TEST TYPES AND RESULTS (FOR BLUETOOTH)

CONDUCTED EMISSION MEASUREMENT

LIMITS OF CONDUCTED EMISSION MEASUREMENT

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dBμV)	
	Quasi-peak	Average
0.15 ~ 0.5	66 to 56	56 to 46
0.5 ~ 5	56	46
5 ~ 30	60	50

NOTE: 1. The lower limit shall apply at the transition frequencies.

2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.

3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED UNTIL
Test Receiver ROHDE & SCHWARZ	ESCS30	100291	Nov. 11, 2006
RF signal cable Woken	5D-FB	Cable-HYC01-01	Jan. 06, 2007
LISN ROHDE & SCHWARZ	ESH3-Z5	100312	Feb. 15, 2007
LISN ROHDE & SCHWARZ	ESH2-Z5	100104	Feb. 07, 2007
Software ADT	ADT_Cond_V3	NA	NA

NOTE: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

2. The test was performed in HwaYa Shielded Room 1.

3. The VCCI Site Registration No. is C-2040.

TEST PROCEDURES

a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.

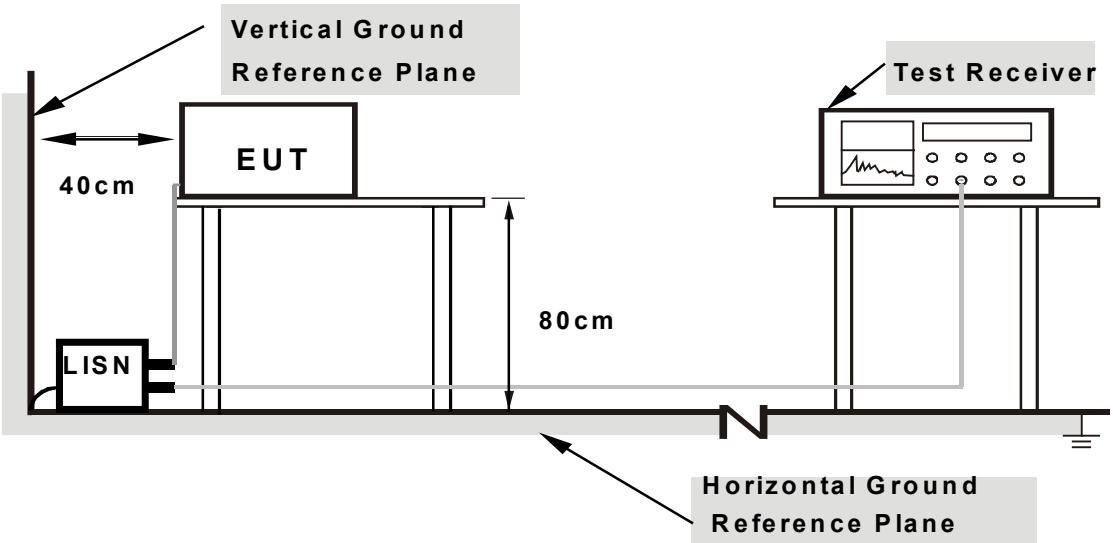
b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

DEVIATION FROM TEST STANDARD

No deviation

TEST SETUP



Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

EUT OPERATING CONDITIONS

Same as 4.1.6

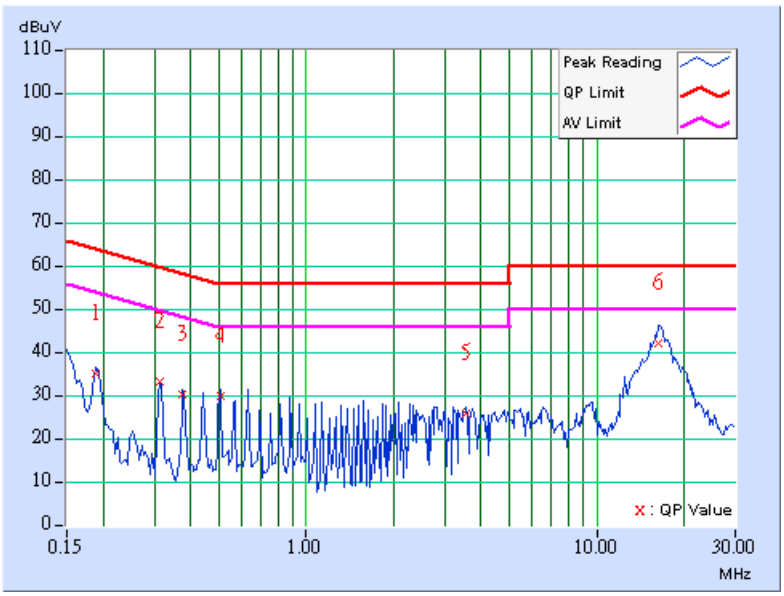
TEST RESULTS

Conducted Worst-Case Data

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 0	PHASE	Line 1
MODULATION TYPE	GFSK	6dB BANDWIDTH	9 kHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	ENVIRONMENTAL CONDITIONS	20deg. C, 60%RH, 991hPa
TESTED BY	Match Tsui		

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.189	0.10	34.50	-	34.60	-	64.08	54.08	-29.48	-
2	0.314	0.10	32.72	-	32.82	-	59.86	49.86	-27.04	-
3	0.377	0.10	29.84	-	29.94	-	58.35	48.35	-28.41	-
4	0.505	0.12	29.38	-	29.50	-	56.00	46.00	-26.50	-
5	3.527	0.41	25.41	-	25.82	-	56.00	46.00	-30.18	-
6	16.367	0.68	41.65	-	42.33	-	60.00	50.00	-17.67	-

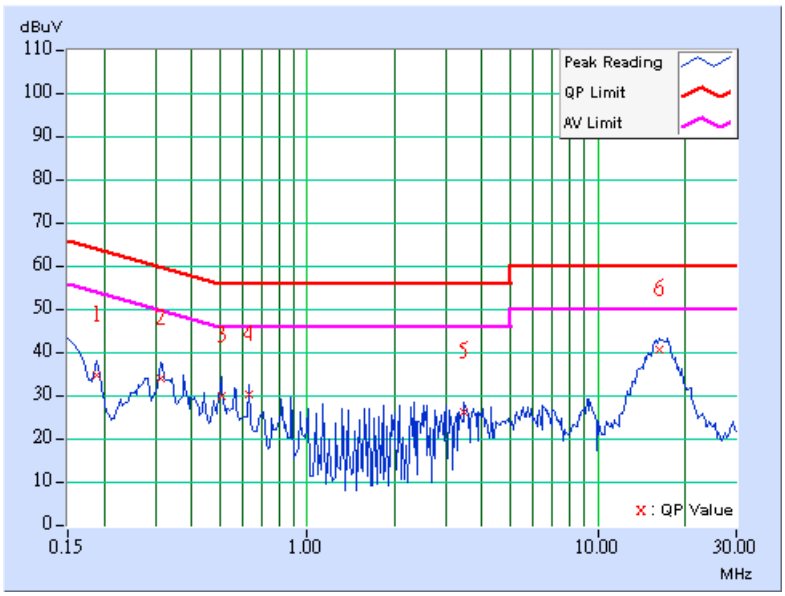
REMARKS: 1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
3. The emission levels of other frequencies were very low against the limit.
4. Margin value = Emission level - Limit value
5. Correction factor = Insertion loss + Cable loss
6. Emission Level = Correction Factor + Reading Value.



EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 0	PHASE	Line 1
MODULATION TYPE	GFSK	6dB BANDWIDTH	9 kHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	ENVIRONMENTAL CONDITIONS	20deg. C, 60%RH, 991hPa
TESTED BY	Match Tsui		

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.189	0.10	34.24	-	34.34	-	64.08	54.08	-29.74	-
2	0.314	0.10	33.54	-	33.64	-	59.86	49.86	-26.22	-
3	0.505	0.10	29.50	-	29.60	-	56.00	46.00	-26.40	-
4	0.630	0.10	29.82	-	29.92	-	56.00	46.00	-26.08	-
5	3.465	0.32	25.84	-	26.16	-	56.00	46.00	-29.84	-
6	16.305	0.56	40.27	-	40.83	-	60.00	50.00	-19.17	-

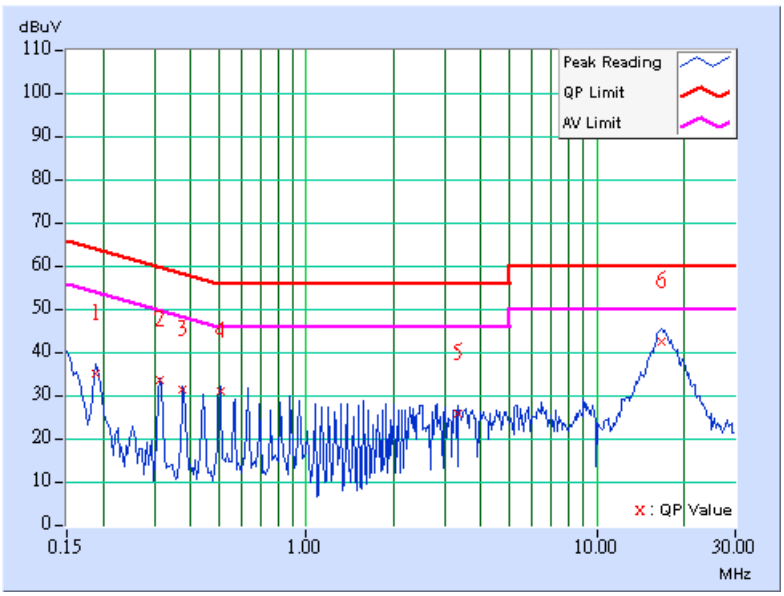
REMARKS: 1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
3. The emission levels of other frequencies were very low against the limit.
4. Margin value = Emission level - Limit value
5. Correction factor = Insertion loss + Cable loss
6. Emission Level = Correction Factor + Reading Value.



EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 39	PHASE	Line 1
MODULATION TYPE	GFSK	6dB BANDWIDTH	9 kHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	ENVIRONMENTAL CONDITIONS	20deg. C, 60%RH, 991hPa
TESTED BY	Match Tsui		

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.189	0.10	34.60	-	34.70	-	64.08	54.08	-29.38	-
2	0.314	0.10	33.18	-	33.28	-	59.86	49.86	-26.58	-
3	0.377	0.10	30.70	-	30.80	-	58.35	48.35	-27.55	-
4	0.505	0.12	30.28	-	30.40	-	56.00	46.00	-25.60	-
5	3.336	0.38	25.24	-	25.62	-	56.00	46.00	-30.38	-
6	**16.626**	**0.70**	**41.99**	**-**	**42.69**	**-**	**60.00**	**50.00**	**-17.31**	**-**

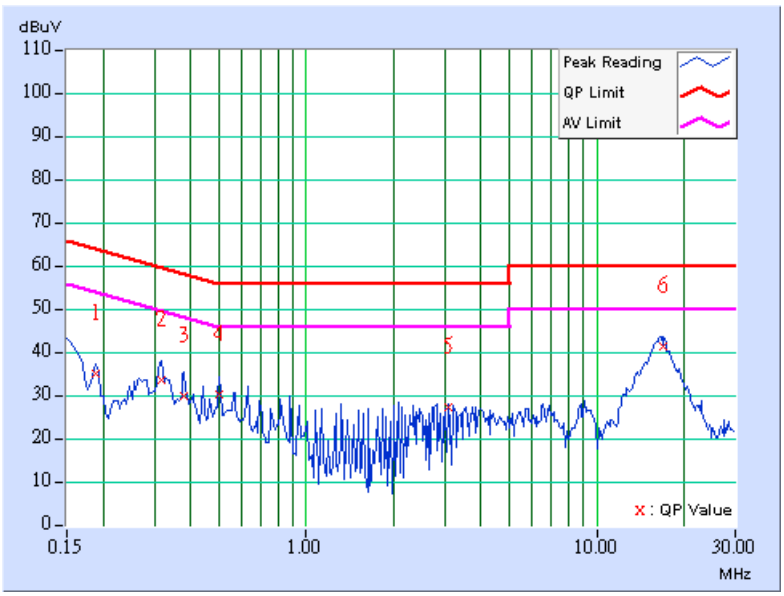
REMARKS: 1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
3. The emission levels of other frequencies were very low against the limit.
4. Margin value = Emission level - Limit value
5. Correction factor = Insertion loss + Cable loss
6. Emission Level = Correction Factor + Reading Value.



EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 39	PHASE	Line 2
MODULATION TYPE	GFSK	6dB BANDWIDTH	9 kHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	ENVIRONMENTAL CONDITIONS	20deg. C, 60%RH, 991hPa
TESTED BY	Match Tsui		

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.189	0.10	34.54	-	34.64	-	64.08	54.08	-29.44	-
2	0.318	0.10	33.25	-	33.35	-	59.76	49.76	-26.41	-
3	0.380	0.10	29.40	-	29.50	-	58.27	48.27	-28.77	-
4	0.502	0.10	29.96	-	30.06	-	56.00	46.00	-25.94	-
5	3.086	0.29	27.00	-	27.29	-	56.00	46.00	-28.71	-
6	17.008	0.57	41.09	-	41.66	-	60.00	50.00	-18.34	-

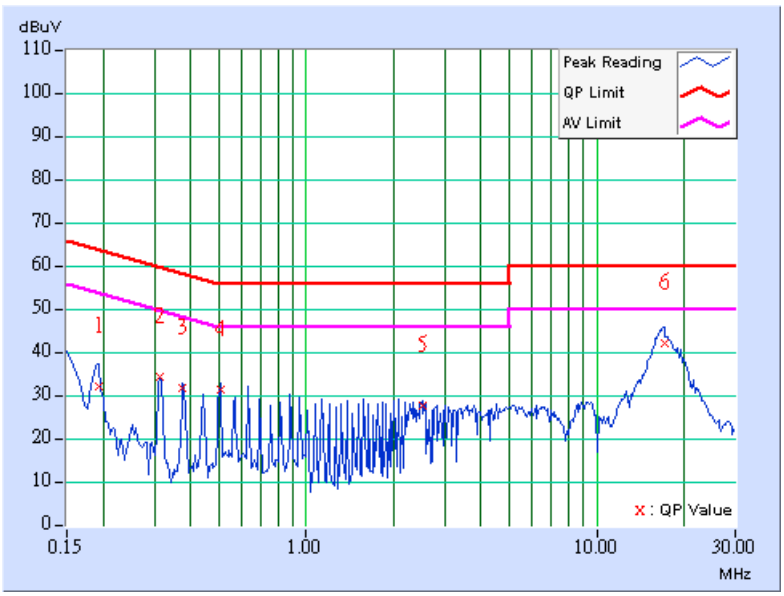
REMARKS: 1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
3. The emission levels of other frequencies were very low against the limit.
4. Margin value = Emission level - Limit value
5. Correction factor = Insertion loss + Cable loss
6. Emission Level = Correction Factor + Reading Value.



EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 78	PHASE	Line 1
MODULATION TYPE	GFSK	6dB BANDWIDTH	9 kHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	ENVIRONMENTAL CONDITIONS	20deg. C, 60%RH, 991hPa
TESTED BY	Match Tsui		

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.193	0.10	31.36	-	31.46	-	63.91	53.91	-32.45	-
2	0.314	0.10	33.70	-	33.80	-	59.86	49.86	-26.06	-
3	0.377	0.10	31.16	-	31.26	-	58.35	48.35	-27.09	-
4	0.505	0.12	30.86	-	30.98	-	56.00	46.00	-25.02	-
5	2.520	0.27	27.04	-	27.31	-	56.00	46.00	-28.69	-
6	17.065	0.71	41.59	-	42.30	-	60.00	50.00	-17.70	-

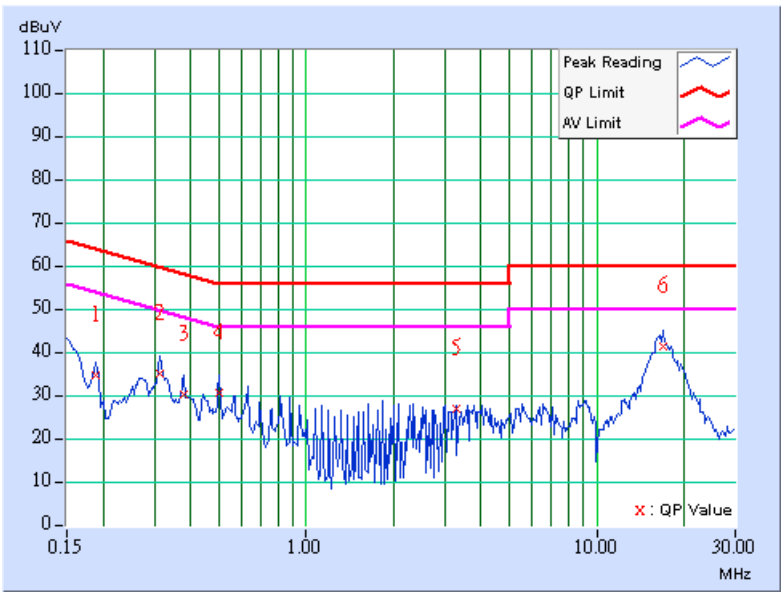
REMARKS: 1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
3. The emission levels of other frequencies were very low against the limit.
4. Margin value = Emission level - Limit value
5. Correction factor = Insertion loss + Cable loss
6. Emission Level = Correction Factor + Reading Value.



EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 78	PHASE	Line 2
MODULATION TYPE	GFSK	6dB BANDWIDTH	9 kHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	ENVIRONMENTAL CONDITIONS	20deg. C, 60%RH, 991hPa
TESTED BY	Match Tsui		

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.189	0.10	34.42	-	34.52	-	64.08	54.08	-29.56	-
2	0.314	0.10	34.56	-	34.66	-	59.86	49.86	-25.20	-
3	0.380	0.10	29.76	-	29.86	-	58.27	48.27	-28.41	-
4	0.502	0.10	30.14	-	30.24	-	56.00	46.00	-25.76	-
5	3.273	0.31	26.33	-	26.64	-	56.00	46.00	-29.36	-
6	16.879	0.57	40.78	-	41.35	-	60.00	50.00	-18.65	-

REMARKS: 1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
3. The emission levels of other frequencies were very low against the limit.
4. Margin value = Emission level - Limit value
5. Correction factor = Insertion loss + Cable loss
6. Emission Level = Correction Factor + Reading Value.



