



RF TEST REPORT

Applicant Xiaomi Communications Co., Ltd.
FCC ID 2AFZZ33L2G
Product Mobile Phone
Brand Redmi
Model 220233L2G
Report No. R2112A1138-R2
Issue Date January 20, 2022

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC CFR47 Part 2 (2020)/ FCC CFR 47 Part 24E (2020)**. 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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Summary of measurement results

No.	Test Case	Clause in FCC rules	Verdict
1	RF Power Output and Effective Isotropic Radiated Power	2.1046 24.232(c)	PASS
2	Occupied Bandwidth	2.1049	PASS
3	Band Edge Compliance	2.1051 / 24.238(a)	PASS
4	Peak-to-Average Power Ratio	24.232/KDB 971168 D01(5.7)	PASS
5	Frequency Stability	2.1055 / 24.235	PASS
6	Spurious Emissions at Antenna Terminals	2.1051 / 24.238(a)	PASS
7	Radiates Spurious Emission	2.1053 / 24.238(a)	PASS

Date of Testing: (Original) April 28, 2020 ~ June 1, 2020

(Variant) December 27, 2021~January 10, 2022

Note: PASS: The EUT complies with the essential requirements in the standard.

FAIL: The EUT does not comply with the essential requirements in the standard.

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.

220233L2G (Report No.: R2112A1138-R2) is a variant model of M2006C3LG (Report No.: R2004A0237-R2V1). Test values partial duplicated from Original for variant. There is only verifying Conducted Power and test Radiated Spurious Emissions for variant in this report. The Difference between M2006C3LG and 220233L2G refer to the following table:

Difference		M2006C3LG (Original)	220233L2G (Variant)
Rear Camera		13M	13M+2M
Finger Print Sensor		not support	support
RF PA Supplier	RF Part	RF band are same between 220233L2G RF PA and M2006C3LG RF PA.	
	RF SW Part	Modem has been changed to adjust PA used and bias. Calibration files have also been updated to improve GSM linearized character, WCDMA performance under extreme condition and LTE current consumption performance.	
	RF HW PART	There are no change of DRX Saw and Duplexer.	
		M2006C3LG RF PA: --TXM+PA --TXM—VC7916-53M --PA-- VC7643-62M	220233L2G RF PA: --TXM+PA --TXM—OM8816-62M --PA-- HS8443-61M
		There are no change of DRX Saw and Duplexer. Except of TXM and PA changes, The capacitance and inductance on the RF path also have some difference.	
Others		The same	The same

The detailed product change description please refers to the Difference Declaration Letter.



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 electromagnetic emissions measurements.

A2LA (Certificate Number: 3857.01)

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

1.3. Testing Location

Company: TA Technology (Shanghai) Co., Ltd.
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2. General Description of Equipment under Test

2.1. Applicant and Manufacturer Information

Applicant	Xiaomi Communications Co., Ltd.
Applicant address	#019, 9th Floor, Building 6, 33 Xi'erqi Middle Road, Haidian District, Beijing, China, 100085
Manufacturer	Xiaomi Communications Co., Ltd.
Manufacturer address	#019, 9th Floor, Building 6, 33 Xi'erqi Middle Road, Haidian District, Beijing, China, 100085

2.2. General information

EUT Description		
Model	220233L2G	
IMEI	Original (M2006C3LG)	IMEI 1: 863234040033848 IMEI 2: 863234040038441
	Variant (220233L2G)	IMEI 1: 862643060048620 IMEI 2: 862643060048638
Hardware Version	P2	
Software Version	MIUI 12.5	
Antenna Type	PIFA Antenna	
Antenna Gain	Frequency(MHz)	Gain (dBi)
	1860	0.0
	1890	0.0
	1920	0.0
Test Mode(s)	GSM1900; WCDMA Band II; LTE Band 2;	
Test Modulation	(GSM)GMSK,8PSK; (WCDMA) BPSK, QPSK,16QAM; (LTE)QPSK,16QAM	
GPRS Multislot Class	12	
EGPRS Multislot Class	12	
HSDPA UE Category	24	
HSUPA UE Category	7	
DC-HSDPA UE Category	7	
HSPA+ UE Category	7	
LTE Category	4	
Maximum E.I.R.P	GSM 1900:	29.32dBm
	WCDMA Band II:	22.74dBm
	LTE Band 2:	22.79dBm
Rated Power Supply Voltage	3.85V	
Extreme Voltage	Minimum: 3.6V Maximum: 4.4V	
Extreme Temperature	Lowest: 0°C Highest: +40°C	



Operating Frequency Range(s)	Band	Tx (MHz)	Rx (MHz)
	GSM1900	1850 ~ 1910	1930 ~ 1990
	WCDMA Band II	1850 ~ 1910	1930 ~ 1990
	LTE Band 2	1850 ~ 1910	1930 ~ 1990
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 24E (2020)

ANSI C63.26 (2015)

Reference standard:

FCC CFR47 Part 2 (2020)

KDB 971168 D01 Power Meas License Digital Systems v03r01

4. Test Configuration

There is more than one SIM card slot, each one should be applied throughout the compliance test respectively, and however, only the worst case (SIM 1) will be recorded in this report.

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), for GSM and WCDMA the worst emission was found in position (Z axis, horizontal polarization) and the worst case was recorded; for LTE the worst emission was found in position (Y axis, vertical polarization) 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 1900	WCDMA Band II
RF Power Output and Effective Isotropic 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 to be reported as the worst case configuration below for LTE Band 2:

Test items	Bandwidth (MHz)						Modulation		RB			Test Channel		
	1.4	3	5	10	15	20	QPSK	16QAM	1	50%	100%	L	M	H
RF Power Output and Effective Isotropic Radiated Power	O	O	O	O	O	O	O	O	O	O	O	O	O	O
Occupied Bandwidth	O	O	O	O	O	O	O	O	-	-	O	O	O	O
Band Edge Compliance	O	O	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	O	O
Frequency Stability	O	O	O	O	O	O	O	O	O	O	O	O	O	O
Conducted Spurious Emissions	O	O	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 Isotropic Radiated Power

Ambient condition

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

Methods of Measurement

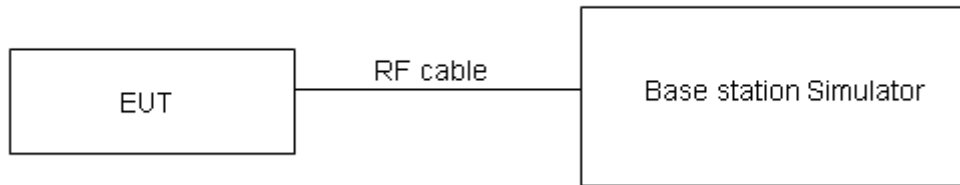
During the process of the testing, The EUT is controlled by the Base Station Simulator to ensure max power transmission and proper modulation.

The testing follows FCC KDB 971168 v03r01 Section 5.8 and ANSI C63.26 (2015).

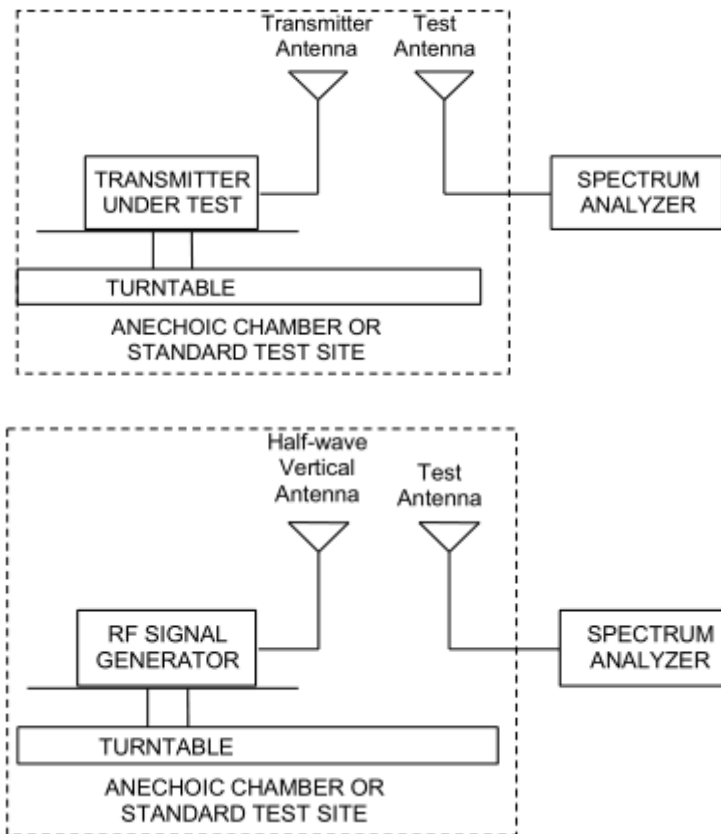
- Connect the equipment as illustrated. Mount the equipment with the manufacturer specified antenna in a vertical orientation on a manufacturer specified mounting surface located on a non-conducting rotating platform of a RF anechoic chamber (preferred) or a standard radiation site.
- Key the transmitter, then rotate the EUT 360° azimuthally and record spectrum analyzer power level (LVL) measurements at angular increments that are sufficiently small to permit resolution of all peaks. If a standard radiation test site is used, raise and lower the test antenna to obtain a maximum reading at each angular increment. (Note: several batteries may be needed to offset the effect of battery voltage droop, which should not exceed 5% of the manufactured specified battery voltage during transmission).
- Replace the transmitter under test with a vertically polarized half-wave dipole (or an antenna whose gain is known relative to an ideal half-wave dipole). The center of the antenna should be at the same location as the center of the antenna under test.
- Connect the antenna to a signal generator with a known output power and record the path loss (in dB) as LOSS. If a standard radiation test site is used, raise and lower the test antenna to obtain a maximum reading. $LOSS = \text{Generator Output Power (dBm)} - \text{Analyzer reading (dBm)}$
- Determine the effective radiated output power at each angular position from the readings in steps b) and d) using the following equation: $ERP \text{ (dBm)} = LVL \text{ (dBm)} + LOSS \text{ (dB)}$
- The maximum ERP is the maximum value determined in the preceding step.
- When calculating ERP, in addition to knowing the antenna radiation and matching characteristics, it is necessary to know the loss values of all elements (e.g.transmission line attenuation, mismatches, filters, combiners) interposed between the point where transmitter output power is measured, and the point where power is applied to the antenna. ERP can then be calculated as follows:
 $EIRP \text{ (dBm)} = \text{Output Power (dBm)} - \text{Losses (dB)} + \text{Antenna Gain (dBi)}$
where:dBd refers to gain relative to an ideal dipole.
 $EIRP \text{ (dBm)} = ERP \text{ (dBm)} + 2.15 \text{ (dB.)}$

The RB allocation refers to section 5.1, using the maximum output power configuration.

Test Setup



The loss between RF output port of the EUT and the input port of the tester has been taken into consideration.



Limits

No specific RF power output requirements in part 2.1046.

Rule Part 24.232(c) Mobile and portable stations are limited to 2 watts EIRP.

Rule Part 24.232(e) Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage.

Limit	$\leq 2 \text{ W}$ (33 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 EIRP.

Test Results

GSM 1900		Conducted Power (dBm)			EIRP (dBm)		
		Channel 512	Channel 661	Channel 810	Channel 512	Channel 661	Channel 810
		1850.2 (MHz)	1880 (MHz)	1909.8 (MHz)	1850.2 (MHz)	1880 (MHz)	1909.8 (MHz)
GSM	Results	29.31	29.14	29.22	29.31	29.14	29.22
GPRS/EGPRS (GMSK)	1TXslot	29.32	29.18	29.22	29.32	29.18	29.22
	2TXslots	27.81	27.66	27.70	27.81	27.66	27.70
	3TXslots	25.83	25.65	25.73	25.83	25.65	25.73
	4TXslots	24.85	24.70	24.79	24.85	24.70	24.79
EGPRS (8PSK)	1TXslot	26.07	25.95	25.93	26.07	25.95	25.93
	2TXslots	24.90	24.64	24.68	24.90	24.64	24.68
	3TXslots	22.80	22.60	22.69	22.80	22.60	22.69
	4TXslots	21.91	21.80	21.86	21.91	21.80	21.86

WCDMA Band II		Conducted Power (dBm)			EIRP (dBm)		
		Channel 9262	Channel 9400	Channel 9538	Channel 9262	Channel 9400	Channel 9538
		1852.4 (MHz)	1880 (MHz)	1907.6 (MHz)	1852.4 (MHz)	1880 (MHz)	1907.6 (MHz)
RMC	12.2k	22.70	22.74	22.73	22.70	22.74	22.73
AMR	12.2k	22.60	22.65	22.60	22.60	22.65	22.60
HSDPA	Sub - Test 1	21.12	21.16	21.15	21.12	21.16	21.15
	Sub - Test 2	21.11	21.15	21.14	21.11	21.15	21.14
	Sub - Test 3	21.10	21.14	21.13	21.10	21.14	21.13
	Sub - Test 4	21.09	21.13	21.12	21.09	21.13	21.12
HSUPA	Sub - Test 1	19.58	19.62	19.61	19.58	19.62	19.61
	Sub - Test 2	19.57	19.61	19.60	19.57	19.61	19.60
	Sub - Test 3	20.55	20.60	20.59	20.55	20.60	20.59
	Sub - Test 4	19.54	19.59	19.58	19.54	19.59	19.58
	Sub - Test 5	20.53	20.58	20.57	20.53	20.58	20.57
DC-HSDPA	Sub - Test 1	21.04	21.10	21.07	21.04	21.10	21.07
	Sub - Test 2	21.03	21.09	21.06	21.03	21.09	21.06
	Sub - Test 3	21.11	21.08	21.07	21.11	21.08	21.07
	Sub - Test 4	21.10	21.07	21.06	21.10	21.07	21.06
HSPA+	16QAM	21.59	21.65	21.63	21.59	21.65	21.63

LTE Band 2				Conducted Power(dBm)			EIRP (dBm)		
BW	Modulation	RB size	RB offset	Channel/Frequency(MHz)					
				18607/ 1850.7	18900/ 1880	19193/ 1909.3	18607/ 1850.7	18900/ 1880	19193/ 1909.3
1.4MHz	QPSK	1	0	22.37	22.45	22.41	22.37	22.45	22.41
		1	2	22.63	22.53	22.62	22.63	22.53	22.62
		1	5	22.23	22.22	22.26	22.23	22.22	22.26
		3	0	22.55	22.79	22.66	22.55	22.79	22.66
		3	2	22.55	22.73	22.61	22.55	22.73	22.61
		3	3	22.59	22.63	22.64	22.59	22.63	22.64
		6	0	21.62	21.75	21.68	21.62	21.75	21.68
	16QAM	1	0	21.87	21.67	21.76	21.87	21.67	21.76
		1	2	21.85	21.87	21.86	21.85	21.87	21.86
		1	5	21.72	21.64	21.65	21.72	21.64	21.65
		3	0	21.57	21.69	21.59	21.57	21.69	21.59
		3	2	21.69	21.57	21.50	21.69	21.57	21.5
		3	3	21.60	21.63	21.55	21.6	21.63	21.55
		6	0	20.65	20.76	20.76	20.65	20.76	20.76
BW	Modulation	RB size	RB offset	Channel/Frequency(MHz)					
				18615/ 1851.5	18900/ 1880	19185/ 1908.5	18615/ 1851.5	18900/ 1880	19185/ 1908.5
3MHz	QPSK	1	0	22.39	22.49	22.44	22.39	22.49	22.44
		1	7	22.61	22.56	22.66	22.61	22.56	22.66
		1	14	22.26	22.27	22.30	22.26	22.27	22.3
		8	0	21.65	21.91	21.79	21.65	21.91	21.79
		8	4	21.67	21.83	21.73	21.67	21.83	21.73
		8	7	21.69	21.74	21.74	21.69	21.74	21.74
		15	0	21.62	21.79	21.71	21.62	21.79	21.71
	16QAM	1	0	21.90	21.69	21.79	21.9	21.69	21.79
		1	7	21.88	21.87	21.90	21.88	21.87	21.9
		1	14	21.74	21.68	21.68	21.74	21.68	21.68
		8	0	20.68	20.82	20.71	20.68	20.82	20.71
		8	4	20.80	20.70	20.62	20.8	20.7	20.62
		8	7	20.70	20.75	20.68	20.7	20.75	20.68
		15	0	20.68	20.80	20.79	20.68	20.8	20.79
BW	Modulation	RB	RB	Channel/Frequency(MHz)					



		size	offset	18625/ 1852.5	18900/ 1880	19175/ 1907.5	18625/ 1852.5	18900/ 1880	19175/ 1907.5
5MHz	QPSK	1	0	22.36	22.47	22.40	22.36	22.47	22.4
		1	13	22.59	22.52	22.63	22.59	22.52	22.63
		1	24	22.23	22.22	22.26	22.23	22.22	22.26
		12	0	21.62	21.86	21.75	21.62	21.86	21.75
		12	6	21.65	21.79	21.68	21.65	21.79	21.68
		12	13	21.67	21.72	21.70	21.67	21.72	21.7
		25	0	21.62	21.78	21.69	21.62	21.78	21.69
	16QAM	1	0	21.87	21.65	21.76	21.87	21.65	21.76
		1	13	21.85	21.85	21.87	21.85	21.85	21.87
		1	24	21.71	21.66	21.64	21.71	21.66	21.64
		12	0	20.66	20.78	20.68	20.66	20.78	20.68
		12	6	20.77	20.65	20.58	20.77	20.65	20.58
		12	13	20.67	20.70	20.64	20.67	20.7	20.64
		25	0	20.66	20.76	20.74	20.66	20.76	20.74
BW	Modulation	RB size	RB offset	Channel/Frequency(MHz)					
				18650/ 1855	18900/ 1880	19150/ 1905	18650/ 1855	18900/ 1880	19150/ 1905
10MHz	QPSK	1	0	22.38	22.48	22.43	22.38	22.48	22.43
		1	25	22.62	22.57	22.67	22.62	22.57	22.67
		1	49	22.25	22.26	22.29	22.25	22.26	22.29
		25	0	21.65	21.91	21.79	21.65	21.91	21.79
		25	13	21.68	21.84	21.72	21.68	21.84	21.72
		25	25	21.69	21.76	21.75	21.69	21.76	21.75
		50	0	21.66	21.80	21.73	21.66	21.8	21.73
	16QAM	1	0	21.89	21.68	21.78	21.89	21.68	21.78
		1	25	21.88	21.89	21.90	21.88	21.89	21.9
		1	49	21.74	21.68	21.67	21.74	21.68	21.67
		25	0	20.69	20.83	20.72	20.69	20.83	20.72
		25	13	20.79	20.69	20.61	20.79	20.69	20.61
		25	25	20.70	20.75	20.68	20.7	20.75	20.68
		50	0	20.69	20.81	20.78	20.69	20.81	20.78
BW	Modulation	RB size	RB offset	Channel/Frequency(MHz)					
				18675/ 1857.5	18900/ 1880	19125/ 1902.5	18675/ 1857.5	18900/ 1880	19125/ 1902.5
15MHz	QPSK	1	0	22.37	22.44	22.41	22.37	22.44	22.41
		1	38	22.60	22.56	22.64	22.6	22.56	22.64



		1	74	22.22	22.21	22.25	22.22	22.21	22.25
		36	0	21.63	21.87	21.76	21.63	21.87	21.76
		36	18	21.65	21.79	21.68	21.65	21.79	21.68
		36	39	21.66	21.73	21.71	21.66	21.73	21.71
		75	0	21.64	21.76	21.68	21.64	21.76	21.68
	16QAM	1	0	21.84	21.66	21.76	21.84	21.66	21.76
		1	38	21.86	21.86	21.88	21.86	21.86	21.88
		1	74	21.71	21.64	21.64	21.71	21.64	21.64
		36	0	20.66	20.81	20.69	20.66	20.81	20.69
		36	18	20.76	20.64	20.57	20.76	20.64	20.57
		36	39	20.68	20.71	20.65	20.68	20.71	20.65
		75	0	20.66	20.76	20.74	20.66	20.76	20.74
BW	Modulation	RB size	RB offset	Channel/Frequency(MHz)					
				18700/ 1860	18900/ 1880	19100/ 1900	18700/ 1860	18900/ 1880	19100/ 1900
20MHz	QPSK	1	0	22.34	22.40	22.38	22.34	22.4	22.38
		1	50	22.59	22.52	22.62	22.59	22.52	22.62
		1	99	22.20	22.20	22.22	22.2	22.2	22.22
		50	0	21.60	21.82	21.72	21.6	21.82	21.72
		50	25	21.63	21.75	21.65	21.63	21.75	21.65
		50	50	21.63	21.68	21.67	21.63	21.68	21.67
		100	0	21.61	21.71	21.64	21.61	21.71	21.64
	16QAM	1	0	21.70	21.62	21.71	21.7	21.62	21.71
		1	50	21.82	21.84	21.84	21.82	21.84	21.84
		1	99	21.69	21.61	21.62	21.69	21.61	21.62
		50	0	20.63	20.77	20.66	20.63	20.77	20.66
		50	25	20.73	20.62	20.54	20.73	20.62	20.54
		50	50	20.65	20.66	20.61	20.65	20.66	20.61
		100	0	20.64	20.72	20.71	20.64	20.72	20.71

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 3kHz, VBW is set to 10kHz for GSM 1900,

RBW is set to 51 kHz, VBW is set to 160kHz for WCDMA Band II,

RBW is set to 30 kHz, VBW is set to 91kHz for LTE Band 2 (1.4MHz),

RBW is set to 62 kHz, VBW is set to 180 kHz for LTE Band 2 (3MHz),

RBW is set to 100 kHz, VBW is set to 300 kHz for LTE Band 2(5MHz),

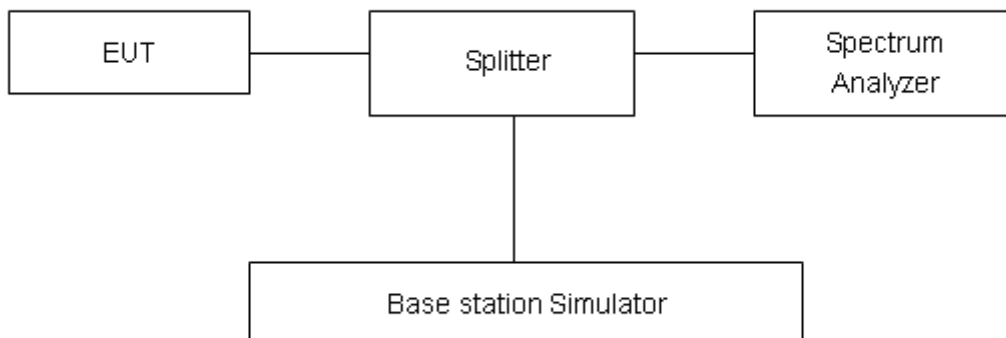
RBW is set to 200 kHz, VBW is set to 620kHz for LTE Band 2 (10MHz),

RBW is set to 300kHz,VBW is set to 910kHz for LTE Band 2 (15MHz).

