TEST REPORT

Test Report No.: 7142FC

Applicant	:	Kenwood Corporation
EUT	:	CD RECEIVER
Model No.	:	KDC-BT838U
Serial No.	:	PPK00001 (Radiated Emission Test)
		PPE00024 (Conducted RF Test via Antenna Terminal)
FCC ID	:	IOM21683
Issue Date	:	17 April 2008
Date of Test	:	3, 4 April 2008 (Radiated Emission Test)
		19 February 2008 (Conducted RF Test via Antenna Terminal)
Test Standard	:	FCC Part 15 Subpart C § 15.207, 15.247 (10-1-06 Edition)
Procedure	:	ANSI C63.4: 2003 PUBLIC NOTICE DA 00-705
Test Results	:	PASS

Approved By: 2008. 4.17
Manager / Kenzo Furuta

NVLAP LAB CODE 200607-0

Reviewed By: 2008-4-17
Chief Engineer / Takeshi Matsumura

Tested By: 2008-4-17
Chief Engineer / Takeshi Matsumura

Table of Contents

Revised Record

Revised Record				
Number of Revised Time	Date	Person in Charge	Detail of Revision	Approved By
Initial	17 April 2008	T. Matsumura	-	-

1 Test Report

(1) This report summarizes the result of a single investigation and test result relate only to tested sample.
(2) The report shall not be reproduced except in full without the written approval of the TAIYO YUDEN Co., Ltd.
(3) This test report must not be used by the client to claim product endorsement by any government agency.
(4) We hereby certify that no party to the applications authorized hereunder is subject to a denial of benefits, including FCC benefits, pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C 853(a).
(5) The test results in this report are traceable to international standards.

2 General Information

2.1 Applicant Information

Company Name	Kenwood Corporation
Address	2967-3 Ishikawa-machi Hachioji-shi Tokyo 192-8525 Japan

2.2 Product Description

EUT	CD RECEIVER
Model No.	KDC-BT838U
Serial No.	PPK00001 (Radiated Emission Test) PPE00024 (Conducted RF Test via Antenna Terminal)
FCC ID	IOM21683
Production Stage	Pre-Production
Type of Wide Band Modulation	FHSS with AFH
Type of Modulation	GFSK
ITU Code	F1D
Power Supply	DC 12.0V from Battery
Operating Voltage Range	DC 10.8V Min. DC 16.0V Max.
AC Adaptor	-
Operating Temperature Range	-30℃ Min. 85℃ Max.
Weight	1.4kg
Dimensions of EUT	W188 mm × D181.5 mm × H58.5 mm
Antenna Type	Ceramic Patch Antenna
Max Antenna Gain	-3.00dBi
Operating Clocks	32.768kHz, 4.332MHz, 9.000MHz, 10.250MHz, 12.000MHz, 13.000MHz and 16.934MHz
Receipt Date of Tested Sample	28 March 2008 (Radiated Emission Test) 1 February 2008 (Conducted RF Test via Antenna Terminal)

EUT is "CD RECEIVER" including 2.4GHz Bluetooth module.
This is operated within the bands 2400 - 2483.5MHz frequency hopping intentional radiators.
It provides 79 channels. And it adopts an AFH function to prevent interference with other wireless applications.
Refer to Appendix 1.

2.3 Summary of Test and Inspection Result

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst Margin	Results
1	AC Powerline Conducted Emission	ANSI C63.4: 2003	FCC 15.207	Conducted Emission Test	N/A	-	N/A
2	Carrier Frequency Separation	ANSI C63.4: 2003 Public Notice DA00-705	FCC 15.247 (a)(1)	Conducted RF Test via Antenna Terminal	N/A	-	Pass
3	Number of Hopping Frequency		FCC 15.247 (a)(1)(iii)		N/A	-	Pass
4	Dwell Time		FCC 15.247 (a)(1)(iii)		N/A	-	Pass
5	Maximum Peak Output Power		FCC 15.247 (b)(1)		N/A	-	Pass
6	Band Edge Compliance		FCC 15.247(d)		N/A	-	Pass
7	Spurious RF Conducted Emission		FCC 15.247(d)		N/A	-	Pass
8	Radiated Emission		FCC 15.247(d)	Radiated Emission Test	N/A	7.0dB Transmitting Mode: 2402MHz Frequency: 74.806MHz Antenna Polarization: Horizontal	Pass
9	e.i.r.p.		FCC 15.247 (b)(5)	Conducted Calculated	N/A	-	Pass

2.4 Test Methodology

Interference measurements were made in accordance with ANSI C63.4: 2003 Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

2.5 Test Facility

TAIYO YUDEN CO., LTD. EMC Center.
5607-2, Nakamuroda-machi, Takasaki-shi, Gunma, 370-3347, Japan.

1. FCC 47CFR, Part 15 Subpart C regulation test were performed on the shielded room, and radiated interference field strength test was performed on the 10 meter semi-anechoic chamber located at TAIYO YUDEN CO., LTD. EMC Center, 5607-2 Nakamuroda-machi, Takasaki-shi, Gunma, 370-3347 Japan.

2. This Laboratory is accredited under the National Voluntary Laboratory Accreditation Program (NVLAP) by United States Department of Commerce, National Institute of Standard and Technology (NIST) for satisfactory compliance with criteria established in Title 15, Part 285 Code of Federal Regulations.

3. These criteria encompass the requirements of ISO/IEC 17025:2005 and the relevant requirements of ISO 9002:1994 as suppliers of calibration or test results. Accreditation awarded for specific services, listed on the Scope of Accreditation for: Electromagnetic Compatibility and Telecommunications FCC. (NVLAP LAB CODE: 200607-0). Refer the certificate of the accreditation to Appendix 2.

4. This laboratory is listed by Federal Communications Commission, Equipment Authorization Division (Registration Number: 606514) and listed by Industry Canada (No.4389A-1).

3 System Test Configuration

3.1 Justification

1. Emission tests were performed with no deviation from the ANSI C63.4: 2003 and FCC 47CFR, Part 15 Section 15.247 regulation tests were performed with no deviation from the FCC Public Notice DA00-705 released March 30, 2000.

2. The system was configured for testing a typical fashion (as a customer would normally use it.).

3. Radiate testing in the range of 1 GHz to 25 GHz was investigated with the spectrum (peak detector function) under the FCC regulation section 15.209 (e) and 15.35 (b). For above 18GHz, test performed at an antenna to EUT distance of 1 meter. The level of any unwanted emissions from EUT did not exceed the level of the fundamental emission (Compliance with 15.209 (c)). And test result found to be compliance with FCC regulation section 15.209 (a) Radiated emission limits (500 micro-volts/meter). Data is presented for the “worst case” measurements, that E.U.T was normal operated.

4. Radiate testing in the range of 30 MHz to 1000 MHz was performed at an antenna to EUT distance of 3 meters under the 15.209 (e) and 15.31(f)(1).

5. Tests were performed with the representative channel operation as follows.

    a. Lowest Frequency Channel: CH0 2402MHz
    b. Middle Frequency Channel: CH39 2441MHz
    c. Highest Frequency Channel: CH78 2480MHz

3.2 Operating Modes

Transmitting Mode

Modulation		GFSK
Signal Pattern		PRBS9
Signal Packet Type	GFSK	DH1, DH3, DH5 for Dwell time test. DH5 for other test
Representative Channel		CH0 2402MHz (Lowest Frequency Channel)
		CH39 2441MHz (Middle Frequency Channel)
		CH78 2480MHz (Highest Frequency Channel)

Remarks:

Signal Pattern PRBS9: Periodic Pseudo Random Bit Sequence. $2^9 - 1$

Signal Packet Type:

DH1, 3, 5: Data high rate, ACL type packet
Data payload with CRC, without FEC
Fully transmission within one consecutive 625-microsecond transmission slots
Number of slot = 1(DH1), 3(DH3), 5(DH5)
Data size of payload = 27bytes (DH1), 183bytes (DH3), 339bytes (DH5)

Software (Controller): The test software supplied by Kenwood Corporation was used to set up the Bluetooth operating mode.

