



RF TEST REPORT

Applicant Quectel Wireless Solutions Company Limited

FCC ID XMR2021SC200LEM

Product Multi-mode Smart LTE Module with Wi-Fi &
Bluetooth

Brand Quectel

Model SC200L-EM

Report No. R2101A0120-R1V1

Issue Date March 11, 2021

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC CFR47 Part 2 (2019)/ FCC CFR 47 Part 22H (2019)**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

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Version	Revision description	Issue Date
Rev.0	Initial issue of report.	March 4, 2021
Rev.1	Update information of applicant and manufacture;	March 11, 2021

Note: This revised report (Report No. R2101A0120-R1V1) supersedes and replaces the previously issued report (Report No. R2101A0120-R1). Please discard or destroy the previously issued report and dispose of it accordingly.



Summary of measurement results

No.	Test Case	Clause in FCC rules	Verdict
1	RF Power Output and Effective Radiated Power	2.1046 22.913(a)(5)	PASS
2	Occupied Bandwidth	2.1049	PASS
3	Band Edge Compliance	2.1051 / 22.917(a)	PASS
4	Peak-to-Average Power Ratio	22.913(d)/ KDB 971168 D01(5.7)	PASS
5	Frequency Stability	2.1055 / 22.355	PASS
6	Spurious Emissions at Antenna Terminals	2.1051 / 22.917(a)	PASS
7	Radiates Spurious Emission	2.1053 / 22.917 (a)	PASS
Date of Testing: February 7, 2021~ February 25, 2021			
Date of Sample Received: February 4, 2021			
Note: All indications of Pass/Fail in this report are opinions expressed by TA Technology (Shanghai) Co., Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only.			



1. Test Laboratory

1.1. Notes of the Test Report

This report shall not be reproduced in full or partial, without the written approval of **TA technology (shanghai) co., Ltd.** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. Measurement Uncertainties were not taken into account and are published for informational purposes only. This report is written to support regulatory compliance of the applicable standards stated above.

1.2. Test facility

FCC (Designation number: CN1179, Test Firm Registration Number: 446626)

TA Technology (Shanghai) Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform measurements.

A2LA (Certificate Number: 3857.01)

TA Technology (Shanghai) Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform measurement.

1.3. Testing Location

Company: TA Technology (Shanghai) Co., Ltd.
Address: No.145, Jintang Rd, Tangzhen Industry Park, Pudong
City: Shanghai
Post code: 201201
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E-mail: xukai@ta-shanghai.com

2. General Description of Equipment under Test

2.3. Applicant and Manufacturer Information

Applicant	Quectel Wireless Solutions Company Limited
Applicant address	Building 5, Shanghai Business Park PhaseIII (Area B),No.1016 Tianlin Road, Minhang District Shanghai China
Manufacturer	Quectel Wireless Solutions Company Limited
Manufacturer address	Building 5, Shanghai Business Park PhaseIII (Area B),No.1016 Tianlin Road, Minhang District Shanghai China

2.4. General Information

EUT Description			
Model	SC200L-EM		
SN	P1C20KB30000013		
Hardware Version	R1.0		
Software Version	SC200LEMNAR02A04		
Power Supply	External power supply		
Antenna Type	External Antenna		
Antenna Gain	2.1 dBi		
Test Mode(s)	GSM 850; WCDMA Band V; LTE Band 5		
Test Modulation	(GSM/GPRS)GMSK, (EGPRS) GMSK/ 8PSK; (WCDMA) BPSK, QPSK,16QAM; (LTE)QPSK 16QAM;		
GPRS Multislot Class	33		
EGPRS Multislot Class	33		
HSDPA UE Category	14		
HSUPA UE Category	7		
DC-HSDPA UE Category	24		
HSPA+ UE Category	7		
LTE Category	4		
Maximum E.R.P.	GSM 850:	32.96 dBm	
	WCDMA Band V:	23.27 dBm	
	LTE Band 5:	23.74 dBm	
Rated Power Supply Voltage	3.8V		
Extreme Voltage	Minimum: 3.23V Maximum: 4.37V		
Extreme Temperature	Lowest: -30°C Highest: +75°C		
Operating Voltage	Minimum: 3.5V Maximum: 4.2V		
Operating Temperature	Lowest: -30°C Highest: +75°C		
Operating Frequency Range(s)	Band	Tx (MHz)	Rx (MHz)



	GSM850	824 ~ 849	869 ~ 894
	WCDMA Band V	824 ~ 849	869 ~ 894
	LTE Band 5	824 ~ 849	869 ~ 894

Note: 1. The EUT is sent from the applicant to TA and the information of the EUT is declared by the applicant.



3. Applied Standards

According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

Test standards:

FCC CFR 47 Part 22H (2019)

ANSI C63.26 (2015)

Reference standard:

FCC CFR47 Part 2 (2019)

KDB 971168 D01 Power Meas License Digital Systems v03r01

4. Test Configuration

Radiated measurements are performed by rotating the EUT in three different orthogonal test planes. EUT stand-up position (Z axis), lie-down position (X, Y axis). Receiver antenna polarization (horizontal and vertical), the worst emission was found in position (X axis, horizontal polarization) for GSM and WCDMA and (Z axis, vertical polarization) for LTE, and the worst case was recorded.

All mode and data rates and positions and RB size and modulations were investigated.

Subsequently, only the worst case emissions are reported.

The following testing in GSM/WCDMA/LTE is set based on the maximum RF Output Power.

Test modes are chosen to be reported as the worst case configuration below:

Test items	Modes/Modulation	
	GSM 850	WCDMA Band V
RF Power Output and Effective Radiated power	GSM GPRS EGPRS	RMC HSDPA/HSUPA DC-HSDPA/HSPA+
Occupied Bandwidth	GSM GPRS(1Tx slot) EGPRS(1Tx slot)	RMC
Band Edge Compliance	GSM GPRS(1Tx slot) EGPRS(1Tx slot)	RMC
Peak-to-Average Power Ratio	GSM GPRS(1Tx slot) EGPRS(1Tx slot)	RMC
Frequency Stability	GSM GPRS(1Tx slot) EGPRS(1Tx slot)	RMC
Spurious Emissions at Antenna Terminals	GSM	RMC
Radiates Spurious Emission	GSM	RMC

Test modes are chosen as the worst case configuration below for LTE Band 5.

Test items	Bandwidth (MHz)				Modulation		RB			Test Channel		
	1.4	3	5	10	QPSK	16QAM	1	50%	100%	L	M	H
RF power output and Effective Radiated power	O	O	O	O	O	O	O	O	O	O	O	O
Occupied Bandwidth	O	O	O	O	O	O	-	-	O	O	O	O
Band Edge Compliance	O	O	O	O	O	O	O	-	O	O	-	O
Peak-to-Average Power Ratio	O	O	O	O	O	O	-	-	O	O	O	O
Frequency Stability	O	O	O	O	O	O	O	-	-	-	O	-
Spurious Emissions at Antenna Terminals	O	O	O	O	O	-	O	-	-	O	O	O
Radiates Spurious Emission	O	-	O	O	O	-	O	-	-	-	O	-
Note	1. The mark "O" means that this configuration is chosen for testing. 2. The mark "-" means that this configuration is not testing.											

5. Test Case Results

5.1. RF Power Output and Effective Radiated Power

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Methods of Measurement

During the process of the testing, The EUT was connected to the Base Station Simulator with a known loss. The EUT is controlled by the Base Station Simulator test set to ensure max power transmission with proper modulation.

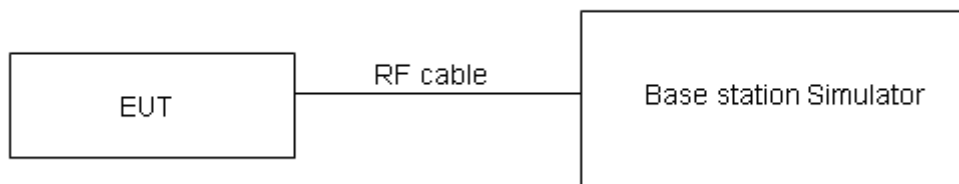
ERP can then be calculated as follows:

$$\text{EIRP (dBm)} = \text{Output Power (dBm)} - \text{Losses (dB)} + \text{Antenna Gain (dBi)}$$

where:dBd refers to gain relative to an ideal dipole.

$$\text{EIRP (dBm)} = \text{ERP (dBm)} + 2.15 \text{ (dB)}.$$

Test Setup



Limits

No specific RF power output requirements in part 2.1046.

Rule Part 22.913(a)(5) specifies that "Mobile/portable stations are limited to 7 watts ERP".

Limit	≤ 7 W (38.45 dBm)
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Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U = 0.4$ dB for RF power output, $k = 2$, $U = 1.19$ dB for ERP.

Test Results

GSM 850		Maximum Output Power (dBm)			ERP (dBm)		
		Channel 128	Channel 190	Channel 251	Channel 128	Channel 190	Channel 251
		824.2 (MHz)	836.6 (MHz)	848.8 (MHz)	824.2 (MHz)	836.6 (MHz)	848.8 (MHz)
GSM(GMSK)	Results	32.83	32.94	33.01	32.78	32.89	32.96
GPRS (GMSK)	1TXslot	32.82	32.91	32.97	32.77	32.86	32.92
	2TXslots	31.75	31.86	31.87	31.70	31.81	31.82
	3TXslots	29.79	29.80	29.78	29.74	29.75	29.73
	4TXslots	28.74	28.75	28.82	28.69	28.70	28.77
EGPRS (8PSK)	1TXslot	27.05	27.27	27.14	27.00	27.22	27.09
	2TXslots	26.01	26.12	26.18	25.96	26.07	26.13
	3TXslots	24.65	24.56	24.43	24.60	24.51	24.38
	4TXslots	23.54	23.70	23.62	23.49	23.65	23.57

WCDMA Band V		Maximum Output Power (dBm)			ERP (dBm)		
		Channel 4132	Channel 4183	Channel 4233	Channel 4132	Channel 4183	Channel 4233
		826.4 (MHz)	836.6 (MHz)	846.6 (MHz)	826.4 (MHz)	836.6 (MHz)	846.6 (MHz)
RMC		23.32	23.26	23.25	23.27	23.21	23.20
HSDPA	Sub - Test 1	22.78	22.68	22.69	22.73	22.63	22.64
	Sub - Test 2	22.77	22.70	22.66	22.72	22.65	22.61
	Sub - Test 3	22.24	22.20	22.18	22.19	22.15	22.13
	Sub - Test 4	22.25	22.21	22.16	22.20	22.16	22.11
HSUPA	Sub - Test 1	22.74	22.67	22.64	22.69	22.62	22.59
	Sub - Test 2	21.73	21.65	21.63	21.68	21.60	21.58
	Sub - Test 3	22.20	22.13	22.12	22.15	22.08	22.07
	Sub - Test 4	21.66	21.62	21.60	21.61	21.57	21.55
	Sub - Test 5	22.67	22.60	22.58	22.62	22.55	22.53
DC-HSDPA	Sub - Test 1	22.66	22.62	22.59	22.61	22.57	22.54
	Sub - Test 2	22.65	22.61	22.58	22.60	22.56	22.53
	Sub - Test 3	22.23	22.10	22.09	22.18	22.05	22.04
	Sub - Test 4	22.22	22.09	22.08	22.17	22.04	22.03
HSPA+	16QAM	22.21	22.17	22.15	22.16	22.12	22.10



Band	Bandwidth (MHz)	UL Channel	RB Size	RB Position	Modulation	Power (dBm)	ERP
LTE Band5	1.4	20407	1	#0	QPSK	23.74	23.69
LTE Band5	1.4	20407	1	#Mid	QPSK	23.79	23.74
LTE Band5	1.4	20407	1	#Max	QPSK	23.77	23.72
LTE Band5	1.4	20407	3	#0	QPSK	23.67	23.62
LTE Band5	1.4	20407	3	#Mid	QPSK	23.66	23.61
LTE Band5	1.4	20407	3	#Max	QPSK	23.64	23.59
LTE Band5	1.4	20407	6	#0	QPSK	22.55	22.50
LTE Band5	1.4	20407	1	#0	QAM16	22.81	22.76
LTE Band5	1.4	20407	1	#Mid	QAM16	22.75	22.70
LTE Band5	1.4	20407	1	#Max	QAM16	22.73	22.68
LTE Band5	1.4	20407	3	#0	QAM16	22.45	22.40
LTE Band5	1.4	20407	3	#Mid	QAM16	22.46	22.41
LTE Band5	1.4	20407	3	#Max	QAM16	22.49	22.44
LTE Band5	1.4	20407	6	#0	QAM16	21.66	21.61
LTE Band5	1.4	20525	1	#0	QPSK	23.55	23.50
LTE Band5	1.4	20525	1	#Mid	QPSK	23.47	23.42
LTE Band5	1.4	20525	1	#Max	QPSK	23.50	23.45
LTE Band5	1.4	20525	3	#0	QPSK	23.66	23.61
LTE Band5	1.4	20525	3	#Mid	QPSK	23.65	23.60
LTE Band5	1.4	20525	3	#Max	QPSK	23.55	23.50
LTE Band5	1.4	20525	6	#0	QPSK	22.59	22.54
LTE Band5	1.4	20525	1	#0	QAM16	23.31	23.26
LTE Band5	1.4	20525	1	#Mid	QAM16	23.25	23.20
LTE Band5	1.4	20525	1	#Max	QAM16	23.28	23.23
LTE Band5	1.4	20525	3	#0	QAM16	22.41	22.36
LTE Band5	1.4	20525	3	#Mid	QAM16	22.41	22.36
LTE Band5	1.4	20525	3	#Max	QAM16	22.49	22.44
LTE Band5	1.4	20525	6	#0	QAM16	21.71	21.66
LTE Band5	1.4	20643	1	#0	QPSK	23.66	23.61
LTE Band5	1.4	20643	1	#Mid	QPSK	23.68	23.63
LTE Band5	1.4	20643	1	#Max	QPSK	23.70	23.65
LTE Band5	1.4	20643	3	#0	QPSK	23.59	23.54
LTE Band5	1.4	20643	3	#Mid	QPSK	23.63	23.58
LTE Band5	1.4	20643	3	#Max	QPSK	23.58	23.53
LTE Band5	1.4	20643	6	#0	QPSK	22.63	22.58
LTE Band5	1.4	20643	1	#0	QAM16	22.12	22.07
LTE Band5	1.4	20643	1	#Mid	QAM16	22.02	21.97
LTE Band5	1.4	20643	1	#Max	QAM16	21.96	21.91
LTE Band5	1.4	20643	3	#0	QAM16	22.37	22.32
LTE Band5	1.4	20643	3	#Mid	QAM16	22.35	22.30



