

FCC Test Report

Report No.: RF150402D07

FCC ID: 2ADYB-TK2002

Test Model: TK2002

Received Date: Feb. 11, 2015

Test Date: Feb. 11 ~ Apr. 13, 2015

Issued Date: Apr. 15, 2015

Applicant: Typo Innovations, LLC

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Release Control Record

Issue No.	Description	Date Issued
RF150402D07	Original release.	Apr. 15, 2015

1 Certificate of Conformity

Product: TYPO for iPad Mini

Brand: TYPO

Test Model: TK2002

Sample Status: Engineering sample

Applicant: Typo Innovations, LLC

Test Date: Feb. 11 ~ Apr. 13, 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 :



(Celia Chen / Senior Specialist)

, Date: Apr. 15, 2015

Approved by :



(Rex Lai / Assistant Manager)

, Date: Apr. 15, 2015

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 -14.27dB at 0.19297MHz.
15.205 & 209	Radiated Emissions	PASS	Meet the requirement of limit. Minimum passing margin is -16.1dB at 38.63MHz.
15.247(d)	Band Edge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -14.5dB at 2400.00MHz.
15.247(d)	Antenna Port Emission	PASS	Meet the requirement of limit.
15.247(a)(2)	6dB bandwidth	PASS	Meet the requirement of limit.
15.247(b)	Conducted power	PASS	Meet the requirement of limit.
15.247(e)	Power Spectral Density	PASS	Meet the requirement of limit.
15.203	Antenna Requirement	PASS	No antenna connector is used.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency	Expended Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	3.43 dB
Radiated Emissions up to 1 GHz	30MHz ~ 1000MHz	4.00 dB
Radiated Emissions above 1 GHz	1GHz ~ 40GHz	3.36 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	TYPO for iPad Mini
Brand	TYPO
Test Model	TK2002
Status of EUT	Engineering sample
Power Supply Rating	5.0Vdc (adapter or host equipment) 3.7Vdc (battery)
Modulation Type	GFSK
Transfer Rate	1Mbit/sec.
Operating Frequency	2402 ~ 2480MHz
Number of Channel	40
Output Power	1.656mW
Antenna Type	Inverted-F antenna with 0.45dBi gain
Antenna Connector	N/A
Accessory Device	N/A
Data Cable Supplied	0.5m shielded USB cable

Note:

1. The EUT is a Wireless Keyboard with Bluetooth function.
2. The EUT was pre-tested with the following modes:
 - 2 Operating Mode
 - 2 Operating + Charge with USB cable

The worst emission level was found when the EUT tested under **Operating + Charge with USB cable**.

3. 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	
-	√	√	√	√	Operating + Charge with USB cable

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, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
-	0 to 39	0, 19, 39	GFSK

Radiated Emission Test (Below 1GHz):

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
-	0 to 39	39	GFSK

Power Line Conducted Emission Test:

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
-	0 to 39	39	GFSK

Antenna Port Conducted Measurement:

- ☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
-	0 to 39	0, 19, 39	GFSK

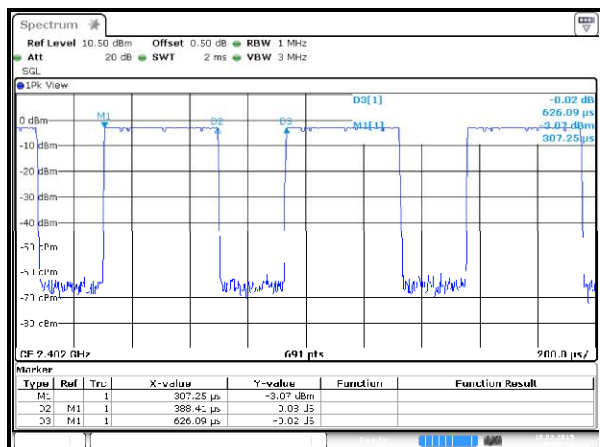
Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER (Adapter)	TESTED BY
RE ³ 1G	20deg. C, 75%RH	120Vac, 60Hz	Dalen Dai
RE<1G	20deg. C, 75%RH	120Vac, 60Hz	Dalen Dai
PLC	21deg. C, 77%RH	120Vac, 60Hz	Jary Huang
APCM	20deg. C, 70%RH	120Vac, 60Hz	Saxon Lee

3.3 Duty Cycle of Signal

Duty cycle of test signal is < 98%

Duty cycle = $0.388/0.626 = 0.62$, Duty factor = $10 * \log(1/0.62) = 2.08$



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.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	EUT	TYPO	TK2002	-	-	-
B.	iPad Mini	Apple	A1455	N/A	BCGA1455	Supplied by client
C.	Adapter of iPad Mini	Apple	A1399	D293022A3DGDY88C0	FCC DoC Approved	Supplied by client

NOTE:

