July 16, 2014

# SPECIFICATION

TYPE No. NJT5830

Specification drawing No.

(1) - (14) CMSE-T5830(1)-1.0 – CMSE-T5830(14)-1.0

(15) - (16) CMSF-T5830(1)-1.0 – CMSF-T5830(2)-1.0

(17) - (18) CMSP-T5830(1)-1.0 – CMSP-T5830(2)-1.0

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   * Equipment Used in the Deep Sea
   * Power Generator Control Equipment (nuclear, steam, hydraulic)
   * Life Maintenance Medical Equipment
   * Fire Alarm/Intruder Detector
   * Vehicle Control Equipment (automobile, airplane, railroad, ship, etc.)
   * Various Safety Equipment
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## 1. Electrical Specifications

(Based on "Inmarsat Global Xpress Maritime Satellite Terminal Requirements Third Party Implementation Kit Specification Version 6.1")

| | | |
|---|---|---|
| 1.1 | Output Frequency Range | 29.0 to 30.0 GHz |
| 1.2 | Input Frequency Range | 950 to 1950 MHz |
| 1.3 | Maximum Operating Power (MOP) | +37 dBm min. @5W/QPSK/8PSK |
| | @Symbol rate=1Msps / Alpha=0.2 | +36 dBm min. @4W/BPSK |
| 1.4 | ACPR @Pout=MOP | -20 dBc max. |
| 1.5 | Modulation Error Ratio (MER) | 19 dB min. |
| 1.6 | AM to AM Conversion | 1 dB max. |
| 1.7 | Gain Roll Off Post Input Level of MOP | -1 dB/dB min. |
| 1.8 | AM to PM Conversion | 6 dB/deg max. |
| 1.9 | Linear Gain | 58 dB min. |
| | | 62 dB nom. |
| | | 66 dB max. |
| 1.10 | Gain over Frequency | 5 dBp-p max over 1 GHz |
| | @ fixed Temperature | 0.5 dBp-p max over 5 MHz |
| | | 1.5 dBp-p max over 36 MHz |
| | Gain Stability over Temperature | 5 dBp-p max. |
| | @ fixed Frequency | 2 dBp-p typ. |
| 1.11 | Group Delay | 2 nsp-p @5 MHz |
| | | 4 nsp-p @36 MHz |
| 1.12 | Carrier Frequency over shoot from nominal | +/-150 kHz @over 10 usec |
| | | +/-150 kHz @over 500 usec |
| 1.13 | Spurious @Out of band | |
| | @1.00 to 2.00 GHz | -55 dBm/100kHz max. |
| | @2.00 to 3.40 GHz | -49 dBm/100kHz max. |
| | @3.40 to 10.70GHz | -43 dBm/100kHz max. |
| | @10.70 to 21.20 GHz | -37 dBm/100kHz max. |
| | @21.20 to 27.35 GHz | -31 dBm/100kHz max. |
| | @27.35 to 28.85 GHz | -31 dBm/100kHz max. |
| | @28.85 to 29.00 GHz | -23 dBm/100kHz max. |
| | @30.00 to 30.15 GHz | -23 dBm/100kHz max. |
| | @30.15 to 60.00 GHz | -31 dBm/100kHz max. |
| 1.14 | Spurious @Inband (29.00 to 30.00GHz) | -41 dBm/100kHz max. @RF OFF |
| | | -16 dBm/100kHz max. @RF ON Pout=MOP |

| | | |
|---|---|---|
| 1.15 | RF Noise Output | -86 dBm/Hz max. @29.0 to 30.0 GHz |
| 1.16 | Rx Noise Density | -161 dBm/Hz max. @19.0 to 21.2GHz |
| 1.17 | Keyline Tx On/Off Isolation | -45 dBc min. |
| 1.18 | LO Frequency | 28.05 GHz |
| 1.19 | Conversion type | Single/Non Inverted |
| 1.20 | LO Disturbance | 200 Hz/sec max. |
| 1.21 | SSB Phase Noise (Target mask) | |
| | @100 Hz | -50 dBc/Hz max. |
| | @1 kHz | -75 dBc/Hz max. |
| | @10 kHz | -81 dBc/Hz max. |
| | @100 kHz | -95 dBc/Hz max. |
| | @1 MHz | -105 dBc/Hz max. |
| | @10 MHz | -112 dBc/Hz max. |
| 1.22 | Integrated Phase Jitter (DSB) | |
| | @BW:100 Hz to 100 kHz | 2.5 deg rms |
| | @BW:1 KHz to 1 MHz | 1.5 deg rms |
| | @BW:5 kHz to 5 MHz | 1.5 deg rms |
| 1.23 | Tx Muted Time | 80 msec max. |
| | @output less than -50dBc when LO unlocked | |
| 1.24 | REF Off to Tx Muted Time | 80 msec max. |
| 1.25 | DC+REF On to Tx On Time | 500 msec max. |
| | @LO within +/-300 Hz | |
| 1.26 | REF On to Tx On Time | 300 msec max. |
| | @LO within +/-300 Hz | |
| 1.27 | Keyline | RS422 Differential, 10MHz Switching Rate. Keyline is a control signal from Core Module to BUC for gating the BUC final power amplifier (PA) in and out of warm standby. |
| | @Keyline Enable | PA On:: [Open inputs] or (A-B) > 0.2V |
| | @Keyline Disable | PA Standby:: [ (A-B) < -0.2V, where A is+input, B is –Input) |