LTE Band5	1.4	20643	3	#Max	QAM16	22.75	22.70
LTE Band5	1.4	20643	6	#0	QAM16	21.70	21.65
LTE Band5	3	20415	1	#0	QPSK	23.47	23.42
LTE Band5	3	20415	1	#Mid	QPSK	23.56	23.51
LTE Band5	3	20415	1	#Max	QPSK	23.55	23.50
LTE Band5	3	20415	8	#0	QPSK	22.51	22.46
LTE Band5	3	20415	8	#Mid	QPSK	22.51	22.46
LTE Band5	3	20415	8	#Max	QPSK	22.69	22.64
LTE Band5	3	20415	15	#0	QPSK	22.62	22.57
LTE Band5	3	20415	1	#0	QAM16	22.33	22.28
LTE Band5	3	20415	1	#Mid	QAM16	22.32	22.27
LTE Band5	3	20415	1	#Max	QAM16	22.44	22.39
LTE Band5	3	20415	8	#0	QAM16	21.65	21.60
LTE Band5	3	20415	8	#Mid	QAM16	21.68	21.63
LTE Band5	3	20415	8	#Max	QAM16	21.68	21.63
LTE Band5	3	20415	15	#0	QAM16	21.55	21.50
LTE Band5	3	20525	1	#0	QPSK	23.55	23.50
LTE Band5	3	20525	1	#Mid	QPSK	23.47	23.42
LTE Band5	3	20525	1	#Max	QPSK	23.45	23.40
LTE Band5	3	20525	8	#0	QPSK	22.56	22.51
LTE Band5	3	20525	8	#Mid	QPSK	22.56	22.51
LTE Band5	3	20525	8	#Max	QPSK	22.51	22.46
LTE Band5	3	20525	15	#0	QPSK	22.62	22.57
LTE Band5	3	20525	1	#0	QAM16	23.31	23.26
LTE Band5	3	20525	1	#Mid	QAM16	23.24	23.19
LTE Band5	3	20525	1	#Max	QAM16	23.19	23.14
LTE Band5	3	20525	8	#0	QAM16	21.70	21.65
LTE Band5	3	20525	8	#Mid	QAM16	21.73	21.68
LTE Band5	3	20525	8	#Max	QAM16	21.73	21.68
LTE Band5	3	20525	15	#0	QAM16	21.75	21.70
LTE Band5	3	20635	1	#0	QPSK	23.77	23.72
LTE Band5	3	20635	1	#Mid	QPSK	23.76	23.71
LTE Band5	3	20635	1	#Max	QPSK	23.71	23.66
LTE Band5	3	20635	8	#0	QPSK	22.56	22.51
LTE Band5	3	20635	8	#Mid	QPSK	22.53	22.48
LTE Band5	3	20635	8	#Max	QPSK	22.59	22.54
LTE Band5	3	20635	15	#0	QPSK	22.61	22.56
LTE Band5	3	20635	1	#0	QAM16	22.04	21.99
LTE Band5	3	20635	1	#Mid	QAM16	22.11	22.06
LTE Band5	3	20635	1	#Max	QAM16	22.11	22.06
LTE Band5	3	20635	8	#0	QAM16	21.69	21.64
LTE Band5	3	20635	8	#Mid	QAM16	21.68	21.63
LTE Band5	3	20635	8	#Max	QAM16	21.75	21.70



LTE Band5	3	20635	15	#0	QAM16	21.52	21.47
LTE Band5	5	20425	1	#0	QPSK	23.50	23.45
LTE Band5	5	20425	1	#Mid	QPSK	23.44	23.39
LTE Band5	5	20425	1	#Max	QPSK	23.52	23.47
LTE Band5	5	20425	12	#0	QPSK	22.55	22.50
LTE Band5	5	20425	12	#Mid	QPSK	22.55	22.50
LTE Band5	5	20425	12	#Max	QPSK	22.61	22.56
LTE Band5	5	20425	25	#0	QPSK	22.78	22.73
LTE Band5	5	20425	1	#0	QAM16	22.17	22.12
LTE Band5	5	20425	1	#Mid	QAM16	22.32	22.27
LTE Band5	5	20425	1	#Max	QAM16	22.27	22.22
LTE Band5	5	20425	12	#0	QAM16	21.55	21.50
LTE Band5	5	20425	12	#Mid	QAM16	21.56	21.51
LTE Band5	5	20425	12	#Max	QAM16	21.46	21.41
LTE Band5	5	20425	25	#0	QAM16	21.71	21.66
LTE Band5	5	20525	1	#0	QPSK	23.62	23.57
LTE Band5	5	20525	1	#Mid	QPSK	23.62	23.57
LTE Band5	5	20525	1	#Max	QPSK	23.66	23.61
LTE Band5	5	20525	12	#0	QPSK	22.55	22.50
LTE Band5	5	20525	12	#Mid	QPSK	22.55	22.50
LTE Band5	5	20525	12	#Max	QPSK	22.64	22.59
LTE Band5	5	20525	25	#0	QPSK	22.60	22.55
LTE Band5	5	20525	1	#0	QAM16	22.68	22.63
LTE Band5	5	20525	1	#Mid	QAM16	22.65	22.60
LTE Band5	5	20525	1	#Max	QAM16	22.69	22.64
LTE Band5	5	20525	12	#0	QAM16	21.59	21.54
LTE Band5	5	20525	12	#Mid	QAM16	21.60	21.55
LTE Band5	5	20525	12	#Max	QAM16	21.68	21.63
LTE Band5	5	20525	25	#0	QAM16	21.66	21.61
LTE Band5	5	20625	1	#0	QPSK	23.48	23.43
LTE Band5	5	20625	1	#Mid	QPSK	23.54	23.49
LTE Band5	5	20625	1	#Max	QPSK	23.50	23.45
LTE Band5	5	20625	12	#0	QPSK	22.48	22.43
LTE Band5	5	20625	12	#Mid	QPSK	22.63	22.58
LTE Band5	5	20625	12	#Max	QPSK	22.54	22.49
LTE Band5	5	20625	25	#0	QPSK	22.66	22.61
LTE Band5	5	20625	1	#0	QAM16	22.66	22.61
LTE Band5	5	20625	1	#Mid	QAM16	22.64	22.59
LTE Band5	5	20625	1	#Max	QAM16	22.70	22.65
LTE Band5	5	20625	12	#0	QAM16	21.59	21.54
LTE Band5	5	20625	12	#Mid	QAM16	21.62	21.57
LTE Band5	5	20625	12	#Max	QAM16	21.51	21.46
LTE Band5	5	20625	25	#0	QAM16	21.58	21.53



LTE Band5	10	20450	1	#0	QPSK	23.58	23.53
LTE Band5	10	20450	1	#Mid	QPSK	23.59	23.54
LTE Band5	10	20450	1	#Max	QPSK	23.50	23.45
LTE Band5	10	20450	25	#0	QPSK	22.64	22.59
LTE Band5	10	20450	25	#Mid	QPSK	22.64	22.59
LTE Band5	10	20450	25	#Max	QPSK	22.70	22.65
LTE Band5	10	20450	50	#0	QPSK	22.60	22.55
LTE Band5	10	20450	1	#0	QAM16	22.49	22.44
LTE Band5	10	20450	1	#Mid	QAM16	22.48	22.43
LTE Band5	10	20450	1	#Max	QAM16	22.44	22.39
LTE Band5	10	20450	25	#0	QAM16	21.58	21.53
LTE Band5	10	20450	25	#Mid	QAM16	21.58	21.53
LTE Band5	10	20450	25	#Max	QAM16	21.66	21.61
LTE Band5	10	20450	50	#0	QAM16	21.63	21.58
LTE Band5	10	20525	1	#0	QPSK	23.74	23.69
LTE Band5	10	20525	1	#Mid	QPSK	23.65	23.60
LTE Band5	10	20525	1	#Max	QPSK	23.72	23.67
LTE Band5	10	20525	25	#0	QPSK	22.50	22.45
LTE Band5	10	20525	25	#Mid	QPSK	22.51	22.46
LTE Band5	10	20525	25	#Max	QPSK	22.51	22.46
LTE Band5	10	20525	50	#0	QPSK	22.53	22.48
LTE Band5	10	20525	1	#0	QAM16	22.59	22.54
LTE Band5	10	20525	1	#Mid	QAM16	22.55	22.50
LTE Band5	10	20525	1	#Max	QAM16	22.75	22.70
LTE Band5	10	20525	25	#0	QAM16	21.71	21.66
LTE Band5	10	20525	25	#Mid	QAM16	21.73	21.68
LTE Band5	10	20525	25	#Max	QAM16	21.69	21.64
LTE Band5	10	20525	50	#0	QAM16	21.70	21.65
LTE Band5	10	20600	1	#0	QPSK	23.56	23.51
LTE Band5	10	20600	1	#Mid	QPSK	23.54	23.49
LTE Band5	10	20600	1	#Max	QPSK	23.67	23.62
LTE Band5	10	20600	25	#0	QPSK	22.52	22.47
LTE Band5	10	20600	25	#Mid	QPSK	22.53	22.48
LTE Band5	10	20600	25	#Max	QPSK	22.66	22.61
LTE Band5	10	20600	50	#0	QPSK	22.53	22.48
LTE Band5	10	20600	1	#0	QAM16	22.49	22.44
LTE Band5	10	20600	1	#Mid	QAM16	22.00	21.95
LTE Band5	10	20600	1	#Max	QAM16	21.99	21.94
LTE Band5	10	20600	25	#0	QAM16	21.65	21.60
LTE Band5	10	20600	25	#Mid	QAM16	21.62	21.57
LTE Band5	10	20600	25	#Max	QAM16	21.64	21.59
LTE Band5	10	20600	50	#0	QAM16	21.56	21.51

5.2. Occupied Bandwidth

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

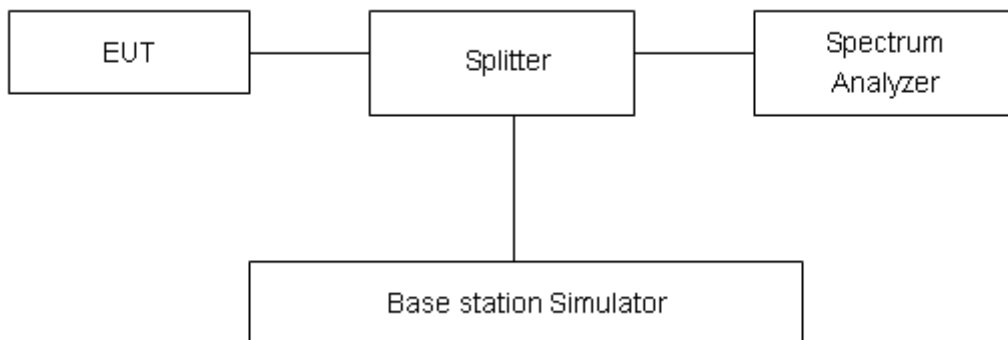
Method of Measurement

The EUT was connected to Spectrum Analyzer and Base Station Simulator via power Splitter. The occupied bandwidth is measured using spectrum analyzer.

RBW is set to 6.2kHz, VBW is set to 20kHz for GSM 850,
 RBW is set to 51kHz, VBW is set to 160kHz for WCDMA Band V,
 RBW is set to 30 kHz, VBW is set to 91kHz for LTE Band 5 (1.4MHz),
 RBW is set to 62 kHz, VBW is set to 180kHz for LTE Band 5 (3MHz),
 RBW is set to 100 kHz, VBW is set to 300kHz for LTE Band 5 (5MHz),
 RBW is set to 200 kHz, VBW is set to 620kHz for LTE Band 5 (10MHz),

99% power and -26dBc occupied bandwidths are recorded. Spectrum analyzer plots are included on the following pages.

Test Setup



Limits

No specific occupied bandwidth requirements in part 2.1049.

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U = 624\text{Hz}$.

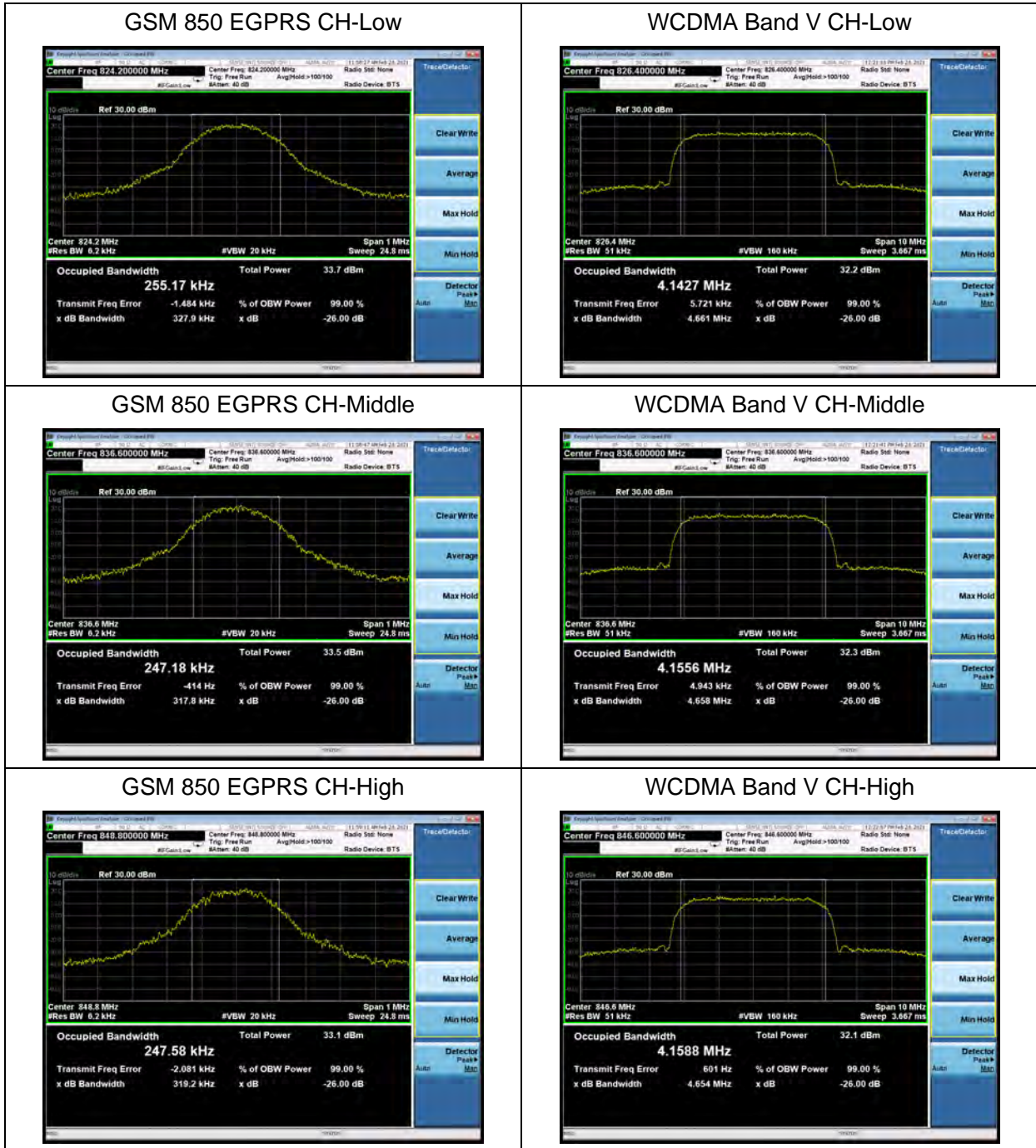
**Test Result**

Mode	Channel	Frequency (MHz)	99% Power Bandwidth (MHz)	-26dBc Bandwidth(MHz)
GSM 850 (GMSK)	128	824.2	0.2438	0.3023
	190	836.6	0.2394	0.2984
	251	848.8	0.2415	0.2983
GPRS 850 (GMSK)	128	824.2	0.2470	0.3125
	190	836.6	0.2432	0.3115
	251	848.8	0.2478	0.2178
EGPRS 850 (8PSK)	128	824.2	0.2551	0.3279
	190	836.6	0.2471	0.3178
	251	848.8	0.2475	0.3192
WCDMA Band V (RMC)	4132	826.4	4.1427	4.6610
	4183	836.6	4.1556	4.6580
	4233	846.6	4.1588	4.6540



