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ROHDE & SCHWARZ MODEL TMU9

ATSC TRANSMITTER TECHNICAL REPORT

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TMU925 TRANSMITTER TECHNICAL REPORT

The following information is provided to support the technical performance of the R & S TMU9 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 four transmitter configurations meet the appropriate requirements. The transmitter configurations are exactly the same except for the number of power amplifiers that are combined. The models submitted are: 5 power amplifiers that produce 2.5 kW, 4 power amplifiers that produce 2.0 kW, 3 power amplifiers that produce 1.5 kW, and 2 power amplifiers that produce 1.0 kW. The transmitter configurations employing 3-5 power amplifiers have exactly the same hardware and software. The transmitter configuration with just 2 power amplifiers producing 1.0 kW uses a slightly different harmonic filter and emission mask filter at the transmitter output. Thus, there is one set of data for the configuration using 3-5 amplifiers and a separate emission mask data set for the transmitter configuration with 2 power amplifiers.

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 2500 watts and 800 watts for the 3-5 power amplifier configurations. Emission mask compliance measurements were also conducted over the 250 watts to 1000 watts range for the 2 power amplifier configuration. Thus, these are the ranges over which type certification for these transmitters are sought. The 3-5 power amplifier transmitter was tested with two emission mask filters from different sources so that the transmitter manufacturer could use either filter in the equipment. The test results for both filters are included in the data set for the 2500 watt and 800 watt power output (measured after the filter) levels.

The test equipment used for the measurements is listed at the end of this document.

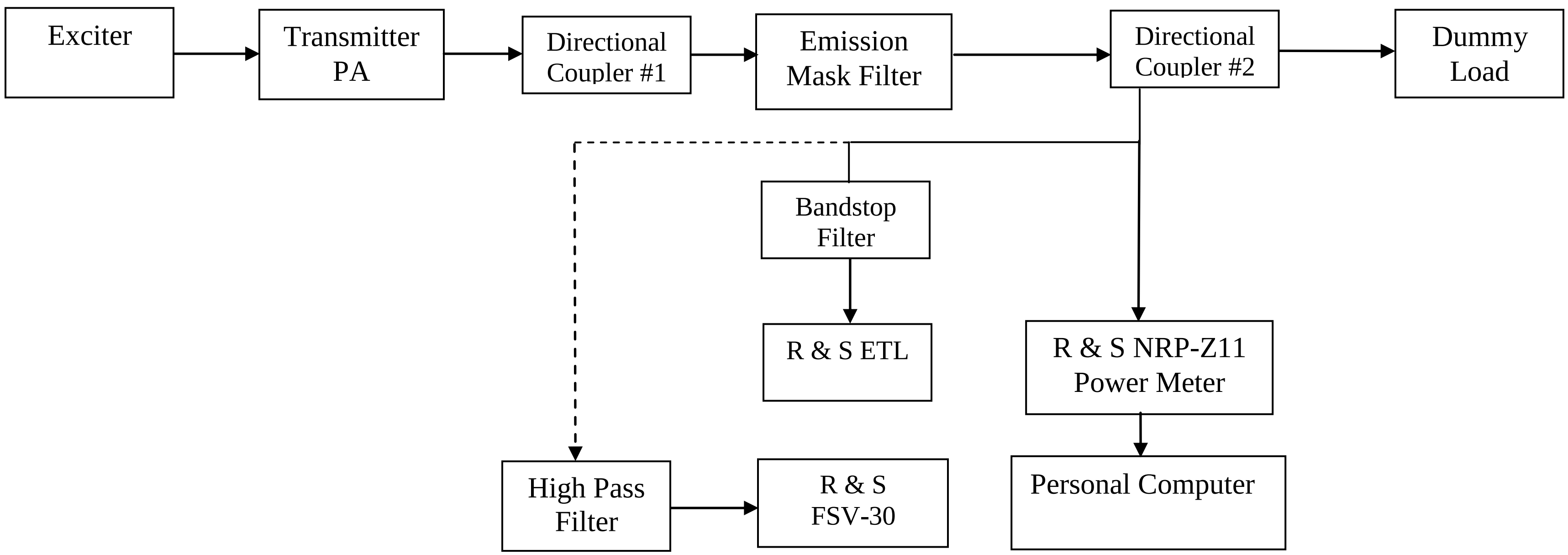


FIGURE 1—TEST EQUIPMENT CONFIGURATION

Note: The coupling factor of directional coupler #2 was determined to be 57.0 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 57.0 dB. Average power was measured with the R & S NRP-Z11 power sensor and displayed on the personal computer using Power Viewer Plus. The indicated reading is shown below.

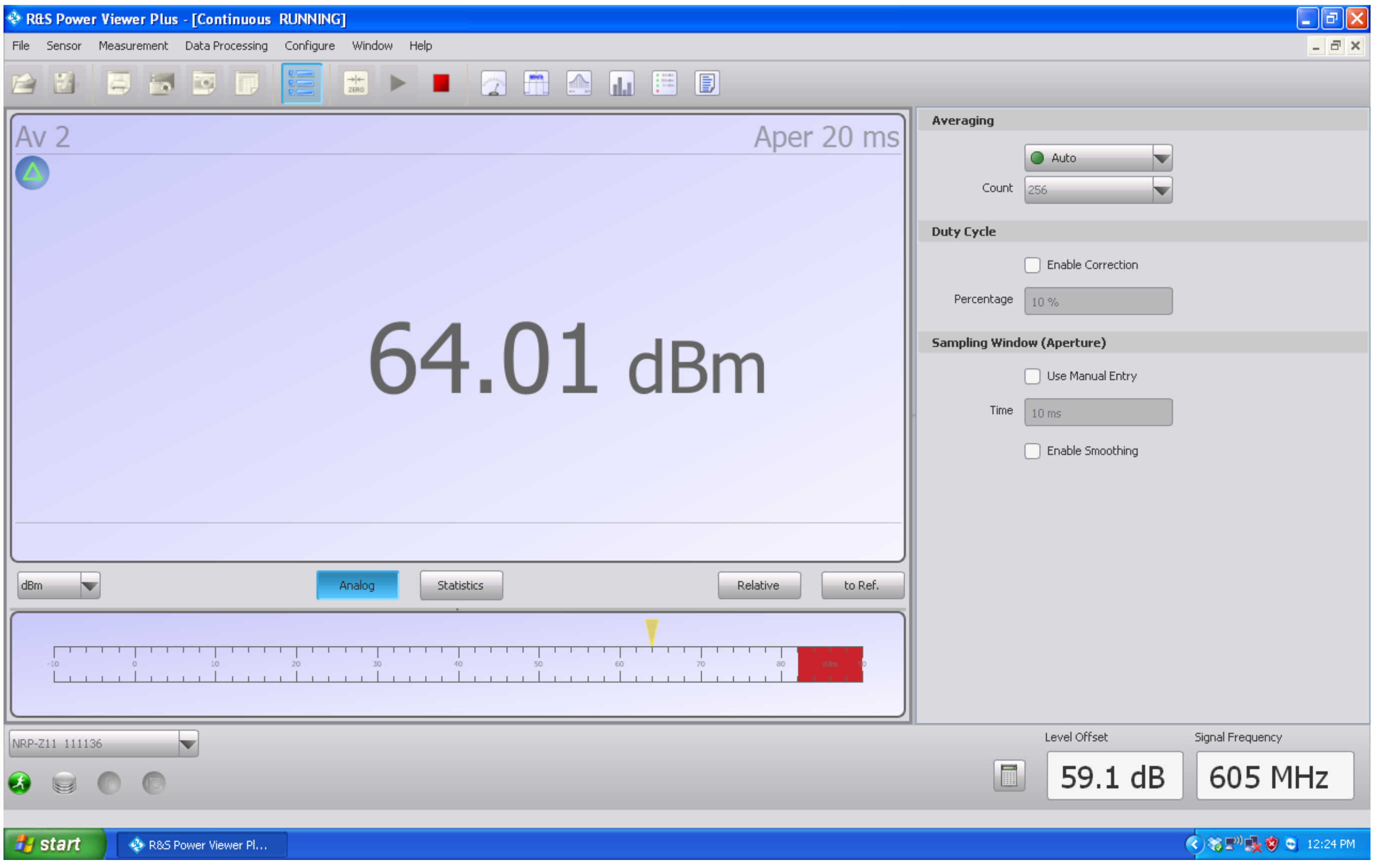


Figure 2—Power Meter Reading at Nominal Transmitter Power

Calculation of Output Power: An offset of 59.1dB from the directional coupler and cable loss was added to the Power Viewer Plus program. The actual value of 5.0 dBm was measured on the Power Viewer Plus display and then the offset value of 59.1 dBm was added to the cable and directional coupler coupling value to display the correct value of 64.0 dBm or 2500 watts. With this operating state, measured transmitter final amplifier voltage is at or below 50 VDC and final amplifier current is 271 Amps. The final RF amplifier stage currents from each amplifier were added and then summed. The power supply voltage for each amplifier was then multiplied by the total current for each amplifier to obtain the total DC power of 13.5 kW to 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 measurements, the R & S ETL spectrum analyzer was used and for harmonic and spurious measurements, the R & S FSV30 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 2500 watts on Channel 36 (center frequency of 605 MHz) as measured at the output of Directional coupler #2 and a reference was established on the ETL spectrum analyzer (using the channel power measurement mode). The bandstop filter insertion loss versus frequency response was previously determined using the ETL spectrum analyzer function 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 attenuation has been indicated in the next section with the table of measured emission values.

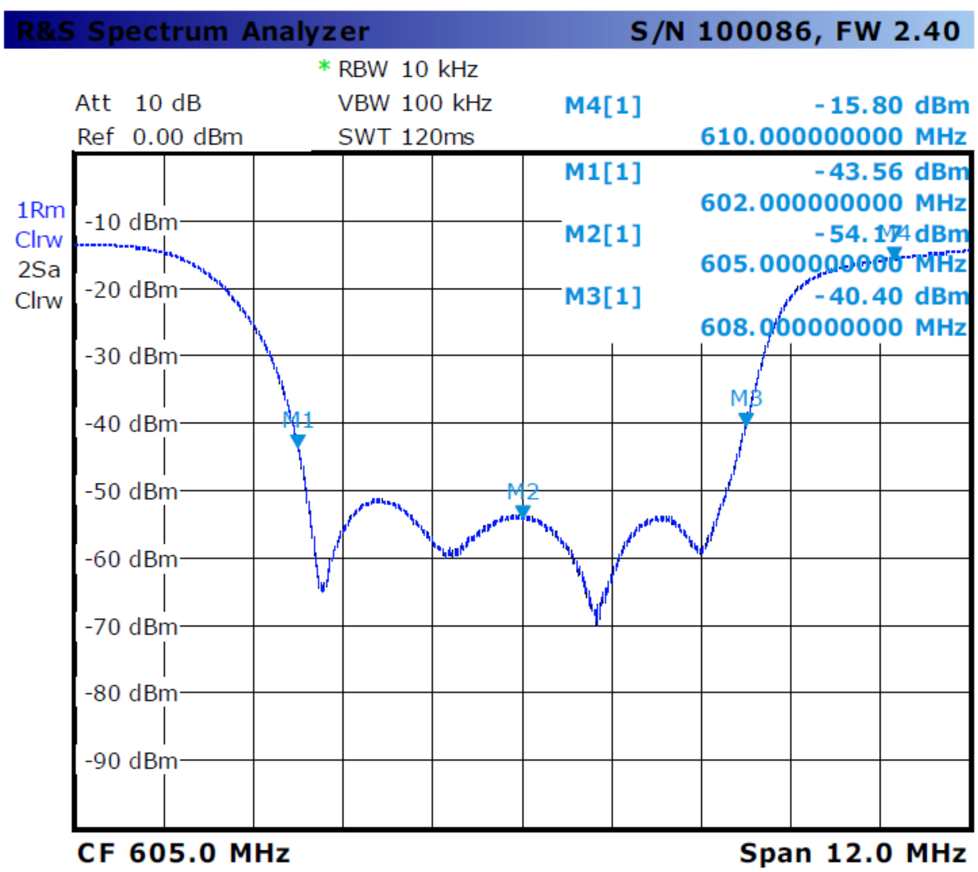


Figure 3 Bandstop Filter Response

The noise floor of the spectrum analyzer in the adjacent channels to channel 36 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 values for this are contained in the emission mask measurement tables on the following page.

The transmitter was energized at 2500 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 ETL 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).

The first set of data is with the emission mask filter made by Spinner and the second set of data is with the emission mask filter made by Dielectric. As can be seen, the adjacent channel energy present using either filter meets the emission mask requirements. The measurements for each filter are identified in the table of results.

Spinner Filter

ATSC TRANSMITTER *TEST REPORT*

2500 W

Spectrum Analyzer 10kHz RBW Noise Floor [dBm]	-120.0
Spectrum Analyzer 500kHz RBW Noise Floor [dBm]	-103.0
Noise floor proximity upper threshold [dBm]	-93.0
Noise floor proximity lower threshold [dBm]	-100.0

Min. Sample Level [dBm]	-26.8
Actual Sample Level [dBm]	2.7

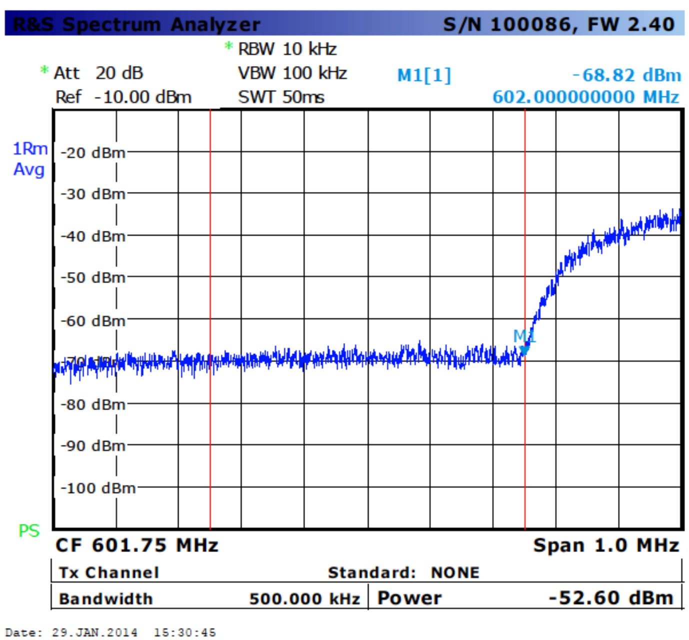
ATSC TRANSMISSION MASK COMPLIANCE TEST

Stringent Mask

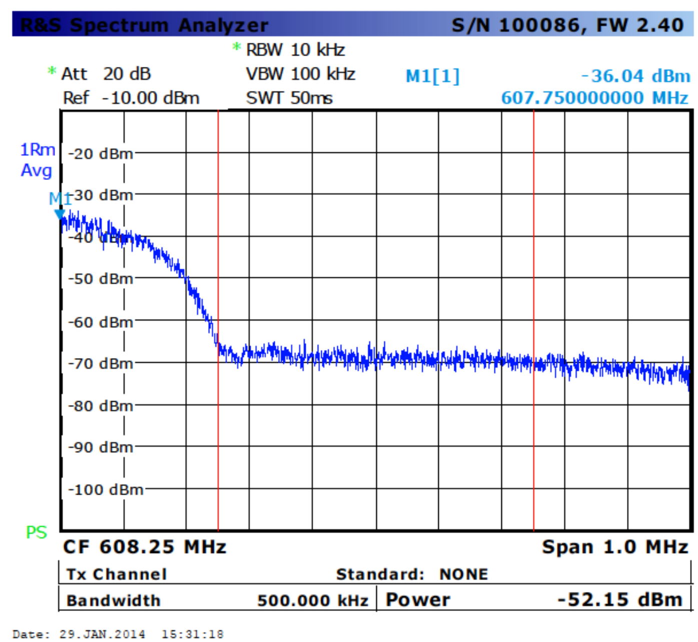
Channel Power [dBm]	2.7
Channel Number	36
Center Frequency [MHz]	605

