

FCC Test Report (Part 22: CA mode (LTE Band 5B))

Report No.: RFBFLF-WTW-P21010278-18

FCC ID: MSQI007D

Test Model: ASUS_I007D

Received Date: Jan. 04, 2021

Test Date: Mar. 11 ~ Apr. 09, 2021

Issued Date: Apr. 12, 2021

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FCC Registration / 788550 / TW0003

Designation Number:



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Release Control Record

Issue No.	Description	Date Issued
RFBFLF-WTW-P21010278-18	Original release	Apr. 12, 2021

1 Certificate of Conformity

Product: EXP21 Smartphone

Brand: ASUS

Test Model: ASUS_I007D

Sample Status: Engineering sample

Applicant: ASUSTeK COMPUTER INC.

Test Date: Mar. 11 ~ Apr. 09, 2021

Standards: FCC Part 22, Subpart H

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:** Apr. 12, 2021
Pettie Chen / Senior Specialist

Approved by : Bruce Chen , **Date:** Apr. 12, 2021
Bruce Chen / Senior Project Engineer

2 Summary of Test Results

Applied Standard: FCC Part 22 & Part 2			
FCC Clause	Test Item	Result	Remarks
2.1046 22.913 (a)	Effective radiated power	Pass	Meet the requirement of limit.
2.1047	Modulation Characteristics	Pass	Refer to Note 2
22.913 (d)	Peak To Average Ratio	Pass	Meet the requirement of limit.
2.1055 22.355	Frequency Stability	Pass	Meet the requirement of limit.
2.1049	Occupied Bandwidth	Pass	Meet the requirement of limit.
22.917	Band Edge Measurements	Pass	Meet the requirement of limit.
2.1051 22.917	Conducted Spurious Emissions	Pass	Meet the requirement of limit.
2.1053 22.917	Radiated Spurious Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -24.76dB at 60.07MHz.

Note:

- Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.
- LTE CA mode is similar to digital modulation in LTE single frequency band, so please refer to BV CPS report no.: RFBFLF-WTW-P21010278-9 for the modulation characteristics data of CA mode

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) (\pm)
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	3.04 dB
	30MHz ~ 200MHz	3.59 dB
	200MHz ~ 1000MHz	3.60 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	2.29 dB
	18GHz ~ 40GHz	2.29 dB

2.2 Test Site and Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver KEYSIGHT	N9038A	MY55420137	Apr. 16, 2020	Apr. 15, 2021
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100039	Jun. 12, 2020	Jun. 11, 2021
Spectrum Analyzer ROHDE & SCHWARZ	FSW43	101866	Dec. 14, 2020	Dec. 13, 2021
MXG Vector signal generator Agilent	N5182B	MY53050430	Nov. 25, 2020	Nov. 24, 2021
5G Wireless Test Platforms Keysight	E7515B	MY58300759	Apr. 18, 2020	Apr. 17, 2021
BILOG Antenna SCHWARZBECK	VULB9168	9168-472	Nov. 06, 2020	Nov. 05, 2021
HORN Antenna SCHWARZBECK	BBHA 9120D	9120D-969	Nov. 22, 2020	Nov. 21, 2021
BILOG Antenna SCHWARZBECK	VULB9168	9168-160	Nov. 06, 2020	Nov. 05, 2021
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-1169	Nov. 22, 2020	Nov. 21, 2021
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Nov. 22, 2020	Nov. 21, 2021
Preamplifier Agilent (Below 1GHz)	8447D	2944A10638	Jun. 08, 2020	Jun. 07, 2021
Preamplifier Agilent (Above 1GHz)	8449B	3008A02367	Feb. 17, 2021	Feb. 16, 2022
RF signal cable HUBER+SUHNER&EMCI	SUCOFLEX 104 & EMC104-SM-SM8000	CABLE-CH9-02 (248780+171006)	Jan. 16, 2021	Jan. 15, 2022
RF signal cable HUBER+SUHNER	SUCOFLEX 104	CABLE-CH9-(250795/4)	Jan. 16, 2021	Jan. 15, 2022
RF signal cable Woken	8D-FB	Cable-CH9-01	Jun. 08, 2020	Jun. 07, 2021
Software BV ADT	ADT_Radiated_ V7.6.15.9.5	NA	NA	NA
Antenna Tower EMCO	2070/2080	512.835.4684	NA	NA
Turn Table EMCO	2087-2.03	NA	NA	NA
Antenna Tower & Turn BV ADT	AT100	AT93021705	NA	NA
Turn Table BV ADT	TT100	TT93021705	NA	NA
Turn Table Controller BV ADT	SC100	SC93021705	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA
Standard Temperature And Humidity Chamber GIANT FORCE	GTH-120-40-CP-AR	MAA1306-019	Sep. 10, 2020	Sep. 09, 2021
JFW 20dB attenuation	50HF-020-SMA	NA	NA	NA
True RMS Clamp Meter Fluke	325	31130711WS	Jun. 06, 2020	Jun. 05, 2021
DC power supply Keysight	U8002A	MY56330015	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 9.

3 General Information

3.1 General Description of EUT

Product	EXP21 Smartphone				
Brand	ASUS				
Test Model	ASUS_I007D				
Sample Status	Engineering sample				
Power Supply Rating	7.74 Vdc (Battery) 5 Vdc / 9 Vdc / 12 Vdc / 15Vdc / 20Vdc (Adapter)				
Modulation Type	LTE: QPSK, 16QAM, 64QAM, 256QAM				
Operating Frequency	LTE Band 5 (CA 5B)	829.0~844.0MHz			
Max. ERP Power	LTE Band 5 (CA 5B) (10MHz+10MHz)	QPSK	16QAM	64QAM	256QAM
		108.143mW (20.34dBm)	89.743mW (19.53dBm)	74.473mW (18.72dBm)	63.387mW (18.02dBm)
Emission Designator	LTE Band 5 (CA 5B) (10MHz+10MHz)	18M6G7D	18M6D7W	18M6D7W	18M6D7W
Antenna Type	Refer to Note as below				
Accessory Device	Refer to Note as below				
Data Cable Supplied	Refer to Note as below				

Note:

1. The EUT contains following accessory devices.

Product	Brand	Model	Description
Battery	SCUD	C21P2002	Rating: 7.74 Vdc, 15.2 Wh
Adapter	AOHAI	A320Q-200325C-US	I/P: 100-240Vac, 50/60Hz, 1.5A O/P: 5 Vdc, 3 A; 9 Vdc, 3 A; 12 Vdc, 3A; 15 Vdc, 3 A; 20 Vdc, 3.25 A
Type A to Type C USB Cable	Luxshare	LA9U2026-CS-R	0.5m
Type C to Type C Cable	Luxshare	LA9UC006-CS-R	1.2m
Bluetooth Earphone	Bang & Olufsen	EQ Earbud R	FCC ID: TTUBEOPLAYEQR IC: 3775B-BEOPLAYEQR
		EQ Earbud L	FCC ID: TTUBEOPLAYEQL IC: 3775B-BEOPLAYEQL
Bluetooth Earphone Charging Case	Bang & Olufsen	EQ Charging case	I/P: 5Vdc/500mA O/P: 5Vdc/ R170mA; L170mA

