TEST REPORT

FCC LTE B48 Test for WW23D
Class II Permissive Change

APPLICANT
Panasonic Corporation of North America

REPORT NO.
HCT-RF-2405-FC053

DATE OF ISSUE
July 23, 2024

Tested by
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Applicant	**Panasonic Corporation of North America** Two Riverfront Plaza, 9th Floor, Newark, NJ 07102-5490, USA
Product Name Model Name	Wirelss Module WW23D
Date of Test	May 02, 2024 ~ May 30, 2024
Location of Test	■ Permanent Testing Lab ☐ On Site Testing (Address: 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383 Republic of Korea)
FCC ID	ACJ9TGWW23D
FCC Classification	Citizens Band End User Devices (CBE)
Test Standard Used	FCC Rule Part(s) : § 96
Test Results	PASS

REVISION HISTORY

The revision history for this test report is shown in table.

Revision No.	Date of Issue	Description
0	July 23, 2024	Initial Release

Notice

Content
The measurements shown in this report were made in accordance with the procedures specified in CFR47 section § 2.947. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. HCT CO., LTD. Certifies that no party to this application has subject to a denial of Federal benefits that includes FCC benefits pursuant to section 5301 of the Anti-Drug Abuse Act of 1998,21 U.S. C.853(a)
The results shown in this test report only apply to the sample(s), as received, provided by the applicant, unless otherwise stated. The test results have only been applied with the test methods required by the standard(s).
The laboratory is not accredited for the test results marked *. Information provided by the applicant is marked **. Test results provided by external providers are marked ***.
When confirmation of authenticity of this test report is required, please contact www.hct.co.kr
The test results in this test report are not associated with the ((KS Q) ISO/IEC 17025) accreditation by KOLAS (Korea Laboratory Accreditation Scheme) / A2LA (American Association for Laboratory Accreditation) that are under the ILAC (International Laboratory Accreditation Cooperation) Mutual Recognition Agreement (MRA).

CONTENTS

MEASUREMENT REPORT

1. GENERAL INFORMATION

Applicant Name:	Panasonic Corporation of North America
Address:	Two Riverfront Plaza, 9th Floor, Newark, NJ 07102-5490, USA
FCC ID:	ACJ9TGWW23D
Application Type:	Class II Permissive Change
FCC Classification:	Citizens Band End User Devices (CBE)
FCC Rule Part(s):	§ 96
EUT Type:	Wirelss Module
Model(s):	WW23D
Additional Model(s)	-
Tx Frequency:	3552.5 – 3697.5 (LTE – Band48 (5 MHz)) 3555.0 – 3695.0 (LTE – Band48 (10 MHz)) 3557.5 – 3692.5 (LTE – Band48 (15 MHz)) 3560.0 – 3690.0 (LTE – Band48 (20 MHz))
Date(s) of Tests:	May 02, 2024 ~ July 19, 2024
Serial number:	S0P-23-01197

2. INTRODUCTION

2.1. DESCRIPTION OF EUT

The EUT was a Wirelss Module with LTE & NR.

2.2. MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

2.3. TEST FACILITY

The Fully-anechoic chamber and conducted measurement facility used to collect the radiated data are located at the **74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA.**

3. DESCRIPTION OF TESTS

3.1 TEST PROCEDURE

Test Description	Test Procedure Used
Conducted Output Power	- KDB 971168 D01 v03r01 - Section 5.2.4 - ANSI C63.26-2015 - Section 5.2.1 & 5.2.4.2
Radiated Spurious and Harmonic Emissions	- KDB 971168 D01 v03r01 – Section 6.2 - ANSI/TIA-603-E-2016 – Section 2.2.12

