

## FCC Test Report (BT-LE)

**Report No.:** RF150126E05-3

**FCC ID:** TLZ-CM2XXNF

**Test Model:** AW-CM195NF

**Series Model:** AW-CM217NF, AW-CM235NF

**Received Date:** Jan. 26, 2015

**Test Date:** Feb. 03 to 24, 2015

**Issued Date:** Feb. 25, 2015

**Applicant:** AzureWave Technologies, Inc.

**Address:** 8 F., No. 94, Baozhong Rd., Xindian, Taipei, Taiwan 231

**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  
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Chu Hsien 307, Taiwan R.O.C.



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## Table of Contents

<b>Release Control Record</b> .....	<b>4</b>
<b>1 Certificate of Conformity</b> .....	<b>5</b>
<b>2 Summary of Test Results</b> .....	<b>6</b>
2.1 Measurement Uncertainty.....	6
2.2 Modification Record.....	6
<b>3 General Information</b> .....	<b>7</b>
3.1 General Description of EUT (BT-LE).....	7
3.2 Description of Test Modes.....	8
3.2.1 Test Mode Applicability and Tested Channel Detail.....	9
3.3 Duty Cycle of Test Signal.....	11
3.4 Description of Support Units.....	12
3.4.1 Configuration of System under Test.....	13
3.5 General Description of Applied Standards.....	14
<b>4 Test Types and Results</b> .....	<b>15</b>
4.1 Radiated Emission and Bandedge Measurement.....	15
4.1.1 Limits of Radiated Emission and Bandedge Measurement.....	15
4.1.2 Test Instruments.....	16
4.1.3 Test Procedures.....	18
4.1.4 Deviation from Test Standard.....	18
4.1.5 Test Setup.....	19
4.1.6 EUT Operating Conditions.....	19
4.1.7 Test Results.....	20
4.2 Conducted Emission Measurement.....	24
4.2.1 Limits of Conducted Emission Measurement.....	24
4.2.2 Test Instruments.....	24
4.2.3 Test Procedures.....	25
4.2.4 Deviation from Test Standard.....	25
4.2.5 Test Setup.....	25
4.2.6 EUT Operating Conditions.....	25
4.2.7 Test Results.....	26
4.3 6dB Bandwidth Measurement.....	28
4.3.1 Limits of 6dB Bandwidth Measurement.....	28
4.3.2 Test Setup.....	28
4.3.3 Test Instruments.....	28
4.3.4 Test Procedures.....	28
4.3.5 Deviation from Test Standard.....	28
4.3.6 EUT Operating Conditions.....	28
4.3.7 Test Results.....	29
4.4 Conducted Output Power Measurement.....	30
4.4.1 Limits of Conducted Output Power Measurement.....	30
4.4.2 Test Setup.....	30
4.4.3 Test Instruments.....	30
4.4.4 Test Procedures.....	30
4.4.5 Deviation from Test Standard.....	30
4.4.6 EUT Operating Conditions.....	30
4.4.7 Test Results.....	31
4.5 Power Spectral Density Measurement.....	32
4.5.1 Limits of Power Spectral Density Measurement.....	32
4.5.2 Test Setup.....	32
4.5.3 Test Instruments.....	32
4.5.4 Test Procedures.....	32
4.5.5 Deviation from Test Standard.....	32
4.5.6 EUT Operating Conditions.....	32



4.5.7 Test Results .....	33
4.6 Conducted Out of Band Emission Measurement.....	34
4.6.1 Limits of Conducted Out of Band Emission Measurement .....	34
4.6.2 Test Setup.....	34
4.6.3 Test Instruments .....	34
4.6.4 Test Procedures.....	34
4.6.5 Deviation from Test Standard .....	34
4.6.6 EUT Operating Conditions.....	35
4.6.7 Test Results .....	35
<b>5 Pictures of Test Arrangements.....</b>	<b>36</b>
<b>Appendix – Information on the Testing Laboratories .....</b>	<b>38</b>



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### Release Control Record

Issue No.	Description	Date Issued
RF150126E05-3	Original release.	Feb. 25, 2015



### 1 Certificate of Conformity

**Product:** IEEE 802.11 a/b/g/n/ac Wireless LAN and Bluetooth M.2 Combo Module  
**Brand:** AzureWave  
**Test Model:** AW-CM195NF  
**Series Model:** AW-CM217NF, AW-CM235NF  
**Sample Status:** ENGINEERING SAMPLE  
**Applicant:** AzureWave Technologies, Inc.  
**Test Date:** Feb. 03 to 24, 2015  
**Standards:** 47 CFR FCC Part 15, Subpart C (Section 15.247)  
ANSI C63.10:2009

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

**Prepared by :** Midoli Peng, **Date:** Feb. 25, 2015  
Midoli Peng / Specialist

**Approved by :** May Chen, **Date:** Feb. 25, 2015  
May Chen / Manager

## 2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (SECTION 15.247)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -15.78dB at 0.51328MHz.
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -3.3dB at 539.42MHz.
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	Antenna connector is i-pex(MHF) not a standard connector.

### 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	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	2.86 dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	5.37 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	3.72 dB
	6GHz ~ 18GHz	4.00 dB
	18GHz ~ 40GHz	4.11 dB

### 2.2 Modification Record

There were no modifications required for compliance.

### 3 General Information

#### 3.1 General Description of EUT (BT-LE)

Product	IEEE 802.11 a/b/g/n/ac Wireless LAN and Bluetooth M.2 Combo Module
Brand	AzureWave
Test Model	AW-CM195NF
Series Model	AW-CM217NF, AW-CM235NF
Status of EUT	ENGINEERING SAMPLE
Power Supply Rating	3.3Vdc from host equipment
Modulation Type	GFSK
Modulation Technology	DTS
Transfer Rate	up to 1Mbps
Operating Frequency	2402MHz ~ 2480MHz
Number of Channel	40
Output Power	7.261mW
Antenna Type	Please see Note
Antenna Connector	Please see Note
Accessory Device	NA
Data Cable Supplied	NA

Note:

1. There are Bluetooth technology and WLAN technology used for the EUT.
2. For WLAN, 2.4GHz and 5GHz technology can not transmit at same time.
3. WLAN (5GHz) and Bluetooth technology can transmit at same time.
4. The EUT support multiple function, therefore the WLAN OFDM will be cover BT OFDM (low power) scenario.
5. The EUT has three model names which are identical to each other in all aspects except for the following table. These solutions have same RF circuit /parameter and are pin to pin compatible. (Detail information please refer declaration letter by client)

AW model name	Difference. Broadcom solution
AW-CM195NF	BCM43540
AW-CM217NF	BCM4356
AW-CM235NF	BCM4354

From the above models, model: **AW-CM195NF** was selected as representative model for the test and its data was recorded in this report.

