



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-R2

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 CFR 47 Part 24E (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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Summary of measurement results

No.	Test Case	Clause in FCC rules	Verdict
1	RF power output	2.1046	PASS
2	Effective Isotropic Radiated power	24.232(c)	PASS
3	Occupied Bandwidth	2.1049	PASS
4	Band Edge Compliance	2.1051 /24.238(a)	PASS
5	Peak-to-Average Power Ratio	24.232/KDB 971168 D01(5.7)	PASS
6	Frequency Stability	2.1055 / 24.235	PASS
7	Spurious Emissions at Antenna Terminals	2.1051 / 24.238(a)	PASS
8	Radiates Spurious Emission	2.1053 / 24.238(a)	PASS
Date of Testing: June 24 ,2017~July 3 ,2017 and December 20, 2018 ~ February 13, 2019			
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-R2) is a variant model of BG96 (Report No: RXA1706-0199RF02R1). Test items tested see the table below. The detailed product change description please refers to the ANNEX B.

Band	Original (RXA1706-0199RF02R1)	Variant (R1811A0536-R2)
GSM1900	Pass	Refer to the Original
LTE Band 2	Pass	Pass
LTE Band 25	NA	Pass

1. Test Laboratory

1.1. Notes of the test report

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

1.2. Test facility

CNAS (accreditation number: L2264)

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

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

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

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

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)		
Antenna Gain	4 dBi		
Test Mode(s)	GSM1900; LTE Band 2; LTE Band 25		
Test Modulation	(GSM)GMSK,8PSK; (LTE)QPSK,16QAM		
LTE Category	M1		
Maximum E.I.R.P	GSM 1900:	32.43 dBm	
	LTE Band 2:	29.66 dBm	
	LTE Band 25:	22.61 dBm	
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)	Band	Tx (MHz)	Rx (MHz)
	GSM1900	1850 ~ 1910	1930 ~ 1990
	LTE Band 2	1850 ~ 1910	1930 ~ 1990
	LTE Band 25	1850 ~ 1915	1930 ~ 1995
Note: 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:

FCC CFR47 Part 2 (2018)

FCC CFR 47 Part 24E (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 stand-up position (Z axis), lie-down position (X, Y axis). Receiver antenna polarization (horizontal and vertical), the worst emission was found in position (X axis, horizontal polarization) and the worst case was recorded.

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

Subsequently, only the worst case emissions are reported.

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

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

Test items	Modes/Modulation
	GSM 1900
RF power output	GPRS EGPRS
Effective Isotropic Radiated power	GPRS(1Tx slot) EGPRS(1Tx slot)
Occupied Bandwidth	GPRS(1Tx slot) EGPRS(1Tx slot)
Band Edge Compliance	GPRS(1Tx slot) EGPRS(1Tx slot)
Peak-to-Average Power Ratio	GPRS(1Tx slot) EGPRS(1Tx slot)
Frequency Stability	GPRS(1Tx slot) EGPRS(1Tx slot)
Spurious Emissions at Antenna Terminals	GPRS(1Tx slot)
Radiates Spurious Emission	GPRS(1Tx slot)



Test modes are chosen to be reported as the worst case configuration below for LTE Band 2/25

Test items	Mode	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 2	O	O	O	O	O	O	O	O	O	O	O	O	O	O
	LTE 25	O	O	O	O	O	O	O	O	O	O	O	O	O	O
Effective Isotropic Radiated power	LTE 2	O	O	O	O	O	O	O	O	-	-	O	O	O	O
	LTE 25	O	O	O	O	O	O	O	O	-	-	O	O	O	O
Occupied Bandwidth	LTE 2	O	O	O	O	O	O	O	O	-	-	O	-	O	-
	LTE 25	O	O	O	O	O	O	O	O	-	-	O	-	O	-
Band Edge Compliance	LTE 2	O	O	O	O	O	O	O	O	O	-	O	O	-	O
	LTE 25	O	O	O	O	O	O	O	O	O	-	O	O	-	O
Peak-to-Average Power Ratio	LTE 2	O	O	O	O	O	O	O	O	-	-	O	-	O	-
	LTE 25	O	O	O	O	O	O	O	O	-	-	O	-	O	-
Frequency Stability	LTE 2	O	O	O	O	O	O	O	O	-	-	O	-	O	-
	LTE 25	O	O	O	O	O	O	O	O	-	-	O	-	O	-
Conducted Spurious Emissions	LTE 2	O	O	O	O	O	O	O	-	O	-	-	O	O	O
	LTE 25	O	O	O	O	O	O	O	-	O	-	-	O	O	O
Radiates Spurious Emission	LTE 2	-	-	-	-	-	O	O	-	O	-	-	O	O	O
	LTE 25	-	-	-	-	-	O	O	-	O	-	-	O	O	O
Note		1. The mark "O" means that this configuration is chosen for testing. 2. The mark "-" means that this configuration is not testing.													

