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Supplemental “Transmit Simultaneously” Test Report

REPORT NO.: RF130911E03-2 R1

MODEL NO.: S4A340A

FCC ID: UXX-S4A340A

RECEIVED: Sep. 11, 2013

TESTED: Sep. 18 to Oct. 21, 2013

ISSUED: Nov. 04, 2013

APPLICANT: Cradlepoint, Inc

ADDRESS: 805W. Franklin Street, Boise, ID 83702

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
RF130911E03-2	Original release	Oct. 24, 2013
RF130911E03-2 R1	Revise Antenna Spec (Set 3) for report typo.	Nov. 04, 2013



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1. CERTIFICATION

PRODUCT : Integrated Mobile Broadband Router

BRAND NAME : cradlepoint

MODEL NO. : S4A340A

TEST ITEM: ENGINEERING SAMPLE

APPLICANT : Cradlepoint, Inc

TESTED: Sep. 18 to Oct. 21, 2013

STANDARDS : FCC Part 15, Subpart C (Section 15.247)

ANSI C63.10-2009

The above equipment (Model: S4A340A) 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 : Midoli Peng, **DATE:** Nov. 04, 2013
(Midoli Peng, Specialist)

APPROVED BY : May Chen, **DATE:** Nov. 04, 2013
(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 -1.91dB at 0.47031MHz
15.247(d) 15.209	Radiated Emissions	PASS	Meet the requirement of limit. Minimum passing margin is -3.5dB at 62.54MHz



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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)	5.46 dB
Radiated emissions (1GHz -6GHz)	3.54 dB
Radiated emissions (6GHz -18GHz)	4.08 dB
Radiated emissions (18GHz -40GHz)	4.11 dB



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3. GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

PRODUCT	Integrated Mobile Broadband Router
MODEL NO.	S4A340A
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 only
MODULATION TECHNOLOGY	DSSS,OFDM
TRANSFER RATE	802.11b: up to 11Mbps 802.11a / g: up to 54Mbps 802.11n: up to 450Mbps 802.11ac: up to 1300Mbps
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) 7 for 802.11n (HT40) 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)



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MAXIMUM OUTPUT POWER	For 15.407 (5GHz) 802.11a: 48.195mW 802.11ac (VHT20): 28.658mW 802.11ac (VHT40): 48.870mW 802.11ac (VHT80): 48.557mW
	For 15.247 (2.4GHz) 802.11b: 437.522mW 802.11g: 251.768mW 802.11n (HT20): 557.816mW 802.11n (HT40): 99.349mW
	For 15.247 (5GHz) 802.11a: 274.157mW 802.11ac (VHT20): 747.107mW 802.11ac (VHT40): 599.259mW 802.11ac (VHT80): 306.036mW
ANTENNA TYPE	Please see NOTE
DATA CABLE	RJ-45 Cable (unshielded, 1.5m) x1
I/O PORTS	Refer to user's manual
ASSOCIATED DEVICES	Adapter x1

NOTE:

1. 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	HON-KWANG	HK-PH36-A12	Input: 100-240V, 1.5A, 50/60Hz AC input cable: 1.9m, unshielded Output: 12V, 3A DC output cable: 1.8m, unshielded
2	HON-KWANG	HK-AH-120A400-DH	Input: 100-240V, 1.6A, 50/60Hz AC input cable: 1.9m, unshielded Output: 12V, 4A DC output cable: 1.8m, unshielded

From the above adapters, the worst radiated emission was found in **Adapter 1**. Therefore only the test data of the modes were recorded in this report.



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

MODULATION MODE	Tx/Rx FUNCTION
802.11a	1Tx(Diversity)/3Rx
802.11b	1Tx(Fixed chain 0)/3Rx
802.11g	1Tx(Diversity)/3Rx
802.11n (HT20)	3Tx/3Rx
802.11n (HT40)	3Tx/3Rx
802.11ac (VHT20)	3Tx/3Rx
802.11ac (VHT40)	3Tx/3Rx
802.11ac (VHT80)	3Tx/3Rx

3. The EUT could be applied with one USB Cellular Modem, therefore emission tests are added for simultaneously transmit between WLAN and USB Cellular Modem. The emission tests have been performed at the worst channel of both WLAN and USB Cellular Modem, the spurious emission of the simultaneous operation (WLAN & USB Cellular Modem) has been evaluated and no non-compliance found. < USB Cellular Modem only for test, not for sale >

Brand name	Model name	FCC ID	Spec.	Testing mode
SIERRA WIRELESS	MC7750	N7NMC7750	3G/LTE USB Dongle (Support LTE band 13 and WCDMA)	GPRS ch128, 824.2MHz



