July 16, 2014

SPECIFICATION

TYPE No. **NJT5830**

STEP ELECTRONICS
A Division of Av-Comm

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

JRC New Japan Radio Co.,Ltd.

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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

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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)

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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.

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1.48 Signals at Input IF Connectors	Tx IF, 27MHz, 50MHz REF
1.49 IF Drive Level	-29 to -21 dBm @MOP +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 2. An “Overdrive Alarm” shall be asserted as part of the BUC Status reporting 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: 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 (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.

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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 2.80 A max. @REF On,Tx carrier Off 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.

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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.

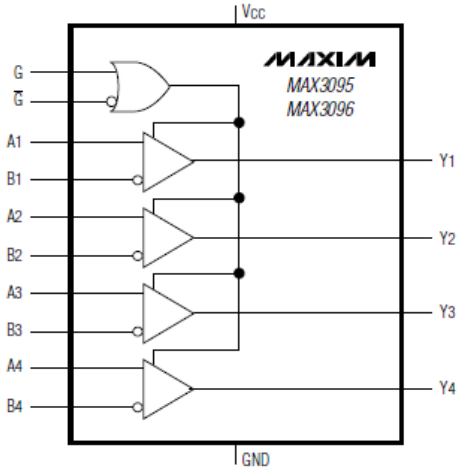

Table 1. Function Table

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"

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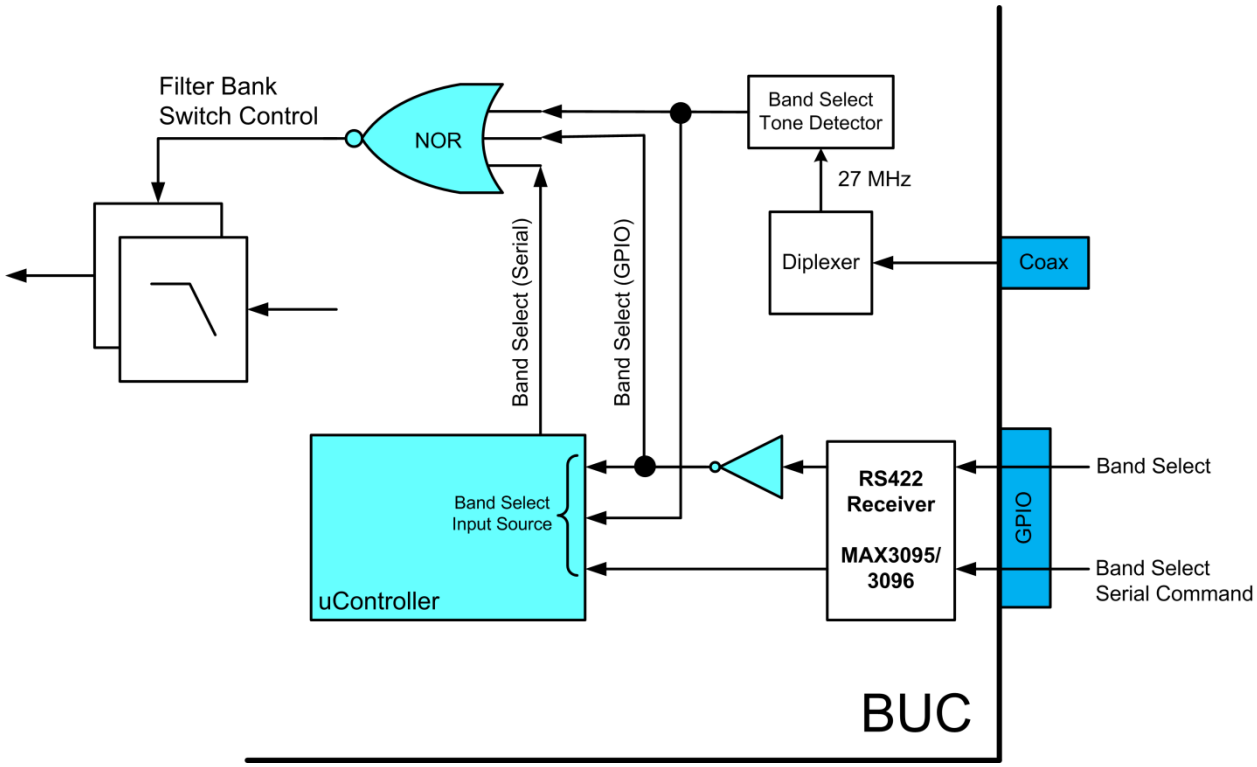
4. 27MHz Tone
   - 0 = Tone Off (Wide Band)
   - 1 = Tone On (Low Band)
5. Band Select Output
   - 0 = Low Band:: 29.0 – 29.4 GHz or equivalent
   - 1 = Wide Band:: 29.4 – 30.0 GHz or equivalent (default band selection)

