

FCC Test Report

Report No.: RF160224C17A-1

FCC ID: S4L4AP54

Test Model: 4AP54

Received Date: Nov. 24, 2016

Test Date: (1) Mar. 04, 2016 ~ Mar. 14, 2016
(2) Dec. 12, 2016

Issued Date: Dec. 20, 2016

Applicant: TomTom International BV

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Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch

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Table of Contents

Release Control Record	4
1 Certificate of Conformity	5
2 Summary of Test Results.....	6
2.1 Measurement Uncertainty.....	6
2.2 Modification Record	6
3 General Information	7
3.1 General Description of EUT	7
3.2 Description of Test Modes.....	8
3.2.1 Test Mode Applicability and Tested Channel Detail.....	9
3.3 Description of Support Units	10
3.3.1 Configuration of System under Test	10
3.4 General Description of Applied Standards.....	10
4 Test Types and Results	11
4.1 Radiated Emission and Bandedge Measurement	11
4.1.1 Limits of Radiated Emission and Bandedge Measurement	11
4.1.2 Test Instruments	12
4.1.3 Test Procedures.....	14
4.1.4 Deviation from Test Standard	14
4.1.5 Test Set Up	15
4.1.6 EUT Operating Conditions.....	15
4.1.7 Test Results	16
4.2 6 dB Bandwidth Measurement.....	22
4.2.1 Limits of 6 dB Bandwidth Measurement.....	22
4.2.2 Test Setup.....	22
4.2.3 Test Instruments	22
4.2.4 Test Procedure	22
4.2.5 Deviation from Test Standard	22
4.2.6 EUT Operating Conditions.....	22
4.2.7 Test Result	23
4.3 Conducted Output Power Measurement	24
4.3.1 Limits of Conducted Output Power Measurement.....	24
4.3.2 Test Setup.....	24
4.3.3 Test Instruments	24
4.3.4 Test Procedures.....	24
4.3.5 Deviation from Test Standard	24
4.3.6 EUT Operating Conditions.....	24
4.3.7 Test Results	24
4.4 Power Spectral Density Measurement	25
4.4.1 Limits of Power Spectral Density Measurement.....	25
4.4.2 Test Setup.....	25
4.4.3 Test Instruments	25
4.4.4 Test Procedure	25
4.4.5 Deviation from Test Standard	25
4.4.6 EUT Operating Condition	25
4.4.7 Test Results	26
4.5 Conducted Out of Band Emission Measurement	27
4.5.1 Limits of Conducted Out of Band Emission Measurement.....	27
4.5.2 Test Setup.....	27
4.5.3 Test Instruments	27
4.5.4 Test Procedure	27
4.5.5 Deviation from Test Standard	27
4.5.6 EUT Operating Condition	27
4.5.7 TEST RESULTS	28

5 Pictures of Test Arrangements.....	30
Appendix – Information on the Testing Laboratories	31

Release Control Record

Issue No.	Description	Date Issued
RF160224C17A-1	Original Release	Dec. 20, 2016

1 Certificate of Conformity

Product: GPS Navigation System

Brand: TomTom

Test Model: 4AP54

Sample Status: Production Unit

Applicant: TomTom International BV

Test Date: (1) Mar. 04, 2016 ~ Mar. 14, 2016

(2) Dec. 12, 2016

Standards: 47 CFR FCC Part 15, Subpart C (Section 15.247)

ANSI C63.10:2013

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 :

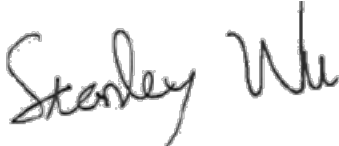


Date:

Dec. 20, 2016

Evonne Liu / Specialist

Approved by :



Date:

Dec. 20, 2016

Stanley Wu / Assistant Manager

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.247)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	Not applicable	Without AC power port of the EUT
15.205 & 209	Radiated Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -12.44 dB at 54.57 MHz.
15.247(d)	Band Edge Measurement	Pass	Meet the requirement of limit.
15.247(d)	Antenna Port Emission	Pass	Meet the requirement of limit.
15.247(a)(2)	6 dB 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:

The listed uncertainties are the worst case uncertainty for the entire range of measurement. Please note that the uncertainty values are provided for informational purposes only and are not used in determining the PASS/FAIL results.

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150 kHz ~ 30 MHz	2.44 dB
Radiated Emissions up to 1 GHz	30 MHz ~ 200 MHz	2.93 dB
	200 MHz ~ 1000 MHz	2.95 dB
Radiated Emissions above 1 GHz	1 GHz ~ 18 GHz	2.26 dB
	18 GHz ~ 40 GHz	1.94 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	GPS Navigation System
Brand	TomTom
Test Model	4AP54
Status of EUT	Production Unit
Power Supply Rating	3.7Vdc (Battery) 5Vdc (Home Charger) 12/24Vdc (Car Battery)
Modulation Type	GFSK
Transfer Rate	1 Mbps
Operating Frequency	2402 ~ 2480 MHz
Number of Channel	40
Output Power	2.099 mW
Antenna Type	Wire antenna with -1.5 dBi gain
Antenna Connector	N/A
Accessory Device	Refer to Note as below
Data Cable Supplied	Refer to Note as below

Note:

1. The details for the models are listed as below.

SKU	Sample	Brand	Model	Difference
1	A	TomTom	4AA53	5" with GPS function only (LCM 1)
	B	TomTom	4AP54	5" plus with GPS and BT function (LCM 1)
2	C	TomTom	4AP54	5" plus with GPS and BT function (LCM 2)

