



RF TEST REPORT

Applicant	Bullitt Group
FCC ID	ZL5S62
Product	4G Mobile Phone
Brand	CAT
Model	S62
Report No.	R2009A0612-R1
Issue Date	February 8, 2021

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC CFR47 Part 2 (2019)/ FCC CFR47 Part 27C (2019)**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

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Summary of Measurement Results

Number	Test Case	Clause in FCC rules	Verdict
1	RF Power Output and Effective Isotropic Radiated Power	2.1046/27.50(h)(2)	PASS
2	Occupied Bandwidth	2.1049	PASS
3	Band Edge Compliance	27.53(m)	PASS
4	Peak-to-Average Power Ratio	27.50(d)/KDB971168 D01(5.7)	PASS
5	Frequency Stability	2.1055 / 27.54	PASS
6	Spurious Emissions at Antenna Terminals	2.1051 /27.53(m)	PASS
7	Radiates Spurious Emission	2.1053 /27.53(m)	PASS

Date of Testing: December 29, 2020 ~ February 5, 2021

Date of Sample Received: January 12, 2021

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

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

All indications of Pass/Fail in this report are opinions expressed by TA Technology (Shanghai) Co., Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only.



1 Test Laboratory

1.1 Notes of the Test Report

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

1.2. Test facility

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

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

A2LA (Certificate Number: 3857.01)

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

1.3 Testing Location

Company: TA Technology (Shanghai) Co., Ltd.
Address: No.145, Jintang Rd, Tangzhen Industry Park, Pudong Shanghai, China
City: Shanghai
Post code: 201201
Country: P. R. China
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Website: <http://www.ta-shanghai.com>
E-mail: xukai@ta-shanghai.com

2 General Description of Equipment under Test

2.1 Applicant and Manufacturer Information

Applicant	Bullitt Group
Applicant address	One Valpy, Valpy Street, Reading, Berkshire, RG1 1AR, United Kingdom
Manufacturer	Bullitt Group
Manufacturer address	One Valpy, Valpy Street, Reading, Berkshire, RG1 1AR, United Kingdom

2.2 General information

EUT Description			
Model	S62		
IMEI	355418110039422		
Hardware Version	Q190_V1		
Software Version	LTE_S02111.10_N_S62_0		
Power Supply	Battery / AC adapter		
Antenna Type	Fixed Internal		
Antenna Gain	1.03dBi		
Test Mode(s)	CA-41C		
Test Modulation	QPSK, 16QAM, 64QAM;		
Maximum E.I.R.P.	CA-41C:	26.31dBm	
Rated Power Supply Voltage:	3.8V		
Extreme Voltage	Minimum: 3.23V	Maximum: 4.37V	
Extreme Temperature	Lowest: -30°C	Highest: +50°C	
Operating Voltage	Minimum: 3.0V	Maximum: 4.35V	
Operating Temperature	Lowest: 10°C	Highest: +45°C	
Operating Frequency Range(s)	Mode	Tx (MHz)	Rx (MHz)
	CA-41C	2496 ~ 2690	2496 ~ 2690
EUT Accessory			
Adapter	Manufacturer: Jiangxi Jian Aohai Technology Co.,Ltd. Model: A138-120150C-US1		
Battery	Manufacturer: Hunan Gaoyuan Battery Co., Ltd. Model: XQ6602G		
Note: 1. The EUT is sent from the applicant to TA and the information of the EUT is declared by the applicant.			



3 Applied Standards

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

Test standards:

FCC CFR47 Part 27C (2019)

ANSI C63.26 (2015)

Reference standard:

FCC CFR47 Part 2 (2019)

KDB 971168 D01 Power Meas License Digital Systems v03r01

4 Test Configuration

Radiated measurements are performed by rotating the EUT in three different orthogonal test planes. EUT stand-up position (Z axis), lie-down position (X, Y axis). Receiver antenna polarization (horizontal and vertical), the worst emission was found in position (X axis, horizontal polarization) 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 CA-41C 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:

Test modes are chosen to be reported as the worst case configuration below for CA-41C:

Test items	Bandwidth (MHz)				Modulation			RB			Test Channel		
	5	10	15	20	QPSK	16QAM	64QAM	1	50%	100%	L	M	H
RF Power Output and Effective Isotropic Radiated Power	O	O	O	O	O	O	O	O	O	O	O	O	O
Occupied Bandwidth	O	O	O	O	O	O	O	-	-	O	O	O	O
Band Edge Compliance	O	O	O	O	O	O	O	O	-	O	O	-	O
Peak-to-Average Power Ratio	O	O	O	O	O	O	O	-	-	O	O	O	O
Frequency Stability	O	O	O	O	O	O	O	O	-	-	-	O	-
Spurious Emissions at Antenna Terminals	O	O	O	O	O	-	-	O	-	-	O	O	O
Radiates Spurious Emission	O	-	-	O	O	-	-	O	-	-	-	O	-
Note	1. The mark "O" means that this configuration is chosen for testing. 2. The mark "-" means that this configuration is not testing.												

5 Test Case Results

5.1 RF Power Output and Effective Isotropic Radiated Power

Ambient condition

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

Methods of Measurement

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

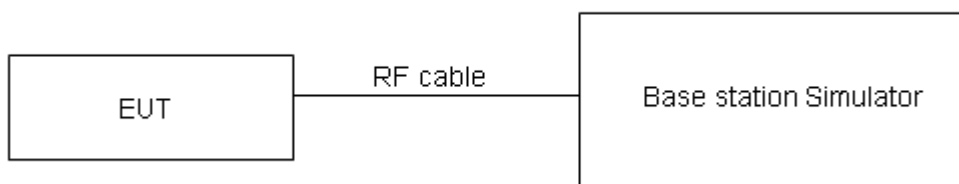
ERP can then be calculated as follows:

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

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

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

Test Setup



Limits

No specific RF power output requirements in part 2.1046.

Rule Part 27.50(h) (2) specifies that “Mobile and other user stations. Mobile stations are limited to 2.0 watts EIRP. All user stations are limited to 2.0 watts transmitter output power.”

Part 27.50(h)(2) Limit	$\leq 2 \text{ W}$ (33 dBm)
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Measurement Uncertainty

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



Test Results

CA_41C	PCC	SCC	PCC RB		SCC1 RB		Conducted Power (dBm)			EIRP (dBm)		
	Frequency (MHz)	Frequency (MHz)	Size	Off set	Size	Off set	QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
5MHz+20MHz	2499.3	2511	1	24	1	0	24.79	25.12	23.10	25.82	26.15	24.13
			25	0	100	0	23.81	23.01	23.04	24.84	24.04	24.07
	2583.8	2595.5	1	24	1	0	24.77	25.05	22.96	25.80	26.08	23.99
			25	0	100	0	23.75	22.85	22.95	24.78	23.88	23.98
	2668.3	2680	1	24	1	0	24.96	25.20	23.14	25.99	26.23	24.17
			25	0	100	0	23.93	23.02	23.04	24.96	24.05	24.07
20MHz+5MHz	2506	2517.7	1	99	1	0	24.83	25.26	23.02	25.86	26.29	24.05
			1	0	1	24	17.39	17.91	17.63	18.42	18.94	18.66
			100	0	25	0	23.87	22.93	23.03	24.90	23.96	24.06
	2590.5	2602.2	1	99	1	0	24.91	25.28	22.97	25.94	26.31	24.00
			1	0	1	24	17.25	17.89	17.40	18.28	18.92	18.43
			100	0	25	0	23.92	22.98	22.97	24.95	24.01	24.00
	2675	2686.7	1	99	1	0	24.95	25.17	23.13	25.98	26.20	24.16
			1	0	1	24	17.34	18.07	17.81	18.37	19.10	18.84
			100	0	25	0	23.91	23.04	23.03	24.94	24.07	24.06
10MHz+20MHz	2501.5	2515.9	1	49	1	0	24.39	25.10	23.25	25.42	26.13	24.28
			50	0	100	0	23.75	23.15	23.17	24.78	24.18	24.20
	2583.6	2598	1	49	1	0	24.56	25.01	23.09	25.59	26.04	24.12
			50	0	100	0	23.69	22.75	22.81	24.72	23.78	23.84
	2665.6	2680	1	49	1	0	25.03	25.18	23.23	26.06	26.21	24.26
			50	0	100	0	23.85	23.17	23.15	24.88	24.20	24.18
20MHz+10MHz	2506	2520.4	1	99	1	0	24.28	25.08	23.19	25.31	26.11	24.22
			100	0	50	0	23.74	23.14	23.16	24.77	24.17	24.19
	2588.1	2602.5	1	99	1	0	24.54	24.98	23.05	25.57	26.01	24.08
			100	0	50	0	23.59	22.76	22.88	24.62	23.79	23.91
	2670.1	2684.5	1	99	1	0	24.91	25.10	23.22	25.94	26.13	24.25
			100	0	50	0	23.75	23.18	23.09	24.78	24.21	24.12
15MHz+15MHz	2503.5	2518.5	1	74	1	0	24.39	24.88	23.15	25.42	25.91	24.18
			75	0	75	0	23.88	23.19	23.18	24.91	24.22	24.21
	2585.5	2600.5	1	74	1	0	24.59	24.89	22.97	25.62	25.92	24.00
			75	0	75	0	23.75	22.63	22.75	24.78	23.66	23.78
	2667.5	2682.5	1	74	1	0	24.73	24.98	23.19	25.76	26.01	24.22
			75	0	75	0	23.85	23.42	23.21	24.88	24.45	24.24
15MHz+20MHz	2503.8	2520.9	1	74	1	0	24.19	25.01	23.29	25.22	26.04	24.32
			75	0	100	0	23.83	23.21	23.26	24.86	24.24	24.29
	2583.3	2600.4	1	74	1	0	24.71	25.15	23.17	25.74	26.18	24.20
			75	0	100	0	23.59	22.76	22.88	24.62	23.79	23.91
	2662.9	2680	1	74	1	0	24.91	25.10	23.22	25.94	26.13	24.25
			75	0	100	0	23.83	23.21	23.26	24.86	24.24	24.29