RADIATED EMISSION MEASUREMENT

LIMITS OF RADIATED EMISSION MEASUREMENT

Emissions radiated outside of the specified bands, shall be according to the general radiated limits in 15.209 as following:

FREQUENCIES (MHz)	FIELD STRENGTH (microvolts/meter)	MEASUREMENT DISTANCE (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED UNTIL
Test Receiver ROHDE & SCHWARZ	ESI7	100033	May. 19, 2006
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100025	Dec. 05, 2006
BILOG Antenna SCHWARZBECK	VULB9168	9168-160	Jun. 01, 2006
HORN Antenna SCHWARZBECK	9120D	9120D-408	Jan. 08, 2007
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170243	Jan. 19, 2007
Preamplifier Agilent	8447D	2944A10633	Nov. 04, 2006
Preamplifier Agilent	8449B	3008A01964	Oct. 30, 2006
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	214377/4	Dec. 13, 2006
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	219272/4	Dec. 13, 2006
Software ADT.	ADT_Radiated_V5.14	NA	NA
Antenna Tower inn-co GmbH	MA 4000	013303	NA
Antenna Tower Controller inn-co GmbH	CO2000	017303	NA
Turn Table ADT.	TT100.	TT93021703	NA
Turn Table Controller ADT.	SC100.	SC93021703	NA
26GHz ~ 40GHz Amplifier	AMF-6F-2600400	923362	Mar. 27, 2007

NOTE: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

2. The test was performed in HwaYa Chamber 2.

3. The horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.

4. The VCCI Site Registration No. is R-237.

5. The IC Site Registration No. is IC4924-3.

TEST PROCEDURES

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

f. If the emission level of the EUT in peak mode was lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

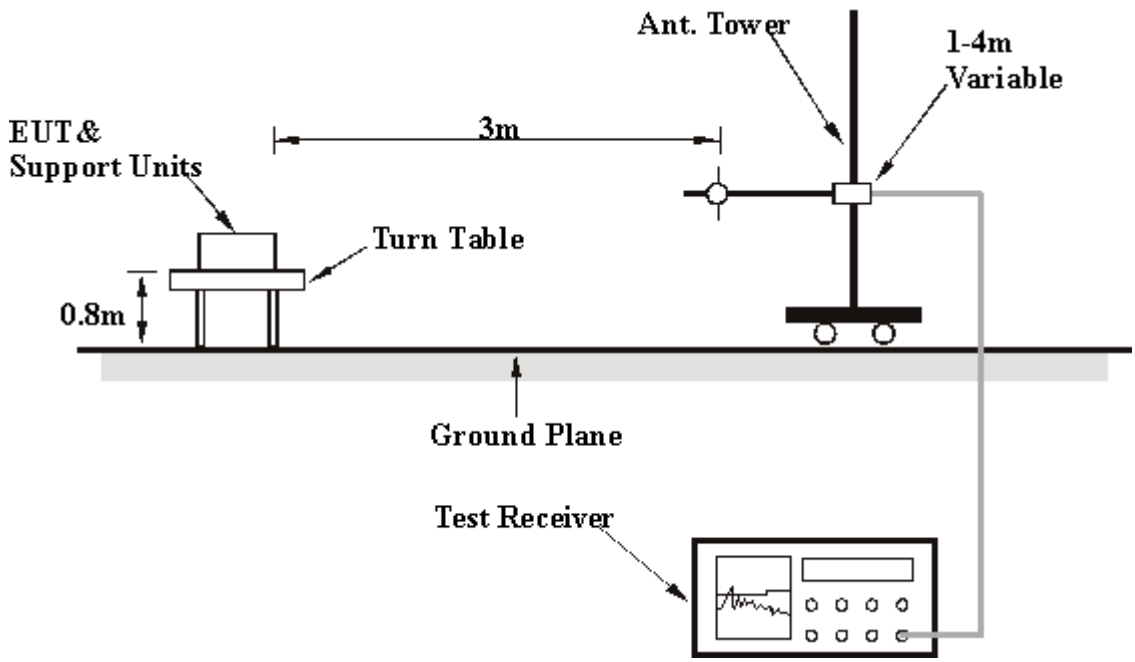
NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection (PK) at frequency above 1GHz.

DEVIATION FROM TEST STANDARD

No deviation

TEST SETUP



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

EUT OPERATING CONDITIONS

Same as 4.1.6

TEST RESULTS

Radiated Worst Case Data: Below 1GHz

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 78	**FREQUENCY RANGE**	Below 1000MHz
MODULATION TYPE	GFSK	**DETECTOR FUNCTION**	Quasi-Peak
INPUT POWER (SYSTEM)	120Vac, 60 Hz	**ENVIRONMENTAL CONDITIONS**	25deg. C, 68%RH, 991hPa
TESTED BY	Morgan Chen		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	214.67	28.03 QP	43.50	-15.47	1.00 H	346	16.42	11.61
2	239.94	34.62 QP	46.00	-11.38	1.00 H	343	22.25	12.37
3	300.20	28.12 QP	46.00	-17.88	1.00 H	310	12.23	15.89
4	624.83	30.98 QP	46.00	-15.02	1.00 H	22	7.63	23.35
5	720.08	28.91 QP	46.00	-17.09	1.00 H	355	3.82	25.10
6	768.68	29.11 QP	46.00	-16.89	1.00 H	307	2.68	26.43
7	817.27	32.97 QP	46.00	-13.03	1.00 H	316	6.14	26.83
8	860.04	29.48 QP	46.00	-16.52	1.00 H	334	2.26	27.22
9	891.14	28.39 QP	46.00	-17.61	1.00 H	334	0.89	27.50
10	912.53	30.72 QP	46.00	-15.28	1.00 H	313	2.95	27.77

REMARKS:
1. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 78	**FREQUENCY RANGE**	Below 1000MHz
MODULATION TYPE	GFSK	**DETECTOR FUNCTION**	Quasi-Peak
INPUT POWER (SYSTEM)	120Vac, 60 Hz	**ENVIRONMENTAL CONDITIONS**	25deg. C, 68%RH, 991hPa
TESTED BY	Morgan Chen		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	432.38	31.99 QP	46.00	-14.01	1.00 V	136	13.12	18.87
2	459.60	29.34 QP	46.00	-16.66	1.25 V	103	9.91	19.43
3	512.08	31.86 QP	46.00	-14.14	1.00 V	157	11.17	20.69
4	527.64	33.49 QP	46.00	-12.51	1.00 V	16	12.53	20.96
5	566.51	33.66 QP	46.00	-12.34	1.00 V	40	11.70	21.95
6	620.94	31.86 QP	46.00	-14.14	1.00 V	286	8.54	23.32
7	**624.83**	**36.82 QP**	**46.00**	**-9.18**	**1.25 V**	**103**	**13.47**	**23.35**
8	675.37	32.43 QP	46.00	-13.57	1.25 V	331	8.50	23.93
9	700.64	31.53 QP	46.00	-14.47	1.00 V	31	7.20	24.33
10	729.80	31.16 QP	46.00	-14.84	1.00 V	40	5.67	25.49
11	766.73	33.70 QP	46.00	-12.30	1.25 V	313	7.28	26.42
12	799.78	31.50 QP	46.00	-14.50	1.00 V	121	4.83	26.67
13	817.27	32.81 QP	46.00	-13.19	1.00 V	16	5.98	26.83
14	863.93	29.87 QP	46.00	-16.13	1.25 V	331	2.61	27.26
15	900.86	30.03 QP	46.00	-15.97	1.25 V	52	2.43	27.59
16	912.53	32.78 QP	46.00	-13.22	1.50 V	124	5.01	27.77
17	1000.00	37.37 QP	54.00	-16.63	1.00 V	2	9.03	28.34

REMARKS:
1. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.

Radiated Worst Case Data: Above 1GHz

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 0	**FREQUENCY RANGE**	1 ~ 25GHz
MODULATION TYPE	GFSK	**DETECTOR FUNCTION**	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	24deg. C, 67%RH, 991hPa	**INPUT POWER (SYSTEM)**	120Vac, 60 Hz
TESTED BY	Morgan Chen	**TEST MODE**	A

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2390.00	40.52 PK	74.00	-33.48	1.07 H	25	8.61	31.91
1	2390.00	31.40 AV	54.00	-22.60	1.07 H	25	-0.51	31.91
2	*2402.00	85.23 PK			1.07 H	25	53.25	31.98
2	*2402.00	55.23 AV			1.07 H	25	23.25	31.98
3	3204.00	43.44 PK	74.00	-30.56	1.18 H	18	9.93	33.51
3	3204.00	31.65 AV	54.00	-22.35	1.18 H	18	-1.86	33.51
4	4804.00	55.59 PK	74.00	-18.41	1.13 H	29	18.10	37.49
4	4804.00	25.59 AV	54.00	-28.41	1.13 H	29	-11.90	37.49

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2390.00	41.55 PK	74.00	-32.45	1.22 V	336	9.64	31.91
1	2390.00	32.43 AV	54.00	-21.57	1.22 V	336	0.52	31.91
2	*2402.00	86.44 PK			1.22 V	336	54.46	31.98
2	*2402.00	56.44 AV			1.22 V	336	24.46	31.98
3	3204.00	44.35 PK	74.00	-29.65	1.01 V	151	10.84	33.51
3	3204.00	32.60 AV	54.00	-21.40	1.01 V	151	-0.91	33.51
4	4804.00	57.12 PK	74.00	-16.88	1.10 V	39	19.63	37.49
4	4804.00	27.12 AV	54.00	-26.88	1.10 V	39	-10.37	37.49

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. The DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625 * 5 per 296.25 ms per channel. Therefore, the duty cycle be equal to: 20log (3.125/100)= -30 dB.
6. Average value = peak reading –20log(duty cycle).

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 39	**FREQUENCY RANGE**	1 ~ 25GHz
MODULATION TYPE	GFSK	**DETECTOR FUNCTION**	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	24deg. C, 67%RH, 991hPa	**INPUT POWER (SYSTEM)**	120Vac, 60 Hz
TESTED BY	Morgan Chen	**TEST MODE**	A

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2441.00	84.51 PK			1.05 H	26	52.29	32.22
1	*2441.00	54.51 AV			1.05 H	26	22.29	32.22
2	3254.00	43.11 PK	74.00	-30.89	1.16 H	12	9.45	33.66
2	3254.00	31.22 AV	54.00	-22.78	1.16 H	12	-2.44	33.66
3	4882.00	55.32 PK	74.00	-18.68	1.10 H	36	17.76	37.56
3	4882.00	25.32 AV	54.00	-28.68	1.10 H	36	-12.24	37.56

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2441.00	85.45 PK			1.16 V	354	53.23	32.22
1	*2441.00	55.45 AV			1.16 V	354	23.23	32.22
2	3254.00	44.12 PK	74.00	-29.88	1.05 V	148	10.46	33.66
2	3254.00	32.42 AV	54.00	-21.58	1.05 V	148	-1.24	33.66
3	4882.00	56.58 PK	74.00	-17.42	1.08 V	45	19.02	37.56
3	4882.00	26.58 AV	54.00	-27.42	1.08 V	45	-10.98	37.56

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. The DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625 * 5 per 296.25 ms per channel. Therefore, the duty cycle be equal to: 20log (3.125/100)= -30 dB.
6. Average value = peak reading –20log(duty cycle).

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 78	**FREQUENCY RANGE**	1 ~ 25GHz
MODULATION TYPE	GFSK	**DETECTOR FUNCTION**	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	24deg. C, 67%RH, 991hPa	**INPUT POWER (SYSTEM)**	120Vac, 60 Hz
TESTED BY	Morgan Chen	**TEST MODE**	A

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2480.00	83.56 PK			1.02 H	16	51.10	32.47
1	*2480.00	53.56 AV			1.02 H	16	21.09	32.47
2	2483.50	39.56 PK	74.00	-34.44	1.02 H	16	7.07	32.49
2	2483.50	31.56 AV	54.00	-22.44	1.02 H	16	-0.93	32.49
3	3306.00	43.19 PK	74.00	-30.81	1.02 H	139	9.38	33.81
3	3306.00	31.42 AV	54.00	-22.58	1.02 H	139	-2.39	33.81
4	4960.00	56.12 PK	74.00	-17.88	1.07 H	38	18.53	37.59
4	4960.00	26.12 AV	54.00	-27.88	1.07 H	38	-11.47	37.59

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2480.00	84.79 PK			1.20 V	328	52.32	32.47
1	*2480.00	54.79 AV			1.20 V	328	22.32	32.47
2	2483.50	40.79 PK	74.00	-33.21	1.20 V	328	8.30	32.49
2	2483.50	32.79 AV	54.00	-21.21	1.20 V	328	0.30	32.49
3	3306.00	44.25 PK	74.00	-29.75	1.04 V	148	10.44	33.81
3	3306.00	32.46 AV	54.00	-21.54	1.04 V	148	-1.35	33.81
4	4960.00	57.02 PK	74.00	-16.98	1.08 V	42	19.43	37.59
4	4960.00	27.02 AV	54.00	-26.98	1.08 V	42	-10.57	37.59

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. The DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625 * 5 per 296.25 ms per channel. Therefore, the duty cycle be equal to: 20log (3.125/100)= -30 dB.
6. Average value = peak reading –20log(duty cycle).

Radiated Worst Case Data: Above 1GHz

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 0	**FREQUENCY RANGE**	1 ~ 25GHz
MODULATION TYPE	8DPSK	**DETECTOR FUNCTION**	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	24deg. C, 67%RH, 991hPa	**INPUT POWER (SYSTEM)**	120Vac, 60 Hz
TESTED BY	Morgan Chen	**TEST MODE**	B

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2390.00	37.28 PK	74.00	-36.72	1.05 H	20	5.37	31.91
1	2390.00	29.28 AV	54.00	-24.72	1.05 H	20	-2.63	31.91
2	*2402.00	84.28 PK			1.05 H	20	52.30	31.98
2	*2402.00	54.28 AV			1.05 H	20	22.30	31.98
3	3204.00	43.32 PK	74.00	-30.68	1.13 H	15	9.81	33.51
3	3204.00	30.58 AV	54.00	-23.42	1.13 H	15	-2.93	33.51
4	4804.00	55.40 PK	74.00	-18.60	1.16 H	25	17.91	37.49
4	4804.00	25.40 AV	54.00	-28.60	1.16 H	25	-12.09	37.49

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2390.00	38.35 PK	74.00	-35.65	1.25 V	342	6.44	31.91
1	2390.00	30.35 AV	54.00	-23.65	1.25 V	342	-1.56	31.91
2	*2402.00	85.35 PK			1.25 V	342	53.37	31.98
2	*2402.00	55.35 AV			1.25 V	342	23.37	31.98
3	3204.00	44.25 PK	74.00	-29.75	1.02 V	148	10.74	33.51
3	3204.00	32.49 AV	54.00	-21.51	1.02 V	148	-1.02	33.51
4	4804.00	56.10 PK	74.00	-17.90	1.12 V	29	18.61	37.49
4	4804.00	26.10 AV	54.00	-27.90	1.12 V	29	-11.39	37.49

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. The DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625 * 5 per 296.25 ms per channel. Therefore, the duty cycle be equal to: 20log (3.125/100)= -30 dB.
6. Average value = peak reading –20log(duty cycle).

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 39	**FREQUENCY RANGE**	1 ~ 25GHz
MODULATION TYPE	8DPSK	**DETECTOR FUNCTION**	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	24deg. C, 67%RH, 991hPa	**INPUT POWER (SYSTEM)**	120Vac, 60 Hz
TESTED BY	Morgan Chen	**TEST MODE**	B

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2441.00	83.25 PK			1.08 H	16	51.03	32.22
1	*2441.00	53.25 AV			1.08 H	16	21.03	32.22
2	3254.00	43.20 PK	74.00	-30.80	1.10 H	12	9.54	33.66
2	3254.00	30.42 AV	54.00	-23.58	1.10 H	12	-3.24	33.66
3	4882.00	55.01 PK	74.00	-18.99	1.12 H	345	17.45	37.56
3	4882.00	25.01 AV	54.00	-28.99	1.12 H	345	-12.55	37.56

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2441.00	84.30 PK			1.20 V	340	52.08	32.22
1	*2441.00	54.30 AV			1.20 V	340	22.08	32.22
2	3254.00	44.10 PK	74.00	-29.90	1.05 V	152	10.44	33.66
2	3254.00	32.37 AV	54.00	-21.63	1.05 V	152	-1.29	33.66
3	4882.00	56.03 PK	74.00	-17.97	1.10 V	32	18.47	37.56
3	4882.00	26.03 AV	54.00	-27.97	1.10 V	32	-11.53	37.56

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. The DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625 * 5 per 296.25 ms per channel. Therefore, the duty cycle be equal to: 20log (3.125/100)= -30 dB.
6. Average value = peak reading –20log(duty cycle).

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 78	**FREQUENCY RANGE**	1 ~ 25GHz
MODULATION TYPE	8DPSK	**DETECTOR FUNCTION**	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	24deg. C, 67%RH, 991hPa	**INPUT POWER (SYSTEM)**	120Vac, 60 Hz
TESTED BY	Morgan Chen	**TEST MODE**	B

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2480.00	81.05 PK			1.03 H	16	48.58	32.47
1	*2480.00	51.05 AV			1.03 H	16	18.58	32.47
2	2483.50	35.05 PK	74.00	-38.95	1.03 H	16	2.56	32.49
2	2483.50	28.05 AV	54.00	-25.95	1.03 H	16	-4.44	32.49
3	3306.00	43.05 PK	74.00	-30.95	1.15 H	12	9.24	33.81
3	3306.00	31.29 AV	54.00	-22.71	1.15 H	12	-2.52	33.81
4	4960.00	54.08 PK	74.00	-19.92	1.18 H	8	16.49	37.59
4	4960.00	24.08 AV	54.00	-29.92	1.18 H	8	-13.51	37.59

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2480.00	82.11 PK			1.17 V	339	49.64	32.47
1	*2480.00	52.11 AV			1.17 V	339	19.64	32.47
2	2483.50	36.11 PK	74.00	-37.89	1.17 V	339	3.62	32.49
2	2483.50	29.11 AV	54.00	-24.89	1.17 V	339	-3.38	32.49
3	3306.00	44.02 PK	74.00	-29.98	1.06 V	148	10.21	33.81
3	3306.00	32.32 AV	54.00	-21.68	1.06 V	148	-1.49	33.81
4	4960.00	55.01 PK	74.00	-18.99	1.12 V	28	17.42	37.59
4	4960.00	25.01 AV	54.00	-28.99	1.12 V	28	-12.58	37.59

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. The DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625 * 5 per 296.25 ms per channel. Therefore, the duty cycle be equal to: 20log (3.125/100)= -30 dB.
6. Average value = peak reading –20log(duty cycle).

NUMBER OF HOPPING FREQUENCY USED

LIMIT OF HOPPING FREQUENCY USED

At least 15 channels frequencies, and should be equally spaced.

TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED UNTIL
SPECTRUM ANALYZER	FSEK30	100049	Aug. 14, 2006

NOTE: The calibration interval of the above test instruments is 12 months. And the calibrations are traceable to NML/ROC and NIST/USA.