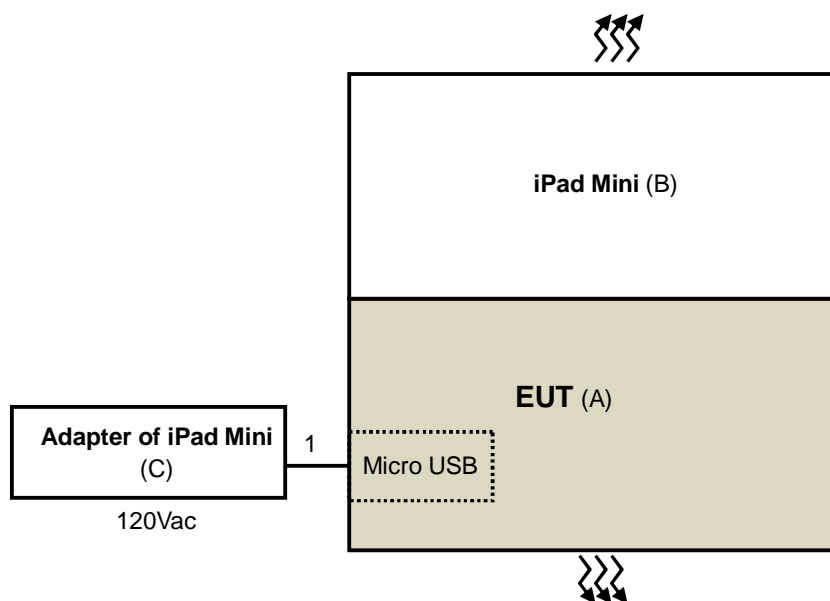
- All power cords of the above support units are non-shielded (1.8 m).
- The rating of support unit C as below.
AC I/P: 100-240Vac, 50/60Hz, 0.15A
DC O/P: 5Vdc, 1A

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	USB cable	1	0.5	Y	0	Supplied by client

Note: The core(s) is(are) originally attached to the cable(s).

3.4.1 Configuration of System under Test

TEST CONFIGURATION



3.5 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

FCC Part 15, Subpart C (15.247)

558074 D01 DTS Meas Guidance v03r02

ANSI C63.10-2009

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

NOTE: The product has been verified to comply with the requirements of FCC Part 15, Subpart B, Class B (DoC). The test report has been issued separately.

4 Test Types and Results

4.1 Radiated Emission and Bandedge Measurement

4.1.1 Limits of Radiated Emission and Bandedge Measurement

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB below the highest level of the desired power:

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

4.1.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
HP Preamplifier	8447D	2432A03504	Feb. 26, 2015	Feb. 25, 2016
HP Preamplifier	8449B	3008A01201	Feb. 26, 2015	Feb. 25, 2016
MITEQ Preamplifier	AMF-6F-260400-3 3-8P	892164	Mar. 01, 2015	Feb. 28, 2016
Agilent Spectrum	E4446A	MY51100050	Oct. 24, 2014	Oct. 23, 2015
Agilent TEST RECEIVER	N9038A	MY51210129	Jan. 20, 2015	Jan. 19, 2016
Schwarzbeck Antenna	VULB 9168	139	Feb. 04, 2015	Feb. 03, 2016
Schwarzbeck Antenna	VHBA 9123	480	May 29, 2013	May 28, 2015
Schwarzbeck Horn Antenna	BBHA-9170	212	Feb. 09, 2015	Feb. 08, 2016
Schwarzbeck Horn Antenna	BBHA 9120-D1	D130	Feb. 10, 2015	Feb. 09, 2016
ADT. Turn Table	TT100	0306	NA	NA
ADT. Tower	AT100	0306	NA	NA
Software	ADT_Radiated_V7. 6.15.9.4	NA	NA	NA
SUHNER RF cable	SF104	CABLE-CH6	Aug. 15, 2014	Aug. 14, 2015
SUHNER RF cable	SF102	Cable-CH8-3.6m	Aug. 15, 2014	Aug. 14, 2015
EMCO Horn Antenna	3115	00028257	Feb. 05, 2015	Feb. 04, 2016
Highpass filter Wainwright Instruments	WHK 3.1/18G-10SS	SN 8	NA	NA
ROHDE & SCHWARZ Spectrum Analyzer	FSV40	101042	Sep. 29, 2014	Sep. 28, 2015
Anritsu Power Sensor	MA2411B	0738404	Apr. 21, 2014	Apr. 20, 2015
Anritsu Power Meter	ML2495A	0842014	Apr. 21, 2014	Apr. 20, 2015

- NOTE:** 1. The calibration interval of the above test instruments is 12/24 months. And the calibrations are traceable to NML/ROC and NIST/USA.
2. The horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
3. The test was performed in Chamber No. 6.
4. The Industry Canada Reference No. IC 7450E-6.
5. The FCC Site Registration No. is 447212.

