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AIR Logic

Dates of Tests: December 01 ~ 08, 2005
Test Report S/N: LR500110512I
Test Site : LTA CO., LTD.

CERTIFICATIO OF COMPLIANCE

FCC ID. **S7ZAH20**

APPLICANT **AIRLOGIC Co., Ltd.**

FCC Classification	:	**FHSS Sequence Spread Spectrum (FHSS)**
Manufacturing Description	:	**Bluetooth Stereo Headset**
Manufacturer	:	**AIRLOGIC Co., Ltd.**
Model name	:	**icombi AH20**
Test Device Serial No.:	:	**Identification**
ETSI Rule Part(s)	:	**FCC Part 15.247 Subpart C; ANSI C-63.4-2003**
Frequency Range	:	**2402 ~ 2480MHz**
RF power Class	:	**2 (-6dBm ~ +4dBm)**
Data of issue	:	**December 21, 2005**

This test report is issued under the authority of:

Dong –Min JUNG, Technical Manager

The test was supervised by:

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®

NVLAP LAB Code.: 200723-0

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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	2006-09-30	ECT accredited Lab.
RRL	KOREA	KR0049	2007-07-13	EMC accredited Lab.
FCC	U.S.A	610755	2008-03-28	FCC filing
VCCI	JAPAN	R2133, C2307	2008-06-22	VCCI registration
IC	CANADA	IC5799	2008-04-23	IC filing

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2. Information's about test item

2-1 Client

Company name	:	AIRLOGIC Co., Ltd.
Address	:	A-606, Ssangyong IT Twin Tower, 442-17, Sangdaewon-dong, Jungwon-gu, Seongnam-si, Gyeonggi-do, 462-723, Korea
Telephone	:	+82 31 747-1031
Facsimile	:	+82 31 747-1034

2-2 Equipment Under Test (EUT)

Trade name	:	Bluetooth Stereo Headset
FCC ID	:	S7ZAH20
Model name	:	icombi AH20
Serial number	:	Identification
Date of receipt	:	December 01, 2005
EUT condition	:	Pre-production, not damaged
Antenna type	:	Chip antenna Gain 0dBi
Frequency Range	:	2402 ~ 2480MHz
RF output power Range	:	-6dBm~+4dBm (Class 2)
Number of channels	:	79
Channel spacing	:	1MHz
Channel Access Protocol	:	Frequency Hopping
Type of Modulation	:	GFSK
Duty cycle TX power	:	78 %
Power Source	:	3.7V (Lithium polymer battery)

2-3 Tested frequency

	LOW	MID	HIGH
Frequency (MHz)	2402	2441	2480

2-4 Ancillary Equipment

Equipment	Model No.	Serial No.	Manufacturer
AC Adaptor	KSAFB0500050W1US	N/A	KTEC
-	-	-	-

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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	> 75 hops		C
15.247(a)	20 dB Bandwidth	< 1 MHz		C
15.247	Dwell Time	< 0.4 seconds		C
15.247(b)	Transmitter Output Power	< 1Watt		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
15.207	AC Conducted Emissions	EN 55022	Line Conducted	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

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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 = 3 MHz (wide enough to capture the peaks of two adjacent channels)

RBW = 300 kHz (1% of the span or more) Sweep = auto

VBW = 300 kHz Detector function = peak

Trace = max hold

Measurement Data:

Test Results	
Carrier Frequency Separation (MHz)	**Result**
1.03	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 the 20dB bandwidth of the hopping channel, whichever is greater.

Measurement Setup

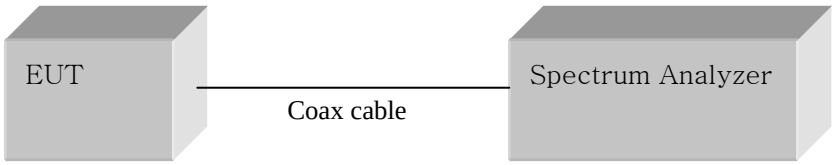

Figure 1: Measurement setup for the carrier frequency separation

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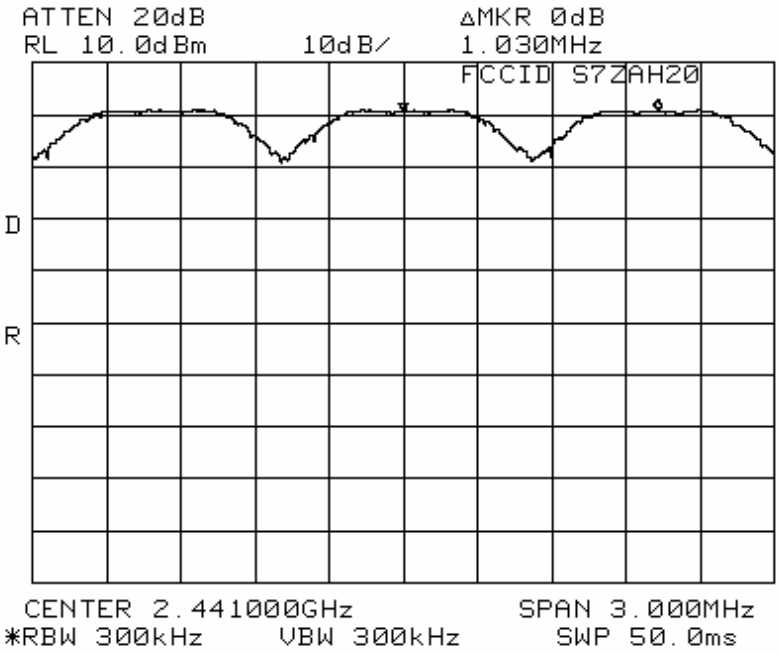
Carrier Frequency Separation



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 = 2389.5MHz, Stop = 2414.5 MHz
2: Start = 2414.5MHz, Stop = 2439.5 MHz
3: Start = 2439.5MHz, Stop = 2464.5 MHz
4: Start = 2464.5MHz, Stop = 2489.5 MHz

RBW = 300 kHz (1% of the span or more) Sweep = auto
VBW = 300 kHz (VBW ≥ RBW) Detector function = peak
Trace = max hold Span = 25MHz

Measurement Data: Complies

Total number of Hopping Channels	79

- See next pages for actual measured spectrum plots.

