



A D T

FCC TEST REPORT

REPORT NO.: RF110113C04-1

MODEL NO.: TR 220

FCC ID: DMORS220T

RECEIVED: Jan. 10, 2011

TESTED: Jan. 17 ~ Jan. 19, 2011

ISSUED: Mar. 28, 2011

APPLICANT: Sennheiser electronic GmbH & Co.KG

ADDRESS: Am Labor 1 D-30900 Wedemark Postfach 100
264 D-30892 Wedemark, Germany

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

LAB ADDRESS: No. 47, 14th Ling, Chia Pau Tsuen, Lin Kou
Hsiang, Taipei Hsien 244, Taiwan, R.O.C.

TEST LOCATION: No. 19, Hwa Ya 2nd Rd, Wen Hwa Tsuen, Kwei
Shan Hsiang, Taoyuan Hsien 333, Taiwan, R.O.C.

This test report consists of 41 pages in total. It may be duplicated completely for legal use with the approval of the applicant. It should not be reproduced except in full, without the written approval of our laboratory. The client should not use it to claim product certification, approval, or endorsement by TAF or any government agency. The test results in the report only apply to the tested sample.





TABLE OF CONTENTS

RELEASE CONTROL RECORD.....	4
1. CERTIFICATION.....	5
2. SUMMARY OF TEST RESULTS	6
2.1 MEASUREMENT UNCERTAINTY	6
3. GENERAL INFORMATION	7
3.1 GENERAL DESCRIPTION OF EUT	7
3.2 DESCRIPTION OF TEST MODES	8
3.2.1 CONFIGURATION OF SYSTEM UNDER TEST	8
3.2.2 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL	9
3.3 GENERAL DESCRIPTION OF APPLIED STANDARDS	11
3.4 DESCRIPTION OF SUPPORT UNITS	11
4. TEST TYPES AND RESULTS	12
4.1 RADIATED EMISSION MEASUREMENT	12
4.1.1 LIMITS OF RADIATED EMISSION MEASUREMENT	12
4.1.2 TEST INSTRUMENTS.....	13
4.1.3 TEST PROCEDURES	14
4.1.4 DEVIATION FROM TEST STANDARD.....	14
4.1.5 TEST SETUP.....	15
4.1.6 EUT OPERATING CONDITIONS	15
4.1.7 TEST RESULT	16
4.2 CONDUCTED EMISSION MEASUREMENT	21
4.2.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT	21
4.2.2 TEST INSTRUMENTS.....	21
4.2.3 TEST PROCEDURES	22
4.2.4 DEVIATION FROM TEST STANDARD.....	22
4.2.5 TEST SETUP	23
4.2.6 EUT OPERATING CONDITIONS	23
4.2.7 TEST RESULTS	24
4.3 6dB BANDWIDTH MEASUREMENT.....	26
4.3.1 LIMITS OF 6dB BANDWIDTH MEASUREMENT	26
4.3.2 TEST INSTRUMENTS.....	26
4.3.3 TEST PROCEDURE.....	26
4.3.4 DEVIATION FROM TEST STANDARD.....	26
4.3.5 TEST SETUP	27
4.3.6 EUT OPERATING CONDITIONS	27
4.3.7 TEST RESULTS	28
4.4 MAXIMUM OUTPUT POWER	29



A D T

4.4.1	LIMITS OF MAXIMUM OUTPUT POWER MEASUREMENT.....	29
4.4.2	INSTRUMENTS.....	29
4.4.3	TEST PROCEDURE.....	29
4.4.4	DEVIATION FROM TEST STANDARD.....	30
4.4.5	TEST SETUP.....	30
4.4.6	EUT OPERATING CONDITIONS.....	30
4.4.7	TEST RESULTS.....	30
4.5	POWER SPECTRAL DENSITY MEASUREMENT.....	31
4.5.1	LIMITS OF POWER SPECTRAL DENSITY MEASUREMENT.....	31
4.5.2	TEST INSTRUMENTS.....	31
4.5.3	TEST PROCEDURE.....	31
4.5.4	DEVIATION FROM TEST STANDARD.....	32
4.5.5	TEST SETUP.....	32
4.5.6	EUT OPERATING CONDITION.....	32
4.5.7	TEST RESULTS.....	33
4.6	BAND EDGES MEASUREMENT.....	34
4.6.1	LIMITS OF BAND EDGES MEASUREMENT.....	34
4.6.2	TEST INSTRUMENTS.....	34
4.6.3	TEST PROCEDURE.....	34
4.6.4	DEVIATION FROM TEST STANDARD.....	34
4.6.5	EUT OPERATING CONDITION.....	34
4.6.6	TEST RESULTS.....	35
5.	PHOTOGRAPHS OF THE TEST CONFIGURATION.....	39
6.	INFORMATION ON THE TESTING LABORATORIES.....	40
7.	APPENDIX A - MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB.....	41



A D T

RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
Original release	N/A	Mar. 28, 2011



A D T

1. CERTIFICATION

PRODUCT: Digital Wireless Headphone System

MODEL: TR 220

BRAND: SENNHEISER

APPLICANT: Sennheiser electronic GmbH & Co.KG

TEST SAMPLE: ENGINEERING SAMPLE

TESTED: Jan. 17 ~ Jan. 19, 2011

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

ANSI C63.4-2003

ANSI C63.10-2009

The above equipment (Model: TR 220) 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 : Joanna Wang , DATE : Mar. 28, 2011
Joanna Wang / Senior Specialist

APPROVED BY : Gary Chang , DATE : Mar. 28, 2011
Gary Chang / Assistant Manager

2. SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC PART 15, SUBPART C (SECTION 15.247)			
STANDARD SECTION	TEST TYPE AND LIMIT	RESULT	REMARK
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -23.67dB at 0.552MHz.
15.247(a)(2)	Spectrum Bandwidth of a Direct Sequence Spread Spectrum System Limit: min. 500kHz	PASS	Meet the requirement of limit.
15.247(b)	Maximum Output Power Limit: max. 30dBm	PASS	Meet the requirement of limit.
15.247(d)	Radiated Emissions Limit: Table 15.209	PASS	Meet the requirement of limit. Minimum passing margin is -4.2dB at 31.84MHz.
15.247(e)	Power Spectral Density Limit: max. 8dBm	PASS	Meet the requirement of limit.
15.247(d)	Band Edge Measurement Limit: 20dB less than the peak value of fundamental frequency	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	9kHz~30MHz	2.44dB
Radiated emissions	30MHz ~ 200MHz	3.19dB
	200MHz ~1000MHz	3.21dB
	1GHz ~ 18GHz	2.26dB
	18GHz ~ 40GHz	1.94dB

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	Digital Wireless Headphone System
MODEL NO.	TR 220
FCC ID	DMORS220T
POWER SUPPLY	9Vdc (adapter)
MODULATION TYPE	QPSK
MODULATION TECHNOLOGY	DSSS
TRANSFER RATE	48kBit
OPERATING FREQUENCY	2412MHz, 2438MHz, 2464MHz
NUMBER OF CHANNEL	3
OUTPUT POWER	7.2mW
ANTENNA TYPE	PIFA antenna with 1.7dBi gain
ANTENNA CONNECTOR	NA
I/O PORTS	Refer to users' manual
DATA CABLE	2.1m non-shielded coaxial cable without core 2.1m non-shielded stereo audio cable with dual RCA plugs
ACCESSORY DEVICES	Adapter, audio adapter(2 RCA sockets to 3.5mm jack plug)

NOTE:

- The EUT was powered by the following adapter:

BRAND	PHIHONG
MODEL	PSM11R-090
INPUT POWER	100-240Vac, 0.3A, 50-60Hz
OUTPUT POWER	9Vdc, 1.12A
POWER LINE	1.8m non-shielded cable without core