| | |
|---|---|
| 1.28 Keyline "Enabled" Command Propagation Time (from GPIO connector to PA bias circuit) | 1 msec max. |
| 1.29 Keyline "Enabled" to +/-1.0dB of Final Power (from GPIO connector to PA RF Output) | 31.25 msec max. |
| 1.30 Band Select Tone Frequency (OOK) | 27.0 MHz |
| 1.31 Tone Sine-Wave Level | -7 to +5 dBm |
| 1.32 Tone Capture Range | +/-35 ppm |
| 1.33 Tone-On Level to Select Lower Band | -15 dBm min. |
| 1.34 Tone-Off Level to Select Upper Band (Default) | -30 dBm max. |
| 1.35 Band Select Switch μs Timing after receiving the command. | |
| @Tone Enable/Disable | 100 usec max. |
| @GPIO Enable/Disable | 100 usec max. |
| @Serial Port Command | 100 msec max. |
| 1.36 Local Oscillator REF Frequency | 50.0 MHz |
| 1.37 50MHz Input REF Sine-wave Level | -7 to +5 dBm |
| 1.38 REF Capture Range | +/-35 ppm |
| 1.39 REF Input Level to Trigger Tx Mute (Disable) | -25 to -15 dBm |
| 1.40 REF Phase Noise Input Requirement | |
| @100Hz | -105 dBc/Hz max. |
| @1kHz | -130 dBc/Hz max. |
| 1.41 Power Detector Type | RMS, negative slope vs. output power (High output gives low ADC value; Low output gives high ADC value.) |
| 1.42 Signal Wave Shape and Crest Factor | Independent |
| 1.43 RMS Power Detector Accuracy Over Temperature (w/ calibration of CM) | +/-1.5 dB |
| 1.44 Detector Stability (with PA On or Off, IF On or Off) | +/-1.5 dB |
| 1.45 Dynamic Range (relative to MOP) | 20 dB min. |
| 1.46 RMS Detector Bandwidth | 20 Hz max. |
| 1.47 RMS Detector Resolution over dynamic range. [assume 30dB range with 10 bits ADC] | 0.03 dB/bit max. |

| | |
|---|---|
| 1.48 Signals at Input IF Connectors | Tx IF, 27MHz, 50MHz REF |
| 1.49 IF Drive Level | -29 to -21 dBm @MOP<br>+5 dBm @No Damage |
| 1.50 When BUC IF Input Level is overdriven such that there is potential to damage to BUC, the BUC shall require to take the following actions: | 1. Self-protect transmit muting shall be employed to prevent damage to BUC<br>2. An "Overdrive Alarm" shall be asserted as part of the BUC Status reporting<br>3. Optional blinking red color LED is visible on the BUC housing |
| 1.51 Input Connector | N-Type |
| 1.52 IF Input Impedance | 50 ohm |
| 1.53 IF Input VSWR | 2:1 max. |
| 1.54 IF Input Surge Protection | +/-4 kV min. |
| 1.55 Output Waveguide | WR-28 with O-ring Groove, #4-40 tapped screw mounting holes (4x) |
| 1.56 RF Output VSWR | 2:1 max. |
| 1.57 Output Load VSWR for Non Damage | Infinite:1 |
| 1.58 Output Stability | Up to 3:1 |
| 1.59 Supply Voltage:<br>The BUC DC power from the Tx coax is NOT supported from the ICM or SCM. BUC DC power must be provided by the AIM with power On/Off control via OpenAMIP<br>(Reverse protection diode O-Ring function between GPIO and Coax power connectors required) | +18 to +51 VDC |
| 1.60 Power Consumption (all conditions) | |
| @Excluding BUC Fan(s) | 80 W max. |
| @Including BUC Fan(s) | 88 W max. |

| | |
|---|---|
| 1.61 Supply Current | |
| (Voltage @ GPIO connector of +18VDC): | |
| @REF On, Tx carrier at MOP Including Fan(s) | 4.9 A max. |
| @Excluding Fan(s)/Fan Off | 4.45 A max. @REF On,Tx carrier at MOP<br>2.80 A max. @REF On,Tx carrier Off<br>0.8 A max. @REF Off |
| 1.62 Inrush Current | BUC and BUC fan(s) shall have sequencing delay start up to minimize peak current surge at power on. |
| @Excluding Fan(s) | |
| Peak with BUC input Voltage @+18VDC. | 6.5 A max. |
| Settling time to 5% of nominal | 10 msec max. |
| 1.63 Supply Voltage Noise Immunity 10Hz – 10MHz | 200 mVp-p min. |
| 1.64 Supply Voltage Noise Emission 10Hz – 10MHz | 100 mVp-p max. |
| 1.65 Supply Voltage Dip Below Threshold to Disable Transmit (Mute) | +12 VDC min. |
| 1.66 BUC Supplemental Cooling | BUC shall have thermostatically controlled fan(s) with Fan-Alarm reporting per Serial Port ICD. Fan shall be of high reliability type and comply with overall BUC MTBF calculation. |
| 1.67 BUC MTBF | The BUC MTBF calculation per Telecordia Parts Count Reliability Predictive Method (MIL-HDBK-217F) shall be 100,000 hours at +40 °C with fans. |

## 2. RS422 Receiver Reference Specifications

Referenced below is the Maxim MAX3095, +/-15KV ESD protected, 10Mbps, Quad RS422 receivers that can be used for the BUC RS422 receiver GPIO interface. Some of the reference designs shown in this document utilize the RS422 criteria.

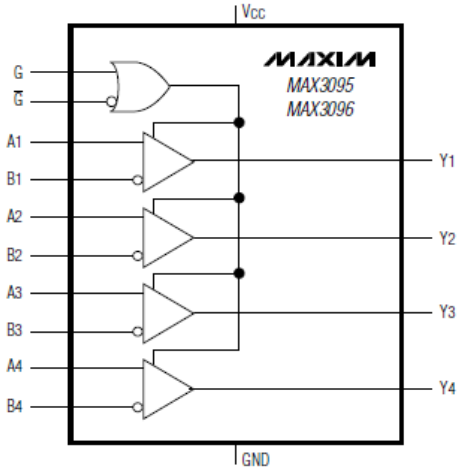



**Table 1. Function Table**

| G | $\overline{G}$ | (A - B) | OUTPUT Y | DEVICE MODE |
|---|---|---|---|---|
| 1 | X | ≥ 200mV | 1 | On |
| 1 | X | ≤ -200mV | 0 | On |
| 1 | X | Open | 1 | On |
| X | 0 | ≥ 200mV | 1 | On |
| X | 0 | ≤ -200mV | 0 | On |
| X | 0 | Open | 1 | On |
| 0 | 1 | X | High-Z | Shutdown |

*X = don't care, High-Z = high impedance*

## 3. BUC Band Filter Select Specifications

The BUC Band Filter selection shall comply with per the following table at input of NOR gate.