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	-48.1	-48.1		-48.1	50.8	47.0	**Pass**
3.75	608.75	-55.3	-55.3		-55.3	58.0	49.9	**Pass**
4.25	609.25	-65.2	-65.2		-65.2	67.9	55.6	**Pass**
4.75	609.75	-69.0	-69.0		-69.0	71.7	61.4	**Pass**
5.25	610.25	-89.5	-89.5	2.9	-86.6	89.3	67.1	**Pass**
5.75	610.75	-98.6	-100.6	2.2	-98.4	101.1	71.9	**Pass**
6.25	611.25	-102.5	-103.0	1.8	-101.2	103.9	76.0	**Pass**
6.75	611.75	-102.2	-103.0	1.6	-101.4	104.1	76.0	**Pass**
7.25	612.25	-102.2	-103.0	1.4	-101.6	104.3	76.0	**Pass**

7.75	612.75	-102.4	-103.0	1.4	-101.6	104.3	76.0	**Pass**
8.25	613.25	-102.5	-103.0	1.4	-101.6	104.3	76.0	**Pass**
8.75	613.75	-102.7	-103.0	1.4	-101.6	104.3	76.0	**Pass**
-3.25	601.75	-48.6	-48.6		-48.6	51.3	47.0	**Pass**
-3.75	601.25	-53.9	-53.9		-53.9	56.6	49.9	**Pass**
-4.25	600.75	-62.8	-62.8		-62.8	65.5	55.6	**Pass**
-4.75	600.25	-67.7	-67.7		-67.7	70.4	61.4	**Pass**
-5.25	599.75	-84.5	-84.5	2.7	-81.8	84.5	67.1	**Pass**
-5.75	599.25	-92.6	-92.6	2.5	-90.1	92.8	71.9	**Pass**
-6.25	598.75	-97.8	-99.4	2.5	-96.9	99.6	76.0	**Pass**
-6.75	598.25	-100.6	-103.0	2.5	-100.5	103.2	76.0	**Pass**
-7.25	597.75	-101.7	-103.0	2.5	-100.5	103.2	76.0	**Pass**
-7.75	597.25	-102.0	-103.0	2.5	-100.5	103.2	76.0	**Pass**
-8.25	596.75	-102.3	-103.0	2.5	-100.5	103.2	76.0	**Pass**
-8.75	596.25	-102.4	-103.0	2.5	-100.5	103.2	76.0	**Pass**



LOWER SIDEBAND MEASUREMENT



UPPER SIDEBAND MEASUREMENT

Dielectric Filter

ATSC TRANSMITTER
TEST REPORT

2500 W

Spectrum Analyzer 10kHz RBW Noise Floor [dBm]	-120.0
Spectrum Analyzer 500kHz RBW Noise Floor [dBm]	-103.0
Noise floor proximity upper threshold [dBm]	-93.0
Noise floor proximity lower threshold [dBm]	-100.0

Min. Sample Level [dBm]	-26.8
Actual Sample Level [dBm]	2.7

ATSC TRANSMISSION MASK COMPLIANCE TEST

Stringent Mask

Channel Power [dBm]	2.7
Channel Number	36
Center Frequency [MHz]	605

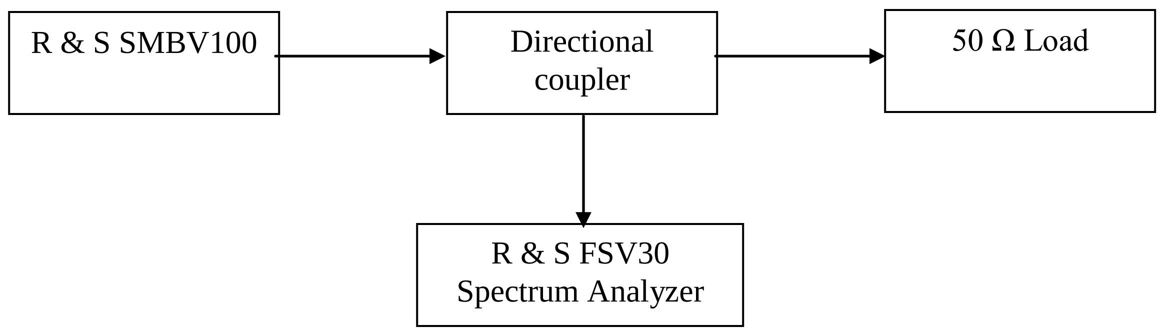
Delta Frequency [MHz]	Frequency [MHz]	Measured Amplitude [dBm]	Corrected for Noise Floor [dBm]	Bandstop Filter (dB)	Corrected Amplitude [dBm]	Amplitude below Channel Power [dB]	FCC Limit [dB]	Pass/Fail
3.25	608.25	-46.0	-46.0		-46.0	48.7	47.0	**Pass**
3.75	608.75	-50.0	-50.0		-50.0	52.7	49.9	**Pass**
4.25	609.25	-57.8	-57.8		-57.8	60.5	55.6	**Pass**
4.75	609.75	-65.3	-65.3		-65.3	68.0	61.4	**Pass**
5.25	610.25	-76.4	-76.4	2.9	-73.5	76.2	67.1	**Pass**
5.75	610.75	-84.0	-84.0	2.2	-81.8	84.5	71.9	**Pass**

6.25	611.25	-91.1	-91.1	1.8	-89.3	92.0	76.0	**Pass**
6.75	611.75	-97.7	-99.2	1.6	-97.6	100.3	76.0	**Pass**
7.25	612.25	-101.6	-103.0	1.4	-101.6	104.3	76.0	**Pass**
7.75	612.75	-102.5	-103.0	1.4	-101.6	104.3	76.0	**Pass**
8.25	613.25	-102.6	-103.0	1.4	-101.6	104.3	76.0	**Pass**
8.75	613.75	-102.5	-103.0	1.4	-101.6	104.3	76.0	**Pass**
-3.25	601.75	-46.6	-46.6		-46.6	49.3	47.0	**Pass**
-3.75	601.25	-49.2	-49.2		-49.2	51.9	49.9	**Pass**
-4.25	600.75	-56.7	-56.7		-56.7	59.4	55.6	**Pass**
-4.75	600.25	-63.1	-63.1		-63.1	65.8	61.4	**Pass**
-5.25	599.75	-78.6	-78.6	2.7	-75.9	78.6	67.1	**Pass**
-5.75	599.25	-86.1	-86.1	2.5	-83.6	86.3	71.9	**Pass**
-6.25	598.75	-92.8	-92.8	2.5	-90.3	93.0	76.0	**Pass**
-6.75	598.25	-98.2	-99.9	2.5	-97.4	100.1	76.0	**Pass**
-7.25	597.75	-101.0	-103.0	2.5	-100.5	103.2	76.0	**Pass**
-7.75	597.25	-101.9	-103.0	2.5	-100.5	103.2	76.0	**Pass**
-8.25	596.75	-102.1	-103.0	2.5	-100.5	103.2	76.0	**Pass**
-8.75	596.25	-102.3	-103.0	2.5	-100.5	103.2	76.0	**Pass**

HARMONIC AND SPURIOUS ENERGY

The next set of tests executed 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 high pass filter was used to prevent erroneous readings regarding harmonic performance of the transmitter. The filter kept the total energy low enough to prevent harmonic energy from being created in the spectrum analyzer at a level that was above the noise floor of the spectrum analyzer. The highpass filter was characterized using the ETL spectrum analyzer function and its tracking generator and for higher frequencies, the R & S SMBV100 signal generator and the FSV-30 spectrum analyzer were used. The highpass filter results are tabulated on the page following the harmonic results table.

The coupling at each harmonic frequency range was determined by calibrating the directional coupler mounted after the emission mask filter. The test set-up is shown below. The signal generator was set to theoretical harmonic spectrum center frequency and the coupling was measured for each harmonic up to the 10th harmonic. Directional coupler #2 coupling values at each of the harmonic frequency regions were tabulated and listed in the table on Page 12.



Calibration of Directional Coupler

Harmonic and spurious energy was measured using the setup of Figure 1. The harmonic measurement values were recorded using the R & S FSV-30. A high pass filter was used in the coupled signal path to permit the spectrum analyzer attenuation to be minimized without the spectrum analyzer being overloaded from the channel 36 signal. 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. Screen captures were made of the conducted harmonic energy at the worst case conditions (6th and 8th harmonics). They are provided beginning on the Page 15.

Spinner Filter

ATSC TRANSMISSION MASK COMPLIANCE TEST

Stringent Mask

Harmonics

Channel Power [dBm]	64.0
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	-102.0	5.1	50.3	-46.6	110.6	76.0	**Pass**
3rd	1815.00	-98.7	5.9	48.3	-44.5	108.5	76.0	**Pass**
4th	2420.00	-98.1	7.4	43.7	-47.0	111.0	76.0	**Pass**
5th	3025.00	-101.9	9.2	38.8	-53.9	117.9	76.0	**Pass**
6th	3630.00	-71.5	9.5	28.6	-33.4	97.4	76.0	**Pass**
7th	4235.00	-89.1	12.0	29.3	-47.8	111.8	76.0	**Pass**
8th	4840.00	-87.0	13.1	30.3	-43.6	107.6	76.0	**Pass**
9th	5445.00	-100.5	13.8	16.7	-70.0	134.0	76.0	**Pass**
10th	6050.00	-100.9	15.1	22.9	-62.9	126.9	76.0	**Pass**

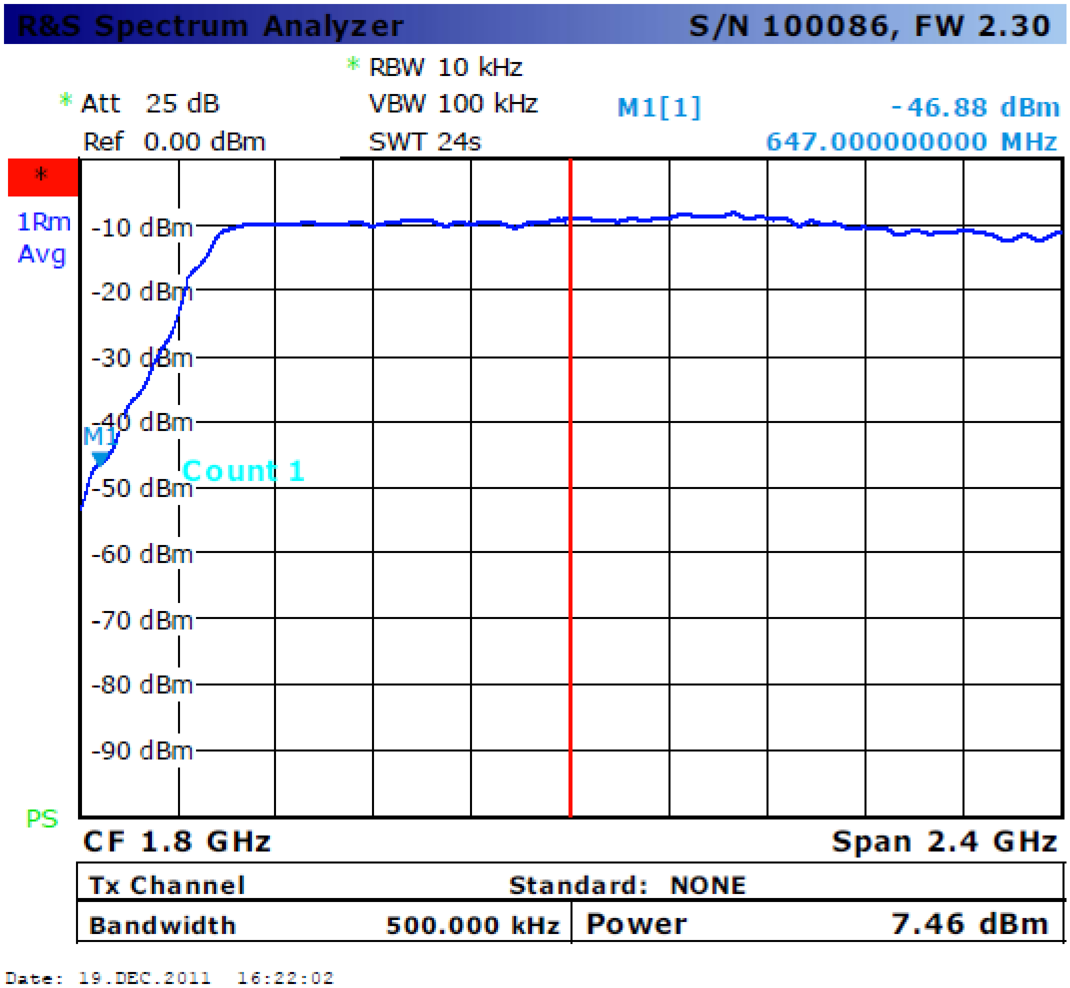
Dielectric Filter

ATSC TRANSMISSION MASK COMPLIANCE TEST

HARMONICS

Channel Power [dBm]	64.0
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	-100.0	5.1	50.3	-44.6	108.6	76.0	**Pass**
3rd	1815.00	-97.6	5.9	48.3	-43.4	107.4	76.0	**Pass**
4th	2420.00	-83.1	7.4	43.7	-32.0	96.0	76.0	**Pass**
5th	3025.00	-99.2	9.2	38.8	-51.2	115.2	76.0	**Pass**
6th	3630.00	-64.5	9.5	28.6	-26.4	90.4	76.0	**Pass**
7th	4235.00	-97.9	12.0	29.3	-56.6	120.6	76.0	**Pass**
8th	4840.00	-95.7	13.1	30.3	-52.3	116.3	76.0	**Pass**
9th	5445.00	-97.4	13.8	16.7	-66.9	130.9	76.0	**Pass**
10th	6050.00	-97.3	15.1	22.9	-59.3	123.3	76.0	**Pass**

