Test Report

FCC ID: 2AT7I-T2

Date of issue: Nov. 10, 2020

Report number:	MTi20061009-2E4
Sample description:	4G Wireless Data & GPS Tracking Device
Model(s):	T2
Applicant:	iFREE GROUP (HK) Ltd
Address:	Suite 06, 19/F, Mira Place Tower A, 132 Nathan Road, Tsim Sha Tsui, Kowloon, Hong Kong.
Date of test:	July. 07, 2019 to Nov. 10, 2020

Shenzhen Microtest Co., Ltd.
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Address: 101, No. 7, Zone 2, Xinxing Industrial Park, Fuhai Avenue, Xinhe Community, Fuhai Street, Bao' an District, Shenzhen, Guangdong, China.

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Test Result Certification

Applicant's name:	iFREE GROUP (HK) Ltd
Address:	Suite 06, 19/F, Mira Place Tower A, 132 Nathan Road, Tsim Sha Tsui, Kowloon, Hong Kong.
Manufacture's name:	iFREE GROUP (HK) Ltd
Address:	Suite 06, 19/F, Mira Place Tower A, 132 Nathan Road, Tsim Sha Tsui, Kowloon, Hong Kong.
Product name:	4G Wireless Data & GPS Tracking Device
Trademark:	MOGO
Model name:	T2
Standards:	FCC Part 22 Subpart H FCC Part 24 Subpart E FCC CFR 47 Part 27
Test procedure:	ANSI/TIA-603-E-2016 ANSI C63.26:2015 KDB 971168 D01 Power Meas License Digital Systems v03r01

This device described above has been tested by Shenzhen Microtest Co., Ltd. and the test results show that the equipment under test (EUT) compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

Tested by: Danny Xu — Nov. 10, 2020

Reviewed by: Leo Su — Nov. 10, 2020

Approved by: Tom Xue — Nov. 10, 2020

1 General description

1.1 Feature of equipment under test (EUT)

Product name:	4G Wireless Data & GPS Tracking Device
Trade name	MOGO
Model name:	T2
Serial model:	N/A
Difference in series models:	N/A
Frequency range:	WCDMA Band II: TX 1852.4MHz~1907.6MHz; RX 1932.4MHz~1987.6MHz; WCDMA Band IV: TX 1712.4-1752.6 MHz; RX 2112.4-2152.6 MHz WCDMA Band V: TX 826.4MHz~846.6MHz; RX 871.4MHz~891.6MHz;
Modulation type:	QPSK/16QAM for WCDMA bands;
SIM card:	The 4G Wireless Data & GPS Tracking Device has One SIM Card socket
Antenna Type	FPC Antenna
Antenna gain:	WCDMA Band II: 0.33dBi WCDMA Band IV: 0.52dBi WCDMA Band V: 0.76dBi
Hardware version	T2M1_VER.A
Software version	T2_V03.02.07.19101T
Power supply:	DC 5V from adapter or DC 3.8V from battery
Battery:	DC 3.8V 2000mAh
Adapter information:	N/A

1.2 Test frequency channel

Frequency Band	Frequency	Channel	Frequency(MHz)
WCDMA Band II	Low	9262	1852.4
	Middle	9400	1880
	High	9538	1907.6
WCDMA Band IV	Low	1312	1712.4
	Middle	1450	1732.6
	High	1513	1752.6
WCDMA Band V	Low	4132	826.4
	Middle	4183	836.4
	High	4233	846.6

1.3 EUT operation mode

During testing, RF test program provided by the manufacture to control the Tx operation followed the test requirement. The EUT is configured to transmit continuously (duty cycle > 98 %) at the maximum power control level.

1.4 Test conditions

During the measurement the environmental conditions were within the listed ranges:

- Temperature: 20ºC~30ºC
- Humidity: 30%~70%
- Atmospheric pressure: 98kPa~101kPa

1.5 Testing site

Test Site	Shenzhen Microtest Co., Ltd.
Test Site Location	101, No. 7, Zone 2, Xinxing Industrial Park, Fuhai Avenue, Xinhe Community, Fuhai Street, Bao' an District, Shenzhen, Guangdong, China.
FCC Registration No.:	448573

1.6 Ancillary equipment list

Equipment	Model	S/N	Manufacturer	Certificate type
/	/	/	/	/

1.7 Measurement uncertainty

Measurement Uncertainty for a Level of Confidence of 95 %, U=2xUc(y)

RF frequency	1 x 10-7
RF power, conducted	± 1 dB
Conducted emission(150kHz~30MHz)	± 2.5 dB
Radiated emission(30MHz~1GHz)	± 4.2 dB
Radiated emission (above 1GHz)	± 4.3 dB
Temperature	±1 degree
Humidity	± 5 %

2 Summary of Test Result

Item	FCC Part No.	Description of Test	Result
1	2.1046, 22.913(a); 24.232(c) 27.50(d) (4)	Maximum output power	Pass
2	2.1046, 22.913(a); 24.232(c) 27.50(d)(5)	Peak to average power radio(PAPR)	Pass
3	2.1046, 22.913(a); 24.232(c) 27.50(d)(4)	Transmitter Radiated Power (EIRP/ERP)	Pass
4	2.1049; 22.917(b); 24.238(b) 27.53(h)	Occupied Bandwidth	Pass
5	2.1051; 22.917(a); 24.238(a) 27.53(h)	Conducted spurious emissions	Pass
6	2.1051; 22.917(b); 24.238(b) 27.53(h)	Spurious emissions at band edge	Pass
7	2.1053; 22.917(a); 24.238(a) 27.53(h)	Radiated spurious emissions	Pass
8	2.1055; 22.355; 24.235 27.54	Frequency Stability	Pass

3 Test facilities and accreditations

4.1 Test laboratory

Test Laboratory	Shenzhen Microtest Co., Ltd
Location	101, No. 7, Zone 2, Xinxing Industrial Park, Fuhai Avenue, Xinhe Community, Fuhai Street, Bao' an District, Shenzhen, Guangdong, China.
FCC Registration No.:	448573

4.2 Environmental conditions

Temperature:	15ºC~35ºC
Humidity	20%~75%
Atmospheric pressure	98kPa~101kPa

4.3 Measurement uncertainty

Measurement Uncertainty for a Level of Confidence of 95 %, U=2xUc(y)

RF frequency	1 x 10-7
RF power, conducted	± 1 dB
Conducted emission(150kHz~30MHz)	± 2.5 dB
Radiated emission(30MHz~1GHz)	± 4.2 dB
Radiated emission (above 1GHz)	± 4.3 dB
Temperature	±1 degree
Humidity	± 5 %

4.4 Test software

Software Name	Manufacturer	Model	Version
WCDMA	Shenzhen JS tonscend co., ltd	JS1120-2	2.1.5.10

4 List of test equipment

Equipment No.	Equipment Name	Manufacturer	Model	Serial No.	Calibration date	Due date
MTI-E004	EMI Test Receiver	Rohde&schwarz	ESPI7	100314	2020/10/09	2021/10/08
MTI-E006	TRILOG Broadband Antenna	schwarabeck	VULB 9163	9163-872	2020/10/15	2021/10/14
MTI-E007	Double Ridged Broadband Horn Antenna	schwarabeck	BBHA 9120 D	9120D-1145	2020/10/13	2021/10/12
MTI-E014	amplifier	Hewlett-Packard	8447D	3113A06150	2020/10/09	2021/10/08
MTI-E036	Single path vehicle AMN(LISN)	Schwarzbeck	NNBM 8124	01175	2020/10/09	2021/10/08
MTI-E038	Low noise active vertical monopole antenna	Schwarzbeck	VAMP 9243	#565	2020/10/16	2021/10/15
MTI-E039	Biconical antenna	Schwarzbeck	BBA 9106	#164	2020/10/15	2021/10/14
MTI-E041	MXG Vector Signal Generator	Agilent	N5182A	MY49060455	2020/04/16	2021/04/15
MTI-E042	ESG Series Analog signal generator	Agilent	E4421B	GB40051240	2020/05/21	2021/05/20
MTI-E044	Thermometer clock humidity monitor	-	HTC-1	/	2020/04/17	2021/04/16
MTI-E062	Log Periodic Antenna	Schwarzbeck	VUSLP 9111B	#312	2020/04/11	2021/04/10
MTI-E063	Log Periodic Dipole Array Antenna	ETS-LINDGREN	3148B	00224524	2020/04/11	2021/04/10
MTI-E065	Amplifier	EMtrace	RP06A	00117	2020/04/29	2021/04/28
MTI-E066	Comprehensive test instrument	Rohde&schwarz	CMW500	149155	2020/04/16	2021/04/15
MTI-E071	PXA Signal Analyzer	Agilent	N9030A	MY51350296	2020/10/25	2021/10/24
MTI-E076	EMI Test Receiver	Rohde&schwarz	ESIB26	100273	2020/04/16	2021/04/15
MTI-E078	Synthesized Sweeper	Agilent	83752A	3610A01957	2020/04/16	2021/04/15
MTI-E079	DC Power Supply	Agilent	E3632A	MY40027695	2020/04/16	2021/04/15
MTI-E093	Artificial mains network	3ctest	LISN J50	ES3911805	2020/04/16	2021/04/15
MTI-E096	Power amplifier	Space-Dtroniccs	EWLNA0118G-P40	1852001	2020/04/29	2021/04/28
MTI-E097	Current Probe	SOLAR ELECTRONICS CO.	9207-1	220095-1	2020/04/17	2021/04/16
MTI-E098	Loop Sensor	SOLAR ELECTRONICS CO.	7334-1	220095-2	2020/04/21	2021/04/20

Note: the calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

5 Test Result

4.5 Maximum output power and EIRP & ERP

5.1.1 Limit

For FCC 22.913: The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

For FCC 24.234: 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. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13dB.

For 27.50 (d)(4) The following power and antenna height requirements apply to stations transmitting in the 1710–1755 MHz and 2110–2155 MHz bands: Fixed, mobile, and portable (hand-held) stations operating in the 1710–1755 MHz band are limited to 1 watt EIRP.

5.1.2 Test method

For Conducted output power:

1.Use a universal radio communication tester, the output power of EUT was measured at the antenna terminal. The path loss was calibrated and entered as an offset into the test equipment.

