FCC TEST REPORT

REPORT NO. : RF970602L08
MODEL NO. : 1363
RECEIVED : Jun. 02, 2008
TESTED : Jun. 23 ~ Jun. 24, 2008
ISSUED : Jul. 01, 2008

APPLICANT : Microsoft Corporation
ADDRESS : One Microsoft Way, Redmond WA 98052-6399, U.S.A

ISSUED BY : Advance Data Technology Corporation
LAB ADDRESS : No. 47, 14th Ling, Chia Pau Tsuen, Lin Kou Hsiang 244, Taipei Hsien, Taiwan, R.O.C.
TEST LOCATION : No. 19, Hwa Ya 2nd Rd., Wen Hwa Tsuen, Kwei Shan Hsiang, Taoyuan Hsien 333, Taiwan, R.O.C.

Testing Laboratory 0528
TESTING CERT # 2177-01

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1. CERTIFICATION

PRODUCT: Microsoft® Explorer Mini Mouse
MODEL: 1363
BRAND: Microsoft®
APPLICANT: Microsoft Corporation
TESTED: Jun. 23 ~ Jun. 24, 2008
TEST SAMPLE: ENGINEERING SAMPLE
STANDARDS: **FCC Part 15, Subpart C (Section 15.249)**
ANSI C63.4-2003

The above equipment (model: 1363) have been tested by **Advance Data Technology Corporation**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

PREPARED BY : Ivy Lin , **DATE:** Jul. 01, 2008
Ivy Lin / Specialist

TECHNICAL ACCEPTANCE : Long Chen , **DATE:** Jul. 01, 2008
Responsible for RF
Long Chen / Senior Engineer

APPROVED BY : Gary Chang , **DATE:** Jul. 01, 2008
Gary Chang / Assistant Manager

2. SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 15, Subpart C (Section 15.249)			
STANDARD PARAGRAPH	**TEST TYPE**	**RESULT**	**REMARK**
15.207	Conducted Emission Test	NA	Power supply is 1.2Vdc from battery.
15.209 15.249 15.249 (d)	Radiated Emission Test Band Edge Measurement Limit: 50dB less than the peak value of fundamental frequency or meet radiated emission limit in section 15.209	PASS	Meet the requirement of limit. Minimum passing margin is -14.95dB at 908.72MHz.

2.1 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

MEASUREMENT	FREQUENCY	UNCERTAINTY
Radiated emissions	30MHz ~ 200MHz	2.93 dB
	200MHz ~1000MHz	2.95 dB
	1GHz ~ 18GHz	2.26 dB
	18GHz ~ 40GHz	1.94 dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

3. GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

EUT	Microsoft® Explorer Mini Mouse
MODEL NO.	1363
FCC ID	C3K1363
POWER SUPPLY	1.2Vdc from battery
MODULATION TYPE	GFSK
FREQUENCY RANGE	2403 - 2480 MHz
NUMBER OF CHANNEL	24
ANTENNA TYPE	PCB antenna with 1.17dBi gain
DATA CABLE	NA
I/O PORT	NA
ACCESSORY DEVICE	NA

NOTE:

1. The details of EUT samples listed as below:

Sample	Serial No.
Mouse sample 1	LAKE-EV2-204
Mouse sample 2	LAKE-EV2-193
Mouse sample 3	LAKE-EV2-188

2. Configuration Information

Lake Configuration Information

Configuration #:		**Comments:** DV phase **Mouse** unit for formal report			
Manufacturer	**Component type**	**Part no.**	**Revision no.**	**Description**	**BOM (if known)**
Microsoft	Mouse	-	-	Model: 1363	-
Infineon	Optical Sensor	11300066200	TR1.1	UAB-M9659-OLQFN-76-1	11300066200
Nordic	RF IC	11300070200	-	NRF24L01	11300070200
Rohm	Blue LED	10740031200	-	SLA560BD2W, T1.75,BLUE	10740031200
Microsoft	firmware	-	-	T2_TR11_Lake_V02.19.ram	-
Happy, Express	PCB	10230176200	05	LAKE SENSOR BOARD, 4L, 62X48MM	10230176200
Happy, Explus	PCB	10230175200	05	LAKE SWITCH BOARD, 2L, 44X38MM	10230175200
KYE	PCB Assy	20000195201	03	PCBA, LAKE, WIRELESS, MS, 2.4GHZ, TX	20000195201

Definition of configuration #: The configuration number (#) is used for traceability to a particular BOM (Bill of Materials). It is an easy way to readily identify and convey the construction of a without having to include all of the details of a BOM on every test data sheet. If two sets of test data have test samples with the same configuration # then the construction details of those test samples can readily be determined (as long as the configuration # correctly corresponds to a BOM) and that these two test samples have been constructed identically.

Detailed information on the configuration of the tested samples is required in order to track performance changes across various revisions of the hardware and to document that the samples tested are representative of the final configuration that will be manufactured in production.

Any prototype or pre-production components must be clearly identified in the configuration table.

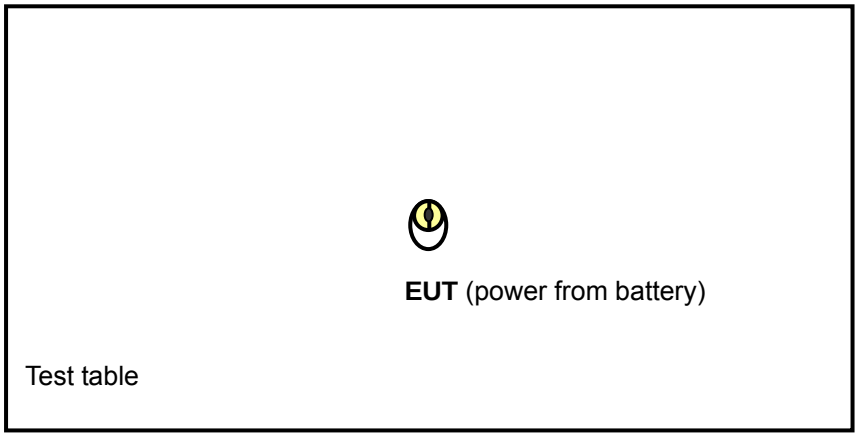
3. The above EUT information was declared by the manufacturer and for more detailed features description, please refer to the manufacturer's specifications or User's Manual.

3.2 DESCRIPTION OF TEST MODES

24 channels are provided to this EUT:

Channel Group	Index	Freq. (MHz)	Channel Group	Index	Freq. (MHz)
Subset A	0	2403	Subset D	12	2420
	1	2429		13	2427
	2	2446		14	2453
	3	2475		15	2480
Subset B	4	2404	Subset E	16	2418
	5	2422		17	2431
	6	2451		18	2444
	7	2478		19	2468
Subset C	8	2407	Subset F	20	2409
	9	2425		21	2442
	10	2449		22	2456
	11	2473		23	2470

3.2.1 CONFIGURATION OF SYSTEM UNDER TEST



3.2.2 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE≥1G	RE<1G	PLC	BM	
A	√	√	NOTE	√	Mouse Serial No.: LAKE-EV2-204
B	√	√	NOTE	-	Mouse Serial No.: LAKE-EV2-193
C	√	√	NOTE	-	Mouse Serial No.: LAKE-EV2-188

Where **PLC:** Power Line Conducted Emission **RE<1G:** Radiated Emission below 1GHz
RE≥1G: Radiated Emission above 1GHz **BM:** Bandedge Measurement

NOTE: No need to concern of Conducted Emission due to the EUT is powered by battery.

