



TESTING LABORATORY
CERTIFICATE #4820.01



FCC PART 24E

MEASUREMENT AND TEST REPORT

For

WTS Positioning Solutions AB

Wallingatan 18, Stockholm, Sweden, 111 24

FCC ID: 2AR8M-TRAX4G

Report Type: Original Report	Product Name: Trax G+
Report Number:	<u>RGMA181010003-00B</u>
Report Date:	<u>2019-07-10</u>
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

EUT Name:	Trax G+
EUT Model:	Trax 4.1.7
Operation modes:	NB-IoT
Operation Frequency:	Band 2:1850-1910 MHz(TX), 1930-1990 MHz(RX)
Maximum Output Power: (Conducted)	band 2: 24.40 dBm
Modulation Type:	BPSK, QPSK
Rated Input Voltage:	DC 3.7V or charged by wireless charger
External Dimension:	55mm(L)*38mm(W)*10.7mm(H)
Serial Number:	181010003
EUT Received Date:	2018-10-10

Objective

This report is prepared on behalf of **WTS Positioning Solutions AB** in accordance with: Part 2-Subpart J, Part 24-Subpart E of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC Rules for output power, modulation characteristic, occupied bandwidth, spurious emissions at antenna terminal, spurious radiated emission, frequency stability and band edge.

Related Submittal(s)/Grant(s)

FCC Part 15C DTS submissions with FCC ID: 2AR8M-TRAX4G

Test Methodology

All tests and measurements indicated in this document were performed in accordance with the Code of Federal Regulations Title 47 Part 2, Sub-part J as well as the following parts:

Part 24 Subpart E - Personal Communication Services

Applicable Standards: TIA/EIA 603-D-2010.

All radiated and conducted emissions measurements were performed at Bay Area Compliance Laboratories Corp.(Dongguan).

Measurement Uncertainty

Parameter	Measurement Uncertainty
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±0.61dB
Unwanted Emissions, radiated	30MHz ~ 1GHz: 5.85 dB 1G~26.5GHz: 5.23 dB
Unwanted Emissions, conducted	±1.5 dB
Temperature	±1 °C
Humidity	±5%
DC and low frequency voltages	±0.4%
Duty Cycle	1%

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.69 Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China.

The lab has been recognized as the FCC accredited lab under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 897218, the FCC Designation No. : CN1220.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0022.

SYSTEM TEST CONFIGURATION

Justification

The EUT was configured for testing according to TIA/EIA-603-D 2010.

The device only supports NB-IoT Band 2, below channels were tested:

Channel	Channel Number	Frequency (MHz)
Low	18601	1850.1
Middle	18900	1880.0
High	19199	1909.9

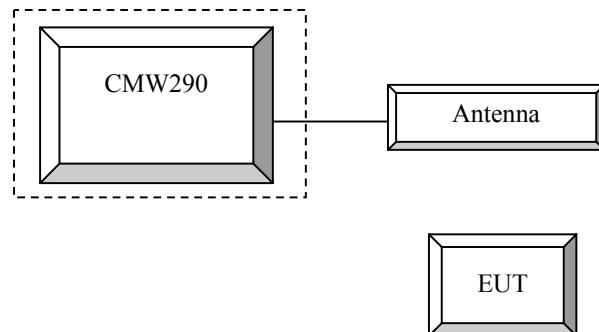
Equipment Modifications

No modification was made to the EUT.

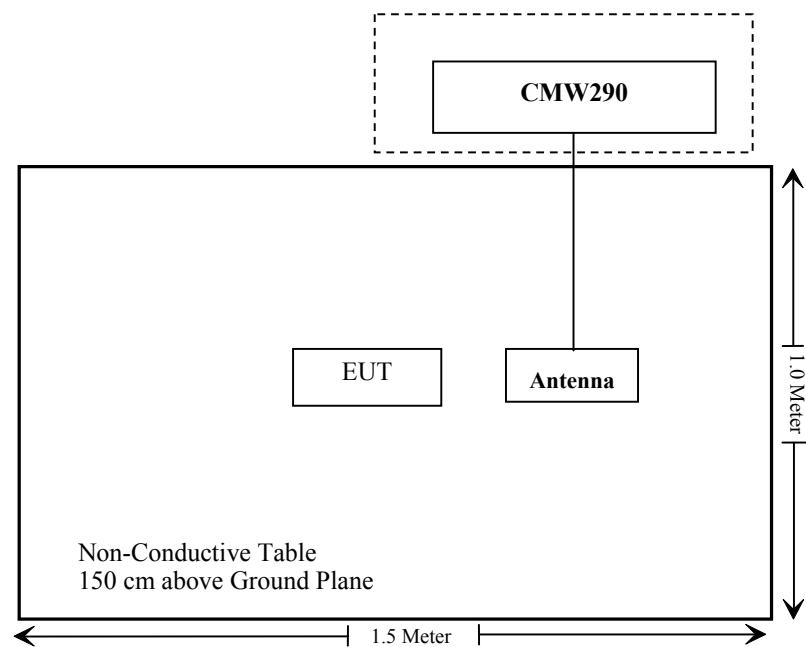
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
R&S	Wideband Radio Communication Tester	CMW290	101742
Unknown	ANTENNA	Unknown	/

Configuration of Test Setup



Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§1.1310 & §2.1093	RF Exposure	Compliance
§2.1046; § 24.232 (c);	RF Output Power	Compliance
§ 2.1047	Modulation Characteristics	Not Applicable
§ 2.1049; § 24.238	Occupied Bandwidth	Compliance
§ 2.1051, § 24.238 (a)	Spurious Emissions at Antenna Terminal	Compliance
§ 2.1053 § 24.238 (a)	Field Strength of Spurious Radiation	Compliance
§ 24.238 (a)	Out of band emission, Band Edge	Compliance
§ 2.1055 § 24.235	Frequency stability vs. temperature Frequency stability vs. voltage	Compliance

FCC §1.1310 & §2.1093- RF EXPOSURE

Applicable Standard

According to §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

According to KDB447498 D01 General RF Exposure Guidance v06:

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0 \text{ for 1-g SAR and } \leq 7.5 \text{ for 10-g extremity SAR, where}$

- $f(\text{GHz})$ is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison
- 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm according to 5) in section 4.1 is applied to determine SAR test exclusion.

