FCC TEST REPORT

REPORT NO.:	RF140728E05
MODEL NO.:	OR8400
FCC ID:	NKR-OR8400
RECEIVED:	July 28, 2014
TESTED:	July 30 to Aug. 04, 2014
TESTEFFD:	Sep. 17, 2014

APPLICANT:	Wistron NeWeb Corp.
ADDRESS:	20 Park Avenue II, Hsinchu Science Park,Hsinchu 308, Taiwan, R.O.C.

ISSUED BY:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory
LAB ADDRESS :	No. 81-1, Lu Liao Keng, 9th Ling,Wu Lung Tsuen, Chiung Lin Hsiang, Hsin Chu Hsien 307, Taiwan, R.O.C.
TEST LOCATION (1):	No. 81-1, Lu Liao Keng, 9th Ling,Wu Lung Tsuen, Chiung Lin Hsiang, Hsin Chu Hsien 307, Taiwan, R.O.C.
TEST LOCATION (2):	No. 49, Ln. 206, Wende Rd., Shangshan Tsuen, Chiung Lin Hsiang, Hsin Chu Hsien 307, Taiwan, R.O.C.

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RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RF140728E05	Original release	Sep. 17, 2014

1 CERTIFICATION

PRODUCT :	High End RFID Reader module
BRAND NAME :	WNC
MODEL NO. :	OR8400
APPLICANT :	Wistron NeWeb Corp.
TESTED DATE:	July 30 to Aug. 04, 2014
TEST SAMPLE :	ENGINEERING SAMPLE
STANDARDS :	FCC Part 15, Subpart C (Section 15.247) ANSI C63.10-2009

The above equipment (Model: OR8400) 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:** Sep. 17, 2014
(Lori Chung, Specialist)

APPROVED BY : _____ , **DATE:** Sep. 17, 2014
(May Chen, Manager)

2 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: 47 CFR 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 -16.91dB at 24.00000 MHz
15.247(a)(1)(i)	Number of Hopping Frequency Used Spec.:	PASS	Meet the requirement of limit
15.247(a)(1)(i)	Dwell Time on Each Channel Spec. : Max. 0.4 second	PASS	Meet the requirement of limit
15.247(a)(1)	Hopping Channel Separation Spec. : Min. 25 kHz or 20 dB bandwidth, which ever is greater	PASS	Meet the requirement of limit
15.247(a)(1)(i)	Spectrum Bandwidth of a Frequency Hopping Sequence Spread Spectrum System Spec.: Max. 0.5 MHz	PASS	Meet the requirement of limit
15.247(b)(2)	Maximum Peak Output Power	PASS	Meet the requirement of limit
15.247(d)	Transmitter Radiated Emissions Spec.: Table 15.209	PASS	Meet the requirement of limit Minimum passing margin is -3.5dB at 2708.25MHz
15.247(d)	Conducted Out-Band Emission Measurement	PASS	Meet the requirement of limit
15.203	Antenna Requirement	-	Antenna connector is RP TNC not a standard connector.

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.

Measurement	Value
Conducted emissions	2.86 dB
Radiated emissions (30MHz-1GHz)	5.43 dB
Radiated emissions (1GHz-6GHz)	3.72 dB
Radiated emissions (6GHz-18GHz)	4.00 dB

3 GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

PRODUCT	High End RFID Reader module
MODEL NO.	OR8400
POWER SUPPLY	DC 12V from power adapter
MODULATION TYPE	ASK
MODULATION TECHNOLOGY	FHSS
FREQUENCY RANGE	902.75MHz ~ 927.25MHz
NUMBER OF CHANNEL	50
OUTPUT POWER	931.108mW
ANTENNA TYPE	Please see NOTE
DATA CABLE	NA
I/O PORTS	Refer to user's manual
ASSOCIATED DEVICES	Adapter x 1

NOTE:

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

Brand	Model No.	Spec.
CHANNEL WELL	KPL-040F	Input: 100-240V, 1.7A, 50-60Hz AC power cable: 1.8m, unshielded Output: 12V, 3.33A DC power cable: 1.6m, unshielded with one core

2. The antennas provided to the EUT, please refer to the following table:

Ant. No.	PCB Chain No.	Brand	Model	Antenna Type	Gain(dBi) (excluding cable loss)	Cable Loss (dB)	Net Gain (dBi)	Frequency range (MHz to MHz)	Cable Length (m)	Antenna Connector
1	1~4	WNC	XRAB-N1	Linear	5.5	1.5	4	902~928	3	RP TNC
2	1~4	WNC	XRAB-N2	Linear	5.0	1.5	3.5	902~928	3	RP TNC
3	1~4	WNC	XRAB-N3	Linear	4.0	1.5	2.5	902~928	3	RP TNC
From the above antennas, **antenna no. 1** was selected as representative antenna for the test and its data was recorded in this report.										

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

3.2 DESCRIPTION OF TEST MODES

50 channels are provided to this EUT.

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
0	902.75	21	913.25	42	923.75
1	903.25	22	913.75	43	924.25
2	903.75	23	914.25	44	924.75
3	904.25	24	914.75	45	925.25
4	904.75	25	915.25	46	925.75
5	905.25	26	915.75	47	926.25
6	905.75	27	916.25	48	926.75
7	906.25	28	916.75	49	927.25
8	906.75	29	917.25		
9	907.25	30	917.75		
10	907.75	31	918.25		
11	908.25	32	918.75		
12	908.75	33	919.25		
13	909.25	34	919.75		
14	909.75	35	920.25		
15	910.25	36	920.75		
16	910.75	37	921.25		
17	911.25	38	921.75		
18	911.75	39	922.25		
19	912.25	40	922.75		
20	912.75	41	923.25		

3.3 TEST MODE APPLICABLITY 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

NOTE: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **Y-plane.**

Power Line Conducted Emission:

☒ Pre-Scan to determine the worst-case mode from all possible combinations between available modulations and packet types.