RADIATED EMISSION TEST (ABOVE 1 GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
A, B, C	0 to 23	0, 21, 15	GFSK

RADIATED EMISSION TEST (BELOW 1 GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
A, B, C	0 to 23	0	GFSK

BANDEDGE MEASUREMENT:

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
A	0 to 23	0, 15	GFSK

3.3 GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

FCC Part 15, Subpart C (Section 15.249)
ANSI C63.4-2003

All test items have been performed and recorded as per the above standards.

NOTE: The EUT is also considered as a kind of computer peripheral, because the connection to computer is necessary for typical use. It has been verified to comply with the requirements of FCC Part 15, Subpart B, Class B (DoC). The test report has been issued separately.

3.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit.

4. TEST TYPES AND RESULTS

4.1 RADIATED EMISSION MEASUREMENT

4.1.1 LIMITS OF RADIATED EMISSION MEASUREMENT

Emissions radiated outside of the specified bands, shall be according to the general radiated limits in 15.209, 15.249 as following:

15.209 Limit		
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
15.249 Limit		
Fundamental Frequency	**Field Strength of Fundamental (millivolts/meter)**	**Field Strength of Harmonics (microvolts/meter)**
902 ~ 928 MHz	50	500
2400 ~ 2483.5 MHz	50	500
5725 ~ 5875 MHz	50	500
24 ~ 24.25 GHz	250	2500

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.

4.1.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED UNTIL
Test Receiver ROHDE & SCHWARZ	ESCI	100424	Jul. 27, 2008
Spectrum Analyzer Agilent	E4446A	MY44360128	Dec. 06, 2008
BILOG Antenna SCHWARZBECK	VULB9168	9168-160	May 01, 2009
HORN Antenna SCHWARZBECK	9120D	9120D-209	Jun. 28, 2008
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170243	Dec. 24, 2008
Preamplifier Agilent	8447D	2944A10633	Oct. 28, 2008
Preamplifier Agilent	8449B	3008A01964	Oct. 23, 2008
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	283402/4	Dec. 06, 2008
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	251644/4	Dec. 06, 2008
Software ADT.	ADT_Radiated_V7.6	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

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 3.

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

4. The FCC Site Registration No. is 988962.

5. The IC Site Registration No. is IC3789B-3.

4.1.3 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.

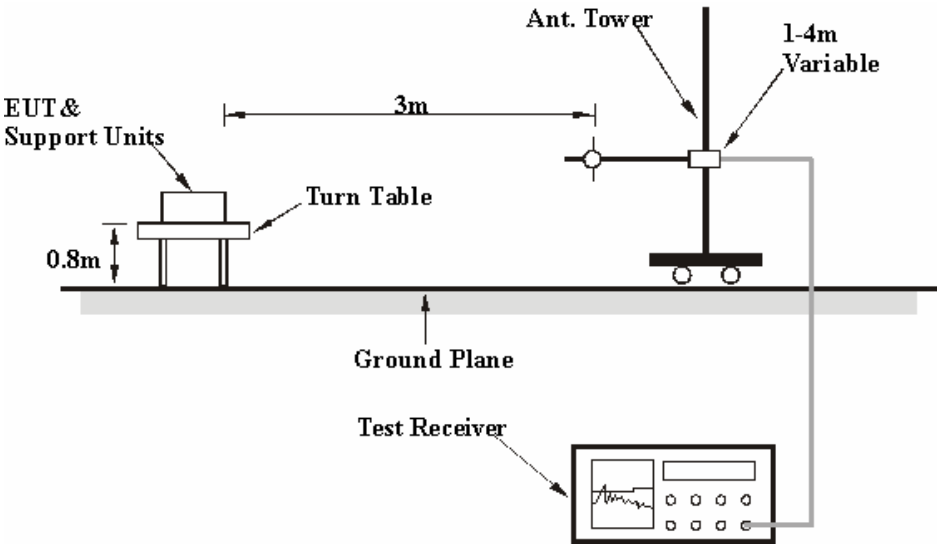
NOTE:

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 of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. All modes of operation were investigated and the worst-case emissions are reported.
4. Duty cycle of EUT is 4.8 % defined by client.
   We get 3.83% duty cycle when EUT in normal operating mode.
   According to formula as below:
   AV=PK+20 Log duty cycle
   4.8% is worse than 3.83 %, so we use 4.8 % to calculate AV value.

4.1.4 DEVIATION FROM TEST STANDARD

No deviation.

4.1.5 TEST SETUP



For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.1.6 EUT OPERATING CONDITIONS

Set the EUT under transmission condition continuously at specific channel frequency.

4.1.7 TEST RESULTS

ABOVE 1GHz DATA

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 0	**FREQUENCY RANGE**	1 ~ 25GHz
MODULATION TYPE	GFSK	**DETECTOR FUNCTION**	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH, 991hPa	**TEST MODE**	A
TESTED BY	Brad Wu		

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	46.85 PK	74.00	-27.15	1.04 H	131	13.48	33.37
2	2390.00	33.58 AV	54.00	-20.42	1.04 H	131	0.21	33.37
3	2400.00	50.59 PK	74.00	-23.41	1.04 H	131	17.19	33.40
4	2400.00	24.21 AV	54.00	-29.79	1.04 H	131	-9.19	33.40
5	*2403.00	92.05 PK	114.00	-21.95	1.04 H	131	58.64	33.41
6	*2403.00	65.67 AV	94.00	-28.33	1.04 H	131	32.26	33.41
7	4806.00	51.35 PK	74.00	-22.65	1.04 H	20	11.66	39.69
8	4806.00	24.97 AV	54.00	-29.03	1.04 H	20	-14.72	39.69

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. " * " : Fundamental frequency
6. The average value of fundamental frequency is: Average = Peak value + 20log (Duty cycle) Where the duty factor is calculated from following formula:
   PW = 192 uSec, T= 4 mSec.
   192 uSec is based on a 32 bytes (max data packet size) which is the max that the Nordic chip can handle. 32 bytes/4 msec = 8Kbytes/sec = 64kbit/sec.
   The duty cycle is 192usec/4 msec = 4.8 %

$$20\log(\text{Duty cycle}) = 20\log\frac{0.192\text{ms}}{4\text{ ms}} = -26.38\text{dB}$$

Please see page 32 for plotted duty

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 0	FREQUENCY RANGE	1 ~ 25GHz
MODULATION TYPE	GFSK	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH, 991hPa	TEST MODE	A
TESTED BY	Brad Wu		

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	46.42 PK	74.00	-27.58	1.00 V	308	13.05	33.37
2	2390.00	33.03 AV	54.00	-20.97	1.00 V	308	-0.34	33.37
3	2400.00	49.06 PK	74.00	-24.94	1.00 V	308	15.66	33.40
4	2400.00	22.68 AV	54.00	-31.32	1.00 V	308	-10.72	33.40
5	*2403.00	90.52 PK	114.00	-23.48	1.00 V	308	57.11	33.41
6	*2403.00	64.14 AV	94.00	-29.86	1.00 V	308	30.73	33.41
7	4806.00	51.22 PK	74.00	-22.78	1.04 V	1	11.53	39.69
8	4806.00	24.84 AV	54.00	-29.16	1.00 V	71	-14.85	39.69

