



RF TEST REPORT

Applicant Flextronics (Shanghai) Co., Ltd
FCC ID 2AP3PAPOC2
Product In-cab telematics tracker
Model FT502-L130-GL
Report No. R2006A0368-R2
Issue Date July 9,2020

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC CFR47 Part 2 (2019)/ FCC CFR 47 Part 24E (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

No.	Test Case	Clause in FCC rules	Verdict
1	Effective Isotropic Radiated Power	24.232(c)	PASS
2	Radiates Spurious Emission	2.1053 / 24.238(a)	PASS
Date of Testing: June 15, 2020~ June 29, 2020			
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.			

Only Effective Isotropic Radiated Power and Radiates Spurious Emission are tested in this report. Other items please refer to EG91-NA module report(Report No.: R1805A0250-R2)



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 electromagnetic emissions measurements.

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

2.3. Applicant and Manufacturer Information

Applicant	Flextronics (Shanghai) Co., Ltd
Applicant address	4F, Bldg. 10, No. 3000 Longdong Ave., Pudong New District, Shanghai 201203, China
Manufacturer	Flex Industrial, Ltd.
Manufacturer address	Level 3, Alexander House, 35 Cybercity, Ebene, Mauritius

2.4. General information

EUT Description			
Model	FT502-L130-GL		
IMEI	866258041991487		
Hardware Version	P2		
Software Version	2.3.23		
Power Supply	External Power Supply		
Antenna Type	Internal Antenna		
Antenna Gain	1.0dBi		
Test Mode(s)	WCDMA Band II; LTE Band 2;		
Test Modulation	(WCDMA) BPSK, QPSK; (LTE)QPSK,16QAM		
HSDPA UE Category	24		
HSUPA UE Category	6		
DC-HSDPA UE Category	24		
LTE Category	4		
Maximum E.I.R.P	WCDMA Band II:	24.38dBm	
	LTE Band 2:	25.44dBm	
Rated Power Supply Voltage	12V		
Extreme Voltage	Minimum: 6V Maximum: 48V		
Extreme Temperature	Lowest: -40°C Highest: +85°C		
Operating Frequency Range(s)	Band	Tx (MHz)	Rx (MHz)
	WCDMA Band II	1850 ~ 1910	1930 ~ 1990
	LTE Band 2	1850 ~ 1910	1930 ~ 1990
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 CFR 47 Part 24E (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 (Z 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 WCDMA/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
	WCDMA Band II
Effective Isotropic Radiated Power	RMC HSDPA/HSUPA DC-HSDPA
Radiates Spurious Emission	RMC

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

Test items	Bandwidth (MHz)						Modulation		RB			Test Channel		
	1.4	3	5	10	15	20	QPSK	16QAM	1	50%	100%	L	M	H
Effective Isotropic Radiated Power	O	O	O	O	O	O	O	O	O	O	O	O	O	O
Radiates Spurious Emission	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. Effective Isotropic Radiated Power

