

# FCC RF Test Report

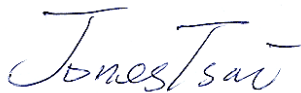
**APPLICANT** : Yulong Computer Telecommunication Scientific (Shenzhen) Co., Ltd.  
**EQUIPMENT** : mobile phone  
**BRAND NAME** : Vodafone  
**MODEL NAME** : Vodafone 990N  
**MARKETING NAME** : Vodafone Smart 4 max  
**FCC ID** : R38YL990N  
**STANDARD** : FCC 47 CFR Part 2, 24(E)  
**CLASSIFICATION** : PCS Licensed Transmitter Held to Ear (PCE)

The product was received on Jan. 26, 2014 and testing was completed on Aug. 11, 2014. We, SPORTON INTERNATIONAL (SHENZHEN) INC., would like to declare that the tested sample has been evaluated in accordance with the test procedures given in ANSI / TIA / EIA-603-C-2004 and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL (SHENZHEN) INC., the test report shall not be reproduced except in full.



Reviewed by: Joseph Lin / Supervisor



Approved by: Jones Tsai / Manager



**SPORTON INTERNATIONAL (SHENZHEN) INC.**

No. 3 Building, the third floor of south, Shahe River west, Fengzeyuan warehouse, Nanshan District, Shenzhen, Guangdong, P.R.C.



## TABLE OF CONTENTS

<b>REVISION HISTORY.....</b>	<b>3</b>
<b>SUMMARY OF TEST RESULT .....</b>	<b>4</b>
<b>1 GENERAL DESCRIPTION .....</b>	<b>5</b>
1.1 Applicant.....	5
1.2 Manufacturer .....	5
1.3 Product Feature of Equipment Under Test .....	5
1.4 Product Specification subjective to this standard.....	5
1.5 Modification of EUT .....	6
1.6 Maximum EIRP Power, Frequency Tolerance, and Emission Designator.....	6
1.7 Testing Location .....	6
1.8 Applicable Standards .....	7
<b>2 TEST CONFIGURATION OF EQUIPMENT UNDER TEST .....</b>	<b>8</b>
2.1 Test Mode.....	8
2.2 Connection Diagram of Test System .....	9
2.3 Support Unit used in test configuration .....	9
2.4 Measurement Results Explanation Example .....	10
<b>3 TEST RESULT .....</b>	<b>11</b>
3.1 Conducted Output Power Measurement.....	11
3.2 Peak-to-Average Ratio .....	13
3.3 Effective Isotropic Radiated Power Measurement .....	19
3.4 99% Occupied Bandwidth and 26dB Bandwidth Measurement.....	22
3.5 Band Edge Measurement.....	30
3.6 Conducted Spurious Emission Measurement.....	35
3.7 Field Strength of Spurious Radiation Measurement .....	42
3.8 Frequency Stability Measurement.....	50
<b>4 LIST OF MEASURING EQUIPMENT .....</b>	<b>54</b>
<b>5 UNCERTAINTY OF EVALUATION .....</b>	<b>55</b>
<b>APPENDIX A. SETUP PHOTOGRAPHS</b>	



## REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FG412407-06	Rev. 01	Initial issue of report	Aug. 22, 2014

## SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	§2.1046	Conducted Output Power	N/A	PASS	-
3.2	§24.232(d)	Peak-to-Average Ratio	<13 dB	PASS	-
3.3	§24.232(c)	Equivalent Isotropic Radiated Power	< 2 Watts	PASS	-
3.4	§2.1049 §24.238(b)	Occupied Bandwidth	N/A	PASS	-
3.5	§2.1051 §24.238(a)	Band Edge Measurement	$< 43 + 10 \log_{10}(P[\text{Watts}])$	PASS	-
3.6	§2.1051 §24.238(a)	Conducted Spurious Emission	$< 43 + 10 \log_{10}(P[\text{Watts}])$	PASS	-
3.7	§2.1053 §24.238(a)	Field Strength of Spurious Radiation	$< 43 + 10 \log_{10}(P[\text{Watts}])$	PASS	Under limit 36.25 dB at 7400.800 MHz
3.8	§2.1055 §24.235	Frequency Stability for Temperature & Voltage	< 2.5 ppm	PASS	-

# 1 General Description

## 1.1 Applicant

**Yulong Computer Telecommunication Scientific (Shenzhen) Co., Ltd.**

Coolpad Information Harbor, 2nd Mengxi Road, Northern Part of Science & Technology Park, Nanshan district, Shenzhen, P.R.China

## 1.2 Manufacturer

**Yulong Computer Telecommunication Scientific (Shenzhen) Co., Ltd.**

Coolpad Information Harbor, 2nd Mengxi Road, Northern Part of Science & Technology Park, Nanshan district, Shenzhen, P.R.China

## 1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	mobile phone
Brand Name	Vodafone
Model Name	Vodafone 990N
Marketing Name	Vodafone Smart 4 max
FCC ID	R38YL990N
EUT supports Radios application	GSM/GPRS/EGPRS/LTE/NFC WLAN 2.4GHz 802.11b/g/n HT20 Bluetooth v3.0+EDR Bluetooth v4.0 LE
HW Version	T3
SW Version	4.4.352.00.T3.140719.KTU84P.VF.DE
EUT Stage	Production Unit

**Remark:** The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

## 1.4 Product Specification subjective to this standard

Product Specification subjective to this standard	
Tx Frequency	GSM1900: 1850.2 MHz ~ 1909.8MHz
Rx Frequency	GSM1900: 1930.2 MHz ~ 1989.8 MHz
Maximum Output Power to Antenna	GSM1900 : 29.04 dBm
Antenna Type	PIFA Antenna
Type of Modulation	GSM: GMSK GPRS: GMSK EDGE: GMSK / 8PSK

## 1.5 Modification of EUT

No modifications are made to the EUT during all test items.

## 1.6 Maximum EIRP Power, Frequency Tolerance, and Emission Designator

FCC Rule	System	Type of Modulation	Maximum EIRP (W)	Frequency Tolerance (ppm)	Emission Designator
Part 24	GSM1900 GSM	GMSK	1.03	0.04 ppm	246KGXW
Part 24	GSM1900 EDGE class 8	8PSK	0.37	0.03 ppm	250KG7W

## 1.7 Testing Location

<b>Test Site</b>	SPORTON INTERNATIONAL (SHENZHEN) INC.		
<b>Test Site Location</b>	No. 3 Building, the third floor of south, Shahe River west, Fengzeyuan warehouse, Nanshan District, Shenzhen, Guangdong, P.R.C. TEL: +86-755- 3320-2398		
<b>Test Site No.</b>	<b>Sporton Site No.</b>		<b>FCC Registration No.</b>
	TH01-SZ	03CH01-SZ	831040

<b>Test Site</b>	SPORTON INTERNATIONAL (SHENZHEN) INC.		
<b>Test Site Location</b>	No. 101, Complex Building C, Guanlong Village, Xili Town, Nanshan District, Shenzhen, Guangdong, P.R.C. TEL:+86-755-8637-9589 FAX: +86-755-8637-9595		
<b>Test Site No.</b>	<b>Sporton Site No.</b>		
	OTA01-SZ		

## **1.8 Applicable Standards**

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ FCC 47 CFR Part 2, 24(E)
- ♦ ANSI / TIA / EIA-603-C-2004
- ♦ FCC KDB 971168 D01 Power Meas. License Digital Systems v02r01

### **Remark:**

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

## 2 Test Configuration of Equipment Under Test

### 2.1 Test Mode

Antenna port conducted and radiated test items were performed according to KDB 971168 D01 Power Meas. License Digital Systems v02r01 with maximum output power.

Radiated measurements were performed with rotating EUT in different three orthogonal test planes to find the maximum emission.

Frequency range investigated for radiated emission: 30MHz to 10th harmonic.

All modes and data rates and positions were investigated.

Test modes are chosen to be reported as the worst case configuration below:

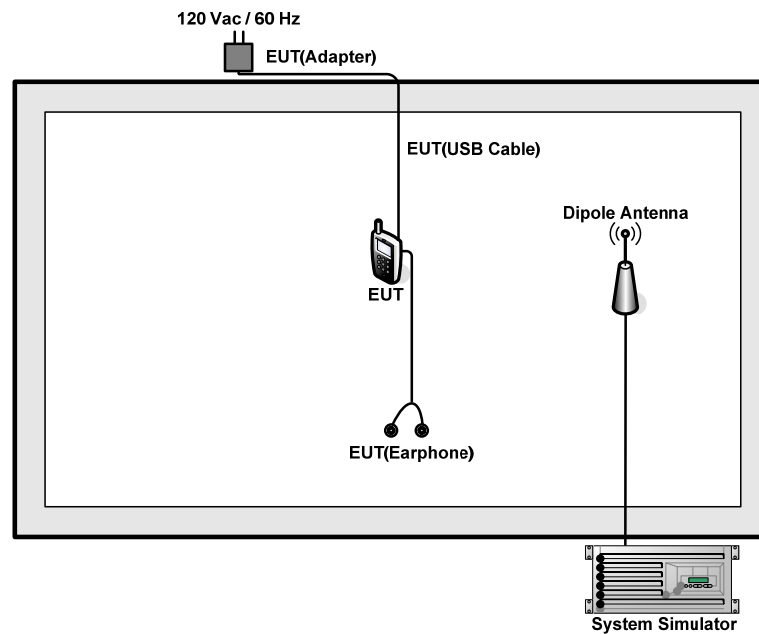
Test Modes		
Band	Radiated TCs	Conducted TCs
<b>GSM 1900</b>	<ul style="list-style-type: none"> <li>■ GSM Link</li> <li>■ EDGE class 8 Link</li> </ul>	<ul style="list-style-type: none"> <li>■ GSM Link</li> <li>■ EDGE class 8 Link</li> </ul>

#### Conducted Power Measurement Results:

Conducted Power (*Unit: dBm)			
Band	GSM1900		
Channel	512	661	810
Frequency	1850.2	1880.0	1909.8
<b>GSM</b>	<b>29.04</b>	28.82	28.71
<b>GPRS class 8</b>	29.02	28.80	28.69
<b>GPRS class 10</b>	25.80	25.64	25.63
<b>GPRS class 11</b>	25.75	25.59	25.58
<b>GPRS class 12</b>	22.68	22.65	22.47
<b>EGPRS class 8</b>	25.10	25.05	24.97
<b>EGPRS class 10</b>	21.21	21.08	21.05
<b>EGPRS class 11</b>	21.17	21.06	21.00
<b>EGPRS class 12</b>	18.51	18.44	18.35



## 2.2 Connection Diagram of Test System



## 2.3 Support Unit used in test configuration

Item	Equipment	Trade Name	Model No.	FCC ID	Data Cable	Power Cord
1.	System Simulator	R&S	CMU 200	N/A	N/A	Unshielded, 1.8 m
2.	DC Power Supply	TOPWORD	3303DR	N/A	N/A	N/A

## 2.4 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between RF conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level will be exactly the RF output level.

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

*Offset = RF cable loss + attenuator factor.*

The following shows an offset computation example with RF cable loss 7.5 dB and a 10dB attenuator.

Example :

$$\begin{aligned}\text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)} \\ &= 7.5 + 10 = 17.5 \text{ (dB)}\end{aligned}$$

### 3 Test Result

#### 3.1 Conducted Output Power Measurement

##### 3.1.1 Description of the Conducted Output Power Measurement

A system simulator was used to establish communication with the EUT. Its parameters were set to enforce EUT transmitting at the maximum power. The measured power in the radio frequency on the transmitter output terminals shall be reported.

