

FCC Test Report (Part 96)

Report No.: RF160920E06A

FCC ID: 2AD8UFW2QADPM01

Test Model: FW2QADPM01

Received Date: Nov. 26, 2019

Test Date: Dec. 14 ~ Dec. 16, 2019

Issued Date: Dec. 16, 2019

Applicant: Nokia Solutions and Networks OY

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**FCC Registration/
Designation Number:** 788550 / TW0003



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Release Control Record

Issue No.	Description	Date Issued
RF160920E06A	Original release.	Dec. 16, 2019

1 Certificate of Conformity

Product: Flexi Zone Multiband Indoor Pico BTS

Brand: Nokia

Test Model: FW2QADPM01

Sample Status: Mass product

Applicant: Nokia Solutions and Networks OY

Test Date: Dec. 14 ~ Dec. 16, 2019

Standards: 47 CFR FCC Part 96

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 RF characteristics under the conditions specified in this report.

Prepared by :

Pettie Chen

, Date:

Dec. 16, 2019

Pettie Chen / Senior Specialist

Approved by :

Bruce Chen

, Date:

Dec. 16, 2019

Bruce Chen / Senior Project Engineer

2 Summary of Test Results

47 CFR FCC Part 96			
FCC Clause	Test Item	Result	Remarks
2.1046 96.41(b)	Maximum Peak Output Power	Pass	Meet the requirement of limit.
2.1046 96.41(b)	Maximum Power Spectral Density	Pass	Meet the requirement of limit.

Note: Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2.1 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Flexi Zone Multiband Indoor Pico BTS		
Brand	Nokia		
Test Model	FW2QADPM01		
Hardware Version	A101		
Status of EUT	Mass product		
Modulation Type	QPSK, 16QAM, 64QAM, 256QAM		
Power Supply Rating	DC 12V from adapter		
Operating Frequency	LTE Band 48	Channel Bandwidth 10MHz	TX: 3555 ~ 3695 MHz RX: 3555 ~ 3695 MHz
		Channel Bandwidth 15MHz	TX: 3557.5 ~ 3692.5 MHz RX: 3557.5 ~ 3692.5 MHz
		Channel Bandwidth 20MHz	TX: 3560 ~ 3690 MHz RX: 3560 ~ 3690 MHz
		2-Carriers (20MHz+20MHz)	TX: 3560 ~ 3690 MHz RX: 3560 ~ 3690 MHz
Channel Bandwidth	LTE Band 48	10MHz, 15MHz, 20MHz & 2-Carriers (20MHz+20MHz) in intra band contiguous spectrum operation	
Max. EIRP Power	LTE Band 48	Gain: 4dBi	
		Channel Bandwidth 10MHz	409.261mW(26.12dBm)
		Channel Bandwidth 15MHz	608.135mW(27.84dBm)
		Channel Bandwidth 20MHz	671.429mW(28.27dBm)
		2-Carriers (20MHz+20MHz)	450.817mW(26.54dBm)
		Gain: 12.5dBi	
		Channel Bandwidth 10MHz	679.204mW(28.32dBm)
		Channel Bandwidth 15MHz	751.623mW(28.76dBm)
		Channel Bandwidth 20MHz	716.143mW(28.55dBm)
		2-Carriers (20MHz+20MHz)	727.780mW(28.62dBm)
Antenna Type	Refer to note as below		
Antenna Connector	Refer to note as below		
Accessory Device	Adapter x 1		
Data Cable Supplied	NA		

Note:

1. This report is prepared for FCC class II permissive change. This report is issued as a supplementary report of BV CPS report no.: RF160920E06A R4. Difference compared with the original report is changing antenna from internal antenna to external antenna. Therefore, the EUT was re-tested Output Power Measurement, Power Spectral Density and presented in the test report.
2. The EUT uses following adapter.

Brand	DVE
Model	DSA-60PFB-12 1 120500
Input Power	100-240Vac, 2.0A, 50/60Hz
Output Power	12Vdc, 5A
Power Line	AC cable 1.8m, Unshielded DC cable 1.1m, Unshielded with one core

3. Representative omni antenna and directional antenna are listed below.

Antenna Spec.

