Supplemental “Transmit Simultaneously” Test Report

REPORT NO.:	RF130930E04-2
MODEL NO.:	WRT1900AC
FCC ID:	Q87-WRT1900AC
RECEIVED:	Sep. 30, 2013
TESTED:	Oct. 03, 2013 to Jan. 17, 2014
ISSUED:	Feb. 27, 2014
APPLICANT:	Linksys LLC
ADDRESS:	131 Theory Drive Irvine California 92617 United States
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.

This report should not be used by the client to claim product certification, approval, or endorsement by TAF or any government agencies.

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RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RF130930E04-2	Original release	Feb. 27, 2014

1. CERTIFICATION

PRODUCT :	Linksys Smart Wi-Fi Router
BRAND NAME :	Linksys
MODEL NO. :	WRT1900AC
TEST ITEM:	ENGINEERING SAMPLE
APPLICANT :	Linksys LLC
TESTED:	Oct. 03, 2013 to Jan. 17, 2014
STANDARDS :	FCC Part 15, Subpart C (Section 15.247) ANSI C63.10-2009

The above equipment (Model: WRT1900AC) 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:** *Feb. 27, 2014*
(Lori Chung, Specialist)

APPROVED BY : _____ , **DATE:** *Feb. 27, 2014*
(May Chen, Manager)

2. SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC PART 15, SUBPART C (SECTION 15.247)			
STANDARD SECTION	**TEST TYPE**	**RESULT**	**REMARK**
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -13.27dB at 0.15391MHz
15.247(d) 15.209	Radiated Emissions	PASS	Meet the requirement of limit. Minimum passing margin is -3.9dB at 228.461MHz

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	2.98 dB
Radiated emissions (30MHz-1GHz)	5.43 dB
Radiated emissions (1GHz -6GHz)	3.72 dB
Radiated emissions (6GHz -18GHz)	4.00 dB
Radiated emissions (18GHz -40GHz)	4.11 dB

3. GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

PRODUCT	Linksys Smart Wi-Fi Router
MODEL NO.	WRT1900AC
POWER SUPPLY	DC 12V from power adapter
MODULATION TYPE	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM 256QAM for OFDM in 11ac mode and VHT20 and VHT40 mode of 2.4GHz Band.
MODULATION TECHNOLOGY	DSSS,OFDM
TRANSFER RATE	**2.4GHz:** 802.11b: up to 11Mbps 802.11g: up to 54Mbps 802.11n: up to 600Mbps 802.11ac: up to 800Mbps **5GHz:** 802.11a: up to 54Mbps 802.11n: up to 600Mbps 802.11ac: up to 3466.7Mbps
OPERATING FREQUENCY	**For 15.407** **5GHz:**5.18 ~ 5.24GHz
	For 15.247 **2.4GHz:** 2.412 ~ 2.462GHz **5GHz:** 5.745 ~ 5.825GHz
NUMBER OF CHANNEL	**For 15.407** 4 for 802.11a, 802.11n (HT20), 802.11ac (VHT20) 2 for 802.11n (HT40), 802.11ac (VHT40) 1 for 802.11ac (VHT80)
	For 15.247 (2.4GHz) 11 for 802.11b, 802.11g, 802.11n (HT20), 802.11ac (VHT20) 7 for 802.11n (HT40), 802.11ac (VHT40) **For 15.247 (5GHz)** 5 for 802.11a, 802.11n (HT20), 802.11ac (VHT20) 2 for 802.11n (HT40), 802.11ac (VHT40) 1 for 802.11ac (VHT80)

MAXIMUM OUTPUT POWER	**For 15.407** 802.11a: 38.122mW 802.11ac (VHT20): 39.293mW 802.11ac (VHT40): 46.905mW 802.11ac (VHT80): 45.611mW **For 15.247(2.4GHz)** 802.11b: 838.786mW 802.11g: 664.545mW 802.11n (HT20): 622.703mW 802.11n (HT40): 162.982mW **For 15.247(5GHz)** 802.11a: 487.878mW 802.11ac (VHT20): 608.021mW 802.11ac (VHT40): 416.829mW 802.11ac (VHT80): 460.019mW
ANTENNA TYPE	Please see NOTE
DATA CABLE	NA
I/O PORTS	Refer to user's manual
ASSOCIATED DEVICES	Adapter x1

NOTE:

1. 2.4GHz and 5GHz technology can transmit at same time.
2. The EUT must be supplied with a power adapter and following two different models could be chosen as following table:

No	Brand	Model No.	Spec.
1	Linksys	KSAH1200400T1M2	Input: 100-240V, 1.2A, 50-60Hz AC input cable: 0.5m, unshielded Output: 12V, 4A DC output cable: 1.5m, unshielded with 1 core
2	CWT	KPL-050F	Input: 100-240V, 1.7A, 50-60Hz AC input cable: 0.5m, unshielded Output: 12V, 4.17A DC output cable: 1.5m, unshielded with 1 core
Note: For radiated emissions test, the EUT was pre-tested with above adapters 1 & 2, the worst case was found in adapter 1. Therefore only the test data of the adapter was recorded in this report.			

