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INTRODUCTION

Pineapple Technology Inc. 25 WATT DTV TRANSMITTER

Pineapple Technologies Inc. (PTI) has designed, built, and tested a 25 watt DTV transmitter with model number DTC25U. The transmitter consists of a baseband input processor that accepts a SMPTE 310 transport stream, a modulator that converts the transport stream to an on-channel 8 VSB RF signal, power amplifier that amplifies the DTV signal to 25 watts, power supply that provides DC power to the RF power amplifier, RF mask filter that prevents interference to other services, and AC distribution/control system that energizes and controls the transmitter. The attached exhibits indicate compliance to appropriate FCC rules.

TEST REPORT

DTC25U DTV TRANSMITTER TECHNICAL REPORT

The following information is provided to support the technical performance of the PTI DTC25U DTV transmitter. The information is supplied for broadcast TV service according to applicable portions of Part 74.

The following information is provided in support of verification that the transmitter meets the appropriate requirements. Measurements were recorded of spectrum and other appropriate data to demonstrate compliance.

1. Power Output Measurements.
2. Frequency Stability tests versus AC input voltage and temperature
3. Harmonic and spurious measurements to demonstrate the transmitter meets the DTV stringent emission mask and the FCC rule 74.794.
4. Measurement of cabinet radiation for spurs and harmonics as specified in FCC Rule 2.1053 and 2.1057.

Measurements for these parameters were conducted at a power output level of 25 watts and the range of power for which type certification is sought is 25% of that value (i.e. 6 watts) to the maximum value of 25 watts.

The test equipment used for the measurements on the next few pages is listed at the back of this exhibit. All test equipment had been calibrated prior to the use of the equipment by the supplier of the test equipment.

RF POWER OUTPUT MEASUREMENTS

The equipment was configured as below shown in Figure 1. The loss through the RF output cable and directional coupler was calibrated at the channel center frequency of 587 MHz. Average power was read on the HP435B Power Meter.

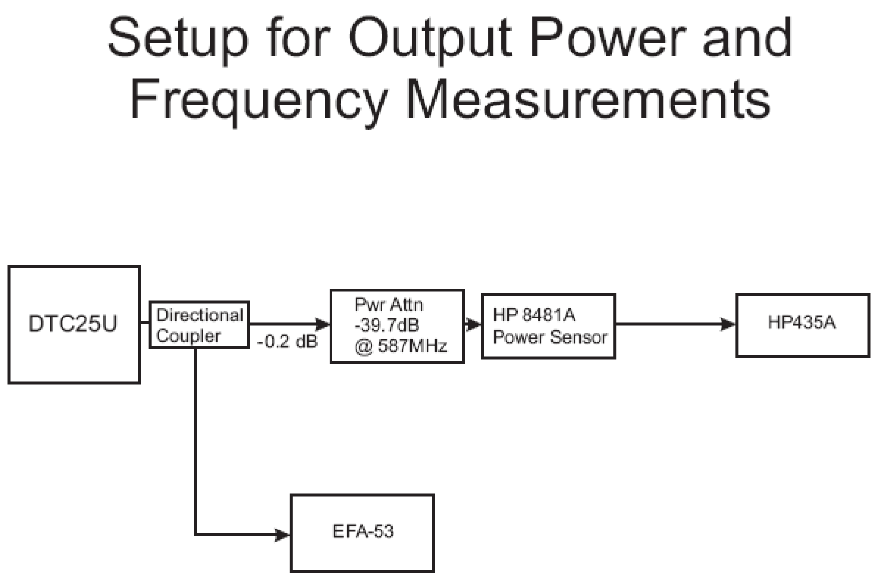


Figure 1

The loss of the directional coupler, interconnecting cable, and power attenuator was determined to be 40.0 dB.

Measurement at Nominal Transmitter power

The transmitter was energized in the test configuration above and the power was read on the HP-435 Power Meter. The indicated reading is shown below.

