

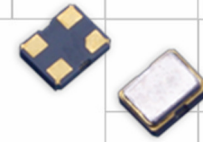


Model 517

HCMOS TCXO

Features

- Ceramic Surface Mount Package
- Low Phase Jitter Performance
- Fundamental Crystal Design
- Frequency Range 9.5 – 60MHz *
- +1.8V, +2.5V, +2.8V, +3.0V and +3.3V Operation
- Output Enable Standard
- Tape and Reel Packaging, EIA-481



Part Dimensions:
2.0 × 1.6 × 0.8mm • 8.29998mg

Standard Frequencies

* See Page 7 for common frequencies.
Check with factory for frequency availability.

Applications

- GPS
- IoT and IIoT
- Wireless Connectivity
- Synchronous Ethernet
- Base Stations/Femto Cells
- Mobile Communication
- WiMax/Wi-Fi/WLAN
- Phase Locked Loop
- Test Equipment

Description

CTS Model 517 is a low cost, small size, high performance Temperature Compensated Crystal Oscillator [TCXO]. Employing analog IC technology that provides a HCMOS output, high order temperature compensation engine; coupled with a fundamental quartz crystal M517 has excellent stability and low jitter/phase noise performance.

Ordering Information

| Model | Supply Voltage | Frequency Code [MHz] | Frequency Stability ² | Temperature Range | Frequency Tuning | Packaging | | | | | | | | | | | | | | | | | | | | | | |
|-------------------------------------|--|--|----------------------------------|-------------------|-------------------------------------|-----------|---------|---|---------|-------------|---------|----------------|---------|----------------|---|----------------|---|------|----------------------|----|--------------|--|--|------|---------------------|---|---------------------------|--|
| 517 | L | XXX | 25 | D | T | R | | | | | | | | | | | | | | | | | | | | | | |
| | <table border="1"> <thead> <tr> <th>Code</th> <th>Voltage</th> </tr> </thead> <tbody> <tr> <td>M</td> <td>+1.8Vdc</td> </tr> <tr> <td>N</td> <td>+2.5Vdc</td> </tr> <tr> <td>T</td> <td>+2.8Vdc</td> </tr> <tr> <td>R</td> <td>+3.0Vdc</td> </tr> <tr> <td>L</td> <td>+3.3Vdc</td> </tr> </tbody> </table> | Code | Voltage | M | +1.8Vdc | N | +2.5Vdc | T | +2.8Vdc | R | +3.0Vdc | L | +3.3Vdc | | <table border="1"> <thead> <tr> <th>Code</th> <th>Stability</th> </tr> </thead> <tbody> <tr> <td>20</td> <td>±2.0ppm³</td> </tr> <tr> <td>25</td> <td>±2.5ppm</td> </tr> </tbody> </table> | Code | Stability | 20 | ±2.0ppm ³ | 25 | ±2.5ppm | | <table border="1"> <thead> <tr> <th>Code</th> <th>Frequency Deviation</th> </tr> </thead> <tbody> <tr> <td>T</td> <td>TCXO [No Voltage Control]</td> </tr> </tbody> </table> | Code | Frequency Deviation | T | TCXO [No Voltage Control] | |
| Code | Voltage | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| M | +1.8Vdc | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| N | +2.5Vdc | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| T | +2.8Vdc | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| R | +3.0Vdc | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| L | +3.3Vdc | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Code | Stability | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 20 | ±2.0ppm ³ | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25 | ±2.5ppm | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Code | Frequency Deviation | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| | | <table border="1"> <thead> <tr> <th>Code</th> <th>Frequency</th> </tr> </thead> <tbody> <tr> <td colspan="2">Product Frequency Code¹</td> </tr> </tbody> </table> | Code | Frequency | Product Frequency Code ¹ | | | <table border="1"> <thead> <tr> <th>Code</th> <th>Temp. Range</th> </tr> </thead> <tbody> <tr> <td>C</td> <td>-20°C to +70°C</td> </tr> <tr> <td>D</td> <td>-30°C to +85°C</td> </tr> <tr> <td>I</td> <td>-40°C to +85°C</td> </tr> </tbody> </table> | Code | Temp. Range | C | -20°C to +70°C | D | -30°C to +85°C | I | -40°C to +85°C | <table border="1"> <thead> <tr> <th>Code</th> <th>Packing</th> </tr> </thead> <tbody> <tr> <td>R</td> <td>3k pcs./reel</td> </tr> </tbody> </table> | Code | Packing | R | 3k pcs./reel | | | | | | | |
| Code | Frequency | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Product Frequency Code ¹ | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Code | Temp. Range | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| C | -20°C to +70°C | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| D | -30°C to +85°C | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| I | -40°C to +85°C | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Code | Packing | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| R | 3k pcs./reel | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Notes:

- 1] Refer to document 016-1454-0, Frequency Code Tables. 3-digits for frequencies <100MHz, 4-digits for frequencies 100MHz or greater.
- 2] Frequency vs. Temperature only.
- 3] Contact factory for availability with Temperature Range codes "D" and "I".

**Not all performance combinations and frequencies may be available.
Contact your local CTS Representative or CTS Customer Service for availability.**

This product is specified for use only in standard commercial applications. Supplier disclaims all express and implied warranties and liability in connection with any use of this product in any non-commercial applications or in any application that may expose the product to conditions that are outside of the tolerances provided in its specification.



Electrical Specifications

Operating Conditions

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNIT |
|------------------------|------------------|--------------------|------|-----|------|------|
| Maximum Supply Voltage | V _{CC} | - | -0.5 | - | 4.6 | V |
| | | | 1.71 | 1.8 | 1.89 | |
| | | | 2.38 | 2.5 | 2.63 | |
| Supply Voltage | V _{CC} | ±5% | 2.66 | 2.8 | 2.94 | V |
| | | | 2.85 | 3.0 | 3.15 | |
| | | | 3.14 | 3.3 | 3.47 | |
| | | | | | | |
| Supply Current | I _{CC} | 9.50MHz - 60.00MHz | - | - | 10 | mA |
| Output Load | C _L | - | - | - | 15 | pF |
| | | | -20 | | +70 | |
| Operating Temperature | T _A | - | -30 | +25 | +85 | °C |
| | | | -40 | | +85 | |
| | | | | | | |
| Storage Temperature | T _{STG} | - | -40 | - | +85 | °C |

Frequency Stability

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNIT |
|---------------------|--------------------|--|------|----------|-----|------|
| Frequency Range | f ₀ | - | | 9.5 - 60 | | MHz |
| Frequency Stability | | | | | | |
| Initial Calibration | Δf/f ₀ | Calibration @ +25°C, After 2 Reflows | -2.0 | - | 2.0 | ppm |
| Temperature Only | Δf/f ₂₅ | Referenced to +25°C Reading | | 2.0, 2.5 | | ±ppm |
| Voltage Coefficient | | Supply Voltage, ±5% | -0.2 | - | 0.2 | ppm |
| Load Coefficient | | Load, ±10% | -0.2 | - | 0.2 | ppm |
| Aging | Δf/f ₂₅ | First Year @ +25°C, nominal V _{CC} and V _C | -1.0 | - | 1.0 | ppm |
| | | 10 Years @ +25°C, nominal V _{CC} and V _C | -10 | - | 10 | |

Output Parameters

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNIT |
|-----------------------|---------------------------------|--------------------------------|--------------------|-------|--------------------|------|
| Output Type | - | - | | HCMOS | | - |
| Output Voltage Levels | V _{OH} | Logic '1' Level, CMOS Load | 0.9V _{CC} | - | - | V |
| | V _{OL} | Logic '0' Level, CMOS Load | - | - | 0.1V _{CC} | |
| Output Duty Cycle | SYM | @ 50% Level | 45 | - | 55 | % |
| Rise and Fall Time | T _R , T _F | @ 20%/80% Levels | - | - | 5 | ns |
| Start Up Time | T _S | Application of V _{CC} | - | - | 5 | ms |
| Phase Noise | - | See Typical Plots | - | - | - | - |

