

FCC TEST REPORT

(15.247_15.4)

REPORT NO.: RF150213C01-2 R1

MODEL NO.: 06A (battery only SKU), 06C
(Line Voltage SKU)

FCC ID: ZQAS30

RECEIVED: Feb. 13, 2015

TESTED: Feb. 25, 2015 ~ Apr. 14, 2015

ISSUED: Apr. 15, 2015

APPLICANT: Nest Labs Inc.

ADDRESS: 3400 Hillview Ave. Palo Alto California, United States
94304

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

LAB ADDRESS: No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist.,
New Taipei City, Taiwan, R.O.C.

TEST LOCATION: No.19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan
Dist., Taoyuan City 33383, TAIWAN (R.O.C.)

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RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RF150213C01-2	Original release	Mar. 20, 2015
RF150213C01-2 R1	1. Add sample B: battery only SKU test data 2. Revise the section 4.1.3 note 4 (p.15) 3. Update the section 3.1 note 1 description	Apr. 15, 2015



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1. CERTIFICATION

PRODUCT: Wireless Protect

MODEL NO.: 06A (battery only SKU), 06C (Line Voltage SKU)

APPLICANT: Nest Labs Inc.

TESTED: Feb. 25, 2015 ~ Apr. 14, 2015

TEST SAMPLE: Identical Prototype

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

ANSI C63.10-2009

The above equipment (model: 06A (battery only SKU), 06C (Line Voltage SKU)) 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 : Evonne Liu , **DATE :** Apr. 15, 2015
Evonne Liu / Specialist

APPROVED BY : Sam Chen , **DATE :** Apr. 15, 2015
Sam Chen / Senior Project Engineer

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 -17.08dB at 0.54491MHz.
15.205 & 209	Radiated Emissions	PASS	Meet the requirement of limit. Minimum passing margin is -0.19dB at 2483.66MHz.
15.247(d)	Band Edge Measurement	PASS	Meet the requirement of limit.
15.247(d)	Antenna Port Emission	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:

MEASUREMENT	FREQUENCY	UNCERTAINTY
Conducted emissions	150kHz~30MHz	2.44 dB
Radiated emissions	30MHz ~ 200MHz	3.59 dB
	200MHz ~1000MHz	3.60 dB
	1GHz ~ 18GHz	2.29 dB
	18GHz ~ 40GHz	2.29 dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k = 2$.

3. GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

EUT	Wireless Protect
MODEL NO.	06A (battery only SKU), 06C (Line Voltage SKU)
MODULATION TYPE	O-QPSK
MODULATION TECHNOLOGY	DSSS
TRANSFER RATE	250kbps
OPERATING FREQUENCY	2405 ~ 2475MHz
NUMBER OF CHANNEL	15
OUTPUT POWER	94.624mW
ANTENNA TYPE / PEAK GAIN	Inverted-F antenna with -0.96dBi gain
ANTENNA CONNECTOR	NA
DATA CABLE	Refer to Note as below
I/O PORTS	Refer to user's manual
ACCESSORY DEVICES	Refer to Note as below

NOTE:

1. The EUT has two configurations as below.

Sample	Model Name	Description
A	06C	06C is powered by AC line and backed up by battery
B	06A	06A is power by battery only

2. The above EUT information is 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

15 channels are provided to this EUT:

CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)
11	2405	15	2425	19	2445	23	2465
12	2410	16	2430	20	2450	24	2470
13	2415	17	2435	21	2455	25	2475
14	2420	18	2440	22	2460		

3.2.1 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE $\geq$ 1G	RE<1G	PLC	APCM	
A	√	√	√	√	Sample A: Line Voltage SKU
B	√	√	-	-	Sample B: battery only SKU

Where **RE $\geq$ 1G**: Radiated Emission above 1GHz

RE<1G: Radiated Emission below 1GHz

PLC: Power Line Conducted Emission

APCM: Antenna Port Conducted Measurement

NOTE: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **X-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 TECHNOLOGY	MODULATION TYPE
A	11 to 25	11, 17, 25	DSSS	O-QPSK
B	11 to 25	25	DSSS	O-QPSK

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 TECHNOLOGY	MODULATION TYPE
A, B	11 to 25	25	DSSS	O-QPSK

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 TECHNOLOGY	MODULATION TYPE
A	11 to 25	25	DSSS	O-QPSK

BANDEDGE 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 TECHNOLOGY	MODULATION TYPE
A	11 to 25	11, 25	DSSS	O-QPSK

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 TECHNOLOGY	MODULATION TYPE
A	11 to 25	11, 17, 25	DSSS	O-QPSK

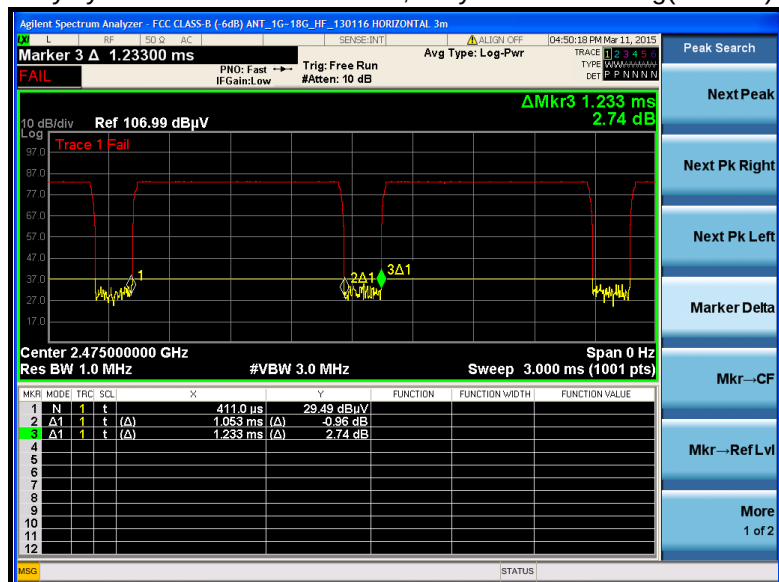
TEST CONDITION:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE≥1G	26deg. C, 64%RH	120Vac, 60Hz	Toby Tian
RE<1G	26deg. C, 64%RH	120Vac, 60Hz	Toby Tian
PLC	26deg. C, 64%RH	120Vac, 60Hz	Anson Lin
APCM	25deg. C, 60%RH	120Vac, 60Hz	Taylor Liu

3.3 DUTY CYCLE OF TEST SIGNAL

If duty cycle is < 98%

Duty cycle = $1.053/1.233 = 0.854$, Duty factor = $10 * \log(1/0.854) = 0.68$



3.4 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.