When an antenna qualifies for the standalone SAR test exclusion of 4.3.1 and also transmits simultaneously with other antennas, the standalone SAR value must be estimated according to the following to determine the simultaneous transmission SAR test exclusion criteria: $[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}/x] \text{ W/kg, for test separation distances } \leq 50 \text{ mm; where } x = 7.5 \text{ for 1-g SAR and } x = 18.75 \text{ for 10-g SAR.}$

Measurement Result

Operation modes	Frequency (MHz)	Maximum Power (dBm)	Duty Cycle (%)	Time based average Power (mW)	Separated distance from user (mm)	Calculated value	Exempt from Test? (Yes/No)
Band 2	1850-1910	25	0.07	0.22	0	0.06	Yes
BLE	2402-2480	-1	100	0.79	0	0.25	Yes

The maximum transmission rate when active is once every 10 second and the data consist of 140bytes. For Cat-NB1, the lowest data rate 20 kbit/s every transmission will last for less than 0,007s with a resulting dutycycle of <0.07%. Please refer to the attention letter for more detail.

WWAN and Bluetooth can transmit Simultaneously:

Operation modes	Frequency (MHz)	Maximum Power (dBm)	Duty Cycle (%)	Time based average Power (mW)	Separated distance from user (mm)	SAR estimation (W/kg)
Band 2	1850-1910	25	0.07	0.22	0	0.01
BLE	2402-2480	-1	100	0.79	0	0.03

SAR estimation=

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})/x}]$ W/kg, for test separation distances ≤ 50 mm; where $x = 7.5$ for 1-g SAR and $x = 18.75$ for 10-g SAR.

$\Sigma \text{SAR} = 0.01 + 0.03 = 0.04 \text{ W/kg} < 1.6 \text{ W/kg}$

So the SAR test is not necessary.

FCC §2.1047 - MODULATION CHARACTERISTIC

According to FCC § 2.1047(d), Part 24E, there is no specific requirement for digital modulation, therefore modulation characteristic is not presented.

FCC § 2.1046, § 24.232 (c) - RF OUTPUT POWER

Applicable Standard

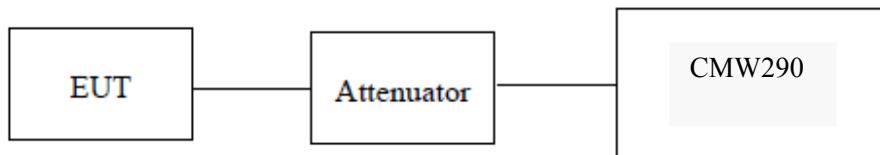
According to FCC §2.1046 and §24.232 (C), mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.

According to §24.232 (d) 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 (e) of this section. In both instances, equipment employed must be authorized in accordance with the provisions of §24.51. 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.

Test Procedure

Conducted method:

The RF output of the transmitter was connected to the CMW290 through sufficient attenuation



Radiated method:

ANSI/TIA-603-D section 2.2.17

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2019-05-09	2020-05-09
TDK RF	Horn Antenna	HRN-0118	130 084	2018-10-12	2021-10-12
ETS-Lindgren	Horn Antenna	3115	000 527 35	2018-10-12	2021-10-12
Unknown	Coaxial Cable	C-NJNJ-50	C-0200-02	2018-09-05	2019-09-05
MICRO-COAX	Coaxial Cable	UFA147-1-2362-100100	64639 231029-001	2019-02-24	2020-02-24
R&S	Wideband Radio Communication Tester	CMW290	101742	2018-08-17	2019-08-17
Agilent	Signal Generator	E8247C	MY43321350	2018-12-10	2019-12-10
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	Each time	/

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	25.8°C
Relative Humidity:	45 %
ATM Pressure:	100.5 kPa

* The testing was performed by Blake Yang on 2019-07-10.

Conducted Output Power:

Test Modulation	Sub-Carrier Spacing	Resource Block & RB offset	Low Channel (dBm)	Middle Channel (dBm)	High Channel (dBm)
BPSK	3.75 kHz	1#0	24.11	24.14	23.51
		1#47	24.21	24.13	23.65
	15 kHz	1#0	23.76	24.03	24.01
		1#11	23.78	23.33	24.1
QPSK	3.75 kHz	1#0	24.19	24.09	23.82
		1#47	24.24	24.15	23.87
	15 kHz	1#0	24.31	24.39	24.18
		1#11	24.29	24.4	24.1
		12#0	22.75	22.65	22.34

PAR:

Test Modulation	Sub-Carrier Spacing	Middle Channel (dB)	PAR Limit (dB)	Result
BPSK	3.75 kHz	8.40	≤13	Pass
	15 kHz	8.40	≤13	Pass
QPSK	3.75 kHz	8.56	≤13	Pass
	15 kHz	8.43	≤13	Pass

Note: peak-to-average ratio (PAR) <13 dB.

EIRP:

Frequency (MHz)	Modulation	Sub-Carrier Spacing	Polar (H/V)	Receiver Reading (dB μ V)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
					Substituted Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
1880.00	BPSK	3.75 kHz	H	87.02	12.24	11.14	1.56	21.82	33.00	11.18
1880.00			V	88.39	13.42	11.14	1.56	23.00	33.00	10.00
1880.00		15 kHz	H	82.54	7.76	11.14	1.56	17.34	33.00	15.66
1880.00			V	86.78	11.81	11.14	1.56	21.39	33.00	11.61
1880.00	QPSK	3.75 kHz	H	86.87	12.09	11.14	1.56	21.67	33.00	11.33
1880.00			V	88.25	13.28	11.14	1.56	22.86	33.00	10.14
1880.00		15 kHz	H	82.41	7.63	11.14	1.56	17.21	33.00	15.79
1880.00			V	85.75	10.78	11.14	1.56	20.36	33.00	12.64

Note:

- 1) The unit of Antenna Gain is dBd for frequency below 1GHz, and the unit of Antenna Gain is dBi for frequency above 1GHz.
- 2) Absolute Level = Substituted Level - Cable loss + Antenna Gain
- 3) Margin = Limit-Absolute Level

FCC §2.1049, §24.238- OCCUPIED BANDWIDTH

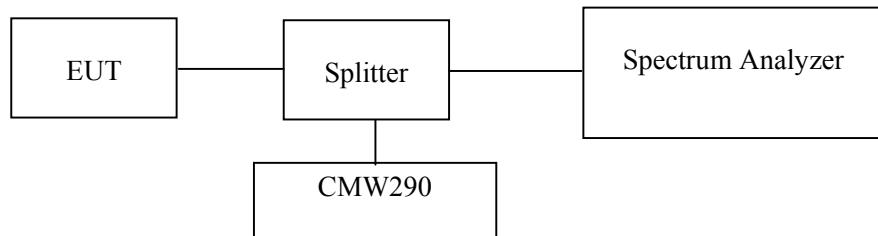
Applicable Standard

FCC §2.1049, §24.238.

Test Procedure

The RF output of the transmitter was connected to the simulator and the spectrum analyzer through sufficient attenuation.

