TEST REPORT

Product Name:	Cinterion PLS63-X2
Trade Mark:	CINTERION
Model No. / HVIN:	PLS63-X2
Report Number:	210127001RFM-2
Test Standards:	FCC 47 CFR Part 90 Subpart R
FCC ID:	QIPPLS63-X2
Test Result:	PASS
Date of Issue:	March 23, 2021

Prepared for:

Thales DIS AIS Deutschland GmbH
Siemensdamm 50, 13629 Berlin, Germany

Prepared by:

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Technical Director

Date: March 23, 2021

Version

Version No.	Date	Description
V1.0	March 23, 2021	Original

CONTENTS

1. GENERAL INFORMATION

1.1 CLIENT INFORMATION

Applicant:	Thales DIS AIS Deutschland GmbH
Address of Applicant:	Siemensdamm 50, 13629 Berlin, Germany
Manufacturer:	Thales DIS AIS Deutschland GmbH
Address of Manufacturer:	Werinherstr. 81, 81541 Munich, Germany

1.2 EUT INFORMATION

1.2.1 General Description of EUT

Product Name:	Cinterion PLS63-X2	
Model No.:	PLS63-X2	
Trade Mark:	CINTERION	
DUT Stage:	Production Unit	
EUT Supports Function:	E-UTRA Bands:	FDD Band 2/ Band 4/ Band 12/ Band 13/ Band 14/ Band 66
Original Sample Received Date:	August 25, 2020	
Original Sample Tested Date:	September 1, 2020 to September 24, 2020	
Original Sample Received Date:	October 19, 2020	
Original Sample Tested Date:	October 19, 2020 to October 26, 2020	
New Sample Received Date:	January 27, 2021	
New Sample Tested Date:	January 28, 2021 to February 7, 2021	

1.2.2 Description of Accessories

None.

1.3 PRODUCT SPECIFICATION SUBJECTIVE TO THIS STANDARD

Support Networks:	LTE		
Type of Modulation:	LTE Band 14:		UL:QPSK, 16QAM DL: QPSK, 16QAM
Frequency Range:	LTE Band 14 (Channel Bandwidth: 5 MHz):		790.5-795.5 MHz
	LTE Band 14 (Channel Bandwidth: 10 MHz):		793 MHz
Max RF Output Power:	LTE Band 14 (Channel Bandwidth: 5 MHz):		23.06 dBm
	LTE Band 14 (Channel Bandwidth: 10 MHz):		23.12 dBm
Type of Emission:	LTE Band 14 QPSK	Channel Bandwidth: 5 MHz	4M54G7D
		Channel Bandwidth: 10 MHz	8M98G7D
	LTE Band 14 16QAM	Channel Bandwidth: 5 MHz	4M54W7D
		Channel Bandwidth: 10 MHz	8M97W7D
Antenna Type:	External Antenna		
Antenna Gain:	50 ohm terminal (0 dBi)		
Normal Test Voltage:	3.8 Vdc		
Extreme Test Voltage:	3.2 to 4.5Vdc		
Extreme Test Temperature:	-30 °C to +65 °C		

1.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested with associated equipment below.

1) Support Equipment

Description	Manufacturer	Model No.	Serial Number	Supplied by
Adaptor	N/A	CD139	20359	Applicant
PCB board	N/A	DSB75	--	Applicant
PCB board	N/A	AH8	--	Applicant
50 ohm terminal	N/A	N/A	N/A	UnionTrust

2) Support Cable

Cable No.	Description	Connector	Length	Supplied by
--	--	--	--	--

1.5 TEST LOCATION

Shenzhen UnionTrust Quality and Technology Co., Ltd.

Address: Unit D/E of 9/F and 16/F, Block A, Building 6, Baoneng science and technology park, Longhua district, Shenzhen, China 518109
Telephone: +86 (0) 755 2823 0888
Fax: +86 (0) 755 2823 0886

1.6 TEST FACILITY

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

CNAS-Lab Code: L9069
The measuring equipment utilized to perform the tests documented in this report has been calibrated once a year or in accordance with the manufacturer's recommendations, and is traceable under the ISO/IEC/EN 17025 to international or national standards. Equipment has been calibrated by accredited calibration laboratories.

A2LA-Lab Certificate No.: 4312.01
Shenzhen UnionTrust Quality and Technology Co., Ltd. has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

ISED Wireless Device Testing Laboratories
CAB identifier: CN0032

FCC Accredited Lab.
Designation Number: CN1194
Test Firm Registration Number: 259480

1.7 DEVIATION FROM STANDARDS

None.

1.8 ABNORMALITIES FROM STANDARD CONDITIONS

None.

1.9 OTHER INFORMATION REQUESTED BY THE CUSTOMER

None.

1.10 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

No.	Item	Measurement Uncertainty
1	Conducted emission 9KHz-150KHz	±3.2 dB
2	Conducted emission 150KHz-30MHz	±2.7 dB
3	Radiated spurious emissions 30MHz-1GHz	± 4.9 dB
4	Radiated spurious emissions 1GHz-18GHz	± 4.8 dB
5	Radiated spurious emissions 18GHz-40GHz	± 5.1 dB
6	Occupied Bandwidth	± 1.86 %
7	DC Supply Voltages	± 0.68 %
8	Temperature	± 0.62 °C
9	Humidity	± 3.9 %
10	Conducted spurious emissions	± 2.7 dB
11	DC Supply Voltages	± 0.68 %
12	AC Supply Voltages	± 1.2 %
13	Radio Frequency	$\pm 6.5 \times 10^{-8}$
14	RF Power, Conducted	± 0.9 dB

2. TEST SUMMARY

FCC 47 CFR Part 90 Subpart R Test Cases			
Test Item	**Test Requirement**	**Test Method**	**Result**
Effective Radiated Power (ERP)	FCC 47 CFR Part 2.1046 & FCC 47 CFR Part 90.542(a)(7)	ANSI C63.26-2015 & KDB 971168 D01v03r01	See Note
Conducted Output Power	FCC 47 CFR Part 2.1046	ANSI C63.26-2015 & KDB 971168 D01v03r01	See Note
99%&26dB Bandwidth	FCC 47 CFR Part 2.1049	ANSI C63.26-2015 & KDB 971168 D01v03r01	See Note
Emission Mask	FCC 47 CFR Part 2.1051 & FCC 47 CFR Part 90.543	ANSI C63.26-2015 & KDB 971168 D01v03r01	See Note
Spurious emissions at antenna terminals	FCC 47 CFR Part 2.1051 & FCC 47 CFR Part 90.543	ANSI C63.26-2015 & KDB 971168 D01v03r01	See Note
Field strength of spurious radiation	FCC 47 CFR Part 2.1053 & FCC 47 CFR Part 90.543	ANSI C63.26-2015 & KDB 971168 D01v03r01	PASS
Frequency stability	FCC 47 CFR Part 2.1055 & FCC 47 CFR Part 90.539	ANSI C63.26-2015 & KDB 971168 D01v03r01	See Note
Peak-to-average power ratio (PAPR)	N/A	ANSI C63.26-2015 & KDB 971168 D01v03r01	See Note

Note:

Difference description:

1) There are hardware differences between PLS63-X2 and PLS63-X Module. For detailed PCB board and component differences, see the difference statement document
2) The UE Category level of PLS63-X2 and PLS63-X is 1

Test Plan:

1) According to the difference description, PLS63-X2 shares the same data from the PLS63-X original report(Report No.: 200722024RFM-3).
2) This report is based on the report of 200722024RFM-3,just update the operating frequency bands and Field strength of spurious radiation
3) The FCC ID of PLS63-X is QIPPLS63-X
4) The ISED NO. of PLS63-X is 7830A-PLS63X
5) The data of PLS63-X was used for PLS63-X2 as below:

Band	Test Item	Description
LTE Band 14	Effective Radiated Power (ERP)	Reuse
	Conducted Output Power	Reuse
	99%&26dB Bandwidth	Reuse
	Emission Mask	Reuse
	Spurious emissions at antenna terminals	Reuse
	Field strength of spurious radiation	Updated data
	Frequency stability	Reuse
	Peak-to-average power ratio (PAPR)	Reuse

3. EQUIPMENT LIST

Radiated Emission Test Equipment List						
Used	**Equipment**	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date (mm dd, yyyy)**	**Cal. Due date (mm dd, yyyy)**
☒	3M Chamber & Accessory Equipment	ETS-LINDGREN	3M	N/A	Dec. 03, 2018	Dec. 03, 2021
☒	Receiver	R&S	ESIB26	100114	Nov. 24, 2019	Nov. 23, 2020
					Nov. 18, 2020	Nov. 17, 2021
☐	Loop Antenna	ETS-LINDGREN	6502	00202525	Nov. 16, 2019	Nov. 15, 2020
					Nov. 14, 2020	Nov. 13, 2021
☒	Broadband Antenna	ETS-LINDGREN	3142E	00201566	Nov. 16, 2019	Nov. 15, 2020
					Nov. 14, 2020	Nov. 13, 2021
☒	6dB Attenuator	Talent	RA6A5-N-18	18103001	Nov. 16, 2019	Nov. 15, 2020
					Nov. 14, 2020	Nov. 13, 2021
☒	Preamplifier	HP	8447F	2805A02960	Nov. 24, 2019	Nov. 23, 2020
					Nov. 10, 2020	Nov. 09, 2021
☐	Broadband Antenna (Pre-amplifier)	ETS-LINDGREN	3142E-PA	00201891	May. 30, 2020	May. 29, 2021
☐	6dB Attenuator	Talent	RA6A5-N-18	18103002	Nov. 24, 2019	Nov. 23, 2020
					Nov. 18, 2020	Nov. 17, 2021
☐	Horn Antenna	ETS-LINDGREN	3117	00164202	Nov. 16, 2019	Nov. 15, 2020
					Nov. 14, 2020	Nov. 13, 2021
☒	Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3117-PA	00201874	May. 30, 2020	May. 29, 2021
☐	Horn Antenna	ETS-LINDGREN	3116C	00200180	Jun. 19, 2020	Jun. 18, 2021
☒	Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3116C-PA	00202652	Nov. 16, 2019	Nov. 15, 2020
					Nov. 14, 2020	Nov. 13, 2021
☒	Multi device Controller	ETS-LINDGREN	7006-001	00160105	N/A	N/A
☒	Test Software	Audix	e3	Software Version: 9.160323		