3.2 CONDUCTED OUTPUT POWER

Test Overview

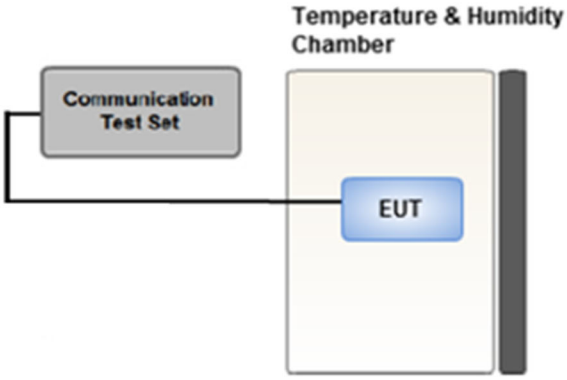
According to ANSI C63.26-2015 Section 5.2.1 when measuring the maximum RF output power from such devices, control over the EUT must be provided either through special test software (provided by manufacturer specifically for compliance testing, but not accessible by an end user) or through use of a base station emulator, communications test set, call box, or similar instrumentation that is capable of establishing a communications link with the EUT to enable control over variable parameters (e.g., output power, OBW, etc.).

In some cases, these instruments also include basic digital spectrum analyzer and/or power meter capabilities that can be utilized to measure the RF output power if the specified detectors and requirements can be realized and the measurement functions have been calibrated.

Test Procedure

1. The RF port of the EUT was connected to the Communication Tester via an RF cable.
2. Conducted average power was measured using a calibrated Radio Communication Tester.

Test setup



3.3 RADIATED SPURIOUS EMISSIONS

Test Overview

Radiated tests are performed in the Fully-anechoic chamber.

Radiated Spurious Emission Measurements at 3 meters by Substitution Method according to ANSI/TIA-603-E-2016.

Test Settings

1. RBW = 100 kHz for emissions below 1 GHz and 1 MHz for emissions above 1 GHz
2. VBW ≥ 3 x RBW
3. Span = 1.5 times the OBW
4. No. of sweep points > 2 x span / RBW
5. Detector = Peak
6. Trace mode = Max Hold
7. The trace was allowed to stabilize
8. Test channel : Low/ Middle/ High
9. Frequency range : We are performed all frequency to 10^{th} harmonics from 9 kHz.

Test Note

1. Measurements value show only up to 3 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
2. The EUT was tested in three orthogonal planes(X, Y, Z) and in all possible test configurations and positioning.
   The worst case emissions are reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations shown in the test data
3. For spurious emissions above 1 GHz, a horn antenna is substituted in place of the EUT. The substitute antenna is driven by a signal generator and the previously recorded signal was duplicated.
   The spurious emissions is calculated by the following formula;

$$\text{Result}_{(dBm)} = Pg_{(dBm)} - \text{cable loss}_{(dB)} + \text{antenna gain}_{(dBi)}$$

   Where: P_g is the generator output power into the substitution antenna.

   If the fundamental frequency is below 1 GHz, RF output power has been converted to EIRP.