The 26 dB & 99% bandwidth was recorded.



Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	831929/005	2018-08-03	2019-08-03
yzjingcheng	Coaxial Cable	KTRFBU-141-50	41010012	Each time	/
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	Each time	/
E-Microwave	Two-way Splitter	ODP-1-6-2S	OE0120142	Each time	/

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	25.8°C
Relative Humidity:	45 %
ATM Pressure:	100.5 kPa

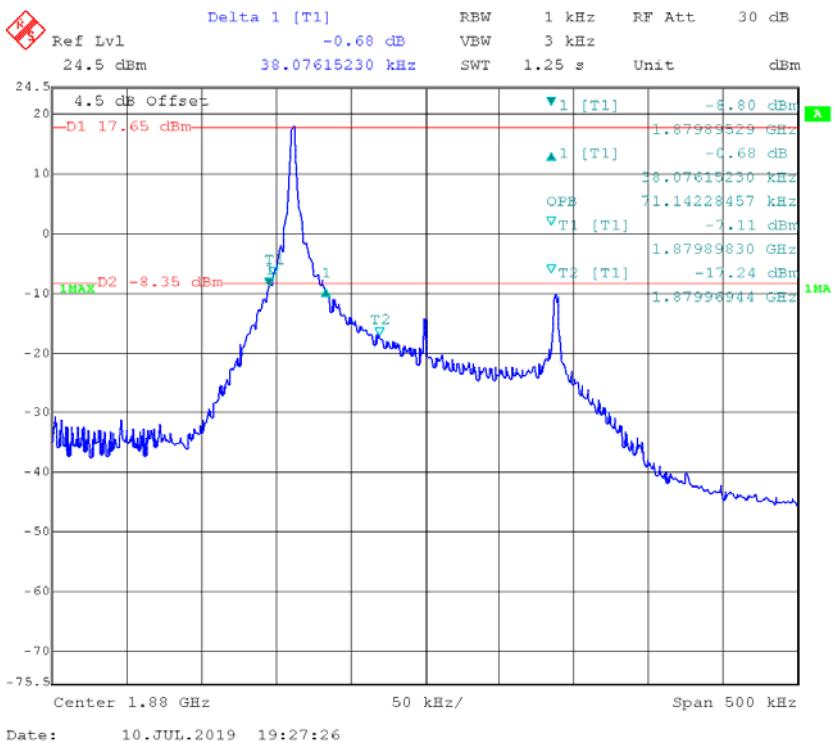
* The testing was performed by Blake Yang on 2019-07-10.

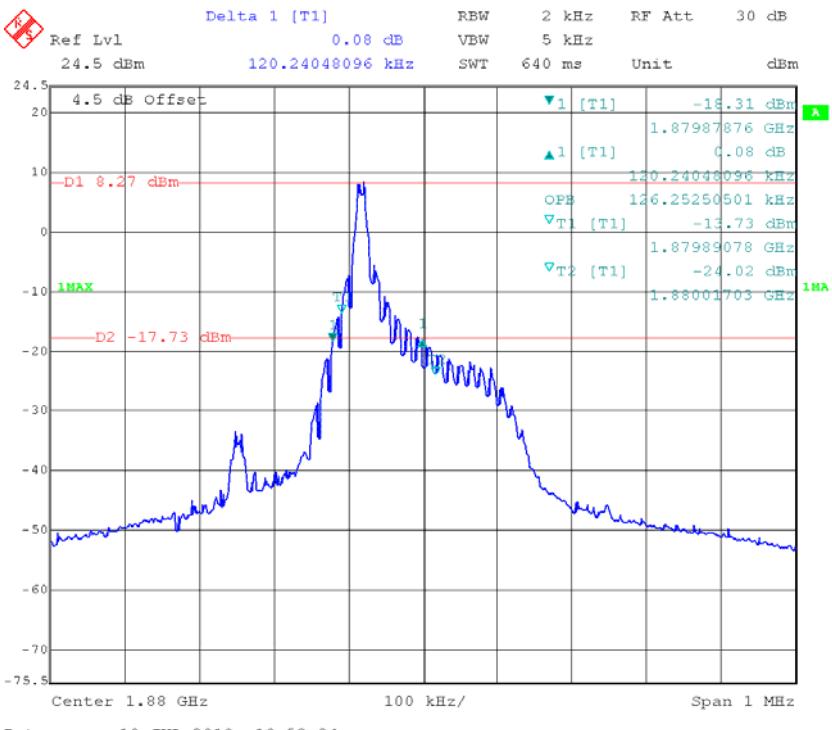
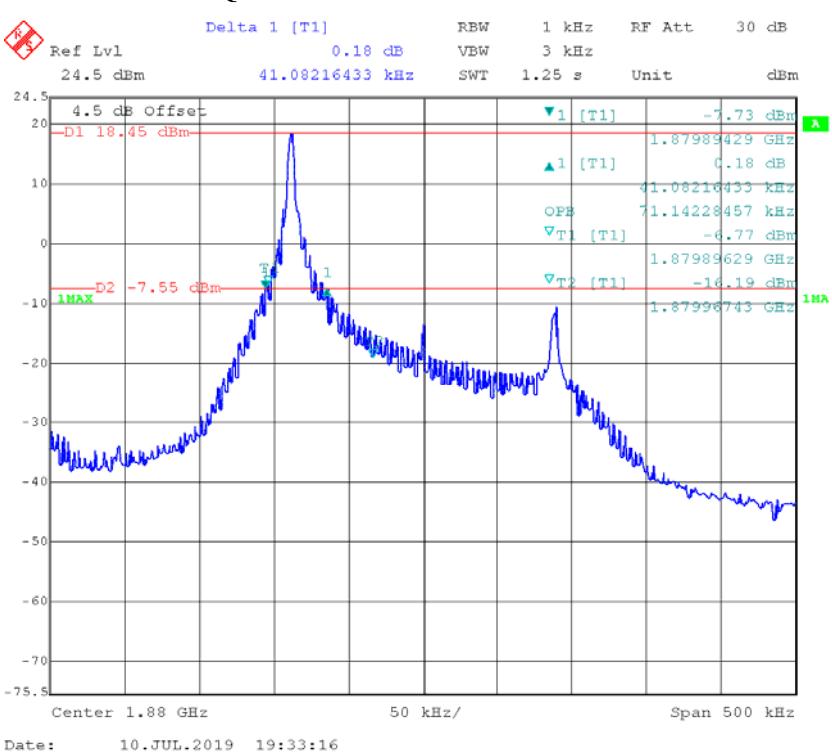
Test Mode: Transmitting

Test Result: Compliant. Please refer to the following table and plots.