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

Set 1									
Transmitter Circuit	Antenna Type	Gain(dBi) (Excludes cable loss)		Cable Loss (dB)		Net Gain (dBi)		Connector Type	Cable Length (cm)
		2.4GHz	5GHz	2.4GHz	5GHz	2.4GHz	5GHz		
Right Side Chain (0)	Dipole	5.03	5.59	1.2	2	3.83	3.59	R-SMA	18
In center Chain (1)	Dipole	5.03	5.59	1	1	4.03	4.59	R-SMA	11
Left Side Chain (2)	Dipole	5.03	5.59	1.2	2	3.83	3.59	R-SMA	18
Set 2									
Transmitter Circuit	Antenna Type	Gain(dBi) (Excludes cable loss)		Cable Loss (dB)		Net Gain (dBi)		Connector Type	Cable Length (cm)
		2.4GHz	5GHz	2.4GHz	5GHz	2.4GHz	5GHz		
Right Side Chain (0)	Dipole	4.7	4.7	1.2	2	3.5	2.7	R-SMA	18
In center Chain (1)	Dipole	4.7	4.7	1	1	3.7	3.7	R-SMA	11
Left Side Chain (2)	Dipole	4.7	4.7	1.2	2	3.5	2.7	R-SMA	18
Set 3									
Transmitter Circuit	Antenna Type	Gain(dBi) (Excludes cable loss)		Cable Loss (dB)		Net Gain (dBi)		Connector Type	Cable Length (cm)
		2.4GHz	5GHz	2.4GHz	5GHz	2.4GHz	5GHz		
Right Side Chain (0)	Dipole	3.8	5.5	1.2	2	2.6	3.5	R-SMA	18
In center Chain (1)	Dipole	3.8	5.5	1	1	2.8	4.5	R-SMA	11
Left Side Chain (2)	Dipole	3.8	5.5	1.2	2	2.6	3.5	R-SMA	18

Set 1 was chosen for final test.

- When the EUT operating in 802.11n, the software operation, which is defined by manufacturer, MCS (Modulation and Coding Schemes) from 0 to 23.
- When the EUT operating in 802.11ac, the software operation, which is defined by manufacturer, MCS (Modulation and Coding Schemes) from 0 to 9.
- 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:

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	PLC	RE < 1G	RE \geq 1G	OB	
1	✓	✓	✓	✓	Adapter 1
2	✓	-	-	-	Adapter 2

Where **PLC**: Power Line Conducted Emission

RE < 1G: Radiated Emission below 1GHz

RE \geq 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 radiated emission worst case was found when positioned on **Y-plane**

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	DATA RATE (Mbps)
2.4 GHz 802.11n (HT20) + 5 GHz 802.11ac (VHT20) + USB Cellular Modem	1 to 11	6	OFDM	BPSK	6.5
	149 to 165	165	OFDM	BPSK	13.5
	-	128	GPRS	-	-



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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	DATA RATE (Mbps)
2.4 GHz 802.11n (HT20) + 5 GHz 802.11ac (VHT20) + USB Cellular Modem	1 to 11	6	OFDM	BPSK	6.5
	149 to 165	165	OFDM	BPSK	13.5
	-	128	GPRS	-	-

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.

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
2.4 GHz 802.11n (HT20) + 5 GHz 802.11ac (VHT20)	1 to 11	6	OFDM	BPSK	6.5
	149 to 165	165	OFDM	BPSK	13.5

TEST CONDITION:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
PLC	27deg. C, 56%RH	120Vac, 60Hz	Sean Huang
	28deg. C, 54%RH		
RE<1G	25deg. C, 65%RH	120Vac, 60Hz	Andy Ho
RE ³ 1G	23deg. C, 68%RH	120Vac, 60Hz	Gary Cheng
OB	25deg. C, 60%RH	120Vac, 60Hz	Chilin Lee