RF Test Equipment List						
Used	**Equipment**	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date (mm dd, yyyy)**	**Cal. Due date (mm dd, yyyy)**
☒	Receiver	R&S	ESR7	1316.3003K07 -101181-K3	Nov. 24, 2019	Nov. 23, 2020
					Nov. 18, 2020	Nov. 17, 2021
☒	EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY51440197	Nov. 24, 2019	Nov. 23, 2020
					Nov. 10, 2020	Nov. 09, 2021
☒	Wideband Radio Communication Tester	R&S	CMW500	119583	Jul. 20, 2020	Jul. 19, 2021
☐	Universal Radio Communication Tester	R&S	CMU200	114713	Nov. 24, 2019	Nov. 23, 2020
					Nov. 10, 2020	Nov. 09, 2021
☒	DC Source	KIKUSUI	PWR400L	LK003024	N/A	N/A
☒	Temp & Humidity chamber	Votisch	VT4002	58566133290 020	May. 11, 2020	May. 10, 2021

4. TEST CONFIGURATION

4.1 ENVIRONMENTAL CONDITIONS FOR TESTING

4.1.1 Normal or Extreme Test Conditions

Test Environment	Selected Values During Tests		
Test Condition	Ambient		
	Temperature (°C)	Voltage (V)	Relative Humidity (%)
TN/VN	+15 to +35	3.8	20 to 75
TL/VL	-30	3.2	20 to 75
TH/VL	+65	3.2	20 to 75
TL/VH	-30	4.5	20 to 75
TH/VH	+65	4.5	20 to 75

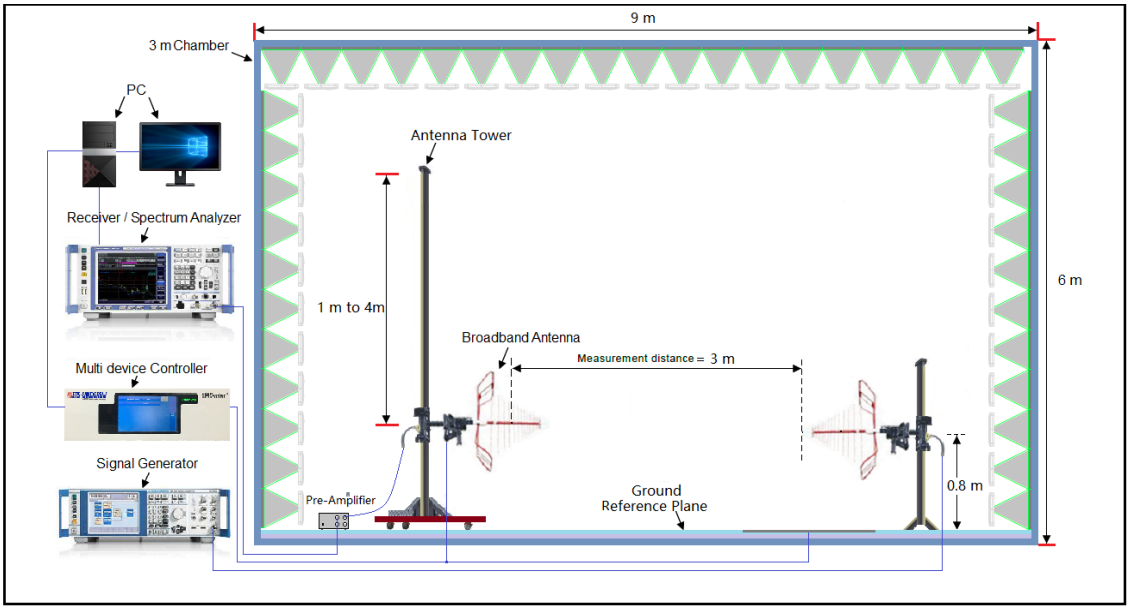
Remark:

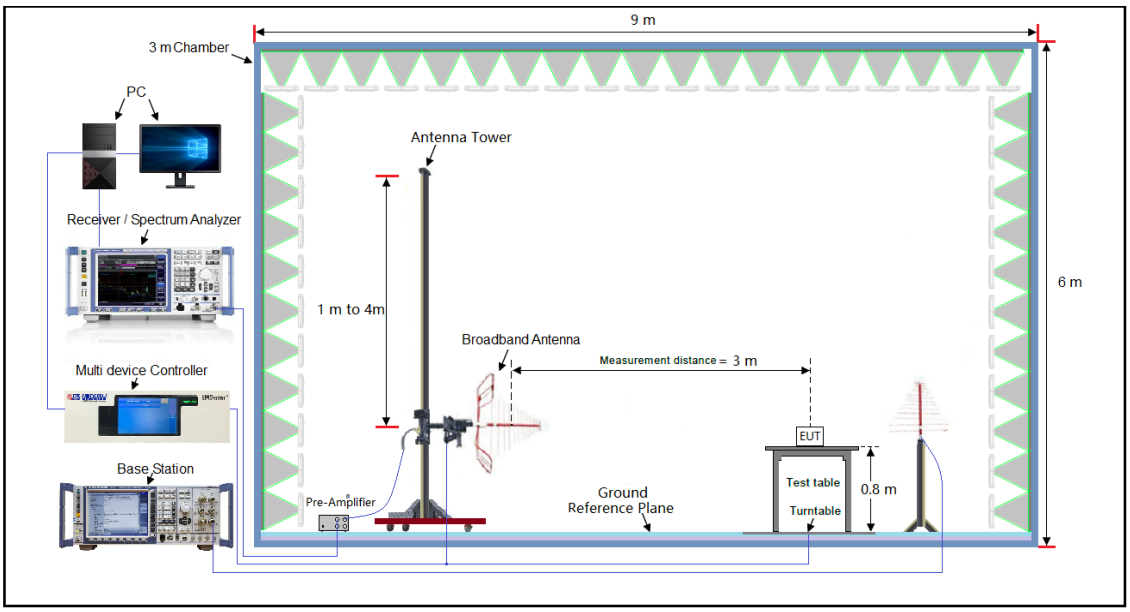
1) The EUT just work in such extreme temperature of -30 °C to +65 °C and the extreme voltage of 3.2 V to 4.5V, so here the EUT is tested in the temperature of -30 °C to +65 °C and the voltage of 3.2 V to 4.5 V.
2) VN: Normal Voltage; TN: Normal Temperature;
TL: Low Extreme Test Temperature; TH: High Extreme Test Temperature;
VL: Low Extreme Test Voltage; VH: High Extreme Test Voltage.

