



FCC TEST REPORT

REPORT NO.: RF980717L13

MODEL NO.: TR160

RECEIVED: Jul. 17, 2009

TESTED: Jul. 22 ~ Aug. 20, 2009

ISSUED: Aug. 24, 2009

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.

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1. CERTIFICATION

PRODUCT: Digital Wireless Headphone System (RS160)
MODEL: TR160
BRAND: SENNHEISER
APPLICANT: Sennheiser electronic GmbH & Co.KG
TESTED: Jul. 22 ~ Aug. 20, 2009
TEST SAMPLE: MASS-PRODUCTION
STANDARDS: **FCC Part 15, Subpart C (Section 15.247)**
ANSI C63.4-2003

The above equipment (model: TR160) 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 :  , **DATE** : Aug. 24, 2009
Joanna Wang / Senior Specialist

TECHNICAL ACCEPTANCE :  , **DATE** : Aug. 24, 2009
Responsible for RF Long Chen / Senior Engineer

APPROVED BY :  , **DATE** : Aug. 24, 2009
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			
Standard Section	Test Type and Limit	Result	Remark
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -18.80dB at 4.809MHz.
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 Peak 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 -2.31dB at 2483.50MHz.
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.

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	2.44dB
Radiated emissions	30MHz ~ 200MHz	2.93dB
	200MHz ~1000MHz	2.95dB
	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

PRODUCT	Digital Wireless Headphone System (RS160)
MODEL NO.	TR160
FCC ID	DMOTR160
POWER SUPPLY	5Vdc from adapter 3.0Vdc from battery
MODULATION TYPE	MSK
TRANSFER RATE	2.37Mb/s
OPERATING FREQUENCY	2403MHz ~ 2478MHz
NUMBER OF CHANNEL	16
MAXIMUM OUTPUT POWER	1.462mW
ANTENNA TYPE	Inverted F antenna with 1.79dBi gain
DATA CABLE	2.1m non-shielded audio cable without core
I/O PORTS	NA
ACCESSORY DEVICES	Adapter

NOTE:

1. The EUT was operated with following power adapter:

BRAND:	SENNHEISER
MODEL:	SSA-4P 5050F
INPUT:	100-240Vac, 50-60Hz, 0.2A
OUTPUT:	5Vdc, 500mA
POWER LINE:	1.8m non-shielded cable without core

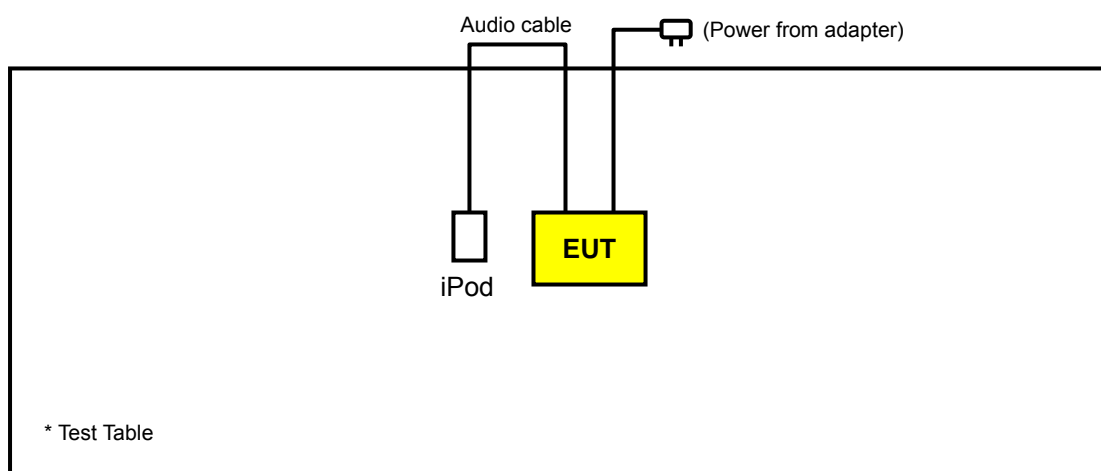
2. The above EUT information was declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

3.2 DESCRIPTION OF TEST MODES

16 channels are provided to this EUT:

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
0	2403MHz	8	2443MHz
1	2408MHz	9	2448MHz
2	2413MHz	10	2453MHz
3	2418MHz	11	2458MHz
4	2423MHz	12	2463MHz
5	2428MHz	13	2468MHz
6	2433MHz	14	2473MHz
7	2438MHz	15	2478MHz

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 \geq 1G	RE<1G	PLC	APCM	
-	√	√	√	√	-

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

RADIATED EMISSION TEST (ABOVE 1 GHz):

- 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
0 to 15	0, 8, 15	MSK

RADIATED EMISSION TEST (BELOW 1 GHz):

- 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
0 to 15	0	MSK

POWER LINE CONDUCTED EMISSION TEST:

- 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
0 to 15	0	MSK

BANDEDGE MEASUREMENT:

- 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
0 to 15	0, 15	MSK

ANTENNA PORT CONDUCTED MEASUREMENT:

- 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
0 to 15	0, 8, 15	MSK

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

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.

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	iPod	Apple	A1112	4H520QU2RS9	NA

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	NA

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	ESIB7	100212	May 25, 2009	May 24, 2010
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100269	Aug. 07, 2009	Aug. 06, 2010
BILOG Antenna SCHWARZBECK	VULB9168	9168-156	Apr. 30, 2009	Apr. 29, 2010
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-563	Aug. 10, 2009	Aug. 09, 2010
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170242	Jan. 06, 2009	Jan. 05, 2010
Preamplifier Agilent	8449B	3008A01911	Sep. 10, 2008	Sep. 09, 2009
Preamplifier Agilent	8447D	2944A10638	Dec. 26, 2008	Dec. 25, 2009
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	218190/4 231241/4	May 13, 2009	May 12, 2010
RF signal cable Worken	8D-FB	Cable-HYCH9-01	Aug. 17, 2009	Aug. 16, 2010
Software	ADT_Radiated_ V7.6.15.9.2	NA	NA	NA
Antenna Tower EMCO	2070/2080	512.835.4684	NA	NA
Turn Table EMCO	2087-2.03	NA	NA	NA
Antenna Tower & Turn Table Controller EMCO	2090	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 Chamber 9.
 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 460141.
 5. The IC Site Registration No. is IC 7450F-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.

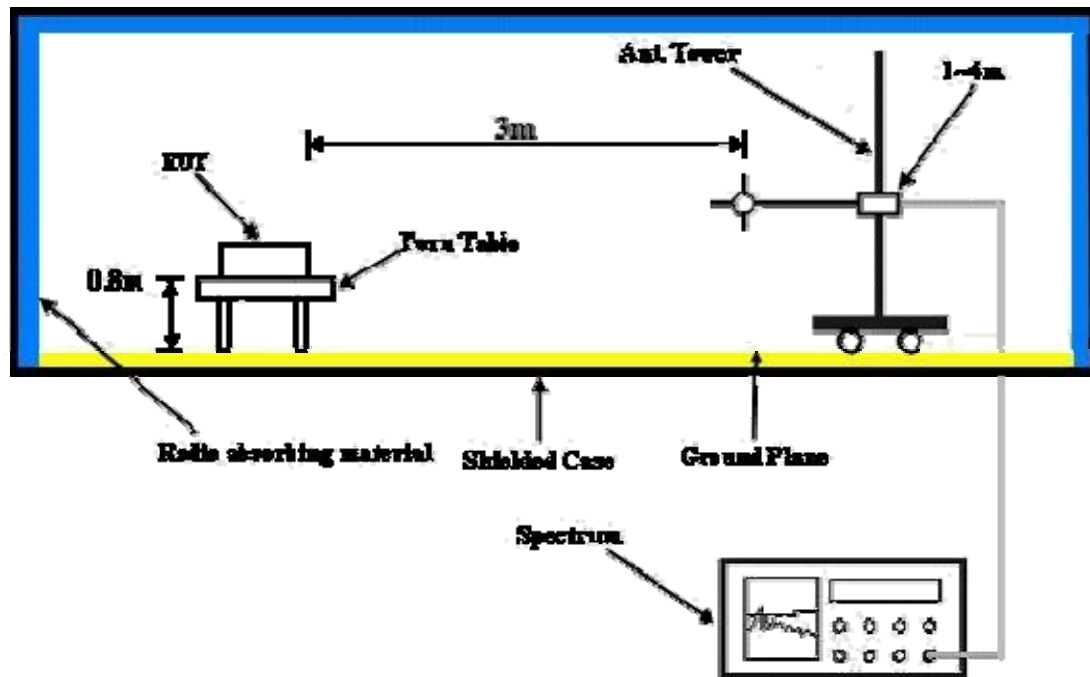
NOTE:

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

- a. Placed the EUT on the testing table.
- b. Set the EUT under transmission condition.
- c. The necessary accessories enable the system in full functions.