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



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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
     - o 10 = NJRC
     - o 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

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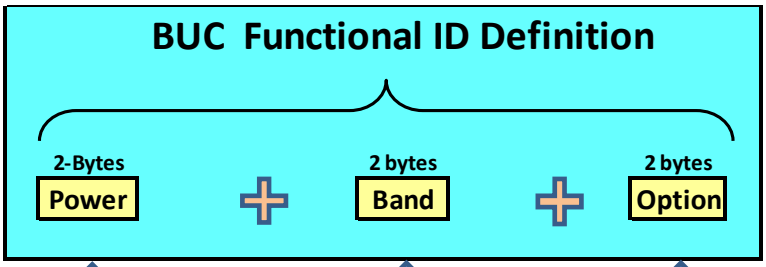
Table 4: BUC Functional ID Definition



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**.

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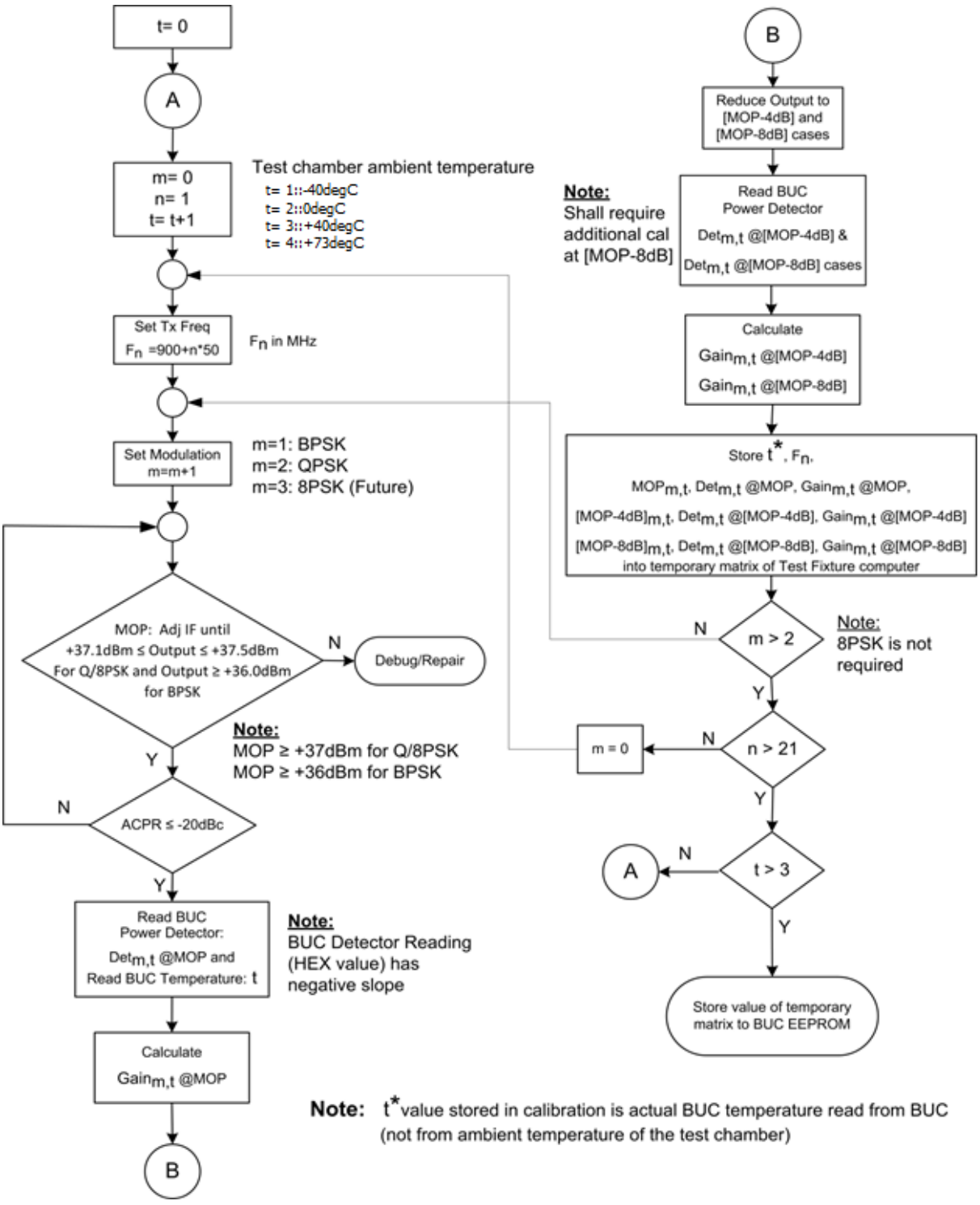
Figure 2: BUC Calibration Process