2. The EUT was configured to transmit on maximum power by the radio communication tester.

3. Measured the peak and average powers.

For EIRP & ERP:

1.In many cases, the RF output power limits for licensed digital transmission devices is specified in terms of effective radiated power (ERP) or equivalent isotropic radiated power (EIRP). Typically, ERP is specified when the operating frequency is less than or equal to 1 GHz and EIRP is specified when the operating frequency is greater than 1 GHz. Both are determined by adding the transmit antenna gain to the conducted RF output power with the primary difference between the two being that when determining the ERP, the transmit antenna gain is referenced to a dipole antenna (i.e., dBd) whereas when determining the EIRP, the transmit antenna gain is referenced to an isotropic antenna (dBi).

2.The relevant equation for determining the ERP or EIRP from the conducted RF output power measured using the guidance provided above is:

$ERP/EIRP = P_{Meas} + GT - LC$

where:

ERP/EIRP = effective or equivalent radiated power, respectively (expressed in the same units as P_{Meas}, typically dBW or dBm);

PMeas = measured transmitter output power or PSD, in dBm or dBW;

GT = gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP);

dBd (ERP)=dBi (EIRP) -2.15 dB

LC = signal attenuation in the connecting cable between the transmitter and antenna, in dB.

For devices utilizing multiple antennas, KDB 662911 provides guidance for determining the effective array transmit antenna gain term to be used in the above equation.

5.1.3 Test setup

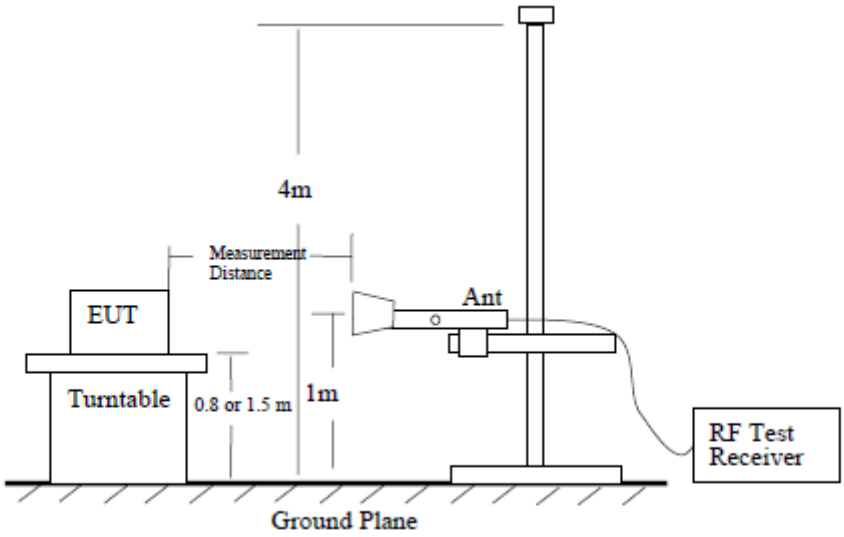


Figure 6—Test site-up for radiated ERP and/or EIRP measurements

5.1.4 Test Result

For Conducted output power:

Output Power for WCDMA BAND II

Mode	Frequency(MHz)	Maximum Average Output Power
HSDPA Subtest 1	1852.4	22.05
	1880	21.55
	1907.6	21.52
HSDPA Subtest 2	1852.4	21.51
	1880	22.21
	1907.6	21.71
HSDPA Subtest 3	1852.4	21.68
	1880	21.67
	1907.6	22.03
HSDPA Subtest 4	1852.4	21.64
	1880	21.60
	1907.6	21.59
HSUPA Subtest 1	1852.4	22.03
	1880	21.51
	1907.6	21.42
HSUPA Subtest 2	1852.4	21.58
	1880	22.32
	1907.6	21.45
HSUPA Subtest 3	1852.4	21.34
	1880	21.61
	1907.6	22.13
HSUPA Subtest 4	1852.4	21.45
	1880	21.64
	1907.6	21.59
HSUPA Subtest 5	1852.4	21.61
	1880	21.24
	1907.6	21.31

Output Power for WCDMA BAND IV

Mode	Frequency(MHz)	Maximum Average Output Power
HSDPA Subtest 1	1712.4	21.40
	1732.6	21.49
	1752.6	21.81
HSDPA Subtest 2	1712.4	20.23
	1732.6	20.88
	1752.6	21.60
HSDPA Subtest 3	1712.4	21.04
	1732.6	20.69
	1752.6	20.87
HSDPA Subtest 4	1712.4	20.68
	1732.6	21.57
	1752.6	21.35
HSUPA Subtest 1	1712.4	22.91
	1732.6	22.79
	1752.6	21.77
HSUPA Subtest 2	1712.4	21.60
	1732.6	22.10
	1752.6	20.19
HSUPA Subtest 3	1712.4	20.81
	1732.6	20.13
	1752.6	21.81
HSUPA Subtest 4	1712.4	21.40
	1732.6	21.09
	1752.6	21.29
HSUPA Subtest 5	1712.4	20.83
	1732.6	20.61
	1752.6	20.52

Output Power for WCDMA BAND V

Mode	Frequency(MHz)	Maximum Average Output Power
HSDPA Subtest 1	826.4	20.75
	836.4	21.15
	846.6	20.97
HSDPA Subtest 2	826.4	19.57
	836.4	20.54
	846.6	19.95
HSDPA Subtest 3	826.4	19.43
	836.4	19.15
	846.6	19.85
HSDPA Subtest 4	826.4	20.09
	836.4	19.84
	846.6	19.29
HSUPA Subtest 1	826.4	19.02
	836.4	19.73
	846.6	20.60
HSUPA Subtest 2	826.4	20.10
	836.4	19.15
	846.6	18.97
HSUPA Subtest 3	826.4	19.57
	836.4	20.54
	846.6	19.95
HSUPA Subtest 4	826.4	19.43
	836.4	20.15
	846.6	19.85
HSUPA Subtest 5	826.4	19.79
	836.4	19.84
	846.6	19.29

For EIRP & ERP:

For WCDMA BAND II

Frequency (MHz)	Polarization	SG Level (dBm)	Cable Loss (dB)	Antenna Gain (dB)	EIRP (dBm)	EIRP (W)
1852.4	H	21.26	0.47	0.33	21.12	0.1294
1880	H	21.19	0.47	0.33	21.05	0.1274
1907.6	H	21.90	0.46	0.33	21.77	0.1502
1852.4	V	22.62	0.47	0.33	22.48	0.1768
1880	V	22.01	0.47	0.33	21.87	0.1538
1907.6	V	22.86	0.46	0.33	22.73	0.1873
Note: EIRP=SG Level+ Cable Loss + Antenna Gain						

For WCDMA BAND IV

Frequency (MHz)	Polarization	SG Level (dBm)	Cable Loss (dB)	Antenna Gain (dB)	EIRP (dBm)	EIRP (W)
1712.4	H	22.75	0.39	0.52	22.88	0.1943
1732.6	H	21.32	0.35	0.52	21.49	0.1411
1752.6	H	22.02	0.32	0.52	22.22	0.1669
1712.4	V	20.33	0.39	0.52	20.46	0.1111
1732.6	V	21.68	0.35	0.52	21.85	0.1530
1752.6	V	21.93	0.32	0.52	22.13	0.1633
Note: EIRP= SG Level+ Cable Loss + Antenna Gain						

For WCDMA BAND V

Radiated Power (ERP) for UMTS band V							
Frequency (MHz)	Polarization	SG Level (dBm)	Cable Loss (dB)	Antenna Gain (dB)	Correction (dBi)	(ERP) (dBm)	ERP (W)
826.4	H	21.54	0.39	0.76	2.15	19.76	0.0946
836.4	H	20.95	0.35	0.76	2.15	19.21	0.0833
846.6	H	21.55	0.32	0.76	2.15	19.84	0.0964
826.4	V	19.49	0.39	0.76	2.15	17.71	0.0590
836.4	V	20.64	0.35	0.76	2.15	18.90	0.0776
846.6	V	19.08	0.32	0.76	2.15	17.37	0.0546
Note: ERP= SG Level+ Cable Loss + Antenna Gain - Correction							

4.6 Peak to average power ratio(PAPR)

5.1.5 Limit

The peak-to-average power ratio (PAPR) of the transmitter output power must not exceed 13 dB. The PAPR measurements should be made using either an instrument with complementary cumulative distribution function (CCDF) capabilities to determine that PAPR will not exceed 13 dB for more than 0.1 percent of the time or other Commission approved procedure. The measurement must be performed using a signal corresponding to the highest PAPR expected during periods of continuous transmission.