3.3 DESCRIPTION OF SUPPORT UNITS

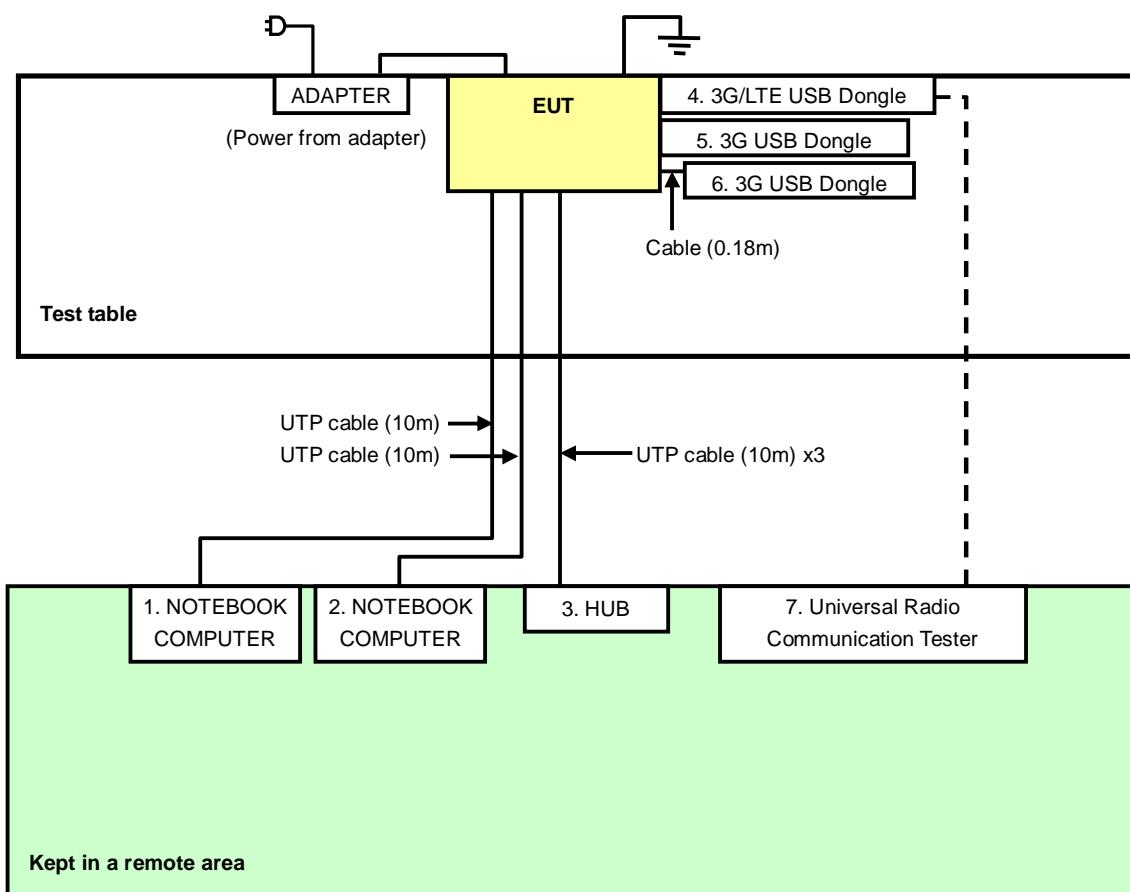
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	NOTEBOOK COMPUTER	DELL	PP27L	7YLB32S	FCC DoC
2	NOTEBOOK COMPUTER	DELL	E6420	482T3R1	FCC DoC
3	HUB	ZyXEL	ES-116P	S060H02000215	FCC DoC
4	3G/LTE USB Dongle	SIERRA WIRELESS	MC7750	NA	N7NMC7750
5	3G USB Dongle	SIERRA WIRELESS	AirCard 595U	NA	N7N-MC5725U
6	3G USB Dongle	HUAWEI	E219	NA	QISE219
7	Universal Radio Communication Tester	R&S	CMU200	121040	NA

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	UTP cable (10m)
2	UTP cable (10m)
3	UTP cable (10m)
4	NA
5	NA
6	3G USB Dongle cable(0.18m)
7	NA

NOTE: All power cords of the above support units are non shielded (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

For test mode 1

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver ROHDE & SCHWARZ	ESCS 30	100287	Feb. 28, 2013	Feb. 27, 2014
Line-Impedance Stabilization Network (for EUT) ROHDE & SCHWARZ	ENV216	100071	Nov. 09, 2012	Nov. 08, 2013
Line-Impedance Stabilization Network (for Peripheral) ROHDE & SCHWARZ	ESH3-Z5	8487731004	Oct. 29, 2012	Oct. 28, 2013
RF Cable (JYEBAO)	5DFB	COACAB-001	May 27, 2013	May 26, 2014
50 ohms Terminator	50	3	Oct. 23, 2012	Oct. 22, 2013
50 ohms Terminator	N/A	EMC-04	Oct. 16, 2012	Oct. 15, 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: Sep. 16, 2013



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For test mode 2

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. 21, 2013



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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.