5. Test Case Results

5.1.RF Power Output

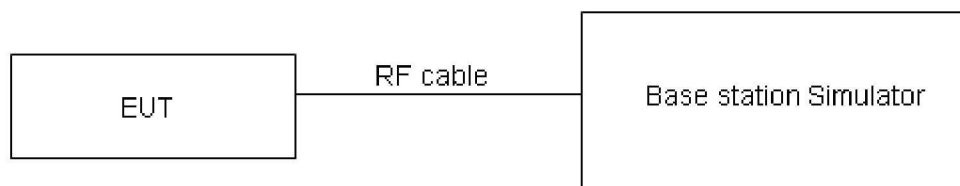
Ambient condition

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**

GSM 1900		Conducted Power(dBm)		
		Channel 512	Channel 661	Channel 810
		1850.2(MHz)	1880(MHz)	1909.8(MHz)
GPRS (GMSK)	1TXslot	29.76	29.66	29.46
	2TXslots	29.65	29.57	29.38
	3TXslots	29.51	29.45	29.27
	4TXslots	29.42	29.32	29.16
EGPRS (8PSK)	1TXslot	26.06	25.88	25.84
	2TXslots	25.89	25.81	25.68
	3TXslots	25.78	25.64	25.49
	4TXslots	25.57	25.45	25.38

Mode	Bandwidth	Channel/ Frequency(MHz)	RB# RBstart	Index	Conducted Power (dBm)	
					QPSK	16QAM
Band2	1.4MHz	18607/1850.7	1#0	0	23.25	23.80
			6#0	0	23.42	23.52
		18900/1880	1#0	0	23.37	23.83
			6#0	0	23.55	23.72
		19193/1909.3	1#5	0	23.73	23.84
			6#0	0	23.70	23.74
	3MHz	18615/1851.5	1#0	0	23.84	23.83
			6#0	0	23.74	23.55
		18900/1880	1#0	0	23.41	23.85
			6#0	0	23.59	23.76
		19185/1908.5	1#5	1	23.76	23.87
			6#0	1	23.73	23.77
	5MHz	18625/1852.5	1#0	0	23.24	23.80
			6#0	0	23.43	23.53
		18900/1880	1#0	0	23.39	23.81
			6#0	0	23.58	23.72
		19175/1907.5	1#5	3	23.72	23.84
			6#0	3	23.71	23.72
	10MHz	18650/1855	1#0	0	23.26	23.82
			4#0	0	23.51	23.56
		18900/1880	1#0	0	23.40	23.84
			4#0	0	23.60	23.77
		19150/1905	1#5	7	23.75	23.86
			4#2	7	23.75	23.76
	15MHz	18675/1857.5	1#0	0	23.25	23.77
			6#0	0	23.49	23.53



		18900/1880	1#0	0	23.36	23.82
			6#0	0	23.56	23.72
		19125/1902.5	1#5	11	23.73	23.84
			6#0	11	23.70	23.72
	20MHz	18700/1860	1#0	0	23.22	23.75
			6#0	0	23.46	23.51
		18900/1880	1#0	0	23.32	23.78
			6#0	0	23.51	23.68
		19100/1900	1#5	15	23.70	23.79
			6#0	15	23.66	23.69



Mode	Bandwidth	Channel/ Frequency(MHz)	RB# RBstart	Index	Conducted Power (dBm)	
					QPSK	16QAM
Band 25	1.4MHz	26047/1850.7	1#0	0	23.41	24.08
			6#0	0	23.53	23.64
		26365/1882.5	1#0	0	24.10	23.94
			6#0	0	23.53	23.56
		26683/1914.3	1#5	0	23.50	23.98
			6#0	0	23.62	23.66
	3MHz	26055/1851.5	1#0	0	23.32	23.88
			6#0	0	23.63	23.56
		26365/1882.5	1#0	0	23.79	23.02
			6#0	0	23.63	24.00
		26675/1913.5	1#5	1	24.02	23.20
			6#0	1	23.70	24.12
	5MHz	26065/1852.5	1#0	0	23.77	23.25
			6#0	0	23.66	24.17
		26365/1882.5	1#0	0	23.69	23.55
			6#0	0	23.60	24.24
		26665/1912.5	1#5	0	23.70	24.52
			6#0	3	23.76	23.86
	10MHz	26090/1855	1#0	0	23.79	23.38
			4#0	0	24.00	24.37
		26365/1882.5	1#0	0	23.50	24.41
			4#0	0	23.66	23.47
		26640/1910	1#5	4	23.65	24.53
			4#2	7	23.85	23.55
	15MHz	26115/1857.5	1#0	0	23.85	23.42
			6#0	0	23.72	24.09
		26365/1882.5	1#0	0	23.56	24.41
			6#0	0	23.68	23.90
		26615/1907.5	1#5	8	23.62	24.50
			6#0	11	23.81	23.80
	20MHz	26140/1860	1#0	0	23.81	23.41
			6#0	0	23.81	24.24
		26365/1882.5	1#0	0	23.58	24.42
			6#0	0	23.78	23.74
		26590/1905	1#5	12	23.99	23.63
			6#0	15	23.84	24.28