2. The following antennas were provided to the EUT.

Ant. No.	Brand	Model	Ant. Type	Connector	Frequency Range
Ant 0	ASUS	ZS675KW	PIFA	LCP+lpex	610-960MHz, 1710-2690MHz
Ant 1	ASUS	ZS675KW	PIFA	LCP+lpex	1427-1510MHz, 1710-2690MHz
Ant 2	ASUS	ZS675KW	PIFA	LCP+lpex	610-960MHz, 1427-1510MHz, 1710-2690MHz
Ant 3	INPAQ	ZS675KW	PIFA	lpex	1575-1610MHz, 2400-2500MHz, 5150-5850MHz, 5925-7125MHz
Ant 4	INPAQ	ZS675KW	PIFA	lpex	1176±10MHz, 2400-2500MHz, 5150-5850MHz, 5925-7125MHz
Ant 5	INPAQ	ZS675KW	PIFA	LCP+lpex	3300-4000MHz, 4400-5000MHz
Ant 6	INPAQ	ZS675KW	PIFA	lpex	1427-1510MHz, 2400-2500MHz, 5150-5850MHz, 5925-7125MHz
Ant 7	INPAQ	ZS675KW	PIFA	LCP+lpex	3300-4000MHz, 4400-5000MHz
Ant 8	ASUS	ZS675KW	PIFA	LCP+lpex	1427-1510MHz, 1710-2690MHz
Ant 9	ASUS	ZS675KW	PIFA	LCP+lpex	1710-2690MHz
Ant 10	INPAQ	ZS675KW	PIFA	lpex	3300-4000MHz, 4400-5000MHz
Ant 11	INPAQ	ZS675KW	PIFA	lpex	3300-4000MHz, 4400-5000MHz

2G / 3G Band													
Band	Freq. Range (MHz)	Gain (dBi)											
		Ant. 0	Ant. 1	Ant. 2	Ant. 3	Ant. 4	Ant. 5	Ant. 6	Ant. 7	Ant. 8	Ant. 9	Ant. 10	Ant. 11
GSM-850	824 ~ 849	-1.891		-4.526									
GSM-1900	1850 ~ 1910		-1.887	-1.394						-2.89579			
WCDMA B2	1850 ~ 1910		-1.887	-1.394						-2.89579			
WCDMA B4	1710 ~ 1755		-2.884	-3.228						-3.13552			
WCDMA B5	824 ~ 849	-1.891		-4.526									
CDMA BC0	815 ~ 849	-1.891		-4.526									
CDMA BC1	1850 ~ 1910		-1.887	-1.394						-2.89579			
CDMA BC10	806 ~ 901	-1.891		-4.526									
LTE B2	1850 ~ 1910		-1.887	-1.394						-2.89579	-1.804		
LTE B4	1710 ~ 1755		-2.884	-3.228						-3.13552	-1.706		
LTE B5	824 ~ 849	-1.891		-4.526									
LTE B7	2500 ~ 2570		0.185	-0.657						-0.50837	-1.117		
LTE B12	698 ~ 716	-2.135		-4.343									
LTE B13	777 ~ 787	-4.37		-8.13									
LTE B14	788 ~ 798	-4.37		-7.931									
LTE B17	704 ~ 716	-2.135		-4.343									
LTE B25	1850 ~ 1915		-1.887	-1.394						-2.89579			
LTE B26	814 ~ 849	-1.891		-4.526									
LTE B30	2305 ~ 2315		-1.326	-2.669						-1.28433			
LTE B66	1710 ~ 1780		-2.884	-2.478						-3.0668	-1.685		
LTE B71	663 ~ 698	-5.741		-7.388									
T-LTE B38	2570 ~ 2620		0.724	-0.912						-0.59557			
T-LTE B40	2300 ~ 2400		-1.326	-2.669						-1.28433			
T-LTE B41	2496 ~ 2690		1.143	-0.657						-0.59557			
T-LTE B42	3400 ~ 3600						0.313		0.5277			-2.493	-0.35195
T-LTE B43	3600 ~ 3800						-0.434		0.5277			-0.477	-0.161
T-LTE B48	3550 ~ 3700						-0.434		0.5277			-0.477	-0.161

5G FR1 Band													
Band	Freq. Range (MHz)	Gain (dBi)											
		Ant. 0	Ant. 1	Ant. 2	Ant. 3	Ant. 4	Ant. 5	Ant. 6	Ant. 7	Ant. 8	Ant. 9	Ant. 10	Ant. 11
n2	1850 ~ 1910		-1.887	-1.394						-2.89579	-1.804		
n5	824 ~ 849	-1.891		-4.526									
n7	2500 ~ 2570		0.185	-0.657						-0.50837	-1.117		
n12	699 ~ 716	-2.135		-4.343									
n13	777 ~ 787	-4.37		-8.13									
n14	788 ~ 798	-4.37		-7.931									
n25	1850 ~ 1915		-1.887	-1.394						-2.89579	-1.627		
n26	814 ~ 849	-1.891		-4.526									
n30	2305 ~ 2315		-1.326	-2.669						-1.28433			
n38	2570 ~ 2620		0.724	-0.912						-0.59557	-1.3		
n41	2496 ~ 2690		1.143	-0.657						-0.59557	-0.076		
n66	1710 ~ 1780		-2.884	-2.478						-3.0668	-1.685		
n71	663 ~ 698	-5.741		-7.388									
n77	3300 ~ 4200						0.313		0.5277			2.017	0.19902
n78	3300 ~ 3800						0.313		0.5277			2.017	-0.161

* The above Antenna information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.

3. For CA mode configuration, please consult the manufacturer to declare the test mode.

4. E-UTRA CA configuration / Bandwidth combination set.

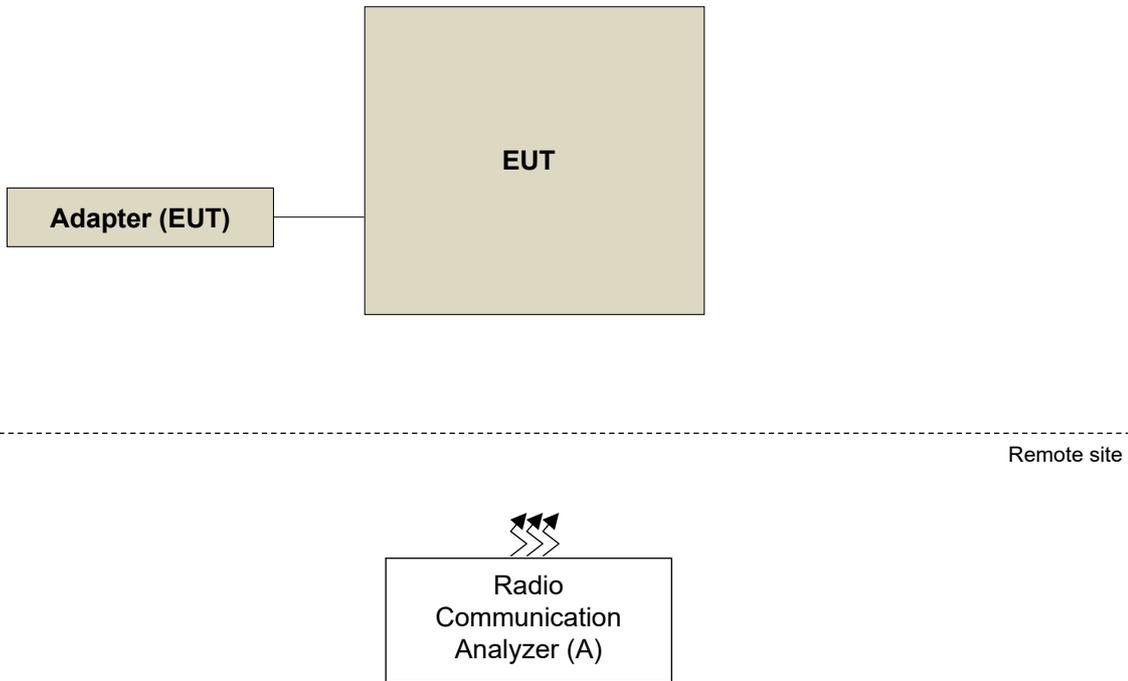
E-UTRA CA configuration / Bandwidth combination set					
E-UTRA CA configuration	Uplink CA configurations	Component carriers in order of increasing carrier frequency		Maximum aggregated bandwidth [MHz]	Bandwidth combination set
		Channel bandwidths for carrier [MHz]	Channel bandwidths for carrier [MHz]		
CA_5B	CA_5B	5, 10	10	20	0
		10	5		

*5B is continuous CA and maximum combination is 10M+10M.