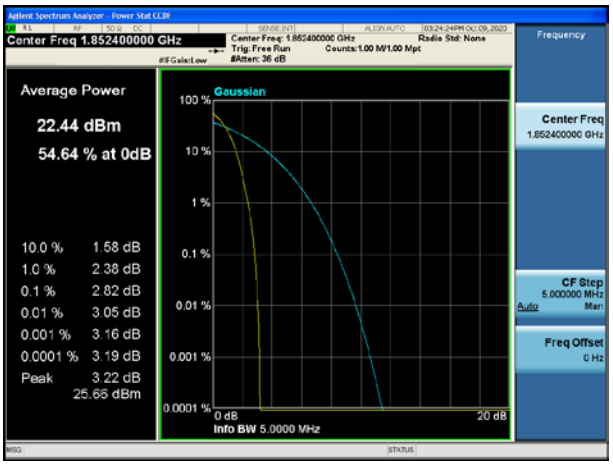
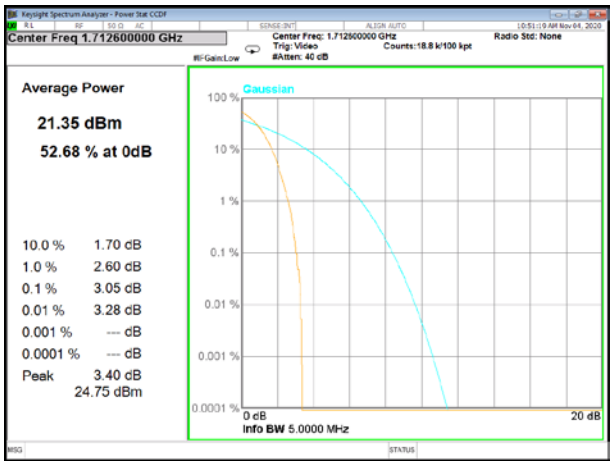
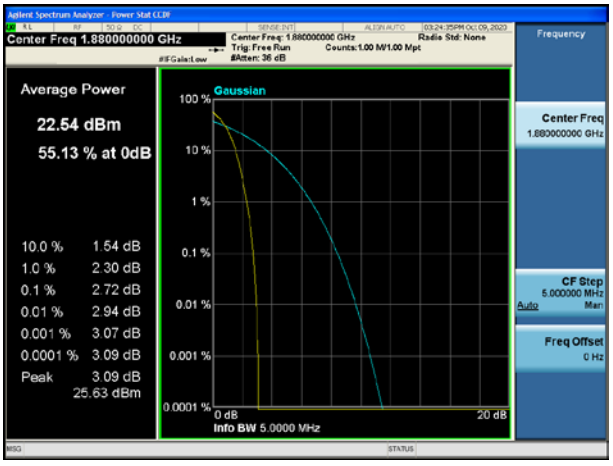
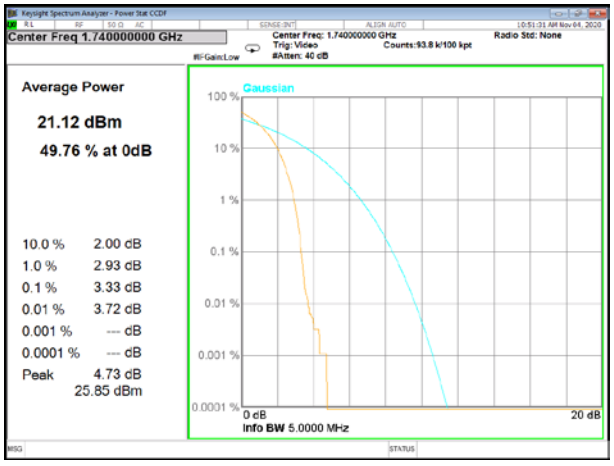
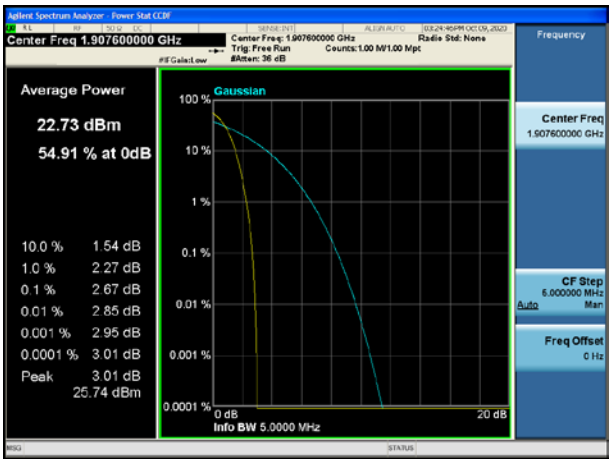
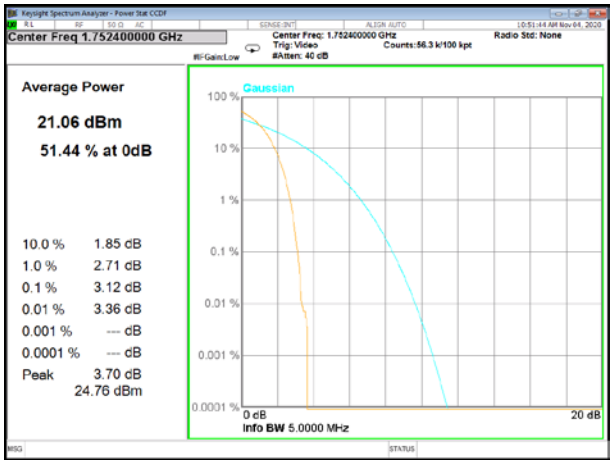
5.1.6 Test method

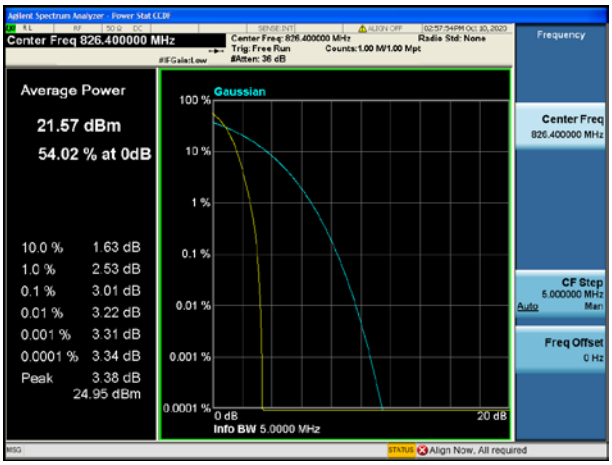
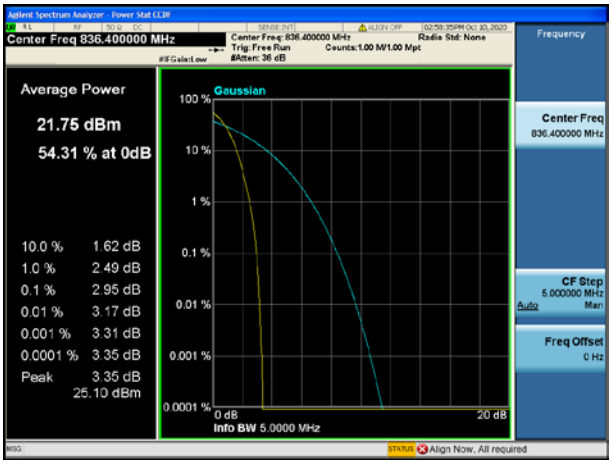
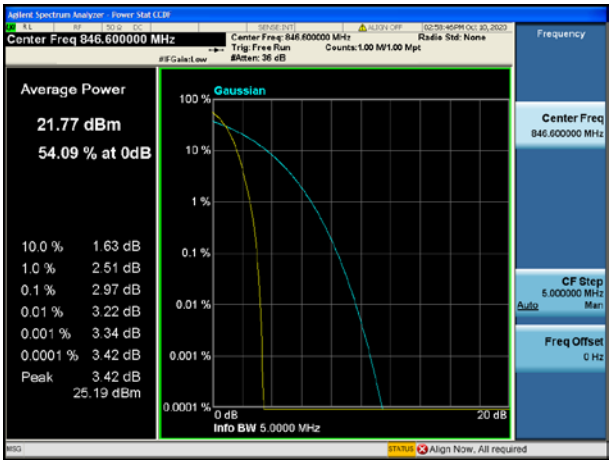
The EUT was connected to Spectrum Analyzer and Base Station via power divider.
The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
Set the number of counts to a value that stabilizes the measured CCDF curve.
Set the measurement interval to 1 ms.
Record the maximum PAPR level associated with a probability of 0.1%.
a) Refer to instrument's analyzer instruction manual for details on how to use the power statistics/CCDF function;
b) Set resolution/measurement bandwidth ≥ signal's occupied bandwidth;
c) Set the number of counts to a value that stabilizes the measured CCDF curve;
d) Set the measurement interval as follows:
1) for continuous transmissions, set to 1 ms,
2) for burst transmissions, employ an external trigger that is synchronized with the EUT burst timing sequence, or use the internal burst trigger with a trigger level that allows the burst to stabilize and set the measurement interval to a time that is less than or equal to the burst duration.
e) Record the maximum PAPR level associated with a probability of 0.1%.

5.1.7 Test Result

Cellular Band						
Modes	WCDMA BAND II			WCDMA BAND IV		
Channel	9262 (Low)	9400 (Mid)	9538 (High)	1312 (Low)	1450 (Mid)	1513 (High)
Frequency(MHz)	1852.4	1880	1907.6	1712.4	1732.6	1752.6
Peak-to-Average Ratio (dB)	2.82	2.72	2.67	3.05	3.33	3.12

Cellular Band						
Modes	WCDMA BAND V			/		
Channel	4132 (Low)	4183 (Mid)	4233 (High)	/	/	/
Frequency(MHz)	826.4	836.4	846.6	/	/	/
Peak-to-Average Ratio (dB)	3.01	2.95	2.97	/	/	/

Test plot	
(WCDMA BAND II)	(WCDMA BAND IV)
Peak-to-Average Ratio on channel 9262	Peak-to-Average Ratio on channel 1312
	
Peak-to-Average Ratio on channel 9400	Peak-to-Average Ratio on channel 1450
	
Peak-to-Average Ratio on channel 9538	Peak-to-Average Ratio on channel 1513
	

Test plot	
(WCDMA BAND V)	/
Peak-to-Average Ratio on channel 4132	/
	/
Peak-to-Average Ratio on channel 4183	/
	/
Peak-to-Average Ratio on channel 4233	/
	/

Note: all modes of EUT have been tested; only the data of worst case mode is reported. Worst mode is HSDPA

