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Ninth Annual Report of the Telemetering Standards Coordination Committee

By - Lawrence W. Gardenhire, Chairman 1969-70

Introduction

The past year has been a busy one for the Telemetering Standards Coordination Committee (TSCC). Although we have had only three formal meetings, much subcommittee work has been done between meetings.

The IRIG Telemetry Standards were completely revised last year, and a new section on AM Baseband added. In addition Use Criteria and Testing Procedures have been added. Each of these require a review, and many hours of Committee members time.

In addition TSCC has reviewed several documents other than those originated by IRIG. They include, The Aerospace and Flight Test Radio Council (AFTRCC), Society of Automotive Engineers (SAE) and the Navy Department.

As retiring Chairman it is a pleasure for me to give the following report on the activities of TSCC during the past year.

Committee Activities

Since the preparation of the Eighth Annual TSCC report, which was published in the 1969 ITC Proceeding's, three TSCC meeting's have been held as follows:

17 & 18 September 1969, Washington, D. C.
14 & 15 January 1970, Corona, California
10 & 11 June 1970, Huntsville, Alabama

TSCC activities and recommendations resulting from these meetings,

which are of interest to the telemetering community, are listed below.

17 & 18 September 1969

1. Under the terms of the existing By Laws three members five year term expires each year for four years and the fifth year only two expire.

   Those expiring in 1969 were, Joe Koukol, Arnold Bentz and Max Lowy. Mr. Koukol decided to serve another five year term as was so elected. Mr. Bentz was replaced by Mr. Harold Jeske also of Sandia Corporation and Mr. Max Lowy was replaced by Mr. Vernon Jennings of the Boeing Company.

2. Recommendations were made to the Aerospace and Flight Test Radio Coordinating Council (AFTRCC) which would bring the FCC Rules and Regulations regarding the 14351535 MHz telemetry band, into line with IRIG 106-69. These recommendations were too detailed to mention here, however, they were in essence accepted by AFTRCC who have petitioned FCC accordingly.

3. The R. F. Standards and Frequency Allocation Subcommittee has for some time been studying the requirement for Wideband Systems, and made arrangements for a presentation by Mr. George Thomas on the use of wideband systems on the ranges.

4. The following recommendations were made to the Telemetry Working Group (TWG) of the Inter Range Instrumentation Group (IRIG) regarding the latest draft of the AM Baseband Standards.

   a. Nomenclature change, i.e. , “channel ambiguity reference” changed to “channel reference tone”.

   b. “Response time of level controllers” was re-defined as the time required after a 6 dB step increase in the level of the composite multiplex signal to return the level of the composite multiplex to within 10% of the final value. The actual levels used for this test should be defined in the final standard.

   c. A system phase reference was defined as the time when positive going axis crossings of the common pilot tone, and the ambiguity reference tone occur simultaneously. This definition permits the sense of a channel to be established.

d. The definition of the ambiguity reference tone (ART) was changed to limit the frequency to odd multiples of 4 KHz below 100 KHz. A specific statement permitting the channel in which the ART is located to be used for data but requiring that the region within ±100 Hz of the ART be kept clear of data components was added.

e. The frequencies stated for the bandwidths of the tracking loops used to recover subcarriers were defined as the undamped natural frequency (fn) of the tracking loop.

f. Table V, Sirgle Sideband (SSB) AM Subcarrier Channels was deleted. Table VI, Double Sideband (DSB) channels changed to Table V, and made applicable to ISM channels only. HSM channels to be defined by nomenclature is standards to permit any type of HSM channel at any of the carrier frequencies defined as Fc - 4n KHz.

g. In the ISM method, a change to forbid SS B channels was made.

h. In ISM systems the need to add the channel reference tone for each bandwidth in the multiplex to the baseband where ambiguity resolution is required was stated specifically.

i. The frequencies of the channel pilot tones available were corrected to: 1. 5 KHz, 3 KHz, 6 KHz, or 12 KHz.

Many detailed wording changes in the draft were suggested and noted by Mr. Ken Berns who is on the IRIG subcommittee that is writing the standard.

5. The final version of IRIG 106-69 PDM, PAM and PCM were reviewed and with only a few exceptions TSCC1s recommendations were incorporated in the document. A letter was written to Mr. Perry Newton, of IRIG, suggesting the following changes be considered:

   5.3.3.1 and 5.4.3.1 did not add “During the period of desired data” to the beginning of the first sentence.