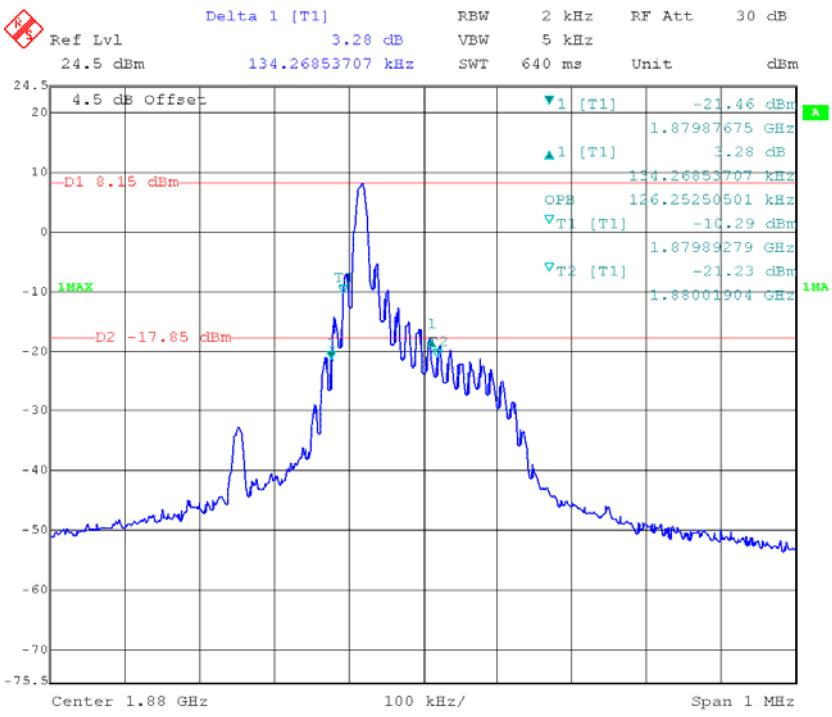
Test Modulation	Sub-Carrier Spacing	Resource Block & RB offset	Test Channel	99% Occupied Bandwidth (MHz)	26 dB Occupied Bandwidth (MHz)
BPSK	3.75 kHz	1#0	Middle	0.071	0.038
	15 kHz	1#0		0.120	0.126
QPSK	3.75 kHz	1#0	Middle	0.071	0.041
	15 kHz	1#0		0.126	0.134
	15 kHz	12#0		0.192	0.261

BPSK 3.75 kHz 1#0 Middle Channel

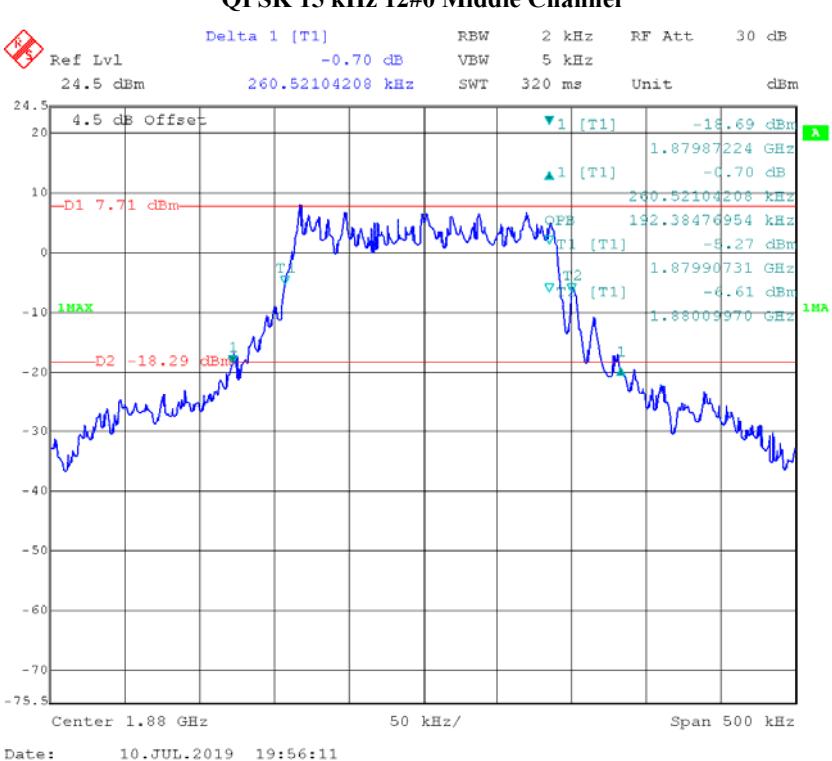


BPSK 15 kHz 1#0 Middle Channel**QPSK 3.75 kHz 1#0 Middle Channel**

QPSK 15 kHz 1#0 Middle Channel



QPSK 15 kHz 12#0 Middle Channel



FCC §2.1051, §24.238(a) - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

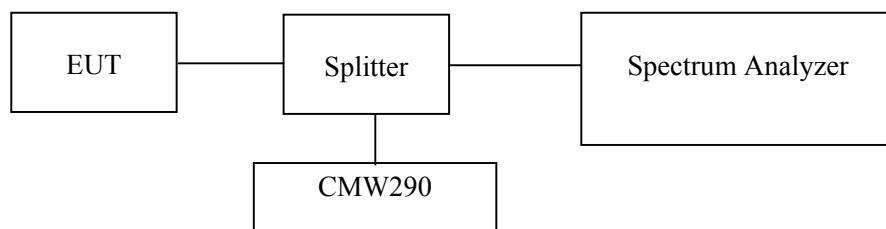
Applicable Standard

FCC §2.1051, §24.238(a).

The spectrum was to be investigated to the tenth harmonics of the highest fundamental frequency as specified in § 2.1051.

Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer and simulator through appropriate attenuation. Sufficient scans were taken to show any out of band emissions up to 10th harmonic.



Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	831929/005	2018-08-03	2019-08-03
yzjingcheng	Coaxial Cable	KTRFBU-141-50	41010012	Each time	N/A
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	Each time	N/A
E-Microwave	Two-way Spliter	ODP-1-6-2S	OE0120142	Each time	N/A

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

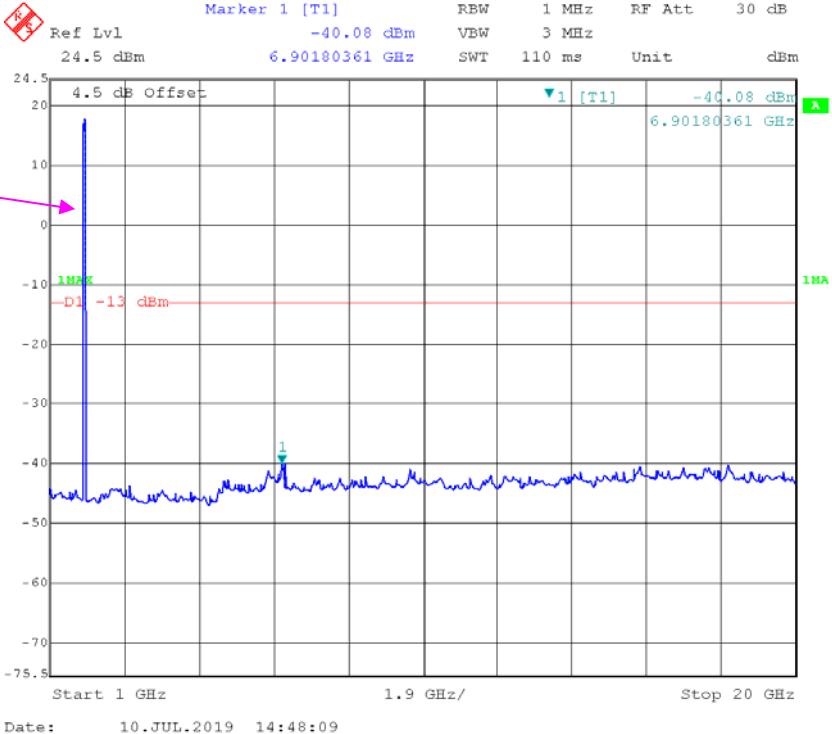
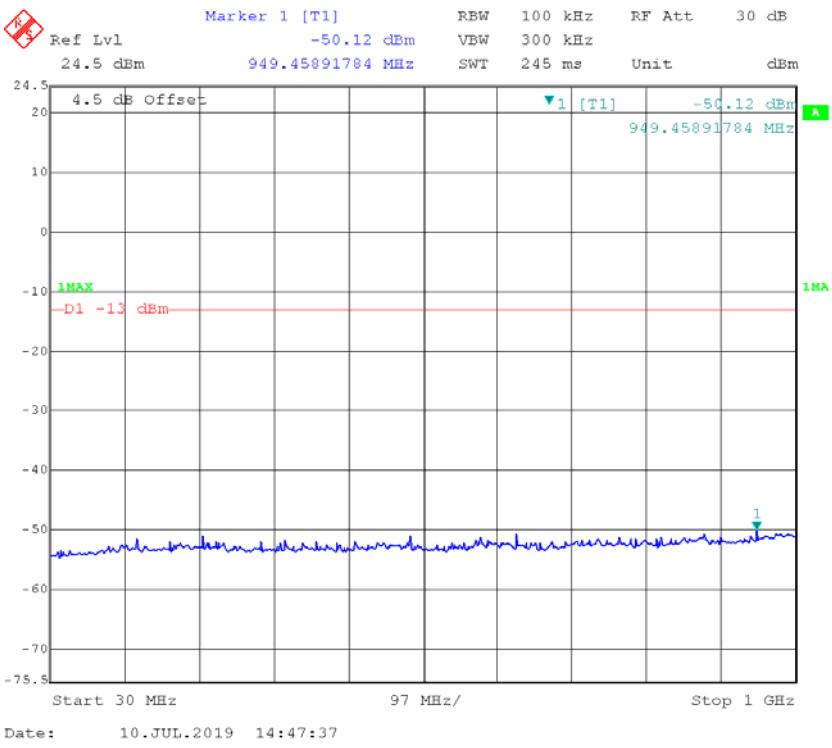
Environmental Conditions

Temperature:	25.8°C
Relative Humidity:	45 %
ATM Pressure:	100.5 kPa

* The testing was performed by Blake Yang on 2019-07-10.

Test Mode: Transmitting

Test Result: Compliance(BPSK 3.75 kHz 1#0Middle Channel was the worst), Please refer to the following plots.

BPSK 3.75 kHz 1#0 Middle Channel

FCC §2.1053, §24.238 - SPURIOUS RADIATED EMISSIONS

Applicable Standard

FCC § 2.1053, §24.238.

Test Procedure

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious emissions in dB = $10 \lg (\text{TXpwr in Watts}/0.001)$ – the absolute level

Spurious attenuation limit in dB = $43 + 10 \log_{10} (\text{power out in Watts})$

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESR3	102453	2019-06-26	2020-06-26
Sunol Sciences	Antenna	JB3	A060611-1	2017-11-10	2020-11-10
EMCO	Adjustable Dipole Antenna	3121C	9109-753	N/A	N/A
Unknown	Coaxial Cable	C-NJNJ-50	C-0400-01	2018-09-05	2019-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0075-01	2018-09-05	2019-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-1400-01	2019-05-06	2020-05-06
HP	Amplifier	8447D	2727A05902	2018-09-05	2019-09-05
R&S	Spectrum Analyzer	FSP 38	100478	2019-05-09	2020-05-09
TDK RF	Horn Antenna	HRN-0118	130 084	2018-10-12	2021-10-12
ETS-Lindgren	Horn Antenna	3115	000 527 35	2018-10-12	2021-10-12
Unknown	Coaxial Cable	C-NJNJ-50	C-0200-02	2018-09-05	2019-09-05
MICRO-COAX	Coaxial Cable	UFA147-1-2362-100100	64639 231029-001	2019-02-24	2020-02-24
Mini	Pre-amplifier	ZVA-183-S+	5969001149	2018-09-05	2019-09-05
Sinoscite	Band-stop filter	BSF1850-1910MS-0935V2	0935V2	2019-06-16	2020-06-16
Agilent	Signal Generator	E8247C	MY43321350	2018-12-10	2019-12-10
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-01 1304	2016-11-18	2019-11-18
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-02 1304	2016-11-18	2019-11-18

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	25.9°C
Relative Humidity:	44 %
ATM Pressure:	100.5 kPa

* The testing was performed by Blake Yang on 2019-07-10.