Calculation of output power.

2.55 mwatts (indicated reading) + 40 dB = 25.5 watts

Low Power Operation

The transmitter was energized in the test configuration above and the power was read on the HP-435 Power Meter. The indicated reading is shown below.

Calculation of output power.

0.65 mwatts (indicated reading) + 40 dB = 6.5 watts

Frequency Stability versus Line Voltage

The equipment was configured as below shown in Figure 2. A variac was inserted in the test configuration between the AC mains service and the DTC25U Transmitter. The AC voltage was set-up at 120 volts and the transmitter was energized and adjusted to produce 25 watts in the RF channel. The nominal frequency was recorded. The variac was adjusted to 85% and115% of nominal voltage and the corresponding changes in pilot frequency measured on the R & S EFA were recorded in the table below.

Line Voltage (Volts)	Measured Pilot Frequency (MHz)
104	650.314231
120 (nominal)	650.314233
140	650.314213

The measured frequency was within the +/- 10 kHz tolerance indicated in FCC rule 74.795.

Frequency Stability versus Temperature

For temperature stability measurements the exciter was placed inside a Tenney temperature chamber equipped with a MicroTenn II temperature controller as shown in Figure 2. The exciter was energized at nominal power and the pilot frequency was measured on the Rhode and Schwarz EFA test set. The temperature was then raised to +50ºC, allowed to stabilize for 15 minutes and then cycled to each colder temperature where it was allowed to stabilize for 10 minutes before recording the measured value.

TEMPERATURE º C	**FREQUENCY (MHz)**
25	650.313153
50	650.311555
40	650.312183
30	650.312961
20	650.312859
10	650.312216
0	650.310763

The maximum variation in frequency over the specified temperature range was 2.39 kHz which was well within the +/- 10 kHz tolerance identified in FCC rule 74.795.

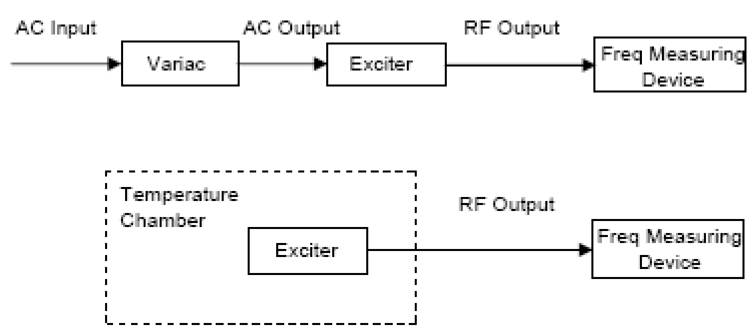


FIGURE 2

Emission Mask Compliance Measurement

To determine emission mask compliance the test equipment configuration shown below was used. The transmitter was tested for compliance with the stringent emission mask classification. The first part of the tests measured the adjacent channel emission and the second part of the tests measured the harmonic and spurious energy.

