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TEST REPORT

Report No.: **GTI20191843E**

FCC ID.....: **2ANTM-MD44014**

Applicant.....: NumberFour AG

Address.....: Schoenhauser Allee 8, 10119 Berlin, Germany

Manufacturer.....: NumberFour AG

Address.....: Schoenhauser Allee 8, 10119 Berlin, Germany

Product Name.....: **Mobile POS System**

Trade Mark.....: ---

Model/Type reference.....: HVN:ED100

Listed Model(s): HVN:MD44014

Standard.....: **FCC CFR Title 47 Part 2, Part 22 Subpart H, Part 24 Subpart E**
FCC CFR Title 47 Part 27 Subpart L

Date of receipt of test sample...: Aug.28.2019

Date of testing.....: Aug.29.2019 to Sep.04.2019

Date of issue.....: Sep.06.2019

Result.....: **PASS**

Compiled by:

(Printed name+signature)

Zaki Zhang

Supervised by:

(Printed name+signature)

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Approved by:

(Printed name+signature)

Walter Chen

Testing Laboratory Name..... **CTC Laboratories, Inc.**

Address..... 1-2/F., Building 2, Jiaquan Building, Guanlan High-Tech Park,
Shenzhen, Guangdong, China

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Table of Contents

Page

1. SUMMARY.....	3
1.1. TEST STANDARDS.....	3
1.2. REPORT VERSION.....	3
1.3. TEST DESCRIPTION.....	4
1.4. TEST FACILITY	5
1.5. ENVIRONMENTAL CONDITIONS	6
2. GENERAL INFORMATION.....	7
2.1. CLIENT INFORMATION	7
2.2. GENERAL DESCRIPTION OF EUT	8
2.3. DESCRIPTION OF TEST MODES AND TEST FREQUENCY.....	9
2.4. MEASUREMENT INSTRUMENTS LIST	9
3. TEST ITEM AND RESULTS.....	11
3.1. CONDUCTED OUTPUT POWER	11
3.2. PEAK-TO-AVERAGE RATIO	12
3.3. OCCUPY BANDWIDTH.....	13
3.4. OUT OF BAND EMISSION AT ANTENNA TERMINALS	14
3.5. BAND EDGE COMPLIANCE	15
3.6. RADIATED POWER MEASUREMENT	16
3.7. RADIATED SPURIOUS EMISSION.....	17
3.8. FREQUENCY STABILITY	20
4. EUT TEST PHOTOS.....	21
5. PHOTOGRAPHS OF EUT CONSTRUCTIONAL	22



1. SUMMARY

1.1. Test Standards

[FCC Rules Part 2](#): FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS

[FCC Rules Part 24](#): PUBLIC MOBILE SERVICES

[TIA/EIA 603 E March 2016](#): Land Mobile FM or PM Communications Equipment Measurement and Performance Standards.

[ANSI C63.26: 2015](#): American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services

[KDB 971168 D01 Power Meas License Digital Systems v03](#): MEASUREMENT GUIDANCE FOR CERTIFICATION OF LICENSED DIGITAL TRANSMITTERS

1.2. Report version

Revised No.	Date of issue	Description
01	Sep.06.2019	Original



1.3. Test Description

Test Item	Section in CFR 47	Result	Test Engineer
Conducted Output Power	Part 24.232(c)	Pass	Roy Luo
Peak-to-Average Ratio	Part 24.232	Pass	Roy Luo
99% Occupied Bandwidth & 26 dB Bandwidth	Part 24.238(b)	Pass	Roy Luo
Band Edge	Part 24.238	Pass	Roy Luo
Conducted Spurious Emissions	Part 24.238	Pass	Roy Luo
Frequency stability vs temperature	Part 24.235	Pass	Roy Luo
Frequency stability vs voltage	Part 24.235	Pass	Roy Luo
ERP and EIRP	Part 24.232(b)	Pass	Roy Luo
Radiated Spurious Emissions	Part 24.238	Pass	Roy Luo

Note: The measurement uncertainty is not included in the test result.



