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INTERFACE SPECIFICATION

(RF DATA TRANSMISSION INTERFACES)

FOR

THE DOD BASE AND INSTALLATION

SECURITY SYSTEM (BISS)

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1.0 SCOPE.

This specification is one of a series of specifications which document the established interfaces between DOD physical security system equipment items. It has been prepared under the auspices of DOD Directive 3224.3 and is maintained under the control of the Security Equipment Integration Working Group (SEIWG). References to the Base and Installation Security System (BISS) contained herein are not to be interpreted as limiting the application of this specification to a single service's security system, but rather to address the architectural aspects of BISS which are presented in BIS-SYS-10000A and which are intended to be applicable to the physical security systems of all DOD components. The purpose of this specification is to define the interface requirements between the RF Data Transmission System and the Physical Security Intrusion Detection Systems being developed by the agencies identified in 1.2.1.

1.1 Item description. The RF Data Transmission System equipment consists of the RF receiver, RF transmitter, RF interference cancellation system (ICS) and the RF repeater. Physical Security Intrusion Detection Systems consist of one or more types of intrusion detection sensors and the appropriate collectors to provide intrusion alarm data over appropriate communication links to one or more operator control/displays. The operator control/displays are normally located apart from the sensors and, as in the case of large military bases, these distances can vary in terms of miles. Sensor alarm data from one or more sensors is normally routed to an intrusion zone collector/control unit and transmitted via hardwire (twisted pair or telephone line) data links to one or more appropriate receiving units for processing and display to the operator(s). The RF Data Transmission System provides an alternate communications link between collectors and signal processing and control/display equipments to the normal hardwire communications links. For some applications the RF means of communication will be the only data link available or feasible. This specification is limited to the interface between the Intrusion Detection System and the RF Data Transmission System. Specific equipment configurations and deployment capabilities are addressed by the applicable system/equipment specifications, hence they are not repeated herein.

1.2 Contractors. This specification will be provided as required to contractors who become involved in the development of DOD physical security equipment, by the respective developing/acquiring activity.

1.2.1 Developing agencies. The following agencies are responsible for the development of security systems relating to these specifications:

a. The Facility Intrusion Detection System (FIDS) is being developed by the U.S. Army Combined Arms Laboratory (STRBE-X), Ft. Belvoir, VA, 22060.

b. The Base and Installation Security System (BISS) is being developed by the U.S. Air Force Physical Security Systems Directorate, Hq. ESD(OCB), Hanscom AFB, MA, 01731.

c. The Remotely Monitored Battlefield Sensor System (REMBASS) is being developed by the U.S. Army Electronics Research and Development Command, USAERADCOM, (DRCPM-FFR-TM) Ft. Monmouth, NJ 07703.

d. The Tactical Remote Sensor System (TRSS) is being developed by the Marine Corps Research Development and Acquisition Command for battlefield surveillance. The system conforms to SEIWG RF transmission format. Some components may be useful in certain physical security installations.

2.0 APPLICABLE DOCUMENTS

2.1 <u>Government documents</u>. The following documents of the exact issue shown form a part of this specification to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this specification, the contents of this specification shall be considered a superseding requirement.

SPECIFICATIONS:

Federal:

None

Military:

MIL-C-26482G Supplement 1 Amendment 4	5 Sep 75 5 Sep 75 28 Sep 84	Connector, Electrical, (Circular, Miniature, Quick Disconnect, Environment Resisting) Receptacles and Plugs, General Specification For

Other Government Activity:

BIS-SYS-10000A	1 Apr 82	General System Specification for the DoD Base and Installation Security System (BISS)
SEIWG-002	15 Nov 82	Interface Specification Collector (Transmitter) /Communication Functional Areas for the DoD Base and Installation Security System (BISS)
SEIWG-004	28 Feb 85 (Draft)	Interface Specification Control Unit/Line Control Processor for DoD Physical Security Systems
RAWS-001	19 May 78	ERADCOM Development Specification, Remote Automatic Weather Station (RAWS) System (Met Station, Automatic, AN/TMQ-30)

RBS-001A (Addendum 3)	16 Jan 81	REMBASS Specification: RF Data Link Interoperability Specification

STANDARDS:

Federal:

None

Military:

MIL-STD-188-100 Notice 1 Notice 2 Notice 3	15 Nov 72 16 Jul 75 1 Jun 76 17 Nov 76	Common Long Haul and Tactical Communication System Technical Standards
MIL-STD-454J Notice 1 Notice 2	30 Jul 82 30 Aug 84 1 Mar 85	Standard General Requirements for Electronic Equipment.

Other Government Activity:

TRSS 87001A0000	31 Oct 88	System Specification for the Tactical Remote Sensor System

DRAWINGS:

None

OTHER PUBLICATIONS:

Manuals:

None

Regulations:

None

Handbooks:

None

Directives:

DOD Dir 3224.3	1 December 1976	Physical Security Equipment; Assignment of Responsibility for Research, Engineering Procurement, Installation and Maintenance

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specified procurement functions should be obtained from the acquiring activity or as directed by the contracting officer.)

2.2 Non-government documents. The following documents of the exact issue shown form a part of this specification to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this specification, the contents of this specification shall be considered a superseding requirement.

