



Dates of Tests: DEC 10 ~ 23, 2008
Test Report S/N: LR500190812C
Test Site : LTA CO., LTD.

CERTIFICATION OF COMPLIANCE

FCC ID.

A3LSWA4100

APPLICANT

Samsung Electronics Co., Ltd.

Equipment Class	:	Part 15 Spread Spectrum Transmitter (DSS)
Manufacturing Description	:	Wireless Amplifier
Manufacturer	:	P.T. Samsung Electronics Indonesia Co. (SEIN) Samsung Electronics Huizhou Co., Ltd. (SEHZ) Samsung Electronics Slovakia s.r.o (SESK) Tianjin Samsung Electronics Company (TSEC) Shin Heung Precision
Model name	:	SWA-4100
Variant Model name	:	SWA-4100P, PS-WWS1
Test Device Serial No.:	:	Identical prototype
Rule Part(s)	:	FCC Part 15.247 Subpart C; ANSI C-63.4-2003 RSS-210 and ISSUE No.: 7 Date: 2007
Frequency Range	:	2404 ~ 2476 MHz
RF power	:	Peak 11.83 dBm - Conducted
Data of issue	:	December 26, 2008

This test report is issued under the authority of:

The test was supervised by:



Dong-Min JUNG, Technical Manager



Kyung-Taek LEE, Test Engineer

This test result only responds to the tested sample. It is not allowed to copy this report even partly without the allowance of the test laboratory. This report must not be used by the applicant to claim product endorsement by any agency.



NVLAP LAB Code.: 200723-0

TABLE OF CONTENTS

1. GENERAL INFORMATION'S	3
2. INFORMATION'S ABOUT TEST ITEM	4
3. TEST REPORT	5
3.1 SUMMARY OF TESTS	5
3.2 TECHNICAL CHARACTERISTICS TEST	6
3.2.1 CARRIER FREQUENCY SEPARATION	6
3.2.2 NUMBER OF HOPPING FREQUENCIES	8
3.2.3 20 dB BANDWIDTH	10
3.2.4 TIME OF OCCUPANCY (Dwell Time)	14
3.2.5 TTANSMITTER OUTPUT POWER	16
3.2.6 BAND – EDGE & SPURIOUS	18
3.2.7 FIELD STRENGTH OF HARMONICS	23
3.2.8 AC CONDUCTED EMISSIONS	26
 APPENDIX	
APPENDIX TEST EQUIPMENT USED FOR TESTS	29

1. General information's

1-1 Test Performed

Company name : LTA Co., Ltd.
 Address : 243, Jubug-ri, Yangji-Myeon, Youngin-Si, Kyunggi-Do, Korea. 449-822
 Web site : <http://www.ltalab.com>
 E-mail : chahn@ltalab.com
 Telephone : +82-31-323-6008
 Facsimile : +82-31-323-6010

Quality control in the testing laboratory is implemented as per ISO/IEC 17025 which is the “General requirements for the competents of calibration and testing laboratory”.

1-2 Accredited agencies

LTA Co., Ltd. is approved to perform EMC testing by the following agencies:

Agency	Country	Accreditation No.	Validity	Reference
NVLAP	U.S.A	200723-0	2009-09-30	ECT accredited Lab.
RRL	KOREA	KR0049	2009-06-20	EMC accredited Lab.
FCC	U.S.A	610755	2011-04-22	FCC filing
VCCI	JAPAN	R2133, C2307	2011-06-21	VCCI registration
IC	CANADA	IC5799	2010-05-03	IC filing

2. Information's about test item

2-1 Client

Company name : Samsung Electronics Co., Ltd.
 Address : 416, maetan-3Dong, Yeongtong-Gu, Suwon-City, Gyeonggi-Do, Korea
 443-742
 Tel / Fax : +82-31-277-6778 / +82-31-277-4008

2-2 Manufacturer

Company name : P.T. Samsung Electronics Indonesia Co. (SEIN)
 Address : Cikarang Industrial Estate II, Jababeka Raya Blok F 29-33 Cikarang.
 Bekasi 17530, Indonesia
 Company name : Samsung Electronics Huizhou Co., Ltd. (SEHZ)
 Address : 516229, Industrial Complex, Chenjiang Town, Huizhou City, Guangdong
 Province, China
 Company name : Samsung Electronics Slovakia s.r.o (SESK)
 Address : Hviezdoslavova 807, 924 27 Galanta, Slovakia
 Company name : Tianjin Samsung Electronics Company (TSEC)
 Address : 300457, TSEC12, 4th Avenue, TEDA, Tianjin, China
 Company name : Shin Heung Precision
 Address : Komarnanska cesta 3, 940 61 Nove Zamky, Slovakia

2-3 Equipment Under Test (EUT)

Trade name : Wireless Amplifier
 FCC ID : A3LSWA4100
 Model name : SWA-4100
 Variant Model name : SWA-4100P, PS-WWS1
 Serial number : Identical prototype
 Date of receipt : December 1, 2008
 EUT condition : Pre-production, not damaged
 Antenna type : PCB antenna with Max. 4.00 dBi gain
 Frequency Range : 2404 ~ 2476 MHz
 RF output power : Peak 11.83 dBm - Conducted
 Number of channels : 25
 Channel spacing : 3 MHz
 Channel Access Protocol : Frequency Hopping Spread Spectrum (FHSS)
 Type of Modulation : GFSK
 Power Source : 120 Vac 60Hz

2-3 Tested frequency

	LOW	MID	HIGH
Frequency (MHz)	2404	2440	2476

2-4 Ancillary Equipment

Equipment	Model No.	Serial No.	Manufacturer
-	-	-	-

3. Test Report

3.1 Summary of tests

FCC Part Section(s)	Parameter	Limit	Test Condition	Status (note 1)
15.247(a)	Carrier Frequency Separation	> 25 kHz	Conducted	C
15.247(a)	Number of Hopping Frequencies	> 15 hops		C
15.247(a)	20 dB Bandwidth 99% Bandwidth	> 1.5 MHz		C
15.247	Dwell Time	< 0.4 seconds		C
15.247(b)	Transmitter Output Power	< 250 mWatt		C
15.247(d)	Conducted Spurious emission	> 20 dBc		C
15.247(d)	Band Edge	> 20 dBc		C
15.249 / 15.209	Field Strength of Harmonics	< 54 dBuV (at 3m)	Radiated	C
15.109	Field Strength	-		C
15.207 / 15.107	AC Conducted Emissions	EN 55022	Line Conducted	C
15.203	Antenna requirement	-	-	C

Note 1: C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable

Note 2: The data in this test report are traceable to the national or international standards.

The sample was tested according to the following specification:
FCC Parts 15.247; ANSI C-63.4-2003

3.2 Transmitter requirements

3.2.1 Carrier Frequency Separation

Procedure:

The carrier frequency separation was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled.

After the trace being stable, the reading value between the peaks of the adjacent channels using the marker-delta function was recorded as the measurement results.

The spectrum analyzer is set to:

Span = 10 MHz (wide enough to capture the peaks of two adjacent channels)

RBW = 10 kHz (1% of the span or more) Sweep = auto

VBW = 10 kHz Detector function = peak

Trace = max hold

Measurement Data:

Test Results	
Carrier Frequency Separation (MHz)	Result
2.9968	Complies

- See next pages for actual measured spectrum plots.

Minimum Standard:

The EUT shall have hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of 20dB bandwidth of the hopping channel, whichever is greater.

Measurement Setup

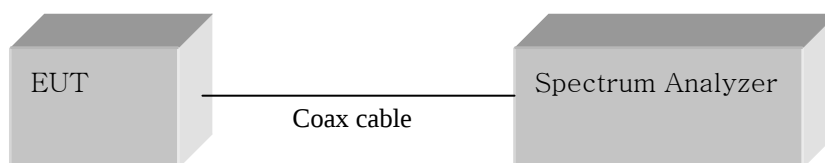
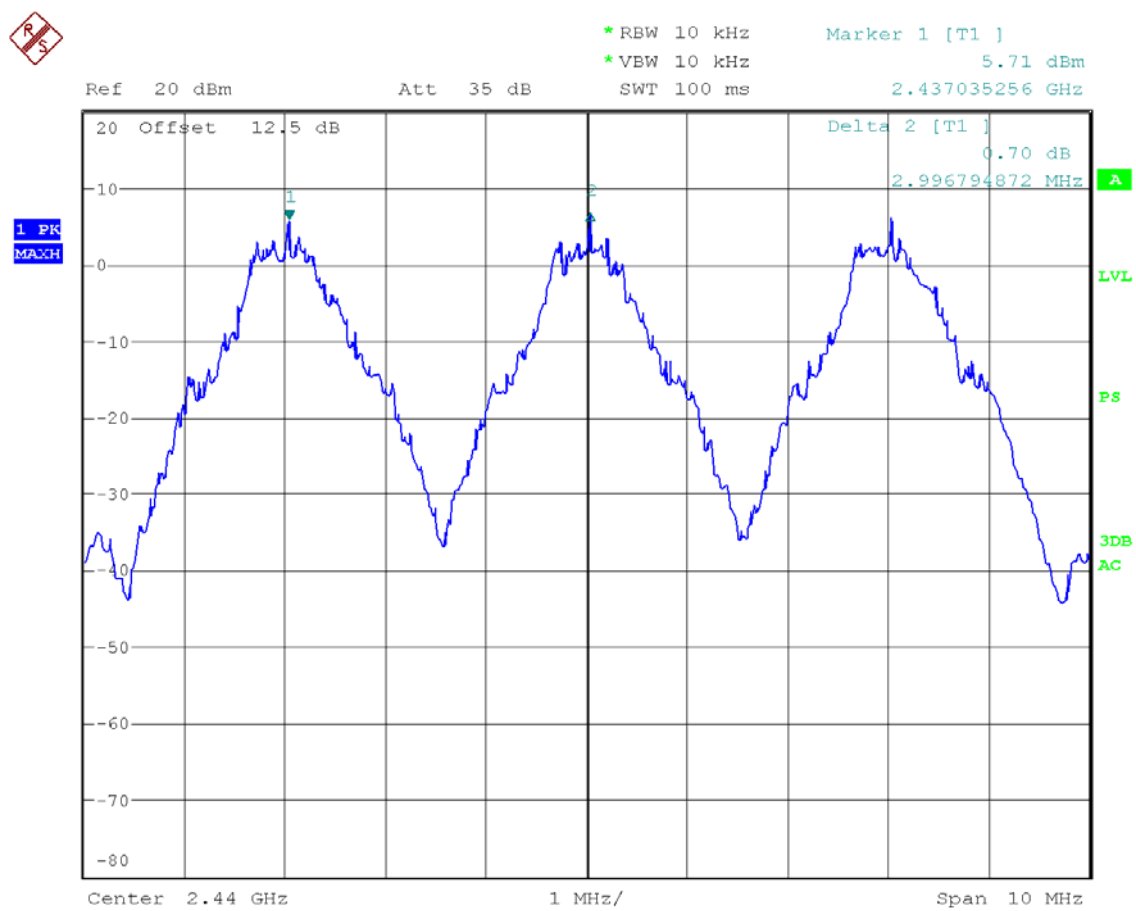


Figure 1: Measurement setup for the carrier frequency separation

Carrier Frequency Separation



3.2.2 Number of Hopping Frequencies

Procedure:

The number of hopping frequencies was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled.

