RF MEASUREMENT REPORT

CERIFICATION OF COMPLIANCE

PRODUCT	:	**Bluetooth Wireless Stereo Audio Transmitter**
MODEL/TYPE NO	:	**AP11**
FCC ID	:	**S7ZAP11**
TRADE NAME	:	**AIRLOGIC Co., Ltd.**
APPLICANT	:	**AIRLOGIC Co., Ltd.** **A-606, Ssangyoung IT Twin Tower, 442-17, Sangdaewon-dong, Jungwon-gu, Seongnam-si, Gyeonggi-do, Korea** **Attn. : Seung Hyun Kim / Assistant**
FCC CLASSIFICATION	:	**DTS Part 15 Digital Transmission System**
FCC RULE PART(S)	:	**FCC Part 15 Subpart C Section 15.247**
FCC PROCEDURE	:	**Certification**
DATES OF TEST	:	**April 1, 2005**
DATES OF ISSUE	:	**April 1, 2005**
TEST REPORT No.	:	**BWS-05-RF-0010**
TEST LAB.	:	**BWS TECH Inc. (Registration No. : 553281)**

This Digital Transmission System has been tested in accordance with the measurement procedures specified in ANSI C63.4-2000 at the BWS TECH/EMC Test Laboratory and has been shown to be complied with the electromagnetic radiated emission limits specified in FCC Rule Part15 Subpart C Section 15.247.
I attest to the accuracy of data. All measurement herein was performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them. The results of testing in this report apply to the product/system, which was tested only. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

TaeHyun Nam
Chief of Laboratory Division
BWS TECH Inc.

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TABLE OF CONTENTS

FCC TEST REPORT

Scope – *Measurement and determination of electromagnetic emission(EME) of radio frequency devices including intentional radiators and/or unintentional radiators for compliance with the technical rules and regulations of the U.S Federal Communications Commission(FCC)*

1. General Information

Applicant

Company Name	:	AIRLOGIC Co., Ltd.
Company Address	:	A-606, Ssangyoung IT Twin Tower, 442-17, Sangdaewon-dong, Jungwon-gu, Seongnam-si, Gyeonggi-do, Korea
Phone/Fax	:	Phone : +82 31 747 1031 Fax : +82 31 747 1034

Manufacturer

Company Name	:	AIRLOGIC Co., Ltd.
Company Address	:	A-606, Ssangyoung IT Twin Tower, 442-17, Sangdaewon-dong, Jungwon-gu, Seongnam-si, Gyeonggi-do, Korea
Phone/Fax	:	Phone : +82 31 747 1031 Fax : +82 31 747 1034

- **EUT Type** : Bluetooth Wireless Stereo Audio Transmitter
- **Model Number** : AP11
- **FCC Identifier** : S7ZAP11
- **S/N** : Prototype
- **Freq. Range** : 2402MHz ~ 2480MHz
- **Number of Channels** : 79
- **Modulation Method** : FHSS (Frequency Hopping Spread Spectrum)
- **FCC Rule Part(s)** : Part 15 Subpart C Section 15.247
- **Test Procedure** : ANSI C63.4-2000
- **Dates of Tests** : April 1, 2005
- **Place of Tests** : BWS TECH Inc.
  EMC Testing Lab (FCC Registration Number : 553281)
  #294-9, Jungdae-Dong, Kwangju-Si,
  Kyunggi-Do, 464-080, Korea
  TEL: +82 31 762 0124 FAX: +82 31 762 0126
- **Test Report No.** : BWS-05-RF-0010

2. Description of Test Facility

The measurement for radiated emission test were practiced at the open area test site of BWS TECH Inc. Measurement for conducted emission test were practiced at the semi EMC Anechoic Chamber test site of BWS TECH Inc. facility located at #294-9, Jungdae-Dong, Kwangju-Si, Kyunggi-Do, Korea. The site is constructed in conformance with the requirements of the ANSI C63.4-2000 and CISPR Publication 16. The BWS TECH measurement facility has been filed to the Commission with the FCC for 3 and 10-meter site configurations. Detailed description of test facility was found to be in compliance with the requirements of Section 2.948 FCC Rules according to the ANSI C63.4-1992 and registered to the Federal Communications Commission (Registration Number : 553281).

The measurement procedure described in American National Standard for Method of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz (ANSI C.63.4-2000) was used in determining radiated emissions from the AIGLOGIC Co., Ltd. Model : AP11.

3. Product Information

3.1 Equipment Description

The Equipment Under Test (EUT) is RF transmitter by the AIRLOGIC Co.,Ltd. Model : AP11. (FCC ID : S7ZAP11).
This product enables convenient cord-free communication with mobile phone(CDMA/GSM/GPRS) and Bluetooth device that are compliant with Bluetooth Version 1.2. It is a highly integrated Bluetooth headset for world wide ISM band(2.4GHz). It has designed with low power consumption and most of functions can controlled by microprocessor. It will minimize your exposure to radio frequency(RF) from your mobile.

3.2 General Specification

Frequency Range	2402MHz ~ 2480MHz
Number of Channel	79
Modulation Method	FHSS(Frequency Hopping Spread Spectrum)
Operating Temperature	-10℃ ~ +55℃
Power Requirement	Used to external audio system power 3.7~3.0V, 100mA
Antenna Type	Chip antenna
Antenna Gain	0 dBi
Size	37 x 24 x 14mm

4. Description of Tests

4.1 Conducted Emission Measurement

Conducted emissions measurements were made in accordance with section 11, "Measurement of Information Technology Equipment" of ANSI C63.4-2000. The measurement were performed over the frequency range of 0.15MHz to 30MHz using a 50Ω/50uH LISN as the input transducer to a Spectrum Analyzer or a Field Intensity Meter. The measurements were made with the detector set for "Peak" amplitude within a bandwidth of 10KHz or for "quasi-peak" within a bandwidth of 9KHz.

