TEST REPORT

Report No. :	ICM05003-FCC
Date :	18th May 2005
Applicant :	Taiyo Yuden Co.,Ltd.
	8-1 Sakae-cho , Takasaki-shi , Gunma ,370-8522 Japan.
EUT :	Bluetooth USB Adaptor
FCC ID :	RYYEYSF3CSUU
Model No. :	EYSF3CSUU
Serial No. :	00037A013e28 , 00037A002FF9
Receipt date of tested sample :	25th April 2005
Date of measurement :	25th , 27th April 2005 (Radiated Emission)
	28th April 2005 (Conducted Emission)
Test location :	Taiyo Yuden Co.,Ltd. EMC Center
	5607-2, Nakamuroda,Haruna-machi,
	Gunma-Gun, Gunma , 370-3347,Japan.
Applied standard :	47 CFR Part 15 Subpart C Section15.207 , Section 15.247
Procedure :	ANSI C63.4-2003
Test results:	PASS

Approved by : Manager / Kenzo Furuta

Reviewed by : Chief Engineer / Takeshi Matsumura

NVLAP LAB CODE 200607-0

Table of Contents

1 TEST REPORT 4

2 GENERAL INFORMATION 4

2.1 PRODUCT DESCRIPTION 4
2.2 SUMMARY OF TEST AND INSPECTION RESULT 5
2.3 TEST METHODOLOGY 5
2.4 TEST FACILITY 6

3 SYSTEM TEST CONFIGURATION 6

3.1 JUSTIFICATION 6
3.2 OPERATING MODES 6
3.3 LIST OF ACCESSORIES 8
3.4 INTERFACE CABLES 8
3.5 SPECIAL TEST CONDITION 8
3.6 EQUIPMENT MODIFICATIONS 8
3.7 CONFIGURATION OF TESTED SYSTEM 8

4 ANTENNA REQUIREMENT 9

5 CONDUCTED EMISSION TEST 9

5.1 TEST SETUP 9
5.2 TEST INSTRUMENTATION 10
5.3 CONDUCTED EMISSION CALCULATION 10
5.4 TEST RESULTS 11
5.4.1 Transmitting mode 11

6 RADIATED EMISSION TEST 14

6.1 TEST SETUP 14
6.2 TEST INSTRUMENTATION 15
6.3 RADIATED EMISSION CALCULATION 16
6.4 TEST RESULTS 17
6.4.1 Transmitting mode 17

7 20DB BANDWIDTH 23

7.1 TEST SETUP 23
7.2 TEST INSTRUMENT 23
7.3 TEST RESULTS 23

8 CARRIER FREQUENCY SEPARATION 24

8.1 TEST SETUP 24
8.2 TEST INSTRUMENT 24
8.3 TEST RESULTS 24

9 NUMBER OF HOPPING FREQUENCY 26

9.1 TEST SETUP 26
9.2 TEST INSTRUMENT 26
9.3 TEST RESULTS 26

10 DWELL TIME 28

10.1 TEST SETUP 28
10.2 TEST INSTRUMENT 28
10.3 TEST RESULTS 28

11 MAXIMUM PEAK OUTPUT POWER 30

11.1 TEST SETUP 30
11.2 TEST INSTRUMENT 30
11.3 TEST RESULTS 30

12 BAND EDGE COMPLIANCE 31

12.1 TEST SETUP 31
12.2 TEST INSTRUMENT 31
12.3 TEST RESULTS 31

13 SPURIOUS RF CONDUCTED EMISSION 35

13.1 TEST SETUP 35
13.2 TEST INSTRUMENT 35
13.3 TEST RESULTS 35

14 EIRP CALCULATION FROM PEAK POWER 48

15 PHOTOS OF TESTED EUT 49

15.1 EXTERNAL PHOTOS 49
15.2 INTERNAL PHOTOS 50

16 PHOTOS OF TEST SETUP 51

16.1 PHOTOS OF RADIATED MEASUREMENT 51
16.2 PHOTOS OF CONDUCTED MEASUREMENT 52

APPENDIX 1 53

APPENDIX 2 55

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 NVLAP or 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) When the test report concerns with the NVLAP accreditation test t he first page of the test report is signed by NVLAP Approved Signatory accompanied by the NVLAP logo.

2 General Information

2.1 Product Description

The pre-production sample of the Taiyo Yuden Co.,Ltd. Bluetooth USB Adaptor was tested as **E**quipment **U**nder **T**est.

EUT	: Bluetooth USB Adaptor
Model No.	: EYSF3CSUU
Serial No.	: 00037A013e28 , 00037A002FF9
FCC ID	: RYYEYSF3CSUU

EUT is attached to the PC provided with the USB port, and it is a wireless applications to communicate with other Bluetooth devices.
This is operated within the bands 2400 – 2483.5MHz frequency hopping intentional radiators that comply with the FCC15.247. It provides 79 channels. And it adopts an AFH function to prevent interference with other wireless applications. Refer to APPENDIX 1.

EUT operates in the unlicensed 2.4 GHz ISM (Industrial Scientific Medical) band. A frequency hop transceiver is applied to combat interference and fading.
Two modulation modes are defined. A mandatory mode, called Basic Rate, uses a shaped, binary FM modulation to minimize transceiver complexity (GFSK). An optional mode, called Enhanced Data Rate, uses PSK modulation and has two variants: π/4-DQPSK and 8DPSK. The symbol rate for all modulation schemes is 1 Ms/s. The gross air data rate is 1 Mbps for Basic Rate, 2 Mbps for Enhanced Data Rate using π/4-DQPSK and 3 Mbps for Enhanced Data Rate using 8DPSK.

2.2 Summary of Test and Inspection Result

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst Margin	Results
1	Conducted Emission	ANSI C63.4:2003	FCC 15.207	-	N/A	Tansmitting mode:2441,2480MHz Receving mode: :2441MHz 20.7 dB VB(QP) 0.167 MHz	Pass
2	Carrier Frequency Separation	ANSI C63.4:2003 Public Notice DA00-705	FCC 15.247(a)(1) FCC 04-165	Conducted	N/A	-	Pass
3	Number of Hoping 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(c)		N/A	-	Pass
7	Spurious RF Conducted Emission		FCC 15.247(c)		N/A	-	Pass
8	Radiated Emission		FCC 15.247(c)	Radiated	N/A	Tansmitting mode:2441MHz Direction:YZ 9.1 dB Horizontal 4882.0MHz	Pass

2.3 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. Radiate testing in the range of 30 MHz to 18GHz was performed at an antenna to EUT distance of 3 meters under the FCC15.209 (e). And radiate testing in the range of 18 GHz to 25 GHz (10th harmonic of the highest fundamental frequency, 15.209 (f) and 15.33 (a) (1) for the spectrum investigation) was performed at an antenna to EUT distance of 1 meters under the 15.209 (e).

2.4 Test Facility

1. FCC 47CFR, Part 15, Section 15.247 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 Haruna-Machi Gunma-Gun 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 17025:1999 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).

3 System Test Configuration

3.1 Justification

1. Emission tests were performed with no deviation from the RSS-210, 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). The 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. All tests were performed with the representative channel operation as follows.

a. Lowest frequency channel : CH0 2402MHz
b. Middle frequency channel : CH39 2442MHz
c. Highest frequency channel : CH78 2480MHz

3.2 Operating modes

Mode	Explanation of the mode	
Transmitting mode	GFSK	Signal pattern : PRBS9 Signal packet type : DH5
	π/4 DQPSK	Signal pattern : PRBS9 Signal packet type : 2-DH5
	8DPSK	Signal pattern : PRBS9 Signal packet type : 3-DH5
Receiving mode	RX continuous	

DH1	Description : A 5 slot, Data High rate, ACL type packet. Supports a data payload of 0 to 27 bytes with CRC, no FEC, and fully transmits within five consecutive 625 microsecond transmission slots. Makes up the front half of a 5/1 multi-slot Frame.
DH3	Description : A 5 slot, Data High rate, ACL type packet. Supports a data payload of 0 to 183 bytes with CRC, no FEC, and fully transmits within five consecutive 625 microsecond transmission slots. Makes up the front half of a 5/1 multi-slot Frame.
DH5	Description : A 5 slot, Data High rate, ACL type packet. Supports a data payload of 0 to 339 bytes with CRC, no FEC, and fully transmits within five consecutive 625 microsecond transmission slots. Makes up the front half of a 5/1 multi-slot Frame.
2-DH5	This packet is similar to the DH5 packet except that the payload is modulated using π/4-DQPSK. The 2-DH5 packet has between 2 and 681 information bytes (including the 2-byte payload header) plus a 16-bit CRC code. The 2-DH5 packet may occupy up to five time slots.
3-DH5	This packet is similar to the DH5 packet except that the payload is modulated using 8DPSK. The 3-DH5 packet has between 2 and 1023 information bytes (including the 2-byte payload header) plus a 16-bit CRC code. The 3-DH5 packet may occupy up to five time slots.
PRBS9	A periodic Pseudo Random Bit Sequence. 2^9 -1

3.3 List of accessories

	Product name	M/N	S/N	Manufacturer	Notes	FCC ID / DoC
a	Personal Computer	PP04S	CN-0Y0119-36521-467-2020	DELL	—	FCC ID: QDS-BRCM1007
b	AC Adapter for PC	PA-1650-05D	—	DELL	—	N/A

3.4 Interface cables

	Cable Type	M/N	Connection	Ferrite core	Shielded	Material of connector	Length	Treatment for the extra length
1	DC cable	-	a⇔b	Yes	Yes	Metal	1.8m	Fold back and forth in the center
2	AC cable	-	b⇔AC	No	Yes	Plastic	0.9m	-
3	USB cable	-	b⇔EUT	No	Yes	Metal	3.0m	Fold back and forth in the center

3.5 Special Test Condition

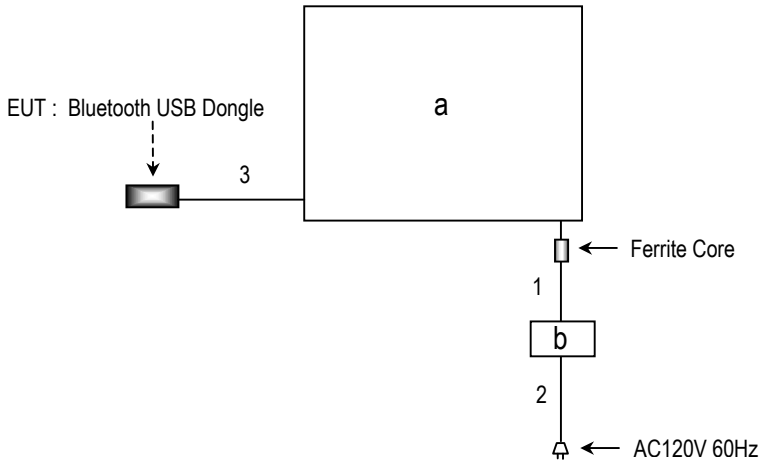
Nothing

3.6 Equipment Modifications

No modification has been carried out by the test laboratory.

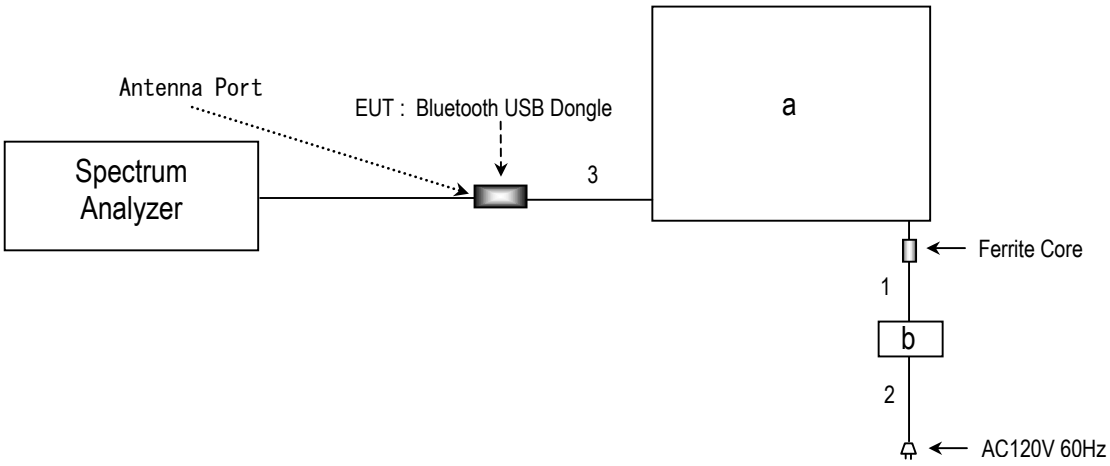
3.7 Configuration of Tested System

Radiated Emission Test and Conducted Emission Test



These numbers and the marks in the picture above are corresponding to the numbers and the mark in Figure 3.3 and 3.4 on page 8.

Operation within the bands 2400-2483.5MHz



4 Antenna Requirement

The EUT provide a permanently attached antenna and it found to be compliance with FCC regulation section 15.203 .
Refer to Section 17.2 Internal Photos.

5 Conducted Emission Test

5.1 Test Setup

Conducted emission measurements were performed from 150kHz to 30 MHz.
The test setup was made according to ANSI STD C63.4-2003 clause 7 in the Shielded room.
The rear of non-conductive wooden table top was placed 0.4 m from a vertical metal reference plane that one of the wall.
Rears of the peripherals were all aligned and flush with rear of non-conductive wooden tabletop.
The height of this table was 0.8 m and 1.5 m wide x 1.0 m deep size.
The spacing between the each equipment was 10 cm.
Connection of the PC connected EUT USB Adapter to the artificial mains network (LISN) was required.
The distance between the closet surface of the EUT and the closet surface of the artificial mains network (LISN) was 0.8 m.
Connection of the all other equipment to the second artificial mains network (LISN) was required. The distance between the peripherals and the closet surface of the second artificial mains network (LISN) was minimum 0.8 m.
The second artificial mains network is terminated with 50 ohm terminator. Where a mains flexible cord is provided by the manufacture this is 2.0 m long and excess cable was folded back and forth as far as possible to 0.8 m so as to from a bundle not exceeding 0.4 m in length. Interconnecting cables of table top equipment that hang closer than 0.4 m to the floor ground plane were folded back and forth forming a bundle 30 to 40 cm long, hanging approximately in the middle between ground plane and table.
The measurement has been conducted with both line and neutral power supply polarization.
The maximum voltage emission was verified with the cable routing and the location of the peripherals.
The highest voltage emission has been recorded.
For further description of the configuration refer to the photographs of this report.

Detector Mode: Quasi-Peak and Average
Bandwidth: 10kHz

5.2 Test Instrumentation

Facility/ Equipment	Manufacturer	Model No.	Serial No.	Next Calibration Due	Note
Shielded room	TDK Co.,Ltd	DA-06912	-	-	-
EMI Test Receiver	R&S	ESHS 10	100005	4th.8.2005.	-
LISN	KYORITSU ELECTRICAL WORK	KNW-407	8-680-1	18th.3.2006.	for EUT
Cable	SUHNER	RG223	CE-1	27th.4.2006.	-
		RG223	CE-2	27th.4.2006.	-
		RG2214	CE-3	27th.4.2006.	-
Attenuator	KYORITSU	KPD-602	5K325	27th.4.2006.	-
Pulse Limiter	Agilent Technologies	11867A	1387	27th.4.2006.	-
RF Selector	TDK Co.,Ltd	NS4900	0302-009	27th.4.2006.	-
Software	TOYO Corporation	EP5/CE Ver.2.0	0208085	-	-

5.3 Conducted Emission Calculation

The basic equation with a sample calculation is as follows:

c.f.= CF + AL
CE = RA + c.f.

Where c.f. = Correction Factor (dB)
CE = Conducted Emission (Emission Level - Result) (dBuV)
RA = Receiver Amplitude (Reading Level) (dBuV)
CF = Cable Attenuation Loss (dB)
AL = Attenuator Loss (dB)

Assume a receiver reading of 27.3 dB μ V is obtained. The Factor of 3.4dB is added, giving a terminal voltage of 30.7 dB μ V. The 30.7 dB μ V value was mathematically converted to its corresponding level in μ V.

CE = 27.3 + 3.4 = 30.7 dB μ V

Level in μ V = Common Antilogarithm [(30.7 dB μ V)/20] = 34.8 μ V

5.4 Test Results

5.4.1 Transmitting mode

Conducted Emission 2402MHz

Serial No. : 00037A013e28
Power : AC 120V 60Hz
Mode : Transmitting mode , (GFSK)
Direction : XY
Temperature : 23℃
Humidity : 32%
Remarks : It was measured at AC port of Personal Computer .

VA

Frequency [MHz]	Meter Reading [dB(μV)]		Factor [dB/m]	Conducted Emission [dB(μV)]		Limits [dB(μV/m)]		Margin [dB]	
	QP	AV		QP	AV	QP	AV	QP	AV
0.165	40.8	24.5	3.4	44.2	27.9	65.2	55.2	21.0	27.3
0.187	37.3	21.8	3.4	40.7	25.2	64.2	54.2	23.5	29.0
0.260	36.1	20.5	3.3	39.4	23.8	61.4	51.4	22.0	27.6
9.790	23.3	17.9	3.7	27.0	21.6	60.0	50.0	33.0	28.4

VB

Frequency [MHz]	Meter Reading [dB(μV)]		Factor [dB/m]	Conducted Emission [dB(μV)]		Limits [dB(μV/m)]		Margin [dB]	
	QP	AV		QP	AV	QP	AV	QP	AV
0.166	40.9	23.5	3.4	44.3	26.9	65.2	55.2	20.9	28.3
0.177	38.2	20.1	3.4	41.6	23.5	64.6	54.6	23.0	31.1
1.334	23.1	21.5	3.3	26.4	24.8	56.0	46.0	29.6	21.2

Conducted Emission 2441MHz

Serial No. : 00037A013e28
Power : AC 120V 60Hz
Mode : Transmitting mode , (GFSK)
Direction : XY
Temperature : 23℃
Humidity : 32%
Remarks : It was measured at AC port of Personal Computer.

