	B U R E A U
	FCC Test Report
Report No.:	RF180802E10
FCC ID:	JNZCU0018
Test Model:	C-U0018
Received Date:	Aug. 02, 2018
Test Date:	Aug. 07 to 09, 2018
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Test Location:	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan R.O.C.
FCC Registration / Designation Number:	723255 / TW2022
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	Testing Laboratory
	2022
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	Release Control Record	
Issue No.	Description	Date Issued
RF180802E10	Original release.	Aug. 30, 2018



# 1 Certificate of Conformity

Product:	Wireless Transceiver
Brand:	Logitech
Test Model:	C-U0018
Sample Status:	ENGINEERING SAMPLE
Applicant:	LOGITECH FAR EAST LTD.
Test Date:	Aug. 07 to 09, 2018
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 :	Mary Ko Mary Ko / Specialist	_, Date:	Aug. 30, 2018
Approved by :	May Chen / Manager	_, Date:	Aug. 30, 2018



# 2 Summary of Test Results

	47 CFR FCC Part 15, Su	bpart C (Sec	ction 15.247)
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -9.96dB at 0.20469MHz
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -5.5dB at 2483.50MHz.
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	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	1.84 dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	5.33 dB
	1GHz ~ 6GHz	5.10 dB
Radiated Emissions above 1 GHz	6GHz ~ 18GHz	4.85 dB
	18GHz ~ 40GHz	5.24 dB

# 2.2 Modification Record

There were no modifications required for compliance.



# 3 General Information

## 3.1 General Description of EUT

Product	Wireless Transceiver
Brand	Logitech
Test Model	C-U0018
Status of EUT	ENGINEERING SAMPLE
Power Supply Rating	DC 5V from host equipment
Modulation Type	GFSK
Transfer Rate	2Mbps
Operating Frequency	2402MHz ~ 2481MHz
Number of Channel	80
Output Power	2.466mW
Antenna Type	Refer to Note
Antenna Connector	NA
Accessory Device	USB stand x 1
Data Cable Supplied	USB to Micro USB cable x 1 (shielded, 1.8m with one core)

Note:

1. The EUT may have a lot of colors for marketing requirement.

2. The antenna provided to the EUT, please refer to the following table:

Antenna Gain (dBi)	Frequency range (GHz)	Antenna Type	Connector Type
7.07	2.4~2.4835	Printed	None

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

Channel	Freq. (MHz)						
0	2402	20	2422	40	2442	60	2462
1	2403	21	2423	41	2443	61	2463
2	2404	22	2424	42	2444	62	2464
3	2405	23	2425	43	2445	63	2465
4	2406	24	2426	44	2446	64	2466
5	2407	25	2427	45	2447	65	2467
6	2408	26	2428	46	2448	66	2468
7	2409	27	2429	47	2449	67	2469
8	2410	28	2430	48	2450	68	2470
9	2411	29	2431	49	2451	69	2471
10	2412	30	2432	50	2452	70	2472
11	2413	31	2433	51	2453	71	2473
12	2414	32	2434	52	2454	72	2474
13	2415	33	2435	53	2455	73	2475
14	2416	34	2436	54	2456	74	2476
15	2417	35	2437	55	2457	75	2477
16	2418	36	2438	56	2458	76	2478
17	2419	37	2439	57	2459	77	2479
18	2420	38	2440	58	2460	78	2480
19	2421	39	2441	59	2461	79	2481