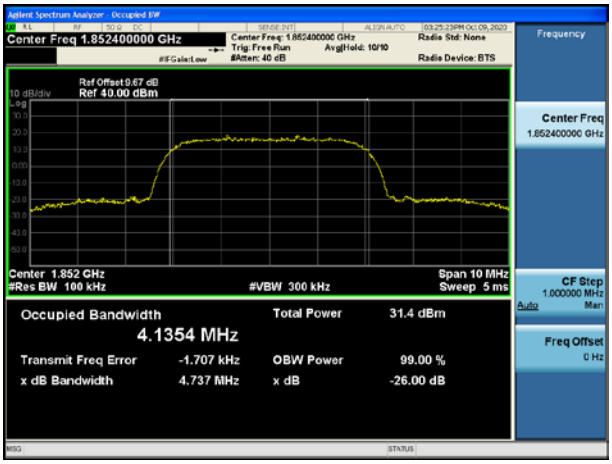
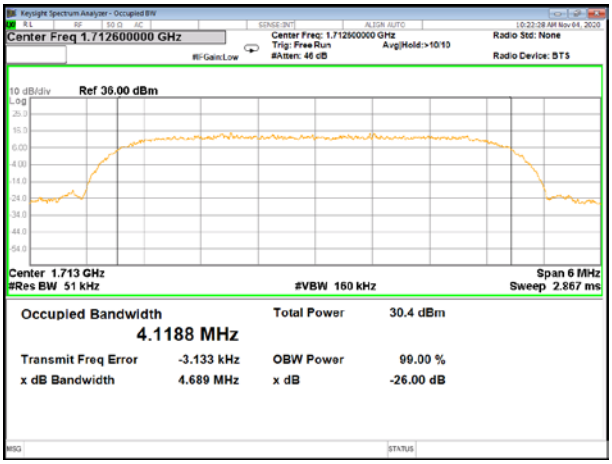
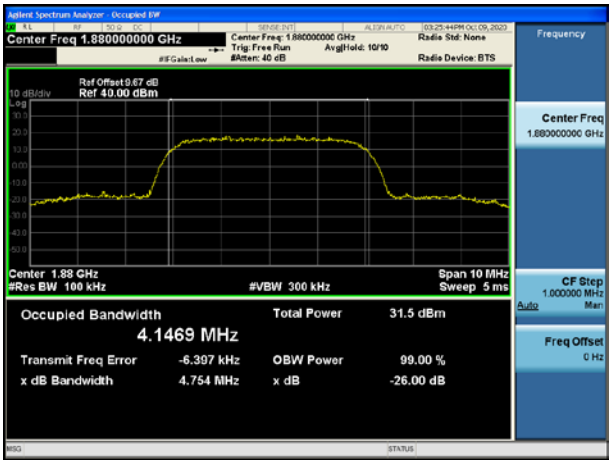
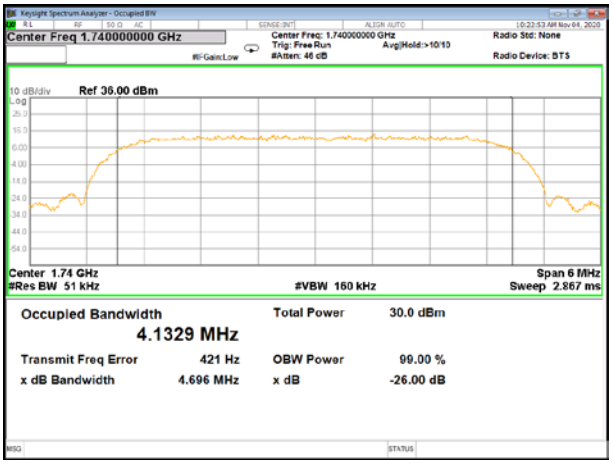
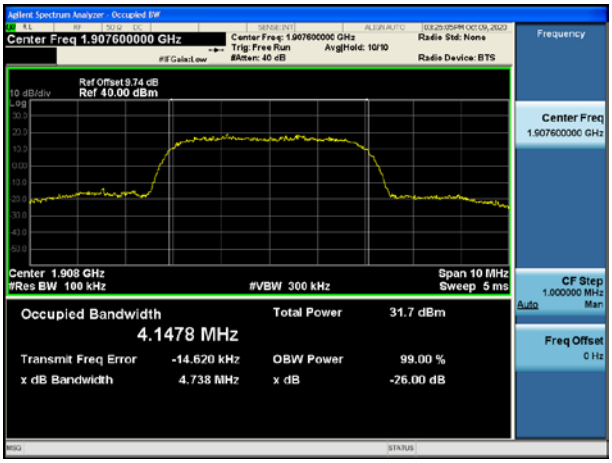
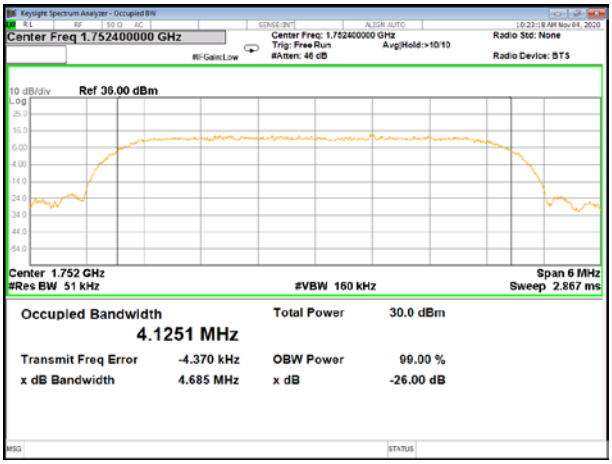
4.7 Occupied bandwidth

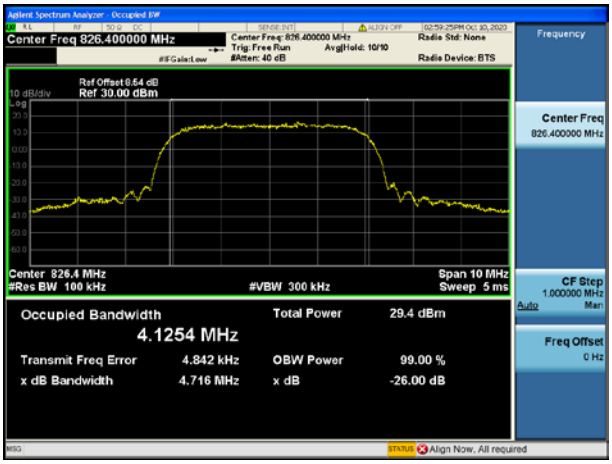
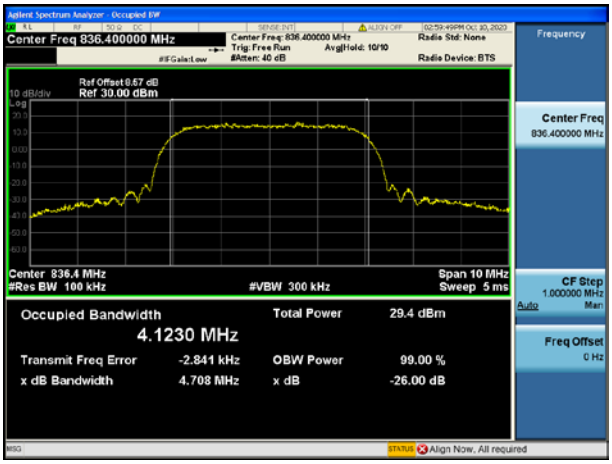
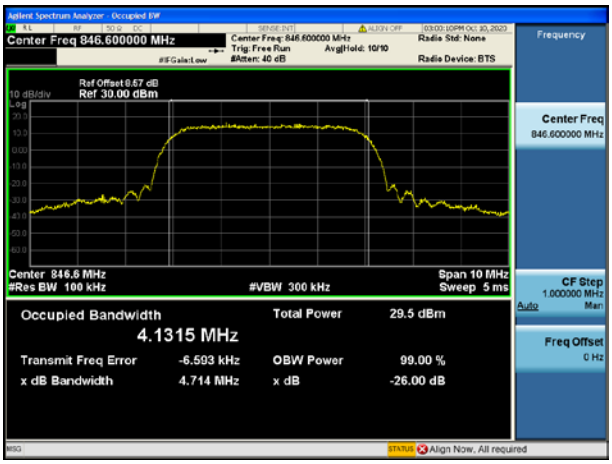
5.1.8 Test method

1. The EUT was directly connected to the spectrum analyzer and Base station via power splitter as show in the block diagram above.
2. The resolution bandwidth of the Spectrum Analyzer is set to at least 1% of the occupied bandwidth.
3. The low, middle and the high channels are selected to perform tests respectively.
4. Set the frequency range of the Spectrum Analyzer suitably to capture the waveform; search peak; make a line whose value is 26dB lower than the peak; mark two points which the line intersected the waveform at; finally record the delta of the two points as the occupied bandwidth and the plot.
5. Set the Spectrum Analyzer Occupied bandwidth function to measure the 99% occupied bandwidth.

5.1.9 Test result

Channel	Frequency (MHz)	26dB Bandwidth (kHz)	99% Bandwidth (MHz)
WCDMA Band II			
9262	1852.4	4737	4135.4
9400	1880	4754	4146.9
9538	1907.6	4738	4147.8
WCDMA Band VI			
1312	1712.4	4685	4125.1
1450	1732.6	4696	4132.9
1513	1752.6	4689	4118.8
WCDMA Band V			
4132	826.4	4716	4125.4
4183	836.4	4708	4123.0
4233	846.6	4714	4131.5

WCDMA Band II – 1852.4MHz	WCDMA Band IV –1712.4MHz
	
WCDMA Band II - 1880MHz	**WCDMA Band IV –1732.6.0MHz**
	
WCDMA Band II – 1907.6MHz	**WCDMA Band IV –1752.6MHz**
	

WCDMA Band V – 826.4MHz	WCDMA Band V –836.4MHz
	
WCDMA Band V –846.6MHz	
	

Note: all modes of EUT have been tested; only the data of worst case mode is reported. Worst mode is HSDPA

4.8 Conducted spurious emissions

5.1.10 Limits

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43+10log (P) dB

5.1.11 Test method

1, The EUT was directly connected to the spectrum analyzer and Base station via power splitter as show in the block diagram above.