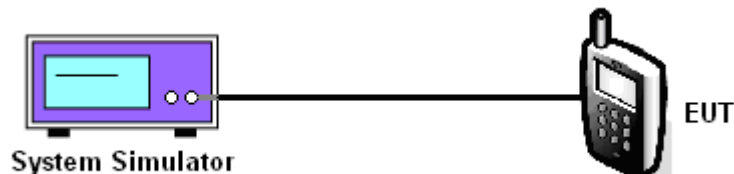
##### 3.1.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

##### 3.1.3 Test Procedures

1. The transmitter output port was connected to the system simulator.
2. Set EUT at maximum power through system simulator.
3. Select lowest, middle, and highest channels for each band and different modulation.
4. Measure the maximum burst average power for GSM and maximum average power for other modulation signal.

##### 3.1.4 Test Setup



### 3.1.5 Test Result of Conducted Output Power

PCS Band						
Modes	GSM1900 (GSM)			GSM1900 (EDGE class 8)		
Channel	512 (Low)	661 (Mid)	810 (High)	512 (Low)	661 (Mid)	810 (High)
Frequency (MHz)	1850.2	1880	1909.8	1850.2	1880	1909.8
Conducted Power (dBm)	29.04	28.82	28.71	25.10	25.05	24.97

**Note:** maximum burst average power for GSM.

## 3.2 Peak-to-Average Ratio

### 3.2.1 Description of the PAR Measurement

The peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

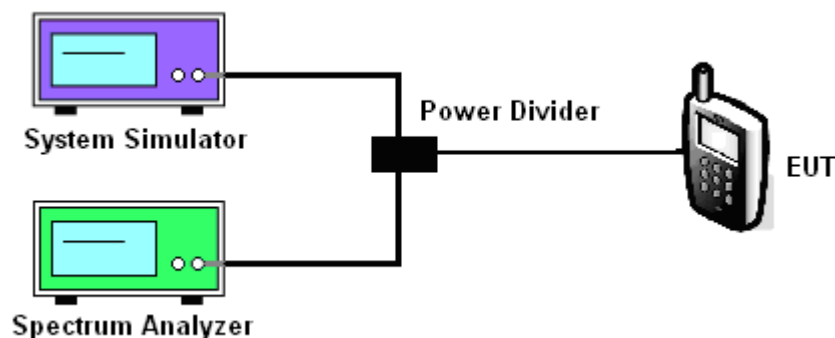
### 3.2.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

### 3.2.3 Test Procedures

1. The testing follows FCC KDB 971168 v02r01 Section 5.7.1.
2. The EUT was connected to the spectrum analyzer and system simulator via a power divider.
3. For GSM/EGPRS operating modes:
  - a. Set EUT in maximum power output.
  - b. Set the RBW = 1MHz, VBW = 3MHz, Peak detector on spectrum analyzer for first trace.
  - c. Set the RBW = 1MHz, VBW = 3MHz, RMS detector on spectrum analyzer for second trace.
  - d. The wanted burst signal is triggered by spectrum analyzer, and measured respectively the peak level and Mean level without burst-off time, after system simulator has synchronized with the spectrum analyzer.
4. Record the deviation as Peak to Average Ratio.

### 3.2.4 Test Setup



### 3.2.5 Test Result of Peak-to-Average Ratio

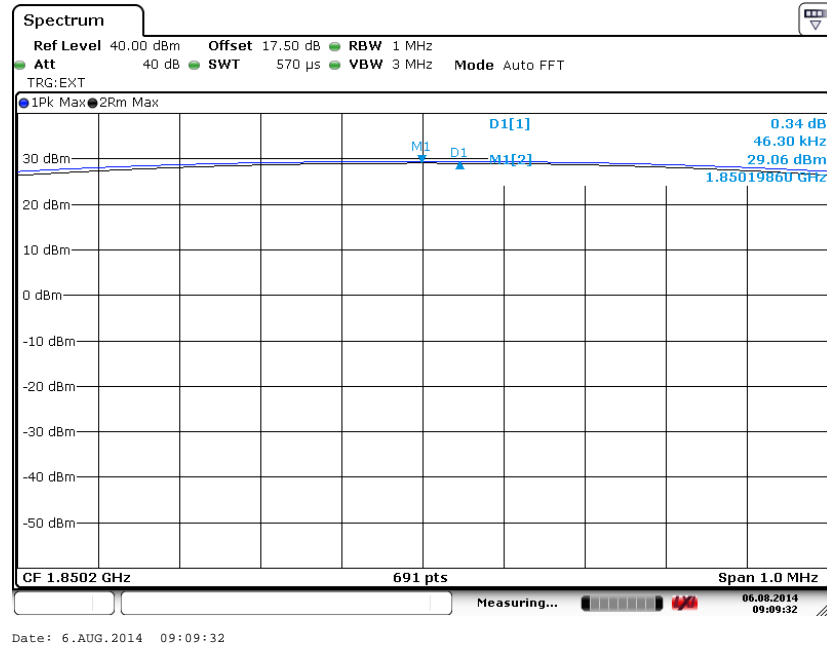
PCS Band						
Modes	GSM1900 (GSM)			GSM1900 (EDGE class 8)		
Channel	512 (Low)	661 (Mid)	810 (High)	512 (Low)	661 (Mid)	810 (High)
Frequency (MHz)	1850.2	1880	1909.8	1850.2	1880	1909.8
Peak-to-Average Ratio (dB)	0.34	0.34	0.33	3.14	3.12	3.13



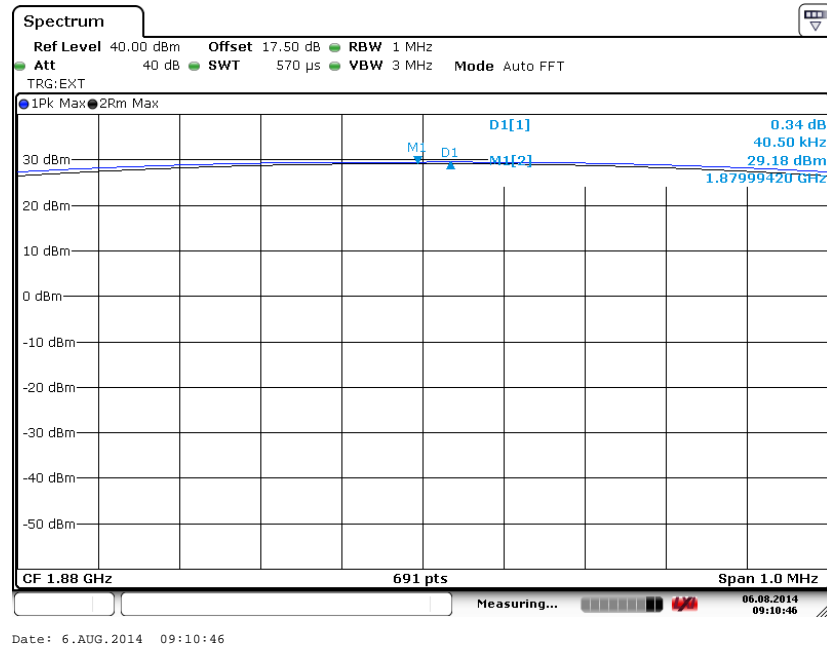
## 3.2.6 Test Result (Plots) of Peak-to-Average Ratio

Band :	GSM 1900	Test Mode :	GSM Link (GMSK)
--------	----------	-------------	-----------------

Peak-to-Average Ratio on Channel 512 (1850.2 MHz)

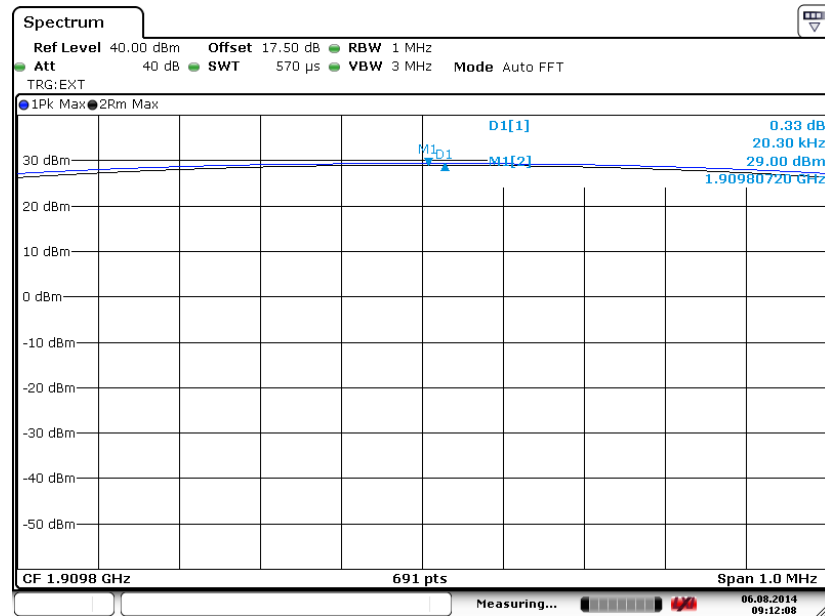


Peak-to-Average Ratio on Channel 661 (1880.0 MHz)





Peak-to-Average Ratio on Channel 810 (1909.8 MHz)



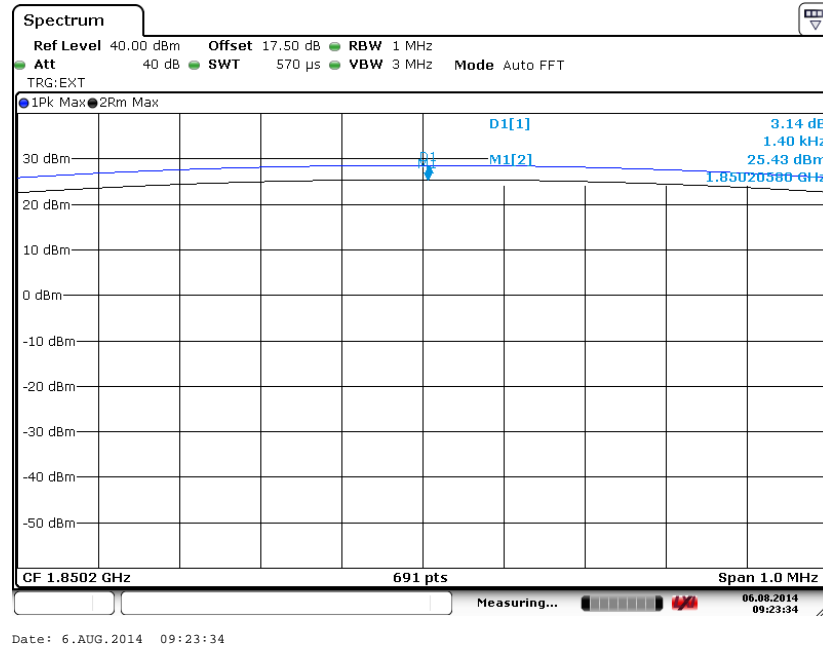
Date: 6.AUG.2014 09:12:08



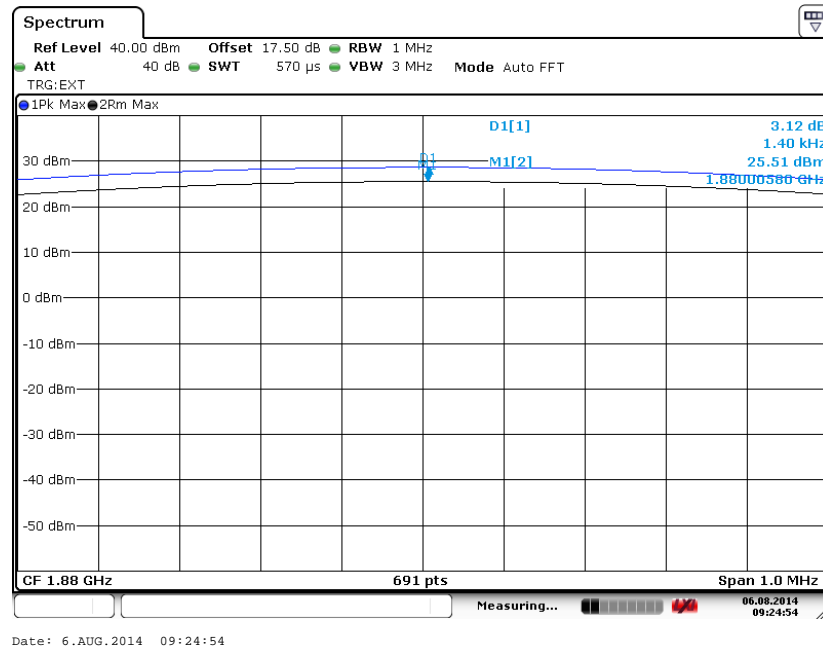


Band :	GSM 1900	Test Mode :	EDGE class 8 Link (8PSK)
--------	----------	-------------	--------------------------

