FCC Test Report
(TR-1007-030-01)

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	**:**	Wireless Audio System (Transmitter)
Trademark	**:**	KEF
Model(s)	**:**	KEF Wireless System
Standard(s)	:	FCC Part 15 Subpart C
Test Result	**:**	Pass
Date of Test	**:**	Aug 11, 2010 to Sep 14, 2010
Report issued Dated	**:**	Sep 14, 2010

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	:	2010.09.14	Technical manager / Date	:	2010. 09.14

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 and RF 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)	:	KEF Wireless System
Serial No.	:	None

2.3 Spec of EUT

Description of Antenna	:	fixed, built-in antenna, 3dBi
Spec of adaptor	:	Trademark: GPE Model: GPE038-090030-1 Input:100-240V 50/60Hz Output:9V 300mA DC
Operation Frequency	:	2403 MHz ~ 2479 MHz
Number of Channels	:	20
Type of Modulation	:	FHSS

2.4 Test Standards List

FCC Part 15 (2009)

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

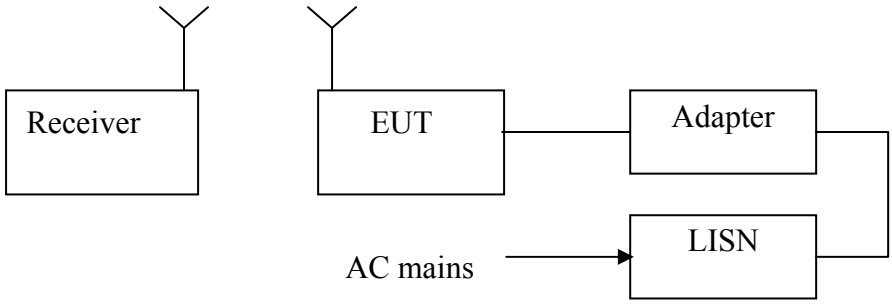
The antenna connector is designed with permanent attachment and no consideration of replacement.
Transmitter antenna of directional gain is 3dBi.

4.2 Conducted Emission (mains)

4.2.1 Test Summary

Test Room	:	Shielded Room
Power Source	:	AC 120V / 60Hz
Standards:	:	FCC Part15 B : 2009
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

2010-08-11 15:35:39

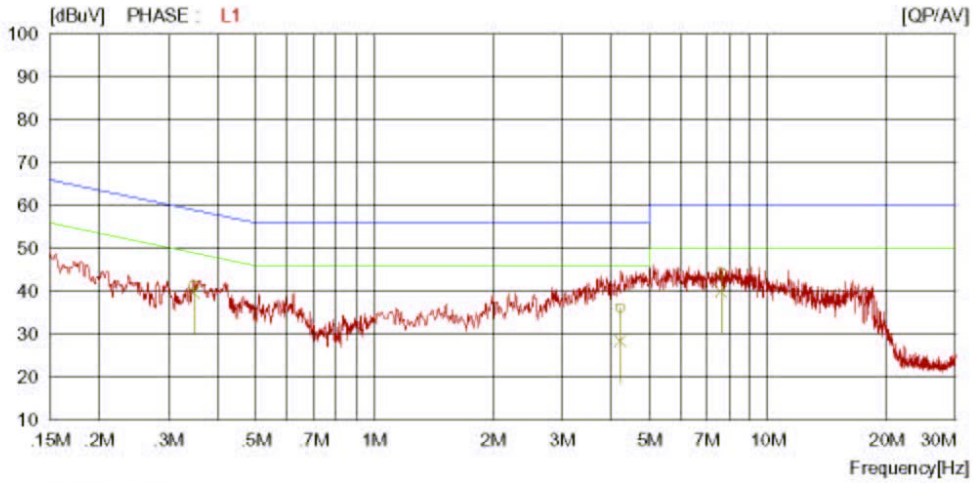
Conducted Emission

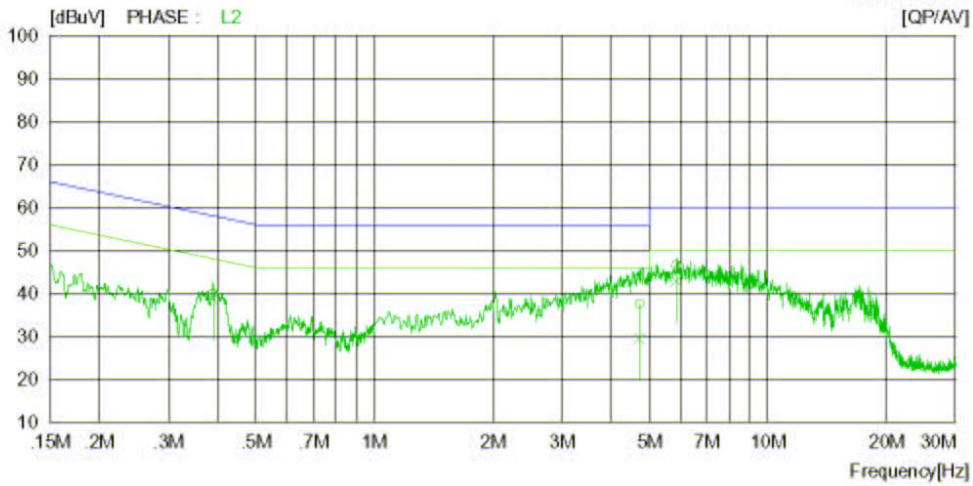
TDK South China EMC Centre
Date : 2010-08-11 15:35:36

Trade Name	: KEF	Document No.	:
Model Name	: KEF Wireless System	Power Supply	: AC 120V/60Hz
Product Name	: Wireless Audio System	Temp/Humi	: 25deg / 52%RH
Test condition	: Transmitter,normal	Operator	: JiaLiang Cao

Memo : INPUT MP3(COWON,iAUDIO9) PLAYING 1KHz

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





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

2010-08-11 15:35:40

Conducted Emission

TDK South China EMC Centre
Date : 2010-08-11 15:35:36

Trade Name	:	KEF	Document No.	:	
Model Name	:	KEF Wireless System	Power Supply	:	AC 120V/60Hz
Product Name	:	Wireless Audio System	Temp/Humi	:	25deg / 52%RH
Test condition	:	Transmitter,normal	Operator	:	JiaLiang Cao

Memo : INPUT MP3(COWON,iAUDIO9) PLAYING 1KHz

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	4.21800	26.1	18.3	10.0	36.1	28.3	56.0	46.0	19.9	17.7	L1
2	0.34800	31.5	29.8	9.9	41.4	39.7	59.0	49.0	17.6	9.3	L1
3	7.61200	34.5	30.1	9.9	44.4	40.0	60.0	50.0	15.6	10.0	L1
4	4.72400	27.4	19.4	10.0	37.4	29.4	56.0	46.0	18.6	16.7	L2
5	0.39000	30.1	28.7	9.9	40.0	38.6	58.1	48.1	18.1	9.5	L2
6	5.86200	36.5	32.8	9.9	46.4	42.7	60.0	50.0	13.6	7.3	L2

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

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.

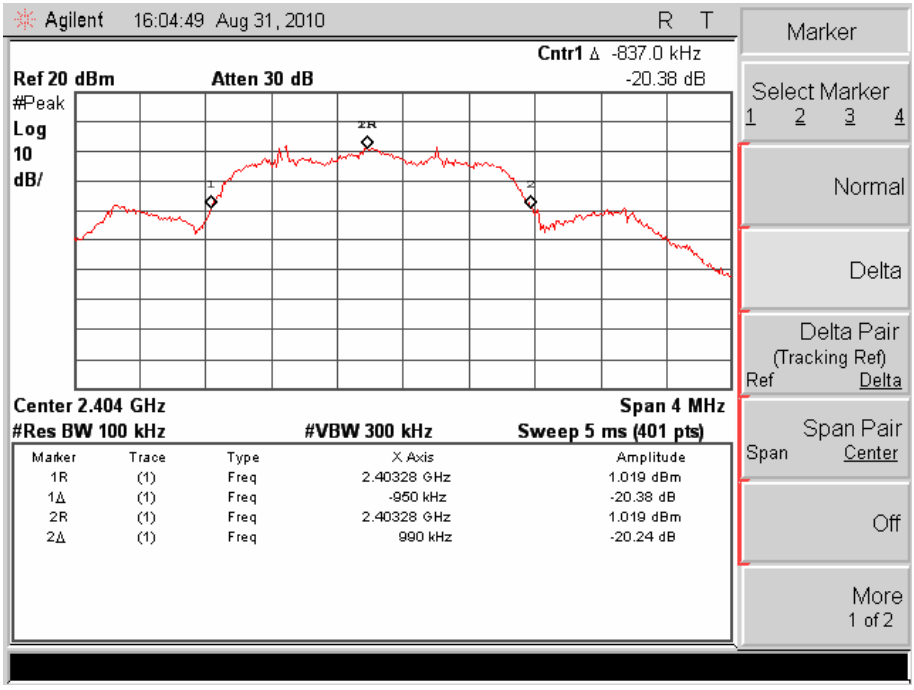
5. Repeat above 1~3 points for the middle and highest channel of the EUT.

4.2.4. Result

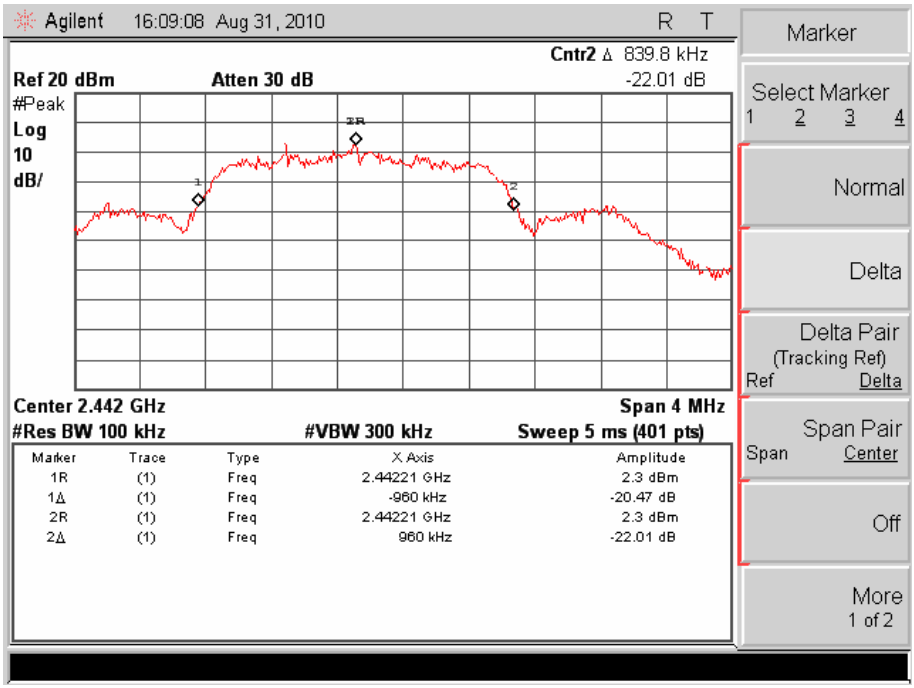
Temperature (℃) : 22~23	EUT: Wireless Audio System
Humidity (%RH): 50~54	M/N: KEF Wireless System
Barometric Pressure (mbar): 950~1000	Operation Condition: Tx Mode
Test data: Aug 31, 2010	Test engineer: Phenix

Channel No.	Frequency (MHz)	20dB Bandwidth (MHz)	Min. Limit (kHz)
LOW	2403	1.940	>25
MID	2442	1.920	>25
HIG	2479	1.900	>25