SPECIFICATIONS:

None

STANDARDS:

EIA STANDARD RS-310-C-77R82	8 Oct 82	Racks, Panels and Associated Equipment
EIA STANDARD RS-422-A	DEC 78	Electrical Characteristics of Balanced Voltage Digital Interface Circuits
EIA STANDARD RS-423-A	DEC 78	Electrical Characteristics of Unbalanced Voltage Digital Interface Circuits

(Available from Electronic Industries Association, Engineering Department, 2001 Eye Street, N.W., Washington, DC 20006)

3.0 INTERFACE REQUIREMENTS

Figure 1 shows the Intrusion Detection System/RF Data Transmission System external interfaces addressed by this specification.

3.1 Physical. The physical (mechanical) interface between the RF Data Transmission System equipment and the Intrusion Detection System shall be in accordance with the following constraints.

3.1.1 Signal connector. Signal interface connections shall be implemented with a MS3112E16-26S connector, per MIL-C-26482, provided by the RF Data Transmission System hardware. Connectors requiring the use of potting compound materials shall be avoided.

3.1.2 Power connectors. AC power connections shall be implemented with a MS3112E14-5P connector, per MIL-C-26482, provided by the RF Data Transmission System hardware. DC power connections shall be implemented with a MS3114E12-3P connector, per MIL-C-26482, provided by the RF Data Transmission System hardware.

3.1.3 Interface cables. Interface cables shall be terminated at the RF Data Transmission System with appropriate connectors that shall mate with the connectors specified in 3.1.1 and 3.1.2. The cables shall be in accordance with MIL-STD-454, Requirement 71.

3.1.4 Electrical equipment cabinet/panel interface. For applications where the RF Data Transmission System equipment will be rack mounted the Intrusion Detection System shall provide the electrical equipment cabinet which will accommodate the RF Data Transmission System equipment panels. The electrical equipment cabinet/panel interface shall be in accordance with EIA Standard RS-310-C.

3.2 Functional.

3.2.1 Electronic. All data interchange, timing, and control circuits between the RF Data Transmission System and the Intrusion Detection System shall be in accordance with EIA Standard RS-422-A, Electrical Characteristics of Balanced Voltage Digital Circuits, or EIA Standard RS-423-A, Electrical Characteristics of Unbalanced Voltage Digital Circuits. All such inputs and outputs shall be balanced or shall be unbalanced, as selected by the installer via a single switch or strap or by using different connector pins, etc. Definitions of binary "1" and binary "0" are as given in the above cited standards.

3.2.1.1 Signal connector. The signal connector pins shall have the following functions:

Pin	Function
A	DATA INHIBIT A
B	DATA INHIBIT B
C	REQUEST TO SEND A
D	REQUEST TO SEND B
E	TX SERIAL DATA A
F	TX SERIAL DATA B
G	TX CARRIER DETECT A
H	TX CARRIER DETECT B
J	RX CARRIER DETECT A
K	RX CARRIER DETECT B
L	DATA PRESENT A
M	DATA PRESENT B
N	RECOVERED CLOCK A
P	RECOVERED CLOCK B
R	RECOVERED NRZ A
S	RECOVERED NRZ B
T	DELAYED MANCHESTER A
U	DELAYED MANCHESTER B
X	GROUND

The A and B designations associated with each signal function are per RS-422-A.

3.2.1.2 RF Transmitter interface signals. Figure 2 shows the RF transmitter interface signals and their timing relationship to each other and the RF power output level.

3.2.1.2.1 Request to Send (RTS). The RTS Command shall be a logic level and shall control the amplification (RF Power ON)/non-amplification (RF Power OFF) of the transmitter RF signal. An RTS RF power ON command shall be a binary "0". An RTS RF Power OFF command shall be a binary "1". The RTS (RF Power ON) command must remain a binary "0" as long as RF power is required.

3.2.1.2.2 TX Carrier Detected. The Tx Carrier Detected signal shall be a logic level. This signal shall be a binary "0" (Tx Carrier ON) whenever the transmitter RF carrier output reaches or exceeds 90% of the rated output and shall be a binary "1" (Tx Carrier OFF) whenever the RF carrier output falls to less than 90% of rated output.

3.2.1.2.3 Serial data. The baseband data message inputted to the RF transmitter for modulation of the RF carrier shall be binary, bi-phase (Manchester) coded at an information bit rate of 1200 ± 36 bits per second. In Manchester code there is always a transition at the middle of the bit period. The bit is assigned the value "1" when the transition at the middle of the bit period is from binary "0" (space) to binary "1" (mark). The bit is assigned the value "0" when the transition at the middle of the bit period is from binary "1" (mark) to binary "0" (space). The first transmitted zero of the message preamble shall not be sent to the transmitter prior to the Tx Carrier Detected signal going ON (binary "0").

3.2.1.3 RF Receiver interface signals. Figure 3 shows the RF receiver interface signals and their timing relationships to each other.

3.2.1.3.1 Receive Carrier Detected. The Receive Carrier Detected signal shall be a logic level. This signal shall be a binary "0" whenever the received RF is of sufficient magnitude to exceed a preset quieting threshold. It shall be a binary "1" at all other times.