Note: t* value stored in calibration is actual BUC temperature read from BUC (not from ambient temperature of the test chamber)

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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 The outline drawing is shown in CMSF-T5830(1)
6.3 Center of Gravity (CG). Relative to W/G input flange surface	28.6 to 38.6 mm @X-Axis -5 to 5 mm @Y-Axis 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, #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 Red Color: PLL Out of Lock, Tx Mute 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 Differential Tx Differential Rx 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.

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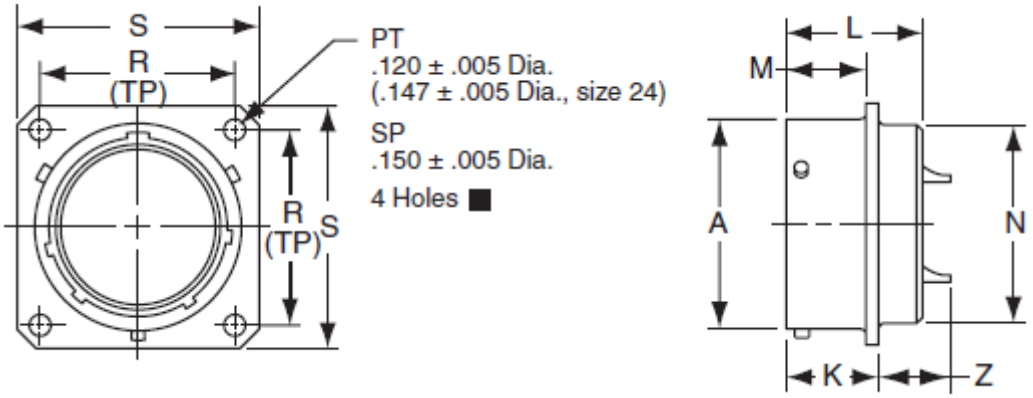
7.5 Primary DC Power	The BUC has an input capacitance load of up to 100uF max. The BUC input voltage rise time must be controlled by the integrator in order to maintain max inrush current specification (slower voltage rise time would result in lower input current surge). Refer to section BUC Electrical 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