VA

Frequency [MHz]	Meter Reading [dB(μV)]		Factor [dB/m]	Conducted Emission [dB(μV)]		Limits [dB(μV/m)]		Margin [dB]	
	QP	AV		QP	AV	QP	AV	QP	AV
0.166	40.8	24.8	3.4	44.2	28.2	65.2	55.2	21.0	27.0
0.187	37.3	21.8	3.4	40.7	25.2	64.2	54.2	23.5	29.0
1.330	21.5	20.1	3.3	24.8	23.4	56.0	46.0	31.2	22.6

VB

Frequency [MHz]	Meter Reading [dB(μV)]		Factor [dB/m]	Conducted Emission [dB(μV)]		Limits [dB(μV/m)]		Margin [dB]	
	QP	AV		QP	AV	QP	AV	QP	AV
0.167	41.0	24.0	3.4	44.4	27.4	65.1	55.1	20.7	27.7
0.248	35.8	22.1	3.3	39.1	25.4	61.8	51.8	22.7	26.4
0.262	36.3	22.6	3.3	39.6	25.9	61.4	51.4	21.8	25.5
1.334	23.1	21.5	3.3	26.4	24.8	56.0	46.0	29.6	21.2
9.878	25.2	18.8	3.6	28.8	22.4	60.0	50.0	31.2	27.6

Conducted Emission 2480MHz

Serial No. : 00037A013e28
Power : AC 120V 60Hz
Mode : Transmitting mode , (GFSK)
Direction : XY
Temperature : 23℃
Humidity : 32%
Remarks : It was measured at AC port of Personal Computer.

VA

Frequency [MHz]	Meter Reading [dB(μV)]		Factor [dB/m]	Conducted Emission [dB(μV)]		Limits [dB(μV/m)]		Margin [dB]	
	QP	AV		QP	AV	QP	AV	QP	AV
0.166	40.8	24.8	3.4	44.2	28.2	65.2	55.2	21.0	27.0
1.330	21.5	20.1	3.3	24.8	23.4	56.0	46.0	31.2	22.6
9.880	24.0	18.9	3.7	27.7	22.6	60.0	50.0	32.3	27.4

VB

Frequency [MHz]	Meter Reading [dB(μV)]		Factor [dB/m]	Conducted Emission [dB(μV)]		Limits [dB(μV/m)]		Margin [dB]	
	QP	AV		QP	AV	QP	AV	QP	AV
0.167	41.0	24.0	3.4	44.4	27.4	65.1	55.1	20.7	27.7
0.248	35.8	22.1	3.3	39.1	25.4	61.8	51.8	22.7	26.4
0.262	36.3	22.6	3.3	39.6	25.9	61.4	51.4	21.8	25.5
0.630	17.4	12.4	3.3	20.7	15.7	56.0	46.0	35.3	30.3
1.334	23.1	21.5	3.3	26.4	24.8	56.0	46.0	29.6	21.2
9.878	25.2	18.8	3.6	28.8	22.4	60.0	50.0	31.2	27.6

6 Radiated Emission Test

6.1 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 the pictures of this report.

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

Spectrum Analyzer Setting

30～1000MHz	Detector : Quasi-Peak Bandwidth : 120kHz
1～25GHz	Detector : Peak and Average Bandwidth : 1MHz

Axial Direction

6.2 Test Instrumentation

Facility/ Equipment	Manufacturer	Model No.	Serial No.	Frequency Range	Next Calibration Due
10m anechoic chamber	TDK Co.,Ltd	DA-06912	-	-	13st.3.2006.
EMI Test Receiver	R&S	ESCS 30	100148	30-1000MHz	29nd.8.2005.
Spectrum Analyzer	Agilent Technologies	8563E	3416A02230	30-1000MHz	4th.4.2006.
		E4446A	US42070181	1-40GHz	31th.3.2006.
Amplifier		8449B	3008A00571	1-26.5GHz	26th.2.2006.
		8447D	2944A06812	30-1000MHz	5th.4.2006.
RF Selector	TDK Co.,Ltd	NS4900	0302-010	-	5th.4.2006.
RF Cable	SUHNER	RG214	RG 1	30-1000MHz	5th.4.2006.
		RG214	RG 3	30-1000MHz	5th.4.2006.
		RG214	RG 8	30-1000MHz	5th.4.2006.
		RG214	RG 5	30-1000MHz	5th.4.2006.
		RG214	RG 6	30-1000MHz	5th.4.2006.
		SUCOFLEX 106	SU1	1-18GHz	28th.2.2006.
		SUCOFLEX 104	SU4	1-18GHz	28th.2.2006.
	HP	85381C	No.3	18-25GHz	15th.7.2005.
		85381C	No.5	18-25GHz	15th.7.2005.
Attenuator	KYORITSU	KPD-602	220142	30-1000MHz	5th.4.2006.
Antenna	Schwarzbeck	BBA9106	No.4	30-300MHz	28rd.2.2006.
		UHALP9108-A	160	300-1000MHz	28rd.2.2006
	EMCO	3115	9403-4232	1-18GHz	31th.3.2006.
		3116	9311-2227	18-40GHz	31th.3.2006.
Software	TOYO Corporation	EP5/RE Ver.2.0	0208086	-	-

6.3 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/m)
RE = Radiated Emission (Emission Level - Result) (dBuV/m)
RA = Receiver Amplitude (Reading Level) (dBuV)
AF = Antenna Factor (dB/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 43.4 dB μ V is obtained. The Correction Factor of –10.2 dB/m is added, giving a Radiated Emission of 33.2 dB μ V/m. The 33.2 dB μ V/m value was mathematically converted to its corresponding level in μ V/m.

RE = 43.4 + (-10.2) = 33.2 dB μ V/m

Level in μ V/m = Common Antilogarithm [(33.2 dB μ V/m)/20] = 45.7 μ V/m

6.4 Test Results

Radiated emission was measured in all test modes; GFSK Modulation, π /4 DQPSK Modulation and 8DPSK Modulation. The results show the worst case.

6.4.1 Transmitting mode

Spurious Emission (Radiated) 2402MHz

Serial No. : 00037A013e28
Power : AC 120V 60Hz
Mode : Transmitting mode (GFSK Modulation)
Temperature : 23℃
Humidity : 32%

Axial Direction : XY-Plane

Frequency [MHz]	Antenna Polarization	Meter Reading [dB(μV)]	Factor [dB/m]	Emission Level [dB(μV/m)]	Limits [dB(μV/m)]	Margin [dB]
		QP		QP		
76.60	Vertical	36.0	-15.4	20.6	40.0	19.4
259.30	Horizontal	36.5	-2.0	34.5	46.0	11.5
518.67	Vertical	31.7	-1.8	29.9	46.0	16.1

Frequency [MHz]	Antenna Polarization	Meter Reading [dB(μV)]		Factor [dB/m]	Emission Level [dB(μV/m)]		Limits [dB(μV/m)]	Margin [dB]	
		Average	Peak		Average	Peak		Average	Peak
1603.0	Horizontal	-----	58.7	-12.5	-----	46.2	74.0	-----	27.8
		56.2	-----	-12.5	43.7	-----	54.0	10.3	-----
1603.0	Vertical	-----	55.6	-12.5	-----	43.1	74.0	-----	30.9
		51.2	-----	-12.5	38.7	-----	54.0	15.3	-----
4804.0	Horizontal	-----	53.3	-1.1	-----	52.2	74.0	-----	21.8
		45.9	-----	-1.1	44.8	-----	54.0	9.2	-----
4804.0	Vertical	-----	51.2	-1.1	-----	50.1	74.0	-----	23.9
		43.0	-----	-1.1	41.9	-----	54.0	12.1	-----
7440.0	Horizontal	-----	46.4	2.9	-----	49.3	74.0	-----	24.7
		33.2	-----	2.9	36.1	-----	54.0	17.9	-----
9920.0	Vertical	-----	45.1	5.5	-----	50.6	74.0	-----	23.4
		33.1	-----	5.5	38.6	-----	54.0	15.4	-----

Axial Direction : YZ-Plane

Frequency [MHz]	Antenna Polarization	Meter Reading [dB(μV)]	Factor [dB/m]	Emission Level [dB(μV/m)]	Limits [dB(μV/m)]	Margin [dB]
		QP		QP		
76.61	Vertical	35.8	-15.4	20.4	40.0	19.6
258.08	Horizontal	36.3	-2.1	34.2	46.0	11.8

Frequency [MHz]	Antenna Polarization	Meter Reading [dB(μV)]		Factor [dB/m]	Emission Level [dB(μV/m)]		Limits [dB(μV/m)]	Margin [dB]	
		Average	Peak		Average	Peak		Average	Peak
1601.0	Horizontal	-----	57.0	-12.5	-----	44.5	74.0	-----	29.5
		53.4	-----	-12.5	40.9	-----	54.0	13.1	-----
1601.0	Vertical	-----	55.8	-12.5	-----	43.3	74.0	-----	30.7
		51.7	-----	-12.5	39.2	-----	54.0	14.8	-----
4804.0	Horizontal	-----	52.6	-1.1	-----	51.5	74.0	-----	22.5
		44.9	-----	-1.1	43.8	-----	54.0	10.2	-----
7440.0	Horizontal	-----	46.4	2.9	-----	49.3	74.0	-----	24.7
		33.2	-----	2.9	36.1	-----	54.0	17.9	-----
9920.0	Vertical	-----	45.1	5.5	-----	50.6	74.0	-----	23.4
		33.1	-----	5.5	38.6	-----	54.0	15.4	-----

Axial Direction : ZX-Plane

Frequency [MHz]	Antenna Polarization	Meter Reading [dB(μV)]	Factor [dB/m]	Emission Level [dB(μV/m)]	Limits [dB(μV/m)]	Margin [dB]
		QP		QP		
76.52	Vertical	35.4	-15.4	20.0	40.0	20.0
258.08	Horizontal	36.3	-2.1	34.2	46.0	11.8
518.67	Vertical	31.7	-1.8	29.9	46.0	16.1

Frequency [MHz]	Antenna Polarization	Meter Reading [dB(μV)]		Factor [dB/m]	Emission Level [dB(μV/m)]		Limits [dB(μV/m)]	Margin [dB]	
		Average	Peak		Average	Peak		Average	Peak
1600.0	Horizontal	-----	55.8	-12.5	-----	43.3	74.0	-----	30.7
		51.3	-----	-12.5	38.8	-----	54.0	15.2	-----
1600.0	Vertical	-----	57.9	-12.5	-----	45.4	74.0	-----	28.6
		55.1	-----	-12.5	42.6	-----	54.0	11.4	-----
7440.0	Horizontal	-----	46.4	2.9	-----	49.3	74.0	-----	24.7
		33.2	-----	2.9	36.1	-----	54.0	17.9	-----
9920.0	Vertical	-----	45.1	5.5	-----	50.6	74.0	-----	23.4
		33.1	-----	5.5	38.6	-----	54.0	15.4	-----

Spurious Emission (Radiated) 2441MHz

Serial No. : 00037A013e28
Power : AC 120V 60Hz
Mode : Transmitting mode (GFSK Modulation)
Temperature : 23℃
Humidity : 32%

Axial Direction : XY-Plane

Frequency [MHz]	Antenna Polarization	Meter Reading [dB(μV)]	Factor [dB/m]	Emission Level [dB(μV/m)]	Limits [dB(μV/m)]	Margin [dB]
		QP		QP		
76.60	Vertical	36.0	-15.4	20.6	40.0	19.4
259.30	Horizontal	36.5	-2.0	34.5	46.0	11.5
518.67	Vertical	31.7	-1.8	29.9	46.0	16.1

Frequency [MHz]	Antenna Polarization	Meter Reading [dB(μV)]		Factor [dB/m]	Emission Level [dB(μV/m)]		Limits [dB(μV/m)]	Margin [dB]	
		Average	Peak		Average	Peak		Average	Peak
1627.0	Horizontal	-----	59.6	-12.4	-----	47.2	74.0	-----	26.8
		56.9	-----	-12.4	44.5	-----	54.0	9.5	-----
1627.0	Vertical	-----	55.6	-12.4	-----	43.2	74.0	-----	30.8
		50.6	-----	-12.4	38.2	-----	54.0	15.8	-----
4882.0	Horizontal	-----	53.0	-0.9	-----	52.1	74.0	-----	21.9
		45.6	-----	-0.9	44.7	-----	54.0	9.3	-----
4882.0	Vertical	-----	49.1	-0.9	-----	48.2	74.0	-----	25.8
		40.1	-----	-0.9	39.2	-----	54.0	14.8	-----
7440.0	Horizontal	-----	46.4	2.9	-----	49.3	74.0	-----	24.7
		33.2	-----	2.9	36.1	-----	54.0	17.9	-----
9920.0	Vertical	-----	45.1	5.5	-----	50.6	74.0	-----	23.4
		33.1	-----	5.5	38.6	-----	54.0	15.4	-----

Axial Direction : YZ-Plane

Frequency [MHz]	Antenna Polarization	Meter Reading [dB(μV)] QP	Factor [dB/m]	Emission Level [dB(μV/m)] QP	Limits [dB(μV/m)]	Margin [dB]
76.61	Vertical	35.8	-15.4	20.4	40.0	19.6
258.08	Horizontal	36.3	-2.1	34.2	46.0	11.8

Frequency [MHz]	Antenna Polarization	Meter Reading [dB(μV)]		Factor [dB/m]	Emission Level [dB(μV/m)]		Limits [dB(μV/m)]	Margin [dB]	
		Average	Peak		Average	Peak		Average	Peak
1627.0	Horizontal	-----	56.6	-12.4	-----	44.2	74.0	-----	29.8
		52.6	-----	-12.4	40.2	-----	54.0	13.8	-----
1627.0	Vertical	-----	56.5	-12.4	-----	44.1	74.0	-----	29.9
		52.4	-----	-12.4	40.0	-----	54.0	14.0	-----
4882.0	Horizontal	-----	53.0	-0.9	-----	52.1	74.0	-----	21.9
		45.8	-----	-0.9	44.9	-----	54.0	9.1	-----
4882.0	Vertical	-----	51.7	-0.9	-----	50.8	74.0	-----	23.2
		43.7	-----	-0.9	42.8	-----	54.0	11.2	-----
7440.0	Horizontal	-----	46.4	2.9	-----	49.3	74.0	-----	24.7
		33.2	-----	2.9	36.1	-----	54.0	17.9	-----
9920.0	Vertical	-----	45.1	5.5	-----	50.6	74.0	-----	23.4
		33.1	-----	5.5	38.6	-----	54.0	15.4	-----

Axial Direction : ZX-Plane

Frequency [MHz]	Antenna Polarization	Meter Reading [dB(μV)] QP	Factor [dB/m]	Emission Level [dB(μV/m)] QP	Limits [dB(μV/m)]	Margin [dB]
76.52	Vertical	35.4	-15.4	20.0	40.0	20.0
258.08	Horizontal	36.3	-2.1	34.2	46.0	11.8
518.67	Vertical	31.7	-1.8	29.9	46.0	16.1

Frequency [MHz]	Antenna Polarization	Meter Reading [dB(μV)]		Factor [dB/m]	Emission Level [dB(μV/m)]		Limits [dB(μV/m)]	Margin [dB]	
		Average	Peak		Average	Peak		Average	Peak
1627.0	Horizontal	-----	55.4	-12.4	-----	43.0	74.0	-----	31.0
		50.6	-----	-12.4	38.2	-----	54.0	15.8	-----
1627.0	Vertical	-----	57.7	-12.4	-----	45.3	74.0	-----	28.7
		54.7	-----	-12.4	42.3	-----	54.0	11.7	-----
7440.0	Horizontal	-----	46.4	2.9	-----	49.3	74.0	-----	24.7
		33.2	-----	2.9	36.1	-----	54.0	17.9	-----
9920.0	Vertical	-----	45.1	5.5	-----	50.6	74.0	-----	23.4
		33.1	-----	5.5	38.6	-----	54.0	15.4	-----

Spurious Emission (Radiated) 2480MHz

Serial No. : 00037A013e28
Power : AC 120V 60Hz
Mode : Transmitting mode (GFSK Modulation)
Temperature : 23℃
Humidity : 32%

Axial Direction : XY-Plane

Frequency [MHz]	Antenna Polarization	Meter Reading [dB(μV)]	Factor [dB/m]	Emission Level [dB(μV/m)]	Limits [dB(μV/m)]	Margin [dB]
		QP		QP		
76.60	Vertical	36.0	-15.4	20.6	40.0	19.4
259.30	Horizontal	36.5	-2.0	34.5	46.0	11.5
518.67	Vertical	31.7	-1.8	29.9	46.0	16.1

Frequency [MHz]	Antenna Polarization	Meter Reading [dB(μV)]		Factor [dB/m]	Emission Level [dB(μV/m)]		Limits [dB(μV/m)]	Margin [dB]	
		Average	Peak		Average	Peak		Average	Peak
1196.0	Vertical	-----	57.4	-12.8	-----	44.6	74.0	-----	29.4
		42.6	-----	-12.8	29.8	-----	54.0	24.2	-----
1358.5	Horizontal	-----	59.3	-12.7	-----	46.6	74.0	-----	27.4
		38.6	-----	-12.7	25.9	-----	54.0	28.1	-----
1358.5	Vertical	-----	55.5	-12.7	-----	42.8	74.0	-----	31.2
		38.4	-----	-12.7	25.7	-----	54.0	28.3	-----
1461.0	Vertical	-----	55.9	-12.7	-----	43.2	74.0	-----	30.8
		39.4	-----	-12.7	26.7	-----	54.0	27.3	-----
1654.0	Horizontal	-----	58.8	-12.3	-----	46.5	74.0	-----	27.5
		56.2	-----	-12.3	43.9	-----	54.0	10.1	-----
1654.0	Vertical	-----	56.7	-12.3	-----	44.4	74.0	-----	29.6
		52.9	-----	-12.3	40.6	-----	54.0	13.4	-----
1809.0	Vertical	-----	53.9	-10.8	-----	43.1	74.0	-----	30.9
		36.7	-----	-10.8	25.9	-----	54.0	28.1	-----
4960.0	Horizontal	-----	48.9	-0.7	-----	48.2	74.0	-----	25.8
		40.0	-----	-0.7	39.3	-----	54.0	14.7	-----
4960.0	Vertical	-----	47.2	-0.7	-----	46.5	74.0	-----	27.5
		35.0	-----	-0.7	34.3	-----	54.0	19.7	-----

