STATEMENT OF WORK

GOES COMMAND RECEIVER

ATTACHMENT 2

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

NATIONAL DATA BUOY CENTER

STENNIS SPACE CENTER, MISSISSIPPI 39529-6000

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1.0 DEFINITIONS/ACRONYMS

a. Payload — NDBC meteorological data acquisition and satellite communication system.

b. ASCII — American Standard Code for Information Interchange

c. BCH — Bose, Chaudhuri, Hocquenghem (Special error detecting code)

d. DACT — Data Acquisition Control and Telemetry

e. GOES — Geostationary Operational Environmental Satellite

f. LRU — Line Replaceable Unit

g. MLS — Maximal Length Sequence

h. MTBF — Mean Time Between Failure

i. NDBC — National Data Buoy Center

j. NIST — National Institute of Standards and Technology

k. NESDIS — National Environmental Satellite Data and Information Service

l. PSK — Phase Shift Keying

m. SOW — Statement of Work

n. VEEP — Value Engineered Environmental Payload

1.1 APPLICABLE DOCUMENTS

The following documents, with the revision in effect on the date of solicitation, are applicable to the extent specified herein. The present source of military specifications and standards is:

Commanding Officer
U.S. Naval Supply Center
(Code DC-1) 5801 Tabor Ave.
Philadelphia, PA 19120

1.1.1 Specifications

a. MIL-D-15024 — Plates, Tags, and Bands for Identification of Equipment

b. MIL-I-45208 — Inspection System Requirements.

1.1.2 Standards

a. DOD-STD-100 — Engineering Drawing Practices

b. MIL-STD-454 — Standard General Requirements for Electronic Equipment

c. MIL-STD-481 — Configuration Control

d. MIL-STD-461 — Electromagnetic Interference Characteristics, Requirements for Equipment

e. MIL-STD-462 — Electromagnetic Interference Characteristics, Measurement of

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g. EIA-STD-414 — Simulated Shipping Tests for Consumer Electronic Products and Electronic Components.

1.1.3 Appendices

a. Appendix A — Interrogated Data Collection Platform Radio Set Certification Standards

b. Appendix B — The GOES Data Collection System Platform Address Code

c. Appendix C — Publication TFS-602 NBS Time via Satellites

d. Appendix D — NDBC Standard Specification for Electrical Wire and Cable (NDBC-8001)

e. Appendix E — Letter, Cy Settles, NESDIS response to NDBC request for information concerning certification of new GOES DCPI receiver

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g. Appendix G — Drawing, 3-Meter Buoy Assembly

h. Appendix H — SOW for VEEP Software Changes.

2.0 INTRODUCTION

2.1 BACKGROUND

The NDBC maintains a network of approximately 100 automatic data collection packages (payloads) that are installed at isolated coastal locations, on offshore platforms, and on moored buoys. These systems normally acquire and process meteorological data with a microprocessor-based electronics unit and report the data hourly via the GOES Data Collection System (DCS). The two generations of payloads which are in current use are the Data Acquisition Control and Telemetry (DACT) and the Value Engineered Environmental Payload (VEEP). These systems operate in the

GOES "Self-Timed" mode in which their data transmissions to the satellite must be made within an assigned 1-minute time slot each hour. However, in special situations more frequent transmission schedules and/or 30-second time slots may be used. Control of the time of payload transmission is maintained by an internal system clock.

Additionally, these systems contain set-up parameters that are entered in the payloads at the time of installation. These system parameters can be changed with the use of a payload test set, but this necessitates direct connection of the test set to the payload or access by telephone. However, buoy installations and some fixed platforms are located in areas where no telephone service exists. In these cases, current practice requires that a technician be sent to the sites to reset the clock or to modify the set-up parameters.

2.2 PURPOSE

The purpose of this procurement is to develop, test, and deliver two prototype and up to 105 production GOES Command Receivers. These Command Receivers shall be capable of receiving commands via the GOES Interrogate RF link. The 12-bit commands that are received shall be converted into ASCII character string instructions that are currently recognized as test set commands by the two payload types. The Command Receivers will be installed with the existing NDBC payloads and will allow remote access to perform such functions as changing the setup parameters or resetting the clock. This will eliminate the need for technician service visits to the sites to perform these functions.

2.3 SCOPE

The work under this contract consists of two major phases. The first phase, prototype development, encompasses the basic design, fabrication, and testing of two prototype and five baseline production receivers. The second phase is the optional production and delivery of up to 100 receivers (to be used with DACT and VEEP payloads on NDBC operational stations), training, and production unit documentation.

3.0 TECHNICAL REQUIREMENTS

3.1 SYSTEM OVERVIEW

3.1.1 Interrogate/Command Operational Process Steps

The Command Receiver shall operate using the protocol described under "Two Address Commanding" in the NOAA Technical Memorandum (Appendix B). "Interrogation" and "Command" are terms that describe instructions sent to the payloads over the GOES Interrogate Command link. "Commands" are instructions to the payload to change its operating mode, such as its transmission schedule or message length. "Interrogation" is a special case command in which the addressed payload is requested to retransmit its last data message. The Interrogate/Command process consists of the following six steps:

Step 1: The process of interrogating or commanding an NDBC payload begins with the issuance of a command via computer terminal that is connected to the NESDIS Data Acquisition and Processing System (DAPS) computer through a telephone modem.

Step 2: The DAPS computer then issues the Command or Interrogate to the Frequency Control Electronics, which transmits it to the proper satellite (GOES east or west) to reach the addressed receiver. The DAPS computer is presently set up to automatically interrogate the NDBC payloads if a self-timed data message is missing or is received with a parity error.

Step 3: The satellite transmits a repetitive series of data frames consisting of three information fields; Universal Time Code (4 bits), frame sync (15 bits), and Bose, Chaudhuri, Hocquenghem (BCH) address (31 bits).

Step 4: The addressed receiver synchronizes with the satellite transmission and decodes and identifies its unique BCH address indicating that the platform is being issued a command and the next data frame received must be examined to determine the nature of the command.

Step 5: The satellite transmits the second data frame. The Receiver decodes the first 9 bits of the BCH address to check for a hexadecimal [redacted] ["1CD" (Binary 110011010)] **If present, it signifies that a command other than a platform interrogate is being issued and that bits 10 through 21 contain the 12-bit command data word. If a platform interrogation is being issued, a bit pattern other than the hexadecimal "CD" will be contained in the first 9 bits, and**

the Receiver shall command the payload to make an immediate retransmission of the last data message.

Step 6: The receiver decodes the command data word (other than a platform interrogation) and issues a corresponding RS-232 data sequence to the payload. This causes the payload to take the appropriate action which includes transmitting the mandatory reply message to the satellite. The reply message will include confirmation that the proper command was received by the payload.

3.1.2 Command Receiver/Payload Operation

The Command Receiver will be installed with the NDBC DACT and VEEP payloads as shown in Figure 1. It shall be packaged in an environmentally sealed enclosure with separate electrical connections for the receive antenna, power, signal output, and receiver test and setup port. Subsequent to setup, and after initialization in the field, the Command Receiver shall operate automatically. During this period of operation, it shall receive and decode the individual satellite commands and translate them into preprogrammed host payload commands. The receiver shall interface with the payloads via their test set connectors and communicate with them in ASCII character string sequences recognized by the payloads as test set commands. The receiver shall synchronize and "lock on" the assigned GOES Command frequency and monitor it at all times, except during required payload transmissions (either self-timed or interrogate/command response). It shall decode properly addressed commands from the satellite, translate them into preprogrammed ASCII character sequences, and output them to the payload over the RS-232 channel. The payload accepts the commands and executes them to control the payload operating mode, to initiate data transmissions, to reset the system clock, and to perform other functions as described later.

3.2 GOES DATA COLLECTION SYSTEM (DCS)

3.2.1 Frequency Characteristics

The Command Receiver shall receive the satellite interrogate command data on any one of the following three frequencies as selected by operator setup:

468.8375 MHz	GOES East
468.8125 MHz	GOES West

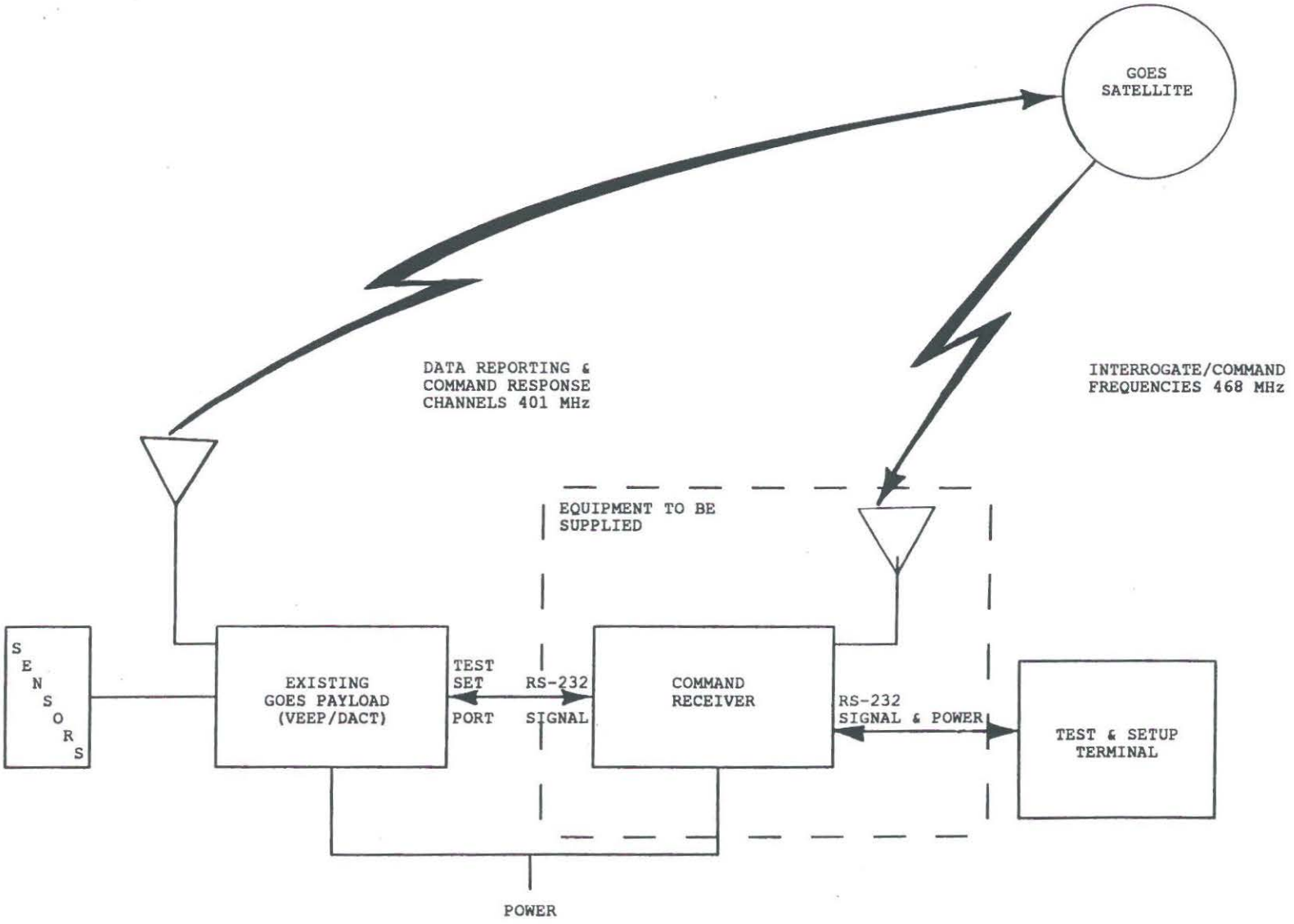

Figure 1. GOES Interrogate Mode Operating Configuration

468.8250 MHz GOES West

It should be noted that these frequencies are in a band designated by the FCC for land and marine (fixed and mobile) service and are not restricted for satellite communications. For this reason, high levels of interfering signals should be anticipated.

The payload transmits the mandatory response to the interrogate command over one of the standard data channels in the 401.7 to 402.0 MHz frequency band.

