FCC Test Report
(TR-0907-007-02)

Applicant	**:**	GP Electronics (HK) Ltd.
Address	**:**	6/F Gold Peak Building, 30 Kwai Wing Road, Kwai Chung, N.T., HK
Manufacturer	**:**	GP Electronics (Huizhou) Co. Ltd.
Address	**:**	No.76, Hui Feng Si Road, Zhong Kai Hi-Tech Inductrial Development Zone, Huizhou, Guangdong, P.R.China 516006
Product Name	**:**	KEF Wireless Subwoofer (Receiver)
Trademark	**:**	KEF
Model(s)	**:**	HTB2SE-W
Standard(s)	:	FCC Part 15 Subpart C
Test Result	**:**	Pass
Date of Test	**:**	Jul 22, 2009 to Aug 21, 2009
Report issued Dated	**:**	Aug 31, 2009

The results in this report apply only to the sample(s) tested. The production units are required to conform to the initial sample as received when the units are placed in the market.

Responsible Engineer	:	Phenix Zhang	Approved by	:	CHAN king-chui
Date	:	2009.08.31	Technical manager / Date	:	2009.08.31

Table of Contents

1. Description of the Test Site

1.1 Test Site Location:

Laboratory	:	TDK South China EMC Center SAE Technologies Development (Dongguan) Co., Ltd. Changan Branch
Address	:	Zhenan Hi-tech Industrial Park, Dongguang City, Guangdong Province, China
Phone no.	:	(86)-769-8564-4678
Fax no.	:	(86)-769-8564-4499
Email	:	emc@cn.tdk.com

1.2 Site Registration

VCCI (September, 2008)	:	Reg. No. R-2205, C-2392
FCC site registration (July, 2008)	:	Reg. No. 732901
IC registration	:	Reg. No. 7993
EMCC (September, 2008)	:	Reg. No. NAR/tl-060330

1.3 Test Scope

EMC testing according to national / international standards

2. Description of the Tested Samples

2.1 Customer Information

Customer	:	GP Electronics (HK) Ltd.
Address	:	6/F Gold Peak Building, 30 Kwai Wing Road, Kwai Chung, N.T., HK
Phone no.	:	852-24243521
Fax no.	:	852-24891309

2.2 Identification of EUT

Trademark	:	KEF
Model(s) No.	:	KEF Wireless Subwoofer (Receiver)
Serial No.	:	None

2.3 Spec of EUT

Description of Antenna	:	fixed, built-in antenna, 2dBi
Power Supply	:	100-240V 50/60Hz
Operation Frequency	:	2402 MHz ~ 2480 MHz
Number of Channels	:	20
Type of Modulation	:	FHSS

2.4 Test Standards List

FCC Part 15 (2008)

American national standard for methods of measurement of radio noise emissions from low-voltage electrical and electronic equipment in the range of 9KHz to 40GHz.

3. Test Specifications

3.1 Standard(s) Used

FCC Rules	Description Of Test	Result
15.203/15.247(b)	Antenna Requirement	Pass
15.207	Conducted Emission	Pass
15.247(a)(1)	Hopping Channel Bandwidth	Pass
15.247(a)(1)	Hopping Channel Separation	Pass
15.247(a)(1)	Number of Hopping Frequency Used	Pass
15.247(a)(1)(iii)	Dwell Time of Each Frequency	Pass
15.247(b)(1)	Maximum Peak Output Power	Pass
15.247(d)	Band Edges Emission	Pass
15.247(d)	Spurious Radiated Emission	Pass

3.2 Deviations from the Test Specification

N/A

4. Test Result

4.1 Antenna Requirement

4.1.1 Standard Applicable

Section 15.203:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna James or electrical connector is prohibited.

Section 15.247(b):

If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

4.1.2 Antenna Connected Construction

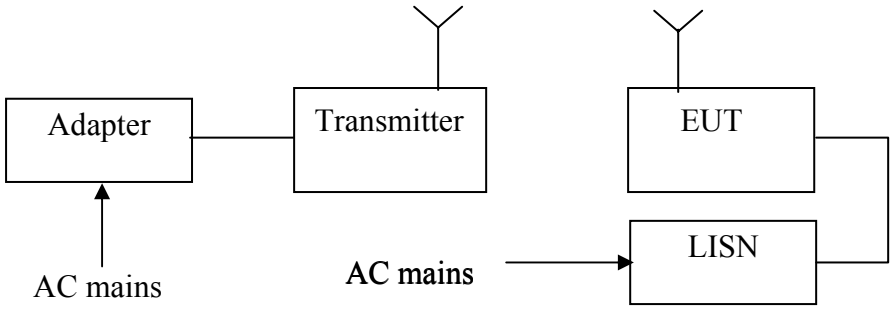
The antenna connector is designed with permanent attachment and no consideration of replacement.
Transmitter antenna of directional gain is 2dBi.

4.2 Conducted Emission (mains)

4.2.1 Test Summary

Test Room	:	Shielded Room
Power Source	:	AC 120V / 60Hz
Standards:	:	FCC Part15 B : 2008
EUT Type	:	Table Top
EUT configuration	:	EUT's highest possible emission level

4.2.2 Block diagram of test setup



4.2.3 Measurement method

The EUT along with its peripherals were placed on a 1.0m (W) x 1.5m(L) and 0.8m in height wooden table and the EUT was adjusted to maintain a 0.4m space from a vertical reference plane. The EUT was connected to power mains through a Artificial Mains Network(AMN), which provided 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room.

The excess power cable between the EUT and the AMN was bundled. All connecting cables of EUT and peripherals were moved to find the maximum emission.

4.2.4. Result

PASS

2009-07-22 16:02:28

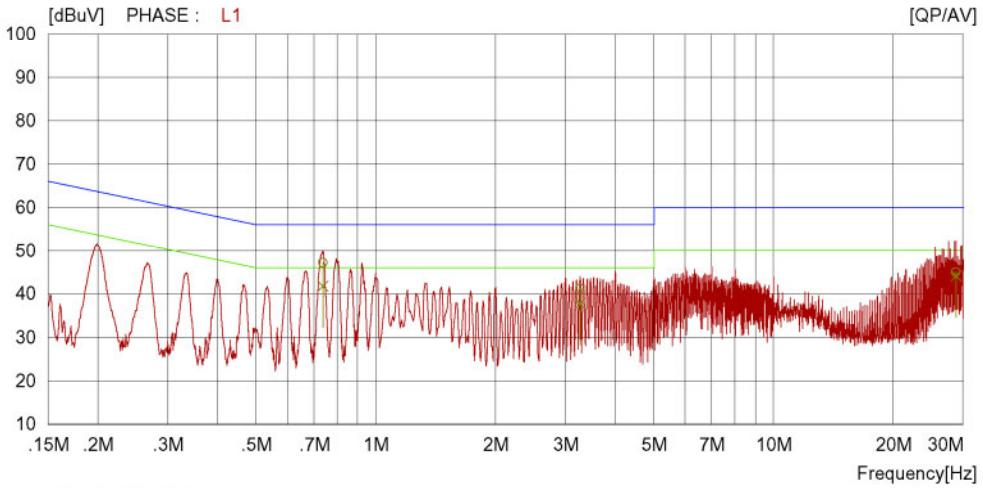
Conducted Emission

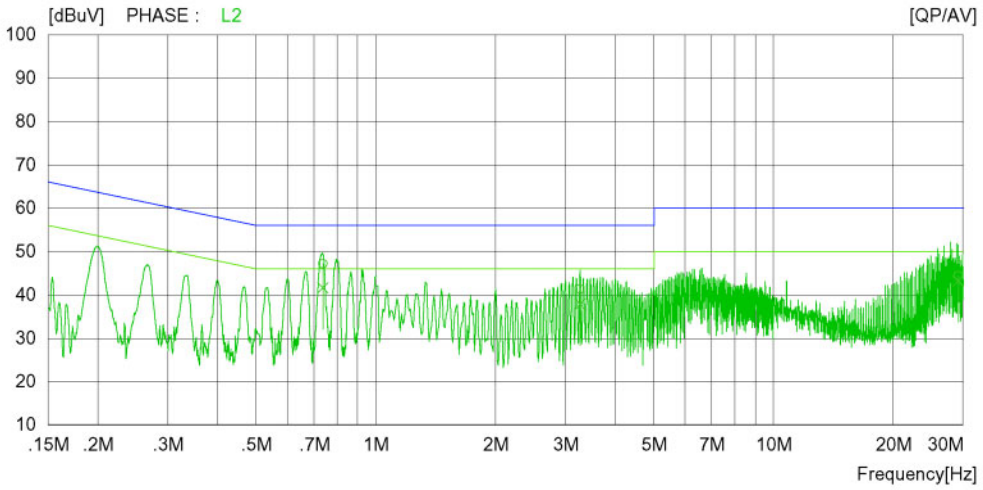
TDK South China EMC Centre
Date : 2009-07-22 16:02:22

Company Name	:	GPE	Document No.	:	
Model Name	:	HTB2SE-W	Power Supply	:	AC120V/60Hz
Serial No.	:		Temp/Humi	:	25deg / 52%RH
Test condition	:	Sony MP3, Playing Pinknoise	Operator	:	Phenix

Memo : KEF Wireless Subwoofer

LIMIT : FCC Part 15 B QP
FCC Part 15 B AV





TDK South China EMC Centre Tell:0769-8564-4678 Fax:0769-8564-4499

2009-07-22 16:02:28

Conducted Emission

TDK South China EMC Centre
Date : 2009-07-22 16:02:22

Company Name	:	GPE	Document No.	:	
Model Name	:	HTB2SE-W	Power Supply	:	AC120V/60Hz
Serial No.	:		Temp/Humi	:	25deg / 52%RH
Test condition	:	Sony MP3, Playing Pinknoise	Operator	:	Phenix

Memo : KEF Wireless Subwoofer

LIMIT : FCC Part 15 B QP
FCC Part 15 B AV

NO	FREQ	READING		C.FACTOR	RESULT		LIMIT		MARGIN		PHASE
		QP	AV		QP	AV	QP	AV	QP	AV	
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.73600	37.2	31.8	10.0	47.2	41.8	56.0	46.0	8.8	4.2	L1
2	3.26000	31.4	28.0	9.8	41.2	37.8	56.0	46.0	14.8	8.2	L1
3	28.74000	35.9	34.9	9.2	45.1	44.1	60.0	50.0	15.0	5.9	L1
4	0.73600	37.1	31.6	10.0	47.1	41.6	56.0	46.0	8.9	4.4	L2
5	3.26000	31.5	28.1	9.8	41.3	37.9	56.0	46.0	14.7	8.1	L2
6	29.13600	35.3	34.1	9.1	44.4	43.2	60.0	50.0	15.6	6.8	L2

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4.3 Hopping Channel Bandwidth

4.3.1 Applicable Standard

Section 15.247(a)(1): Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

4.2.2 Block diagram of test setup

Spectrum

Connection method: delete the antenna of EUT and connect receiver with a cable. The connector of cable is N type. The Zc of the cable is 50 OHM. The other side of cable solder on the antenna terminal. Because the impedance of antennal terminal is 50 OHM,and the impedance of receiver is also 50 OHM, so this connection is matching.

4.2.3 Measurement method

1. The transmitter output was connected to the spectrum analyzer through an attenuator.

2. Set RBW of spectrum analyzer to 100KHz and VBW to 300KHz.

3. Set Detector to Peak, Trace to Max Hold and Sweep Time is Auto.

4. Measure spectrum width with level more than 20dB below the peak level.

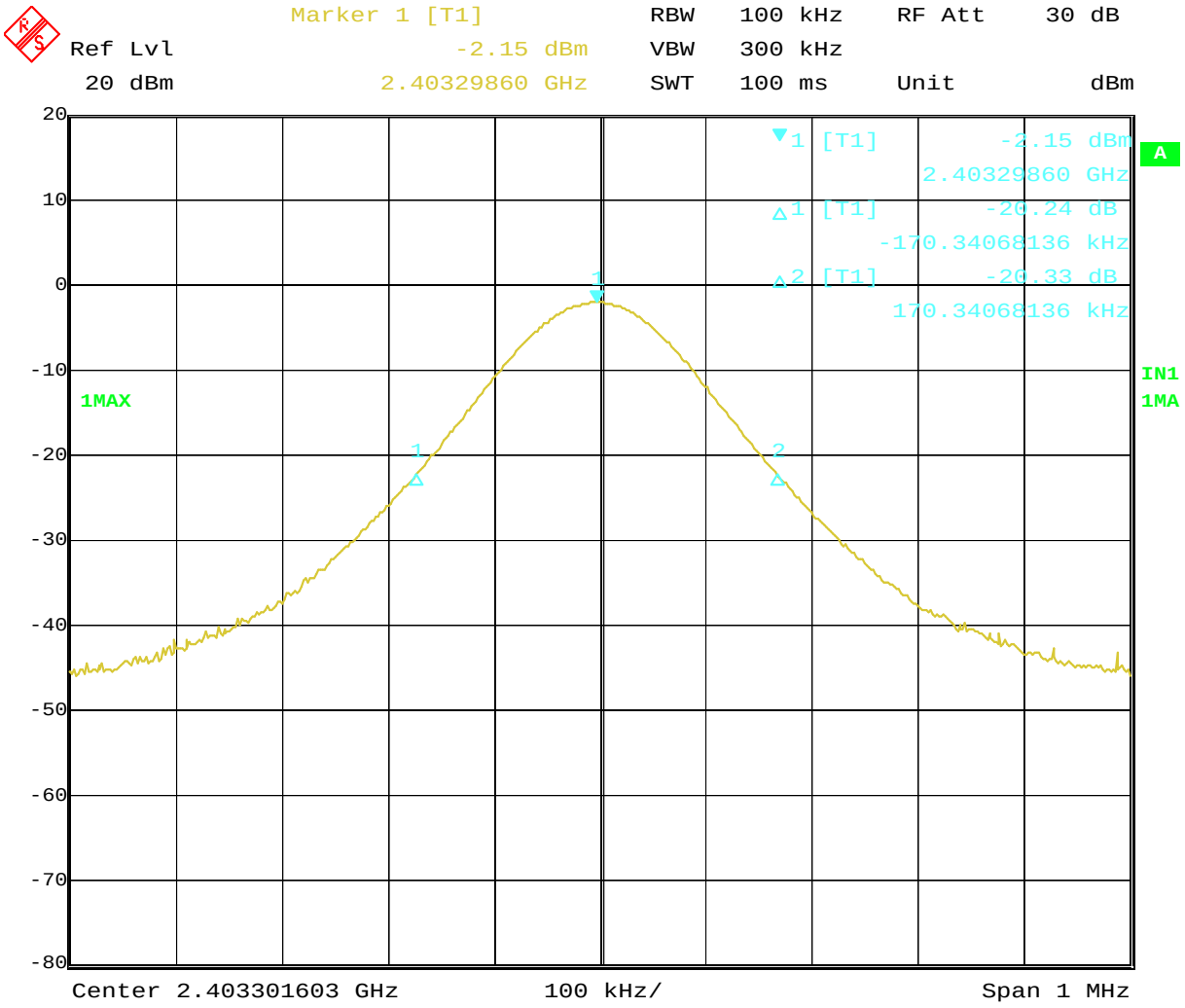
5. Repeat above 1~3 points for the middle and highest channel of the EUT.

4.2.4. Result

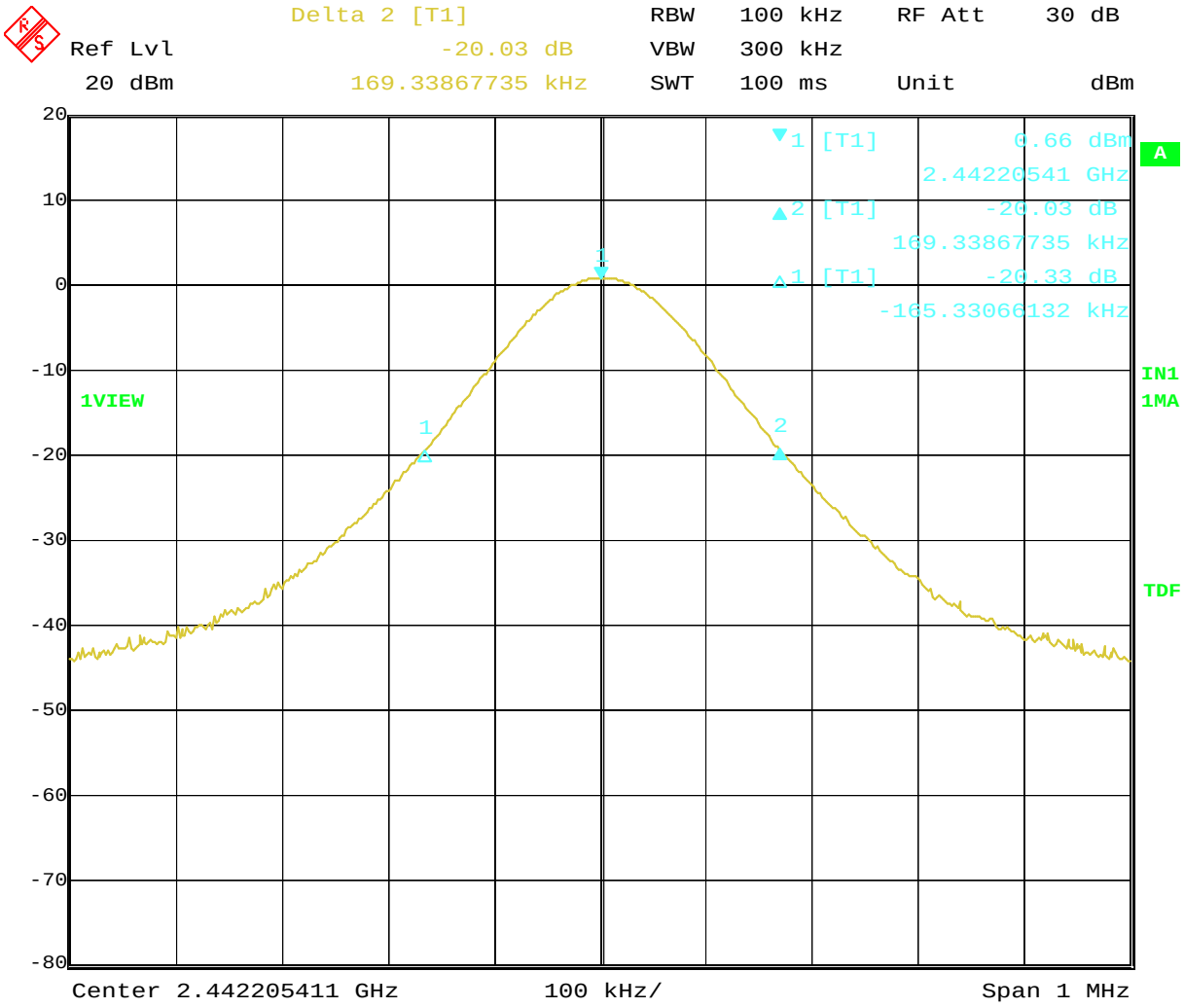
Temperature (℃) : 22~23	EUT: KEF Wireless Subwoofer (Receiver)
Humidity (%RH): 50~54	M/N: HTB2SE-W
Barometric Pressure (mbar): 950~1000	Operation Condition: Tx Mode
Test data: Aug 05, 2009	Test engineer: Phenix

Channel No.	**Frequency (MHz)**	**20dB Bandwidth (kHz)**	**Min. Limit (kHz)**
LOW	2403	340.6	>25
MID	2442	334.6	>25
HIG	2479	332.6	>25

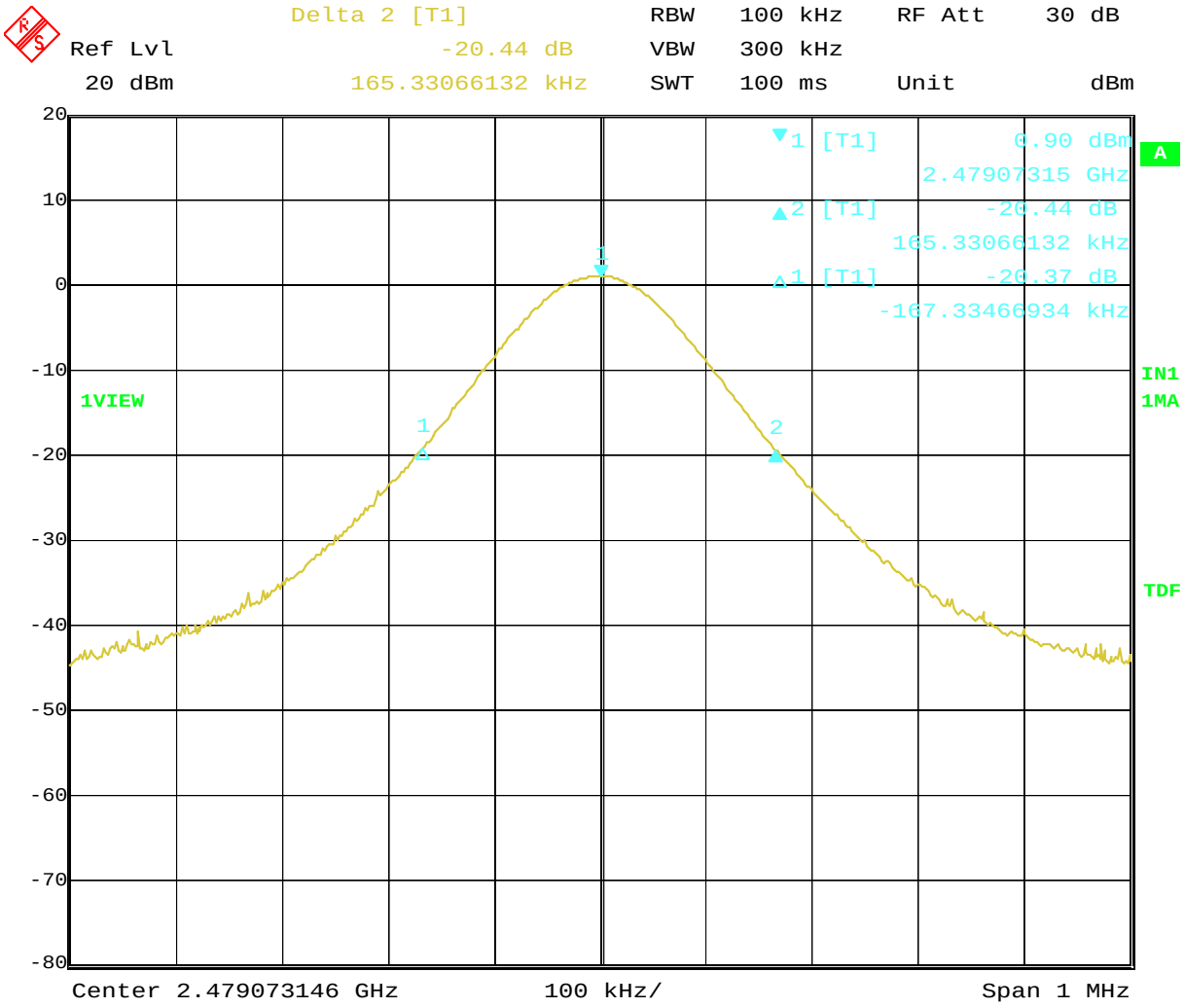
Channel LOW：


Marker 1 [T1]
RBW 100 kHz
RF Att 30 dB
Ref Lvl
-2.15 dBm
VBW 300 kHz
20 dBm
2.40329860 GHz
SWT 100 ms
Unit dBm
1 [T1] -2.15 dBm
2.40329860 GHz
Δ1 [T1] -20.24 dB
-170.34068136 kHz
Δ2 [T1] -20.33 dB
170.34068136 kHz
A
IN1
1MA
1MAX
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 2.403301603 GHz
100 kHz/
Span 1 MHz
Date: 5.AUG.2009 03:26:06