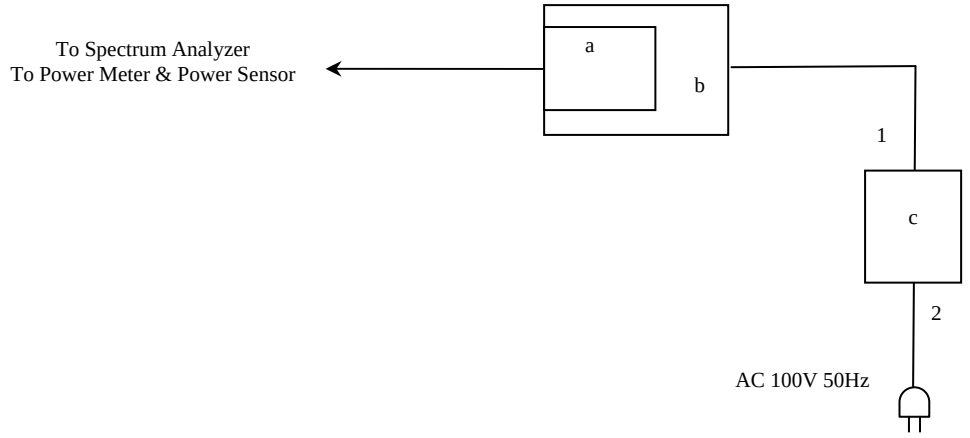
3.3 Configuration of Tested System

(1) Conducted RF Test via Antenna Terminal

These numbers and the marks in the picture are corresponding to the numbers and the marks in Tables below.

Test Setting for Normal Frequency Hopping and Non Frequency Hopping Mode

Power Supply of EUT: DC12.0V from Regulated DC Power Supply "c".



List of EUT and Accessories

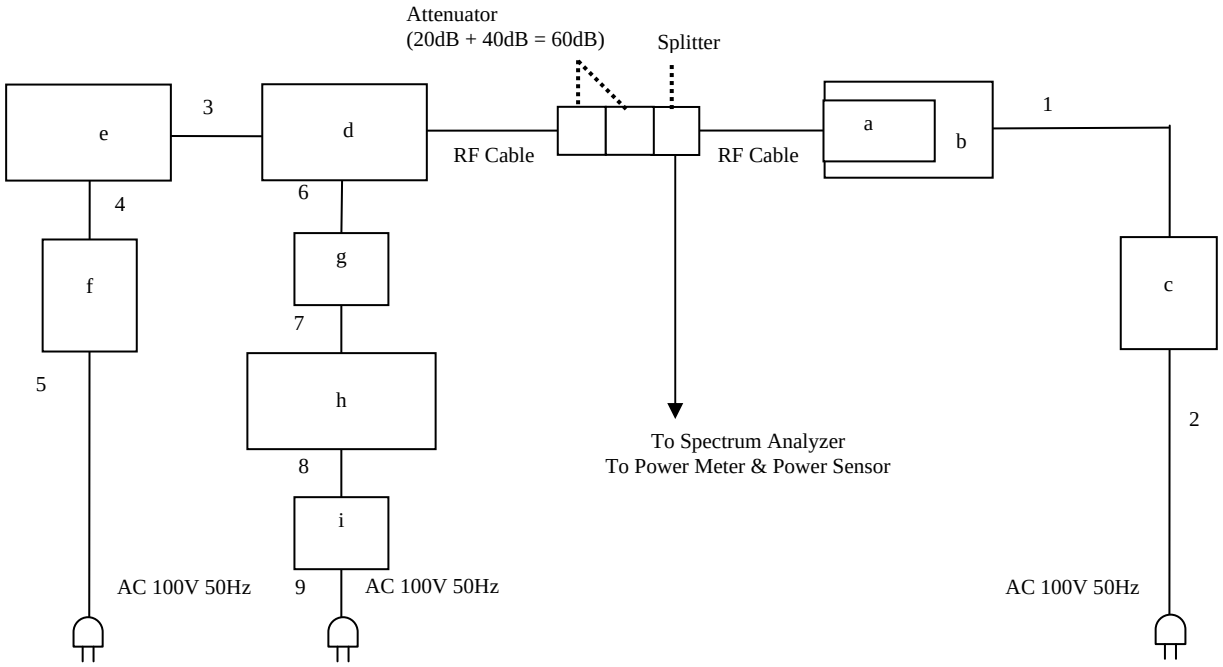
	Product Name	M/N	S/N	Manufacturer	EUT / Accessory	FCC ID / DoC
a	CD RECEIVER	KDC-BT838U (RF Module)	PPK00001	Kenwood Corporation	EUT	IOM21683
b	Jig	DNX8220BT	PPE00024	Kenwood Corporation	Accessory	-
c	Regulated DC Power Supply	PMC18-3A	FB000315	KIKUSUI	Accessory	-

Interface Cables

	Cable Type	M/N	Shielded	Ferrite Core	Material of Connector	Length	Notes
1	DC Cable	-	No	No	Plastic	2.20m	-
2	AC Cable	-	No	No	Plastic	2.45m	-

Test Setting for Adaptive Frequency Hopping Mode

Power Supply of EUT: DC12.0V from Regulated DC Power Supply “c”.



List of EUT and Accessories

	Product Name	M/N	S/N	Manufacturer	EUT / Accessory	FCC ID / DoC
a	CD RECEIVER	KDC-BT838U (RF Module)	PPK00001	Kenwood Corporation	EUT	IOM21683
b	Jig	DNX8220BT	PPE00024	Kenwood Corporation	Accessory	-
c	Regulated DC Power Supply	PMC18-3A	FB000315	KIKUSUI	Accessory	-
d	Car Audio System	KCA-BT200	PPE00019	Kenwood Corporation	Accessory	-
e	CD Receiver	KDC-W5641U	KE1447V1100106	Kenwood Corporation	Accessory	-
f	Regulated DC Power Supply	PMC18-5A	LJ001201	KIKUSUI	Accessory	-
g	Evaluation Board	WB4-40	18	Parrot	Accessory	-
h	Personal Computer	N1010vP180x 420DC120	TW30710675	Hewlett Packard	Accessory	-
i	AC/DC Adapter	ADP-75HB	MVT0305016771	Hewlett Packard	Accessory	-

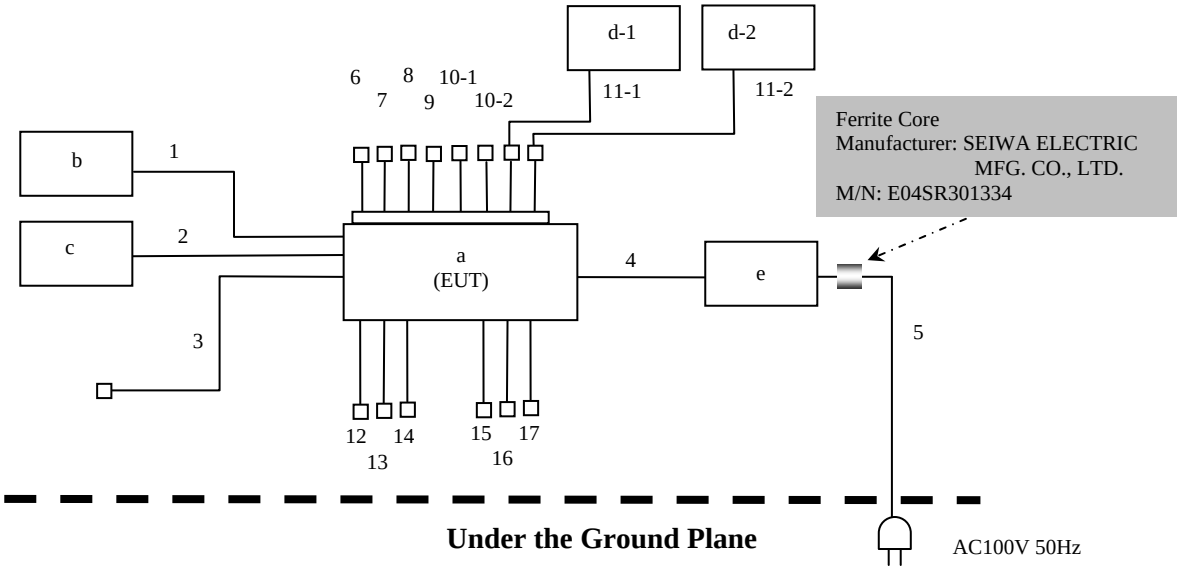
Interface Cables

No.	Cable Type	M/N	Shielded	Ferrite Core	Material of Connector	Length	Notes
1	DC Cable	-	No	No	Plastic	2.20m	-
2	AC Cable	-	No	No	Plastic	2.45m	-
3	Interface Cable (*1)	-	Yes	No	Metal	1.41m	-
4	DC Cable	-	No	No	Plastic	1.05m	-
5	AC Cable	-	No	No	Plastic	2.45m	-
6	Bus Cable	-	No	No	Plastic	0.44m	-
7	RS232C Cable	-	No	No	Metal	1.62m	-
8	DC Cable	-	No	No	Plastic	1.80m	-
9	AC Cable	-	No	No	Plastic	1.80m	-

(*1) : This cable is able to provide “Signal-Interface” and “DC Power-Supply”.

(2) Radiated Emission Test

These numbers and the marks in the picture are corresponding to the numbers and the marks in Tables below.
Power Supply of EUT: DC12.0V from Regulated DC Power Supply "e".



