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Eight Annual Report of the Telemetry Standards Coordination Committee

By - Lawrence W. Gardenhire, Chairman 1969-70

Introduction

The Telemetry Standards Coordination Committee (TSCC) has enjoyed a very eventful history. In 1960 when it was organized there was no way for the various facets of the telemetering community to communicate. The Inter-Range Instrumentation Group (IRIG) had, since the days of the Research and Development Board (RDB), continued updating telemetering standards. The RDB was composed of industrial, governmental and military people. The IRIG which is a committee established to represent all national range commanders and is therefore limited to range people. When it became necessary to establish completely new standards, in an area where the ranges were not experienced, problems occurred. The first real problem was the advent of PCM in the mid 50's. Although PCM did not become operational until the late 50's or early 60's, many attempts were made to establish a standard.

As early as 1957 the National Telemetry Conference (NTC) attempted to form a joint committee with the Defense Department to aid in the formation of Telemetry Standards. It was felt that the attendees of NTC represented all interests within the telemetering community and could aid the Defense Department in preparation of Telemetry Standards. This attempt was not successful, and in 1959 NTC decided to form a permanent Standards operation as a part of NTC. Studies were performed by several well known telemetry experts and a recommendation made in early 1960. As a result TSCC as we now know it was formed by an activation committee on August 18 and 19, 1960 at Sandia Base, Albuquerque, New Mexico.

Since that time TSCC has been involved with all standards published by IRIG and has made many recommendations before the standards were printed. Most of these recommendations have been accepted by IRIG and are reflected in the current standards. Since TSCC has members representing; Government, Telemetry Users, and Telemetry Industry, there has been no problem with commercialism. The recommendations have been purely technical and must be approved by ten of TSCC's fourteen members. It should be noted that TSCC is not a standards-writing group, rather it is a review board. It will review any telemetry standards written by any organization which so requests. The major reviews have, however, been on the IRIG Standards.

Committee Activities

Since the preparation of the Seventh Annual TSCC report, which was published in the 1968 ITC Proceedings, and three TSCC meetings have been held as follows:

7 October 1968, Los Angeles, California

29 January 1969, Melbourne, Florida

21 May 1969, Goddard Space Flight Center Greenbelt, Maryland

TSCC activities and actions resulting from these meetings, which are of interest to the telemetry community, are listed below.

7 October 1968

1. The re-write of the Time Division Standards (PCM, PAM & PDM) was reviewed. Many detailed recommendations were made to TWG. Further review will follow.
2. A meeting was held with members of TWG regarding transmitter stability. TSCC recommendations to change the transmitter stability from $\pm 0.005\%$ to $\pm 0.003\%$, exempting the stability requirement during the first second, was accepted by IRIG.
3. Mr. Bill Hines was unable to serve on TSCC therefore Mr. Ken Berns was elected to replace him.
4. Mr. Ken Halls term of office expired and he was replaced by Mr. Cecil Kortman.

29 January 1969

1 An AM Baseband presentation was made to TSCC by Mr. Berns and Mr. Uglow.

TSCC Recommends

That the AM Baseband Standards for independent subcarriers and harmonically related carriers be separated since a ground station capable of demodulating both does not appear to be feasible.

For the harmonically related subcarriers it is recommended that the following changes be made in the existing draft:

- a. Channels with 1 KC, 2KC, 4KC, or 8KC nominal frequency response should be permitted for any of the 44 subcarrier frequencies specified.
 - b. SSB should be permitted with either upper or lower sideband at the user's option.
 - c. A carrier tone for reconstructing the carriers should be transmitted at 4KC, 8KC, 16KC, 32KC, 64KC, or 128KC.
 - d. Where ambiguity must be resolved a second pilot tone at an odd multiple of 4KC should be employed.
2. The rewritten Time Division Standards were further reviewed and following five major changes made. In addition several minor editorial type changes were made verbally to Mr. Thomas of IRIG,
- a. When expressing the narrowest pulse width in PDM, the word rate in PAM and the bit rate in PCM, both the premodulation filter and the IF bandwidth should be referenced. The more constricting of these filters should set the different widths.
 - b. In the PAM Standard, it is recommended that the last sentence of paragraph 5. 4. 2. 2 dealing with the pedestal required for 50% AM be included as part of paragraph 5. 4. 2. 1. It is further recommended that Figure 2 reflect this by putting it under "minimum signal" rather than zero calibration.
 - c. It is recommended that paragraph 5. 4. Z. 4(b) not include any mention of PAM/PM.

- d. It is recommended that the words “assigned carrier frequency” be substituted for the words “the frequency of the unmodulated carrier” in paragraph 5. 3. 5. 2, 5. 4. 5, and 5. 5. 5. 1.
 - e. It is recommended that paragraph 5. 5. 5. 3 be modified to read “the subcarrier channel shall be chosen such that twice the maximum frequency response ...”.
3. A review of Receiver Frequency Stability was made and TSCC recommended that TWG state the definition of receiver frequency stability in the standard and subsequently review the numerical value cited to assure compatibility with the corresponding transmitter frequency stability standard.
 4. A review of the first draft of Standard Test Procedures for Frequency Division and PCM was made. A recommendation was made for a general reorganization and rewording of the Test Procedures.