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:

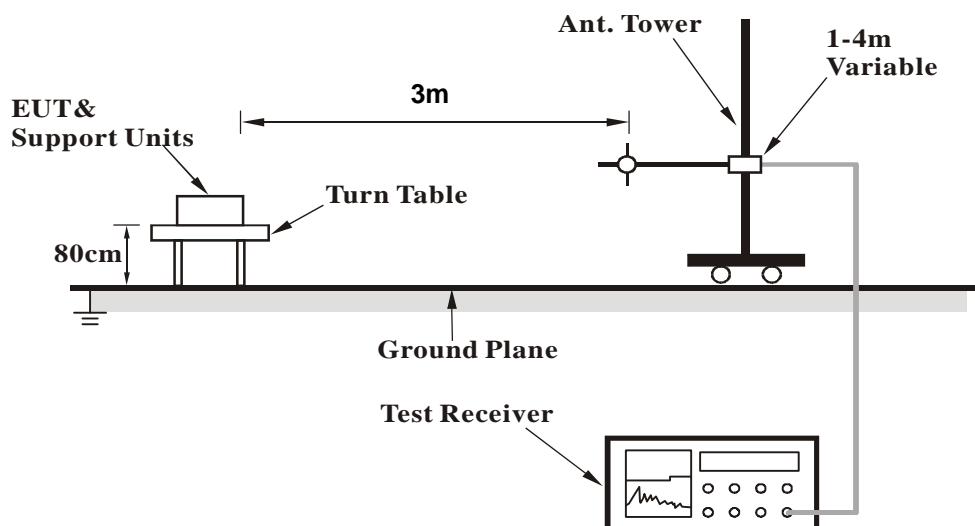
1. For emission measurements above 1 GHz, the EUT shall be placed at a height of 1.5 m above the ground at 3 meter chamber room for test
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
4. 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 ($10 \log(1/\text{duty cycle})$).
5. 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.
6. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

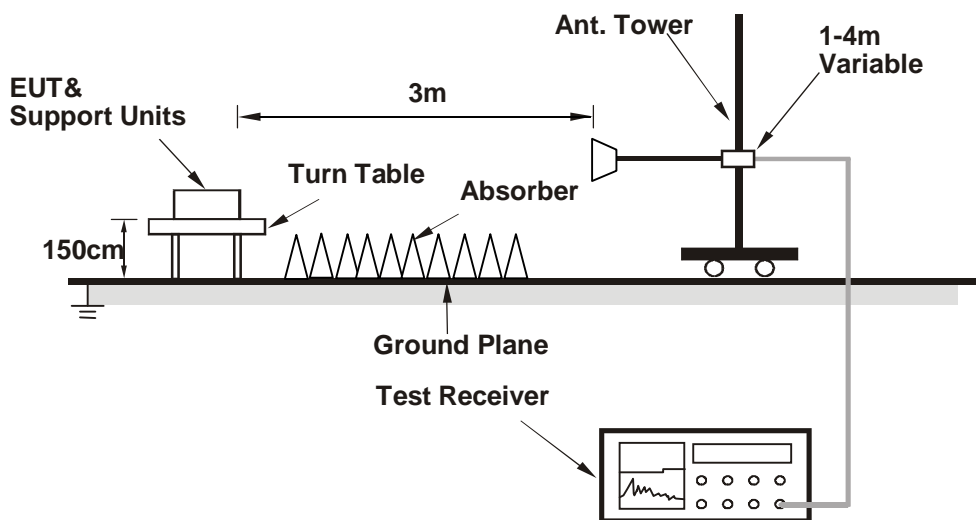
No deviation.

4.1.5 Test Set Up

<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

- Placed the EUT on the testing table.
- Connected the EUT to AC adapter.
- Set the EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

Above 1GHz Data :

CHANNEL	TX Channel 0	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	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	43.2 PK	74.0	-30.9	1.78 H	146	46.82	-3.67
2	2390.00	30.7 AV	54.0	-23.3	1.78 H	146	34.39	-3.67
3	#2400.00	52.9 PK	67.4	-14.5	1.78 H	146	56.51	-3.60
4	#2400.00	30.7 AV	45.7	-14.9	1.78 H	146	34.33	-3.60
5	*2402.00	87.4 PK			1.78 H	146	91.02	-3.59
6	*2402.00	65.7 AV			1.78 H	146	69.24	-3.59
7	4804.00	46.9 PK	74.0	-27.1	1.42 H	286	43.72	3.18
8	4804.00	34.8 AV	54.0	-19.2	1.42 H	286	31.58	3.18
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	41.3 PK	74.0	-32.7	1.95 V	214	44.96	-3.67
2	2390.00	29.4 AV	54.0	-24.6	1.95 V	214	33.08	-3.67
3	#2400.00	47.0 PK	62.2	-15.3	1.95 V	214	50.55	-3.60
4	#2400.00	24.8 AV	40.4	-15.5	1.95 V	214	28.43	-3.60
5	*2402.00	82.2 PK			1.95 V	214	85.81	-3.59
6	*2402.00	60.4 AV			1.95 V	214	63.94	-3.59
7	4804.00	47.5 PK	74.0	-26.5	2.04 V	217	44.35	3.18
8	4804.00	35.9 AV	54.0	-18.2	2.04 V	217	32.67	3.18

REMARKS:

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

CHANNEL	TX Channel 19	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	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	*2440.00	84.8 PK			1.22 H	227	88.24	-3.40
2	*2440.00	64.1 AV			1.22 H	227	67.49	-3.40
3	4880.00	46.9 PK	74.0	-27.1	1.51 H	287	43.55	3.34
4	4880.00	34.8 AV	54.0	-19.2	1.51 H	287	31.47	3.34
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	*2440.00	82.5 PK			1.73 V	227	85.88	-3.40
2	*2440.00	61.0 AV			1.73 V	227	64.37	-3.40
3	4880.00	48.0 PK	74.0	-26.1	1.90 V	225	44.61	3.34
4	4880.00	35.9 AV	54.0	-18.1	1.90 V	225	32.54	3.34

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) – 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.

