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FCC TEST REPORT

REPORT NO.: RF120607D14B

MODEL NO.: LD-6L

FCC ID: QE9LD-6L

RECEIVED: Jul. 11, 2013

TESTED: Jul. 14 ~ 23, 2013

ISSUED: Jul. 24, 2013

APPLICANT: Quuppa Oy

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

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RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RF120607D14B	Original release	Jul. 24, 2013

1. CERTIFICATION

PRODUCT: HAIP Locator
BRAND NAME: Quuppa
MODEL NO.: LD-6L
APPLICANT: Quuppa Oy
TESTED: Jul. 14 ~ 23, 2013
TEST SAMPLE: ENGINEERING SAMPLE
STANDARDS: **FCC Part 15, Subpart C (Section 15.247)**
ANSI C63.10-2009

The above equipment 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 : *Jessica Cheng* , **DATE:** Jul. 24, 2013
(Jessica Cheng / Specialist)

APPROVED BY : *Ken Liu* , **DATE:** Jul. 24, 2013
(Ken Liu / Senior 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 -7.98dB at 0.51762MHz.
15.247(d) 15.209	Radiated Emissions	PASS	Meet the requirement of limit. Minimum passing margin is -2.0dB at 2400.0MHz.
15.247(d)	Band Edge Measurement	PASS	Meet the requirement of limit.
15.247(a)(2)	6dB bandwidth	PASS	Meet the requirement of limit.
15.247(b)	Conducted power	PASS	Meet the requirement of limit.
15.247(e)	Power Spectral Density	PASS	Meet the requirement of limit.
15.203	Antenna Requirement	PASS	No antenna connector is used.

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	2.41 dB
Radiated emissions	30MHz ~ 1GHz	4.30 dB
	Above 1GHz	3.36 dB



3. GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

EUT	HAIP Locator
MODEL NO.	LD-6L
POWER SUPPLY	12Vdc from AC adapter 48Vdc from POE
MODULATION TYPE	GFSK
OPERATING FREQUENCY	2401 ~ 2481 MHz
NUMBER OF CHANNEL	81
OUTPUT POWER	2.1mW
ANTENNA TYPE	Printed antenna with -6dBi gain
ANTENNA CONNECTOR	N/A
DATA CABLE	N/A
I/O PORTS	N/A
ACCESSORY DEVICES	N/A

NOTE:

1. The EUT is a HAIP Locator with 1TX & 15RX functions.
2. 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

81 channels are provided to this EUT:

CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)
0	2401	21	2422	42	2443	63	2464
1	2402	22	2423	43	2444	64	2465
2	2403	23	2424	44	2445	65	2466
3	2404	24	2425	45	2446	66	2467
4	2405	25	2426	46	2447	67	2468
5	2406	26	2427	47	2448	68	2469
6	2407	27	2428	48	2449	69	2470
7	2408	28	2429	49	2450	70	2471
8	2409	29	2430	50	2451	71	2472
9	2410	30	2431	51	2452	72	2473
10	2411	31	2432	52	2453	73	2474
11	2412	32	2433	53	2454	74	2475
12	2413	33	2434	54	2455	75	2476
13	2414	34	2435	55	2456	76	2477
14	2415	35	2436	56	2457	77	2478
15	2416	36	2437	57	2458	78	2479
16	2417	37	2438	58	2459	79	2480
17	2418	38	2439	59	2460	80	2481
18	2419	39	2440	60	2461		
19	2420	40	2441	61	2462		
20	2421	41	2442	62	2463		

3.2.1 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

EUT CONFIGURE MODE	APPLICABLE TO					DESCRIPTION
	PLC	RE < 1G	RE ≥ 1G	APCM	OB	
A	√	√	√	√	√	EUT powered from POE
B	√	√	-	-	-	EUT powered from adapter

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 **Z-plane**.

RADIATED EMISSION TEST (ABOVE 1GHz):

- 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.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
A	0 to 80	0, 40, 80	GFSK

RADIATED EMISSION TEST (BELOW 1GHz):

- 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.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
A & B	0 to 80	0	GFSK

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.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
A & B	0 to 80	0	GFSK



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.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
A	0 to 80	0, 80	GFSK

ANTENNA PORT CONDUCTED MEASUREMENT:

- This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
- 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.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
A	0 to 80	0, 40, 80	GFSK

TEST CONDITION:

APPLICABLE TO	EUT CONFIGURE	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE ³ 1G	A	26deg. C, 82%RH	48Vdc	Dalen Dai
RE<1G	A	24deg. C, 79%RH	48Vdc	Dalen Dai
	B	24deg. C, 79%RH	120Vac, 60Hz	Dalen Dai
PLC	A	27deg. C, 72%RH	48Vdc	Chad Lee
	B	27deg. C, 72%RH	120Vac, 60Hz	Chad Lee
APCM	A	24deg. C, 79%RH	48Vdc	Dalen Dai
OB	A	24deg. C, 79%RH	48Vdc	Dalen Dai



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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.