Channel MID：


Delta 2 [T1]
RBW 100 kHz
RF Att 30 dB
Ref Lvl
-20.03 dB
VBW 300 kHz
20 dBm
169.33867735 kHz
SWT 100 ms
Unit dBm
1 [T1] 0.66 dBm
2.44220541 GHz
2 [T1] -20.03 dB
169.33867735 kHz
1 [T1] -20.33 dB
-165.33066132 kHz
1VIEW
A
IN1
1MA
TDF
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 2.442205411 GHz
100 kHz/
Span 1 MHz
Date: 5.AUG.2009 04:00:24

Channel HIG：


Delta 2 [T1]
RBW 100 kHz
RF Att 30 dB
Ref Lvl
-20.44 dB
VBW 300 kHz
20 dBm
165.33066132 kHz
SWT 100 ms
Unit dBm
1 [T1] 0.90 dBm
2.47907315 GHz
2 [T1] -20.44 dB
165.33066132 kHz
Δ1 [T1] -20.37 dB
-167.33466934 kHz
A
IN1
1MA
TDF
1VIEW
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 2.479073146 GHz
100 kHz/
Span 1 MHz
Date: 5.AUG.2009 04:08:47

4.4 Hopping Channel Separation

4.4.1 Applicable Standard

Section 15.247(a)(1): Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

4.4.2 Block diagram of test setup

Spectrum

Connection method: delete the antenna of EUT and connect receiver with a cable. The connector of cable is N type. The Zc of the cable is 50 OHM. The other side of cable solder on the antenna terminal. Because the impedance of antennal terminal is 50 OHM,and the impedance of receiver is also 50 OHM, so this connection is matching.

4.4.3 Measurement method

1. The transmitter output was connected to the spectrum analyzer through an attenuator.

2. Set RBW of spectrum analyzer to 100KHz and VBW to 300KHz.

3. Set Detector to Peak, Trace to Max Hold and Sweep Time is Auto.

4. The Hopping Channel Separation is defined as the separation between 2 neighboring hopping frequencies.

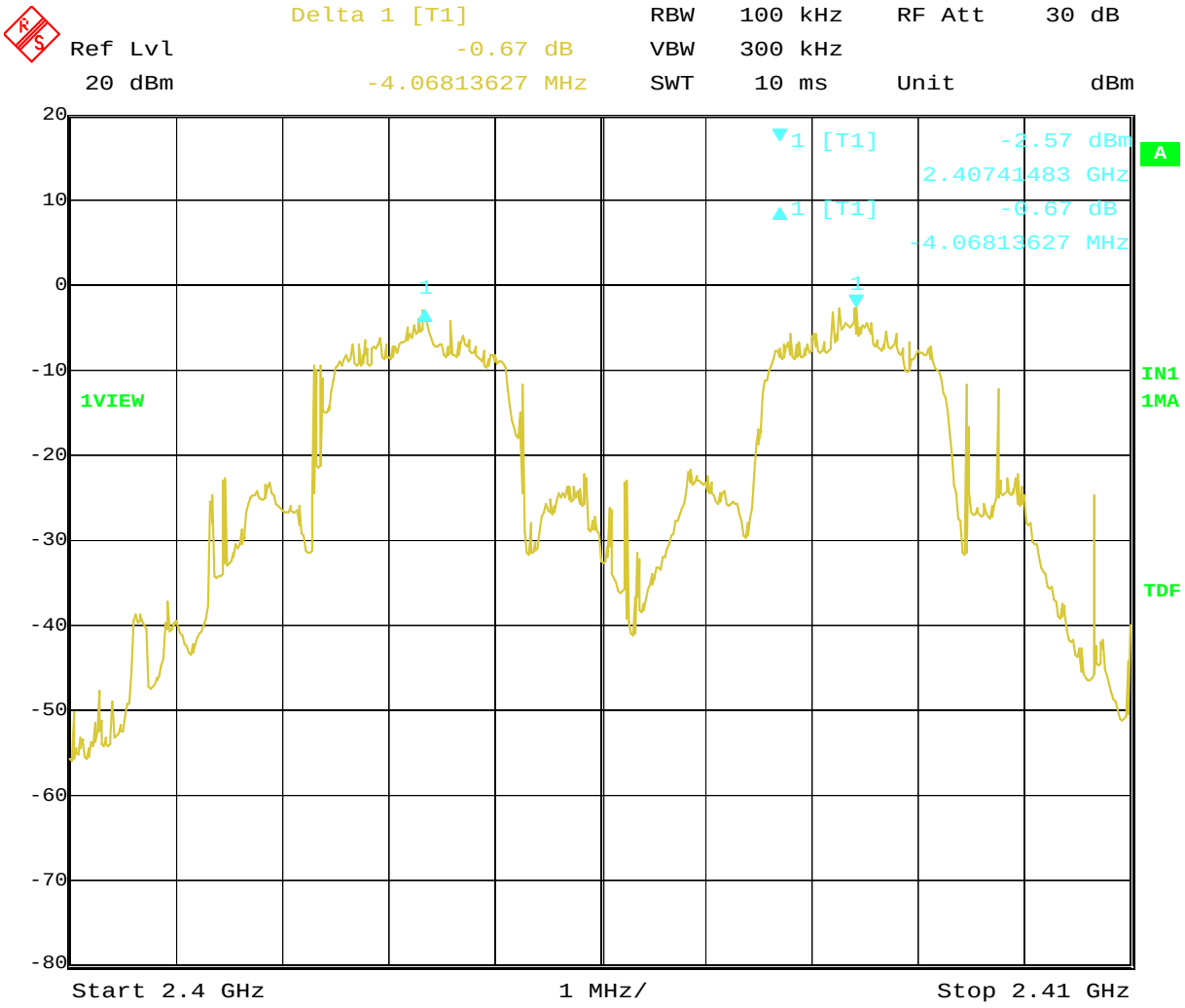
5. Repeat above 1~3 points for the middle and highest channel of the EUT.

4.4.4. Result

Temperature (℃) : 22~23	EUT: KEF Wireless Subwoofer (Receiver)
Humidity (%RH): 50~54	M/N: HTB2SE-W
Barometric Pressure (mbar): 950~1000	Operation Condition: Tx Mode
Test data: Aug 05, 2009	Test engineer: Phenix

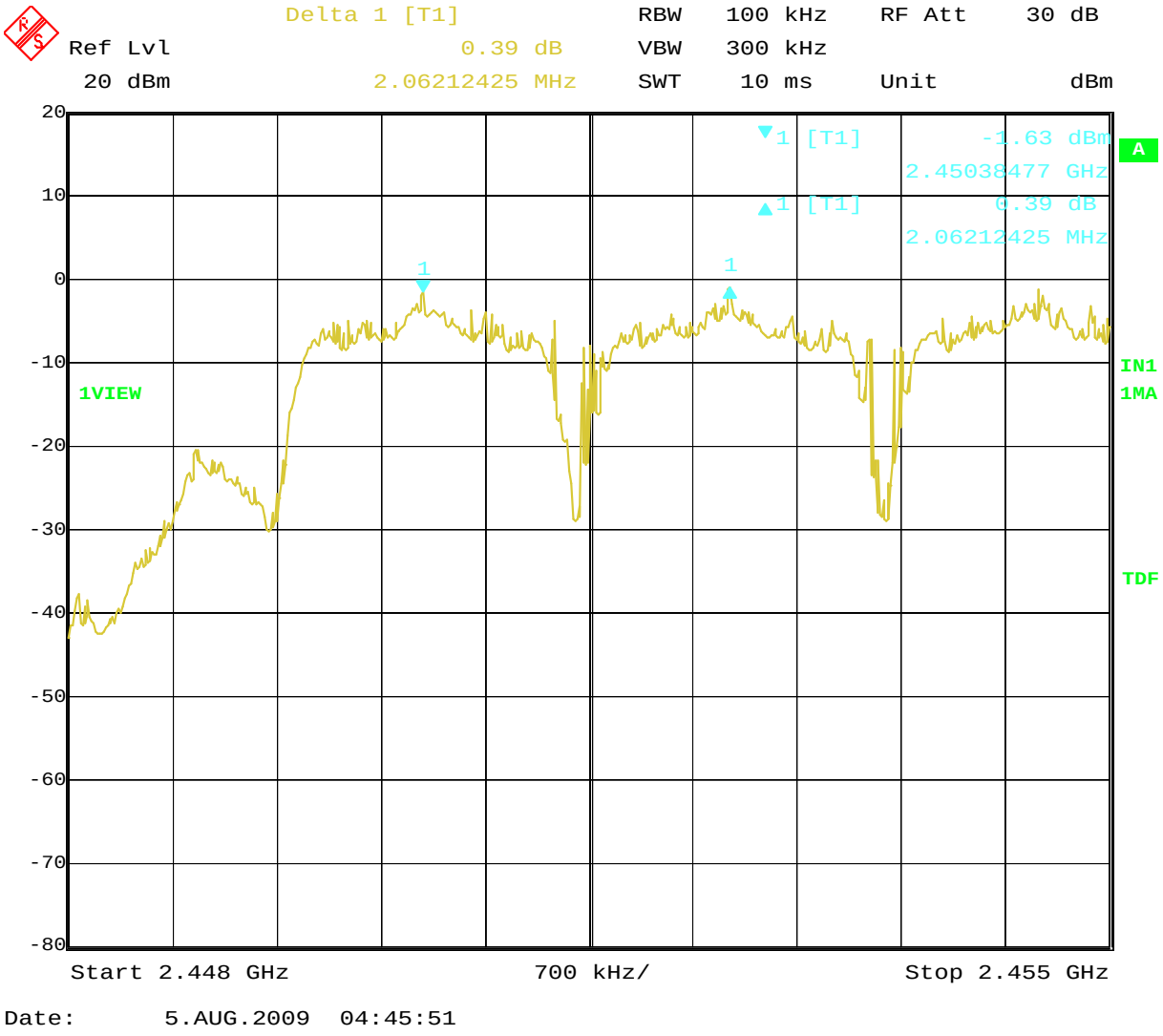
Channel No.	**Frequency (MHz)**	**Channel Separation (MHz)**
LOW(channel 1)	2403	4.068
MID(channel 11)	2442	2.062
HIG(channel 20)	2479	4.076

Channel Low：

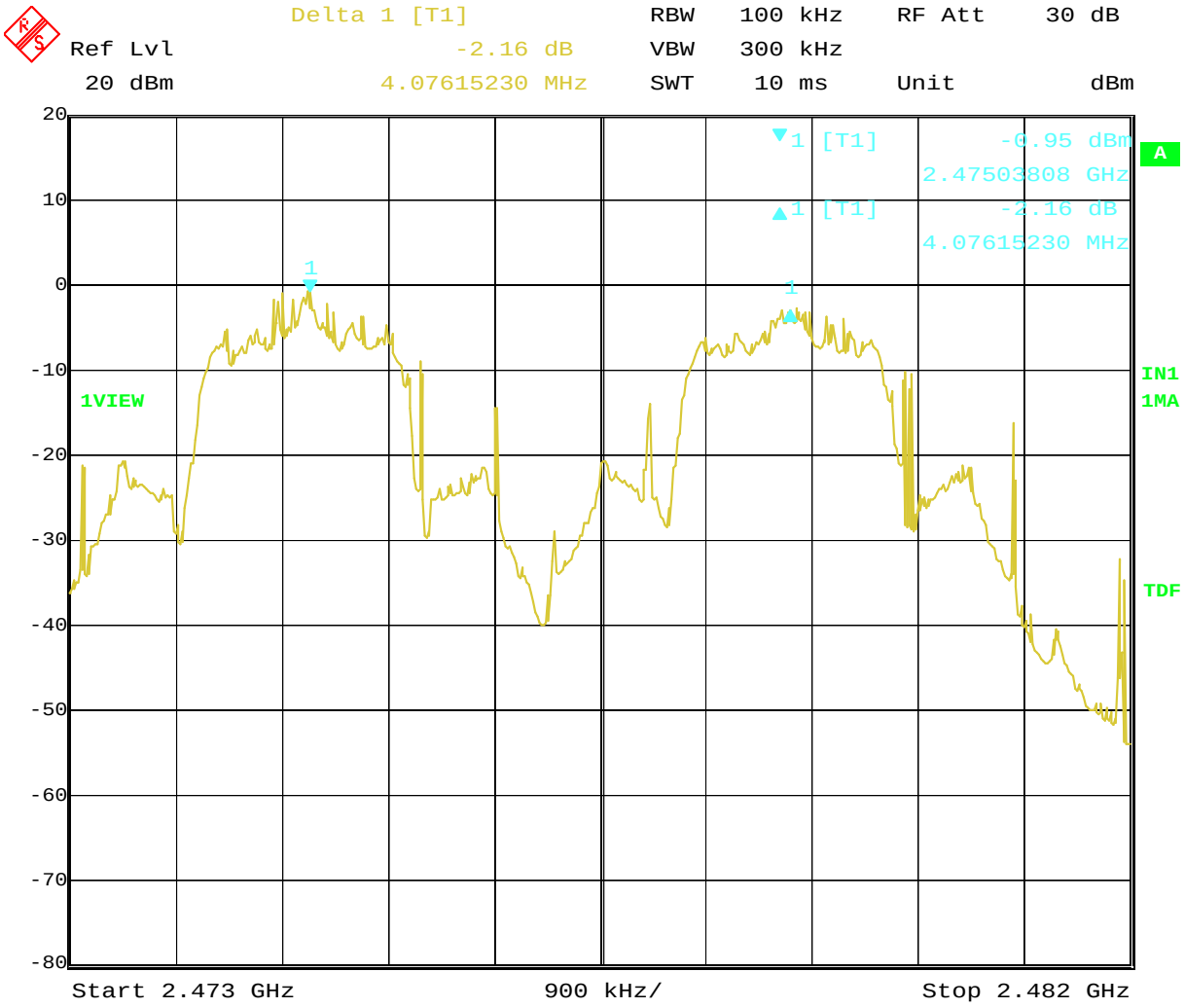


Date: 5.AUG.2009 04:43:22

Channel MID：


Delta 1 [T1]
0.39 dB
2.06212425 MHz
RBW 100 kHz
VBW 300 kHz
SWT 10 ms
RF Att 30 dB
Unit dBm
Ref Lvl
20 dBm
1 [T1] -1.63 dBm
2.45038477 GHz
1 [T1] 0.39 dB
2.06212425 MHz
1VIEW
A
IN1
1MA
TDF
Start 2.448 GHz
700 kHz/
Stop 2.455 GHz
Date: 5.AUG.2009 04:45:51

Channel HIG：



Date: 5.AUG.2009 04:47:39

4.5 Number of Hopping Frequency

4.5.1 Applicable Standard

Section 15.247(a)(1)(iii): For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 15 non-overlapping hopping channels. Frequency hopping system which use fewer than 75 hopping frequencies may employ intelligent hopping techniques to avoid interference to other transmissions. Frequency hopping system may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 non-overlapping channels are used.

4.5.2 Block diagram of test setup

Spectrum

Connection method: delete the antenna of EUT and connect receiver with a cable. The connector of cable is N type. The Zc of the cable is 50 OHM. The other side of cable solder on the antenna terminal. Because the impedance of antennal terminal is 50 OHM,and the impedance of receiver is also 50 OHM, so this connection is matching.

4.5.3 Measurement method

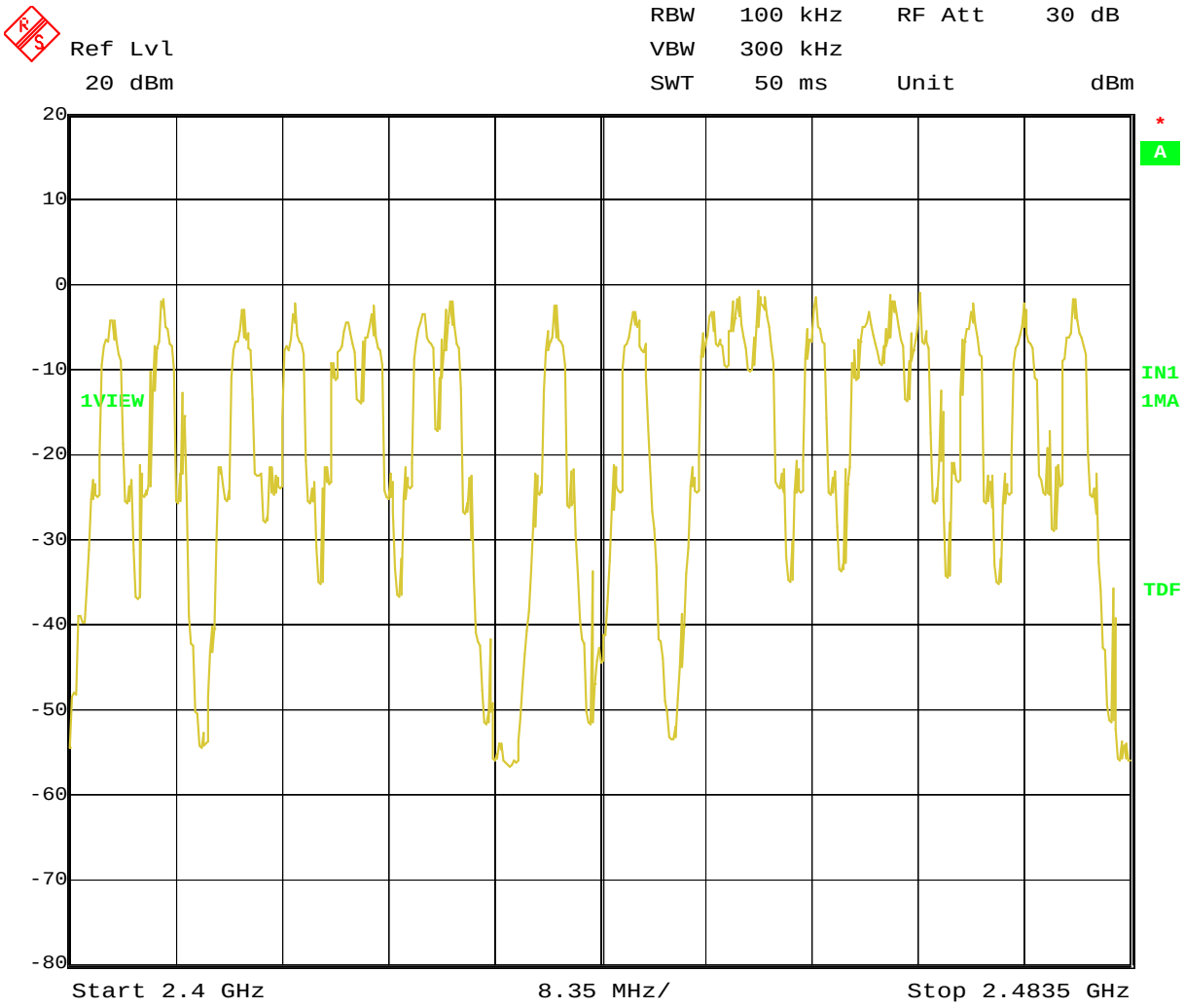
1. The transmitter output was connected to the spectrum analyzer through an attenuator.
2. Set RBW of spectrum analyzer to 100KHz and VBW to 300KHz.
3. Set Detector to Peak, Trace to Max Hold and Sweep Time is Auto.
4. Observe frequency hopping in 2400MHz~2483.5MHz, there are 20 non-overlapping channels.

4.5.4. Result

Temperature (℃) : 22~23	EUT: KEF Wireless Subwoofer (Receiver)
Humidity (%RH): 50~54	M/N: HTB2SE-W
Barometric Pressure (mbar): 950~1000	Operation Condition: Tx Mode
Test data: Aug 05, 2009	Test engineer: Phenix

Frequency (MHz)	Number of Hopping Channel	Min. Limit (Channels)
2400~2483	20	>15

Test Plot:



Date: 5.AUG.2009 04:38:36

4.6 Dwell Time of Each Frequency

4.6.1 Applicable Standard

Section 15.247(a)(1)(iii): For frequency hopping systems operating in the 2400-2483.5 MHz band. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4seconds multiplied by the number of hopping channels employed.

