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Supplemental “Transmit Simultaneously” Test Report

REPORT NO.: RF121115E05-2

MODEL NO.: RTL8723AEN0

FCC ID: TX2-RTL8723AEN0

RECEIVED: Nov. 15, 2012

TESTED: Nov. 20 to 26, 2012

ISSUED: Dec. 04, 2012

APPLICANT: Realtek Semiconductor Corp.

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ISSUED BY: Bureau Veritas Consumer Products Services
(H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory

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RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RF121115E05-2	Original release	Dec. 04, 2012



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1. CERTIFICATION

PRODUCT: 802.11b/g/n RTL8723AE Combo NGFF Card
BRAND NAME: Realtek
MODEL NO.: RTL8723AEN0
TEST SAMPLE: ENGINEERING SAMPLE
APPLICANT: Realtek Semiconductor Corp.
TESTED: Nov. 20 to 26, 2012
STANDARDS: **FCC Part 15, Subpart C (Section 15.247)**
ANSI C63.10-2009

The above equipment (Model: RTL8723AEN0) 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. 04, 2012
(Lori Chung, Specialist)

APPROVED BY :  , **DATE:** Dec. 04, 2012
(May Chen, Deputy Manager)



2. SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

For WLAN 2.4GHz & BT

APPLIED STANDARD: FCC PART 15, SUBPART C (SECTION 15.247)			
STANDARD SECTION	TEST TYPE	RESULT	REMARK
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -13.84dB at 0.16562MHz
15.247(d) 15.209	Radiated Emissions	PASS	Meet the requirement of limit. Minimum passing margin is -3.1dB at 174.00MHz

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	FREQUENCY	UNCERTAINTY
Conducted emissions	150kHz ~ 30MHz	2.98 dB
Radiated emissions	30MHz ~1000MHz	5.59 dB
	1GHz -6GHz	3.56 dB
	6GHz -18GHz	4.10 dB
	18GHz ~ 40GHz	4.24 dB



3. GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

PRODUCT	802.11b/g/n RTL8723AE Combo NGFF Card
MODEL NO.	RTL8723AEN0
POWER SUPPLY	DC 7.4V from battery DC 12V to direct charging adapter
MODULATION TYPE	For WLAN CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
	For BT GFSK, $\pi/4$ -DQPSK, 8DPSK BT-LE (GFSK) for DTS
MODULATION TECHNOLOGY	For WLAN : DSSS, OFDM
	For BT : FHSS, DTS
TRANSFER RATE	For WLAN 802.11b: Up to 11Mbps 802.11g: Up to 54Mbps 802.11n (HT20, 800ns GI): Up to 65Mbps 802.11n (HT20, 400ns GI): Up to 72.2Mbps 802.11n (HT40, 800ns GI): Up to 135Mbps 802.11n (HT40, 400ns GI): Up to 150Mbps
	For BT Up to 3Mbps BT-LE (GFSK): 1Mbps
OPERATING FREQUENCY	For WLAN 802.11b/g/n (HT20): 2.412 ~ 2.462GHz
	For BT 2402MHz ~ 2480MHz BT-LE (GFSK): 2.402 ~ 2.480GHz
NUMBER OF CHANNEL	For WLAN 11 for 802.11b, 802.11g, 802.11n (HT20) 7 for 802.11n (HT40)
	For BT: 79 for GFSK, $\pi/4$ -DQPSK, 8DPSK 40 (37 hopping + 3 advertising channel) for BT-LE (GFSK)



MAXIMUM OUTPUT POWER	For WLAN 802.11b: 87.096mW 802.11g: 204.174mW 802.11n (HT20): 204.174mW 802.11n (HT40): 177.828mW
	For BT GFSK : 12.794 mW 8DPSK: 13.152 mW BT-LE (GFSK): 3.020 mW
ANTENNA TYPE	Please see NOTE
DATA CABLE	NA
I/O PORTS	Refer to user's manual
ASSOCIATED DEVICES	NA

NOTE:

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

Transmitter Circuit	Brand	Model	Antenna Type	Gain (dBi) (Include cable loss)	Connector type	Diversity	Frequency range (MHz to MHz)
Chain (0)	LYNwave	ALA110-22205 0-300011	PIFA	3.5	IPEXMHF4	Yes	2400-2500
Chain (1)	LYNwave	ALA110-22205 0-300011	PIFA	3.5	IPEXMHF4	Yes	2400-2500

2. The EUT incorporates a SISO function without beam forming.

MODULATION MODE	Tx/Rx FUNCTION
802.11b	1Tx/1Rx
802.11g	1Tx/1Rx
802.11n (HT20)	1Tx/1Rx
802.11n (HT40)	1Tx/1Rx

3. When the EUT operating in 802.11n, the software operation, which is defined by manufacturer, MCS (Modulation and Coding Schemes) from 0 to 7.

4. 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 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL:

Simultaneously Transmission Mode (WLAN + BT)

EUT configure mode	Applicable to			Description
	PLC	RE<1G	RE≥1G	
-	√	√	√	-

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

POWER LINE CONDUCTED EMISSION TEST:

- 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.

Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type
(802.11g) + Bluetooth	1 to 11	6	OFDM	BPSK
	0 to 78	0	FHSS	8DPSK

Radiated Emission Test:

- 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.

Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type
(802.11g) + Bluetooth	1 to 11	6	OFDM	BPSK
	0 to 78	0	FHSS	8DPSK

TEST CONDITION:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER (SYSTEM)	TESTED BY
PLC	26deg. C, 61%RH	120Vac, 60Hz	Jyunchun Lin
RE<1G	25deg. C, 65%RH	120Vac, 60Hz	Nelson Teng
RE≥1G	21deg. C, 70%RH	120Vac, 60Hz	Amos Chuang



3.3 DESCRIPTION OF SUPPORT UNITS

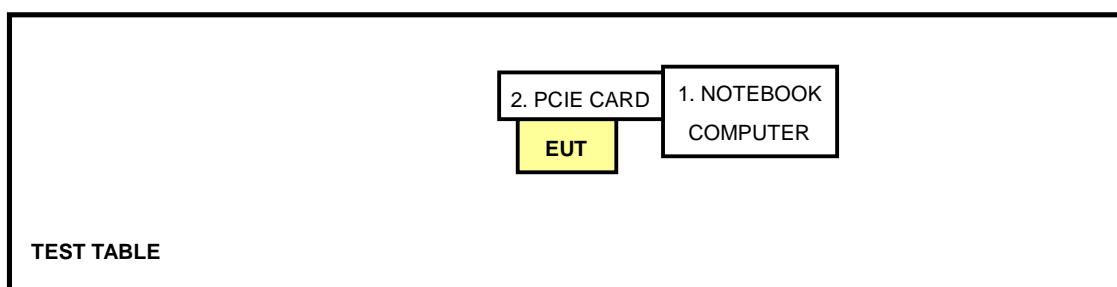
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	NOTEBOOK COMPUTER (For conducted emission test)	DELL	E6420	B92T3R1	FCC DoC
	NOTEBOOK COMPUTER (For other test items)	DELL	PP19L	CN-OHC416-7016 6-5CA-0448	PIW63250051661 0
2	PCIE CARD	Realtek	NA	NA	NA

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	NA
2	NA

NOTE: The power cords of the above support units were unshielded (1.8m).

3.4 CONFIGURATION OF SYSTEM UNDER TEST





4. TEST TYPES AND RESULTS

4.1 CONDUCTED EMISSION MEASUREMENT

4.1.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dB μ 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 0.50 MHz.