2. The EUT contains following accessory devices.

Product	Brand	Model	Description
Battery	TomTom	AT5	3.7Vdc, 920mAh
Car Charger 1	TomTom	4UUC3Z	I/P: 12/24 Vdc O/P: 5Vdc, 1.2A Type A
Car Charger 2	TomTom	4UUC3Z	I/P: 12/24 Vdc O/P: 5Vdc, 1.2A Type B
Car Charger 3	TomTom	4UUC23	I/P: 12/24 Vdc O/P: 5Vdc, 1.2A
Car Charger 4	TomTom	4UUC23B	I/P: 12/24 Vdc O/P: 5Vdc, 1.2A
Car Charger 5	TomTom	4UUC25	I/P: 12/24 Vdc O/P: 5Vdc, 2.1A
Car Charger 6	TomTom	4UUC5B	I/P: 12/24 Vdc O/P: 5Vdc, 1.2A
Car Charger 7	TomTom	4UUC9	I/P: 12/24 Vdc O/P: 5Vdc, 1.2A / 2.1A 12/24 Vdc, 2.0A
Car Charger 8	TomTom	4UUC26	I/P: 12/24 Vdc O/P: 5Vdc, 2.4A / 1.5A
Home Charger	TomTom	4UUC6B	I/P: 110-240 Vac O/P: 5Vdc, 1.2A

Product	Brand	Model	Description
USB Cable 1	TomTom	4UUC.001.24	1.5m shielded cable w/o core
USB Cable 2	TomTom	4UUC.001.35	1.5m shielded cable w/o core
LCM 1	Samsung	LTR050VP01	5.0" WQVGA resistive LCM
LCM 2	Innolux	ZD050NA-05H	5.0" WQVGA resistive LCM

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 $\geq$ 1G	RE<1G	APCM	
A	√	√	√	SKU 1: Sample A+B
B	√	√	-	SKU 2: Sample C

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

APCM: Antenna Port Conducted Measurement

NOTE:

1. The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **Z-plane**.
2. "-" means no effect.

Radiated Emission Test (Above 1 GHz):

- ☒ 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	Data Rate (Mbps)
A	0 to 39	0, 19, 39	GFSK	1
B	0 to 39	19	GFSK	1

Radiated Emission Test (Below 1 GHz):

- ☒ 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	Data Rate (Mbps)
A, B	0 to 39	19	GFSK	1

Antenna Port Conducted Measurement:

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

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type	Data Rate (Mbps)
A	0 to 39	0, 19, 39	GFSK	1

Test Condition:

Applicable To	Environmental Conditions	Input Power	Tested by
RE $\geq$ 1G	25 deg. C, 65 % RH	DC24V	Karl Lee
RE<1G	25 deg. C, 65 % RH	DC24V	Karl Lee
APCM	25 deg. C, 65 % RH	3.7 Vdc	Luke Chen

3.3 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.

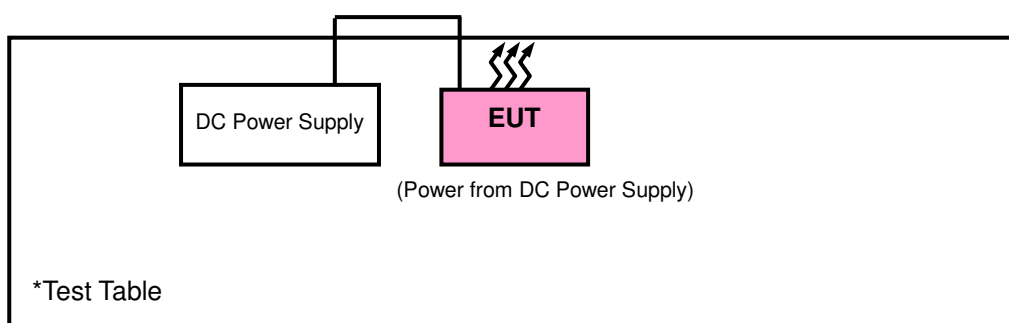
No.	Product	Brand	Model No.	Serial No.	FCC ID
1.	DC Power Supply	Com Solve	33010D	807748	N/A

No.	Signal Cable Description Of The Above Support Units
1.	N/A

Note:

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

3.3.1 Configuration of System under Test



3.4 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 v03r04

ANSI C63.10-2013

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

NOTE: The EUT 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 20 dB 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 1000 MHz, 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 20 dB under any condition of modulation.

4.1.2 Test Instruments

(1) Test data: Mar. 04, 2016 ~ Mar. 14, 2016

Description & Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date of Calibration
Test Receiver Agilent	N9038A	MY51210203	Jan. 21, 2016	Jan. 20, 2017
Spectrum Analyzer Agilent	N9010A	MY52220314	Sep.03, 2015	Sep.02, 2016
Spectrum Analyzer ROHDE & SCHWARZ	FSU43	101261	Dec. 17, 2015	Dec. 16, 2016
BILOG Antenna SCHWARZBECK	VULB9168	9168-472	Jan. 07, 2016	Jan. 06, 2017
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-969	Jan. 04, 2016	Jan. 03, 2017
HORN Antenna SCHWARZBECK	BBHA 9170	9170-480	Jan. 08, 2016	Jan. 07, 2017
Loop Antenna	EM-6879	269	Jul. 31, 2015	Jul. 30, 2016
Preamplifier EMCI	EMC 012645	980115	Dec. 21, 2015	Dec. 20, 2016
Preamplifier EMCI	EMC 184045	980116	Dec. 21, 2015	Dec. 20, 2016
Preamplifier EMCI	EMC 330H	980112	Dec. 28, 2015	Dec. 27, 2016
Power Meter Anritsu	ML2495A	1232002	Sep. 21, 2015	Sep. 20, 2016
Power Sensor Anritsu	MA2411B	1207325	Sep. 21, 2015	Sep. 20, 2016
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	309219/4 2950114	Oct. 12, 2015	Oct. 11, 2016
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	250130/4	Oct. 12, 2015	Oct. 11, 2016
RF Coaxial Cable Worken	8D-FB	Cable-Ch10-01	Oct. 12, 2015	Oct. 11, 2016
Software BV ADT	E3 6.120103	NA	NA	NA
Antenna Tower MF	MFA-440H	NA	NA	NA
Turn Table MF	MFT-201SS	NA	NA	NA
Antenna Tower & Turn Table Controller MF	MF-7802	NA	NA	NA