3.2.2 Interrogate Command Data Format

As described in Appendix B, the Interrogate/Command Link data format consists of repetitive sequences of time code (4 bits), MLS frame sync (15 bits), and the 21/31 BCH address (31 bits). The BCH address is, itself, broken down into four data fields: User ID (9 bits), Priority (2 bits), Platform Index (10 bits), and BCH Check (10 bits). This 50-bit sequence is transmitted continually at a rate of 100 bits/second and is repeated every 0.5 second.

A platform is interrogated (or commanded) by inserting a code that matches the stored platform address (called the Primary Address) in the 31-bit BCH address field for one 0.5-second sequence. A second data sequence must then be transmitted that contains a unique bit pattern in the User ID portion of the BCH address field. This signifies that the data in the 12-bit positions of the combined Priority and Platform Index fields contain the command data word. This command data word shall be decoded by the Command Receiver and translated into the specific payload commands.

3.2.3 NIST Time Code

Each data frame that is transmitted by the satellite contains four data bits of Universal Time Code. Once every 0.5 second, a 4-bit segment of a complete 240-bit time code is transmitted. A complete time code is transmitted every 30 seconds, beginning on the minute and half-minute, and contains the day, hour, minute, and second. The time code format is 40 sync bits (alternating 1's and 0's), 32 bits of time code followed by 168 bits of other information not needed for this application. This information is necessary for the Receiver to command the payload to reset the clock. Additional information is available in Appendix C.

3.3 NESDIS CERTIFICATION

3.3.1 Certification Standards and Testing

NESDIS policy regarding certification is that platforms, which have previously been certified as conforming to the "Self-Timed Certification Standards," have to be recertified to the "Interrogated Mode Certification Standards" to be allowed to operate in that mode. This means that a separate certification test shall be required for the Command Receiver operating with each type of NDBC payload. (See Appendix F)

3.3.2 Contractor Responsibilities

The Contractor shall be responsible for developing preliminary and final certification test procedures, providing test equipment and facilities, and conducting all testing necessary to achieve NESDIS certification (Appendices A and F). Preliminary procedures shall be submitted for approval during prototype development. Final procedures shall be submitted with the Final Acceptance Test Procedure per Paragraph 4.2. Government approval will be provided within 2 weeks. NDBC will provide one each of the payloads, which contain fully tested software modifications to support operation with a Command Receiver, as GFE for certification testing.

The Contractor shall also reimburse NESDIS for all costs incurred by NESDIS personnel in witnessing certification testing as described in Appendix E.

3.4 SYSTEM DESIGN

The Command Receiver shall be designed using low-power, industrial-grade components, as a minimum. Emphasis shall be placed on reliability, modularity, and simplicity of field setup and operation.

It is anticipated that the Command Receiver may consist of two major functional sections — the RF Section and the Decoder/Interpreter Section. Additionally, the system shall include power regulation/conditioning circuitry, a receive antenna, and interconnecting cabling. The NDBC Standard Specification for Electrical Wire and Cable (NDBC-8001) is provided as Appendix D.

3.4.1 RF Section/Antenna

3.4.1.1 RF Section

The Command Receiver RF section shall receive the GOES DCS Interrogate signal transmitted by the satellite on any one of the three Interrogate frequencies. It shall demodulate and synchronize the incoming bit stream for decoding in the Decoder/Interpreter section.

The Command Receiver shall acquire initial signal lock within 1 minute. The acquired signal lock shall be within the stated ±100-Hz frequency uncertainty of the satellite transmission at a -130-dBm signal level and an E_b/N_o > 15 db (E_b/N_o is a figure of merit used in digital communications and is defined as energy per bit divided by broadband noise) with a maximum BER of 10^{-6}. Once having acquired signal lock, it shall maintain signal lock down to -135 dBm with a maximum BER of 10^{-4}. It is not required that the Receiver maintain signal lock during payload GOES transmissions (either "Self-Timed" or "Interrogate Response"), but it shall regain lock within 30 seconds of the completion of the transmission.

3.4.1.2 Interfering Signals

As described in Section 3.2.1, the frequency band in which the Command Receiver must operate is a shared band, and high levels of adjacent channel interference should be expected. While the majority of the NDBC installation sites are located in very remote areas or at sea where very little RF interference would be expected, there are instances in which this is not the case.

The Command Receiver shall be capable of normal operation at installations where the transmit and receive antennas are separated by as little as 3 feet.

3.4.1.3 Antenna

The contractor shall provide antennas and interconnecting cabling with the prototype receivers. If one type of antenna meets both operating conditions described below, two of those antennas shall be supplied. If two types of antenna are required, one of each type shall be supplied. No antennas or cabling are required for the production units. These antennas shall be compatible with the Receiver input characteristics described in Paragraph 3.4.1.1 when operating in the respective zones of GOES coverage described below.

The nominal satellite elevation shall be between 20 and 70 degrees for buoy sites, and the omnidirectional antenna may be optimized for reception for those angles. The antenna shall be less than one square foot in cross-sectional area (to minimize wind loading effects) and shall have a maximum length of 18 inches with a maximum 8-inch-diameter mounting flange to simplify mounting. An outline drawing of the NDBC 3-meter buoy, which is the most restrictive for antenna installation, is enclosed as Appendix G. The Contractor shall return with his proposal a modified copy of this drawing showing his proposed installation design. The antenna shall be ruggedized, corrosion-resistant, and waterproof so as to withstand exposure to salt spray, momentary inundation, and the shock and vibration that will be experienced when mounted on a small buoy that is moored in an offshore marine environment.

Some fixed installation sites that are on the extreme edge of GOES satellite coverage will have satellite elevation angles approaching 5 degrees. For these applications a directional, fixed-orientation antenna may be provided. In this case the maximum length restriction, specified in the previous paragraph, is increased to 30 inches.

Both antennas shall be capable of operating with the Receiver separated from the antenna by a distance up to 50 feet.

3.4.2 Decoder/Interpreter Section

The Decoder/Interpreter section shall accept the synchronized data input from the RF section and decode the NIST time, the primary address, and the command data word and shall provide interpreted commands to the payload.

3.4.2.1 Data Communication Error Detection/Correction

The Command Receiver shall include a processing algorithm that implements the error detection and correction capabilities of the BCH address code to correct up to 2-bit transmission errors in the 31-bit BCH address and command data word as described in Appendix B.

Four additional types of data transmission error detection are required. Two of these error checks, Types 1 and 2, shall be made by the Receiver. Types 3 and 4 error checks will be made by the payload. These four error checks are:

Type 1 — Validation of the 31-bit command data word from the satellite as a legitimate command.

Type 2 — Character validation (echo-check) of the ASCII data transfer between the Command Receiver and the payload.

Type 3 — Checksum verification of the command transfer between the Command Receiver and the payload.

Type 4 — Verification of the legitimacy of the command by the payload.

Detection of any of these four types of errors shall result in the command execution process being aborted and an appropriate response transmission, identifying the type of error, being sent to the satellite.

3.4.2.2 Payload/Command Receiver Interface

The payloads currently are capable of receiving commands as ASCII character strings via their test set ports when the Test Sets are connected. The terminating character for each string is an ASCII Carriage Return. The payload "echoes-back" each ASCII character as it is received until the terminating character is detected, at which time the command is executed.

The commands which are sent to the payloads from the Command Receiver will consist of up to ten of the original test set commands to accomplish a given function. These may be viewed as command steps comprising the satellite command. As the command steps are sent to the payload they will be buffered for execution after the Command Receiver and the payload have verified that the correct command has been received by the payload. This shall be accomplished by the Receiver by performing a character-by-character verification of the ASCII characters as they are "echoed-back." Once the complete command has been sent to the payload, and its echo-check completed, the Command Receiver shall compute a checksum for the entire command and shall send it to the payload with a double Carriage Return. The payload will recompute the checksum on the buffered command and will verify that the command steps are valid, Types 3 and 4 error checks. Once these checks have been successfully completed, the payload will begin execution of the command.

If an invalid 12-bit command data word (i.e., one which is not contained in the command repertoire for the current payload) or a character transmission error is detected by the Receiver, it shall discontinue sending any additional command steps, as well as the checksum and double carriage

return. It shall, instead, send an abort command (to be identified later) to the payload with the designation of a Type 1 or Type 2 error condition. The payload will respond to the abort command by cancelling all command steps that it has previously received. If the payload receives an abort command from the Command Receiver, or if it cannot validate the checksum or command legitimacy, it will transmit a "Command Aborted — Type X (1, 2, 3, or 4) Error" response message to the satellite.

3.4.2.3 Payload Command Processing

As previously described, once the payload receives the complete command, it begins to process the command. As a first step, owing to the timing requirements for the mandatory GOES DCS command response, the payload prepares the response message, shifts the transmitter to the command response channel that has been previously loaded into the payload as a setup parameter, and transmits the response message. This message contains sufficient information so that operational personnel can confirm that the correct command was received by the payload.

After the response message is transmitted, the payload executes the command. Confirmation, by operational personnel, that the payload correctly responded to the command is determined from subsequent "Self-Timed" data transmissions.

3.4.3 Interpreted Commands

The Receiver shall contain a preprogrammed command repertoire for both the DACT and VEEP payloads. A particular command shall be issued by decoding the 12-bit satellite command data word, which shall be converted by the Receiver into one or more test set commands to the payload according to the preprogrammed command set. Each command to the payload will consist of up to ten RS-232 transmit/receive sequences. Each sequence may consist of up to 60 ASCII characters.

The commanded payload functions will consist of the following:

a. Command an immediate retransmission of data

b. Reset the payload clock

c. Command wave data acquisition and processing, and/or the Loran receiver on and off

d. Change the data acquisition and transmission schedule

e. Command GOES transmission on and off.

The commands are described in additional detail in the following paragraphs. The ASCII character sequences comprising these commands are shown in Table 1 for the VEEP commands and in Table 2 for the DACT commands.

In addition to the commands described in Table 1, the Command Receiver shall also include a partial implementation of ten additional commands for future change or expansion. These commands will be implemented to the point where the satellite data words are decoded and basic software linkages are included. This will allow the command implementation to be completed at a later time by the Government by adding the ASCII character sequences to the software source code and recompiling the system software.

3.4.3.1 Retransmission of Data (Interrogate)

As previously described, the payload/Command Receiver will be "interrogated" in order to recover the data from the previous, incorrectly received, "Self-Timed" synoptic GOES transmission. In this case no special command response message will be prepared by the payload. It will simply shift to the response channel and retransmit the previous message.

3.4.3.2 Reset the Payload Clock

The Command Receiver shall maintain and continuously update an internal time reference that is accurate to within ±0.1 second of the NIST time code transmitted by the satellite. The Receiver shall contain provision for validating the NIST time that is decoded, by comparing successive time code updates, such that the possibility of corrupting the internal timing reference is minimized. The Receiver shall maintain a record of the currency of time code updates that it uses and, if it has not performed two updates in the hour preceding the receipt of a command to reset the payload clock, it shall send a "Time Code Questionable" abort command to the payload.