To get higher resolution, four frequency ranges within the 2400 ~ 2483.5 MHz FH band were examined.

The spectrum analyzer is set to:

Frequency range 1: Start = 2400.0MHz, Stop = 2480 MHz

RBW = 100 kHz (1% of the span or more) Sweep = auto

VBW = 100 kHz (VBW $\geq$ RBW) Detector function = peak

Trace = max hold Span > 40MHz

Measurement Data: Complies

Total number of Hopping Channels	25
---	----

- See next pages for actual measured spectrum plots.

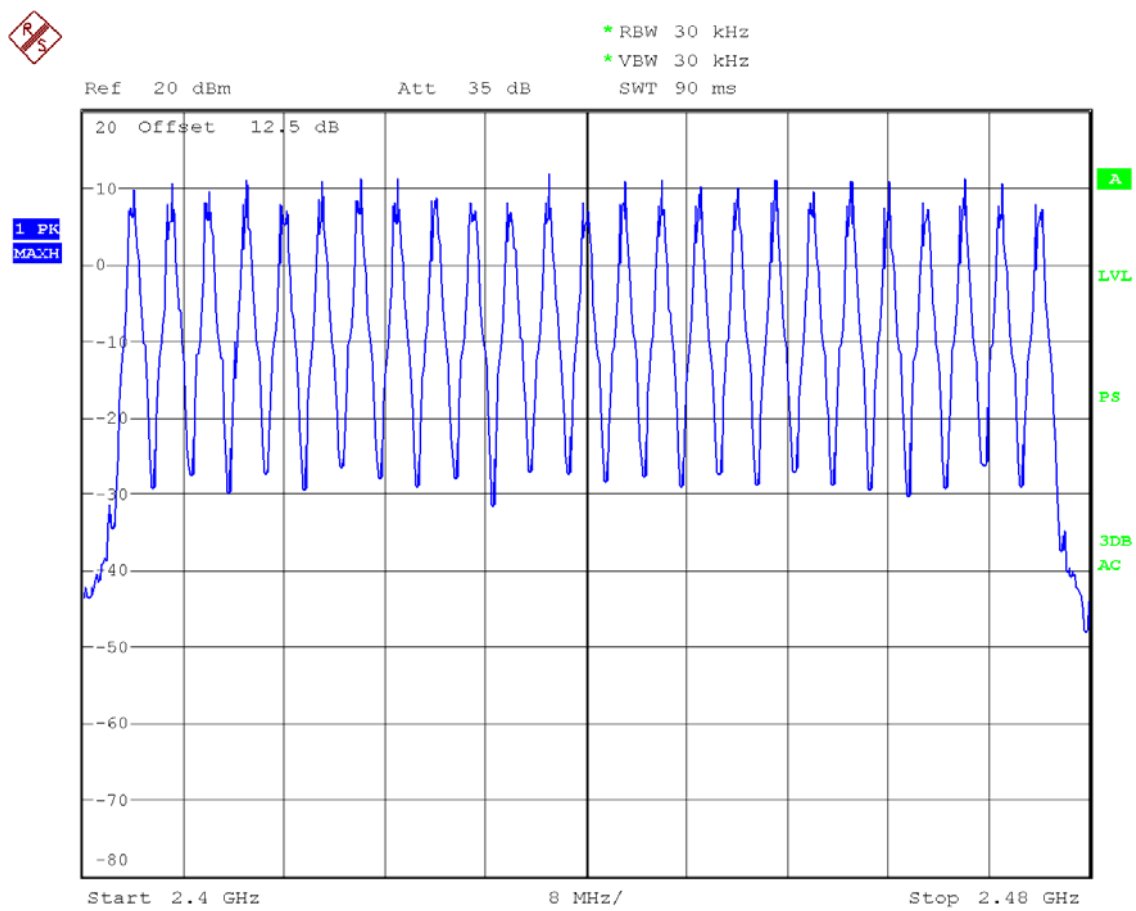
Minimum Standard:

At least 15 hopes

Measurement Setup

Same as the Chapter 3.2.1 (Figure 1)

Number of Hopping Frequencies



3.2.3 20 dB Bandwidth

Procedure:

The bandwidth at 20 dB below the highest inband spectral density was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function disabled at the highest, middle and the lowest available channels..

After the trace being stable, Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 20dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 20 dB bandwidth of the emission.

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

Span = 3 MHz (approximately 2 or 3 times of the 20 dB bandwidth)

RBW = 30 kHz

Sweep = auto

VBW = 30 kHz (VBW $\geq$ RBW)

Detector function = peak

Trace = max hold

dB/Div = 5dB

Measurement Data: Basic Mode

Frequency (MHz)	Channel No.	Test Results(MHz)	
		20dB Bandwidth	99% Bandwidth
2404	1	1.434	1.675
2440	13	1.450	1.675
2476	25	1.442	1.675

- See next pages for actual measured spectrum plots.

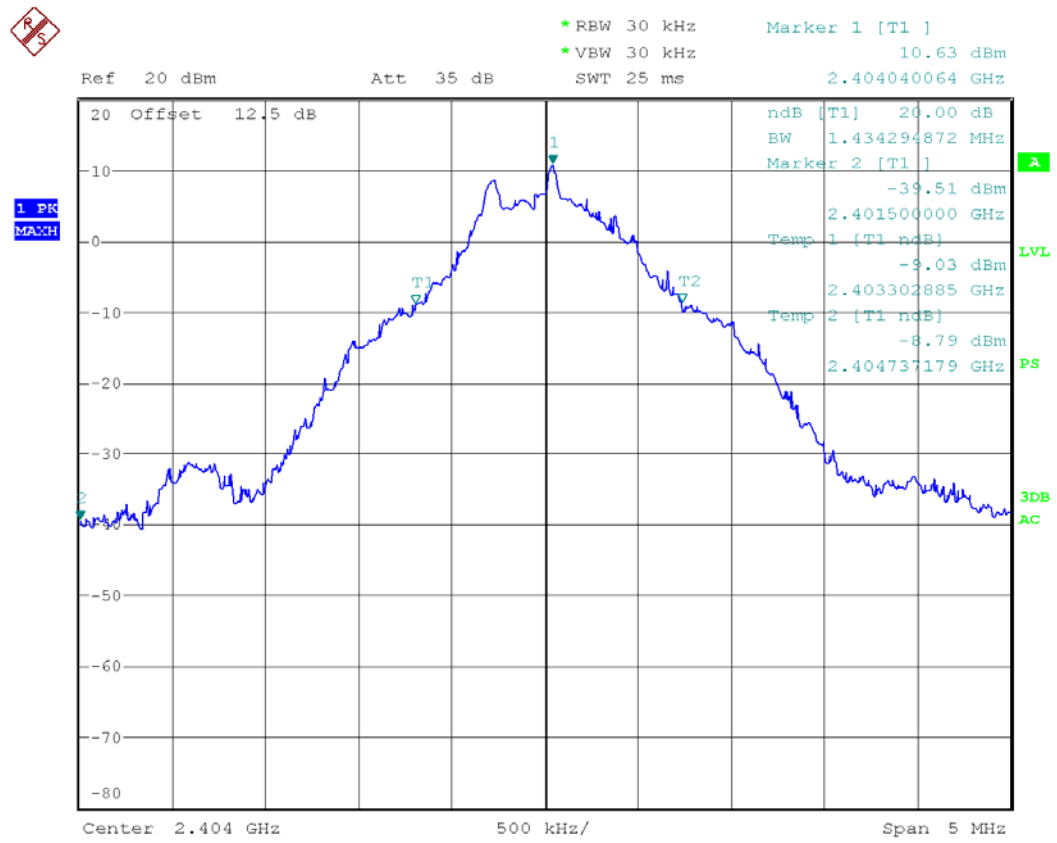
Minimum Standard:

The EUT shall have hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of 20dB bandwidth of the hopping channel, whichever is greater. Therefore, limit of 20dB bandwidth is 4.5MHz.