- 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 10.
3. The horn antenna and preamplifier (model: EMC 184045) are used only for the measurement of emission frequency above 1GHz if tested.
4. The FCC Site Registration No. is 690701.
5. The IC Site Registration No. is IC7450F-10.

(2) Test data: Dec. 12, 2016

Description & Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date of Calibration
Test Receiver Agilent	N9038A	MY51210203	Jan. 21, 2016	Jan. 20, 2017
Spectrum Analyzer Agilent	N9010A	MY52220314	Nov. 16, 2016	Nov. 15, 2017
Spectrum Analyzer ROHDE & SCHWARZ	FSU43	101261	Dec. 17, 2015	Dec. 16, 2016
BILOG Antenna SCHWARZBECK	VULB9168	9168-472	Jan. 07, 2016	Jan. 06, 2017
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-969	Jan. 04, 2016	Jan. 03, 2017
HORN Antenna SCHWARZBECK	BBHA 9170	9170-480	Jan. 08, 2016	Jan. 07, 2017
Fixed Attenuator Mini-Circuits	BW-N10W5+	NA	Jul. 08, 2016	Jul. 07, 2017
MXG Vector signal generator Agilent	N5182B	MY53050430	Oct. 19, 2016	Oct. 18, 2017
Loop Antenna	EM-6879	269	Aug. 11, 2016	Aug. 10, 2017
Bluetooth Tester	CBT	100980	Apr. 27, 2015	Apr. 26, 2017
Preamplifier EMCI	EMC 012645	980115	Oct. 21, 2016	Oct. 20, 2017
Preamplifier EMCI	EMC 184045	980116	Oct. 21, 2016	Oct. 20, 2017
Preamplifier EMCI	EMC 330H	980112	Oct. 21, 2016	Oct. 20, 2017
Power Meter Anritsu	ML2495A	1232002	Sep. 08, 2016	Sep. 07, 2017
Power Sensor Anritsu	MA2411B	1207325	Sep. 08, 2016	Sep. 07, 2017
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	309219/4 2950114	Oct. 21, 2016	Oct. 20, 2017
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	250130/4	Oct. 21, 2016	Oct. 20, 2017
RF Coaxial Cable Worken	8D-FB	Cable-Ch10-01	Oct. 21, 2016	Oct. 20, 2017
Software BV ADT	E3 6.120103	NA	NA	NA
Antenna Tower MF	MFA-440H	NA	NA	NA
Turn Table MF	MFT-201SS	NA	NA	NA
Antenna Tower & Turn Table Controller MF	MF-7802	NA	NA	NA
Fixed Attenuator Mini-Circuits	BW-N10W5+	NA	Jul. 08, 2016	Jul. 07, 2017

- 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 10.
 3. The horn antenna and preamplifier (model: EMC 184045) are used only for the measurement of emission frequency above 1 GHz if tested.
 4. The FCC Site Registration No. is 690701.
 5. The IC Site Registration No. is IC7450F-10.

4.1.3 Test Procedures

- a. The EUT was placed on the top of a rotating table 0.8 meters (for below 1 GHz) / 1.5 meters (for above 1 GHz) 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 detected function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

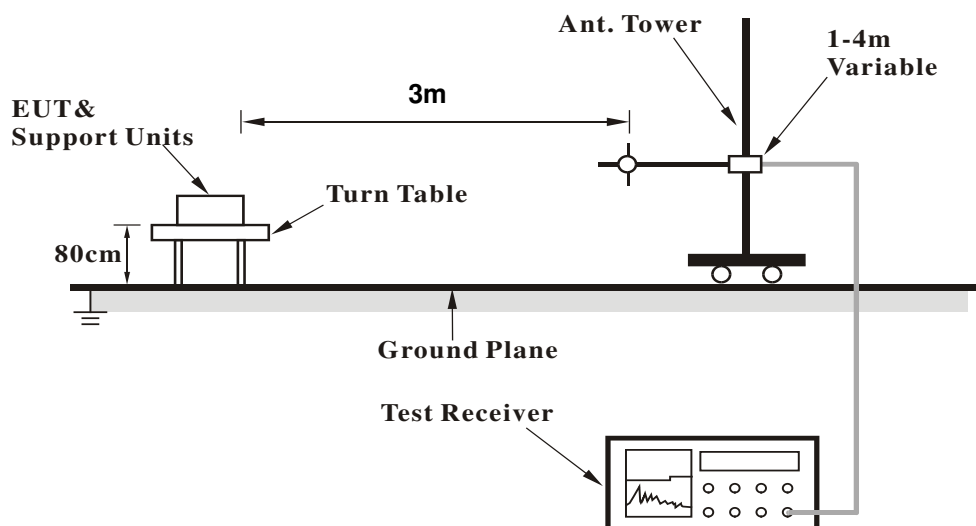
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) at frequency below 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1 GHz.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