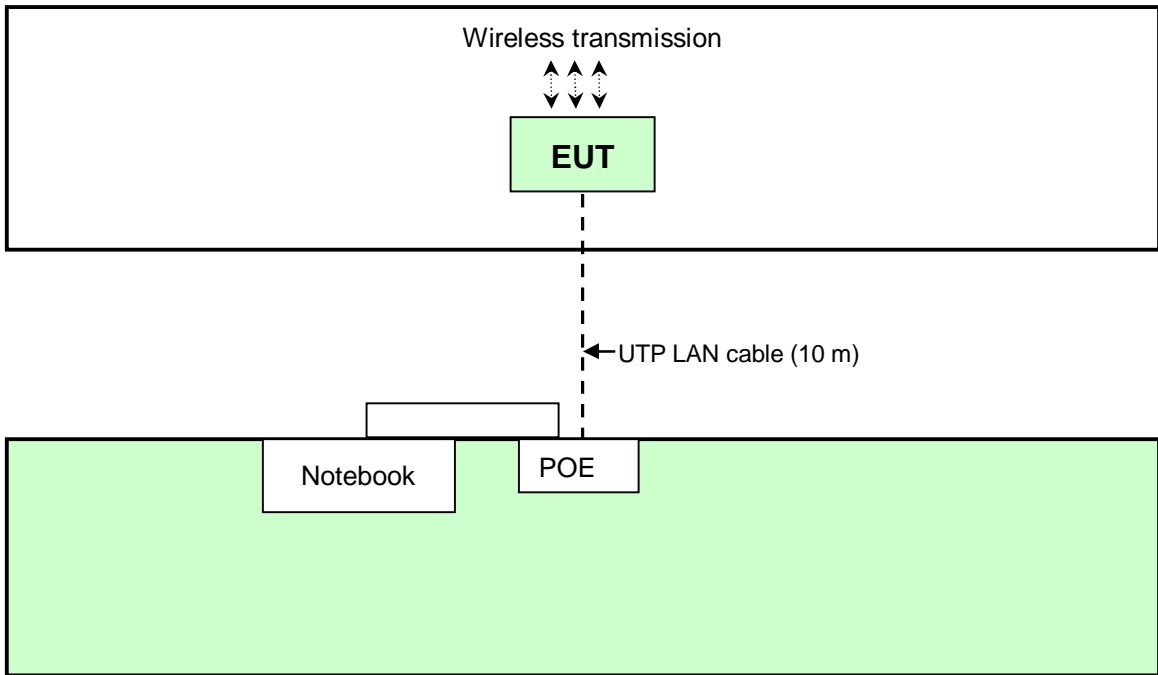
NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	NOTEBOOK COMPUTER	DELL	PP27L	8SNZ12S	FCC DoC Approved
2	AC Adapter	APD	WA-24E12	N/A	N/A
3	POE	VIVOTEK	POE-IJ-1748NDN	N/A	N/A

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	10m UTP LAN Cable
2	AC I/P: 100-240V, 50-60Hz, 0.65A DC O/P: 12V, 2A AC 2-pin, Non-Shielded DC Cable (1.8m)
3	AC I/P: 90 V ~ AC 264 V, 0.4A 110 V, 0.2A 220 V DC O/P: 48V, 350mA

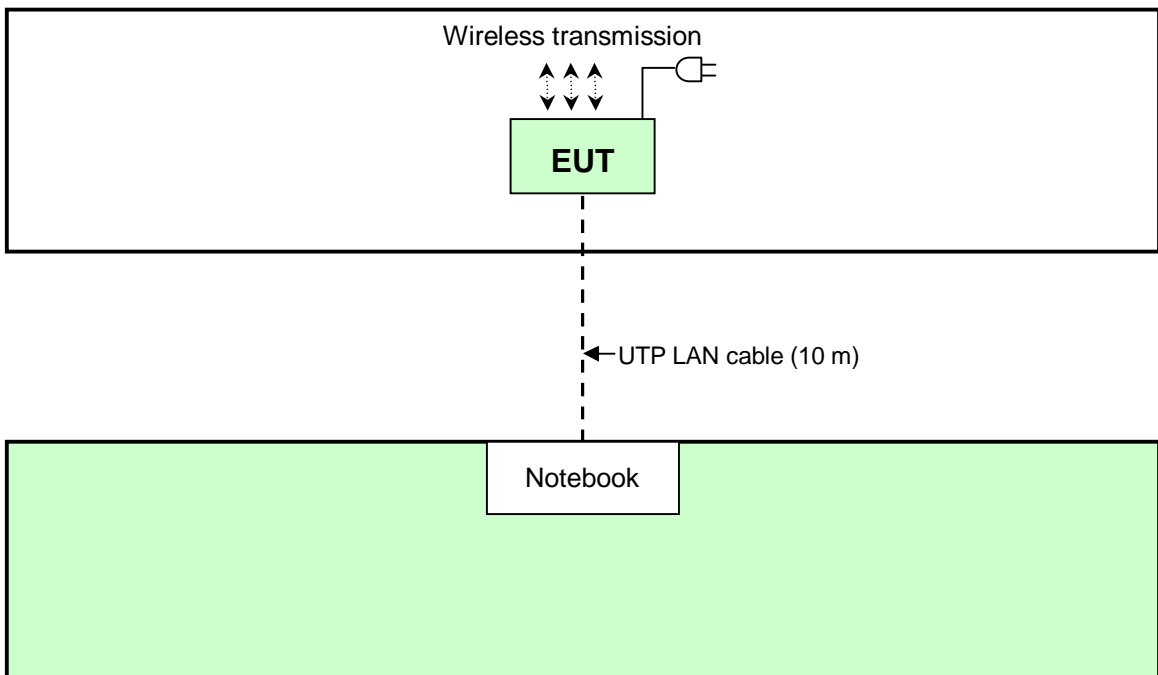
NOTE: (1) All power cords of the above support units are non shielded (1.8m).
(2) The support units 2 ~ 3 were provided by client.

3.3.1 CONFIGURATION OF SYSTEM UNDER TEST

For Mode A



For Mode B



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)

558074 D01 DTS Meas Guidance v02

ANSI C63.10-2009

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

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. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

4.1.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
ROHDE & SCHWARZ TEST RECEIVER	ESCS 30	100276	Jan. 07, 2013	Jan. 06, 2014
ROHDE & SCHWARZ Artificial Mains Network (for EUT)	ESH3-Z5	100219	Nov. 28, 2012	Nov. 27, 2013
LISN With Adapter (for EUT)	AD10	C10Ada-001	Nov. 28, 2012	Nov. 27, 2013
ROHDE & SCHWARZ Artificial Mains Network (for peripherals)	ESH3-Z5	100218	Dec. 05, 2012	Dec. 04, 2013
Software	ADT_Cond_V7.3.7	NA	NA	NA
Software	ADT_ISN_V7.3.7	NA	NA	NA
RF cable (JYEBAO)	5D-FB	Cable-C10.01	Feb. 19, 2013	Feb. 18, 2014
SUHNER Terminator (For ROHDE & SCHWARZ LISN)	65BNC-5001	E1-010773	Feb. 06, 2013	Feb. 05, 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. The test was performed in Shielded Room No. 10.
 3. The VCCI Site Registration No. C-1852.