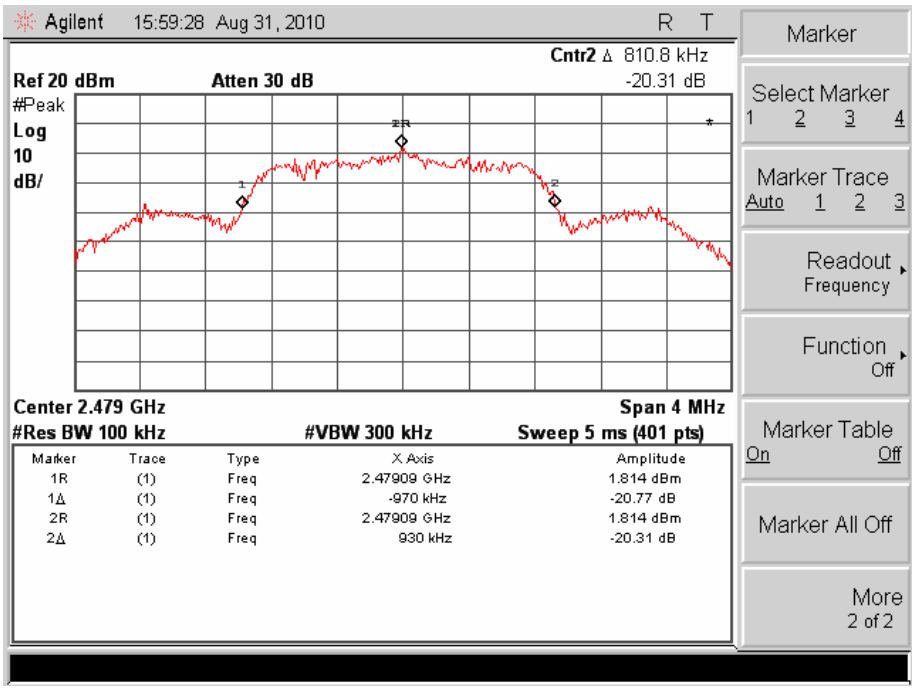
Channel LOW：



Channel MID：



Channel HIG：



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.

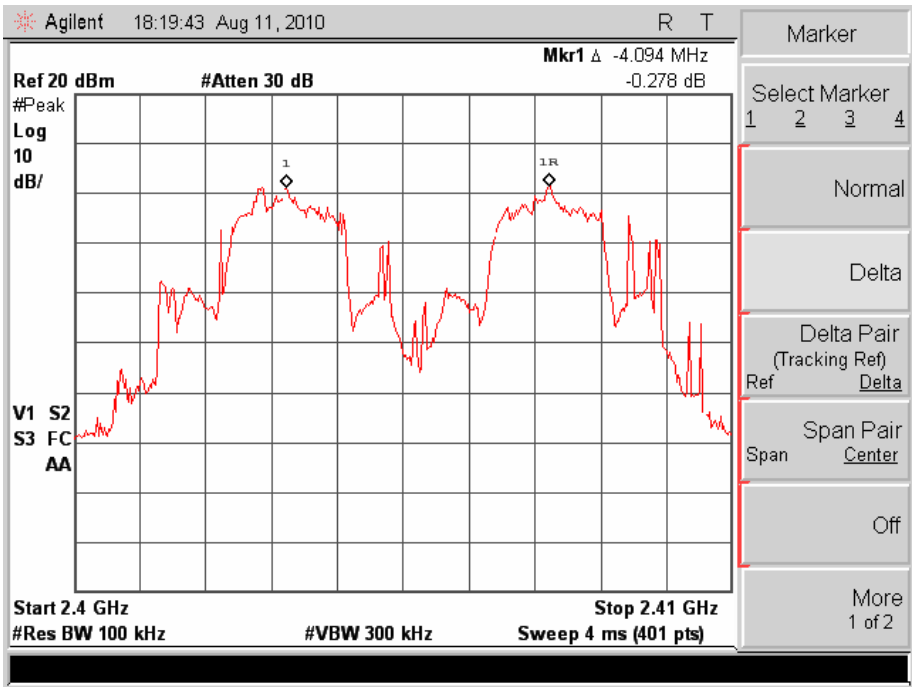
5. Repeat above 1~3 points for the middle and highest channel of the EUT.

4.4.4. Result

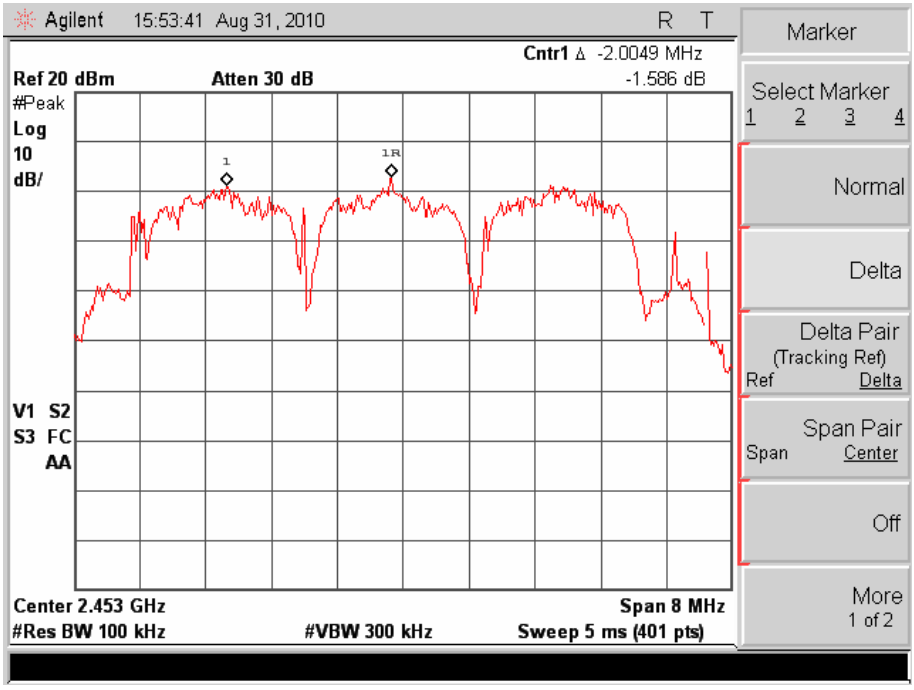
Temperature (℃) : 22~23	EUT: Wireless Audio System
Humidity (%RH): 50~54	M/N: KEF Wireless System
Barometric Pressure (mbar): 950~1000	Operation Condition: Tx Mode
Test data: Aug 11,2010 and Aug 31,2010	Test engineer: Phenix

Channel No.	Frequency (MHz)	Channel Separation (MHz)	20dB Bandwidth
LOW(channel 1)	2403	4.094	1.940
MID(channel 11-12)	2442	2.005	1.920
HIG(channel 20)	2479	4.093	1.900

Channel Low：

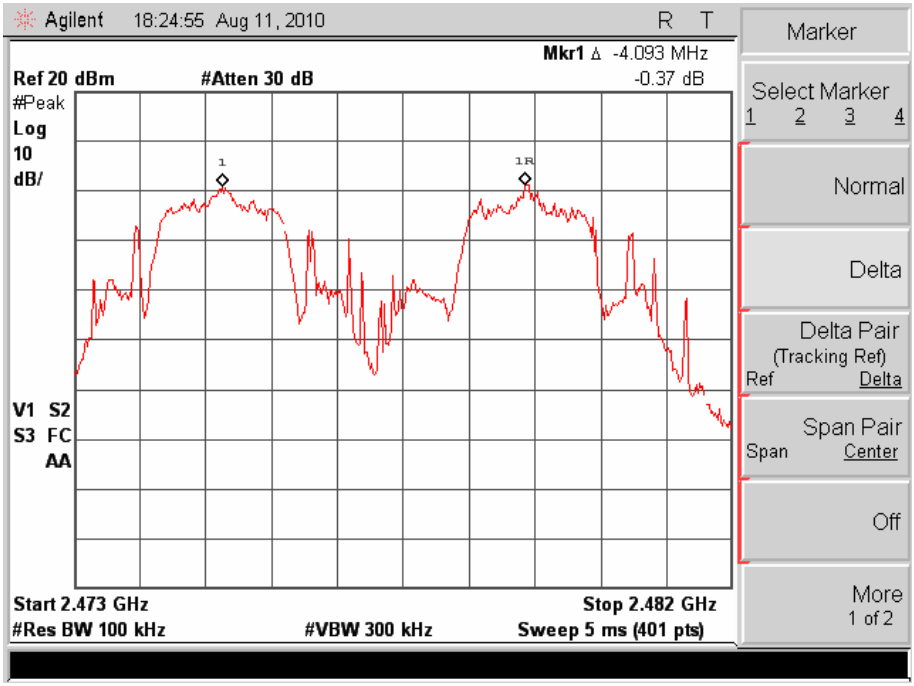


Channel MID：



Note: The separation of CH 11 to 12 is lowest of all channels.

Channel HIG：



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

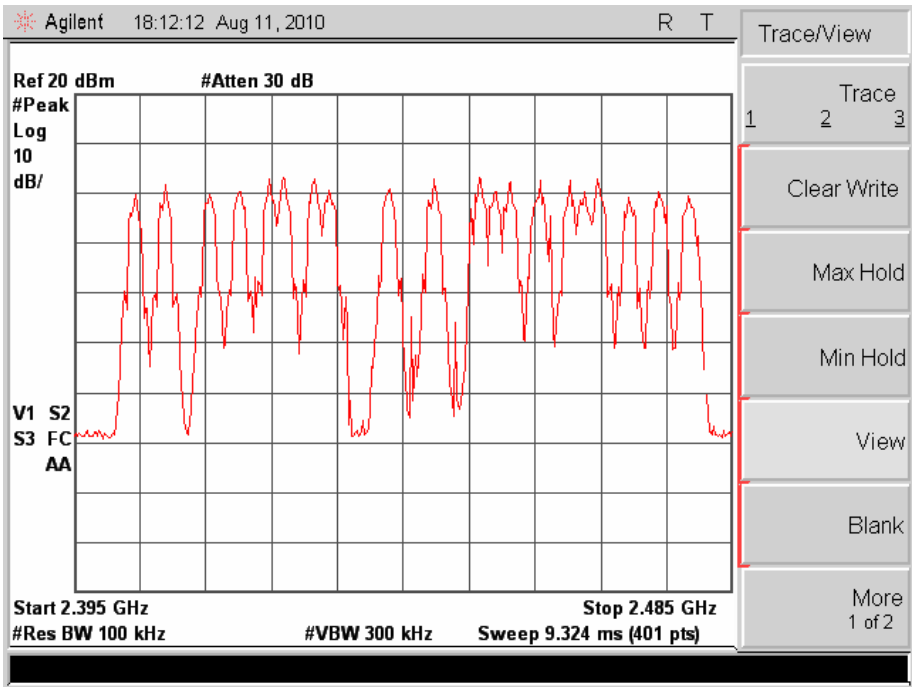
1. The transmitter output was connected to the spectrum analyzer through an attenuator.
2. Set RBW of spectrum analyzer to 100KHz and VBW to 300KHz.
3. Set Detector to Peak, Trace to Max Hold and Sweep Time is Auto.
4. Observe frequency hopping in 2400MHz~2483.5MHz, there are 20 non-overlapping channels.