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

Transmitter Circuit	Brand	Gain (dBi)	Cable Loss (dB)	Net Gain (dBi)	Frequency Range (GHz to GHz)	Antenna Type	Connecter Type
Chain (0)	LINKSYS	2.5	1	1.5	2.4 ~ 2.4835	DIPOLE	R-SMA
		2.6	1.6	1	5.15 ~ 5.25		
		3.8	1.9	1.9	5.725 ~ 5.85		
Chain (1)	LINKSYS	2.5	1	1.5	2.4 ~ 2.4835	DIPOLE	R-SMA
		2.6	1.5	1.1	5.15 ~ 5.25		
		3.8	2.1	1.7	5.725 ~ 5.85		
Chain (2)	LINKSYS	2.5	1	1.5	2.4 ~ 2.4835	DIPOLE	R-SMA
		2.6	1.5	1.1	5.15 ~ 5.25		
		3.8	2.1	1.7	5.725 ~ 5.85		
Chain (3)	LINKSYS	2.5	0.5	2	2.4 ~ 2.4835	DIPOLE	R-SMA
		2.6	0.9	1.7	5.15 ~ 5.25		
		3.8	1.6	2.2	5.725 ~ 5.85		

4. The EUT has two different Transformer types could be chosen and please refer the below table:

Type 1 (Vendor: MINGTEK)		
Vendor P/N	**Vendor**	**Location**
HN1878CG	MINGTEK	T1
HN3678CG	MINGTEK	T2, T3
Type 2 (Vendor: MYJWD)		
Vendor P/N	**Vendor**	**Location**
DG18107-1G	MYJWD	T1
DG36005-1G	MYJWD	T2, T3

From the above types, the worst case was found in **Type 2 (Vendor: MYJWD)**. Therefore only the test data of the type were recorded in this report.

5. The EUT incorporates a MIMO function with beam forming except 802.11b.

MODULATION MODE	Tx/Rx FUNCTION
802.11a	3TX / 4TX / 4RX
802.11b	4TX / 4RX
802.11g	4TX / 4RX
802.11n (HT20) <2.4GHz>	4TX / 4RX
802.11n (HT40) <2.4GHz>	4TX / 4RX
802.11n (HT20) <5GHz>	3TX / 4TX / 4RX
802.11n (HT40) <5GHz>	3TX / 4TX / 4RX
802.11ac (VHT20)	3TX / 4TX / 4RX
802.11ac (VHT40)	3TX / 4TX / 4RX
802.11ac (VHT80)	3TX / 4TX / 4RX

Note: 1. The modulation and bandwidth are similar for 802.11n mode for 20MHz (40MHz) and 802.11ac mode for 20MHz (40MHz), therefore investigated worst case to representative mode in test report.

6. When the EUT operating in 802.11n, the software operation, which is defined by manufacturer, MCS (Modulation and Coding Schemes) from 0 to 31.

7. When the EUT operating in 802.11ac and support 256QAM of VHT20 and VHT40 for 2.4GHz band, the software operation, which is defined by manufacturer, MCS (Modulation and Coding Schemes) from 0 to 9.

8. 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 APPLICABLITY AND TESTED CHANNEL DETAIL:

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	PLC	RE < 1G	RE ³ 1G	OB	
1	√	√	√	√	Adapter 1
2	√	-	-	-	Adapter 2

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

RE ³ 1G: Radiated Emission above 1GHz **OB:** Conducted Out-Band Emission Measurement

NOTE: 1. "-"means no effect.
2. The EUT had been pre-tested on the positioned of each 2 axis. The worst case was found when positioned on **Y-plane** (for below 1GHz) and **X-plane** (for above 1GHz)**.**

POWER LINE CONDUCTED EMISSION TEST:

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

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
For 2.4 GHz 802.11b + For 5 GHz 802.11a	1 to 11	1	DSSS	DBPSK	1
	149 to 165	149	OFDM	BPSK	6

RADIATED EMISSION TEST:

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

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
For 2.4 GHz 802.11b + For 5 GHz 802.11a	1 to 11	1	DSSS	DBPSK	1
	149 to 165	149	OFDM	BPSK	6

CONDUCTED OUT-BAND EMISSION MEASUREMENT:

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

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
For 2.4 GHz 802.11b + For 5 GHz 802.11a	1 to 11	1	DSSS	DBPSK	1
	149 to 165	149	OFDM	BPSK	6

TEST CONDITION:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
PLC	26deg. C, 67%RH	120Vac, 60Hz	Sean Huang
RE<1G	21deg. C, 63%RH	120Vac, 60Hz	Andy Ho
RE≥1G	25deg. C, 65%RH	120Vac, 60Hz	Nelson Teng
OB	25deg. C, 60%RH	120Vac, 60Hz	Chilin Lee

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.