# 80 channels are provided to this EUT:



# 3.2.1 Test Mode Applicability and Tested Channel Detail

EUT ONFIGURE		APP	LICABLE TO		DECOD	
MODE	RE≥1G	RE<1G	PLC	APCM	DESCRI	
-	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	-	
<b>`</b>	G: Radiated Em		e 1GHz & R	E<1G: Radiated	Emission below 1GHz	
	edge Measurem Power Line Cor		ssion 🛛	PCM: Antenna P	ort Conducted Measurement	ŀ
1GHz) & diated En Pre-Scar between architecto Following	z-plane (above nission Test n has been co available mo ure).	1GHz). (Above 1 onducted t dulations, was (were IEL	GHz): to determine th data rates and e) selected for t <u>TESTED C</u> 0, 40,	e worst-case d antenna port he final test a <b>HANNEL</b>	t case was found when positi mode from all possible is (if EUT with antenna s listed below. <u>MODULATION TYP</u> GFSK	combinati diversity
tiated En	nission Test	(Below 1	<u>GHZ).</u>			
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Pre-Scar between architecto Following	n has been co available mo ure). g channel(s) v	onducted t dulations, was (were	to determine th data rates and e) selected for t	d antenna port he final test a HANNEL	ts (if EUT with antenna s listed below.	diversity
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<ul> <li>Pre-Scar between architectul</li> <li>Following</li> <li>Avai</li> <li>Pre-Scar between architectul</li> <li>Following</li> <li>Avai</li> <li>Avai</li> <li>Pre-Scar between architectul</li> <li>This item mode.</li> <li>Pre-Scar between architectul</li> <li>Following</li> </ul>	a has been co available mo g channel(s) <u>LABLE CHANN</u> 0 to 79 <u>Conducted I</u> a has been co available mo ure). g channel(s) <u>LABLE CHANN</u> 0 to 79 <u>Dert Conducted</u> includes all a has been co available mo ure).	ed Measu test value onducted t dulations, mas (were test value onducted t dulations,	to determine the data rates and e) selected for t TESTED C 40 Test: to determine the data rates and e) selected for t TESTED C 40 rement: of each mode, to determine the data rates and	d antenna port he final test a HANNEL e worst-case d antenna port he final test a HANNEL but only inclu e worst-case d antenna port he final test a	Is (if EUT with antenna s listed below.	diversity

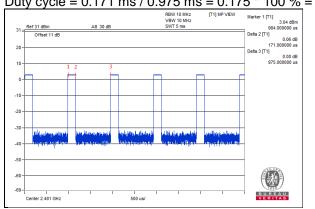


# Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER (system)	TESTED BY
RE≥1G	22deg. C, 64%RH	120Vac, 60Hz	Robert Cheng
RE<1G	21deg. C, 65%RH	120Vac, 60Hz	Frank Chuang
PLC	25deg. C, 75%RH	120Vac, 60Hz	Frank Chuang
APCM	25deg. C, 60%RH	120Vac, 60Hz	Jyunchun Lin



# 3.3 Duty Cycle of Test Signal



Duty cycle = 0.171 ms / 0.975 ms = 0.175 \* 100 % = 17.5 %



# 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.

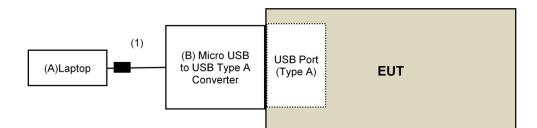
Micro USB to USB Logitech NA NA NA Supplied by clier								
Micro USB to USB Logitech NA NA NA Supplied by clier	ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks	
B Logitech NA NA Supplied by clier	A.	Laptop	DELL	E6420	B92T3R1	FCC DoC	Provided by Lab	
B. Type & Converter Logitech NA NA Supplied by clief	5	Micro USB to USB	Logitoph	NIA	NIA	NIA	Supplied by client	
Type A Conventer	В.	Type A Converter	Logitech	NA	INA	NA	Supplied by client	

Note:

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

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	USB Cable	1	1.8	Yes	1	Supplied by client

# 3.4.1 Configuration of System under Test





# 3.5 General Description of Applied Standards

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

FCC Part 15, Subpart C (15.247) KDB 558074 D01 DTS Meas Guidance v05 ANSI C63.10-2013