4.6.2 Block diagram of test setup

Spectrum

Connection method: delete the antenna of EUT and connect receiver with a cable. The connector of cable is N type. The Zc of the cable is 50 OHM. The other side of cable solder on the antenna terminal. Because the impedance of antennal terminal is 50 OHM,and the impedance of receiver is also 50 OHM, so this connection is matching.

4.6.3 Measurement method

1. The transmitter output was connected to the spectrum analyzer through an attenuator.
2. Set RBW of spectrum analyzer to 1MHz and VBW to 3MHz.
3. Set Detector to Peak, Trace to Max Hold and Sweep Time is more than once pulse time.
4. Set the center frequency on any frequency would be measure and set the frequency span to zero span.
5. Measure the maximum time duration of one single pulse.

4.6.4. Result

Temperature (℃) : 22~23	EUT: KEF Wireless Subwoofer (Receiver)
Humidity (%RH): 50~54	M/N: HTB2SE-W
Barometric Pressure (mbar): 950~1000	Operation Condition: Tx Mode
Test data: Aug 05, 2009	Test engineer: Phenix

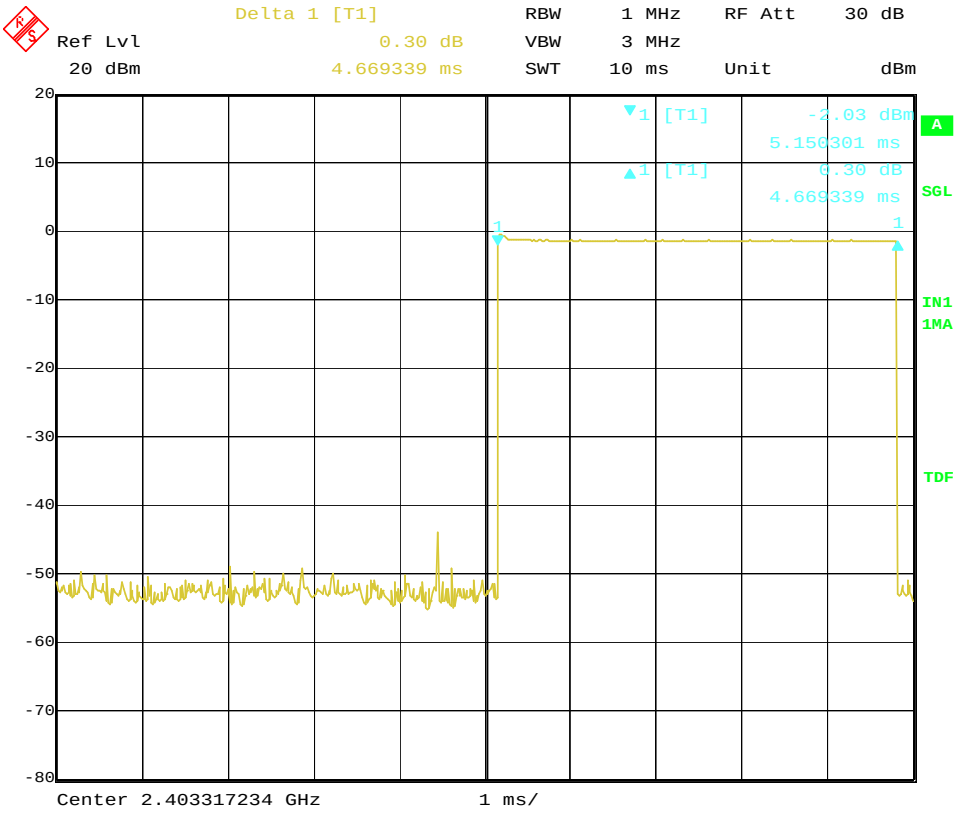
Calculate:
The Dwell Time = (time of Pulse / Pulse Cycle) x 0.4(second) x 20(channels)

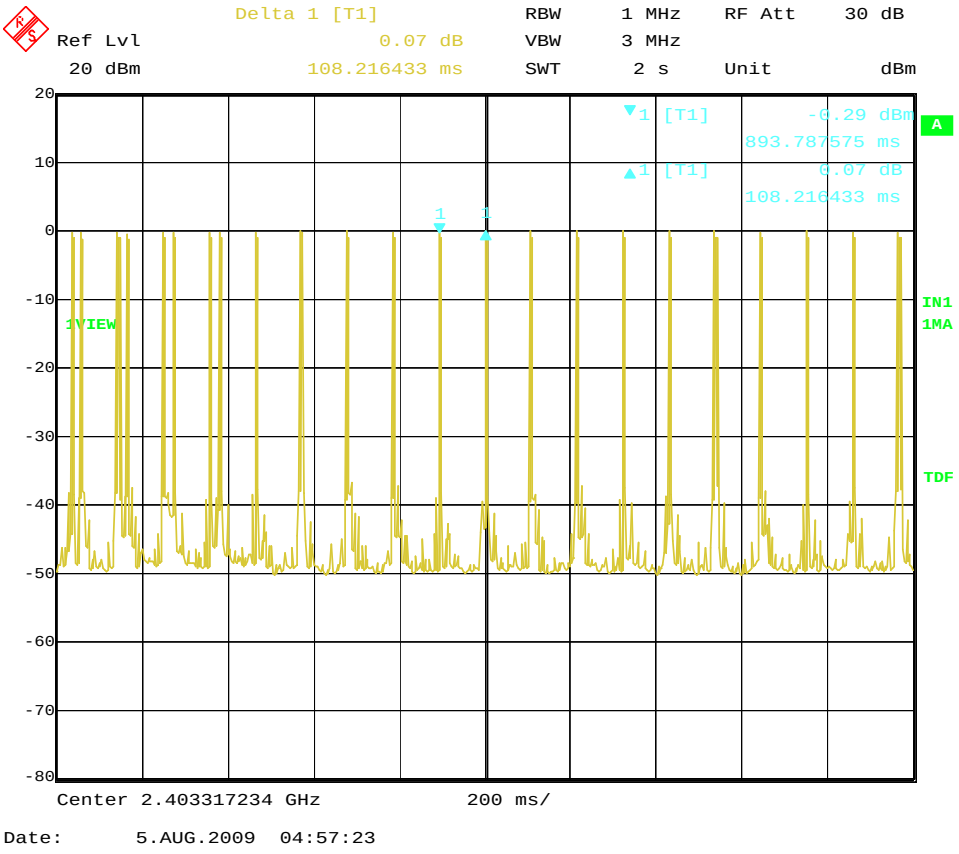
Channel	Time of Pulse (ms)	Pulse Cycle (ms)	Dwell Time (ms)	Limit (ms)	Result
LOW	4.67	108.2	345.3	400	Pass
MID	4.65	108.9	341.6	400	Pass
HIG	4.65	107.8	345.1	400	Pass

The maximum time of occupancy for a particular channel is 345.3 ms, which is less than the 400 ms allowed by the rules; therefore, it meets the requirements of this section.

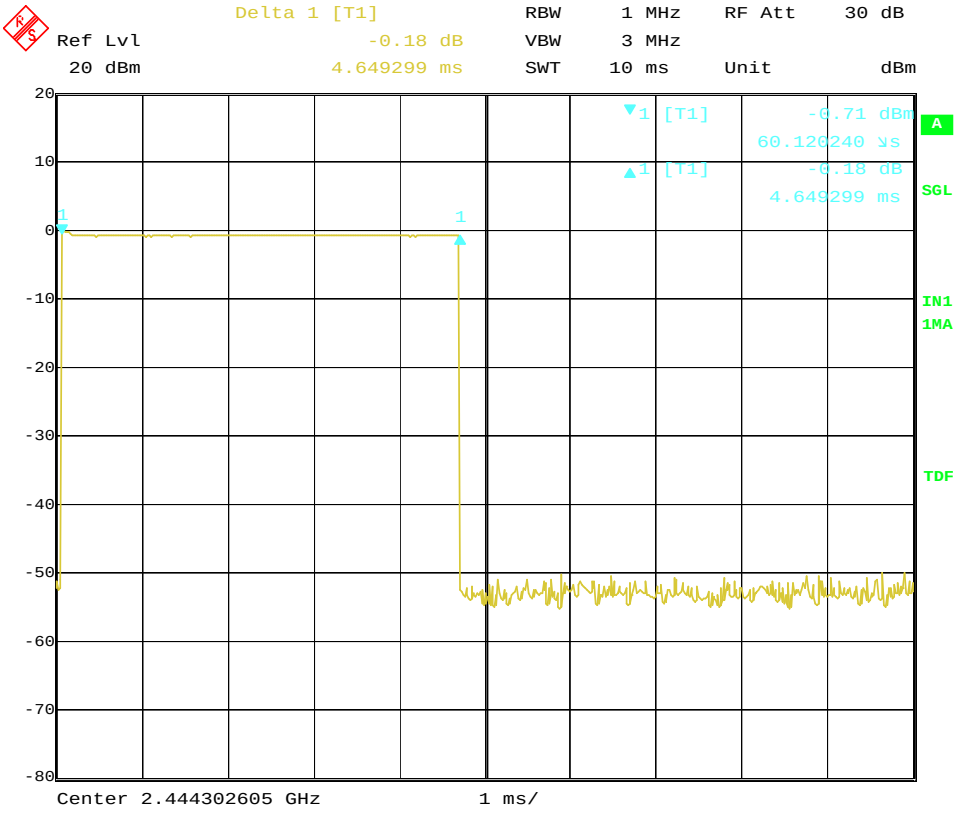
Test Plot:

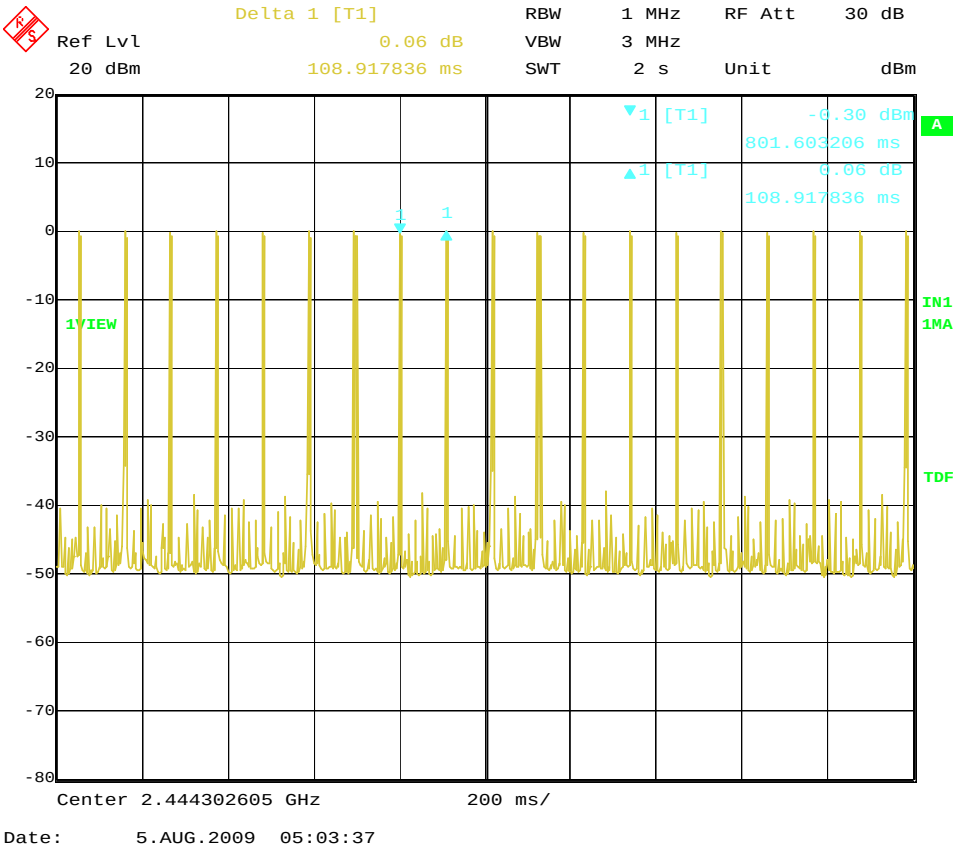
Channel LOW：



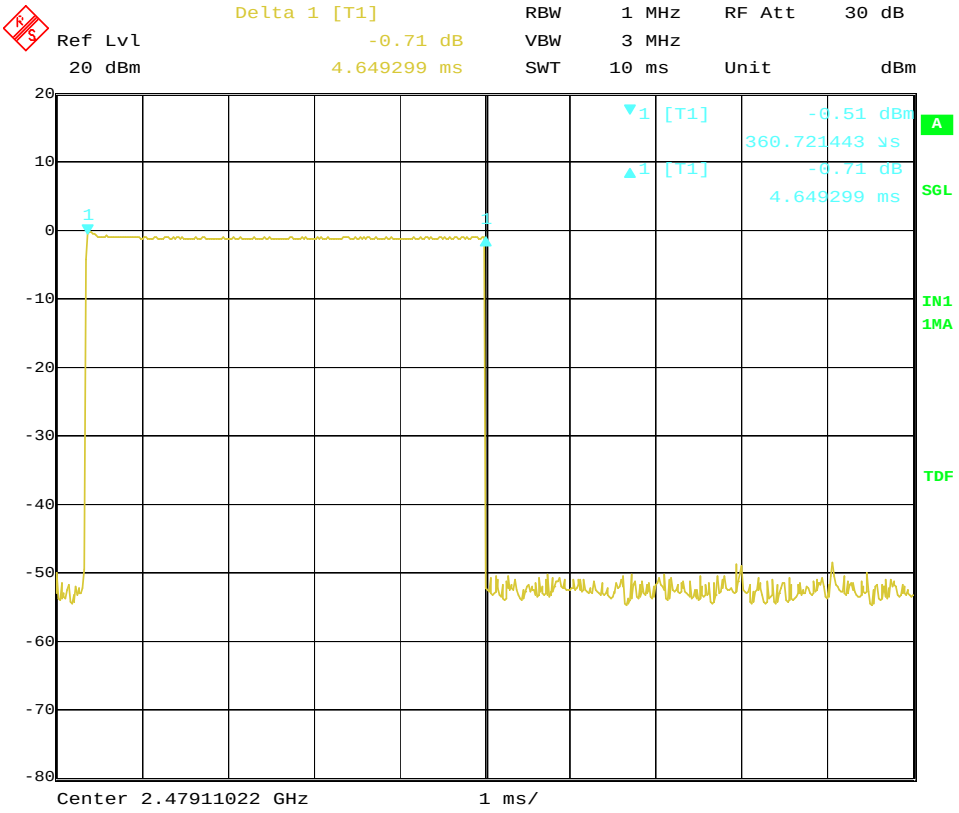


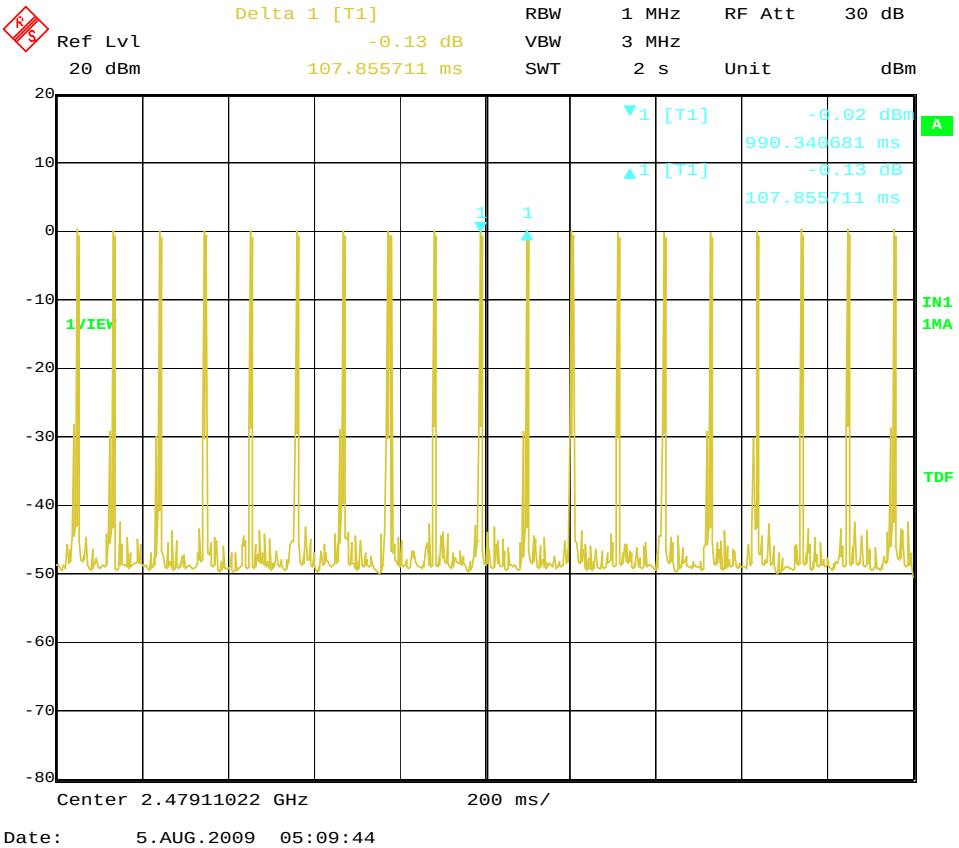
Channel MID：


Delta 1 [T1]
RBW 1 MHz
RF Att 30 dB
Ref Lvl
-0.18 dB
VBW 3 MHz
20 dBm
4.649299 ms
SWT 10 ms
Unit dBm
1 [T1] -0.71 dBm
60.120240 µs
1 [T1] -0.18 dB
4.649299 ms
A
SGL
IN1
1MA
TDF
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 2.444302605 GHz
1 ms/
Date: 5.AUG.2009 05:02:17


Delta 1 [T1]
RBW 1 MHz
RF Att 30 dB
Ref Lvl
0.06 dB
VBW 3 MHz
20 dBm
108.917836 ms
SWT 2 s
Unit dBm
1 [T1] -0.30 dBm
801.603206 ms
1 [T1] 0.06 dB
108.917836 ms
A
1VIEW
IN1
1MA
TDF
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 2.444302605 GHz
200 ms/
Date: 5.AUG.2009 05:03:37

Channel HIG：


Delta 1 [T1]
RBW 1 MHz
RF Att 30 dB
Ref Lvl
-0.71 dB
VBW 3 MHz
20 dBm
4.649299 ms
SWT 10 ms
Unit dBm
1 [T1] -0.51 dBm
360.721443 µs
1 [T1] -0.71 dBm
4.649299 ms
A
SGL
IN1
1MA
TDF
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 2.47911022 GHz
1 ms/
Date: 5.AUG.2009 05:07:11


Delta 1 [T1]
RBW 1 MHz
RF Att 30 dB
Ref Lvl
-0.13 dB
VBW 3 MHz
20 dBm
107.855711 ms
SWT 2 s
Unit dBm
1 [T1] -0.02 dBm
990.346681 ms
1 [T1] -0.13 dBm
107.855711 ms
A
IN1
1MA
TDF
1/IEW
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 2.47911022 GHz
200 ms/
Date: 5.AUG.2009 05:09:44

4.7 Maximum Peak Output Power

4.7.1 Applicable Standard

Section 15.247(b)(1): For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels and The maximum peak output power shall not exceed 1 watt. For all other frequency hopping systems in this frequency band, The maximum peak output power shall not exceed 0.125 watt.

4.7.2 Block diagram of test setup

Spectrum

Connection method: delete the antenna of EUT and connect receiver with a cable. The connector of cable is N type. The Zc of the cable is 50 OHM. The other side of cable solder on the antenna terminal. Because the impedance of antennal terminal is 50 OHM,and the impedance of receiver is also 50 OHM, so this connection is matching.

