FCC TEST REPORT (15.407)

REPORT NO.:	RF130927E06-1
MODEL NO.:	AP One In-Wall, AP One InWall, Flex AP, MAX, Surf Pro, AP One, AP Pro, Device Connector, Express, Balance, Pismo902
FCC ID:	U8G-P1902
RECEIVED:	Sep. 27, 2013
TESTED:	Nov. 07, 2013 to Feb. 19, 2014
ISSUED:	Feb. 27, 2014
APPLICANT:	Pismo Labs Technology Limited
ADDRESS:	FLAT/RM A5, 5/F, HK SPINNERS IND BLDG PHASE 6, 481 CASTLE PEAK ROAD, CHEUNG SHA WAN, HONG KONG.
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
RF130927E06-1	Original release	Feb. 27, 2014

1. CERTIFICATION

PRODUCT:	Pepwave / Peplink / Pismo Wireless Product
BRAND NAME:	Pepwave / Peplink / Pismo
MODEL NO.:	AP One In-Wall, AP One InWall, Flex AP, MAX, Surf Pro, AP One, AP Pro, Device Connector, Express, Balance, Pismo902
TEST SAMPLE:	ENGINEERING SAMPLE
APPLICANT:	Pismo Labs Technology Limited
TESTED:	Nov. 07, 2013 to Feb. 19, 2014
STANDARDS:	FCC Part 15, Subpart E (Section 15.407) ANSI C63.10-2009

The above equipment (Model: AP One In-Wall) 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 cha racteristics 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:

For 5GHz, 5150~5250MHz Band

APPLIED STANDARD: FCC PART 15, SUBPART E (SECTION 15.407)			
STANDARD SECTION	**TEST TYPE**	**RESULT**	**REMARK**
15.407(b)(6)	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -0.59 dB at 0.52541MHz
15.407(b/1/2/3)(b)(6)	Spurious Emissions	PASS	Meet the requirement of limit. Minimum passing margin is -0.3dB at 10400.00MHz & 15690.00MHz
15.407(a/1/2)	Transmit Power	PASS	Meet the requirement of limit.
15.407(a)(6)	Peak Power Excursion	PASS	Meet the requirement of limit.
15.407(a/1/2)	Peak Power Spectral Density	PASS	Meet the requirement of limit.
15.407(g)	Frequency Stability	PASS	Meet the requirement of limit.
15.203	Antenna Requirement	PASS	Antenna connector is IPEX not a standard connector.

NOTE: 1. For WLAN: The EUT was operating in 2.400 ~ 2.4835GHz, 5.15~5.25GHz and 5.725~5.850GHz frequencies band. This report was recorded the RF parameters including 5.15~5.25GHz. For the 2.400 ~ 2.4835GHz and 5.725~5.850GHz RF parameters was recorded in another test report.

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	Pepwave / Peplink / Pismo Wireless Product
MODEL NO.	AP One In-Wall, AP One InWall, Flex AP, MAX, Surf Pro, AP One, AP Pro, Device Connector, Express, Balance, Pismo902
POWER SUPPLY	DC 43-57V from POE
MODULATION TYPE	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
MODULATION TECHNOLOGY	DSSS,OFDM
TRANSFER RATE	802.11b: up to 11Mbps 802.11a/g: up to 54Mbps 802.11n: up to 300Mbps
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) 2 for 802.11n (HT40)
	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) 2 for 802.11n (HT40)

MAXIMUM OUTPUT POWER	**For 15.407** 802.11a: 33.911mW 802.11n (HT20): 34.679mW 802.11n (HT40): 47.170mW **For 15.247(2.4GHz)** 802.11b: 494.988mW 802.11g: 855.093mW 802.11n (HT20): 871.033mW 802.11n (HT40): 641.297mW **For 15.247(5GHz)** 802.11a: 237.716mW 802.11n (HT20): 237.716mW 802.11n (HT40): 234.980mW
ANTENNA TYPE	Please see NOTE
DATA CABLE	NA
I/O PORTS	Refer to user's manual
ASSOCIATED DEVICES	NA

NOTE:

1. The EUT has eleven model names, which are identical to each other in all aspects except for the following information:

Product Name	Brand	Model No.	Different
Pepwave / Peplink / Pismo Wireless Product	Pepwave / Peplink / Pismo	AP One In-Wall	For marketing requirement
		AP One InWall	
		Flex AP	
		MAX	
		Surf Pro	
		AP One	
		AP Pro	
		Device Connector	
		Express	
		Balance	
		Pismo902	

From the above models, model: **AP One In-Wall** was selected as representative model for the test and its data was recorded in this report.

2. 2.4GHz and 5GHz technology can transmit at same time.

3. The EUT must be supplied with a POE (Only for test, not for sale) as following table:

Brand	Model No.	Spec.
PHIHONG	POE36U-1AT-R	AC I/P: 100-240V, 50/60Hz DC O/P: 56V, 0.6A

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

MODULATION MODE	TX/RX FUNCTION
802.11a	2TX/2RX
802.11b	2TX/2RX
802.11g	2TX/2RX
802.11n (HT20)	2TX/2RX
802.11n (HT40)	2TX/2RX

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

For 2.4GHz						
Transmitter Circuit	Brand	Model	Antenna Type	Gain (dBi) (Include cable loss)	Connecter Type	Frequency range (MHz to MHz)
Chain (0)	Pulse	W3008C	Chip	2.2	NA	2400 ~ 2500
Chain (1)	Pulse	W3008C	Chip	2.2	NA	2400 ~ 2500
For 5GHz						
Transmitter Circuit	Brand	Model	Antenna Type	Gain (dBi) (Include cable loss)	Connecter Type	Frequency range (MHz to MHz)
Chain (0) (Left)	SmartAnt	ADV05-220580	Embedded	2.64	IPEX	5150 ~ 5250
				4.27	IPEX	5725 ~ 5850
Chain (1) (Right)	SmartAnt	ADV05-220580	Embedded	3.27	IPEX	5150 ~ 5250
				1.87	IPEX	5725 ~ 5850

6. When the EUT operating in 802.11n, the software operation, which is defined by manufacturer, MCS (Modulation and Coding Schemes) from 0 to 15.

7. The emission of the simultaneous operation (2.4GHz & 5GHz) has been evaluated and no non-compliance was found.

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 DESCRIPTION OF TEST MODES

Operated in 5150 ~ 5350MHz band:

4 channels are provided for 802.11a, 802.11n (HT20):

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
36	5180 MHz	44	5220 MHz
40	5200 MHz	48	5240 MHz

2 channels are provided for 802.11n (HT40):

CHANNEL	FREQUENCY
38	5190 MHz
46	5230 MHz

3.2.1 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	PLC	RE < 1G	RE ³ 1G	APCM	
-	√	√	√	√	-

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

RE ³ 1G: Radiated Emission above 1GHz **APCM:** Antenna Port Conducted Measurement

Note: The EUT had been pre-tested on the positioned of each 2 axis. The worst case was found when positioned on **X-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)
802.11n (HT40)	38 to 46	38	OFDM	BPSK	13.5

RADIATED EMISSION TEST (BELOW 1 GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

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

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (MBPS)
802.11n (HT40)	38 to 46	38	OFDM	BPSK	13.5

RADIATED EMISSION TEST (ABOVE 1 GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

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

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
802.11a	36 to 48	36, 40, 48	OFDM	BPSK	6
802.11n (HT20)	36 to 48	36, 40, 48	OFDM	BPSK	6.5
802.11n (HT40)	38 to 46	38, 46	OFDM	BPSK	13.5

ANTENNA PORT CONDUCTED MEASUREMENT:

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

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

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
802.11a	36 to 48	36, 40, 48	OFDM	BPSK	6
802.11n (HT20)	36 to 48	36, 40, 48	OFDM	BPSK	6.5
802.11n (HT40)	38 to 46	38, 46	OFDM	BPSK	13.5

TEST CONDITION:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER (SYSTEM)	TESTED BY
PLC	21deg. C, 60%RH	120Vac, 60Hz	Jyunchun Lin
RE<1G	25deg. C, 68%RH	120Vac, 60Hz	Andy Ho
RE≥1G	23deg. C, 68%RH	120Vac, 60Hz	Tim Ho
APCM	25deg. C, 60%RH	120Vac, 60Hz	Robert Cheng

3.3 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 E (15.407)
789033 D01 General UNII Test Procedures v01 r03
662911 D01 Multiple Transmitter Output v02
ANSI C63.10-2009

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

3.4 DUTY CYCLE OF TEST SIGNAL

If duty cycle of test signal is < 98%, duty factor shall be considered.