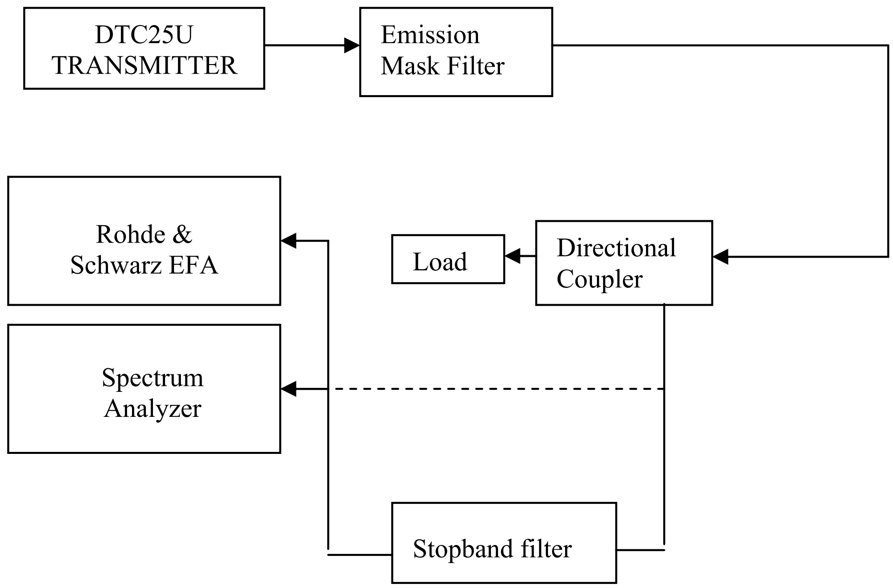
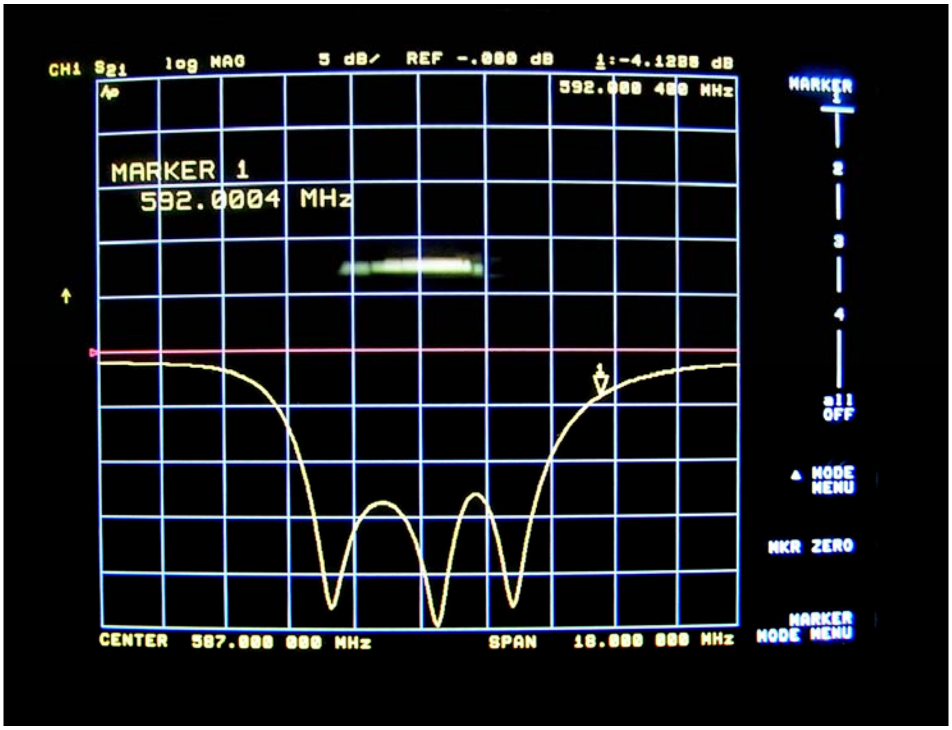