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



# 4 Test Types and Results

# 4.1 Radiated Emission and Bandedge Measurement

#### 4.1.1 Limits of Radiated Emission and Bandedge Measurement

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

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

## NOTE:

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



# 4.1.2 Test Instruments

<b>DESCRIPTION &amp;</b>	MODEL NO.	SERIAL NO.	CALIBRATED	CALIBRATED	
MANUFACTURER	JRER		DATE	UNTIL	
Test Receiver	N9038A	MY54450088	July 05, 2018	July 04, 2019	
Keysight	NOUSOA	1011 34430000	July 03, 2010	July 04, 2019	
Pre-Amplifier EMCI	EMC001340	980142	Feb. 09, 2018	Feb. 08, 2019	
Loop Antenna <sup>(*)</sup> Electro-Metrics	EM-6879	264	Dec. 16, 2016	Dec. 15, 2018	
RF Cable	NA	LOOPCAB-001	Jan. 15, 2018	Jan. 14, 2019	
RF Cable	NA	LOOPCAB-002	Jan. 15, 2018	Jan. 14, 2019	
Pre-Amplifier Mini-Circuits	ZFL-1000VH2B	AMP-ZFL-01	Nov. 09, 2017	Nov. 08, 2018	
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-406	Nov. 29, 2017	Nov. 28, 2018	
RF Cable	8D	966-4-1	Mar. 21, 2018	Mar. 20, 2019	
RF Cable	8D	966-4-2	Mar. 21, 2018	Mar. 20, 2019	
RF Cable	8D	966-4-3	Mar. 21, 2018	Mar. 20, 2019	
Fixed attenuator Mini-Circuits	attenuator		Oct. 03, 2017	Oct. 02, 2018	
Horn_Antenna SCHWARZBECK	BBHA 9120D	9120D-783	Dec. 12, 2017	Dec. 11, 2018	
Pre-Amplifier EMCI	EMC12630SE	980385 Jan. 29, 2018		Jan. 28, 2019	
RF Cable	EMC104-SM-SM-1200	160923	Jan. 29, 2018	Jan. 28, 2019	
RF Cable	EMC104-SM-SM-2000	150318	Jan. 29, 2018	Jan. 28, 2019	
RF Cable	EMC104-SM-SM-5000	150321	Jan. 29, 2018	Jan. 28, 2019	
Pre-Amplifier EMCI	EMC184045SE	980387	Jan. 29, 2018	Jan. 28, 2019	
Horn_Antenna SCHWARZBECK	BBHA 9170	BBHA9170608	Dec. 14, 2017	Dec. 13, 2018	
RF Cable	EMC102-KM-KM-1200	160925	Jan. 29, 2018	Jan. 28, 2019	
Software	ADT_Radiated_V8.7.08	NA	NA	NA	
Boresight Antenna Tower & Turn Table Max-Full	MF-7802BS	MF780208530	NA	NA	
Spectrum Analyzer R&S	FSv40	100964	June 20, 2018	June 19, 2019	
Power meter Anritsu	ML2495A	1014008	May 09, 2018	May 08, 2019	
Power sensor Anritsu	MA2411B	0917122	May 09, 2018	May 08, 2019	

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 calibration interval of the above test instruments is 24 months and the calibrations are traceable to NML/ROC and NIST/USA.

3. The test was performed in 966 Chamber No. 4.

- 4. The CANADA Site Registration No. is 20331-2
- 5. Loop antenna was used for all emissions below 30 MHz.
- 6. Tested Date: Aug. 07 to 09, 2018



# 4.1.3 Test Procedures

## For Radiated emission below 30MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. 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. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case 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.

#### NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

#### For Radiated emission above 30MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) 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 detects function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

#### Note:

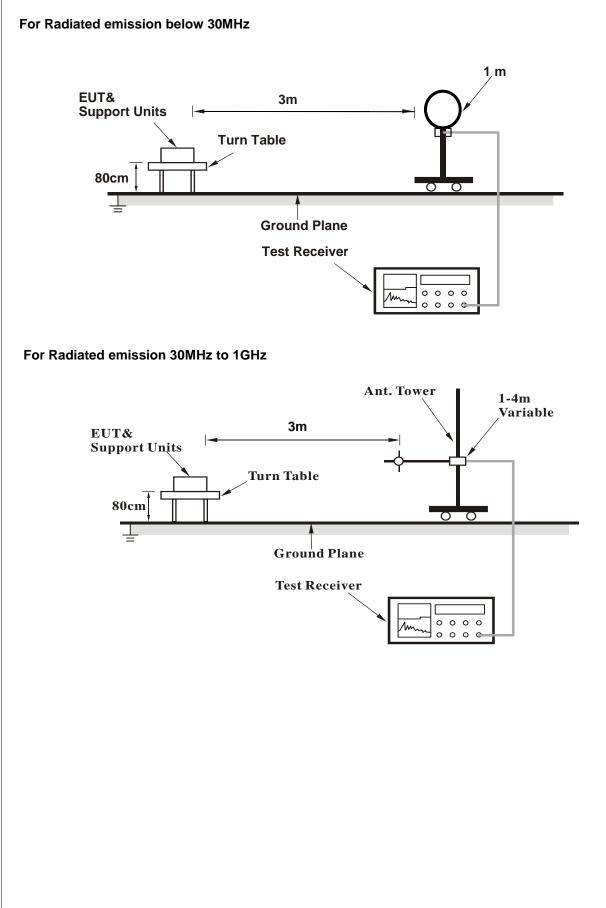
- 1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
- 2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.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