CHANNEL	TX Channel 39	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	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	85.5 PK			1.19 H	202	88.73	-3.23
2	*2480.00	64.6 AV			1.19 H	202	67.79	-3.23
3	2483.50	45.8 PK	74.0	-28.3	1.19 H	202	48.96	-3.21
4	2483.50	33.7 AV	54.0	-20.3	1.19 H	202	36.94	-3.21
5	4960.00	47.1 PK	74.0	-26.9	1.45 H	277	43.71	3.42
6	4960.00	34.7 AV	54.0	-19.3	1.45 H	277	31.27	3.42
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	82.5 PK			1.88 V	221	85.71	-3.23
2	*2480.00	61.0 AV			1.88 V	221	64.27	-3.23
3	2483.50	43.4 PK	74.0	-30.6	1.88 V	221	46.58	-3.21
4	2483.50	31.6 AV	54.0	-22.4	1.88 V	221	34.77	-3.21
5	4960.00	48.2 PK	74.0	-25.8	1.74 V	251	44.75	3.42
6	4960.00	36.1 AV	54.0	-18.0	1.74 V	251	32.63	3.42

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:

CHANNEL	TX Channel 39	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M

NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	41.64	18.8 QP	40.0	-21.2	1.66 H	125	33.08	-14.26
2	164.98	24.2 QP	43.5	-19.3	1.53 H	201	37.62	-13.42
3	218.33	21.1 QP	46.0	-24.9	1.72 H	184	37.08	-15.97
4	601.14	22.8 QP	46.0	-23.2	1.27 H	156	29.00	-6.21
5	739.99	26.8 QP	46.0	-19.2	1.41 H	316	30.78	-3.98
6	868.76	27.7 QP	46.0	-18.3	2.17 H	340	29.62	-1.94

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M

NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	38.63	24.0 QP	40.0	-16.1	1.69 V	337	38.52	-14.57
2	119.58	18.1 QP	43.5	-25.4	1.54 V	146	34.14	-16.01
3	569.42	22.4 QP	46.0	-23.6	1.73 V	77	29.56	-7.15
4	687.27	25.5 QP	46.0	-20.5	2.17 V	215	30.50	-4.98
5	805.51	26.8 QP	46.0	-19.2	1.95 V	239	29.69	-2.85
6	917.50	28.3 QP	46.0	-17.7	2.27 V	301	29.32	-1.00

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) – 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.	Cal. Date	Cal. Due
ROHDE & SCHWARZ TEST RECEIVER	ESCS 30	100292	Dec. 18, 2014	Dec. 17, 2015
ROHDE & SCHWARZ Artificial Mains Network (for EUT)	ESH2-Z5	100104	Dec. 04, 2014	Dec. 03, 2015
LISN With Adapter (for EUT)	AD10	C09Ada-001	Dec. 04, 2014	Dec. 03, 2015
ROHDE & SCHWARZ Artificial Mains Network (for peripherals)	ESH3-Z5	847265/023	Oct. 21, 2014	Oct. 20, 2015
SCHWARZBECK Artificial Mains Network (For EUT)	NNLK8129	8129229	May 08, 2014	May 07, 2015
Software	ADT_Cond_V7.3.7	NA	NA	NA
RF cable (JYEBAO)	5D-FB	Cable-C09.01	Feb. 24, 2015	Feb. 23, 2016
SUHNER Terminator (For ROHDE & SCHWARZ LISN)	65BNC-5001	E1-010789	May 20, 2014	May 19, 2015
ROHDE & SCHWARZ Artificial Mains Network (For TV EUT)	ESH3-Z5	100220	Nov. 20, 2014	Nov. 19, 2015
LISN With Adapter (for TV EUT)	100220	N/A	Nov. 20, 2014	Nov. 19, 2015

Notes: 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. 9.

3. The VCCI Site Registration No. C-1312.

4.2.3 Test Procedures

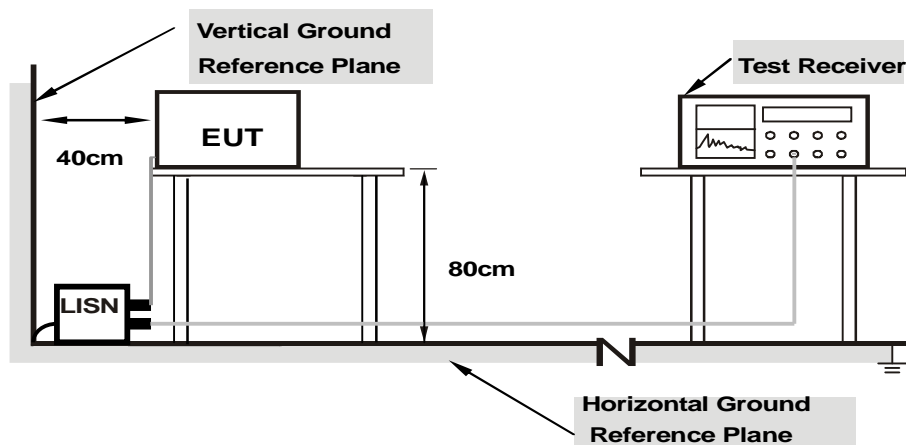
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance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