Peak-to-Average Ratio on Channel 512 (1850.2 MHz)

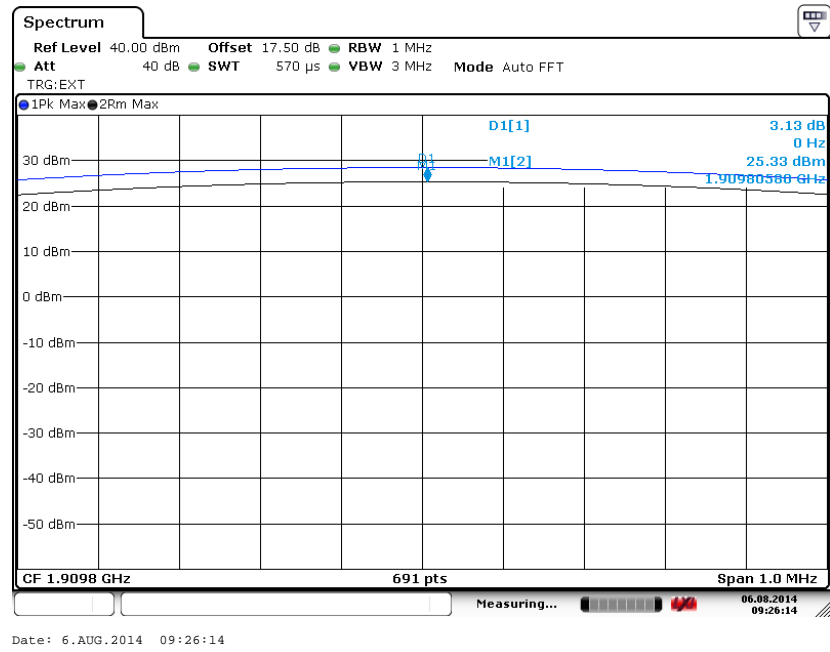


Peak-to-Average Ratio on Channel 661 (1880.0 MHz)





Peak-to-Average Ratio on Channel 810 (1909.8 MHz)



### **3.3 Effective Isotropic Radiated Power Measurement**

#### **3.3.1 Description of the EIRP Measurement**

The substitution method, in ANSI / TIA / EIA-603-C-2004, was used for EIRP measurement, and the spectrum analyzer configuration follows KDB 971168 D01 Power Meas. License Digital Systems v02r01. The EIRP of mobile transmitters are limited to 2 Watts.

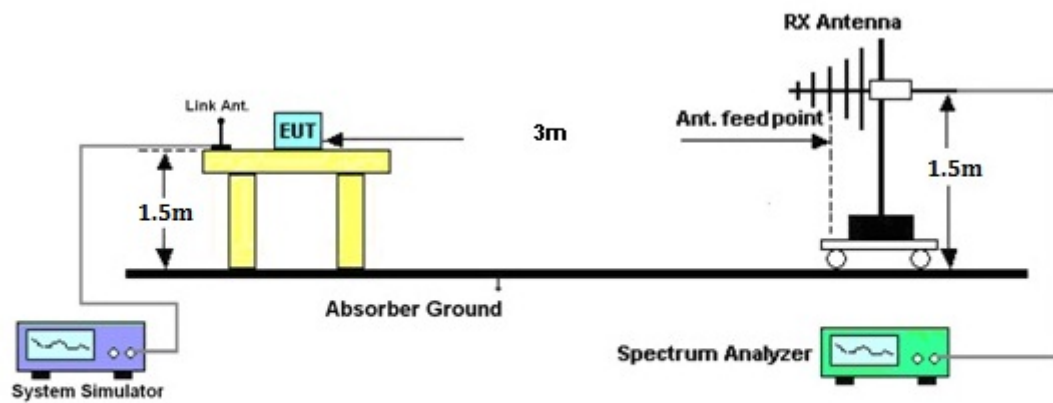
#### **3.3.2 Measuring Instruments**

The measuring equipment is listed in the section 4 of this test report.

#### **3.3.3 Test Procedures**

1. The testing follows FCC KDB 971168 v02r01 Section 5.2.1. (for CDMA/WCDMA), Section 5.2.2.2 (for GSM/GPRS/EDGE) and ANSI / TIA-603-C-2004 Section 2.2.17.
2. The EUT was placed on a turntable 1.5 meters high in a fully anechoic chamber.
3. The EUT was placed 3 meters from the receiving antenna, which was mounted on the antenna tower.
4. GSM operating modes: Set RBW= 1MHz, VBW= 3MHz, RMS detector over burst; and use channel power option with bandwidth=5MHz, per KDB 971168 D01.
5. The table was rotated 360 degrees to determine the position of the highest radiated power.
6. The height of the receiving antenna is adjusted to look for the maximum EIRP.
7. Taking the record of maximum EIRP.
8. A dipole antenna was substituted in place of the EUT and was driven by a signal generator.
9. The conducted power at the terminal of the dipole antenna is measured.
10. Repeat step 3 to step 5 to get the maximum EIRP of the substitution antenna.
11.  $EIRP = P_s + E_t - E_s + G_s = P_s + R_t - R_s + G_s$   
     $P_s$  (dBm) : Input power to substitution antenna.  
     $G_s$  (dBi or dBd) : Substitution antenna Gain.  
     $E_t = R_t + AF$   
     $E_s = R_s + AF$   
     $AF$  (dB/m) : Receive antenna factor  
     $R_t$  : The highest received signal in spectrum analyzer for EUT.  
     $R_s$  : The highest received signal in spectrum analyzer for substitution antenna.

### 3.3.4 Test Setup



### 3.3.5 Test Result of EIRP

<b>GSM1900 (GSM) Radiated Power EIRP</b>						
Horizontal Polarization						
Frequency (MHz)	Rt (dBm)	Rs (dBm)	Ps (dBm)	Gs (dBi)	EIRP (dBm)	EIRP (W)
1850.20	-24.37	-51.88	0.00	1.96	29.47	0.89
1880.00	-25.53	-52.99	0.00	2.00	29.46	0.88
1909.80	-26.45	-54.28	0.00	1.98	29.81	0.96
Vertical Polarization						
Frequency (MHz)	Rt (dBm)	Rs (dBm)	Ps (dBm)	Gs (dBi)	EIRP (dBm)	EIRP (W)
1850.20	-24.57	-52.13	0.00	1.96	29.52	0.90
1880.00	-25.54	-53.17	0.00	2.00	29.63	0.92
1909.80	-25.96	-54.13	0.00	1.98	30.15	1.03

<b>GSM1900 (EDGE class 8) Radiated Power EIRP</b>						
Horizontal Polarization						
Frequency (MHz)	Rt (dBm)	Rs (dBm)	Ps (dBm)	Gs (dBi)	EIRP (dBm)	EIRP (W)
1850.20	-29.23	-51.88	0.00	1.96	24.61	0.29
1880.00	-30.10	-52.99	0.00	2.00	24.89	0.31
1909.80	-30.87	-54.28	0.00	1.98	25.39	0.35
Vertical Polarization						
Frequency (MHz)	Rt (dBm)	Rs (dBm)	Ps (dBm)	Gs (dBi)	EIRP (dBm)	EIRP (W)
1850.20	-29.00	-52.13	0.00	1.96	25.09	0.32
1880.00	-29.97	-53.17	0.00	2.00	25.20	0.33
1909.80	-30.41	-54.13	0.00	1.98	25.70	0.37

### **3.4 99% Occupied Bandwidth and 26dB Bandwidth Measurement**

#### **3.4.1 Description of 99% Occupied Bandwidth and 26dB Bandwidth Measurement**

The 99% occupied bandwidth is the width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5% of the total mean transmitted power.

The emission bandwidth is defined as the width of the signal between two points, located at the 2 sides of the carrier frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

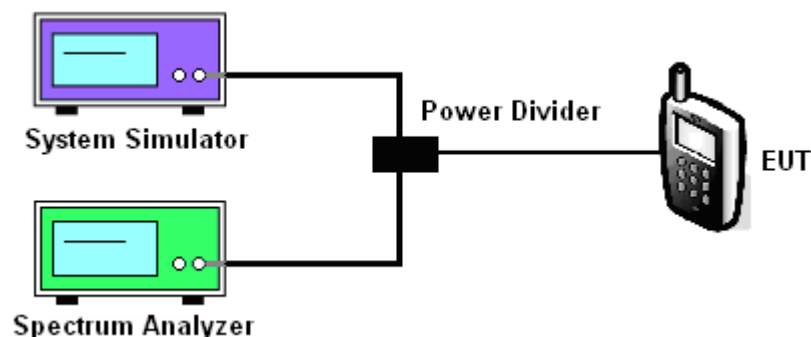
#### **3.4.2 Measuring Instruments**

The measuring equipment is listed in the section 4 of this test report.

#### **3.4.3 Test Procedures**

1. The testing follows FCC KDB 971168 v02r01 Section 4.2.
2. The EUT was connected to the spectrum analyzer and system simulator via a power divider.
3. The RF output of the EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
4. The 99% occupied bandwidth were measured, set RBW= 1% of span, VBW= 3\*RBW, sample detector, trace maximum hold.
5. The 26dB bandwidth were measured, set RBW= 1% of EBW, VBW= 3\*RBW, peak detector, trace maximum hold.