802.11a

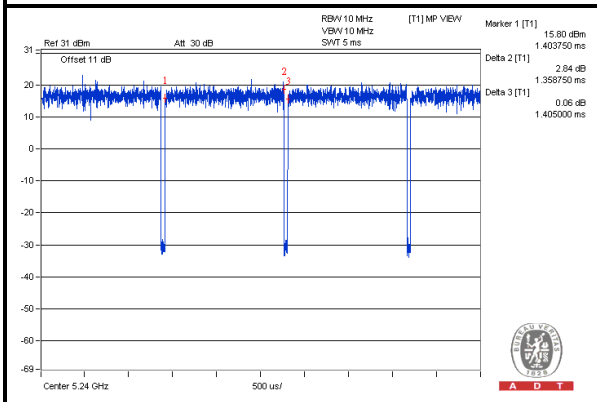
BPSK: Duty cycle = 1.359 ms/1.405 ms = 0.967, Duty factor = 10 * log(1/0.967) = 0.14

QPSK: Duty cycle = 0.687 ms/0.734 ms = 0.936, Duty factor = 10 * log(1/0.936) = 0.29

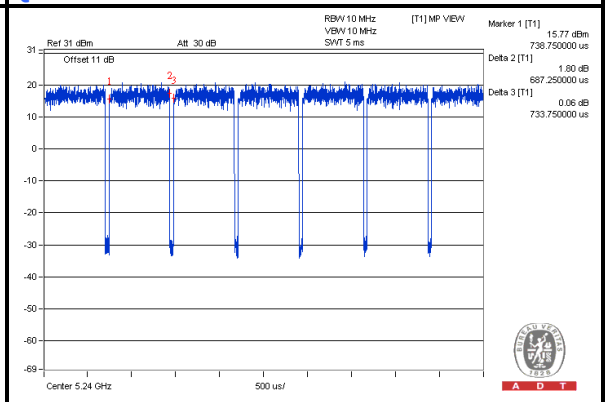
16QAM: Duty cycle = 0.353 ms/0.4 ms = 0.883, Duty factor = 10 * log(1/0.883) = 0.54

64QAM: Duty cycle = 0.186 ms/0.233 ms = 0.798, Duty factor = 10 * log(1/0.798) = 0.98

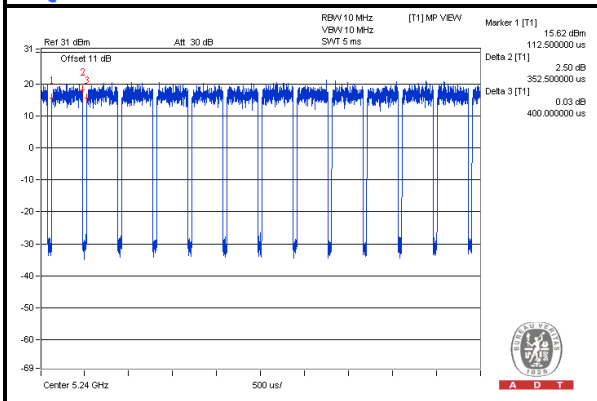
BPSK



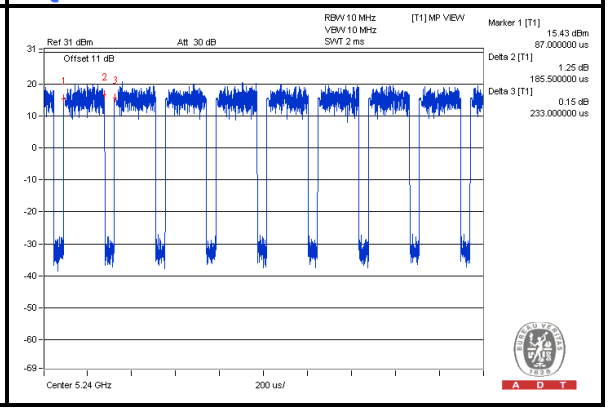
QPSK



16QAM



64QAM



802.11n (HT20)

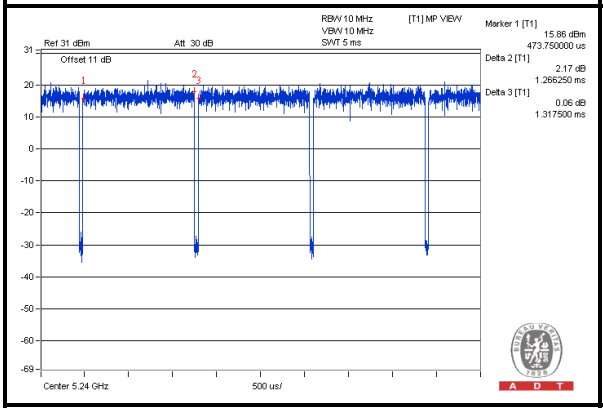
BPSK: Duty cycle = 1.266 ms/1.317 ms = 0.961, Duty factor = 10 * log(1/0.961) = 0.17

QPSK: Duty cycle = 0.654 ms/0.701 ms = 0.933, Duty factor = 10 * log(1/0.933) = 0.3

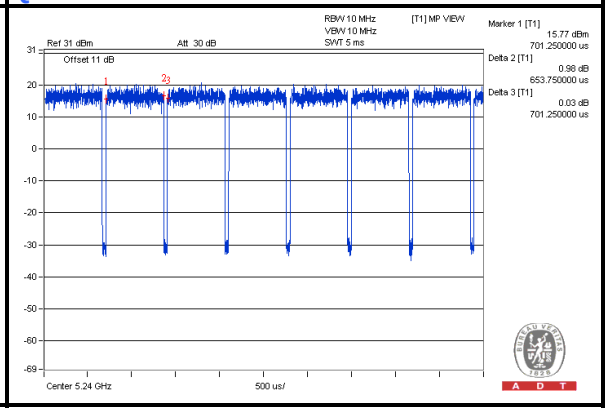
16QAM: Duty cycle = 0.347 ms/0.392 ms = 0.885, Duty factor = 10 * log(1/0.885) = 0.53

64QAM: Duty cycle = 0.19 ms/0.235 ms = 0.809, Duty factor = 10 * log(1/0.809) = 0.92

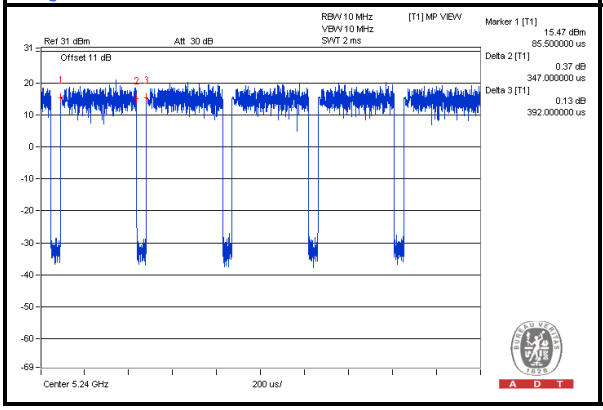
BPSK



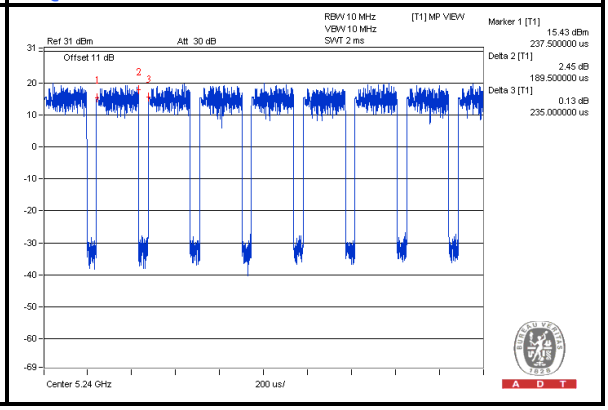
QPSK



16QAM



64QAM



802.11n (HT40)

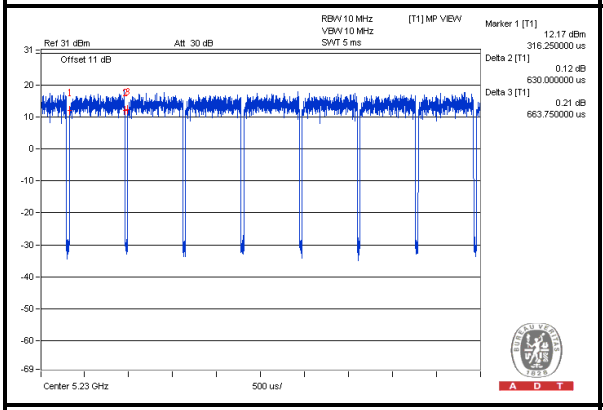
BPSK: Duty cycle = 0.63 ms/0.664 ms = 0.949, Duty factor = 10 * log(1/0.949) = 0.23

QPSK: Duty cycle = 0.335 ms/0.368 ms = 0.91, Duty factor = 10 * log(1/0.91) = 0.41

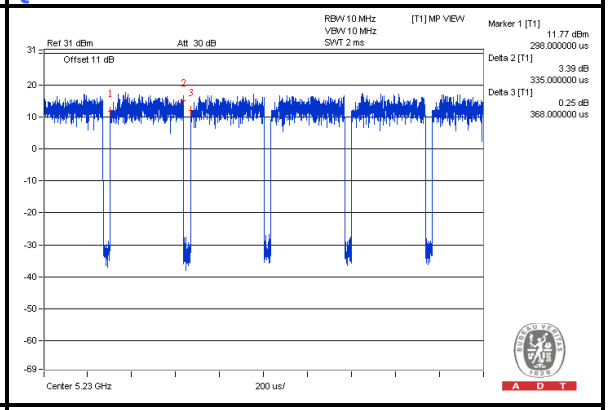
16QAM: Duty cycle = 0.188 ms/0.22 ms = 0.855, Duty factor = 10 * log(1/0.855) = 0.68

64QAM: Duty cycle = 0.112 ms/0.145 ms = 0.772, Duty factor = 10 * log(1/0.772) = 1.12

