	-95.3	4.7	8.0	67.22	-31.4	-3.0	P
10	6.05	-95.5	5.0	5.9	68.14	-28.3	-3.0	P

270 DEGREE VIEW

Harmonic	Frequency GHz	SIGNAL LEVEL dBm	CABLE LOSS dB dB	ANTENNA GAIN dB dB	PATH LOSS dB dB	ADJ LEVEL dBm	MAXIMUM LEVEL dBm	STATUS
Fundamental	0.605	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2	1.21	-98.4	2.0	7.6	54.16	-49.8	-3.0	P
3	1.815	-97.5	2.5	6.7	57.68	-44.0	-3.0	P
4	2.42	-95.5	2.9	7.0	60.18	-39.4	-3.0	P
5	3.025	-95.7	3.3	4.9	62.11	-35.2	-3.0	P
6	3.63	-95.3	3.7	6.2	63.70	-34.1	-3.0	P
7	4.235	-94.2	4.0	6.8	65.04	-32.0	-3.0	P
8	4.84	-94.4	4.3	7.7	66.20	-31.6	-3.0	P
9	5.445	-95.3	4.7	8.0	67.22	-31.4	-3.0	P
10	6.05	-95.3	5.0	5.9	68.14	-28.1	-3.0	P

Low Power Operation---125 Watts

For operation at power levels below 500 watts, power output and emission mask compliance data was repeated for the transmitter operating at a lower power level. For this test, the transmitter was energized in the same test configuration as in Figure 1 except at the output power of 125 watts. Average power was measured with the R & S NRP-Z91 power sensor and displayed on the personal computer using the Power Viewer program. The indicated reading is shown below.



Calculation of Output Power: An offset of 42.83 dB from the directional coupler was added to the Power Viewer program. The actual value of 8.17 dBm was measured on NRP-Z91 power sensor and the offset value of 42.83 dB was added for the directional coupler coupling value to display the correct value of 51.0 dBm or 125 watts. With this operating state, measured transmitter final amplifier voltage was 29.8 VDC and final amplifier current was 27.8 Amps. The power supply voltage for each amplifier was multiplied by the total current for each amplifier to obtain the total DC power of 829 watts to the final amplifier stage.

Emission Mask Compliance 125 Watts Output Power

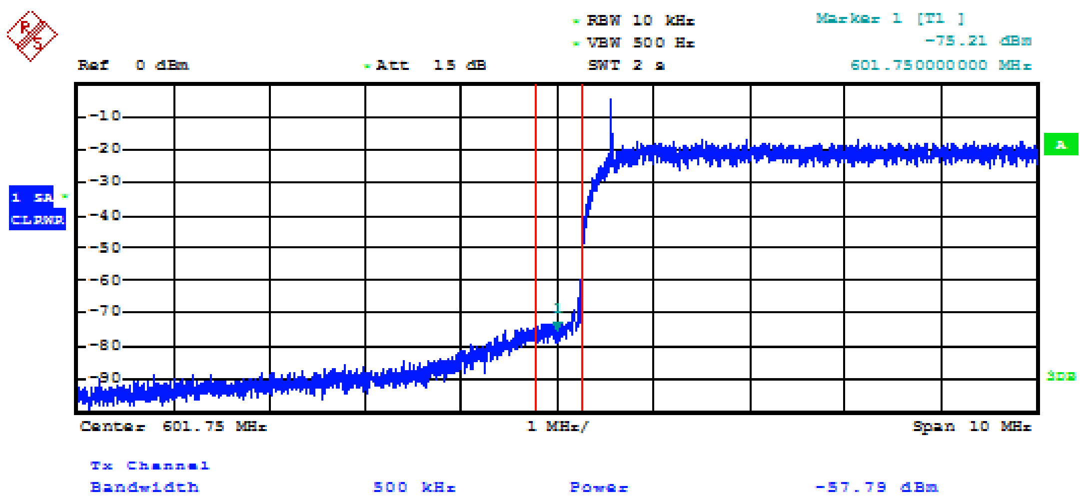
To determine conducted radiation emission mask compliance, the test equipment configuration shown on Figure 1 was used. For adjacent channel measurements, the R & S FSU8 spectrum analyzer was used. The transmitter was tested for compliance with the emission mask as specified in FCC rule 74.794 (A) (2) (II). The IEEE 2008-1631 Recommended Practice On 8-VSB Digital Television Transmission Compliance Measurement was used as the test measurement methodology. The first part of the tests measured the adjacent channel emission and the second part of the tests measured the harmonic and spurious energy.