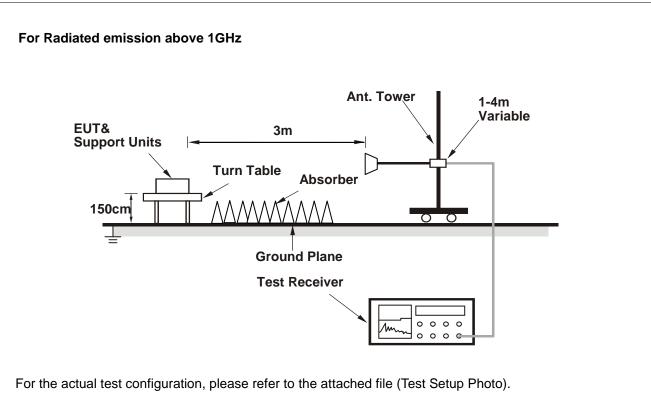
No deviation.



#### 4.1.5 Test Setup







- 4.1.6 EUT Operating Conditions
- a. Placed the EUT on the testing table.
- b. Controlling command (Press"Num\_Lock"key, then"Notepad") has been activated to set the EUT on specific status.



# 4.1.7 Test Results

## Above 1GHz Data:

CHANNEL	TX Channel 0	DETECTOR	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz	FUNCTION	Average (AV)

		ANTENNA	POLARITY	& TEST DIS	TANCE: HO	RIZONTAL	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	2338.00	59.2 PK	74.0	-14.8	1.46 H	98	61.1	-1.9
2	2338.00	40.7 AV	54.0	-13.3	1.46 H	98	42.6	-1.9
3	*2402.00	99.1 PK			1.46 H	98	101.4	-2.3
4	*2402.00	84.0 AV			1.46 H	98	86.3	-2.3
5	4804.00	42.3 PK	74.0	-31.7	1.69 H	100	40.5	1.8
6	4804.00	27.2 AV	54.0	-26.8	1.69 H	100	25.4	1.8
		ANTENNA	<b>POLARITY</b>	& TEST DI	STANCE: V	ERTICAL A	Т 3 М	
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	2338.00	58.1 PK	74.0	-15.9	2.46 V	57	60.0	-1.9
2	2338.00	39.2 AV	54.0	-14.8	2.46 V	57	41.1	-1.9
3	*2402.00	98.3 PK			2.46 V	57	100.6	-2.3
4	*2402.00	83.2 AV			2.46 V	57	85.5	-2.3
5	4804.00	43.8 PK	74.0	-30.2	2.00 V	100	42.0	1.8
6	4804.00	28.7 AV	54.0	-25.3	2.00 V	100	26.9	1.8

## **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 average value of fundamental and harmonic frequency is: Average = Peak value + 20 log(Duty cycle) Where the duty factor is calculated from following formula:
20 log(Duty cycle) = 20 log(0.171 ms / 0.975 ms) = -15.1 dB

Please see page 11 for plotted duty.

CHANNEL	TX Channel 40		
CHANNEL	TX Channel 40	DETECTOR	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz	FUNCTION	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	1 *2442.00 103.4 PK 1.55 H 98 106.0 -2.6									
2	2 *2442.00 88.3 AV 1.55 H 98 90.9 -2.6									
3	3 4884.00 42.9 PK 74.0 -31.1 1.67 H 115 40.9 2.0									
4	4 4884.00 27.8 AV 54.0 -26.2 1.67 H 115 25.8 2.0									
5 7326.00 51.8 PK 74.0 -22.2 2.42 H 160 43.3 8.5										
6	6 7326.00 36.7 AV 54.0 -17.3 2.42 H 160 28.2 8.5									
		ANTENNA	POLARITY	/ & TEST DI	STANCE: V	ERTICAL A	Т 3 М			