Minimum Standard:

At least 75 hopes

Measurement Setup

Same as the Chapter 3.2.1 (Figure 1)

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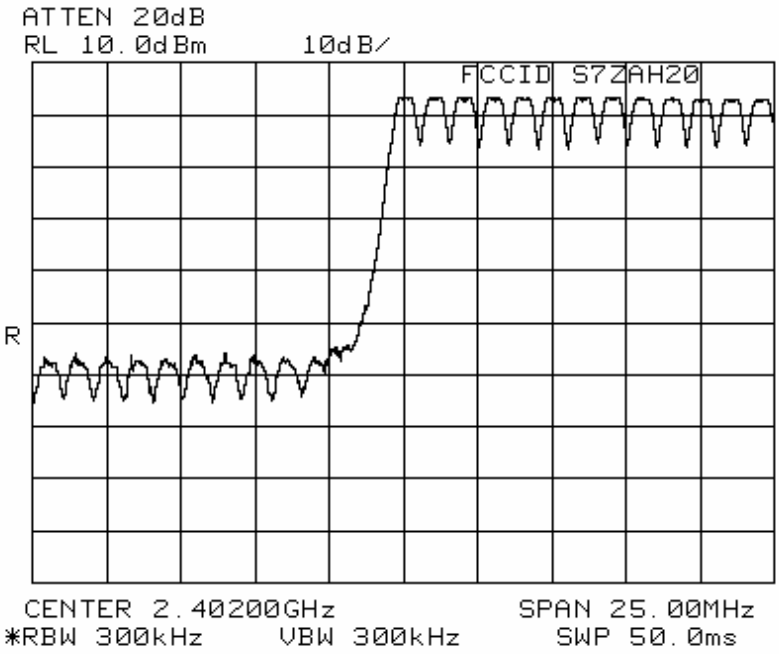
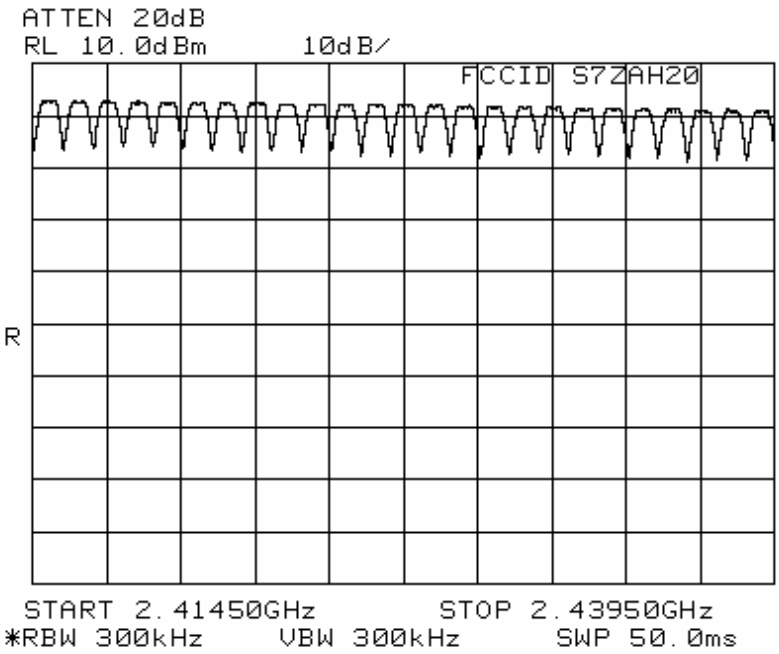
Number of Hopping Frequencies





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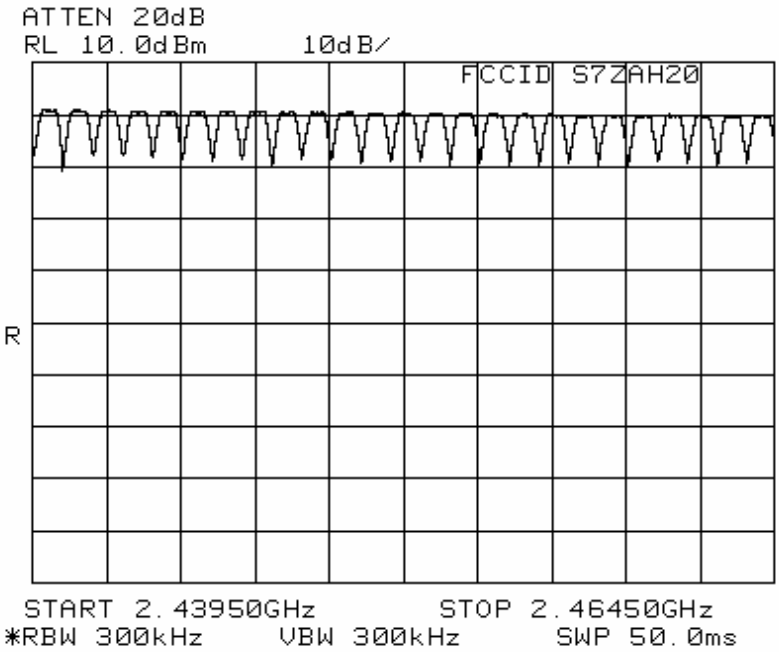
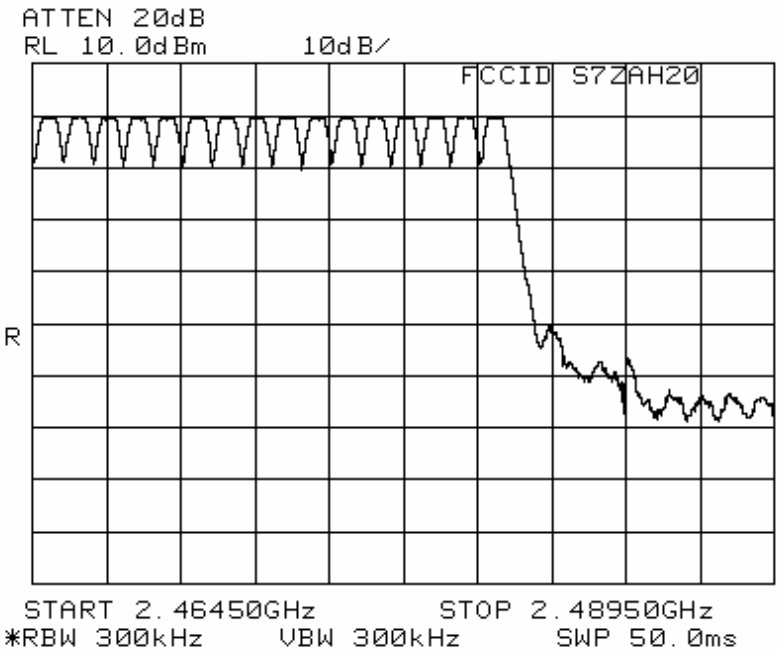
Number of Hopping Frequencies





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

RBW = 30 kHz

VBW = 30 kHz (VBW ≥ RBW)

Trace = max hold

Sweep = auto

Detector function = peak

Measurement Data:

Frequency (MHz)	Channel No.	Test Results	
		Measured Bandwidth (MHz)	Result
2441	**39**	**0.863**	Complies

- See next pages for actual measured spectrum plots.

Minimum Standard:

The transmitter shall have a maximum 20dB bandwidth of 1 MHz.