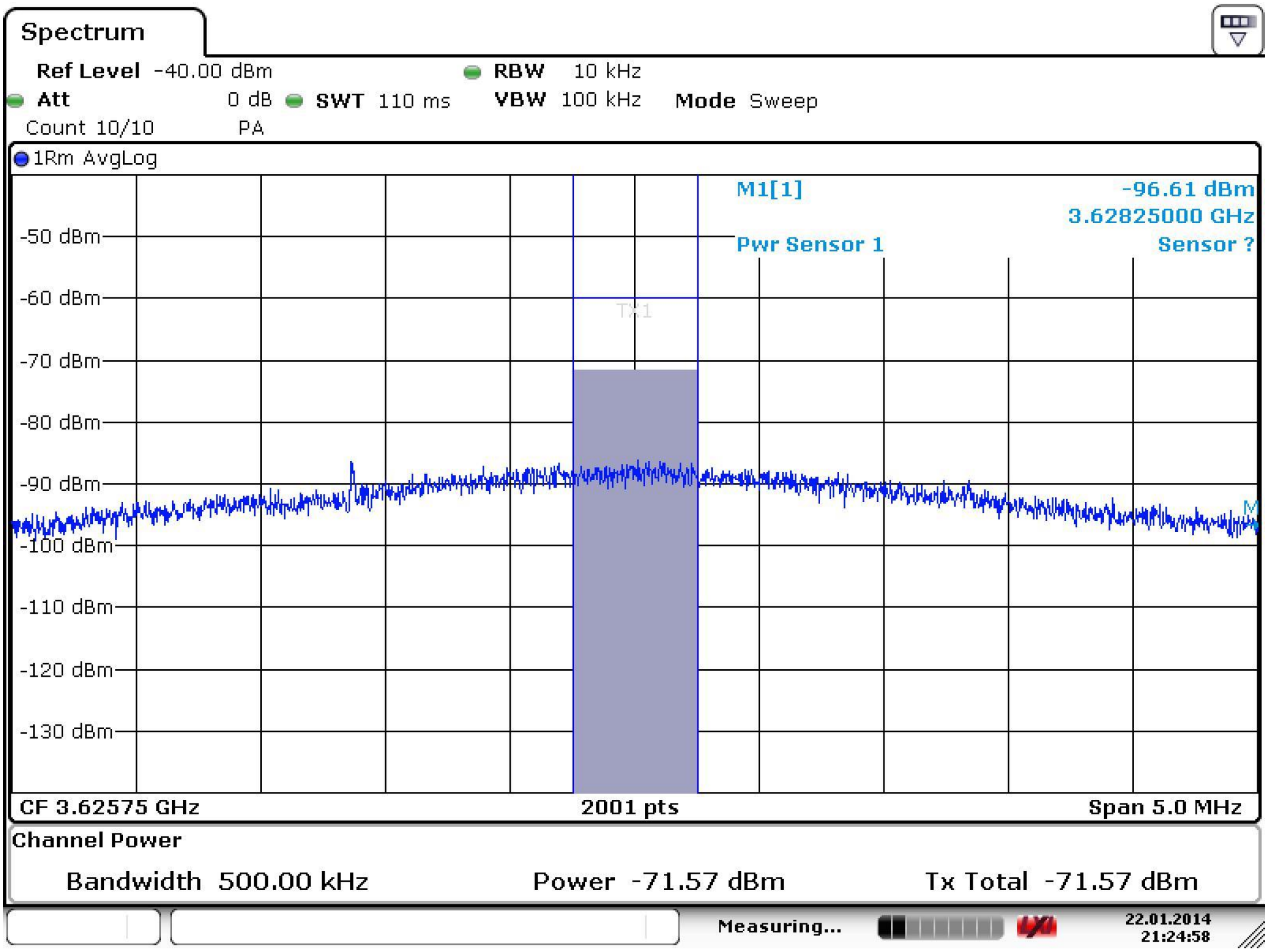


SWEPT RESPONSE OF HIGH PASS FILTER USING
TRACKING GENERATOR AND SPECTRUM ANALYZER

HPF & Cable Loss Tabulated Values

Frequency (MHz)	Reference (dBm)	Measured Value (dBm)	HPF + Cable Loss (dB)
605	-20.0	-42.7	42.7
1210	-20.0	-25.1	5.1
1815	-20.0	-25.9	5.9
2420	-20.0	-27.4	7.4
3025	-20.0	-29.2	9.2
3630	-20.0	-29.5	9.5
4235	-20.0	-32.0	12.0
4840	-20.0	-33.1	13.1
5445	-20.0	-33.8	13.8
6050	-20.0	-35.1	15.1

Harmonic Spectrum with Spinner Filter



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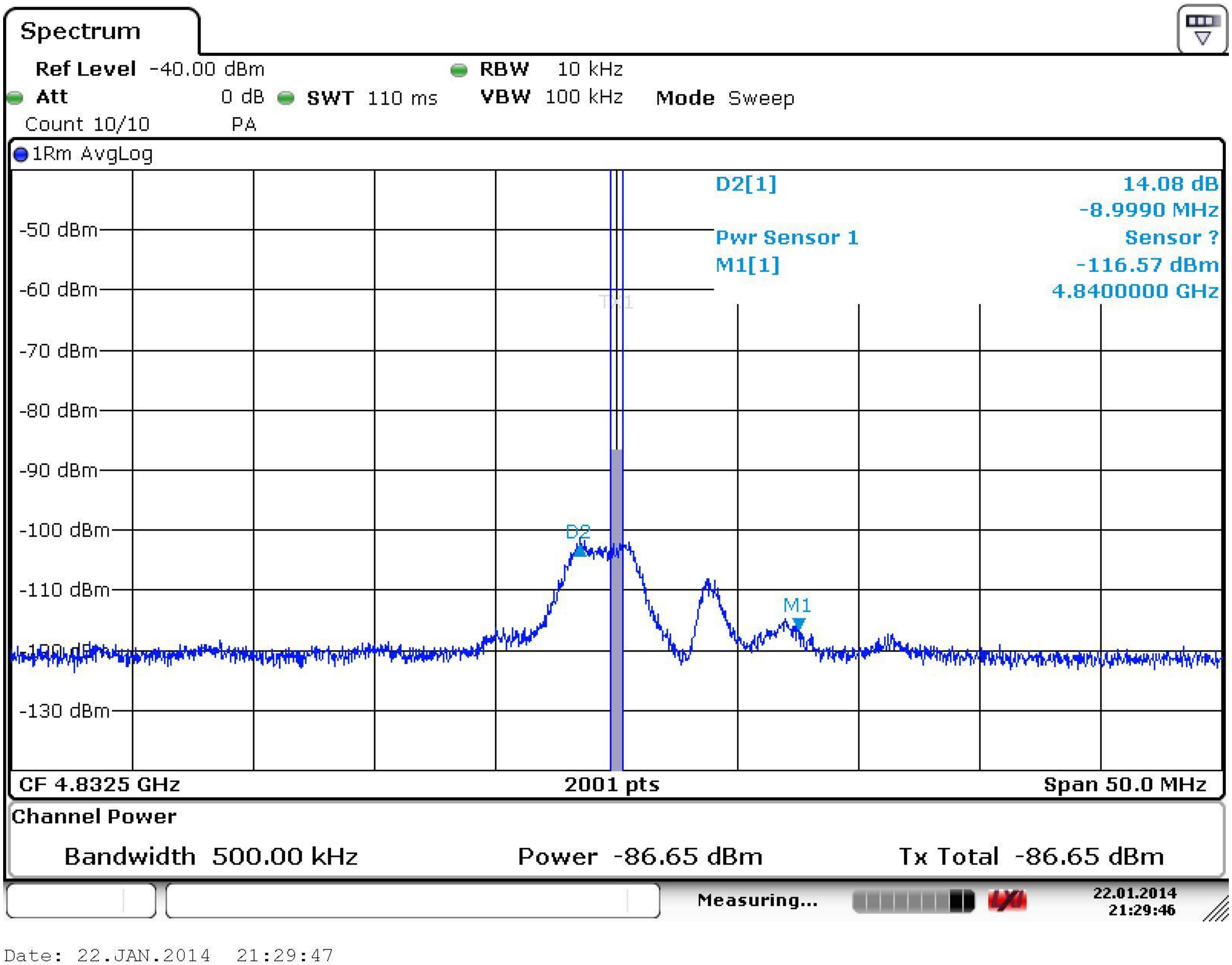
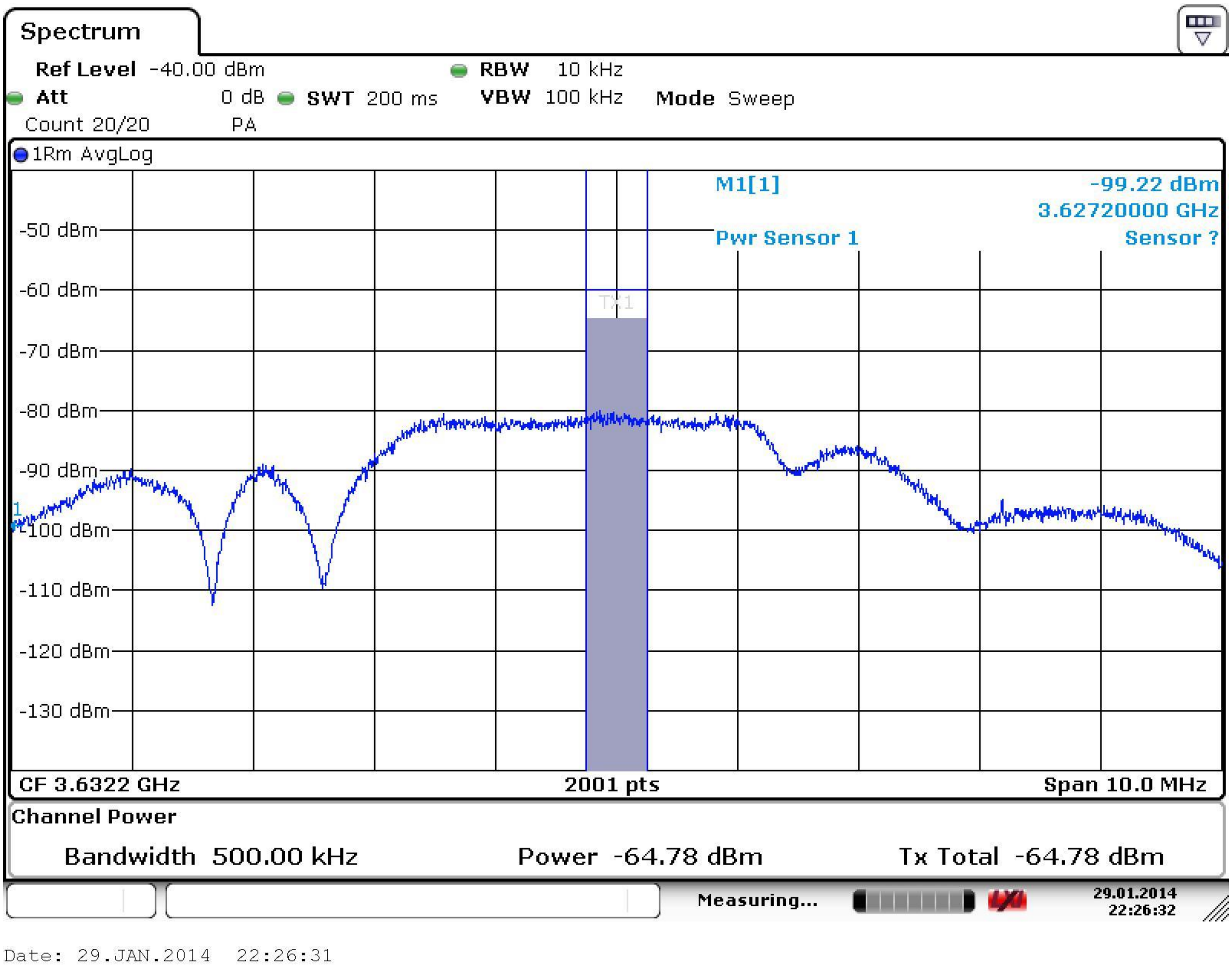
6th Harmonic Spectrum