3.2.1.3.2 Data Present. The Data Present signal shall be a logic level. This signal shall be a binary "0" whenever the received RF is of sufficient magnitude to exceed a preset quieting threshold and at least 5 sequential correctly positioned zeros at a 1200 ± 36 bit per second rate have been detected. It shall remain a binary "0" for the length of the message, as determined by the detector. This signal shall be a binary "1" at all other times.

3.2.1.3.3 Recovered NRZ data. The Recovered NRZ data output signal shall be NRZ coded at an information bit rate of 1200 ± 36 bits per second.

3.2.1.3.4 NRZ clock. The NRZ clock shall be 1200 ± 36 bits per second. The clock-data relationship shall be per MIL-STD-188-100.

3.2.1.3.5 Delayed Manchester data. The delayed Manchester data (reformatted Manchester data which includes a regenerated preamble) shall be binary, bi-phase (Manchester) coded at an information bit rate of 1200 ± 36 bits per second. The delayed Manchester data shall be outputted upon detection of the first "1" (start bit) following receipt of five (5) or more correctly positioned zeros.

3.2.1.3.6 Data Inhibit. The Data Inhibit command, when extended to the receiver, shall control the state of the NRZ Data, the NRZ Clock, and the Delayed Manchester Data line drivers. A binary "0" (Data Inhibit ON) shall cause these line drivers to assume a high impedance (tri-stated) condition and the respective receiver baseband data outputs shall be inhibited. A binary "1" (Data Inhibit OFF) shall cause the line driver outputs to assume a low impedance state, allowing data to be sent out. When the Data Inhibit control line is not connected to the receiver, the line drivers shall be as if a binary "1" (Data Inhibit OFF) is applied via this control line.

3.2.1.4 RF characteristics.

3.2.1.4.1 RF system band. The RF tuning range over which the receiver and transmitter may be operated shall be from 138 MHz to 153 MHz.

3.2.1.4.2 On/Off switching times. The time for the transmitter to reach 90% of peak power and to be within the steady-state space frequency tolerance after the RTS (RF Power ON) command shall be 2 ms maximum. Transmitter power shall fall to below 10% of peak power within 2 milliseconds after RF Power OFF (RTS to binary "1").

3.2.1.4.3 Long term stability. Long term stability is the maximum allowable deviation or shift of the carrier frequency from the specified channel center frequency as measured over a long period. Long term stability shall not exceed ± 5 parts per million when measured over a one year duration.

3.2.1.4.4 Short term stability. The carrier frequency shall not vary more than 2 parts per million after the RF power has reached 90% of its peak value measured over a 30-second period.

3.2.1.4.5 Channel description. The RF Data Link channel is a 25 KHz frequency range about a specifically assigned center frequency, and an associated channel number from 1 to 599, over which a message (information) is transferred. The channel bandwidth includes an information band, and sufficient bandwidth to accommodate the carrier frequency uncertainty due to transmitter and receiver instability. The nominal channel bandwidth shall be 25 KHz. Channel 1 center frequency (f_c) shall be 138.025 MHz; Channel 2 shall be 138.050 MHz, etc., and Channel 599, the last channel, shall be 152.975 MHz.

3.2.1.4.5.1 Emission Bandwidth. (See Figure 4) The emission bandwidth is defined as that appearing at the antenna terminals and includes any significant attenuation contributed by filtering in the output circuit or transmission lines. The emission bandwidth shall not exceed 16.8 kHz at -3dB, 19 kHz at -20dB and 25 kHz at -60dB referenced to the peak envelope power.

3.2.1.4.6 Polarization. The transmitted signal shall be vertically polarized.

3.2.1.4.7 Modulation. The method used by the transmitter to modulate the RF carrier f_c shall be binary, frequency shift keying (FSK) where $f_c +$ f and $f_c -$ f shall designate "mark" and "space" frequencies, respectively. The steady state f shall be 3.0 KHz ± 300 Hz (See Figure 5).

3.2.1.4.7.1 Biphase (Manchester) coding. Bi-phase (Manchester) coding shall be used to transmit information. Figure 6 shows that the frequency transition, which occurs in the center of all bit periods, determines the bit value. A transition from "mark" to "space" in the middle of a bit period is defined as a bit value "1"; conversely, a transition from "space" to "mark" is defined as bit value "0". The bit value definition according to the mark to space and space to mark transitions, as set forth in this paragraph for the RF domain, is not the same as the corresponding definition in 3.2.1.2.3.

3.2.1.4.7.2 Message bit rate. The message bit rate shall be 1200 ± 36 bps.

3.2.1.4.7.3 Incidental deviation. Incidental deviation is the spurious deviation with no modulation input. Incidental deviation shall be less than 60 Hz.

3.2.1.4.8 Message recognition formats.

3.2.1.4.8.1 Preamble. DoD Physical Security System RF transmitted messages shall have a common preamble (message bits 1-9). The entire preamble sequence shall be eight "zeros" followed by a "one". A logical "one" received following the detection of the minimal fragment of the preamble (five or more sequential zeros that occur at bit rate intervals) is deemed to be the start bit, (message bit 9).