Axial Direction : YZ-Plane

Frequency [MHz]	Antenna Polarization	Meter Reading [dB(μV)] QP	Factor [dB]	Emission Level [dB(μV/m)] QP	Limits [dB(μV/m)]	Margin [dB]
76.61	Vertical	35.8	-15.4	20.4	40.0	19.6
258.08	Horizontal	36.3	-2.1	34.2	46.0	11.8
518.67	Vertical	31.7	-1.8	29.9	46.0	16.1

Frequency [MHz]	Antenna Polarization	Meter Reading [dB(μV)]		Factor [dB/m]	Emission Level [dB(μV/m)]		Limits [dB(μV/m)]	Margin [dB]	
		Average	Peak		Average	Peak		Average	Peak
1653.0	Horizontal	-----	56.9	-12.3	-----	44.6	74.0	-----	29.4
		53.1	-----	-12.3	40.8	-----	54.0	13.2	-----
1653.0	Vertical	-----	56.1	-12.3	-----	43.8	74.0	-----	30.2
		52.6	-----	-12.3	40.3	-----	54.0	13.7	-----
7440.0	Horizontal	-----	46.4	2.9	-----	49.3	74.0	-----	24.7
		33.2	-----	2.9	36.1	-----	54.0	17.9	-----
9920.0	Vertical	-----	45.1	5.5	-----	50.6	74.0	-----	23.4
		33.1	-----	5.5	38.6	-----	54.0	15.4	-----

Axial Direction : ZX-Plane

Frequency [MHz]	Antenna Polarization	Meter Reading [dB(μV)] QP	Factor [dB/m]	Emission Level [dB(μV/m)] QP	Limits [dB(μV/m)]	Margin [dB]
76.52	Vertical	35.4	-15.4	20.0	40.0	20.0
258.08	Horizontal	36.3	-2.1	34.2	46.0	11.8
518.67	Vertical	31.7	-1.8	29.9	46.0	16.1

Frequency [MHz]	Antenna Polarization	Meter Reading [dB(μV)]		Factor [dB/m]	Emission Level [dB(μV/m)]		Limits [dB(μV/m)]	Margin [dB]	
		Average	Peak		Average	Peak		Average	Peak
1653.0	Horizontal	-----	54.5	-12.3	-----	42.2	74.0	-----	31.8
		50.2	-----	-12.3	37.9	-----	54.0	16.1	-----
1653.0	Vertical	-----	56.7	-12.3	-----	44.4	74.0	-----	29.6
		53.2	-----	-12.3	40.9	-----	74.0	13.1	-----
7440.0	Horizontal	-----	46.4	2.9	-----	49.3	74.0	-----	24.7
		33.2	-----	2.9	36.1	-----	54.0	17.9	-----
9920.0	Vertical	-----	45.1	5.5	-----	50.6	74.0	-----	23.4
		33.1	-----	5.5	38.6	-----	54.0	15.4	-----

7 20dB Bandwidth

7.1 Test Setup

The spectrum analyzer was connected directly to the transmitter output.

Spectrum analyzer setting : -
DETECTOR MODE : PEAK
RBW : 30kHz
VBW : 30kHz
SPAN : 2MHz
SWEEP TIME : AUTO

7.2 Test Instrument

Equipment	Manufacture	Model No.	Serial No.	Next Calibration Due
Spectrum Analyzer	Rohode&Schwarz	FSIQ26	840061/0004	7th.2.2006.

7.3 Test Results

Serial No. : 00037a01f019
Power : DC 5.0V (Supply by USB Port)
Mode : Transmitting mode , Non Frequency Hopping
Temperature : 24 ℃
Humidity : 50%

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

CH	Freqency [MHz]	20dB Bandwidth [MHz]
0ch(Lowest)	2402.0	0.942
39ch(Middle)	2441.0	0.942
78ch(Highest)	2480.0	0.942

(2) Operation mode: Transmitting mode (π /4 DQPSK Modulation)

CH	Freqency [MHz]	20dB Bandwidth [MHz]
0ch(Lowest)	2402.0	1.238
39ch(Middle)	2441.0	1.238
78ch(Highest)	2480.0	1.242

(3) Operation mode: Transmitting mode (8DPSK Modulation)

CH	Freqency [MHz]	20dB Bandwidth [MHz]
0ch(Lowest)	2402.0	1.275
39ch(Middle)	2441.0	1.271
78ch(Highest)	2480.0	1.271

8 Carrier Frequency Separation

8.1 Test Setup

The spectrum analyzer was connected directly to the transmitter output.

Spectrum Analyzer setting : -
DETECTOR MODE :PEAK
RBW : 100kHz
VBW : 300kHz
SPAN : 3MHz
SWEEP TIME : AUTO

8.2 Test Instrument

Equipment	Manufacture	Model No.	Serial No.	Next Calibration Due
Spectrum Analyzer	Rohode&Schwarz	FSIQ26	840061/0004	7th.2.2006.

8.3 Test Results

Serial No. : 00037a01f019
Power : DC 5.0V (Supply by USB Port)
Mode : Transmitting mode , Frequency Hopping (79ch)
Transmitting mode , Adoptive Frequency Hopping (20ch)
Temperature : 24 ℃
Humidity : 50%
Regulation : FCC Part15 C §15.247 (a)(1)
FCC 04-165

(1) Operation mode: Transmitting mode (GFSK Modulation)
Transmitting mode , Frequency Hopping (79ch)

Channel	Channel Separation [MHz]	Limit
Low frequency (0ch-1ch)	0.956	> two-thirds of the 20dB Bandwidth
Middle frequency (38ch-39ch)	1.004	> two-thirds of the 20dB Bandwidth
High frequency (77ch-78ch)	1.004	> two-thirds of the 20dB Bandwidth

Transmitting mode , Adoptive Frequency Hopping (20ch)

Channel	Channel Separation [MHz]	Limit
Low frequency	1.004	> two-thirds of the 20dB Bandwidth
Middle frequency	1.016	> two-thirds of the 20dB Bandwidth
High frequency	1.004	> two-thirds of the 20dB Bandwidth

Remarks: 20dB Bandwidth is 0.628MHz. Refer to Clause 7.3

(2) Operation mode: Transmitting mode (π /4 DQPSK Modulation)

Transmitting mode , Frequency Hopping (79ch)

Channel	Channel Separation [MHz]	Limit
Low frequency (0ch-1ch)	1.004	> two-thirds of the 20dB Bandwidth
Middle frequency (38ch-39ch)	0.998	> two-thirds of the 20dB Bandwidth
High frequency (77ch-78ch)	1.004	> two-thirds of the 20dB Bandwidth

Transmitting mode , Adoptive Frequency Hopping (20ch)

Channel	Channel Separation [MHz]	Limit
Low frequency	1.010	> two-thirds of the 20dB Bandwidth
Middle frequency	1.004	> two-thirds of the 20dB Bandwidth
High frequency	1.004	> two-thirds of the 20dB Bandwidth

Remarks: 20dB Bandwidth is 0.825MHz. Refer to Clause 7.3

(3) Operation mode: Transmitting mode (8DPSK Modulation)

Transmitting mode , Frequency Hopping (79ch)

Channel	Channel Separation [MHz]	Limit
Low frequency (0ch-1ch)	1.004	> two-thirds of the 20dB Bandwidth
Middle frequency (38ch-39ch)	0.974	> two-thirds of the 20dB Bandwidth
High frequency (77ch-78ch)	1.004	> two-thirds of the 20dB Bandwidth

Transmitting mode , Adoptive Frequency Hopping (20ch)

Channel	Channel Separation [MHz]	Limit
Low frequency	1.004	> two-thirds of the 20dB Bandwidth
Middle frequency	1.022	> two-thirds of the 20dB Bandwidth
High frequency	1.016	> two-thirds of the 20dB Bandwidth

Remarks: 20dB Bandwidth is 0.850MHz. Refer to Clause 7.3

9 Number of Hopping Frequency

9.1 Test Setup

The spectrum analyzer was connected directly to the transmitter output.

spectrum analyzer setting : -
DETECTOR MODE : PEAK
RBW : 300kHz
VBW : 300kHz
SWEEP TIME : AUTO

9.2 Test Instrument

Equipment	Manufacture	Model No.	Serial No.	Next Calibration Due
Spectrum Analyzer	Rohode&Schwarz	FSIQ26	840061/0004	7th.2.2006.

9.3 Test Results

Serial No. : 00037a01f019
Power : DC 5.0V (Supply by USB Port)
Mode : Transmitting mode , Frequency Hopping (79ch)
Transmitting mode , Adoptive Frequency Hopping (20ch)
Temperature : 24 ℃
Humidity : 50%
Regulation : FCC Part15 C §15.247 (a)(1)(iii)

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

Mode	Number of channel [time]	Limit [time]
Transmitting mode Frequency Hopping (79ch)	79	≧ 75
Transmitting mode Adoptive Frequency Hopping (20ch)	20 *A	≧ 15

AFH: Intelligent hopping techniques to avoid interference to other transmission.

*A: All of them are not overlapped to each other.

(2) Operation mode: Transmitting mode (π /4 DQPSK Modulation)

Mode	Number of channel [time]	Limit [time]
Transmitting mode Frequency Hopping (79ch)	79	≧ 75
Transmitting mode Adoptive Frequency Hopping (20ch)	20 *A	≧ 15

AFH: Intelligent hopping techniques to avoid interference to other transmission.

*A: All of them are not overlapped to each other.

(3) Operation mode: Transmitting mode (8DPSK Modulation)

Mode	Number of channel [time]	Limit [time]
Transmitting mode Frequency Hopping (79ch)	79	≧ 75
Transmitting mode Adoptive Frequency Hopping (20ch)	20 *A	≧ 15

AFH: Intelligent hopping techniques to avoid interference to other transmission.

*A: All of them are not overlapped to each other.

10 Dwell Time

10.1 Test Setup

The spectrum analyzer was connected directly to the transmitter output.

Spectrum analyzer setting : -
DETECTOR MODE : PEAK
RBW : 1MHz
VBW : 1MHz
SPAN : 0Hz
SWEEP TIME : AUTO

10.2 Test Instrument

Equipment	Manufacture	Model No.	Serial No.	Next Calibration Due
Spectrum Analyzer	Rohode&Schwarz	FSIQ26	840061/0004	7th.2.2006.

10.3 Test Results

Serial No. : 00037a01f019
Power : DC 5.0V (Supply by USB Port)
Mode : Transmitting mode (GFSK Modulation), Frequency Hopping (79ch)
Temperature : 22 ℃
Humidity : 42%
Regulation : FCC Part15 C §15.247 (a)(1)(iii)

Packet	Dwell time [ms]	Limit [ms]
DH1	134.77ms	400
DH3	271.23ms	400
DH5	312.65ms	400

-

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

Time of occupancy (Dwell Time) for packet type DH1.

FH hop 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 426.7μs (see next plot).
Then dwell time is 320.11 x 421us = 134.77ms per 31.6 seconds.

Time of occupancy (Dwell Time) for packet type DH3.

FH hop 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=5.1 (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.
5.1 x 31.6 = 161.16 (times)

Transmitting time is 1.683ms (see next plot).
Then dwell time is 161.16 x 1.683ms = 271.23ms per 31.6 seconds.

Time of occupancy (Dwell Time) for packet type DH5.

FH hop 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 2.933ms (see next plot).
Then dwell time is 106.49 x 2.936ms = 312.65ms per 31.6 seconds.

11 Maximum Peak Output Power

11.1 Test Setup

The spectrum analyzer was connected directly to the transmitter output.

spectrum analyzer setting : -
DETECTOR MODE : PEAK
RBW : 1MHz
VBW : 1MHz
SWEEP TIME : AUTO

11.2 Test Instrument

Equipment	Manufacture	Model No.	Serial No.	Next Calibration Due
Spectrum Analyzer	Rohode&Schwarz	FSIQ26	840061/0004	7th.2.2006.

11.3 Test Results

Serial No. : 00037a01f019
Power : DC 5.0V
Mode : Transmitting mode , Non Frequency Hopping
Temperature : 24 ℃
Humidity : 50%
Regulation : FCC Part15 C §15.247 (b)(1)

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

CH	Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Result [dBm]	Limit [dBm]
0ch(Lowest)	2402.0	-2.18	1.67	-0.51	30.0
39ch(Middle)	2441.0	-1.84	1.67	-0.17	30.0
78ch(Highest)	2480.0	-2.85	1.67	-1.18	30.0

Result = Reading + Cable Loss

(2) Operation mode: Transmitting mode (π /4 DQPSK (Modulation)

CH	Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Result [dBm]	Limit [dBm]
0ch(Lowest)	2402.0	-2.65	1.67	-0.98	30.0
39ch(Middle)	2441.0	-3.29	1.67	-1.62	30.0
78ch(Highest)	2480.0	-3.87	1.67	-2.20	30.0

Result = Reading + Cable Loss

(3) Operation mode: Transmitting mode (8DPSK Modulation)

CH	Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Result [dBm]	Limit [dBm]
0ch(Lowest)	2402.0	-2.63	1.67	-0.96	30.0
39ch(Middle)	2441.0	-3.27	1.67	-1.60	30.0
78ch(Highest)	2480.0	-3.83	1.67	-2.16	30.0

Result = Reading + Cable Loss

12 Band Edge Compliance

12.1 Test Setup

The spectrum analyzer was connected directly to the transmitter output.

Spectrum analyzer setting : -
DETECTOR MODE : PEAK
RBW : 100kHz
VBW : 100kHz
SWEEP TIME : AUTO

12.2 Test Instrument

Equipment	Manufacture	Model No.	Serial No.	Next Calibration Due
Spectrum Analyzer	Rohode&Schwarz	FSIQ26	840061/0004	7th.2.2006.

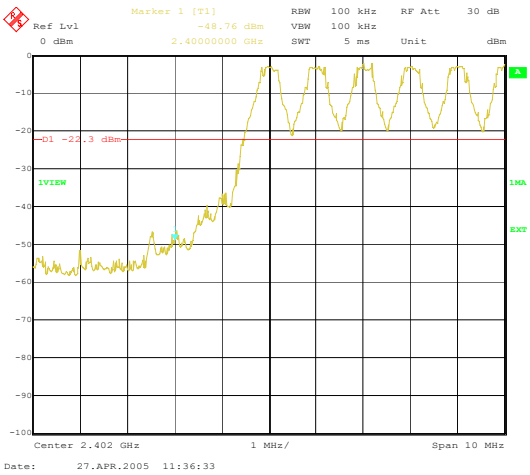
12.3 Test Results

Serial No. : 00037a01f019
Power : DC 5.0V
Mode : Transmitting mode , Frequency Hopping (79ch)
Transmitting mode , Adoptive Frequency Hopping (20ch)
Temperature : 24 ℃
Humidity : 50%
Regulation : FCC Part15 C §15.247 (c)

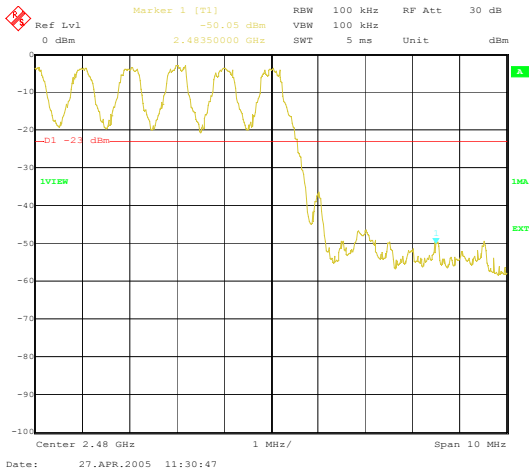
The spectrum data are attached below. Display line indicates the 20dB offset below highest level. It shows compliance with the requirement in part 15.247(c)

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

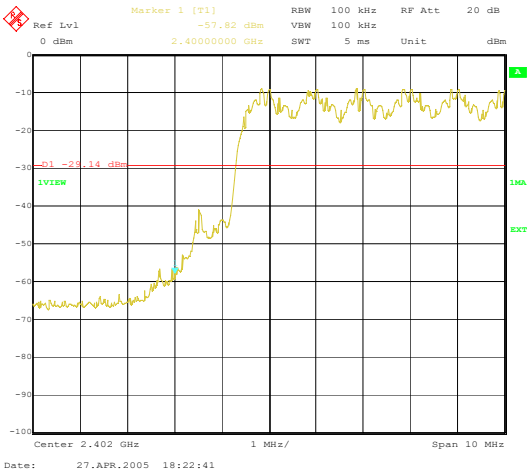
Frequency Hopping 79ch (2402MHz)



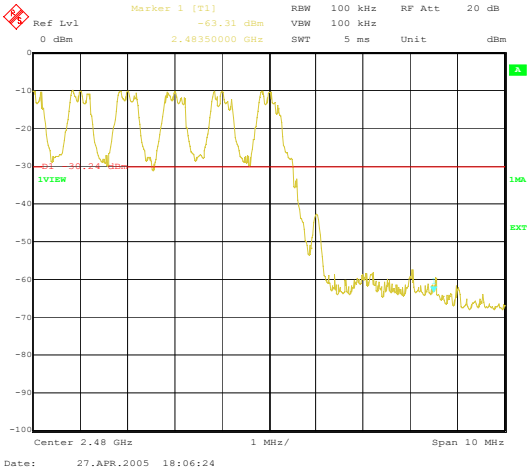
Frequency Hopping 79ch (2480MHz)



