TEST REPORT

Application No.:	KSCR2111000279CR
FCC ID:	WBKRU4370
Applicant:	BTI Wireless
Address of Applicant:	6185 Phyllis Drive #D, Cypress, California 90630, United States
Manufacturer:	BTI Wireless
Address of Manufacturer:	6185 Phyllis Drive #D, Cypress, California 90630, United States
Factory:	Sunwave Communications Co., Ltd
Address of Factory:	581 Huoju Avenue, Binjiang District Hangzhou China
Equipment Under Test (EUT):	
EUT Name:	Remote Radio Unit
Model No.:	RU4370
Trade mark:	BTI WIRELESS
Standard(s) :	FCC Part 2; FCC Part 96;
Date of Receipt:	2021-11-25
Date of Test:	2021-11-26 to 2021-12-21
Date of Issue:	2021-12-22
Test Result:	**Pass***

* In the configuration tested, the EUT complied with the standards specified above.

Eric Lin
Laboratory Manager

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Revision Record			
Version	**Description**	**Date**	**Remark**
00	Original	2021-12-22	/

Authorized for issue by:				
		Damon zhou		
		Damon Zhou / Project Engineer		
		Eric Lin		
		Eric Lin / Reviewer		

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2 Test Summary

Test Item	Test Requirement	Test Method	Result
Power, PSD and Peak to Average Power Ratio	47 CFR Part 96.41(b)(c)(g) 2.1046	ANSI C63.26:2015	PASS
Occupied Bandwidth	47 CFR Part 96.41(e)(3) 2.1049	ANSI C63.26:2015	PASS
Unwanted Emissions at Band Edge	47 CFR Part 96.41(e)(1) 2.1051	ANSI C63.26:2015	PASS
Conducted Unwanted Emission	47 CFR Part 96.41(e)(2) 2.1051	ANSI C63.26:2015	PASS
Radiated Unwanted Emissions	47 CFR Part 96.41(e)(1)(2) 2.1053	ANSI C63.26:2015	PASS
Frequency Stability	47 CFR Part 2.1055	ANSI C63.26:2015	PASS

Remark:

EUT: In this whole report EUT means Equipment Under Test.

Tx: In this whole report Tx (or tx) means Transmitter.

Rx: In this whole report Rx (or rx) means Receiver.

The EUT includes 4 TX/RX ports. It can be configured to transmit in MIMO mode, and the MIMO mode was used for measurements as the worst configuration. The complete testing was performed with the EUT transmitting at maximum RF power unless otherwise stated.

Initial pre-testing was carried out to determine the worst case modulation scheme by measuring the output power from QPSK, 16QAM and 64QAM on the middle channel of one antenna port. From these tests, it was determined that 64QAM was the worst case modulation scheme and was used for all testing.

All modes have been tested and only record the worst test result.

Test method standard:

ANSI C63.26-2015

KDB 971168 D01 v03r01

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4 General Information

4.1 Details of E.U.T.

Product Name:	Remote Radio Unit
Model No.:	RU4370
Trade Mark:	BTI
Antenna Type:	External Antenna
Antenna Gain:	Max Antenna Gain 15.0 dBi(Provided by manufacturer)
Power Supply:	48V DC, ±20%
Test Voltage	DC 48V
Max Power Consumption:	150W
Sample Type:	Fixed device
CBSD Class:	Category B CBSD (Base Station)
Transmitter Frequency Band:	LTE Band 48
Support Bandwidth:	20MHz
Maximum Number of Supported Carriers:	1 Carrier
Type of Modulation	QPSK/16QAM/64QAM
Frequency Band:	3550MHz-3700MHz
Normal Output Power:	For SISO Mode: 30±2dBm (downlink) For MIMO Mode: 32±2dBm (downlink)
MIMO Type:	4T4R MIMO

4.2 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
Note Book	LENOVO	Y510P	SZSMT55INP141501639
Base Band Unit	BTI	sCELL-T4000	/
Wireless Router	Smawave	CP860	/

Configuration	Carrier	Carrier Bandwidth (MHz)	Carrier Frequency Configuration (MHz)		
			Bottom	Middle	High
LTE TDD Band 48	1	20	3560	3625	3690

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4.3 Measurement Uncertainty

No.	Item	Measurement Uncertainty
1	Radio Frequency	± 7.25 x 10^{-8}
2	Occupied Bandwidth	± 3%
3	Conduction emission	± 3.0dB (150kHz to 30MHz)
4	RF conducted power	± 0.75dB
5	RF power density	± 2.84dB
6	Conducted Spurious emissions	± 0.75dB
7	RF Radiated power	± 4.5dB (Below 1GHz)
		± 4.8dB (Above 1GHz)
8	Radiated Spurious emission test	± 4.5dB (Below 1GHz)
		± 4.8dB (Above 1GHz)
9	Temperature test	± 1°C
10	Humidity test	± 3%
11	Supply voltages	± 1.5%
12	Time	± 3%

Remark:

The U_{lab} (lab Uncertainty) is less than U_{cispr} (CISPR Uncertainty), so the test results

- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

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4.4 Test Location

All tests were performed at:

Compliance Certification Services (Kunshan) Inc.

No.10 Weiye Rd, Innovation park, Eco&Tec, Development Zone, Kunshan City, Jiangsu, China.

Tel: +86 512 5735 5888 Fax: +86 512 5737 0818

No tests were sub-contracted.

4.5 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **CNAS (No. CNAS L4354)**

CNAS has accredited Compliance Certification Services (Kunshan) Inc. to ISO/IEC 17025:2017 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

- **A2LA (Certificate No. 2541.01)**

Compliance Certification Services (Kunshan) Inc. is accredited by the American Association for Laboratory Accreditation (A2LA). Certificate No. 2541.01.

- **FCC (Designation Number: CN1172)**

Compliance Certification Services Inc. has been recognized as an accredited testing laboratory.

Designation Number: CN1172.

- **ISED (CAB Identifier: CN0072)**

Compliance Certification Services (Kunshan) Inc. has been recognized by Innovation, Science and Economic Development (ISED) Canada as an accredited testing laboratory.

CAB Identifier: CN0072.

- **VCCI (Member No.: 1938)**

The 3m and 10m Semi-anechoic chamber and Shielded Room of Compliance Certification Services (Kunshan) Inc. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-20134, C-11707, T-11499, G-10216 respectively.

4.6 Deviation from Standards

None

4.7 Abnormalities from Standard Conditions

None

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5 Equipment List

Item	Equipment	Manufacturer	Model	Serial Number	Cal Date	Cal. Due Date
RF Conducted Test						
1	Spectrum Analyzer	Agilent	E4446A	MY44020154	04/16/2021	04/15/2022
2	Spectrum Analyzer	Keysight	N9020A	MY55370209	10/11/2021	10/10/2022
3	Spectrum Analyzer	Keysight	N9010A	MY56480443	02/01/2021	01/31/2022
4	Signal Generator	Agilent	N5182A	MY50142015	08/27/2021	08/26/2022
5	Spectrum Analyzer	R&S	FSV40	101493	10/11/2021	10/10/2022
6	Radio Communication Test Station	Anritsu	MT8000A	6262012849	N/A	N/A
7	Radio Communication Analyzer	Anritsu	MT8821C	6201692222	N/A	N/A
8	Universal Radio Communication Tester	R&S	CMW500	159275	10/12/2021	10/11/2022
9	Universal Radio Communication Tester	R&S	CMW500	167239	04/16/2021	04/15/2022
10	Power Meter	Anritsu	ML2495A	1445010	04/15/2021	04/14/2022
11	Switcher	CCSRF	FY562	KUS2001M001-3	10/12/2021	10/11/2022
12	AC Power Source	EXTECH	6605	1570106	N.C.R	N.C.R
13	DC Power Supply	Aglient	E3632A	MY50340053	N.C.R	N.C.R
14	6dB Attenuator	Mini-Circuits	NAT-6-2W	15542-1	N.C.R	N.C.R
15	Power Divider	AISI	IOWOPE2068	PE2068	N.C.R	N.C.R
16	Filter	MICRO-TRONICS	BRM50701	5	N.C.R	N.C.R
17	Conducted test cable	/	RF01-RF04	/	04/15/2021	04/14/2022
18	Software	BST	TST-PASS	N/A	N/A	N/A
19	Temp. / Humidity Chamber	TERCHY	MHK-120AK	X30109	04/15/2021	04/14/2022
20	Thermometer	Anymetre	TH603	CCS007	10/14/2021	10/13/2022
RF Radiated Test						
1	Spectrum Analyzer	R&S	FSV40	101493	10/11/2021	10/10/2022
2	Signal Generator	Agilent	E8257C	MY43321570	10/18/2021	10/17/2022
3	Loop Antenna	Schwarzbeck	HXYZ9170	9170-108	02/22/2021	02/21/2022
4	Bilog Antenna	TESEQ	CBL 6112D	35403	06/21/2021	06/20/2023
5	Bilog Antenna	SCHWARZBECK	VULB9160	9160-3342	04/13/2021	04/12/2023
6	Horn-antenna(1-18GHz)	Schwarzbeck	BBHA9120D	267	10/26/2020	10/25/2022
7	Horn-antenna(1-18GHz)	ETS-LINDGREN	3117	00143290	02/22/2021	02/21/2023
8	Horn Antenna(18-40GHz)	Schwarzbeck	BBHA9170	BBHA9170171	02/22/2021	02/21/2022
9	Pre-Amplifier(30MHz~18GHz)	LNA	/	/	04/15/2021	04/14/2022
10	Amplifier(18~40GHz)	COM-POWER	PAM-840A	461332	10/18/2021	10/17/2022
11	Low Pass Filter	MICRO-TRONICS	VLFX-950	RV142900829	N.C.R	N.C.R
12	High Pass Filter	Mini-Circuits	VHF-1200	15542	N.C.R	N.C.R
13	Filter (5450MHz～5770 MHz)	MICRO-TRONICS	BRC50704-01	2	N.C.R	N.C.R
14	Filter (5690 MHz～5930 MHz)	MICRO-TRONICS	BRC50705-01	4	N.C.R	N.C.R
15	Filter (5150 MHz～5350 MHz)	MICRO-TRONICS	BRC50703-01	2	N.C.R	N.C.R
16	Filter (885 MHz～915 MHz)	MICRO-TRONICS	BRM14698	1	N.C.R	N.C.R
17	Filter (815 MHz～860 MHz)	MICRO-TRONICS	BRM14697	1	N.C.R	N.C.R
18	Filter (1745 MHz～1910 MHz)	MICRO-TRONICS	BRM14700	1	N.C.R	N.C.R
19	Filter (1922 MHz～1977 MHz)	MICRO-TRONICS	BRM50715	1	N.C.R	N.C.R
20	Filter (2550 MHz)	MICRO-TRONICS	HPM13362	5	N.C.R	N.C.R