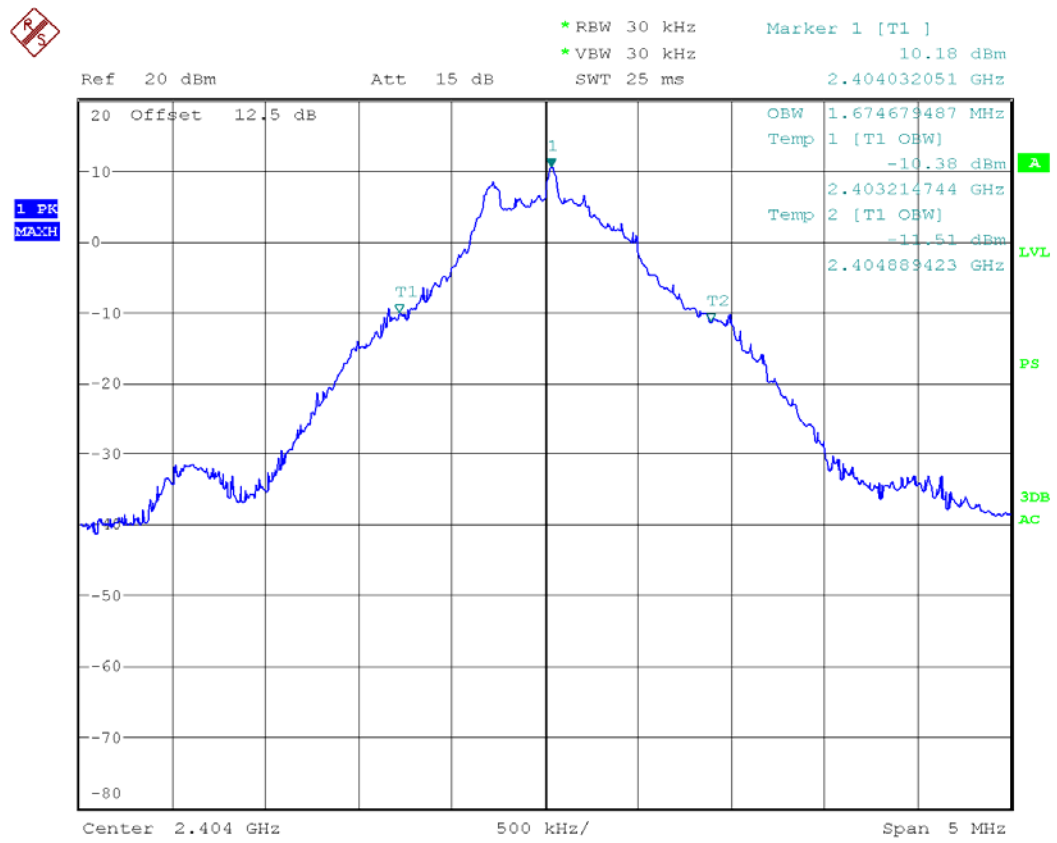
Measurement Setup

Same as the Chapter 3.2.1 (Figure 1)

