



# FCC TEST REPORT

**REPORT NO.:** RF120829E01  
**MODEL NO.:** DAS-2420  
**FCC ID:** BY4-DAS2420  
**RECEIVED:** Aug. 29, 2012  
**TESTED:** Aug. 31 to Oct. 28, 2012  
**ISSUED:** Dec. 21, 2012

**APPLICANT:** Trans Electric Co., Ltd.  
**ADDRESS:** 771, Sec.2 Chungsan Rd, Huatang, Changhua, Taiwan.

**ISSUED BY:** Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory  
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**TEST LOCATION (1):** No. 81-1, Lu Liao Keng, 9th Ling, Wu Lung Tsuen, Chiung Lin Hsiang, Hsin Chu Hsien 307, Taiwan, Taiwan, R.O.C.

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## RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RF120829E01	Original release	Dec. 21, 2012



## 1 CERTIFICATION

**PRODUCT :** 2.4G Digital Audio Sender  
**BRAND NAME :** PX  
**MODEL NO. :** DAS-2420  
**TEST SAMPLE :** ENGINEERING SAMPLE  
**APPLICANT :** Trans Electric Co., Ltd.  
**TESTED DATE :** Aug. 31 to Oct. 28, 2012  
**STANDARDS :** **FCC Part 15, Subpart C (Section 15.247)**  
ANSI C63.10-2009

The above equipment (Model: DAS-2420) has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, 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 :** , **DATE:** Dec. 21, 2012  
(Lori Chung, Specialist)

**APPROVED BY :** , **DATE:** Dec. 21, 2012  
(May Chen, Deputy Manager)



## 2 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 15, Subpart C			
STANDARD SECTION	TEST TYPE AND LIMIT	RESULT	REMARK
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -15.89dB at 0.47422MHz.
15.247(a)(1) (iii)	Number of Hopping Frequency Used	PASS	Meet the requirement of limit.
15.247(a)(1) (iii)	Dwell Time on Each Channel	PASS	Meet the requirement of limit.
15.247(a)(1)	1. Hopping Channel Separation 2. Spectrum Bandwidth of a Frequency Hopping Sequence Spread Spectrum System	PASS	Meet the requirement of limit.
15.247(b)	Maximum Peak Output Power	PASS	Meet the requirement of limit.
15.247(d)	Transmitter Radiated Emissions	PASS	Meet the requirement of limit. Minimum passing margin is -4.0dB at 7416.00MHz.
15.247(d)	Band Edge Measurement	PASS	Meet the requirement of limit.
15.203	Antenna Requirement	PASS	No antenna connector is used.

NOTE: Frequency Hopping System operating in the 2400-2483.5MHz band and the output power less than 125mW. The hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of hopping channel whichever is greater.

## 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:

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

<b>Measurement</b>	<b>Value</b>
Conducted emissions	2.98 dB
Radiated emissions (30MHz-1GHz)	5.69 dB
Radiated emissions (1GHz -6GHz)	3.84 dB
Radiated emissions (6GHz -18GHz)	4.09 dB
Radiated emissions (18GHz -40GHz)	4.24 dB



### 3 GENERAL INFORMATION

#### 3.1 GENERAL DESCRIPTION OF EUT

<b>PRODUCT</b>	2.4G Digital Audio Sender
<b>MODEL NO.</b>	DAS-2420
<b>POWER SUPPLY</b>	DC 5V from power adapter
<b>MODULATION TYPE</b>	GFSK
<b>MODULATION TECHNOLOGY</b>	FHSS
<b>DATE RATE</b>	Up to 1Mbps
<b>FREQUENCY RANGE</b>	2406MHz ~ 2472MHz
<b>NUMBER OF CHANNEL</b>	34
<b>MAX. OUTPUT POWER</b>	3.926 mW
<b>ANTENNA TYPE</b>	Please see NOTE
<b>DATA CABLE</b>	AV cable (unshielded, 1.5m) × 2
<b>I/O PORTS</b>	Refer to user's manual
<b>ASSOCIATED DEVICES</b>	Adapter x1

**NOTE:**

1. The EUT (2.4GHz wireless digital audio sender) is designed to work with portable receivers.

2. The EUT must be supplied with power adapter as following table:

Brand	Model No.	Spec.
Intertek	S006MV0500100	Input: 100-240V, 300mA, 50/60Hz Output: 5V, 1000mA DC output cable: unshielded, 1.5m

3. The antenna provided to the EUT, please refer to the following table:

Antenna Type	Gain (dBi) (Include cable loss)	Frequency range (MHz to MHz)
PIFA	2.08	2400 ~ 2500

4. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.



### 3.2 DESCRIPTION OF TEST MODES

34 channels are provided for Bluetooth.

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
1	2406	10	2424	19	2442	28	2460
2	2408	11	2426	20	2444	29	2462
3	2410	12	2428	21	2446	30	2464
4	2412	13	2430	22	2448	31	2466
5	2414	14	2432	23	2450	32	2468
6	2416	15	2434	24	2452	33	2470
7	2418	16	2436	25	2454	34	2472
8	2420	17	2438	26	2456		
9	2422	18	2440	27	2458		



### 3.3 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL:

EUT CONFIGURE MODE	APPLICABLE TO					DESCRIPTION
	PLC	RE < 1G	RE ≥ 1G	APCM	OB	
-	√	√	√	√	√	-

Where **PLC**: Power Line Conducted Emission      **RE < 1G**: Radiated Emission below 1GHz  
**RE ≥ 1G**: Radiated Emission above 1GHz      **APCM**: Antenna Port Conducted Measurement  
**OB**: Conducted Out-Band Emission Measurement

#### RADIATED EMISSION TEST (BELOW 1 GHz):

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

Available Channel	Tested Channel	Modulation Technology	Modulation Type	Packet Type
1 to 34	34	FHSS	GFSK	DH1

#### RADIATED EMISSION TEST (ABOVE 1 GHz):

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

Available Channel	Tested Channel	Modulation Technology	Modulation Type	Packet Type
1 to 34	1, 18, 34	FHSS	GFSK	DH1

#### ANTENNA PORT CONDUCTED MEASUREMENT:

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

Available Channel	Tested Channel	Modulation Technology	Modulation Type	Packet Type
1 to 34	1, 18, 34	FHSS	GFSK	DH1



**CONDUCTED OUT-BAND EMISSION MEASUREMENT:**

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

Available Channel	Tested Channel	Modulation Technology	Modulation Type	Packet Type
1 to 34	1, 34	FHSS	GFSK	DH1

**TEST CONDITION:**

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER (SYSTEM)	TESTED BY
PLC	26deg. C, 64%RH,	120Vac, 60Hz	Jyunchun Lin
RE<1G	25deg. C, 76%RH	120Vac, 60Hz	Amos Chuang
RE <sup>3</sup> 1G	27deg. C, 74%RH	120Vac, 60Hz	Amos Chuang
APCM	25deg. C, 60%RH	120Vac, 60Hz	Evan Huang
OB	25deg. C, 60%RH	120Vac, 60Hz	Evan Huang



### 3.4 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. (15.247)**

ANSI C63.10-2009

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

**Note:** The EUT has been verified to comply with the requirements of FCC Part 15, Subpart B, Class B (DoC). The test report has been issued separately.