#### **3.4.4 Test Setup**



### 3.4.5 Test Result of Occupied Bandwidth and 26dB Bandwidth

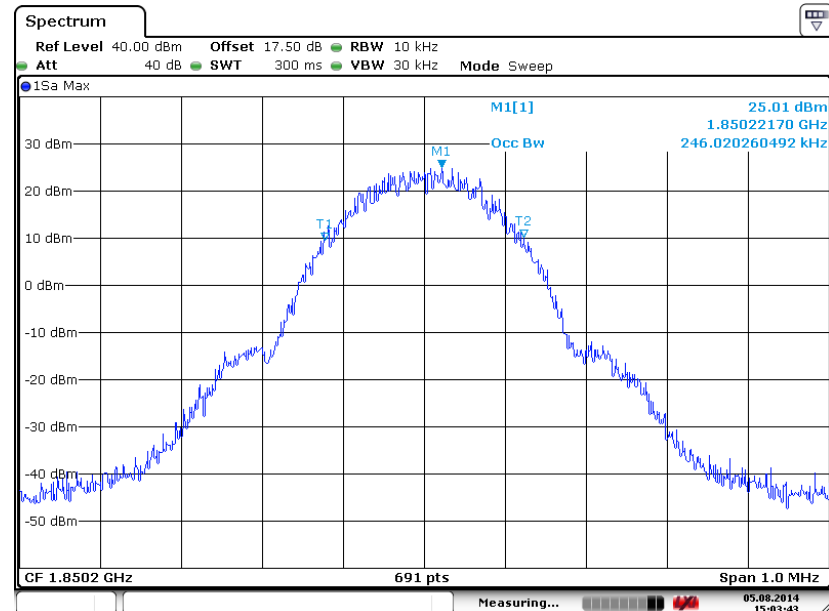
PCS Band						
Modes	GSM1900 (GSM)			GSM1900 (EDGE class 8)		
Channel	512 (Low)	661 (Mid)	810 (High)	512 (Low)	661 (Mid)	810 (High)
Frequency (MHz)	1850.2	1880	1909.8	1850.2	1880	1909.8
99% OBW (kHz)	246.02	244.57	246.02	246.02	250.36	246.02
26dB BW (kHz)	306.80	308.20	302.50	306.80	305.40	292.30



## 3.4.6 Test Result (Plots) of Occupied Bandwidth and 26dB Bandwidth

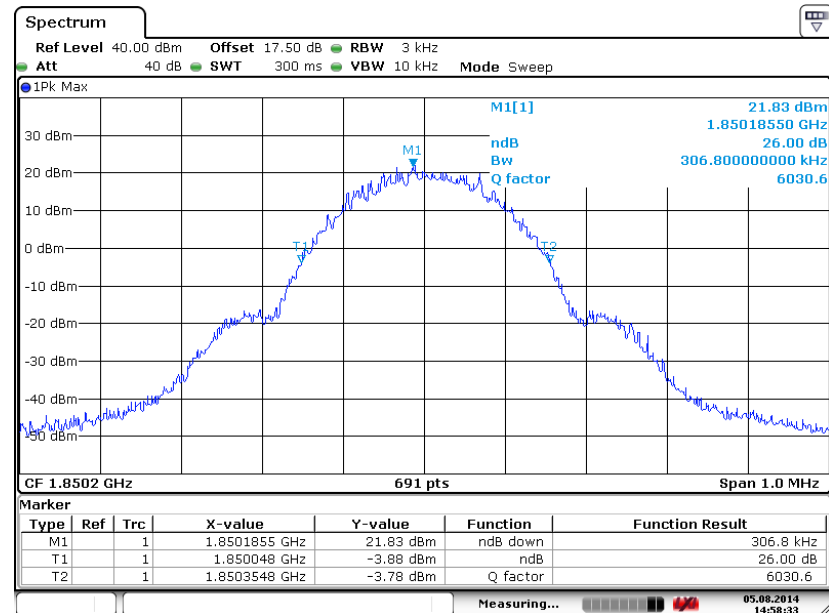
Band :	GSM 1900	Test Mode :	GSM Link (GMSK)
--------	----------	-------------	-----------------

## 99% Occupied Bandwidth Plot on Channel 512 (1850.2 MHz)



Date: 5.AUG.2014 15:03:43

## 26dB Bandwidth Plot on Channel 512 (1850.2 MHz)

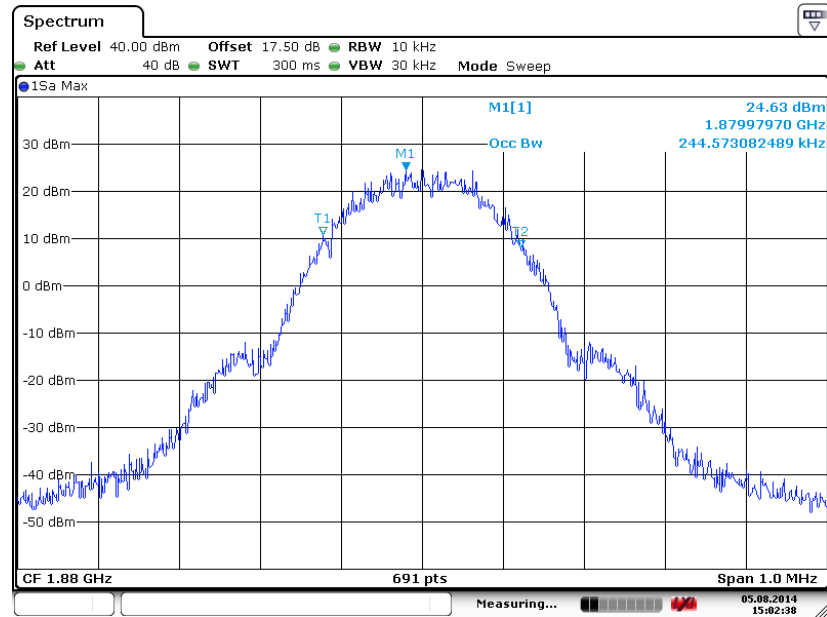


Date: 5.AUG.2014 14:58:32

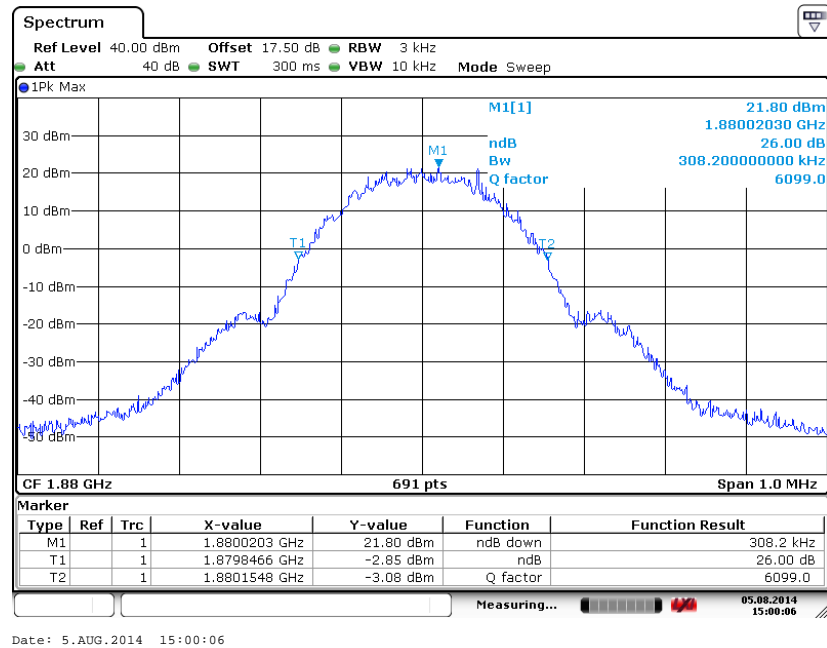




99% Occupied Bandwidth Plot on Channel 661 (1880.0 MHz)

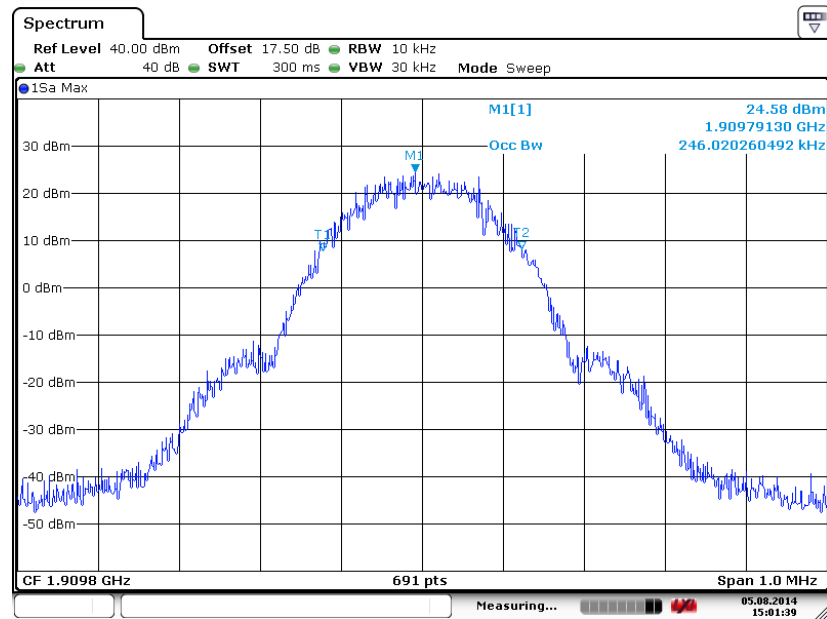


26dB Bandwidth Plot on Channel 661 (1880.0 MHz)



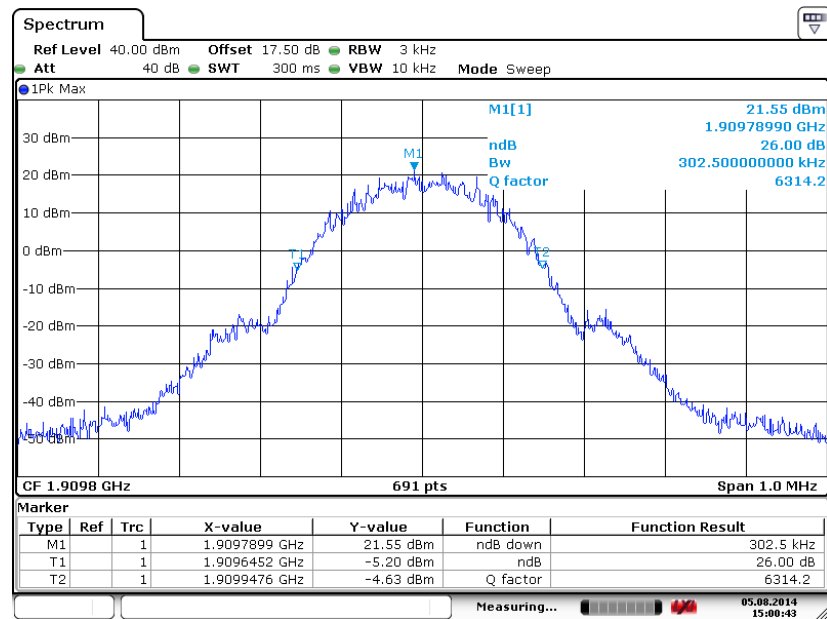


99% Occupied Bandwidth Plot on Channel 810 (1909.8 MHz)



Date: 5.AUG.2014 15:01:39

26dB Bandwidth Plot on Channel 810 (1909.8 MHz)