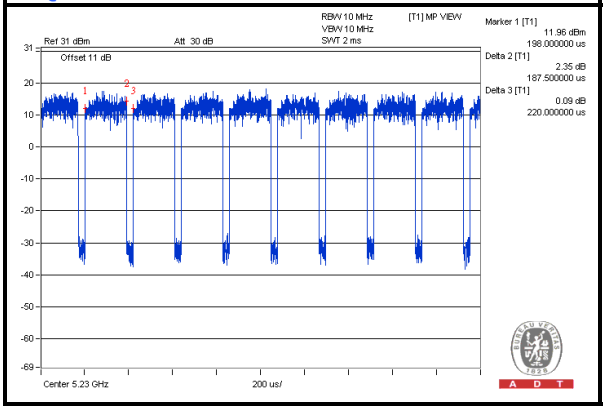
BPSK



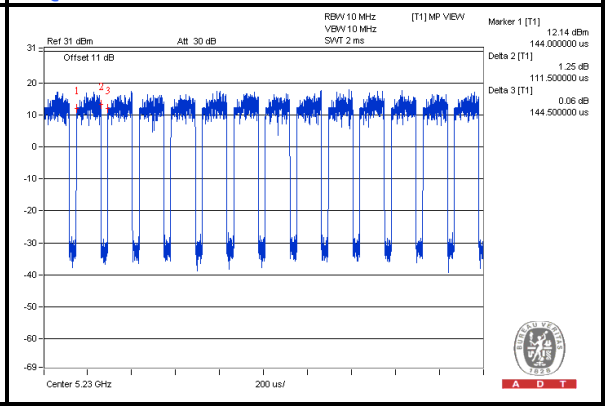
QPSK



16QAM



64QAM



3.5 DESCRIPTION OF SUPPORT UNITS

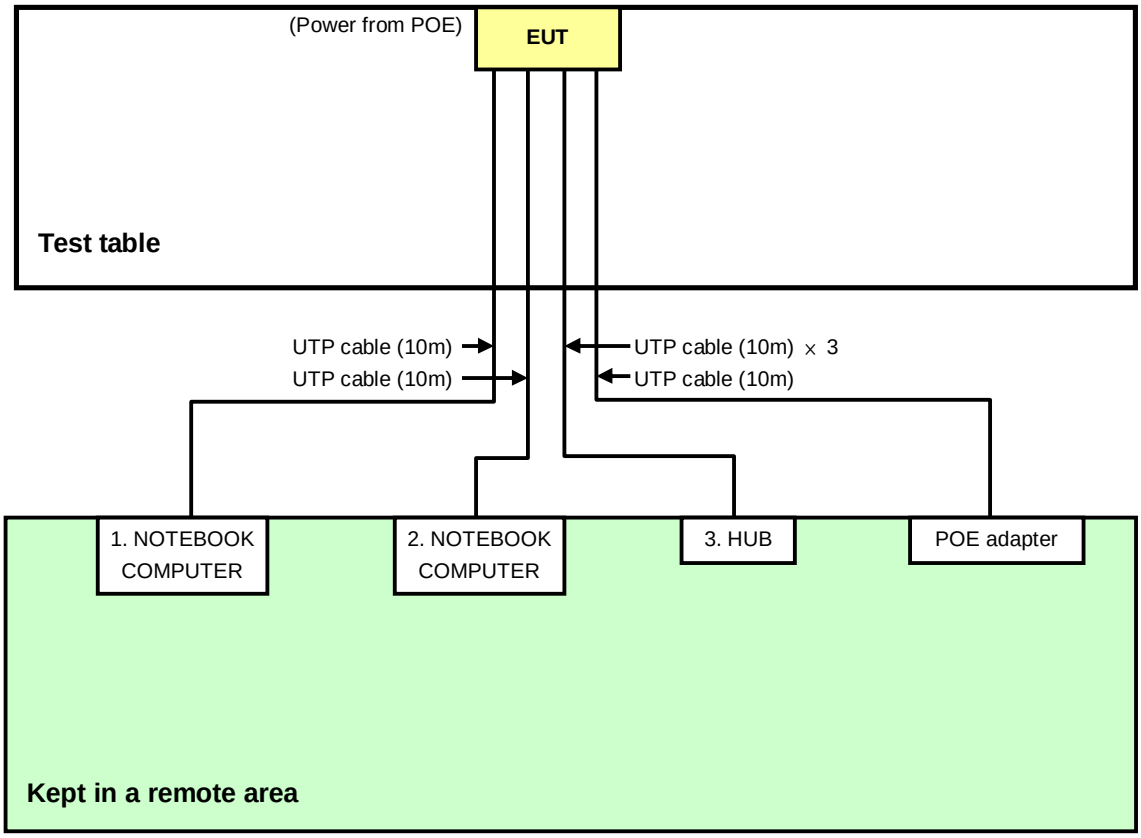
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	NOTEBOOK COMPUTER	DELL	PP32LA	FSLB32S	FCC DoC
2	NOTEBOOK COMPUTER	DELL	PP32LA	GSLB32S	FCC DoC
3	HUB	ZyXEL	ES-116P	S060H02000215	FCC DoC

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	UTP Cable (10m)
2	UTP Cable (10m)
3	UTP Cable (10m)

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

3.6 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 (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	100287	Feb. 28, 2013	Feb. 27, 2014
Line-Impedance Stabilization Network (for EUT) ROHDE & SCHWARZ	NSLK-8127	5127-523	Oct. 02, 2013	Oct. 01, 2014
Line-Impedance Stabilization Network (for Peripheral) ROHDE & SCHWARZ	ENV216	100071	Nov. 13, 2013	Nov. 12, 2014
RF Cable (JYEBAO)	5DFB	COACAB-001	May 27, 2013	May 26, 2014
50 ohms Terminator	50	3	Oct. 17, 2013	Oct. 16, 2014
50 ohms Terminator	N/A	EMC-04	Oct. 17, 2013	Oct. 16, 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. A.
3 The VCCI Con A Registration No. is C-817.
4. Tested Date: Jan. 06, 2014

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 level under (Limit – 20dB) was not recorded.

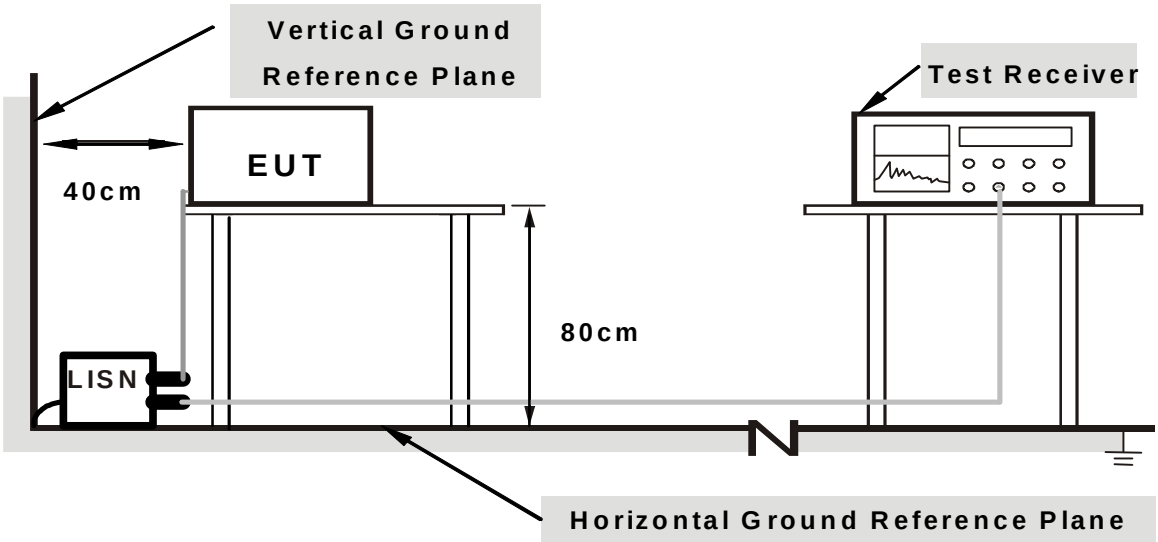
NOTE:

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 “artgui.exe[ver2.3]” to enable EUT under transmission/receiving condition continuously at specific channel frequency.