4.5.4. Result

Temperature (℃) : 22~23	EUT: Wireless Audio System
Humidity (%RH): 50~54	M/N: KEF Wireless System
Barometric Pressure (mbar): 950~1000	Operation Condition: Tx Mode
Test data: Aug 11, 2010	Test engineer: Phenix

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

Test Plot:



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: Wireless Audio System
Humidity (%RH): 50~54	M/N: KEF Wireless System
Barometric Pressure (mbar): 950~1000	Operation Condition: Tx Mode
Test data: Aug 11, 2010	Test engineer: Phenix

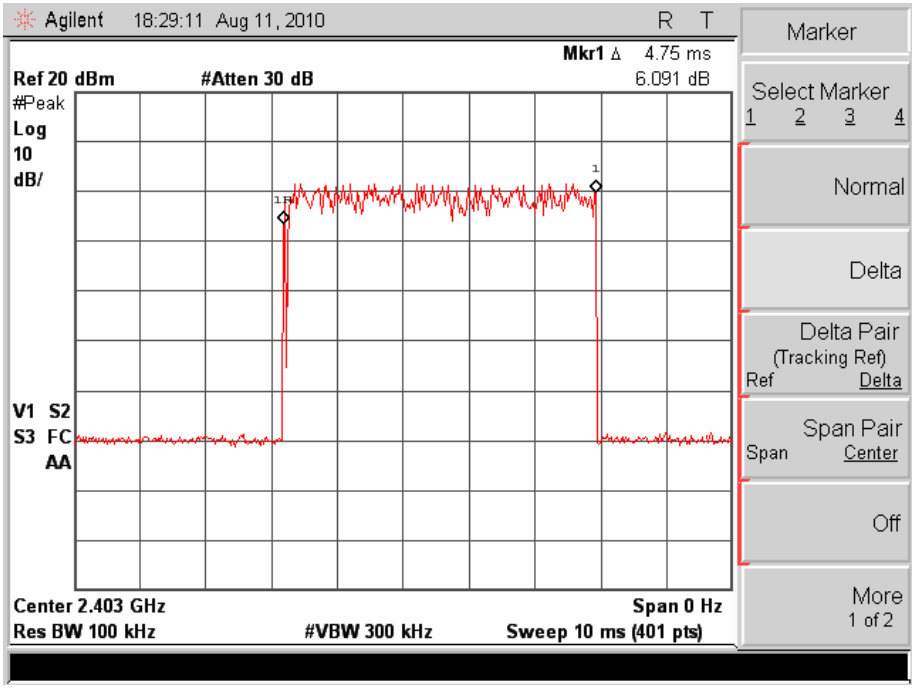
Calculate:
The Dwell Time = (time of Pulse / Pulse Cycle) x 0.4(second) x 20(channels)

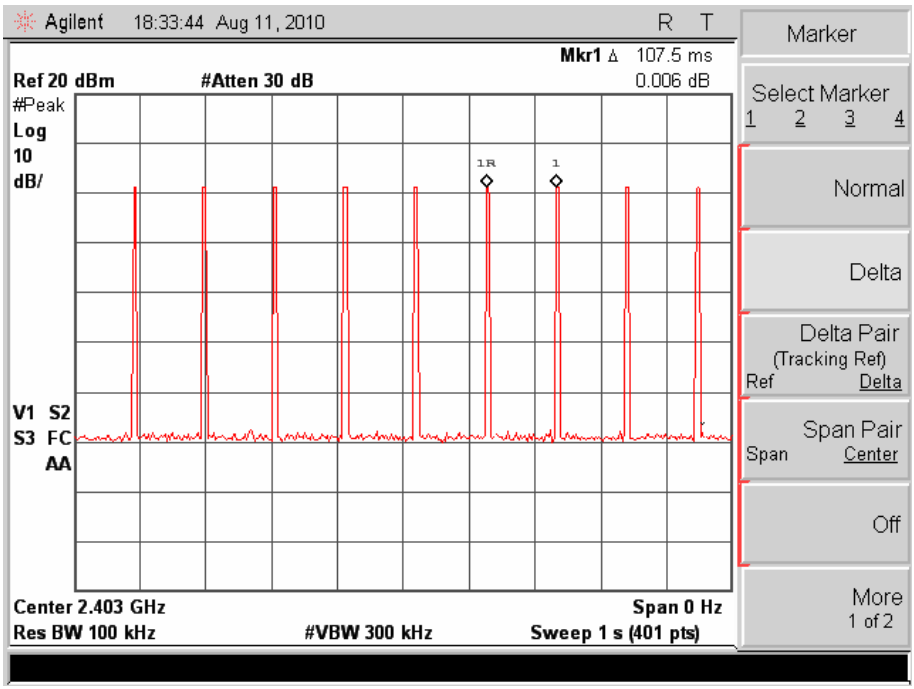
Channel	Time of Pulse (ms)	Pulse Cycle (ms)	Dwell Time (ms)	Limit (ms)	Result
LOW	4.75	107.5	353.49	400	Pass
MID	4.65	105.0	354.29	400	Pass
HIG	4.725	107.5	351.63	400	Pass

The maximum time of occupancy for a particular channel is 354.29 ms, which is less than the 400 ms allowed by the rules; therefore, it meets the requirements of this section.

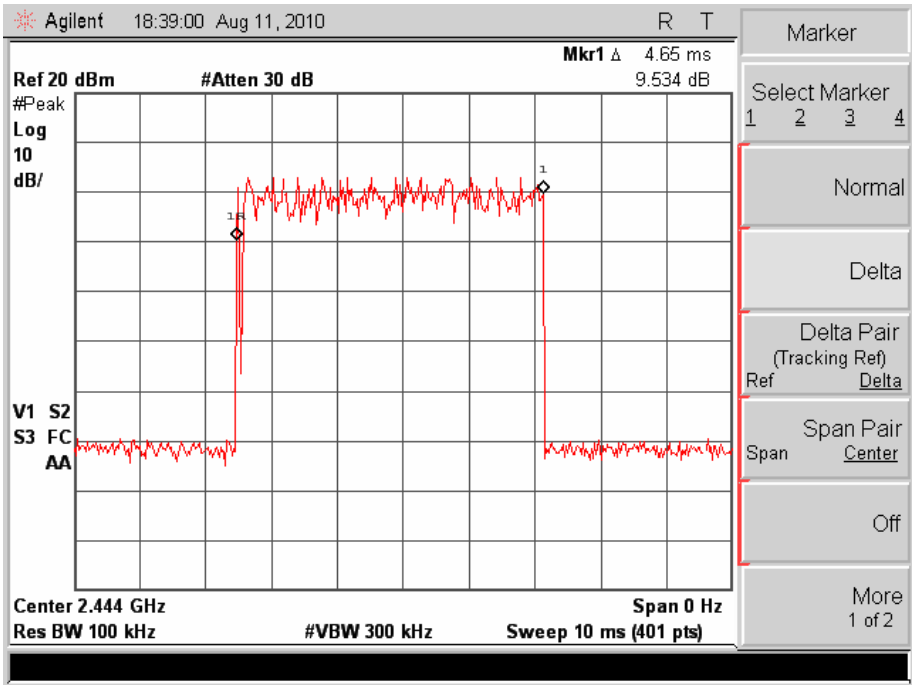
Test Plot:

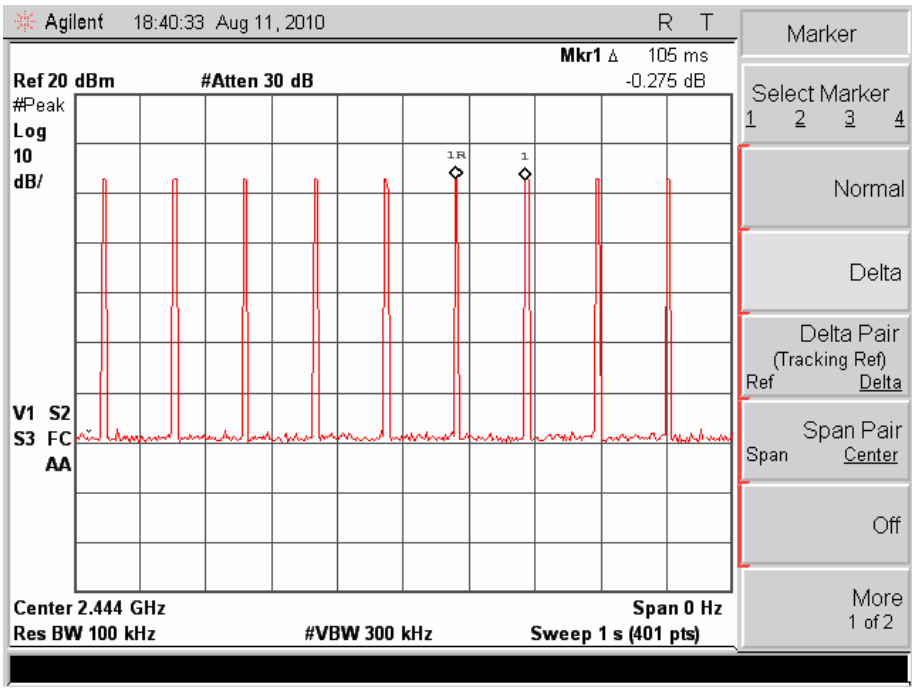
Channel LOW：



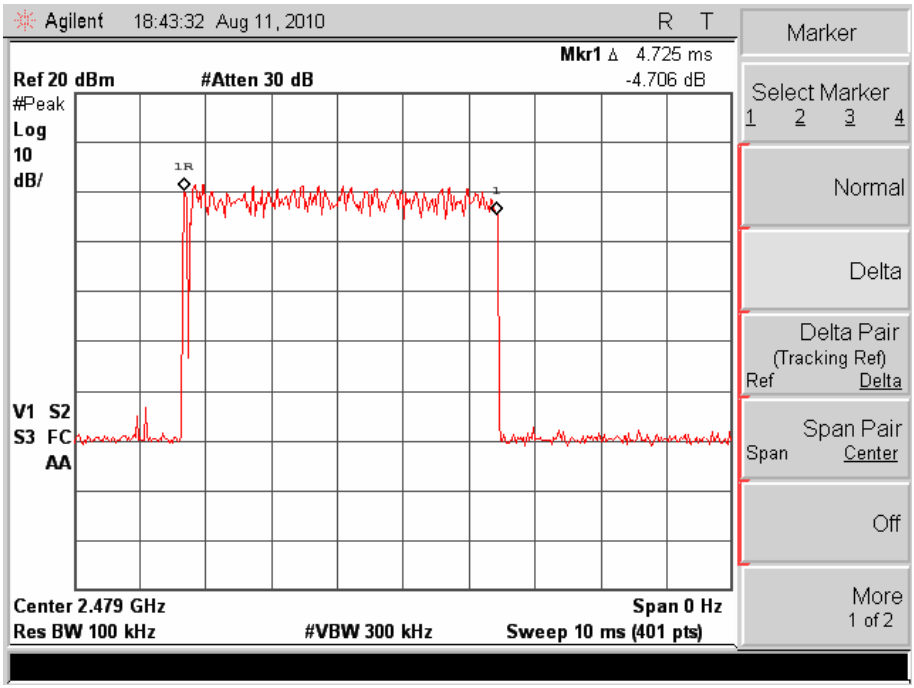


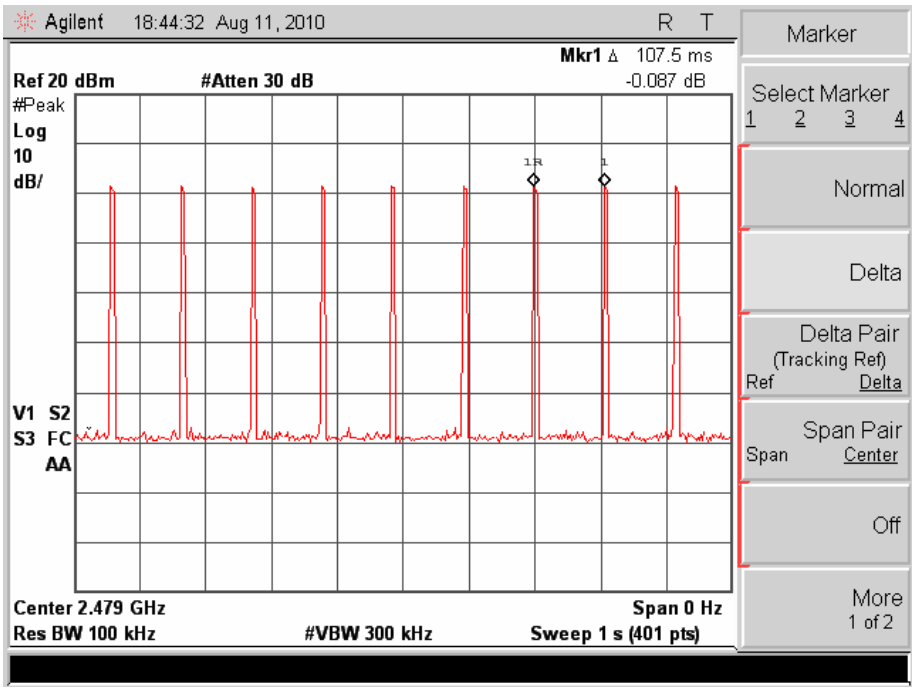
Channel MID：


Agilent 18:39:00 Aug 11, 2010
R T
Mkr1 Δ 4.65 ms
9.534 dB
Ref 20 dBm
#Atten 30 dB
#Peak
Log
10
dB/
V1 S2
S3 FC
AA
Center 2.444 GHz
Res BW 100 kHz
#VBW 300 kHz
Span 0 Hz
Sweep 10 ms (401 pts)
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2