3.2.1.4.8.2 Message code field. All DoD Physical Security System RF transmitted messages have a message code field (message bits 10-13). Table I identifies the assignments made to date. These bits allow individual users to uniquely select messages desired. In addition, these bits may also be used for additional functions if deemed appropriate. In Table I, message bits 10-13 are denoted by M_0, M_1, M_2, M_3 where M_0 is the bit transmitted first.

3.2.1.4.8.3 Message data fields. Starting with message bit 14 and beyond, the bit assignments are unique to the individual users. BISS and REMBASS have traditionally used a 29 bit digital message. The FIDS message is made up of varying numbers of 11 bit bytes, following eight (8) or more zeros. The first byte of a FIDS message incorporates the start bit (bit 9) and the Message Code field (bits 10-13). However, message length is not restricted by this document. The actual bit assignments for each message code assigned are provided in applicable documents (See Table I). These are SEIWG documents that are under SEIWG configuration management control.

3.2.1.5 Duty cycle. The RF transmitter and RF receiver shall each be capable of continuous duty operation.

3.2.2 Electrical.

3.2.2.1 Power connectors.

3.2.2.1.1 AC power connector. The AC power connector pins shall have the following functions:

Pin	Function
1	AC Line
2	AC Neutral

3.2.2.1.2 DC power connector. The DC power connector pins shall have the following functions:

Pin	Function
1	DC +
2	DC -

3.2.2.2 Power. The RF Data Transmission System shall be capable of accepting each of the following prime power inputs, and shall be capable of operating when supplied with any one of these inputs by the Intrusion Detection System.

3.2.2.2.1 AC power single phase.

a. Voltage: 115/230 Vac, ± 10%

b. Frequency: 48 to 63 Hertz

c. Phase: One phase, 3 wire

3.2.2.2.2 <u>+24 Vdc power</u>.

a. Voltage: +24 Vdc, +8, -4 Vdc

3.3 <u>Environmental</u>. Not applicable to this specification.

3.4 <u>Safety</u>. Not applicable to this specification.

4.0 QUALITY ASSURANCE PROVISIONS

Inspection and test requirements to verify hardware and/or software compliance with the specified interface requirements of Section 3 shall be included in specifications of those interdependent systems, subsystems, components and equipments which use the interface specified herein.

5.0 NOTES

5.1 <u>Specification change marking</u>. Symbols are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.

5.2 <u>Custodian</u>. The Physical Security Systems Directorate (PSSD) has been designated as custodian of this specification. Appropriate comments, questions and suggested changes should be forwarded to HQ ESD/OCBR, LG Hanscom AFB, MA 01731 for resolution or referral to the Security Equipment Integration Working Group.

TABLE 1 MESSAGE RECOGNITION FORMAT

1 2 3 4 5 6 7 8	9	10 11 12 13	14 15 16 ... N	
PREAMBLE		MESSAGE CODE	DATA	MESSAGE LENGTH (N)
	START			
0 0 0 0 0 0 0 0	1	M_0 M_1 M_2 M_3	(See cited applicable specification for definition of bit assignments.)	
BISS:			SEIWG-002	
ALARM		1 0 1 0		29 Bits
SUPERVISION		1 1 0 0		29 Bits
SELF TEST		0 1 0 1		29 Bits
REMBASS:			RBS 001A (Addendum 3)	
CLASSIFICATION		0 1 1 0		29 Bits
ANALOG		1 0 1 1		29 Bits plus 15 sec. audio
COMMAND		1 0 0 1	To be specified	TBD
DIGITIZED IMAGE		1 0 0 0		TBD
TRSS:			TRS 87001A0000	
SHORT CODE		0 1 1 1		20 Bits
LONG CODE		1 1 0 1		29 Bits
COMMAND		1 1 1 1		29 Bits
DIGITIZED IMAGE		1 1 1 0		4125 Bits
OTHERS:				
RAWS		0 0 1 1	RAWS-001	101 Bits
TO BE ASSIGNED		0 1 1 1	To be specified	TBD
		1 1 0 1		TBD
		1 1 1 1		TBD