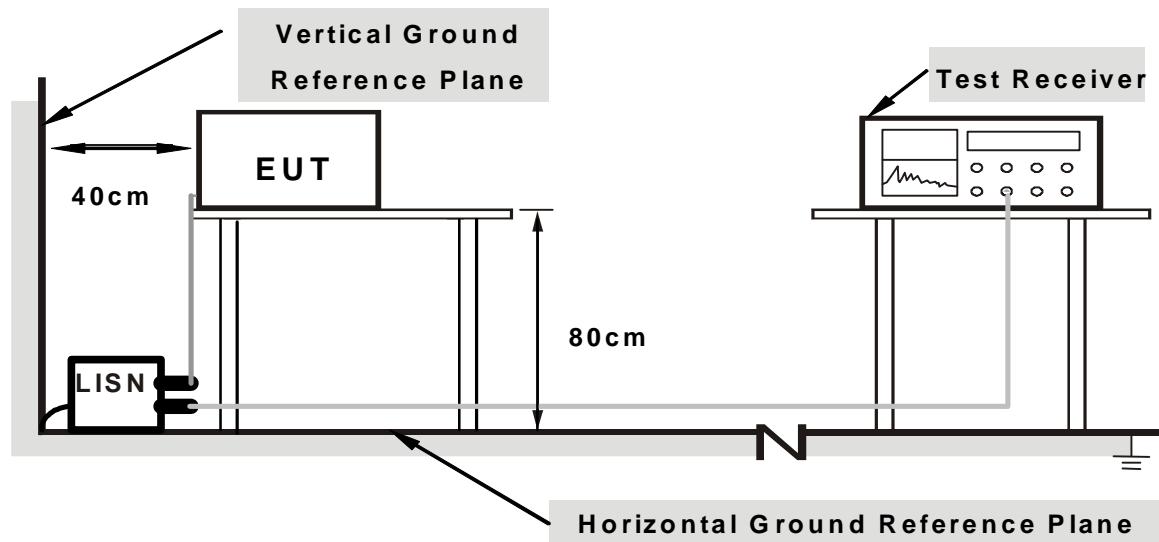
NOTE:

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. Placed the EUT on testing table.
2. Prepared computer system (support units 1 ~ 2) to act as communication partner.
3. The communication partner ran test program “Mtool” to enable EUT under transmission/receiving condition continuously.
4. Support unit 4 (3G/LTE USB Dongle) links support units 7 (Universal Radio Communication Tester) via 3G Link.

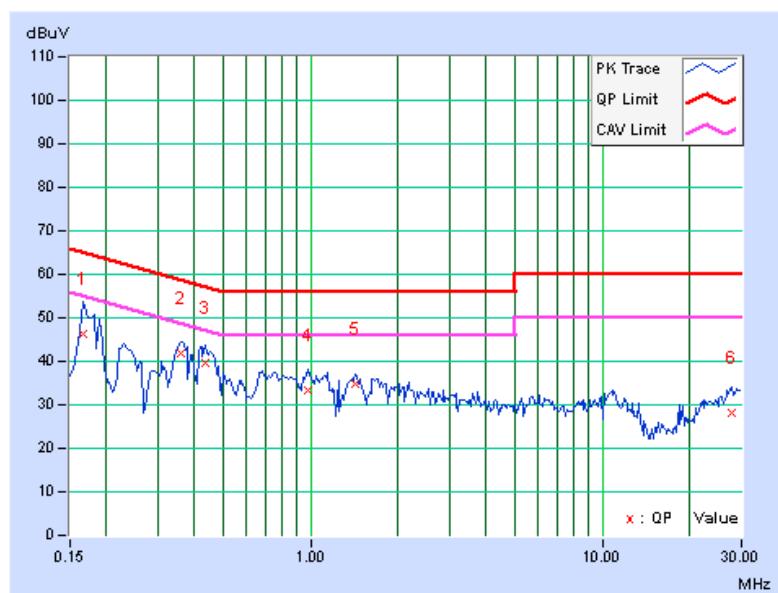
4.1.7 TEST RESULTS (MODE 1)

PHASE	Line (L)		DETECTOR FUNCTION	Quasi-Peak (QP) / Average (AV)
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No	Freq. [MHz]	Corr. Factor (dB)	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16562	9.75	36.69	34.18	46.44	43.93	65.18	55.18	-18.73	-11.24
2	0.36094	9.79	32.00	18.98	41.79	28.77	58.71	48.71	-16.91	-19.93
3	0.43516	9.80	29.92	15.49	39.72	25.29	57.15	47.15	-17.43	-21.86
4	0.97813	9.82	23.33	8.08	33.15	17.90	56.00	46.00	-22.85	-28.10
5	1.42188	9.83	25.09	14.05	34.92	23.88	56.00	46.00	-21.08	-22.12
6	27.70703	10.18	18.15	12.47	28.33	22.65	60.00	50.00	-31.67	-27.35