Figure 3

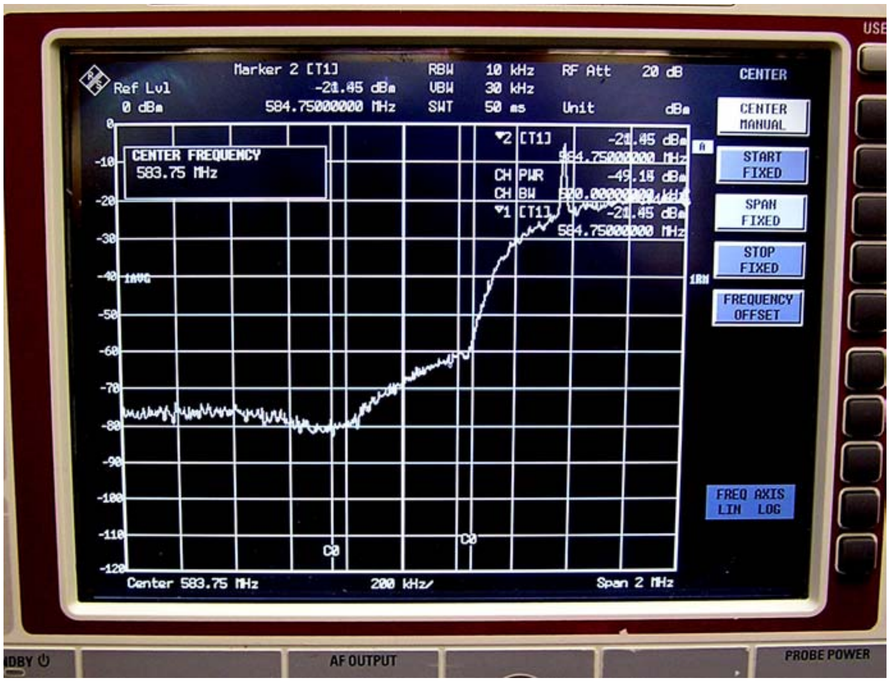
Dashed line indicates connection for first part of the adjacent channel measurement.

The transmitter was energized at 25 watts on channel 33 (center frequency of 587 MHz) as calculated by the insertion loss of the directional coupler and the interconnecting cables and a reference was established on the spectrum analyzer (using the channel power measurement mode) and also on the EFA test equipment. The minimum displayed average noise level (DANL) for the spectrum analyzer was determined to be -120 dBm in a 10 kHz bandwidth. In order to measure a signal equivalent to the emission mask, the RF sample level must be 93 dB above the DANL using the RBW of 10 kHz. That level will be -27 dBm. In this case, the RF sample level was + 8 dBm as measured with the channel power measurement mode of the spectrum analyzer so an adequate signal level was available. The bandstop filter frequency response was determined using a network analyzer. 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 below.

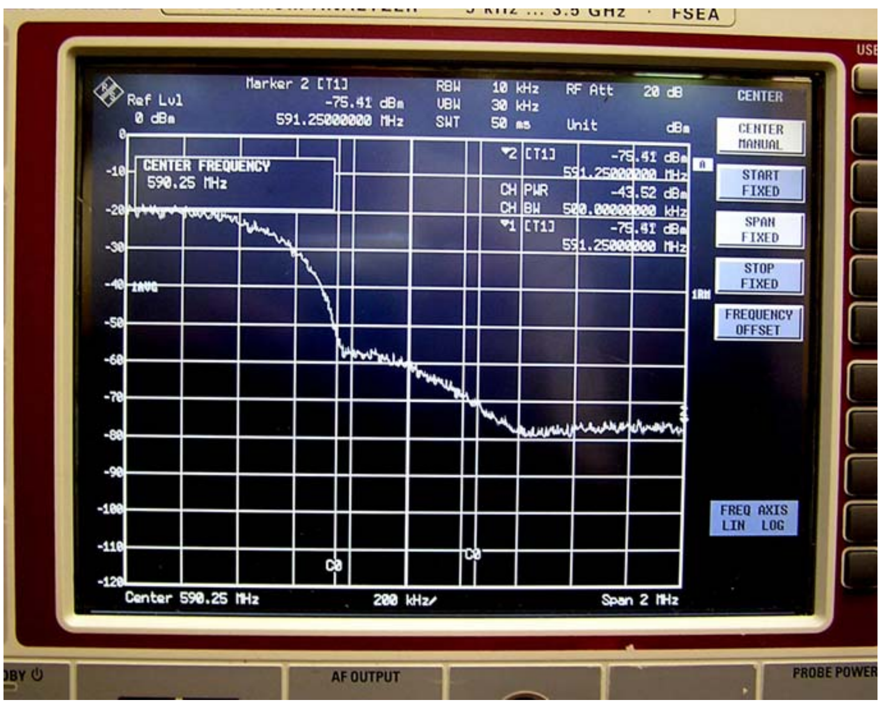


The filter was inserted in the path between the coupler and the spectrum analyzer and amount of change indicated in the channel power was 16.4 dB so this is the value of attenuation used for further optimization of the input level later in the measurements.