4.7.3 Measurement method

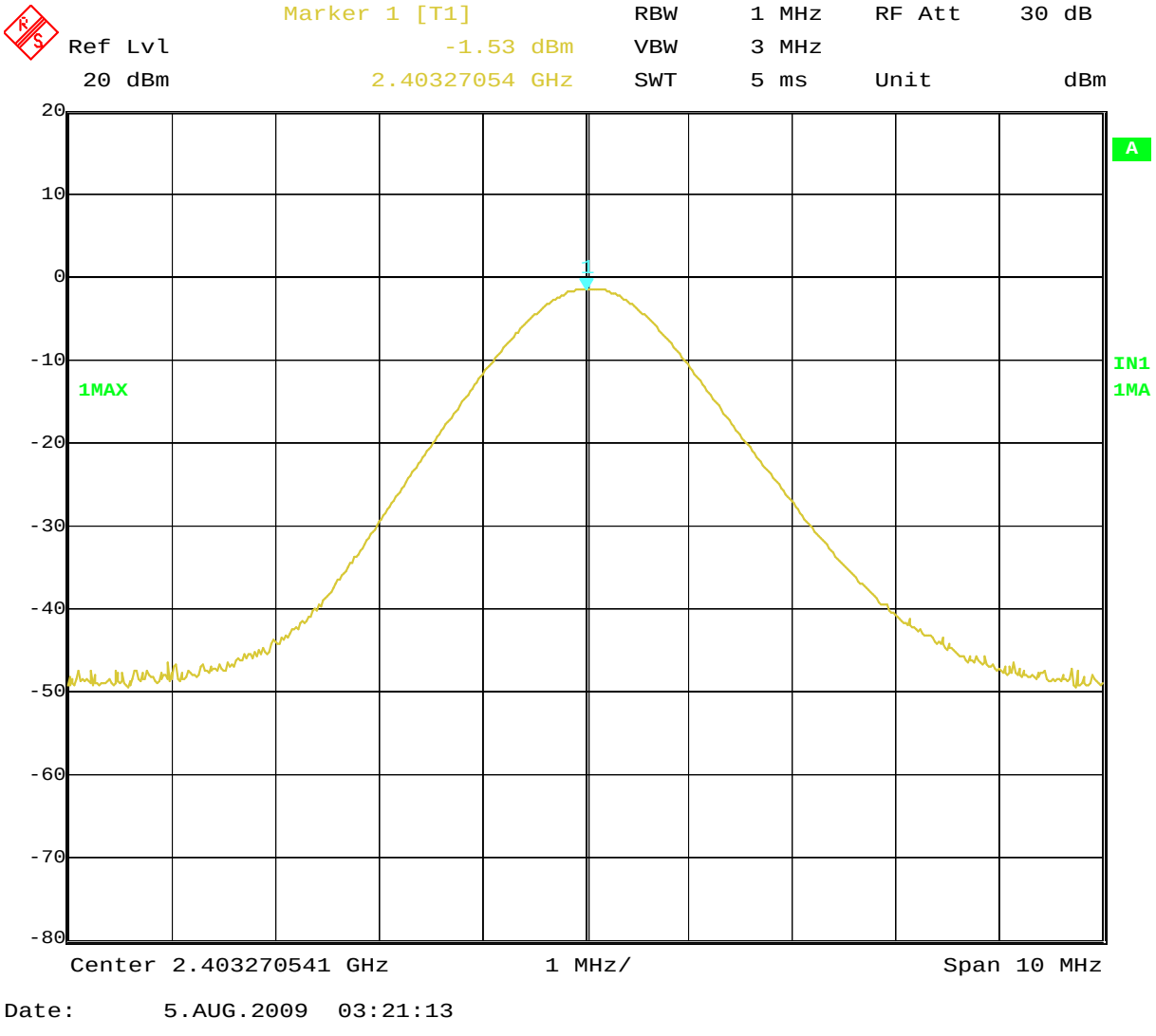
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in above figure without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
3. Use the following spectrum analyzer settings:
   Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
   RBW > the 20 dB bandwidth of the emission being measured
   VBW ≥ RBW
   Sweep = auto
   Detector function = peak
   Trace = max hold
4. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power. Plot the result on the screen of spectrum analyzer.
5. Repeat above procedures until all frequencies measured were complete.

4.7.4. Result

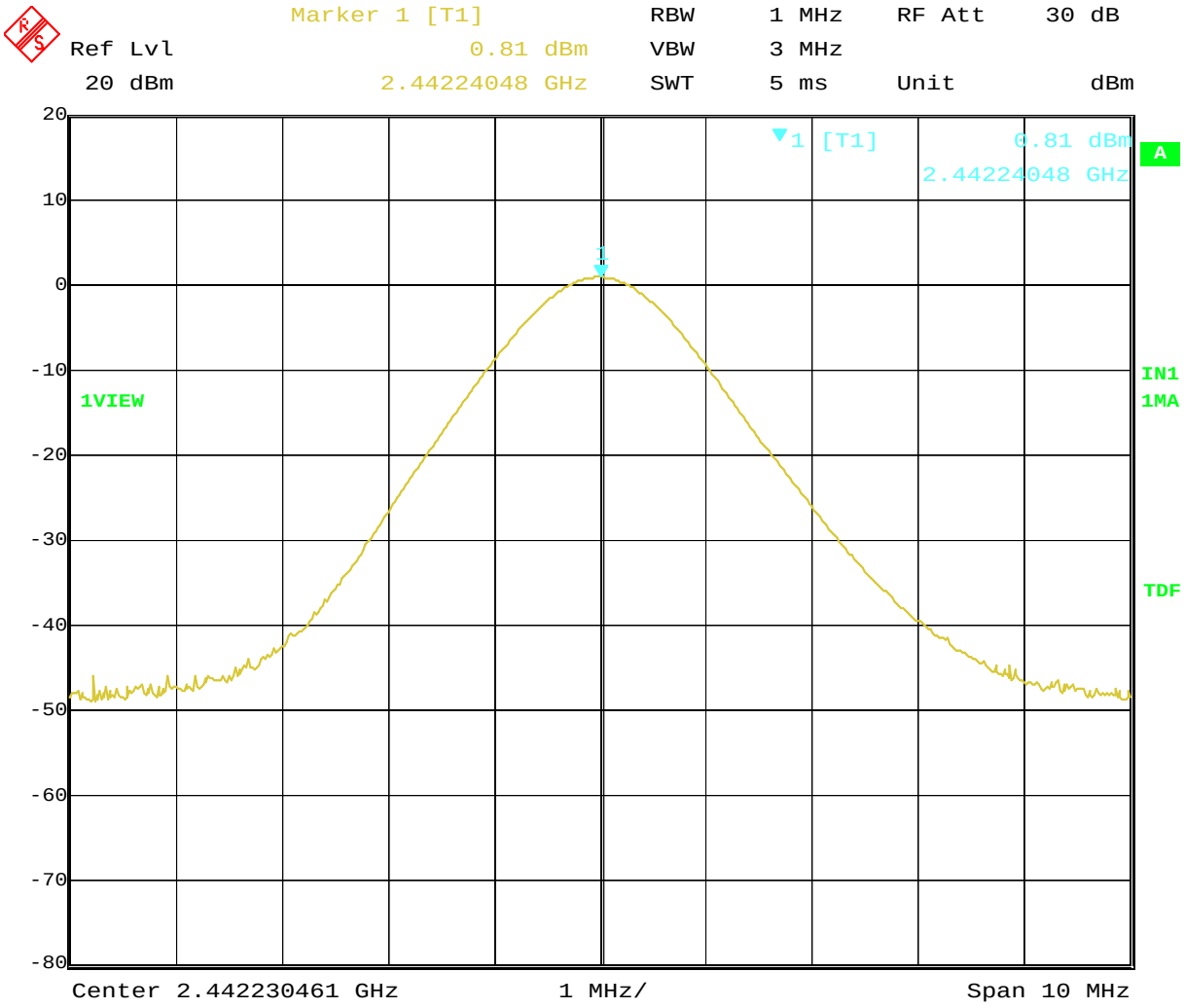
Temperature (℃) : 22~23	EUT: KEF Wireless Subwoofer (Receiver)
Humidity (%RH): 50~54	M/N: HTB2SE-W
Barometric Pressure (mbar): 950~1000	Operation Condition: Tx Mode
Test data: Aug 05, 2009	Test engineer: Phenix

Channel No.	Frequency (MHz)	Output Power (dBm)	Limits (dBm)
LOW	2403	-1.53	20.97
MID	2442	0.81	20.97
HIG	2479	1.71	20.97

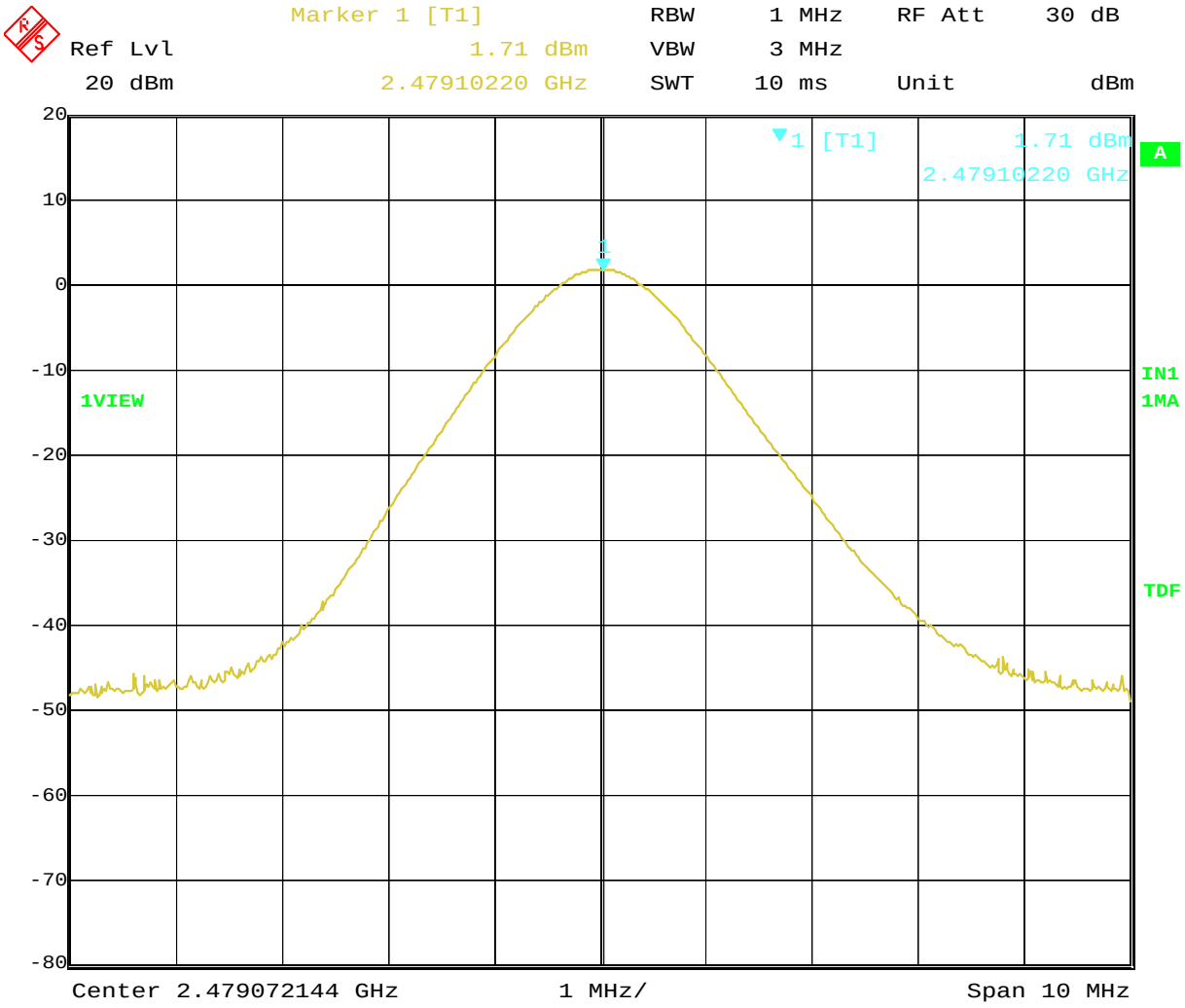
Channel LOW：



Channel MID：


Marker 1 [T1]
RBW 1 MHz
RF Att 30 dB
Ref Lvl
0.81 dBm
VBW 3 MHz
20 dBm
2.44224048 GHz
SWT 5 ms
Unit dBm
1 [T1]
0.81 dBm
2.44224048 GHz
A
IN1
1MA
1VIEW
TDF
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 2.442230461 GHz
1 MHz/
Span 10 MHz
Date: 5.AUG.2009 03:58:07

Channel HIG：


Marker 1 [T1]
RBW 1 MHz
RF Att 30 dB
Ref Lvl
1.71 dBm
VBW 3 MHz
20 dBm
2.47910220 GHz
SWT 10 ms
Unit dBm
1 [T1]
1.71 dBm
2.47910220 GHz
A
IN1
1MA
1VIEW
TDF
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 2.479072144 GHz
1 MHz/
Span 10 MHz
Date: 5.AUG.2009 04:12:41

4.8 Band Edges Emission

4.8.1 Applicable Standard

Section 15.247(d): In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. In addition, radiated emissions that fall in the restricted bands, as defined in Section 15.205, must also comply with the radiated emission limits specified in Section 15.209.

4.8.2 Block diagram of test setup

Spectrum

Connection method: delete the antenna of EUT and connect receiver with a cable. The connector of cable is N type. The Zc of the cable is 50 OHM. The other side of cable solder on the antenna terminal. Because the impedance of antennal terminal is 50 OHM,and the impedance of receiver is also 50 OHM, so this connection is matching.

4.8.3 Measurement method

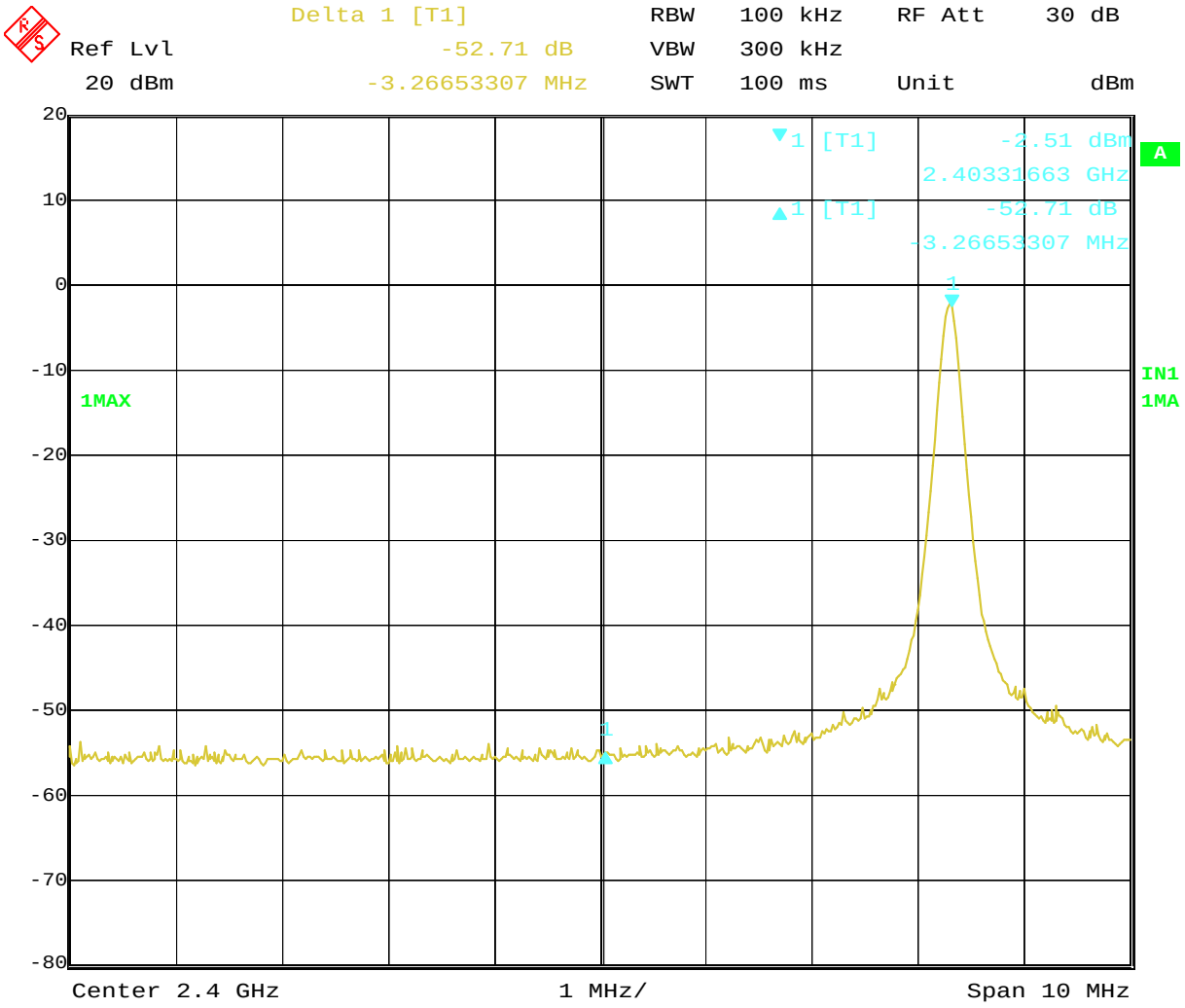
1. The transmitter is set to the lowest channel.
2. The transmitter output was connected to the spectrum analyzer via a cable and cable loss is used as the offset of the spectrum analyzer.
3. Set both RBW and VBW of spectrum analyzer to 100KHz with convenient frequency span including 10MHz bandwidth from lower band edge. Then detector set to peak and max hold this trace.
4. The lowest band edges emission was measured and recorded.
5. The transmitter set to the highest channel and repeated 2~4.

4.8.4. Result

Temperature (℃) : 22~23	EUT: KEF Wireless Subwoofer (Receiver)
Humidity (%RH): 50~54	M/N: HTB2SE-W
Barometric Pressure (mbar): 950~1000	Operation Condition: Tx Mode
Test data: Aug 05, 2009	Test engineer: Phenix

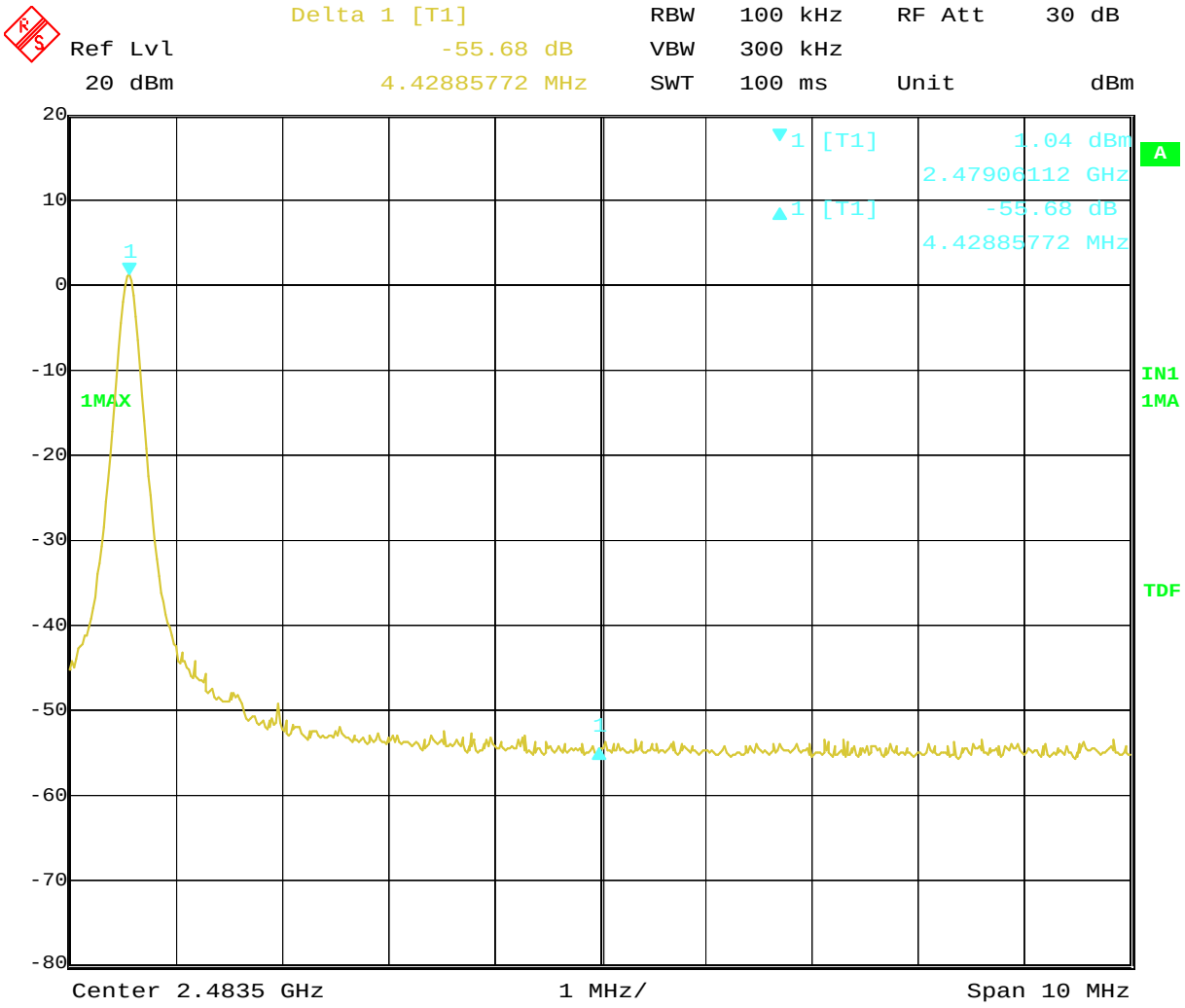
Frequency (MHz)	**Read Delta (dB)**	**Limits (dB)**	**Margin (dB)**
2400	-52.71	-20	32.71
2483.5	-55.68	-20	35.68

Channel LOW：



Date: 5.AUG.2009 03:28:52

Channel HIG：



Date: 5.AUG.2009 04:17:18

4.9 Spurious Radiated Emission

4.9.1 Applicable Standard

Section 15.247(d): In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. In addition, radiated emissions that fall in the restricted bands, as defined in Section 15.205, must also comply with the radiated emission limits specified in Section 15.209.