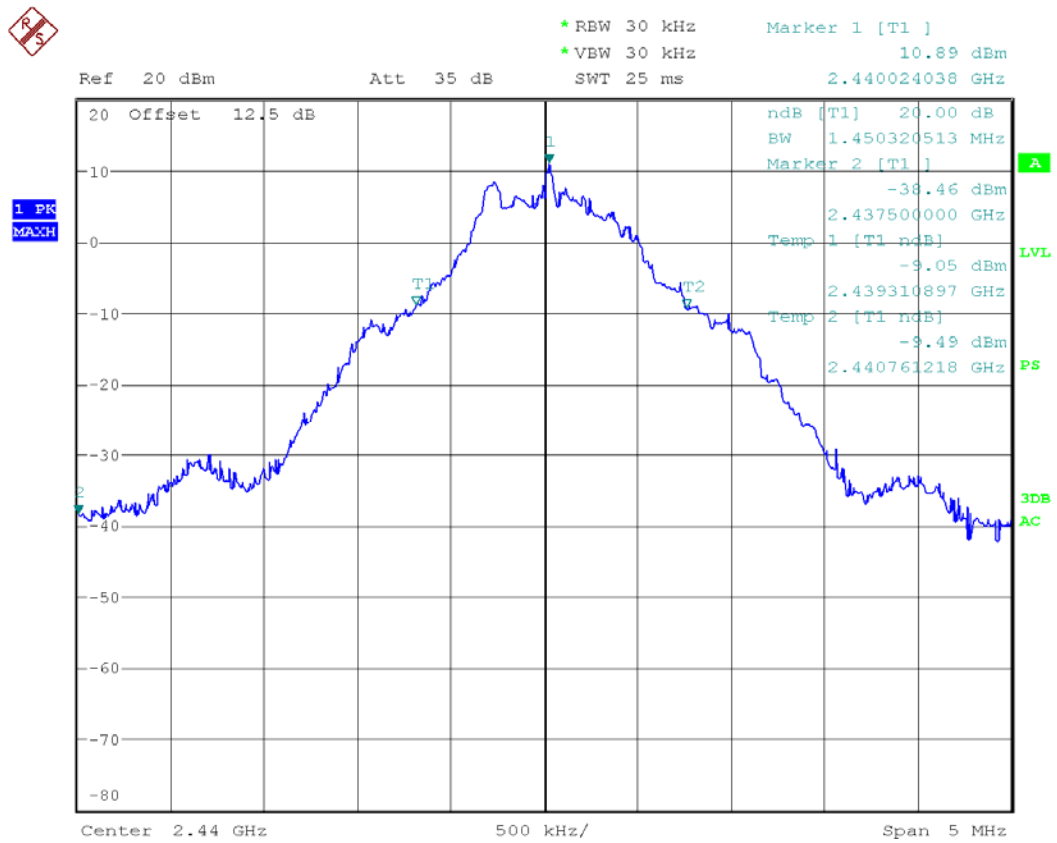
20 dB Bandwidth at Low Channel



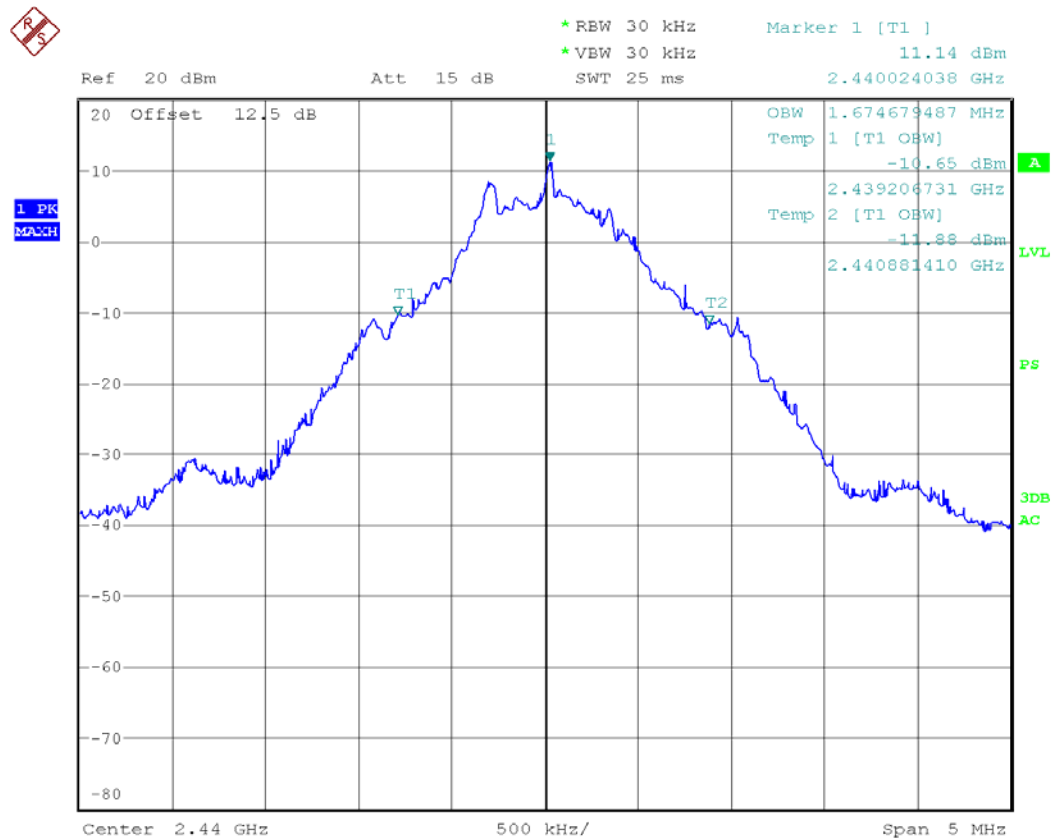
99% Bandwidth at Low Channel



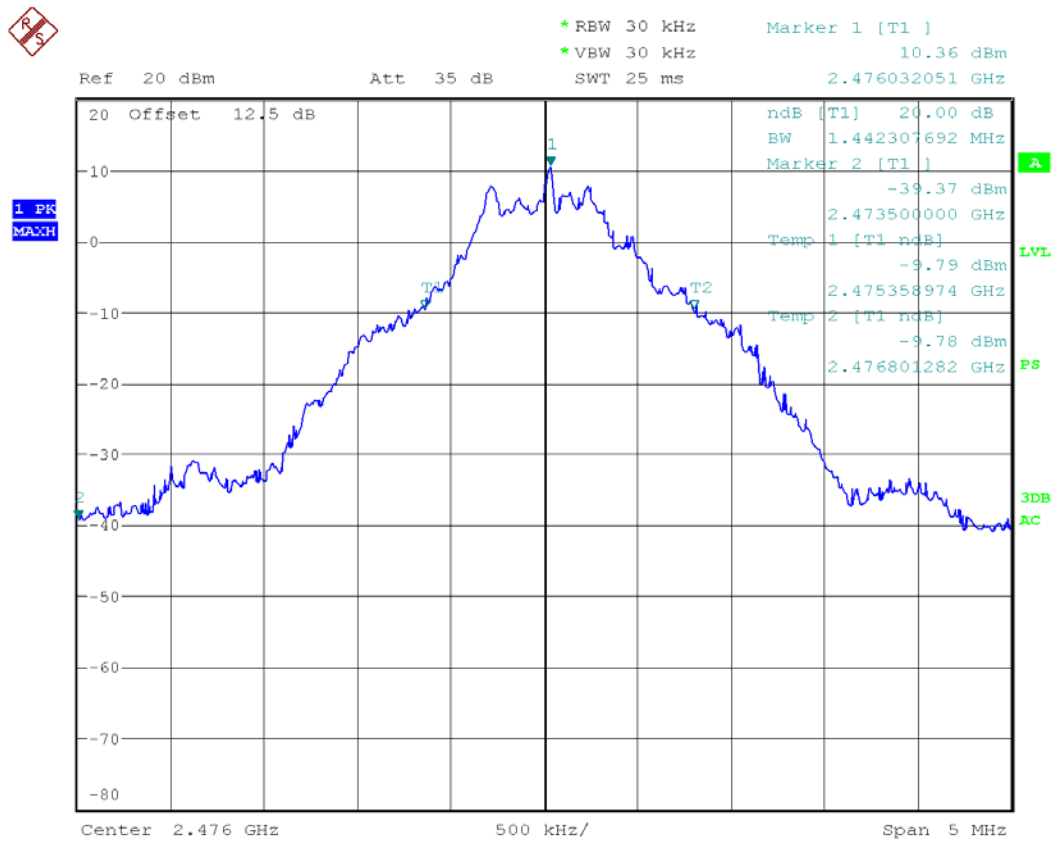
20 dB Bandwidth at Middle Channel



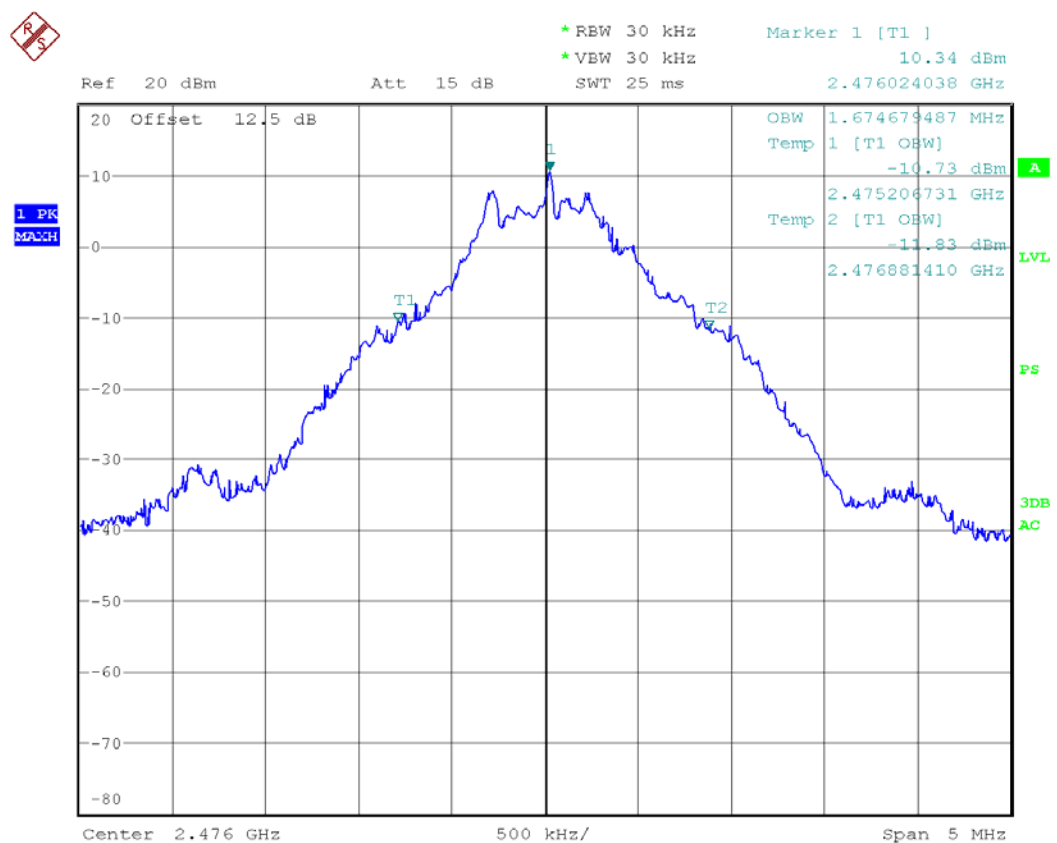
99% Bandwidth at Middle Channel



20 dB Bandwidth at High Channel



99% Bandwidth at High Channel



3.2.4 Time of Occupancy (Dwell Time)

Procedure:

The dwell time was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled.

The spectrum analyzer is set to:

Center frequency = 2441 MHz

Span = zero

RBW = 1 MHz

VBW = 1 MHz ($VBW \geq RBW$)

Trace = max hold

Detector function = peak

Measurement Data:

Channel Number	Channel Frequency (MHz)	Test Results	
		Dwell Time (ms)	Result
13	2440	3.734	Complies

- See next pages for actual measured spectrum plots.

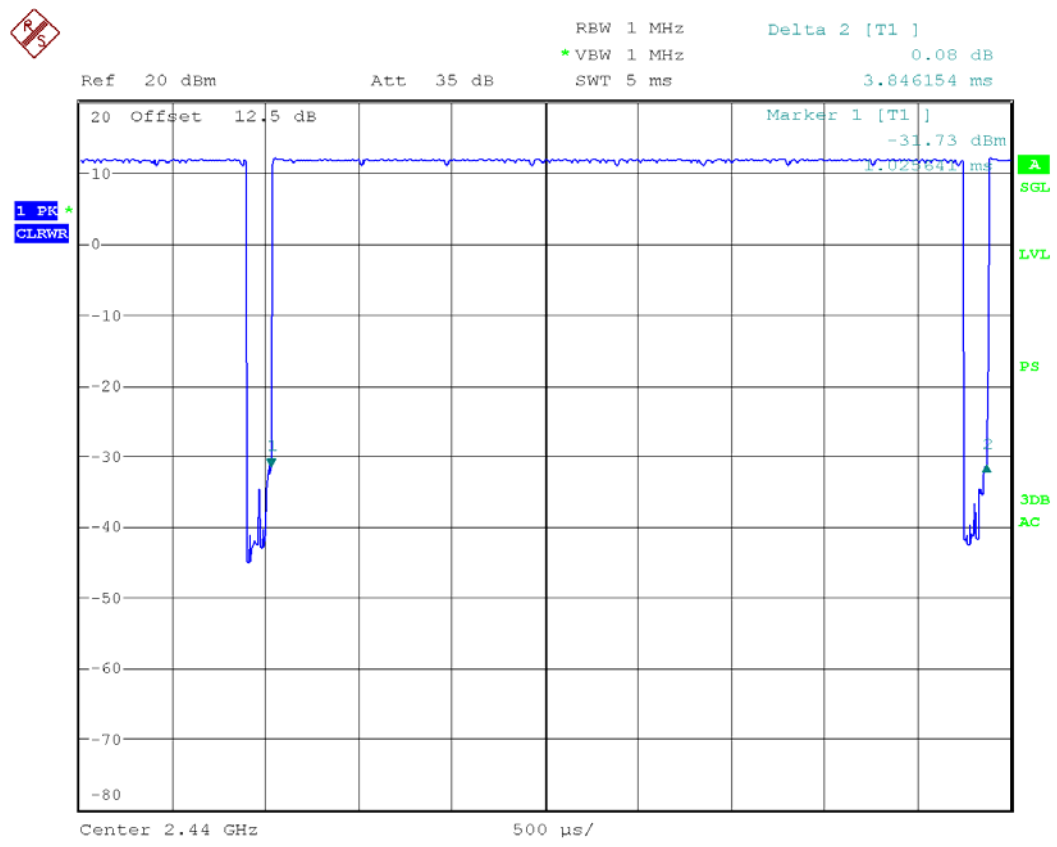
Minimum Standard:

0.4 seconds within a 30 second period per any frequency

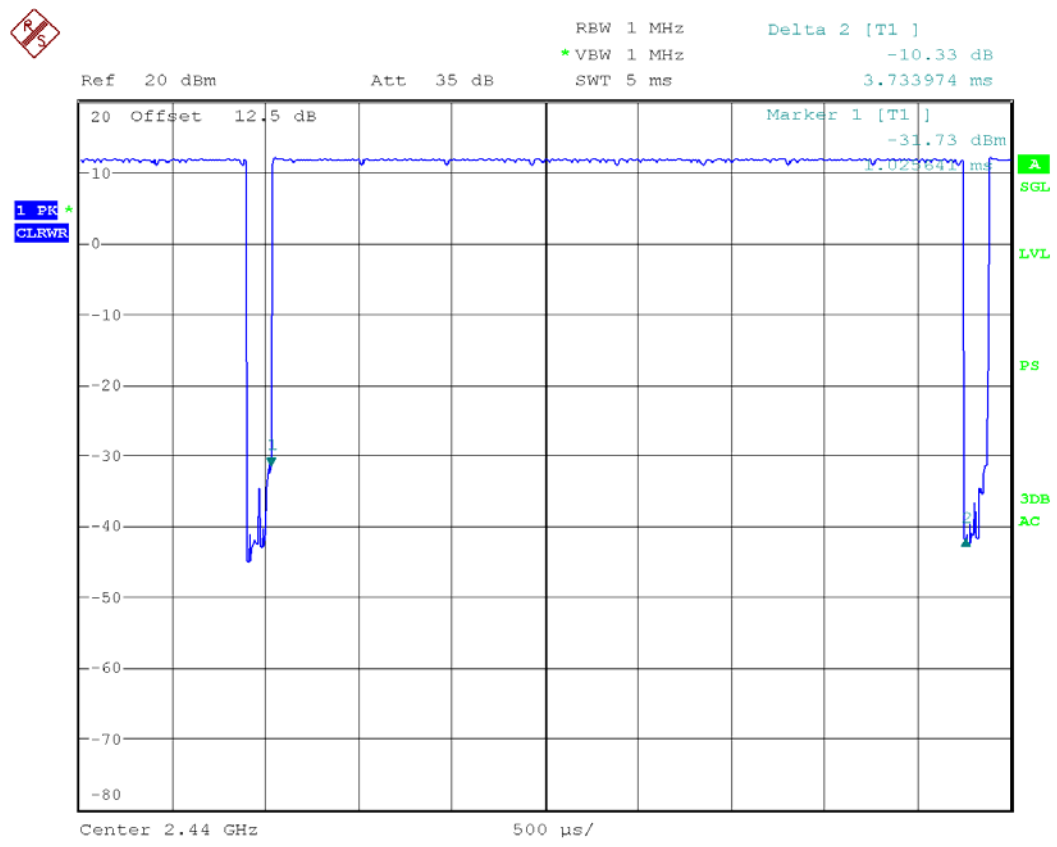
Measurement Setup

Same as the Chapter 3.2.1 (Figure 1)

Period



Dwell time



3.2.5 Transmitter Output Power

Procedure:

The peak output power was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function disabled at the highest, middle and the lowest available channels..