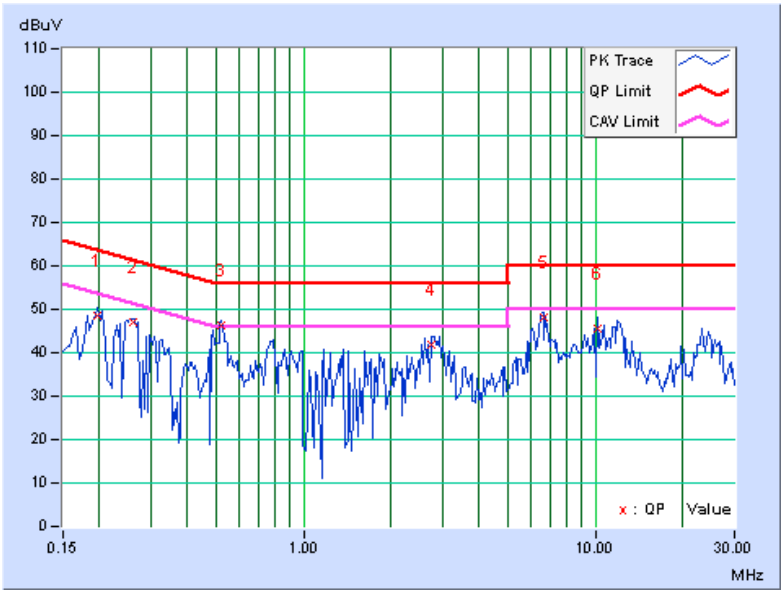
4.1.7 TEST RESULTS

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	0.19687	0.06	48.39	46.78	48.45	46.84	63.74	53.74	-15.29	-6.90
2	0.25938	0.07	46.92	46.45	46.99	46.52	61.45	51.45	-14.46	-4.93
3	0.52500	0.11	46.15	43.74	46.26	43.85	56.00	46.00	-9.74	-2.15
4	2.73828	0.23	41.67	33.19	41.90	33.42	56.00	46.00	-14.10	-12.58
5	6.62109	0.39	47.85	46.55	48.24	46.94	60.00	50.00	-11.76	-3.06
6	10.24519	0.46	45.18	43.79	45.64	44.25	60.00	50.00	-14.36	-5.75

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

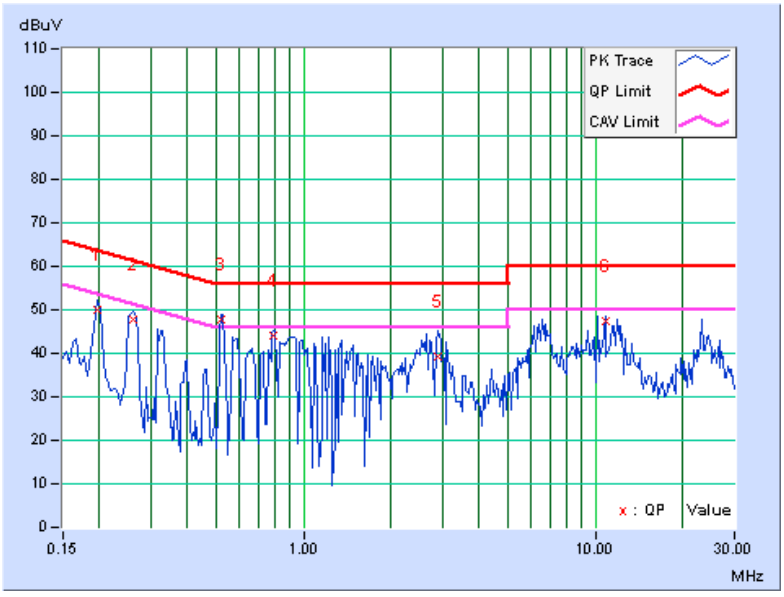


PHASE	Neutral (N)	DETECTOR FUNCTION	Quasi-Peak (QP) / Average (AV)

	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	0.19687	0.05	50.13	49.18	50.18	49.23	63.74	53.74	-13.56	-4.51
2	0.25938	0.07	47.62	46.79	47.69	46.86	61.45	51.45	-13.76	-4.59
3	**0.52541**	**0.12**	**47.75**	**45.29**	**47.87**	**45.41**	**56.00**	**46.00**	**-8.13**	**-0.59**
4	0.78478	0.13	43.82	41.74	43.95	41.87	56.00	46.00	-12.05	-4.13
5	2.89063	0.21	39.11	26.29	39.32	26.50	56.00	46.00	-16.68	-19.50
6	10.79297	0.48	47.09	45.30	47.57	45.78	60.00	50.00	-12.43	-4.22

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 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:

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 LIMITS OF UNWANTED EMISSION OUT OF THE RESTRICTED BANDS

APPLICABLE TO	LIMIT	
√	FIELD STRENGTH AT 3m (dBμV/m)	
	PK	AV
	74	54
	EIRP LIMIT (dBm)	EQUIVALENT FIELD STRENGTH AT 3m (dBμV/m)
	PK	PK
	-27	68.3

NOTE:

1. The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength:

$$E = \frac{1000000\sqrt{30P}}{3}$$ μV/m, where P is the eirp (Watts).

4.2.3 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-1000VH2B	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. 06, 2013	Oct. 05, 2014
Spectrum Analyzer R&S	FSV40	100964	July 15, 2013	July 14, 2014
Horn_Antenna AISI	AIH.8018	0000220091110	Nov. 27, 2012	Nov. 26, 2013
Pre-Amplifier Agilent	8449B	3008A01923	Oct. 29, 2013	Oct. 28, 2014
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. 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: Nov. 07, 2013

4.2.4 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:

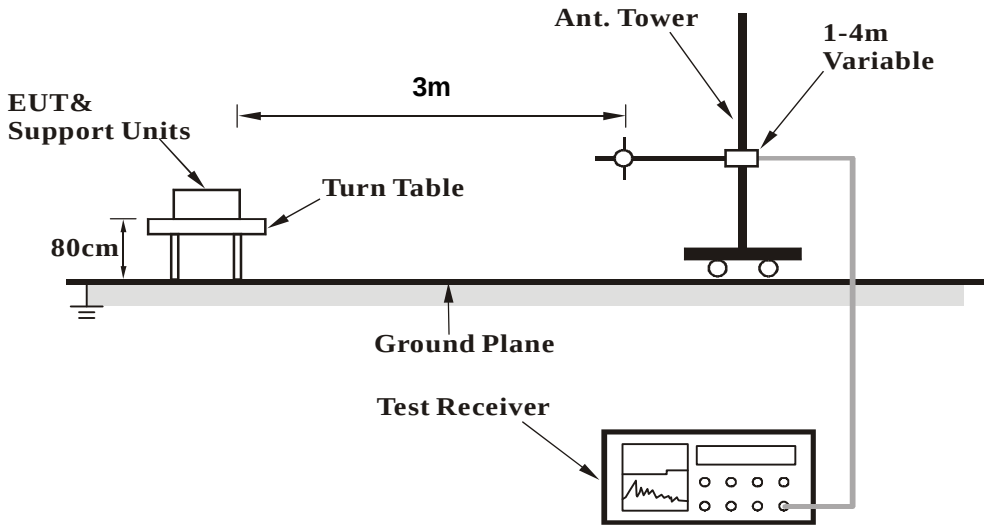
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.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

4.2.5 DEVIATION FROM TEST STANDARD

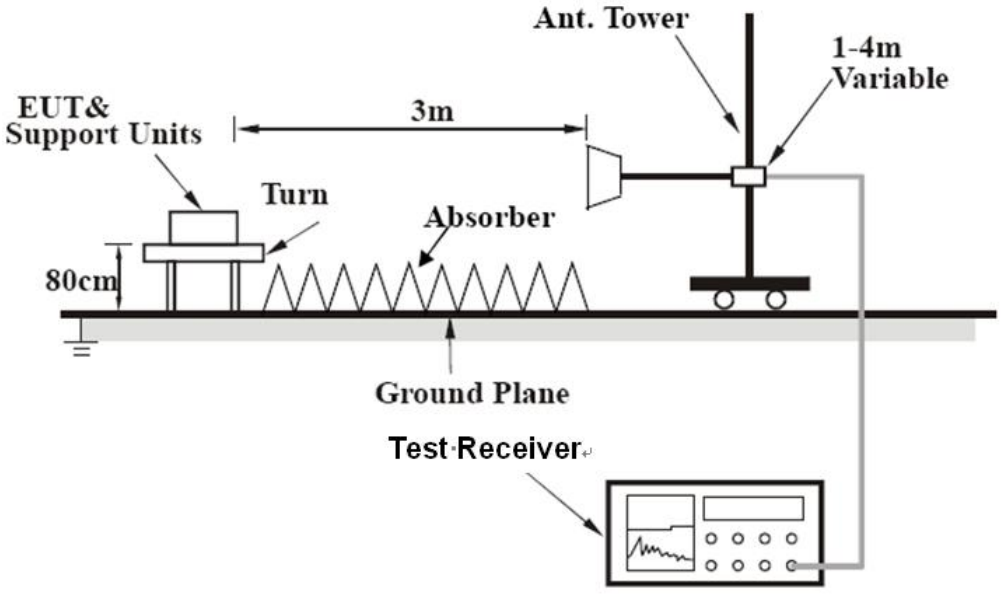
No deviation

4.2.6 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.