List of EUT and Accessories

	Product Name	M/N	S/N	Manufacturer	EUT / Accessory	FCC ID / DoC
a	CD RECEIVER	KDC-BT838U	PPK00001	Kenwood Corporation	EUT	IOM21683
b	Microphone	W01-1676-05	8	HOSHIDEN	Accessory	-
c	FM Antenna	LR-36	3	-	Accessory	-
d-1	Speaker	PR-100S	50704401298	BM Audio Labs. Inc	Accessory	-
d-2						
e	Regulated DC Power Supply	PA 18-1.2	2110071	Kenwood Corporation	Accessory	-

Interface Cables

	Cable Type	M/N	Shielded	Ferrite Core	Material of Connector	Length	Notes
1	Mic Cable	-	No	No	Plastic	3.00m	Fold back and forth in the center
2	FM Antenna Cable	-	Yes	No	Plastic	3.35m	
3	CD Changer Cable	-	Yes	No	Plastic	2.44m	
4	DC Cable	-	No	No	Plastic	2.21m	-
5	AC Cable	-	No	Yes	Plastic	1.90m	-
6	Ant Cont Cable	-	No	No	Plastic	0.10m	-
7	Power Cont Cable	-	No	No	Plastic	0.10m	-
8	Mute Cont Cable		No	No	Plastic	0.10m	-
9	Dimmer Cont Cable	-	No	No	Plastic	0.10m	-
10-1	Speaker Cable	-	No	No	Plastic	0.10m	-
10-2							
11-1	Speaker Cable	-	No	No	Plastic	3.06m	Fold back and forth in the center
11-2							
12	Remote Control Cable	-	No	No	Plastic	1.00m	
13	Aux Input Cable	-	No	No	Plastic	2.02m	
14	USB Cable	-	Yes	No	Metal	1.00m	
15	Audio Out Cable (Rear)	-	Yes	No	Metal	0.98m	
16	Audio Out Cable (Front)	-	Yes	No	Metal	0.98m	
17	Audio Out Cable (Sub Woofer)	-	Yes	No	Metal	0.98m	

3.4 Test Instruments

About test instruments for all tests, please refer to appendix 3.

3.5 Special Test Condition

Nothing

3.6 Equipment Modifications

No modification has been carried out by TAIYO YUDEN CO., LTD. EMC Center.

4 Antenna Requirement

The EUT provides a permanently attached antenna and it was found to be compliant with FCC regulation section 15.203.

Antenna Type	Ceramic Patch Antenna
Antenna Gain	-3.00dBi

5 AC Powerline Conducted Emission

N/A

This EUT is intended for use in vehicles. So this measurement is not applied to this EUT.

6 20dB Bandwidth

6.1 Test Setup

The spectrum analyzer was connected to the transmitter output port through the RF cable.

Spectrum Analyzer Setting:

Detector Mode	Peak
RBW	30kHz
VBW	30kHz
Span	2MHz
Sweep Time	Auto

6.2 Test Results

Serial No.	:	PPE00024
Power	:	DC 12.0V
Mode	:	Transmitting Mode, Non Frequency Hopping
Temperature	:	22.9 ℃
Humidity	:	53.4 %

(1) Operation Mode: Transmitting Mode (GFSK Modulation)

CH	Frequency [MHz]	20dB Bandwidth [MHz]
0ch(Lowest)	2402.0	0.877
39ch(Middle)	2441.0	0.863
78ch(Highest)	2480.0	0.870

7 Carrier Frequency Separation

7.1 Test Setup

The spectrum analyzer was connected to the transmitter output port through the RF cable.

Spectrum Analyzer Setting:

Detector Mode	Peak
RBW	100kHz
VBW	300kHz
Span	3MHz
Sweep Time	Auto

7.2 Test Results

Serial No.	:	PPE00024
Power	:	DC 12.0V
Mode	:	Transmitting Mode, Frequency Hopping Transmitting Mode, Adoptive Frequency Hopping
Temperature	:	22.9 ℃
Humidity	:	53.4 %
Regulation	:	FCC Part15 C §15.247 (a)(1)

(1) Operating Mode: Transmitting Mode (GFSK Modulation)
Transmitting Mode, Frequency Hopping (79ch)

Channel	Channel Separation [MHz]	Limit *1 [MHz]
Low Frequency (0ch-1ch)	0.955	> 0.585
Middle Frequency (38ch-39ch)	1.015	> 0.576
High Frequency (77ch-78ch)	1.010	> 0.581

Transmitting Mode, Adoptive Frequency Hopping (20ch)

Channel	Channel Separation [MHz]	Limit *1 [MHz]
Low Frequency (0ch-1ch)	1.000	> 0.585
Middle Frequency (38ch-39ch)	1.010	> 0.576
High Frequency (77ch-78ch)	1.015	> 0.581

*1: Limit value of Carrier Frequency Separation is 2/3 of 20dB Bandwidth.
Refer the result of 20dB Bandwidth to Section 6.

8 Number of Hopping Frequency

8.1 Test Setup

The spectrum analyzer was connected to the transmitter output port through the RF cable.

Spectrum Analyzer Setting:

Detector Mode	Peak
RBW	300kHz
VBW	300kHz
Sweep Time	Auto

8.2 Test Results

Serial No.	:	PPE00024
Power	:	DC 12.0V
Mode	:	Transmitting Mode, Frequency Hopping Transmitting Mode, Adoptive Frequency Hopping
Temperature	:	22.9 ℃
Humidity	:	53.4 %
Regulation	:	FCC Part15 C §15.247 (a)(1)(iii)

(1) Operating Mode: Transmitting Mode (GFSK Modulation)

Mode	Number of Channel [time]	Limit [time]
Transmitting Mode Frequency Hopping (79ch)	79	≧15
Transmitting Mode Adoptive Frequency Hopping (20ch)	20	≧15

Adaptive Frequency Hopping: Intelligent hopping techniques to avoid interference to other transmission.

9 Dwell Time

9.1 Test Setup

The spectrum analyzer was connected to the transmitter output port through the RF cable.

Spectrum Analyzer Setting:

Detector Mode	Peak
RBW	1MHz
VBW	1MHz
Span	0Hz
Sweep Time	Auto

9.2 Test Results

Serial No.	:	PPE00024
Power	:	DC 12.0V
Mode	:	Transmitting Mode (DH1, DH3, DH5), Frequency Hopping Transmitting Mode (DH1, DH3, DH5), Adoptive Frequency Hopping
Temperature	:	22.9 ℃
Humidity	:	53.4 %
Regulation	:	FCC Part15 C §15.247 (a)(1)(iii)

(1) Operating Mode: Transmitting Mode, Frequency Hopping (79ch)

GFSK Modulation		
Packet	Dwell Time [ms]	Limit [ms]
DH1	147.20	400
DH3	274.72	400
DH5	316.48	400

(2) Operating Mode: Transmitting Mode, Adaptive Frequency Hopping (20ch)

GFSK Modulation		
Packet	Dwell Time [ms]	Limit [ms]
DH1	147.20	400
DH3	274.72	400
DH5	316.48	400

Data of Dwell Time (Frequency Hopping (79ch))

Time of Occupancy (Dwell Time) for Packet Type DH1

The frequency-hopping rate of Bluetooth system is 1600hops per 1 second.
A DH1 packet needs 1 time slot for transmitting and 1 time slot for receiving.

In a DH1 packet, it hops 800 times for transmitting per 1 second.
The number of hopping channel is 79.
The number of times that appears in 1 channel per 1 second is as follows.
800/79=10.13 [times]

The average time of occupancy on any channel shall not be greater than 0.4 seconds (400ms) within a period of 0.4 seconds multiplied by the number of hopping channels employed 0.4 x 79 = 31.6 seconds
The number of times that appears in 1 channel per 31.6 seconds is as follows.
10.13 x 31.6 = 320.11 [times]

Transmitting time is 0.460 ms.
Then, dwell time is 320.11 x 0.460 ms = 147.20 ms per 31.6 seconds.

Time of Occupancy (Dwell Time) for Packet Type DH3

The frequency-hopping rate of Bluetooth system is 1600hops per 1 second.
A DH3 packet needs 3 times slot for transmitting and 1 time slot for receiving.

In a DH3 packet, it hops 400 times for transmitting per 1 second.
The number of hopping channel is 79.
The number of times that appears in 1 channel per 1 second is as follows.
400/79=5.06 [times]

The average time of occupancy on any channel shall not be greater than 0.4 seconds (400ms) within a period of 0.4 seconds multiplied by the number of hopping channels employed 0.4 x 79 = 31.6 seconds
The number of times that appears in 1 channel per 31.6 seconds is as follows.
5.06 x 31.6 = 159.90 [times]

Transmitting time is 1.717ms.
Then, dwell time is 161.16 x 1.717ms = 274.72ms per 31.6 seconds.