5. The EUT support the following CA Configuration.

Band Configuration
5B
7C
38C
41C
48C
66B
66C

3.2 Configuration of System under Test



3.2.1 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.	Radio Communication Analyzer	Anritsu	MT8821C	6261806803	NA	-

Note:

1. All power cords of the above support units are non-shielded (1.8m).
2. Item A acted as a communication partner to transfer data.

3.3 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 Y-plane. Following channel(s) was (were) selected for the final test as listed below.

LTE Band 5 (CA 5B)

EUT Configure Mode	Test item	Available channel	Tested channel	Channel Bandwidth	Modulation	Mode
-	ERP	20450 to 20501 20549 to 20600	20450(829.0MHz)+ 20549(838.9MHz), 20476(831.6MHz)+ 20575(841.5MHz), 20501(834.1MHz)+ 20600(844.0MHz)	10MHz + 10MHz	QPSK / 16QAM / 64QAM / 256QAM	1 RB / 0 RB Offset 1 RB / 49 RB Offset
-	Frequency Stability	20450 to 20501 20549 to 20600	20476(831.6MHz)+ 20575(841.5MHz)	10MHz + 10MHz	QPSK	50 RB / 0 RB offset
-	Occupied Bandwidth	20450 to 20501 20549 to 20600	20450(829.0MHz)+ 20549(838.9MHz), 20476(831.6MHz)+ 20575(841.5MHz), 20501(834.1MHz)+ 20600(844.0MHz)	10MHz + 10MHz	QPSK / 16QAM / 64QAM / 256QAM	100 RB / 0 RB offset
-	Band Edge	20450 to 20501 20549 to 20600	20450(829.0MHz)+ 20549(838.9MHz), 20501(834.1MHz)+ 20600(844.0MHz)	10MHz + 10MHz	QPSK	1 RB / 49 RB Offset 1 RB / 0 RB Offset 50 RB / 0 RB offset
-	Peak to Average Ratio	20450 to 20501 20549 to 20600	20450(829.0MHz)+ 20549(838.9MHz), 20476(831.6MHz)+ 20575(841.5MHz), 20501(834.1MHz)+ 20600(844.0MHz)	10MHz + 10MHz	QPSK / 16QAM / 64QAM / 256QAM	1 RB / 49 RB Offset 1 RB / 0 RB Offset
-	Conducted Emission	20450 to 20501 20549 to 20600	20450(829.0MHz)+ 20549(838.9MHz), 20476(831.6MHz)+ 20575(841.5MHz), 20501(834.1MHz)+ 20600(844.0MHz)	10MHz + 10MHz	QPSK	1 RB / 49 RB Offset 1 RB / 0 RB Offset
-	Radiated Emission Below 1GHz	20450 to 20501 20549 to 20600	20450(829.0MHz)+ 20549(838.9MHz)	10MHz + 10MHz	QPSK	1 RB / 49 RB Offset 1 RB / 0 RB Offset
-	Radiated Emission Above 1GHz	20450 to 20501 20549 to 20600	20450(829.0MHz)+ 20549(838.9MHz), 20476(831.6MHz)+ 20575(841.5MHz), 20501(834.1MHz)+ 20600(844.0MHz)	10MHz + 10MHz	QPSK	1 RB / 49 RB Offset 1 RB / 0 RB Offset

Note:

1. This device was tested under all bandwidths, RB configurations and modulations. The worst case was found in QPSK modulation.
2. For radiated emission below 1 GHz, choose the maximum ERP power worst mode for final test.
3. LTE CA mode is similar to digital modulation in LTE single frequency band, so please refer to BV CPS report no.: RFBFLF-WTW-P21010278-9 for the modulation characteristics data of CA mode.

Test Condition:

Test Item	Environmental Conditions	Input Power (system)	Tested By
ERP	25deg. C, 60%RH	120Vac, 60Hz	Willy Cheng
Frequency Stability	25deg. C, 60%RH	7.74Vdc	Willy Cheng
Occupied Bandwidth	25deg. C, 60%RH	120Vac, 60Hz	Willy Cheng
Band Edge	25deg. C, 60%RH	120Vac, 60Hz	Willy Cheng
Peak To Average Ratio	25deg. C, 60%RH	120Vac, 60Hz	Willy Cheng
Conducted Emission	25deg. C, 60%RH	120Vac, 60Hz	Willy Cheng
Radiated Emission	22deg. C, 66%RH	120Vac, 60Hz	Rex Wang

3.4 EUT Operating Conditions

The EUT makes a call to the communication simulator. The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency

3.5 General Description of Applied Standards and References

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

Test Standard:

FCC 47 CFR Part 2

FCC 47 CFR Part 22

ANSI/TIA/EIA-603-E 2016

ANSI 63.26-2015

References Test Guidance:

KDB 971168 D01 Power Meas License Digital Systems v03r01

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

4 Test Types and Results

4.1 Output Power Measurement

4.1.1 Limits of Output Power Measurement

Mobile / Portable station are limited to 7 watts e.r.p.

4.1.2 Test Procedures

Conducted Power Measurement:

The EUT was set up for the maximum power with LTE link data modulation and link up with simulator. Set the EUT to transmit under low, middle and high channel and record the power level shown on simulator.

Maximum EIRP / ERP

The relevant equation for determining the maximum ERP or EIRP from the measured RF output power is given in Equation as follows:

$$\text{EIRP} = P_{\text{Meas}} + G_{\text{T}}$$

$$\text{ERP} = P_{\text{Meas}} + G_{\text{T}} - 2.15$$

where

ERP or EIRP effective radiated power or equivalent isotropically radiated power, respectively
(expressed in the same units as P_{Meas} , e.g., dBm or dBW)

P_{Meas} measured transmitter output power or PSD, in dBm or dBW

G_{T} gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP)

4.1.3 Test Setup

Conducted Power Measurement:



4.1.4 Test Results

Conducted Output Power (dBm)

LTE Band 5 (CA 5B)

Con-figuration	Com-bination	PCC							SCC							Measurement Power	
		Band	BW (MHz)	Modu-lation	RB Size	RB Offset	UL Chan.	UL Freq. (MHz)	Band	BW (MHz)	Modu-lation	RB Size	RB Offset	UL Chan.	UL Freq. (MHz)	Tx Power with UL-CA Active (dBm)	Total
Intra Band Contiguous	CA_5B	5	10	QPSK	1	0	20450	829	5	10	QPSK	1	49	20549	838.9	14.89	
					1	49						24.38					
		5	10	QPSK	1	0	20476	831.6	5	10	QPSK	1	49	20575	841.5	14.90	
					1	49						24.22					
		5	10	QPSK	1	0	20501	834.1	5	10	QPSK	1	49	20600	844.0	14.93	
					1	49						24.23					

Con-figuration	Com-bination	PCC							SCC							Measurement Power	
		Band	BW (MHz)	Modu-lation	RB Size	RB Offset	UL Chan.	UL Freq. (MHz)	Band	BW (MHz)	Modu-lation	RB Size	RB Offset	UL Chan.	UL Freq. (MHz)	Tx Power with UL-CA Active (dBm)	Total
Intra Band Contiguous	CA_5B	5	10	16QAM	1	0	20450	829	5	10	16QAM	1	49	20549	838.9	14.14	
					1	49						23.57					
		5	10	16QAM	1	0	20476	831.6	5	10	16QAM	1	49	20575	841.5	14.14	
					1	49						23.47					
		5	10	16QAM	1	0	20501	834.1	5	10	16QAM	1	49	20600	844	14.10	
					1	49						23.45					