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21	Filter (1532 MHz～1845 MHz)	MICRO-TRONICS	BRM50713	1	N.C.R	N.C.R
22	Filter (2.4GHz)	MICRO-TRONICS	BRM50701	5	N.C.R	N.C.R
23	RE test cable	/	RE01-RE04	/	04/15/2021	04/14/2022
24	Software	Faratronic	EZ_EMC-v 3A1	N/A	N/A	N/A

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6 Test Results

6.1 Test conditions

Input voltage:	AC 120V	
Test voltage	Normal	AC 120V
	Extreme	AC 102V ~ AC 138V
Operating Environment:		
Test Temperature:	Normal	22°C ~ 26°C
	Extreme	-40 ~ 55°C
Humidity:	46% ~ 56% RH	
Atmospheric Pressure:	990 ~ 1005mbar	
Test Requirement:	The RF output power of the EUT was measured at the antenna port, by adjusting the input power of signal generator to drive the EUT to get to maximum output power point and keep the EUT at maximum gain setting for all tests. The device should be tested on downlink.	
	For detail test Modulation and Frequency, please refer to 7.2.	

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6.2 Test Procedure & Measurement Data

6.2.1 Power, PSD and Peak to Average Power Ratio

Test Requirement: 47 CFR Part 96.41(b)(c)(g) 2.1046

Test Method: ANSI C63.26:2015

Limit: Maximum effective isotropic radiated power (EIRP): 47dBm/10MHz
Maximum Power Spectral Density (PSD): 37dBm/MHz
Peak to Average Ratio: ≤13 dB

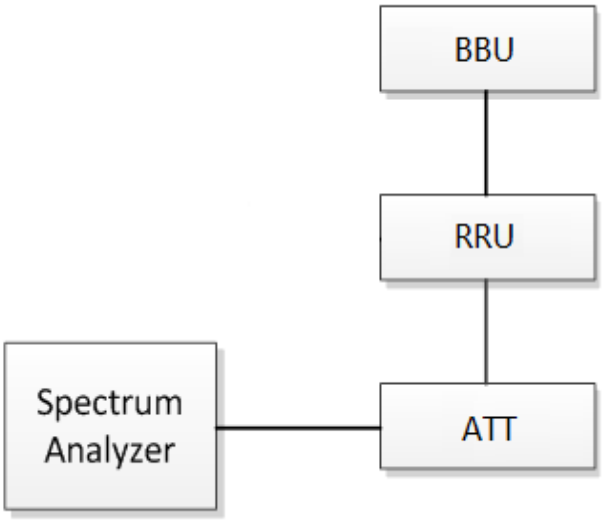
EUT Operation:

Status: Drive the EUT to maximum output power.

Conditions: Normal conditions

Application: Cellular Band RF output ports

Test Configuration:



Test Procedure: Measurements were performed with a Spectrum Analyzer using the Band Power measurement function. The detector was set to RMS with an RBW of at least 1% of the carrier bandwidth and a VBW of at least 3 times the RBW.

The integration bandwidth was configured to be 10MHz as defined in 96.41(b). Where the carrier width was greater than 10MHz, the integration bandwidth was moved to the region with the highest PSD to find the maximum band power.

For PSD measurements in a 1MHz bandwidth, an RMS detector was used with a single sweep. The highest PSD was established over the entire emission bandwidth and the result recorded.

The measured results were summed in accordance with FCC KDB 662911 to account for 4 ports MIMO operation.

CCDF measurements were carried out in accordance with ANSI C63.26 Clause 5.2.3.4.

6.2.1.1 Measurement Record:

Mode	Operation Band	Channel Bandwidth (MHz)	Frequency (MHz)	Modulation	Ant Port	Power (dBm)	Power (dBm/10 MHz)	PSD (dBm/MHz)
SISO								
LTE TDD Band 48	3550 ~ 3700MHz	20	3560	64QAM	1	29.26	26.43	17.17
					2	/	/	/
					3	/	/	/
					4	/	/	/
					Total	29.26	26.43	17.17
		Antenna gain				15.0dBi		
		EIRP				44.26	41.43	32.17
		20	3625	64QAM	26.15	16.86	25.81	15.87
					2	/	/	/
					3	/	/	/
					4	/	/	/
					Total	29.00	26.15	16.86
		Antenna gain				15.0dBi		
		EIRP				44.00	41.15	31.86
		20	3690	64QAM	26.24	17.00	25.53	15.85
					2	/	/	/
					3	/	/	/
					4	/	/	/
					Total	29.05	26.24	17.00
		Antenna gain				15.0dBi		
		EIRP				44.05	41.24	32.00

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Mode	Operation Band	Channel Bandwidth (MHz)	Frequency (MHz)	Modulation	Ant Port	Power (dBm)	Power (dBm/10 MHz)	PSD (dBm/MHz)
MIMO								
LTE TDD Band 48	3550 ~ 3700MHz	20	3560	64QAM	1	28.01	25.24	16.03
					2	28.02	25.25	16.01
					3	27.93	25.14	15.90
					4	27.97	25.18	15.89
					Total	34.00	31.22	21.98
		Antenna gain				15.0dBi		
		EIRP				49.00	46.22	36.98
		20	3625	64QAM	1	28.08	25.27	16.02
					2	27.96	25.16	15.92
					3	27.93	25.13	15.93
					4	27.89	25.10	15.85
					Total	33.99	31.19	21.95
		Antenna gain				15.0dBi		
		EIRP				48.99	46.19	36.95
		20	3690	64QAM	1	28.09	25.27	16.02
					2	28.02	25.22	15.98
					3	27.87	25.07	15.87
					4	27.90	25.07	15.82
					Total	33.99	31.18	21.94
		Antenna gain				15.0dBi		
		EIRP				48.99	46.18	36.94

Remark:

1. The EUT supports SISO working mode. Each antenna can be used as SISO working port. We only present the worst result, the test data of ant 1 port.
2. This EUT also supports 4*4 MIMO.
3. The customer claims that the signal emitted by the antenna of their product is completely uncorrelated, so the antenna gain is 15dBi.
4. Initial pre-testing was carried out to determine the worst case modulation scheme by measuring the output power from QPSK, 16QAM and 64QAM on the middle channel of one antenna port. From the tests, it was determined that 64QAM was the worst case modulation scheme and was used for all testing.

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Mode	Operation Band	Frequency (MHz)	Modulation	Ant Port	PAPR (dB)	Limit (dB)
LTE TDD Band 48	3550 ~ 3700MHz	3560	64QAM	1	8.37	13.0
				2	8.43	13.0
				3	8.39	13.0
				4	8.25	13.0
		3625	64QAM	1	8.55	13.0
				2	8.29	13.0
				3	8.44	13.0
				4	8.36	13.0
		3690	64QAM	1	8.49	13.0
				2	8.24	13.0
				3	8.46	13.0
				4	8.31	13.0
Remark： Initial pre-testing was carried out to determine the worst case modulation scheme by measuring the output power from QPSK, 16QAM and 64QAM on the middle channel of one antenna port. From the tests, it was determined that 64QAM was the worst case modulation scheme and was used for all testing.						

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6.2.2 Occupied Bandwidth

Test Requirement: 47 CFR Part 96.41(e)(3) 2.1049

Test Method: ANSI C63.26:2015

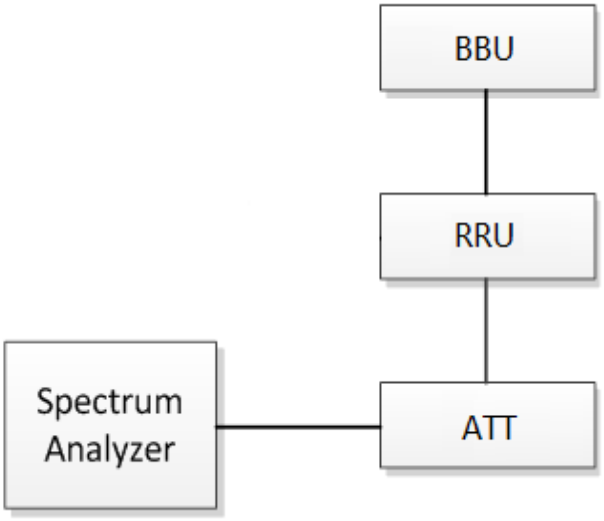
EUT Operation:

Status: Drive the EUT to maximum output power.