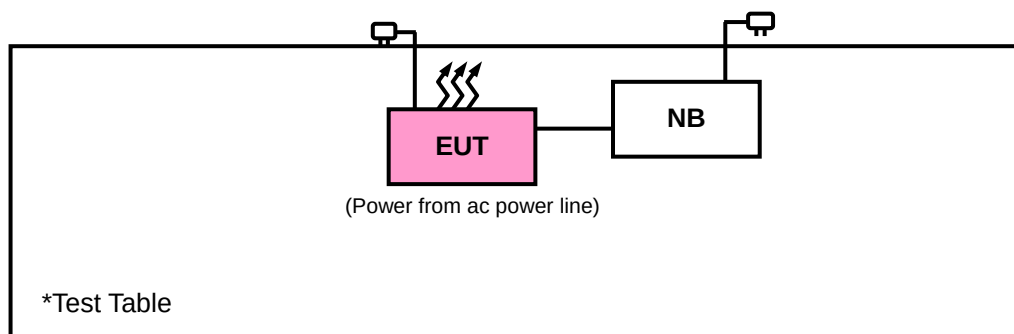
NO.	PRODUCT	MODEL NO.	SERIAL NO.	FCC ID
1	NB	N/A	N/A	N/A

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	N/A

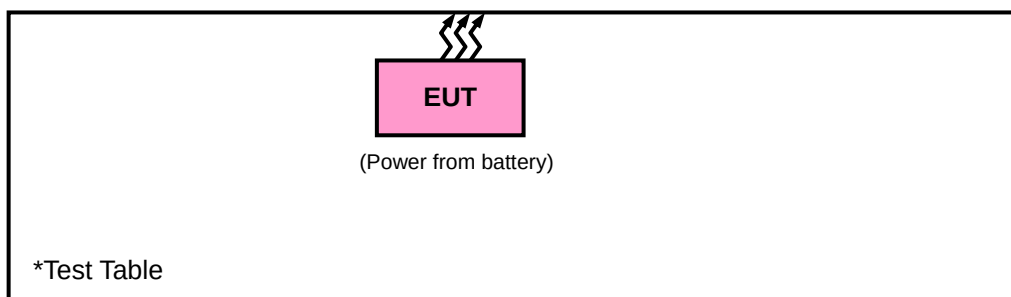
NOTE: All power cords of the above support units are non shielded (1.8m).

3.4.1 CONFIGURATION OF SYSTEM UNDER TEST

MODE A



MODE B



3.5 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 v03r02

ANSI C63.10-2009

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

NOTE: The EUT is also considered as a kind of computer peripheral, because the connection to computer is necessary for typical use. It has been verified to comply with the requirements of FCC Part 15, Subpart B, Class B (DoC). The test report has been issued separately.

4. TEST TYPES AND RESULTS

4.1 RADIATED EMISSION AND BANDEDGE MEASUREMENT

4.1.1 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.

4.1.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
Test Receiver Agilent	N9038A	MY52260177	May 19, 2014	May 18, 2015
Spectrum Analyzer Agilent	N9010A	MY52220314	Sep. 03, 2014	Sep. 02, 2015
Spectrum Analyzer ROHDE & SCHWARZ	FSU43	101261	Dec. 10, 2014	Dec. 09, 2015
BILOG Antenna SCHWARZBECK	VULB9168	9168-472	Feb. 05, 2015	Feb. 04, 2016
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-969	Feb. 10, 2015	Feb. 09, 2016
HORN Antenna SCHWARZBECK	BBHA 9170	9170-480	Aug. 27, 2014	Aug. 26, 2015
Preamplifier EMCI	EMC 012645	980115	Dec. 12, 2014	Dec. 11, 2015
Preamplifier EMCI	EMC 184045	980116	Jan. 09, 2015	Jan. 08, 2016
Preamplifier EMCI	EMC 330H	980112	Dec. 27, 2014	Dec. 26, 2015
Power Meter Anritsu	ML2495A	1232002	Sep. 17, 2014	Sep. 16, 2015
Power Sensor Anritsu	MA2411B	1207325	Sep. 17, 2014	Sep. 16, 2015
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	309219/4 2950114	Oct. 18, 2014	Oct. 17, 2015
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	250130/4	Oct. 18, 2014	Oct. 17, 2015
RF Coaxial Cable Worken	8D-FB	Cable-Ch10-01	Nov. 07, 2014	Nov. 06, 2015
Software BV ADT	E3 6.120103	NA	NA	NA
Antenna Tower MF	MFA-440H	NA	NA	NA
Turn Table MF	MFT-201SS	NA	NA	NA
Antenna Tower & Turn Table Controller MF	MF-7802	NA	NA	NA
Power Meter	ML2495A	1232002	Sep. 17, 2014	Sep. 16, 2015
Power Sensor	MA2411B	1207325	Sep. 17, 2014	Sep. 16, 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. The calibration interval of the loop antenna is 24 months and the calibrations are traceable to NML/ROC and NIST/USA.
 3. The test was performed in HwaYa Chamber 10.
 4. The horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
 5. The FCC Site Registration No. is 690701.
 6. The IC Site Registration No. is IC 7450F-10.

4.1.3 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:

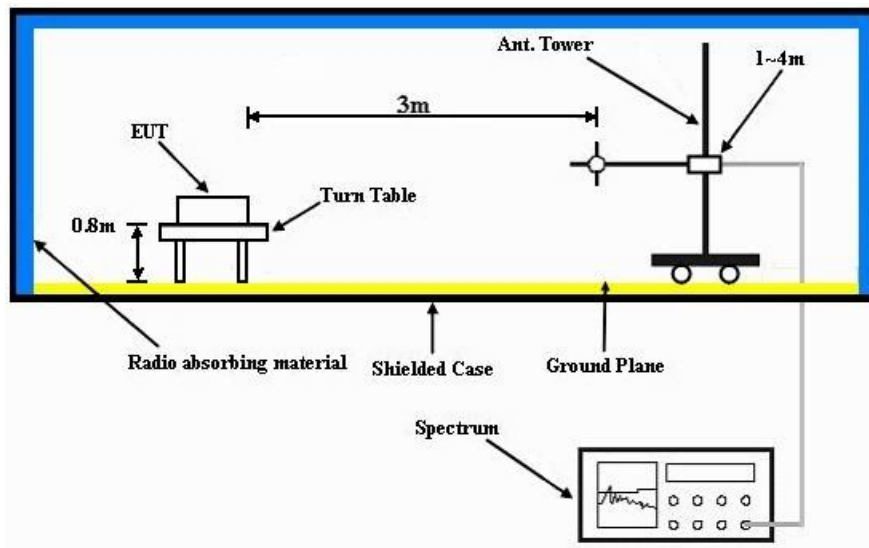
1. For emission measurements above 1 GHz, the EUT shall be placed at a height of 1.5 m above the ground at 3 meter chamber room for test
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
4. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 2Hz for Average detection (AV) at frequency above 1GHz.
5. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 DEVIATION FROM TEST STANDARD

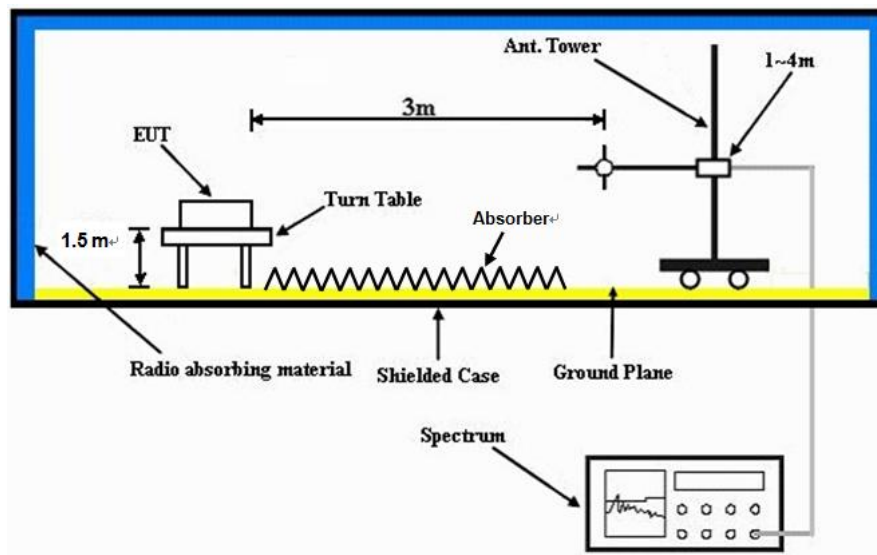
No deviation.