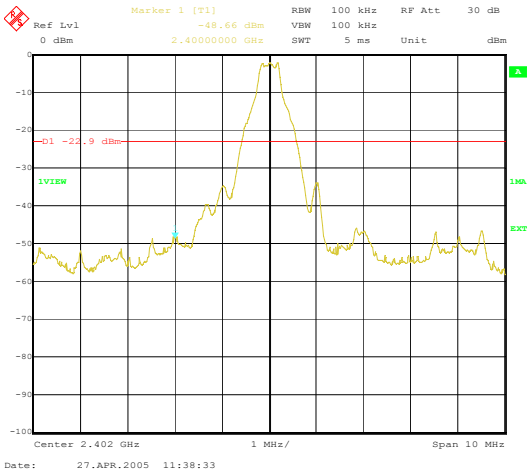
Adoptive Frequency Hopping 20ch (2402MHz)



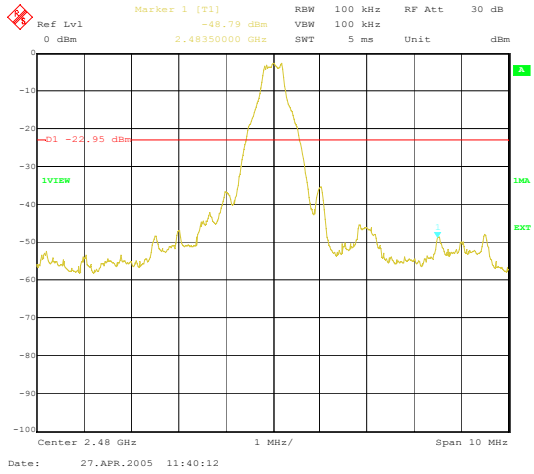
Adoptive Frequency Hopping 20ch (2480MHz)



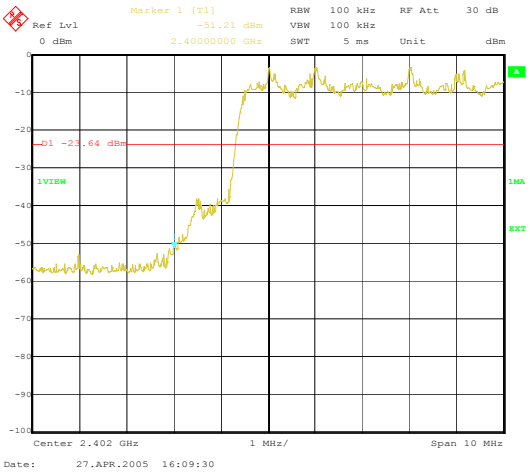
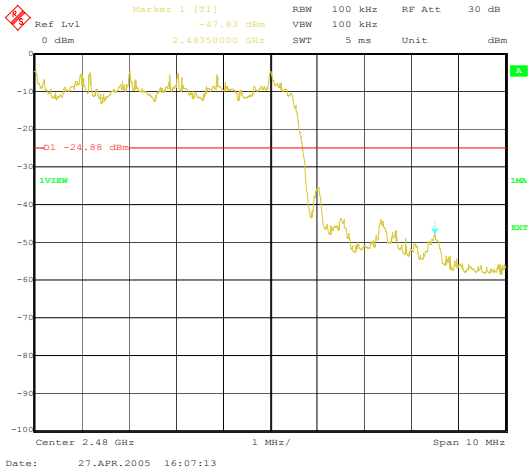
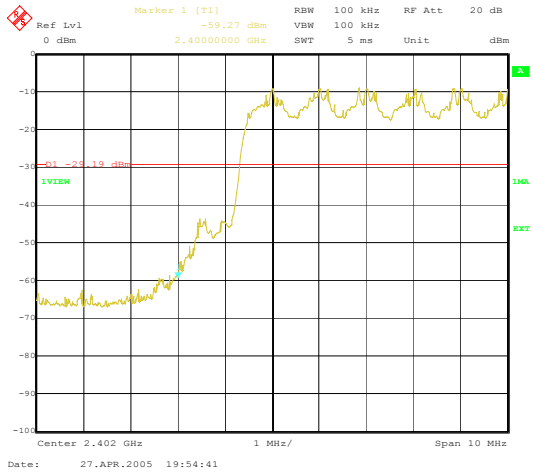
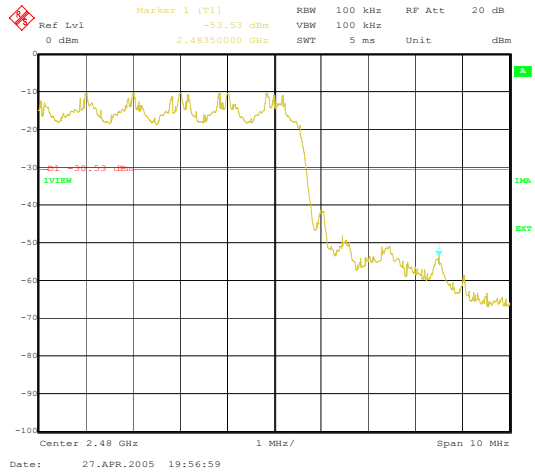
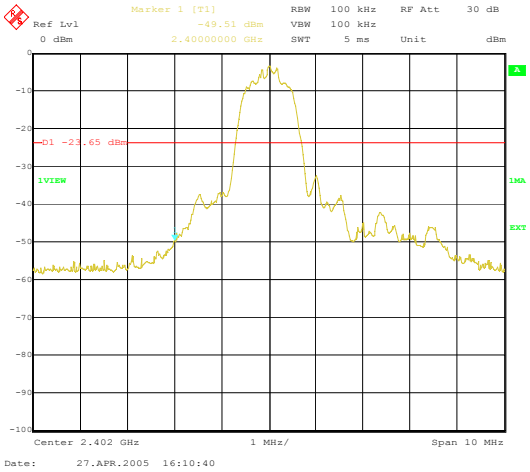
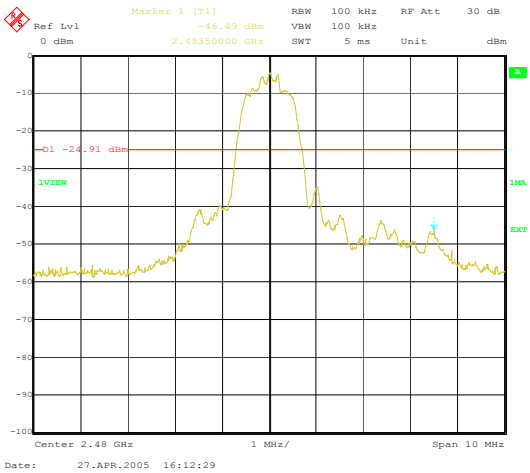
Non Frequency Hopping (0ch(Lowest) 2402MHz)



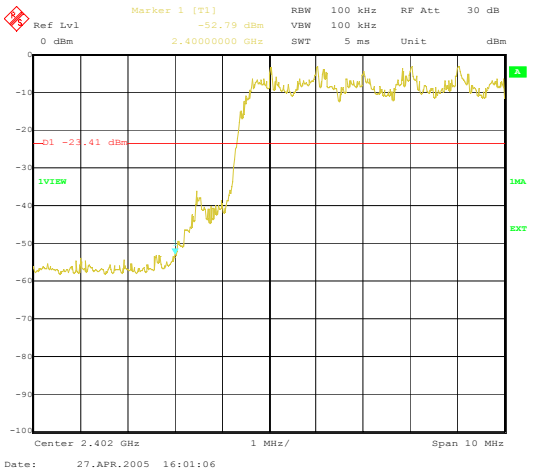
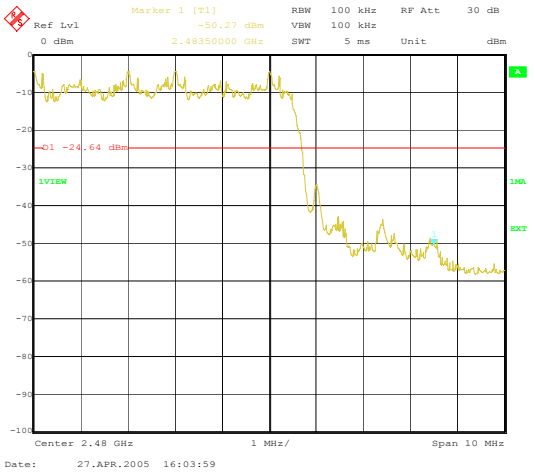
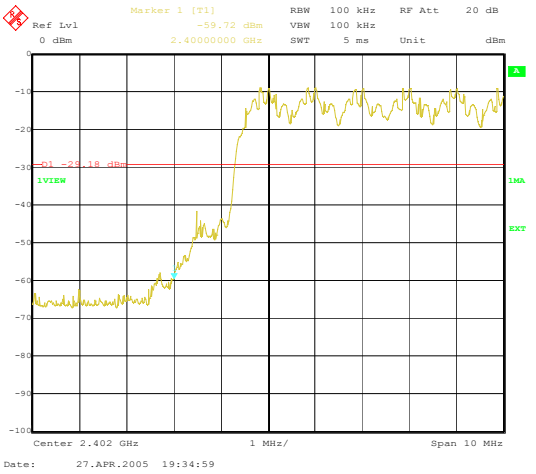
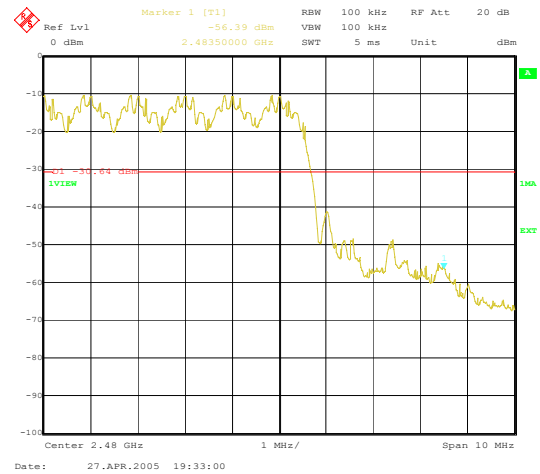
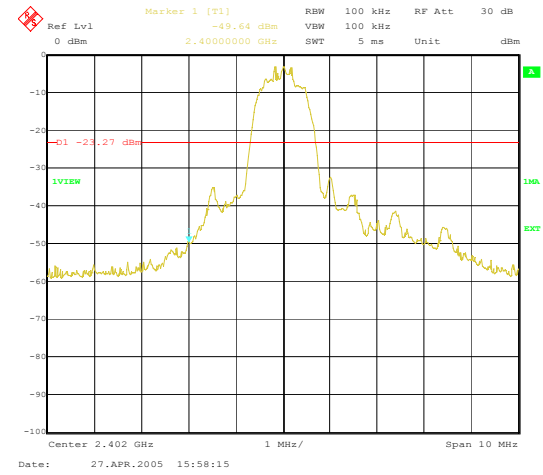
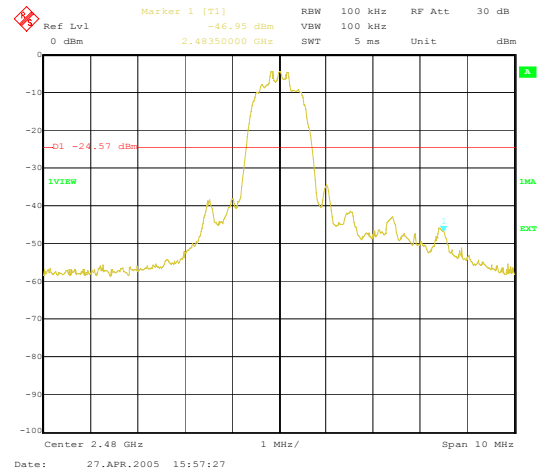
Non Frequency Hopping (0ch(Lowest) 2480MHz)



Operation mode: Transmitting mode , (π/4 DQPSK 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(0ch(Lowest) 2480MHz)
	

(2) Operation mode: Transmitting mode , (8DPSK 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 (0ch(Lowest) 2480MHz)**
	

13 Spurious RF Conducted Emission

13.1 Test Setup

The spectrum analyzer was connected directly to the transmitter output.

spectrum analyzer setting : -
DETECTOR : PEAK
RBW : 100kHz
VBW : 100kHz
SWEEP TIME : AUTO

13.2 Test Instrument

Equipment	Manufacture	Model No.	Serial No.	Next Calibration Due
Spectrum Analyzer	Rohode&Schwarz	FSIQ26	840061/0004	7th.2.2006.

13.3 Test Results

Serial No. : 00037a01f019
Power : DC 5.0V
Mode : Transmitting mode , Non Frequency Hopping
Temperature : 24 ℃
Humidity : 50%
Regulation : FCC Part15 C §15.247 (c)

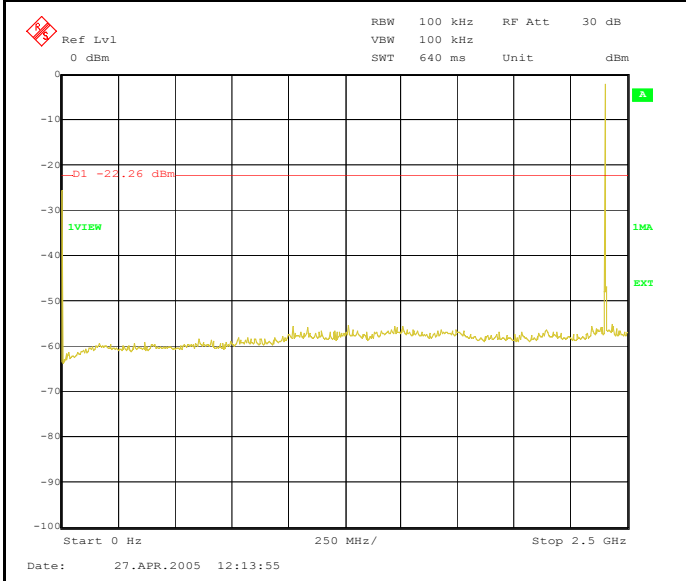
The spectrum data are attached below. Display line indicates the 20dB offset below highest level.
It shows compliance with the requirement in part 15.247(c)

Non Frequency Hopping

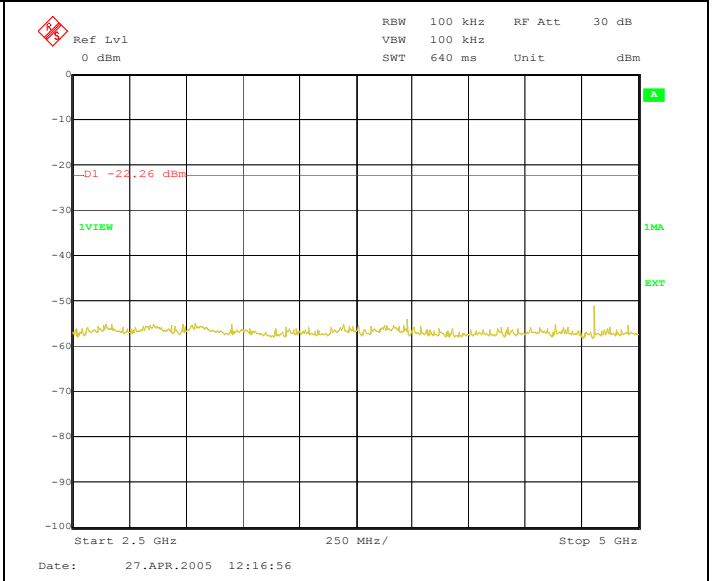
(1) Operation mode: Transmitting mode , (GFSK Modulation)

