

# **Client Margining Methodology**

## **Introduction**

This document is the guideline for the calculation of the client margin requirement due from a client to an Exchange Participant or from a Non-Clearing Participant ("NCP") to its General Clearing Participant ("GCP") (i.e. Client Margin). Terms used in this document bear the same meanings as in PRiME Margining Guide.

## **Part 1. Client Margin Calculation Algorithm**

This part explains how the margin requirements are calculated. Please refer to PRiME Margining Guide for different components in arriving at the final margin requirement.

## **Part 2. Examples**

This part contains examples to illustrate the steps in calculating the margin requirement as stated in Part 1.

# Part 1. Client Margin Calculation Algorithm

## 1.1 Client Total Margin Requirement for Net Margining

1. Calculate Risk Margin of each Combined Commodity by multiplying the Risk Margin in 2.9 in PRiME Margining Guide by Client Margin Multiplier. The value of this multiplier is specified by clearing house from time to time.
2. Check to see if all of the positions for this Combined Commodity are solely long puts and/or long calls. If so, and if this result is greater than the Long Option Value, reduce this result to the Long Option Value.
3. Repeat steps 1 through 2 for all the Combined Commodity in the portfolio.
4. Group the result in step 3 by Currency of the Contract.
5. For HKCC's futures and futures-style options, Total Margin Requirement in each Currency of the Contract  
$$= \sum \text{Result from step 4 of that Currency of the Contract}$$
6. For SEOCH's premium-style options,
  - A. Calculate the Mark-to-Market Margin (i.e. total option value) of that Currency of the Contract  
$$= \sum \text{Short Option Value of that Currency of the Contract} - \sum \text{Long Option Value of that Currency of the Contract}$$
  - B. Calculate the Total Margin Requirement in each Currency of the Contract  
$$= \sum \text{Result from step 4 of that Currency of the Contract} + \text{Mark-to-Market Margin of that Currency of the Contract}$$
  - C. Check to see if there is a margin credit (negative Total Margin Requirement) in one Currency of the Contract and a margin debit (positive Total Margin Requirement) in other Currency of the Contract. If so, apply the margin credit to offset the margin debit. Before the offset, convert the margin credit into the currency (conversion rate will be determined by the clearing house from time to time) in which the margin debit is denominated.
  - D. If step C results in margin debit(s), the margin debit(s) will become the Total Margin Requirement. If step C results in margin credit(s), the margin credit will be set to zero and there will be no Total Margin Requirement.

## 1.2 Client Total Margin Requirement for Gross Margining

1. Calculate Scan Risk for each of the contract.
2. Calculate Spot Month Charge for each of the applicable contract.
3. Take the maximum of result from the sum of steps 1 and 2, and the Short Option Minimum Charge for the contract.
4. Calculate Risk Margin by multiplying the sum of result in step 3 by Combined Commodity by Client Margin Multiplier. The value of this multiplier is specified by clearing house from time to time.
5. Check to see if all of the positions for this Combined Commodity are solely long puts and/or long calls. If so, and if the result in step 4 is greater than the Long Option Value, reduce this result to the Long Option Value. (This step is not applicable to SEOCH's premium-style options, as long positions in gross margined account of SEOCH will be treated as non-marginable positions for margin calculation purpose.)
6. Repeat steps 1 through 5 for all the Combined Commodities in the portfolio.
7. Group the result in step 6 by Currency of the Contract
8. Add up the result in step 7.

For HKCC's futures and futures-style options, Total Margin Requirement in each Currency of the Contract

=  $\sum$  Result from step 7 of that Currency of the Contract

For SEOCH's premium-style options, Total Margin Requirement in each Currency of the Contract

=  $\sum$  Result from step 7 of that Currency of the Contract + Mark-to-Market Margin of that Currency of the Contract

## Part 2. Examples

### 2.1 HKCC Products

#### Portfolio A under Net Margining

Long 1 MAY HSI Futures

Short 4 JUN Mini-HSI Futures

HSI and Mini-HSI contracts are grouped into the same Combined Commodity. Delta Scaling Factor for HSI is 1.0 and mini-HSI is 0.2.

## 1. Scan Risk

### Risk Arrays:

Line	+1 MAY HSI Futures P/L	-4 JUN Mini-HSI Futures P/L	Total P/L (\$)
1	0	0	0
2	0	0	0
3	-10,000	+8,000	-2,000
4	-10,000	+8,000	-2,000
5	+10,000	-8,000	+2,000
6	+10,000	-8,000	+2,000
7	-20,000	+16,000	-4,000
8	-20,000	+16,000	-4,000
9	+20,000	-16,000	+4,000
10	+20,000	-16,000	+4,000
11	-30,000	+24,000	-6,000
12	-30,000	+24,000	-6,000
13	+30,000	-24,000	<b>+6,000</b>
14	+30,000	-24,000	<b>+6,000</b>
15	-21,000	+16,800	-4,200
16	+21,000	-16,800	+4,200
17	+1.00	-4.00	