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	*2442.00	102.3 PK			2.48 V	61	104.9	-2.6
2	*2442.00	87.2 AV			2.48 V	61	89.8	-2.6
3	4884.00	44.0 PK	74.0	-30.0	2.00 V	100	42.0	2.0
4	4884.00	28.9 AV	54.0	-25.1	2.00 V	100	26.9	2.0
5	7326.00	55.6 PK	74.0	-18.4	1.22 V	108	47.1	8.5
6	7326.00	40.5 AV	54.0	-13.5	1.22 V	108	32.0	8.5

### **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 average value of fundamental and harmonic frequency is: Average = Peak value + 20 log(Duty cycle) Where the duty factor is calculated from following formula:

20 log(Duty cycle) = 20 log(0.171 ms / 0.975 ms) = -15.1 dB

Please see page 11 for plotted duty.

CHANNEL	TX Channel 79	DETECTOR	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz	FUNCTION	Average (AV)

		ANTENNA	POLARITY	& TEST DIS	TANCE: HO	RIZONTAL	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	*2481.00	103.6 PK			1.46 H	98	106.1	-2.5
2	*2481.00	88.5 AV			1.46 H	98	91.0	-2.5
3	2483.50	68.5 PK	74.0	-5.5	1.46 H	98	70.9	-2.4
4	2483.50	41.4 AV	54.0	-12.6	1.46 H	98	43.8	-2.4
5	4962.00	42.3 PK	74.0	-31.7	1.71 H	102	40.2	2.1
6	4962.00	27.2 AV	54.0	-26.8	1.71 H	102	25.1	2.1
7	7443.00	52.4 PK	74.0	-21.6	2.46 H	158	43.7	8.7
8	7443.00	37.3 AV	54.0	-16.7	2.46 H	158	28.6	8.7
		ANTENNA		/ & TEST DI	STANCE: V	ERTICAL A	Т 3 М	
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	*2481.00	102.9 PK			2.54 V	51	105.4	-2.5
2	*2481.00	87.8 AV			2.54 V	51	90.3	-2.5
3	2483.50	68.1 PK	74.0	-5.9	2.54 V	51	70.5	-2.4
4	2483.50	40.2 AV	54.0	-13.8	2.54 V	51	42.6	-2.4
5	4962.00	44.5 PK	74.0	-29.5	2.00 V	100	42.4	2.1
6	4962.00	29.4 AV	54.0	-24.6	2.00 V	100	27.3	2.1
7	7443.00	55.2 PK	74.0	-18.8	1.22 V	108	46.5	8.7
8	7443.00	40.1 AV	54.0	-13.9	1.22 V	108	31.4	8.7

## **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 average value of fundamental and harmonic frequency is: Average = Peak value + 20 log(Duty cycle) Where the duty factor is calculated from following formula:

20 log(Duty cycle) = 20 log(0.171 ms / 0.975 ms) = -15.1 dB

Please see page 11 for plotted duty.



#### Below 1GHz Data:

CHANNEL	TX Channel 40	DETECTOR	
FREQUENCY RANGE	9kHz ~ 1GHz	FUNCTION	Quasi-Peak (QP)

	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	39.99	34.1 QP	40.0	-5.9	1.50 H	258	42.3	-8.2
2	100.59	27.4 QP	43.5	-16.1	1.50 H	298	39.6	-12.2
3	166.58	31.7 QP	43.5	-11.8	1.50 H	298	39.7	-8.0
4	225.33	39.7 QP	46.0	-6.3	1.50 H	132	50.8	-11.1
5	273.98	31.3 QP	46.0	-14.7	1.00 H	276	39.1	-7.8
6	651.94	29.2 QP	46.0	-16.8	1.50 H	158	27.8	1.4
		ANTENNA	<b>POLARITY</b>	/ & TEST DI	STANCE: V	ERTICAL A	Т 3 М	
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	77.63	31.9 QP	40.0	-8.1	2.00 V	1	43.7	-11.8
2	166.58	33.7 QP	43.5	-9.8	1.00 V	270	41.7	-8.0
3	233.46	35.3 QP	46.0	-10.7	1.00 V	132	45.3	-10.0
4	258.12	34.2 QP	46.0	-11.8	1.00 V	186	42.8	-8.6
5	287.44	35.3 QP	46.0	-10.7	2.00 V	221	42.7	-7.4
6	380.95	25.7 QP	46.0	-20.3	1.00 V	110	30.3	-4.6
	VDK6							

## **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. Margin value = Emission Level – Limit value

4. The emission levels were very low against the limit of frequency range 9kHz ~ 30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.