5.2. Effective Isotropic Radiated Power

Ambient condition

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

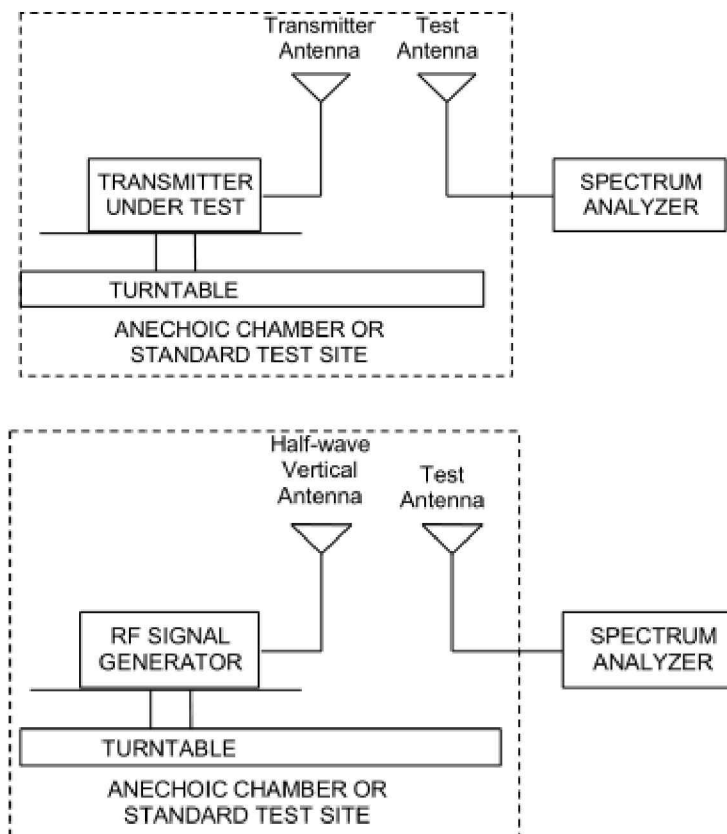
Methods of Measurement

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

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

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

Test setup



Limits

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

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

Limit	$\leq 2 \text{ W}$ (33 dBm)
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Measurement Uncertainty

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

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.

Mode	Polarization	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Conclusion
GPRS 1900	H	1850.2	31.88	33	Pass
	H	1880	31.82	33	Pass
	H	1909.8	32.43	33	Pass
EGPRS 1900	H	1850.2	28.06	33	Pass
	H	1880	27.88	33	Pass
	H	1909.8	27.84	33	Pass

LTE Band 2							
Bandwidth	Channel/ Frequency (MHz)	Polarization	RB	Index	EIRP (dBm)	Limit (dBm)	Conclusion
1.4 MHz (QPSK)	18607/1850.7	Horizontal	1#0	0	28.96	33	Pass
	18900/1880	Horizontal	1#2	0	29.66	33	Pass
	19193/1909.3	Horizontal	1#5	0	29.38	33	Pass
3 MHz (QPSK)	18615/1851.5	Horizontal	1#0	0	29.27	33	Pass
	18900/1880	Horizontal	1#5	0	29.54	33	Pass
	19185/1908.5	Horizontal	1#5	1	29.45	33	Pass
5 MHz (QPSK)	18625/1852.5	Horizontal	1#0	0	28.76	33	Pass
	18900/1880	Horizontal	1#5	1	28.96	33	Pass
	19175/1907.5	Horizontal	1#5	3	29.00	33	Pass
10 MHz (QPSK)	18650/1855	Horizontal	4#0	0	27.74	33	Pass
	18900/1880	Horizontal	4#2	3	28.31	33	Pass
	19150/1905	Horizontal	4#2	7	28.25	33	Pass
15 MHz (QPSK)	18675/1857.5	Horizontal	1#0	0	27.23	33	Pass
	18900/1880	Horizontal	1#5	5	27.53	33	Pass
	19125/1902.5	Horizontal	1#5	11	27.53	33	Pass
20 MHz (QPSK)	18700/1860	Horizontal	6#0	0	26.34	33	Pass
	18900/1880	Horizontal	6#0	7	26.74	33	Pass
	19100/1900	Horizontal	6#0	15	26.67	33	Pass
1.4 MHz (16QAM)	18607/1850.7	Horizontal	1#0	0	28.65	33	Pass
	18900/1880	Horizontal	1#2	0	29.30	33	Pass
	19193/1909.3	Horizontal	1#5	0	29.05	33	Pass
3 MHz (16QAM)	18615/1851.5	Horizontal	1#0	0	29.00	33	Pass
	18900/1880	Horizontal	1#5	0	29.22	33	Pass
	19185/1908.5	Horizontal	1#5	1	29.15	33	Pass
5 MHz	18625/1852.5	Horizontal	1#0	0	28.42	33	Pass