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

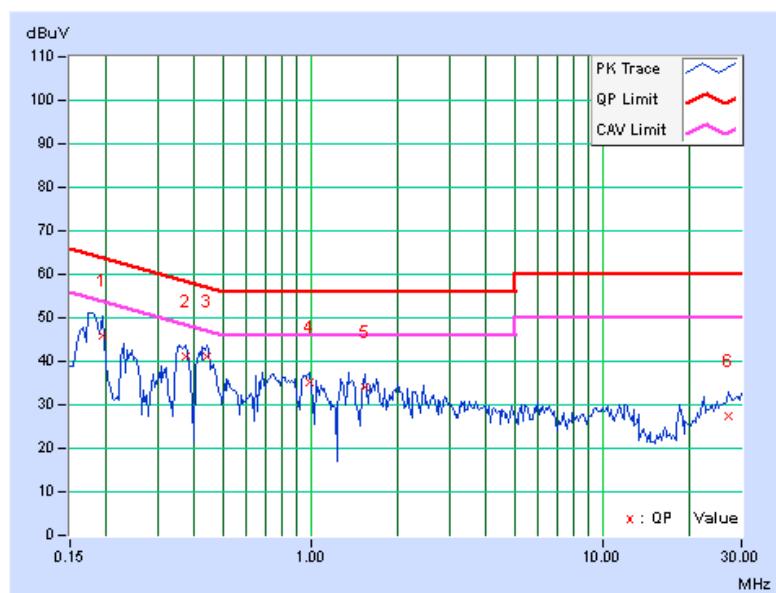


PHASE	Neutral (N)		DETECTOR FUNCTION	Quasi-Peak (QP) / Average (AV)	
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No	Freq.	Corr.	Reading Value		Emission Level		Limit		Margin	
	[MHz]	Factor (dB)	[dB (uV)]	[dB (uV)]	[dB (uV)]	[dB (uV)]	[dB (uV)]	[dB (uV)]	(dB)	
1	0.19297	9.75	36.06	22.63	45.81	32.38	63.91	53.91	-18.10	-21.53
2	0.37266	9.79	31.26	18.09	41.05	27.88	58.44	48.44	-17.39	-20.56
3	0.44297	9.80	31.36	17.49	41.16	27.29	57.01	47.01	-15.84	-19.71
4	0.99375	9.82	25.23	12.86	35.05	22.68	56.00	46.00	-20.95	-23.32
5	1.53906	9.84	24.29	10.31	34.13	20.15	56.00	46.00	-21.87	-25.85
6	27.08203	10.38	16.94	11.21	27.32	21.59	60.00	50.00	-32.68	-28.41

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



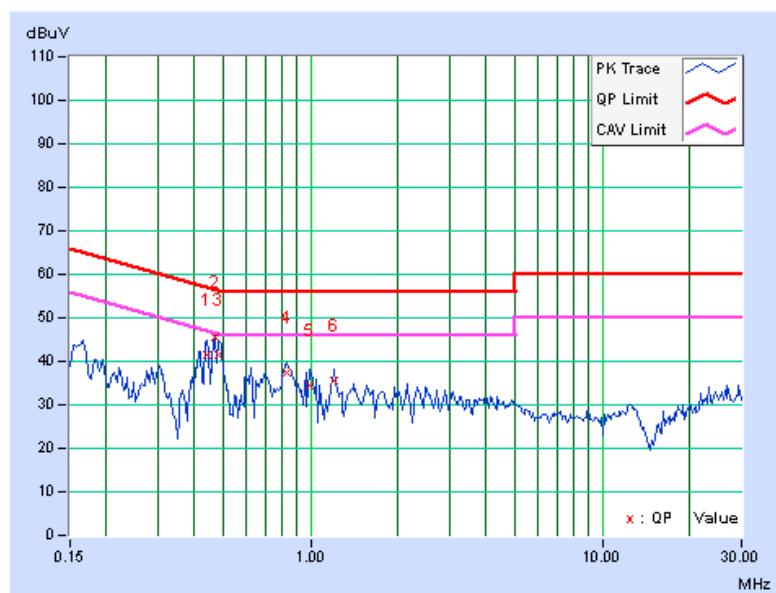
4.1.8 TEST RESULTS (MODE 2)

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

No	Freq.	Corr.	Reading Value		Emission Level		Limit		Margin	
	[MHz]	Factor (dB)	[dB (uV)]	[dB (uV)]	[dB (uV)]	[dB (uV)]	[dB (uV)]	[dB (uV)]	[dB]	
1	0.43906	0.14	41.30	40.08	41.44	40.22	57.08	47.08	-15.64	-6.86
2	0.47031	0.14	45.24	44.45	45.38	44.59	56.51	46.51	-11.12	-1.91
3	0.48594	0.14	41.17	33.06	41.31	33.20	56.24	46.24	-14.92	-13.03
4	0.82969	0.16	37.13	33.12	37.29	33.28	56.00	46.00	-18.71	-12.72
5	0.99766	0.17	34.28	32.84	34.45	33.01	56.00	46.00	-21.55	-12.99
6	1.20313	0.18	35.53	31.74	35.71	31.92	56.00	46.00	-20.29	-14.08