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. " * " : Fundamental frequency
6. The average value of fundamental frequency is: Average = Peak value + 20log (Duty cycle) Where the duty factor is calculated from following formula:
   PW = 192 uSec, T= 4 mSec.
   192 uSec is based on a 32 bytes (max data packet size) which is the max that the Nordic chip can handle. 32 bytes/4 msec = 8Kbytes/sec = 64kbit/sec.
   The duty cycle is 192usec/4 msec = 4.8 %

$$20\log(\text{Duty cycle}) = 20\log\frac{0.192\text{ms}}{4\text{ ms}} = -26.38\text{dB}$$

Please see page 32 for plotted duty

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 21	FREQUENCY RANGE	1 ~ 25GHz
MODULATION TYPE	GFSK	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH, 991hPa	TEST MODE	A
TESTED BY	Brad Wu		

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	*2442.00	92.15 PK	114.00	-21.85	1.05 H	132	58.66	33.49
2	*2442.00	65.77 AV	94.00	-28.23	1.05 H	132	32.28	33.49
3	4884.00	51.46 PK	74.00	-22.54	1.05 H	134	11.45	40.01
4	4884.00	25.08 AV	54.00	-28.92	1.05 H	134	-14.93	40.01

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. " * " : Fundamental frequency
6. The average value of fundamental frequency is: Average = Peak value + 20log (Duty cycle) Where the duty factor is calculated from following formula:
   PW = 192 uSec, T= 4 mSec.
   192 uSec is based on a 32 bytes (max data packet size) which is the max that the Nordic chip can handle. 32 bytes/4 msec = 8Kbytes/sec = 64kbit/sec.
   The duty cycle is 192usec/4 msec = 4.8 %

$$20\log(\text{Duty cycle}) = 20\log\frac{0.192\text{ms}}{4\text{ ms}} = -26.38\text{dB}$$

Please see page 32 for plotted duty

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 21	FREQUENCY RANGE	1 ~ 25GHz
MODULATION TYPE	GFSK	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH, 991hPa	TEST MODE	A
TESTED BY	Brad Wu		

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	*2442.00	90.58 PK	114.00	-23.42	1.00 V	304	57.09	33.49
2	*2442.00	64.20 AV	94.00	-29.80	1.00 V	304	30.71	33.49
3	4884.00	51.26 PK	74.00	-22.74	1.05 V	234	11.24	40.01
4	4884.00	24.88 AV	54.00	-29.12	1.05 V	234	-15.13	40.01

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. " * " : Fundamental frequency
6. The average value of fundamental frequency is: Average = Peak value + 20log (Duty cycle) Where the duty factor is calculated from following formula:
   PW = 192 uSec, T= 4 mSec.
   192 uSec is based on a 32 bytes (max data packet size) which is the max that the Nordic chip can handle. 32 bytes/4 msec = 8Kbytes/sec = 64kbit/sec.
   The duty cycle is 192usec/4 msec = 4.8 %

$$20\log(\text{Duty cycle}) = 20\log\frac{0.192\text{ms}}{4\text{ ms}} = -26.38\text{dB}$$

Please see page 32 for plotted duty

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 15	FREQUENCY RANGE	1 ~ 25GHz
MODULATION TYPE	GFSK	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH, 991hPa	TEST MODE	A
TESTED BY	Brad Wu		

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	91.41 PK	114.00	-22.59	1.00 H	148	57.84	33.57
2	*2480.00	65.03 AV	94.00	-28.97	1.00 H	148	31.46	33.57
3	2483.50	47.18 PK	74.00	-26.82	1.01 H	143	13.60	33.58
4	2483.50	20.80 AV	54.00	-33.20	1.01 H	143	-12.78	33.58
5	4960.00	51.56 PK	74.00	-22.44	1.00 H	143	11.36	40.20
6	4960.00	25.18 AV	54.00	-28.82	1.00 H	143	-15.02	40.20

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. " * " : Fundamental frequency
6. The average value of fundamental frequency is: Average = Peak value + 20log (Duty cycle) Where the duty factor is calculated from following formula:
   PW = 192 uSec, T= 4 mSec.
   192 uSec is based on a 32 bytes (max data packet size) which is the max that the Nordic chip can handle. 32 bytes/4 msec = 8Kbytes/sec = 64kbit/sec.
   The duty cycle is 192usec/4 msec = 4.8 %

$$20\log(\text{Duty cycle}) = 20\log\frac{0.192\text{ms}}{4\text{ ms}} = -26.38\text{dB}$$

Please see page 32 for plotted duty

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 15	FREQUENCY RANGE	1 ~ 25GHz
MODULATION TYPE	GFSK	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH, 991hPa	TEST MODE	A
TESTED BY	Brad Wu		

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	89.88 PK	114.00	-24.12	1.01 V	310	56.31	33.57
2	*2480.00	63.50 AV	94.00	-30.50	1.01 V	310	29.93	33.57
3	2483.50	45.65 PK	74.00	-28.35	1.01 V	310	12.07	33.58
4	2483.50	19.27 AV	54.00	-34.73	1.01 V	310	-14.31	33.58
5	4960.00	51.46 PK	74.00	-22.54	1.05 V	6	11.26	40.20
6	4960.00	25.08 AV	54.00	-28.92	1.05 V	6	-15.12	40.20

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. " * " : Fundamental frequency
6. The average value of fundamental frequency is: Average = Peak value + 20log (Duty cycle) Where the duty factor is calculated from following formula:
   PW = 192 uSec, T= 4 mSec.
   192 uSec is based on a 32 bytes (max data packet size) which is the max that the Nordic chip can handle. 32 bytes/4 msec = 8Kbytes/sec = 64kbit/sec.
   The duty cycle is 192usec/4 msec = 4.8 %

$$20\log(\text{Duty cycle}) = 20\log\frac{0.192\text{ms}}{4\text{ ms}} = -26.38\text{dB}$$

Please see page 32 for plotted duty

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 0	FREQUENCY RANGE	1 ~ 25GHz
MODULATION TYPE	GFSK	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH, 991hPa	TEST MODE	B
TESTED BY	Brad Wu		

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	46.94 PK	74.00	-27.06	1.11 H	166	13.57	33.37
2	2390.00	33.53 AV	54.00	-20.47	1.11 H	166	0.16	33.37
3	2400.00	49.30 PK	74.00	-24.70	1.11 H	166	15.90	33.40
4	2400.00	22.92 AV	54.00	-31.08	1.11 H	166	-10.48	33.40
5	*2403.00	90.58 PK	114.00	-23.42	1.11 H	166	57.17	33.41
6	*2403.00	64.20 AV	94.00	-29.80	1.11 H	166	30.79	33.41
7	4806.00	51.26 PK	74.00	-22.74	1.04 H	29	11.57	39.69
8	4806.00	24.88 AV	54.00	-29.12	1.04 H	29	-14.81	39.69

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. " * " : Fundamental frequency
6. The average value of fundamental frequency is: Average = Peak value + 20log (Duty cycle) Where the duty factor is calculated from following formula:
   PW = 192 uSec, T= 4 mSec.
   192 uSec is based on a 32 bytes (max data packet size) which is the max that the Nordic chip can handle. 32 bytes/4 msec = 8Kbytes/sec = 64kbit/sec.
   The duty cycle is 192usec/4 msec = 4.8 %

$$20\log(\text{Duty cycle}) = 20\log\frac{0.192\text{ms}}{4\text{ ms}} = -26.38\text{dB}$$