⇒ Scan Risk = \$ 6,000

## 2. Intracommodity Spread Charge

Composite Delta for HSI Futures: +1

Composite Delta for Mini-HSI Futures: +1

The Composite Delta after adjusted by the Delta Scaling Factor:

Long 1 MAY HSI Futures = +1 x 1 x 1.0 = +1

Short 4 JUN Mini-HSI Futures = +1 x (-4) x 0.2 = -0.8

0.8 Intracommodity Spread can be formed

⇒ Intracommodity Spread Charge = 0.8 x \$7,500 = \$6,000

## 3. Client Total Margin Requirement

Client Total Margin Requirement

= Max (Commodity Risk, Short Option Minimum Charge) x Client Margin Multiplier

= Max (Scan Risk + Intracommodity Spread Charge, 0) x Client Margin Multiplier

= Max (6,000 + 6,000, 0) x 1.33\*

= HKD15,960

\*The Client Margin Multiplier is assumed to be 1.33 and the same in the following examples.

## Portfolio A under Gross Margining

Long 1 MAY HSI Futures

Short 4 JUN Mini-HSI Futures

### 1. Scan Risk

#### Risk Arrays:

Line	+1 MAY HSI Futures P/L	-4 JUN Mini-HSI Futures P/L
1	0	0
2	0	0
3	-10,000	+8,000
4	-10,000	+8,000
5	+10,000	-8,000
6	+10,000	-8,000
7	-20,000	+16,000
8	-20,000	+16,000
9	+20,000	-16,000
10	+20,000	-16,000
11	-30,000	+24,000
12	-30,000	<b>+24,000</b>
13	+30,000	-24,000
14	<b>+30,000</b>	-24,000
15	-21,000	+16,800
16	+21,000	-16,800
17	+1.00	-4.00

#### Scan Risk

⇒ Long 1 MAY HSI Futures: **30,000**

⇒ Short 4 JUN Mini-HSI Futures: **24,000**

### 2. Client Total Margin Requirement

Client Total Margin Requirement

$$\begin{aligned}
 &= \sum [\text{Max (Scan Risk, Short Option Minimum Charge) for each contract in HSI}] \times \text{Client Margin Multiplier} \\
 &= [\text{Max (30,000,0)} + \text{Max (24,000,0)}] \times 1.33 \\
 &= \$ 71,820
 \end{aligned}$$

## Portfolio B under Net Margining

Long 1 MAY HSI Futures  
 Short 2 JUN HSI 10,000 Call Options

**1. Scan Risk**

**Risk Arrays:**

Line	+1 MAY HSI Futures P/L	-2 JUN HSI 10,000 Call P/L	Total P/L (\$)
1	0	+4,336	+4,336
2	0	-4,337	-4,337
3	-10,000	+5,555	-4,445
4	-10,000	+7,054	-2,946
5	+10,000	-5,166	+4,834
6	+10,000	-13,488	-3,488
7	-20,000	+28,404	+8,404
8	-20,000	+20,539	+539
9	+20,000	-12,939	+7,061
10	+20,000	-20,422	-422
11	-30,000	+42,735	<b>+12,735</b>
12	-30,000	+35,842	+5,842
13	+30,000	-19,057	+10,943
14	+30,000	-25,338	+4,662
15	-21,000	+31,745	+10,745
16	+21,000	-10,717	+10,283
17	+1.00	-1.04	

⇒ **Scan Risk = \$ 12,735**

**2. Intracommodity Spread Charge**

Composite Delta for 1 HSI Futures: +1  
 Composite Delta for 1 10,000 HSI Call Options: +0.52

The Composite Delta after adjusted by Delta Scaling Factor

Long 1 MAY HSI Futures = +1 x 1 = +1  
 Short 2 JUN HSI Call Options = +0.52 x (-2) = -1.04

i.e. One Intracommodity Spread can be formed

⇒ Intracommodity Spread Charge = 1 x \$7,500 = \$7,500

**3. Short Option Minimum Charge**

Short Option Minimum = \$6,000 x 2 = \$12,000

**4. Client Total Margin Requirement**

Client Total Margin Requirement

$$\begin{aligned} &= \text{Max [Commodity Risk, Short Option Minimum Charge]} \times \text{Client Margin Multiplier} \\ &= \text{Max [Scan Risk + Intracommodity Spread Charge, Short Option Minimum Charge]} \times \text{Client Margin Multiplier} \\ &= \text{Max [12,735 + 7,500, 12,000]} \times 1.33 \\ &= \$ 26,913 \end{aligned}$$