Agilent 18:40:33 Aug 11, 2010
R T
Mkr1 Δ 105 ms
-0.275 dB
Ref 20 dBm
#Atten 30 dB
#Peak
Log
10
dB/
V1 S2
S3 FC
AA
Center 2.444 GHz
Res BW 100 kHz
#VBW 300 kHz
Span 0 Hz
Sweep 1 s (401 pts)
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2

Channel HIG：


Agilent 18:43:32 Aug 11, 2010
R T
Mkr1 Δ 4.725 ms
-4.706 dB
Ref 20 dBm
#Atten 30 dB
#Peak
Log
10
dB/
1R
1
V1 S2
S3 FC
AA
Center 2.479 GHz
Res BW 100 kHz
#VBW 300 kHz
Span 0 Hz
Sweep 10 ms (401 pts)
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2


Agilent 18:44:32 Aug 11, 2010
R T
Mkr1 Δ 107.5 ms
-0.087 dB
Ref 20 dBm
#Atten 30 dB
#Peak
Log
10
dB/
1R
1
V1 S2
S3 FC
AA
Center 2.479 GHz
Res BW 100 kHz
#VBW 300 kHz
Span 0 Hz
Sweep 1 s (401 pts)
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2

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

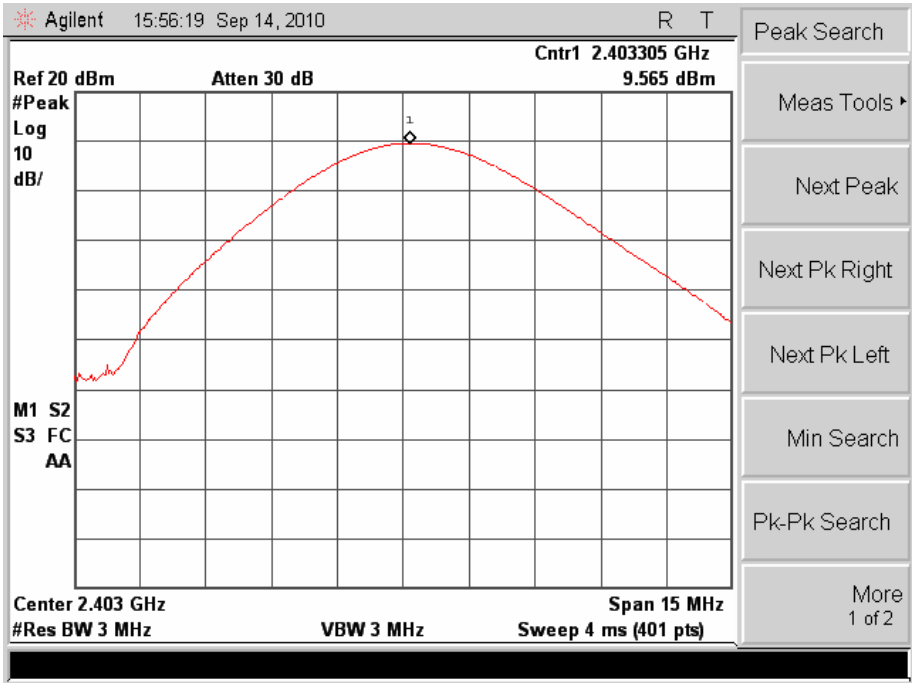
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in above figure without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument 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

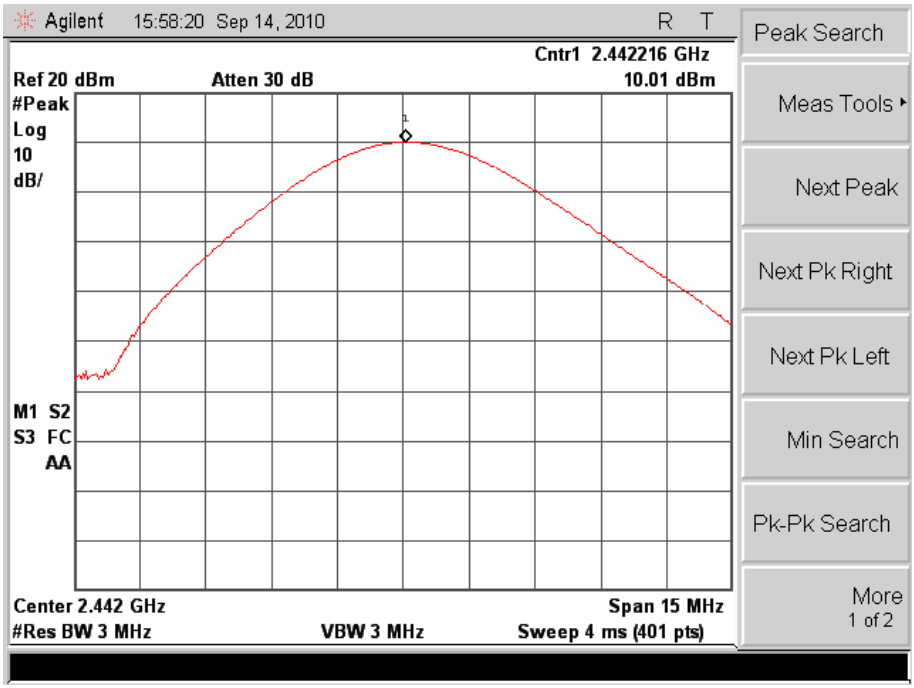
Temperature (℃) : 22~23	EUT: Wireless Audio System
Humidity (%RH): 50~54	M/N: KEF Wireless System
Barometric Pressure (mbar): 950~1000	Operation Condition: Tx Mode
Test data: Sep 14, 2010	Test engineer: Phenix

Channel No.	Frequency (MHz)	Output Power (dBm)	Limits (dBm)
LOW	2403	9.565	20.97
MID	2442	10.01	20.97
HIG	2479	9.974	20.97

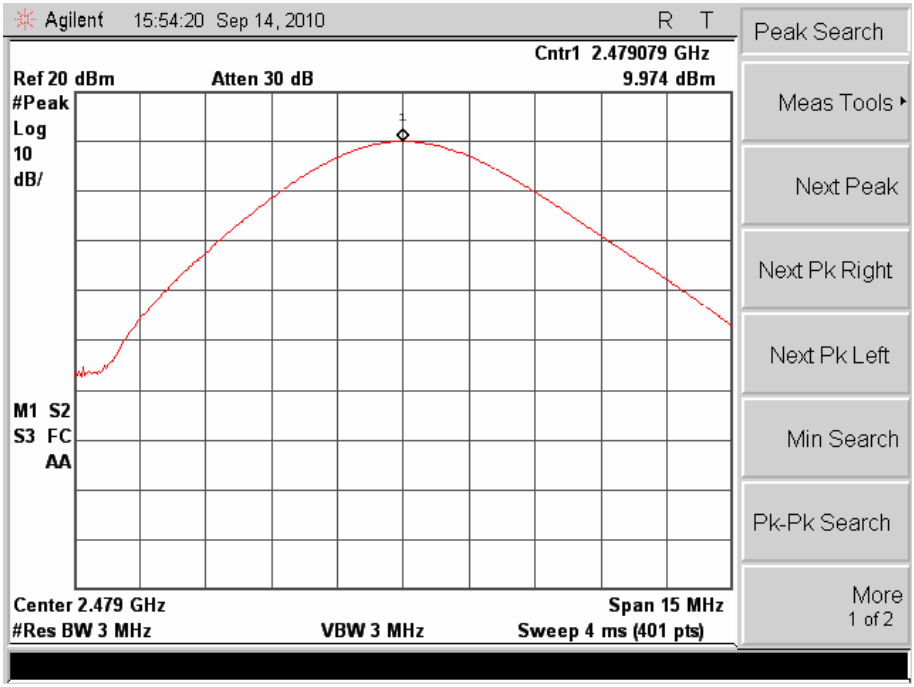
Channel LOW：



Channel MID：



Channel HIG：



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.

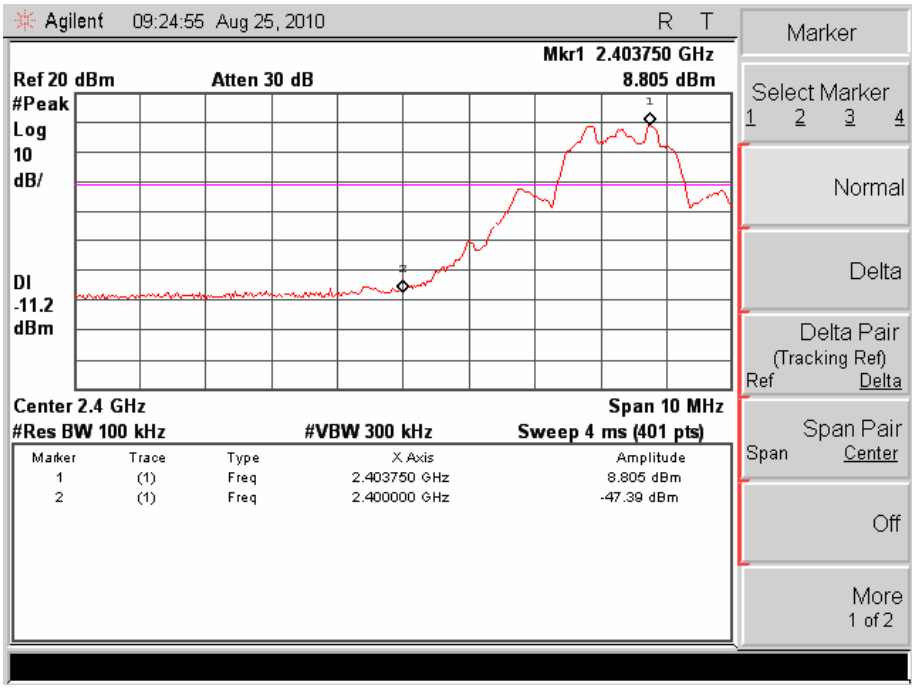
4.8.4. Result

Temperature (℃) : 22~23	EUT: Wireless Audio System
Humidity (%RH): 50~54	M/N: KEF Wireless System
Barometric Pressure (mbar): 950~1000	Operation Condition: Tx Mode
Test data: Aug 24,2010 to Aug 25,2010	Test engineer: Phenix

