

EMC TEST REPORT

Project No.	LBE20115053	Issue No.	None
Applicant	Name of organization	Samsung Electronics Co., Ltd.	
	Address	416, Maetan 3-dong, Yeongtong-gu, Suwon-si, Gyeonggi-do, 443-742, Republic of Korea	
	Date of application	October 19, 2011	
EUT	Type of device	Class B computing devices peripheral	
	Equipment authorization	☐ Declaration of Conformity ☒ Certification ☐ Verification	
	FCC ID	A3LSHWM420K	
	Kind of product	Mobile Phone	
	Model No.	SHW-M420K	
	Variant Model No.	Refer to clause 3.5	
	Manufacturer	SAMSUNG ELECTRONICS CO., LTD. 94-1, Imsu-dong, Gumi-si, Gyengsangbuk-do, 730-722, Republic of Korea TIANJIN SAMSUNG TELECOM TECHNOLOGY CO., LTD. 300385 China Tianjin No.9, WeiWu Rd., Micro Electronic Industrial Park, Xiqing Dist, Tianjin, China	
Applied Standards		FCC Part 15, Subpart B, Class B / ANSI C63.4-2003	
Test Period		October 21, 2011 ~ October 31, 2011	
Issue date		November 2, 2011	

Test result : Complied

The equipment under test has found to be compliant with the applied standards.
(Refer to the attached test result for more detail.)

Tested by : Young-Jin Kim



Reviewed by : Tae-Young Jang



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1. Summary of test results

1.1 Emission

The EUT has been tested according to the following specifications:

Applied	Test type	Applied standard	Result	Remarks
☒	Conducted Disturbance (Mains port)	FCC Part 15 Subpart B / ANSI C63.4-2003	Complied	Meets Class B Limit
☒	Radiated Disturbance		Complied	Meets Class B Limit

2. General Information

2.1 Test facility

The CS & Environment center is located on Samsung Electronics Co., Ltd. at 416, Maetan 3-dong, Yeongtong-gu, Suwon-si, Gyeonggi-do, Republic of Korea.

All testing are performed in Semi-anechoic chambers conforming to the site attenuation Characteristics defined by ANSI C63.4, CISPR 22, 16-1 and 16-2. and Shielded rooms.

The CS & Environment center is operated as testing laboratory in accordance with the requirements of ISO/IEC 17025:2005.

3. Test Setup configuration

3.1 Test Peripherals

The cables used for these peripherals are either permanently attached by the peripheral manufacturer or coupled with an assigned cable as defined below.

The following is a listing of the EUT and peripherals utilized during the performance of EMC test:

Description	Model No.	Serial No.	Manufacturer	FCC ID / DoC
Mobile Phone	SHW-M420K	-	SAMSUNG	A3LSHWM420K
Battery	EB-L1F2HBK	NAaBA13AS/4-B	SAMSUNG	-
Note PC	NT-P530	0933008588	SAMSUNG	DoC
AC Adapter	AD-6019	CNBA4400162ABJ6F6551560	SAMSUNG	-
USB Mouse	B138	Z5F8353	SAMSUNG	DoC
USB Keyboard	SEM-DT-35US	KB3V082SUAAB-REV2.09200 0824	GPE	DoC
USB Cable	ECC1DU0BBK	KD1Z827TS E	SAMSUNG	-
Headset	EHS44ASSBE	-	SAMSUNG	

3.2 EUT operating mode

To achieve compliance applied standard specification, the following mode(s) were made during compliance testing:

Operating Mode 1	USB Mode (Data Communication)
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3.3 Details of Sampling

Customer selected, single unit.