4.2.7 EUT OPERATING CONDITION

Same as 4.1.6

4.2.8 TEST RESULTS

BELOW 1GHz WORST-CASE DATA

802.11n (HT40)

CHANNEL	TX Channel 38	**DETECTOR FUNCTION**	Quasi-Peak (QP)
FREQUENCY RANGE	Below 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	87.81	35.5 QP	40.0	-4.5	1.52 H	238	54.07	-18.61
2	226.57	33.0 QP	46.0	-13.0	1.45 H	122	48.42	-15.39
3	500.01	42.1 QP	46.0	-3.9	1.31 H	287	49.16	-7.06
4	700.03	36.4 QP	46.0	-9.6	1.50 H	241	39.75	-3.32
5	899.99	35.8 QP	46.0	-10.2	1.00 H	143	35.32	0.44
6	1000.00	40.5 QP	54.0	-13.5	1.00 H	106	38.60	1.94
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	73.81	38.9 QP	40.0	-1.1	1.24 V	281	54.94	-16.03
2	500.01	40.8 QP	46.0	-5.2	1.00 V	106	47.82	-7.06
3	600.02	43.4 QP	46.0	-2.6	1.12 V	305	48.17	-4.80
4	700.03	37.1 QP	46.0	-8.9	1.00 V	106	40.45	-3.32
5	799.99	37.4 QP	46.0	-8.6	1.00 V	19	38.56	-1.13
6	899.99	38.5 QP	46.0	-7.5	1.50 V	225	38.06	0.44

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

802.11a

CHANNEL	TX Channel 36	**DETECTOR FUNCTION**	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 40GHz		

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	5000.00	58.1 PK	74.0	-15.9	1.36 H	243	14.83	43.27
2	5000.00	49.7 AV	54.0	-4.3	1.36 H	243	6.43	43.27
3	5149.00	71.2 PK	74.0	-2.8	1.36 H	249	27.63	43.57
4	5149.00	51.2 AV	54.0	-2.8	1.36 H	249	7.63	43.57
5	*5180.00	116.5 PK			1.36 H	249	72.86	43.64
6	*5180.00	107.0 AV			1.36 H	249	63.36	43.64
7	#10360.00	64.5 PK	74.0	-9.5	1.29 H	260	13.76	50.74
8	#10360.00	51.0 AV	54.0	-3.0	1.29 H	260	0.26	50.74
9	15540.00	64.3 PK	74.0	-9.7	1.00 H	203	8.24	56.06
10	15540.00	50.6 AV	54.0	-3.4	1.00 H	203	-5.46	56.06
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	5000.00	54.8 PK	74.0	-19.2	1.00 V	220	11.53	43.27
2	5000.00	44.3 AV	54.0	-9.7	1.00 V	220	1.03	43.27
3	5149.00	55.6 PK	74.0	-18.4	1.00 V	263	12.03	43.57
4	5149.00	43.5 AV	54.0	-10.5	1.00 V	263	-0.07	43.57
5	*5180.00	105.4 PK			1.00 V	263	61.76	43.64
6	*5180.00	95.5 AV			1.00 V	263	51.86	43.64
7	#10360.00	67.3 PK	74.0	-6.7	1.35 V	15	16.56	50.74
8	#10360.00	53.4 AV	54.0	-0.6	1.35 V	15	2.66	50.74
9	15540.00	62.8 PK	74.0	-11.2	1.15 V	51	6.74	56.06
10	15540.00	49.6 AV	54.0	-4.4	1.15 V	51	-6.46	56.06

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

CHANNEL	TX Channel 40	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		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	5000.00	58.1 PK	74.0	-15.9	1.34 H	243	14.83	43.27
2	5000.00	49.6 AV	54.0	-4.4	1.34 H	243	6.33	43.27
3	*5200.00	113.9 PK			1.34 H	245	70.22	43.68
4	*5200.00	103.9 AV			1.34 H	245	60.22	43.68
5	#10400.00	64.7 PK	74.0	-9.3	1.27 H	258	14.03	50.67
6	#10400.00	51.0 AV	54.0	-3.0	1.27 H	258	0.33	50.67
7	15600.00	64.9 PK	74.0	-9.1	1.00 H	206	8.89	56.01
8	15600.00	51.0 AV	54.0	-3.0	1.00 H	206	-5.01	56.01
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	5000.00	55.5 PK	74.0	-18.5	1.00 V	276	12.23	43.27
2	5000.00	45.2 AV	54.0	-8.8	1.00 V	276	1.93	43.27
3	*5200.00	105.6 PK			1.00 V	162	61.92	43.68
4	*5200.00	96.1 AV			1.00 V	162	52.42	43.68
5	#10400.00	67.6 PK	74.0	-6.4	1.26 V	84	16.93	50.67
6	#10400.00	53.2 AV	54.0	-0.8	1.26 V	84	2.53	50.67
7	15600.00	64.3 PK	74.0	-9.7	1.11 V	16	8.29	56.01
8	15600.00	51.1 AV	54.0	-2.9	1.11 V	16	-4.91	56.01

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

CHANNEL	TX Channel 48	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		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	5000.00	57.8 PK	74.0	-16.2	1.32 H	83	14.53	43.27
2	5000.00	49.3 AV	54.0	-4.7	1.32 H	83	6.03	43.27
3	*5240.00	113.6 PK			1.32 H	250	69.87	43.73
4	*5240.00	104.6 AV			1.32 H	250	60.87	43.73
5	#10480.00	61.0 PK	74.0	-13.0	1.30 H	267	9.97	51.03
6	#10480.00	47.8 AV	54.0	-6.2	1.30 H	267	-3.23	51.03
7	15720.00	66.7 PK	74.0	-7.3	1.00 H	212	10.82	55.88
8	15720.00	52.2 AV	54.0	-1.8	1.00 H	212	-3.68	55.88
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	5000.00	55.2 PK	74.0	-18.8	1.00 V	275	11.93	43.27
2	5000.00	44.9 AV	54.0	-9.1	1.00 V	275	1.63	43.27
3	*5240.00	104.4 PK			1.00 V	263	60.67	43.73
4	*5240.00	94.6 AV			1.00 V	263	50.87	43.73
5	#10480.00	64.8 PK	74.0	-9.2	1.39 V	91	13.77	51.03
6	#10480.00	52.5 AV	54.0	-1.5	1.39 V	91	1.47	51.03
7	15720.00	67.3 PK	74.0	-6.7	1.12 V	252	11.42	55.88
8	15720.00	53.2 AV	54.0	-0.8	1.12 V	252	-2.68	55.88

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
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

802.11n (HT20)

CHANNEL	TX Channel 36	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		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	5150.00	71.5 PK	74.0	-2.5	1.37 H	249	27.93	43.57
2	5150.00	47.6 AV	54.0	-6.4	1.37 H	249	4.03	43.57
3	*5180.00	116.3 PK			1.37 H	249	72.66	43.64
4	*5180.00	104.9 AV			1.37 H	249	61.26	43.64
5	#10360.00	59.2 PK	74.0	-14.8	1.48 H	177	8.46	50.74
6	#10360.00	46.5 AV	54.0	-7.5	1.48 H	177	-4.24	50.74
7	15540.00	65.6 PK	74.0	-8.4	1.02 H	177	9.54	56.06
8	15540.00	50.2 AV	54.0	-3.8	1.02 H	177	-5.86	56.06
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	5150.00	62.9 PK	74.0	-11.1	1.00 V	168	19.33	43.57
2	5150.00	48.5 AV	54.0	-5.5	1.00 V	168	4.93	43.57
3	*5180.00	104.3 PK			1.00 V	168	60.66	43.64
4	*5180.00	94.8 AV			1.00 V	168	51.16	43.64
5	#10360.00	67.7 PK	74.0	-6.3	1.29 V	10	16.96	50.74
6	#10360.00	51.4 AV	54.0	-2.6	1.29 V	10	0.66	50.74
7	15540.00	64.2 PK	74.0	-9.8	1.08 V	64	8.14	56.06
8	15540.00	53.2 AV	54.0	-0.8	1.08 V	64	-2.86	56.06

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

CHANNEL	TX Channel 40	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		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	*5200.00	117.7 PK			1.37 H	248	74.02	43.68
2	*5200.00	107.4 AV			1.37 H	248	63.72	43.68
3	#10400.00	64.3 PK	74.0	-9.7	1.43 H	176	13.63	50.67
4	#10400.00	51.1 AV	54.0	-2.9	1.43 H	176	0.43	50.67
5	15600.00	66.2 PK	74.0	-7.8	1.00 H	174	10.19	56.01
6	15600.00	50.5 AV	54.0	-3.5	1.00 H	174	-5.51	56.01
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	*5200.00	106.0 PK			1.01 V	175	62.32	43.68
2	*5200.00	96.7 AV			1.01 V	175	53.02	43.68
3	#10400.00	67.8 PK	74.0	-6.2	1.34 V	9	17.13	50.67
4	**#10400.00**	**53.7 AV**	**54.0**	**-0.3**	**1.34 V**	**9**	**3.03**	**50.67**
5	15600.00	65.4 PK	74.0	-8.6	1.09 V	66	9.39	56.01
6	15600.00	50.6 AV	54.0	-3.4	1.09 V	66	-5.41	56.01

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

CHANNEL	TX Channel 48	**DETECTOR FUNCTION**	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		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	*5240.00	117.0 PK			1.37 H	247	73.27	43.73
2	*5240.00	107.0 AV			1.37 H	247	63.27	43.73
3	#10480.00	63.7 PK	74.0	-10.3	1.48 H	177	12.67	51.03
4	#10480.00	50.6 AV	54.0	-3.4	1.48 H	177	-0.43	51.03
5	15720.00	66.1 PK	74.0	-7.9	1.06 H	186	10.22	55.88
6	15720.00	50.5 AV	54.0	-3.5	1.06 H	186	-5.38	55.88
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	*5240.00	105.5 PK			1.00 V	168	61.77	43.73
2	*5240.00	96.3 AV			1.00 V	168	52.57	43.73
3	#10480.00	66.1 PK	74.0	-7.9	1.17 V	105	15.07	51.03
4	#10480.00	53.2 AV	54.0	-0.8	1.17 V	105	2.17	51.03
5	15720.00	67.0 PK	74.0	-7.0	1.13 V	66	11.12	55.88
6	15720.00	53.3 AV	54.0	-0.7	1.13 V	66	-2.58	55.88

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
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

802.11n (HT40)