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



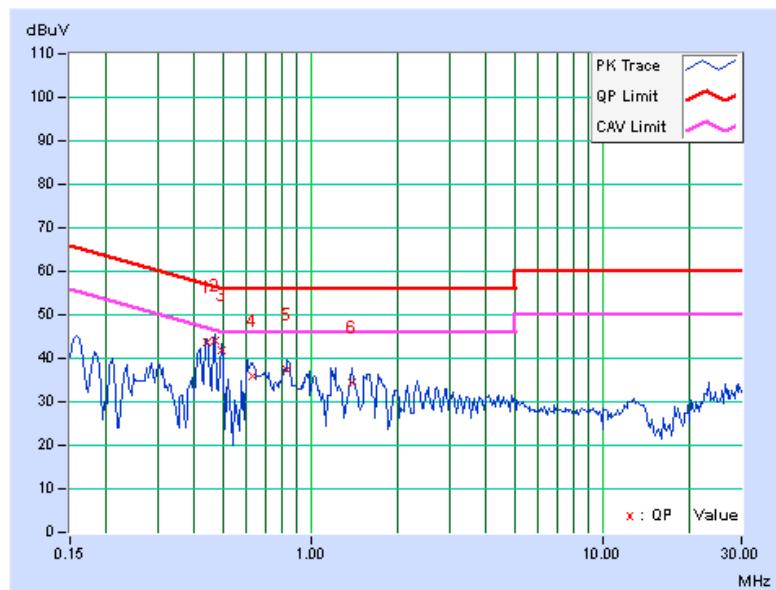


PHASE	Neutral (N)	DETECTOR FUNCTION	Quasi-Peak (QP) / Average (AV)
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No	Freq.	Corr.	Reading Value		Emission Level		Limit		Margin	
	[MHz]	Factor (dB)	[dB (uV)]	[dB (uV)]	[dB (uV)]	[dB (uV)]	[dB (uV)]	[dB (uV)]	(dB)	
1	0.44266	0.14	43.67	42.88	43.81	43.02	57.01	47.01	-13.20	-3.99
2	0.47031	0.14	43.94	43.90	44.08	44.04	56.51	46.51	-12.42	-2.46
3	0.49375	0.14	41.70	41.43	41.84	41.57	56.10	46.10	-14.26	-4.53
4	0.63438	0.15	35.68	25.15	35.83	25.30	56.00	46.00	-20.17	-20.70
5	0.83359	0.16	37.28	35.12	37.44	35.28	56.00	46.00	-18.56	-10.72
6	1.37891	0.19	34.14	31.33	34.33	31.52	56.00	46.00	-21.67	-14.48

REMARKS:

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





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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
MXE EMI Receiver Agilent	N9038A	MY50010156	Jan. 16, 2013	Jan. 15, 2014
Pre-Amplifier Mini-Circuits	ZFL-1000VH2 B	AMP-ZFL-04	Nov. 14, 2012	Nov. 13, 2013
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-361	Mar. 25, 2013	Mar. 24, 2014
RF Cable	NA	CHHCAB_001	Oct. 07, 2012	Oct. 06, 2013
Horn_Antenna AISI	AIH.8018	0000220091110	Nov. 27, 2012	Nov. 26, 2013
Pre-Amplifier Agilent	8449B	3008A01923	Oct. 30, 2012	Oct. 29, 2013
RF Cable	NA	RF104-205 RF104-207 RF104-202	Dec. 26, 2012	Dec. 25, 2013
Spectrum Analyzer Agilent	E4446A	MY48250253	Aug. 28, 2013	Aug. 27, 2014
Pre-Amplifier SPACEK LABS	SLKKa-48-6	9K16	Nov. 14, 2012	Nov. 13, 2013
Horn_Antenna SCHWARZBECK	BBHA 9170	9170-424	Oct. 12, 2012	Oct. 11, 2013
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: Sep. 23 to 25, 2013



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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:

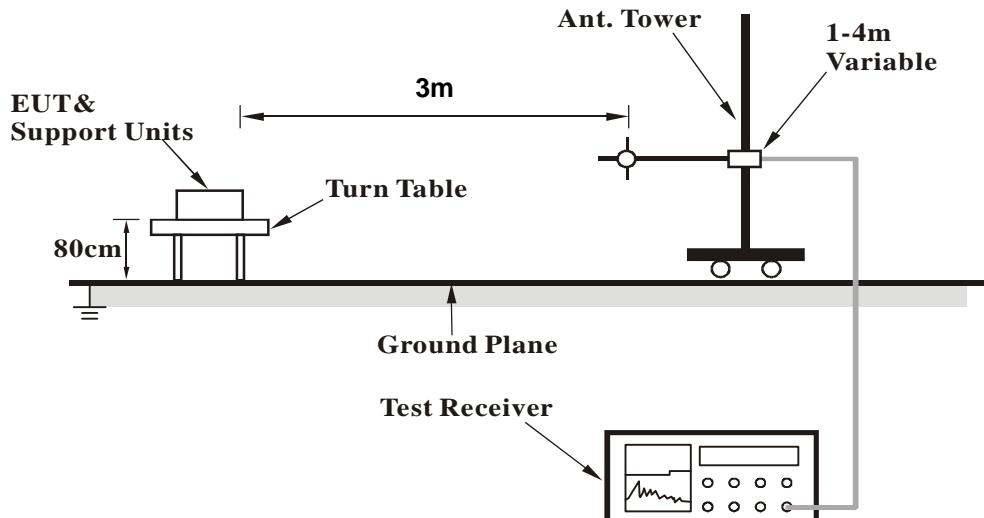
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10 Hz for Average detection (AV) at frequency above 1GHz.
4. If the EUT transiting at duty cycle is < 98%, the duty cycle correction is required that emission.
5. All modes of operation were investigated and the worst-case emissions are reported.