4.1.7 TEST RESULTS

ABOVE 1GHz DATA

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 0	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	24deg. C, 64%RH 1004 hPa	TESTED BY	Match Tsui

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	48.66 PK	74.00	-25.34	1.40 H	280	16.43	32.22
2	2390.00	32.26 AV	54.00	-21.74	1.40 H	280	0.03	32.22
3	#2400.00	72.59 PK	83.05	-10.46	1.36 H	305	40.33	32.26
4	#2400.00	64.26 AV	74.72	-10.46	1.36 H	305	32.00	32.26
5	*2403.00	103.05 PK			1.36 H	305	70.78	32.27
6	*2403.00	94.72 AV			1.36 H	305	62.45	32.27
7	4806.00	51.23 PK	74.00	-22.77	1.00 H	61	12.93	38.30
8	4806.00	34.09 AV	54.00	-19.91	1.00 H	61	-4.21	38.30
9	#9612.00	58.49 PK	83.05	-24.56	1.00 H	31	11.15	47.34
10	#9612.00	40.50 AV	74.72	-34.22	1.00 H	31	-6.84	47.34

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 radiated frequency is out the restricted band.
7. The average value of fundamental frequency and harmonics is calculated by using formula as below

$$\text{Average} = \text{Reading value of RBW=1MHz and VBW=10Hz} + 20 \log (\text{duty cycle})$$

$$20 \log (\text{Duty cycle}) = 20 \log (52.26 \text{ ms} / 100 \text{ ms}) = -5.64 \text{ dB}$$

Therefore

$$\text{Average} = \text{Reading value of RBW=1MHz and VBW=10Hz} - 5.64 \text{ dB}$$

Please see page 20 for plotted duty.



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EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 0	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	24deg. C, 64%RH 1004 hPa	TESTED BY	Match Tsui

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	43.36 PK	74.00	-30.64	1.09 V	112	11.13	32.22
2	2390.00	31.85 AV	54.00	-22.15	1.09 V	112	-0.38	32.22
3	#2400.00	66.14 PK	76.64	-10.50	1.06 V	112	33.88	32.26
4	#2400.00	57.80 AV	68.30	-10.50	1.06 V	112	25.54	32.26
5	*2403.00	96.64 PK			1.06 V	112	64.37	32.27
6	*2403.00	88.30 AV			1.06 V	112	56.03	32.27
7	4806.00	49.99 PK	74.00	-24.01	1.39 V	30	11.69	38.30
8	4806.00	32.40 AV	54.00	-21.60	1.39 V	30	-5.90	38.30
9	#9612.00	59.56 PK	76.64	-17.08	1.56 V	82	12.22	47.34
10	#9612.00	42.23 AV	68.30	-26.07	1.56 V	82	-5.11	47.34

- 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 radiated frequency is out the restricted band.
 7. The average value of fundamental frequency and harmonics is calculated by using formula as below

$$\text{Average} = \text{Reading value of RBW=1MHz and VBW=10Hz} + 20 \log (\text{duty cycle})$$

$$20 \log (\text{Duty cycle}) = 20 \log (52.26 \text{ ms} / 100 \text{ ms}) = -5.64 \text{ dB}$$

Therefore

$$\text{Average} = \text{Reading value of RBW=1MHz and VBW=10Hz} - 5.64 \text{ dB}$$

Please see page 20 for plotted duty.



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EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 8	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	24deg. C, 64%RH 1004 hPa	TESTED BY	Match Tsui

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	*2443.00	103.54 PK			1.33 H	265	71.13	32.41
2	*2443.00	95.19 AV			1.33 H	265	62.78	32.41
3	4886.00	53.49 PK	74.00	-20.51	1.02 H	51	15.07	38.43
4	4886.00	36.00 AV	54.00	-18.00	1.02 H	51	-2.42	38.43
5	#9772.00	60.72 PK	83.54	-22.82	1.44 H	66	13.18	47.53
6	#9772.00	42.11 AV	75.19	-33.08	1.44 H	66	-5.43	47.53
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	*2443.00	96.12 PK			1.04 V	109	63.71	32.41
2	*2443.00	87.75 AV			1.04 V	109	55.34	32.41
3	4886.00	52.25 PK	74.00	-21.75	1.09 V	56	13.83	38.43
4	4886.00	33.55 AV	54.00	-20.45	1.09 V	56	-4.87	38.43
5	#9772.00	58.73 PK	76.12	-17.39	1.02 V	355	11.19	47.53
6	#9772.00	39.17 AV	67.75	-28.58	1.02 V	355	-8.37	47.53

- 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 radiated frequency is out the restricted band.
 7. The average value of fundamental frequency and harmonics is calculated by using formula as below

$$\text{Average} = \text{Reading value of RBW=1MHz and VBW=10Hz} + 20 \log (\text{duty cycle})$$

$$20 \log (\text{Duty cycle}) = 20 \log (52.26 \text{ ms} / 100 \text{ ms}) = -5.64 \text{ dB}$$

Therefore
Average=Reading value of RBW=1MHz and VBW=10Hz -5.64 dB

Please see page 20 for plotted duty.



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EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 15	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	24deg. C, 64%RH 1004 hPa	TESTED BY	Match Tsui

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	*2478.00	102.88 PK			1.30 H	277	70.34	32.54
2	*2478.00	94.50 AV			1.30 H	277	61.96	32.54
3	2483.50	60.07 PK	74.00	-13.93	1.32 H	278	27.51	32.56
4	2483.50	51.69 AV	54.00	-2.31	1.32 H	278	19.13	32.56
5	4956.00	52.67 PK	74.00	-21.33	1.00 H	48	14.07	38.60
6	4956.00	35.76 AV	54.00	-18.24	1.00 H	48	-2.84	38.60
7	#9912.00	61.21 PK	82.88	-21.67	1.44 H	80	13.45	47.75
8	#9912.00	42.78 AV	74.50	-31.72	1.44 H	80	-4.98	47.75

REMARKS:

- Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
- Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
- The other emission levels were very low against the limit.
- Margin value = Emission level – Limit value.
- " * ": Fundamental frequency.
- "#": The radiated frequency is out the restricted band.
- The average value of fundamental frequency and harmonics is calculated by using formula as below

$$\text{Average} = \text{Reading value of RBW=1MHz and VBW=10Hz} + 20 \log (\text{duty cycle})$$

$$20 \log (\text{Duty cycle}) = 20 \log (52.26 \text{ ms} / 100 \text{ ms}) = -5.64 \text{ dB}$$

Therefore

$$\text{Average} = \text{Reading value of RBW=1MHz and VBW=10Hz} - 5.64 \text{ dB}$$

Please see page 20 for plotted duty.



EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 15	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	24deg. C, 64%RH 1004 hPa	TESTED BY	Match Tsui

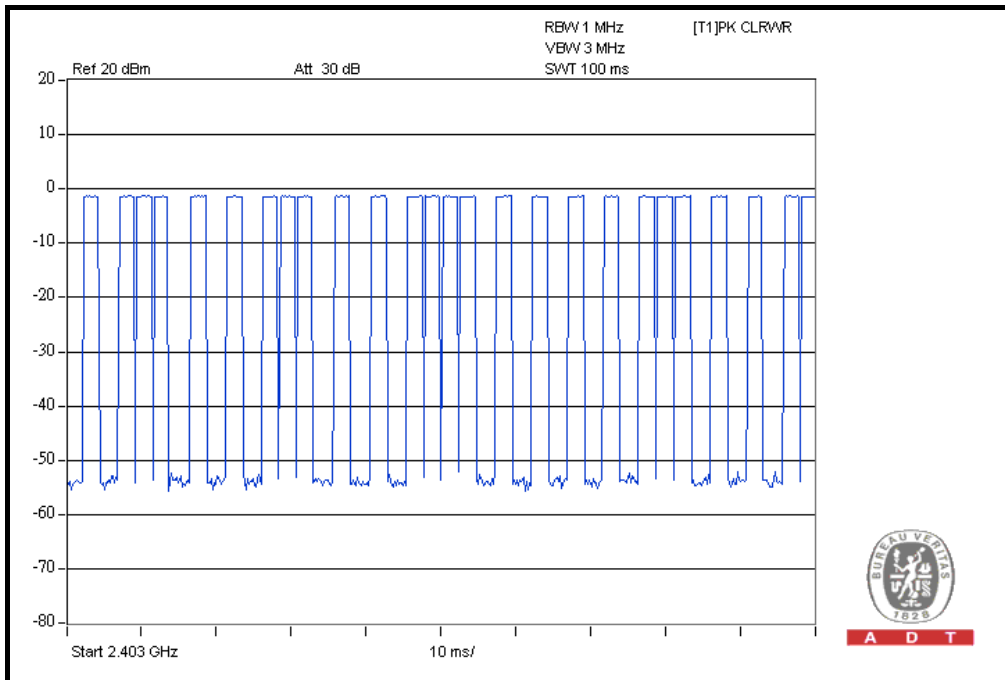
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2478.00	95.14 PK			1.02 V	111	62.60	32.54
2	*2478.00	86.75 AV			1.02 V	111	54.21	32.54
3	2483.50	52.19 PK	74.00	-21.81	1.05 V	111	19.63	32.56
4	2483.50	43.80 AV	54.00	-10.20	1.05 V	111	11.24	32.56
5	4956.00	52.05 PK	74.00	-21.95	1.07 V	60	13.45	38.60
6	4956.00	34.19 AV	54.00	-19.81	1.07 V	60	-4.41	38.60
7	#9912.00	59.28 PK	75.14	-15.86	1.42 V	222	11.52	47.75
8	#9912.00	41.91 AV	66.75	-24.84	1.42 V	222	-5.85	47.75