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 Item 4.1.6

4.2.7 Test Results

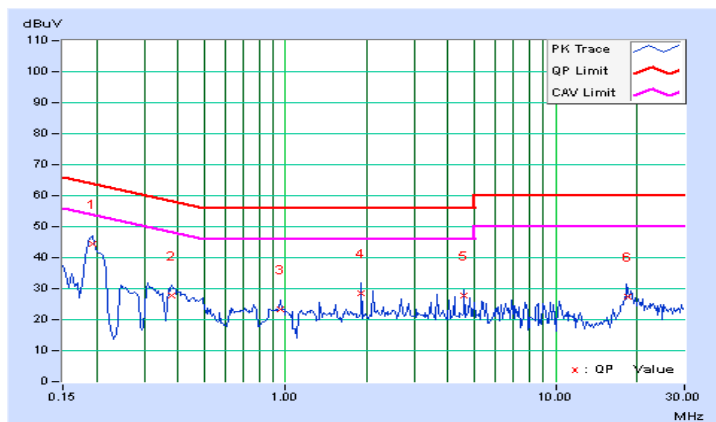
CONDUCTED WORST-CASE DATA

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
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No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.19297	0.21	44.41	39.43	44.62	39.64	63.91	53.91	-19.29	-14.27
2	0.38047	0.25	27.53	18.85	27.78	19.10	58.27	48.27	-30.49	-29.17
3	0.95859	0.32	23.00	18.56	23.32	18.88	56.00	46.00	-32.68	-27.12
4	1.91406	0.38	28.26	26.67	28.64	27.05	56.00	46.00	-27.36	-18.95
5	4.59766	0.48	27.46	25.72	27.94	26.20	56.00	46.00	-28.06	-19.80
6	18.39445	1.00	26.24	20.33	27.24	21.33	60.00	50.00	-32.76	-28.67

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

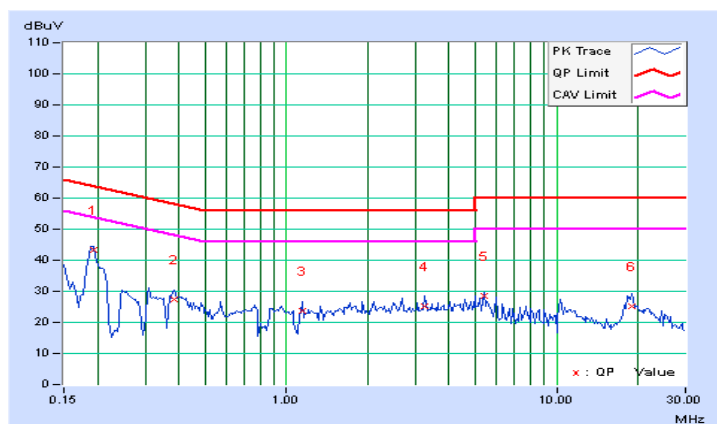


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
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No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.19245	0.22	43.05	38.89	43.27	39.11	63.93	53.93	-20.66	-14.82
2	0.38438	0.26	27.17	21.21	27.43	21.47	58.18	48.18	-30.76	-26.72
3	1.14844	0.34	23.31	19.42	23.65	19.76	56.00	46.00	-32.35	-26.24
4	3.25391	0.44	24.92	21.67	25.36	22.11	56.00	46.00	-30.64	-23.89
5	5.36328	0.51	27.83	26.08	28.34	26.59	60.00	50.00	-31.66	-23.41
6	18.96094	0.85	24.50	18.47	25.35	19.32	60.00	50.00	-34.65	-30.68

Remarks:

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

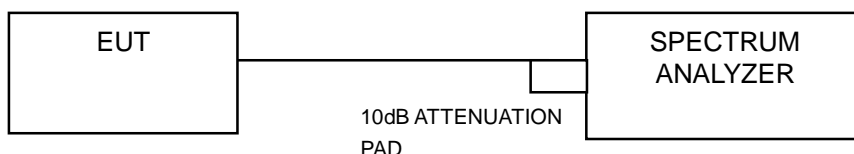


4.3 6dB Bandwidth Measurement

4.3.1 Limits of 6dB Bandwidth Measurement

The minimum of 6dB Bandwidth Measurement is 0.5 MHz.