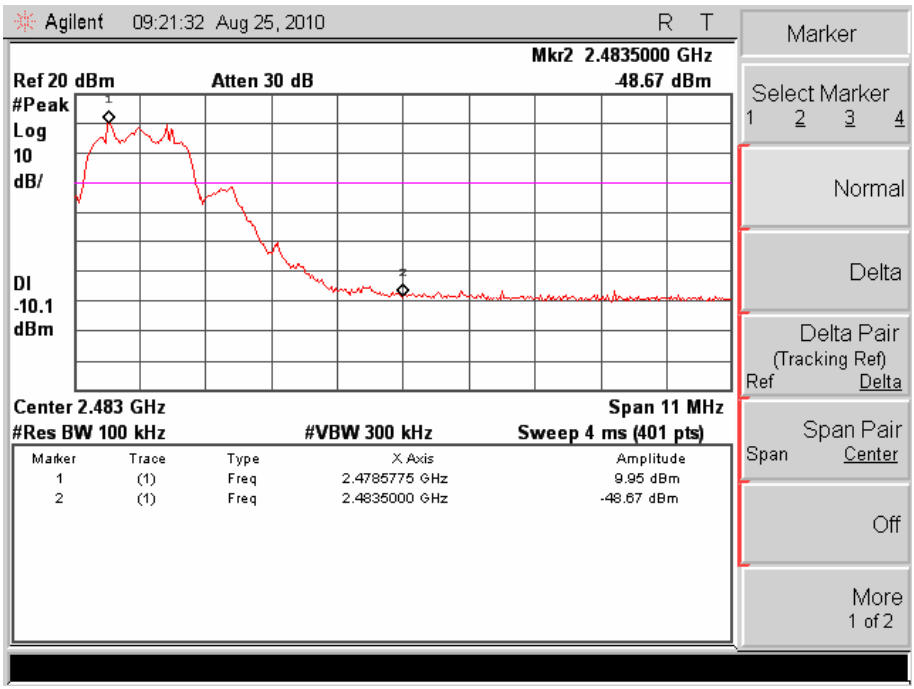
Conducted:

Frequency (MHz)	Read Delta (dB)	Limits (dB)	Margin (dB)
2400	-56.2	-20	36.2
2483.5	-58.6	-20	38.6

Channel LOW：



Channel HIG：



Radiated:

CH LOW:

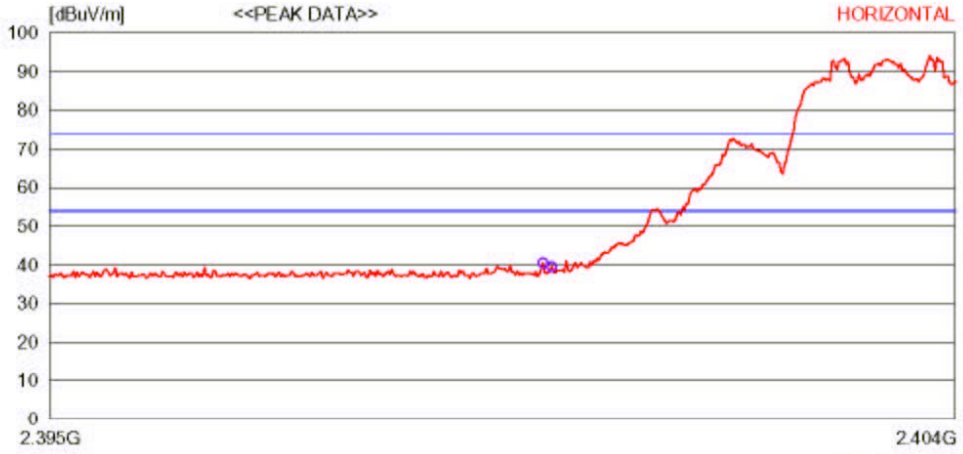
2010-08-24 14:17:00

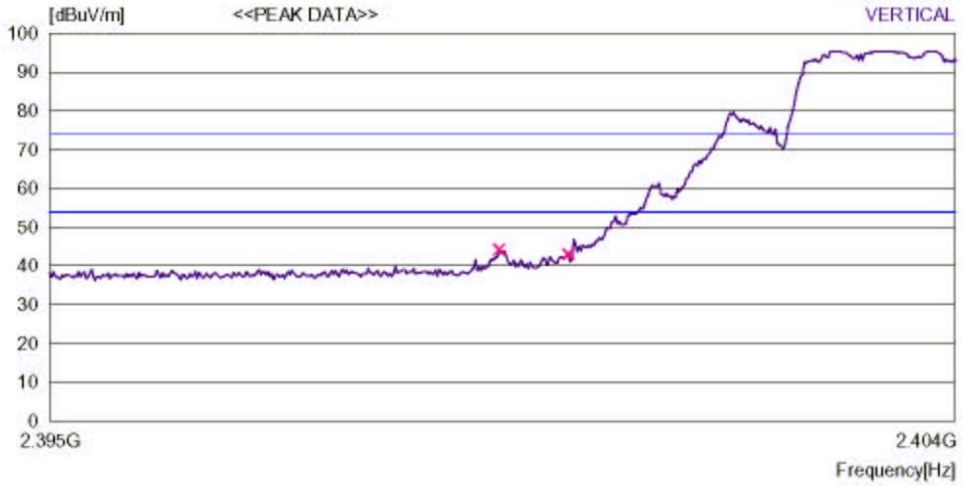
RADIATED EMISSION

Date : 2010-08-24 14:16:54

Trade Name	:	KEF	Document No.	:	
Model Name	:	KEF Wireless System	Power Supply	:	AC 120V/60Hz
Product Name	:	Wireless Audio System	Temp/Humi	:	27/55RH%
Test Condition	:	transmitter,TX mode,CH LOW	Operator	:	Phenix
Memo	:	add 16dB atten.			

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





2010-08-24 14:17:00

RADIATED EMISSION

Date : 2010-08-24 14:16:54

Trade Name	:	KEF	Document No.	:	
Model Name	:	KEF Wireless System	Power Supply	:	AC 120V/60Hz
Product Name	:	Wireless Audio System	Temp/Humi	:	27/55RH%
Test Condition	:	transmitter,TX mode,CH LOW	Operator	:	Phenix

Memo : add 16dB atten.

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

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	2399.896	43.1	31.4	5.5	39.5	40.5	54	13.5	200	92
2	2399.986	42.1	31.4	5.5	39.5	39.5	54	14.5	100	65
----- Vertical ------										
3	2399.462	46.8	31.4	5.5	39.5	44.2	54	9.8	100	30
4	2400.149	45.6	31.4	5.5	39.5	43.0	54	11.0	100	9

Calculated Result:

No.	Frequency (MHz)	Result (above) (dBuV/m)	External atten. (dB)	Result Peak (dBuV/m)	Result AV (dBuV/m)	Limit (dBuV/m)		Margin (dB)	
						Peak	AV	Peak	AV
---Horizontal---									
1	2399.896	40.5	15.5	56	39.1	74	54	18	14.9
2	2399.986	39.5	15.5	55	39.6	74	54	19	14.4
---Vertical---									
1	2399.462	44.2	15.5	59.7	41.8	74	54	14.3	12.2
2	2400.149	43.0	15.5	58.5	42.4	74	54	15.5	11.6

Note:
The average measurement setup as below:
RBW = 1MHz, VBW = 10 Hz, Sweep time = Auto, Detector = Peak, Trace = Max Hold.

CH HIG:

2010-08-24 15:14:50

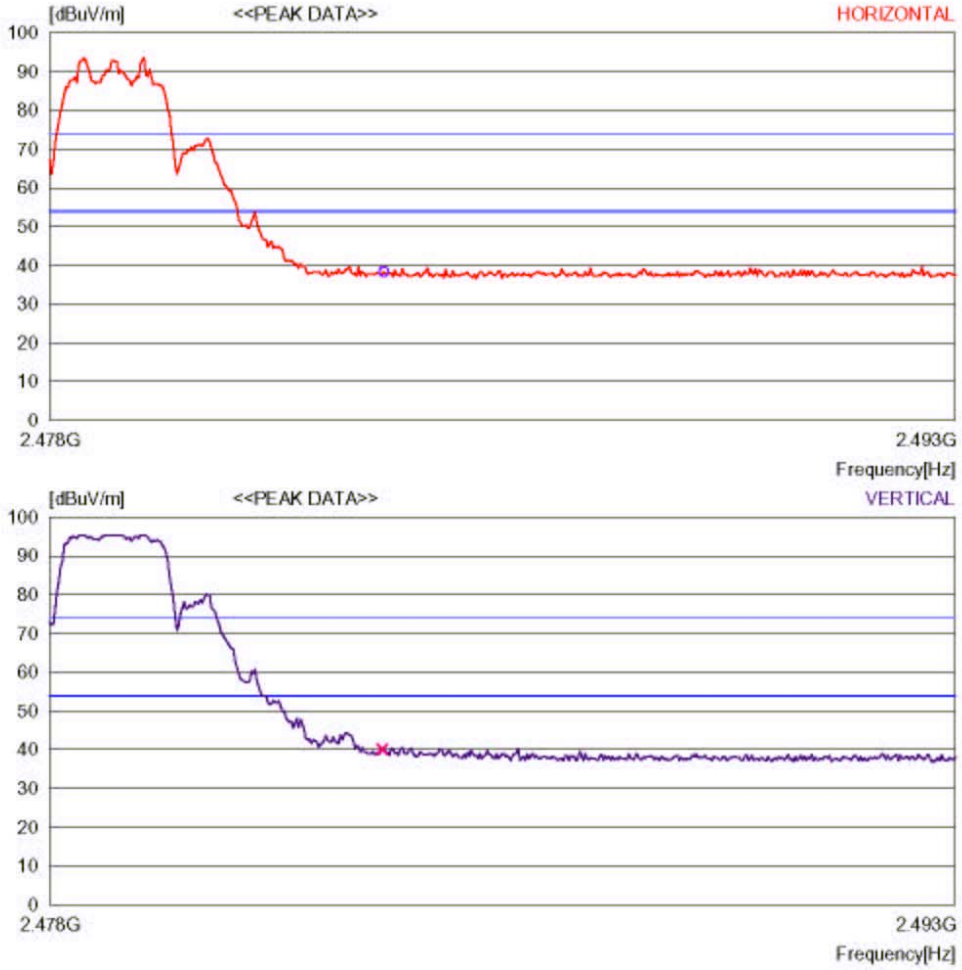
RADIATED EMISSION

Date : 2010-08-24 15:14:44

Trade Name	:	KEF	Document No.	:	
Model Name	:	KEF Wireless System	Power Supply	:	AC 120V/60Hz
Product Name	:	Wireless Audio System	Temp/Humi	:	27/55RH%
Test Condition	:	transmitter,TX mode,CH HIG	Operator	:	Phenix

Memo : add 16dB atten.

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



2010-08-24 15:14:50

RADIATED EMISSION

Date : 2010-08-24 15:14:44

Trade Name	:	KEF	Document No.	:	
Model Name	:	KEF Wireless System	Power Supply	:	AC 120V/60Hz
Product Name	:	Wireless Audio System	Temp/Humi	:	27/55RH%
Test Condition	:	transmitter,TX mode,CH HIG	Operator	:	Phenix

Memo : add 16dB atten.

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

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	2483.525	41.0	31.2	5.6	39.4	38.4	54	15.6	200	324
----- Vertical ------										
2	2483.495	42.7	31.2	5.6	39.4	40.1	54	13.9	100	8

Calculated Result:

No.	Frequency (MHz)	Result (above) (dBuV/m)	External atten. (dB)	Result Peak (dBuV/m)	Result AV (dBuV/m)	Limit (dBuV/m)		Margin (dB)	
						Peak	AV	Peak	AV
---Horizontal---									
1	2483.525	38.4	16	54.4	37.5	74	54	19.6	16.5
---Vertical---									
1	2483.495	40.1	16	56.1	38.0	74	54	17.9	16.0

Note:
The average measurement setup as below:
RBW = 1MHz, VBW = 10 Hz, Sweep time = Auto, Detector = Peak, Trace = Max Hold.