Conditions: Normal conditions

Application: RF output ports

Test Configuration:



Test Procedure: Using the Occupied Bandwidth measurement function in the spectrum analyzer, the 99% and 26dB bandwidth was measured in accordance with FCC KDB 971168 D01 v03r01 Clause 4.2.

6.2.2.1 Measurement Record:

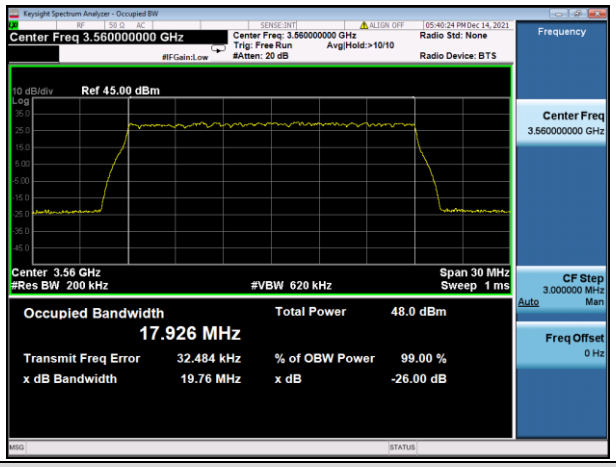
Antenna Port	Modulation	Bandwidth (MHz)	Frequency (MHz)	99% Occupied Bandwidth (MHz)	26dB Occupied Bandwidth (MHz)
1	64QAM	20	3560	17.926	19.760
			3625	17.908	19.420
			3690	17.937	19.150

Remark:

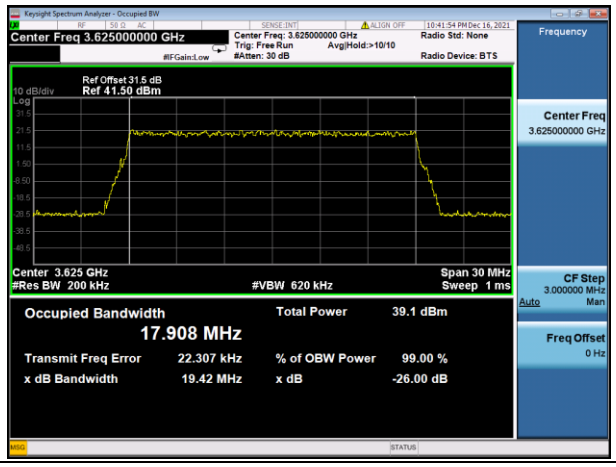
1. The EUT supports SISO and MIMO working mode. Each antenna can be used as SISO working port. We only present the worst result, the test data of ant 1 port.
2. Initial pre-testing was carried out to determine the worst case modulation scheme by measuring the output power from QPSK, 16QAM and 64QAM on the middle channel of one antenna port. From the tests, it was determined that 64QAM was the worst case modulation scheme and was used for all testing.

LTE TDD Band 48 _ BW 20MHz _ 64QAM

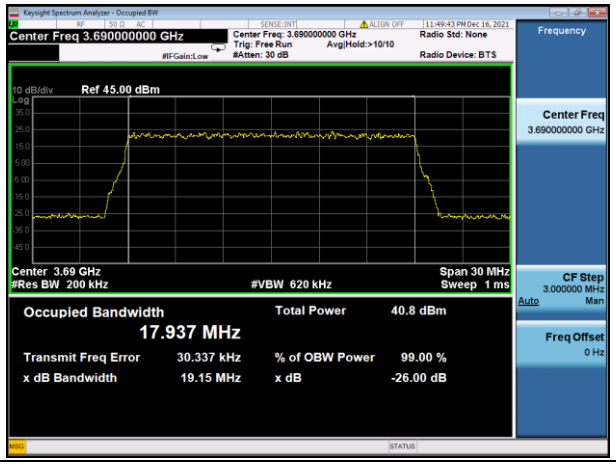
Bottom Channel 3560MHz



Middle Channel 3625MHz



Top Channel 3690MHz



6.2.3 Unwanted Emissions at Band Edge

Test Requirement: 47 CFR Part 96.41(e)(1) 2.1051

Test Method: ANSI C63.26:2015

Limit: Except as otherwise specified in paragraph (e)(2) of this section, for channel and frequency assignments made by the SAS to CBSDs, the conducted power of any emission outside the fundamental emission (whether in or outside of the authorized band) shall not exceed -13 dBm/MHz within 0-10 megahertz above the upper SAS-assigned channel edge and within 0-10 megahertz below the lower SAS-assigned channel edge.

At all frequencies greater than 10 megahertz above the upper SAS assigned channel edge and less than 10 MHz below the lower SAS assigned channel edge, the conducted power of any emission shall not exceed -25 dBm/MHz.

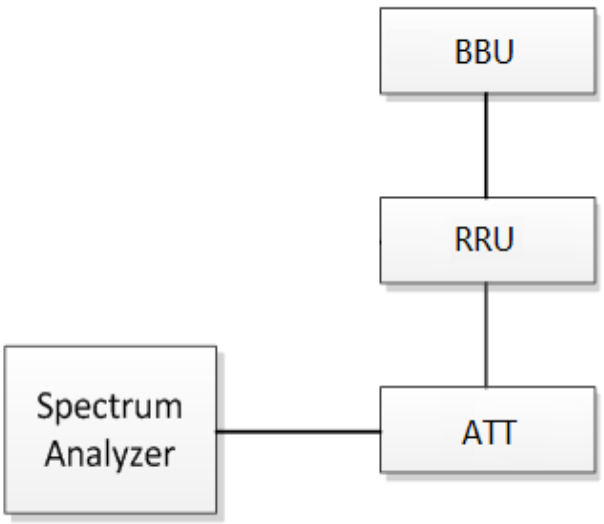
EUT Operation:

Status: Drive the EUT to maximum output power.

Conditions: Normal conditions

Application: Cellular Band RF output ports

Test Configuration:



Test Procedure: All measurements were made according with KDB 971168 D01 v03r01.

For MIMO mode configurations, the limit was adjusted with a correction of -6dB [10Log(1/4)] by using the Measure and Add 10Log(N) dB technique according to KDB 662911 D01 Multiple Transmitter Output accounting for simultaneous transmission from antenna ports .

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 and a RBW of 1MHz for measurements of emissions > 1MHz away from the band edges.

Spectrum analyzer detector was set as RMS.

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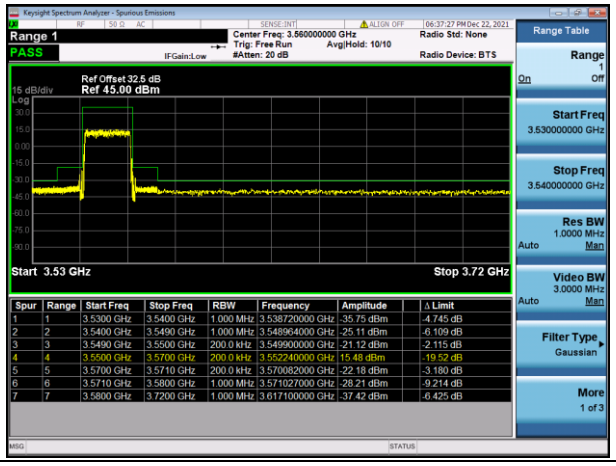
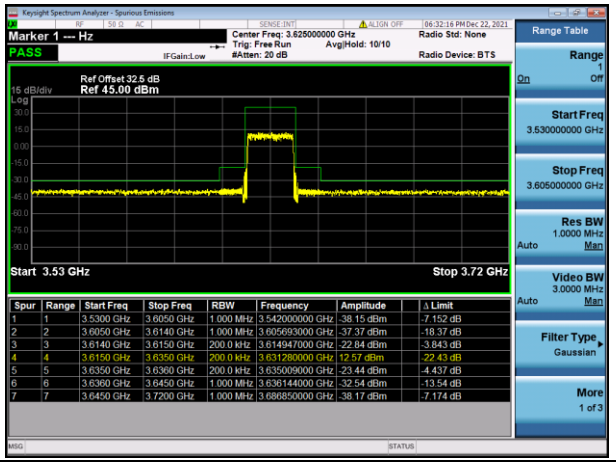
6.2.3.1 Measurement Record:

Antenna Port	Modulation	Bandwidth (MHz)	Frequency (MHz)	Result
1	64QAM	20	3560	Pass
			3625	Pass
			3690	Pass

Remark:

1. The EUT supports SISO and MIMO working mode. Each antenna can be used as SISO working port. We only present the worst result, the test data of ant 1 port.
2. This EUT supports 4*4 MIMO, since we only presented the results of a test port of the worst, so we subtract the limit 10 * log (4).
3. Initial pre-testing was carried out to determine the worst case modulation scheme by measuring the output power from QPSK, 16QAM and 64QAM on the middle channel of one antenna port. From the tests, it was determined that 64QAM was the worst case modulation scheme and was used for all testing.
4. In the 1 megahertz bands immediately outside and adjacent to the licensee's authorized frequency channel, a resolution bandwidth of no less than one percent of the fundamental emission bandwidth may be employed.