Output Enable/Disable

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNIT |
|-----------------------|------------------|---------------------------------|--------------------|-----|--------------------|------|
| Enable Function | | Standby | | | | |
| Enable Input Voltage | V _{IH} | Pin 1 Logic '1', Output Enabled | 0.7V _{CC} | - | - | V |
| Disable Input Voltage | V _{IL} | Pin 1 Logic '0', Output Standby | - | - | 0.3V _{CC} | V |
| Standby Current | I _{STB} | Pin 1 Logic '0', Output Standby | - | - | 10 | μA |
| Enable Time | T _{PLZ} | Pin 1 Logic '1' | - | - | 5 | ms |

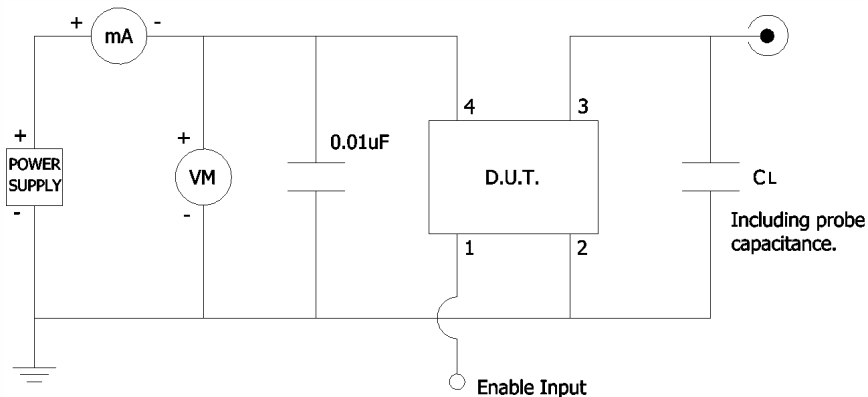
Electrical Specifications

Enable Truth Table

| Pin 1 | Pin 3 |
|-----------|------------------------------------|
| Logic '1' | Output Enabled |
| Open | Output Enabled |
| Logic '0' | Output Disabled, High Impedance |