2, Spectrum Setting:

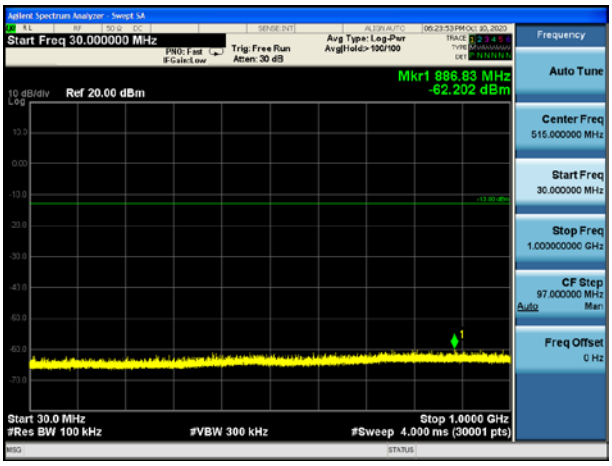
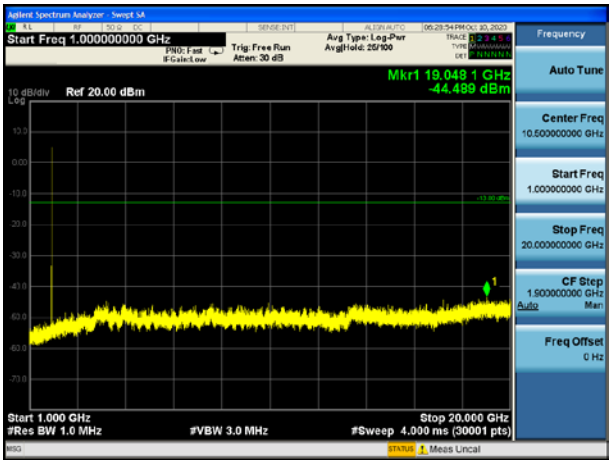
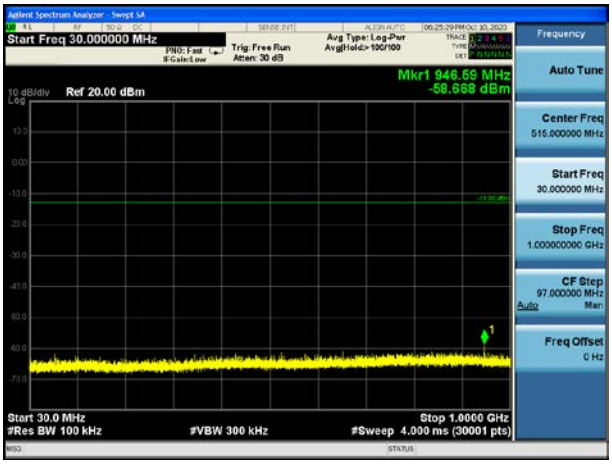
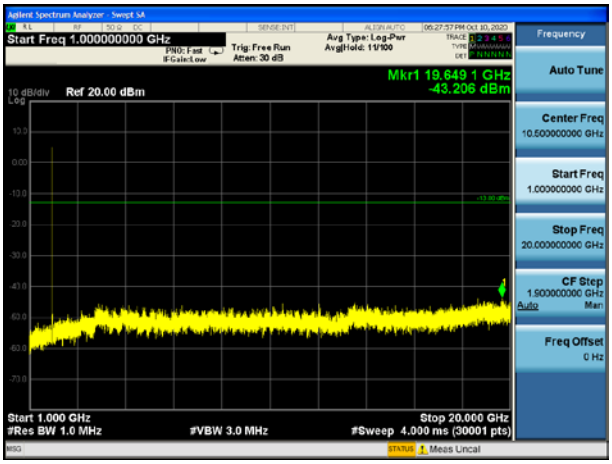
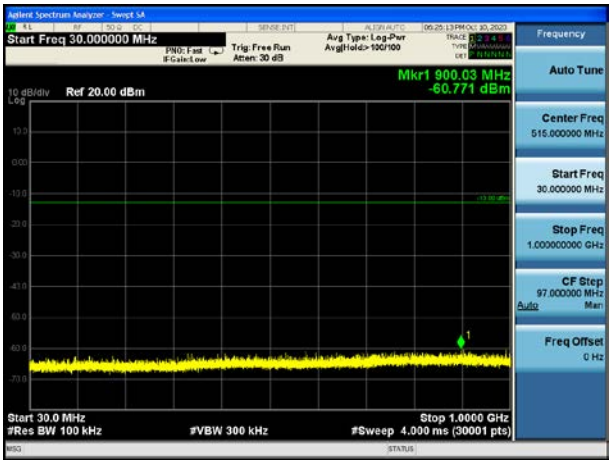
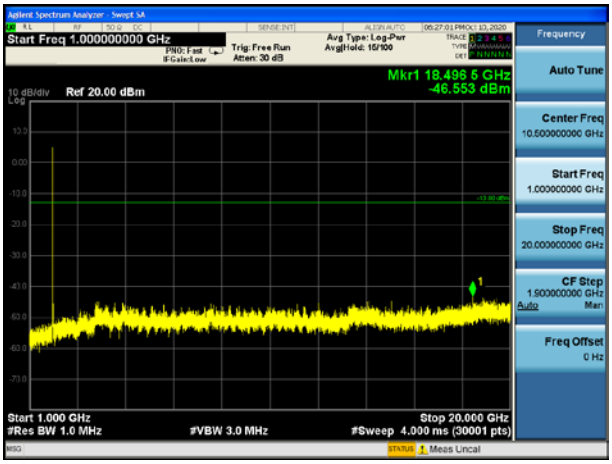
Frequency bellow 1 GHz: RBW=100 kHz, VBW=300 kHz.

Frequency above 1 GHz: RBW=1 MHz, VBW=3 MHz.

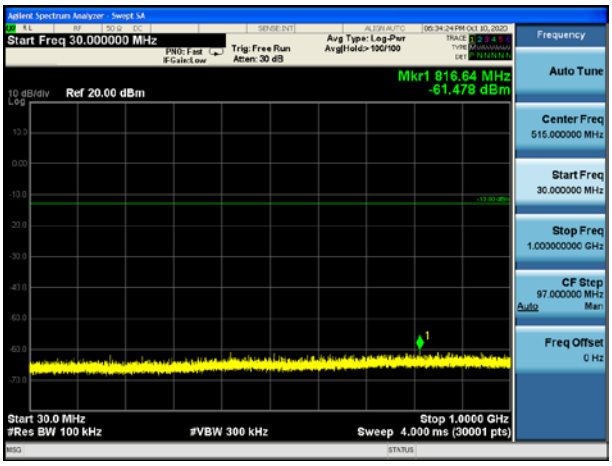
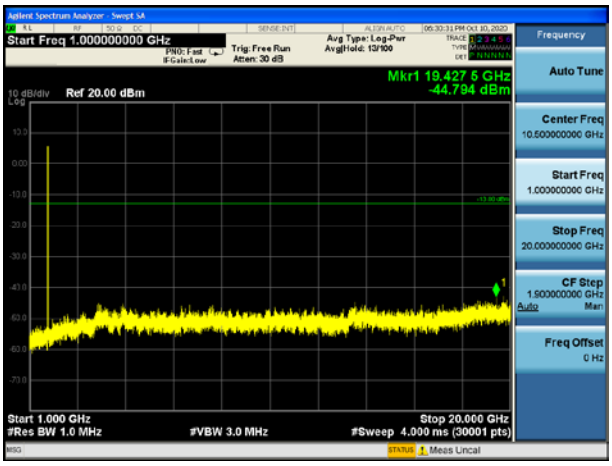
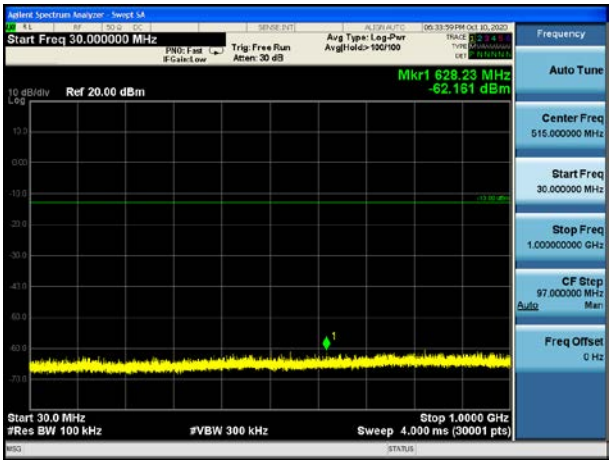
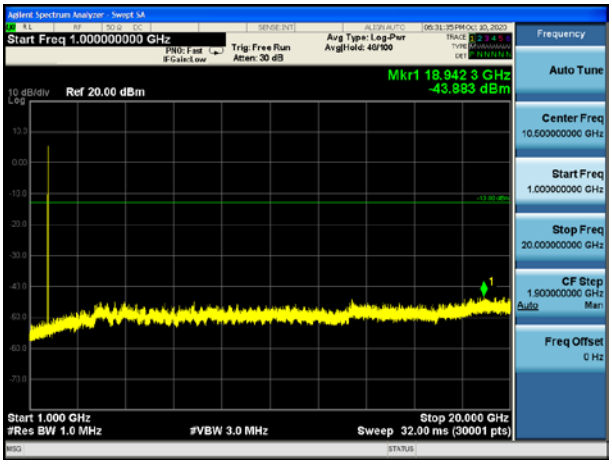
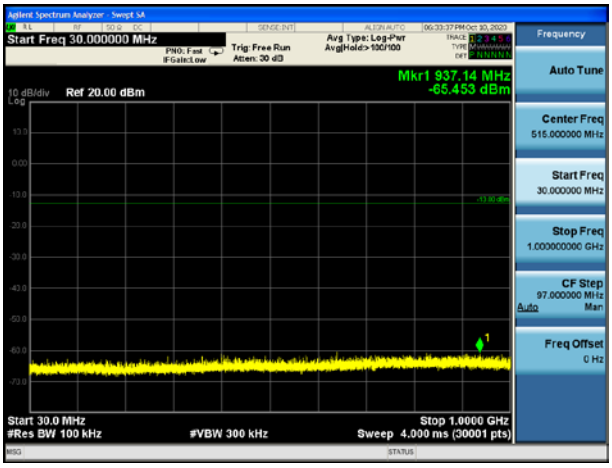
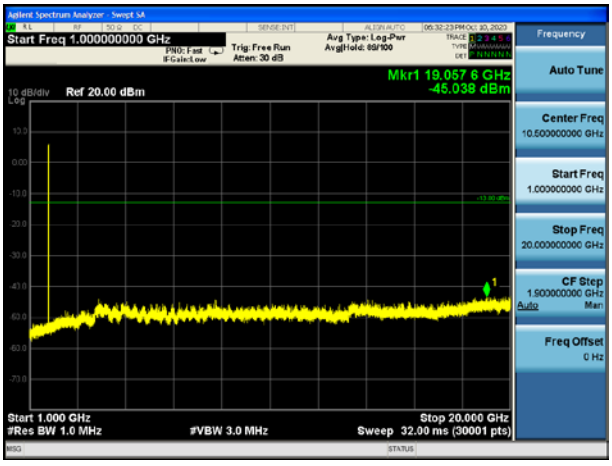
3, The low, middle and high channels of each band and mode's spurious emissions for 30 MHz to 10th Harmonic were measured by Spectrum analyzer.