Con-figuration	Com-bination	PCC							SCC							Measurement Power	
		Band	BW (MHz)	Modu-lation	RB Size	RB Offset	UL Chan.	UL Freq. (MHz)	Band	BW (MHz)	Modu-lation	RB Size	RB Offset	UL Chan.	UL Freq. (MHz)	Tx Power with UL-CA Active (dBm)	Total
Intra Band Contiguous	CA_5B	5	10	64QAM	1	0	20450	829	5	10	64QAM	1	49	20549	838.9	13.46	
					1	49						22.69					
		5	10	64QAM	1	0	20476	831.6	5	10	64QAM	1	49	20575	841.5	13.28	
					1	49						22.77					
		5	10	64QAM	1	0	20501	834.1	5	10	64QAM	1	49	20600	844	13.31	
					1	49						22.61					

Con-figuration	Com-bination	PCC							SCC							Measurement Power	
		Band	BW (MHz)	Modu-lation	RB Size	RB Offset	UL Chan.	UL Freq. (MHz)	Band	BW (MHz)	Modu-lation	RB Size	RB Offset	UL Chan.	UL Freq. (MHz)	Tx Power with UL-CA Active (dBm)	Total
Intra Band Contiguous	CA_5B	5	10	256QAM	1	0	20450	829	5	10	256QAM	1	49	20549	838.9	12.76	
					1	49						21.95					
		5	10	256QAM	1	0	20476	831.6	5	10	256QAM	1	49	20575	841.5	12.68	
					1	49						22.06					
		5	10	256QAM	1	0	20501	834.1	5	10	256QAM	1	49	20600	844	12.56	
					1	49						21.80					

ERP Power (dBm)

Con-figuration	Com-bination	PCC							SCC							Measurement Power	
		Band	BW (MHz)	Modu-lation	RB Size	RB Offset	UL Chan.	UL Freq. (MHz)	Band	BW (MHz)	Modu-lation	RB Size	RB Offset	UL Chan.	UL Freq. (MHz)	ERP (dBm)	
																Total	
Intra Band Conti-guous	CA_5B	5	10	QPSK	1	0	20450	829	5	10	QPSK	1	49	20549	838.9	10.84	
					1	49						20.34					
		5	10	QPSK	1	0	20476	831.6	5	10	QPSK	1	49	20575	841.5	10.86	
					1	49						20.17					
		5	10	QPSK	1	0	20501	834.1	5	10	QPSK	1	49	20600	844.0	10.89	
					1	49						20.18					

Con-figuration	Com-bination	PCC							SCC							Measurement Power	
		Band	BW (MHz)	Modu-lation	RB Size	RB Offset	UL Chan.	UL Freq. (MHz)	Band	BW (MHz)	Modu-lation	RB Size	RB Offset	UL Chan.	UL Freq. (MHz)	ERP (dBm)	
																Total	
Intra Band Conti-guous	CA_5B	5	10	16QAM	1	0	20450	829	5	10	16QAM	1	49	20549	838.9	10.10	
					1	49						19.53					
		5	10	16QAM	1	0	20476	831.6	5	10	16QAM	1	49	20575	841.5	10.10	
					1	49						19.43					
		5	10	16QAM	1	0	20501	834.1	5	10	16QAM	1	49	20600	844	10.06	
					1	49						19.41					

Con-figuration	Com-bination	PCC							SCC							Measurement Power	
		Band	BW (MHz)	Modu-lation	RB Size	RB Offset	UL Chan.	UL Freq. (MHz)	Band	BW (MHz)	Modu-lation	RB Size	RB Offset	UL Chan.	UL Freq. (MHz)	ERP (dBm)	
																Total	
Intra Band Conti-guous	CA_5B	5	10	64QAM	1	0	20450	829	5	10	64QAM	1	49	20549	838.9	9.42	
					1	49						18.64					
		5	10	64QAM	1	0	20476	831.6	5	10	64QAM	1	49	20575	841.5	9.24	
					1	49						18.72					
		5	10	64QAM	1	0	20501	834.1	5	10	64QAM	1	49	20600	844	9.27	
					1	49						18.56					

Con-figuration	Com-bination	PCC							SCC							Measurement Power	
		Band	BW (MHz)	Modu-lation	RB Size	RB Offset	UL Chan.	UL Freq. (MHz)	Band	BW (MHz)	Modu-lation	RB Size	RB Offset	UL Chan.	UL Freq. (MHz)	ERP (dBm)	
																Total	
Intra Band Conti-guous	CA_5B	5	10	256QAM	1	0	20450	829	5	10	256QAM	1	49	20549	838.9	8.72	
					1	49						17.91					
		5	10	256QAM	1	0	20476	831.6	5	10	256QAM	1	49	20575	841.5	8.64	
					1	49						18.02					
		5	10	256QAM	1	0	20501	834.1	5	10	256QAM	1	49	20600	844	8.52	
					1	49						17.76					

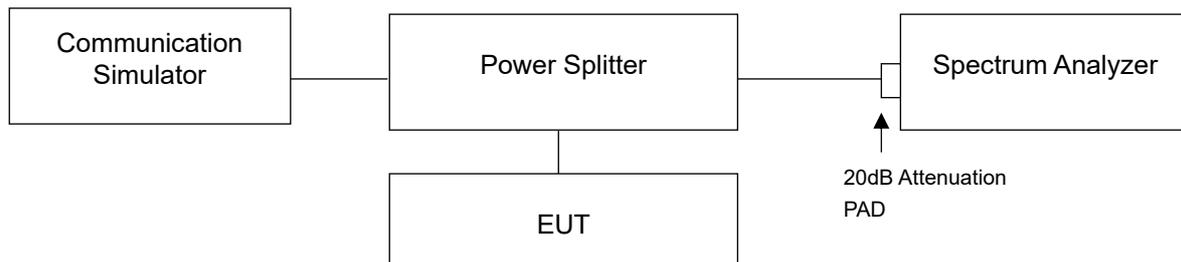
4.2 Occupied Bandwidth Measurement

4.2.1 Test Procedure

The EUT makes a call to the communication simulator. All measurements were done at low, middle and high operational frequency range. The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency. Refer to ANSI C63.26 section 5.4.4. Use OBW measurement function of Spectrum analyzer to measure 99 % occupied bandwidth.

For the 26dBc bandwidth measurement method, please refer to section 5.4.3 of ANSI C63.26.

4.2.2 Test Setup



4.2.3 Test Result

LTE Band 5 (CA 5B)

Occupied Bandwidth

LTE Band 5 (CA 5B), Channel Bandwidth 10MHz+10MHz					
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
20450+20549	829.0+838.9	18.556	18.533	18.568	18.518
20476+20575	831.6+841.5	18.579	18.606	18.588	18.594
20501+20600	834.1+844.0	18.575	18.566	18.591	18.545

26dB Bandwidth

LTE Band 5 (CA 5B), Channel Bandwidth 10MHz+10MHz					
Channel	Frequency (MHz)	26dB Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
20450+20549	829.0+838.9	19.35	19.34	19.34	19.35
20476+20575	831.6+841.5	19.33	19.32	19.34	19.33
20501+20600	834.1+844.0	19.34	19.33	19.33	19.34



4.3 Frequency Stability Measurement

4.3.1 Limits of Frequency Stability Measurement

1.5 ppm is for base and fixed station. 2.5 ppm is for mobile station.