Time of Occupancy (Dwell Time) for Packet Type DH5

The frequency-hopping rate of Bluetooth system is 1600hops per 1 second.
A DH5 packet needs 5 times slot for transmitting and 1 time slot for receiving.

In a DH5 packet, it hops 266.67 times for transmitting per 1 second.
The number of hopping channel is 79.
The number of times that appears in 1 channel per 1 second is as follows.
266.67/79=3.37 [times]

The average time of occupancy on any channel shall not be greater than 0.4 seconds (400ms) within a period of 0.4 seconds multiplied by the number of hopping channels employed 0.4 x 79 = 31.6 seconds
The number of times that appears in 1 channel per 31.6 seconds is as follows.
3.37 x 31.6 = 106.49 [times]

Transmitting time is 2.967 ms.
Then, dwell time is 106.49 x 2.967ms = 316.48ms per 31.6 seconds.

Data of Dwell Time (Frequency Hopping (20ch))

Time of Occupancy (Dwell Time) for Packet Type DH1

The frequency-hopping rate of Bluetooth system is 1600hops per 1 second.
A DH1 packet needs 1 time slot for transmitting and 1 time slot for receiving.

In a DH1 packet, it hops 800 times for transmitting per 1 second.
The number of hopping channel is 20.
The number of times that appears in 1 channel per 1 second is as follows.
800/20=40 [times]

The average time of occupancy on any channel shall not be greater than 0.4 seconds (400ms) within a period of 0.4 seconds multiplied by the number of hopping channels employed 0.4 x 20 = 8.0 seconds
The number of times that appears in 1 channel per 8.0 seconds is as follows.
40 x 8.0 = 320.00 [times]

Transmitting time is 0.460 ms.
Then, dwell time is 320.00 x 0.460ms = 147.20ms per 8.0 seconds.

Time of Occupancy (Dwell Time) for Packet Type DH3

The frequency-hopping rate of Bluetooth system is 1600hops per 1 second.
A DH3 packet needs 3 times slot for transmitting and 1 time slot for receiving.

In a DH3 packet, it hops 400 times for transmitting per 1 second.
The number of hopping channel is 20.
The number of times that appears in 1 channel per 1 second is as follows.
400/20=20 [times]

The average time of occupancy on any channel shall not be greater than 0.4 seconds (400ms) within a period of 0.4 seconds multiplied by the number of hopping channels employed 0.4 x 20 = 8.0 seconds
The number of times that appears in 1 channel per 8.0 seconds is as follows.
20 x 8.0 = 160.00 [times]

Transmitting time is 1.717 ms.
Then, dwell time is 160.00 x 1.717ms = 274.72ms per 8.0 seconds.

Time of Occupancy (Dwell Time) for Packet Type DH5

The frequency-hopping rate of Bluetooth system is 1600hops per 1 second.
A DH5 packet needs 5 times slot for transmitting and 1 time slot for receiving.

In a DH5 packet, it hops 266.67 times for transmitting per 1 second.
The number of hopping channel is 20.
The number of times that appears in 1 channel per 1 second is as follows.
266.67/20=13.34 [times]

The average time of occupancy on any channel shall not be greater than 0.4 seconds (400ms) within a period of 0.4 seconds multiplied by the number of hopping channels employed 0.4 x 20 = 8.0 seconds
The number of times that appears in 1 channel per 8.0 seconds is as follows.
13.34 x 8.0 = 106.72 [times]

Transmitting time is 2.967 ms.
Then, dwell time is 106.72 x 2.967ms = 316.48ms per 8.0 seconds.

10 Maximum Peak Output Power

10.1 Test Setup

The spectrum analyzer was connected to the transmitter output port through the RF cable.

Spectrum Analyzer Setting:

Detector Mode	Peak
RBW	1MHz
VBW	1MHz
Span	5MHz
Sweep Time	Auto

10.2 Test Results

Serial No.	:	PPE00024
Power	:	DC 12.0V
Mode	:	Transmitting Mode, Non Frequency Hopping
Temperature	:	22.9 ℃
Humidity	:	53.4 %
Regulation	:	FCC Part15 C §15.247 (b)(1)

(1) Operating Mode: Transmitting Mode (GFSK Modulation)

CH	Frequency [MHz]	Reading [dBm]	Cable Loss1 [dB]	Cable Loss2 [dB]	Result		Limit	
					[dBm]	[mW]	[dBm]	[mW]
0ch(Lowest)	2402	-4.99	0.56	0.33	-4.10	0.389	30.0	1000
39ch(Middle)	2441	-5.56	0.60	0.33	-4.63	0.344	30.0	1000
78ch(Highest)	2480	-6.68	0.57	0.33	-5.78	0.264	30.0	1000

Result = Reading + Cable Loss1 + Cable Loss2

Note: Cable Loss1: RF Cable
Cable Loss2: Conversion cable used for connecting to SMA type

11 Band Edge Compliance

11.1 Test Setup

The spectrum analyzer was connected to the transmitter output port through the RF cable.

Spectrum Analyzer Setting:

Detector Mode	Peak
RBW	100kHz
VBW	100kHz
Span	10MHz
Sweep Time	Auto

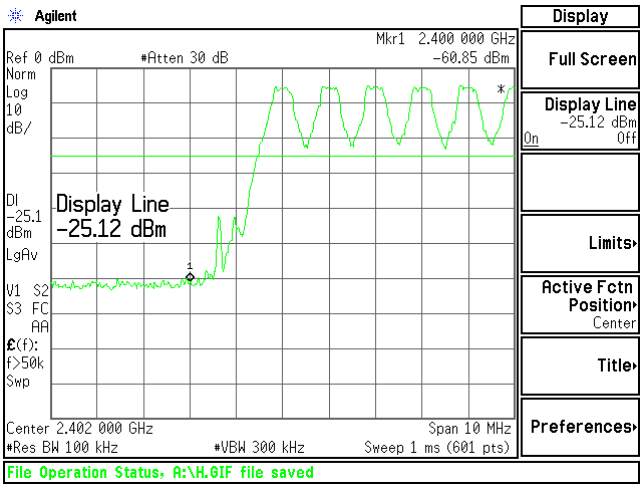
11.2 Test Results

Serial No.	:	PPE00024
Power	:	DC 12.0V
Mode	:	Transmitting Mode, Frequency Hopping (79ch) Transmitting Mode, Adoptive Frequency Hopping (20ch) Transmitting Mode, Non Frequency Hopping
Temperature	:	22.9 ℃
Humidity	:	53.4 %
Regulation	:	FCC Part15 C §15.247 (d)

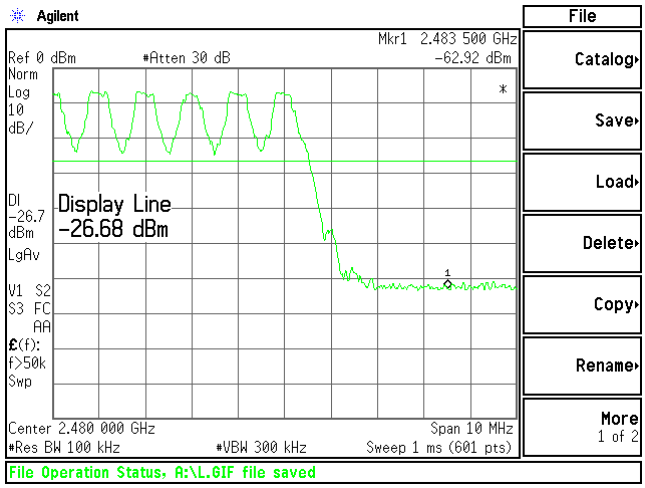
The spectrum data are attached next page. Display line indicates the 20dB offset below highest level. It shows compliance with the requirement in part 15.247(d).