Brand	Model	Antenna Type	Antenna Net Gain(dBi)
CommScope	CMAX-OMF3-UW53	Omni Antenna	4
Alpha Wireless	AW3372-T0-N	Directional Antenna	12.5

4. The EUT support single carrier and two carriers in intra-band contiguous spectrum operation, the two carrier mode is operation in 20MHz channel bandwidth and MIMO technology.
5. 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 Bandwidth (MHz)	Channel
10	Low
	Middle
	High
15	Low
	Middle
	High
20	Low
	Middle
	High
2-Carriers (20MHz+20MHz)	Low
	Middle
	High

3.2.1 Test Mode Applicability and Tested Channel Detail

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis and antenna ports

The worst case was found when positioned on Z-plane. Following channel(s) was (were) selected for the final test as listed below:

LTE SC MODE

Test Item	Available Channel	Tested Channel	Channel Bandwidth	Modulation
EIRP	55290 to 56690	55290 (3555.0MHz), 55990 (3625.0MHz), 56690 (3695.0MHz)	10MHz	QPSK
	55315 to 56665	55315 (3557.5MHz), 55990 (3625.0MHz), 56665 (3692.5MHz)	15MHz	QPSK
	55340 to 56640	55340 (3560.0MHz), 55990 (3625.0MHz), 56640 (3690.0MHz)	20MHz	QPSK
PSD	55290 to 56690	55290 (3555.0MHz), 55990 (3625.0MHz), 56690 (3695.0MHz)	10MHz	QPSK
	55315 to 56665	55315 (3557.5MHz), 55990 (3625.0MHz), 56665 (3692.5MHz)	15MHz	QPSK
	55340 to 56640	55340 (3560.0MHz), 55990 (3625.0MHz), 56640 (3690.0MHz)	20MHz	QPSK

LTE MC MODE

Test Item	Available Channel	Test Frequency	Carrier Conf. Description	Ch. BW (MHz)	Modulation	Test Configuration
EIRP	55340 to 56640	3560 MHz + 3580 MHz, 3615 MHz + 3635 MHz, 3670 MHz + 3690 MHz	2	20+20	QPSK	UTC1
PSD	55340 to 56640	3560 MHz + 3580 MHz, 3615 MHz + 3635 MHz, 3670 MHz + 3690 MHz	2	20+20	QPSK	UTC1

Test Condition:

Test Item	Environmental Conditions	Input Power	Tested By
Maximum Output Power	25deg. C, 63%RH	120Vac, 60Hz	James Yang
Power Spectral Density	25deg. C, 63%RH	120Vac, 60Hz	James Yang

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.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Test Tool	Foxconn	NA	NA	NA	Supplied by client

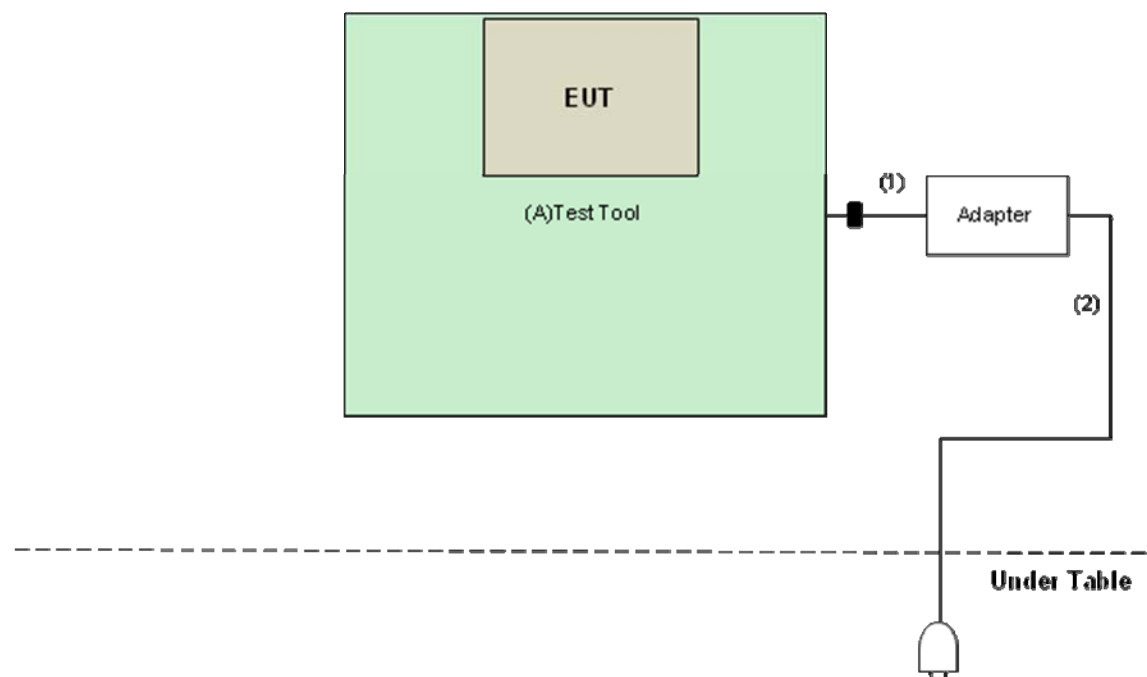
Note:

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.	DC Cable	1	1.1	No	1	Supplied by client
2.	AC Cable	1	1.8	No	0	Supplied by client

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

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 47 CFR Part 2

FCC 47 CFR Part 96

KDB 971168 D01 Power Meas License Digital Systems v03r01

KDB 662911 D01 Multiple Transmitter Output v02r01

KDB 940660 D01 Part 96 CBRS v02

KDB 552295 D01 CBP Guidance for 3650 3700 Band v03

ANSI/TIA/EIA-603-D-2010

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

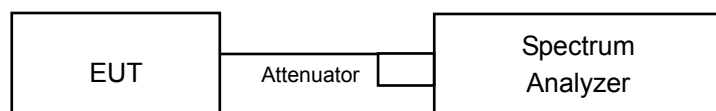
4 Test Types and Results

4.1 Maximum Output Power Measurement

4.1.1 Limits of Maximum Output Power Measurement

Device		Maximum Output Power (dBm/10 MHz)
☐	End User Device	23
☒	Category A CBSD	30
☐	Category B CBSD	47

4.1.2 Test Setup



4.1.3 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date of Calibration
Spectrum Analyzer KEYSIGHT	N9030B	MY57140953	Jun. 28, 2019	Jun. 27, 2020

- Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 2. The test was performed in HwaYa Chamber 9.

4.1.4 Test Procedures

Conducted Measurement Method

1. Connect the DUT transmitter output to the spectrum analyzer via coaxial cable while ensuring proper impedance matching.
2. Set span to at least 1.5 times the OBW.
3. Set RBW = 1-5% of the OBW, not to exceed 1 MHz.
4. Set VBW $\geq 3 \times$ RBW.
5. Set number of points in sweep $\geq 2 \times$ span / RBW.
6. Sweep time = auto-couple.
7. Detector = RMS (power averaging).
8. If the EUT can be configured to transmit continuously (i.e., burst duty cycle $\geq 98\%$), then set the trigger to free run.
9. If the EUT cannot be configured to transmit continuously (i.e., burst duty cycle $< 98\%$), then use a sweep trigger with the level set to enable triggering only on full power bursts and configure the EUT to transmit at full power for the entire duration of each sweep. Ensure that the sweep time is less than or equal to the transmission burst duration.
10. Trace average at least 100 traces in power averaging (i.e., RMS) mode.
11. Compute the power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function, with the band limits set equal to the OBW band edges. If the instrument does not have a band power function, then sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.

4.1.5 Deviation from Test Standard

No deviation.

4.1.6 EUT Operating Conditions

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

4.1.7 Test Results

For Antenna Gain: 4dBi

For Maximum EIRP (dBm/10MHz) Measurement @ FCC Part 96

LTE SC MODE

Channel	Freq. (MHz)	10MHz				Limit (dBm/10MHz)	Pass /Fail
		QPSK					
		Conducted Average Power (dBm/10MHz)			Gain(dBi)	4	
		Chain 0	Chain 1	Total	EIRP (dBm/10MHz)	Maximum	
Low	3555	19.08	19.13	22.12	26.12	30.0	Pass
Middle	3625	19.14	19.22	22.19	26.19	30.0	Pass
High	3695	19.02	18.89	21.97	25.97	30.0	Pass

Channel	Freq. (MHz)	15MHz				Limit (dBm/10MHz)	Pass /Fail	
		QPSK						
		Conducted Average Power (dBm/10MHz)			Gain(dBi)			4
		Chain 0	Chain 1	Total	EIRP (dBm/10MHz)			Maximum
Low	3557.5	19.75	19.84	22.81	26.81		30.0	Pass
Middle	3625	19.62	19.59	22.62	26.62		30.0	Pass
High	3692.5	19.81	19.89	22.86	26.86		30.0	Pass