4.3.2 Test Procedure

- Device is placed at the oven room. The oven room could control the temperatures and humidity. Power warm up is at least 15 min and power applied should perform before recording frequency error.
- EUT is connected the external power supply to control the DC input power. The test voltage range is from minimum to maximum working voltage. Each step shall be record the frequency error rate.
- The temperature range step is 10 degrees in this test items. All temperature levels shall be hold the ± 0.5 °C during the measurement testing. The each temperature step shall be at least 0.5 hours, consider the EUT could be test under the stability condition.

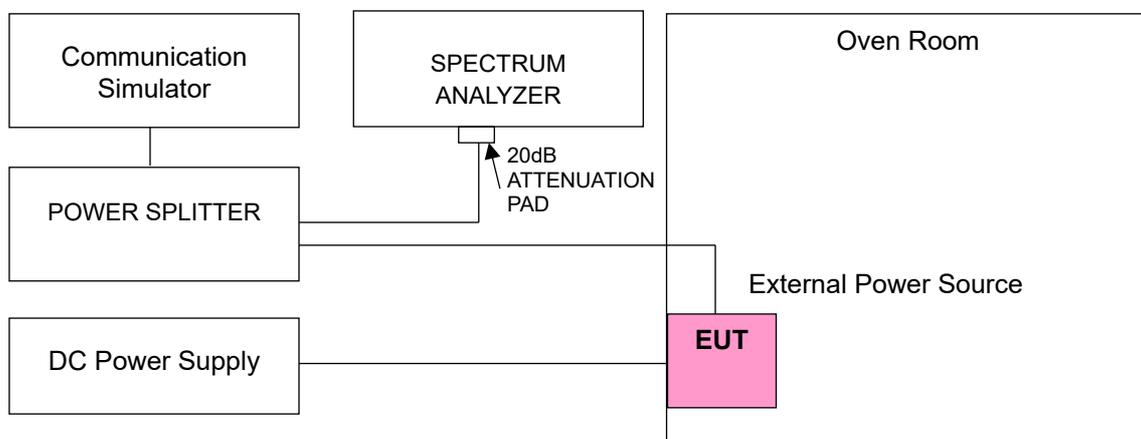
Note: The frequency error was recorded frequency error from the communication simulator.

4.3.3 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Radio Communication Analyzer Anritsu	MT8820C	6201010284	Dec. 28, 2020	Dec. 27, 2021
Temperature & Humidity Chamber TERCHY	HRM-120RF	931022	Dec. 24, 2020	Dec. 23, 2021
Digital Multimeter Fluke	87-III	70360742	Jun. 23, 2020	Jun. 22, 2021
DC Power Supply Topward	6306A	727263	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.

4.3.4 Test Setup



4.3.5 Test Results

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 5 (CA 5B), Channel Bandwidth 10MHz+10MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
8.90	831.600002	0.002	841.500004	0.005
7.74	831.600003	0.004	841.500003	0.003
6.58	831.600003	0.003	841.500003	0.003

Note: The applicant defined the normal working voltage is from 6.58Vdc to 8.90Vdc.

Frequency Error vs. Temperature

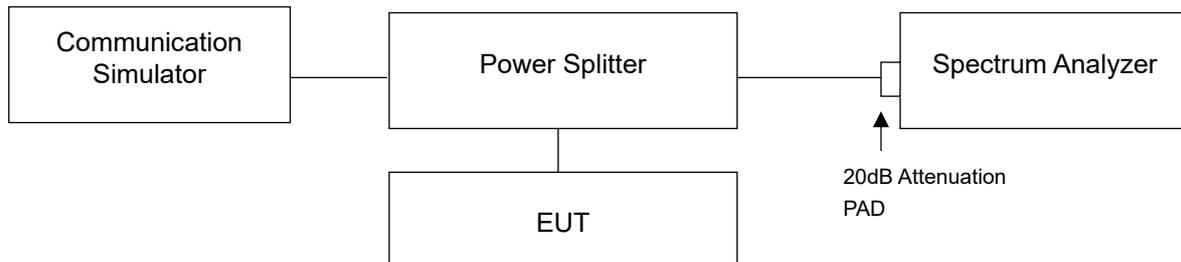
Temp. (°C)	LTE Band 5 (CA 5B), Channel Bandwidth 10MHz+10MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	831.600003	0.003	841.500004	0.004
-20	831.600001	0.001	841.500002	0.003
-10	831.600002	0.003	841.500001	0.001
0	831.600003	0.004	841.500003	0.003
10	831.599998	-0.002	841.499998	-0.003
20	831.599999	-0.001	841.499998	-0.002
30	831.599997	-0.004	841.499998	-0.002
40	831.599997	-0.004	841.499998	-0.002
50	831.599997	-0.004	841.499997	-0.004

4.4 Band Edge Measurement

4.4.1 Limits of Band Edge Measurement

Power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

4.4.2 Test Setup



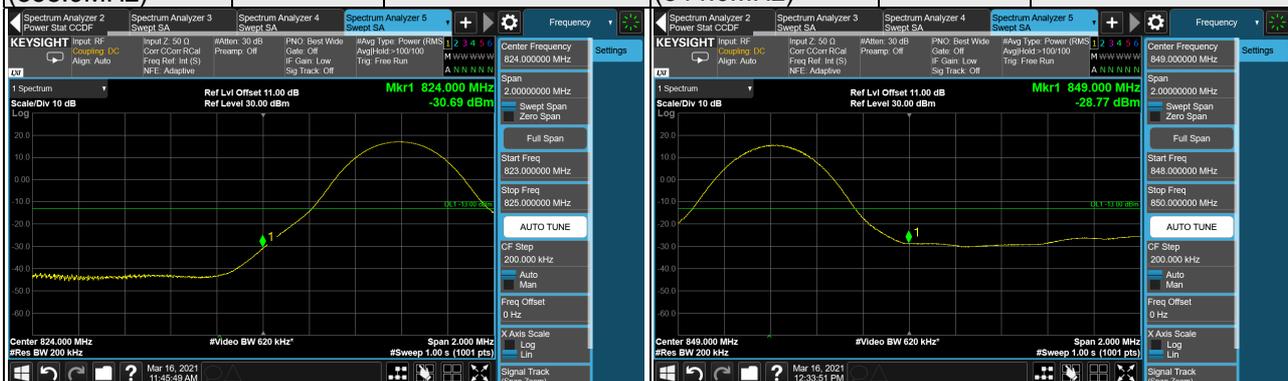
4.4.3 Test Procedures

- All measurements were done at low and high operational frequency range.
- The center frequency of spectrum is the band edge frequency and span is 10MHz. RB of the spectrum is 200kHz and VB of the spectrum is 620kHz (LTE Channel Bandwidth 10MHz+10MHz)
- Record the max trace plot into the test report.