EUT Operation Mode: Transmitting

LTE Band 2 (30MHz-20GHz):

Frequency (MHz)	Polar (H/V)	Receiver Reading (dB μ V)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Substituted Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
Worst: BPSK 3.75 kHz 1#0, Frequency: 1880.000 MHz								
3760.00	H	59.21	-41	12.25	1.53	-30.28	-13.00	17.28
3760.00	V	58.64	-41.27	12.25	1.53	-30.55	-13.00	17.55
5640.00	H	55.93	-39.37	13.00	1.28	-27.65	-13.00	14.65
5640.00	V	53.11	-42.5	13.00	1.28	-30.78	-13.00	17.78
390.10	H	46.5	-58.69	0.00	0.60	-59.29	-13.00	46.29
307.20	V	39.68	-70.17	0.00	0.53	-70.7	-13.00	57.7

Note:

- 1) The unit of Antenna Gain is dBd for frequency below 1GHz, and the unit of Antenna Gain is dBi for frequency above 1GHz.
- 2) Absolute Level = Substituted Level - Cable loss + Antenna Gain
- 3) Margin = Limit-Absolute Level

FCC §24.238(a) - BAND EDGES

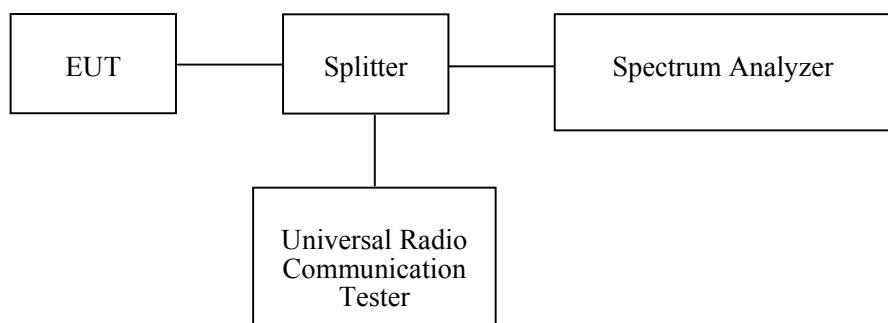
Applicable Standard

FCC § 2.1053, § 24.238

Test Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

The center of the spectrum analyzer was set to block edge frequency.



Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	831929/005	2018-08-03	2019-08-03
yzjingcheng	Coaxial Cable	KTRFBU-141-50	41010012	Each time	/
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	Each time	/
E-Microwave	Two-way Spliter	ODP-1-6-2S	OE0120142	Each time	/

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

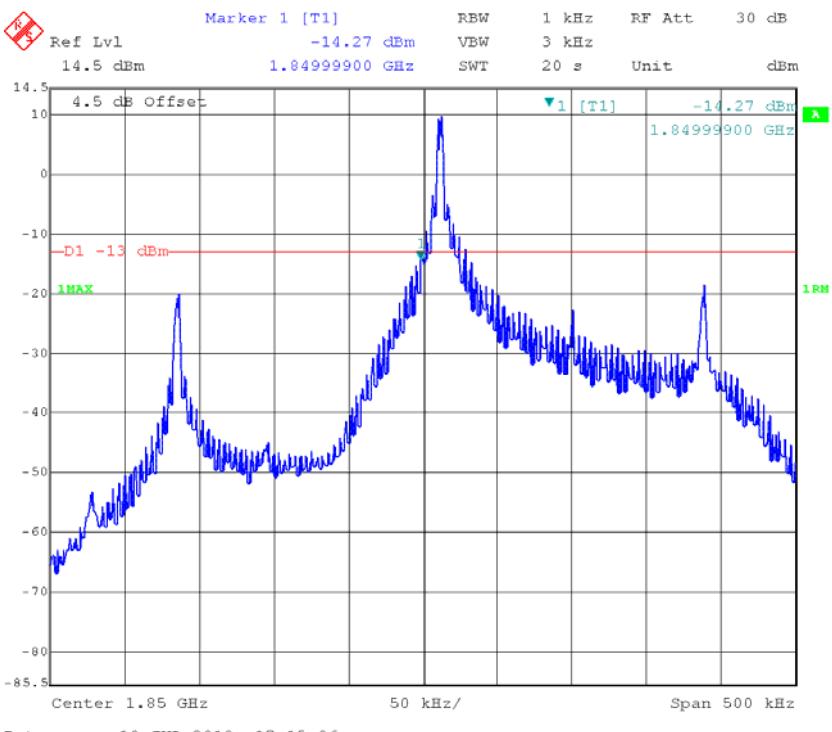
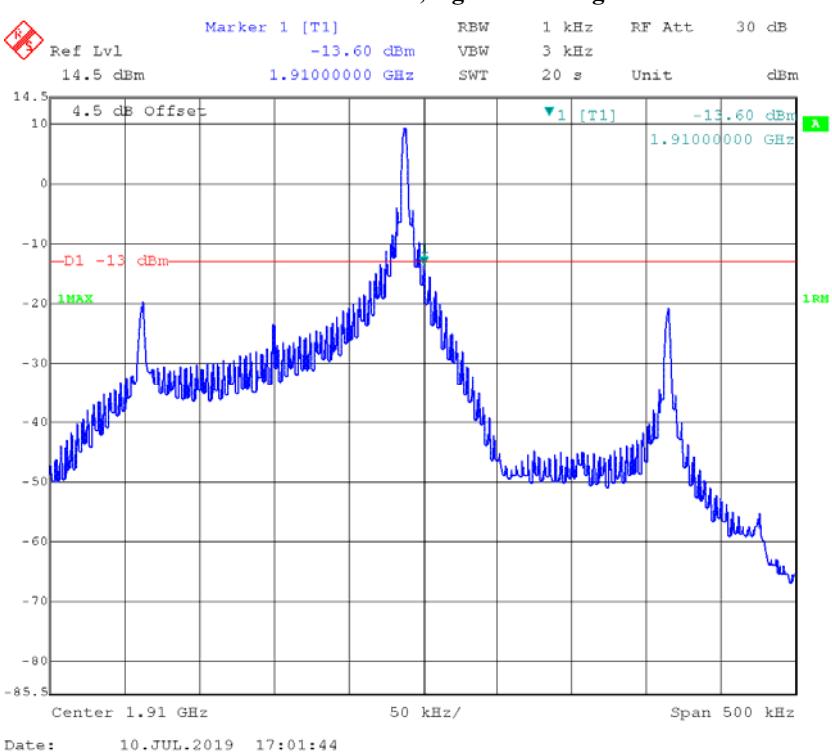
Environmental Conditions