$$EIRP_{(dBm)} = ERP_{(dBm)} + 2.15$$

4. LIST OF TEST EQUIPMENT

Equipment	Model	Manufacture	Serial No.	Due to Calibration	Calibration Interval
Precision Dipole Antenna	UHAP	Schwarzbeck	01273	03/10/2026	Biennial
Precision Dipole Antenna	UHAP	Schwarzbeck	01274	03/10/2026	Biennial
Horn Antenna(1~18 GHz)	BBHA 9120D	Schwarzbeck	02289	02/14/2026	Biennial
Horn Antenna(1~18 GHz)	BBHA 9120D	Schwarzbeck	9120D-1299	04/27/2025	Biennial
Horn Antenna(15~40 GHz)	BBHA 9170	Schwarzbeck	BBHA9170342	09/29/2024	Biennial
Horn Antenna(15~40 GHz)	BBHA 9170	Schwarzbeck	BBHA9170124	03/28/2025	Biennial
Loop Antenna(9 kHz~30 MHz)	FMZB1513	Rohde & Schwarz	1513-175	01/16/2025	Biennial
Bilog Antenna	VULB9160	Schwarzbeck	3150	03/09/2025	Biennial
Hybrid Antenna	VULB9160	Schwarzbeck	760	02/24/2025	Biennial
RF Switching System	FBSR-06B (1G HPF + LNA)	T&M SYSTEM	F3L1	05/14/2025	Annual
RF Switching System	FBSR-06B (3G HPF + LNA)	T&M SYSTEM	F3L2	05/14/2025	Annual
RF Switching System	FBSR-06B (6G HPF + LNA)	T&M SYSTEM	F3L3	05/14/2025	Annual
RF Switching System	FBSR-06B (LNA)	T&M SYSTEM	F3L4	05/14/2025	Annual
Power Amplifier	CBL18265035	CERNEX	22966	11/17/2024	Annual
Power Amplifier	CBL26405040	CERNEX	25956	02/26/2025	Annual
DC Power Supply	E3632A	Hewlett Packard	MY40004427	08/25/2024	Annual
Power Splitter(DC~26.5 GHz)	11667B	Hewlett Packard	11275	02/29/2025	Annual
Chamber	SU-642	ESPEC	93008124	02/19/2025	Annual
Signal Analyzer(10 Hz~26.5 GHz)	N9020A	Agilent	MY51110063	04/04/2025	Annual
ATTENUATOR(20 dB)	8493C	Hewlett Packard	17280	04/17/2025	Annual
Spectrum Analyzer(10 Hz~40 GHz)	FSV40	REOHDE & SCHWARZ	101436	02/13/2025	Annual
Base Station	8960 (E5515C)	Agilent	MY48360800	08/10/2024	Annual
Wideband Radio Communication Tester	MT8821C	Anritsu Corp.	6262287701	05/16/2025	Annual
Wideband Radio Communication Tester	MT8000A	Anritsu Corp.	6262302511	05/14/2025	Annual
Signal Analyzer(5 Hz~40.0 GHz)	N9030B	KEYSIGHT	MY55480167	05/17/2025	Annual
4-Way Divider	ZC4PD-K1844+	Mini-Circuits	942907	09/19/2024	Annual
FCC LTE Mobile Conducted RF Automation Test Software	-	HCT CO., LTD.,	-	-	-

Note:

1. Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.
2. Especially, all antenna for measurement is calibrated in accordance with the requirements of C63.5 (Version : 2017).

5. MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4:2014.

All measurement uncertainty values are shown with a coverage factor of $k = 2$ to indicate a 95 % level of confidence. The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded Uncertainty (±dB)
Conducted Disturbance (150 kHz ~ 30 MHz)	1.98 (Confidence level about 95 %, k=2)
Radiated Disturbance (9 kHz ~ 30 MHz)	4.36 (Confidence level about 95 %, k=2)
Radiated Disturbance (30 MHz ~ 1 GHz)	5.70 (Confidence level about 95 %, k=2)
Radiated Disturbance (1 GHz ~ 18 GHz)	5.52 (Confidence level about 95 %, k=2)
Radiated Disturbance (18 GHz ~ 40 GHz)	5.66 (Confidence level about 95 %, k=2)
Radiated Disturbance (Above 40 GHz)	5.58 (Confidence level about 95 %, k=2)

6. SUMMARY OF TEST RESULTS

6.1 Test Condition : Conducted Test

Test Description	FCC Part Section(s)	Test Limit	Test Result
Occupied Bandwidth	§ 2.1049	N/A	NT[Note3]
Band Edge / Spurious and Harmonic Emissions at Antenna Terminal.	§ 2.1051, § 96.41(e)	■ -13 dBm/Mhz at frequencies within 0-10 MHz of channel edge ■ -25 dBm/MHz at frequencies greater than 10 MHz above and below channel edge ■ -40 dBm/MHz at frequencies below 3530 MHz and above 3720 MHz	NT[Note3]
Conducted Output Power	§ 2.1046	N/A	C[Note5]
Frequency stability / variation of ambient temperature	§ 2.1055,	Emission must remain in band	NT[Note3]
Peak- to- Average Ratio	§ 96.41	< 13 dB	NT[Note3]
End User Device Additional Requirements (CBSD Protocol)	§ 96.47	End User Devices may operate only if they can positively receive and decode an authorization signal transmitted by a CBSD, including the frequencies and power limits for their operation. An End User Device must discontinue operations, change frequencies, or change its operational power level within 10 seconds of receiving instructions from its associated CBSD.	NT[Note3]

Note:
1. See SAR Report
2. C = Comply, NT = Not Tested, NA = Not Applicable, NC = Not Comply
3. C2PC models are electrically identical to the Original models.
   The Product Equality Declaration includes detailed information about the changes between the devices.
4. The data from that application has been verified through appropriate spot checks to demonstrate compliance for this device as shown in the test result of section 8
5. Output power was verified to be within the expected tune up tolerances prior to performing the spot checks for radiated spurious emissions and Conducted power to confirm that the proposed changes to the digital circuitry had not adversely affected the previously reported values in the original filing.