The transmitter was energized at 125 watts on Channel 36 (center frequency of 605 MHz) as determined by the directional coupler and a reference was established on the spectrum analyzer (using the channel power measurement mode). The same bandstop filter used in the first set of measurements at 500 watts was also used for this set of measurements at 125 watts.

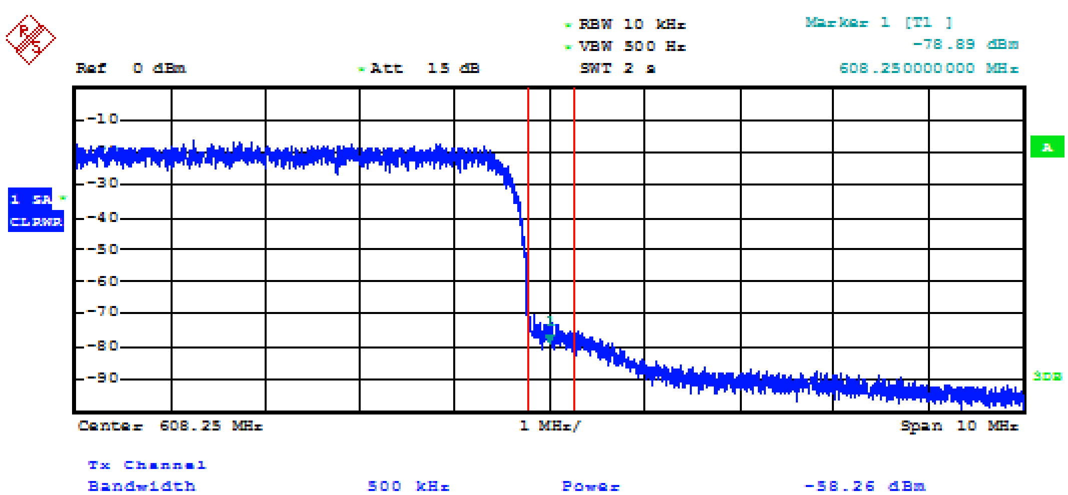
The noise floor of the spectrum analyzer was found. From that, the minimum RF sample level was determined (assuming the transmitter exactly met the emission mask requirements identified in the FCC rules). The actual RF sample level was well above the required minimum RF sample so plenty of margin was available with the test configuration used.

The transmitter was optimized for linearity. The 6 MHz DTV channel power was first measured for the channel 36 signal power reference. Then the twelve 500 kHz segments on both sides of the channel 36 signal were measured. The closest four 500 kHz segments on either side of the Channel 36 signal were measured without the use of the bandstop filter because those signals were above the noise floor with the spectrum analyzer with the existing attenuator setting. The bandstop filter was inserted in the path according to the set-up in Figure 1. The spectrum analyzer attenuator was reduced to the minimum without overloading the spectrum analyzer. The remaining 500 kHz segments on each side of channel 36 were measured and the data was recorded in the emission mask table provided on the next page.

The measured values were corrected for proximity to the noise floor first and then for the bandstop filter insertion loss. The transmitter emissions met the requirements as indicated by comparison with the FCC Emission Mask from FCC Rule 74.794 (a) (2) (ii) as shown on the following pages.



LOWER SIDEBAND MEASUREMENT



UPPER SIDEBAND MEASUREMENT

ATSC TRANSMITTER
TEST REPORT

125 W

Spectrum Analyzer 10kHz RBW Noise Floor [dBm]	-115.0
Spectrum Analyzer 500kHz RBW Noise Floor [dBm]	-98.0
Noise floor proximity upper threshold [dBm]	-88.0
Noise floor proximity lower threshold [dBm]	-95.0

Min. Sample Level [dBm]	-21.8
Actual Sample Level [dBm]	5.8

ATSC TRANSMISSION MASK COMPLIANCE TEST

Stringent Mask

Channel Power [dBm]	5.8
Channel Number	36
Center Frequency [MHz]	605

Delta Frequency [MHz]	Frequency [MHz]	Measured Amplitude [dBm]	Corrected for Noise Floor [dBm]	Bandstop Filter (dB)	Corrected Amplitude [dBm]	Amplitude below Channel Power [dB]	FCC Limit [dB]	Pass/Fail
3.25	608.25	-58.0	-58.0		-58.0	63.8	47.0	**Pass**
3.75	608.75	-63.8	-63.8		-63.8	69.6	49.9	**Pass**
4.25	609.25	-70.8	-70.8		-70.8	76.6	55.6	**Pass**
4.75	609.75	-75.0	-75.0		-75.0	80.8	61.4	**Pass**
5.25	610.25	-91.5	-92.6	5.2	-87.4	93.2	67.1	**Pass**
5.75	610.75	-94.7	-97.4	4.8	-92.7	98.5	71.9	**Pass**
6.25	611.25	-96.1	-98.0	4.4	-93.6	99.4	76.0	**Pass**