### 3.5 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

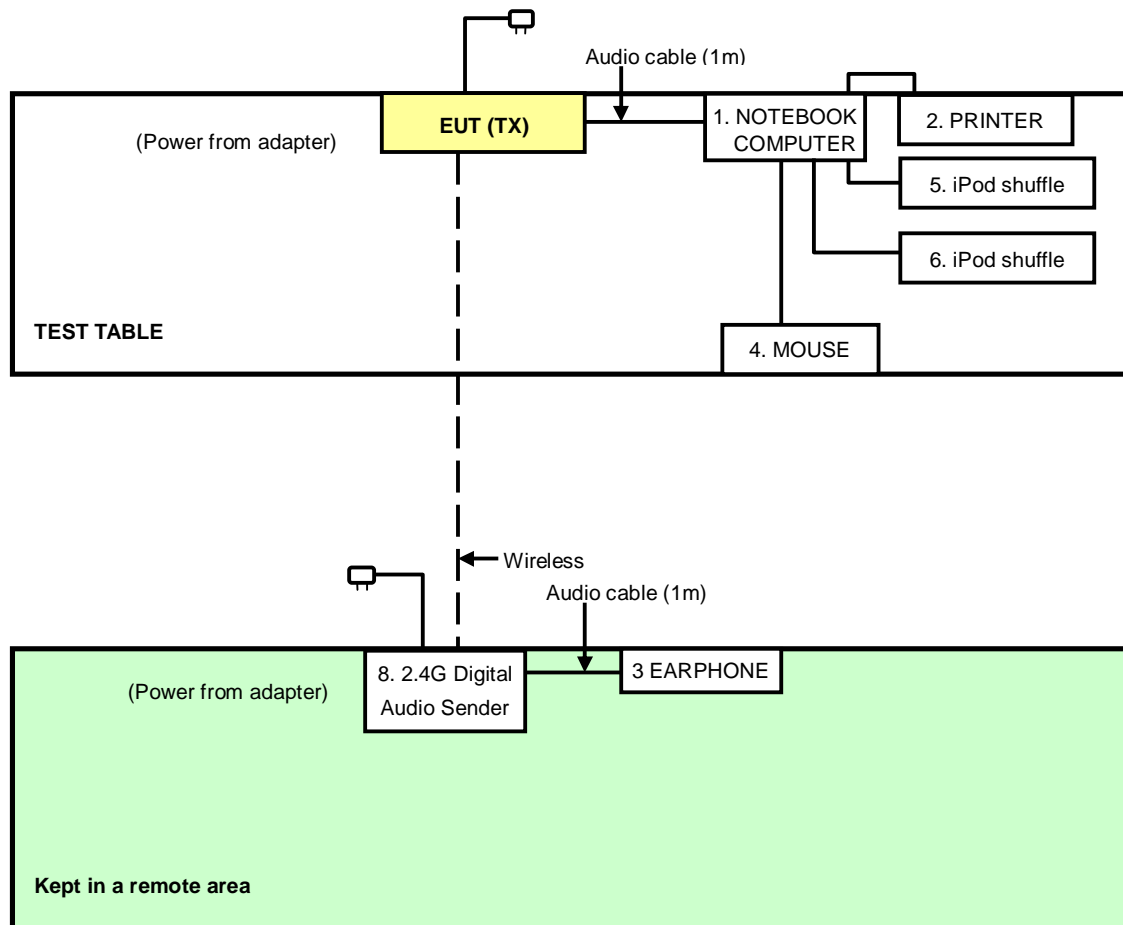
NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	NOTEBOOK COMPUTER	DELL	PP32LA	HSLB32S	FCC DoC
2	PRINTER	EPSON	LQ-300+II	G88Y074083	FCC DoC
3	EARPHONE	Hawk	HKC920	H003	FCC DoC
4	MOUSE	DELL	MOC5UO	I1401MLU	FCC DoC
5	iPod shuffle	Apple	MC749TA/A	CC4DMFJUDFDM	NA
6	iPod shuffle	Apple	MC749TA/A	CC4DN25WDFDM	NA
7	iPod shuffle	Apple	MC749TA/A	CC4DM9M8DFDM	NA
8	2.4G Digital Audio Sender	PX	DAS-2420	NA	BY4-DAS242

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	Audio cable (1m)
2	USB cable (1.8m)
3	Audio cable (1m) / Audio cable (1.8m)
4	USB cable (1.8m)
5	USB cable (0.1m)
6	USB cable (0.1m)
7	Audio cable (1.5m)
8	NA

**NOTE:** All power cords of the above support units are non shielded (1.8m).

### 3.6 CONFIGURATION OF SYSTEM UNDER TEST

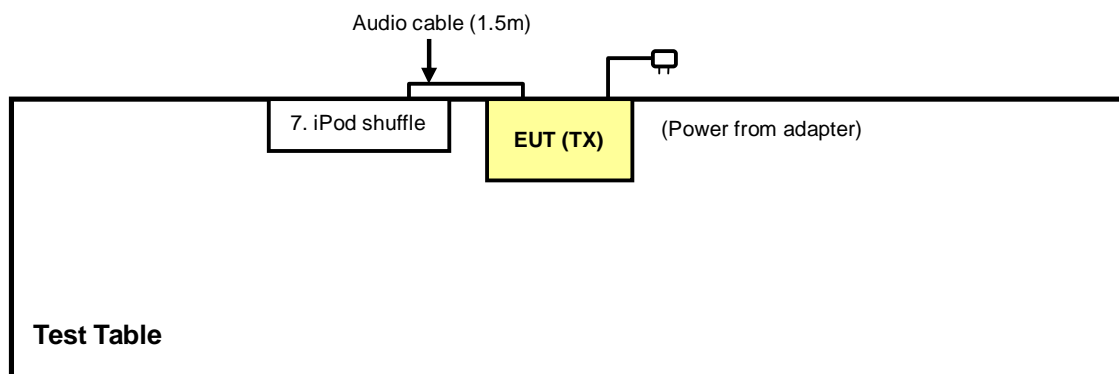
For conducted test:





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For other test items:



## 4 TEST PROCEDURES AND RESULTS

### 4.1 CONDUCTED EMISSION MEASUREMENT

#### 4.1.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dB $\mu$ V)	
	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 0.50MHz.