(16QAM)	18900/1880	Horizontal	1#5	1	28.66	33	Pass
	19175/1907.5	Horizontal	1#5	3	28.69	33	Pass
10 MHz (16QAM)	18650/1855	Horizontal	4#0	0	27.42	33	Pass
	18900/1880	Horizontal	4#2	3	28.01	33	Pass
	19150/1905	Horizontal	4#2	7	27.95	33	Pass
15 MHz (16QAM)	18675/1857.5	Horizontal	1#0	0	26.92	33	Pass
	18900/1880	Horizontal	1#5	5	27.22	33	Pass
	19125/1902.5	Horizontal	1#5	11	27.22	33	Pass
20 MHz (16QAM)	18700/1860	Horizontal	6#0	0	26.04	33	Pass
	18900/1880	Horizontal	6#0	7	26.41	33	Pass
	19100/1900	Horizontal	6#0	15	26.35	33	Pass

LTE Band 25								
bandwidth	Channel	Frequency (MHz)	Polarization	RB	Index	EIRP (dBm)	Limit (dBm)	Conclusion
1.4 MHz (QPSK)	Low	1850.7	Horizontal	1#0	0	22.16	33	Pass
	Mid	1882.5	Horizontal	1#2	0	22.06	33	Pass
	High	1914.3	Horizontal	1#5	0	21.27	33	Pass
3 MHz (QPSK)	Low	1851.5	Horizontal	1#0	0	22.23	33	Pass
	Mid	1882.5	Horizontal	1#5	0	22.12	33	Pass
	High	1913.5	Horizontal	1#5	1	21.68	33	Pass
5 MHz (QPSK)	Low	1852.5	Horizontal	1#0	0	22.37	33	Pass
	Mid	1882.5	Horizontal	1#5	1	22.24	33	Pass
	High	1912.5	Horizontal	1#5	3	21.37	33	Pass
10 MHz (QPSK)	Low	1855	Horizontal	4#0	0	22.49	33	Pass
	Mid	1882.5	Horizontal	4#2	3	21.89	33	Pass
	High	1910	Horizontal	4#2	7	21.45	33	Pass
15 MHz (QPSK)	Low	1857.5	Horizontal	1#0	0	22.59	33	Pass
	Mid	1882.5	Horizontal	1#5	5	22.03	33	Pass
	High	1907.5	Horizontal	1#5	11	21.47	33	Pass
20 MHz (QPSK)	Low	1860	Horizontal	6#0	0	22.61	33	Pass
	Mid	1882.5	Horizontal	6#0	7	22.29	33	Pass
	High	1905	Horizontal	6#0	15	21.11	33	Pass
1.4 MHz (16QAM)	Low	1850.7	Horizontal	1#0	0	21.67	33	Pass
	Mid	1882.5	Horizontal	1#2	0	21.59	33	Pass
	High	1914.3	Horizontal	1#5	0	20.83	33	Pass
3 MHz (16QAM)	Low	1851.5	Horizontal	1#0	0	21.76	33	Pass
	Mid	1882.5	Horizontal	1#5	0	21.68	33	Pass
	High	1913.5	Horizontal	1#5	1	21.09	33	Pass
5 MHz	Low	1852.5	Horizontal	1#0	0	21.77	33	Pass



LTE Band 25								
bandwidth	Channel	Frequency (MHz)	Polarization	RB	Index	EIRP (dBm)	Limit (dBm)	Conclusion
(16QAM)	Mid	1882.5	Horizontal	1#5	1	21.69	33	Pass
	High	1912.5	Horizontal	1#5	3	20.81	33	Pass
10 MHz (16QAM)	Low	1855	Horizontal	4#0	0	22.01	33	Pass
	Mid	1882.5	Horizontal	4#2	3	21.39	33	Pass
	High	1910	Horizontal	4#2	7	20.97	33	Pass
15 MHz (16QAM)	Low	1857.5	Horizontal	1#0	0	21.93	33	Pass
	Mid	1882.5	Horizontal	1#5	5	21.51	33	Pass
	High	1907.5	Horizontal	1#5	11	21.04	33	Pass
20 MHz (16QAM)	Low	1860	Horizontal	6#0	0	22.14	33	Pass
	Mid	1882.5	Horizontal	6#0	7	21.67	33	Pass
	High	1905	Horizontal	6#0	15	20.51	33	Pass