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

Available Channel	Tested Channel	Modulation Technology	Modulation Type
0 to 49	24	FHSS	ASK

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
0 to 49	0, 24, 49	FHSS	ASK

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
0 to 49	0, 24, 49	FHSS	ASK

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
0 to 49	0, 24, 49	FHSS	ASK

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
0 to 49	0, 49	FHSS	ASK

※ **TEST CONDITION:**

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
PLC	30deg. C, 70%RH	120Vac, 60 Hz	Mike Hsieh
RE≥1G	21deg. C, 66%RH	120Vac, 60 Hz	Robert Cheng
RE<1G	25deg. C, 66%RH 25deg. C, 67%RH	120Vac, 60 Hz	Robert Cheng
APCM	25deg. C, 60%RH	120Vac, 60 Hz	James Chan
OB	25deg. C, 60%RH	120Vac, 60 Hz	James Chan

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	Remark
A	NOTEBOOK COMPUTER	DELL	E6420	H62T3R1	FCC DoC	Provided by Lab
B	Test Tool	Wistron NeWeb Corp.	NA	NA	NA	Supplied by Client

NOTE:

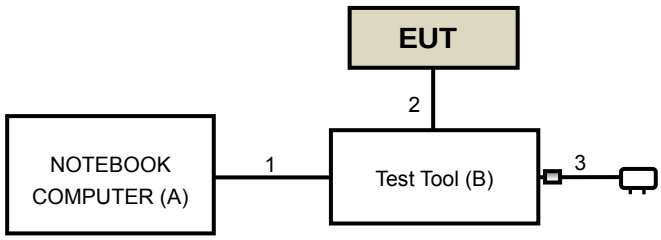
1. All power cords of the above support units are non-shielded (1.8 m).

No.	Cable	Qty.	Length (m)	Shielded (Yes/ No)	Cores (Number)	Remark
1	USB	1	1.8	Yes	0	Supplied by Client
2	Data	1	0.13	No	0	Supplied by Client
3	DC	1	1.5	Yes	1	Supplied by Client

NOTE:

1. The core(s) is(are) originally attached to the cable(s).

3.6 CONFIGURATION OF SYSTEM UNDER TEST



4 TEST PROCEDURES AND RESULTS

4.1 CONDUCTED EMISSION MEASUREMENT

4.1.1 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.

4.1.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver ROHDE & SCHWARZ	ESCS 30	100375	Apr. 29, 2014	Apr. 28, 2015
Line-Impedance Stabilization Network (for EUT) SCHWARZBECK	NSLK8127	8127-522	Sep. 12, 2013	Sep. 11, 2014
Line-Impedance Stabilization Network (for Peripheral) ROHDE & SCHWARZ	ENV216	100071	Nov. 13, 2013	Nov. 12, 2014
RF Cable (JYEBAO)	5DFB	COCCAB-001	Mar. 10 , 2014	Mar. 09, 2015
50 ohms Terminator	N/A	EMC-03	Sep. 24, 2013	Sep. 23, 2014
50 ohms Terminator	N/A	EMC-02	Oct. 01, 2013	Sep. 30, 2014
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. 04, 2014

4.1.3 TEST PROCEDURES

a. The EUT/HOST placed 0.4 meters from the conducting wall of the shielded room with EUT/HOST 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.

b. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.

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

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

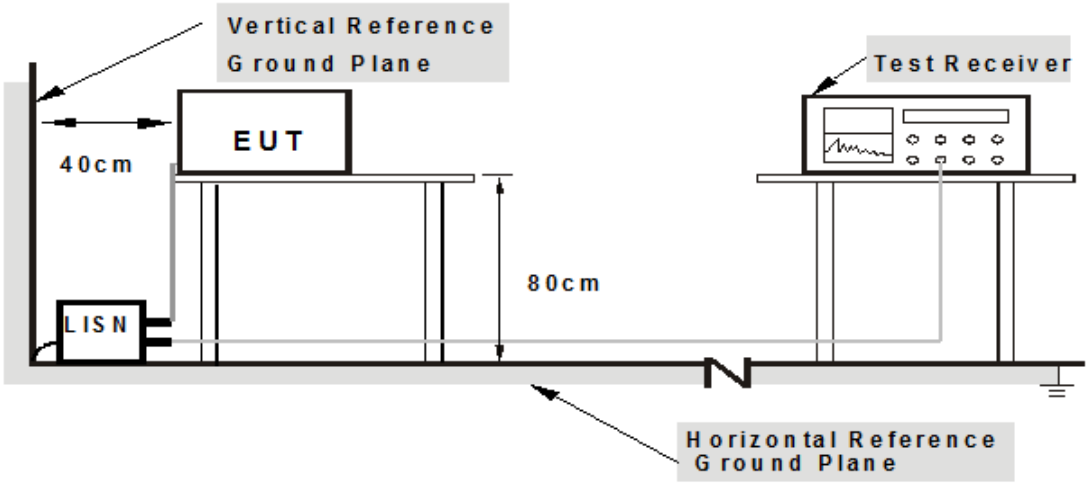
NOTE:

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

4.1.4 DEVIATION FROM TEST STANDARD

No deviation

4.1.5 TEST SETUP



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

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

4.1.6 EUT OPERATING CONDITIONS

1. Placed the EUT on the testing table.
2. The support unit A (NB) runs test program “TuningTool Version:0.2.0.1” to enable EUT under transmission condition continuously at specific channel frequency.