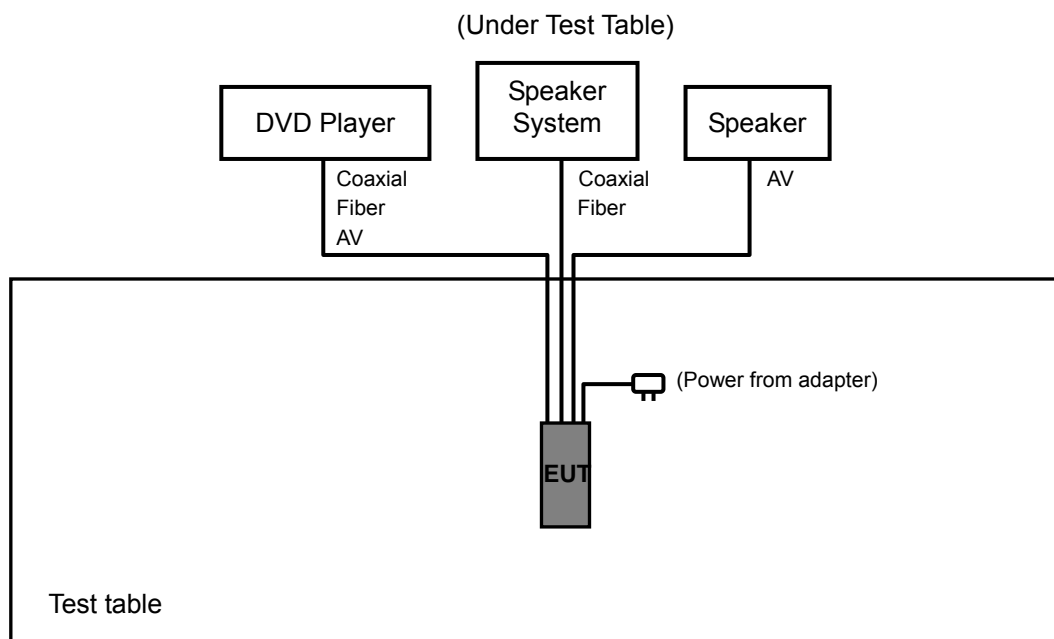
- The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

3.2 DESCRIPTION OF TEST MODES

3 channels are provided to this EUT:

CHANNEL	FREQUENCY
1	2412MHz
2	2438MHz
3	2464MHz

3.2.1 CONFIGURATION OF SYSTEM UNDER TEST



3.2.2 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

RADIATED EMISSION TEST (ABOVE 1GHz):

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations 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
1 to 3	1, 2, 3	QPSK

RADIATED EMISSION TEST (BELOW 1GHz):

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations 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
1 to 3	1	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.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
1 to 3	1	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.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
1 to 3	1, 3	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.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
1 to 3	1, 2, 3	QPSK

TEST CONDITION:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE \geq 1G	24deg. C, 65%RH, 1023 hPa	120Vac, 60Hz	Brad Wu
RE<1G	22deg. C, 65%RH, 1021 hPa	120Vac, 60Hz	Brad Wu
PLC	22deg. C, 62%RH, 1019 hPa	120Vac, 60Hz	David Huang
APCM	23deg. C, 68%RH, 1021 hPa	120Vac, 60Hz	Sun Lin

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 C (15.247)

ANSI C63.4-2003

ANSI C63.10-2009

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

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
1	SPEAKER SYSTEM	Logitech	Z-5500	NA	NA
2	DVD PLAYER	SONY	DVP-NS530	1003509	Verification
3	SPEAKER	SANYO	SYSP-802	SP07500040300838	NA

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	2.1m coaxial cable, 1m fiber cable.
2	2.1m coaxial cable, 1m fiber cable, 2.1m AV cable.
3	2.1m AV cable.

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

4. TEST TYPES AND RESULTS

4.1 RADIATED EMISSION MEASUREMENT

4.1.1 LIMITS OF RADIATED EMISSION MEASUREMENT

Emissions radiated outside of the specified bands, shall be according to the general radiated limits in 15.209 as following:

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. As shown in 15.35(b), 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 ROHDE & SCHWARZ	ESI7	838496/016	Dec. 27, 2010	Dec. 26, 2011
Spectrum Analyzer ROHDE & SCHWARZ	FSU43	100115	Aug. 02, 2010	Aug. 01, 2011
BILOG Antenna SCHWARZBECK	VULB9168	9168-155	Apr. 28, 2010	Apr. 27, 2011
HORN Antenna SCHWARZBECK	BBHA 9120D	9120D-408	Jan. 06, 2011	Jan. 05, 2012
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170243	Dec. 27, 2010	Dec. 26, 2011
Preamplifier Agilent	8449B	3008A01961	Nov. 02, 2010	Nov. 01, 2011
Preamplifier Agilent	8447D	2944A10738	Nov. 02, 2010	Nov. 01, 2011
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	274041/4	Aug. 21, 2010	Aug. 20, 2011
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	283397/4	Aug. 21, 2010	Aug. 20, 2011
Software ADT.	ADT_Radiated_ V7.6.15.9.2	NA	NA	NA
Antenna Tower inn-co GmbH	MA 4000	010303	NA	NA
Antenna Tower Controller inn-co GmbH	CO2000	019303	NA	NA
Turn Table ADT.	TT100.	TT93021704	NA	NA
Turn Table Controller ADT.	SC100.	SC93021704	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 Chamber 4.
 3. The horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
 4. The FCC Site Registration No. is 988962.
 5. The IC Site Registration No. is IC7450F-4.

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. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. If the emission level of the EUT in peak mode was lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

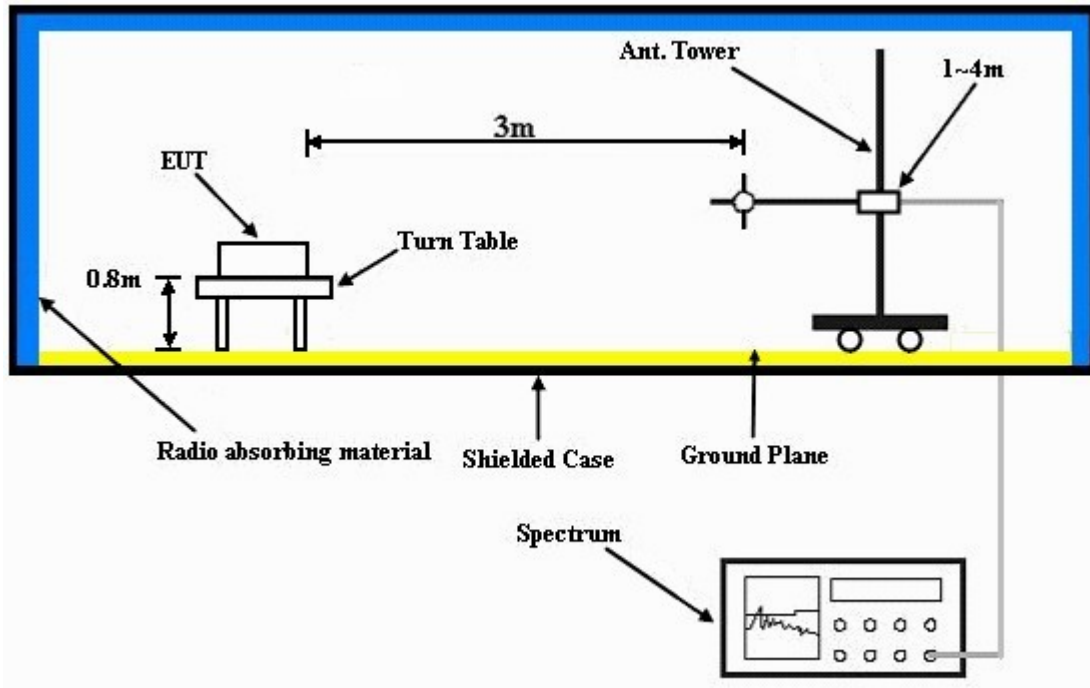
NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz for Average detection (AV) at frequency above 1GHz.
4. 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



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

4.1.6 EUT OPERATING CONDITIONS

- Placed the EUT on the testing table.
- Set the EUT under transmitting condition continuously at specific channel frequency.
- The necessary accessories enable the system in full functions.