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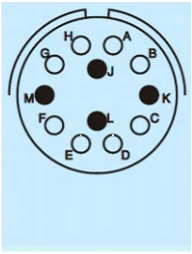
PIN #	Function
A	BUC Serial Tx – (RS422)
B	BUC Serial Tx + (RS422)
C	Band Select + (RS422)
D	Band Select – (RS422)
E	Keyline + (RS422)
F	Keyline – (RS422)
G	BUC Serial Rx + (RS422)
H	BUC Serial Rx – (RS422)
J	BUC Power +
K	BUC Power – (Return)
L	BUC Manufacturer Use Only - Do Not Connect
M	BUC Manufacturer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

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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

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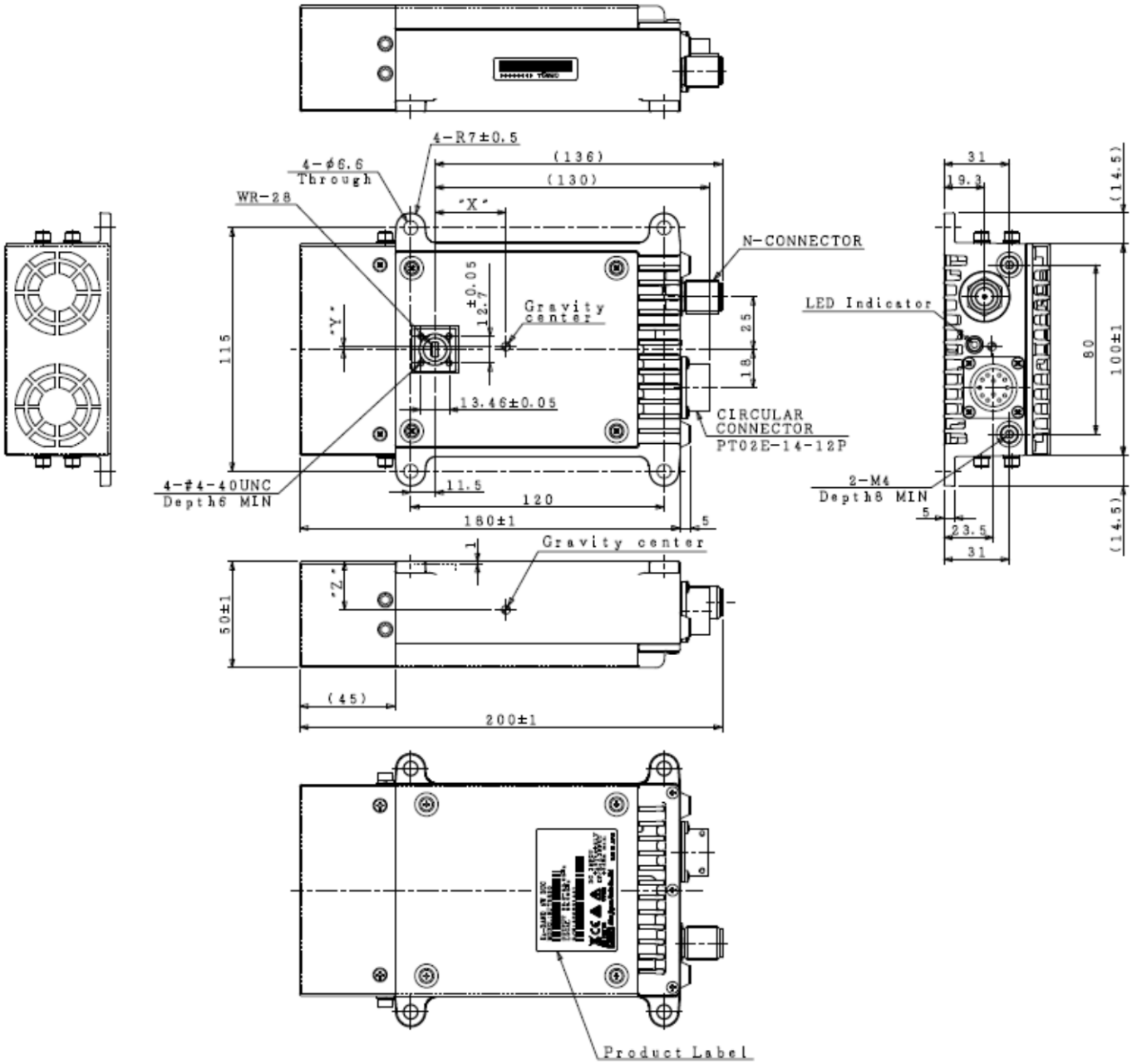
11. T5830 Outline