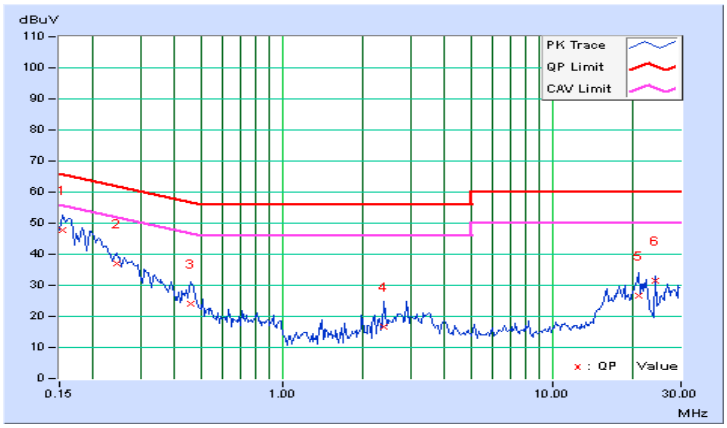
4.1.7 TEST RESULTS

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

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	0.15391	0.07	47.61	28.29	47.68	28.36	65.79	55.79	-18.11	-27.43
2	0.24375	0.07	37.14	19.27	37.21	19.34	61.97	51.97	-24.75	-32.62
3	0.45859	0.09	23.90	10.36	23.99	10.45	56.72	46.72	-32.72	-36.26
4	2.39453	0.19	16.55	8.30	16.74	8.49	56.00	46.00	-39.26	-37.51
5	20.82422	0.73	25.84	15.84	26.57	16.57	60.00	50.00	-33.43	-33.43
6	24.00000	0.82	30.78	30.49	31.60	31.31	60.00	50.00	-28.40	-18.69

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

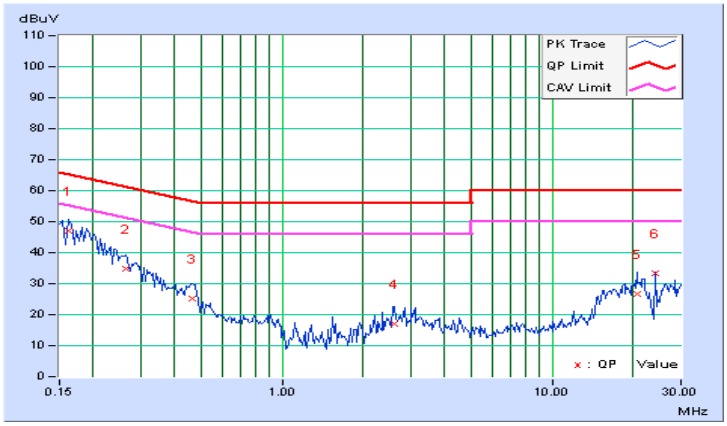


PHASE	Neutral (N)	DETECTOR FUNCTION	Quasi-Peak (QP) / Average (AV)

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	0.16172	0.07	46.90	28.89	46.97	28.96	65.38	55.38	-18.40	-26.41
2	0.26328	0.08	34.82	17.07	34.90	17.15	61.33	51.33	-26.43	-34.18
3	0.46250	0.09	25.11	14.17	25.20	14.26	56.65	46.65	-31.44	-32.38
4	2.60938	0.20	16.69	10.48	16.89	10.68	56.00	46.00	-39.11	-35.32
5	20.65234	0.72	25.82	16.40	26.54	17.12	60.00	50.00	-33.46	-32.88
6	**24.00000**	**0.81**	**32.43**	**32.28**	**33.24**	**33.09**	**60.00**	**50.00**	**-26.76**	**-16.91**

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 NUMBER OF HOPPING FREQUENCY USED

4.2.1 LIMIT OF HOPPING FREQUENCY USED

CONDITION	HOPPING FREQUENCY USED	APPLICATION
20dB Bandwidth <250kHz	hopping channels ≧50	v
20dB Bandwidth >250kHz	hopping channels ≧25	x

4.2.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
SPECTRUM ANALYZER R&S	FSV 40	100964	July 05, 2014	July 04, 2015

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 : Aug. 04, 2014

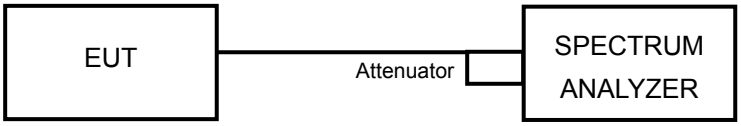
4.2.3 TEST PROCEDURES

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. 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.
3. 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.
4. Set the SA on View mode and then plot the result on SA screen.
5. Repeat above procedures until all frequencies measured were complete.

4.2.4 DEVIATION FROM TEST STANDARD

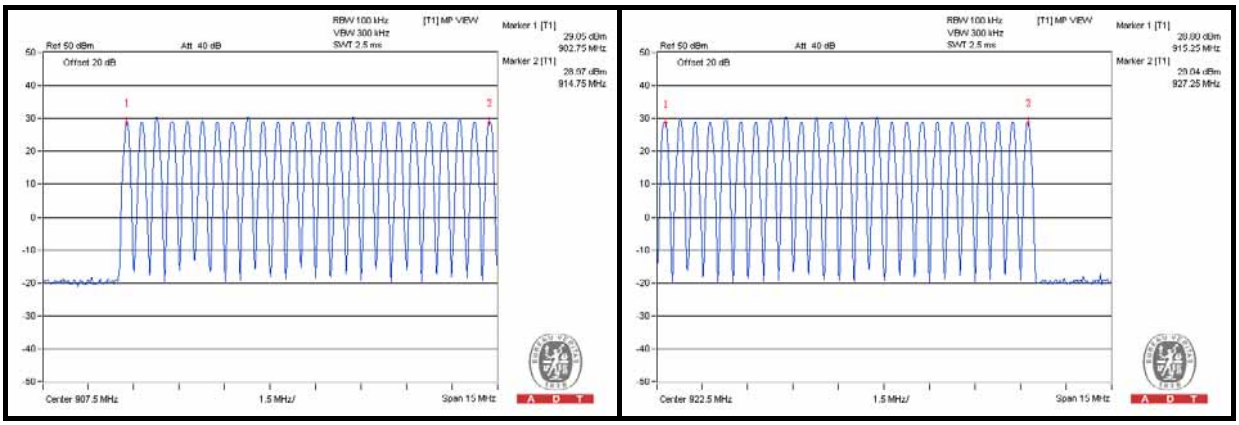
No deviation

4.2.5 TEST SETUP



4.2.6 TEST RESULTS

There are 50 hopping frequencies in the hopping mode. Please refer to next page for the test result. On the plots, it shows that the hopping frequencies are equally spaced.