4.3.2 Test Setup



4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.3.4 Test Procedure

- Set resolution bandwidth (RBW) = 100kHz
- Set the video bandwidth (VBW) $\geq 3 \times$ RBW, Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission

4.3.5 Deviation from Test Standard

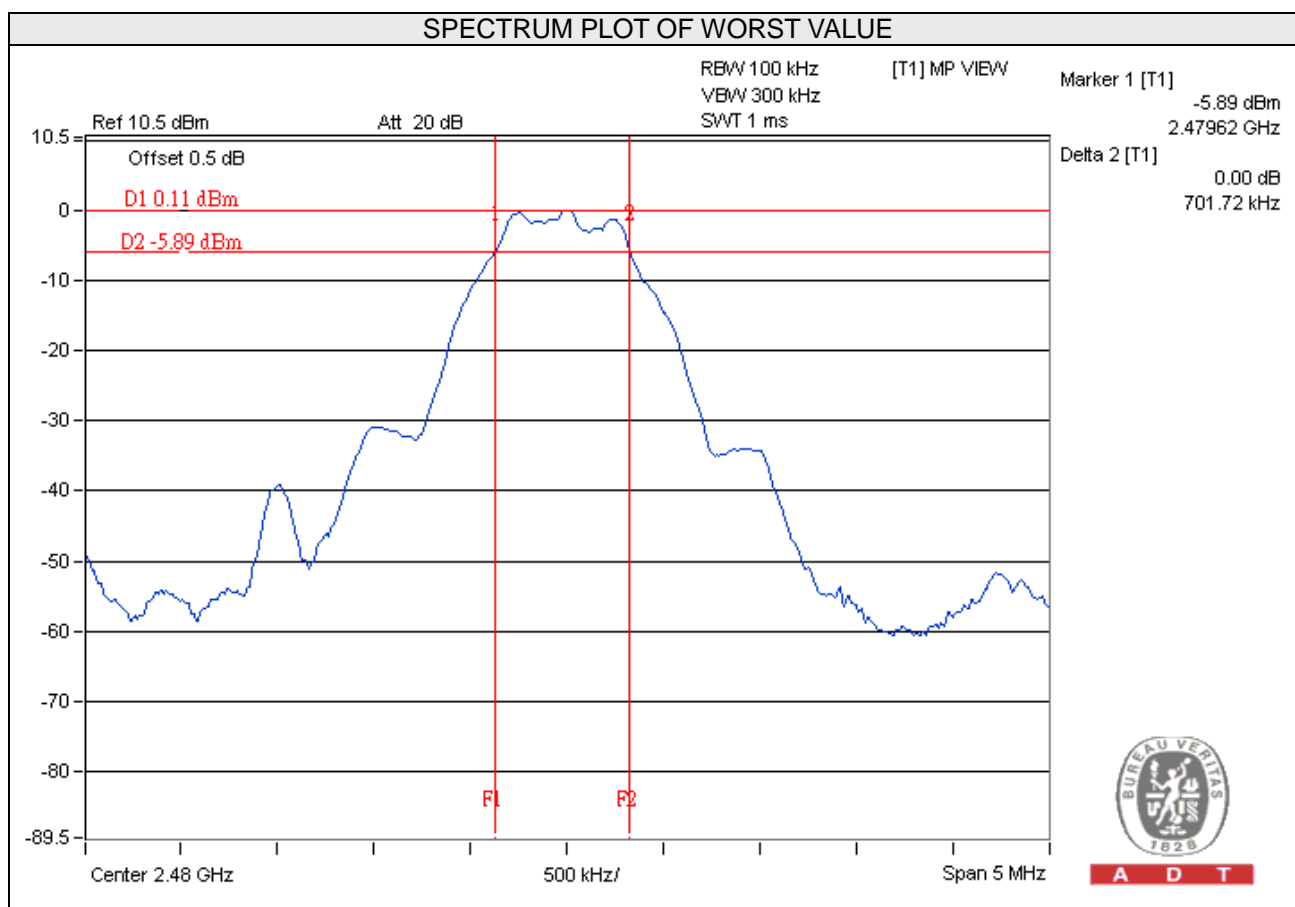
No deviation.

4.3.6 EUT Operating Conditions

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.3.7 Test Result

CHANNEL	FREQUENCY (MHz)	6dB BANDWIDTH (MHz)	MINIMUM LIMIT (MHz)	PASS / FAIL
0	2402	0.69	0.5	PASS
19	2440	0.69	0.5	PASS
39	2480	0.70	0.5	PASS

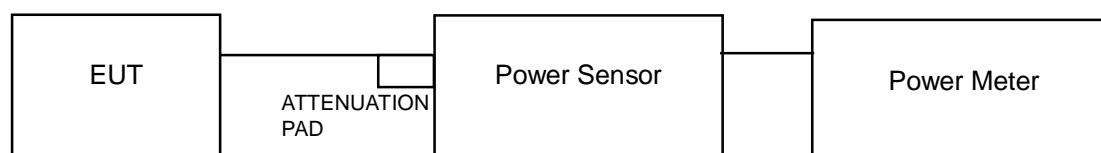


4.4 Conducted Output Power Measurement

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

Refer to section 4.1.2 to get information of above instrument.

4.4.4 Test Procedures

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

4.4.5 Deviation from Test Standard

No deviation.