4.2 TEST SETUP

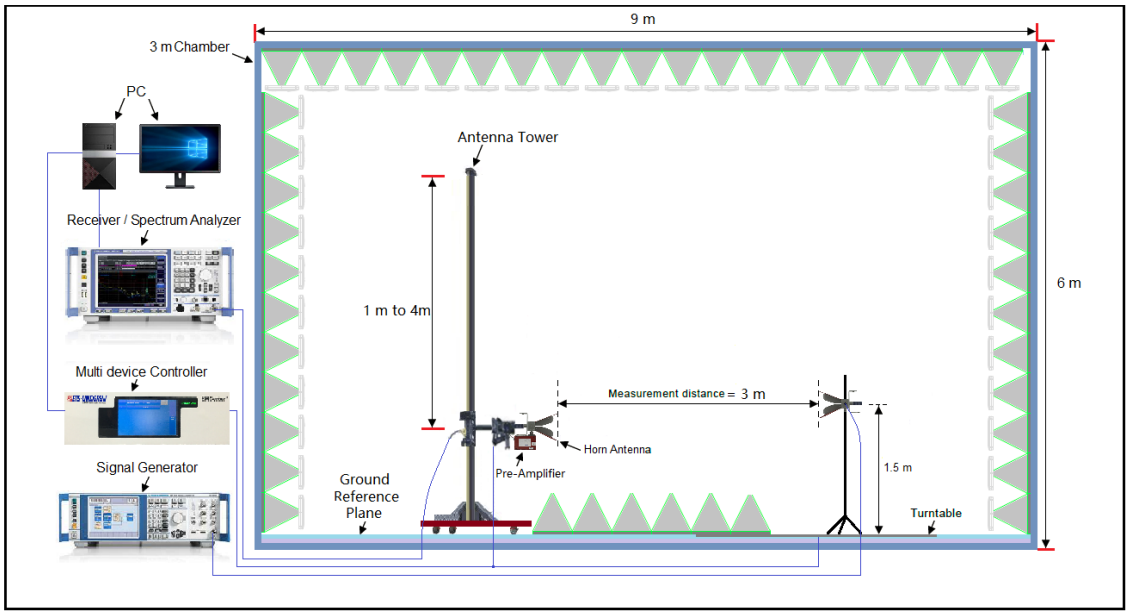
4.2.1 For Radiated Emissions test setup

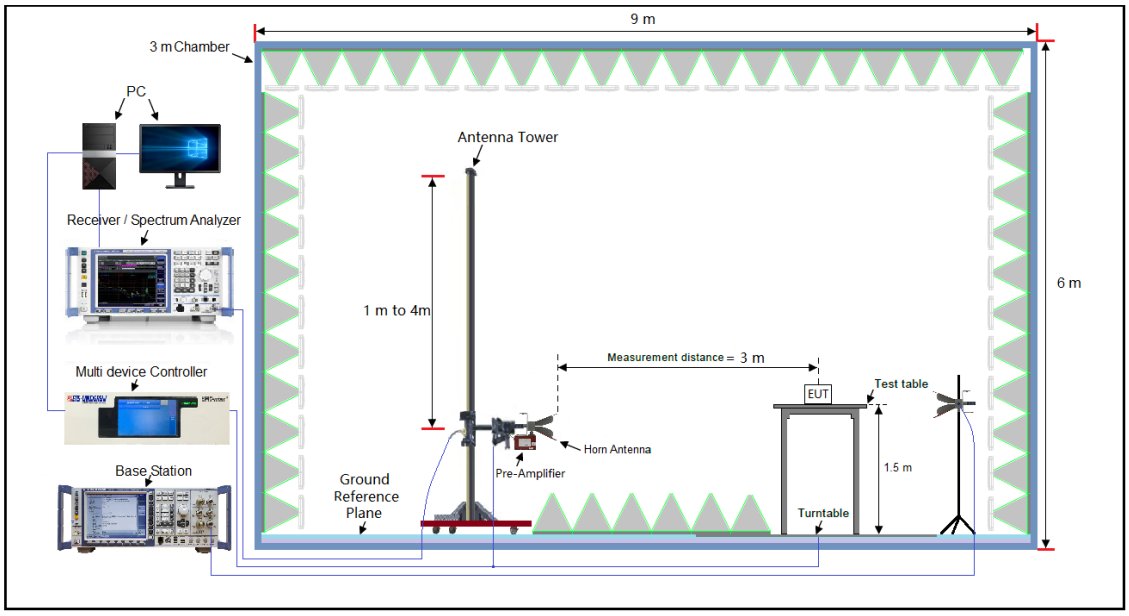
Setup - 1_ERP Test setup



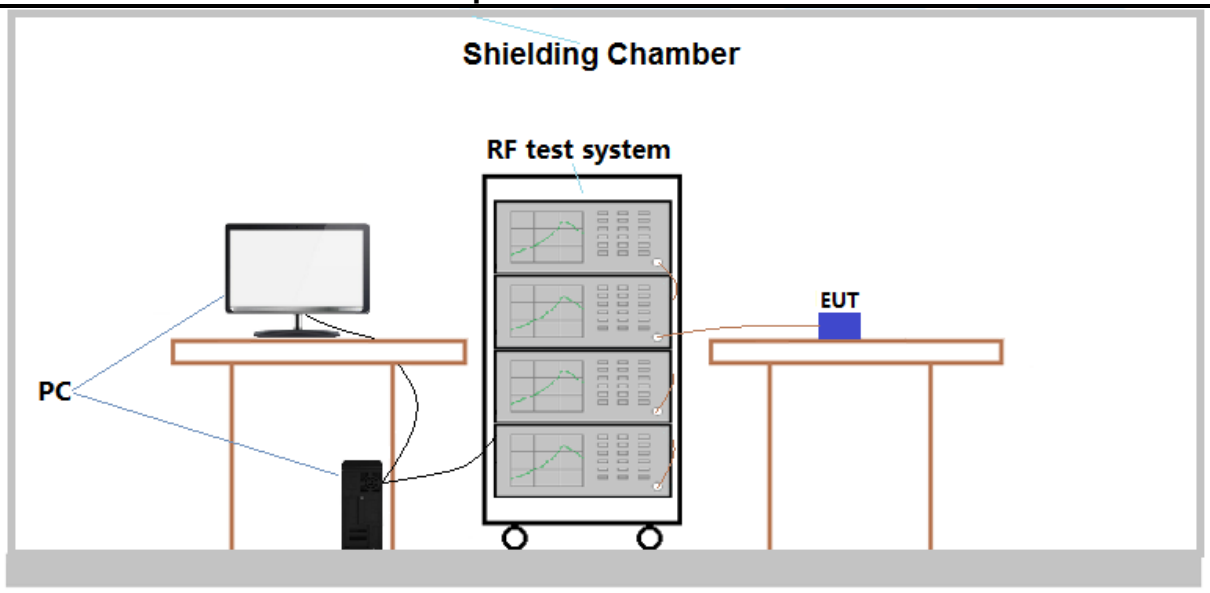


Setup - 2_EIRP Test setup

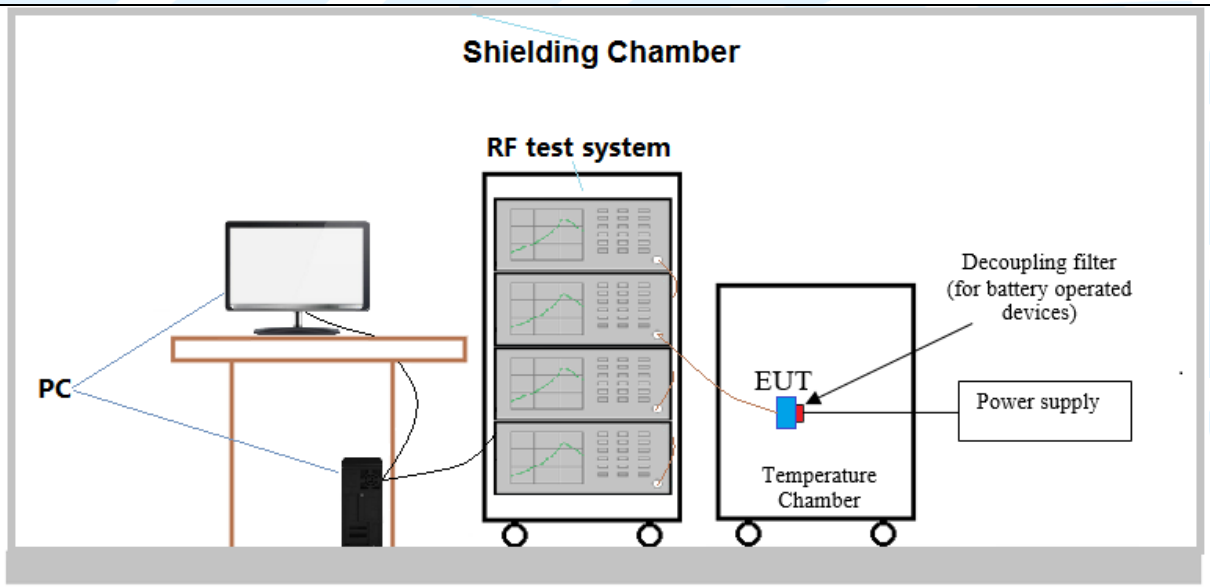




4.2.2 For Conducted RF test setup



Normal Environment



Extreme Environment

4.3 TEST CHANNELS

Band	Test Frequency ID	Bandwidth (MHz)	Number [UL]	Frequency of Uplink (MHz)
TX: 814 MHz to 824 MHz	Low Range	5	23305	790.5
		10	23330	793
	Middle Range	5/10	23330	793
	High Range	5	23355	795.5
		10	23330	793

4.4 SYSTEM TEST CONFIGURATION

For emissions testing, the equipment under test (EUT) setup to transmit continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing. During testing, radiated emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario. Only the worst case data were recorded in this test report.

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, X/Y/Z axis, and antenna ports.
The worst case was found when positioned as the table below.

Band	Mode	Antenna Port	Worst-case axis positioning
LTE Band 14	1TX	Chain 0	Z axis

All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance. Analyzer resolution is 100 kHz or greater for frequencies below 1000MHz. The resolution is 1 MHz or greater for frequencies above 1000MHz. The spurious emissions more than 20 dB below the permissible value are not reported.

Radiated emission measurement were performed from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

4.5 PRE-SCAN

LTE Band 14 Maximum Average Power (dBm)										
Modulation	RB		Test Channel			RB		Test Channel		
	Size	Offset	Low	Mid	High	Size	Offset	Low	Mid	High
	Channel Bandwidth: 5 MHz					Channel Bandwidth: 10 MHz				
QPSK	1	0	22.89	22.93	22.78	1	0	22.97	/	/
	1	12	22.95	23.06	23.06	1	24	23.12	/	/
	1	24	22.80	22.76	22.79	1	49	22.96	/	/
	12	0	21.87	21.83	21.92	25	0	22.02	/	/
	12	6	21.76	21.75	21.79	25	12	21.94	/	/
	12	13	21.76	21.74	21.81	25	25	21.85	/	/
	25	0	21.88	21.91	21.89	50	0	22.00	/	/
16QAM	1	0	21.86	21.82	21.82	1	0	21.87	/	/
	1	12	21.88	21.96	21.85	1	24	22.03	/	/
	1	24	21.61	21.61	21.77	1	49	21.80	/	/
	12	0	20.92	20.99	20.92	25	0	21.08	/	/
	12	6	20.86	20.92	20.99	25	12	21.00	/	/
	12	13	20.88	21.03	20.98	25	25	21.05	/	/
	25	0	20.88	20.91	20.82	50	0	21.00	/	/

Pre-scan all bandwidth and RB, find worse case mode are chosen to the report, the LTE worse case mode applicability and tested channel detail as below:

Item	Channel Bandwidth(MHz)						Modulation			RB #			Test		
	1.4	3	5	10	15	20	QPSK	16QAM	64QAM	1	Half	Full	L	M	H
LTE Band 14															
EIRP	☐	☐	☒	☒	☐	☐	☒	☒	☐	☒	☐	☐	☒	☒	☒
Conducted output power	☐	☐	☒	☒	☐	☐	☒	☒	☐	☒	☒	☒	☒	☒	☒
Peak-to-average ratio	☐	☐	☐	☒	☐	☐	☒	☒	☐	☐	☐	☒	☒	☒	☒
99%&26dB Bandwidth	☐	☐	☒	☒	☐	☐	☒	☒	☐	☐	☐	☒	☒	☒	☒
Band Edge at antenna terminals	☐	☐	☒	☒	☐	☐	☒	☒	☐	☒	☐	☒	☒	☐	☒
Spurious emissions at antenna terminals	☐	☐	☒	☒	☐	☐	☒	☒	☐	☒	☐	☐	☒	☒	☒
Field strength of spurious radiation	☐	☐	☒	☒	☐	☐	☒	☐	☐	☒	☐	☐	☐	☒	☐
Frequency stability	☐	☐	☐	☒	☐	☐	☒	☐	☐	☐	☐	☒	☐	☒	☐

Remark:
The mark "☒" means is chosen for testing;
The mark "☐" means is not chosen for testing;
The mark "--" means is not supported bandwidth.