A D T

4.1.7 TEST RESULT

ABOVE 1GHz DATA

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 1	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	24deg. C, 65%RH 1023 hPa	TESTED BY	Brad Wu

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	2280.00	56.5 PK	74.0	-17.5	1.00 H	185	25.80	30.70
2	2280.00	45.7 AV	54.0	-8.3	1.00 H	185	15.00	30.70
3	2390.00	55.7 PK	74.0	-18.3	1.00 H	185	24.60	31.10
4	2390.00	44.5 AV	54.0	-9.5	1.00 H	185	13.40	31.10
5	*2412.00	100.0 PK			1.00 H	184	68.80	31.20
6	*2412.00	89.3 AV			1.00 H	184	58.10	31.20
7	4824.00	50.8 PK	74.0	-23.2	1.38 H	289	13.60	37.20
8	4824.00	40.1 AV	54.0	-13.9	1.38 H	289	2.90	37.20
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	2280.00	54.2 PK	74.0	-19.8	1.26 V	29	23.50	30.70
2	2280.00	43.1 AV	54.0	-10.9	1.26 V	29	12.40	30.70
3	2390.00	55.2 PK	74.0	-18.8	1.26 V	29	24.10	31.10
4	2390.00	43.5 AV	54.0	-10.5	1.26 V	29	12.40	31.10
5	*2412.00	96.9 PK			1.26 V	29	65.70	31.20
6	*2412.00	86.2 AV			1.26 V	29	55.00	31.20
7	4824.00	56.2 PK	74.0	-17.8	1.08 V	351	19.00	37.20
8	4824.00	45.5 AV	54.0	-8.5	1.08 V	351	8.30	37.20

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).
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. “ * ” : Fundamental frequency
6. The average value of fundamental frequency is: Average = Peak value + 20log(Duty cycle) Where the duty factor is calculated from following formula:
 $20 \log (\text{Duty cycle}) = 20 \log (29.12 \text{ ms} / 100 \text{ ms}) = -10.7 \text{ dB}$
Please see page 19 for plotted duty.



A D T

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 2	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	24deg. C, 65%RH 1023 hPa	TESTED BY	Brad Wu

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	2305.00	57.7 PK	74.0	-16.3	1.03 H	180	26.90	30.80
2	2305.00	46.6 AV	54.0	-7.4	1.03 H	180	15.80	30.80
3	*2438.00	99.2 PK			1.00 H	181	68.00	31.20
4	*2438.00	88.5 AV			1.00 H	181	57.30	31.20
5	4876.00	50.4 PK	74.0	-23.6	1.21 H	272	13.10	37.30
6	4876.00	39.7 AV	54.0	-14.3	1.21 H	272	2.40	37.30
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	2305.00	54.6 PK	74.0	-19.4	1.25 V	30	23.80	30.80
2	2305.00	43.4 AV	54.0	-10.6	1.25 V	30	12.60	30.80
3	*2438.00	95.8 PK			1.25 V	30	64.60	31.20
4	*2438.00	85.1 AV			1.25 V	30	53.90	31.20
5	4876.00	54.0 PK	74.0	-20.0	1.08 V	354	16.70	37.30
6	4876.00	43.3 AV	54.0	-10.7	1.08 V	354	6.00	37.30

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).
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. “ * “ : Fundamental frequency
6. The average value of fundamental frequency is: Average = Peak value + 20log(Duty cycle) Where the duty factor is calculated from following formula:
20 log (Duty cycle) = 20 log (29.12 ms / 100 ms) = -10.7 dB
Please see page 19 for plotted duty.

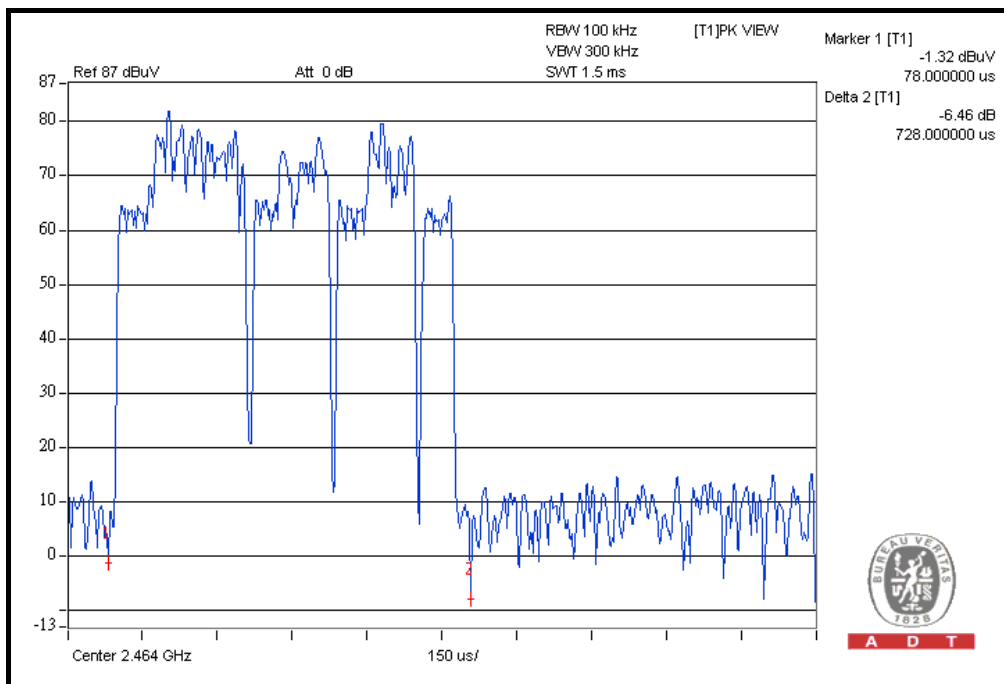
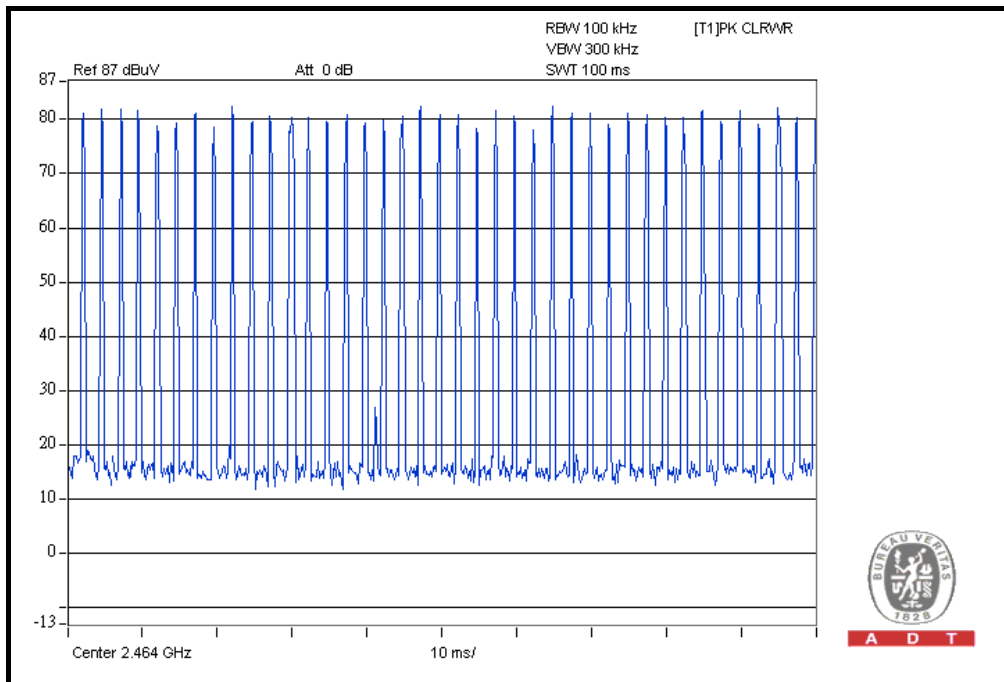


A D T

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 3	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	24deg. C, 65%RH 1023 hPa	TESTED BY	Brad Wu

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	2331.00	58.7 PK	74.0	-15.3	1.02 H	185	27.80	30.90
2	2331.00	48.5 AV	54.0	-5.5	1.02 H	185	17.60	30.90
3	*2464.00	98.2 PK			1.00 H	181	66.90	31.30
4	*2464.00	87.5 AV			1.00 H	181	56.20	31.30
5	2483.50	55.6 PK	74.0	-18.4	1.00 H	181	24.20	31.40
6	2483.50	44.5 AV	54.0	-9.5	1.00 H	181	13.10	31.40
7	4928.00	47.7 PK	74.0	-26.3	1.46 H	78	10.30	37.40
8	4928.00	37.0 AV	54.0	-17.0	1.46 H	78	-0.40	37.40
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	2331.00	54.8 PK	74.0	-19.2	1.26 V	31	23.90	30.90
2	2331.00	43.6 AV	54.0	-10.4	1.26 V	31	12.70	30.90
3	*2464.00	94.8 PK			1.26 V	31	63.50	31.30
4	*2464.00	84.1 AV			1.26 V	31	52.80	31.30
5	2483.50	55.2 PK	74.0	-18.8	1.26 V	31	23.80	31.40
6	2483.50	44.0 AV	54.0	-10.0	1.26 V	31	12.60	31.40
7	4928.00	53.8 PK	74.0	-20.2	1.09 V	230	16.40	37.40
8	4928.00	43.1 AV	54.0	-10.9	1.09 V	230	5.70	37.40