The line-conducted emission test is conducted inside a shielded anechoic chamber room with 1m x 1.5m x 0.8m wooden table, which is placed 40cm away from the vertical wall, and 1.5m away from the sidewall of the chamber room. Two LISNs are bonded to the shielded room. The EUT is powered from the PMM LISN and the support equipment is powered from the LISN. Power to the LISNs is filtered by a noise cut power line filters. All electrical cables are shielded by braided tinned steel tubing with inner ϕ 1.2cm. If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and these supply lines will be connected to the LISN. All interconnecting cables more than 1m were shortened by non-inductive bundling (serpentine fashion) to a 1m length. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the Spectrum Analyzer to determine the frequency producing the max. Emission from the EUT. The frequency producing the max. Level was reexamined using the detector function set to the CISPR Quasi-Peak mode by manual, after scanned by automatic Peak mode from 0.45 to 30MHz. The bandwidth of the Spectrum Analyzer was set to 9kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Each emission was maximized by switching power lines, varying the mode of operation or resolution, clock or data exchange speed, if applicable, whichever determined the worst-case emission. Each emission reported was calibrated using self-calibrating mode.

Photographs of the worst-case emission can be seen in photographs of conducted emission test setup.

4.2 Radiated Emission Measurement

Preliminary measurements were made at indoors 3-meter semi EMC Anechoic Chamber using broadband antennas, broadband amplifier, and spectrum analyzer to determine the emission frequencies producing the maximum EME.

Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configurations, mode of operation, turntable azimuth with respect to the antenna were noted for each frequency found. The spectrum was scanned from 30 to 1000MHz using bi-log antenna and above 1000MHz, linearly polarized double ridge horn antennas were used. Above 1GHz, linearly polarized double ridge horn antennas were used. The measurements were performed with three frequencies, which were selected as bottom, middle, and top frequency in the operating band. Emission level from the EUT with various configurations was examined on the spectrum analyzer connected with the RF amplifier and plotted graphically.

Final measurements were made outdoors open site at 3-meter test range using biconical and log periodic, Horn antenna. The output from the antenna was connected, via a preselector or a preamplifier, to the input of the EMI Measuring Receiver and Spectrum analyzer (for above 25GHz). The detector function was set to the quasi-peak or peak mode as appropriate. The measurement bandwidth on the Field strength receiver was set to at least 120kHz (1MHz for measurement above 1GHz), with all post-detector filtering no less than 10 times the measurement bandwidth. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition.

Each frequency found during preliminary measurement was examined and investigated as the same set up and configuration which produced the maximum emission The EUT, support equipment and interconnecting cables were configured to the set-up producing the maximum emission for the frequency and were placed on top of a 0.8-meter high non-metallic 1m x 1.5 meter table. The turntable containing the system was rotated and the antenna height was varied 1 to 4 meters and stopped at the azimuth or height producing the maximum emission.

Varying the mode of operating frequencies of the EUT maximized each emission. The system was tested in all the three orthogonal planes and changing the polarity of the antenna. The worst-case emissions are recorded in the data tables. If necessary, the radiated emission measurement could be performed at a closer distance to ensure higher accuracy and the results were extrapolated to the specified distance using an inverse linear distance extrapolation factor (20dB/decade) as per section 15.31(f).

5. Test Condition

5.1 Test Configuration

The device was configured for testing in a typical fashion (as a customer would normally use it). During the tests, the EUT and the supported equipments were installed to meet FCC requirement and operated in a manner, which tends to maximize its emission level in a typical application.

Radiated Emission Test

Preliminary radiated emission tests were conducted using the procedure in ANSI C63.4/2000 Clause 8.3.1.1 to determine the worst operating condition. Final radiated emission tests were measured at 3-meter open field test site. To complete the test configuration required by the FCC, the EUT was tested in all three orthogonal planes.

5.2 EUT operation

EUT was tested according to the operation modes provided by the specifications given by the manufacturer, and reported the worst emissions.

6. TEST RESULTS

Summary of Test Results

The measurement results were obtained with the EUT tested in the conditions described in this report. Detailed measurement data and plots showing the maximum emission of the EUT are reported.

APPLIED STANDARD : 47 CFR Part 15, Subpart C			
FCC Rule	**Description of Test**	**Limit**	**Result**
15.207	Power Line Conducted Emission	Various	Pass
15.247(a)	20dB Bandwidth	Less than 1MHz	Pass
15.247(a)	Dwell Time on each channel	Less than 0.4 second	Pass
15.247(b)	Maximum Peak Output Power	Less than 30dBm	Pass
15.247(c) 15.209	Radiated Emission	Various	Pass
15.247(c)	Conducted Emission & 100kHz Bandwidth of Frequency Band Edges	More than 20dBc	Pass
15.247(a)	Minimum Hopping Channels	More than 75 channels	Pass
15.203	Antenna Requirement	Less than 6dBi	Pass

The data collected shows that the product complies with technical requirements of the Part 15.247 of the FCC Rules.

Note : Modification to EUT

The device tested is not modified anything, mechanical or circuits to improve EMI status during a measurement. No EMI suppression device(s) was added and/or modified.

6.1 Power Line Conducted Emission

Frequency Range of Test	:	150 kHz to 30 MHz
Test Standard	:	FCC Part15 Subpart C Section 15.207
Operating Condition	:	The EUT was operated at transmitting condition continuously during the test.
Temperature/Humidity	:	22.0 °C/ 41 %

The following table shows the highest levels of conducted emissions on both phase of Hot and Neutral line.

Power Line Conducted Emission Test Data

Detector Mode ; CISPR Quasi Peak mode (6dB Bandwidth : 9kHz)