CHANNEL	TX Channel 38	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		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	5150.00	70.2 PK	74.0	-3.8	1.35 H	248	26.63	43.57
2	5150.00	53.5 AV	54.0	-0.5	1.35 H	248	9.93	43.57
3	*5190.00	111.0 PK			1.35 H	248	67.34	43.66
4	*5190.00	100.0 AV			1.35 H	248	56.34	43.66
5	#10380.00	51.6 PK	74.0	-22.4	1.53 H	266	0.89	50.71
6	#10380.00	38.8 AV	54.0	-15.2	1.53 H	266	-11.91	50.71
7	15570.00	53.9 PK	74.0	-20.1	1.13 H	217	-2.13	56.03
8	15570.00	41.9 AV	54.0	-12.1	1.13 H	217	-14.13	56.03
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	5150.00	66.3 PK	74.0	-7.7	1.00 V	166	22.73	43.57
2	5150.00	51.9 AV	54.0	-2.1	1.00 V	166	8.33	43.57
3	*5190.00	98.8 PK			1.00 V	166	55.14	43.66
4	*5190.00	88.5 AV			1.00 V	166	44.84	43.66
5	#10380.00	56.5 PK	74.0	-17.5	1.29 V	122	5.79	50.71
6	#10380.00	41.3 AV	54.0	-12.7	1.29 V	122	-9.41	50.71
7	15570.00	54.7 PK	74.0	-19.3	1.22 V	348	-1.33	56.03
8	15570.00	41.8 AV	54.0	-12.2	1.22 V	348	-14.23	56.03

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

CHANNEL	TX Channel 46	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		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	5141.00	72.2 PK	74.0	-1.8	1.36 H	248	28.64	43.56
2	5141.00	53.2 AV	54.0	-0.8	1.36 H	248	9.64	43.56
3	*5230.00	115.8 PK			1.36 H	248	72.08	43.72
4	*5230.00	105.3 AV			1.36 H	248	61.58	43.72
5	#10460.00	62.5 PK	74.0	-11.5	1.31 H	269	11.56	50.94
6	#10460.00	50.0 AV	54.0	-4.0	1.31 H	269	-0.94	50.94
7	15690.00	69.1 PK	74.0	-4.9	1.00 H	177	13.18	55.92
8	**15690.00**	**53.7 AV**	**54.0**	**-0.3**	**1.00 H**	**177**	**-2.22**	**55.92**
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	5141.00	60.4 PK	74.0	-13.6	1.00 V	167	16.84	43.56
2	5141.00	47.4 AV	54.0	-6.6	1.00 V	167	3.84	43.56
3	*5230.00	103.4 PK			1.00 V	167	59.68	43.72
4	*5230.00	93.4 AV			1.00 V	167	49.68	43.72
5	#10460.00	65.1 PK	74.0	-8.9	1.37 V	126	14.16	50.94
6	#10460.00	51.5 AV	54.0	-2.5	1.37 V	126	0.56	50.94
7	15690.00	57.6 PK	74.0	-16.4	1.18 V	1	1.68	55.92
8	15690.00	46.8 AV	54.0	-7.2	1.18 V	1	-9.12	55.92

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

4.3 TRANSMIT POWER MEASUREMENT

4.3.1 LIMITS OF TRANSMIT POWER MEASUREMENT

FREQUENCY BAND	LIMIT
5.150 ~ 5.250GHz	The lesser of 50mW (17dBm) or 4dBm + 10logB
5.250 ~ 5.350GHz	The lesser of 250mW (24dBm) or 11dBm + 10logB
5.470 ~ 5.725GHz	The lesser of 250mW (24dBm) or 11dBm + 10logB

NOTE: Where B is the 26dB emission bandwidth in MHz.

Per KDB 662911 D01 Multiple Transmitter Output Method of conducted output power measurement on IEEE 802.11 devices,

Array Gain = 0 dB (i.e., no array gain) for NANT ≤ 4;

Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any NANT;

Array Gain = 5 log(NANT/NSS) dB or 3 dB, whichever is less for 20-MHz channel widths with NANT ≥ 5.

For power measurements on all other devices: Array Gain = 10 log(NANT/NSS) dB.

4.3.2 TEST INSTRUMENTS

FOR POWER OUTPUT MEASUREMENT

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Power meter Anritsu	ML2495A	0824006	May 20, 2013	May 19, 2014
Power sensor Anritsu	MA2411B	0738172	May 20, 2013	May 19, 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 : Feb. 19, 2014

FOR 26dB OCCUPIED BANDWIDTH

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer R&S	FSP 40	100036	Jan. 21, 2014	Jan. 20, 2015

Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. Tested date : Jan. 21, 2014

4.3.3 TEST PROCEDURE

FOR POWER OUTPUT MEASUREMENT

Method PM is used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of TX on burst. Duty factor is not added to measured value.

FOR 26dB OCCUPIED BANDWIDTH

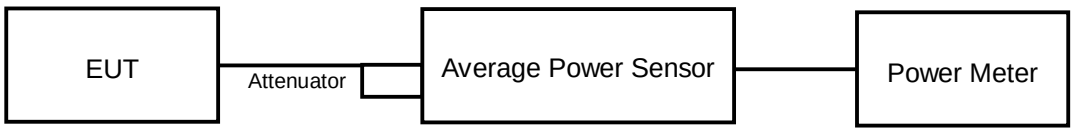
1. Set RBW = approximately 1% of the emission bandwidth.
2. Set the VBW > RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

4.3.4 DEVIATION FROM TEST STANDARD

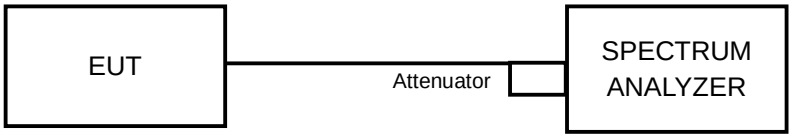
No deviation

4.3.5 TEST SETUP

FOR POWER OUTPUT MEASUREMENT



FOR 26dB OCCUPIED BANDWIDTH



4.3.6 EUT OPERATING CONDITIONS

The software provided by client to enable the EUT under transmission condition continuously at specific channel frequencies individually.

4.3.7 TEST RESULTS

802.11a

POWER OUTPUT:

CHAN.	CHAN. FREQ. (MHz)	AVERAGE POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)	POWER LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1				
36	5180	13.14	11.24	33.911	15.30	17	PASS
40	5200	13.02	11.31	33.566	15.26	17	PASS
48	5240	12.73	11.67	33.439	15.24	17	PASS

26dB OCCUPIED BANDWIDTH:

CHANNEL	CHANNEL FREQUENCY (MHz)	26dBc BANDWIDTH (MHz)	
		CHAIN 0	CHAIN 1
36	5180	23.09	22.20
40	5200	23.12	22.23
48	5240	22.72	22.37

Note: For FCC output power limitation is determined based on 26dBc bandwidth.

Power Limit = 4dBm + 10logB < UNII Band 1>			
Channel Number	Freq.(MHz)	Min. B(MHz)	Determined Conducted Limit (dBm)
36	5180	22.20	17.46 > 17
40	5200	22.23	17.46 > 17
48	5240	22.37	17.49 > 17

802.11n (HT20)

POWER OUTPUT:

CHAN.	CHAN. FREQ. (MHz)	AVERAGE POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)	POWER LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1				
36	5180	13.11	11.32	34.016	15.32	17	PASS
40	5200	13.04	11.34	33.751	15.28	17	PASS
48	5240	13.03	11.64	34.679	15.40	17	PASS

26dB OCCUPIED BANDWIDTH:

CHANNEL	CHANNEL FREQUENCY (MHz)	26dBc BANDWIDTH (MHz)	
		CHAIN 0	CHAIN 1
36	5180	24.15	23.09
40	5200	24.12	23.78
48	5240	23.78	23.08

Note: For FCC output power limitation is determined based on 26dBc bandwidth.

Power Limit = 4dBm + 10logB < UNII Band 1>			
Channel Number	Freq.(MHz)	Min. B(MHz)	Determined Conducted Limit (dBm)
36	5180	23.09	17.63 > 17
40	5200	23.78	17.76 > 17
48	5240	23.08	17.63 > 17

802.11n (HT40)

POWER OUTPUT:

CHAN.	CHAN. FREQ. (MHz)	AVERAGE POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)	POWER LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1				
38	5190	14.62	12.60	47.170	16.74	17	PASS
46	5230	14.20	12.90	45.801	16.61	17	PASS

26dB OCCUPIED BANDWIDTH:

CHANNEL	CHANNEL FREQUENCY (MHz)	26dBc BANDWIDTH (MHz)	
		CHAIN 0	CHAIN 1
38	5190	49.78	48.95
46	5230	51.21	48.78

Note: For FCC output power limitation is determined based on 26dBc bandwidth.