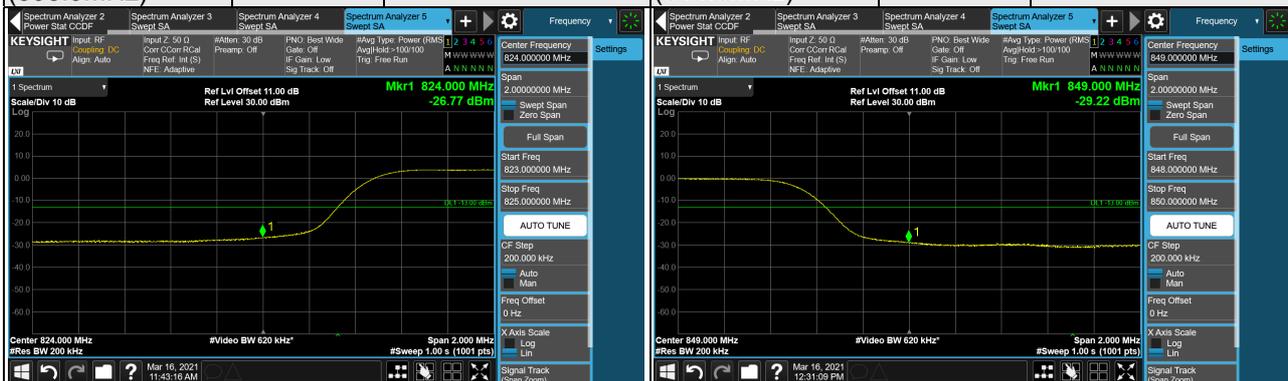
4.4.4 Test Results

LTE Band 5 (CA 5B), Channel Bandwidth 10MHz+10MHz

Channel 20450 (829.0MHz)+ Channel 20549 (838.9MHz)	QPSK	1 RB / 0 RB Offset	Channel 20501 (834.1MHz)+ Channel 20600 (844.0MHz)	QPSK	1 RB / 49 RB Offset
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Channel 20450 (829.0MHz)+ Channel 20549 (838.9MHz)	QPSK	50 RB / 0 RB Offset	Channel 20501 (834.1MHz)+ Channel 20600 (844.0MHz)	QPSK	50 RB / 0 RB Offset
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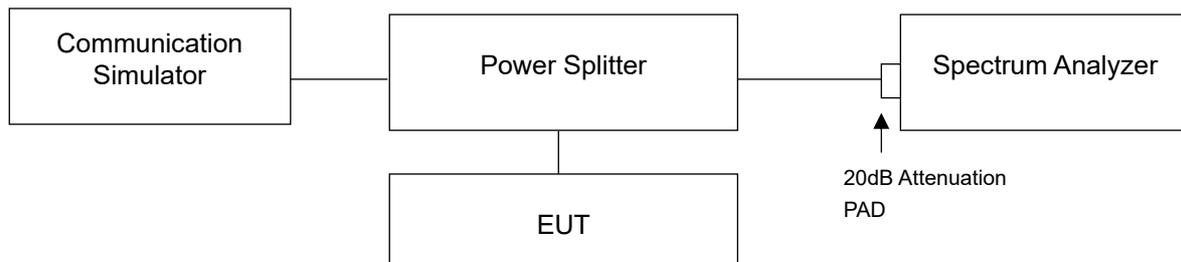


4.5 Peak to Average Ratio

4.5.1 Limits of Peak to Average Ratio Measurement

In measuring transmissions in this band using an average power technique, the peak to-average ratio (PAR) of the transmission may not exceed 13 dB

4.5.2 Test Setup



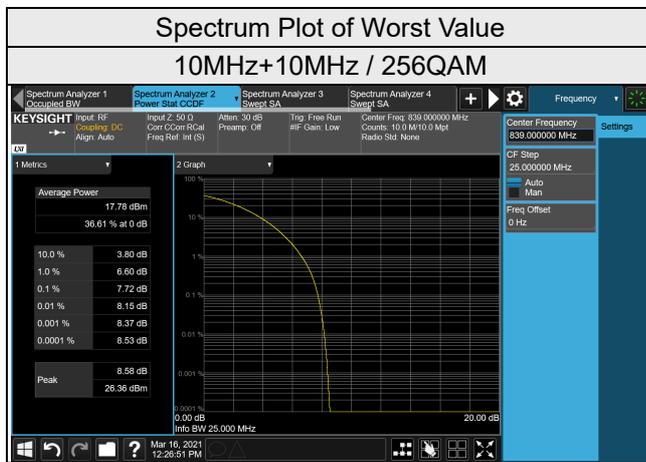
4.5.3 Test Procedures

- Set resolution/measurement bandwidth \geq signal's occupied bandwidth;
- Set the number of counts to a value that stabilizes the measured CCDF curve;
- Record the maximum PAPR level associated with a probability of 0.1%.

4.5.4 Test Results

LTE Band 5 (CA 5B)

LTE Band 5 (CA 5B), Channel Bandwidth 10MHz+10MHz					
Channel	Frequency (MHz)	Peak To Average Ratio (dB)			
		QPSK	16QAM	64QAM	256QAM
20450+20549	829.0+838.9	6.03	6.45	7.04	7.01
20476+20575	831.6+841.5	6.13	6.96	6.46	6.99
20501+20600	834.1+844.0	6.30	7.02	7.71	7.72

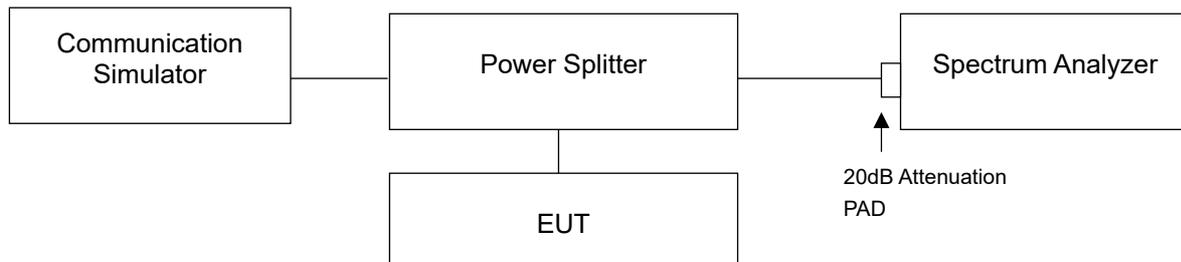


4.6 Conducted Spurious Emissions

4.6.1 Limits of Conducted Spurious Emissions Measurement

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB. The emission limit equal to -13dBm .

4.6.2 Test Setup



4.6.3 Test Procedure

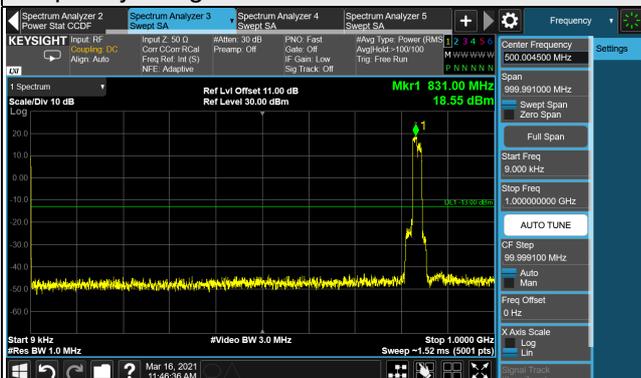
- The EUT makes a phone call to the communication simulator. All measurements were done at low, middle and high operational frequency range.
- Measuring frequency range is from 9kHz to 1GHz. 20dB attenuation pad is connected with spectrum. RBW=100kHz and VBW=300kHz is used for conducted emission measurement.
- Measuring frequency range is from 1GHz to 9GHz. 20dB attenuation pad is connected with spectrum. RBW=1MHz and VBW=3MHz is used for conducted emission measurement.

