



RF TEST REPORT

Applicant Quectel Wireless Solutions Co., Ltd.

FCC ID XMR201707BG96

Product LTE Cat M1 & Cat NB1 & EGPRS Module

Brand Quectel

Model BG96, BG96 MINIPCIE

Marketing Quectel BG96, Quectel BG96 MINIPCIE

Report No. R1811A0536-R3

Issue Date February 26, 2019

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC CFR47 Part 2 (2018)/ FCC CFR47 Part 27C (2018)**. 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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Table of Contents

1	Test Laboratory	4
1.1	Notes of the Test Report	4
1.2	Test facility	4
1.3	Testing Location	5
2	General Description of Equipment under Test	6
3	Applied Standards	7
4	Test Configuration	8
5	Test Information	10
5.1	RF Power Output	10
5.2	Effective Isotropic Radiated Power	13
5.3	Occupied Bandwidth	19
5.4	Band Edge Compliance	25
5.5	Peak-to-Average Power Ratio (PAPR)	43
5.6	Frequency Stability	45
5.7	Spurious Emissions at Antenna Terminals	52
5.8	Radiates Spurious Emission	68
6	Main Test Instruments	89
ANNEX A: EUT Appearance and Test Setup		90
A.1	EUT Appearance	90
A.2	Test Setup	92
ANNEX B: Product Change Description		93

Summary of Measurement Results

Number	Test Case	Clause in FCC rules	Verdict
1	RF power output	2.1046	PASS
2	Effective Isotropic Radiated power	27.50(d)(4) /27.50(b)(10) /27.50(c)(10)	PASS
3	Occupied Bandwidth	2.1049	PASS
4	Band Edge Compliance	27.53(h) /27.53(g)	PASS
5	Peak-to-Average Power Ratio	27.50(d)/KDB971168 D01(5.7)	PASS
6	Frequency Stability	2.1055 / 27.54	PASS
7	Spurious Emissions at Antenna Terminals	2.1051 /27.53(h) /27.53(g) /27.53(f)	PASS
8	Radiates Spurious Emission	2.1053 /27.53(h) /27.53(g) /27.53(f)	PASS
Date of Testing: June 24, 2017~ July 3, 2017			
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.			

BG96, BG96 MINIPCIE (Report No: R1811A0536-R3) is a variant model of BG96 (Report No: RXA1706-0199RF03R1). The detailed product change description please refers to the ANNEX B.



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. This report must not be used by the client to claim product certification, approval, or endorsement by any government agencies.

1.2 Test facility

CNAS (accreditation number: L2264)

TA Technology (Shanghai) Co., Ltd. has obtained the accreditation of China National Accreditation Service for Conformity Assessment (CNAS).

FCC (recognition number is 428261)

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

IC (recognition number is 8510A)

TA Technology (Shanghai) Co., Ltd. has been listed by industry Canada to perform electromagnetic emission measurement.

VCCI (recognition number is C-4595, T-2154, R-4113, G-10766)

TA Technology (Shanghai) Co., Ltd. has been listed by industry Japan to perform electromagnetic emission measurement.

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

Client Information

Applicant	Quectel Wireless Solutions Co., Ltd.
Applicant address	7th Floor, Hongye Building, No. 1801 Hongmei Road, Xuhui District, Shanghai, China
Manufacturer	Quectel Wireless Solutions Co., Ltd.
Manufacturer address	7th Floor, Hongye Building, No. 1801 Hongmei Road, Xuhui District, Shanghai, China

General information

General Information:

EUT Description			
Model:	BG96, BG96 MINIPCIE		
IMEI:	866425038291656		
Hardware Version:	R1.2		
Software Version:	BG96MAR04A01M1G		
Power Supply:	External power supply		
Antenna Type:	The EUT don't have standard Antenna, The Antenna used for testing in this report is the after-market accessory (Dipole Antenna)		
Test Mode(s):	LTE Band 4; LTE Band 12, LTE Band 13;		
Test Modulation	QPSK 16QAM;		
LTE Category	M1		
Maximum E.I.R.P./ E.R.P.	LTE Band 4:	29.98dBm	
	LTE Band 12:	27.79dBm	
	LTE Band 13:	27.17dBm	
Rated Power Supply Voltage:	3.8V		
Extreme Voltage:	Minimum: 3.3V Maximum: 4.3V		
Extreme Temperature:	Lowest: -40°C Highest: +85°C		
Operating Frequency Range(s)	Mode	Tx (MHz)	Rx (MHz)
	LTE Band 4	1710 ~ 1755	2110 ~ 2155
	LTE Band 12	699 ~ 716	729 ~ 746
	LTE Band 13	777 ~ 787	746 ~ 756
Note: 1. The information of the EUT is declared by the manufacturer.			

The series model number is: BG96 MINIPCIE. The difference of these models are have different marketing requirement.

Accessory equipment	
Evaluation Board	RF Cable
RS232-to-USB Cable	Antenna: Dipole Antenna
Headset	USB Cable



3 Applied Standards

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

Test standards

FCC CFR47 Part 2 (2018)

FCC CFR47 Part 27C (2018)

ANSI C63.26 (2015)

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 lie-down stand-up position (X, Y axis), lie-down position (Z axis),. Receiver antenna polarization (horizontal and vertical), the worst emission was found in position (Z 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 LTE is set based on the maximum RF Output Power.

The following testing in different Bandwidth is set to detail in the following table:

Test modes are chosen to be reported as the worst case configuration below for LTE Band 4/12/13:

Test items	Modes	Bandwidth (MHz)						Modulation		RB			Test Channel		
		1.4	3	5	10	15	20	QPSK	16QAM	1	50%	100%	L	M	H
RF power output	LTE 4	O	O	O	O	O	O	O	O	O	O	O	O	O	O
	LTE 12	O	O	O	O	-	-	O	O	O	O	O	O	O	O
	LTE 13	-	-	O	O	-	-	O	O	O	O	O	O	O	O
Effective Isotropic Radiated power	LTE 4	O	O	O	O	O	O	O	O	-	-	O	O	O	O
	LTE 12	O	O	O	O	-	-	O	O	-	-	O	O	O	O
	LTE 13	-	-	O	O	-	-	O	O	-	-	O	O	O	O
Occupied Bandwidth	LTE 4	O	O	O	O	O	O	O	O	-	-	O	-	O	-
	LTE 12	O	O	O	O	-	-	O	O	-	-	O	-	O	-
	LTE 13	-	-	O	O	-	-	O	O	-	-	O	-	O	-
Band Edge Compliance	LTE 4	O	O	O	O	O	O	O	O	O	-	O	O	-	O
	LTE 12	O	O	O	O	-	-	O	O	O	-	O	O	-	O
	LTE 13	-	-	O	O	-	-	O	O	O	-	O	O	-	O
Peak-to-Average Power Ratio	LTE 4	O	O	O	O	O	O	O	O	-	-	O	-	O	-
	LTE 12	O	O	O	O	-	-	O	O	-	-	O	-	O	-
	LTE 13	-	-	O	O	-	-	O	O	-	-	O	-	O	-
Frequency Stability	LTE 4	O	O	O	O	O	O	O	O	-	-	O	-	O	-
	LTE 12	O	O	O	O	-	-	O	O	-	-	O	-	O	-
	LTE 13	-	-	O	O	-	-	O	O	-	-	O	-	O	-
Spurious Emissions at Antenna Terminals	LTE 4	O	O	O	O	O	O	O	-	O	-	-	O	O	O
	LTE 12	O	O	O	O	-	-	O	-	O	-	-	O	O	O
	LTE 13	-	-	O	O	-	-	O	-	O	-	-	O	O	O



Radiates Spurious Emission	LTE 4	-	-	-	-	-	O	O	-	O	-	-	O	O	O
	LTE 12	-	-	-	O	-	-	O	-	O	-	-	O	O	O
	LTE 13	-	-	-	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 Information

5.1 RF Power Output

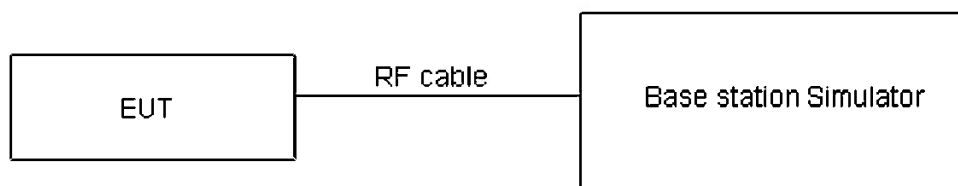
Ambient condition

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.

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.

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	Bandwidth	Channel/ Frequency(MHz)	RB	Index	Conducted Power (dBm)	
					QPSK	16QAM
Band4	1.4MHz	19957 1710.7	1#0	0	22.38	21.94
			6#0	0	22.13	22.06
		20175/1732.5	1#0	0	22.31	22.02
			6#0	0	22.09	22.03
		20393/1754.3	1#5	0	22.37	22.13
			6#0	0	22.23	22.21
	3MHz	19965/1711.5	1#0	0	22.40	21.97
			6#0	0	22.16	22.09
		20175/1732.5	1#0	0	22.35	22.04
			6#0	0	22.13	22.07
		20385/1753.5	1#5	1	22.40	22.16
			6#0	1	22.26	22.24
	5MHz	19975/1712.5	1#0	0	22.37	21.94
			6#0	0	22.14	22.07
		20175/1732.5	1#0	0	22.33	22.00
			6#0	0	22.12	22.03
		20375/1752.5	1#5	3	22.36	22.13
			6#0	3	22.24	22.19
	10MHz	20000/1715	1#0	0	22.39	21.96
			4#0	0	22.22	22.10
		20175/1732.5	1#0	0	22.34	22.03
			4#0	0	22.14	22.08
		20350/1750	1#5	7	22.39	22.15
			4#2	7	22.28	22.23
	15MHz	20025/1717.5	1#0	0	22.38	21.91
			6#0	0	22.20	22.07
		20175/1732.5	1#0	0	22.30	22.01
			6#0	0	22.10	22.03
		20325/1747.5	1#5	11	22.37	22.13
			6#0	11	22.23	22.19
	20MHz	20050/1720	1#0	0	22.35	21.89
			6#0	0	22.17	22.05
		20175/1732.5	1#0	0	22.26	21.97
			6#0	0	22.05	21.99
		20300/1745	1#5	15	22.34	22.08
			6#0	15	22.19	22.16

Mode	Bandwidth	Channel/ Frequency(MHz)	RB	Index	Conducted Power (dBm)	
					QPSK	16QAM
Band12	1.4MHz	23017/699.7	1#0	0	22.74	23.23
			6#0	0	22.48	22.71
		23095/707.5	1#0	0	23.12	22.81
			6#0	0	22.66	22.90
		23173/715.3	1#5	0	23.37	23.02
			6#0	0	22.64	22.79
	3MHz	23025/700.5	1#0	0	22.76	23.25
			6#0	0	22.56	22.74
		23095/707.5	1#0	0	23.13	22.84
			6#0	0	22.68	22.95
		23165/714.5	1#5	1	23.40	23.04
			6#0	1	22.68	22.83
	5MHz	23035/701.5	1#0	0	22.75	23.20
			6#0	0	22.54	22.71
		23095/707.5	1#0	0	23.09	22.82
			6#0	0	22.64	22.90
		23155/713.5	1#5	3	23.38	23.02
			6#0	3	22.63	22.79
	10MHz	23060/704	1#0	0	22.72	23.18
			4#0	0	22.51	22.69
		23095/707.5	1#0	0	23.05	22.78
			4#0	0	22.59	22.86
		23130/711	1#5	7	23.35	22.97
			4#2	7	22.59	22.76

Mode	Bandwidth	Channel/ Frequency(MHz)	RB	Index	Conducted Power (dBm)	
					QPSK	16QAM
Band13	5MHz	23205/779.5	1#0	0	23.10	23.81
			6#0	0	22.80	21.84
		23230/782	1#0	0	23.32	23.14
			6#0	0	22.68	22.19
		23255/784.5	1#5	3	23.11	23.72
			6#0	3	22.67	21.93
	10MHz	23230/782	1#0	0	23.07	23.70
			4#0	0	22.77	22.95

5.2 Effective Isotropic Radiated Power

Ambient condition

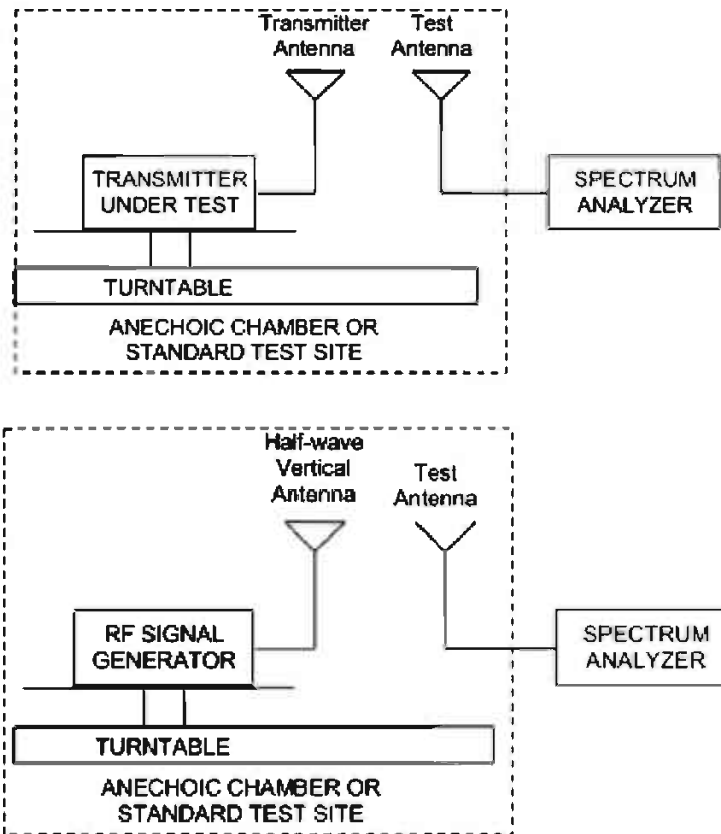
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Methods of Measurement

1. The testing follows FCC KDB 971168 D01 v03r01 Section 5.8 and ANSI C63.26 (2015).
 - a) 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.
 - b) 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).
 - c) 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.
 - d) 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. $LOSS = \text{Generator Output Power (dBm)} - \text{Analyzer reading (dBm)}$
 - e) Determine the effective radiated output power at each angular position from the readings in steps b) and d) using the following equation: $ERP \text{ (dBm)} = LVL \text{ (dBm)} + LOSS \text{ (dB)}$
 - f) The maximum ERP is the maximum value determined in the preceding step.
 - g) 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



Note: Area side:2.4mX3.6m

The radiated emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in stand-up position (Z axis) and the worst case was recorded.

Limits

Rule Part 27.50(b) (10) specifies that "Portable stations (hand-held devices) transmitting in the 746-757 MHz, 776-788 MHz, and 805-806 MHz bands are limited to 3 watts ERP"

Rule Part 27.50(c) (10) specifies that "Portable stations (hand-held devices) in the 600 MHz uplink band and the 698-746 MHz band, and fixed and mobile stations in the 600 MHz uplink band are limited to 3 watts ERP"

Rule Part 27.50(d) (4) specifies that "Fixed, mobile and portable (hand-held) stations operating in the 1710–1755 MHz band are limited to 1 watt EIRP"

Part 27.50(b)(10)Limit	$\leq 3 \text{ W}$ (34.77 dBm)
Part 27.50(c)(10)Limit	$\leq 3 \text{ W}$ (34.77 dBm)
Part 27.50(d)(4)Limit	$\leq 1 \text{ W}$ (30 dBm)

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U = 1.19 \text{ dB}$

Test Results

The measurement is performed for both of horizontal and vertical antenna Polarization, and only the data of worst mode is recorded in this report.

LTE Band 4							
Band width	Channel/ Frequency (MHz)	Polarization	RB	Index	EIRP (dBm)	Limit (dBm)	Conclusion
1.4MHz (QPSK)	19957/1710.7	Horizontal	1#0	0	29.04	30	pass
	20175/1732.5	Horizontal	1#2	0	29.25	30	pass
	20393/1754.3	Horizontal	1#5	0	29.52	30	pass
3MHz (QPSK)	19965/1711.5	Horizontal	1#0	0	29.25	30	pass
	20175/1732.5	Horizontal	1#5	0	29.98	30	pass
	20385/1753.5	Horizontal	1#5	1	29.32	30	pass
5MHz (QPSK)	19975/1712.5	Horizontal	1#0	0	29.73	30	pass
	20175/1732.5	Horizontal	1#5	1	29.18	30	pass
	20375/1752.5	Horizontal	1#5	3	29.29	30	pass
10MHz (QPSK)	20000/1715	Horizontal	4#0	0	29.05	30	pass
	20175/1732.5	Horizontal	4#2	3	29.24	30	pass
	20350/1750	Horizontal	4#2	7	29.47	30	pass
15MHz (QPSK)	20025/1717.5	Horizontal	1#0	0	27.28	30	pass
	20175/1732.5	Horizontal	1#5	5	27.80	30	pass
	20325/1747.5	Horizontal	1#5	11	27.93	30	pass
20MHz (QPSK)	20050/1720	Horizontal	6#0	0	26.65	30	pass
	20175/1732.5	Horizontal	6#0	7	26.95	30	pass
	20300/1745	Horizontal	6#0	15	26.06	30	pass
1.4MHz (16QAM)	19957/1710.7	Horizontal	1#0	0	29.72	30	pass
	20175/1732.5	Horizontal	1#2	0	29.94	30	pass
	20393/1754.3	Horizontal	1#5	0	29.21	30	pass
3MHz (16QAM)	19965/1711.5	Horizontal	1#0	0	29.95	30	pass
	20175/1732.5	Horizontal	1#5	0	29.66	30	pass
	20385/1753.5	Horizontal	1#5	1	29.01	30	pass
5MHz (16QAM)	19975/1712.5	Horizontal	1#0	0	29.41	30	pass
	20175/1732.5	Horizontal	1#5	1	29.55	30	pass
	20375/1752.5	Horizontal	1#5	3	29.00	30	pass
10MHz (16QAM)	20000/1715	Horizontal	4#0	0	28.70	30	pass
	20175/1732.5	Horizontal	4#2	3	28.92	30	pass
	20350/1750	Horizontal	4#2	7	29.15	30	pass
15MHz (16QAM)	20025/1717.5	Horizontal	1#0	0	26.97	30	pass
	20175/1732.5	Horizontal	1#5	5	27.50	30	pass
	20325/1747.5	Horizontal	1#5	11	27.62	30	pass
20MHz	20050/1720	Horizontal	6#0	0	26.32	30	pass



(16QAM)	20175/1732.5	Horizontal	6#0	7	26.63	30	pass
	20300/1745	Horizontal	6#0	15	25.75	30	pass

LTE Band 12							
Band width	Frequency (MHz)	Polarization	RB	Index	EIRP (dBm)	Limit (dBm)	Conclusion
1.4MHz (QPSK)	23017/699.7	Horizontal	1#0	0	25.51	34.7	pass
	23095/707.5	Horizontal	1#2	0	26.10	34.7	pass
	23173/715.3	Horizontal	1#5	0	26.92	34.7	pass
3MHz (QPSK)	23025/700.5	Horizontal	1#0	0	25.50	34.7	pass
	23095/707.5	Horizontal	1#5	0	26.79	34.7	pass
	23165/714.5	Horizontal	1#5	1	27.79	34.7	pass
5MHz (QPSK)	23035/701.5	Horizontal	1#0	0	25.36	34.7	pass
	23095/707.5	Horizontal	1#5	1	26.32	34.7	pass
	23155/713.5	Horizontal	1#5	3	27.30	34.7	pass
10MHz (QPSK)	23060/704	Horizontal	4#0	0	24.70	34.7	pass
	23095/707.5	Horizontal	4#2	3	25.44	34.7	pass
	23130/711	Horizontal	4#2	7	25.97	34.7	pass
1.4MHz (16QAM)	23017/699.7	Horizontal	1#0	0	25.18	34.7	pass
	23095/707.5	Horizontal	1#2	0	25.80	34.7	pass
	23173/715.3	Horizontal	1#5	0	27.60	34.7	pass
3MHz (16QAM)	23025/700.5	Horizontal	1#0	0	25.17	34.7	pass
	23095/707.5	Horizontal	1#5	0	26.45	34.7	pass
	23165/714.5	Horizontal	1#5	1	27.47	34.7	pass
5MHz (16QAM)	23035/701.5	Horizontal	1#0	0	25.07	34.7	pass
	23095/707.5	Horizontal	1#5	1	26.00	34.7	pass
	23155/713.5	Horizontal	1#5	3	26.98	34.7	pass
10MHz (16QAM)	23060/704	Horizontal	4#0	0	24.40	34.7	pass
	23095/707.5	Horizontal	4#2	3	25.10	34.7	pass
	23130/711	Horizontal	4#2	7	25.66	34.7	pass



LTE Band 13							
Band width	Frequency (MHz)	Polarization	RB	Index	EIRP (dBm)	Limit (dBm)	Conclusion
5MHz (QPSK)	23205/779.5	Horizontal	1#0	0	27.00	34.7	pass
	23230/782	Horizontal	1#5	1	26.97	34.7	pass
	23255/784.5	Horizontal	1#5	3	27.00	34.7	pass
10MHz (QPSK)	23230/782	Horizontal	4#2	3	26.86	34.7	pass
5MHz (16QAM)	23035/701.5	Horizontal	1#0	0	26.99	34.7	pass
	23095/707.5	Horizontal	1#5	1	26.96	34.7	pass
	23155/713.5	Horizontal	1#5	3	27.17	34.7	pass
10MHz (16QAM)	23230/782	Horizontal	4#2	3	26.55	34.7	pass

Note: 1. EIRP= E.R.P+2.15

5.3 Occupied Bandwidth

Ambient condition

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

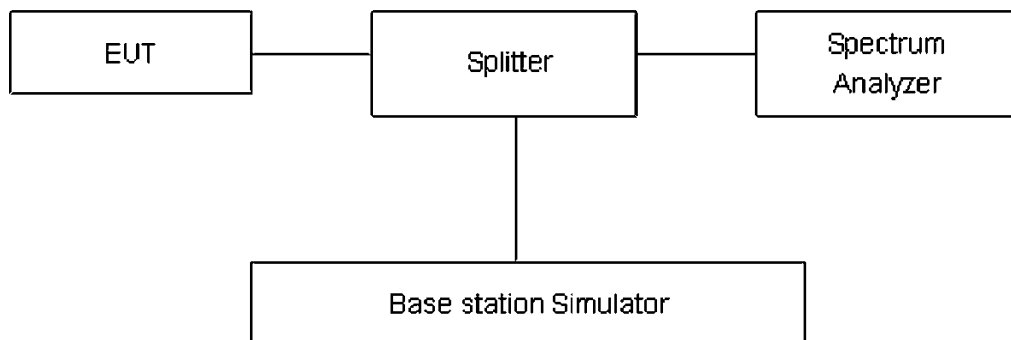
Method of Measurement

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 51 kHz, VBW is set to 160 kHz for LTE Band 4/12/13 .

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

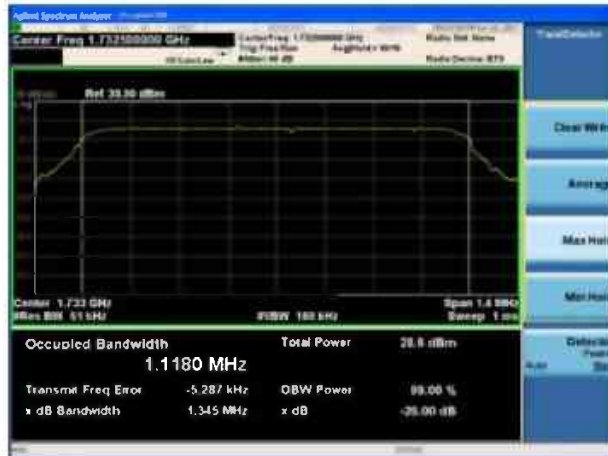
Mode	Bandwidth	Modulation	Channel/ Frequency(MHz)	RB	Index	Bandwidth(MHz)	
						99% Power	-26dBc
Band4	1.4MHz	QPSK	20175/1732.5	6#0	0	1.1180	1.345
		16QAM	20175/1732.5	6#0	0	0.93883	1.215
	3MHz	QPSK	20175/1732.5	6#0	0	1.15040	1.655
		16QAM	20175/1732.5	6#0	0	0.98073	1.337
	5MHz	QPSK	20175/1732.5	6#0	0	1.13010	1.472
		16QAM	20175/1732.5	6#0	0	1.0162	1.496
	10MHz	QPSK	20175/1732.5	6#0	0	1.1840	1.796
		16QAM	20175/1732.5	6#0	0	1.0660	1.795
	15MHz	QPSK	20175/1732.5	6#0	0	1.1955	1.894
		16QAM	20175/1732.5	6#0	0	1.0578	1.889
	20MHz	QPSK	20175/1732.5	6#0	0	1.2079	1.782
		16QAM	20175/1732.5	6#0	0	1.1125	1.862

Mode	Bandwidth	Modulation	Channel/ Frequency(MHz)	RB	Index	Bandwidth(MHz)	
						99% Power	-26dBc
Band12	1.4MHz	QPSK	23095/707.5	6#0	0	1.1082	1.332
		16QAM	23095/707.5	6#0	0	0.93878	1.195
	3MHz	QPSK	23095/707.5	6#0	0	1.1525	1.66
		16QAM	23095/707.5	6#0	0	0.98517	1.343
	5MHz	QPSK	23095/707.5	6#0	0	1.1445	1.506
		16QAM	23095/707.5	6#0	0	0.97604	1.423
	10MHz	QPSK	23095/707.5	6#0	0	1.2051	1.738
		16QAM	23095/707.5	6#0	0	1.0835	1.731

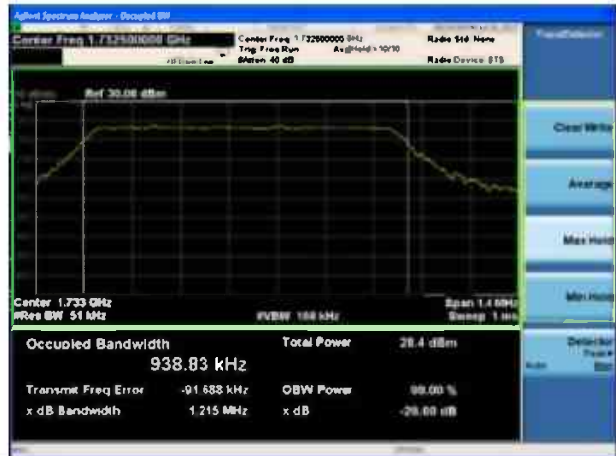
Mode	Bandwidth	Modulation	Channel/ Frequency(MHz)	RB	Index	Bandwidth(MHz)	
						99% Power	-26dBc
Band13	5MHz	QPSK	23230/782	6#0	0	1.149	1.481
		16QAM	23230/782	6#0	0	0.97695	1.356
	10MHz	QPSK	23230/782	6#0	0	1.1775	1.721
		16QAM	23230/782	6#0	0	1.0331	1.537