Table 2: BUC Band Select Logic at NOR Gate Input

| Band Selection Logic | | | |
|---|---|---|---|
| **GPIO after Invert** | **Serial Port** | **27MHz Tone** | **Band Select** |
| **0** | **0** | **0** | **Wide Band (Default)** |
| 0 | 0 | **1** | Low Band |
| 0 | **1** | 0 | Low Band |
| 0 | **1** | **1** | Low Band |
| 1 | X | X | Low Band |

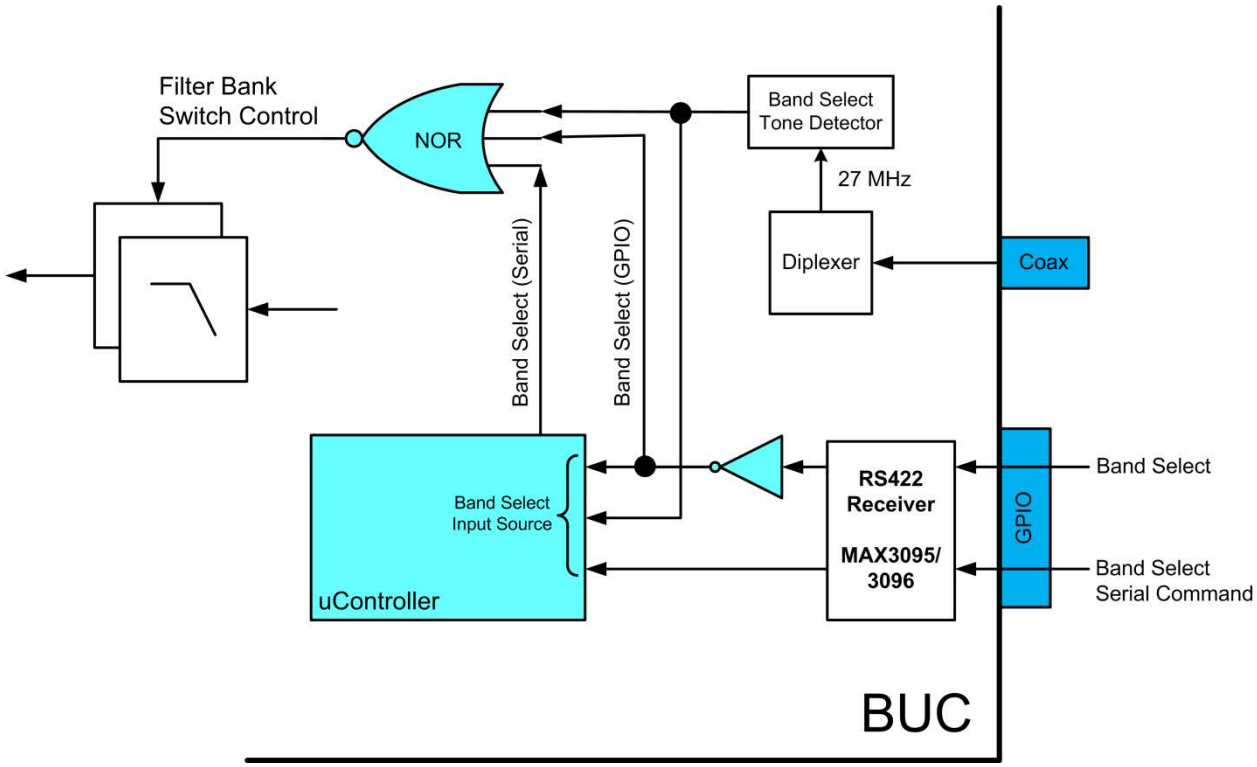
**Note:**

1. X = Don't Care
2. GPIO Logic **after Inverter** (as referenced in **section 2** and **Figure 1**):
   - 0 = Open; Open / un-connect input at GPIO connector
   - 1 = (A-B) < -0.2V; A & B are RS422 differential Input(+) and Input(-) respectively
3. Serial Port:
   - 0 = Select "Wide Band"
   - 1 = Select "Low Band"

4. 27MHz Tone
   - 0 = Tone Off (Wide Band)
   - 1 = Tone On (Low Band)
5. Band Select Output
   - 0 = Low Band:: 29.0 – 29.4 GHz or equivalent
   - 1 = Wide Band:: 29.4 – 30.0 GHz or equivalent (default band selection)

The BUC micro-controller shall monitor the three possible Band Select input sources.
The logical implementation is shown in Figure 1
The micro-controller shall report back the actual logic switch setting when query via serial port by Core Module.
The "NOR" function must be implemented with fast logic to ensure proper timing is met for real-time control via 27MHz tone or discrete RS-422 on GPIO port.
The BUC micro-controller shall monitor the three possible Band Select input sources.

**Figure1: Band Selection Logic Implementation**



## 4. BUC EEPROM and Identification Specifications

The BUC EEPROM shall minimally have enough memory to store Manufacturer ID, Functional ID and the BUC calibration file. Minimally, the EEPROM shall contain the following information:

1. In the One-Time-Programmable (OTP) page
   a. BUC Part Number (BPN)
   b. BUC Manufacturer ID (MID)
   c. BUC Serial Number with embedded date code and Revision per **section 12** (BSN)
   d. BUC Functional ID (FID)
2. In the erasable page (with lock feature)
   a. Calibration file (XML Format)
3. Check Sum

**Table 3: BUC Identification**

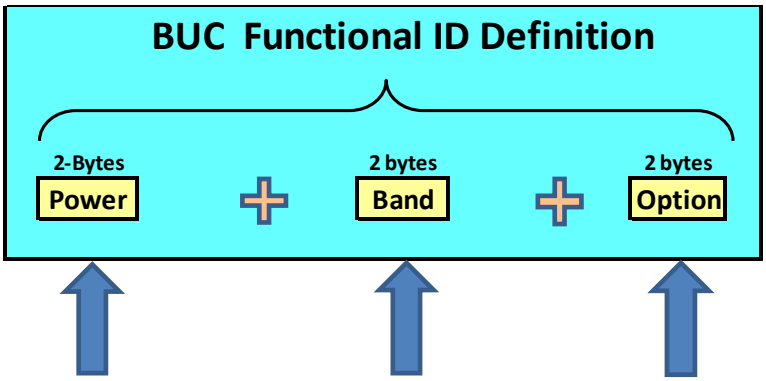
| BUC Description | Manufacture | BUC PN (BPN) Up to 13 bytes | Manufacture ID (MID) 2 bytes | Functional ID (FID) 6 bytes |
|---|---|---|---|---|
| 5W-Ka 29.0-30.0GHZ | NJRC | E0001659-0001 | 10 | 050300 |
| | STEE/Agilis | E0001659-0002 | 20 | 050300 |
| | Reserved/Future | E0001659-0003 | 30 | TBD |
| | Reserved/Future | E0001659-0004 | 40 | TBD |