After the trace being stable, Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power.

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

Span = 10 MHz (approximately 5 times of the 20 dB bandwidth)

RBW = 3 MHz (greater than the 20dB bandwidth of the emission being measured)

VBW = 3 MHz (VBW $\geq$ RBW)

Detector function = peak

Trace = max hold

Sweep = auto

Measurement Data:

Frequency (MHz)	Ch.	Test Results		
		dBm	mW	Result
2404	1	11.68	14.72	Complies
2440	13	11.83	15.24	Complies
2476	25	11.28	13.43	Complies

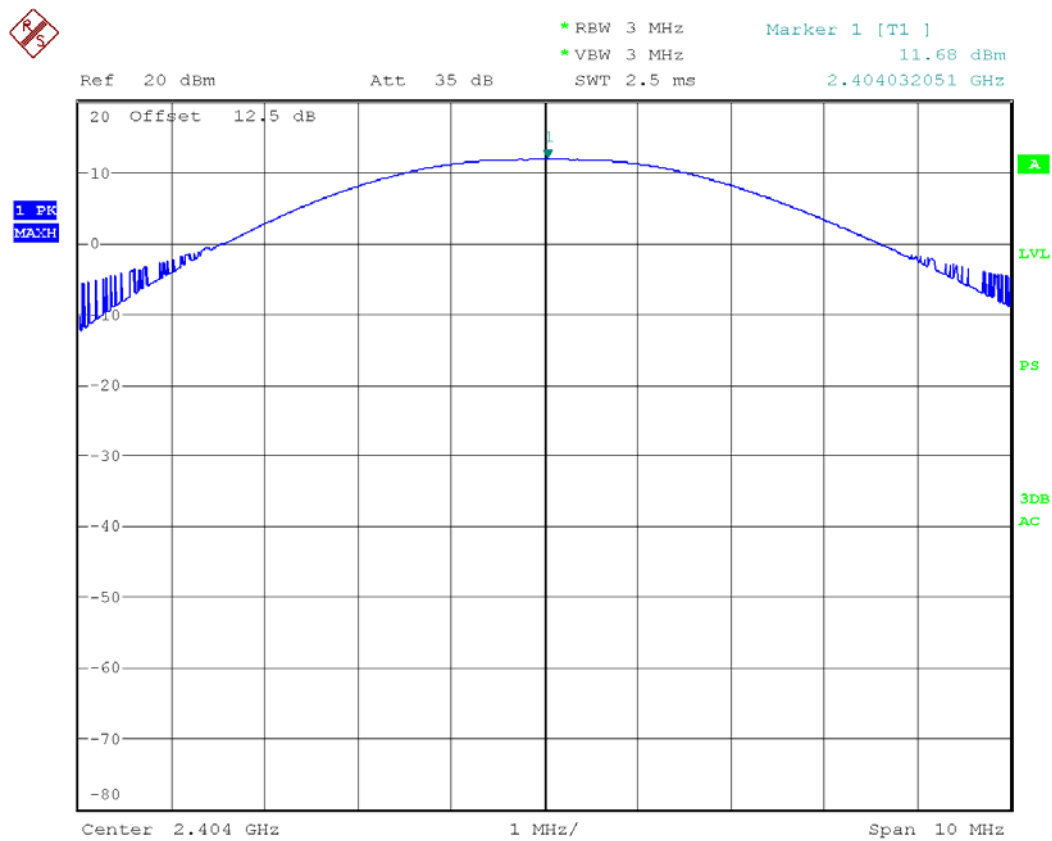
- See next pages for actual measured spectrum plots.

Minimum Standard:	< 250 mW
--------------------------	----------

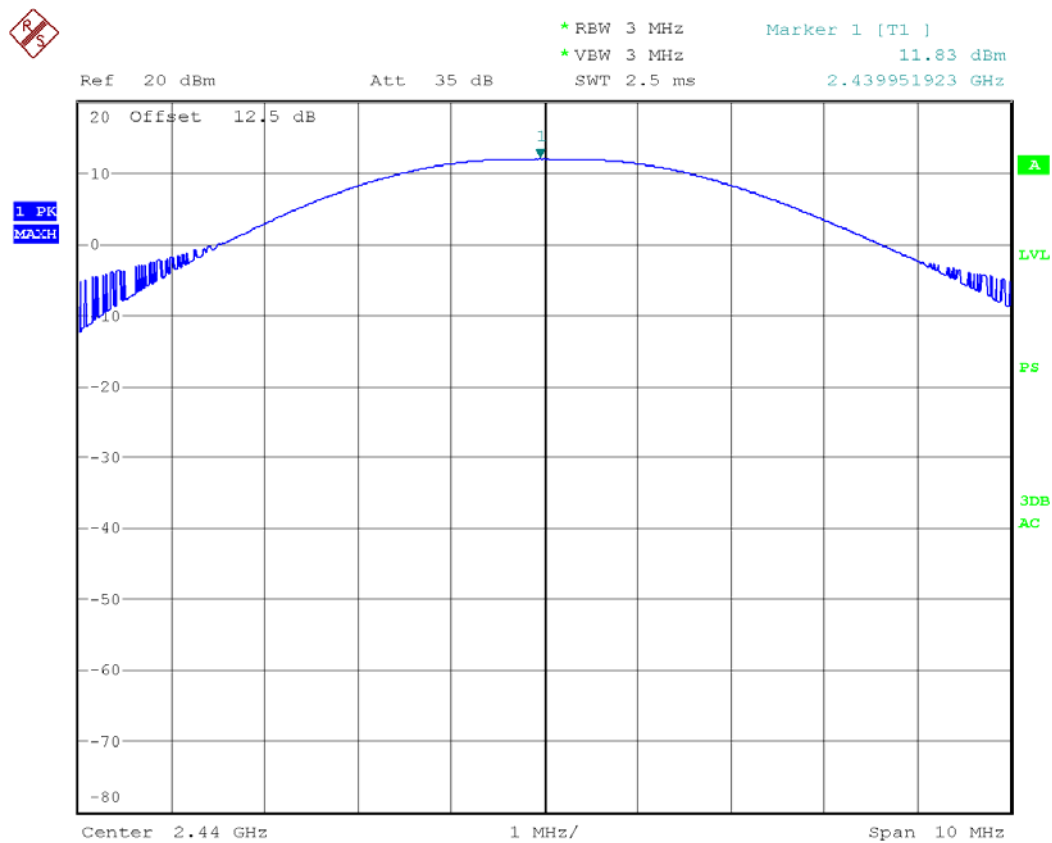
Measurement Setup

Same as the Chapter 3.2.1 (Figure 1)

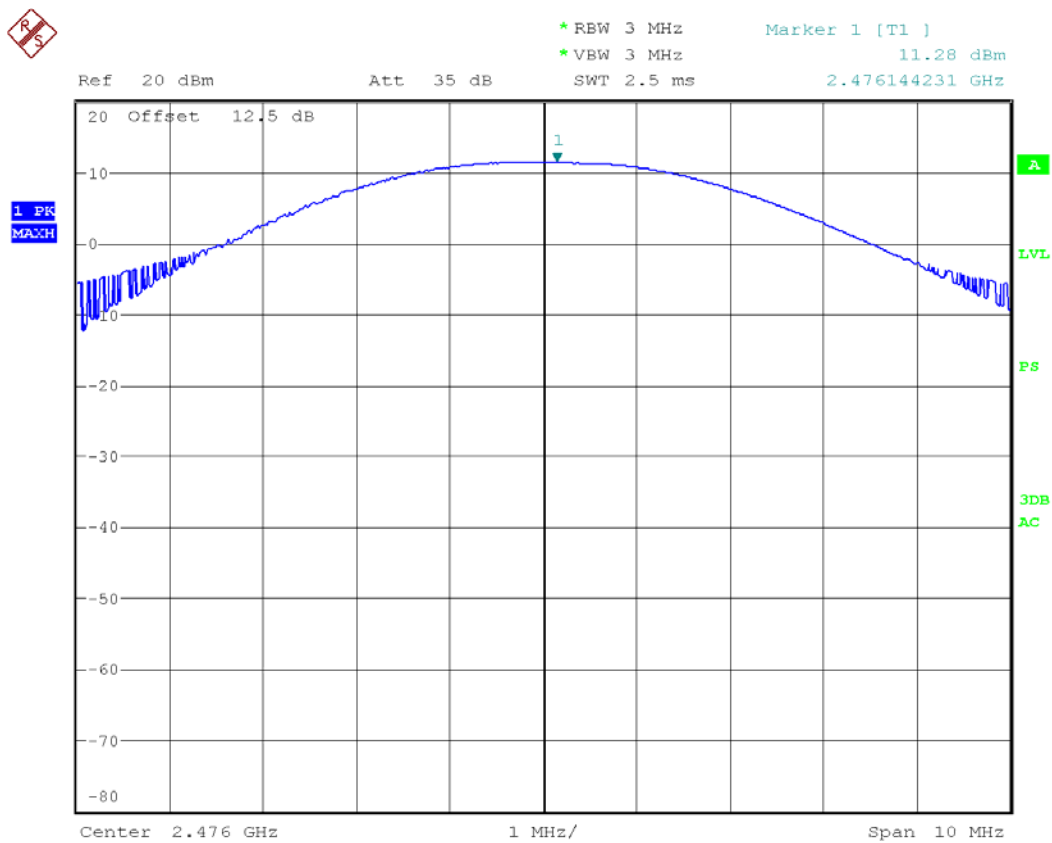
Low Channel



Middle Channel



High Channel



3.2.6 Band Edge

Procedure:

The bandwidth at 20dB down from the highest inband spectral density is measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function disabled at the highest, middle and the lowest available channels.