#### 4.1.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver	ESCS 30	100375	Mar. 12, 2012	Mar. 11, 2013
Line-Impedance Stabilization Network (for EUT) SCHWARZBECK	NSLK8127	8127-522	Sep. 07, 2011	Sep. 06, 2012
Line-Impedance Stabilization Network (for Peripheral)	ENV216	100072	June 08, 2012	June 07, 2013
RF Cable (JYEBAO)	5DFB	COCCAB-001	Aug. 28, 2012	Aug. 27, 2013
50 ohms Terminator	50	EMC-3	Sep. 26, 2011	Sep. 25, 2012
Software ADT	BV ADT_Cond_V7.3.7.3	NA	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 Shielded Room No. C.
3. The VCCI Con C Registration No. is C-3611.
4. Tested Date: Aug. 31, 2012



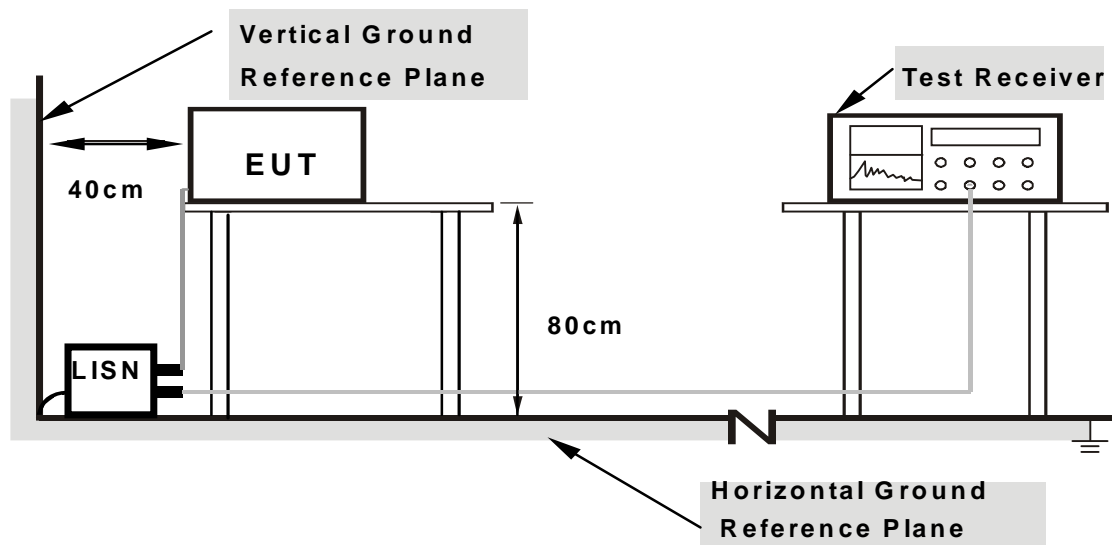
#### 4.1.3 TEST PROCEDURES

- 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.

**NOTE:**

1. The resolution bandwidth of test receiver is 9kHz for Quasi-peak detection (QP) & Average detection (AV).

#### 4.1.4 TEST SETUP



**Note: 1. Support units were connected to second LISN.**

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

#### 4.1.5 EUT OPERATING CONDITIONS

1. Connect the EUT with the support unit 1 (Notebook Computer) which is placed in test table.
2. Controlling software (Button Function) has been activated to set the EUT on specific status.



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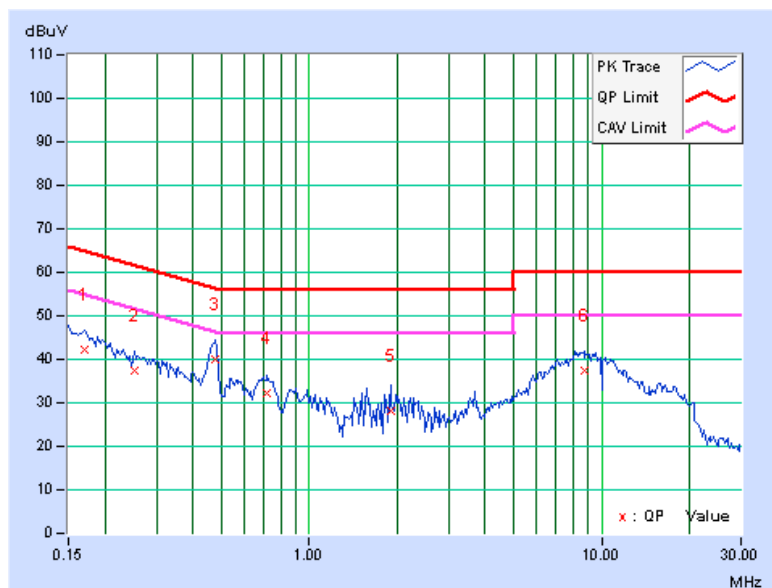
### 4.1.6 TEST RESULTS

PHASE	Line (L)	DETECTOR FUNCTION	Quasi-Peak (QP) / Average (AV)
-------	----------	-------------------	--------------------------------

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
	[MHz]		[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16953	0.09	42.08	30.04	42.17	30.13	64.98	54.98	-22.81	-24.85
2	0.25156	0.12	37.22	25.54	37.34	25.66	61.71	51.71	-24.36	-26.04
<b>3</b>	<b>0.47422</b>	<b>0.17</b>	<b>39.80</b>	<b>30.38</b>	<b>39.97</b>	<b>30.55</b>	<b>56.44</b>	<b>46.44</b>	<b>-16.47</b>	<b>-15.89</b>
4	0.71641	0.19	32.02	24.44	32.21	24.63	56.00	46.00	-23.79	-21.37
5	1.89453	0.26	28.00	19.24	28.26	19.50	56.00	46.00	-27.74	-26.50
6	8.71484	0.67	36.86	29.82	37.53	30.49	60.00	50.00	-22.47	-19.51