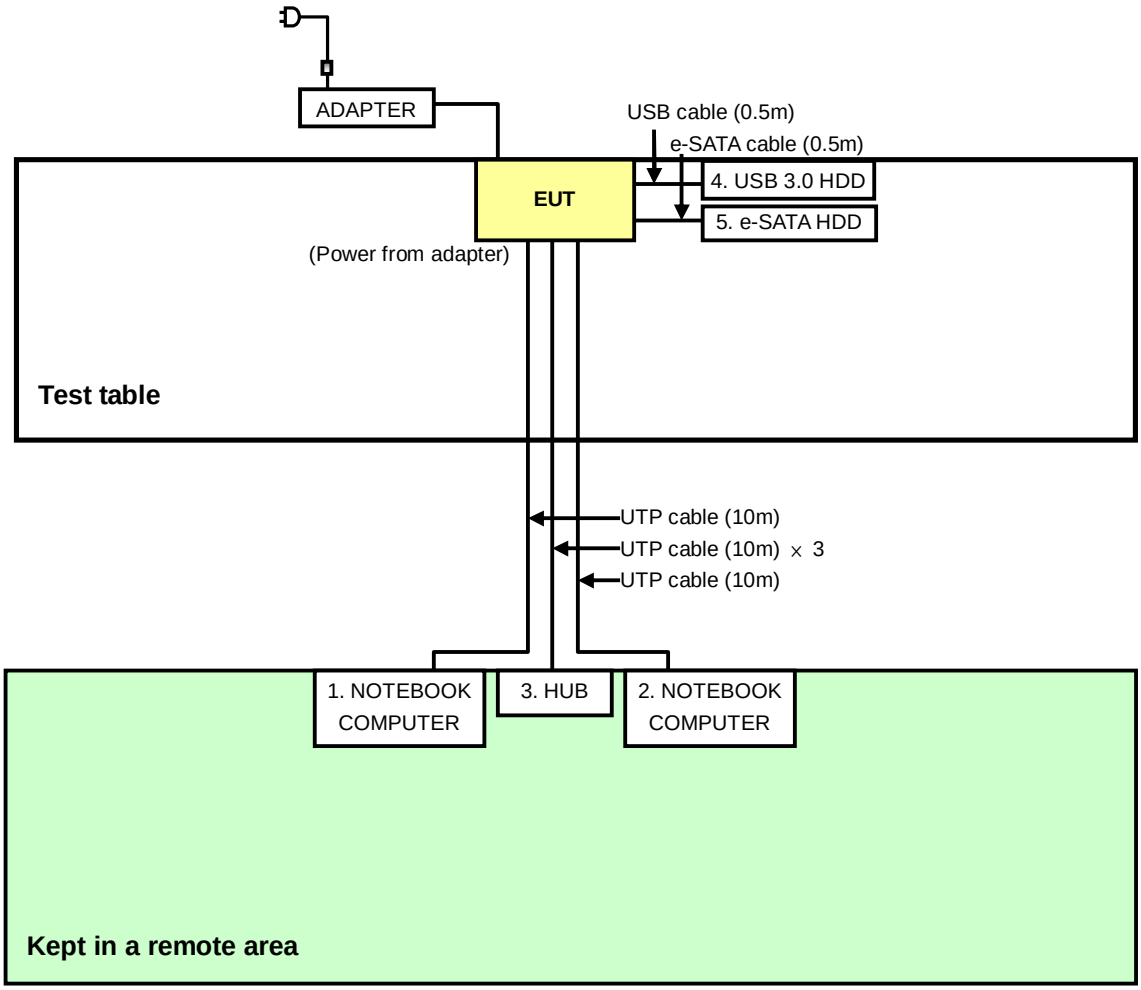
NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	NOTEBOOK COMPUTER	DELL	PP32LA	FSLB32S	FCC DoC
2	NOTEBOOK COMPUTER	DELL	PP32LA	GSLB32S	FCC DoC
3	HUB	ZyXEL	ES-116P	S060H02000215	FCC DoC
4	USB 3.0 HDD	WD	WDBACW0010HBK-SESN	WCAZAL625787	NA
5	e-SATA HDD	HITACHI	HTS541680J9SA00	SGCZ35SE	NA

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	UTP cable (10m)
2	UTP cable (10m)
3	UTP cable (10m)
4	USB cable (0.5m)
5	e-SATA cable (0.5m)

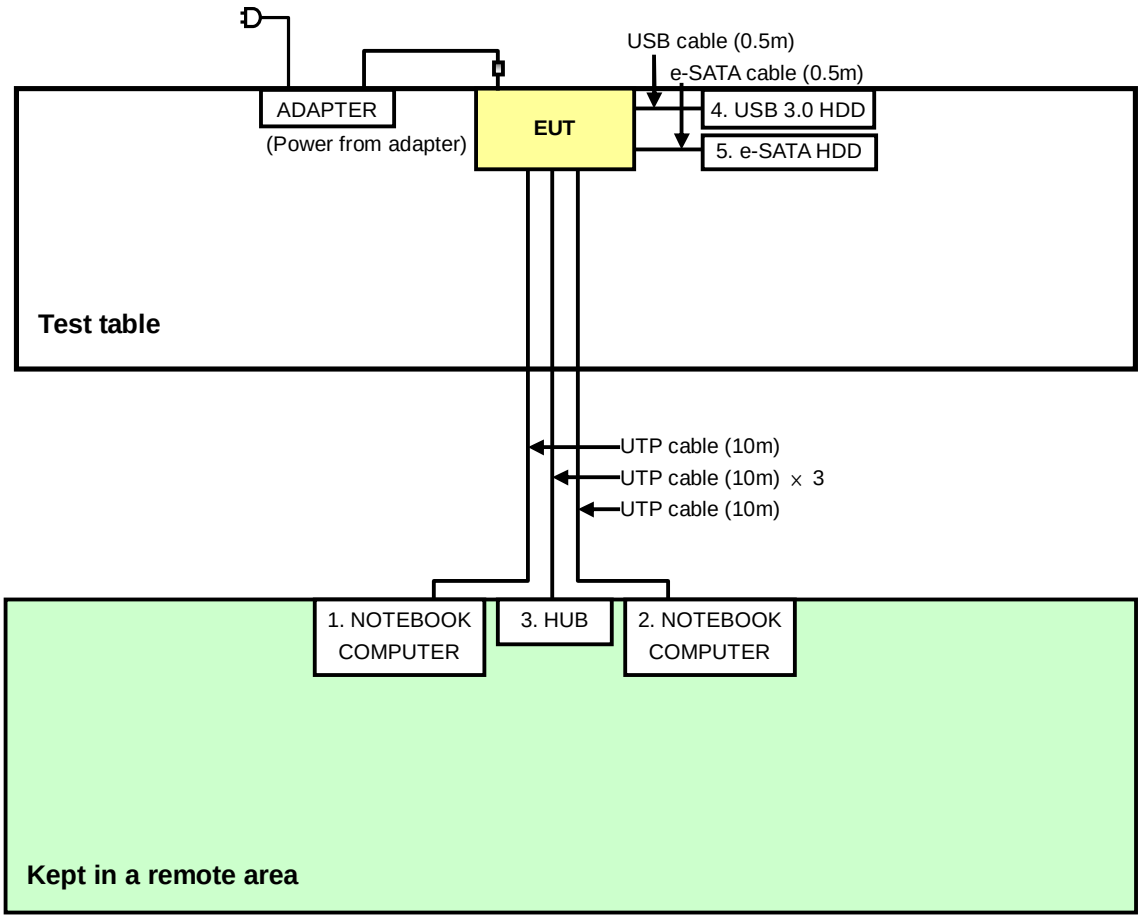
NOTE: All power cords of the above support units are non shielded (1.8m).

