
1. Safety Precautions

1-1. Repair Precaution

- Before attempting any repair or detailed tuning, shield the device from RF noise or static electricity discharges.
(Use only antistatic glove and strape.)
- Do not touch metallic parts or circuits with your bare hands as device(parts, circuits, etc) may be corroded.
- Use only demagnetized tools that are specifically designed for small electronic repairs, as most electronic parts are sensitive to electromagnetic forces.
- Use only high quality screwdrivers when servicing products. Low quality screwdrivers can easily damage the heads of screws.
- Use only conductor wire of the properly gauge and insulation for low resistance, because of the low margin of error of most testing equipment.
We recommend 22-gauge twisted copper wire.
- Hand-soldering is not recommended, because printed circuit boards (PCBs) can be easily damaged, even with relatively low heat. Never use a soldering iron with a power rating of more than 100 watts and use only lead-free solder with a melting point below 250°C (482°F).
- Prior to disassembling the battery charger for repair, ensure that the AC power is disconnected.
Always use the replacement parts that are registered in the SEC system. Third-party replacement parts may not function properly.

1. Safety Precautions

1-2. ESD(Electrostatically Sensitive Devices) Precaution

Many semiconductors and ESDs in electronic devices are particularly sensitive to static discharge and can be easily damaged by it. We recommend protecting these components with conductive anti-static bags when you store or transport them.

- Always use an anti-static strap or wristband and remove electrostatic buildup or dissipate static electricity from your body before repairing ESDs.
- Ensure that soldering irons have AC adapter with ground wires and that the ground wires are properly connected.
- Use only desoldering tools with plastic tips to prevent static discharge.
- Properly shield the work environment from accidental electrostatic discharge before opening packages containing ESDs.
- The potential for static electricity discharge may be increased in low humidity environments, such as air-conditioned rooms. Increase the airflow to the working area to decrease the chance of accidental static electricity discharges.

2. Specification

2-1. GSM General Specification

Item	GSM850	EGSM 900	DCS1800	PCS1900
Freq. Band[MHz] Uplink/ Downlink ARFCN range	824~849 869~894 128~251	880~915 925~960 0~124 & 975~1023	1710~1785 1805~1880 512~885	1850~1910 1930~1990 512~810
Tx/Rx spacing	45MHz	45MHz	95MHz	80MHz
Mod. Bit rate/ Bit Period	270.833kbps 3.692us	270.833kbps 3.692us	270.833kbps 3.692us	270.833kbps 3.692us
Time Slot Period/ Frame Period	576.9us 4.615ms	576.9us 4.615ms	576.9us 4.615ms	576.9us 4.615ms
Modulation	0.3GMSK	0.3GMSK	0.3GMSK	0.3GMSK
MS Power	33dBm~ 5dBm	33dBm~ 5dBm	30dBm~ 0dBm	30dBm~ 0dBm
Power Class	5pcl ~ 19pcl	5pcl ~ 19pcl	0pcl ~ 15pcl	0pcl ~ 15pcl
Sensitivity	-102dBm	-102dBm	-100dBm	-100dBm
TDMA Mux	8	8	8	8
Cell Radius	35Km	35Km	2Km	2Km

2. Specification

2-2. WCDMA General Specification

Item	WCDMA 2100	WCDMA 1900	WCDMA 1700	WCDMA 850	WCDMA 900
Freq. Band[MHz] Uplink/ Downlink	1922~1977 2112~2167	1852~1907 1932~1987	1710~1755 2110~2155	824~849 869~894	880~915 925~960
ARFCN range	UL: 9612~9888 DL: 10562~10838	UL: 9262~9538 DL: 9662~9938	UL: 1312~1513 DL: 1537~1738	UL: 4132~4233 DL: 4357~4458	UL: 2712~2863 DL: 2937~3088
Tx/Rx spacing	190MHz	80MHz	400MHz	45MHz	45MHz
Mod. Bit rate/ Bit Period	3.84Mcps	3.84Mcps	3.84Mcps	3.84Mcps	3.84Mcps
Time Slot Period/ Frame Period	FrameLength: 10ms Slotlength: 0.667ms	FrameLength: 10ms Slotlength: 0.667ms	FrameLength: 10ms Slotlength: 0.667ms	FrameLength: 10ms Slotlength: 0.667ms	FrameLength: 10ms Slotlength: 0.667ms
Modulation	QPSK HQPSK	QPSK HQPSK	QPSK HQPSK	QPSK HQPSK	QPSK HQPSK
MS Power	24dBm~ -50dBm	24dBm~ -50dBm	24dBm~ -50dBm	24dBm~ -50dBm	24dBm~ -50dBm
Power Class	3(max+24dBm)	3(max+24dBm)	3(max+24dBm)	3(max+24dBm)	3(max+24dBm)
Sensitivity	-106.7dBm	-106.7dBm	-106.7dBm	-106.7dBm	-106.7dBm
TDMA Mux	8	8	8	8	8
Cell Radius	2Km	2Km	2Km	2Km	2Km

2. Specification

2-3. CDMA General Specification

Item	US PCS	CDMA	CDMA BC10
Tx Freq. range	1850 ~ 1910MHz	824.04 ~ 848.97MHz	817.9 ~ 823.1MHz
Rx Freq. range	1930 ~ 1990MHz	869.04 ~ 893.97MHz	862.9 ~ 868.1MHz
Channel Bandwidth	1.23MHz	1.23MHz	1.23MHz
Channel Spacing	50KHz	30KHz	25KHz
aNumber of Channel	1200	832	205
Duplex Separation	80MHz	45MHz	45MHz
Type of Emission	1M28F9W	1M28F9W	1M28F9W
Tx Local Frequency	$F_{Tx} * 0.7999$	$F_{Tx} * 1.6666$	$F_{Tx} * 1.6666$
Rx Local Frequency	$F_{Rx} * 0.8888$	$F_{Rx} * 2$	$F_{Rx} * 2$
Frequency Stability	$(F_{Rx}-80MHz) \pm 150Hz$	$(F_{Rx}-45MHz) \pm 300Hz$	$(F_{Rx}-45MHz) \pm 300Hz$
Operating Temperature	-30 °C ~ +60 °C	-30 °C ~ +60 °C	-30 °C ~ +60 °C

2. Specification

2-4. GSM Tx Power Class

TX Power control level	GSM850	TX Power control level	EGSM900	TX Power control level	DCS1800	TX Power control level	PCS1900
5	33±2 dBm	5	33±2 dBm	0	30±3 dBm	0	30±3 dBm
6	31±2 dBm	6	31±2 dBm	1	28±3 dBm	1	28±3 dBm
7	29±2 dBm	7	29±2 dBm	2	26±3 dBm	2	26±3 dBm
8	27±2 dBm	8	27±2 dBm	3	24±3 dBm	3	24±3 dBm
9	25±2 dBm	9	25±2 dBm	4	22±3 dBm	4	22±3 dBm
10	23±2 dBm	10	23±2 dBm	5	20±3 dBm	5	20±3 dBm
11	21±2 dBm	11	21±2 dBm	6	18±3 dBm	6	18±3 dBm
12	19±2 dBm	12	19±2 dBm	7	16±3 dBm	7	16±3 dBm
13	17±2 dBm	13	17±2 dBm	8	14±3 dBm	8	14±3 dBm
14	15±2 dBm	14	15±2 dBm	9	12±4 dBm	9	12±4 dBm
15	13±2 dBm	15	13±2 dBm	10	10±4 dBm	10	10±4 dBm
16	11±3 dBm	16	11±3 dBm	11	8±4 dBm	11	8±4 dBm
17	9±3dBm	17	9±3dBm	12	6±4 dBm	12	6±4 dBm
18	7±3 dBm	18	7±3 dBm	13	4±4 dBm	13	4±4 dBm
19	5±3 dBm	19	5±3 dBm	14	2±5 dBm	14	2±5 dBm
-	-	-	-	15	0±5 dBm	15	0±5 dBm

2. Specification

2-5. LTE General Specification

Item	LTE FDD B1	LTE FDD B2	LTE FDD B3	LTE FDD B4
Tx Freq. range	1920~1980 MHz	1850 ~ 1910 MHz	1710 ~ 1785 MHz	1710~1755 MHz
Rx Freq. range	2110~2170 MHz	1930 ~ 1990 MHz	1805 ~ 1880 MHz	2110~2155 MHz
Channel Bandwidth	5, 10, 15, 20MHz	1.4, 3, 5, 10, 15, 20 MHz	1.4, 3, 5, 10, 15, 20 MHz	1.4, 3, 5, 10, 15, 20 MHz
Channel Spacing	180KHz	180KHz	180KHz	180KHz
Number of Channel	25, 50, 75, 100	6, 15, 25, 50, 75, 100	6, 15, 25, 50, 75, 100	6, 15, 25, 50, 75, 100
Duplex Separation	190 MHz	80 MHz	95 MHz	400 MHz
Type of Emission	4M50G7D (QPSK) 4M50W7D (16QAM) 4M50W7D (64QAM) 4M50W7D (256QAM) 9M00G7D (QPSK) 9M00W7D (16QAM) 9M00W7D (64QAM) 9M00W7D (256QAM) 13M5G7D (QPSK) 13M5W7D (16QAM) 13M5W7D (64QAM) 13M5W7D (256QAM) 18M0G7D (QPSK) 18M0W7D (16QAM) 18M0W7D (64QAM) 18M0W7D (256QAM)	1M10G7D (QPSK) 1M10W7D (16QAM) 1M10W7D (64QAM) 1M10W7D (256QAM) 2M71G7D (QPSK) 2M72W7D (16QAM) 2M71W7D (64QAM) 2M70W7D (256QAM) 4M52G7D (QPSK) 4M52W7D (16QAM) 4M52W7D (64QAM) 4M50W7D (256QAM) 9M04G7D (QPSK) 8M97W7D (16QAM) 9M02W7D (64QAM) 8M98W7D (256QAM) 13M5G7D (QPSK) 13M5W7D (16QAM) 13M5W7D (64QAM) 13M5W7D (256QAM) 18M0G7D (QPSK) 18M0W7D (16QAM) 17M9W7D (64QAM) 18M0W7D (256QAM)	1M11G7D (QPSK) 1M11W7D (16QAM) 1M11W7D (64QAM) 1M11W7D (256QAM) 2M71G7D (QPSK) 2M71W7D (16QAM) 2M71W7D (64QAM) 2M71W7D (256QAM) 4M50G7D (QPSK) 4M50W7D (16QAM) 4M50W7D (64QAM) 4M50W7D (256QAM) 9M00G7D (QPSK) 9M00W7D (16QAM) 9M00W7D (64QAM) 9M00W7D (256QAM) 13M5G7D (QPSK) 13M5W7D (16QAM) 13M5W7D (64QAM) 13M5W7D (256QAM) 18M0G7D (QPSK) 18M0W7D (16QAM) 18M0W7D (64QAM) 18M0W7D (256QAM)	1M10G7D (QPSK) 1M10W7D (16QAM) 1M10W7D (64QAM) 1M10W7D (256QAM) 2M71G7D (QPSK) 2M72W7D (16QAM) 2M71W7D (64QAM) 2M72W7D (256QAM) 4M51G7D (QPSK) 4M52W7D (16QAM) 4M53W7D (64QAM) 4M50W7D (256QAM) 9M04G7D (QPSK) 8M99W7D (16QAM) 9M00W7D (64QAM) 8M99W7D (256QAM) 13M5G7D (QPSK) 13M5W7D (16QAM) 13M5W7D (64QAM) 13M5W7D (256QAM) 18M0G7D (QPSK) 18M9W7D (16QAM) 18M0W7D (64QAM) 17M9W7D (256QAM)
Operating Temperature	-30°C ~ +60°C	-30°C ~ +60°C	-30°C ~ +60°C	-30°C ~ +60°C

2. Specification

Item	LTE FDD B5	LTE FDD B7	LTE FDD B8	LTE FDD B12
Tx Freq. range	824 ~ 849 MHz	2500~2570 MHz	880 ~ 915 MHz	699 ~ 716 MHz
Rx Freq. range	869 ~ 894 MHz	2620~2690 MHz	925 ~ 960 MHz	729 ~ 746 MHz
Channel Bandwidth	1.4, 3, 5, 10 MHz	5, 10,15, 20 MHz	1.4, 3, 5, 10 MHz	1.4, 3, 5, 10 MHz
Channel Spacing	180KHz	180KHz	180KHz	180KHz
Number of Channel	6, 15, 25, 50	25, 50, 75, 100	6, 15, 25, 50	25, 50, 75, 100
Duplex Separation	45 MHz	45 MHz	45 MHz	30 MHz
Type of Emission	1M10G7D (QPSK)	4M52G7D (QPSK)	1M11G7D (QPSK)	1M10G7D (QPSK)
	1M10W7D (16QAM)	4M50W7D (16QAM)	1M11W7D (16QAM)	1M10W7D (16QAM)
	1M10W7D (64QAM)	4M49W7D (64QAM)	1M11W7D (64QAM)	1M10W7D (64QAM)
	1M09W7D (256QAM)	4M52W7D (256QAM)	1M11W7D (256QAM)	1M09W7D (256QAM)
	2M71G7D (QPSK)	9M03G7D (QPSK)	2M71G7D (QPSK)	2M72G7D (QPSK)
	2M72W7D (16QAM)	8M99W7D (16QAM)	2M71W7D (16QAM)	2M72W7D (16QAM)
	2M72W7D (64QAM)	9M02W7D (64QAM)	2M71W7D (64QAM)	2M71W7D (64QAM)
	2M71W7D (256QAM)	9M00W7D (256QAM)	2M71W7D (256QAM)	2M71W7D (256QAM)
	4M52G7D (QPSK)	13M5G7D (QPSK)	4M50G7D (QPSK)	4M51G7D (QPSK)
	4M52W7D (16QAM)	13M5W7D (16QAM)	4M50W7D (16QAM)	4M50W7D (16QAM)
	4M52W7D (64QAM)	13M5W7D (64QAM)	4M50W7D (64QAM)	4M53W7D (64QAM)
	4M52W7D (256QAM)	13M5W7D (256QAM)	4M50W7D (256QAM)	4M51W7D (256QAM)
	9M07G7D (QPSK)	18M0G7D (QPSK)	9M00G7D (QPSK)	9M04G7D (QPSK)
	9M01W7D (16QAM)	18M0W7D (16QAM)	9M00W7D (16QAM)	8M97W7D (16QAM)
	9M03W7D (64QAM)	18M0W7D (64QAM)	9M00W7D (64QAM)	9M02W7D (64QAM)
	9M01W7D (256QAM)	18M0W7D (256QAM)	9M00W7D (256QAM)	9M02W7D (256QAM)
Operating Temperature	-30°C ~ +60°C	-30°C ~ +60°C	-30°C ~ +60°C	-30°C ~ +60°C