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).
 3. The other emission levels were very low against the limit.
 4. Margin value = Emission level – Limit value.
 5. “ * ” : Fundamental frequency
 6. The average value of fundamental frequency is: Average = Peak value + 20log(Duty cycle) Where the duty factor is calculated from following formula:
 $20 \log (\text{Duty cycle}) = 20 \log (29.12 \text{ ms} / 100 \text{ ms}) = -10.7 \text{ dB}$
 Please see page 19 for plotted duty.



$$20 \log (\text{Duty cycle}) = 20 \log (40 \times 0.728 \text{ ms} / 100 \text{ ms}) = -10.7 \text{ dB}$$



A D T

BELOW 1GHz WORST-CASE DATA

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 1	FREQUENCY RANGE	Below 1000MHz
INPUT POWER	120Vac, 60 Hz	DETECTOR FUNCTION	Quasi-Peak
ENVIRONMENTAL CONDITIONS	22deg. C, 65%RH 1021 hPa	TESTED BY	Brad Wu

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	119.34	26.5 QP	43.5	-17.0	1.50 H	265	14.00	12.50
2	158.22	32.0 QP	43.5	-11.5	1.50 H	106	17.10	14.90
3	195.16	28.6 QP	43.5	-14.9	1.50 H	262	16.10	12.50
4	269.05	26.4 QP	46.0	-19.6	1.25 H	238	12.20	14.20
5	830.95	29.1 QP	46.0	-16.9	1.75 H	40	1.30	27.80
6	904.83	33.7 QP	46.0	-12.3	1.50 H	325	5.00	28.70
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	31.84	35.8 QP	40.0	-4.2	1.00 V	190	22.90	12.90
2	88.23	29.0 QP	43.5	-14.5	1.00 V	250	19.10	9.90
3	160.17	29.5 QP	43.5	-14.0	1.00 V	310	14.60	14.90
4	245.72	25.2 QP	46.0	-20.8	1.00 V	235	11.80	13.40
5	311.82	24.5 QP	46.0	-21.5	1.50 V	259	8.80	15.70
6	527.64	24.5 QP	46.0	-21.5	1.00 V	217	2.50	22.00

- 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).
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 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	ESCS30	100291	Nov. 30, 2010	Nov. 29, 2011
RF signal cable Woken	5D-FB	Cable-HYC01-01	Dec. 30, 2010	Dec. 29, 2011
LISN ROHDE & SCHWARZ	ESH3-Z5	100312	Jun. 28, 2010	Jun. 27, 2011
V-LISN SCHWARZBECK	NNBL 8226-2	8226-142	Jul. 12, 2010	Jul. 11, 2011
LISN ROHDE & SCHWARZ	ENV216	100072	Jun. 11, 2010	Jun. 10, 2011
Software ADT	ADT_Conc_ V7.3.7	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.

4.2.3 TEST PROCEDURES

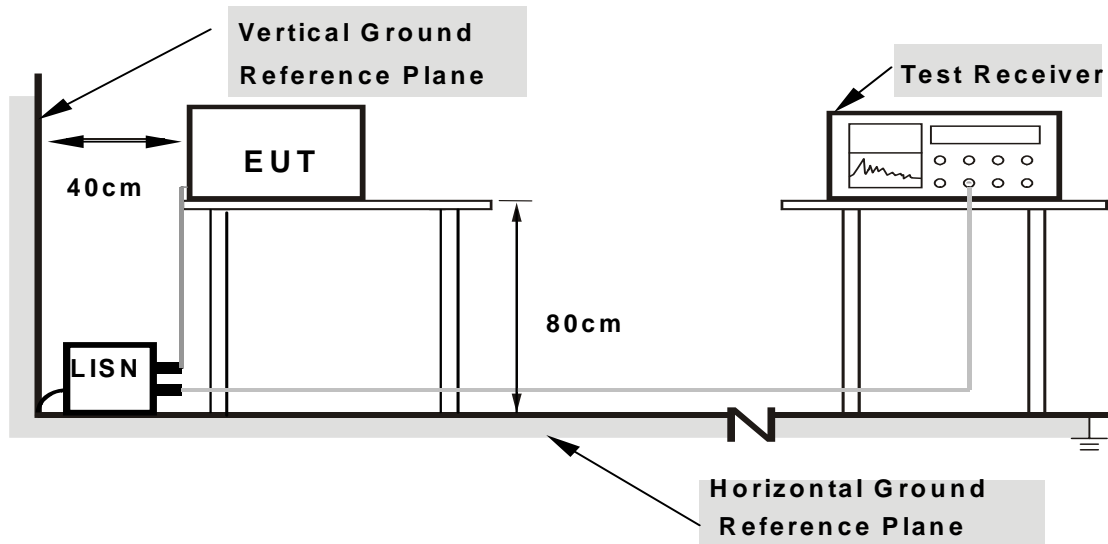
- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling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

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.

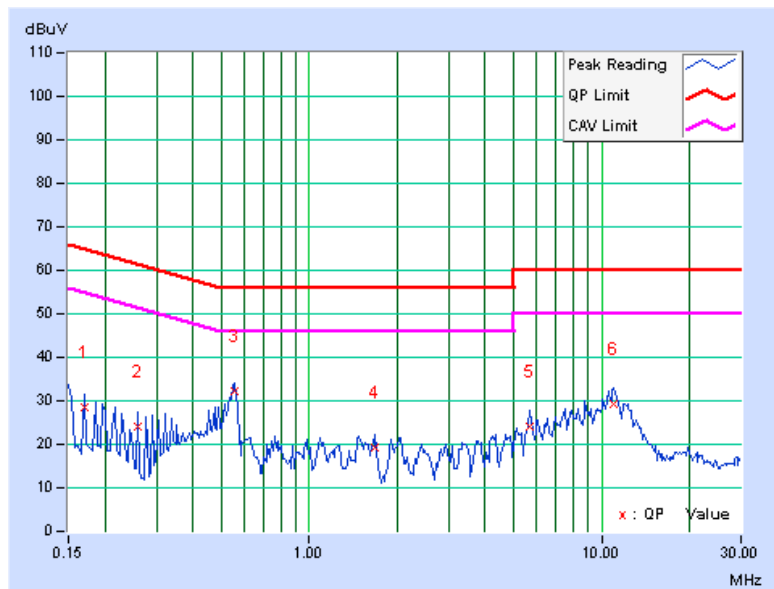
4.2.7 TEST RESULTS

CONDUCTED WORST-CASE DATA :

PHASE	Line 1	6dB BANDWIDTH	9kHz
-------	--------	---------------	------

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.170	0.14	28.46	-	28.60	-	64.98	54.98	-36.38	-
2	0.259	0.14	23.75	-	23.89	-	61.45	51.45	-37.56	-
3	0.552	0.16	32.17	-	32.33	-	56.00	46.00	-23.67	-
4	1.672	0.21	19.09	-	19.30	-	56.00	46.00	-36.70	-
5	5.656	0.48	23.67	-	24.15	-	60.00	50.00	-35.85	-
6	11.016	0.87	28.45	-	29.32	-	60.00	50.00	-30.68	-

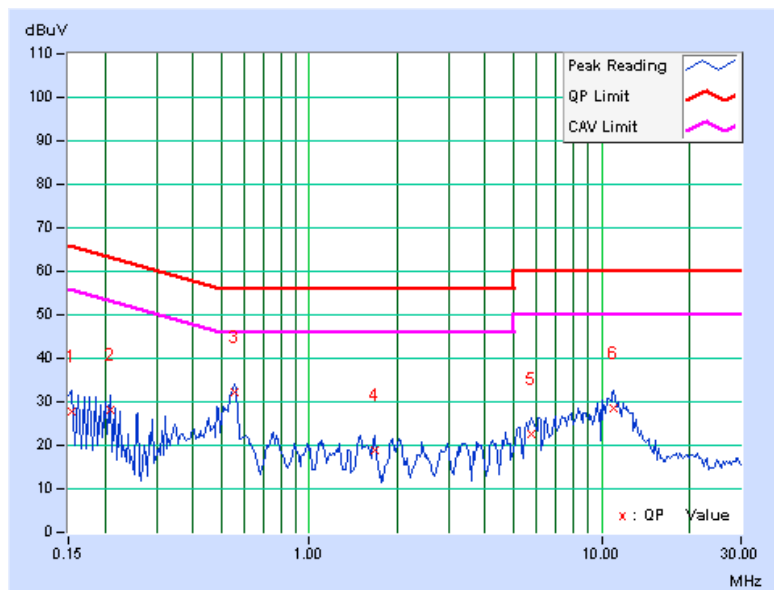
- REMARKS:**
1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
 2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
 3. The emission levels of other frequencies were very low against the limit.
 4. Margin value = Emission level - Limit value
 5. Correction factor = Insertion loss + Cable loss
 6. Emission Level = Correction Factor + Reading Value.