3.4 Used cable description

The EUT is configured, installed, arranged and operated in a manner consistent with typical applications. Interface cables/loads/devices are connected to at least one of each type of interface port of the EUT, and where practical, each cable shall be terminated in a device typical of actual usage. The type(s) of interconnecting cables to be used and the interface port (of the EUT) to which these were connected;

Connected cable	Length [m]	Shielded [Y/N]	Note
Data Cable	0.8	Yes	From EUT to Note PC
Headset	1.3	No	For Headset
Power	1.8	No	For AC Adapter
USB	1.8	Yes	From Note PC to Mouse
USB	1.5	Yes	From Note PC to Keyboard

3.5 EUT Description

1. The following features describe EUT represented by this report:

Item	Specification	
Frequency Range	GSM 1900	TX : 1 850.2 ~ 1 909.8 MHz RX : 1 930.2 ~ 1 989.8 MHz
Size (Standard Battery)	135.5 (L) X 67.94 (W) X 8.84 (H) (mm)	
Weight (Standard Battery)	135 g (±1 g)	
LCD Specification	4.65" Super AMOLED PLUS (720 X 1280)	
Operating Temperature (°C)	-20 ~ +50	
Operating Humidity (%)	0 ~ 95	
Bluetooth	TX/RX Frequency : 2 402 ~ 2 480 MHz Version : 3.0 + HS	
Wi-Fi	TX/RX Frequency : 2 400 ~ 2 483.5 MHz (801.11 b/g/n) TX/RX Frequency : 5 150 ~ 5 250, 5 250 ~ 5 350 MHz 5 470 ~ 5 650, 5 725 ~ 5 825 MHz (801.11 a/n)	
NFC	TX/RX Frequency : 13.5605 MHz	
Memory	Internal Memory : 13.3 GB External Memory : Not Support	

2. The variant models

- None

3.6 Clock Frequencies

Kind of Clocks	Frequency [MHz]
CPU	1 500

3.7 Test configuration and condition

The EUT exercise program which is the samsung standardized emission test program for windows was used during all EMC measurements were tested.

This program was contained on the PC hard disk drive.

Once loaded, the program sequentially exercises each system component in turn.

The system was configured for testing in a typical fashion that a customer would normally use, and was tested while in an automated non-attendant mode.

Power source for the EUT operating was supplied by CVCF made by the Pacific.

- Test Voltage : AC 120 V, 60 Hz

3.8 Measurement uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus: (According to CISPR 16-4 and UKAS Lab 34.)

3.8.1 Emission

Test type		Measurement uncertainty (C.L. 95 %, k = 2)
Conducted disturbance	AC Mains	± 3.03 dB
Radiated Disturbance (30 MHz ~ 1 GHz)	Horizontal	± 4.61 dB
	Vertical	± 4.60 dB
Radiated Disturbance (1 GHz ~ 6 GHz)		± 4.09 dB

4. Results of individual test

4.1 Conducted disturbance

Both conducted lines are measured in Quasi-Peak and Average mode, including the worst-case data points for each tested configuration. The EUT measured in accordance with the methods described in standards.

Limits for conducted disturbance at the mains ports

Frequency range Limits MHz	Resolution Bandwidth	Limits dB(μV)	
		Quasi-peak	Average
0,15 to 0,50	9 kHz	66 to 56	56 to 46
0,50 to 5	9 kHz	56	46
5 to 30	9 kHz	60	50