#### REMARKS:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.





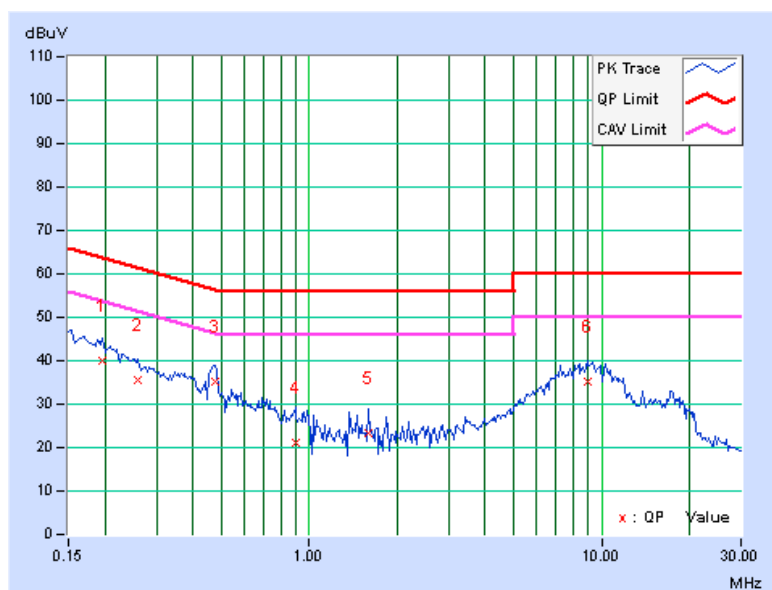
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<b>PHASE</b>	Neutral (N)	<b>DETECTOR FUNCTION</b>	Quasi-Peak (QP) / Average (AV)
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No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
			1	0.19687	0.11	39.96	24.82	40.07	24.93	63.74
2	0.25938	0.12	35.32	20.90	35.44	21.02	61.45	51.45	-26.01	-30.43
3	0.47422	0.16	34.88	25.66	35.04	25.82	56.44	46.44	-21.40	-20.62
4	0.89609	0.18	21.00	11.98	21.18	12.16	56.00	46.00	-34.82	-33.84
5	1.59375	0.23	23.20	15.78	23.43	16.01	56.00	46.00	-32.57	-29.99
6	8.94922	0.60	34.70	25.88	35.30	26.48	60.00	50.00	-24.70	-23.52

**REMARKS:**

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.



## 4.2 RADIATED EMISSION AND BANDEGE MEASUREMENT

### 4.2.1 LIMITS OF RADIATED EMISSION AND BANDEGE MEASUREMENT

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB below the highest level of the desired power:

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. 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.



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#### 4.2.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer Agilent	E4446A	MY48250253	Sep. 03, 2012	Sep. 02, 2013
Pre-Selector Agilent	N9039A	MY46520310	Sep. 03, 2012	Sep. 02, 2013
Signal Generator Agilent	N5181A	MY49060347	July 24, 2012	July 23, 2013
Pre-Amplifier Mini-Circuits	ZFL-1000VH2 B	AMP-ZFL-04	Nov. 15, 2011	Nov. 14, 2012
Pre-Amplifier Agilent	8449B	3008A02465	Feb. 27, 2012	Feb. 26, 2013
SPACEK LABS	SLKKa-48-6	9K16	Nov. 15, 2011	Nov. 14, 2012
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-361	Apr. 06, 2012	Apr. 05, 2013
Horn_Antenna AISI	AIH.8018	0000220091110	Nov. 23, 2011	Nov. 22, 2012
Horn_Antenna SCHWARZBECK	BBHA 9170	9170-424	Oct. 12, 2012	Oct. 11, 2013
RF Cable	NA	RF104-205 RF104-207 RF104-202	Dec. 27, 2011	Dec. 26, 2012
RF Cable	NA	CHHCAB_001	Oct. 07, 2012	Oct. 06, 2013
Software	ADT_Radiated _V8.7.05	NA	NA	NA
Antenna Tower & Turn Table CT	NA	NA	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 horn antenna, preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
- 3 The test was performed in 966 Chamber No. H.
4. The FCC Site Registration No. is 797305.
- 5 The CANADA Site Registration No. is IC 7450H-3.
- 6 Tested Date: Oct. 28, 2012

#### 4.2.3 TEST PROCEDURES

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meters chamber room. 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 height of antenna 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 quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz.

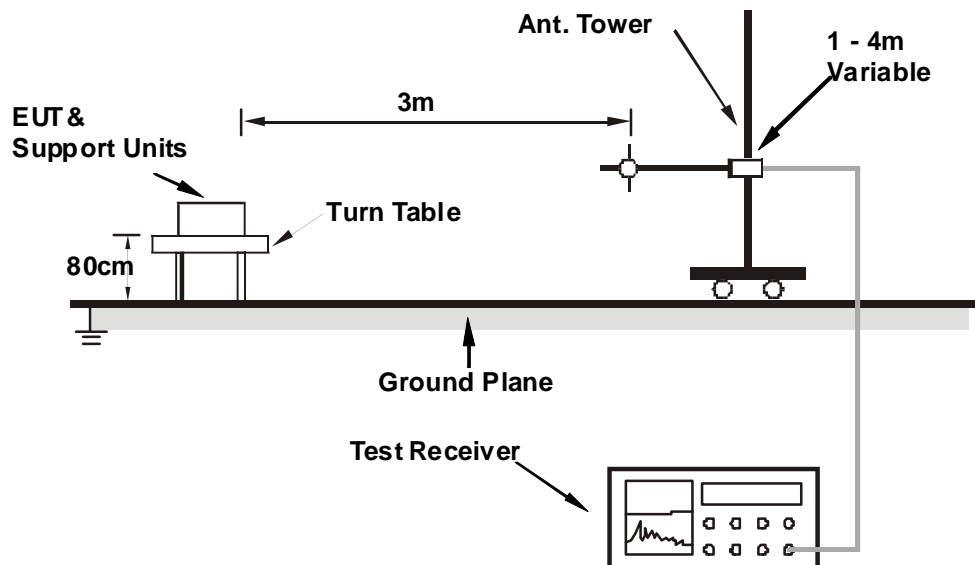
**NOTE:**

2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 1MHz for Peak detection at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