Measurement Setup

Same as the Chapter 3.2.1 (Figure 1)

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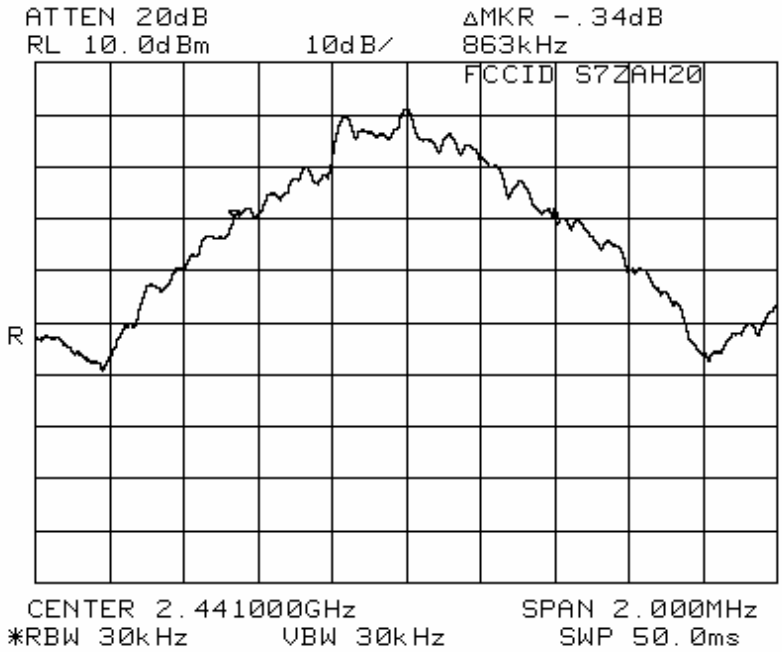
20 dB Bandwidth



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 ≥ RBW)

Trace = max hold Detector function = peak

Measurement Data:

Channel Number	Channel Frequency (MHz)	Test Results	
		Dwell Time (ms)	Result
39	**2441**	**2.908**	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)

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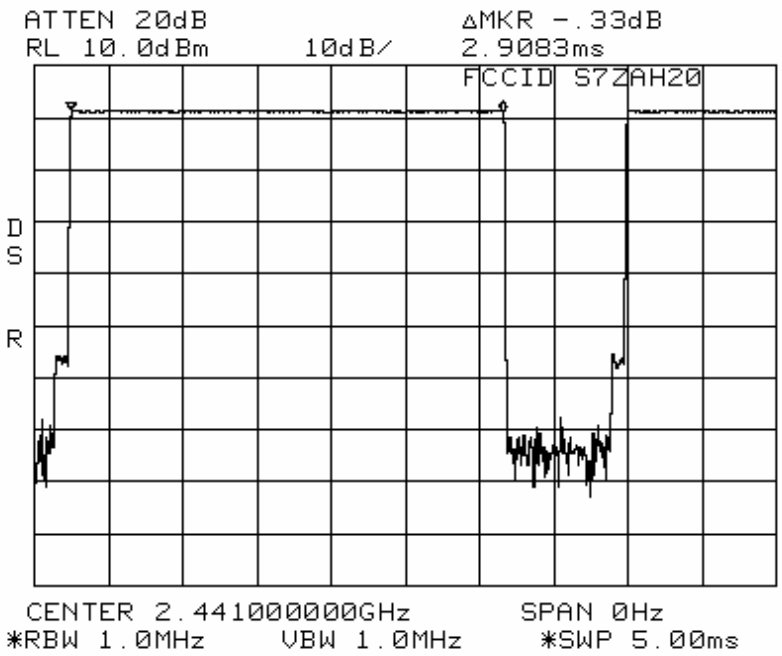
Time of Occupancy



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

RBW = 1 MHz (greater than the 20dB bandwidth of the emission being measured)

VBW = 1 MHz (VBW ≥ RBW) Detector function = peak

Trace = max hold Sweep = auto

Measurement Data:

Frequency (MHz)	Ch.	Test Results		
		dBm	W	Result
2402	0	**3.83**	**0.0024**	Complies
2441	39	**1.50**	**0.0014**	Complies
2480	78	**0.17**	**0.0010**	Complies

- See next pages for actual measured spectrum plots.

Minimum Standard:	< 1W

Measurement Setup

Same as the Chapter 3.2.1 (Figure 1)

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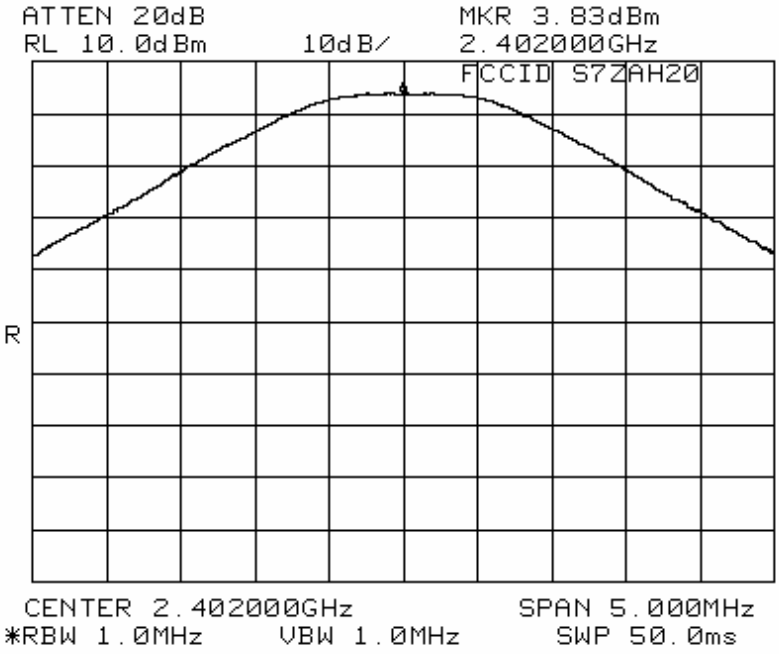
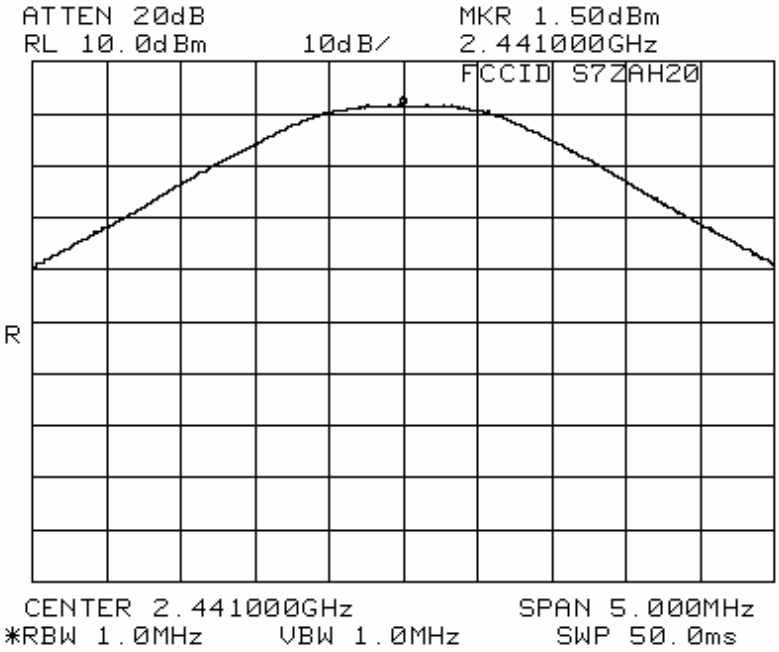
Peak Output Power