1.4. Test Facility

1.3.1 Address of the test laboratory

CTC Laboratories, Inc.

Add: 1F, 2 Block, Jiaquan Building, Guanlan High-tech Park Baoan District, Shenzhen, Guangdong, China

1.3.2 Laboratory accreditation

The test facility is recognized, certified, or accredited by the following organizations:

ISED Registration No.: CN0029

The 3m alternate test site of CTC Laboratories, Inc. EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration NO.: CN0029 on Dec, 2018.

FCC-Registration No.: CN1208

CTC Laboratories, Inc. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration CN1208, Sep 07, 2017.

Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements and is documented in the CTC Laboratories, Inc quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for CTC Laboratories, Inc. is reported:

Test Items	Measurement Uncertainty	Notes
Frequency stability	25 Hz	(1)
Transmitter power conducted	0.57 dB	(1)
Transmitter power Radiated	2.20 dB	(1)
Conducted spurious emission 9KHz-12.75 GHz	1.60 dB	(1)
Conducted Emission 9KHz-30MHz	3.39 dB	(1)
Radiated Emission 30~1000MHz	4.24 dB	(1)
Radiated Emission 1~18GHz	5.16 dB	(1)
Radiated Emission 18-40GHz	5.54 dB	(1)
Occupied Bandwidth	-----	(1)
Emission Mask	-----	(1)
Modulation Characteristic	-----	(1)
Transmitter Frequency Behavior	-----	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.



1.5. Environmental conditions

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

Normal Temperature:	25°C
Relative Humidity:	55 %
Air Pressure:	101 kPa



2. GENERAL INFORMATION

2.1. Client Information

Applicant:	NumberFour AG
Address:	Schoenhauser Allee 8, 10119 Berlin, Germany
Manufacturer:	NumberFour AG
Address:	Schoenhauser Allee 8, 10119 Berlin, Germany
Factory:	Zhangzhou Wanlida Technology Co.,Ltd.
Address:	Wanlida Industrial Zone , Nanjing,Zhangzhou, Fujian, China



2.2. General Description of EUT

Product Name:	Mobile POS System
Model/Type reference:	HVN:ED100
Marketing Name:	--
Listed Model(s):	HVN:MD44014
Power supply:	3.85Vdc 2810mAh from Li-ion Battery
Adapter:	Model: DSA-18QFB FUSA Input: 100-240VAC 50/60Hz 0.8A Output: 5VDC 3A or 9VDC 2A or 12VDC 1.5A
Adapter Manufacturer:	Dee Van Enterprise Co., Ltd
Hardware version:	A267C
Software version:	ED100-1.x.x-1.x
WCDMA	
Operation Band:	Band II: UL: 1852.4MHz~1907.6MHz, DL: 1932.6MHz~1987.4MHz
Modulation Type:	QPSK for WCDMA/HSUPA/HSDPA
Antenna Type:	FPC Antenna
Antenna Gain:	WCDMA II: 0.50dBi



2.3. Description of Test Modes and Test Frequency

The EUT has been tested under typical operating condition. The CUM200 used to control the EUT staying in continuous transmitting and receiving mode for testing.

Test Frequency:

WCDMA Band II	
Channel	Frequency (MHz)
9262	1852.40
9400	1880.00
9538	1907.60

2.4. Measurement Instruments List

Output Power (Radiated) & Radiated Spurious Emission					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	EMI Test Receiver	R&S	ESCI	100967	Dec. 28, 2019
2	High pass filter	Compliance Direction systems	BSU-6	34202	Dec. 28, 2019
3	Log-Bicon Antenna	Schwarzbeck	CBL6141A	4180	Dec. 28, 2019
4	Log-Bicon Antenna	Schwarzbeck	CBL6141A	4181	Dec. 28, 2019
5	Spectrum Analyzer	HP	8563E	02052	Dec. 28, 2019
6	Horn Antenna	Schwarzbeck	BBHA 9120D	648	Dec. 28, 2019
7	Horn Antenna	Schwarzbeck	BBHA 9120D	649	Dec. 28, 2019
8	Ultra-Broadband Antenna	ShwarzBeck	BBHA9170	25841	Dec. 28, 2019
9	Ultra-Broadband Antenna	ShwarzBeck	BBHA9170	25842	Dec. 28, 2019
10	Pre-Amplifier	HP	8447D	1937A03050	Dec. 28, 2019
11	Pre-Amplifier	EMCI	EMC051835	980075	Dec. 28, 2019
12	Splitter	Mini-Circuit	ZAPD-4	400059	Dec. 28, 2019
13	Signal Generator	Agilent	N5182A	1019356	Dec. 28, 2019
14	UNIVERSAL RADIO COMMUNICATION	Rohde & Schwarz	CMU200	114694	Dec. 28, 2019
15	Antenna Mast	UC	UC3000	N/A	N/A
16	Antenna mast	MATURO	TAM-4.0-P	N/A	N/A
17	Turn Table	UC	UC3000	N/A	N/A
18	Cable Below 1GHz	Schwarzbeck	AK9515E	33155	Dec. 28, 2019
19	Cable Above 1GHz	Hubersuhner	SUCOFLEX102	DA1580	Dec. 28, 2019



Output Power(Conducted) & Occupied Bandwidth & Emission Bandwidth & Band Edge Compliance & Conducted Spurious Emission					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	UNIVERSAL RADIO COMMUNICATION	Rohde & Schwarz	CMU200	114694	Dec. 28, 2019
2	Spectrum Analyzer	Rohde & Schwarz	FSU	100105	Dec. 28, 2019
3	Spectrum Analyzer	Rohde & Schwarz	FUV40-N	101331	Dec. 28, 2019
4	Splitter	Mini-Circuit	ZAPD-4	400059	Dec. 28, 2019
5	RF Connection Cable	HUBER+SUHNER	RE-7-FL	N/A	Dec. 28, 2019
6	RF Connection Cable	Chengdu E-Microwave	---	---	Dec. 28, 2019
7	Attenuator	Chengdu E-Microwave	EMCAXX-10R NZ-3	---	Dec. 28, 2019

Frequency Stability					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	UNIVERSAL RADIO COMMUNICATION	Rohde & Schwarz	CMU200	114694	Dec. 28, 2019
2	Spectrum Analyzer	Rohde & Schwarz	FSU	100105	Dec. 28, 2019
3	Spectrum Analyzer	Rohde & Schwarz	FUV40-N	101331	Dec. 28, 2019
4	Splitter	Mini-Circuit	ZAPD-4	400059	Dec. 28, 2019
5	Climate Chamber	ESPEC	EL-10KA	05107008	Dec. 28, 2019

Note: 1. The Cal. Interval was one year.

2. The cable loss has calculated in test result which connection between each test instruments.

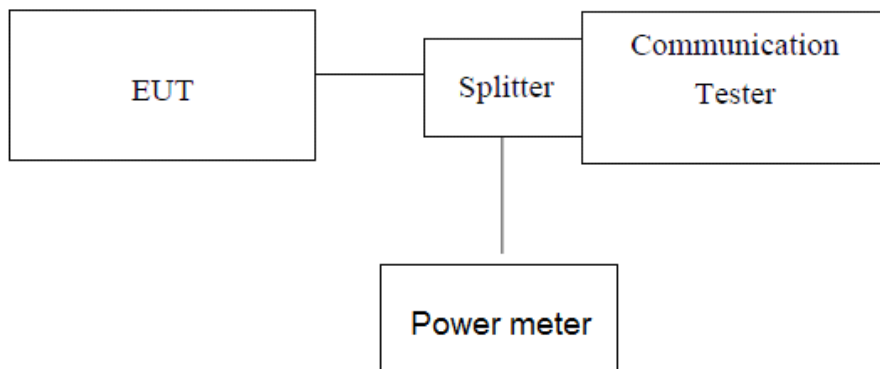
3. TEST ITEM AND RESULTS

3.1. Conducted Output Power

LIMIT:

WCDMA Band II: 2W

TEST CONFIGURATION



Note: Measurement setup for testing on Antenna connector

TEST PROCEDURE

1. The transmitter output port was connected to base station.
2. The RF output of EUT was connected to the power meter by RF cable and attenuator, the path loss was compensated to the results for each measurement.
3. Set EUT at maximum power through base station.
4. Select lowest, middle, and highest channels for each band and different modulation.
5. Measure the maximum PK burst power and maximum Avg. burst power.

TEST RESULTS

See WCDMA Appendix for Band 2



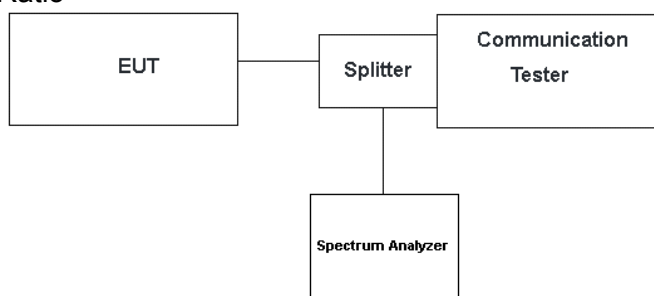
3.2. Peak-to-Average Ratio

LIMIT:

The Peak-to-Average Ratio (PAR) of the transmission may not exceed 13dB.

TEST CONFIGURATION

- For Peak-to-Average Ratio



TEST PROCEDURE

- For Peak-to-Average Ratio
1. The testing follows FCC KDB 971168 v02r02 Section 5.7.1.
 2. The EUT was connected to spectrum and communication tester via a splitter
 3. Set the CCDF (Complementary Cumulative Distribution Function) option in spectrum analyzer.
 4. The highest RF powers were measured and recorded the maximum PAPR level associated with a probability of 0.1 %.
 6. Record the deviation as Peak to Average Ratio.

TEST RESULTS

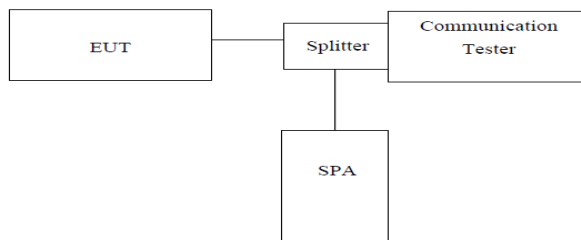
See WCDMA Appendix for Band 2

Remark: We tested all the patterns, but only the worst data was found in the appendix.



3.3. Occupy Bandwidth

TEST CONFIGURATION



Note: Measurement setup for testing on Antenna connector

TEST PROCEDURE

1. The EUT's output RF connector was connected with a short cable to the spectrum analyzer
2. RBW was set to about 1% of emission BW, $VBW \geq 3$ times RBW.
3. -26dBc display line was placed on the screen (or 99% bandwidth), the occupied bandwidth is the delta frequency between the two points where the display line intersects the signal trace.

TEST RESULTS

See WCDMA Appendix for Band 2

Remark: We tested all the patterns, but only the worst data was found in the appendix.



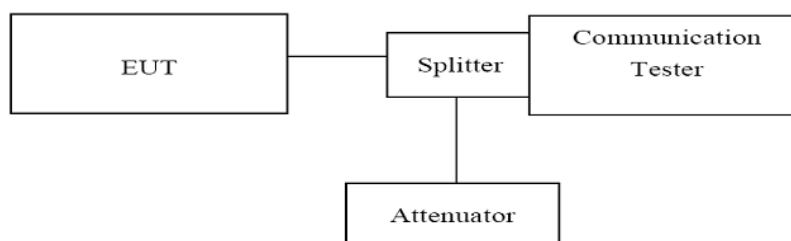
3.4. Out of band emission at antenna terminals

LIMIT

Part 24.238 and Part 22.917 specify that 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 $43 + 10 \log(P)$ dB.