LTE Band 4 QPSK 1.4MHz CH-Middle



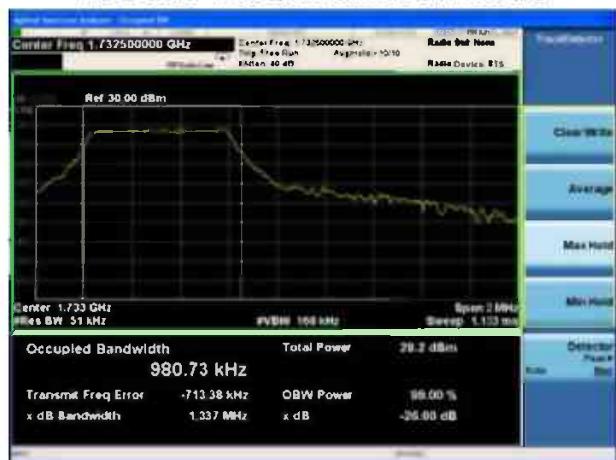
LTE Band 4 16QAM 1.4MHz CH-Middle



LTE Band 4 QPSK 3MHz CH-Middle



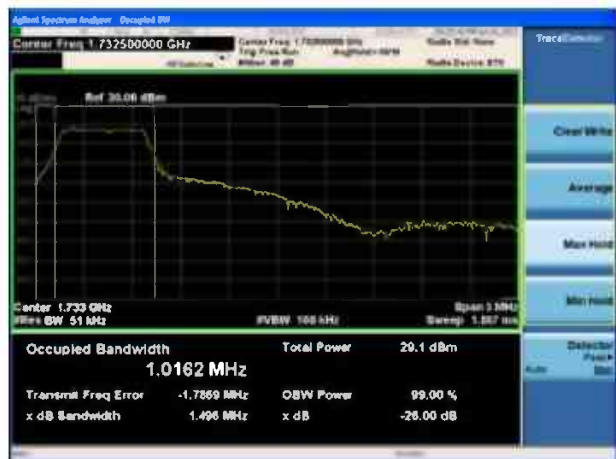
LTE Band 4 16QAM 3MHz CH-Middle



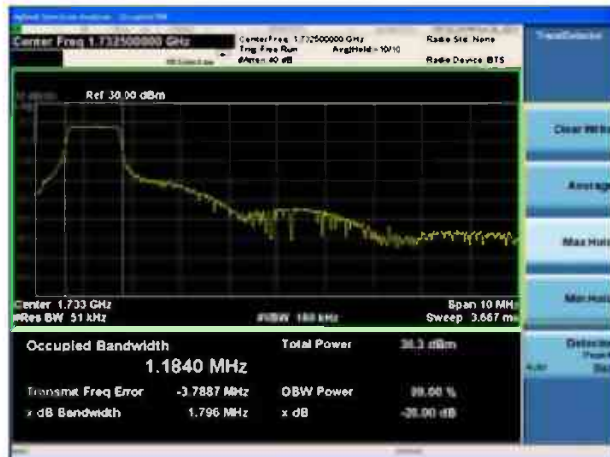
LTE Band 4 QPSK 5MHz CH-Middle



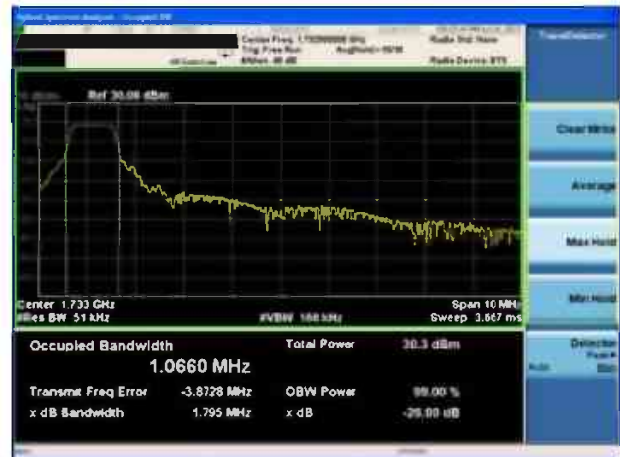
LTE Band 4 16QAM 5MHz CH-Middle



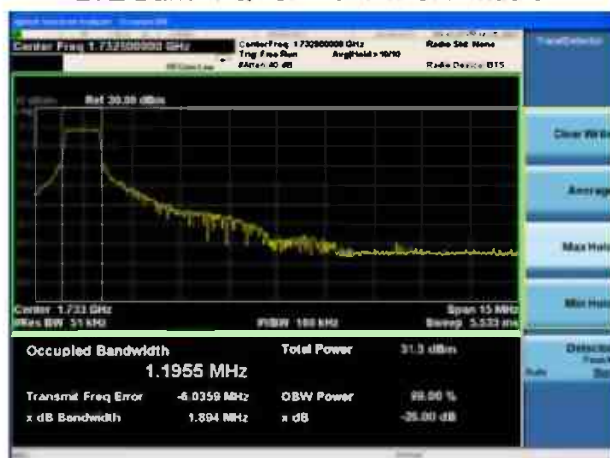
LTE Band 4 QPSK 10MHz CH-Middle



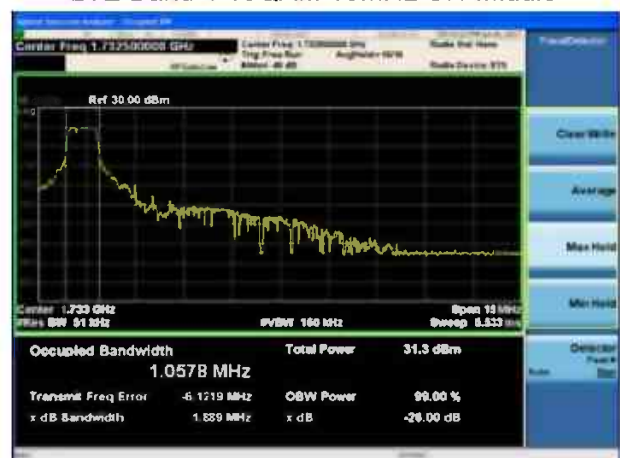
LTE Band 4 16QAM 10MHz CH-Middle



LTE Band 4 QPSK 15MHz CH-Middle



LTE Band 4 16QAM 15MHz CH-Middle



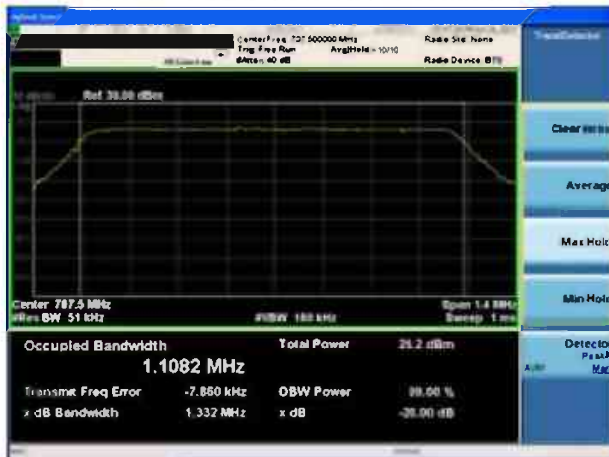
LTE Band 4 QPSK 20MHz CH-Middle



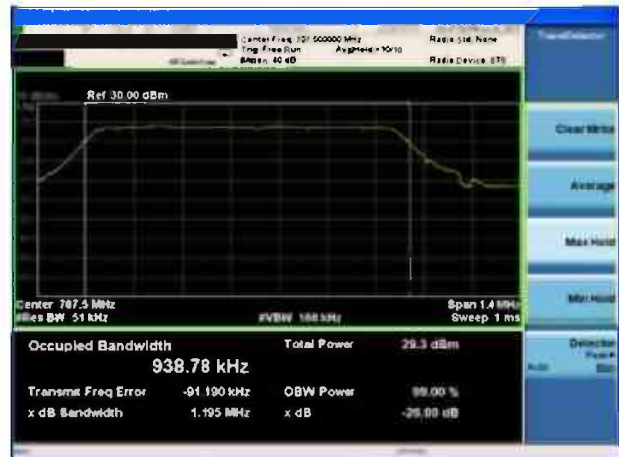
LTE Band 4 16QAM 20MHz CH-Middle



LTE Band 12 QPSK 1.4MHz CH-Middle



LTE Band 12 16QAM 1.4MHz CH-Middle



LTE Band 12 QPSK 3MHz CH-Middle



LTE Band 12 16QAM 3MHz CH-Middle



LTE Band 12 QPSK 5MHz CH-Middle



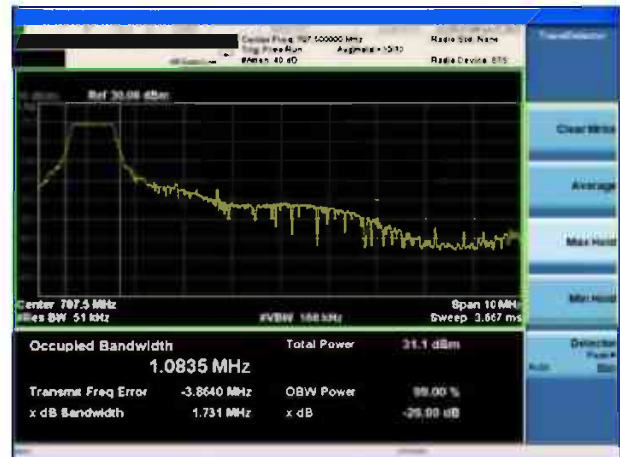
LTE Band 12 16QAM 5MHz CH-Middle



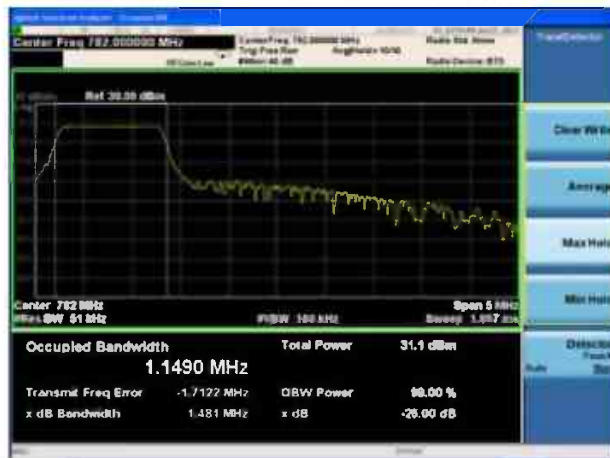
LTE Band 12 QPSK 10MHz CH-Middle



LTE Band 12 16QAM 10MHz CH-Middle



LTE Band 13 QPSK 5MHz CH-Middle



LTE Band 13 16QAM 5MHz CH-Middle



LTE Band 13 QPSK 10MHz CH-Middle



LTE Band 13 16QAM 10MHz CH-Middle



5.4 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 testing follows KDB 971168 v02r02 Section 6.0

The EUT was connected to spectrum analyzer and system simulator via a power divider.

The band edges of low and high channels for the highest RF powers were measured.

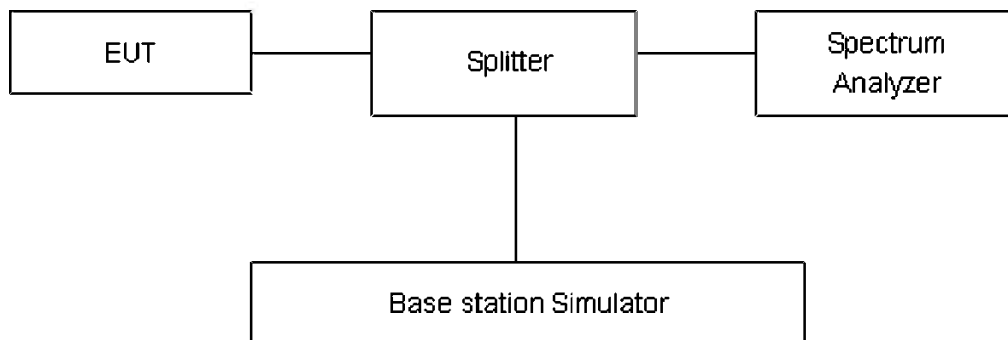
RBW is set to 51 kHz, VBW is set to 160 kHz for LTE Band 4/12/13 on spectrum analyzer.

Set spectrum analyzer with RMS detector.

The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

Checked that all the results comply with the emission limit line.

Test Setup



Limits

Rule Part 27.53(h)/ specifies that " for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10} (P)$ dB"

Part 27.53(g) specifies that " For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least $43 + 10 \log_{10} (P)$ dB."

Part 27.53(m) (4)/ specifies that "for BRS and EBS stations. For mobile digital stations, the attenuation factor shall be not less than $40 + 10 \log (P)$ dB on all frequencies between the channel edge and 5 megahertz from the channel edge, $43 + 10 \log (P)$ dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and $55 + 10 \log (P)$ dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(4) of this section. In addition, the attenuation factor shall not be less that $43 + 10 \log (P)$ dB on all frequencies between 2490.5 MHz and 2496 MHz and $55 + 10 \log (P)$ dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

Example:

The limit line is derived from $43 + 10 \log (P)$ dB below the transmitter power P(Watts)

$= P(W) - [43 + 10 \log(P)]$ (dB)

$= [30 + 10 \log (P)]$ (dBm) - $[43 + 10 \log(P)]$ (dB) = -13dBm.

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

All the test traces in the plots shows the test results clearly.