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

Antenna No	Chain No.	Brand	Model	Gain (dBi)	Antenna Type	Connector Type	Frequency range (GHz to GHz)	Cable Length (External only)
1	Chain (0) (Aux)	MAG.LAYERS	MSA-4008-25GC1-A1	2.98	PIFA	i-pex(MHF)	2.4~2.5	15cm
				5.16			4.9~5.9	
	Chain (1) (Main)	MAG.LAYERS	MSA-4008-25GC1-A1	2.98	PIFA	i-pex(MHF)	2.4~2.5	15cm
				5.16			4.9~5.9	
2	Chain (0) (Aux)	LUXSHARE ICT	Speedy	1.43	PIFA	i-pex(MHF)	2.4~2.5	507mm
				-3.12			4.9~5.9	
	Chain (1) (Main)	LUXSHARE ICT	Speedy	-2.46	PIFA	i-pex(MHF)	2.4~2.5	472mm
				-0.02			4.9~5.9	

Antenna 1 was chosen for final test.

7. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

### 3.2 Description of Test Modes

40 channels are provided to this EUT:

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480



### 3.2.1 Test Mode Applicability and Tested Channel Detail

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

Where **RE≥1G**: Radiated Emission above 1GHz      **RE<1G**: Radiated Emission below 1GHz  
**PLC**: Power Line Conducted Emission      **APCM**: Antenna Port Conducted Measurement

NOTE:

1. The EUT's antenna (PIFA) 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.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
0 to 39	0, 19, 39	GFSK	1

#### **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.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
0 to 39	39	GFSK	1

#### **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.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
0 to 39	39	GFSK	1

#### **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.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
0 to 39	0, 19, 39	GFSK	1

**Test Condition:**

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER (SYSTEM)	TESTED BY
RE $\geq$ 1G	22deg. C, 66%RH	120Vac, 60Hz	Robert Cheng
RE<1G	26deg. C, 67%RH	120Vac, 60Hz	Robert Cheng
PLC	22deg. C, 60%RH	120Vac, 60Hz	Barry Lee
APCM	25deg. C, 60%RH	120Vac, 60Hz	Anderson Chen



### 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.

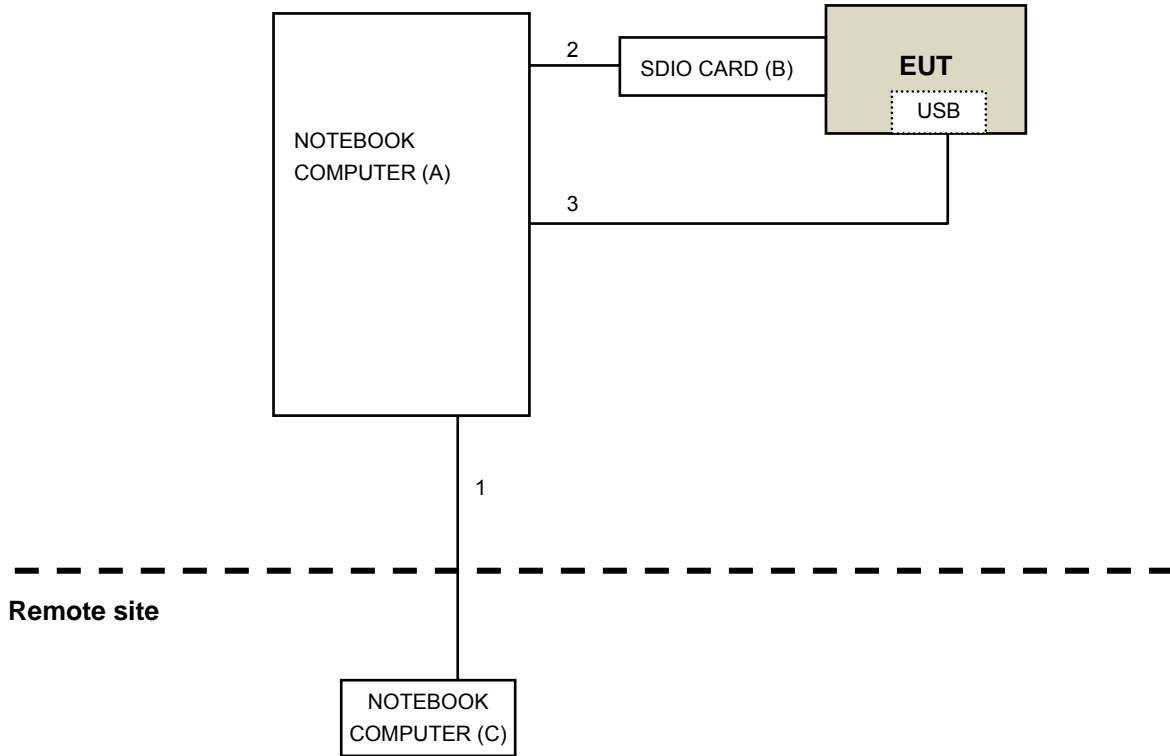
No.	Product	Brand	Model No.	Serial No.	FCC ID	Remark
A	NOTEBOOK COMPUTER	ASUS	A42J	NA	FCC DoC	Supplied by Client
B	SDIO CARD	AzureWave	NA	NA	NA	Supplied by Client
C	NOTEBOOK COMPUTER	DELL	PP32LA	DSL32S	NA	Provided by Lab