4.1.1 Test instrumentation

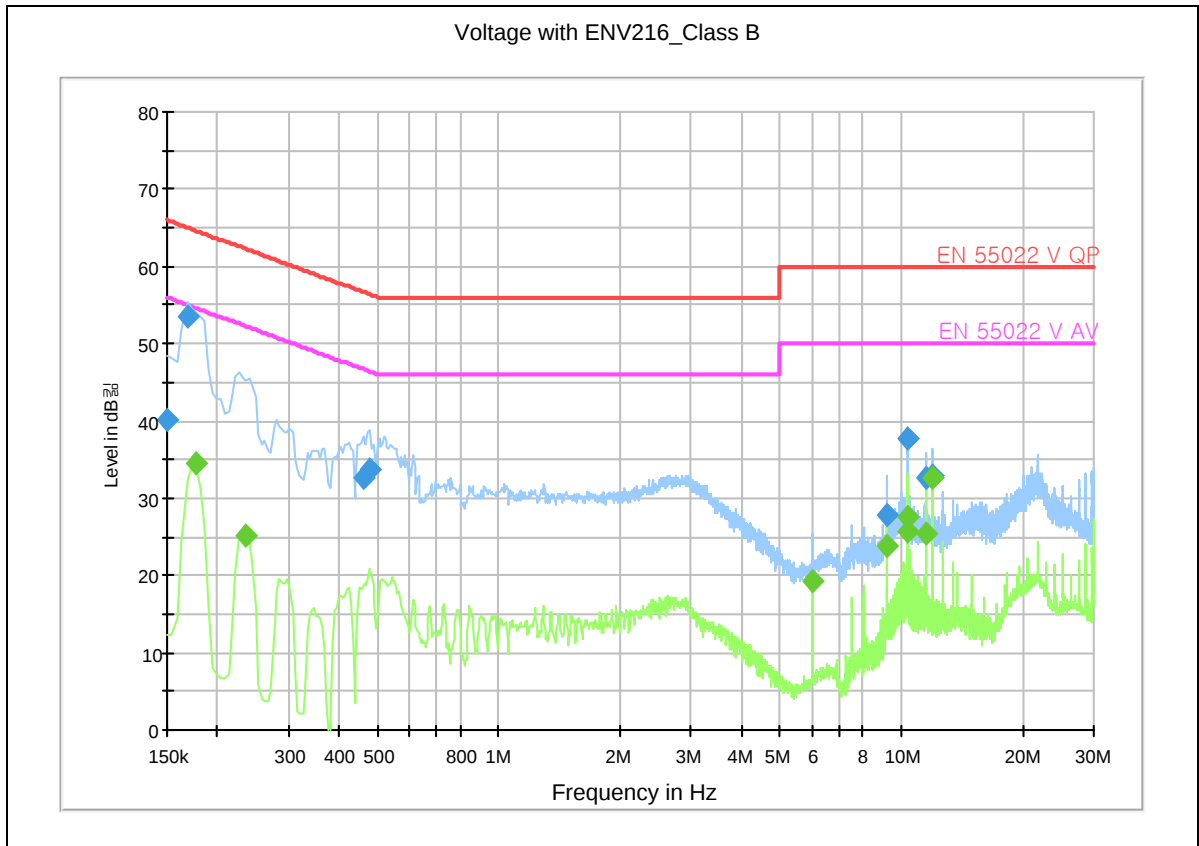
EMC No.	Test Instrument	Model name	Manufacturer	Serial No.	Calibration	
					Date	Interval (Month)
E3I-093	Test Receiver	ESCS30	R&S	830986/004	2011-02-11	12
E3I-050	LISN	R&S	ESH3-Z5	100263	2011-10-12	12
E3I-259	LISN	R&S	ENV216	101369	2011-10-11	12

4.1.2 Temperature and humidity condition

Test date	2011-10-31	Test engineer	Young-Jin Kim
Climate condition	Ambient temperature	22.8 °C	Limit (15.0 to 35.0) °C
	Relative humidity	41.0 % R.H.	Limit (25.0 to 75.0) % R.H.
	Atmospheric pressure	100.1 kPa	Limit (86.0 to 106.0) kPa
Test place	Shield Room (SR8)		

4.1.3 Test results

- Operating Mode 1: AC Mains



Note 1) Two graphs measured for both Live(L1) and Neutral(N) of the LISN are combined into one graph.

Quasi-peak final measurement results table

Frequency (MHz)	Level (dB μ V)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.150	40.2	L1	9.9	25.80	66.00
0.168	53.5	N	10.3	11.50	65.10
0.460	32.7	L1	10.0	23.90	56.70
0.478	33.8	N	10.0	22.60	56.40
9.177	27.7	N	9.8	32.30	60.00
10.320	37.7	L1	9.8	22.30	60.00
11.463	32.6	L1	9.8	27.40	60.00
11.980	33.0	L1	9.8	27.00	60.00

Average final measurement results table

Frequency (MHz)	Level (dB μ V)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.177	34.6	L1	10.2	20.00	54.60
0.235	25.1	L1	10.0	27.10	52.30
5.991	19.1	L1	9.7	30.90	50.00
9.181	23.8	N	9.8	26.20	50.00
10.320	25.8	L1	9.8	24.20	50.00
10.329	27.6	N	9.8	22.40	50.00
11.467	25.3	L1	9.8	24.70	50.00
11.980	32.7	L1	9.8	17.30	50.00