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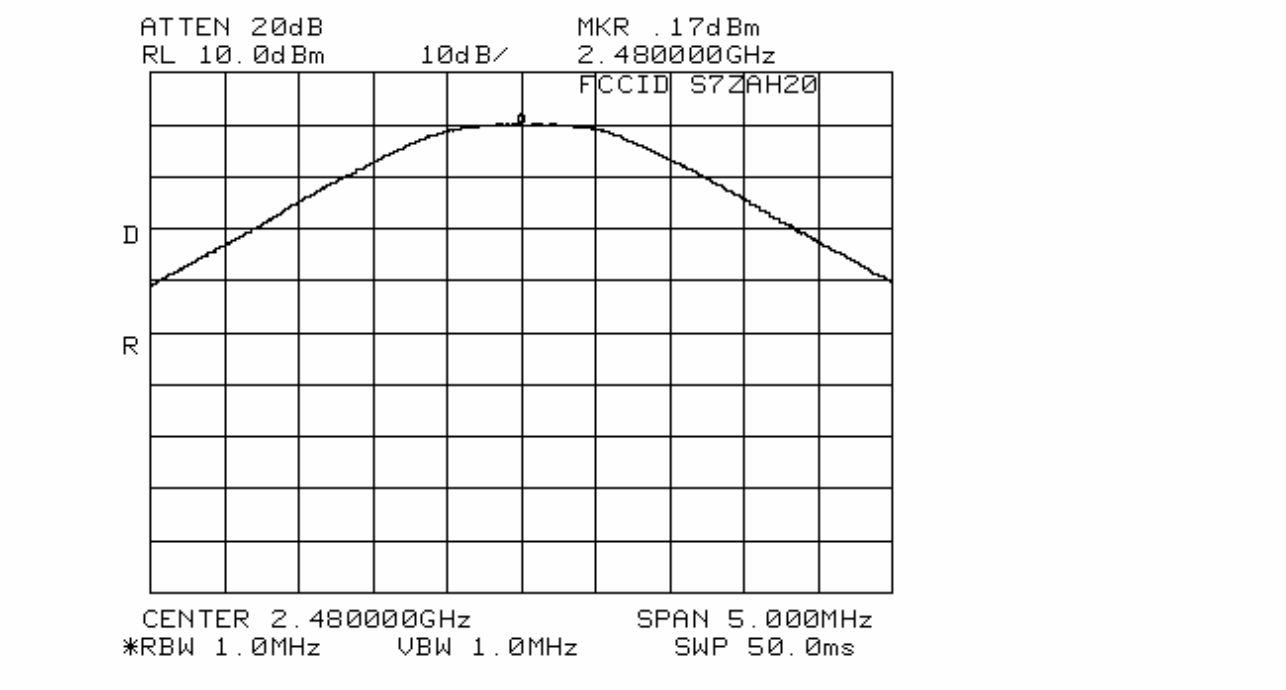
Peak Output Power



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)

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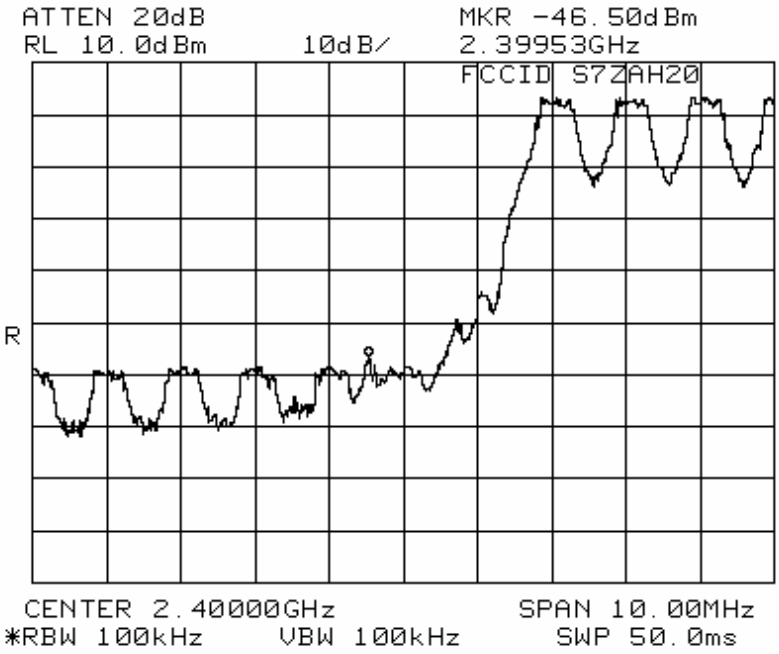
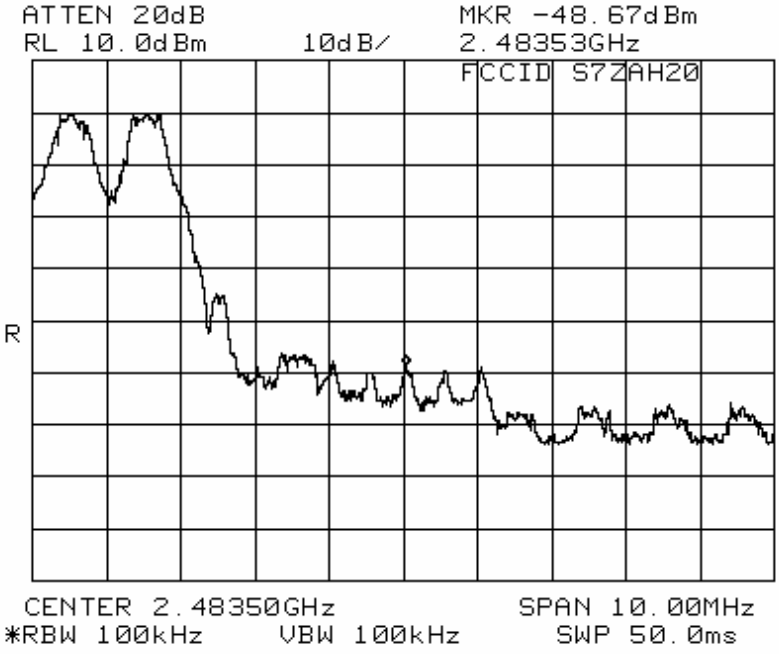
Band - edge (with Hopping)





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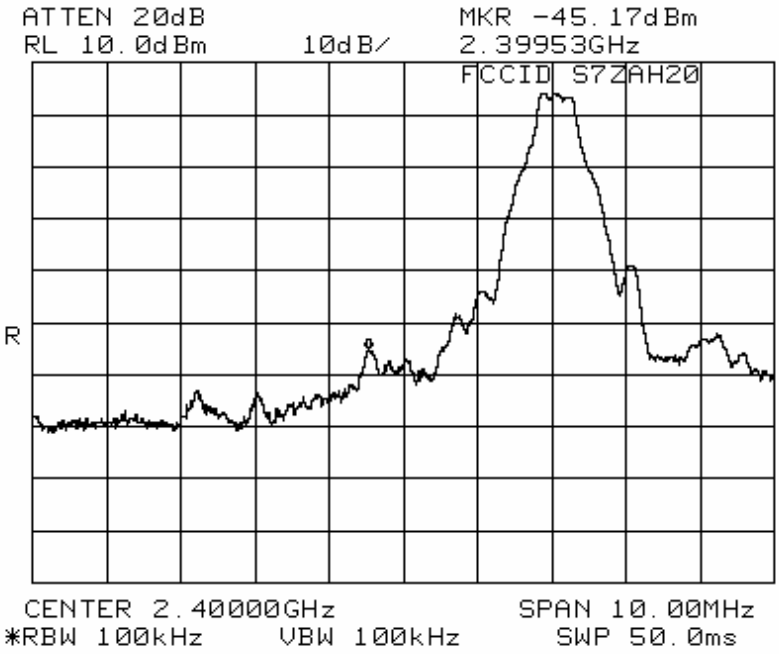
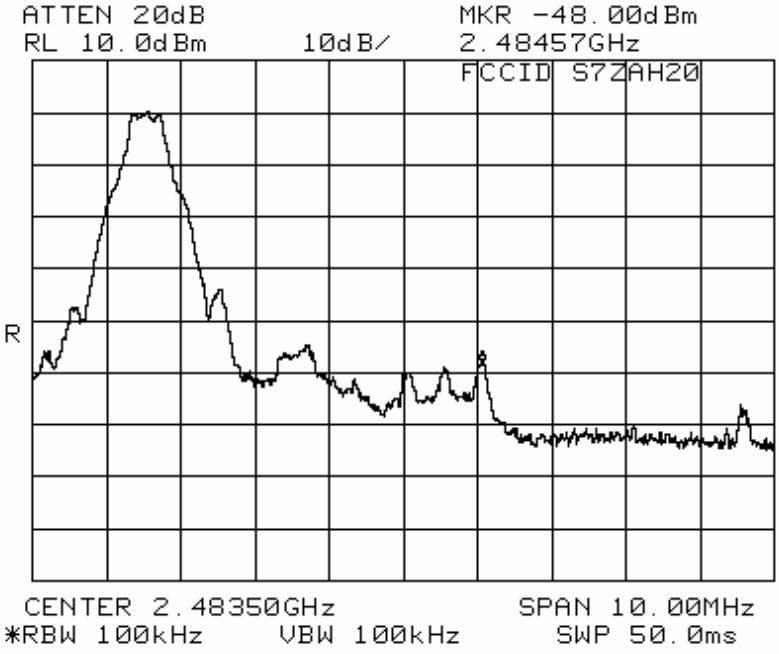
Band - edge (without Hopping)