**NOTE:**

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

No.	Cable	Qty.	Length (m)	Shielded (Yes/ No)	Cores (Number)	Remark
1	RJ45	1	10	No	0	Provided by Lab
2	USB	1	2	No	0	Provided by Lab
3	USB	1	1.8	No	0	Provided by Lab

### 3.4.1 Configuration of System under Test



### 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.

## 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

##### For Below 1GHz:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
MXE EMI Receiver Agilent	N9038A	MY51210105	July 21, 2014	July 20, 2015
Pre-Amplifier Mini-Circuits	ZFL-1000VH2 B	AMP-ZFL-03	Nov. 12, 2014	Nov. 11, 2015
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-360	Feb. 26, 2014	Feb. 25, 2015
RF Cable	NA	CHGCAB_001	Oct. 04, 2014	Oct. 03, 2015
Horn_Antenna AISI	AIH.8018	0000320091110	Aug. 27, 2014	Aug. 26, 2015
Pre-Amplifier Agilent	8449B	3008A02578	June 24, 2014	June 23, 2015
RF Cable	NA	131205 131214 SNMY23684/4	Jan. 16, 2015	Jan. 15, 2016
Spectrum Analyzer R&S	FSV40	100964	July 05, 2014	July 04, 2015
Pre-Amplifier EMCI	EMC184045	980143	Jan. 15, 2015	Jan. 14, 2016
Horn_Antenna SCHWARZBECK	BBHA 9170	9170-424	Aug. 26, 2014	Aug. 25, 2015
RF Cable	NA	RF104-121 RF104-204	Dec. 11, 2014	Dec. 10, 2015
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. G.
4. The FCC Site Registration No. is 966073.
- 5 The VCCI Site Registration No. is G-137.
- 6 The CANADA Site Registration No. is IC 7450H-2.
- 7 Tested Date: Feb. 04, 2015



**For Above 1GHz:**

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
MXE EMI Receiver Agilent	N9038A	MY50010156	Aug. 11, 2014	Aug. 10, 2015
Pre-Amplifier Mini-Circuits	ZFL-1000VH2 B	AMP-ZFL-04	Nov. 12, 2014	Nov. 11, 2015
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-361	Feb. 27, 2014	Feb. 26, 2015
RF Cable	NA	CHHCAB_001	Oct. 05, 2014	Oct. 04, 2015
Horn_Antenna AISI	AIH.8018	0000220091110	Aug. 26, 2014	Aug. 25, 2015
Pre-Amplifier Agilent	8449B	300801923	Oct. 28, 2014	Oct. 27, 2015
RF Cable	NA	131206 131215 SNMY23685/4	Jan. 16, 2015	Jan. 15, 2016
Spectrum Analyzer R&S	FSV40	100964	July 05, 2014	July 04, 2015
Pre-Amplifier EMCI	EMC184045	980143	Jan. 16, 2015	Jan. 15, 2016
Horn_Antenna SCHWARZBECK	BBHA 9170	9170-424	Aug. 26, 2014	Aug. 25, 2015
RF Cable	NA	RF104-121 RF104-204	Dec. 11, 2014	Dec. 10, 2015
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: Feb. 24, 2015

#### 4.1.3 Test Procedures

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

**Note:**

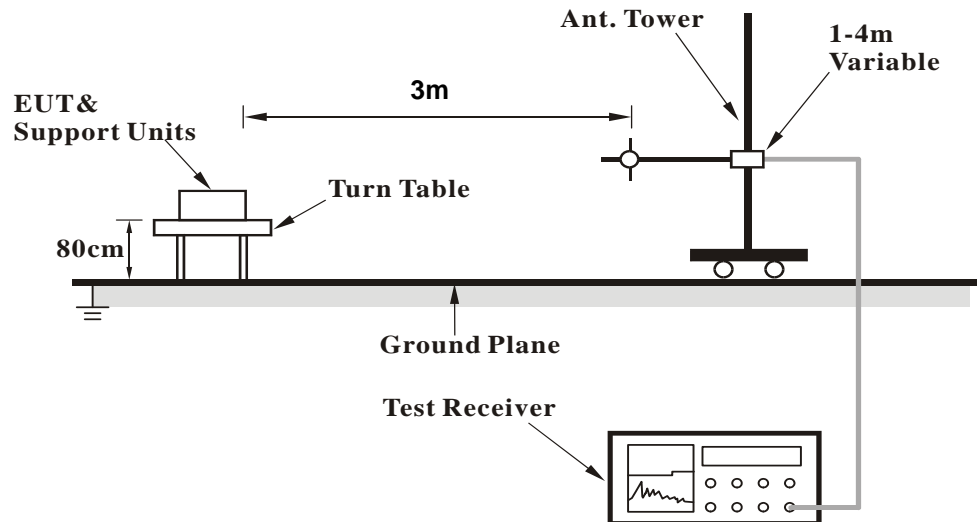
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for RMS Average (Duty cycle < 98%) for Average detection (AV) at frequency above 1GHz, then the measurement results was added to a correction factor ( $10 \log(1/\text{duty cycle})$ ).
4. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz (Duty cycle  $\geq 98\%$ ) 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

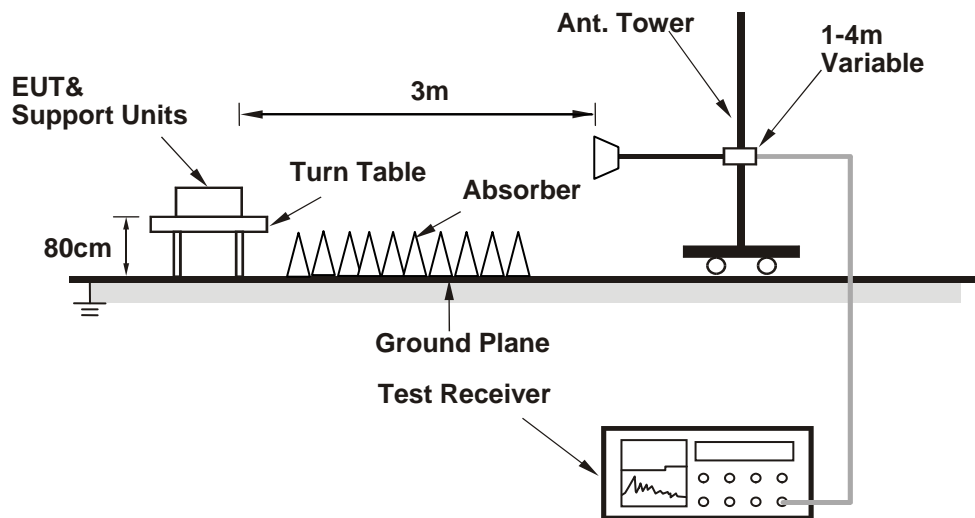
No deviation.