Channel	Freq. (MHz)	20MHz				Limit (dBm/10MHz)	Pass /Fail	
		QPSK						
		Conducted Average Power (dBm/10MHz)			Gain(dBi)			4
		Chain 0	Chain 1	Total	EIRP (dBm/10MHz)			Maximum
Low	3560	19.35	19.48	22.43	26.43		30.0	Pass
Middle	3625	19.18	19.26	22.23	26.23		30.0	Pass
High	3690	18.99	19.05	22.03	26.03		30.0	Pass

LTE MC MODE

Channel	Freq. (MHz)	2-Carriers (20MHz+20MHz)									Pass /Fail
		QPSK									
		Conducted Average Power (dBm/10MHz)						Gain (dBi)	4	Limit (dBm/10MHz)	
		Chain 0		Chain 1		Chain0	Chain1	Total	EIRP (dBm/10MHz)	Maximum	
		Low	High	Low	High						
Low	3560+3580	15.06	15.16	15.18	15.27	18.12	18.24	21.19	25.19	30.0	Pass
Middle	3615+3635	14.24	14.19	14.2	14.13	17.23	17.18	20.21	24.21	30.0	Pass
High	3670+3690	14.83	14.78	15.1	15.03	17.82	18.08	20.96	24.96	30.0	Pass

For Maximum EIRP Measurement @ Total EIRP for Each Bandwidth LTE SC MODE

Channel	Freq. (MHz)	10MHz			
		QPSK			
		Conducted Average Power (dBm)			Gain(dBi) 4
		Chain 0	Chain 1	Total	EIRP (dBm)
Low	3555	19.08	19.13	22.12	26.12
Middle	3625	19.14	19.22	22.19	26.19
High	3695	19.02	18.89	21.97	25.97

Channel	Freq. (MHz)	15MHz			
		QPSK			
		Conducted Average Power (dBm)			Gain(dBi) 4
		Chain 0	Chain 1	Total	EIRP (dBm)
Low	3557.5	20.64	20.68	23.67	27.67
Middle	3625	20.72	20.63	23.69	27.69
High	3692.5	20.91	20.75	23.84	27.84

Channel	Freq. (MHz)	20MHz			
		QPSK			
		Conducted Average Power (dBm)			Gain(dBi) 4
		Chain 0	Chain 1	Total	EIRP (dBm)
Low	3560	21.22	21.16	24.20	28.20
Middle	3625	21.43	21.08	24.27	28.27
High	3690	20.78	21.11	23.96	27.96

LTE MC MODE

Channel	Freq. (MHz)	2-Carriers (20MHz+20MHz)			
		QPSK			
		Conducted Average Power (dBm)			Gain(dBi) 4
		Chain 0	Chain 1	Total	EIRP (dBm)
Low	3560+3580	19.51	19.53	22.53	26.53
Middle	3615+3635	19.14	19.32	22.24	26.24
High	3670+3690	19.62	19.43	22.54	26.54

For Antenna Gain: 12.5dBi

For Maximum EIRP (dBm/10MHz) Measurement @ FCC Part 96

LTE SC MODE

Channel	Freq. (MHz)	10MHz				Limit (dBm/10MHz)	Pass /Fail
		QPSK					
		Conducted Average Power (dBm/10MHz)			Gain(dBi)	12.5	
		Chain 0	Chain 1	Total	EIRP (dBm/10MHz)	Maximum	
Low	3555	12.80	12.71	15.77	28.27	30.0	Pass
Middle	3625	13.02	12.59	15.82	28.32	30.0	Pass
High	3695	12.03	12.76	15.42	27.92	30.0	Pass

Channel	Freq. (MHz)	15MHz				Limit (dBm/10MHz)	Pass /Fail	
		QPSK						
		Conducted Average Power (dBm/10MHz)			Gain(dBi)			12.5
		Chain 0	Chain 1	Total	EIRP (dBm/10MHz)			Maximum
Low	3557.5	12.06	12.08	15.08	27.58		30.0	Pass
Middle	3625	11.63	11.81	14.73	27.23		30.0	Pass
High	3692.5	12.82	12.91	15.88	28.38		30.0	Pass