UNIT:mm
Tolerance:±0.3

TITLE:	DRAWING No.	Rev.
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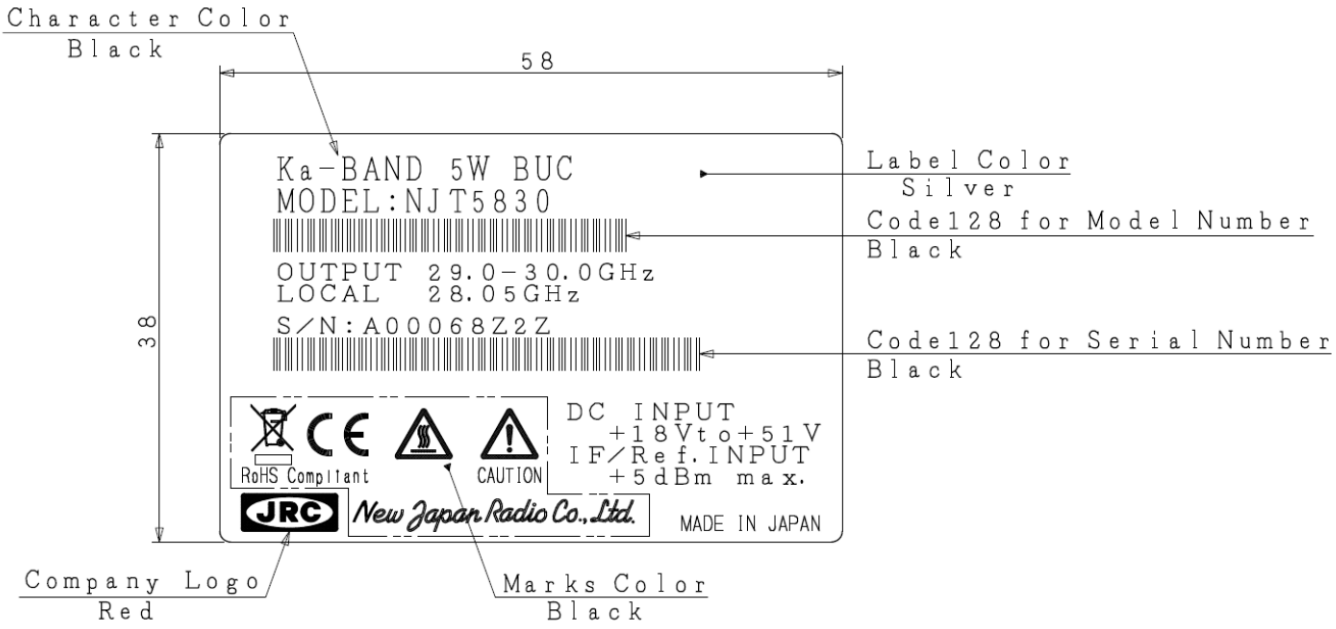
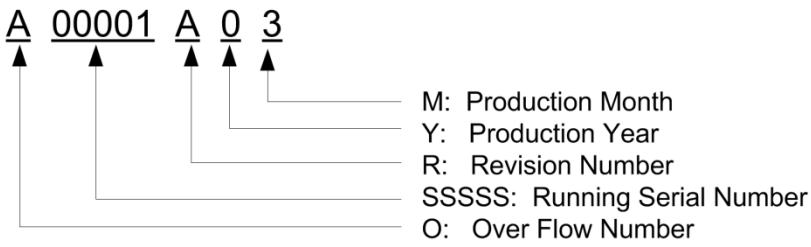
12. T5830 Label