2. Specification

Item	LTE FDD B13	LTE FDD B14	LTE FDD B18	LTE FDD B19
Tx Freq. range	777~787 MHz	788 ~ 798 MHz	815 ~ 830 MHz	830 ~ 845 MHz
Rx Freq. range	746~756 MHz	758 ~ 768 MHz	860 ~ 875 MHz	875 ~ 890 MHz
Channel Bandwidth	5, 10 MHz	5, 10 MHz	5, 10, 15 MHz	5, 10, 15 MHz
Channel Spacing	180KHz	180KHz	180KHz	180KHz
Number of Channel	25, 50	25, 50	25, 50, 75	25, 50, 75
Duplex Separation	-31 MHz	-30 MHz	45 MHz	45 MHz
Type of Emission	4M53G7D (QPSK) 4M50W7D (16QAM) 4M53W7D (64QAM) 4M52W7D (256QAM) 9M02G7D (QPSK) 8M98W7D (16QAM) 9M00W7D (64QAM) 8M99W7D (256QAM)	4M51G7D (QPSK) 4M51W7D (16QAM) 4M52W7D (64QAM) 4M52W7D (256QAM) 9M03G7D (QPSK) 8M99W7D (16QAM) 9M02W7D (64QAM) 8M98W7D (256QAM)	4M50G7D (QPSK) 4M50W7D (16QAM) 4M50W7D (64QAM) 4M50W7D (256QAM) 9M00G7D (QPSK) 9M00W7D (16QAM) 9M00W7D (64QAM) 9M00W7D (256QAM) 13M5G7D (QPSK) 13M5W7D (16QAM) 13M5W7D (64QAM) 13M5W7D (256QAM)	4M50G7D (QPSK) 4M50W7D (16QAM) 4M50W7D (64QAM) 4M50W7D (256QAM) 9M00G7D (QPSK) 9M00W7D (16QAM) 9M00W7D (64QAM) 9M00W7D (256QAM) 13M5G7D (QPSK) 13M5W7D (16QAM) 13M5W7D (64QAM) 13M5W7D (256QAM)
Operating Temperature	-30°C ~ +60°C	-30°C ~ +60°C	-30°C ~ +60°C	-30°C ~ +60°C

2. Specification

Item	LTE FDD B20	LTE FDD B25	LTE FDD B26	LTE FDD B28
Tx Freq. range	832 ~ 862 MHz	1850~1915 MHz	814 ~ 849 MHz	703 ~ 748 MHz
Rx Freq. range	791 ~ 821 MHz	1930~1995 MHz	859 ~ 894 MHz	758 ~ 803 MHz
Channel Bandwidth	5, 10, 15, 20 MHz	1.4, 3, 5, 10, 15, 20 MHz	1.4, 3, 5, 10, 15 MHz	3, 5, 10, 15, 20 MHz
Channel Spacing	180KHz	180KHz	180KHz	180KHz
Number of Channel	25, 50, 75, 100	6, 15, 25, 50, 75, 100	6, 15, 25, 50, 75	15, 25, 50, 75, 100
Duplex Separation	-41 MHz	80 MHz	45 MHz	55 MHz
Type of Emission	4M50G7D (QPSK) 4M50W7D (16QAM) 4M50W7D (64QAM) 4M50W7D (256QAM) 9M00G7D (QPSK) 9M00W7D (16QAM) 9M00W7D (64QAM) 9M00W7D (256QAM) 13M5G7D (QPSK) 13M5W7D (16QAM) 13M5W7D (64QAM) 13M5W7D (256QAM) 18M0G7D (QPSK) 18M0W7D (16QAM) 18M0W7D (64QAM) 18M0W7D (256QAM)	1M10G7D (QPSK) 1M10W7D (16QAM) 1M10W7D (64QAM) 1M10W7D (256QAM) 2M71G7D (QPSK) 2M72W7D (16QAM) 2M71W7D (64QAM) 2M70W7D (256QAM) 4M52G7D (QPSK) 4M52W7D (16QAM) 4M52W7D (64QAM) 4M50W7D (256QAM) 9M04G7D (QPSK) 8M97W7D (16QAM) 9M02W7D (64QAM) 8M98W7D (256QAM) 13M5G7D (QPSK) 13M5W7D (16QAM) 13M5W7D (64QAM) 13M5W7D (256QAM) 18M0G7D (QPSK) 18M0W7D (16QAM) 17M9W7D (64QAM) 18M0W7D (256QAM)	1M10G7D (QPSK) 1M10W7D (16QAM) 1M10W7D (64QAM) 1M09W7D (256QAM) 2M71G7D (QPSK) 2M72W7D (16QAM) 2M72W7D (64QAM) 2M71W7D (256QAM) 4M52G7D (QPSK) 4M52W7D (16QAM) 4M52W7D (64QAM) 9M07G7D (QPSK) 9M01W7D (16QAM) 9M03W7D (64QAM) 9M01W7D (256QAM) 13M5G7D (QPSK) 13M5W7D (16QAM) 13M5W7D (64QAM) 13M5W7D (256QAM)	2M71G7D (QPSK) 2M71W7D (16QAM) 2M71W7D (64QAM) 2M71W7D (256QAM) 4M50G7D (QPSK) 4M50W7D (16QAM) 4M50W7D (64QAM) 4M50W7D (256QAM) 9M00G7D (QPSK) 9M00W7D (16QAM) 9M00W7D (64QAM) 9M00W7D (256QAM) 13M5G7D (QPSK) 13M5W7D (16QAM) 13M5W7D (64QAM) 13M5W7D (256QAM) 18M0G7D (QPSK) 18M0W7D (16QAM) 18M0W7D (64QAM) 18M0W7D (256QAM)
Operating Temperature	-30°C ~ +60°C	-30°C ~ +60°C	-30°C ~ +60°C	-30°C ~ +60°C

2. Specification

Item	LTE FDD B30	LTE TDD B38	LTE TDD B39	LTE TDD B40
Tx Freq. range	2305 ~ 2315 MHz	2570 ~ 2620 MHz	1880~1920 MHz	2300 ~ 2400 MHz
Rx Freq. range	2350 ~ 2360 MHz	2570 ~ 2620 MHz	1880~1920 MHz	2300 ~ 2400 MHz
Channel Bandwidth	5, 10 MHz	5, 10, 15, 20 MHz	5, 10, 15, 20 MHz	5, 10, 15, 20 MHz
Channel Spacing	180KHz	180KHz	180KHz	180KHz
Number of Channel	25, 50	25, 50, 75, 100	25, 50, 75, 100	25, 50, 75, 100
Duplex Separation	45 MHz	-	-	-
Type of Emission	4M51G7D (QPSK) 4M50W7D (16QAM) 4M52W7D (64QAM) 4M52W7D (256QAM) 9M02G7D (QPSK) 9M01W7D (16QAM) 9M02W7D (64QAM) 9M01W7D (256QAM)	4M51G7D (QPSK) 4M51W7D (16QAM) 4M53W7D (64QAM) 4M51W7D (256QAM) 9M01G7D (QPSK) 9M00W7D (16QAM) 9M01W7D (64QAM) 8M99W7D (256QAM) 13M5G7D (QPSK) 13M5W7D (16QAM) 13M5W7D (64QAM) 13M5W7D (256QAM) 18M0G7D (QPSK) 18M0W7D (16QAM) 17M9W7D (64QAM) 17M9W7D (256QAM)	4M50G7D (QPSK) 4M50W7D (16QAM) 4M50W7D (64QAM) 4M50W7D (256QAM) 9M00G7D (QPSK) 9M00W7D (16QAM) 9M00W7D (64QAM) 9M00W7D (256QAM) 13M5G7D (QPSK) 13M5W7D (16QAM) 13M5W7D (64QAM) 13M5W7D (256QAM) 18M0G7D (QPSK) 18M0W7D (16QAM) 18M0W7D (64QAM) 18M0W7D (256QAM)	4M50G7D (QPSK) 4M50W7D (16QAM) 4M50W7D (64QAM) 4M50W7D (256QAM) 9M00G7D (QPSK) 9M00W7D (16QAM) 9M00W7D (64QAM) 9M00W7D (256QAM) 13M5G7D (QPSK) 13M5W7D (16QAM) 13M5W7D (64QAM) 13M5W7D (256QAM) 18M0G7D (QPSK) 18M0W7D (16QAM) 18M0W7D (64QAM) 18M0W7D (256QAM)
Operating Temperature	-30°C ~ +60°C	-30°C ~ +60°C	-30°C ~ +60°C	-30°C ~ +60°C

2. Specification

Item	LTE TDD B41	LTE TDD B48	LTE FDD B66	LTE FDD B71
Tx Freq. range	2496~ 2690 MHz	3550~ 3700 MHz	1710 ~ 1780 MHz	663 ~ 698 MHz
Rx Freq. range	2496~ 2690 MHz	3550~ 3700 MHz	2110 ~ 2200 MHz	617 ~ 652 MHz
Channel Bandwidth	5, 10, 15, 20 MHz	5, 10, 15, 20 MHz	1.4, 3, 5, 10, 15, 20 MHz	5, 10, 15, 20 MHz
Channel Spacing	180KHz	180KHz	180KHz	180KHz
Number of Channel	25, 50, 75, 100	25, 50, 75, 100	6, 15, 25, 50, 75, 100	25, 50, 75, 100
Duplex Separation	-	-	400 MHz	-46 MHz
Type of Emission	4M51G7D (QPSK) 4M51W7D (16QAM) 4M52W7D (64QAM) 4M49W7D (256QAM) 9M01G7D (QPSK) 8M99W7D (16QAM) 9M01W7D (64QAM) 8M97W7D (256QAM) 13M5G7D (QPSK) 13M5W7D (16QAM) 13M5W7D (64QAM) 13M5W7D (256QAM) 18M0G7D (QPSK) 18M0W7D (16QAM) 17M9W7D (64QAM) 17M9W7D (256QAM)	4M53G7D (QPSK) 4M53W7D (16QAM) 4M52W7D (64QAM) 4M50W7D (256QAM) 9M01G7D (QPSK) 9M01W7D (16QAM) 9M03W7D (64QAM) 8M99W7D (256QAM) 13M5G7D (QPSK) 13M5W7D (16QAM) 13M5W7D (64QAM) 13M5W7D (256QAM) 18M0G7D (QPSK) 18M0W7D (16QAM) 18M0W7D (64QAM) 17M9W7D (256QAM)	1M10G7D (QPSK) 1M10W7D (16QAM) 1M10W7D (64QAM) 1M10W7D (256QAM) 2M71G7D (QPSK) 2M72W7D (16QAM) 2M71W7D (64QAM) 2M72W7D (256QAM) 4M51G7D (QPSK) 4M52W7D (16QAM) 4M53W7D (64QAM) 4M50W7D (256QAM) 9M04G7D (QPSK) 8M99W7D (16QAM) 9M00W7D (64QAM) 8M99W7D (256QAM) 13M5G7D (QPSK) 13M5W7D (16QAM) 13M5W7D (64QAM) 13M5W7D (256QAM) 18M0G7D (QPSK) 13M5W7D (16QAM) 13M5W7D (64QAM) 13M5W7D (256QAM) 18M0G7D (QPSK) 18M9W7D (16QAM) 18M0W7D (64QAM) 17M9W7D (256QAM)	4M52G7D (QPSK) 4M51W7D (16QAM) 4M52W7D (64QAM) 4M50W7D (256QAM) 9M04G7D (QPSK) 9M00W7D (16QAM) 9M02W7D (64QAM) 9M00W7D (256QAM) 13M5G7D (QPSK) 13M5W7D (16QAM) 13M5W7D (64QAM) 13M4W7D (256QAM) 18M0G7D (QPSK) 18M0W7D (16QAM) 18M0W7D (64QAM) 18M0W7D (256QAM)
Operating Temperature	-30°C ~ +60°C	-30°C ~ +60°C	-30°C ~ +60°C	-30°C ~ +60°C

2. Specification

Item	LTE FDD B29	LTE TDD B46
Tx Freq. range	-	-
Rx Freq. range	717 ~ 728MHz	5150 ~ 5925 MHz
Channel Bandwidth	3, 5,10 MHz	10, 20 MHz
Channel Spacing	180KHz	180KHz
Number of Channel	15, 25, 50	50, 100
Duplex Separation	-	-
Type of Emission	-	-
Operating Temperature	-30°C ~ +60°C	-30°C ~ +60°C

2. Specification

2-6. NR General Specification

Item	N71 FDD	N41 TDD	N5 FDD
Tx Freq. range	663~698	2496~2690	824~849
Rx Freq. range	617~652	2496~2690	869~894
Channel Bandwidth	5,10,15,20	20, 40, 50, 60, 80, 90, 100 MHz	5,10,15,20
Duplex Separation	-46	0	45
Type of Emission	4M52G7D(QPSK) 4M51W7D(16QAM) 4M54W7D(64QAM) 4M50W7D(256QAM) 9M00G7D(QPSK) 8M93W7D(16QAM) 8M97W7D(64QAM) 9M00W7D(256QAM) 14M0G7D(QPSK) 13M8W7D(16QAM) 13M8W7D(64QAM) 13M5W7D(256QAM) 18M0G7D(QPSK) 17M9W7D(16QAM) 18M0W7D(64QAM) 17M9W7D(256QAM)	18M3G7D(QPSK) 18M3W7D(16QAM) 18M3W7D(64QAM) 18M3W7D(256QAM) 37M9G7D(QPSK) 37M9W7D(16QAM) 37M9W7D(64QAM) 37M7W7D(256QAM) 47M6G7D(QPSK) 47M4W7D(16QAM) 47M5W7D(64QAM) 47M4W7D(256QAM) 58M0G7D(QPSK) 58M0W7D(16QAM) 57M9W7D(64QAM) 57M7W7D(256QAM) 78M4G7D(QPSK) 78M6W7D(16QAM) 78M5W7D(64QAM) 78M2W7D(256QAM) 87M9G7D(QPSK) 88M1W7D(16QAM) 87M8W7D(64QAM) 87M9W7D(256QAM) 97M7G7D(QPSK) 97M5W7D(16QAM) 97M7W7D(64QAM) 97M7W7D(256QAM)	4M50G7D(QPSK) 4M54W7D(16QAM) 4M53W7D(64QAM) 4M53W7D(256QAM) 9M04G7D(QPSK) 8M95W7D(16QAM) 8M99W7D(64QAM) 9M00W7D(256QAM) 13M5G7D(QPSK) 13M4W7D(16QAM) 13M5W7D(64QAM) 13M5W7D(256QAM) 18M0G7D(QPSK) 18M0W7D(16QAM) 17M9W7D(64QAM) 17M9W7D(256QAM)
Operating Temperature	-30°C ~ +60°C	-30°C ~ +60°C	-30°C ~ +60°C