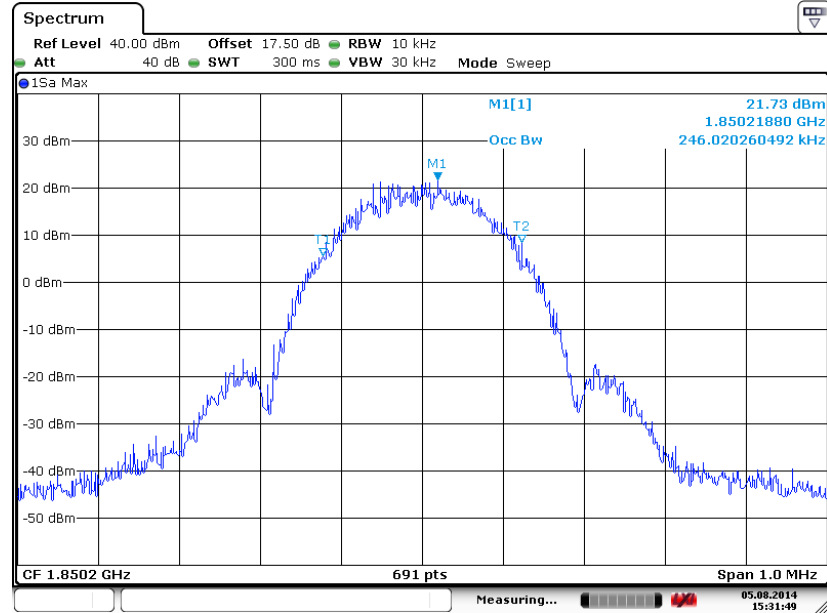


Date: 5.AUG.2014 15:00:43



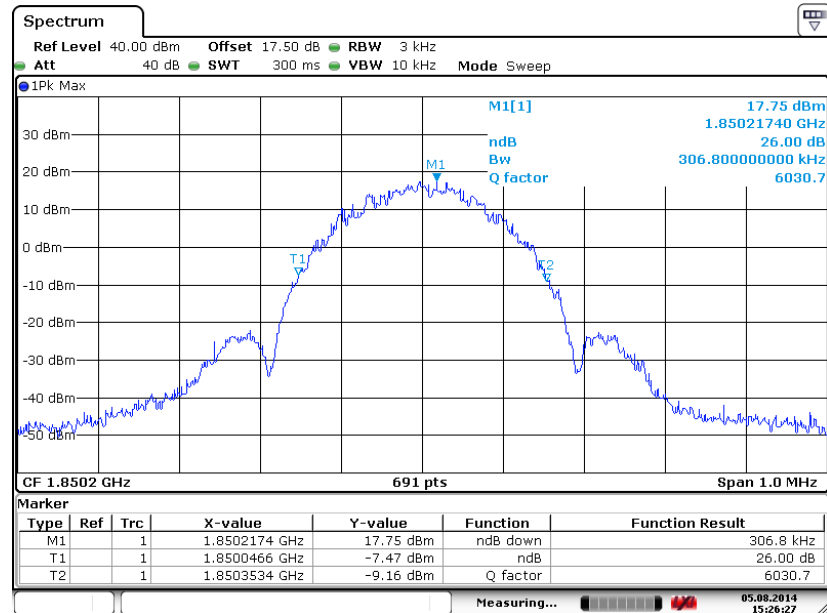
Band :	GSM 1900	Test Mode :	EDGE class 8 Link (8PSK)
--------	----------	-------------	--------------------------

99% Occupied Bandwidth Plot on Channel 512 (1850.2 MHz)



Date: 5.AUG.2014 15:31:49

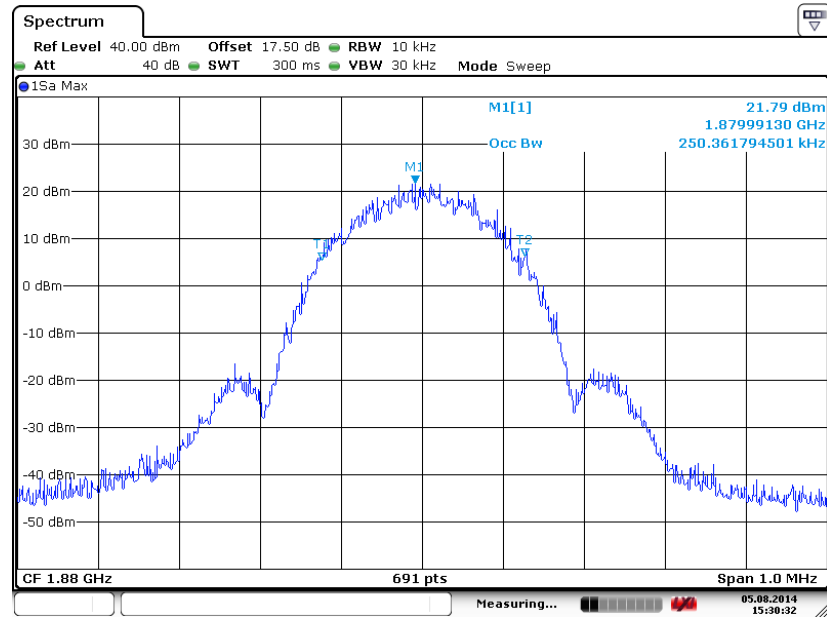
26dB Bandwidth Plot on Channel 512 (1850.2 MHz)



Date: 5.AUG.2014 15:26:27

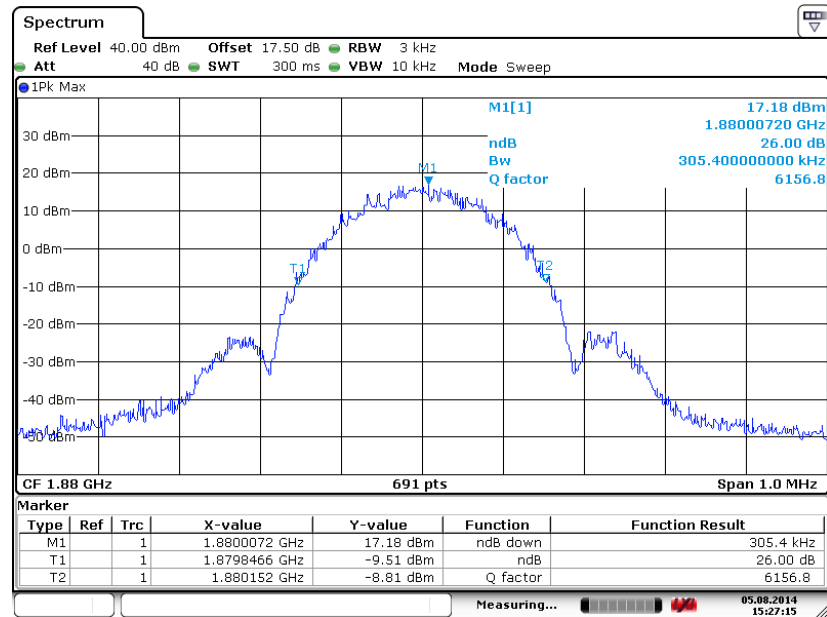


99% Occupied Bandwidth Plot on Channel 661 (1880.0 MHz)



Date: 5.AUG.2014 15:30:32

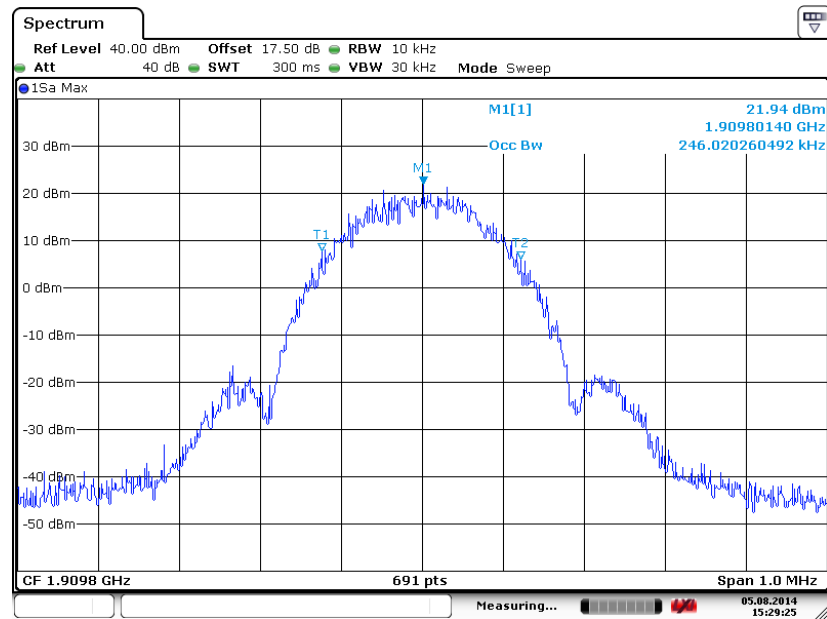
26dB Bandwidth Plot on Channel 661 (1880.0 MHz)



Date: 5.AUG.2014 15:27:15

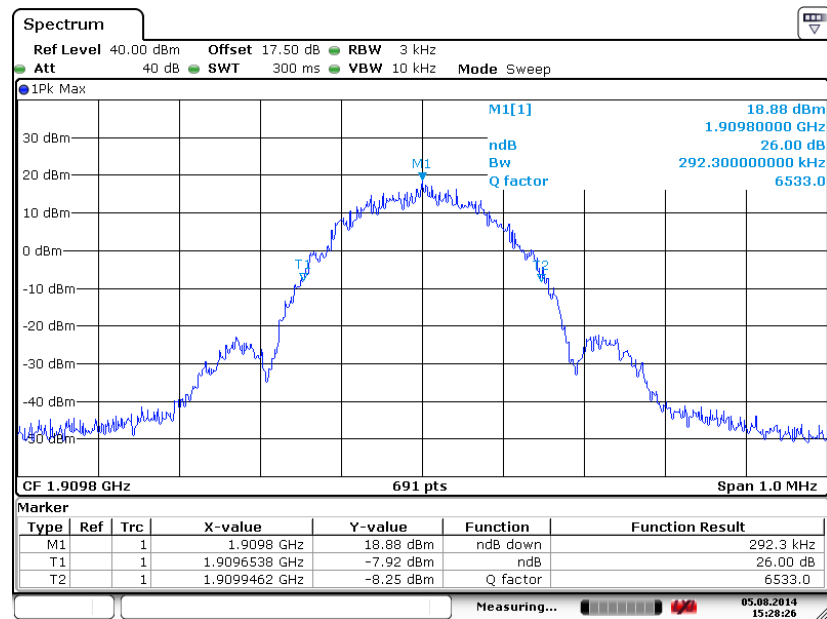


99% Occupied Bandwidth Plot on Channel 810 (1909.8 MHz)



Date: 5.AUG.2014 15:29:25

26dB Bandwidth Plot on Channel 810 (1909.8 MHz)



Date: 5.AUG.2014 15:28:26

## 3.5 Band Edge Measurement

### 3.5.1 Description of Band Edge Measurement

The power of any emission outside of the authorized operating frequency ranges must be lower than the transmitter power (P) by a factor of at least  $43 + 10 \log (P)$  dB.

### 3.5.2 Measuring Instruments

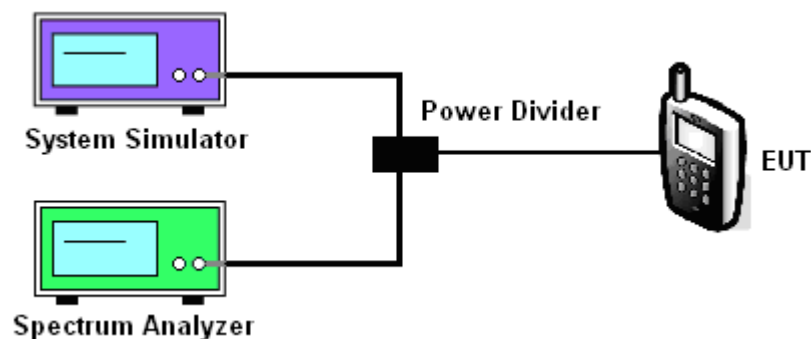
The measuring equipment is listed in the section 4 of this test report.