PHASE	Line 2	6dB BANDWIDTH	9kHz
-------	--------	---------------	------

No	Freq.	Corr.	Reading Value		Emission Level		Limit		Margin	
	[MHz]	Factor	[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
		(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.154	0.13	27.67	-	27.80	-	65.79	55.79	-37.99	-
2	0.209	0.13	28.14	-	28.27	-	63.26	53.26	-34.99	-
3	0.552	0.15	32.11	-	32.26	-	56.00	46.00	-23.74	-
4	1.676	0.20	18.85	-	19.05	-	56.00	46.00	-36.95	-
5	5.766	0.44	22.17	-	22.61	-	60.00	50.00	-37.39	-
6	11.020	0.78	27.84	-	28.62	-	60.00	50.00	-31.38	-

- REMARKS:** 1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
3. The emission levels of other frequencies were very low against the limit.
4. Margin value = Emission level - Limit value
5. Correction factor = Insertion loss + Cable loss
6. 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 INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
SPECTRUM ANALYZER R&S	FSP40	100039	Jan. 11, 2011	Jan. 10, 2012

NOTE: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

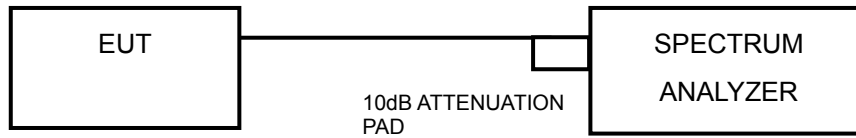
4.3.3 TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 100kHz RBW and 300kHz VBW. The 6dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6dB.

4.3.4 DEVIATION FROM TEST STANDARD

No deviation.

4.3.5 TEST SETUP



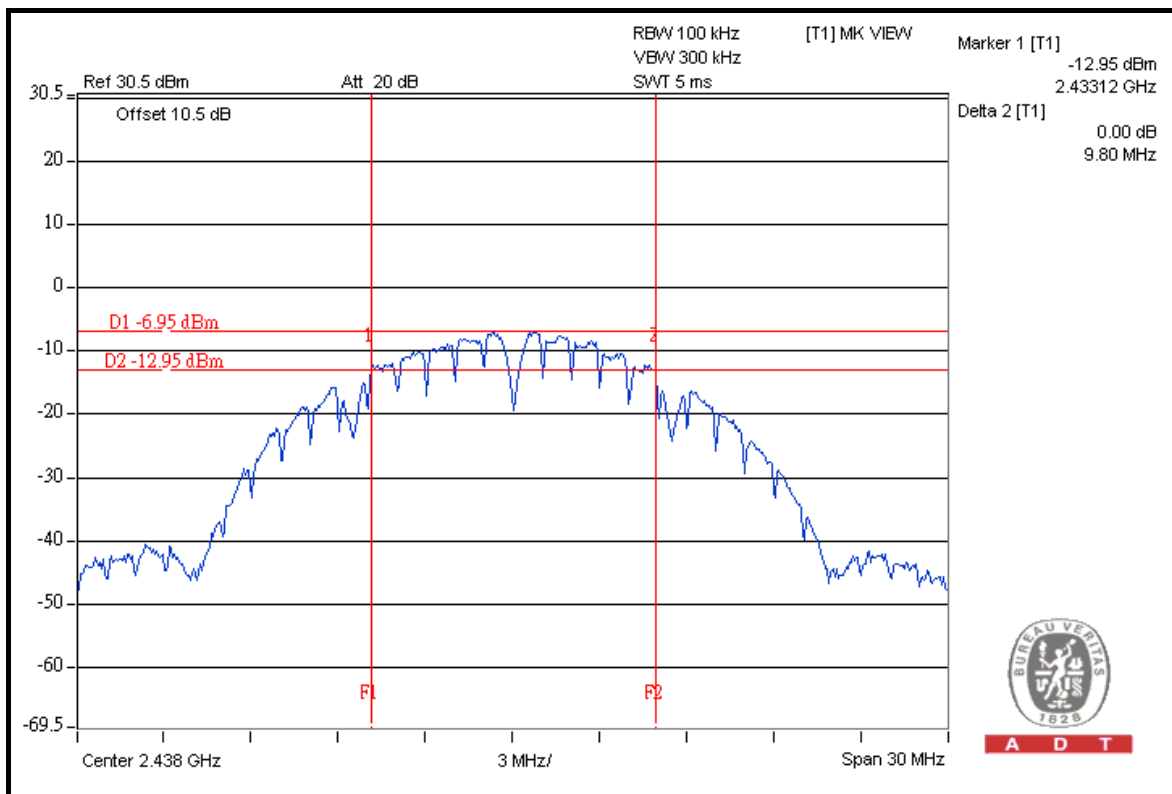
4.3.6 EUT OPERATING CONDITIONS

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	CHANNEL FREQUENCY (MHz)	6dB BANDWIDTH (MHz)	MINIMUM LIMIT (MHz)	PASS / FAIL
1	2412	9.73	0.5	PASS
2	2438	9.80	0.5	PASS
3	2464	9.67	0.5	PASS

CH 2



4.4 MAXIMUM OUTPUT POWER

4.4.1 LIMITS OF MAXIMUM OUTPUT POWER MEASUREMENT

The Maximum Output Power Measurement is 30dBm.

4.4.2 INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
High Speed Peak Power Meter	ML2495A	0842014	Apr. 21, 2010	Apr. 20, 2011
Power Sensor	MA2411B	0738404	Apr. 21, 2010	Apr. 20, 2011

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. Measurement Bandwidth of ML2495A is 65MHz greater than 6dB bandwidth of emission.

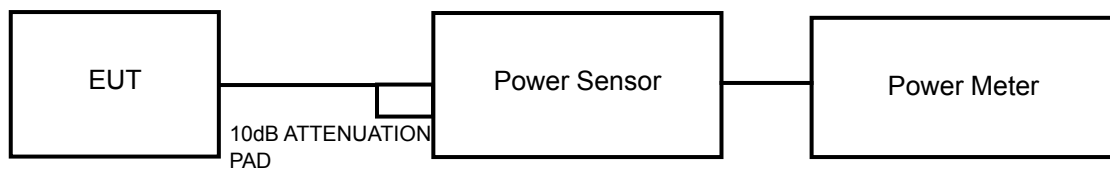
4.4.3 TEST PROCEDURE

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

4.4.4 DEVIATION FROM TEST STANDARD

No deviation.

4.4.5 TEST SETUP



4.4.6 EUT OPERATING CONDITIONS

Same as Item 4.3.6.

4.4.7 TEST RESULTS

CHANNEL	CHANNEL FREQUENCY (MHz)	POWER OUTPUT (mW)	POWER OUTPUT (dBm)	POWER LIMIT (dBm)	PASS/FAIL
1	2412	7.2	8.6	30	PASS
2	2438	6.3	8.0	30	PASS
3	2464	5.4	7.3	30	PASS

4.5 POWER SPECTRAL DENSITY MEASUREMENT

4.5.1 LIMITS OF POWER SPECTRAL DENSITY MEASUREMENT

The Maximum of Power Spectral Density Measurement is 8dBm.

4.5.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
SPECTRUM ANALYZER R&S	FSP40	100039	Jan. 11, 2011	Jan. 10, 2012

NOTE: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

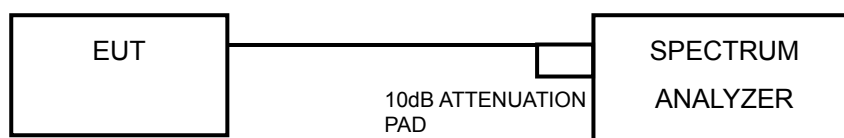
4.5.3 TEST PROCEDURE

1. Follow DTS measurement (PSD Option 2), the transmitter output was connected to the spectrum analyzer through an attenuator, the bandwidth of the fundamental frequency was measured with the spectrum analyzer. Locate and zoom in on emission peak(s) within the pass band.
2. Set RBW = 3 kHz /VBW > 9 kHz and sweep time to Automatic.
3. Detector use peak mode and a video trigger with the trigger level set to enable triggering only on full power pulses.
4. Trace average 100 traces in power averaging mode. The power spectral density was measured and recorded.