0ch(Lowest) 2402MHz

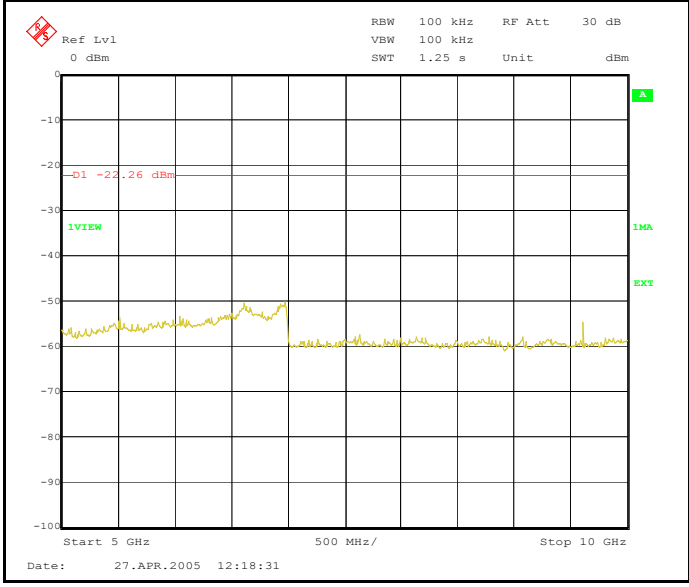
10MHz～2.5GHz



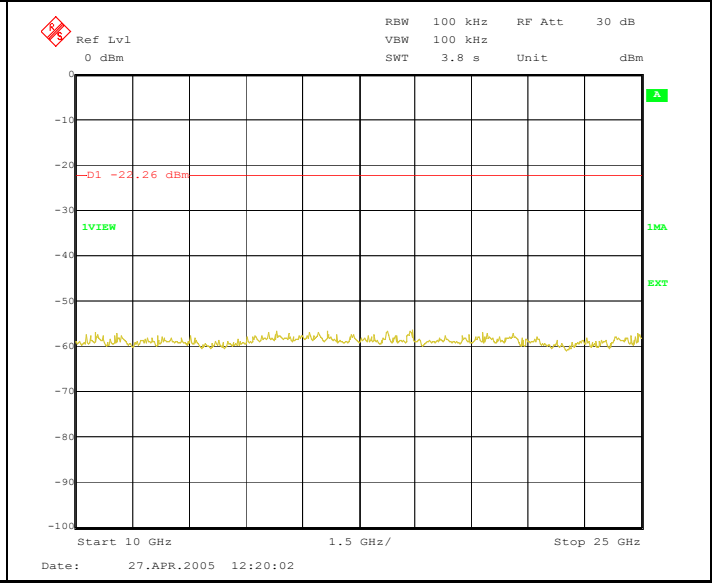
2.5GHz～10GHz



5GHz～10GHz

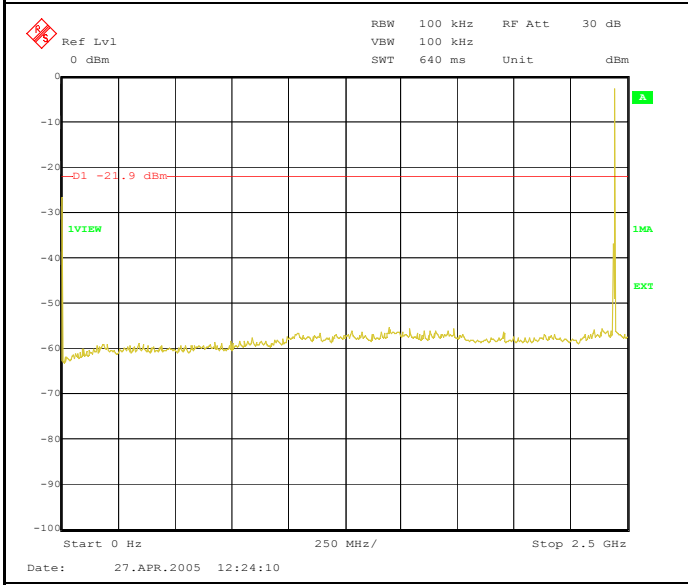


10GHz～25GHz

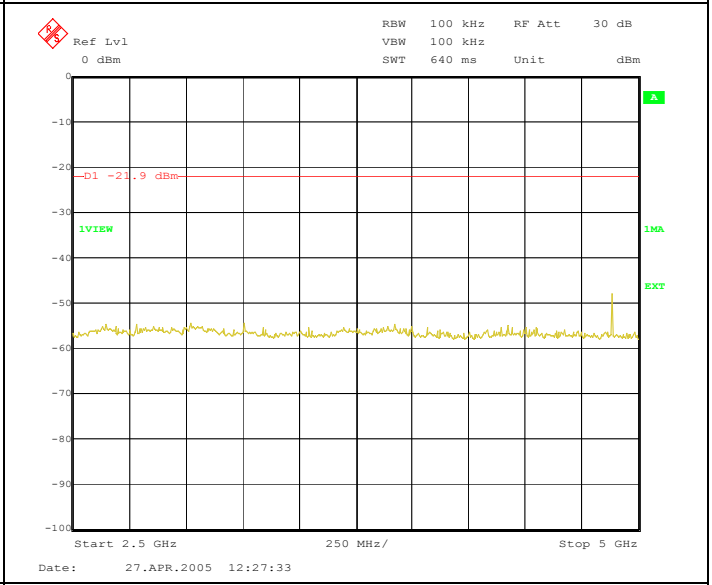


39ch(Middle) 2441MHz

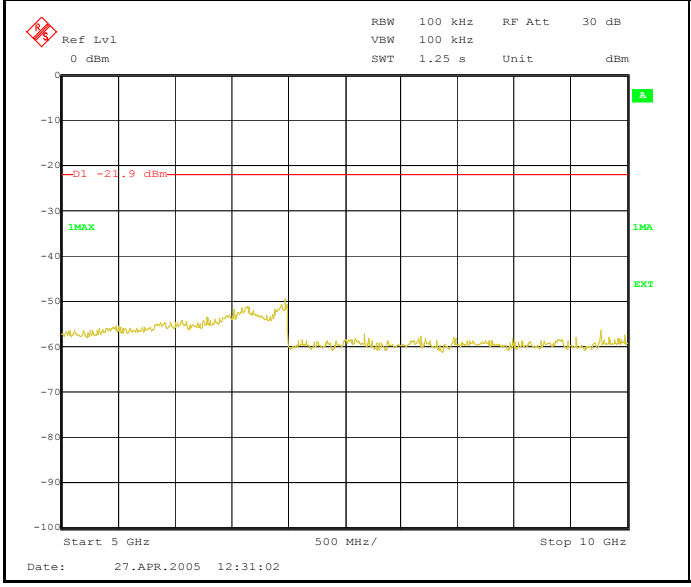
10MHz～2.5GHz



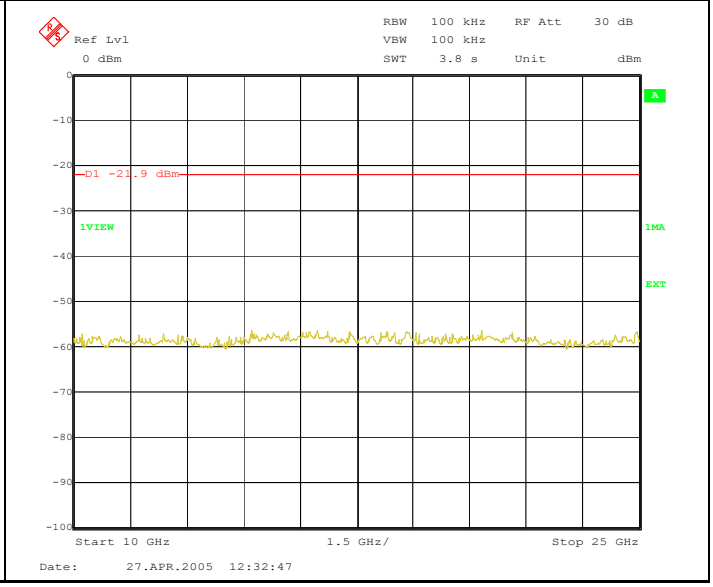
2.5GHz～10GHz



5GHz～10GHz

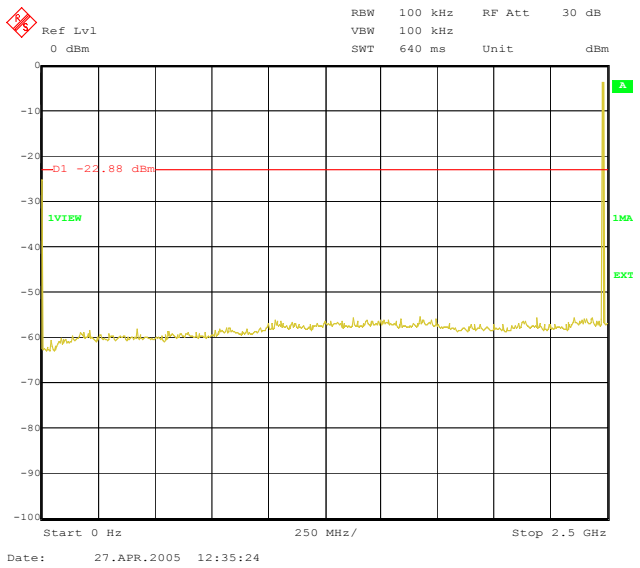


10GHz～25GHz

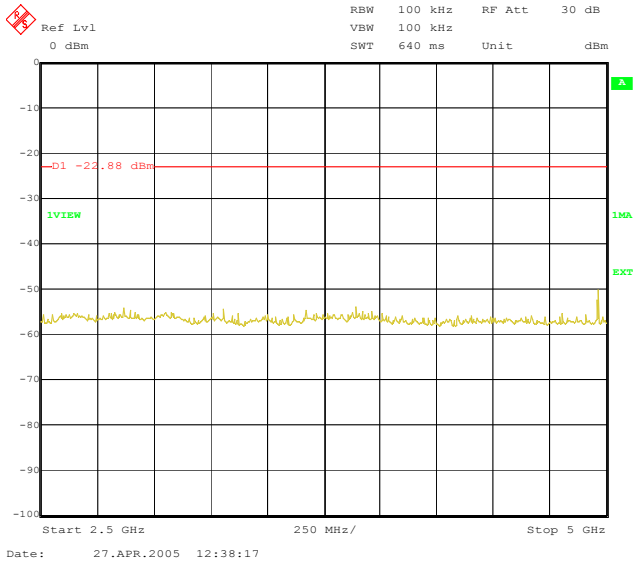


78ch(Highest) 2480MHz

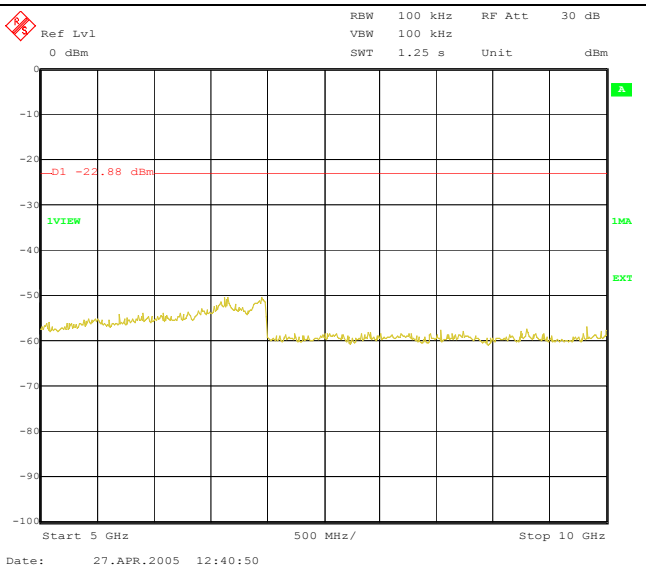
10MHz～2.5GHz



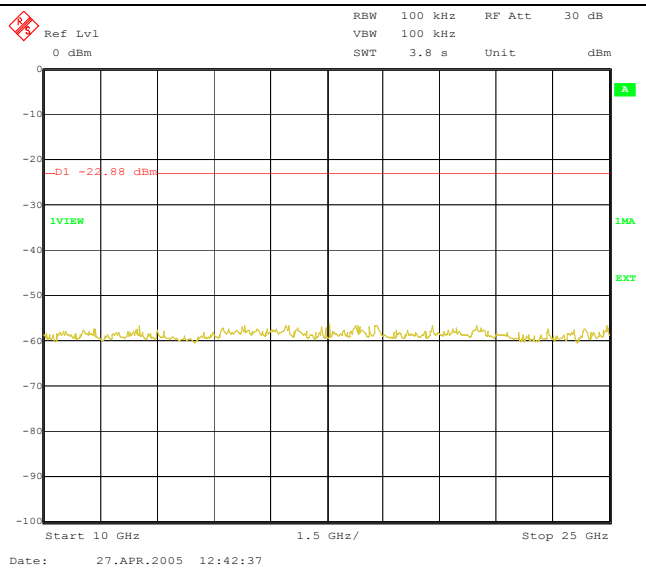
2.5GHz～10GHz



5GHz～10GHz

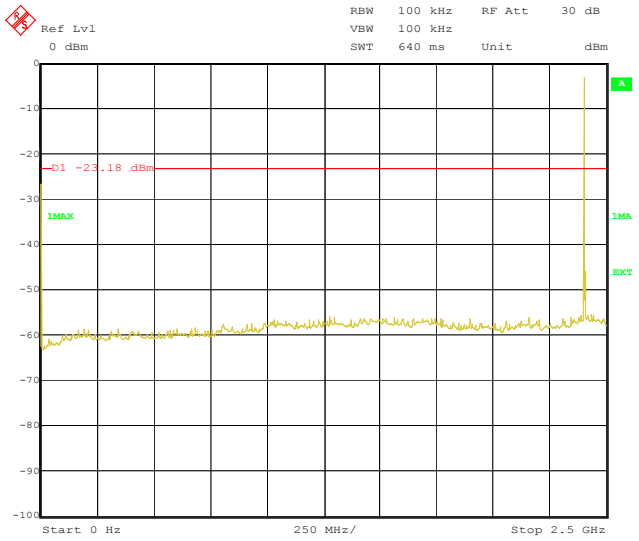
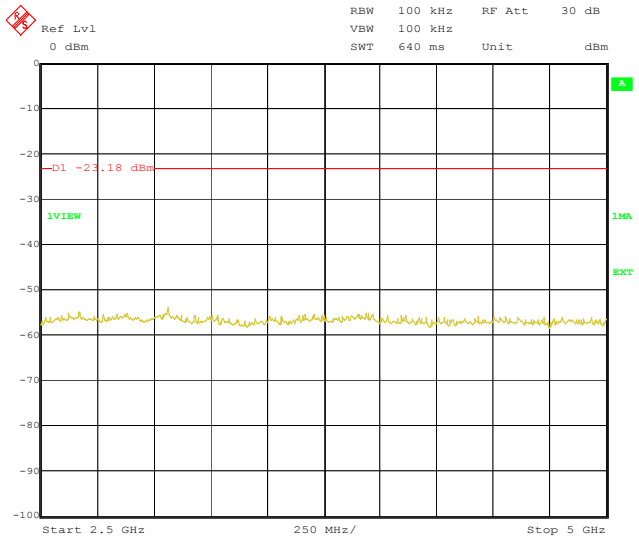
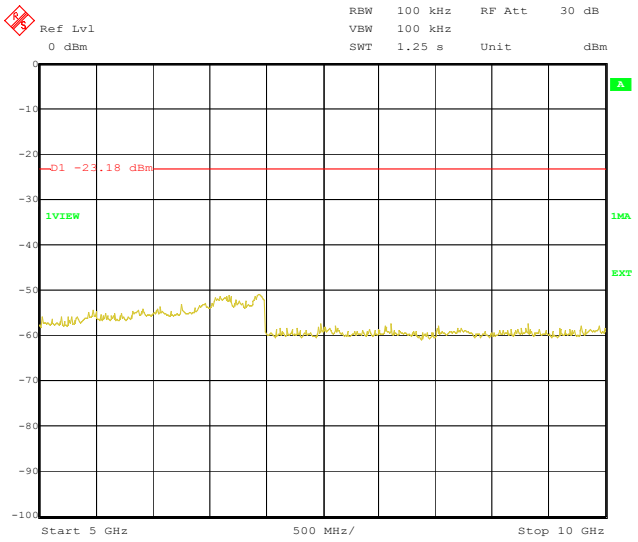
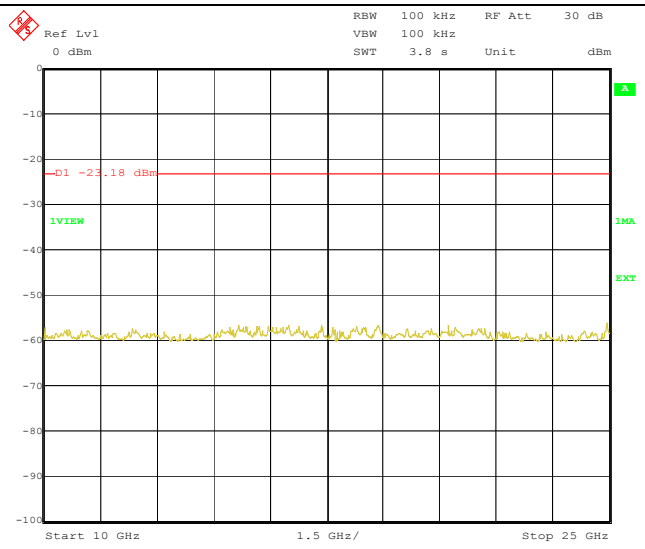


10GHz～25GHz



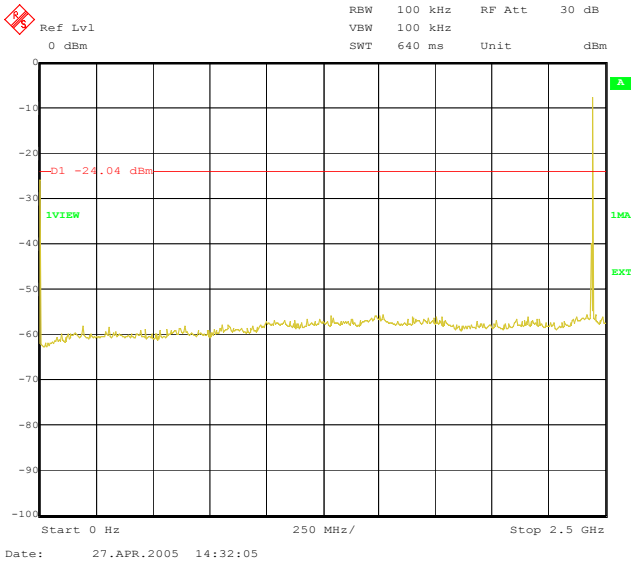
(2) Operation mode: Transmitting mode , (π/4 DQPSK Modulation)