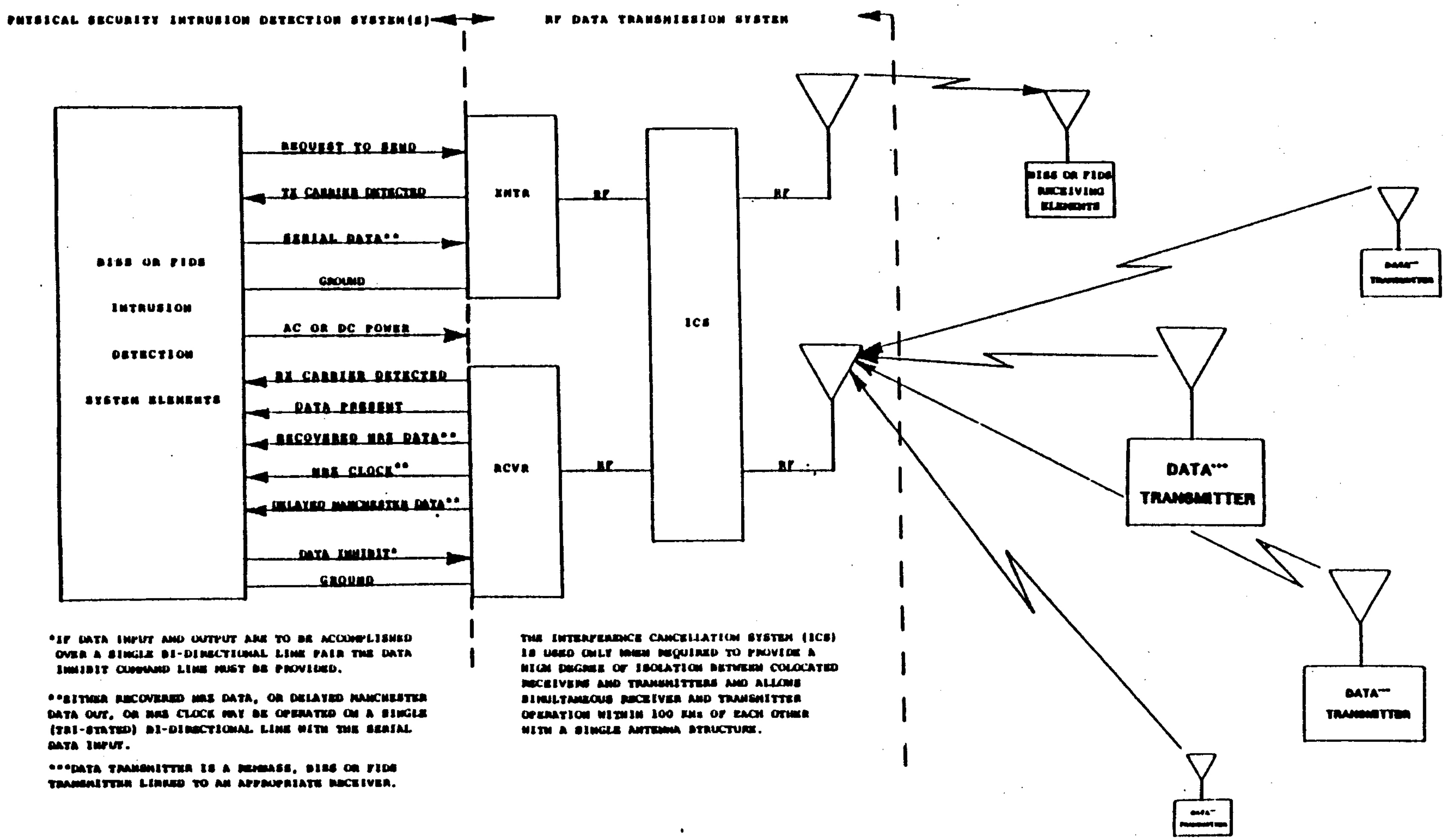
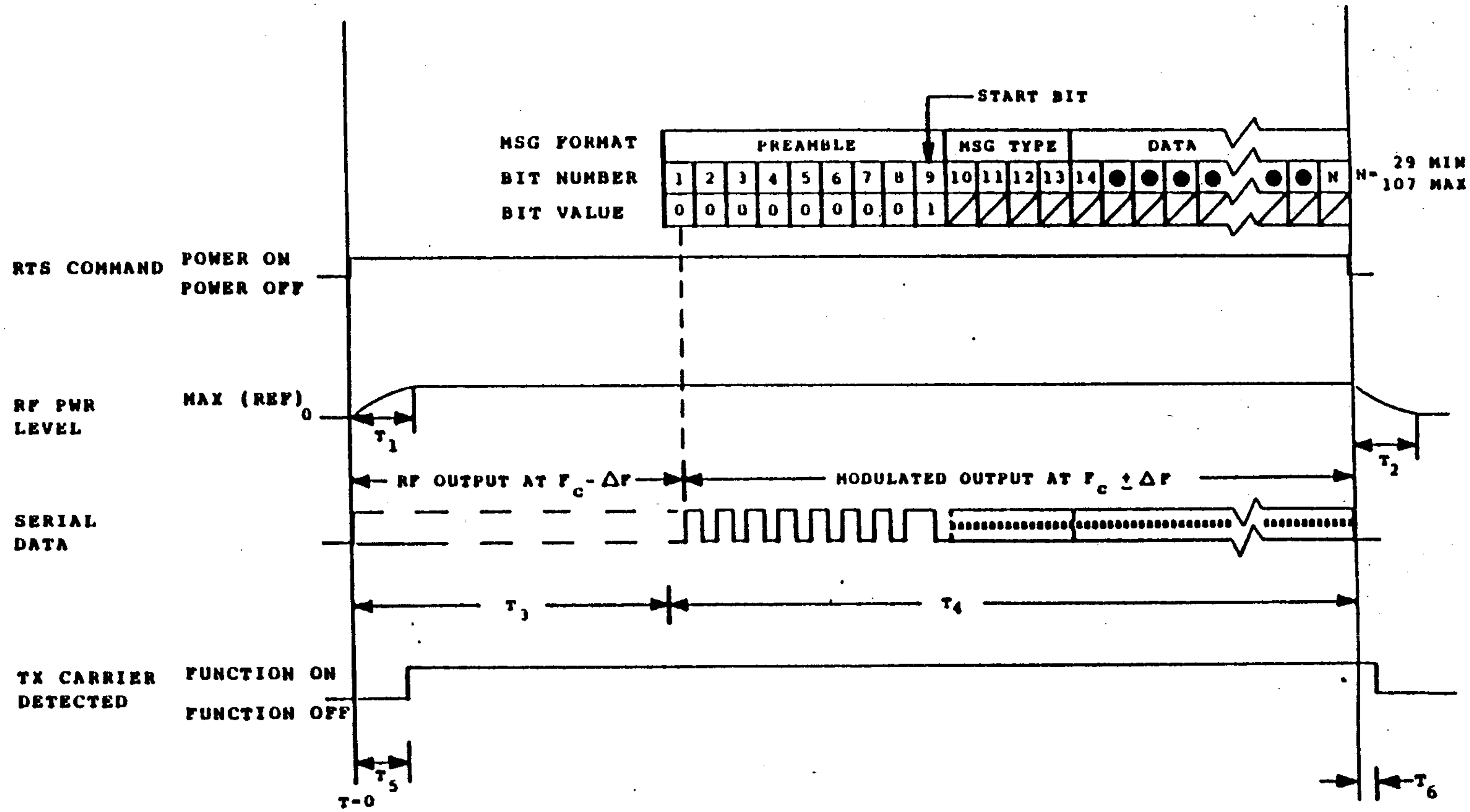