### 3.5.3 Test Procedures

1. The testing follows FCC KDB 971168 v02r01 Section 6.0.
2. The EUT was connected to the spectrum analyzer and system simulator via a power divider.
3. The RF output of EUT was connected to the spectrum analyzer by an RF cable and attenuator. The path loss was compensated to the results for each measurement.
4. The band edges of low and high channels for the highest RF powers were measured.
5. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
6. The limit line is derived from  $43 + 10\log(P)$  dB below the transmitter power P(Watts)  
 $= P(W) - [43 + 10\log(P)] \text{ (dB)}$   
 $= [30 + 10\log(P)] \text{ (dBm)} - [43 + 10\log(P)] \text{ (dB)}$   
 $= -13\text{dBm}.$

### 3.5.4 Test Setup

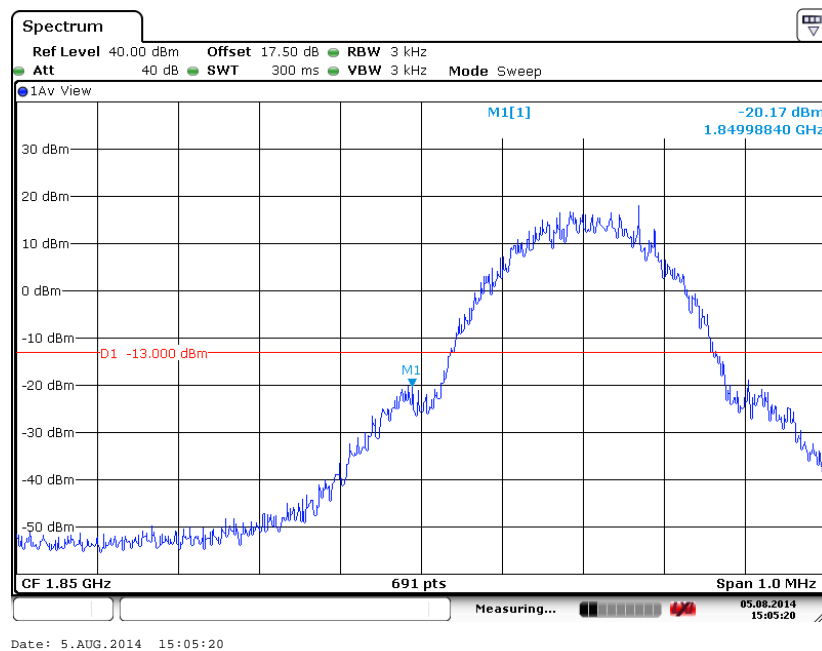
<Conducted Band Edge >



### 3.5.5 Test Result (Plots) of Conducted Band Edge

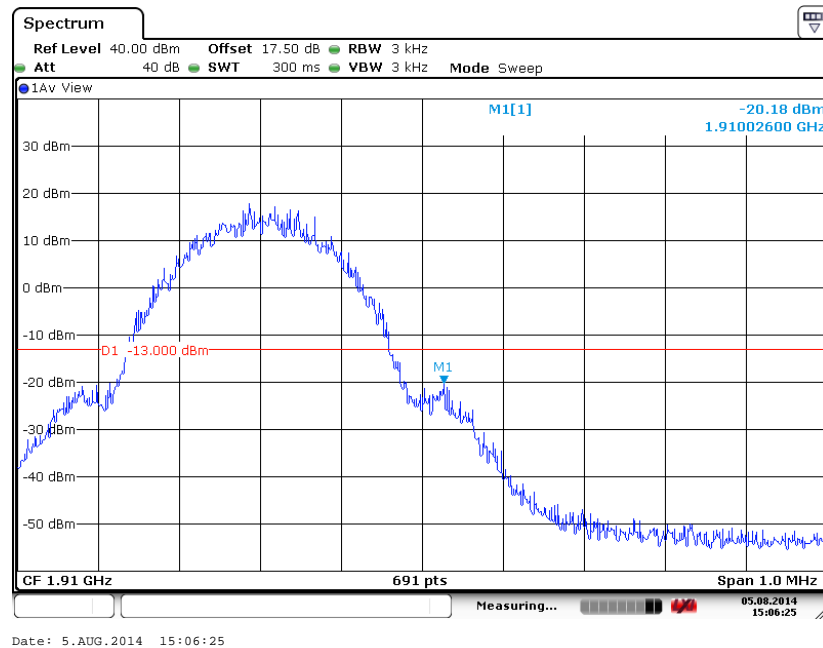
<b>Band :</b>	GSM1900	<b>Test Mode :</b>	GSM Link (GMSK)
<b>Correction Factor :</b>	0.12dB	<b>Maximum 26dB Bandwidth :</b>	0.308MHz
<b>Band Edge :</b>	-20.05dBm	<b>Measurement Value :</b>	-20.17dBm

**Lower Band Edge Plot on Channel 512 (1850.2 MHz)**



1. Correction Factor(dB)=  $10\log(1\% \text{ Emission BW/RBW})$
2. Band Edge= Measurement Value + Correction Factor(dB)

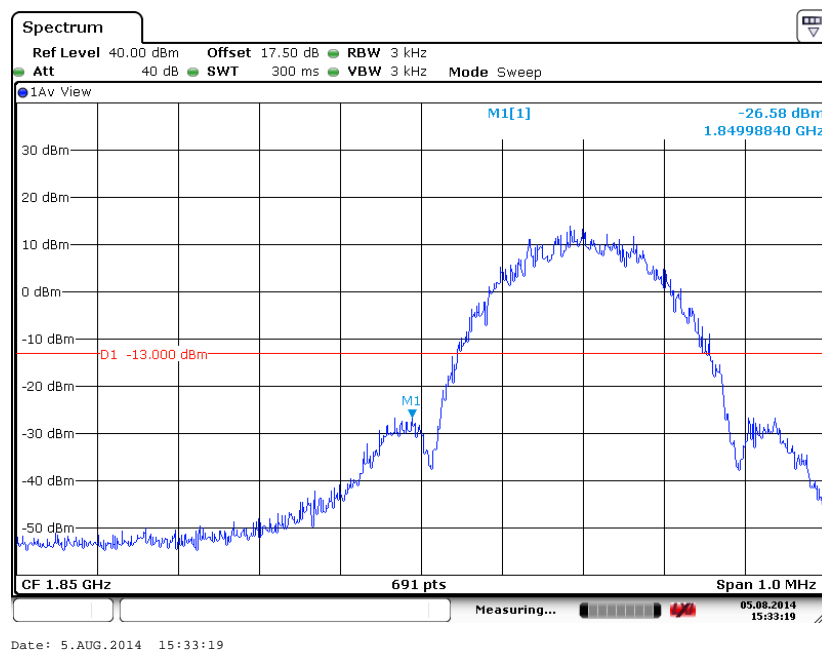
<b>Band :</b>	GSM1900	<b>Test Mode :</b>	GSM Link (GMSK)
<b>Correction Factor :</b>	0.12dB	<b>Maximum 26dB Bandwidth :</b>	0.308MHz
<b>Band Edge :</b>	-20.06dBm	<b>Measurement Value :</b>	-20.18dBm

**Higher Band Edge Plot on Channel 810 (1909.8 MHz)**


1. Correction Factor(dB)=  $10\log(1\% \text{ Emission BW/RBW})$
2. Band Edge= Measurement Value + Correction Factor(dB)

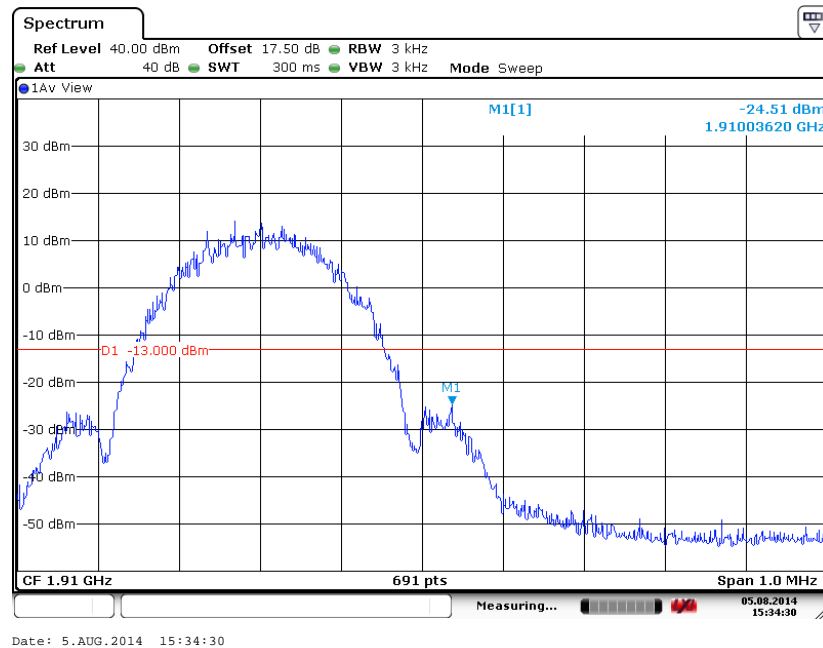


<b>Band :</b>	GSM1900	<b>Test Mode :</b>	EDGE class 8 Link (8PSK)
<b>Correction Factor :</b>	0.10dB	<b>Maximum 26dB Bandwidth :</b>	0.307MHz
<b>Band Edge :</b>	-26.48dBm	<b>Measurement Value :</b>	-26.58dBm

**Lower Band Edge Plot on Channel 512 (1850.2 MHz)**


1. Correction Factor(dB)=  $10\log(1\% \text{ Emission BW/RBW})$
2. Band Edge= Measurement Value + Correction Factor(dB)

<b>Band :</b>	GSM1900	<b>Test Mode :</b>	EDGE class 8 Link (8PSK)
<b>Correction Factor :</b>	0.10dB	<b>Maximum 26dB Bandwidth :</b>	0.307MHz
<b>Band Edge :</b>	-24.41dBm	<b>Measurement Value :</b>	-24.51dBm

**Higher Band Edge Plot on Channel 810 (1909.8 MHz)**


### 3.6 Conducted Spurious Emission Measurement

#### 3.6.1 Description of Conducted Spurious Emission Measurement

The power of any emission outside of the authorized operating frequency ranges must be lower than the transmitter power (P) by a factor of at least  $43 + 10 \log (P)$  dB.

It is measured by means of a calibrated spectrum analyzer and scanned from 30 MHz up to a frequency including its 10<sup>th</sup> harmonic.