RBW is set to 430kHz,VBW is set to 1.2MHz for LTE Band 2 (20MHz).

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 1900 (GSM)	512	1850.2	0.2471	0.3134
	661	1880.0	0.2453	0.3137
	810	1909.8	0.2459	0.3088
GPRS 1900 (GMSK)	512	1850.2	0.2449	0.3095
	661	1880.0	0.2456	0.3121
	810	1909.8	0.2483	0.3162
EGPRS 1900 (8-PSK)	512	1850.2	0.2524	0.3035
	661	1880.0	0.2521	0.3183
	810	1909.8	0.2527	0.324
WCDMA Band II (RMC)	9262	1852.4	4.1654	4.666
	9400	1880	4.1641	4.672
	9538	1907.6	4.1727	4.67

LTE Band 2					
Modulation	Bandwidth (MHz)	Channel	Frequency (MHz)	99% Power Bandwidth(MHz)	-26dBc Bandwidth(MHz)
QPSK	1.4	18607	1850.7	1.0981	1.28
		18900	1880.0	1.0954	1.275
		19193	1909.3	1.0937	1.287
	3	18615	1851.5	2.6873	2.904
		18900	1880	2.6902	2.916
		19185	1908.5	2.6861	2.918
	5	18625	1852.5	4.5057	4.896
		18900	1880	4.495	4.926
		19175	1907.5	4.5179	4.903
	10	18650	1855	8.9807	9.641
		18900	1880	8.9769	9.623
		19150	1905	8.9764	9.644
	15	18675	1857.5	13.444	14.53
		18900	1880	13.452	14.71



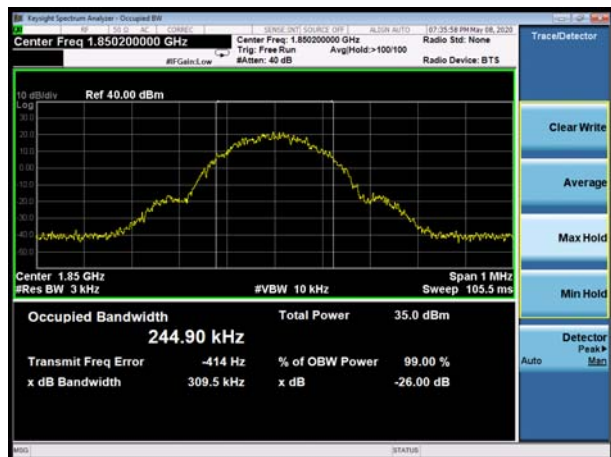
	20	19125	1902.5	13.443	14.49
		18700	1860	17.9	19.26
		18900	1880	17.959	19.21
		19100	1900	17.91	19.32
16QAM	1.4	18607	1850.7	1.0924	1.306
		18900	1880.0	1.0959	1.297
		19193	1909.3	1.0903	1.263
	3	18615	1851.5	2.692	2.924
		18900	1880	2.6825	2.935
		19185	1908.5	2.688	2.916
	5	18625	1852.5	4.5227	4.893
		18900	1880	4.5064	4.878
		19175	1907.5	4.514	4.906
	10	18650	1855	8.9726	9.591
		18900	1880	8.9966	9.657
		19150	1905	8.9822	9.639
	15	18675	1857.5	13.44	14.56
		18900	1880	13.469	14.51
		19125	1902.5	13.461	14.46
	20	18700	1860	17.93	19.12
		18900	1880	17.983	19.54
		19100	1900	17.926	19.10