4.1.4 Deviation from Test Standard

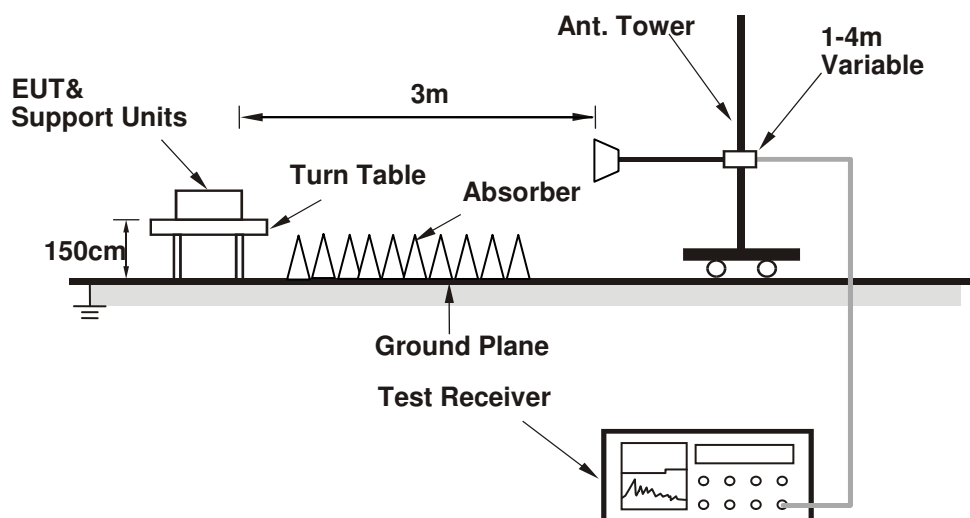
No deviation.

4.1.5 Test Set Up

<Frequency Range below 1 GHz>



<Frequency Range above 1 GHz>



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 transmission condition continuously at specific channel frequency.

4.1.7 Test Results

Mode A

ABOVE 1 GHz DATA :

EUT Test Condition		Measurement Detail	
Channel	Channel 0	Frequency Range	1 GHz ~ 25 GHz
Input Power	DC24V	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Karl Lee

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2356	40.55	38.92	54	-13.45	31.76	5.37	35.5	128	161	Average
2356	55.15	53.52	74	-18.85	31.76	5.37	35.5	128	161	Peak
2402	86.04	84.31			31.8	5.4	35.47	128	161	Average
2402	87.81	86.08			31.8	5.4	35.47	128	161	Peak
2498	41.27	39.25	54	-12.73	31.9	5.53	35.41	128	161	Average
2498	55.58	53.56	74	-18.42	31.9	5.53	35.41	128	161	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2316	40.79	39.3	54	-13.21	31.71	5.3	35.52	184	272	Average
2316	55.45	53.96	74	-18.55	31.71	5.3	35.52	184	272	Peak
2402	80.02	78.29			31.8	5.4	35.47	184	272	Average
2402	81.87	80.14			31.8	5.4	35.47	184	272	Peak
2492	41.27	39.25	54	-12.73	31.9	5.53	35.41	184	272	Average
2492	55.97	53.95	74	-18.03	31.9	5.53	35.41	184	272	Peak

Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin value = Emission level – Limit value
- 2402 MHz: Fundamental frequency.

EUT Test Condition		Measurement Detail	
Channel	Channel 19	Frequency Range	1 GHz ~ 25 GHz
Input Power	DC24V	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Karl Lee

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2344	40.49	38.92	54	-13.51	31.74	5.33	35.5	125	167	Average
2344	55.46	53.89	74	-18.54	31.74	5.33	35.5	125	167	Peak
2440	86.8	84.95			31.85	5.46	35.46	125	167	Average
2440	87.51	85.66			31.85	5.46	35.46	125	167	Peak
2494	41.4	39.38	54	-12.6	31.9	5.53	35.41	125	167	Average
2494	55.01	52.99	74	-18.99	31.9	5.53	35.41	125	167	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2366	40.96	39.32	54	-13.04	31.76	5.37	35.49	199	272	Average
2366	55.34	53.7	74	-18.66	31.76	5.37	35.49	199	272	Peak
2440	80.05	78.2			31.85	5.46	35.46	199	272	Average
2440	81.81	79.96			31.85	5.46	35.46	199	272	Peak
2500	41.35	39.33	54	-12.65	31.9	5.53	35.41	199	272	Average
2500	56.28	54.26	74	-17.72	31.9	5.53	35.41	199	272	Peak

Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin value = Emission level – Limit value
- 2440 MHz: Fundamental frequency.

EUT Test Condition		Measurement Detail	
Channel	Channel 39	Frequency Range	1 GHz ~ 25 GHz
Input Power	DC24V	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Karl Lee

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2354	40.24	38.65	54	-13.76	31.76	5.33	35.5	124	167	Average
2354	56.2	54.61	74	-17.8	31.76	5.33	35.5	124	167	Peak
2480	86.19	84.23			31.88	5.5	35.42	124	167	Average
2480	87.42	85.46			31.88	5.5	35.42	124	167	Peak
2490	40.92	38.91	54	-13.08	31.9	5.53	35.42	124	167	Average
2490	55.98	53.97	74	-18.02	31.9	5.53	35.42	124	167	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2344	40.35	38.78	54	-13.65	31.74	5.33	35.5	199	272	Average
2344	55.18	53.61	74	-18.82	31.74	5.33	35.5	199	272	Peak
2480	80.36	78.4			31.88	5.5	35.42	199	272	Average
2480	81.23	79.27			31.88	5.5	35.42	199	272	Peak
2490	41.08	39.07	54	-12.92	31.9	5.53	35.42	199	272	Average
2490	55.59	53.58	74	-18.41	31.9	5.53	35.42	199	272	Peak

Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin value = Emission level – Limit value
- 2480 MHz: Fundamental frequency.