6.75	611.75	-96.3	-98.0	4.2	-93.8	99.6	76.0	**Pass**
7.25	612.25	-96.5	-98.0	4.0	-94.0	99.8	76.0	**Pass**
7.75	612.75	-96.6	-98.0	3.8	-94.2	100.0	76.0	**Pass**
8.25	613.25	-96.5	-98.0	3.7	-94.3	100.1	76.0	**Pass**
8.75	613.75	-96.5	-98.0	3.7	-94.3	100.1	76.0	**Pass**
-3.25	601.75	-57.9	-57.9		-57.9	63.7	47.0	**Pass**
-3.75	601.25	-63.0	-63.0		-63.0	68.8	49.9	**Pass**
-4.25	600.75	-69.1	-69.1		-69.1	74.9	55.6	**Pass**
-4.75	600.25	-73.6	-73.6		-73.6	79.4	61.4	**Pass**
-5.25	599.75	-89.2	-89.8	5.2	-84.7	90.5	67.1	**Pass**
-5.75	599.25	-93.5	-95.4	5.0	-90.4	96.2	71.9	**Pass**
-6.25	598.75	-95.3	-98.0	4.9	-93.1	98.9	76.0	**Pass**
-6.75	598.25	-96.3	-98.0	4.8	-93.2	99.0	76.0	**Pass**
-7.25	597.75	-96.6	-98.0	4.7	-93.3	99.1	76.0	**Pass**
-7.75	597.25	-96.5	-98.0	4.6	-93.4	99.2	76.0	**Pass**
-8.25	596.75	-96.5	-98.0	4.5	-93.5	99.3	76.0	**Pass**
-8.75	596.25	-96.5	-98.0	4.4	-93.7	99.5	76.0	**Pass**

HARMONIC AND SPURIOUS ENERGY

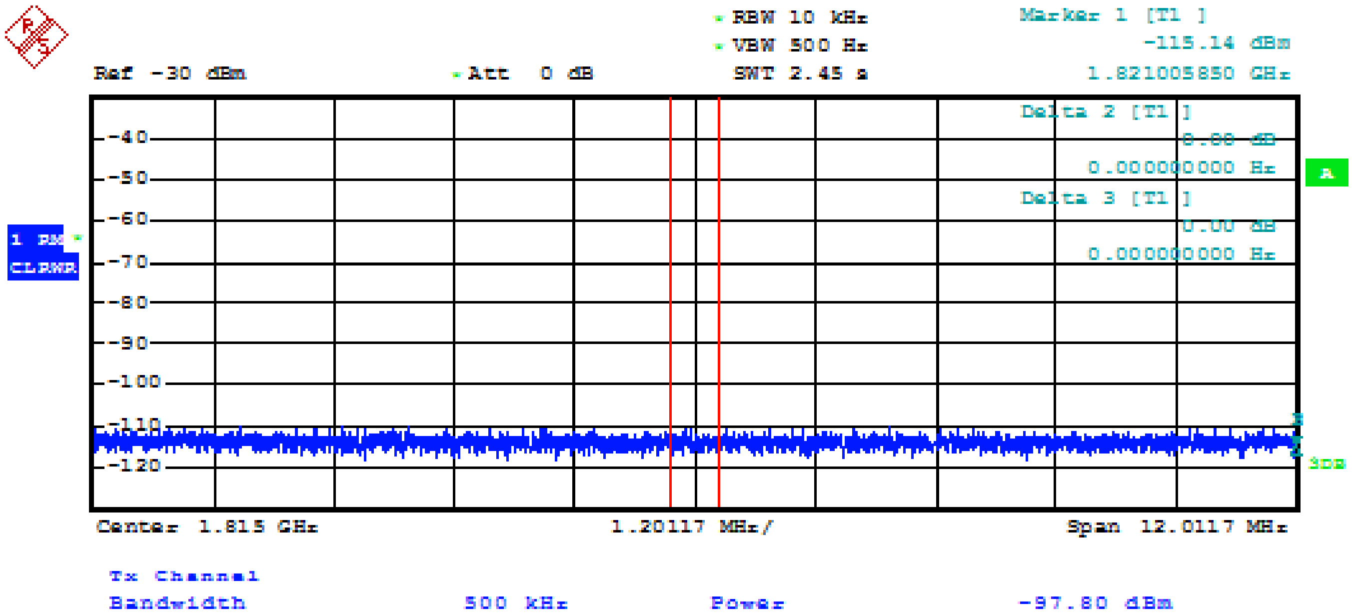
The next set of tests provided measurements of conducted harmonic and spurious energy from the transmitter. The frequency spectrum up to the 10^{th} harmonic was investigated for harmonic and spurious energy. The test setup of Figure 1 was used with the RF sample feeding the high pass filter and then the spectrum analyzer. A highpass filter was used to keep the total energy applied to the FSU8 spectrum analyzer low enough to prevent harmonic energy from being created in the spectrum analyzer itself. The highpass filter and cables to and from the unit under test was characterized using a network analyzer. These results are tabulated in the harmonic results table. The coupling value at each harmonic frequency range was determined by calibrating the directional coupler mounted after the emission mask filter as described earlier in the report.