### Portfolio B under Gross Margining

Long 1 MAY HSI Futures  
Short 2 JUN HSI 10,000 Call Options

#### 1. Scan Risk

##### Risk Arrays:

Line	+1 MAY HSI Futures P/L	-2 JUN HSI 10,000 Call P/L
1	0	+4,336
2	0	-4,337
3	-10,000	+5,555
4	-10,000	+7,054
5	+10,000	-5,166
6	+10,000	-13,488
7	-20,000	+28,404
8	-20,000	+20,539
9	+20,000	-12,939
10	+20,000	-20,422
11	-30,000	<b>+42,735</b>
12	-30,000	+35,842
13	+30,000	-19,057
14	<b>+30,000</b>	-25,338
15	-21,000	+31,745
16	+21,000	-10,717
17	+1.00	-1.04

##### Scan Risk

⇒Long 1 MAY HSI Futures: 30,000

⇒Short 2 JUN HSI 10,000 Call Options: 42,735

#### 2. Client Total Margin Requirement

Client Total Margin Requirement

$$\begin{aligned}
&= \sum [\text{Max (Scan Risk, Short Option Minimum Charge)} \text{ for each contract in HSI}] \times \text{Client Margin Multiplier} \\
&= [\text{Max (30,000, 0)} + \text{Max (42,735, 2 x 6,000)}] \times 1.33 \\
&= \$96,738
\end{aligned}$$

### Portfolio C under Net Margining

Long 2 MAR CNH Futures (applicable to Spot Month Charge)

Short 1 APR CNH Futures

#### 1. Scan Risk

##### Risk Arrays:

Line	+2 MAR CNH Futures P/L	-1 APR CNH Futures P/L	Total P/L (RMB)
1	0	0	0
2	0	0	0
3	-4,000	+2,000	-2,000
4	-4,000	+2,000	-2,000
5	+4,000	-2,000	+2,000
6	+4,000	-2,000	+2,000
7	-8,000	+4,000	-4,000
8	-8,000	+4,000	-4,000
9	+8,000	-4,000	+4,000
10	+8,000	-4,000	+4,000
11	-12,000	+6,000	-6,000
12	-12,000	+6,000	-6,000
13	+12,000	-6,000	<b>+6,000</b>
14	+12,000	-6,000	<b>+6,000</b>
15	-10,800	+5,400	-5,400
16	+10,800	-5,400	+5,400
17	+2.00	-1.00	

⇒ **Scan Risk = RMB 6,000**

#### 2. Intracommodity Spread Charge

Composite Delta for Long 2 MAR CNH Futures = +1 x 2 = +2

Composite Delta for Short 1 APR CNH Futures = +1 x (-1) = -1

1 Intracommodity Spread can be formed

⇒ Intracommodity Spread Charge = 1 x RMB 3,600 = RMB 3,600

#### 3. Spot Month Charge



Delta of spot month contract consumed by Intracommodity Spread = 1

Delta of spot month contract remaining in outrights = 1

⇒ Spot Month Charge

= (Delta consumed by spread x Spot Month Charge per Delta consumed by spread)

+ (Delta remaining in outrights x Spot Month Charge per Delta remaining in outrights)

= RMB (1 x 1,200 + 1 x 1,200) = RMB 2,400

#### 4. Client Total Margin Requirement

Client Total Margin Requirement

= Max (Commodity Risk, Short Option Minimum Charge) x Client Margin Multiplier

= Max (Scan Risk + Intracommodity Spread Charge + Spot Month Charge, 0) x Client Margin Multiplier

= Max (6,000 + 3,600 + 2,400, 0) x 1.33

= RMB 15,960

#### Portfolio C under Gross Margining

Long 2 MAR CNH Futures (applicable to Spot Month Charge)

Short 1 APR CNH Futures

##### 1. Scan Risk

**Risk Arrays:**

Line	+2 MAR CNH Futures P/L	-1 APR CNH Futures P/L
1	0	0
2	0	0
3	-4,000	+2,000
4	-4,000	+2,000
5	+4,000	-2,000
6	+4,000	-2,000
7	-8,000	+4,000
8	-8,000	+4,000
9	+8,000	-4,000
10	+8,000	-4,000
11	-12,000	<b>+6,000</b>
12	-12,000	<b>+6,000</b>
13	<b>+12,000</b>	-6,000
14	<b>+12,000</b>	-6,000
15	-10,800	+5,400

16	+10,800	-5,400
17	+2.00	-1.00

### Scan Risk

⇒ Long 2 MAR CNH Futures : 12,000

⇒ Short 1 APR CNH Futures : 6,000

## 2. Spot Month Charge

Delta of spot month contract remaining in outrights = 2

⇒ Spot Month Charge

= Delta remaining in outrights x Spot Month Charge per Delta remaining in outrights

= 2 x RMB 1,200 = RMB 2,400

## 3. Client Total Margin Requirement

Client Total Margin Requirement

=  $\sum$  [Max (Scan Risk + Spot Month Charge, Short Option Minimum Charge) for each contract in CNH] x Client Margin Multiplier