9 kHz ~ 30 MHz DATA:

The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

30 MHz ~ 1 GHz WORST-CASE DATA:

EUT Test Condition		Measurement Detail	
Channel	Channel 19	Frequency Range	30 MHz ~ 1 GHz
Input Power	DC24V	Detector Function	Peak (PK) Quasi-peak (QP)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Karl Lee

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
73.2	19.89	42.8	40	-20.11	8.2	1.11	32.22	152	124	Peak
140.16	27.78	49.31	43.5	-15.72	9.36	1.38	32.27	169	134	Peak
206.04	19.07	38.56	43.5	-24.43	11.13	1.65	32.27	127	145	Peak
412.7	27.19	39.1	46	-18.81	17.88	2.41	32.2	169	135	Peak
671.7	22.99	28.66	46	-23.01	23.4	3.05	32.12	127	123	Peak
873.3	25.54	28.95	46	-20.46	24.8	3.44	31.65	176	138	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
54.57	27.56	51.56	40	-12.44	7.33	0.9	32.23	184	132	Peak
137.19	22.74	44.34	43.5	-20.76	9.28	1.38	32.26	168	246	Peak
240.87	11.63	29.32	46	-34.37	12.59	1.85	32.13	129	133	Peak
426.7	19.91	31.95	46	-26.09	17.73	2.41	32.18	169	154	Peak
676.6	23.52	29.23	46	-22.48	23.36	3.05	32.12	108	133	Peak
871.2	26.3	29.92	46	-19.7	24.6	3.44	31.66	139	122	Peak

Remarks:

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

Mode B

ABOVE 1 GHz DATA :

EUT Test Condition		Measurement Detail	
Channel	Channel 19	Frequency Range	1 GHz ~ 25 GHz
Input Power	DC24V	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Karl Lee

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2382	40.27	38.58	54	-13.73	31.78	5.4	35.49	153	128	Average
2382	55.26	53.57	74	-18.74	31.78	5.4	35.49	153	128	Peak
2440	85.92	84.07			31.85	5.46	35.46	153	128	Average
2440	86.48	84.63			31.85	5.46	35.46	153	128	Peak
2486	41.35	39.36	54	-12.65	31.88	5.53	35.42	153	128	Average
2486	55.13	53.14	74	-18.87	31.88	5.53	35.42	153	128	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2372	40.83	39.17	54	-13.17	31.78	5.37	35.49	211	283	Average
2372	55.29	53.63	74	-18.71	31.78	5.37	35.49	211	283	Peak
2440	80.96	79.11			31.85	5.46	35.46	211	283	Average
2440	81.93	80.08			31.85	5.46	35.46	211	283	Peak
2494	41.26	39.24	54	-12.74	31.9	5.53	35.41	211	283	Average
2494	56.21	54.19	74	-17.79	31.9	5.53	35.41	211	283	Peak

Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin value = Emission level – Limit value
- 2440 MHz: Fundamental frequency.

9 kHz ~ 30 MHz DATA:

The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

30 MHz ~ 1 GHz WORST-CASE DATA:

EUT Test Condition		Measurement Detail	
Channel	Channel 19	Frequency Range	30 MHz ~ 1 GHz
Input Power	DC24V	Detector Function	Peak (PK) Quasi-peak (QP)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Karl Lee

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
124.5	22.16	44.09	43.5	-21.34	8.93	1.38	32.24	129	164	Peak
152.31	27.67	48.14	43.5	-15.83	10.28	1.52	32.27	139	207	Peak
226.29	16.74	35.12	46	-29.26	11.96	1.85	32.19	153	125	Peak
435.8	24.71	36.55	46	-21.29	17.84	2.49	32.17	108	127	Peak
752.9	23.15	28.82	46	-22.85	23.25	3.22	32.14	169	254	Peak
957.3	25.99	27.26	46	-20.01	26.04	3.67	30.98	137	114	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
67.8	23.94	47.44	40	-16.06	7.82	0.9	32.22	133	175	Peak
156.9	17.92	38.1	43.5	-25.58	10.57	1.52	32.27	193	126	Peak
261.93	13.08	29.88	46	-32.92	13.37	1.94	32.11	164	127	Peak
500.9	18.26	28.54	46	-27.74	19.19	2.63	32.1	109	168	Peak
643.7	21.47	28.53	46	-24.53	22.1	2.99	32.15	155	324	Peak
799.8	25.59	29.73	46	-20.41	24.6	3.32	32.06	165	117	Peak

Remarks:

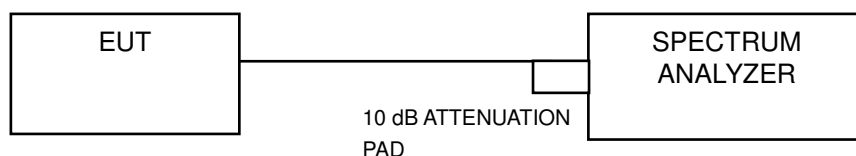
- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin value = Emission level – Limit value

4.2 6 dB Bandwidth Measurement

4.2.1 Limits of 6 dB Bandwidth Measurement

The minimum of 6 dB Bandwidth Measurement is 0.5 MHz.