TEST PROCEDURES

a. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.

b. Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.

c. Set the SA on MaxHold Mode, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been recorded.

d. Set the SA on View mode and then plot the result on SA screen.

e. Repeat above procedures until all frequencies measured were complete.

DEVIATION FROM TEST STANDARD

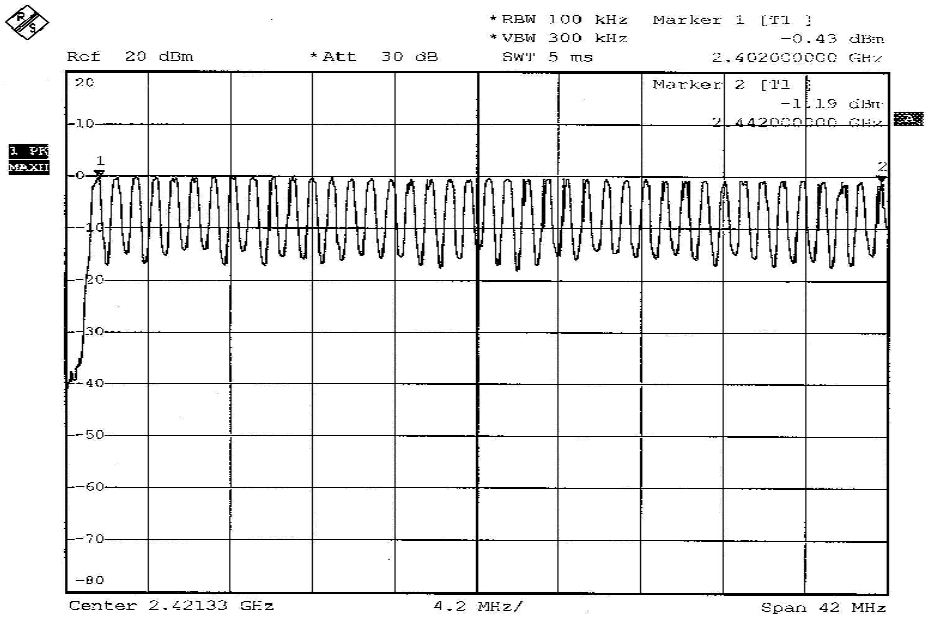
No deviation.

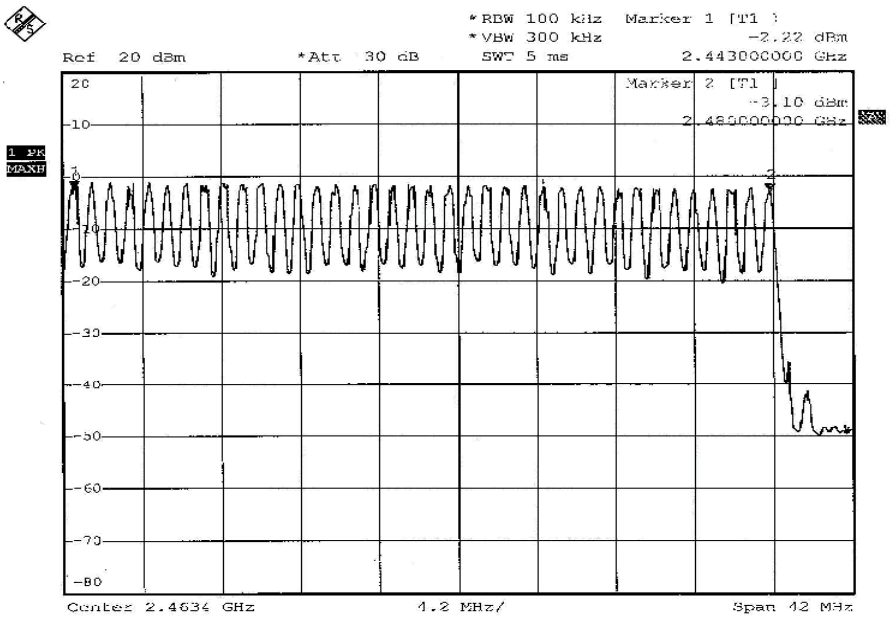
TEST SETUP

TEST RESULTS

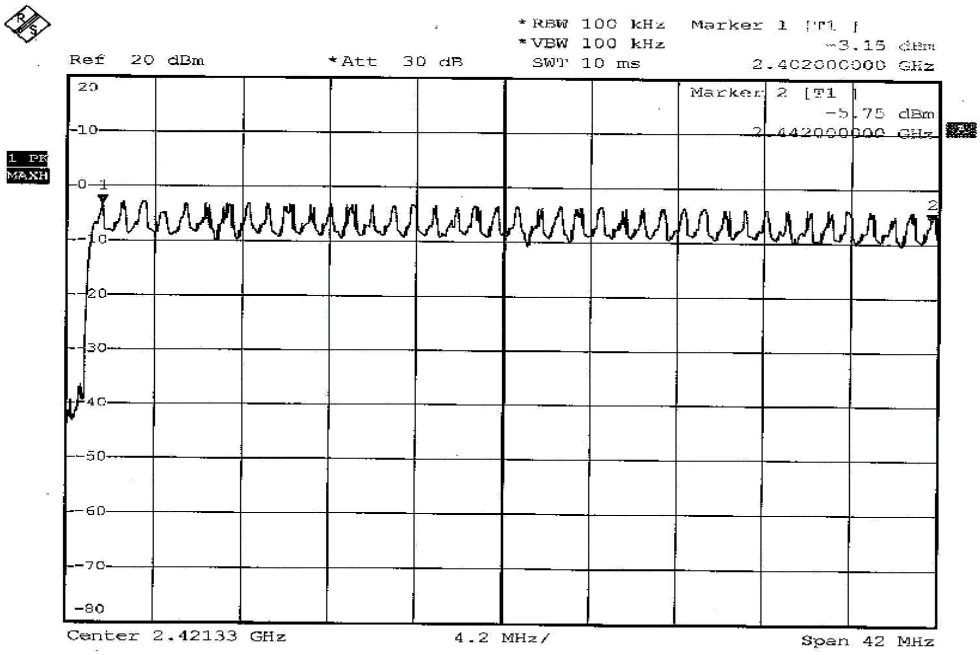
There are 79 hopping frequencies in the hopping mode. Please refer to next two pages for the test result. On the plots, it shows that the hopping frequencies are equally spaced.

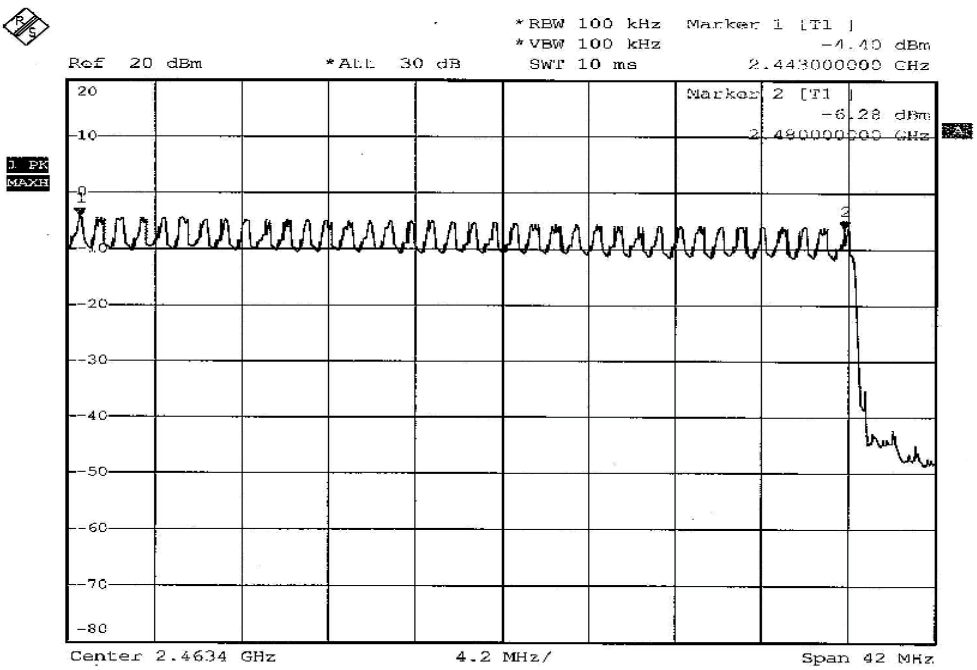
TEST MODE A


*RBW 100 kHz
*VBW 300 kHz
SWT 5 ms
Marker 1 [T1]
-0.43 dBm
2.402000000 GHz
Ref 20 dBm
*Att 30 dB
Marker 2 [T1]
-1.19 dBm
2.442000000 GHz
1 PK
MAXH
Center 2.42133 GHz
4.2 MHz/
Span 42 MHz


*RBW 100 kHz
*VBW 300 kHz
SWT 5 ms
Marker 1 [T1]
-2.22 dBm
2.443000000 GHz
Ref 20 dBm
*Att 30 dB
Marker 2 [T1]
-3.10 dBm
2.480000000 GHz
1 PK
MAXH
Center 2.4634 GHz
4.2 MHz/
Span 42 MHz

TEST MODE B


*RBW 100 kHz
*VBW 100 kHz
SWT 10 ms
Marker 1 [T1]
-3.15 dBm
2.402000000 GHz
Ref 20 dBm
*Att 30 dB
Marker 2 [T1]
-5.75 dBm
2.442000000 GHz
1 PK
MAXH
Center 2.42133 GHz
4.2 MHz/
Span 42 MHz


*RBW 100 kHz
*VBW 100 kHz
SWT 10 ms
Marker 1 [T1]
-4.40 dBm
2.448000000 GHz
Ref 20 dBm
*Att 30 dB
Marker 2 [T1]
-6.28 dBm
2.480000000 GHz
1 PK
MAXH
Center 2.4634 GHz
4.2 MHz/
Span 42 MHz

DWELL TIME ON EACH CHANNEL

LIMIT OF DWELL TIME USED

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED UNTIL
SPECTRUM ANALYZER	FSEK30	100049	Aug. 14, 2006

NOTES: The calibration interval of the above test instruments is 12 months. And the calibrations are traceable to NML/ROC and NIST/USA.

TEST PROCEDURES

a. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.

b. Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.

c. Adjust the center frequency of SA on any frequency be measured and set SA to zero span mode. And then, set RBW and VBW of spectrum analyzer to proper value.

d. Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.

e. Repeat above procedures until all different time-slot modes have been completed.

DEVIATION FROM TEST STANDARD

No deviation.

TEST SETUP

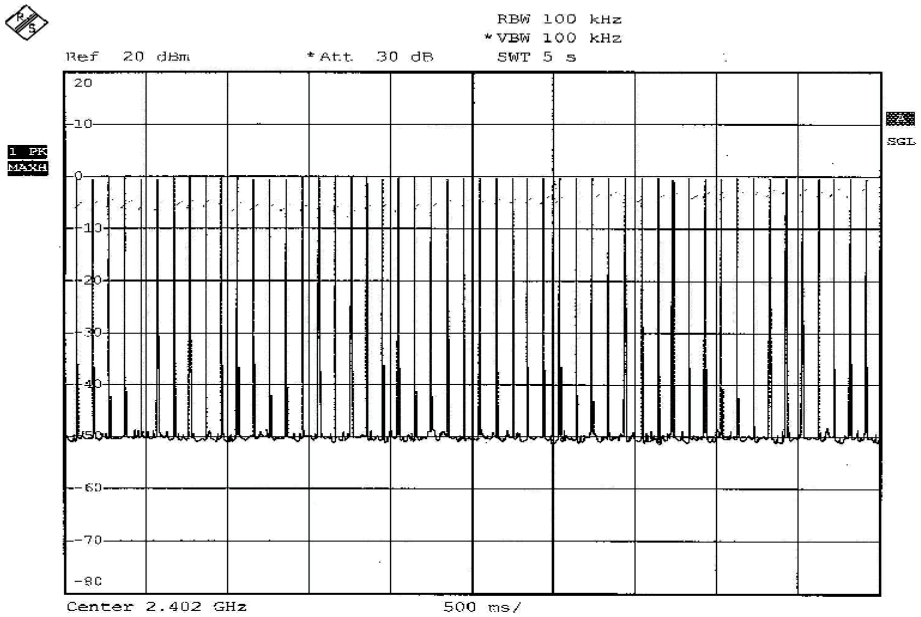
TEST RESULTS

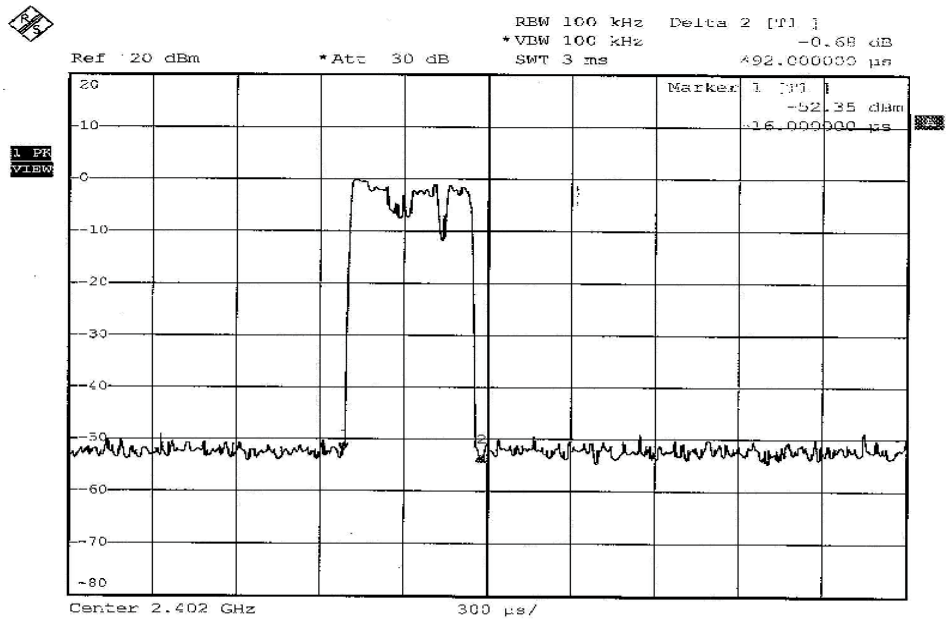
TEST MODE A

MODE	NUMBER OF TRANSMISSION IN A 31.6 (79HOPPING * 0.4)	LENGTH OF TRANSMISSION TIME (msec)	RESULT (msec)	LIMIT (msec)
DH1	50 (times / 5 sec) * 6.32 = 316.00 times	0.492	154.472	400
DH3	25 (times / 5 sec) * 6.32 = 158.00times	1.758	277.764	400
DH5	17 (times / 5 sec) * 6.32 = 107.44 times	3.018	324.25	400

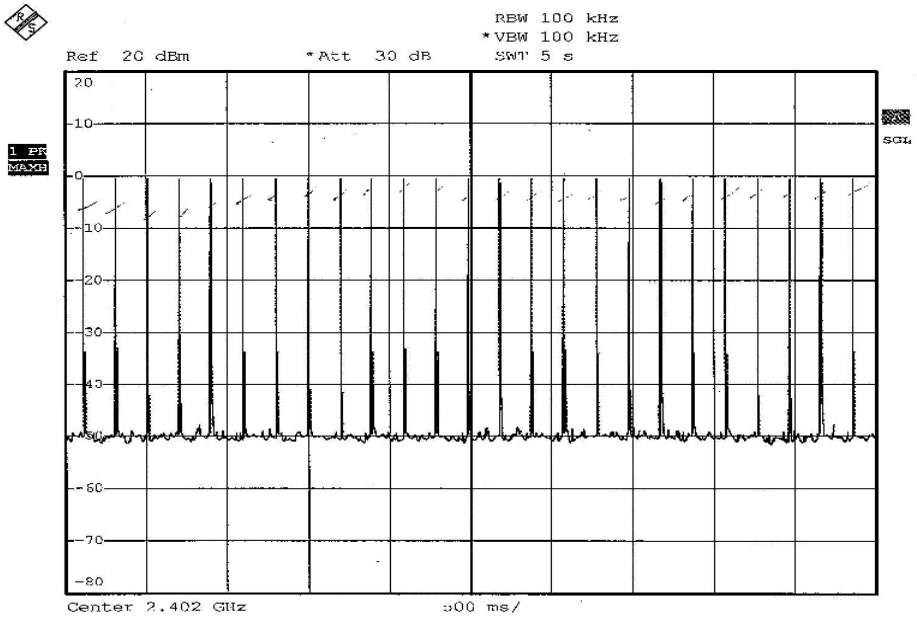
NOTE: Test plots of the transmitting time slots are shown on next 3 pages.