BPN= a, MID= b, BSN= c, FID= d

Where a, b, c, d are stored values in ASCII as follows:

1. BUC PN per manufacturer P/N assignment:
   - a:: up to 13 bytes
   - Un-use trailing bytes fill with ‘”x”
2. Manufacturer ID per iDirect assignment in **Table 3**
   - b:: 2 bytes
     - 10 = NJRC
     - 20 = Agilis
3. BUC S/N per **section 12**
   - c:: 9 bytes
4. Functional ID per **Table 4**
   - d:: 6 bytes
   - Example: 5W, 29.0-30.0GHz, Standard:: → 050300

Table 4: BUC Functional ID Definition




| | |
|---|---|
| 2W | 02 |
| 3W | 03 |
| 4W | 04 |
| 5W | 05 |
| 7W | 07 |
| 8W | 08 |
| 10W | 10 |

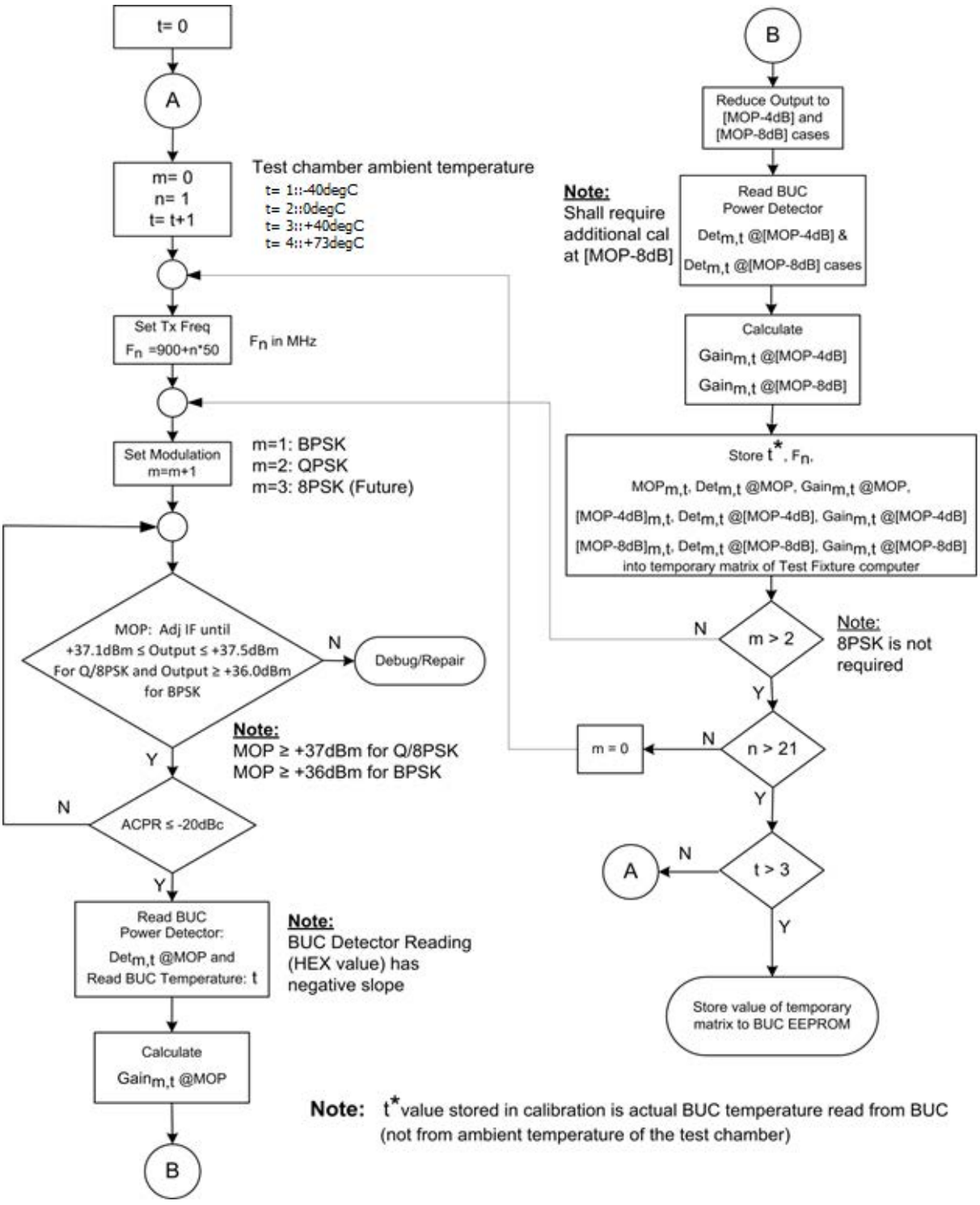
| | |
|---|---|
| 29.0 - 29.5 GHz | 01 |
| 29.5 - 30.0 GHz | 02 |
| 29.0 - 30.0 GHz | 03 |
| 30.0 - 31.0 GHz | 04 |
| 29.5 - 31.0 GHz | 05 |
| | |
| | |

| | |
|---|---|
| Standard | 00 |
| | |
| | |
| | |
| | |
| | |
| | |

## 5. BUC Output Power Calibration

The BUC output power shall be factory calibrated with IF stimulus at four temperature points of -40 °C, 0 °C, +40 °C, +73 °C, in that order. The BUC shall be calibrated at MOP, [MOP-4dB], and [MOP-8dB] for better linearity interpolation by the CM. The resultant calibration data shall be stored with on-board BUC EEPROM and be electronically retrievable via an M&C query. The BUC Calibration process is shown in **Figure 2**.