# 4.2 Conducted Emission Measurement

## 4.2.1 Limits of Conducted Emission Measurement

	Conducted Limit (dBuV)			
Frequency (MHz)	Quasi-peak	Average		
0.15 - 0.5	66 - 56	56 - 46		
0.50 - 5.0	56	46		
5.0 - 30.0	60	50		

Note: 1. The lower limit shall apply at the transition frequencies.

2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

4.2.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver R&S	ESCS 30	847124/029	Nov. 01, 2017	Oct. 31, 2018
Line-Impedance Stabilization Network (for EUT) R&S	ESH3-Z5	848773/004	Nov. 15, 2017	Nov. 14, 2018
Line-Impedance Stabilization Network (for Peripheral) R&S	ENV216	100072	June 04, 2018	June 03, 2019
50 ohms Terminator	N/A	EMC-02	Sep. 22, 2017	Sep. 21, 2018
RF Cable	5D-FB	COCCAB-001	Sep. 29, 2017	Sep. 28, 2018
Fixed attenuator EMCI	STI02-2200-10	003	Mar. 16, 2018	Mar. 15, 2019
Software BVADT	BVADT_Cond_ V7.3.7.4	NA	NA	NA

### Note:

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

2. The test was performed in Conduction 1.

3. Tested Date: Aug. 09, 2018

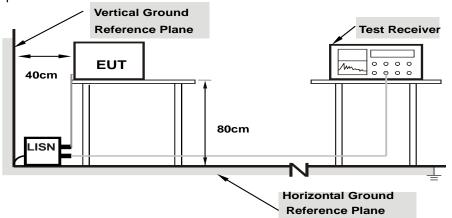


#### 4.2.3 Test Procedures

- 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:** The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.
- 4.2.4 Deviation from Test Standard

No deviation.

4.2.5 Test Setup



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

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

### 4.2.6 EUT Operating Conditions

Same as 4.1.6.

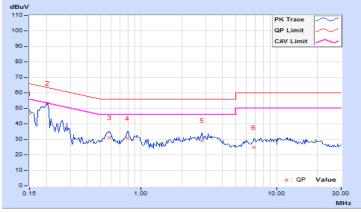


## 4.2.7 Test Results

Phase Line (L)			C	Detector Fu	nction	Quasi-l Averag	Peak (QP) e (AV)	/		
	_	Corr.	Reading Value Emission Level		Lir	nit	Mar	gin		
No	Freq.	Factor	[dB	(uV)]	[dE	8 (uV)]	[dB (	uV)]	(dl	3)
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	10.03	36.81	26.38	46.84	36.41	66.00	56.00	-19.16	-19.59
2	0.20469	10.06	43.40	18.97	53.46	29.03	63.42	53.42	-9.96	-24.39
3	0.58359	10.12	20.82	10.64	30.94	20.76	56.00	46.00	-25.06	-25.24
4	0.79453	10.14	20.72	8.87	30.86	19.01	56.00	46.00	-25.14	-26.99
5	2.82813	10.22	18.89	12.63	29.11	22.85	56.00	46.00	-26.89	-23.15
6	6.81250	10.40	14.53	9.33	24.93	19.73	60.00	50.00	-35.07	-30.27

#### **REMARKS**:

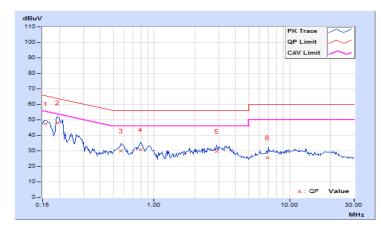
- 1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
- 2. The emission levels of other frequencies were very low against the limit.
- 3. Margin value = Emission level Limit value
- 4. Correction factor = Insertion loss + Cable loss
- 5. Emission Level = Correction Factor + Reading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