3.4 CONFIGURATION OF SYSTEM UNDER TEST

For conducted emission MODE 1 test:



For other test items:



4. TEST TYPES 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	Mar. 08, 2013	Mar. 07, 2014
Line-Impedance Stabilization Network (for EUT) SCHWARZBECK	NSLK8127	8127-522	Sep. 05, 2013	Sep. 04, 2014
Line-Impedance Stabilization Network (for Peripheral)	ENV216	100072	June 06, 2013	June 05, 2014
RF Cable (JYEBAO)	5DFB	COCCAB-001	Mar. 11, 2013	Mar. 10, 2014
50 ohms Terminator	50	EMC-03	Sep. 24, 2013	Sep. 23, 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: Oct. 08, 2013

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.
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.

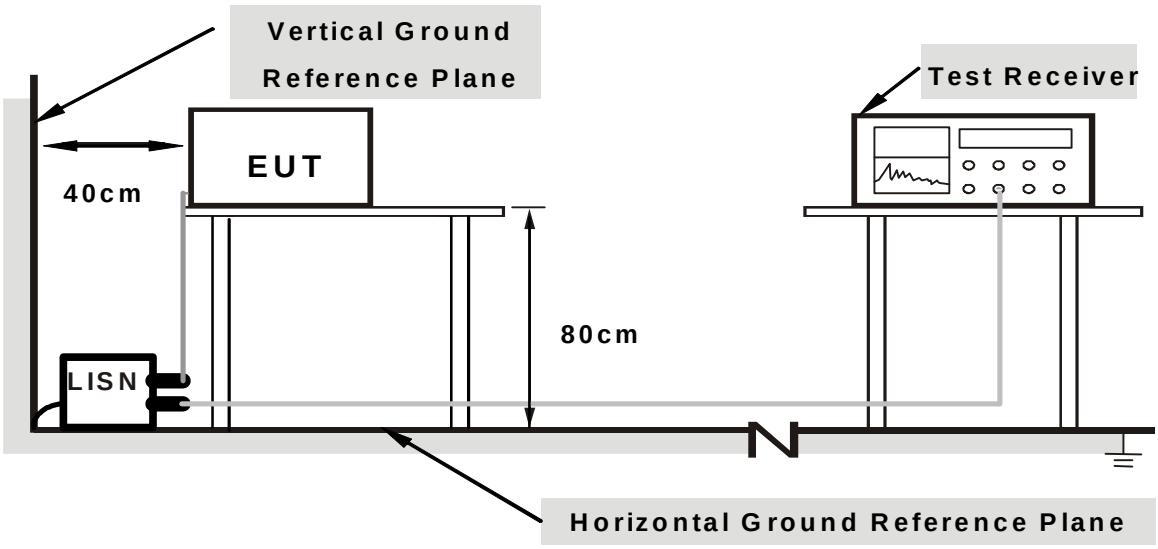
NOTE:

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. Place the EUT on testing table.
2. Prepare computer system (support unit 1) to act as communication partner.
3. The communication partner runs test program “DupApiMimoApApp.exex [ver.2.0.0.22]” to enable EUT under transmission/receiving condition continuously at specific channel frequency.

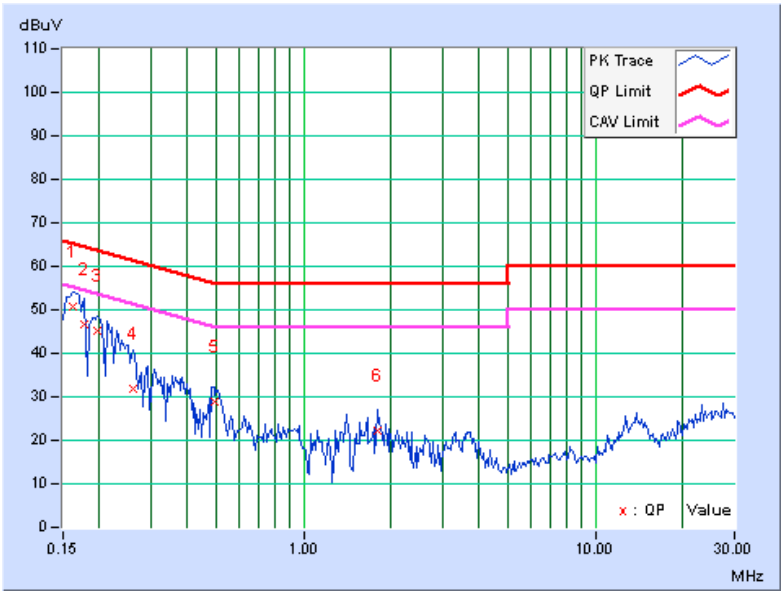
4.1.7 TEST RESULTS (MODE 1)