The specification that emissions shall be attenuated below the transmitter power (P) by at least $43 + 10 \log(P)$ dB, translates in the relevant power range (1 to 0.001 W) to -13 dBm. At 1 W the specified minimum attenuation becomes 43 dB and relative to a 30 dBm (1 W) carrier becomes a limit of -13 dBm. At 0.001 W (0 dBm) the minimum attenuation is 13 dB, which again yields a limit of -13 dBm. In this way a translation of the specification from relative to absolute terms is carried out.

TEST CONFIGURATION



TEST PROCEDURE

1. The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation.
2. The resolution bandwidth of the spectrum analyzer was set at 1MHz; sufficient scans were taken to show the out of band Emissions if any up to 10th harmonic.
3. For the out of band: Set the RBW = 1MHz VBW ≥ 3 times RBW, Start=30MHz, Stop= 10th harmonic.

TEST RESULTS

See WCDMA Appendix for Band 2

Remark: We tested all the patterns, but only the worst data was found in the appendix.

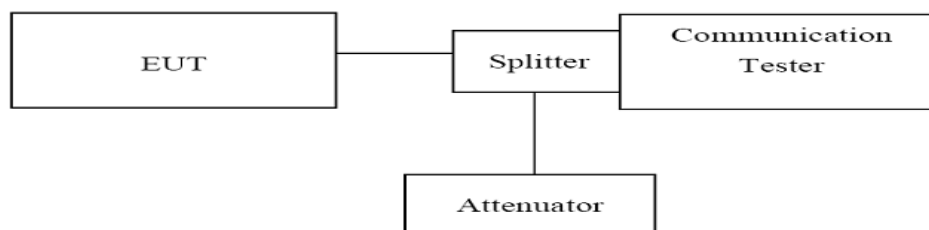


3.5. Band Edge compliance

LIMIT

Part 24.238 specifies that 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 $43 + 10 \log(P)$ dB. The specification that emissions shall be attenuated below the transmitter power (P) by at least $43 + 10 \log(P)$ dB, translates in the relevant power range (1 to 0.001 W) to -13 dBm. At 1 W the specified minimum attenuation becomes 43 dB and relative to a 30 dBm (1 W) carrier becomes a limit of -13 dBm. At 0.001 W (0 dBm) the minimum attenuation is 13 dB, which again yields a limit of -13 dBm. In this way a translation of the specification from relative to absolute terms is carried out.

TEST CONFIGURATION



TEST PROCEDURE

1. The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation.
2. Set the RBW=5 KHz, VBW = 50KHz, Span=1MHz Sweep time= Auto for 2G system measurement.
3. Set the RBW=50 KHz, VBW = 300KHz, Span=1MHz Sweep time= Auto for 3G system measurement.

TEST RESULTS

See WCDMA Appendix for Band 2

Remark: We tested all the patterns, but only the worst data was found in the appendix.

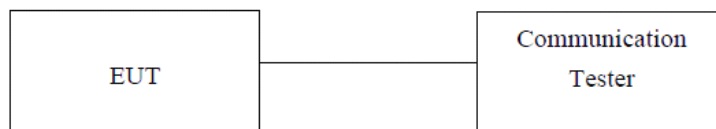


3.6. Radiated Power Measurement

LIMIT

24.232(c) - Mobile/portable stations are limited to 2 watts e.i.r.p. peak power and the equipment must employ means to limit the power to the minimum necessary for successful communications.