Phase Neutral (N)			[	Detector Fu	nction	Quasi- Averag	Peak (QP) e (AV)	/		
			Emiss	ion Level	Lir	nit	Mar	gin		
No	Freq.	Factor	[dB (	(uV)]	[dE	8 (uV)]	[dB (	(uV)]	(dl	B)
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15781	9.95	37.39	27.34	47.34	37.29	65.58	55.58	-18.24	-18.29
2	0.19297	9.96	38.11	24.62	48.07	34.58	63.91	53.91	-15.84	-19.33
3	0.56797	10.01	20.08	10.62	30.09	20.63	56.00	46.00	-25.91	-25.37
4	0.79063	10.02	20.68	10.29	30.70	20.31	56.00	46.00	-25.30	-25.69
5	2.88672	10.10	19.37	13.34	29.47	23.44	56.00	46.00	-26.53	-22.56
6	6.84766	10.26	15.45	10.34	25.71	20.60	60.00	50.00	-34.29	-29.40

### **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

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

#### 4.3.5 Deviation fromTest Standard

No deviation.

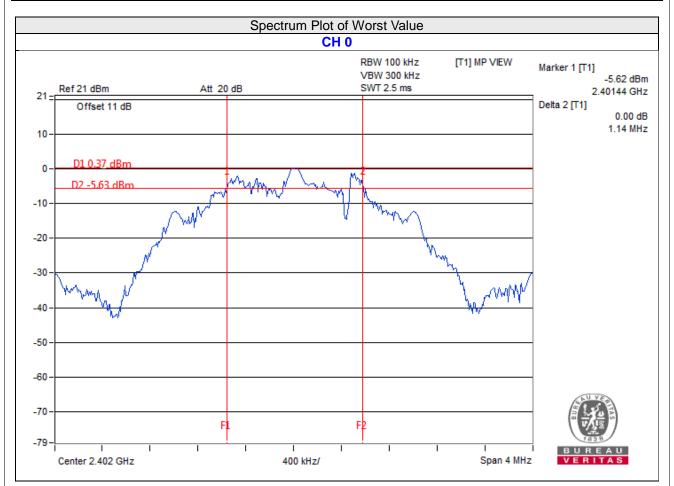
#### 4.3.6 EUT Operating Conditions

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	1.14	0.5	Pass
40	2442	1.14	0.5	Pass
79	2481	1.17	0.5	Pass



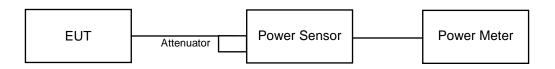


# 4.4 Conducted Output Power Measurement

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

Average power sensor was used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of TX on burst. Duty factor is not added to measured value.

# 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	1.236	0.92	28.93	Pass
40	2442	2.466	3.92	28.93	Pass
79	2481	2.328	3.67	28.93	Pass

**Note:** 1. Max. gain = 7.07dBi > 6dBi, so the power limit shall be reduced to 30-(7.07-6) = 28.93dBm.

# FOR AVERAGE POWER

Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)
0	2402	1.169	0.68
40	2442	2.393	3.79
79	2481	2.249	3.52



# 4.5 **Power Spectral Density Measurement**

4.5.1 Limits of Power Spectral Density Measurement

The Maximum of Power Spectral Density Measurement is 8dBm in any 3 kHz.

## 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

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

i. Use the peak marker function to determine the maximum amplitude level within the RBW.

4.5.5 Deviation from Test Standard

No deviation.