2. Specification

Item	N2 FDD	N66 TDD	N261 TDD	N260 TDD
Tx Freq. range	1850~1910	2110~2200	27500~28350	37000~40000
Rx Freq. range	1930~1990	1710~1780	27500~28350	37000~40000
Channel Bandwidth	5,10,15,20 MHz	5,10,15,20 MHz	50,100,200,400	50,100,200,400
Duplex Separation	80	-400	-	-
Type of Emission	4M52G7D(QPSK) 4M49W7D(16QAM) 4M51W7D(64QAM) 4M49W7D(256QAM) 9M33G7D(QPSK) 8M97W7D(16QAM) 8M96W7D(64QAM) 9M02W7D(256QAM) 14M2G7D(QPSK) 13M5W7D(16QAM) 13M5W7D(64QAM) 13M5W7D(256QAM) 19M0G7D(QPSK) 18M9W7D(16QAM) 19M0W7D(64QAM) 19M0W7D(256QAM)	4M54G7D(QPSK) 4M51W7D(16QAM) 4M57W7D(64QAM) 4M50W7D(256QAM) 9M31G7D(QPSK) 9M34W7D(16QAM) 9M33W7D(64QAM) 9M36W7D(256QAM) 14M2G7D(QPSK) 14M2W7D(16QAM) 14M2W7D(64QAM) 14M2W7D(256QAM) 19M0G7D(QPSK) 19M1W7D(16QAM) 19M1W7D(64QAM) 19M0W7D(256QAM)	45M7G7D(QPSK) 45M3W7D(16QAM) 45M2W7D(64QAM) 94M9G7D(QPSK) 94M6W7D(16QAM) 94M4W7D(64QAM) 90M7G7D(QPSK) 90M5W7D(16QAM) 90M8W7D(64QAM) 189MG7D(QPSK) 189MW7D(16QAM) 190MW7D(64QAM)	45M2G7D(QPSK) 45M3W7D(16QAM) 45M6W7D(64QAM) 94M8G7D(QPSK) 94M8W7D(16QAM) 94M8W7D(64QAM) 90M9G7D(QPSK) 90M6W7D(16QAM) 90M8W7D(64QAM) 189MG7D(QPSK) 189MW7D(16QAM) 190MW7D(64QAM)
Operating Temperature	-30°C ~ +60°C	-30°C ~ +60°C	-30°C ~ +60°C	-30°C ~ +60°C

3. Product Function

Specification

Item	Description
OS	Android Q OS V10.0
Network	2G - GSM : GSM850 / GSM900 / DCS1800 / PCS1900 3G - WCDMA : B1 / B2 / B4 / B5 / B8 4G LTE - FDD : B1 / B2 / B3 / B4 / B5 / B7 / B8 / B12 / B13 / B14 / B18 / B19 / B20 / B25 / B26 / B28 / B29 / B30 / B66 / B71 - TDD : B38 / B39 / B40 / B41 / B46 / B48 5G - Sub6 : n71, n5, n66, n2, n41 - mmWave : n260, n261
Battery	4,500 mAh
Processor	SM8250-2-AB, 3.09 GHz / 2.4 GHz /1.8 GHz
Connectivity	GPS, Glonass, Galileo, BT 5.0 full support, USB 3.1,WiFi 11 a/b/g/n/ac/ax (2.4G+5GHz),NFC, MST
Camera	Rear - Wide : 108MP, A/F, OIS, F1.8 - Tele : 12MP, A/F, OIS, F3.0 - Ultra Wide : 12MP, F2.2 Front : 10MP, A/F, F2.2
Display	6.9" QHD+, Dynamic AMOLED 2X
RAM	12 GB
ROM	128 / 512 GB
Sensor	Accelerometer, Barometer, Fingerprint Sensor, Gyro Sensor, Geomagnetic Sensor, Hall Sensor, Light Sensor, Proximity Sensor, Laser AF sensor

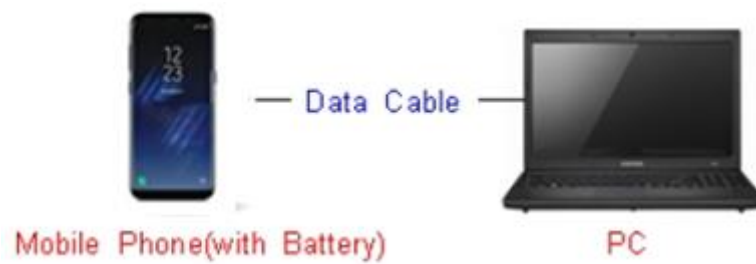
6. Level 1 Repair

6-1. S/W Update

6-1-1. Preparation

- S/W Update program: **Fenrir 5.19.xxxx**
- Mobile Phone
- Data Cable

※ Settings



Data Cable :
GH39-02023A
GH39-02025A
GH39-02031A
GH39-02033A

6. Level 1 Repair

6-1-2. How to use 'Fenrir' S/W update program.



1) Launch Fenrir by clicking on the icon on the desktop

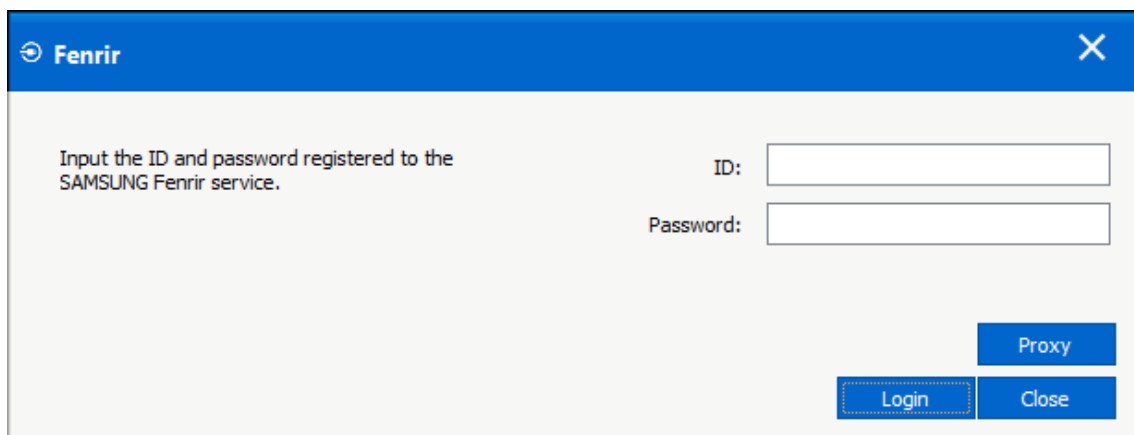
- SVH (Fenrir_Home) : It uses Home binary which does not have user data area in the memory when flashed to a device. (Keep user data)

- SVC (Fenrir_Factory) : It uses Factory binary which erases all user data in the memory when flashed to a device. (Clear user data)

- SVA (Fenrir_All) : It uses Factory and Home binaries. you can download Home and Factory binary in a PC. (but requires double HDD storage and NW traffic)

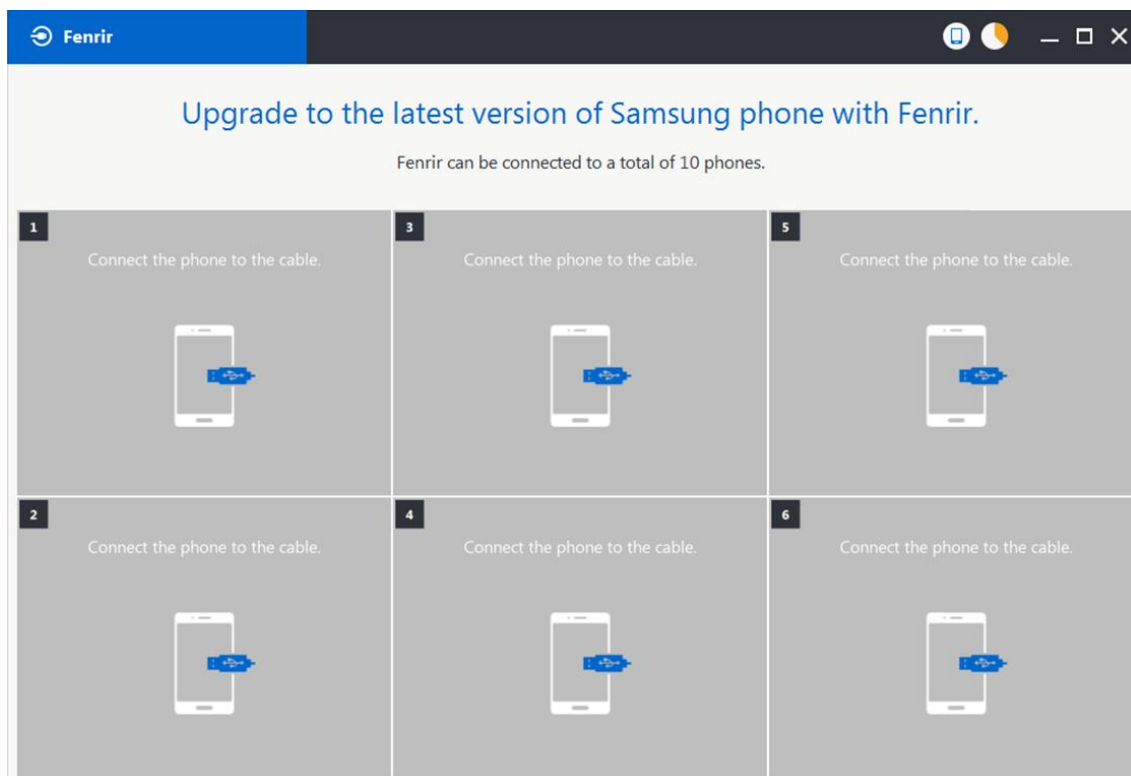
2) Input ID & password

※ You need to reset the ID information in case of PC change and format and repair, hard disk change.

A screenshot of the Fenrir software interface. It has a blue header bar with the 'Fenrir' logo and a close button (X). The main area is light gray. On the left, it says 'Input the ID and password registered to the SAMSUNG Fenrir service.' On the right, there are two input fields: 'ID:' and 'Password:'. Below these fields are three buttons: 'Proxy', 'Login', and 'Close'. The 'Login' button is highlighted with a dashed orange border.

6. Level 1 Repair

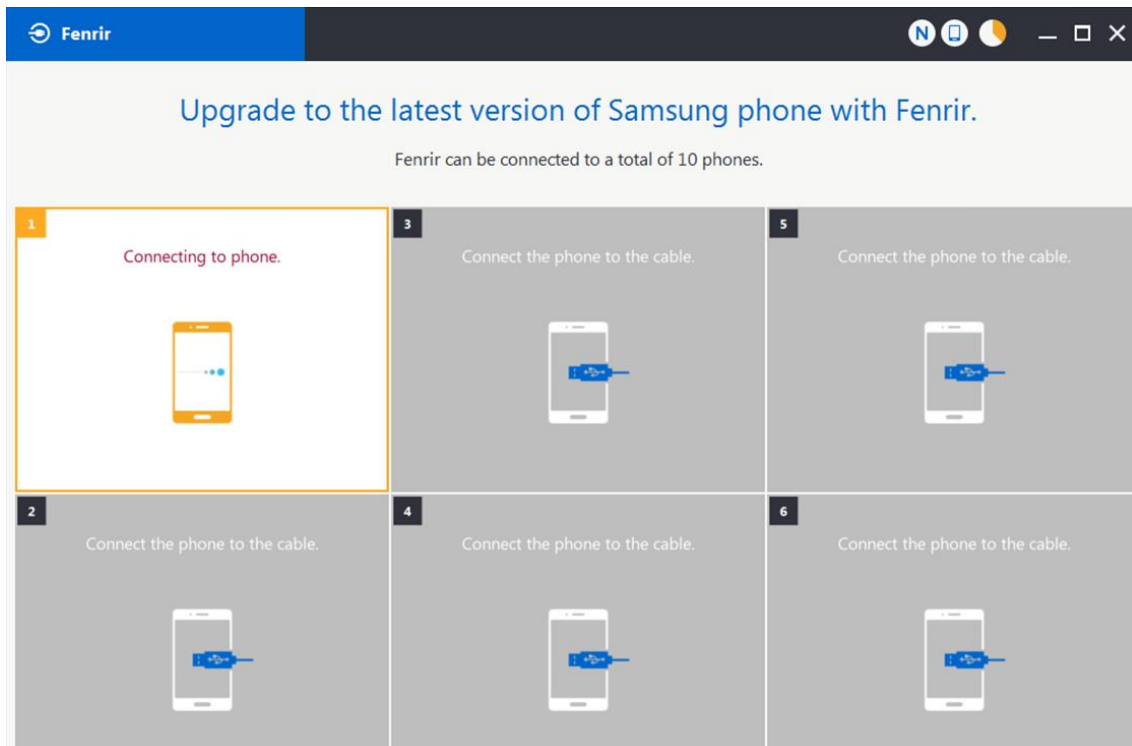
3) Ensure device has sufficient charge (at least 20%) to start firmware update.



4) Connect the device to PC via data cable.