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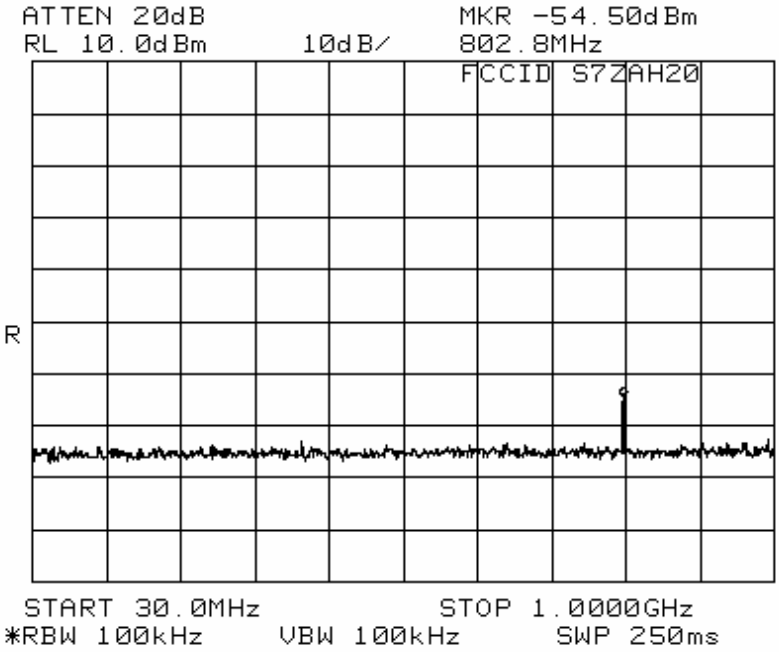
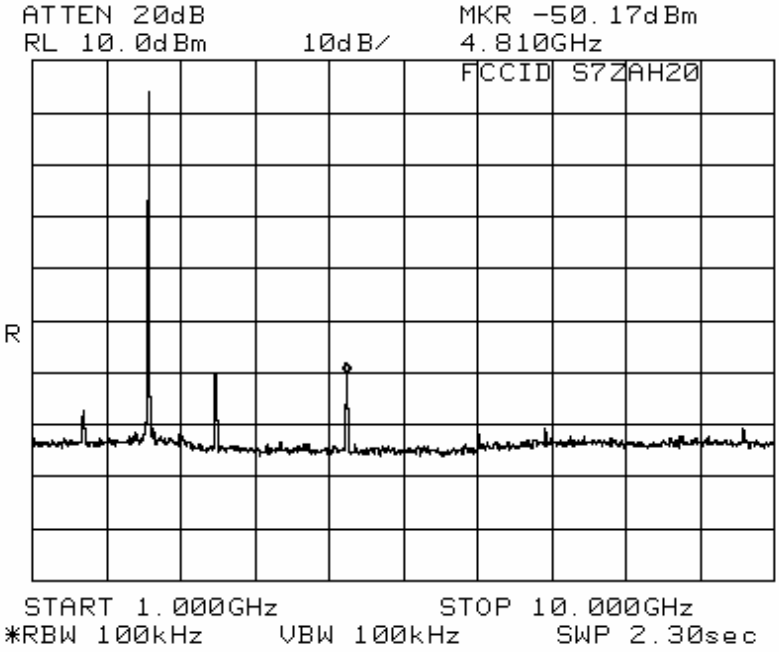
Band - edge (at 20 dB blow) – Low channel

Frequency Range = 30 MHz ~ 10th harmonic.