LTE TDD Band 48 _ BW 20MHz _ 64QAM	
Bottom Channel 3560MHz	Middle Channel 3625MHz
	

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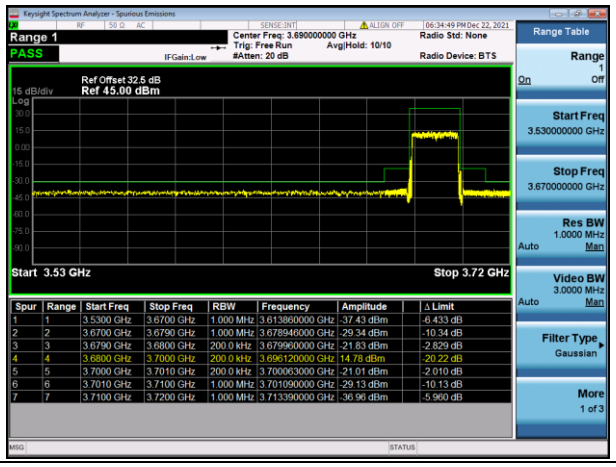
LTE TDD Band 48 _ BW 20MHz _ 64QAM	
Top Channel 3690MHz	
	

Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	3.5300 GHz	3.6700 GHz	1.000 MHz	3.613860000 GHz	-37.43 dBm	-6.433 dB
2	2	3.6700 GHz	3.6790 GHz	1.000 MHz	3.678946000 GHz	-29.34 dBm	-10.34 dB
3	3	3.6790 GHz	3.6800 GHz	200.0 kHz	3.679960000 GHz	-21.83 dBm	-2.829 dB
4	4	3.6800 GHz	3.7000 GHz	200.0 kHz	3.696120000 GHz	14.78 dBm	-20.22 dB
5	5	3.7000 GHz	3.7010 GHz	200.0 kHz	3.700063000 GHz	-21.01 dBm	-2.010 dB
6	6	3.7010 GHz	3.7100 GHz	1.000 MHz	3.701090000 GHz	-29.13 dBm	-10.13 dB
7	7	3.7100 GHz	3.7200 GHz	1.000 MHz	3.713390000 GHz	-36.96 dBm	-5.960 dB

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6.2.4 Conducted Unwanted Emission

Test Requirement: 47 CFR Part 96.41(e)(2) 2.1051

Test Method: ANSI C63.26:2015

Limit: The conducted power of any emissions below 3530 MHz or above 3720 MHz shall not exceed -40dBm/MHz.

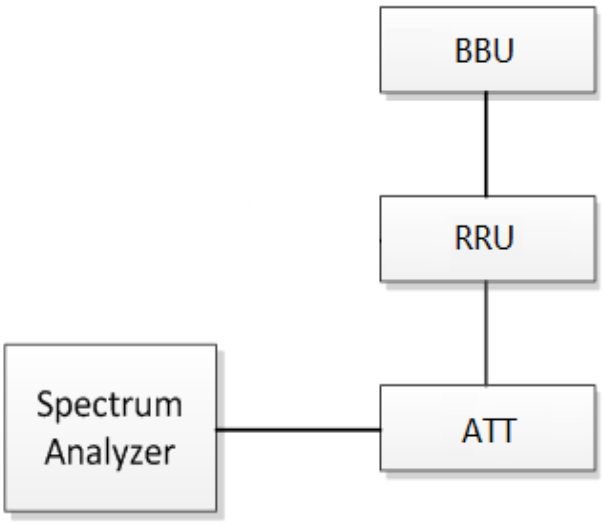
EUT Operation:

Status: Drive the EUT to maximum output power.

Conditions: Normal conditions

Application: Enclosure

Test Configuration:



Test Procedure: All measurements were made according with KDB 971168 D01 v03r01.

For MIMO mode configurations, the limit was adjusted with a correction of -6dB [10*Log(1/4)] by using the Measure and Add 10Log(N) dB technique according to KDB 662911 D01 Multiple Transmitter Output accounting for simultaneous transmission from antenna ports.

The detector of the Spectrum analyzer was set as RMS, the RBW was set as 1MHz, the VBW was set as 3MHz.

6.2.4.1 Measurement Record:

Antenna Port	Modulation	Bandwidth (MHz)	Frequency (MHz)	Frequency Range (MHz)	Worst Level (dBm)	Limit (dBm)	Result
1	64QAM	20	3560	0.009-0.150	-53.196	-46.02	Pass
				0.150-10	-55.140	-46.02	Pass
				10-30	-60.409	-46.02	Pass
				30-1000	-48.254	-46.02	Pass
				1000-3530	-47.952	-46.02	Pass
				3720-5000	-47.430	-46.02	Pass
				5000-12750	-48.777	-46.02	Pass
				12750-16000	-50.948	-46.02	Pass
				16000-26000	-51.878	-46.02	Pass
				26000-40000	-55.430	-46.02	Pass
			3625	0.009-0.150	-52.769	-46.02	Pass
				0.150-10	-53.244	-46.02	Pass
				10-30	-60.033	-46.02	Pass
				30-1000	-48.457	-46.02	Pass
				1000-3530	-47.916	-46.02	Pass
				3720-5000	-48.834	-46.02	Pass
				5000-12750	-49.174	-46.02	Pass
				12750-16000	-50.127	-46.02	Pass
				16000-26000	-52.589	-46.02	Pass
				26000-40000	-56.380	-46.02	Pass
			3690	0.009-0.150	-53.304	-46.02	Pass
				0.150-10	-54.138	-46.02	Pass
				10-30	-60.618	-46.02	Pass
				30-1000	-47.527	-46.02	Pass
				1000-3530	-48.144	-46.02	Pass
				3720-5000	-47.517	-46.02	Pass
				5000-12750	-48.606	-46.02	Pass
				12750-16000	-50.838	-46.02	Pass
				16000-26000	-51.827	-46.02	Pass
				26000-40000	-56.390	-46.02	Pass

Remark:

1. The EUT supports SISO and MIMO working mode. Each antenna can be used as SISO working port. We only present the worst result, the test data of ant 1 port.
2. This EUT supports 4*4 MIMO, since we only presented the results of a test port of the worst, so we subtract the limit 10 * log (4).
3. Initial pre-testing was carried out to determine the worst case modulation scheme by measuring the output power from QPSC, 16QAM and 64QAM on the middle channel of one antenna port. From the tests, it was determined that 64QAM was the worst case modulation scheme and was used for all testing.

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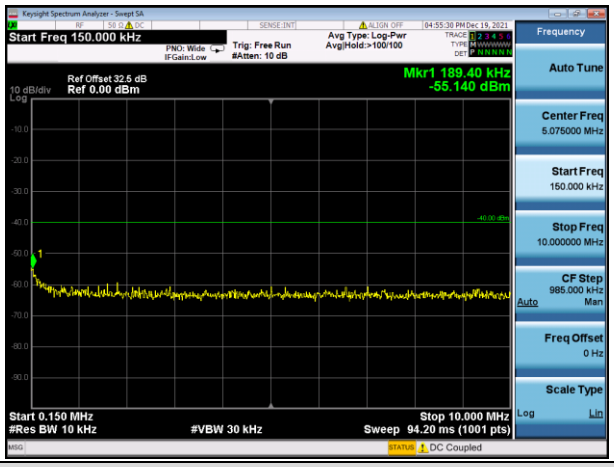
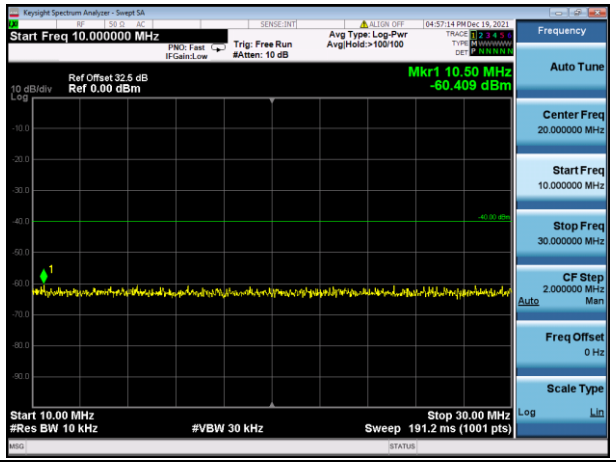
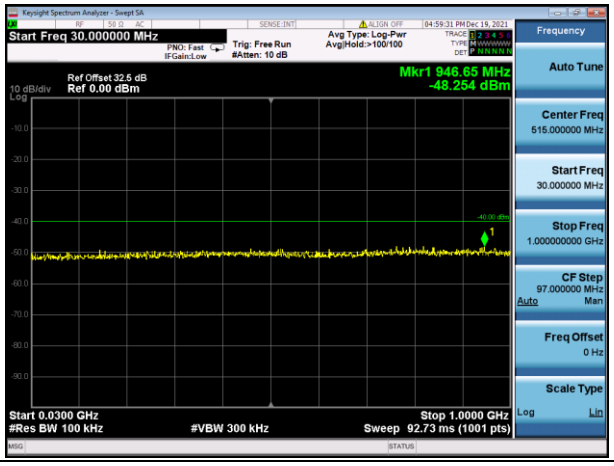
4. In the 1 megahertz bands immediately outside and adjacent to the licensee's authorized frequency channel, a resolution bandwidth of no less than one percent of the fundamental emission bandwidth may be employed.