LTE Band 4 QPSK 1.4MHz CH-Low, 1 RB



LTE Band 4 QPSK 1.4MHz CH-High, 1 RB



LTE Band 4 QPSK 1.4MHz CH-Low, 100%RB



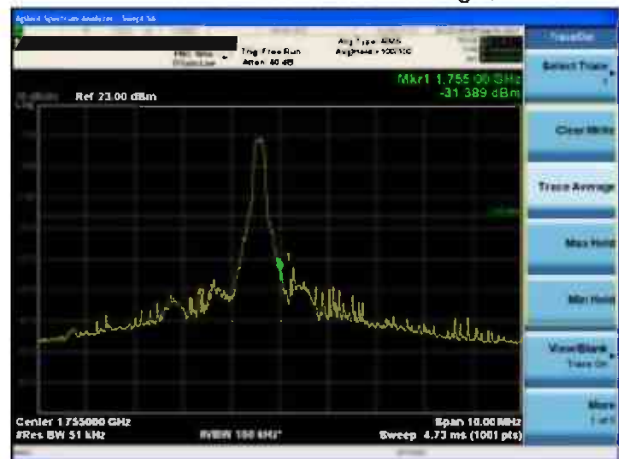
LTE Band 4 QPSK 1.4MHz CH-High, 100%RB



LTE Band 4 QPSK 3MHz CH-Low, 1 RB



LTE Band 4 QPSK 3MHz CH-High, 1 RB





LTE Band 4 QPSK 3MHz CH-Low, 100%RB



LTE Band 4 QPSK 3MHz CH-High, 100%RB



LTE Band 4 QPSK 5MHz CH-Low, 1 RB



LTE Band 4 QPSK 5MHz CH-High, 1 RB



LTE Band 4 QPSK 5MHz CH-Low, 100%RB



LTE Band 4 QPSK 5MHz CH-High, 100%RB

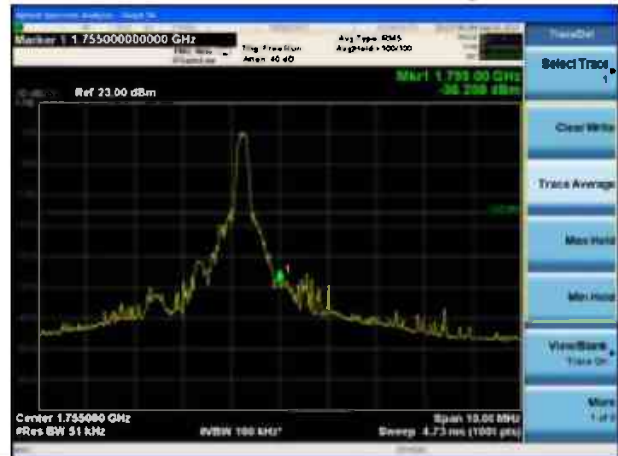




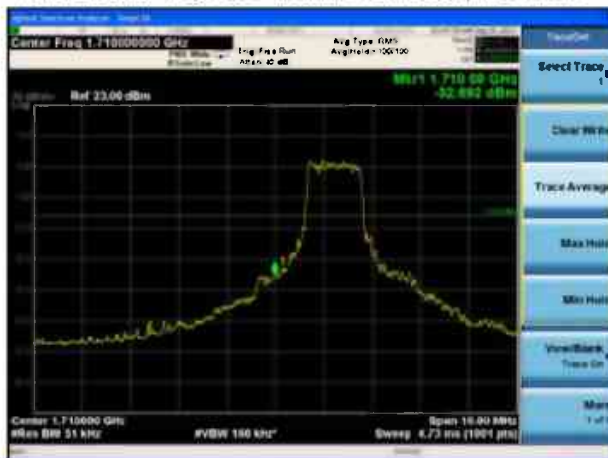
LTE Band 4 QPSK 10MHz CH-Low, 1 RB



LTE Band 4 QPSK 10MHz CH-High, 1 RB



LTE Band 4 QPSK 10MHz CH-Low, 100%RB



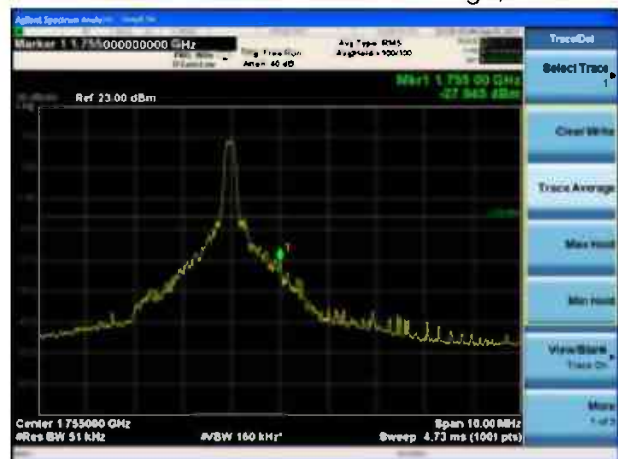
LTE Band 4 QPSK 10MHz CH-High, 100%RB



LTE Band 4 QPSK 15MHz CH-Low, 1 RB



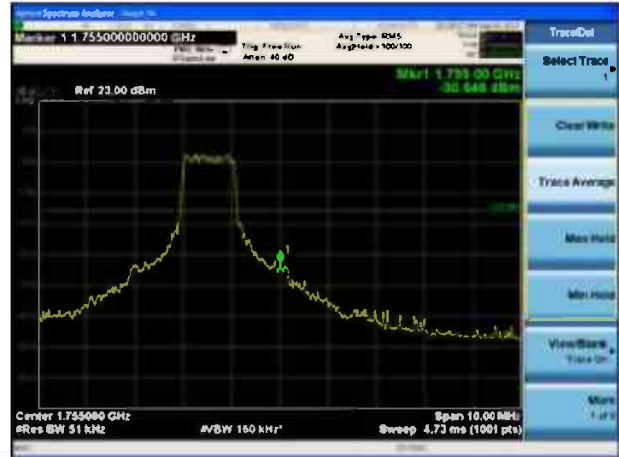
LTE Band 4 QPSK 15MHz CH-High, 1 RB



LTE Band 4 QPSK 15MHz CH-Low, 100%RB



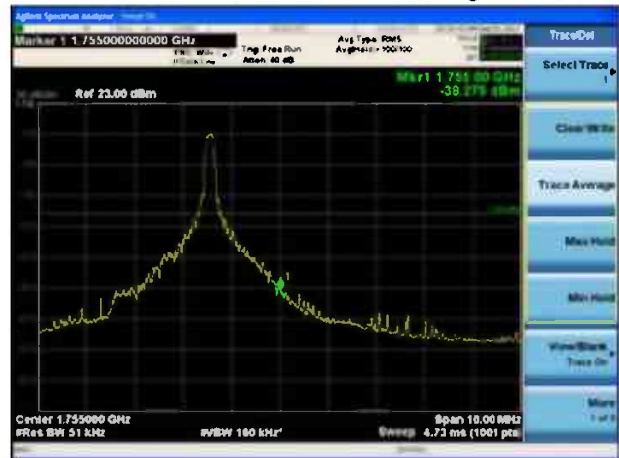
LTE Band 4 QPSK 15MHz CH-High, 100%RB



LTE Band 4 QPSK 20MHz CH-Low, 1 RB



LTE Band 4 QPSK 20MHz CH-High, 1 RB



LTE Band 4 QPSK 20MHz CH-Low, 100%RB



LTE Band 4 QPSK 20MHz CH-High, 100%RB





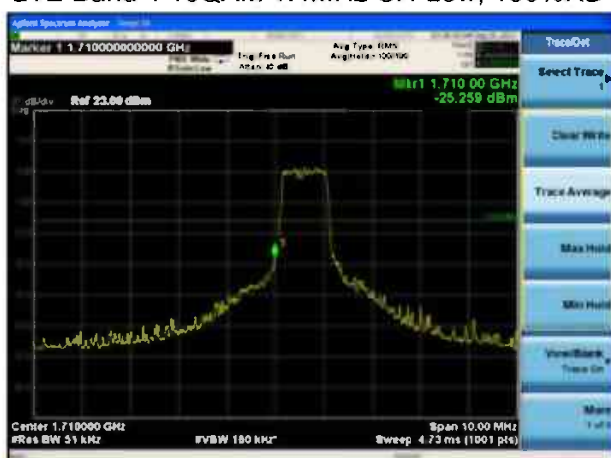
LTE Band 4 16QAM 1.4MHz CH-Low, 1 RB



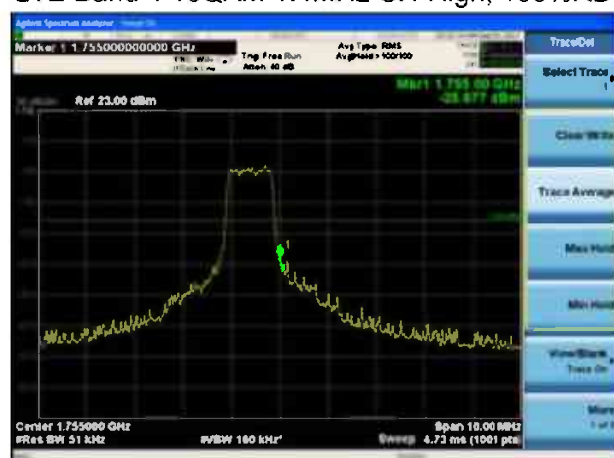
LTE Band 4 16QAM 1.4MHz CH-High, 1 RB



LTE Band 4 16QAM 1.4MHz CH-Low, 100%RB



LTE Band 4 16QAM 1.4MHz CH-High, 100%RB



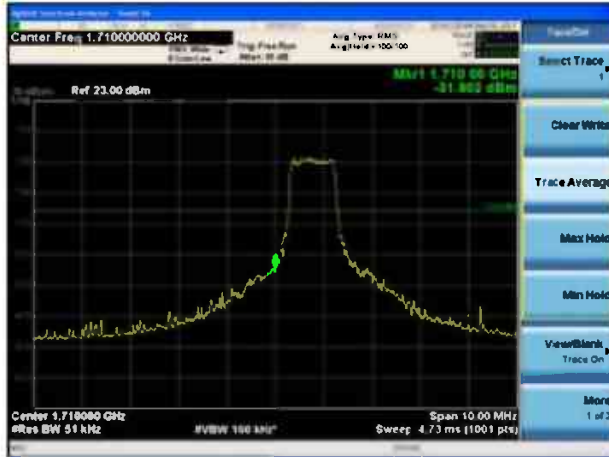
LTE Band 4 16QAM 3MHz CH-Low, 1 RB



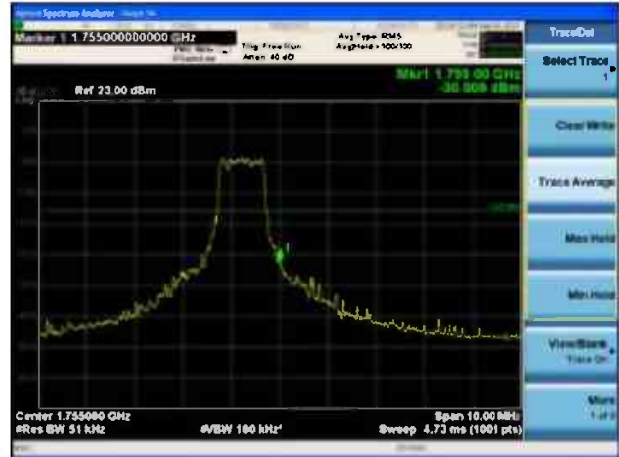
LTE Band 4 16QAM 3MHz CH-High, 1 RB



LTE Band 4 16QAM 3MHz CH-Low, 100%RB



LTE Band 4 16QAM 3MHz CH-High, 100%RB



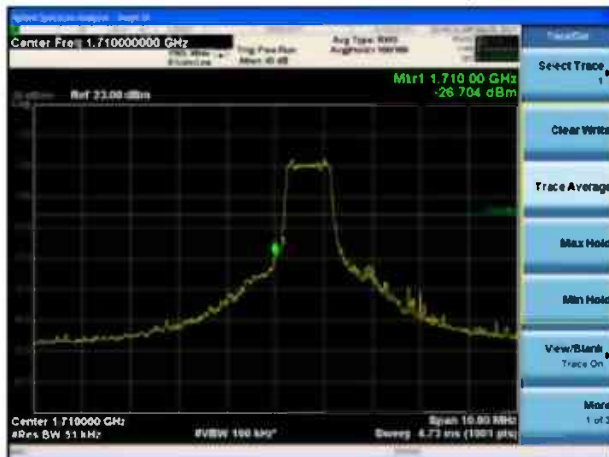
LTE Band 4 16QAM 5MHz CH-Low, 1 RB



LTE Band 4 16QAM 5MHz CH-High, 1 RB



LTE Band 4 16QAM 5MHz CH-Low, 100%RB



LTE Band 4 16QAM 5MHz CH-High, 100%RB





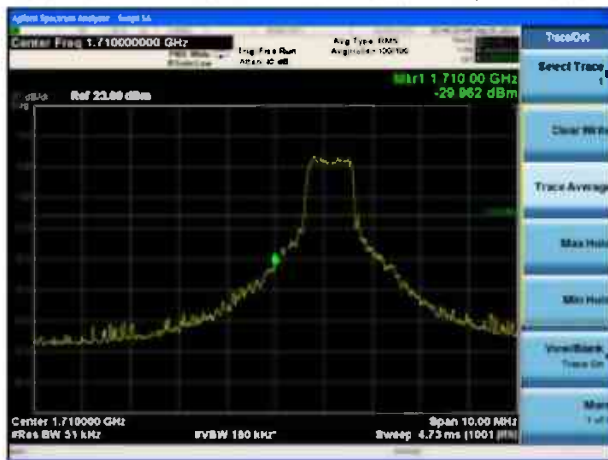
LTE Band 4 16QAM 10MHz CH-Low, 1 RB



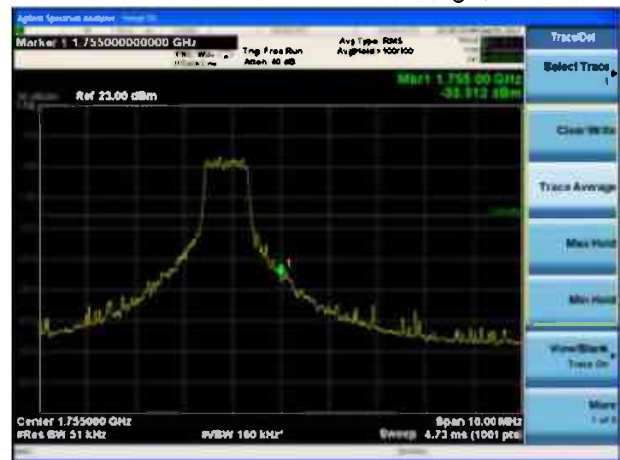
LTE Band 4 16QAM 10MHz CH-High, 1 RB



LTE Band 4 16QAM 10MHz CH-Low, 100%RB



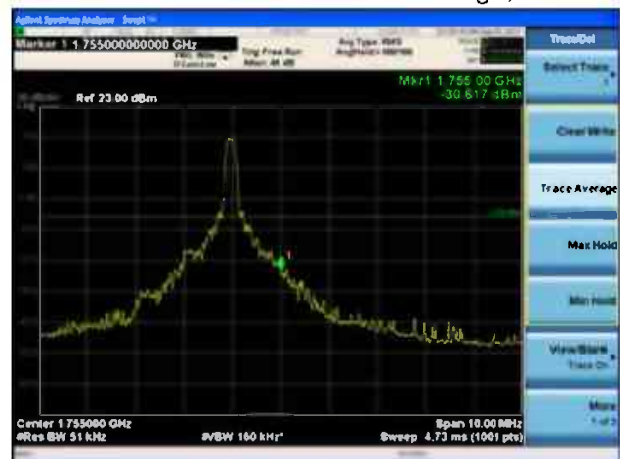
LTE Band 4 16QAM 10MHz CH-High, 100%RB



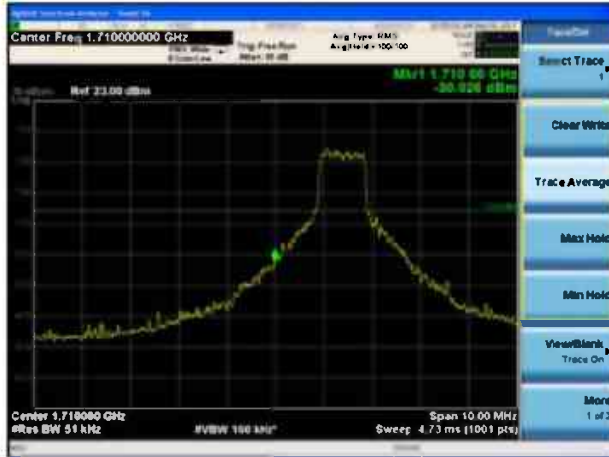
LTE Band 4 16QAM 15MHz CH-Low, 1 RB



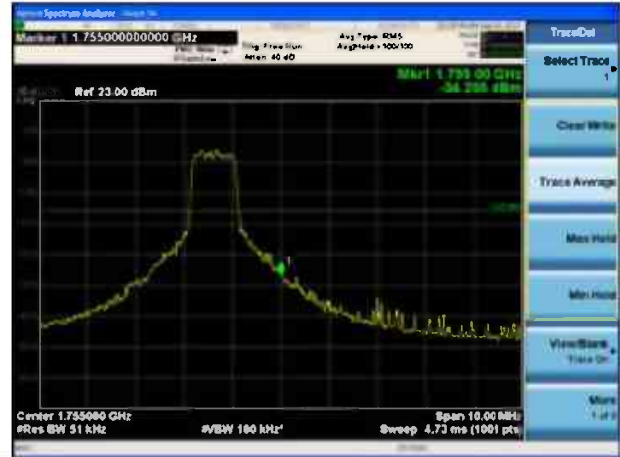
LTE Band 4 16QAM 15MHz CH-High, 1 RB



LTE Band 4 16QAM 15MHz CH-Low, 100%RB



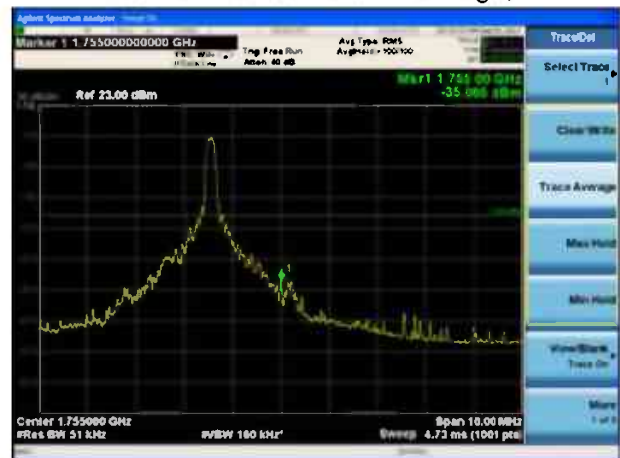
LTE Band 4 16QAM 15MHz CH-High, 100%RB



LTE Band 4 16QAM 20MHz CH-Low, 1 RB



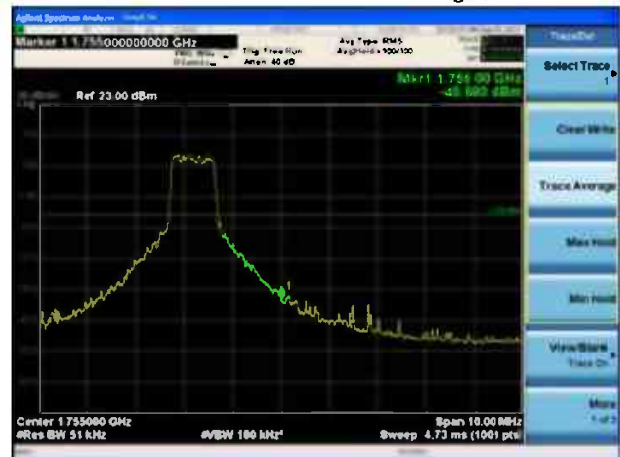
LTE Band 4 16QAM 20MHz CH-High, 1 RB



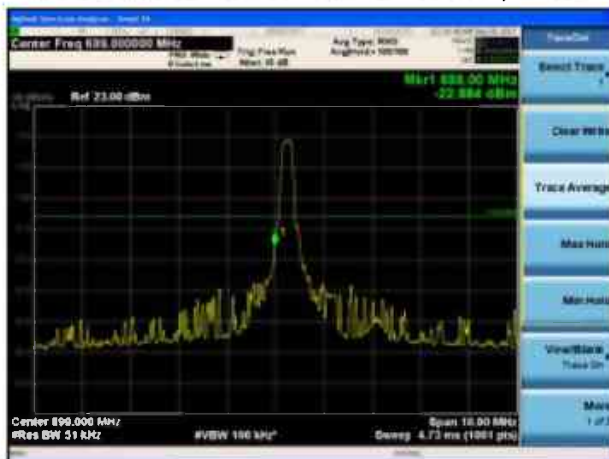
LTE Band 4 16QAM 20MHz CH-Low, 100%RB



LTE Band 4 16QAM 20MHz CH-High, 100%RB



LTE Band 12 QPSK 1.4MHz CH-Low, 1 RB



LTE Band 12 QPSK 1.4MHz CH-High, 1 RB



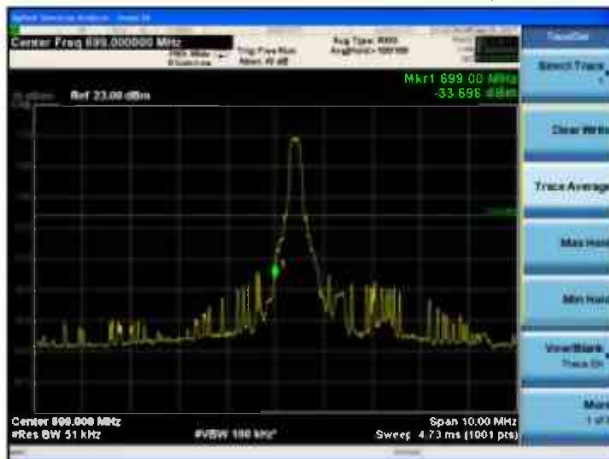
LTE Band 12 QPSK 1.4MHz CH-Low, 100%RB



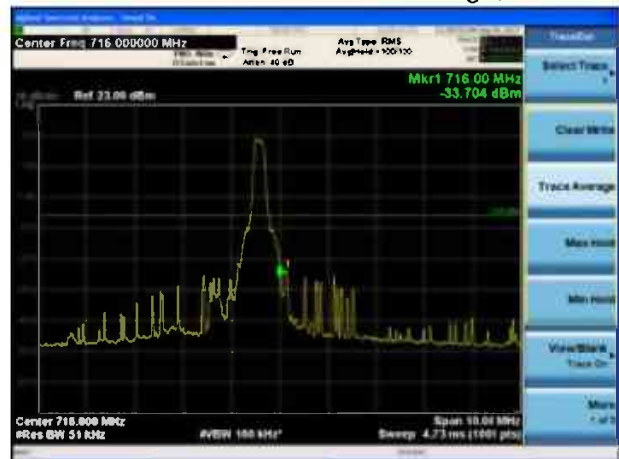
LTE Band 12 QPSK 1.4MHz CH-High, 100%RB



LTE Band 12 QPSK 3MHz CH-Low, 1 RB

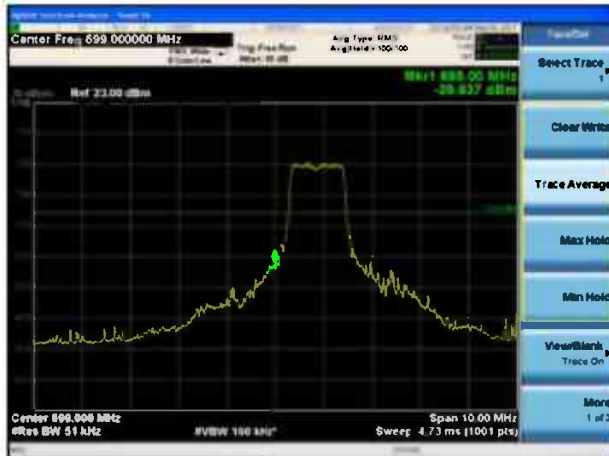


LTE Band 12 QPSK 3MHz CH-High, 1 RB

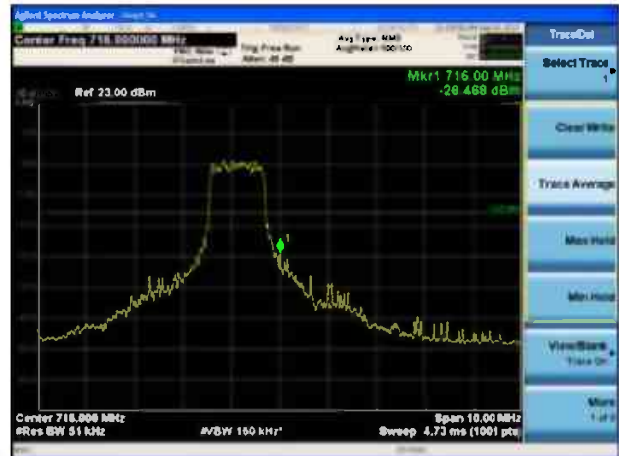




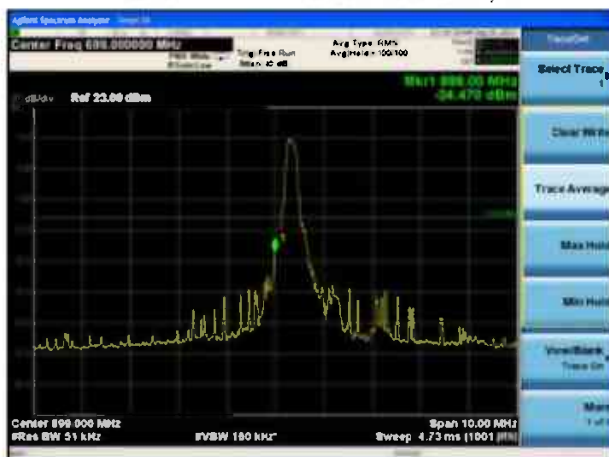
LTE Band 12 QPSK 3MHz CH-Low, 100%RB



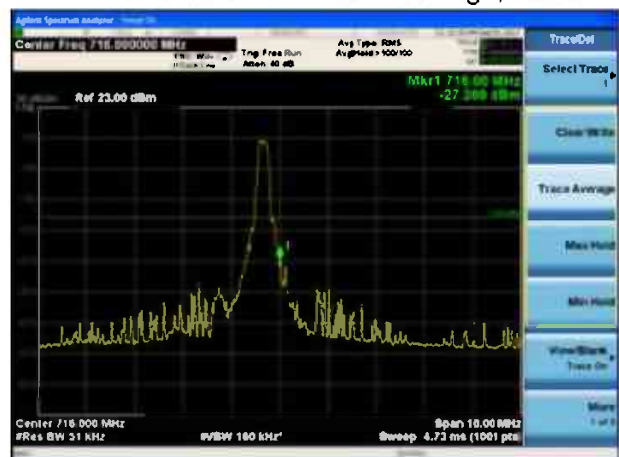
LTE Band 12 QPSK 3MHz CH-High, 100%RB



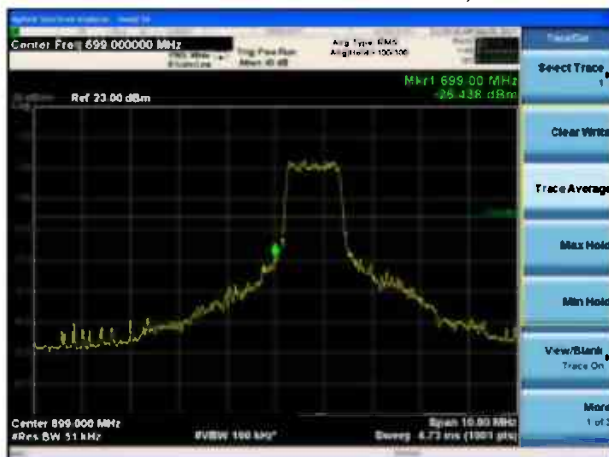
LTE Band 12 QPSK 5MHz CH-Low, 1 RB



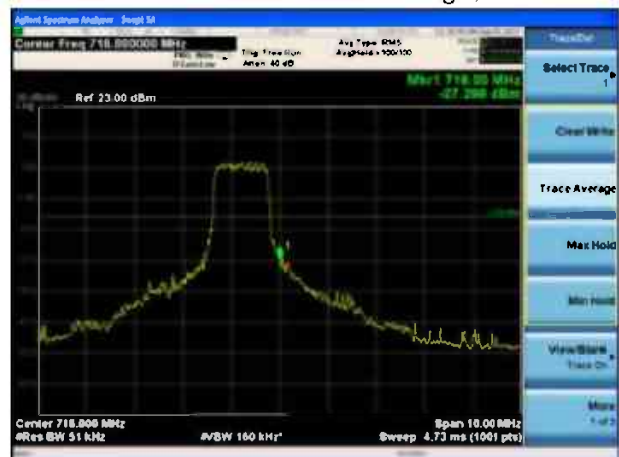
LTE Band 12 QPSK 5MHz CH-High, 1 RB



LTE Band 12 QPSK 5MHz CH-Low, 100%RB



LTE Band 12 QPSK 5MHz CH-High, 100%RB

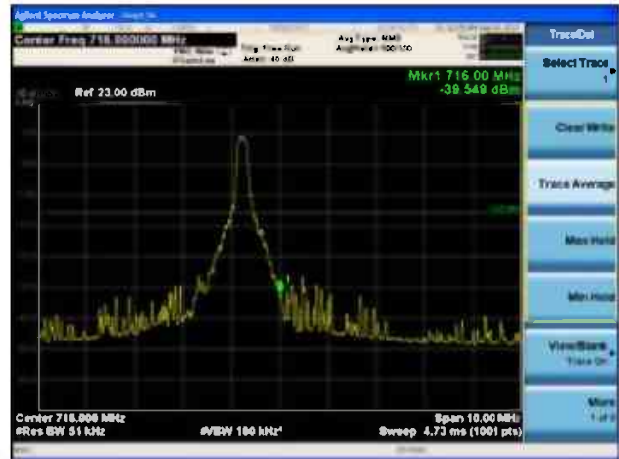




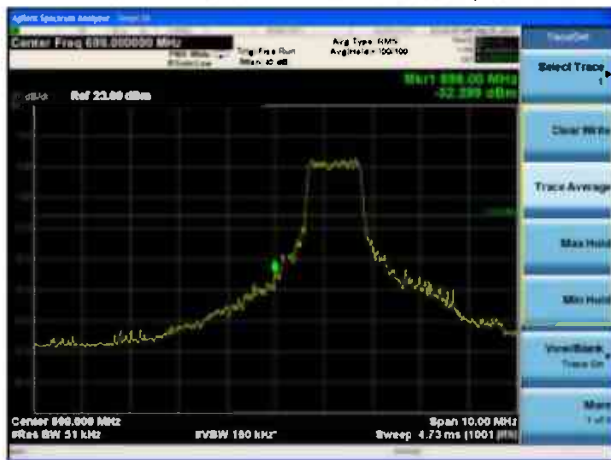
LTE Band 12 QPSK 10MHz CH-Low, 1 RB



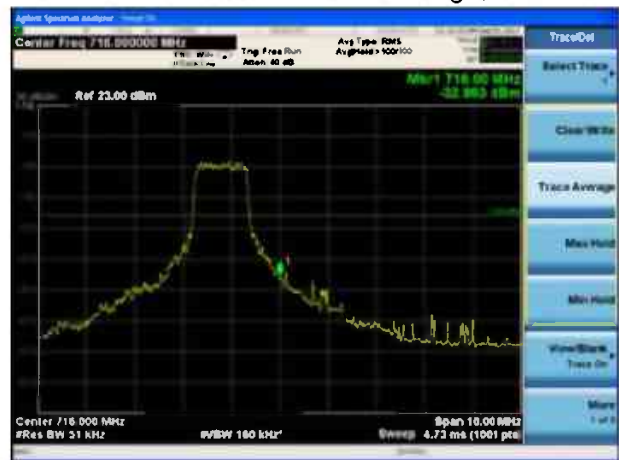
LTE Band 12 QPSK 10MHz CH-High, 1 RB



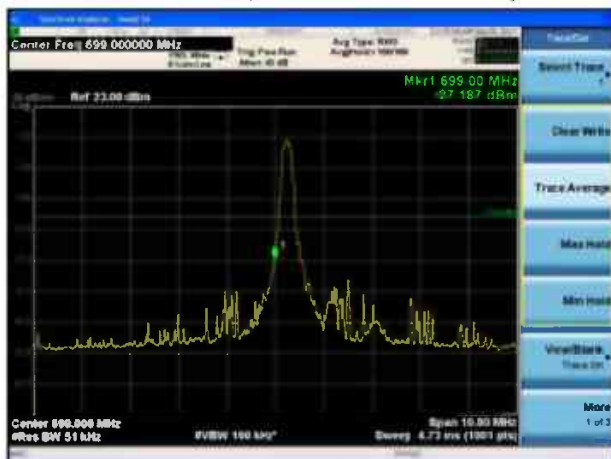
LTE Band 12 QPSK 10MHz CH-Low, 100%RB



LTE Band 12 QPSK 10MHz CH-High, 100%RB



LTE Band 12 16QAM 1.4MHz CH-Low, 1 RB

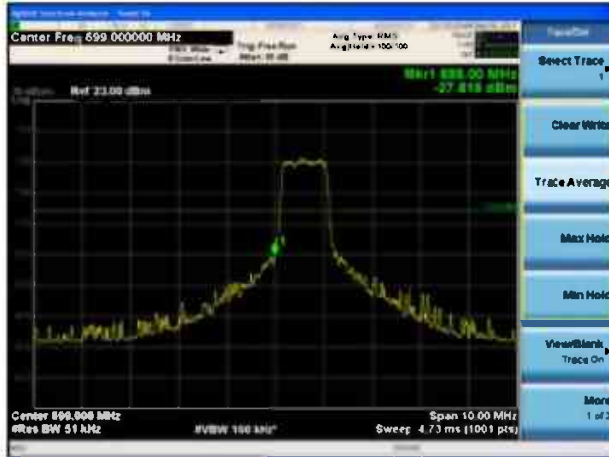


LTE Band 12 16QAM 1.4MHz CH-High, 1 RB

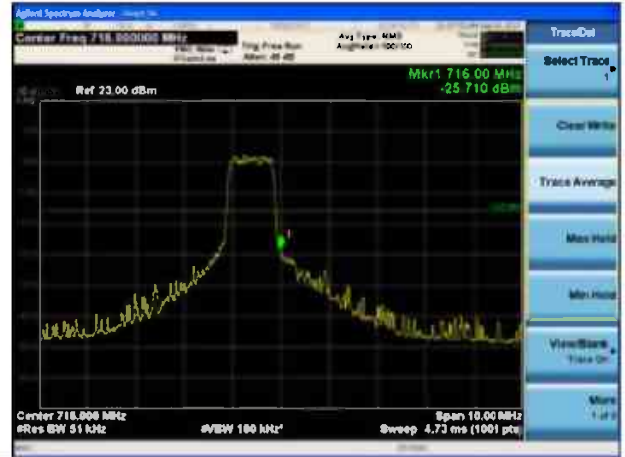




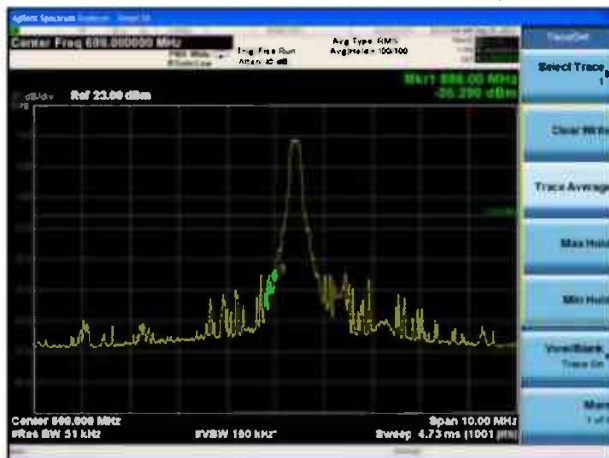
LTE Band 12 16QAM 1.4MHz CH-Low, 100%RB



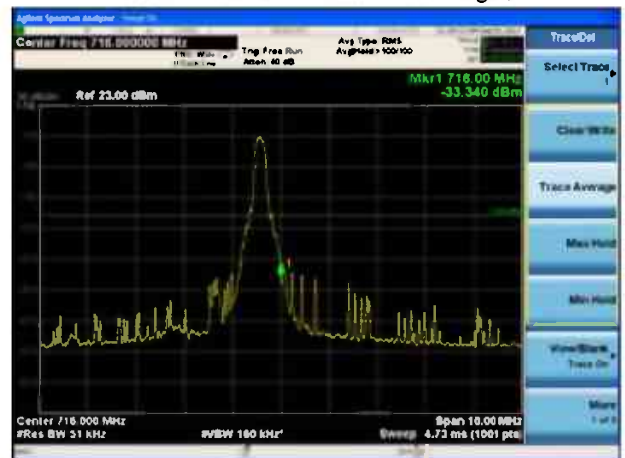
LTE Band 12 16QAM 1.4MHz CH-High, 100%RB