The next step was to measure the first four 500 kHz subbands on each side of the desired channel. For this part of the measurement, the stopband filter was not necessary. The attenuator on the spectrum analyzer was adjusted so that it was not being overloaded. Once the first four subbands were measured the signal was close to the noise floor. The following photos shows the spectrum on each side of the desired channel as an example of the measurements.



Lower sideband spectrum measurement using channel power mode.
Center frequency = 583.75 MHz

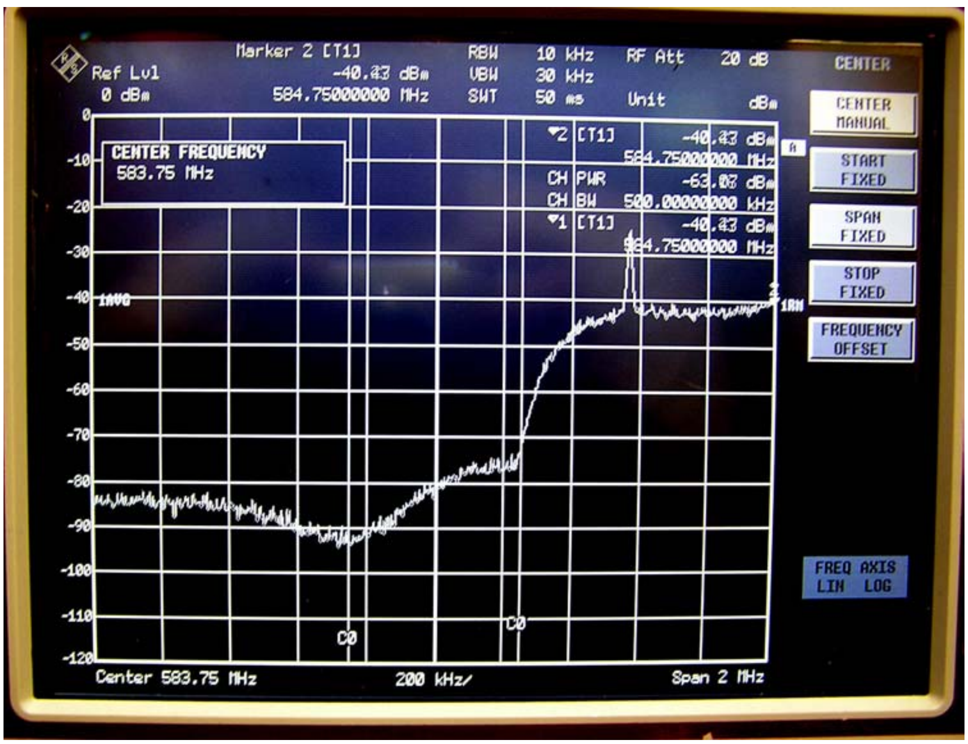


Upper sideband spectrum measurement using channel power mode.
Center frequency = 590.25 MHz

The noise floor was subtracted from the measured values when the measured values were within 7 dB of the noise floor.

The next step was to install the bandstop filter in the path from the coupler to the spectrum analyzer and reduce the attenuation so that the emissions in the remaining subbands could be measured.

The first step of the procedure optimized the level of the spectrum analyzer dynamic range ensuring the noise floor was below the value assumed if the transmitter spectrum just met the limits of the emission mask. Once that was done, the spectrum analyzer attenuator was not changed and the channel power mode was engaged to measure each of the remaining 500 kHz segments (on both sides of the desired channel) using the center frequency of that segment. The following photo shows an example of the lower adjacent channel measurement with the filter in place.