			75	0	100	0	23.75	23.18	23.09	24.78	24.21	24.12
20MHz+ 15MHz	2506	2523.1	1	99	1	0	24.48	25.07	23.15	25.51	26.10	24.18
			100	0	75	0	23.77	23.14	23.19	24.80	24.17	24.22
	2585.6	2602.7	1	99	1	0	24.55	24.89	22.97	25.58	25.92	24.00
			100	0	75	0	23.75	22.71	22.75	24.78	23.74	23.78
	2665.1	2682.2	1	99	1	0	23.85	23.41	23.21	24.88	24.44	24.24
			100	0	75	0	23.85	23.19	23.15	24.88	24.22	24.18
20MHz+ 20MHz	2506	2525.8	1	99	1	0	24.67	25.12	23.03	25.70	26.15	24.06
			1	0	1	99	17.44	17.95	17.76	18.47	18.98	18.79
			100	0	100	0	23.98	22.94	22.98	25.01	23.97	24.01
	2583.1	2602.9	1	99	1	0	24.78	25.14	23.13	25.81	26.17	24.16
			1	0	1	99	17.14	17.78	17.59	18.17	18.81	18.62
			100	0	100	0	23.85	22.92	22.89	24.88	23.95	23.92
	2660.2	2680	1	99	1	0	24.87	25.18	23.11	25.90	26.21	24.14
			1	0	1	99	17.52	18.13	17.84	18.55	19.16	18.87
			100	0	100	0	23.98	23.15	23.01	25.01	24.18	24.04

5.2 Occupied Bandwidth

Ambient condition

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

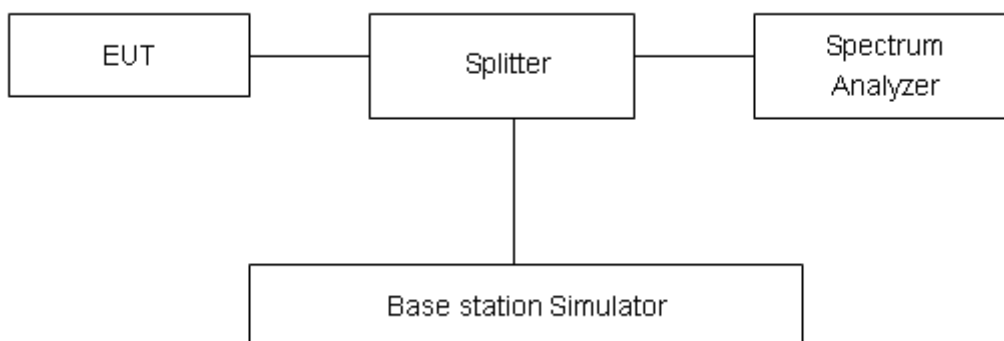
Method of Measurement

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

RBW is set to 1 MHz, VBW is set to 3 MHz for CA-41C.

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

CA_41C	PCC		SCC1		PCC RB	SCC1 RB	Bandwidth (MHz)	
	Channel	Frequency (MHz)	Channel	Frequency (MHz)			99% Power	-26dBc
CA_41C_5MHz+20MHz_QPSK	40528	2583.8	40645	2595.5	25#0	100#0	23.502	25.35
CA_41C_5MHz+20MHz_16QAM	40528	2583.8	40645	2595.5	25#0	100#0	23.359	25.10
CA_41C_5MHz+20MHz_64QAM	40528	2583.8	40645	2595.5	25#0	100#0	23.364	25.17
CA_41C_20MHz+5MHz_QPSK	40595	2590.5	40712	2602.2	100#0	25#0	23.327	25.22
CA_41C_20MHz+5MHz_16QAM	40595	2590.5	40712	2602.2	100#0	25#0	23.321	25.11
CA_41C_20MHz+5MHz_64QAM	40595	2590.5	40712	2602.2	100#0	25#0	23.354	25.20
CA_41C_10MHz+15MHz_QPSK	40549	2585.9	40669	2597.9	50#0	75#0	23.590	25.63
CA_41C_10MHz+15MHz_16QAM	40549	2585.9	40669	2597.9	50#0	75#0	23.567	25.48
CA_41C_10MHz+15MHz_64QAM	40549	2585.9	40669	2597.9	50#0	75#0	23.574	25.50
CA_41C_15MHz+10MHz_QPSK	40571	2588.1	40691	2600.1	75#0	50#0	23.559	25.67
CA_41C_15MHz+10MHz_16QAM	40571	2588.1	40691	2600.1	75#0	50#0	23.602	25.56
CA_41C_15MHz+10MHz_64QAM	40571	2588.1	40691	2600.1	75#0	50#0	23.619	25.59
CA_41C_15MHz+15MHz_QPSK	40545	2585.5	40695	2600.5	75#0	75#0	28.632	30.83
CA_41C_15MHz+15MHz_16QAM	40545	2585.5	40695	2600.5	75#0	75#0	28.733	30.91
CA_41C_15MHz+15MHz_64QAM	40545	2585.5	40695	2600.5	75#0	75#0	28.696	31.01
CA_41C_15MHz+20MHz_QPSK	40523	2583.3	40694	2600.4	75#0	100#0	32.873	35.16
CA_41C_15MHz+20MHz_16QAM	40523	2583.3	40694	2600.4	75#0	100#0	32.924	35.11
CA_41C_15MHz+20MHz_64QAM	40523	2583.3	40694	2600.4	75#0	100#0	32.897	35.25
CA_41C_20MHz+15MHz_QPSK	40546	2585.6	40717	2602.7	100#0	75#0	32.981	35.21
CA_41C_20MHz+15MHz_16QAM	40546	2585.6	40717	2602.7	100#0	75#0	32.878	35.16
CA_41C_20MHz+15MHz_64QAM	40546	2585.6	40717	2602.7	100#0	75#0	32.973	35.19
CA_41C_20MHz+20MHz_QPSK	40521	2583.1	40719	2602.9	100#0	100#0	37.823	40.27
CA_41C_20MHz+20MHz_16QAM	40521	2583.1	40719	2602.9	100#0	100#0	37.739	40.11
CA_41C_20MHz+20MHz_64QAM	40521	2583.1	40719	2602.9	100#0	100#0	37.752	40.13