4.2.2 Test Setup



4.2.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.2.4 Test Procedure

- Set resolution bandwidth (RBW) = 100 kHz
- 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

4.2.5 Deviation from Test Standard

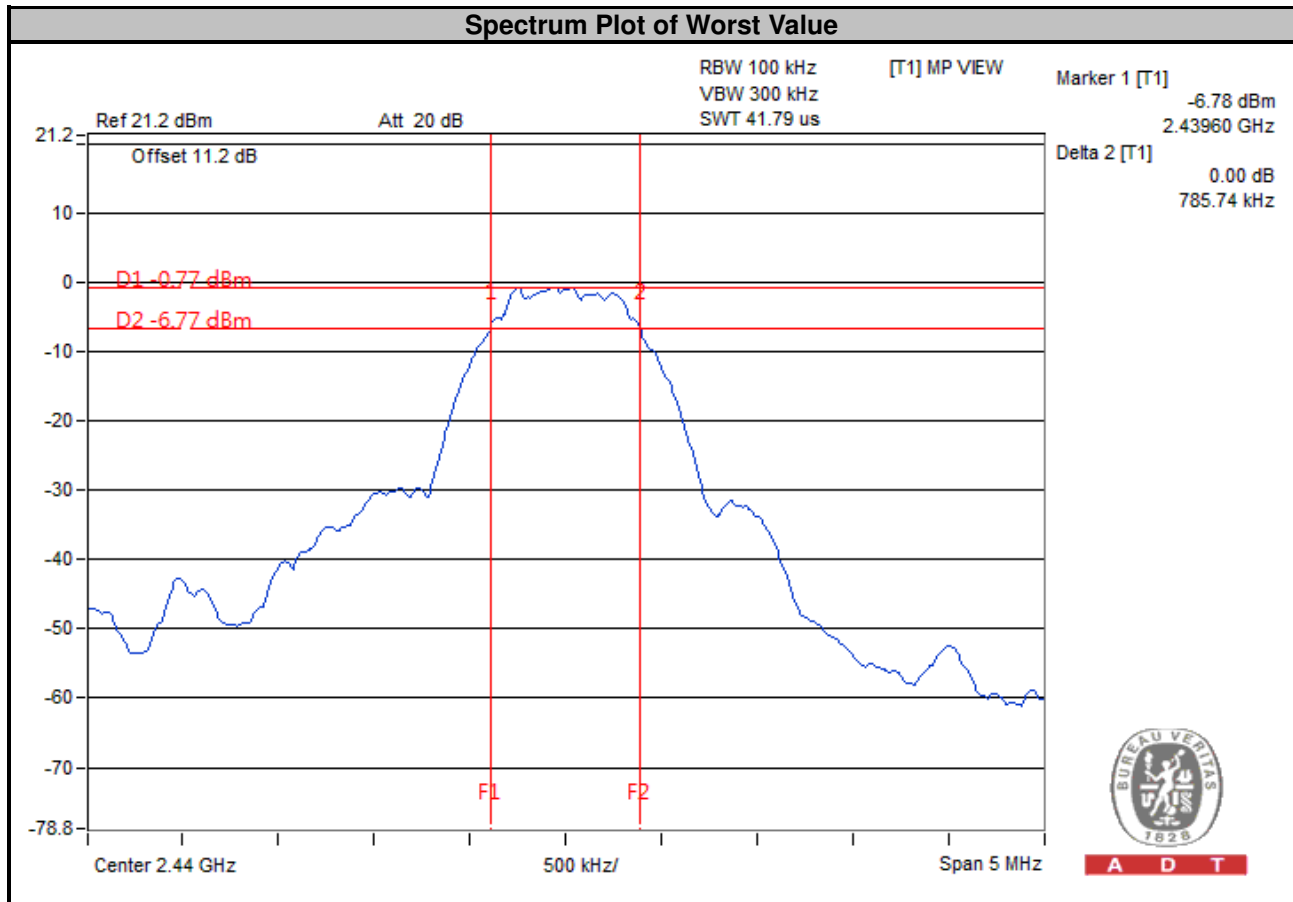
No deviation.

4.2.6 EUT Operating Conditions

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

4.2.7 Test Result

Channel	Frequency (MHz)	6 dB Bandwidth (kHz)	Minimum Limit (MHz)	Pass / Fail
0	2402	745.990	0.5	Pass
19	2440	785.740	0.5	Pass
39	2480	774.530	0.5	Pass

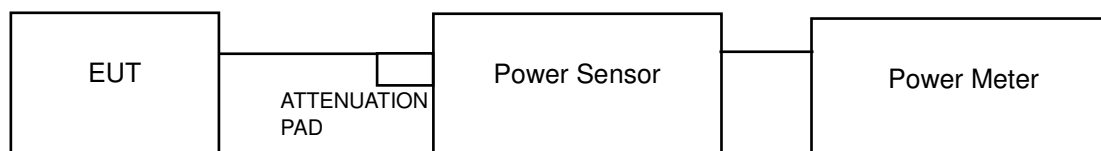


4.3 Conducted Output Power Measurement

4.3.1 Limits of Conducted Output Power Measurement

For systems using digital modulation in the 2400–2483.5 MHz bands: 1 Watt (30 dBm)

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 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.

4.3.5 Deviation from Test Standard

No deviation.

4.3.6 EUT Operating Conditions

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

4.3.7 Test Results

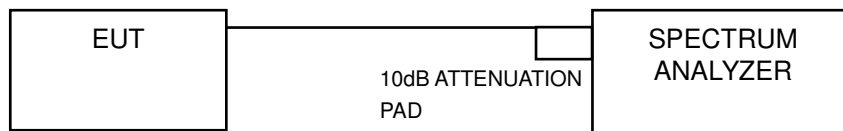
Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass / Fail
0	2402	2.099	3.22	30	Pass
19	2440	1.750	2.43	30	Pass
39	2480	1.416	1.51	30	Pass

4.4 Power Spectral Density Measurement

4.4.1 Limits of Power Spectral Density Measurement

The Maximum of Power Spectral Density Measurement is 8 dBm.