Lower sideband spectrum measurement using channel power mode.
Center frequency = 583.75 MHz

The final step was to make any adjustments necessary for the proximity of the noise floor and to take into account the stopband filter loss in that order, and record the values in the table. Then those recorded power levels were subtracted from the total power in the desired channel and values were tabulated to determine if they met the emission mask.

The table with the corrected emission mask measurement values is presented below. The transmitter emissions met the requirements as indicated by the comparison with the FCC Stringent Emission Mask.

Lower adjacent Channel Measurements

Subband	Frequency MHz	Measured Value* dBm	Channel Power dBm	Corrected Valued dB_{DTV}	FCC Emission Mask dB_{DTV}
1	583.75	-49.2	8	57.2	47
2	583.25	-61.0	8	69.0	49.9
3	582.75	-60.5	8	68.5	55.6
4	582.25	-63.7	8	71.7	61.4
5	581.75	-68.2	8	76.2	71.9
6	581.25	-73.9	8	81.9	76
7	580.75	-78.7	8	86.7	76
8	580.25	-81.4	8	89.4	76
9	579.75	-82.7	8	90.7	76
10	579.25	-83.3	8	91.3	76
11	578.75	-83.5	8	91.5	76
12	578.25	-83.5	8	91.5	76

Upper adjacent Channel Measurements

Subband	Frequency MHz	Measured Value* dBm	Channel Power dBm	Corrected Valued dB_{DTV}	FCC Emission Mask dB_{DTV}
1	590.25	-43.3	8	51.3	47
2	590.75	-59.4	8	67.4	49.9
3	591.25	-60.8	8	68.8	55.6
4	591.75	-65.1	8	73.1	61.4
5	592.25	-72.0	8	64.0	71.9
6	592.75	-77.2	8	85.2	76
7	593.25	-77.9	8	85.9	76
8	593.75	-77.9	8	85.9	76
9	594.25	-80.2	8	88.2	76
10	594.75	-82.7	8	90.7	76
11	595.25	-83.4	8	91.4	76
12	595.75	-83.5	8	91.5	76

*Measured values corrected for noise floor proximity and stopband filter insertion loss, if any.

Conducted Harmonic and Spurious Measurements

The test setup of Figure 3 is used except that a high pass filter replaces the bandstop filter. First the highpass filter is characterized over the spectrum of investigation. An amplitude reference of 14 dBm was obtained using the channel power measurement mode of the spectrum analyzer without the highpass filter in the system. Then the high pass filter was inserted into the path from the directional coupler to the spectrum analyzer. In this case, the highpass filter provided 40 dB attenuation to the main channel signal. The sensitivity of the spectrum analyzer was increased so that the noise floor of the spectrum analyzer was -100 dBm measured using a marker and a 10 kHz resolution bandwidth (RBW). The spectrum from just above the upper adjacent channel to the 10th harmonic of the fundamental frequency was investigated to determine if any spurious or harmonic energy existed. Measurements of harmonics were taken using the 10 kHz RBW of the spectrum analyzer and the power was scaled to a bandwidth of 500 kHz. Photos of the spectrum at the harmonics were taken and are displayed below. However, no energy was measurable. Using the directional coupler calibration factors up to the 5^{th} harmonic, the energy was computed. This value of harmonic energy was compared to the total channel power and the resultant dB_{DTV} value was calculated and compared to the -76dB FCC requirement. The results are shown in the table below.