4.1.5 TEST SETUP

Frequency range 30MHz~1GHz



Frequency Range above 1GHz



For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.1.6 EUT OPERATING CONDITIONS

- a. Placed the EUT on a testing table.
- b. Use the software to control the EUT under transmission condition continuously at specific channel frequency.

4.1.7 TEST RESULTS

MODE A

ABOVE 1GHz WORST-CASE DATA :

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 11	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	26deg. C, 64%RH	TESTED BY	Toby Tian

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2390	45.44	52.51	54	-8.56	26.91	3.54	37.52	109	193	Average
2390	61.47	68.54	74	-12.53	26.91	3.54	37.52	109	193	Peak
2405	100.43	107.45			26.96	3.54	37.52	109	193	Average
2405	116.46	123.48			26.96	3.54	37.52	109	193	Peak
2498	39.59	46.02	54	-14.41	27.2	3.62	37.25	109	193	Average
2498	55.62	62.05	74	-18.38	27.2	3.62	37.25	109	193	Peak
4810	26.9	43.28	54	-27.1	30.97	5.75	53.1	100	175	Average
4810	42.93	59.31	74	-31.07	30.97	5.75	53.1	100	175	Peak
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2390	41.05	48.12	54	-12.95	26.91	3.54	37.52	110	291	Average
2390	57.08	64.15	74	-16.92	26.91	3.54	37.52	110	291	Peak
2405	92.59	99.61			26.96	3.54	37.52	110	291	Average
2405	108.62	115.64			26.96	3.54	37.52	110	291	Peak
2494	39.89	46.32	54	-14.11	27.2	3.62	37.25	110	291	Average
2494	55.92	62.35	74	-18.08	27.2	3.62	37.25	110	291	Peak
4810	25.84	42.22	54	-28.16	30.97	5.75	53.1	103	114	Average
4810	41.87	58.25	74	-32.13	30.97	5.75	53.1	103	114	Peak

REMARKS:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin value = Emission level – Limit value
- 2405MHz: Fundamental frequency.
- The average values are :
Average = Peak value + 20log (Dwell Time/100ms)
Where the duty factor is calculated from following formula:
20log (Dwell Time/100ms) = 20log (0.157) = -16.03.
Please see as below for plotted duty.



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EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 17	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	26deg. C, 64%RH	TESTED BY	Toby Tian

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2386	44.13	51.2	54	-9.87	26.91	3.52	37.5	106	204	Average
2386	60.16	67.23	74	-13.84	26.91	3.52	37.5	106	204	Peak
2435	100.14	107.03			27.01	3.56	37.46	106	204	Average
2435	116.17	123.06			27.01	3.56	37.46	106	204	Peak
2484	42.11	48.68	54	-11.89	27.15	3.6	37.32	106	204	Average
2484	58.14	64.71	74	-15.86	27.15	3.6	37.32	106	204	Peak
4870	26.59	42.78	54	-27.41	31.06	5.8	53.05	100	183	Average
4870	42.62	58.81	74	-31.38	31.06	5.8	53.05	100	183	Peak
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2328	40.53	47.8	54	-13.47	26.72	3.48	37.47	109	291	Average
2328	56.56	63.83	74	-17.44	26.72	3.48	37.47	109	291	Peak
2435	92.36	99.25			27.01	3.56	37.46	109	291	Average
2435	108.39	115.28			27.01	3.56	37.46	109	291	Peak
2500	39.76	46.19	54	-14.24	27.2	3.62	37.25	109	291	Average
2500	55.79	62.22	74	-18.21	27.2	3.62	37.25	109	291	Peak
4870	25.21	41.4	54	-28.79	31.06	5.8	53.05	100	193	Average
4870	41.24	57.43	74	-32.76	31.06	5.8	53.05	100	193	Peak

REMARKS:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin value = Emission level – Limit value
- 2435MHz: Fundamental frequency.
- The average values are :
Average = Peak value + 20log (Dwell Time/100ms)
Where the duty factor is calculated from following formula:
 $20\log (Dwell\ Time/100ms) = 20\log (0.157) = -16.03.$
Please see as below for plotted duty.



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EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 25	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	26deg. C, 64%RH	TESTED BY	Toby Tian

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2382.77	44.03	51.15	54	-9.97	26.86	3.52	37.5	104	198	Average
2382.77	60.06	67.18	74	-13.94	26.86	3.52	37.5	104	198	Peak
2475	99.93	106.5			27.15	3.6	37.32	104	198	Average
2475	115.96	122.53			27.15	3.6	37.32	104	198	Peak
2483.66	53.81	60.38	54	-0.19	27.15	3.6	37.32	104	198	Average
2483.66	69.84	76.41	74	-4.16	27.15	3.6	37.32	104	198	Peak
4950	24.81	40.87	54	-29.19	31.14	5.84	53.04	100	203	Average
4950	40.21	56.27	74	-33.79	31.14	5.84	53.04	100	203	Peak
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2366	40.3	47.47	54	-13.7	26.81	3.52	37.5	103	288	Average
2366	56.33	63.5	74	-17.67	26.81	3.52	37.5	103	288	Peak
2475	90.29	96.86			27.15	3.6	37.32	103	288	Average
2475	106.32	112.89			27.15	3.6	37.32	103	288	Peak
2484	46.55	53.12	54	-7.45	27.15	3.6	37.32	103	288	Average
2484	62.58	69.15	74	-11.42	27.15	3.6	37.32	103	288	Peak
4950	25.45	41.51	54	-28.55	31.14	5.84	53.04	100	159	Average
4950	41.48	57.54	74	-32.52	31.14	5.84	53.04	100	159	Peak

REMARKS:

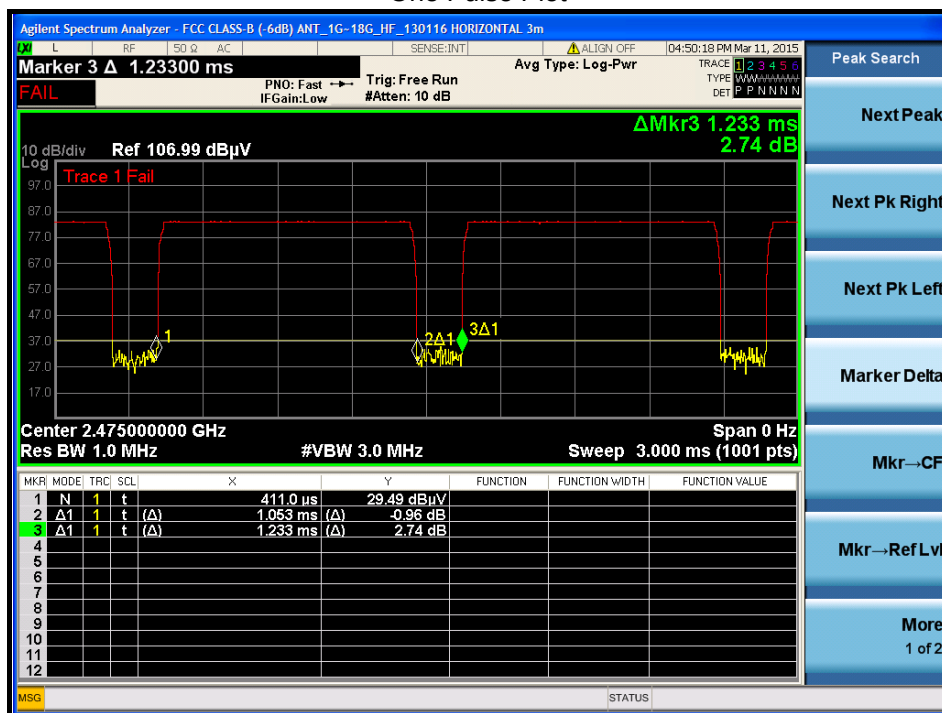
- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin value = Emission level – Limit value
- 2475MHz: Fundamental frequency.
- The average values are :
Average = Peak value + 20log (Dwell Time/100ms)
Where the duty factor is calculated from following formula:
 $20\log (Dwell\ Time/100ms) = 20\log (0.157) = -16.03.$
Please see as below for plotted duty.



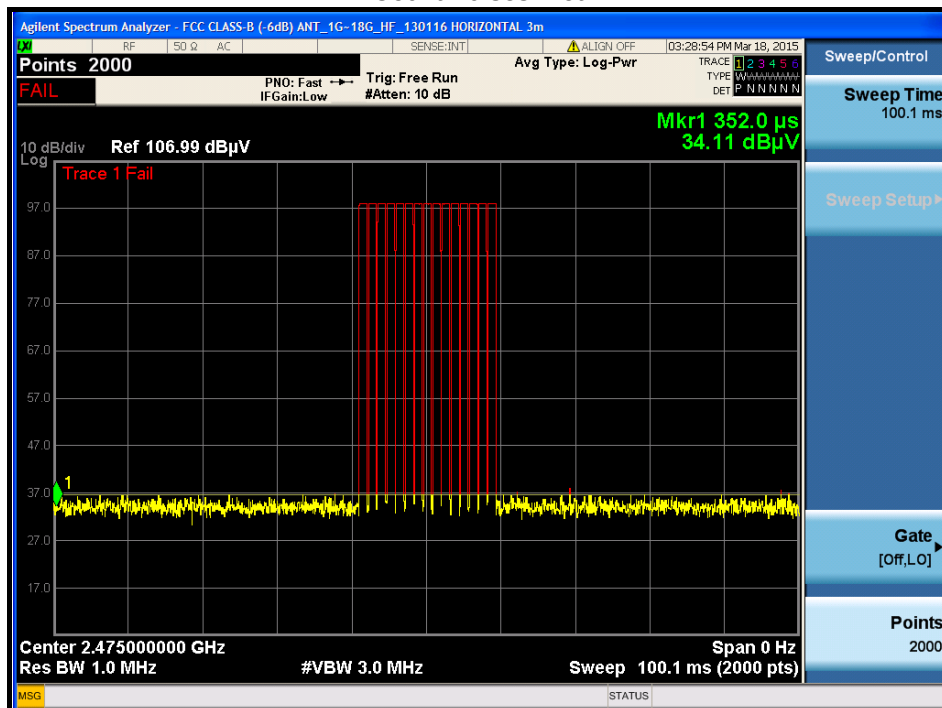
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<Duty cycle correction factor>

One Pulse Plot



Count Pulses Plot



Note: Dwell Time = 15 * 1.053 = 15.795

Duty cycle correction factor = 20 log (Dwell Time/100ms) = -16.03dB

BELOW 1GHz WORST-CASE DATA

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 25	FREQUENCY RANGE	Below 1000MHz
INPUT POWER	120Vac, 60 Hz	DETECTOR FUNCTION	Peak(PK) Quasi-Peak(QP)
ENVIRONMENTAL CONDITIONS	26deg. C, 64%RH	TESTED BY	Toby Tian

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
55.11	27.59	45.67	40	-12.41	12.45	0.8	31.33	100	265	Peak
89.13	28.67	51.28	43.5	-14.83	8.28	1.02	31.91	106	142	Peak
189.03	35.16	55.19	43.5	-8.34	10.12	1.54	31.69	100	288	Peak
305.6	32.03	48.78	46	-13.97	13.08	2.07	31.9	118	265	Peak
575.8	32.9	42.92	46	-13.1	19.06	3.02	32.1	109	224	Peak
627.6	36.59	45.63	46	-9.41	19.94	3.17	32.15	100	17	Peak
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
38.1	33.43	50.58	40	-6.57	13.24	0.63	31.02	115	168	Peak
89.4	28.75	51.36	43.5	-14.75	8.28	1.02	31.91	104	331	Peak
180.12	32.91	52.51	43.5	-10.59	10.74	1.5	31.84	100	249	Peak
304.2	32.83	49.59	46	-13.17	13.06	2.07	31.89	125	134	Peak
629	35.51	44.51	46	-10.49	19.96	3.18	32.14	122	108	Peak
696.2	35.51	43.13	46	-10.49	20.77	3.42	31.81	100	203	Peak

REMARKS: Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin value = Emission level – Limit value

MODE B

ABOVE 1GHz WORST-CASE DATA :

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 25	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	26deg. C, 64%RH	TESTED BY	Toby Tian