#### 4.2.4 DEVIATION FROM TEST STANDARD

No deviation

#### 4.2.5 TEST SETUP



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

#### 4.2.6 EUT OPERATING CONDITIONS

Same as 4.1.6



## 4.2.7 TEST RESULTS

### BELOW 1GHz WORST-CASE DATA

<b>CHANNEL</b>	TX Channel 34	<b>DETECTOR FUNCTION</b>	Quasi-Peak (QP)
<b>FREQUENCY RANGE</b>	Below 1GHz		

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	145.00	23.6 QP	43.5	-19.9	1.20 H	3	10.49	13.15
2	206.49	27.2 QP	43.5	-16.3	1.50 H	127	17.32	9.88
3	247.38	27.6 QP	46.0	-18.4	1.03 H	259	16.06	11.57
4	370.90	21.5 QP	46.0	-24.5	1.06 H	32	6.56	14.96
5	490.13	19.8 QP	46.0	-26.2	1.67 H	105	2.35	17.44
6	915.00	21.1 QP	46.0	-24.9	1.00 H	170	-2.29	23.37

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	52.00	21.5 QP	40.0	-18.5	1.09 V	241	8.48	13.04
2	97.00	20.6 QP	43.5	-22.9	1.88 V	35	12.25	8.34
3	234.00	23.1 QP	46.0	-22.9	1.20 V	336	12.11	11.02
4	258.00	25.4 QP	46.0	-20.6	1.00 V	185	13.47	11.97
5	690.00	18.2 QP	46.0	-27.9	1.20 V	266	-2.34	20.49
6	937.00	23.1 QP	46.0	-22.9	1.00 V	180	-0.55	23.61

#### 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.



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### ABOVE 1GHz DATA

<b>CHANNEL</b>	TX Channel 1	<b>DETECTOR FUNCTION</b>	Peak (PK)
<b>FREQUENCY RANGE</b>	1GHz ~ 25GHz		Average (AV)

#### 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	57.2 PK	74.0	-16.8	1.32 H	132	24.82	32.38
2	2390.00	44.5 AV	54.0	-9.5	1.32 H	132	12.12	32.38
3	*2406.00	98.7 PK			1.32 H	132	66.27	32.43
4	*2406.00	95.5 AV			1.32 H	132	63.07	32.43
5	4812.00	52.9 PK	74.0	-21.1	1.00 H	357	10.98	41.92
6	4812.00	44.1 AV	54.0	-9.9	1.00 H	357	2.18	41.92

#### 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	56.8 PK	74.0	-17.2	1.55 V	265	24.42	32.38
2	2390.00	44.7 AV	54.0	-9.3	1.55 V	265	12.32	32.38
3	*2406.00	97.5 PK			1.55 V	265	65.07	32.43
4	*2406.00	94.3 AV			1.55 V	265	61.87	32.43
5	4812.00	56.3 PK	74.0	-17.7	1.85 V	276	14.38	41.92
6	4812.00	46.9 AV	54.0	-7.1	1.85 V	276	4.98	41.92

#### 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.



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<b>CHANNEL</b>	TX Channel 18	<b>DETECTOR FUNCTION</b>	Peak (PK)
<b>FREQUENCY RANGE</b>	1GHz ~ 25GHz		Average (AV)

**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	*2440.00	99.3 PK			1.31 H	128	66.79	32.51
2	*2440.00	96.2 AV			1.31 H	128	63.69	32.51
3	4880.00	52.1 PK	74.0	-21.9	1.00 H	353	10.10	42.00
4	4880.00	44.3 AV	54.0	-9.7	1.00 H	353	2.30	42.00
5	7320.00	53.1 PK	74.0	-20.9	1.00 H	152	6.55	46.55
6	7320.00	42.5 AV	54.0	-11.5	1.00 H	152	-4.05	46.55

**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	*2440.00	98.3 PK			1.51 V	270	65.79	32.51
2	*2440.00	95.6 AV			1.51 V	270	63.09	32.51
3	4880.00	56.3 PK	74.0	-17.7	1.83 V	274	14.30	42.00
4	4880.00	47.5 AV	54.0	-6.5	1.83 V	274	5.50	42.00
5	7320.00	56.9 PK	74.0	-17.1	1.79 V	254	10.35	46.55
6	7320.00	46.5 AV	54.0	-7.5	1.79 V	254	-0.05	46.55

**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.



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<b>CHANNEL</b>	TX Channel 34	<b>DETECTOR FUNCTION</b>	Peak (PK)
<b>FREQUENCY RANGE</b>	1GHz ~ 25GHz		Average (AV)

**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	*2472.00	101.5 PK			1.29 H	120	68.90	32.60
2	*2472.00	98.5 AV			1.29 H	120	65.90	32.60
3	2483.50	64.1 PK	74.0	-9.9	1.29 H	120	31.47	32.63
4	2483.50	44.1 AV	54.0	-9.9	1.29 H	120	11.47	32.63
5	4944.00	52.5 PK	74.0	-21.5	1.00 H	349	10.50	42.00
6	4944.00	44.7 AV	54.0	-9.3	1.00 H	349	2.70	42.00
7	7416.00	54.2 PK	74.0	-19.8	1.00 H	156	7.41	46.79
8	7416.00	43.3 AV	54.0	-10.7	1.00 H	156	-3.49	46.79

**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	*2472.00	99.9 PK			1.47 V	272	67.30	32.60
2	*2472.00	96.9 AV			1.47 V	272	64.30	32.60
3	2483.50	62.5 PK	74.0	-11.5	1.47 V	272	29.87	32.63
4	2483.50	44.3 AV	54.0	-9.7	1.47 V	272	11.67	32.63
5	4944.00	56.7 PK	74.0	-17.3	1.86 V	277	14.70	42.00
6	4944.00	46.9 AV	54.0	-7.1	1.86 V	277	4.90	42.00
7	7416.00	59.1 PK	74.0	-14.9	1.77 V	251	12.31	46.79
8	7416.00	50.0 AV	54.0	-4.0	1.77 V	251	3.21	46.79

**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.

### 4.3 NUMBER OF HOPPING FREQUENCY USED

#### 4.3.1 LIMIT OF HOPPING FREQUENCY USED

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

#### 4.3.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
R&S SPECTRUM ANALYZER	FSP40	100036	Dec. 14, 2011	Dec. 13, 2012

**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. Tested date : Oct. 25, 2012

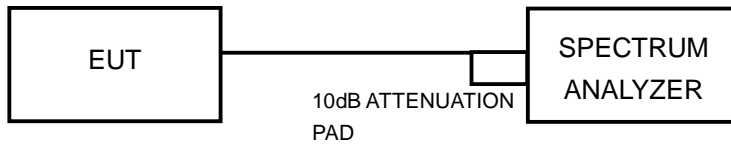
#### 4.3.3 TEST PROCEDURES

- 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.

