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.

Peng Tao

Performed by: Peng Tao

Kai Xu

Approved by: Kai Xu

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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.
Address:	No.145, Jintang Rd, Tangzhen Industry Park, Pudong Shanghai, China
City:	Shanghai
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E-mail:	xukai@ta-shanghai.com

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)		
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 detailin 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

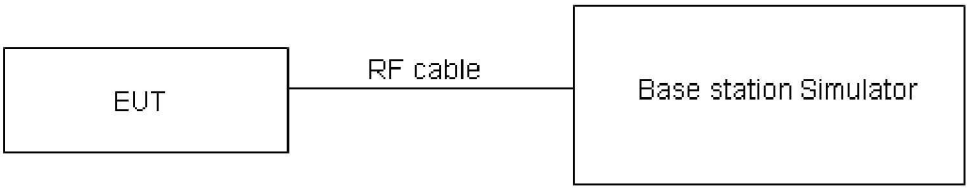
Ambient condition

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

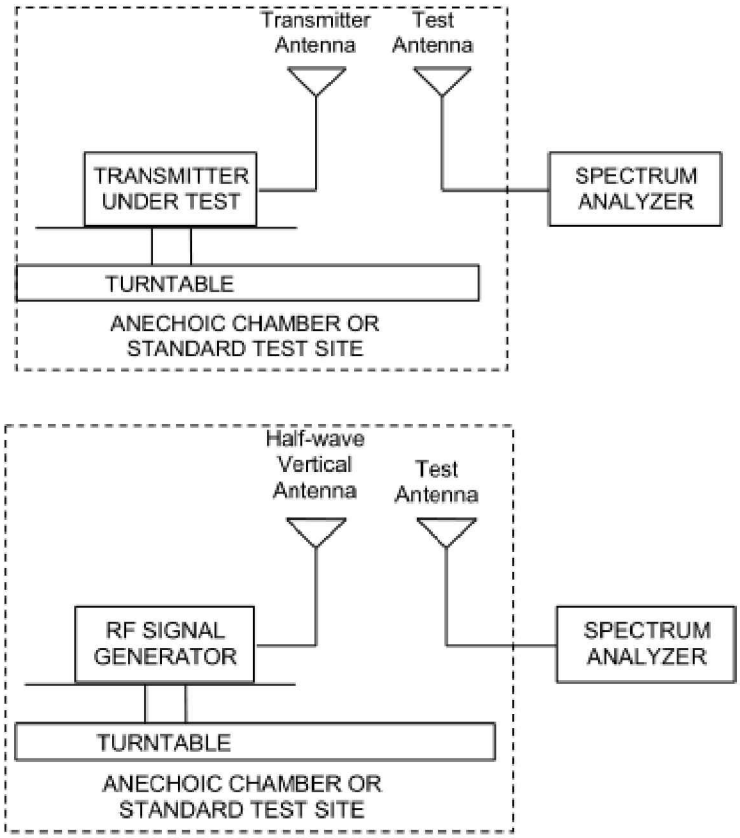
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

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 = Generator Output Power (dBm) – 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 (dBm) = LVL (dBm) + LOSS (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 (dBm) = Output Power (dBm) - Losses (dB) + Antenna Gain (dBi)
where:dBd refers to gain relative to an ideal dipole.
EIRP (dBm) = ERP (dBm) + 2.15 (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	≤ 3 W (34.77 dBm)
Part 27.50(c)(10)Limit	≤ 3 W (34.77 dBm)
Part 27.50(d)(4)Limit	≤ 1 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 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