The only energy coming from the transmitter was found to be harmonics. Channel power measurements using a 500 kHz channel power bandwidth were taken at harmonics up to the 10^{th} and the largest signal level in any 500 kHz segment of the energy was recorded on the table below. The measured values were converted back to an equivalent power at the transmitter output using the directional coupler factor and compared with the total power of the channel 36 power. A screen capture was made of the conducted harmonic energy at the worst case condition. In this case, no harmonic power above the spectrum analyzer noise floor was observed.

ATSC TRANSMISSION MASK COMPLIANCE TEST
HARMONICS

Channel Power [dBm]	51.0
Channel Number	36
Center Frequency [MHz]	605

Harmonic	Frequency [MHz]	Measured Amplitude [dBm]	HPF & Cable Loss [dB]	Coupling Value [dB]	Corrected Amplitude [dBm]	Amplitude below Channel Power[dB]	FCC Limit [dB]	Pass/Fail
2nd	1210.00	-98.7	2.0	58.3	-38.4	89.4	76.0	**Pass**
3rd	1815.00	-97.8	2.5	42.7	-52.6	103.6	76.0	**Pass**
4th	2420.00	-95.7	2.9	48.3	-44.5	95.5	76.0	**Pass**
5th	3025.00	-96.0	3.3	44.0	-48.7	99.7	76.0	**Pass**
6th	3630.00	-95.2	3.7	44.6	-46.9	97.9	76.0	**Pass**
7th	4235.00	-94.4	4.0	46.6	-43.8	94.8	76.0	**Pass**
8th	4840.00	-94.7	4.3	42.6	-47.8	98.8	76.0	**Pass**
9th	5445.00	-95.9	4.7	51.3	-39.9	90.9	76.0	**Pass**
10th	6050.00	-95.5	5.0	42.1	-48.4	99.4	76.0	**Pass**



3rd Harmonic Spectrum

Test Equipment List

The following test equipment was used in the various test equipment configurations or to create calibration of equipment at various frequencies. All equipment was within its calibration period.

VENDOR	MODEL NUMBER	DESCRIPTION	SERIAL NUMBER
Rohde & Schwarz	FSU8	Spectrum Analyzer	200305
Rohde & Schwarz	ZNB8	Network Analyzer	105162
Mini-Circuits	NHP-1000	Hi Pass Filter	15542
Microwave Filter Company	R16560-36	DTV Bandstop Filter	N/A
Rohde & Schwarz	NRP-Z91	Power Sensor	100021
Spinner	531694	2500 Watt Dummy Load	30364
Rohde & Schwarz	ETL	TV Test Receiver/Spectrum Analyzer	103658
Tenney	T10C	Temperature Chamber with Watlow Temperature Controller/Monitor	26708-05
AH Systems	SAS-519-7	Log Periodic Antenna with tripod	175

SUMMARY AND CONCLUSION

The TMU91 transmitter configuration was tested for compliance versus applicable FCC Rules for broadcast transmitter acceptability for Part 74 use.

Test results indicate that all parameters were measured using industry standard practices and have demonstrated compliance with the appropriate FCC Rules.