REMARKS:

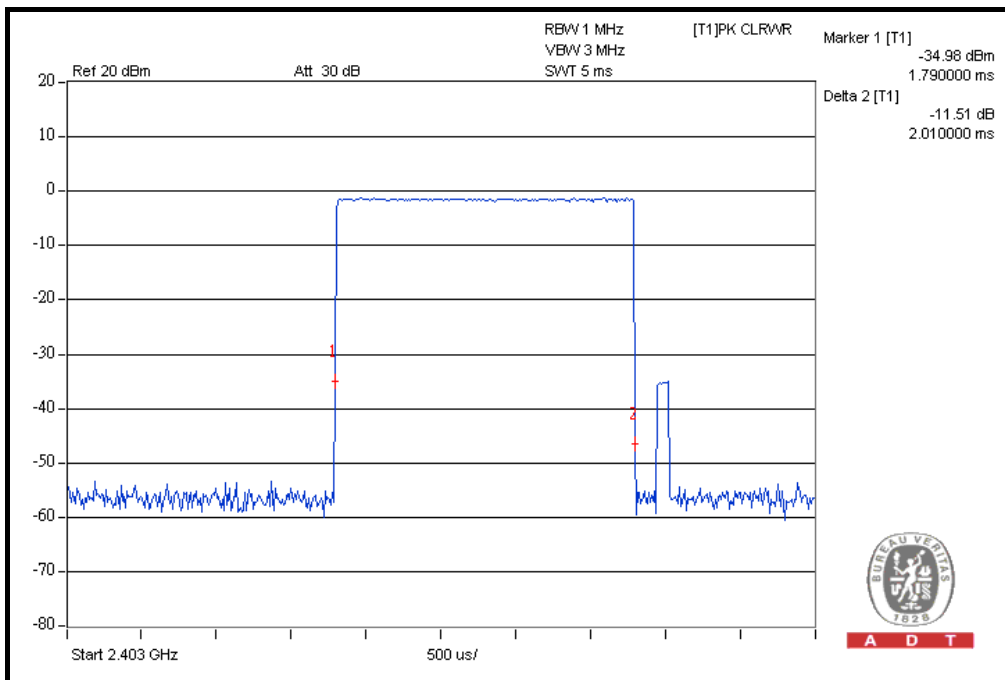
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. “ * “: Fundamental frequency.
6. "#":The radiated frequency is out the restricted band.
7. The average value of fundamental frequency and harmonics is calculated by using formula as below
 Average = Reading value of RBW=1MHz and VBW=10Hz + 20 log (duty cycle)
 $20 \log (\text{Duty cycle}) = 20 \log (52.26 \text{ ms} / 100 \text{ ms}) = -5.64 \text{ dB}$
 Therefore
 Average=Reading value of RBW=1MHz and VBW=10Hz -5.64 dB
 Please see page 20 for plotted duty.



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$$20 \log (\text{Duty cycle}) = 20 \log (2.01 \times 26 \text{ ms} / 100 \text{ ms}) = -5.64 \text{ dB}$$



BELOW 1GHz WORST-CASE DATA

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 0	FREQUENCY RANGE	Below 1000MHz
INPUT POWER	120Vac, 60 Hz	DETECTOR FUNCTION	Quasi-Peak
ENVIRONMENTAL CONDITIONS	23deg. C, 68%RH 1006 hPa	TESTED BY	Sun Lin

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	156.28	24.34 QP	43.50	-19.16	2.00 H	112	9.97	14.37
2	228.22	35.20 QP	46.00	-10.80	1.50 H	259	22.74	12.47
3	288.49	36.43 QP	46.00	-9.57	1.00 H	142	21.44	14.99
4	335.15	33.33 QP	46.00	-12.67	1.00 H	160	16.94	16.39
5	372.09	32.02 QP	46.00	-13.98	1.00 H	154	14.75	17.28
6	539.30	31.00 QP	46.00	-15.00	1.50 H	235	9.27	21.74
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	47.40	21.10 QP	40.00	-18.90	1.00 V	202	8.05	13.06
2	101.84	21.24 QP	43.50	-22.26	1.00 V	163	11.69	9.55
3	195.16	21.68 QP	43.50	-21.82	1.25 V	319	10.70	10.98
4	251.55	16.26 QP	46.00	-29.74	1.00 V	70	3.40	12.86
5	488.75	18.58 QP	46.00	-27.42	1.25 V	268	-0.32	18.90
6	642.35	23.29 QP	46.00	-22.71	1.00 V	10	1.04	22.25

- 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 0.50 MHz.
 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	100288	Sep. 22, 2008	Sep. 21, 2009
RF signal cable Woken	5D-FB	Cable-HYCO2-01	Dec. 31, 2008	Dec. 30, 2009
LISN ROHDE & SCHWARZ	ESH2-Z5	100100	Dec. 29, 2008	Dec. 28, 2009
LISN ROHDE & SCHWARZ	ESH3-Z5	100311	Jul. 29, 2009	Jul. 28, 2010
Software ADT	ADT_Cond_ 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 2.
 3. The VCCI Site Registration No. is C-2047.

4.2.3 TEST PROCEDURES

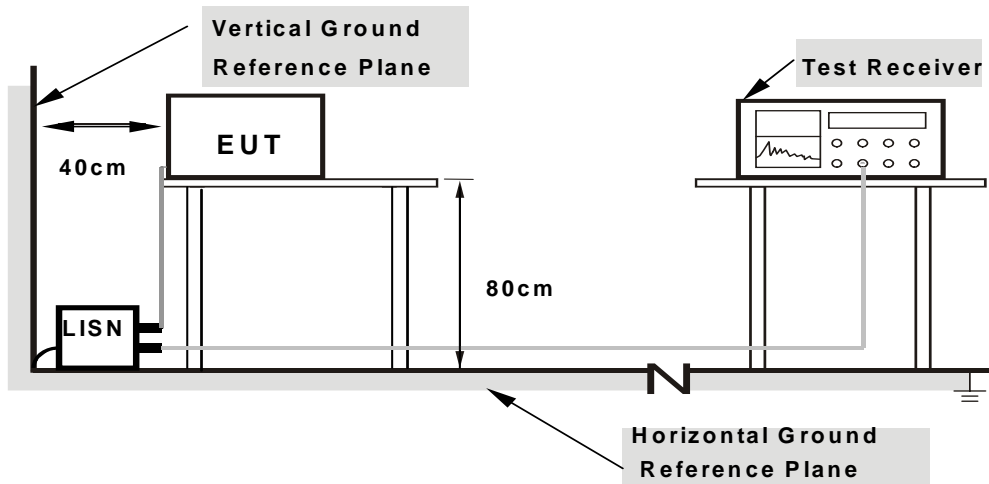
- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling 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.

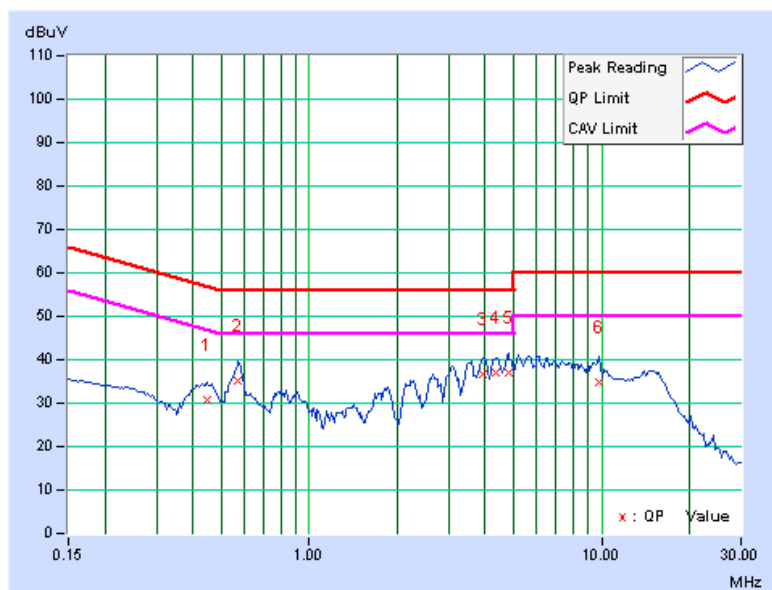
4.2.7 TEST RESULTS

CONDUCTED WORST-CASE DATA

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 0	PHASE	Line 1
MODULATION TYPE	MSK	INPUT POWER	120Vac, 60Hz
ENVIRONMENTAL CONDITIONS	26deg. C, 67%RH, 1006hPa	6dB BANDWIDTH	9kHz
TESTED BY	Dean Wang		

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	0.447	0.14	30.58	-	30.72	-	56.93	46.93	-26.21	-
2	0.572	0.15	35.08	-	35.23	-	56.00	46.00	-20.77	-
3	3.930	0.28	36.27	-	36.55	-	56.00	46.00	-19.45	-
4	4.375	0.29	36.60	-	36.89	-	56.00	46.00	-19.11	-
5	4.809	0.30	36.90	-	37.20	-	56.00	46.00	-18.80	-
6	9.813	0.43	34.53	-	34.96	-	60.00	50.00	-25.04	-

- 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.