Because of inherent limitations in the design of the GOES DCS system, it is not possible for the system operator to control the precise time that a satellite command is issued. For this reason, when a command is issued to reset the payload clock, the Command Receiver shall formulate, transfer, and verify correct reception of the command steps to the payload in advance of the actual time of day contained in the code. A synchronizing code, "SSS(C/R)," shall then be issued by the Command

Table 1. ASCII Character Sequences for VEEP Commands

1. Immediate Retransmission of Data

Command Receiver Command Strings	Description
(C/R)GOESXMI(C/R)	Retransmit last data buffer

2. Reset Clock

Command Receiver Command Strings	Description
(C/R)GOESTIM(C/R)	Enter time mode
HHMMSS DDDYY(C/R)	Enter the time to be set
EXI(C/R)	Exit Time-set Mode

3. Turn On or Off the Wave Processing or the Loran C

Command Receiver Command Strings	Description
(C/R)GOESSET(C/R)	Enter Set-up mode
47(C/R)	Waves parameter number
ON(C/R)	Turns Waves ON
OFF(C/R)	Turns Waves OFF
EXI(C/R)	Exit Setup Mode
Y(C/R)	Yes, Save the changes
RUN(C/R)	Command VEEP to Run Mode
(C/R)GOESSET(C/R)	Enter Setup Mode
46(C/R)	LORAN parameter number
ON(C/R)	Turn LORAN ON
OFF(C/R)	Turn LORAN OFF
EXI(C/R)	Exit Setup Mode
Y(C/R)	Yes, save the changes
RUN(C/R)	Enter the Run Mode

4. Change the Data Acquisition or Transmission Schedule

Command Receiver Command Strings	Description
(C/R)GOESSET(C/R)	Enter the Setup Mode
6(C/R)	Transmit Interval
H(C/R)	Enter new interval (Hours)
EXI(C/R)	Exit Setup Mode
Y(C/R)	Yes, Save the changes
RUN(C/R)	Enter RUN Mode
(C/R)GOESSET(C/R)	Enter the Setup Mode
5(C/R)	Acquisition Interval
HMM(C/R)	Enter new Interval
EXI(C/R)	Exit Setup Mode
Y(C/R)	Yes, Save the changes
RUN(C/R)	Enter RUN Mode

5. GOES Transmission On/Off

Command Receiver Command Strings	Description
(C/R)GOESSTO(C/R)	Command VEEP to Stop Mode
(C/R)GOESRUN(C/R)	Command VEEP to Run Mode

(C/R) = CARRIAGE RETURN

Table 2. ASCII Character Sequences for DACT Commands

1. Immediate Retransmission of Data

Command Receiver Command Strings	Description
(C/R)GOESXMI(C/R)	Retransmit last data buffer

2. Reset Clock

Command Receiver Command Strings	Description
(C/R)GOESSC(C/R) YRYRMODAHHMM(C/R)	Set Clock Enter the time to be set

3. Turn On or Off the Wave Processing or the Loran C

Command Receiver Command Strings	Description
(C/R)GOESPE(C/R)	Parameter Entry mode
J031(C/R)	LORAN Status
E(C/R)	Enable LORAN
D(C/R)	Disable LORAN
J999(C/R)	Exit Parameter Entry Mode
GO(C/R)	Restart System
(C/R)GOESPE(C/R)	Parameter Entry Mode
J034(C/R)	Wave parameter number
WS(C/R)	Enable Wave Spectra
DL(C/R)	Enable Directional Spectra
DI(C/R)	Disable Waves
J999(C/R)	Exit Parameter Entry
GO(C/R)	Restart System

Table 2. ASCII Character Sequences for DACT Commands (Continued)

4. Change the Data Acquisition or Transmission Schedule

Command Receiver Command Strings	Description
(C/R)GOESPE(C/R)	Parameter Entry Mode
J016(C/R)	Transmit Interval
H(C/R)	Enter new interval H=1 to 9
J999	Exit Parameter Entry
GO(C/R)	Restart system
(C/R)GOESPE(C/R)	Parameter Entry Mode
J014(C/R)	Acquisition Interval
HHMM(C/R)	Enter new Interval
J999(C/R)	Exit Parameter Entry Mode
GO(C/R)	Restart system

5. GOES Transmission On/Off

Command Receiver Command Strings	Description
(C/R)GOESSTO(C/R)	Command DACT to Stop Mode
(C/R)GOESGO(C/R)	Command DACT to Run Mode

(C/R) = CARRIAGE RETURN

Receiver to the payload, at the precise time of day contained in the code, within its previously specified accuracy limit. This will be used by the payload as the synchronizing event to update its internal clock.

3.4.3.3 Waves Processing and Loran Control

This command function will simply consist of toggling the waves measurement parameter or the Loran receiver on or off. It shall be assumed that the use of this command will be operationally restricted to payloads that have previously had all of the other waves setup parameters correctly entered by a means other than the Command Receiver (i.e., via the payload test set at installation). The purpose of turning off the waves parameter or Loran would be to conserve power in a system with a marginal power supply and thereby extend its operational life. The capability to turn the parameter back on if events warrant shall also be included.

3.4.3.4 Reschedule Acquisition and Transmission

This command function will be used to change the synoptic data acquisition and reporting interval from the 1-hour standard value to ½-, 3-, or 6-hour intervals, or back to the 1-hour standard. This command will be used to reset the payload to a more frequent reporting interval during critical weather periods, or to a less frequent interval as a power conservation measure.

3.4.3.5 GOES Transmitter Control

This command provides emergency control over the payload GOES transmit function. It is used to stop all GOES synoptic transmissions after the reply message to this command has been issued. The Receiver shall have the capability to turn the transmit function back on.

3.4.4 Software

All contractor-developed software/firmware shall be designed using standard industry practices, such as structured programming techniques and a modular programming structure. In the proposal, it shall be shown how this modularity will facilitate and accommodate changes to the coding. All source code shall be written in the compiler language "C." Assembly language may be used in time-critical applications, such as I/O drivers and interrupt routines, but shall be minimized. The Contractor shall describe in his proposal the system that will be used to maintain software configuration

and version control. He shall also describe the software engineering standards and practices used in software development and modification.

A copy of all off-the-shelf software, compilers, assemblers, libraries, and licenses used in the development of the Command Receiver system software shall be delivered to the Government.

3.4.5 System Setup, Self-Test, and Activation

The Command Receiver shall contain a Test and Setup Port that allows the following functions to be performed via a standard ASCII terminal:

a. Display of current satellite/Receiver updated time-of-day

b. Display of 12-bit Command Data Word received and decoded from satellite

c. Allow execution of all payload commands for test

d. Execute a complete diagnostic test of Decoder/Interpreter Section

e. Allow entry and change of all Receiver setup parameters, which include:

   1. Host Payload ID (DACT or VEEP)

   2. RS-232 Ports Setup

   3. GOES Interrogate/Command Frequency Selection

   4. Receiver Address.

The Command Receiver will be initialized with the user-entered setup parameters prior to installation at an operational site. The system shall have sufficient nonvolatile memory to store all the required data when power is removed from the unit so as to allow entry of these parameters prior to departure to the field.

3.4.6 Power Distribution/Regulation

The Command Receiver shall operate from the 12-volt nominal power source available at the host payload RS-232(C) interface connector. The 12-volt power source can vary between 10.5 and 15 VDC. The Receiver shall contain protection from application of this power in a reverse polarity. Protection shall also be provided against voltage transients or surges, such as those that would occur by disconnecting power while the receiver is in operation.

The Receiver shall provide whatever power conversion, conditioning, regulation, and distribution are necessary to develop its own internal operating voltages.

The Contractor shall use the latest technology in low-power circuits to reduce power consumption to the lowest level possible. The maximum allowable consumption is 20 watt hours per day (exclusive of the Test and Setup Terminal).

3.4.7 RS-232(C) Interfaces

The Command Receiver shall contain two RS-232(C) interface ports. One of these ports shall be the main Receiver/payload command interface. The second shall accommodate the Test and Setup Terminal. These interfaces shall be comprised of five conductors — transmit data, receive data, signal/power ground, 12-volt power (test set only), and shield. Each interface shall operate at a selectable 110, 150, 300, or 1200 baud, in asynchronous mode using ASCII character code with 1 start bit, 7 data bits, selectable parity, and selectable 1 or 2 stop bits. Both ports shall be configurable via the Test and Setup Terminal and revert to default values if power is removed and reapplied.

3.4.8 General Design and Packaging

3.4.8.1 Packaging

The Command Receiver shall be packaged in a single, compact, lightweight, ruggedized, sealed enclosure. The enclosure shall be equipped with a purge valve and a positive and negative pressure relief valve. The relief valve shall include a desiccant chamber so that incoming air is passed through it when venting negative pressure. Suitable provision shall be made for removing and changing the desiccant. All signal and power electrical connections shall be made via watertight connectors so that field replacement can be made without breaking the package seal.

The enclosure shall be capable of being mounted and operated in any physical orientation. The enclosure, mounts, and fasteners shall be aluminum or stainless steel.

The Contractor shall provide mounting brackets, flanges, or some other mechanical attachment on the Receiver that will allow simple installation on a flat surface by one technician.

The Receiver will be installed in a variety of structures and buoy hulls. In order to fit the most confining installations, the Receiver shall have a volume of less than 0.5 cubic foot with a maximum diagonal measure, on a single flat surface, of less than 19 inches.

3.4.8.2 Electrical Connectors

All signal and power electrical connectors into and out of the Receiver enclosure shall be locking, environmentally sealed pin and socket type, including those for the RS-232 ports. They shall have aluminum or fiberglass shells and gold-plated pins and sockets individually keyed to prevent misconnection. Dust covers shall be provided for use during transport. A more permanent locking and sealed cap shall be provided for the Test and Setup Port connector.

3.4.8.3 Transient Voltage Protection

The Command Receiver shall be internally protected from transient voltages and power surges of short duration, such as those caused by lightning and electrostatic discharges. The system shall be protected so that up to 15 kV static discharges to the case and all signal (except for the Receiver signal input), power, and ground conductors cause no damage or interruption to normal operation. The Contractor shall describe in his proposal how he intends to protect the system and what test methods he plans to use.

There shall be a case-mounted system ground stud for connecting to earth ground. This stud shall be the single point Receiver ground return for all subassemblies.

3.4.8.4 Component Selection

NDBC policy has been to use high reliability integrated circuits that have been burned in at elevated temperatures. If the Contractor, in the interest of overall cost savings, elects to procure integrated circuits that have not been screened by a reliability burn-in process, he shall show in his proposal alternative methods he will use in eliminating infant mortality failures.

3.4.9 Future Growth

The Command Receiver Interpreter/Decoder shall be designed with a 40% reserve of memory, I/O, data storage, and throughput to meet future expansion requirements (i.e., only 60% of capacity in all areas, exclusive of the RF Section, may be used in meeting the performance requirements of this SOW).

3.5 ENVIRONMENT

All system components shall be designed and constructed to operate within the environmental limits specified herein. The nonoperating environment will be dictated by the shock, vibration, and temperature associated with transportation to the installation site. The most severe shock and vibration to be experienced by the components will be possible rough handling during shipping with the unit packaged in its shipping container. Once installed in the buoy or at the fixed site, the shock and vibration exposure levels will be negligible. The most severe nonoperating temperature exposure will be during transport in an unheated or unairconditioned storage compartment in an aircraft, ship, or truck.

Once installed, it will be exposed to the temperature, humidity, and salt air associated with a marine environment. The operating and nonoperating exposure levels that are required to be met are summarized in Table 3.

Table 3. Environmental Extremes

Parameter	Operating	Nonoperating
Air Temperature	-40°C to +50°C	-60°C to +70°C
Relative Humidity	100%, condensing	100%, condensing

3.6 RELIABILITY

The Command Receiver shall be designed for continuous, unattended operation and for a minimum Mean-Time-Between-Failure (MTBF) of 24 months. Supporting calculations shall be provided with the proposal. A failure shall be defined as one or more of the following: inability to maintain lock on the satellite RF signal, inability to decode and maintain time-of-day, inability to decode the complete instruction repertoire and issue the corresponding commands to the payload, or inability to pass the internal diagnostic tests initiated by the Test and Setup Terminal.

4.0 PRODUCT ASSURANCE

The Contractor shall provide quality control, documentation control, test control, and workmanship as set forth below:

a. Quality Assurance — MIL-I-45208

b. Drawing Control — Best commercial practice

c. Configuration Control & Waivers — MIL-STD-481 or equivalent

d. Specification for Manuals — Good commercial practice

e. Identification — MIL-P-15024 or equivalent

f. Standard of Workmanship — MIL-STD-454, Requirements 1, 5, 9, 19, and 69

g. Shipping and Handling — RS-414.

4.1 QUALITY ASSURANCE

The Contractor shall develop, implement, and maintain a Quality Assurance Plan in accordance with MIL-I-45208. The Contractor's Quality Assurance Plan and procedures must be submitted with his proposal.

To assure that this equipment complies with the requirements of this SOW, component and subsystem development and test activities shall be conducted as needed to show that all system requirements can be met by the Receiver design. The Contractor shall establish and document pass/fail criteria for the Receiver.

