

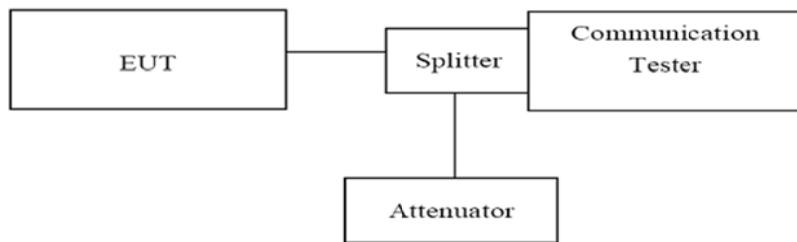
4.5. Band Edge compliance

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. For the bandedge: 2G: Set the RBW=10KHz, VBW = 30KHz, Sweep time= Auto
3G: Set the RBW=100KHz, VBW = 300KHz, Sweep time= Auto

TEST RESULTS

GSM850					
Channel Number	Frequency (MHz)	Measurement Results		Limit (dBm)	Verdict
		Frequency (MHz)	Values (dBm)		
128	824.20	824.00	-20.79	-13.00	Pass
251	848.80	849.00	-17.84	-13.00	Pass

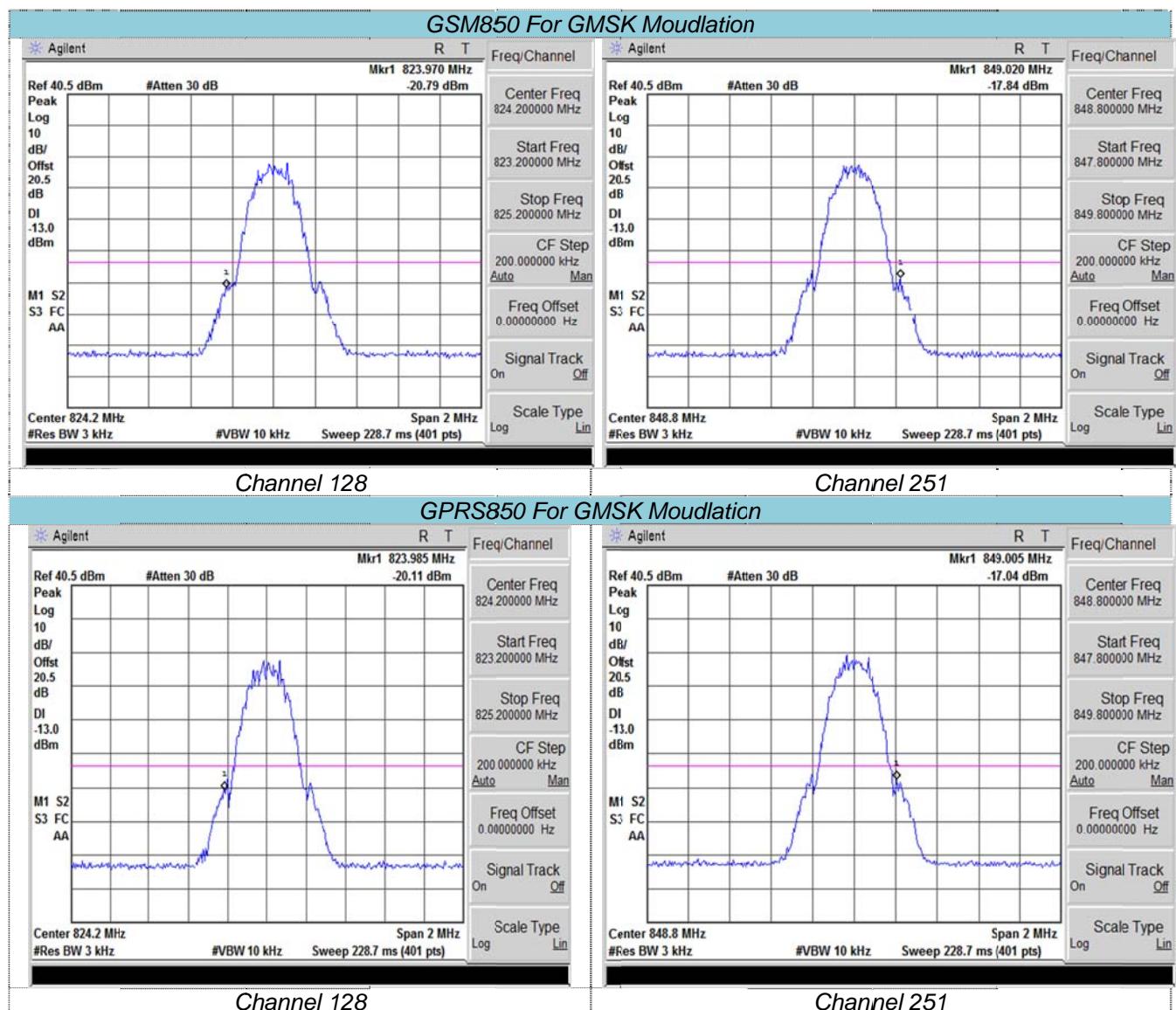
GPRS850					
Channel Number	Frequency (MHz)	Measurement Results		Limit (dBm)	Verdict
		Frequency (MHz)	Values (dBm)		
128	824.20	823.99	-20.11	-13.00	Pass
251	848.80	849.00	-17.04	-13.00	Pass