4.9.2 Block diagram of test setup

Radiated Measurement Setup:

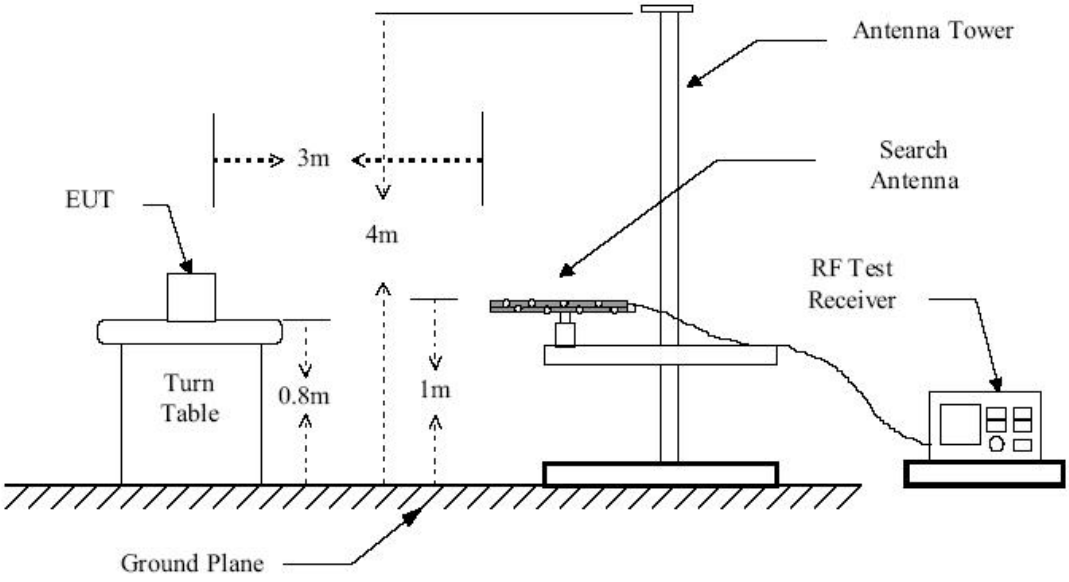


Figure 1: Frequencies measured from 30MHz to 1GHz configuration

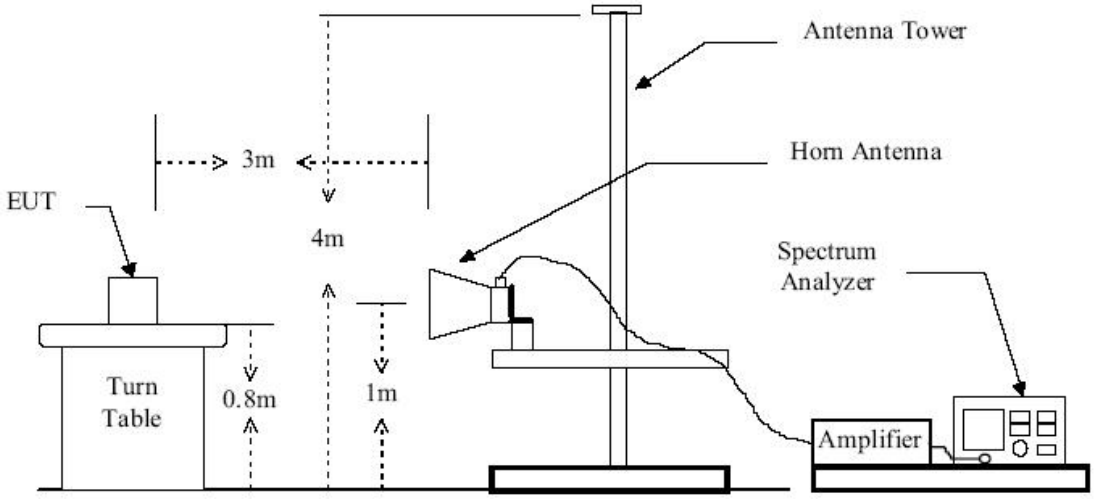


Figure 2 : Frequencies measured above 1 GHz configuration

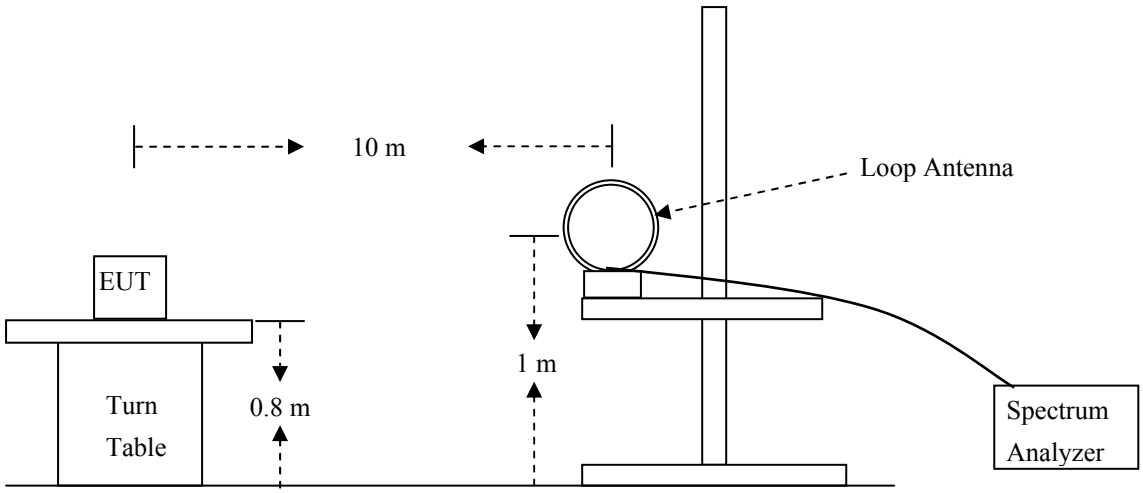


Figure 3: Frequencies measured below 30MHz configuration

Conducted Measurement Setup:

Spectrum

Connection method: delete the antenna of EUT and connect receiver with a cable. The connector of cable is N type. The Zc of the cable is 50 OHM. The other side of cable solder on the antenna terminal. Because the impedance of antennal terminal is 50 OHM,and the impedance of receiver is also 50 OHM, so this connection is matching.

4.9.3 Measurement method

Radiated Measurement

1. Configure the EUT according to ANSI C63.4.
2. The EUT was placed on the top of the turntable 0.8 meter above ground.
3. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
4. Power on the EUT and all the supporting units.
5. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
6. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emission field strength of both horizontal and vertical polarization.
7. For each suspected emission, the antenna tower was scanned (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
8. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.

Conducted Measurement

1. For emission above 1GHz, conducted measurement method is used.
2. The transmitter is set to the lowest channel.
3. The transmitter output was connected to the spectrum analyzer via a cable and cable loss is used as the offset of the spectrum analyzer.
4. Set RBW to 100KHz and VBW to 300 KHz, Then detector set to peak and max hold this trace.
5. The lowest band edges emission was measured and recorded.
6. The transmitter set to the highest channel and repeated 2~4.

4.9.4. Result

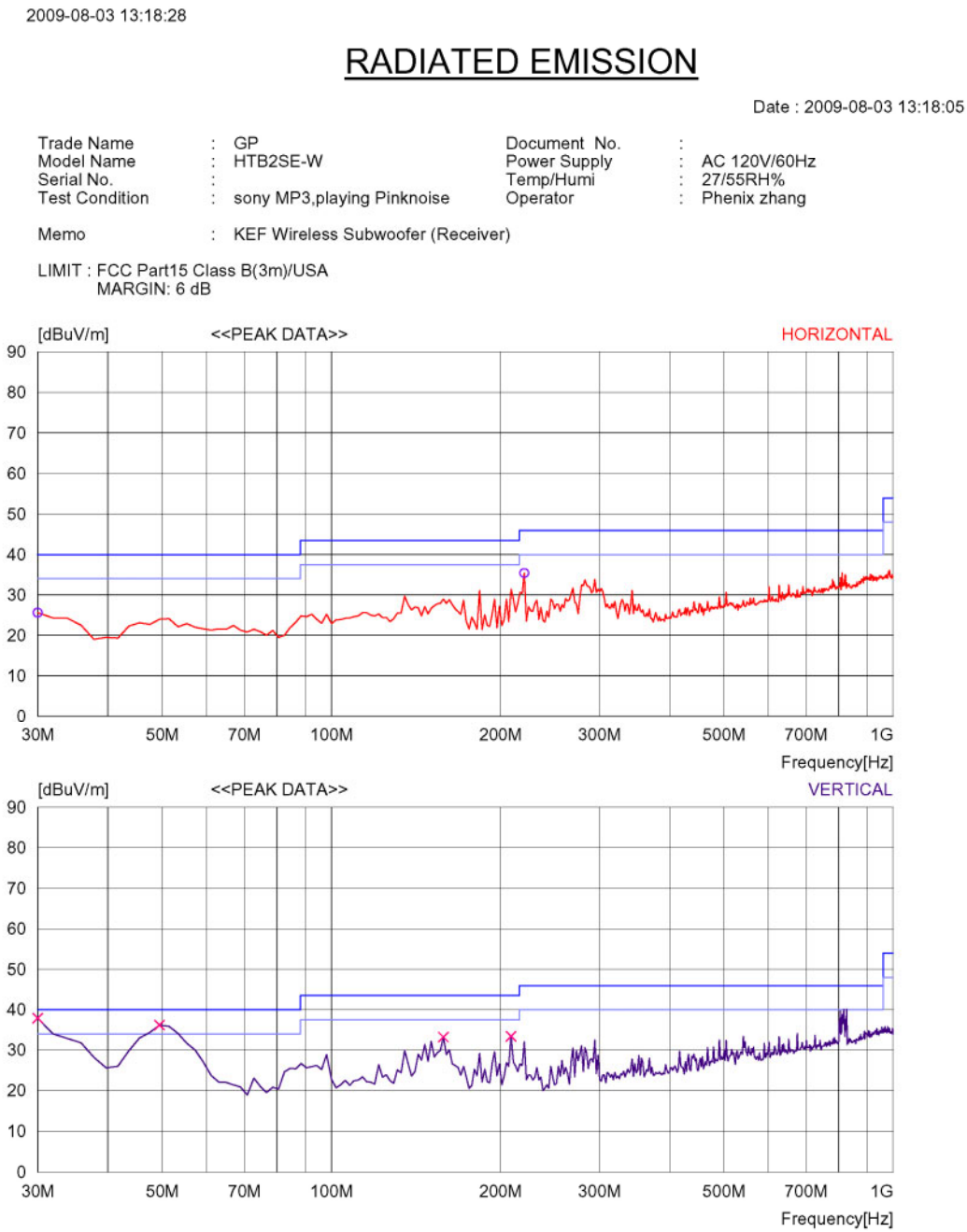
PASS

Radiated:

Below 30MHz:

No further spurious emissions found between lowest internal used or generated frequency and 30 MHz found.

30M - 1GHz：



2009-08-03 13:18:28

RADIATED EMISSION

Date : 2009-08-03 13:18:05

Trade Name	:	GP	Document No.	:	
Model Name	:	HTB2SE-W	Power Supply	:	AC 120V/60Hz
Serial No.	:		Temp/Humi	:	27/55RH%
Test Condition	:	sony MP3,playing Pinknoise	Operator	:	Phenix zhang

Memo : KEF Wireless Subwoofer (Receiver)

LIMIT : FCC Part15 Class B(3m)/USA
MARGIN: 6 dB

No.	FREQ	READING PEAK	ANT FACTOR	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	[dBuV]	[dB]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Horizontal ------										
1	30.000	38.1	12.5	6.7	31.7	25.6	40	14.4	400	283
2	220.501	45.9	12.8	8.2	31.5	35.4	46	10.6	100	18
----- Vertical ------										
3	30.000	50.4	12.5	6.7	31.7	37.9	40	2.1	100	216
4	49.439	50.1	10.9	6.9	31.7	36.2	40	3.8	100	359
5	158.297	45.1	11.8	7.8	31.5	33.2	43.5	10.3	100	331
6	208.838	43.7	13.2	8.0	31.5	33.4	43.5	10.1	100	13

Above 1GHz:

Normal Mode:

2009-08-21 15:57:55

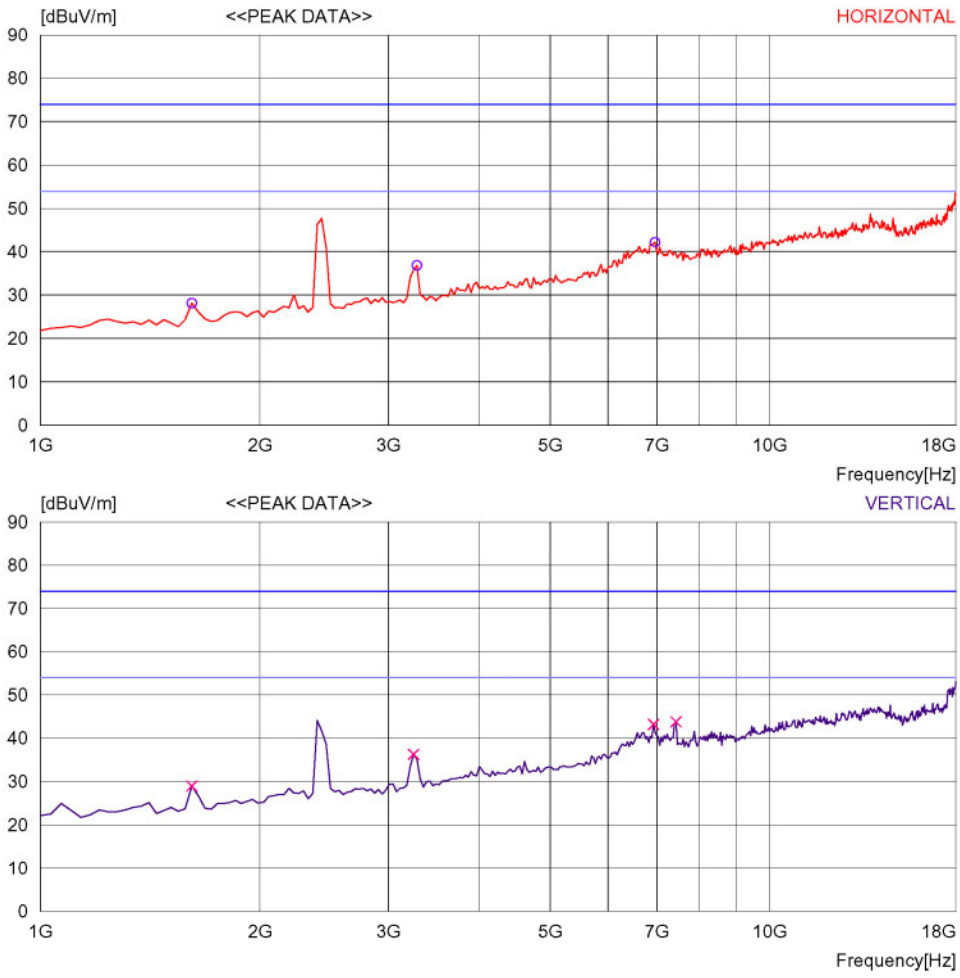
RADIATED EMISSION

Date : 2009-08-21 15:57:44

Trade Name	:	GP	Document No.	:	
Model Name	:	HTB2SE-W	Power Supply	:	AC 120V/60Hz
Serial No.	:		Temp/Humi	:	27/55RH%
Test Condition	:	Normal mode	Operator	:	Phenix zhang

Memo : KEF Wireless Subwoofer (Receiver)

LIMIT : FCC Part15 C transmitter spurious above1G(peak)
FCC Part15 C transmitter spurious above1G(average)



2009-08-21 15:57:56

RADIATED EMISSION

Date : 2009-08-21 15:57:44

Trade Name	:	GP	Document No.	:	
Model Name	:	HTB2SE-W	Power Supply	:	AC 120V/60Hz
Serial No.	:		Temp/Humi	:	27/55RH%
Test Condition	:	Normal mode	Operator	:	Phenix zhang

Memo : KEF Wireless Subwoofer (Receiver)

LIMIT : FCC Part15 C transmitter spurious above1G(peak)
FCC Part15 C transmitter spurious above1G(average)

No.	FREQ [MHz]	READING PEAK [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal ------										
1	1613.226	34.5	29.1	4.5	40.0	28.1	74	45.9	400	51
2	3282.564	36.0	33.4	6.5	39.1	36.8	74	37.2	400	125
3	6961.941	31.0	40.9	9.6	39.3	42.2	74	31.8	400	249
----- Vertical ------										
4	1613.226	35.4	29.1	4.5	40.0	29.0	74	45.0	400	143
5	3248.496	35.6	33.3	6.5	39.1	36.3	74	37.7	400	266
6	6927.873	32.3	40.7	9.5	39.3	43.2	74	30.8	400	196
7	7438.898	32.2	40.8	9.9	39.1	43.8	74	30.2	400	184

Continuous transmit mode:

2009-08-05 15:01:59

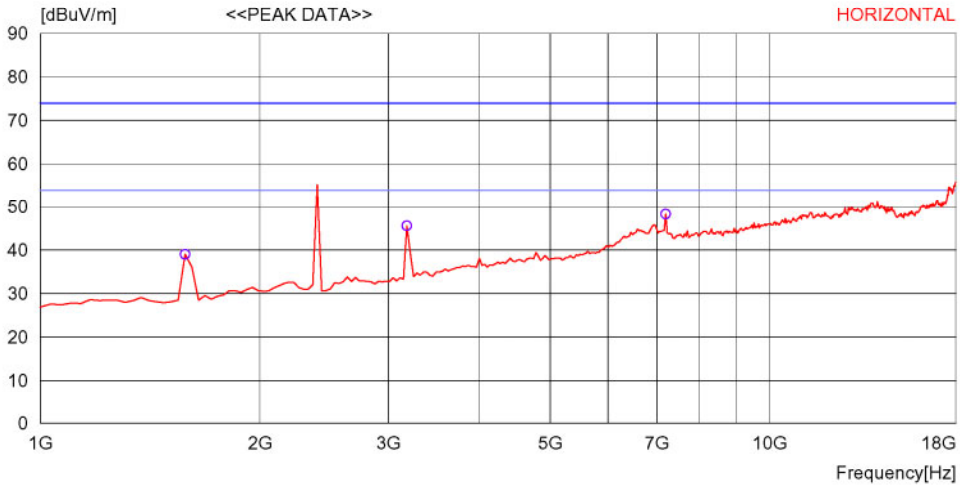
RADIATED EMISSION

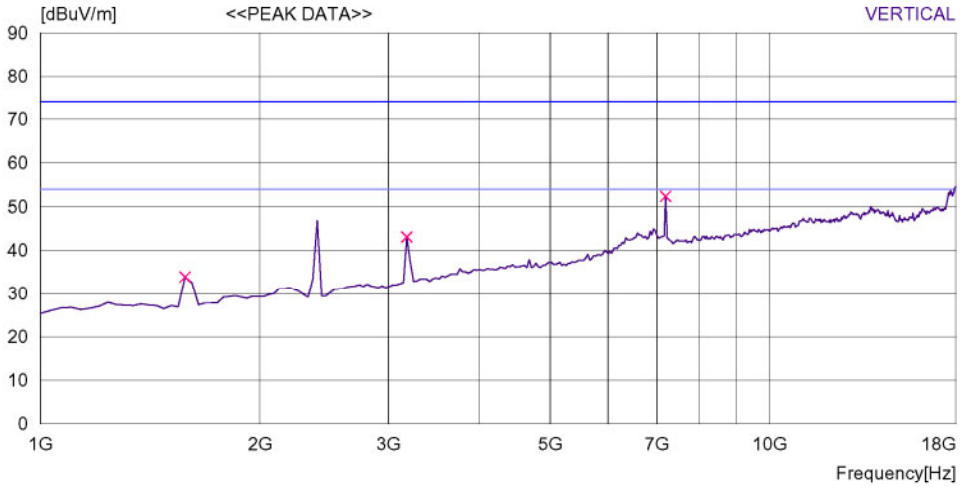
Date : 2009-08-05 15:01:38

Trade Name	:	GP	Document No.	:	
Model Name	:	HTB2SE-W	Power Supply	:	AC 120V/60Hz
Serial No.	:		Temp/Humi	:	27/55RH%
Test Condition	:	TX MODE, CH LOW	Operator	:	Phenix zhang

Memo : KEF Wireless Subwoofer (Receiver)

LIMIT : FCC Part15 C transmitter spurious above1G(peak)
FCC Part15 C transmitter spurious above1G(average)





2009-08-05 15:01:59

RADIATED EMISSION

Date : 2009-08-05 15:01:38

Trade Name	:	GP	Document No.	:	
Model Name	:	HTB2SE-W	Power Supply	:	AC 120V/60Hz
Serial No.	:		Temp/Humi	:	27/55RH%
Test Condition	:	TX MODE, CH LOW	Operator	:	Phenix zhang

Memo : KEF Wireless Subwoofer (Receiver)

LIMIT : FCC Part15 C transmitter spurious above1G(peak)
FCC Part15 C transmitter spurious above1G(average)

No.	FREQ [MHz]	READING PEAK [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal ------										
1	1579.158	45.7	29.0	4.4	40.1	39.0	74	35.0	200	80
2	3180.359	45.2	33.2	6.4	39.2	45.6	74	28.4	200	298
3	7200.419	36.0	41.5	9.9	39.1	48.3	74	25.7	100	102
----- Vertical ------										
4	1579.158	40.6	29.0	4.4	40.1	33.9	74	40.1	100	249
5	3180.359	42.7	33.2	6.4	39.2	43.1	74	30.9	200	180
6	7200.419	40.1	41.5	9.9	39.1	52.4	74	21.6	100	175