Please see page 32 for plotted duty

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 0	FREQUENCY RANGE	1 ~ 25GHz
MODULATION TYPE	GFSK	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH, 991hPa	TEST MODE	B
TESTED BY	Brad Wu		

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	46.14 PK	74.00	-27.86	1.00 V	145	12.77	33.37
2	2390.00	33.42 AV	54.00	-20.58	1.00 V	145	0.05	33.37
3	2400.00	47.98 PK	74.00	-26.02	1.00 V	145	14.58	33.40
4	2400.00	21.60 AV	54.00	-32.40	1.00 V	145	-11.80	33.40
5	*2403.00	89.26 PK	114.00	-24.74	1.00 V	145	55.85	33.41
6	*2403.00	62.88 AV	94.00	-31.12	1.00 V	145	29.47	33.41
7	4806.00	51.34 PK	74.00	-22.66	1.02 V	35	11.65	39.69
8	4806.00	24.96 AV	54.00	-29.04	1.02 V	35	-14.73	39.69

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. " * " : Fundamental frequency
6. The average value of fundamental frequency is: Average = Peak value + 20log (Duty cycle) Where the duty factor is calculated from following formula:
   PW = 192 uSec, T= 4 mSec.
   192 uSec is based on a 32 bytes (max data packet size) which is the max that the Nordic chip can handle. 32 bytes/4 msec = 8Kbytes/sec = 64kbit/sec.
   The duty cycle is 192usec/4 msec = 4.8 %

$$20\log(\text{Duty cycle}) = 20\log\frac{0.192\text{ms}}{4\text{ ms}} = -26.38\text{dB}$$

Please see page 32 for plotted duty

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 21	FREQUENCY RANGE	1 ~ 25GHz
MODULATION TYPE	GFSK	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH, 991hPa	TEST MODE	B
TESTED BY	Brad Wu		

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	*2442.00	90.75 PK	114.00	-23.25	1.10 H	164	57.26	33.49
2	*2442.00	64.37 AV	94.00	-29.63	1.10 H	164	30.88	33.49
3	4884.00	51.56 PK	74.00	-22.44	1.05 H	316	11.55	40.01
4	4884.00	25.18 AV	54.00	-28.82	1.05 H	316	-14.83	40.01

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. " * " : Fundamental frequency
6. The average value of fundamental frequency is: Average = Peak value + 20log (Duty cycle) Where the duty factor is calculated from following formula:
   PW = 192 uSec, T= 4 mSec.
   192 uSec is based on a 32 bytes (max data packet size) which is the max that the Nordic chip can handle. 32 bytes/4 msec = 8Kbytes/sec = 64kbit/sec.
   The duty cycle is 192usec/4 msec = 4.8 %

$$20\log(\text{Duty cycle}) = 20\log\frac{0.192\text{ms}}{4\text{ ms}} = -26.38\text{dB}$$

Please see page 32 for plotted duty

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 21	FREQUENCY RANGE	1 ~ 25GHz
MODULATION TYPE	GFSK	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH, 991hPa	TEST MODE	B
TESTED BY	Brad Wu		

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	*2442.00	89.05 PK	114.00	-24.95	1.01 V	313	55.56	33.49
2	*2442.00	62.67 AV	94.00	-31.33	1.01 V	313	29.18	33.49
3	4884.00	51.26 PK	74.00	-22.74	1.01 V	191	11.25	40.01
4	4884.00	24.88 AV	54.00	-29.12	1.01 V	191	-15.13	40.01

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. " * " : Fundamental frequency
6. The average value of fundamental frequency is: Average = Peak value + 20log (Duty cycle) Where the duty factor is calculated from following formula:
   PW = 192 uSec, T= 4 mSec.
   192 uSec is based on a 32 bytes (max data packet size) which is the max that the Nordic chip can handle. 32 bytes/4 msec = 8Kbytes/sec = 64kbit/sec.
   The duty cycle is 192usec/4 msec = 4.8 %

$$20\log(\text{Duty cycle}) = 20\log\frac{0.192\text{ms}}{4\text{ ms}} = -26.38\text{dB}$$

Please see page 32 for plotted duty

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 15	FREQUENCY RANGE	1 ~ 25GHz
MODULATION TYPE	GFSK	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH, 991hPa	TEST MODE	B
TESTED BY	Brad Wu		

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	91.86 PK	114.00	-22.14	1.05 H	162	58.29	33.57
2	*2480.00	65.48 AV	94.00	-28.52	1.05 H	162	31.91	33.57
3	2483.50	48.41 PK	74.00	-25.59	1.05 H	162	14.83	33.58
4	2483.50	22.03 AV	54.00	-31.97	1.05 H	162	-11.55	33.58
5	4960.00	51.65 PK	74.00	-22.35	1.00 H	235	11.45	40.20
6	4960.00	25.27 AV	54.00	-28.73	1.00 H	235	-14.93	40.20

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. " * " : Fundamental frequency
6. The average value of fundamental frequency is: Average = Peak value + 20log (Duty cycle) Where the duty factor is calculated from following formula:
   PW = 192 uSec, T= 4 mSec.
   192 uSec is based on a 32 bytes (max data packet size) which is the max that the Nordic chip can handle. 32 bytes/4 msec = 8Kbytes/sec = 64kbit/sec.
   The duty cycle is 192usec/4 msec = 4.8 %

$$20\log(\text{Duty cycle}) = 20\log\frac{0.192\text{ms}}{4\text{ ms}} = -26.38\text{dB}$$

Please see page 32 for plotted duty

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 15	FREQUENCY RANGE	1 ~ 25GHz
MODULATION TYPE	GFSK	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH, 991hPa	TEST MODE	B
TESTED BY	Brad Wu		

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	90.02 PK	114.00	-23.98	1.05 V	319	56.45	33.57
2	*2480.00	63.64 AV	94.00	-30.36	1.05 V	319	30.07	33.57
3	2483.50	46.57 PK	74.00	-27.43	1.05 V	319	12.99	33.58
4	2483.50	20.19 AV	54.00	-33.81	1.05 V	319	-13.39	33.58
5	4960.00	51.52 PK	74.00	-22.48	1.10 V	29	11.32	40.20
6	4960.00	25.14 AV	54.00	-28.86	1.10 V	29	-15.06	40.20

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. " * " : Fundamental frequency
6. The average value of fundamental frequency is: Average = Peak value + 20log (Duty cycle) Where the duty factor is calculated from following formula:
   PW = 192 uSec, T= 4 mSec.
   192 uSec is based on a 32 bytes (max data packet size) which is the max that the Nordic chip can handle. 32 bytes/4 msec = 8Kbytes/sec = 64kbit/sec.
   The duty cycle is 192usec/4 msec = 4.8 %

$$20\log(\text{Duty cycle}) = 20\log\frac{0.192\text{ms}}{4\text{ ms}} = -26.38\text{dB}$$

Please see page 32 for plotted duty

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 0	FREQUENCY RANGE	1 ~ 25GHz
MODULATION TYPE	GFSK	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH, 991hPa	TEST MODE	C
TESTED BY	Brad Wu		