4.3 DWELL TIME ON EACH CHANNEL

4.3.1 LIMIT OF DWELL TIME USED

For FHSS, the average time of occupancy on any frequency shall not be greater than as below:

CONDITION	DWELL TIME	APPLICATION
20dB Bandwidth <250kHz (hopping channels ≧50)	0.4 seconds within a 20 second period	v
20dB Bandwidth >250kHz (hopping channels ≧25)	0.4 seconds within a 10 second period	x

4.3.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
SPECTRUM ANALYZER R&S	FSV 40	100964	July 05, 2014	July 04, 2015

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 : Aug. 04, 2014

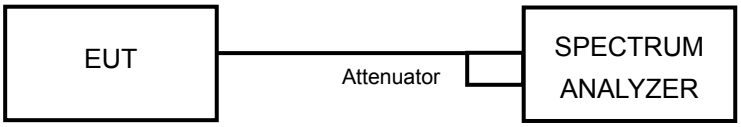
4.3.3 TEST PROCEDURES

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. 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.
3. 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.
4. Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.
5. Repeat above procedures until all frequencies measured were complete.

4.3.4 DEVIATION FROM TEST STANDARD

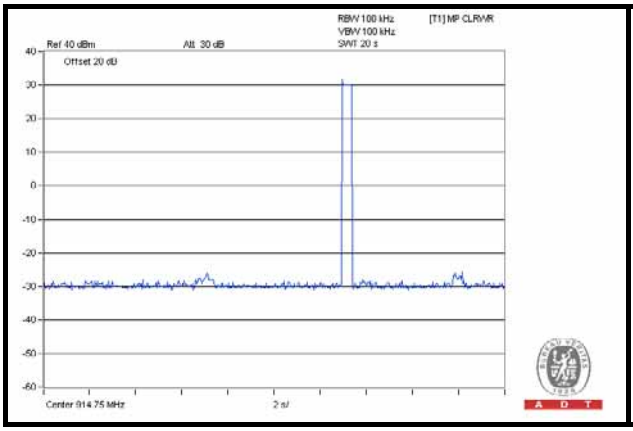
No deviation

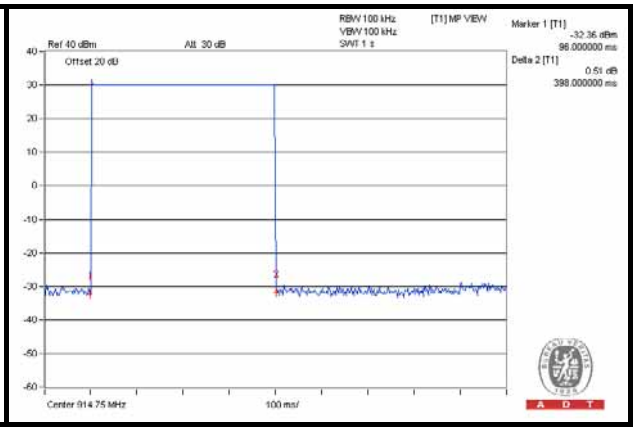
4.3.5 TEST SETUP



4.3.6 TEST RESULTS

Number of transmission in a 20 s	Length of transmission time (msec)	Result (msec)	Limit (msec)
1 time	398	398	400





4.4 CHANNEL BANDWIDTH

For frequency hopping system operating in the 902-928MHz, the maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

CONDITION	APPLICATION
20dB Bandwidth <250kHz (hopping channels ≧50)	v
20dB Bandwidth >250kHz (hopping channels ≧25)	x

4.4.1 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
SPECTRUM ANALYZER R&S	FSV 40	100964	July 05, 2014	July 04, 2015

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 : Aug. 04, 2014

4.4.2 TEST PROCEDURE

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. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