Ambient condition

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

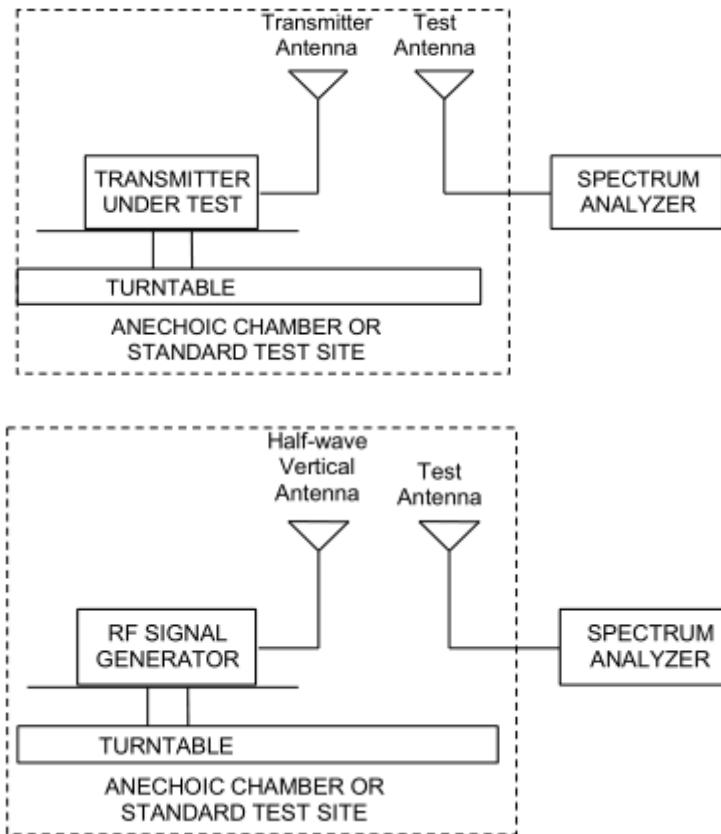
Methods of Measurement

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 $k = 2$, $U = 1.19 \text{ dB}$ for EIRP.

Test Results

WCDMA Band II		EIRP (dBm)		
		Channel 9262	Channel 9400	Channel 9538
		1852.4 (MHz)	1880 (MHz)	1907.6 (MHz)
RMC	12.2k	24.38	24.33	24.18
	64k	24.32	24.21	24.02
	144k	24.23	24.16	24.01
	384k	24.22	24.17	24.02
HSDPA	Sub - Test 1	23.36	23.37	23.35
	Sub - Test 2	23.39	23.37	23.30
	Sub - Test 3	22.86	22.87	22.80
	Sub - Test 4	22.90	22.81	22.80
HSUPA	Sub - Test 1	23.40	23.39	23.30
	Sub - Test 2	22.90	22.88	22.82
	Sub - Test 3	23.43	23.38	23.34
	Sub - Test 4	23.48	23.34	23.32
	Sub - Test 5	23.32	23.21	23.18
DC-HSDPA	Sub - Test 1	24.31	24.22	24.07
	Sub - Test 2	24.30	24.21	24.06
	Sub - Test 3	23.79	23.70	23.55
	Sub - Test 4	23.78	23.79	23.53

LTE Band 2				EIRP (dBm)		
BW	Modulation	RB size	RB offset	Channel/Frequency(MHz)		
				18607/ 1850.7	18900/ 1880	19193/ 1909.3
1.4MHz	QPSK	1	0	24.90	24.76	24.58
		1	2	25.19	24.97	24.68
		1	5	25.22	24.89	24.78
		3	0	24.86	24.87	24.81
		3	2	24.96	24.65	24.86
		3	3	25.12	24.89	24.67
		6	0	23.98	23.88	23.84
	16QAM	1	0	23.89	23.67	24.09
		1	2	24.05	23.96	24.17
		1	5	23.95	23.85	23.95
BW	Modulation	RB size	RB offset	Channel/Frequency(MHz)		
				18615/ 1851.5	18900/ 1880	19185/ 1908.5
3MHz	QPSK	1	0	24.98	24.77	24.64
		1	7	25.13	24.84	25.43
		1	14	24.82	24.58	24.52
		8	0	23.96	23.95	23.74
		8	4	23.90	23.82	23.94
		8	7	23.87	23.88	23.89
		15	0	23.82	23.89	23.98
	16QAM	1	0	24.17	23.99	24.43
		1	7	24.76	23.88	25.14
		1	14	24.09	23.90	24.32
BW	Modulation	RB size	RB offset	Channel/Frequency(MHz)		
				18625/ 1852.5	18900/ 1880	19175/ 1907.5
5MHz	QPSK	1	0	24.95	24.75	24.60
		1	13	25.11	24.80	25.40
		1	24	24.79	24.53	24.48
		12	0	23.93	23.90	23.70
		12	6	23.88	23.78	23.89
		12	13	23.85	23.86	23.85
		25	0	23.80	23.88	23.96