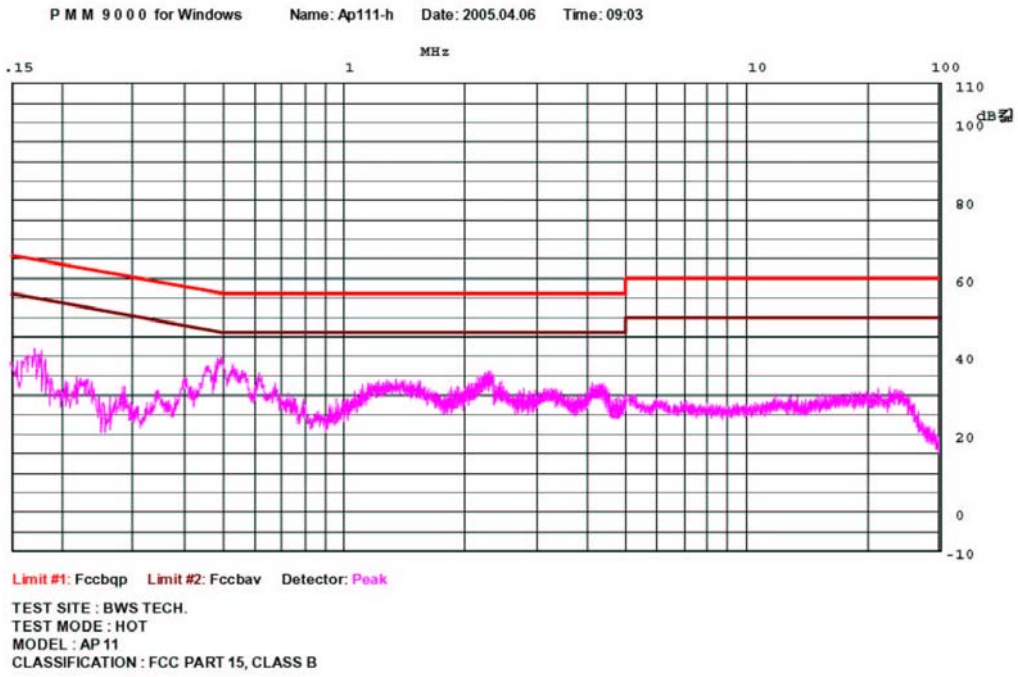
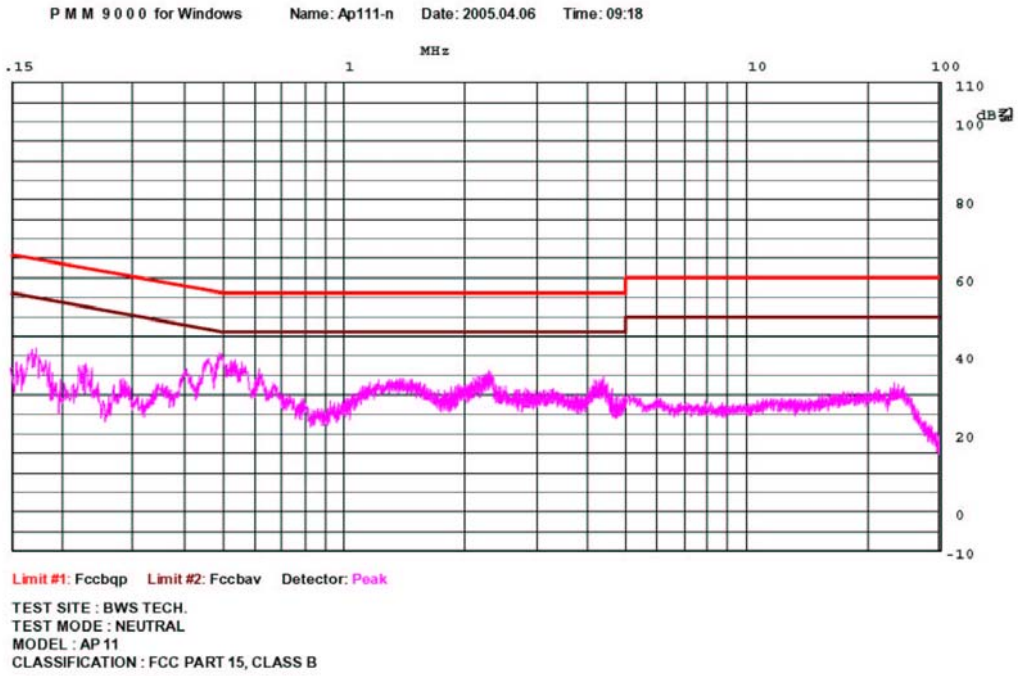
Freq [MHz]	Correcton		Phase [H/N]	Quasi-Peak Mode		
	AMN	C.L		Limit	Reading	Emission Level
				[dBuV]	[dBuV]	[dBuV]
0.171	0.06	0.03	H	65.40	42.00	42.09
0.228	0.07	0.10	N	63.90	37.90	38.07
0.343	0.08	0.22	N	60.60	32.80	33.10
0.405	0.08	0.26	N	58.70	36.60	36.94
0.458	0.07	0.28	N	57.30	39.40	39.75
0.489	0.07	0.28	N	56.40	40.90	41.25
0.557	0.07	0.30	N	56.00	38.40	38.77
0.609	0.07	0.30	N		36.70	37.07
0.665	0.07	0.30	N		33.10	33.47
1.395	0.03	0.45	N		34.20	34.68
2.277	0.03	0.56	H		36.30	36.89
4.340	0.04	0.80	N		34.80	35.64
5.190	0.05	0.87	H	60.00	30.10	31.02
5.930	0.06	0.90	N		29.30	30.26
6.820	0.04	0.96	H		28.40	29.40
11.700	0.04	1.13	H		30.30	31.47
20.990	0.07	1.42	H		31.80	33.29
23.080	0.09	1.45	N		33.00	34.54

NOTES :

1. *H : Hot Line , N :Neutral Line*
2. *Emission Level = Reading + Correction Factor*
3. *Measurements were performed at the AC Power Inlet of the host PC with the EUT plugged in the frequency band of 150kHz ~30MHz*

Tested by ***Yang, Eun Jung***

Plots of Power Line Conducted Emission

Mode	Plot
Hot	
Neutral	

6.2 20 dB Bandwidth

Test Standard	:	FCC Part15 Subpart C Section 15.247(a)(1)
Operating Condition	:	The EUT was operated at transmitting condition continuously during the test.
Temperature/Humidity	:	22.0 °C/ 41 %

20 dB Bandwidth Test Data

Frequency (MHz)	20 dB Bandwidth (kHz)	Limit
2402	763	Less than 1 MHz
2440	810	
2480	797	

NOTES :

1. *Measure 20 dB bandwidth of relevant channel using Spectrum Analyzer.*
2. *RBW 30kHz, VBW 30kHz, Sweep Time 50ms.*
3. *20 dB less than both bandwidth than maximum peak power.*