LTE TDD Band 48 _ BW 20MHz _ 64QAM	
Bottom Channel 3560MHz	
0.009-0.150	0.150-10
	
10-30	30-1000
	

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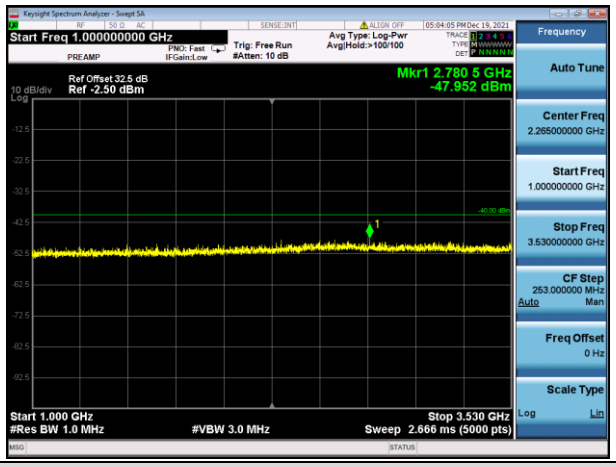
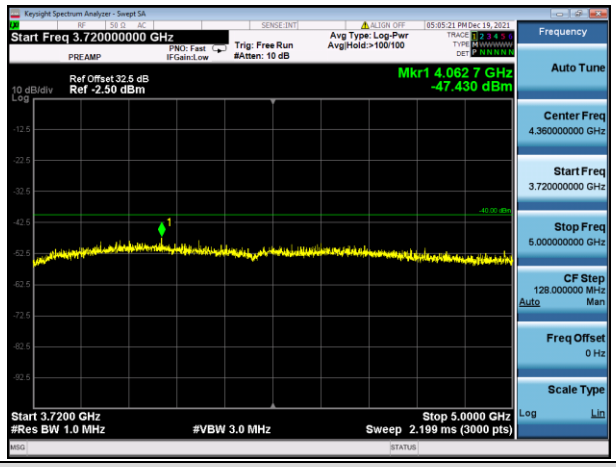
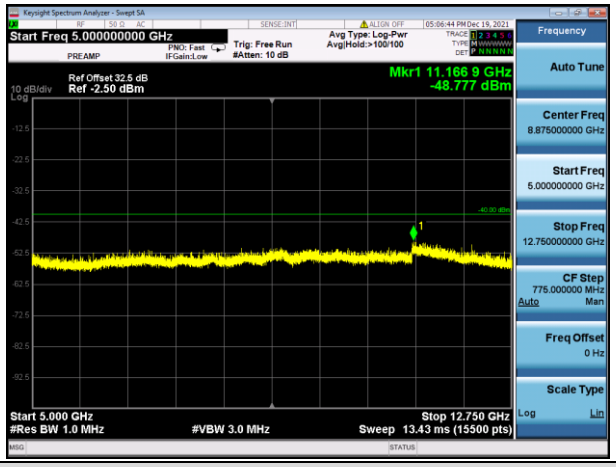
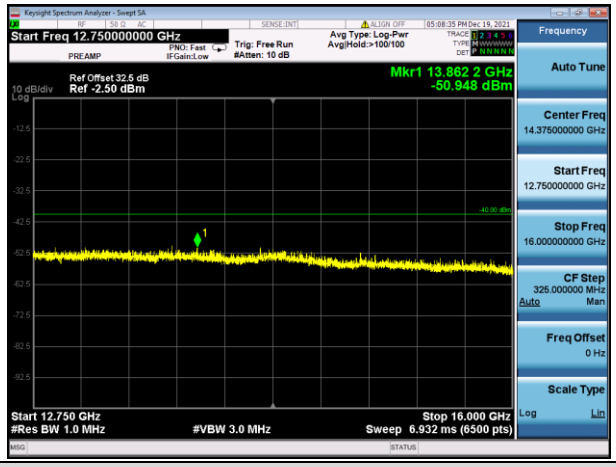
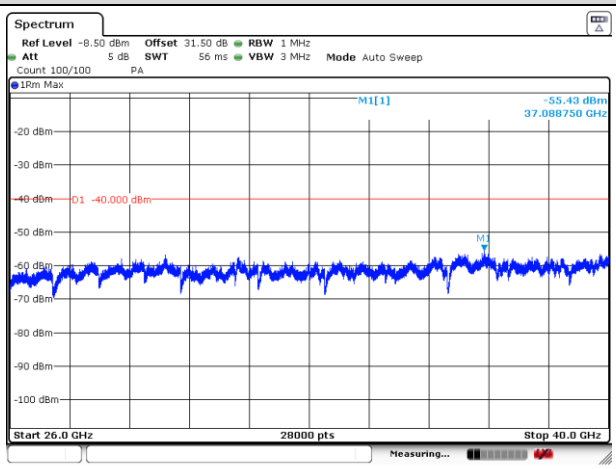
Bottom Channel 3560MHz	
1000-3530	3720-5000
	
5000-12750	12750-16000
	
16000-26000	26000-40000
	

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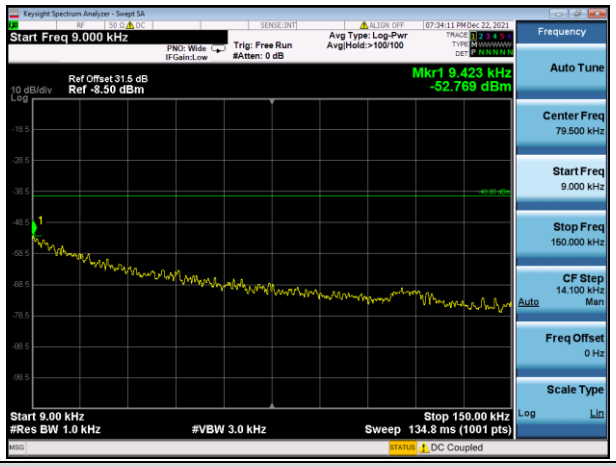
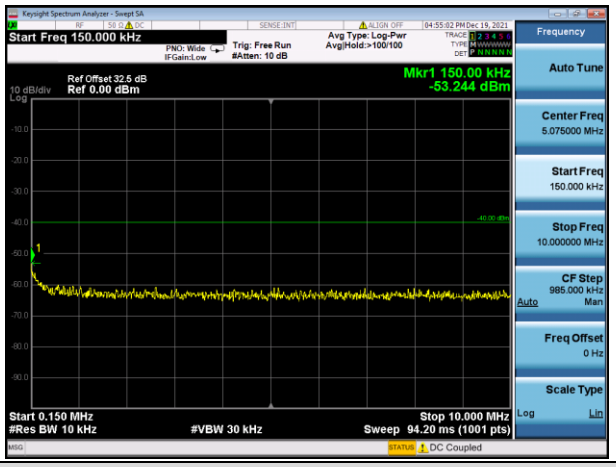
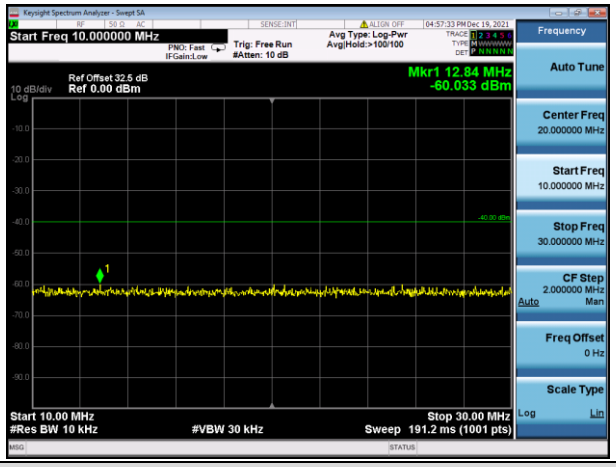
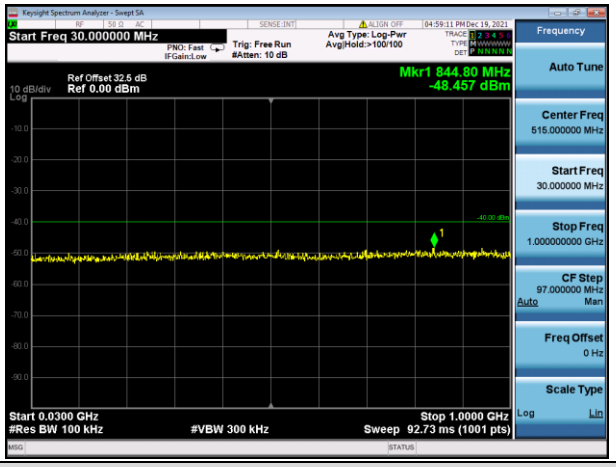
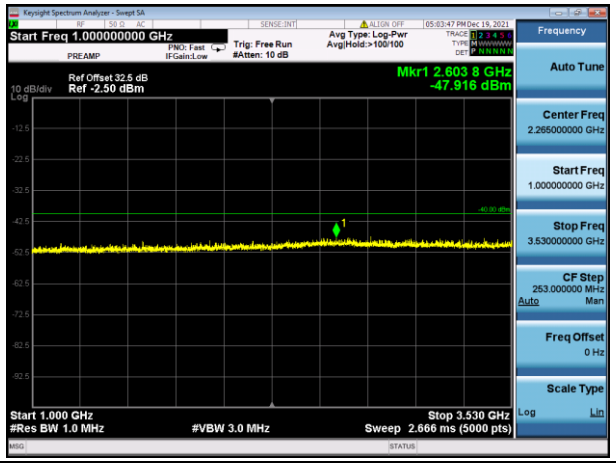
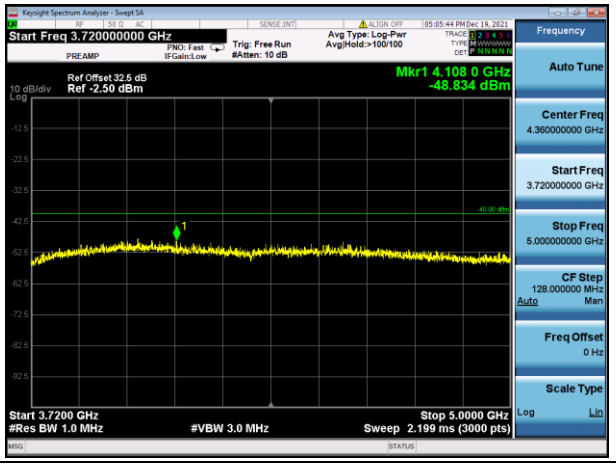
LTE TDD Band 48 _ BW 20MHz _ 64QAM	
Middle Channel 3625MHz	
0.009-0.150	0.150-10
	