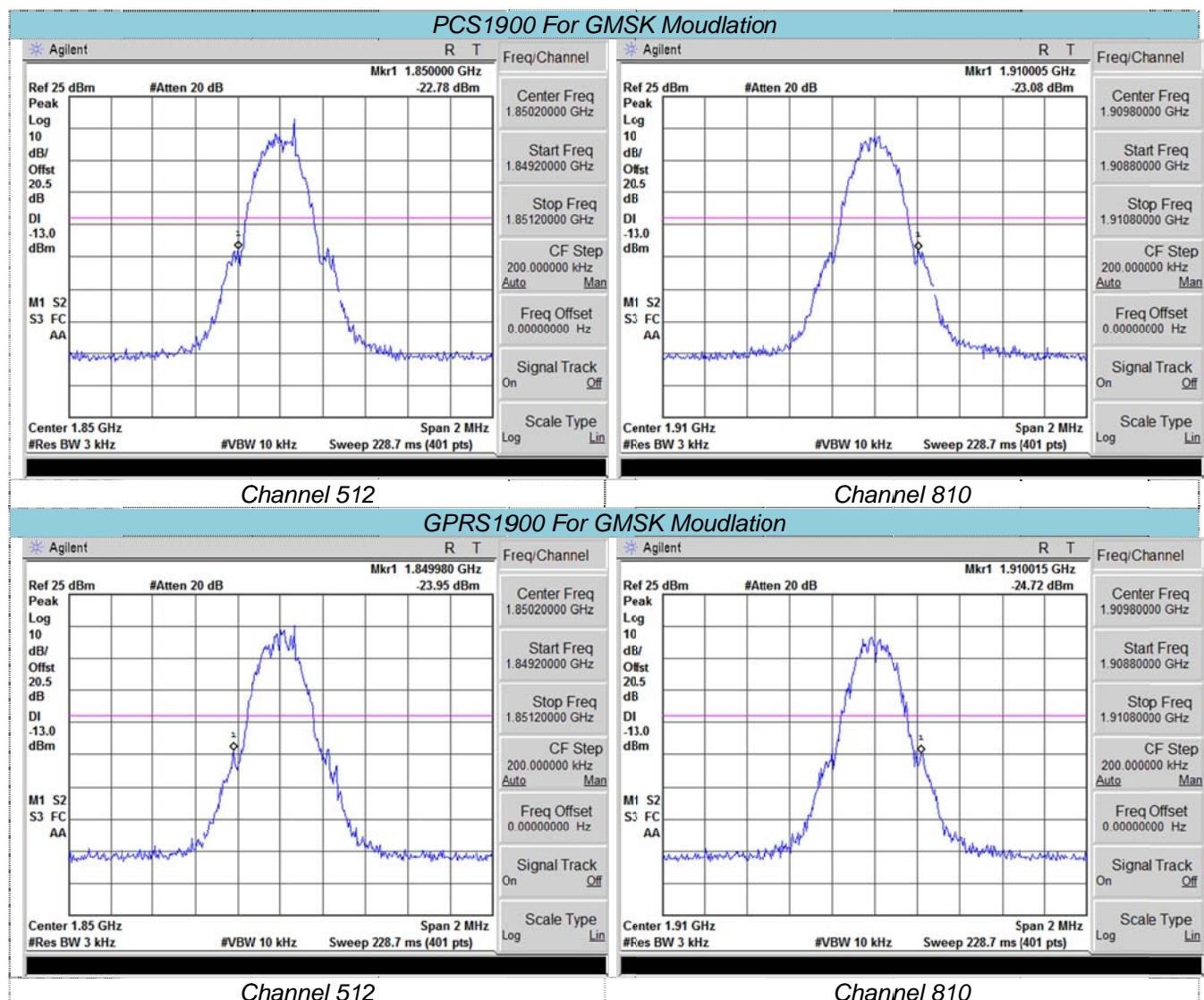
PCS1900					
Channel Number	Frequency (MHz)	Measurement Results		Limit (dBm)	Verdict
		Frequency (MHz)	Values (dBm)		
512	1850.20	1850.00	-22.78	-13.00	Pass
810	1909.80	1910.00	-23.08	-13.00	Pass