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 Procedure

- Set the RBW = 3 kHz, VBW = 10 kHz, Detector = peak.
- Sweep time = auto couple, Trace mode = max hold, allow trace to fully stabilize.
- Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

4.4.5 Deviation from Test Standard

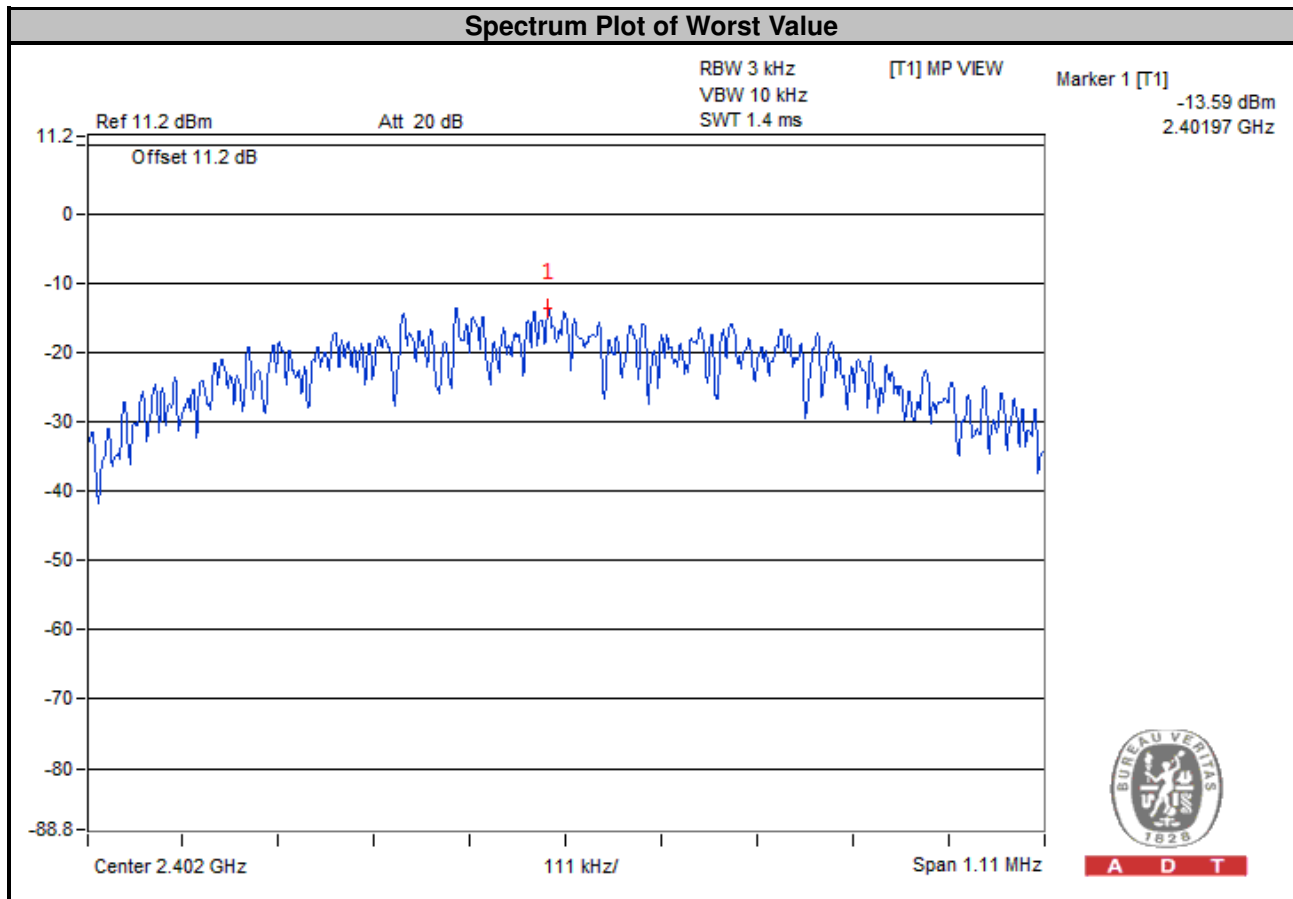
No deviation.

4.4.6 EUT Operating Condition

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

4.4.7 Test Results

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Pass / Fail
0	2402	-13.59	8	Pass
19	2440	-14.38	8	Pass
39	2480	-15.01	8	Pass