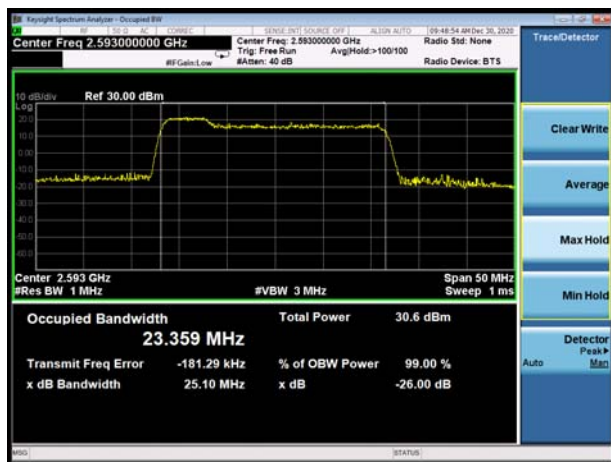
CA_41C QPSK 5MHz+20MHz



CA_41C QPSK 20MHz+5MHz



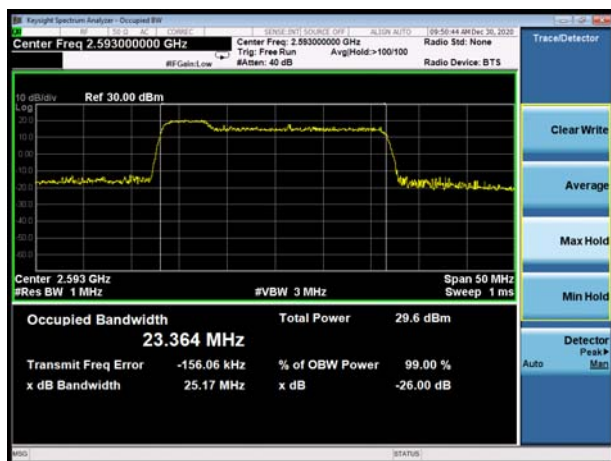
CA_41C 16QAM 5MHz+20MHz



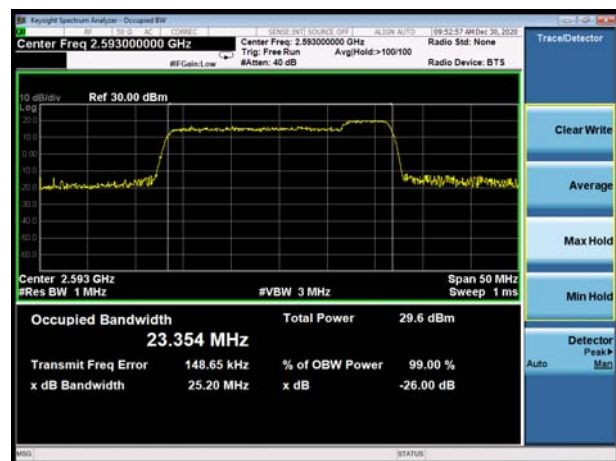
CA_41C 16QAM 20MHz+5MHz



CA_41C 64QAM 5MHz+20MHz



CA_41C 64QAM 20MHz+5MHz





CA_41C QPSK 10MHz+15MHz



CA_41C QPSK 15MHz+10MHz



CA_41C 16QAM 10MHz+15MHz



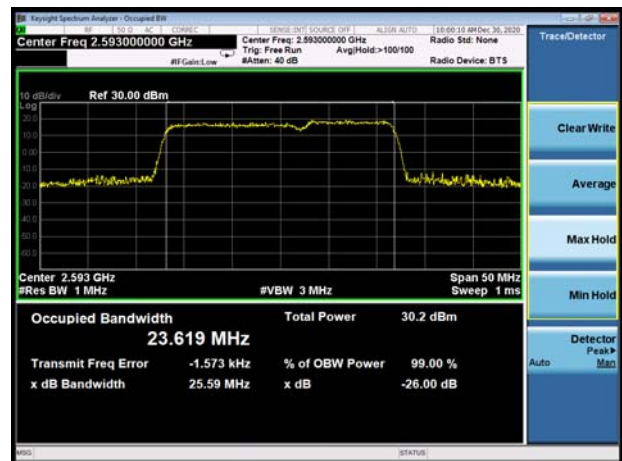
CA_41C 16QAM 15MHz+10MHz



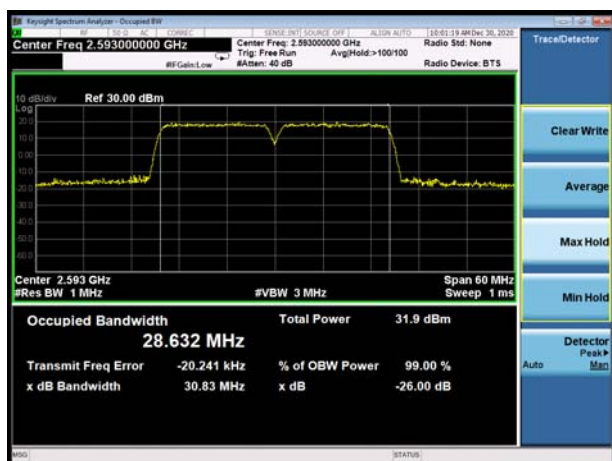
CA_41C 64QAM 10MHz+15MHz



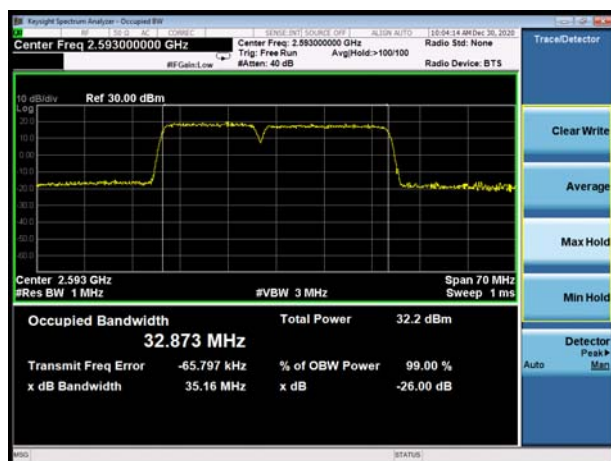
CA_41C 64QAM 15MHz+10MHz



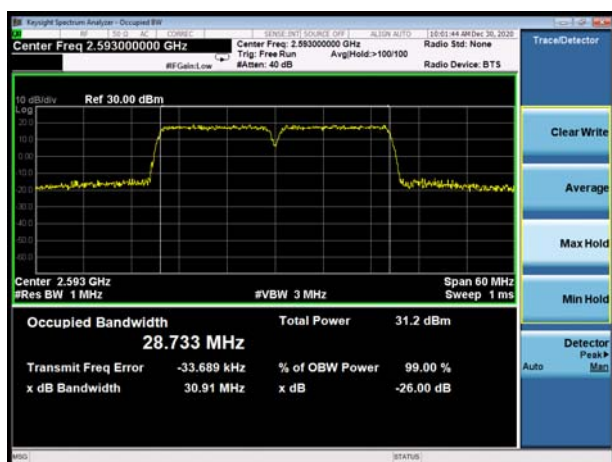
CA_41C QPSK 15MHz+15MHz



CA_41C QPSK 15MHz+20MHz



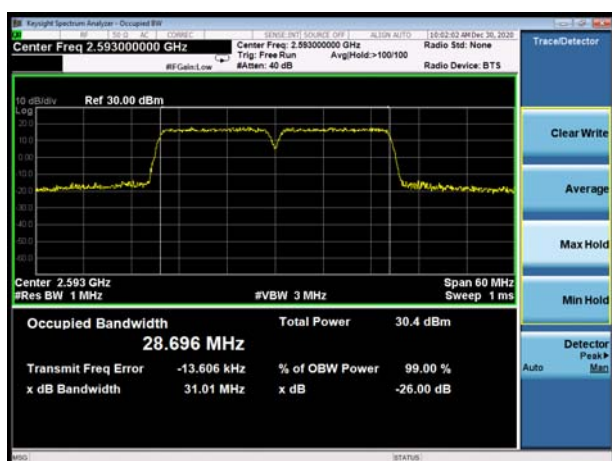
CA_41C 16QAM 15MHz+15MHz



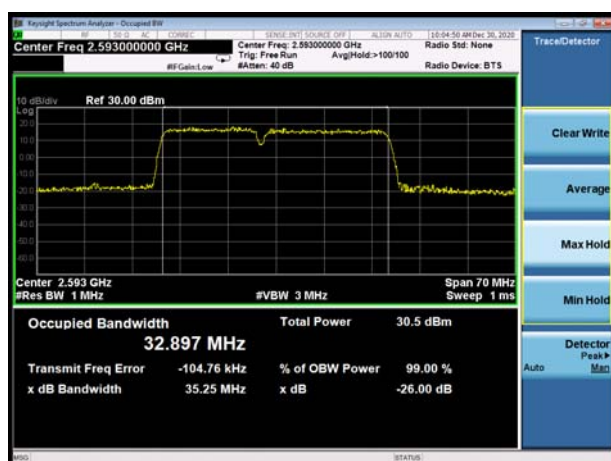
CA_41C 16QAM 15MHz+20MHz



CA_41C 64QAM 15MHz+15MHz



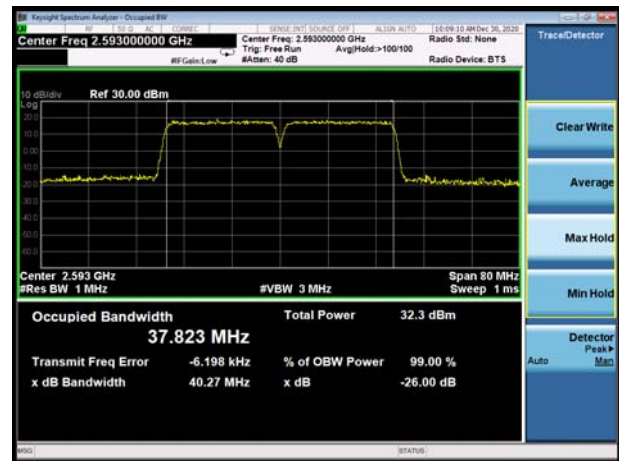
CA_41C 64QAM 15MHz+20MHz



CA_41C QPSK 20MHz+15MHz



CA_41C QPSK 20MHz+20MHz



CA_41C 16QAM 20MHz+15MHz



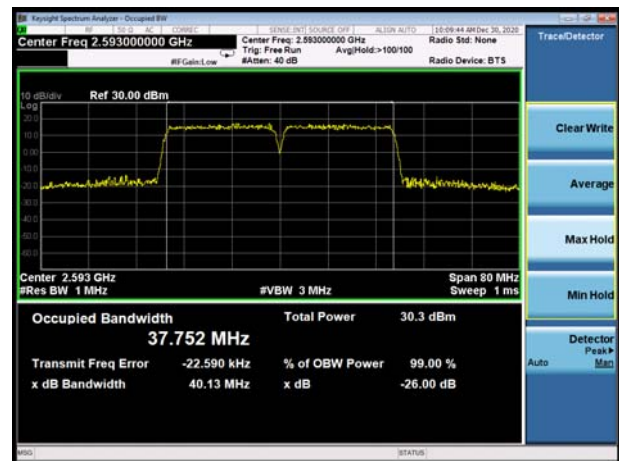
CA_41C 16QAM 20MHz+20MHz



CA_41C 64QAM 20MHz+15MHz



CA_41C 64QAM 20MHz+20MHz



5.3 Band Edge Compliance

Ambient condition

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

Method of Measurement

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

The testing follows KDB 971168 D01 v03r01 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.

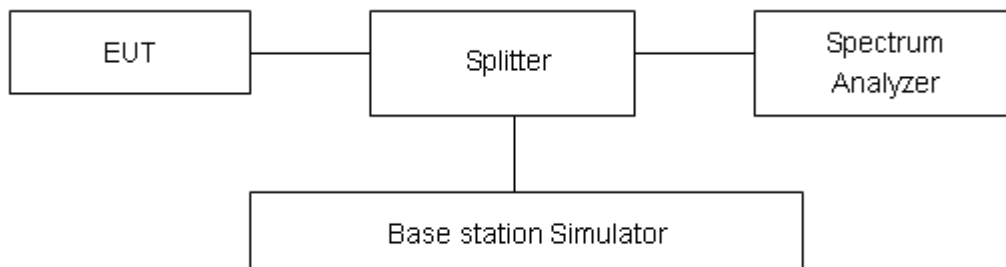
For CA-41C low channel set RBW $\geq$ 2% EBW in the 1MHz band immediately outside and adjacent to the band edge. Beyond the 1 MHz band from the band edge, RBW=1MHz was used. on spectrum analyzer.