6. Level 1 Repair

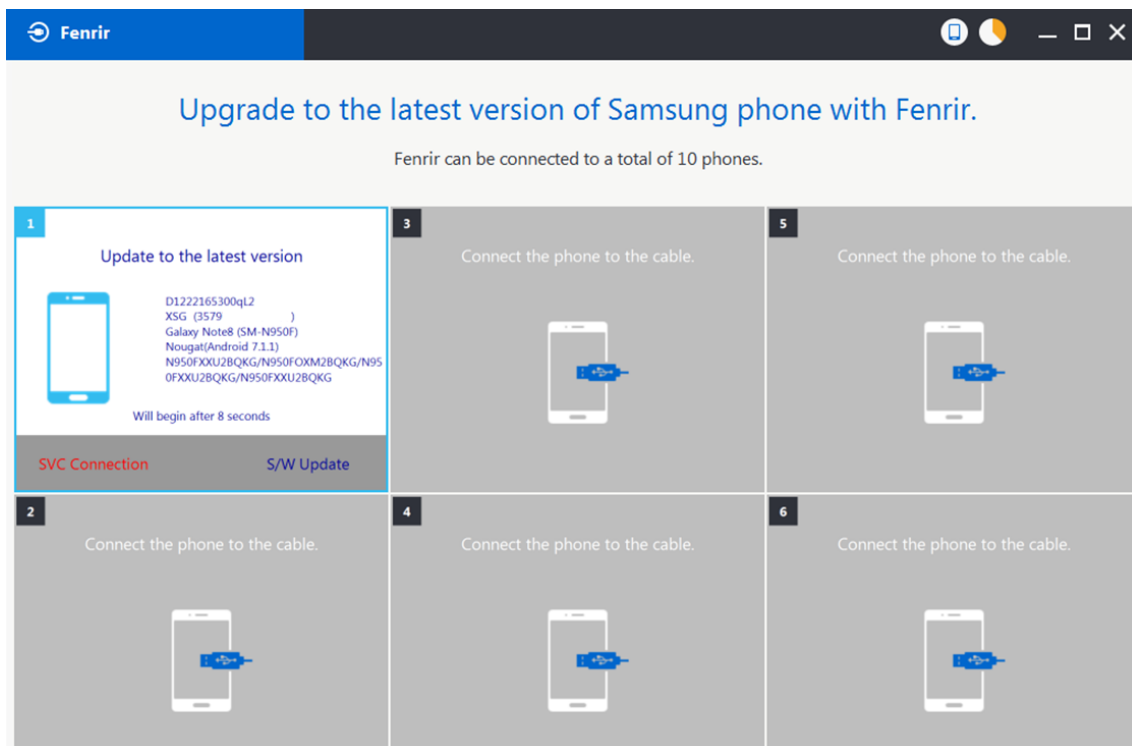
5) Upon USB connection, you will be presented with below screen.



6) Once device is detected, you will be presented with below screen.

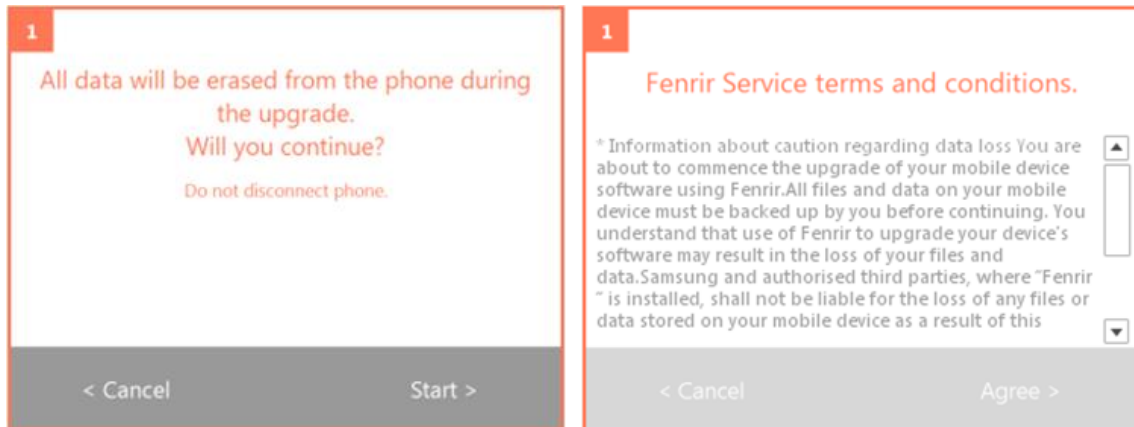
To update S/W, select "S/W Update" or to exit select "SVC Connection".

If you select "SVC Connection", only Fenrir connection history (record) will be stored in the FUS server to support warranty validation. (This is known as "Service Connection" history)

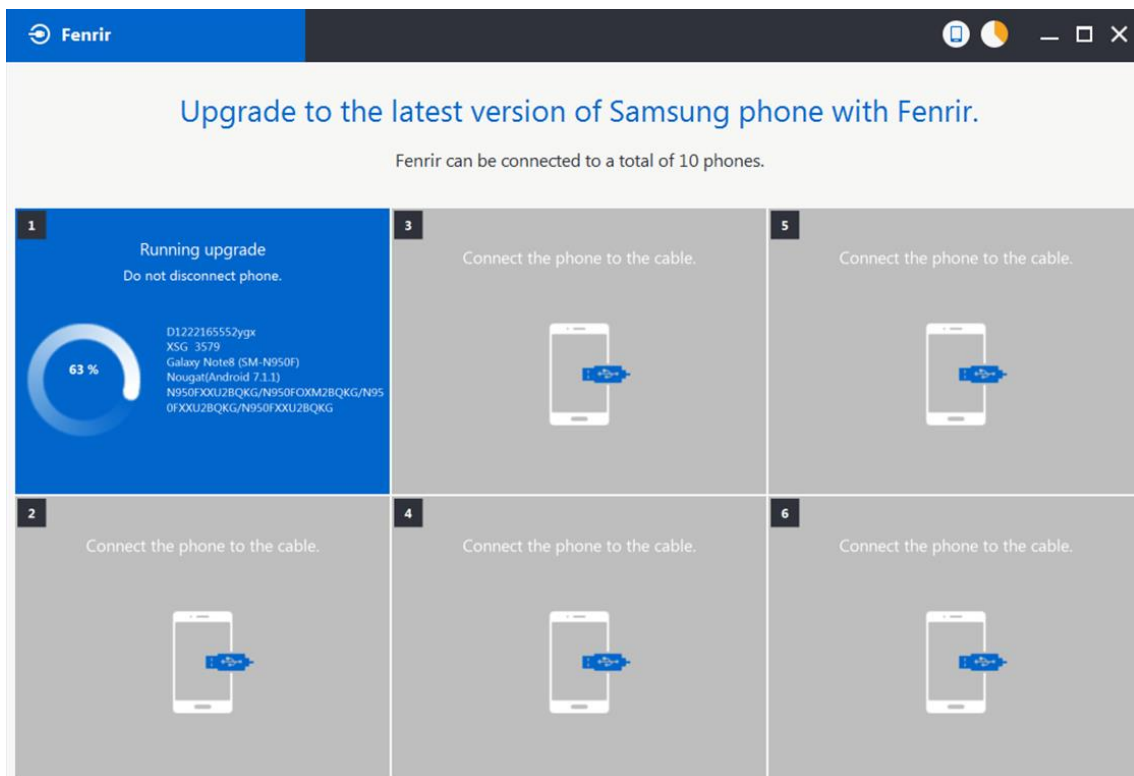


6. Level 1 Repair

7) Once Fenrir starts, application will display the below screen. And select the Start button & Agree button.

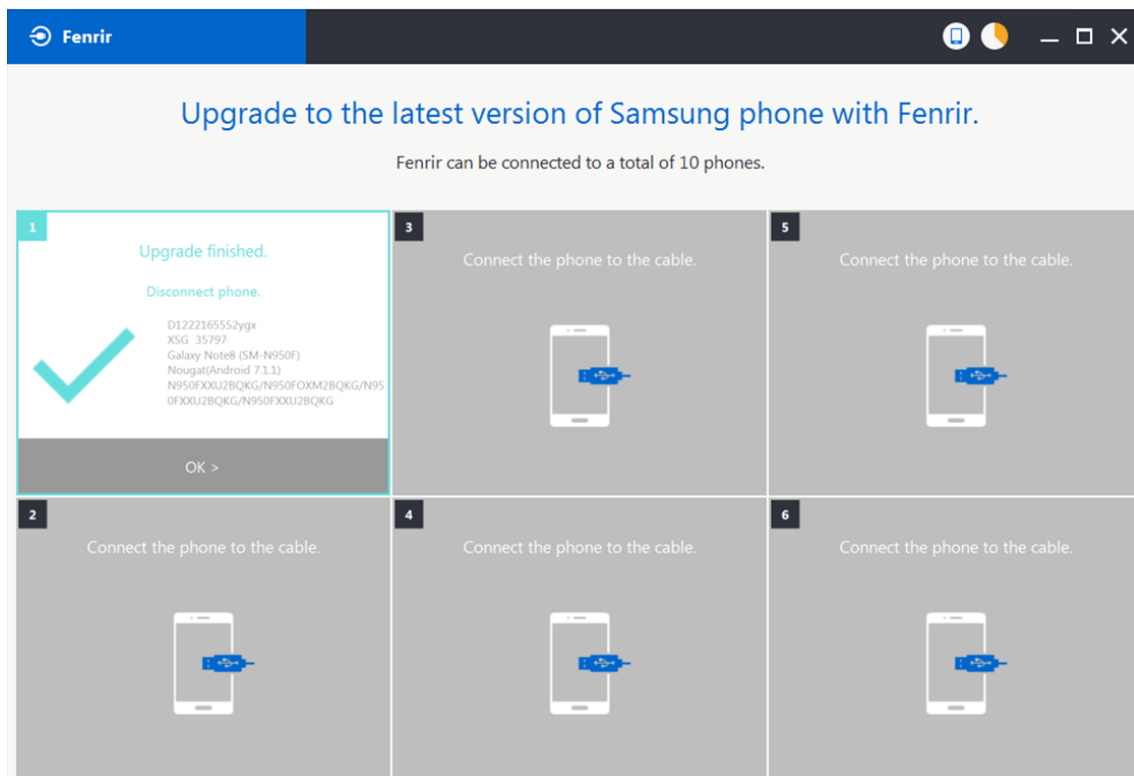


8) The status circle increases as the update installs.
The update process takes approximately 5-10 minutes to complete.
Do not disconnect the device from USB during processing.



6. Level 1 Repair

9) Once complete, application will present the below screen indicating update complete. Click Ok and detach device from USB.



6. Level 1 Repair

6-2. How to use 'Odin' program

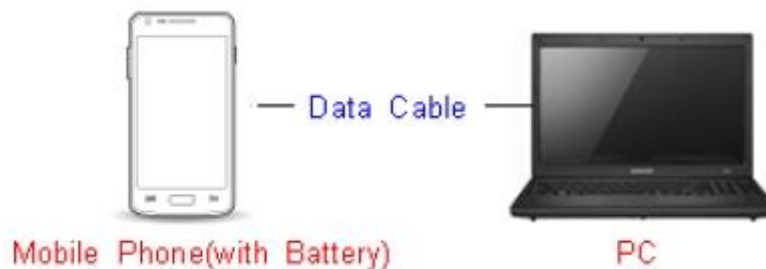
※ S/W Update via Fenrir is mandatory.

Below is the method to use 'Odin' program in any specific case.

6-2-1. Preparation

- Installation program: **Odin3 v3.14.4.exe or above**
- Mobile Phone
- Data Cable
- S/W Binary files (downloaded from GSPN)

※ Settings

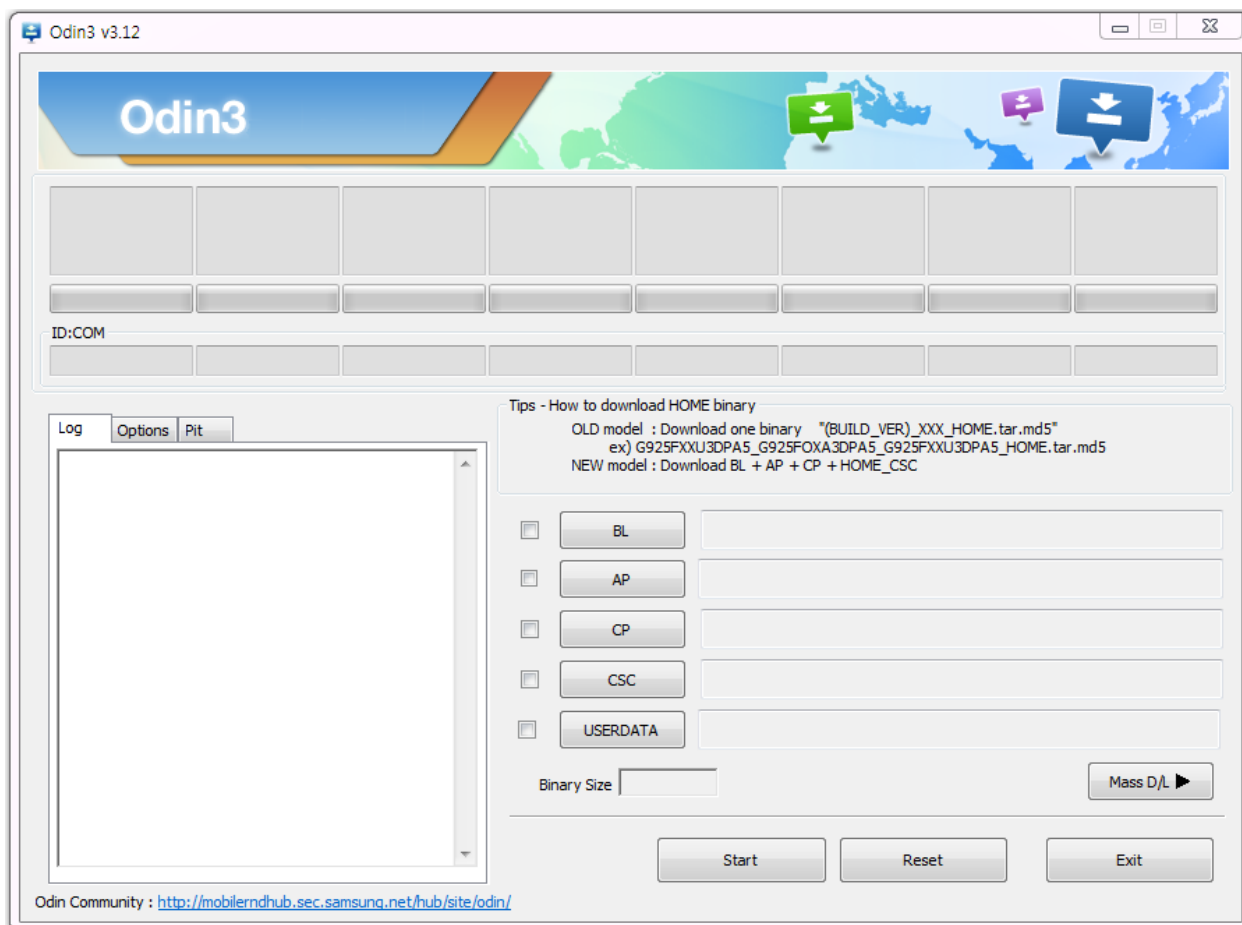


Data Cable :
GH39-02023A
GH39-02025A
GH39-02031A
GH39-02033A

6. Level 1 Repair

6-2-2. S/W Installation Program (Downloader program)