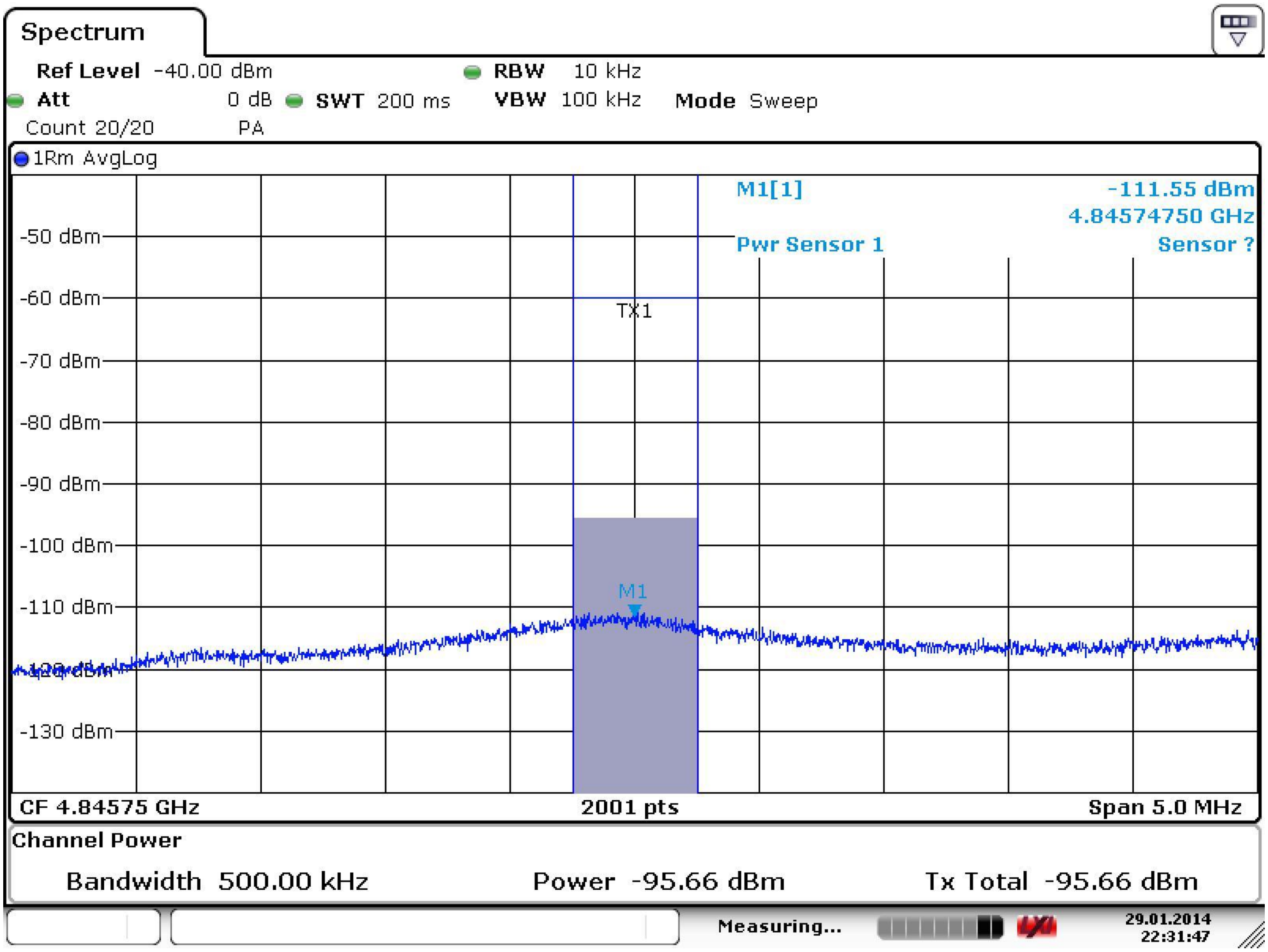


8th Harmonic Spectrum

Harmonic Spectrum with Dielectric Filter



6th Harmonic Spectrum



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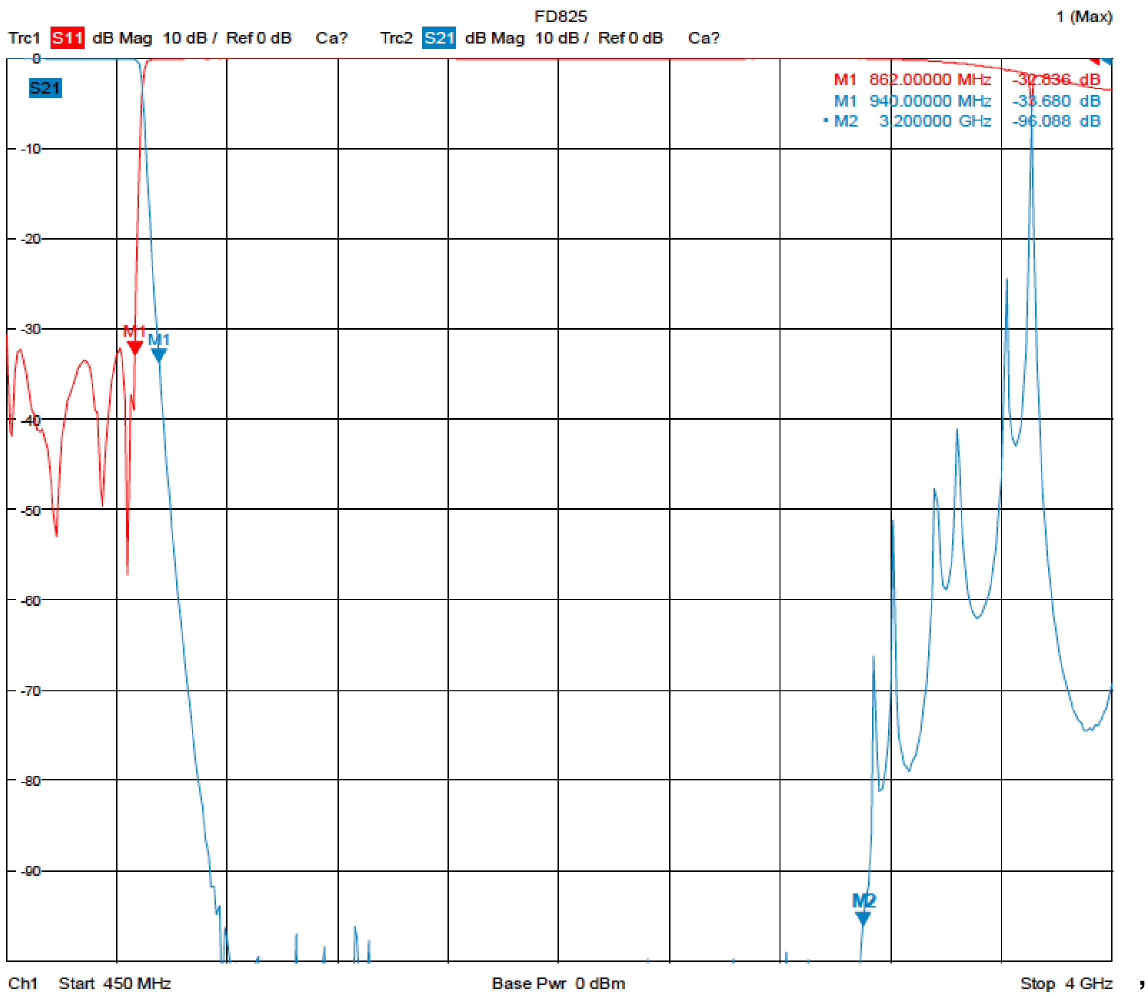
8th Harmonic Spectrum

Filter Attenuation to GPS Band Frequencies

The plot below indicates the amount of attenuation from the harmonic filter used for the 3-5 power amplifier transmitter configuration to energy that would fall into the GPS bands from 1.1 GHz to 1.61 GHz. As can be seen by these plots, the attenuation by the harmonic filter alone is equal to or greater than 85 dB as specified by FCC Rule 74.794 (b) (1). Therefore compliance to the rule is demonstrated.

HARMONIC FILTER ATTENUATION AT GPS BAND FREQUENCIES



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 DTV 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	3:05	0	602,309,488.8	Reference (Start of Test)
1/13/2014	3:20	0	602,309,486.9	1.9
1/13/2014	3:40	10	602,309,484.8	4.0
1/13/2014	4:05	20	602,309,482.2	6.6
1/13/2014	4:25	25	602,309,480.4	8.4
1/13/2014	4:40	30	602,309,479.2	9.6
1/13/2014	5:00	40	602,309,477.7	11.1
1/13/2014	5:20	45	602,309,475.8	13.0

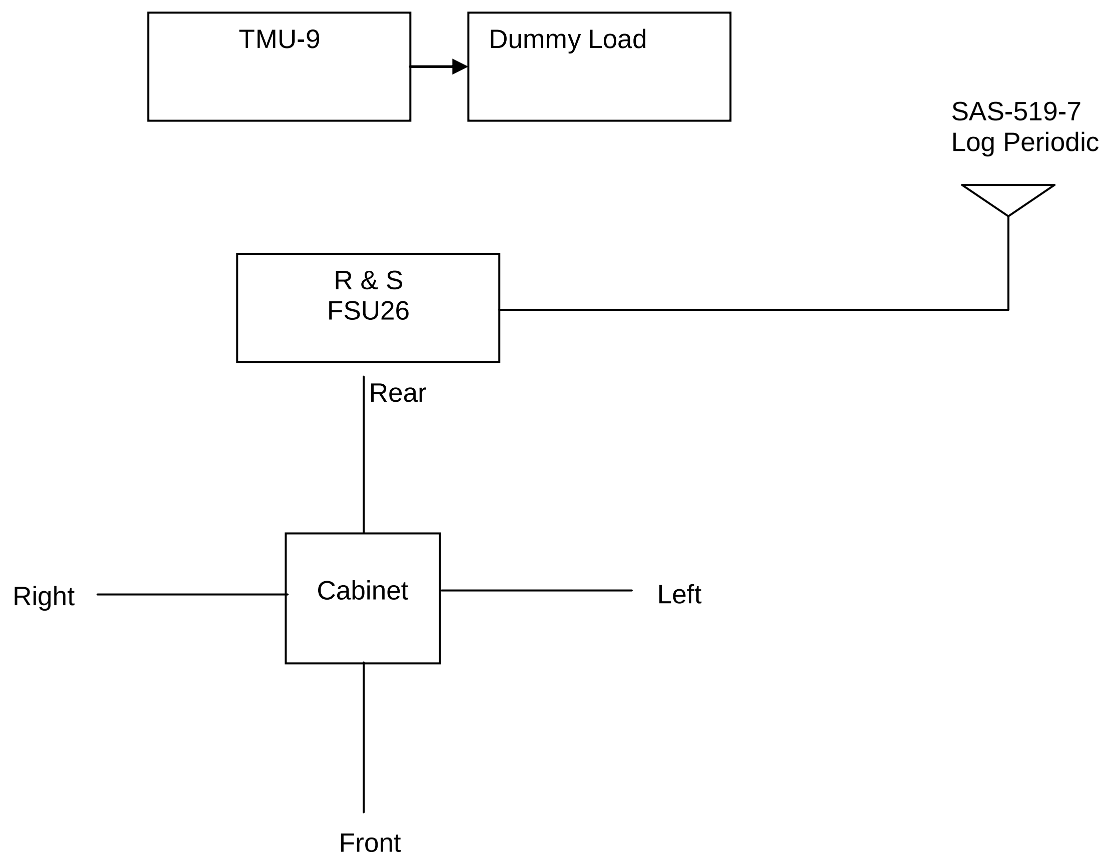
The line voltage was adjusted for nominal voltage and the frequency was recorded. Then the line voltage was adjusted to 85% and 115% of the nominal voltage and the frequency was recorded at each voltage level. The results are tabulated below:

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 2500 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 9.1 meters in 4 different physical rotation angles: 0° (front), 90° (right), 180° (Rear), and 270° (Left). The cabinet radiation was measured in four directions 90 degrees apart so that all angles of the transmitter were evaluated. The measured value for each spectrum emission emanating from the cabinet was recorded in the tables beginning on the next page.

Test Equipment Configuration for Cabinet Radiation



Cabinet Radiation Test Results

As indicated from the table data on the following pages, the worst case measurement was -97.4 dB 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 and Parameters
Test Date	January 23, 2014
Test Engineer	Greg Best
Transmitter Model Number	TMU-9
Operating Power Output Level	64.0 dBm 2500 watts
Center Frequency	0.605 GHz Channel 36
Antenna Model Number	A H Systems SAS 519-7 Log Periodic Serial Number 160
Spectrum Analyzer Model	R & S FSV30
Distance to Transmitter	9.1 meters

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.

0 DEGREE VIEW

Harmonic	Center Frequency GHz	Signal Level dBm	Cable Loss dB	Antenna Gain dB	Path Loss dB	Adj Level dBm	Maximum Permitted Level dBm	Status P=Pass
Fundamental	0.605	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2	1.21	-91	1.0	7.7	53.34	-44.4	4.0	P
3	1.815	-106.5	1.0	6.7	56.86	-55.3	4.0	P
4	2.42	-99.7	1.7	6.8	59.36	-45.4	4.0	P
5	3.025	-106.5	2.0	5.1	61.30	-48.3	4.0	P
6	3.63	-106.3	2.0	6.7	62.88	-48.1	4.0	P
7	4.235	-106.5	2.8	6.6	64.22	-46.1	4.0	P
8	4.84	-106	3.2	7.7	65.38	-45.1	4.0	P
9	5.445	-105.3	3.1	7.9	66.40	-43.7	4.0	P
10	6.05	-104.2	3.6	5.6	67.32	-38.9	4.0	P

90 DEGREE VIEW

Harmonic	Center Frequency GHz	Signal Level dBm	Cable Loss dB	Antenna Gain dB	Path Loss 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	-106	1.0	7.7	53.34	-59.4	4.0	P
3	1.815	-100	1.0	6.7	56.86	-48.8	4.0	P
4	2.42	-101	1.7	6.8	59.36	-46.7	4.0	P
5	3.025	-107	2.0	5.1	61.30	-48.8	4.0	P
6	3.63	-105	2.0	6.7	62.88	-46.8	4.0	P
7	4.235	-106.5	2.8	6.6	64.22	-46.1	4.0	P
8	4.84	-106	3.2	7.7	65.38	-45.1	4.0	P
9	5.445	-105	3.1	7.9	66.40	-43.4	4.0	P
10	6.05	-104	3.6	5.6	67.32	-38.7	4.0	P

180 DEGREE VIEW

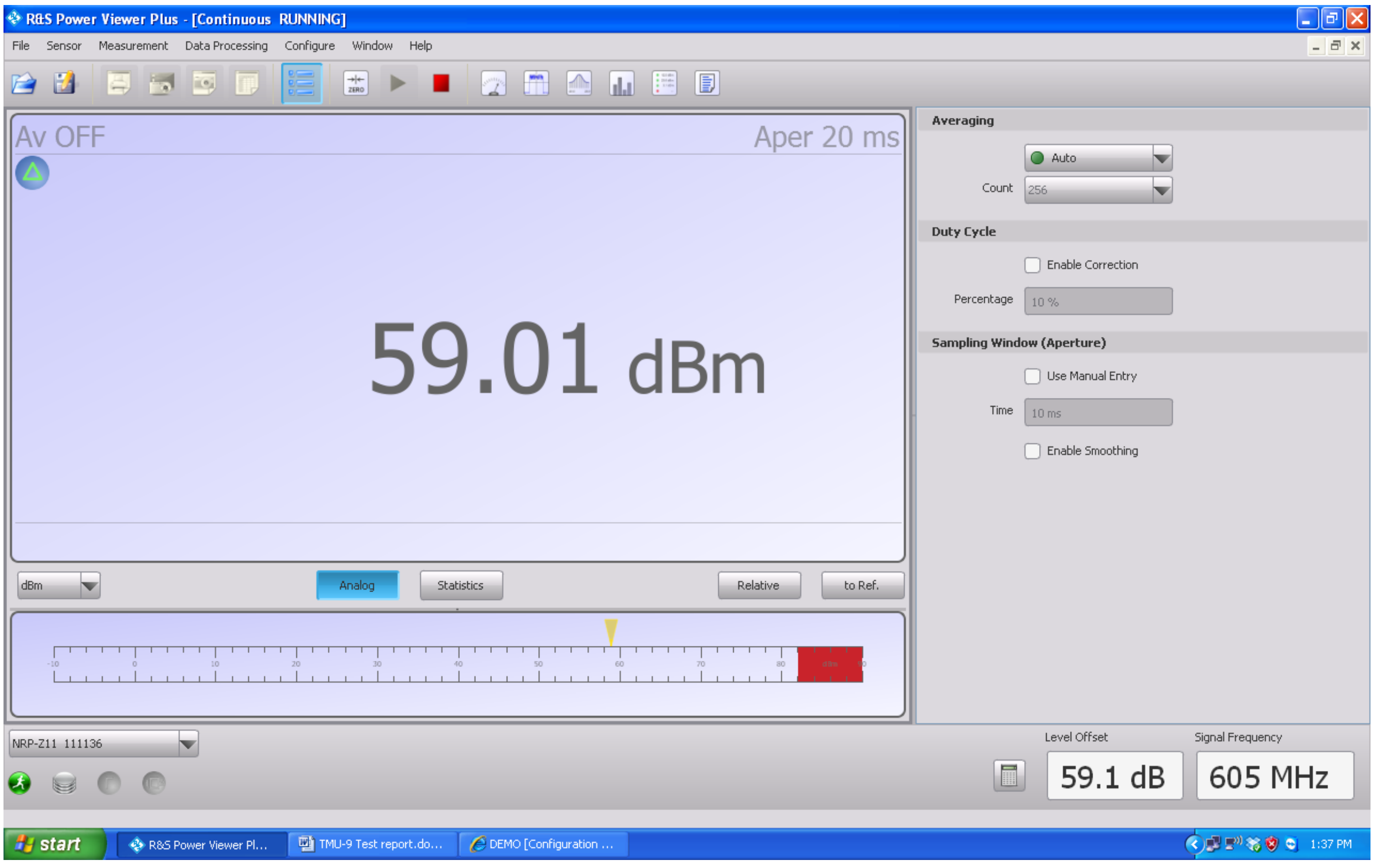
Harmonic	Center Frequency GHz	Signal Level dBm	Cable Loss dB	Antenna Gain dB	Path Loss dB	Adj. Level dBm	Maximum Level dBm	Status
Fundamental	0.605	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2	1.21	-92.5	1.0	7.7	53.34	-45.9	4.0	P
3	1.815	-101.9	1.0	6.7	56.86	-50.7	4.0	P
4	2.42	-103.3	1.7	6.8	59.36	-49.0	4.0	P
5	3.025	-107	2.0	5.1	61.30	-48.8	4.0	P
6	3.63	-106.2	2.0	6.7	62.88	-48.0	4.0	P
7	4.235	-106.5	2.8	6.6	64.22	-46.1	4.0	P
8	4.84	-106	3.2	7.7	65.38	-45.1	4.0	P
9	5.445	-105.3	3.1	7.9	66.40	-43.7	4.0	P
10	6.05	-104.1	3.6	5.6	67.32	-38.8	4.0	P

270 DEGREE VIEW

Harmonic	Center Frequency GHz	Signal Level dBm	Cable Loss dB	Antenna Gain dB	Path Loss 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	-80	1.0	7.7	53.34	-33.4	4.0	P
3	1.815	-106	1.0	6.7	56.86	-54.8	4.0	P
4	2.42	-97.5	1.7	6.8	59.36	-43.2	4.0	P
5	3.025	-106.5	2.0	5.1	61.30	-48.3	4.0	P
6	3.63	-104	2.0	6.7	62.88	-45.8	4.0	P
7	4.235	-106.4	2.8	6.6	64.22	-46.0	4.0	P
8	4.84	-106	3.2	7.7	65.38	-45.1	4.0	P
9	5.445	-105	3.1	7.9	66.40	-43.4	4.0	P
10	6.05	-104.3	3.6	5.6	67.32	-39.0	4.0	P

Low Power Operation---800 Watts

For operation at power levels below 2500 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 800 watts. Average power was measured with the R & S NRP-Z11 power sensor and displayed on the personal computer using Power Viewer Plus. The indicated reading is shown below.