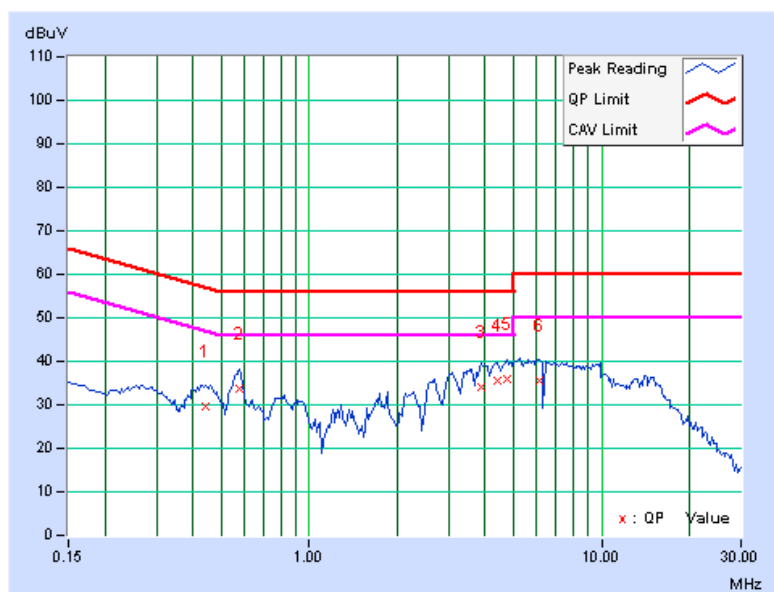


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EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 0	PHASE	Line 2
MODULATION TYPE	MSK	INPUT POWER	120Vac, 60Hz
ENVIRONMENTAL CONDITIONS	26deg. C, 67%RH, 1006hPa	6dB BANDWIDTH	9kHz
TESTED BY	Dean Wang		

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	0.443	0.15	29.54	-	29.69	-	57.01	47.01	-27.31	-
2	0.580	0.16	33.43	-	33.59	-	56.00	46.00	-22.41	-
3	3.898	0.29	33.80	-	34.09	-	56.00	46.00	-21.91	-
4	4.383	0.31	35.28	-	35.59	-	56.00	46.00	-20.41	-
5	4.777	0.33	35.65	-	35.98	-	56.00	46.00	-20.02	-
6	6.090	0.37	35.30	-	35.67	-	60.00	50.00	-24.33	-

- 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	100040	Jul. 07, 2009	Jul. 06, 2010

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

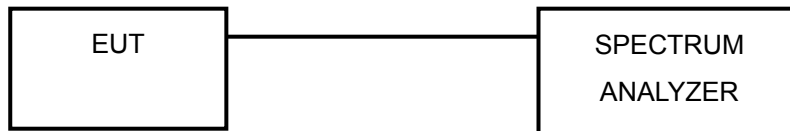
4.3.3 TEST PROCEDURE

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.



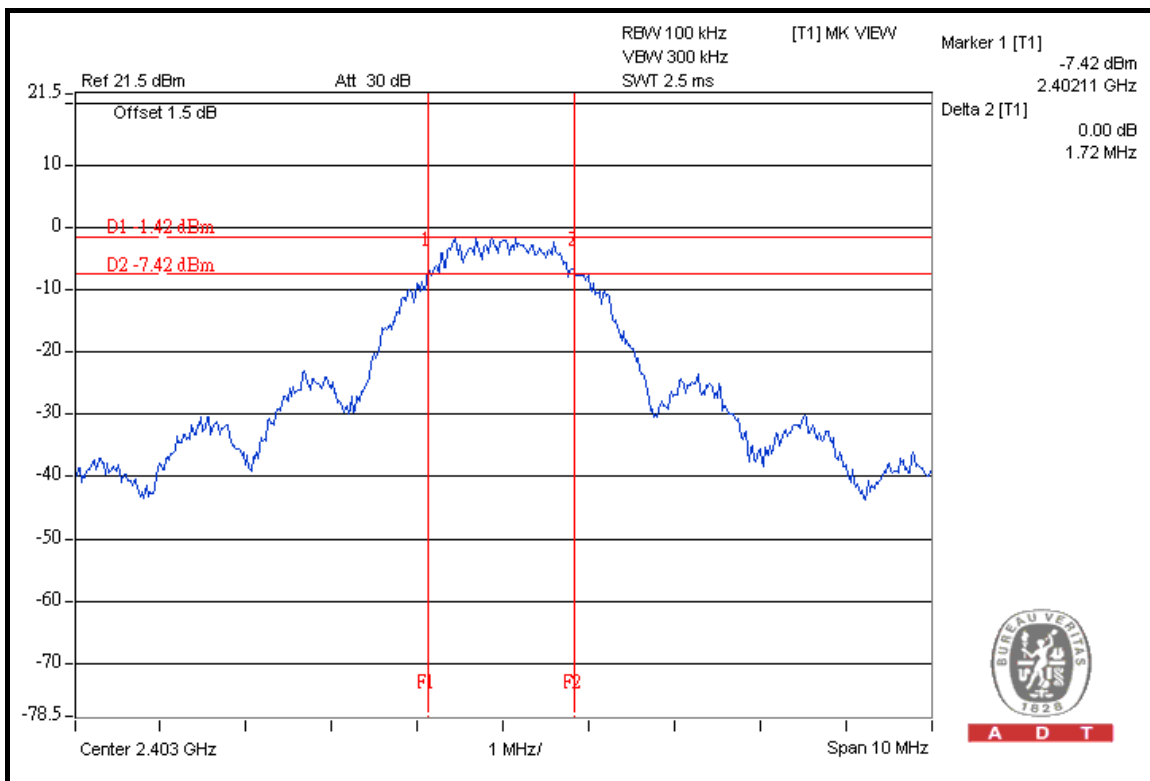
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4.3.7 TEST RESULTS

MODULATION TYPE	MSK	ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH, 1004hPa
INPUT POWER	120Vac, 60 Hz	TESTED BY	Brad Wu

CHANNEL	CHANNEL FREQUENCY (MHz)	6dB BANDWIDTH (MHz)	MINIMUM LIMIT (MHz)	PASS / FAIL
0	2403	1.72	0.5	PASS
8	2443	1.87	0.5	PASS
15	2478	1.70	0.5	PASS