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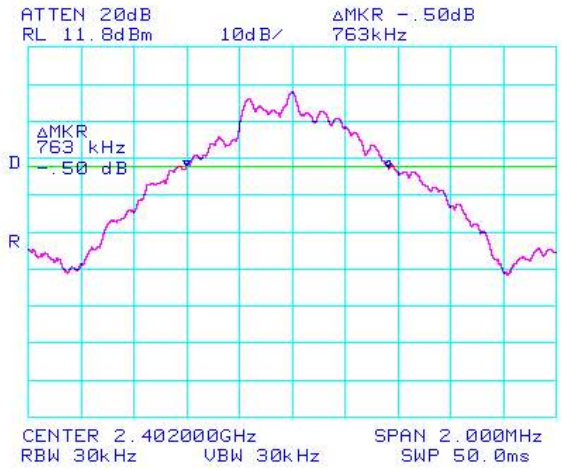
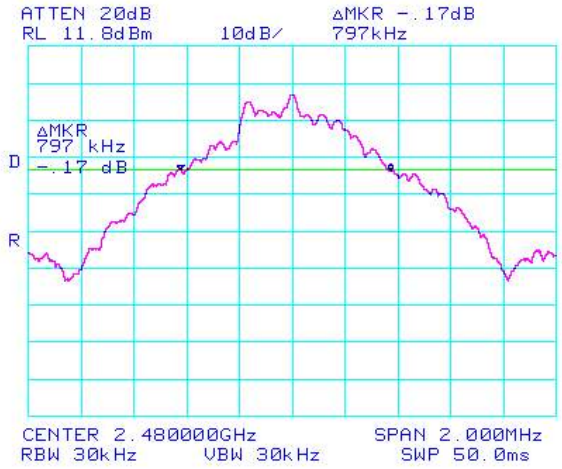
Plots of 20 dB Bandwidth

Frequency	20 dB Bandwidth
2402 MHz 763 kHz	
2440 MHz 810 kHz	
2480 MHz 797 kHz	

6.3 Dwell Time on each channel

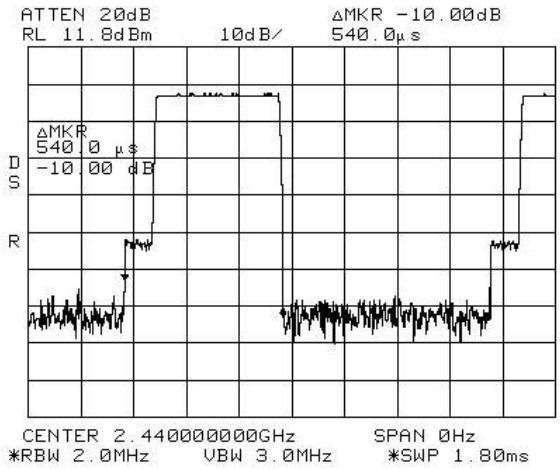
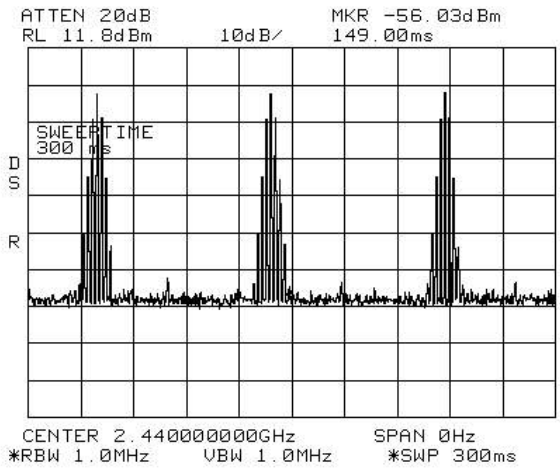
Test Standard	:	FCC Part15 Subpart C Section 15.247(a)(1)(ii)
Operating Condition	:	The EUT was operated at transmitting condition continuously during the test.
Temperature/Humidity	:	22.0 °C/ 41 %

The dwell time is 0.540(ms)×3×100 = 162 ms

NOTES :

1. Average 0.4 seconds maximum occupancy in 30 seconds, 2400 ~ 2483.5 MHz.
*2. '100' indicates 30 seconds period. (300ms * 100 = 30 seconds period.)*

Tested by ***Yang, Eun Jung***

Duration	
In 300 ms period	

6.4 Maximum Peak Output Power

Test Standard	:	FCC Part15 Subpart C Section 15.247(b)(1)
Operating Condition	:	The EUT was operated at transmitting condition continuously during the test.
Temperature/Humidity	:	22.0 °C/ 41 %

Maximum Peak Output Power Test Data

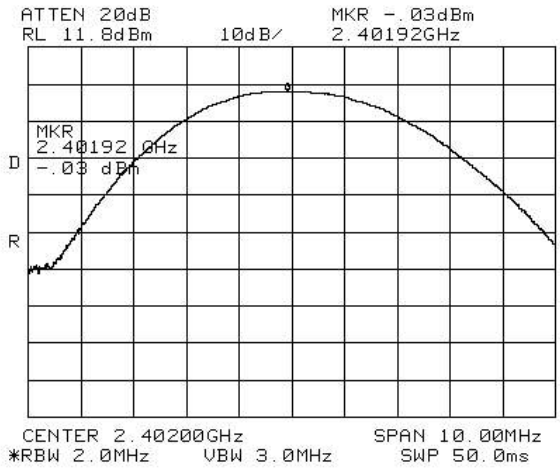
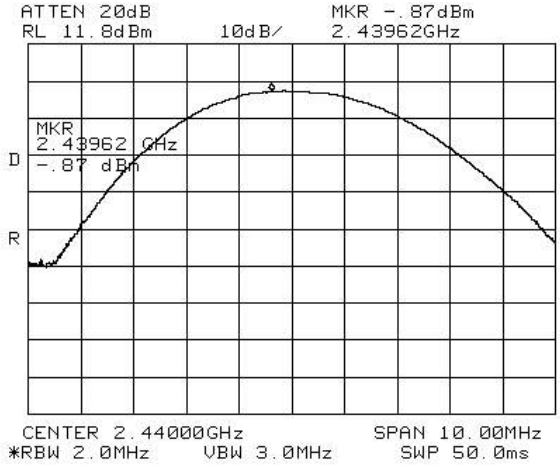
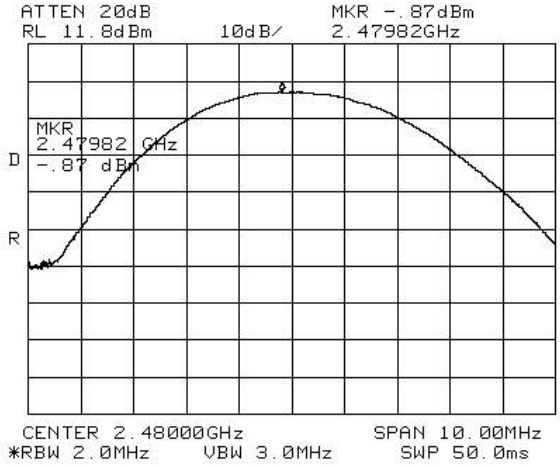
Frequency (MHz)	Maximum Peak Output Power (dBm)	Limit
2402	-0.03	Less than 30 dBm
2440	-0.87	
2480	-0.87	