5. RADIO TECHNICAL REQUIREMENTS SPECIFICATION

5.1 REFERENCE DOCUMENTS FOR TESTING

No.	Identity	Document Title
1	FCC 47 CFR Part 2	Frequency allocations and radio treaty matters; general rules and regulations
2	FCC 47 CFR Part 90	Private Land Mobile Radio Services
3	ANSI C63.26-2015	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
4	KDB 971168 D01	KDB 971168 D01 Power Meas License Digital Systems v03r01

5.2 EFFECTIVE RADIATED POWER (ERP)

Test Requirement: FCC 47 CFR Part 2.1046 & FCC 47 CFR Part 90.542(a)(7)

Test Method: ANSI C63.26-2015 & KDB 971168 D01v03r01

Limit:

Portable stations (hand-held devices) transmitting in the 758-768 MHz band and the 788-798 MHz band are limited to 3 watts ERP.

Test Procedure:

Test procedure as below:

1) The EUT was powered ON and placed on a 0.8/1.5m high table at a 3 meter semi/fully Anechoic Chamber. The antenna of the transmitter was extended to its maximum length. Modulation mode and the measuring receiver shall be tuned to the frequency of the transmitter under test.
2) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
3) The disturbance of the transmitter was maximized on the test receiver display by raising and lowering from 1m to 4m the receive antenna and by rotating through 360° the turntable. After the fundamental emission was maximized, a field strength measurement was made.
4) Steps 1) to 3) were performed with the EUT and the receive antenna in both vertical and horizontal polarization.
5) The transmitter was then removed and replaced with another antenna. The center of the antenna was approximately at the same location as the center of the transmitter.
6) A signal at the disturbance was fed to the substitution antenna by means of a non-radiating cable. With both the substitution and the receive antennas horizontally polarized, the receive antenna was raised and lowered to obtain a maximum reading at the test receiver. The level of the signal generator was adjusted until the measured field strength level in step 3) is obtained for this set of conditions.
7) The output power into the substitution antenna was then measured.
8) Steps 6) and 7) were repeated with both antennas polarized.
9) Calculate power in dBm by the following formula:

ERP(dBm) = Pg(dBm) – cable loss (dB) + antenna gain (dBd)
EIRP(dBm) = Pg(dBm) – cable loss (dB) + antenna gain (dBi)
EIRP=ERP+2.15dB

where:
Pg is the generator output power into the substitution antenna.

10) Test the EUT in the lowest channel, the middle channel the Highest channel
11) The radiation measurements are performed in X, Y, Z axis positioning for EUT operation mode, and found the positioning which it is worse case.
12) Repeat above procedures until all frequencies measured was complete.

Receiver Setup:

Frequency	Detector	RBW	VBW	Remark
30MHz-1GHz	Peak	100kHz	300kHz	Peak
Above 1GHz	Peak	1MHz	3MHz	Peak

Test Setup: Refer to section 4.2.1 for details.

Instruments Used: Refer to section 3 for details

Test Mode: Link mode

Test Results: Pass

Test Data: See table below

LTE Band 14 Maximum ERP (dBm)					
Channel	**QPSK; RB:1**	**16QAM; RB:1**	**64QAM; RB:1**	**Limit (dBm)**	**Result**
Channel Bandwidth: 5MHz					
Lowest	20.80	19.73	/	34.77	Pass
Middle	20.91	19.81	/	34.77	Pass
Highest	20.91	19.70	/	34.77	Pass
Channel Bandwidth: 10MHz					
Middle	20.97	19.88	/	34.77	Pass

5.3 CONDUCTED OUTPUT POWER

Test Requirement: FCC 47 CFR Part 2.1046

Test Method: ANSI C63.26-2015 & KDB 971168 D01v03r01

Limit:

No Limit

Test Procedure:

The EUT was set up for the maximum power with CMW500, and 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.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

Test Setup: Refer to section 4.2.2 for details.

Instruments Used: Refer to section 3 for details

Test Mode: Link mode

Test Results: Pass

Test Data: The full result refer to section 4.5 for details.

5.4 99%&26DB BANDWIDTH

Test Requirement: FCC 47 CFR Part 2.1049

Test Method: ANSI C63.26-2015 & KDB 971168 D01v03r01

Limit: No Limit

Test Procedure:

The transmitter output was connected to a calibrated coaxial cable and coupler, the other end of which was connected to a spectrum analyzer. The occupied bandwidth was measured with the spectrum analyzer at the low, middle and high channel in each band. The 99% and -26dB bandwidths was also measured and recorded.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

Test Setup: Refer to section 4.2.2 for details.

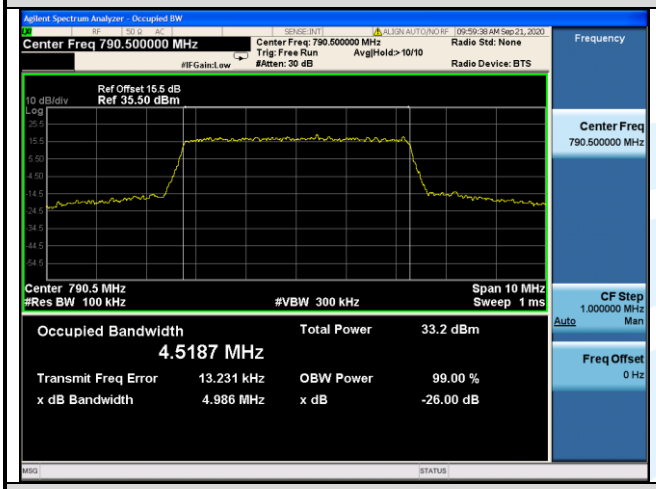
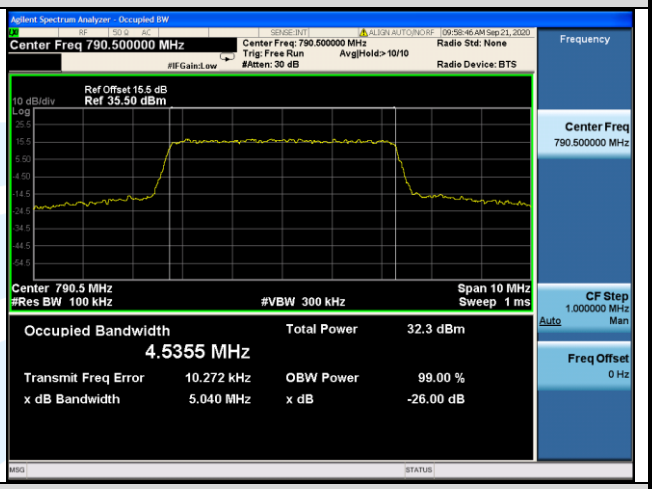
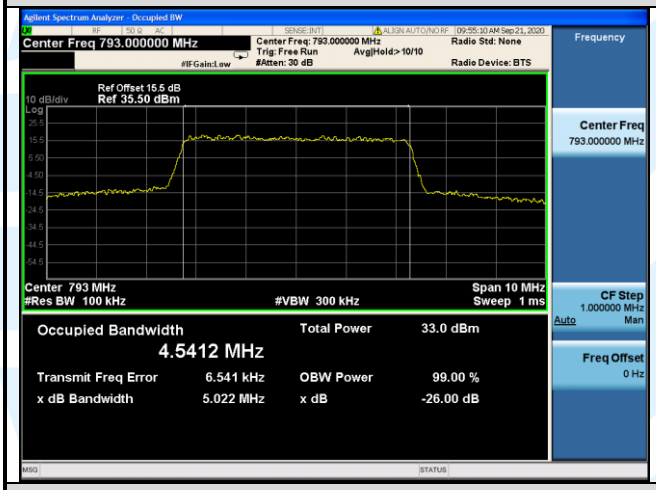
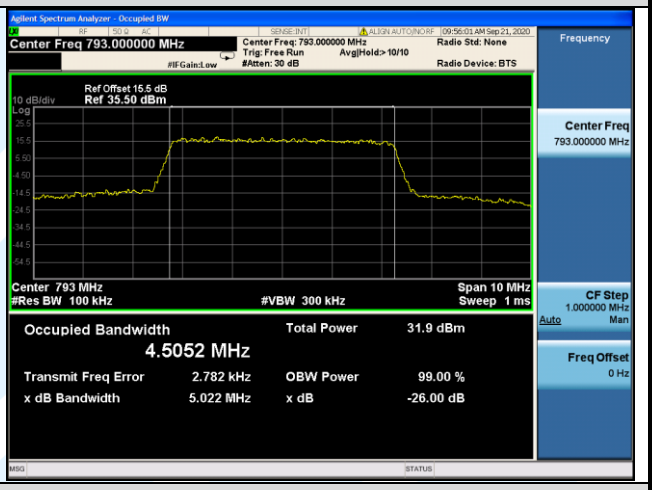
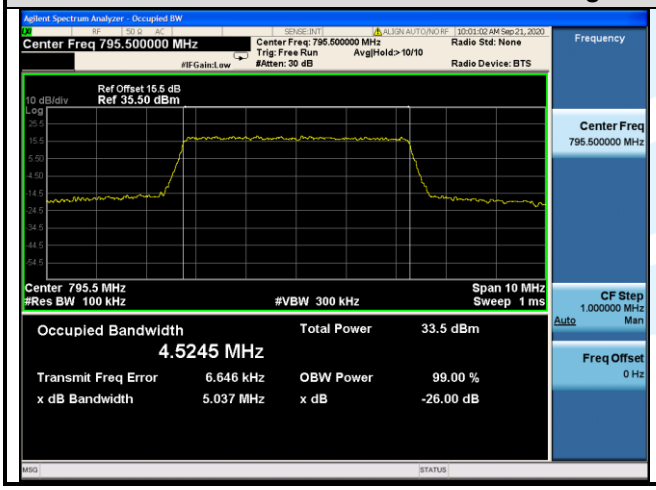
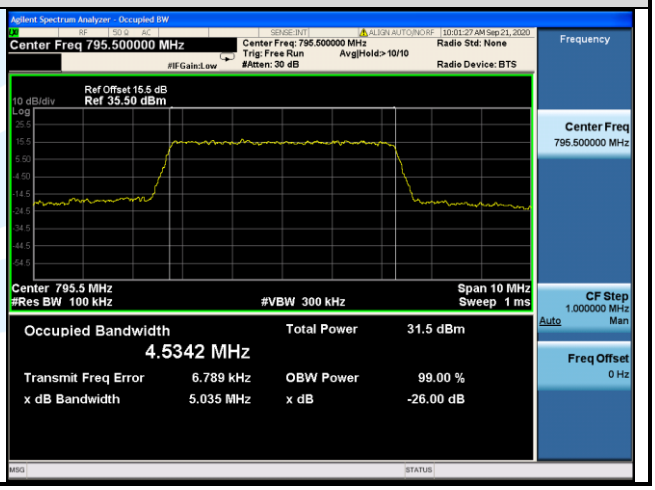
Instruments Used: Refer to section 3 for details