Table of DTC25U Harmonic and Spurious Energy Measurements

Frequency (MHz)	Measured Signal (dBm)	Coupler + Filter Correction (dB)	Corrected Spurious Power (dBm)	Main Channel Power (dBm)	Spurious to Main ratio (dB_{DTV})	FCC Limits (dB_{DTV})
1174	-83	32.3	-50.7	44.4	95.1	76
1761	-83	33.1	-49.9	44.4	94.3	76
2348	-83	33	-50	44.4	94.4	76
2935	-83	21	-62	44.4	106.4	76

All measured signal values were at the noise floor of the spectrum analyzer and measured in a 10 kHz RBW. The noise floor was converted to a signal power in 500 kHz bandwidth for comparison.

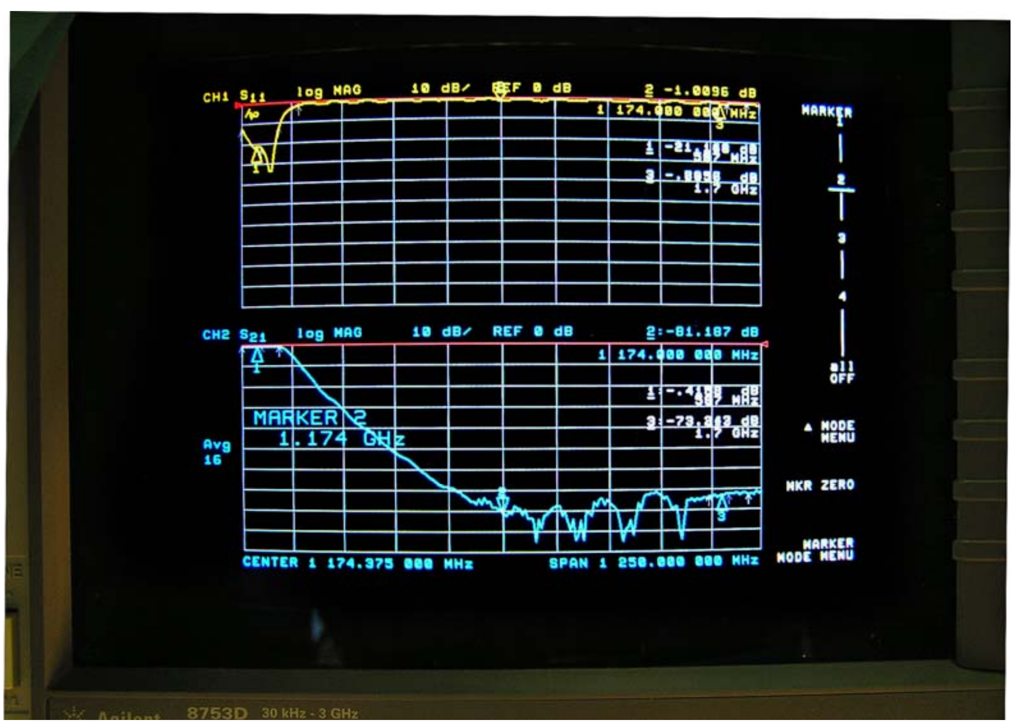
All the results meet the -76 dB_{DTV} FCC requirement for the stringent emission mask.

Filter attenuation provided at the RNSS bands

FCC rule 74.794 (b) (1) requires that all transmitters operating on channels 22-24, 32-36, 38, and 65-69 provide 85 dB of filtering in the frequency band of 1164-1240 MHz and 1559 to 1610 MHz. The DCT25U uses the combination of the bandpass filter supplied with every transmitter and also an additional low pass filter for transmitters operating on the above mentioned channels. The bandpass filter provides a minimum of 70 dB attenuation at the specified frequencies and the lowpass filter provides an additional 70 dB of filtering. The combination of these two filters greatly exceeds the 85 dB required amount of filtering. The filter responses of the bandstop filter and the lowpass filter are shown below.

BANDPASS FILTER USED ON DCT25U

Upper trace is return loss and lower trace is amplitude versus frequency response.



LOWPASS FILTER USED ON DCT25U

Upper trace is return loss and lower trace is amplitude versus frequency response.