= [Max (12,000 + 2,400, 0) + Max (6,000 + 0, 0)] x 1.33

= RMB 27,132

## Portfolio D under Net Margining

Short 2 MAR AAA Futures

Long 2 Apr AAA 20000 Call

Long 2 MAR BBB Futures

Intercommodity Spread (HKCC)

Priority	Leg 1			Leg 2			Spread Credit Rate
	Combined Commodity	Delta per Spread Ratio	Side	Combined Commodity	Delta per Spread Ratio	Side	
1	CAH	1	A	CAR	2	B	75%
2	BBB	3	A	AAA	2	B	70%
3	BBB	5	A	CAH	4	B	50%

## 1. Scan Risk

### Risk Arrays of BBB:

Line	+2 MAR BBB Futures	Total P/L
	P/L	P/L

1	0	0
2	0	0
3	-26,500	-26,500
4	-26,500	-26,500
5	26,500	26,500
6	26,500	26,500
7	-53,000	-53,000
8	-53,000	-53,000
9	53,000	53,000
10	53,000	53,000
11	-79,500	-79,500
12	-79,500	-79,500
13	79,500	<b>79,500</b>
14	79,500	<b>79,500</b>
15	-71,550	-71,550
16	71,550	71,550
17	+2.00	

⇒ **Scan Risk of BBB = HKD79,500**

**Risk Arrays of AAA:**

Line	-2 MAR AAA Futures P/L	+2 APR 20000 AAA Call P/L	Total P/L P/L
1	0	-14,892	-14,892
2	0	16,086	16,086
3	39,800	-39,244	556
4	39,800	-9,834	29,966
5	-39,800	6,734	-33,066
6	-39,800	37,866	-1,934
7	79,500	-66,144	13,356
8	79,500	-39,414	40,086
9	-79,500	25,526	-53,974
10	-79,500	55,288	-24,212
11	119,300	-95,354	23,946
12	119,300	-72,022	<b>47,278</b>
13	-119,300	41,460	-77,840
14	-119,300	68,456	-50,844
15	107,400	-90,118	17,282
16	-107,400	26,976	-80,424
17	-2.00	+1.16	

⇒ **Scan Risk of AAA = HKD47,278**

## 2. Intracommodity Spread Charge

Composite Delta for AAA Futures: +1  
 Composite Delta for AAA 20000 Call: +0.58

The Composite Delta after adjustment by the Delta Scaling Factor:  
 Short 2 MAR AAA Futures = +1 x (-2) x 1.0 = -2.00  
 Long 2 APR AAA 20000 Call = +0.58 x (+2) x 1.0 = +1.16

1.16 Intracommodity Spread can be formed

⇒ Intracommodity Spread Charge = 1.16 x HKD 7,500 = HKD8,700

## 3. Intercommodity Spread Credit

### a. Number of Intercommodity Spread

Intercommodity Spread Priority <sup>a)</sup>	2.BBB-AAA
Composite Delta <sup>b)</sup> available to form Intercommodity Spread:	
BBB	+1 x (+2) x 1.0 = +2.00
AAA	+1 x (-2) x 1.0 + 0.58 x (+2) x 1.0 = -0.84
Number of Intercommodity Spread formed	Min( +2 /3,  -0.84 /2) = 0.4200

Note:

- a) As there are no delta from CAH and CAR in this portfolio, it is not possible to form the CAH-CAR spread.  
 b) The Composite Deltas are all adjusted by their Delta Scaling Factors.

### b. Weighted Price Risk (WPR)

Combined Commodity	BBB	AAA
Time Risk = (Scenario 1 Loss + Scenario 2 Loss)/2	(0 + 0)/2 = HKD 0	(-14,892 + 16,086)/2 = HKD597.00
Scan Risk Scenario	13	12
Paired Scenario	14	11
Price Risk = (Scan Risk Scenario Loss + Paired Scenario Loss)/2 - Time Risk	(79,500+79,500)/2 - 0 = HKD 79,500.00	(47,278 + 23,946)/2 - 597 = HKD 35,015.00
Composite Delta	+2	-0.84

WPR = Price Risk/  Composite Delta	79,500.00/ +2  = HKD 39,750.00	35,015.00/ -0.84  = HKD 41,684.52
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c. Intercommodity Spread Credit

Combined Commodity	BBB	AAA
WPR	HKD 39,750.00	HKD 41,684.52
Intercommodity Spread:		
Priority 2. BBB-AAA		
a) Number of Spread	0.4200	0.4200
b) Delta per Spread Ratio	3	2
c) Spread Credit Rate	70%	70%
Intercommodity Spread Credit = WPR × a) × b) × c)	HKD 35,060	HKD 24,510
Intercommodity Spread Credit of Combined Commodity	HKD 35,060	HKD 24,510