	16QAM	1	0	24.14	23.95	24.40
		1	13	24.73	23.86	25.11
		1	24	24.06	23.88	24.28
BW	Modulation	RB size	RB offset	Channel/Frequency(MHz)		
				18650/ 1855	18900/ 1880	19150/ 1905
10MHz	QPSK	1	0	24.97	24.76	24.63
		1	25	25.14	24.85	25.44
		1	49	24.81	24.57	24.51
		25	0	23.96	23.95	23.74
		25	13	23.91	23.83	23.93
		25	25	23.87	23.90	23.90
		50	0	23.88	23.90	24.00
	16QAM	1	0	24.16	23.98	24.42
		1	25	24.76	23.90	25.14
		1	49	24.09	23.90	24.31
BW	Modulation	RB size	RB offset	Channel/Frequency(MHz)		
				18675/ 1857.5	18900/ 1880	19125/ 1902.5
15MHz	QPSK	1	0	24.96	24.72	24.61
		1	38	25.12	24.84	25.41
		1	74	24.78	24.52	24.47
		36	0	23.94	23.91	23.71
		36	18	23.88	23.78	23.89
		36	39	23.84	23.87	23.86
		75	0	23.86	23.86	23.95
	16QAM	1	0	24.11	23.96	24.40
		1	38	24.74	23.87	25.12
		1	74	24.06	23.86	24.28
BW	Modulation	RB size	RB offset	Channel/Frequency(MHz)		
				18700/ 1860	18900/ 1880	19100/ 1900
20MHz	QPSK	1	0	24.93	24.68	24.58
		1	50	25.11	24.80	25.39
		1	99	24.76	24.51	24.44
		50	0	23.91	23.86	23.67
		50	25	23.86	23.74	23.86
		50	50	23.81	23.82	23.82



		100	0	23.83	23.81	23.91
	16QAM	1	0	24.09	23.92	24.35
		1	50	24.70	23.85	25.08
		1	99	24.04	23.83	24.26

5.2. 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 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:

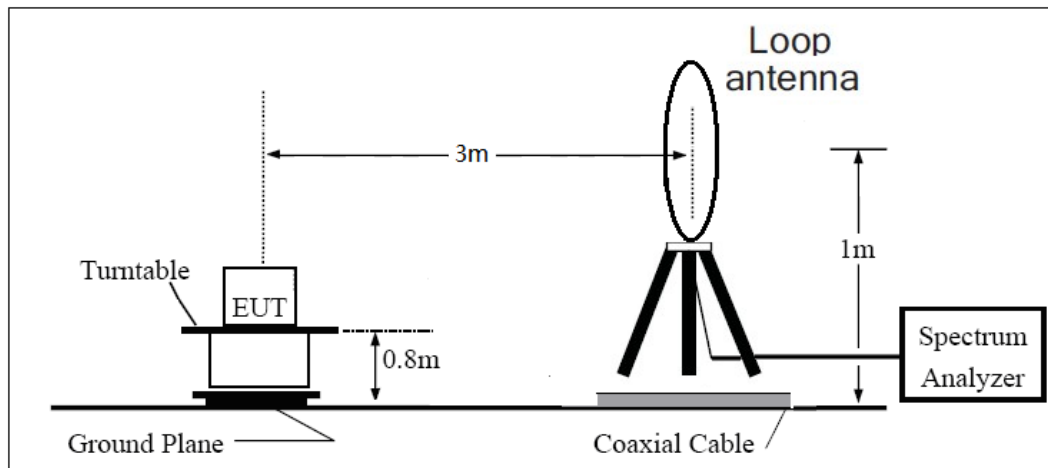
$$\text{Power(EIRP)} = \text{PMea} - \text{Pcl} + \text{Ga}$$
8. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi)

and known input power. ERP can be calculated from EIRP by subtracting the gain of the dipole, $ERP = EIRP - 2.15\text{dBi}$.