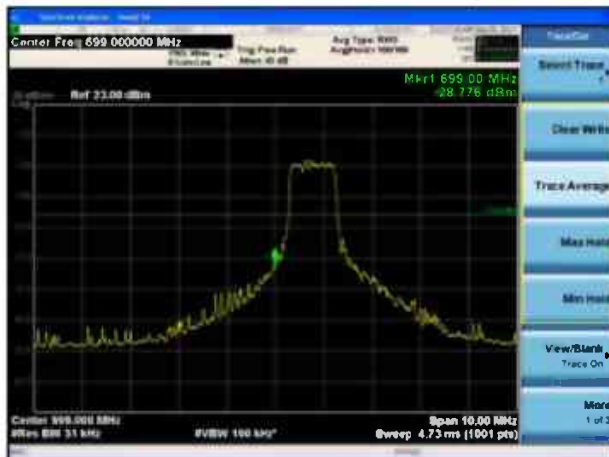
LTE Band 12 16QAM 3MHz CH-Low, 1 RB



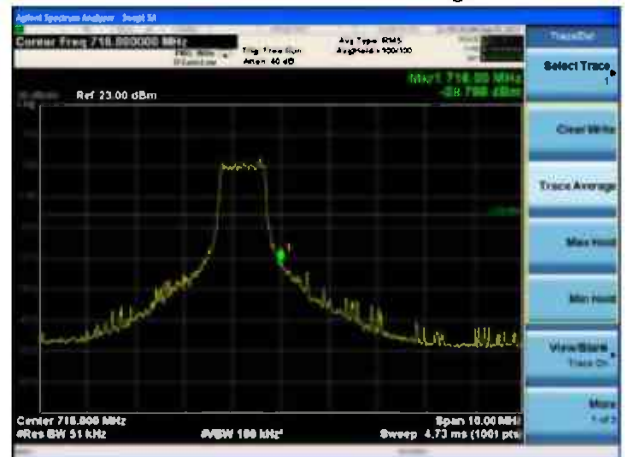
LTE Band 12 16QAM 3MHz CH-High, 1 RB



LTE Band 12 16QAM 3MHz CH-Low, 100%RB

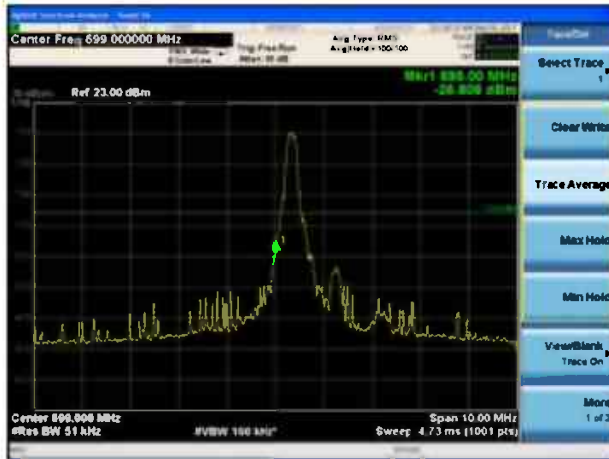


LTE Band 12 16QAM 3MHz CH-High, 100%RB





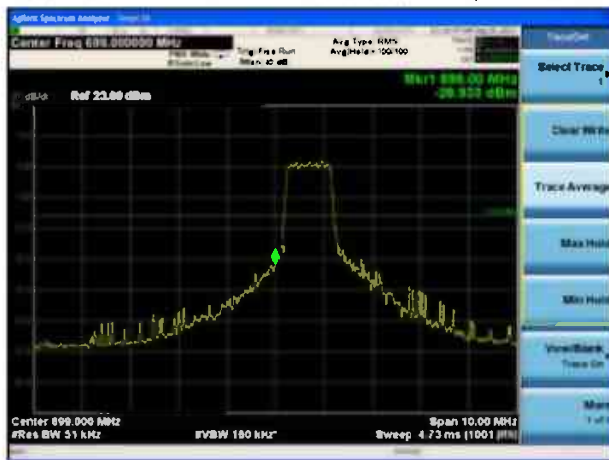
LTE Band 12 16QAM 5MHz CH-Low, 1 RB



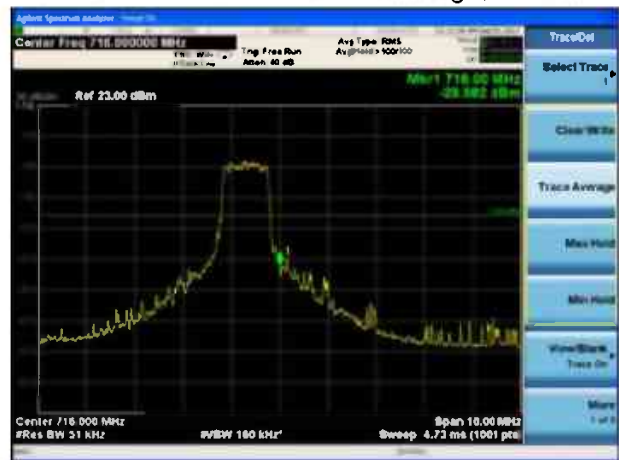
LTE Band 12 16QAM 5MHz CH-High, 1 RB



LTE Band 12 16QAM 5MHz CH-Low, 100%RB



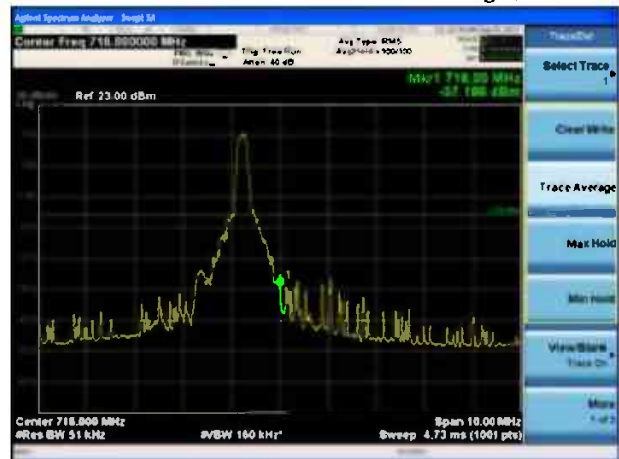
LTE Band 12 16QAM 5MHz CH-High, 100%RB



LTE Band 12 16QAM 10MHz CH-Low, 1 RB

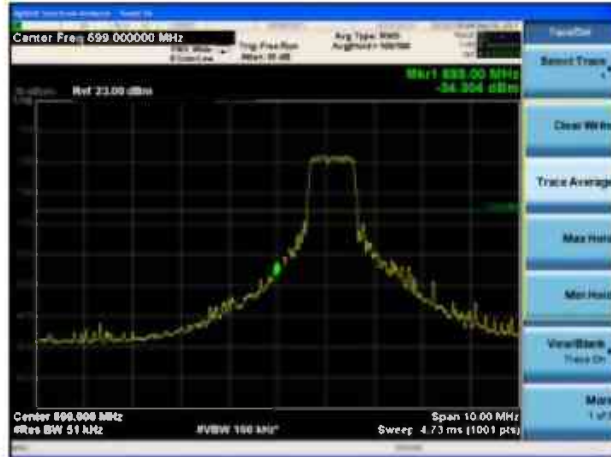


LTE Band 12 16QAM 10MHz CH-High, 1 RB

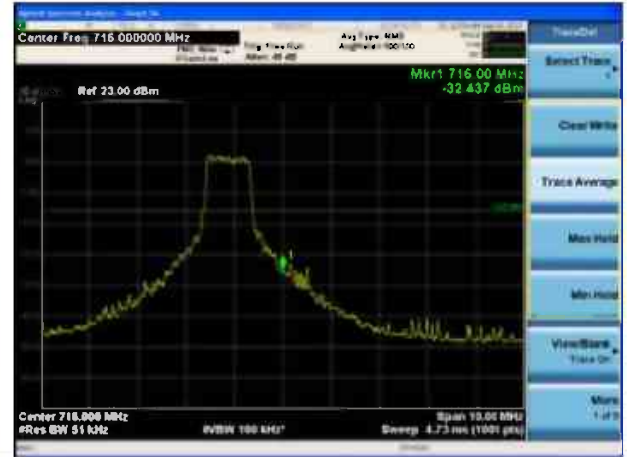




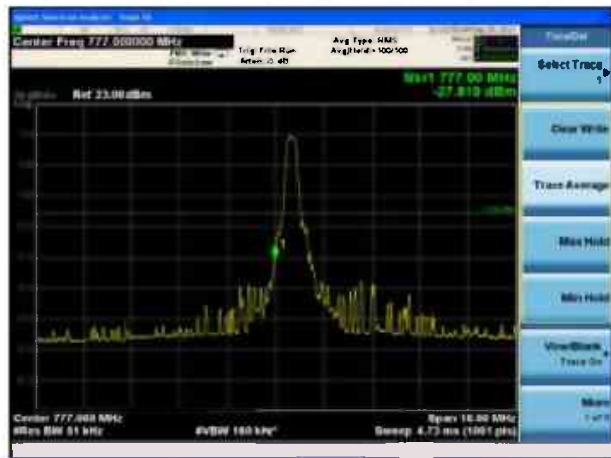
LTE Band 12 16QAM 10MHz CH-Low, 100%RB



LTE Band 12 16QAM 10MHz CH-High, 100%RB



LTE Band 13 QPSK 5MHz CH-Low, 1 RB



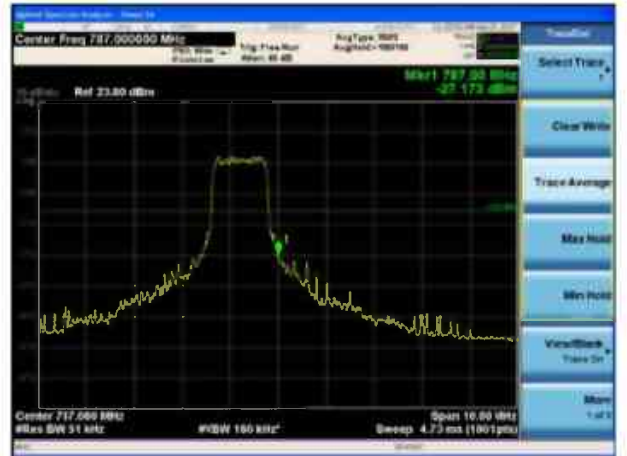
LTE Band 13 QPSK 5MHz CH-High, 1 RB



LTE Band 13 QPSK 5MHz CH-Low, 100%RB

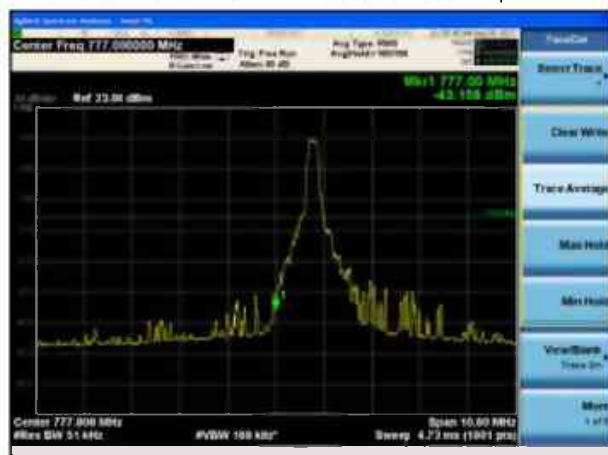


LTE Band 13 QPSK 5MHz CH-High, 100%RB

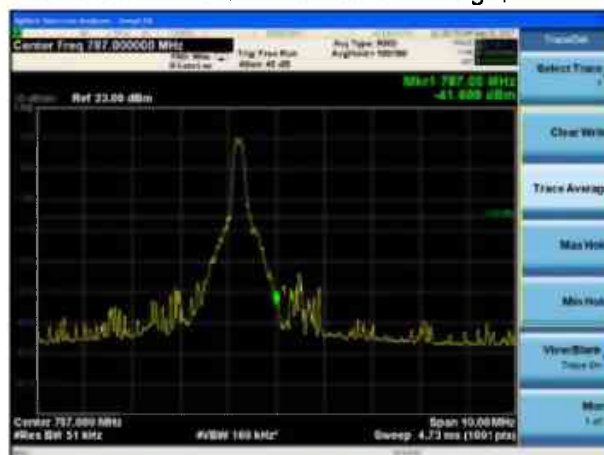




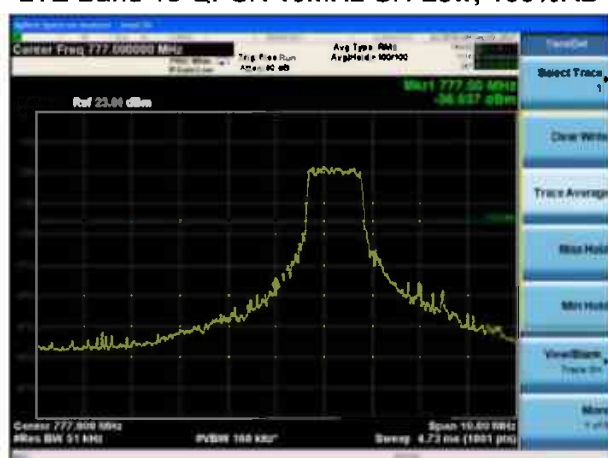
LTE Band 13 QPSK 10MHz CH-Low, 1 RB



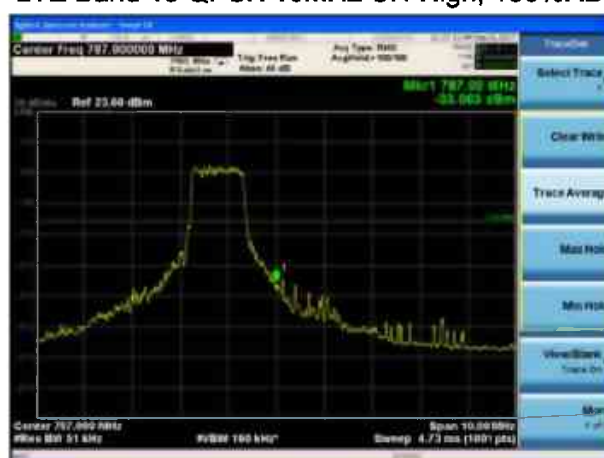
LTE Band 13 QPSK 10MHz CH-High, 1 RB



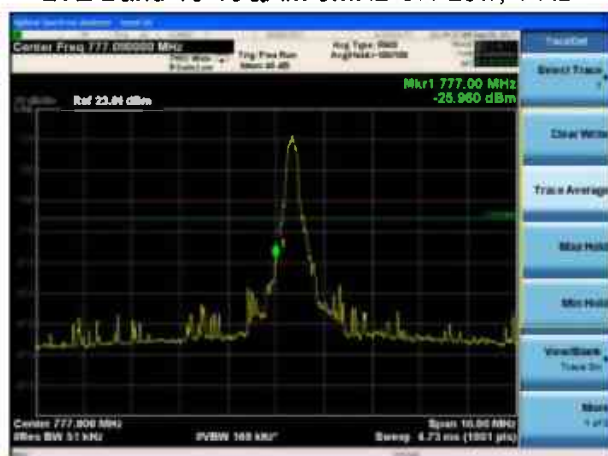
LTE Band 13 QPSK 10MHz CH-Low, 100%RB



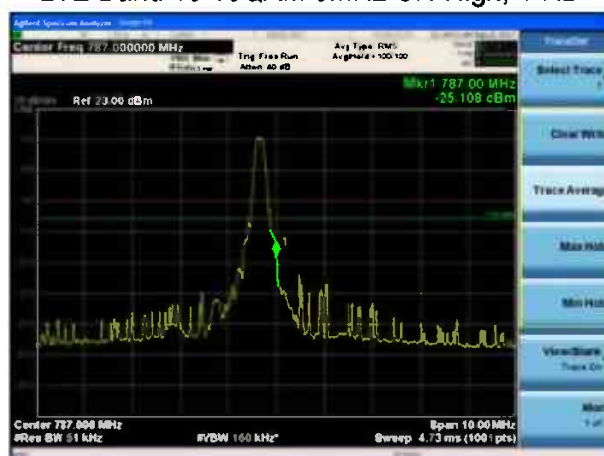
LTE Band 13 QPSK 10MHz CH-High, 100%RB



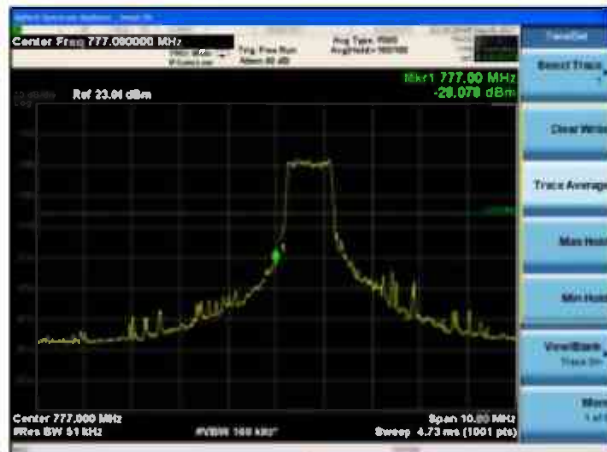
LTE Band 13 16QAM 5MHz CH-Low, 1 RB



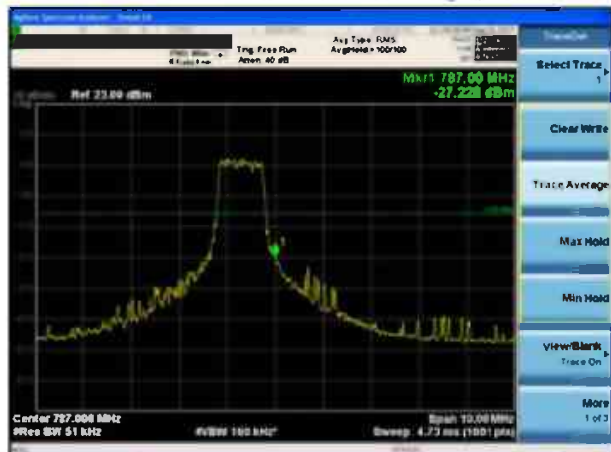
LTE Band 13 16QAM 5MHz CH-High, 1 RB



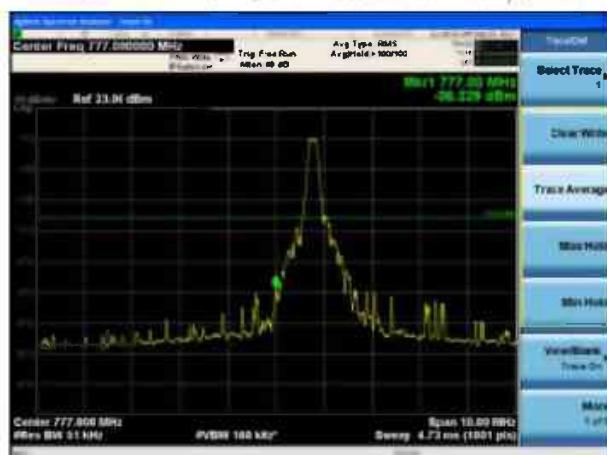
LTE Band 13 16QAM 5MHz CH-Low, 100%RB



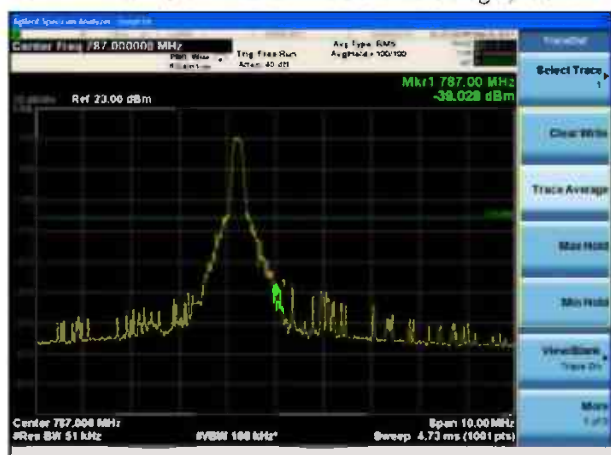
LTE Band 13 16QAM 5MHz CH-High, 100%RB



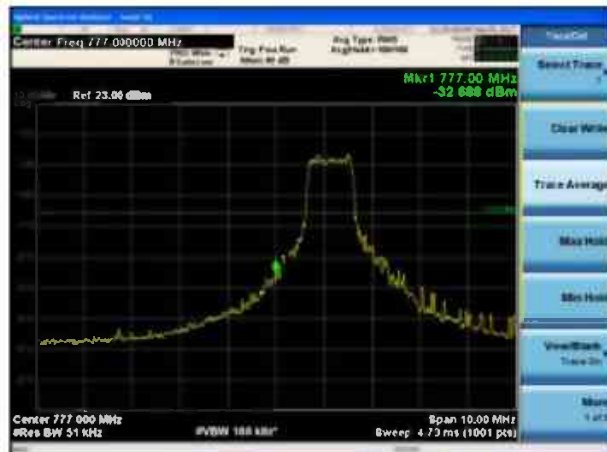
LTE Band 13 16QAM 10MHz CH-Low, 1 RB



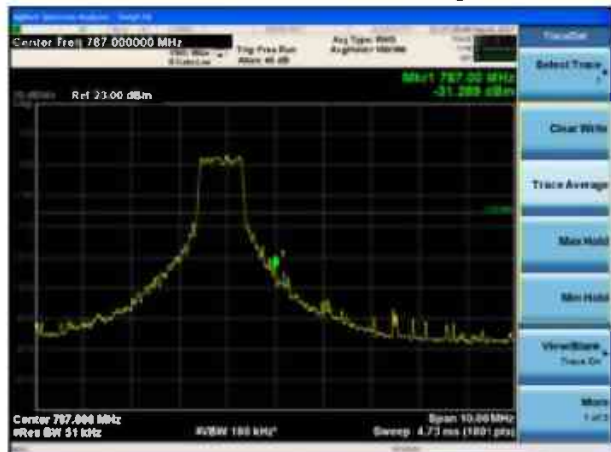
LTE Band 13 16QAM 10MHz CH-High, 1 RB



LTE Band 13 16QAM 10MHz CH-Low, 100%RB



LTE Band 13 16QAM 10MHz CH-High, 100%RB



5.5 Peak-to-Average Power Ratio (PAPR)

Ambient condition

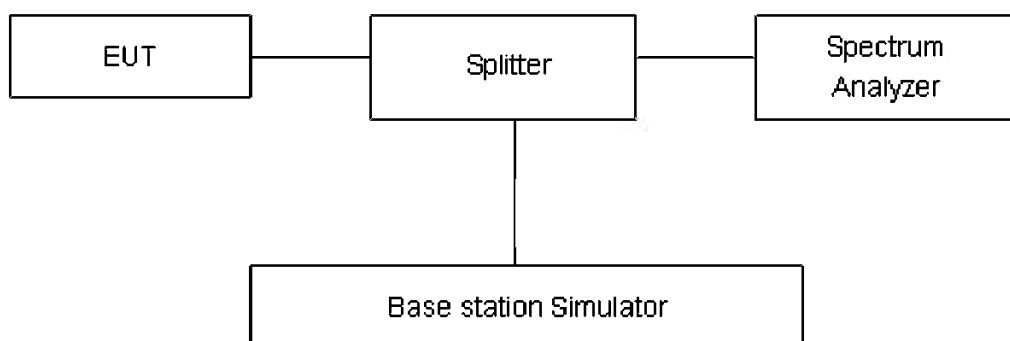
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

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

Rule Part 27.50(d)(5) Equipment employed must be authorized in accordance with the provisions of 24.51. Power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (d)(6) of this section. 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.

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	Bandwidth	Modulation	Channel/ Frequency(MHz)	Peak-to-Average Power Ratio (PAPR)		
				Peak(dBm)	Avg(dBm)	PAPR(dB)
Band4	1.4MHz	QPSK	20175/1732.5	33.37	22.09	11.28
		16QAM	20175/1732.5	34.13	22.03	12.10
	3MHz	QPSK	20175/1732.5	33.56	22.13	11.43
		16QAM	20175/1732.5	33.94	22.07	11.87
	5MHz	QPSK	20175/1732.5	32.06	22.12	9.94
		16QAM	20175/1732.5	32.62	22.03	10.59
	10MHz	QPSK	20175/1732.5	31.69	22.14	9.55
		16QAM	20175/1732.5	32.14	22.08	10.06
	15MHz	QPSK	20175/1732.5	30.77	22.10	8.67
		16QAM	20175/1732.5	30.68	22.03	8.65
	20MHz	QPSK	20175/1732.5	30.92	22.05	8.87
		16QAM	20175/1732.5	31.17	21.99	9.18

Mode	Bandwidth	Modulation	Channel/ Frequency(MHz)	Peak-to-Average Power Ratio (PAPR)		
				Peak(dBm)	Avg(dBm)	PAPR(dB)
Band12	1.4MHz	QPSK	23095/707.5	32.63	22.66	9.97
		16QAM	23095/707.5	34.21	22.90	11.31
	3MHz	QPSK	23095/707.5	32.56	22.68	9.88
		16QAM	23095/707.5	33.51	22.95	10.56
	5MHz	QPSK	23095/707.5	32.27	22.64	9.63
		16QAM	23095/707.5	33.75	22.90	10.85
	10MHz	QPSK	23095/707.5	31.88	22.59	9.29
		16QAM	23095/707.5	32.03	22.86	9.17

Mode	Bandwidth	Modulation	Channel/ Frequency(MHz)	Peak-to-Average Power Ratio (PAPR)		
				Peak(dBm)	Avg(dBm)	PAPR(dB)
Band13	5MHz	QPSK	23230/782	32.64	22.68	9.96
		16QAM	23230/782	32.23	22.19	10.04
	10MHz	QPSK	23230/782	32.46	22.77	9.69
		16QAM	23230/782	32.68	22.95	9.73

5.6 Frequency Stability

Ambient condition

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

Method of Measurement

1. Frequency Stability (Temperature Variation)

The temperature inside the climate chamber is varied from -40°C to +85°C in 10°C step size.

(1) With all power removed, the temperature was decreased to -10°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 -40°C to +85°C. Allow at least 1.5 hours at each temperature, un-powered, before making measurements.

2. Frequency Stability (Voltage Variation)

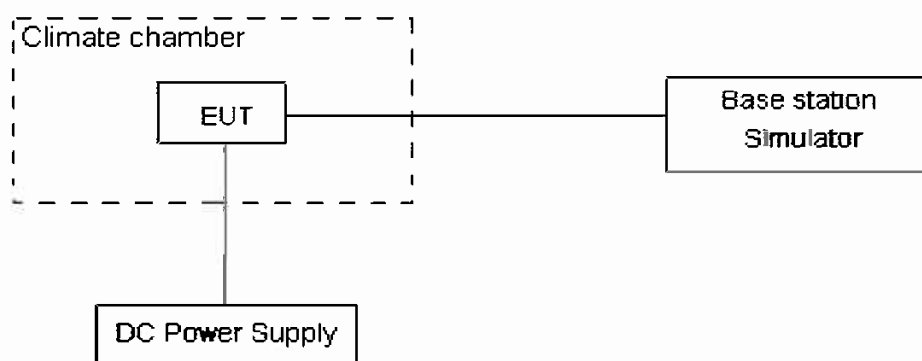
The frequency stability shall be measured with variation of primary supply voltage as follows:

(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 3.3 V and 4.3 V, with a nominal voltage of 3.8V.

Test setup



Limits

No specific frequency stability requirements in part 27.54

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

Bandwidth	Test status	LTE Band 4 Channel 20175 Test Results (ppm)	
		QPSK	16QAM
1.4MHz	-40°C/Normal Voltage	-0.00444	-0.01766
	-30°C/Normal Voltage	-0.00386	-0.01513
	-20°C/Normal Voltage	-0.00514	-0.02027
	-10°C/Normal Voltage	-0.00174	-0.01773
	0°C/Normal Voltage	-0.00164	-0.01986
	10°C/Normal Voltage	-0.00239	-0.00601
	20°C/Normal Voltage	0.00020	-0.00454
	30°C/Normal Voltage	-0.00166	-0.00570
	40°C/Normal Voltage	-0.00035	-0.00673
	50°C/Normal Voltage	0.00115	-0.01853
	60°C/Normal Voltage	-0.00061	-0.00405
	70°C/Normal Voltage	-0.00411	-0.01242
	80°C/Normal Voltage	-0.00212	-0.02252
	85°C/Normal Voltage	-0.00124	-0.00496
	20°C/Min Voltage	-0.00300	-0.00576
	20°C/Max Voltage	-0.00315	-0.00454
3MHz	-40°C/Normal Voltage	-0.00127	-0.00275
	-30°C/Normal Voltage	-0.00184	-0.00448
	-20°C/Normal Voltage	0.00117	0.01527
	-10°C/Normal Voltage	0.00008	0.01465
	0°C/Normal Voltage	-0.00119	-0.00583
	10°C/Normal Voltage	-0.00255	-0.01694
	20°C/Normal Voltage	-0.00071	-0.00506
	30°C/Normal Voltage	-0.00063	-0.00412
	40°C/Normal Voltage	-0.00178	-0.00533
	50°C/Normal Voltage	-0.00078	-0.00294
	60°C/Normal Voltage	-0.00163	-0.01732
	70°C/Normal Voltage	-0.00091	0.01451
	80°C/Normal Voltage	-0.00111	-0.00443
	85°C/Normal Voltage	0.00137	-0.00253
	20°C/Min Voltage	0.00068	-0.00301
	20°C/Max Voltage	-0.00234	-0.00293
5MHz	-40°C/Normal Voltage	0.00119	-0.00739
	-30°C/Normal Voltage	0.00248	-0.00478
	-20°C/Normal Voltage	0.00018	-0.00477
	-10°C/Normal Voltage	-0.00357	0.00540



	0°C/Normal Voltage	0.00002	-0.00554
	10°C/Normal Voltage	0.00259	-0.00377
	20°C/Normal Voltage	-0.00129	-0.00622
	30°C/Normal Voltage	-0.00012	-0.00676
	40°C/Normal Voltage	0.00036	0.00380
	50°C/Normal Voltage	-0.00119	-0.00579
	60°C/Normal Voltage	-0.00008	-0.00890
	70°C/Normal Voltage	-0.00115	-0.00618
	80°C/Normal Voltage	-0.00023	-0.00478
	85°C/Normal Voltage	-0.00179	-0.00302
	20°C/Min Voltage	-0.00188	0.00584
	20°C/Max Voltage	-0.00266	0.00141
10MHz	-40°C/Normal Voltage	0.00069	0.00372
	-30°C/Normal Voltage	0.00066	0.00297
	-20°C/Normal Voltage	-0.00119	0.01093
	-10°C/Normal Voltage	-0.00178	0.00982
	0°C/Normal Voltage	0.00127	0.00394
	10°C/Normal Voltage	0.00330	0.00301
	20°C/Normal Voltage	0.00152	0.01114
	30°C/Normal Voltage	0.00156	0.00070
	40°C/Normal Voltage	0.00224	0.01124
	50°C/Normal Voltage	0.00122	0.00386
	60°C/Normal Voltage	-0.00124	0.00870
	70°C/Normal Voltage	-0.00087	0.01063
	80°C/Normal Voltage	-0.00141	0.00606
	85°C/Normal Voltage	-0.00106	0.00305
	20°C/Min Voltage	-0.00190	0.00424
	20°C/Max Voltage	-0.00160	0.01408
15MHz	-40°C/Normal Voltage	0.00057	-0.00057
	-30°C/Normal Voltage	-0.00003	0.00023
	-20°C/Normal Voltage	0.00023	0.00077
	-10°C/Normal Voltage	-0.00110	-0.00147
	0°C/Normal Voltage	0.00182	-0.00067
	10°C/Normal Voltage	-0.00091	0.00086
	20°C/Normal Voltage	0.00169	-0.00042
	30°C/Normal Voltage	0.00042	-0.00301
	40°C/Normal Voltage	-0.00143	-0.00330
	50°C/Normal Voltage	0.00126	-0.00059
	60°C/Normal Voltage	0.00121	-0.00017
	70°C/Normal Voltage	-0.00056	-0.00046



	80°C/Normal Voltage	0.00105	0.00106
	85°C/Normal Voltage	0.00025	-0.00055
	20°C/Min Voltage	-0.00002	-0.00061
	20°C/Max Voltage	0.00123	-0.00216
20MHz	-40°C/Normal Voltage	-0.00081	-0.02835
	-30°C/Normal Voltage	-0.00053	-0.02789
	-20°C/Normal Voltage	-0.00130	-0.02891
	-10°C/Normal Voltage	0.00002	-0.02948
	0°C/Normal Voltage	-0.00100	-0.02863
	10°C/Normal Voltage	0.00290	-0.02879
	20°C/Normal Voltage	-0.00079	-0.02917
	30°C/Normal Voltage	-0.00088	-0.03142
	40°C/Normal Voltage	-0.00241	-0.03015
	50°C/Normal Voltage	0.00066	-0.02809
	60°C/Normal Voltage	0.00032	-0.02992
	70°C/Normal Voltage	-0.00111	-0.02986
	80°C/Normal Voltage	0.00077	-0.02887
	85°C/Normal Voltage	-0.00151	-0.03063
	20°C/Min Voltage	-0.00136	-0.02918
	20°C/Max Voltage	0.00297	-0.02678

Bandwidth	Test status	LTE Band 12 Channel 23095 Test Results (ppm)	
		QPSK	16QAM
1.4M	-40°C/Normal Voltage	-0.00582	-0.00338
	-30°C/Normal Voltage	-0.00315	-0.01134
	-20°C/Normal Voltage	-0.00743	-0.00290
	-10°C/Normal Voltage	-0.01025	-0.00325
	0°C/Normal Voltage	-0.00144	-0.00519
	10°C/Normal Voltage	-0.00079	-0.00345
	20°C/Normal Voltage	-0.00287	-0.00647
	30°C/Normal Voltage	-0.00308	-0.00445
	40°C/Normal Voltage	-0.00445	-0.00366
	50°C/Normal Voltage	-0.00411	0.00037
	60°C/Normal Voltage	-0.00223	0.00114
	70°C/Normal Voltage	-0.00192	0.00225
	80°C/Normal Voltage	-0.00257	-0.00076
	85°C/Normal Voltage	-0.00143	-0.00016
	20°C/Min Voltage	0.00037	0.00018
	20°C/Max Voltage	-0.00075	-0.00814
3M	-40°C/Normal Voltage	-0.00160	-0.02580
	-30°C/Normal Voltage	-0.00225	-0.02440
	-20°C/Normal Voltage	-0.00334	-0.02595
	-10°C/Normal Voltage	-0.00411	-0.02786
	0°C/Normal Voltage	-0.00343	-0.02806
	10°C/Normal Voltage	-0.00035	-0.02717
	20°C/Normal Voltage	-0.00117	-0.03013
	30°C/Normal Voltage	-0.00107	-0.02297
	40°C/Normal Voltage	-0.00177	-0.02185
	50°C/Normal Voltage	0.00148	-0.03153
	60°C/Normal Voltage	-0.00040	-0.02669
	70°C/Normal Voltage	0.00119	-0.02451
	80°C/Normal Voltage	-0.00037	-0.02336
	85°C/Normal Voltage	-0.00083	-0.02500
	20°C/Min Voltage	-0.00392	-0.02601
	20°C/Max Voltage	-0.00034	-0.02301
5MHz	-40°C/Normal Voltage	-0.00300	-0.03608
	-30°C/Normal Voltage	-0.00358	-0.03801
	-20°C/Normal Voltage	-0.00165	-0.04188
	-10°C/Normal Voltage	-0.00182	-0.03238
	0°C/Normal Voltage	-0.00225	-0.02841



	10°C/Normal Voltage	-0.00376	-0.04006
	20°C/Normal Voltage	-0.00023	-0.02157
	30°C/Normal Voltage	-0.00059	-0.01495
	40°C/Normal Voltage	-0.00177	-0.01673
	50°C/Normal Voltage	-0.00110	-0.02314
	60°C/Normal Voltage	-0.00414	-0.02293
	70°C/Normal Voltage	0.00170	-0.02475
	80°C/Normal Voltage	0.00024	-0.01739
	85°C/Normal Voltage	-0.00040	-0.02205
	20°C/Min Voltage	0.00365	-0.03228
	20°C/Max Voltage	-0.00274	-0.03902
10MHz	-40°C/Normal Voltage	-0.00411	0.00379
	-30°C/Normal Voltage	-0.00327	0.00582
	-20°C/Normal Voltage	-0.00362	-0.00310
	-10°C/Normal Voltage	-0.00174	-0.00280
	0°C/Normal Voltage	-0.00083	-0.00351
	10°C/Normal Voltage	-0.00202	0.00114
	20°C/Normal Voltage	-0.00194	0.00220
	30°C/Normal Voltage	-0.00016	-0.00488
	40°C/Normal Voltage	-0.00100	-0.00423
	50°C/Normal Voltage	-0.00232	0.00377
	60°C/Normal Voltage	-0.00271	-0.00411
	70°C/Normal Voltage	-0.00400	-0.00150
	80°C/Normal Voltage	0.00120	0.00522
	85°C/Normal Voltage	-0.00137	0.00083
	20°C/Min Voltage	0.00259	-0.00408
	20°C/Max Voltage	-0.00250	0.00533

Bandwidth	Test status	LTE Band 13 Channel 23230 Test Results (ppm)	
		QPSK	16QAM
5MHz	-40°C/Normal Voltage	0.00022	-0.02604
	-30°C/Normal Voltage	-0.00203	-0.02249
	-20°C/Normal Voltage	-0.00272	-0.00797
	-10°C/Normal Voltage	-0.00165	0.03445
	0°C/Normal Voltage	-0.00018	0.03297
	10°C/Normal Voltage	-0.00093	-0.02716
	20°C/Normal Voltage	-0.00330	-0.03679
	30°C/Normal Voltage	-0.00271	-0.00685
	40°C/Normal Voltage	-0.00263	-0.00830
	50°C/Normal Voltage	-0.00049	-0.01060
	60°C/Normal Voltage	-0.00203	-0.01101
	70°C/Normal Voltage	0.00084	-0.01442
	80°C/Normal Voltage	0.00040	-0.02146
	85°C/Normal Voltage	-0.00301	-0.02216
	20°C/Min Voltage	-0.00225	-0.02006
	20°C/Max Voltage	-0.00334	-0.02955
10MHz	-40°C/Normal Voltage	-0.00396	-0.01558
	-30°C/Normal Voltage	-0.00301	-0.01306
	-20°C/Normal Voltage	-0.00224	-0.01606
	-10°C/Normal Voltage	-0.00465	-0.01453
	0°C/Normal Voltage	-0.00260	-0.01353
	10°C/Normal Voltage	-0.00377	-0.01633
	20°C/Normal Voltage	0.00173	-0.01482
	30°C/Normal Voltage	0.00276	-0.01651
	40°C/Normal Voltage	-0.00032	-0.01604
	50°C/Normal Voltage	-0.00161	-0.01311
	60°C/Normal Voltage	-0.00087	-0.01611
	70°C/Normal Voltage	-0.00093	-0.01573
	80°C/Normal Voltage	0.00185	-0.01488
	85°C/Normal Voltage	0.00023	-0.01517
	20°C/Min Voltage	-0.00132	-0.01306
	20°C/Max Voltage	-0.00390	-0.01573

5.7 Spurious Emissions at Antenna Terminals

Ambient condition

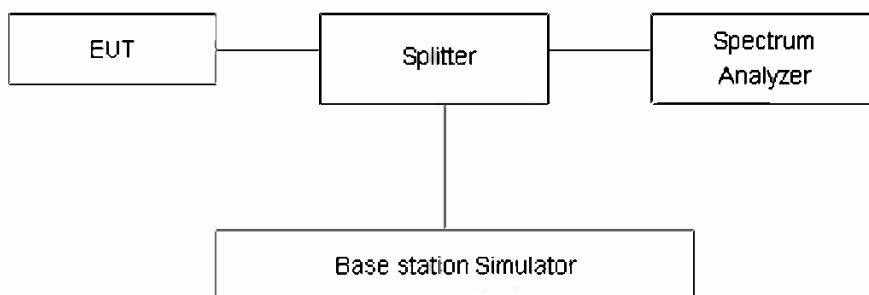
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

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 30MHz to the 10th harmonic of the carrier. The peak detector is used. Set RBW 1MHz and VBW3MHz, Sweep is set to ATUO.