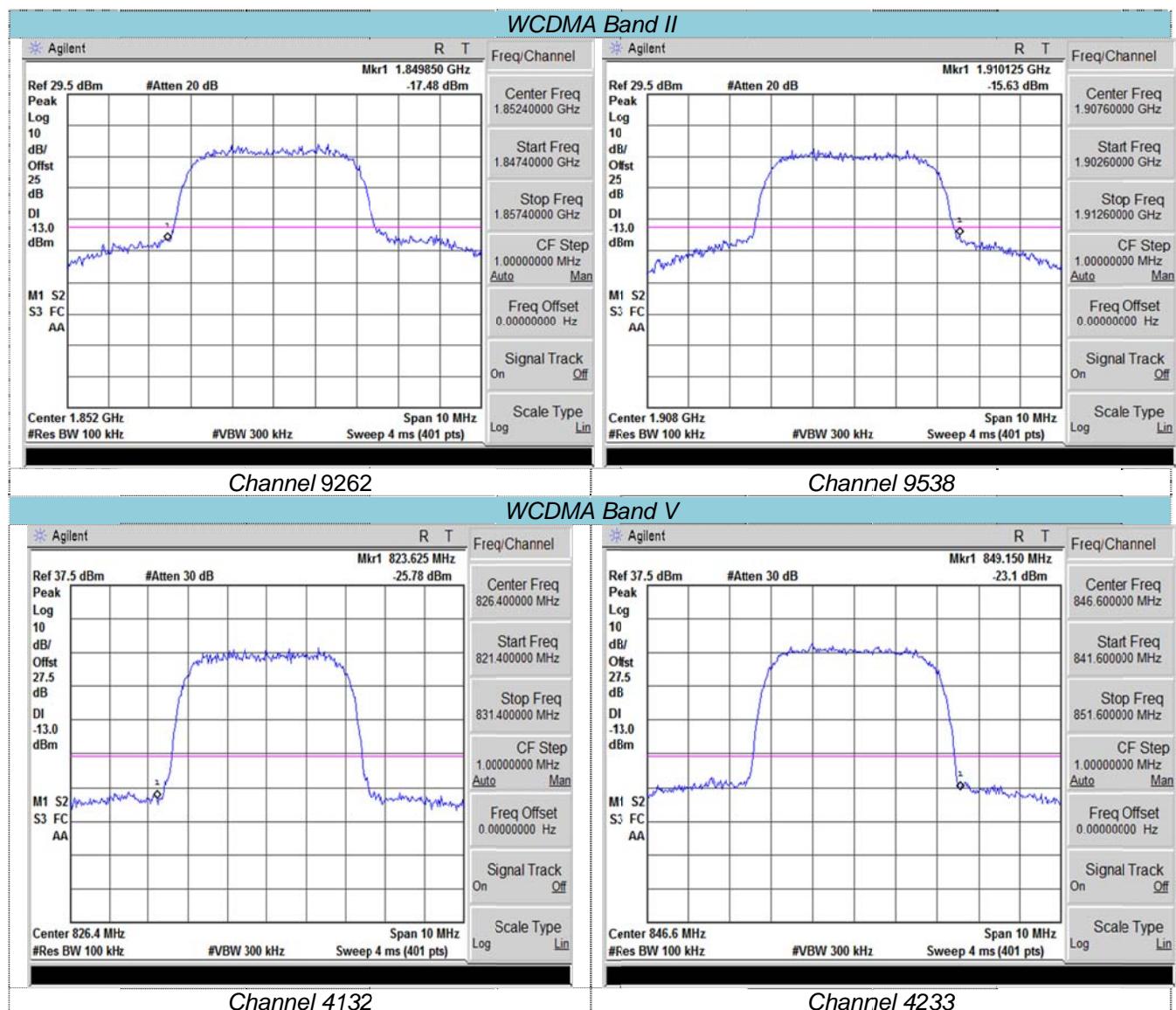
GPRS1900					
Channel Number	Frequency (MHz)	Measurement Results		Limit (dBm)	Verdict
		Frequency (MHz)	Values (dBm)		
512	1850.20	1850.00	-23.95	-13.00	Pass
810	1909.80	1910.00	-24.72	-13.00	Pass

WCDMA Band II					
Channel Number	Frequency (MHz)	Measurement Results		Limit (dBm)	Verdict
		Frequency (MHz)	Values (dBm)		
9262	1852.4	1850.00	-17.48	-13.00	Pass
9538	1907.6	1910.69	-15.63	-13.00	Pass

WCDMA Band V					
Channel Number	Frequency (MHz)	Measurement Results		Limit (dBm)	Verdict
		Frequency (MHz)	Values (dBm)		
4132	826.4	824.00	-25.78	-13.00	Pass
4233	846.6	849.09	-23.1	-13.00	Pass