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	46.90 PK	74.00	-27.10	1.08 H	161	13.53	33.37
2	2390.00	33.55 AV	54.00	-20.45	1.08 H	161	0.18	33.37
3	2400.00	49.16 PK	74.00	-24.84	1.08 H	161	15.76	33.40
4	2400.00	22.78 AV	54.00	-31.22	1.08 H	161	-10.62	33.40
5	*2403.00	90.35 PK	114.00	-23.65	1.08 H	161	56.94	33.41
6	*2403.00	63.97 AV	94.00	-30.03	1.08 H	161	30.56	33.41
7	4806.00	51.13 PK	74.00	-22.87	1.01 H	15	11.44	39.69
8	4806.00	24.75 AV	54.00	-29.25	1.01 H	15	-14.94	39.69

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. " * " : Fundamental frequency
6. The average value of fundamental frequency is: Average = Peak value + 20log (Duty cycle) Where the duty factor is calculated from following formula:
   PW = 192 uSec, T= 4 mSec.
   192 uSec is based on a 32 bytes (max data packet size) which is the max that the Nordic chip can handle. 32 bytes/4 msec = 8Kbytes/sec = 64kbit/sec.
   The duty cycle is 192usec/4 msec = 4.8 %

$$20\log(\text{Duty cycle}) = 20\log\frac{0.192\text{ms}}{4\text{ ms}} = -26.38\text{dB}$$

Please see page 32 for plotted duty

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 0	FREQUENCY RANGE	1 ~ 25GHz
MODULATION TYPE	GFSK	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH, 991hPa	TEST MODE	C
TESTED BY	Brad Wu		

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	46.53 PK	74.00	-27.47	1.00 V	312	13.16	33.37
2	2390.00	33.42 AV	54.00	-20.58	1.00 V	312	0.05	33.37
3	2400.00	47.44 PK	74.00	-26.56	1.00 V	312	14.04	33.40
4	2400.00	21.06 AV	54.00	-32.94	1.00 V	312	-12.34	33.40
5	*2403.00	88.63 PK	114.00	-25.37	1.00 V	312	55.22	33.41
6	*2403.00	62.25 AV	94.00	-31.75	1.00 V	312	28.84	33.41
7	4806.00	51.22 PK	74.00	-22.78	1.03 V	245	11.53	39.69
8	4806.00	24.84 AV	54.00	-29.16	1.03 V	245	-14.85	39.69

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. " * " : Fundamental frequency
6. The average value of fundamental frequency is: Average = Peak value + 20log (Duty cycle) Where the duty factor is calculated from following formula:
   PW = 192 uSec, T= 4 mSec.
   192 uSec is based on a 32 bytes (max data packet size) which is the max that the Nordic chip can handle. 32 bytes/4 msec = 8Kbytes/sec = 64kbit/sec.
   The duty cycle is 192usec/4 msec = 4.8 %

$$20\log(\text{Duty cycle}) = 20\log\frac{0.192\text{ms}}{4\text{ ms}} = -26.38\text{dB}$$

Please see page 32 for plotted duty

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 21	FREQUENCY RANGE	1 ~ 25GHz
MODULATION TYPE	GFSK	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH, 991hPa	TEST MODE	C
TESTED BY	Brad Wu		

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	*2442.00	90.85 PK	114.00	-23.15	1.09 H	162	57.36	33.49
2	*2442.00	64.47 AV	94.00	-29.53	1.09 H	162	30.98	33.49
3	4884.00	51.34 PK	74.00	-22.66	1.03 H	223	11.33	40.01
4	4884.00	24.96 AV	54.00	-29.04	1.03 H	223	-15.05	40.01

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. " * " : Fundamental frequency
6. The average value of fundamental frequency is: Average = Peak value + 20log (Duty cycle) Where the duty factor is calculated from following formula:
   PW = 192 uSec, T= 4 mSec.
   192 uSec is based on a 32 bytes (max data packet size) which is the max that the Nordic chip can handle. 32 bytes/4 msec = 8Kbytes/sec = 64kbit/sec.
   The duty cycle is 192usec/4 msec = 4.8 %

$$20\log(\text{Duty cycle}) = 20\log\frac{0.192\text{ms}}{4\text{ ms}} = -26.38\text{dB}$$

Please see page 32 for plotted duty

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 21	**FREQUENCY RANGE**	1 ~ 25GHz
MODULATION TYPE	GFSK	**DETECTOR FUNCTION**	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH, 991hPa	**TEST MODE**	C
TESTED BY	Brad Wu		

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	*2442.00	89.12 PK	114.00	-24.88	1.00 V	316	55.63	33.49
2	*2442.00	62.74 AV	94.00	-31.26	1.00 V	316	29.25	33.49
3	4884.00	51.39 PK	74.00	-22.61	1.03 V	206	11.38	40.01
4	4884.00	25.01 AV	54.00	-28.99	1.03 V	206	-15.00	40.01

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. " * " : Fundamental frequency
6. The average value of fundamental frequency is: Average = Peak value + 20log (Duty cycle) Where the duty factor is calculated from following formula:
   PW = 192 uSec, T= 4 mSec.
   192 uSec is based on a 32 bytes (max data packet size) which is the max that the Nordic chip can handle. 32 bytes/4 msec = 8Kbytes/sec = 64kbit/sec.
   The duty cycle is 192usec/4 msec = 4.8 %

$$20\log(\text{Duty cycle}) = 20\log\frac{0.192\text{ms}}{4\text{ ms}} = -26.38\text{dB}$$

Please see page 32 for plotted duty

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 15	FREQUENCY RANGE	1 ~ 25GHz
MODULATION TYPE	GFSK	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH, 991hPa	TEST MODE	C
TESTED BY	Brad Wu		

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	92.29 PK	114.00	-21.71	1.03 H	158	58.73	33.57
2	*2480.00	65.91 AV	94.00	-28.09	1.03 H	158	32.34	33.57
3	2483.50	49.04 PK	74.00	-24.96	1.03 H	158	15.46	33.58
4	2483.50	22.66 AV	54.00	-31.34	1.03 H	158	-10.92	33.58
5	4960.00	51.84 PK	74.00	-22.16	1.03 H	24	11.64	40.20
6	4960.00	25.46 AV	54.00	-28.54	1.03 H	24	-14.74	40.20

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. " * " : Fundamental frequency
6. The average value of fundamental frequency is: Average = Peak value + 20log (Duty cycle) Where the duty factor is calculated from following formula:
   PW = 192 uSec, T= 4 mSec.
   192 uSec is based on a 32 bytes (max data packet size) which is the max that the Nordic chip can handle. 32 bytes/4 msec = 8Kbytes/sec = 64kbit/sec.
   The duty cycle is 192usec/4 msec = 4.8 %

$$20\log(\text{Duty cycle}) = 20\log\frac{0.192\text{ms}}{4\text{ ms}} = -26.38\text{dB}$$