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

	Freq.	Corr.	Reading Value		Emission Level		Limit		Margin	
No		Factor	[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16172	0.08	50.84	33.53	50.92	33.61	65.38	55.38	-14.45	-21.76
2	0.17734	0.09	46.40	21.28	46.49	21.37	64.61	54.61	-18.12	-33.24
3	0.19687	0.10	45.07	28.49	45.17	28.59	63.74	53.74	-18.57	-25.15
4	0.25938	0.11	31.76	15.41	31.87	15.52	61.45	51.45	-29.58	-35.93
5	0.49375	0.14	28.65	17.26	28.79	17.40	56.10	46.10	-27.31	-28.70
6	1.79688	0.20	22.02	14.86	22.22	15.06	56.00	46.00	-33.78	-30.94

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

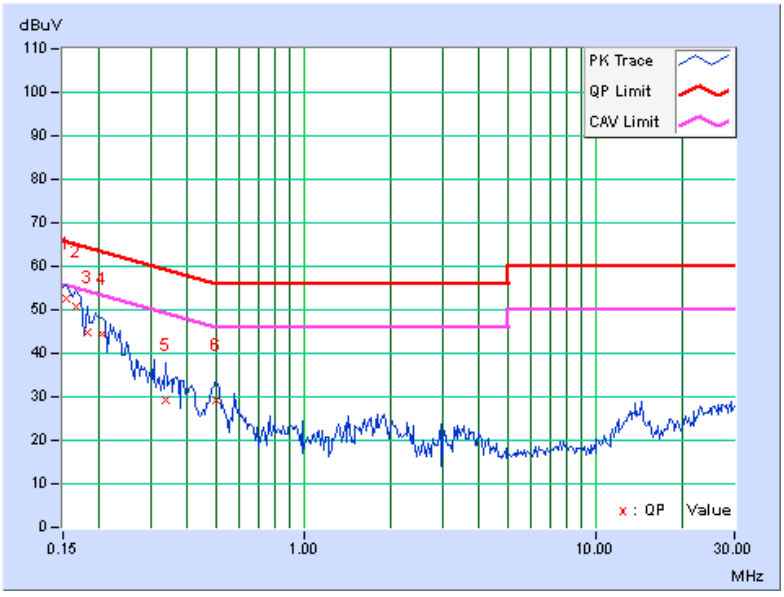


PHASE	Neutral (N)	DETECTOR FUNCTION	Quasi-Peak (QP) / Average (AV)

	Freq.	Corr.	Reading Value		Emission Level		Limit		Margin	
No		Factor	[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	**0.15391**	**0.09**	**52.43**	**35.65**	**52.52**	**35.74**	**65.79**	**55.79**	**-13.27**	**-20.05**
2	0.16562	0.09	50.74	33.02	50.83	33.11	65.18	55.18	-14.34	-22.06
3	0.18125	0.10	44.80	29.21	44.90	29.31	64.43	54.43	-19.53	-25.12
4	0.20469	0.10	44.44	26.80	44.54	26.90	63.42	53.42	-18.88	-26.52
5	0.33750	0.13	29.15	10.32	29.28	10.45	59.26	49.26	-29.99	-38.82
6	0.50547	0.15	28.97	19.43	29.12	19.58	56.00	46.00	-26.88	-26.42

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



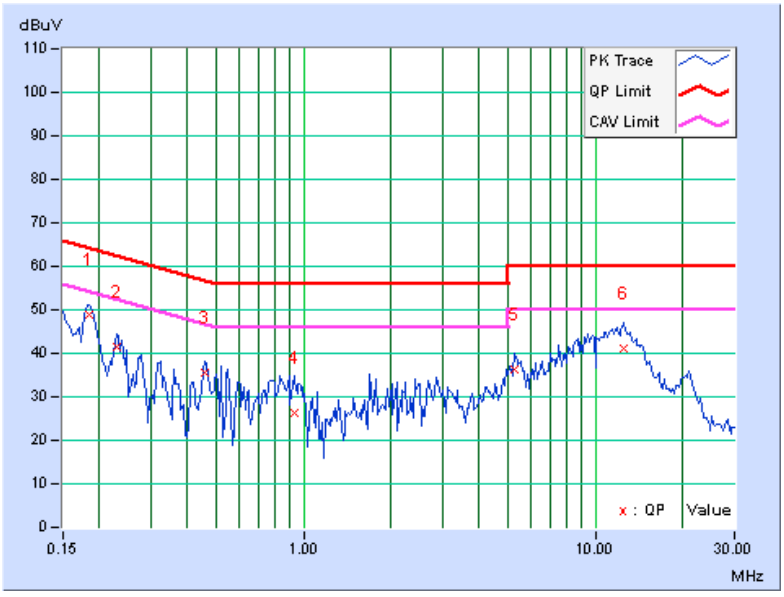
4.1.8 TEST RESULTS (MODE 2)