4.1.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver ROHDE & SCHWARZ	ESCS 30	100287	Feb. 29, 2012	Feb. 28, 2013
Line-Impedance Stabilization Network (for EUT) SCHWARZBECK	NSLK 8127	8127-523	Sep. 19, 2012	Sep. 20, 2013
Line-Impedance Stabilization Network (for Peripheral) ROHDE & SCHWARZ	ESH3-Z5	848773/004	Oct. 29, 2012	Oct. 28, 2013
RF Cable (JYEBAO)	5DFB	COACAB-002	Aug. 05, 2012	Aug. 04, 2013
50 ohms Terminator	50	3	Oct. 23, 2012	Oct. 22, 2013
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. A.
3. The VCCI Con A Registration No. is C-817.
4. Tested Date: Nov. 26, 2012

4.1.3 TEST PROCEDURES

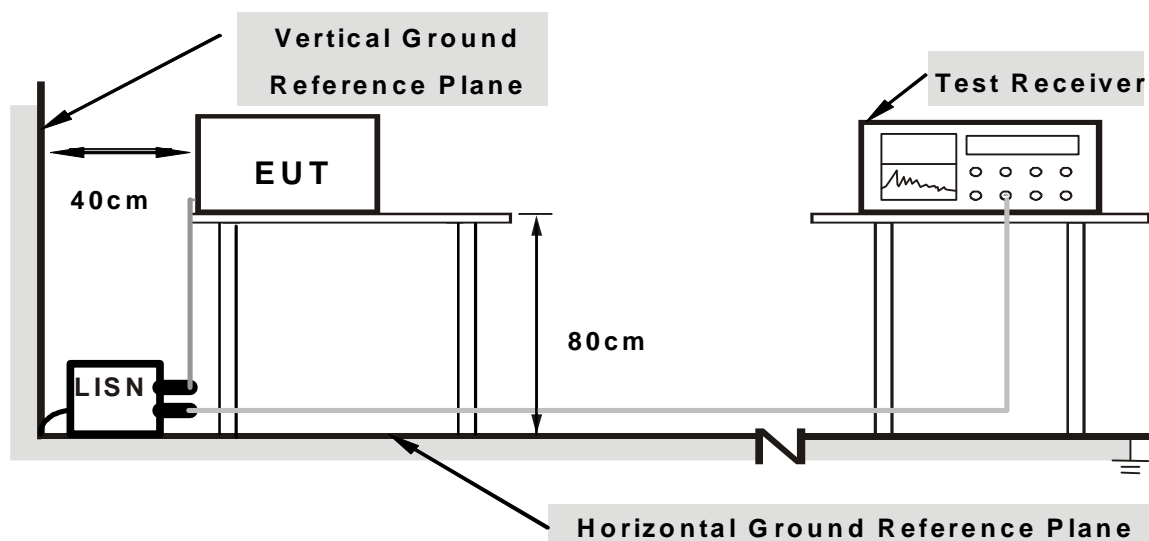
- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling 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) were not recorded.

Note: 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. Turned on the power of all equipment.
2. Support unit 1 (Notebook computer) ran test program "MP819xVC.exe" to enable EUT under transmission/receiving condition continuously.