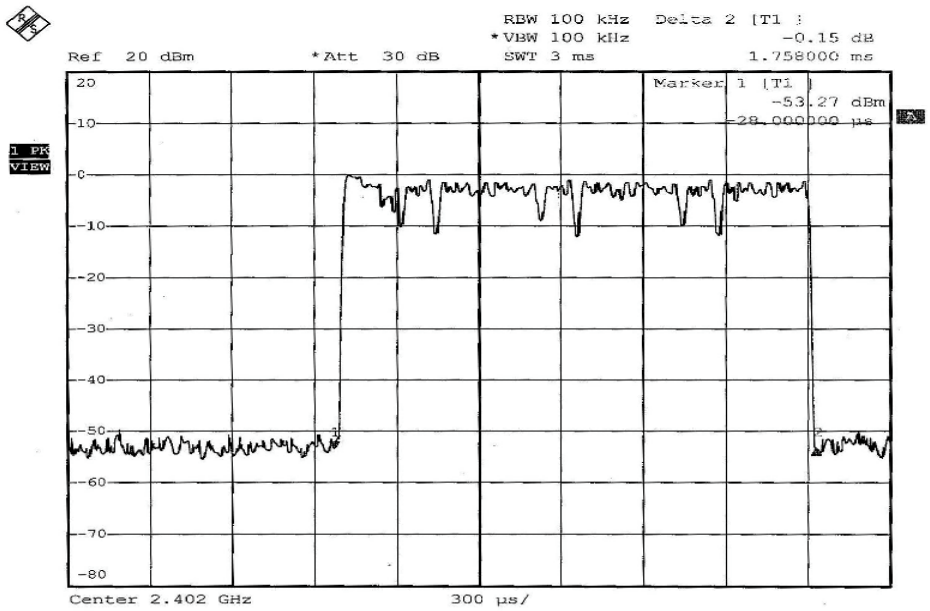
DH1


RBW 100 kHz
*VBW 100 kHz
Ref 20 dBm
*Att 30 dB
SWT 5 s
1 PK
MAXH
SGL
Center 2.402 GHz
500 ms/

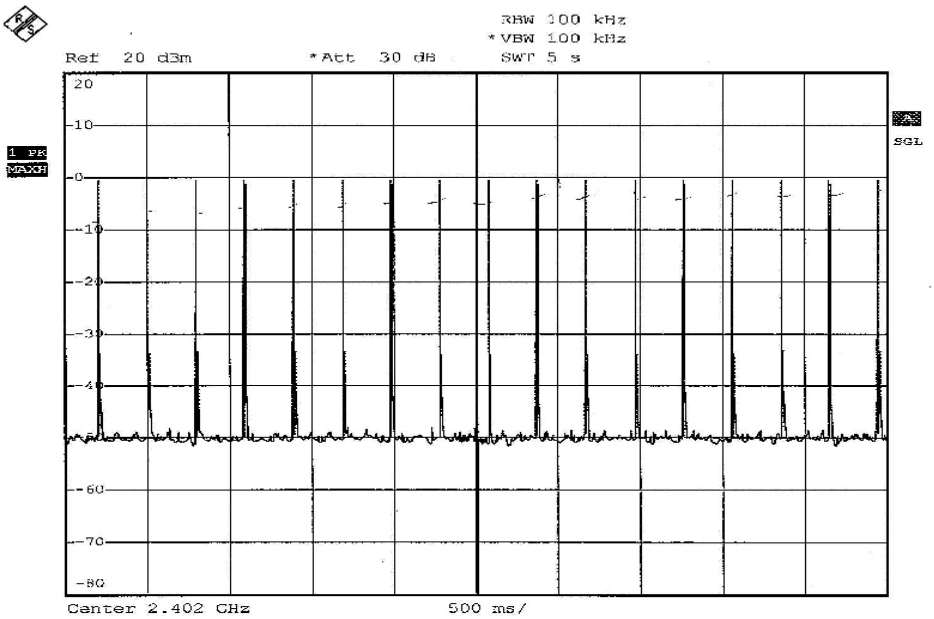

RBW 100 kHz
Delta 2 [T1]
*VBW 100 kHz
-0.68 dB
Ref 20 dBm
*Att 30 dB
SWT 3 ms
*92.000000 µs
Marker 1 [T1]
-52.35 dBm
-16.000000 µs
1 PK
VIEW
Center 2.402 GHz
300 µs/

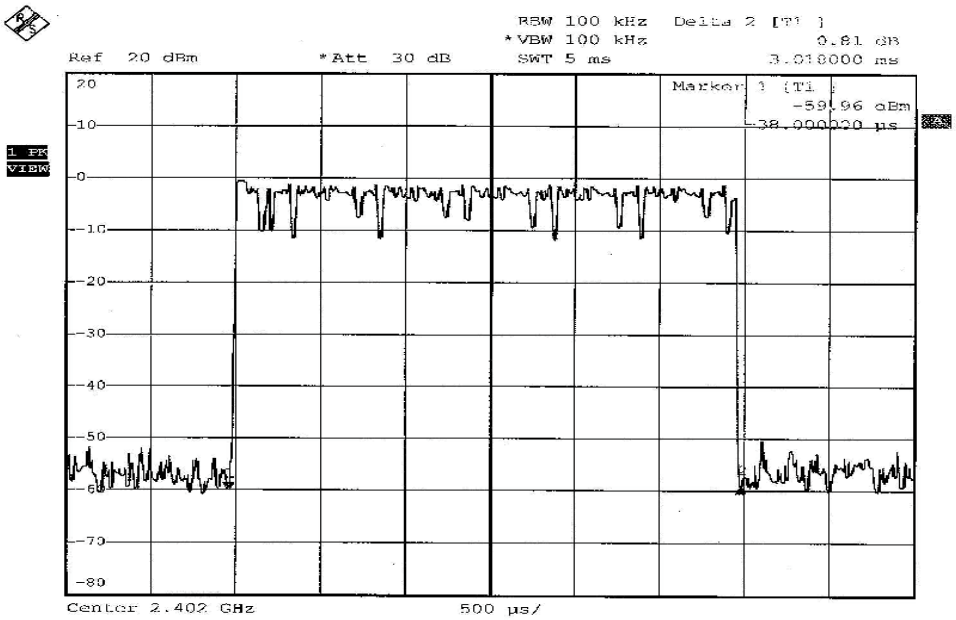
DH3


RBW 100 kHz
*VBW 100 kHz
Ref 20 dBm
*Att 30 dB
SWT 5 s
1 PK
MAXH
SGL
Center 2.402 GHz
500 ms/


RBW 100 kHz
Delta 2 [T1]
*VBW 100 kHz
-0.15 dB
Ref 20 dBm
*Att 30 dB
SWT 3 ms
1.758000 ms
Marker 1 [T1]
-53.27 dBm
1 PK
VIEW
Center 2.402 GHz
300 µs/

DH5


RBW 100 kHz
*VBW 100 kHz
Ref 20 dBm
*Att 30 dB
SWT 5 s
1 PK
MAXH
SGL
Center 2.402 GHz
500 ms/

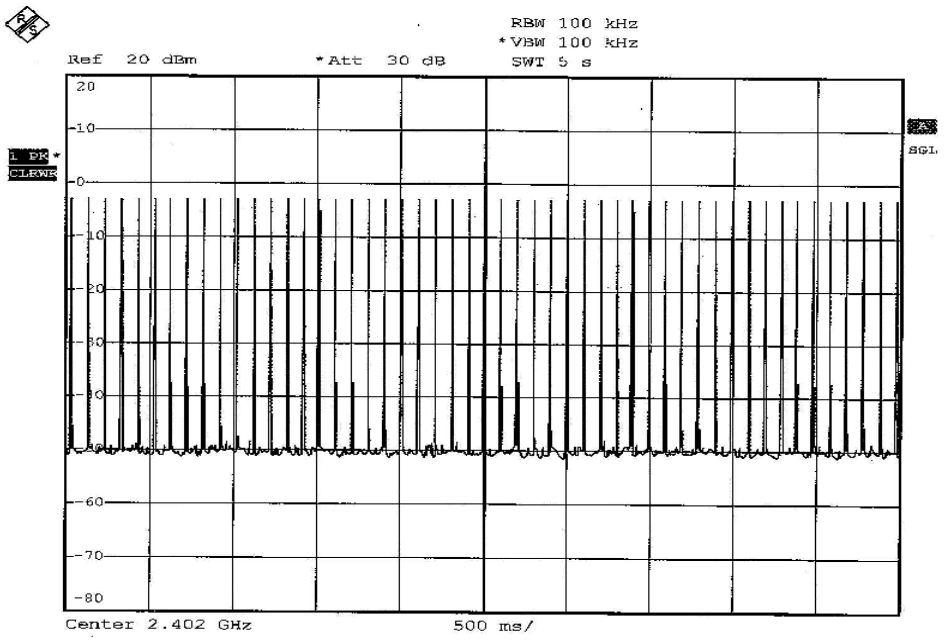

RBW 100 kHz
*VBW 100 kHz
Ref 20 dBm
*Att 30 dB
SWT 5 ms
1 PK
VIEW
Center 2.402 GHz
500 µs/

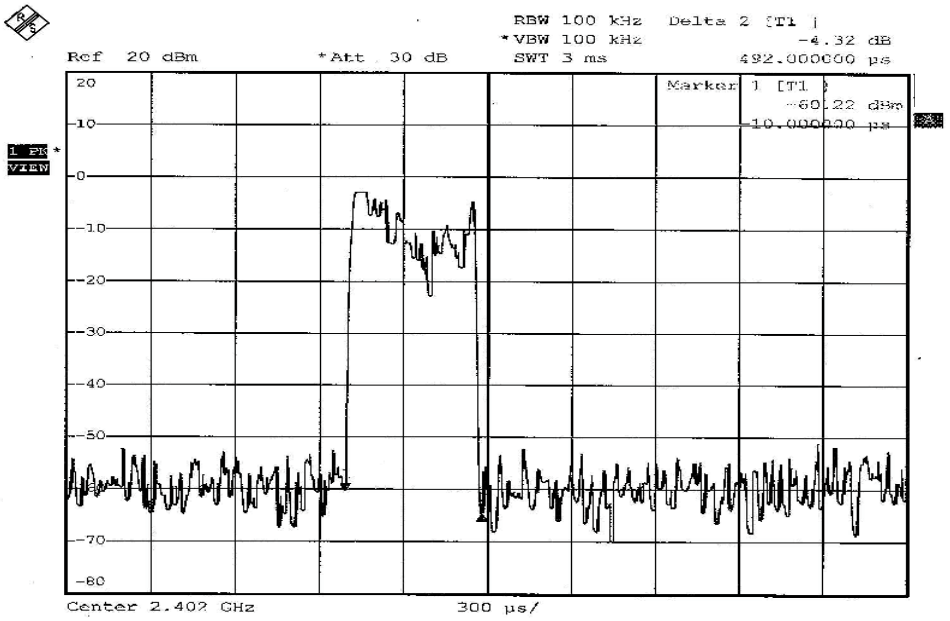
TEST MODE B

MODE	NUMBER OF TRANSMISSION IN A 31.6 (79HOPPING * 0.4)	LENGTH OF TRANSMISSION TIME (msec)	RESULT (msec)	LIMIT (msec)
DH1	51 (times / 5 sec) * 6.32 = 322.32 times	0.492	158.58	400
DH3	25 (times / 5 sec) * 6.32 = 158.00times	1.746	275.87	400
DH5	16 (times / 5 sec) * 6.32 = 101.12 times	3.05	308.42	400

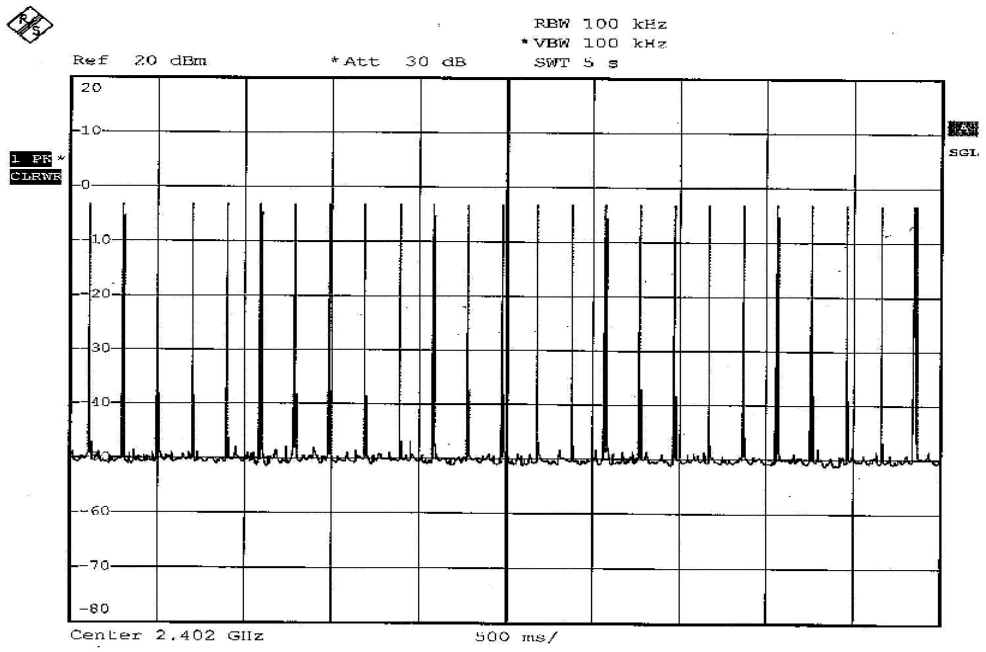
NOTE: Test plots of the transmitting time slots are shown on next 3 pages.

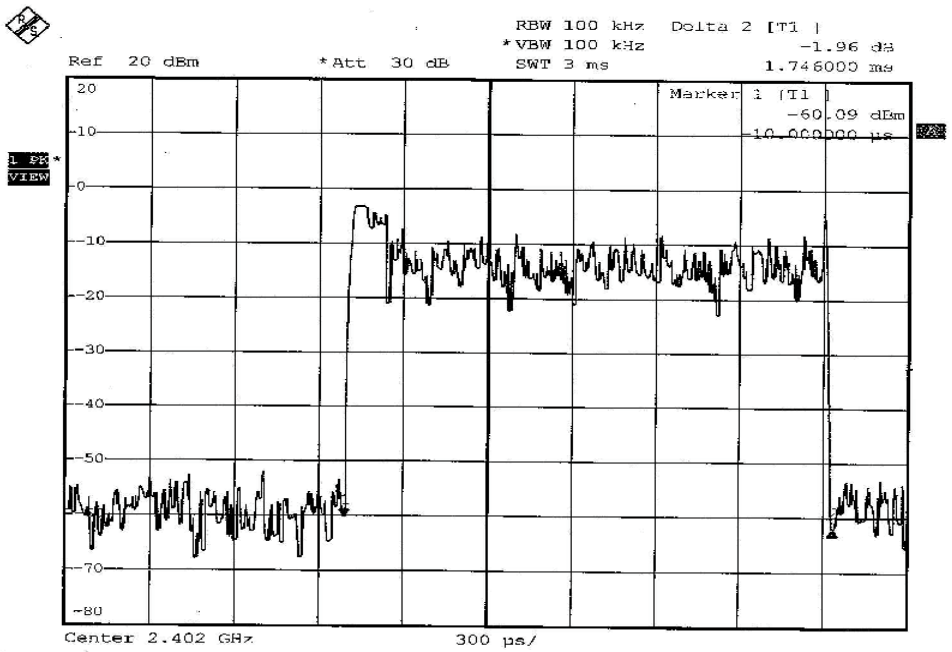
DH1


RBW 100 kHz
*VBW 100 kHz
Ref 20 dBm
*Att 30 dB
SWT 5 s
1 PK
CLRWR
SGL
Center 2.402 GHz
500 ms/

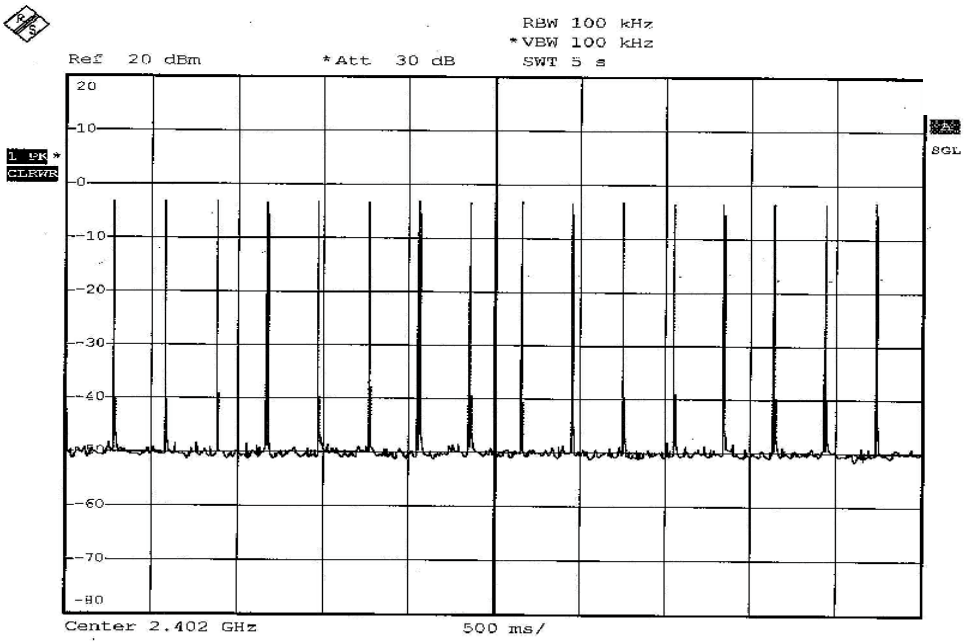

RBW 100 kHz
Delta 2 [T1]
*VBW 100 kHz
-4.32 dB
Ref 20 dBm
*Att 30 dB
SWT 3 ms
492.000000 µs
Marker 1 [T1]
-60.22 dBm
-10.000000 µs
1 PK
VIEW
Center 2.402 GHz
300 µs/

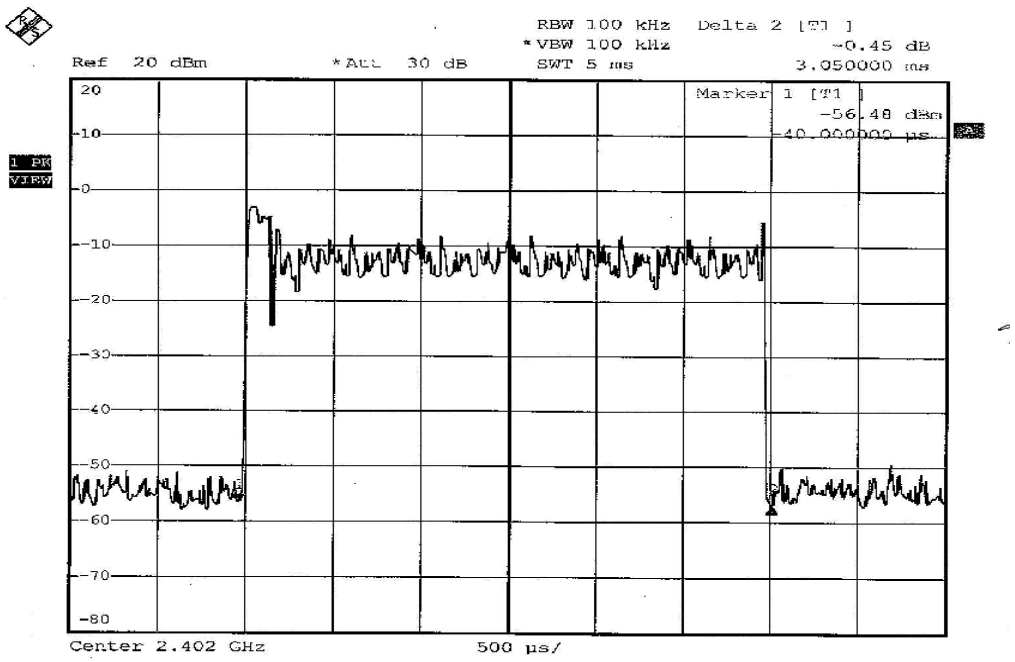
DH3


RBW 100 kHz
*VBW 100 kHz
Ref 20 dBm
*Att 30 dB
SWT 5 s
1 PK
CLRWR
SGL
Center 2.402 GHz
500 ms/


RBW 100 kHz
*VBW 100 kHz
Ref 20 dBm
*Att 30 dB
SWT 3 ms
Delta 2 [T1]
-1.96 dB
1.746000 ms
Marker 1 [T1]
-60.09 dBm
1 PK
VIEW
Center 2.402 GHz
300 µs/

DH5


RBW 100 kHz
*VBW 100 kHz
SWT 5 s
Ref 20 dBm
*Att 30 dB
1 PK
CLRWR
SGL
Center 2.402 GHz
500 ms/


RBW 100 kHz
*VBW 100 kHz
SWT 5 ms
Delta 2 [T1]
-0.45 dB
3.050000 ms
Ref 20 dBm
*Att 30 dB
Marker 1 [T1]
-56.48 dBm
40.000000 µs
1 PK
VIEW
Center 2.402 GHz
500 µs/

CHANNEL BANDWIDTH

LIMITS OF CHANNEL BANDWIDTH

For frequency hopping system operating in the 2400-2483.5MHz, If the 20dB bandwidth of hopping channel is greater than 25kHz, the 20dBbandwidth of hopping channel shell be a minimum limit for the hopping channel separation.

TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED UNTIL
SPECTRUM ANALYZER	FSEK30	100049	Aug. 14, 2006

NOTE: The calibration interval of the above test instruments is 12 months. And the calibrations are traceable to NML/ROC and NIST/USA.

TEST PROCEDURE

a. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.

b. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.

c. Measure the frequency difference of two frequencies that were attenuated 20dB from the reference level. Record the frequency difference as the emission bandwidth.

d. Repeat above procedures until all frequencies measured were complete.

DEVIATION FROM TEST STANDARD

No deviation.

TEST SETUP

EUT OPERATING CONDITION

The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

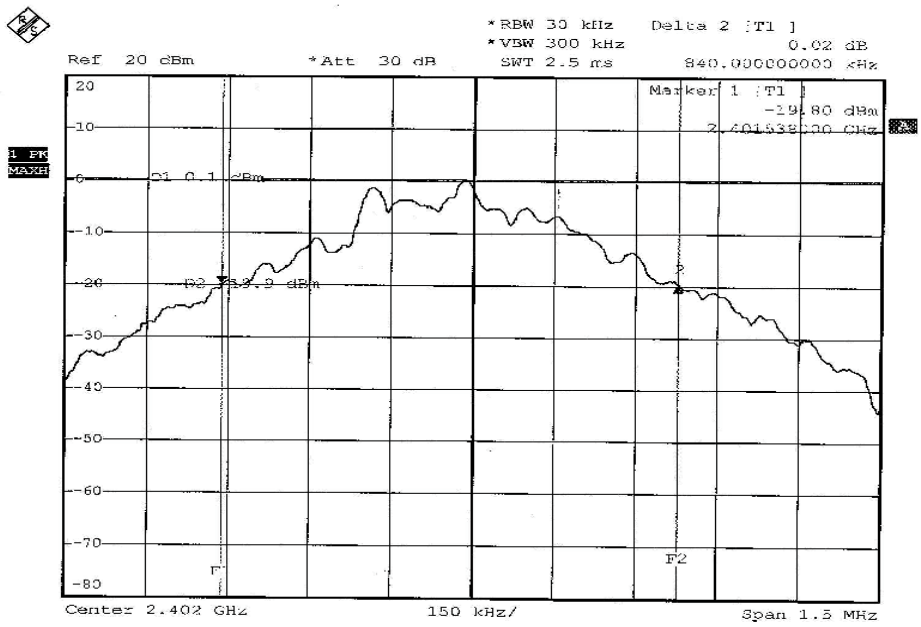
TEST RESULTS

TEST MODE A

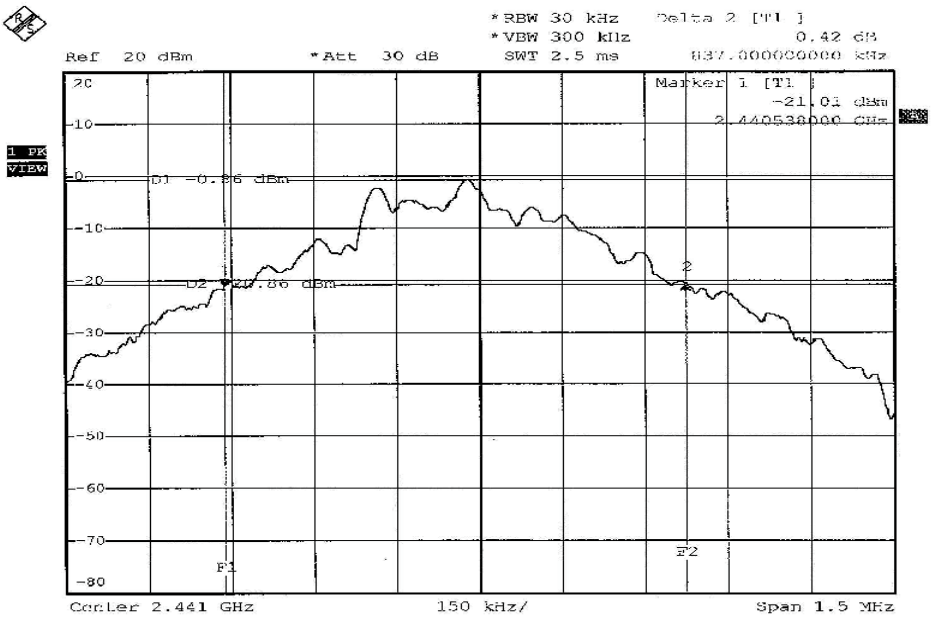
MODULATION TYPE	GFSK	**ENVIRONMENTAL CONDITIONS**	23deg. C, 54%RH, 991hPa
INPUT POWER (SYSTEM)	120Vac, 60 Hz	**TESTED BY**	Morgan Chen

CHANNEL	CHANNEL FREQUENCY (MHz)	20dB BANDWIDTH (MHz)
0	2402	0.840
39	2441	0.837
78	2480	0.843

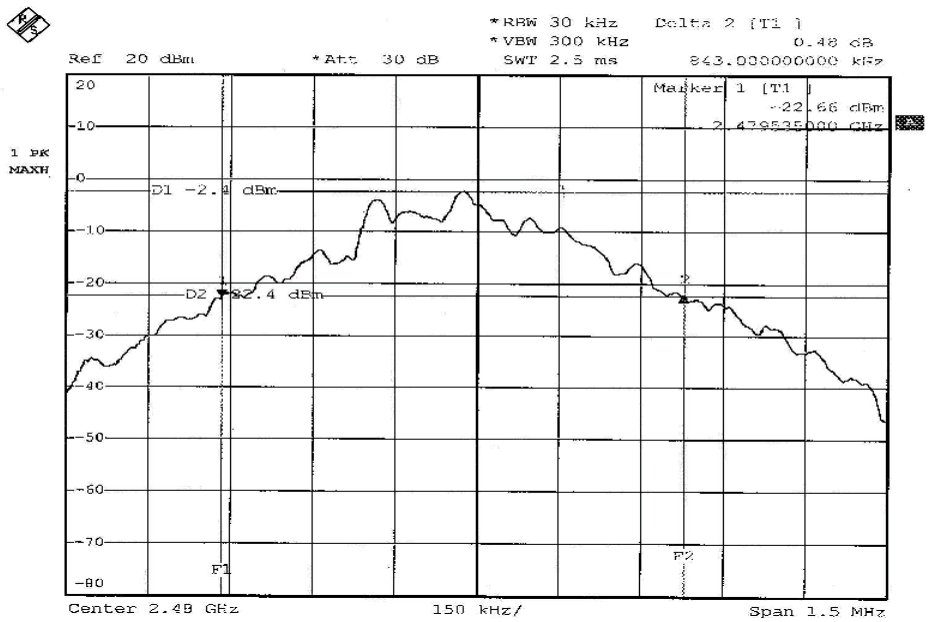
CH 0


*RBW 30 kHz
*VBW 300 kHz
SWT 2.5 ms
Delta 2 [T1]
0.02 dB
840.000000000 kHz
Ref 20 dBm
*Att 30 dB
Marker 1 [T1]
-29.80 dBm
1 PK
MAXH
D1 0.1 dBm
D2 -33.9 dBm
F1
F2
Center 2.402 GHz
150 kHz/
Span 1.5 MHz

CH 39


*RBW 30 kHz
*VBW 300 kHz
SWT 2.5 ms
Delta 2 [T1]
0.42 dB
837.000000000 kHz
Ref 20 dBm
*Att 30 dB
Marker 1 [T1]
-21.01 dBm
1 PK
VIEW
D1 -0.86 dBm
D2 -20.86 dBm
F1
F2
Center 2.441 GHz
150 kHz/
Span 1.5 MHz

CH 78

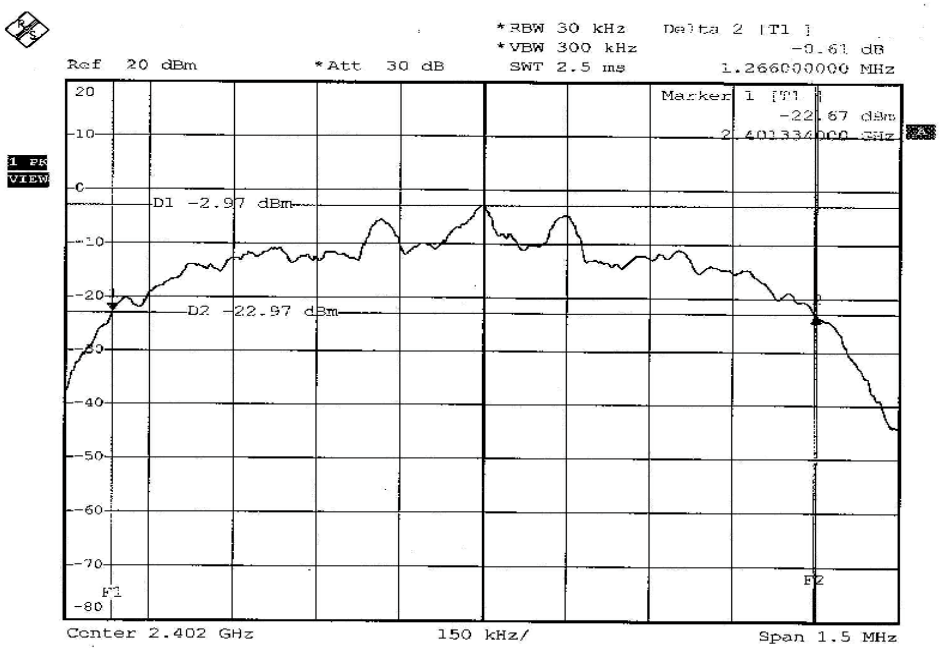

*RBW 30 kHz
*VBW 300 kHz
SWT 2.5 ms
Delta 2 [T1]
0.48 dB
843.000000000 kHz
Ref 20 dBm
*Att 30 dB
Marker 1 [T1]
-22.66 dBm
2.479535000 GHz
1 PK
MAXH
D1 -2.4 dBm
D2 -2.4 dBm
F1
F2
Center 2.48 GHz
150 kHz/
Span 1.5 MHz

TEST MODE B

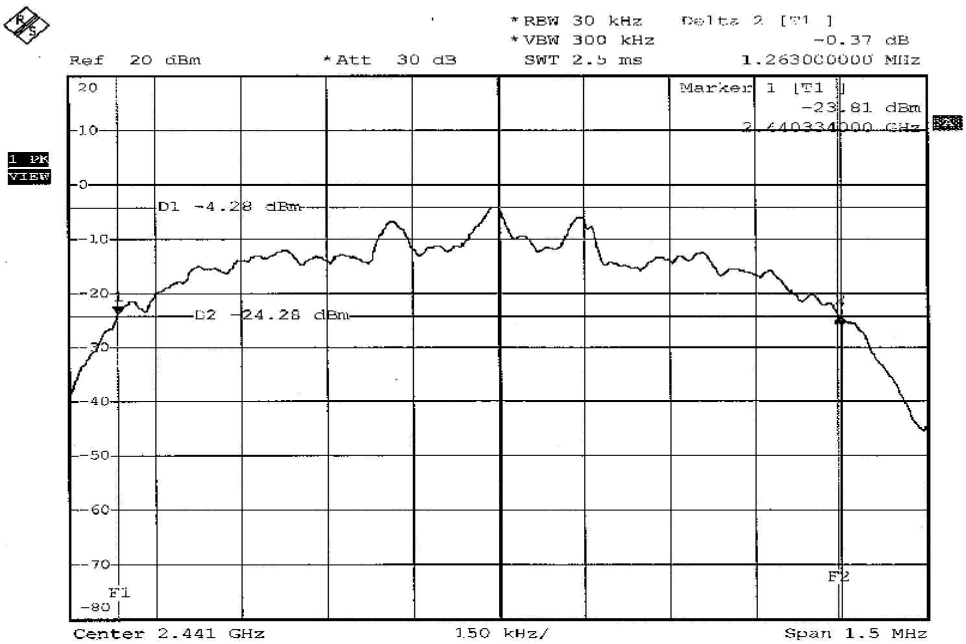
MODULATION TYPE	8DPSK	**ENVIRONMENTAL CONDITIONS**	23deg. C, 54%RH, 991hPa
INPUT POWER (SYSTEM)	120Vac, 60 Hz	**TESTED BY**	Morgan Chen

CHANNEL	CHANNEL FREQUENCY (MHz)	20dB BANDWIDTH (MHz)
0	2402	1.266
39	2441	1.263
78	2480	1.269

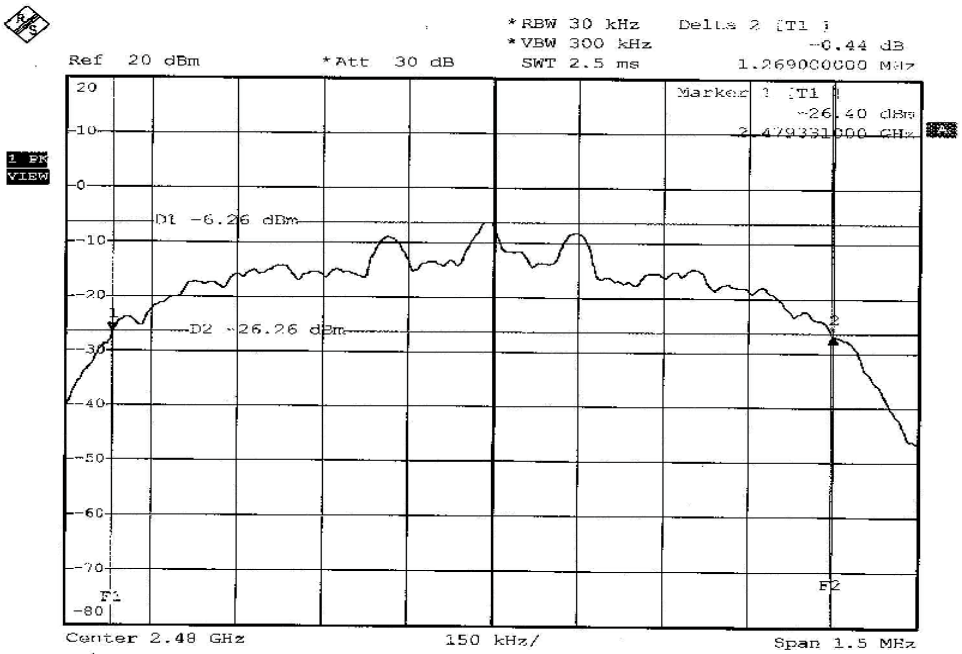
CH 0


*RBW 30 kHz
*VBW 300 kHz
SWT 2.5 ms
Delta 2 [T1]
-0.61 dB
1.266000000 MHz
Ref 20 dBm
*Att 30 dB
Marker 1 [T1]
-22.67 dBm
2.401334000 GHz
1 PK
VIEW
D1 -2.97 dBm
D2 -22.97 dBm
F1
F2
Center 2.402 GHz
150 kHz/
Span 1.5 MHz

CH 39


*RBW 30 kHz
*VBW 300 kHz
SWT 2.5 ms
Delta 2 [T1]
-0.37 dB
1.263000000 MHz
Ref 20 dBm
*Att 30 dB
Marker 1 [T1]
-23.81 dBm
2.440334000 GHz
1 PK
VIEW
D1 -4.28 dBm
D2 -24.28 dBm
F1
F2
Center 2.441 GHz
150 kHz/
Span 1.5 MHz

CH 78


*RBW 30 kHz
*VBW 300 kHz
SWT 2.5 ms
Delta 2 [T1]
-0.44 dB
1.269000000 MHz
Ref 20 dBm
*Att 30 dB
Marker 1 [T1]
-26.40 dBm
2.479331000 GHz
1 PK
VIEW
D1 -6.26 dBm
D2 -26.26 dBm
F1
F2
Center 2.48 GHz
150 kHz/
Span 1.5 MHz

HOPPING CHANNEL SEPARATION

LIMIT OF HOPPING CHANNEL SEPARATION

At least 25kHz or two-third of 20dB hopping channel bandwidth (whichever is greater).

TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED UNTIL
SPECTRUM ANALYZER	FSEK30	100049	Aug. 14, 2006

NOTES: The calibration interval of the above test instruments is 12 months. And the calibrations are traceable to NML/ROC and NIST/USA.

TEST PROCEDURES

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range.
3. By using the MaxHold function record the separation of two adjacent channels.
4. Measure the frequency difference of these two adjacent channels by SA MARK function. And then plot the result on SA screen.
5. Repeat above procedures until all frequencies measured were complete.

DEVIATION FROM TEST STANDARD

No deviation.