0ch(Lowest) 2402MHz

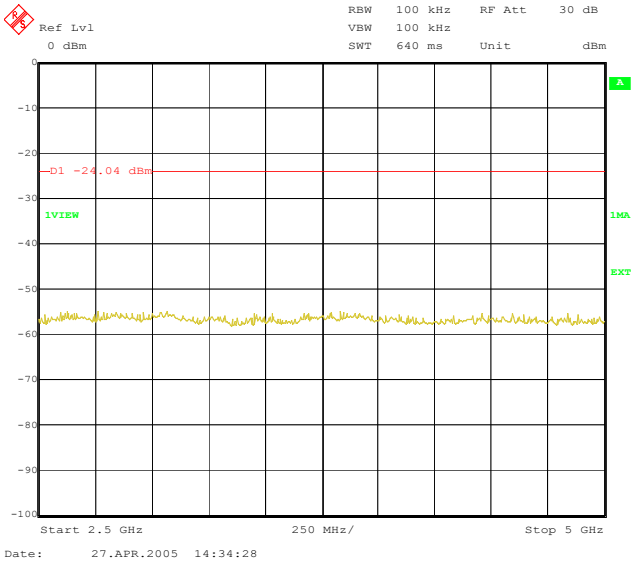
10MHz～2.5GHz	2.5GHz～10GHz
	
5GHz～10GHz	10GHz～25GHz
	

39ch(Middle) 2441MHz

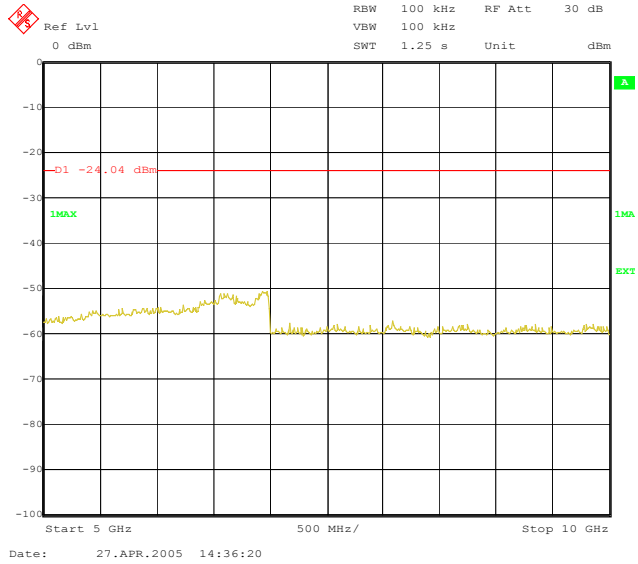
10MHz～2.5GHz



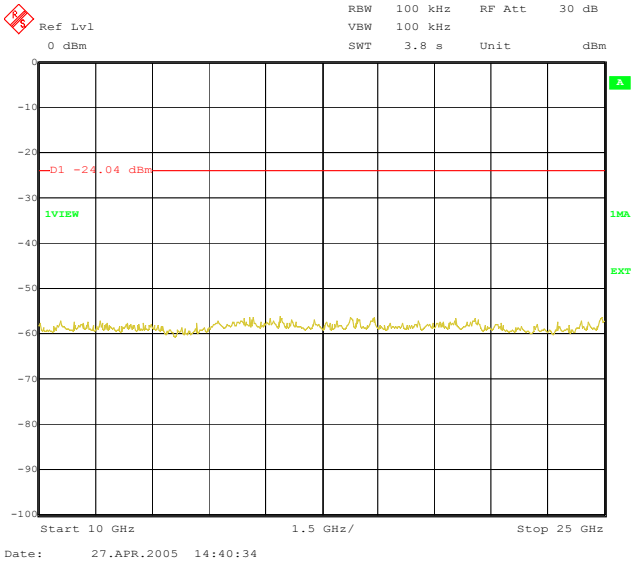
2.5GHz～10GHz



5GHz～10GHz

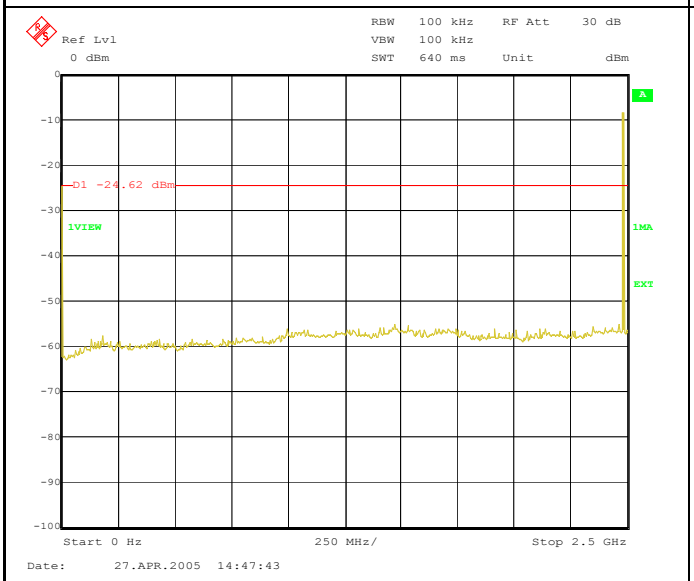


10GHz～25GHz

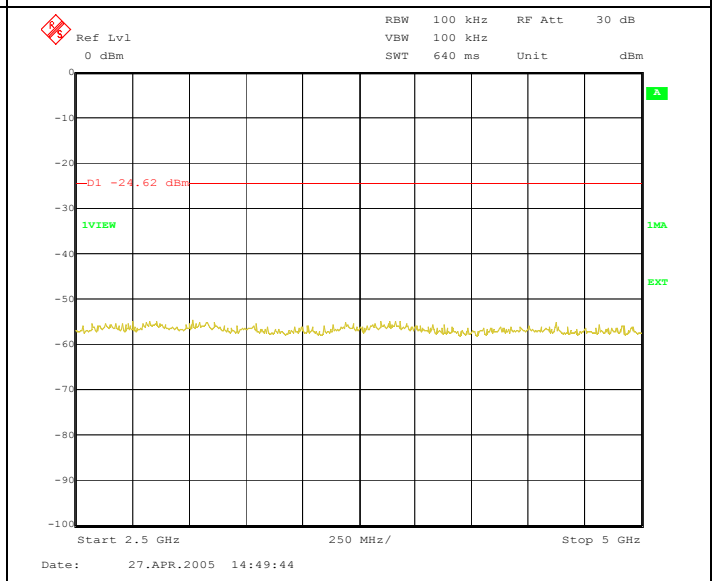


78ch(Highest) 2480MHz

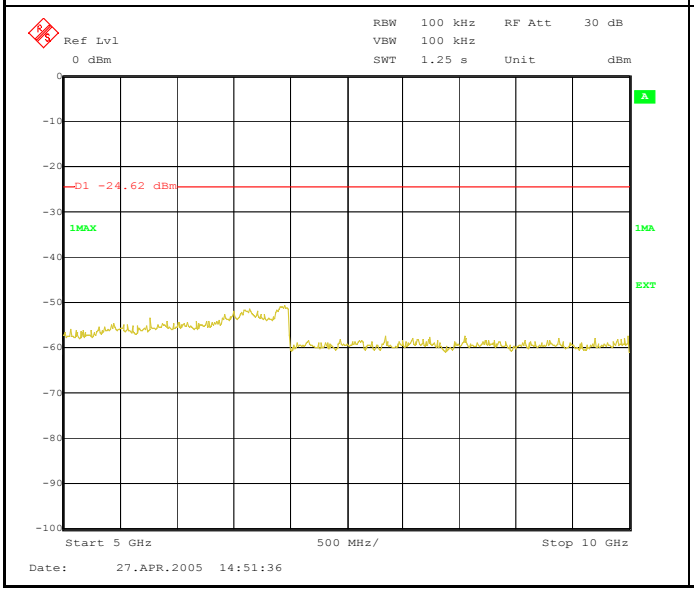
10MHz～2.5GHz



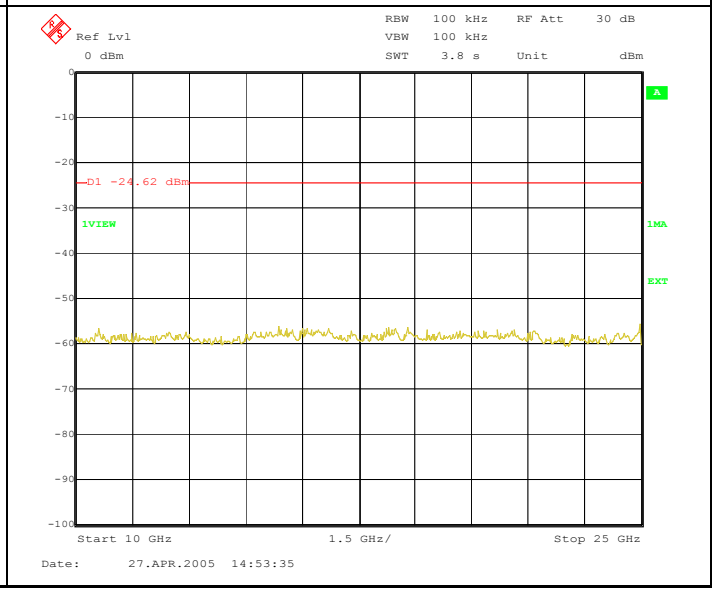
2.5GHz～10GHz



5GHz～10GHz

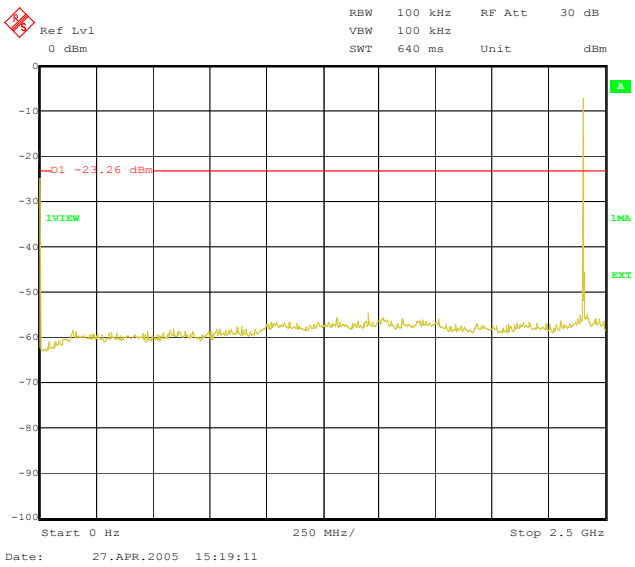
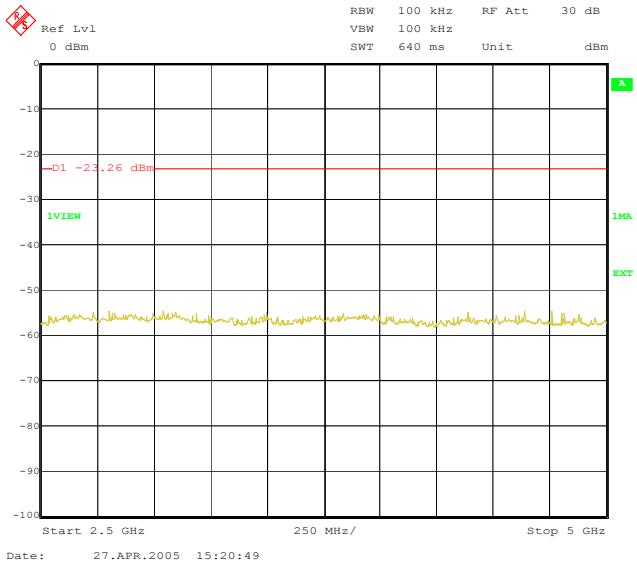
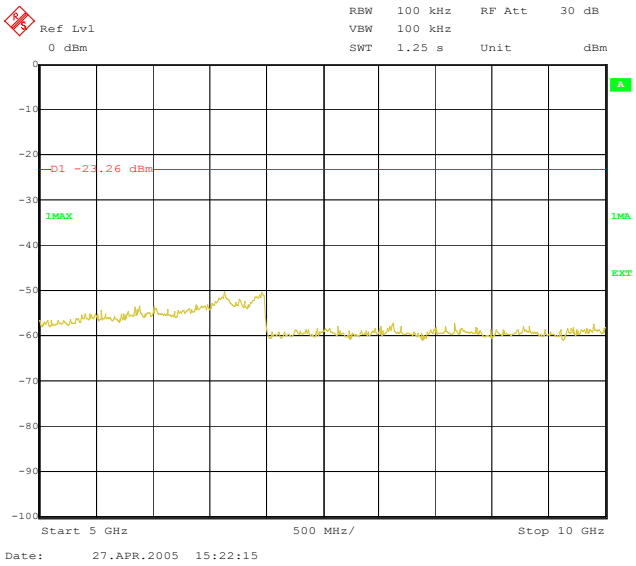
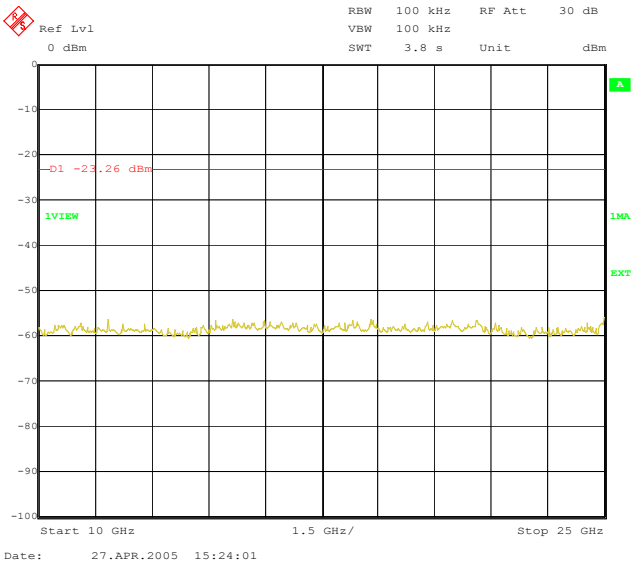


10GHz～25GHz



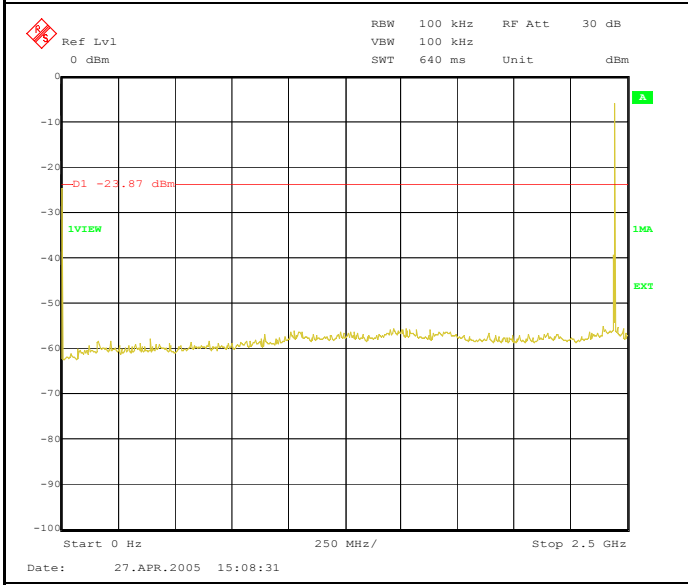
(3) Operation mode: Transmitting mode , (8DPSK Modulation)