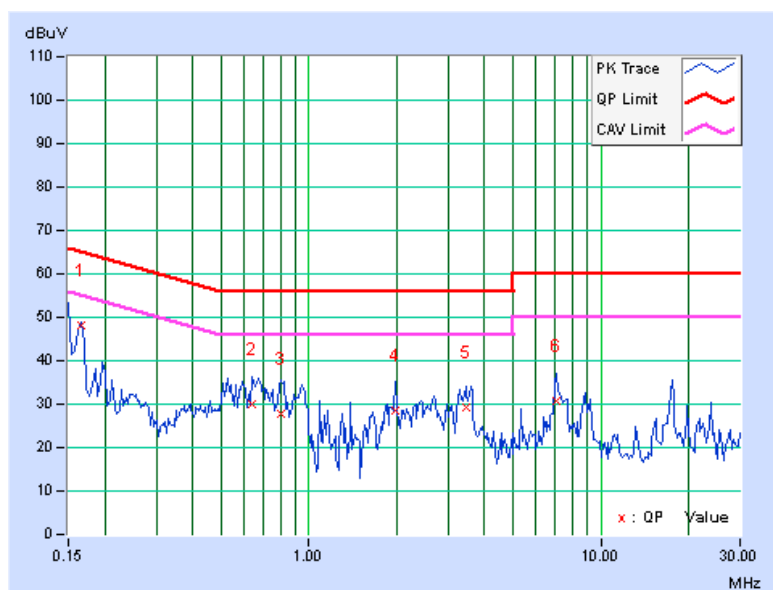
4.1.7 TEST RESULTS

PHASE	Line (L)	DETECTOR FUNCTION	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	0.16562	0.09	48.16	41.25	48.25	41.34	65.18	55.18	-16.93	-13.84
2	0.63828	0.16	29.66	14.54	29.82	14.70	56.00	46.00	-26.18	-31.30
3	0.80625	0.17	27.77	14.28	27.94	14.45	56.00	46.00	-28.06	-31.55
4	1.96875	0.25	28.39	18.98	28.64	19.23	56.00	46.00	-27.36	-26.77
5	3.44141	0.31	29.06	19.12	29.37	19.43	56.00	46.00	-26.63	-26.57
6	7.02734	0.43	30.14	20.28	30.57	20.71	60.00	50.00	-29.43	-29.29

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.



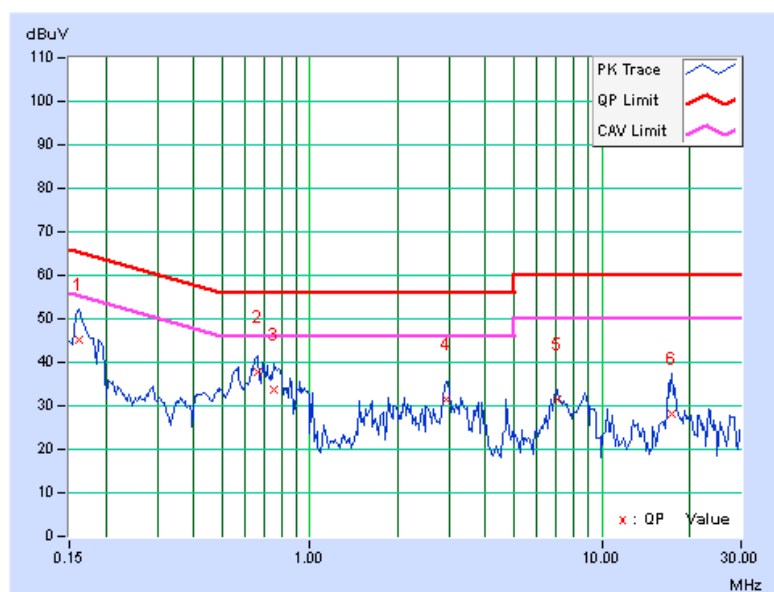


PHASE	Neutral (N)	DETECTOR FUNCTION	Quasi-Peak (QP) / Average (AV)
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No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16172	0.10	45.15	40.16	45.25	40.26	65.38	55.38	-20.13	-15.12
2	0.66563	0.17	37.58	22.34	37.75	22.51	56.00	46.00	-18.25	-23.49
3	0.75547	0.17	33.67	20.64	33.84	20.81	56.00	46.00	-22.16	-25.19
4	2.94531	0.27	31.25	21.08	31.52	21.35	56.00	46.00	-24.48	-24.65
5	7.01953	0.41	31.00	20.42	31.41	20.83	60.00	50.00	-28.59	-29.17
6	17.32031	0.65	27.62	20.00	28.27	20.65	60.00	50.00	-31.73	-29.35

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 MEASUREMENT

4.2.1 LIMITS OF RADIATED EMISSION 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.



4.2.2 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. 14, 2012	Nov. 13, 2013
Pre-Amplifier Agilent	8449B	3008A02465	Feb. 27, 2012	Feb. 26, 2013
SPACEK LABS	SLKKa-48-6	9K16	Nov. 14, 2012	Nov. 13, 2013
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: Nov. 20 to 22, 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 meter 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 and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