Channel	Freq. (MHz)	20MHz				Limit (dBm/10MHz)	Pass /Fail	
		QPSK						
		Conducted Average Power (dBm/10MHz)			Gain(dBi)	12.5		
		Chain 0	Chain 1	Total	EIRP (dBm/10MHz)			Maximum
Low	3560	10.90	11.07	14.00	26.50		30.0	Pass
Middle	3625	10.57	10.64	13.62	26.12		30.0	Pass
High	3690	10.71	10.92	13.83	26.33		30.0	Pass

LTE MC MODE

Channel	Freq. (MHz)	2-Carriers (20MHz+20MHz)									Pass /Fail	
		QPSK										
		Conducted Average Power (dBm/10MHz)							Gain (dBi)	12.5		Limit (dBm/10MHz)
		Chain 0		Chain 1		Chain0	Chain1	Total	EIRP (dBm/10MHz)	Maximum		
		Low	High	Low	High							
Low	3560+3580	8.21	8.30	8.34	8.32	11.27	11.34	14.31	26.81	30.0	Pass	
Middle	3615+3635	7.93	7.87	8.03	7.96	10.91	11.01	13.97	26.47	30.0	Pass	
High	3670+3690	8.06	8.04	8.14	8.06	11.06	11.11	14.10	26.60	30.0	Pass	

For Maximum EIRP Measurement @ Total EIRP for Each Bandwidth LTE SC MODE

Channel	Freq. (MHz)	10MHz			
		QPSK			
		Conducted Average Power (dBm)			Gain(dBi) 12.5
		Chain 0	Chain 1	Total	EIRP (dBm)
Low	3555	12.80	12.71	15.77	28.27
Middle	3625	13.02	12.59	15.82	28.32
High	3695	12.03	12.76	15.42	27.92

Channel	Freq. (MHz)	15MHz			
		QPSK			
		Conducted Average Power (dBm)			Gain(dBi) 12.5
		Chain 0	Chain 1	Total	EIRP (dBm)
Low	3557.5	12.92	12.72	15.83	28.33
Middle	3625	13.06	12.66	15.87	28.37
High	3692.5	13.02	13.47	16.26	28.76

Channel	Freq. (MHz)	20MHz			
		QPSK			
		Conducted Average Power (dBm)			Gain(dBi) 12.5
		Chain 0	Chain 1	Total	EIRP (dBm)
Low	3560	13.05	13.03	16.05	28.55
Middle	3625	13.18	12.57	15.90	28.40
High	3690	12.49	12.90	15.71	28.21

LTE MC MODE

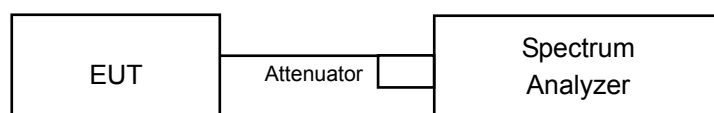
Channel	Freq. (MHz)	2-Carriers (20MHz+20MHz)			
		QPSK			
		Conducted Average Power (dBm)			Gain(dBi) 12.5
		Chain 0	Chain 1	Total	EIRP (dBm)
Low	3560+3580	13.09	13.13	16.12	28.62
Middle	3615+3635	13.17	12.41	15.82	28.32
High	3670+3690	12.81	13.02	15.93	28.43

4.2 Maximum Power Spectral Density Measurement

4.2.1 Limits of Maximum Power Spectral Density Measurement

Device		Maximum PSD (dBm/MHz)
☐	End User Device	n/a
☒	Category A CBSD	20
☐	Category B CBSD	37

4.2.2 Test Setup



4.2.3 Test Instruments

Refer to section 4.1.3 to get information of above instrument.

4.2.4 Test Procedure

1. Connect the transmitter to the spectrum analyzer via coaxial cable while ensuring proper impedance matching.
2. Set instrument center frequency to OBW center frequency.
3. Set span to at least 1.5 times the OBW.
4. Set the RBW to the specified reference bandwidth (often 1 MHz).
5. Set VBW $\geq 3 \times$ RBW.
6. Detector = RMS (power averaging).
7. Ensure that the number of measurement points in the sweep $\geq 2 \times$ span/RBW.
8. Sweep time = auto couple.
9. Employ trace averaging (RMS) mode over a minimum of 100 traces.
10. Use the peak marker function to determine the maximum amplitude level within the reference bandwidth (PSD).

4.2.5 Deviation from Test Standard

No deviation.