5.1.12 Test result

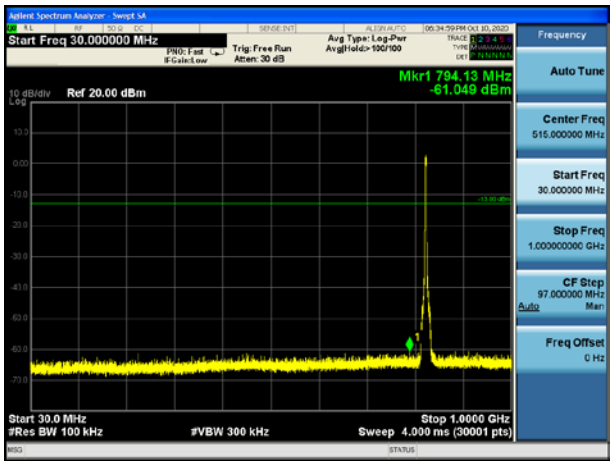
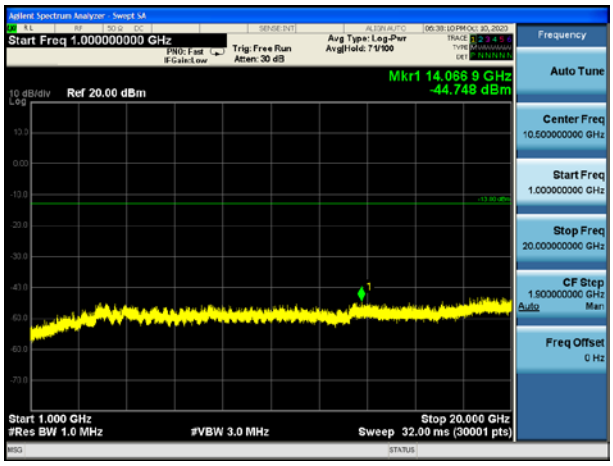
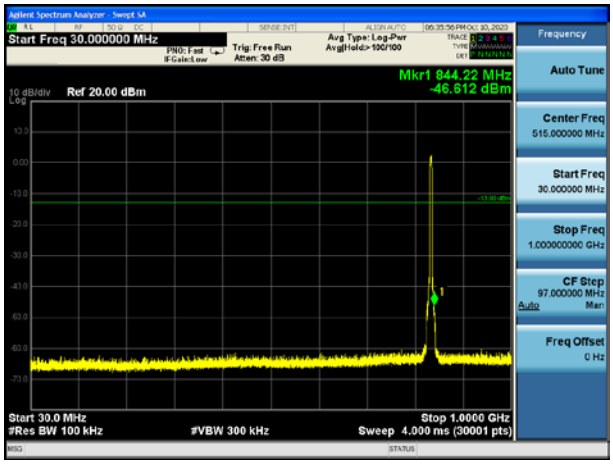
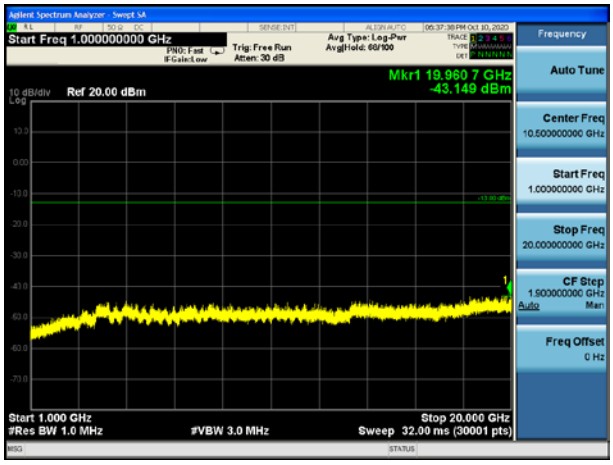
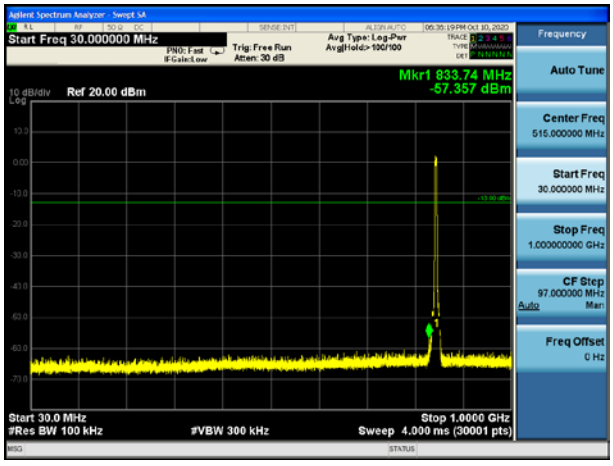
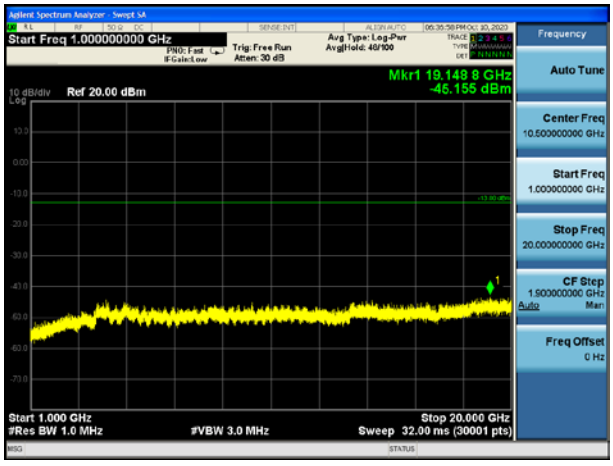
WCDMA Band II

Low Channel – 30MHz-1GHz	Low Channel –1GHz - 20GHz
	
Middle Channel– 30MHz-1GHz	**Middle Channel– 1GHz-20GHz**
	
High Channel– 30MHz-1GHz	**High Channel–1GHz - 20GHz**
	

WCDMA Band IV

Low Channel – 30MHz-1GHz	Low Channel –1GHz - 20GHz
	
Middle Channel–30MHz-1GHz	Middle Channel–1GHz - 20GHz
	
High Channel–30MHz-1GHz	High Channel–10GHz - 2GHz
	

WCDMA Band V

Low Channel – 30MHz-1GHz	Low Channel –1GHz - 20GHz
	
Middle Channel–30MHz-1GHz	Middle Channel–1GHz - 20GHz
	
High Channel–30MHz-1GHz	High Channel–1GHz -20GHz
	

Note: all modes of EUT have been tested; only the data of worst case mode is reported. Worst mode is HSDPA

4.9 Band edge

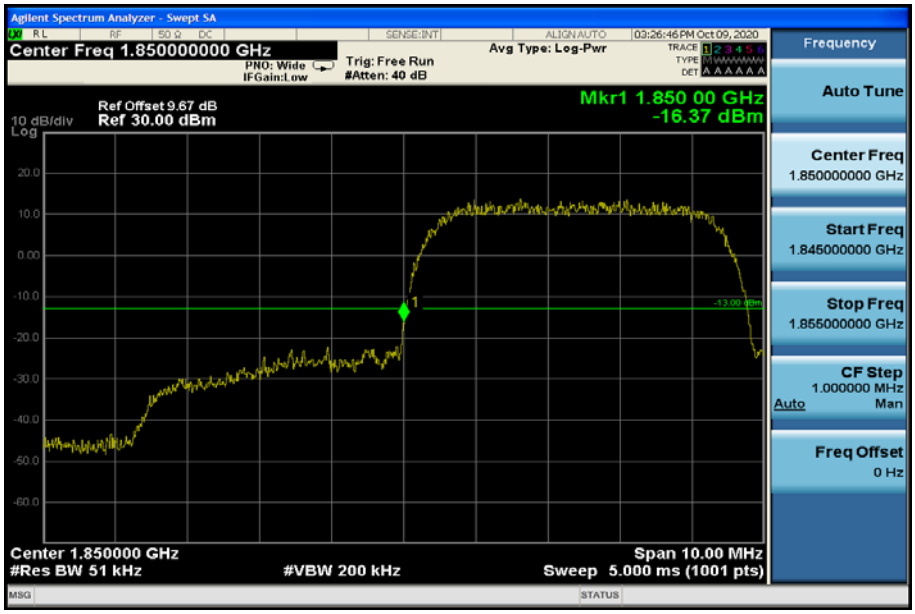
5.1.13 Limits

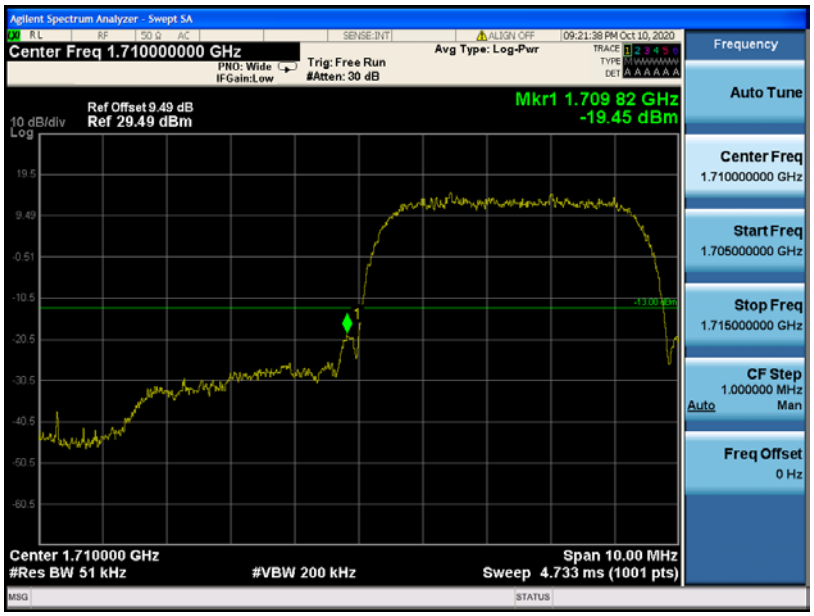
The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43+10log (P) dB, for all power levels +30 dBm to 0 dBm, this becomes a constant specification limit of -13 dBm