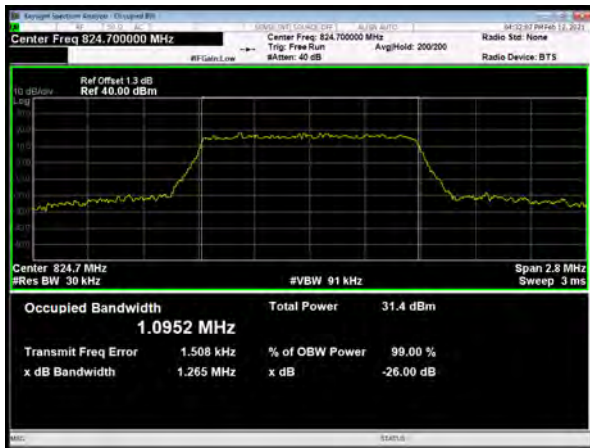
LTE Band 5						
RB	Modulation	Bandwidth (MHz)	Channel	Frequency (MHz)	99% Power Bandwidth(MHz)	-26dBc Bandwidth(MHz)
100%	QPSK	1.4	20407	824.7	1.0952	1.265
			20525	836.5	1.0911	1.255
			20643	848.3	1.0916	1.288
		3	20415	825.5	2.6927	2.972
			20525	836.5	2.6982	2.952
			20635	847.5	2.6968	2.957
		5	20425	826.5	4.5095	4.939
			20525	836.5	4.5015	4.906
			20625	846.5	4.4991	4.887
		10	20450	829	8.9494	9.634
			20525	836.5	8.9875	9.623
			20600	844	8.9632	9.752
	16QAM	1.4	20407	824.7	1.0999	1.269
			20525	836.5	1.0985	1.282
			20643	848.3	1.0926	1.259
		3	20415	825.5	2.6937	2.973
			20525	836.5	2.6932	2.986
			20635	847.5	2.6891	2.997
		5	20425	826.5	4.5030	4.906
			20525	836.5	4.5178	4.875
			20625	846.5	4.5140	4.946
		10	20450	829	8.9459	9.702
			20525	836.5	8.9911	9.689
			20600	844	8.9718	9.751



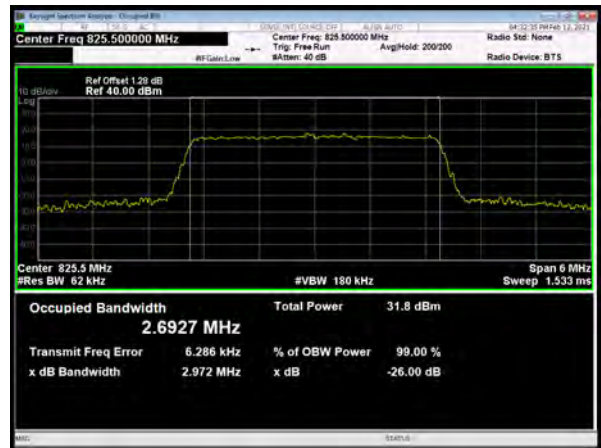




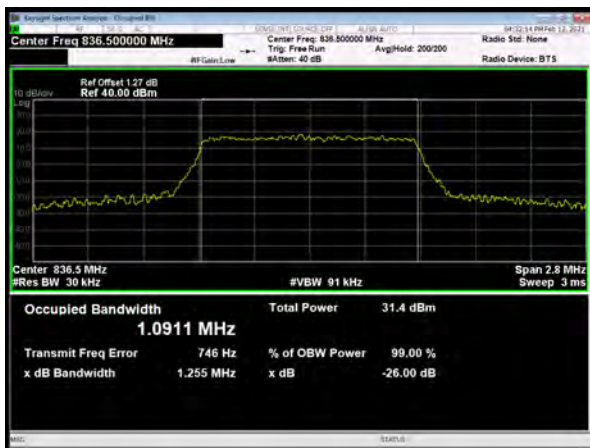
LTE Band 5 QPSK 1.4MHz CH-Low



LTE Band 5 QPSK 3MHz CH-Low



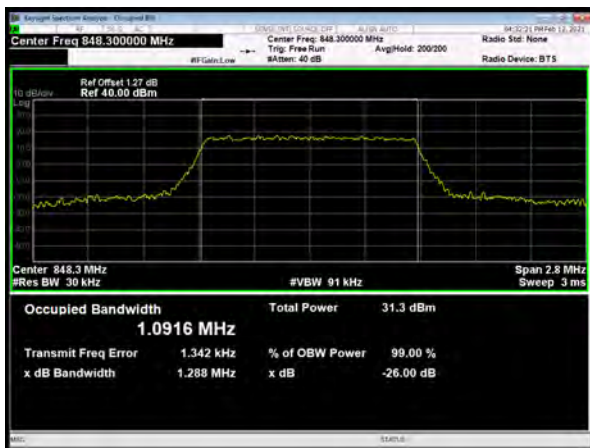
LTE Band 5 QPSK 1.4MHz CH-Middle



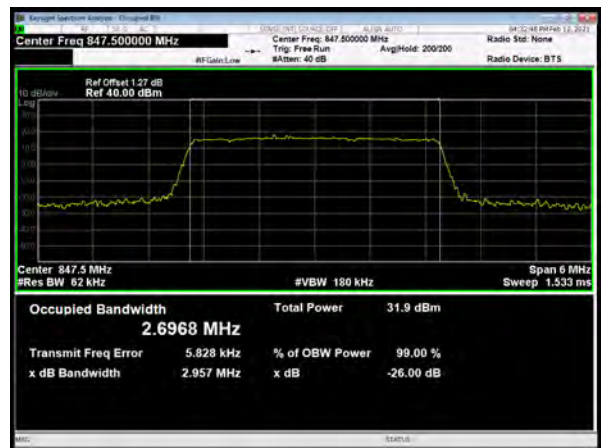
LTE Band 5 QPSK 3MHz CH-Middle

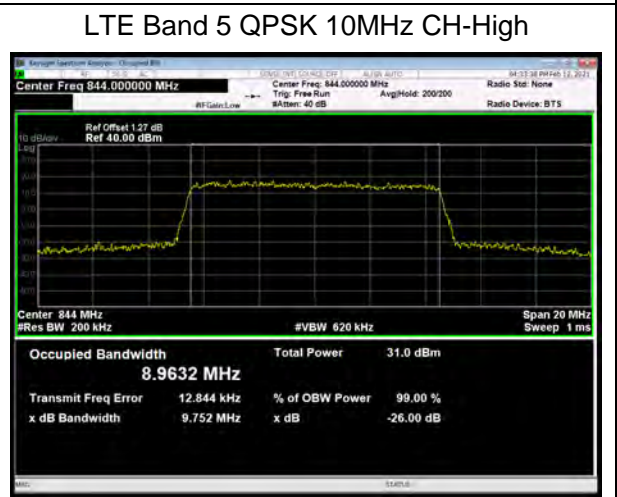
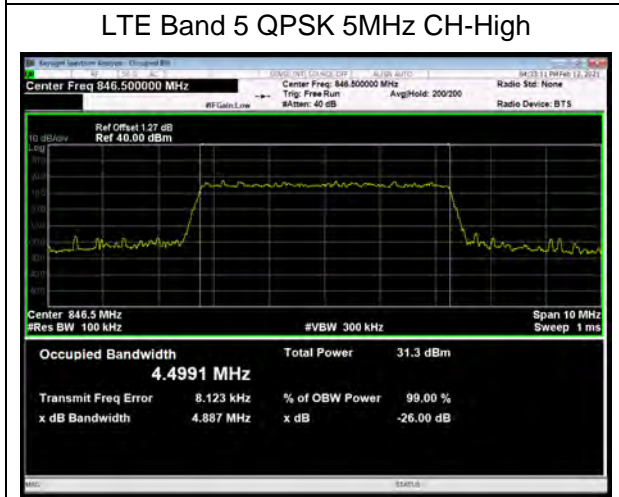
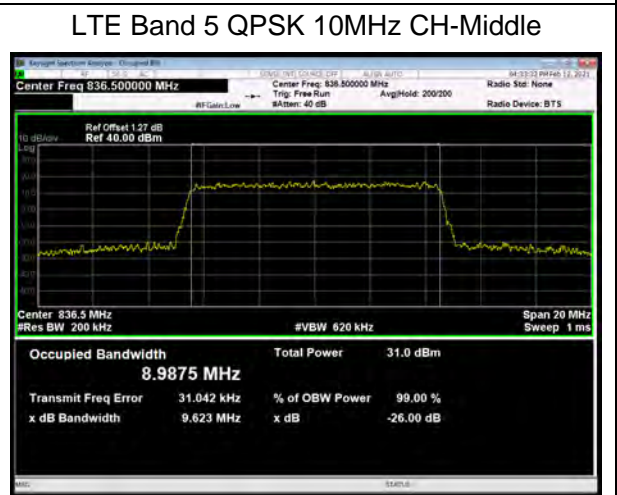
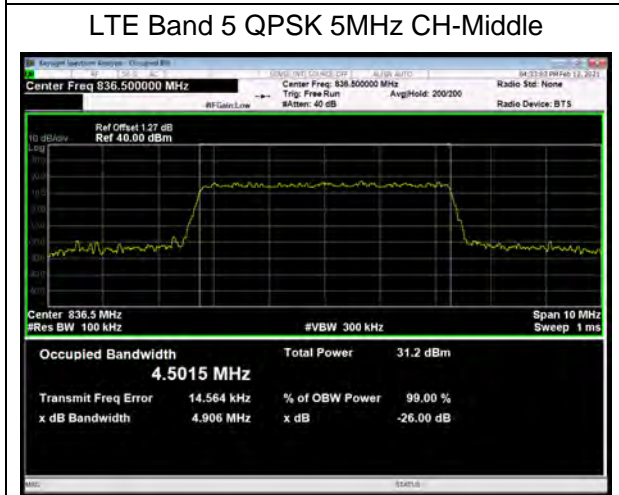
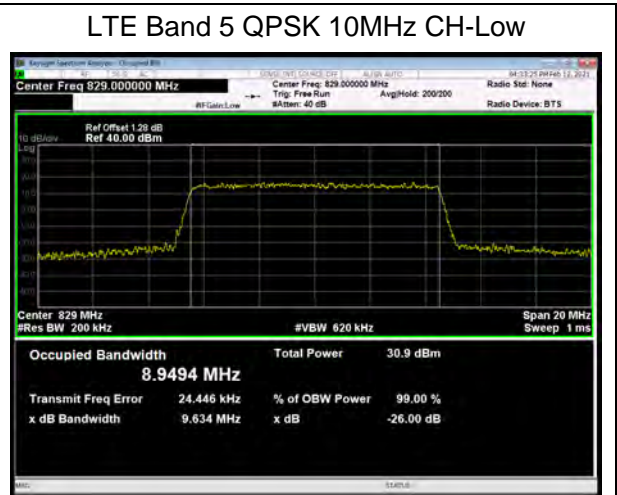
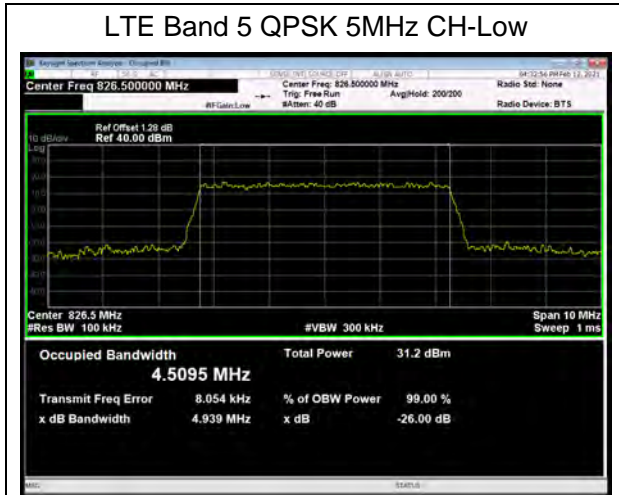