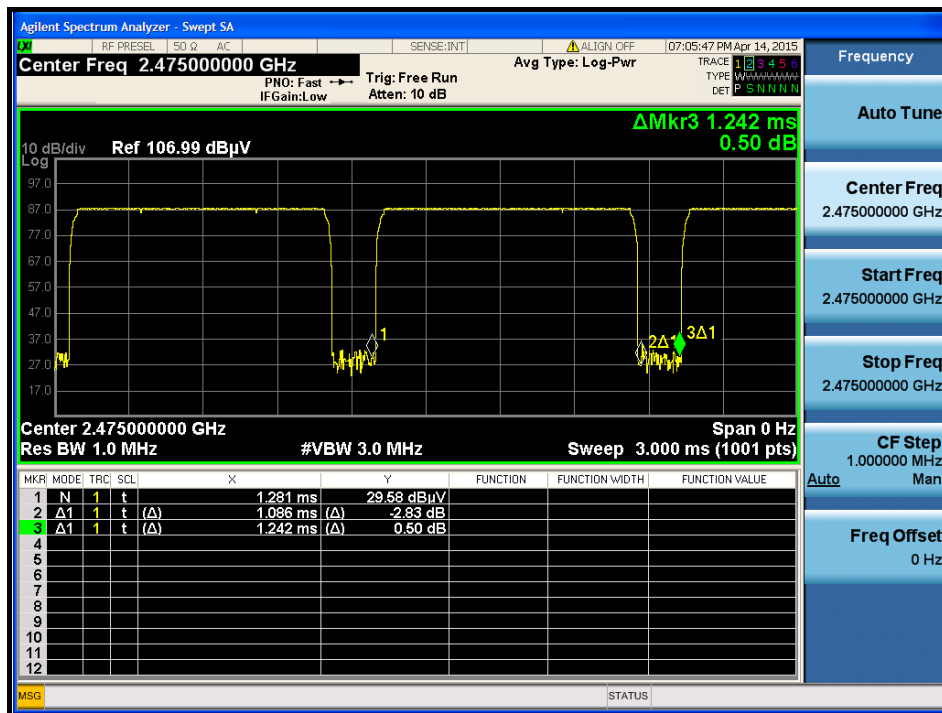
ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2370	41.65	48.77	54	-12.35	26.86	3.52	37.5	100	193	Average
2370	57.41	64.53	74	-16.59	26.86	3.52	37.5	100	193	Peak
2475	99.48	106.05			27.15	3.6	37.32	100	193	Average
2475	115.24	121.81			27.15	3.6	37.32	100	193	Peak
2484	53.52	60.09	54	-0.48	27.15	3.6	37.32	100	193	Average
2484	69.28	75.85	74	-4.72	27.15	3.6	37.32	100	193	Peak
4950	24.24	40.3	54	-29.76	31.14	5.84	53.04	112	231	Average
4950	40	56.06	74	-34	31.14	5.84	53.04	112	231	Peak
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2382	40.66	47.78	54	-13.34	26.86	3.52	37.5	102	294	Average
2382	56.42	63.54	74	-17.58	26.86	3.52	37.5	102	294	Peak
2475	92.44	99.01			27.15	3.6	37.32	102	294	Average
2475	108.2	114.77			27.15	3.6	37.32	102	294	Peak
2484	47.21	53.78	54	-6.79	27.15	3.6	37.32	102	294	Average
2484	62.97	69.54	74	-11.03	27.15	3.6	37.32	102	294	Peak
4950	24.99	41.05	54	-29.01	31.14	5.84	53.04	104	178	Average
4950	40.75	56.81	74	-33.25	31.14	5.84	53.04	104	178	Peak

REMARKS:

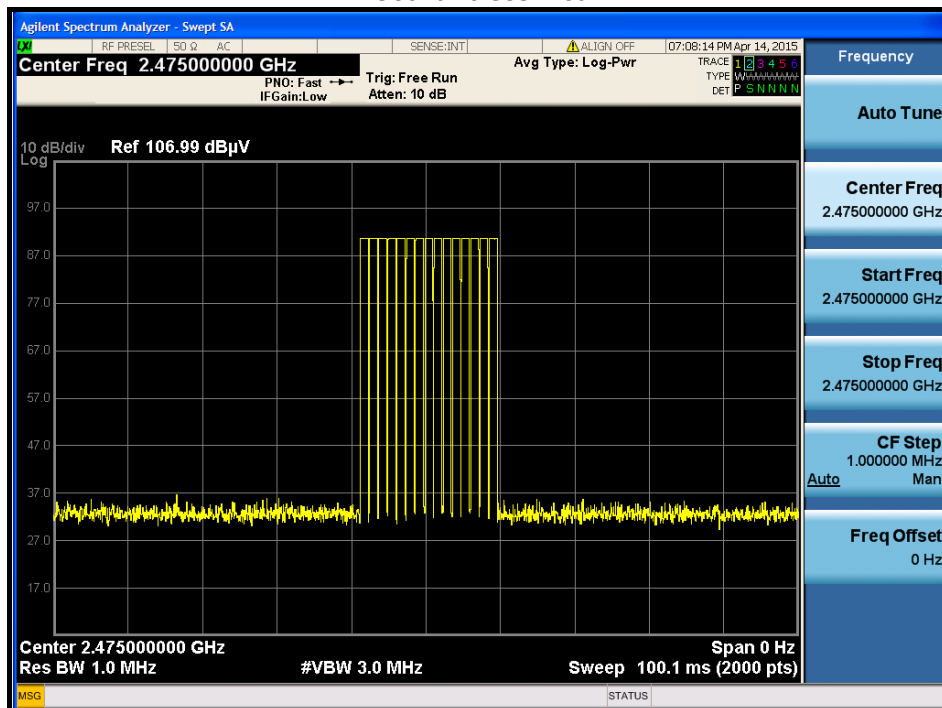
- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin value = Emission level – Limit value
- 2475MHz: Fundamental frequency.
- The average values are :
Average = Peak value + 20log (Dwell Time/100ms)
Where the duty factor is calculated from following formula:
 $20\log (\text{Dwell Time}/100\text{ms}) = 20\log (0.157) = -16.03$.
Please see as below for plotted duty.

<Duty cycle correction factor>

One Pulse Plot



Count Pulses Plot



Note: Dwell Time = 15 * 1.086 = 16.29

Duty cycle correction factor = 20 log (Dwell Time/100ms) = -15.76dB



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BELOW 1GHz WORST-CASE DATA

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 25	FREQUENCY RANGE	Below 1000MHz
INPUT POWER	120Vac, 60 Hz	DETECTOR FUNCTION	Peak(PK) Quasi-Peak(QP)
ENVIRONMENTAL CONDITIONS	26deg. C, 64%RH	TESTED BY	Toby Tian

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
42.69	20.15	36.95	40	-19.85	13.58	0.7	31.08	109	244	Peak
56.46	17.61	35.8	40	-22.39	12.35	0.8	31.34	136	291	Peak
140.43	15.66	33.63	43.5	-27.84	12.37	1.3	31.64	138	356	Peak
367.2	18.31	33.38	46	-27.69	14.56	2.3	31.93	112	329	Peak
519.8	21.7	32.65	46	-24.3	17.77	2.85	31.57	114	87	Peak
638.1	24.86	33.69	46	-21.14	20.07	3.2	32.1	123	39	Peak
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
42.69	19.77	36.57	40	-20.23	13.58	0.7	31.08	126	310	Peak
55.92	18.21	36.4	40	-21.79	12.35	0.8	31.34	100	200	Peak
128.82	14.89	33.93	43.5	-28.61	11.61	1.23	31.88	119	252	Peak
381.9	19.14	33.85	46	-26.86	14.91	2.35	31.97	106	343	Peak
513.5	21.97	33.11	46	-24.03	17.62	2.82	31.58	134	202	Peak
554.1	22.55	33.03	46	-23.45	18.55	2.96	31.99	133	80	Peak

REMARKS: Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor

Margin value = Emission level – Limit value

4.2 CONDUCTED EMISSION MEASUREMENT

4.2.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dB μ V)	
	Quasi-peak	Average
0.15 ~ 0.5	66 to 56	56 to 46
0.5 ~ 5	56	46
5 ~ 30	60	50

- NOTE:** 1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.
3. 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.

4.2.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
Test Receiver ROHDE & SCHWARZ	ESCI	100612	Sep. 30, 2014	Sep. 29, 2015
RF signal cable Woken	5D-FB	Cable-HYC01-01	Dec. 26, 2014	Dec. 25, 2015
LISN ROHDE & SCHWARZ (EUT)	ESH3-Z5	835239/001	Feb. 13, 2014	Feb. 12, 2015
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Jul. 21, 2014	Jul. 20, 2015
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 HwaYa Shielded Room 1.
3. The VCCI Site Registration No. is C-2040.
4. Test Date: Feb. 11, 2015.