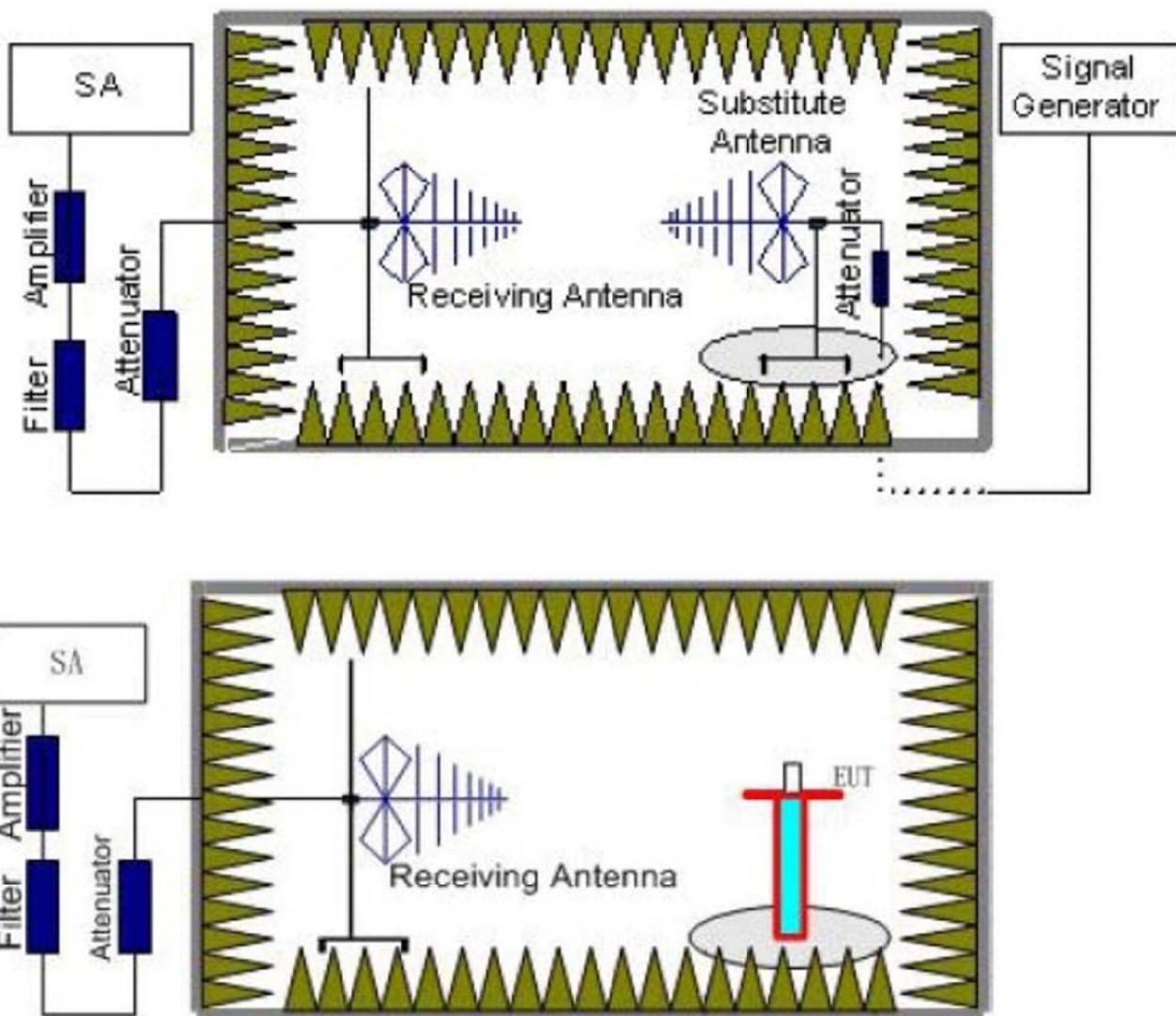
4.6. Radiated Power Measurement

LIMIT

GSM850/WCDMA Band V: 7W ERP

PCS1900/WCDMA Band II: 2W EIRP

TEST CONFIGURATION



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 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.

5. 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.

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, $\text{ERP} = \text{EIRP} - 2.15\text{dBi}$.

TEST RESULTS

GSM:

Mode	Channel	Antenna Pol.	ERP	Limit (dBm)	Result
GSM850	128	V	32.45	38.45	Pass
		H	26.74		
	190	V	32.47		
		H	27.38		
	251	V	32.52		
		H	27.65		
GPRS850	128	V	28.45	38.45	Pass
		H	26.47		
	190	V	28.64		
		H	26.52		
	251	V	28.92		
		H	25.47		

Mode	Channel	Antenna Pol.	EIRP	Limit (dBm)	Result
PCS1900	512	V	28.52	33.01	Pass
		H	26.75		
	661	V	28.64		
		H	25.96		
	810	V	28.47		
		H	26.78		
GPRS1900	512	V	27.33	33.01	Pass
		H	25.62		
	661	V	28.52		
		H	25.46		
	810	V	28.02		
		H	26.75		

WCDMA:

Mode	Channel	Antenna Pol.	EIRP	Limit (dBm)	Result
WCDMA Band II	9262	V	19.45	33.01	Pass
		H	16.52		
	9400	V	20.08		
		H	18.64		
	9538	V	20.43		
		H	17.95		

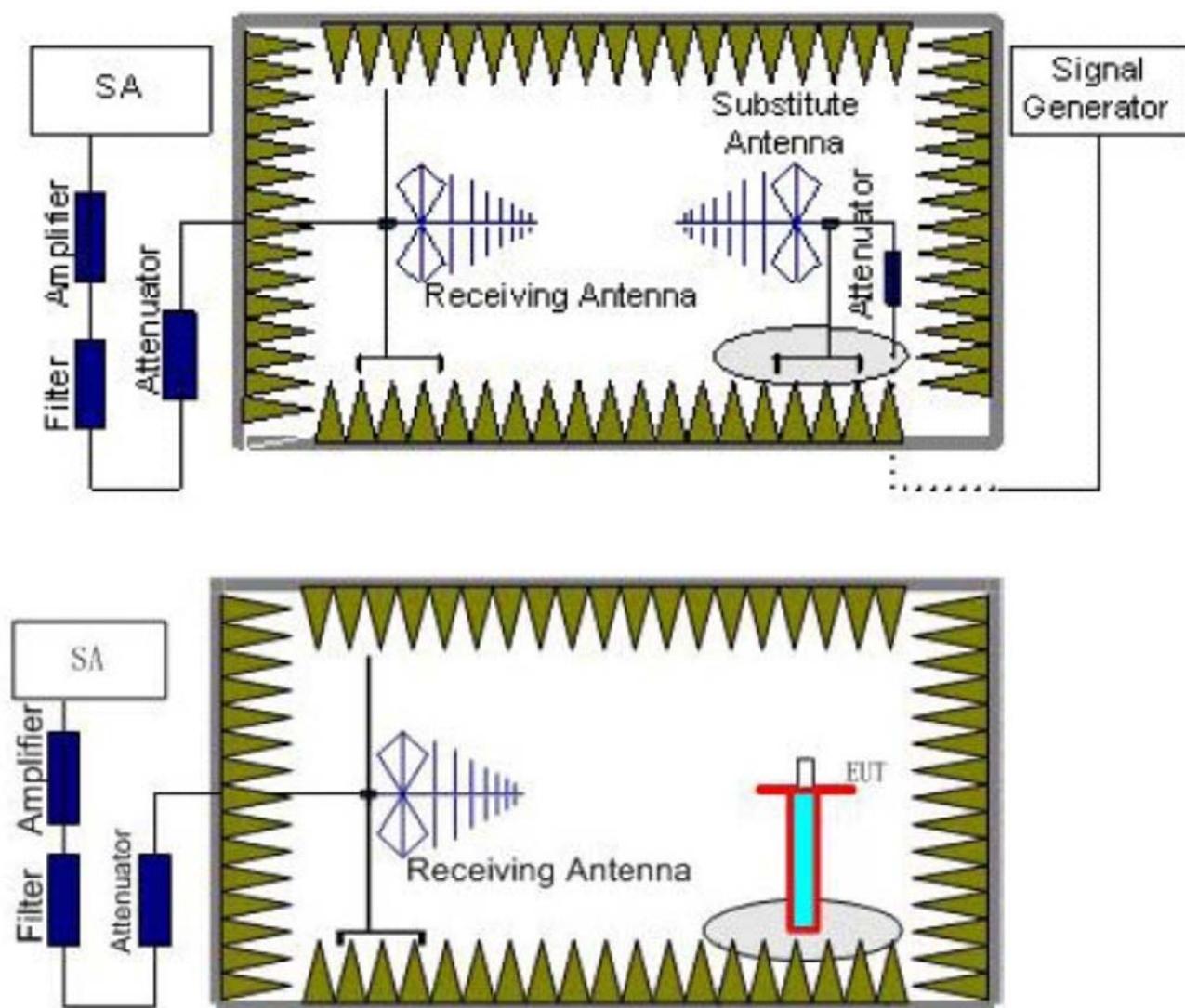
Mode	Channel	Antenna Pol.	EIRP	Limit (dBm)	Result
WCDMA Band V	4132	V	21.46	38.45	Pass
		H	18.85		
	4182	V	21.52		
		H	19.69		
	4233	V	21.86		
		H	18.46		

