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| **Recommendation ITU-R M.2034**  **(02/2013)** |
| **Telegraphic alphabet for data communication by phase shift  keying at 31 Bd in the amateur  and amateur-satellite services** |
| **M Series**  **Mobile, radiodetermination, amateur**  **and related satellite services** |

Foreword

The role of the Radiocommunication Sector is to ensure the rational, equitable, efficient and economical use of the radio-frequency spectrum by all radiocommunication services, including satellite services, and carry out studies without limit of frequency range on the basis of which Recommendations are adopted.

The regulatory and policy functions of the Radiocommunication Sector are performed by World and Regional Radiocommunication Conferences and Radiocommunication Assemblies supported by Study Groups.

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ITU-R policy on IPR is described in the Common Patent Policy for ITU-T/ITU-R/ISO/IEC referenced in Annex 1 of Resolution ITU-R 1. Forms to be used for the submission of patent statements and licensing declarations by patent holders are available from <http://www.itu.int/ITU-R/go/patents/en> where the Guidelines for Implementation of the Common Patent Policy for ITU‑T/ITU‑R/ISO/IEC and the ITU-R patent information database can also be found.

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| Series of ITU-R Recommendations  (Also available online at <http://www.itu.int/publ/R-REC/en>) | |
| **Series** | Title |
| **BO** | Satellite delivery |
| **BR** | Recording for production, archival and play-out; film for television |
| **BS** | Broadcasting service (sound) |
| **BT** | Broadcasting service (television) |
| **F** | Fixed service |
| M | Mobile, radiodetermination, amateur and related satellite services |
| **P** | Radiowave propagation |
| **RA** | Radio astronomy |
| **RS** | Remote sensing systems |
| **S** | Fixed-satellite service |
| **SA** | Space applications and meteorology |
| **SF** | Frequency sharing and coordination between fixed-satellite and fixed service systems |
| **SM** | Spectrum management |
| **SNG** | Satellite news gathering |
| **TF** | Time signals and frequency standards emissions |
| **V** | Vocabulary and related subjects |

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| ***Note***: *This ITU-R Recommendation was approved in English under the procedure detailed in Resolution ITU-R 1.* |

*Electronic Publication*

Geneva, 2013

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RECOMMENDATION ITU-R M.2034

Telegraphic alphabet for data communication by phase shift keying  
at 31 Bd in the amateur and amateur-satellite services

(Question ITU-R 48-6/5)

(2013)

Scope

This Recommendation establishes a telegraphic alphabet and transmission protocols for phase shift keying at 31 Bd in the amateur and amateur-satellite services.

The ITU Radiocommunication Assembly,

considering

a) that phase shift keying at a data rate of 31 Bd has become a predominant transmission mode in the amateur and amateur-satellite services;

b) that phase shift keying at 31 Bd utilizes a telegraphic alphabet, commonly called “Varicode”, optimized for the English language, in which more frequently used characters occupy fewer bits;

c) that telegraphic alphabets should be documented and updated from time to time to meet the needs of radiocommunication services,

recommends

**1** that the Annex should be used to define Varicode characters and their applications in the amateur and amateur-satellite services.

Annex

# 1 Introduction

PSK‑31 is a digital communication mode which is intended for live keyboard-to-keyboard conversations, similar to radioteletype. Its data rate is 31.25 Bd (about 50 words per minute), and its narrow bandwidth (approximately 60 Hz at –26 dB) reduces its susceptibility to noise. PSK‑31’s ITU emission designator is 60H0J2B. It uses either BPSK modulation without error correction or QPSK modulation with error correction (convolutional encoding and Viterbi decoding). In order to minimize occupied bandwidth, the output is cosine-filtered before reaching the transmitter audio input. PSK‑31 is readily monitored and the most popular implementations use DSP software running on a computer soundcard.

Each transmission has a preamble, an idle signal of continuous zeroes corresponding to continuous phase reversals at the symbol rate of 31.25 reversals/second, and a postamble, continuous unmodulated carrier representing a series of logical ones. The absence of phase reversals squelches the decoder.

While a symbol rate of 31.25 Bd is typical of most amateur service use, the symbol rate can be varied in direct proportion to the frequency of phase reversals. Transmissions at symbol rates as high as 125 Bd have been achieved.

# 2 Varicode characters

Different characters are represented by a variable-length combination of bits called Varicode. Because shorter bit-lengths are used for the more common letters in the English language, Varicode improves efficiency in terms of the average character duration. Varicode is also self-synchronizing. No separate process is needed to define where one character ends and the next begins since the pattern used to represent a gap between two characters (at least two consecutive zeroes) never occurs in a character. Because no Varicode characters can begin or end with a zero (0), the shortest character is a single one (1) by itself. The next is 11, then 101, 111, 1011, and 1101, but not 10, 100, or 1000 (because they end with zeroes), and not 1001 (since it contains two consecutive zeros). This scheme generates the 128-character ASCII set with ten bits. The encoding philosophy, however, accommodates longer bit sequences which allow for additional characters, e.g. accented characters.