TEST CONFIGURATION



Note: Measurement setup for testing on Antenna connector

TEST PROCEDURE

EIRP/ERP:

1. EIRP= Conducted Power +Antenan gain
2. ERP power=EIPR power-2.15dBi.

TEST RESULTS

Measurement Data (worst case) :

Mode	Channel	Conducted Power	EIRP	Limit (dBm)	Result
WCDMA Band II (QPSK)	9262	23.07	23.57	33.00	Pass
	9400	22.86	23.36		
	9538	23.07	23.57		

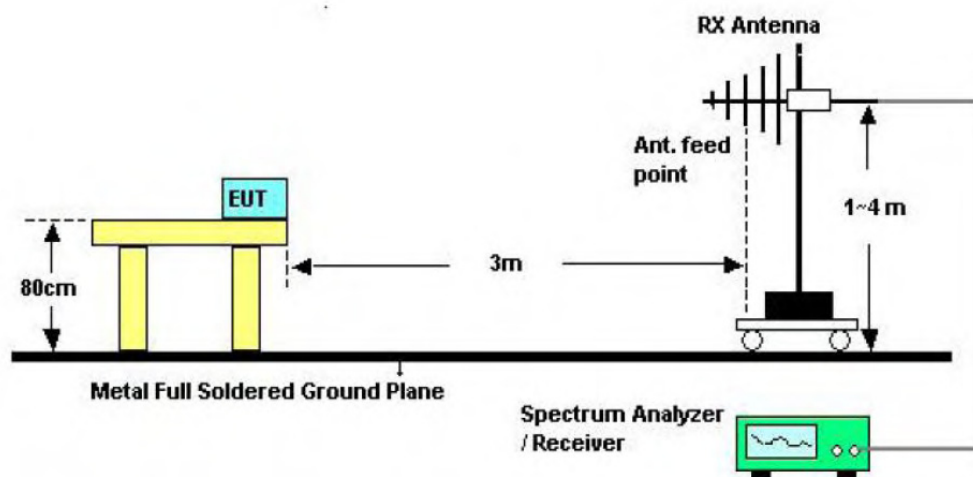
3.7. Radiated Spurious Emission

LIMIT

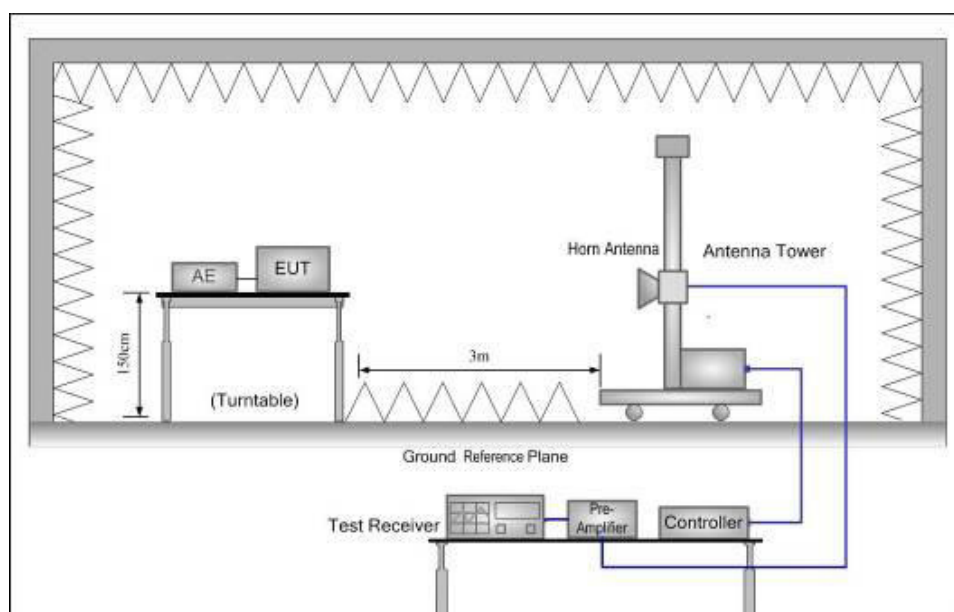
-13dBm

TEST CONFIGURATION

For the actual test configuration, please refer to the related Item – EUT Test Photos.