10-30	30-1000
	
1000-3530	3720-5000
	

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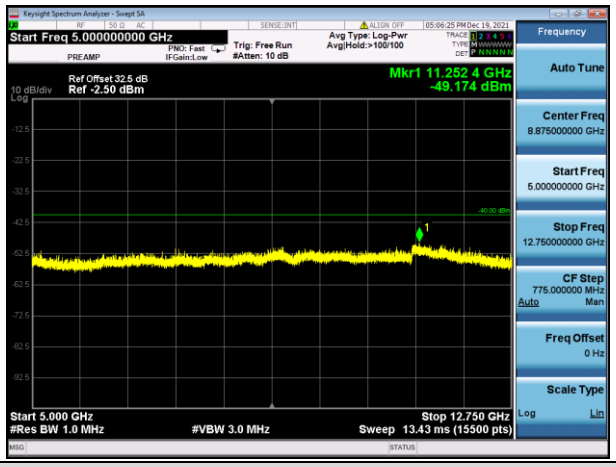
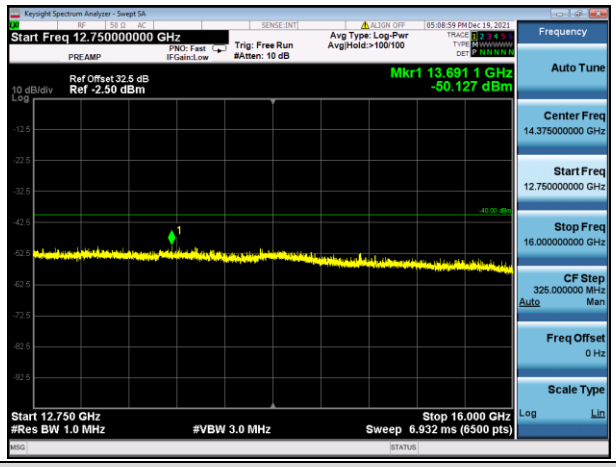
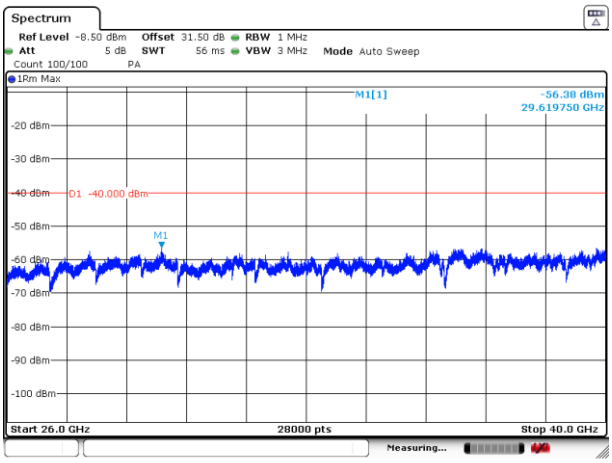
Middle Channel 3625MHz	
5000-12750	12750-16000
	
16000-26000	26000-40000
	

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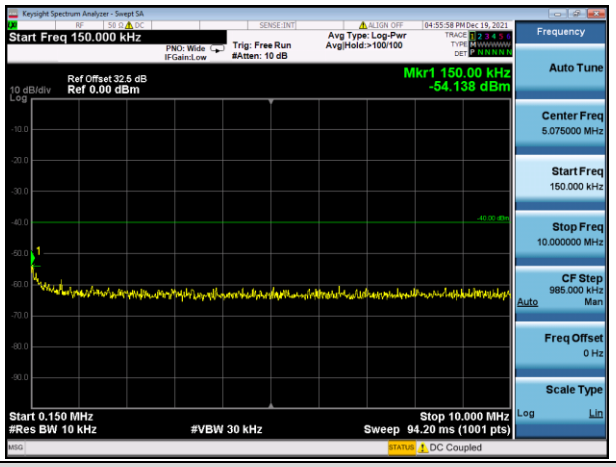
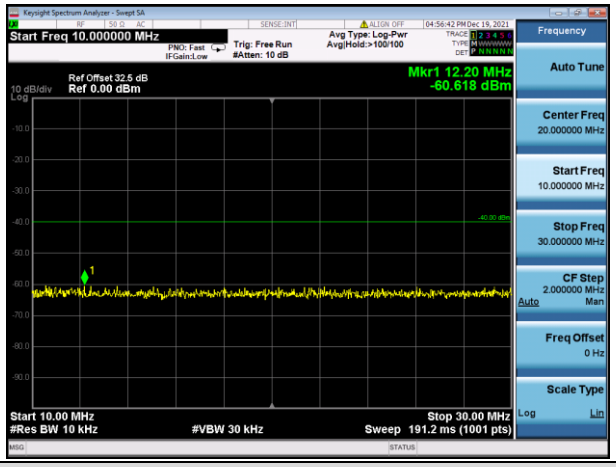
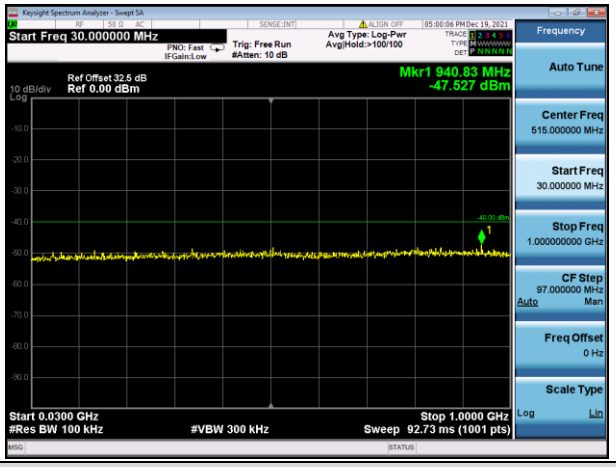
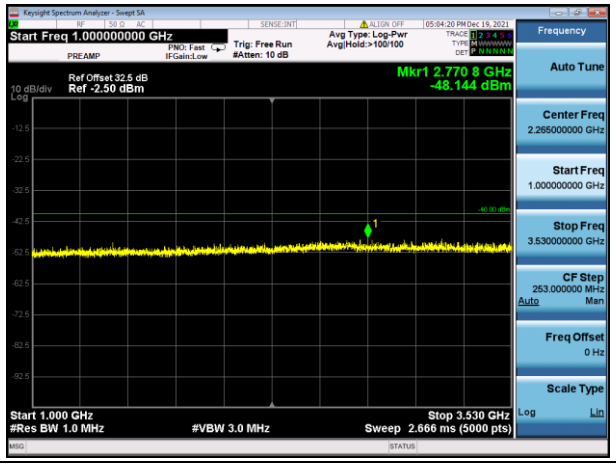
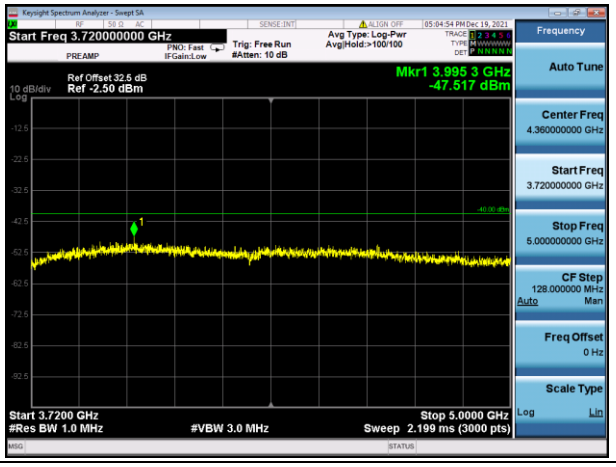
LTE TDD Band 48 _ BW 20MHz _ 64QAM	
Top Channel 3690MHz	
0.009-0.150	0.150-10
	