GSM1900 GSM CH-Low



GSM1900 GPRS CH-Low



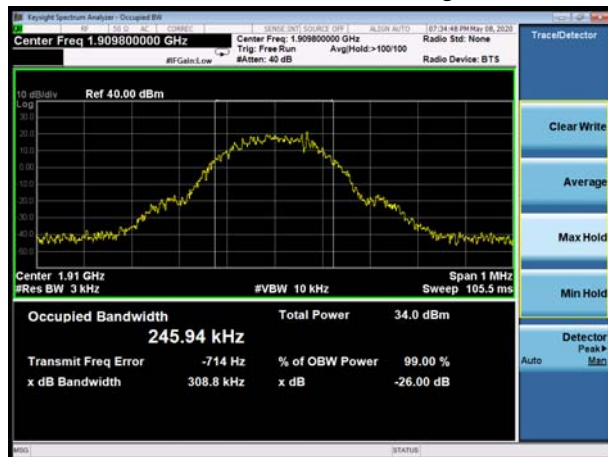
GSM 1900 GSM CH-Middle



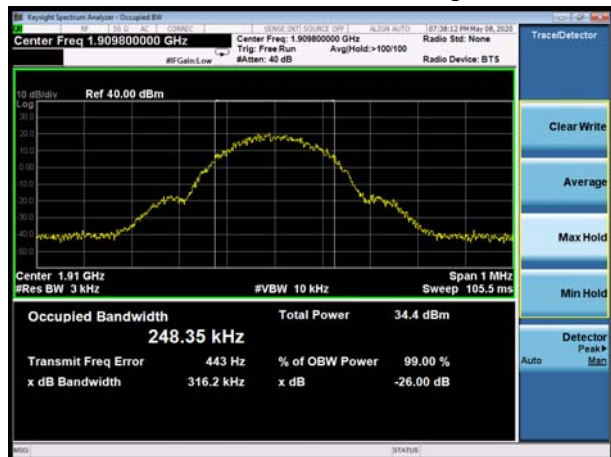
GSM 1900 GPRS CH-Middle



GSM 1900 GSM CH-High



GSM 1900 GPRS CH-High





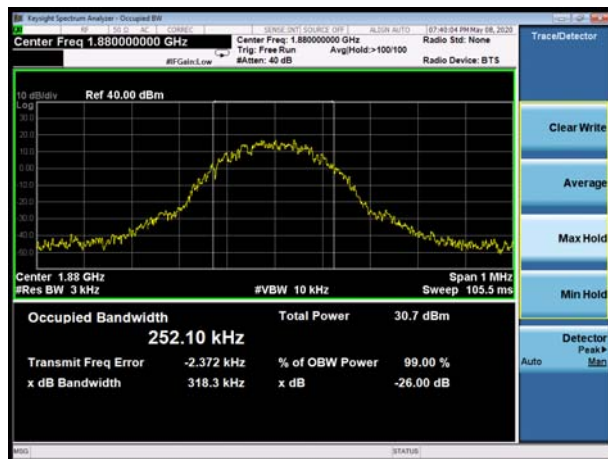
GSM1900 EGPRS CH-Low



WCDMA Band II RMC CH-LOW



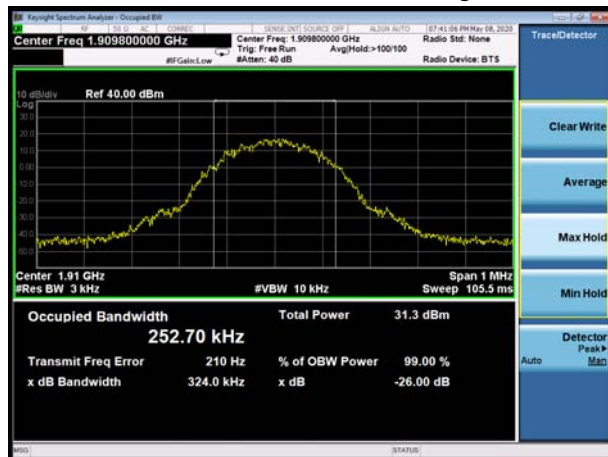
GSM 1900 EGPRS CH-Middle



WCDMA Band II RMC CH-Middle



GSM 1900 EGPRS CH-High



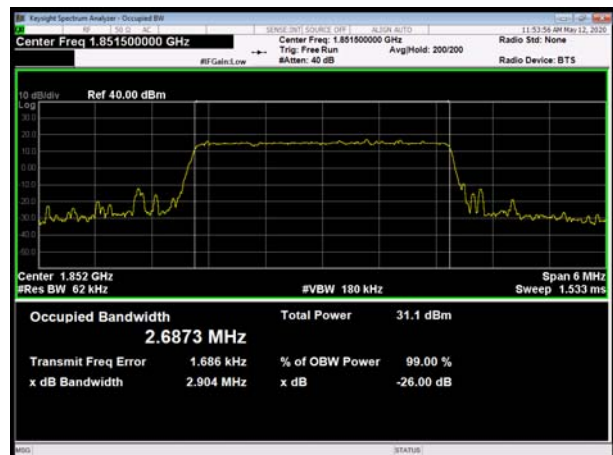
WCDMA Band II RMC CH-High



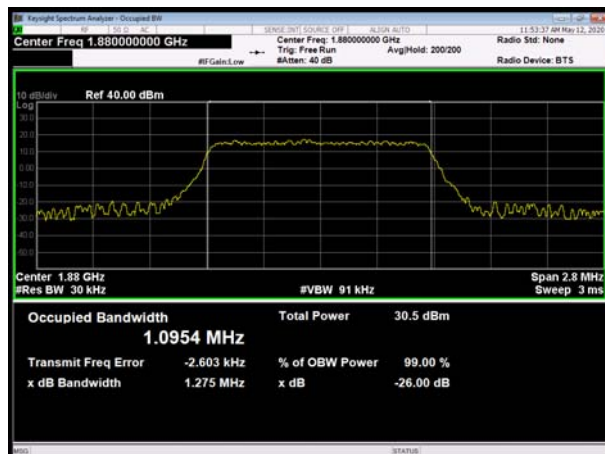
LTE Band 2 1.4MHz QPSK CH-Low



LTE Band 2 3MHz QPSK CH-Low



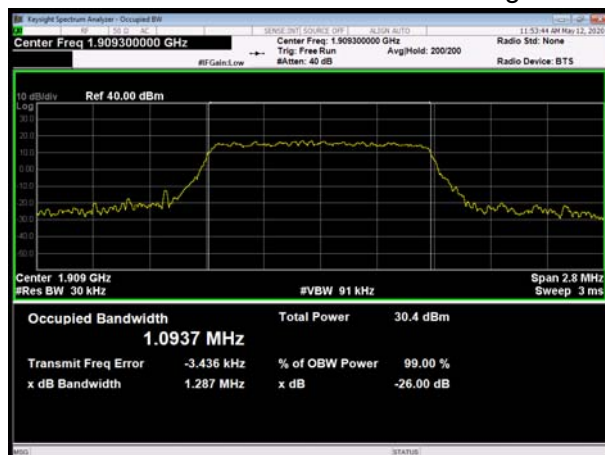
LTE Band 2 1.4MHz QPSK CH-Middle



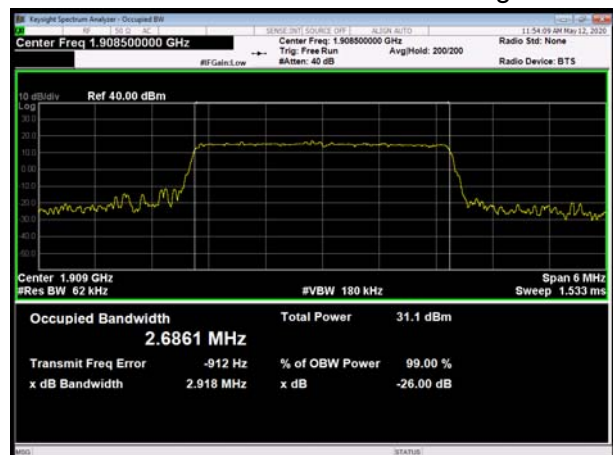
LTE Band 2 3MHz QPSK CH-Middle



LTE Band 2 1.4MHz QPSK CH-High

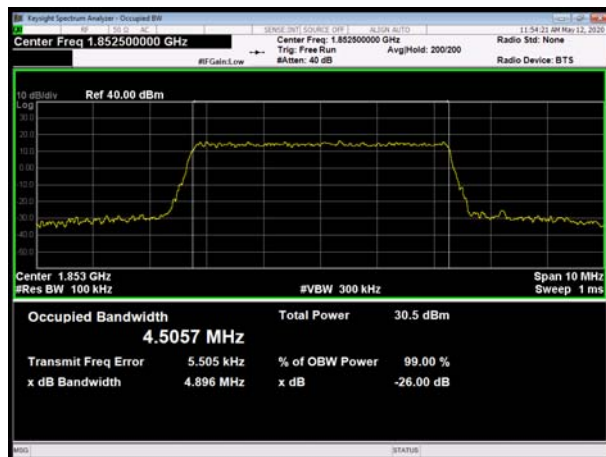


LTE Band 2 3MHz QPSK CH-High

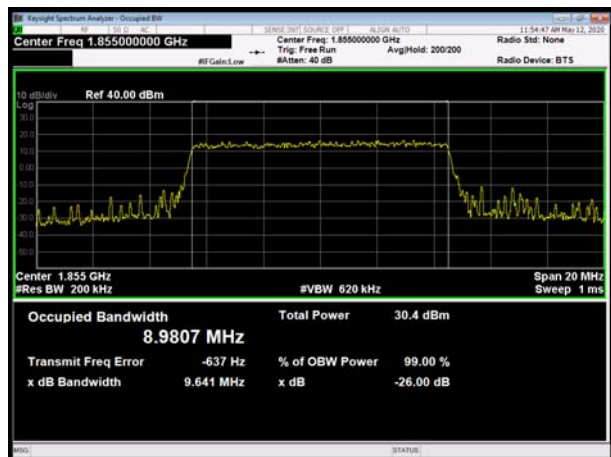




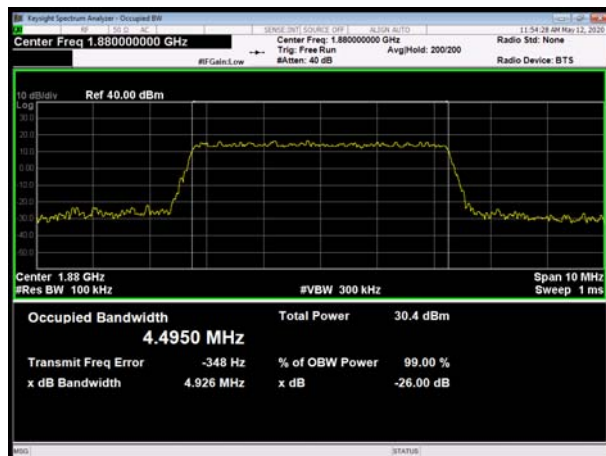
LTE Band 2 5MHz QPSK CH-Low



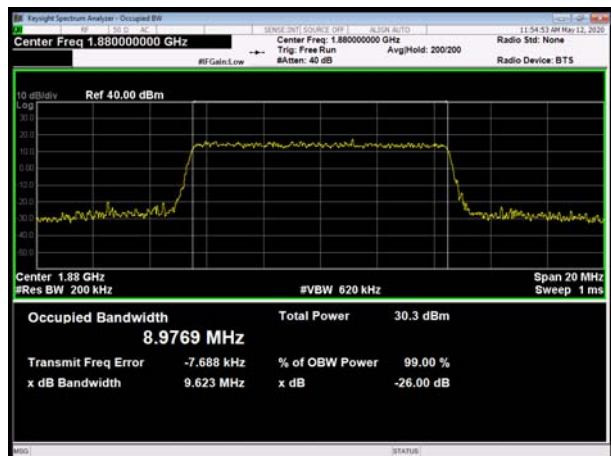
LTE Band 2 10MHz QPSK CH-Low



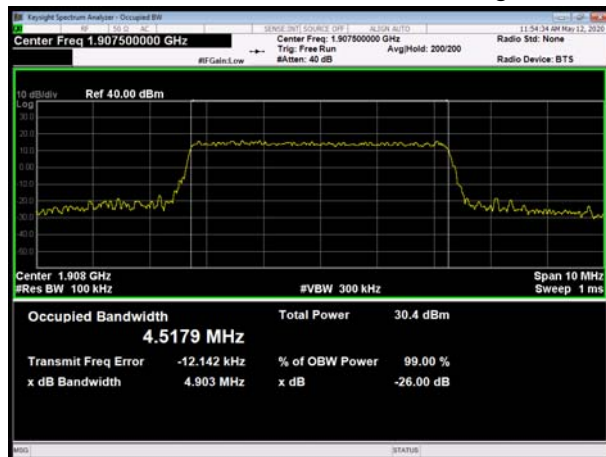
LTE Band 2 5MHz QPSK CH-Middle



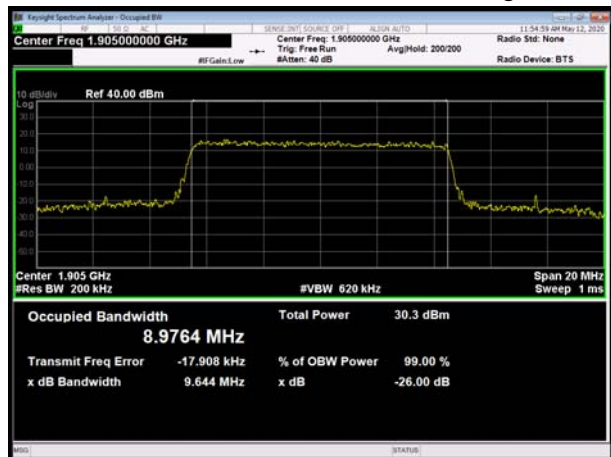
LTE Band 2 10MHz QPSK CH-Middle



LTE Band 2 5MHz QPSK CH-High

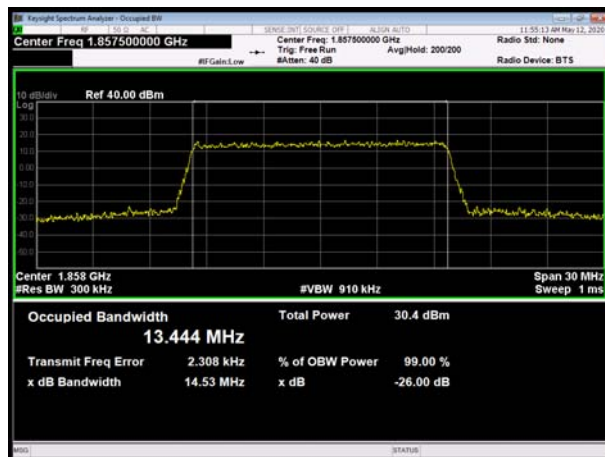


LTE Band 2 10MHz QPSK CH-High

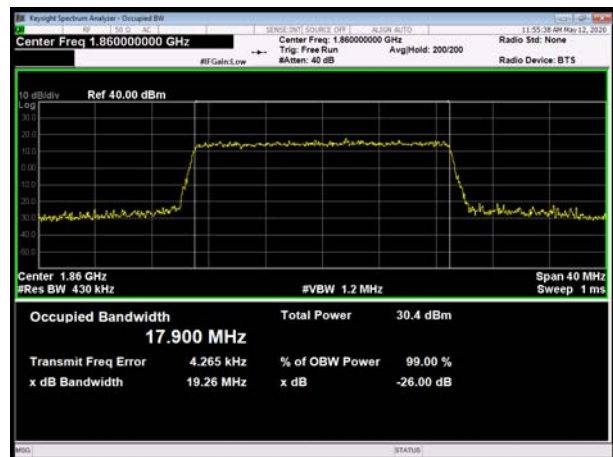




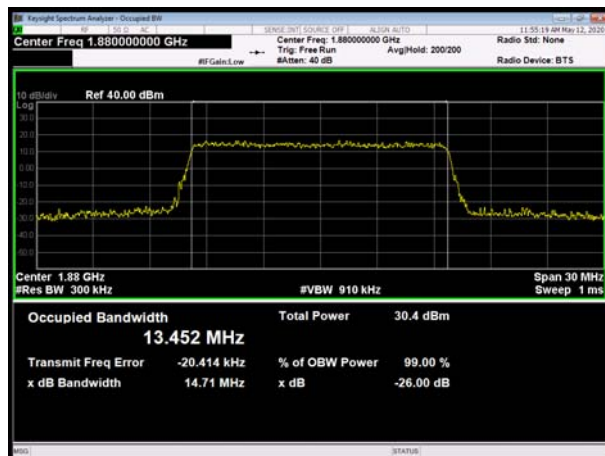
LTE Band 2 15MHz QPSK CH-Low



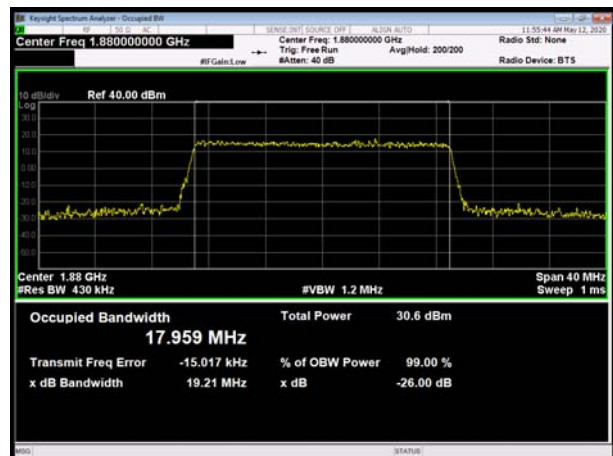
LTE Band 2 20MHz QPSK CH-Low



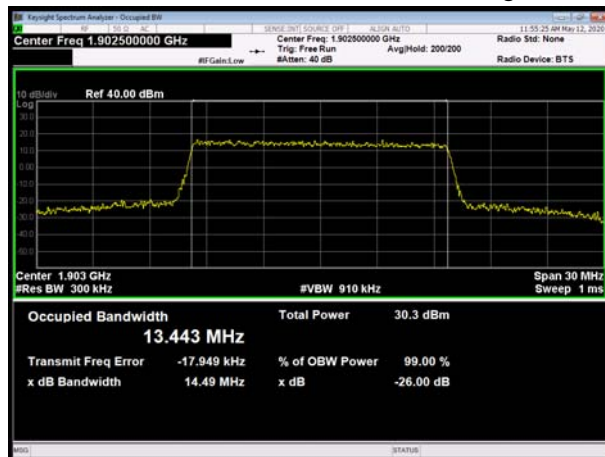
LTE Band 2 15MHz QPSK CH-Middle



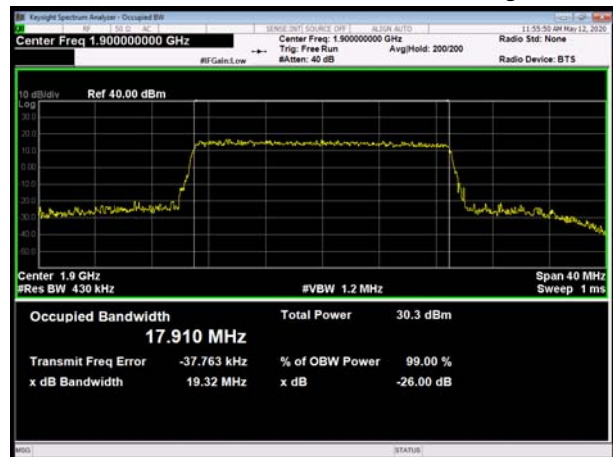
LTE Band 2 20MHz QPSK CH-Middle



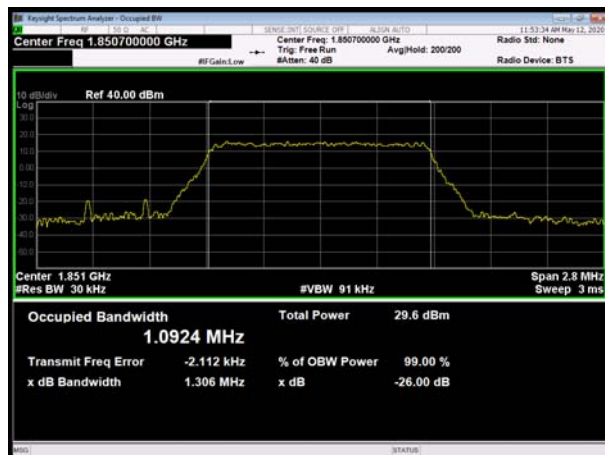
LTE Band 2 15MHz QPSK CH-High



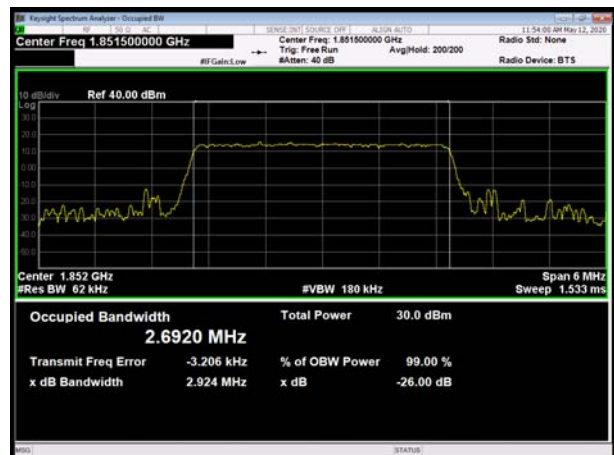
LTE Band 2 20MHz QPSK CH-High



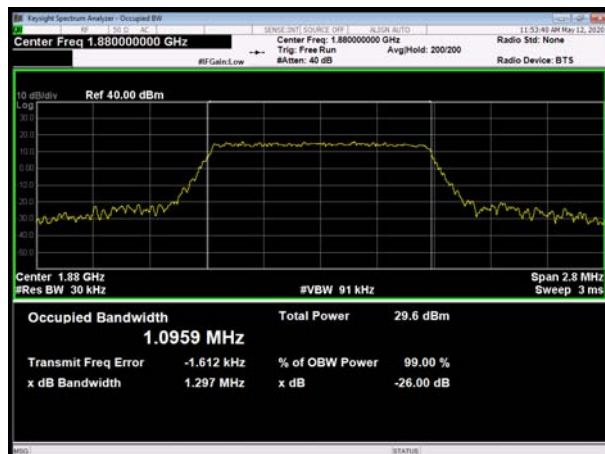
LTE Band 2 1.4MHz 16QAM CH-Low



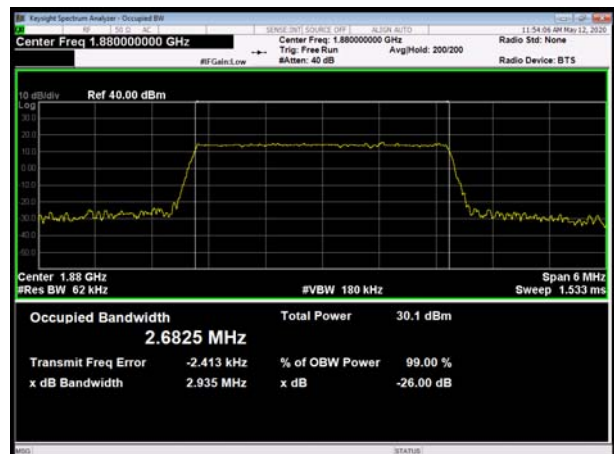
LTE Band 2 3MHz 16QAM CH-Low



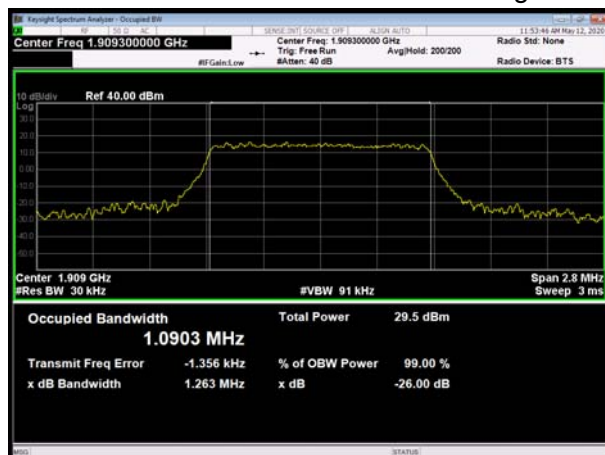
LTE Band 2 1.4MHz 16QAM CH-Middle



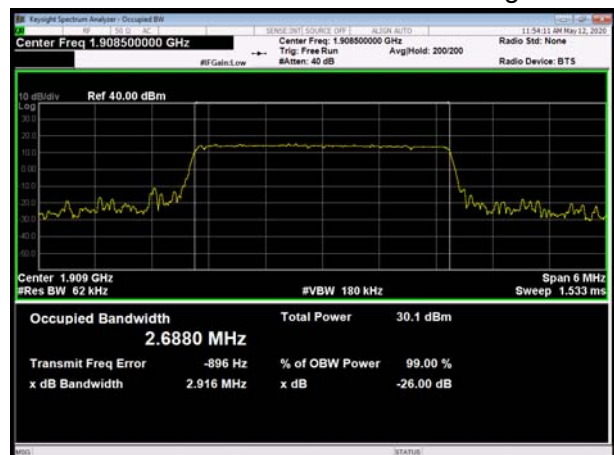
LTE Band 2 3MHz 16QAM CH-Middle



LTE Band 2 1.4MHz 16QAM CH-High