4.2.4 DEVIATION FROM TEST STANDARD

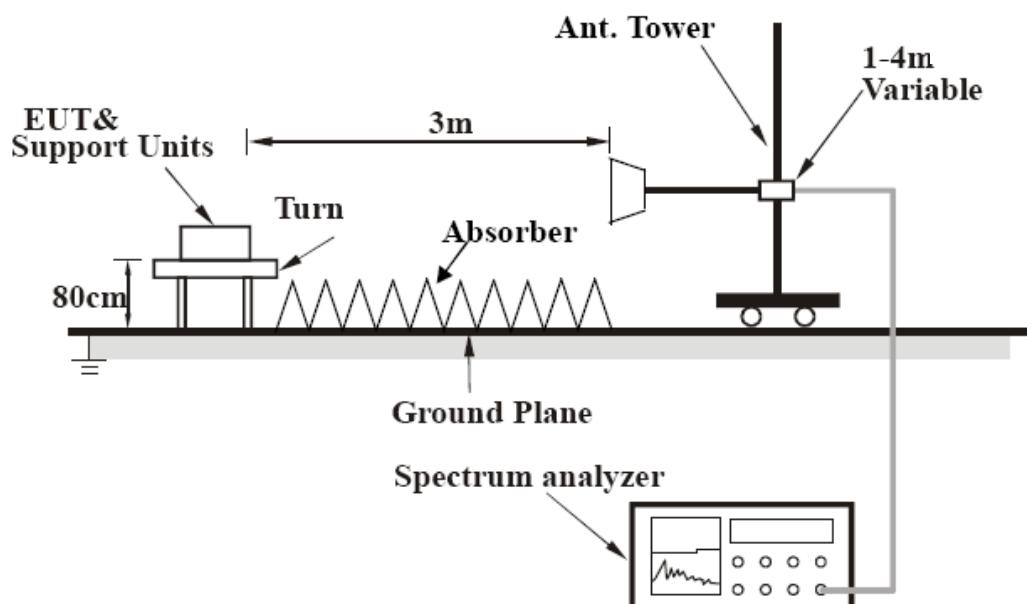
No deviation

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



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4.2.7 TEST RESULTS

BELOW 1GHz 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	54.35	31.2 QP	40.0	-8.8	1.00 H	152	44.07	-12.87
2	85.00	30.1 QP	40.0	-9.9	2.00 H	296	49.09	-19.03
3	151.54	33.4 QP	43.5	-10.1	1.00 H	221	46.39	-12.96
4	199.31	34.8 QP	43.5	-8.7	1.00 H	226	51.15	-16.34
5	297.04	32.4 QP	46.0	-13.6	1.00 H	264	44.71	-12.31
6	480.03	39.0 QP	46.0	-7.0	2.00 H	200	47.05	-8.03

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	37.78	32.1 QP	40.0	-7.9	1.00 V	301	45.78	-13.72
2	62.54	36.5 QP	40.0	-3.5	1.00 V	143	50.33	-13.84
3	85.53	36.5 QP	40.0	-3.6	1.00 V	224	55.51	-19.06
4	197.86	35.6 QP	43.5	-7.9	1.00 V	255	51.78	-16.19
5	480.03	35.2 QP	46.0	-10.8	1.00 V	146	43.23	-8.03
6	500.01	35.4 QP	46.0	-10.6	1.00 V	214	42.93	-7.53

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)	
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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	4874.00	48.8 PK	74.0	-25.2	1.08 H	360	6.81	41.99
2	4874.00	35.0 AV	54.0	-19.0	1.08 H	360	-6.99	41.99
3	7311.00	55.9 PK	74.0	-18.1	1.00 H	211	9.34	46.56
4	7311.00	42.7 AV	54.0	-11.3	1.00 H	211	-3.86	46.56
5	11650.00	60.4 PK	74.0	-13.6	1.50 H	201	10.52	49.88
6	11650.00	47.2 AV	54.0	-6.8	1.50 H	201	-2.68	49.88

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	50.4 PK	74.0	-23.6	1.09 V	193	8.41	41.99
2	4874.00	38.8 AV	54.0	-15.2	1.09 V	193	-3.19	41.99
3	7311.00	54.6 PK	74.0	-19.4	1.00 V	346	8.04	46.56
4	7311.00	43.8 AV	54.0	-10.2	1.00 V	346	-2.76	46.56
5	11650.00	58.3 PK	74.0	-15.7	1.46 V	314	8.42	49.88
6	11650.00	46.9 AV	54.0	-7.1	1.46 V	314	-2.98	49.88