4.2 ACCEPTANCE TESTING

In addition to the NESDIS Certification Tests specified in Section 3.3, the Contractor shall provide facilities and test equipment and shall perform the following system testing of prototype and production Receivers. The objective of this testing is to demonstrate that the Receivers meet the performance requirements specified in Section 3.0. The Contractor shall submit a preliminary test plan with his proposal. An updated plan and detailed procedures shall be prepared by the Contractor during the prototype development phase and submitted to the Government for approval. This approval/disapproval will be provided within 2 weeks after receipt of the plan and procedures. The tests shall be designed to show that:

a. The Receiver can perform all required functions over all ranges and combinations of temperature extremes, supply voltage, and satellite signal level.

b. The Receiver can perform all required functions in an unattended mode and is unaffected by power surges, voltage transients, and static discharges.

c. The Receiver can execute all specified commands for both the DACT and VEEP payloads.

d. The internal diagnostic tests that are initiated by the Test and Setup Terminal perform a complete test of the digital electronics portion of the Receiver.

The final acceptance test procedures shall be developed during the design phase of the contract and shall be submitted to the Government for approval 1 month prior to acceptance testing. This approval/disapproval will be provided within 2 weeks after receipt of procedures. As a minimum, they shall contain the following:

a. Equipment required

b. Detailed diagrams showing test setup, interconnections, and cables

c. Step-by-step instructions showing:

   1. Equipment operating modes

   2. Test setup

   3. Expected results (Pass/Fail criteria)

d. Data sheets for recording test results.

A designated Government representative will witness the formal testing for each prototype and the first production unit. The Contractor shall notify the Government representative at least five (5) working days before a test is to be conducted.

A test data log shall be maintained for both prototypes and each production unit. Test data shall be recorded on appropriate forms that show compliance with requirements. Applicable test data and Equipment Failure Reports (EFR's) shall be delivered with each prototype and production unit.

All failures that occur during factory acceptance testing shall be documented. EFR forms shall include, as a minimum, failed unit identification (part number and serial number), failure symptom, failed subassembly (down to the component level, with part number and serial number), cause of failure, and corrective action taken. One copy of each completed EFR shall be sent to NDBC with the delivered unit.

4.2.1 Prototype Testing

The Contractor's acceptance testing of both prototype systems shall include demonstration of the complete system capability, including the functions controlled by the Test and Setup Terminal for both the DACT and VEEP payloads.

As a minimum, these tests shall include:

a. Demonstrate the complete functional capability at ambient conditions.

b. Demonstrate the capability of the Command Receiver to survive shipping and handling per EIA-STD-RS-414A. (Appendix I)

c. Demonstrate all system functions, including command execution through the satellite, at combinations of environmental extremes (-40°C to +50°C), and supply voltage. This shall include hot soak, cold soak, and cyclic excursions through the dew point. The systems shall be soaked at each temperature extreme for 24 hours prior to conducting the test.

d. 300-hour period of "hands-off" testing of the system at ambient conditions. This shall consist of a complete system test in which the entire instruction repertoire is executed once daily through the satellite. Verification of the issuance of proper instructions from the Receiver may be verified on a suitable display device.

In the event of a system failure, the failure shall be documented and redesign/repair made to preclude the same type of failure from recurring. A catastrophic system failure shall result in restart of the tests. A catastrophic system failure shall be defined as the failure of the Command Receiver to complete the execution of any command.

The Government plans to conduct additional environmental and functional testing of the prototype systems immediately after delivery. This testing will include verification of the Command Receiver operation with each of the NDBC payloads. It will be completed within 30 days. Authorization to proceed with production will be given following successful completion of these tests.

4.2.2 Production Unit Testing

Acceptance testing of the first production Command Receiver shall include all steps in Section 4.2.1. Testing of subsequent production units shall include, as a minimum, steps (a) and (d) of Section 4.2.1, with step (d) reduced to a 100-hour period. However, in the event of catastrophic

failure of any production unit during the "hands-off" testing, the contractor shall be required to restart the entire applicable test sequence following repairs.

4.3 DOCUMENTATION

The preliminary technical manual and prototype drawings shall be delivered with the prototype units under the Prototype Development Phase of the Contract. Final Documentation, which includes the Production Drawing Aperture Cards and Final Technical Manual, are an option under the Contract Production Phase.

4.3.1 Drawings

Using best commercial drafting practices, the Contractor shall document the prototype unit "as-built" and shall include any modifications required to meet acceptance test criteria. All delivered prototype drawings shall be one set of 35-mm aperture cards. The contractor shall update the original drawings to reflect the changes (if any) implemented as a result of prototype testing at NDBC. Aperture cards of all updated drawings shall be delivered to NDBC.

Detail drawings shall be prepared for all parts, subassemblies, and major assemblies of all hardware as required for identification, specification, fabrication, and testing. Prior to acceptance of the prototype, preliminary drawings must be reviewed and accepted by the government. This approval/disapproval will be provided within 2 weeks after receipt of preliminary drawings. After the establishment of the production unit Product Configuration Baseline, aperture cards produced from original drawings shall be required. A configuration drawing tree shall be prepared by the contractor and submitted as part of the deliverable documentation. Engineering drawings shall include:

a. Complete system electrical schematics, electrical interfaces, component layout, and signal/timing diagrams

b. Complete mechanical configuration including assembly envelopes, mechanical mounting interfaces, etc.

4.3.2 Software Documentation

All Contractor-developed software/firmware provided with the system shall be documented using the Federal Information Processing Standards Publication 38 (FIPS PUB 38) as a guideline.

System documentation shall contain functional and detailed flow charts, a narrative description of each subroutine, all data formats, and well-commented source code listings. All basic elements of documentation shall be prepared in typewritten form, but not necessarily in a finished format suitable for publication (see working document level three in FIPS PUB 38).

Detailed documentation for all off-the-shelf software compilers, assemblers, and libraries, per paragraph 3.4.4, shall be provided. Also, documentation shall be included that describes any changes or modifications to the off-the-shelf software that are made by the Contractor.

4.3.3 Technical Manual

A comprehensive technical manual shall be prepared providing operation and maintenance instructions. It shall cover system installation, operation, troubleshooting, adjusting, replacing, and testing the entire receiver as well as major component testing at the depot. The level of presentation shall be for use by high school graduates with previous training and experience in the operation and maintenance (including depot) of similar or related equipment.

4.4 CONFIGURATION CONTROL

The contractor shall maintain adequate drawing change records during prototype assembly and testing to document the prototype configuration, including updates for any modifications needed to meet Acceptance Test criteria and subsequent environmental test requirements. A Product Configuration Baseline will be established for the production receiver at the conclusion of prototype testing at NDBC. This baseline configuration shall be maintained for the production units. Changes to this baseline configuration will be made only via Engineering Change Proposals (form DD-1693). Requests for deviations/waivers involving the deliverable end items will require the submittal of Form DD-1694. MIL-STD-481 or equivalent shall apply in establishing and maintaining configuration control.

After the establishment of the production baseline configuration, all subsequent spares and modular subassemblies shall be interchangeable from unit to unit, including the accepted prototypes, without readjustment.

Proper configuration identification, serial number control, and traceability of materials, at least to the module level, shall be followed.

A name plate shall be required on the receiver that identifies the equipment (MIL-D-15024).

5.0 SUMMARY OF TASKS

The work on this project is comprised of the five tasks described in Paragraphs 5.1 through 5.5. Together, they include the design, development, fabrication, test, and delivery of two prototype Command Receivers capable of being configured with either a DACT or VEEP payload. Additionally, 5 baseline production units are to be produced and delivered, and options for up to 100 production units, a 1-week training course, and a documentation package may be exercised.

The contractor shall perform all work and provide all facilities and materials to design, fabricate, and acceptance test the equipment described in this Statement of Work. The contractor shall hold a design review and provide documentation, training, and test support per Section 7.1 and 7.2 and as defined in the tasks below.

5.1 TASK I — SYSTEM DESIGN

The contractor shall design and document the Command Receiver. These designs shall meet the requirements of Section 3.0 of this Statement of Work. The system design shall be based on the design concepts and features included in the offeror's proposal.

Upon completion of the detail design and preliminary drawings, and prior to prototype fabrication, the contractor shall provide drawings for review by the Government 2 weeks prior to design review. The contractor shall present his detail design during a Design Review at the contractor's facility.

5.2 TASK II — PROTOTYPE FABRICATION AND TESTING

Two Command Receiver prototypes, capable of being configured with either a DACT or VEEP, shall be fabricated and acceptance tested under this task. The prototypes shall include the interconnecting cables and antennas.

Acceptance testing shall be in accordance with the requirements of Section 4.2.1. Certification testing shall be conducted in accordance with Section 3.3. A set of drawing aperture cards or drawings, preliminary technical manuals reflecting the prototype configuration, off-the-shelf software, and software documentation shall be delivered with the prototype hardware.

5.3 TASK III — MONTHLY PROGRESS REPORT

The contractor shall prepare and deliver three copies of Monthly Progress Reports to the Contracting Officer. Progress Reports shall include, but shall not be limited to, the following:

a. Summary of progress during the period being reported.

b. Unanticipated technical or management problems (ranked), and proposed solutions or the approach to solutions. An assessment of the impact of the problem and/or solution on the contract end items and on other program efforts.

c. Summary of important trips, conferences, and briefings concerning the contract during the report period. Indicate those planned for the following period and the possible need for NDBC attendance.

d. Percent completion to date versus planned completion to date, by task.

e. Actions required of the Government, including date needed.

5.4 TASK IV — BASELINE AND OPTIONAL PRODUCTION UNITS

Under this task, 5 baseline and up to 100 optional GOES Command Receivers shall be fabricated, acceptance tested, and delivered per Section 7.2. Cables shall not be provided for the production units. These units shall meet all performance requirements of Section 3.0 and shall be configured in accordance with the Product Configuration Baseline established at the conclusion of environmental testing of the prototypes at NDBC.

Drawings and technical manuals shall be updated to reflect the production configuration. One set of aperture cards and twelve technical manuals shall be delivered with the first optional production unit.

5.5 TASK V — TRAINING (OPTIONAL)

The contractor shall also provide a 1-week formal training session at SSC for up to 20 NDBC and support contractor personnel on GOES Command Receiver operation and maintenance. Training must be "hands-on" with delivered DACT/VEEP Command Receivers and technical manuals, and shall include as a minimum:

a. Theory of operation

b. System operation

c. Troubleshooting and maintenance of DACT/VEEP Command Receivers.

The contractor shall be responsible for providing course material and travel for this task, if this option is exercised.

6.0 GOVERNMENT-FURNISHED EQUIPMENT (GFE)

The Government will provide one DACT and one VEEP system (minus sensors) for the development and certification testing of the GOES Command Receiver within 4 months of Contract award. This equipment shall be returned to the Government within 60 days following the completion of certification testing.

7.0 DELIVERABLES

Section 7.1 lists the deliverables required under the Prototype Phase. Section 7.2 lists the deliverables required under the Production Phase.

7.1 SCHEDULE OF DELIVERABLES — PROTOTYPE DEVELOPMENT PHASE

TASK	ITEM	QUANTITY	SCHEDULE (WEEKS AFTER EFFECTIVE DATE OF CONTRACT)
I	Design Review, Drawings per Section 5.1	3 Sets	30
I	Revised Acceptance Test Plan per Section 4.2 including Preliminary Certification Procedures	3 Copies	30
II	Final Acceptance Test Procedures per Section 4.2 including Final Certification Procedures	4 Copies	36
II	Prototype GOES Command Receiver per Section 5.2	2	52
II	Preliminary Technical Manual per Section 5.2	3 Copies	52
II	Test Data and Failure Reports per Section 4.2	2 Copies	52
II	Prototype Drawings per Section 5.2	3 Sets	52
II	All Software and Documentation per Section 3.4.4 and 4.3.2	2 Copies	52

II	Receiver Certification Test (Coordinated effort with NDBC)	1 DACT & 1 VEEP	52
III	Monthly Progress Reports per Section 5.3	3 Copies	By 15th of each month
IV	Baseline Production Command Receivers per Section 5.4	5	3 Months After Production Authorization

7.2 SCHEDULE OF DELIVERABLES — PRODUCTION PHASE

TASK	ITEM	OPTION DATE (MONTHS AFTER PROTOTYPE DELIVERY)	QUANTITY	SCHEDULE (MONTHS AFTER EXERCISE DATE)
V	Option A Formal Training Session at SSC per Section 5.5	Up to 18	1 Week (40 Hours)	1
IV	Option B GOES Command Receivers	Up to 10	10-30	8 for 1st Unit; 2/Mo. Min. Thereafter
	Production Dwg. Aperture Cards		1 Set	
	Final Tech. Manual		12	
IV	Option C (GOES Command Receivers)	Up to 18	10-30	8 for 1st Unit; 4/Mo. Min. Thereafter
IV	Option D (GOES Command Receivers)	Up to 24	10-40	8 for 1st Unit; 4/Mo. Min. Thereafter

ATTACHMENT 3

APPENDICES A - H

APPENDIX A

Interrogated Data Collection Platform Radio Set Certification Standards S23.011 (enclosed) as amended by the enclosed memo to Jerry C. McCall from Farris T. Kahwajy dated April 18, 1986

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL ENVIRONMENTAL SATELLITE SERVICE
Washington, D.C. 20233

November 16, 1981 OA/S23:JHP
NO. S23.011

INTERROGATED DATA COLLECTION PLATFORM RADIO SET CERTIFICATION STANDARDS

(Revised November 1981)

1. RF POWER OUTPUT

The Effective Isotropic Radiated Power (EIRP), of a DCPRS and antenna shall not exceed 50dBm under any combination of service conditions.