4.2.6 EUT Operating Condition

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

4.2.7 Test Results

For Antenna Gain: 4dBi

LTE SC MODE

Channel Number	Freq. (MHz)	10MHz						PASS /FAIL
		QPSK						
		Conducted Power density (dBm/MHz)			Radiated Power density(dBm/MHz)			
		CHAIN0	CHAIN1	Total	Gain(dBi)	PSD	Limit	
Low	3555	9.20	10.22	12.75	4	16.75	20.0	PASS
Middle	3625	10.77	10.05	13.44	4	17.44	20.0	PASS
High	3695	10.50	11.14	13.84	4	17.84	20.0	PASS

Channel Number	Freq. (MHz)	15MHz						PASS /FAIL
		QPSK						
		Conducted Power density (dBm/MHz)			Radiated Power density(dBm/MHz)			
		CHAIN0	CHAIN1	Total	Gain(dBi)	PSD	Limit	
Low	3557.5	9.09	10.32	12.76	4	16.76	20.0	PASS
Middle	3625	9.90	10.02	12.97	4	16.97	20.0	PASS
High	3692.5	10.81	11.53	14.20	4	18.20	20.0	PASS

Channel Number	Freq. (MHz)	20MHz						PASS /FAIL
		QPSK						
		Conducted Power density (dBm/MHz)			Radiated Power density(dBm/MHz)			
		CHAIN0	CHAIN1	Total	Gain(dBi)	PSD	Limit	
Low	3560	8.21	8.35	11.29	4	15.29	20.0	PASS
Middle	3625	8.02	8.26	11.15	4	15.15	20.0	PASS
High	3690	7.09	7.28	10.20	4	14.20	20.0	PASS

LTE MC MODE

Channel Number	Freq. (MHz)	2-Carriers (20MHz+20MHz)						PASS /FAIL
		QPSK						
		Conducted Power density (dBm/MHz)			Radiated Power density(dBm/MHz)			
		CHAIN0	CHAIN1	Total	Gain(dBi)	PSD	Limit	
Low	3560+3580	5.43	5.48	8.47	4	12.47	20.0	PASS
Middle	3615+3635	5.25	4.36	7.84	4	11.84	20.0	PASS
High	3670+3690	5.49	4.68	8.11	4	12.11	20.0	PASS

For Antenna Gain: 12.5dBi
LTE SC MODE

Channel Number	Freq. (MHz)	10MHz						PASS /FAIL
		QPSK						
		Conducted Power density (dBm/MHz)			Radiated Power density(dBm/MHz)			
		CHAIN0	CHAIN1	Total	Gain(dBi)	PSD	Limit	
Low	3555	4.07	3.64	6.87	12.5	19.37	20.0	PASS
Middle	3625	3.12	3.73	6.45	12.5	18.95	20.0	PASS
High	3695	3.23	3.60	6.43	12.5	18.93	20.0	PASS

Channel Number	Freq. (MHz)	15MHz						PASS /FAIL
		QPSK						
		Conducted Power density (dBm/MHz)			Radiated Power density(dBm/MHz)			
		CHAIN0	CHAIN1	Total	Gain(dBi)	PSD	Limit	
Low	3557.5	2.45	2.7	5.59	12.5	18.09	20.0	PASS
Middle	3625	2.50	2.68	5.60	12.5	18.10	20.0	PASS
High	3692.5	2.97	3.84	6.44	12.5	18.94	20.0	PASS

Channel Number	Freq. (MHz)	20MHz						PASS /FAIL
		QPSK						
		Conducted Power density (dBm/MHz)			Radiated Power density(dBm/MHz)			
		CHAIN0	CHAIN1	Total	Gain(dBi)	PSD	Limit	
Low	3560	1.25	1.77	4.53	12.5	17.03	20.0	PASS
Middle	3625	2.21	-0.38	4.12	12.5	16.62	20.0	PASS
High	3690	0.86	1.41	4.15	12.5	16.65	20.0	PASS

LTE MC MODE

Channel Number	Freq. (MHz)	2-Carriers (20MHz+20MHz)						PASS /FAIL
		QPSK						
		Conducted Power density (dBm/MHz)			Radiated Power density(dBm/MHz)			
		CHAIN0	CHAIN1	Total	Gain(dBi)	PSD	Limit	
Low	3560+3580	-1.26	-0.92	1.92	12.5	14.42	20.0	PASS
Middle	3615+3635	-1.64	-1.80	1.29	12.5	13.79	20.0	PASS
High	3670+3690	-1.11	-1.71	1.61	12.5	14.11	20.0	PASS

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

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