#### 4.1.5 Test Setup

##### <Frequency Range below 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

1. Connect the EUT with the support unit A (Notebook computer) which is placed on a testing table.
2. The communication partner run test program "paste AW-CM195 BT command" to enable EUT under transmission/receiving condition continuously at specific channel frequency.

#### 4.1.7 Test Results

Above 1GHz Data:

BT\_LE-GFSK

<b>CHANNEL</b>	TX Channel 0	<b>DETECTOR FUNCTION</b>	Peak (PK)
<b>FREQUENCY RANGE</b>	1GHz ~ 25GHz		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	2390.00	47.3 PK	74.0	-26.7	1.37 H	306	49.75	-2.45
2	2390.00	35.7 AV	54.0	-18.3	1.37 H	306	38.15	-2.45
3	*2402.00	102.2 PK			1.37 H	306	104.59	-2.39
4	*2402.00	101.0 AV			1.37 H	306	103.39	-2.39
5	4804.00	46.8 PK	74.0	-27.2	1.04 H	204	41.14	5.66
6	4804.00	38.4 AV	54.0	-15.6	1.04 H	204	32.74	5.66
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	47.9 PK	74.0	-26.1	1.00 V	147	50.35	-2.45
2	2390.00	35.6 AV	54.0	-18.4	1.00 V	147	38.05	-2.45
3	*2402.00	100.0 PK			1.00 V	147	102.39	-2.39
4	*2402.00	98.8 AV			1.00 V	147	101.19	-2.39
5	4804.00	49.7 PK	74.0	-24.3	1.02 V	23	44.04	5.66
6	4804.00	40.1 AV	54.0	-13.9	1.02 V	23	34.44	5.66

#### 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.

<b>CHANNEL</b>	TX Channel 19	<b>DETECTOR FUNCTION</b>	Peak (PK)
<b>FREQUENCY RANGE</b>	1GHz ~ 25GHz		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	2390.00	46.7 PK	74.0	-27.3	1.34 H	305	49.15	-2.45
2	2390.00	38.2 AV	54.0	-15.8	1.34 H	305	40.65	-2.45
3	*2440.00	104.1 PK			1.34 H	305	106.32	-2.22
4	*2440.00	102.9 AV			1.34 H	305	105.12	-2.22
5	2483.50	48.8 PK	74.0	-25.2	1.34 H	305	50.81	-2.01
6	2483.50	36.7 AV	54.0	-17.3	1.34 H	305	38.71	-2.01
7	4880.00	46.9 PK	74.0	-27.1	1.04 H	203	40.94	5.96
8	4880.00	38.2 AV	54.0	-15.8	1.04 H	203	32.24	5.96
9	7320.00	53.9 PK	74.0	-20.1	1.25 H	133	40.67	13.23
10	7320.00	40.2 AV	54.0	-13.8	1.25 H	133	26.97	13.23

**ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M**

NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	48.1 PK	74.0	-25.9	1.02 V	152	50.55	-2.45
2	2390.00	35.8 AV	54.0	-18.2	1.02 V	152	38.25	-2.45
3	*2440.00	100.5 PK			1.02 V	152	102.72	-2.22
4	*2440.00	99.1 AV			1.02 V	152	101.32	-2.22
5	2483.50	47.9 PK	74.0	-26.1	1.02 V	152	49.91	-2.01
6	2483.50	35.8 AV	54.0	-18.2	1.02 V	152	37.81	-2.01
7	4880.00	49.8 PK	74.0	-24.2	1.04 V	20	43.84	5.96
8	4880.00	40.4 AV	54.0	-13.6	1.04 V	20	34.44	5.96
9	7320.00	56.4 PK	74.0	-17.6	1.10 V	102	43.17	13.23
10	7320.00	42.1 AV	54.0	-11.9	1.10 V	102	28.87	13.23

**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.

<b>CHANNEL</b>	TX Channel 39	<b>DETECTOR FUNCTION</b>	Peak (PK)
<b>FREQUENCY RANGE</b>	1GHz ~ 25GHz		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	*2480.00	105.7 PK			1.32 H	307	107.74	-2.04
2	*2480.00	104.4 AV			1.32 H	307	106.44	-2.04
3	2483.50	48.9 PK	74.0	-25.1	1.32 H	307	50.91	-2.01
4	2483.50	38.7 AV	54.0	-15.3	1.32 H	307	40.71	-2.01
5	4960.00	46.2 PK	74.0	-27.8	1.00 H	193	39.92	6.28
6	4960.00	38.0 AV	54.0	-16.0	1.00 H	193	31.72	6.28
7	7440.00	54.1 PK	74.0	-19.9	1.33 H	138	40.95	13.15
8	7440.00	40.4 AV	54.0	-13.6	1.33 H	138	27.25	13.15

**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	*2480.00	100.2 PK			1.05 V	133	102.24	-2.04
2	*2480.00	99.2 AV			1.05 V	133	101.24	-2.04
3	2483.50	47.7 PK	74.0	-26.3	1.05 V	133	49.71	-2.01
4	2483.50	35.4 AV	54.0	-18.6	1.05 V	133	37.41	-2.01
5	4960.00	49.5 PK	74.0	-24.5	1.08 V	17	43.22	6.28
6	4960.00	40.3 AV	54.0	-13.7	1.08 V	17	34.02	6.28
7	7440.00	56.0 PK	74.0	-18.0	1.11 V	102	42.85	13.15
8	7440.00	41.8 AV	54.0	-12.2	1.11 V	102	28.65	13.15