Of those disturbances below (limit – 20 dB), the mark is not required for the EUT.

Test setup



Limits

LTE -4 Rule Part 27.53(h) specifies that “for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10} (P)$ dB..”

LTE -12 Rule Part 27.53 (g) For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least $43 + 10 \log (P)$ dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

LTE -13 Rule Part 27.53(f)For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to –70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and –80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be

tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

LTE B4/12 Limit

Limit	-13 dBm
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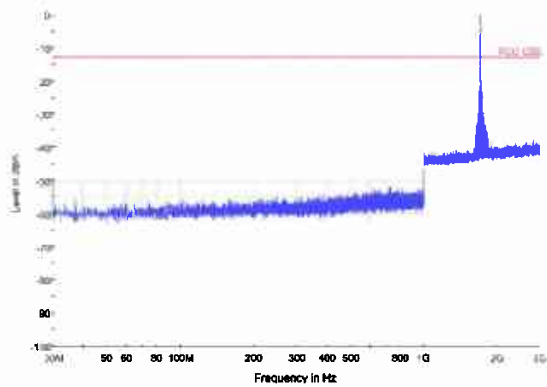
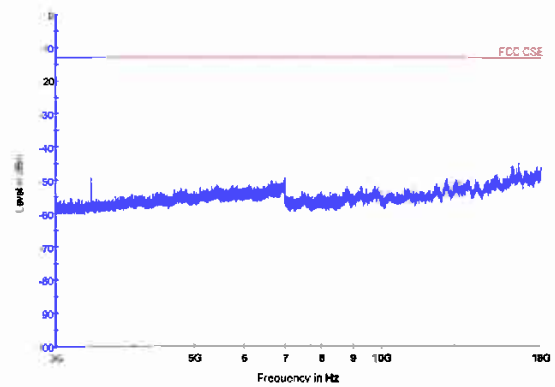
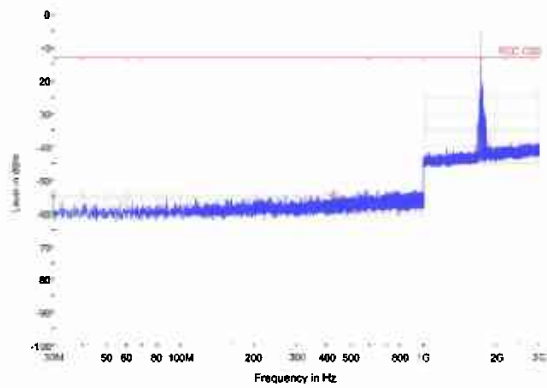
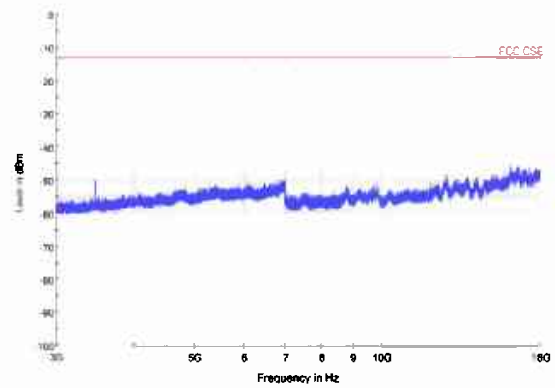
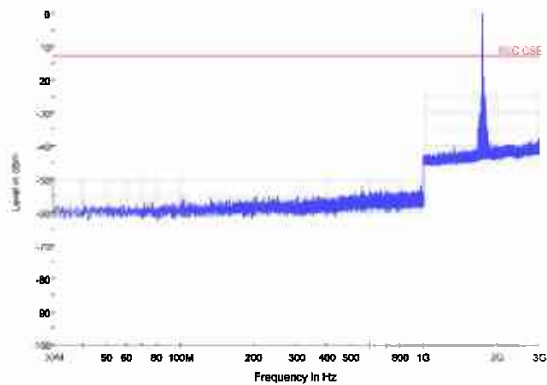
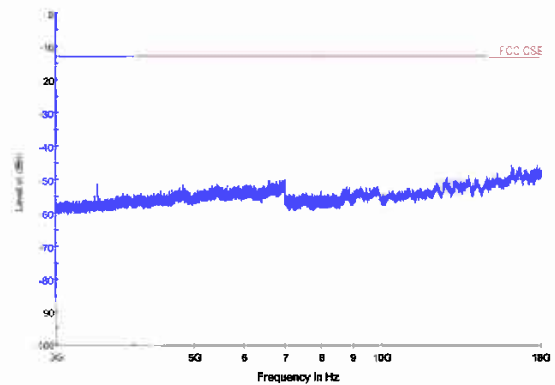
LTE B13 Limit

Limit out of the band 1559-1610 MHz	-13 dBm
Limit in the band 1559-1610 MHz	-40 dBm

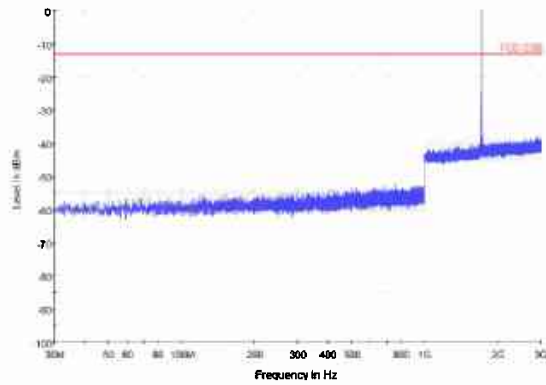
Measurement Uncertainty

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

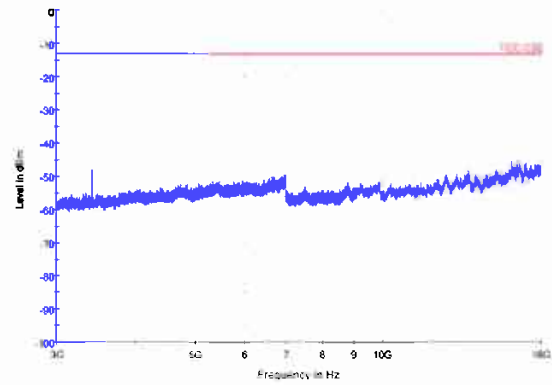
Frequency	Uncertainty
100kHz-2GHz	0.684 dB
2GHz-12.75GHz	1.407 dB

**Test Result: PASS****LTE Band 4 1.4MHz CH-Low 30MHz~3GHz****LTE Band 4 1.4MHz CH-Low 3GHz~18GHz****LTE Band 4 1.4MHz CH-Middle 30MHz~3GHz****LTE Band 4 1.4MHz CH-Middle 3GHz~18GHz****LTE Band 4 1.4MHz CH-High 30MHz~3GHz****LTE Band 4 1.4MHz CH-High 3GHz~18GHz**

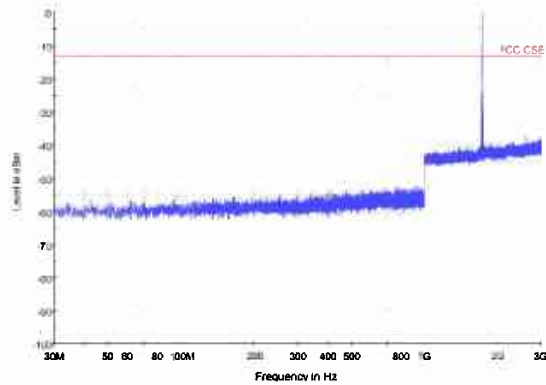
LTE Band 4 3MHz CH-Low 30MHz~3GHz



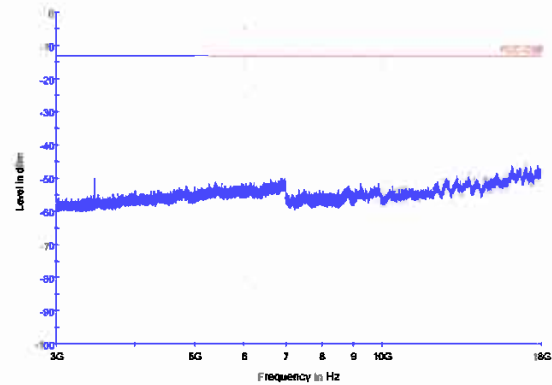
LTE Band 4 3MHz CH-Low 3GHz~18GHz



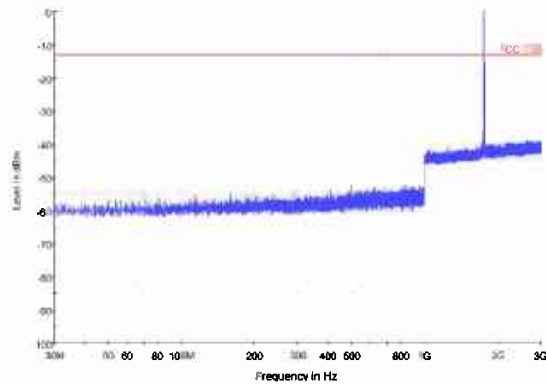
LTE Band 4 3MHz CH-Middle 30MHz~3GHz



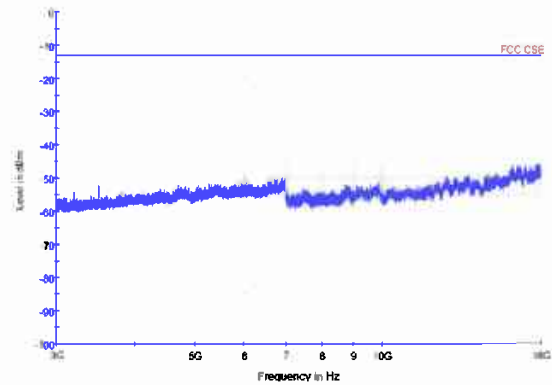
LTE Band 4 3MHz CH-Middle 3GHz~18GHz



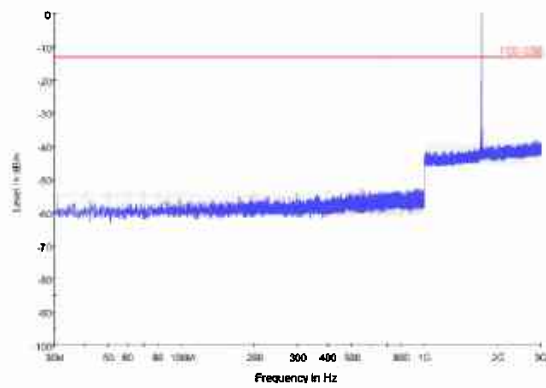
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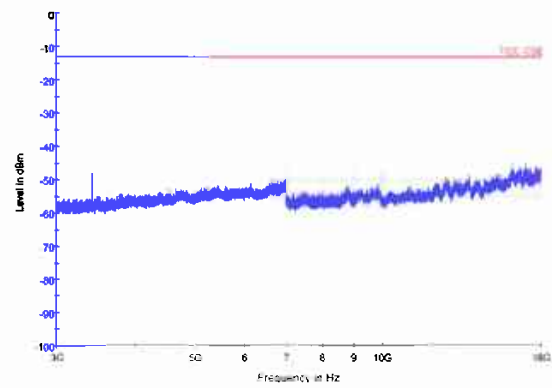
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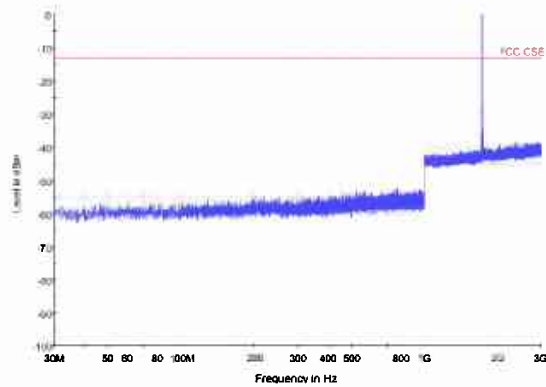
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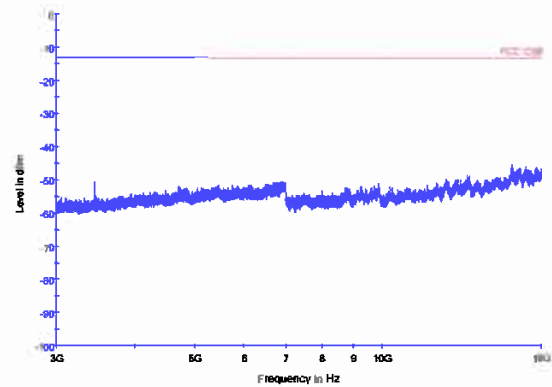
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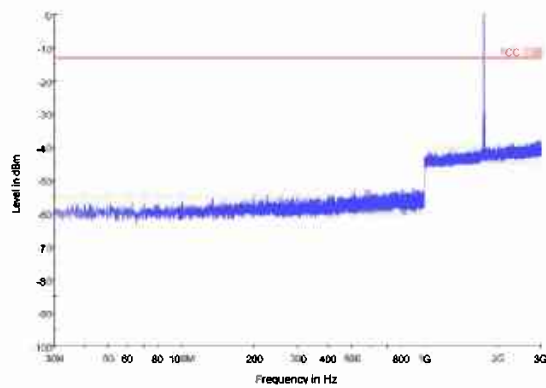
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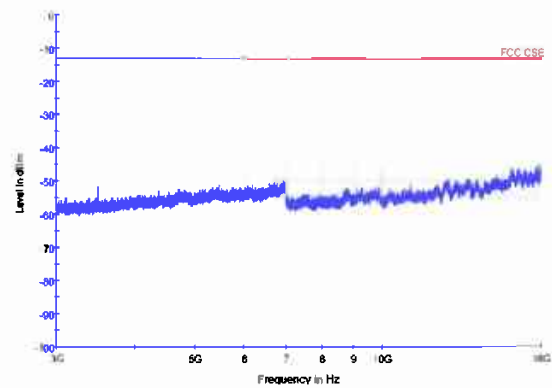
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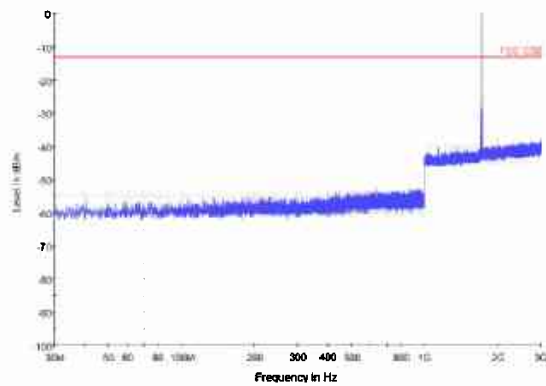
LTE Band 4 5MHz CH-High 30MHz~3GHz



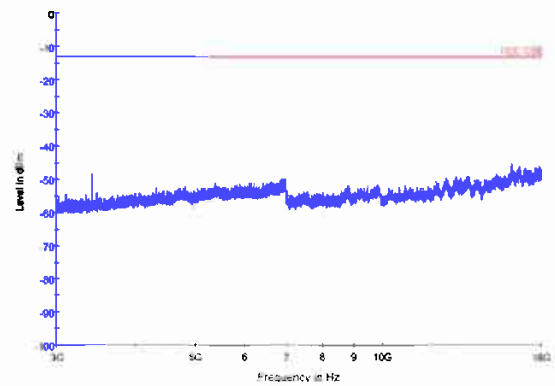
LTE Band 4 5MHz CH-High 3GHz~18GHz



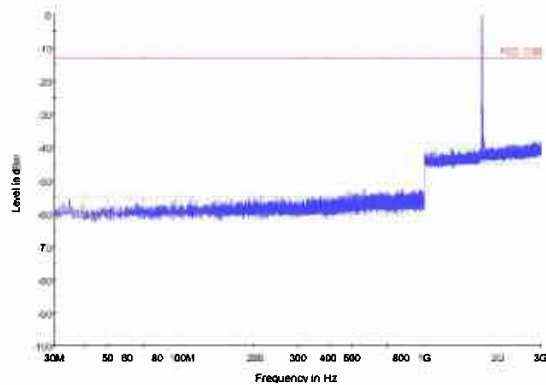
LTE Band 4 10MHz CH-Low 30MHz~3GHz



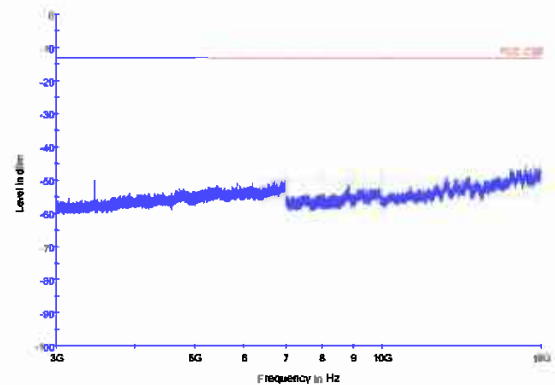
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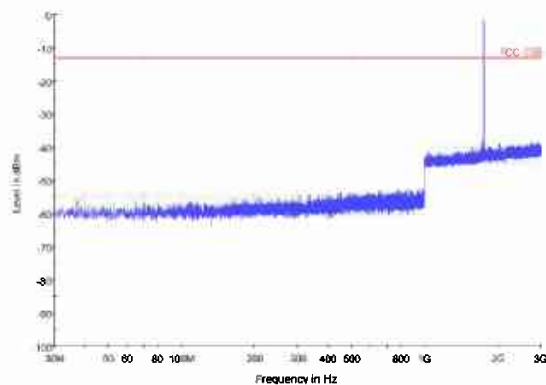
LTE Band 4 10MHz CH-Middle 30MHz~3GHz



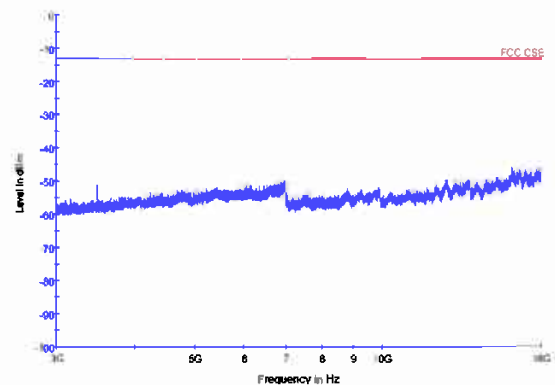
LTE Band 4 10MHz CH-Middle 3GHz~18GHz



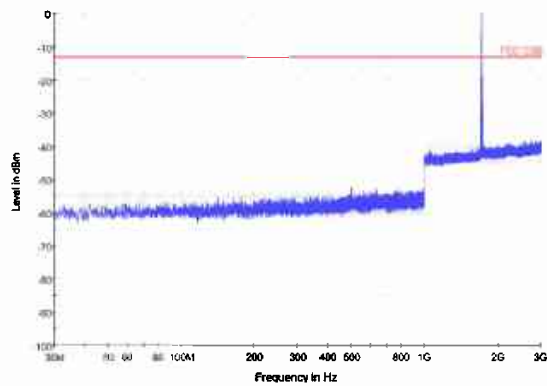
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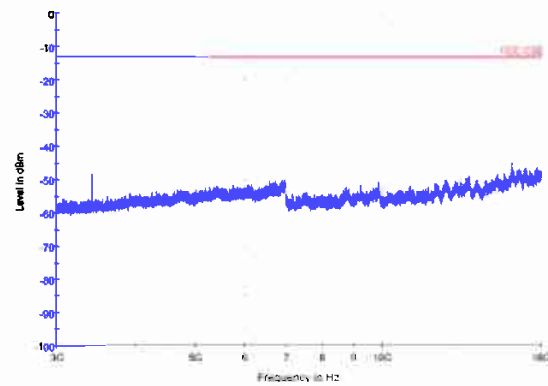
LTE Band 4 10MHz CH-High 3GHz~18GHz



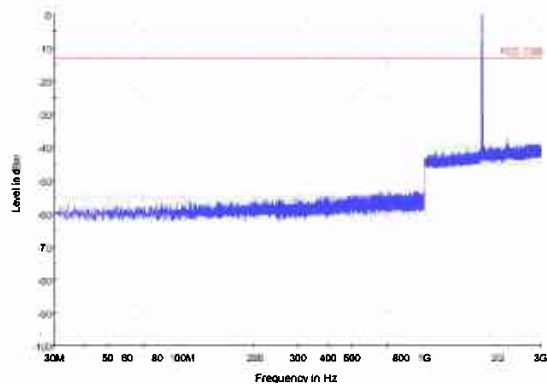
LTE Band 4 15MHz CH-Low 30MHz~3GHz



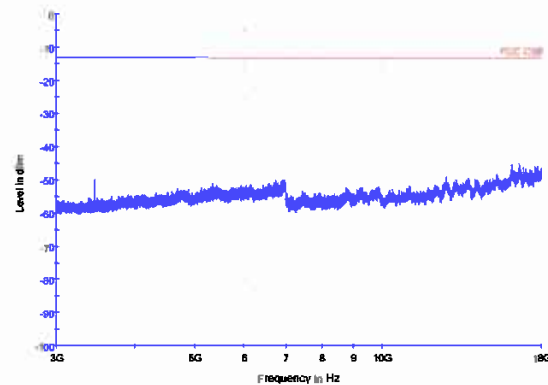
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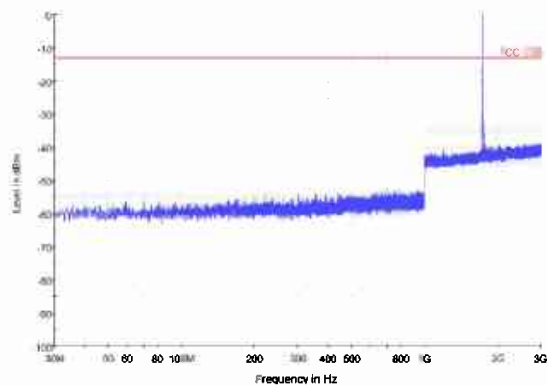
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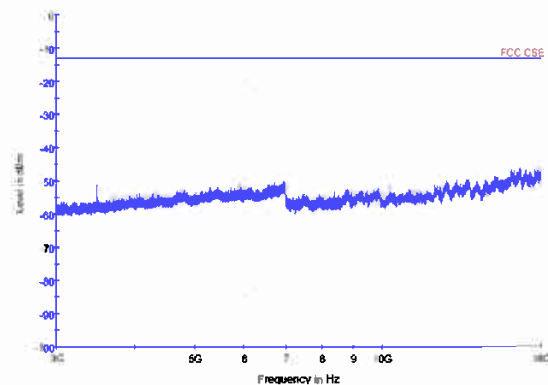
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LTE Band 4 15MHz CH-High 30MHz~3GHz