Open up the S/W Installation Program by executing the "**Odin3 v3.14.4.exe**"

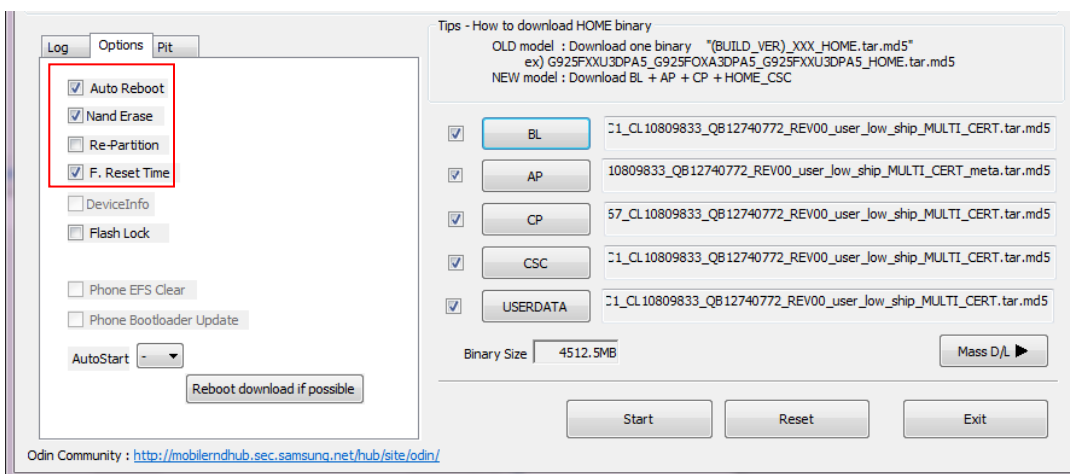
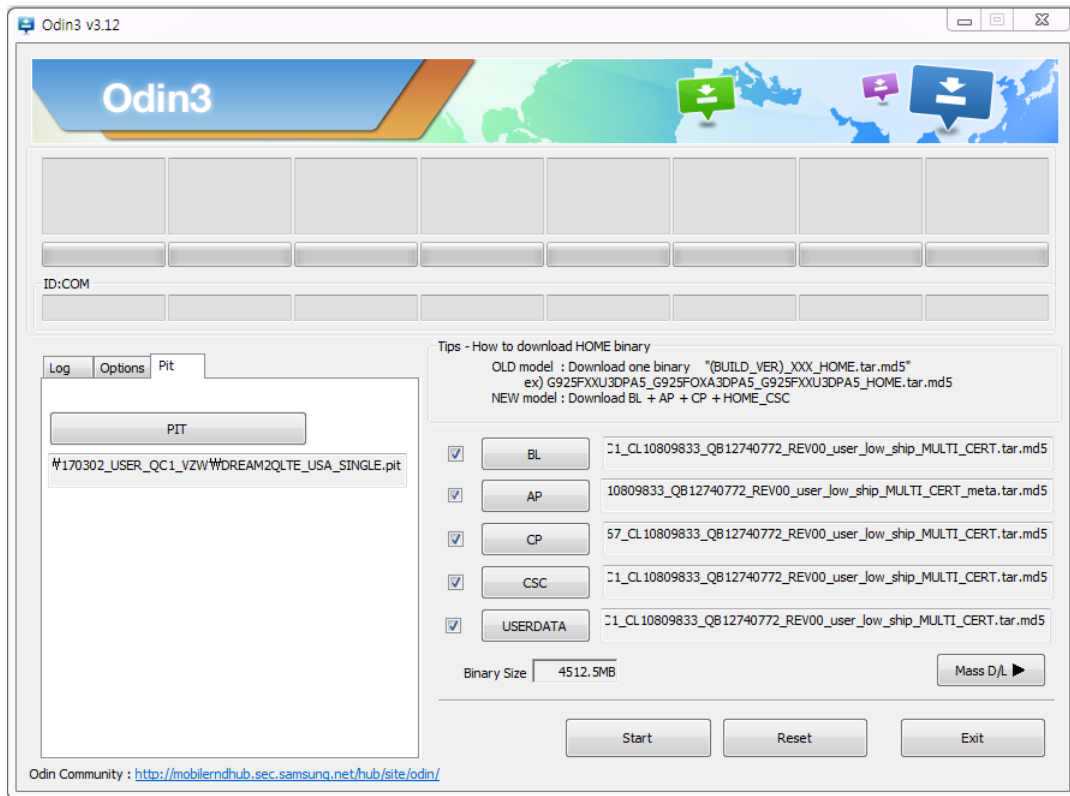


6. Level 1 Repair

1. Enable the check mark by click on the following options

- Check Auto Reboot, F. Reset Time, Nand Erase
- Check BOOTLOADER, PDA, PHONE, CSC and USERDATA Files

* Note : "Odin v3.14.4 or above" checks MD5 checksum just after file selection.



6. Level 1 Repair

2. Enter into Download Mode

- Enter into Download Mode by pressing 2 button(Volume Up button + Volume Down) simultaneously and connect USB cable.
- Press volume up button after 'Warning' message and 'Downloading' message is displayed.



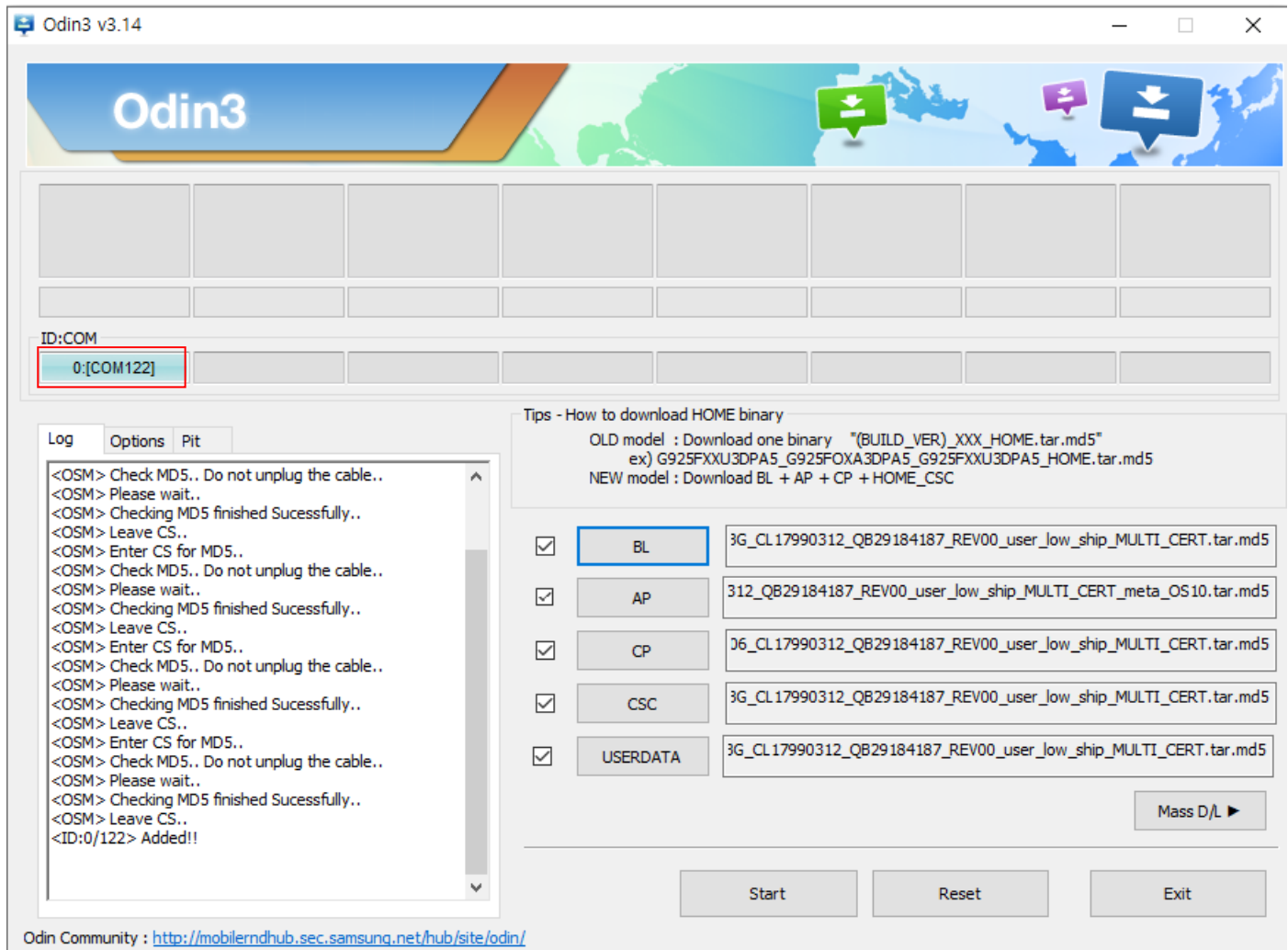
**Volume Up
+
Volume Down**

USB Cable

6. Level 1 Repair

3. Connect the device to PC via Data Cable.

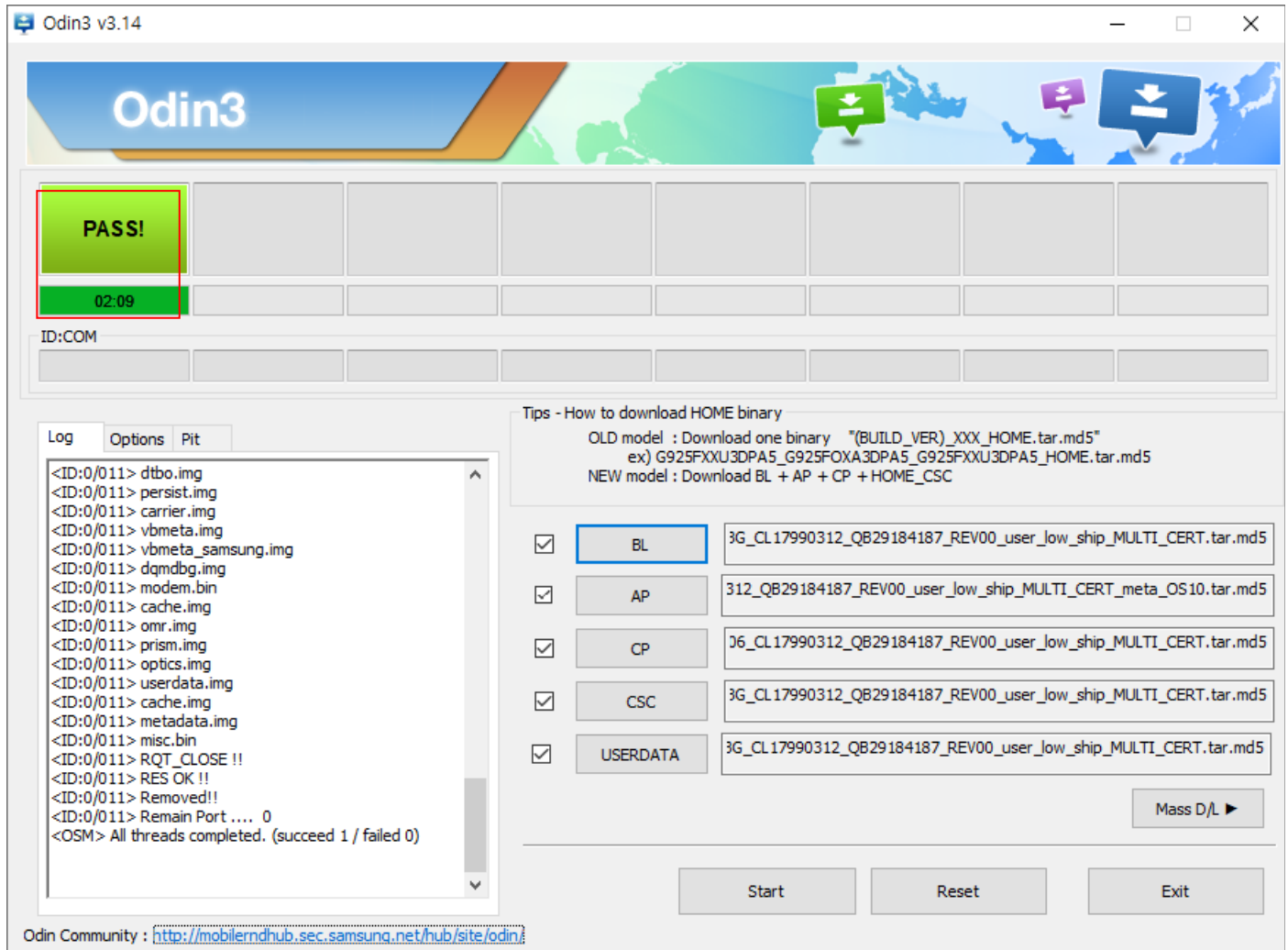
Make sure that the one of communication ports [ID:COM] box is highlighted in sky blue.
The device is now connected with the PC and ready to download the binary files in it.



6. Level 1 Repair

4. Start downloading the binary files into the device by clicking Start button on the screen.

The green colored "PASS!" sign will appear on the upper-left box if the binary files have been successfully downloaded into the device.



5. Disconnect the device from the Data cable.

6. Once the device boots up, you can check the version of the binary file or name by pressing the following code in sequence; ***#1234#**

You can perform Factory data Reset by Settings → General Management → Reset

※ Caution. Never disconnect during the S/W downloading.