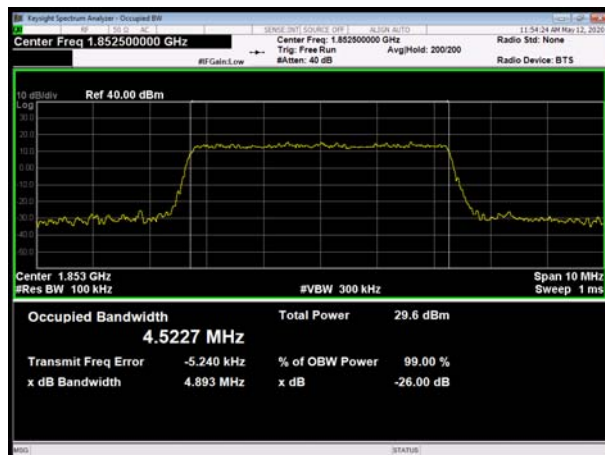


LTE Band 2 3MHz 16QAM CH-High

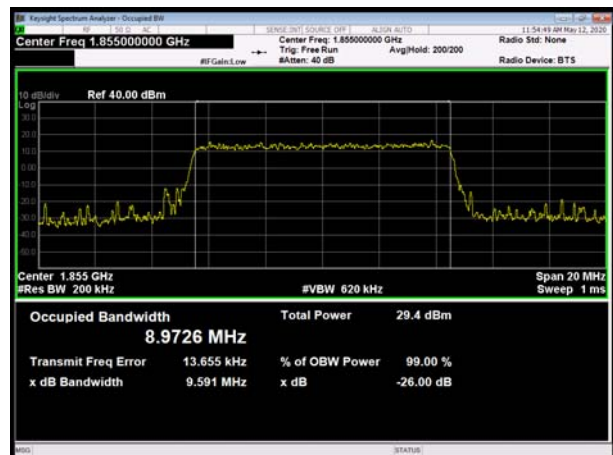




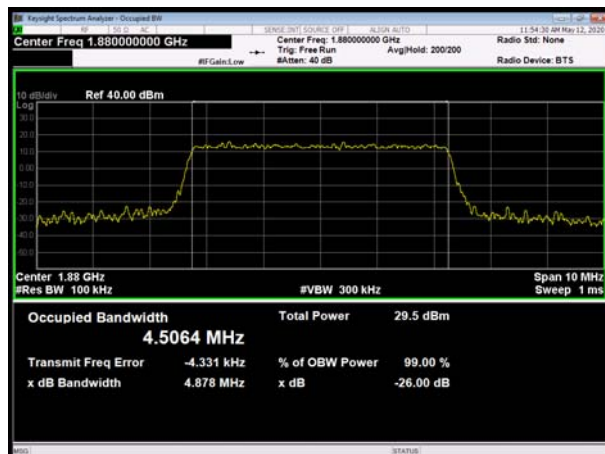
LTE Band 2 5MHz 16QAM CH-Low



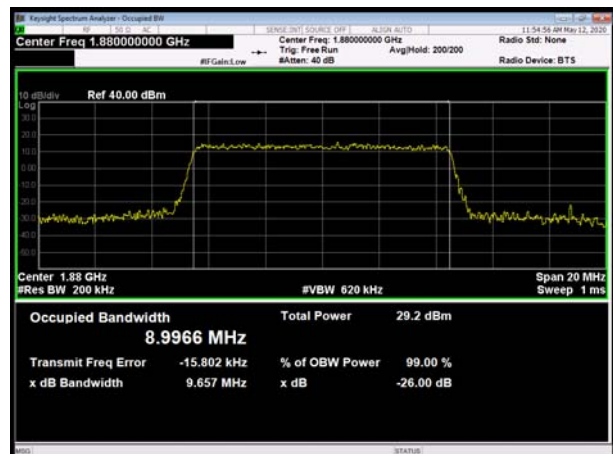
LTE Band 2 10MHz 16QAM CH-Low



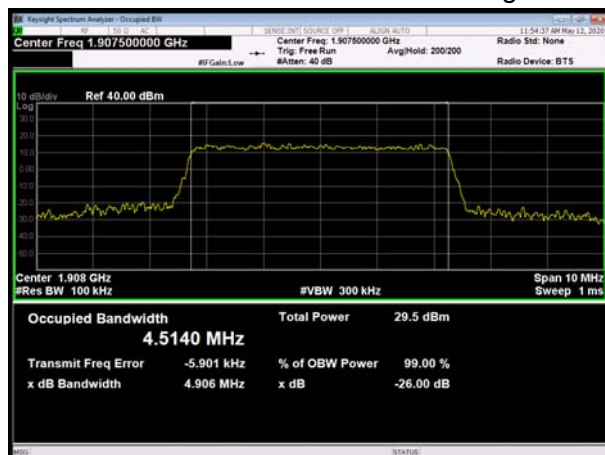
LTE Band 2 5MHz 16QAM CH-Middle



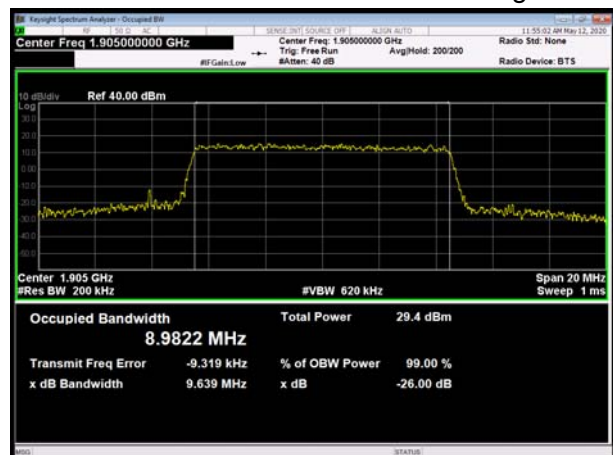
LTE Band 2 10MHz 16QAM CH-Middle



LTE Band 2 5MHz 16QAM CH-High

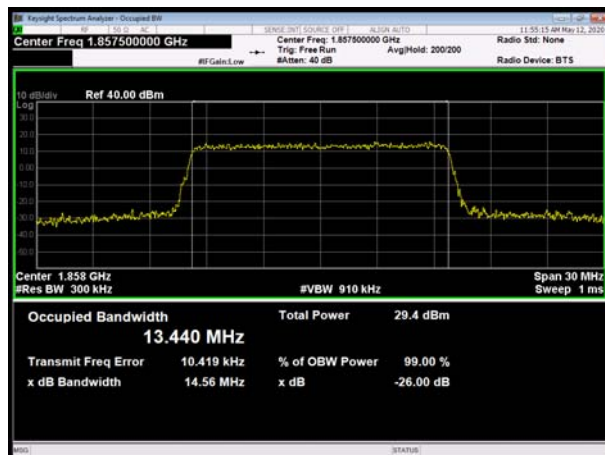


LTE Band 2 10MHz 16QAM CH-High

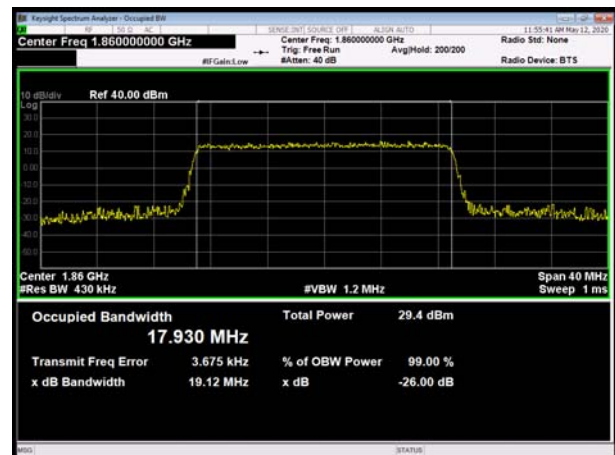




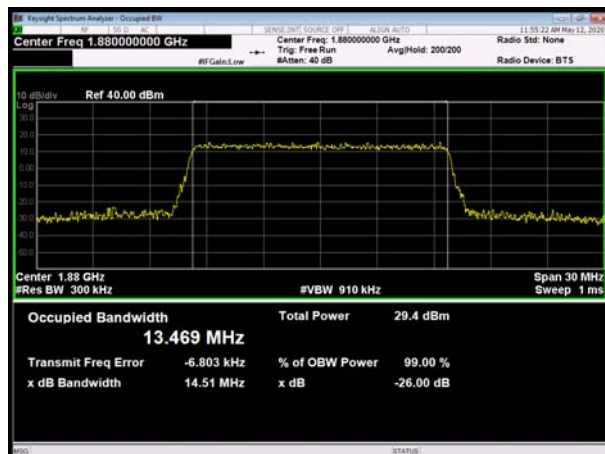
LTE Band 2 15MHz 16QAM CH-Low



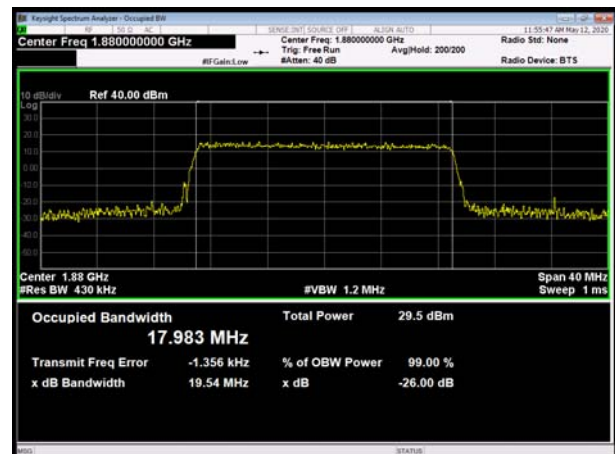
LTE Band 2 20MHz 16QAM CH-Low



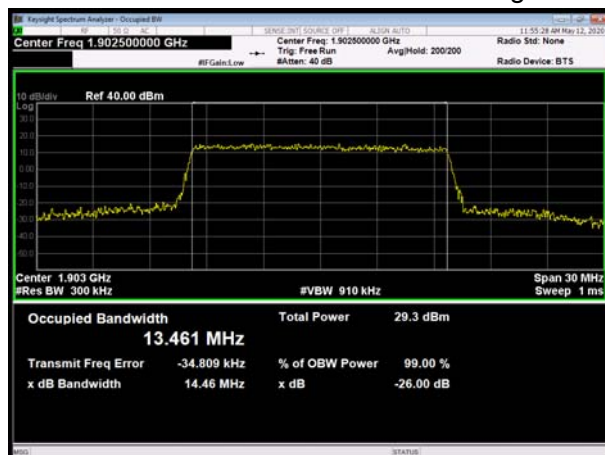
LTE Band 2 15MHz 16QAM CH-Middle



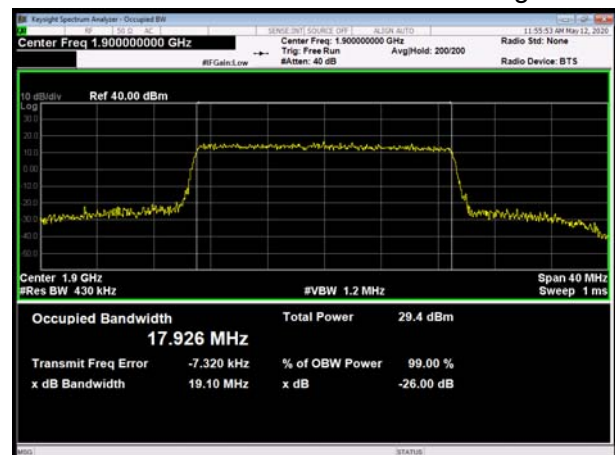
LTE Band 2 20MHz 16QAM CH-Middle



LTE Band 2 15MHz 16QAM CH-High



LTE Band 2 20MHz 16QAM CH-High



5.3. Band Edge Compliance

Ambient condition

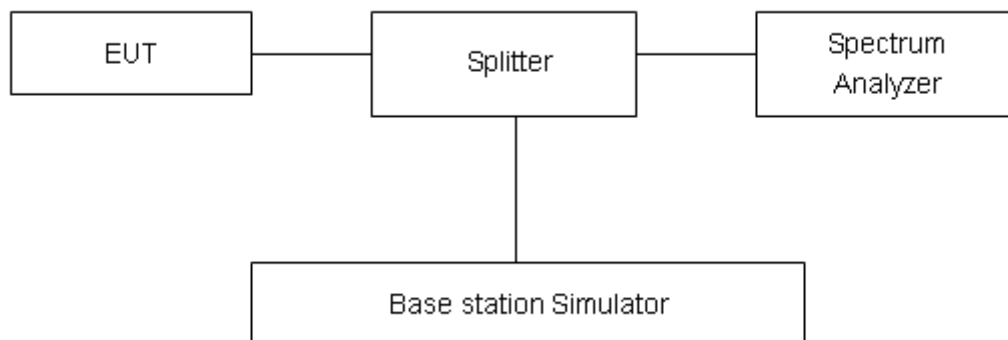
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

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 and RBW is set to 3kHz, VBW is set to 10kHz for GSM 1900, RBW is set to 51kHz, VBW is set to 160kHz for WCDMA Band II, RBW is set to 15kHz, VBW is set to 43kHz for LTE Band 2 (1.4MHz), RBW is set to 30kHz, VBW is set to 91kHz for LTE Band 2 (3MHz), RBW is set to 51kHz, VBW is set to 150kHz for LTE Band 2 (5MHz), RBW is set to 100kHz, VBW is set to 300kHz for LTE Band 2 (10MHz), RBW is set to 150kHz, VBW is set to 470kHz for LTE Band 2 (15MHz), RBW is set to 200kHz, VBW is set to 620kHz for LTE Band 2 (20MHz).

Spectrum analyzer plots are included on the following pages.

Test Setup



Limits

Rule Part 24.238(a) specifies that “on any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least $43 + 10 \log_{10} (P)$ dB.”

Limit	-13 dBm
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Measurement Uncertainty

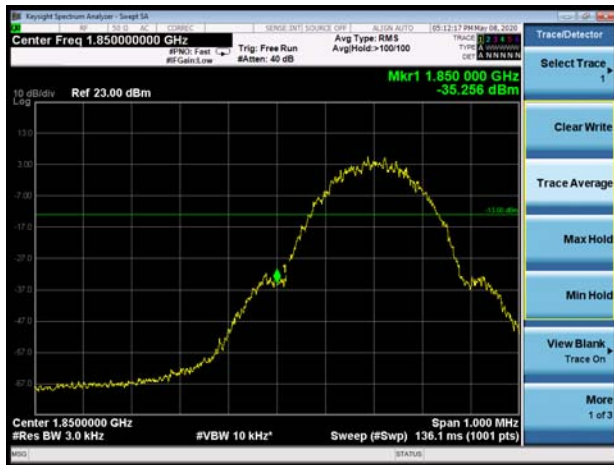
The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is



with the coverage factor $k = 1.96$, $U=0.684\text{dB}$.

Test Result:

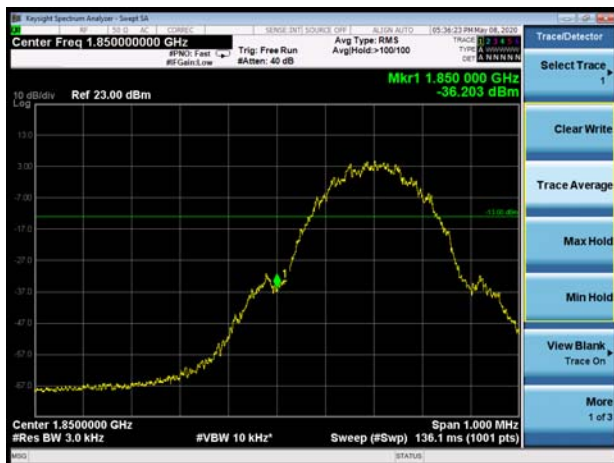
GSM1900 GSM CH-Low



GSM 1900 GSM CH-High



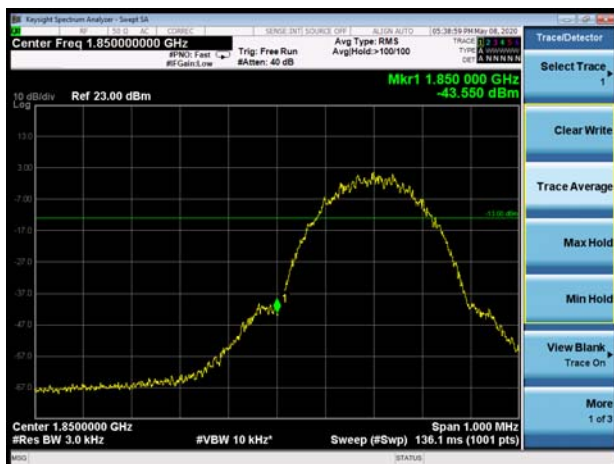
GSM1900 GPRS CH-Low



GSM 1900 GPRS CH-High



GSM1900 EGPRS CH-Low



GSM 1900 EGPRS CH-High



WCDMA Band II RMC CH-Low



WCDMA Band II RMC CH-High



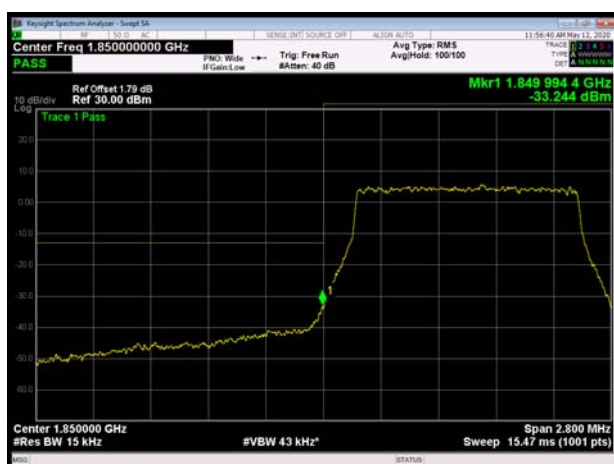
LTE Band 2 1.4MHz QPSK 1RB CH-Low



LTE Band 2 1.4MHz QPSK 1RB CH-High



LTE Band 2 1.4MHz QPSK 100%RB CH-Low



LTE Band 2 1.4MHz QPSK 100%RB CH-High





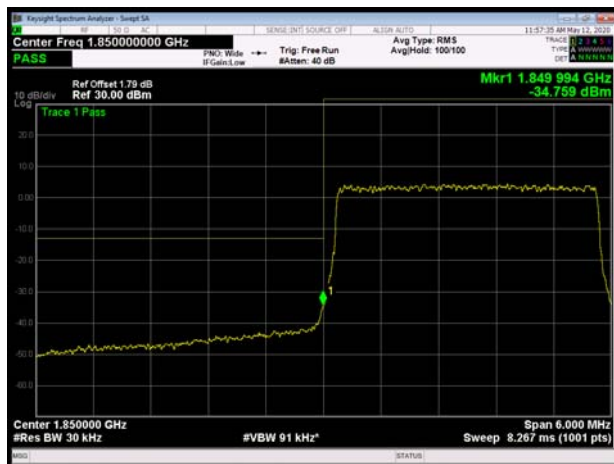
LTE Band 2 3MHz QPSK 1RB CH-Low



LTE Band 2 3MHz QPSK 1RB CH-High



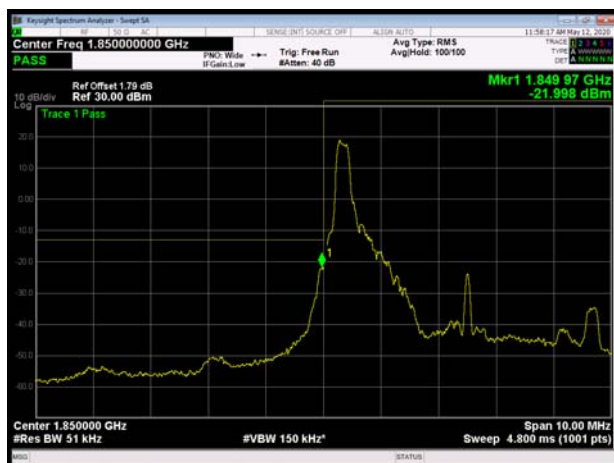
LTE Band 2 3MHz QPSK 100%RB CH-Low



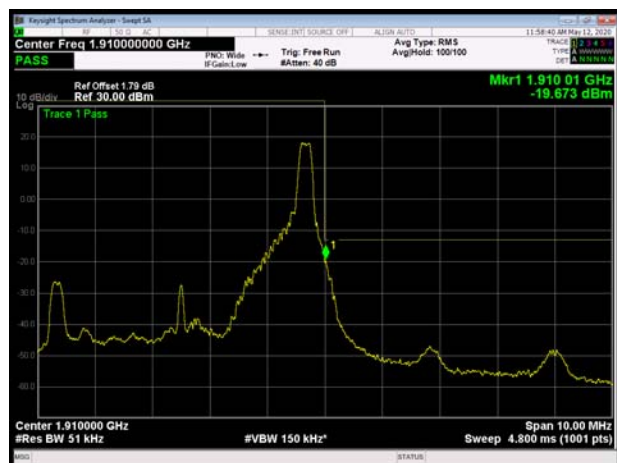
LTE Band 2 3MHz QPSK 100%RB CH-High



LTE Band 2 5MHz QPSK 1RB CH-Low

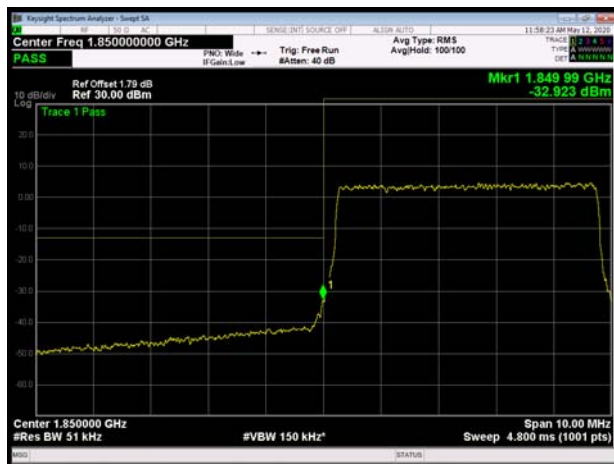


LTE Band 2 5MHz QPSK 1RB CH-High





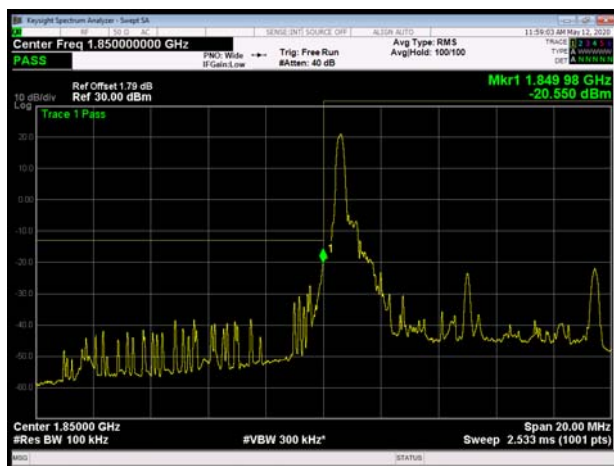
LTE Band 2 5MHz QPSK 100%RB CH-Low



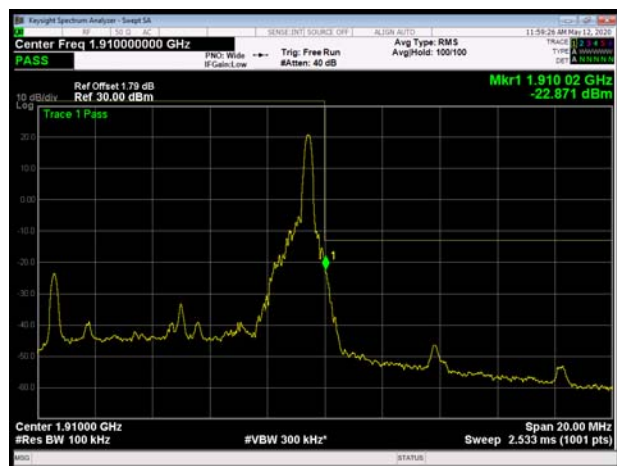
LTE Band 2 5MHz QPSK 100%RB CH-High



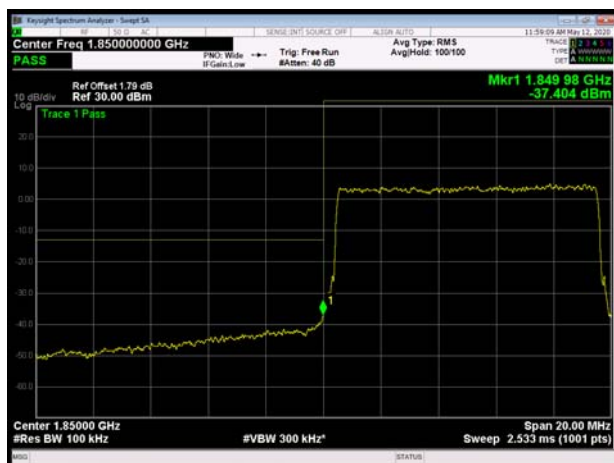
LTE Band 2 10MHz QPSK 1RB CH-Low



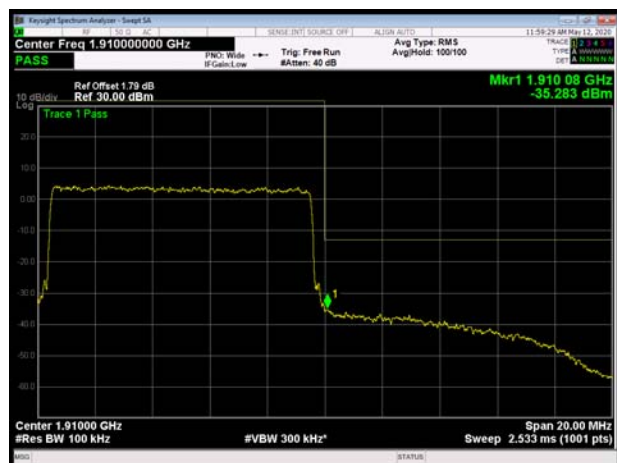
LTE Band 2 10MHz QPSK 1RB CH-High



LTE Band 2 10MHz QPSK 100%RB CH-Low

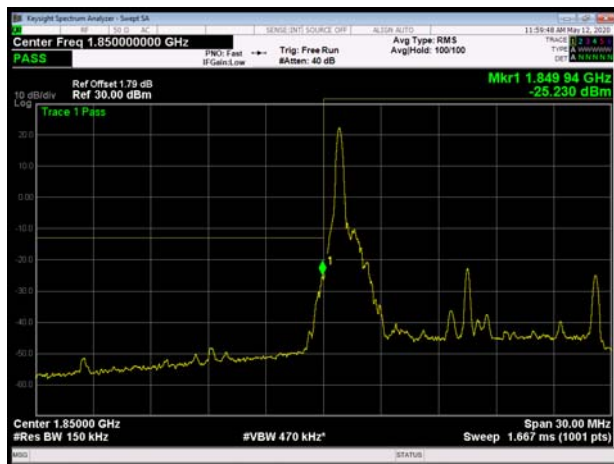


LTE Band 2 10MHz QPSK 100%RB CH-High

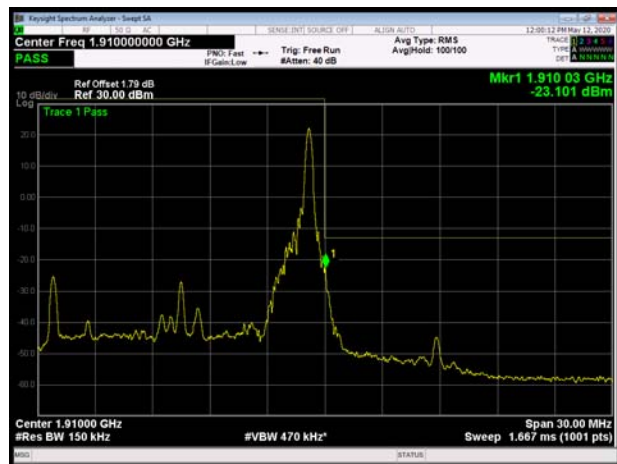




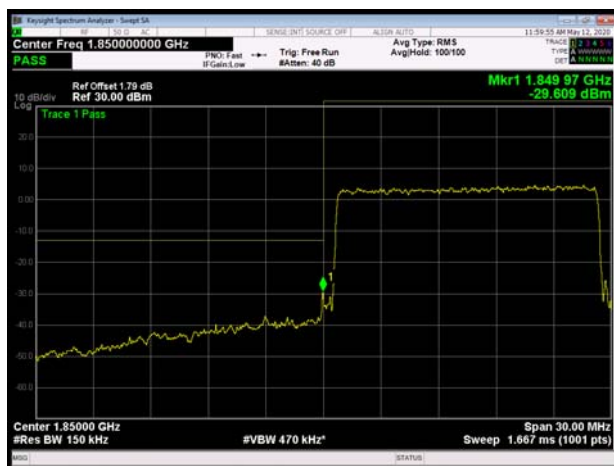
LTE Band 2 15MHz QPSK 1RB CH-Low



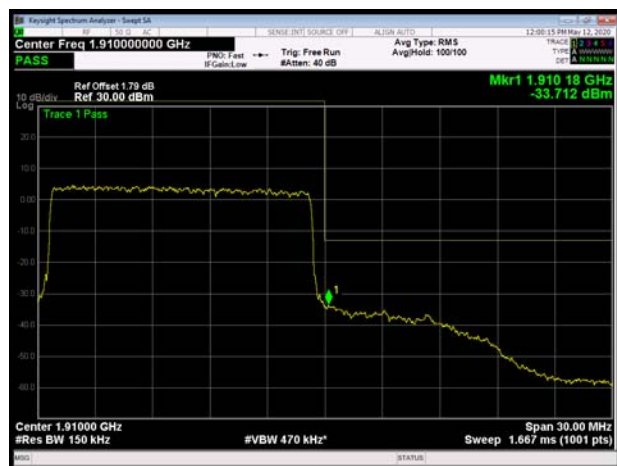
LTE Band 2 15MHz QPSK 1RB CH-High



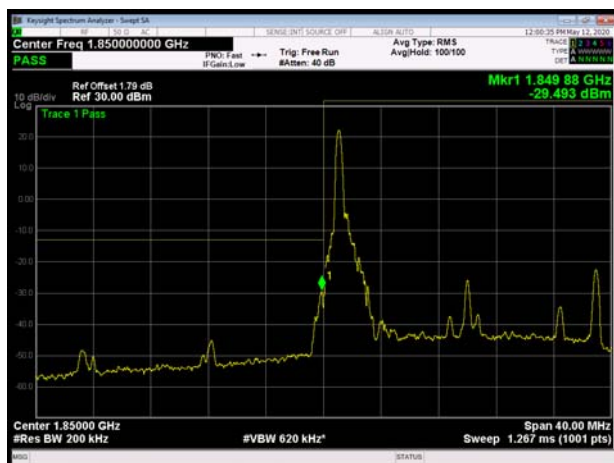
LTE Band 2 15MHz QPSK 100%RB CH-Low



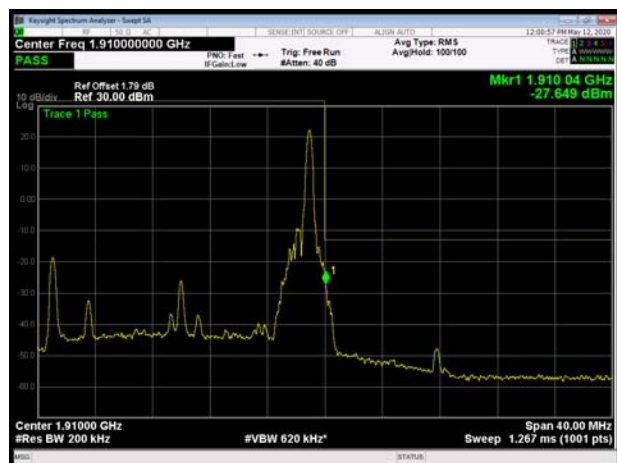
LTE Band 2 15MHz QPSK 100%RB CH-High



LTE Band 2 20MHz QPSK 1RB CH-Low

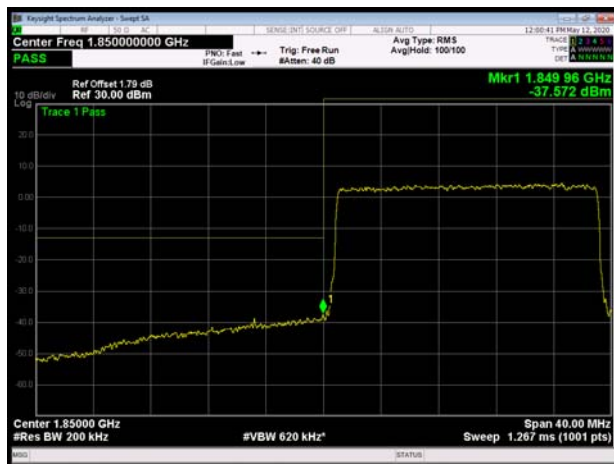


LTE Band 2 20MHz QPSK 1RB CH-High





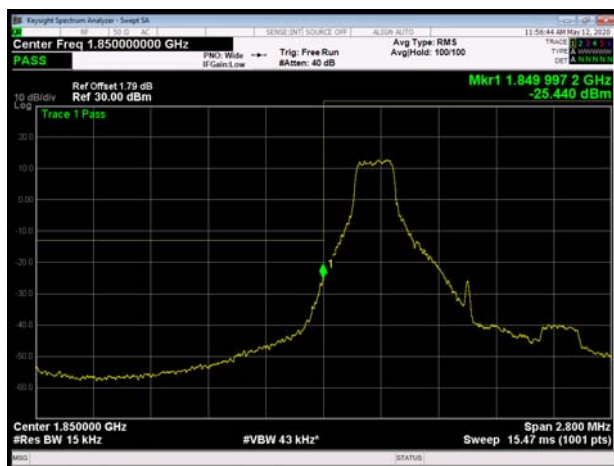
LTE Band 2 20MHz QPSK 100%RB CH-Low



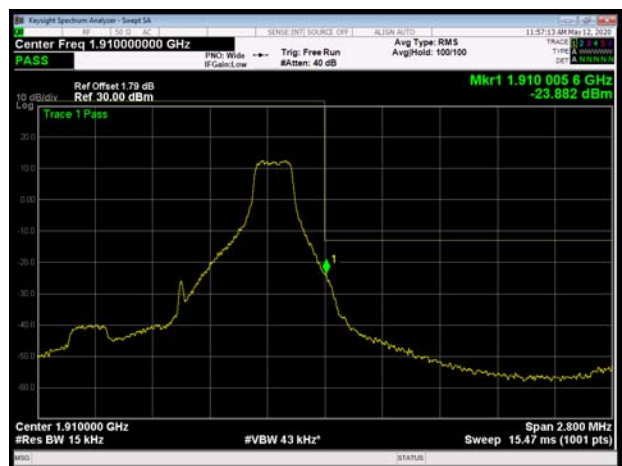
LTE Band 2 20MHz QPSK 100%RB CH-High



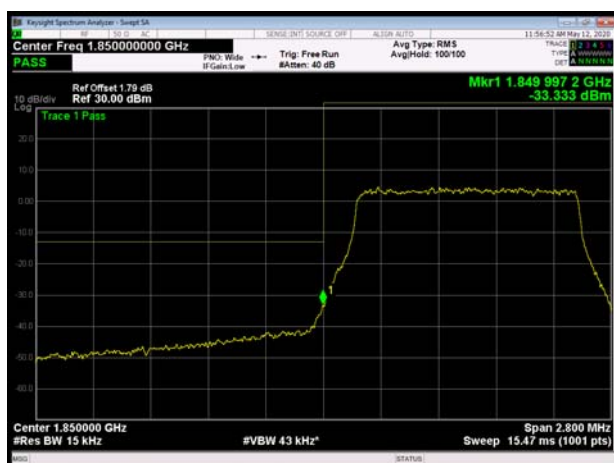
LTE Band 2 1.4MHz 16QAM 1RB CH-Low



LTE Band 2 1.4MHz 16QAM 1RB CH-High



LTE Band 2 1.4MHz 16QAM 100%RB CH-Low



LTE Band 2 1.4MHz 16QAM 100%RB CH-High

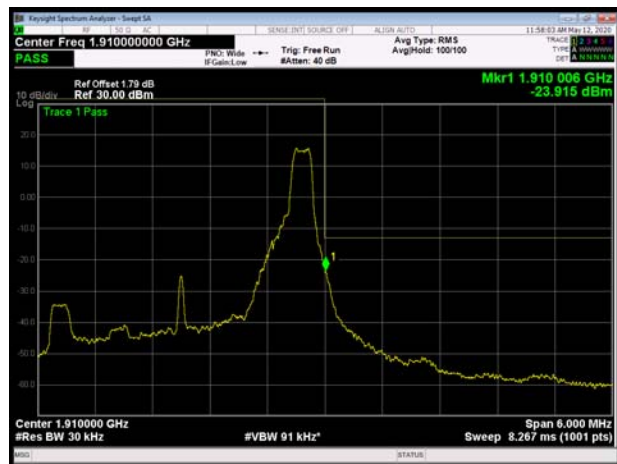




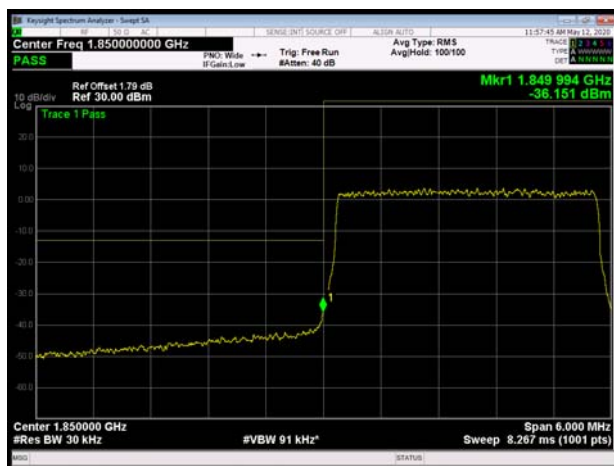
LTE Band 2 3MHz 16QAM 1RB CH-Low



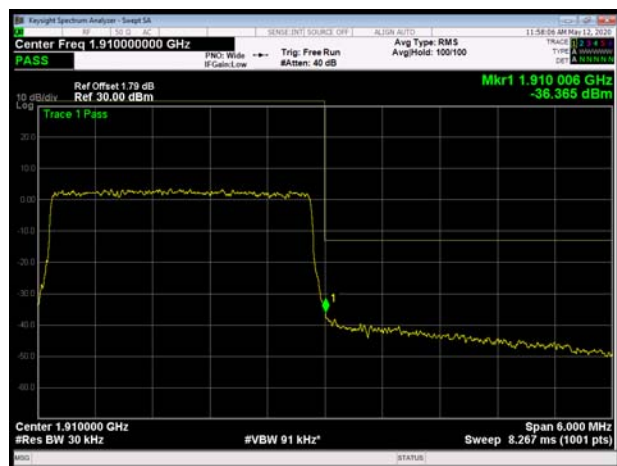
LTE Band 2 3MHz 16QAM 1RB CH-High



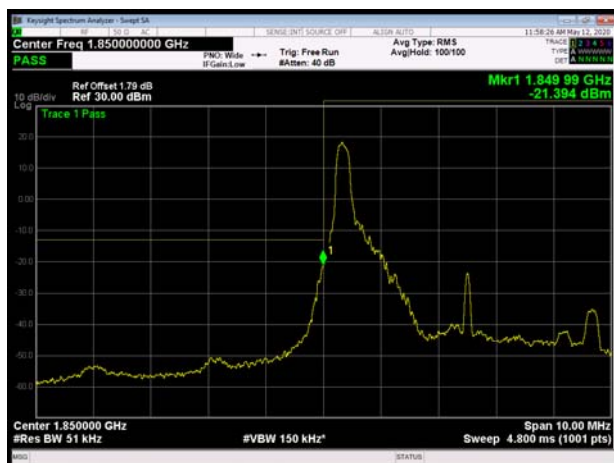
LTE Band 2 3MHz 16QAM 100%RB CH-Low



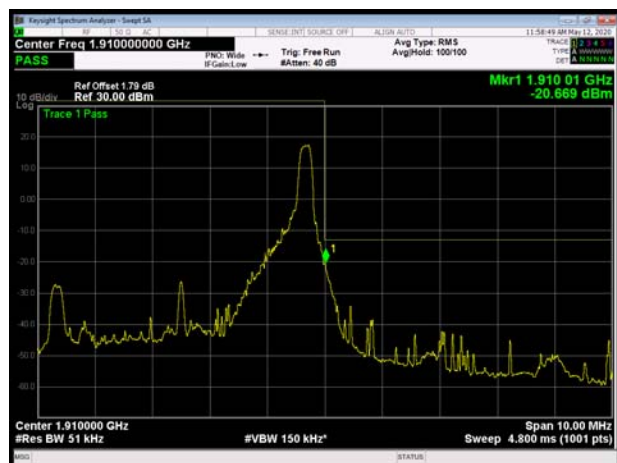
LTE Band 2 3MHz 16QAM 100%RB CH-High



LTE Band 2 5MHz 16QAM 1RB CH-Low

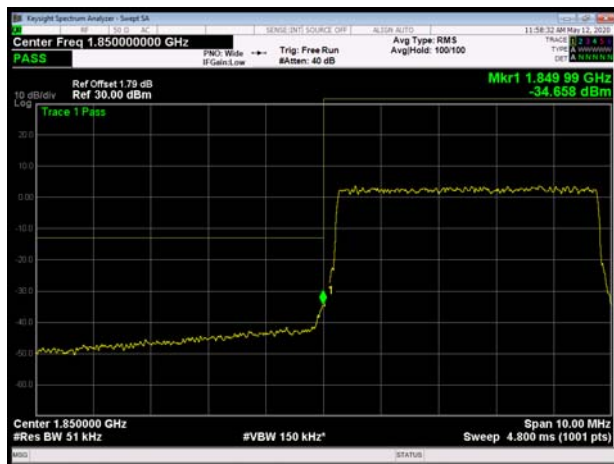


LTE Band 2 5MHz 16QAM 1RB CH-High





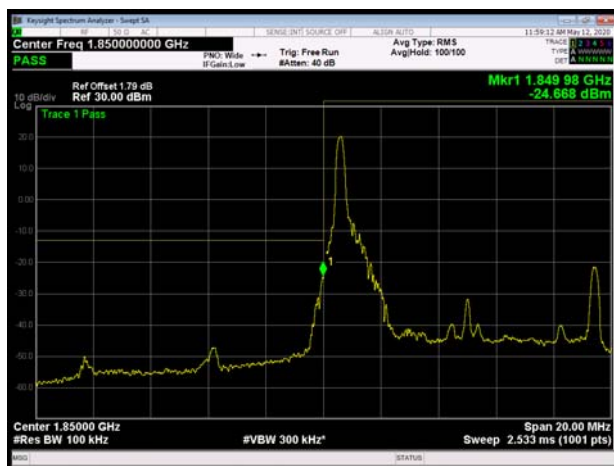
LTE Band 2 5MHz 16QAM 100%RB CH-Low



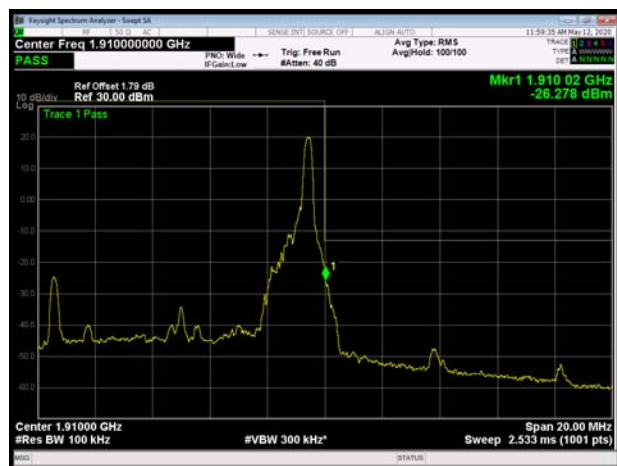
LTE Band 2 5MHz 16QAM 100%RB CH-High



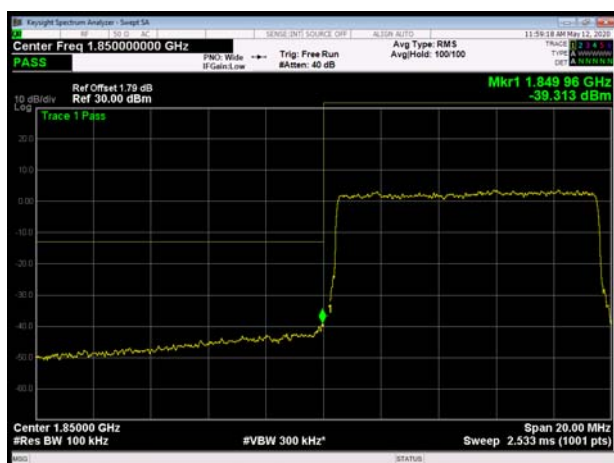
LTE Band 2 10MHz 16QAM 1RB CH-Low



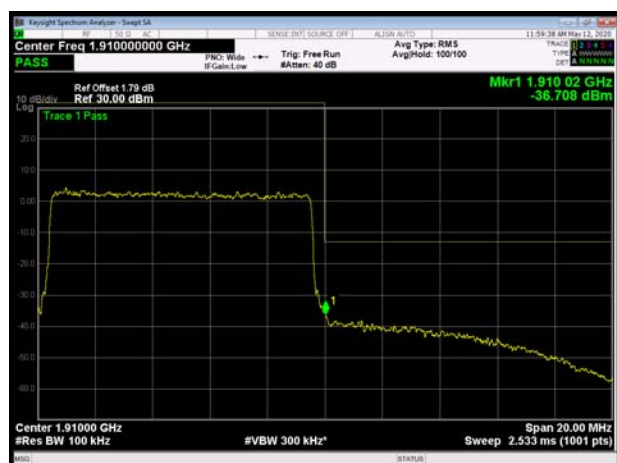
LTE Band 2 10MHz 16QAM 1RB CH-High



LTE Band 2 10MHz 16QAM 100%RB CH-Low



LTE Band 2 10MHz 16QAM 100%RB CH-High

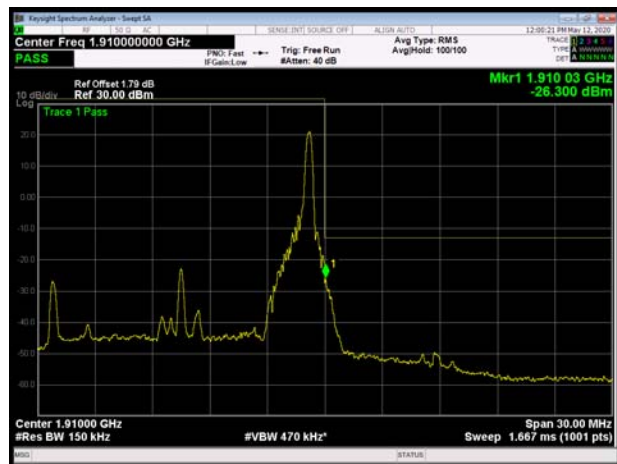




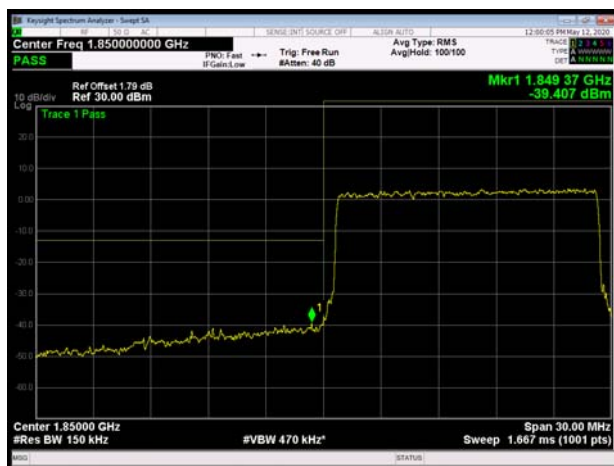
LTE Band 2 15MHz 16QAM 1RB CH-Low



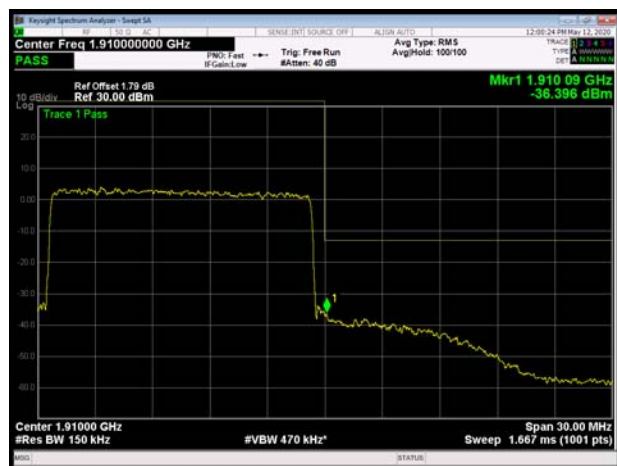
LTE Band 2 15MHz 16QAM 1RB CH-High



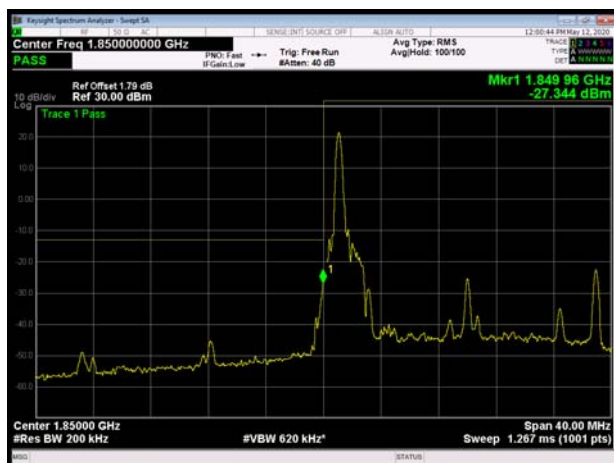
LTE Band 2 15MHz 16QAM 100%RB CH-Low



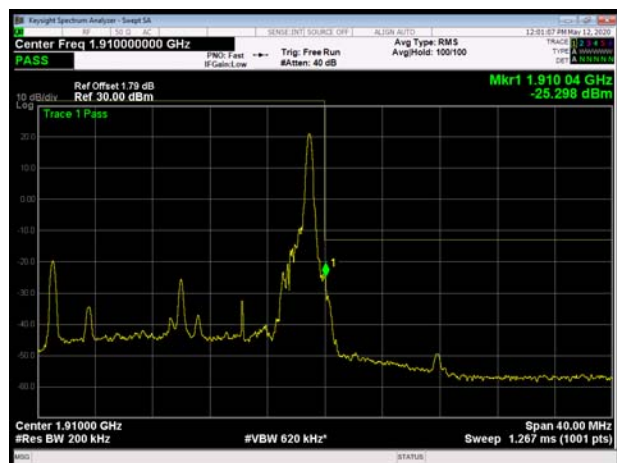
LTE Band 2 15MHz 16QAM 100%RB CH-High



LTE Band 2 20MHz 16QAM 1RB CH-Low

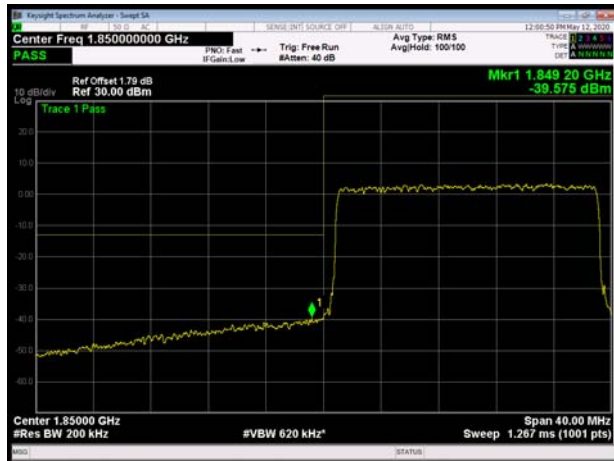


LTE Band 2 20MHz 16QAM 1RB CH-High





LTE Band 2 20MHz 16QAM 100%RB CH-Low



LTE Band 2 20MHz 16QAM 100%RB CH-High



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

Ambient condition

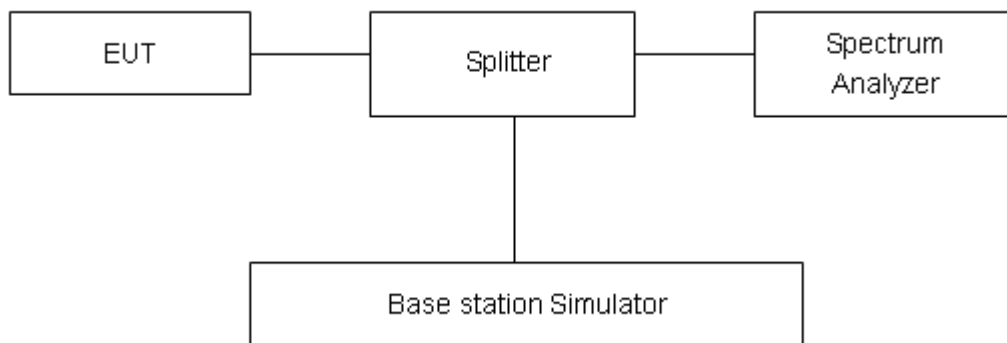
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Methods of Measurement

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

$$\text{PAPR (dB)} = \text{PPk (dBm)} - \text{PAvg (dBm)}.$$

Test Setup



Limits

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 in 24.232(d).

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 1900 (GSM)	512	1850.2	30.44	29.31	1.13	≤13	PASS
	661	1880	30.38	29.14	1.24	≤13	PASS
	810	1909.8	30.38	29.22	1.16	≤13	PASS
GPRS 1900 (GMSK)	512	1850.2	30.51	29.32	1.19	≤13	PASS
	661	1880	30.39	29.18	1.21	≤13	PASS
	810	1909.8	30.37	29.22	1.15	≤13	PASS
EGPRS 1900 (8-PSK)	512	1850.2	27.91	26.07	1.84	≤13	PASS
	661	1880	27.71	25.95	1.76	≤13	PASS
	810	1909.8	27.76	25.93	1.83	≤13	PASS
WCDMA Band II (RMC)	9262	1852.4	24.99	21.93	3.06	≤13	PASS
	9400	1880	24.95	21.92	3.03	≤13	PASS
	9538	1907.6	24.67	21.72	2.95	≤13	PASS

LTE Band 2								
Modulation	Bandwidth (MHz)	Channel	Frequency (MHz)	Peak (dBm)	Avg (dBm)	PAPR (dB)	Limit (dB)	Conclusion
QPSK	1.4	18607	1850.7	27.78	22.47	5.31	≤13	PASS
		18900	1880.0	27.61	22.43	5.18	≤13	PASS
		19193	1909.3	27.37	22.47	4.90	≤13	PASS
	3	18615	1851.5	27.77	22.43	5.34	≤13	PASS
		18900	1880	27.65	22.42	5.23	≤13	PASS
		19185	1908.5	27.38	22.44	4.94	≤13	PASS
	5	18625	1852.5	28.03	22.50	5.53	≤13	PASS
		18900	1880	27.74	22.41	5.33	≤13	PASS
		19175	1907.5	27.52	22.47	5.05	≤13	PASS
	10	18650	1855	27.90	22.49	5.41	≤13	PASS
		18900	1880	27.81	22.47	5.34	≤13	PASS
		19150	1905	27.38	22.44	4.94	≤13	PASS
	15	18675	1857.5	28.21	22.52	5.69	≤13	PASS
		18900	1880	28.18	22.49	5.69	≤13	PASS
		19125	1902.5	27.85	22.48	5.37	≤13	PASS
	20	18700	1860	27.84	22.43	5.41	≤13	PASS
		18900	1880	28.07	22.52	5.55	≤13	PASS
		19100	1900	27.70	22.36	5.34	≤13	PASS
16QAM	1.4	18607	1850.7	27.57	21.44	6.13	≤13	PASS
		18900	1880.0	27.40	21.44	5.96	≤13	PASS
		19193	1909.3	27.31	21.50	5.81	≤13	PASS
	3	18615	1851.5	27.62	21.44	6.18	≤13	PASS
		18900	1880	27.51	21.43	6.08	≤13	PASS
		19185	1908.5	27.21	21.40	5.81	≤13	PASS
	5	18625	1852.5	27.79	21.52	6.27	≤13	PASS
		18900	1880	27.52	21.44	6.08	≤13	PASS
		19175	1907.5	27.28	21.47	5.81	≤13	PASS
	10	18650	1855	27.68	21.51	6.17	≤13	PASS
		18900	1880	27.54	21.46	6.08	≤13	PASS
		19150	1905	27.19	21.44	5.75	≤13	PASS
	15	18675	1857.5	27.72	21.48	6.24	≤13	PASS
		18900	1880	27.72	21.47	6.25	≤13	PASS
		19125	1902.5	27.40	21.44	5.96	≤13	PASS
	20	18700	1860	27.64	21.44	6.20	≤13	PASS
		18900	1880	27.73	21.50	6.23	≤13	PASS
		19100	1900	27.44	21.38	6.06	≤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 +55°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 +55°C. Allow at least 1.5 hours at each temperature, un-powered, before making measurements.

Frequency Stability (Voltage Variation)

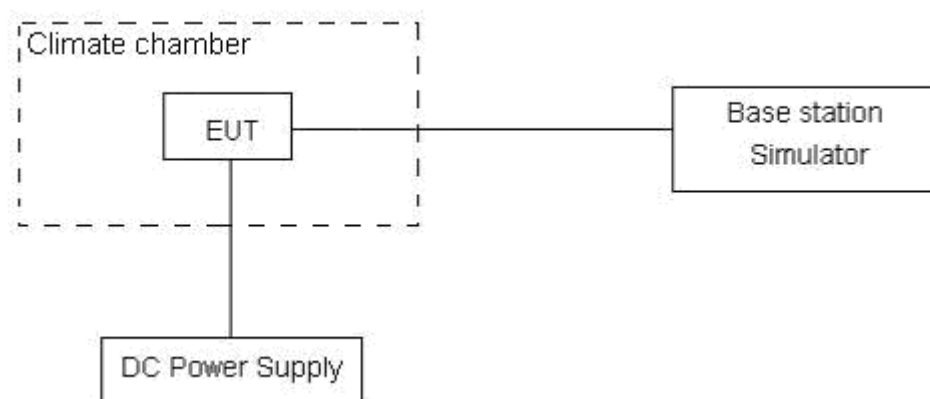
The frequency stability shall be measured with variation of primary supply voltage as follows:

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