CH 0

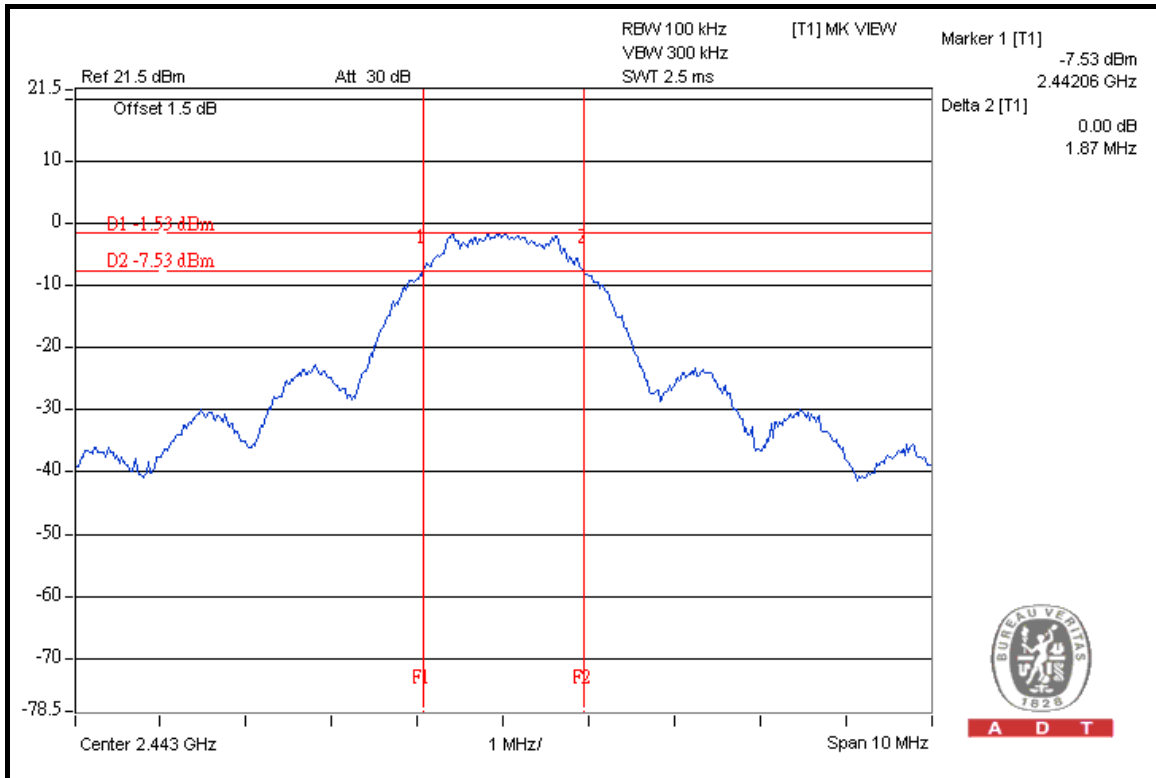


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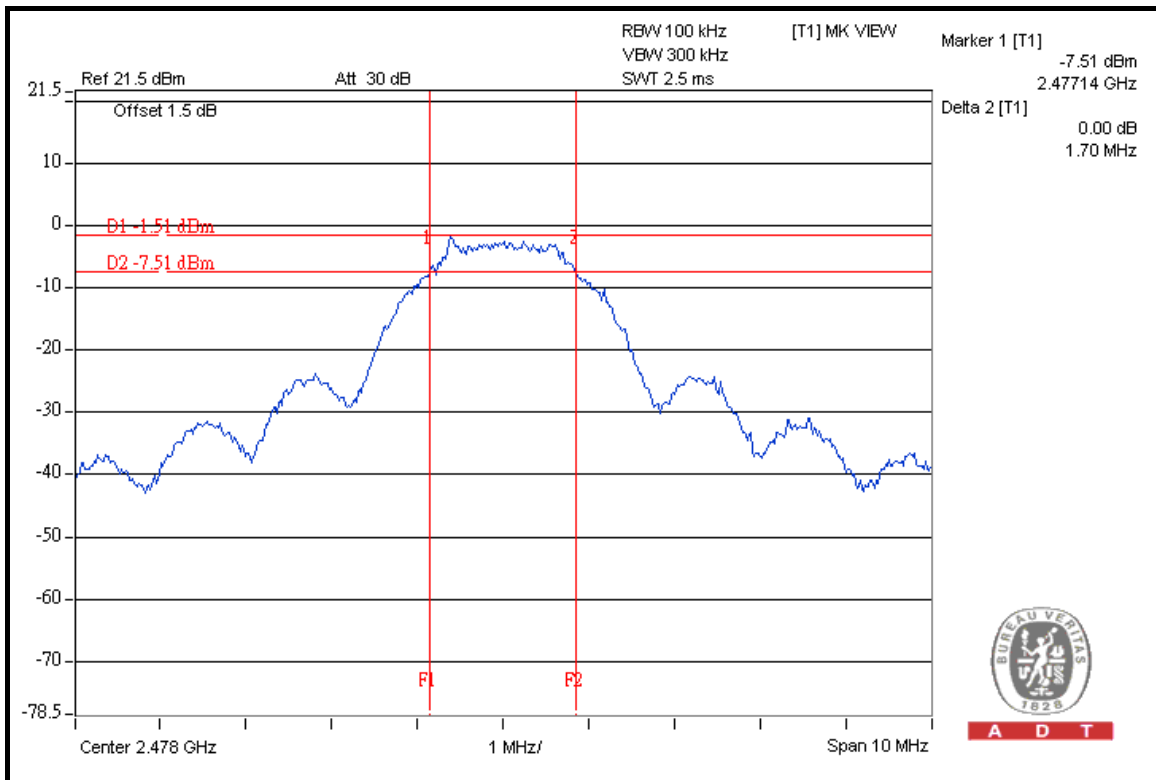
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CH 8



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CH 15



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4.4 MAXIMUM PEAK OUTPUT POWER

4.4.1 LIMITS OF MAXIMUM PEAK OUTPUT POWER MEASUREMENT

The Maximum Peak 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	0824012	Aug. 10, 2009	Aug. 09, 2010
Power Sensor	MA2411B	0738138	Aug. 10, 2009	Aug. 09, 2010

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.

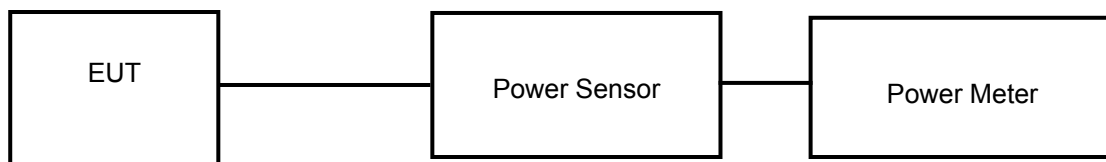
4.4.3 TEST PROCEDURES

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

MODULATION TYPE	MSK	ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH, 1004hPa
INPUT POWER	120Vac, 60 Hz	TESTED BY	Brad Wu

CHAN	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (mW)	PEAK POWER OUTPUT (dBm)	PEAK POWER LIMIT (dBm)	PASS/FAIL
0	2403	1.462	1.65	30	PASS
8	2443	1.416	1.51	30	PASS
15	2478	1.334	1.25	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	100040	Jul. 07, 2009	Jul. 06, 2010

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

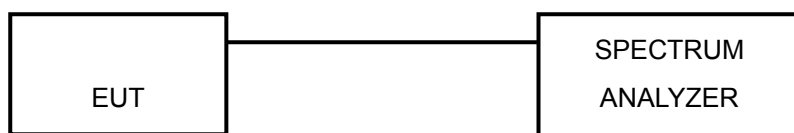
The transmitter output was connected to the spectrum analyzer through an attenuator, the bandwidth of the fundamental frequency was measured with the spectrum analyzer using 3kHz RBW and 30kHz VBW, set sweep time = span/3kHz. The power spectral density was measured and recorded.

The sweep time is allowed to be longer than span/3kHz for a full response of the mixer in the spectrum analyzer.

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.



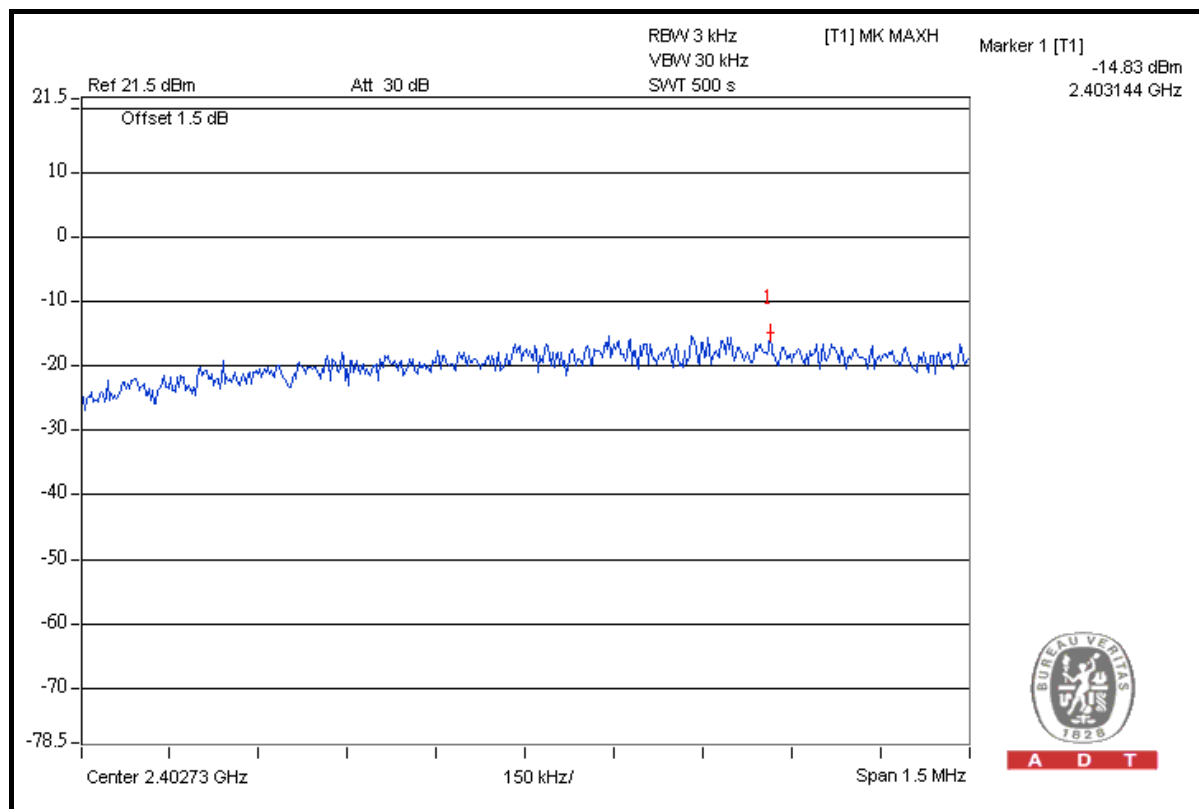
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4.5.7 TEST RESULTS

MODULATION TYPE	MSK	ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH, 1004hPa
INPUT POWER	120Vac, 60 Hz	TESTED BY	Brad Wu

CHANNEL	CHANNEL FREQUENCY (MHz)	RF POWER LEVEL IN 3 kHz BW (dBm)	MAXIMUM LIMIT (dBm)	PASS/FAIL
0	2403	-14.83	8	PASS
8	2443	-14.86	8	PASS
15	2478	-14.95	8	PASS