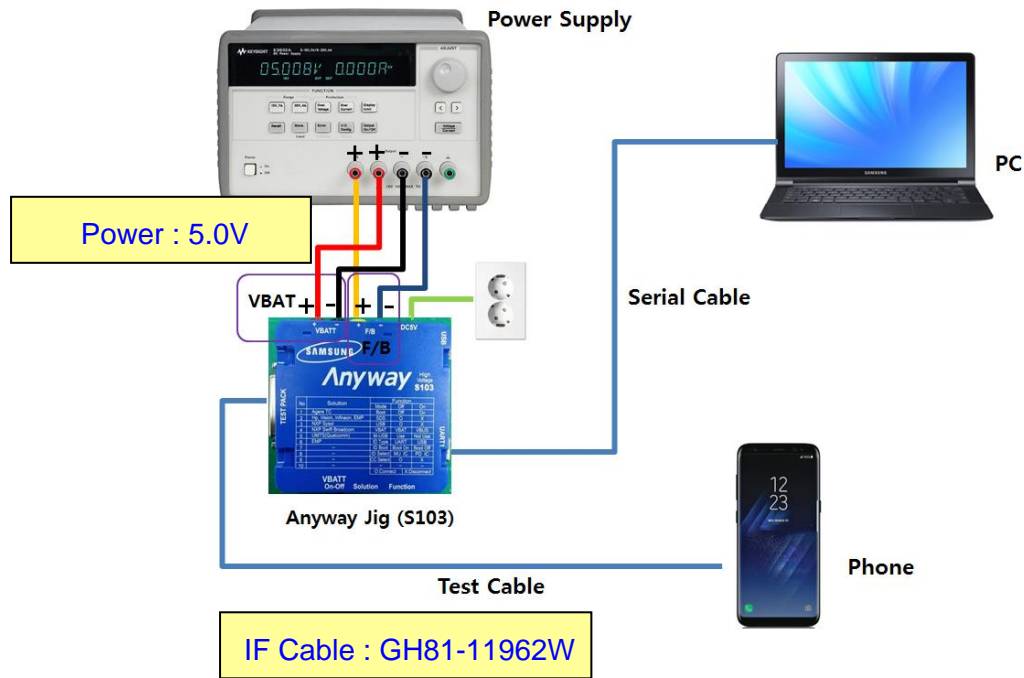
6. Level 1 Repair

6-3. IMEI writing

6-3-1. Preparation

- New IMEI writing Program has been released.
- Supported Model : Models which CAB files are uploaded on HHPsvc INI File category, instead of ini file.
- Refer to below IMEI writing procedure.

- H/W



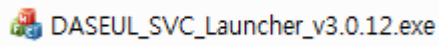
- S/W

① Library Install	To use Daseul, library files should be installed. Refer to SVC Bulletin “(11-82) Daseul (New IMEI writing Program) Library Install guide_rev1.0”
② Launcher	DASEUL_SVC_Launcher_v3.0.12 or higher -Uploaded on HHPsvc Notice
③ Runtime File	1. DASEUL_IMEI_ALL_Runtime_3.1.281.0_r00405.CAB or higher -Uploaded on HHPsvc Notice 2. Make 'ModelName' folder at the same position with launcher & Runtime file. DASEUL_IMEI_ALL_SVC_Runtime_3.1.478.0_r00704 DASEUL_SVC_Launcher_v3.0.12 SM-G986U_SIM(VZW)_IMEI_Ver_3.1.454.4
④ Model File	Copy Model File under the 'Model Name' folder

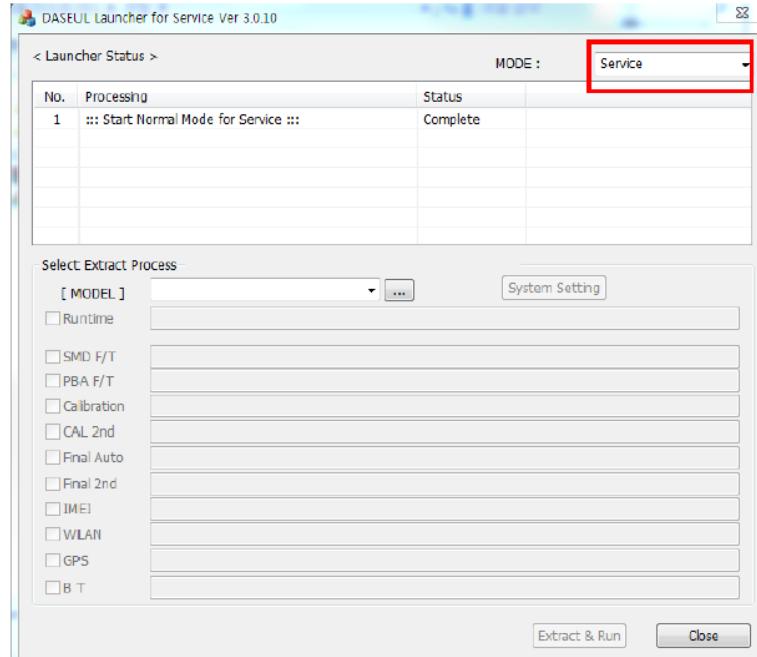
6. Level 1 Repair


6-3-2. IMEI writing Process

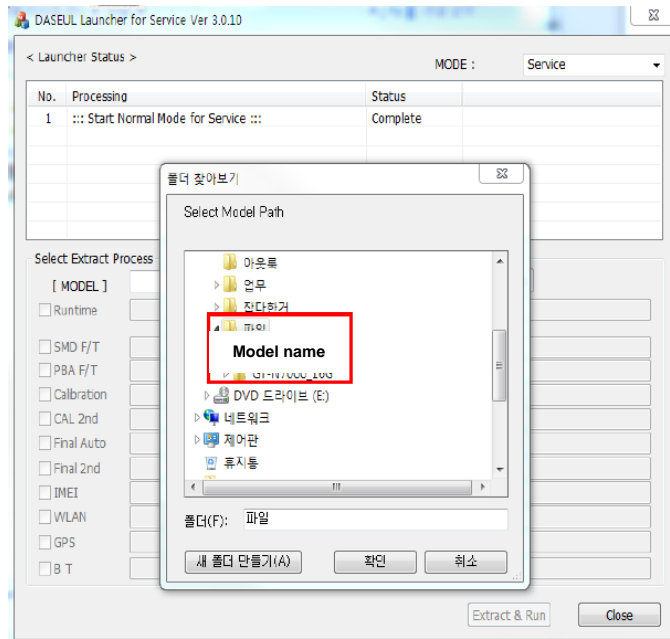
1. Run DASEUL_SVC_Launcher_v3.0.12.exe



2. Select Service Mode

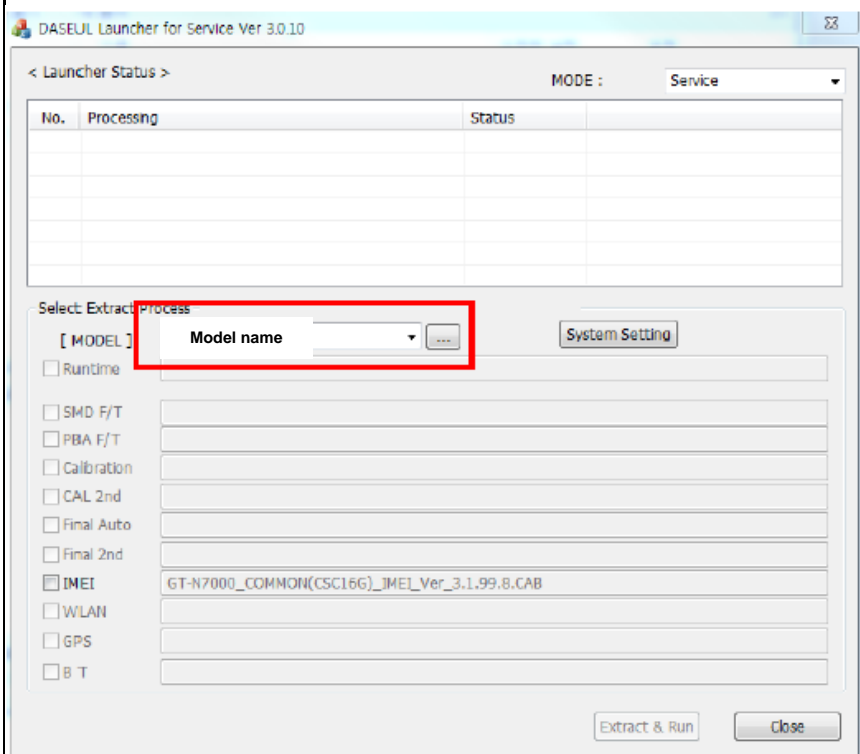


3. Click  and Select folder where the Launcher exists



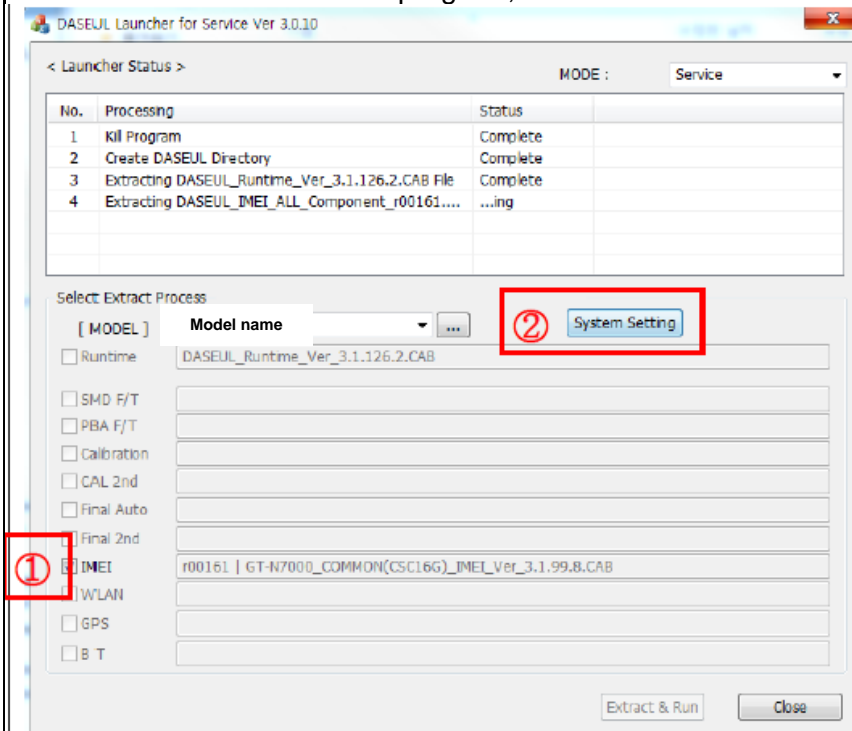
6. Level 1 Repair

4. Select Model



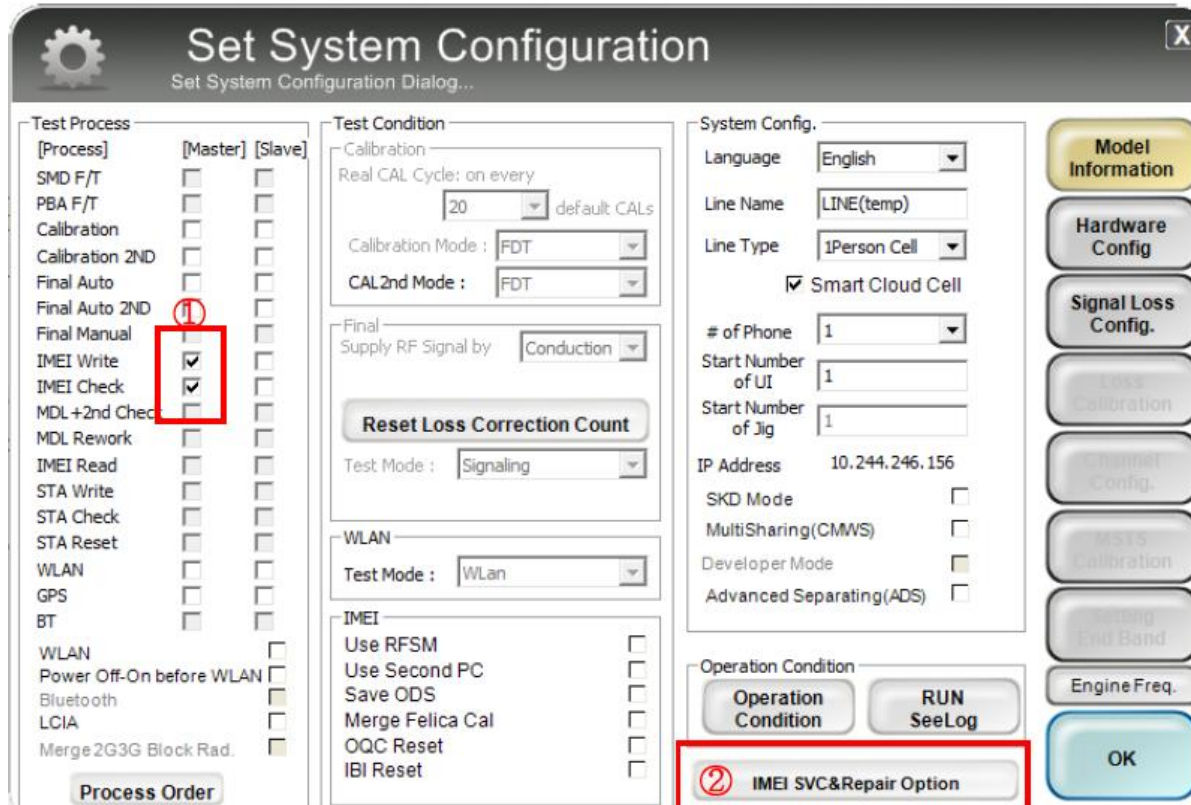
5. Check IMEI and click System Setting

※ Once you setup the setting, you don't have to do it again, unless there is change.
From second run of the IMEI program, check IMEI and click Extract & Run.



6. Level 1 Repair

6. Check IMEI Write / IMEI Check and click IMEI SVC & Repair Option.



The 'Set System Configuration' dialog box is shown. It has a title bar with a gear icon and a close button. The main area is divided into several sections: 'Test Process' with a table of checkboxes for various tests; 'Test Condition' with settings for calibration and RF signal; 'System Config.' with settings for language, line name, and network; and a right sidebar with buttons for 'Model Information', 'Hardware Config', 'Signal Loss Config.', 'Loss Calibration', 'Channel Config.', 'MMS Calibration', 'Setting End Band', and 'Engine Freq.'. At the bottom, there are buttons for 'Operation Condition', 'RUN SeeLog', and 'IMEI SVC&Repair Option' (which is circled in red with a '2'). A red box with a '1' highlights the 'IMEI Write' and 'IMEI Check' checkboxes in the 'Test Process' table.