(2) For hand carried, battery powered equipment, reduce primary supply voltage 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 3.6 V and 4.4 V, with a nominal voltage of 3.85V.

Test setup



Limits

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block

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

GSM1900						
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability (ppm)	Frequency Stability (ppm)	Verdict
Temperature	Voltage	GMSK	8PSK	GMSK	8PSK	
Normal (25℃)	Normal	11.24	13.95	0.00598	0.00742	PASS
Extreme (55℃)		9.16	14.09	0.00487	0.00749	PASS
Extreme (50℃)		13.63	8.46	0.00725	0.00450	PASS
Extreme (40℃)		4.32	13.79	0.00230	0.00733	PASS
Extreme (30℃)		14.20	10.08	0.00755	0.00536	PASS
Extreme (20℃)		15.22	11.92	0.00810	0.00634	PASS
Extreme (10℃)		11.26	4.60	0.00599	0.00245	PASS
Extreme (0℃)		17.55	13.58	0.00934	0.00722	PASS
Extreme (-10℃)		11.39	2.70	0.00606	0.00143	PASS
Extreme (-20℃)		1.82	3.78	0.00097	0.00201	PASS
Extreme (-30℃)		11.28	12.29	0.00600	0.00654	PASS
25℃	LV	2.88	15.90	0.00153	0.00846	PASS
	HV	13.46	2.23	0.00716	0.00119	PASS

WCDMA Band II						
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability (ppm)	Frequency Stability (ppm)	Verdict
Temperature	Voltage	QPSK	BPSK	QPSK	BPSK	
Normal (25℃)	Normal	12.64	3.19	0.00672	0.00170	PASS
Extreme (55℃)		8.59	4.45	0.00457	0.00236	PASS
Extreme (50℃)		16.63	16.66	0.00885	0.00886	PASS
Extreme (40℃)		10.25	8.62	0.00545	0.00459	PASS
Extreme (30℃)		12.05	8.18	0.00641	0.00435	PASS
Extreme (20℃)		6.56	12.33	0.00349	0.00656	PASS
Extreme (10℃)		1.42	7.65	0.00075	0.00407	PASS
Extreme (0℃)		4.80	8.86	0.00255	0.00471	PASS
Extreme (-10℃)		5.02	4.74	0.00267	0.00252	PASS
Extreme (-20℃)		4.52	12.78	0.00240	0.00680	PASS
Extreme (-30℃)		3.26	7.54	0.00173	0.00401	PASS
25℃	LV	14.37	14.27	0.00764	0.00759	PASS
	HV	17.95	16.98	0.00955	0.00903	PASS

LTE B2						
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℃)	Normal	17.94	9.35	0.00954	0.00497	PASS
Extreme (55℃)		15.37	7.70	0.00817	0.00410	PASS
Extreme (50℃)		11.90	4.06	0.00633	0.00216	PASS
Extreme (40℃)		9.35	4.38	0.00498	0.00233	PASS
Extreme (30℃)		11.79	16.02	0.00627	0.00852	PASS
Extreme (20℃)		5.67	5.75	0.00302	0.00306	PASS
Extreme (10℃)		17.98	9.37	0.00956	0.00499	PASS
Extreme (0℃)		11.15	11.45	0.00593	0.00609	PASS
Extreme (-10℃)		15.54	2.93	0.00827	0.00156	PASS
Extreme (-20℃)		10.68	5.76	0.00568	0.00306	PASS
Extreme (-30℃)		15.25	11.56	0.00811	0.00615	PASS
25℃	LV	16.72	10.05	0.00889	0.00535	PASS
	HV	10.22	5.23	0.00543	0.00278	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℃)	Normal	3.94	8.66	0.00210	0.00461	PASS
Extreme (55℃)		7.69	2.42	0.00409	0.00129	PASS
Extreme (50℃)		3.59	2.99	0.00191	0.00159	PASS
Extreme (40℃)		8.75	2.45	0.00465	0.00130	PASS
Extreme (30℃)		14.45	9.54	0.00768	0.00507	PASS
Extreme (20℃)		14.18	13.55	0.00754	0.00721	PASS
Extreme (10℃)		7.86	6.58	0.00418	0.00350	PASS
Extreme (0℃)		2.24	5.44	0.00119	0.00290	PASS
Extreme (-10℃)		2.19	2.75	0.00116	0.00146	PASS
Extreme (-20℃)		4.31	16.51	0.00229	0.00878	PASS
Extreme (-30℃)		8.88	7.41	0.00472	0.00394	PASS
25℃	LV	14.20	6.81	0.00755	0.00362	PASS
	HV	14.16	13.93	0.00753	0.00741	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℃)	Normal	10.35	14.46	0.00550	0.00769	PASS



Extreme (55℃)		9.32	9.21	0.00496	0.00490	PASS
Extreme (50℃)		12.62	2.32	0.00671	0.00123	PASS
Extreme (40℃)		13.88	1.96	0.00738	0.00104	PASS
Extreme (30℃)		16.07	1.27	0.00855	0.00068	PASS
Extreme (20℃)		4.65	13.82	0.00247	0.00735	PASS
Extreme (10℃)		1.11	2.96	0.00059	0.00158	PASS
Extreme (0℃)		13.24	2.20	0.00704	0.00117	PASS
Extreme (-10℃)		17.13	11.28	0.00911	0.00600	PASS
Extreme (-20℃)		2.00	17.58	0.00107	0.00935	PASS
Extreme (-30℃)		10.82	16.35	0.00576	0.00870	PASS
25℃	LV	4.54	4.98	0.00242	0.00265	PASS
	HV	8.88	4.03	0.00473	0.00215	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℃)	Normal	11.68	10.50	0.00621	0.00558	PASS
Extreme (55℃)		4.96	8.69	0.00264	0.00462	PASS
Extreme (50℃)		14.17	17.03	0.00753	0.00906	PASS
Extreme (40℃)		2.86	15.78	0.00152	0.00839	PASS
Extreme (30℃)		17.20	10.87	0.00915	0.00578	PASS
Extreme (20℃)		8.05	11.80	0.00428	0.00627	PASS
Extreme (10℃)		17.58	11.32	0.00935	0.00602	PASS
Extreme (0℃)		2.99	4.85	0.00159	0.00258	PASS
Extreme (-10℃)		1.73	10.89	0.00092	0.00579	PASS
Extreme (-20℃)		6.55	5.91	0.00348	0.00314	PASS
Extreme (-30℃)		15.01	14.12	0.00798	0.00751	PASS
25℃	LV	7.84	4.75	0.00417	0.00253	PASS
	HV	7.95	16.99	0.00423	0.00904	PASS
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability (ppm)	Frequency Stability (ppm)	Verdict
BANDWIDTH	15MHz					
Temperature	Voltage	16QAM	QPSK	16QAM	QPSK	
Normal (25℃)	Normal	15.57	5.22	0.00828	0.00278	PASS
Extreme (55℃)		4.40	8.83	0.00234	0.00469	PASS
Extreme (50℃)		16.31	16.24	0.00868	0.00864	PASS
Extreme (40℃)		11.77	2.83	0.00626	0.00150	PASS
Extreme (30℃)		16.48	2.45	0.00877	0.00130	PASS
Extreme (20℃)		2.40	11.30	0.00128	0.00601	PASS
Extreme (10℃)		9.89	3.98	0.00526	0.00212	PASS
Extreme (0℃)		16.71	1.66	0.00889	0.00088	PASS
Extreme (-10℃)		6.03	16.15	0.00321	0.00859	PASS



Extreme (-20℃)		13.07	2.67	0.00695	0.00142	PASS
Extreme (-30℃)		12.28	2.80	0.00653	0.00149	PASS
25℃	LV	6.80	7.87	0.00362	0.00419	PASS
	HV	14.64	4.99	0.00779	0.00265	PASS
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability (ppm)	Frequency Stability (ppm)	Verdict
BANDWIDTH	20MHz					
Temperature	Voltage	16QAM	QPSK	16QAM	QPSK	
Normal (25℃)	Normal	8.48	10.06	0.00451	0.00535	PASS
Extreme (55℃)		10.22	12.09	0.00544	0.00643	PASS
Extreme (50℃)		9.60	3.33	0.00511	0.00177	PASS
Extreme (40℃)		14.43	6.18	0.00768	0.00329	PASS
Extreme (30℃)		5.27	4.08	0.00280	0.00217	PASS
Extreme (20℃)		12.48	10.05	0.00664	0.00534	PASS
Extreme (10℃)		7.66	16.87	0.00407	0.00897	PASS
Extreme (0℃)		9.04	1.61	0.00481	0.00086	PASS
Extreme (-10℃)		13.78	14.52	0.00733	0.00773	PASS
Extreme (-20℃)		3.62	2.44	0.00192	0.00130	PASS
Extreme (-30℃)		16.27	7.65	0.00865	0.00407	PASS
25℃	LV	15.10	16.31	0.00803	0.00868	PASS
	HV	9.46	9.16	0.00503	0.00487	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 is set to 100kHz, VBW is set to 300kHz for 30MHz~1GHz

RBW is set to 1MHz, VBW is set to 3MHz for above 1GHz, Sweep is set to ATUO.

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

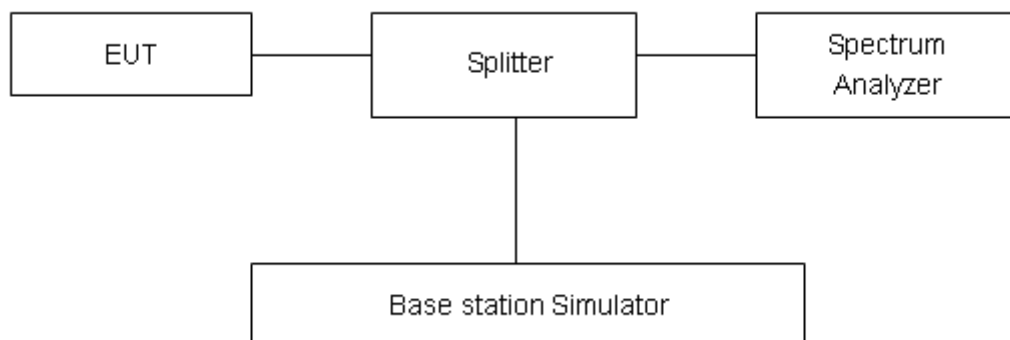
RBW is set to 10 kHz (0.15 MHz~ 30 MHz)

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 24.238(a) specifies that “on any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least $43 + 10 \log_{10} (P)$ dB.”

Limit	-13 dBm
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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 $k = 1.96$.