6.2 Test Condition : Radiated Test

Test Description	FCC Part Section(s)	Test Limit	Test Result
Equivalent Isotropic Radiated Power	§ 96.41(b)	23 dBm/10 MHz	NT[Note2]
Radiated Spurious and Harmonic Emissions	§ 2.1053, § 96.41(e)	-40 dBm/MHz	C[Note3]

Note:

1. C = Comply, NT = Not Tested, NA = Not Applicable, NC = Not Comply
2. C2PC models are electrically identical to the Original models.
   The Product Equality Declaration includes detailed information about the changes between the devices.
3. The data from that application has been verified through appropriate spot checks to demonstrate compliance for this device as shown in the test result of section 8

7. SAMPLE CALCULATION

7.1 ERP Sample Calculation

Ch./ Freq.		Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain (dBd)	C.L	Pol.	ERP	
channel	Freq.(MHz)						W	dBm
128	824.20	-21.37	38.40	-10.61	0.95	H	0.483	26.84

ERP = Substitute LEVEL(dBm) + Ant. Gain – CL(Cable Loss)

1) The EUT mounted on a non-conductive turntable is 2.5 meter above test site ground level.
2) During the test, the turn table is rotated until the maximum signal is found.
3) Record the field strength meter's level.
4) Replace the EUT with dipole/Horn antenna that is connected to a calibrated signal generator.
5) Increase the signal generator output till the field strength meter's level is equal to the item (3).
6) The signal generator output level with Ant. Gain and cable loss are the rating of effective radiated power.

7.2 EIRP Sample Calculation

Ch./ Freq.		Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain (dBi)	C.L	Pol.	EIRP	
channel	Freq.(MHz)						W	dBm
20175	1,732.50	-15.75	18.45	9.90	1.76	H	0.456	26.59

EIRP = Substitute LEVEL(dBm) + Ant. Gain – CL(Cable Loss)

1) The EUT mounted on a non-conductive turntable is 2.5 meter above test site ground level.
2) During the test, the turn table is rotated until the maximum signal is found.
3) Record the field strength meter's level.
4) Replace the EUT with dipole/Horn antenna that is connected to a calibrated signal generator.
5) Increase the signal generator output till the field strength meter's level is equal to the item (3).
6) The signal generator output level with Ant. Gain and cable loss are the rating of equivalent isotropic radiated power.

7.3. Emission Designator

GSM Emission Designator

Emission Designator = 249KGXW
GSM BW = 249 kHz
G = Phase Modulation
X = Cases not otherwise covered
W = Combination (Audio/Data)

EDGE Emission Designator

Emission Designator = 249KG7W
GSM BW = 249 kHz
G = Phase Modulation
7 = Quantized/Digital Info
W = Combination (Audio/Data)

WCDMA Emission Designator

Emission Designator = 4M17F9W
WCDMA BW = 4.17 MHz
F = Frequency Modulation
9 = Composite Digital Info
W = Combination (Audio/Data)

QPSK Modulation

Emission Designator = 4M48G7D
LTE BW = 4.48 MHz
G = Phase Modulation
7 = Quantized/Digital Info
D = Data transmission; telemetry; telecommand

QAM Modulation

Emission Designator = 4M48W7D
LTE BW = 4.48 MHz
W = Amplitude/Angle Modulated
7 = Quantized/Digital Info
D = Data transmission; telemetry; telecommand