NOTES :

1. *Measure Maximum Peak Output of relevant channel using Spectrum analyzer.*
2. *RBW 2 MHz, VBW 3 MHz, Sweep Time 50ms.*

Tested by ***Yang, Eun Jung***

Plots of Maximum Peak Output Power

Frequency	Maximum Peak Output Power
2402 MHz -0.03 dBm	
2440 MHz -0.87 dBm	
2480 MHz -0.87 dBm	

6.5 Radiated Emission

Test Standard	:	FCC Part15 Subpart C Section 15.247(c)
Operating Condition	:	The EUT was operated at transmitting condition continuously during the test.
Temperature/Humidity	:	22.0 °C/ 41 %

Radiated Emission Test Data(below 1 GHz)

Frequency [MHz]	Reading [dBμV]	Polarization [*H/**V]	Ant.Factor [dB]	Cable Loss [dB]	Limit [dBμV/m]	Emission Level [dBμV/m]	Margin [dB]
171.90	16.36	V	15.84	2.91	40.00	35.11	-4.89
192.00	14.99	V	16.35	3.08	40.00	34.43	-5.57
362.98	17.84	V	14.15	4.25	43.50	36.25	-7.25
540.03	13.43	H	19.49	5.29	43.50	38.21	-5.29
575.98	13.45	H	20.07	5.46	43.50	38.98	-4.52
611.98	13.49	H	20.22	5.65	46.00	39.36	-6.64
648.03	14.30	H	20.35	5.86	46.00	40.51	-5.49

Radiated Emission Test Data(above 1 GHz)

All emissions below noise floor of 20dBuV/m

NOTES :

1. *All modes of operation were investigated and the worst-case emissions are reported.*
2. *AF = Antenna Factor CL = Cable Loss F/S = Field Strength*
3. *POL H = Horizontal POL V = Vertical*

Tested by ***Yang, Eun Jung***

6.6 Conducted Emission

& 100 kHz Bandwidth of Frequency Band Edges

Test Standard	:	FCC Part15 Subpart C Section 15.247(c)
Operating Condition	:	The EUT was operated at transmitting condition continuously during the test.
Temperature/Humidity	:	22.0 °C/ 41 %

6.6.1 Conducted Emission Test

Result : Please refer to the attached Plots for details :

2402 MHz	Plots 6.6.1.1 ~ 6.6.1.6
2440 MHz	Plots 6.6.2.1 ~ 6.6.2.5
2480 MHz	Plots 6.6.3.1 ~ 6.6.3.6

6.6.2 100 kHz Bandwidth of Frequency Band Edges

The additional test was performed to show compliance with the requirement at the band-edge frequency 2483.5 MHz and up to 2500 MHz.

The transmitter was setup to transmit at the highest channel. The spectrum analyzer with resolution bandwidth 1 MHz was connected to the antenna terminal of the transmitter. The antenna conducted emissions in the band 2400 - 2483.5 MHz were measured and plotted. The difference (delta) between the levels on fundamental frequency and on the frequency 2483.5 MHz was determined. Then the field strength (E0 in dBuV/m) of radiated emission at the fundamental frequency at 3 m was measured.
The radiated emission (E1 in dBuV/m) at 2483.5 MHz was calculated as follows:
E1 = E0 - delta.
The same procedure was used to measure the radiated emissions at the frequency 2390 MHz and down to 2310 MHz.

The measured E0 is 106.98 dBuV/m.

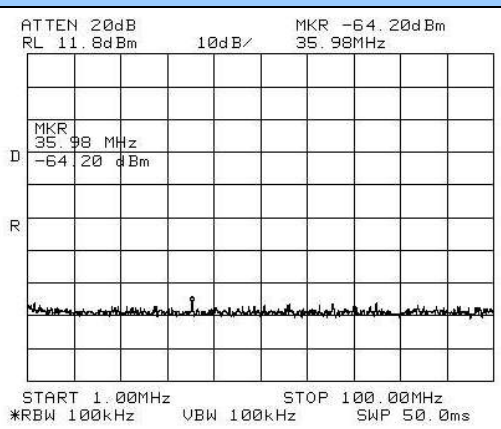
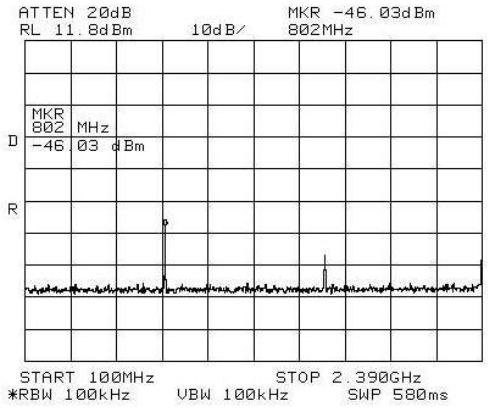
E1 = 106.98 – 62.00 = 44.98 dBuV/m