Power Limit = 4dBm + 10logB < UNII Band 1>			
Channel Number	Freq.(MHz)	Min. B(MHz)	Determined Conducted Limit (dBm)
38	5190	48.95	20.89 > 17
46	5230	48.78	20.88 > 17

4.4 PEAK POWER SPECTRAL DENSITY MEASUREMENT

4.4.1 LIMITS OF PEAK POWER SPECTRAL DENSITY MEASUREMENT

FREQUENCY BAND	LIMIT
5.15 ~ 5.25GHz	4dBm
5.25 ~ 5.35GHz	11dBm
5.47 – 5.725GHz	11dBm
5.725 ~ 5.825GHz	17dBm

4.4.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer R&S	FSP40	100036	Jan. 21, 2014	Jan. 20, 2015

Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. Tested date : Jan. 21, 2014

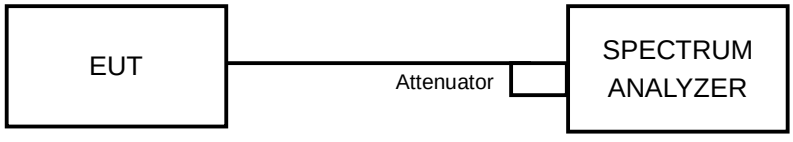
4.4.3 TEST PROCEDURES

1. Set span to encompass the entire emission bandwidth (EBW) of the signal.
2. Set RBW = 1 MHz, Set VBW ≥ 3 MHz, Detector = RMS
3. Sweep time = auto, trigger set to “free run”.
4. Trace average at least 100 traces in power averaging mode.
5. Record the max value and for duty cycle of test signal is < 98% add 10 log (1/duty cycle)

4.4.4 DEVIATION FROM TEST STANDARD

No deviation

4.4.5 TEST SETUP



4.4.6 EUT OPERATING CONDITIONS

Same as 4.3.6

4.4.7 TEST RESULTS

802.11a

CHANNEL	CHANNEL FREQUENCY (MHz)	PSD (dBm)		TOTAL POWER DENSITY (dBm)	MAX. LIMIT (dBm)	PASS/FAIL
		CHAIN 0	CHAIN 1			
36	5180	1.52	-0.78	3.67	4	PASS
40	5200	1.51	-0.45	3.79	4	PASS
48	5240	1.50	-0.42	3.80	4	PASS

NOTE:
1. Method a) of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
2. Directional gain = 10 log[$(10^{G1/20} + 10^{G2/20})^2$ / 2] = 5.97dBi < 6dBi , so the power density limit shall not be reduced.

802.11n (HT20)

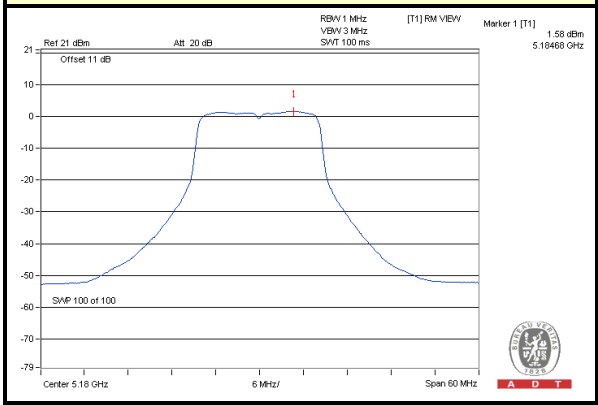
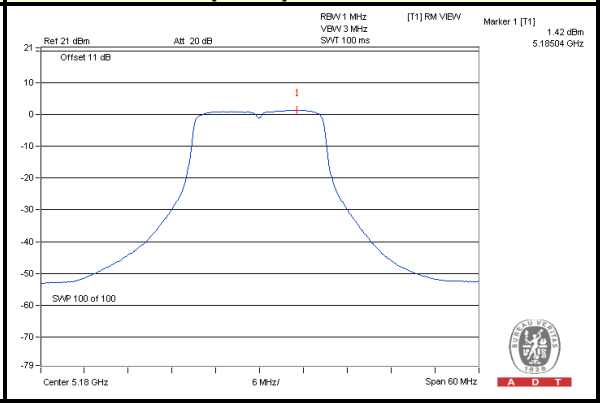
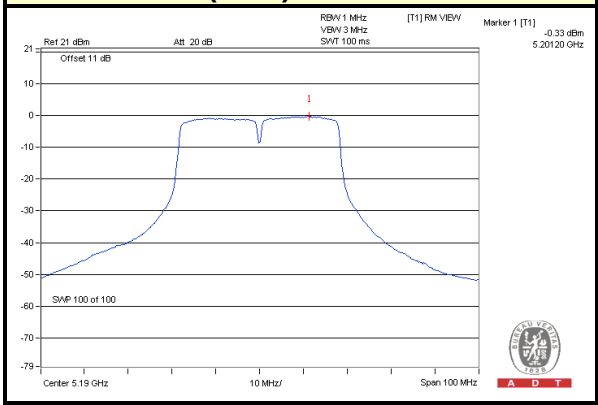
CHANNEL	CHANNEL FREQUENCY (MHz)	PSD (dBm)		TOTAL POWER DENSITY (dBm)	MAX. LIMIT (dBm)	PASS/FAIL
		CHAIN 0	CHAIN 1			
36	5180	1.42	-0.50	3.75	4	PASS
40	5200	1.22	-0.61	3.58	4	PASS
48	5240	1.25	-0.88	3.49	4	PASS

NOTE:
1. Method a) of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
2. Directional gain = 10 log[$(10^{G1/20} + 10^{G2/20})^2$ / 2] = 5.97dBi < 6dBi , so the power density limit shall not be reduced.

802.11n (HT40)

CHANNEL	CHANNEL FREQUENCY (MHz)	PSD (dBm)		TOTAL POWER DENSITY (dBm)	MAX. LIMIT (dBm)	PASS/FAIL
		CHAIN 0	CHAIN 1			
38	5190	-0.33	-2.30	2.04	4	PASS
46	5230	-0.70	-2.24	1.84	4	PASS

NOTE:
1. Method a) of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
2. Directional gain = 10 log[$(10^{G1/20} + 10^{G2/20})^2$ / 2] = 5.97dBi < 6dBi , so the power density limit shall not be reduced.

SPECTRUM PLOT OF WORST VALUE	
802.11a / Chain 0 / CH36	**802.11n (HT20) / Chain 0 / CH36**
	
802.11n (HT40) / Chain 0 / CH38	
	

4.5 PEAK POWER EXCURSION MEASUREMENT

4.5.1 LIMITS OF PEAK POWER EXCURSION MEASUREMENT

Shall not exceed 13 dB

4.5.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer R&S	FSP 40	100036	Jan. 21, 2014	Jan. 20, 2015

Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. Tested date : Jan. 21, 2014

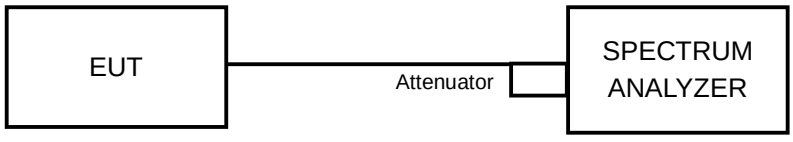
4.5.3 TEST PROCEDURE

1. Set RBW = 1 MHz, VBW ≥ 3 MHz, Detector = peak.
2. Trace mode = max-hold. Allow the sweeps to continue until the trace stabilizes.
3. Use the peak search function to find the peak of the spectrum.
4. Measure the PPSD.
5. Compute the ratio of the maximum of the peak-max-hold spectrum to the PPSD.

4.5.4 DEVIATION FROM TEST STANDARD

No deviation

4.5.5 TEST SETUP



4.5.6 EUT OPERATING CONDITIONS

The software provided by client to enable the EUT under transmission condition continuously at specific channel frequencies individually.

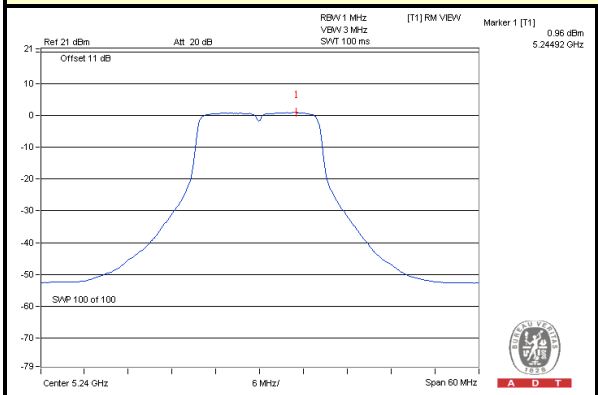
4.5.7 TEST RESULTS

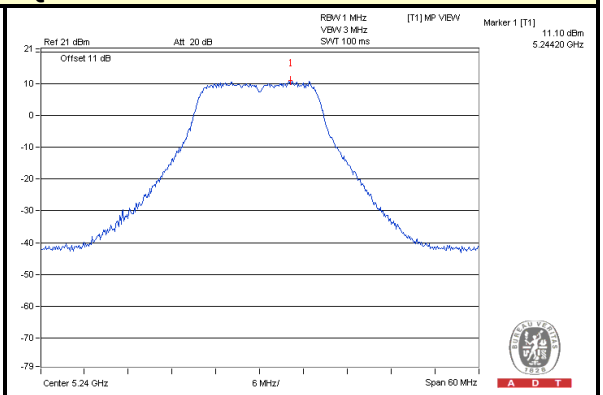
MODULATION MODE	MODULATION TYPE	CHAN. FREQ. (MHz)	PEAK VALUE (dBm)	PPSD WITHOUT DUTY FACTOR (dBm)	PPSD WITH DUTY FACTOR (dBm)	PEAK EXCURSION (dB)	LIMIT (dB)	PASS /FAIL
802.11a	BPSK	5240	10.68	1.5	1.64	9.04	13	PASS
	QPSK		11.1	0.96	1.25	9.85	13	PASS
	16QAM		10.74	0.72	1.26	9.48	13	PASS
	64QAM		10.7	0.31	1.29	9.41	13	PASS
802.11n (HT20)	BPSK	5240	10.14	1.25	1.42	8.72	13	PASS
	QPSK		10.7	0.77	1.07	9.63	13	PASS
	16QAM		10.55	0.3	0.83	9.72	13	PASS
	64QAM		11.45	0.16	1.08	10.37	13	PASS
802.11n (HT40)	BPSK	5230	8.24	-0.7	-0.47	8.71	13	PASS
	QPSK		8.67	-1.3	-0.89	9.56	13	PASS
	16QAM		9.68	-1.38	-0.7	10.38	13	PASS
	64QAM		9.47	-1.3	-0.18	9.65	13	PASS

NOTE: 1. Refer to section 3.4 for duty cycle spectrum plot.