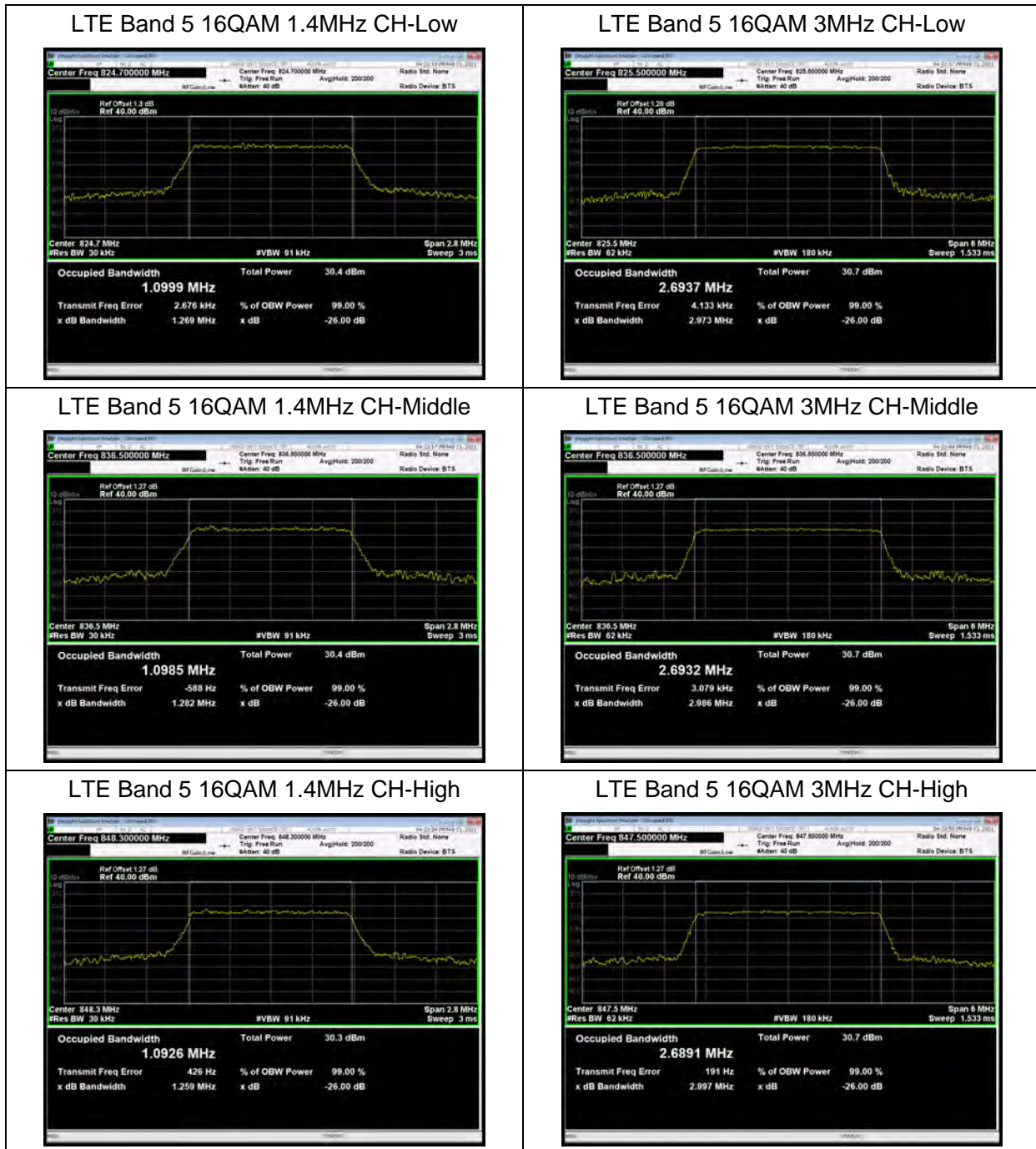
LTE Band 5 QPSK 1.4MHz CH-High



LTE Band 5 QPSK 3MHz CH-High









5.3. Band Edge Compliance

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

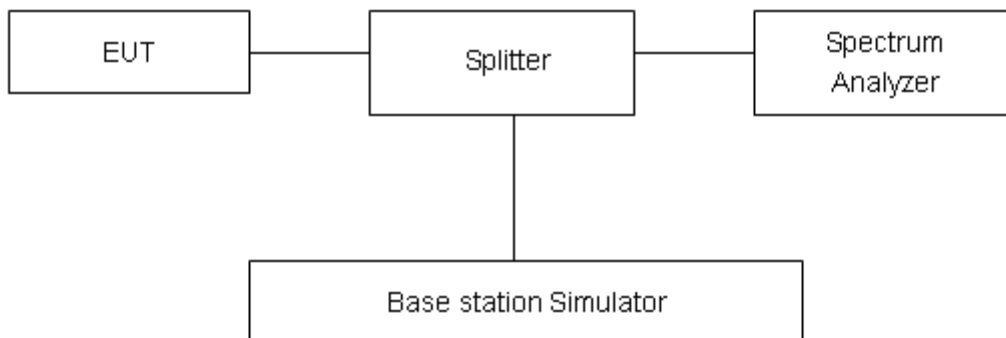
Method of Measurement

The EUT was connected to Spectrum Analyzer and Base Station Simulator via power Splitter. The band edge of the lowest and highest channels were measured. The average detector is used.

- RBW is set to 6.2kHz,VBW is set to 20kHz for GSM 850,
- RBW is set to 51kHz,VBW is set to 160kHz for WCDMA Band V,
- RBW is set to 15kHz, VBW is set to 43kHz for LTE Band 5 (1.4MHz),
- RBW is set to 30kHz,VBW is set to 91kHz for LTE Band 5 (3MHz),
- RBW is set to 51kHz,VBW is set to 150kHz for LTE Band 5 (5MHz),
- RBW is set to 100kHz,VBW is set to 300kHz for LTE Band 5 (10MHz),

Spectrum analyzer plots are included on the following pages.

Test Setup



Limits

Rule Part 22.917(a) specifies that “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.”

Limit	-13 dBm
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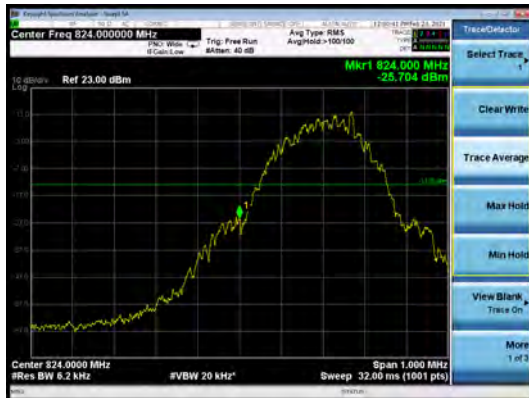
Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 1.96$, $U=0.684$ dB.

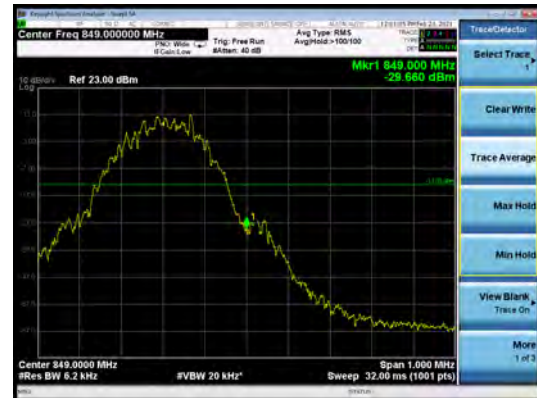


Test Result:

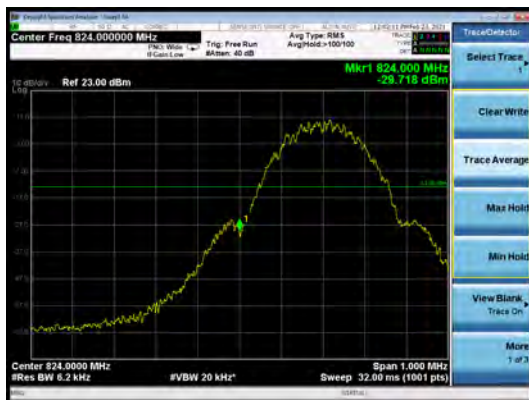
GSM 850 CH-Low



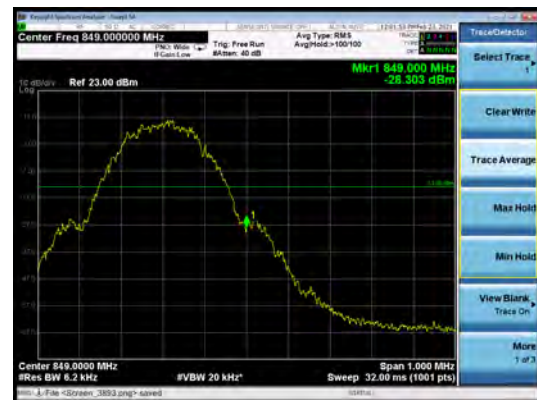
GSM 850 CH-High



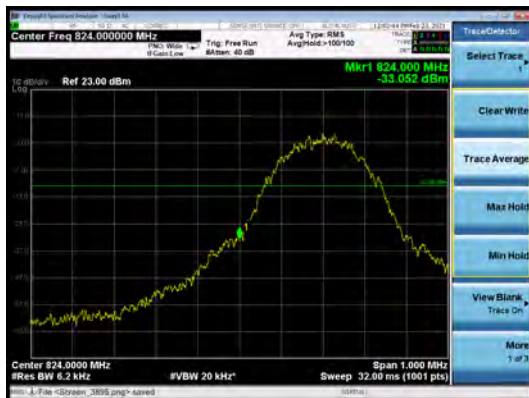
GSM 850 GPRS CH-Low



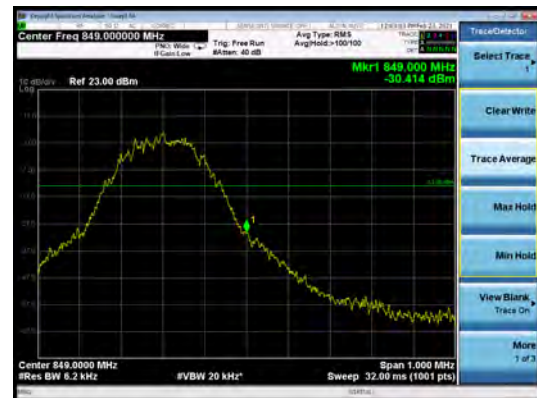
GSM 850 GPRS CH-High



GSM 850 EGPRS CH-Low



GSM 850 EGPRS CH-High





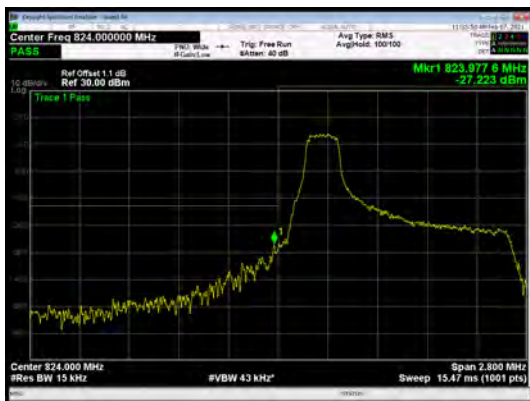
WCDMA Band V CH-Low



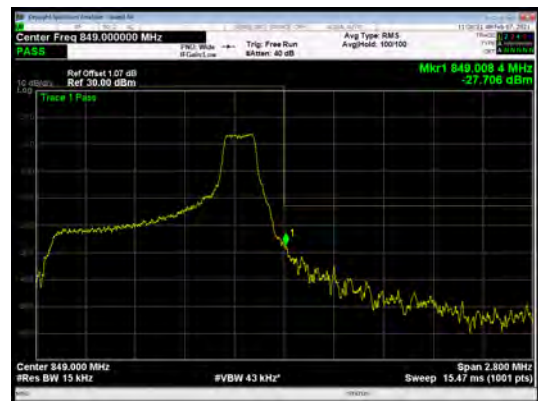
WCDMA Band V CH-High



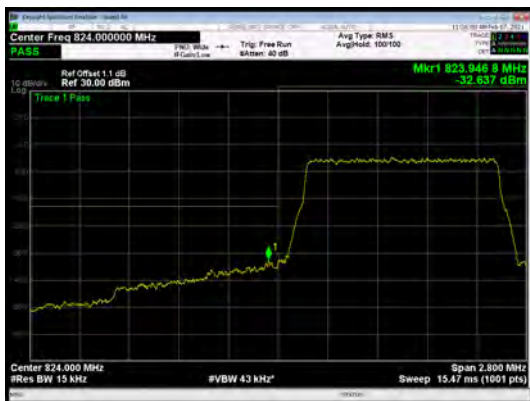
LTE Band 5 QPSK 1.4MHz CH-Low 1RB



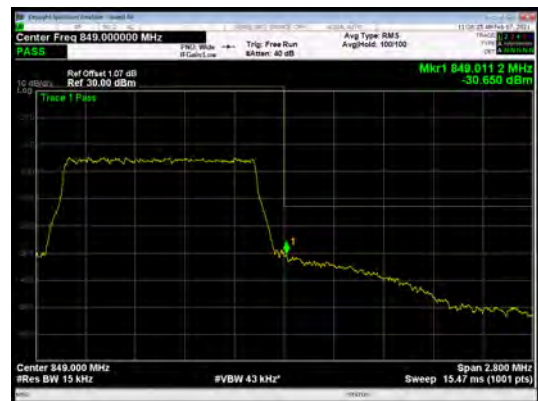
LTE Band 5 QPSK 1.4MHz CH-High 1RB



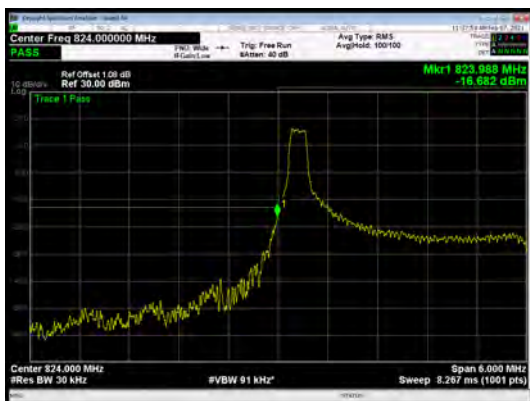
LTE Band 5 QPSK 1.4MHz CH-Low 100%RB



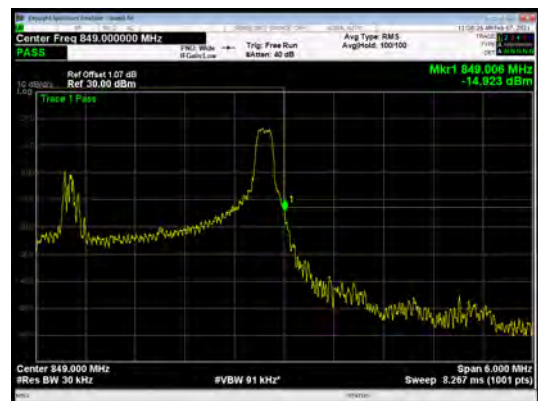
LTE Band 5 QPSK 1.4MHz CH-High 100%RB



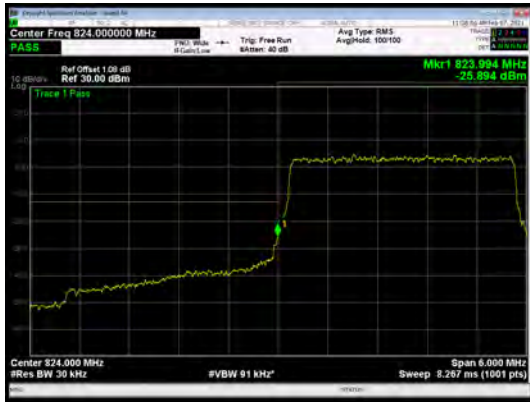
LTE Band 5 QPSK 3MHz CH-Low 1RB



LTE Band 5 QPSK 3MHz CH-High 1RB



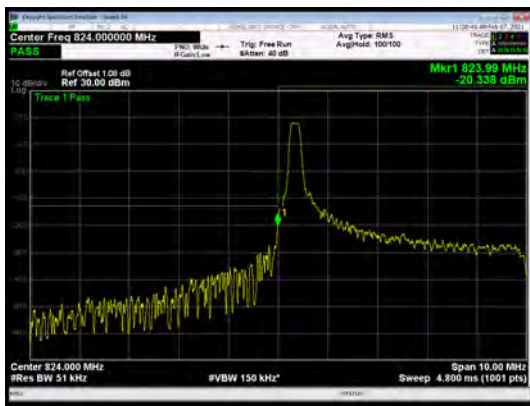
LTE Band 5 QPSK 3MHz CH-Low 100%RB



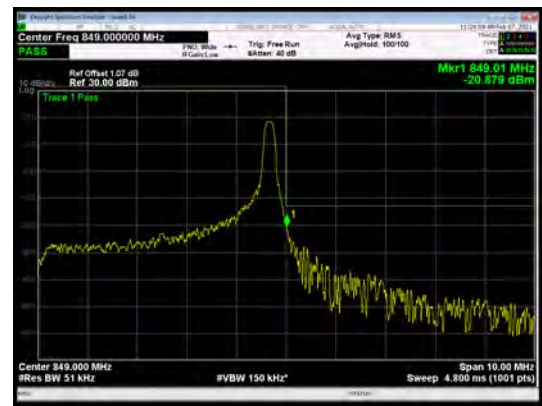
LTE Band 5 QPSK 3MHz CH-High 100%RB



LTE Band 5 QPSK 5MHz CH-Low 1RB



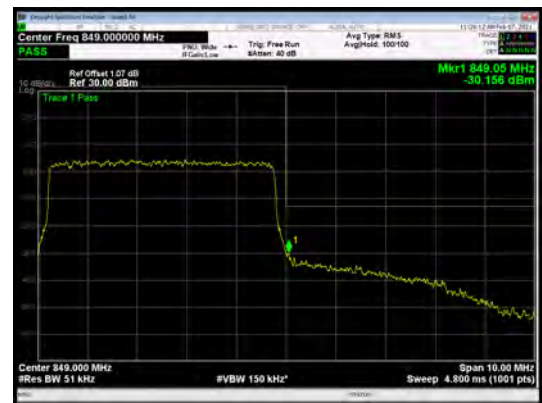
LTE Band 5 QPSK 5MHz CH-High 1RB



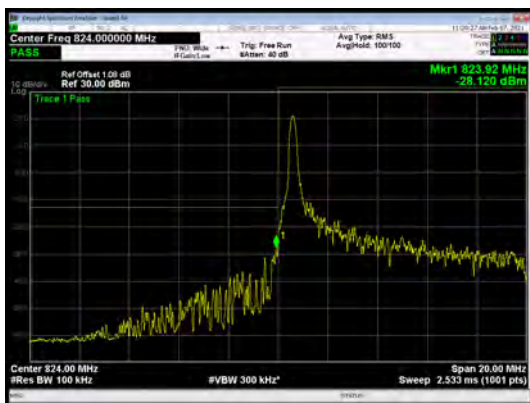
LTE Band 5 QPSK 5MHz CH-Low 100%RB



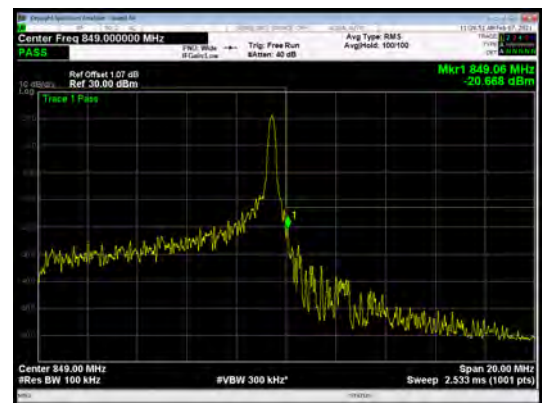
LTE Band 5 QPSK 5MHz CH-High 100%RB



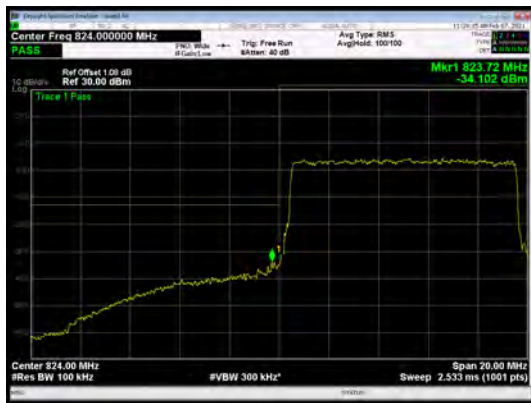
LTE Band 5 QPSK 10MHz CH-Low 1RB



LTE Band 5 QPSK 10MHz CH-High 1RB



LTE Band 5 QPSK 10MHz CH-Low 100%RB



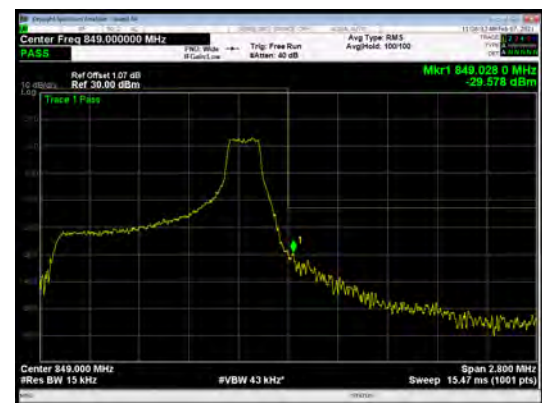
LTE Band 5 QPSK 10MHz CH-High 100%RB



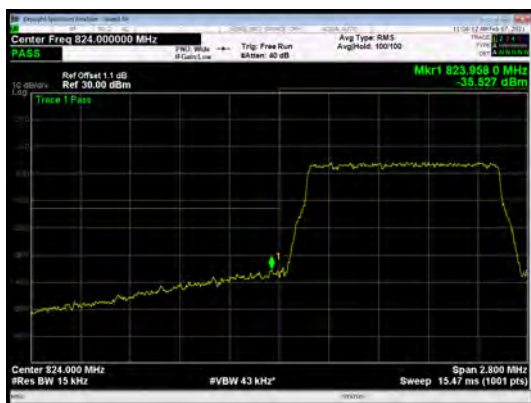
LTE Band 5 16QAM 1.4MHz CH-Low 1RB



LTE Band 5 16QAM 1.4MHz CH-High 1RB



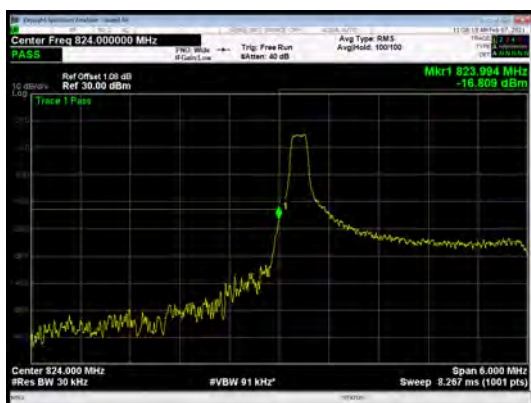
LTE Band 5 16QAM 1.4MHz CH-Low 100%RB



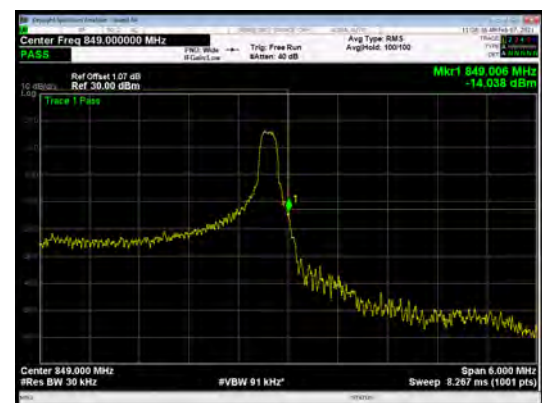
LTE Band 5 16QAM 1.4MHz CH-High 100%RB



LTE Band 5 16QAM 3MHz CH-Low 1RB

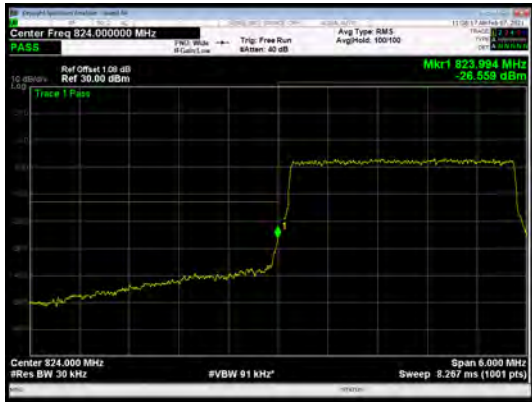


LTE Band 5 16QAM 3MHz CH-High 1RB





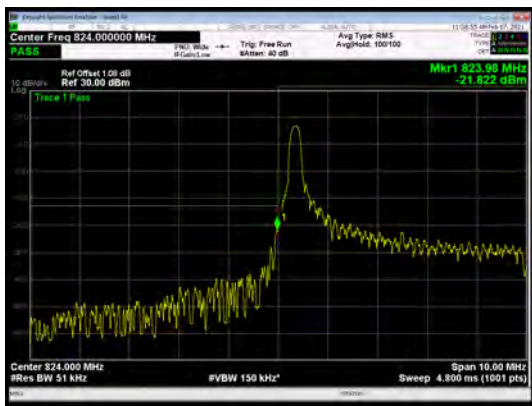
LTE Band 5 16QAM 3MHz CH-Low 100%RB



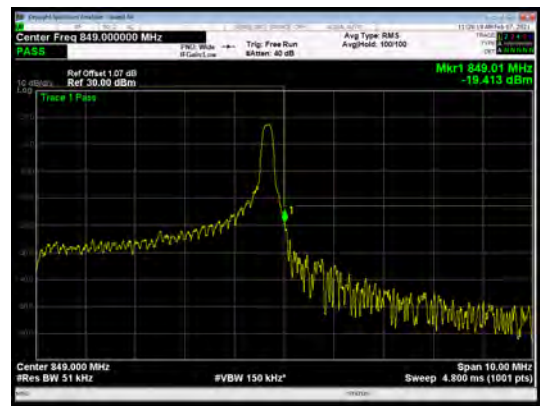
LTE Band 5 16QAM 3MHz CH-High 100%RB



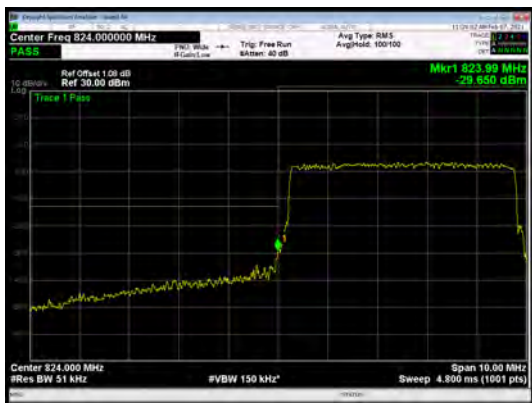
LTE Band 5 16QAM 5MHz CH-Low 1RB



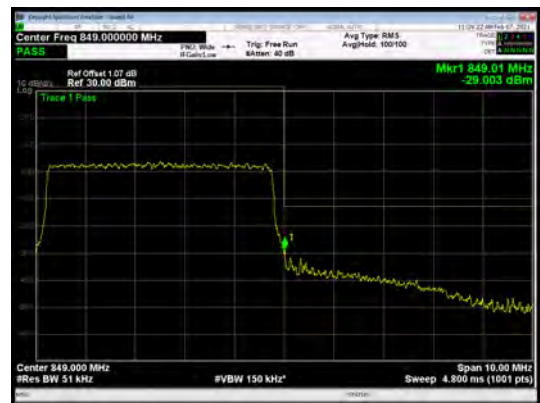
LTE Band 5 16QAM 5MHz CH-High 1RB



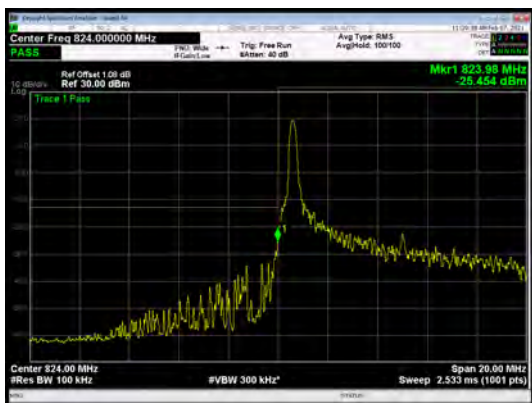
LTE Band 5 16QAM 5MHz CH-Low 100%RB



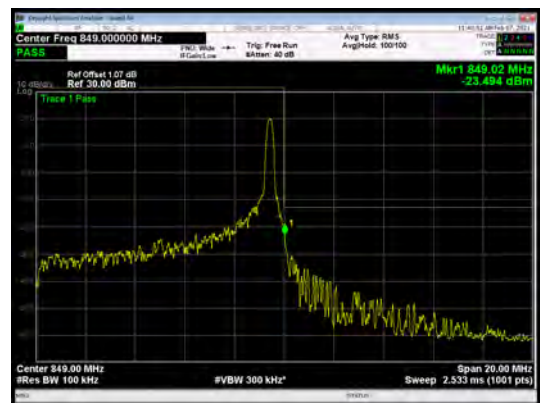
LTE Band 5 16QAM 5MHz CH-High 100%RB



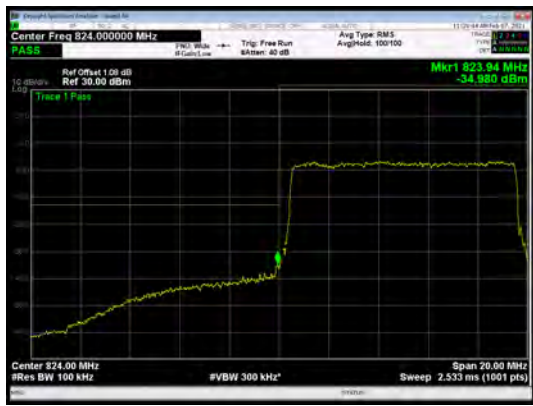
LTE Band 5 16QAM 10MHz CH-Low 1RB



LTE Band 5 16QAM 10MHz CH-High 1RB



LTE Band 5 16QAM 10MHz CH-Low 100%RB



LTE Band 5 16QAM 10MHz CH-High 100%RB



5.4. Peak-to-Average Power Ratio (PAPR)

Ambient condition

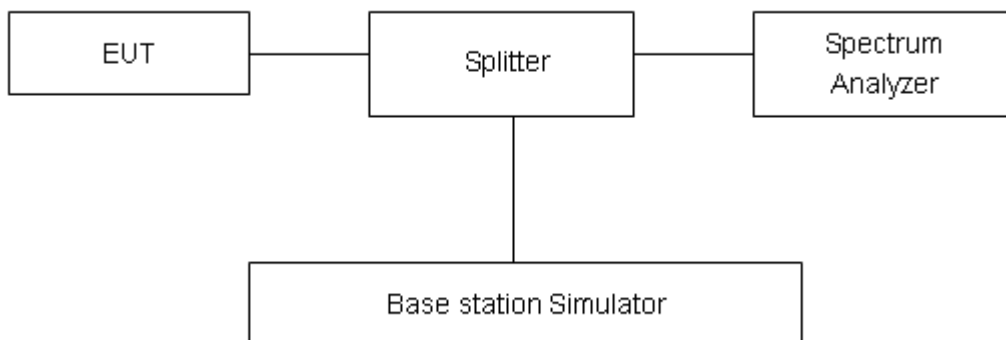
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Methods of Measurement