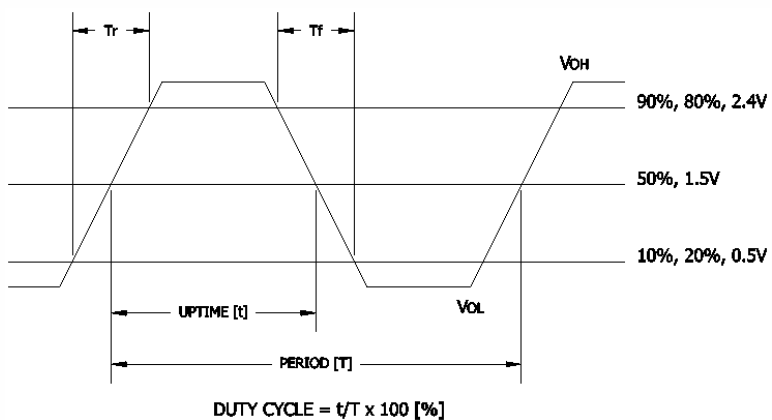
Test Circuit

HCMOS



Output Waveform

HCMOS



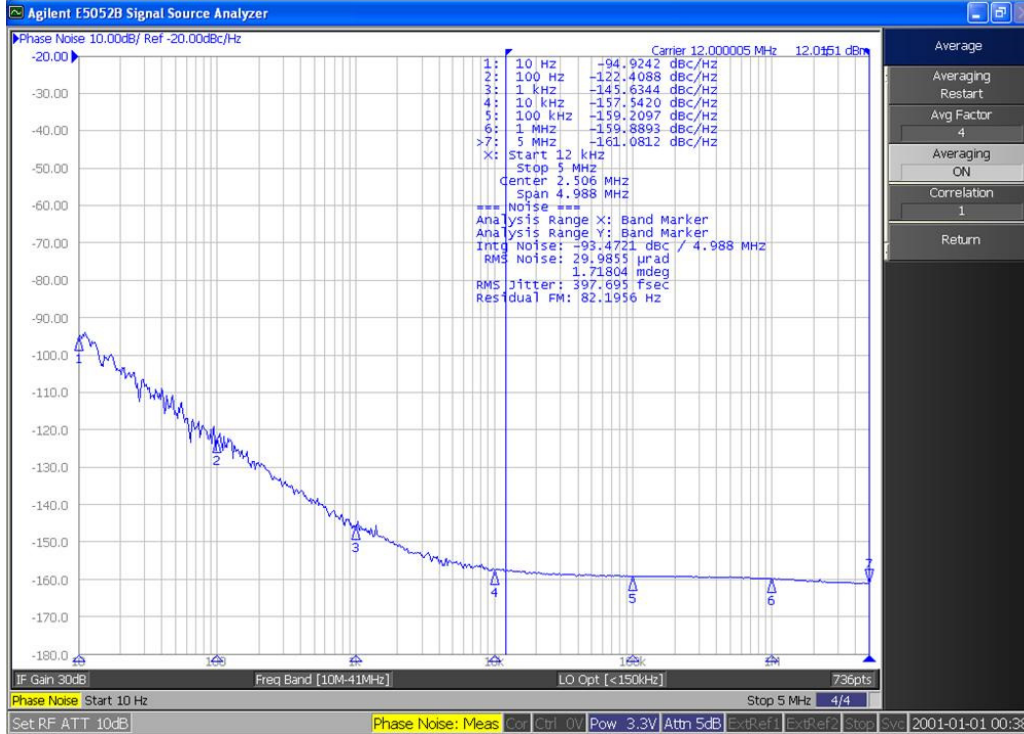


Electrical Specifications

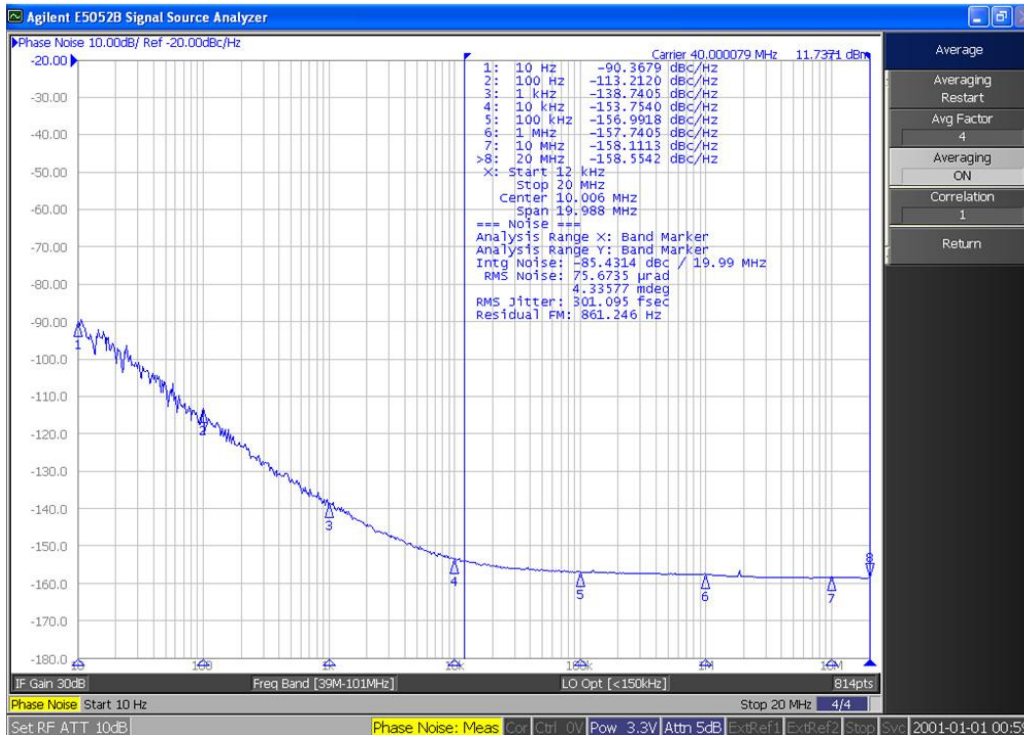
Performance Data

Phase Noise [typical]