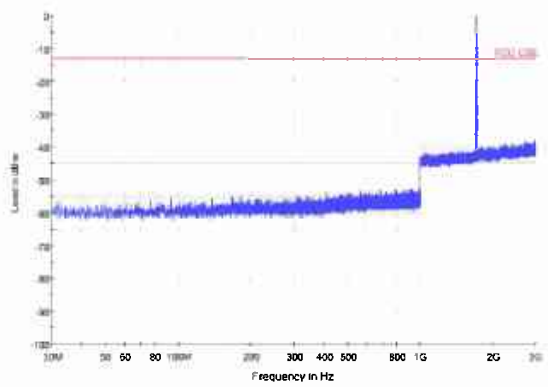


LTE Band 4 15MHz CH-High 3GHz~18GHz

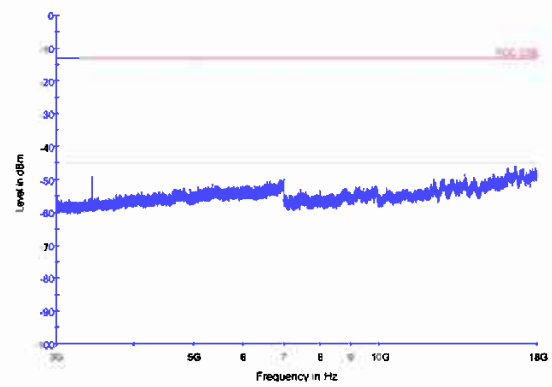




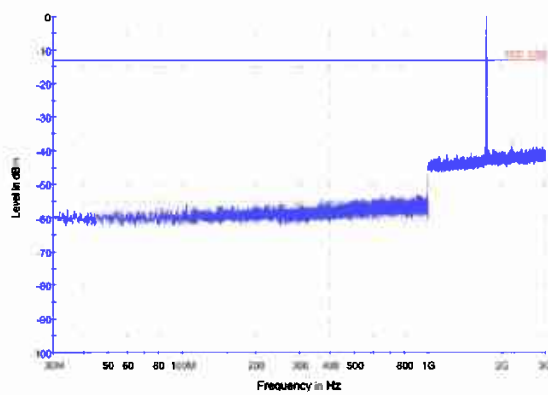
LTE Band 4 20MHz CH-Low 30MHz~3GHz



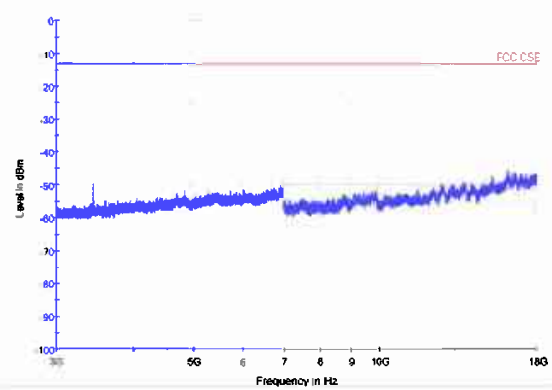
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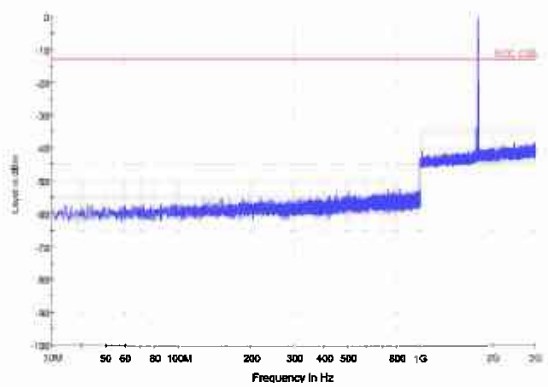
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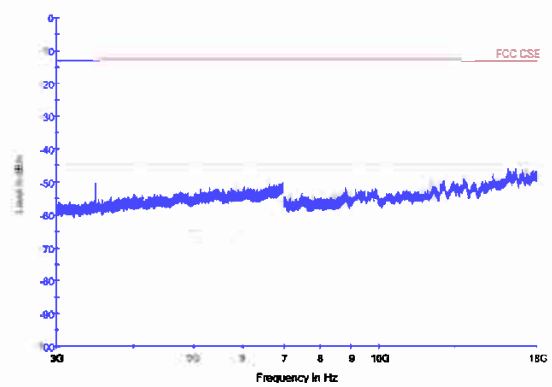
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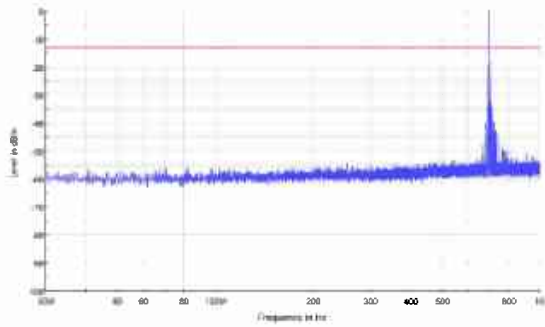
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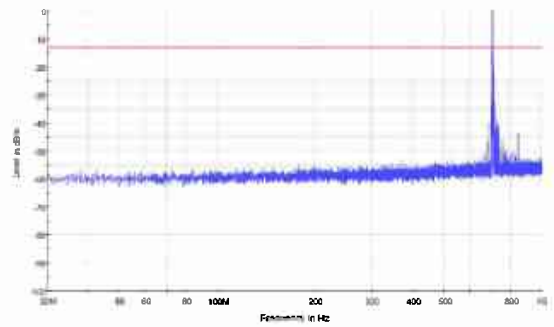
LTE Band 4 20MHz CH-High 3GHz~18GHz



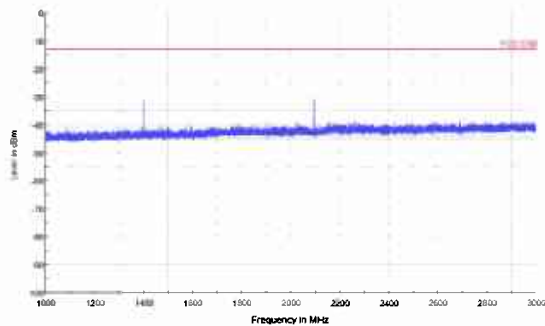
LTE Band 12 1.4MHz CH-Low 30MHz~1GHz



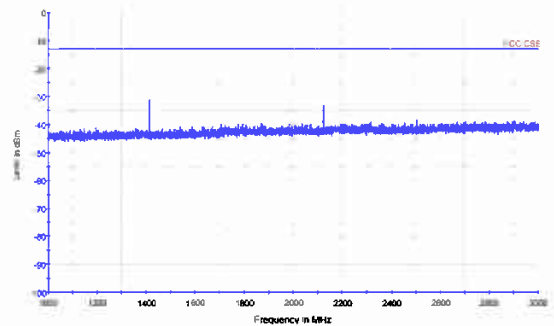
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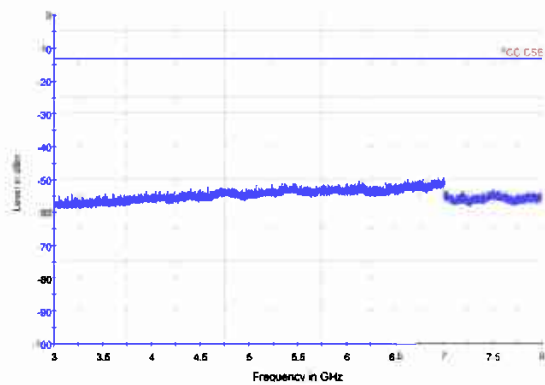
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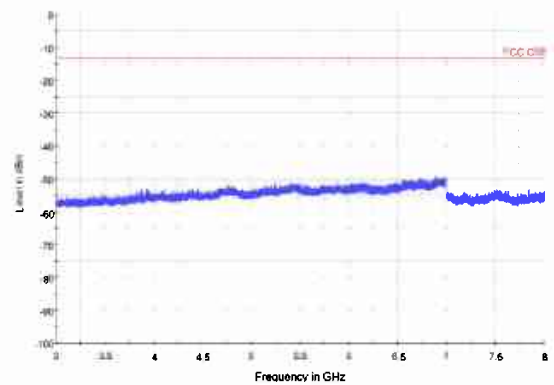
LTE Band 12 1.4MHz CH-Middle 1GHz~3GHz



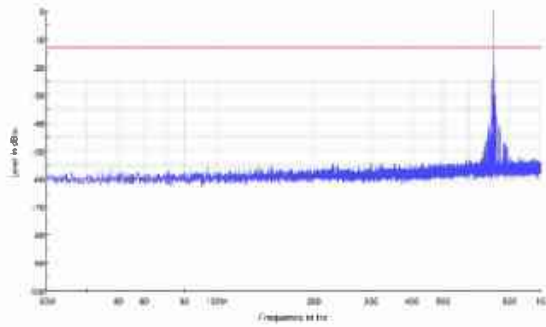
LTE Band 12 1.4MHz CH-Low 3GHz~8GHz



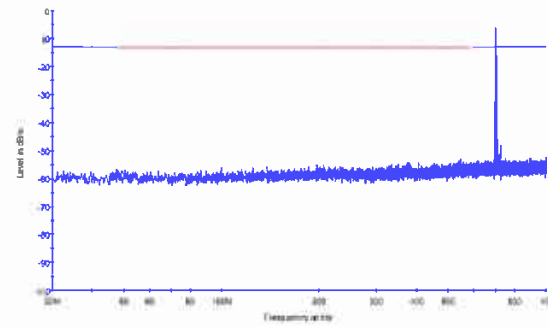
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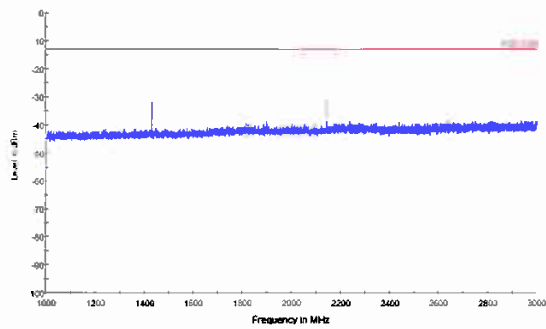
LTE Band 12 1.4MHz CH-High 30MHz~1GHz



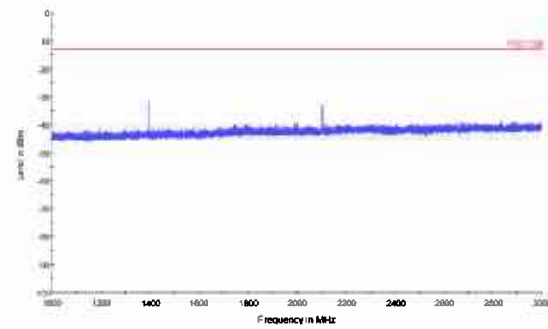
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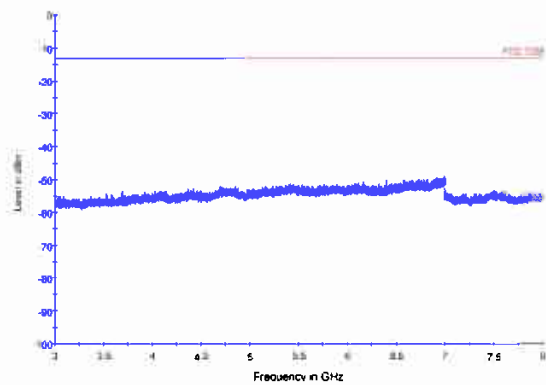
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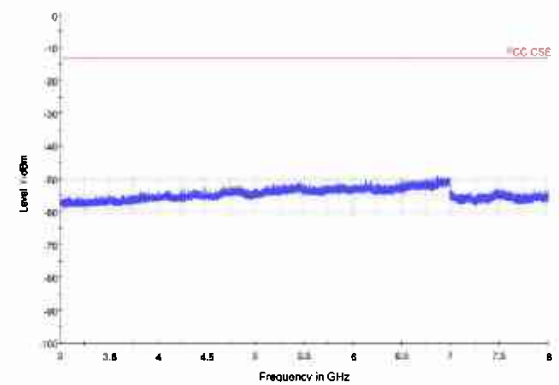
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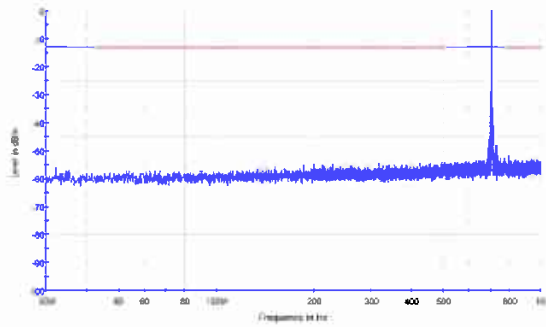
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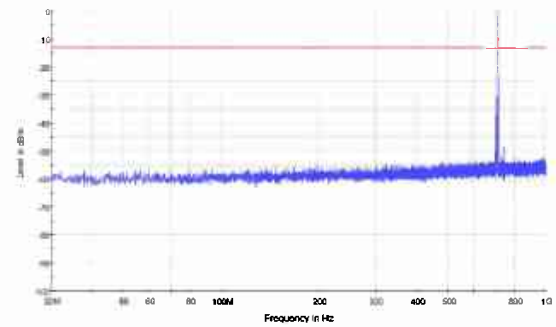
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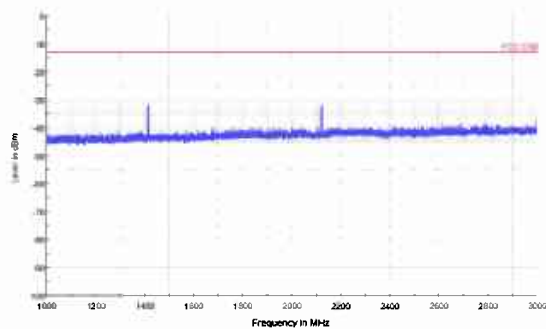
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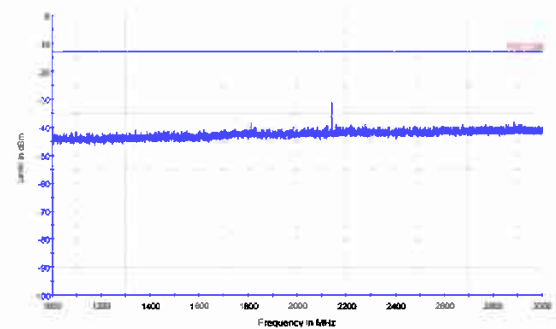
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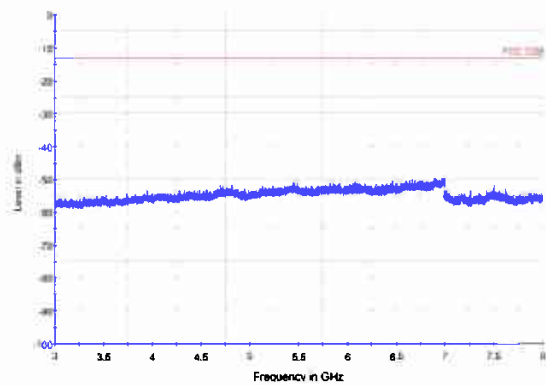
LTE Band 12 3MHz CH-Middle 1GHz~3GHz



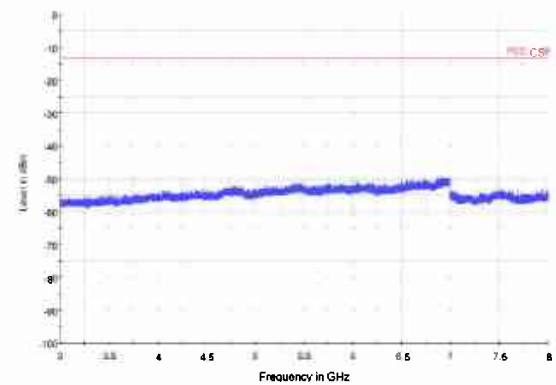
LTE Band 12 3MHz CH-High 1GHz~3GHz



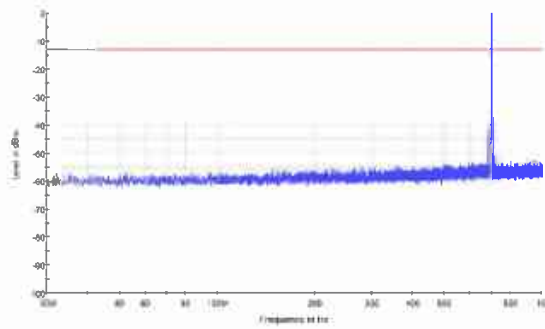
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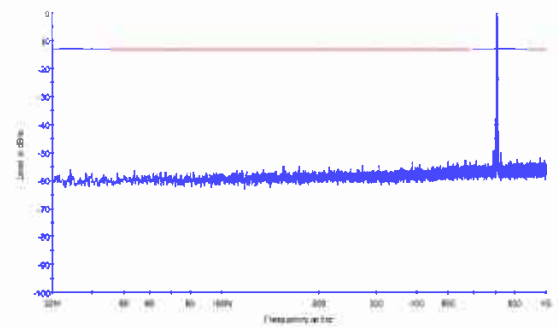
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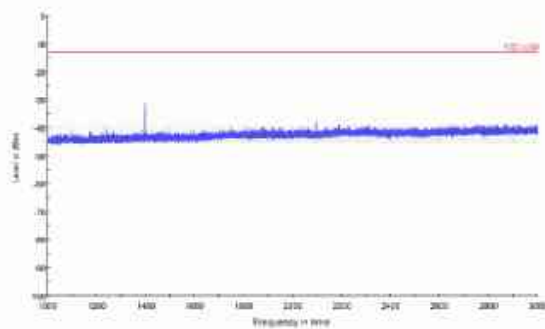
LTE Band 12 5MHz CH-Low 30MHz~1GHz



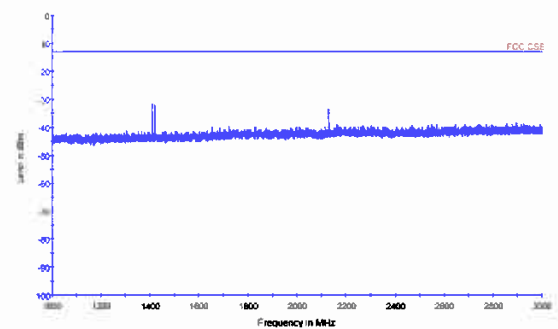
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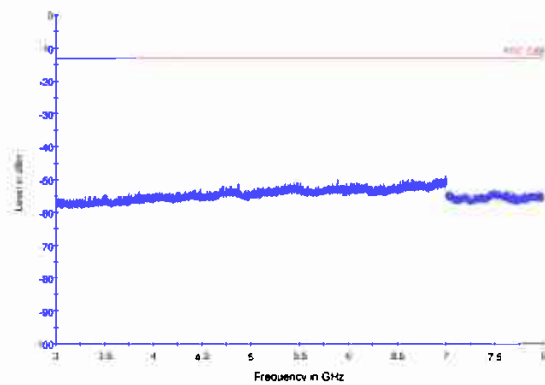
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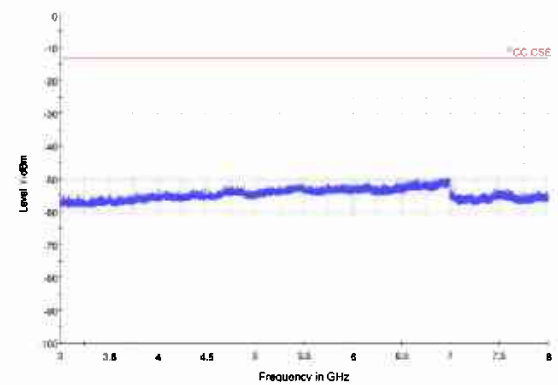
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LTE Band 12 5MHz CH-Low 3GHz~8GHz

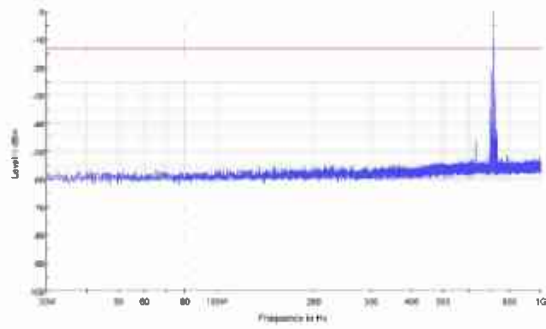


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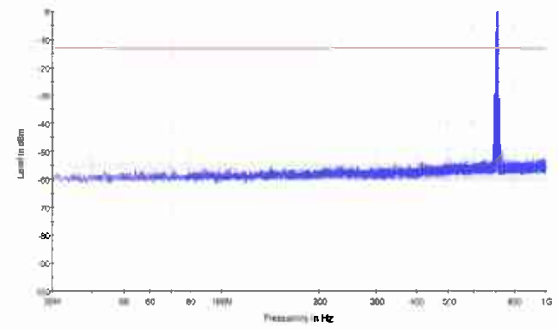




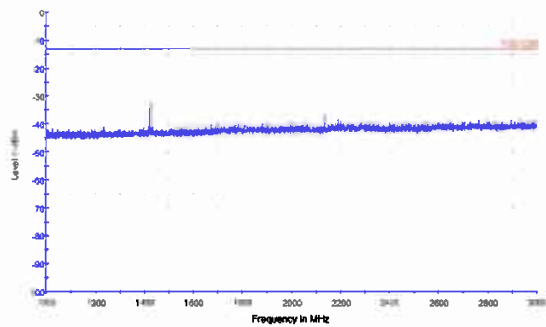
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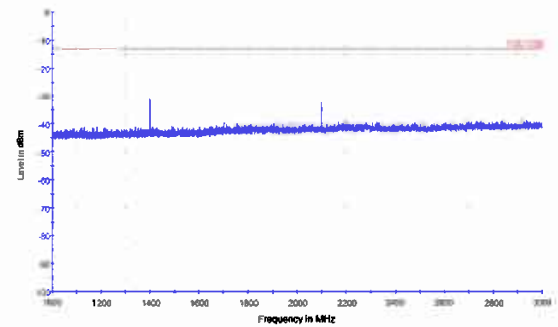
LTE Band 12 10MHz CH-Low 30MHz~1GHz



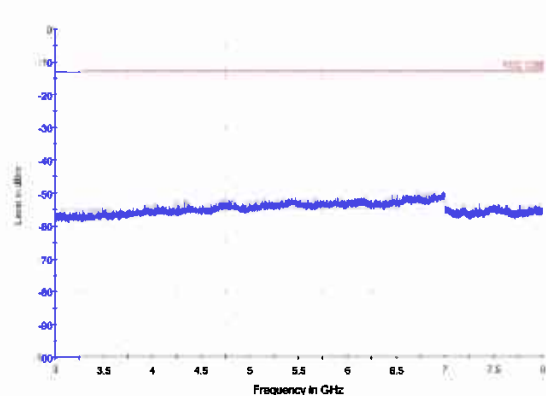
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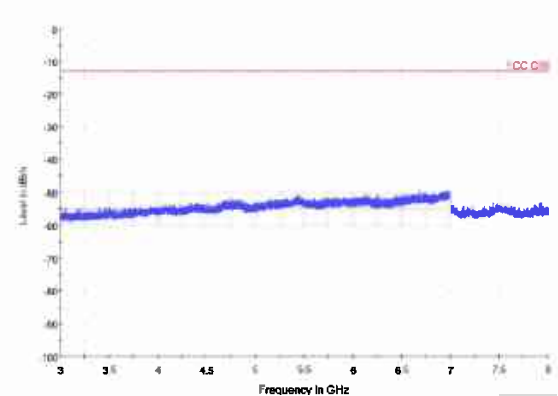
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LTE Band 12 5MHz CH-High 3GHz~8GHz