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:

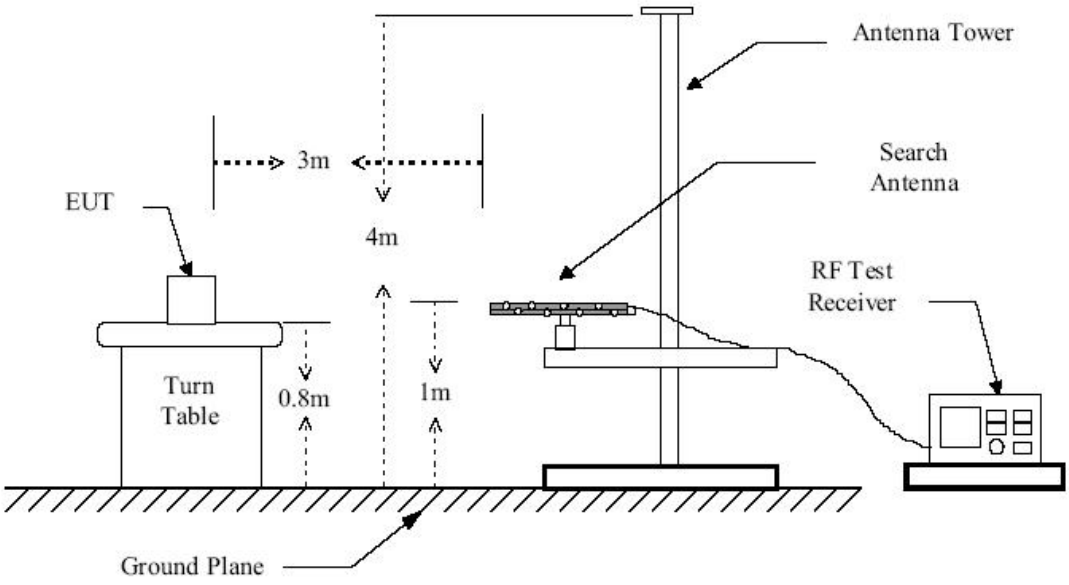


Figure 1 : Frequencies measured below 1 GHz configuration

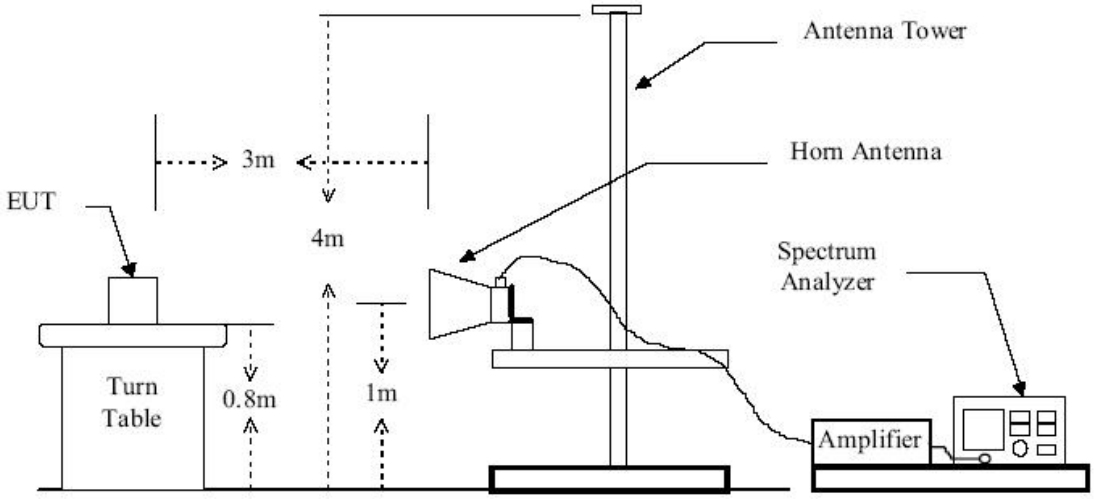


Figure 2 : Frequencies measured above 1 GHz configuration

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(2003).

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

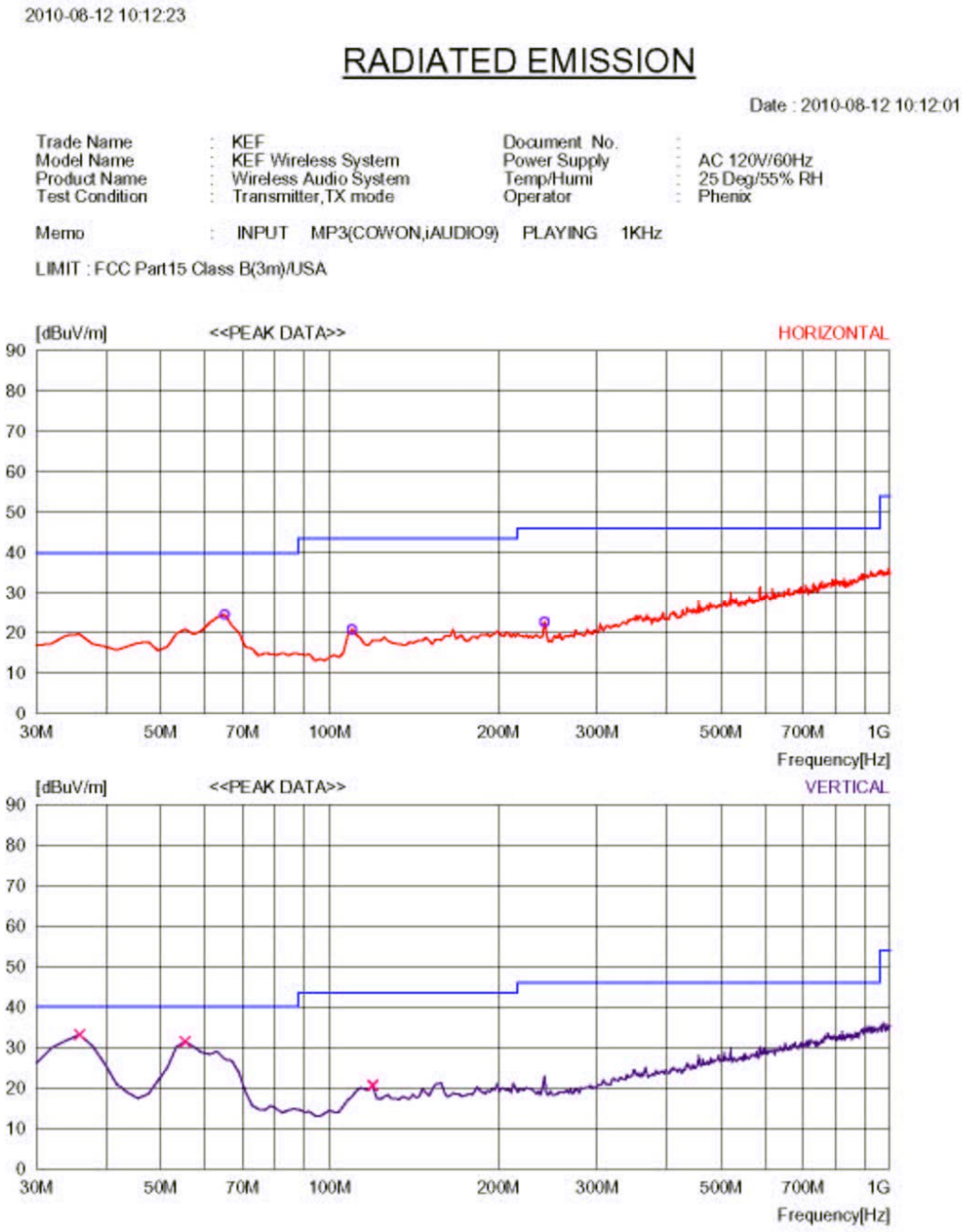
PASS

Radiated:

Below 30MHz:

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

30M- 1GHz:



2010-08-12 10:12:23

RADIATED EMISSION

Date : 2010-08-12 10:12:01

Trade Name	:	KEF	Document No.	:	
Model Name	:	KEF Wireless System	Power Supply	:	AC 120V/60Hz
Product Name	:	Wireless Audio System	Temp/Humi	:	25 Deg/55% RH
Test Condition	:	Transmitter,TX mode	Operator	:	Phenix

Memo : INPUT MP3(COWON,iAUDIO9) PLAYING 1KHz

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

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	64.990	38.7	10.5	6.9	31.6	24.5	40	15.5	400	287
2	109.699	35.6	9.5	7.3	31.6	20.8	43.5	22.7	300	96
3	241.884	34.2	12.0	8.1	31.6	22.7	46	23.3	200	135
----- Vertical ------										
4	35.832	46.7	11.3	6.7	31.6	33.1	40	6.9	100	33
5	55.271	45.4	10.8	6.8	31.6	31.4	40	8.6	100	62
6	119.419	34.1	10.6	7.5	31.6	20.6	43.5	22.9	100	350

Above 1GHz:
CH LOW:

Temperature (℃) : 22~23	EUT: Wireless Audio System
Humidity (%RH): 50~54	M/N: KEF Wireless System
Barometric Pressure (mbar): 950~1000	Operation Condition: Tx Mode
Test data: Sep 10, 2010	Test engineer: Phenix

No.	Frequency (GHz)	Reading (dBuV/m)		Ant. Factor (dB)	Loss (dB)	Result (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
		Peak	AV			Peak	AV	Peak	AV	Peak	AV
---Horizontal---											
1	4.806	14.43	4.01	36.4	7.83	58.66	48.24	74	54	15.34	5.76
2	7.209	15.48	0.21	41.5	9.99	66.97	51.70	74	54	7.03	2.30
---Vertical---											
1	4.806	25.59	3.96	36.4	7.83	69.82	48.19	74	54	4.18	5.81
2	7.209	15.93	0.17	41.5	9.99	67.42	51.66	74	54	6.58	2.34

Note:
The average measurement setup as below:
RBW = 1MHz, VBW = 10 Hz, Sweep time = Auto, Detector = Peak, Trace = Max Hold.

No further spurious emissions found between highest frequency in the table and 25GHz.

CH MID:

Temperature (℃) : 22~23	EUT: Wireless Audio System
Humidity (%RH): 50~54	M/N: KEF Wireless System
Barometric Pressure (mbar): 950~1000	Operation Condition: Tx Mode
Test data: Sep 10, 2010	Test engineer: Phenix

No.	Frequency (GHz)	Reading (dBuV/m)		Ant. Factor (dB)	Loss (dB)	Result (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
		Peak	AV			Peak	AV	Peak	AV	Peak	AV
---Horizontal---											
1	1.613	15.74	2.35	29.0	4.29	49.03	35.64	74	54	24.97	18.36
2	4.886	14.25	4.01	36.4	7.83	58.48	48.24	74	54	15.52	5.76
3	7.329	15.58	0.19	41.5	9.99	67.07	51.68	74	54	6.93	3.32
---Vertical---											
1	1.613	20.01	2.51	29.0	4.29	53.30	35.80	74	54	20.70	18.20
2	4.886	27.26	4.22	36.4	7.83	71.49	48.45	74	54	2.51	5.55
3	7.329	16.22	0.21	41.5	9.99	67.71	51.70	74	54	6.29	2.30

Note:
The average measurement setup as below:
RBW = 1MHz, VBW = 10 Hz, Sweep time = Auto, Detector = Peak, Trace = Max Hold.

No further spurious emissions found between highest frequency in the table and 25GHz.

