Responses to Technical Questions as part of the ADTV Pre-Certification Process

The following questions and issues were raised in the documents cited below.

Questions 1 and 2: Letter from Charles W. Rhodes (ATTC) and Brian James (CableLabs) to Mark Richer (Chairman, SS/WP-2), 27 February 1991.

Questions 3 to 14: Letter from Charles W. Rhodes to Birney D. Dayton (Chairman SS/WP-1), 10 October 1990.

Questions 15 to 19: Letter from Brian James to Birney D. Dayton, 27 February 1991.

Responses to the questions are shown in italics

1. Interference Testing, RF Power Level Calibration. In testing for interference, it is essential that the combined D and U signals feeding the ATV receiver must be switched off before either of them is incremented or decremented. Once the attenuations have changed, the combined D and U is switched on. In making this calibration, the RF power cannot be simply incremented as the plan suggests. The RF power must be switched off, incremented, and then switched back on.

Receiver will be built for such operation.

2. Establishing a Second 'Carrier Offset' Relationship in ATV-ATV Testing. In conducting ATV into ATV, the same IF modulated signal serves for both D and U. One of these IF signals is delayed relative to the other with the signal having the greatest delay being the Desired signal and it will have less attenuation than the other which is the Undesired signal by definition. Each of these IF signals will be heterodyned to the appropriate channel. The frequency used to heterodyne each signal to its test channel will be such that the normal carrier offset with respect to NTSC is provided. It may be that one ATV transmitter location must protect an NTSC transmission having +10 KHz offset, while the other ATV transmission must protect another NTSC transmission having either zero or -10 KHz offset. The Undesired signal will therefore have a frequency offset from the Desired signal which may be up to 20 KHz. As this range is large, SS/WP-1 should be asked to determine through its analysis of each ATV system what the expected effect is of differences in carrier

frequencies of ATV systems for ATV-ATV interference. The Test Plan may have to be suitably modified to reflect the differences in systems, or its results may have to be compromised.

The nature of interference between two ADTV signals is essentially the same with or without 20 KHz frequency offset.

3. Describe the changes that have been made to the ATV system since it received preliminary certification.

Not applicable, since this is the first time we are applying for ADTV pre-certification.

4. Can the ATV system be adequately tested, for the purposes of the Advisory Committee, with the approved test procedures developed by SS/WP-2, and with the testing laboratory facilities established to implement those procedures (ATTC, CableLabs, CRC/Canada)? Identify potential problems.

We believe that ATTC can satisfactorily test ADTV. In view of the increased interest in digital transmission SS/WP-2 may, however, revise the testing plans. The ATRC will participate in any such discussions on revisions at SS/WP-2 meetings.

5. Identify all ATV system features that are claimed by the proponent, but which will not be implemented -- and, therefore, cannot be tested -- in the "full television system" hardware to be delivered to ATTC for testing.

It is our intention to implement all the claimed features in the hardware to be supplied to ATTC for testing.

6. Identify the number of audio channels the ATV system provides, and the proposed use and bandwidth of each channel. (Note: SS/WP-2 will determine channel(s) to be tested on the basis of this information.)

Two stereo pairs, which are equivalent to four mono channels. Each mono channel has a compressed data rate of 128 KBPS.

7. If the ATV system provides a separate digital channel for ancillary data transmission, specify the data transmission rate.

The ADTV system is capable of transmitting ancillary data at any reasonable rate, up to 1 Mbps. However, in the hardware to be supplied to the ATTC provision for testing ancillary data quality at 256 Kbps will exist.

8. Specify each digital clock frequency at which the encoder and/or decoder process signals (video, audio, and data). (Note: These are of importance to ATTC because of interference considerations.)

A full description of digital clock frequencies will be provided in the near future.

9. Identify the intermediate and local oscillator frequencies (IF and LO) of the ATV system demodulator. If double conversion is used, furnish data on both conversions, including the bandwidths of both intermediate frequencies.

A tuner, similar to standard TV receiver tuners, will be used to translate the received signal frequency from RF to standard IF (41 to 47 MHz). A second frequency translation will be used to down convert to the signal frequencies to 0 to 8 MHz. This signal will then be demodulated. The LO frequency for the second frequency translation will be in the range of 39 to 51 MHz, excluding 41 to 47 MHz. Precise values will be provided in the near future.