4.4.6 EUT Operating Conditions

Same as Item 4.3.6

4.4.7 Test Results

FOR PEAK POWER

CHANNEL	FREQUENCY (MHz)	PEAK POWER (mW)	PEAK POWER (dBm)	LIMIT (dBm)	PASS/FAIL
0	2402	0.931	-0.31	30	PASS
19	2440	1.330	1.24	30	PASS
39	2480	1.656	2.19	30	PASS

FOR AVERAGE POWER

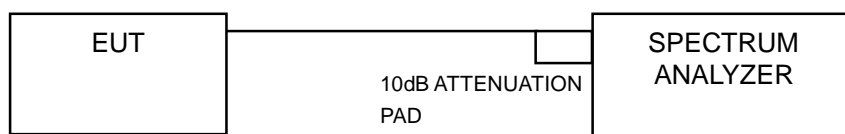
CHANNEL	FREQUENCY (MHz)	AVERAGE POWER (dBm)
0	2402	-1.29
19	2440	0.28
39	2480	1.26

4.5 Power Spectral Density Measurement

4.5.1 Limits of Power Spectral Density Measurement

The Maximum of Power Spectral Density Measurement is 8dBm.

4.5.2 Test Setup



4.5.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.5.4 Test Procedure

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

4.5.5 Deviation from Test Standard

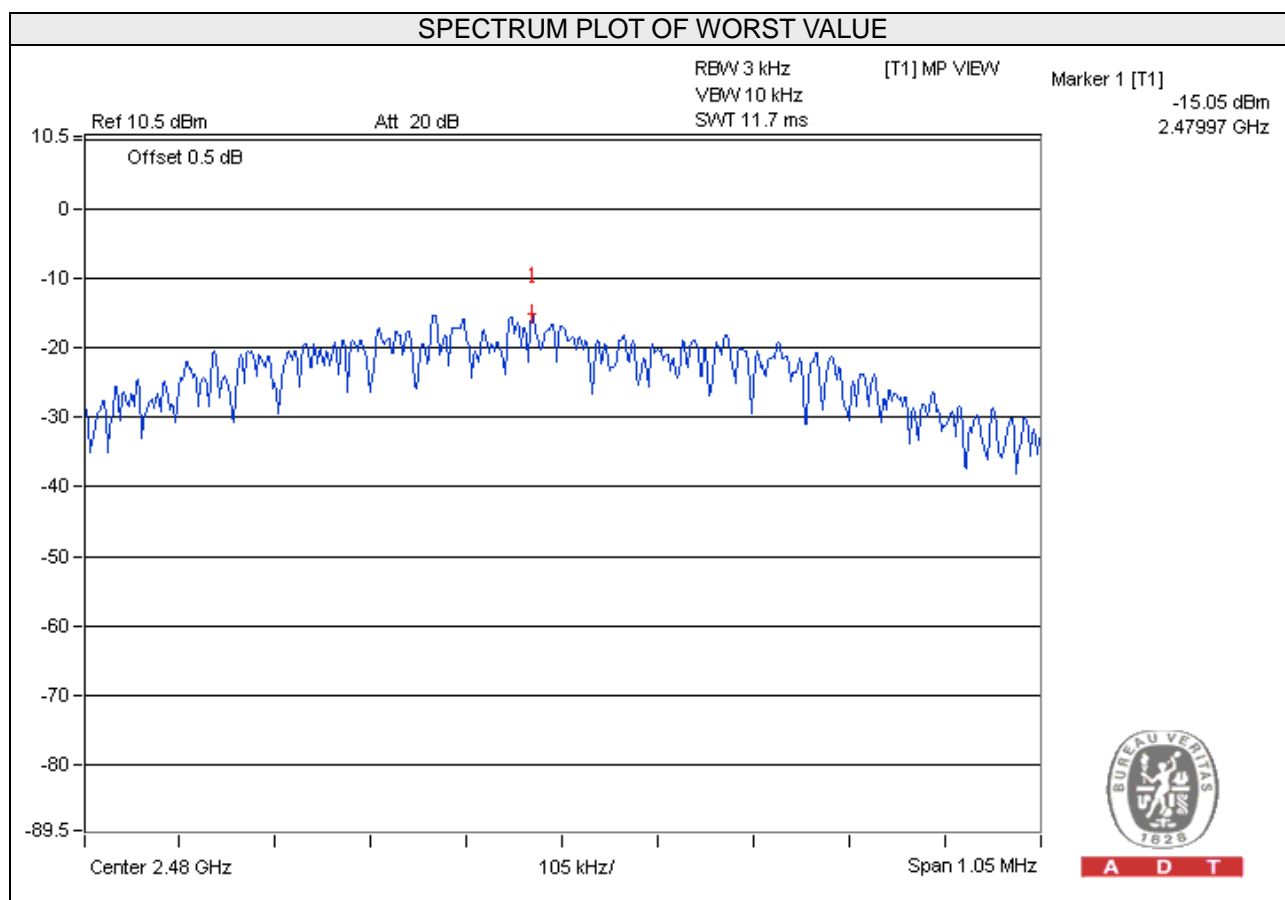
No deviation.