2. FREQUENCY CHARACTERISTICS

(a.) Received Frequency Characteristics

The DCPRS received radio-frequency (RF) shall be as follows:

1. The Geostationary Operational Environmental Satellite (GOES) East 468.8375 MHz.
2. The GOES West 468.8125 MHz or 468.825 MHz.
3. Furthermore, these frequencies shall be selectable without requiring reallignment.

(b.) Transmit Frequency Characteristics

The DCPRS transmitted RF shall be in the 401.7 MHz to 402.0 MHz band. See Table 1. The DCPRS design, and the procedures specified in its associated O&M manual, shall provide a capability to adjust the transmit frequency to within ±100 Hz.

3. STABILITY

(a.) Temperature

The transmitter carrier frequency shall change by less than ±0.5 parts per million over the temperature range of -40°C to +50°C.

(b.) Long-Term

The long-term stability (including temperature variations) shall be better than ± one part per million per year.

(c.) Phase

The integrated phase noise on the transmit carrier shall be less than 3 degrees RMS when measured through a phase locked loop two sided noise bandwidth (2 BL) of 20 Hz and within ±2 kHz (See Figure 1).

4. SPURIOUS EMISSIONS

(a.) Individual

The mean power of any emission supplied to the transmission line as compared with the mean power of the fundamental shall be in accordance with the following:

4. SPURIOUS EMISSIONS

(a.) Individual

The mean power of any emission supplied to the transmission line as compared with the mean power of the fundamental shall be in accordance with the following:

1) On any frequency removed from the assigned frequency (carrier frequency) by more than ±1125 Hz but less than or equal to ±2250 Hz at least 25dB attenuation;

2) On any frequency removed from assigned frequency (carrier frequency) by more than ±2250 Hz but less than or equal to ±4500 Hz at least 35dB attenuation;

3) On any frequency removed from the assigned frequency (carrier frequency) by more than ±4500 Hz at least 60dB attenuation.

(b.) Combined

All combined transmitter spurious emisssions within a ± 500 kHz bandwidth when measured in a 50 Ohm load and with a duplexer (if used) connected, shall be down from the unmodulated carrier level by 50dB. The measurement IF bandwidth shall be 30 kHz.

5. TRANSMISSION FORMAT

(a.) Preamble

Data transmissions shall be preceded by the following sequence:

1. A minimum of 0.5 seconds of unmodulated carrier.

2. A minimum of 0.48 seconds of alternating ones and zeros.

3. Exactly .015 seconds (15 bits) of the Maximal Length Sequence (MLS) sync word (100010011010111---MSB first).

4. Exactly 0.31 seconds (31 bits) Bose-Chaudhuri-Hocquenghem (BCH) coded address word (0011010010000101011101100011111---MSB first) is expressed as 3485763E in Hexidecimal.

Maximum duration of this preamble shall be 1.5 seconds.

As an additional operating mode, the DCPRS may transmit the following preamble:

5. A minimum of 4.9 seconds of unmodulated carrier.

6. A minimum of 2.4 seconds of alternating ones and zeros.

7. Exactly 0.15 seconds (15 bits) of the Maximal Length Sequence (MLS) sync word (100010011010111---MSB first).

8. Exactly 0.31 seconds (31 bits) Bose-Chaudhuri-Hocquenghem (BCH) coded address word (0011010010000101011101100011111---MSB first) is expressed as 3485763E in Hexidecimal.

Maximum duration of this additionally supported preamble shall be 8.0 seconds.

(b.) Data

All data transmissions shall be in American Standard Code for Information Interchange (ASCII)[1], eight bit characters (LSB first) with odd parity or modified ASCII. Furthermore, the following ASCII control characters shall not appear in the DCPRS data message: DLE, NAK, SYN, ETB, CAN, GS, RS, SOH, STX, ETX, ENQ, ACK, AND EOT. (See Figure 2).

(c.) End of Transmission

Immediately after sending the sensor data, the DCPRS shall transmit a 8 bit End of Transmission (EOT) code (bit pattern 00100000---MSB first), which is a ASCII EOT with odd parity. This code shall be sent continuously at the end of the sensor data (no break) and return to the standby condition.

The transmission format is shown in Figure 2.

6. MANCHESTER ENCODING

All binary data shall be Non Return to Zero (NRZ) Manchester encoded (split phase).

7. MODULATION

(a.) Phase Shift Keying

All Manchester encoded binary data shall modulate the carrier in the following manner:

1. The carrier shall be the reference as zero phase.

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[1]As defined in Federal Information Processing Standards No. 1, 16 and 17.

2. A data "0" shall consist of a $+60^{o}$ $\pm 5^{o}$ carrier phase shift for 5 milliseconds, followed by a -60^{o} $\pm 5^{o}$ carrier phase shift for 5 milliseconds.

3. A data "1" shall consist of a -60^{o} $\pm 5^{o}$ carrier phase shift for 5 milliseconds, followed by a $+60^{o}$ $\pm 5^{o}$ carrier phase shift for 5 milliseconds.

8. FAIL SAFE DESIGN

The DCPRS shall incorporate a "fail safe" design feature such that malfunctioning of the equipment shall in no way cause continuous transmission. The fail safe feature must incorporate a circuit independent of the normal transmission sequencer that permanently removes the supply voltage to the power amplifier. The fail safe shall prevent a transmission from exceeding 4½ minutes in duration. It shall also ensure a minimum of 60 seconds off-time between successive transmissions.

9. INTERROGATION SIGNAL

(a.) Format

The DCPRS shall be capable of receiving and demodulating the following sequence:

1. 4 bit Binary Coded Decimal (BCH) time code followed by,

2. 15 bit MLS sync word (bit pattern 100010011010111) followed by,

3. 31 bit BCH address word (e.g. bit pattern 0011010010000101011101100011111). The DCPRS shall respond to one or more assinged addresses within 1 second. The DCPRS shall respond whenever the received sequence is exact or within two bits of the assigned address(es). All transmission times and their durations shall be subject to the "fail safe" requirement--see Section 8.

(b.) Acquisition Time

The receiver shall acquire lock-on to the interrogation signal format in two minutes or less, from standby conditions when the interrogation signal carrier is within ± 100 Hz. This acquisition shall be accomplished in the presence of modulation.

(c.) Level

The DCPRS shall lock-on and demodulate the interrogation signal over the range of -100dBm maximum to -130dBm minimum centered at the carrier frequencies specified in paragraph 2, and measured at the receiver antenna terminals.

(d.) Mean Time to Cycle Slip (MTCS)

The MTCS for the carrier tracking loop shall be equal to or greater than 1 minute.

10. ANTENNA

(a.) Polarization

Polarization shall be right-hand circular, according to IEEE Standard 65.34.159 and have an axial ratio of equal to or less than 6dB on axis.

(b.) Transmit Gain

A transmit gain shall be specified that results in the Maximum EIRP in paragraph 1 and the DCPRS so labeled.