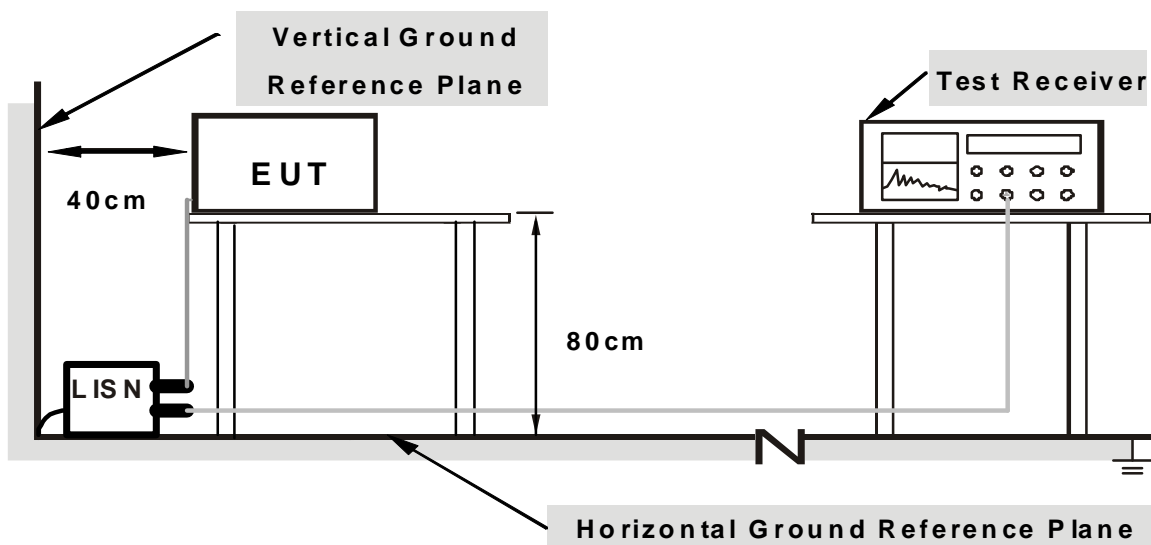
4.1.3 TEST PROCEDURES

- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- c. The frequency range from 150kHz to 30MHz was searched. Emission levels under limit - 20dB was not recorded.

4.1.4 DEVIATION FROM TEST STANDARD

No deviation.

4.1.5 TEST SETUP



Note: 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

For Mode A

- a. Connected the EUT with POE (kept in a remote area) placed on testing table.
- b. Turn on the power of all equipment.
- c. EUT ran a test program (provided by manufacture) to enable it under transmitting condition at specific channel continuously.

For Mode B

- a. Connected the EUT with AC adapter placed on testing table.
- b. Turn on the power of all equipment.
- c. EUT ran a test program (provided by manufacture) to enable it under transmitting condition at specific channel continuously.

4.1.7 TEST RESULTS

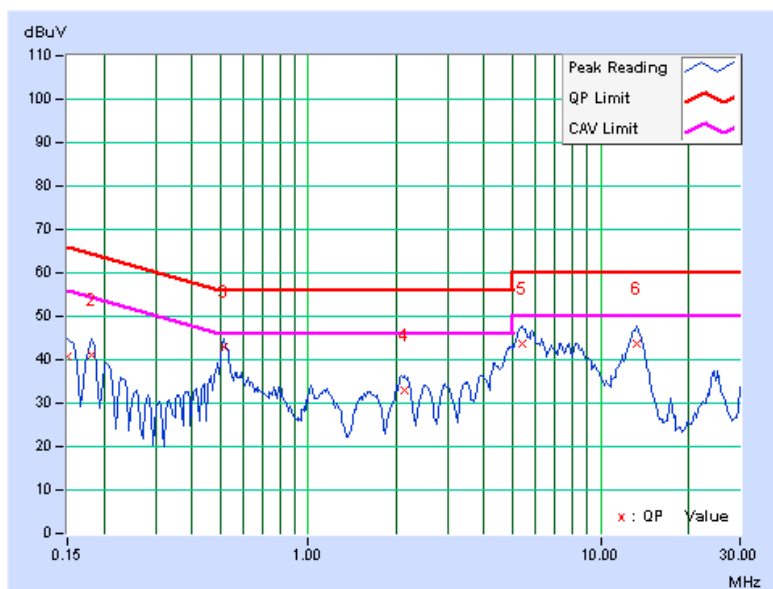
CONDUCTED WORST CASE DATA

PHASE	Line 1	6dB BANDWIDTH	9 kHz
TEST MODE	A		

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	0.15011	0.15	40.43	31.82	40.58	31.97	65.99	55.99	-25.41	-24.02
2	0.18142	0.15	41.08	37.16	41.23	37.31	64.42	54.42	-23.19	-17.11
3	0.51352	0.20	42.83	34.36	43.03	34.56	56.00	46.00	-12.97	-11.44
4	2.13658	0.30	32.82	26.17	33.12	26.47	56.00	46.00	-22.88	-19.53
5	5.37541	0.49	43.37	38.04	43.86	38.53	60.00	50.00	-16.14	-11.47
6	13.33602	0.92	42.82	36.23	43.74	37.15	60.00	50.00	-16.26	-12.85