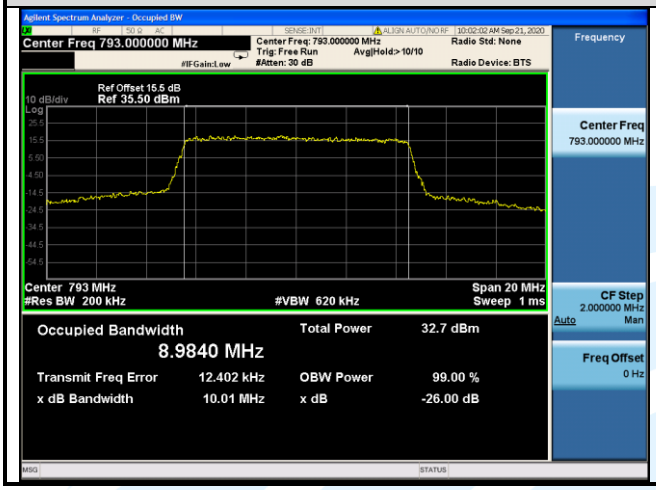
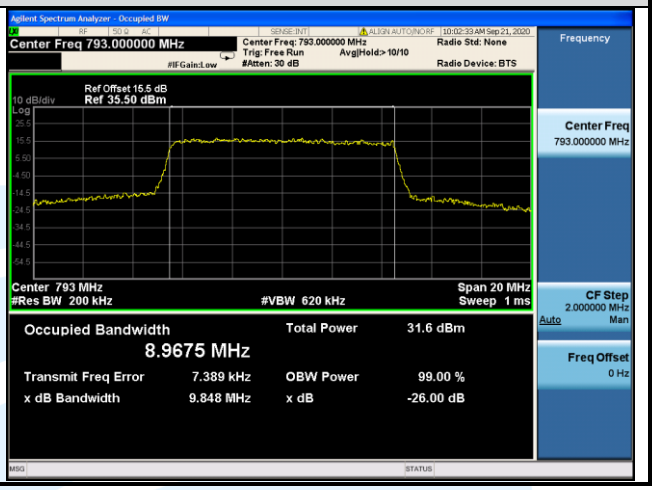
Test Mode: Link mode

Test Results: Pass

LTE Band 14								
Channel	RB Configuration		26 dB BW (MHz)			99% BW (MHz)		
	Size	Offset	QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
Channel Bandwidth: 5 MHz								
Lowest	25	0	4.986	5.040	/	4.5187	4.5355	/
Middle	25	0	5.022	5.022	/	4.5412	4.5052	/
Highest	25	0	5.037	5.035	/	4.5245	4.5342	/
Channel Bandwidth: 10 MHz								
Middle	50	0	10.01	9.848	/	8.9840	8.9675	/

The test plot as follows:

LTE Band 14_ Channel Bandwidth: 5 MHz	
QPSK	16QAM
Lowest Channel	
	
Middle Channel	
	
Highest Channel	
	

LTE Band 14_ Channel Bandwidth: 10 MHz	
QPSK	16QAM
Middle Channel	
	

5.5 EMISSION MASK

Test Requirement: FCC 47 CFR Part 2.1051 & FCC 47 CFR Part 90.543

Test Method: ANSI C63.26-2015 & KDB 971168 D01v03r01

Limit:

(e) For operations in the 758-768 MHz and the 788-798 MHz bands, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(2) On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than 65 + 10 log (P) dB in a 6.25 kHz band segment, for mobile and portable stations.

(3) On any frequency between 775-788 MHz, above 805 MHz, and below 758 MHz, by at least 43 + 10 log (P) dB.

(4) Compliance with the provisions of paragraphs (e)(1) and (2) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.

(5) Compliance with the provisions of paragraph (e)(3) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of 30 kHz may be employed.

(f) For operations in the 758-775 MHz and 788-805 MHz bands, all emissions including harmonics in the band 1559-1610 MHz shall be limited to −70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and −80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

Test Procedure:

The transmitter output was connected to a calibrated coaxial cable and coupler, the other end of which was connected to a spectrum analyzer.

For each band edge measurement:

1) Set the spectrum analyzer span to include the low or high channels.
2) Set the emissions mask of low or high channels.
3) Set resolution bandwidth to at least 1% of emission bandwidth and the VBW set 3 times of RBW.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

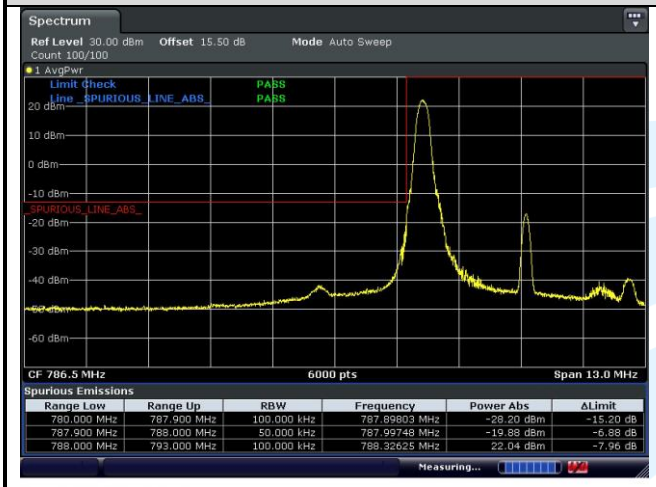
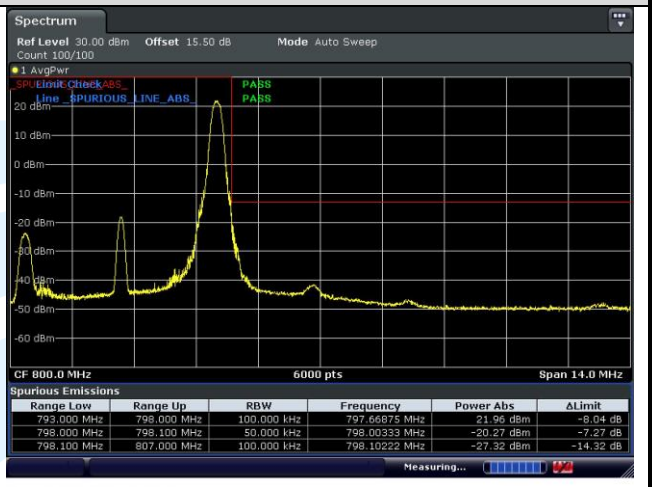
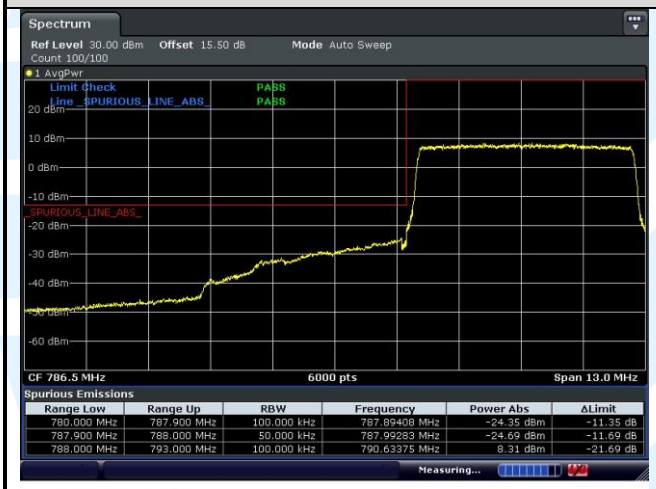
Test Setup: Refer to section 4.2.2 for details.