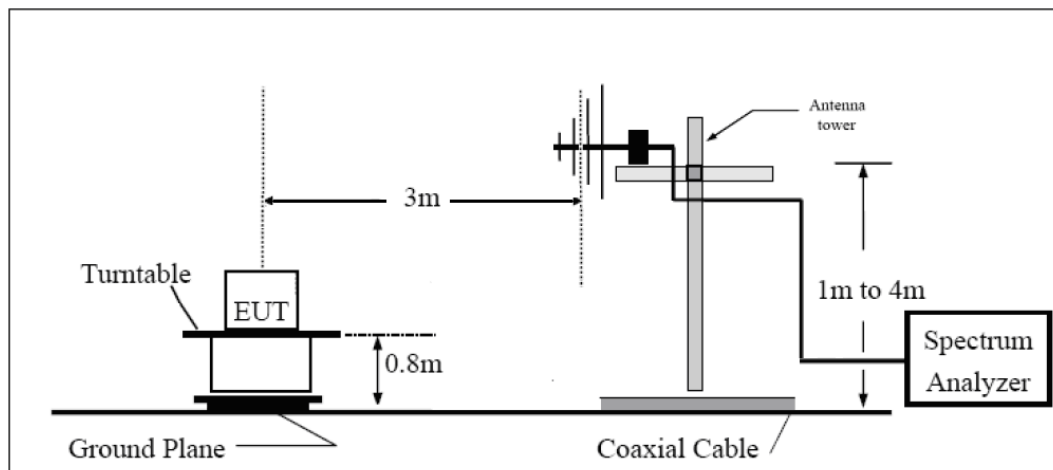
The modulation mode and RB allocation refer to section 5.1, using the maximum output power configuration.

Test setup

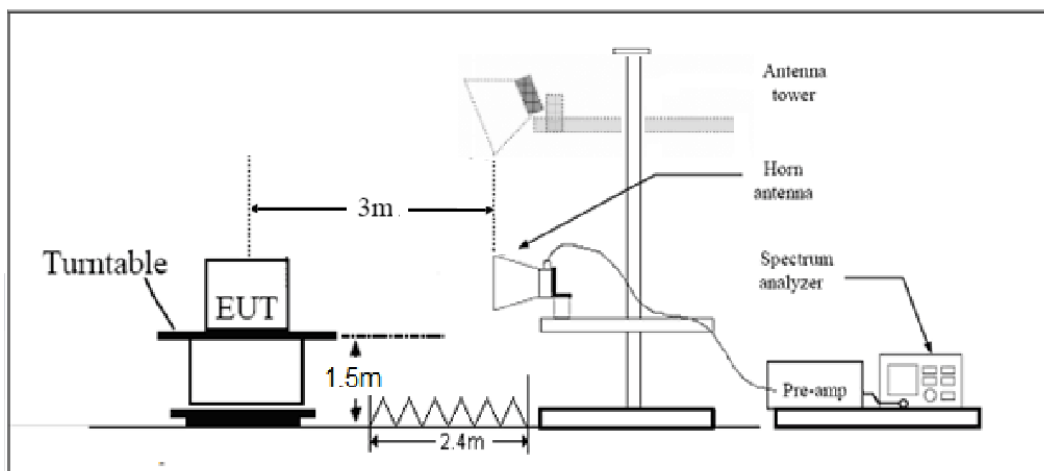
9KHz ~ 30MHz



30MHz ~ 1GHz



Above 1GHz





Note: Area side: 2.4mX3.6m

Limits

Rule Part 24.238(a) specifies that “on any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least $43 + 10 \log_{10} (P)$ dB.”

Limit	-13 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 $k = 1.96$, $U = 3.55$ 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.