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

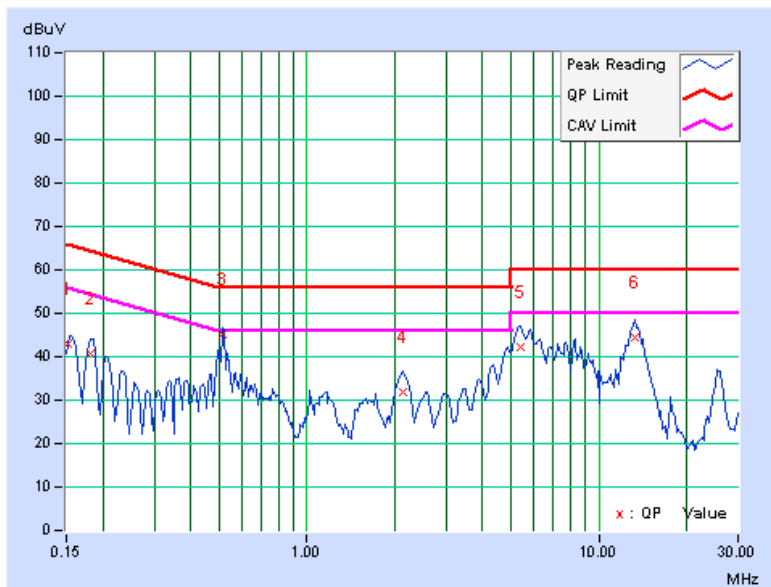


PHASE	Line 2	6dB BANDWIDTH	9 kHz
TEST MODE	A		

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	0.15283	0.14	42.98	37.63	43.12	37.77	65.84
2	0.18162	0.15	40.76	36.72	40.91	36.87	64.41	54.41	-23.50	-17.54
3	0.51762	0.20	44.87	37.82	45.07	38.02	56.00	46.00	-10.93	-7.98
4	2.12173	0.29	31.72	25.86	32.01	26.15	56.00	46.00	-23.99	-19.85
5	5.37542	0.44	41.67	36.82	42.11	37.26	60.00	50.00	-17.89	-12.74
6	13.27341	0.73	43.87	37.02	44.60	37.75	60.00	50.00	-15.40	-12.25

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

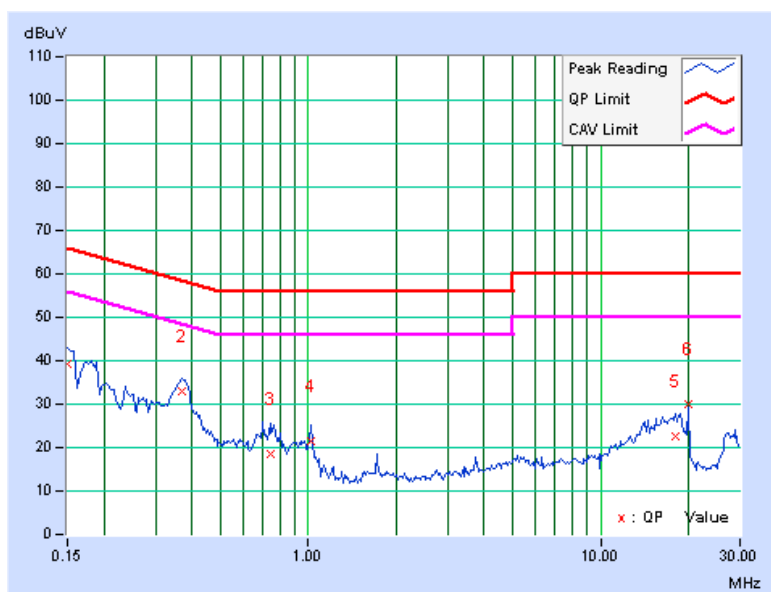


PHASE	Line 1	6dB BANDWIDTH	9 kHz
TEST MODE	B		

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	0.15003	0.16	38.92	25.47	39.08	25.63	66.00	56.00	-26.92
2	0.36827	0.21	32.66	25.87	32.87	26.08	58.54	48.54	-25.67	-22.46
3	0.73972	0.22	18.24	11.56	18.46	11.78	56.00	46.00	-37.54	-34.22
4	1.02742	0.23	21.07	17.12	21.30	17.35	56.00	46.00	-34.70	-28.65
5	18.10582	1.25	21.27	11.24	22.52	12.49	60.00	50.00	-37.48	-37.51
6	20.00403	1.34	28.72	24.19	30.06	25.53	60.00	50.00	-29.94	-24.47

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

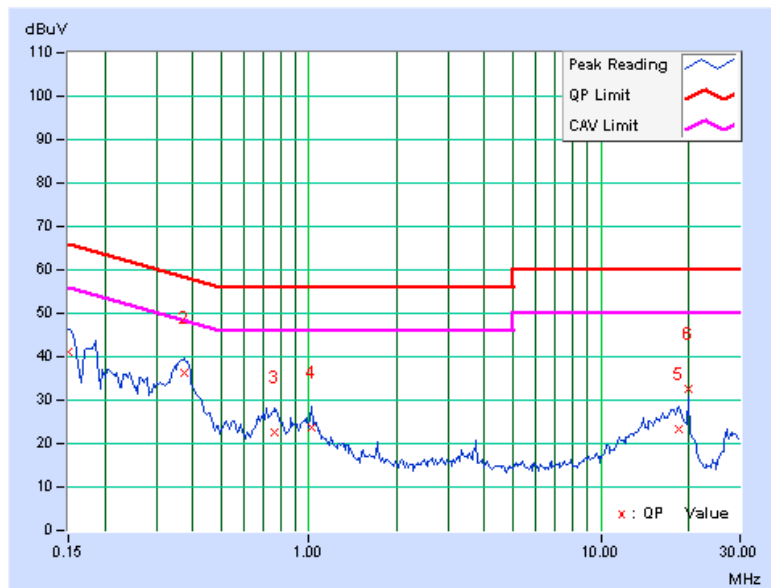


PHASE	Line 2	6dB BANDWIDTH	9 kHz
TEST MODE	B		

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	0.15002	0.15	40.86	30.12	41.01	30.27	66.00
2	0.37243	0.21	35.92	29.13	36.13	29.34	58.45	48.45	-22.32	-19.11
3	0.76753	0.22	22.52	16.71	22.74	16.93	56.00	46.00	-33.26	-29.07
4	1.01932	0.23	23.48	17.98	23.71	18.21	56.00	46.00	-32.29	-27.79
5	18.52362	0.96	22.53	11.71	23.49	12.67	60.00	50.00	-36.51	-37.33
6	20.00302	1.00	31.42	27.41	32.42	28.41	60.00	50.00	-27.58	-21.59

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 AND BANDEDGE MEASUREMENT

4.2.1 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.