CH 0

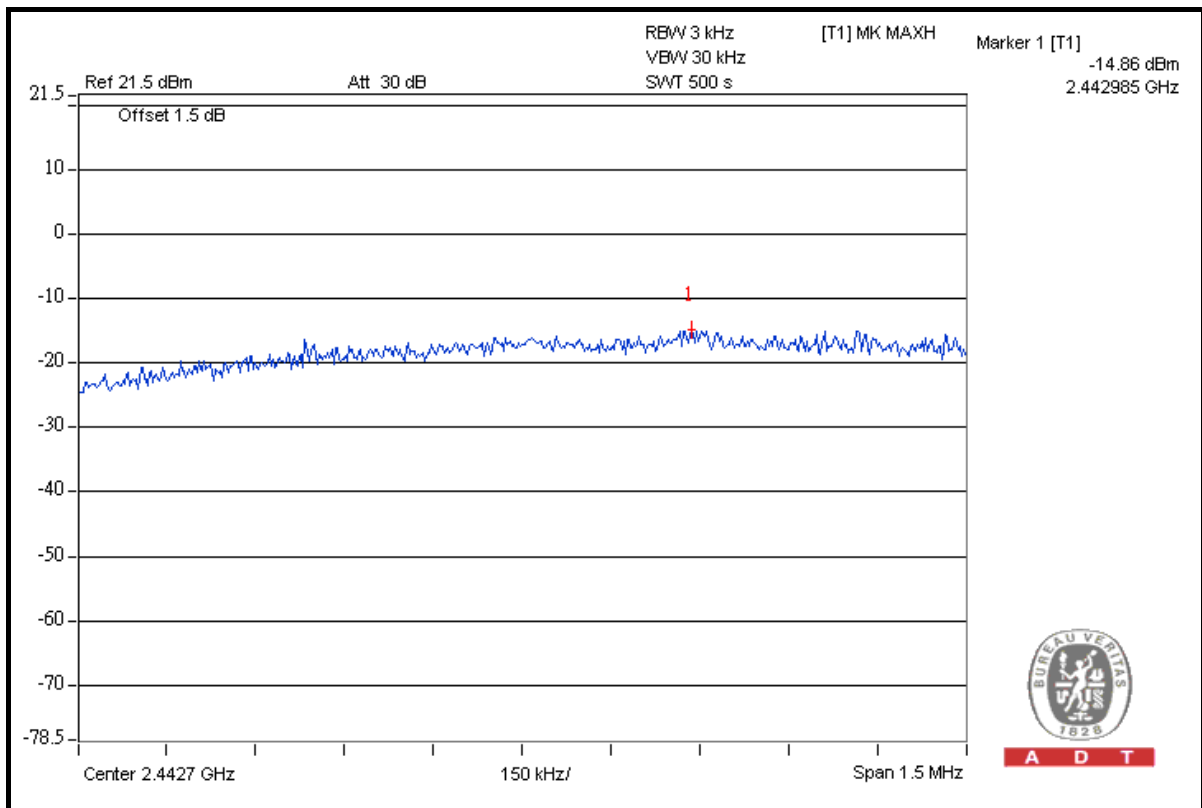


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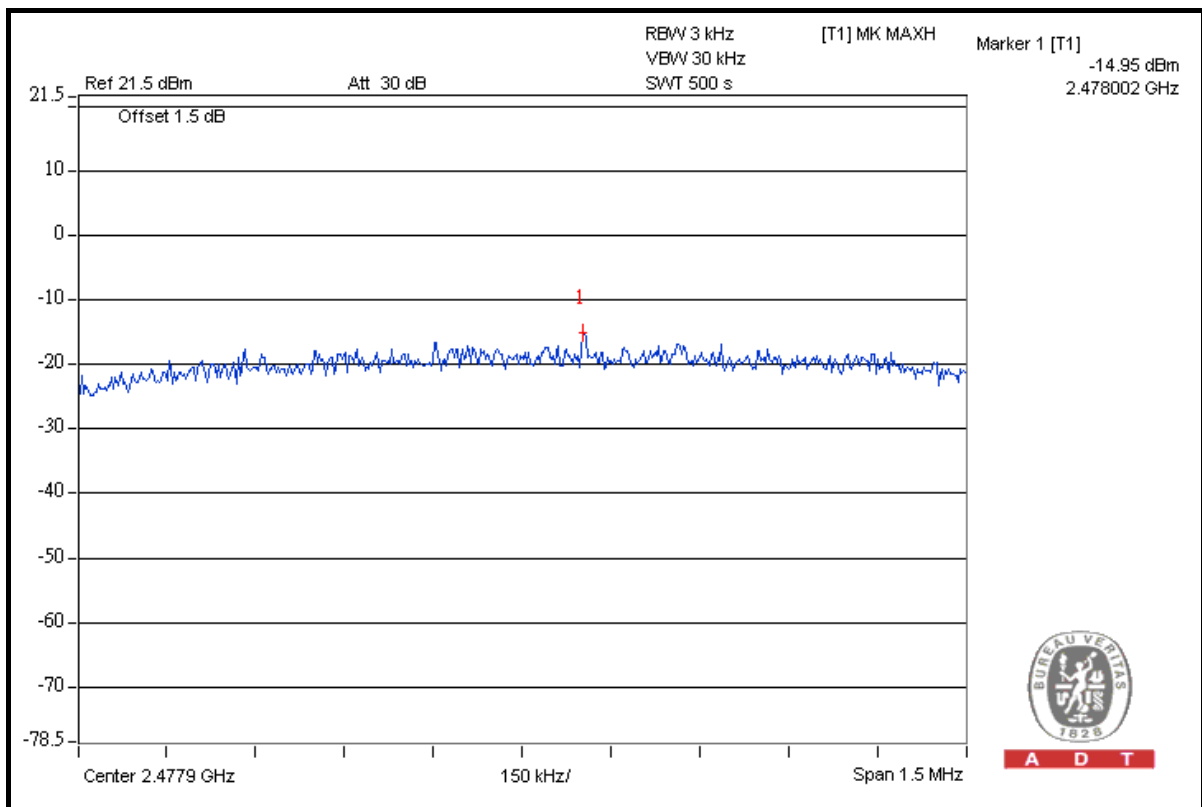


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CH 8



CH 15



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	100040	Jul. 07, 2009	Jul. 06, 2010

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 lose 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 was 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 6 images. 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).

NOTE 1: The band edge emission plot on the next page shows 44.10dBc between carrier maximum power and local maximum emission in restrict band (2.35280GHz). The emission of carrier strength list in the test result of channel 0 at the item 4.1.7 is 103.05dBuV/m (Peak), so the maximum field strength in restrict band is $103.05 - 44.10 = 58.95$ dBuV/m which is under 74dBuV/m limit.

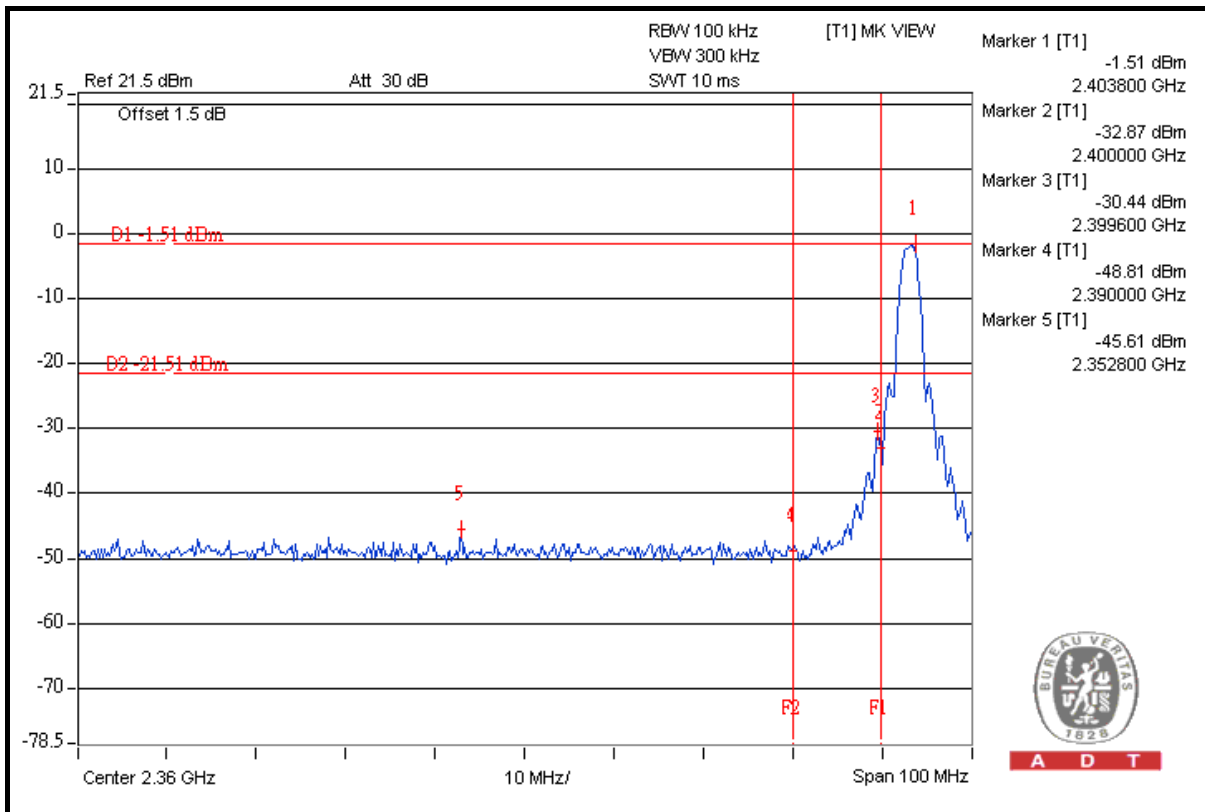
The band edge emission plot on the next page shows 57.23dBc between carrier maximum power and local maximum emission in restrict band (2.38020GHz). The emission of carrier strength list in the test result of channel 0 at the item 4.1.7 is 94.72dBuV/m (Average), so the maximum field strength in restrict band is $94.72 - 57.23 = 37.49$ dBuV/m which is under 54dBuV/m limit.