10-30	30-1000
	
1000-3530	3720-5000
	

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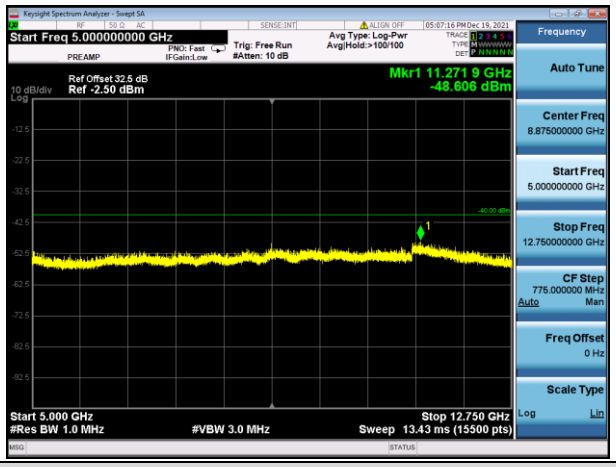
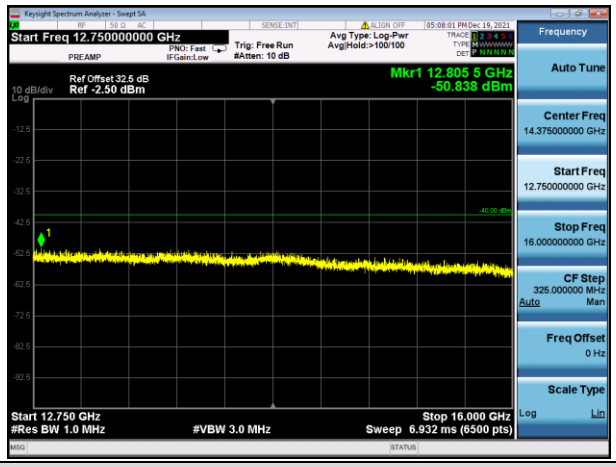
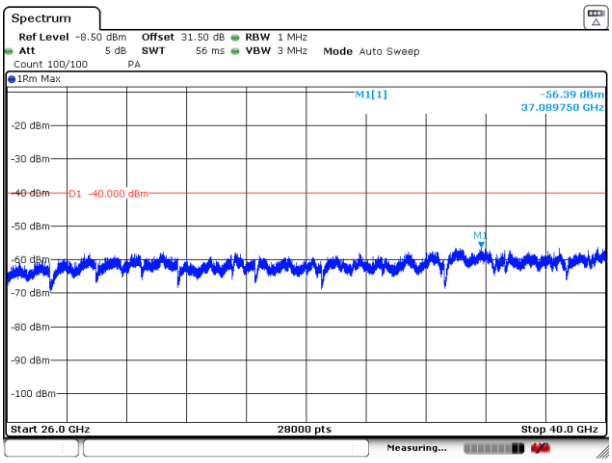
Top Channel 3690MHz	
5000-12750	12750-16000
	
16000-26000	26000-40000
	

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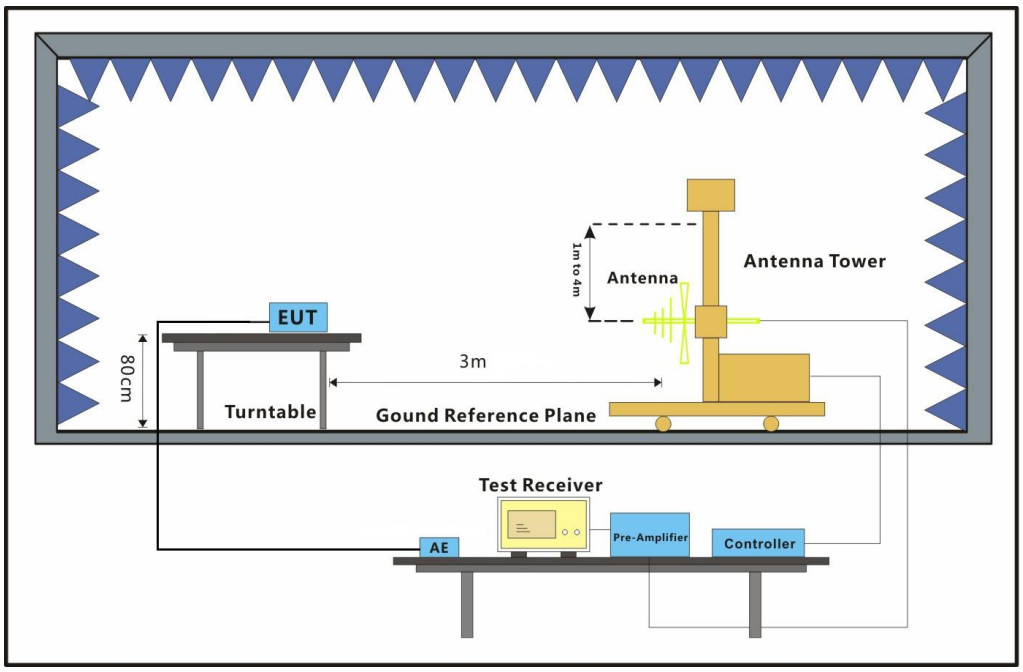
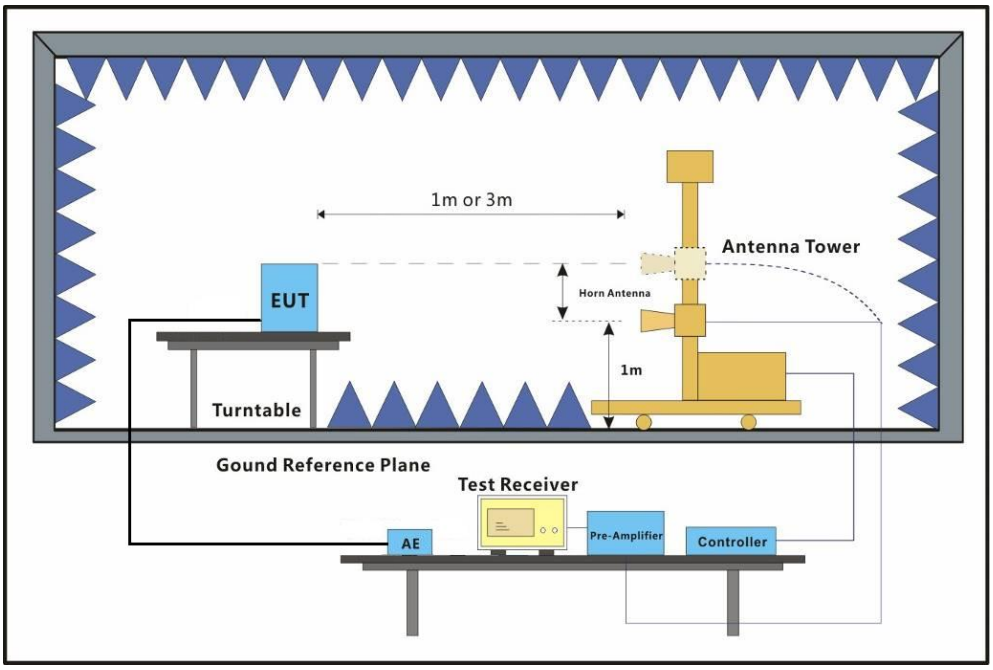
6.2.5 Radiated Unwanted Emission

Test Requirement:	47 CFR Part 96.41(e)(1)(2) 2.1053
Test Method:	ANSI C63.26:2015
Limit:	As per FCC Part 96, at all frequencies greater than 10 megahertz above the upper SAS assigned channel edge and less than 10 MHz below the lower SAS assigned channel edge, the conducted power of any emission shall not exceed −25 dBm/MHz. In addition, the power of any emissions below 3530 MHz or above 3720 MHz shall not exceed −40dBm/MHz.
EUT Operation:	
Status:	Drive the EUT to maximum output power.
Conditions:	Normal conditions
Application:	RF output ports
Test Configuration:	

30MHz to 1GHz emissions:



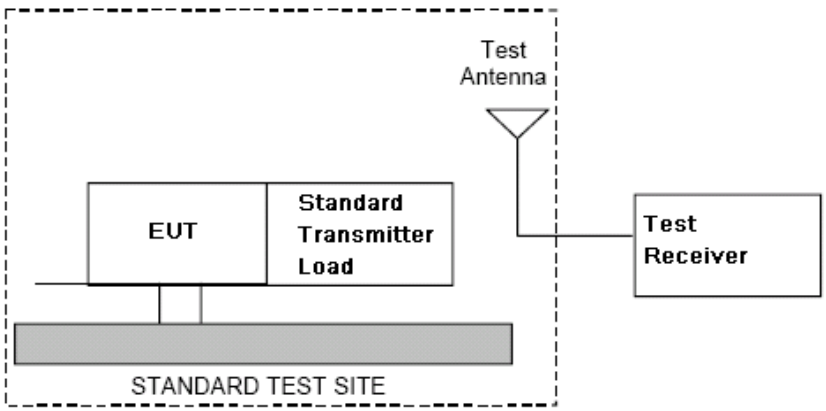
1GHz to 40GHz emissions:



Test Procedure:

1. Test the background noise level with all the test facilities;
2. Keep one transmitting path, all other connectors shall be connected by normal power or RF leads;
3. Select the suitable RF notch filter to avoid the test receiver or spectrum analyzer produce unwanted spurious emissions;
4. Keep the EUT continuously transmitting in max power;
5. Read the radiated emissions of the EUT enclosure.

Radiated Emissions Test Procedure:



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a) Connect the equipment as illustrated.

b) Adjust the spectrum analyzer for the following settings:

1) Resolution Bandwidth = 100 kHz for spurious emissions below 1 GHz, and 1 MHz for spurious emissions above 1GHz.

2) Video Bandwidth = 300 kHz for spurious emissions below 1 GHz, and 3 MHz for spurious emissions above 1 GHz.

3) Sweep Speed slow enough to maintain measurement calibration.

4) Detector Mode = Positive Peak.