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4.2.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
HP Preamplifier	8447D	2432A03504	Feb. 26, 2013	Feb. 25, 2014
HP Preamplifier	8449B	3008A01201	Feb. 26, 2013	Feb. 25, 2014
Agilent TEST RECEIVER	N9038A	MY51210129	Jan. 03, 2013	Jan. 02, 2014
Schwarzbeck Antenna	VULB 9168	137	Mar. 20, 2013	Mar. 19, 2014
Schwarzbeck Antenna	VHBA 9123	480	May 29, 2013	May 28, 2014
ADT. Turn Table	TT100	0306	NA	NA
ADT. Tower	AT100	0306	NA	NA
Software	ADT_Radiated_V 7.6.15.9.2	NA	NA	NA
SUHNER RF cable	SF102	CABLE-CH6	Aug. 19, 2012	Aug. 18, 2013
Schwarzbeck Horn Antenna	BBHA 9120-D1	D130	May 13, 2013	May 12, 2014
Highpass filter Wainwright Instruments	WHK 3.1/18G-10SS	SN 8	NA	NA
Anritsu Power Sensor	MA2411B	0738404	Apr. 24, 2013	Apr. 23, 2014
Anritsu Power Meter	ML2495A	0842014	Apr. 25, 2013	Apr. 24, 2014

- NOTE:**
1. The calibration interval of the above test instruments is 12/24 months. And the calibrations are traceable to NML/ROC and NIST/USA.
 2. The horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
 3. The test was performed in Chamber No. 6.
 4. The Industry Canada Reference No. IC 7450E-6.
 5. The FCC Site Registration No. is 447212.



4.2.3 TEST PROCEDURES

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meters semi-anechoic chamber. 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. Height of receiving 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.

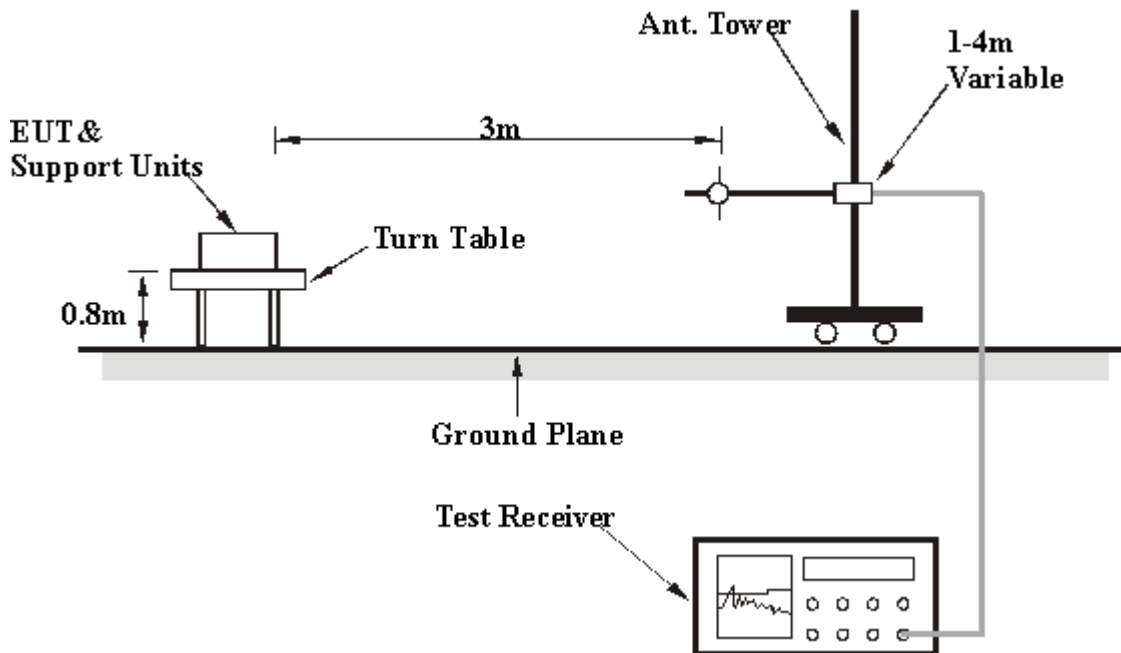
NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz 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 3kHz 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 attached file (Test Setup Photo).

4.2.6 EUT OPERATING CONDITIONS

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



4.2.7 TEST RESULTS

ABOVE 1GHz DATA

CHANNEL	TX Channel 0	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)
TEST MODE	A		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	54.4 PK	74.0	-19.6	1.36 H	354	58.13	-3.75
2	2390.00	44.2 AV	54.0	-9.9	1.36 H	354	47.90	-3.75
3	#2400.00	75.3 PK	77.4	-2.1	1.36 H	354	79.02	-3.70
4	#2400.00	41.3 AV	43.4	-2.1	1.36 H	354	45.02	-3.70
5	*2401.00	97.4 PK			1.36 H	354	101.05	-3.70
6	*2401.00	63.4 AV			1.36 H	354	67.05	-3.70
7	4802.00	42.6 PK	74.0	-31.4	1.03 H	161	38.90	3.71
8	4802.00	32.1 AV	54.0	-22.0	1.03 H	161	28.34	3.71
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	53.7 PK	74.0	-20.3	1.17 V	108	57.44	-3.75
2	2390.00	43.1 AV	54.0	-10.9	1.17 V	108	46.87	-3.75
3	#2400.00	67.2 PK	69.2	-2.0	1.17 V	108	70.91	-3.70
4	#2400.00	33.2 AV	35.2	-2.0	1.17 V	108	36.91	-3.70
5	*2401.00	89.2 PK			1.17 V	108	92.94	-3.70
6	*2401.00	55.2 AV			1.17 V	108	58.94	-3.70
7	4802.00	42.0 PK	74.0	-32.0	1.00 V	308	38.25	3.71
8	4802.00	31.6 AV	54.0	-22.4	1.00 V	308	27.87	3.71

REMARKS:

- Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
- Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
- The other emission levels were very low against the limit.
- Margin value = Emission Level – Limit value
- " * ": Fundamental frequency.
- " # ": The radiated frequency is out of the restricted band.
- The average value of fundamental frequency is: Average = Peak value + 20 log(Duty cycle)
Where the duty factor is calculated from following formula:
20 log (Duty cycle) = 20 log (2 ms / 100 ms) = -34.0 dB
Please see page 28 for plotted duty.