   5.4.2.1 - we recommended the words “zero level” rather than “zero calibration level”.

   5.5.2.3 - we recommended changing minimum word length to 4 bits. It still reads 6 bits.

5.5.3 - title of paragraph still “Maximum Bit Rate”. Should be just “Bit Rate” since minimum is also spelled out. The last sentence should be made the second sentence.

In Figure 4, “PCM Waveforms”, the BiO-M and BiO-S pictures are still reversed.

6. A presentation on “Telemetry Ground System and Subsystem Test Methods” was made by Dr. Walter Hedernan of Aerospace Corporation and Mr. George Thomas of IRIG. Their intentions are to expand the test method to include not only the end-to-end system test but Block Box tests.

   The committee reviewed the first draft of the document prepared by Dr. Hedeman and Dr. Nichols and discussed possible changes. No official action was taken since it was understood that the document was to have a major revision.

7. The R. F. Standards and Allocation Subcommittee is preparing a canvas of S-Band telemetry receiver manufacturers, regarding receiver frequency stability.

<u>14 & 15 January 1970</u>

1. “The TSCC recommend to the Chairman of the IRIG that a glossary of the more significant telemetering terminology be included in the next issue of the telemetry standards, 106-70, as an appendix. This would supplement the more comprehensive golssary of IRIG 104-64 (revision 69) that is referenced in 106-69. The increasing application of telemetry words to other electronic applications, often with a different meaning, has clouded the definition of some common telemetry nomenclature. An appropriate glossary should remove the confusion.”

2. A document titled “Proposed General Multiple Interior Communications Systems (MINCOMS) Standard” as prepared for the Naval Air Development Center was reviewed. It was also learned that SAE Subcommittee A-2K is preparing a standard for “Multiplexing Systems for Aircraft”. The chairman since the last meeting has offered to review this document for SAE. Further information on remote multiplexing will be presented at the next meeting.

3. The following recommendation was made to, the IRIG TWG Transmitter/Receiver Committee.

   At the January meeting of the TSCC the question of receiver frequency stability was discussed. Our inverstigation thus far leads the TSCC to a preliminary recommendation that the combined errors of all local oscillators of discreetly

tuned, crystal controlled receivers should not exceed 0. 001% of the assigned frequency under all operating conditions.

It is recognized that other factors enter into the determination of receiver frequency stability. Also, a different approach to achieving successful operation might possibly be more effective than defining a standard stability. Nonetheless, the above recommendation appears likely to be compatible with successful operation in any approach.

4. The following recommendations on the latest Frequency Multiplex Standards were made to IRIG.

Page 2 - 5.2.2 Third line, "In DSB, only the spectral component at the subcarrier frequency is suppressed. In SSB, the subcarrier component as well as the modulation sideband on one side of the subcarrier frequency is suppressed."

Page 3 - 5.2.2.1 Response Time of Level Controllers

"The time required to change the gain of the level controller to re-establish the output to within 51o of the full modulation output voltage after the common multiplex signal has been subjected to a 6 dB step in voltage when initial or final value is the full modulation value for decreasing or increasing steps, respectively. The response time . . . . "

Page 4 - 5.2.2.2 Second paragraph on page 4.

Delete second sentence, "The ambiguity reference tone may be modulated, etc." Add: "The channel which contains the Ambiguity Reference Tone may also be used for data provided the ART amplitude and phase is not disturbed and the region of ±50 Hz around this tone is kept free of data components."

Page 4 - 5.2.2.2 Fifth paragraph on page 4.

Change last sentence: "The nominal attack and recovery response times will be selected from the following: 0.5, 1.0, 2.0, 4.0, 8.0 and 16.0 milliseconds."

5. A set of application notes for FM Subcarrier Systems, as prepared by the Frequency Division Subcommittee, was approved for submission to IRIG. These notes can be added to the Use Criteria (Appendix B) of 106-69.

10 & 11 June 1970

3. In April the Aerospace and Flight Test Radio Coordinating Council (AFTRCC) contacted the TSCC Chairman seeking support in opposing the re-allocation of 70 MHz in the 14351535 Hz telemetry band for use by two Canadian satellites. The chairman polled the members by phone and then wrote a letter to the FCC supporting AFTRCC position, and requested that the U.S. government oppose this re-allocation.