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(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)

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

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

Measurement Uncertainty

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



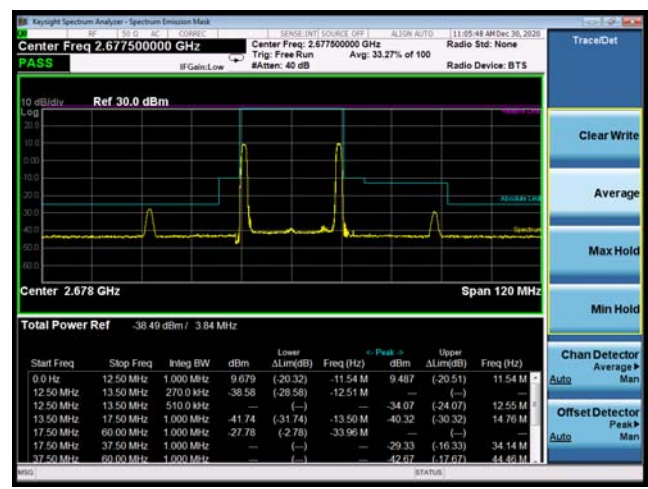
Test Result

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

CA_41C QPSK 20MHz+5MHz CH-Low, 1 RB



CA_41C QPSK 20MHz+5MHz CH-High, 1 RB



CA_41C QPSK 20MHz+5MHz CH-Low, 100%RB



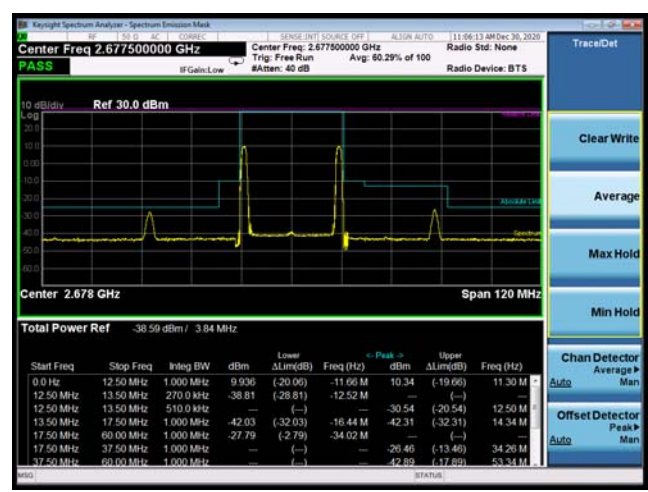
CA_41C QPSK 20MHz+5MHz CH-High, 100%RB



CA_41C 16QAM 20MHz+5MHz CH-Low, 1 RB



CA_41C 16QAM 20MHz+5MHz CH-High, 1 RB





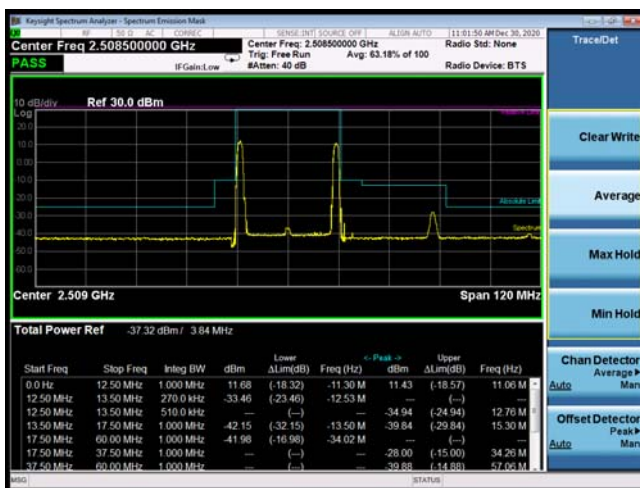
CA_41C 16QAM 20MHz+5MHz CH-Low, 100%RB



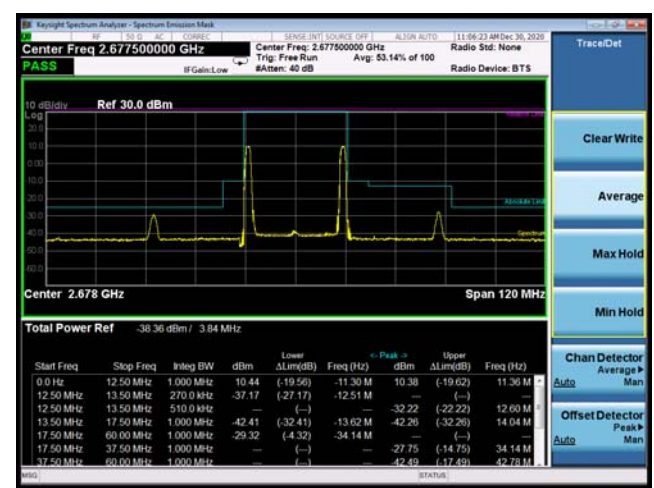
CA_41C 16QAM 20MHz+5MHz CH-High, 100%RB



CA_41C 64QAM 20MHz+5MHz CH-Low, 1 RB



CA_41C 64QAM 20MHz+5MHz CH-High, 1 RB



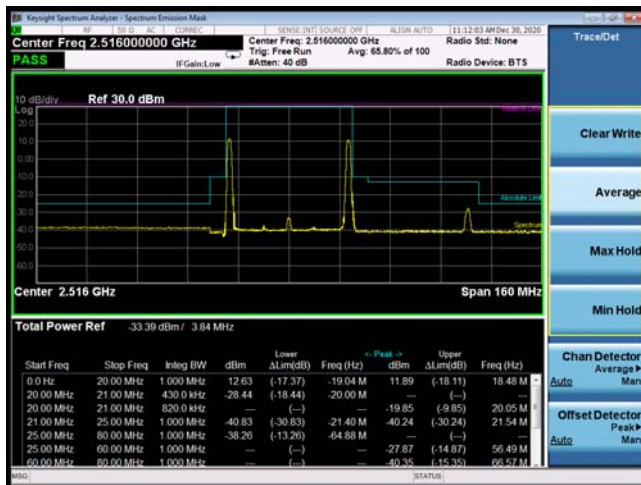
CA_41C 64QAM 20MHz+5MHz CH-Low, 100%RB



CA_41C 64QAM 20MHz+5MHz CH-High, 100%RB



CA_41C QPSK 20MHz+20MHz CH-Low, 1 RB



CA_41C QPSK 20MHz+20MHz CH-High, 1 RB



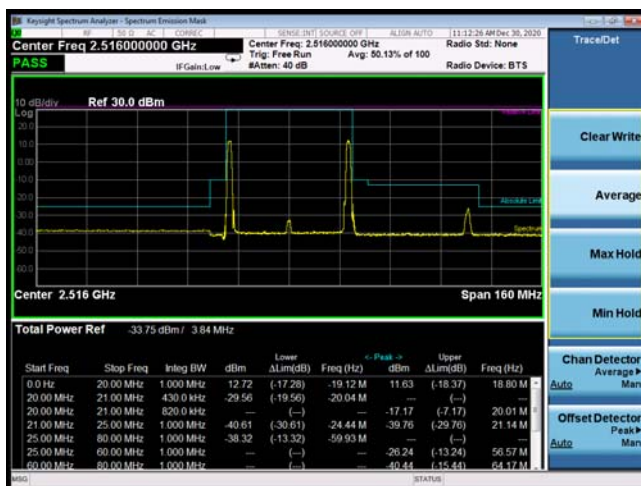
CA_41C QPSK 20MHz+20MHz CH-Low, 100%RB



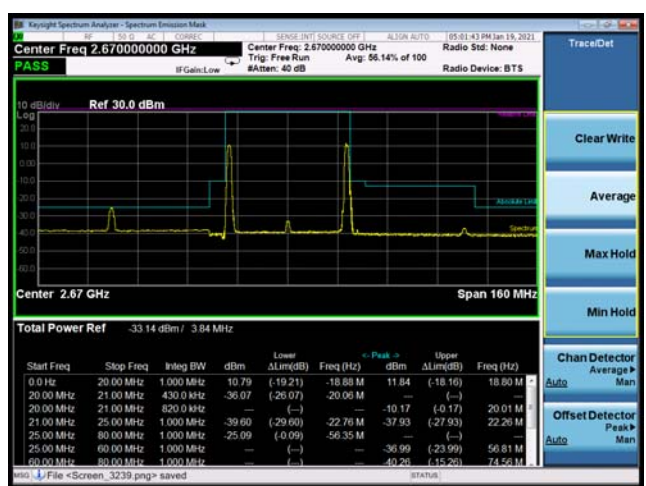
CA_41C QPSK 20MHz+20MHz CH-High, 100%RB



CA_41C 16QAM 20MHz+20MHz CH-Low, 1 RB

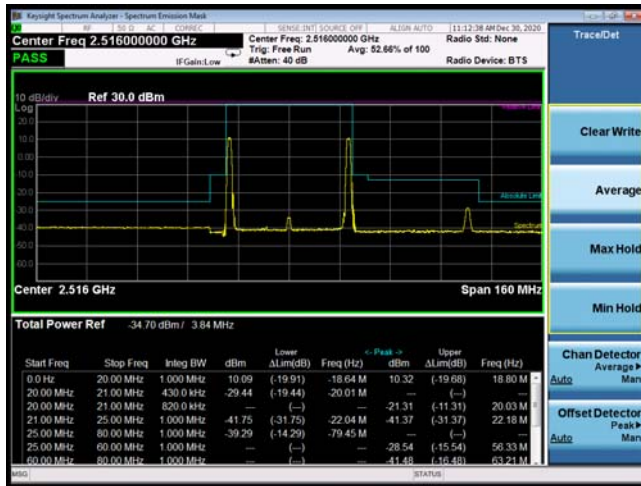


CA_41C 16QAM 20MHz+20MHz CH-High, 1 RB



CA_41C 16QAM 20MHz+20MHz CH-Low,
100%RBCA_41C 16QAM 20MHz+20MHz CH-High,
100%RB

CA_41C 64QAM 20MHz+20MHz CH-Low, 1 RB



CA_41C 64QAM 20MHz+20MHz CH-High, 1 RB

CA_41C 64QAM 20MHz+20MHz CH-Low,
100%RBCA_41C 64QAM 20MHz+20MHz CH-High,
100%RB

5.4 Peak-to-Average Power Ratio (PAPR)

Ambient condition

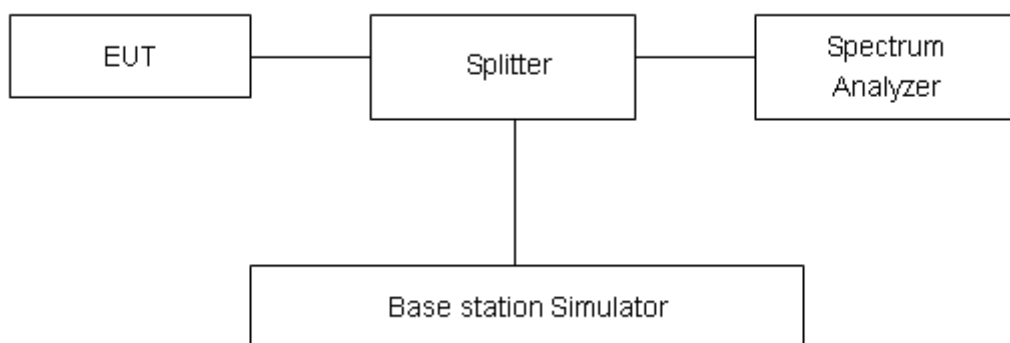
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Methods of Measurement