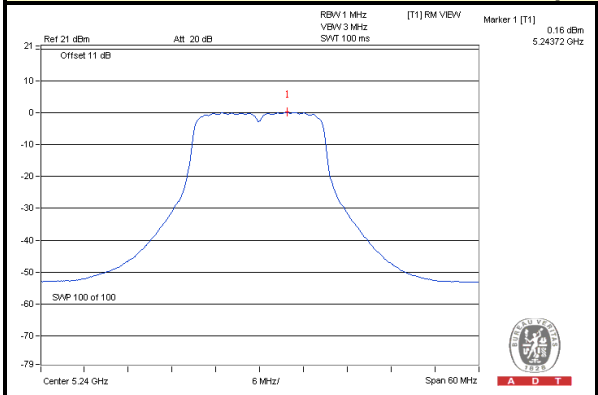
SPECTRUM PLOT OF WORST VALUE

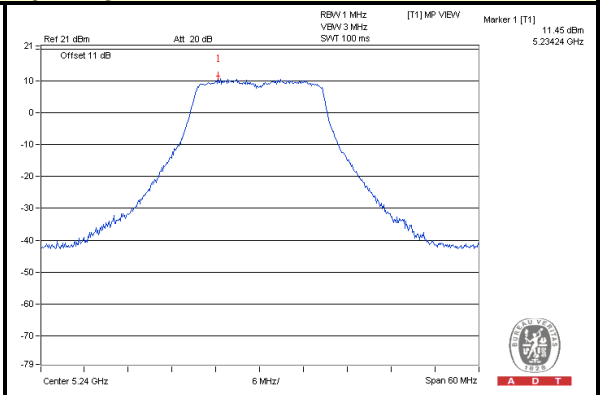
802.11a / QPSK



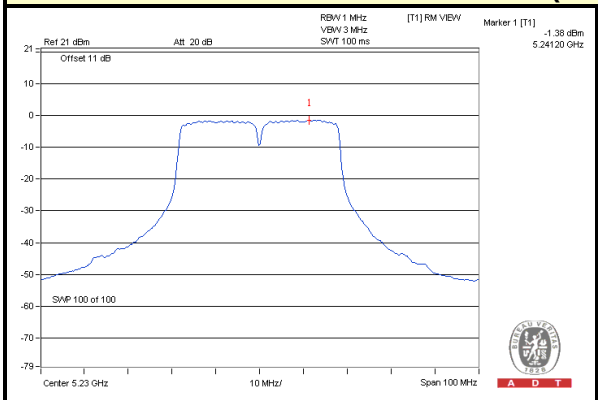


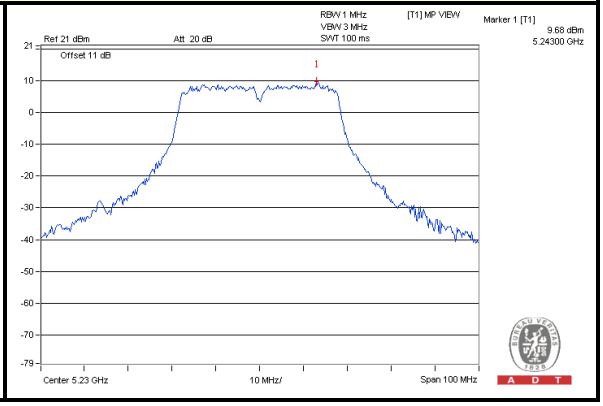
802.11n (HT20) / 64QAM





802.11n (HT40) / 16QAM





4.6 FREQUENCY STABILITY

4.6.1 LIMITS OF FREQUENCY STABILITY MEASUREMENT

The frequency of the carrier signal shall be maintained within band of operation

4.6.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer R&S	FSP 40	100036	Jan. 21, 2014	Jan. 20, 2015
Temperature & Humidity Chamber GIANTFORCE	GTH-150-40 -SP-AR	MAA0812-008	Jan. 13, 2014	Jan. 12, 2015

Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. Tested date : Jan. 21, 2014

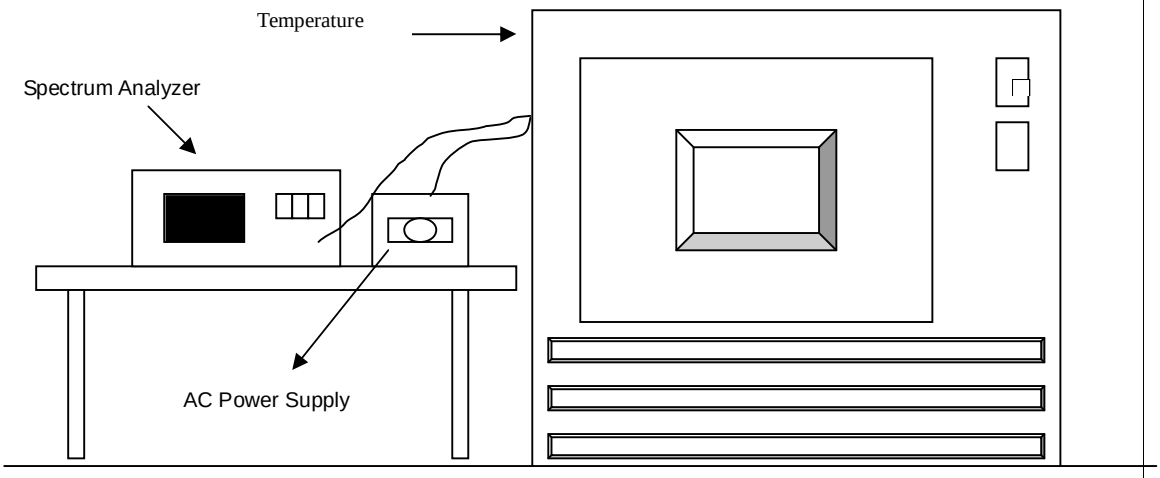
4.6.3 TEST PROCEDURE

1. The EUT was placed inside the environmental test chamber and powered by nominal AC voltage.
2. Turn the EUT on and couple its output to a spectrum analyzer.
3. Turn the EUT off and set the chamber to the highest temperature specified.
4. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT on and measure the operating frequency after 2, 5, and 10 minutes.
5. Repeat step 2 and 3 with the temperature chamber set to the lowest temperature.
6. The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record.

4.6.4 DEVIATION FROM TEST STANDARD

No deviation

4.6.5 TEST SETUP



4.6.6 EUT OPERATING CONDITION

Set the EUT transmit at un-modulation mode to test frequency stability.

4.6.7 TEST RESULTS

FREQUEMCY STABILITY VERSUS TEMP.									
OPERATING FREQUENCY: 5240MHz									
TEMP. (℃)	POWER SUPPLY (Vac)	0 MINUTE		2 MINUTE		5 MINUTE		10 MINUTE	
		Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift
		(MHz)	%	(MHz)	%	(MHz)	%	(MHz)	%
50	120	5239.9811	-0.00036	5239.9859	-0.00027	5239.9832	-0.00032	5239.9838	-0.00031
40	120	5239.9793	-0.00040	5239.9764	-0.00045	5239.9835	-0.00031	5239.9828	-0.00033
30	120	5239.9762	-0.00045	5239.9768	-0.00044	5239.9799	-0.00038	5239.9716	-0.00054
20	120	5239.9788	-0.00040	5239.9759	-0.00046	5239.9754	-0.00047	5239.9702	-0.00057
10	120	5239.9788	-0.00040	5239.9788	-0.00040	5239.9765	-0.00045	5239.977	-0.00044
0	120	5239.9737	-0.00050	5239.9774	-0.00043	5239.9692	-0.00059	5239.9728	-0.00052
-10	120	5240.0069	0.00013	5240.0056	0.00011	5240.0052	0.00010	5240.0085	0.00016
-20	120	5239.9804	-0.00037	5239.98	-0.00038	5239.9838	-0.00031	5239.979	-0.00040
-30	120	5239.999	-0.00002	5240.0034	0.00006	5239.997	-0.00006	5240.0066	0.00013

FREQUEMCY STABILITY VERSUS VOLTAGE									
OPERATING FREQUENCY: 5240MHz									
TEMP. (℃)	POWER SUPPLY (Vac)	0 MINUTE		2 MINUTE		5 MINUTE		10 MINUTE	
		Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift
		(MHz)	%	(MHz)	%	(MHz)	%	(MHz)	%
20	138	5239.9797	-0.00039	5239.976	-0.00046	5239.9751	-0.00048	5239.9699	-0.00057
	120	5239.9788	-0.00040	5239.9759	-0.00046	5239.9754	-0.00047	5239.9702	-0.00057
	102	5239.9794	-0.00039	5239.9762	-0.00045	5239.9755	-0.00047	5239.9694	-0.00058

5. PHOTOGRAPHS OF THE TEST CONFIGURATION

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

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:

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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.

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.

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