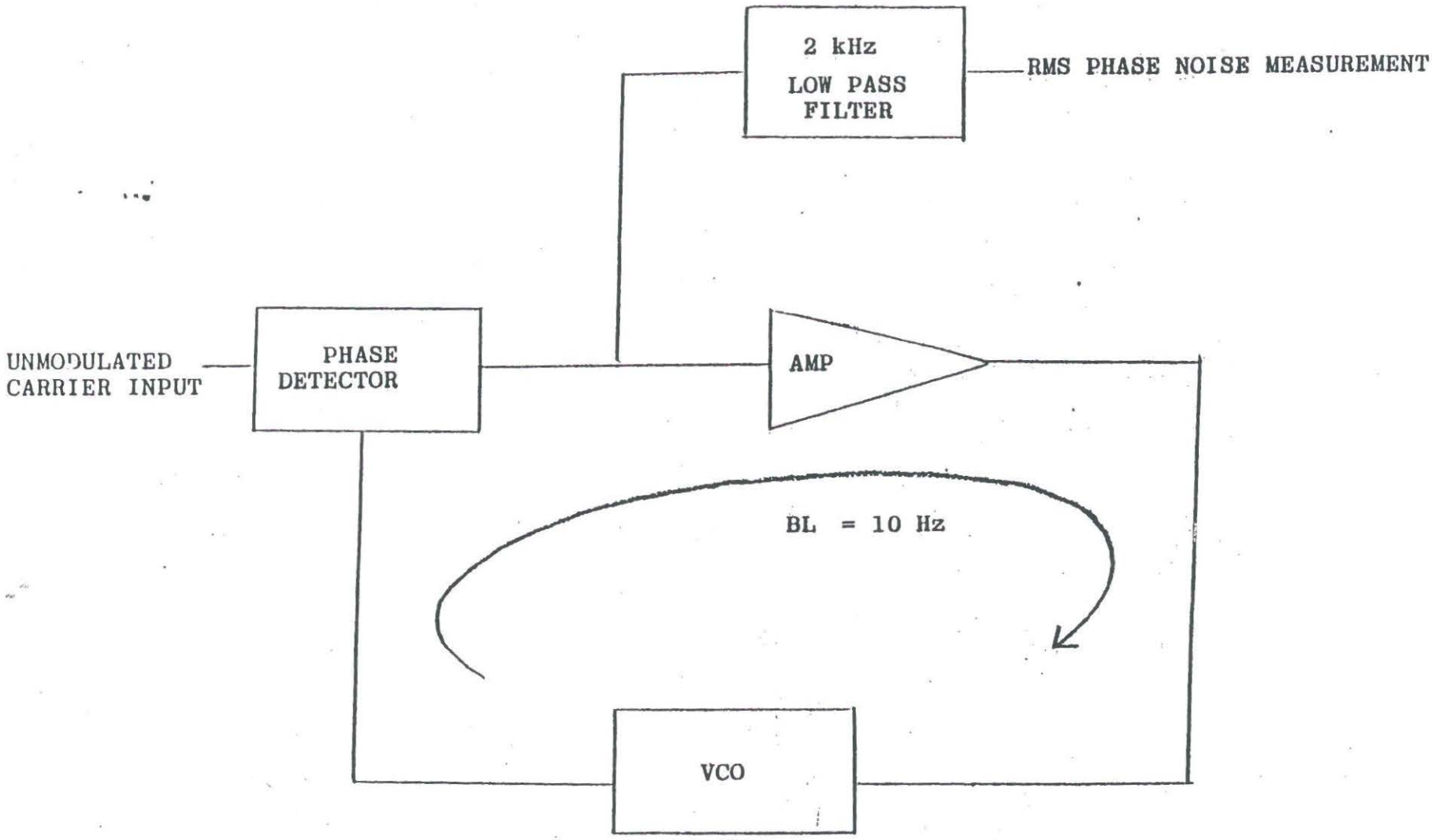
TABLE 1

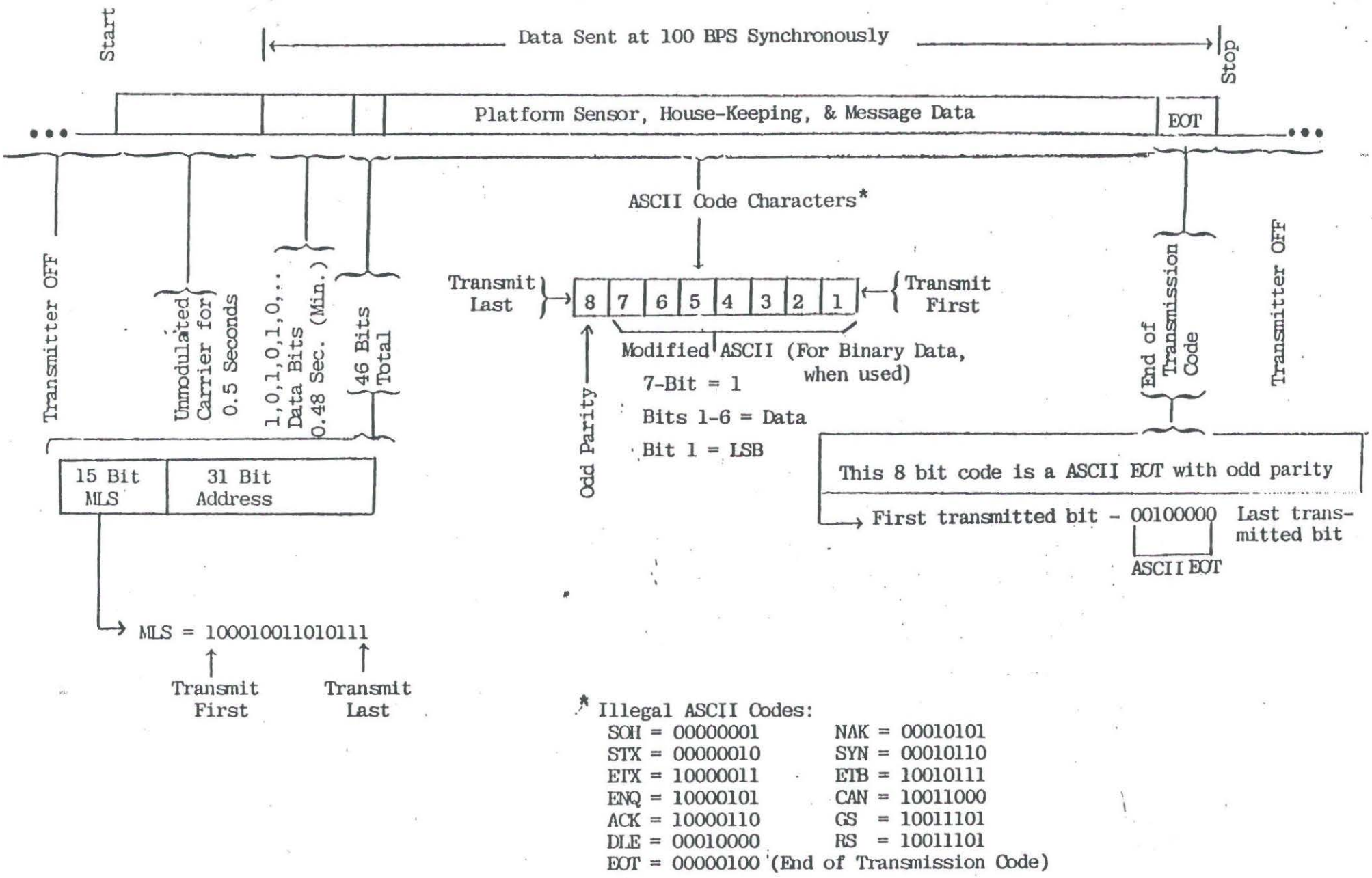
DCPRS TRANSMIT FREQUENCIES

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
1	401.7010	50	401.7745
2	401.7025	51	401.7760
3	401.7040	52	401.7775
4	401.7055	53	401.7790
5	401.7070	54	401.7805
6	401.7085	55	401.7820
7	401.7100	56	401.7835
8	401.7115	57	401.7850
9	401.7130	58	401.7865
10	401.7145	59	401.7880
11	401.7160	60	401.7895
12	401.7175	61	401.7910
13	401.7190	62	401.7925
14	401.7205	63	401.7940
15	401.7220	64	401.7955
16	401.7235	65	401.7970
17	401.7250	66	401.7985
18	401.7265	67	401.8000
19	401.7280	68	401.8015
20	401.7295	69	401.8030
21	401.7310	70	401.8045
22	401.7325	71	401.8060
23	401.7340	72	401.8075
24	401.7355	73	401.8090
25	401.7370	74	401.8105
26	401.7385	75	401.8120
27	401.7400	76	401.8135
28	401.7415	77	401.8150
29	401.7430	78	401.8165
30	401.7445	79	401.8180
31	401.7460	80	401.8195
32	401.7475	81	401.8210
33	401.7490	82	401.8225
34	401.7505	83	401.8240
35	401.7520	84	401.8255
36	401.7535	85	401.8270
37	401.7550	86	401.8285
38	401.7565	87	401.8300
39	401.7580	88	401.8315
40	401.7595	89	401.8330
41	401.7610	90	401.8345
42	401.7625	91	401.8360
43	401.7640	92	401.8375
44	401.7655	93	401.8390
45	401.7670	94	401.8405
46	401.7685	95	401.8420
47	401.7700	96	401.8435
48	401.7715	97	401.8450
49	401.7730	98	401.8465
		99	401.8480

CHANNEL	FREQUENCY
100	401.8495
101	401.8510
102	401.8525
103	401.8540
104	401.8555
105	401.8570
106	401.8585
107	401.8600
108	401.8615
109	401.8630
110	401.8645
111	401.8660
112	401.8675
113	401.8690
114	401.8705
115	401.8720
116	401.8735
117	401.8750
118	401.8765
119	401.8780
120	401.8795
121	401.8810
122	401.8825
123	401.8840
124	401.8855
125	401.8870
126	401.8885
127	401.8900
128	401.8915
129	401.8930
130	401.8945
131	401.8960
132	401.8975
133	401.8990
134	401.9005
135	401.9020
136	401.9035
137	401.9050
138	401.9065
139	401.9080
140	401.9095
141	401.9110
142	401.9125
143	401.9140
144	401.9155
145	401.9170
146	401.9185
147	401.9200
148	401.9215
149	401.9230

CHANNEL	FREQUENCY
150	401.9245
151	401.9260
152	401.9275
153	401.9290
154	401.9305
155	401.9320
156	401.9335
157	401.9350
158	401.9365
159	401.9380
160	401.9395
161	401.9410
162	401.9425
163	401.9440
164	401.9455
165	401.9470
166	401.9485
167	401.9500
168	401.9515
169	401.9530
170	401.9545
171	401.9560
172	401.9575
173	401.9590
174	401.9605
175	401.9620
176	401.9635
177	401.9650
178	401.9665
179	401.9680
180	401.9695
181	401.9710
182	401.9725
183	401.9740
184	401.9755
185	401.9770
186	401.9785
187	401.9800
188	401.9815
189	401.9830
190	401.9845
191	401.9860
192	401.9875
193	401.9890
194	401.9905
195	401.9920
196	401.9935
197	401.9950
198	401.9965
199	401.9980


2 kHz
LOW PASS
FILTER
RMS PHASE NOISE MEASUREMENT
UNMODULATED
CARRIER INPUT
PHASE
DETECTOR
AMP
BL = 10 Hz
VCO



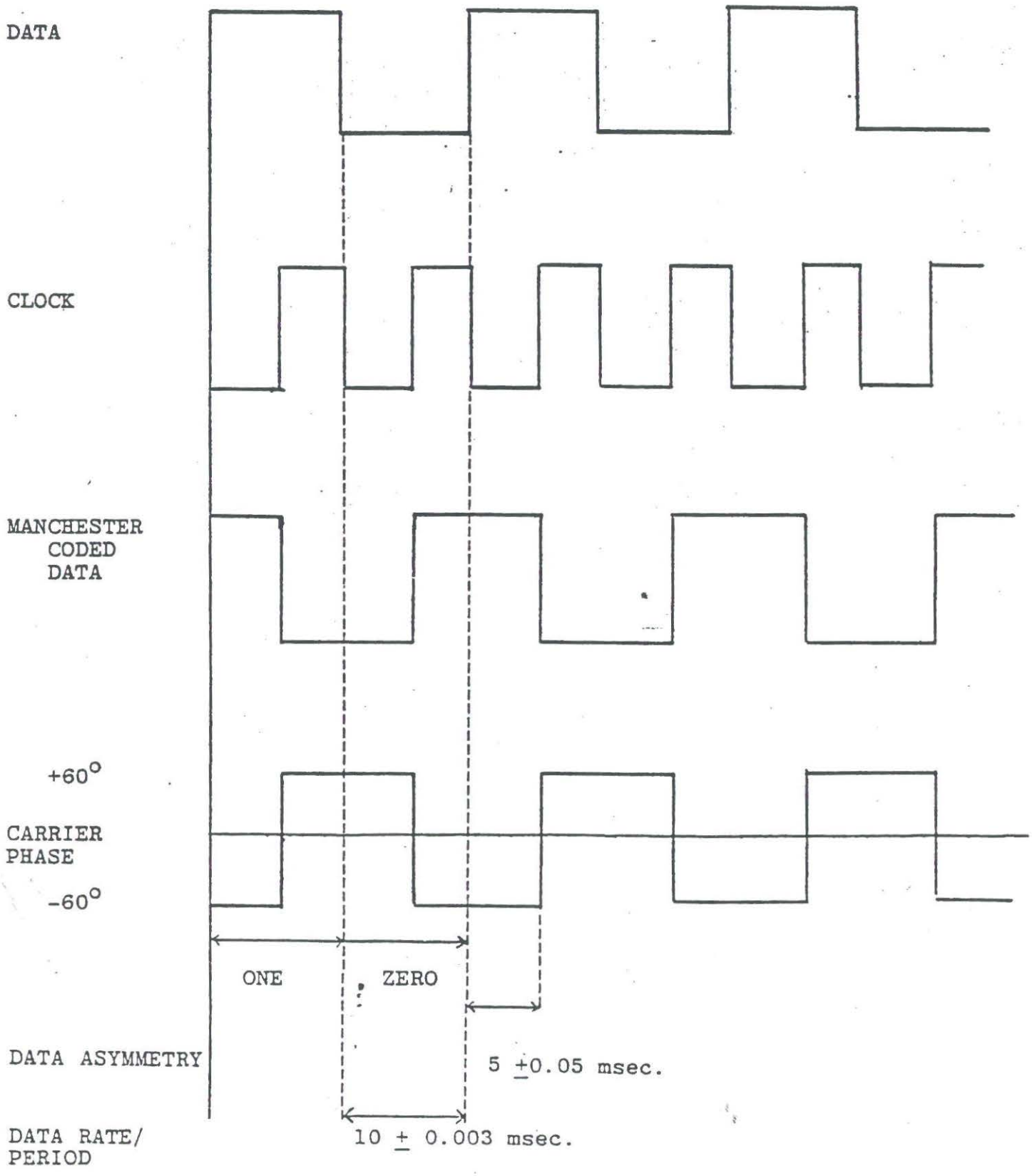
* Illegal ASCII Codes:

SOH = 00000001	NAK = 00010101
STX = 00000010	SYN = 00010110
ETX = 10000011	ETB = 10010111
ENQ = 10000101	CAN = 10011000
ACK = 10000110	GS = 10011101
DLE = 00010000	RS = 10011101
EOT = 00000100 (End of Transmission Code)	

Figure 2. Transmission format information for the data collection platform GOES data link

FIGURE 3

MODULATION DEFINITION



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL ENVIRONMENTAL SATELLITE, DATA, AND INFORMATION SERVICE
Washington, D.C. 20233

E/SPD:FK

APR 18 1986

MEMORANDUM FOR: Jerry C. McCall, Director
National Data Buoy Center (NDBC)

FROM: Faris T. Kahwajy, Acting Chief
Systems Planning Development Staff

SUBJECT: GOES Interrogated Platform Certification Standard

REFERENCE: Memo F300, DB11:86-0031 dated February 5, 1986 from Jerry C. McCall to E. Larry Heacock

We have reviewed your request for modifying the GOES "Interrogated Data Collection Platform Radio Certification Standard" response time requirement (paragraph 9.a.3) from 1 second to 15 seconds.

We are willing to accept this change with the following comments:

1. The 15 second delay will be permitted only when the short preamble is to be used--it will be 8½ seconds for the long preamble. This will be reflected in the updated version to standard S23.011.