4.4.3 DEVIATION FROM TEST STANDARD

No deviation

4.4.4 TEST SETUP

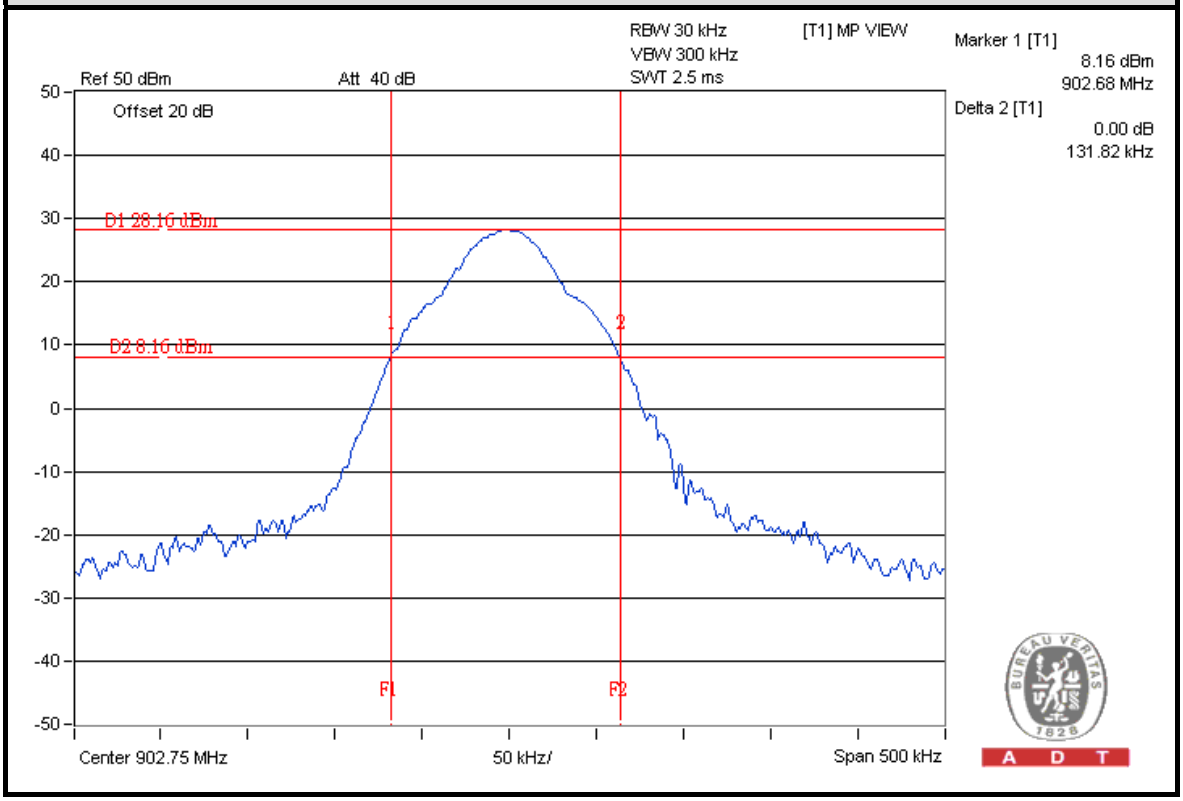
4.4.5 EUT OPERATING CONDITION

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

4.4.6 TEST RESULTS

CHANNEL	CHANNEL FREQUENCY (MHz)	20dB BANDWIDTH (MHz)
0	902.75	0.13
24	914.75	0.12
49	927.25	0.13

SPECTRUM PLOT OF WORST VALUE



4.5 HOPPING CHANNEL SEPARATION

4.5.1 LIMIT OF HOPPING CHANNEL SEPARATION

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

4.5.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
SPECTRUM ANALYZER R&S	FSV 40	100964	July 05, 2014	July 04, 2015

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 : Aug. 04, 2014

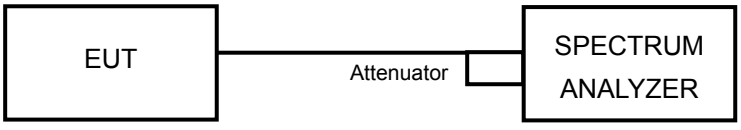
4.5.3 TEST PROCEDURES

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.

4.5.4 DEVIATION FROM TEST STANDARD

No deviation

4.5.5 TEST SETUP

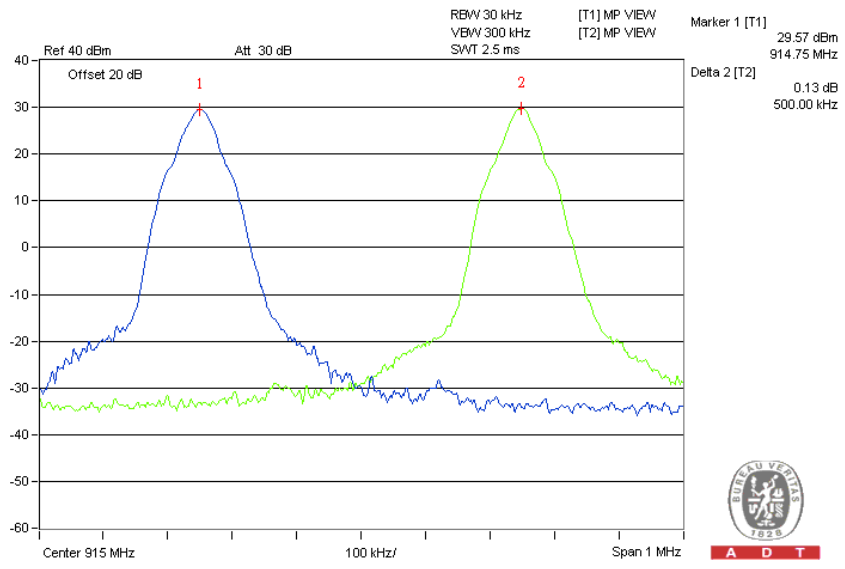


4.5.6 TEST RESULTS

Channel	Frequency (MHz)	Adjacent Channel Separation (MHz)	Minimum Limit (MHz)	Pass / Fail
0	902.75	0.50	0.13	PASS
24	914.75	0.50	0.12	PASS
49	927.25	0.51	0.13	PASS

The minimum limit is 20dB bandwidth.

SPECTRUM PLOT OF WORST VALUE



4.6 MAXIMUM PEAK OUTPUT POWER

4.6.1 LIMITS OF MAXIMUM PEAK OUTPUT POWER MEASUREMENT

The Maximum Peak Output Power Measurement as below:

CONDITION	OUTPUT POWER	APPLICATION
hopping channels ≧50	1 W	v
hopping channels ≧25 & ≦50	0.25W	x

4.6.2 INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
SPECTRUM ANALYZER R&S	FSV 40	100964	July 05, 2014	July 04, 2015

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 : Aug. 04, 2014

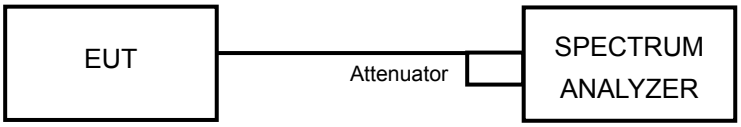
4.6.3 TEST PROCEDURES

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. Set a reference level on the measuring instrument equal to the highest peak value.
3. The center frequency of the spectrum analyzer is set to the fundamental frequency and using 3 MHz RBW and 10 MHz VBW.
4. Measure the captured power within the band and recording the plot.
5. Repeat above procedures until all frequencies measured were complete.