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

	Freq.	Corr.	Reading Value		Emission Level		Limit		Margin	
No		Factor	[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.18516	0.09	48.96	36.65	49.05	36.74	64.25	54.25	-15.20	-17.51
2	0.22812	0.11	41.50	29.43	41.61	29.54	62.52	52.52	-20.91	-22.98
3	0.45859	0.14	35.28	31.19	35.42	31.33	56.72	46.72	-21.30	-15.39
4	0.92734	0.17	26.15	15.17	26.32	15.34	56.00	46.00	-29.68	-30.66
5	5.31641	0.32	35.96	31.86	36.28	32.18	60.00	50.00	-23.72	-17.82
6	12.51172	0.55	40.72	34.07	41.27	34.62	60.00	50.00	-18.73	-15.38

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

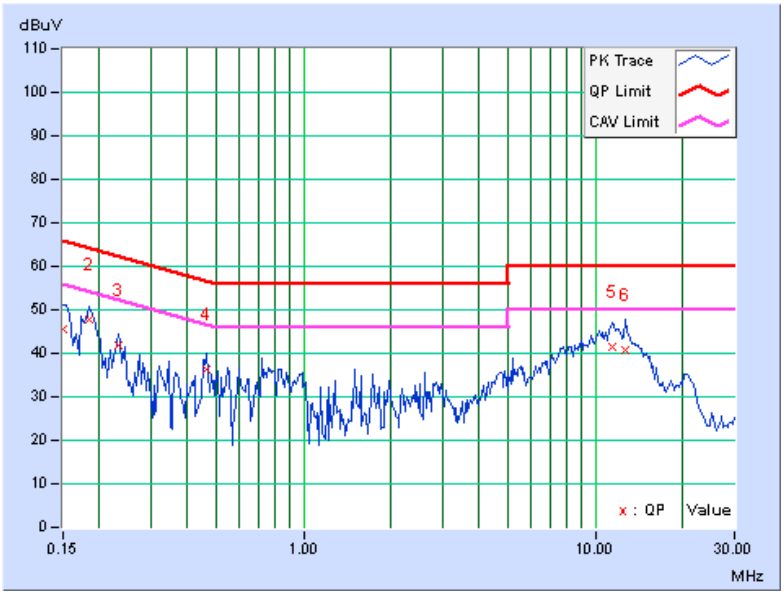


PHASE	Neutral (N)	DETECTOR FUNCTION	Quasi-Peak (QP) / Average (AV)

	Freq.	Corr.	Reading Value		Emission Level		Limit		Margin	
No		Factor	[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	0.09	45.58	25.33	45.67	25.42	66.00	56.00	-20.33	-30.58
2	0.18516	0.10	47.80	35.82	47.90	35.92	64.25	54.25	-16.35	-18.33
3	0.23203	0.11	41.60	30.22	41.71	30.33	62.38	52.38	-20.67	-22.05
4	0.46641	0.14	36.26	30.79	36.40	30.93	56.58	46.58	-20.17	-15.64
5	11.41797	0.51	40.86	33.65	41.37	34.16	60.00	50.00	-18.63	-15.84
6	12.75000	0.55	40.20	33.71	40.75	34.26	60.00	50.00	-19.25	-15.74

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 30dB 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

For below 1GHz test

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
MXE EMI Receiver Agilent	N9038A	MY50010156	Jan. 16, 2013	Jan. 15, 2014
Pre-Amplifier Mini-Circuits	ZFL-1000VH2 B	AMP-ZFL-04	Nov. 13, 2013	Nov. 12, 2014
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-361	Mar. 25, 2013	Mar. 24, 2014
RF Cable	NA	CHHCAB_001	Oct. 06, 2013	Oct. 05, 2014
Spectrum Analyzer R&S	FSV40	100964	July 15, 2013	July 14, 2014
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
Spectrum Analyzer Agilent	E4446A	MY48250253	Aug. 28, 2013	Aug. 27, 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: Jan. 10, 2014

For above 1GHz test

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	Mar. 25, 2013	Mar. 24, 2014
RF Cable	NA	CHHCAB_001	Oct. 06, 2013	Oct. 05, 2014
Spectrum Analyzer R&S	FSV40	100964	July 15, 2013	July 14, 2014
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
Spectrum Analyzer Agilent	E4446A	MY48250253	Aug. 28, 2013	Aug. 27, 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: Jan. 17, 2014

4.2.3 TEST PROCEDURES

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at 3 meter chamber room for test. 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:

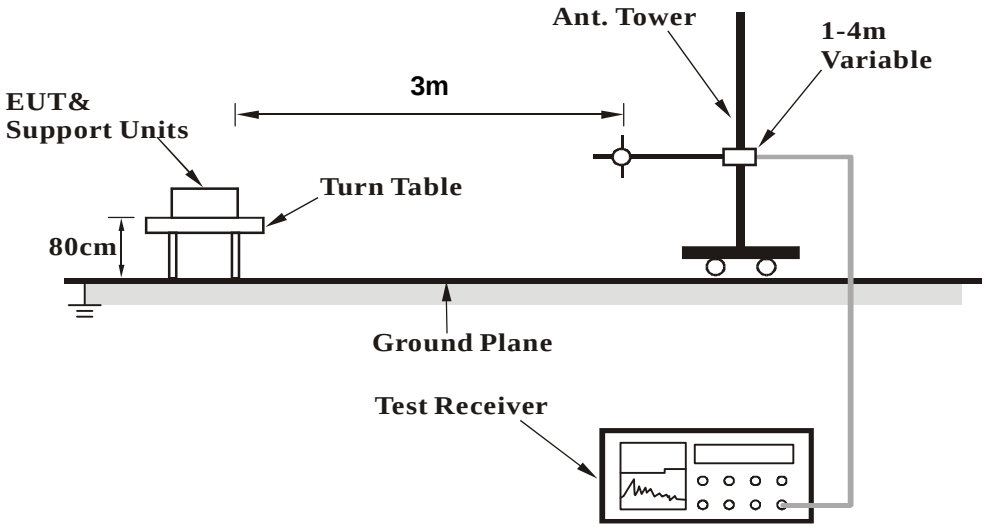
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for RMS Average (Duty cycle < 98%) for Average detection (AV) at frequency above 1GHz, then the measurement results was added to a correction factor (10 log(1/duty cycle)).
4. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz (Duty cycle ≥ 98%) for Average detection (AV) at frequency above 1GHz.
5. All modes of operation were investigated and the worst-case emissions are reported.