2009-08-05 15:26:34

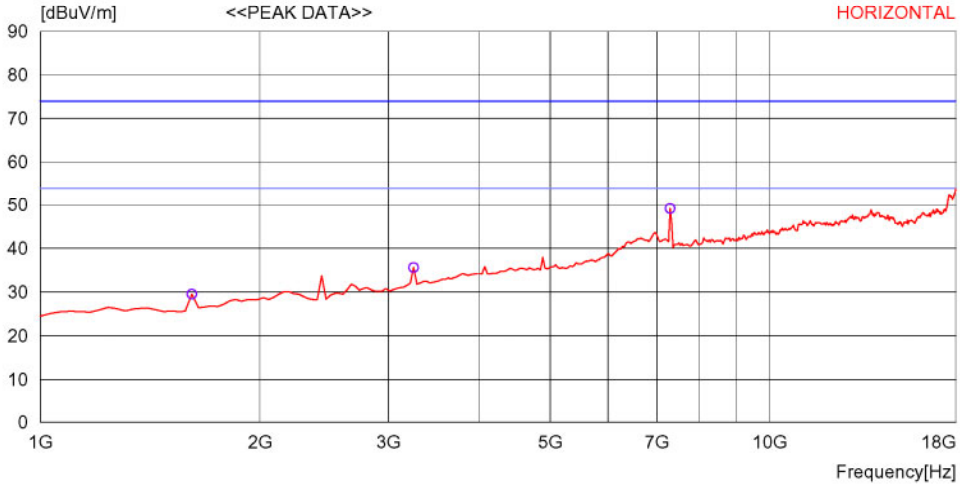
RADIATED EMISSION

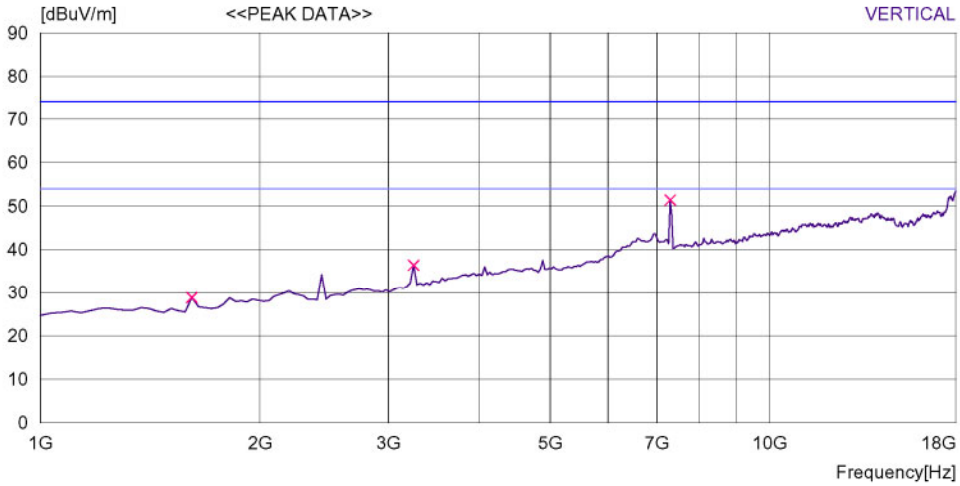
Date : 2009-08-05 15:26:22

Trade Name	:	GP	Document No.	:	
Model Name	:	HTB2SE-W	Power Supply	:	AC 120V/60Hz
Serial No.	:		Temp/Humi	:	27/55RH%
Test Condition	:	TX MODE, CH MID	Operator	:	Phenix zhang

Memo : KEF Wireless Subwoofer (Receiver)

LIMIT : FCC Part15 C transmitter spurious above1G(peak)
FCC Part15 C transmitter spurious above1G(average)





2009-08-05 15:26:34

RADIATED EMISSION

Date : 2009-08-05 15:26:22

Trade Name	:	GP	Document No.	:	
Model Name	:	HTB2SE-W	Power Supply	:	AC 120V/60Hz
Serial No.	:		Temp/Humi	:	27/55RH%
Test Condition	:	TX MODE, CH MID	Operator	:	Phenix zhang

Memo : KEF Wireless Subwoofer (Receiver)

LIMIT : FCC Part15 C transmitter spurious above1G(peak)
FCC Part15 C transmitter spurious above1G(average)

No.	FREQ	READING PEAK	ANT FACTOR	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	[dBuV]	[dB]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Horizontal ------										
1	1613.226	35.9	29.1	4.5	40.0	29.5	74	44.5	200	80
2	3248.496	34.9	33.3	6.5	39.1	35.6	74	38.4	100	118
3	7302.625	37.2	41.1	9.9	39.1	49.1	74	24.9	100	40
----- Vertical ------										
4	1613.226	35.2	29.1	4.5	40.0	28.8	74	45.2	200	193
5	3248.496	35.7	33.3	6.5	39.1	36.4	74	37.6	200	189
6	7302.625	39.5	41.1	9.9	39.1	51.4	74	22.6	100	174

2009-08-05 15:39:32

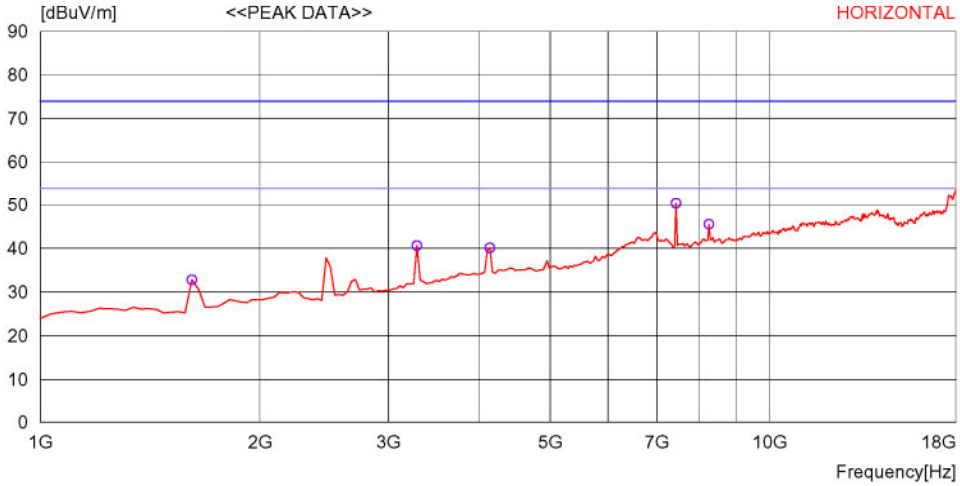
RADIATED EMISSION

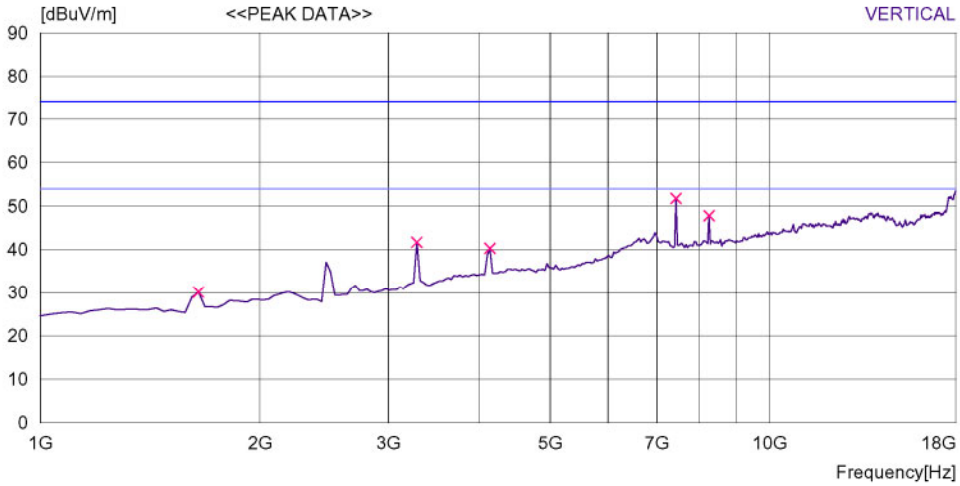
Date : 2009-08-05 15:39:26

Trade Name	:	GP	Document No.	:	
Model Name	:	HTB2SE-W	Power Supply	:	AC 120V/60Hz
Serial No.	:		Temp/Humi	:	27/55RH%
Test Condition	:	TX MODE, CH HIG	Operator	:	Phenix zhang

Memo : KEF Wireless Subwoofer (Receiver)

LIMIT : FCC Part15 C transmitter spurious above1G(peak)
FCC Part15 C transmitter spurious above1G(average)





2009-08-05 15:39:33

RADIATED EMISSION

Date : 2009-08-05 15:39:26

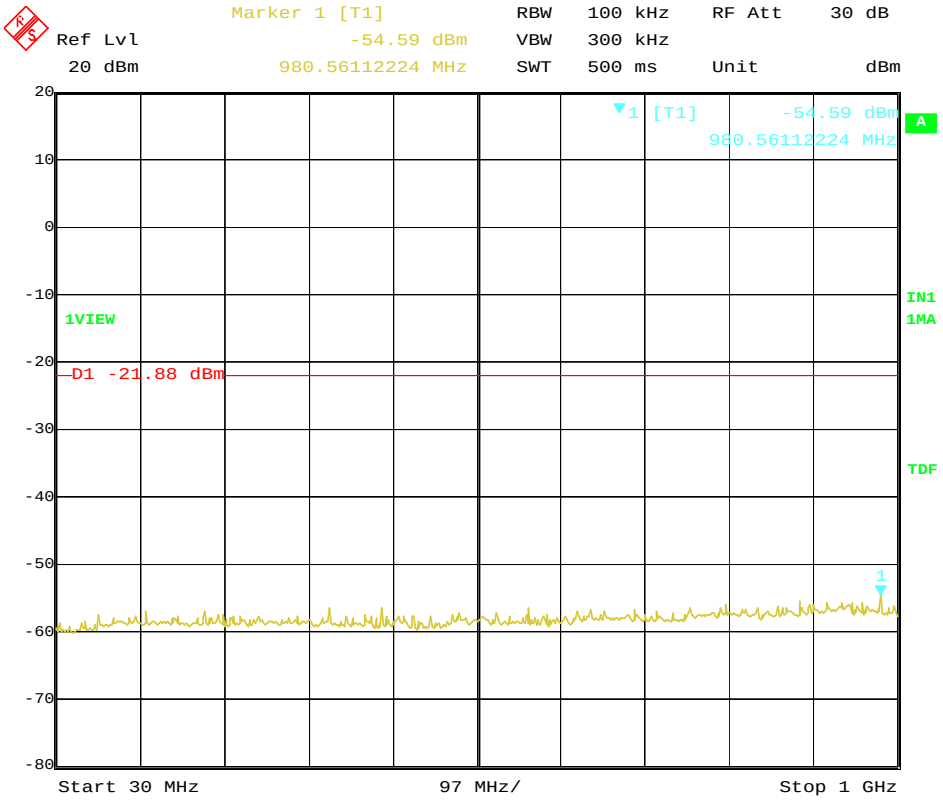
Trade Name	:	GP	Document No.	:	
Model Name	:	HTB2SE-W	Power Supply	:	AC 120V/60Hz
Serial No.	:		Temp/Humi	:	27/55RH%
Test Condition	:	TX MODE, CH HIG	Operator	:	Phenix zhang

Memo : KEF Wireless Subwoofer (Receiver)

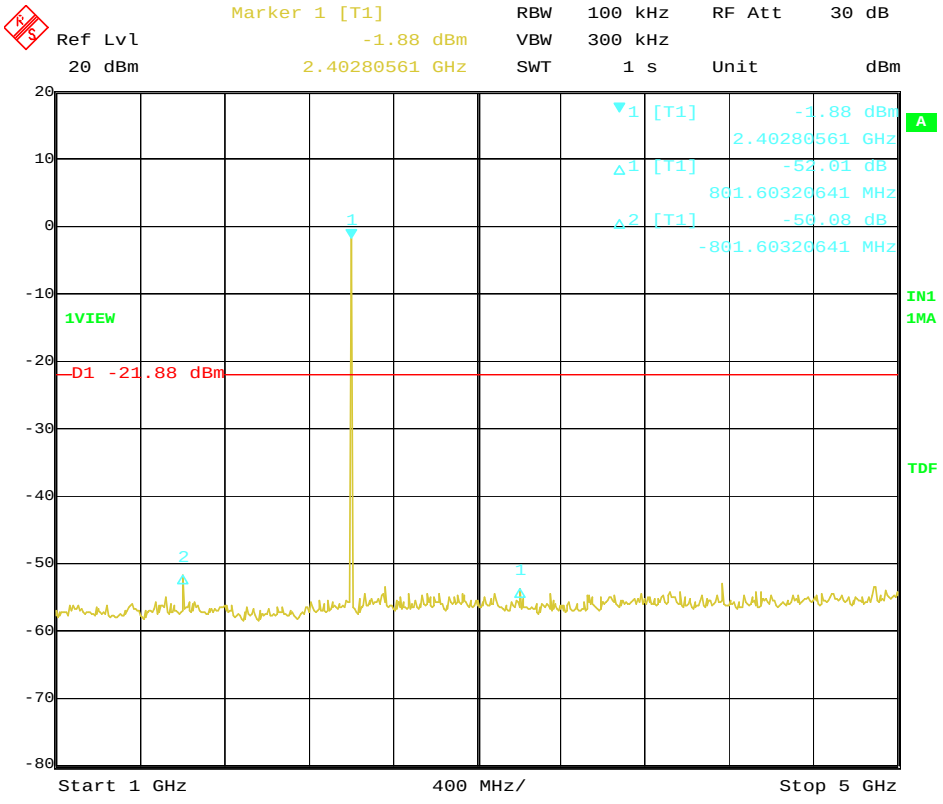
LIMIT : FCC Part15 C transmitter spurious above1G(peak)
FCC Part15 C transmitter spurious above1G(average)

No.	FREQ [MHz]	READING PEAK [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal ------										
1	1613.226	39.2	29.1	4.5	40.0	32.8	74	41.2	100	247
2	3282.564	39.8	33.4	6.5	39.1	40.6	74	33.4	200	353
3	4134.267	36.3	35.6	7.1	38.9	40.1	74	33.9	200	24
4	7438.898	38.7	40.8	9.9	39.1	50.3	74	23.7	200	201
5	8256.538	33.0	40.9	10.7	39.1	45.5	74	28.5	200	176
----- Vertical ------										
6	1647.294	36.4	29.2	4.5	40.0	30.1	74	43.9	200	180
7	3282.564	40.9	33.4	6.5	39.1	41.7	74	32.3	200	180
8	4134.267	36.5	35.6	7.1	38.9	40.3	74	33.7	200	275
9	7438.898	40.2	40.8	9.9	39.1	51.8	74	22.2	200	118
10	8256.538	35.3	40.9	10.7	39.1	47.8	74	26.2	100	46

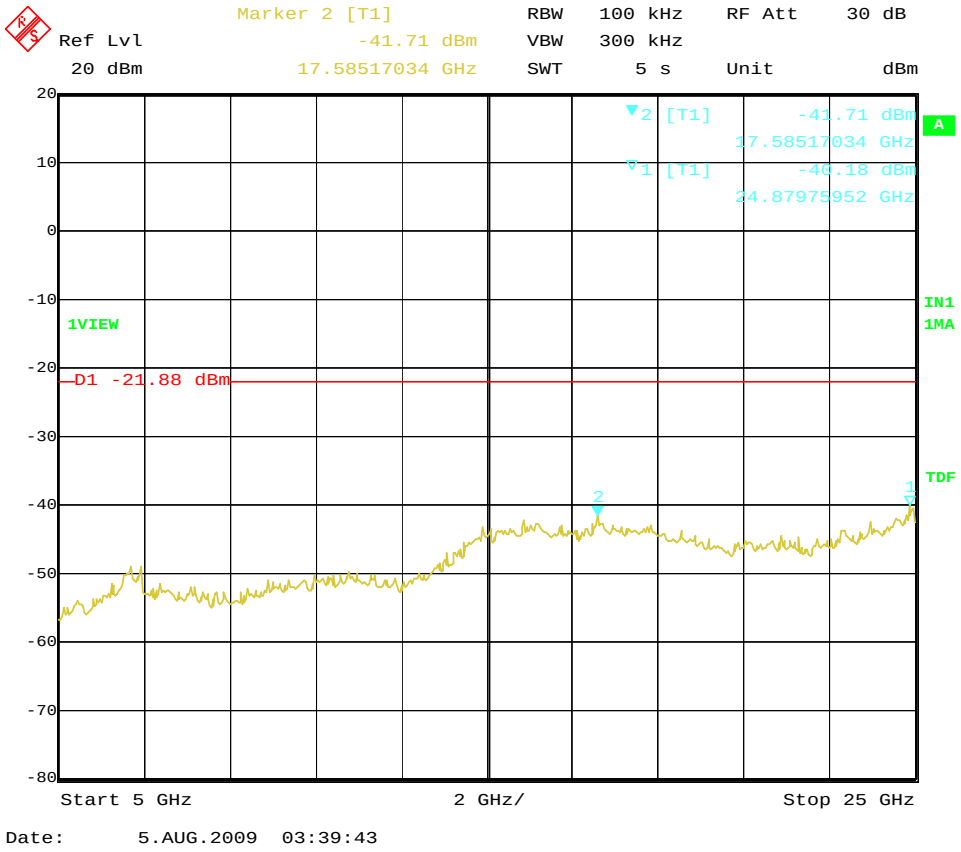
Conducted:
Channel LOW：



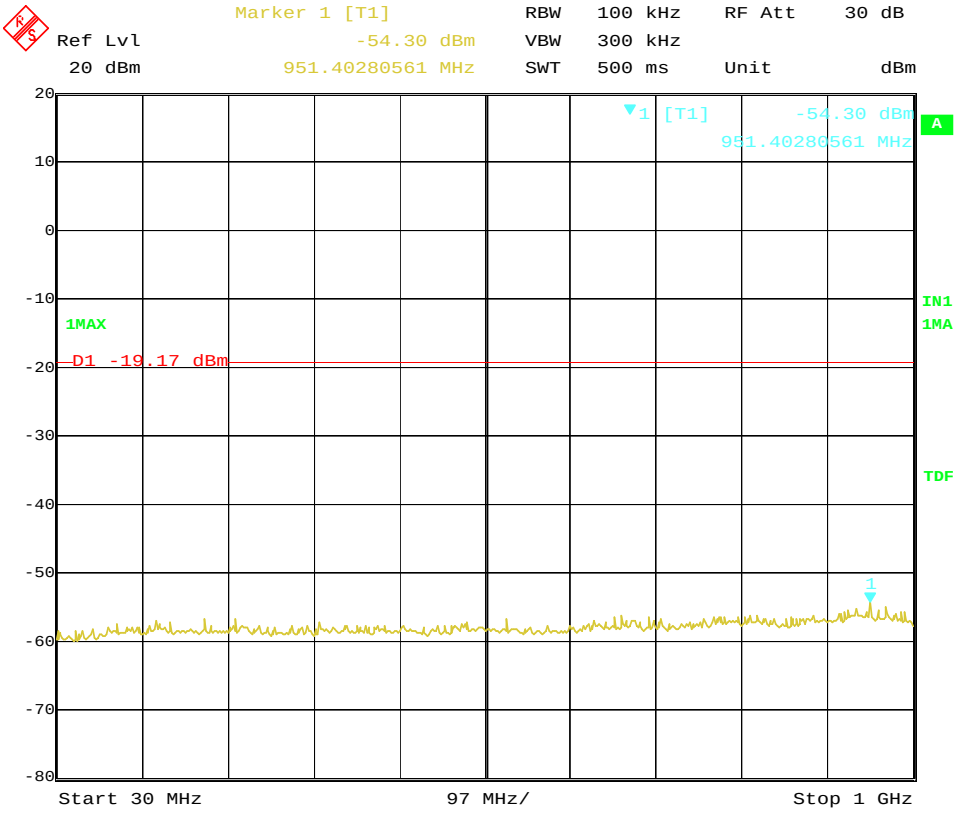
Date: 5.AUG.2009 03:37:59

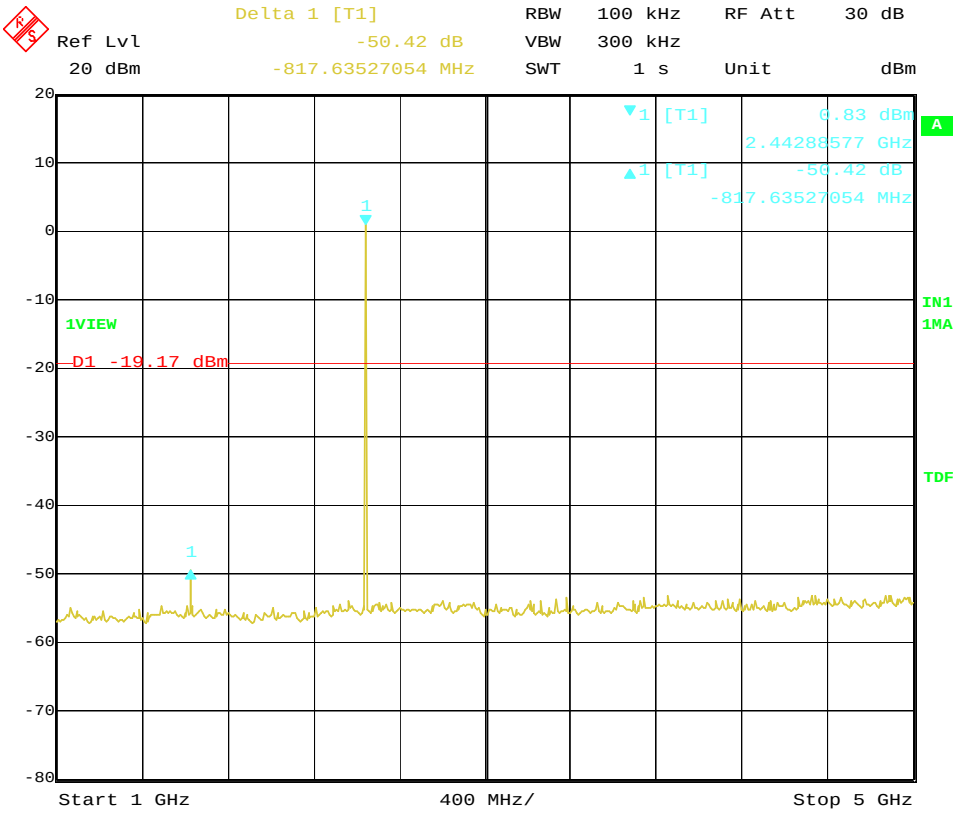


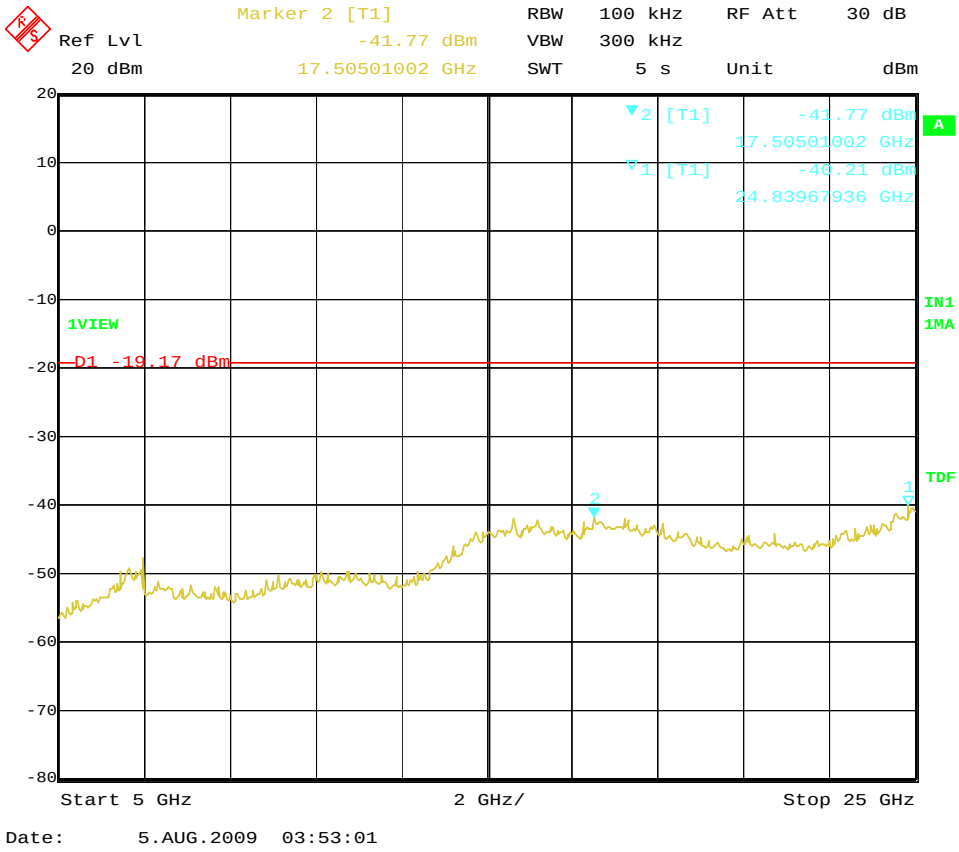
Date: 5.AUG.2009 03:34:04


Marker 2 [T1]
RBW 100 kHz
RF Att 30 dB
Ref Lvl
-41.71 dBm
VBW 300 kHz
20 dBm
17.58517034 GHz
SWT 5 s
Unit dBm
2 [T1] -41.71 dBm
17.58517034 GHz
1 [T1] -40.18 dBm
24.87975952 GHz
A
IN1
1MA
TDF
1VIEW
D1 -21.88 dBm
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Start 5 GHz
2 GHz/
Stop 25 GHz
Date: 5.AUG.2009 03:39:43