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 20dB 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
R&S SPECTRUM ANALYZER	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 : Sep. 28, 2013

4.3.3 TEST PROCEDURE

Measurement Procedure - Reference Level

1. Set the RBW = 100 kHz.
2. Set the VBW \geq 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.



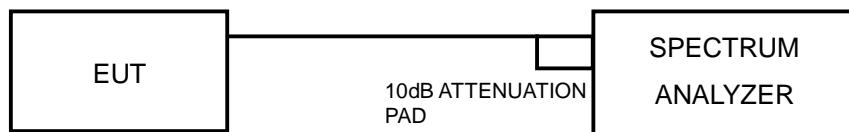
Measurement Procedure –Unwanted Emission Level

1. Set RBW = 100 kHz.
2. Set VBW \geq 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 4.3.6

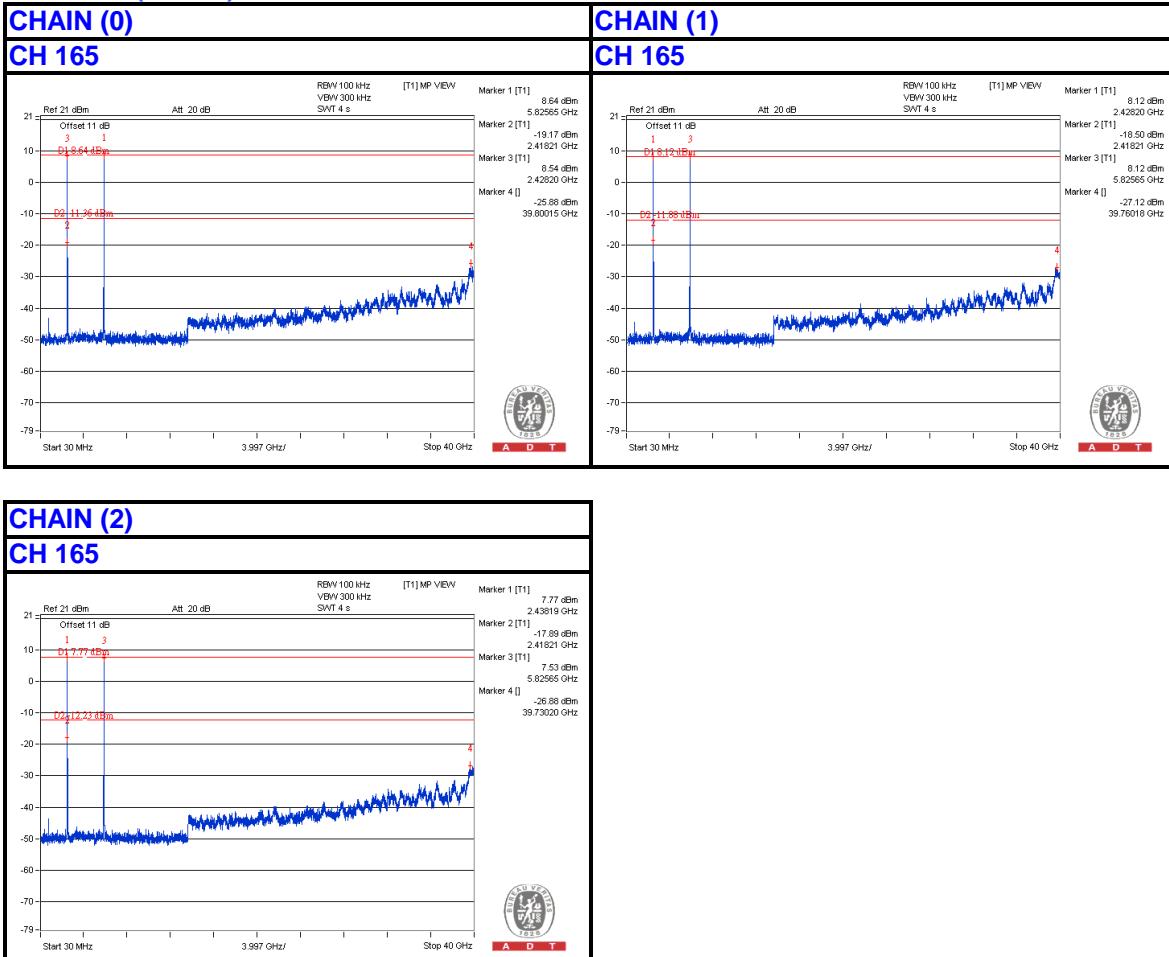
4.3.7 TEST RESULTS

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



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802.11ac (VHT20)





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4. INFORMATION ON THE TESTING LABORATORIES

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

If you have any comments, please feel free to contact us at the following:

Linko EMC/RF Lab:

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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.

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