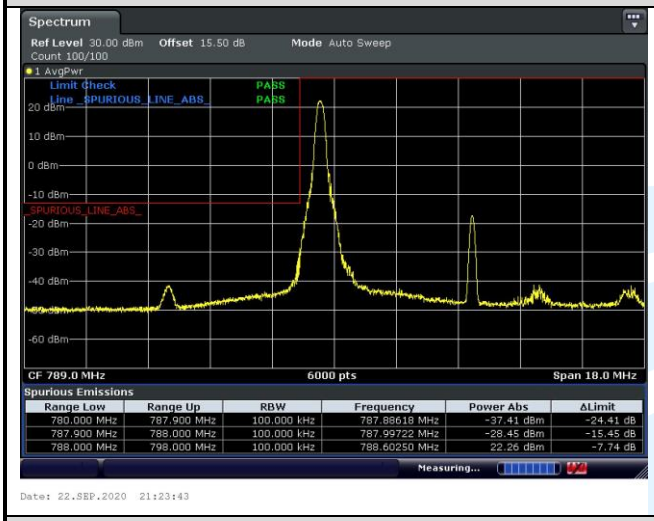
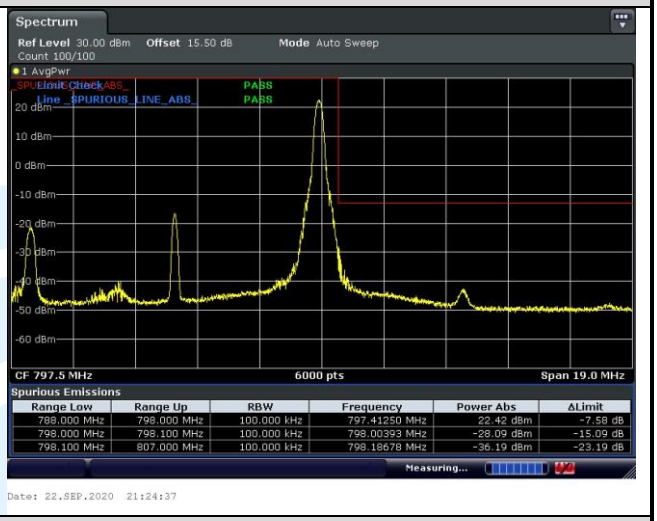
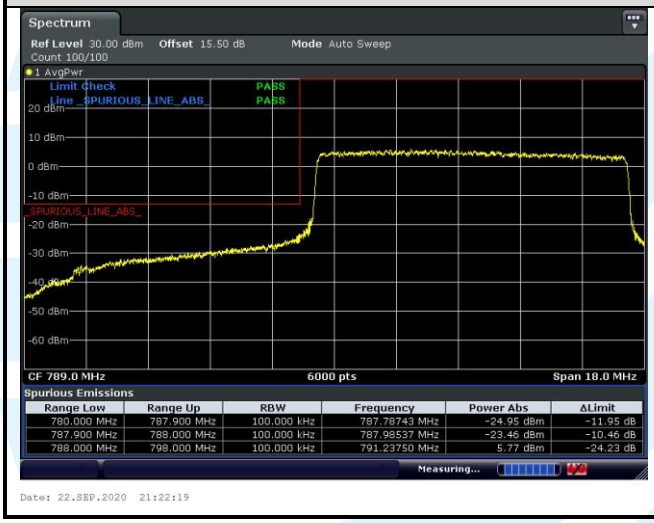
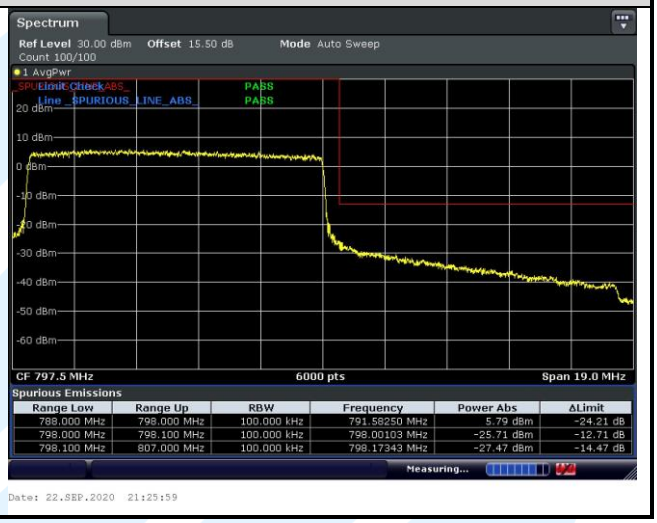
Instruments Used: Refer to section 3 for details

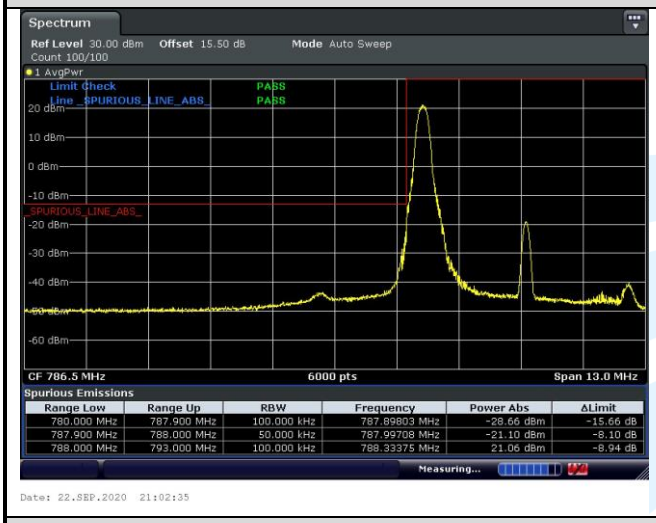
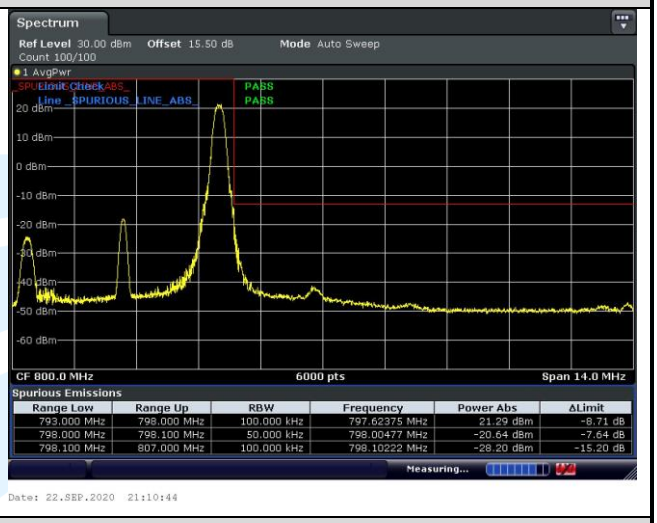
Test Mode: Link mode

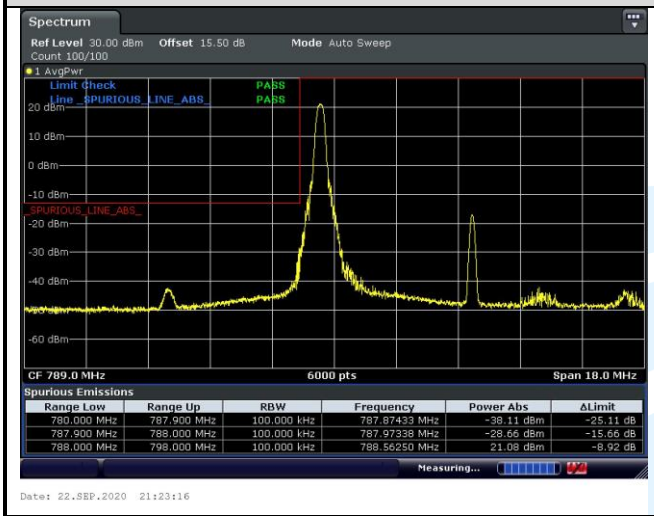
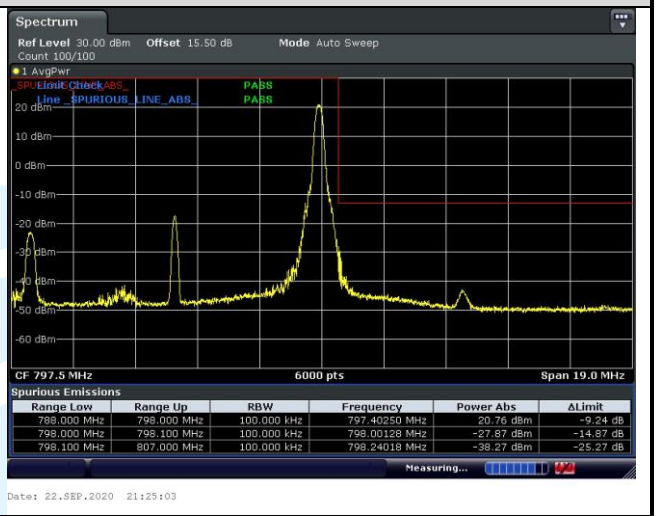
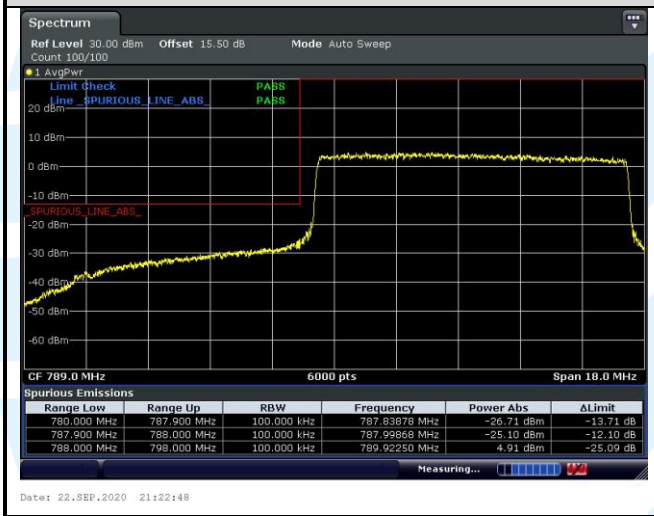
Test Results: Pass

The test plot as follows:

LTE Band 14 / 5 MHz / QPSK	
Lowest Channel	**Highest Channel**
1 RB	
	
Full RB	
	

LTE Band 14 / 10 MHz / QPSK	
Lowest Channel	**Highest Channel**
1 RB	
	
Full RB	
	

LTE Band 14 / 5 MHz / 16QAM	
Lowest Channel	**Highest Channel**
1 RB	
	
Full RB	
	

LTE Band 14 / 10 MHz / QPSK	
Lowest Channel	**Highest Channel**
1 RB	
	
Full RB	
	

5.6 SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Test Requirement: FCC 47 CFR Part 2.1051 & FCC 47 CFR Part 90.543

Test Method: ANSI C63.26-2015 & KDB 971168 D01v03r01

Limit:

The minimum permissible attenuation level of any spurious emissions is 43 + 10 log (P) dB where transmitting power (P) in Watts.