0ch(Lowest) 2402MHz

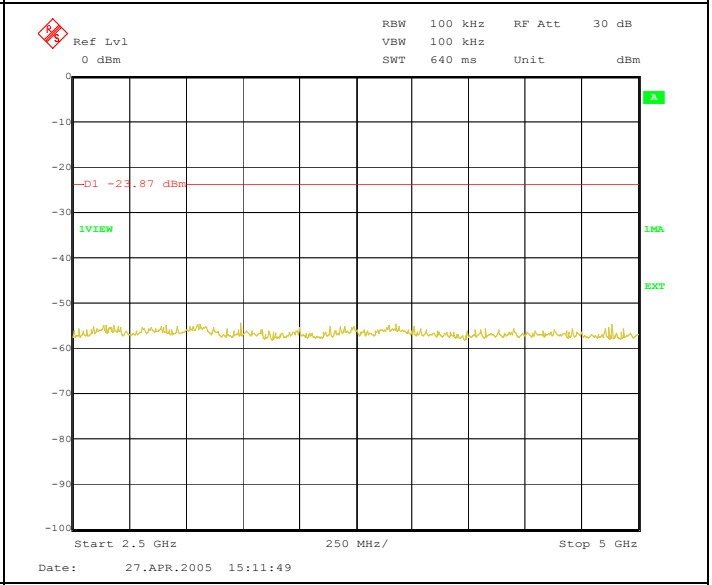
10MHz～2.5GHz	2.5GHz～10GHz
	
5GHz～10GHz	10GHz～25GHz
	

39ch(Middle) 2441MHz

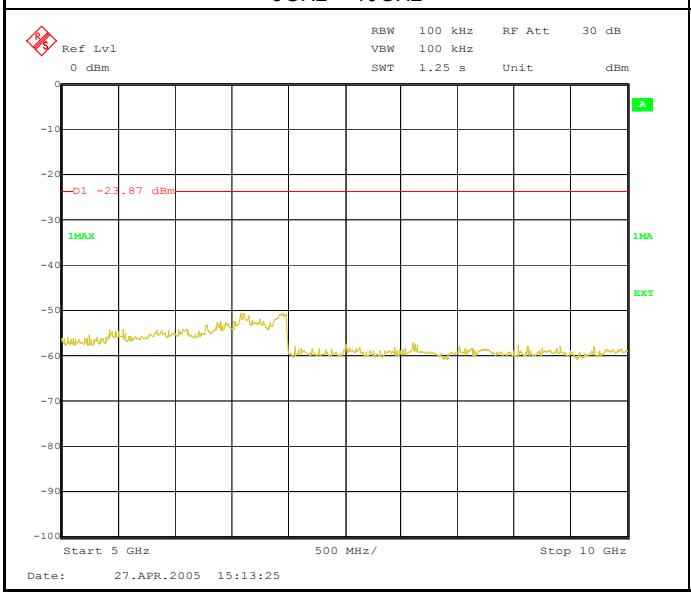
10MHz～2.5GHz



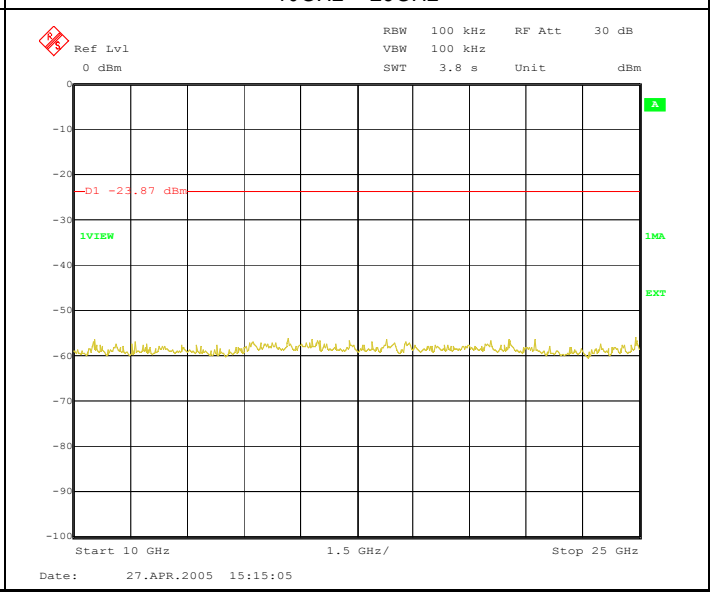
2.5GHz～10GHz



5GHz～10GHz

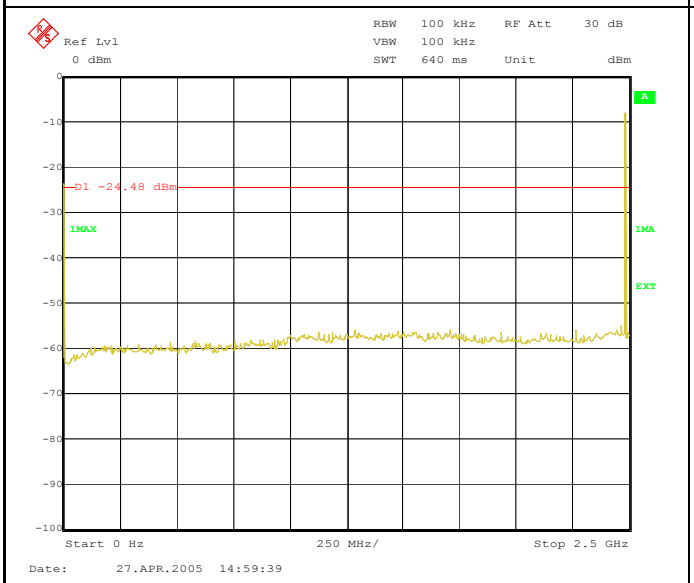


10GHz～25GHz

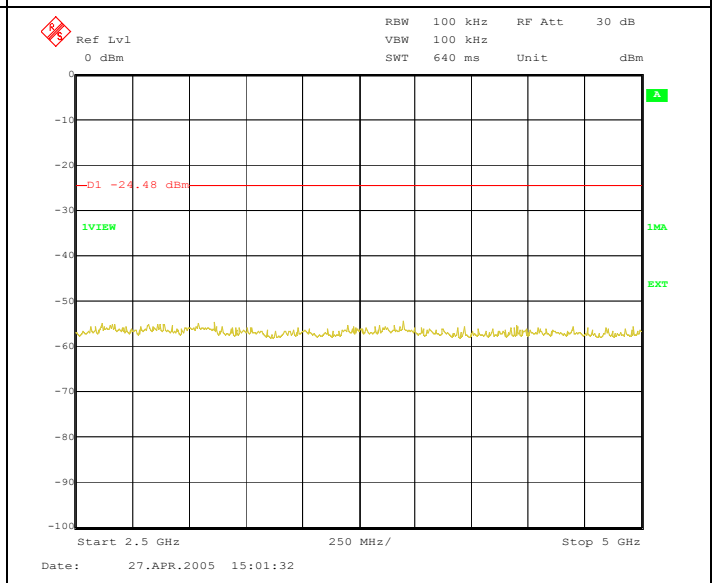


78ch(Highest) 2480MHz

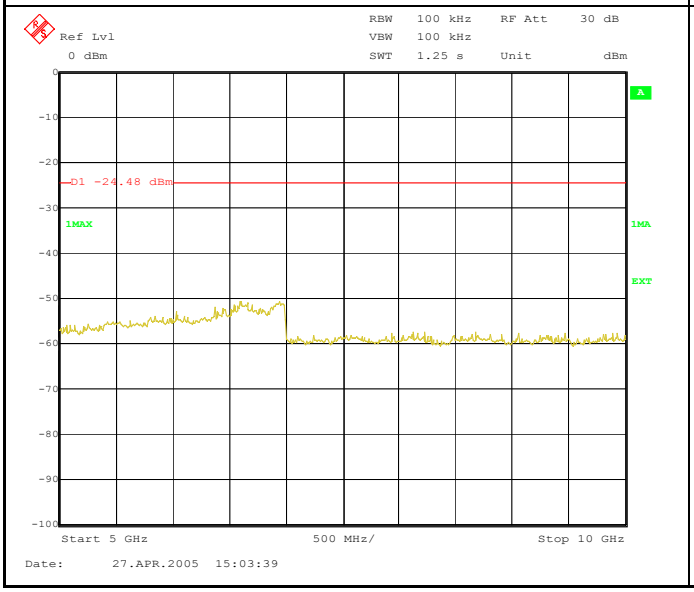
10MHz～2.5GHz



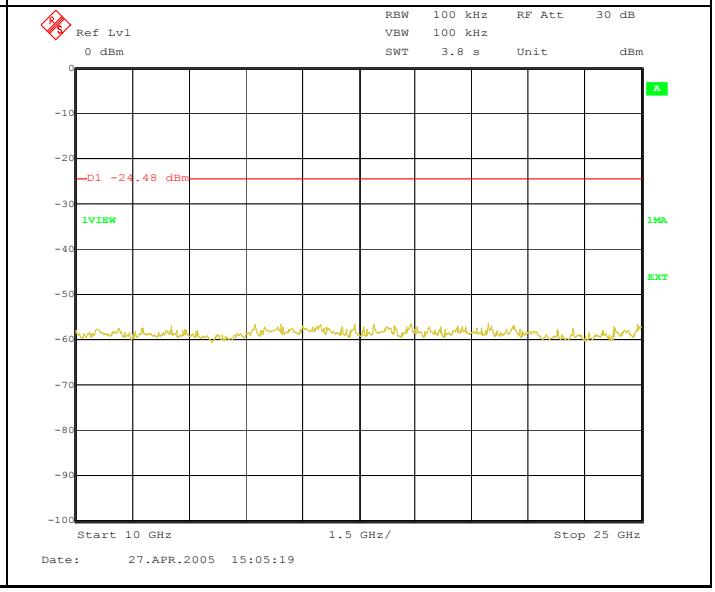
2.5GHz～10GHz



5GHz～10GHz



10GHz～25GHz

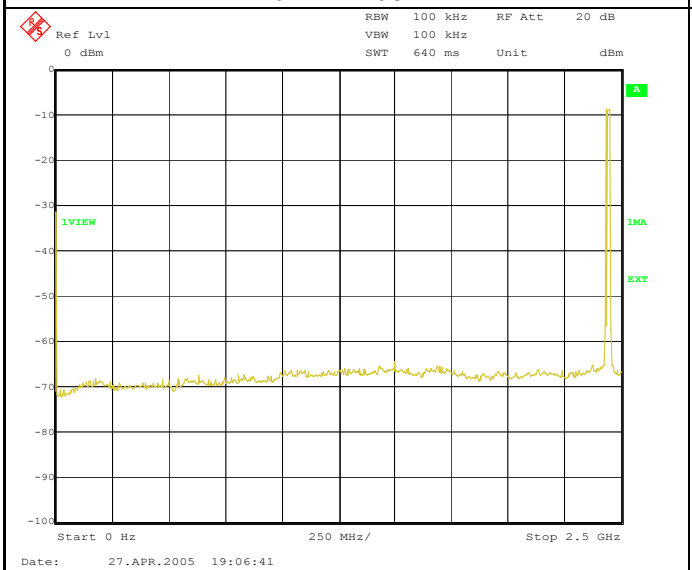


The spectrum data are attached below. Display line indicates the 20dB offset below highest level.
It shows compliance with the requirement in part 15.247(c)

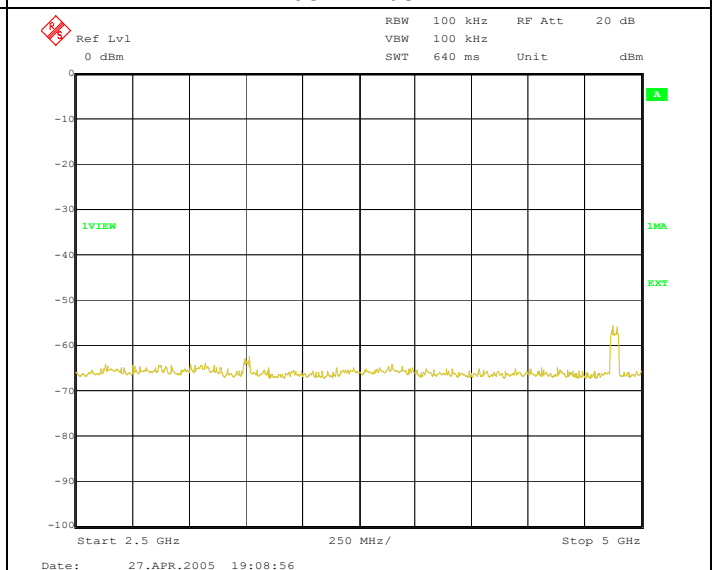
Adoptive Frequency Hopping (20ch)

(1) Operation mode: Transmitting mode , (GFSK Modulation)

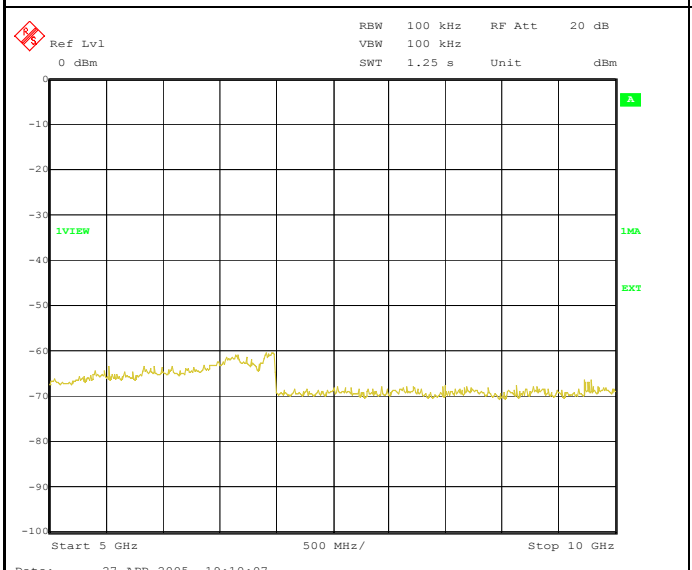
10MHz～2.5GHz



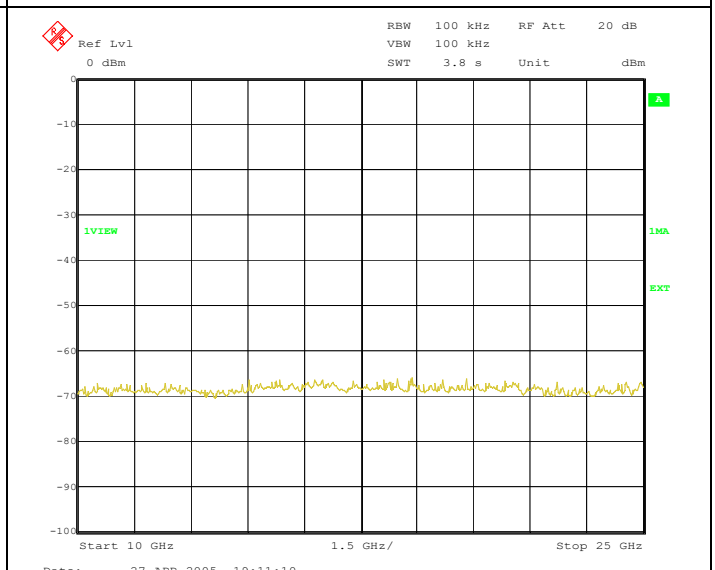
2.5GHz～10GHz



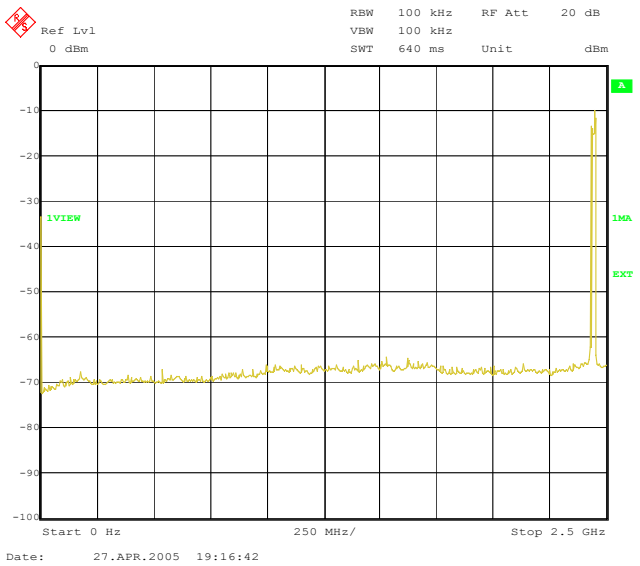
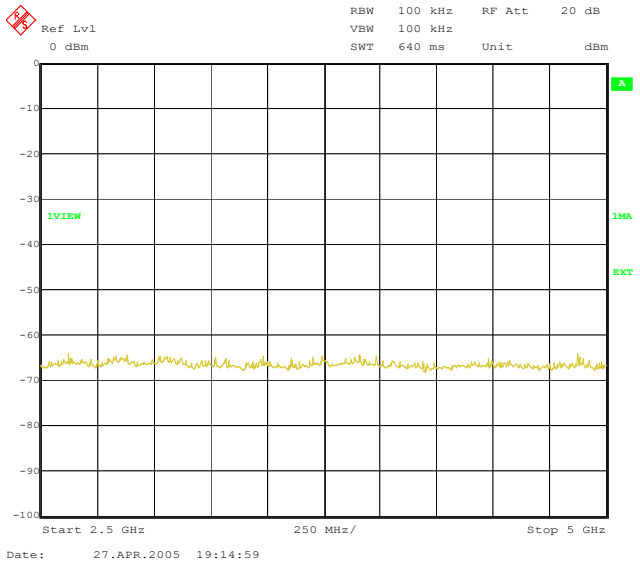
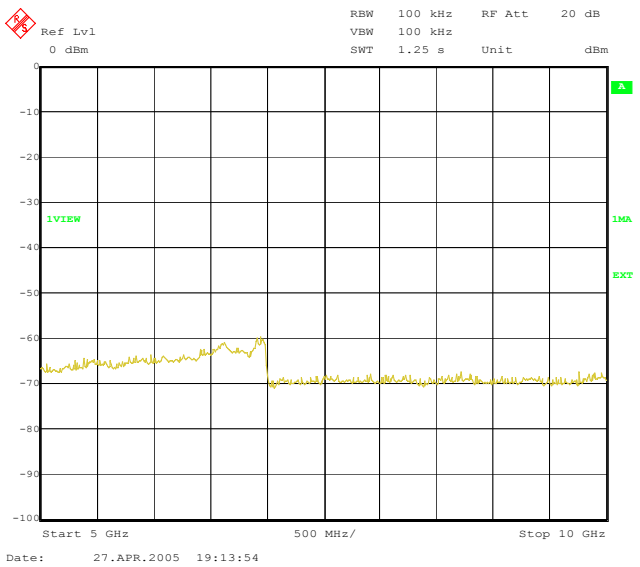
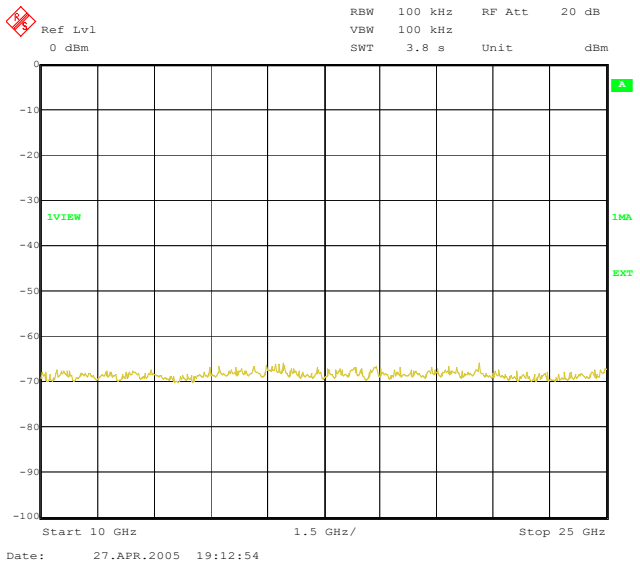
5GHz～10GHz



10GHz～25GHz

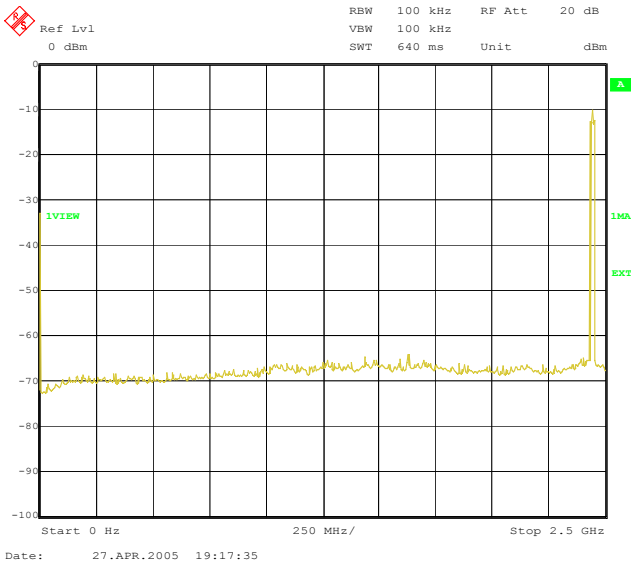


(2) Operation mode: Transmitting mode , (π/4 DQPSK Modulation)