Please see page 32 for plotted duty

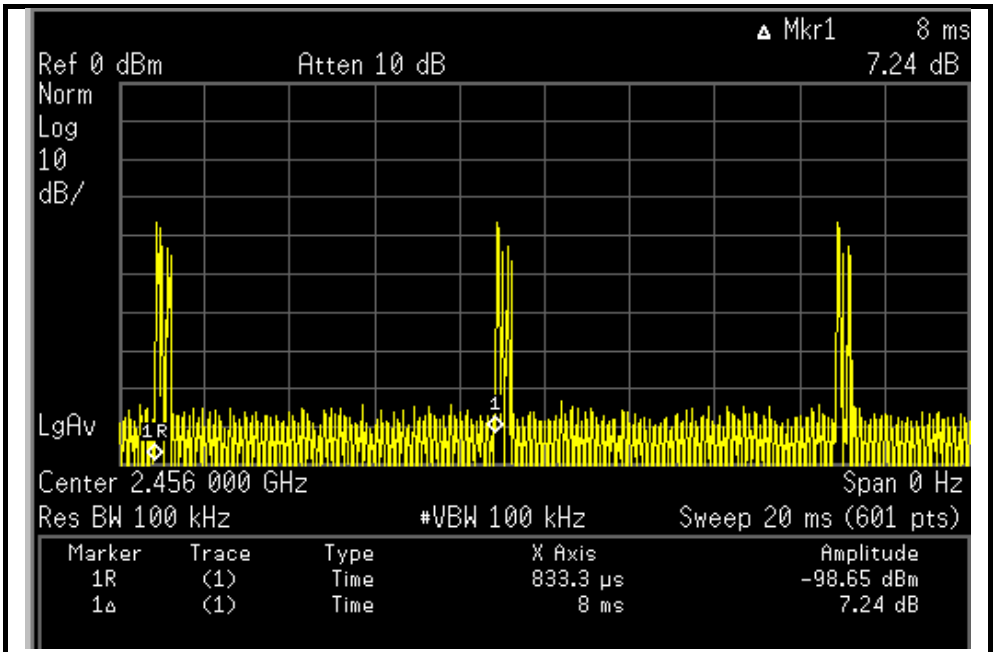
EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 15	FREQUENCY RANGE	1 ~ 25GHz
MODULATION TYPE	GFSK	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH, 991hPa	TEST MODE	C
TESTED BY	Brad Wu		

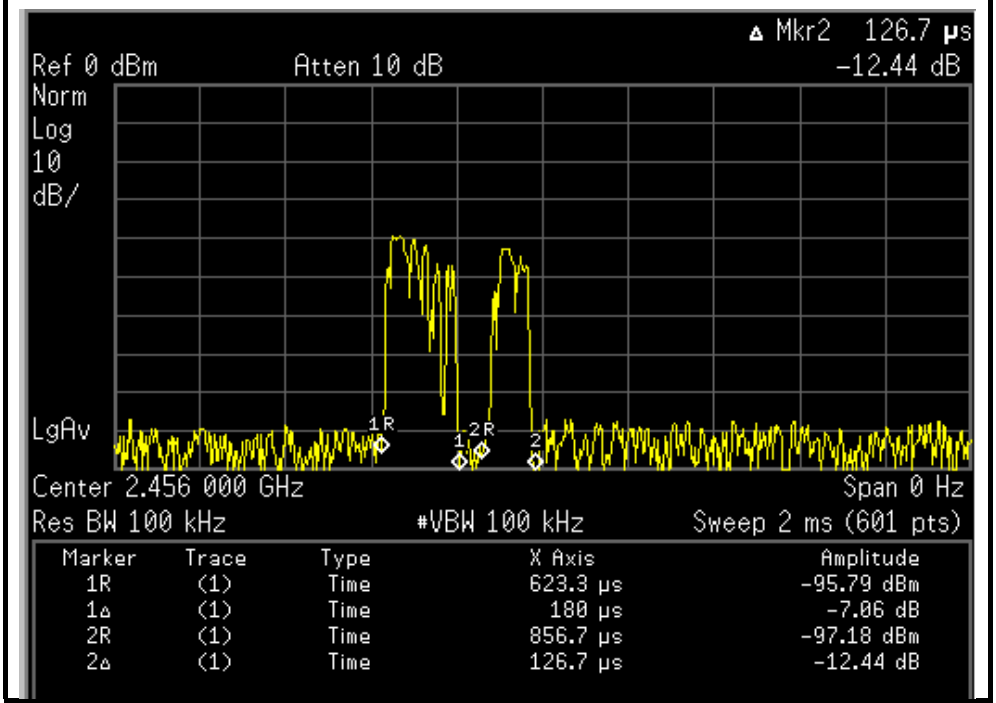
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2480.00	90.38 PK	114.00	-23.62	1.02 V	324	56.81	33.57
2	*2480.00	64.00 AV	94.00	-30.00	1.02 V	324	30.43	33.57
3	2483.50	47.13 PK	74.00	-26.87	1.02 V	324	13.55	33.58
4	2483.50	20.75 AV	54.00	-33.25	1.02 V	324	-12.83	33.58
5	4960.00	51.36 PK	74.00	-22.64	1.13 V	24	11.16	40.20
6	4960.00	24.98 AV	54.00	-29.02	1.13 V	24	-15.22	40.20

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. " * " : Fundamental frequency
6. The average value of fundamental frequency is: Average = Peak value + 20log (Duty cycle) Where the duty factor is calculated from following formula:
   PW = 192 uSec, T= 4 mSec.
   192 uSec is based on a 32 bytes (max data packet size) which is the max that the Nordic chip can handle. 32 bytes/4 msec = 8Kbytes/sec = 64kbit/sec.
   The duty cycle is 192usec/4 msec = 4.8 %

$$20\log(\text{Duty cycle}) = 20\log\frac{0.192\text{ms}}{4\text{ ms}} = -26.38\text{dB}$$

Please see page 32 for plotted duty





Duty cycle= $\frac{180+126.7us}{8\ ms}$ x100%=3.83%

RADIATED WORST-CASE DATA: BELOW 1GHz

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 0	FREQUENCY RANGE	Below 1000MHz
MODULATION TYPE	GFSK	DETECTOR FUNCTION	Quasi-Peak
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH, 991hPa	TEST MODE	A
TESTED BY	Brad Wu		

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	197.11	21.06 QP	43.50	-22.44	1.50 H	97	9.55	11.51
2	329.32	19.73 QP	46.00	-26.27	1.00 H	328	3.81	15.92
3	387.65	19.37 QP	46.00	-26.63	1.00 H	4	2.01	17.35
4	514.03	20.89 QP	46.00	-25.11	1.00 H	10	0.33	20.56
5	762.90	27.04 QP	46.00	-18.96	1.00 H	187	1.33	25.71
6	885.39	28.64 QP	46.00	-17.36	1.50 H	127	1.23	27.41
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	49.34	16.44 QP	40.00	-23.56	1.50 V	184	1.63	14.81
2	158.22	16.21 QP	43.50	-27.29	1.50 V	130	1.77	14.44
3	224.33	17.09 QP	46.00	-28.91	1.50 V	331	4.75	12.35
4	286.55	18.69 QP	46.00	-27.31	1.50 V	28	3.86	14.83
5	469.31	20.65 QP	46.00	-25.35	1.00 V	130	0.91	19.74
6	784.28	26.46 QP	46.00	-19.54	1.00 V	238	0.65	25.81

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 0	FREQUENCY RANGE	Below 1000MHz
MODULATION TYPE	GFSK	DETECTOR FUNCTION	Quasi-Peak
ENVIRONMENTAL CONDITIONS	25deg. C, 60%RH, 991hPa	TEST MODE	B
TESTED BY	Brad Wu		