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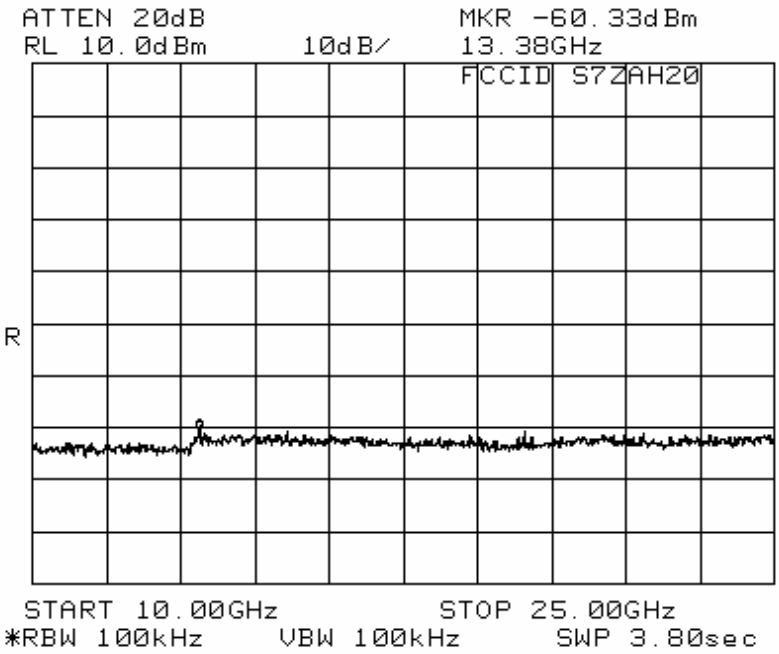
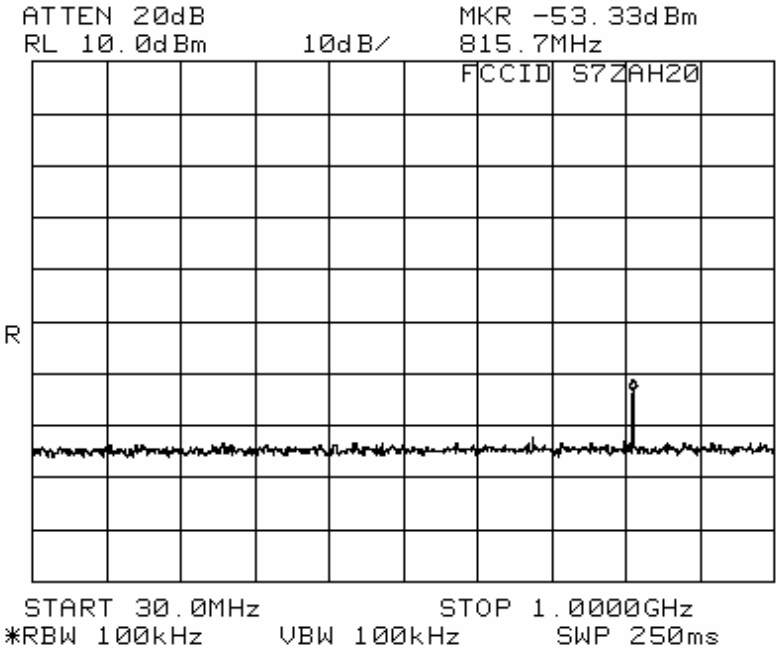
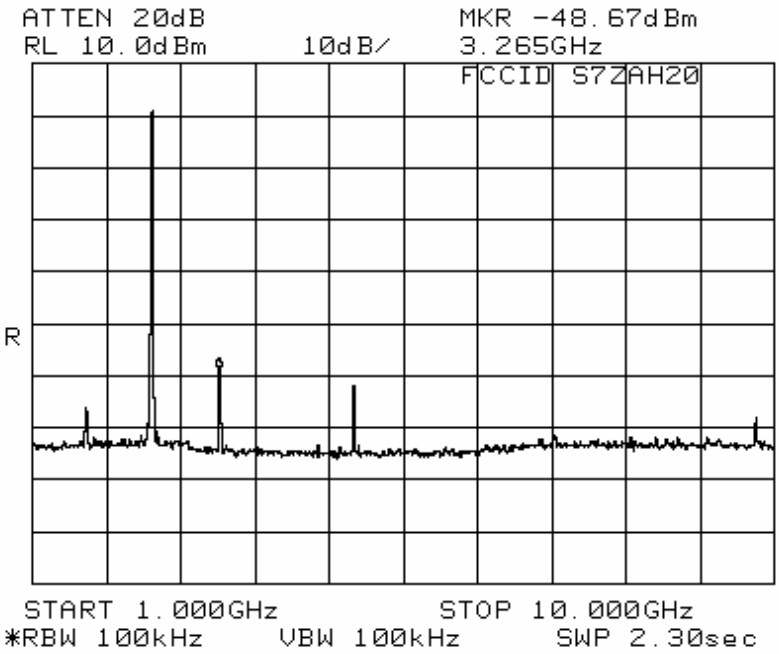
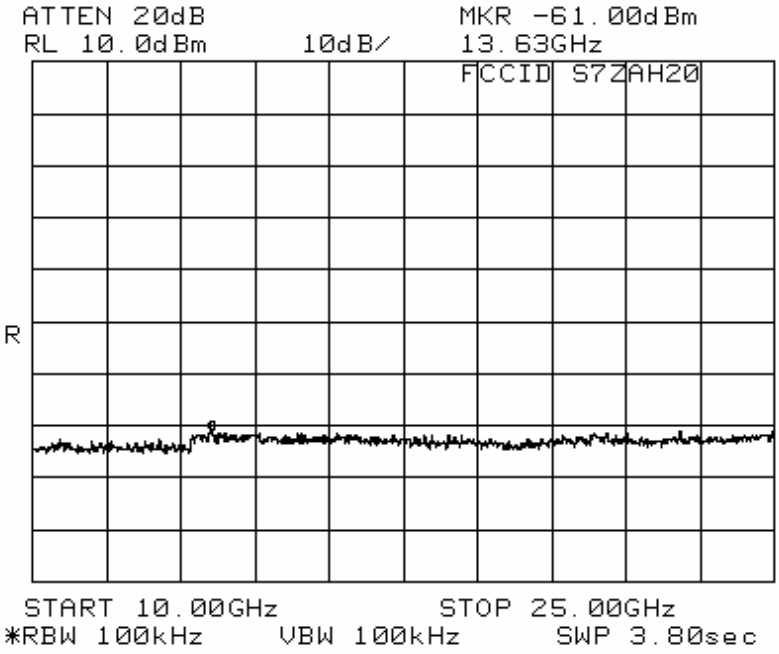

ATTEN 20dB
RL 10.0dBm
10dB/
MKR -60.33dBm
13.38GHz
FCCID S7ZAH20
R
START 10.00GHz
STOP 25.00GHz
*RBW 100kHz
VBW 100kHz
SWP 3.80sec

Band - edge (at 20 dB blow) – Mid channel

Frequency Range = 30 MHz ~ 10th harmonic.