After the trace being stable, Use the marker-to-peak function to measure 20 dB down both sides of the intentional emission.

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

RBW = 100 kHz

VBW = 100 kHz

Span = 10 MHz

Detector function = peak

Trace = max hold

Sweep = auto

Measurement Data: Complies

- All conducted emission in any 100kHz bandwidth outside of the spread spectrum band was at least 20dB lower than the highest inband spectral density. Therefore the applying equipment meets the requirement.
- See next pages for actual measured spectrum plots.

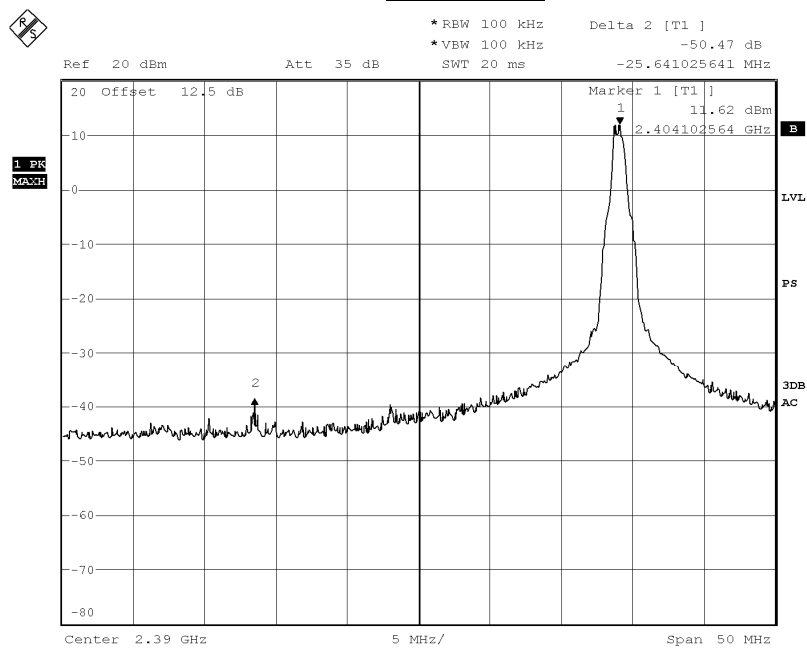
Minimum Standard:	> 20 dBc
--------------------------	----------

Measurement Setup

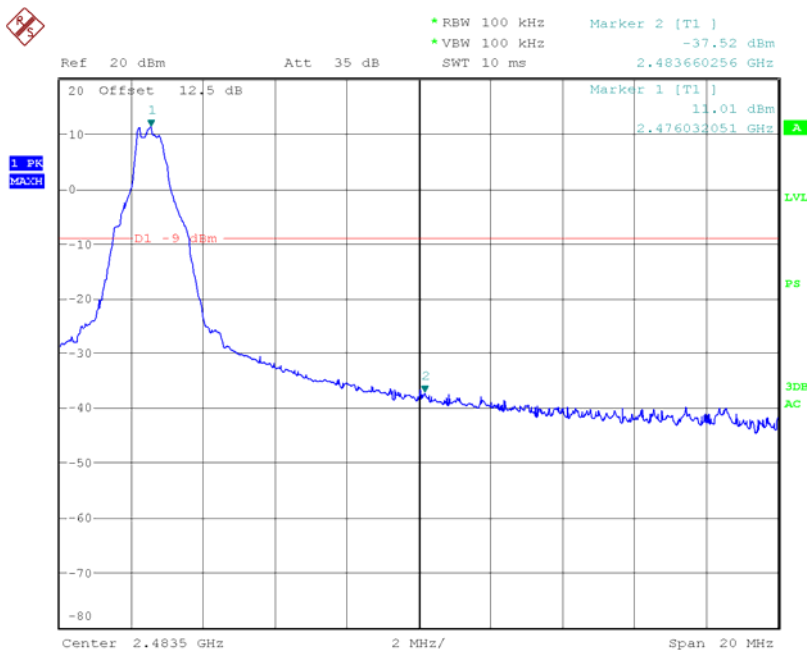
Same as the Chapter 3.2.1 (Figure 1)

Band - edge (without Hopping)

Lower edge



Upper edge



Band-edges in the restricted band 2483.5 ~ 2500 MHz measurement

- Document DA 00-705 Marker Delta Method

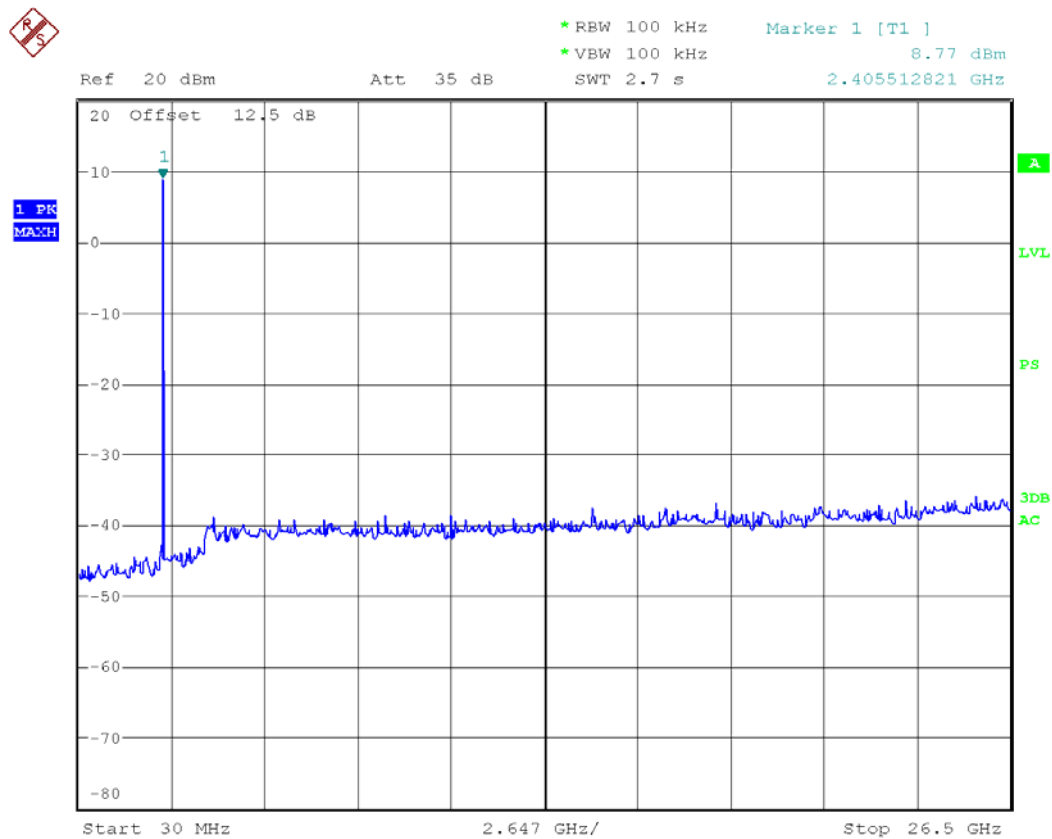
Frequency (MHz)	Detect mode	Pol.	Reading (dBUV/m)	T.F (dB)	Step 1 Data	delta	Step 3 Data	Limit
2483.5	PK	V	115.5	1.1	109.8	47.5	62.3	74
	AV	V	100.8	1.1	96.0	47.5	48.5	54