Calculation of Output Power: An offset of 59.1 dB from the directional coupler and cable loss was added to the Power Viewer Plus program. The actual value of -0.05 dBm was measured on the Power Viewer Plus display and then the offset value of 59.1 dBm was added to the cable and directional coupler coupling value to display the correct value of 59.05 dBm or 800 watts. With this operating state, measured transmitter final amplifier voltage is at or below 50 VDC and final amplifier current is 149 Amps. The final RF amplifier stage currents from each amplifier were added and then summed. The power supply voltage for each amplifier was then multiplied by the total current for each amplifier to obtain the total DC power of 7450 watts to the final amplifier stage.

Emission Mask Compliance   800 Watts Output Power

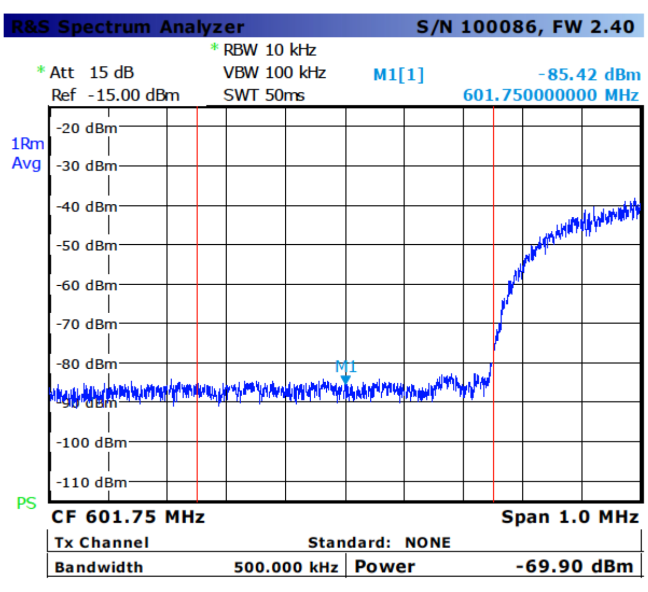
To determine conducted radiation emission mask compliance, the test equipment configuration shown on Figure 1 was used. For adjacent channel measurements, the R & S ETL spectrum analyzer was used and for frequencies above 3 GHz, the R & S FSU26 was used. The transmitter was tested for compliance with 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 800 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 2500 watts was also used for this set of measurements at 800 watts.

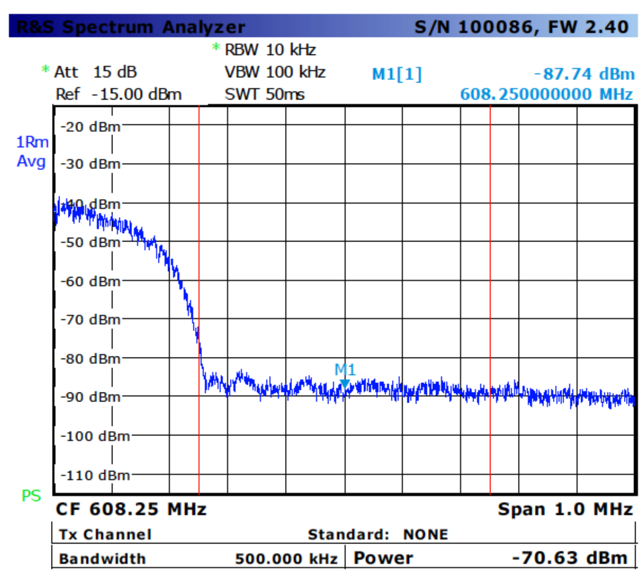
The noise floor of the spectrum analyzer was found. From that, the minimum RF sample level was determined (assuming the transmitter exactly met the emission mask requirements identified in the FCC rules). The actual RF sample level was well above the required minimum RF sample so plenty of margin was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

Spinner Filter

ATSC TRANSMITTER
TEST REPORT

800 W

Spectrum Analyzer 10kHz RBW Noise Floor [dBm]	-120.0
Spectrum Analyzer 500kHz RBW Noise Floor [dBm]	-103.0
Noise floor proximity upper threshold [dBm]	-93.0
Noise floor proximity lower threshold [dBm]	-100.0

Min. Sample Level [dBm]	-26.8
Actual Sample Level [dBm]	-2.3

ATSC TRANSMISSION MASK COMPLIANCE TEST
Stringent Mask

Channel Power [dBm]	-2.3
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	-60.6	-60.6		-60.6	58.3	47.0	**Pass**
3.75	608.75	-65.9	-65.9		-65.9	63.6	49.9	**Pass**
4.25	609.25	-72.2	-72.2		-72.2	69.9	55.6	**Pass**
4.75	609.75	-74.5	-74.5		-74.5	72.2	61.4	**Pass**
5.25	610.25	-97.9	-99.5	2.9	-96.6	94.3	67.1	**Pass**
5.75	610.75	-101.9	-103.0	2.2	-100.8	98.5	71.9	**Pass**
6.25	611.25	-102.9	-103.0	1.8	-101.2	98.9	76.0	**Pass**

6.75	611.75	-102.7	-103.0	1.6	-101.4	99.1	76.0	**Pass**
7.25	612.25	-102.8	-103.0	1.4	-101.6	99.3	76.0	**Pass**
7.75	612.75	-102.9	-103.0	1.4	-101.6	99.3	76.0	**Pass**
8.25	613.25	-103.0	-103.0	1.4	-101.6	99.3	76.0	**Pass**
8.75	613.75	-103.0	-103.0	1.4	-101.6	99.3	76.0	**Pass**
-3.25	601.75	-65.2	-65.2		-65.2	62.9	47.0	**Pass**
-3.75	601.25	-71.5	-71.5		-71.5	69.2	49.9	**Pass**
-4.25	600.75	-73.6	-73.6		-73.6	71.3	55.6	**Pass**
-4.75	600.25	-73.7	-73.7		-73.7	71.4	61.4	**Pass**
-5.25	599.75	-98.4	-100.2	2.7	-97.5	95.2	67.1	**Pass**
-5.75	599.25	-100.7	-103.0	2.5	-100.5	98.2	71.9	**Pass**
-6.25	598.75	-101.7	-103.0	2.5	-100.5	98.2	76.0	**Pass**
-6.75	598.25	-102.2	-103.0	2.5	-100.5	98.2	76.0	**Pass**
-7.25	597.75	-102.4	-103.0	2.5	-100.5	98.2	76.0	**Pass**
-7.75	597.25	-102.5	-103.0	2.5	-100.5	98.2	76.0	**Pass**
-8.25	596.75	-102.6	-103.0	2.5	-100.5	98.2	76.0	**Pass**
-8.75	596.25	-102.6	-103.0	2.5	-100.5	98.2	76.0	**Pass**

Dielectric Filter

ATSC TRANSMITTER
TEST REPORT

800 W

Spectrum Analyzer 10kHz RBW Noise Floor [dBm]	-120.0
Spectrum Analyzer 500kHz RBW Noise Floor [dBm]	-103.0
Noise floor proximity upper threshold [dBm]	-93.0
Noise floor proximity lower threshold [dBm]	-100.0

Min. Sample Level [dBm]	-26.8
Actual Sample Level [dBm]	-2.2

ATSC TRANSMISSION MASK COMPLIANCE TEST
Stringent Mask

Channel Power [dBm]	-2.2
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	-64.3	-64.3		-64.3	62.1	47.0	**Pass**
3.75	608.75	-67.8	-67.8		-67.8	65.6	49.9	**Pass**
4.25	609.25	-71.7	-71.7		-71.7	69.5	55.6	**Pass**
4.75	609.75	-73.6	-73.6		-73.6	71.4	61.4	**Pass**
5.25	610.25	-97.3	-98.7	2.9	-95.8	93.6	67.1	**Pass**

5.75	610.75	-100.7	-103.0	2.2	-100.8	98.6	71.9	**Pass**
6.25	611.25	-102.4	-103.0	1.8	-101.2	99.0	76.0	**Pass**
6.75	611.75	-102.5	-103.0	1.6	-101.4	99.2	76.0	**Pass**
7.25	612.25	-102.9	-103.0	1.4	-101.6	99.4	76.0	**Pass**
7.75	612.75	-102.9	-103.0	1.4	-101.6	99.4	76.0	**Pass**
8.25	613.25	-102.8	-103.0	1.4	-101.6	99.4	76.0	**Pass**
8.75	613.75	-102.8	-103.0	1.4	-101.6	99.4	76.0	**Pass**
-3.25	601.75	-63.6	-63.6		-63.6	61.4	47.0	**Pass**
-3.75	601.25	-65.4	-65.4		-65.4	63.2	49.9	**Pass**
-4.25	600.75	-69.9	-69.9		-69.9	67.7	55.6	**Pass**
-4.75	600.25	-76.0	-76.0		-76.0	73.8	61.4	**Pass**
-5.25	599.75	-97.0	-98.3	2.7	-95.6	93.4	67.1	**Pass**
-5.75	599.25	-100.7	-103.0	2.5	-100.5	98.3	71.9	**Pass**
-6.25	598.75	-102.0	-103.0	2.5	-100.5	98.3	76.0	**Pass**
-6.75	598.25	-102.3	-103.0	2.5	-100.5	98.3	76.0	**Pass**
-7.25	597.75	-102.4	-103.0	2.5	-100.5	98.3	76.0	**Pass**
-7.75	597.25	-102.4	-103.0	2.5	-100.5	98.3	76.0	**Pass**
-8.25	596.75	-102.4	-103.0	2.5	-100.5	98.3	76.0	**Pass**
-8.75	596.25	-102.4	-103.0	2.5	-100.5	98.3	76.0	**Pass**

HARMONIC AND SPURIOUS ENERGY

The next set of data were measurements of conducted radiation 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 high pass filter was used to prevent erroneous readings regarding harmonic performance of the transmitter. The filter kept the total energy low enough to prevent harmonic energy from being created in the spectrum analyzer at a level that was above the noise floor of the spectrum analyzer. The highpass filter was characterized using the ETL spectrum analyzer function and its tracking generator and for higher frequencies, the R & S SMBV100 signal generator and the FSV-30 spectrum analyzer were used and the results are tabulated on the page following the harmonic results table.

The coupling at each harmonic frequency range was determined by calibrating the directional coupler mounted after the emission mask filter. The signal generator was set to the theoretical harmonic spectrum center frequency and the coupling was measured for each harmonic up to the 10^{th} harmonic. Directional coupler #2 coupling values at each of the harmonic frequency regions were recorded and are listed in the table on the following page.

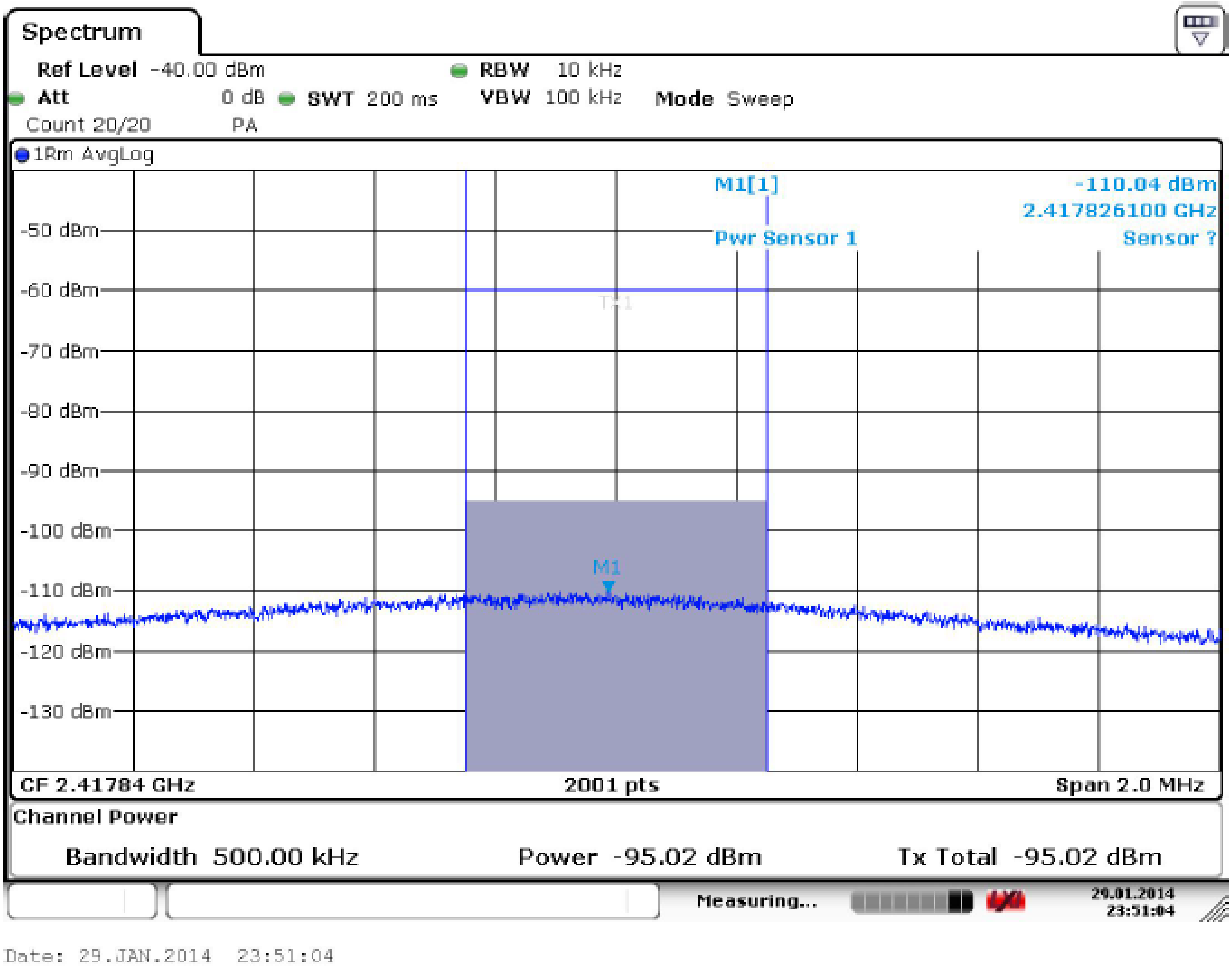
Harmonic and spurious energy was measured using the setup of Figure 1. A high pass filter was used in the coupled signal path to permit the spectrum analyzer attenuation to be minimized without the spectrum analyzer being overloaded from the channel 36 signal. The only energy coming from the transmitter 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. Screen captures of the conducted harmonic energy at the worst case conditions (5^{th} and 6^{th} harmonics) were taken.