Measure the total peak power and record as P_{Pk} . And measure the total average power and record as P_{Avg} . Both the peak and average power levels must be expressed in the same logarithmic units (e.g., dBm). Determine the PAPR from:

$$PAPR (dB) = P_{Pk} (dBm) - P_{Avg} (dBm).$$

Test Setup



Limits

According to the Sec. 22.913(d), The peak-to-average ratio (PAR) of the transmission must not exceed 13 dB.

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U = 0.4$ dB.



Test Results

Mode	Channel	Frequency (MHz)	Peak (dBm)	Avg (dBm)	PAPR (dB)	Limit (dB)	Conclusion
GSM 850 (GMSK)	128	824.2	34.08	32.83	1.25	≤13	PASS
	190	836.6	34.39	32.94	1.45	≤13	PASS
	251	848.8	34.28	33.01	1.27	≤13	PASS
GPRS 850 (GMSK)	128	824.2	34.10	32.82	1.28	≤13	PASS
	190	836.6	34.27	32.91	1.36	≤13	PASS
	251	848.8	34.29	32.97	1.32	≤13	PASS
EGPRS 850 (8PSK)	128	824.2	29.09	27.05	2.04	≤13	PASS
	190	836.6	29.38	27.27	2.11	≤13	PASS
	251	848.8	29.19	27.14	2.05	≤13	PASS
WCDMA Band V (RMC)	4132	826.4	26.12	23.18	2.94	≤13	PASS
	4183	836.6	26.05	23.11	2.94	≤13	PASS
	4233	846.6	25.97	23.09	2.88	≤13	PASS

LTE Band 5								
Modulation	Bandwidth (MHz)	Channel	Frequency (MHz)	Peak (dBm)	Avg (dBm)	PAPR (dB)	Limit (dB)	Conclusion
QPSK	1.4	20407	824.7	27.53	22.27	5.26	≤13	PASS
		20525	836.5	27.65	22.31	5.34	≤13	PASS
		20643	848.3	27.28	22.22	5.06	≤13	PASS
	3	20415	825.5	27.64	22.38	5.26	≤13	PASS
		20525	836.5	27.58	22.29	5.29	≤13	PASS
		20635	847.5	27.26	22.23	5.03	≤13	PASS
	5	20425	826.5	27.60	22.42	5.18	≤13	PASS
		20525	836.5	27.61	22.24	5.37	≤13	PASS
		20625	846.5	27.39	22.34	5.05	≤13	PASS
	10	20450	829	27.56	22.31	5.25	≤13	PASS
		20525	836.5	27.64	22.31	5.33	≤13	PASS
		20600	844	27.48	22.37	5.11	≤13	PASS
16QAM	1.4	20407	824.7	27.30	21.40	5.90	≤13	PASS
		20525	836.5	27.49	21.48	6.01	≤13	PASS
		20643	848.3	27.26	21.47	5.79	≤13	PASS
	3	20415	825.5	27.39	21.29	6.10	≤13	PASS
		20525	836.5	27.62	21.46	6.16	≤13	PASS
		20635	847.5	27.14	21.08	6.06	≤13	PASS
	5	20425	826.5	27.36	21.40	5.96	≤13	PASS
		20525	836.5	27.44	21.35	6.09	≤13	PASS
		20625	846.5	27.21	21.35	5.86	≤13	PASS
	10	20450	829	27.45	21.44	6.01	≤13	PASS
		20525	836.5	27.61	21.49	6.12	≤13	PASS
		20600	844	27.11	21.17	5.94	≤13	PASS

5.5. Frequency Stability

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

Frequency Stability (Temperature Variation)

The temperature inside the climate chamber is varied from -30°C to +75°C in 10°C step size,

(1) With all power removed, the temperature was decreased to 0°C and permitted to stabilize for three hours.

(2) Measure the carrier frequency with the test equipment in a “call mode”. These measurements should be made within 1 minute of powering up the mobile station, to prevent significant self warming.

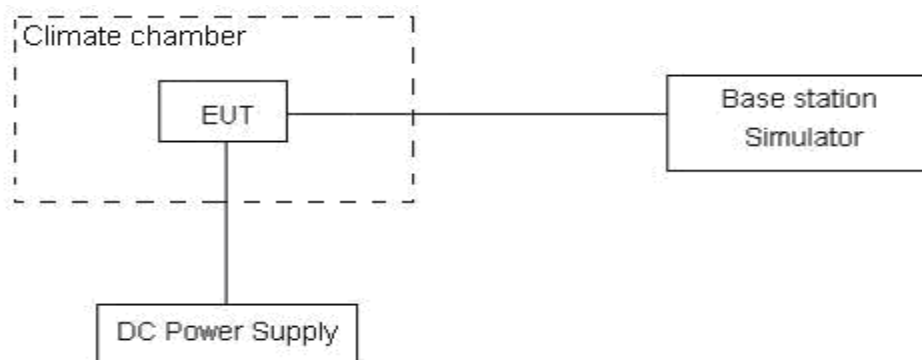
(3) Repeat the above measurements at 10°C increments from -30°C to +75°C. Allow at least 1.5 hours at each temperature, un-powered, before making measurements. Frequency Stability (Voltage Variation)

The frequency stability shall be measured with variation of primary supply voltage as follows:

Primary Supply Voltage: The primary supply voltage is varied from 85% to 115% of the nominal value for non hand-carried battery and AC powered equipment. For hand-carried, battery-powered equipment, primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacturer.

This transceiver is specified to operate with an input voltage of between 3.23 V and 4.37 V, with a nominal voltage of 3.8V.

Test setup



Limits

According to the Sec. 22.355, the frequency stability of the carrier shall be accurate to within 2.5 ppm of the received frequency for mobile stations.

Limits	≤ 2.5 ppm
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Measurement Uncertainty

The assessed measurement uncertainty to ensure 99.75% confidence level for the normal distribution is with the coverage factor $k = 3$, $U = 0.01\text{ppm}$.



Test Result

GSM850

Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability (ppm)	Frequency Stability (ppm)	Verdict
Temperature	Voltage	GMSK	8PSK	GMSK	8PSK	
Normal (25°C)	Normal	13.17	10.07	0.00701	0.00536	PASS
Extreme (75°C)		6.63	10.65	0.00353	0.00567	PASS
Extreme (70°C)		10.02	13.73	0.00533	0.00730	PASS
Extreme (60°C)		16.88	7.28	0.00898	0.00387	PASS
Extreme (50°C)		1.29	5.71	0.00068	0.00304	PASS
Extreme (40°C)		10.88	13.35	0.00579	0.00710	PASS
Extreme (30°C)		8.67	4.29	0.00461	0.00228	PASS
Extreme (20°C)		7.38	16.60	0.00393	0.00883	PASS
Extreme (10°C)		13.05	13.27	0.00694	0.00706	PASS
Extreme (0°C)		12.99	8.75	0.00691	0.00465	PASS
Extreme (-10°C)		6.98	8.35	0.00371	0.00444	PASS
Extreme (-20°C)		8.55	13.06	0.00455	0.00695	PASS
Extreme (-30°C)		4.08	4.34	0.00217	0.00231	PASS
25°C	LV	8.31	12.29	0.00442	0.00654	PASS
	HV	14.97	8.20	0.00796	0.00436	PASS

WCDMA B5

Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability (ppm)	Frequency Stability (ppm)	Verdict
Temperature	Voltage	BPSK	QPSK	BPSK	QPSK	
Normal (25°C)	Normal	16.95	9.42	0.00902	0.00501	PASS
Extreme (75°C)		12.18	8.57	0.00648	0.00456	PASS
Extreme (70°C)		1.65	11.83	0.00088	0.00629	PASS
Extreme (60°C)		14.93	8.97	0.00794	0.00477	PASS
Extreme (50°C)		13.42	3.66	0.00714	0.00194	PASS
Extreme (40°C)		3.38	6.94	0.00180	0.00369	PASS
Extreme (30°C)		9.73	11.37	0.00518	0.00605	PASS
Extreme (20°C)		5.04	16.66	0.00268	0.00886	PASS
Extreme (10°C)		5.37	10.67	0.00286	0.00567	PASS
Extreme (0°C)		9.58	5.71	0.00510	0.00304	PASS
Extreme (-10°C)		3.22	10.02	0.00171	0.00533	PASS



Extreme (-20°C)		3.36	9.29	0.00179	0.00494	PASS
Extreme (-30°C)		12.94	9.95	0.00689	0.00529	PASS
25°C	LV	13.83	15.48	0.00736	0.00823	PASS
	HV	9.32	15.17	0.00496	0.00807	PASS

LTE BAND5

Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability (ppm)	Frequency Stability (ppm)	Verdict
BANDWIDTH	1.4MHz					
Temperature	Voltage	16QAM	QPSK	16QAM	QPSK	
Normal (25°C)	Normal	16.55	17.42	0.00880	0.00927	PASS
Extreme (75°C)		17.66	14.40	0.00939	0.00766	PASS
Extreme (70°C)		2.20	12.86	0.00117	0.00684	PASS
Extreme (60°C)		8.18	15.64	0.00435	0.00832	PASS
Extreme (50°C)		17.27	13.34	0.00918	0.00710	PASS
Extreme (40°C)		14.01	3.03	0.00745	0.00161	PASS
Extreme (30°C)		13.31	15.21	0.00708	0.00809	PASS
Extreme (20°C)		15.09	9.94	0.00802	0.00529	PASS
Extreme (10°C)		14.67	2.46	0.00780	0.00131	PASS
Extreme (0°C)		5.24	17.59	0.00279	0.00936	PASS
Extreme (-10°C)		12.05	12.75	0.00641	0.00678	PASS
Extreme (-20°C)		6.06	12.34	0.00322	0.00656	PASS
Extreme (-30°C)		9.16	2.12	0.00487	0.00113	PASS
25°C		LV	5.19	13.70	0.00276	0.00729
	HV	2.74	12.27	0.00146	0.00653	PASS
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability (ppm)	Frequency Stability (ppm)	Verdict
BANDWIDTH	3MHz					
Temperature	Voltage	16QAM	QPSK	16QAM	QPSK	
Normal (25°C)	Normal	16.19	1.07	0.00861	0.00057	PASS
Extreme (75°C)		8.13	16.78	0.00433	0.00893	PASS
Extreme (70°C)		4.38	16.07	0.00233	0.00855	PASS
Extreme (60°C)		9.16	17.42	0.00487	0.00927	PASS
Extreme (50°C)		2.23	12.76	0.00118	0.00679	PASS
Extreme (40°C)		17.47	6.79	0.00929	0.00361	PASS
Extreme (30°C)		10.43	7.47	0.00555	0.00397	PASS
Extreme (20°C)		17.56	12.57	0.00934	0.00669	PASS
Extreme (10°C)		13.42	5.05	0.00714	0.00269	PASS
Extreme (0°C)		4.41	13.01	0.00234	0.00692	PASS
Extreme (-10°C)		15.48	2.89	0.00823	0.00154	PASS
Extreme (-20°C)		13.22	9.72	0.00703	0.00517	PASS
Extreme (-30°C)		1.15	8.93	0.00061	0.00475	PASS



25°C	LV	7.77	15.06	0.00413	0.00801	PASS
	HV	6.03	6.05	0.00321	0.00322	PASS
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability (ppm)	Frequency Stability (ppm)	Verdict
BANDWIDTH	5MHz					
Temperature	Voltage	16QAM	QPSK	16QAM	QPSK	
Normal (25°C)	Normal	15.99	12.19	0.00851	0.00648	PASS
Extreme (75°C)		7.12	14.06	0.00379	0.00748	PASS
Extreme (70°C)		13.90	12.78	0.00740	0.00680	PASS
Extreme (60°C)		4.65	1.86	0.00248	0.00099	PASS
Extreme (50°C)		16.03	6.83	0.00853	0.00363	PASS
Extreme (40°C)		10.02	16.04	0.00533	0.00853	PASS
Extreme (30°C)		6.50	1.50	0.00346	0.00080	PASS
Extreme (20°C)		1.62	3.02	0.00086	0.00161	PASS
Extreme (10°C)		12.79	15.76	0.00680	0.00838	PASS
Extreme (0°C)		14.66	11.17	0.00780	0.00594	PASS
Extreme (-10°C)		3.64	13.65	0.00193	0.00726	PASS
Extreme (-20°C)		13.31	9.29	0.00708	0.00494	PASS
Extreme (-30°C)	15.36	12.47	0.00817	0.00663	PASS	
25°C	LV	10.39	1.03	0.00553	0.00055	PASS
	HV	1.42	5.25	0.00076	0.00279	PASS
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability (ppm)	Frequency Stability (ppm)	Verdict
BANDWIDTH	10MHz					
Temperature	Voltage	16QAM	QPSK	16QAM	QPSK	
Normal (25°C)	Normal	4.40	11.88	0.00234	0.00632	PASS
Extreme (75°C)		16.85	17.21	0.00896	0.00916	PASS
Extreme (70°C)		6.71	13.66	0.00357	0.00726	PASS
Extreme (60°C)		1.96	16.74	0.00104	0.00891	PASS
Extreme (50°C)		10.63	16.84	0.00565	0.00896	PASS
Extreme (40°C)		6.02	7.59	0.00320	0.00404	PASS
Extreme (30°C)		6.63	4.81	0.00353	0.00256	PASS
Extreme (20°C)		14.31	10.06	0.00761	0.00535	PASS
Extreme (10°C)		14.16	8.50	0.00753	0.00452	PASS
Extreme (0°C)		7.25	6.85	0.00385	0.00364	PASS
Extreme (-10°C)		10.29	16.05	0.00547	0.00854	PASS
Extreme (-20°C)		10.47	14.52	0.00557	0.00772	PASS
Extreme (-30°C)	7.67	8.25	0.00408	0.00439	PASS	
25°C	LV	14.11	12.18	0.00751	0.00648	PASS
	HV	5.05	15.14	0.00269	0.00805	PASS

5.6. Spurious Emissions at Antenna Terminals

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

The EUT was connected to Spectrum Analyzer and Base Station Simulator via power Splitter. The measurement is carried out using a spectrum analyzer. The spectrum analyzer scans from 9kHz to the 10th harmonic of the carrier.