#### 4.3.4 DEVIATION FROM TEST STANDARD

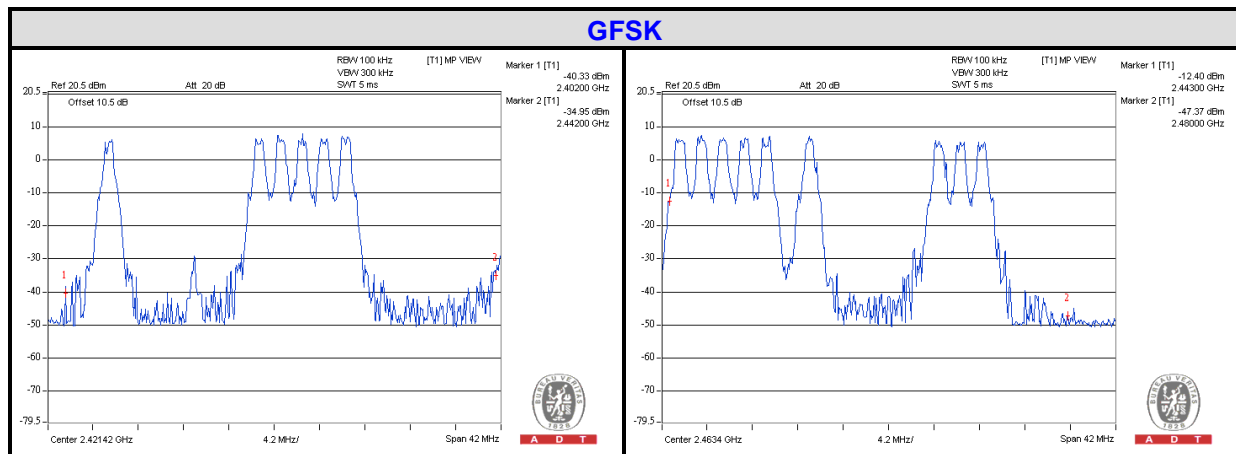
No deviation

### 4.3.5 TEST SETUP



### 4.3.6 TEST RESULTS

There are 34 hopping frequencies in the hopping mode. Please refer to the test result. On the plots, it shows that the hopping frequencies are equally spaced.



## 4.4 DWELL TIME ON EACH CHANNEL

### 4.4.1 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.

### 4.4.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
R&S Spectrum Analyzer	FSP40	100036	Dec. 14, 2011	Dec. 13, 2012

**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. Tested date : Oct. 25, 2012

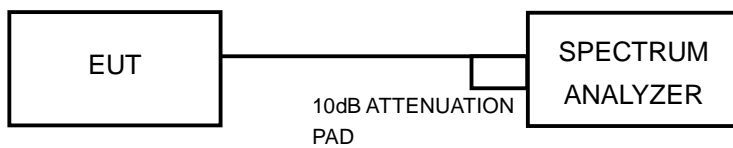
### 4.4.3 TEST PROCEDURES

- 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.

#### 4.4.4 DEVIATION FROM TEST STANDARD

No deviation

#### 4.4.5 TEST SETUP





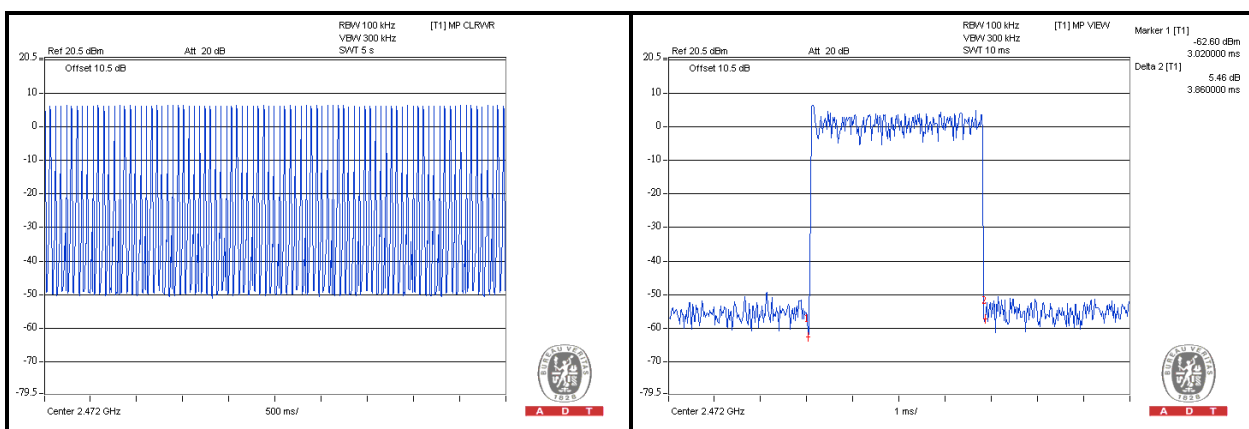


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#### 4.4.6 TEST RESULTS

Number of transmission in a 6 (15Hopping*0.4)	Length of transmission time (msec)	Result (msec)	Limit (msec)
86 (times / 5 sec) *1.2=103.2 times	3.86	398.35	400

**NOTE:** Test plots of the transmitting time slot as below.



## 4.5 CHANNEL BANDWIDTH

### 4.5.1 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, two-thirds 20dB bandwidth of hopping channel shall be a minimum limit for the hopping channel separation.

### 4.5.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
R&S Spectrum Analyzer	FSP40	100036	Dec. 14, 2011	Dec. 13, 2012

**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. Tested date : Oct. 25, 2012

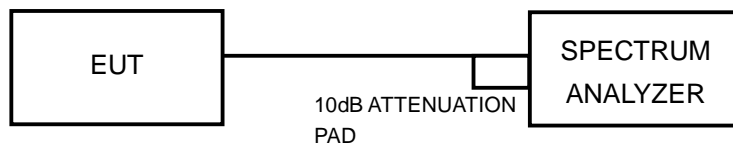
### 4.5.3 TEST PROCEDURE

- 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.