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	228.22	15.09 QP	46.00	-30.91	1.50 H	76	2.57	12.52
2	286.55	18.53 QP	46.00	-27.47	1.00 H	232	3.71	14.83
3	387.65	17.95 QP	46.00	-28.05	1.50 H	22	0.59	17.35
4	593.74	21.83 QP	46.00	-24.17	1.00 H	67	-0.48	22.31
5	716.23	26.01 QP	46.00	-19.99	1.50 H	79	1.34	24.67
6	904.83	29.29 QP	46.00	-16.71	1.50 H	91	1.62	27.67
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	158.22	14.95 QP	43.50	-28.55	1.50 V	301	0.51	14.44
2	241.83	17.60 QP	46.00	-28.40	1.50 V	238	4.47	13.13
3	358.48	18.66 QP	46.00	-27.34	1.50 V	277	1.99	16.67
4	510.14	20.67 QP	46.00	-25.33	1.50 V	169	0.19	20.48
5	636.52	23.67 QP	46.00	-22.33	1.00 V	214	0.39	23.28
6	862.06	27.54 QP	46.00	-18.46	1.50 V	40	0.43	27.11

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 0	FREQUENCY RANGE	Below 1000MHz
MODULATION TYPE	GFSK	DETECTOR FUNCTION	Quasi-Peak
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH, 991hPa	TEST MODE	C
TESTED BY	Brad Wu		

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	228.22	16.56 QP	46.00	-29.44	1.00 H	220	4.05	12.52
2	286.55	18.48 QP	46.00	-27.52	1.50 H	274	3.66	14.83
3	387.65	19.09 QP	46.00	-26.91	1.50 H	247	1.74	17.35
4	514.03	23.23 QP	46.00	-22.77	1.50 H	358	2.67	20.56
5	741.51	25.59 QP	46.00	-20.41	1.00 H	10	0.19	25.40
6	**908.72**	**31.05 QP**	**46.00**	**-14.95**	**1.00 H**	**319**	**3.33**	**27.72**
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	286.55	19.25 QP	46.00	-26.75	1.50 V	10	4.42	14.83
2	329.32	18.01 QP	46.00	-27.99	1.50 V	340	2.09	15.92
3	430.42	19.56 QP	46.00	-26.44	1.50 V	142	0.85	18.71
4	539.30	21.85 QP	46.00	-24.15	1.00 V	25	0.81	21.05
5	722.07	25.49 QP	46.00	-20.51	1.50 V	349	0.65	24.84
6	871.78	27.48 QP	46.00	-18.52	1.00 V	10	0.24	27.24

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.

4.2 BAND EDGES MEASUREMENT

4.2.1 LIMITS OF BAND EDGES MEASUREMENT

Below –50dB of the highest emission level of operating band (in 100kHz Resolution Bandwidth).

4.2.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED UNTIL
SPECTRUM ANALYZER	FSP40	100041	Apr. 21, 2009

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

4.2.3 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 and 100 kHz with suitable frequency span including 100 MHz bandwidth from band edge. The band edges was measured and recorded.
The spectrum plots are attached on the following pages.

4.2.4 DEVIATION FROM TEST STANDARD

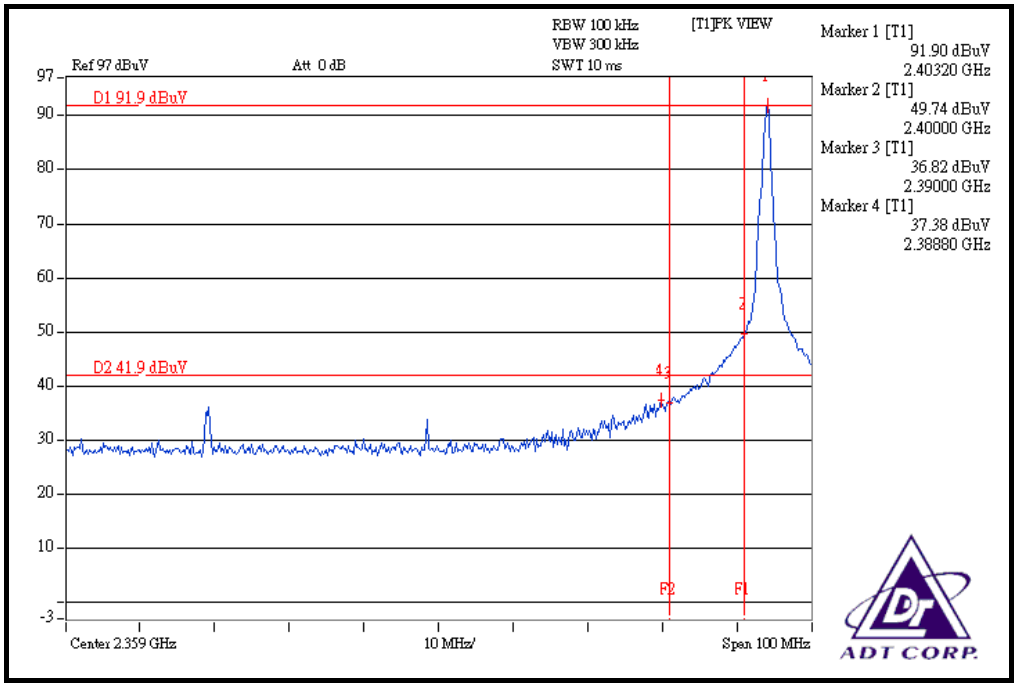
No deviation.