CH HIG:

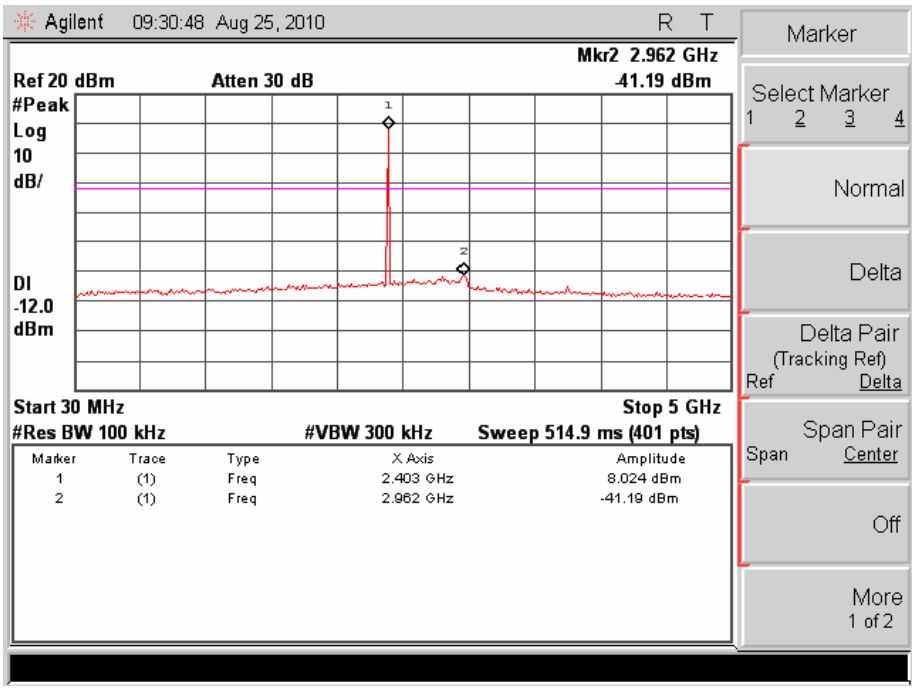
Temperature (℃) : 22~23	EUT: Wireless Audio System
Humidity (%RH): 50~54	M/N: KEF Wireless System
Barometric Pressure (mbar): 950~1000	Operation Condition: Tx Mode
Test data: Sep 10, 2010	Test engineer: Phenix

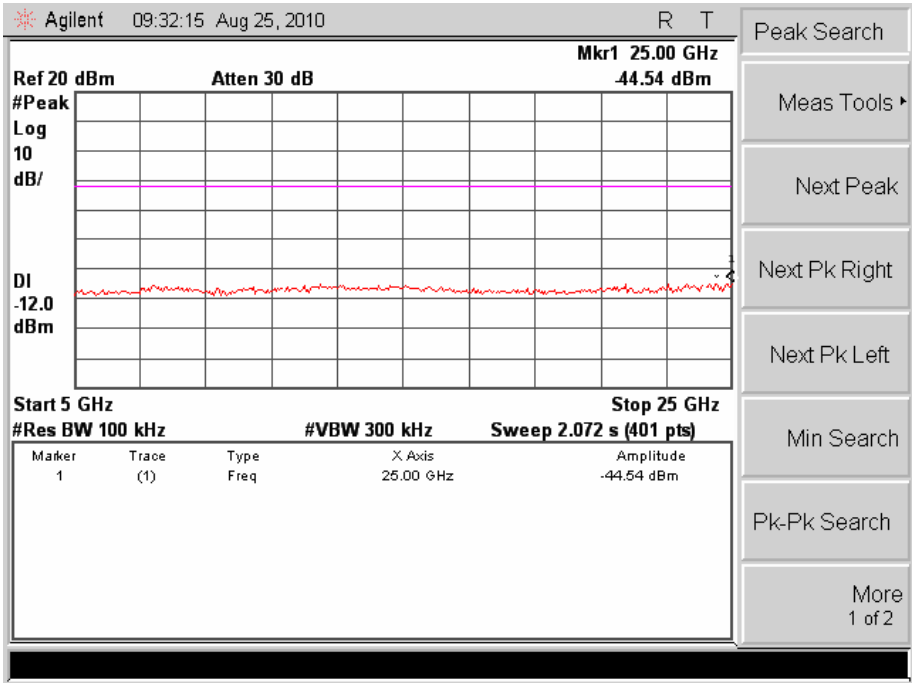
No.	Frequency (GHz)	Reading (dBuV/m)		Ant. Factor (dB)	Loss (dB)	Result (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
		Peak	AV			Peak	AV	Peak	AV	Peak	AV
---Horizontal---											
1	4.958	13.82	3.96	36.4	7.83	58.05	48.19	74	54	15.95	5.81
2	7.437	15.58	0.17	41.5	9.99	67.07	51.66	74	54	6.93	2.34
---Vertical---											
1	4.958	26.31	4.01	36.4	7.83	70.54	48.24	74	54	3.46	5.76
2	7.437	17.29	0.21	41.5	9.99	68.78	51.70	74	54	5.22	2.30

Note:
The average measurement setup as below:
RBW = 1MHz, VBW = 10 Hz, Sweep time = Auto, Detector = Peak, Trace = Max Hold.

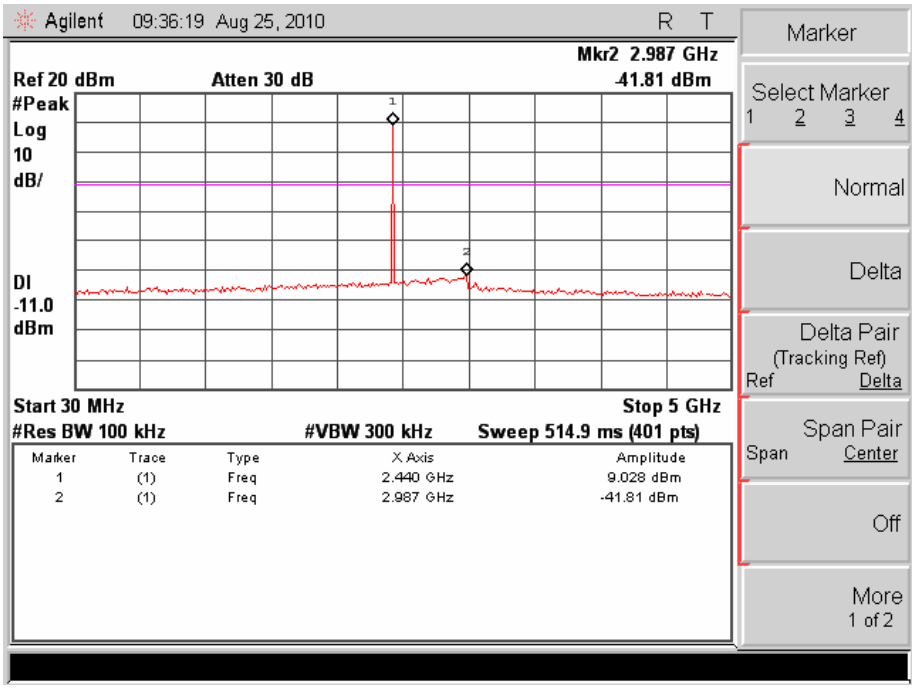
No further spurious emissions found between highest frequency in the table and 25GHz.

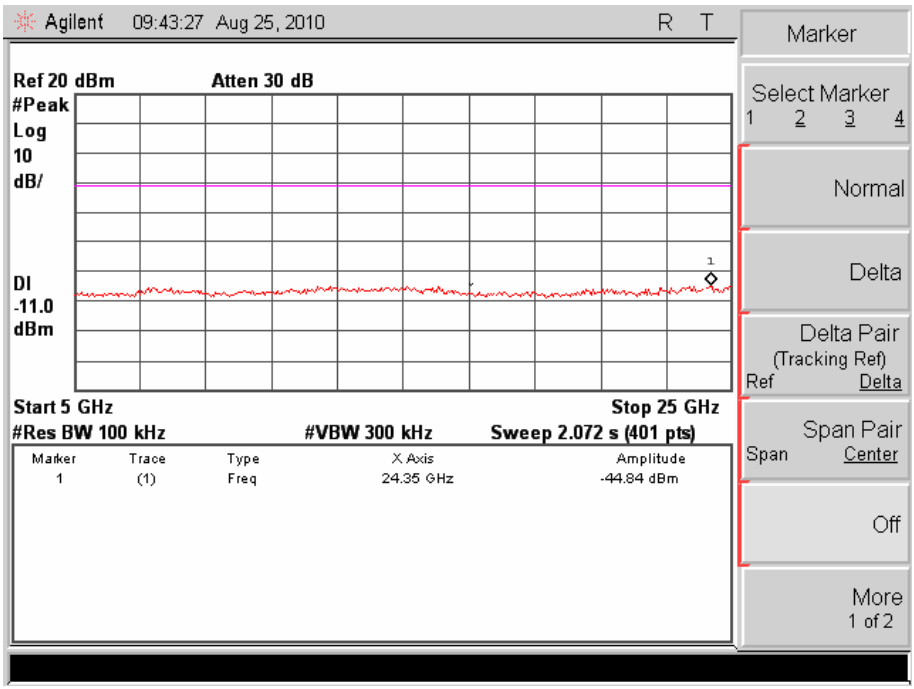
Conducted:
Channel LOW：



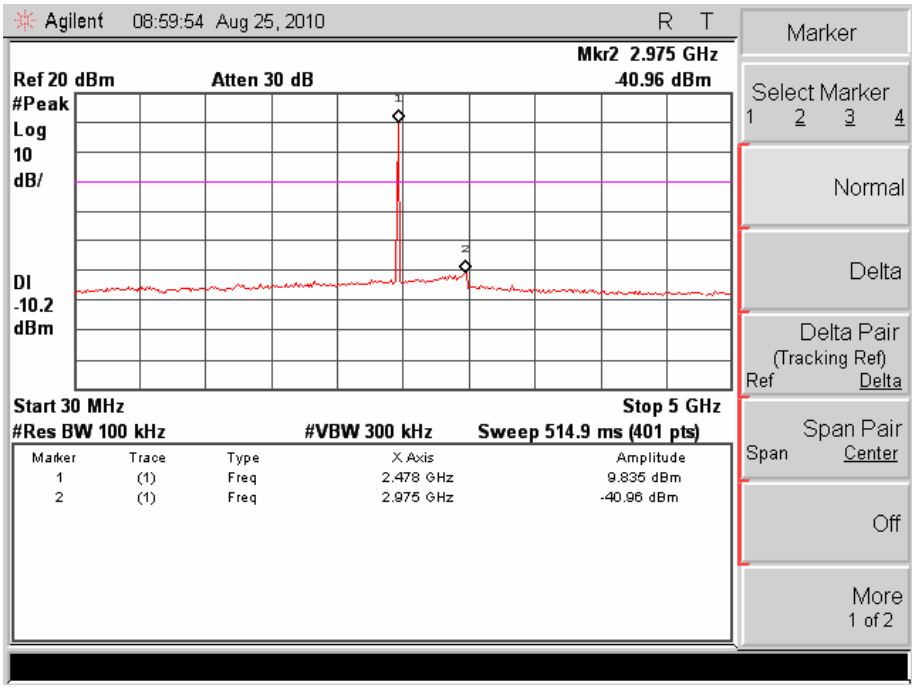


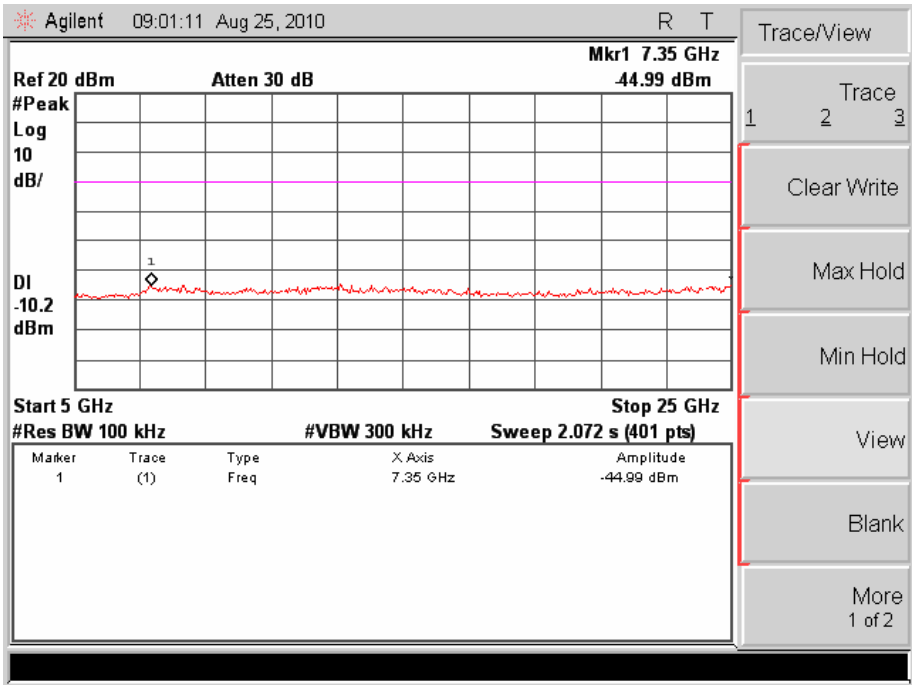
Channel MID：


Agilent 09:36:19 Aug 25, 2010
R T
Mkr2 2.987 GHz
Ref 20 dBm
Atten 30 dB
-41.81 dBm
#Peak
Log
10
dB/
DI
-11.0
dBm
Start 30 MHz
Stop 5 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 514.9 ms (401 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 2.440 GHz 9.028 dBm
2 (1) Freq 2.987 GHz -41.81 dBm
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2