### 4.5.4 DEVIATION FROM TEST STANDARD

No deviation

#### 4.5.5 TEST SETUP



#### 4.5.6 EUT OPERATING CONDITION

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



## 4.6 HOPPING CHANNEL SEPARATION

### 4.6.1 LIMIT OF HOPPING CHANNEL SEPARATION

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

### 4.6.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
R&S Spectrum Analyzer	FSP40	100036	Dec. 14, 2011	Dec. 13, 2012

**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. Tested date : Oct. 25, 2012

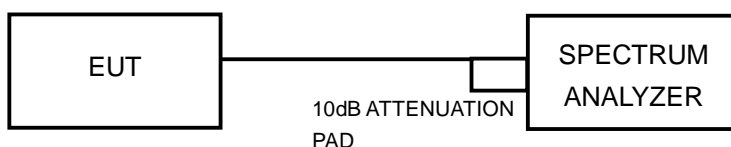
### 4.6.3 TEST PROCEDURES

- 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.
- c. By using the MaxHold function record the separation of two adjacent channels.
- d. Measure the frequency difference of these two adjacent channels by SA MARK function. And then plot the result on SA screen.
- e. Repeat above procedures until all frequencies measured were complete.

### 4.6.4 DEVIATION FROM TEST STANDARD

No deviation

### 4.6.5 TEST SETUP



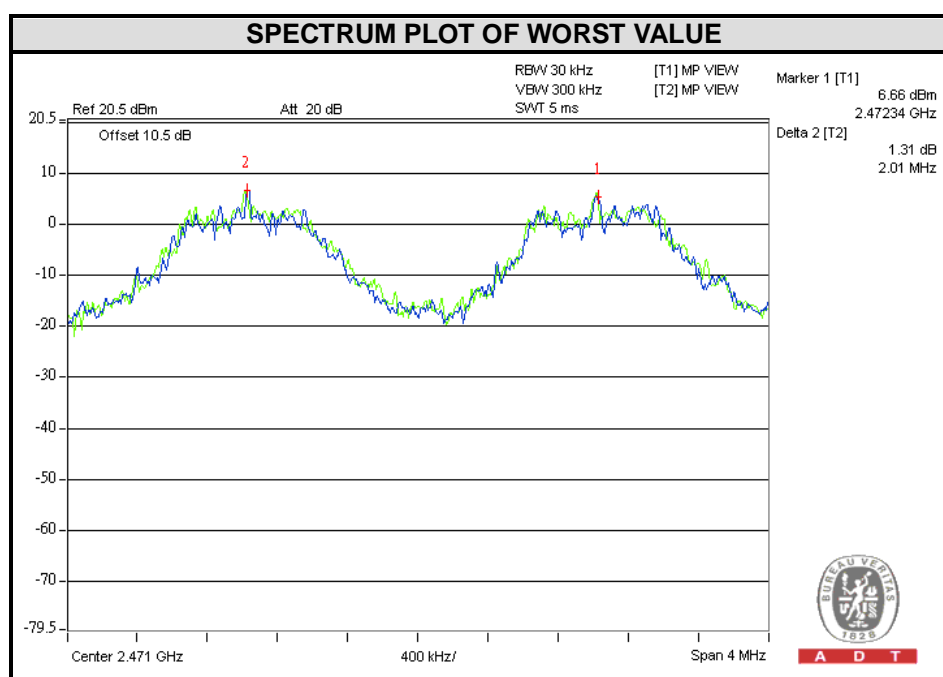


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### 4.6.6 TEST RESULTS

CHANNEL	FREQUENCY (MHz)	ADJACENT CHANNEL SEPARATION (MHz)	20dB BANDWIDTH (MHz)	MINIMUM LIMIT (MHz)	PASS / FAIL
1	2406	2.00	1.83	1.22	PASS
18	2440	2.00	1.41	0.94	PASS
34	2472	2.01	1.37	0.91	PASS

**NOTE:** The minimum limit is two-third 20dB bandwidth.



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## 4.7 MAXIMUM PEAK OUTPUT POWER

### 4.7.1 LIMITS OF MAXIMUM PEAK OUTPUT POWER MEASUREMENT

The Maximum Peak Output Power Limit is 125mW.

### 4.7.2 INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
R&S Spectrum Analyzer	FSP40	100036	Dec. 14, 2011	Dec. 13, 2012

**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. Tested date : Oct. 25, 2012

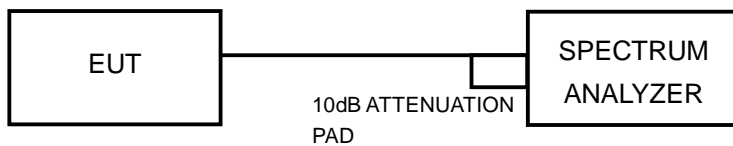
### 4.7.3 TEST PROCEDURES

- 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 3MHz 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.