4.6.4 Test Results

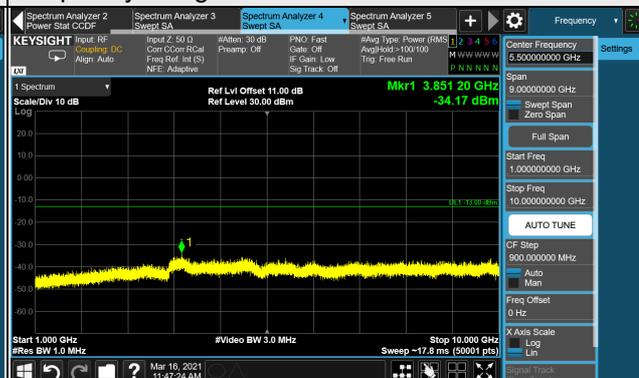
LTE Band 5 (CA 5B), Channel Bandwidth 10MHz+10MHz

Channel 20450(829.0MHz) + Channel 20549(838.9MHz)

Frequency Range : 9kHz~1GHz

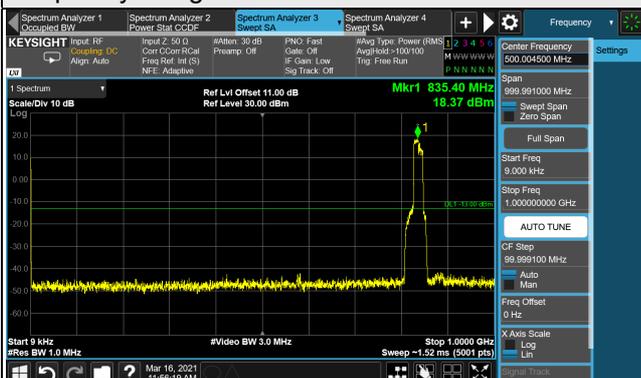


Frequency Range : 1GHz~10GHz

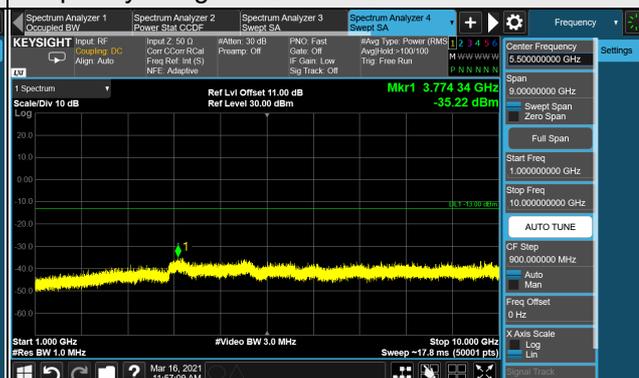


Channel 20476(831.6MHz) + Channel 20575(841.5MHz)

Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~10GHz

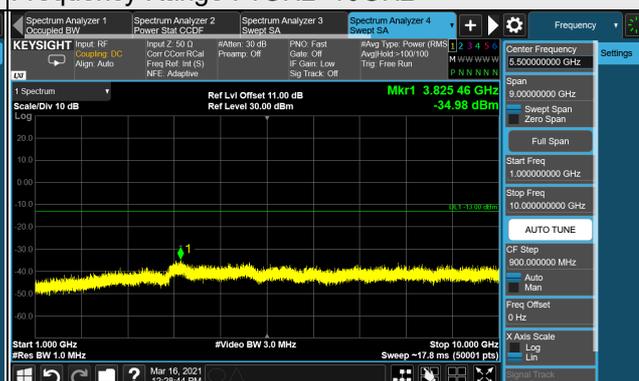


Channel 20501(834.1MHz) + Channel 20600(844.0MHz)

Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~10GHz



*The 9kHz signal over the limit is from Spectrum.

4.7 Radiated Emission Measurement

4.7.1 Limits of Radiated Emission Measurement

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB. The emission limit equal to -13dBm .

4.7.2 Test Procedure

- a. Substitution method is used for E.I.R.P measurement. In the semi-anechoic chamber, EUT placed on the 0.8m (below or equal 1 GHz) and/or 1.5 m (above 1 GHz) height of Turn Table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1m to 4m to find the maximum polar radiated power. The "Read Value" is the spectrum reading the maximum power value.
- b. $\text{EIRP} = \text{Output power level of S.G} - \text{TX cable loss} + \text{Antenna gain of substitution horn}$. Correction Factor (includes EIRP and ERP unit conversion factor) = Antenna gain of substitution horn. – Tx cable loss. Measurement method refers to ANSI C63.26 section 5.5.3.2.
- c. E.R.P power can be calculated form E.I.R.P power by subtracting the gain of dipole, $\text{E.R.P power} = \text{E.I.R.P power} - 2.15\text{dBi}$.

NOTE:

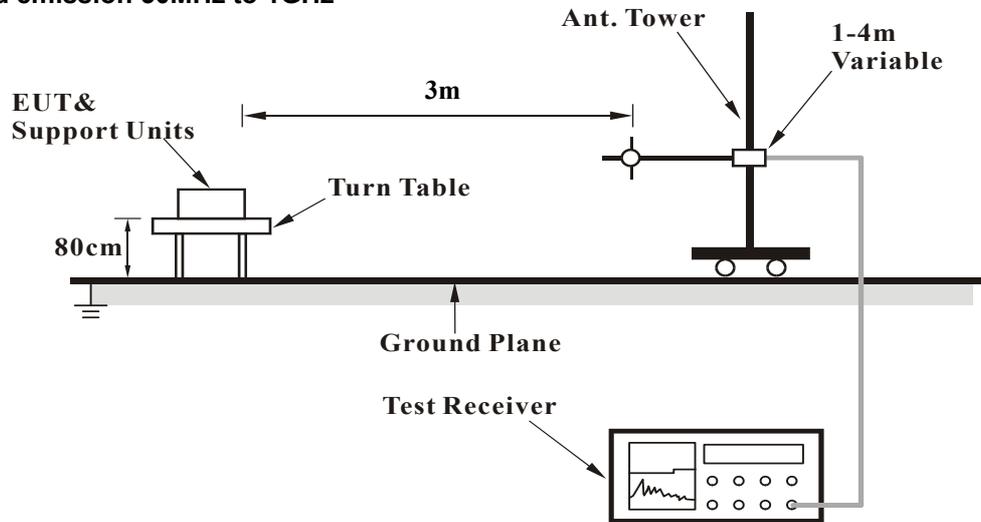
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1MHz/3MHz.
2. The emission levels were against the limit of frequency range 9 kHz ~ 30 MHz:
The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

4.7.3 Deviation from Test Standard

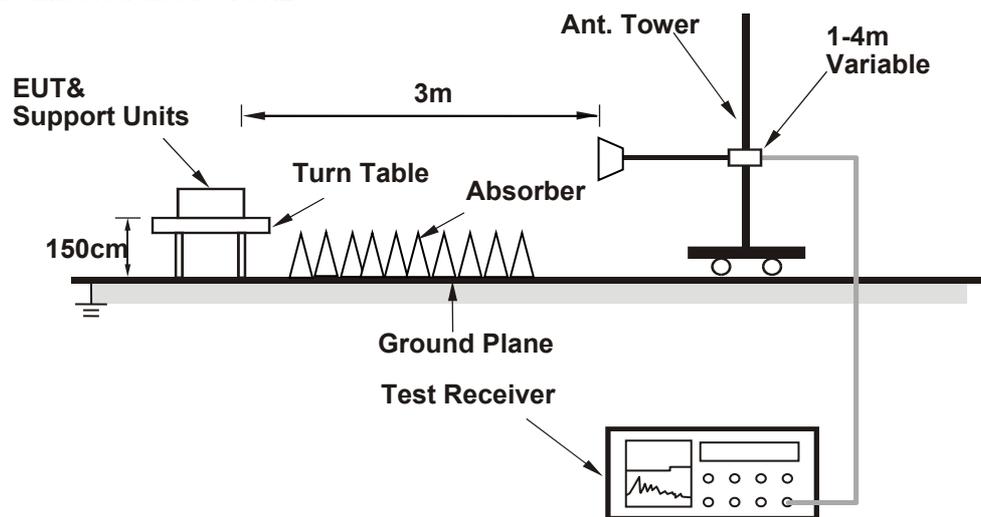
No deviation.