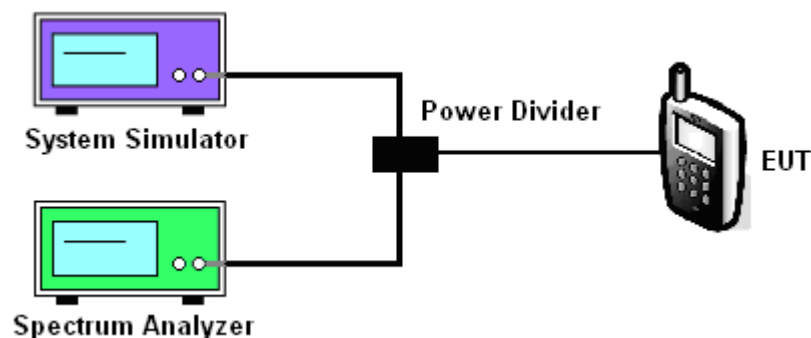
#### 3.6.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

#### 3.6.3 Test Procedures

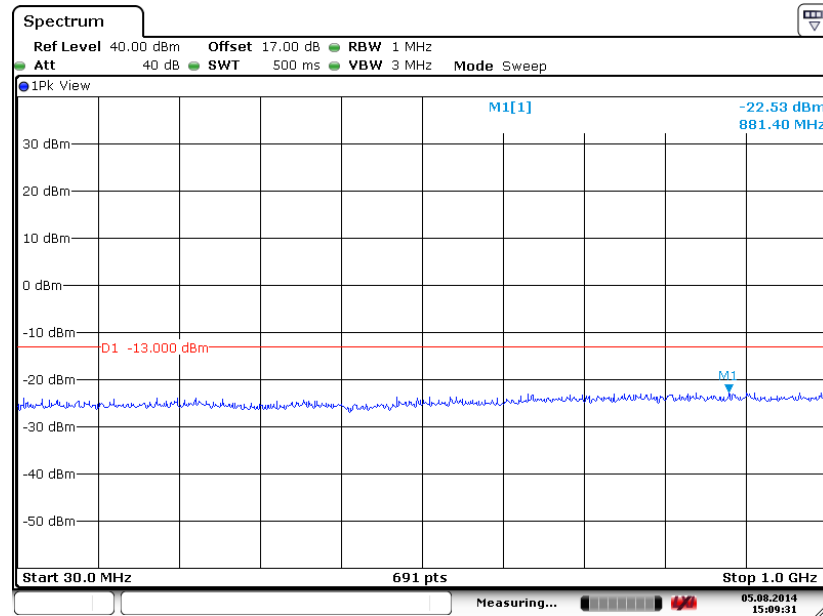
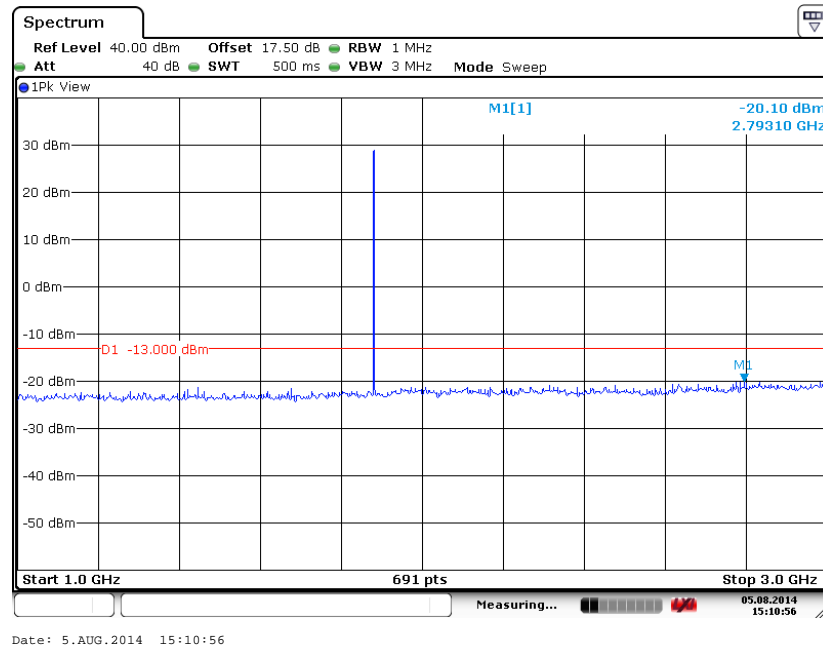
1. The testing follows FCC KDB 971168 v02r01 Section 6.0.
2. The EUT was connected to the spectrum analyzer and system simulator via a power divider.
3. The RF output of EUT was connected to the spectrum analyzer by an RF cable and attenuator. The path loss was compensated to the results for each measurement.
4. The middle channel for the highest RF power within the transmitting frequency was measured.
5. The conducted spurious emission for the whole frequency range was taken.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
7. The limit line is derived from  $43 + 10\log(P)$  dB below the transmitter power P(Watts)  
 $= P(W) - [43 + 10\log(P)] \text{ (dB)}$   
 $= [30 + 10\log(P)] \text{ (dBm)} - [43 + 10\log(P)] \text{ (dB)}$   
 $= -13\text{dBm}.$

#### 3.6.4 Test Setup



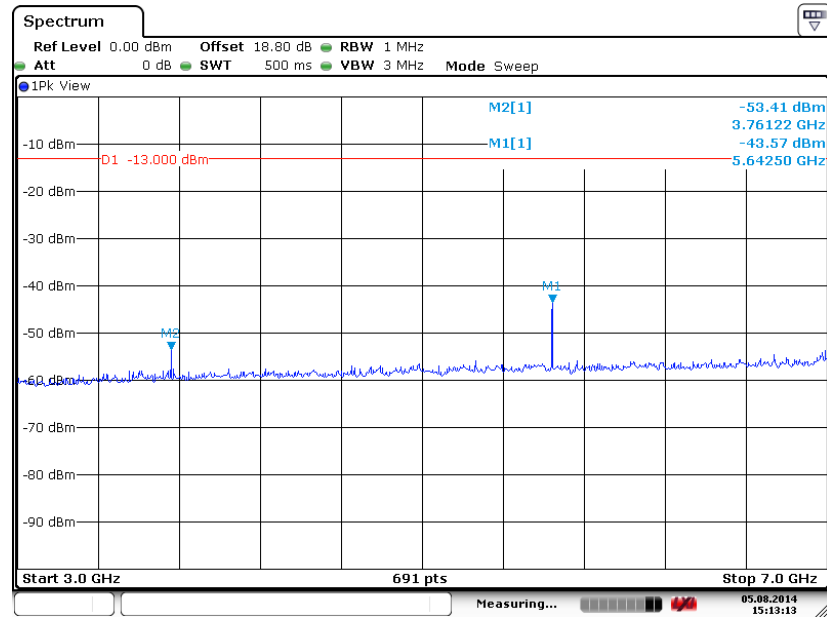
**3.6.5 Test Result (Plots) of Conducted Spurious Emission**

<b>Band :</b>	GSM1900	<b>Channel :</b>	CH661
<b>Test Mode :</b>	GSM Link (GMSK)	<b>Frequency :</b>	1880.0 MHz

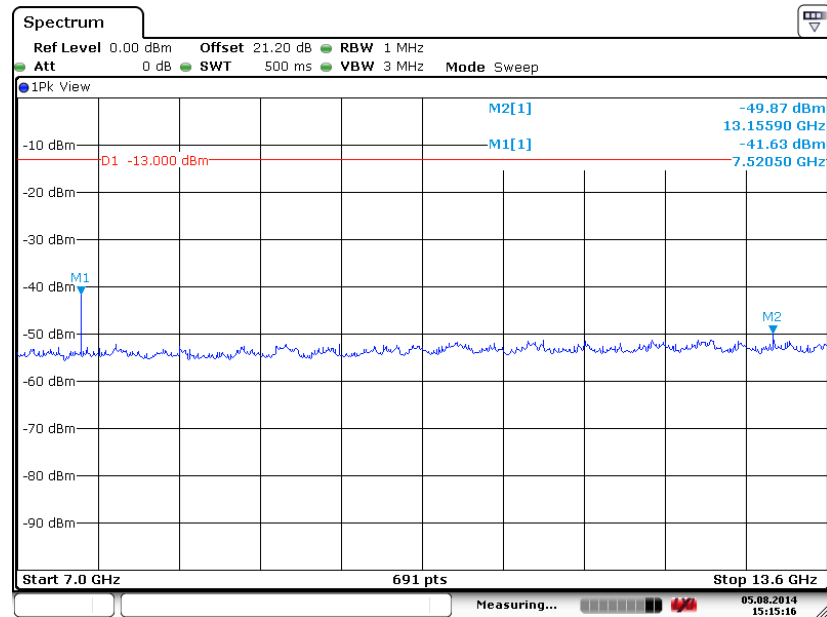
**Conducted Spurious Emission Plot between 30MHz ~ 1GHz****Conducted Spurious Emission Plot between 1GHz ~ 3GHz**



### Conducted Spurious Emission Plot between 3GHz ~ 7GHz

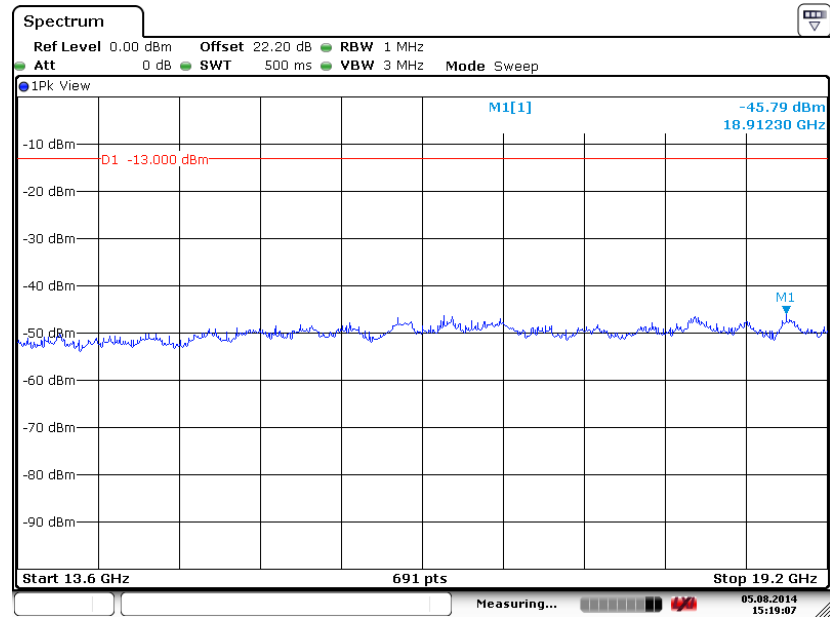


### Conducted Spurious Emission Plot between 7GHz ~ 13.6GHz





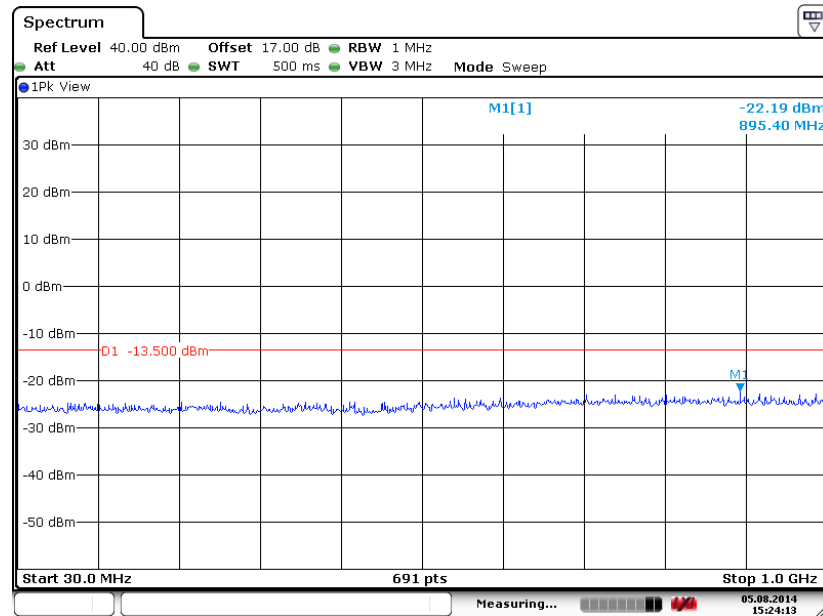
Conducted Spurious Emission Plot between 13.6GHz ~ 19.2GHz