TEST SETUP

TEST RESULTS

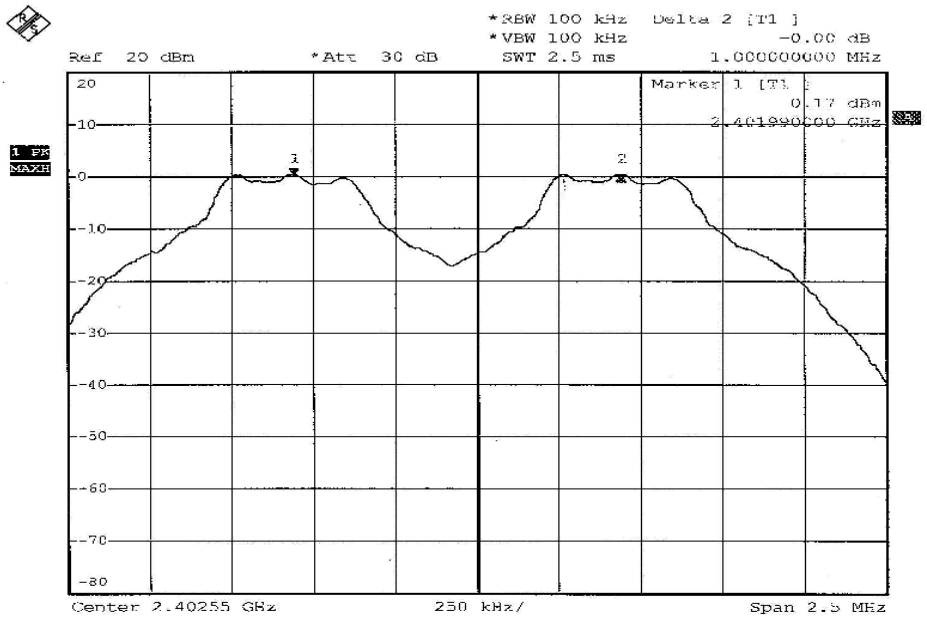
TEST MODE A

MODULATION TYPE	GFSK	**ENVIRONMENTAL CONDITIONS**	23deg. C, 54%RH, 991hPa
INPUT POWER (SYSTEM)	120Vac, 60 Hz	**TESTED BY**	Morgan Chen

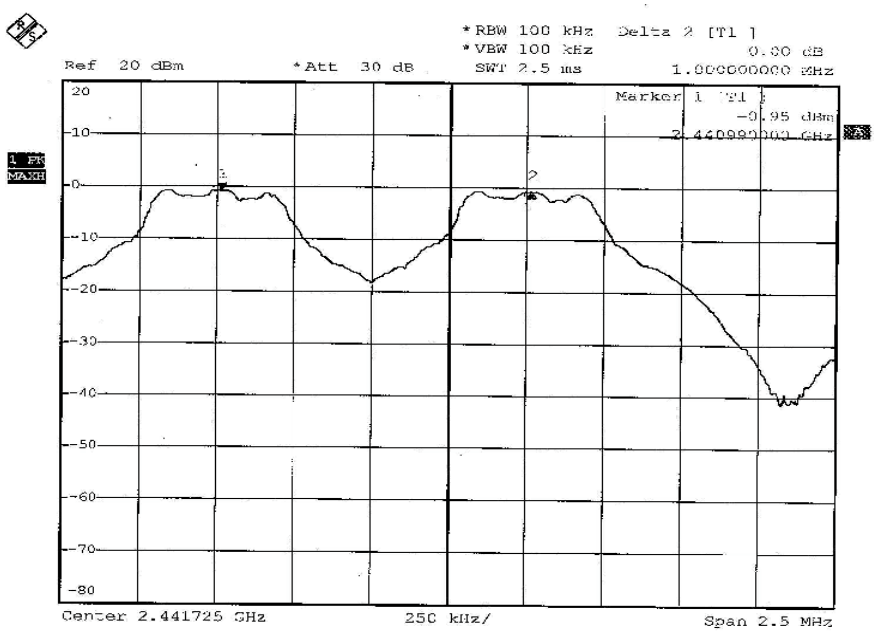
CHANNEL	FREQUENCY (MHZ)	ADJACENT CHANNEL SEPARATION (MHZ)	20DB BANDWIDTH (MHZ)	MINIMUM LIMIT (MHZ)	PASS / FAIL
0	2402	1.001	0.840	0.560	PASS
39	2441	1.002	0.837	0.558	PASS
78	2480	1.002	0.843	0.562	PASS

NOTE: The minimum limit is two-third 20dB bandwidth. Test results please refer to next two pages.

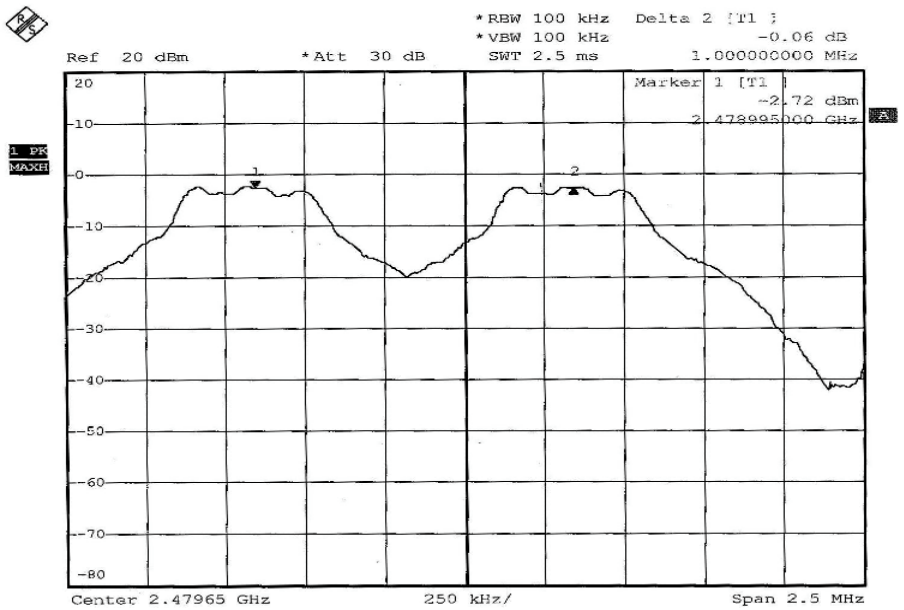
CH 0


*RBW 100 kHz
*VBW 100 kHz
SWT 2.5 ms
Delta 2 [T1]
-0.00 dB
1.000000000 MHz
Ref 20 dBm
*Att 30 dB
Marker 1 [T1]
0.17 dBm
2.401990000 GHz
1 PK
MAXH
Center 2.40255 GHz
250 kHz/
Span 2.5 MHz

CH 39


*RBW 100 kHz
*VBW 100 kHz
SWT 2.5 ms
Delta 2 [T1]
0.00 dB
1.000000000 MHz
Ref 20 dBm
*Att 30 dB
Marker 1 [T1]
-0.95 dBm
1 PK
MAXH
Center 2.441725 GHz
250 kHz/
Span 2.5 MHz

CH 78


*RBW 100 kHz
*VBW 100 kHz
SWT 2.5 ms
Delta 2 [T1]
-0.06 dB
1.000000000 MHz
Ref 20 dBm
*Att 30 dB
Marker 1 [T1]
-2.72 dBm
2.478995000 GHz
1 PR
MAXH
A
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 2.47965 GHz
250 kHz/
Span 2.5 MHz

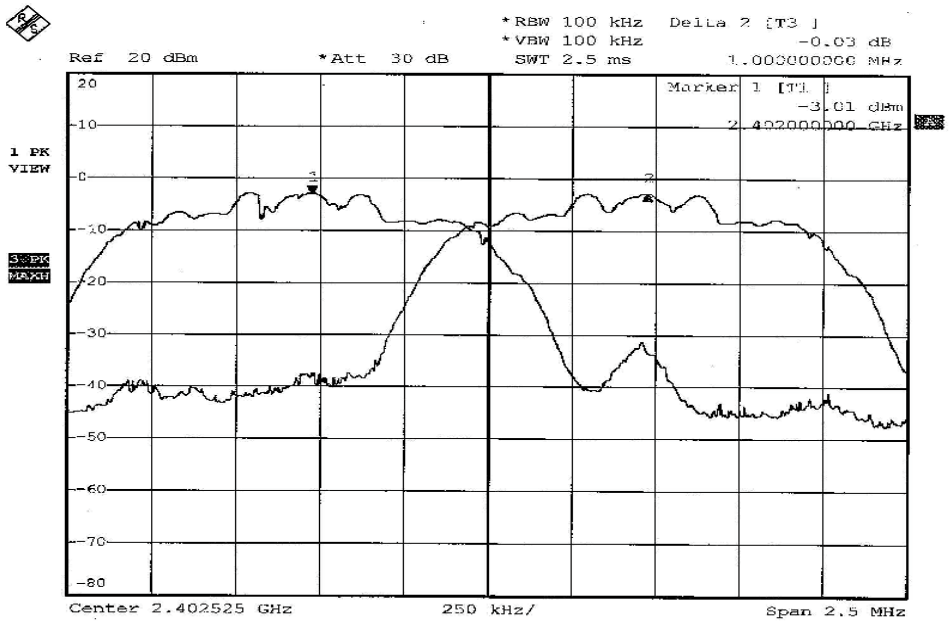
TEST MODE B

MODULATION TYPE	8DPSK	**ENVIRONMENTAL CONDITIONS**	23deg. C, 54%RH, 991hPa
INPUT POWER (SYSTEM)	120Vac, 60 Hz	**TESTED BY**	Morgan Chen

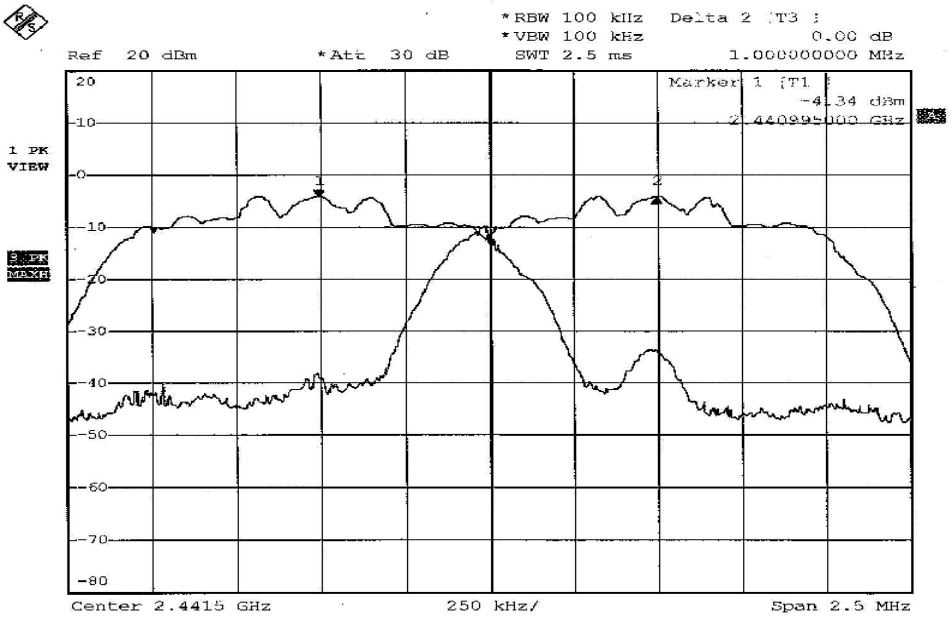
CHANNEL	FREQUENCY (MHz)	ADJACENT CHANNEL SEPARATION (MHz)	20dB BANDWIDTH (MHz)	MINIMUM LIMIT (MHz)	PASS / FAIL
0	2402	1.000	1.266	0.844	PASS
39	2441	1.000	1.263	0.842	PASS
78	2480	1.004	1.269	0.846	PASS

NOTE: The minimum limit is two-third 20dB bandwidth. Test results please refer to next two pages.

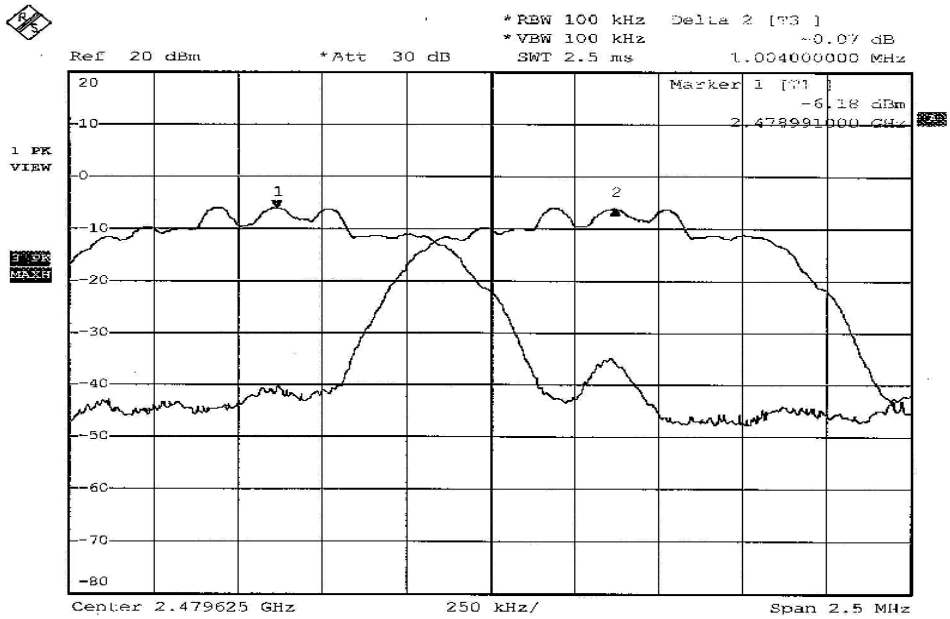
CH 0


*RBW 100 kHz
*VBW 100 kHz
SWT 2.5 ms
Delta 2 [T3]
-0.03 dB
1.000000000 MHz
Ref 20 dBm
*Att 30 dB
Marker 1 [T1]
-3.01 dBm
2.402000000 GHz
1 PK
VIEW
3 PK
MAXH
Center 2.402525 GHz
250 kHz/
Span 2.5 MHz

CH 39


*RBW 100 kHz
*VBW 100 kHz
SWT 2.5 ms
Delta 2 [T3]
0.00 dB
1.000000000 MHz
Ref 20 dBm
*Att 30 dB
Marker 1 [T1]
-4.34 dBm
2.440995000 GHz
1 PK
VIEW
3 PK
MAXH
Center 2.4415 GHz
250 kHz/
Span 2.5 MHz

CH 78


*RBW 100 kHz
*VBW 100 kHz
SWT 2.5 ms
Delta 2 [T3]
-0.07 dB
1.004000000 MHz
Ref 20 dBm
*Att 30 dB
Marker 1 [T1]
-6.18 dBm
2.478991000 GHz
1 PK
VIEW
Center 2.479625 GHz
250 kHz/
Span 2.5 MHz

MAXIMUM PEAK OUTPUT POWER

LIMITS OF MAXIMUM PEAK OUTPUT POWER MEASUREMENT

The Maximum Peak Output Power Measurement is125mW.

TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED UNTIL
SPECTRUM ANALYEER	FSEK30	100049	Aug. 14, 2006

NOTE: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

TEST PROCEDURES

a. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.

b. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.

c. The center frequency of the spectrum analyzer is set to the fundamental frequency and using 3 MHz RBW and 10 MHz VBW.

d. Measure the captured power within the band and recording the plot.

e. Repeat above procedures until all frequencies required were complete.

DEVIATION FROM TEST STANDARD

No deviation

TEST SETUP

For the actual test configuration, please refer to the related Item – Photographs of the Test Configuration.

EUT OPERATING CONDITION

The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

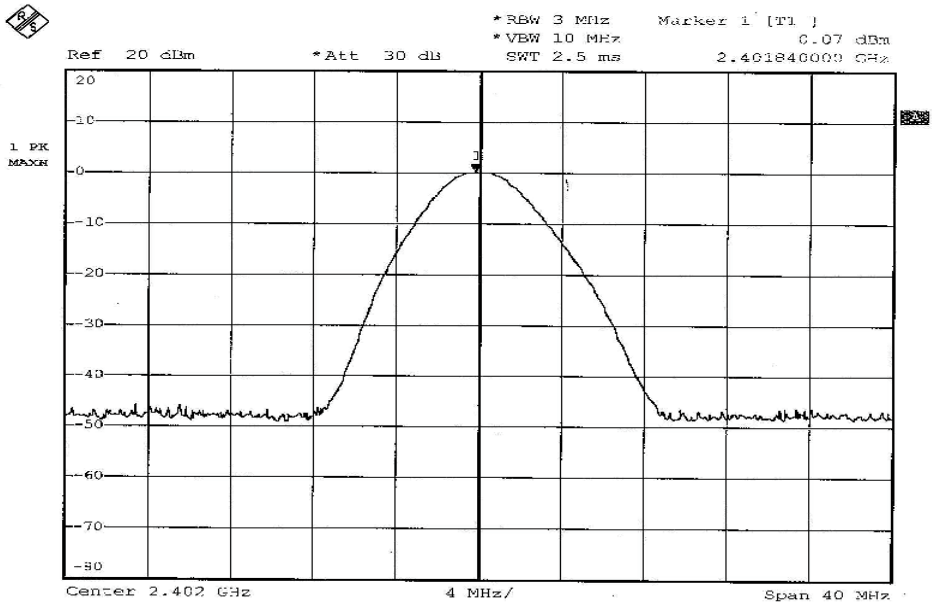
TEST RESULTS

TEST MODE A

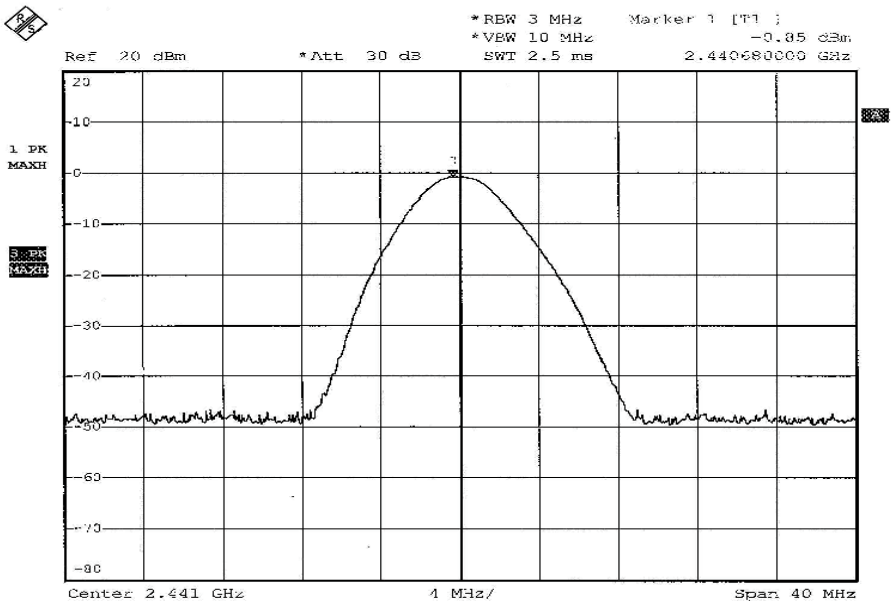
MODULATION TYPE	GFSK	**ENVIRONMENTAL CONDITIONS**	23deg. C, 54%RH, 991hPa
INPUT POWER (SYSTEM)	120Vac, 60 Hz	**TESTED BY**	Morgan Chen

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (mW)	PEAK POWER OUTPUT (dBm)	PEAK POWER LIMIT (mW)	PASS/FAIL
0	2402	1.016	0.07	125	PASS
39	2441	0.822	-0.85	125	PASS
78	2480	0.596	-2.25	125	PASS