WCDMA Band II CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3760.0	-42.25	5.10	11.05	Horizontal	-36.30	-13.00	23.30	270
3	5640.0	-51.83	5.42	12.65	Horizontal	-44.60	-13.00	31.60	225
4	7520.0	-55.10	6.70	13.85	Horizontal	-47.95	-13.00	34.95	90
5	9400.0	-53.64	7.01	14.75	Horizontal	-45.90	-13.00	32.90	0
6	11280.0	-51.97	7.48	15.95	Horizontal	-43.50	-13.00	30.50	0
7	13160.0	-50.03	7.51	16.55	Horizontal	-40.99	-13.00	27.99	45
8	15040.0	-47.31	8.24	15.35	Horizontal	-40.20	-13.00	27.20	135
9	16920.0	-46.30	8.41	14.95	Horizontal	-39.76	-13.00	26.76	225
10	18800.0	-	-	-	-	-	-	-	-

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

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

LTE Band 2 1.4MHz CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3759.0	-39.29	5.10	11.05	Horizontal	-33.34	-13.00	20.34	135
3	5638.9	-47.02	5.42	12.65	Horizontal	-39.79	-13.00	26.79	45
4	7520.0	-53.45	6.70	13.85	Horizontal	-46.30	-13.00	33.30	0
5	9400.0	-46.04	7.01	14.75	Horizontal	-38.30	-13.00	25.30	0
6	11280.0	-49.17	7.48	15.95	Horizontal	-40.70	-13.00	27.70	90
7	13160.0	-47.04	7.51	16.55	Horizontal	-38.00	-13.00	25.00	270
8	15040.0	-47.61	8.24	15.35	Horizontal	-40.50	-13.00	27.50	135
9	16920.0	-45.94	8.41	14.95	Horizontal	-39.40	-13.00	26.40	180
10	18800.0	-	-	-	-	-	-	-	-

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

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



LTE Band 2 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	3755.6	-40.75	5.10	11.05	Horizontal	-34.80	-13.00	21.80	135
3	5633.6	-50.43	5.42	12.65	Horizontal	-43.20	-13.00	30.20	180
4	7520.0	-54.25	6.70	13.85	Horizontal	-47.10	-13.00	34.10	270
5	9400.0	-46.74	7.01	14.75	Horizontal	-39.00	-13.00	26.00	0
6	11280.0	-51.77	7.48	15.95	Horizontal	-43.30	-13.00	30.30	45
7	13160.0	-49.34	7.51	16.55	Horizontal	-40.30	-13.00	27.30	90
8	15040.0	-48.41	8.24	15.35	Horizontal	-41.30	-13.00	28.30	45
9	16920.0	-45.64	8.41	14.95	Horizontal	-39.10	-13.00	26.10	135
10	18800.0	-	-	-	-	-	-	-	-

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

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

LTE Band 2 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	3742.1	-41.85	5.10	11.05	Horizontal	-35.90	-13.00	22.90	0
3	5613.4	-49.83	5.42	12.65	Horizontal	-42.60	-13.00	29.60	45
4	7484.6	-53.65	6.70	13.85	Horizontal	-46.50	-13.00	33.50	90
5	9400.0	-49.70	7.01	14.75	Horizontal	-41.96	-13.00	28.96	90
6	11280.0	-52.27	7.48	15.95	Horizontal	-43.80	-13.00	30.80	315
7	13160.0	-50.84	7.51	16.55	Horizontal	-41.80	-13.00	28.80	90
8	15040.0	-48.61	8.24	15.35	Horizontal	-41.50	-13.00	28.50	45
9	16920.0	-44.04	8.41	14.95	Horizontal	-37.50	-13.00	24.50	135
10	18800.0	-	-	-	-	-	-	-	-

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

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

6. Main Test Instruments

Name	Manufacturer	Type	Serial Number	Calibration Date	Expiration Date
Base Station Simulator	R&S	CMU200	118133	2020-05-17	2021-05-16
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
Universal Radio Communication Tester	Key sight	E5515C	MY48367192	2020-05-27	2021-05-26
Signal Analyzer	R&S	FSV30	100815	2019-12-15	2020-12-14
Loop Antenna	SCHWARZBECK	FMZB1519	1519-047	2017-09-26	2020-09-25
Trilog Antenna	SCHWARZBECK	VUBL 9163	9163-201	2017-11-18	2020-11-17
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	2017-12-17	2020-12-16
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	2020-06-12	2020-12-11
Software	R&S	EMC32	9.26.0	/	/

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