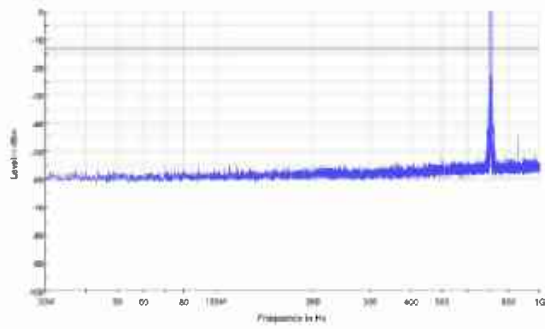


LTE Band 12 10MHz CH-Low 3GHz~8GHz

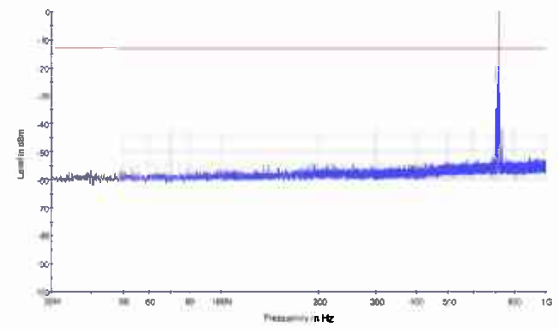




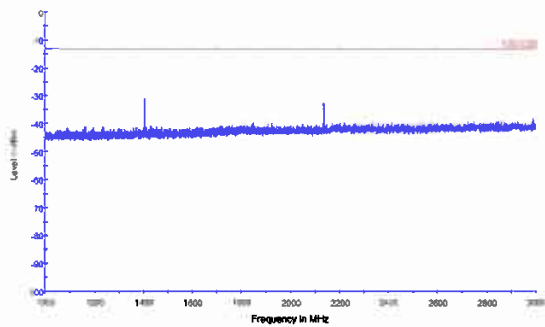
LTE Band 12 10MHz CH-Middle 30MHz~1GHz



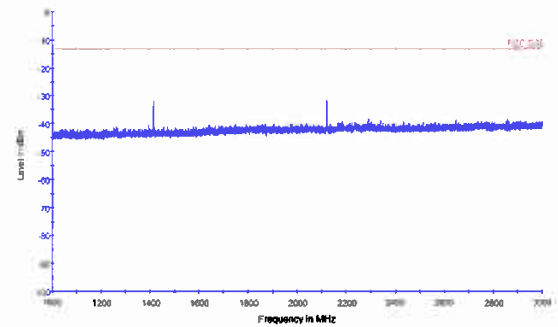
LTE Band 12 10MHz CH-High 30MHz~1GHz



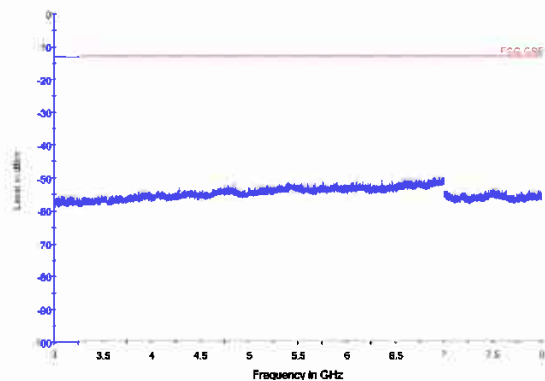
LTE Band 12 10MHz CH-Middle 1GHz~3GHz



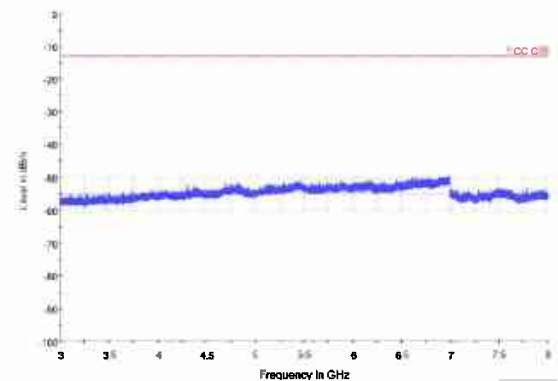
LTE Band 12 10MHz CH-High 1GHz~3GHz



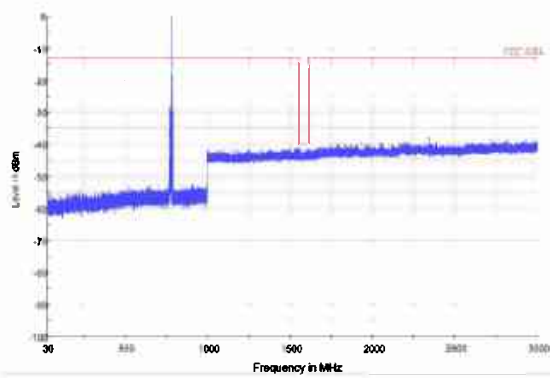
LTE Band 12 10MHz CH-Middle 3GHz~8GHz



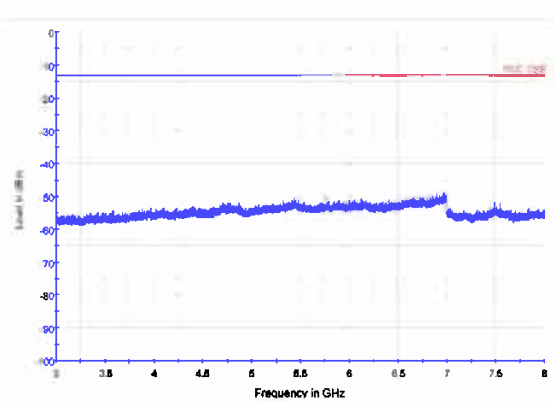
LTE Band 12 10MHz CH-High 3GHz~8GHz



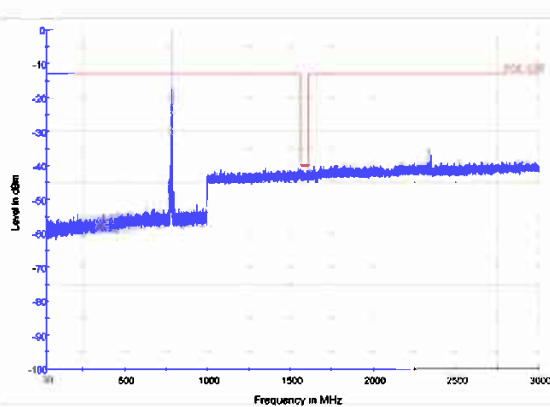
LTE Band 13 5MHz CH-Low 30MHz~3GHz



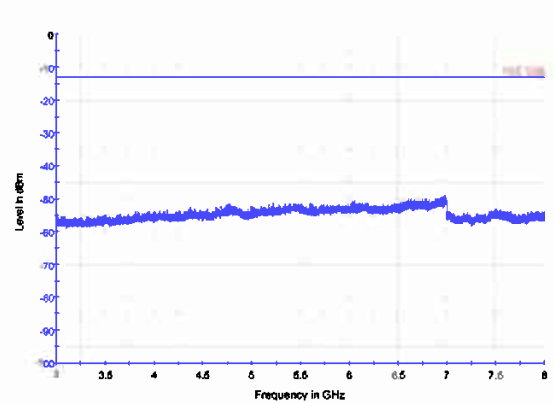
LTE Band 13 5MHz CH-Low 3GHz~8GHz



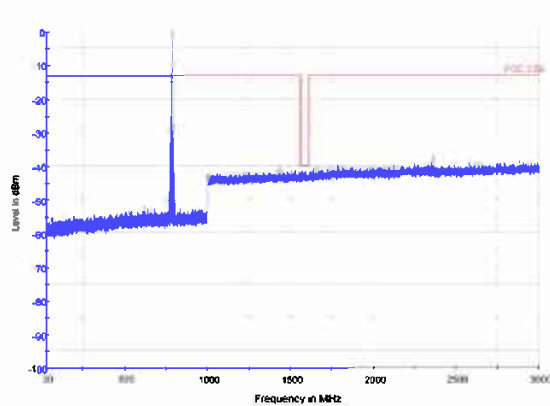
LTE Band 13 5MHz CH-Middle 30MHz~3GHz



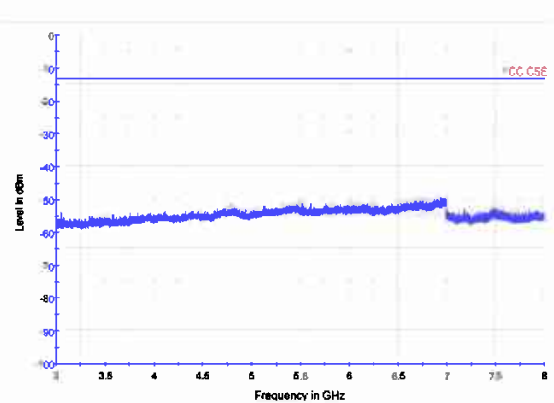
LTE Band 13 5MHz CH-Middle 3GHz~8GHz



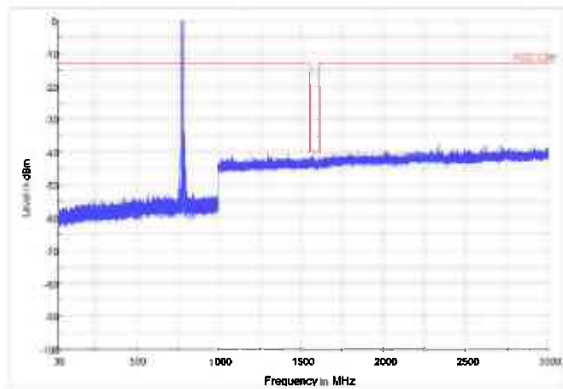
LTE Band 13 5MHz CH-High 30MHz~3GHz



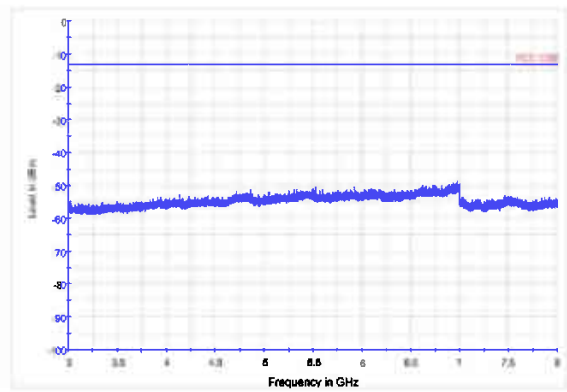
LTE Band 13 5MHz CH-High 3GHz~8GHz



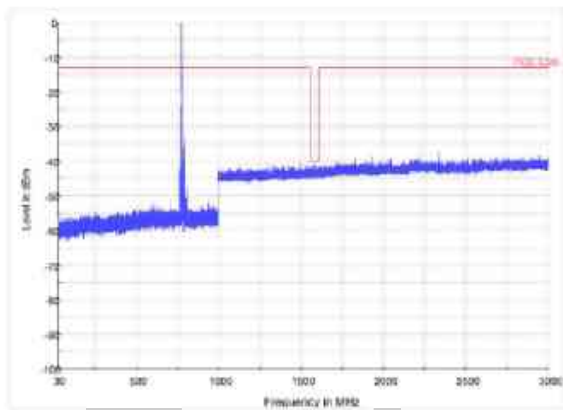
LTE Band 13 10MHz CH-Low 30MHz~3GHz



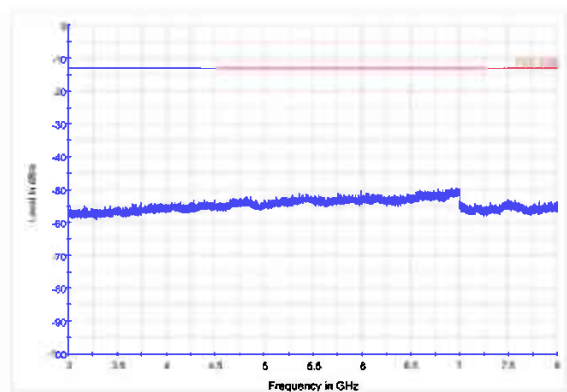
LTE Band 13 10MHz CH-Low 3GHz~8GHz



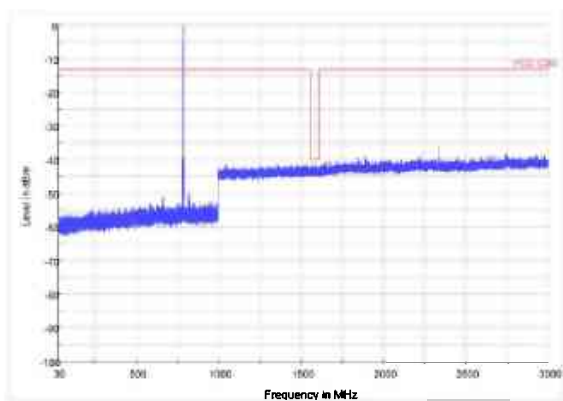
LTE Band 13 10MHz CH-Middle 30MHz~3GHz



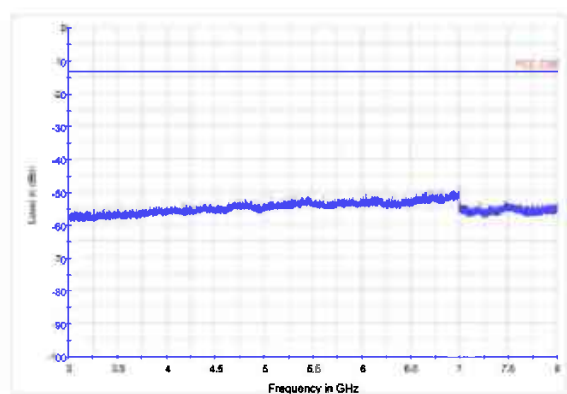
LTE Band 13 10MHz CH-Middle 3GHz~8GHz



LTE Band 13 10MHz CH-High 30MHz~3GHz



LTE Band 13 10MHz CH-High 3GHz~8GHz



5.8 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 D01 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:

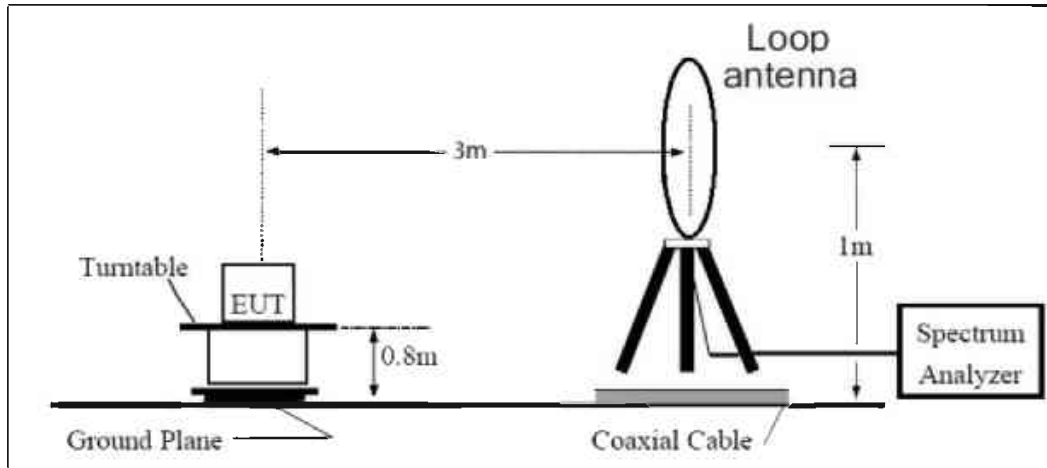
$$\text{Power(EIRP)} = \text{PMea} - \text{Pcl} + \text{Ga}$$
8. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power. ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP

= EIRP-2.15dBi.

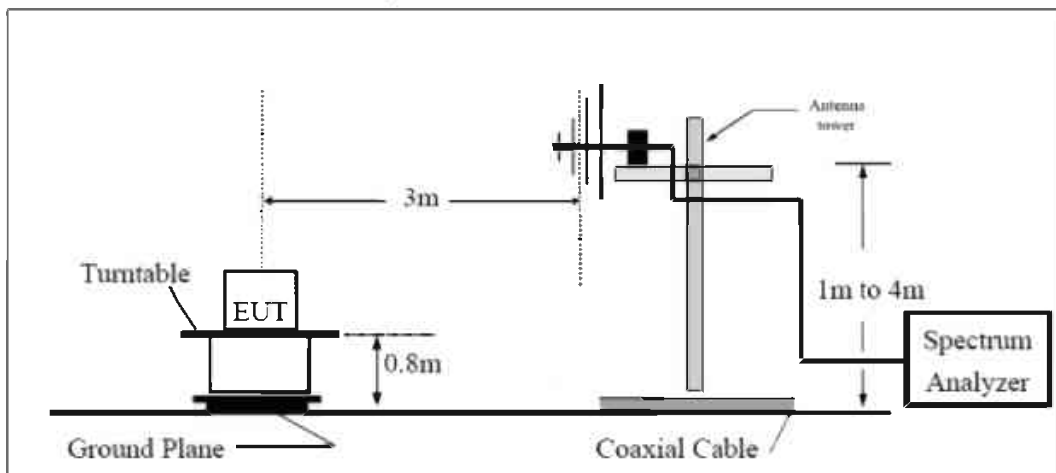
The modulation mode and RB allocation refer to section 5.1, using the maximum output power configuration.

Test setup

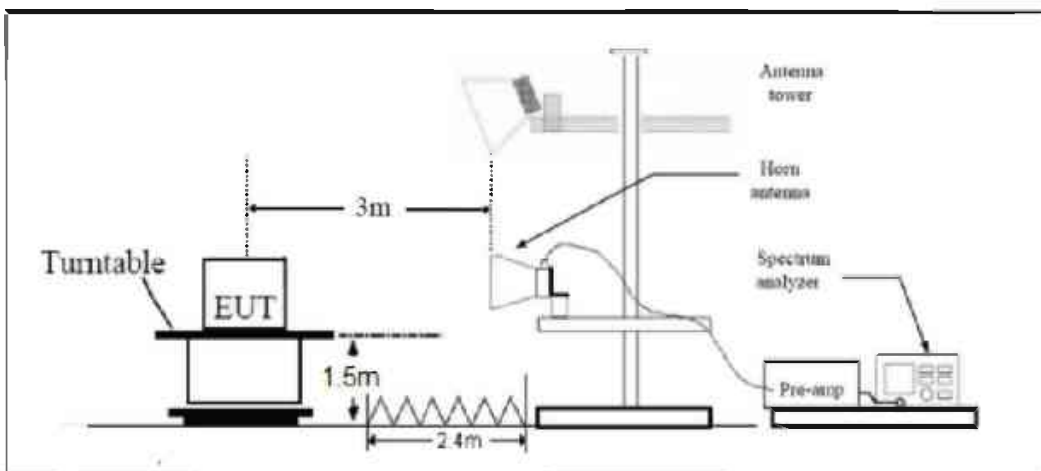
9KHz ~ 30MHz



30MHz ~ 1GHz



Above 1GHz



Note: Area side:2.4mX3.6m

Limits

LTE -4 Rule Part 27.53(h) specifies that “for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10} (P)$ dB.”

LTE -12 Rule Part 27.53 (g) For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least $43 + 10 \log (P)$ dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

LTE -13 Rule Part 27.53(f) For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

Part 27.53(h)/(g) Limit		-13 dBm
Part 27.53(f) Limit	Limit out of the band 1559-1610 MHz	-13 dBm
	Limit in the band 1559-1610 MHz	-40 dBm

Measurement Uncertainty

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

**Test Result**

LTE Band 4 QPSK 1.4MHz CH-Low, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3421.4	-56.35	2.6	10.15	Vertical	-48.8	-13	35.8	45
3	5132.1	-51.85	2.4	11.35	Vertical	-42.9	-13	29.9	0
4	6842.8	-49.65	4.5	10.85	Vertical	-43.3	-13	30.3	135
5	8553.5	-47.15	5.1	11.35	Vertical	-40.9	-13	27.9	225
6	10264.2	-45.55	5.3	11.95	Vertical	-38.9	-13	25.9	135
7	11974.9	-45.85	5.5	13.55	Vertical	-37.8	-13	24.8	45
8	13685.6	-42.85	6.3	13.75	Vertical	-35.4	-13	22.4	90
9	15396.3	-43.35	6.7	13.85	Vertical	-36.2	-13	23.2	225
10	17107.0	-43.05	6.8	14.25	Vertical	-35.6	-13	22.6	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 vertical position.

LTE Band 4 QPSK 1.4MHz CH-Middle, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3465.0	-54.85	2.6	10.75	Vertical	-46.7	-13	33.7	135
3	5197.5	-49.65	2.4	11.05	Vertical	-41.0	-13	28.0	45
4	6930.0	-49.45	4.5	11.15	Vertical	-42.8	-13	29.8	90
5	8662.5	-48.55	5.1	11.35	Vertical	-42.3	-13	29.3	225
6	10395.0	-44.35	5.3	11.95	Vertical	-37.7	-13	24.7	45
7	12127.5	-45.95	5.5	13.55	Vertical	-37.9	-13	24.9	90
8	13860.0	-41.75	6.3	13.75	Vertical	-34.3	-13	21.3	135
9	15592.5	-45.65	6.7	13.85	Vertical	-38.5	-13	25.5	135
10	17325.0	-41.95	6.8	14.25	Vertical	-34.5	-13	21.5	90

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 4 QPSK 1.4MHz CH-High, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3508.6	-53.15	2.6	10.15	Vertical	-45.6	-13	32.6	45
3	5262.9	-56.65	2.4	11.05	Vertical	-48.0	-13	35.0	45
4	7017.2	-49.75	4.5	11.15	Vertical	-43.1	-13	30.1	135
5	8771.5	-47.05	5.1	11.35	Vertical	-40.8	-13	27.8	45
6	10525.8	-45.05	5.3	11.95	Vertical	-38.4	-13	25.4	90
7	12280.1	-45.25	5.5	13.55	Vertical	-37.2	-13	24.2	135
8	14034.4	-42.15	6.3	13.75	Vertical	-34.7	-13	21.7	45
9	15788.7	-44.55	6.7	13.85	Vertical	-37.4	-13	24.4	90
10	17543.0	-42.45	6.8	14.25	Vertical	-35.0	-13	22.0	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 vertical position.

LTE Band 4 QPSK 3MHz CH-Low, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3423.0	-59.35	2.6	10.15	Vertical	-51.8	-13	38.8	180
3	5134.5	-47.45	2.4	11.35	Vertical	-38.5	-13	25.5	225
4	6846.0	-50.65	4.5	10.85	Vertical	-44.3	-13	31.3	135
5	8557.5	-48.45	5.1	11.35	Vertical	-42.2	-13	29.2	225
6	10269.0	-45.35	5.3	11.95	Vertical	-38.7	-13	25.7	90
7	11980.5	-46.15	5.5	13.55	Vertical	-38.1	-13	25.1	90
8	13692.0	-42.65	6.3	13.75	Vertical	-35.2	-13	22.2	45
9	15403.5	-45.35	6.7	13.85	Vertical	-38.2	-13	25.2	180
10	17115.0	-43.05	6.8	14.25	Vertical	-35.6	-13	22.6	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 vertical position.



LTE Band 4 QPSK 3MHz CH-Middle, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3465.0	-54.25	2.6	10.75	Vertical	-46.1	-13	33.1	0
3	5197.5	-48.95	2.4	11.05	Vertical	-40.3	-13	27.3	135
4	6930.0	-48.75	4.5	11.15	Vertical	-42.1	-13	29.1	225
5	8662.5	-46.55	5.1	11.35	Vertical	-40.3	-13	27.3	315
6	10395.0	-45.25	5.3	11.95	Vertical	-38.6	-13	25.6	270
7	12127.5	-44.75	5.5	13.55	Vertical	-36.7	-13	23.7	225
8	13860.0	-41.95	6.3	13.75	Vertical	-34.5	-13	21.5	135
9	15592.5	-44.95	6.7	13.85	Vertical	-37.8	-13	24.8	225
10	17325.0	-41.65	6.8	14.25	Vertical	-34.2	-13	21.2	0

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 4 QPSK 3MHz CH-High, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3507.0	-54.85	2.6	10.15	Vertical	-47.3	-13	34.3	135
3	5260.5	-47.15	2.4	11.05	Vertical	-38.5	-13	25.5	225
4	7014.0	-50.25	4.5	11.15	Vertical	-43.6	-13	30.6	315
5	8767.5	-45.95	5.1	11.35	Vertical	-39.7	-13	26.7	270
6	10521.0	-44.35	5.3	11.95	Vertical	-37.7	-13	24.7	225
7	12274.5	-46.55	5.5	13.55	Vertical	-38.5	-13	25.5	135
8	14028.0	-42.35	6.3	13.75	Vertical	-34.9	-13	21.9	225
9	15781.5	-44.75	6.7	13.85	Vertical	-37.6	-13	24.6	90
10	17535.0	-42.15	6.8	14.25	Vertical	-34.7	-13	21.7	90

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 4 QPSK 5MHz CH-Low, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3425.0	-57.85	2.6	10.15	Vertical	-50.3	-13	37.3	45
3	5137.5	-57.75	2.4	11.35	Vertical	-48.8	-13	35.8	180
4	6850.0	-47.95	4.5	10.85	Vertical	-41.6	-13	28.6	225
5	8562.5	-47.05	5.1	11.35	Vertical	-40.8	-13	27.8	135
6	10275.0	-45.15	5.3	11.95	Vertical	-38.5	-13	25.5	225
7	11987.5	-45.65	5.5	13.55	Vertical	-37.6	-13	24.6	90
8	13700.0	-44.75	6.3	13.75	Vertical	-37.3	-13	24.3	90
9	15412.5	-45.25	6.7	13.85	Vertical	-38.1	-13	25.1	45
10	17125.0	-42.75	6.8	14.25	Vertical	-35.3	-13	22.3	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 vertical position.

LTE Band 4 QPSK 5MHz CH-Middle, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3465.0	-55.05	2.6	10.75	Vertical	-46.9	-13	33.9	45
3	5197.5	-57.45	2.4	11.05	Vertical	-48.8	-13	35.8	0
4	6930.0	-49.45	4.5	11.15	Vertical	-42.8	-13	29.8	135
5	8662.5	-48.65	5.1	11.35	Vertical	-42.4	-13	29.4	225
6	10395.0	-44.75	5.3	11.95	Vertical	-38.1	-13	25.1	315
7	12127.5	-47.25	5.5	13.55	Vertical	-39.2	-13	26.2	270
8	13860.0	-41.65	6.3	13.75	Vertical	-34.2	-13	21.2	225
9	15592.5	-44.35	6.7	13.85	Vertical	-37.2	-13	24.2	135
10	17325.0	-41.35	6.8	14.25	Vertical	-33.9	-13	20.9	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 vertical position.



LTE Band 4 QPSK 5MHz CH-High, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3505.0	-53.65	2.6	10.15	Vertical	-46.1	-13	33.1	0
3	5257.5	-56.95	2.4	11.05	Vertical	-48.3	-13	35.3	135
4	7010.0	-49.75	4.5	11.15	Vertical	-43.1	-13	30.1	225
5	8762.5	-46.85	5.1	11.35	Vertical	-40.6	-13	27.6	315
6	10515.0	-44.75	5.3	11.95	Vertical	-38.1	-13	25.1	270
7	12267.5	-46.55	5.5	13.55	Vertical	-38.5	-13	25.5	225
8	14020.0	-41.35	6.3	13.75	Vertical	-33.9	-13	20.9	135
9	15772.5	-44.15	6.7	13.85	Vertical	-37.0	-13	24.0	225
10	17525.0	-43.85	6.8	14.25	Vertical	-36.4	-13	23.4	90

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 4 QPSK 10MHz CH-Low, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3430.0	-56.15	2.6	10.15	Vertical	-48.6	-13	35.6	90
3	5145.0	-51.65	2.4	11.35	Vertical	-42.7	-13	29.7	45
4	6860.0	-49.25	4.5	10.85	Vertical	-42.9	-13	29.9	180
5	8575.0	-46.95	5.1	11.35	Vertical	-40.7	-13	27.7	225
6	10290.0	-44.55	5.3	11.95	Vertical	-37.9	-13	24.9	135
7	12005.0	-44.45	5.5	13.55	Vertical	-36.4	-13	23.4	225
8	13720.0	-43.15	6.3	13.75	Vertical	-35.7	-13	22.7	90
9	15435.0	-44.65	6.7	13.85	Vertical	-37.5	-13	24.5	90
10	17150.0	-42.65	6.8	14.25	Vertical	-35.2	-13	22.2	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 vertical position.



LTE Band 4 QPSK 10MHz CH-Middle, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3465.0	-54.95	2.6	10.75	Vertical	-46.8	-13	33.8	180
3	5197.5	-57.25	2.4	11.05	Vertical	-48.6	-13	35.6	45
4	6930.0	-50.05	4.5	11.15	Vertical	-43.4	-13	30.4	0
5	8662.5	-46.35	5.1	11.35	Vertical	-40.1	-13	27.1	135
6	10395.0	-44.85	5.3	11.95	Vertical	-38.2	-13	25.2	225
7	12127.5	-45.55	5.5	13.55	Vertical	-37.5	-13	24.5	315
8	13860.0	-42.45	6.3	13.75	Vertical	-35.0	-13	22.0	270
9	15592.5	-43.85	6.7	13.85	Vertical	-36.7	-13	23.7	225
10	17325.0	-41.45	6.8	14.25	Vertical	-34.0	-13	21.0	135

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 4 QPSK 10MHz CH-High, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3500.0	-53.65	2.6	10.15	Vertical	-46.1	-13	33.1	225
3	5250.0	-57.35	2.4	11.05	Vertical	-48.7	-13	35.7	315
4	7000.0	-49.95	4.5	11.15	Vertical	-43.3	-13	30.3	270
5	8750.0	-47.15	5.1	11.35	Vertical	-40.9	-13	27.9	225
6	10500.0	-44.35	5.3	11.95	Vertical	-37.7	-13	24.7	135
7	12250.0	-45.65	5.5	13.55	Vertical	-37.6	-13	24.6	225
8	14000.0	-42.15	6.3	13.75	Vertical	-34.7	-13	21.7	315
9	15750.0	-44.75	6.7	13.85	Vertical	-37.6	-13	24.6	270
10	17500.0	-42.45	6.8	14.25	Vertical	-35.0	-13	22.0	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 vertical position.

LTE Band 4 QPSK 15MHz CH Low, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3435.0	-58.45	2.6	10.15	Vertical	-50.9	-13	37.9	135
3	5152.5	-51.15	2.4	11.35	Vertical	-42.2	-13	29.2	225
4	6870.0	-49.45	4.5	10.85	Vertical	-43.1	-13	30.1	90
5	8587.5	-46.45	5.1	11.35	Vertical	-40.2	-13	27.2	90
6	10305.0	-46.95	5.3	11.95	Vertical	-40.3	-13	27.3	45
7	12022.5	-45.65	5.5	13.55	Vertical	-37.6	-13	24.6	180
8	13740.0	-43.75	6.3	13.75	Vertical	-36.3	-13	23.3	225
9	15457.5	-44.65	6.7	13.85	Vertical	-37.5	-13	24.5	135
10	17175.0	-41.65	6.8	14.25	Vertical	-34.2	-13	21.2	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 vertical position.

LTE Band 4 QPSK 15MHz CH-Middle, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3465.0	-55.85	2.6	10.75	Vertical	-47.7	-13	34.7	90
3	5197.5	-57.45	2.4	11.05	Vertical	-48.8	-13	35.8	90
4	6930.0	-50.45	4.5	11.15	Vertical	-43.8	-13	30.8	45
5	8662.5	-47.85	5.1	11.35	Vertical	-41.6	-13	28.6	180
6	10395.0	-43.95	5.3	11.95	Vertical	-37.3	-13	24.3	270
7	12127.5	-45.75	5.5	13.55	Vertical	-37.7	-13	24.7	225
8	13860.0	-41.75	6.3	13.75	Vertical	-34.3	-13	21.3	135
9	15592.5	-45.65	6.7	13.85	Vertical	-38.5	-13	25.5	225
10	17325.0	-42.05	6.8	14.25	Vertical	-34.6	-13	21.6	315

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 4 QPSK 15MHz CH-High, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3495.0	-53.55	2.6	10.15	Vertical	-46.0	-13	33.0	270
3	5242.5	-57.65	2.4	11.05	Vertical	-49.0	-13	36.0	225
4	6990.0	-49.85	4.5	11.15	Vertical	-43.2	-13	30.2	135
5	8737.5	-47.05	5.1	11.35	Vertical	-40.8	-13	27.8	225
6	10485.0	-44.25	5.3	11.95	Vertical	-37.6	-13	24.6	90
7	12232.5	-45.25	5.5	13.55	Vertical	-37.2	-13	24.2	45
8	13980.0	-41.05	6.3	13.75	Vertical	-33.6	-13	20.6	180
9	15727.5	-46.15	6.7	13.85	Vertical	-39.0	-13	26.0	45
10	17475.0	-42.65	6.8	14.25	Vertical	-35.2	-13	22.2	0

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 4 QPSK 20MHz CH-Low, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3440.0	-59.05	2.6	10.15	Vertical	-51.5	-13	38.5	135
3	5160.0	-58.15	2.4	11.35	Vertical	-49.2	-13	36.2	225
4	6880.0	-51.25	4.5	10.85	Vertical	-44.9	-13	31.9	315
5	8600.0	-47.05	5.1	11.35	Vertical	-40.8	-13	27.8	270
6	10320.0	-45.95	5.3	11.95	Vertical	-39.3	-13	26.3	225
7	12040.0	-47.75	5.5	13.55	Vertical	-39.7	-13	26.7	135
8	13760.0	-41.95	6.3	13.75	Vertical	-34.5	-13	21.5	225
9	15480.0	-47.05	6.7	13.85	Vertical	-39.9	-13	26.9	135
10	17200.0	-44.75	6.8	14.25	Vertical	-37.3	-13	24.3	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 vertical position.



LTE Band 4 QPSK 20MHz CH-Middle, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3465.0	-58.95	2.6	10.75	Vertical	-50.8	-13	37.8	315
3	5197.5	-52.75	2.4	11.05	Vertical	-44.1	-13	31.1	270
4	6930.0	-50.15	4.5	11.15	Vertical	-43.5	-13	30.5	225
5	8662.5	-46.55	5.1	11.35	Vertical	-40.3	-13	27.3	135
6	10395.0	-45.25	5.3	11.95	Vertical	-38.6	-13	25.6	225
7	12127.5	-44.95	5.5	13.55	Vertical	-36.9	-13	23.9	90
8	13860.0	-42.45	6.3	13.75	Vertical	-35.0	-13	22.0	90
9	15592.5	-44.95	6.7	13.85	Vertical	-37.8	-13	24.8	45
10	17325.0	-42.85	6.8	14.25	Vertical	-35.4	-13	22.4	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 vertical position.