10. Describe all subcarriers used in the ATV system signal as to frequencies, levels, and type(s) of modulation and indicate the estimated potential for interference of each to both NTSC and ATV.

There are no subcarriers of the type used in NTSC or ACTV.

11. For co-channel interference testing regarding NTSC (i.e. ATV-into-NTSC and NTSC-into-ATV), the Test Center will set the NTSC visual carrier to 205.250000 MHz (Ch. 12, zero offset). The proponent must specify the precise frequency (to 1 Hz) to which the ATV carrier should be set. For co-channel interference testing between ATV signals, the proponent must specify the precise frequency difference (to 1 Hz) at which the tests are to be run for minimum interference. Also, SS/WP-1 should require that the proponent specify sufficient technical detail concerning the ATV system's characteristics in order to permit

SS/WP-1 to determine, and to report to SS/WP-2 and the testing laboratories, whether a different frequency offset would result in significantly greater co-channel interference conditions.

The levels of co-channel interference introduced by NTSC-into-ADTV or ADTV-into-NTSC are unaffected by small changes (less than 50 KHz) in the carrier frequency difference. Exact frequency specifications will be made in the near future.

12. Describe the matrix equations for converting the R, G, and B signals at the encoder input to luminance and chrominance components, and for converting back to R, G, and B outputs at the decoder. If the equations are those specified by the FCC for NTSC, or as are defined in SMPTE 240M, this should be noted. If temporal and spatial responses of the color difference signals are not the same as specified by the FCC for NTSC, or as defined in SMPTE 240M, then the color difference signals should be specified separately.

The matrix equations used for converting the R, G, B signals at the ADTV encoder input to luminance and chrominance components are the same as defined by SMPTE 240M including the temporal and spatial response of the color difference signals. Likewise a 240M equivalent inverse matrix is used for converting back to R, G, B, outputs at the decoder.

13. Describe in full technical detail the automatic gain control (AGC) reference provided in the ATV system signal. Report and describe the relevant range of signal levels over which the system should operate.

AGC is expected to have a dynamic range of 80 dB, minimum, and 90 dB, typical. System should lock at a tuner input level of 50 mV. However, this does not include propagation variation.

14. PS/WP-6 has specified a subjective test motion sequence to be used in interference testing. If SS/WP-1's analysis of an ATV system indicates the specified material(s) would not produce the desired results, this should be explained and alternative material(s) indicated. (Note: PS/WP-6 can supply the final written description of this test sequence.)

Assessment of the picture material in the context of the proposed ADTV video compression and transmission system is being done. An answer will be provided in the near future.

15. What is the time range over which the channel equalizer is able to remove reflections? A recent change to the ATV-ATV interference tests has the undesired signal as a leading ghost on the assumption that the equalizer cannot cancel that signal.

Minimum of 16 microseconds, for normal ghosts. We intend to extend this to 40 microseconds. The equalizer will cancel leading and lagging ghosts. During ATV-ATV interference tests the equalizer can be disabled.

16. Provide a detailed description of the interface between their video compression system and the digital transmission system.

The details of interface have not been finalized. The front-end of the digital modulator is the Forward Error Correction (FEC) encoder, which is based on byte-oriented Reed-Solomon coding. The interfaces will be byte oriented. However, for performance verification in the modulator-demodulator (along with FEC) chain, test points will be provided. Please note that the ATRC does not endorse separate video and modem testing, since ADTV has been optimized for combined source and channel coding. The ATRC believes that this is approach is superior to those which treat video encoding and data modulation as separable.

17. Describe any hysteresis the system exhibits with varying received signal levels or changes in impairment levels.

None expected.

18. How fast does the channel equalizer converge? Does it reset with a channel change or loss of signal? Does it remember previous values for each channel?

Precise value of time to equalize is not yet available, but is expected to be less than a few seconds. The equalizer will reset with channel change. In the hardware to be delivered to the ATTC, the equalizer will not remember values for each channel.

19. Is the channel equalizer capable of cancelling undesired signals (such as NTSC signals, discrete carriers, intermodulation products, etc.) present in the ATV channel?

No.