**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.

**Below 1GHz Data:**

<b>CHANNEL</b>	TX Channel 39	<b>DETECTOR FUNCTION</b>	Quasi-Peak (QP)
<b>FREQUENCY RANGE</b>	Below 1GHz		

<b>ANTENNA POLARITY &amp; TEST DISTANCE: HORIZONTAL AT 3 M</b>								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	62.65	34.6 QP	40.0	-5.4	1.75 H	245	48.65	-14.09
2	96.11	39.3 QP	43.5	-4.2	1.75 H	67	57.58	-18.24
3	273.25	39.3 QP	46.0	-6.7	1.45 H	304	52.22	-12.88
4	345.42	41.5 QP	46.0	-4.6	1.45 H	245	52.26	-10.81
<b>5</b>	<b>539.42</b>	<b>42.7 QP</b>	<b>46.0</b>	<b>-3.3</b>	<b>1.45 H</b>	<b>301</b>	<b>48.60</b>	<b>-5.93</b>
6	791.75	42.6 QP	46.0	-3.4	1.45 H	301	43.29	-0.65
<b>ANTENNA POLARITY &amp; TEST DISTANCE: VERTICAL AT 3 M</b>								
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	96.02	36.2 QP	43.5	-7.3	1.34 V	214	54.47	-18.26
2	276.52	39.8 QP	46.0	-6.3	1.24 V	178	52.45	-12.70
3	324.21	38.6 QP	46.0	-7.4	1.24 V	201	49.80	-11.16
4	432.42	41.5 QP	46.0	-4.5	1.54 V	98	49.60	-8.06
5	744.25	42.5 QP	46.0	-3.5	1.34 V	214	44.02	-1.50
6	912.52	41.8 QP	46.0	-4.2	1.54 V	124	40.64	1.14

**REMARKS:**

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

## 4.2 Conducted Emission Measurement

### 4.2.1 Limits of Conducted Emission Measurement

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30.0	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.

### 4.2.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver ROHDE & SCHWARZ	ESCS 30	100375	Apr. 29, 2014	Apr. 28, 2015
Line-Impedance Stabilization Network (for EUT) SCHWARZBECK	NSLK-8127	8127-522	Sep. 15, 2014	Sep. 14, 2015
Line-Impedance Stabilization Network (for Peripheral) ROHDE & SCHWARZ	ENV216	100071	Nov. 10, 2014	Nov. 09, 2015
RF Cable (JYEBAO)	5DFB	COCCAB-001	Mar. 10, 2014	Mar. 09, 2015
50 ohms Terminator	N/A	EMC-03	Sep. 22, 2014	Sep. 21, 2015
50 ohms Terminator	N/A	EMC-02	Sep. 30, 2014	Sep. 29, 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 Shielded Room No. C.
3. The VCCI Con C Registration No. is C-3611.
4. Tested Date: Feb. 03, 2015



#### 4.2.3 Test Procedures

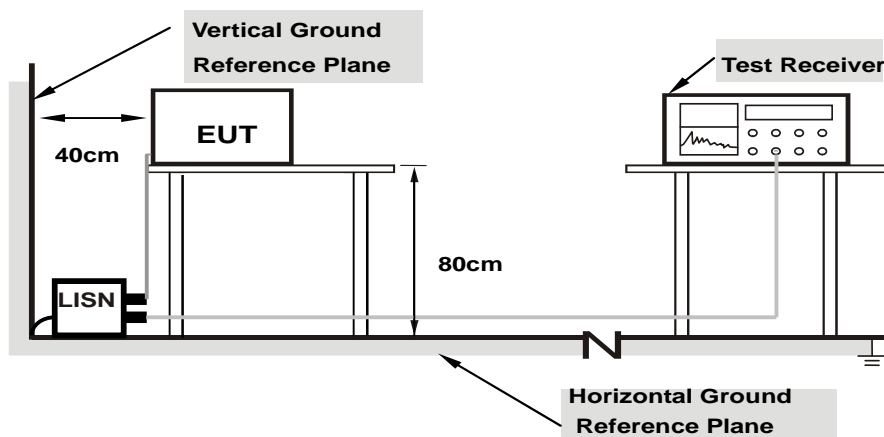
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance 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:** The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.

#### 4.2.4 Deviation from Test Standard

No deviation.

#### 4.2.5 Test Setup



**Note: 1.Support units were connected to second LISN.**

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.