(1) Operating Mode: Transmitting Mode (GFSK Modulation)

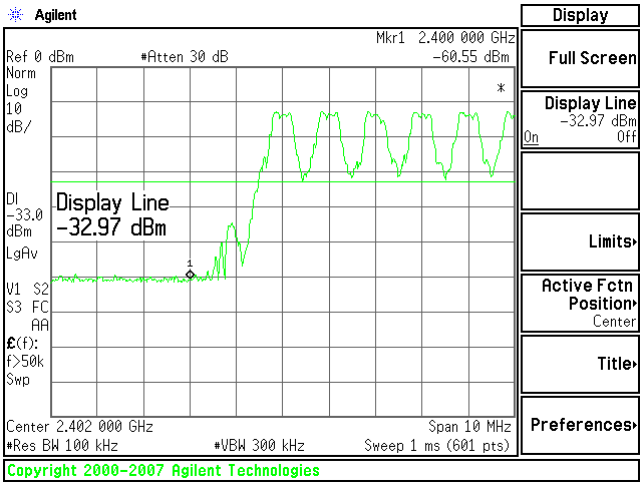
Frequency Hopping 79ch (2402MHz)



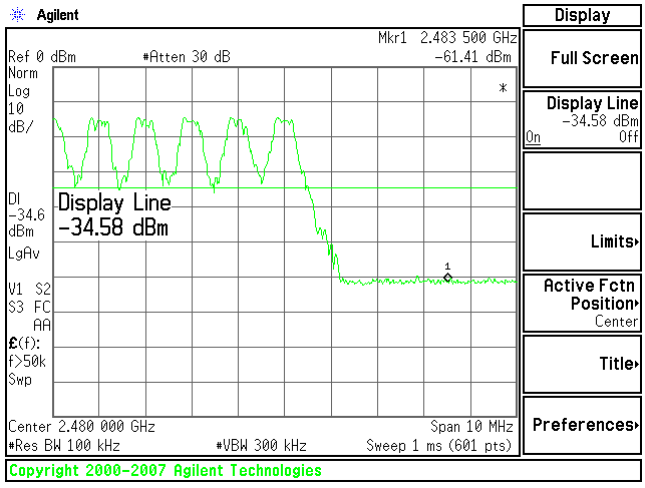
Frequency Hopping 79ch (2480MHz)



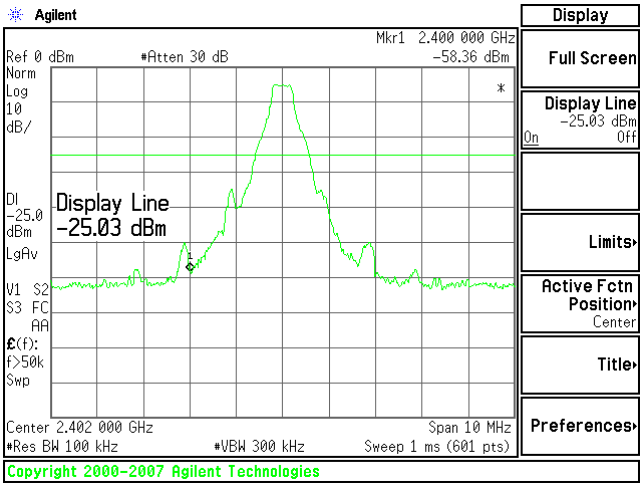
Adoptive Frequency Hopping 20ch (2402MHz)



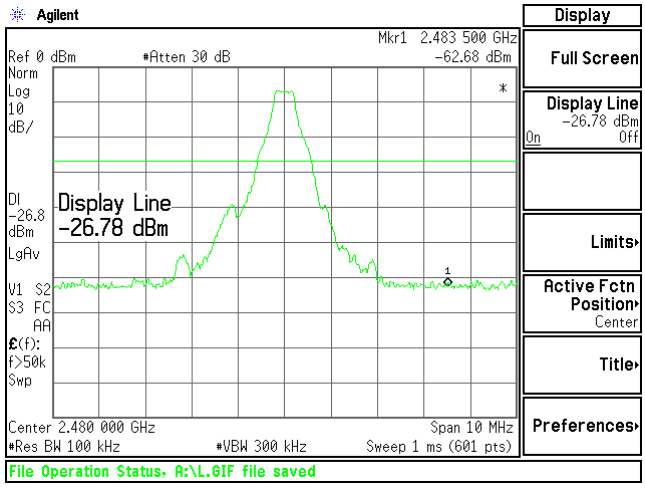
Adoptive Frequency Hopping 20ch (2480MHz)



Non Frequency Hopping (0ch(Lowest) 2402MHz)



Non Frequency Hopping (78ch(Highest) 2480MHz)



12 Spurious RF Conducted Emission

12.1 Test Setup

The spectrum analyzer was connected to the transmitter output port through the RF cable.

Spectrum Analyzer Setting:

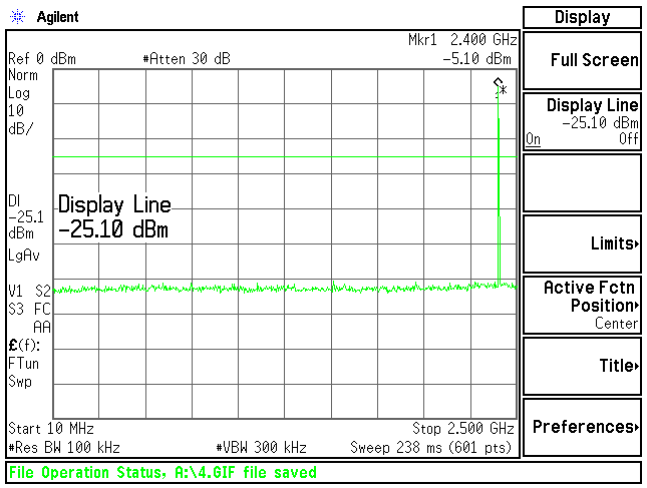
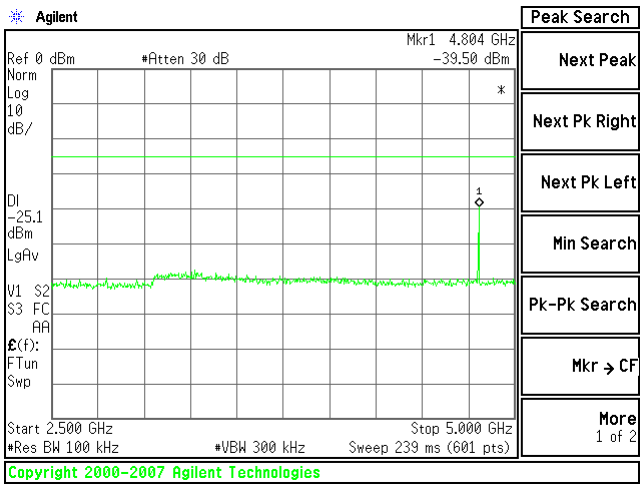
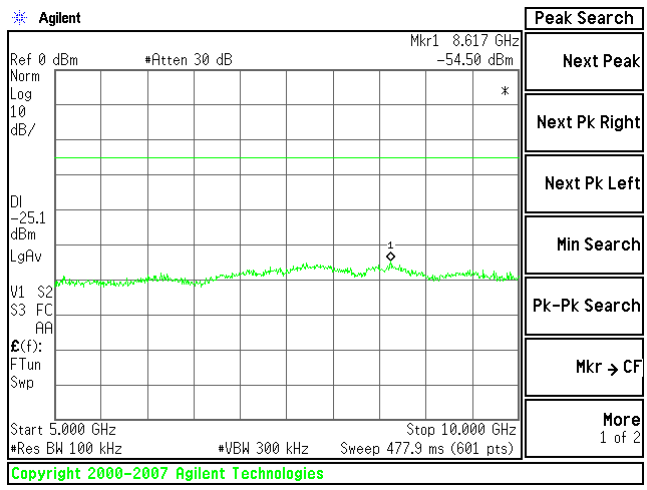
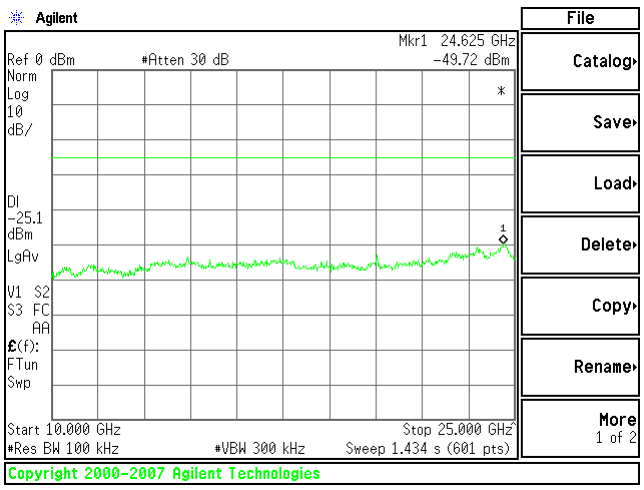
Detector Mode	Peak
RBW	100kHz
VBW	100kHz
Sweep Time	Auto

12.2 Test Results

Serial No.	:	PPE00024
Power	:	DC 12.0V
Mode	:	Transmitting Mode, Non Frequency Hopping
Temperature	:	22.9 ℃
Humidity	:	53.4 %
Regulation	:	FCC Part15 C §15.247 (d)

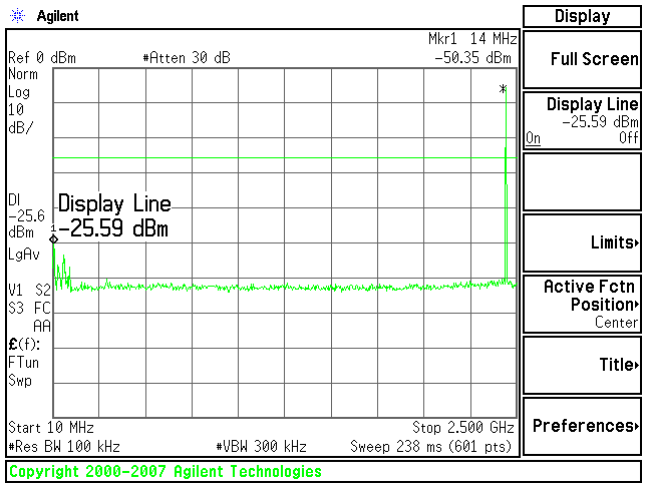
The spectrum data are attached next page. Display line indicates the 20dB offset below highest level. It shows compliance with the requirement in part 15.247(d).