Test Procedure:

The EUT makes a phone call to the communication simulator. All measurements were done at low, middle and high operational frequency range. b. Measuring frequency range is from 9 kHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower. Set RBW & VBW to 100 kHz for the measurement below 1 GHz, and 1 MHz for the measurement above 1 GHz.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

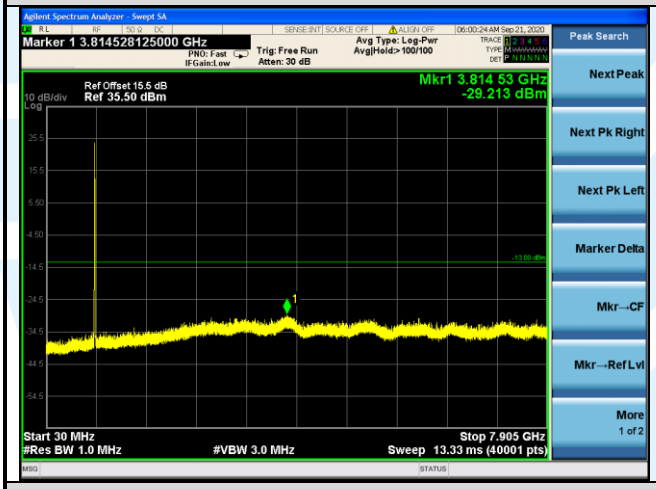
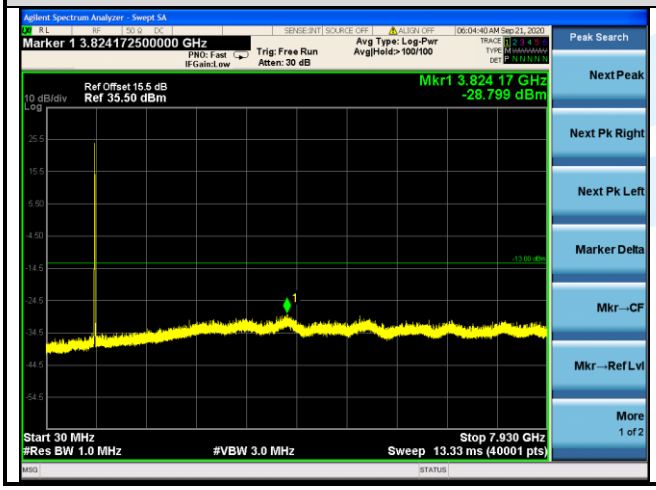
Test Setup: Refer to section 4.2.2 for details.

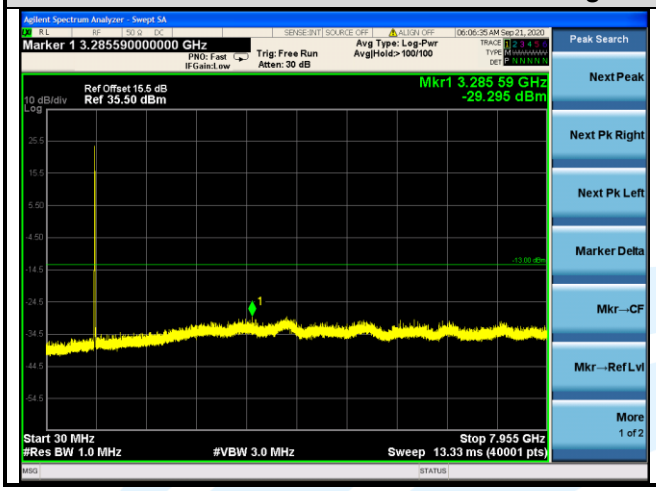
Instruments Used: Refer to section 3 for details

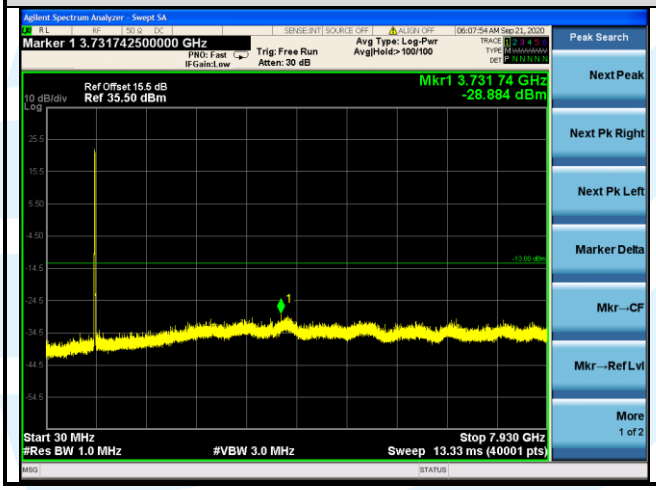
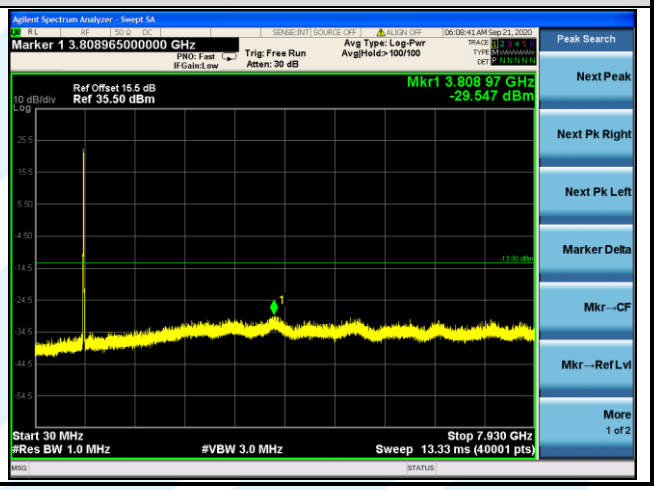
Test Mode: Link mode

Test Results: Pass

The test plot as follows:

LTE Band 14_ Channel Bandwidth: 5 MHz	
QPSK	16QAM
Lowest Channel	
	
Middle Channel	
	

Highest Channel	
	

LTE Band 14_ Channel Bandwidth: 10 MHz	
QPSK	16QAM
Middle Channel	
	

5.7 FIELD STRENGTH OF SPURIOUS RADIATION

Test Requirement: FCC 47 CFR Part 2.1051 & FCC 47 CFR Part 90.543

Test Method: ANSI C63.26-2015 & KDB 971168 D01v03r01

Limits:

(e) (3) On any frequency between 775-788 MHz, above 805 MHz, and below 758 MHz, by at least 43 + 10 log (P) dB.

(f) For operations in the 758-775 MHz and 788-805 MHz bands, all emissions including harmonics in the band 1559-1610 MHz shall be limited to −70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and −80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

Test Setup: Refer to section 4.2.1 for details.

Test Procedures:

1. Scan up to 10th harmonic, find the maximum radiation frequency to measure.
2. The technique used to find the Spurious Emissions of the transmitter was the antenna substitution method. Substitution method was performed to determine the actual ERP/EIRP emission levels of the EUT.

Test procedure as below:

1) The EUT was powered ON and placed on a 0.8/1.5m high table at a 3 meter semi/fully Anechoic Chamber. The antenna of the transmitter was extended to its maximum length. Modulation mode and the measuring receiver shall be tuned to the frequency of the transmitter under test.
2) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
3) The disturbance of the transmitter was maximized on the test receiver display by raising and lowering from 1m to 4m the receive antenna and by rotating through 360° the turntable. After the fundamental emission was maximized, a field strength measurement was made.
4) Steps 1) to 3) were performed with the EUT and the receive antenna in both vertical and horizontal polarization.
5) The transmitter was then removed and replaced with another antenna. The center of the antenna was approximately at the same location as the center of the transmitter.
6) A signal at the disturbance was fed to the substitution antenna by means of a non-radiating cable. With both the substitution and the receive antennas horizontally polarized, the receive antenna was raised and lowered to obtain a maximum reading at the test receiver. The level of the signal generator was adjusted until the measured field strength level in step 3) is obtained for this set of conditions.
7) The output power into the substitution antenna was then measured.
8) Steps 6) and 7) were repeated with both antennas polarized.
9) Calculate power in dBm by the following formula:

ERP(dBm) = Pg(dBm) – cable loss (dB) + antenna gain (dBd)
EIRP(dBm) = Pg(dBm) – cable loss (dB) + antenna gain (dBi)
EIRP=ERP+2.15dB

where:
Pg is the generator output power into the substitution antenna.

10) Test the EUT in the lowest channel, the middle channel the Highest channel
11) The radiation measurements are performed in X, Y, Z axis positioning for EUT operation mode, and found the Y positioning which it is worse case.

1) Repeat above procedures until all frequencies measured was complete.

Equipment Used: Refer to section 3 for details.

Test Result: Pass

The measurement data as follows:

LTE Band 14 / 5 MHz / QPSK _ Below 1G							
No.	Frequency	SA Reading	Correction factor	EIRP Result	Limit	Margin	Ant. Pol.
	(MHz)	(dBm)	(dB/m)	(dBm)	(dBm)	(dB)	
Lowest Channel							
1	30.639	-89.95	32.39	-57.56	-13.00	-44.56	Horizontal
2	415.449	-88.40	34.87	-53.53	-13.00	-40.53	Horizontal
3	952.000	-86.66	43.44	-43.22	-13.00	-30.22	Horizontal
4	31.735	-90.68	31.92	-58.76	-13.00	-45.76	Vertical
5	550.290	-88.14	37.75	-50.39	-13.00	-37.39	Vertical
6	965.474	-86.35	41.99	-44.36	-13.00	-31.36	Vertical
Middle Channel							
1	30.855	-89.99	32.28	-57.71	-13.00	-44.71	Horizontal
2	412.539	-87.60	34.89	-52.71	-13.00	-39.71	Horizontal
3	952.000	-86.52	43.44	-43.08	-13.00	-30.08	Horizontal
4	30.425	-91.51	32.74	-58.77	-13.00	-45.77	Vertical
5	708.694	-87.15	39.45	-47.70	-13.00	-34.70	Vertical
6	938.714	-85.49	42.04	-43.45	-13.00	-30.45	Vertical
Highest Channel							
1	30.855	-90.00	32.28	-57.72	-13.00	-44.72	Horizontal
2	286.265	-87.65	30.63	-57.02	-13.00	-44.02	Horizontal
3	986.044	-86.15	42.90	-43.25	-13.00	-30.25	Horizontal
4	31.735	-91.37	31.92	-59.45	-13.00	-46.45	Vertical
5	263.115	-89.00	30.10	-58.90	-13.00	-45.90	Vertical
6	958.714	-86.72	42.00	-44.72	-13.00	-31.72	Vertical