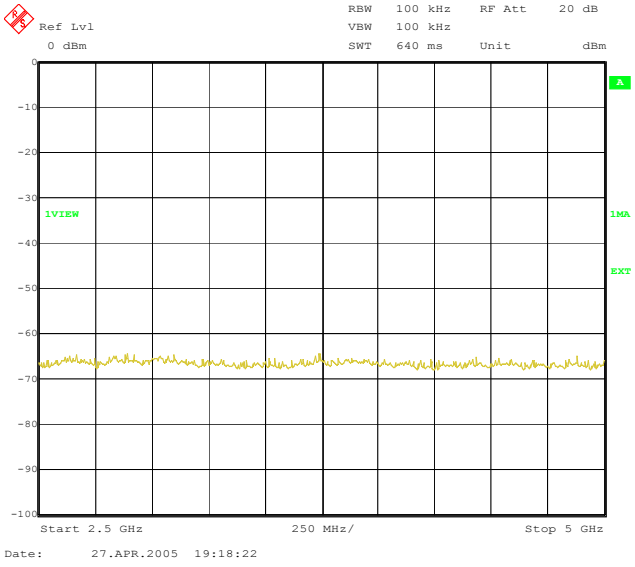
10MHz～2.5GHz	2.5GHz～10GHz
	
5GHz～10GHz	10GHz～25GHz
	

(3) Operation mode: Transmitting mode , (8DPSK Modulation)

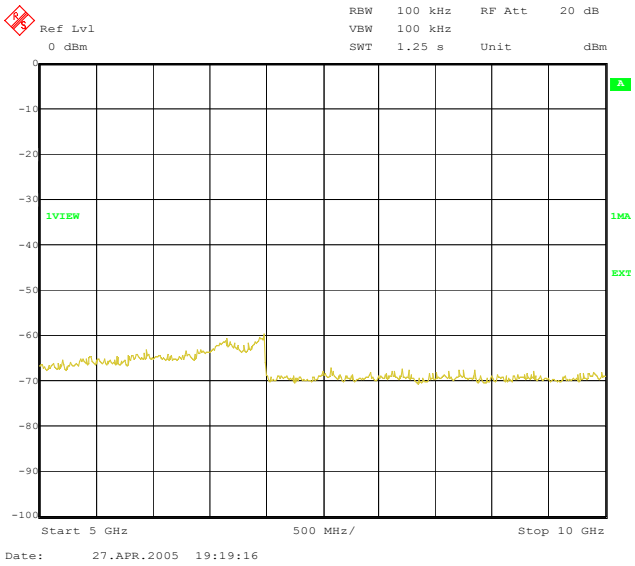
10MHz～2.5GHz



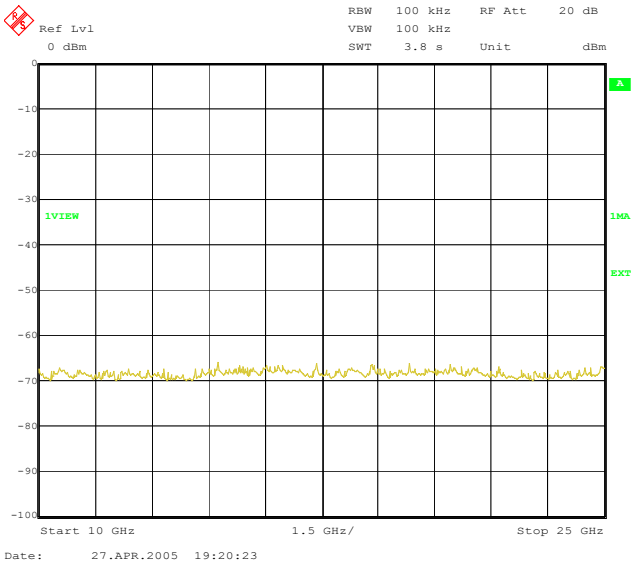
2.5GHz～10GHz



5GHz～10GHz



10GHz～25GHz



14 EIRP 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.

EIRP Calculation :

A	B	C	D	E
Specified Antenna Gain (dBi)	Minimum Cable Losses (dB)	Total Antenna Gain (dBi)	Max. RF Output Power at Antenna Terminal (dBm)	**Total EIRP (dBm)**
2.078	0	2.078	-1.07	**1.008**

Calculation : C = A + B, E = C + D

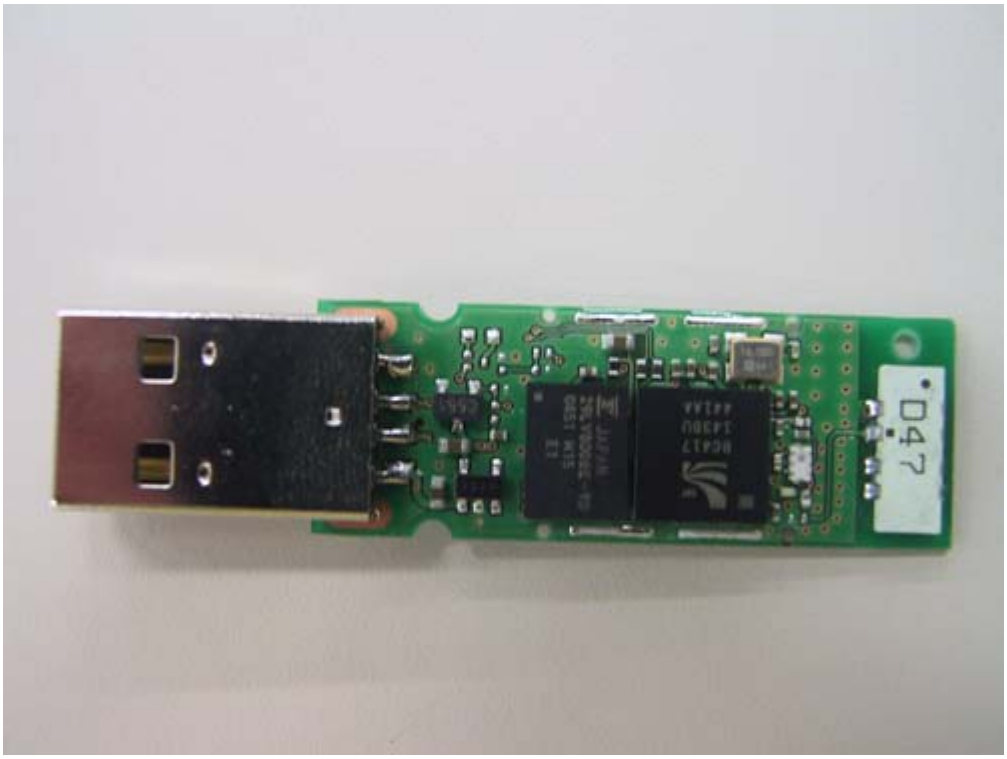
Note : Cable losses was very small and it can not measured due to the antenna and the transmitting circuit was connected by printed circuit.

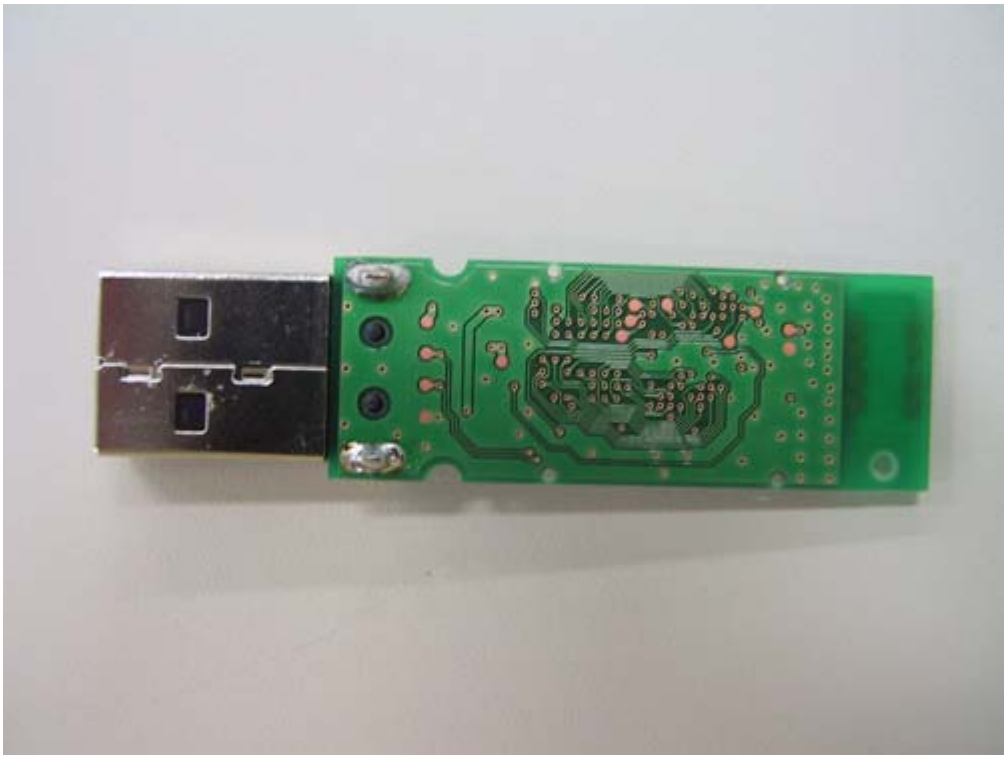
EIRP = 1.008dBm = 1.26mW

15 PHOTOS OF TESTED EUT

15.1 External Photos

15.2 Internal Photos

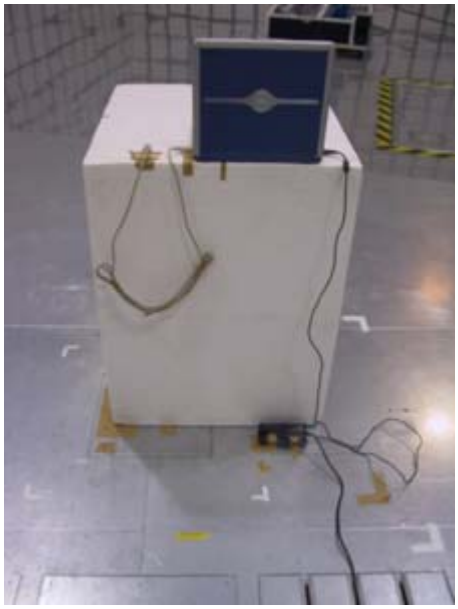




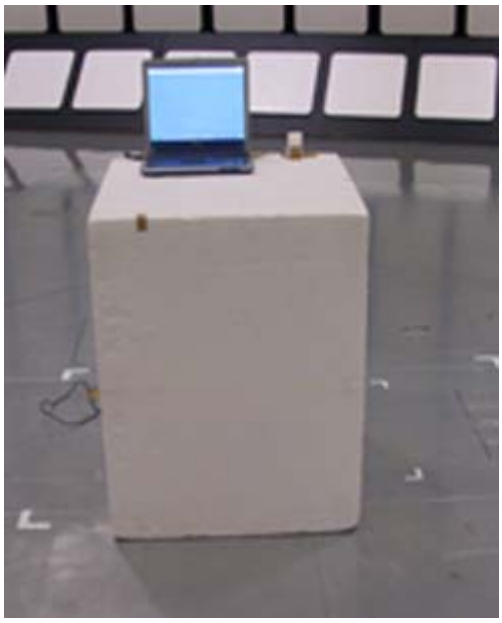
16 PHOTOS OF TEST SETUP

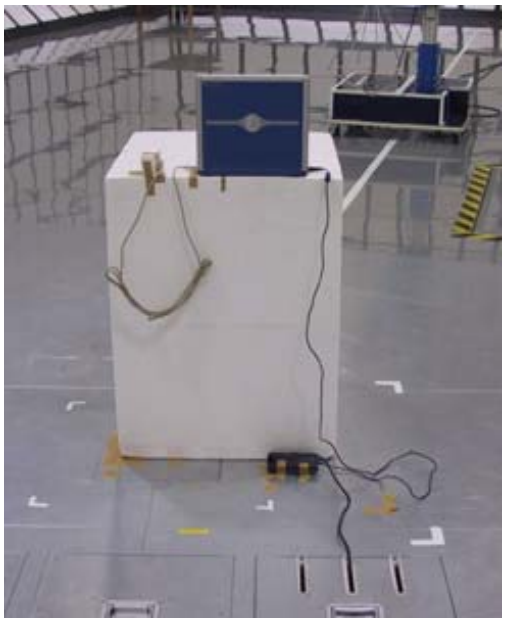
16.1 Photos of Radiated Measurement

Axial Direction : XY-Plane

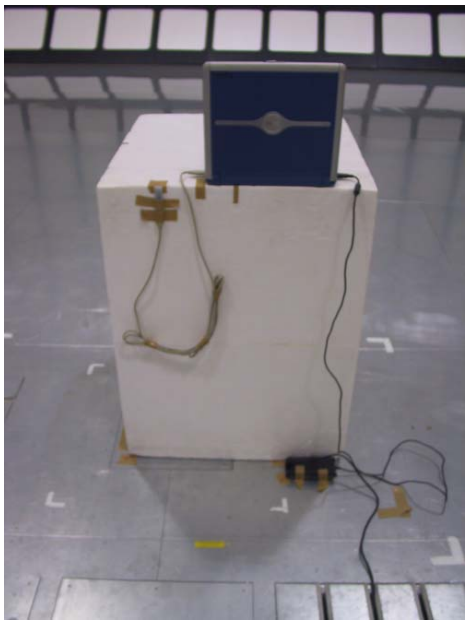


Axial Direction : YZ-Plane

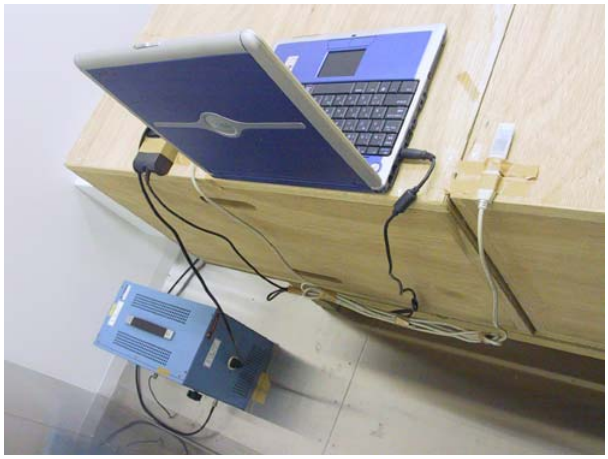




Axial Direction : ZX-Plane



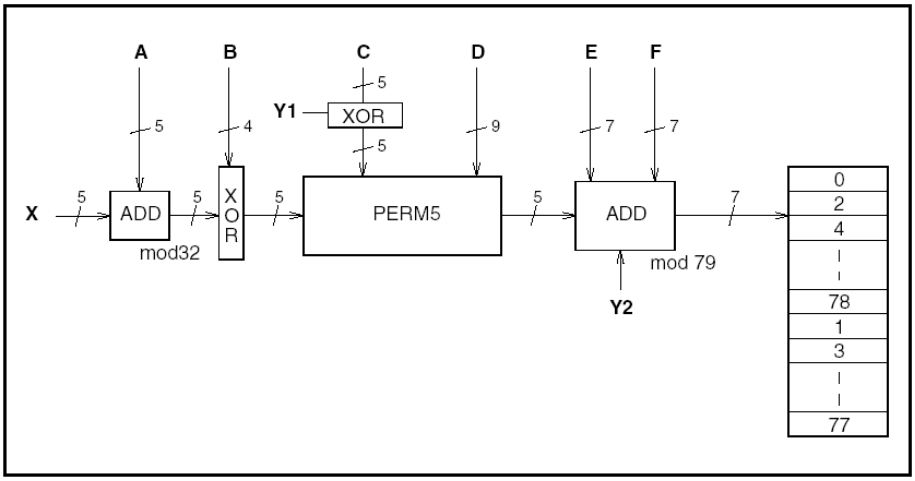
16.2 Photos of Conducted Measurement



APPENDIX 1

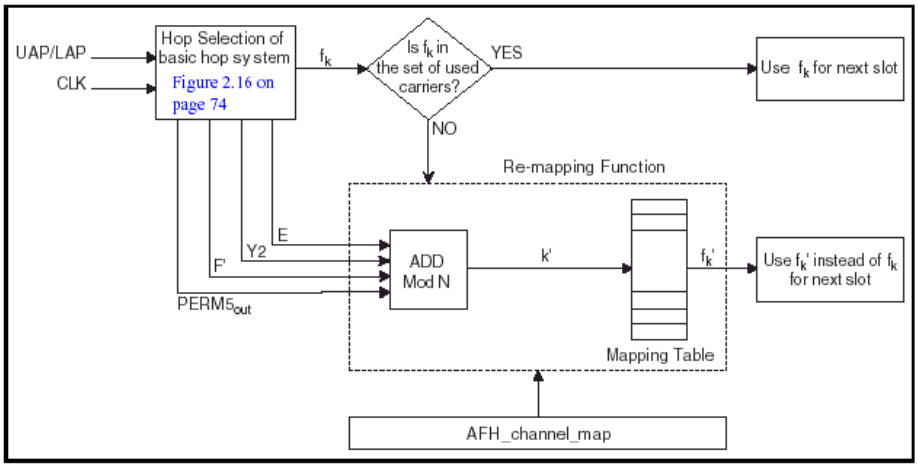
About AFH-Hopping Sequence

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 160 that 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	$16 \times CLK_{27-7}$ mod 79
F'	n/a	n/a	n/a	$16 \times CLK_{27-7}$ mod N

APPENDIX 2

United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

ISO/IEC 17025:1999
ISO 9002:1994

Certificate of Accreditation

DEPARTMENT OF COMMERCE ★ UNITED STATES OF AMERICA ★

COPY

TAIYO YUDEN CO., LTD. EMC CENTER
GUNMA-GUN GUNMA 370-3347
JAPAN

is recognized by the National Voluntary Laboratory Accreditation Program for satisfactory compliance with criteria set forth in NIST Handbook 150:2001, all requirements of ISO/IEC 17025:1999, and relevant requirements of ISO 9002:1994. Accreditation is awarded for specific services, listed on the Scope of Accreditation, for:

ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS

September 30, 2005
Effective through

For the National Institute of Standards and Technology
NVLAP Lab Code: 200607-0

NVLAP-01C (06-01)