4.2.3 TEST PROCEDURES

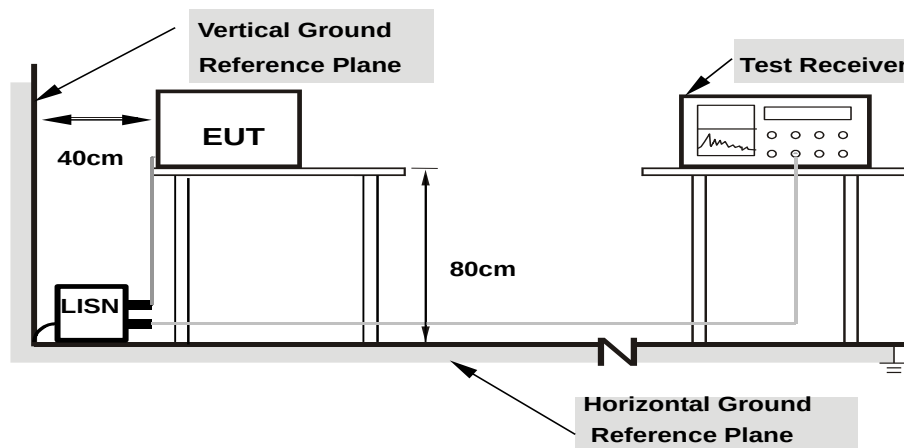
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance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

NOTE: 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



Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.2.6 EUT OPERATING CONDITIONS

Same as 4.1.6.

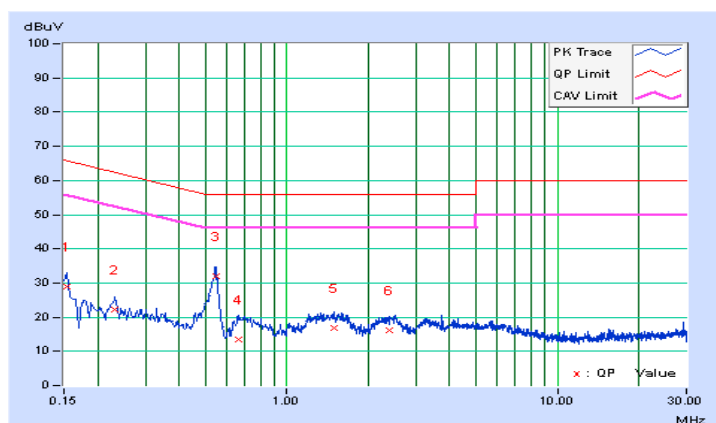
4.2.7 TEST RESULTS

Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	Environmental Conditions	25°C, 65%RH
Tested by	Anson Lin	Test Date	2015/2/25

Phase Of Power : Line (L)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15391	9.57	19.52	18.68	29.09	28.25	65.79	55.79	-36.70	-27.54
2	0.23216	9.56	12.73	9.26	22.29	18.82	62.37	52.37	-40.08	-33.55
3	0.54491	9.56	22.53	19.36	32.09	28.92	56.00	46.00	-23.91	-17.08
4	0.66605	9.56	4.05	1.27	13.61	10.83	56.00	46.00	-42.39	-35.17
5	1.48722	9.57	7.38	4.78	16.95	14.35	56.00	46.00	-39.05	-31.65
6	2.38652	9.57	6.60	3.15	16.17	12.72	56.00	46.00	-39.83	-33.28

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

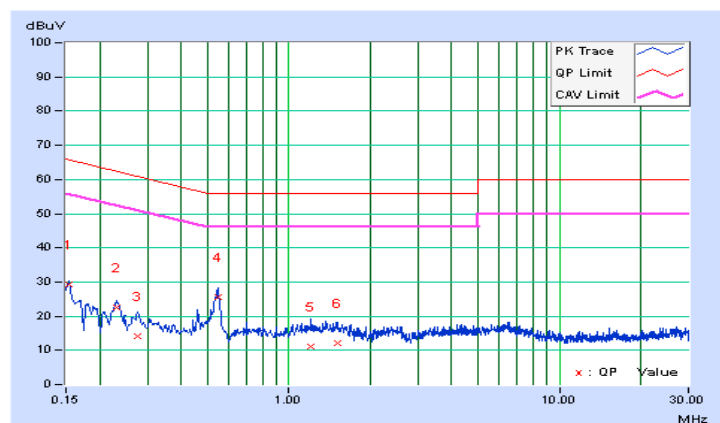


Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	Environmental Conditions	25°C, 65%RH
Tested by	Anson Lin	Test Date	2015/2/25

Phase Of Power : Neutral (N)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15391	9.56	19.88	19.31	29.44	28.87	65.79	55.79	-36.35	-26.92
2	0.23155	9.56	13.13	10.76	22.69	20.32	62.39	52.39	-39.70	-32.07
3	0.27553	9.56	4.54	-0.40	14.10	9.16	60.95	50.95	-46.85	-41.79
4	0.54491	9.56	16.11	13.70	25.67	23.26	56.00	46.00	-30.33	-22.74
5	1.20570	9.57	1.61	-1.41	11.18	8.16	56.00	46.00	-44.82	-37.84
6	1.50677	9.57	2.48	-0.30	12.05	9.27	56.00	46.00	-43.95	-36.73

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

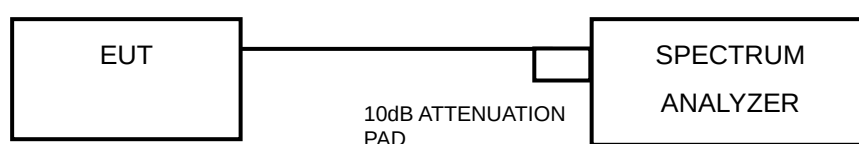


4.3 6dB BANDWIDTH MEASUREMENT

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 4.1.2 to get information of above instrument.

4.3.4 TEST PROCEDURE

- a. Set resolution bandwidth (RBW) = 100kHz
- b. Set the video bandwidth (VBW) $\geq 3 \times$ RBW, Detector = Peak.
- c. Trace mode = max hold.
- d. Sweep = auto couple.
- e. 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