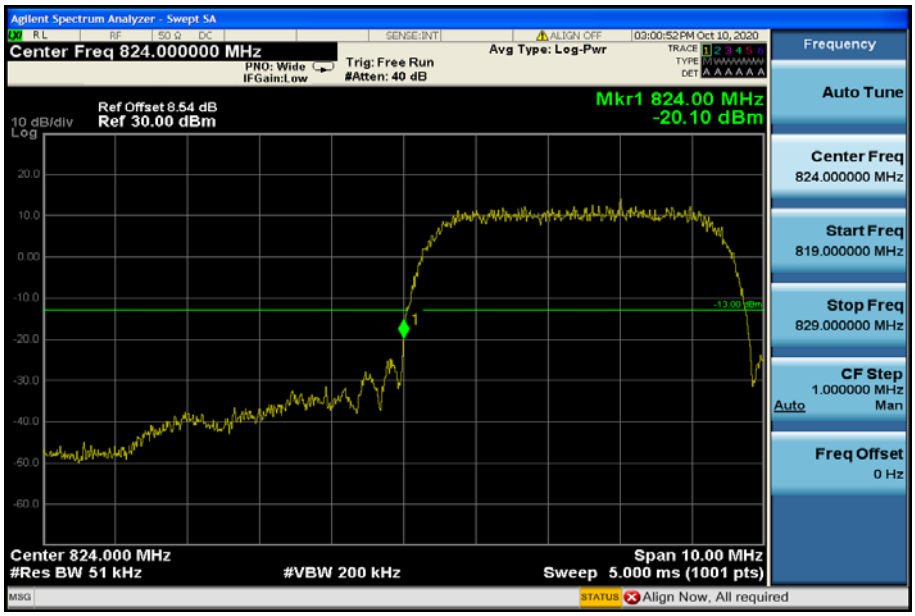
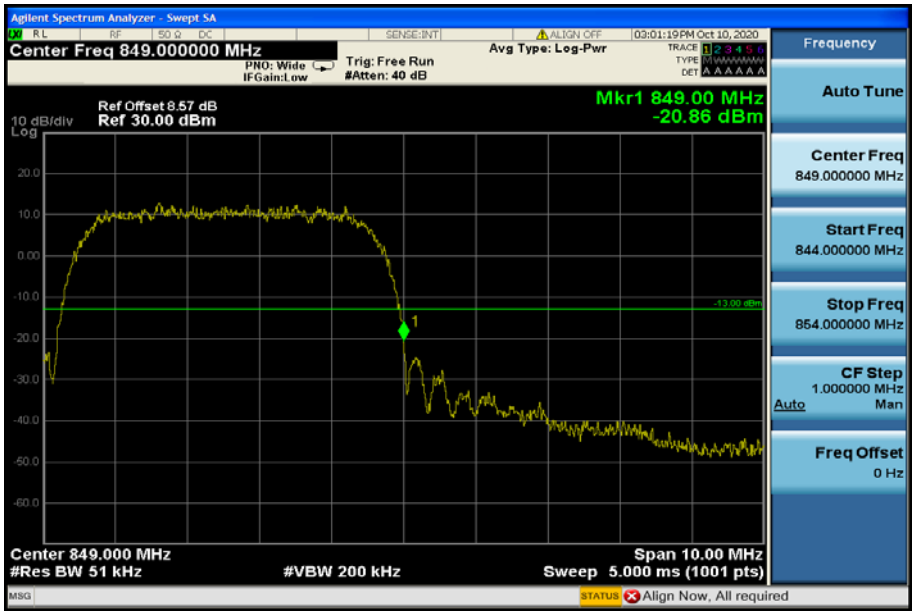
5.1.14 Test method

The testing follows FCC KDB 971168 v03r01 Section 6.0.
The EUT was connected to Spectrum Analyzer and Base Station via power divider.
The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.
The path loss was compensated to the results for each measurement.
The band edges of low and high channels for the highest RF powers were measured.
The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
The limit line is derived from 43 + 10log(P) dB below the transmitter power P(Watts)
= P(W) - [43 + 10log(P)] (dB)
= [30 + 10log(P)] (dBm) - [43 + 10log(P)] (dB)
= -13dBm.

5.1.15 Test result

WCDMA Band II – Left band

WCDMA Band II – Right band


WCDMA Band IV – Left band

WCDMA Band IV– Right band


WCDMA Band V – Left band

WCDMA Band V – Right band


Note: all modes of EUT have been tested; only the data of worst case mode is reported. Worst mode is HSDPA

4.10 Radiated spurious emission

5.1.16 Limit

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43+10log (P) dB

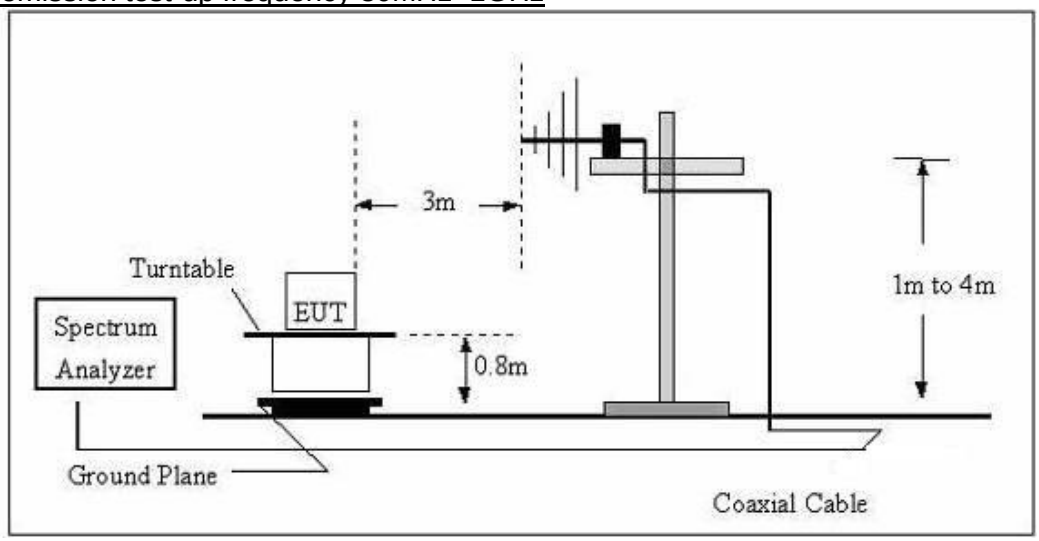
5.1.17 Test method

1. The test system setup as show in the block diagram above.
2. The EUT was placed on an non-conductive rotating platform in an anechoic chamber. The radiated spurious emissions from 30MHz to 10th harmonious of fundamental frequency were measured at 3 m with a test antenna and a spectrum analyzer with RBW=1 MHz, VBW=1 MHz, peak detector settings.
3. During the measurement, the EUT was enforced in maximum power and linked with a base station. All the spurious emissions at 3m were measured by rotation of the turntable and the test antenna raised and lowered over a range from 1 to 4 meters in both horizontally and vertically polarized orientations.
4. When found the maximum level of emissions from the EUT. 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.

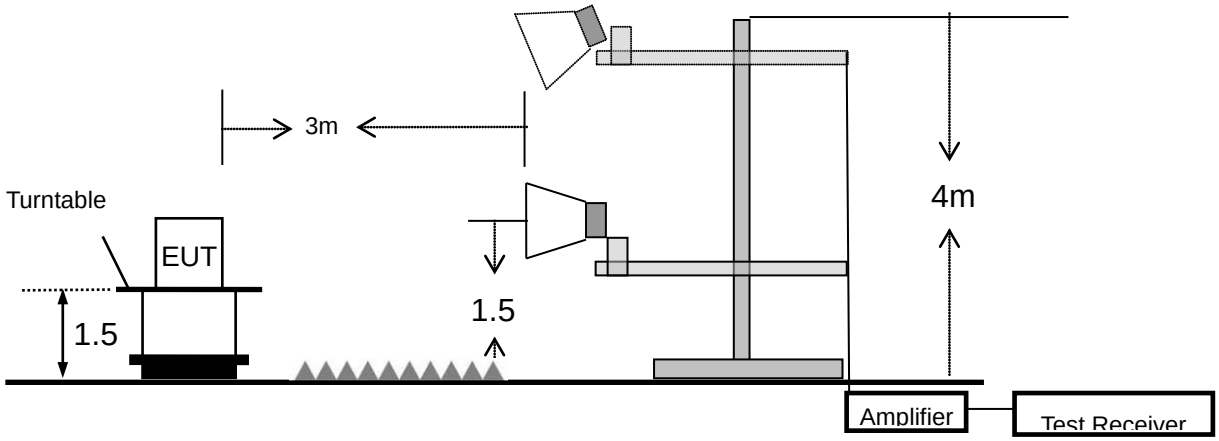
Spurious emissions in dB=10 log(TX power in Watts/0.001)-the absolute level
Spurious attenuation limit in dB=43+10 log(power out in Watts).

5.1.18 Test setup

Radiated emission test-up frequency 30MHz~1GHz



Radiated emission test-up frequency above 1GHz



5.1.19 Test Result

Note: All the configuration was tested and only the worse case was reported

For WCDMA (30MHz – 20GHz)