The Varicode character set is shown below. The codes are transmitted left bit first, with 0 representing a phase reversal on BPSK and 1 representing a steady carrier. A minimum of two zeros is inserted between characters. Some implementations may not handle all the codes below 32. Note that the lower case letters have the shortest patterns and so are the fastest to transmit.

The varicode character set control characters

| Varicode | Abbreviation | Description |
| --- | --- | --- |
| 1010101011 | NUL | Null character |
| 1011011011 | SOH | Start of Header |
| 1011101101 | STX | Start of Text |
| 1101110111 | ETX | End of Text |
| 1011101011 | EOT | End of Transmission |
| 1101011111 | ENQ | Enquiry |
| 1011101111 | ACK | Acknowledgment |
| 1011111101 | BEL | Bell |
| 1011111111 | BS | Backspace |
| 11101111 | HT | Horizontal Tab |
| 11101 | LF | Line feed |
| 1101101111 | VT | Vertical Tab |
| 1011011101 | FF | Form feed |
| 11111 | CR | Carriage return |
| 1101110101 | SO | Shift Out |
| 1110101011 | SI | Shift In |
| 1011110111 | DLE | Data Link Escape |
| 1011110101 | DC1 | Device Control 1 (XON) |
| 1110101101 | DC2 | Device Control 2 |
| 1110101111 | DC3 | Device Control 3 (XOFF) |
| 1101011011 | DC4 | Device Control 4 |
| 1101101011 | NAK | Negative Acknowledgement |
| 1101101101 | SYN | Synchronous Idle |
| 1101010111 | ETB | End of Trans. Block |
| 1101111011 | CAN | Cancel |
| 1101111101 | EM | End of Medium |
| 1110110111 | SUB | Substitute |
| 1101010101 | ESC | Escape |
| 1101011101 | FS | File Separator |
| 1110111011 | GS | Group Separator |
| 1011111011 | RS | Record Separator |
| 1101111111 | US | Unit Separator |
| 1110110101 | DEL | Delete |

Printable characters

| Varicode | Glyph |  | Varicode | Glyph |  | Varicode | Glyph |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | SP |  | 1010111101 | @ |  | 1011011111 | ` |
| 111111111 | ! |  | 1111101 | A |  | 1011 | a |
| 101011111 | " |  | 11101011 | B |  | 1011111 | b |
| 111110101 | # |  | 10101101 | C |  | 101111 | c |
| 111011011 | $ |  | 10110101 | D |  | 101101 | d |
| 1011010101 | % |  | 1110111 | E |  | 11 | e |
| 1010111011 | & |  | 11011011 | F |  | 111101 | f |
| 101111111 | ' |  | 11111101 | G |  | 1011011 | g |
| 11111011 | ( |  | 101010101 | H |  | 101011 | h |
| 11110111 | ) |  | 1111111 | I |  | 1101 | i |
| 101101111 | \* |  | 111111101 | J |  | 111101011 | j |
| 111011111 | + |  | 101111101 | K |  | 10111111 | k |
| 1110101 | , |  | 11010111 | L |  | 11011 | l |
| 110101 | - |  | 10111011 | M |  | 111011 | m |
| 1010111 | . |  | 11011101 | N |  | 1111 | n |
| 110101111 | / |  | 10101011 | O |  | 111 | o |
| 10110111 | 0 |  | 11010101 | P |  | 111111 | p |
| 10111101 | 1 |  | 111011101 | Q |  | 110111111 | q |
| 11101101 | 2 |  | 10101111 | R |  | 10101 | r |
| 11111111 | 3 |  | 1101111 | S |  | 10111 | s |
| 101110111 | 4 |  | 1101101 | T |  | 101 | t |
| 101011011 | 5 |  | 101010111 | U |  | 110111 | u |
| 101101011 | 6 |  | 110110101 | V |  | 1111011 | v |
| 110101101 | 7 |  | 101011101 | W |  | 1101011 | w |
| 110101011 | 8 |  | 101110101 | X |  | 11011111 | x |
| 110110111 | 9 |  | 101111011 | Y |  | 1011101 | y |
| 11110101 | : |  | 1010101101 | Z |  | 111010101 | z |
| 110111101 | ; |  | 111110111 | [ |  | 1010110111 | { |
| 111101101 | < |  | 111101111 | \ |  | 110111011 | | |
| 1010101 | = |  | 111111011 | ] |  | 1010110101 | } |
| 111010111 | > |  | 1010111111 | ^ |  | 1011010111 | ~ |
| 1010101111 | ? |  | 101101101 | \_ |  |  |  |