Measure the total peak power and record as 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

CA_41C										
Bandwidth	PCC		SCC1		Modulation	Peak-to-Average Power Ratio (PAPR)			Limit (dB)	Conclusion
	Channel	Frequency (MHz)	Channel	Frequency (MHz)		Peak (dBm)	Avg (dBm)	PAPR (dB)		
CA_41C_5MHz+20MHz_QPSK	40528	2583.8	40645	2595.5	QPSK	29.36	19.89	9.47	≤13	PASS
CA_41C_5MHz+20MHz_16QAM	40528	2583.8	40645	2595.5	16QAM	29.05	18.61	10.44	≤13	PASS
CA_41C_5MHz+20MHz_64QAM	40528	2583.8	40645	2595.5	64QAM	28.14	17.35	10.79	≤13	PASS
CA_41C_20MHz+5MHz_QPSK	40595	2590.5	40712	2602.2	QPSK	29.39	19.88	9.51	≤13	PASS
CA_41C_20MHz+5MHz_16QAM	40595	2590.5	40712	2602.2	16QAM	29.19	18.48	10.71	≤13	PASS
CA_41C_20MHz+5MHz_64QAM	40595	2590.5	40712	2602.2	64QAM	28.26	17.93	10.33	≤13	PASS
CA_41C_10MHz+20MHz_QPSK	40526	2583.6	40670	2598	QPSK	28.98	19.35	9.63	≤13	PASS
CA_41C_10MHz+20MHz_16QAM	40526	2583.6	40670	2598	16QAM	28.72	18.16	10.56	≤13	PASS
CA_41C_10MHz+20MHz_64QAM	40526	2583.6	40670	2598	64QAM	27.81	17.41	10.40	≤13	PASS
CA_41C_20MHz+10MHz_QPSK	40571	2588.1	40715	2602.5	QPSK	29.00	19.14	9.86	≤13	PASS
CA_41C_20MHz+10MHz_16QAM	40571	2588.1	40715	2602.5	16QAM	28.66	18.30	10.36	≤13	PASS
CA_41C_20MHz+10MHz_64QAM	40571	2588.1	40715	2602.5	64QAM	27.81	17.91	9.90	≤13	PASS
CA_41C_15MHz+15MHz_QPSK	40545	2585.5	40695	2600.5	QPSK	29.21	19.60	9.61	≤13	PASS
CA_41C_15MHz+15MHz_16QAM	40545	2585.5	40695	2600.5	16QAM	28.87	18.22	10.65	≤13	PASS
CA_41C_15MHz+15MHz_64QAM	40545	2585.5	40695	2600.5	64QAM	27.85	17.27	10.58	≤13	PASS
CA_41C_15MHz+20MHz_QPSK	40523	2583.3	40694	2600.4	QPSK	28.72	19.14	9.58	≤13	PASS
CA_41C_15MHz+20MHz_16QAM	40523	2583.3	40694	2600.4	16QAM	28.43	17.83	10.60	≤13	PASS
CA_41C_15MHz+20MHz_64QAM	40523	2583.3	40694	2600.4	64QAM	27.33	16.77	10.56	≤13	PASS
CA_41C_20MHz+15MHz_QPSK	40546	2585.6	40717	2602.7	QPSK	28.74	18.46	10.28	≤13	PASS
CA_41C_20MHz+15MHz_16QAM	40546	2585.6	40717	2602.7	16QAM	28.39	17.71	10.68	≤13	PASS
CA_41C_20MHz+15MHz_64QAM	40546	2585.6	40717	2602.7	64QAM	27.51	16.86	10.65	≤13	PASS
CA_41C_20MHz+20MHz_QPSK	40521	2583.1	40719	2602.9	QPSK	28.51	17.97	10.54	≤13	PASS
CA_41C_20MHz+20MHz_16QAM	40521	2583.1	40719	2602.9	16QAM	28.06	17.36	10.70	≤13	PASS
CA_41C_20MHz+20MHz_64QAM	40521	2583.1	40719	2602.9	64QAM	27.03	16.12	10.91	≤13	PASS

5.5 Frequency Stability

Ambient condition

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

Method of Measurement

Frequency Stability (Temperature Variation)

The temperature inside the climate chamber is varied from -30°C to +50°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 -30°C to +50°C. Allow at least 1.5 hours at each temperature, un-powered, before making measurements.

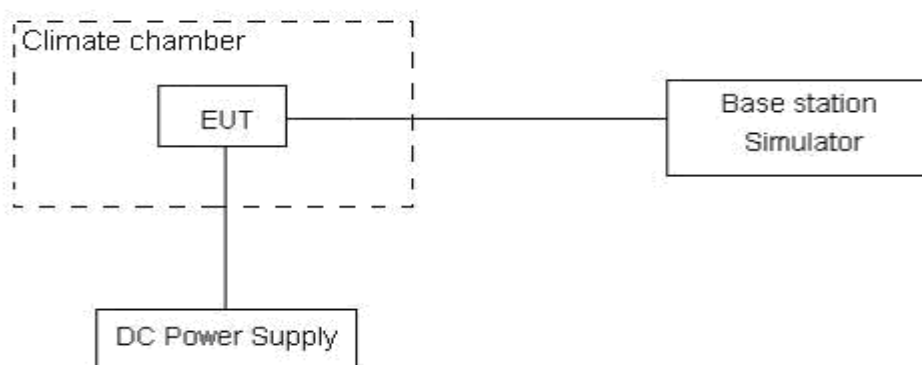
Frequency Stability (Voltage Variation)

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

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

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

Test setup



Limits

The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

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

CA_41C_QPSK		20MHz+10MHz (Bandwidth)		20MHz+20MHz (Bandwidth)		Verdict
Condition		Delta (Hz)	Frequency Stability (ppm)	Delta (Hz)	Frequency Stability (ppm)	
Temperature	Voltage					
Normal (25℃)	Normal	3.34	0.00178	13.35	0.00710	PASS
Extreme (50℃)		5.02	0.00267	8.39	0.00446	PASS
Extreme (40℃)		2.71	0.00144	12.98	0.00690	PASS
Extreme (30℃)		13.00	0.00691	14.76	0.00785	PASS
Extreme (20℃)		5.01	0.00266	13.98	0.00743	PASS
Extreme (10℃)		16.08	0.00855	11.35	0.00604	PASS
Extreme (0℃)		16.75	0.00891	6.93	0.00368	PASS
Extreme (-10℃)		10.11	0.00538	10.51	0.00559	PASS
Extreme (-20℃)		1.18	0.00063	3.06	0.00163	PASS
Extreme (-30℃)		12.11	0.00644	4.56	0.00242	PASS
25℃	LV	11.60	0.00617	3.11	0.00165	PASS
	HV	10.00	0.00532	3.10	0.00165	PASS
CA_41C_16QAM		20MHz+10MHz (Bandwidth)		20MHz+20MHz (Bandwidth)		Verdict
Condition		Delta (Hz)	Frequency Stability (ppm)	Delta (Hz)	Frequency Stability (ppm)	
Temperature	Voltage					
Normal (25℃)	Normal	4.28	0.00228	17.48	0.00930	PASS
Extreme (50℃)		14.63	0.00778	3.78	0.00201	PASS
Extreme (40℃)		1.37	0.00073	5.62	0.00299	PASS
Extreme (30℃)		5.57	0.00296	10.06	0.00535	PASS
Extreme (20℃)		6.92	0.00368	2.91	0.00155	PASS
Extreme (10℃)		3.33	0.00177	17.16	0.00913	PASS
Extreme (0℃)		5.51	0.00293	5.36	0.00285	PASS
Extreme (-10℃)		6.09	0.00324	4.17	0.00222	PASS
Extreme (-20℃)		13.19	0.00702	6.77	0.00360	PASS
Extreme (-30℃)		2.39	0.00127	14.84	0.00789	PASS
25℃	LV	10.29	0.00547	8.72	0.00464	PASS
	HV	7.91	0.00421	4.93	0.00262	PASS
CA_41C_64QAM		20MHz+10MHz (Bandwidth)		20MHz+20MHz (Bandwidth)		Verdict
Condition		Delta (Hz)	Frequency Stability (ppm)	Delta (Hz)	Frequency Stability (ppm)	
Temperature	Voltage					
Normal (25℃)	Normal	16.23	0.00863	4.74	0.00252	PASS
Extreme (50℃)		1.29	0.00069	16.72	0.00889	PASS



Extreme (40℃)		17.00	0.00904	6.98	0.00371	PASS
Extreme (30℃)		10.84	0.00577	14.99	0.00797	PASS
Extreme (20℃)		11.80	0.00628	3.07	0.00163	PASS
Extreme (10℃)		9.48	0.00504	6.05	0.00322	PASS
Extreme (0℃)		1.07	0.00057	7.23	0.00385	PASS
Extreme (-10℃)		11.50	0.00612	16.94	0.00901	PASS
Extreme (-20℃)		11.63	0.00618	13.54	0.00720	PASS
Extreme (-30℃)		17.22	0.00916	9.66	0.00514	PASS
25℃	LV	10.43	0.00555	14.08	0.00749	PASS
	HV	17.21	0.00916	2.04	0.00108	PASS

5.6 Spurious Emissions at Antenna Terminals

Ambient condition

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

Method of Measurement

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

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

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

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

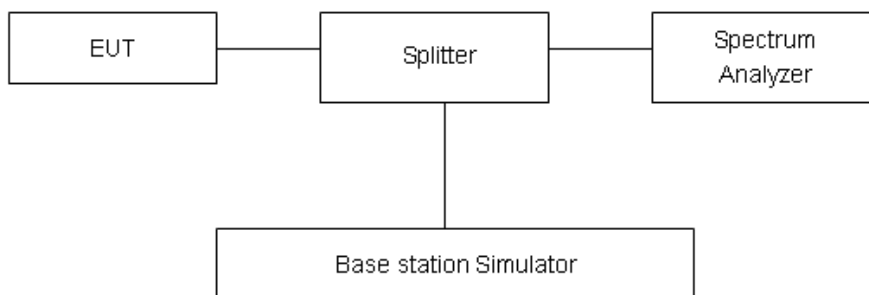
RBW is set to 1000 kHz (above 1000MHz)

Sweep is set to ATUO.