4.2.4 DEVIATION FROM TEST STANDARD

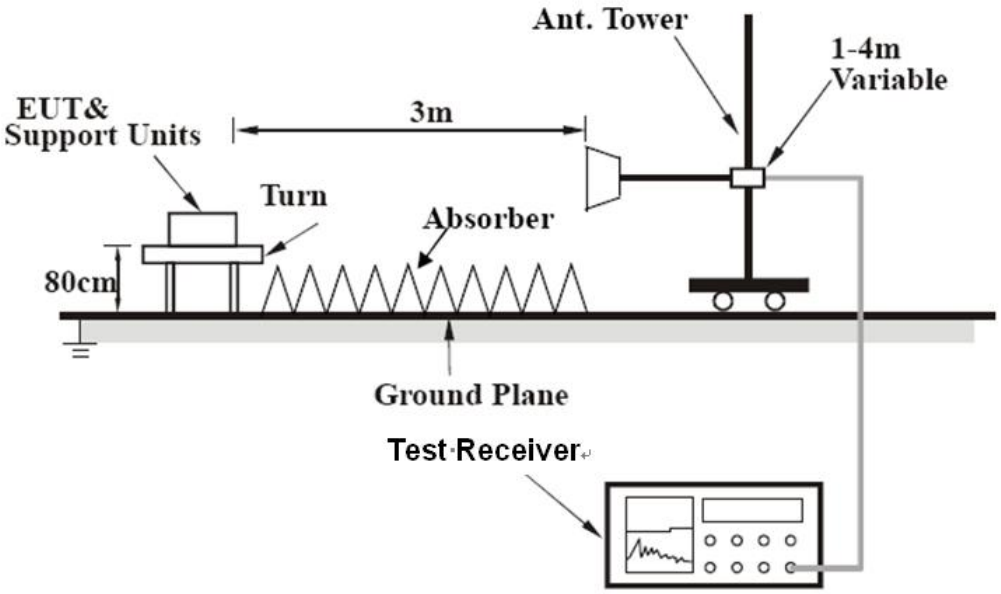
No deviation

4.2.5 TEST SETUP

<Frequency Range below 1GHz>



<Frequency Range above 1GHz>



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

4.2.6 EUT OPERATING CONDITIONS

Same as 4.1.6

4.2.7 TEST RESULTS

BELOW 1GHz WORST-CASE DATA

FREQUENCY RANGE	Below 1GHz	DETECTOR FUNCTION	Quasi-Peak (QP)

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	62.11	26.8 QP	40.0	-13.2	2.00 H	52	40.14	-13.31
2	194.76	35.0 QP	43.5	-8.5	1.50 H	225	50.70	-15.72
3	279.64	41.6 QP	46.0	-4.4	1.00 H	205	53.99	-12.35
4	555.69	36.6 QP	46.0	-9.5	1.50 H	292	42.50	-5.95
5	600.02	37.7 QP	46.0	-8.3	1.50 H	279	42.36	-4.63
6	625.00	38.3 QP	46.0	-7.8	1.50 H	268	42.31	-4.06
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	35.63	35.8 QP	40.0	-4.2	1.50 V	0	49.19	-13.43
2	60.02	34.4 QP	40.0	-5.6	1.00 V	115	47.87	-13.44
3	**228.46**	**42.2 QP**	**46.0**	**-3.9**	**1.50 V**	**126**	**57.38**	**-15.23**
4	281.52	36.2 QP	46.0	-9.8	1.00 V	225	48.44	-12.20
5	551.13	37.2 QP	46.0	-8.9	1.00 V	288	43.20	-6.05
6	599.97	34.2 QP	46.0	-11.8	1.00 V	228	38.82	-4.63

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

ABOVE 1GHz DATA

FREQUENCY RANGE	1GHz ~ 40GHz	DETECTOR FUNCTION	Peak (PK) 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	4874.00	48.3 PK	74.0	-25.7	1.00 H	223	5.06	43.24
2	4874.00	37.1 AV	54.0	-16.9	1.00 H	223	-6.14	43.24
3	7311.00	54.6 PK	74.0	-19.4	1.10 H	220	6.53	48.07
4	7311.00	40.8 AV	54.0	-13.2	1.10 H	220	-7.27	48.07
5	11650.00	58.3 PK	74.0	-15.7	1.01 H	246	6.89	51.41
6	11650.00	45.4 AV	54.0	-8.6	1.01 H	246	-6.01	51.41
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	4874.00	51.7 PK	74.0	-22.3	1.00 V	152	8.46	43.24
2	4874.00	39.0 AV	54.0	-15.0	1.00 V	152	-4.24	43.24
3	7311.00	55.9 PK	74.0	-18.1	1.00 V	152	7.83	48.07
4	7311.00	44.1 AV	54.0	-9.9	1.00 V	152	-3.97	48.07
5	11650.00	58.0 PK	74.0	-16.0	1.65 V	183	6.59	51.41
6	11650.00	45.0 AV	54.0	-9.0	1.65 V	183	-6.41	51.41

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

4.3 CONDUCTED OUT-BAND EMISSION MEASUREMENT

4.3.1 LIMITS OF CONDUCTED OUT-BAND EMISSION MEASUREMENT

Below 30dB of the highest emission level of operating band (in 100kHz Resolution Bandwidth).