Note 2) Level (QP and/or AV) = Meter Reading (QP and/or AV) + Corr. (LISN Insertion Loss + Cable Loss)
 Margin (QP and/or AV) = Limit – Level (QP and/or AV)
 QP = Quasi-Peak, AV = Average

4.2 Radiated disturbance

Of those disturbances above ($L - 20\text{dB}$), where L is the limit level in logarithmic units, record at least the disturbance levels and the frequencies of the six highest disturbances.

The following data lists the significant emission frequencies, measured levels, correction factors (for antenna and cables), orientation of table, polarization and height of antenna, the corrected reading, the limit, and the amount of margin.

Peak measurements were made over the changeable frequency range 30 MHz to 1 GHz at a measurement distance of 3 m for the following antenna and turntable arrangements:

Antenna Height [cm]	Antenna Polarisation	Resolution bandwidth	Video bandwidth	Turntable position [degrees]
100 ~ 400	Horizontal, Vertical	120 kHz	300 kHz	Continuous

Measurements within 20 dB of the limit were then maximized by adjusting turntable position. Final measurements were made using quasi-peak detectors.

Limits for radiated disturbance of ITE at a measuring distance of 3 m

Frequency range Limits [MHz]	Field Strength	
	$\mu\text{V/m}$	$\text{dB}(\mu\text{V/m})$
30 to 88	100	40.0
88 to 216	150	43.5
216 to 960	200	46.0
Above 960	500	54.0

Peak/Average measurements were made over the changeable frequency range 1GHz to 40GHz or 5th in accordance with internal maximum operating frequency at a measurement distance of 3m for the following antenna and turntable arrangements:

Antenna Height [cm]	Antenna Polarisation	Resolution bandwidth	Video bandwidth	Turntable position [degrees]
100 ~ 200	Horizontal, Vertical	1 MHz	1 MHz	Continuous

Limits for radiated disturbance of ITE at a measurement distance of 3 m

Class	Limits [$\text{dB}(\mu\text{V/m})$]	
	Peak	Average
A	80	60
B	74	54
Average limit $500, 20 \log 500 = 53.979 \text{ dB} \approx 54 \text{ dB}$		

Measurements within 20 dB of the limit were then maximized by adjusting turntable position.

Final measurements were made using peak and average detectors.

Results checked manually; and points close to the limit line were re-measured.

4.2.1 Test instrumentation

EMC No.	Test Instrument	Model name	Manufacturer	Serial No.	Calibration	
					Date	Interval (Month)
E3I-130	BILOG Antenna	CBL6112D	TESEQ	25513	2010-11-12	24
E3I-132	EMI Test Receiver	ESIB-26	R&S	100291	2011-04-06	12
E3I-170	Double-Ridged Waveguide Horn Antenna	R&S	HF906	1000028	2010-10-07	24
E3I-212	Preamplifier	310N	Sonoma	282362	2010-12-01	12