Below 1GHz



Above 1GHz



TEST PROCEDURE

1. EUT was placed on a 1.50 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The height of receiving antenna is 1.50m. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all transmit frequencies in three channels (High, Middle, Low) were measured with peak detector.
2. A log-periodic antenna or double-ridged waveguide 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.
3. The EUT is then put into continuously transmitting mode at its maximum power level during the test. Set Test Receiver or Spectrum RBW=1MHz, VBW=3MHz, and the maximum value of the receiver should be recorded as (Pr).
4. 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 adjusts 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.
5. An amplifier should be connected to the Signal Source output port. And the cable should be connecting 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.
6. The measurement results are obtained as described below:
$$\text{Power(EIRP)} = \text{PMea} - \text{PAG} - \text{Pcl} + \text{Ga}$$

We used SMF100A microwave signal generator which signal level can up to 33dBm, so we not used power Amplifier for substitution test; The measurement results are amend as described below:

$$\text{Power(EIRP)} = \text{PMea} - \text{Pcl} + \text{Ga}$$
7. 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, $\text{ERP} = \text{EIRP} - 2.15\text{dBi}$.
8. Test frequency range should extend to 10th harmonic of highest fundamental frequency.

TEST RESULTS

Remark:

1. By preliminary testing and verifying three axis (X, Y and Z) position of EUT transmitted status, it was found that "Z axis" position was the worst, and test data recorded in this report.
2. We test all modulation type and record worst case at Voice mode.
3. Above 18G test data reference to the test report No.: C180811Z01-RP2.

**Measurement Data (worst case):**

WCDMA Band II					
Channel	Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
		Polarization	Level (dBm)		
9262	3705.20	Vertical	-41.32	-13.00	Pass
	5557.80	Vertical	-49.42		
	3705.20	Horizontal	-48.34		
	5557.80	Horizontal	-51.27		
9400	3760.00	Vertical	-46.01		
	5640.00	Vertical	-50.26		
	3760.00	Horizontal	-44.32		
	5640.00	Horizontal	-51.72		
9538	3814.80	Vertical	-40.47		
	5722.20	Vertical	-50.29		
	3814.80	Horizontal	-44.82		
	5722.20	Horizontal	-44.91		

Remark :

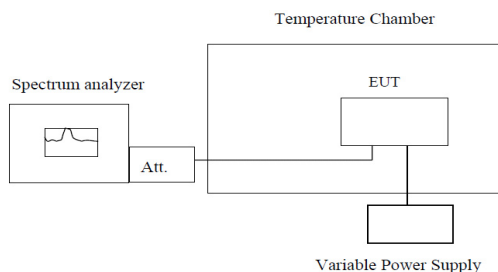
1. The emission levels of below 1 GHz are very lower than the limit above 10dB and not show in test report.

3.8. Frequency stability

LIMIT

Cellular Band: $\pm 2.5\text{ppm}$ PCS Band: Within the authorized frequency block

TEST CONFIGURATION



Note : Measurement setup for testing on Antenna connector

TEST PROCEDURE

1. The equipment under test was connected to an external DC power supply and input rated voltage.
2. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators.
3. The EUT was placed inside the temperature chamber.
4. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 25°C operating frequency as reference frequency.
5. Turn EUT off and set the chamber temperature to -30°C. After the temperature stabilized for approximately 30 minutes recorded the frequency.
6. Repeat step measure with 10°C increased per stage until the highest temperature of +50°C reached.
7. Reduce the input voltage to specified extreme voltage variation (+/- 15%) and endpoint, record the maximum frequency change.

TEST RESULTS

See WCDMA Appendix for Band 2



4. EUT TEST PHOTOS

Reference to the document No.: Test Photographs .



5. PHOTOGRAPHS OF EUT CONSTRUCTIONAL

Reference to the document No.: External Photographs and Internal Photographs.

*****THE END*****