4.3.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer R&S	FSP40	100036	Jan. 21, 2013	Jan. 20, 2014

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. 03, 2014

4.3.3 TEST PROCEDURE

Measurement Procedure - Reference Level

1. Set the RBW = 100 kHz.
2. Set the VBW ≥ 300 kHz.
3. Detector = peak.
4. Sweep time = auto couple.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

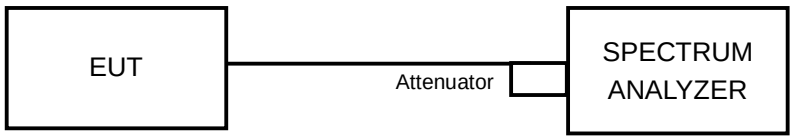
Measurement Procedure –Unwanted Emission Level

1. Set RBW = 100 kHz.
2. Set VBW ≥ 300 kHz.
3. Set span to encompass the spectrum to be examined.
4. Detector = peak.
5. Trace Mode = max hold.
6. Sweep = auto couple.

4.3.4 DEVIATION FROM TEST STANDARD

No deviation

4.3.5 TEST SETUP



4.3.6 EUT OPERATING CONDITION

Same as Item 4.1.6

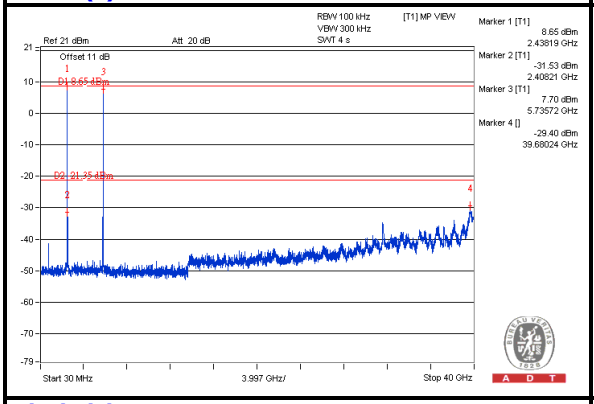
4.3.7 TEST RESULTS

The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 30dB offset below D1. It shows compliance with the requirement.

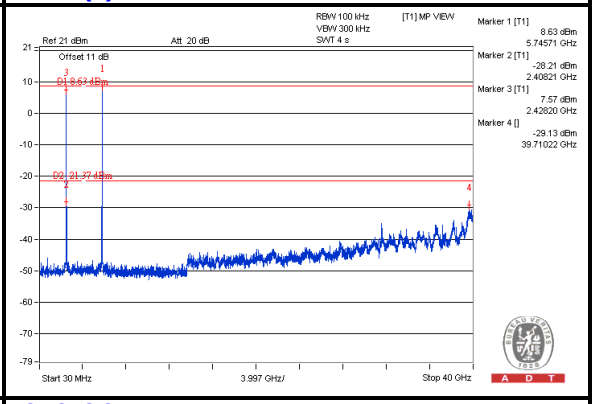
For 2.4 GHz_802.11b + For 5 GHz_802.11a

CH 1 + CH 149

Chain(0)



Chain(1)



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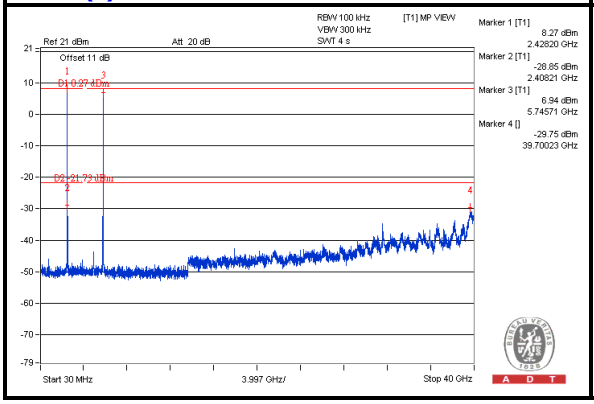
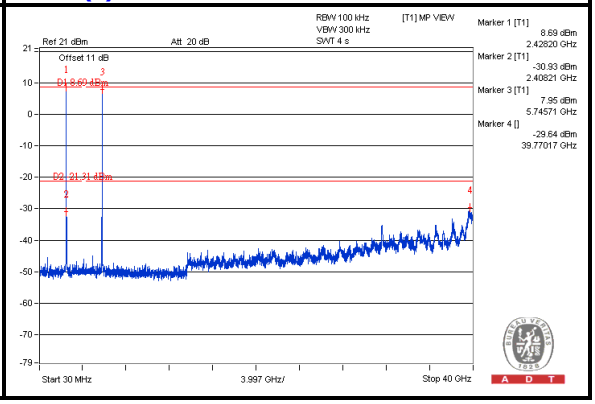


Chain(3)



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: 886-2-26052943

Hsin Chu EMC/RF Lab:
Tel: 886-3-5935343
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Hwa Ya EMC/RF/Safety/Telecom Lab:
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Email: service.adt@tw.bureauveritas.com
Web Site: www.bureauveritas-adt.com

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

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