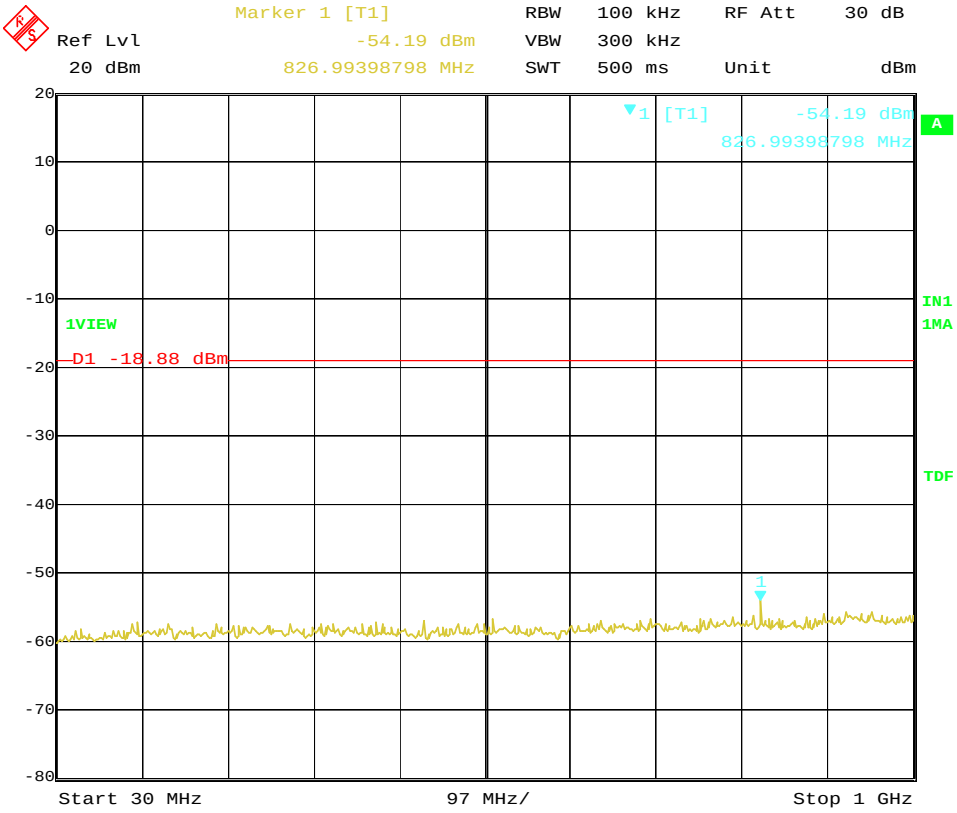
Channel MID：

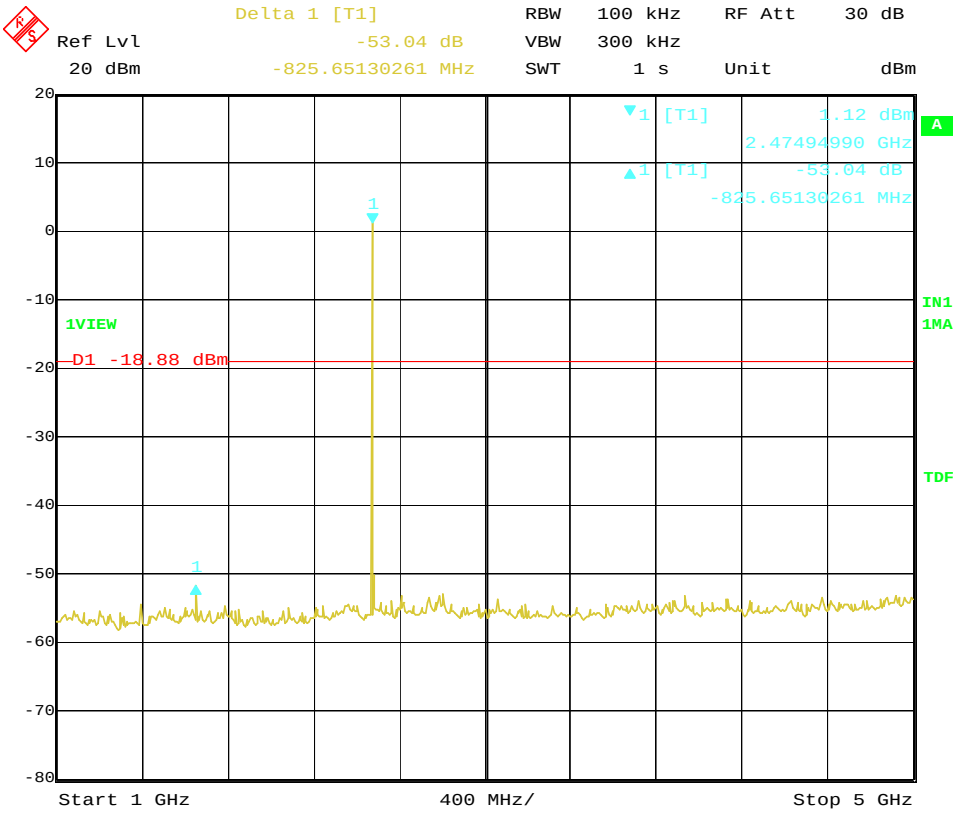

Marker 1 [T1]
RBW 100 kHz
RF Att 30 dB
Ref Lvl
-54.30 dBm
VBW 300 kHz
20 dBm
951.40280561 MHz
SWT 500 ms
Unit dBm
1 [T1]
-54.30 dBm
951.40280561 MHz
A
IN1
1MA
TDF
1MAX
D1 -19.17 dBm
Start 30 MHz
97 MHz/
Stop 1 GHz
Date: 5.AUG.2009 03:51:11

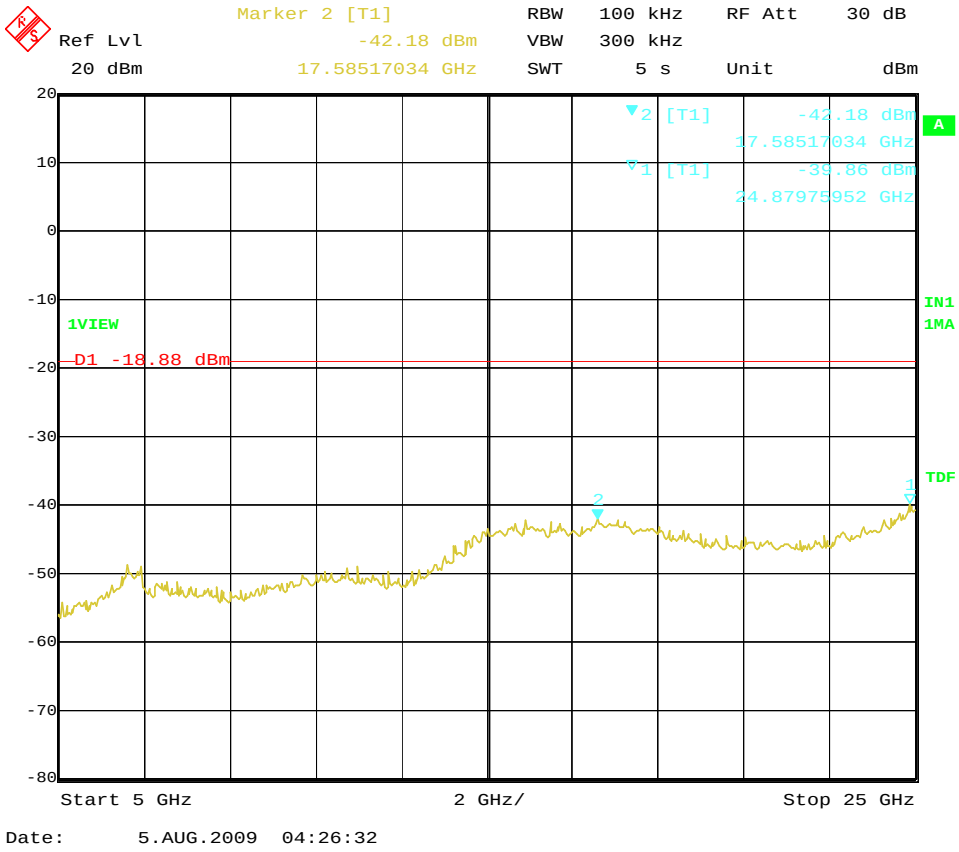

Delta 1 [T1]
RBW 100 kHz
RF Att 30 dB
Ref Lvl
-50.42 dB
VBW 300 kHz
20 dBm
-817.63527054 MHz
SWT 1 s
Unit dBm
1 [T1]
0.83 dBm
2.44288577 GHz
1 [T1]
-50.42 dB
-817.63527054 MHz
A
IN1
1MA
TDF
1VIEW
D1 -19.17 dBm
Start 1 GHz
400 MHz/
Stop 5 GHz
Date: 5.AUG.2009 03:49:25


Marker 2 [T1]
RBW 100 kHz
RF Att 30 dB
Ref Lvl
-41.77 dBm
VBW 300 kHz
20 dBm
17.50501002 GHz
SWT 5 s
Unit dBm
2 [T1] -41.77 dBm
17.50501002 GHz
1 [T1] -40.21 dBm
24.83967936 GHz
A
IN1
1MA
TDF
1VIEW
D1 -19.17 dBm
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Start 5 GHz
2 GHz/
Stop 25 GHz
Date: 5.AUG.2009 03:53:01

Channel HIG：


Marker 1 [T1]
RBW 100 kHz
RF Att 30 dB
Ref Lvl
-54.19 dBm
VBW 300 kHz
20 dBm
826.99398798 MHz
SWT 500 ms
Unit dBm
1 [T1] -54.19 dBm
826.99398798 MHz
A
IN1
1MA
TDF
1VIEW
D1 -18.88 dBm
Start 30 MHz
97 MHz/
Stop 1 GHz
Date: 5.AUG.2009 04:24:43

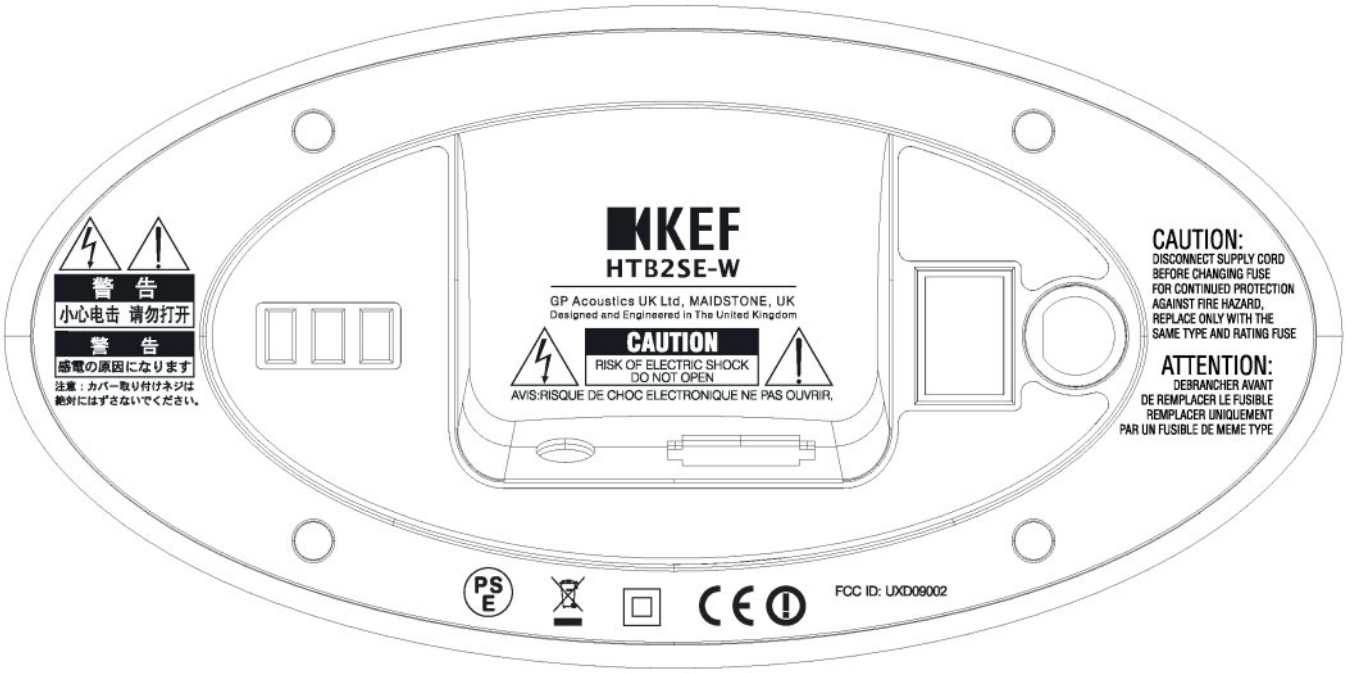

Delta 1 [T1]
RBW 100 kHz
RF Att 30 dB
Ref Lvl
-53.04 dB
VBW 300 kHz
20 dBm
-825.65130261 MHz
SWT 1 s
Unit dBm
1 [T1] 1.12 dBm
2.47494990 GHz
1 [T1] -53.04 dB
-825.65130261 MHz
A
IN1
1MA
TDF
1VIEW
D1 -18.88 dBm
Start 1 GHz
400 MHz/
Stop 5 GHz
Date: 5.AUG.2009 04:23:18


Marker 2 [T1]
RBW 100 kHz
RF Att 30 dB
Ref Lvl
-42.18 dBm
VBW 300 kHz
20 dBm
17.58517034 GHz
SWT 5 s
Unit dBm
2 [T1] -42.18 dBm
17.58517034 GHz
1 [T1] -39.86 dBm
24.87975952 GHz
A
IN1
1MA
TDF
1VIEW
D1 -18.88 dBm
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Start 5 GHz
2 GHz/
Stop 25 GHz
Date: 5.AUG.2009 04:26:32

5. FCC ID Label

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:(1)this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Mark Location:



5. Test Setup

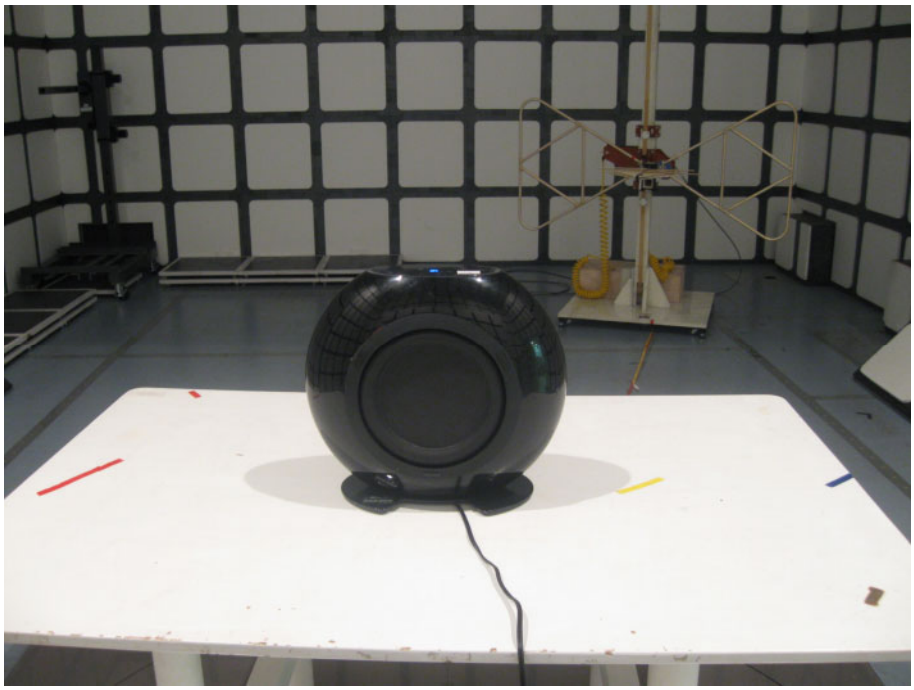
5.1 Ancillary and Accessory Equipment Used

No.	Description	Specification	Quantity
1.	Transmitter	FCC ID:UXD09001	1
2.	MP3 Player	SONY, M/N: NWZ-B135F, S/N:7138661	1
3.	Audio Line	1.5m, with 2 cores	1

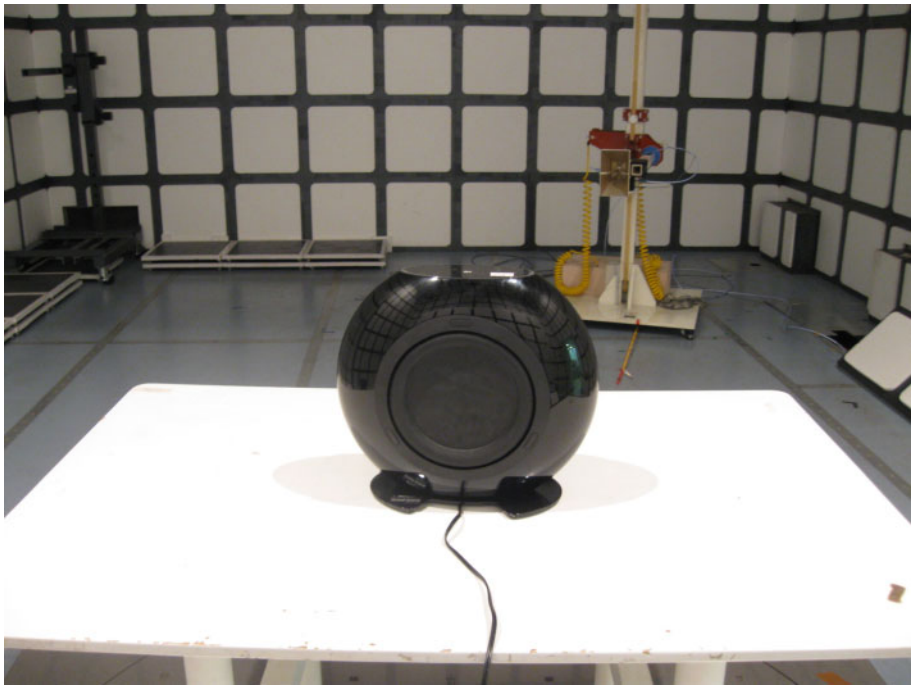
5.2 Photographs of the Test Configuration