ATSC TRANSMISSION MASK COMPLIANCE TEST

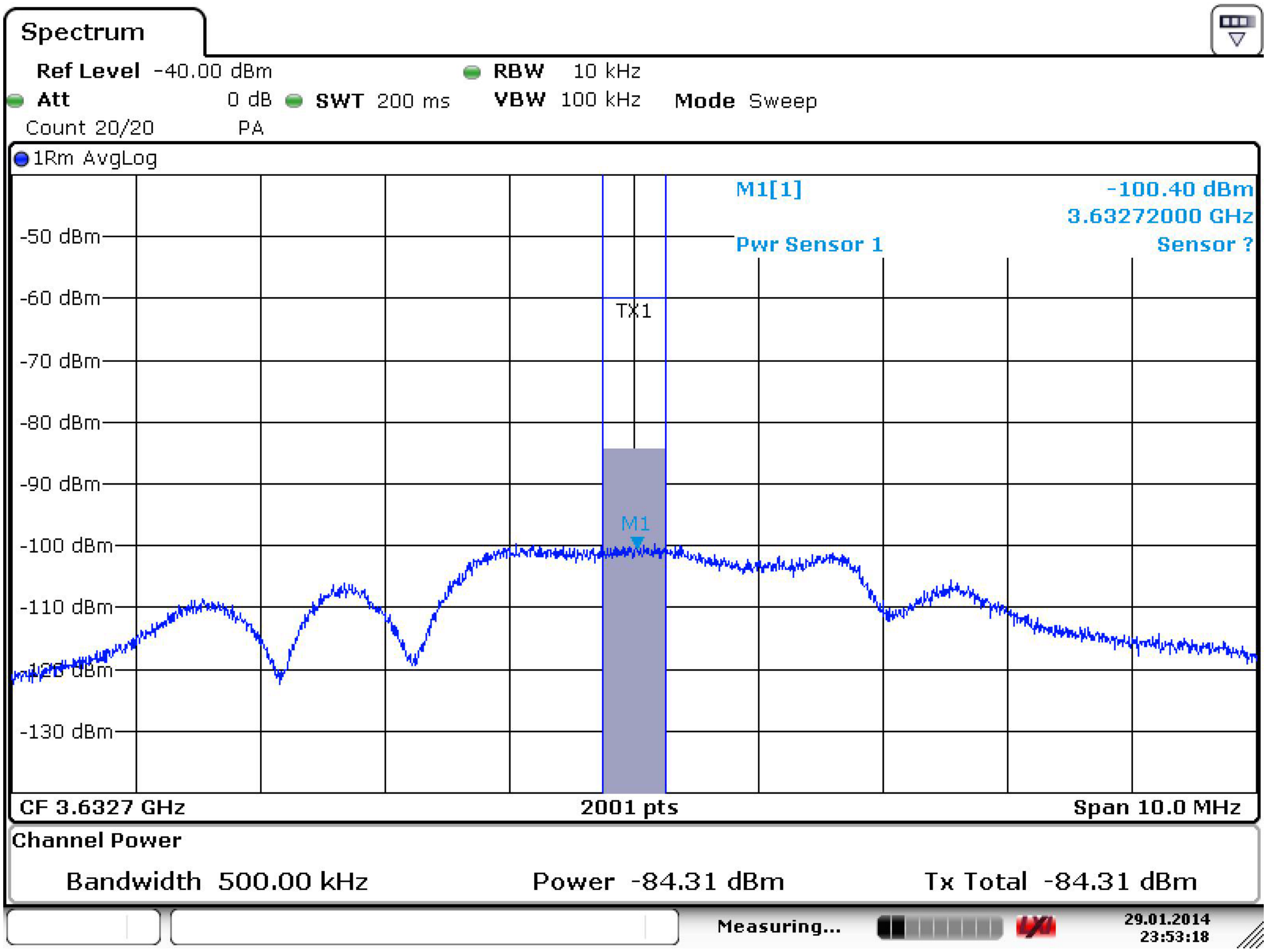
HARMONICS

Channel Power [dBm]	59.5
Channel Number	43
Center Frequency [MHz]	647

Harmonic	Frequency [MHz]	Measured Amplitude [dBm]	COUPLING	Corrected Amplitude [dBm]	Amplitude below Channel Power[dB]	FCC Limit [dB]	Pass/Fail
2nd	1294	-102.0	44.0	-58.0	117.6	76.0	**Pass**
3rd	1941	-96.7	40.5	-56.2	115.8	76.0	**Pass**
4th	2588	-99.0	38.0	-61.0	120.6	76.0	**Pass**
5th	3235	-93.9	36.0	-57.9	117.5	76.0	**Pass**
6th	3882	-95.2	34.4	-60.8	120.4	76.0	**Pass**
7th	4529	-95.4	33.1	-62.3	121.9	76.0	**Pass**
8th	5176	-96.0	31.9	-64.1	123.7	76.0	**Pass**
9th	5823	-95.6	30.9	-64.7	124.3	76.0	**Pass**
10th	6470	-96.1	30.0	-66.1	125.7	76.0	**Pass**



Worst case Harmonic Energy at 5th Harmonic



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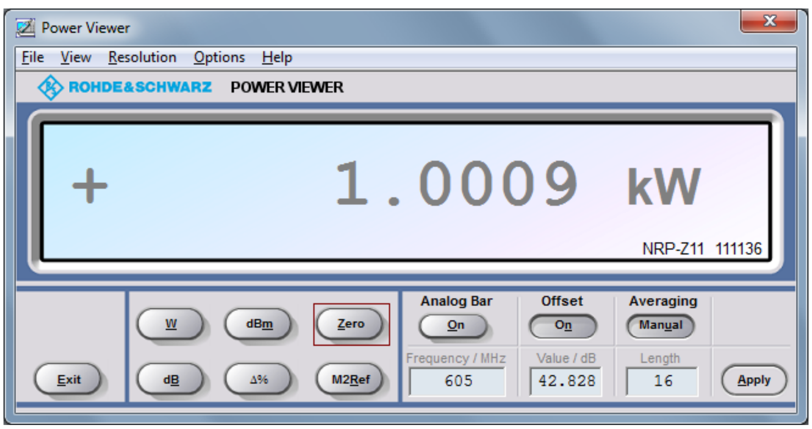
Worst case Harmonic Energy at 6th Harmonic

TWO POWER AMPLIFIER CONFIGURATION TRANSMITTER EMISSION MASK COMPLIANCE TESTS

The following section of this report provides the test results of the two power amplifier configuration producing 1000 watts. This configuration uses a different emission mask filter than the 2.5 kW transmitter configuration and that is why additional test results are included.

Emission Mask Compliance   1000 Watts Output Power
To determine conducted radiation emission mask compliance, the test equipment configuration shown on Figure 1 was used with the following minor change. For adjacent channel measurements and harmonic measurements, the R & S FSU50 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.

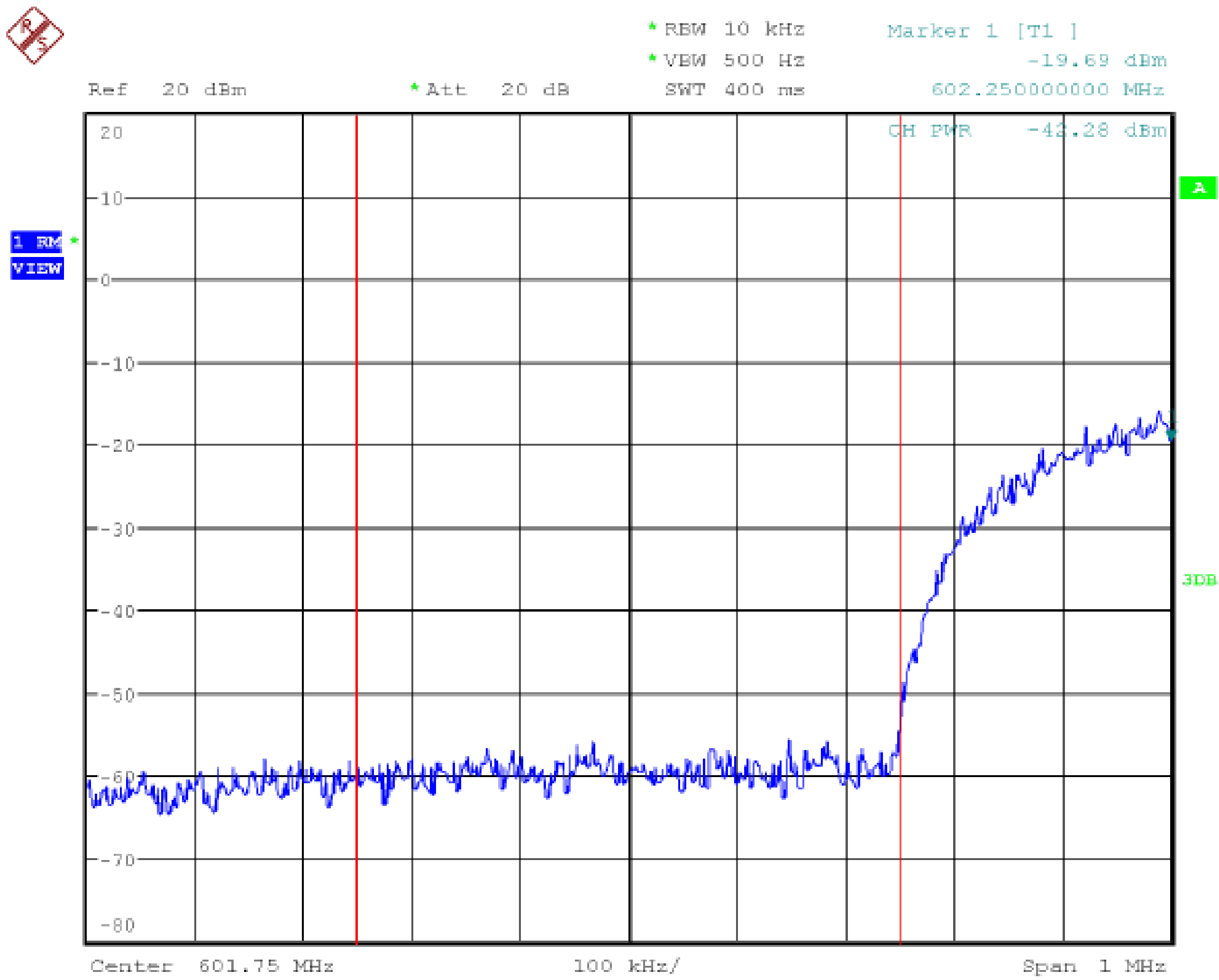
The transmitter was energized at 1000 watts on Channel 36 (center frequency of 605 MHz) as determined by the directional coupler (42.83 dB coupling) and power meter and a reference was established on the spectrum analyzer (using the channel power measurement mode). The same bandstop filter used in the first set of measurements at 2500 watts was also used for this set of measurements at 1000 watts. The power meter display was captured indicating the operating power and is shown below.



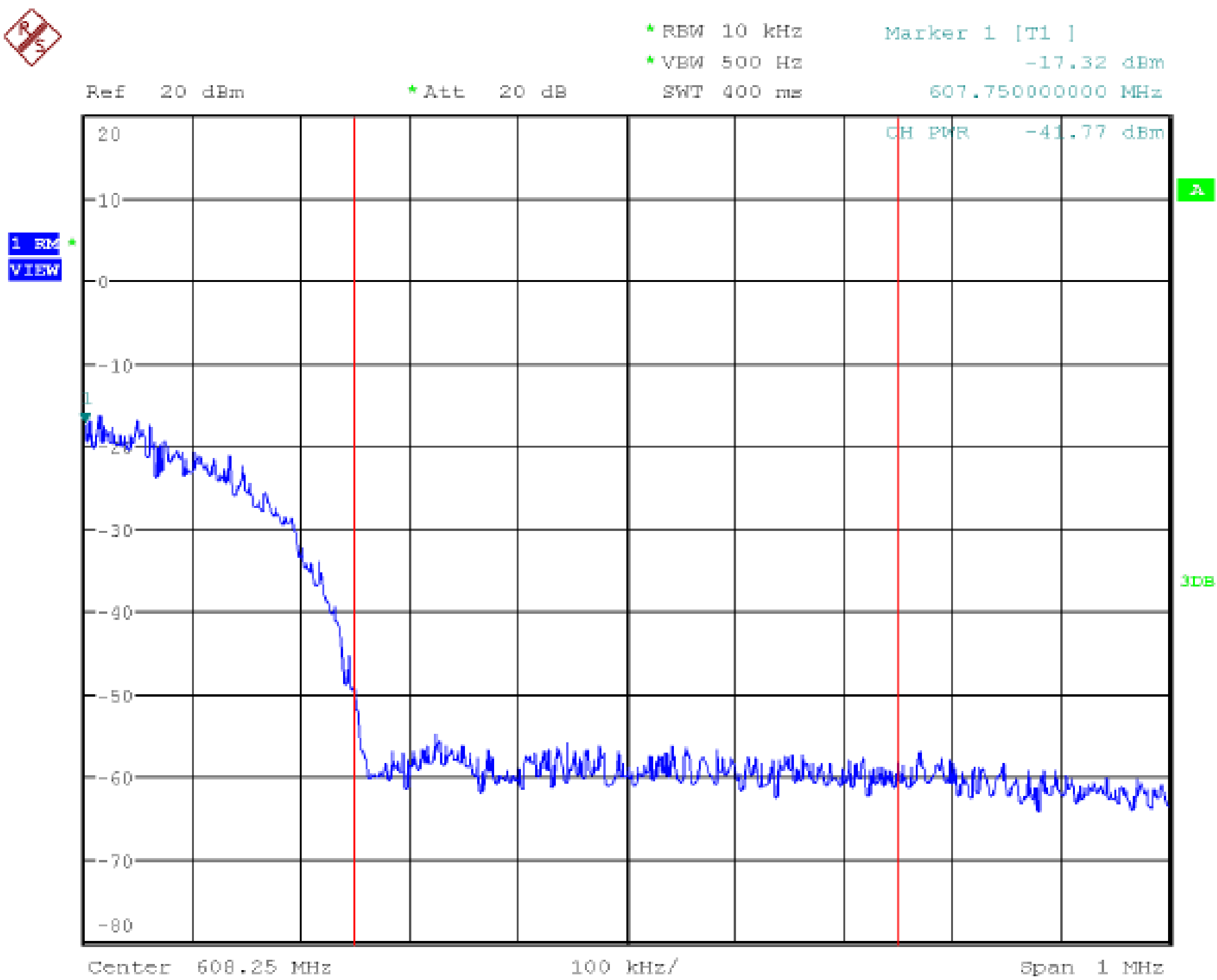
The noise floor of the R & S FSU50 spectrum analyzer was found. From that, the minimum RF sample level was determined (assuming the transmitter exactly met the emission mask requirements identified in the FCC rules). The actual RF sample level was well above the required minimum RF sample so plenty of 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. 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 Page 36.

The measured values were corrected for proximity to the noise floor first and then for the bandstop filter insertion loss. Screen captures of the lower and upper sideband response. 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 page following the screen captures.