4.6.4 DEVIATION FROM TEST STANDARD

No deviation

4.6.5 TEST SETUP



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

4.6.6 EUT OPERATING CONDITION

The software (TuningTool Version:0.2.0.1) provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

4.6.7 TEST RESULTS

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (mW)	PEAK POWER OUTPUT (dBm)	PEAK POWER LIMIT (mW)	PASS/FAIL
0	902.75	924.698	29.66	1000	PASS
24	914.75	931.108	29.69	1000	PASS
49	927.25	924.698	29.66	1000	PASS

4.7 RADIATED EMISSION AND BANDEDGE MEASUREMENT

4.7.1 LIMITS OF RADIATED EMISSION AND BANDEDGE 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.

4.7.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
MXE EMI Receiver Agilent	N9038A	MY50010156	Jan. 15, 2014	Jan. 14, 2015
Pre-Amplifier Mini-Circuits	ZFL-1000VH2 B	AMP-ZFL-04	Nov. 13, 2013	Nov. 12, 2014
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-361	Feb. 27, 2014	Feb. 26, 2015
RF Cable	NA	CHHCAB_001	Oct. 06, 2013	Oct. 05, 2014
Spectrum Analyzer R&S	FSV40	100964	July 05, 2014	July 04, 2015
Horn_Antenna AISI	AIH.8018	0000220091110	Dec. 06, 2013	Dec. 05, 2014
Pre-Amplifier Agilent	8449B	3008A01923	Oct. 29, 2013	Oct. 28, 2014
RF Cable	NA	RF104-205 RF104-207 RF104-202	Dec. 12, 2013	Dec. 11, 2014
Pre-Amplifier SPACEK LABS	SLKKa-48-6	9K16	Nov. 13, 2013	Nov. 12, 2014
Horn_Antenna SCHWARZBECK	BBHA 9170	9170-424	Oct. 08, 2013	Oct. 07, 2014
Software	ADT_Radiated _V8.7.07	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: Aug. 01, 2014

4.7.3 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 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:

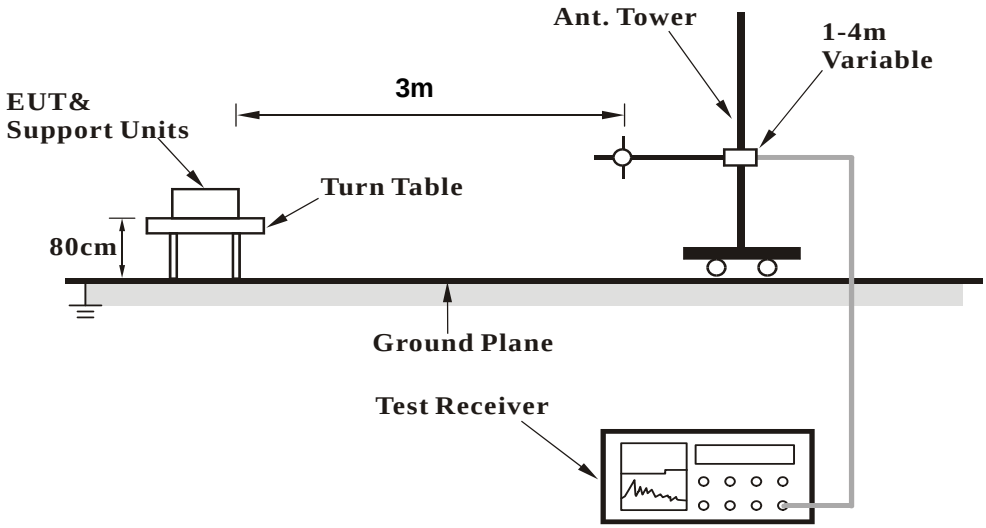
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz for Average detection (AV) at frequency above 1GHz.

4.7.4 DEVIATION FROM TEST STANDARD

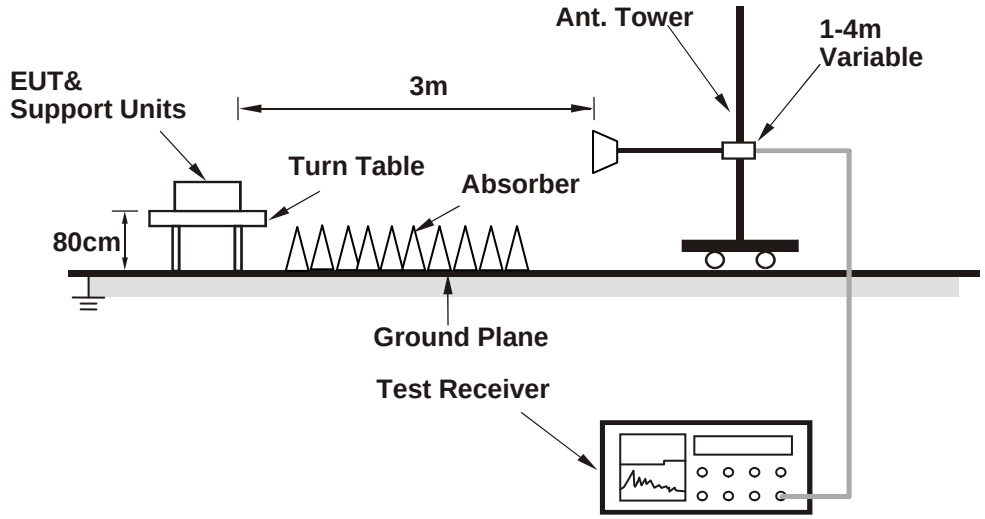
No deviation

4.7.5 TEST SETUP

<Frequency Range below 1GHz>



<Frequency Range above 1GHz>



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

4.7.6 EUT OPERATING CONDITION

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

4.7.7 TEST RESULTS

BELOW 1GHz WORST-CASE DATA

CHANNEL	TX Channel 0	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 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	96.06	36.5 QP	43.5	-7.0	1.50 H	340	54.44	-17.91
2	152.46	36.5 QP	43.5	-7.0	2.00 H	268	48.93	-12.46
3	166.58	39.9 QP	43.5	-3.6	1.79 H	25	52.85	-12.94
4	217.74	38.6 QP	46.0	-7.4	1.00 H	253	54.30	-15.74
5	232.39	39.8 QP	46.0	-6.3	1.50 H	274	54.37	-14.62
6	252.28	37.4 QP	46.0	-8.6	1.00 H	253	51.01	-13.59
7	902.00	60.5 QP	106.3	-45.8	1.00 H	103	32.83	27.67
8	*902.75	126.3 QP	-	-	1.00 H	103	98.62	27.68
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	41.46	35.2 QP	40.0	-4.8	1.68 V	195	48.55	-13.34
2	60.21	31.4 QP	40.0	-8.6	1.65 V	185	44.94	-13.52
3	96.12	31.4 QP	43.5	-12.1	1.65 V	302	49.31	-17.90
4	166.52	35.7 QP	43.5	-7.9	1.64 V	302	48.58	-12.93
5	233.40	27.5 QP	46.0	-18.5	1.56 V	302	41.95	-14.43
6	252.12	31.4 QP	46.0	-14.6	1.75 V	301	45.01	-13.59
7	902.00	65.3 QP	110.3	-45	1.54 H	219	37.63	27.67
8	*902.75	130.3 QP	-	-	1.54 H	219	102.62	27.68