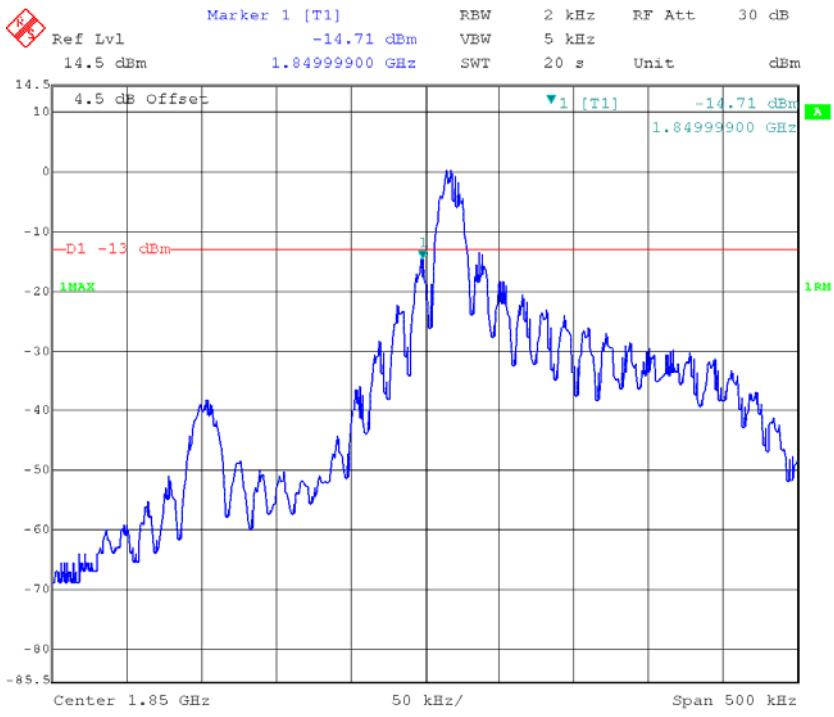
Temperature:	25.8°C
Relative Humidity:	45 %
ATM Pressure:	100.5 kPa

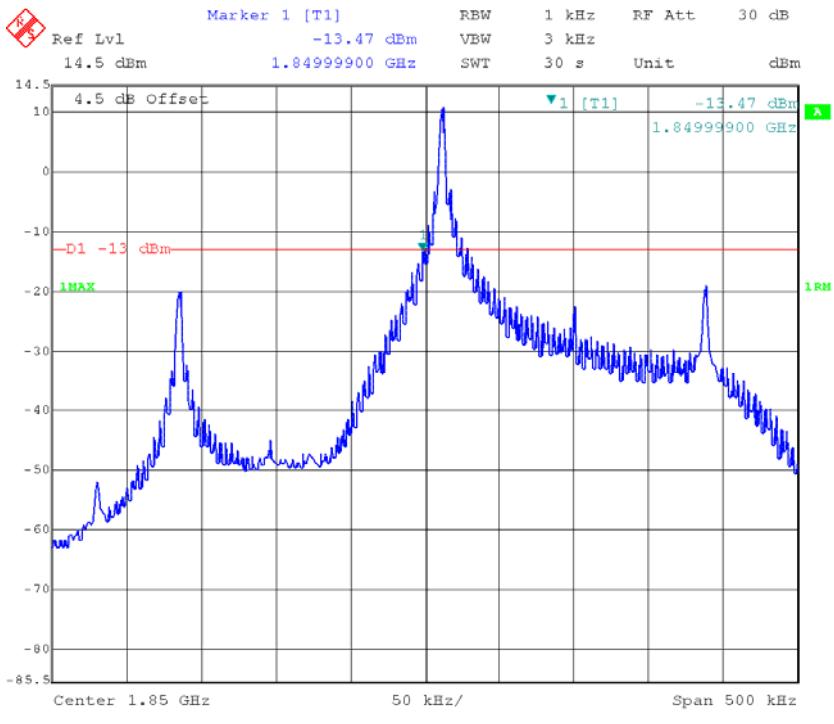
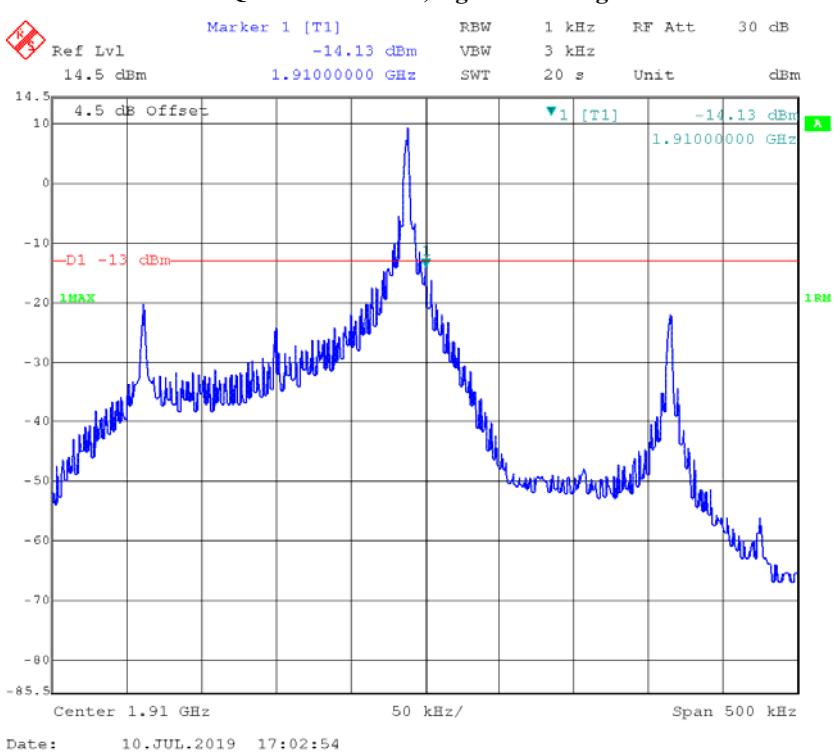
* The testing was performed by Blake Yang on 2019-07-10.