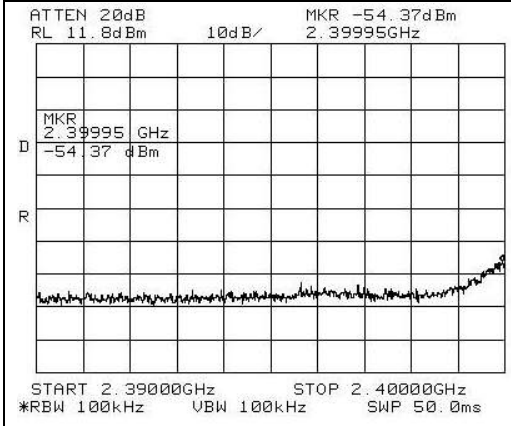
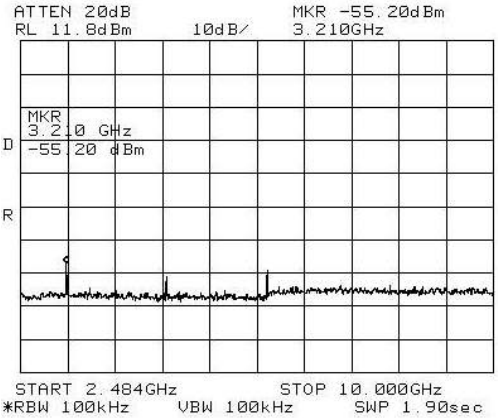
Result : Please refer to plot numbers 6.6.1.3, 6.6.1.6, 6.6.3.5, 6.6.3.6.

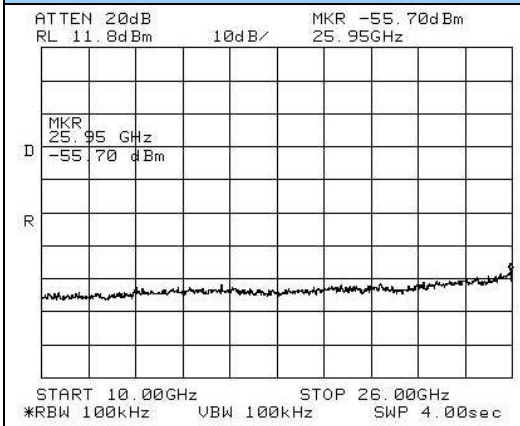
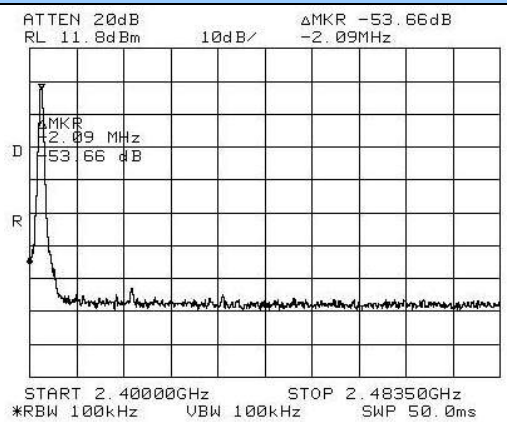
Tested by ***Yang, Eun Jung***

Plots of Conducted Emission

2402 MHz

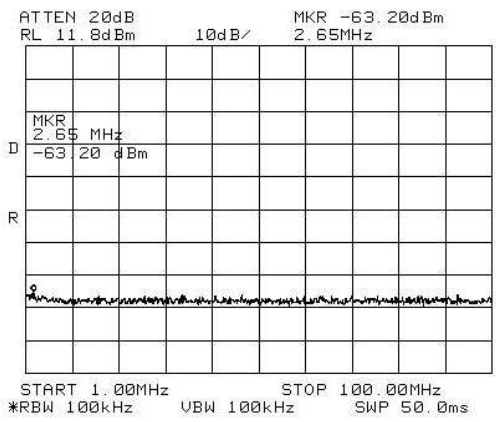
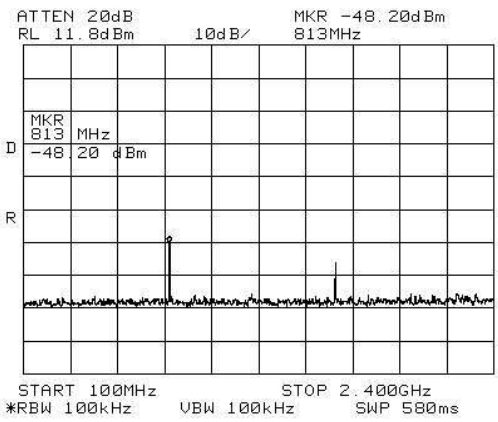
1 MHz ~ 100 MHz	100 MHz ~ 2.39 GHz
	
Plot 6.6.1.1	Plot 6.6.1.2

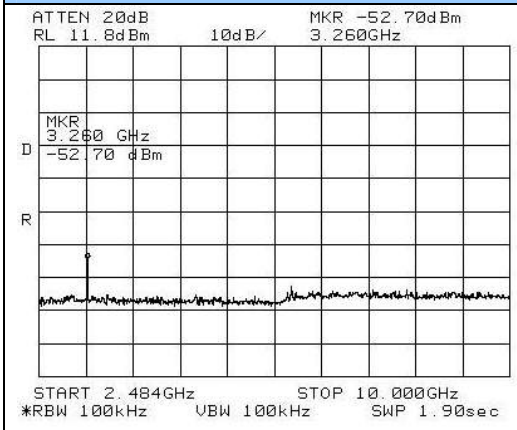
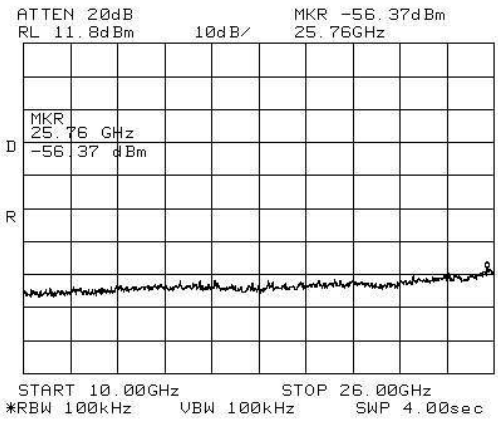
2.39 GHz ~ 2.40 GHz	2.484 GHz ~ 10 GHz
	