NOTE 2: The band edge emission plot on the next second page shows 39.70dBc between carrier maximum power and local maximum emission in restrict band (2.48380GHz). The emission of carrier strength list in the test result of channel 15 at the item 4.1.7 is 102.88dBuV/m (Peak), so the maximum field strength in restrict band is $102.88 - 39.70 = 63.18$ dBuV/m which is under 74dBuV/m limit.

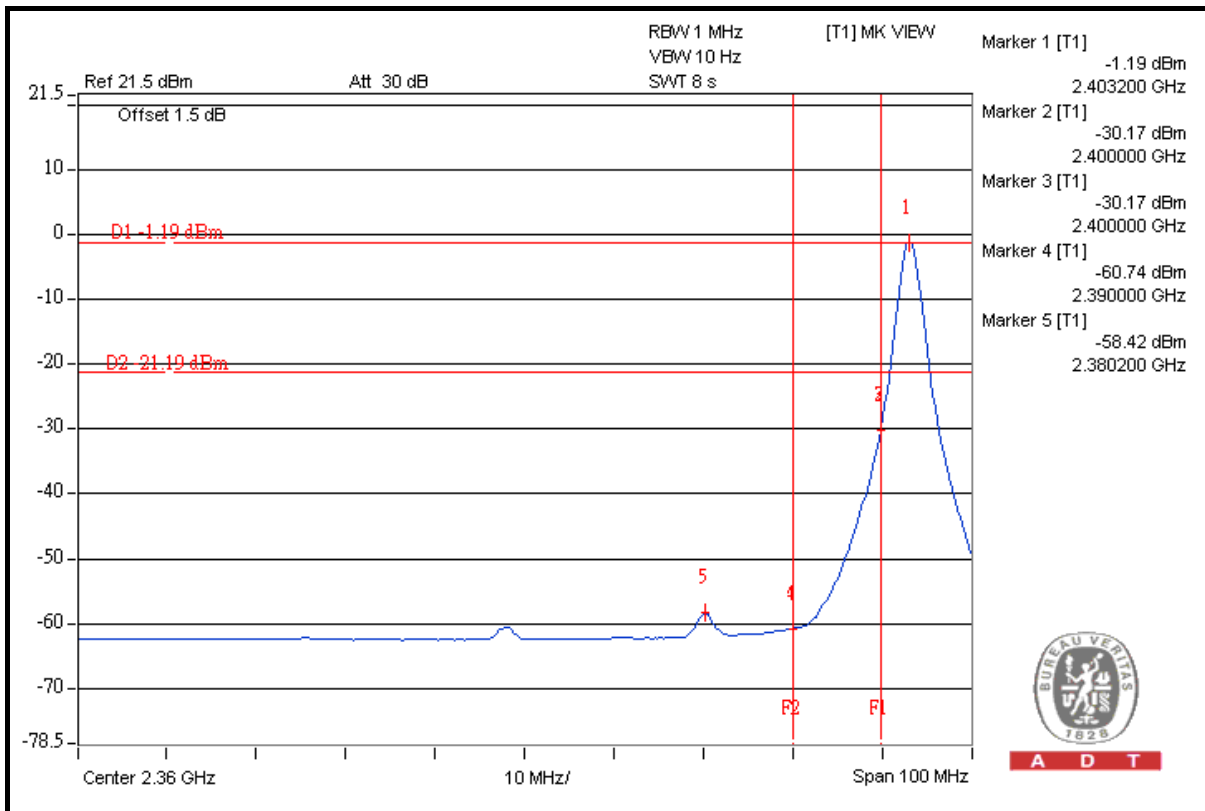
The band edge emission plot on the next third page shows 41.61dBc between carrier maximum power and local maximum emission in restrict band (2.48350GHz). The emission of carrier strength list in the test result of channel 15 at the item 4.1.7 is 94.50dBuV/m (Average), so the maximum field strength in restrict band is $94.50 - 41.61 = 52.89$ dBuV/m which is under 54dBuV/m limit.



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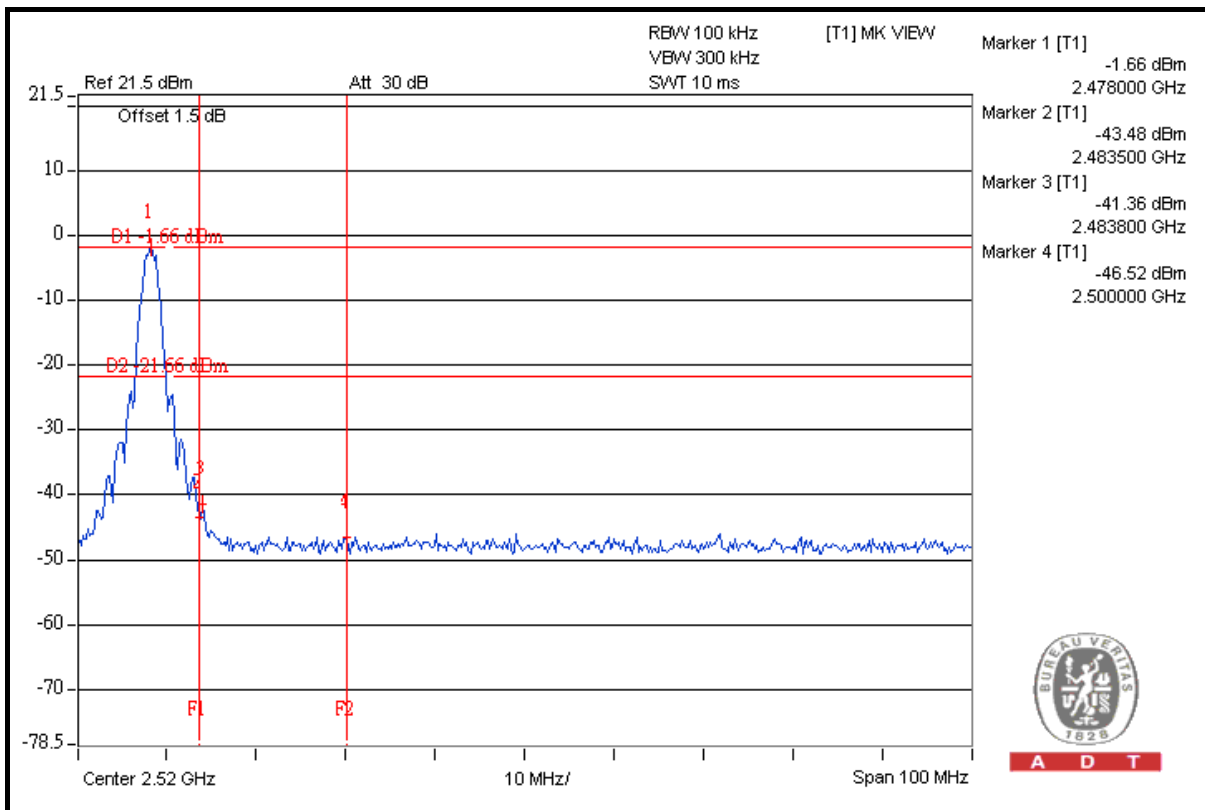
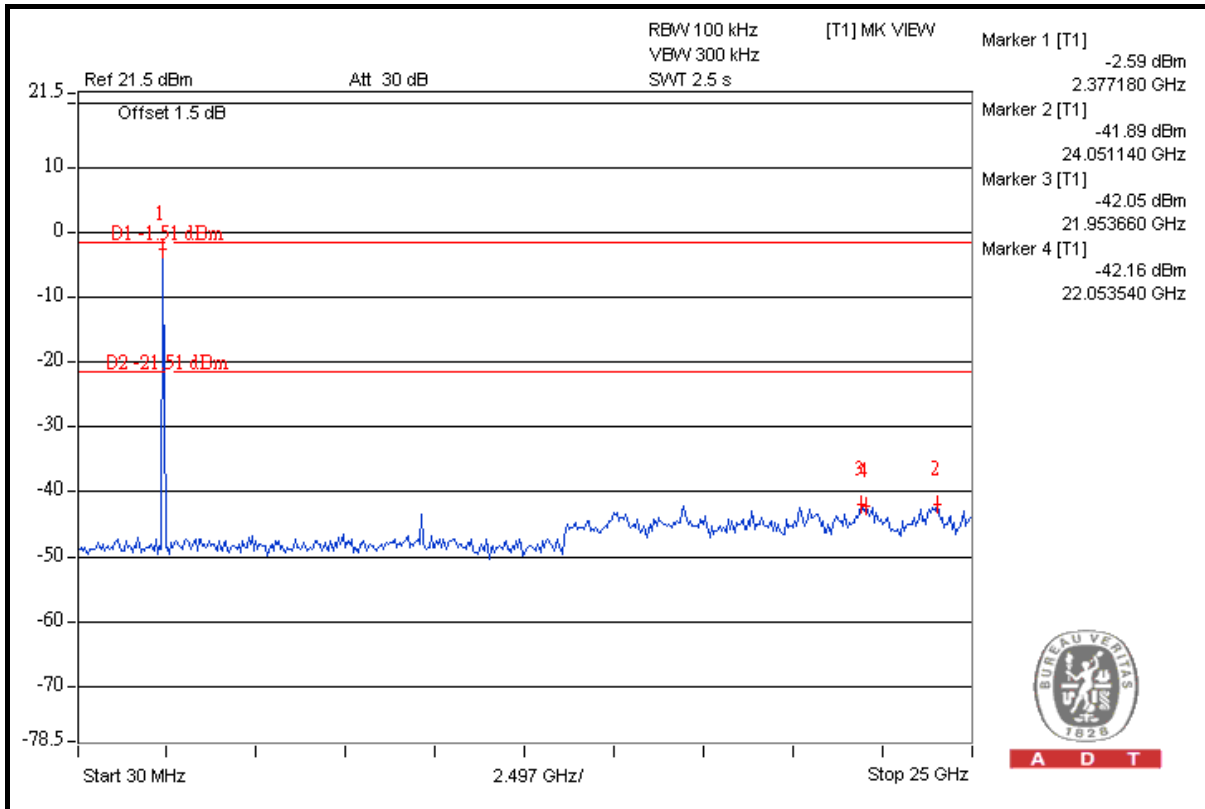
A D T