(1) Operating Mode: Transmitting Mode (GFSK Modulation)
(i) 0ch (Lowest) 2402MHz

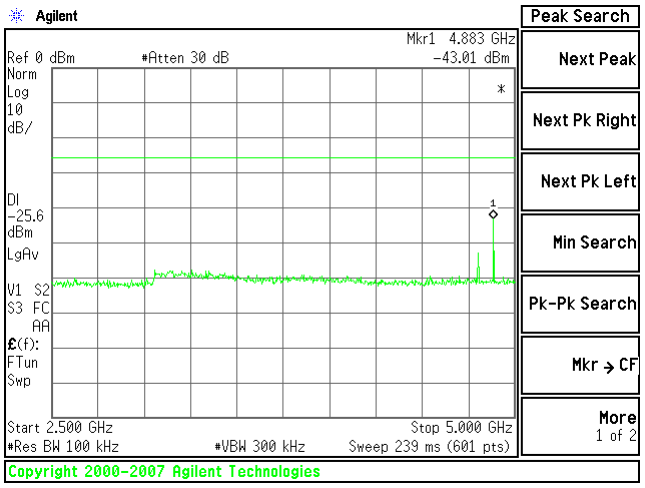
10MHz～2.5GHz	2.5GHz～5GHz
	
5GHz～10GHz	10GHz～25GHz
	

(ii) 39ch (Middle) 2441MHz

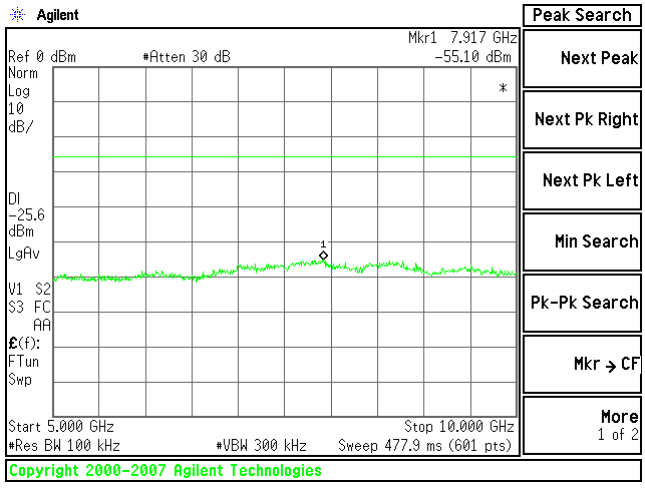
10MHz～2.5GHz



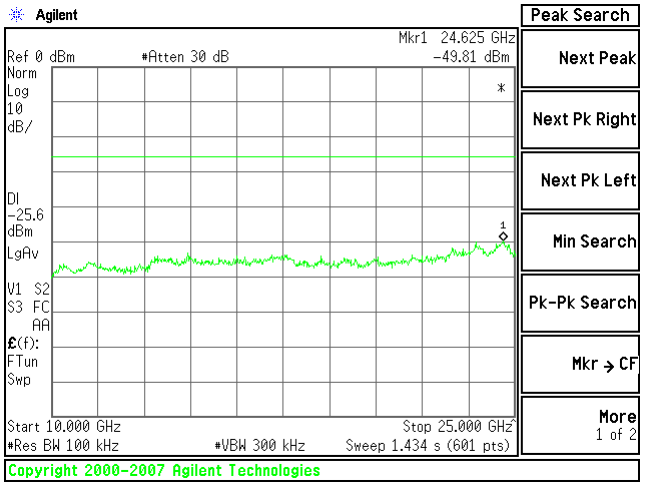
2.5GHz～5GHz



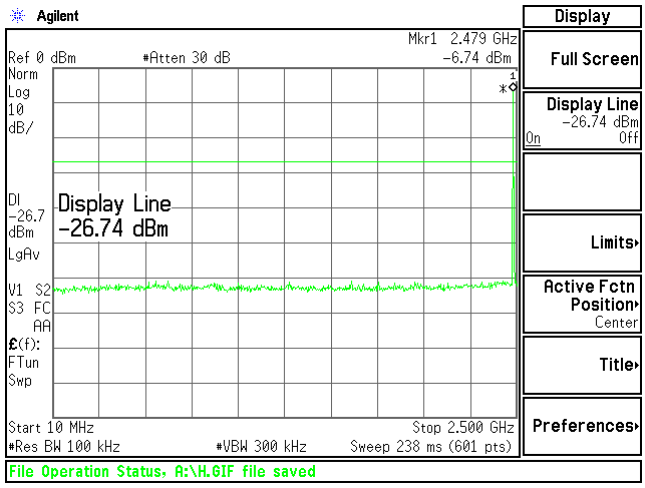
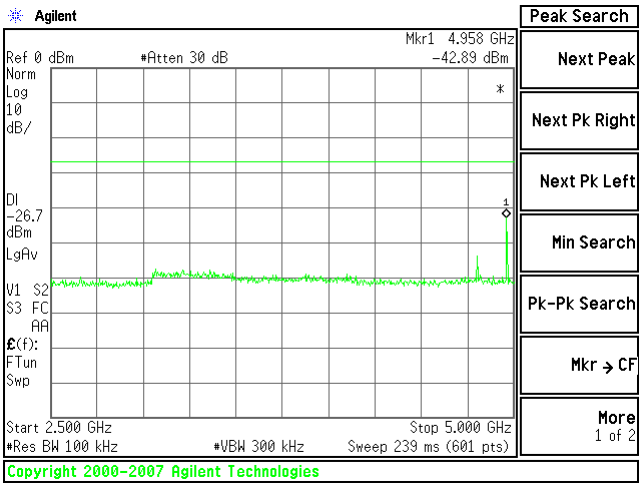
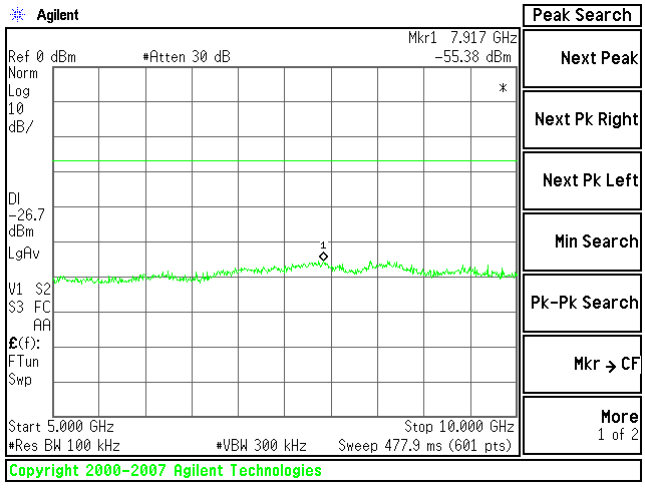
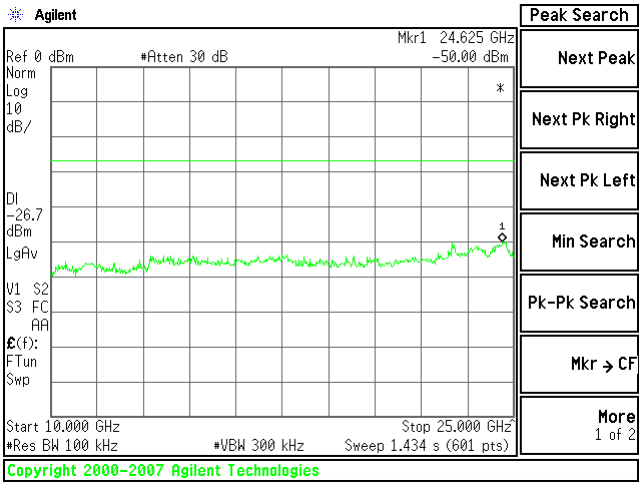
5GHz～10GHz



10GHz～25GHz



(iii) 78ch (Highest) 2480MHz

10MHz～2.5GHz	2.5GHz～5GHz
	
5GHz～10GHz	10GHz～25GHz
	

13 Radiated Emission

13.1 Test Setup

The test setup was made according to ANSI STD C63.4: 2003 clause 8 on the 10-meter semi-anechoic chamber, which allows a 3 or 1 m distance measurement.
EUT was placed on non-conductive table (foam polystyrene).
The height of this table was 0.8 m.
The measurement has been conducted with both horizontal and vertical antenna polarization.
The turntable has been fully rotated. The highest radiation of the equipment has been recorded.
For further description of the configuration refer to separate document named “Test Setup Photos (7142FC)”.