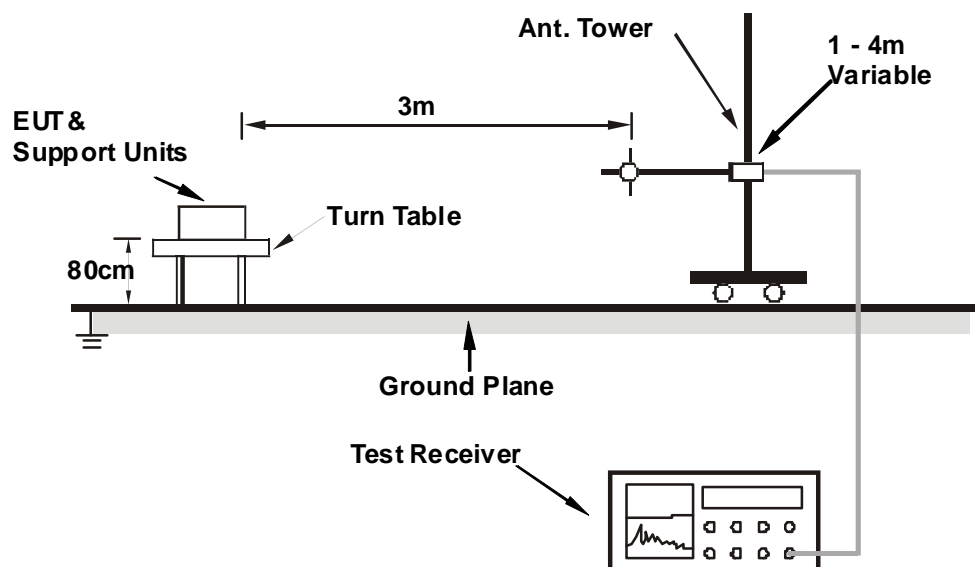
NOTE:

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



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4.2.7 TEST RESULTS

WORST-CASE DATA

FREQUENCY RANGE	Below 1GHz	DETECTOR FUNCTION	Quasi-Peak (QP)
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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	100.00	31.8 QP	43.5	-11.7	1.37 H	18	22.12	9.71
2	174.00	40.4 QP	43.5	-3.1	1.38 H	16	26.93	13.44
3	235.00	37.4 QP	46.0	-8.6	1.19 H	230	24.82	12.62
4	435.00	36.2 QP	46.0	-9.8	1.00 H	297	17.69	18.55
5	600.00	41.3 QP	46.0	-4.7	1.18 H	357	19.07	22.26
6	795.00	38.1 QP	46.0	-7.9	1.35 H	178	12.49	25.58

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	168.70	34.2 QP	43.5	-9.3	1.78 V	311	20.42	13.76
2	299.89	39.1 QP	46.0	-7.0	1.20 V	270	23.74	15.31
3	432.04	35.9 QP	46.0	-10.1	1.18 V	246	17.38	18.48
4	597.72	37.4 QP	46.0	-8.6	1.17 V	142	15.19	22.21
5	750.48	33.3 QP	46.0	-12.7	1.23 V	21	8.63	24.65
6	796.08	37.9 QP	46.0	-8.2	1.20 V	205	12.25	25.60

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

FREQUENCY RANGE	1GHz ~ 25GHz	DETECTOR FUNCTION	Peak (PK) Average (AV)
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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	4804.00	52.1 PK	74.0	-21.9	1.00 H	7	17.70	34.40
2	4804.00	22.0 AV	54.0	-32.0	1.00 H	7	-12.40	34.40
3	4874.00	44.6 PK	74.0	-29.4	1.33 H	303	10.22	34.40
4	4874.00	32.1 AV	54.0	-21.9	1.33 H	303	-2.27	34.40
5	7311.00	49.1 PK	74.0	-24.9	1.00 H	155	11.88	37.26
6	7311.00	37.1 AV	54.0	-16.9	1.00 H	155	-0.20	37.26

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	4804.00	53.9 PK	74.0	-20.1	1.00 V	101	19.50	34.40
2	4804.00	23.8 AV	54.0	-30.2	1.00 V	101	-10.60	34.40
3	4874.00	42.6 PK	74.0	-31.4	1.00 V	204	8.20	34.40
4	4874.00	31.5 AV	54.0	-22.5	1.00 V	204	-2.90	34.40
5	7311.00	49.1 PK	74.0	-24.9	1.00 V	125	11.84	37.26
6	7311.00	35.7 AV	54.0	-18.3	1.00 V	125	-1.56	37.26

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



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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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