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

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

Test setup



Limits

Rule Part 27.53(m) $55 + 10 \log (P)$ 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.

Part 27.53(m) Limit	-25 dBm
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Measurement Uncertainty

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

Frequency	Uncertainty
-----------	-------------



9kHz-1GHz	0.684 dB
1GHz-27GHz	1.407 dB

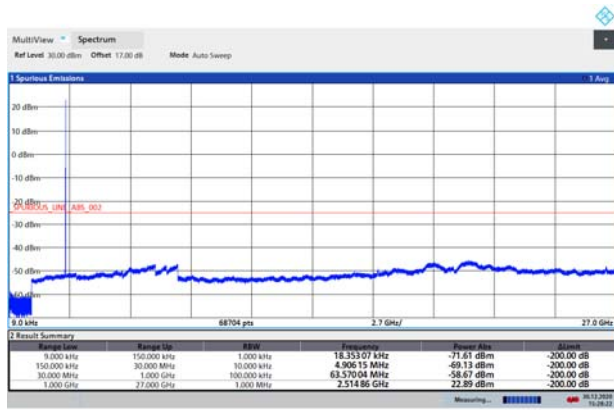


Test Result

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

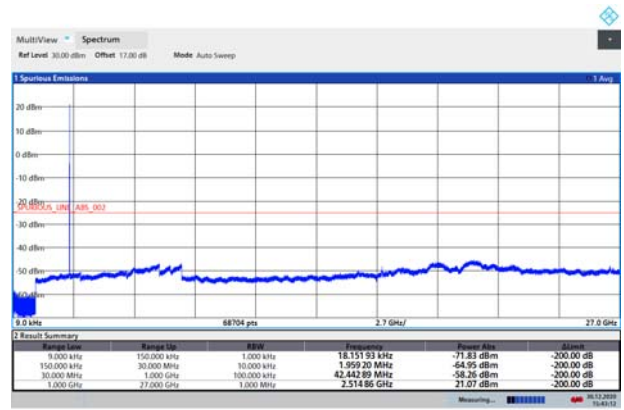
The signal beyond the limit is carrier.

CA_41C QPSK 20MHz+5MHz CH- Low
9kHz~27GHz



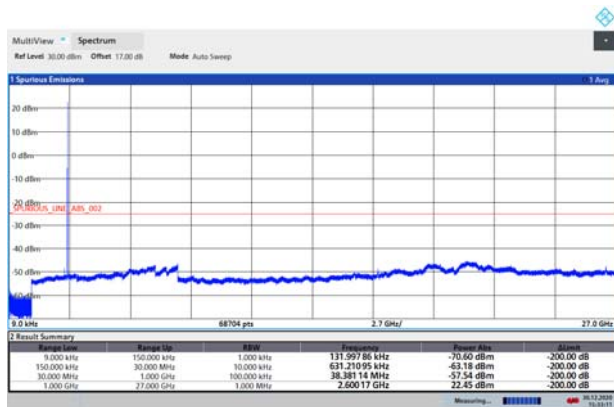
15:29:22 30.12.2020

CA_41C QPSK 20MHz+20MHz CH- Low
9kHz~27GHz



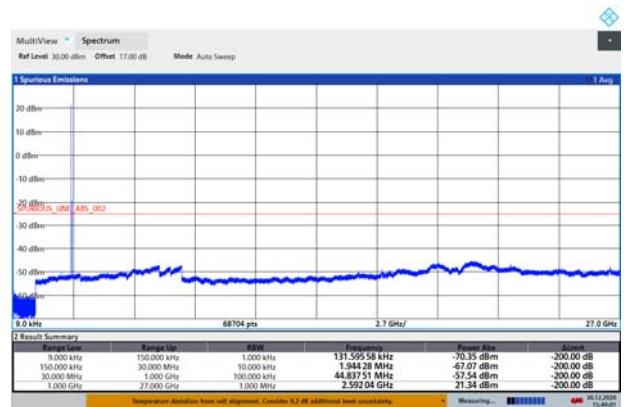
15:43:13 30.12.2020

CA_41C QPSK 20MHz+5MHz CH- Middle
9kHz~27GHz



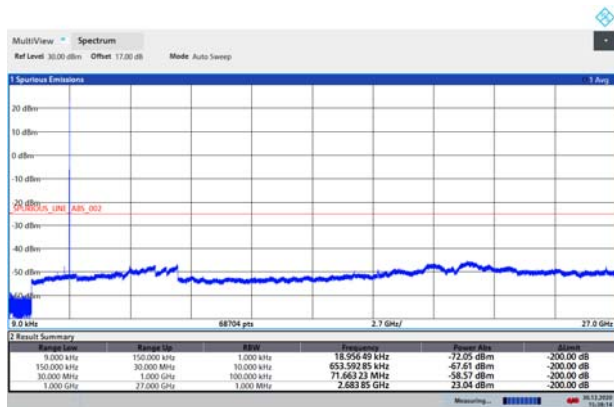
15:33:12 30.12.2020

CA_41C QPSK 20MHz+20MHz CH- Middle
9kHz~27GHz



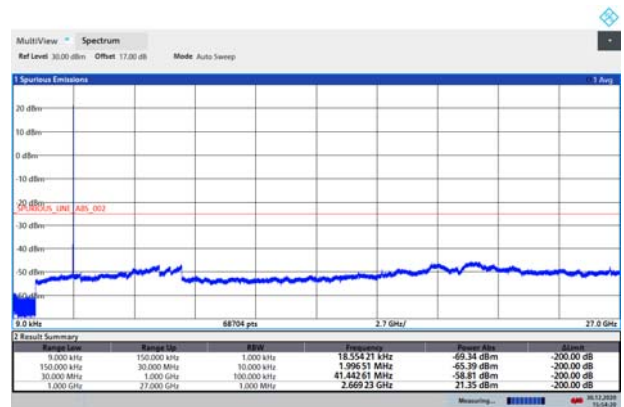
15:49:01 30.12.2020

CA_41C QPSK 20MHz+5MHz CH-High
9kHz~27GHz

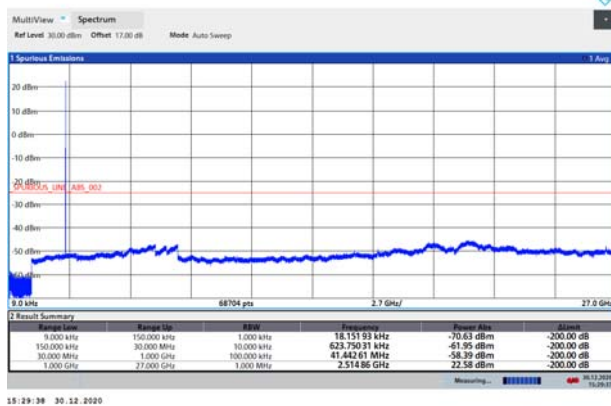


15:36:15 30.12.2020

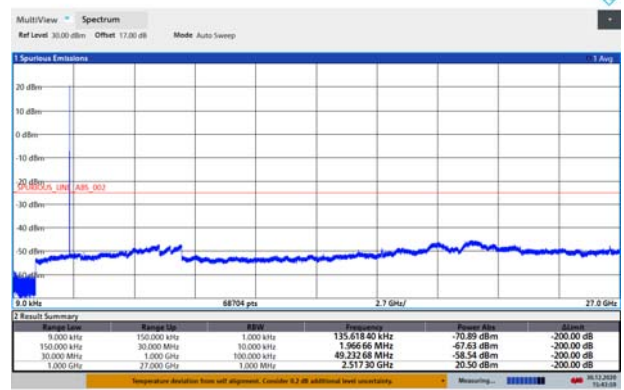
CA_41C QPSK 20MHz+20MHz CH-High
9kHz~27GHz