4. A presentation on the Miller Code, as patented by Ampex for recording high bit rate PCM, was made by Mr. Cecil Kortman. As a result the following recommendations were made to the Telemetry Working Group of IRIG regarding the Time Division Multiplex Standards.

   TSCC recommends that TWG consider the possibility of adding the "Miller Code", or the almost identical "Delay Modulation Technique" to the list of Standard PCM Waveforms. (Par. 5. 5. Z. 5) This method has all the advantages of Bi-Phase types and required considerably less bandwidth.

   TSCC further recommends the inclusion of a Time Division Multiplex Use Criteris Section in the 106 Standards, similar to that in Appendix B, Page 89 of 106-69 for Frequency Division, or the updated version that is currently being reviewed. For example a discussion of the considerations in choosing one of the alternative PCM Waveforms shown on Page 25 of 106-69 on the methods referred to above, would be of direct value in the use of the Telemetry Standards.

5. The final draft of Sections 5. 6 and 5. 7 (Tape Recording) Standards and Test Procedures) were reviewed and the following recommendations made:

   A. The Magnetic Tape Recorder/Reproducer Standards Section

      1. Paragraph 5.6.2.1.2 be changed to: (1) Eliminate Section "d", and (2) Revise Section "c" to read:

         c. Wideband

            (1) 1.5 MHz direct record response to 1.5 MHz nominal at 120 i.p.s.[4]

            (2) 2.0 MHz direct record response to 2.0 MHz at 120 i.p.s. [4]

The purpose of this recommendation is to simplify the standards by use of only one wideband catergory, with sub-headings, rather than two separate wide band categories.

2. On Figure 5, eliminate the identification of “tape centerline”. Since all dimensions are given from the reference edge it appears that labeling the centerline is confusing and of no value. Also correct the typographical error which labels the 1 inch tape at 0.005" rather than 0.5".

B. The Procedures for Testing Recorder/Reproducer Systems

1. Paragraph 5.6.2.3.2 text and Figure 5. 6-4 be made consistent by changing the low pass identification in the figure to read “bandpass filter, flutter” and to add the word “carrier” after the bandpass filter preceeding the discriminator.

These changes are recommended to correct a discrepancy between the text and the figure, and to eliminate an ambiguity.

C. The Magnetic Tape Test Procedures

1. Paragraph 5. 7. 2. 2 be changed to correct a typographical error on line 5 which now incorrectly reads 11 1 - 14 inch”.

4. The final draft of document “Use Criteria for Frequency Division Multiplexing” was reviewed and the following recommendations made:

Page 6 - (60, AM Subcarrier Background)

A warning of the possible undesirable effects of the use of TMC should be inserted. The second paragraph on Page 22 of the paper by Walter Frost in the Dec. /Jan. 1970 issue of the “Telemetry Journal” is suggested.

Page 7 - 70.1 HSM Systems

Replace first two paragraphs with bottom two paragraphs on left side of Page 20, W. Frost article Dec. /Jan. 1970 “Telemetry Journal”.

Insert after above “The zero phase reference time for each subcarrier is the time when the common pilot time (CPT) and the ambiguity reference time (ART) have simultaneous positive going zero crossings.”

Last paragraph 70.1

When TMC is used the ART should not be included in the multiplex controlled by the TMC loop.

Page 8 - 70.3 SSB Systems

This section should be combined with the section on HSM Systems.

Page 8 - 70.4

Pre-emphasis is AM baseband systems should be similar to CBW FM when TMC is not used. No pre-emphasis should be used when TMC is used.

Page 9 - 80.1

Baseband Level Control should operate only on the channels included in TMC loop.

Page 9 - 80.2

First paragraph last sentence -- The ground station phase adjustments should be made to minimize the phase error to reduce errors due to tape flutter and jitter of the phase reference.

5 . Presentations on Internal Multiplexing was made by the following:

Mr. Walt Frost - Internal Multiplexing for the NASA Space Shuttle. Mr. Irv Lantor - The SAE Committee Activities and Internal Multiplexing from the commercial airplane manufacturers standpoint. Mr. Jack Webster - The Status of ARINC Research Corporation. Multiple Interior Communications Systems (MINCOMS) Standards.

The presentations were very interesting and informative, however, none of the three areas are far enough along to warrant review by TSCC at this time.

Lawrence W Gardenhire

Lawrence W. Gardenhire - Chairman
Telemetering Standards Coordination
Committee