4.5.6 EUT Operating Condition

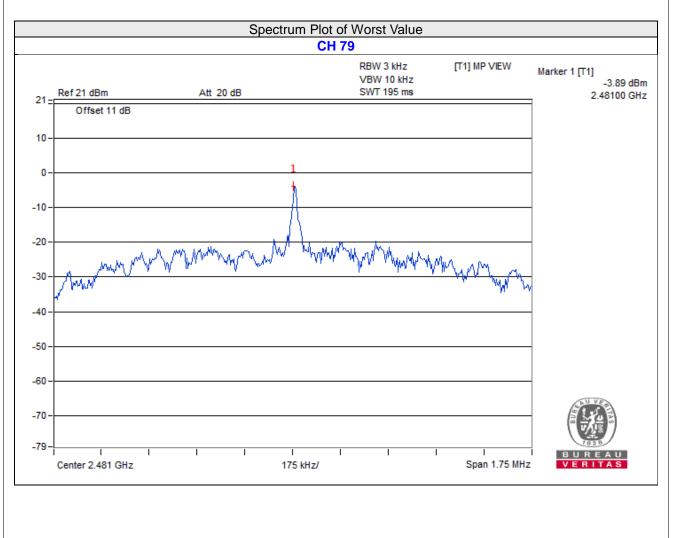
Same as Item 4.3.6



# 4.5.7 Test Results

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Pass /Fail
0	2402	-6.16	6.93	Pass
40	2442	-3.98	6.93	Pass
79	2481	-3.89	6.93	Pass

**Note:** 1. Max. gain = 7.07dBi > 6dBi, so the power density limit shall be reduced to 8-(7.07-6) = 6.93dBm.



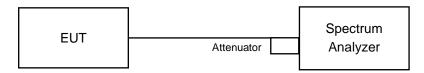


# 4.6 Conducted Out of Band Emission Measurement

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 kHz.
- 3. Detector = peak.
- 4. Sweep time = auto couple.
- 5. Trace mode = max hold.
- 6. Allow trace to fully stabilize.
- 7. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

### MEASUREMENT PROCEDURE OOBE

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

### 4.6.5 Deviation from Test Standard

No deviation.

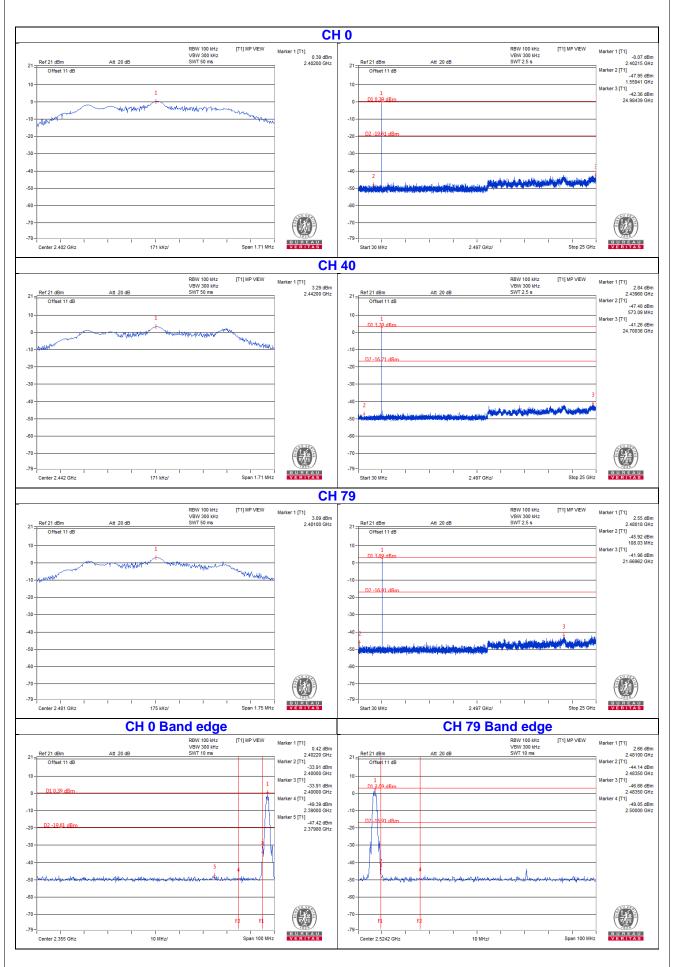
4.6.6 EUT Operating Condition

Same as Item 4.3.6

# 4.6.7 Test Results

The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 20dB offset below D1. It shows compliance with the requirement.







# 5 Pictures of Test Arrangements

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



## Appendix – Information on the Testing Laboratories

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

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

Linkou EMC/RF Lab Tel: 886-2-26052180 Fax: 886-2-26051924 Hsin Chu EMC/RF/Telecom Lab Tel: 886-3-6668565 Fax: 886-3-6668323

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Email: <u>service.adt@tw.bureauveritas.com</u> Web Site: <u>www.bureauveritas-adt.com</u>

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

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