4.7. Radiated Spurious Emission

LIMIT

-13dBm

TEST CONFIGURATION



TEST RESULTS

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 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.
5. 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.
6. The measurement results are obtained as described below:
Power(EIRP)=PMea- PAg - Pcl + 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:
Power(EIRP)=PMea- Pcl + 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, $ERP = EIRP - 2.15\text{ dBi}$.

TEST RESULTS

GSM850					
Channel	Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
		Polarization	Level (dBm)		
128	1648.40	Vertical	-27.52	-13.00	Pass
	2472.60	V	-46.48		
	3296.80	V	-36.55		
	4121.00	V	-42.65		
	4945.20	V	---		
	1648.40	Horizontal	-31.74	-13.00	Pass
	2472.60	H	-48.42		
	3296.80	H	-38.52		
	4121.00	H	-45.38		
	4945.20	H	---		
190	1673.20	Vertical	-28.69	-13.00	Pass
	2509.80	V	-46.37		
	3346.40	V	-37.43		
	4183.00	V	-42.62		
	5019.60	V	---		
	1673.20	Horizontal	-30.63	-13.00	Pass
	2509.80	H	-47.84		
	3346.40	H	-38.59		
	4183.00	H	-45.06		
	5019.60	H	---		
251	1697.60	Vertical	-27.74	-13.00	Pass
	2546.40	V	-46.28		
	3395.20	V	-36.53		
	4244.00	V	-42.52		
	5092.80	V	---		
	1697.60	Horizontal	-32.32	-13.00	Pass
	2546.40	H	-48.73		
	3395.20	H	-38.52		
	4244.00	H	-45.45		
	5092.80	H	---		

Remark :

1. The emission behaviour belongs to narrowband spurious emission.
2. Remark"---" means that the emission level is too low to be measured
3. The emission levels of below 1 GHz are very lower than the limit and not show in test report.

PCS1900					
Channel	Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
		Polarization	Level (dBm)		
512	3700.40	Vertical	-34.62	-13.00	Pass
	5550.60	V	-29.56		
	7400.80	V	-34.78		
	9251.00	V	-42.52		
	11101.20	V	---		
	3700.40	Horizontal	-37.85	-13.00	Pass
	5550.60	H	-34.64		
	7400.80	H	-37.85		
	9251.00	H	-45.24		
	11101.20	H	---		
661	3760.00	Vertical	-34.64	-13.00	Pass
	5640.00	V	-29.59		
	7520.00	V	-34.73		
	9400.00	V	-42.58		
	11280.00	V	---		
	3760.00	Horizontal	-38.06	-13.00	Pass
	5640.00	H	-32.32		
	7520.00	H	-36.75		
	9400.00	H	-45.06		
	11280.00	H	---		
810	3819.60	Vertical	-36.54	-13.00	Pass
	5729.40	V	-29.35		
	7639.20	V	-34.69		
	9549.00	V	-41.83		
	11458.80	V	---		
	3819.60	Horizontal	-38.74	-13.00	Pass
	5729.40	H	-34.26		
	7639.20	H	-37.57		
	9549.00	H	-45.36		
	11458.80	H	---		

Remark :

1. The emission behaviour belongs to narrowband spurious emission.
2. Remark"---" means that the emission level is too low to be measured
3. The emission levels of below 1 GHz are very lower than the limit and not show in test report.

WCDMA Band II					
Channel	Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
		Polarization	Level (dBm)		
9262	3704.80	Vertical	-42.74	-13.00	Pass
	5557.20	V	-45.85		
	7409.60	V	-49.52		
	9262.00	V	---		
	3704.80	Horizontal	-43.74	-13.00	Pass
	5557.20	H	-48.67		
	7409.60	H	-50.85		
	9262.00	H	---		
9400	3760.00	Vertical	-41.65	-13.00	Pass
	5640.00	V	-44.94		
	7520.00	V	-49.37		
	9400.00	V	---		
	3760.00	Horizontal	-43.86	-13.00	Pass
	5640.00	H	-47.58		
	7520.00	H	-50.69		
	9400.00	H	---		
9538	3815.20	Vertical	-41.76	-13.00	Pass
	5722.80	V	-42.35		
	7630.40	V	-49.51		
	9538.00	V	---		
	3815.20	Horizontal	-43.67	-13.00	Pass
	5722.80	H	-48.85		
	7630.40	H	-51.37		
	9538.00	H	---		

Remark :

4. The emission behaviour belongs to narrowband spurious emission.
5. Remark"---" means that the emission level is too low to be measured
6. The emission levels of below 1 GHz are very lower than the limit and not show in test report.