Note) Step 1 = Reading + T.F

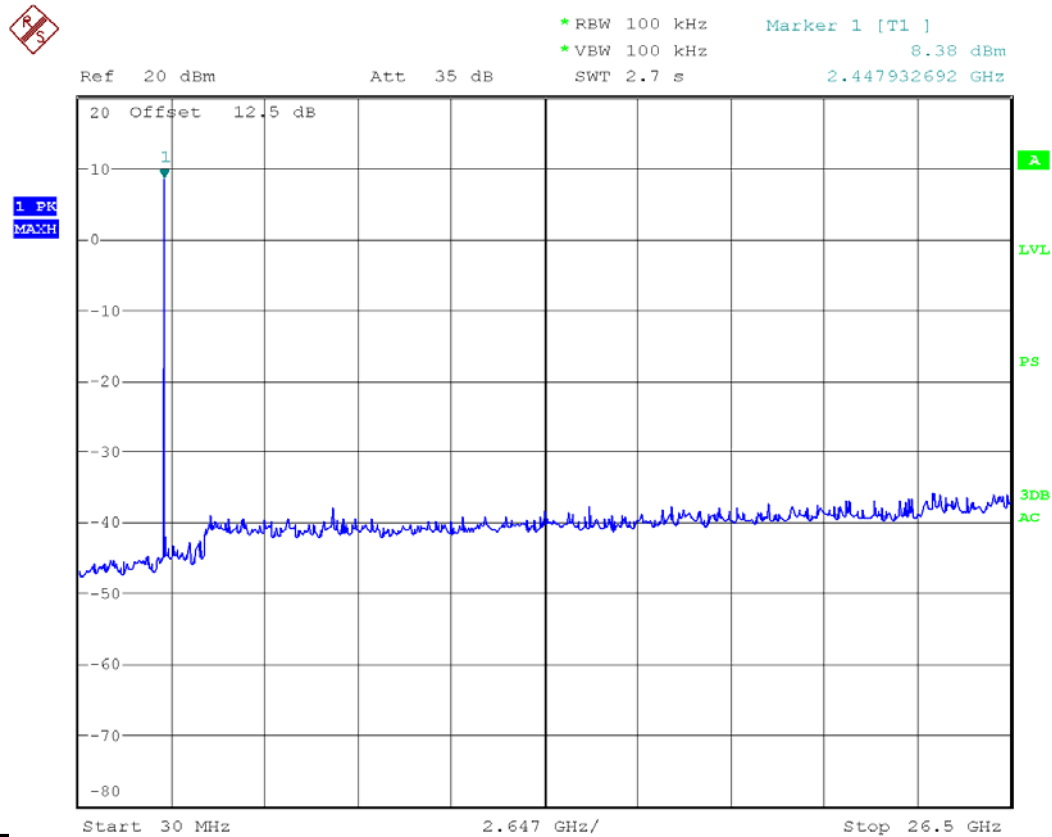
T.F = Ant.F + Cable loss – PreAmp Gain

Step 3 = Step 1 – Delta Value

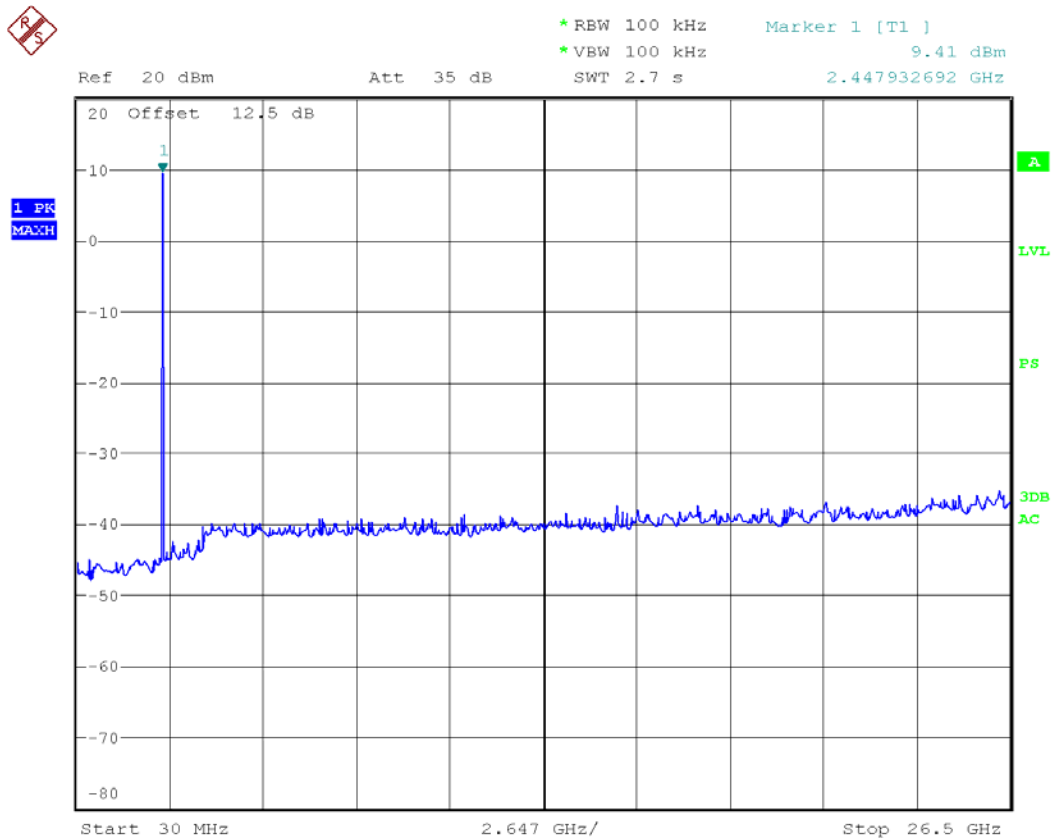
Unwanted Emission – Low channel



Unwanted Emission – Middle channel



Unwanted Emission – High channel



3.2.7 Field Strength of Harmonics

Procedure:

The EUT was placed on a 0.8m high wooden table inside a shielded enclosure. An antenna was placed near the EUT and measurements of frequencies and amplitudes of field strengths were recorded for reference during final measurements. For final radiated testing, measurements were performed in OATS. Measurements were performed with the EUT oriented in 3 orthogonal axis and rotated 360 degrees to determine worst-case orientation for maximum emissions.

The spectrum analyzer is set to:

Center frequency = the worst channel

Frequency Range = 30 MHz ~ 10th harmonic.

RBW = 100 kHz (30MHz ~ 1 GHz)

= 1 MHz (1 GHz ~ 10th harmonic)

Span = 100 MHz

Trace = max hold

Peak:VBW $\geq$ RBW

Average:VBW=10Hz

Detector function = Peak and Average

Sweep = auto

Measurement Data: Complies

- Refer to the next page.
- No other emissions were detected at a level greater than 10dB below limit.

Minimum Standard: FCC Part 15.209(a)

Frequency (MHz)	Limit (uV/m) @ 3m
30 ~ 88	100 **
88 ~ 216	150 **
216 ~ 960	200 **
Above 960	500

** Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88MHz, 174-216MHz or 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

Measurement Data:**1. PEAK data**

Low channel		Mid channel		High channel	
Frequency (MHz)	Level (dBuV/m)	Frequency (MHz)	Level (dBuV/m)	Frequency (MHz)	Level (dBuV/m)
No emissions were detected at a level greater than 20dB below limit.					
Measurement uncertainty		± 6 dB			

2. AVERAGE data

Low channel		Mid channel		High channel	
Frequency (MHz)	Level (dBuV/m)	Frequency (MHz)	Level (dBuV/m)	Frequency (MHz)	Level (dBuV/m)
No emissions were detected at a level greater than 20dB below limit.					
Measurement uncertainty		± 6 dB			

Field strength

243 Jubug-ri, yangji-Myeon, Youngin-si,
Gyeonggi-do 449-822 Korea
Tel :+82-31-3236008,9
Fax:+82-31-3236010

EUT/Model No.: SWA-4100

TEST MODE: Wireless mode

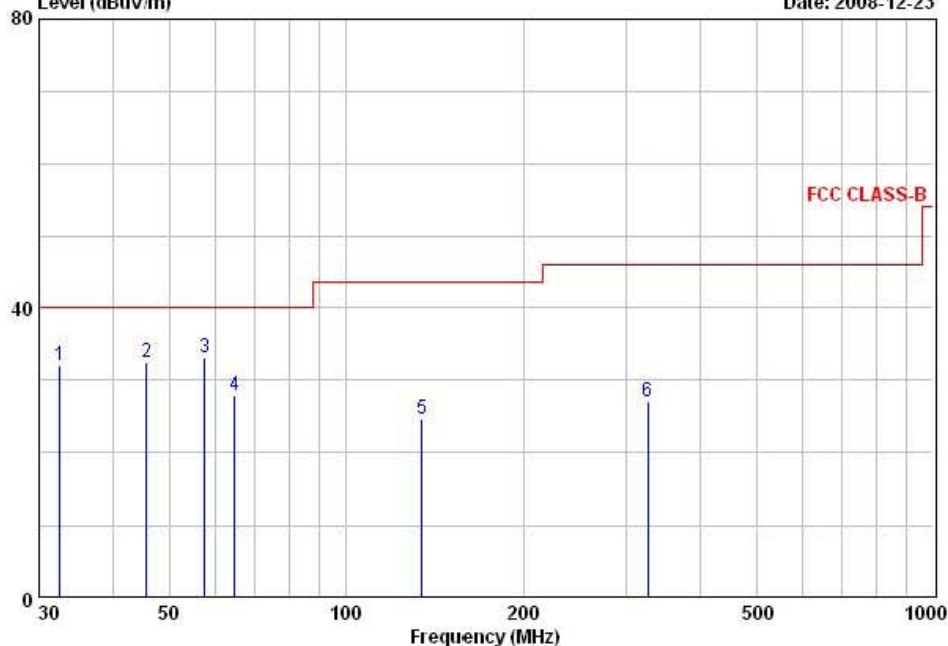
Temp Humi : 5 / 34

Tested by: KIM.B.S

Data: 36

Level (dBuV/m)

Date: 2008-12-23



	Freq	Reading	C.F	Result	Limit	Margin	Height	Angle	Polarity
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	deg	
1	32.55	47.10	-15.01	32.09	40.00	7.91	100	192	VERTICAL
2	45.78	46.10	-13.67	32.43	40.00	7.57	100	221	VERTICAL
3	57.58	47.20	-14.08	33.12	40.00	6.88	100	250	VERTICAL
4	64.76	42.80	-15.00	27.80	40.00	12.20	100	155	VERTICAL
5	135.16	36.90	-12.16	24.74	43.50	18.76	142	162	HORIZONTAL
6	325.92	36.10	-9.00	27.10	46.00	18.90	100	182	VERTICAL

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain

3.2.8 AC Conducted Emissions

Procedure:

The conducted emissions are measured in the shielded room with a spectrum analyzer in peak hold. While the measurement, EUT had its hopping function disabled at the middle channels in line with Section 15.31(m). Emissions closest to the limit are measured in the quasi-peak mode (QP) with the tuned receiver using a bandwidth of 9 kHz. The emissions are maximized further by cable manipulation and Exerciser operation. The highest emissions relative to the limit are listed.

Measurement Data: Complies

- See next pages for actual measured spectrum plots.
- No emissions were detected at a level greater than 10dB below limit.