A D T

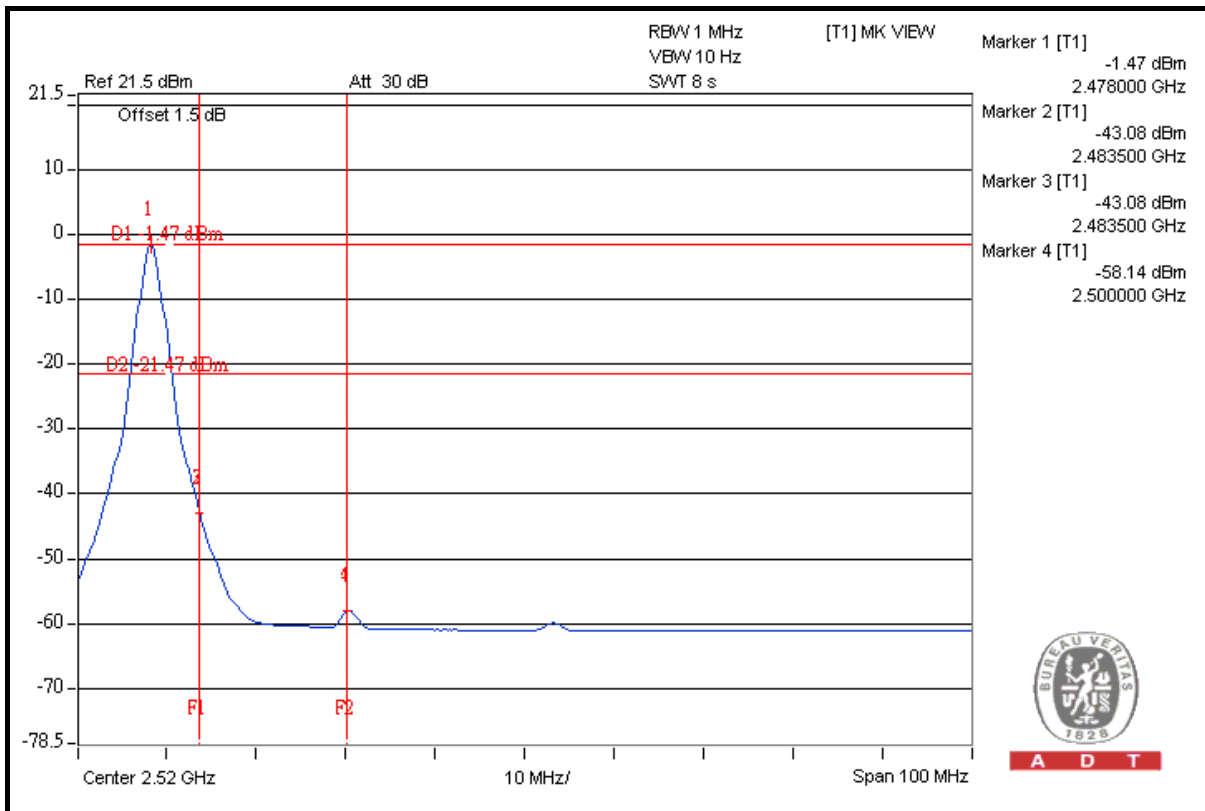


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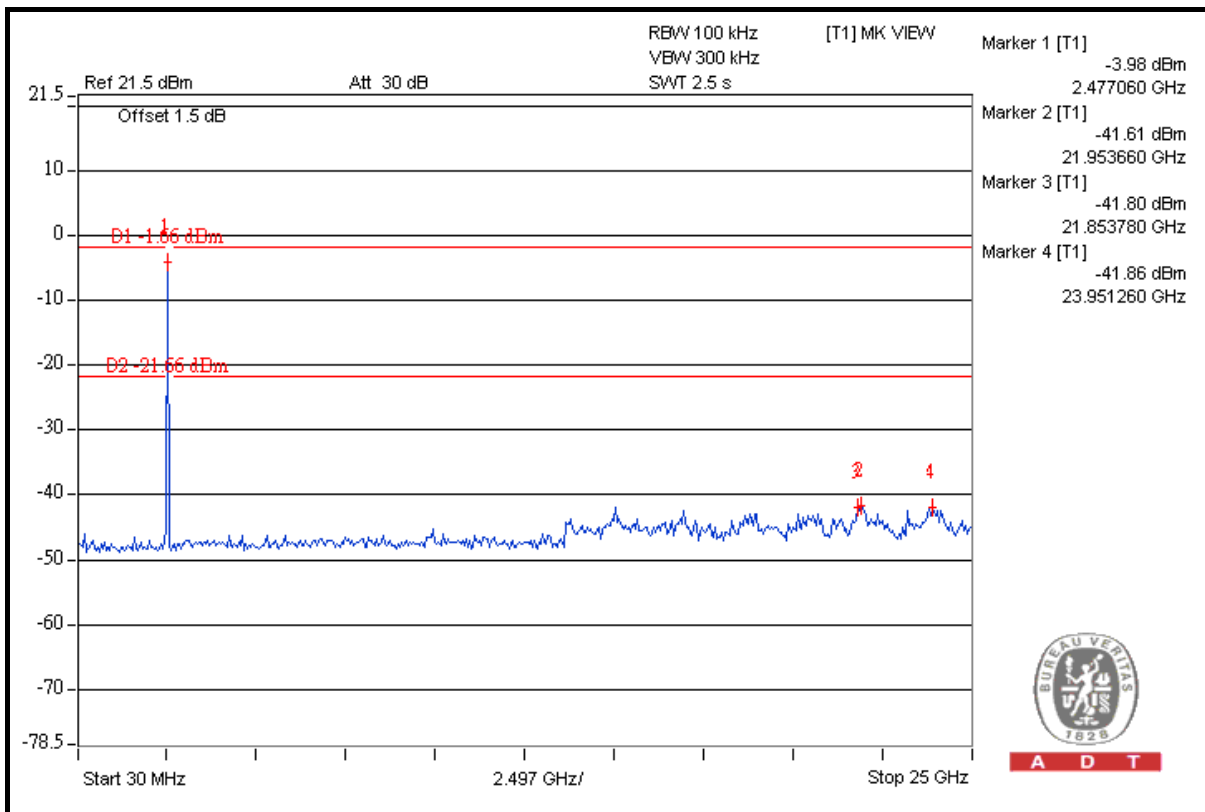




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4.7 ANTENNA REQUIREMENT

4.7.1 STANDARD APPLICABLE

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

4.7.2 ANTENNA CONNECTED CONSTRUCTION

The antenna used in this product is Inverted F antenna without antenna connector. The maximum Gain of the antenna is 1.79dBi.

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 by the following approval agencies according to ISO/IEC 17025.

USA	FCC, NVLAP
Germany	TUV Rheinland
Japan	VCCI
Norway	NEMKO
Canada	INDUSTRY CANADA , CSA
R.O.C.	TAF, BSMI, NCC
Netherlands	Telefication
Singapore	GOST-ASIA(MOU)
Russia	CERTIS(MOU)

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 Telecom 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.

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.

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