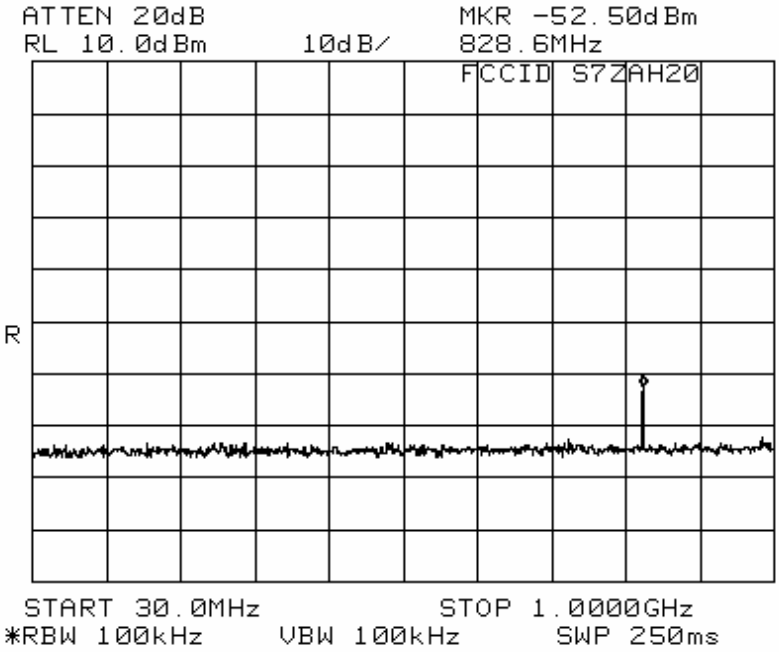


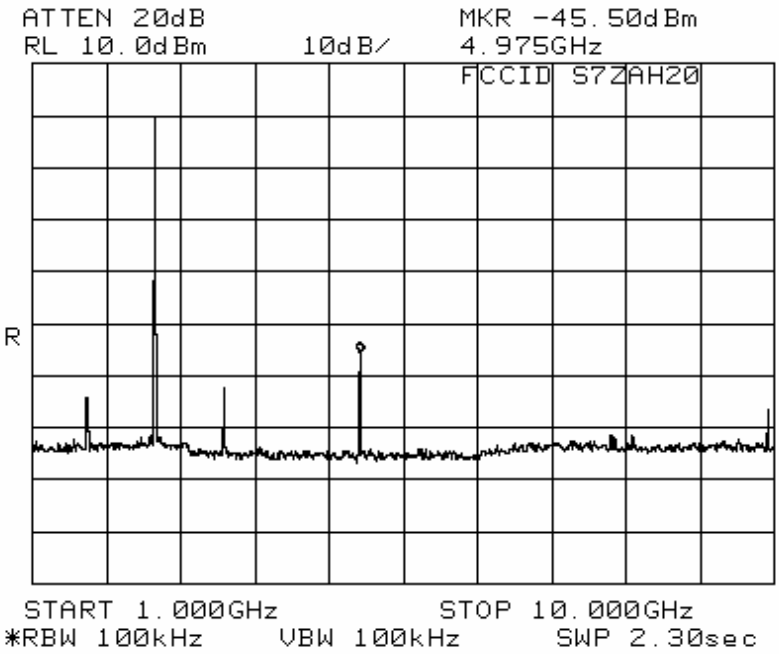


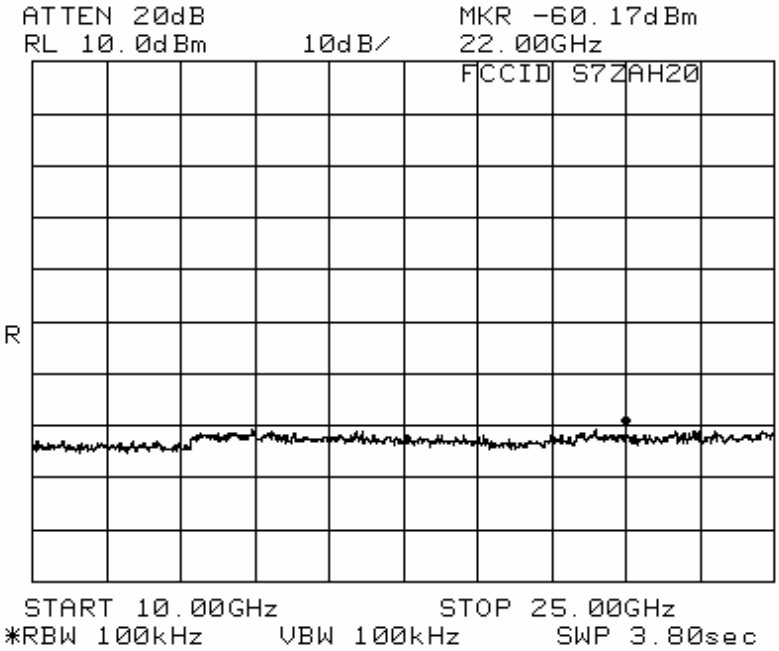

ATTEN 20dB
MKR -61.00dBm
RL 10.0dBm
10dB/
13.63GHz
FCCID S7ZAH20
R
START 10.00GHz
STOP 25.00GHz
*RBW 100kHz
VBW 100kHz
SWP 3.80sec

Band - edge (at 20 dB blow) – High channel

Frequency Range = 30 MHz ~ 10th harmonic.






ATTEN 20dB
RL 10.0dBm
10dB/
MKR -60.17dBm
22.00GHz
FCCID S7ZAH20
R
START 10.00GHz
STOP 25.00GHz
*RBW 100kHz
VBW 100kHz
SWP 3.80sec

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 = 120 kHz (30MHz ~ 1 GHz) VBW ≥ RBW

= 1 MHz (1 GHz ~ 10th harmonic)

Span = 100 MHz Detector function = peak

Trace = max hold Sweep = auto

Measurement Data: Complies

Low channel		Mid channel		High channel	
Frequency (MHz)	**Level (dBuV)**	**Frequency (MHz)**	**Level (dBuV)**	**Frequency (MHz)**	**Level (dBuV)**
3214	**32.08**	**3256**	**33.15**	**3310**	**31.41**
4804	**32.82**	**4882**	**31.33**	**4960**	**35.13**
-	-	-	-	-	-
Measurement uncertainty		± 6 dB			

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.

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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

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AC Conducted Emissions –Line

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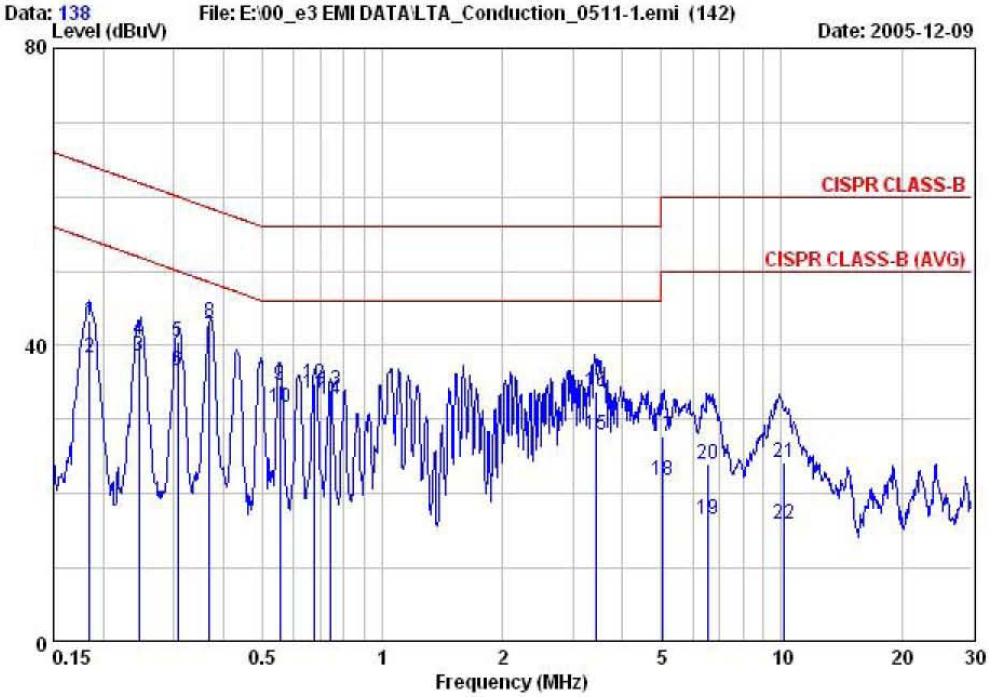
Gyeonggi-do 449-822 Korea
Tel :+82-31-323-6008
Fax:+82-31-323-6010

EUT / Model No.	: Icombi AH20	Phase	: LINE
Test Mode	: Charging mode	Test Power	: 120 / 60
Temp./Humi.	: 19 / 20	Test Engineer	: K.T. LEE



Freq MHz	RD QP dBuV	RD AV dBuV	C.F dB	Result QP dBuV	Result AV dBuV	Limit QP dBuV	Limit AV dBuV	Margin QP dB	Margin AV dB
0.19	43.00	38.00	0.30	43.30	38.30	64.26	54.26	20.96	15.96
0.25	40.60	38.30	0.23	40.83	38.53	61.89	51.89	21.06	13.36
0.31	40.30	36.40	0.29	40.59	36.69	60.05	50.05	19.46	13.36
0.37	42.80	40.80	0.35	43.15	41.15	58.52	48.52	15.37	7.37
0.55	34.30	31.40	0.29	34.59	31.69	56.00	46.00	21.41	14.31
0.68	34.60	33.20	0.30	34.90	33.50	56.00	46.00	21.10	12.50
0.74	33.60	32.40	0.34	33.94	32.74	56.00	46.00	22.06	13.26
3.45	33.30	27.30	0.55	33.85	27.85	56.00	46.00	22.15	18.15
5.05	27.20	21.30	0.55	27.75	21.85	60.00	50.00	32.25	28.15
6.56	23.50	15.90	0.56	24.06	16.46	60.00	50.00	35.94	33.54
10.11	23.30	15.00	0.90	24.20	15.90	60.00	50.00	35.80	34.10