LTE Band 14 / 5 MHz / QPSK _ Above 1G							
No.	Frequency	SA Reading	Correction factor	EIRP Result	Limit	Margin	Ant. Pol.
	(MHz)	(dBm)	(dB/m)	(dBm)	(dBm)	(dB)	
Lowest Channel							
1	1581.000	-65.47	-0.33	-65.80	-13.00	-52.80	Horizontal
2	2371.500	-64.88	2.48	-62.40	-13.00	-49.40	Horizontal
3	1581.000	-64.62	-1.16	-65.78	-13.00	-52.78	Vertical
4	2371.500	-64.31	2.05	-62.26	-13.00	-49.26	Vertical
Middle Channel							
1	1586.000	-65.06	-0.31	-65.37	-13.00	-52.37	Horizontal
2	2379.000	-65.18	2.50	-62.68	-13.00	-49.68	Horizontal
3	1586.000	-63.75	-1.14	-64.89	-13.00	-51.89	Vertical
4	2379.000	-64.48	2.08	-62.40	-13.00	-49.40	Vertical
Highest Channel							
1	1591.000	-64.63	-0.29	-64.92	-13.00	-51.92	Horizontal
2	2386.500	-64.45	2.52	-61.93	-13.00	-48.93	Horizontal
3	1591.000	-64.03	-1.12	-65.15	-13.00	-52.15	Vertical
4	2386.500	-63.44	2.10	-61.34	-13.00	-48.34	Vertical

Remark:

1. Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain, the value was added to Original Receiver Reading by the software automatically.
2. Result = Reading + Correct Factor.
3. Margin = Result – Limit

5.8 FREQUENCY STABILITY

Test Requirement: FCC 47 CFR Part 2.1055, FCC 47 CFR Part 90.539

Test Method: ANSI C63.26-2015 & KDB 971168 D01v03r01

Limits:

The frequency stability of mobile, portable and control transmitters operating in the wideband segment must be 1.25 parts per million or better when AFC is locked to a base station, and 5 parts per million or better when AFC is not locked.

Test Setup: Refer to section 4.2.2 for details.

Test Procedures:

1) Use CMW 500 with Frequency Error measurement capability.
   a) Temp. =−30° to +50°C
   b) Voltage =low voltage, 3.2 Vdc, Normal, 3.8 Vdc and High voltage, 4.5 Vdc.
2) Frequency Stability vs Temperature:

The EUT is place inside a temperature chamber. The temperature is set to 20ºC and allowed to stabilize. After sufficient soak time, the transmitting frequency error is measured. The temperature is increased by 10 degrees, allowed to stabilize and soak, and then the measurement is repeated. This is repeated until +50ºC is reached.

3) Frequency Stability vs Voltage:

The peak frequency error is recorded (worst-case).

Equipment Used: Refer to section 3 for details.

Test Result: Pass

Modulation	Channel/ Frequency (MHz)	Voltage (Vdc)	Temperature (℃)	Deviation (Hz)	Deviation (ppm)	Limit (ppm)	Pass/ Fail
LTE Band 14 / 10MHz / Full RB							
QPSK	23330 / 793	VL	TN	-31	-0.0391	± 1.25	Pass
		VN		-24	-0.0303	± 1.25	Pass
		VH		-23	-0.0290	± 1.25	Pass
		VN	50	-28	-0.0353	± 1.25	Pass
			40	-26	-0.0328	± 1.25	Pass
			30	-28	-0.0353	± 1.25	Pass
			20	-33	-0.0416	± 1.25	Pass
			10	-31	-0.0391	± 1.25	Pass
			0	-27	-0.0340	± 1.25	Pass
			-10	-26	-0.0328	± 1.25	Pass
			-20	-31	-0.0391	± 1.25	Pass
			-30	-33	-0.0416	± 1.25	Pass

Modulation	Channel/ Frequency	Voltage	Temperature	Deviation	Deviation	Limit	Pass/ Fail
	(MHz)	(Vdc)	(℃)	(Hz)	(ppm)	(ppm)	
LTE Band 14 / 10MHz / Full RB							
QPSK	23330 / 793	VL	TN	-29	-0.0366	± 5	Pass
		VN		-23	-0.0290	± 5	Pass
		VH		-21	-0.0265	± 5	Pass
		VN	50	-24	-0.0303	± 5	Pass
			40	-26	-0.0328	± 5	Pass
			30	-28	-0.0353	± 5	Pass
			20	-33	-0.0416	± 5	Pass
			10	-31	-0.0391	± 5	Pass
			0	-23	-0.0290	± 5	Pass
			-10	-26	-0.0328	± 5	Pass
			-20	-28	-0.0353	± 5	Pass
			-30	-27	-0.0340	± 5	Pass

5.9 PEAK-TO-AVERAGE RATIO

Test Method: KDB 971168 D01v03r01

Limit: 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

Test Procedure:

The transmitter output was connected to a calibrated coaxial cable and coupler, the other end of which was connected to a spectrum analyzer.

a) Set resolution/measurement bandwidth ≥ signal's occupied bandwidth
b) Set the number of counts to a value that stabilizes the measured CCDF curve
c) Record the maximum PAPR level associated with a probability of 0.1 %

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

Test Setup: Refer to section 4.2.2 for details.

Instruments Used: Refer to section 3 for details

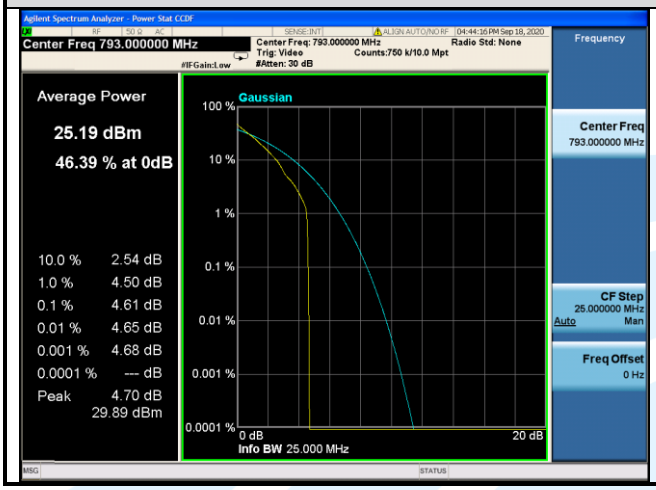
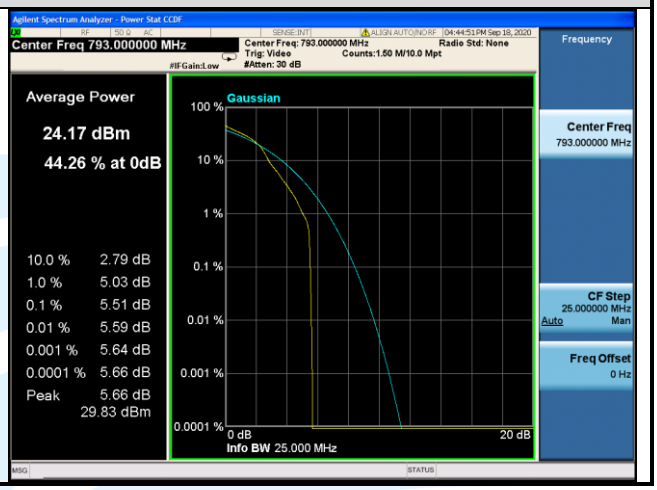
Test Mode: Link mode

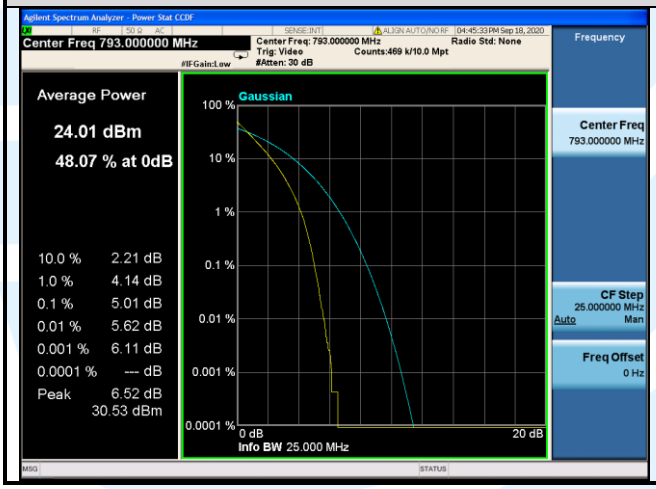
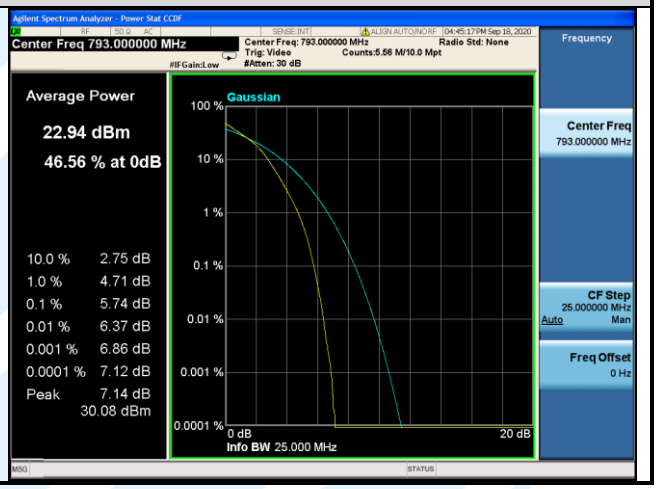
Test Results: Pass

Test Data: See table below

LTE Band 14 Peak-to-average ratio (dB)						
Channel	RB Configuration	Channel Bandwidth: 10 MHz			Limit (dB)	Result
		QPSK	16QAM	64QAM		
Middle	1 RB	4.61	5.51	/	13	Pass
Middle	Full RB	5.01	5.74	/	13	Pass

The test plot as follows:

LTE Band 14 / 10 MHz 1 RB	
QPSK	16QAM
Middle Channel	
	

LTE Band 14 / 10 MHz Full RB	
QPSK	16QAM
Middle Channel	
	

APPENDIX 1 PHOTOS OF TEST SETUP

See test photos attached in Appendix 1 for the actual connections between Product and support equipment.

APPENDIX 2 PHOTOS OF EUT CONSTRUCTIONAL DETAILS

Refer to Appendix 2 for EUT external and internal photos.

*** End of Report ***