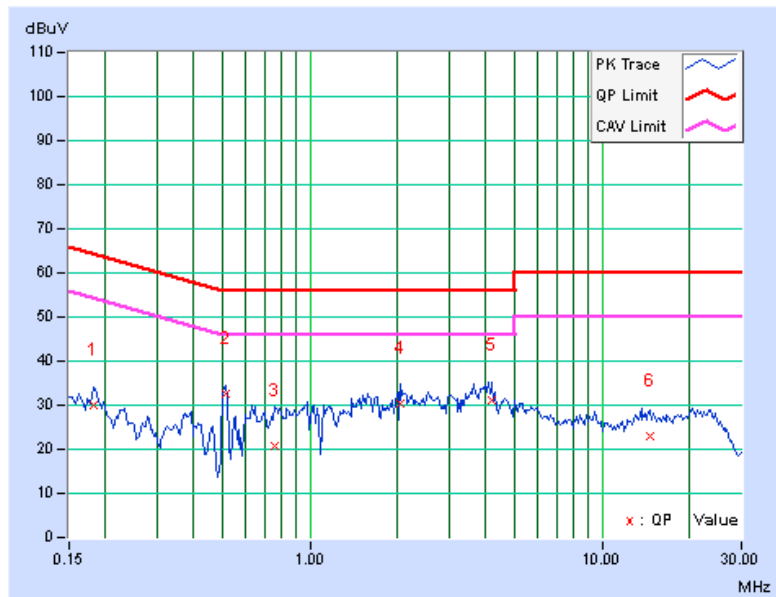
#### 4.2.7 Test Results

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
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No	Freq. [MHz]	Corr.	Reading Value		Emission Level		Limit		Margin	
		Factor (dB)	[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.18125	0.07	30.10	24.66	30.17	24.73	64.43	54.43	-34.26	-29.70
<b>2</b>	<b>0.51328</b>	<b>0.10</b>	<b>32.56</b>	<b>30.12</b>	<b>32.66</b>	<b>30.22</b>	<b>56.00</b>	<b>46.00</b>	<b>-23.34</b>	<b>-15.78</b>
3	0.75938	0.11	20.48	15.38	20.59	15.49	56.00	46.00	-35.41	-30.51
4	2.05078	0.18	30.16	20.72	30.34	20.90	56.00	46.00	-25.66	-25.10
5	4.19141	0.26	30.86	20.82	31.12	21.08	56.00	46.00	-24.88	-24.92
6	14.62500	0.57	22.26	15.26	22.83	15.83	60.00	50.00	-37.17	-34.17

#### REMARKS:

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

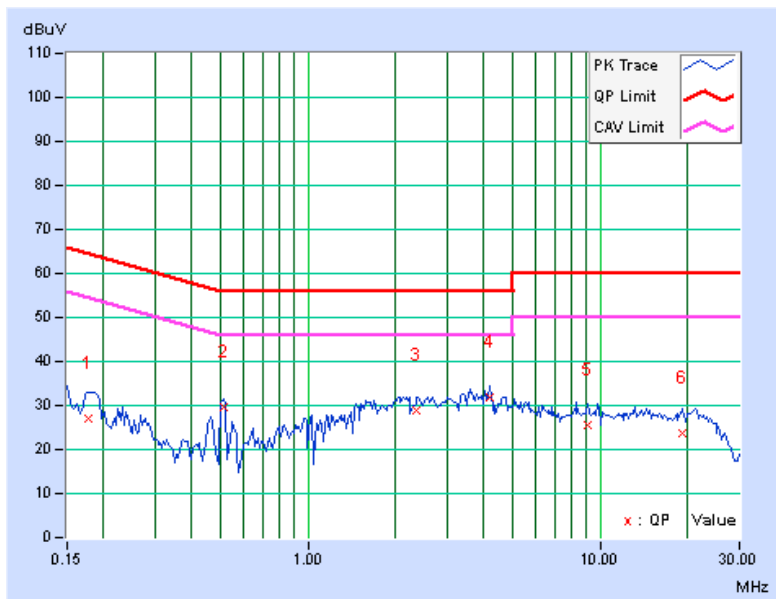


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
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No	Freq. [MHz]	Corr.	Reading Value		Emission Level		Limit		Margin	
		Factor (dB)	[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.17734	0.06	27.14	20.50	27.20	20.56	64.61	54.61	-37.41	-34.05
2	0.51328	0.10	29.70	27.52	29.80	27.62	56.00	46.00	-26.20	-18.38
3	2.35938	0.19	28.58	22.92	28.77	23.11	56.00	46.00	-27.23	-22.89
4	4.18359	0.27	31.58	21.72	31.85	21.99	56.00	46.00	-24.15	-24.01
5	9.03125	0.43	25.12	19.90	25.55	20.33	60.00	50.00	-34.45	-29.67
6	19.10156	0.72	22.90	17.78	23.62	18.50	60.00	50.00	-36.38	-31.50

**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

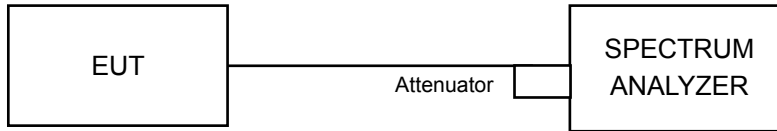


### 4.3 6dB Bandwidth Measurement

#### 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

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
SPECTRUM ANALYZER R&S	FSP 40	100060	May 08, 2014	May 07, 2015

- NOTE:**
1. The test was performed in Oven room B.
  2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
  3. Tested Date: Feb. 10, 2015

#### 4.3.4 Test Procedures

- 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.

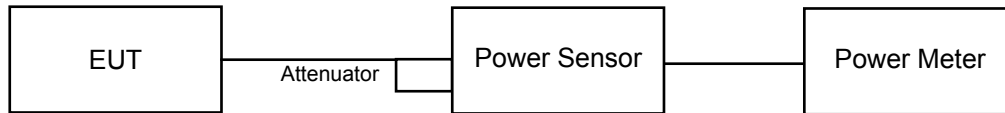


#### 4.4 Conducted Output Power Measurement

##### 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

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Power Meter Anritsu	ML2495A	1014008	Apr. 30, 2014	Apr. 29, 2015
Power Sensor Anritsu	MA2411B	0917122	Apr. 30, 2014	Apr. 29, 2015

- NOTE:**
1. The test was performed in Oven room B.
  2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
  3. Tested Date: Feb. 10, 2015

##### 4.4.4 Test Procedures

The 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
0	2402	3.926	5.94	30	Pass
19	2440	5.508	7.41	30	Pass
39	2480	7.261	8.61	30	Pass

##### FOR AVERAGE POWER

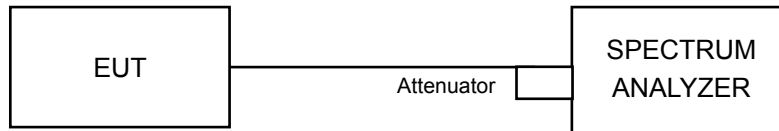
Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)
0	2402	3.606	5.57
19	2440	5.212	7.17
39	2480	6.950	8.42

## 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

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
SPECTRUM ANALYZER R&S	FSP 40	100060	May 08, 2014	May 07, 2015

- NOTE:**
1. The test was performed in Oven room B.
  2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
  3. Tested Date: Feb. 10, 2015

### 4.5.4 Test Procedures

- a. Set analyzer center frequency to DTS channel center frequency.
- b. Set the span to 1.5 times the DTS bandwidth.
- c. Set the RBW to:  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$ .
- d. Set the VBW  $\geq 3 \times \text{RBW}$ .
- e. Detector = peak.
- f. Sweep time = auto couple.
- g. Trace mode = max hold.
- h. Allow trace to fully stabilize.
- i. Use the peak marker function to determine the maximum amplitude level within the RBW.