Test Mode: Transmitting

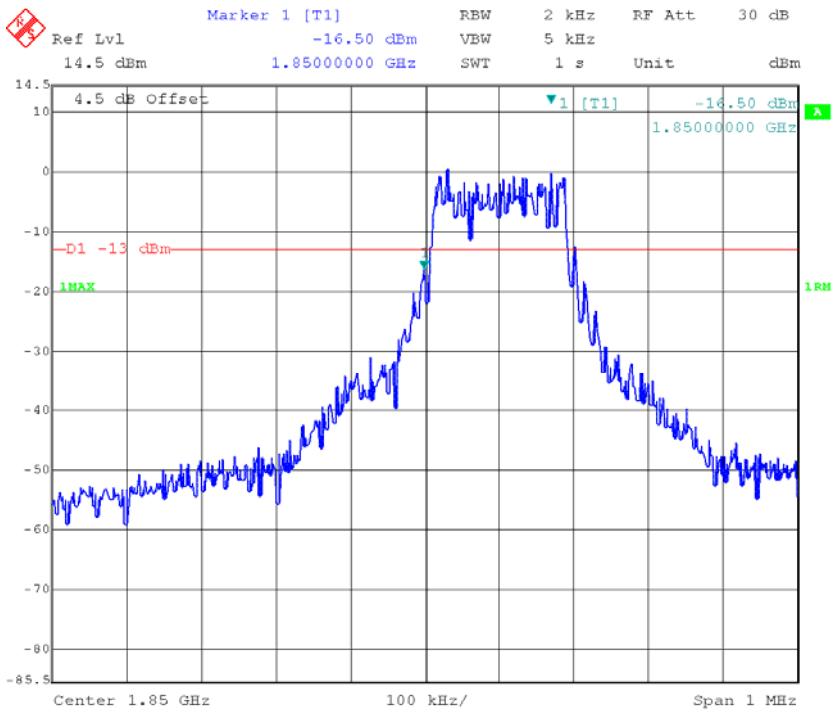
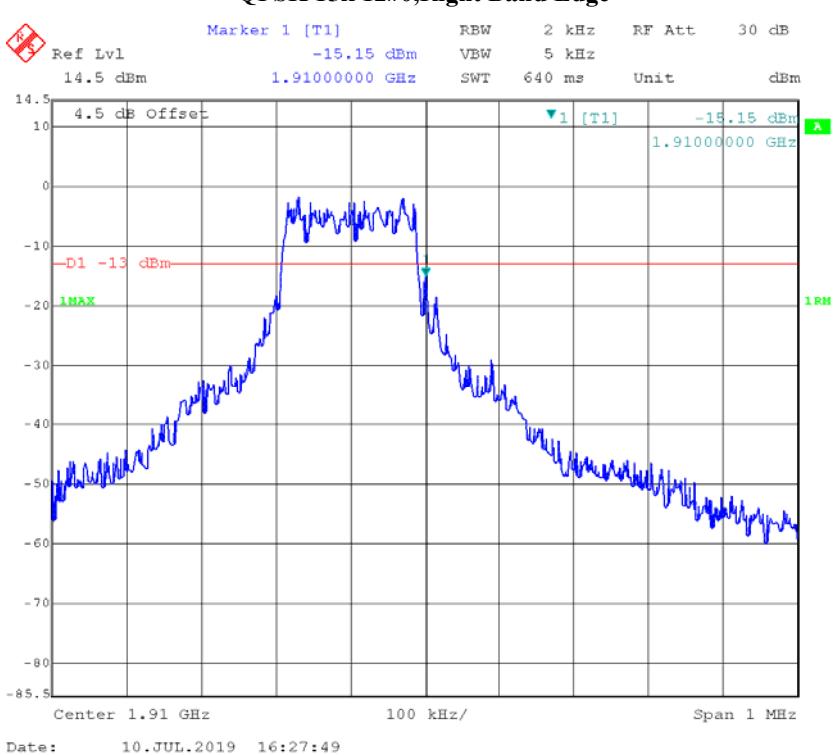
Test Result: Compliant. Please refer to the following plots.

BPSK 3.75k, 1#0 Left Band Edge**BPSK 3.75k 1#47,Right Band Edge**

BPSK 15k, 1#0 Left Band Edge**BPSK 15k 1#11,Right Band Edge**

QPSK 3.75k, 1#0 Left Band Edge**QPSK 3.75k 1#47, Right Band Edge**

QPSK 15k, 1#0 Left Band Edge**QPSK 15k 1#11,Right Band Edge**

QPSK 15k, 12#0 Left Band Edge**QPSK 15k 12#0,Right Band Edge**

FCC §2.1055, §24.235 - FREQUENCY STABILITY

Applicable Standard

FCC § 2.1055 (a), § 2.1055 (d), §24.235

According to §22.355, the carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances given in Table below:

Frequency Tolerance for Transmitters in the Public Mobile Services

Frequency Range (MHz)	Base, fixed (ppm)	Mobile > 3 watts (ppm)	Mobile ≤ 3 watts (ppm)
25 to 50	20.0	20.0	50.0
50 to 450	5.0	5.0	50.0
450 to 512	2.5	5.0	5.0
821 to 896	1.5	2.5	2.5
928 to 929.	5.0	N/A	N/A
929 to 960.	1.5	N/A	N/A
2110 to 2220	10.0	N/A	N/A

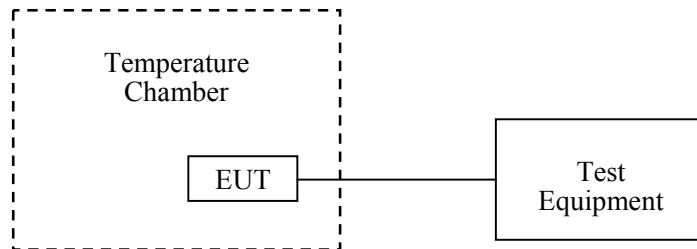
According to §24.235, the frequency stability shall be sufficient to ensure that the fundamental emissions stays within the authorized frequency block.

Test Procedure

Frequency Stability vs. Temperature: The equipment under test was connected to an external power supply and the RF output was connected to communication test set via feed-through attenuators. The EUT was placed inside the temperature chamber. The power leads and RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the communication test set.

Frequency Stability vs. Voltage: An external variable C power supply was connected to the terminals of the equipment under test. The voltage was set of the nominal value and was then decreased until the transmitter light no longer illuminated. The output frequency was recorded for each battery voltage.



Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Wideband Radio Communication Tester	CMW290	101742	2018-08-17	2019-08-17
ESPEC	Constant temperature and humidity Tester	ESX-4CA	018 463	2019-03-26	2020-03-26
UNI-T	Multimeter	UT39A	M130199938	2018-07-24	2019-07-24
yzjingcheng	Coaxial Cable	KTRFBU-141-50	41010012	Each time	N/A
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	Each time	N/A

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data**Environmental Conditions**

Temperature:	25.8°C
Relative Humidity:	45 %
ATM Pressure:	100.5 kPa

* The testing was performed by Blake Yang on 2019-07-10.

BPSK, Middle Channel, $f_c = 1880$ MHz				
Temperature	Voltage	Frequency Error	Frequency Error	Result
°C	V _{DC}	Hz	ppm	
-30	3.7	8	0.0043	Pass
-20		8	0.0043	
-10		6	0.0032	
0		6	0.0032	
10		4	0.0021	
20		10	0.0053	
30		7	0.0037	
40		5	0.0027	
50		8	0.0043	
20	3.5	8	0.0043	
20	4.2	9	0.0048	

QPSK, Middle Channel, $f_c = 1880$ MHz				
Temperature	Voltage	Frequency Error	Frequency Error	Result
°C	V _{DC}	Hz	ppm	
-30	3.7	6	0.0032	Pass
-20		5	0.0027	
-10		10	0.0053	
0		7	0.0037	
10		9	0.0048	
20		4	0.0021	
30		7	0.0037	
40		4	0.0021	
50		5	0.0027	
20	3.5	8	0.0043	
20	4.2	9	0.0048	

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