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CHANNEL	TX Channel 40	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)
TEST MODE	A		

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	*2441.00	94.1 PK			1.00 H	329	97.62	-3.51
2	*2441.00	60.1 AV			1.00 H	329	63.62	-3.51
3	4882.00	42.9 PK	74.0	-31.2	1.02 H	189	39.09	3.76
4	4882.00	32.3 AV	54.0	-21.7	1.02 H	189	28.53	3.76

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	*2441.00	93.1 PK			1.08 V	213	96.65	-3.51
2	*2441.00	59.1 AV			1.08 V	213	62.65	-3.51
3	4882.00	42.0 PK	74.0	-32.0	1.00 V	284	38.27	3.76
4	4882.00	31.9 AV	54.0	-22.1	1.00 V	284	28.10	3.76

REMARKS:

- Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
- Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
- The other emission levels were very low against the limit.
- Margin value = Emission Level – Limit value
- " * ": Fundamental frequency.
- The average value of fundamental frequency is: Average = Peak value + 20 log(Duty cycle)
Where the duty factor is calculated from following formula:
20 log (Duty cycle) = 20 log (2 ms / 100 ms) = -34.0 dB
Please see page 28 for plotted duty.



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CHANNEL	TX Channel 80	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)
TEST MODE	A		

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	*2481.00	93.3 PK			1.26 H	93	96.61	-3.33
2	*2481.00	59.3 AV			1.26 H	93	62.61	-3.33
3	2483.50	65.9 PK	74.0	-8.1	1.26 H	93	69.19	-3.32
4	2483.50	31.9 AV	54.0	-22.1	1.26 H	93	35.19	-3.32
5	4962.00	42.9 PK	74.0	-31.1	1.07 H	225	39.17	3.70
6	4962.00	32.3 AV	54.0	-21.7	1.07 H	225	28.64	3.70

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M

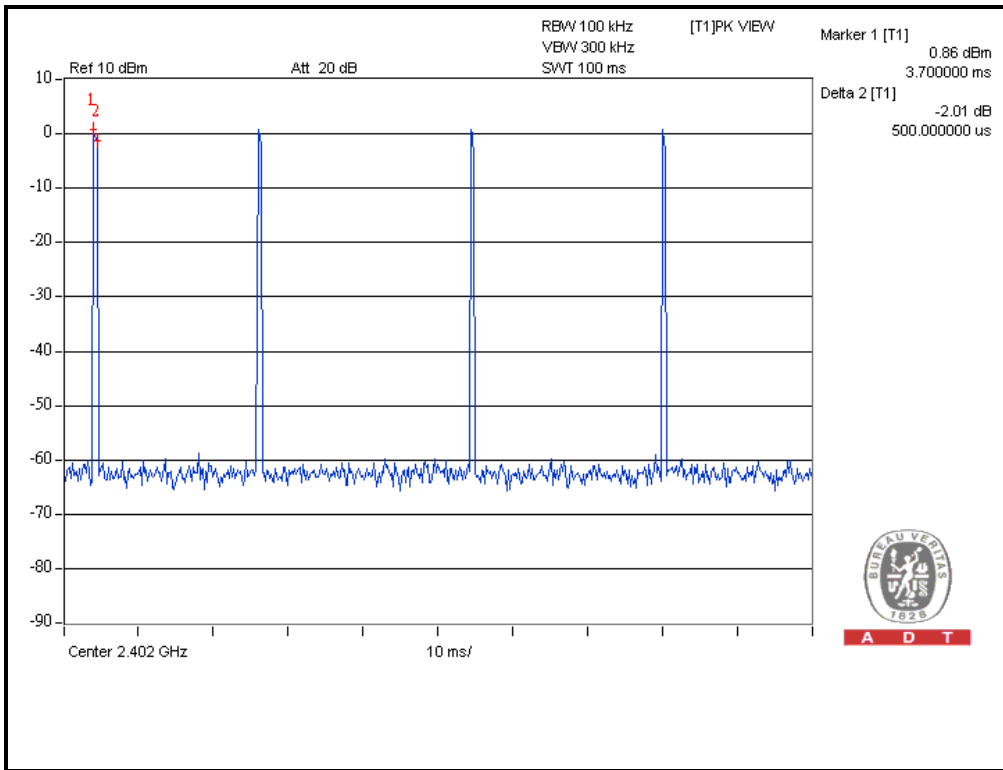
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2481.00	87.0 PK			1.00 V	346	90.29	-3.33
2	*2481.00	53.0 AV			1.00 V	346	56.29	-3.33
3	2483.50	59.6 PK	74.0	-14.5	1.00 V	346	62.87	-3.32
4	2483.50	25.6 AV	54.0	-28.5	1.00 V	346	28.87	-3.32
5	4962.00	41.7 PK	74.0	-32.3	1.06 V	271	38.02	3.70
6	4962.00	31.5 AV	54.0	-22.6	1.06 V	271	27.75	3.70

REMARKS:

- Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
- Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
- The other emission levels were very low against the limit.
- Margin value = Emission Level – Limit value
- " * ": Fundamental frequency.
- The average value of fundamental frequency is: Average = Peak value + 20 log(Duty cycle)
Where the duty factor is calculated from following formula:
20 log (Duty cycle) = 20 log (2 ms / 100 ms) = -34.0 dB
Please see page 28 for plotted duty.



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$$20 \log (\text{Duty cycle}) = 20 \log (0.5 \text{ ms} \times 4 / 100 \text{ ms}) = -34.0 \text{ dB}$$



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BELOW 1GHz WORST-CASE DATA

CHANNEL	TX Channel 0	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz		
TEST MODE	A		

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	34.62	29.0 QP	40.0	-11.0	1.36 H	196	44.04	-15.02
2	99.81	29.7 QP	43.5	-13.9	1.08 H	154	47.70	-18.05
3	199.96	33.6 QP	43.5	-9.9	1.05 H	221	49.57	-15.95
4	280.58	26.6 QP	46.0	-19.4	1.00 H	143	38.45	-11.89
5	384.14	37.2 QP	46.0	-8.9	1.00 H	201	47.00	-9.85
6	479.74	38.0 QP	46.0	-8.0	1.47 H	193	45.77	-7.79
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	34.65	31.8 QP	40.0	-8.2	1.76 V	25	46.84	-15.01
2	99.76	28.7 QP	43.5	-14.8	1.12 V	138	46.80	-18.06
3	199.97	30.3 QP	43.5	-13.2	1.00 V	354	46.21	-15.95
4	288.59	26.9 QP	46.0	-19.1	1.61 V	271	38.67	-11.75
5	384.13	38.9 QP	46.0	-7.1	1.00 V	189	48.73	-9.85
6	479.63	39.3 QP	46.0	-6.7	1.23 V	149	47.05	-7.79