Figure 1. Intrusion Detection System/RF Data Transmission System Interface



NOTE:

WAVEFORMS REPRESENT BINARY LOGIC LEVELS AS FOLLOWS:

BINARY "0"

BINARY "1"

F_C UNDEVIATED CARRIER FREQUENCY
ΔF CARRIER DEVIATION
T_1 2.0 MS MAX TO ACHIEVE 90% OF RF PWR OUTPUT
T_2 2.0 MS MAX TO FALL BELOW 10% OF RF PWR OUTPUT
T_3 FIRST ZERO OF PREAMBLE WITHHELD UNTIL RECEIPT OF TX CARRIER DETECTED ON
T_4 N BITS X 833 MICROSECONDS (NOMINAL)
T_5 VARIES WITH RF PWR LEVEL $\leq$ 2 MS
T_6 VARIES WITH RF PWR LEVEL $\leq$ 2 MS

Figure 2. RF Transmission Signal Timing

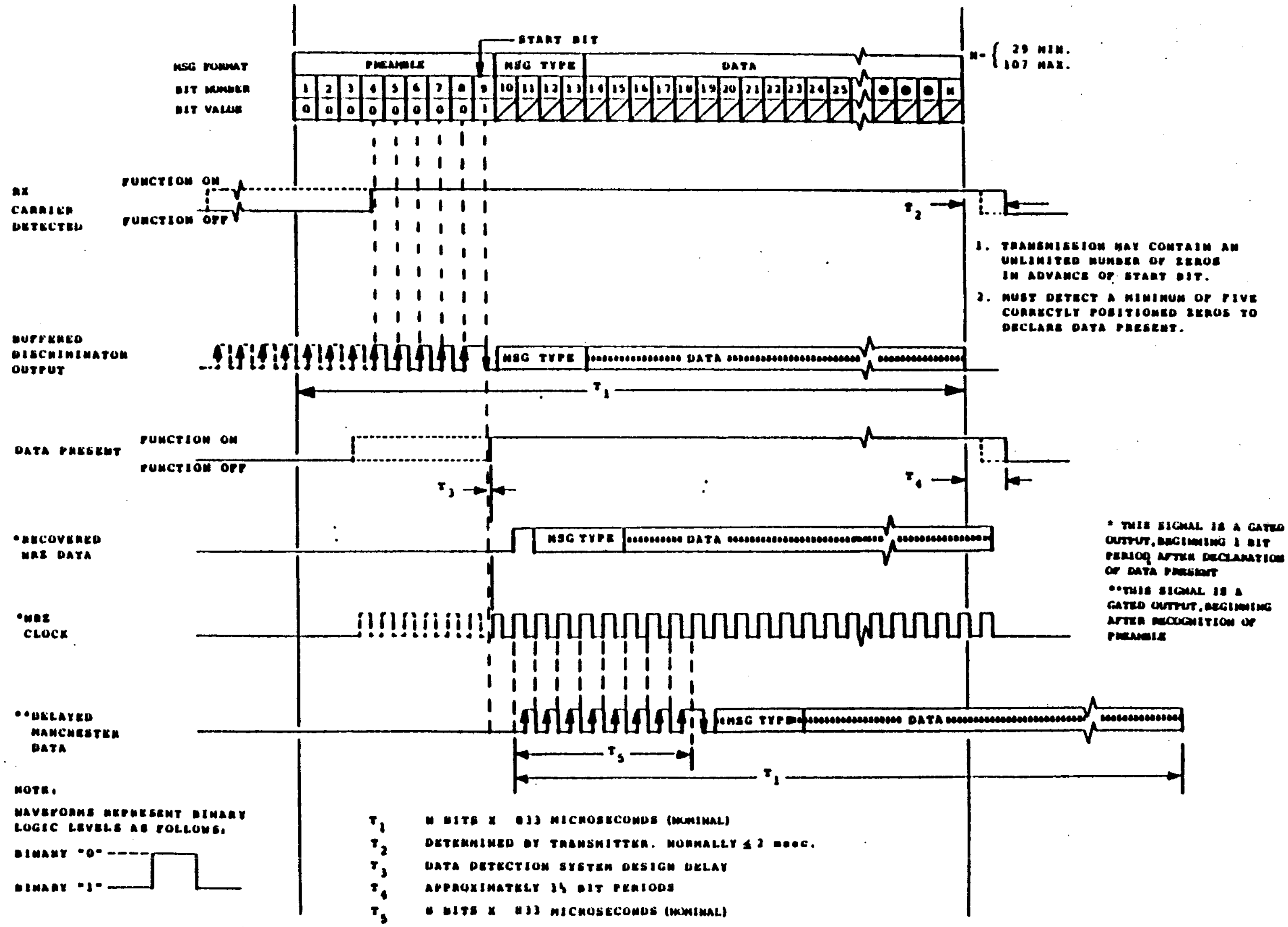