#### 4. Client Total Margin Requirement

Client Total Margin Requirement

$$\begin{aligned}
&= \sum [\text{Max (Commodity Risk – Intercommodity Spread Credit, Short Option Minimum Charge)} \\
&\quad \times \text{Client Margin Multiplier for each Combined Commodity}] \\
&= \sum [\text{Max (Scan Risk + Intracommodity Charge + Spot Month Charge – Intercommodity} \\
&\quad \text{Spread Credit, Short Option Minimum Charge)} \times \text{Client Margin Multiplier for each} \\
&\quad \text{Combined Commodity}] \\
&= \text{Max (79,500 – 35,060, 0)} \times 1.33 + \text{Max (47,278 + 8,700 – 24,510, 0)} \times 1.33 \\
&= 44,440 \times 1.33 + 31,468 \times 1.33 \\
&= \text{HKD 100,958}
\end{aligned}$$

#### Portfolio E under Net Margining

Long 2 MAR BBB Futures  
Short 2 MAR CAR Futures  
Long 1 MAR CAH Futures

CAR Futures is traded and settled in RMB

Intercommodity Spread (HKCC)

Priority	Leg 1			Leg 2			Spread Credit Rate
	Combined Commodity	Delta per Spread Ratio	Side	Combined Commodity	Delta per Spread Ratio	Side	
1	CAH	1	A	CAR	1	B	75%
2	BBB	3	A	AAA	2	B	70%
3	CAR	4	A	BBB	5	B	50%

## 1. Scan Risk

### Risk Arrays of CAH:

Line	+1 MAR CAH Futures P/L	Total P/L P/L(HKD)
1	0	0
2	0	0
3	-1,500	-1,500
4	-1,500	-1,500
5	+1,500	+1,500
6	+1,500	+1,500
7	-3,000	-3,000
8	-3,000	-3,000
9	+3,000	+3,000
10	+3,000	+3,000
11	-4,500	-4,500
12	-4,500	-4,500
13	+4,500	<b>+4,500</b>
14	+4,500	<b>+4,500</b>
15	-4,050	-4,050
16	+4,050	+4,050
17	+1.00	

⇒ Scan Risk of CAH= HKD 4,500

### Risk Arrays of CAR:

Line	-2 MAR CAR Futures P/L	Total P/L P/L(RMB)
1	0	0
2	0	0
3	+2,400	+2,400
4	+2,400	+2,400

5	-2,400	-2,400
6	-2,400	-2,400
7	+4,800	+4,800
8	+4,800	+4,800
9	-4,800	-4,800
10	-4,800	-4,800
11	+7,200	<b>+7,200</b>
12	+7,200	<b>+7,200</b>
13	-7,200	-7,200
14	-7,200	-7,200
15	+6,480	+6,480
16	-6,480	-6,480
17	-2.00	

⇒ Scan Risk of CAR= RMB 7,200

**Risk Arrays of BBB:**

Line	+2 MAR BBB Futures P/L	Total P/L P/L(HKD)
1	0	0
2	0	0
3	-26,500	-26,500
4	-26,500	-26,500
5	26,500	26,500
6	26,500	26,500
7	-53,000	-53,000
8	-53,000	-53,000
9	53,000	53,000
10	53,000	53,000
11	-79,500	-79,500
12	-79,500	-79,500
13	79,500	<b>79,500</b>
14	79,500	<b>79,500</b>
15	-71,550	-71,550
16	71,550	71,550
17	+2.00	

⇒ Scan Risk of BBB = HKD 79,500

## 2. Intercommodity Spread Credit

### a. Number of Intercommodity Spread

Since the spread CAH-CAR is higher in priority, it will be formed first before CAR-BBB

Intercommodity Spread Priority <sup>a)</sup>	1.CAH-CAR	3.CAR-BBB
Composite Delta available to form Intercommodity Spread:		
CAH	+1 x (+1) x 1.0 = +1	
CAR	+1 x (-2) x 1.0 = -2	-2 - (-1) = -1 <sup>b)</sup>
BBB		+1 x (+2) x 1.0 = +2
Number of Intercommodity Spread formed	Min( +1 /1,  -2 /1) = 1	Min( -1 /4,  +2 /5) = 0.25

Note:

- Since there is no delta from AAA, forming spread of BBB-AAA is not possible.
- Available delta of CAR to form CAR-BBB spread is -1 instead of -2 as -1 delta has already been consumed by the CAH-CAR spread higher in priority. Available delta of CAR for CAR-BBB spread = -2.00 – Number of Intercommodity Spread formed in CAH-CAR x Delta per Spread of CAR in that CAH-CAR spread = -2 – (1x-1).