**Figure 2: BUC Calibration Process**



## 6. Mechanical Specifications

| | |
|---|---|
| 6.1 General Description | The BUC shall be housed in a solid, fully sealed aluminum die-cast enclosure with cooling fins for the outdoor environment |
| 6.2 Dimension and Housing | 180 mm (L) x 100 mm (W) x 50 mm (H) without interface connector and mounting ears<br>The outline drawing is shown in CMSF-T5830(1) |
| 6.3 Center of Gravity (CG).<br>Relative to W/G input flange surface | 28.6 to 38.6 mm @X-Axis<br>-5 to 5 mm @Y-Axis<br>17.7 to 27.7 mm @Z-Axis |
| 6.4 Weight | 1.6 kg max. [ 3.53 lbs max.] |
| 6.5 Output Interface | WR-28 with O-ring Groove,<br>#4-40 tapped screw mounting holes (4x) |
| 6.6 Waveguide Hardware Kit | Silicon-type O-ring, #4-40 Stainless-Steel screws with captive lock-washers. |
| 6.7 Earth Grounding Tag | M4, (8mm depth inner thread or equiv.) |
| 6.8 LED Indicator (Optional) | Green Color: Normal<br>Red Color: PLL Out of Lock, Tx Mute<br>Blinking Red: IF input is overdriven to damage point. Tx Mute |
| 6.9 Passivation | RoHS Compliant Chromate |
| 6.10 Finish | Powder coated cured or spray paint equivalent |
| 6.11 Color | Semi-dull White or equivalent. |

## 7. BUC GPIO Specifications

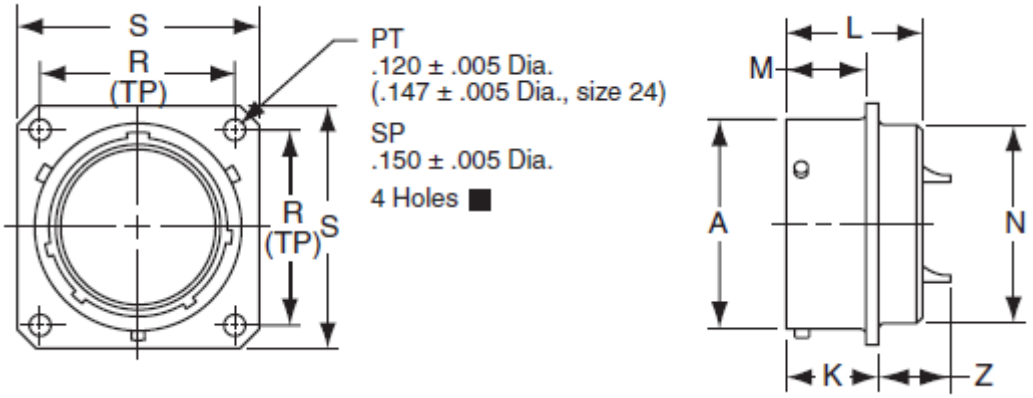
| | |
|---|---|
| 7.1 BUC Serial ASCII Command Functions | Refer to iDirect Serial Port ICD (E0001651) |
| 7.2 BUC MicroController Serial Interface<br>Differential Tx<br>Differential Rx<br>Shield Drain | RS-422: Two twisted-pairs wire interface plus shield drain shall be grounded |
| 7.3 Serial Interface | 38400, 8, N, 1 |
| 7.4 Serial Protocol | iDirect Serial Protocol with Kermit file transfer |
| 7.5 KeyLine, Band-Select | RS-422: twisted-pair differential Input. |

| | | |
|---|---|---|
| 7.5 | Primary DC Power | The BUC has an input capacitance load of up to 100uF max. The BUC input voltage rise time must be controlled by the integrator in order to maintain max inrush current specification (slower voltage rise time would result in lower input current surge). Refer to section BUC Electrical Specification-Supply Voltage |
| 7.6 | Connector Type | PT02E-14-12P. IP67 Circular-Type, 12-pins. See **Figure 3** for pin-out. |
| 7.7 | Surge protection | Minimum +/-4kV Lightning surge protection on all pins |
| 7.8 | Interface Cabling Requirement | Dual foil/mesh with shield drain shall be grounded |

## 8. BUC GPIO Connector Specifications

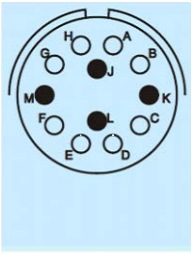
The drawing below is a representation dimension for the Amphenol PT02E-14-12P environmental connector. Vendors must use the actual manufacturer's latest data sheet.

Figure 3: BUC GPIO Connector (Shell Size 14)




| Shell Size | Receptacle Front View | | | | Receptacle Side View | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | R (TP) | | S | | A +.001 −.005 | K +.020 −.010 | | L Max. | M +.010 −.000 | | N Dia. Max. | Z Max. | |
| | PT | SP | PT | SP | | PT | SP | | PT | SP | | PT | SP |
| 6 | .469 | .641 | .688 | .953 | .348 | .493 | .524 | .825 | .431 | .462 | .323 | .465 | .438 |
| 8 | .594 | .734 | .812 | 1.047 | .473 | .493 | .524 | .825 | .431 | .462 | .449 | .465 | .438 |
| 10 | .719 | .812 | .938 | 1.125 | .590 | .493 | .524 | .825 | .431 | .462 | .573 | .465 | .438 |
| 12 | .812 | .938 | 1.031 | 1.250 | .750 | .493 | .524 | .825 | .431 | .462 | .699 | .465 | .438 |
| 14 | .906 | 1.031 | 1.125 | 1.344 | .875 | .493 | .524 | .825 | .431 | .462 | .823 | .465 | .438 |
| 16 | .969 | 1.125 | 1.219 | 1.438 | 1.000 | .493 | .524 | .825 | .431 | .462 | .949 | .465 | .438 |
| 18 | 1.062 | 1.203 | 1.312 | 1.516 | 1.125 | .493 | .524 | .825 | .431 | .462 | 1.073 | .465 | .438 |
| 20 | 1.156 | 1.297 | 1.438 | 1.672 | 1.250 | .650 | .650 | 1.076 | .556 | .556 | 1.199 | .526 | .531 |
| 22 | 1.250 | 1.375 | 1.562 | 1.750 | 1.375 | .650 | .650 | 1.076 | .556 | .556 | 1.323 | .526 | .531 |
| 24 | 1.375 | 1.500 | 1.688 | 1.875 | 1.500 | .683 | .683 | 1.109 | .589 | .589 | 1.449 | .493 | .497 |