### 4.5.5 Deviation from Test Standard

No deviation.

### 4.5.6 EUT Operating Conditions

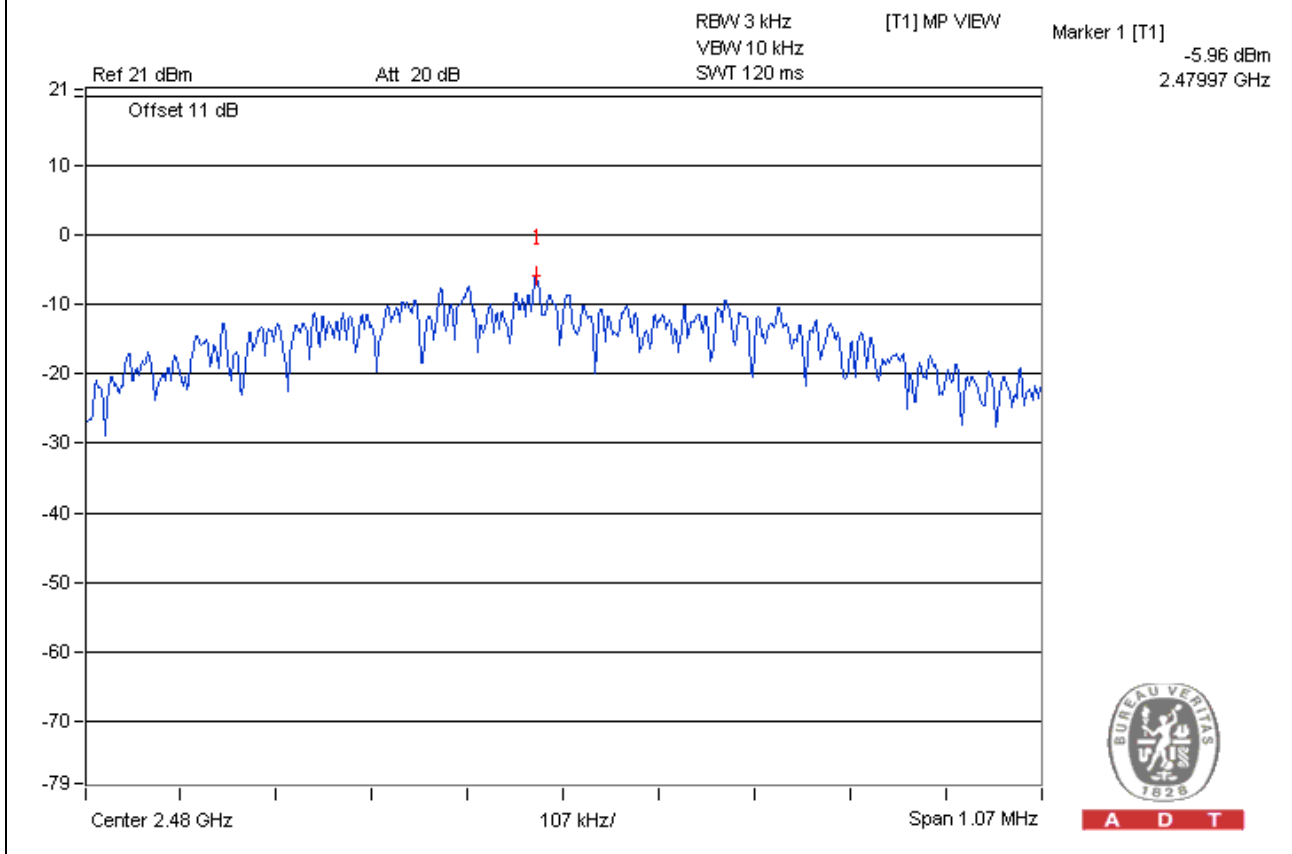
Same as Item 4.3.6



### 4.5.7 Test Results

Channel	Freq. (MHz)	PSD (dBm)	Limit (dBm)	PASS /FAIL
0	2402	-9.17	8	PASS
19	2440	-7.19	8	PASS
39	2480	-5.96	8	PASS

SPECTRUM PLOT OF WORST VALUE / CH39

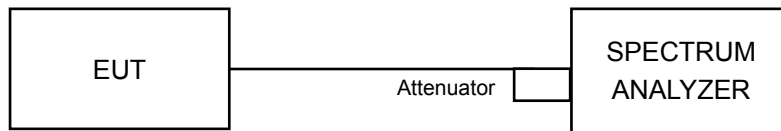


#### 4.6 Conducted Out of Band Emission Measurement

##### 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

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
SPECTRUM ANALYZER R&S	FSP 40	100060	May 08, 2014	May 07, 2015

- NOTE:**
1. The test was performed in Oven room B.
  2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
  3. Tested Date: Feb. 10, 2015