The peak detector is used. RBW are set to 100 kHz and VBW are set to 300 kHz for below 1G, RBW are set to 1MHz and VBW are set to 3MHz for above 1G, Sweep is set to ATUO.

RBW is set to 1 kHz (0.009MHz~ 0.15 MHz),

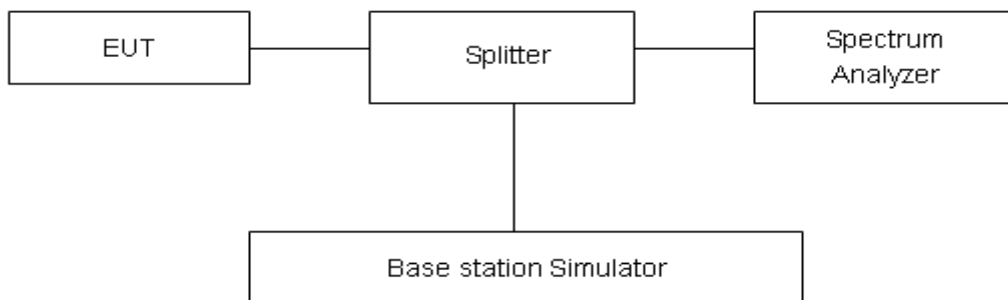
RBW is set to 10 kHz (0.15 MHz~ 30 MHz)

RBW is set to 100 kHz (30MHz~1000 MHz)

RBW is set to 1000 kHz (above 1000MHz)

The modulation mode and RB allocation refer to section 5.1, using the maximum output power configuration.

Test setup



Limits

Rule Part 22.917(a) specifies that “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.”

Limit	-13 dBm

Measurement Uncertainty

The assessed measurement uncertainty to ensure 99.75% confidence level for the normal distribution is with the coverage factor $k = 1.96$.

Frequency	Uncertainty
9kHz-1GHz	0.684 dB
1GHz-18GHz	1.407 dB



Test Result

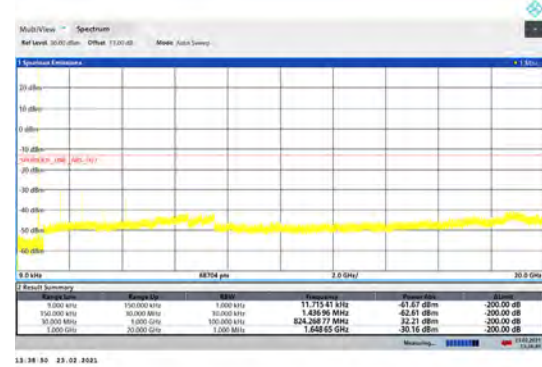
Sweep the whole frequency band through the range from 9kHz to the 10th harmonic of the carrier, the emissions more than 20 dB below the limit are not reported.

The signal beyond the limit is carrier.