### b. Weighted Price Risk(WPR)

Combined Commodity	CAH	CAR	BBB
Time Risk = (Scenario 1 Loss+ Scenario 2 Loss)/2	0	0	0
Scan Risk Scenario	13	11	13
Paired Scenario	14	12	14
Price Risk = (Scan Risk Scenario Loss + Paired Scenario Loss)/2 - Time Risk	(4,500+4,500)/2 - 0 = HKD 4,500.00	(7,200+7,200)/2 - 0 = RMB 7,200.00	(79,500+79,500)/2 - 0 = HKD 79,500.00
Composite Delta	+1	-2	+2
WPR = Price Risk/  Composite Delta	4,500.00/ +1  = HKD 4,500.00	7,200.00/ -2  = RMB 3,600.00	79,500.00/ +2  = HKD 39,750.00

### c. Intercommodity Spread Credit

Combined Commodity	CAH	CAR	BBB
WPR	HKD 4,500.00	RMB 3,600.00	HKD 39,750.00
Intercommodity Spread:			
Priority 1.CAH-CAR			



a)Number of Spread	1	1	N/A
b)Delta per Spread Ratio	1	1	N/A
c)Spread Credit Rate	75%	75%	N/A
Intercommodity Spread Credit = WPR × a) × b) × c)	HKD 3,375	RMB 2,700	N/A
Priority 3.CAR-BBB			
a)Number of Spread	N/A	0.25	0.25
b)Delta per Spread Ratio	N/A	4	5
c)Spread Credit Rate	N/A	50%	50%
Intercommodity Spread Credit = WPR × a) × b) × c)	N/A	RMB1,800	HKD 24,844
Intercommodity Spread Credit of Combined Commodity	HKD 3,375	2,700 + 1,800 = RMB 4,500	HKD 24,844

### 3. Client Total Margin Requirement

Client Total Margin Requirement

$$= \sum [\text{Max (Commodity Risk – Intercommodity Spread Credit, Short Option Minimum Charge)} \\ \times \text{Client Margin Multiplier for each Combined Commodity}]$$

$$= \sum [\text{Max (Scan Risk + Intracommodity Charge + Spot Month Charge – Intercommodity} \\ \text{Spread Credit, Short Option Minimum Charge)} \times \text{Client Margin Multiplier for each} \\ \text{Combined Commodity}]$$

Client Total Margin Requirement (HKD)

$$= \text{Total Margin Requirement of CAH} + \text{Total Margin Requirement of BBB}$$

$$= \text{Max (4,500 – 3,375, 0)} \times 1.33 + \text{Max (79,500 – 24,844, 0)} \times 1.33$$

$$= 1,125 \times 1.33 + 54,656 \times 1.33$$

$$= \text{HKD 74,189}$$

Client Total Margin Requirement (RMB)

$$= \text{Total Margin Requirement of CAR}$$

$$= \text{Max (7,200 – 4,500, 0)} \times 1.33$$

$$= \text{RMB 3,591}$$

## 2.2 SEOCH Products

### Portfolio F under Net Margining

Long 1 MAY HKB90.00 Call, Settlement Price = HKD 1.00

Short 2 JUN HKB100.00 Call, Settlement Price = HKD 0.60

Long 1 MAY RMZ50.00 Call, Settlement Price = RMB 3.00

HKB is denominated in HKD while RMZ is denominated in RMB.

#### 1. Scan Risk

##### Risk Arrays of HKB (HKD):

Line	+1 MAY HKB90.00 Call P/L	-2 JUN HKB100.00 Call P/L	Total P/L (HKD)
1	0	+80	+80
2	+1,100	-50	+1,050
3	-623	+1,234	+611
4	-623	+1,126	+503
5	+623	-1,018	-395
6	+623	-1,288	-665
7	-1,247	+2,422	+1,175
8	-1,247	+2,366	+1,119
9	+1,242	-2,018	-776
10	+1,242	-2,408	-1,166
11	-1,871	+3,642	<b>+1,771</b>
12	-1,871	+3,612	+1,741
13	+1,854	-2,946	-1,092
14	+1,868	-2,414	-546
15	-1,310	+2,574	+1,264
16	+1,251	-1,810	-559
17	+1	-1.30	

⇒ Scan Risk = HKD 1,771

##### Risk Arrays of RMZ (RMB):

Line	+1 MAY RMZ50.00 Call P/L	Total P/L (RMB)
1	-315	-315
2	+393	+393
3	-840	-840
4	-198	-198
5	+124	+124
6	+812	+812

7	-1,445	-1,445
8	-924	-924
9	+475	+475
10	+1,063	+1,063
11	-2,120	-2,120
12	-1,736	-1,736
13	+742	+742
14	+1,185	<b>+1,185</b>
15	-2,094	-2,094
16	+375	+375
17	+0.50	

⇒ **Scan Risk = RMB 1,185**

## 2. Intracommodity Spread Charge

Composite Delta for 1 MAY HKB90.00 Call: +1

Composite Delta for 1 JUN HKB100.00 Call: +0.65

The Composite Delta:

Long 1 MAY HKB90.00 Call = +1 x 1 = +1

Short 2 JUN HKB100.00 Call = + 0.65 x (-2) = -1.30

i.e. One Intracommodity Spread of HKB can be formed in the Portfolio F

⇒ **Intracommodity Spread Charge = 1 x HKD 450 = HKD 450**

Composite Delta for 1 MAY RMZ50.00 Call: +0.5

The Composite Delta:

Long 1 MAY RMZ50.00 Call = +1 x 0.5 = +0.5

i.e. As there is only one contract month, no Intracommodity Spread of RMZ can be formed in the Portfolio F.