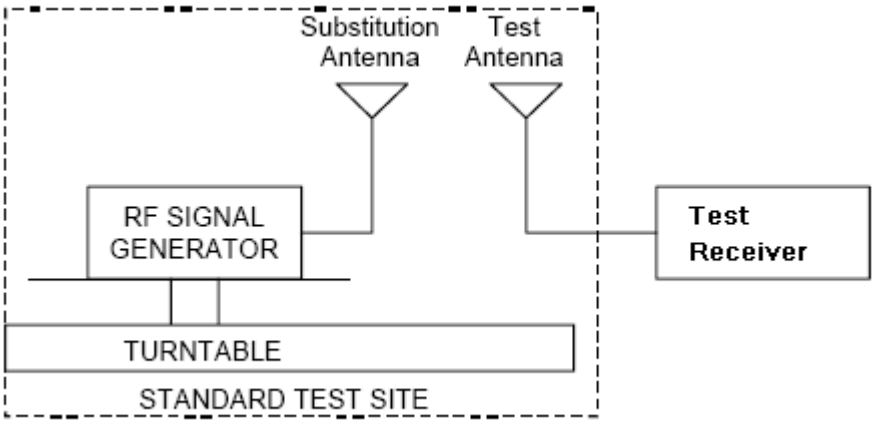
c) Place the transmitter to be tested on the turntable in the standard test site, The transmitter is transmitting into a no radiating load that is placed on the turntable. The RF cable to this load should be of minimum length.

d) Measurements shall be made from30MHz to 10 times of fundamental carrier, except for the region close to the carrier equal to ± the carrier bandwidth.

e) Key the transmitter without modulation or normal modulation base the standard.

f) For each spurious frequency, raise and lower the test antenna from 1 m to 4 m to obtain a maximum reading on the spectrum analyzer with the test antenna at horizontal polarity. Then the turntable should be rotated 360° to determine the maximum reading. Repeat this procedure to obtain the highest possible reading. Record this maximum reading.

g) Repeat step f) for each spurious frequency with the test antenna polarized vertically.



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h) Reconnect the equipment as illustrated.

i) Keep the spectrum analyzer adjusted as in step b).

j) Remove the transmitter and replace it with a substitution antenna (the antenna should be half-wavelength for each frequency involved). The center of the substitution antenna should be approximately at the same location as the center of the transmitter. At the lower frequencies, where the substitution antenna is very long, this will be impossible to achieve when the antenna is polarized vertically. In such case the lower end of the antenna should be 0.3 m above the ground.

k) Feed the substitution antenna at the transmitter end with a signal generator connected to the antenna by means of a no radiating cable. With the antennas at both ends horizontally polarized, and with the signal generator tuned to a particular spurious frequency, raise and lower the test antenna to obtain a maximum reading at the spectrum analyzer. Adjust the level of the signal generator output until the previously recorded maximum reading for this set of conditions is obtained. This should be done carefully repeating the adjustment of the test antenna and generator output.

l) Repeat step k) with both antennas vertically polarized for each spurious frequency.

m) Calculate power in dBm into a reference ideal half-wave dipole antenna by reducing the readings obtained in steps k) and l) by the power loss in the cable between the generator and the antenna, and further corrected for the gain of the substitution antenna used relative to an ideal half-wave dipole antenna by the following formula:

Pd(dBm) = *Pg*(dBm) - *cable loss* (dB) + *antenna gain* (dB)

where:

Pd is the dipole equivalent power and

Pg is the generator output power into the substitution antenna.

NOTE:

1) It is permissible to use other antennas provided they can be referenced to a dipole.

2) For below 1GHz signal, the *antenna gain* (dB) is dBd, and for above 1GHz signal, the *antenna gain* (dB) is dBi

3) Effective radiated power (e.r.p) refers to the radiation of a half wave tuned dipole instead of an isotropic antenna. There is a constant difference of 2.15 dB between e.i.r.p. and e.r.p.

e.r.p (dBm) = e.i.r.p. (dBm) - 2.15

4) For this test, the BBU are put outside of the chamber; connect to the RRU through the optical fiber.

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6.2.5.1 Measurement Record:

Low Channel					
Frequency	Spurious Emission Level			Limit	Over limit
(MHz)	(Deg)	Polaxis	(dBm)	dBm	(dB)
198.4	71.0	Horizontal	-51.3	-40.0	-11.3
520.6	79.0	Horizontal	-44.9	-40.0	-4.9
856.6	167.0	Horizontal	-41.9	-40.0	-1.9
2500.0	27.0	Horizontal	-47.9	-40.0	-7.9
6347.4	162.0	Horizontal	-43.0	-40.0	-3.0
11475.9	222.0	Horizontal	-41.6	-40.0	-1.6
110.4	67.0	Vertical	-49.4	-40.0	-9.4
455.6	223.0	Vertical	-43.6	-40.0	-3.6
715.7	340.0	Vertical	-44.7	-40.0	-4.7
2512.2	265.0	Vertical	-42.5	-40.0	-2.5
6364.0	304.0	Vertical	-42.9	-40.0	-2.9
12091.7	249.0	Vertical	-42.4	-40.0	-2.4

Middle Channel					
Frequency	Spurious Emission Level			Limit	Over limit
(MHz)	(Deg)	Polaxis	(dBm)	dBm	(dB)
121.6	122.0	Horizontal	-44.7	-40.0	-4.7
408.8	253.0	Horizontal	-48.0	-40.0	-8.0
732.4	81.0	Horizontal	-54.9	-40.0	-14.9
2503.3	24.0	Horizontal	-47.2	-40.0	-7.2
6341.3	89.0	Horizontal	-42.8	-40.0	-2.8
9657.5	44.0	Horizontal	-43.6	-40.0	-3.6
203.8	191.0	Vertical	-41.8	-40.0	-1.8
456.8	268.0	Vertical	-47.5	-40.0	-7.5
762.3	352.0	Vertical	-49.8	-40.0	-9.8
2522.6	14.0	Vertical	-43.1	-40.0	-3.1
6337.8	66.0	Vertical	-42.1	-40.0	-2.1
10874.7	100.0	Vertical	-41.5	-40.0	-1.5

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High Channel					
Frequency	Spurious Emission Level			Limit	Over limit
(MHz)	(Deg)	Polaxis	(dBm)	dBm	(dB)
160.3	264.0	Horizontal	-55.5	-40.0	-15.5
462.2	100.0	Horizontal	-47.5	-40.0	-7.5
761.0	97.0	Horizontal	-46.2	-40.0	-6.2
2498.9	95.0	Horizontal	-44.6	-40.0	-4.6
6353.9	93.0	Horizontal	-46.3	-40.0	-6.3
11560.0	205.0	Horizontal	-44.8	-40.0	-4.8
85.2	122.0	Vertical	-50.1	-40.0	-10.1
321.9	352.0	Vertical	-46.4	-40.0	-6.4
771.8	20.0	Vertical	-45.6	-40.0	-5.6
2511.8	29.0	Vertical	-41.3	-40.0	-1.3
6341.1	271.0	Vertical	-41.3	-40.0	-1.3
9892.6	230.0	Vertical	-42.4	-40.0	-2.4

Remark:

We only show the worst test result, which is the test of the external antenna with 50 ohm impedance.

No emissions were detected within 20dB below the limit for the Downlink direction.

The cabinet radiation was measured with the equipment transmitting a CW signal into a non-radiating 50 Ohm load at maximum output power on a signal frequency.

Measured were performed in the lowest, middle and highest frequency for the Downlink.

Initial pre-testing was carried out to determine the worst case modulation scheme by measuring the output power from QPSK, 16QAM and 64QAM on the middle channel of one antenna port. From the tests, it was determined that 64QAM was the worst case modulation scheme and was used for all testing

The spectrum was searched from 30MHz to 18GHz or 10th Harmonic for downlink.

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6.2.6 Frequency Stability

Test Requirement: 47 CFR Part 2.1055

Test Method: ANSI C63.26:2015

Limit: The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

EUT Operation:

Status: Drive the EUT to maximum output power.

Conditions: Temperature conditions, voltage conditions

Application: Cellular Band RF output ports

Test Procedure:

1. Temperature conditions:
   a) The RF output port of the EUT was connected to Frequency Meter;
   b) Set the working Frequency in the middle channel;
   c) record the 20°C and norminal voltage frequency value as reference point;
   d) vary the temperature from -40°C to 50°C with step 10°C
   e) when reach a temperature point, keep the temperature banlance at least 1 hour to make the product working in this status;
   f) read the frequency at the relative temperature.
2. Voltage conditions:
   a) record the 20°C and norminal voltage frequency value as reference point;
   b) vary the voltage from -15% norminal voltage to +15% voltage;
   c) read the frequency at the relative voltage.

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6.2.6.1 Measurement Record:

Frequency Stability vs temperature:

1. Test for 3550MHz to 3700MHz (middle channel=3625MHz)

Ant Port	Modulation	Temperature (°C)	Voltage (V dc)	Frequency Error (Hz)	Tolerance (ppm)
1	64QAM	50	48.0	60.50	0.0789
		40	48.0	61.92	0.0808
		30	48.0	1.84	0.0024
		20	48.0	29.92	0.0390
		10	48.0	8.84	0.0115
		0	48.0	45.73	0.0597
		-10	48.0	2.26	0.0029
		-20	48.0	26.85	0.0350
		-30	48.0	6.87	0.0090
		-40	48.0	1.01	0.0013

Frequency Stability vs voltage:

1. Test for 3550MHz to 3700MHz (middle channel=3625MHz)

Ant Port	Modulation	Voltage (V dc)	Temperature (°C)	Frequency Error (Hz)	Tolerance (ppm)
1	64QAM	40.8	20	35.19	0.0459
		48.0	20	47.08	0.0614
		55.2	20	36.70	0.0479

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7 Photographs - Test Setup

Please refer to test setup photo

8 Photographs - EUT Constructional Details

Please refer to external and internal photo

--The End of Report--

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