WCDMA Band II _ Low Channel							
Frequency	SG Level	Cable Loss	Antenna Gain	Absolute Level	Limit	Margin	Polarization
(MHz)	(dBm)	(dB)	(dB)	(dBm)	(dBm)	(dB)	H/V
257.9	-54.65	0.44	5.5	-49.59	-13	-36.59	H
398.3	-54.44	0.45	5.9	-48.99	-13	-35.99	H
3704.8	-43.95	5.26	9.88	-39.33	-13	-26.33	H
5557.2	-48.20	6.11	11.36	-42.95	-13	-29.95	H
257.3	-54.11	0.44	5.5	-49.05	-13	-36.05	V
398.7	-53.94	0.45	5.9	-48.49	-13	-35.49	V
3704.8	-50.00	5.26	9.88	-45.38	-13	-32.38	V
5557.2	-55.15	6.11	11.36	-49.90	-13	-36.90	V
WCDMA Band II _ Middle Channel							
Frequency	SG Level	Cable Loss	Antenna Gain	Absolute Level	Limit	Margin	Polarization
(MHz)	(dBm)	(dB)	(dB)	(dBm)	(dBm)	(dB)	H/V
217.4	-53.32	0.44	5.5	-48.26	-13	-35.26	H
378.9	-55.50	0.45	5.9	-50.05	-13	-37.05	H
3760	-38.85	5.32	10.03	-34.14	-13	-21.14	H
5640	-47.24	6.19	11.41	-42.02	-13	-29.02	H
217.4	-53.82	0.44	5.5	-48.76	-13	-35.76	V
378.9	-53.66	0.45	5.9	-48.21	-13	-35.21	V
3760	-46.48	5.32	10.03	-41.77	-13	-28.77	V
5640	-54.10	6.19	11.41	-48.88	-13	-35.88	V
WCDMA Band II _ High Channel							
Frequency	SG Level	Cable Loss	Antenna Gain	Absolute Level	Limit	Margin	Polarization
(MHz)	(dBm)	(dB)	(dB)	(dBm)	(dBm)	(dB)	H/V
257.9	-53.79	0.44	5.5	-48.73	-13	-35.73	H
398.3	-54.61	0.45	5.9	-49.16	-13	-36.16	H
3815.2	-49.00	5.36	9.62	-44.74	-13	-31.74	H
5722.8	-54.48	6.24	11.46	-49.26	-13	-36.26	H
257.3	-53.46	0.44	5.5	-48.40	-13	-35.40	V
398.7	-53.64	0.45	5.9	-48.19	-13	-35.19	V
3815.2	-52.64	5.36	9.62	-48.38	-13	-35.38	V
5722.8	-56.83	6.24	11.46	-51.61	-13	-38.61	V

WCDMA Band IV _ Low Channel							
Frequency	SG Level	Cable Loss	Antenna Gain	Absolute Level	Limit	Margin	Polarization
(MHz)	(dBm)	(dB)	(dB)	(dBm)	(dBm)	(dB)	H/V
257.9	-54.78	0.44	5.5	-49.72	-13	-36.72	H
398.3	-54.61	0.45	5.9	-49.16	-13	-36.16	H
1946.4	-44.86	3.86	8.56	-40.16	-13	-27.16	H
3424.8	-48.21	4.29	6.98	-45.52	-13	-32.52	H
257.3	-53.39	0.44	5.5	-48.33	-13	-35.33	V
398.7	-53.57	0.45	5.9	-48.12	-13	-35.12	V
1946.4	-41.86	3.86	8.56	-37.16	-13	-24.16	V
3424.8	-41.61	4.29	6.98	-38.92	-13	-25.92	V
WCDMA Band IV _ Middle Channel							
Frequency	SG Level	Cable Loss	Antenna Gain	Absolute Level	Limit	Margin	Polarization
(MHz)	(dBm)	(dB)	(dB)	(dBm)	(dBm)	(dB)	H/V
257.9	-54.66	0.44	5.5	-49.60	-13	-36.60	H
398.3	-54.79	0.45	5.9	-49.34	-13	-36.34	H
1982.4	-43.03	3.9	8.58	-38.35	-13	-25.35	H
3480	-44.21	4.32	6.8	-41.73	-13	-28.73	H
257.3	-53.82	0.44	5.5	-48.76	-13	-35.76	V
398.7	-54.12	0.45	5.9	-48.67	-13	-35.67	V
1982.4	-38.78	3.9	8.58	-34.10	-13	-21.10	V
3480	-42.24	4.32	6.8	-39.76	-13	-26.76	V
WCDMA Band IV _ High Channel							
Frequency	SG Level	Cable Loss	Antenna Gain	Absolute Level	Limit	Margin	Polarization
(MHz)	(dBm)	(dB)	(dB)	(dBm)	(dBm)	(dB)	H/V
257.9	-54.11	0.44	5.5	-49.05	-13	-36.05	H
398.3	-54.79	0.45	5.9	-49.34	-13	-36.34	H
2015.2	-46.95	3.91	9.06	-41.80	-13	-28.80	H
3505.2	-47.64	4.32	6.65	-45.31	-13	-32.31	H
257.3	-53.68	0.44	5.5	-48.62	-13	-35.62	V
398.7	-53.75	0.45	5.9	-48.30	-13	-35.30	V
2015.2	-43.85	3.91	9.06	-38.70	-13	-25.70	V
3505.2	-43.73	4.32	6.65	-41.40	-13	-28.40	V

WCDMA Band V _ Low Channel							
Frequency	SG Level	Cable Loss	Antenna Gain	Absolute Level	Limit	Margin	Polarization
(MHz)	(dBm)	(dB)	(dB)	(dBm)	(dBm)	(dB)	H/V
257.9	-54.39	0.44	5.5	-49.33	-13	-36.33	H
398.3	-54.29	0.45	5.9	-48.84	-13	-35.84	H
1652.8	-46.12	3.86	8.56	-41.42	-13	-28.42	H
2479.2	-48.34	4.29	6.98	-45.65	-13	-32.65	H
257.3	-53.68	0.44	5.5	-48.62	-13	-35.62	V
398.7	-53.87	0.45	5.9	-48.42	-13	-35.42	V
1652.8	-41.94	3.86	8.56	-37.24	-13	-24.24	V
2479.2	-41.70	4.29	6.98	-39.01	-13	-26.01	V
WCDMA Band V _ Middle Channel							
Frequency	SG Level	Cable Loss	Antenna Gain	Absolute Level	Limit	Margin	Polarization
(MHz)	(dBm)	(dB)	(dB)	(dBm)	(dBm)	(dB)	H/V
257.9	-54.29	0.44	5.5	-49.23	-13	-36.23	H
398.3	-54.40	0.45	5.9	-48.95	-13	-35.95	H
1672.8	-43.81	3.9	8.58	-39.13	-13	-26.13	H
2509.2	-45.07	4.32	6.8	-42.59	-13	-29.59	H
257.3	-53.33	0.44	5.5	-48.27	-13	-35.27	V
398.7	-53.84	0.45	5.9	-48.39	-13	-35.39	V
1672.8	-37.48	3.9	8.58	-32.80	-13	-19.80	V
2509.2	-42.13	4.32	6.8	-39.65	-13	-26.65	V
WCDMA Band V _ High Channel							
Frequency	SG Level	Cable Loss	Antenna Gain	Absolute Level	Limit	Margin	Polarization
(MHz)	(dBm)	(dB)	(dB)	(dBm)	(dBm)	(dB)	H/V
257.9	-55.68	0.44	5.5	-50.62	-13	-37.62	H
398.3	-54.24	0.45	5.9	-48.79	-13	-35.79	H
1693.2	-46.53	3.91	9.06	-41.38	-13	-28.38	H
2539.8	-48.76	4.32	6.65	-46.43	-13	-33.43	H
257.3	-54.50	0.44	5.5	-49.44	-13	-36.44	V
398.7	-53.85	0.45	5.9	-48.40	-13	-35.40	V
1693.2	-43.81	3.91	9.06	-38.66	-13	-25.66	V
2539.8	-44.40	4.32	6.65	-42.07	-13	-29.07	V

4.11 Frequency stability

5.1.20 Limit

For FCC part 22.355: the carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances 2.5ppm for mobile ≤ 3W condition.

For FCC part 24.235: The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

For FCC Part 27.

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. As this transceiver is considered "Hand carried, battery powered equipment" Section 2.1055(d) (2) applies. This requires that the lower voltage for frequency stability testing be specified by the manufacturer. This transceiver is specified to operate with an input voltage of between 32.4VDC and 41.4VDC, with a nominal voltage of 36VDC. Operation above or below these voltage limits is prohibited by transceiver software in order to prevent improper operation as well as to protect components from overstress. These voltages represent a tolerance from -5.4% to 10.8%. For the purposes of measuring frequency stability these voltage limits are to be used.

5.1.21 Test method

Test Procedures for Temperature Variation:

1, The EUT was set up in the thermal chamber and connected with the base station.
2, With power off, the temperature was decreased to -30℃ and the EUT was stabilized for three hours. Power was applied and the maximum change in frequency was recorded within one minute.
3, With power off, the temperature was raised in 10℃ set up to 50℃ and the EUT was stabilized for three hours. Power was applied and the maximum change in frequency was recorded within one minute.
4, measure the carrier frequency error.

Test Procedures for Voltage Variation:

Frequency Stability vs. Temperature: The equipment under test was connected to an external DC 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 DC 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 DC power supply was connected to the battery terminals of the equipment under test. The voltage was set to 115% of the nominal value and was then decreased until the transmitter light no longer illuminated; i.e., the battery end point. The output frequency was recorded for each battery voltage.

5.1.22 Test Result

Band	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
WCDMA Band II	3.42	12.65	0.0067
	3.8	19.48	0.0104
	4.18	24.94	0.0133

Band	Temperature (℃)	Frequency Error (Hz)	Frequency Error (ppm)
WCDMA Band II	-30	37.98	0.0202
	-20	15.10	0.0080
	-10	34.20	0.0182
	0	29.61	0.0157
	10	30.08	0.0160
	20	36.03	0.0192
	30	22.68	0.0121
	40	28.34	0.0151
	50	21.05	0.0112

Band	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
WCDMA Band IV	3.42	24.94	0.0298
	3.8	19.06	0.0228
	4.18	12.76	0.0153

Band	Temperature (℃)	Frequency Error (Hz)	Frequency Error (ppm)
WCDMA Band IV	-30	33.03	0.0395
	-20	27.83	0.0333
	-10	31.91	0.0381
	0	25.41	0.0304
	10	21.57	0.0258
	20	18.95	0.0227
	30	14.89	0.0178
	40	19.15	0.0229
	50	24.70	0.0295

Band	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
WCDMA Band V	3.42	24.08	0.0288
	3.8	19.08	0.0228
	4.18	12.48	0.0149

Band	Temperature (℃)	Frequency Error (Hz)	Frequency Error (ppm)
WCDMA Band V	-30	33.00	0.0395
	-20	27.50	0.0329
	-10	31.85	0.0381
	0	25.16	0.0301
	10	21.31	0.0255
	20	18.55	0.0222
	30	14.91	0.0178
	40	19.67	0.0235
	50	24.90	0.0298

Note:
1. Normal Voltage = 3.8V; Battery End Point (BEP) = 3.42V; Maximum Voltage =4.12V
2. All modes of EUT have been tested; only the data of worst case mode is reported.

Photographs of the Test Setup

Radiated emission

Photographs of the EUT

See the APPENDIX 1: EUT PHOTO in the report No.: MTi20061009-2E1-1.

----END OF REPORT----