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value



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CHANNEL	TX Channel 0	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz		
TEST MODE	B		

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	199.98	32.14 QP	43.50	-11.36	1.67 H	289	48.09	-15.95
2	335.28	32.08 QP	46.00	-13.92	1.37 H	167	42.77	-10.69
3	384.13	37.56 QP	46.00	-8.44	1.06 H	205	47.41	-9.85
4	479.66	37.01 QP	46.00	-8.99	1.17 H	253	44.80	-7.79
5	576.27	30.79 QP	46.00	-15.21	1.71 H	135	36.70	-5.91
6	831.51	36.05 QP	46.00	-9.95	1.24 H	354	37.57	-1.52

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	42.68	31.01 QP	40.00	-8.99	1.59 V	355	45.04	-14.03
2	127.06	27.78 QP	43.50	-15.72	1.93 V	292	42.71	-14.93
3	199.99	31.05 QP	43.50	-12.45	1.33 V	67	47.00	-15.95
4	384.12	37.81 QP	46.00	-8.19	1.09 V	167	47.66	-9.85
5	479.52	37.28 QP	46.00	-8.72	1.44 V	258	45.08	-7.80
6	576.53	31.91 QP	46.00	-14.09	1.00 V	274	37.81	-5.90

REMARKS:

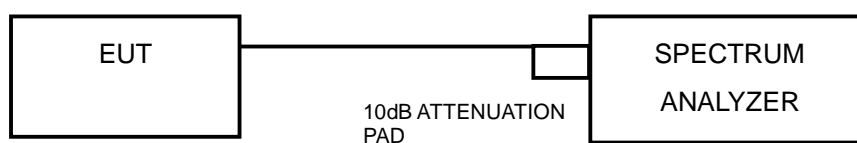
1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

4.3 6dB BANDWIDTH MEASUREMENT

4.3.1 LIMITS OF 6dB BANDWIDTH MEASUREMENT

The minimum of 6dB Bandwidth Measurement is 0.5 MHz.

4.3.2 TEST SETUP



4.3.3 TEST INSTRUMENTS

Refer to section 4.2.2 to get information of above instrument.

4.3.4 TEST PROCEDURE

- Set resolution bandwidth (RBW) = approximately 1% of the emission bandwidth
- Set the video bandwidth (VBW) $\geq 3 \times$ RBW, Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission

4.3.5 DEVIATION FROM TEST STANDARD

No deviation.

4.3.6 EUT OPERATING CONDITIONS

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.



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4.3.7 TEST RESULTS

MODE A

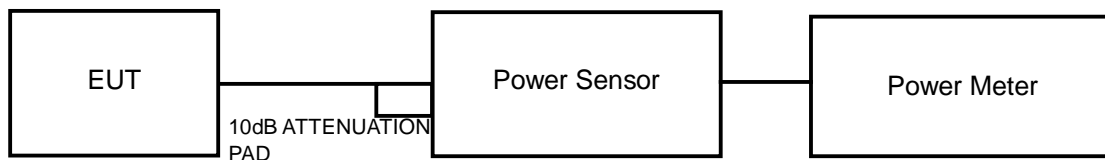
CHANNEL	FREQUENCY (MHz)	6dB BANDWIDTH (MHz)	MINIMUM LIMIT (MHz)	PASS / FAIL
0	2401	0.77	0.5	PASS
40	2441	0.77	0.5	PASS
80	2481	0.77	0.5	PASS

4.4 CONDUCTED OUTPUT POWER

4.4.1 LIMITS OF CONDUCTED OUTPUT POWER MEASUREMENT

For systems using digital modulation in the 2400–2483.5 MHz bands: 1 Watt (30dBm)

4.4.2 TEST SETUP



4.4.3 TEST INSTRUMENTS

Refer to section 4.2.2 to get information of above instrument.

4.4.4 TEST PROCEDURES

A peak power sensor was used on the output port of the EUT. A power meter was used to read the response of the peak power sensor. Record the peak power level.

4.4.5 DEVIATION FROM TEST STANDARD

No deviation.

4.4.6 EUT OPERATING CONDITIONS

Same as Item 4.3.6.



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4.4.7 TEST RESULTS

MODE A

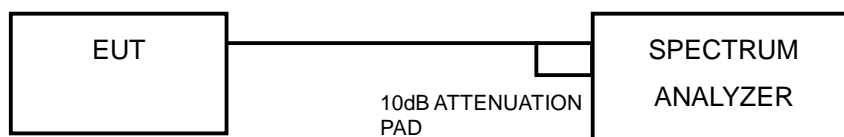
CHANNEL	FREQUENCY (MHz)	PEAK POWER (mW)	PEAK POWER (dBm)	LIMIT (dBm)	PASS/FAIL
0	2401	2.1	3.3	30	PASS
40	2441	2.0	3.0	30	PASS
80	2481	1.8	2.6	30	PASS

4.5 POWER SPECTRAL DENSITY MEASUREMENT

4.5.1 LIMITS OF POWER SPECTRAL DENSITY MEASUREMENT

The Maximum of Power Spectral Density Measurement is 8dBm.

4.5.2 TEST SETUP



4.5.3 TEST INSTRUMENTS

Refer to section 4.2.2 to get information of above instrument.

4.5.4 TEST PROCEDURE

- Set the RBW = 3 kHz, VBW = 10 kHz, Detector = peak.
- Sweep time = auto couple, Trace mode = max hold, allow trace to fully stabilize.
- Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

4.5.5 DEVIATION FROM TEST STANDARD

No deviation.

4.5.6 EUT OPERATING CONDITION

Same as Item 4.3.6



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4.5.7 TEST RESULTS

MODE A

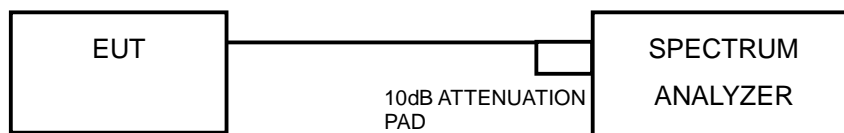
Channel	FREQ. (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	PASS /FAIL
0	2401	-14.27	8	PASS
40	2441	-14.75	8	PASS
80	2481	-15.35	8	PASS

4.6 CONDUCTED OUT OF BAND EMISSION MEASUREMENT

4.6.1 LIMITS OF CONDUCTED OUT OF BAND EMISSION MEASUREMENT

Below -20dB of the highest emission level of operating band (in 100kHz Resolution Bandwidth).