Plot 6.6.1.3	Plot 6.6.1.4

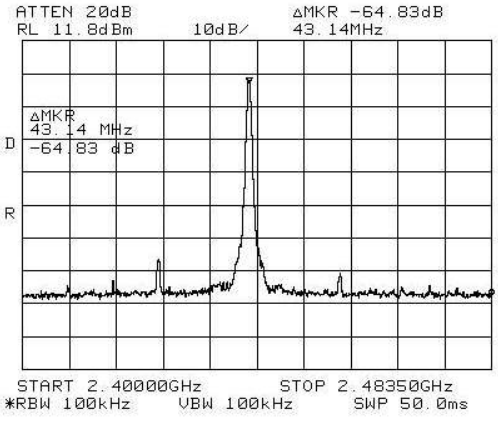
10 GHz ~ 26 GHz	2.4 GHz ~ 2.4835 GHz
	
Plot 6.6.1.5	Plot 6.6.1.6

Plots of Conducted Emission

2440 MHz

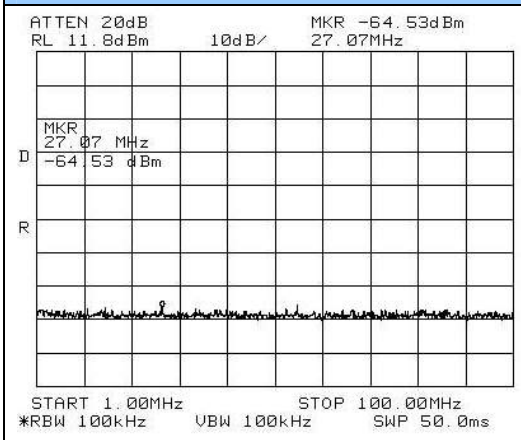
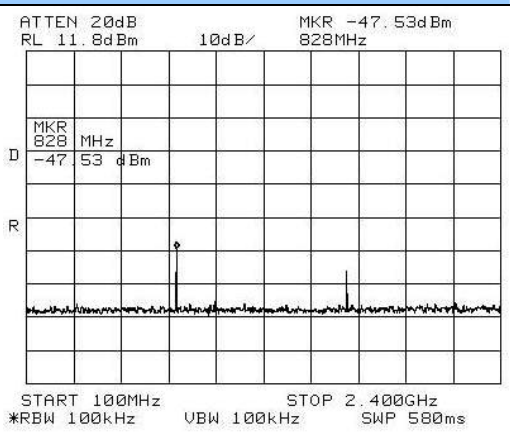
1 MHz ~ 100 MHz	100 MHz ~ 2.4 GHz
	
Plot 6.6.2.1	Plot 6.6.2.2

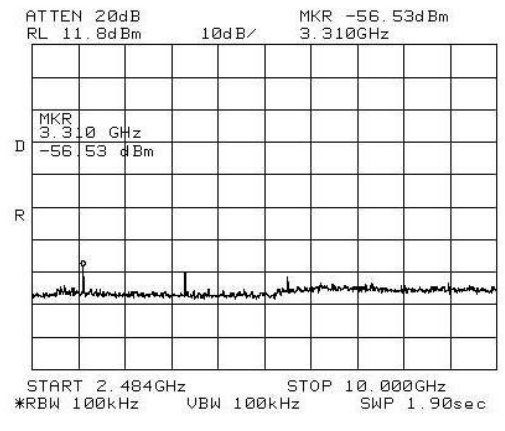
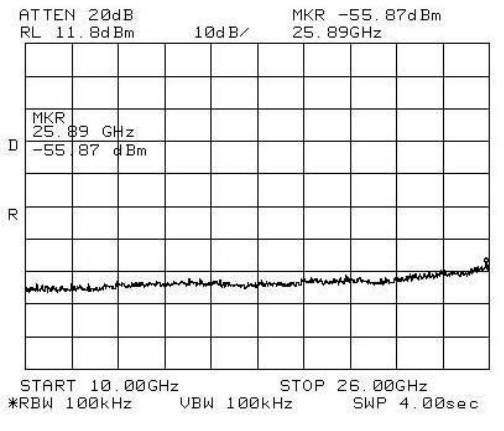
2.484 GHz ~ 10 GHz	10 GHz ~ 26 GHz
	
Plot 6.6.2.3	Plot 6.6.2.4

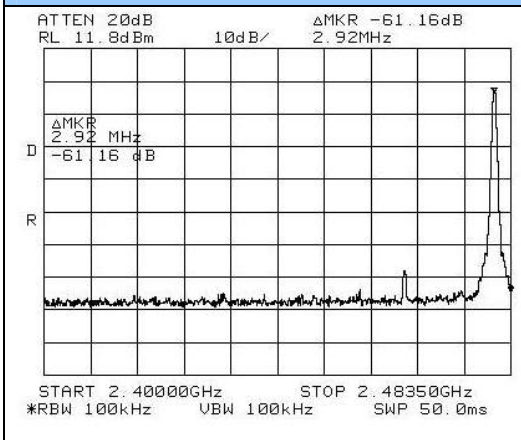
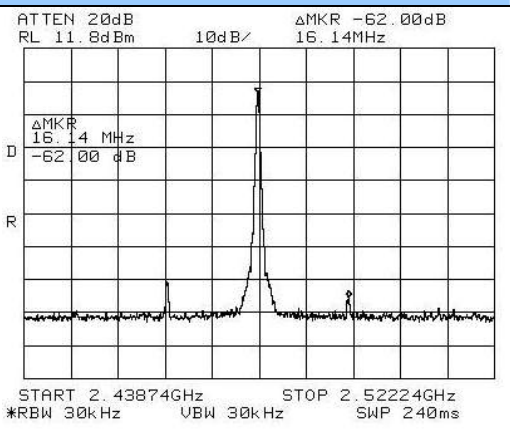
2.4 GHz ~ 2.4835 GHz	
	
Plot 6.6.2.5	

Plots of Conducted Emission

2480 MHz

1 MHz ~ 100 MHz	100 MHz ~ 2.40 GHz
	
Plot 6.6.3.1	Plot 6.6.3.2

2.484 GHz ~ 10 GHz	10 GHz ~ 26 GHz
	
Plot 6.6.3.3	Plot 6.6.3.4

2.4 GHz ~ 2.4835 GHz	2.438 GHz ~ 2.522 GHz
	
Plot 6.6.3.5	Plot 6.6.3.6

6.7 Minimum Hopping Channels

Test Standard	:	FCC Part15 Subpart C Section 15.247(a)(1)
Operating Condition	:	The EUT was operated at transmitting condition continuously during the test.
Temperature/Humidity	:	22.0 °C/ 41 %