## 3. Short Option Minimum Charge

Short Option Minimum of HKB = HKD 500 x 2 = HKD 1,000

Short Option Minimum of RMZ = RMB 0

## 4. Long Option Value

Long Option Value of RMZ = RMB 3.00 x 400 = RMB 1,200

## 5. Client Total Margin Requirement

Client Total Margin Requirement of a Combined Commodity with short options

$$= \text{Max [Commodity Risk, Short Option Minimum Charge]} \times \text{Client Margin Multiplier} + \text{Mark-to-Market Margin}$$

$$= \text{Max [Scan Risk + Intracommodity Spread Charge, Short Option Minimum Charge]} \times \text{Client Margin Multiplier} + \text{Mark-to-Market Margin}$$

Client Total Margin Requirement of a Combined Commodity with solely long puts and/or long calls

$$= \text{Min [(Scan Risk + Intracommodity Spread Charge) \times Client Margin Multiplier, Long Option Value]} + \text{Mark-to-Market Margin}$$

Client Total Margin Requirement of HKB (HKD)

$$= \text{Max [1,771 + 450, 1,000]} \times 1.33 + (-\text{HKD } 1.00 \times 1 \times 400 + \text{HKD } 0.60 \times 2 \times 400)$$

$$= \text{HKD } 3,034$$

Client Total Margin Requirement of RMZ (RMB)

$$= \text{Min [(1,185 + 0) \times 1.33, 1,200]} + (-\text{RMB } 3.00 \times 400)$$

$$= \text{RMB } 1,200 - \text{RMB } 1,200$$

$$= \text{RMB } 0$$

### Portfolio G under Gross Margining

Long 1 MAY HKB90.00 Call

Short 2 JUN HKB100.00 Call, Settlement Price = HKD 0.60

Long 1 MAY RMZ50.00 Call

#### 1. Scan Risk

##### Risk Arrays of HKB (HKD):

Line	+1 MAY HKB90.00 Call* P/L	-2 JUN HKB100.00 Call P/L
1	0	+80
2	0	-50
3	0	+1,234
4	0	+1,126
5	0	-1,018
6	0	-1,288
7	0	+2,422
8	0	+2,366

9	0	-2,018
10	0	-2,408
11	0	<b>+3,642</b>
12	0	+3,612
13	0	-2,946
14	0	-2,414
15	0	+2,574
16	0	-1,810
17	0	-1.30

\* Long position is ignored

⇒ **Scan Risk = HKD 3,642**

**Risk Arrays of RMZ (RMB):**

Line	+1 MAY RMZ 50.00 Call*	P/L
1		0
2		0
3		0
4		0
5		0
6		0
7		0
8		0
9		0
10		0
11		0
12		0
13		0
14		0
15		0
16		0
17		0

\* Long position is ignored

⇒ **Scan Risk = RMB 0**

## 2. Client Total Margin Requirement

Client Total Margin Requirement of HKB (HKD)

$$\begin{aligned}
&= \Sigma [\text{Max (Scan Risk, Short Option Minimum Charge) for each contract in HKB}] \times \text{Client Margin Multiplier} + \text{Mark-to-Market Margin} \\
&= \text{Max [3,642, 2 x 500]} \times 1.33 + (0.6 \times 2 \times 400) \\
&= \text{HKD 4,844} + \text{HKD 480} \\
&= \text{HKD 5,324}
\end{aligned}$$

Client Total Margin Requirement of RMZ (RMB)

$$= \text{RMB 0}$$

### Portfolio H under Net Margining

Long 1 MAY RHK 45.00 Call, Settlement Price = 5.50

Short 1 MAY RMZ 50.00 Call, Settlement Price = 1.80

RHK is denominated in HKD while RMZ is denominated in RMB.