WCDMA Band V					
Channel	Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
		Polarization	Level (dBm)		
4132	1652.80	Vertical	-41.52	-13.00	Pass
	2479.20	V	-46.63		
	3305.60	V	-48.74		
	4132.00	V	---		
	1652.80	Horizontal	-43.32	-13.00	Pass
	2479.20	H	-49.67		
	3305.60	H	-51.02		
	4132.00	H	---		
4182	1673.20	Vertical	-42.63	-13.00	Pass
	2509.80	V	-44.52		
	3346.40	V	-48.74		
	4183.00	V	---		
	1673.20	Horizontal	-43.65	-13.00	Pass
	2509.80	H	-47.37		
	3346.40	H	-49.42		
	4183.00	H	---		
4233	1693.20	Vertical	-41.36	-13.00	Pass
	2539.80	V	-42.42		
	3386.40	V	-49.79		
	4233.00	V	---		
	1693.20	Horizontal	-43.58	-13.00	Pass
	2539.80	H	-48.63		
	3386.40	H	-50.25		
	4233.00	H	---		

Remark :

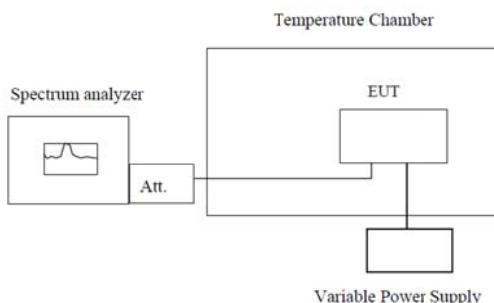
4. The emission behaviour belongs to narrowband spurious emission.
5. Remark"---" means that the emission level is too low to be measured
6. The emission levels of below 1 GHz are very lower than the limit and not show in test report.

4.8. Frequency stability V.S. Temperature measurement

LIMIT

2.5ppm

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.

TEST RESULTS

Reference Frequency: GSM850 Middle channel=190 channel=836.6MHz					
Power supplied (Vdc)	Temperature (°C)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
3.70	-30	28	0.033	2.5	Pass
	-20	16	0.019		
	-10	30	0.036		
	0	12	0.014		
	10	26	0.031		
	20	19	0.023		
	30	32	0.038		
	40	31	0.037		
	50	22	0.026		
Reference Frequency: PCS1900 Middle channel=661 channel=1880MHz					
Power supplied (Vdc)	Temperature (°C)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
3.70	-30	19	0.010	2.5	Pass
	-20	22	0.012		
	-10	28	0.015		
	0	32	0.017		
	10	30	0.016		
	20	25	0.013		
	30	37	0.020		
	40	26	0.014		
	50	18	0.010		

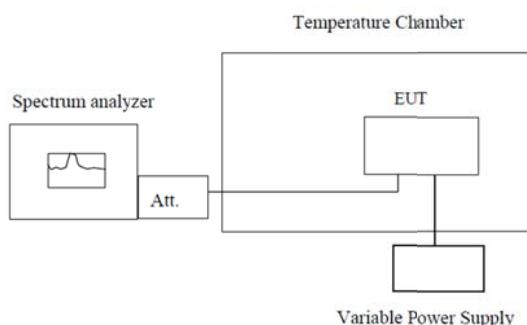
Reference Frequency: WCDMA Band II Middle channel=9400 channel=1880MHz					
Power supplied (Vdc)	Temperature (°C)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
3.70	-30	26	0.014	2.5	Pass
	-20	19	0.010		
	-10	32	0.017		
	0	41	0.022		
	10	25	0.013		
	20	19	0.010		
	30	28	0.015		
	40	32	0.017		
	50	17	0.009		
Reference Frequency: WCDMA Band V Middle channel=4182 channel=836.6MHz					
Power supplied (Vdc)	Temperature (°C)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
3.70	-30	18	0.022	2.5	Pass
	-20	26	0.031		
	-10	19	0.023		
	0	33	0.039		
	10	32	0.038		
	20	18	0.022		
	30	26	0.031		
	40	27	0.032		
	50	25	0.030		

4.9. Frequency stability V.S. Temperature measurement

LIMIT

2.5ppm

TEST CONFIGURATION



Note : Measurement setup for testing on Antenna connector

TEST PROCEDURE

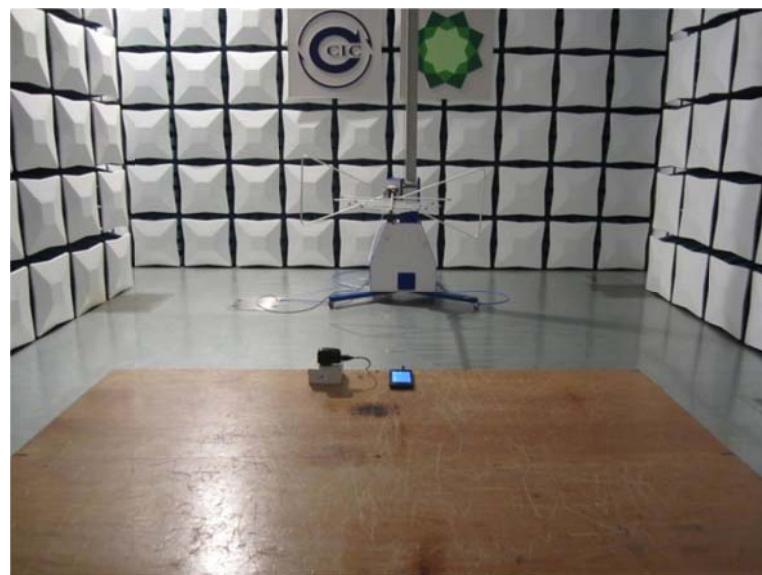
1. Set chamber temperature to 25°C. Use a variable DC power source to power the EUT and set the voltage to rated voltage.
2. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and recorded the frequency.
3. Reduce the input voltage to specified extreme voltage variation (+/- 15%) and endpoint, record the maximum frequency change.