### 4.7.4 DEVIATION FROM TEST STANDARD

No deviation

#### 4.7.5 TEST SETUP



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

#### 4.7.6 EUT OPERATING CONDITION

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

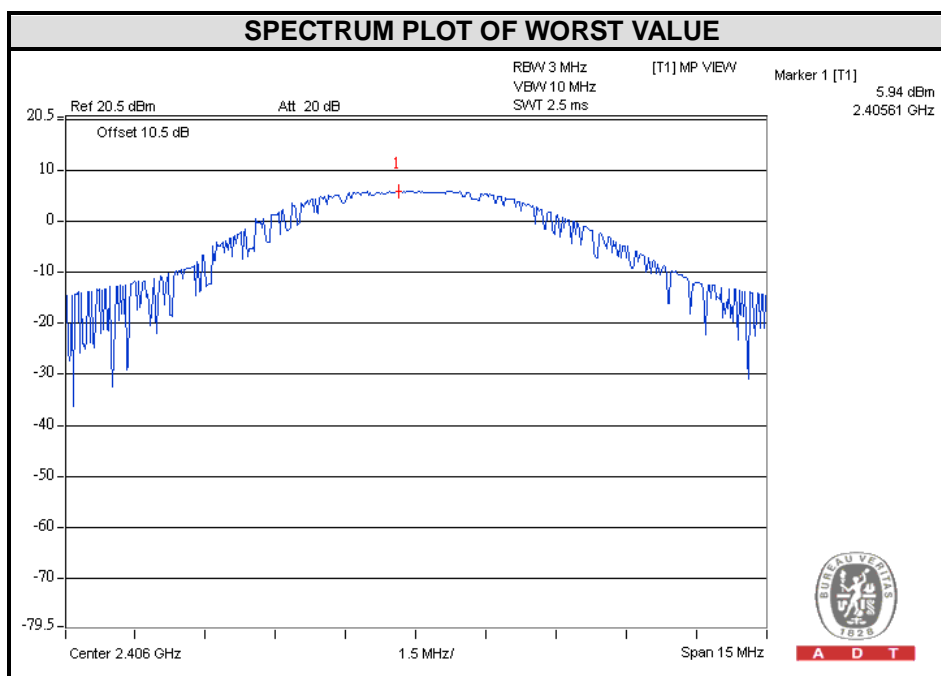




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### 4.7.7 TEST RESULTS

CHANNEL	FREQUENCY (MHz)	OUTPUT POWER (mW)	OUTPUT POWER (dBm)	POWER LIMIT (mW)	PASS / FAIL
1	2406	3.926	5.94	21	PASS
18	2440	3.846	5.85	21	PASS
34	2472	3.483	5.42	21	PASS



## 4.8 CONDUCTED OUT-BAND EMISSION MEASUREMENT

### 4.8.1 LIMITS OF CONDUCTED OUT-BAND EMISSION MEASUREMENT

Below  $-20\text{dB}$  of the highest emission level of operating band (in 100kHz RBW).

### 4.8.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
R&S Spectrum Analyzer	FSP40	100036	Dec. 14, 2011	Dec. 13, 2012

**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. Tested date : Oct. 25, 2012

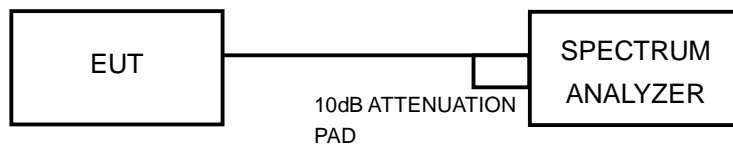
### 4.8.3 TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer via a low lose cable. Set RBW a of spectrum analyzer to 100 kHz and VBW of spectrum analyzer to 300 kHz with suitable frequency span including 100 MHz bandwidth from band edge. The band edges was measured and recorded.

### 4.8.4 DEVIATION FROM TEST STANDARD

No deviation

### 4.8.5 TEST SETUP



### 4.8.6 EUT OPERATING CONDITION

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

#### 4.8.7 TEST RESULTS

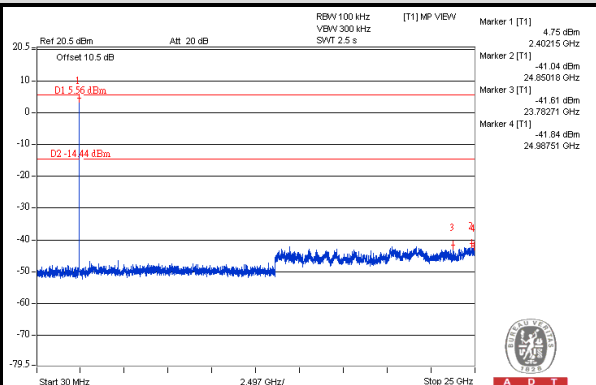
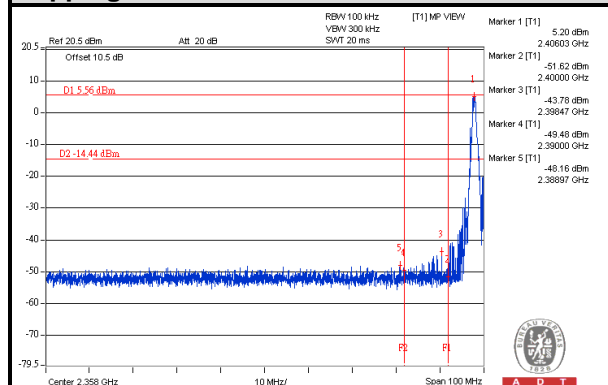
The spectrum plots are attached on the following images. D1 line indicates the highest level, and D2 line indicates the 20dB offset below D1. It shows compliance with the requirement.



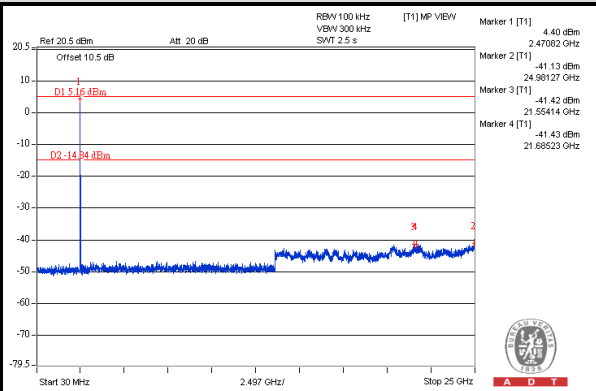
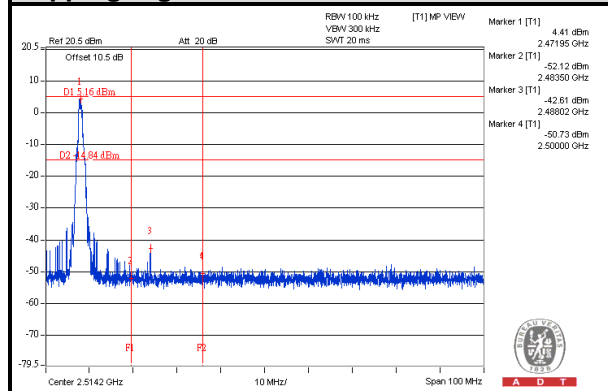
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# GFSK

## Hopping Low Channel



## Hopping High Channel





## 5 PHOTOGRAPHS OF THE TEST CONFIGURATION

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



## 6 INFORMATION ON THE TESTING LABORATORIES

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

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:**

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Fax: 886-3-3270892

**Email:** [service.adt@tw.bureauveritas.com](mailto:service.adt@tw.bureauveritas.com)

**Web Site:** [www.bureauveritas-adt.com](http://www.bureauveritas-adt.com)

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 modifications were made to the EUT by the lab during the test.

**--- END ---**