GSM 850 CH-Low 9kHz ~ 20GHz



GPRS 850 CH-Low 9kHz ~ 20GHz



GSM 850 CH-Middle 9kHz ~ 20GHz



GPRS 850 CH-Middle 9kHz ~ 20GHz



GSM 850 CH-High 9kHz ~ 20GHz



GPRS 850 CH-High 9kHz ~ 20GHz





EGPRS 850 CH-Low 9kHz ~ 20GHz



13 40 40 23. 02. 2023

WCDMA BAND V CH-Low 9kHz ~ 20GHz



13 21 23 23. 02. 2023

EGPRS 850 CH-Middle 9kHz ~ 20GHz



13 41 08 23. 02. 2023

WCDMA BAND V CH-Middle 9kHz ~ 20GHz



13 21 24 23. 02. 2023

EGPRS 850 CH-High 9kHz ~ 20GHz



13 41 30 23. 02. 2023

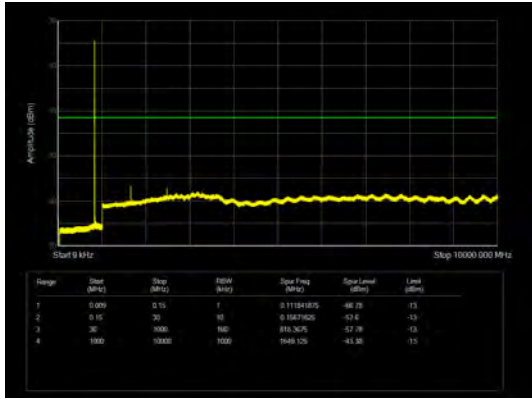
WCDMA BAND V CH-High 9kHz ~ 20GHz



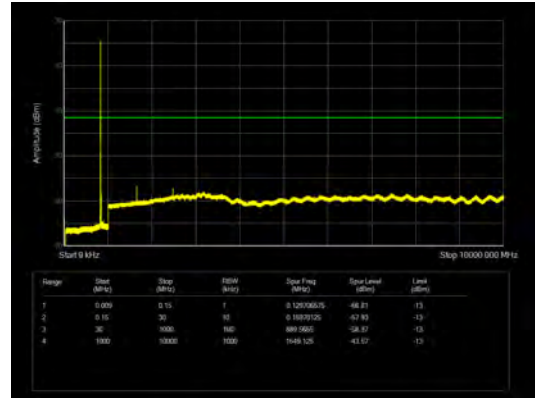
13 23 11 23. 02. 2023



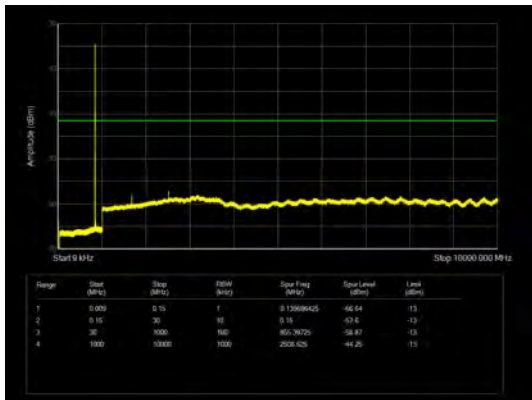
LTE Band 5 1.4MHz CH-Low 9kHz~10GHz



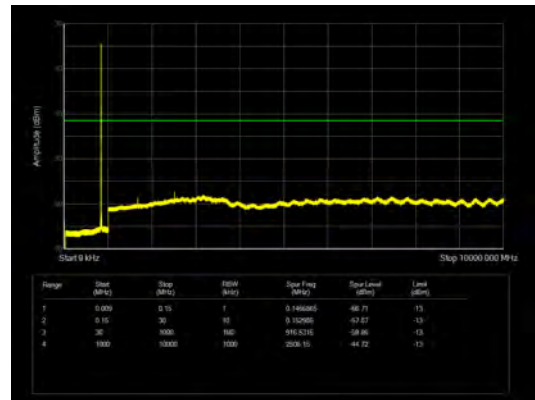
LTE Band 5 3MHz CH-Low 9kHz~10GHz



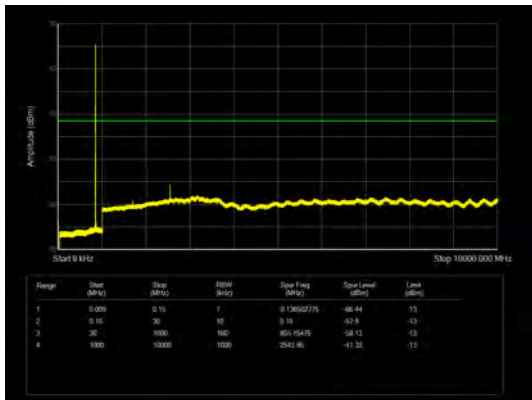
LTE Band 5 1.4MHz CH-Middle 9kHz~10GHz



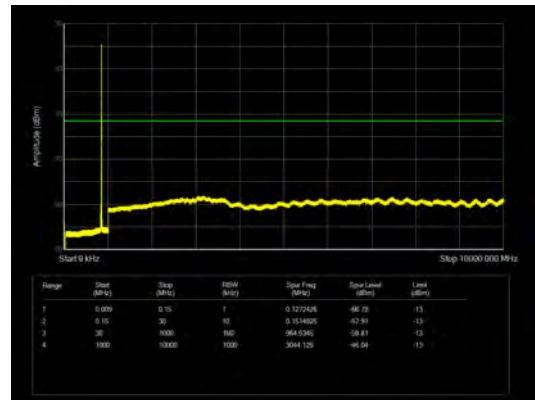
LTE Band 5 3MHz CH-Middle 9kHz~10GHz



LTE Band 5 1.4MHz CH-High 9kHz~10GHz

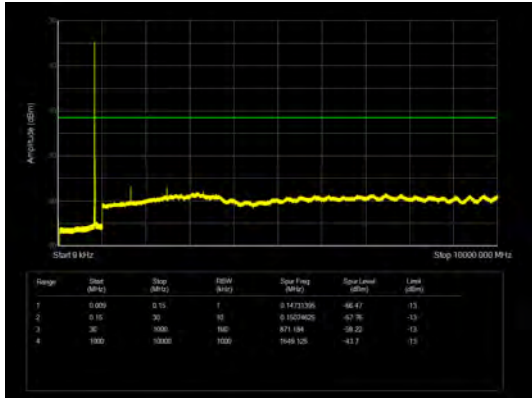


LTE Band 5 3MHz CH-High 9kHz~10GHz

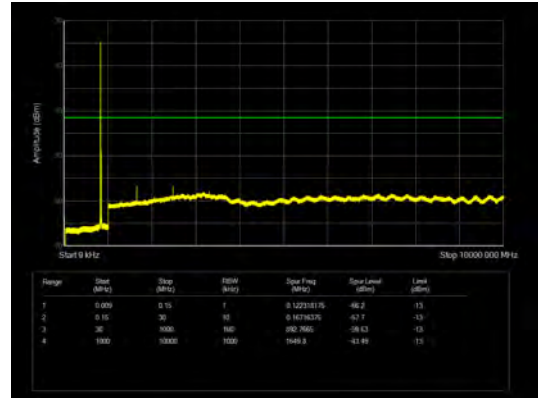




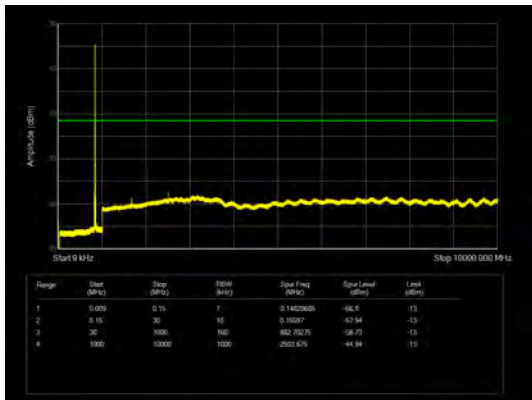
LTE Band 5 5MHz CH-Low 9kHz~10GHz



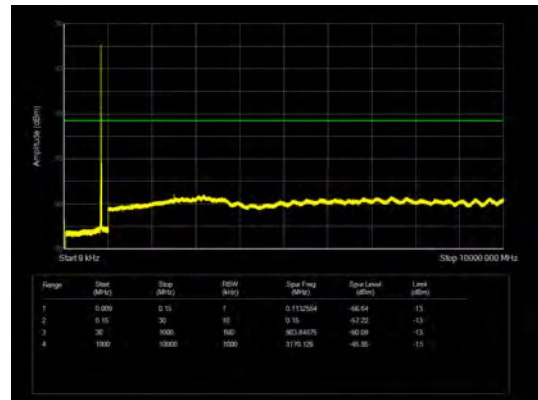
LTE Band 5 10MHz CH-Low 9kHz~10GHz



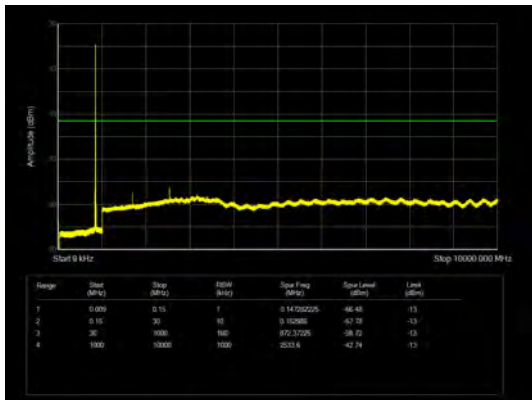
LTE Band 5 5MHz CH-Middle 9kHz~10GHz



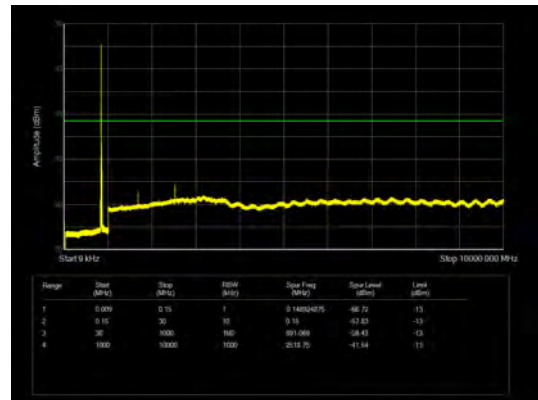
LTE Band 5 10MHz CH-Middle 9kHz~10GHz



LTE Band 5 5MHz CH-High 9kHz~10GHz



LTE Band 5 10MHz CH-High 9kHz~10GHz



5.7. Radiates Spurious Emission

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

1. The testing follows FCC KDB 971168 v03r01 Section 5.8 and ANSI C63.26 (2015).
2. Below 1GHz: The EUT is placed on a turntable 0.8 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, the height range of antenna is 1 m to 4 m, the azimuth range of turntable is 0° to 360°, and the receive antenna has two polarizations Vertical (V) and Horizontal (H). Above 1GHz: (Note: the FCC's permission to use 1.5m as an alternative per TCBC Conf call of Dec. 2, 2014.) The EUT is placed on a turntable 1.5 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, the height range of antenna is 1 m to 4 m, the azimuth range of turntable is 0° to 360°, and the receive antenna has two polarizations Vertical (V) and Horizontal (H).
3. A loop antenna, A log-periodic antenna or horn antenna shall be substituted in place of the EUT. The log-periodic antenna will be driven by a signal generator and the level will be adjusted till the same power value on the spectrum analyzer or receiver. The level of the spurious emissions can be calculated through the level of the signal generator, cable loss, the gain of the substitution antenna and the reading of the spectrum analyzer or receiver.
4. The EUT is then put into continuously transmitting mode at its maximum power level during the test. Set Test Receiver or Spectrum RBW=200Hz,VBW=600Hz for 9kHz-150kHz , RBW=10kHz, VBW=30kHz 150kHz-30MHz , RBW=100kHz,VBW=300kHz for 30MHz to 1GHz and RBW=1MHz, VBW=3MHz for above 1GHz, And the maximum value of the receiver should be recorded as (Pr).
5. The EUT shall be replaced by a substitution antenna. In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power (PMea) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded (Pr). The power of signal source (PMea) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.
6. A amplifier should be connected to the Signal Source output port. And the cable should be connect between the Amplifier and the Substitution Antenna. The cable loss (Pcl) ,the Substitution Antenna Gain (Ga) and the Amplifier Gain (PAg) should be recorded after test.
7. The measurement results are obtained as described below:
$$\text{Power(EIRP)} = \text{PMea} - \text{PAg} - \text{Pcl} + \text{Ga}$$

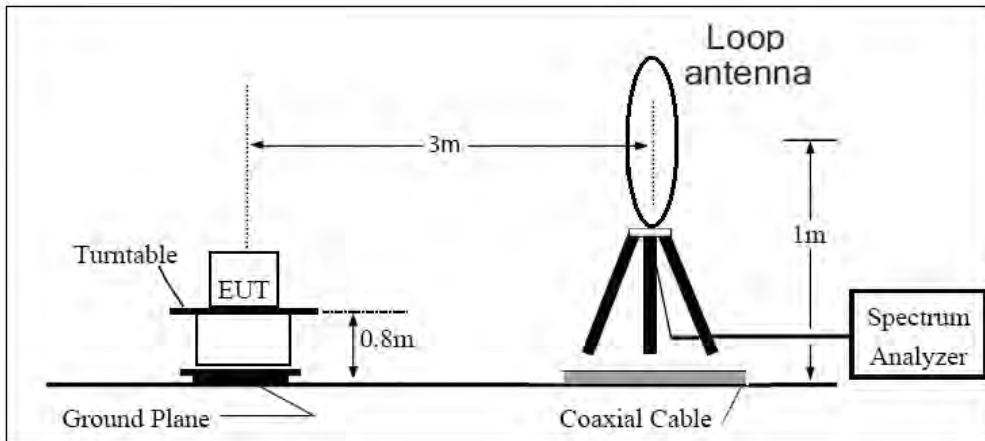
The measurement results are amend as described below:
$$\text{Power(EIRP)} = \text{PMea} - \text{Pcl} + \text{Ga}$$
8. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi)

and known input power. ERP can be calculated from EIRP by subtracting the gain of the dipole, $ERP = EIRP - 2.15\text{dBi}$.

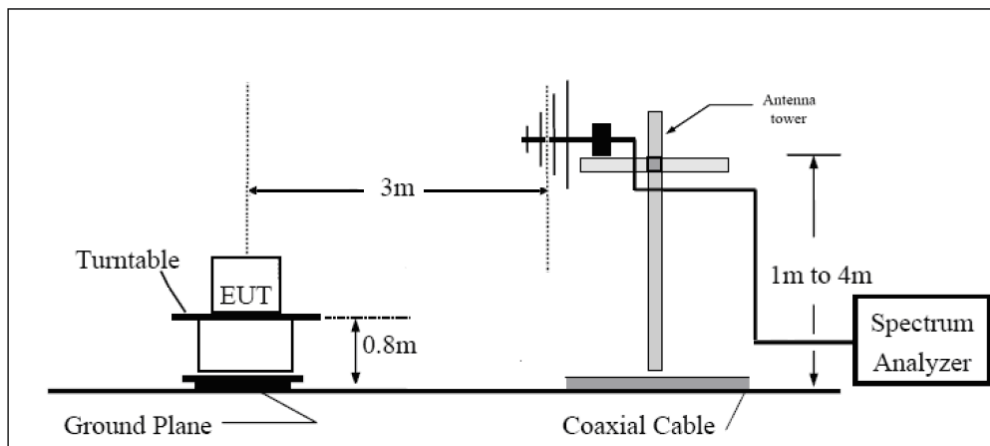
The modulation mode and RB allocation refer to section 5.1, using the maximum output power configuration.

Test setup

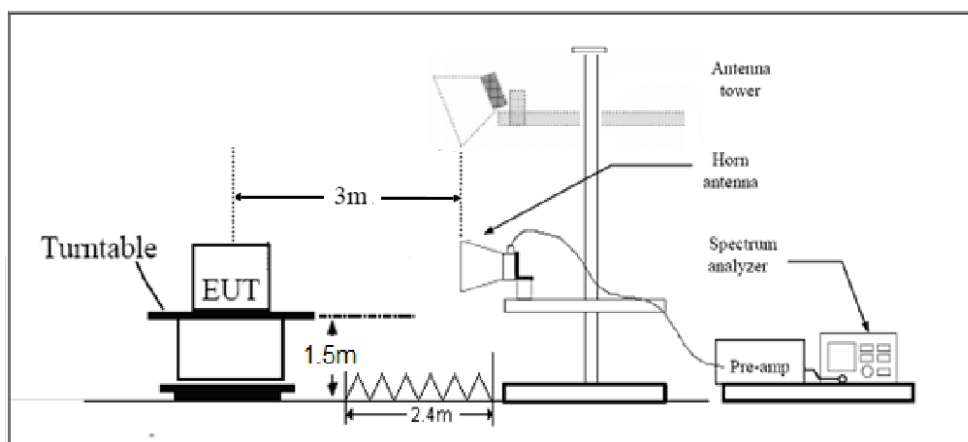
9KHz ~ 30MHz



30MHz ~ 1GHz



Above 1GHz



Note: Area side: 2.4mX3.6m



Limits

Rule Part 22.917(a) specifies that “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.”

Limit	-13 dBm
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Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 1.96$, $U = 3.55$ dB.

**Test Result**

Sweep the whole frequency band through the range from 9kHz to the 10th harmonic of the carrier, the emissions below the noise floor will not be recorded in the report.

GSM 850 CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1673.88	-48.56	1.70	8.70	Horizontal	-43.71	-13.00	30.71	45
3	2509.69	-45.67	2.30	12.00	Horizontal	-38.12	-13.00	25.12	135
4	3346.40	-53.22	2.70	12.70	Horizontal	-45.37	-13.00	32.37	45
5	4183.00	-49.29	3.00	12.50	Horizontal	-41.94	-13.00	28.94	315
6	5019.60	-55.96	3.40	12.50	Horizontal	-49.01	-13.00	36.01	135
7	5856.20	-59.36	3.40	12.80	Horizontal	-52.11	-13.00	39.11	45
8	6692.80	-56.41	4.10	11.50	Horizontal	-51.16	-13.00	38.16	135
9	7529.40	-54.86	4.20	12.20	Horizontal	-49.01	-13.00	36.01	45
10	8366.00	-54.66	4.30	12.50	Horizontal	-48.61	-13.00	35.61	180

Note: 1.The other Spurious RF Radiated emissions level is no more than noise floor.

2.The worst emission was found in the antenna is Horizontal position.

WCDMA Band V CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1673.20	-55.56	1.70	8.70	Horizontal	-50.71	-13.00	37.71	135
3	2509.80	-50.96	2.30	12.00	Horizontal	-43.41	-13.00	30.41	270
4	3346.40	-61.08	2.70	12.70	Horizontal	-53.23	-13.00	40.23	45
5	4183.00	-60.61	3.00	12.50	Horizontal	-53.26	-13.00	40.26	315
6	5019.60	-57.72	3.40	12.50	Horizontal	-50.77	-13.00	37.77	45
7	5856.20	-59.86	3.40	12.80	Horizontal	-52.61	-13.00	39.61	135
8	6692.80	-58.20	4.10	11.50	Horizontal	-52.95	-13.00	39.95	315
9	7529.40	-53.55	4.20	12.20	Horizontal	-47.70	-13.00	34.70	270
10	8366.00	-54.86	4.30	12.50	Horizontal	-48.81	-13.00	35.81	45

Note: 1.The other Spurious RF Radiated emissions level is no more than noise floor.

2.The worst emission was found in the antenna is Horizontal position.

LTE Band 5 1.4MHz CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1673.00	-56.74	1.70	8.70	Horizontal	-51.89	-13.00	38.89	45
3	2509.50	-45.09	2.30	12.00	Horizontal	-37.54	-13.00	24.54	135
4	3346.00	-60.64	2.70	12.70	Horizontal	-52.79	-13.00	39.79	45
5	4182.50	-55.76	3.00	12.50	Horizontal	-48.41	-13.00	35.41	180
6	5019.00	-57.31	3.40	12.50	Horizontal	-50.36	-13.00	37.36	225
7	5855.50	-57.73	3.40	12.80	Horizontal	-50.48	-13.00	37.48	315
8	6692.00	-58.10	4.10	11.50	Horizontal	-52.85	-13.00	39.85	0
9	7528.50	-52.88	4.20	12.20	Horizontal	-47.03	-13.00	34.03	45
10	8365.00	-52.42	4.30	12.50	Horizontal	-46.37	-13.00	33.37	180

Note: 1.The other Spurious RF Radiated emissions level is no more than noise floor.
 2.The worst emission was found in the antenna is Horizontal position.

LTE Band 5 5MHz CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1668.60	-41.84	1.70	8.70	Horizontal	-36.99	-13.00	23.99	225
3	2503.30	-58.49	2.30	12.00	Horizontal	-50.94	-13.00	37.94	225
4	3336.75	-57.96	2.70	12.70	Horizontal	-50.11	-13.00	37.11	45
5	4171.88	-55.61	3.00	12.50	Horizontal	-48.26	-13.00	35.26	90
6	5019.00	-57.02	3.40	12.50	Horizontal	-50.07	-13.00	37.07	135
7	5855.00	-57.82	3.40	12.80	Horizontal	-50.57	-13.00	37.57	90
8	6692.00	-57.14	4.10	11.50	Horizontal	-51.89	-13.00	38.89	315
9	7528.00	-52.81	4.20	12.20	Horizontal	-46.96	-13.00	33.96	900
10	8365.50	-48.70	4.30	12.50	Horizontal	-42.65	-13.00	29.65	45

Note: 1.The other Spurious RF Radiated emissions level is no more than noise floor.
 2.The worst emission was found in the antenna is Horizontal position.



LTE Band 5 10MHz CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1664.40	-56.71	1.70	8.70	Horizontal	-51.86	-13.00	38.86	90
3	2496.60	-44.65	2.30	12.00	Horizontal	-37.10	-13.00	24.10	0
4	3346.00	-59.21	2.70	12.70	Horizontal	-51.36	-13.00	38.36	180
5	4182.50	-57.11	3.00	12.50	Horizontal	-49.76	-13.00	36.76	180
6	5019.00	-57.72	3.40	12.50	Horizontal	-50.77	-13.00	37.77	0
7	5855.50	-58.92	3.40	12.80	Horizontal	-51.67	-13.00	38.67	315
8	6692.00	-57.55	4.10	11.50	Horizontal	-52.30	-13.00	39.30	225
9	7528.50	-55.15	4.20	12.20	Horizontal	-49.30	-13.00	36.30	135
10	8365.00	-51.27	4.30	12.50	Horizontal	-45.22	-13.00	32.22	225

Note: 1.The other Spurious RF Radiated emissions level is no more than noise floor.

2.The worst emission was found in the antenna is Horizontal position.



6. Main Test Instruments

Name	Manufacturer	Type	Serial Number	Calibration Date	Expiration Date
Base Station Simulator	R&S	CMW500	113824	2020-05-18	2021-05-17
Power Splitter	Hua Xiang	SHX-GF2-2-13	10120101	/	/
Spectrum Analyzer	Key sight	N9010A	MY50210259	2020-05-18	2021-05-17
Universal Radio Communication Tester	Key sight	E5515C	MY48367192	2020-05-27	2021-05-26
Signal Analyzer	R&S	FSV30	100815	2020-12-13	2021-12-12
Loop Antenna	SCHWARZBECK	FMZB1519	1519-047	2020-04-02	2023-04-01
TRILOG Broadband Antenna	SCHWARZBECK	VULB 9163	391	2019-12-16	2021-12-15
Horn Antenna	R&S	HF907	102723	2018-08-11	2021-08-10
Horn Antenna	ETS-Lindgren	3160-09	00102643	2018-06-20	2021-06-19
Signal generator	R&S	SMB 100A	102594	2020-05-18	2021-05-17
Climatic Chamber	ESPEC	SU-242	93000506	2020-12-13	2021-12-12
Preamplifier	R&S	SCU18	102327	2020-05-18	2021-05-17
MOB COMMS DC SUPPLY	Keysight	66319D	MY43004105	2020-05-18	2021-05-17
RF Cable	Agilent	SMA 15cm	0001	2020-12-10	2021-06-09
Software	R&S	EMC32	9.26.0	/	/

*****END OF REPORT *****



ANNEX A: The EUT Appearance

The EUT Appearance are submitted separately.



ANNEX B: Test Setup Photos

The Test Setup Photos are submitted separately.