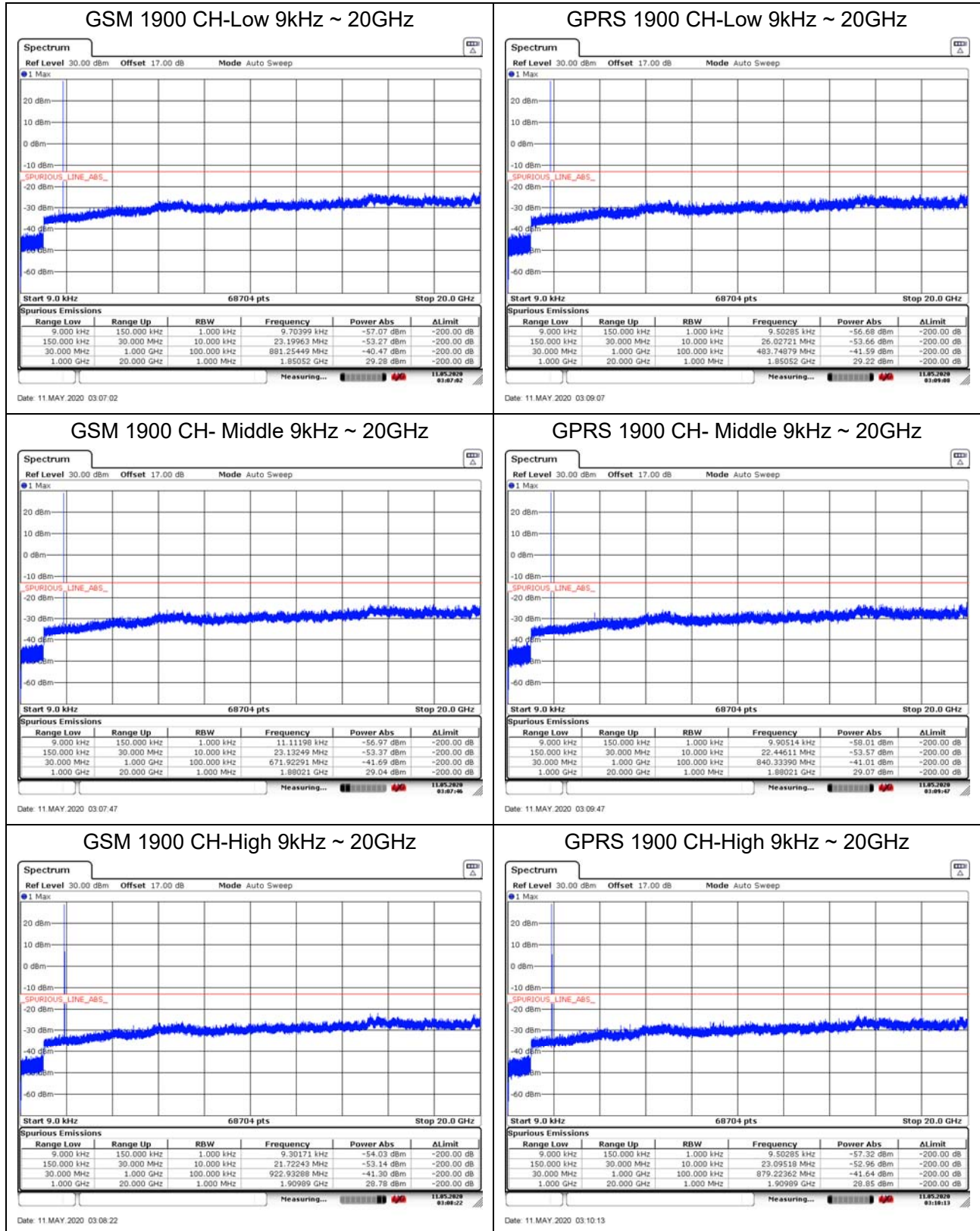
Frequency	Uncertainty
9kHz-1GHz	0.684 dB
1GHz-20GHz	1.407 dB



Test Result

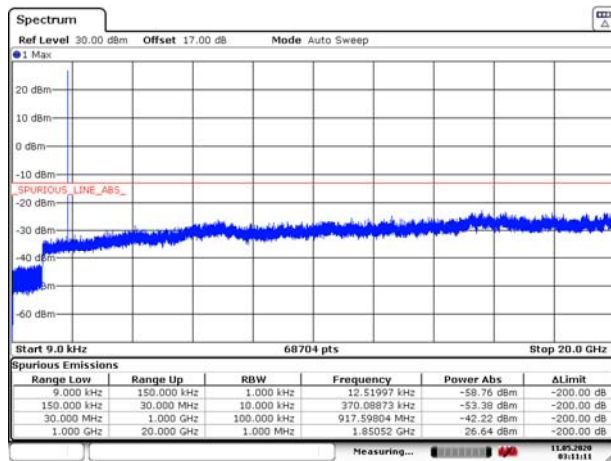
Sweep the whole frequency band through the range from 9kHz to the 10th harmonic of the carrier, the emissions more than 20 dB below the limit are not reported.

The signal beyond the limit is carrier.