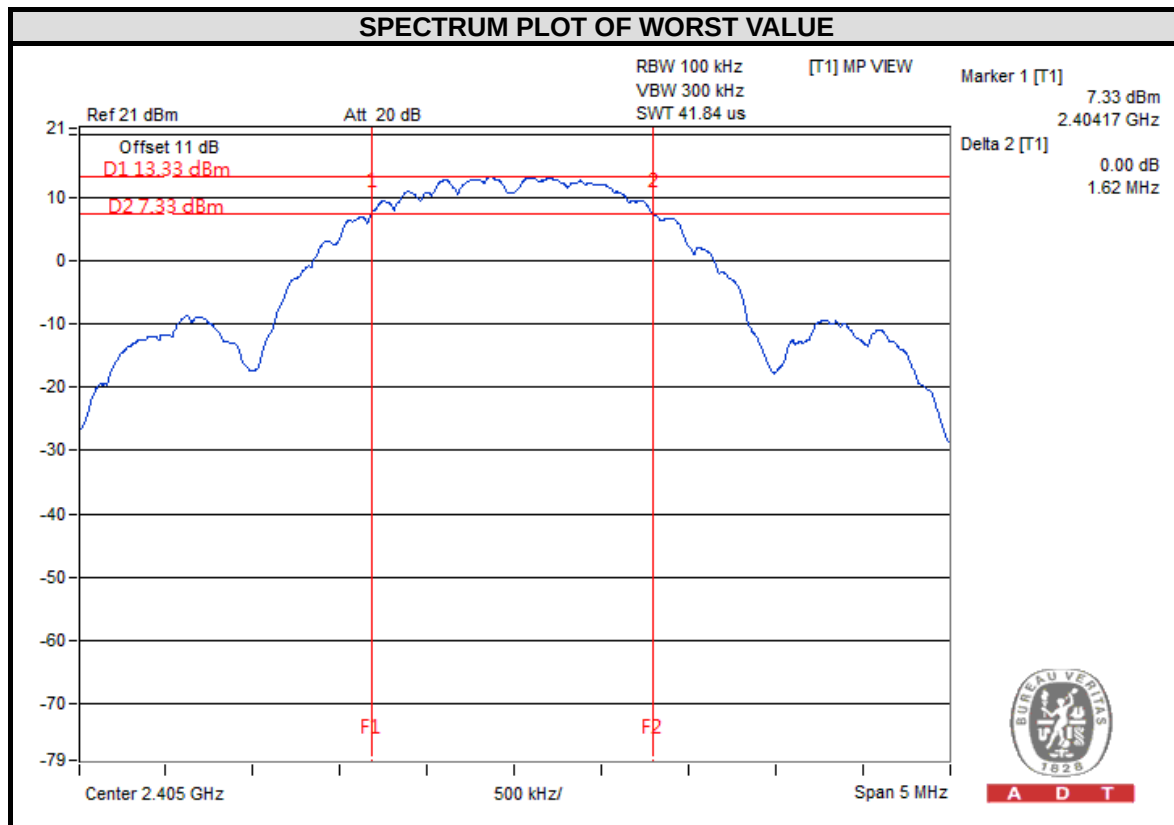
No deviation.

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.

4.3.7 TEST RESULTS

CHANNEL	FREQUENCY (MHz)	6dB BANDWIDTH (MHz)	MINIMUM LIMIT (MHz)	PASS / FAIL
11	2405	1.62	0.5	PASS
17	2435	1.58	0.5	PASS
25	2475	1.56	0.5	PASS

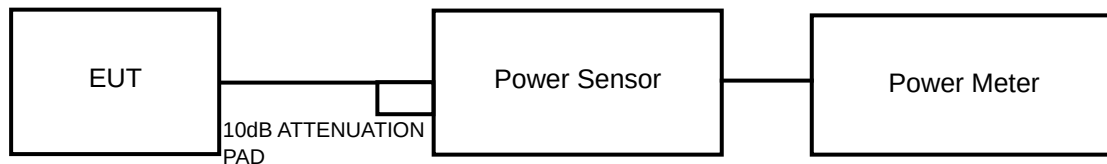


4.4 CONDUCTED OUTPUT POWER

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 4.1.2 to get information of above instrument.

4.4.4 TEST PROCEDURES

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

4.4.5 DEVIATION FROM TEST STANDARD

No deviation.

4.4.6 EUT OPERATING CONDITIONS

Same as Item 4.3.6.

4.4.7 TEST RESULTS

FOR PEAK POWER

CHANNEL	FREQUENCY (MHz)	PEAK POWER (mW)	PEAK POWER (dBm)	LIMIT (dBm)	PASS/FAIL
11	2405	81.658	19.12	30	PASS
17	2435	93.325	19.7	30	PASS
25	2475	94.624	19.76	30	PASS

FOR AVERAGE POWER

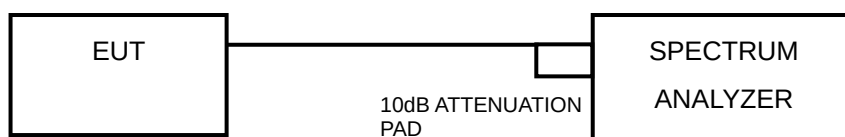
CHANNEL	FREQUENCY (MHz)	AVERAGE POWER (mW)	AVERAGE POWER (dBm)
11	2405	80.910	19.08
17	2435	92.470	19.66
25	2475	93.325	19.7

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 4.1.2 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

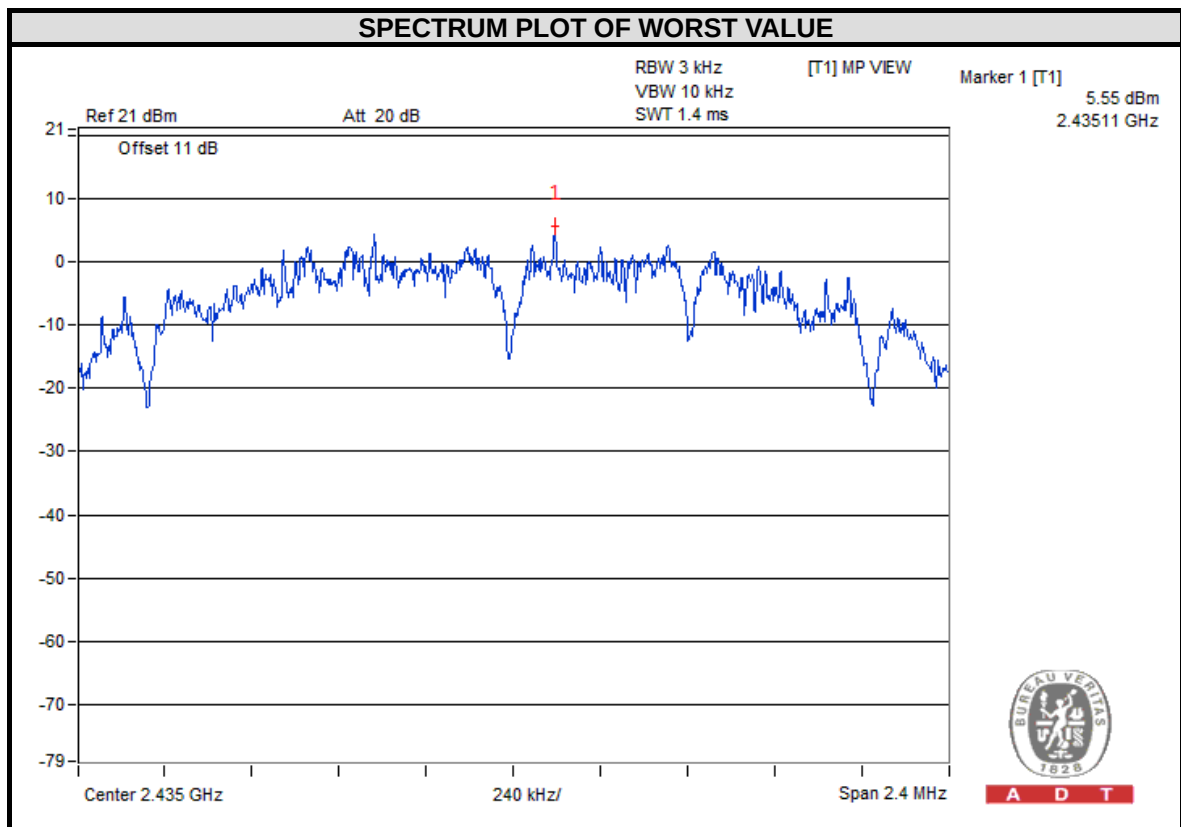
Same as Item 4.3.6



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4.5.7 TEST RESULTS

Channel	Freq. (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	PASS /FAIL
11	2405	4.84	8	PASS
17	2435	5.55	8	PASS
25	2475	5.50	8	PASS

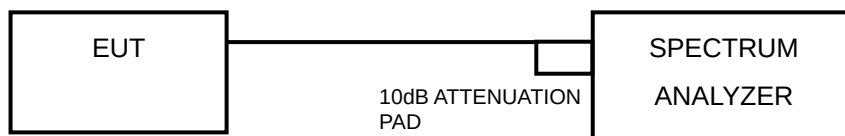


4.6 CONDUCTED OUT OF BAND EMISSION MEASUREMENT

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 4.1.2 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.