[Process]	[Master]	[Slave]
SMD F/T	<input type="checkbox"/>	<input type="checkbox"/>
PBA F/T	<input type="checkbox"/>	<input type="checkbox"/>
Calibration	<input type="checkbox"/>	<input type="checkbox"/>
Calibration 2ND	<input type="checkbox"/>	<input type="checkbox"/>
Final Auto	<input type="checkbox"/>	<input type="checkbox"/>
Final Auto 2ND	<input type="checkbox"/>	<input type="checkbox"/>
Final Manual	<input type="checkbox"/>	<input type="checkbox"/>
IMEI Write	<input checked="" type="checkbox"/>	<input type="checkbox"/>
IMEI Check	<input checked="" type="checkbox"/>	<input type="checkbox"/>
MDL+2nd Check	<input type="checkbox"/>	<input type="checkbox"/>
MDL Rework	<input type="checkbox"/>	<input type="checkbox"/>
IMEI Read	<input type="checkbox"/>	<input type="checkbox"/>
STA Write	<input type="checkbox"/>	<input type="checkbox"/>
STA Check	<input type="checkbox"/>	<input type="checkbox"/>
STA Reset	<input type="checkbox"/>	<input type="checkbox"/>
WLAN	<input type="checkbox"/>	<input type="checkbox"/>
GPS	<input type="checkbox"/>	<input type="checkbox"/>
BT	<input type="checkbox"/>	<input type="checkbox"/>
WLAN	<input type="checkbox"/>	<input type="checkbox"/>
Power Off-On before WLAN	<input type="checkbox"/>	<input type="checkbox"/>
Bluetooth	<input type="checkbox"/>	<input type="checkbox"/>
LCIA	<input type="checkbox"/>	<input type="checkbox"/>
Merge 2G3G Block Rad.	<input type="checkbox"/>	<input type="checkbox"/>

Test Condition

Calibration

Real CAL Cycle: on every default CALs

Calibration Mode:

CAL2nd Mode:

Final

Supply RF Signal by:

Reset Loss Correction Count

Test Mode:

WLAN

Test Mode:

IMEI

Use RFSM ☐

Use Second PC ☐

Save ODS ☐

Merge Felica Cal ☐

OQC Reset ☐

IBI Reset ☐

System Config.

Language:

Line Name:

Line Type:

☒ Smart Cloud Cell

of Phone:

Start Number of UI:

Start Number of Jlg:

IP Address: 10.244.246.156

SKD Mode ☐

MultiSharing(CMWS) ☐

Developer Mode ☐

Advanced Separating(ADS) ☐

Operation Condition

Operation Condition

IMEI SVC&Repair Option

Model Information

Hardware Config

Signal Loss Config.

Loss Calibration

Channel Config.

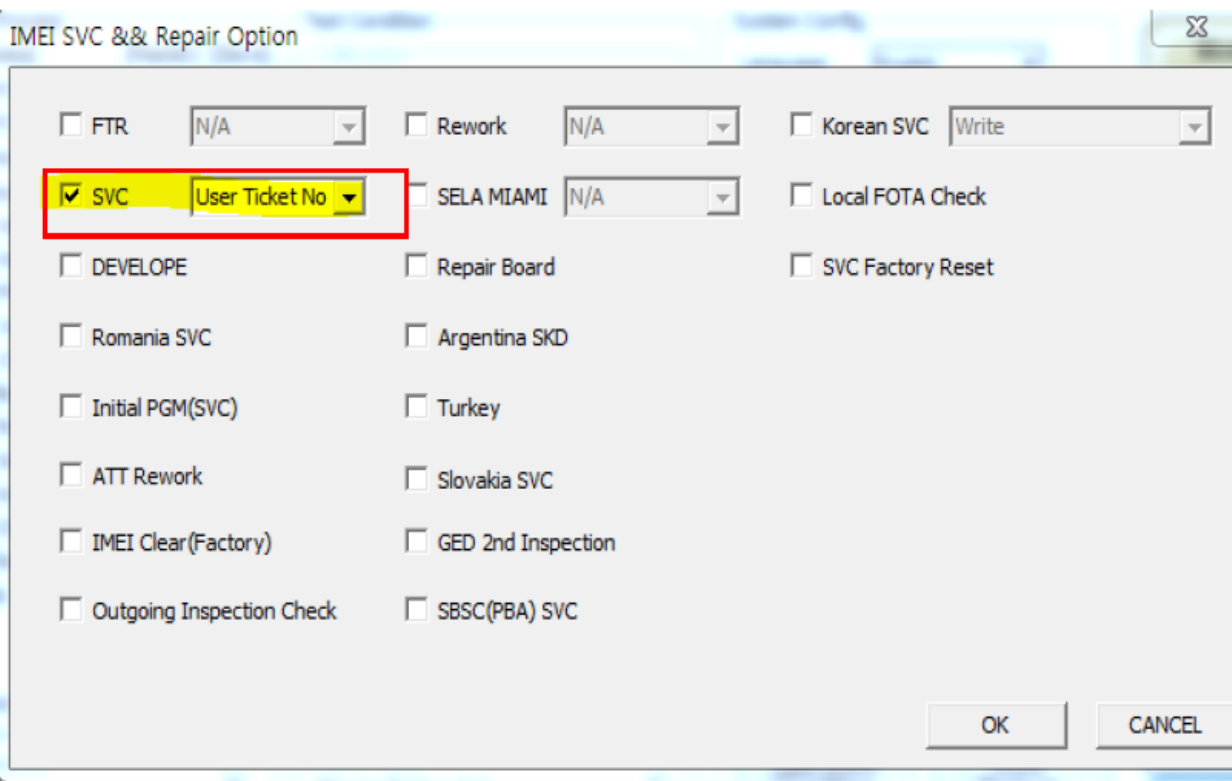
MMS Calibration

Setting End Band

Engine Freq.

OK

7. Check 'SVC , User Ticket No' and click OK



The 'IMEI SVC && Repair Option' dialog box is shown. It has a title bar with a close button. The main area contains a grid of checkboxes and dropdown menus for various service options. A red box highlights the 'SVC' checkbox and the 'User Ticket No' dropdown menu. At the bottom, there are 'OK' and 'CANCEL' buttons.

IMEI SVC && Repair Option

☐ FTR ☐ Rework ☐ Korean SVC

☒ SVC ☐ SELA MIAMI ☐ Local FOTA Check

☐ DEVELOPE ☐ Repair Board ☐ SVC Factory Reset

☐ Romania SVC ☐ Argentina SKD

☐ Initial PGM(SVC) ☐ Turkey

☐ ATT Rework ☐ Slovakia SVC

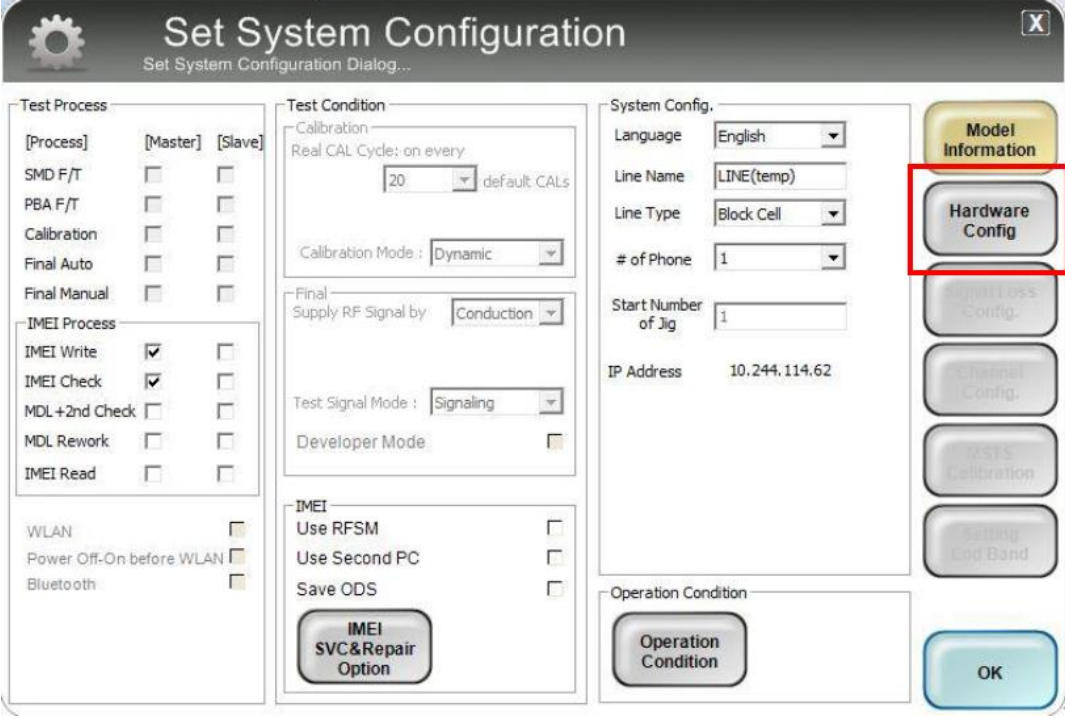
☐ IMEI Clear(Factory) ☐ GED 2nd Inspection

☐ Outgoing Inspection Check ☐ SBSC(PBA) SVC

OK CANCEL

6. Level 1 Repair

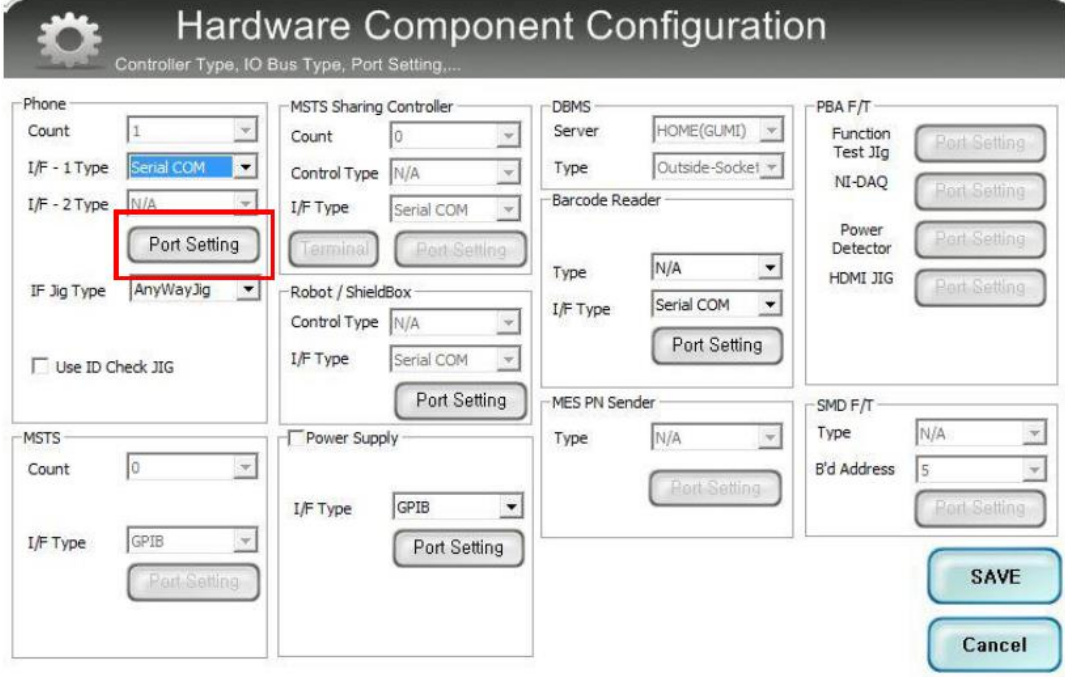
8. Click 'Hardware Config'



The 'Set System Configuration' dialog box is shown. It has a title bar with a gear icon and the text 'Set System Configuration Dialog...'. The dialog is divided into several sections:

- Test Process:** Includes checkboxes for [Process], [Master], [Slave], SMD F/T, PBA F/T, Calibration, Final Auto, Final Manual, IMEI Process, IMEI Write, IMEI Check, MDL+2nd Check, MDL Rework, IMEI Read, WLAN, Power Off-On before WLAN, and Bluetooth.
- Test Condition:** Includes Calibration (Real CAL Cycle: on every 20 default CALs), Calibration Mode (Dynamic), Final Supply RF Signal by (Conduction), Test Signal Mode (Signaling), Developer Mode, IMEI Use RFSM, Use Second PC, and Save ODS.
- System Config:** Includes Language (English), Line Name (LINE(temp)), Line Type (Block Cell), # of Phone (1), Start Number of Jig (1), IP Address (10.244.114.62), and Operation Condition.
- Model Information:** A vertical sidebar on the right with buttons for Model Information, Hardware Config (highlighted with a red box), Signal Loss Config, Channel Config, MSTS Calibration, Setting End Band, and OK.

9. Click 'Port Setting'



The 'Hardware Component Configuration' dialog box is shown. It has a title bar with a gear icon and the text 'Controller Type, IO Bus Type, Port Setting,...'. The dialog is divided into several sections:

- Phone:** Includes Count (1), I/F - 1 Type (Serial COM), I/F - 2 Type (N/A), IF Jig Type (AnyWayJig), and Use ID Check JIG.
- MSTS Sharing Controller:** Includes Count (0), Control Type (N/A), I/F Type (Serial COM), and Port Setting buttons for Terminal and Port Setting.
- Robot / ShieldBox:** Includes Control Type (N/A), I/F Type (Serial COM), and Port Setting.
- Power Supply:** Includes I/F Type (GPIO) and Port Setting.
- DBMS:** Includes Server (HOME(GUMI)), Type (Outside-Socket), Barcode Reader (Type: N/A, I/F Type: Serial COM, Port Setting), and MES PN Sender (Type: N/A, Port Setting).
- PBA F/T:** Includes Function Test Jig, NI-DAQ, Power Detector, and HDMI JIG, each with a Port Setting button.
- SMD F/T:** Includes Type (N/A), B'd Address (5), and Port Setting.
- MSTS:** Includes Count (0), I/F Type (GPIO), and Port Setting.
- Buttons:** SAVE and Cancel buttons at the bottom right.

6. Level 1 Repair

10. Select Port Number and SAVE

Set IO BUS Configuration

Phone IO Bus Setting

Common

BaudRate: 115200
Data Bit: 8
Parity: No
Stop Bit: 1

No.	Port #1
1	1

SAVE

Cancel

11. Click OK to proceed

Set System Configuration

Set System Configuration Dialog...