4.5.4 DEVIATION FROM TEST STANDARD

No deviation.

4.5.5 TEST SETUP



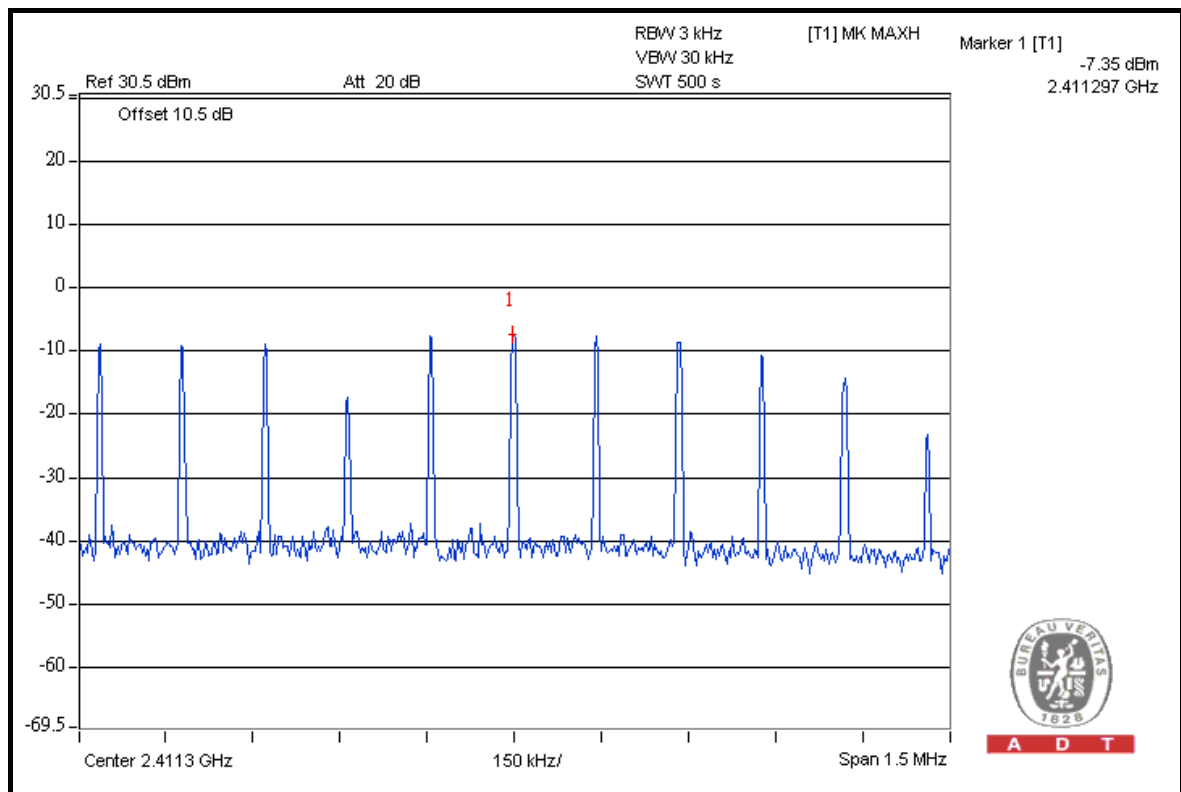
4.5.6 EUT OPERATING CONDITION

Same as Item 4.3.6.

4.5.7 TEST RESULTS

CHANNEL	CHANNEL FREQUENCY (MHz)	RF POWER LEVEL IN 3 kHz BW (dBm)	MAXIMUM LIMIT (dBm)	PASS/FAIL
1	2412	-7.35	8	PASS
2	2438	-7.94	8	PASS
3	2464	-8.63	8	PASS

CH 1



4.6 BAND EDGES MEASUREMENT

4.6.1 LIMITS OF BAND EDGES MEASUREMENT

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

4.6.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
SPECTRUM ANALYZER R&S	FSP40	100039	Jan. 11, 2011	Jan. 10, 2012

NOTE: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

4.6.3 TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer via a low loss cable. Set both RBW and VBW of spectrum analyzer to 100kHz and 300kHz with suitable frequency span including 100MHz bandwidth from band edge. The band edges were measured and recorded.

The spectrum plots (Peak RBW = 100kHz, VBW = 300kHz; Average RBW = 1MHz, VBW = 10Hz) are attached on the following pages.

4.6.4 DEVIATION FROM TEST STANDARD

No deviation.

4.6.5 EUT OPERATING CONDITION

Same as Item 4.3.6.

4.6.6 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 in part 15.247(d).

RESTRICT BAND (2310 ~ 2390 MHz)

FREQUENCY (MHz)	FUNDAMENTAL EMISSION (dBuV/m)	DELTA (dB)	MAXIMUM FIELD STRENGTH IN RESTRICT BAND (dBuV/m)	LIMIT (dBuV/m)
2412.00 (PK)	100.00	41.01	58.99	74.00
2412.00 (AV)	89.30	57.35	31.95	54.00

RESTRICT BAND (2483.5 ~ 2500 MHz)

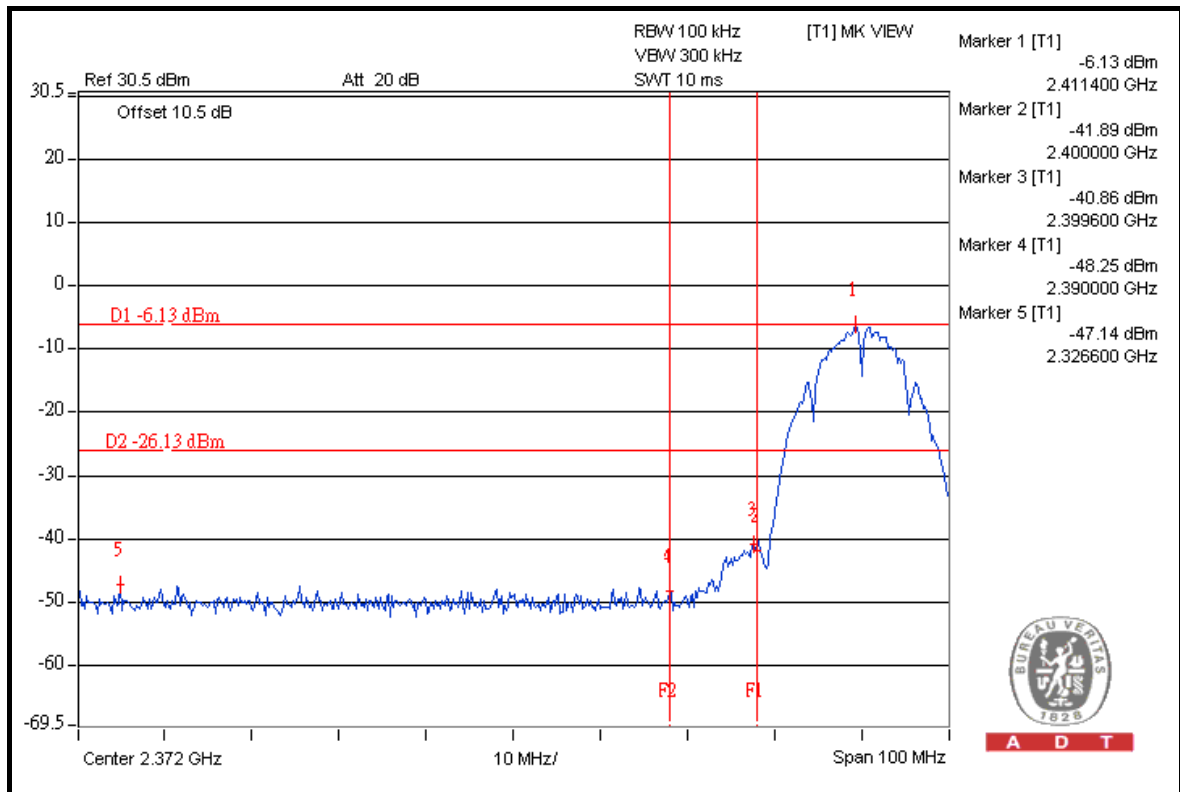
FREQUENCY (MHz)	FUNDAMENTAL EMISSION (dBuV/m)	DELTA (dB)	MAXIMUM FIELD STRENGTH IN RESTRICT BAND (dBuV/m)	LIMIT (dBuV/m)
2464.00 (PK)	98.20	40.27	57.93	74.00
2464.00 (AV)	87.50	58.17	29.33	54.00