MEASUREMENT PROCEDURE OOB

1. Set RBW = 100 kHz.
2. Set VBW $\geq$ 300 kHz.
3. Detector = peak.
4. Sweep = auto couple.
5. Trace Mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum amplitude level.

4.6.5 DEVIATION FROM TEST STANDARD

No deviation.

4.6.6 EUT OPERATING CONDITION

Same as Item 4.3.6

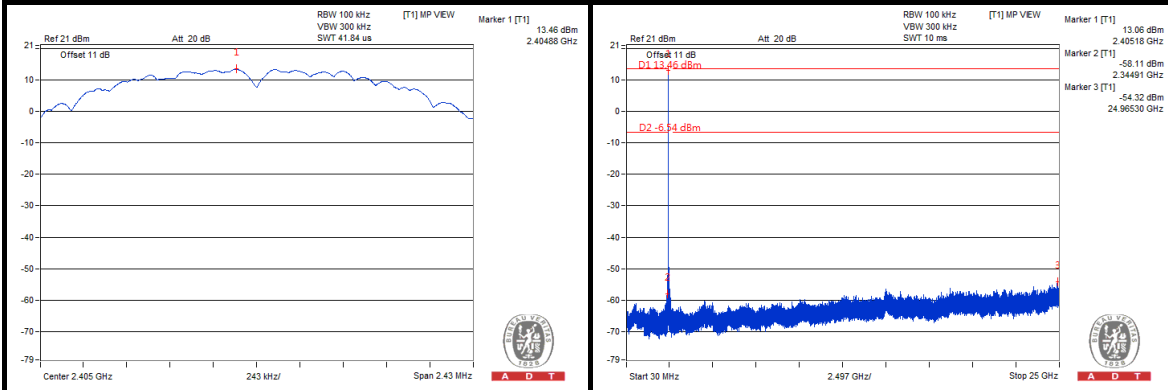
4.6.7 TEST RESULTS

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.

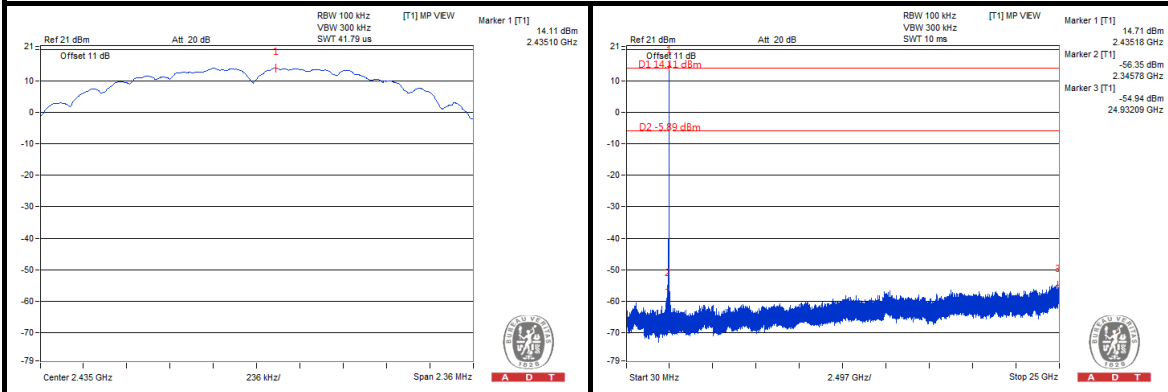


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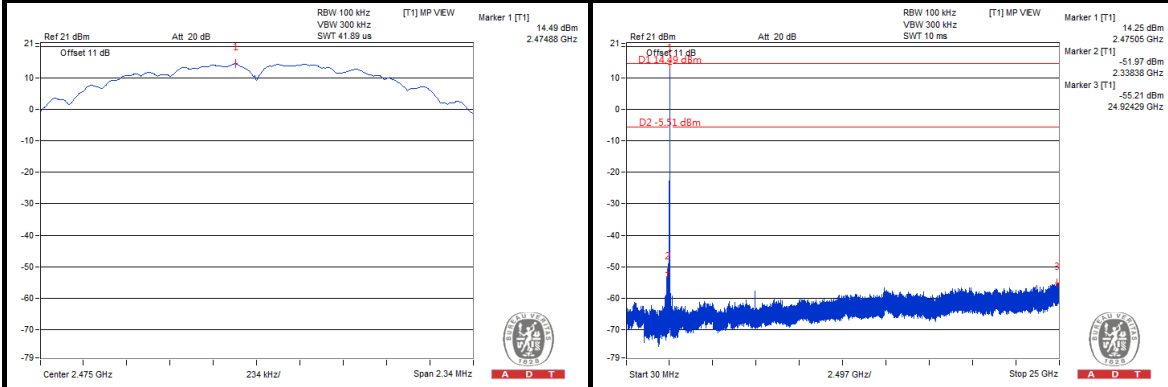
CH 11



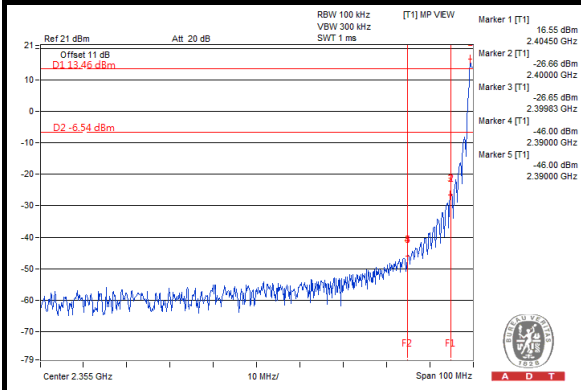
CH 17



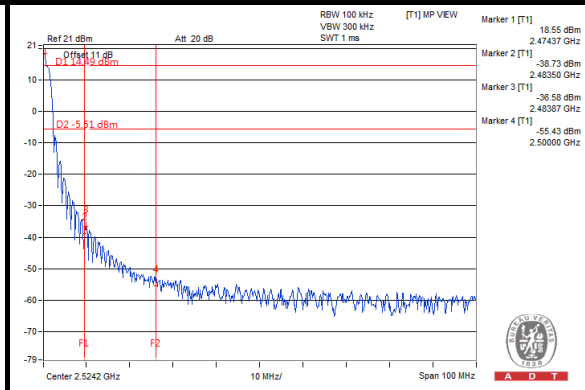
CH 25



CH 11 Band edge



CH 25 Band edge



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:

Linko EMC/RF Lab:

Tel: 886-2-26052180

Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab:

Tel: 886-3-5935343

Fax: 886-3-5935342

Hwa Ya EMC/RF/Safety 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 any modifications are made to the EUT by the lab during the test.

---END---