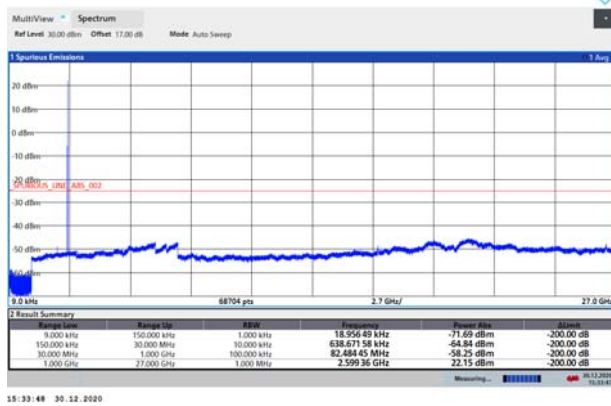
15:44:24 30.12.2020

CA_41C 16QAM 20MHz+5MHz CH- Low
9kHz~27GHz

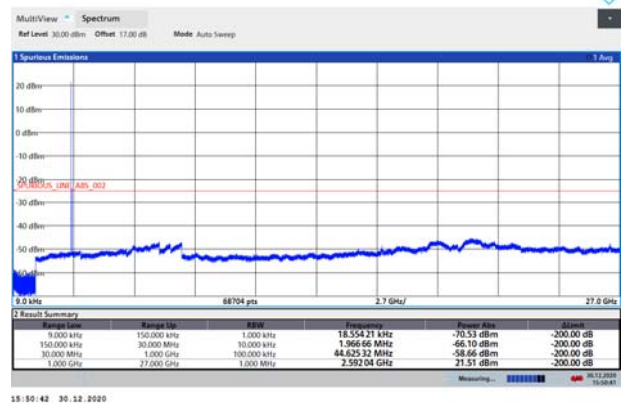
15:29:38 30.12.2020

CA_41C 16QAM 20MHz+20MHz CH- Low
9kHz~27GHz

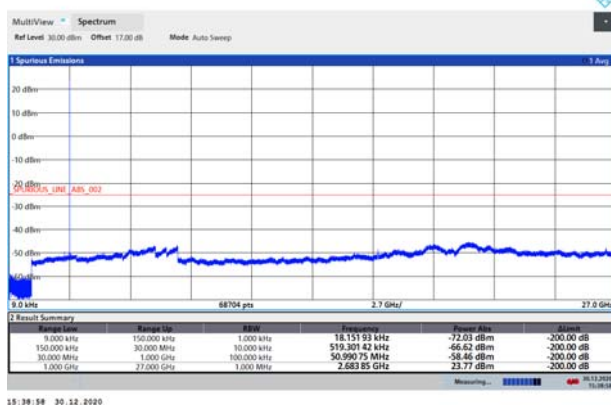
15:43:59 30.12.2020

CA_41C 16QAM 20MHz+5MHz CH- Middle
9kHz~27GHz

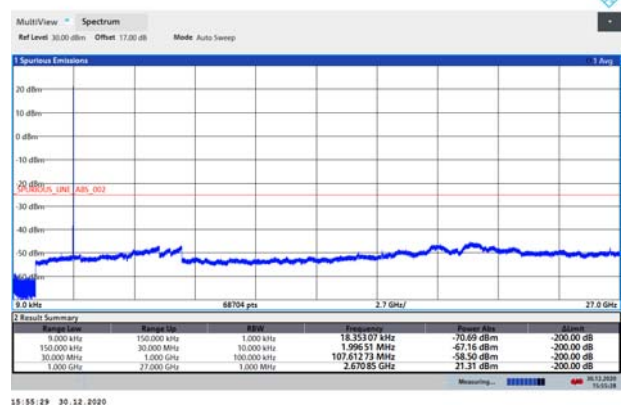
15:33:48 30.12.2020

CA_41C 16QAM 20MHz+20MHz CH- Middle
9kHz~27GHz

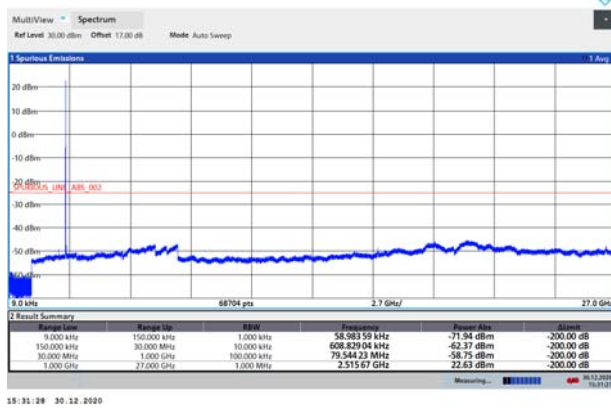
15:50:42 30.12.2020

CA_41C 16QAM 20MHz+5MHz CH-High
9kHz~27GHz

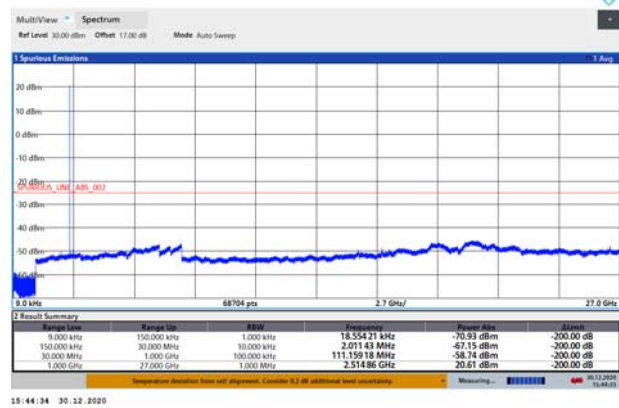
15:39:58 30.12.2020

CA_41C 16QAM 20MHz+20MHz CH-High
9kHz~27GHz

15:55:29 30.12.2020

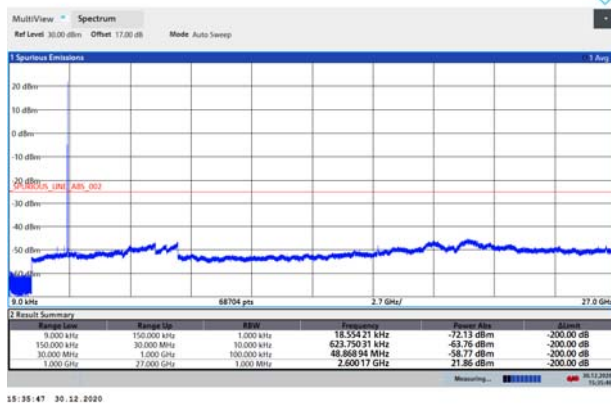
CA_41C 64QAM 20MHz+5MHz CH- Low
9kHz~27GHz

15:35:28 30.12.2020

CA_41C 64QAM 20MHz+20MHz CH- Low
9kHz~27GHz

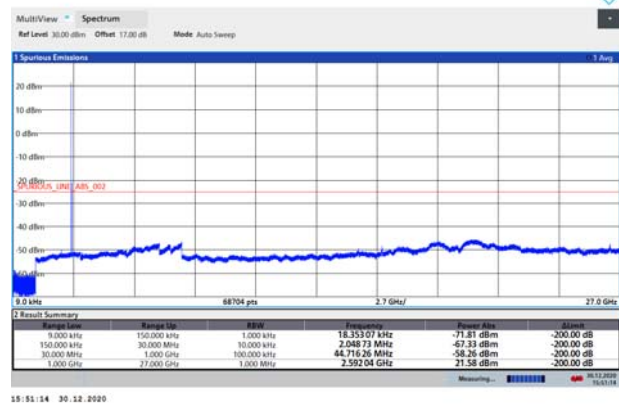
15:44:34 30.12.2020

CA_41C 64QAM 20MHz+5MHz CH- Middle

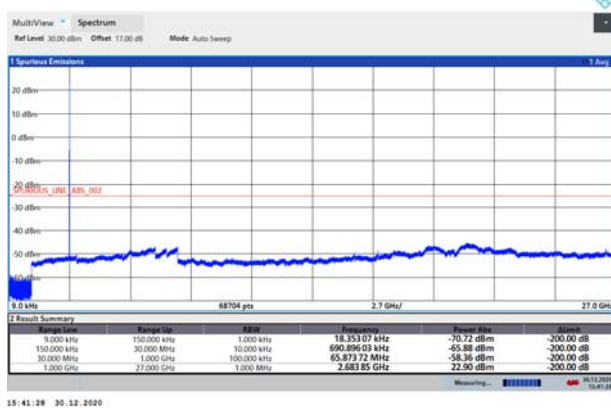


15:35:47 30.12.2020

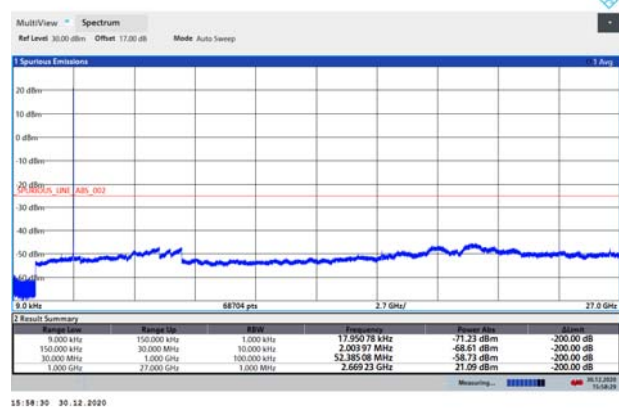
CA_41C 64QAM 20MHz+20MHz CH- Middle



15:44:34 30.12.2020

CA_41C 64QAM 20MHz+5MHz CH-High
9kHz~27GHz

15:45:28 30.12.2020

CA_41C 64QAM 20MHz+20MHz CH-High
9kHz~27GHz

15:58:30 30.12.2020

5.7 Radiates Spurious Emission

Ambient condition

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

Method of Measurement

1. The testing follows FCC KDB 971168 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 9kHz-150kHz , RBW=10kHz, VBW=30kHz 150kHz-30MHz ,RBW=100kHz,VBW=300kHz for 30MHz to 1GHz and RBW=1MHz, VBW=3MHz for above 1GHz And the maximum value of the receiver should be recorded as (Pr).
5. The EUT shall be replaced by a substitution antenna. In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power (PMea) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded (Pr). The power of signal source (PMea) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.
6. A amplifier should be connected to the Signal Source output port. And the cable should be connect between the Amplifier and the Substitution Antenna. The cable loss (Pcl) ,the Substitution Antenna Gain (Ga) and the Amplifier Gain (PAg) should be recorded after test.
7. The measurement results are obtained as described below:

$$\text{Power(EIRP)} = \text{PMea} - \text{PAg} - \text{Pcl} + \text{Ga}$$
The measurement results are amend as described below:

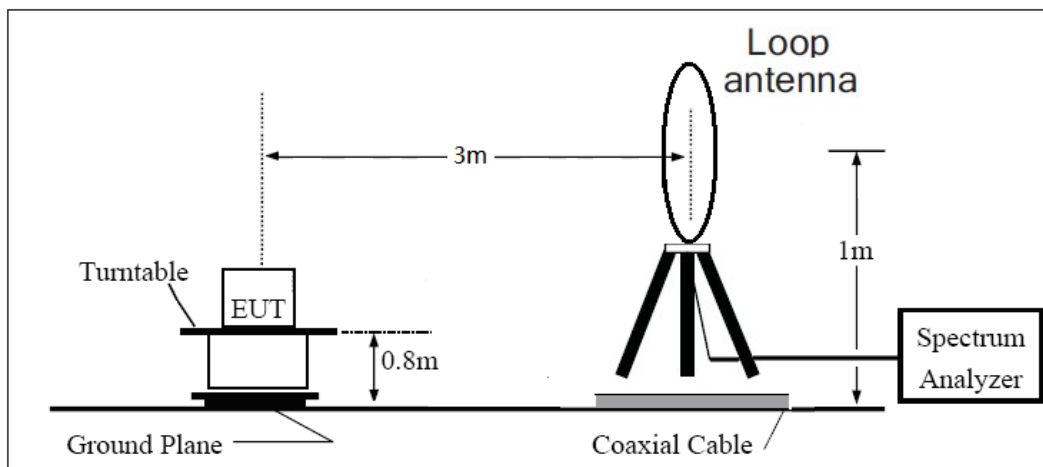
$$\text{Power(EIRP)} = \text{PMea} - \text{Pcl} + \text{Ga}$$
8. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power. ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP

= EIRP-2.15dBi.

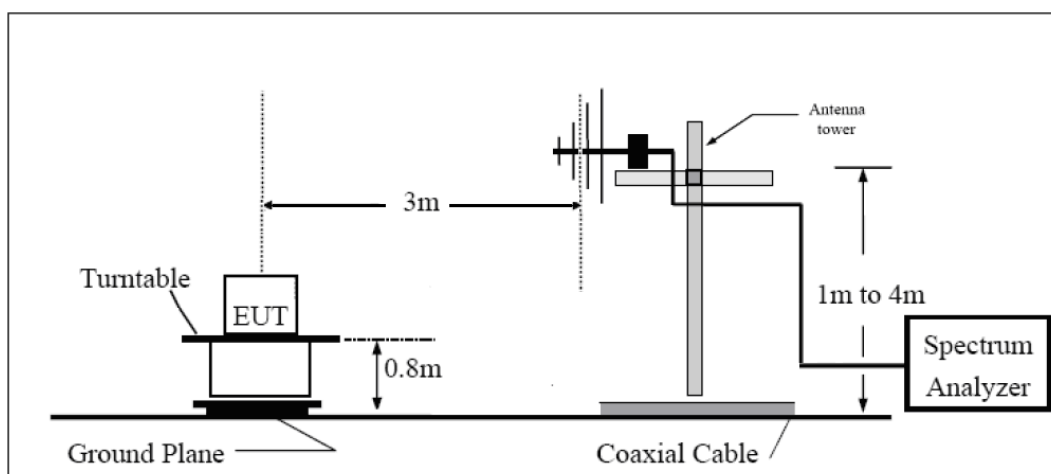
The modulation mode and RB allocation refer to section 5.1, using the maximum output power configuration.

Test setup

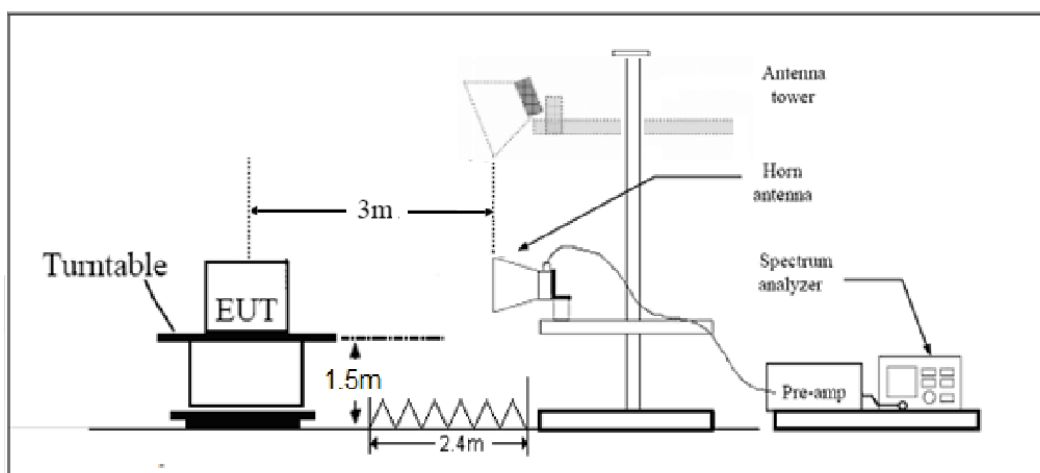
9KHz ~ 30MHz



30MHz ~ 1GHz



Above 1GHz



Note: Area side:2.4mX3.6m



Limits

Rule Part 27.53(m) $55 + 10 \log (P)$ 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.

Part 27.53(m) Limit	-25 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 $k = \pm 1.96$, $U = \pm 3.55$ dB.

**Test Result**

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

CA-41C QPSK 5MHz+20MHz CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	5167.60	-36.77	2.00	9.15	Horizontal	-29.62	-25.00	4.62	45
3	7751.40	-57.24	2.50	11.35	Horizontal	-48.39	-25.00	23.39	315
4	10335.20	-48.78	4.20	12.05	Horizontal	-40.93	-25.00	15.93	225
5	12919.00	-49.04	5.20	12.85	Horizontal	-41.39	-25.00	16.39	90
6	15502.80	-56.68	5.50	14.23	Horizontal	-47.95	-25.00	22.95	45
7	18086.60	--	--	--	--	--	--	--	--
8	20670.40	--	--	--	--	--	--	--	--
9	23254.20	--	--	--	--	--	--	--	--
10	25838.00	--	--	--	--	--	--	--	--

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

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

CA-41C QPSK 20MHz+5MHz CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	5163.38	-45.27	2.00	10.15	Horizontal	-37.12	-25.00	12.12	45
3	5181.00	-48.11	2.50	11.35	Horizontal	-39.26	-25.00	14.26	135
4	7771.50	-55.83	4.20	12.05	Horizontal	-47.98	-25.00	22.98	315
5	10362.00	-50.48	5.20	14.85	Horizontal	-40.83	-25.00	15.83	90
6	12952.50	-48.66	5.50	13.23	Horizontal	-40.93	-25.00	15.93	180
7	15543.00	--	--	--	--	--	--	--	--
8	18133.50	--	--	--	--	--	--	--	--
9	20724.00	--	--	--	--	--	--	--	--
10	23314.50	--	--	--	--	--	--	--	--

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

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



CA-41C QPSK 10MHz+20MHz CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	5167.20	-36.91	2.00	9.15	Horizontal	-29.76	-25.00	4.76	270
3	7750.80	-57.11	2.50	11.35	Horizontal	-48.26	-25.00	23.26	315
4	10334.40	-49.10	4.20	12.05	Horizontal	-41.25	-25.00	16.25	225
5	12918.00	-48.92	5.20	12.85	Horizontal	-41.27	-25.00	16.27	45
6	15501.60	-57.54	5.50	14.23	Horizontal	-48.81	-25.00	23.81	90
7	18085.20	--	--	--	--	--	--	--	--
8	20668.80	--	--	--	--	--	--	--	--
9	23252.40	--	--	--	--	--	--	--	--
10	25836.00	--	--	--	--	--	--	--	--
Note: 1.The other Spurious RF Radiated emissions level is no more than noise floor. 2. The worst emission was found in the antenna is Horizontal position.									

CA-41C QPSK 20MHz+10MHz CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	5176.20	-44.83	2.00	10.15	Horizontal	-36.68	-25.00	11.68	45
3	7764.30	-56.99	2.50	11.35	Horizontal	-48.14	-25.00	23.14	135
4	10352.40	-51.00	4.20	12.05	Horizontal	-43.15	-25.00	18.15	45
5	12940.50	-51.22	5.20	14.85	Horizontal	-41.57	-25.00	16.57	225
6	15528.60	-56.00	5.50	13.23	Horizontal	-48.27	-25.00	23.27	90
7	18116.70	--	--	--	--	--	--	--	--
8	20704.80	--	--	--	--	--	--	--	--
9	23292.90	--	--	--	--	--	--	--	--
10	25881.00	--	--	--	--	--	--	--	--
Note: 1.The other Spurious RF Radiated emissions level is no more than noise floor. 2. The worst emission was found in the antenna is Horizontal position.									



CA-41C QPSK 20MHz+20MHz CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	5166.20	-39.04	2.00	10.15	Horizontal	-30.89	-25.00	5.89	45
3	7749.30	-57.15	2.50	11.35	Horizontal	-48.30	-25.00	23.30	225
4	10332.40	-49.44	4.20	12.05	Horizontal	-41.59	-25.00	16.59	45
5	12915.50	-51.01	5.20	14.85	Horizontal	-41.36	-25.00	16.36	90
6	15498.60	-56.19	5.50	13.23	Horizontal	-48.46	-25.00	23.46	315
7	18081.70	--	--	--	--	--	--	--	--
8	20664.80	--	--	--	--	--	--	--	--
9	23247.90	--	--	--	--	--	--	--	--
10	25831.00	--	--	--	--	--	--	--	--
Note: 1.The other Spurious RF Radiated emissions level is no more than noise floor. 2. The worst emission was found in the antenna is Horizontal position.									



6 Main Test Instruments

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

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



ANNEX A: The EUT Appearance

The EUT Appearance are submitted separately.



ANNEX B: Test Setup Photos

The Test Setup Photos are submitted separately.