| PIN # | Function |
|---|---|
| A | BUC Serial Tx – (RS422) |
| B | BUC Serial Tx + (RS422) |
| C | Band Select + (RS422) |
| D | Band Select – (RS422) |
| E | Keyline + (RS422) |
| F | Keyline – (RS422) |
| G | BUC Serial Rx + (RS422) |
| H | BUC Serial Rx – (RS422) |
| J | BUC Power + |
| K | BUC Power – (Return) |
| L | BUC Manufacturer Use Only - Do Not Connect |
| M | BUC Manufacturer Use Only - Do Not Connect |




| | |
|---|---|
| Insert arrangement | 14-12 |
| Service rating | I |
| Number of contacts | 4 8 |
| Contact size | 16 20 |

## 9. BUC Serial Commands Interface Specifications

The BUC Serial Command interface is defined in the BUC Serial Interface ICD specification (E0001651).

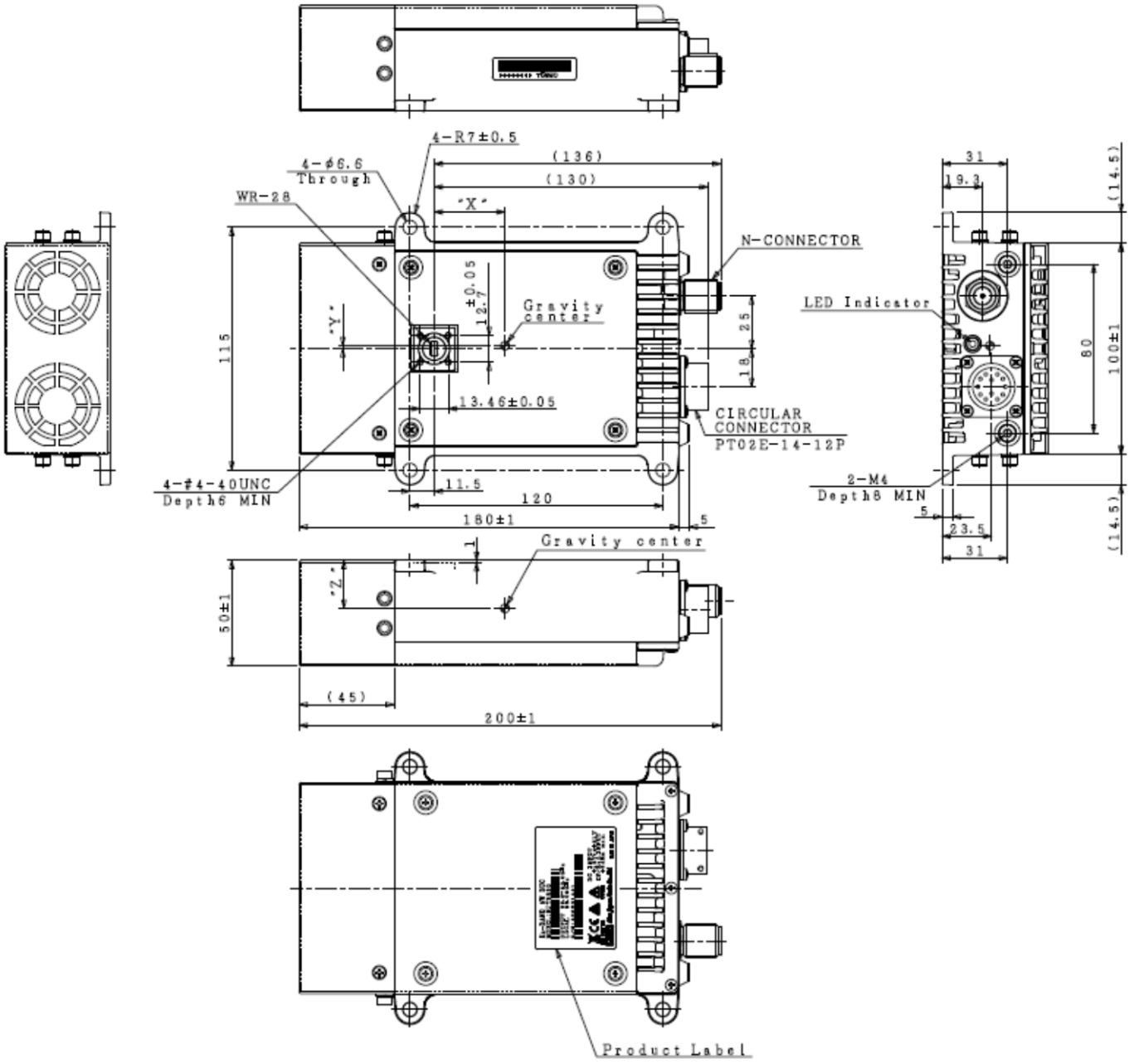
This document will be used as a reference for the implementation of the serial interface between the BUC and the CM.

## 10. Environmental Specifications

| | | |
|---|---|---|
| 10.1 | Operational Temperature | -40 degree C to +73 degree C |
| 10.2 | Storage Temperature | -40 degree C to +85 degree C |
| 10.3 | Water Proofing | IP65 |
| 10.4 | Humidity | 20 to 100% |
| 10.5 | Salt | not show any sign of oxidation or degradation (Salt mist) |
| 10.6 | Altitude | 4,572 m (15,000 feet) |
| 10.7 | Shock | 300 $m/s^2$ (3 times) (30 G) |
| 10.8 | Vibration | 5 mm 0-p (1 Hz to 150 Hz) 20 $m/s^2$ (2.0 G) |