12MHz, $V_{CC} = +3.3V$, $T_A = +25^\circ C$

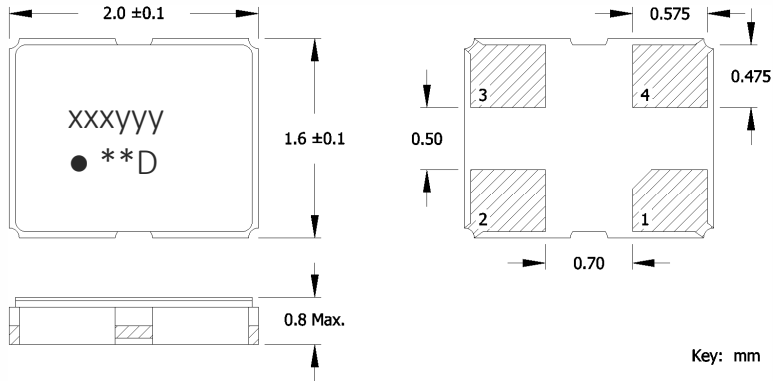


40MHz, $V_{CC} = +3.3V$, $T_A = +25^\circ C$



Mechanical Specifications

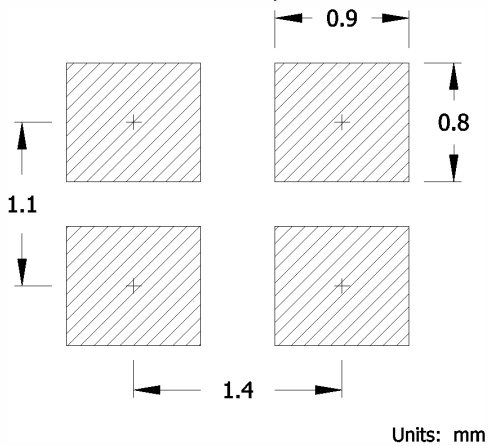
Package Drawing



Marking Information

- xxx – Frequency Code.
3-digits for frequencies <100MHz
[See document 016-1454-0, Frequency Code Tables.]
- yyy – Crystal Lot Code or Date Code [Optional].
- – Pin 1 identifier.
- ** – Manufacturing Site Code.
- D – Date Code. See Table I for codes.

Recommended Pad Layout



Notes

- JEDEC termination code (e4). Barrier plating is nickel [Ni] with gold [Au] flash plate.
- Reflow conditions per JEDEC J-STD-020; +260°C maximum, 20 seconds.
- MSL = 1.

Pin Assignments

| Pin | Symbol | Function |
|-----|-----------------|--------------------------------|
| 1 | EOH | Output Enable/Disable [Note 1] |
| 2 | GND | Circuit & Package |
| 3 | Output | RF Output |
| 4 | V _{CC} | Supply Voltage |

Notes

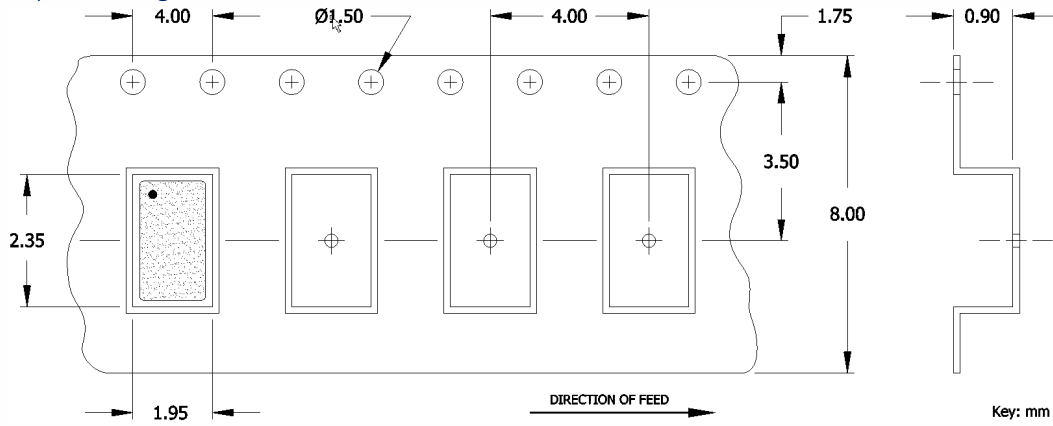
- Pin 1 can be left floating if enable function is not needed. Pin connected to V_{CC} through internal pull-up resistor. Do not connect to ground.