8. TEST DATA

8.1 Conducted Power

Bandwidth	Modulation	RB Size	RB Offset	Max.Average Power (dBm)			Target MPR (dB)	Target Power
				55265	55990	56715		
				3552.5 MHz	3625 MHz	3697.5 MHz		
5 MHz	QPSK	1	0	16.72	17.22	17.09	0	17.3
		1	12	16.70	17.20	16.97	0	17.3
		1	24	16.83	17.22	17.10	0	17.3
		12	0	16.92	17.23	17.09	0	17.3
		12	6	16.92	17.28	17.14	0	17.3
		12	11	16.93	17.20	17.14	0	17.3
		25	0	16.95	17.18	17.14	0	17.3
	16QAM	1	0	17.18	17.55	17.45	0	17.3
		1	12	17.20	17.63	17.45	0	17.3
		1	24	17.21	17.56	17.49	0	17.3
		12	0	16.98	17.30	17.19	0	17.3
		12	6	17.01	17.31	17.15	0	17.3
		12	11	16.97	17.32	17.16	0	17.3
		25	0	16.95	17.24	17.14	0	17.3
	64QAM	1	0	17.25	17.46	17.40	0	17.3
		1	12	17.22	17.45	17.28	0	17.3
		1	24	17.27	17.54	17.44	0	17.3
		12	0	16.79	17.35	17.28	0	17.3
		12	6	16.84	17.41	17.24	0	17.3
		12	11	16.84	17.33	17.24	0	17.3
		25	0	16.75	17.29	17.23	0	17.3
	256QAM	1	0	16.94	17.57	17.44	0	17.3
		1	12	16.93	17.51	17.32	0	17.3
		1	24	17.05	17.58	17.46	0	17.3
		12	0	16.64	17.26	17.18	0	17.3
		12	6	16.69	17.32	17.15	0	17.3
		12	11	16.63	17.25	17.15	0	17.3
		25	0	16.61	17.25	17.16	0	17.3

Bandwidth	Modulation	RB Size	RB Offset	Max.Average Power (dBm)			Target MPR (dB)	Target Power
				55290	55990	56690		
				3555 MHz	3625 MHz	3695 MHz		
10 MHz	QPSK	1	0	17.00	17.19	17.07	0	17.3
		1	24	16.93	17.17	16.98	0	17.3
		1	49	17.04	17.28	17.15	0	17.3
		25	0	17.06	17.22	17.13	0	17.3
		25	12	17.04	17.25	17.15	0	17.3
		25	24	16.97	17.27	17.18	0	17.3
		50	0	17.07	17.25	17.17	0	17.3
	16QAM	1	0	17.39	17.56	17.39	0	17.3
		1	24	17.49	17.51	17.30	0	17.3
		1	49	17.42	17.58	17.45	0	17.3
		25	0	17.07	17.22	17.13	0	17.3
		25	12	17.05	17.23	17.11	0	17.3
		25	24	17.04	17.20	17.17	0	17.3
		50	0	17.06	17.32	17.22	0	17.3
	64QAM	1	0	17.18	17.34	17.25	0	17.3
		1	24	17.14	17.42	17.28	0	17.3
		1	49	17.25	17.48	17.39	0	17.3
		25	0	16.74	17.34	17.28	0	17.3
		25	12	16.80	17.38	17.30	0	17.3
		25	24	16.88	17.37	17.25	0	17.3
		50	0	16.77	17.31	17.26	0	17.3
	256QAM	1	0	16.93	17.56	17.49	0	17.3
		1	24	16.95	17.60	17.43	0	17.3
		1	49	17.19	17.63	17.55	0	17.3
		25	0	16.63	17.23	17.20	0	17.3
		25	12	16.71	17.29	17.16	0	17.3
		25	24	16.76	17.29	17.23	0	17.3
		50	0	16.74	17.25	17.22	0	17.3