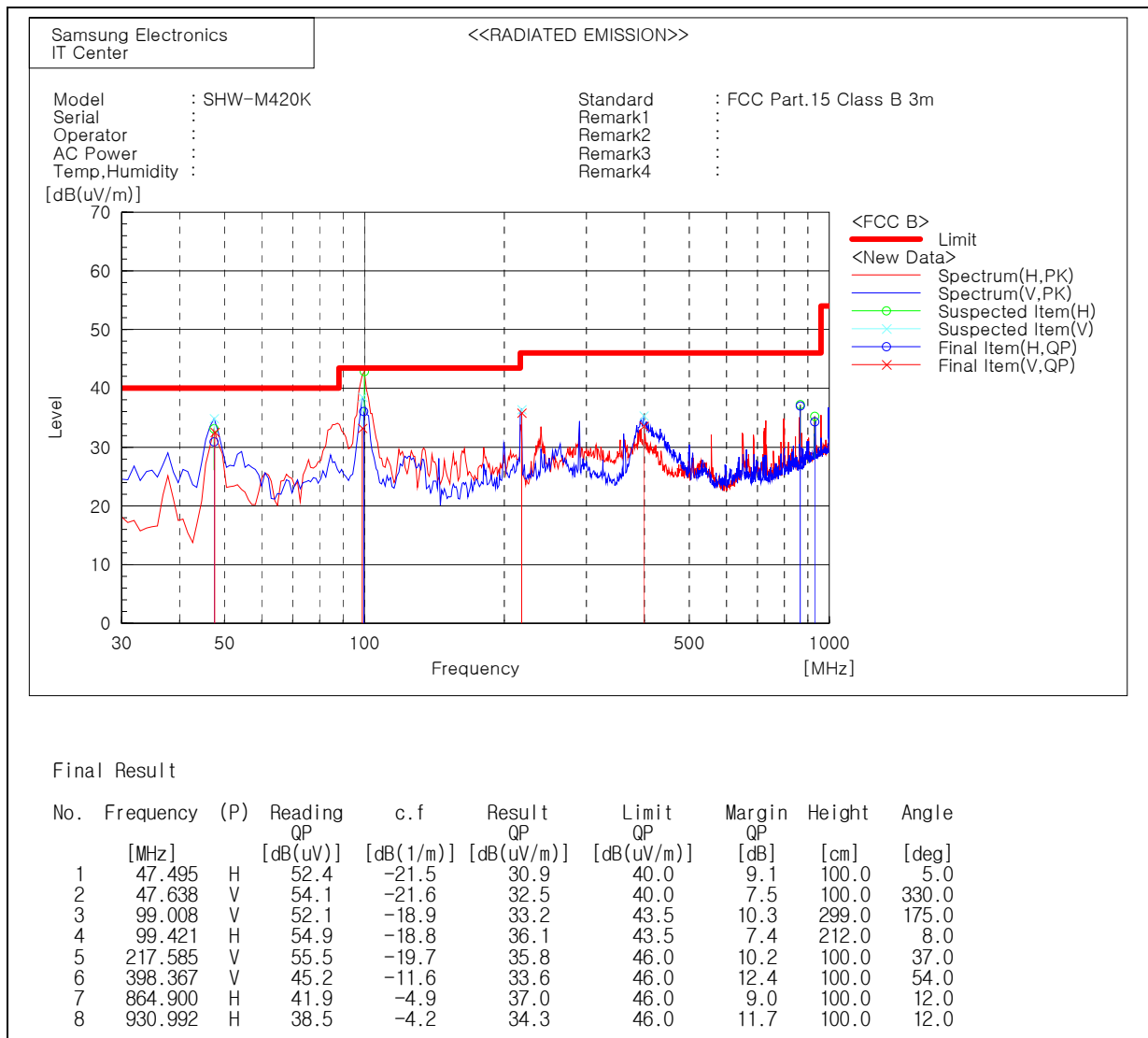
4.2.2 Temperature and humidity condition

Test date	2011-10-21	Test engineer	Young-Jin Kim
Climate condition	Ambient temperature	23.0 °C	Limit (15.0 to 35.0) °C
	Relative humidity	38.0 % R.H.	Limit (25.0 to 75.0) % R.H.
	Atmospheric pressure	100.4 kPa	Limit (86.0 to 106.0) kPa
Test place	Semi-Anechoic Chamber (SAC4)		