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

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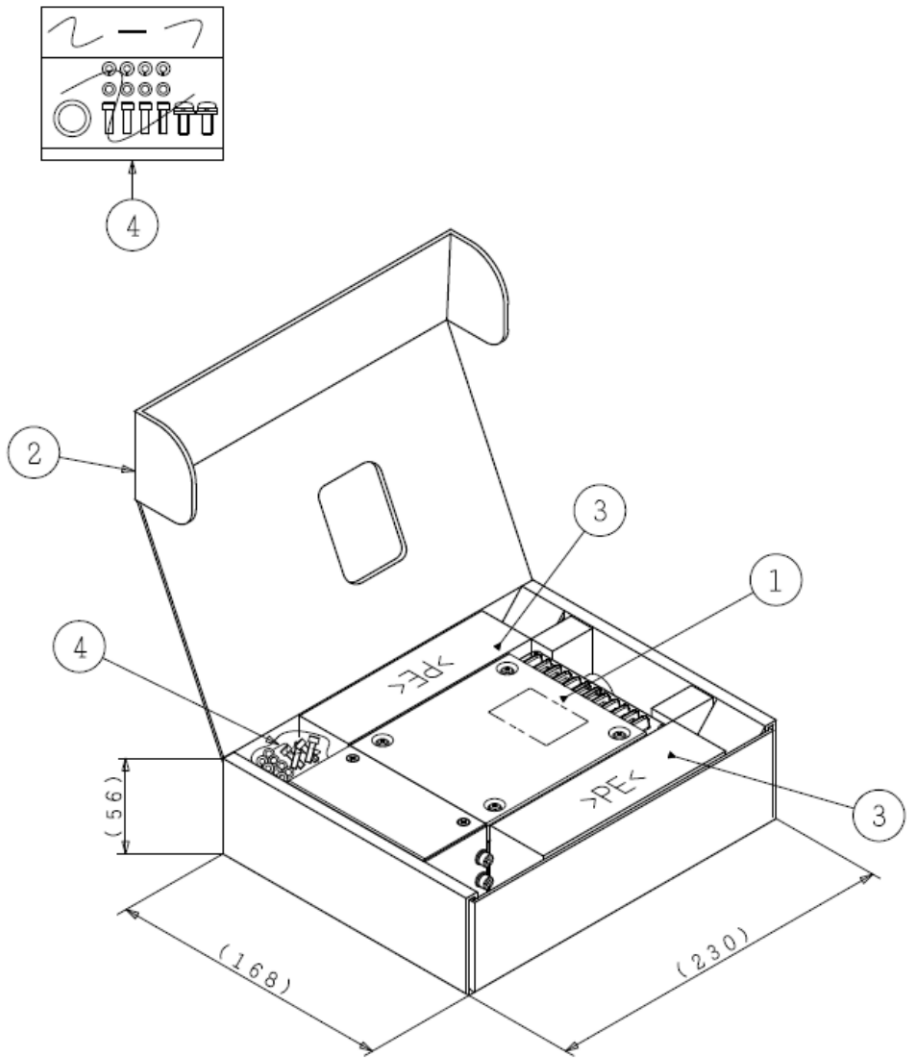
13. T5830 Package