Minimum Standard: FCC Part 15.207(a)/EN 55022

Frequency Range (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15 ~ 0.5	66 to 56 *	56 to 46 *
0.5 ~ 5	56	46
5 ~ 30	60	50

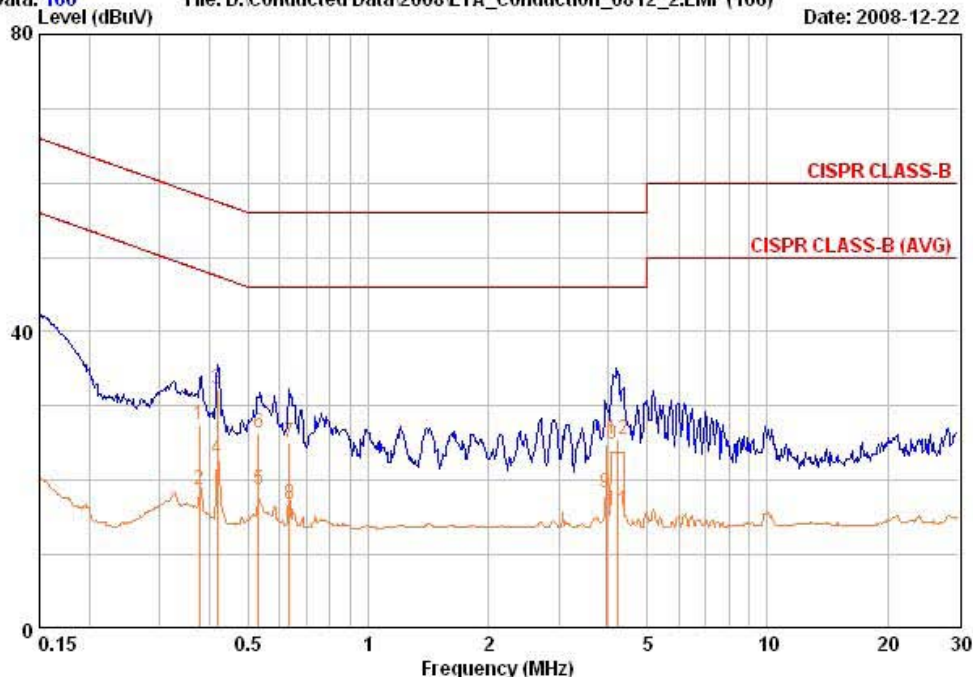
* Decreases with the logarithm of the frequency

AC Conducted Emissions – Line

243 Jubug-ni, yangji-Myeon, Youngin-si,
Gyeonggi-do 449-822 Korea
Tel :+82-31-323-6008
Fax:+82-31-323-6010

EUT / Model No. : SWA-4100	Phase : LINE
Test Mode : Wireless mode	Test Power : 120 / 60
Temp./Humi. : 23 / 15	Test Engineer : B.S KIM

Data: 166 File: D:\Conducted Data\2008\LTA_Conduction_0812_2.EMI (166) Date: 2008-12-22



Freq	RD	RD	C.F	Result	Result	Limit	Limit	Margin	Margin
MHz	QP	AV		QP	AV	QP	AV	QP	AV
	dBuV	dBuV	dB	dBuV	dBuV	dBuV	dBuV	dB	dB
0.378	17.90	9.30	9.50	27.40	18.80	58.32	48.32	30.92	29.52
0.419	22.70	13.40	9.51	32.21	22.91	57.47	47.47	25.25	24.55
0.532	16.80	9.20	9.55	26.35	18.75	56.00	46.00	29.65	27.25
0.633	15.40	7.30	9.57	24.97	16.87	56.00	46.00	31.03	29.13
3.934	15.10	8.60	9.68	24.78	18.28	56.00	46.00	31.22	27.72
4.208	15.80	6.30	9.67	25.47	15.97	56.00	46.00	30.53	30.03

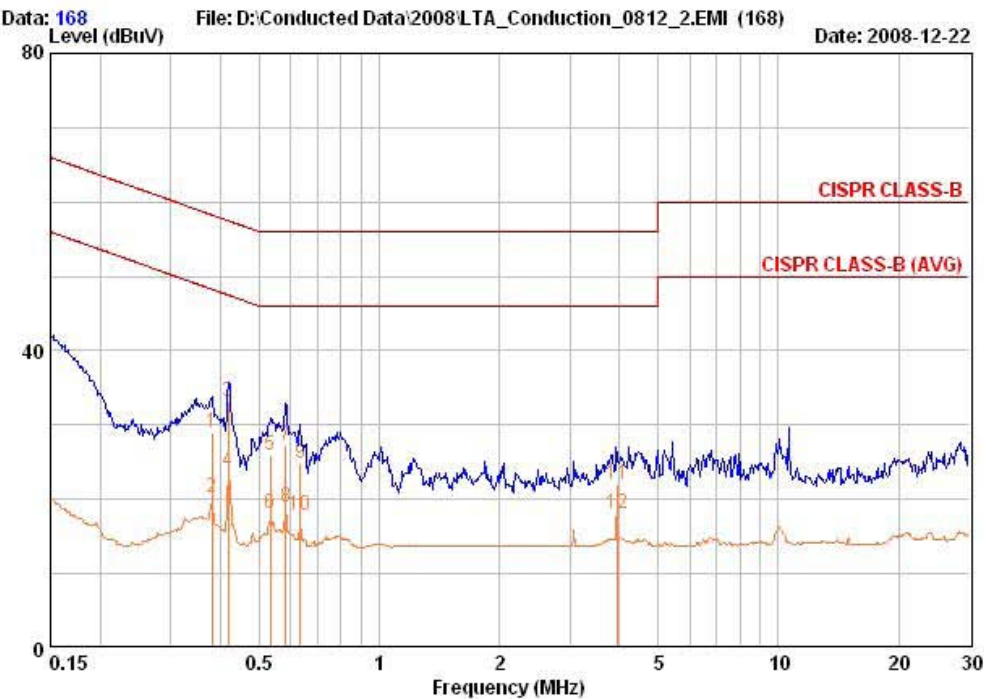
Remarks: C.F (Correction Factor) = Insertion loss + Cable loss

AC Conducted Emissions – Neutral



243 Jibug-ri, yangji-Myeon, Youngin-si,
Gyeonggi-do 449-822 Korea
Tel :+82-31-323-6008
Fax:+82-31-323-6010

EUT / Model No. : SWA-4100	Phase : NEUTRAL
Test Mode : Wireless mode	Test Power : 120 / 60
Temp./Humi. : 23 / 15	Test Engineer : B.S KIM



Freq	RD	RD	C.F	Result	Result	Limit	Limit	Margin	Margin
MHz	QP	AV		QP	AV	QP	AV	QP	AV
	dBuV	dBuV	dB	dBuV	dBuV	dBuV	dBuV	dB	dB
0.381	19.40	10.70	9.49	28.89	20.19	58.26	48.26	29.36	28.06
0.419	23.70	14.30	9.51	33.21	23.81	57.47	47.47	24.26	23.66
0.534	16.30	8.60	9.54	25.84	18.14	56.00	46.00	30.16	27.86
0.582	17.60	9.40	9.56	27.16	18.96	56.00	46.00	28.84	27.04
0.633	15.30	8.40	9.57	24.87	17.97	56.00	46.00	31.13	28.03
3.933	12.40	8.40	9.68	22.08	18.08	56.00	46.00	33.92	27.92

Remarks: C.F (Correction Factor) = Insertion loss + Cable loss

APPENDIX

TEST EQUIPMENT USED FOR TESTS

	Description	Model No.	Serial No.	Manufacturer	Next Cal. Date
1	Spectrum Analyzer	8594E	3649A03649	HP	Apr-09
2	Signal Generator	8648C	3623A02597	HP	Apr-09
3	Attenuator (3dB)	8491A	37822	HP	Oct-09
4	Attenuator (10dB)	8491A	63196	HP	Oct-09
5	EMI Test Receiver	ESVD	843748/001	R&S	Aug-09
6	LISN	KNW-407	8-1430-1	Kyoritsu	Jan-09
7	Two-Line V-Network	ESH3-Z5	893045/017	R&S	Oct-09
8	RF Amplifier	8447D	2949A02670	HP	Jan-09
9	RF Amplifier	8447D	2439A09058	HP	Oct-09
10	RF Amplifier	8449B	3008A02126	HP	Apr-09
11	Test Receiver	ESHS10	828404009	R&S	Aug-09
12	TRILOG Antenna	VULB 9160	9160-3212	SCHWARZBECK	Jul-09
13	Log.-Per. Antenna	VULP 9118	9118 A 401	SCHWARZBECK	Apr-09
14	Biconical Antenna	BBA 9106	VHA 9103-2315	SCHWARZBECK	Apr-09
15	Horn Antenna	3115	00055005	ETS LINDGREN	Mar-09
16	Dipole Antenna	VHA9103	2116	Schwarzbeck	Nov-09
17	Dipole Antenna	VHA9103	2117	Schwarzbeck	Nov-09
18	Dipole Antenna	UHA9105	2261	Schwarzbeck	Nov-09
19	Dipole Antenna	UHA9105	2262	Schwarzbeck	Nov-09
20	Spectrum Analyzer	ESU	100109	R&S	Mar-09
21	Spectrum Analyzer	8563E	3425A02505	HP	Apr-09
22	Hygro-Thermograph	THB-36	0041557-01	ISUZU	Apr-09
23	Splitter (SMA)	ZFSC-2-2500	SF617800326	Mini-Circuits	Jun-09
24	RF Switch	MP59B	6200414971	ANRITSU	Jun-09
25	RF Switch	MP59B	6200438565	ANRITSU	Jun-09
26	Power Divider	11636A	6243	HP	Oct-09
27	DC Power Supply	6622A	3448A03079	HP	Oct-09
28	Attenuator (30dB)	11636A	6243	HP	Oct-09
29	Frequency Counter	5342A	2826A12411	HP	Apr-09
30	Power Meter	EPM-441A	GB32481702	HP	Apr-09
31	Power Sensor	8481A	2702A64048	HP	Apr-09
32	Audio Analyzer	8903B	3729A18901	HP	Oct-09
33	Modulation Analyzer	8901B	3749A05878	HP	Oct-09
34	TEMP & HUMIDITY Chamber	YJ-500	L05022	JinYoung Tech	Oct-09
35	LOOP-ANTENNA	FMZB 1516	151602/94	SCHWARZBECK	Mar-09
36	Stop Watch	HS-3	601Q09R	CASIO	Apr-09