TEST RESULTS

Reference Frequency: GSM850 (GSM link) Middle channel=190 channel=836.6MHz					
Temperature (°C)	Power supplied (Vdc)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
25	4.25	27	0.032	2.5	Pass
	3.70	19	0.023		
	3.40	24	0.029		
Reference Frequency: PCS1900 (GSM link) Middle channel=661 channel=1880MHz					
Temperature (°C)	Power supplied (Vdc)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
25	4.25	15	0.008	2.5	Pass
	3.70	26	0.014		
	3.40	29	0.015		
Reference Frequency: WCDMA Band II Middle channel=9400 channel=1880MHz					
Temperature (°C)	Power supplied (Vdc)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
25	4.25	21	0.011	2.5	Pass
	3.70	29	0.015		
	3.40	28	0.015		
Reference Frequency: WCDMA Band V Middle channel=4182 channel=836.6MHz					
Temperature (°C)	Power supplied (Vdc)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
25	4.25	15	0.018	2.5	Pass
	3.70	16	0.019		
	3.40	32	0.038		

5. Test Setup Photos of the EUT

Radiated emission:

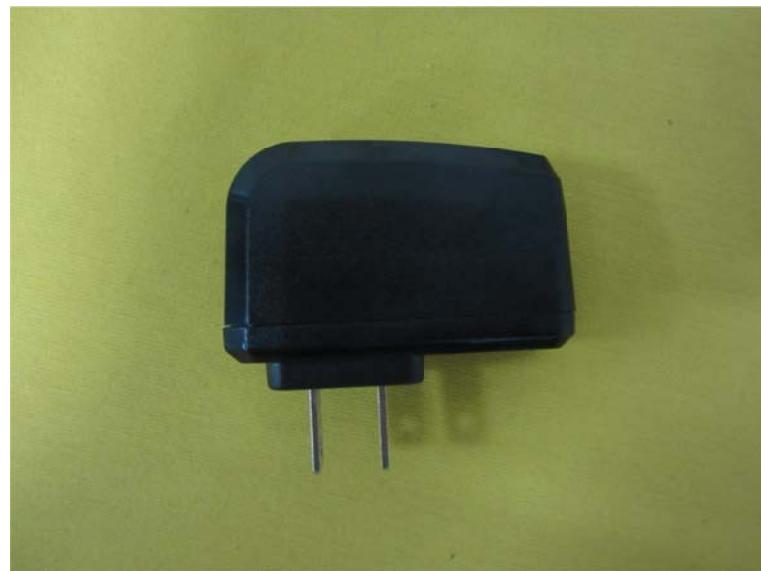


Conducted emission:



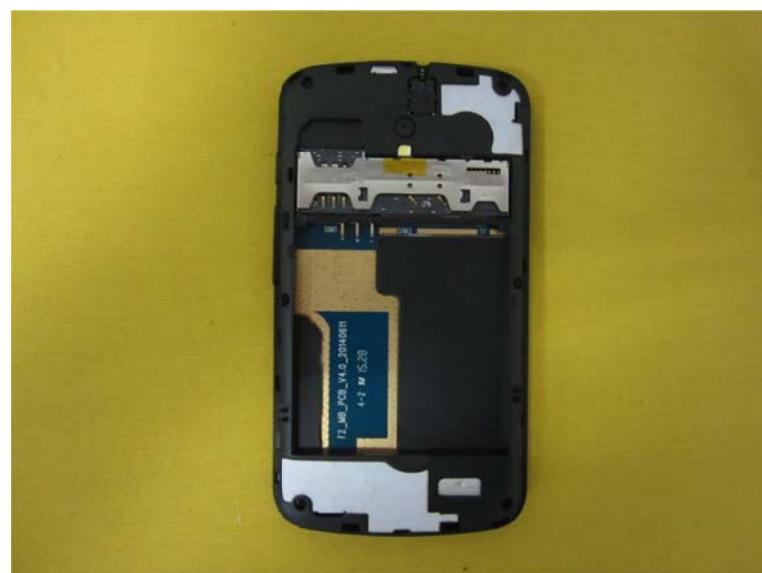
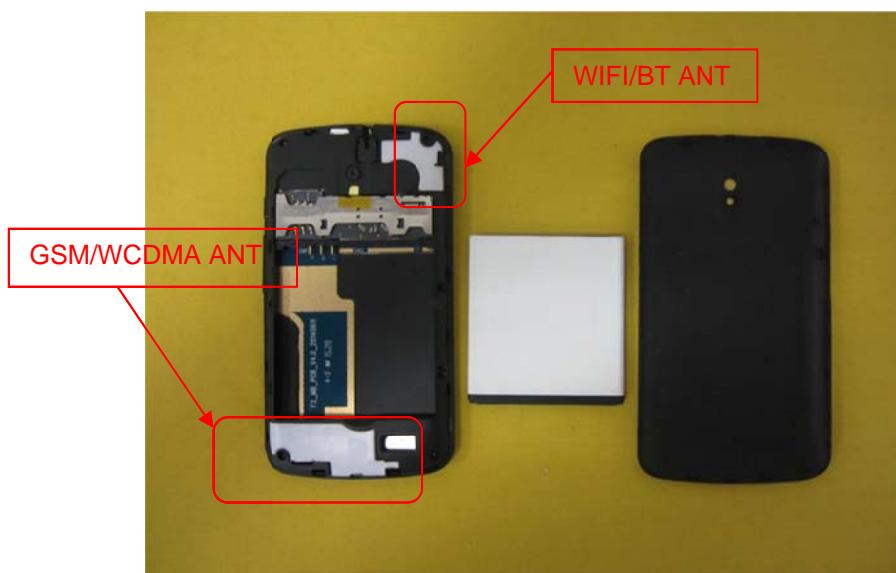
6. External and Internal Photos of the EUT