Test Process

[Process]	[Master]	[Slave]
SMD F/T	<input type="checkbox"/>	<input type="checkbox"/>
PBA F/T	<input type="checkbox"/>	<input type="checkbox"/>
Calibration	<input type="checkbox"/>	<input type="checkbox"/>
Final Auto	<input type="checkbox"/>	<input type="checkbox"/>
Final Manual	<input type="checkbox"/>	<input type="checkbox"/>

IMEI Process

IMEI Write	<input checked="" type="checkbox"/>	<input type="checkbox"/>
IMEI Check	<input checked="" type="checkbox"/>	<input type="checkbox"/>
MDL +2nd Check	<input type="checkbox"/>	<input type="checkbox"/>
MDL Rework	<input type="checkbox"/>	<input type="checkbox"/>
IMEI Read	<input type="checkbox"/>	<input type="checkbox"/>

WLAN ☐
Power Off-On before WLAN ☐
Bluetooth ☐

Test Condition

Calibration
Real CAL Cycle: on every 20 default CALs
Calibration Mode: Dynamic

Final
Supply RF Signal by: Conduction

Test Signal Mode: Signaling

Developer Mode ☐

IMEI
Use RFSM ☐
Use Second PC ☐
Save ODS ☐

IMEI SVC&Repair Option

System Config.

Language: English
Line Name: LINE(temp)
Line Type: Block Cell
of Phone: 1
Start Number of Jig: 1
IP Address: 10.244.114.62

Operation Condition

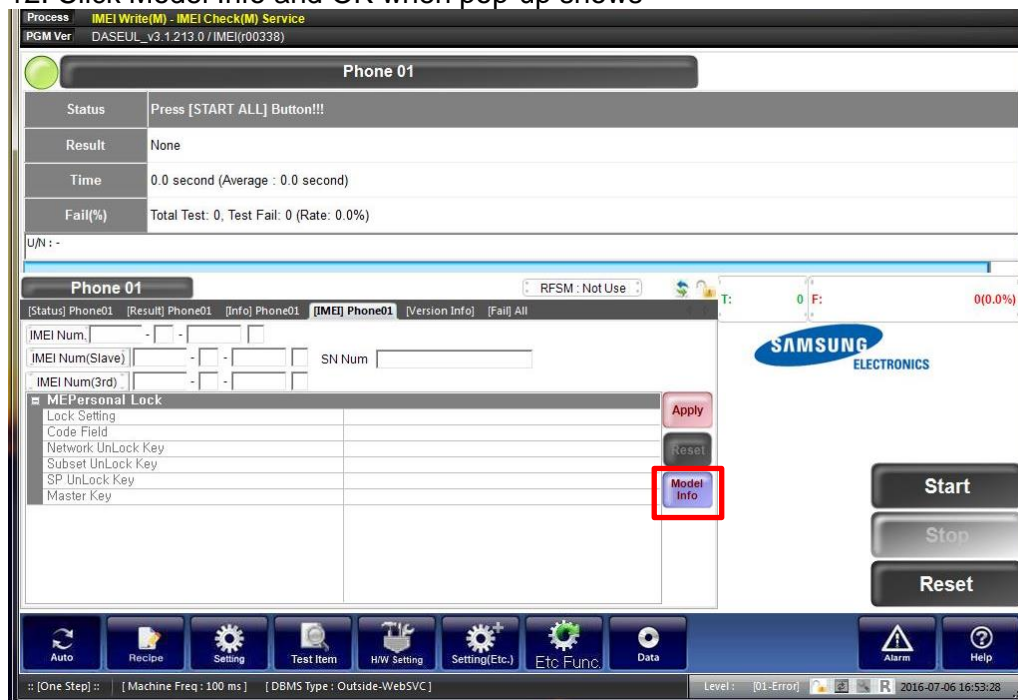
Operation Condition

Model Information
Hardware Config
Signal Loss Config.
Channel Config.
Auto Calibration
Setting End Band

OK

6. Level 1 Repair

12. Click Model Info and OK when pop-up shows



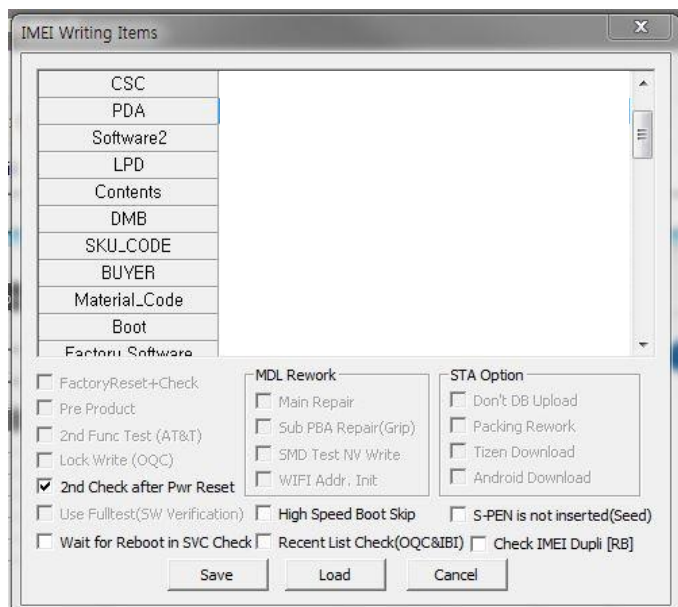
13. Click OK



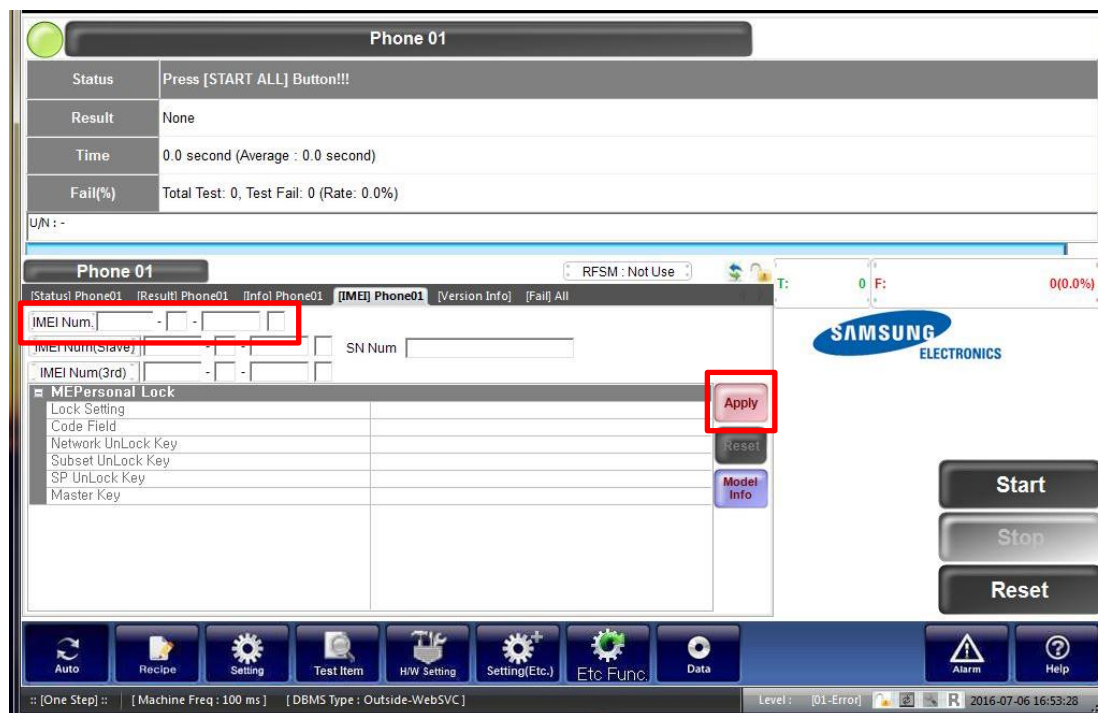
6. Level 1 Repair

14. Input SKU_CODE and BUYER, then click Save button.

※ Refer to HHPsvc→IMEI Review to check SKU Code and buyer

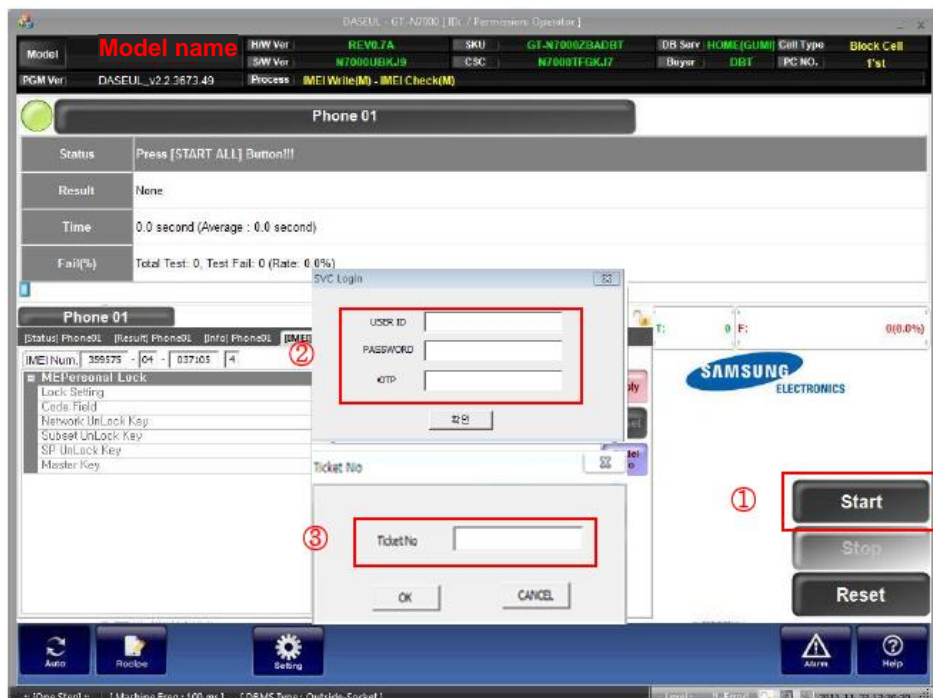


15. Input IMEI Number and click Apply



6. Level 1 Repair

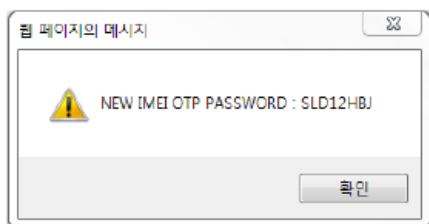
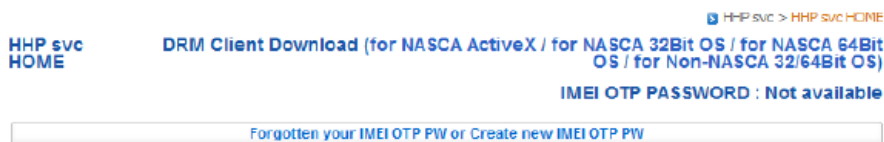
16. ① Click Start → ② Input IMEI writing ID and Password & OTP → ③ Input Ticket No



※ OTP(One time Password) : OTP is valid for 6 hours.

After that, you can get new OTP by click the “Forgotten your IMEI OTP PW or Create new IMEI OTP PW” button.

☞ OTP Location : GSPN → Knowledge → HHP svc → Home

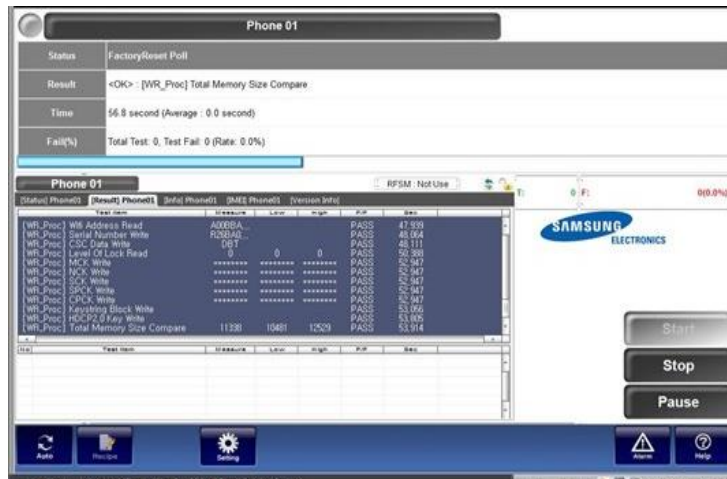


6. Level 1 Repair

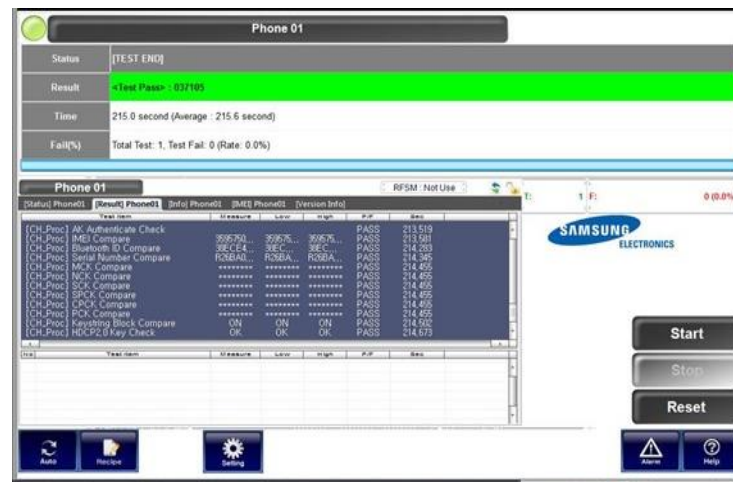
17. Connect the phone to Anyway JIG

- ※ When you connect the phone, the phone should be turned off.
After connecting the phone, the phone will be booted automatically.

18. IMEI Writing Proceeding



19. IMEI Writing Success



9. Reference Abbreviation

Reference Abbreviation

- **AAC**: Advanced Audio Coding.
- **AVC** : Advanced Video Coding.
- **BER** : Bit Error Rate
- **BPSK**: Binary Phase Shift Keying
- **CA** : Conditional Access
- **CDM** : Code Division Multiplexing
- **C/I** : Carrier to Interference
- **DMB** : Digital Multimedia Broadcasting
- **EN** : European Standard
- **ES** : Elementary Stream
- **ETSI**: European Telecommunications Standards Institute
- **MPEG**: Moving Picture Experts Group
- **PN** : Pseudo-random Noise
- **PS** : Pilot Symbol
- **QPSK**: Quadrature Phase Shift Keying
- **RS** : Reed-Solomon
- **SI** : Service Information
- **TDM** : Time Division Multiplexing
- **TS** : Transport Stream