Distance between equipment and antenna : 3m (30MHz to 18GHz)
1m (18GHz to 25GHz)

Test Receiver Setting:

30~1000MHz:

Detector Mode	Quasi-Peak
Bandwidth	120kHz

Spectrum Analyzer Setting:

1~25GHz:

Detector Mode	Peak and Average
Bandwidth	Peak: RBW: 1MHz, VBW: 1MHz
	Average: RBW: 1MHz, VBW: 10Hz

13.2 Radiated Emission Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain (if any) from the measured reading.
The basic equation with a sample calculation is as follows:

c.f. = AF + CF + AL - AG - DF
RE = RA + c.f.

Where c.f. : Correction Factor [dB(1/m)]
RE : Radiated Emission (Emission Level - Result) [dB(uV/m)]
RA : Receiver Amplitude (Reading Level) [dBuV]
AF : Antenna Factor [dB(1/m)]
CF : Cable Attenuation Loss [dB]
AG : Amplifier Gain [dB]
AL : Attenuator Loss [dB]
DF : Distance Factor
Distance between equipment and antenna: 3m = 0 [dB]
Distance between equipment and antenna: 1m = 9.5 [dB]

Assume a receiver reading of 36.5 dBuV is obtained.
The Correction Factor of -2.0 dB/m is added, giving a Radiated Emission of 34.5 dBuV/m.
The 34.5 dBuV/m value was mathematically converted to its corresponding level in uV/m.

RE = 36.5 + (-2.0) = 34.5 dBuV/m

Level in uV/m = Common Antilogarithm: 10^ (34.5/20) = 53.1 uV/m

13.3 Test Results

13.3.1 Transmitter Spurious Emissions

Product	:	CD RECEIVER	Model	:	KDC-BT838U
Serial No.	:	PPK00001	Test Standard	:	FCC Part15 Subpart C §15.247(d)
Power Supply	:	DC 12.0V			
Operator	:	T. Matsumura	Temperature / Humidity (Test Date)		:
			23.5℃ / 35.9%		(3 April)
Remark	:	Transmitting Mode	23.0℃ / 33.0%		(4 April)
		GFSK Modulation			

Radiated Emission: Lch (2402MHz)

Below 1GHz

Frequency [MHz]	Pol. [H / V]	Reading [dB(uV)] QP / AV / PK			Factor [dB/m]	Level [dB(uV/m)] QP / AV / PK			Limit [dB(uV/m)]	Margin [dB] QP / AV / PK			Remark
74.806	H	45.1			-12.1	33.0			40.0	7.0			
113.416	H	42.6			-10.3	32.3			43.5	11.2			
127.986	H	42.4			-9.4	33.0			43.5	10.5			
132.801	H	42.0			-9.1	32.9			43.5	10.6			

Above 1GHz

Frequency [MHz]	Pol. [H / V]	Reading [dB(uV)] QP / AV / PK			Factor [dB/m]	Level [dB(uV/m)] QP / AV / PK			Limit [dB(uV/m)]	Margin [dB] QP / AV / PK			Remark
4804.000	H			47.5	1.2			48.7	74.0			25.3	
4804.000	H		38.0		1.2		39.2		54.0		14.8		
4804.000	V			47.8	1.2			49.0	74.0			25.0	
4804.000	V		37.4		1.2		38.6		54.0		15.4		
7206.000	H			42.2	4.1			46.3	74.0			27.7	Floor Noise
7206.000	H		31.2		4.1		35.3		54.0		18.7		Floor Noise

15.247(d):
Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Radiated Emission: Mch (2441MHz)

Below 1GHz

Frequency [MHz]	Pol. [H / V]	Reading [dB(uV)] QP / AV / PK			Factor [dB/m]	Level [dB(uV/m)] QP / AV / PK			Limit [dB(uV/m)]	Margin [dB] QP / AV / PK			Remark
74.796	H	45.0			-12.1	32.9			40.0	7.1			
113.490	H	43.0			-10.3	32.7			43.5	10.8			
127.903	H	43.0			-9.4	33.6			43.5	9.9			
132.718	H	42.9			-9.1	33.8			43.5	9.7			

Above 1GHz

Frequency [MHz]	Pol. [H / V]	Reading [dB(uV)] QP / AV / PK			Factor [dB/m]	Level [dB(uV/m)] QP / AV / PK			Limit [dB(uV/m)]	Margin [dB] QP / AV / PK			Remark
4882.000	H			48.1	1.4			49.5	74.0			24.5	
4882.000	H		38.8		1.4		40.2		54.0		13.8		
4882.000	V			50.4	1.4			51.8	74.0			22.2	
4882.000	V		41.6		1.4		43.0		54.0		11.0		
7323.000	H			42.5	4.7			47.2	74.0			26.8	Floor Noise
7323.000	H		31.6		4.7		36.3		54.0		17.7		Floor Noise

15.247(d):
Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Radiated Emission: Hch (2480MHz)

Below 1GHz

Frequency [MHz]	Pol. [H / V]	Reading [dB(uV)] QP / AV / PK			Factor [dB/m]	Level [dB(uV/m)] QP / AV / PK			Limit [dB(uV/m)]	Margin [dB] QP / AV / PK			Remark
74.816	H	44.8			-12.1	32.7			40.0	7.3			
113.427	H	43.6			-10.3	33.3			43.5	10.2			
127.979	H	43.1			-9.4	33.7			43.5	9.8			
132.804	H	42.6			-9.1	33.5			43.5	10.0			

Above 1GHz

Frequency [MHz]	Pol. [H / V]	Reading [dB(uV)] QP / AV / PK			Factor [dB/m]	Level [dB(uV/m)] QP / AV / PK			Limit [dB(uV/m)]	Margin [dB] QP / AV / PK			Remark
4960.000	H			45.7	1.6			47.3	74.0			26.7	Floor Noise
4960.000	H		33.2		1.6		34..8		54.0		19.2		Floor Noise
4960.000	V			46.8	1.6			48.4	74.0			25.6	Floor Noise
4960.000	V		36.3		1.6		37.9		54.0		36.1		Floor Noise
7440.000	H			45.9	4.8			50.7	74.0			23.3	Floor Noise
7440.000	H		32.3		4.8		37.1		54.0		16.9		Floor Noise

In this test condition, the spurious emission was not found.

15.247(d):
Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

14 e.i.r.p. Calculation from Peak Power

15.247 (b)(5): Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.
(Limit [W] =60 / f [MHz], 24mW at 2.5GHz)

EIRP Calculation:

A	B	C		
Specified Antenna Gain [dBi]	Max. RF Output Power at Antenna Terminal [dBm]	Total EIRP		Limit [mW] 60 / f [MHz]
		[dBm]	[mW]	
-3.00	-4.10	-7.10	0.19	25

Calculation: C [dBm] = A [dBi] + B [dBm]

EIRP = -7.10dBm = 0.19mW

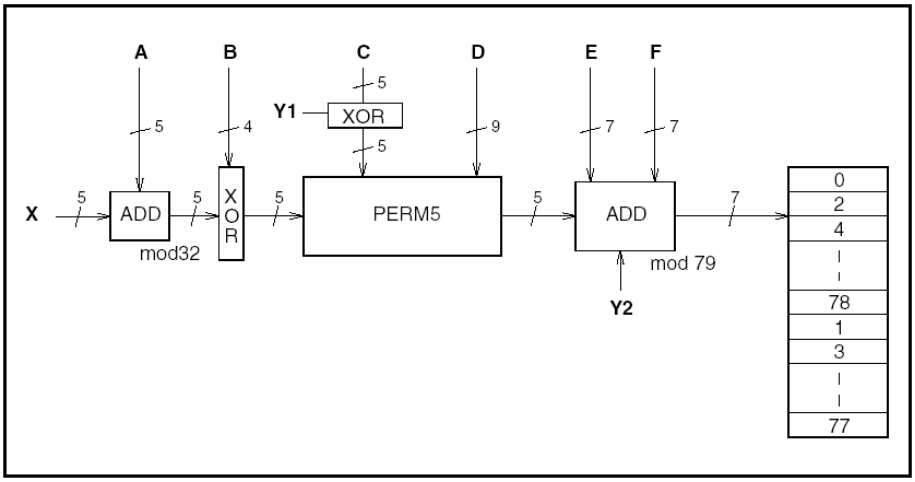
15 Photos of Tested EUT and Test Setup

Setup photo with EUT has been submitted as separate document named “Test Setup Photos (7142FC)”.