Figure 3. RF Receiver Signal Timing

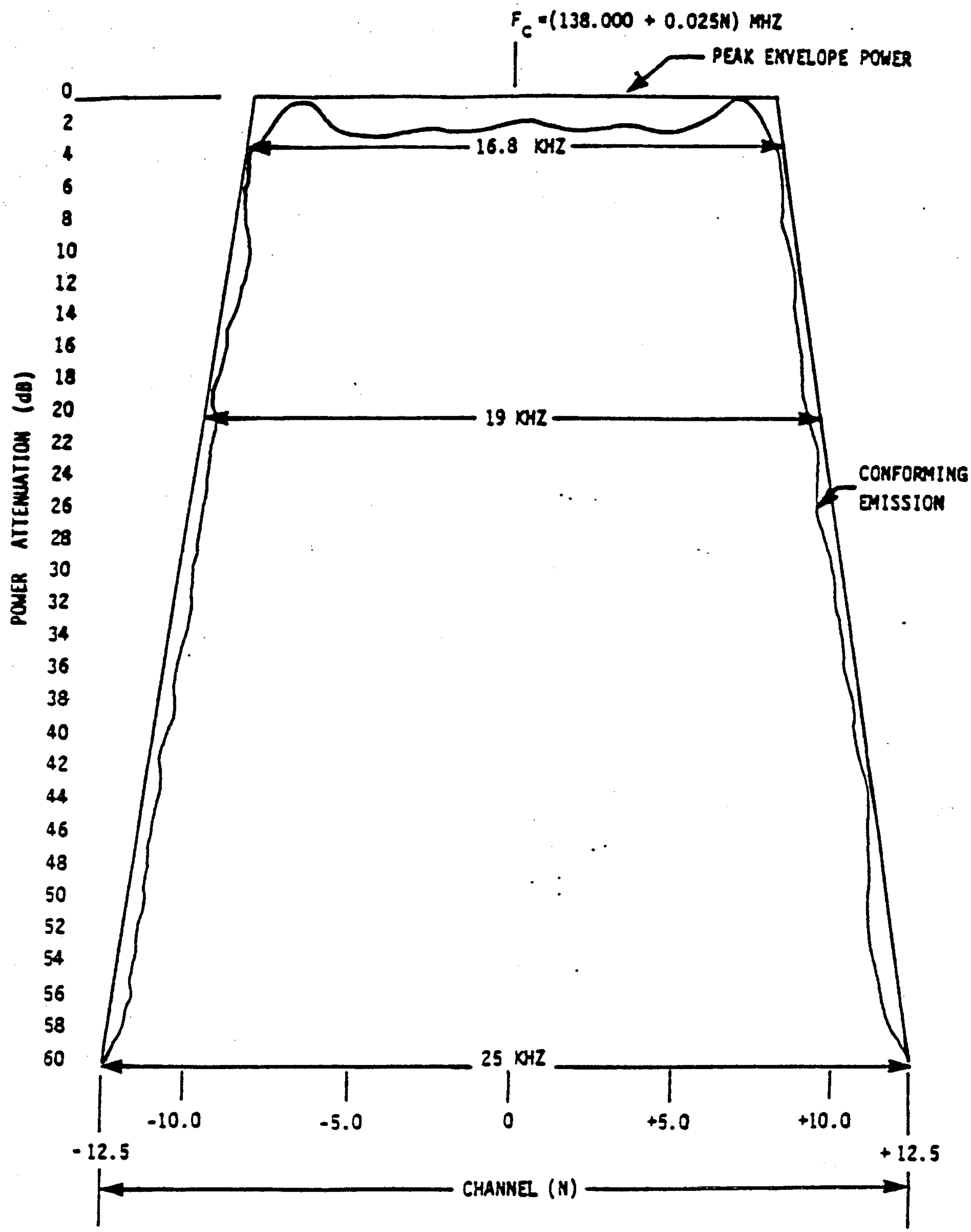


FIGURE 4. TRANSMITTER EMISSION BANDWIDTH

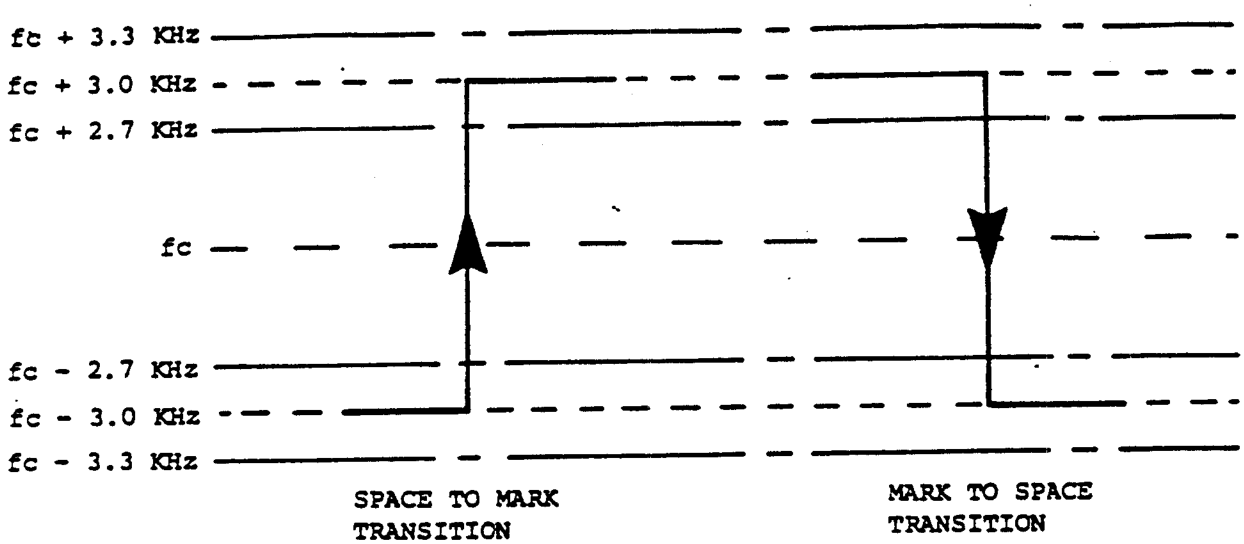


Figure 5. Transmitter FSK Modulation

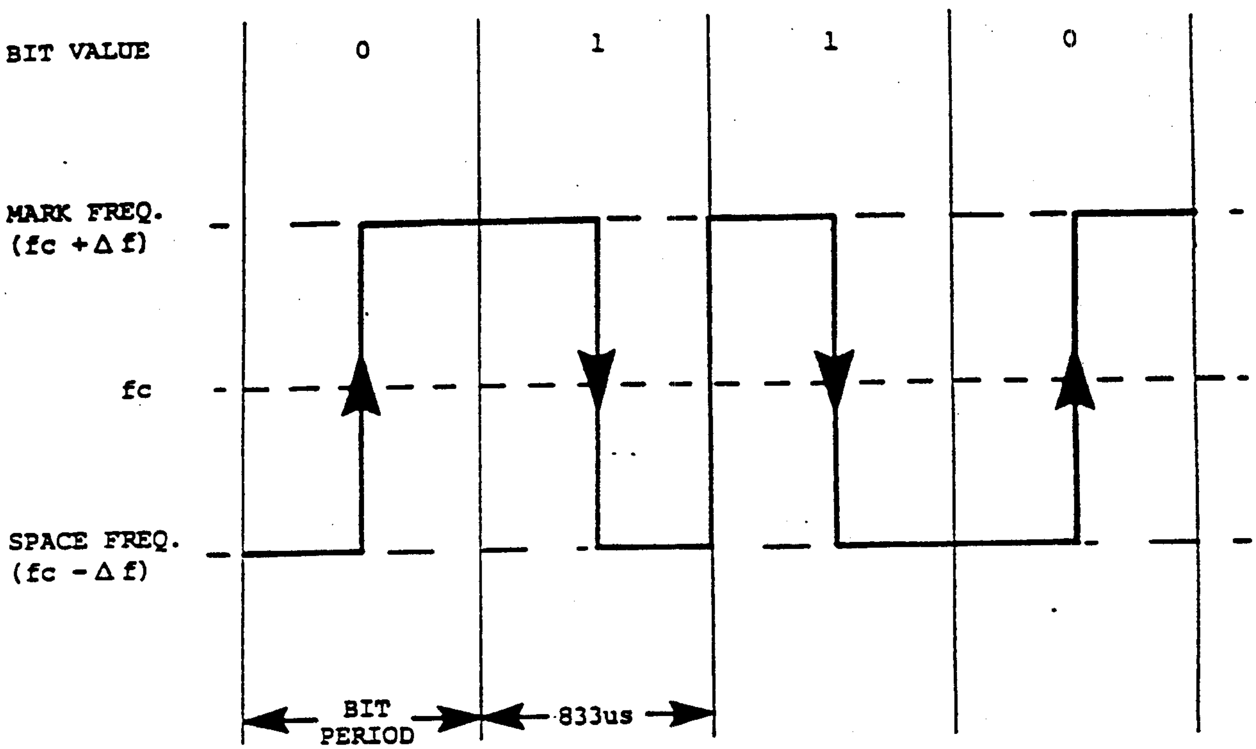


Figure 6. Bi-phase Manchester Coding of RF Signals