4.2.3 Test results

☐ Operating Mode 1

- Frequency range: 30 ~ 1 000 MHz



Note) Receiving antenna polarization : Horizontal, Vertical

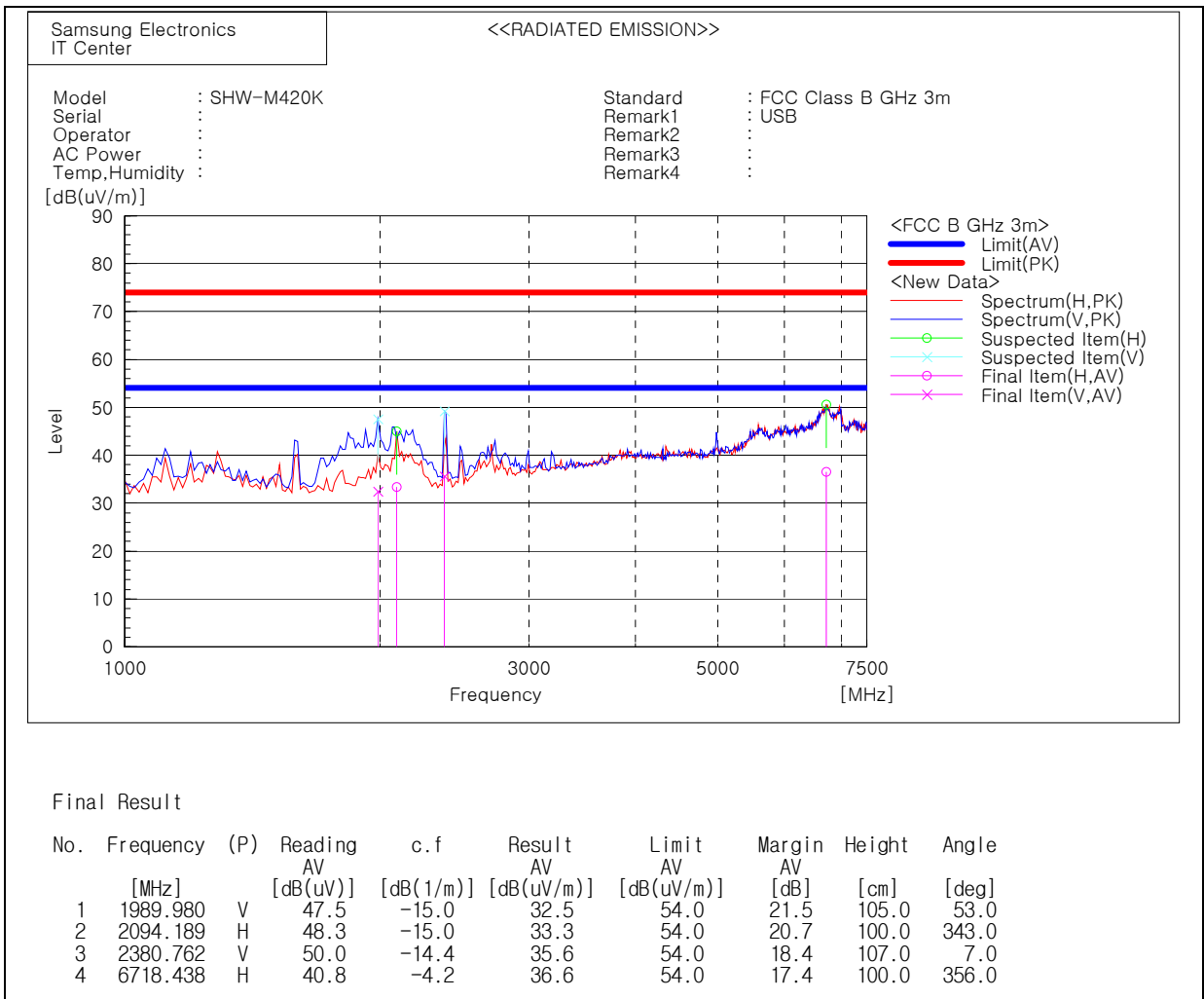
Test Distance : 3 m, Antenna Height : 1 to 4 meters

Result (QP) = Reading (QP) + c.f (Antenna Factor + Cable Loss - Amp. Gain)

Margin (QP) = Limit - Result (QP)

QP = Quasi-Peak

☐ Operating Mode 1

- Frequency range: 1 000 ~ 7 500 MHz


Note1) Representative operating modes were selected by customer and any emissions that do NOT exceed Average limit were not tested with peak detector mode.

Note2) Receiving antenna polarization : Horizontal, Vertical

Test Distance : 3 m, Antenna Height : 1 ~ 2 meters

Result (AV) = Reading (AV) + c.f (Antenna Factor + Cable Loss - Amp. Gain)

Margin (AV) = Limit – Result (AV)

AV = Average