10.9 Comply with RoHS (Restricting the use of Hazardous Substances) directives

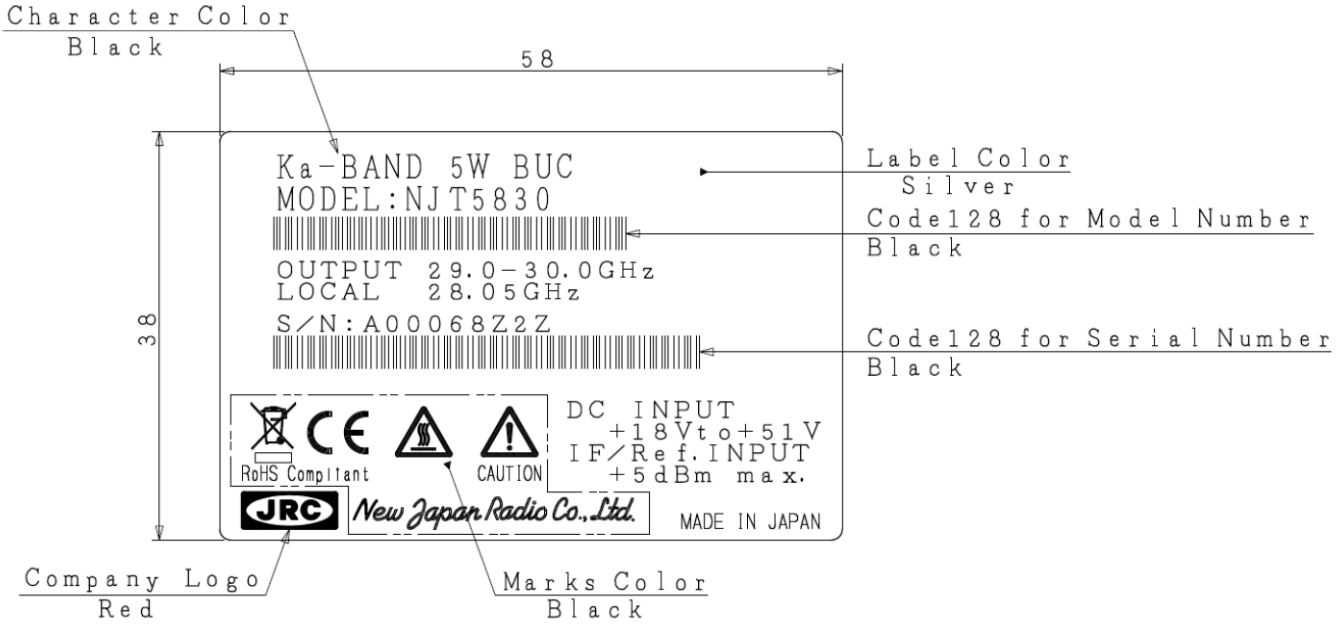
## 11. T5830 Outline



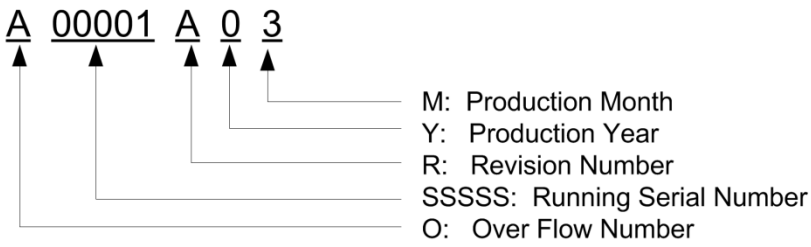

UNIT:mm
Tolerance:±0.3

| | | |
|---|---|---|
| TITLE: NJT5830 | DRAWING No. CMSF-T5830(1) | Rev. 1.0 |
| | PAGE 17 | |

## 12. T5830 Label



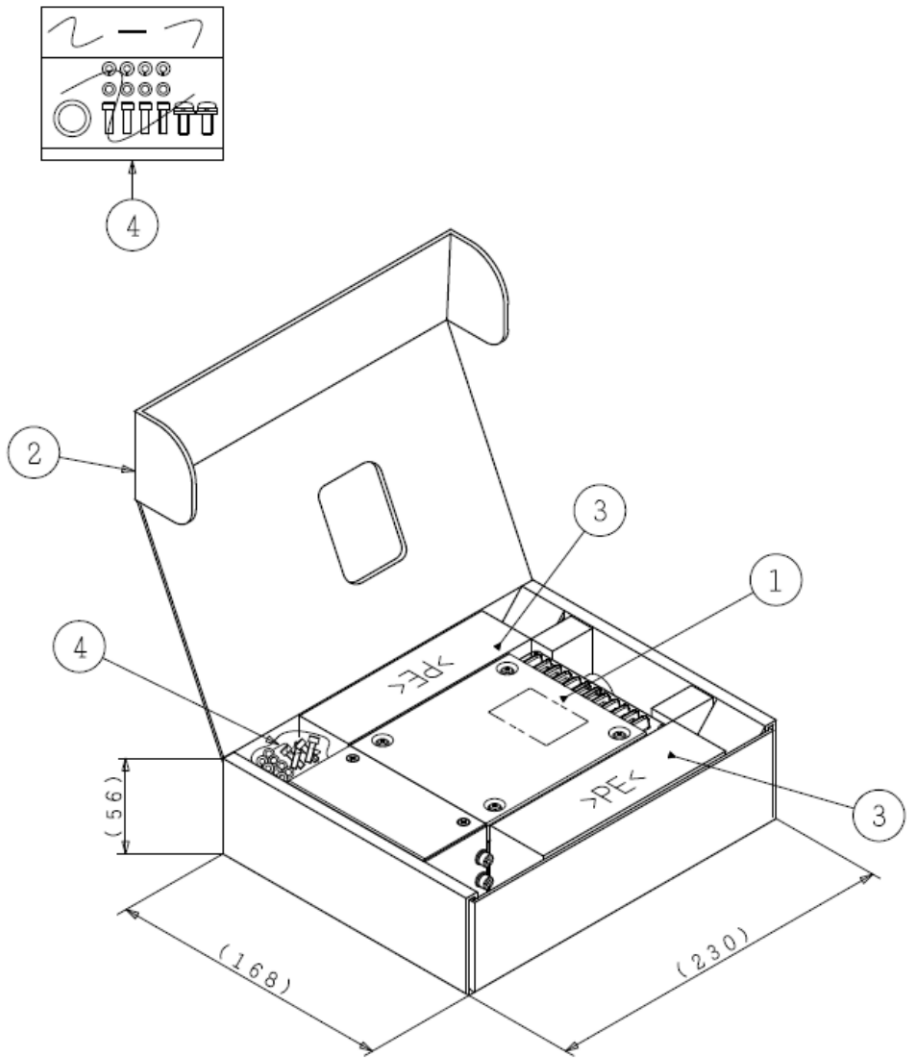

Serial Number: (OSSSSSRYM) – AlphaNumeric (9 characters)