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

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AC Conducted Emissions -Neutral

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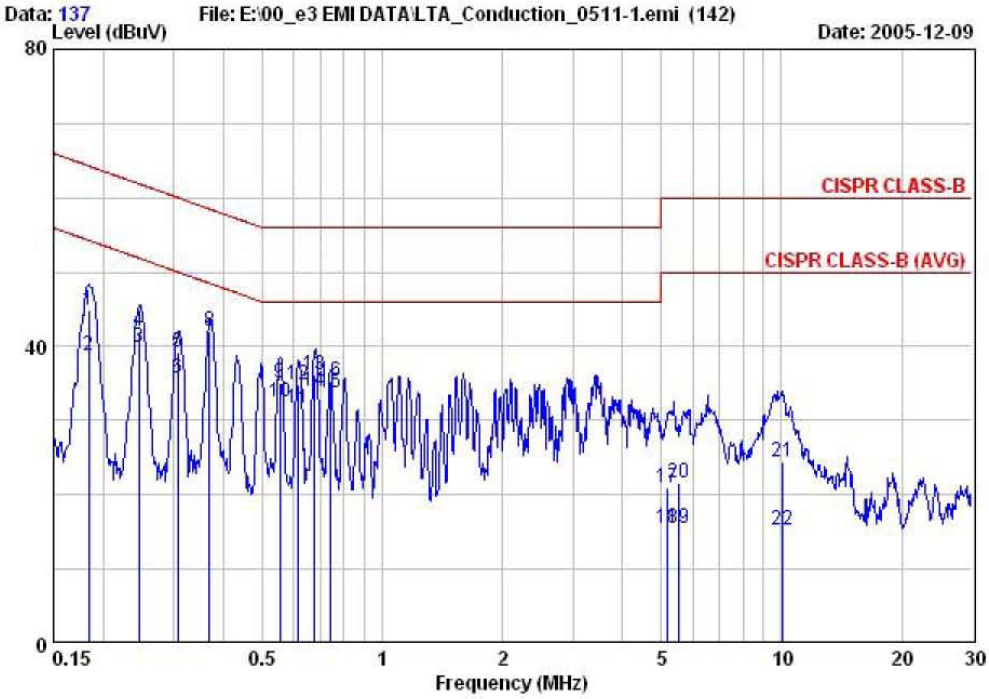
EUT / Model No.	: Icombi AH20	Phase	: NEUTRAL
Test Mode	: Charging mode	Test Power	: 120 / 60
Temp./Humi.	: 19 / 20	Test Engineer	: K.T. LEE



Freq MHz	RD QP dBuV	RD AV dBuV	C.F dB	Result QP dBuV	Result AV dBuV	Limit QP dBuV	Limit AV dBuV	Margin QP dB	Margin AV dB
0.18	44.60	38.60	0.31	44.91	38.91	64.30	54.30	19.40	15.40
0.25	41.80	39.60	0.23	42.03	39.83	61.89	51.89	19.87	12.07
0.31	38.90	35.40	0.29	39.19	35.69	60.02	50.02	20.84	14.34
0.37	41.70	40.50	0.35	42.05	40.85	58.52	48.52	16.47	7.67
0.55	34.80	32.20	0.28	35.08	32.48	56.00	46.00	20.92	13.52
0.62	34.60	31.40	0.29	34.89	31.69	56.00	46.00	21.11	14.31
0.68	36.00	33.80	0.29	36.29	34.09	56.00	46.00	19.71	11.91
0.74	34.90	33.40	0.33	35.23	33.73	56.00	46.00	20.77	12.27
5.20	20.40	15.00	0.51	20.91	15.51	60.00	50.00	39.09	34.49
5.54	21.10	15.00	0.53	21.63	15.53	60.00	50.00	38.37	34.47
10.02	23.50	14.40	0.88	24.38	15.28	60.00	50.00	35.62	34.72

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

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APPENDIX

TEST EQUIPMENT USED FOR TESTS

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	Description	Model No.	Serial No.	Manufacturer	Next Cal. Date
1	Spectrum Analyzer	8594E	3649A03649	HP	Dec-05
2	Signal Generator	8657A	3430U02049	HP	Dec-05
3	Attenuator (3dB)	8491A	37822	HP	Dec-05
4	Attenuator (3dB)	8491A	28881	HP	Dec-05
5	EMI Test Receiver	ESVD	843748/001	R&S	Dec-05
6	Spectrum Analyzer	8591E	3649A05888	HP	Feb-06
7	Spectrum Analyzer	R3272	82420423	ADVANTEST	Feb-06
8	RF Amplifier	8447D	2949A02670	HP	Jan-06
9	RF Amplifier	8447D	2439A09058	HP	Jan-06
10	RF Amplifier	8449B	3008A02126	HP	Jun-06
11	TRILOG Antenna	VULB 9160	9160-3172	SCHWARZBECK	Feb-06
12	Log.-Per. Antenna	VULP 9118	9118 A 401	SCHWARZBECK	Feb-06
13	Biconical Antenna	BBA 9106	VHA 9103-2315	SCHWARZBECK	Feb-06
14	Horn Antenna	3115	00055005	ETS LINDGREN	Jun-07
15	Horn Antenna	BBHA 9120D	0499	Schwarzbeck	Jun-07
16	Hygro-Thermograph	THB-36	0041557-01	ISUZU	Feb-06
17	Splitter (BNC)	ZFM-150	15542	Mini-Circuits	-
18	Splitter (SMA)	ZFSC-2-2500	SF617800326	Mini-Circuits	-
19	Power Divider	11636A	6243	HP	Apr-06
20	DC Power Supply	6622A	3448A03079	HP	Apr-06
21	Attenuator (30dB)	11636A	6243	HP	Apr-06
22	Attenuator (10dB)	8491A	63196	HP	Apr-06
23	Power Meter	EPM-441A	GB32481702	HP	Apr-06
24	Power Sensor	8481A	2702A64048	HP	Apr-06
25	Audio Analyzer	8903B	3729A18901	HP	May-06
26	Modulation Analyzer	8901B	3749A05878	HP	May-06
27	Dipole Antenna	VHA9103	2116	Schwarzbeck	Oct-06
28	Dipole Antenna	VHA9103	2117	Schwarzbeck	Oct-06
29	Dipole Antenna	UHA9105	2261	Schwarzbeck	Oct-06
30	Dipole Antenna	UHA9105	2262	Schwarzbeck	Oct-06
31	Digital Multimeter	34401A	US36062141	HP	Apr-06
32	LISN	KNW-407	8-1430-1	Kyoritsu	Dec-05
33	Two-Line V-Network	ESH3-Z5	893045/017	R&S	Jan-06
34	Test Receiver	ESH3	894718/017	R&S	Jan-06
35	TEMP & HUMIDITY Chamber	YJ-500	L05022	JinYoung Tech	-

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