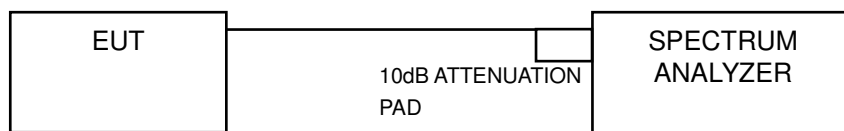


4.5 Conducted Out of Band Emission Measurement

4.5.1 Limits of Conducted Out of Band Emission Measurement

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

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

MEASUREMENT PROCEDURE REF

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

MEASUREMENT PROCEDURE OOB

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

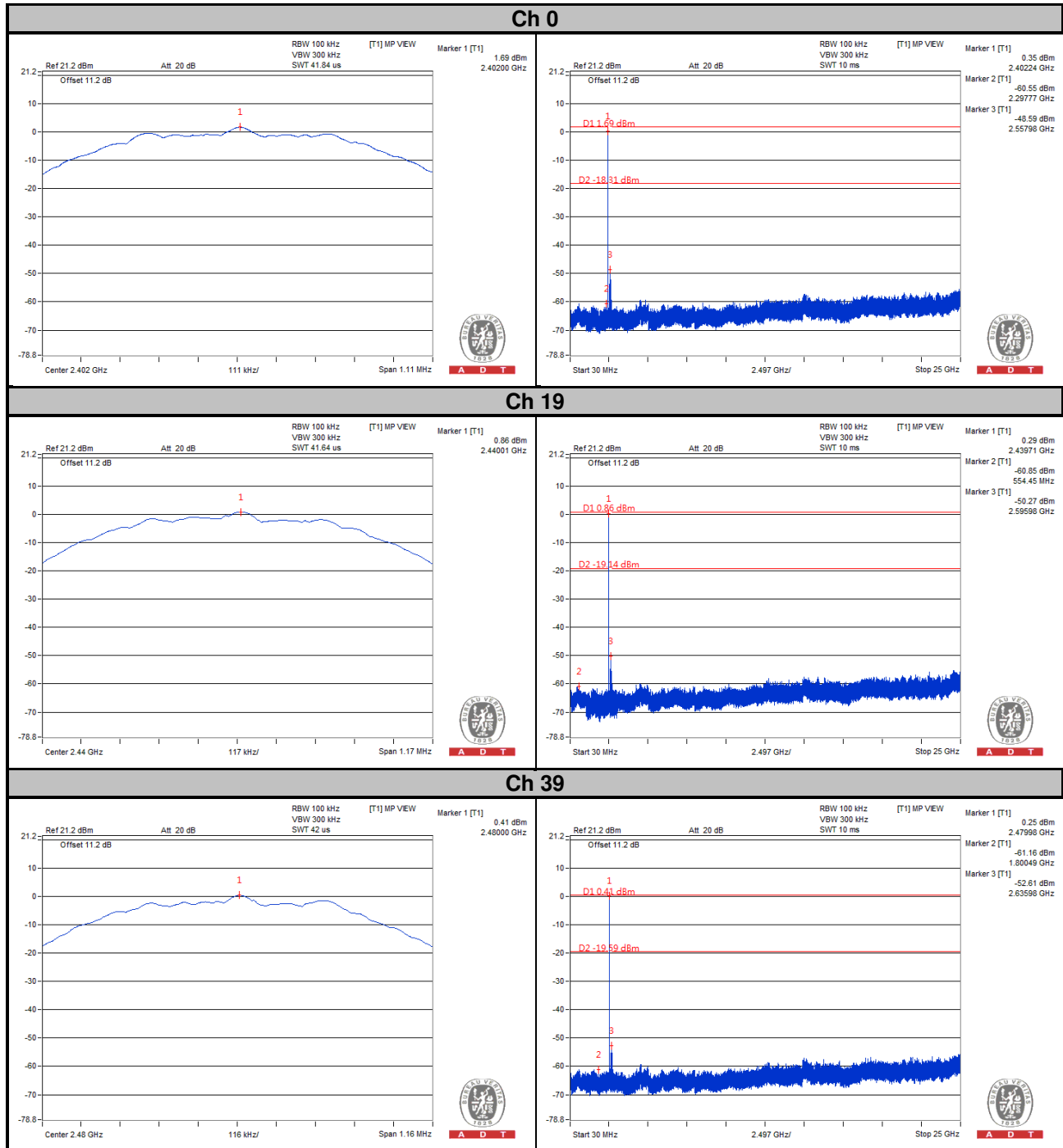
4.5.5 Deviation from Test Standard

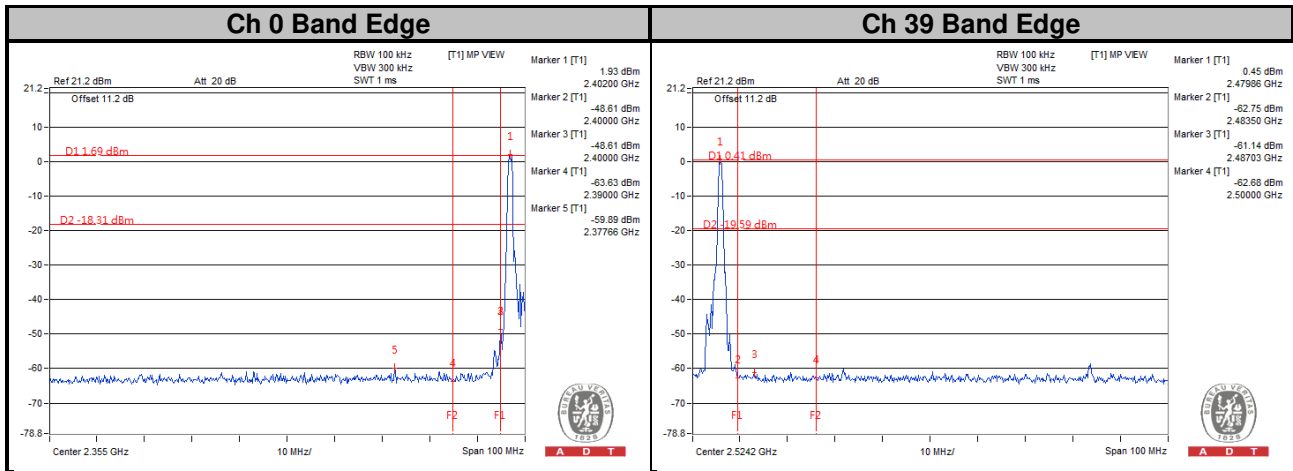
No deviation.

4.5.6 EUT Operating Condition

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

4.5.7 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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