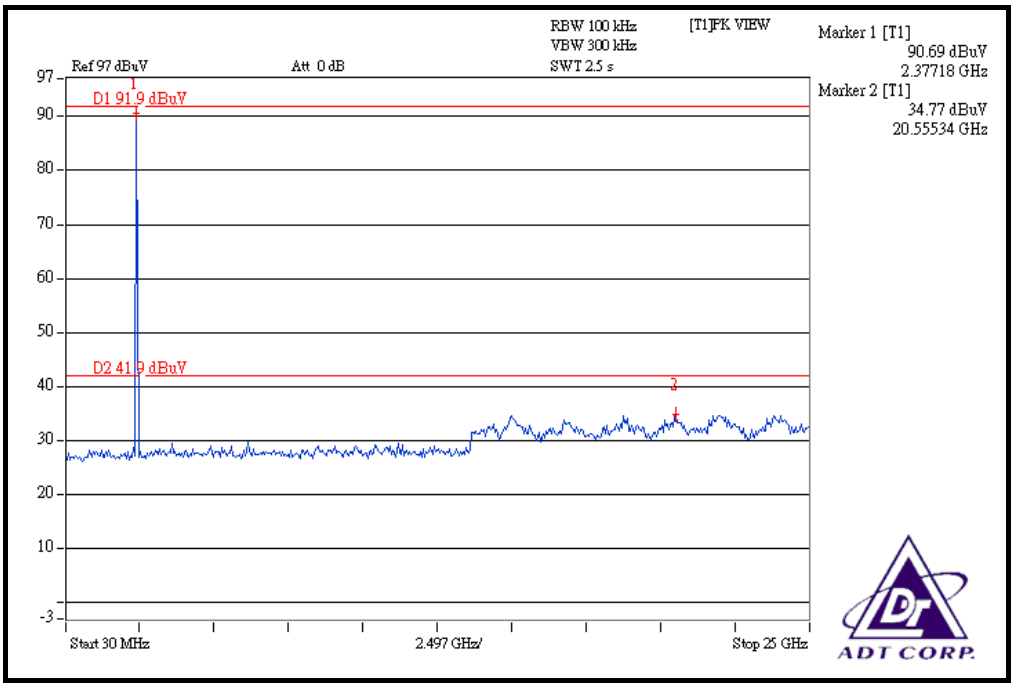
4.2.5 EUT OPERATING CONDITION

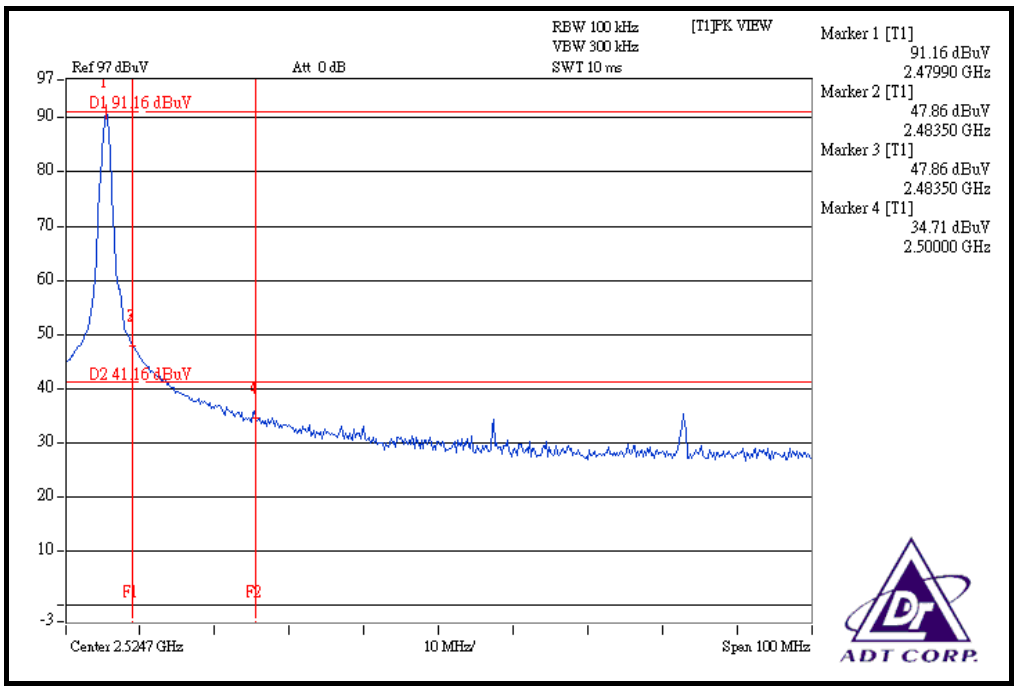
The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

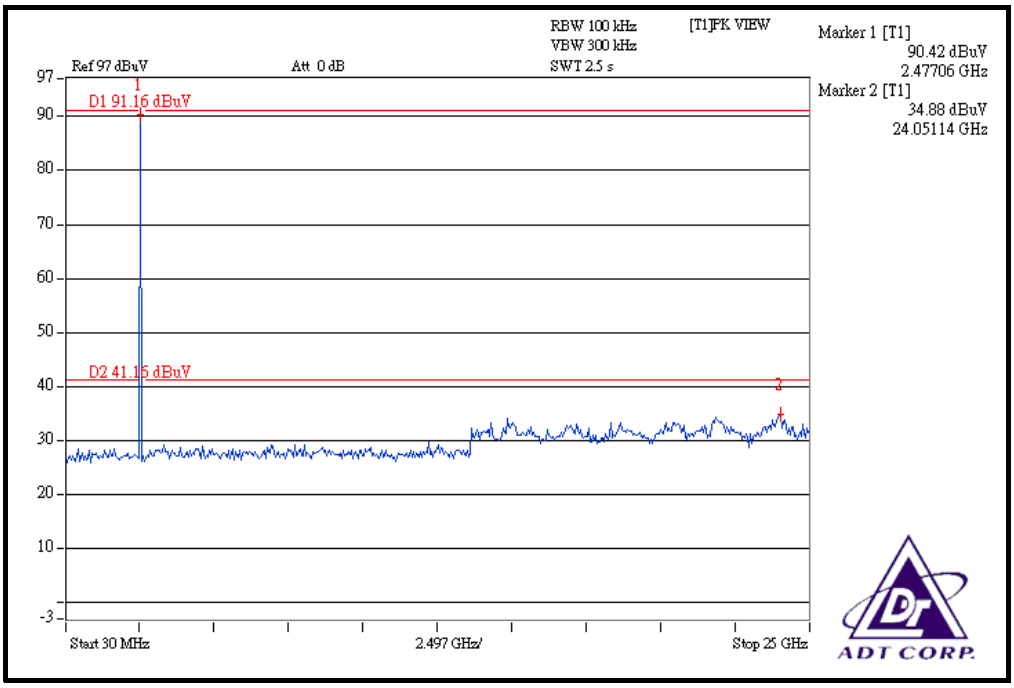
4.2.6 TEST RESULTS

The spectrum plots are attached on the following 4 images. D1 line indicates the highest level, and D2 line indicates the 50dB offset below D1. It shows compliance with the requirement in part 15.249 (d).


RBW 100 kHz
VBW 300 kHz
SWT 10 ms
[T1]FK VIEW
Ref 97 dBuV
Att 0 dB
D1 91.9 dBuV
D2 41.9 dBuV
Marker 1 [T1]
91.90 dBuV
2.40320 GHz
Marker 2 [T1]
49.74 dBuV
2.40000 GHz
Marker 3 [T1]
36.82 dBuV
2.39000 GHz
Marker 4 [T1]
37.38 dBuV
2.38880 GHz
97
90
80
70
60
50
40
30
20
10
-3
F2
F1
Center 2.359 GHz
10 MHz/
Span 100 MHz
ADT CORP.


RBW 100 kHz
VBW 300 kHz
SWT 2.5 s
[T1]FK VIEW
Ref 97 dBuV
Att 0 dB
D1 91.9 dBuV
D2 41.9 dBuV
Marker 1 [T1]
90.69 dBuV
2.37718 GHz
Marker 2 [T1]
34.77 dBuV
20.55534 GHz
97
90
80
70
60
50
40
30
20
10
-3
Start 30 MHz
2.497 GHz/
Stop 25 GHz
ADT CORP.


RBW 100 kHz
VBW 300 kHz
SWT 10 ms
[T1]FK VIEW
Ref 97 dBuV
Att 0 dB
D1 91.16 dBuV
D2 41.16 dBuV
Marker 1 [T1]
91.16 dBuV
2.47990 GHz
Marker 2 [T1]
47.86 dBuV
2.48350 GHz
Marker 3 [T1]
47.86 dBuV
2.48350 GHz
Marker 4 [T1]
34.71 dBuV
2.50000 GHz
Center 2.5247 GHz
10 MHz/
Span 100 MHz
ADT CORP.


RBW 100 kHz
VBW 300 kHz
SWT 2.5 s
[T1]FK VIEW
Ref 97 dBuV
Att 0 dB
D1 91.16 dBuV
D2 41.16 dBuV
Marker 1 [T1]
90.42 dBuV
2.47706 GHz
Marker 2 [T1]
34.88 dBuV
24.05114 GHz
Start 30 MHz
2.497 GHz/
Stop 25 GHz
ADT CORP.

5. PHOTOGRAPHS OF THE TEST CONFIGURATION

Please refer to the attached file (Test Setup Photo).

6. 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.	TAF, BSMI, NCC
Netherlands	Telefication
Singapore	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: 886-2-26051924

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

Web Site: www.adt.com.tw

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

7. 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.

--- END ---