NOTE:

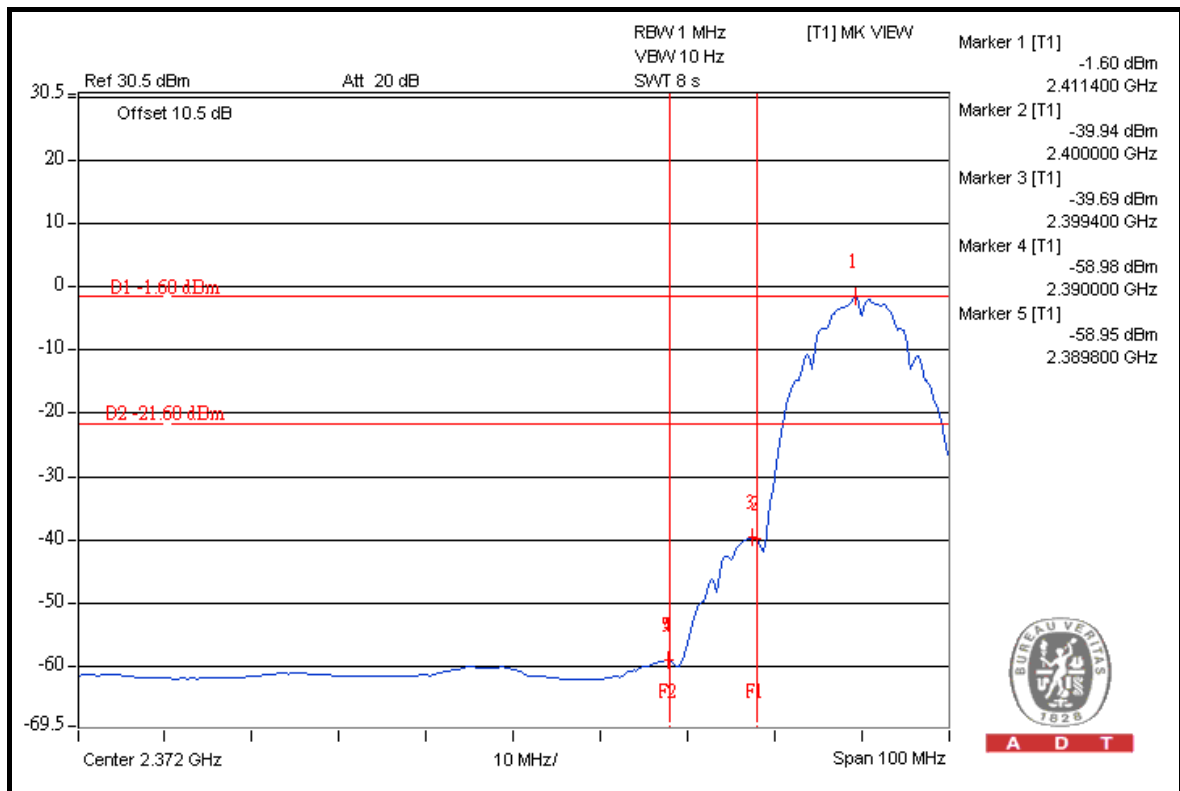
1. Delta = Amplitude between the peak of the fundamental and the peak of the band edge emission. Please check following 3 pages.
2. Maximum field strength in restrict band = Fundamental emission – Delta.