4.7.4 Test Setup

For radiated emission 30MHz to 1GHz



For radiated emission above 1GHz



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

4.7.5 Test Results

Below 1GHz

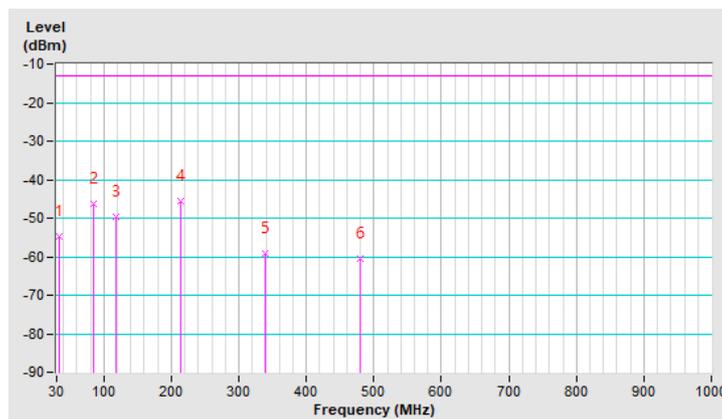
LTE Band 5 (CA 5B), Channel Bandwidth: 10MHz+10MHz

Mode	TX channel 20450(829.0MHz)+ TX channel 20549(838.9MHz)	Frequency Range	Below 1000 MHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Rex Wang		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	ERP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	34.85	-54.66	-13.00	-41.66	1.00 H	70	52.97	-107.63
2	84.32	-46.25	-13.00	-33.25	2.00 H	132	65.19	-111.44
3	117.30	-49.53	-13.00	-36.53	1.49 H	71	58.85	-108.38
4	213.33	-45.60	-13.00	-32.60	1.00 H	181	62.71	-108.31
5	339.43	-59.17	-13.00	-46.17	1.00 H	30	44.13	-103.30
6	480.08	-60.63	-13.00	-47.63	1.49 H	142	39.73	-100.36

Remarks:

1. $ERP(dBm) = Raw\ Value(dBuV) + Correction\ Factor(dB/m)$
2. $Correction\ Factor(dB/m) = Antenna\ Factor(dB/m) + Cable\ Factor(dB) - Pre-Amplifier\ Factor(dB) + 20\log(D) - 104.8 - 2.15$
3. $Margin\ value = ERP - Limit\ value$
4. The other ERP levels were very low against the limit.

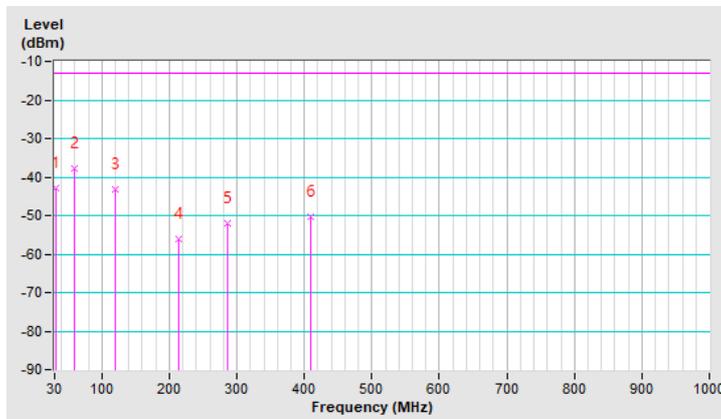


Mode	TX channel 20450(829.0MHz)+ TX channel 20549(838.9MHz)	Frequency Range	Below 1000 MHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Rex Wang		

Antenna Polarity & Test Distance : Vertical at 3m								
No	Frequency (MHz)	ERP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	31.94	-42.90	-13.00	-29.90	1.00 V	283	64.84	-107.74
2	60.07	-37.76	-13.00	-24.76	1.00 V	226	69.01	-106.77
3	119.24	-43.25	-13.00	-30.25	1.25 V	85	64.96	-108.21
4	214.30	-56.06	-13.00	-43.06	1.25 V	255	52.20	-108.26
5	286.08	-52.16	-13.00	-39.16	1.00 V	134	52.36	-104.52
6	409.27	-50.32	-13.00	-37.32	1.00 V	134	51.68	-102.00

Remarks:

1. ERP(dBm) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + 20log(D) – 104.8 - 2.15
3. Margin value = ERP – Limit value
4. The other ERP levels were very low against the limit.



Above 1GHz

LTE Band 5 (CA 5B), Channel Bandwidth: 10MHz+10MHz

Mode	TX channel 20450 (829.0MHz)+ TX channel 20549 (838.9MHz)	Frequency Range	1GHz ~ 10GHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Rex Wang		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	ERP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	1658.00	-58.22	-13.00	-45.22	2.20 H	25	45.26	-103.48
2	1677.80	-57.84	-13.00	-44.84	2.24 H	28	45.60	-103.44
Antenna Polarity & Test Distance : Vertical at 3m								
No	Frequency (MHz)	ERP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	1658.00	-57.86	-13.00	-44.86	1.39 V	293	45.62	-103.48
2	1677.80	-57.76	-13.00	-44.76	1.42 V	295	45.68	-103.44

Remarks:

1. $ERP(dBm) = Raw\ Value(dBuV) + Correction\ Factor(dB/m)$
2. $Correction\ Factor(dB/m) = Antenna\ Factor(dB/m) + Cable\ Factor(dB) - Pre-Amplifier\ Factor(dB) + 20\log(D) - 104.8 - 2.15$
3. $Margin\ value = ERP - Limit\ value$
4. The other ERP levels were very low against the limit.

Mode	TX channel 20476 (831.6MHz)+ TX channel 20575 (841.5MHz)	Frequency Range	1GHz ~ 10GHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Rex Wang		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	ERP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	1663.20	-58.14	-13.00	-45.14	2.27 H	24	45.32	-103.46
2	1683.00	-58.22	-13.00	-45.22	2.31 H	25	45.21	-103.43
Antenna Polarity & Test Distance : Vertical at 3m								
No	Frequency (MHz)	ERP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	1663.20	-58.05	-13.00	-45.05	1.43 V	294	45.41	-103.46
2	1683.00	-58.21	-13.00	-45.21	1.38 V	296	45.22	-103.43

Remarks:

1. $ERP(dBm) = Raw\ Value(dBuV) + Correction\ Factor(dB/m)$
2. $Correction\ Factor(dB/m) = Antenna\ Factor(dB/m) + Cable\ Factor(dB) - Pre-Amplifier\ Factor(dB) + 20\log(D) - 104.8 - 2.15$
3. $Margin\ value = ERP - Limit\ value$
4. The other ERP levels were very low against the limit.

Mode	TX channel 20501 (834.1MHz)+ TX channel 20600 (844.0MHz)	Frequency Range	1GHz ~ 10GHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Rex Wang		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	ERP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	1668.20	-58.37	-13.00	-45.37	2.21 H	26	45.09	-103.46
2	1688.00	-57.63	-13.00	-44.63	2.18 H	25	45.78	-103.41
Antenna Polarity & Test Distance : Vertical at 3m								
No	Frequency (MHz)	ERP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	1668.20	-57.74	-13.00	-44.74	1.46 V	289	45.72	-103.46
2	1688.00	-58.34	-13.00	-45.34	1.42 V	291	45.07	-103.41

Remarks:

1. $ERP(dBm) = Raw\ Value(dBuV) + Correction\ Factor(dB/m)$
2. $Correction\ Factor(dB/m) = Antenna\ Factor(dB/m) + Cable\ Factor(dB) - Pre-Amplifier\ Factor(dB) + 20\log(D) - 104.8 - 2.15$
3. $Margin\ value = ERP - Limit\ value$
4. The other ERP levels were very low against the limit.

5 Pictures of Test Arrangements

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

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 FCC recognized accredited test firms and 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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