Appendix 1: AFH-Hopping Sequence

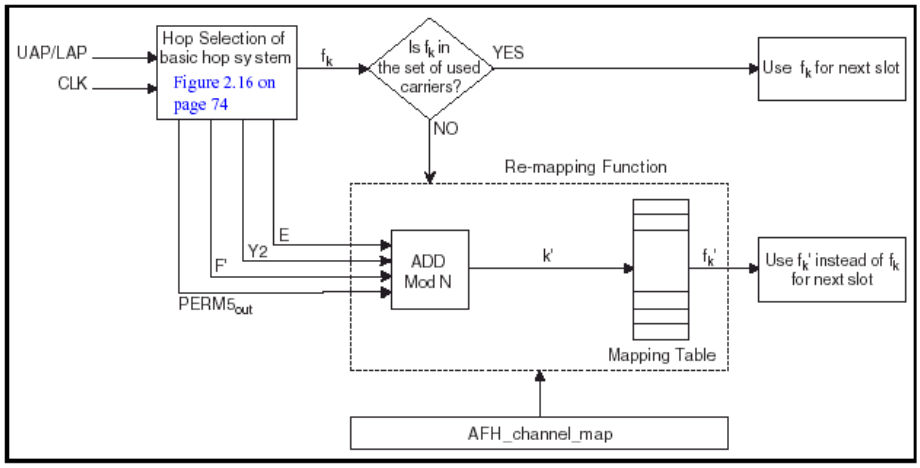
AFH-Hopping Sequence is provided for in the Bluetooth Spec 1.2. Here is an outline below.

1. In the case of 79Hopping



Due to the above flow, 32 hops are made into 5 ways. Then, the sign of the sign head 160 is formed. The remainder that is worked out by dividing with 79 is assigned to Hopping Channel.
Each parameter of the above figure uses the value calculated from the Bluetooth clock and the Bluetooth address, which are shown in the next page.

2. In the case of AFH-Hopping



Also in the case of AFH, the fundamental sign adopt the sign head 160that is the same as the case of 79Hopping. Hopping Pattern uses the value that is worked out by dividing with the number of AFH-Channel's. Then, available Hopping becomes even as well as 79Hopping.
The selection of the communication Channel is done by the communication error rate and the receiving signal strength. Frequency is determined by pairing the channel and the value, which is divided by the number of AFH-Channel one-to-one.
It is decided in the specifications that Communication Channel has to have "20Channels" at least. However, if the number of communication Channel is controlled to be under 20 back to 79Channel-Hopping, and select the communication Channel again.

3. The parameter list which decides Hopping-Pattern

	Page scan / Interlaced Page Scan / Inquiry scan / Interlaced Inquiry Scan	Page/Inquiry	Master/Slave page response and Inquiry response	Connection state
X	$CLKN_{16-12}$ / $(CLKN_{16-12}+16) mod 32$ / Xir_{4-0} / $Xir_{4-0}+16) mod 32$	Xp_{4-0} / Xi_{4-0}	$Xprm_{4-0}$ / $Xprs_{4-0}$ / Xir_{4-0}	CLK_{6-2}
Y1	0	$CLKE_1$ / $CLKN_1$	$CLKE_1$ / $CLKN_1$ / 1	CLK_1
Y2	0	$32 \times CLKE_1$ / $32 \times CLKN_1$	$32 \times CLKE_1$ / $32 \times CLKN_1$ / 32×1	$32 \times CLK_1$
A	A_{27-23}	A_{27-23}	A_{27-23}	$A_{27-23} \oplus CLK_{25-21}$
B	A_{22-19}	A_{22-19}	A_{22-19}	A_{22-19}
C	$A_{8,6,4,2,0}$	$A_{8,6,4,2,0}$	$A_{8,6,4,2,0}$	$A_{8,6,4,2,0} \oplus CLK_{20-16}$
D	A_{18-10}	A_{18-10}	A_{18-10}	$A_{18-10} \oplus CLK_{15-7}$
E	$A_{13,11,9,7,5,3,1}$	$A_{13,11,9,7,5,3,1}$	$A_{13,11,9,7,5,3,1}$	$A_{13,11,9,7,5,3,1}$
F	0	0	0	$16 \times CLK_{27-7} \bmod 79$
F'	n/a	n/a	n/a	$16 \times CLK_{27-7} \bmod N$

Appendix 2: Certificate of Accreditation

United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 200607-0

Taiyo Yuden Co., Ltd. EMC Center
Takasaki-shi Gunma 370-3347
JAPAN

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated 18 June 2005).

2007-10-01 through 2008-09-30
Effective dates

Sally A. Bruce
For the National Institute of Standards and Technology

NVLAP-01C (REV. 2006-09-13)

Appendix 3: Test Instruments

1. Conducted RF Test via Antenna Terminal

Instrument	Manufacturer	Model No.	Serial No.	Calibration Date (Interval (year))	
Spectrum Analyzer	Rohde & Schwarz	FSIQ26	840061/0004	14 February 2007 (1)	○
	Agilent Technologies	E4446A	US42070181	17 October 2007 (1)	●
Power Meter	Rohde & Schwarz	NRVD	838380/0043	5 February 2007 (1)	○
	Agilent Technologies	N1911A	MY45100612	8 June 2007 (1)	○
		E4416A	MY45100855	4 September 2007 (1)	●
Power Sensor	Rohde & Schwarz	NRV-Z1	838357/0001	5 February 2007 (1)	○
	Agilent Technologies	N1922A	MY45240439	8 June 2007 (1)	○
		8482A	MY41094396	4 September 2007 (1)	●
RF Cable	SUHNER	SUCOFLEX 104	RF2-2	3 July 2007 (1)	●
		SUCOFLEX 104E	RF3-3	4 April 2007 (1)	●
		SUCOFLEX 103	SU5	1 August 2007 (1)	●
	HP	85381C	No.3		●
Power Divider	Aeroflex / Inmet	6005-03	RF-8	3 July 2007 (1)	●
Attenuator	Anritsu	MP721D	M04067	1 August 2007 (1)	●
		MP721F	M40372		●
Multi Meter	Advantest	R6451A	67840312	19 September 2007 (1)	●
	Agilent Technologies	34401A	MY41038383	5 June 2007 (1)	○
Temperature Chamber	TABAI ESPEC	PU-2KTH	14006759	6 February 2007 (1)	○
Hygro thermograph	SEKONIC	ST-200	HD01-000797	6 September 2007 (1)	●

Note:
●: Applied by measurement.
○: Not applied by measurement.

2. Radiated Emission Test

Instrument	Manufacturer	Model No.	Serial No.	Calibration Date (Interval (year))	
10m Anechoic Chamber	TDK Co., Ltd.	DA-06912	-	13 February 2008 (1)	●
EMI Test Receiver	Rohde & Schwarz	ESCS 30	100148	31 July 2007 (1)	●
Spectrum Analyzer	Agilent Technologies	E4407B	MY44221019	23 April 2007 (1)	●
		E4446A	US42070181	17 October 2007 (1)	●
Amplifier	Agilent Technologies	83017A	3950M00169	1 August 2007 (1)	●
		8447D	2944A06812		●
RF Selector	TDK Co., Ltd	NS4900	0302-010		●
Tunable Filter	TOYO Corporation	NF-49BT	No.1		○
RF Filter	Microtronics	ERM50702-01	020		○
RF Cable	SUHNER	RG214	RG1		●
		RG214	RG3		●
		RG214	RG5		●
		RG214	RG7		●
		RG214	RG8		●
	HP	HP8120-4782	163 9232		●
	SUHNER	SUCOFLEX 106	SU1		●
		SUCOFLEX 103	SU5		●
		SUCOFLEX 103	SU6		○
	HP	85381C	No.3		●
Attenuator	KYORITSU	KPD-602	220142		●
Antenna	Schwarzbeck	BBA9106	No.3	19 December 2007 (1)	○
		UHALP9108-A	0160		○
		VULB9160	3179		●
		VHA9103	No.3 (+D3-1, 2)		○
		UHA9105	No.3		○
	EMCO	3115	9403-4232	13 February 2008 (2)	●
		3116	9311-2227		●
Hygro thermograph	SEKONIC	ST-50	HE01-00511	14 February 2008 (1)	●

Note:
●: Applied by measurement.
○: Not applied by measurement.