A D T



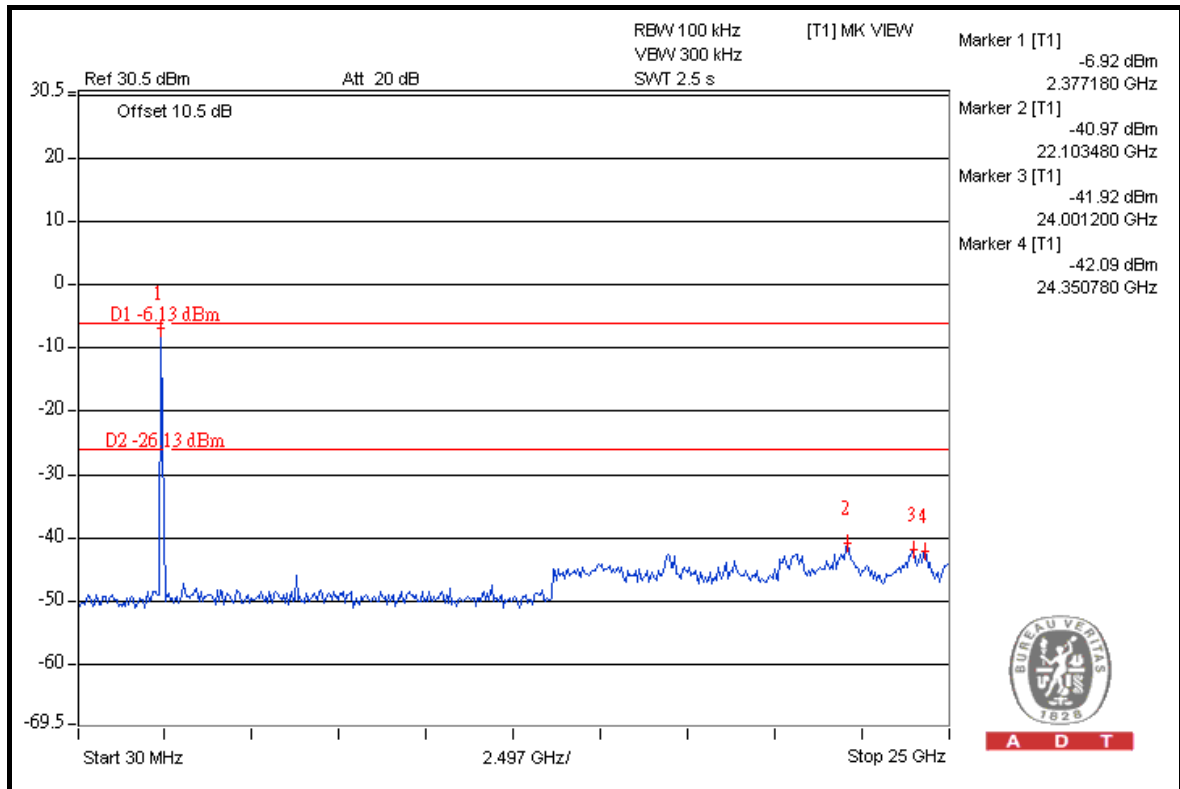
A D T



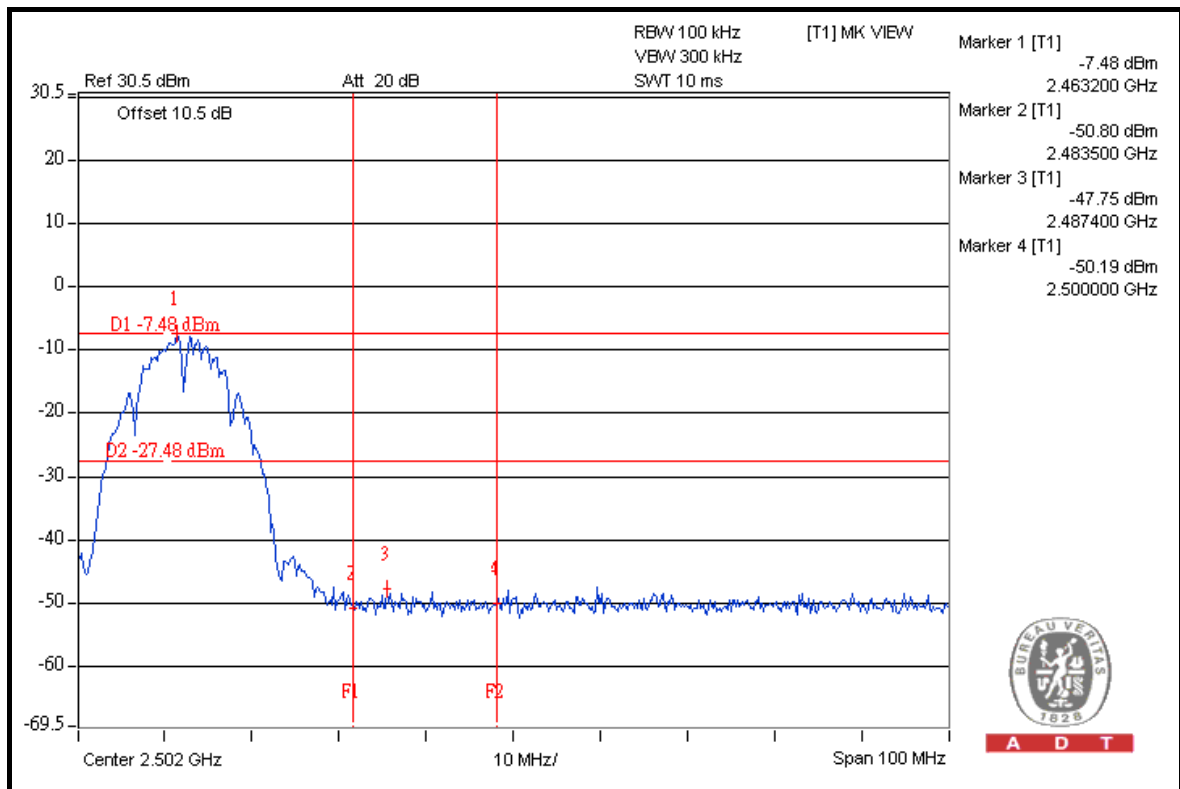
A D T



A D T



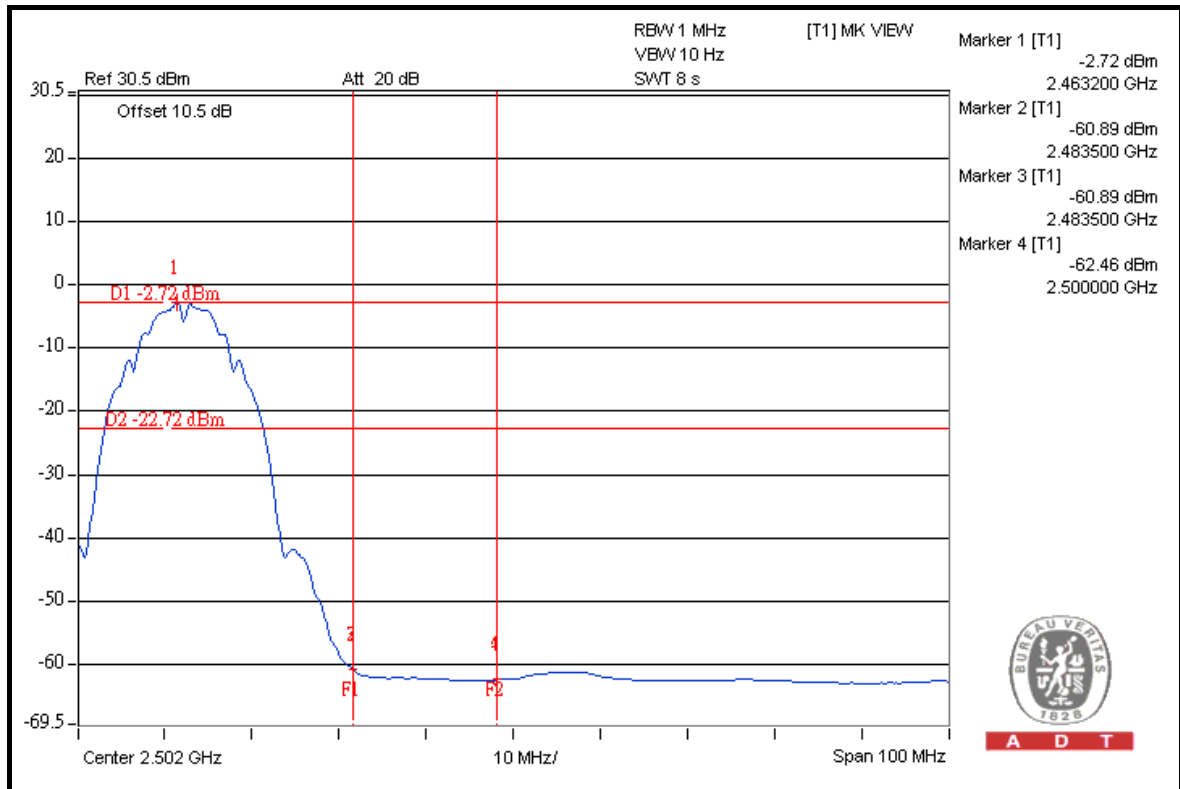
A D T



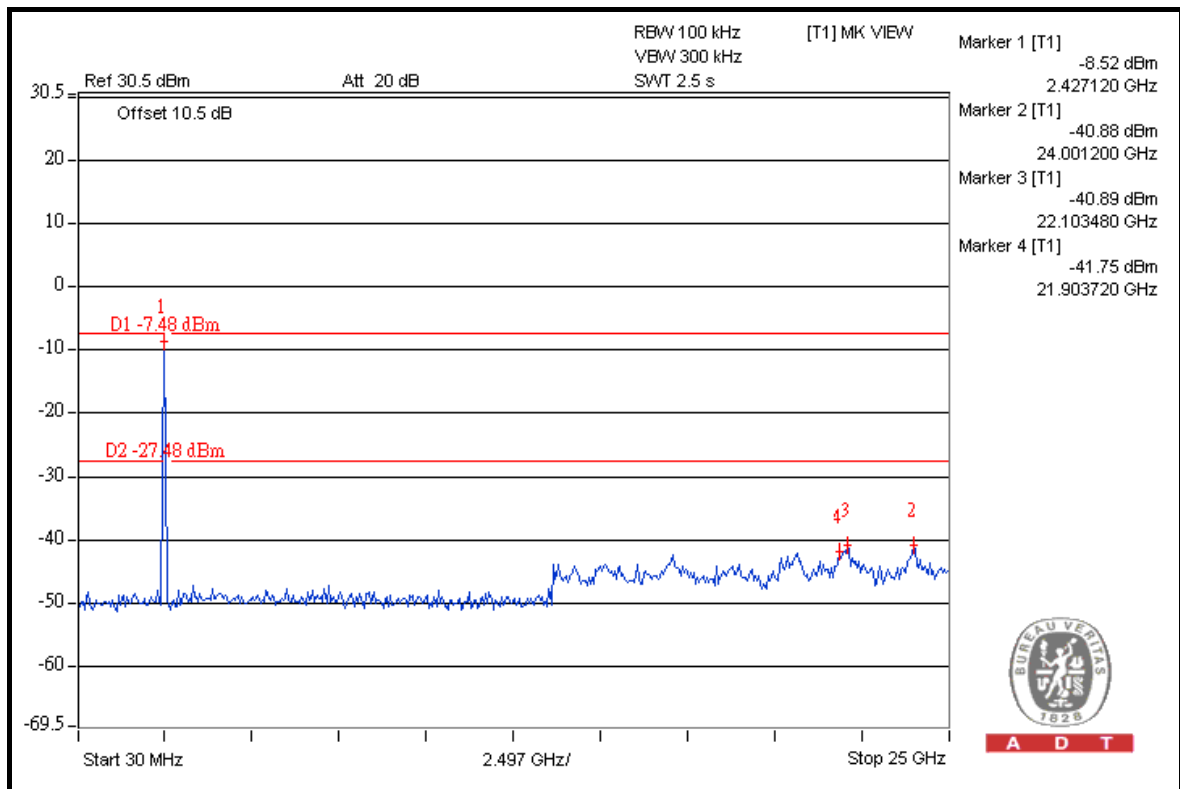
A D T



A D T



A D T



A D T



A D T

5. PHOTOGRAPHS OF THE TEST CONFIGURATION

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



A D T

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:

Copies of accreditation certificates of our laboratories obtained from approval agencies can be downloaded from our web site:

www.adt.com.tw/index.5.phtml. If you have any comments, please feel free to contact us at the following:

Linko EMC/RF Lab:

Tel: 886-2-26052180

Fax: 886-2-26051924

Hsin Chu EMC/RF Lab:

Tel: 886-3-5935343

Fax: 886-3-5935342

Hwa Ya EMC/RF/Safety/TPCI Lab:

Tel: 886-3-3183232

Fax: 886-3-3185050

Web Site: www.adt.com.tw

The address and road map of all our labs can be found in our web site also.



A D T

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---