Minimum Hopping Channels Test Data

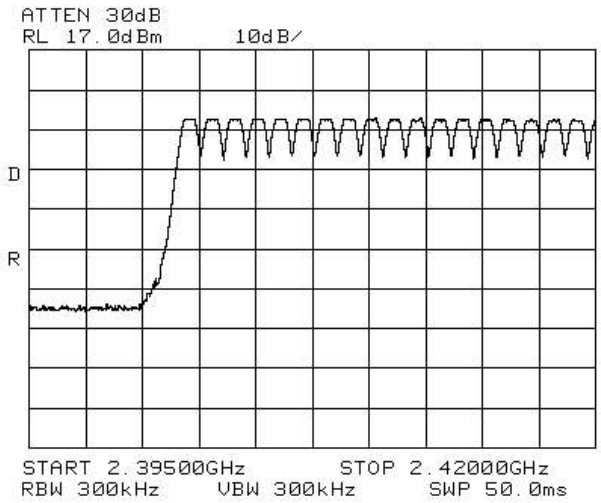
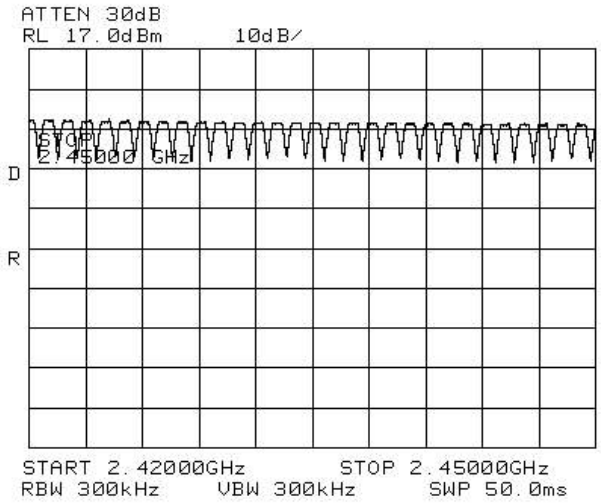
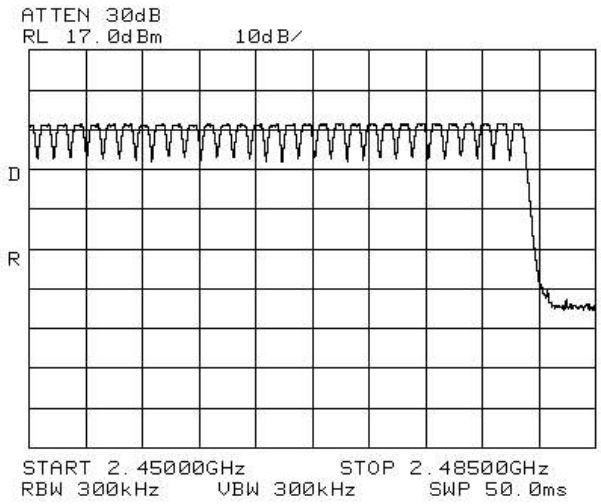
Number of hopping channels	Limit
79	More than 75 channels

NOTES :

1. *Minimum Hopping Channels using Spectrum Analyzer.*
2. *With the analyzer set to MAX HOLD readings were taken for 1 ~ 2 minutes in each band.*

Tested by ***Yang, Eun Jung***

Plots of Minimum Hopping Channels

Channels	Minimum Hopping Channels
18 channels	
30 channels	
31 channels	

7. TEST EQUIPMENTS LIST

The listing below denotes the test equipments utilized for the test(s).

Test Equipment	Model	Mfg.	Serial No.	Cal. Due Date
Spectrum Analyzer	8594E	H.P.	3911A08040	05-12-28
Spectrum Analyzer	E7403A	ADVANTEST	61720002	05-05-18
Receiver	ESH3	R & S	892580/014	05-08-30
Signal Generator	E4432B	H.P.	US40053157	06-03-10
Signal Generator	GT9000	GIGATRONICS	9604010	06-03-10
Power Meter	E4418A	H.P.	GB38272621	06-03-10
Power Sensor	8481A	H.P.	3318A92101	06-03-10
Audio Analyzer	8903B	H.P.	3011A09344	06-03-10
Modulation Analyzer	8901B	H.P.	3028A03124	06-03-10
Function Generator	FG-2002C	GOLD STAR	207095	06-01-13
Broadband Power Amplifier	100W 10000M 11	Amplifier Research	18649	05-12-29
Broadband Power Amplifier	75A220	Amplifier Research	15326	05-12-29
Preamplifier	8447E	H.P.	2945A02712	05-08-30
Preamplifier	8449B	H.P.	US39172380	05-08-30
Horn Antenna	BBHA 9120 D	Schwarz Beck	234	07-02-07
Horn Antenna	BBHA 9170	Schwarz Beck	157	07-02-07
Dipole Antenna	VDA6106A / UHA9105	Schaffner-chase	1277	05-09-12
Biconical Antenna	VHA9103	Schwarzbeck	-	06-02-04
Log Periodic Antenna	UPA6109	SCHAFFNER	1076	06-02-04
Attenuator	8325	BIRD	4572	06-03-10
Attenuator	RFA500NMF30	RFA500NMF30	9522	05-12-28
Termination	8173	BIRD	2501	-
Dual directional coupler	772D	H.P.	2839A00395	05-12-28
Dual directional coupler	778D	H.P.	1144A08477	05-10-15
LISN	LI-115	COM-POWER	8-920-20	05-10-27
Digital Oscilloscope	TDS3032	Tektronix	B081558	05-12-28
Turn-Table	JAC-2	JAEMC	-	-
Antenna Master	JAC-1	Daeil EMC	-	-
Plotter	7550A	H.P	2725A 75529	-
EMC Anechoic Chamber	-	SEMITECH	000815	
Temp/Humidity Chamber	-	Seo jin	-	05-09-03
Thermo Hygrograph	PC-5000TRH-II	SATO	-	-
BaroMeter	KEIRYOKI	SATO	564021	05-09-15
Slidacs	DeaKyong Slidacs	DeaKyong	-	-