Agilent 09:43:27 Aug 25, 2010
R T
Ref 20 dBm
Atten 30 dB
#Peak
Log
10
dB/
DI
-11.0
dBm
Start 5 GHz
Stop 25 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 2.072 s (401 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 24.35 GHz -44.84 dBm
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2

Channel HIG：


Agilent 08:59:54 Aug 25, 2010
R T
Mkr2 2.975 GHz
Ref 20 dBm
Atten 30 dB
-40.96 dBm
#Peak
Log
10
dB/
DI
-10.2
dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 5 GHz
Sweep 514.9 ms (401 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 2.478 GHz 9.835 dBm
2 (1) Freq 2.975 GHz -40.96 dBm
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2


Agilent 09:01:11 Aug 25, 2010
R T
Mkr1 7.35 GHz
Ref 20 dBm
Atten 30 dB
-44.99 dBm
#Peak
Log
10
dB/
DI
-10.2
dBm
Start 5 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25 GHz
Sweep 2.072 s (401 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 7.35 GHz -44.99 dBm
Trace/View
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2

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

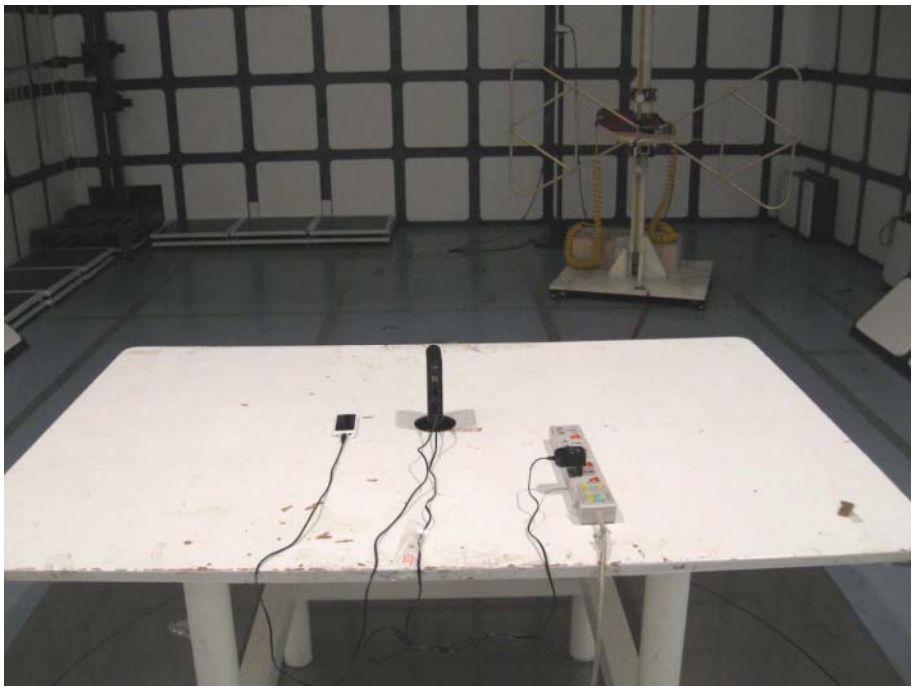
5.1 Ancillary and Accessory Equipment Used

No.	Description	Specification	Quantity
1.	MP3 Player	COWON, M/N: iAUDIO9, S/N:HN09104010571	1
2.	Audio Line	1.5m, without core	1

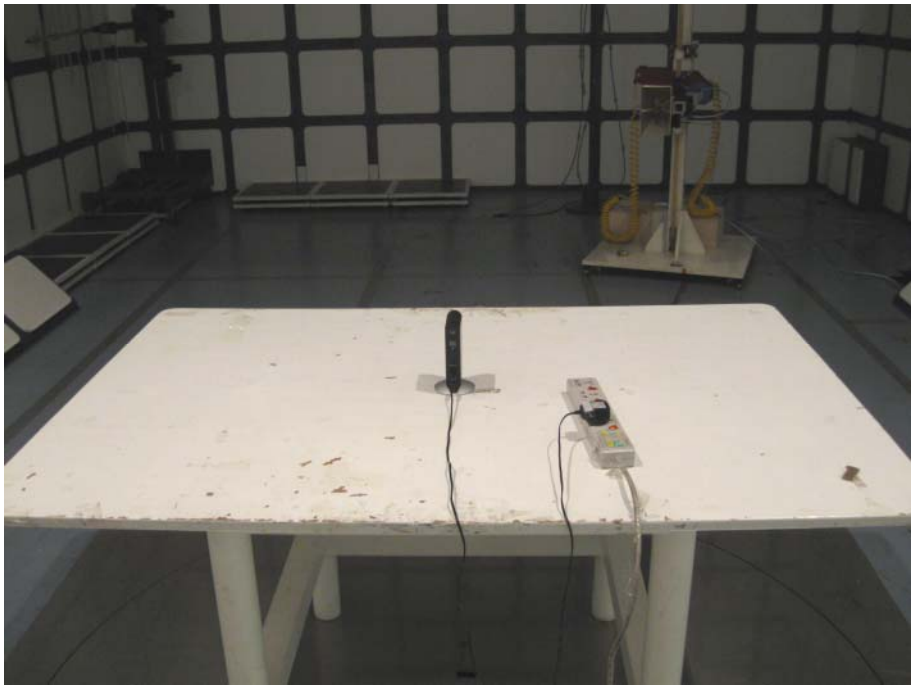
5.2 Photographs of the Test Configuration

5.2.1 Radiated emission

Below 1GHz:

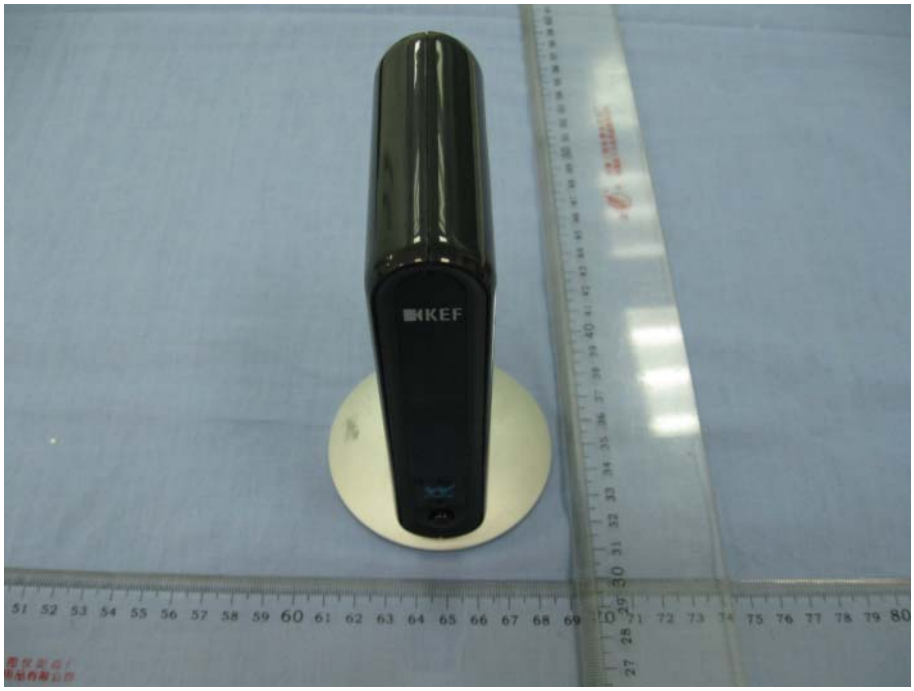


Above 1GHz:



5.2.2 Conducted emission

5.3 Photographs of the EUT



Enclosure of EUT

Enclosure of EUT

Internal of EUT

Photo of adapter

6. Equipment List

No.	Equipment	Manufacturer	Model	Serial No.	Calibration Date
1	Precision Biconical Antenna	TDK Co.	PBA-2030	090500	2009-09-18
2	Precision Log Periodic Antenna	TDK Co.	PLP-3003	061001	2009-09-18
3	Hybrid Log Periodic Antenna	TDK	HLP-3003C	130174	2009-09-18
4	Horn antenna	TDK	HRN-0118	130186	2010-04-07
5	Attenuator 6 dB	Agilent	8491B	MY39260147	2009-09-18
6	Preamplifier	TDK Sonoma	310	242803	2010-04-07
7	Preamplifier	ELENA	EAU-3718 GXA	A070701	2010-04-07
8	EMI Receiver	Rohde & Schwarz	ESIB26	100234	2010-04-07
9	EMI Receiver	Rohde & Schwarz	ESCS30	100350	2010-04-07
10	Spectrum Analyzer	Agilent	E4403B	MY44210199	2010-04-07
11	Art. Mains Network	EMCO	3816/2	00044921	2010-04-07
12	Transient Limiter(10 dB)	Agilent	11947A	3107A03736	2010-04-07
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	2010-04-07
16	Shielded Room	TDK Co.	N/A	N/A	N/A
17	Loop Antenna	EMCO	6502	9107-2440	2010-04-07

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 35.832MHz, vertical, Page 37.

	Reading	+	Antenna factor	+	Cable loss	-	Gain	=	Result
Example	46.7	+	11.3	+	6.7	-	31.6	=	33.1

Conducted Emission

For example the point of 4.218MHz, L1, Page 9.

	Reading	+	C. FACTOR	=	Result
Example	26.1	+	10.0	=	36.1

8.2 Compliance Statements

Subclause 15.247 (a) – Equal Hopping Frequency Use
Requirement: Each of the transmitter's hopping channels is used equally on average.
The Transmitter operates by selecting a palette (or group) of random channels out of the total 38. Any channels with poor transmission rates are replaced with better channels from the remaining unused channels. The switching pattern from channel to channel is a random pattern.

Subclause 15.247 (a) – Receiver Input Bandwidth
Requirement: The associated receiver(s) complies with the requirement that its input bandwidth matches the bandwidth of the transmitted signal.
The hopping frequency range is 78.057MHz and channel bandwidth is <2MHz for both transmitter and receiver. When the receiver receives a good data packet from a transmitter, the receiver sends an acknowledgment back to the transmitter. Once the receiver has responded to the transmitter, then both the transmitter and receiver units each hop to the next frequency channel and the process is repeated

Subclause 15.247 (a) – Receiver Hopping Capability
Requirement: The associated receiver has the ability to shift frequencies in synchronisation with the transmitted signals.
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 3dB IF filter BW is 1.405MHz. 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.

Subclause 15.247 (a) – Hopping Sequence

Requirement: The hopping sequence is generated and provided with an example.

This product firmware operates by selecting a palette (or group) of random channels out of the total 20. Upon startup, a pre-defined 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 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.

In addition, each customer is assigned a "License ID" number. Upon accepting the Software License Agreement, each customer agrees to incorporate their license ID number into their Tx and Rx firmware versions. Once the ID is imbedded in the firmware, then only Rx products with the customer's specific license ID can receive and decode the digitized audio.