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) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 24	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 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	96.11	36.6 QP	43.5	-6.9	1.65 H	278	54.52	-17.90
2	152.44	36.5 QP	43.5	-7.0	1.95 H	302	49.00	-12.46
3	166.56	39.8 QP	43.5	-3.7	1.85 H	40	52.76	-12.94
4	217.75	38.6 QP	46.0	-7.4	1.24 H	301	54.36	-15.74
5	232.37	39.4 QP	46.0	-6.6	2.31 H	302	54.04	-14.62
6	252.10	37.2 QP	46.0	-8.8	1.65 H	360	50.80	-13.59
7	*914.75	126 QP	-	-	1.00 H	118	97.97	28.03
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	41.60	35.4 QP	40.0	-4.6	1.47 V	165	48.76	-13.34
2	60.11	31.3 QP	40.0	-8.7	1.78 V	168	44.82	-13.50
3	96.21	31.6 QP	43.5	-11.9	1.24 V	234	49.44	-17.88
4	166.61	35.9 QP	43.5	-7.7	1.24 V	345	48.79	-12.94
5	233.20	27.4 QP	46.0	-18.6	1.45 V	342	41.88	-14.46
6	252.01	31.7 QP	46.0	-14.3	1.67 V	321	45.30	-13.59
7	*914.75	130.2 QP	-	-	1.5 V	212	102.17	28.03

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) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 49	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 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	96.11	36.4 QP	43.5	-7.1	1.45 H	222	54.32	-17.90
2	152.45	36.4 QP	43.5	-7.1	1.67 H	275	48.87	-12.46
3	166.42	39.6 QP	43.5	-3.9	1.75 H	100	52.54	-12.92
4	217.61	38.4 QP	46.0	-7.6	1.42 H	178	54.15	-15.73
5	232.38	39.1 QP	46.0	-6.9	2.04 H	268	53.76	-14.62
6	252.14	37.1 QP	46.0	-8.9	1.75 H	298	50.73	-13.59
7	*927.25	126.4 QP	-	-	1.00 H	88	98.14	28.26
8	928.00	60.9 QP	106.4	-45.5	1.00 H	88	32.61	28.29
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	41.69	35.6 QP	40.0	-4.4	1.50 V	195	48.94	-13.34
2	60.07	31.6 QP	40.0	-8.5	1.50 V	195	45.05	-13.50
3	96.11	31.7 QP	43.5	-11.8	1.00 V	225	49.60	-17.90
4	166.58	35.8 QP	43.5	-7.7	1.00 V	332	48.70	-12.94
5	233.22	27.6 QP	46.0	-18.4	1.00 V	360	42.05	-14.46
6	252.28	31.9 QP	46.0	-14.1	1.50 V	332	45.46	-13.59
7	*927.25	130.4 QP	-	-	1.60 H	228	102.14	28.26
8	928.00	56.2 QP	110.4	-45.2	1.60 H	228	36.91	28.29

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) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

ABOVE 1GHz DATA

CHANNEL	TX Channel 0	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 10GHz		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	2708.25	64.9 PK	74.0	-9.1	2.80 H	52	68.78	-3.88
2	**2708.25**	**50.5 AV**	**54.0**	**-3.5**	**2.80 H**	**52**	**54.38**	**-3.88**
3	3611.00	49.8 PK	74.0	-24.2	2.54 H	346	51.00	-1.20
4	3611.00	46.1 AV	54.0	-7.9	2.54 H	346	47.30	-1.20
5	4513.75	57.4 PK	74.0	-16.6	2.96 H	327	52.65	4.75
6	4513.75	49.8 AV	54.0	-4.2	2.96 H	327	45.05	4.75
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	2708.25	62.0 PK	74.0	-12.0	2.03 V	264	65.88	-3.88
2	2708.25	49.1 AV	54.0	-4.9	2.03 V	264	52.98	-3.88
3	3611.00	48.9 PK	74.0	-25.1	1.00 V	110	50.10	-1.20
4	3611.00	44.3 AV	54.0	-9.7	1.00 V	110	45.50	-1.20
5	4513.75	47.8 PK	74.0	-26.2	1.01 V	266	43.05	4.75
6	4513.75	45.2 AV	54.0	-8.8	1.01 V	266	40.45	4.75

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) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

CHANNEL	TX Channel 24	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 10GHz		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	2744.25	64.5 PK	74.0	-9.5	2.86 H	43	68.25	-3.75
2	2744.25	50.0 AV	54.0	-4.0	2.86 H	43	53.75	-3.75
3	3659.00	50.2 PK	74.0	-23.8	2.66 H	360	51.14	-0.94
4	3659.00	45.9 AV	54.0	-8.1	2.66 H	360	46.84	-0.94
5	4573.75	57.6 PK	74.0	-16.4	3.04 H	337	52.70	4.90
6	4573.75	49.9 AV	54.0	-4.1	3.04 H	337	45.00	4.90
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	2744.25	62.2 PK	74.0	-11.8	2.03 V	252	65.95	-3.75
2	2744.25	49.2 AV	54.0	-4.8	2.03 V	252	52.95	-3.75
3	3659.00	48.9 PK	74.0	-25.1	1.01 V	109	49.84	-0.94
4	3659.00	44.2 AV	54.0	-9.8	1.01 V	109	45.14	-0.94
5	4573.75	47.9 PK	74.0	-26.1	1.00 V	263	43.00	4.90
6	4573.75	45.0 AV	54.0	-9.0	1.00 V	263	40.10	4.90