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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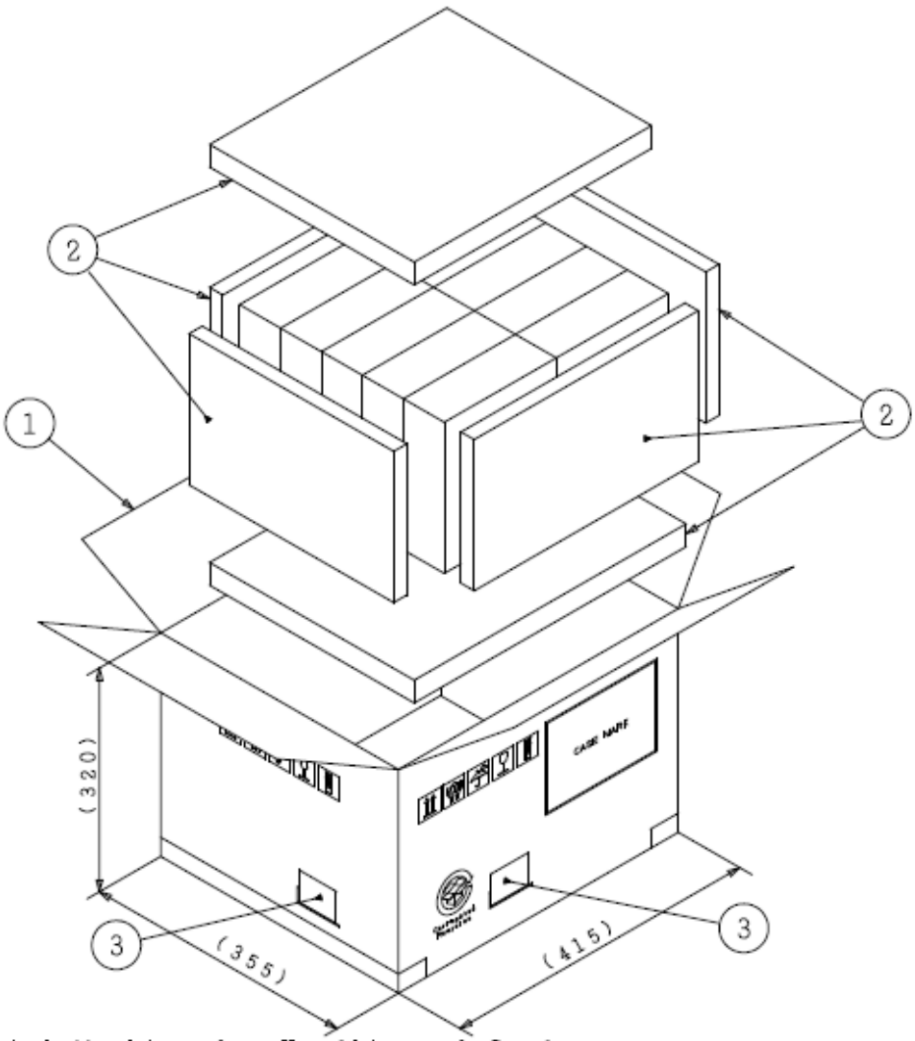


Pictorial Marking for Handling of Goods

THIS WAY UP

HANDLE WITH CARE

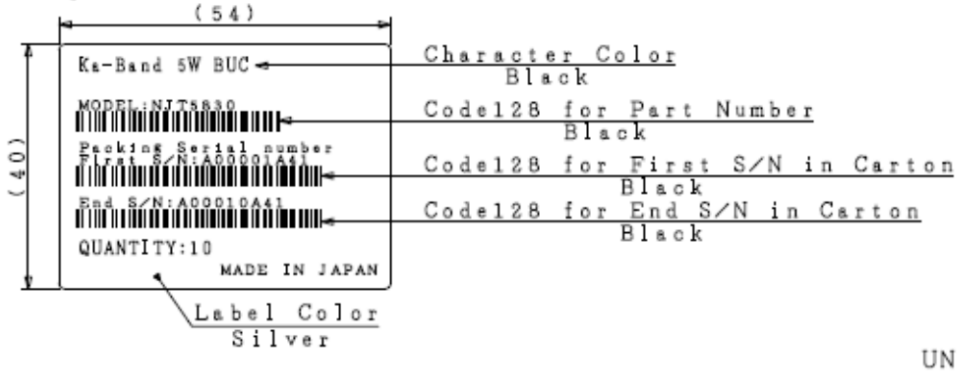
KEEP DRY

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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