2. The user, in this case NDBC, must recognize that this delay will increase the amount of time on the DCP's reply channel that must be reserved for each transmission. Channel utilization, particularly for short messages can be significantly reduced. Since GOES supports a total of only 233 channels for all users, this resource must be used efficiently. We do not view this as a significant problem for long messages, or when interrogations are sent in frequently for emergency data or for retransmission in the event of a missed self-timed message.

3. Use of a certified DCP does not, in itself, provide the user an allocation of sufficient channel capacity to meet his programs needs. Requests for channel assignments and allocations should be directed to:

Chief, Data Collection and Direct
Broadcast Branch
NOAA/NESDIS
WWB, Room 806, E/SP2
Washington, D.C. 20233

In terms of obtaining certification for your new receivers, the following guidelines may be helpful:

a) Since modifications to your self-timed DCP's will be required to operate with the receivers, both the receivers and transmitters must be certified together as a new interrogated DCP.

b) Certification testing is witnessed by NESDIS, usually at the manufacturers facility. In this case, because the receivers are to be integrated by NDBC, testing at your facility may be appropriate.

c) At least two weeks prior to testing we would like to have a test plan submitted for our review which shows how each requirement of the DCP certification standards will be validated. You will probably want your receiver manufacturer to prepare at least the portions of this plan which pertain to the receiver performance.

If you have any procedural questions on performing these tests, I suggest you contact Mr. Gerald Mott at Wallops, who normally witnesses these tests. He can be reached at (FTS)925-3331. To expedite our approval of the plan, it would be helpful if both Mr. Mott and Mr. Mazur of our office receive duplicate copies.

Revised certification standards will be issued at a later date. In the mean-time you can consider this letter a waiver to the standards.

I hope the above proves helpful. NESDIS feels that the procurement you are undertaking, which will develop an add-on receiver for interrogated DCP use, to be very important to the future of this mode of operation in the GOES DCS. Good Luck.

cc: Doug MacCallum

APPENDIX E

LETTER, CY SETTLES

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL ENVIRONMENTAL SATELLITE, DATA,
AND INFORMATION SERVICE
Washington, D.C. 20233

December 22, 1989 E/S020:CAS

Mr. Bob Timko
NOAA Data Bouy Center
Building 1100
Stennis Space Center, Miss.

Dear Bob:

This is in response to your request for information concerning Certification of the new GOES DCPI receiver.

NESDIS considers any DCP, previously certified or not, to which a modification such as yours is made, to be a new system requiring full certification tests under the Interrogated DCP Certification Standards. NESDIS will entertain requests for abbreviated tests. The vehicle for such requests is the test plan. A complete, detailed test plan is required. The test plan should include block diagrams of each test set-up, a list of test equipment type and model number, a detailed description of each test to be performed and a test documentation form. Two copies of the test plan must be provided. One copy should be sent to me at:

Cy Settles
NOAA DCP Certification Officer
P.O. Box 39
Wallops Station, VA 23337

The second copy should be sent to:

Wilfred C. Mazur
NOAA/NESDIS
Federal Office Building #4, OSD E/OSD 3
Room 3301
Washington, DC 20233

After the test plan has been received and approved, I will contact you and set up a mutually convenient test date. Approximately fifteen to thirty working days prior to the scheduled test date, I must receive a letter from the manufacturer formally requesting my attendance at the facility for DCPR Certification testing and stating that the Company will reimburse the United States Government for all my expenses relative to the testing. These expenses shall include at least the following:

1) Round trip air fare - unknown at this time.

2) Per Diem - Amount based on Government rates for manufacturer's location.

3) Rental Car

4) Miscellaneous expenses - Tolls, one phone call home per day, etc.

5) Salary - Approximately $25.00 per hour for each hour worked plus overtime if any.

I hope this has answered most of your questions concerning certification. Should you require further information please contact me by phone at (804) 824-3446.

Sincerely,

Cyril A. Settles
NOAA DCP Certification Officer

CAS/rp

APPENDIX F

CERTIFICATION TEST PLAN

FOR

GOES COMMAND RECEIVER

GOES Command Receiver
Certification Test Plan

Background

NDBC plans to undertake the contractual development of a GOES Command Receiver for use with existing DCPs. These DCPs have already been tested by their manufacturers (Artais, Inc., Columbus, OH and Magnavox Corp., Fort Wayne, IN) and certified by NESDIS to comply with the "Self-Timed Data Collection Platform Certification Standards." The Command Receiver will interface with the existing DCPs via their Test Set ports as dipicted in Figure 1. The DCPs will continue to be used in the "Self-Timed" operating mode with the command receivers continually monitoring the Interrogate/Command satellite transmission. When anomalous DCP operation is detected by NDBC a maintenance command will be issued via the satellite/command receiver to correct the problem. This will cause the DCP to switch momentarily to the "Interrogate" mode to generate the proper response transmission, after which it will revert to the "Self-Timed" mode. Modifications to the DCP's existing operating system software will be required in order for them to respond properly to the commands.

NESDIS policy regarding upgrade certification of these DCPs operating in the "interrogate" mode (i.e. with a command receiver) is to require recertification of the combined Command Receiver/Data Collection Platform as one system to the requirements of the "Interrogated Data Collection Platform Certification Standards." This plan is intended to describe the certification tests necessary to satisfy this requirement.

The "Interrogated Data Collection Platform Certification Standards" consist of 10 sections which describe the requirements for RF performance, modulation, coding and data formats for an "Interrogated" DCP which includes the receiver and transmitter. Eight of these sections apply exclusively to transmitter requirements. Two sections apply to both. In general, the assumption upon which this plan is based, is that those portions of the Standard which apply exclusively to the DCP transmitter have already been adequately demonstrated and duplication of this testing would be unnecessary. Those portions of the Standard which apply to the command receiver and the modified operation of the DCP will be demonstrated. Both are described in additional detail.

Test Requirements

Previously Tested Transmitter Functions

Eight sections of the "Interrogated" and "Self-Timed" Standards, which apply exclusively to the DCP transmitter, are identical. These are listed below (the identifying numbers are the section numbers from the Standards):

Section 1 -- RF POWER OUTPUT

" 3 -- STABILITY

" 4 -- SPURIOUS EMISSIONS

" 5 -- TRANSMISSION FORMAT

" 6 -- MANCHESTER ENCODING

" 7 -- MODULATION

" 8 -- FAIL SAFE DESIGN

" 10 - ANTENNA

It is not planned to repeat testing for compliance for any of these requirements since that has been done previously in the certification testing for the individual DCPs.

An additional transmitter requirement appears in Section 2 -- FREQUENCY CHARACTERISTICS, Subsection (b.), "Transmitter Frequency Characteristics," which is identical to Section 2 of the "Self-Timed" Standard. Testing for this requirement, likewise, will not be repeated for the Command Receiver certification.

Transmitter Functions Requiring Test

Testing to assure that the transmitter can switch to a designated response channel and transmit a reply message beginning within the 15-sec window, specified in the Kahwajy to McCall letter, will be included since this has not been previously tested.

Testing will also be included to demonstrate that the transmitter will not make any transmissions which violate any GOES DCS system requirement in response to any valid command. One or more commands of each type in the system repertoire will be executed to verify that the response transmission meets all system requirements.

Receiver Functions Requiring Test

Tests will be included to verify compliance with the requirements of:

Section 2a -- Received Frequency Characteristics

" 9 -- Interrogation Signal

It is the opinion of NDBC that an allowable bit error rate figure should be included in the requirement for Section 9c, Level.

Certification Testing

The software modifications to the DCPs enabling them to generate the proper responses to commands that are received from the Command Receiver will be developed, installed and tested by NDBC or the DCP manufacturers concurrently with the Command Receiver development. It is planned to have the DCP modifications completed and tested before the prototype Command Receiver is completed so that certification testing is not delayed.

The Command Receiver Development Contractor will be required to prepare a detailed test procedure meeting the requirements of this plan which includes the following items:

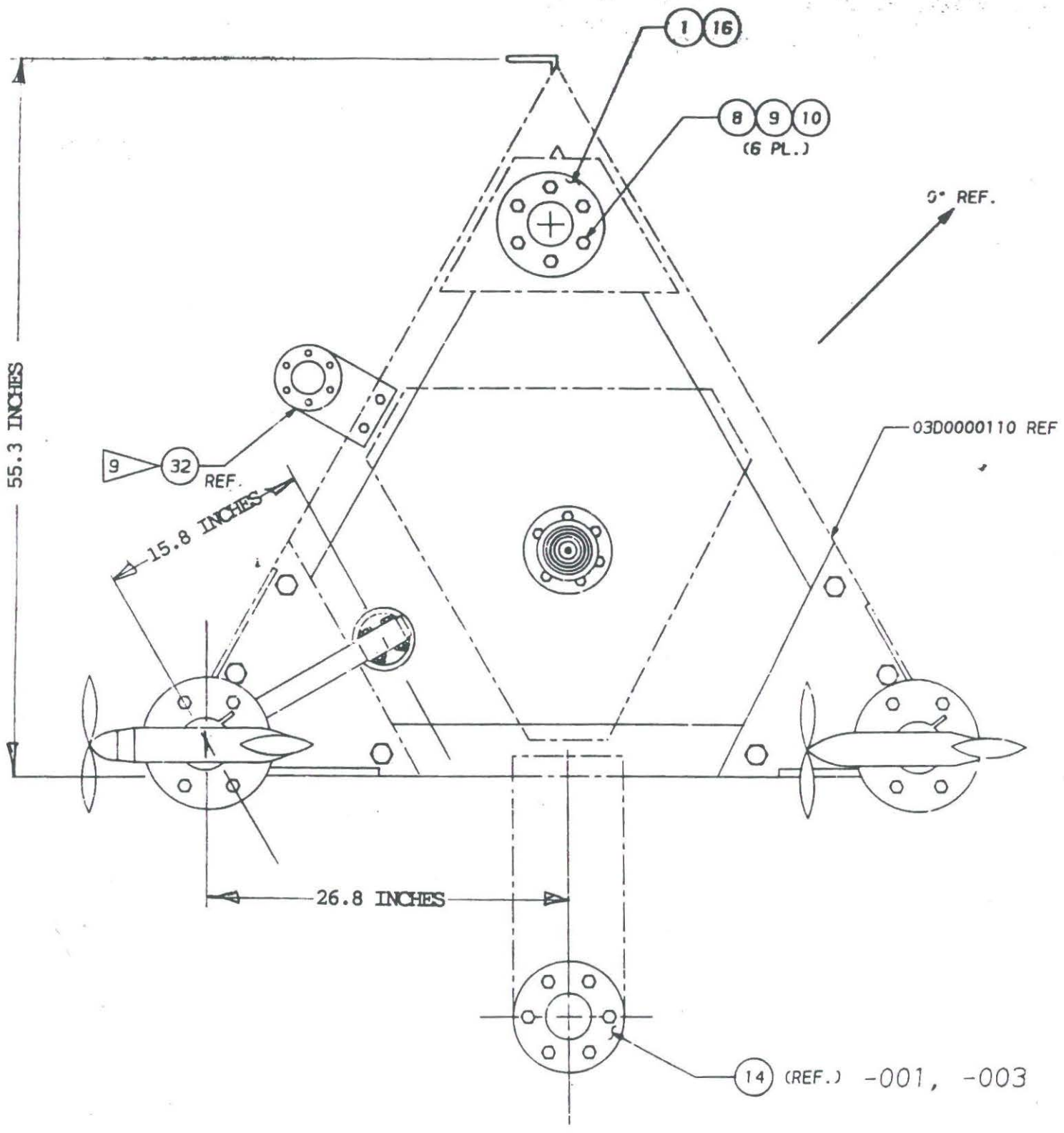
- Detailed description of each test to be performed.
- A list of test equipment required.
- A detailed description and/or diagram of the test setup.
- Go/No-Go criteria for evaluating test results.
- Form for recording test results.
- Step-by-step instructions for conducting the test.

The Command Receiver Development Contractor will be responsible for developing a test procedure, providing test equipment and facilities, and conducting all testing necessary to achieve certification. He will be responsible for making any design changes or other modifications to the command receiver which are necessary to pass the certification tests.