##### 4.6.4 Test Procedures

###### 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 OOBE

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

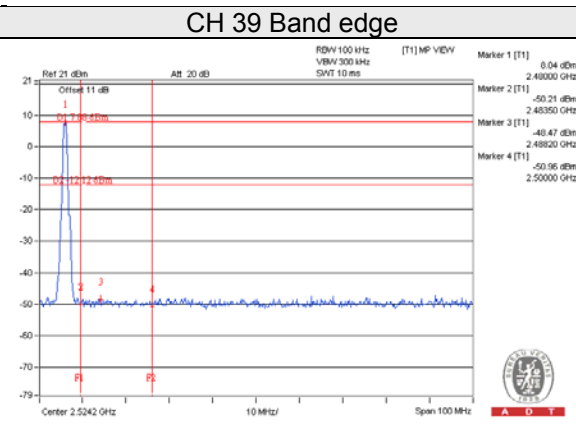
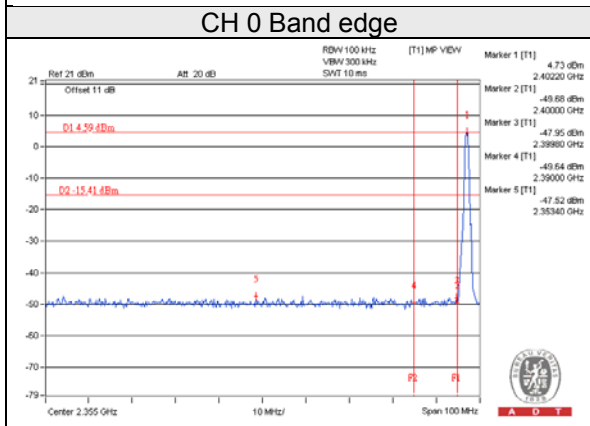
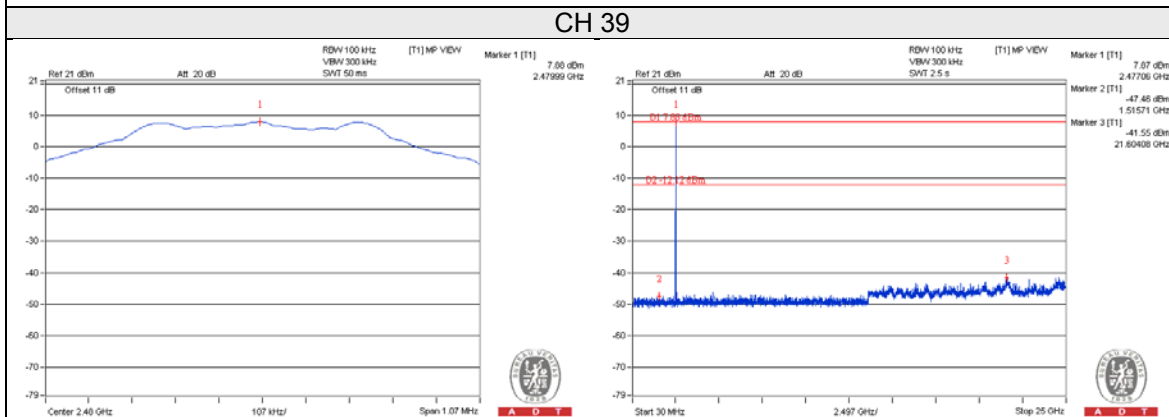
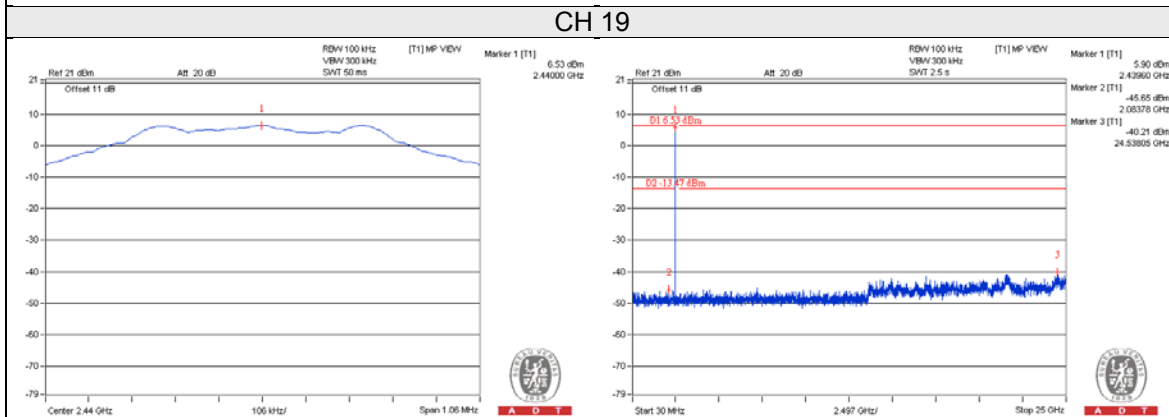
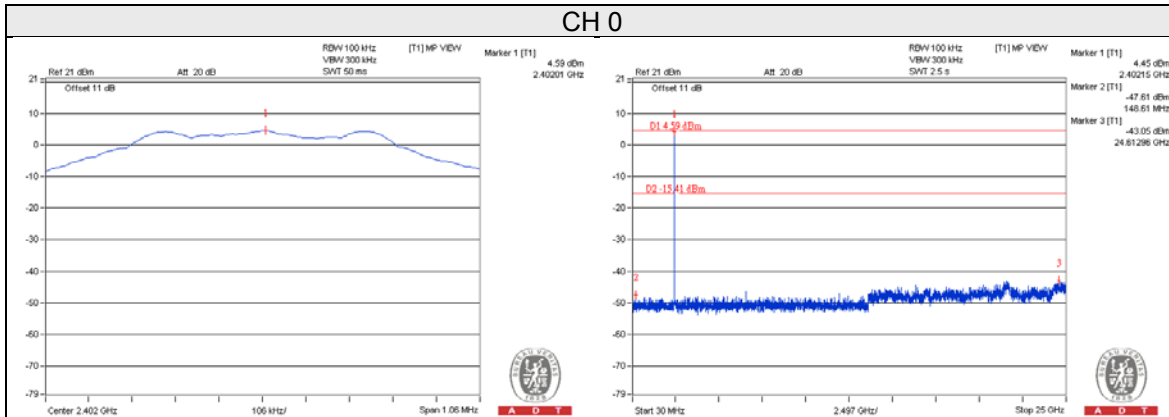
No deviation.

#### 4.6.6 EUT Operating Conditions

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.



## 5 Pictures of Test Arrangements

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

## Appendix – Information on the Testing Laboratories

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

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

**Linko EMC/RF Lab**

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Fax: 886-2-26051924

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**Web Site:** [www.bureauveritas-adt.com](http://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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