4.6.2 TEST SETUP



4.6.3 TEST INSTRUMENTS

Refer to section 4.2.2 to get information of above instrument.

4.6.4 TEST PROCEDURE

MEASUREMENT PROCEDURE REF

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.



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MEASUREMENT PROCEDURE OOB

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.

4.6.5 DEVIATION FROM TEST STANDARD

No deviation.

4.6.6 EUT OPERATING CONDITION

Same as Item 4.3.6

4.6.7 TEST RESULTS

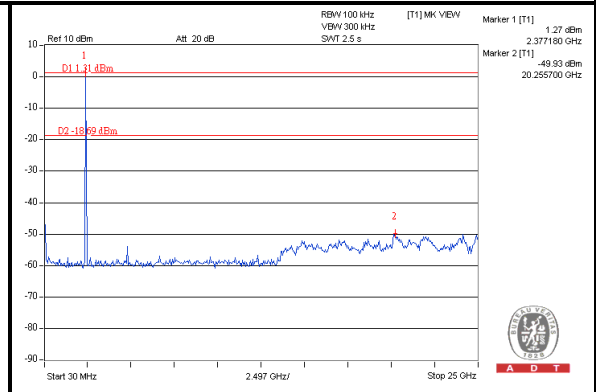
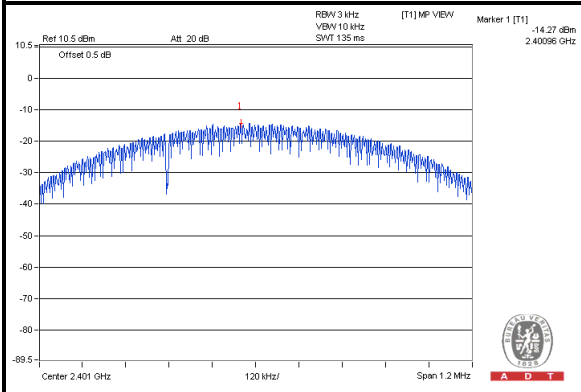
The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 20dB offset below D1. It shows compliance with the requirement.



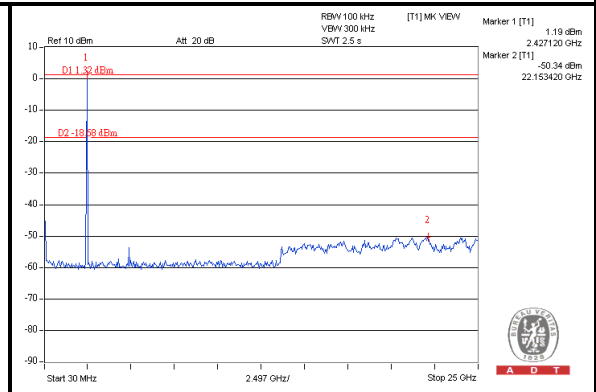
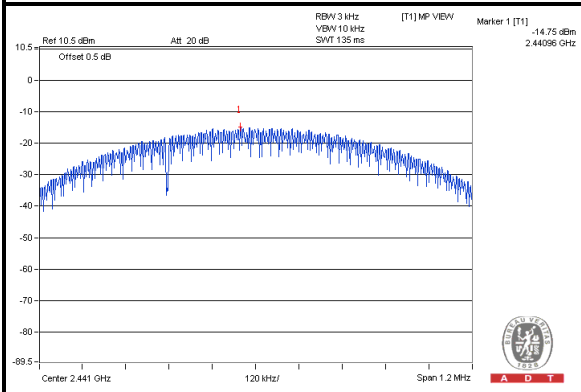
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MODE A

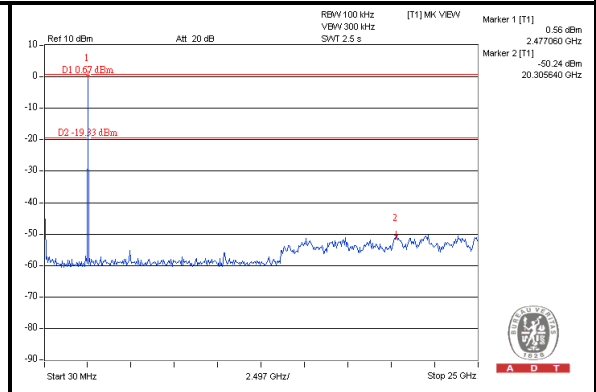
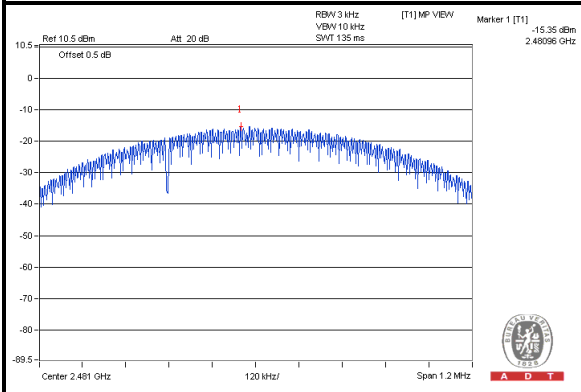
CH 0



CH 40



CH 80





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5. PHOTOGRAPHS OF THE TEST CONFIGURATION

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



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6. INFORMATION ON THE TESTING LABORATORIES

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

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

Linko EMC/RF Lab:

Tel: 886-2-26052180

Fax: 886-2-26051924

Hsin Chu EMC/RF Lab:

Tel: 886-3-5935343

Fax: 886-3-5935342

Hwa Ya EMC/RF/Safety/Telecom Lab:

Tel: 886-3-3183232

Fax: 886-3-3270892

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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7. APPENDIX A - MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB

No modifications were made to the EUT by the lab during the test.

---END---