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) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

CHANNEL	TX Channel 49	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 10GHz		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	2781.75	64.8 PK	74.0	-9.2	2.81 H	50	68.42	-3.62
2	2781.75	50.4 AV	54.0	-3.6	2.81 H	50	54.02	-3.62
3	3709.00	50.0 PK	74.0	-24.0	2.60 H	358	50.71	-0.71
4	3709.00	46.0 AV	54.0	-8.0	2.60 H	358	46.71	-0.71
5	4636.25	57.7 PK	74.0	-16.3	3.00 H	329	52.83	4.87
6	4636.25	49.9 AV	54.0	-4.1	3.00 H	329	45.03	4.87
7	7418.00	57.6 PK	74.0	-16.4	1.78 H	9	47.57	10.03
8	7418.00	49.8 AV	54.0	-4.2	1.78 H	9	39.77	10.03
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	2781.75	61.7 PK	74.0	-12.3	2.02 V	262	65.32	-3.62
2	2781.75	48.9 AV	54.0	-5.1	2.02 V	262	52.52	-3.62
3	3709.00	48.9 PK	74.0	-25.1	1.00 V	115	49.61	-0.71
4	3709.00	44.4 AV	54.0	-9.6	1.00 V	115	45.11	-0.71
5	4636.25	48.2 PK	74.0	-25.8	1.00 V	273	43.33	4.87
6	4636.25	45.3 AV	54.0	-8.7	1.00 V	273	40.43	4.87

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) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

4.8 CONDUCTED OUT-BAND EMISSION MEASUREMENT

4.8.1 LIMITS OF CONDUCTED OUT-BAND EMISSION MEASUREMENT

Below –20dB 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
SPECTRUM ANALYZER R&S	FSV 40	100964	July 05, 2014	July 04, 2015

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 : Aug. 04, 2014

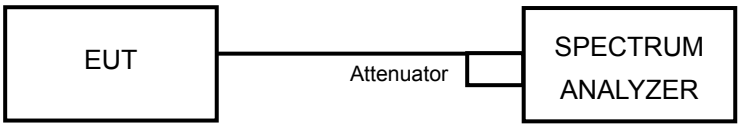
4.8.3 TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer via a low lose cable. Set RBW of spectrum analyzer to 100kHz and VBW of spectrum analyzer to 300kHz with suitable frequency span including 20 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



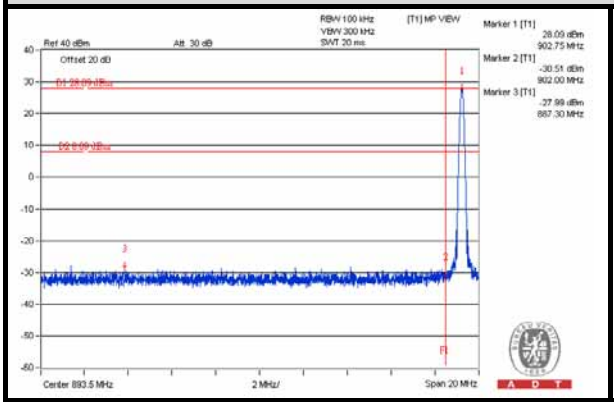
4.8.6 EUT OPERATING CONDITION

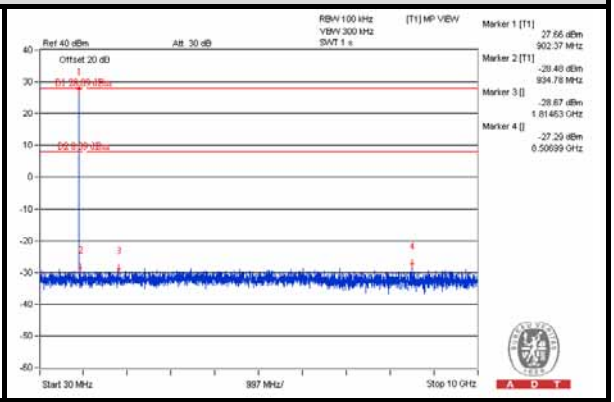
The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

4.8.7 TEST RESULTS

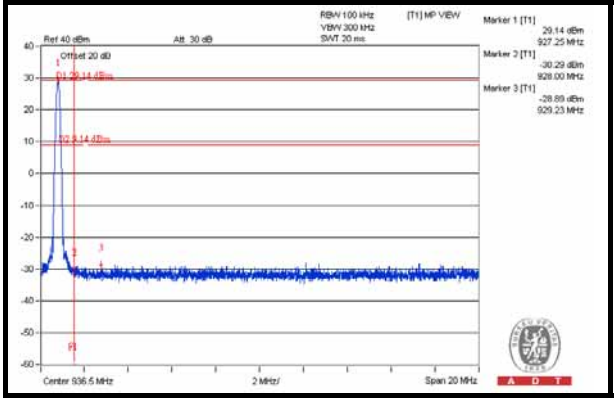
The spectrum plots are attached on the following images. D1 line indicates the highest level, and D2 line indicates the 20dB offset below D1. It shows compliance with the requirement.

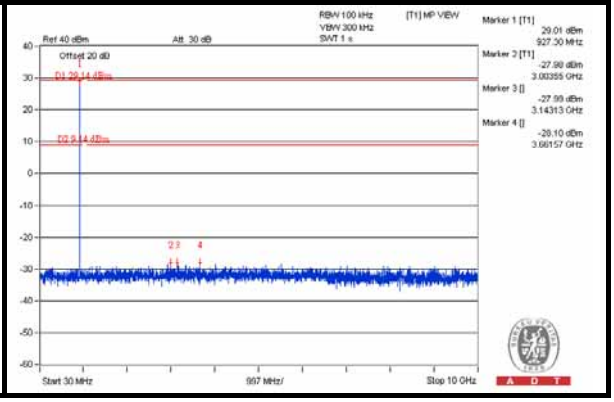
CH0





CH49





5 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:

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Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab:
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Web Site: www.bureauveritas-adt.com

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

6 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.

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