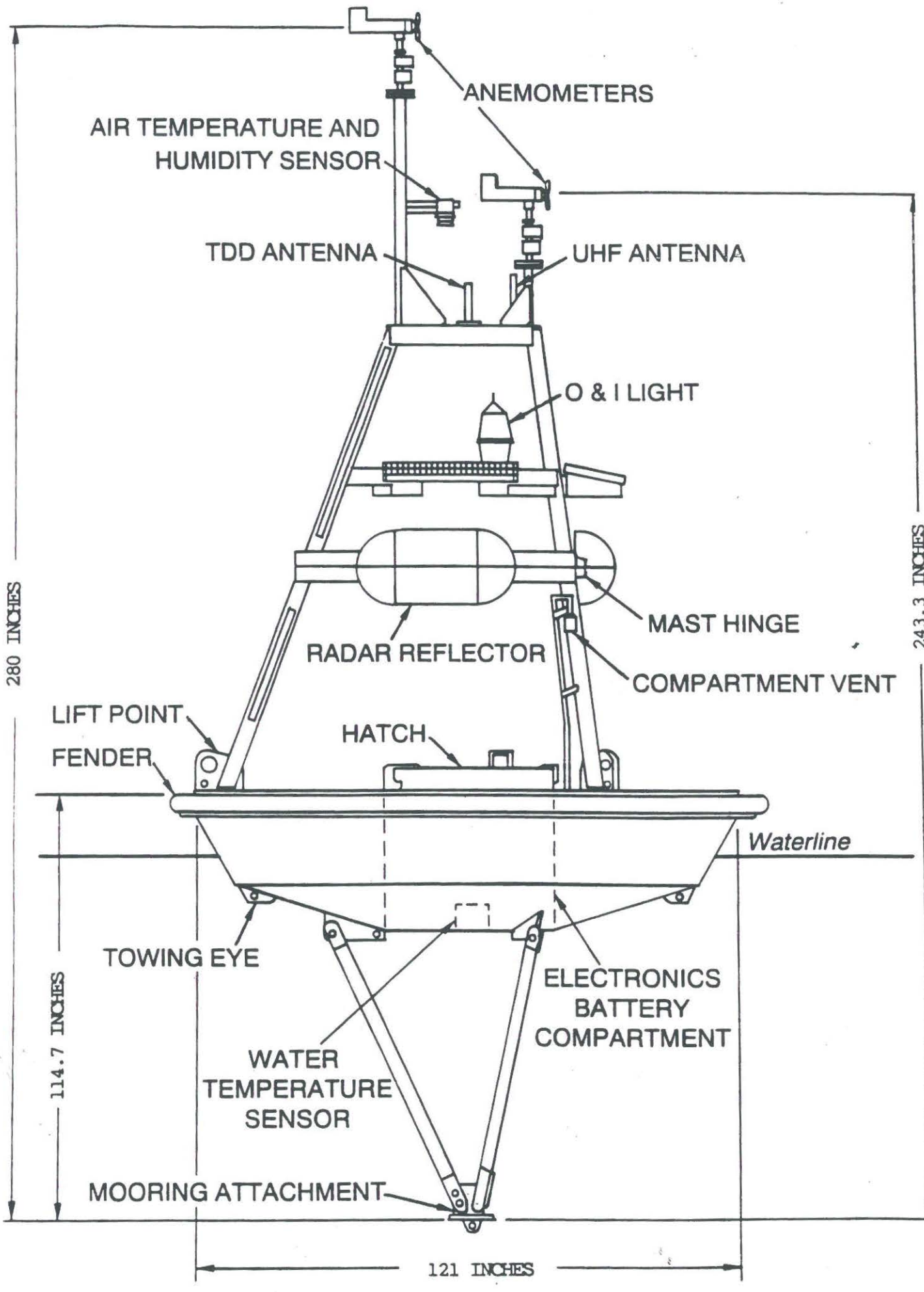
The Contractor will be allowed to choose the test location, based on total cost to the Government, overall efficiency and program schedule. Final selection will require approval of NDBC and NESDIS. The Contractor will reimburse NESDIS for all travel, per diem, and salary costs incurred by NESDIS personnel while they are involved in certification testing.

APPENDIX G

DRAWING, 3-METER BUOY ASSEMBLY



PLAN VIEW TOP OF MASK


ANEMOMETERS
AIR TEMPERATURE AND
HUMIDITY SENSOR
TDD ANTENNA
UHF ANTENNA
O & I LIGHT
MAST HINGE
RADAR REFLECTOR
COMPARTMENT VENT
LIFT POINT
FENDER
HATCH
Waterline
TOWING EYE
ELECTRONICS
BATTERY
COMPARTMENT
WATER
TEMPERATURE
SENSOR
MOORING ATTACHMENT
280 INCHES
243.3 INCHES
114.7 INCHES
121 INCHES

Appendix H

Statement of Work for VEEP Software Changes to Support Operation with the Command Receiver

Background

This document describes the modifications to the VEEP payload software that are necessary to allow it to operate with the GOES Command Receiver. The work desribed herein will be performed by a contractor independent of the Command Receiver development. This information is provided for reference purposes only.

General

The GOES Command Receiver will interface with the test set port to provide commands to the VEEP similar to the test set, including handshaking. The VEEP software shall be modified to recognize that a command is originating from the Receiver instead of the test set or a standard ASCII terminal. (The VEEP software is already equipped with the capability to test for a jumper connection between two pins in the test set connector which, if present, indicate that the test set is connected. Otherwise, it assumes it is communicating with a standard ASCII terminal.) This will be accomplished by having the Receiver precede the ASCII command string with a unique 4-character identifier.

The Command Receiver will be issuing commands to control the following five VEEP functions:

1. Command an immediate retransmission of the last data buffer
2. Reset the VEEP clock
3. Command wave data acquisition and processing, and/or the LORAN receiver on and off.
4. Change the data acquisition and transmission schedule
5. Command GOES transmission on and off

In order to comply with the timing requirement specified by NESDIS, it will be necessary for the VEEP to shift to the preassigned Interrogate/Command Response Channel and transmit a response message so that the BCH address is received by the satellite not longer than 15 seconds after the last bit of the 12-bit command data word has been received by the Command Receiver. The exact content of the response message will be dependent upon the command issued, as described later.

VEEP Operation with the Command Receiver

Receiver to Payload Command Transfer

The Command Receiver will transmit the ASCII character sequences followed by a "Carriage Return" to the VEEP in exactly the same manner as the VEEP test set. The Command Receiver and the payload will perform the error detection as described in the next section. The VEEP shall store the test set command steps in a buffer for execution after the Command Receiver has completed the command data transfer and verification. Once the Receiver has completed the character verification it will compute a checksum which it will send to the

VEEP, followed by a double "Carriage Return." This will be the indication to the payload that it should begin execution of the command.

Error Detection

Four types of error detection are required when the VEEP is operating with the Command Receiver. These are:

1. Validation of the 12-bit command data word from the satellite as a legitimate command for the VEEP.

2. ASCII character validation of the command step transfer between the Command Receiver and the VEEP.

3. Checksum verification of the command transfer between the Command Receiver and the VEEP.

4. Verification of the legitimacy of the command by the payload.

Checks for these four types of errors will be made sequentially as the command transfer and execution progresses through the Command Receiver into the VEEP. Types 1 and 2 errors will be detected in the Command Receiver. Types 3 and 4 errors shall be detected in the VEEP. The result of detection of an error will be:

- Suspension of any further command processing
- Cancellation of any command steps pending execution
- Transmitting the Command Aborted response to the satellite

If an invalid 12-bit command data word (i.e., one which is not contained in the command repertoire for the current payload) is detected by the Command Receiver, it will send and abort command to the payload, indicating that a Type 1 error has been detected.

If a character transmission error is detected by the Command Receiver (echo-back character incorrect) it will suspend character transfer and cause a time-out error in the VEEP. This will indicate to the VEEP that a Type 2 error has occurred.

Following the transfer of the last command step, the VEEP shall recompute and verify the check-sum that has been transferred from the Command Receiver. Failure of check-sum verification shall constitute a Type 3 error.

After verifying the check-sum, the payload shall verify the legitimacy of the command. Failure of this verification shall constitute a Type 4 error.

The detection of any type of error shall cause the payload to transmit a "Command Aborted -- Type X Error" response message to the satellite, where X is 1, 2, 3, or 4.

Payload Command Processing

The first step in the payload command execution process, following the error detection describe above, shall be for the payload to identify the command type and issue the appropriate positive response message transmission to the satellite. It shall then execute the individual command steps.

VEEP Commands

1. Immediate Retransmission of Data -- This command will be automatically issued by the NESDIS processing system when one of the VEEP hourly synoptic data messages is received in error or is not received. The purpose of the command is to simply have the VEEP retransmit the last data buffer. It will be comprised of the following two character string sequences:

Sequence 1 -- XMI(C/R)

Sequence 2 -- (Checksum)(C/R)(C/R)

The response message will consist of an identical retransmission of the last "Self-Timed" GOES message on a previously selected response channel.

2. Reset the VEEP Clock -- The time reference for this command will be maintained in the Command Receiver updated at 30-second intervals from the NBS time code that is transmitted with the command data. The command steps will be comprised of the following character sequences:

Sequence 1 -- TIM(C/R)

" 2 -- HHMMSS_DDDYY(C/R)

" 3 -- (Checksum)(C/R)(C/R)

" 4 -- SSS(C/R)

The VEEP shall suppress the normal test set display messages that are sent to the test set after the command step terminating (C/R).
The response message shall be "Time Reset: HHMMSS_DDDYY"

3. Wave Data Acquisition On/Off -- This command and the companion command for the LORAN receiver control are used in an emergency situation when a station's power supply is failing. This command consists of the following character sequences:

Sequence 1 --	SET(C/R)	Enter Setup Mode
" 2 --	47(C/R)	Waves Parameter Number
" 3 --	OFF(C/R)	ON(C/R) to turn it on
" 4 --	EXI(C/R)	Exit Setup Mode
" 5 --	Y(C/R)	Yes, save the changes
" 6 --	RUN(C/R)	Command VEEP to "Run" Mode
" 7 --	(Checksum)(C/R)(C/R)	

The companion command for on/off control of the LORAN receiver is identical to the above sequences except the Parameter Number in Sequence 2 is 34.

The response message format shall be "Waves Off(or On) -- HHMMSS_DDDYY", or "LORAN Off(or On) -- HHMMSS_DDDYY".

4. Change the Data Acquisition and Transmission Interval -- As with the Type 3 commands the purpose of this command it to change to a less frequent data acquisition and transmission schedule to conserve power. The command consists of the following character sequences:

Sequence 1 --	SET(C/R)	Enter Setup Mode
" 2 --	5(C/R)	Acquisition Interval Parameter Number
" 3 --	HMM(C/R)	Acquisition Interval
" 4 --	EXI(C/R)	Exit Setup Mode
" 5 --	Y(C/R)	Yes, Save Changes
" 6 --	RUN(C/R)	Command VEEP to Run Mode
" 7 --	(Checksum)(C/R)(C/R)	

The companion command for changing the transmit interval would be similar to above with the following changes:

Sequence 2 --	6(C/R)	Transmit Interval Parameter Number
" 3 --	H(C/R)	Transmit Interval (Limited to 1-hour increments)

The format for the satellite response shall be "Acquisition Interval HMM -- HHMMSS_DDDYY". The time for the response message shall be the current GMT from the VEEP system clock.

5. GOES Transmission On/Off -- This command would be for emergency use only when it becomes necessary to discontinue GOES transmission. It consists of the following:

Sequence 1 --	STO(C/R)	Command VEEP to Stop Mode
" 2 --	(Checksum)(C/R)(C/R)	

To restart the VEEP the following sequences would be sent:

Sequence 1 -- RUN(C/R)

Sequence 2 -- (Checksum)(C/R)(C/R)

The response message formats shall be "VEEP Stopped -- HHMMSS_DDDYY" and "VEEP Run -- HHMMSS_DDDYY", respectively.

<u>VEEP Setup Parameters</u>

The following VEEP setup parameters will have to be added to support operation with the Command Receiver:

Command Response Channel ID -- 3 Characters

BCH Address -- ??

APPENDIX I

EIA STANDARD -
Simulated Shipping Tests for Consumer
Electronic Products and Electronic Components

RS-414-A (Revision of RS-414)