Intercommodity Spread (SEOCH):

Priority	Leg 1			Leg 2			Spread Credit Rate
	Combined Commodity	Delta per Spread Ratio	Side	Combined Commodity	Delta per Spread Ratio	Side	
1	RHK	1	A	RMZ	1	B	75%

### 1. Scan Risk

#### Risk Arrays of RHK (HKD):

Line	+1 MAY RHK 45.00 Call P/L	Total P/L (HKD)
1	-215	-215
2	+210	+210
3	-930	-930
4	-620	-620
5	+441	+441
6	+984	+984
7	-1,693	-1,693
8	-1,480	-1,480
9	+1,029	+1,029
10	+1,665	+1,665
11	-2,492	-2,492
12	-2,353	-2,353
13	+1,539	+1,539
14	+2,216	<b>+2,216</b>

15	-2,289	-2,289
16	+921	+921
17	+0.80	

⇒ Scan Risk = HKD 2,216

**Risk Arrays of RMZ (RMB):**

Line	-1 MAY RMZ 50.00 Call P/L	Total P/L (RMB)
1	+315	+315
2	-393	-393
3	+840	+840
4	+198	+198
5	-124	-124
6	-812	-812
7	+1,445	+1,445
8	+924	+924
9	-475	-475
10	-1,063	-1,063
11	+2,120	<b>+2,120</b>
12	+1,736	+1,736
13	-742	-742
14	-1,185	-1,185
15	+2,094	+2,094
16	-375	-375
17	-0.50	

⇒ Scan Risk = RMB 2,120

**2. Intercommodity Spread Credit**

a. Number of Intercommodity Spread

Intercommodity Spread Priority	1.RHK-RMZ
Composite Delta available to form Intercommodity Spread:	
RHK	+0.8 x (+1) x 1.0 = +0.80
RMZ	-0.5 x (+1) x 1.0 = -0.50
Number of Intercommodity Spread formed	Min( +0.80 /1,  -0.50 /1) = 0.5000

b. Weighted Price Risk (WPR)

<b>Combined Commodity</b>	<b>RHK</b>	<b>RMZ</b>
Time Risk = (Scenario 1 Loss+ Scenario 2 Loss)/2	$(-215 + 210)/2 = -2.50$	$(+315 - 393)/2 = -39.00$
Scan Risk Scenario	14	11
Paired Scenario	13	12
Price Risk = (Scan Risk Scenario Loss + Paired Scenario Loss)/2 - Time Risk	$(2,216 + 1,539)/2 - (-2.50) = \text{HKD } 1,880.00$	$(2,120 + 1,736)/2 - (-39) = \text{RMB } 1,967.00$
Composite Delta	+0.80	-0.50
WPR = Price Risk/  Composite Delta	$1,880/ +0.80  = \text{HKD } 2,350.00$	$1,967/ -0.50  = \text{RMB } 3,934.00$

c. Intercommodity Spread Credit

<b>Combined Commodity</b>	<b>RHK</b>	<b>RMZ</b>
WPR	HKD 2,350.00	RMB 3,934.00
Intercommodity Spread:		
Priority 1.RHK-RMZ		
a)Number of Spread	0.5000	0.5000
b)Delta per Spread Ratio	1	1
c)Spread Credit Rate	75%	75%
Intercommodity Spread Credit = WPR × a) × b) × c)	HKD 881	RMB 1,475
Intercommodity Spread Credit of Combined Commodity	<b>HKD 881</b>	<b>RMB 1,475</b>

3. **Short Option Minimum**

Short Option Minimum of RMZ =  $200 \times 1 = \text{RMB } 200$

4. **Long Option Value**

Long Option Value of RHK =  $400 \times \text{HKD } 5.50 = \text{HKD } 2,200$

5. **Client Total Margin Requirement**

Client Total Margin Requirement of RHK



$$\begin{aligned}
&= \text{Min} [(Commodity Risk - Intercommodity Spread Credit) \times Client Margin Multiplier, Long Option Value] + \text{Mark-to-Market Margin} \\
&= \text{Min} [(2,216 - 881) \times 1.33, 2,200] + (- 5.50 \times 400) \\
&= \text{HKD } 1,776 - 2,200 \\
&= - \text{HKD } 424
\end{aligned}$$

Client Total Margin Requirement of RMZ

$$\begin{aligned}
&= \text{Max} [Commodity Risk - Intercommodity Spread Credit, Short Option Minimum Charge] \times Client Margin Multiplier + \text{Mark-to-Market Margin} \\
&= \text{Max} (2,120 - 1,475, 200) \times 1.33 + 1.80 \times 400 \\
&= \text{RMB } 858 + 720 \\
&= \text{RMB } 1,578
\end{aligned}$$

Since there is margin credit in HKD (i.e. negative Total Margin Requirement) and margin debit in RMB (i.e. positive Total Margin Requirement), the margin credit will be used to offset the margin debit. Before the offset, the margin credit will first be converted into the currency in which margin debit is denominated.

Assuming the Conversion rate for HKD/RMB = 0.8152,

Client Total Margin Requirement after cross-currency margin credit offset

$$\begin{aligned}
&= \text{RMB } 1,365 - \text{HKD } 424 \times 0.8152 \\
&= \text{RMB } 1,019
\end{aligned}$$