LOWER SIDEBAND RESPONSE



UPPER SIDEBAND RESPONSE

Dielectric Filter

ATSC TRANSMITTER
TEST REPORT

1000W

Spectrum Analyzer 10kHz RBW Noise Floor [dBm]	-110.0
Spectrum Analyzer 500kHz RBW Noise Floor [dBm]	-93.0
Noise floor proximity upper threshold [dBm]	-83.0
Noise floor proximity lower threshold [dBm]	-90.0

Min. Sample Level [dBm]	-16.8
Actual Sample Level [dBm]	15.2

ATSC TRANSMISSION MASK COMPLIANCE TEST

Stringent Mask

Channel Power [dBm]	15.2
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	-41.8	-41.8		-41.8	57.0	47.0	**Pass**
3.75	608.75	-48.3	-48.3		-48.3	63.5	49.9	**Pass**
4.25	609.25	-55.7	-55.7		-55.7	70.9	55.6	**Pass**
4.75	609.75	-60.6	-60.6		-60.6	75.8	61.4	**Pass**

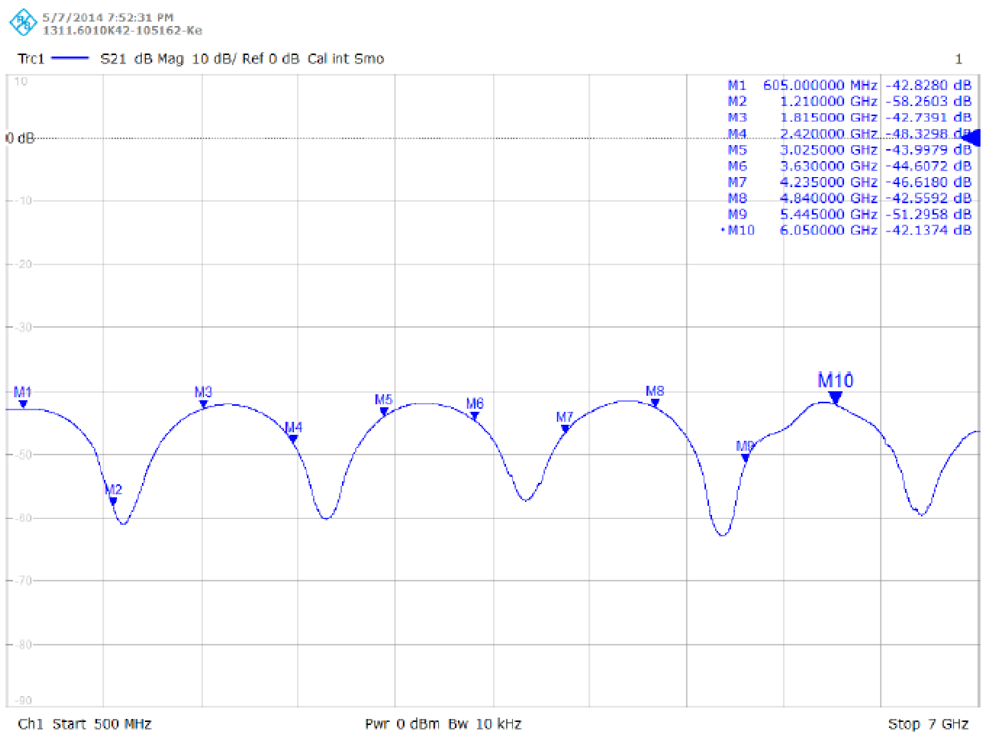
5.25	610.25	-75.1	-75.1	2.9	-72.2	87.4	67.1	**Pass**
5.75	610.75	-81.5	-81.5	2.2	-79.3	94.5	71.9	**Pass**
6.25	611.25	-87.6	-89.1	1.8	-87.3	102.5	76.0	**Pass**
6.75	611.75	-90.7	-93.0	1.6	-91.4	106.6	76.0	**Pass**
7.25	612.25	-91.3	-93.0	1.4	-91.6	106.8	76.0	**Pass**
7.75	612.75	-91.6	-93.0	1.4	-91.6	106.8	76.0	**Pass**
8.25	613.25	-91.8	-93.0	1.4	-91.6	106.8	76.0	**Pass**
8.75	613.75	-91.5	-93.0	1.4	-91.6	106.8	76.0	**Pass**
-3.25	601.75	-42.3	-42.3		-42.3	57.5	47.0	**Pass**
-3.75	601.25	-46.6	-46.6		-46.6	61.8	49.9	**Pass**
-4.25	600.75	-53.6	-53.6		-53.6	68.8	55.6	**Pass**
-4.75	600.25	-58.9	-58.9		-58.9	74.1	61.4	**Pass**
-5.25	599.75	-75.1	-75.1	2.7	-72.4	87.6	67.1	**Pass**
-5.75	599.25	-82.1	-82.1	2.5	-79.6	94.8	71.9	**Pass**
-6.25	598.75	-87.3	-88.7	2.5	-86.2	101.4	76.0	**Pass**
-6.75	598.25	-90.1	-93.0	2.5	-90.5	105.7	76.0	**Pass**
-7.25	597.75	-91.4	-93.0	2.5	-90.5	105.7	76.0	**Pass**
-7.75	597.25	-91.5	-93.0	2.5	-90.5	105.7	76.0	**Pass**
-8.25	596.75	-91.6	-93.0	2.5	-90.5	105.7	76.0	**Pass**
-8.75	596.25	-91.6	-93.0	2.5	-90.5	105.7	76.0	**Pass**

HARMONIC AND SPURIOUS ENERGY

The next set of tests executed measurements of conducted radiation 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 FSU50 spectrum analyzer. A high pass filter was used to prevent erroneous readings regarding harmonic performance of the transmitter. The filter kept the total energy low enough to prevent harmonic energy from being created in the spectrum analyzer at a level that was above the noise floor of the spectrum analyzer. The highpass filter was characterized earlier in this test report.

The directional coupler at the output of the emission mask filter was calibrated at each harmonic of the transmitter. This was accomplished using the tracking generator of the FSU50 spectrum analyzer before the directional coupler was inserted into the test equipment configuration. Coupling values at each of the harmonic frequency regions were captured in the display below and are also tabulated in the table on the following page.

Harmonic and spurious energy was measured using the setup of Figure 1. The harmonic measurement values were recorded using the R & S FSU50. The high pass filter permitted the spectrum analyzer attenuation to be minimized without the spectrum analyzer being overloaded from the channel 36 signal. 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 harmonic and the largest signal level in any 500 kHz segment of the harmonic energy was recorded on 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 channel 36 power. A screen capture of the conducted harmonic energy at the worst-case condition (5th harmonic) was taken and is provided on the page following the table.



COUPLING VALUE VERSUS FREQUENCY FOR DIRECTIONAL COUPLER

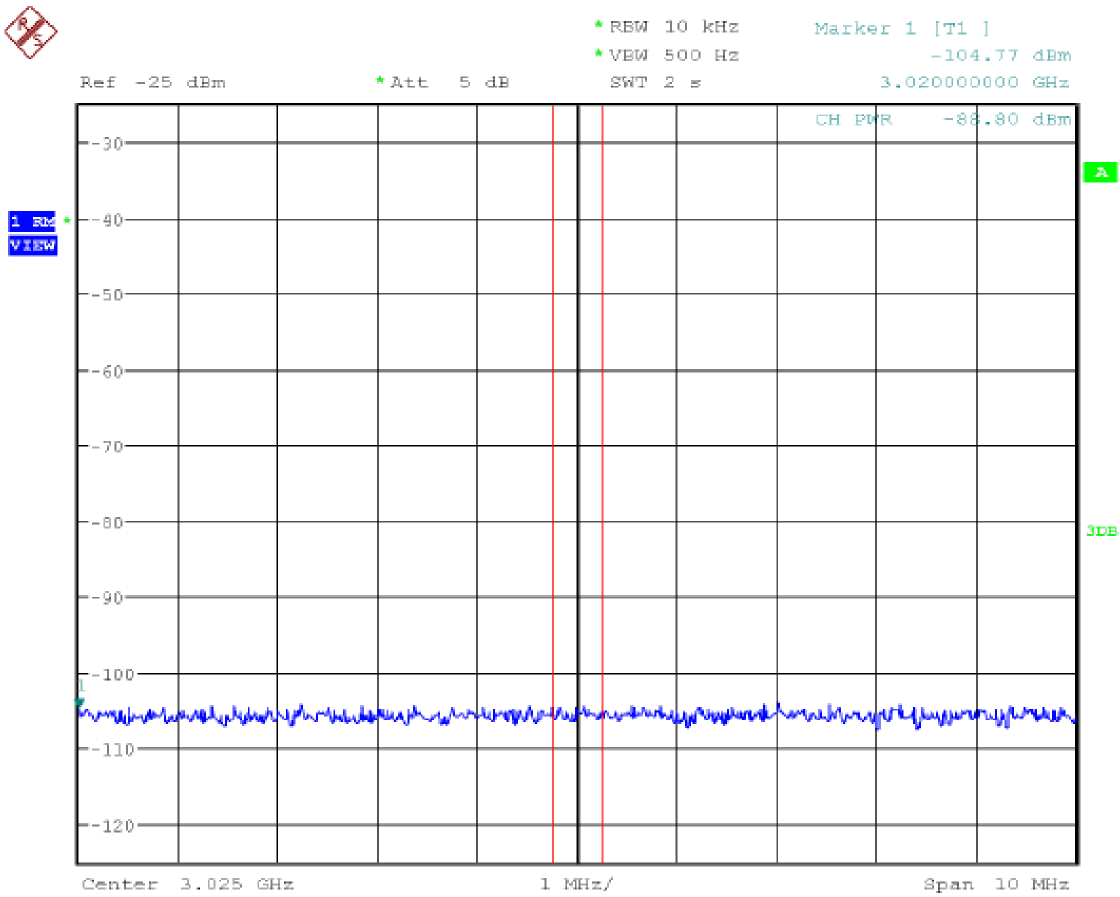
ATSC TRANSMISSION MASK COMPLIANCE TEST

Stringent Mask

Harmonics

Channel Power [dBm]	60.0
Channel Number	36
Center Frequency [MHz]	605

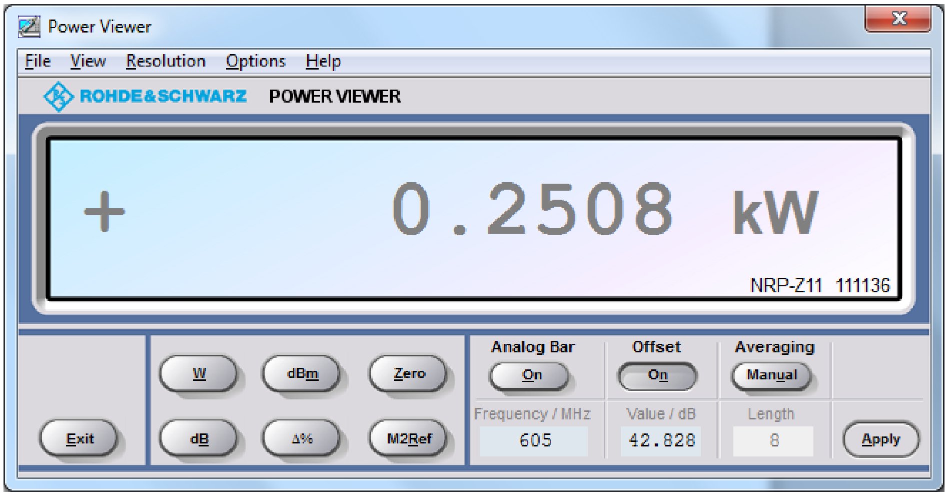
Harmonic	Frequency [MHz]	Measured Amplitude [dBm]	HPF & Cable Loss [dB]	Coupling Value [dB]	Corrected Amplitude [dBm]	Amplitude below Channel Power[dB]	FCC Limit [dB]	Pass/Fail
2nd	1210.00	-92.4	1.5	58.3	-32.7	92.7	76.0	**Pass**
3rd	1815.00	-90.9	1.6	42.7	-46.6	106.6	76.0	**Pass**
4th	2420.00	-89.1	2.0	48.3	-38.9	98.9	76.0	**Pass**
5th	3025.00	-88.8	2.1	44.0	-42.7	102.7	76.0	**Pass**
6th	3630.00	-89.8	2.4	44.6	-42.8	102.8	76.0	**Pass**
7th	4235.00	-89.1	2.7	46.6	-39.8	99.8	76.0	**Pass**
8th	4840.00	-91.1	3.3	42.6	-45.2	105.2	76.0	**Pass**
9th	5445.00	-91.1	3.6	51.3	-36.2	96.2	76.0	**Pass**
10th	6050.00	-91.4	5.7	42.1	-43.5	103.5	76.0	**Pass**



WORST CASE HARMONIC ENERGY (5TH HARMONIC)

LOW POWER OPERATION---TWO POWER AMPLIFIER CONFIGURATION AT 250 WATTS

For operation at power levels below 1000 watts, power output and emission mask compliance data was repeated for the transmitter operating at the lower power level of 250 watts. The same test configuration as in Figure 1 except using the same FSU50 spectrum analyzer. Average power was measured with the directional coupler (42.83 dB coupling) and the R & S NRP-Z11 power sensor, and displayed on the personal computer using Power Viewer Plus. The indicated reading is shown below.



Emission Mask Compliance 250 Watts Output Power

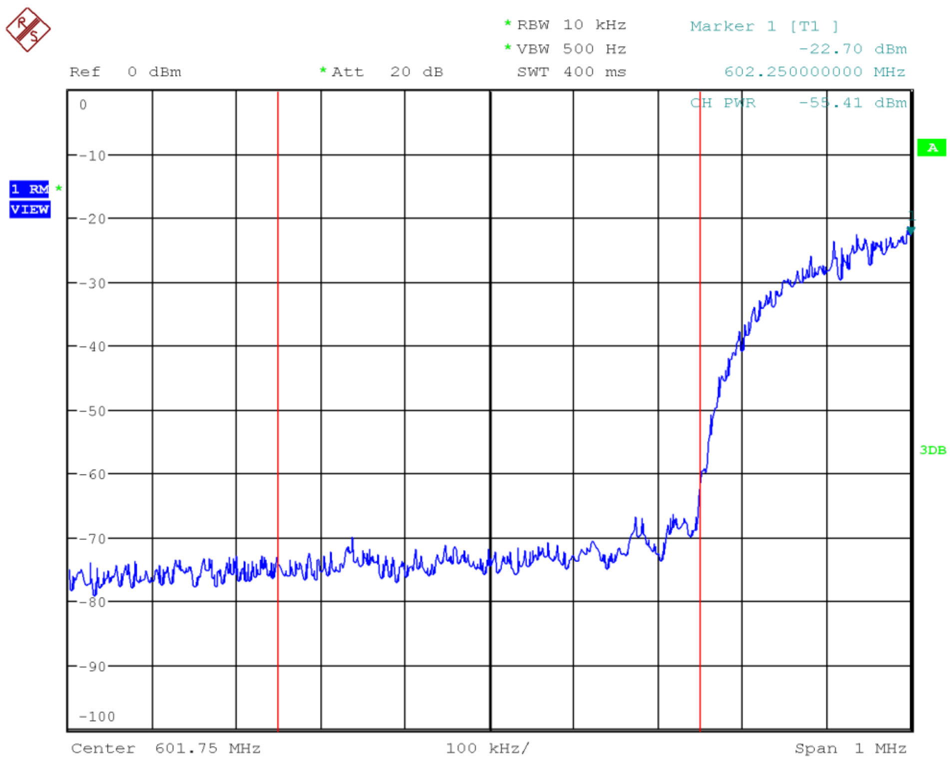
To determine conducted radiation emission mask compliance, the test equipment configuration shown on Figure 1 was used. For adjacent channel measurements and harmonic measurements, the R & S FSU50 spectrum analyzer was used. The transmitter was tested for compliance with the emission mask as specified 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 250 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 2500 watts was also used for this set of measurements at 250 watts.