4.5.6 EUT Operating Condition

Same as Item 4.3.6

4.5.7 Test Results

Channel	Freq. (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	PASS /FAIL
0	2402	-18.23	8	PASS
19	2440	-15.85	8	PASS
39	2480	-15.05	8	PASS

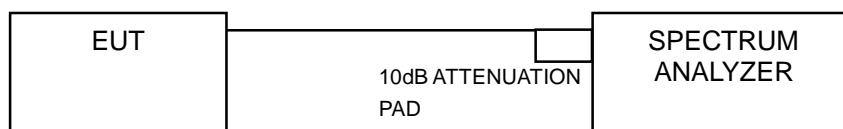


4.6 Conducted Out of Band Emission Measurement

4.6.1 Limits of Conducted Out of Band Emission Measurement

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

4.6.2 Test Setup



4.6.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.6.4 Test Procedure

MEASUREMENT PROCEDURE REF

1. Set the RBW = 100 kHz .
2. Set the VBW $\geq 300\text{ kHz}$.
3. Detector = peak.
4. Sweep time = auto couple.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

MEASUREMENT PROCEDURE OOB

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

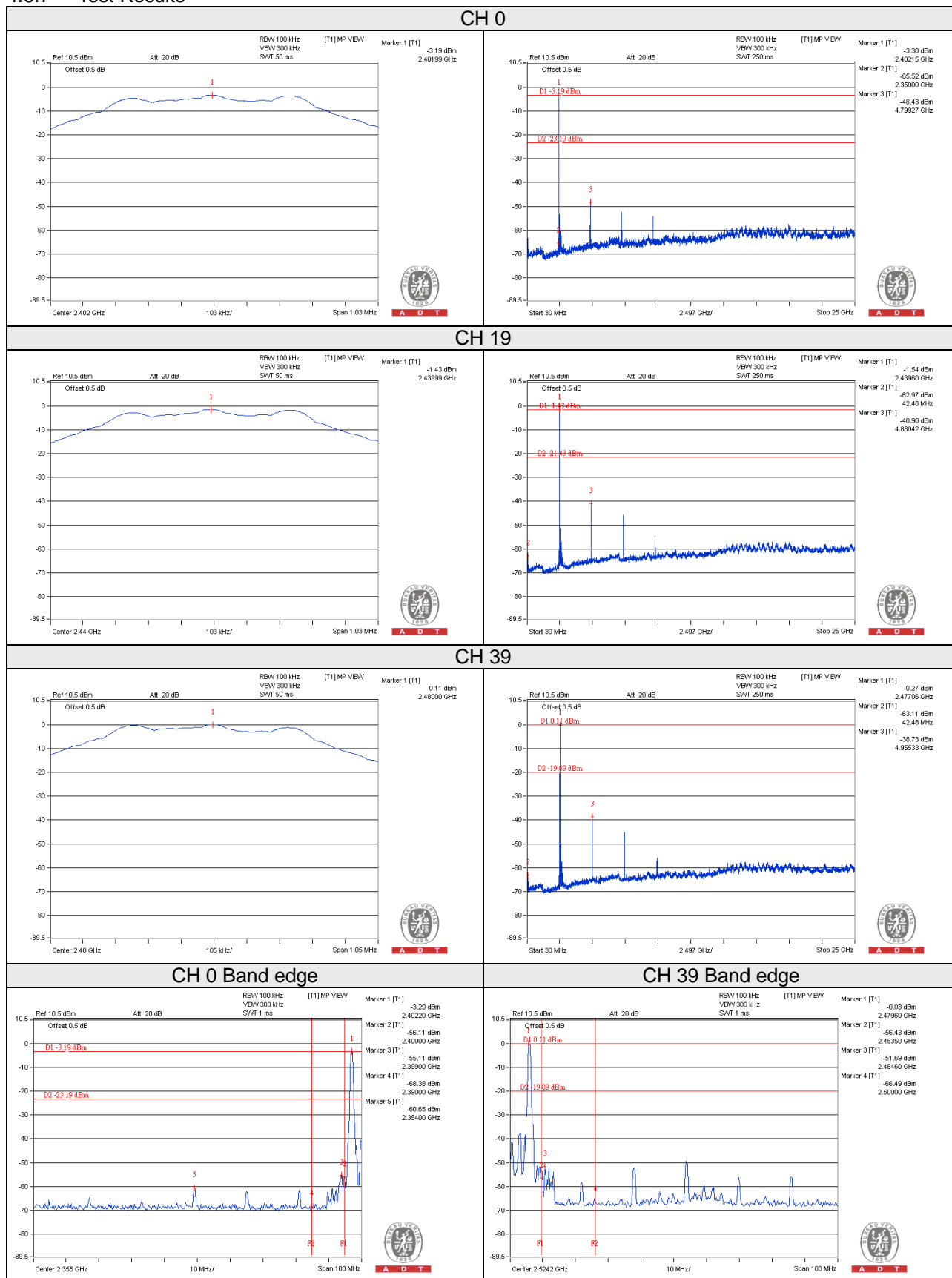
4.6.5 Deviation from Test Standard

No deviation.

4.6.6 EUT Operating Condition

Same as Item 4.3.6

4.6.7 Test Results



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:

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Web Site: www.bureauveritas-adt.com

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

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