Bandwidth	Modulation	RB Size	RB Offset	Max.Average Power (dBm)			Target MPR (dB)	Target Power
				55315	55990	56665		
				3557.5 MHz	3625 MHz	3692.5 MHz		
15 MHz	QPSK	1	0	16.79	17.09	17.05	0	17.3
		1	36	16.63	17.13	16.98	0	17.3
		1	74	16.85	17.25	17.12	0	17.3
		36	0	16.97	17.17	17.12	0	17.3
		36	18	16.99	17.19	17.15	0	17.3
		36	39	17.00	17.22	17.14	0	17.3
		75	0	17.00	17.23	17.15	0	17.3
	16QAM	1	0	17.31	17.53	17.36	0	17.3
		1	36	17.21	17.46	17.37	0	17.3
		1	74	17.39	17.61	17.50	0	17.3
		36	0	17.05	17.26	17.18	0	17.3
		36	18	16.99	17.25	17.18	0	17.3
		36	39	17.04	17.31	17.18	0	17.3
		75	0	17.05	17.27	17.25	0	17.3
	64QAM	1	0	17.11	17.44	17.32	0	17.3
		1	36	17.07	17.52	17.27	0	17.3
		1	74	17.31	17.45	17.39	0	17.3
		36	0	16.70	17.26	17.21	0	17.3
		36	18	16.76	17.25	17.18	0	17.3
		36	39	16.97	17.24	17.19	0	17.3
		75	0	16.81	17.28	17.19	0	17.3
	256QAM	1	0	17.11	17.55	17.51	0	17.3
		1	36	16.97	17.60	17.42	0	17.3
		1	74	17.41	17.65	17.53	0	17.3
		36	0	16.66	17.27	17.19	0	17.3
		36	18	16.66	17.24	17.20	0	17.3
		36	39	16.85	17.28	17.21	0	17.3
		75	0	16.71	17.24	17.18	0	17.3

Bandwidth	Modulation	RB Size	RB Offset	Max.Average Power (dBm)			Target MPR (dB)	Target Power
				55340	55990	56640		
				3552.5 MHz	3625 MHz	3690 MHz		
20 MHz	QPSK	1	0	16.92	17.15	17.09	0	17.3
		1	49	16.66	17.12	16.95	0	17.3
		1	99	16.86	17.20	17.10	0	17.3
		50	0	16.99	17.21	17.14	0	17.3
		50	25	17.00	17.21	17.19	0	17.3
		50	49	17.02	17.24	17.12	0	17.3
		100	0	16.98	17.18	17.16	0	17.3
	16QAM	1	0	17.32	17.50	17.41	0	17.3
		1	49	17.16	17.48	17.35	0	17.3
		1	99	17.37	17.63	17.43	0	17.3
		50	0	17.02	17.20	17.18	0	17.3
		50	25	17.01	17.25	17.21	0	17.3
		50	49	17.04	17.21	17.09	0	17.3
		100	0	17.06	17.23	17.24	0	17.3
	64QAM	1	0	17.14	17.42	17.40	0	17.3
		1	49	17.10	17.43	17.28	0	17.3
		1	99	17.30	17.47	17.40	0	17.3
		50	0	16.73	17.25	17.26	0	17.3
		50	25	16.87	17.30	17.27	0	17.3
		50	49	17.00	17.32	17.19	0	17.3
		100	0	16.82	17.30	17.25	0	17.3
	256QAM	1	0	17.02	17.55	17.55	0	17.3
		1	49	17.07	17.58	17.50	0	17.3
		1	99	17.44	17.67	17.54	0	17.3
		50	0	16.71	17.25	17.25	0	17.3
		50	25	16.87	17.28	17.27	0	17.3
		50	49	17.00	17.30	17.16	0	17.3
		100	0	16.84	17.27	17.22	0	17.3

Note:

1. The tested was using TDD UL Config 5.

8.2 RADIATED SPURIOUS EMISSIONS

▣ MODE: LTE B48

▣ MODULATION SIGNAL: 15 MHz QPSK

▣ DISTANCE: 1 meters

Freq (MHz)	Measured Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	Limit (dBm)
55315 (3557.5)	7 115.00	-62.10	10.50	-55.04	4.37	V	-48.91	-40.00
	10 672.50	-63.43	11.10	-52.26	5.47	V	-46.63	-40.00
	14 230.00	-60.39	12.40	-51.59	6.44	V	-45.63	-40.00

Note:

1. All modes of operation were investigated and the worst case configuration results are reported.
2. The tested was using TDD UL Config 5.

Band	Bandwidth (MHz)	Freq (MHz)	RSE (dBm)		Gap
			Original	C2PC	
LTE B48	15	7 115.00	-44.04	-48.91	4.87

9. ANNEX A_ TEST SETUP PHOTO

Please refer to test setup photo file no. as follows;

No.	Description
1	HCT-RF-2405-FC053-P