21 May 1969

4. Review of Tape Speed Measurement Procedure found the proposed changes to the IRIG Tape Speed Test was found to be desirable in the opinion of the TSCC.

TSCC made the following recommendations to IRIG.

- a. The conditions of use of the standard test tape (temperature, humidity, tension, aging, etc.) should be explicitly stated.
- b. Provision should be made for rechecking the standard tape.
- c. The percent speed deviation should be explicitly stated as a formula in terms of the measured parameter.
- d. The closing paragraph should be changed to read (additions underlined):

Standard tapes may be procured with 1.5 mil polyester tape backing on standard precision reels for improved mechanical stability. The user may wish to use a 1.0 mil standard test tape and/or a specific reel diameter.

2. Receiver Frequency Stability

The committee is continuing its review of receiver standards, and as an additional action on its part, intends to canvass S-band telemetry receiver manufacturers for difficulties they may be experiencing in complying with the present standards, for

their interpretation of “receiver frequency stability”, for practices in testing their product, and for any further comments they wish to make on aerospace telemetry standards. We shall advise TWG of the results of the canvass.

3. **AM Baseband Standards Review**

As a result of this review, the Committee recommends that Single Sideband Type II AM subcarrier systems not be allowed and Table V be eliminated. Intolerable frequency translation errors for the high frequency subcarriers can be expected if such a technique were used. For instance, the frequency axis error associated with a power spectral density (PSD) measurement using a 100 KHz subcarrier of typical L-C oscillators stability, is estimated to be as much as 300 Hz. Few PSD applications can tolerate such an error. Because we feel that Type II AM baseband systems should be limited to Double Sideband (DSB) Systems only.

The Committee further feels that it cannot give full support to the issuance of a standard which embodies two methods of implementing DSB. However, there may be overriding consideration beyond the scope of this Committee which require the issuance of a standard at this time. If such is the case, it is recommended that technical evidence be generated to allow the eventual choice of one system over the other with the eventual elimination of one type from the standard.

Additional specific recommendations to the present draft standard are enumerated below.

- a. Paragraph 5. 2. 2 - Use descriptive names for the two types of AM baseband. We suggest that Type I be called “Coherent Subcarrier, Common Reference” and that Type II be called “Independent Subcarrier”.
- b. Paragraph 5. 2. 2. 1 - Use “Composite Signal” or “Composite Multiplex” for “Baseband Signal” throughout the standard. In defining Common Pilot Tone add “tone” after “fixed frequency”, omit “timing” and the parenthesis around “phase” and strike “and ambiguity resolution”. Change “Rise Time of Level Controller” to “AGC Response”. Under Baseband Level Control, strike the last part of the first sentence beginning with “a portion of . . .” and substitute “some of the multiplexed channels”. Reword Channel Level Control by substituting “level stabilizer” for “gain control”.
- c. Paragraph 5. 2. 2. 2 - In the first sentence, change “known phase relationships” to “fixed phase relationships”. In the sentence starting “A common pilot tone . . .”, insert “one of the following”: before the list of frequencies. Also eliminate 128 KHz from the list. The sentence starting “The receiving system . . .” should be moved to the use criteria section since it defines a method of handling tape flutter

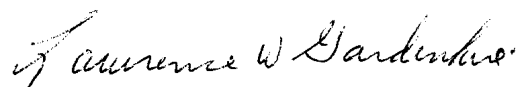
which is not the only method possible. In addition, change “reference tone” to “pilot tone” and add 256 Hz to the list of frequency responses. This paragraph should also advise against post detection recording.

Under ambiguity resolution, change “second common pilot” to “secondary reference” and change “176” to “68”. Under “Automatic gain controls” eliminate 0.5 from the listed rise times. Delete all starting with sentence “channel-level-control ...” since this will complicate the ground stations without improving the signal to noise of the system because it is applied at the receiving end of the system.

The committee feels that the nomenclature for describing channels as to carrier frequency, bandwidth, Double or Single Sideband (and which sideband) should be made part of 5. 2. 2. 2. This would be analogous to paragraph 5. 2. 1. 1 which explains a standard nomenclature for the various FM Subcarrier Characteristics. The AM subcarrier table now use channel nomenclature which is quite adequate except, in the case of SSB, one should be able to call out either the upper or lower sideband. One possible nomenclature would be to use the last letter to describe the sideband structure. Thus 4 BD would be double sideband, 4 BU would be upper sideband only, 4 BL would be lower sideband only.

In Table VI, channels 1AD, 2AD, and 2BD should be restricted to Type I systems only. This is because the method of reconstructing Type II carriers makes these channels difficult to realize.

Sincerely,

A handwritten signature in cursive script that reads "Lawrence W. Gardenhire".

Lawrence W. Gardenhire
Chairman - TSCC