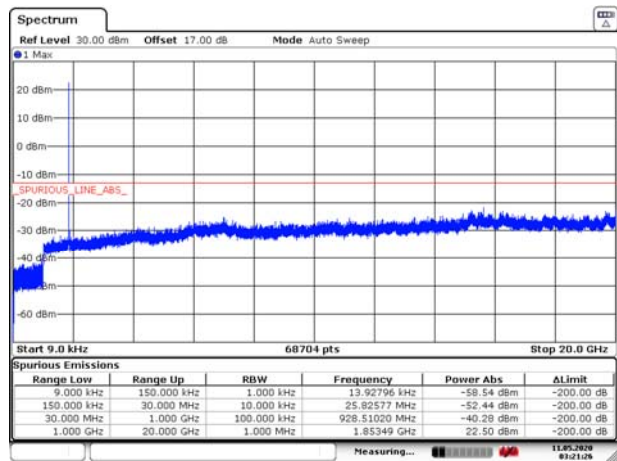


EGPRS 1900 CH-Low 9kHz ~ 20GHz



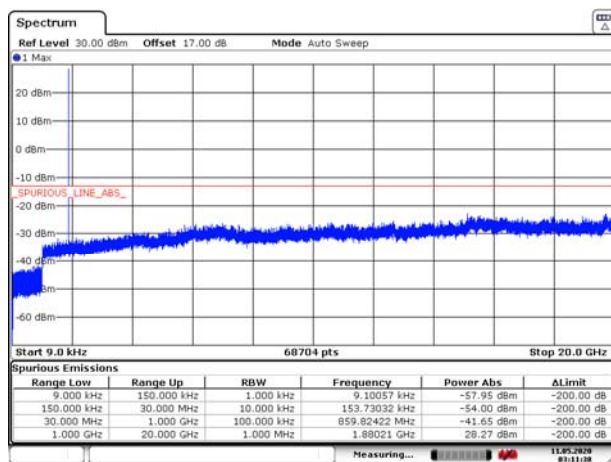
Date: 11 MAY 2020 03:11:12

WCDMA BAND II CH-Low 9kHz ~ 20GHz



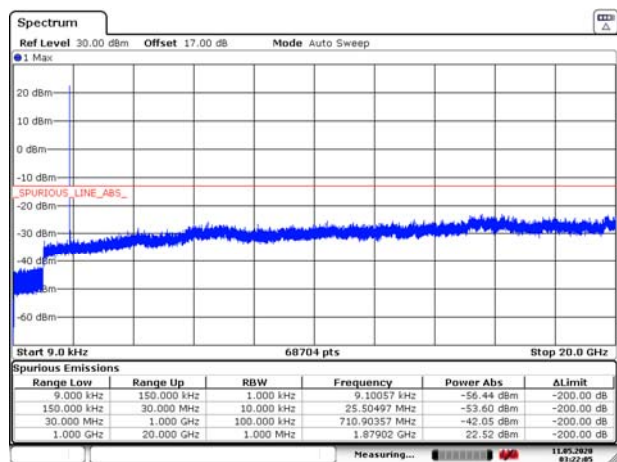
Date: 11 MAY 2020 03:21:26

EGPRS 1900 CH- Middle 9kHz ~ 20GHz



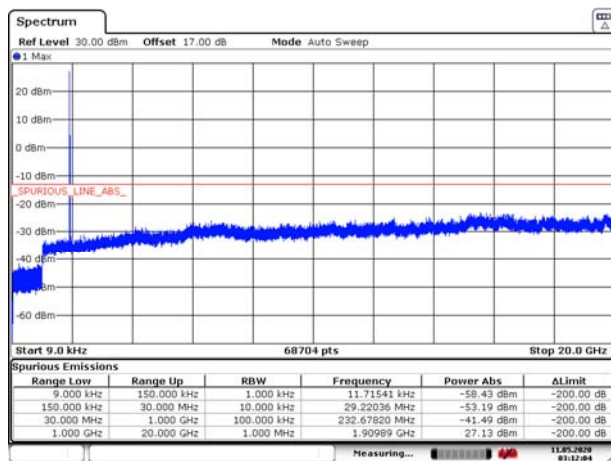
Date: 11 MAY 2020 03:11:38

WCDMA BAND II CH- Middle 9kHz ~ 20GHz



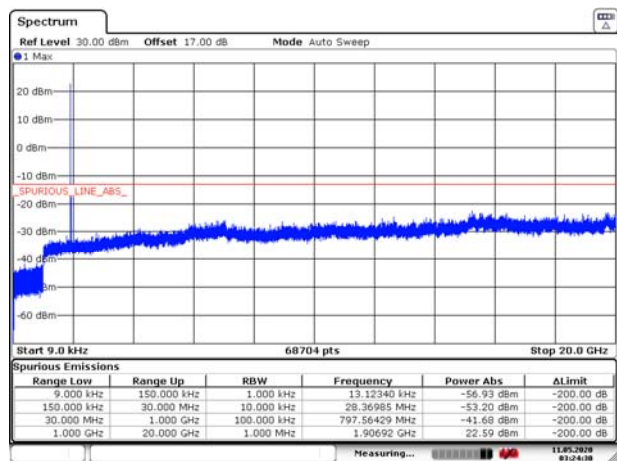
Date: 11 MAY 2020 03:22:05

EGPRS 1900 CH-High 9kHz ~ 20GHz



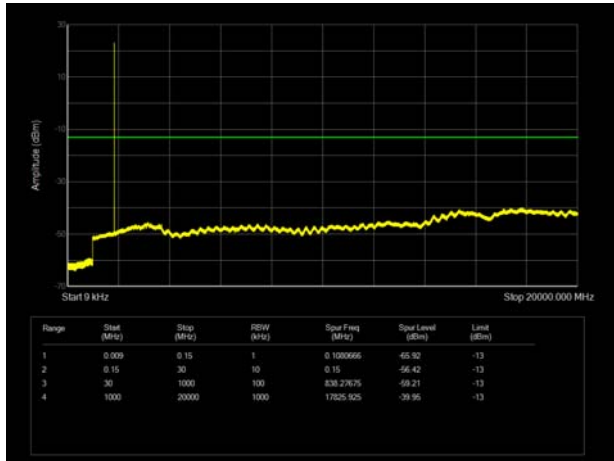
Date: 11 MAY 2020 03:12:04

WCDMA BAND II CH-High 9kHz ~ 20GHz

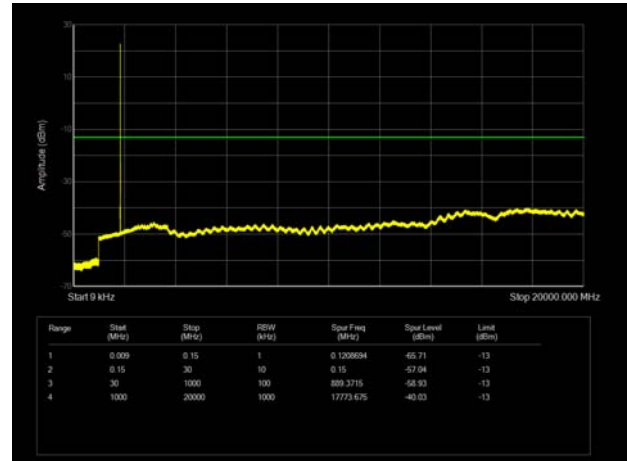


Date: 11 MAY 2020 03:24:30

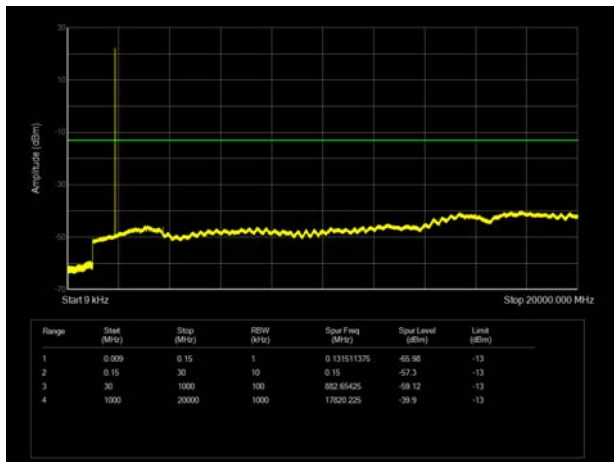
LTE Band 2 1.4MHz CH-Low 9kHz~20GHz



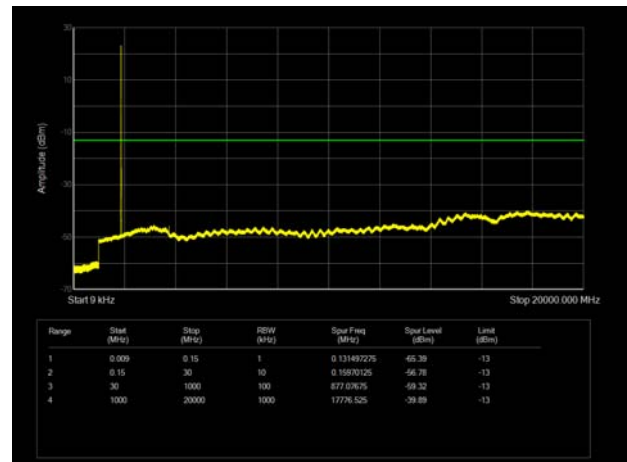
LTE Band 2 3MHz CH-Low 9kHz~20GHz



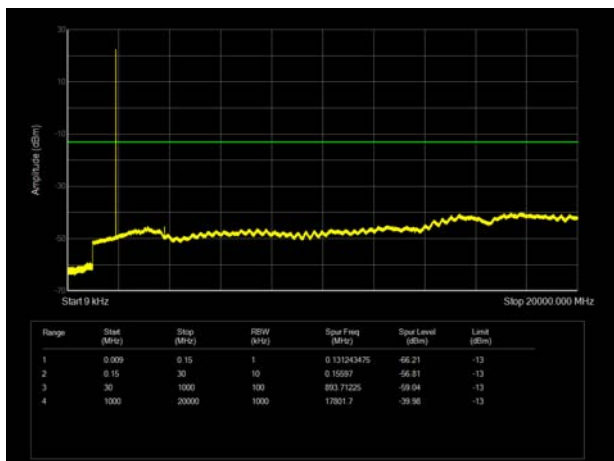
LTE Band 2 1.4MHz CH-Middle 9kHz~20GHz



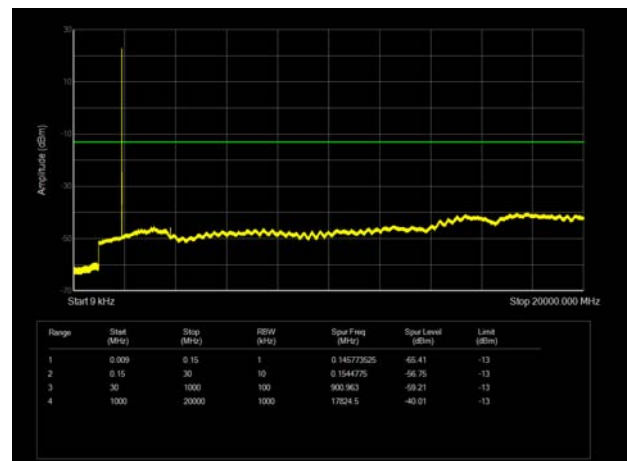
LTE Band 2 3MHz CH-Middle 9kHz~20GHz



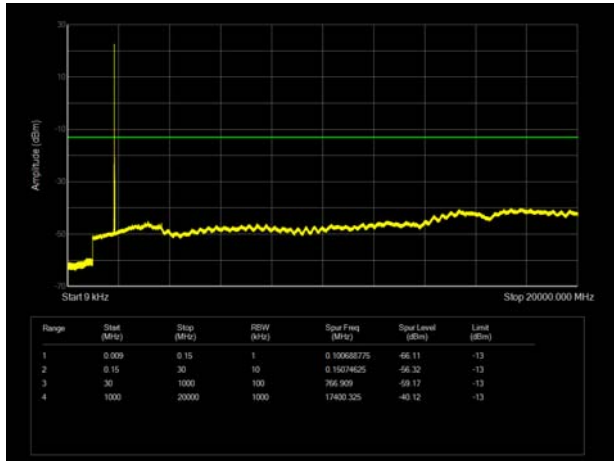
LTE Band 2 1.4MHz CH-High 9kHz~20GHz



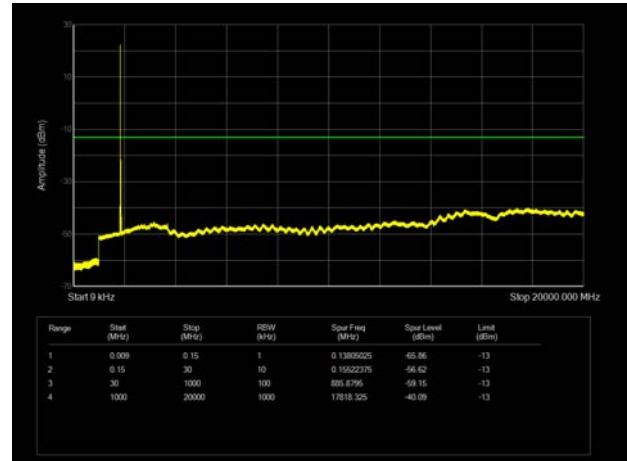
LTE Band 2 3MHz CH-High 9kHz~20GHz



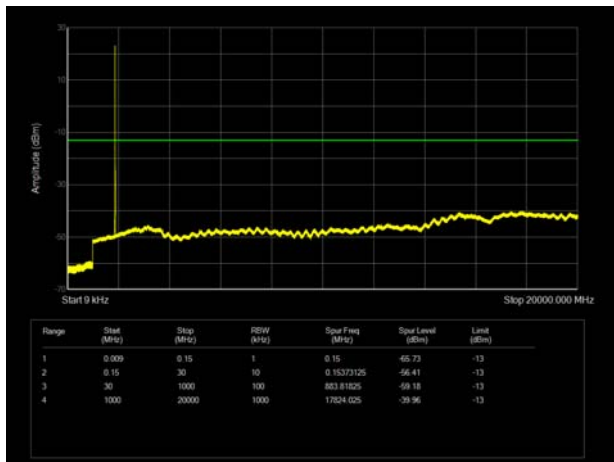
LTE Band 2 5MHz CH-Low 9kHz~20GHz



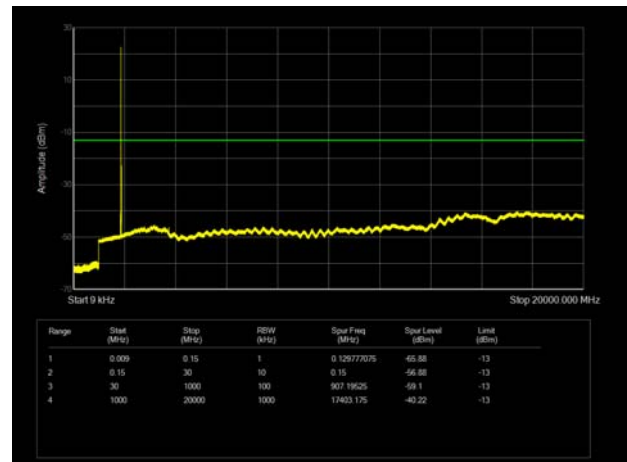
LTE Band 2 10MHz CH-Low 9kHz~20GHz



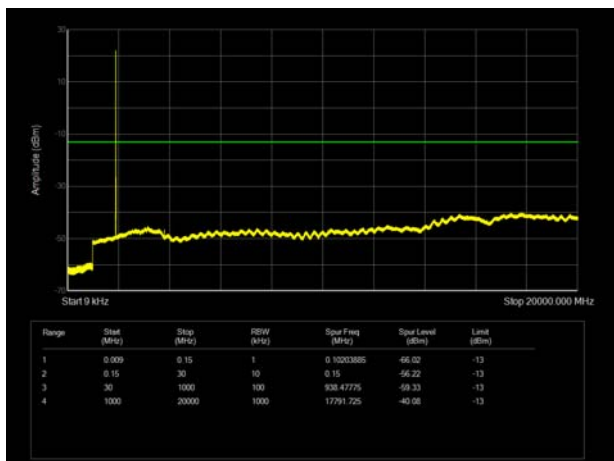
LTE Band 2 5MHz CH-Middle 9kHz~20GHz



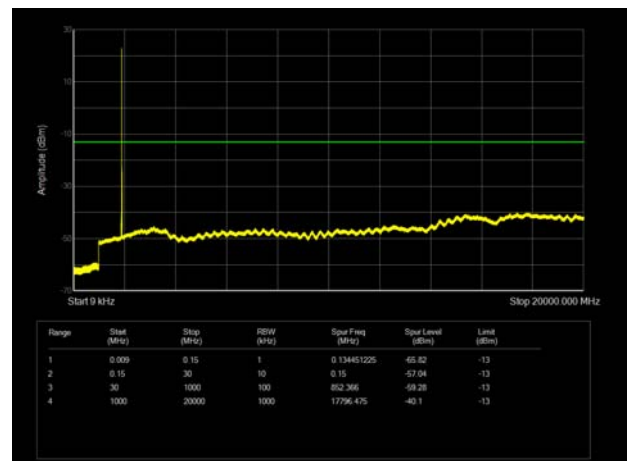
LTE Band 2 10MHz CH-Middle 9kHz~20GHz



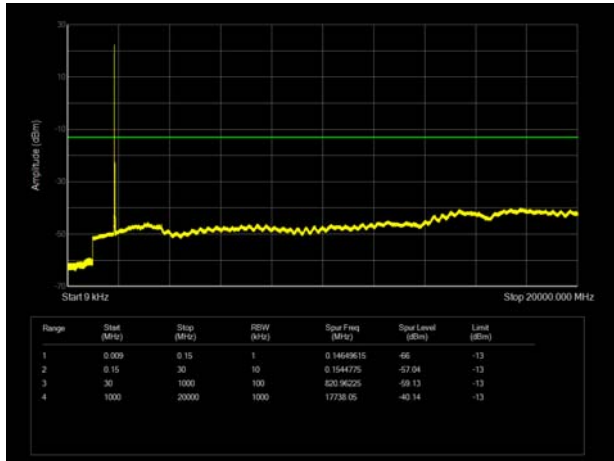
LTE Band 2 5MHz CH-High 9kHz~20GHz



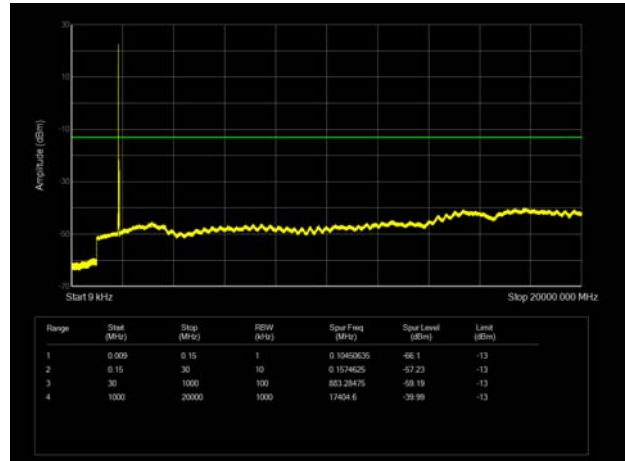
LTE Band 2 10MHz CH-High 9kHz~20GHz



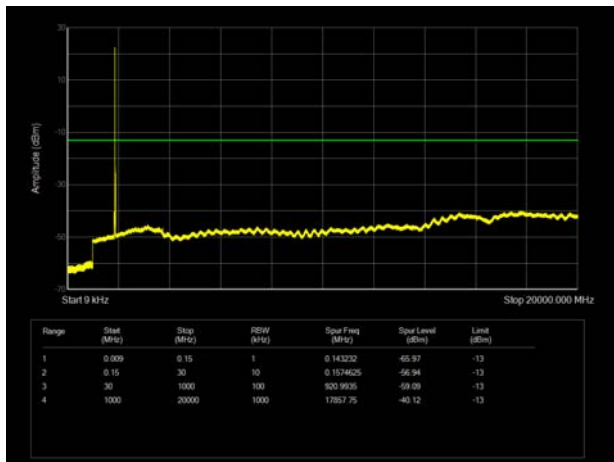
LTE Band 2 15MHz CH-Low 9kHz~20GHz



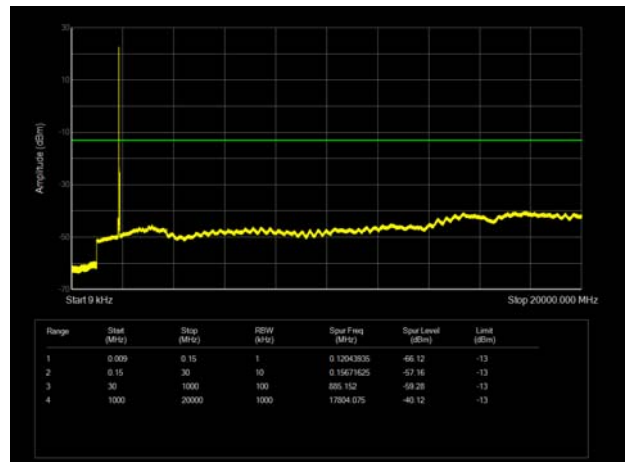
LTE Band 2 20MHz CH-Low 9kHz~20GHz



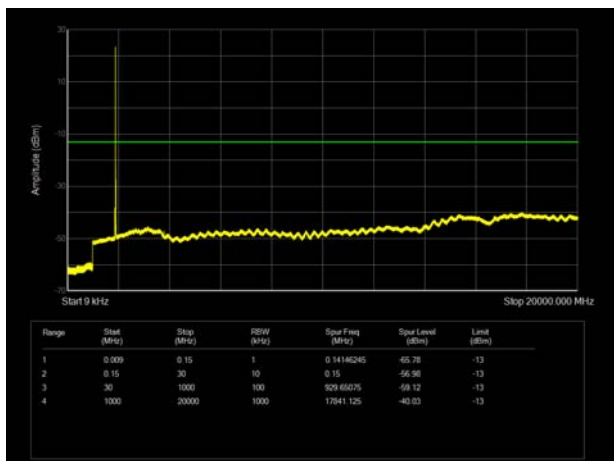
LTE Band 2 15MHz CH-Middle 9kHz~20GHz



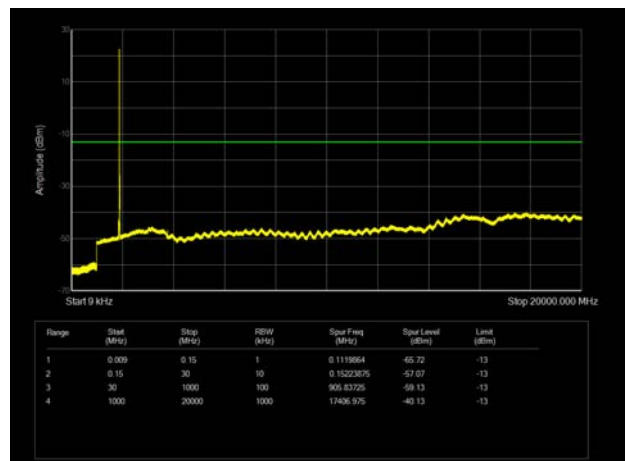
LTE Band 2 20MHz CH-Middle 9kHz~20GHz



LTE Band 2 15MHz CH-High 9kHz~20GHz



LTE Band 2 20MHz CH-High 9kHz~20GHz



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 9kHz150kHz , 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:
$$\text{Power(EIRP)} = \text{PMea} - \text{PAg} - \text{Pcl} + \text{Ga}$$

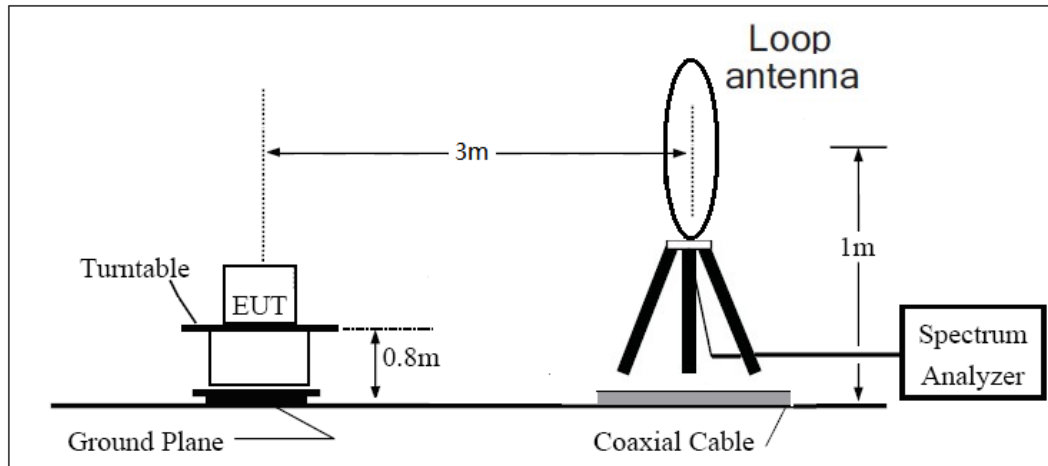
The measurement results are amend as described below:
$$\text{Power(EIRP)} = \text{PMea} - \text{Pcl} + \text{Ga}$$
8. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi)

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

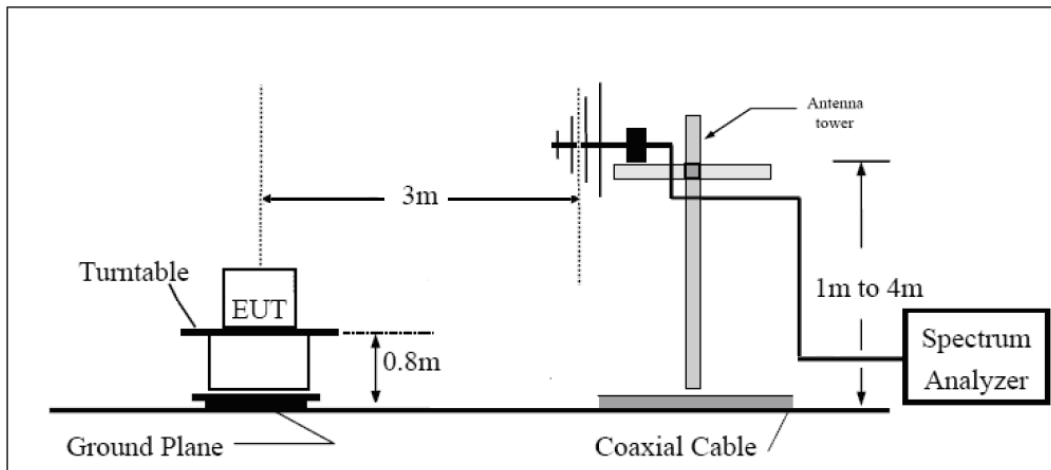
The modulation mode and RB allocation refer to section 5.1, using the maximum output power configuration.

Test setup

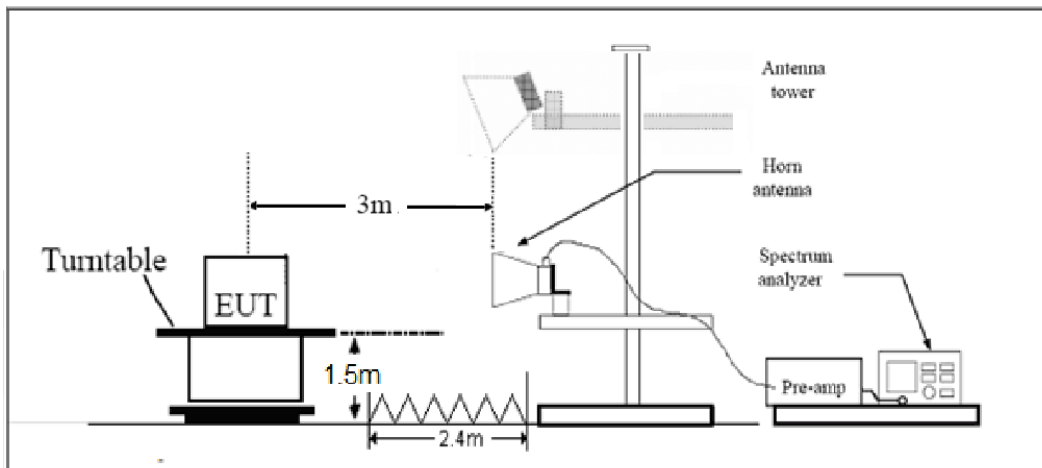
9KHz ~ 30MHz



30MHz ~ 1GHz



Above 1GHz





Note: Area side: 2.4mX3.6m

Limits

Rule Part 24.238(a) specifies that “on any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least $43 + 10 \log_{10} (P)$ 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 1900 CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3760.00	-58.60	5.10	11.05	Horizontal	-52.65	-13.00	39.65	315
3	5640.00	-56.78	5.42	12.65	Horizontal	-49.55	-13.00	36.55	90
4	7520.00	-56.29	6.70	13.85	Horizontal	-49.14	-13.00	36.14	45
5	9400.00	-54.03	7.01	14.75	Horizontal	-46.29	-13.00	33.29	180
6	11280.00	-50.97	7.48	15.95	Horizontal	-42.50	-13.00	29.50	225
7	13160.00	-51.87	7.51	16.55	Horizontal	-42.83	-13.00	29.83	315
8	15040.00	-44.64	8.24	15.35	Horizontal	-37.53	-13.00	24.53	90
9	16920.00	-46.51	8.41	14.95	Horizontal	-39.97	-13.00	26.97	0
10	18800.00	-	-	-	-	-	-	-	-

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 II CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3760.00	-56.20	5.10	11.05	Horizontal	-50.25	-13.00	37.25	225
3	5640.00	-59.96	5.42	12.65	Horizontal	-52.73	-13.00	39.73	45
4	7520.00	-55.78	6.70	13.85	Horizontal	-48.63	-13.00	35.63	180
5	9400.00	-53.57	7.01	14.75	Horizontal	-45.83	-13.00	32.83	315
6	11280.00	-52.02	7.48	15.95	Horizontal	-43.55	-13.00	30.55	45
7	13160.00	-52.93	7.51	16.55	Horizontal	-43.89	-13.00	30.89	0
8	15040.00	-47.42	8.24	15.35	Horizontal	-40.31	-13.00	27.31	135
9	16920.00	-47.34	8.41	14.95	Horizontal	-40.80	-13.00	27.80	225
10	18800.00	-	-	-	-	-	-	-	-

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 2 1.4MHz CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3759.10	-50.14	5.10	11.05	Vertical	-44.19	-13.00	31.19	45
3	5638.88	-57.87	5.42	12.65	Vertical	-50.64	-13.00	37.64	90
4	7520.00	-56.94	6.70	13.85	Vertical	-49.79	-13.00	36.79	45
5	9400.00	-55.43	7.01	14.75	Vertical	-47.69	-13.00	34.69	270
6	11280.00	-53.16	7.48	15.95	Vertical	-44.69	-13.00	31.69	180
7	13160.00	-54.73	7.51	16.55	Vertical	-45.69	-13.00	32.69	0
8	15040.00	-46.76	8.24	15.35	Vertical	-39.65	-13.00	26.65	45
9	16920.00	-49.51	8.41	14.95	Vertical	-42.97	-13.00	29.97	315
10	18800.00	-	-	-	-	-	-	-	-

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 Vertical position.

LTE Band 2 5MHz CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3755.00	-51.34	5.10	11.05	Vertical	-45.39	-13.00	32.39	180
3	5632.50	-57.02	5.42	12.65	Vertical	-49.79	-13.00	36.79	0
4	7510.00	-56.98	6.70	13.85	Vertical	-49.83	-13.00	36.83	45
5	9387.50	-54.32	7.01	14.75	Vertical	-46.58	-13.00	33.58	90
6	11265.00	-53.57	7.48	15.95	Vertical	-45.10	-13.00	32.10	225
7	13142.50	-52.45	7.51	16.55	Vertical	-43.41	-13.00	30.41	315
8	15020.00	-47.29	8.24	15.35	Vertical	-40.18	-13.00	27.18	45
9	16897.50	-48.92	8.41	14.95	Vertical	-42.38	-13.00	29.38	0
10	18800.00	-	-	-	-	-	-	-	-

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 Vertical position.

LTE Band 2 20MHz CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3740.00	-52.53	5.10	11.05	Vertical	-46.58	-13.00	33.58	270
3	5610.00	-56.72	5.42	12.65	Vertical	-49.49	-13.00	36.49	180
4	7480.00	-56.17	6.70	13.85	Vertical	-49.02	-13.00	36.02	0
5	9350.00	-53.79	7.01	14.75	Vertical	-46.05	-13.00	33.05	45
6	11220.00	-53.86	7.48	15.95	Vertical	-45.39	-13.00	32.39	90
7	13090.00	-53.09	7.51	16.55	Vertical	-44.05	-13.00	31.05	225
8	14960.00	-46.96	8.24	15.35	Vertical	-39.85	-13.00	26.85	315
9	16830.00	-48.31	8.41	14.95	Vertical	-41.77	-13.00	28.77	0
10	18800.00	-	-	-	-	-	-	-	-

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 Vertical position.

6. Main Test Instruments

Original: April 28, 2020 ~ June 1, 2020

Name	Manufacturer	Type	Serial Number	Calibration Date	Expiration Date
Base Station Simulator	R&S	CMU200	118133	2019-05-19	2020-05-18
Base Station Simulator	R&S	CMU200	118133	2020-05-18	2021-05-17
Base Station Simulator	R&S	CMW500	113824	2019-05-19	2020-05-18
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	2019-05-19	2020-05-18
Spectrum Analyzer	Key sight	N9010A	MY50210259	2020-05-18	2021-05-17
Universal Radio Communication Tester	Key sight	E5515C	MY48367192	2019-05-19	2020-05-18
Universal Radio Communication Tester	Key sight	E5515C	MY48367192	2020-05-18	2021-05-17
Signal Analyzer	R&S	FSV30	100815	2019-12-15	2020-12-14
Loop Antenna	SCHWARZBECK	FMZB1519	1519-047	2017-09-26	2020-09-25
Trilog Antenna	SCHWARZBECK	VUBL 9163	9163-201	2017-11-18	2020-11-17
Horn Antenna	R&S	HF907	100126	2018-07-07	2020-07-06
Horn Antenna	ETS-Lindgren	3160-09	00102643	2018-06-20	2020-06-19
Signal generator	R&S	SMB 100A	102594	2019-05-19	2020-05-18
Signal generator	R&S	SMB 100A	102594	2020-05-18	2021-05-17
Climatic Chamber	ESPEC	SU-242	93000506	2017-12-17	2020-12-16
Preamplifier	R&S	SCU18	102327	2019-05-19	2020-05-18
Preamplifier	R&S	SCU18	102327	2020-05-18	2021-05-17



MOB COMMS DC SUPPLY	Keysight	66319D	MY43004105	2019-05-19	2020-05-18
MOB COMMS DC SUPPLY	Keysight	66319D	MY43004105	2020-05-18	2021-05-17
RF Cable	Agilent	SMA 15cm	0001	2019-12-13	2020-06-12
Software	R&S	EMC32	9.26.0	/	/

Variant: December 27, 2021~January 10, 2022

Name	Manufacturer	Type	Serial Number	Calibration Date	Expiration Time
Radiates Spurious Emission					
Trilog Antenna	Schwarzbeck	VULB 9163	01111	2019-09-12	2022-09-11
Horn Antenna	Schwarzbeck	BBHA 9120D	1594	2020-12-17	2023-12-16
Horn Antenna	ETS-Lindgren	3160-09	00102643	2018-06-20	2023-06-19
Spectrum Analyzer	R&S	FSV30	104028	2021-05-15	2022-05-14
Software	R&S	EMC32	9.26.0	/	/



ANNEX A: The EUT Appearance

The EUT Appearance are submitted separately.



ANNEX B: Test Setup Photos

The Test Setup Photos are submitted separately.



ANNEX C: Product Change Description

The Product Change Description are submitted separately.

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