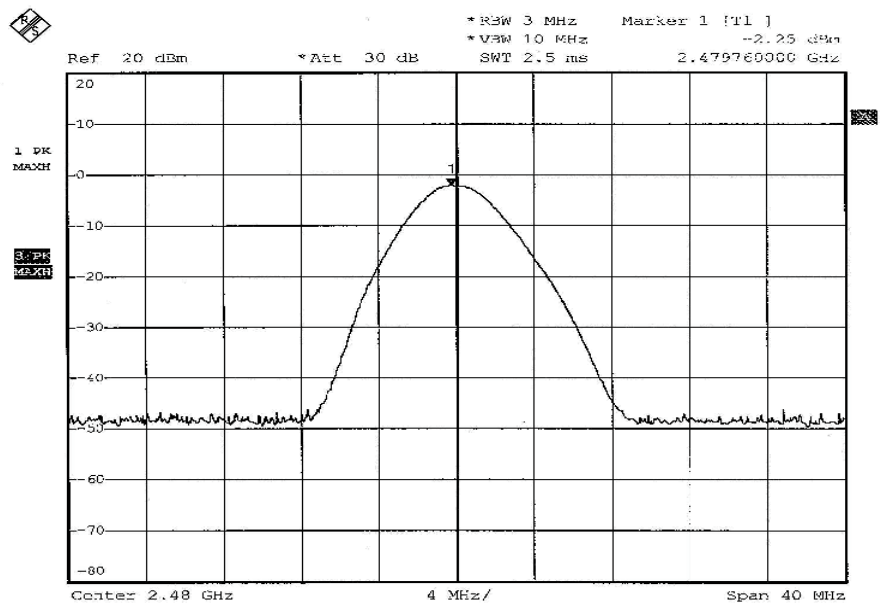
CH 0


*RBW 3 MHz
*VBW 10 MHz
SWT 2.5 ms
Marker 1 [T1]
0.07 dBm
2.401840000 GHz
Ref 20 dBm
*Att 30 dB
1 PK
MAXH
Center 2.402 GHz
4 MHz/
Span 40 MHz

CH 39


*RBW 3 MHz
*VBW 10 MHz
SWT 2.5 ms
Marker 1 [T1]
-0.85 dBm
2.440680000 GHz
Ref 20 dBm
*Att 30 dB
1 PK
MAXH
Center 2.441 GHz
4 MHz/
Span 40 MHz

CH 78

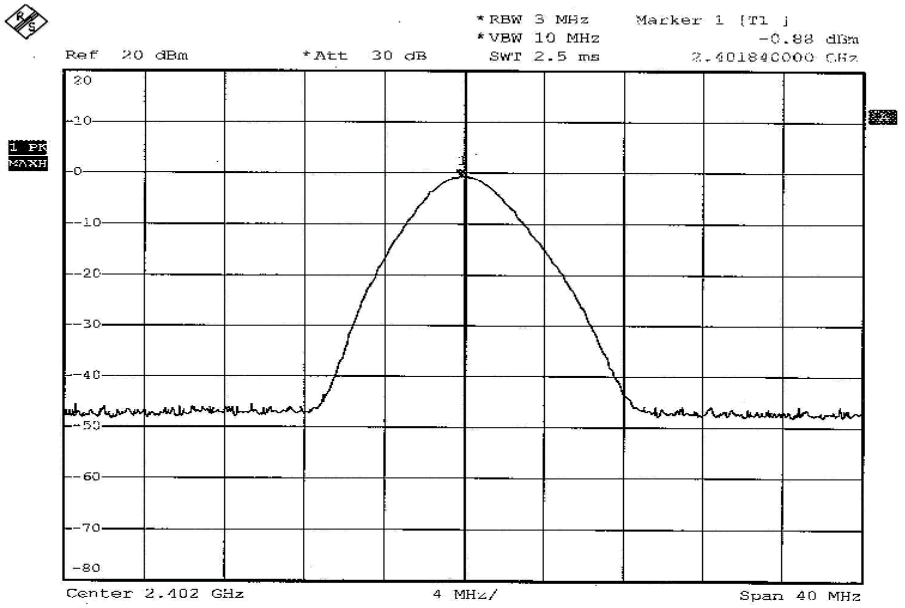

*RBW 3 MHz
*VBW 10 MHz
SWT 2.5 ms
Marker 1 [T1]
-2.25 dBm
2.479760000 GHz
Ref 20 dBm
*Att 30 dB
1 PK
MAXH
3 PK
MAXH
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 2.48 GHz
4 MHz/
Span 40 MHz

TEST MODE B

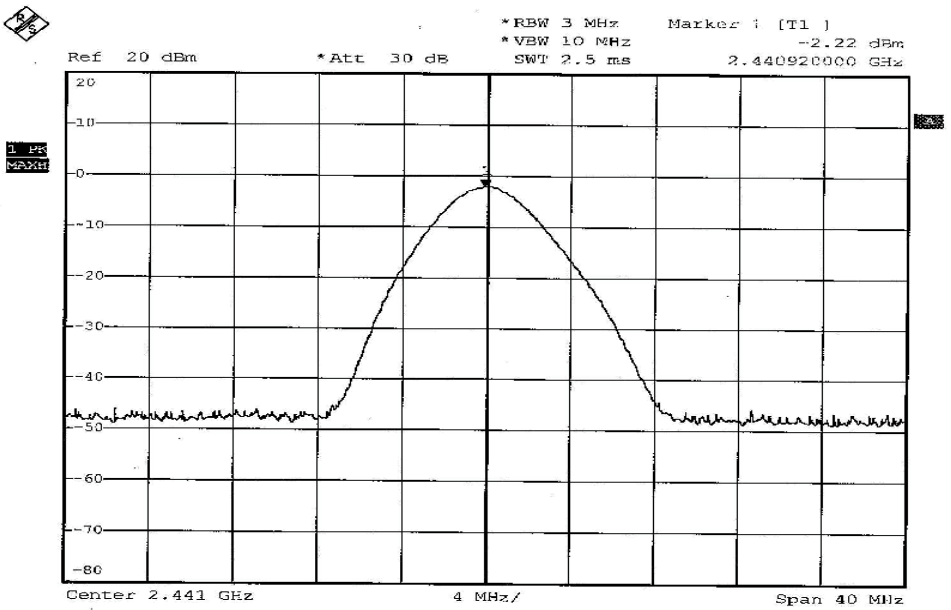
MODULATION TYPE	8DPSK	**ENVIRONMENTAL CONDITIONS**	23deg. C, 54%RH, 991hPa
INPUT POWER (SYSTEM)	120Vac, 60 Hz	**TESTED BY**	Morgan Chen

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (mW)	PEAK POWER OUTPUT (dBm)	PEAK POWER LIMIT (mW)	PASS/FAIL
0	2402	0.817	-0.88	125	PASS
39	2441	0.600	-2.22	125	PASS
78	2480	0.380	-4.20	125	PASS

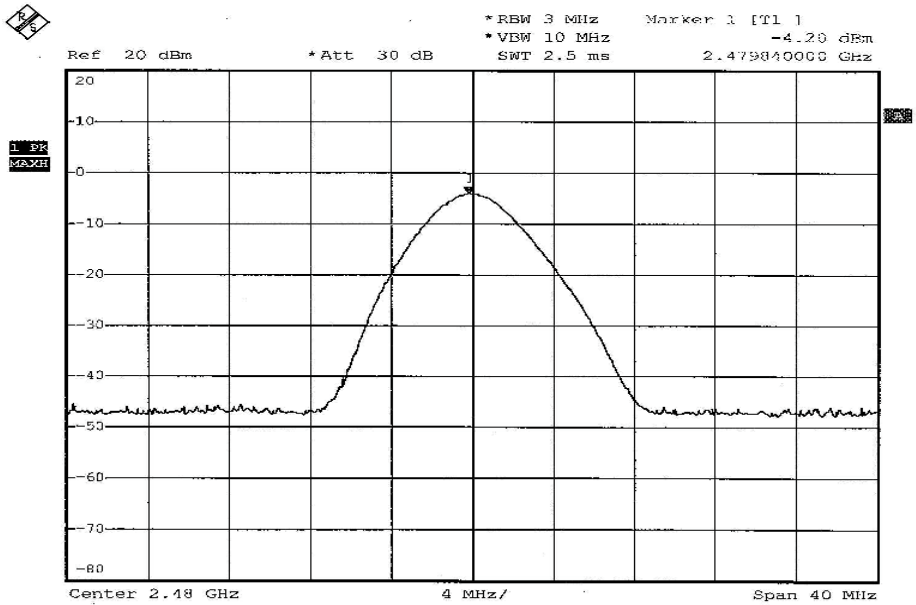
CH 0


*RBW 3 MHz
*VBW 10 MHz
SWT 2.5 ms
Marker 1 [T1]
-0.88 dBm
2.401840000 GHz
Ref 20 dBm
*Att 30 dB
1 Pk
MAXH
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 2.402 GHz
4 MHz/
Span 40 MHz

CH 39


*RBW 3 MHz
*VBW 10 MHz
SWT 2.5 ms
Marker 1 [T1]
-2.22 dBm
2.440920000 GHz
Ref 20 dBm
*Att 30 dB
1 Pk
MAXH
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 2.441 GHz
4 MHz/
Span 40 MHz

CH 78


*RBW 3 MHz
*VBW 10 MHz
SWT 2.5 ms
Marker 1 [T1]
-4.20 dBm
2.479840000 GHz
Ref 20 dBm
*Att 30 dB
1 RM
MAXH
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 2.48 GHz
4 MHz/
Span 40 MHz

BAND EDGES MEASUREMENT

LIMITS OF BAND EDGES MEASUREMENT

Below –20dB of the highest emission level of operating band (in 100KHz RBW).

TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED UNTIL
SPECTRUM ANALYZER	FSEK30	100049	Aug. 14, 2006

NOTES: The calibration interval of the above test instruments is 12 months. And the calibrations are traceable to NML/ROC and NIST/USA.

TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer via a low lose cable. Set both RBW and VBW of spectrum analyzer to 100 kHz with suitable frequency span including 100 MHz bandwidth from band edge. The band edges was measured and recorded.

DEVIATION FROM TEST STANDARD

No deviation.

EUT OPERATING CONDITION

The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

TEST RESULTS

The spectrum plots are attached on the following 4 images. D1 line indicates the highest level, D2 line indicates the 20dB offset below D1. It shows compliance with the requirement in part 15.247(d).

TEST MODE A

NOTE 1:

The band edge emission plot on the next page shows 49.03dBc between carrier maximum power and local maximum emission in restrict band (2.3880GHz). The emission of carrier strength list in the test result of channel 0 at the item 6.2.7 is 86.44dBuV/m (Peak), so the maximum field strength in restrict band is 86.44-49.03=37.41dBuV/m, which is under 74 dBuV/m limit.

Average value = 37.41-30=7.41dBuV/m, which is under 54dBuV/m limit.

The DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625 * 5 per 296.25 ms per channel. Therefore, the duty cycle be equal to: 20log (3.125/100)= -30 dB.

Average value = Peak reading-30

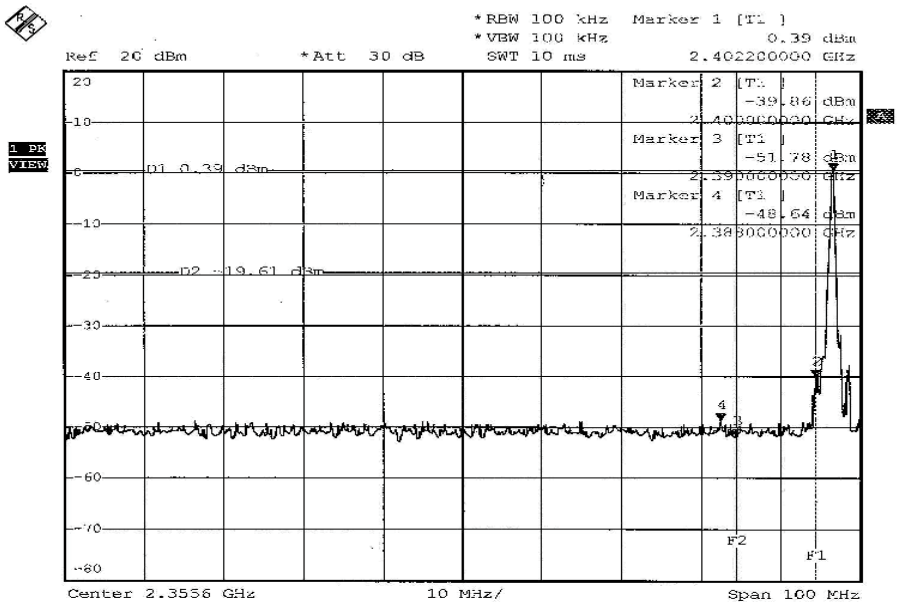
NOTE 2:

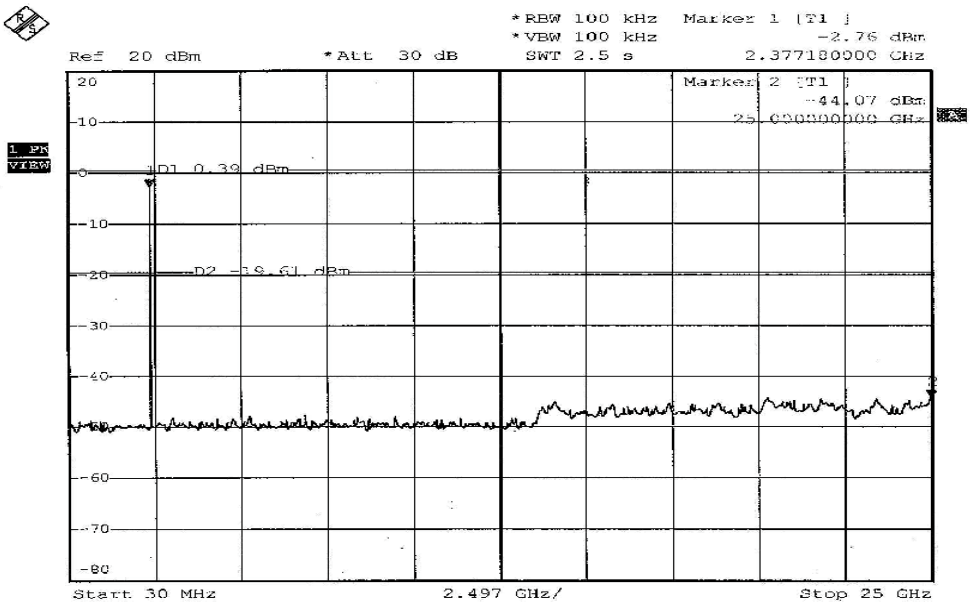
The band edge emission plot on the next second page shows 46.04dBc between carrier maximum power and local maximum emission in restrict band (2.4908GHz). The emission of carrier strength list in the test result of channel 78 at the item 6.2.7 is 84.79dBuV/m (Peak), so the maximum field strength in restrict band is 84.79-46.04=38.75dBuV/m, which is under 74 dBuV/m limit.

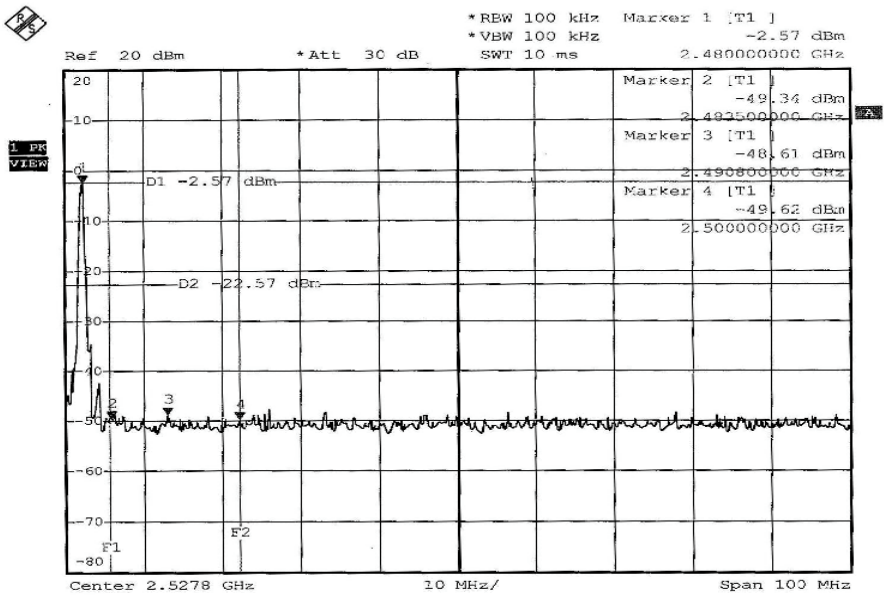
Average value = 38.75-30=8.75dBuV/m, which is under 54dBuV/m limit.

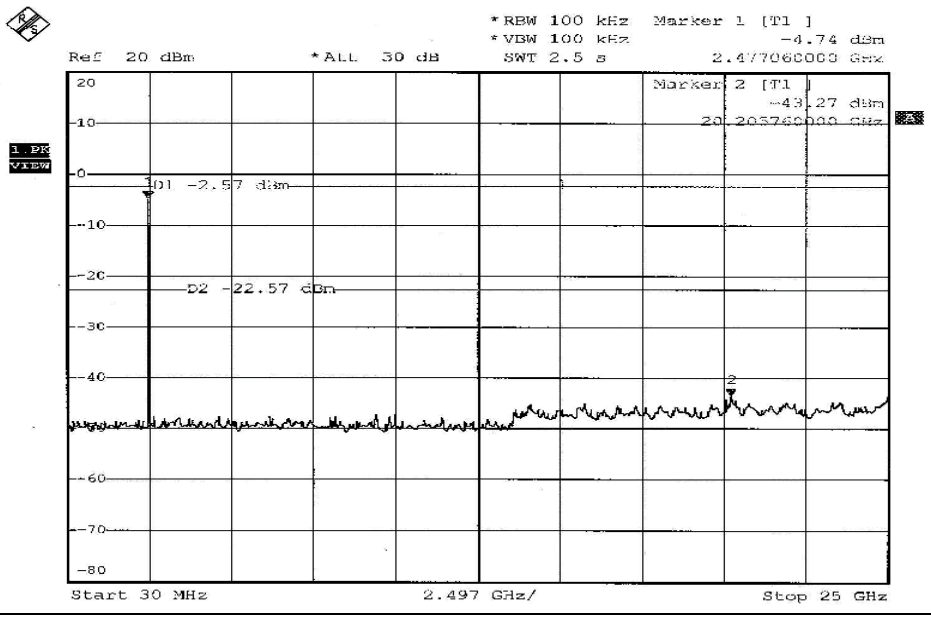
The DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625 * 5 per 296.25 ms per channel. Therefore, the duty cycle be equal to: 20log (3.125/100)= -30 dB.