O: Overflow Number – Alphabet (1 character)
"A" to "Z", e.g.: A99999 → B00001
SSSSS: Running Serial Number – Number (5 digits)
"00001" to "99999"
R: Revision Number – Alphabet (1character)
"A" to "Z"
Y: Production Year – Number (1 digit)
Calendar Number, e.g.: 2011:1, 2012=2, 2013=3....
M: Production Month- AlphaNumeric (1 character)
"1" to "9" as October, "Y" as November, "Z" as December

## 13. T5830 Package

Accessories
・O-ring
・Hexagon Socket Head Bolts
#4-40×3/8Inch 4pieces(SUS) for Waveguide Flange Holes
・Plain Washers
M2.6 type 4pieces(SUS) for Weveguide Flange Holes
・Spring lock washers
M2.6 type 4pieces(SUS) for Weveguide Flange Holes
・Cross Recessed Head Screws
M4×10 2 pieces(SUS, SW and W) for Ground Holes




①:BUC
②:Single Wall Corrugated Fiberboard
③:Polyethylene Foam For Package Cushioning
④:Accessories

UNIT:mm

| | | |
|---|---|---|
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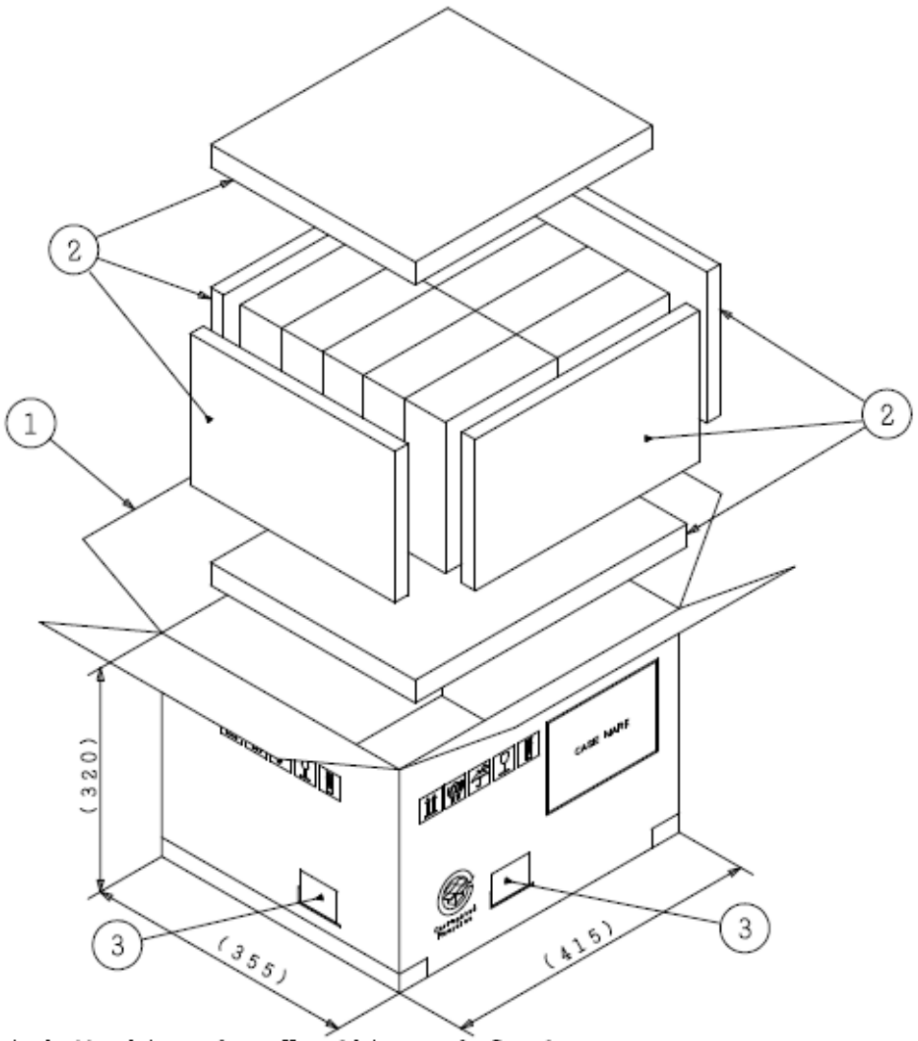



Pictorial Marking for Handling of Goods

THIS WAY UP

HANDLE WITH CARE

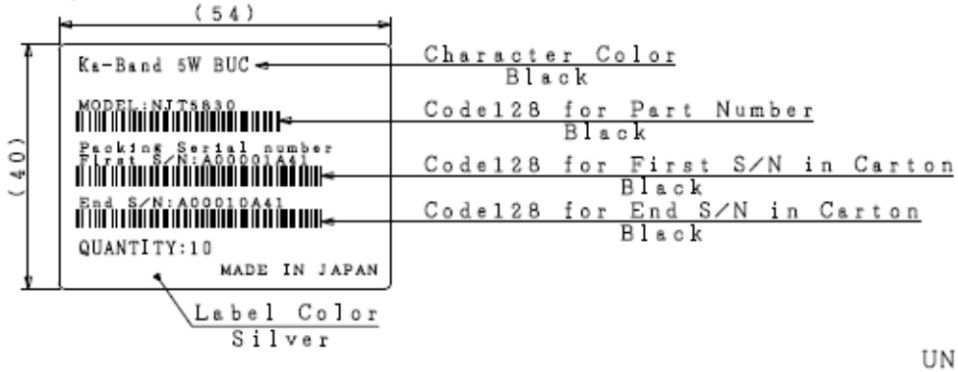
KEEP DRY

FRAGILE

LAYERS LIMIT:5

①:Double Wall Corrugated Fiberboard
②:Polystyrene Foam For Package Cushioning
③:Package Label

Nameplates(Labels)




UNIT:mm

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|---|---|---|
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