Table I - Date Code, Beginning year 2021

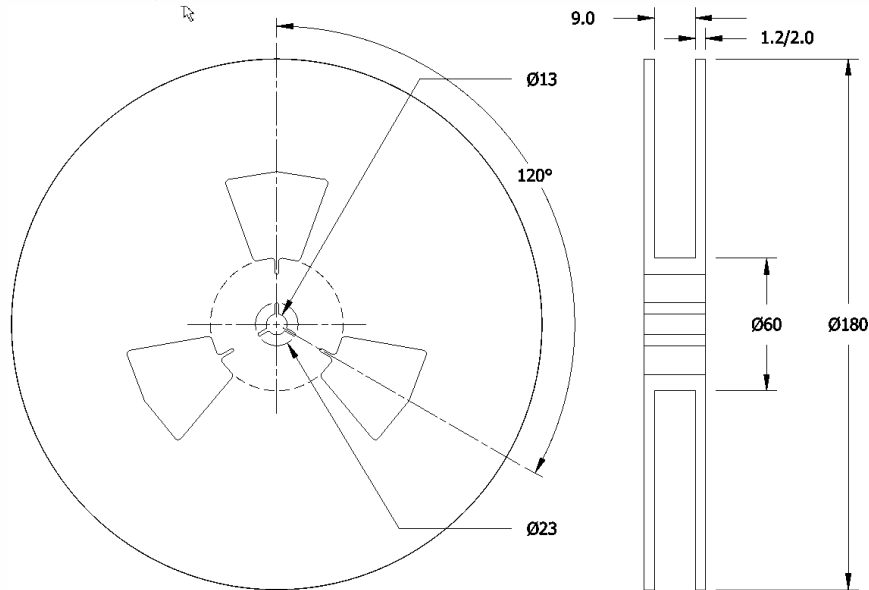
| MONTH | | | | | YEAR | | | | | | | | | | | |
|-------|------|------|------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| | | | | | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
| 2021 | 2025 | 2029 | 2033 | 2037 | A | B | C | D | E | F | G | H | J | K | L | M |
| 2022 | 2026 | 2030 | 2034 | 2038 | N | P | Q | R | S | T | U | V | W | X | Y | Z |
| 2023 | 2027 | 2031 | 2035 | 2039 | a | b | c | d | e | f | g | h | j | k | l | m |
| 2024 | 2028 | 2032 | 2036 | 2040 | n | p | q | r | s | t | u | v | w | x | y | z |

Packaging - Tape and Reel

Tape Drawing



Reel Drawing



Notes

1. Device quantity is 1k pieces minimum and 3k pieces maximum per 180mm reel.
2. Complete CTS part number, frequency value and date code information must appear on reel and carton labels.



Addendum

Common Frequencies Available – MHz

| FREQUENCY | ORDERING CODE | FREQUENCY | ORDERING CODE | FREQUENCY | ORDERING CODE | FREQUENCY | ORDERING CODE |
|-----------|---------------|-----------|---------------|-----------|---------------|-----------|---------------|
| 10.000000 | 100 | 26.000000 | 260 | | | | |
| 14.400000 | 144 | 27.000000 | 270 | | | | |
| 14.745600 | 147 | 30.720000 | 307 | | | | |
| 16.000000 | 160 | 32.000000 | 320 | | | | |
| 16.384000 | 163 | 38.400000 | 384 | | | | |
| 18.432000 | 184 | 40.000000 | 400 | | | | |
| 19.200000 | 192 | 44.000000 | 440 | | | | |
| 20.000000 | 200 | 48.000000 | 480 | | | | |
| 24.000000 | 240 | 50.000000 | 500 | | | | |
| 25.000000 | 250 | 52.000000 | 520 | | | | |