5.2.1 Radiated emission

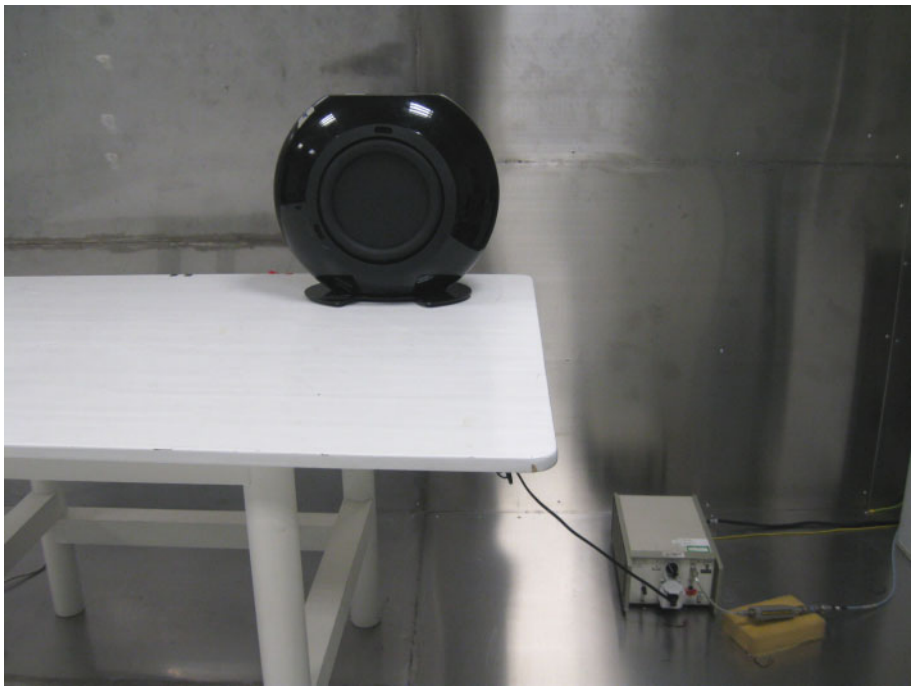
Below 1G:



Above 1G:



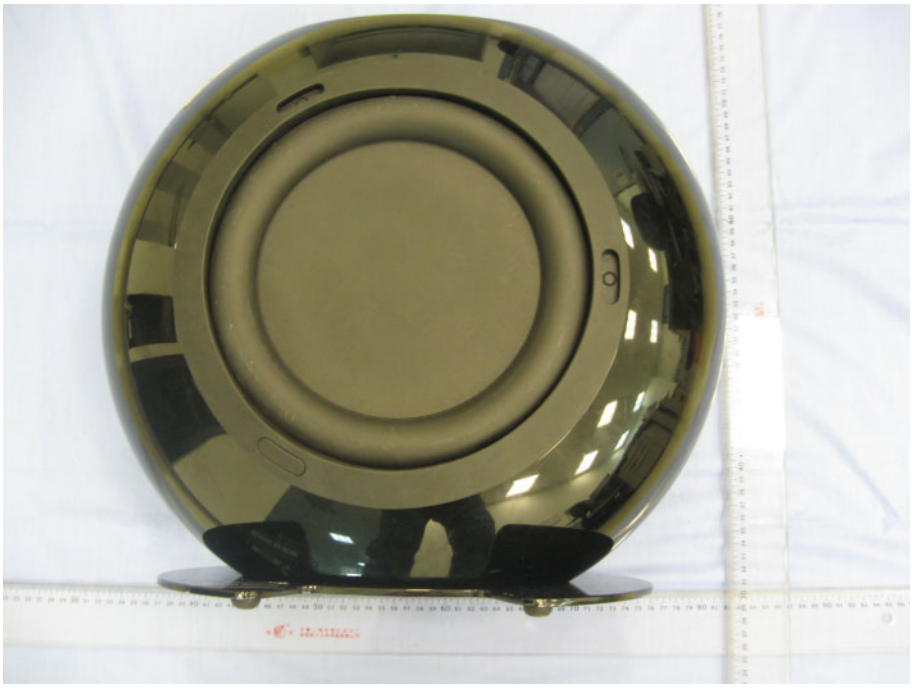
5.2.2 Conducted emission



5.3 Photographs of the EUT

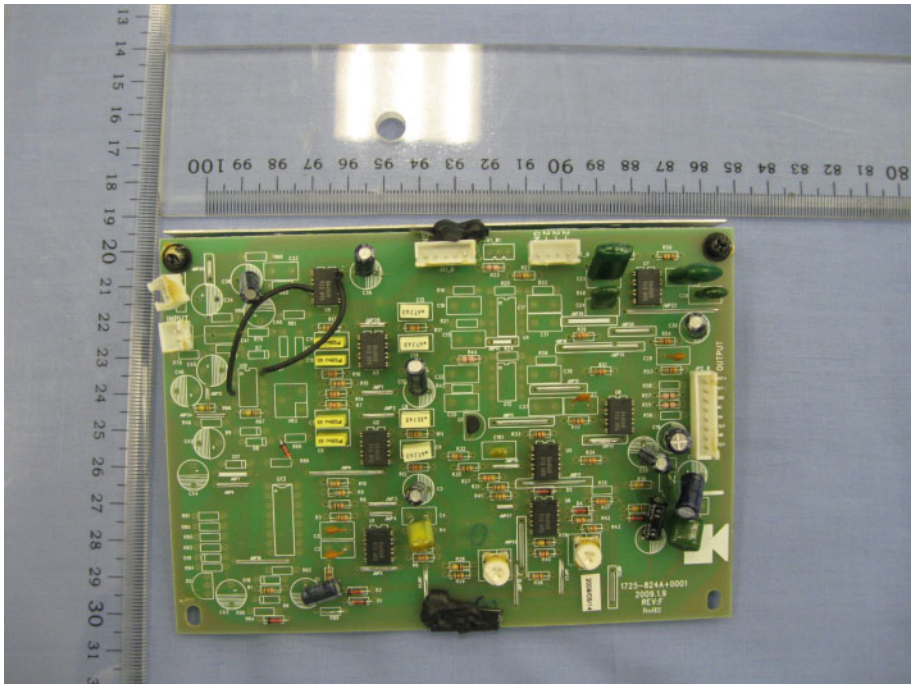
Enclosure of EUT

Enclosure of EUT

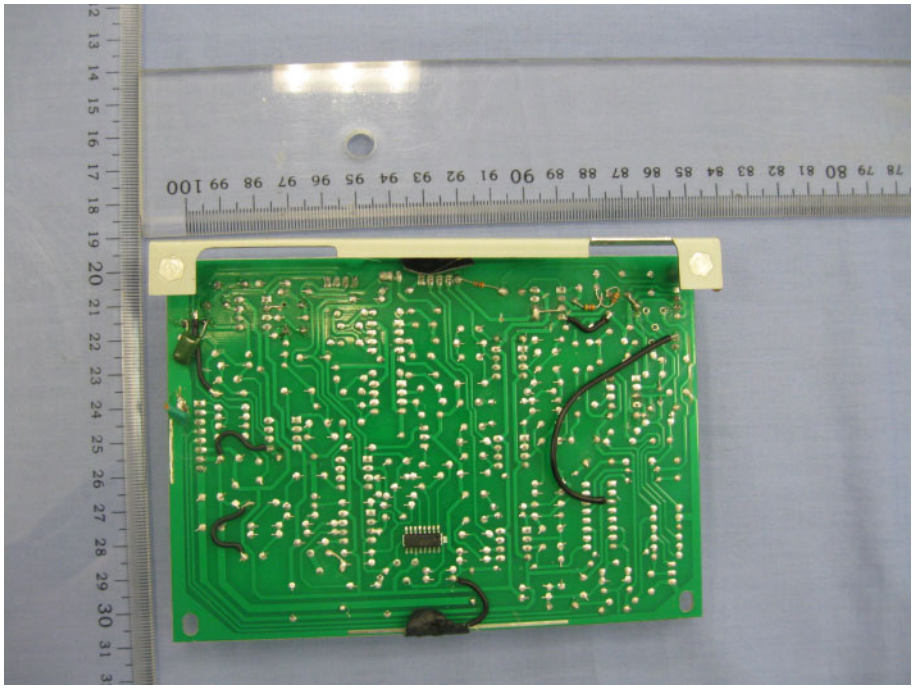


Enclosure of EUT

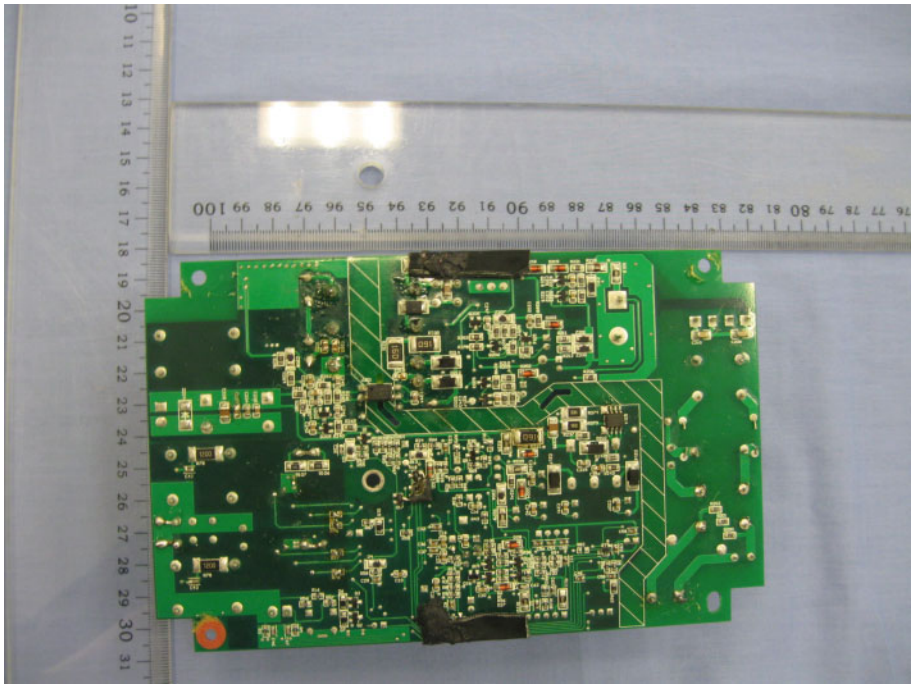
Internal of EUT



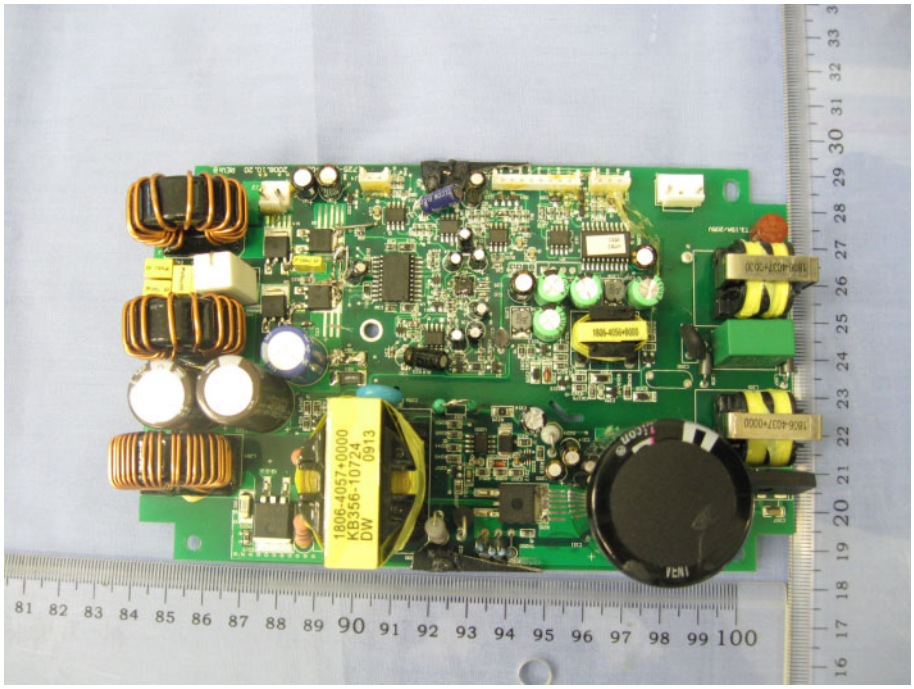
Preamplifier



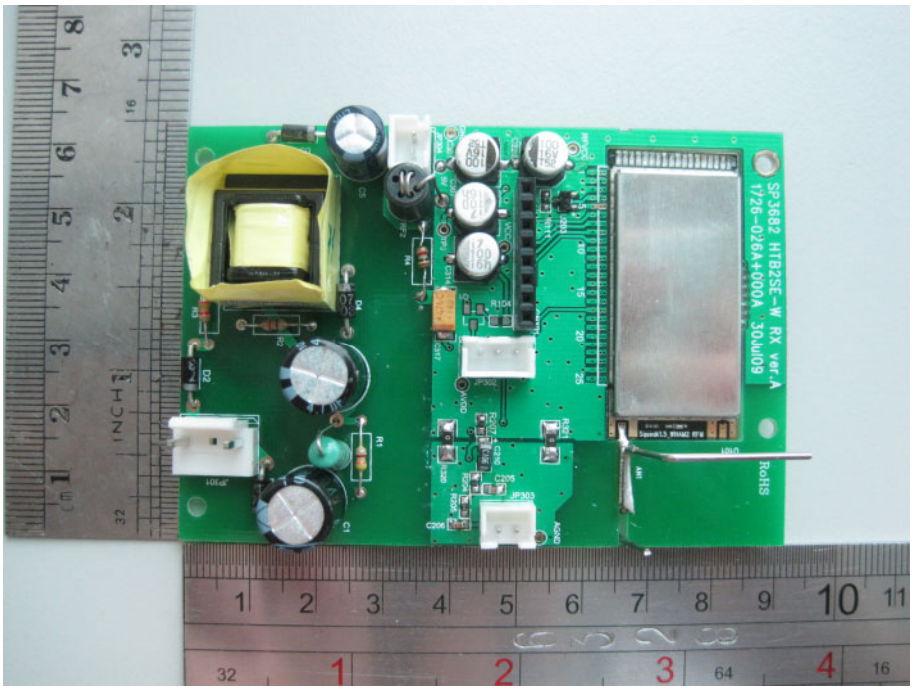
Preamplifier



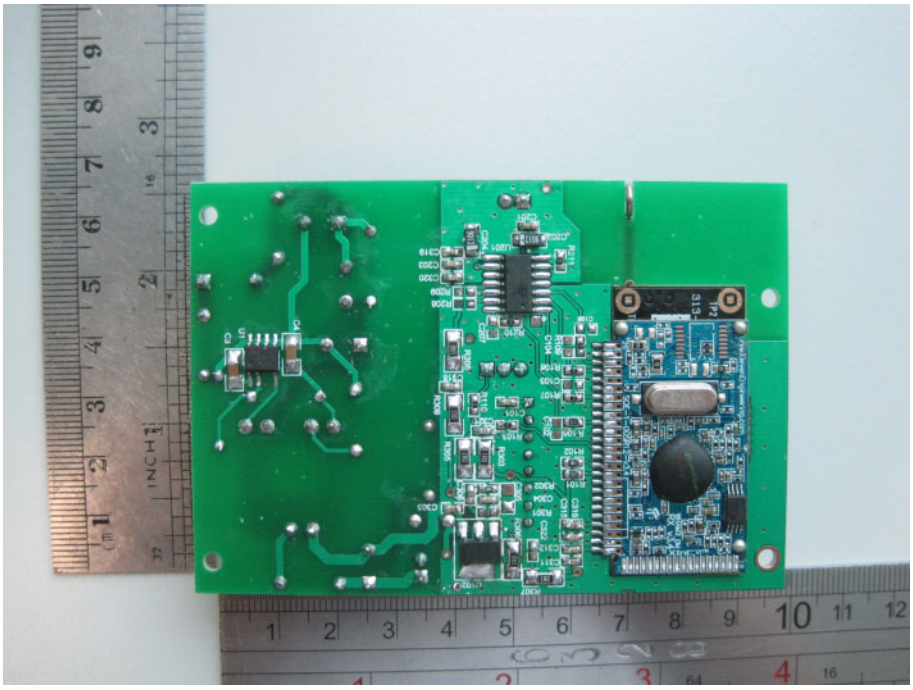
Power Board



Power Board



PCB of RF modular



PCB of RF modular

6. Equipment List

No.	Equipment	Manufacturer	Model	Serial No.	Calibration Date
1	Precision Biconical Antenna	TDK Co.	PBA-2030	090500	2008-09-18
2	Precision Log Periodic Antenna	TDK Co.	PLP-3003	061001	2008-09-18
3	Hybrid Log Periodic Antenna	TDK	HLP-3003C	130174	2008-09-18
4	Horn antenna	TDK	HRN-0118	130186	2009-04-07
5	Attenuator 6 dB	Agilent	8491B	MY39260147	2008-09-18
6	Preamplifier	TDK Sonoma	310	242803	2009-04-07
7	Preamplifier	ELENA	EAU-3718 GXA	A070701	2009-04-07
8	EMI Receiver	Rohde & Schwarz	ESIB26	100234	2009-04-07
9	EMI Receiver	Rohde & Schwarz	ESCS30	100350	2009-04-07
10	Spectrum Analyzer	Agilent	E4403B	MY44210199	2009-04-07
11	Art. Mains Network	EMCO	3816/2	00044921	2009-04-07
12	Transient Limiter(10 dB)	Agilent	11947A	3107A03736	2009-04-07
13	Personal Computer	HP	DX2000MT	MXD4250FZM	N/A
14	Personal Computer	HP	DX2000MT	MXD4130B2N	N/A
15	Semi-Anechoic Chamber	TDK Co.	N/A	N/A	2009-04-07
16	Shielded Room	TDK Co.	N/A	N/A	N/A
17	Loop Antenna	EMCO	6502	9107-2440	2009-04-07

7. Test Uncertainty

Test	Range	Confidence Level	Calculated Uncertainty
Radiated emission(3m)	30-1000MHz	95%	4.3dB
Conducted emission	0.15-30MHz	95%	3.3dB

8. Appendix

8.1 Confirmation of Compliance within the Limits

8.1.1 Method of calculating measurement result

Radiated Emission

For example the point of 30.00MHz, vertical, Page 40.

	Reading	+	Antenna factor	+	Cable loss	-	Gain	=	Result
Example	50.4	+	12.5	+	6.7	-	31.7	=	37.9

Conducted Emission

For example the point of 0.736MHz, L1, Page 9.

	Reading	+	C. FACTOR	=	Result
Example	37.2	+	10.0	=	47.2

8.2 Compliance Statements

HTB2SE-W Operational Description for Regulatory Compliance
20 Hopping Channels

In order to achieve regulatory compliance in the USA, the FCC body requires an operational description of the unit under test which describes how the hopping and BW requirements are met. This document provides appropriate prose which can be used to achieve compliance. HTB2SE-W Customers may extract the text contained in this document and complete the submission.

The descriptions below may be applied to WHAM2 modules manufactured with either both the HTB2SE-W 50 m RD02 or HTB2SE-W 25 m RFM RF modules.

FCC Rules:
2.1(c) Terms and Definitions of Frequency Hopping Systems
15.247(a)(1) "…The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudorandomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter."
15.247(a)(1)(iii) "Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

HTB2SE-W Description
HTB2SE-W is a frequency hopping system according to the definition located in the section 2.1. HTB2SE-W has channel palette of 38 channels which are spaced every 2048 MHz starting at 2403.33 MHz. From this palette, 20 channels are used by the system at any given moment. Upon startup, a pre-defined ordered list of 20 channels is used and the system starts hopping between them. The hopping sequence is a pseudo random ordered list of the 20 channels, which is 20 elements long. During operation, the performance of a given channel is monitored. If the performance is deemed poor, the channel is removed from the hopping list and is replaced by another channel from the palette. The new channel is then entered into the pseudo random sequence and the system hops according to the new list. The channel palette is also a pseudo-random ordered list of 18 unused channels. The initial ordered list of channel numbers are: 5, 9, 1, 2, 12, 7, 10, 17, 20, 27, 30, 25, 35, 36, 24, 33, 29, 23, 31, 13.

HTB2SE-W always uses 20 hopping channels. The system has a regular hopping rate of 9.5 hops per second and has a dwell time of less than 5.33 ms in each period.Every hop cycle contains a transmission and no channels in the current list of 20 are skipped. This ensures that all 20 channels are used equally on average, and that the total dwell time on any channel within the hop set is within the 0.4 s in any 0.4s period on the 20 channels used.

FCC Rule:
15.247(a)(1) "…The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals."

HTB2SE-W Description:
The RF section uses a complete integrated circuit as the RF transceiver. The receiver is a dual conversion heterodyne, with a low IF frequency. All IF and base band filters are contained within the integrated circuit. The 20 dB IF filter BW is less than 0.4 MHz. This matches the transmission BW, and provides a functional radio.

The receiver is a dual conversion heterodyne receiver. Changing the receiver channel is achieved by changing the frequency of the PLL controlled local oscillator. The signal from the local oscillator is fed to two mixers which convert the received signal to the IF frequency. The incoming signal is then filtered and demodulated.

Upon startup the receiver searches for a transmitter on all 38 channels. When the receiver captures a packet sent by the transmitter, it extracts the current hopping channels and matches the hopping sequence. At this point the transmitter and receiver have a connection and are now synchronized to the hopping time. Before the hopping sequence adapts, the change request is sent by the transmitter to the receiver on several channels. The hop set change does not occur until the receiver has acknowledged the change. This way the transceivers within the system maintain synchronization.

FCC Rule: 15.247(h) "The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hop sets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted."
HTB2SE-W Description: There is no coordination of hopping frequencies between systems. The decision to adapt the hopping sequence is based purely on the performance of the current hop set. Transmissions from any other transmitter are regarded as interference, and poor channels are simply replaced in the current hop set. Other HTB2SE-W systems do not coordinate their hopping channels or hopping times. An unique ID is assigned to every HTB2SE-W system and only communication within the system is allowed.

Document History

Version 1.0	Document created from 15 channel version	Mike Szelewicki	05/19/06