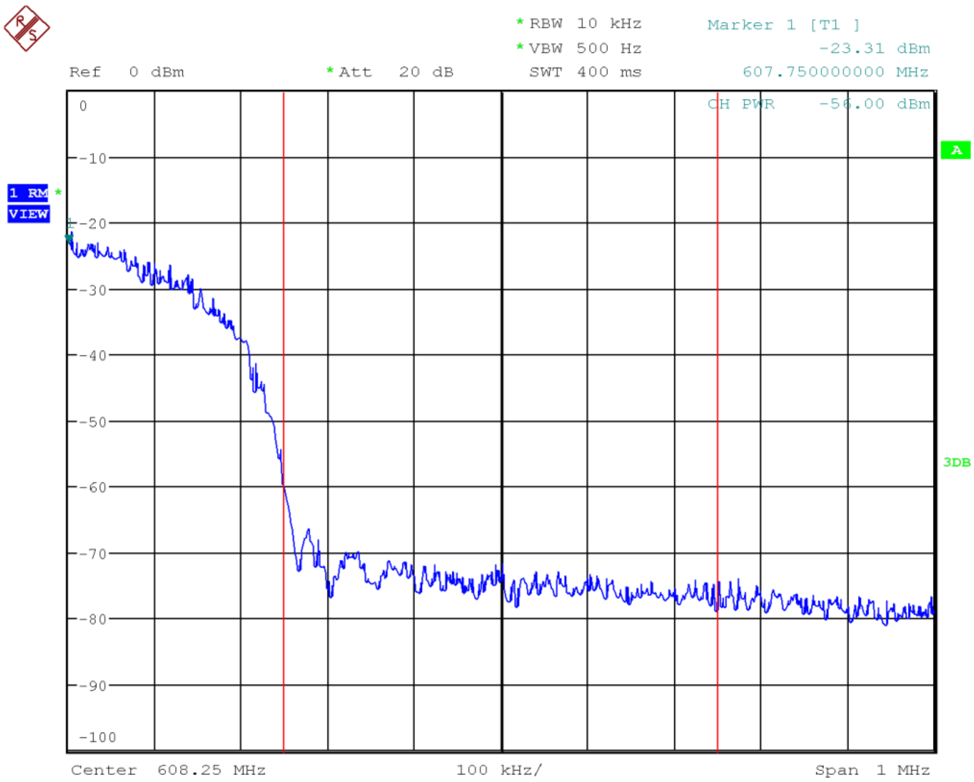
The noise floor of the spectrum analyzer was found. From that, the minimum RF sample level was determined (assuming the transmitter exactly met the emission mask requirements identified in the FCC rules). The actual RF sample level was well above the required minimum RF sample so plenty of margin was 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. 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 following the screen captures below. Screen captures of the lower sideband and upper sideband shoulder levels are shown below.

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 TRANSMISSION MASK COMPLIANCE TEST

Stringent Mask

Channel Power [dBm]	8.8
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	-56.0	-56.0		-56.0	64.8	47.0	**Pass**
3.75	608.75	-61.4	-61.4		-61.4	70.2	49.9	**Pass**
4.25	609.25	-67.9	-67.9		-67.9	76.7	55.6	**Pass**
4.75	609.75	-73.2	-73.2		-73.2	82.0	61.4	**Pass**
5.25	610.25	-87.0	-88.3	2.9	-85.4	94.2	67.1	**Pass**
5.75	610.75	-90.1	-93.0	2.2	-90.8	99.6	71.9	**Pass**
6.25	611.25	-90.8	-93.0	1.8	-91.2	100.0	76.0	**Pass**
6.75	611.75	-91.6	-93.0	1.6	-91.4	100.2	76.0	**Pass**
7.25	612.25	-91.3	-93.0	1.4	-91.6	100.4	76.0	**Pass**
7.75	612.75	-91.4	-93.0	1.4	-91.6	100.4	76.0	**Pass**
8.25	613.25	-91.9	-93.0	1.4	-91.6	100.4	76.0	**Pass**
8.75	613.75	-91.9	-93.0	1.4	-91.6	100.4	76.0	**Pass**
-3.25	601.75	-55.4	-55.4		-55.4	64.2	47.0	**Pass**
-3.75	601.25	-60.5	-60.5		-60.5	69.3	49.9	**Pass**
-4.25	600.75	-66.8	-66.8		-66.8	75.6	55.6	**Pass**
-4.75	600.25	-71.7	-71.7		-71.7	80.5	61.4	**Pass**

-5.25	599.75	-85.8	-86.7	2.7	-84.0	92.8	67.1	**Pass**
-5.75	599.25	-88.2	-89.9	2.5	-87.4	96.2	71.9	**Pass**
-6.25	598.75	-88.8	-90.9	2.5	-88.4	97.2	76.0	**Pass**
-6.75	598.25	-90.5	-93.0	2.5	-90.5	99.3	76.0	**Pass**
-7.25	597.75	-90.2	-93.0	2.5	-90.5	99.3	76.0	**Pass**
-7.75	597.25	-90.4	-93.0	2.5	-90.5	99.3	76.0	**Pass**
-8.25	596.75	-91.6	-93.0	2.5	-90.5	99.3	76.0	**Pass**
-8.75	596.25	-91.7	-93.0	2.5	-90.5	99.3	76.0	**Pass**

HARMONIC AND SPURIOUS ENERGY

The next set of tests executed measurements of conducted radiation 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 R & S FSU50 spectrum analyzer. A high pass filter was used to prevent erroneous readings regarding harmonic performance of the transmitter. The filter kept the total energy low enough to prevent harmonic energy from being created in the spectrum analyzer at a level that was above the noise floor of the spectrum analyzer. The highpass filter was characterized earlier in this test report. The harmonic measurement results are tabulated on the following page.

The directional coupler at the output of the emission mask filter was calibrated at each harmonic of the transmitter. This was accomplished using the tracking generator of the FSU50 spectrum analyzer before the directional coupler was inserted into the test equipment configuration. Coupling values at each of the harmonic frequency regions were captured in the display shown on Page 38.

Harmonic and spurious energy was measured using the setup of Figure 1 using the R & S FSU50. A high pass filter was used in the coupled signal path to permit the spectrum analyzer attenuation to be minimized without the spectrum analyzer being overloaded from the channel 36 signal. 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} harmonic and the largest signal level in any 500 kHz segment of the harmonic energy was recorded on 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 of the conducted harmonic energy at the worst-case condition (5^{th} harmonic) was taken and is provided on the page following the harmonics results table.

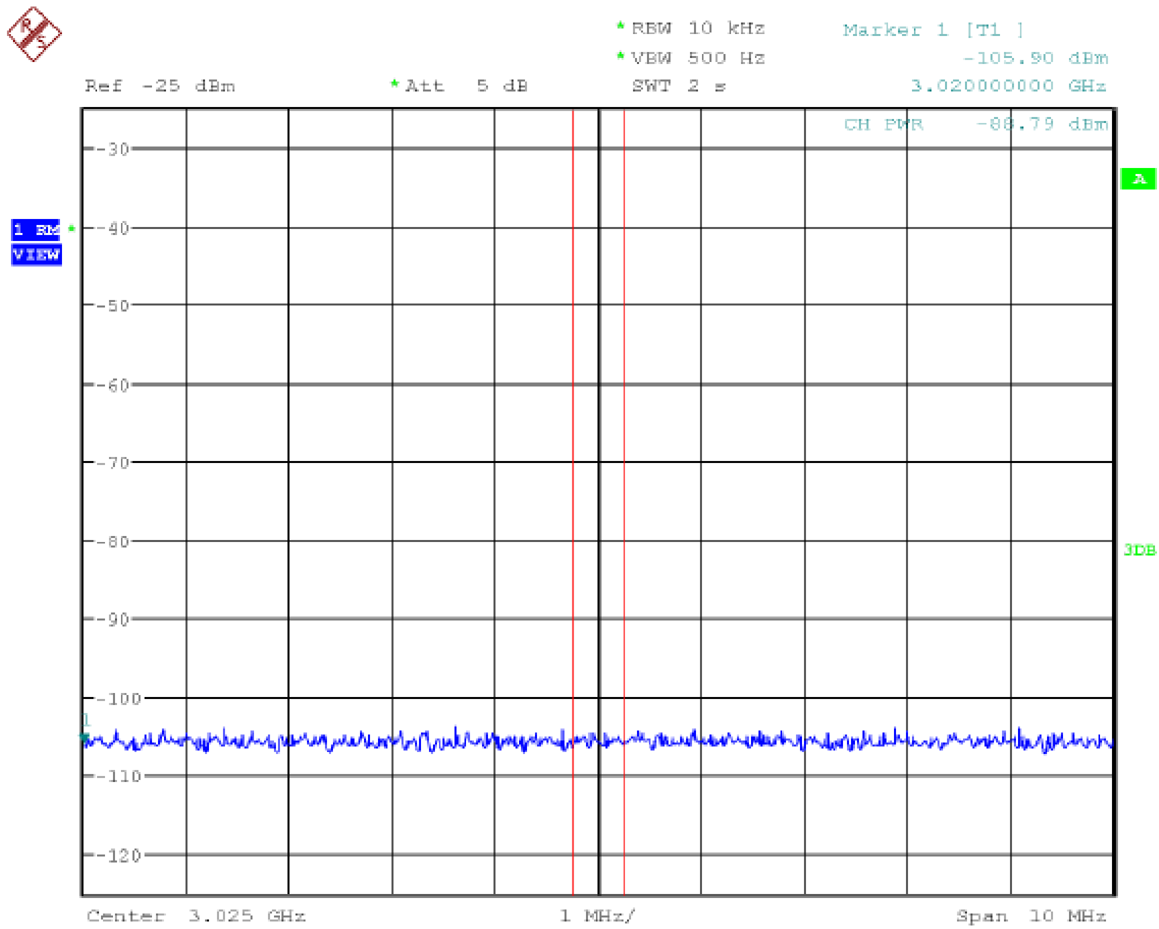
ATSC TRANSMISSION MASK COMPLIANCE TEST

Stringent Mask

Harmonics

Channel Power [dBm]	54.0
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	-92.5	1.5	58.3	-32.8	86.8	76.0	**Pass**
3rd	1815.00	-91.2	1.6	42.7	-46.8	100.8	76.0	**Pass**
4th	2420.00	-89.3	2.0	48.3	-39.0	93.0	76.0	**Pass**
5th	3025.00	-88.8	2.1	44.0	-42.7	96.7	76.0	**Pass**
6th	3630.00	-90.3	2.4	44.6	-43.3	97.3	76.0	**Pass**
7th	4235.00	-89.3	2.7	46.6	-40.0	94.0	76.0	**Pass**
8th	4840.00	-90.8	3.3	42.6	-44.9	98.9	76.0	**Pass**
9th	5445.00	-91.0	3.6	51.3	-36.1	90.1	76.0	**Pass**
10th	6050.00	-91.5	5.7	42.1	-43.6	97.6	76.0	**Pass**

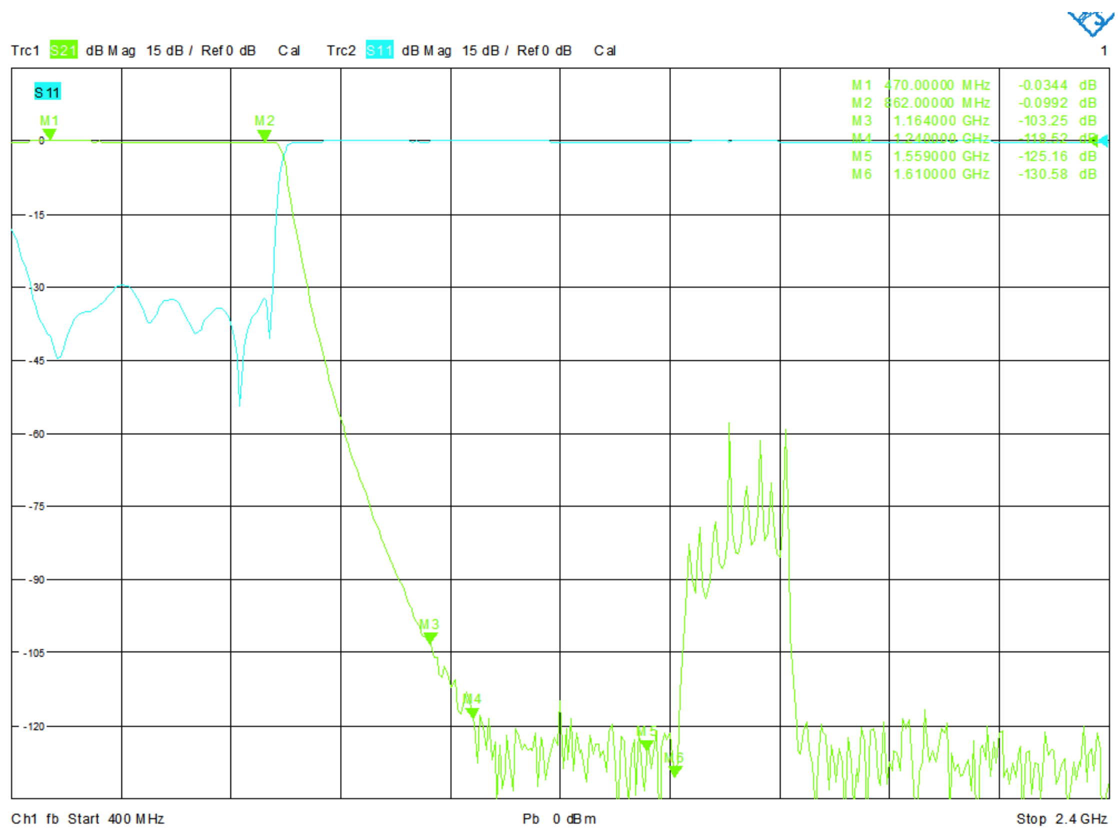


WORST CASE HARMONIC ENERGY (5TH HARMONIC)

Filter Attenuation to GPS Band Frequencies

The plot on below indicates the amount of attenuation from the harmonic filter used with the 2 power amplifier configuration to energy that would fall into the GPS bands from 1.1 GHz to 1.61 GHz. As can be seen by these plots, the attenuation by the harmonic filter alone is equal to or greater than 85 dB as specified by FCC Rule 74.794 (b) (1). Therefore, compliance to the rule is demonstrated.

HARMONIC FILTER ATTENUATION AT GPS BAND FREQUENCIES



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	FSV-30	Spectrum Analyzer	1307.9002K30
Rohde & Schwarz	FSU50	Spectrum Analyzer	1313.9000.50 101145
Rohde & Schwarz	SMBV100A	Vector Signal Generator	1407.6004k02
Mini-Circuits	NHP-1000	Hi Pass Filter	15542
Microwave Filter Company	R16560-36	DTV Bandstop Filter	N/A
Rohde & Schwarz	NRP-Z11	Power Sensor	1138.3004.02
RCA/Bird Electronics	MI560482	5000 Watt Dummy Load	N/A
Rohde & Schwarz	ETL	TV Test Receiver/Spectrum Analyzer	100086
Tenney	T10C	Temperature Chamber with Watlow Temperature Controller/Monitor	26708-05
AH Systems	SAS-519-7	Log Periodic Antenna with tripod	160

CONCLUSION

Transmitter configurations for 3-5 power amplifiers with 2 different output emission mask filters and the 2 power amplifier transmitter configuration were 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.