LTE Band 4 QPSK 20MHz CH-High, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3490.0	-54.35	2.6	10.15	Vertical	-46.8	-13	33.8	225
3	5235.0	-48.85	2.4	11.05	Vertical	-40.2	-13	27.2	135
4	6980.0	-49.55	4.5	11.15	Vertical	-42.9	-13	29.9	225
5	8725.0	-47.05	5.1	11.35	Vertical	-40.8	-13	27.8	90
6	10470.0	-45.35	5.3	11.95	Vertical	-38.7	-13	25.7	90
7	12215.0	-45.65	5.5	13.55	Vertical	-37.6	-13	24.6	45
8	13960.0	-44.45	6.3	13.75	Vertical	-37.0	-13	24.0	180
9	15705.0	-45.25	6.7	13.85	Vertical	-38.1	-13	25.1	45
10	17450.0	-43.65	6.8	14.25	Vertical	-36.2	-13	23.2	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 vertical position.

LTE Band 12 QPSK 1.4MHz CH-Low, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1399.40	-52.45	2.00	10.15	Vertical	-44.3	-13	31.3	225
3	2099.10	-58.65	2.50	11.35	Vertical	-49.8	-13	36.8	315
4	2798.80	-56.15	4.20	10.85	Vertical	-49.5	-13	36.5	135
5	3498.50	-56.05	5.20	11.35	Vertical	-49.9	-13	36.9	225
6	4198.20	-54.55	5.50	11.95	Vertical	-48.1	-13	35.1	90
7	4897.90	-52.95	5.70	13.55	Vertical	-45.1	-13	32.1	135
8	5597.60	-52.05	6.30	13.75	Vertical	-44.6	-13	31.6	45
9	6297.30	-50.55	6.80	13.85	Vertical	-43.5	-13	30.5	225
10	6997.00	-49.05	6.90	14.25	Vertical	-41.7	-13	28.7	135

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 12 QPSK 1.4MHz CH-Middle, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1415.00	-57.75	2.00	10.75	Vertical	-49.0	-13	36.0	45
3	2122.50	-59.04	2.51	11.05	Vertical	-50.5	-13	37.5	90
4	2830.00	-56.45	4.20	11.15	Vertical	-49.5	-13	36.5	225
5	3537.50	-56.45	5.20	11.15	Vertical	-50.5	-13	37.5	45
6	4245.00	-54.55	5.50	11.95	Vertical	-48.1	-13	35.1	135
7	4952.50	-52.15	5.70	13.55	Vertical	-44.3	-13	31.3	135
8	5660.00	-52.65	6.30	13.75	Vertical	-45.2	-13	32.2	225
9	6367.50	-50.25	6.80	13.85	Vertical	-43.2	-13	30.2	90
10	7075.00	-49.35	6.90	14.25	Vertical	-42.0	-13	29.0	90

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 12 QPSK 1.4MHz CH-High, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1430.60	-60.65	2.00	10.15	Vertical	-52.5	-13	39.5	225
3	2145.90	-56.14	2.51	11.05	Vertical	-47.6	-13	34.6	45
4	2861.20	-57.25	4.20	11.15	Vertical	-50.3	-13	37.3	90
5	3576.50	-56.05	5.20	11.15	Vertical	-50.1	-13	37.1	135
6	4291.80	-54.85	5.50	11.95	Vertical	-48.4	-13	35.4	135
7	5007.10	-52.15	5.70	13.55	Vertical	-44.3	-13	31.3	90
8	5722.40	-52.35	6.30	13.75	Vertical	-44.9	-13	31.9	135
9	6437.70	-50.55	6.80	13.85	Vertical	-43.5	-13	30.5	90
10	7153.00	-49.45	6.90	14.25	Vertical	-42.1	-13	29.1	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 vertical position.

LTE Band 12 QPSK 3MHz CH-Low, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1401.00	-55.95	2.00	10.15	Vertical	-47.8	-13	34.8	135
3	2101.50	-58.34	2.51	11.35	Vertical	-49.5	-13	36.5	225
4	2802.00	-56.25	4.20	10.85	Vertical	-49.6	-13	36.6	90
5	3502.50	-56.55	5.20	11.35	Vertical	-50.4	-13	37.4	90
6	4203.00	-54.85	5.50	11.95	Vertical	-48.4	-13	35.4	45
7	4903.50	-52.95	5.70	13.55	Vertical	-45.1	-13	32.1	180
8	5604.00	-52.85	6.30	13.75	Vertical	-45.4	-13	32.4	225
9	6304.50	-50.35	6.80	13.85	Vertical	-43.3	-13	30.3	135
10	7005.00	-49.15	6.90	14.25	Vertical	-41.8	-13	28.8	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 vertical position.

LTE Band 12 QPSK 3MHz CH-Middle, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1415.00	-57.85	2.00	10.75	Vertical	-49.1	-13	36.1	90
3	2122.50	-58.64	2.51	11.05	Vertical	-50.1	-13	37.1	90
4	2830.00	-57.35	4.20	11.15	Vertical	-50.4	-13	37.4	45
5	3537.50	-56.35	5.20	11.15	Vertical	-50.4	-13	37.4	180
6	4245.00	-55.15	5.50	11.95	Vertical	-48.7	-13	35.7	45
7	4952.50	-52.35	5.70	13.55	Vertical	-44.5	-13	31.5	0
8	5660.00	-52.55	6.30	13.75	Vertical	-45.1	-13	32.1	135
9	6367.50	-50.95	6.80	13.85	Vertical	-43.9	-13	30.9	225
10	7075.00	-48.75	6.90	14.25	Vertical	-41.4	-13	28.4	90

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 12 QPSK 3MHz CH-High, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1429.00	-59.25	2.00	10.15	Vertical	-51.1	-13	38.1	45
3	2143.50	-57.24	2.51	11.05	Vertical	-48.7	-13	35.7	180
4	2858.00	-57.05	4.20	11.15	Vertical	-50.1	-13	37.1	225
5	3572.50	-55.85	5.20	11.15	Vertical	-49.9	-13	36.9	135
6	4287.00	-54.75	5.50	11.95	Vertical	-48.3	-13	35.3	225
7	5001.50	-52.55	5.70	13.55	Vertical	-44.7	-13	31.7	90
8	5716.00	-51.95	6.30	13.75	Vertical	-44.5	-13	31.5	90
9	6430.50	-50.45	6.80	13.85	Vertical	-43.4	-13	30.4	45
10	7145.00	-49.05	6.90	14.25	Vertical	-41.7	-13	28.7	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 vertical position.

LTE Band 12 QPSK 5MHz CH-Low, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1403.00	-51.85	2.00	10.15	Vertical	-43.7	-13	30.7	45
3	2104.50	-59.15	2.50	11.35	Vertical	-50.3	-13	37.3	0
4	2806.00	-56.85	4.20	10.85	Vertical	-50.2	-13	37.2	135
5	3507.50	-56.45	5.20	11.35	Vertical	-50.3	-13	37.3	45
6	4209.00	-55.35	5.50	11.95	Vertical	-48.9	-13	35.9	90
7	4910.50	-52.15	5.70	13.55	Vertical	-44.3	-13	31.3	45
8	5612.00	-52.55	6.30	13.75	Vertical	-45.1	-13	32.1	180
9	6313.50	-50.65	6.80	13.85	Vertical	-43.6	-13	30.6	315
10	7015.00	-49.05	6.90	14.25	Vertical	-41.7	-13	28.7	135

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 12 QPSK 5MHz CH-Middle, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1415.00	-57.15	2.00	10.75	Vertical	-48.4	-13	35.4	225
3	2122.50	-58.24	2.51	11.05	Vertical	-49.7	-13	36.7	90
4	2830.00	-56.25	4.20	11.15	Vertical	-49.3	-13	36.3	180
5	3537.50	-55.75	5.20	11.15	Vertical	-49.8	-13	36.8	45
6	4245.00	-55.35	5.50	11.95	Vertical	-48.9	-13	35.9	180
7	4952.50	-52.25	5.70	13.55	Vertical	-44.4	-13	31.4	45
8	5660.00	-52.65	6.30	13.75	Vertical	-45.2	-13	32.2	0
9	6367.50	-50.25	6.80	13.85	Vertical	-43.2	-13	30.2	135
10	7075.00	-49.05	6.90	14.25	Vertical	-41.7	-13	28.7	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 vertical position.

LTE Band 12 QPSK 5MHz CH-High, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1427.00	-57.85	2.00	10.15	Vertical	-49.7	-13	36.7	90
3	2140.50	-57.34	2.51	11.05	Vertical	-48.8	-13	35.8	225
4	2854.00	-55.65	4.20	11.15	Vertical	-48.7	-13	35.7	180
5	3567.50	-56.15	5.20	11.15	Vertical	-50.2	-13	37.2	270
6	4281.00	-54.55	5.50	11.95	Vertical	-48.1	-13	35.1	135
7	4994.50	-52.95	5.70	13.55	Vertical	-45.1	-13	32.1	225
8	5708.00	-52.35	6.30	13.75	Vertical	-44.9	-13	31.9	135
9	6421.50	-50.65	6.80	13.85	Vertical	-43.6	-13	30.6	90
10	7135.00	-49.15	6.90	14.25	Vertical	-41.8	-13	28.8	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 vertical position.

LTE Band 12 QPSK 10MHz CH-Low, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1408.00	-52.25	2.00	10.15	Vertical	-44.1	-13	31.1	180
3	2112.00	-58.94	2.51	11.35	Vertical	-50.1	-13	37.1	45
4	2816.00	-57.05	4.20	10.85	Vertical	-50.4	-13	37.4	0
5	3520.00	-55.75	5.20	11.35	Vertical	-49.6	-13	36.6	135
6	4224.00	-54.35	5.50	11.95	Vertical	-47.9	-13	34.9	225
7	4928.00	-53.95	5.70	13.55	Vertical	-46.1	-13	33.1	90
8	5632.00	-52.55	6.30	13.75	Vertical	-45.1	-13	32.1	45
9	6336.00	-51.55	6.80	13.85	Vertical	-44.5	-13	31.5	180
10	7040.00	-48.55	6.90	14.25	Vertical	-41.2	-13	28.2	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 vertical position.

LTE Band 12 QPSK 10MHz CH-Middle, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1415.00	-56.35	2.00	10.75	Vertical	-47.6	-13	34.6	135
3	2122.50	-57.84	2.51	11.05	Vertical	-49.3	-13	36.3	225
4	2830.00	-57.65	4.20	11.15	Vertical	-50.7	-13	37.7	90
5	3537.50	-55.25	5.20	11.15	Vertical	-49.3	-13	36.3	90
6	4245.00	-53.35	5.50	11.95	Vertical	-46.9	-13	33.9	45
7	4952.50	-54.25	5.70	13.55	Vertical	-46.4	-13	33.4	180
8	5660.00	-52.95	6.30	13.75	Vertical	-45.5	-13	32.5	45
9	6367.50	-50.55	6.80	13.85	Vertical	-43.5	-13	30.5	0
10	7075.00	-49.15	6.90	14.25	Vertical	-41.8	-13	28.8	135

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 12 QPSK 10MHz CH-High, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1422.00	-57.15	2.00	10.15	Vertical	-49.0	-13	36.0	225
3	2133.00	-58.04	2.51	11.05	Vertical	-49.5	-13	36.5	90
4	2844.00	-58.55	4.20	11.15	Vertical	-51.6	-13	38.6	45
5	3555.00	-55.05	5.20	11.15	Vertical	-49.1	-13	36.1	180
6	4266.00	-53.05	5.50	11.95	Vertical	-46.6	-13	33.6	225
7	4977.00	-53.95	5.70	13.55	Vertical	-46.1	-13	33.1	135
8	5688.00	-52.55	6.30	13.75	Vertical	-45.1	-13	32.1	225
9	6399.00	-50.35	6.80	13.85	Vertical	-43.3	-13	30.3	90
10	7110.00	-48.85	6.90	14.25	Vertical	-41.5	-13	28.5	90

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 13 QPSK 5MHz CH-Low, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1559.0	-61.25	2.00	10.15	Vertical	-53.1	-40	13.1	180
3	2338.5	-52.75	2.50	11.35	Vertical	-43.9	-13	30.9	270
4	3118.0	-57.45	4.20	10.85	Vertical	-50.8	-13	37.8	135
5	3897.5	-55.05	5.20	11.35	Vertical	-48.9	-13	35.9	225
6	4677.0	-53.35	5.50	11.95	Vertical	-46.9	-13	33.9	135
7	5456.5	-52.85	5.70	13.55	Vertical	-45.0	-13	32.0	90
8	6236.0	-52.35	6.30	13.75	Vertical	-44.9	-13	31.9	45
9	7015.5	-50.75	6.80	13.85	Vertical	-43.7	-13	30.7	180
10	7795.0	-48.25	6.90	14.25	Vertical	-40.9	-13	27.9	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 vertical position.

LTE Band 13 QPSK 5MHz CH-Middle, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1564.0	-61.45	2.00	10.75	Vertical	-52.7	-40	12.7	0
3	2346.0	-52.14	2.51	11.05	Vertical	-43.6	-13	30.6	135
4	3128.0	-56.75	4.20	11.15	Vertical	-49.8	-13	36.8	225
5	3910.0	-54.35	5.20	11.15	Vertical	-48.4	-13	35.4	90
6	4692.0	-53.45	5.50	11.95	Vertical	-47.0	-13	34.0	45
7	5474.0	-52.75	5.70	13.55	Vertical	-44.9	-13	31.9	180
8	6256.0	-52.15	6.30	13.75	Vertical	-44.7	-13	31.7	45
9	7038.0	-50.45	6.80	13.85	Vertical	-43.4	-13	30.4	0
10	7820.0	-47.25	6.90	14.25	Vertical	-39.9	-13	26.9	135

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 13 QPSK 5MHz CH-High, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1569.0	-62.45	2.00	10.15	Vertical	-54.3	-40	14.3	225
3	2353.5	-52.14	2.51	11.05	Vertical	-43.6	-13	30.6	315
4	3138.0	-56.15	4.20	11.15	Vertical	-49.2	-13	36.2	270
5	3922.5	-53.95	5.20	11.15	Vertical	-48.0	-13	35.0	225
6	4707.0	-53.35	5.50	11.95	Vertical	-46.9	-13	33.9	135
7	5491.5	-52.75	5.70	13.55	Vertical	-44.9	-13	31.9	225
8	6276.0	-51.85	6.30	13.75	Vertical	-44.4	-13	31.4	90
9	7060.5	-50.15	6.80	13.85	Vertical	-43.1	-13	30.1	90
10	7845.0	-47.05	6.90	14.25	Vertical	-39.7	-13	26.7	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 vertical position.

LTE Band 13 QPSK 10MHz CH-Low, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1564.0	-62.25	2.00	10.15	Vertical	-54.1	-40	14.1	180
3	2346.0	-52.94	2.51	11.35	Vertical	-44.1	-13	31.1	225
4	3128.0	-56.15	4.20	10.85	Vertical	-49.5	-13	36.5	135
5	3910.0	-54.65	5.20	11.35	Vertical	-48.5	-13	35.5	225
6	4692.0	-54.25	5.50	11.95	Vertical	-47.8	-13	34.8	90
7	5474.0	-53.55	5.70	13.55	Vertical	-45.7	-13	32.7	90
8	6256.0	-52.25	6.30	13.75	Vertical	-44.8	-13	31.8	45
9	7038.0	-49.45	6.80	13.85	Vertical	-42.4	-13	29.4	180
10	7820.0	-48.05	6.90	14.25	Vertical	-40.7	-13	27.7	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 vertical position.



LTE Band 13 QPSK 10MHz CH-Middle, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1564.0	-63.05	2.00	10.75	Vertical	-54.3	-40	14.3	0
3	2346.0	-52.64	2.51	11.05	Vertical	-44.1	-13	31.1	135
4	3128.0	-56.25	4.20	11.15	Vertical	-49.3	-13	36.3	225
5	3910.0	-54.75	5.20	11.15	Vertical	-48.8	-13	35.8	315
6	4692.0	-54.05	5.50	11.95	Vertical	-47.6	-13	34.6	270
7	5474.0	-53.25	5.70	13.55	Vertical	-45.4	-13	32.4	90
8	6256.0	-52.25	6.30	13.75	Vertical	-44.8	-13	31.8	45
9	7038.0	-49.75	6.80	13.85	Vertical	-42.7	-13	29.7	180
10	7820.0	-47.75	6.90	14.25	Vertical	-40.4	-13	27.4	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 vertical position.

LTE Band 13 QPSK 10MHz CH-High, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1564.0	-62.45	2.00	10.15	Vertical	-54.3	-40	14.3	0
3	2346.0	-52.44	2.51	11.05	Vertical	-43.9	-13	30.9	135
4	3128.0	-56.65	4.20	11.15	Vertical	-49.7	-13	36.7	225
5	3910.0	-54.25	5.20	11.15	Vertical	-48.3	-13	35.3	315
6	4692.0	-53.95	5.50	11.95	Vertical	-47.5	-13	34.5	270
7	5474.0	-53.55	5.70	13.55	Vertical	-45.7	-13	32.7	225
8	6256.0	-52.05	6.30	13.75	Vertical	-44.6	-13	31.6	135
9	7038.0	-49.25	6.80	13.85	Vertical	-42.2	-13	29.2	225
10	7820.0	-48.15	6.90	14.25	Vertical	-40.8	-13	27.8	90

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

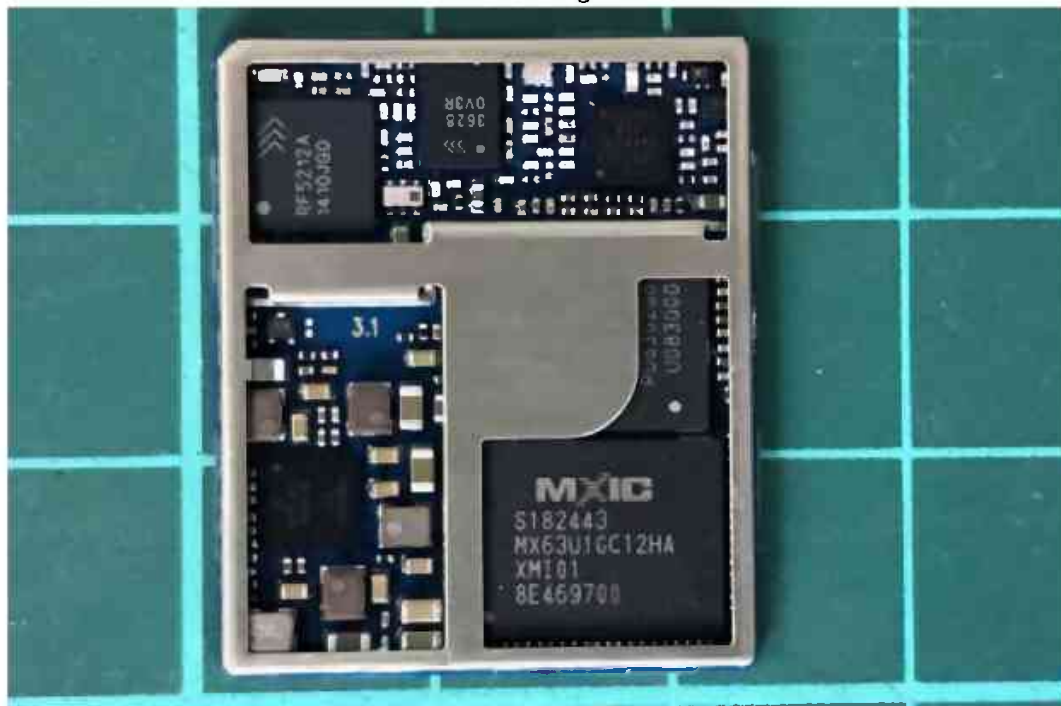
Name	Manufacturer	Type	Serial Number	Calibration Date	Expiration Time
Base Station Simulator	R&S	CMW500	150415	2017-05-14	2018-05-13
Power Splitter	Hua Xiang	SHX-GF2-2-13	10120101	2017-05-14	2018-05-13
Universal Radio Communication Tester	Agilent	E5515C	MY48367192	2017-05-14	2018-05-13
Spectrum Analyzer	Agilent	N9010A	MY47191109	2017-05-14	2018-05-13
Signal Analyzer	R&S	FSV30	100815	2016-12-16	2017-12-15
Signal generator	R&S	SMB 100A	102594	2017-05-14	2018-05-13
EMI Test Receiver	R&S	ESCI	100948	2017-05-20	2018-05-19
Trilog Antenna	SCHWARZBECK	VUBL 9163	9163-201	2014-12-06	2017-12-05
Horn Antenna	R&S	HF907	100126	2014-12-06	2017-12-05
Horn Antenna	ETS-Lindgren	3160-09	00102643	2015-01-30	2018-01-29
Climatic Chamber	Re Ce	PT-30B	20101891	2015-07-18	2018-07-17
RF Cable	Agilent	SMA 15cm	0001	2017-02-06	2017-08-05
Preamplifier	R&S	SCU18	102327	2017-06-18	2018-06-17

ANNEX A: EUT Appearance and Test Setup

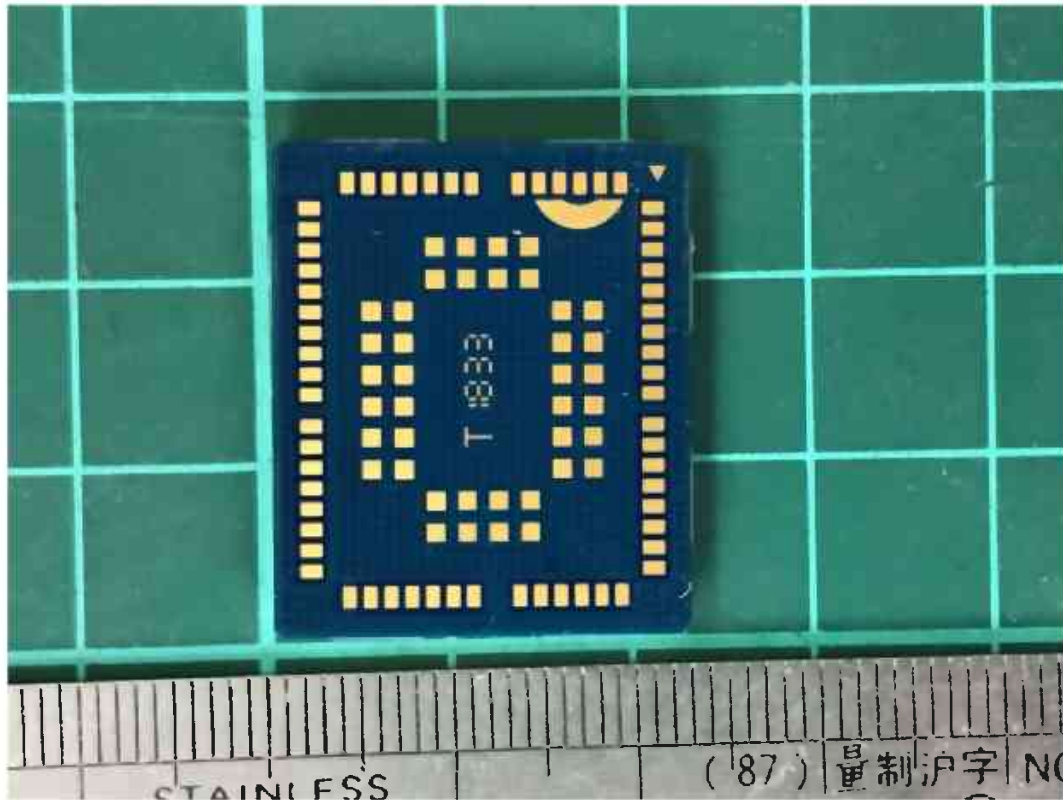
A.1 EUT Appearance



shielding



No shielding
Front Side



Back Side
a: EUT
Picture 1 EUT

A.2 Test Setup



Picture 2: Radiated Spurious Emissions Test setup

ANNEX B: Product Change Description



BG96 R1.1 & BG96 R1.2 Differences Statement

LTE Module Series

PCB Rev.: R1.2

Date: 2018-10-08



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Based on BG96 R1.1, BG96 R1.2 has enabled VDD_QFPROM_PRG hardware interface, which is connected to ground directly in BG96 R1.1, so as to support secure boot feature.

Some points are highlighted as below:

- BG96 R1.1 and R1.2 versions share the same hardware architecture and key components.
- BG96 R1.1 and R1.2 versions share the same pinout placements.
- Secure boot is enabled through a set of hardware fuses in BG96 R1.2. For the code to be executed, it must be signed by the trusted entity identified in the hardware fuses, so we have to enable VDD_QFPROM_PRG hardware interface.
- The new hardware will be used with the new software baseline TX3.0, and the software version is R04Axx.

The details are illustrated as below:

1. What's Secure Boot

Secure boot refers to the bootup sequence that establishes a trusted platform for secure applications. It starts as an immutable sequence that validates the origin of the code using cryptographic authentication so only authorized software can be executed. The bootup sequence places the device in a known security state and protects against binary manipulation of software and reflashing attacks.

A secure boot system adds cryptographic checks to each stage of the boot up process. This process asserts the authenticity of all secure software images that are executed by the device. This additional check prevents any unauthorized or maliciously modified software from running on the device. Secure boot is enabled through a set of hardware fuses. For the code to be executed, it must be signed by the trusted entity identified in the hardware fuses.

In simple terms, secure boot ensures running of signed/authorized software on the module, and unsigned/unauthorized software will not be allowed to run.

2. Enabled VDD_QFPROM_PRG Hardware Interface

A. BG96 R1.1 does not support secure boot function

The VDD_QFPROM_PRG (N19) pin of baseband chip is for secure boot function. In BG96 R1.1, this pin is connected to ground directly, which means secure boot function is disabled.

B. BG96 R1.2 supports secure boot function

According to Qualcomm's suggestion and our customers' requirements, the VDD_QFPROM_PRG pin is connected to VREG_L3_1P8(1.8V) in BG96 R1.2 so as to enable secure boot function.

The following pictures show the schematic and PCB designs of BG96 R1.1 and R1.2.

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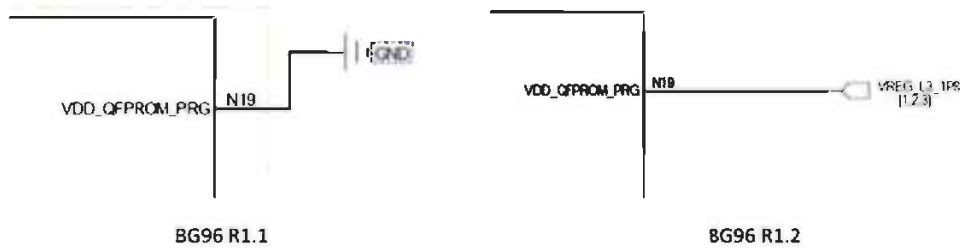



Figure 1: Schematic Designs of BG96 R1.1 and R1.2

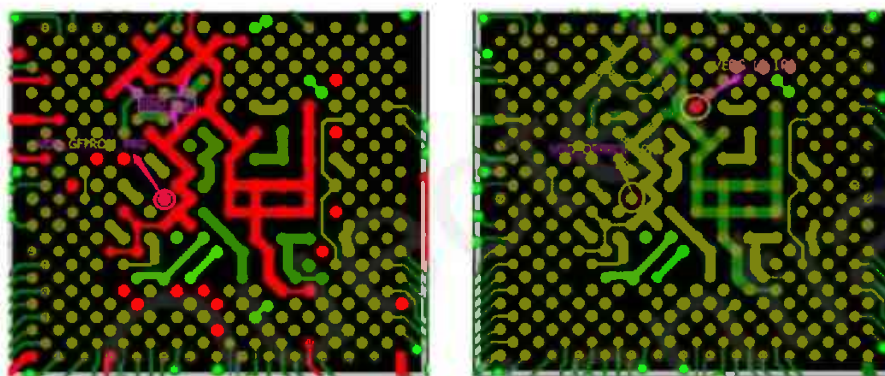


Figure 2: PCB Designs of BG96 R1.1 and R1.2

3. TX2.0 vs TX3.0

The biggest difference of TX3.0 as compared with TX2.0 lies in the adding of VoLTE and handover features. Since VoLTE environment has not been built so maturely yet, the main concern of customers is the handover function.

For TX2.0, re-selection is supported, while handover is not supported.

BG96 supports re-selection mechanism, which means when disconnection happens during cell handover, the module will reconnect automatically. This process lasts for about 1 (or 2) seconds, and the data transmitted (may happen by coincidence) will be buffered and resent once the reconnection established. So, the disconnection is generally imperceptible to customers.

- If the data transmission occurs at the moment that cell handover occurs coincidentally, the connection is kept with handover function; the connection is broken and re-connection established in about 1 (or 2) seconds with re-selection. This causes nearly no difference for data telematics because users even cannot feel this disconnection, whereas VoLTE might be affected because of the short time disconnection.



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- If the data transmission occurs in the period that no cell alternates, then no any influence will be caused.

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