Average value = Peak reading-30


*RBW 100 kHz
*VBW 100 kHz
SWT 10 ms
Marker 1 [T1]
0.39 dBm
2.402200000 GHz
Ref 20 dBm
*Att 30 dB
Marker 2 [T1]
-39.86 dBm
Marker 3 [T1]
-51.78 dBm
Marker 4 [T1]
-48.64 dBm
1 PK
VIEW
D1 0.39 dBm
D2 -19.61 dBm
F2
F1
Center 2.3556 GHz
10 MHz/
Span 100 MHz


*RBW 100 kHz
*VBW 100 kHz
SWT 2.5 s
Marker 1 [T1]
-2.76 dBm
2.377180000 GHz
Ref 20 dBm
*Att 30 dB
Marker 2 [T1]
-44.07 dBm
1 PK
VIEW
D1 0.39 dBm
D2 -19.61 dBm
Start 30 MHz
2.497 GHz/
Stop 25 GHz


*RBW 100 kHz
*VBW 100 kHz
SWT 10 ms
Marker 1 [T1]
-2.57 dBm
2.480000000 GHz
Ref 20 dBm
*Att 30 dB
Marker 2 [T1]
-49.34 dBm
2.483500000 GHz
Marker 3 [T1]
-48.61 dBm
2.490800000 GHz
Marker 4 [T1]
-49.62 dBm
2.500000000 GHz
1 PK
VIEW
D1 -2.57 dBm
D2 -22.57 dBm
F1
F2
Center 2.5278 GHz
10 MHz/
Span 100 MHz


*RBW 100 kHz
*VBW 100 kHz
SWT 2.5 s
Marker 1 [T1]
-4.74 dBm
2.477060000 GHz
Ref 20 dBm
*Att 30 dB
Marker 2 [T1]
-43.27 dBm
20.203760000 GHz
1 PK
VIEW
D1 -2.57 dBm
D2 -22.57 dBm
Start 30 MHz
2.497 GHz/
Stop 25 GHz

TEST MODE B

NOTE 1:

The band edge emission plot on the next page shows 44.64dBc between carrier maximum power and local maximum emission in restrict band (2.34212GHz). The emission of carrier strength list in the test result of channel 0 at the item 6.2.7 is 85.35dBuV/m (Peak), so the maximum field strength in restrict band is 85.35-44.64=40.71dBuV/m, which is under 74 dBuV/m limit.

Average value = 40.71-30=10.71dBuV/m, which is under 54dBuV/m limit.

The DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625 * 5 per 296.25 ms per channel. Therefore, the duty cycle be equal to: 20log (3.125/100)= -30 dB.

Average value = Peak reading-30

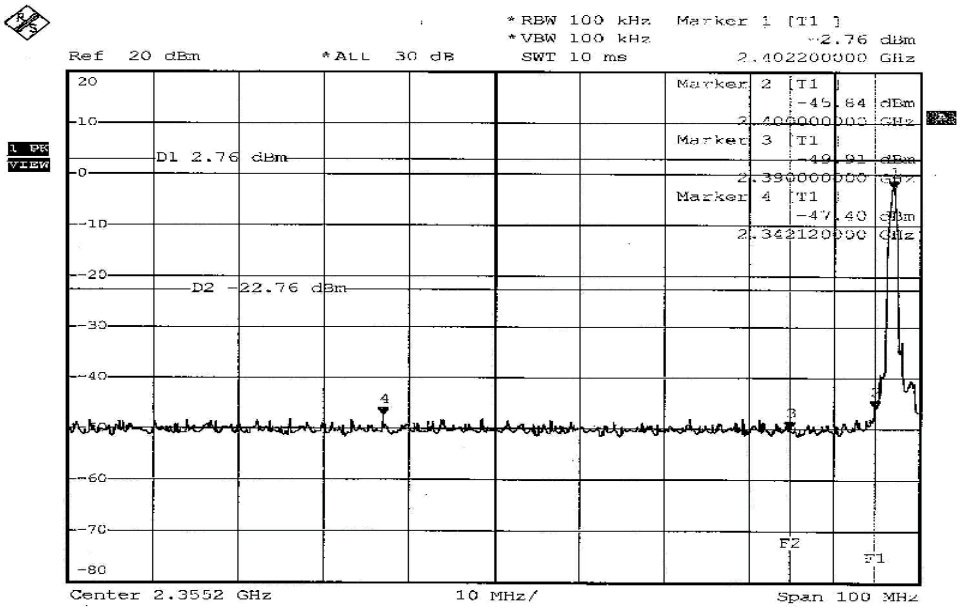
NOTE 2:

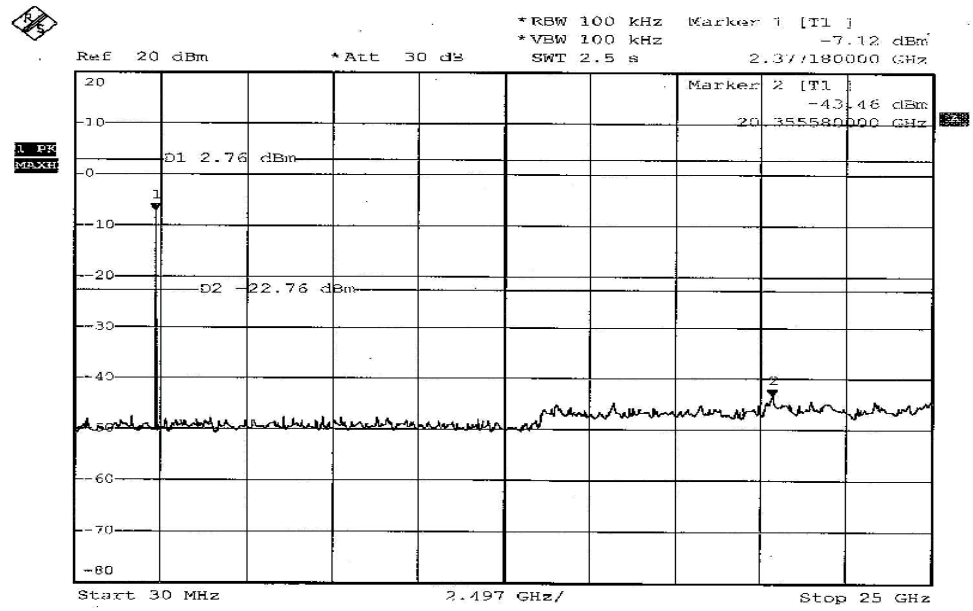
The band edge emission plot on the next second page shows 41.68dBc between carrier maximum power and local maximum emission in restrict band (2.4835GHz). The emission of carrier strength list in the test result of channel 78 at the item 6.2.7 is 82.11dBuV/m (Peak), so the maximum field strength in restrict band is 82.11-41.68=40.43dBuV/m, which is under 74 dBuV/m limit.

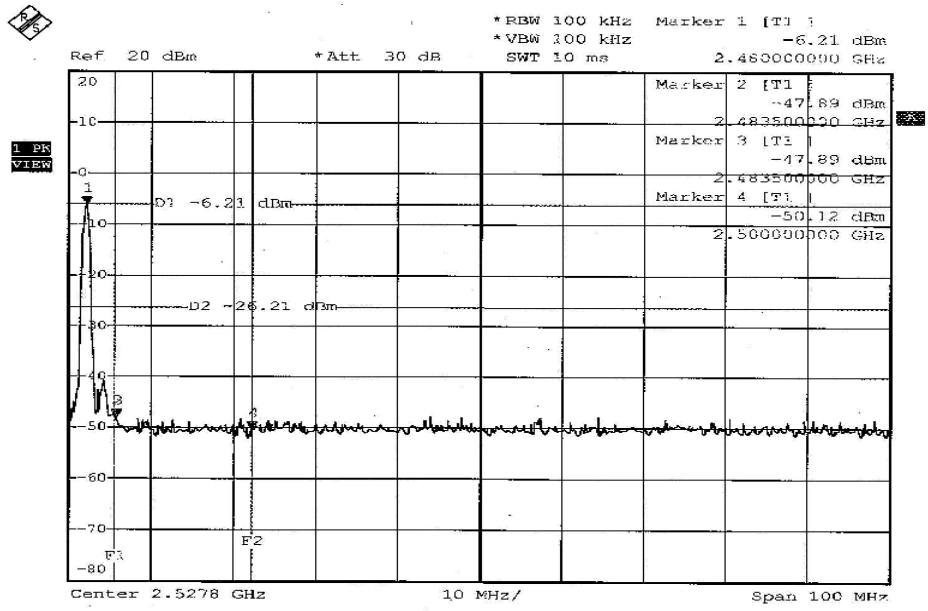
Average value = 40.43-30=10.43dBuV/m, which is under 54dBuV/m limit.

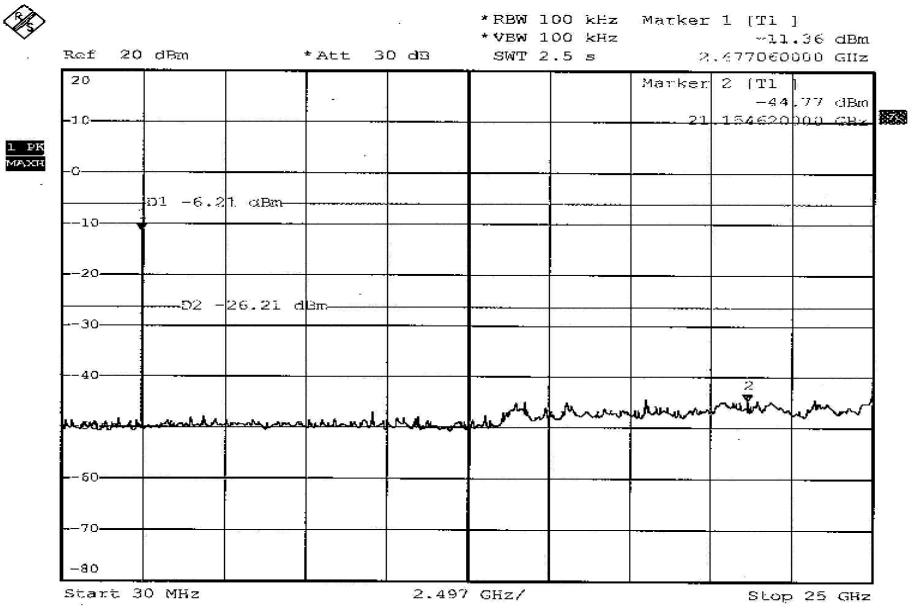
The DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625 * 5 per 296.25 ms per channel. Therefore, the duty cycle be equal to: 20log (3.125/100)= -30 dB.

Average value = Peak reading-30


*RBW 100 kHz
*VBW 100 kHz
SWT 10 ms
Marker 1 [T1]
-2.76 dBm
2.402200000 GHz
Ref 20 dBm
*ALL 30 dB
Marker 2 [T1]
-45.84 dBm
2.400000000 GHz
Marker 3 [T1]
-49.91 dBm
2.390000000 GHz
Marker 4 [T1]
-47.40 dBm
2.342120000 GHz
1 PK VIEW
D1 2.76 dBm
D2 -22.76 dBm
F2
F1
Center 2.3552 GHz
10 MHz/
Span 100 MHz


*RBW 100 kHz
*VBW 100 kHz
SWT 2.5 s
Marker 1 [T1]
-7.12 dBm
2.377180000 GHz
Ref 20 dBm
*Att 30 dB
Marker 2 [T1]
-43.46 dBm
20.355580000 GHz
1 PK MAXH
D1 2.76 dBm
D2 -22.76 dBm
Start 30 MHz
2.497 GHz/
Stop 25 GHz


*RBW 100 kHz
*VBW 100 kHz
SWT 10 ms
Marker 1 [T1]
-6.21 dBm
2.480000000 GHz
Ref 20 dBm
*Att 30 dB
Marker 2 [T1]
-47.89 dBm
2.483500000 GHz
Marker 3 [T1]
-47.89 dBm
2.483500000 GHz
Marker 4 [T1]
-50.12 dBm
2.500000000 GHz
1 PK
VIEW
D1 -6.21 dBm
D2 -26.21 dBm
F1
F2
Center 2.5278 GHz
10 MHz/
Span 100 MHz


*RBW 100 kHz
*VBW 100 kHz
SWT 2.5 s
Marker 1 [T1]
-11.36 dBm
2.477060000 GHz
Ref 20 dBm
*Att 30 dB
Marker 2 [T1]
-44.77 dBm
21.154620000 GHz
1 PK
MAXH
D1 -6.21 dBm
D2 -26.21 dBm
Start 30 MHz
2.497 GHz/
Stop 25 GHz

ANTENNA REQUIREMENT

STANDARD APPLICABLE

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

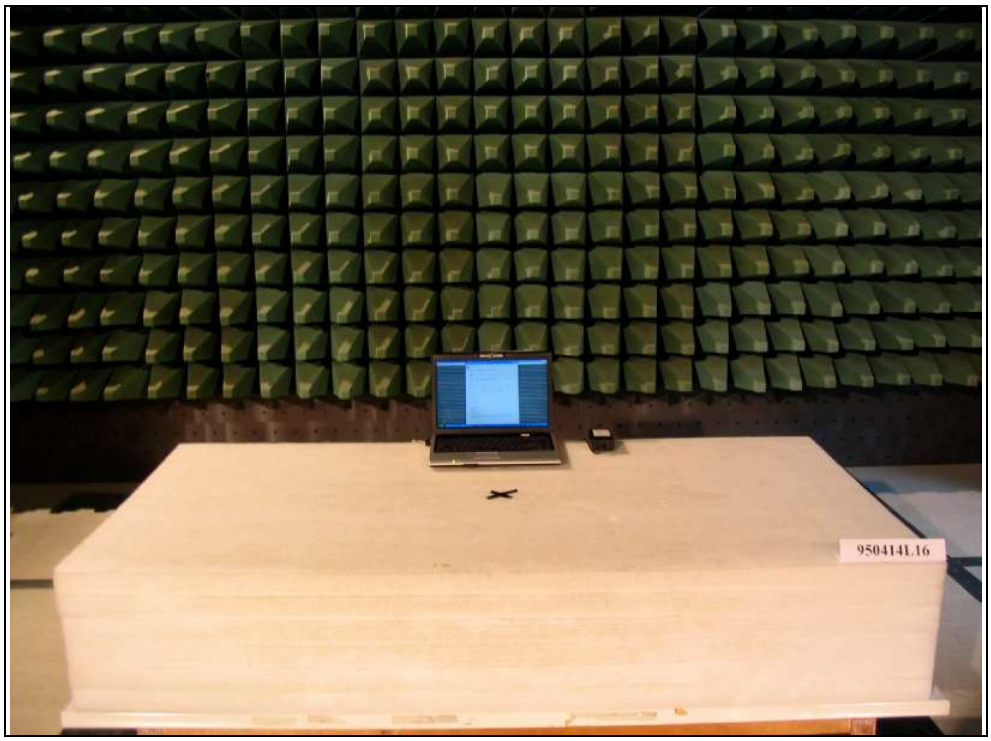
ANTENNA CONNECTED CONSTRUCTION

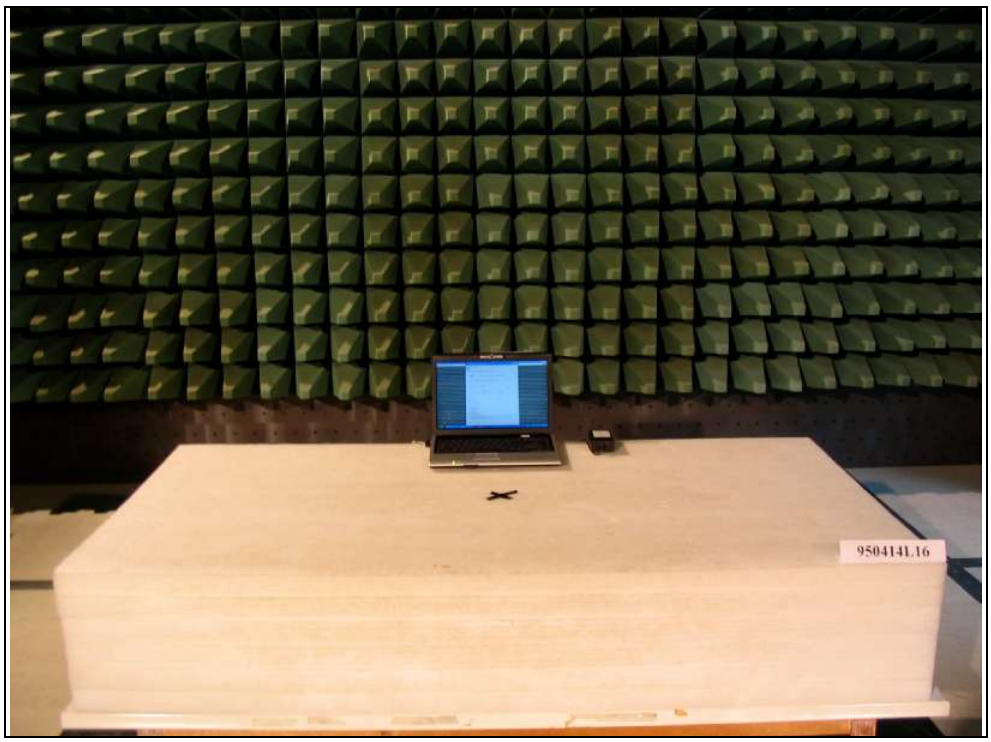
The antenna used in this product is PIFA antenna with UFL antenna connector. The maximum gain of this antenna is –1.51038dBi.

PHOTOGRAPHS OF THE TEST CONFIGURATION

CONDUCTED EMISSION TEST

RADIATED EMISSION TEST





INFORMATION ON THE TESTING LABORATORIES

We, ADT Corp., were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved by the following approval agencies according to ISO/IEC 17025.

USA	FCC, UL, A2LA
Germany	TUV Rheinland
Japan	VCCI
Norway	NEMKO
Canada	INDUSTRY CANADA , CSA
R.O.C.	CNLA, BSMI, DGT
Netherlands	Telefication
Singapore	PSB , GOST-ASIA(MOU)
Russia	CERTIS(MOU)

Copies of accreditation certificates of our laboratories obtained from approval agencies can be downloaded from our web site: www.adt.com.tw/index.5/phtml. If you have any comments, please feel free to contact us at the following:

Linko EMC/RF Lab:
Tel: 886-2-26052180
Fax: 886-2-26052943

Hsin Chu EMC/RF Lab:
Tel: 886-3-5935343
Fax: 886-3-5935342

Hwa Ya EMC/RF/Safety Telecom Lab:
Tel: 886-3-3183232
Fax: 886-3-3185050

Linko RF Lab.
Tel: 886-3-3270910
Fax: 886-3-3270892

Web Site: www.adt.com.tw

The address and road map of all our labs can be found in our web site also.

APPENDIX-A

MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB

No any modifications are made to the EUT by the lab during the test.