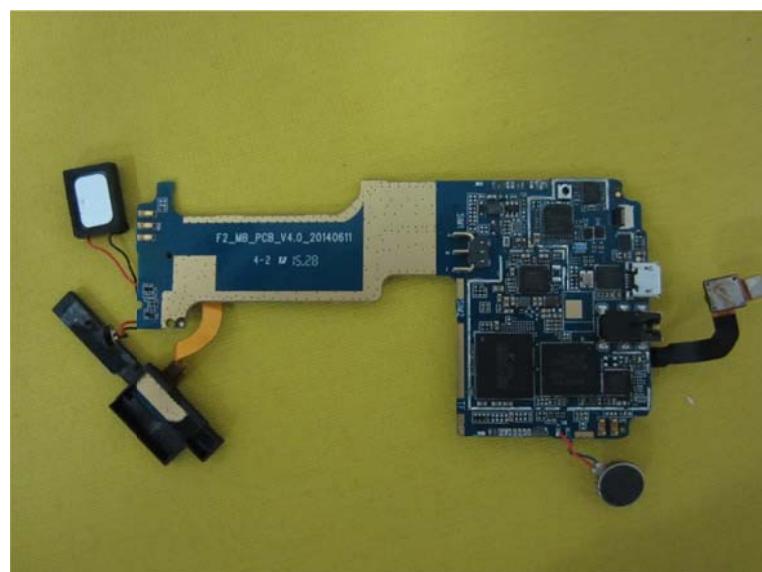
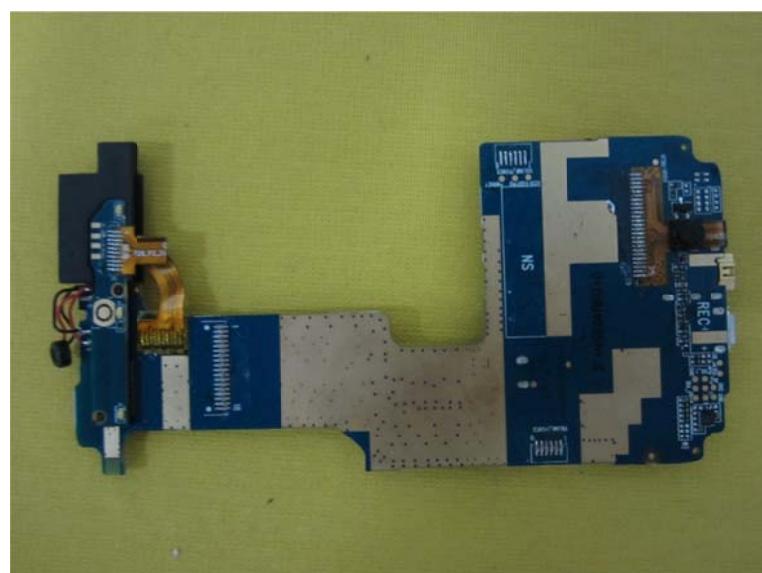
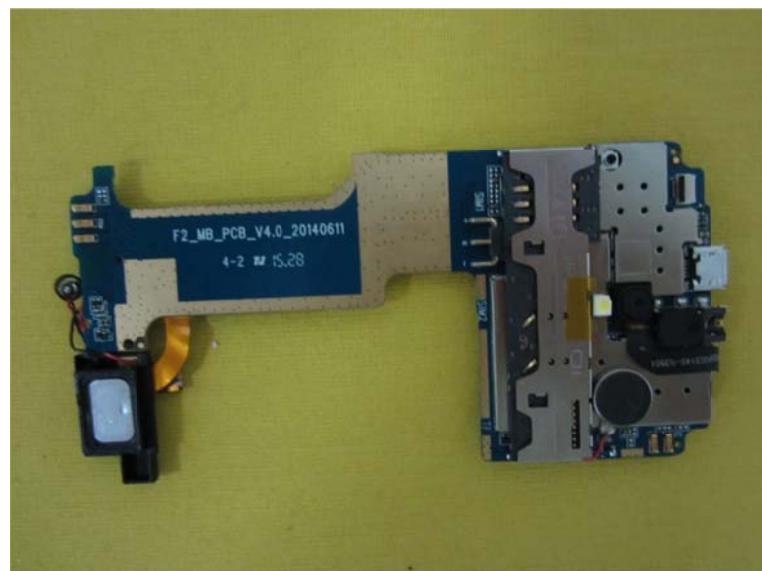
External photos of the EUT







Internal photos of the EUT





.....End of Report.....