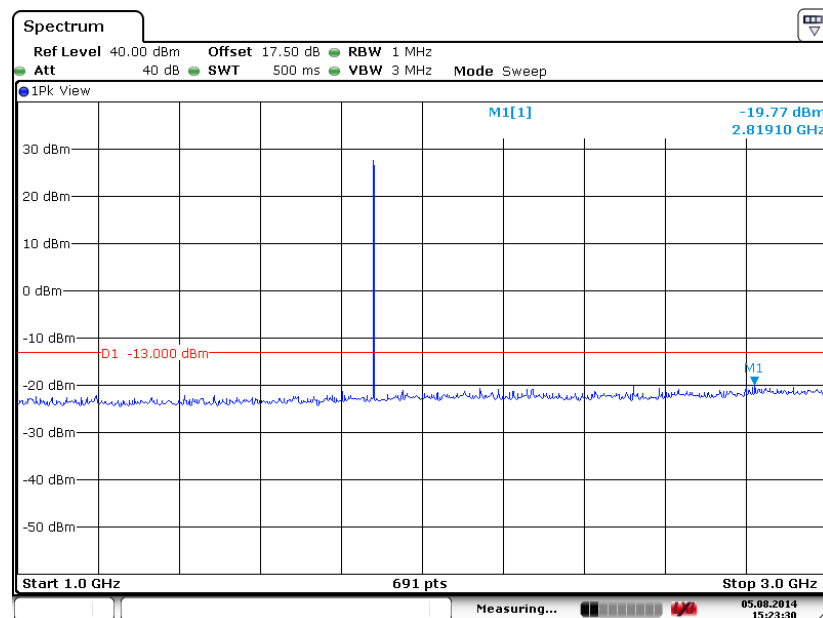
Date: 5.AUG.2014 15:19:07



<b>Band :</b>	GSM1900	<b>Channel :</b>	CH661
<b>Test Mode :</b>	EDGE class 8 Link (8PSK)	<b>Frequency :</b>	1880.0 MHz

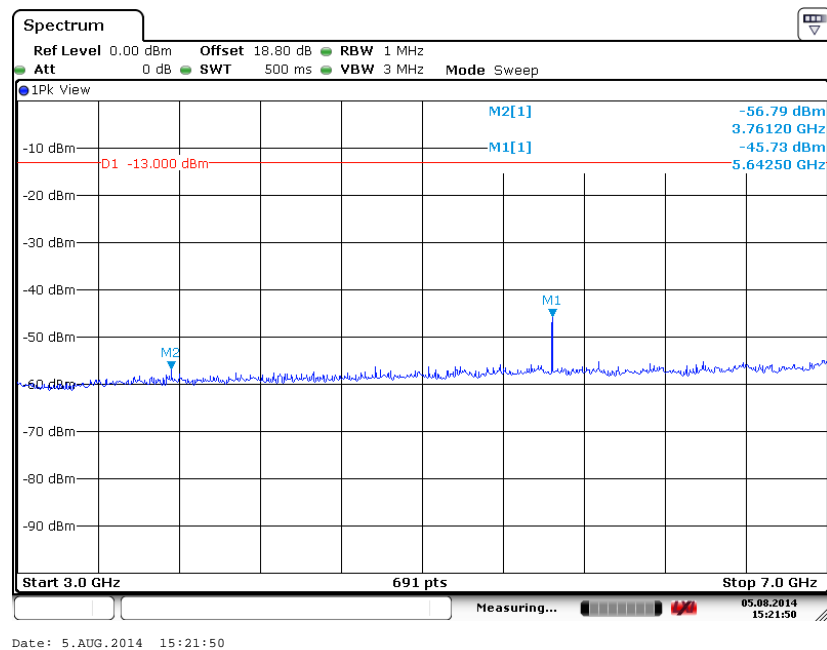
**Conducted Spurious Emission Plot between 30MHz ~ 1GHz**

Date: 5.AUG.2014 15:24:13

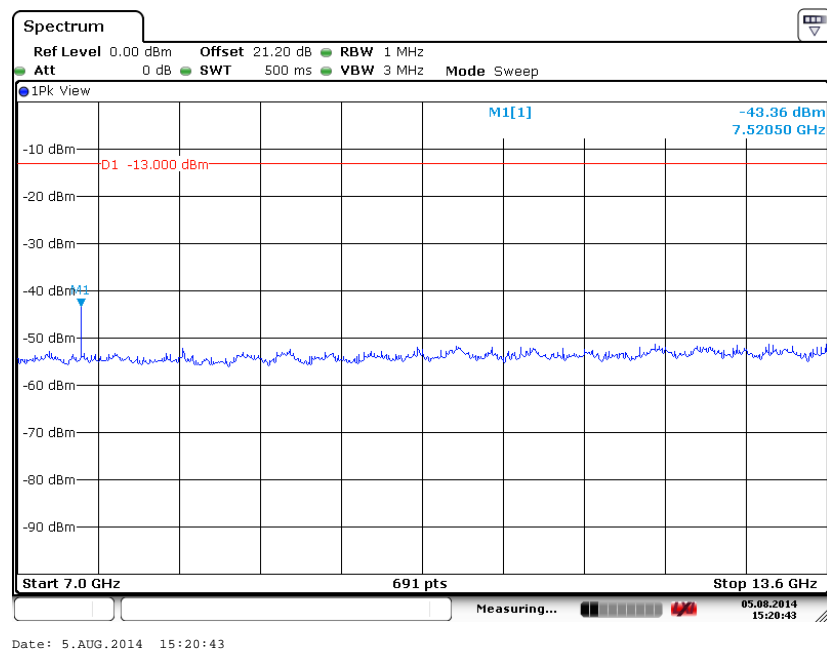
**Conducted Spurious Emission Plot between 1GHz ~ 3GHz**

Date: 5.AUG.2014 15:23:30

### Conducted Spurious Emission Plot between 3GHz ~ 7GHz

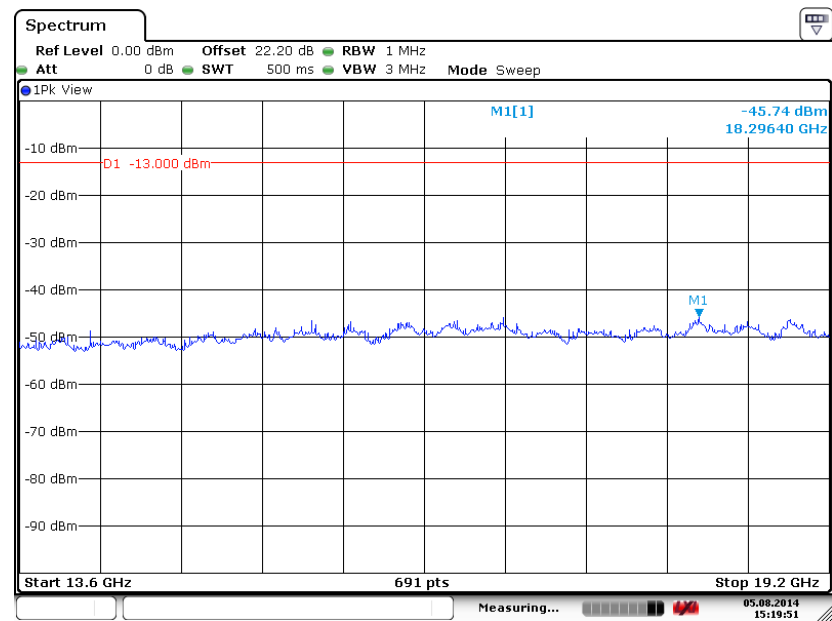


### Conducted Spurious Emission Plot between 7GHz ~ 13.6GHz





### Conducted Spurious Emission Plot between 13.6GHz ~ 19.2GHz



Date: 5.AUG.2014 15:19:51

### 3.7 Field Strength of Spurious Radiation Measurement

#### 3.7.1 Description of Field Strength of Spurious Radiated Measurement

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitter power (P) by a factor of at least  $43 + 10 \log (P)$  dB. The spectrum is scanned from 30 MHz up to a frequency including its 10th harmonic.

#### 3.7.2 Measuring Instruments

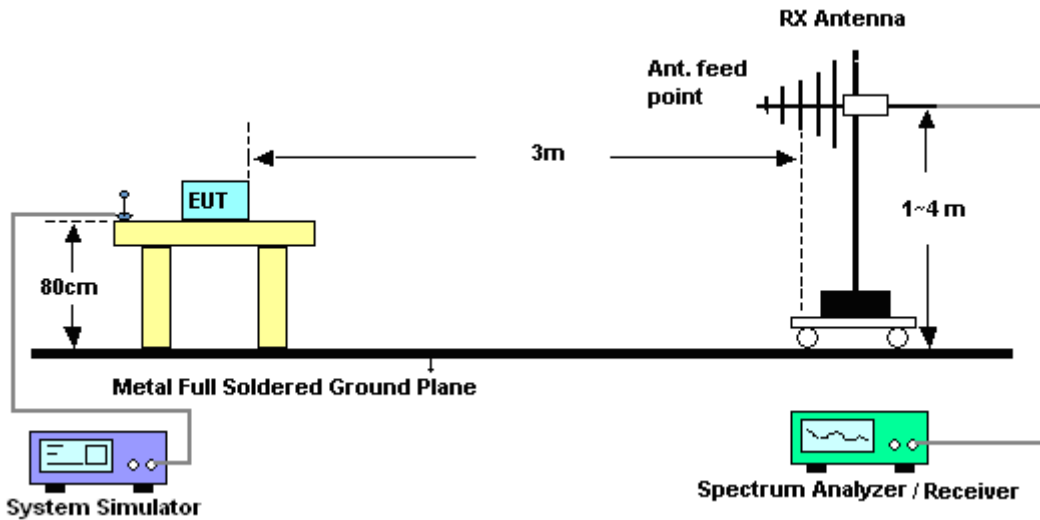
The measuring equipment is listed in the section 4 of this test report.

#### 3.7.3 Test Procedures

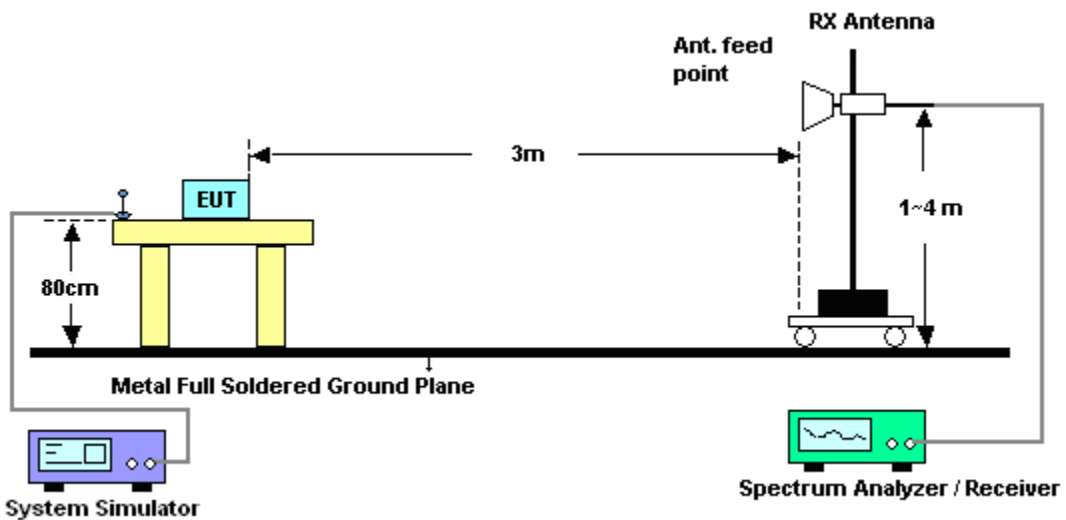
1. The testing follows FCC KDB 971168 v02r01 Section 5.8 and ANSI / TIA-603-C-2004 Section 2.2.12.
2. The EUT was placed on a rotatable wooden table 0.8 meters above the ground.
3. The EUT was set 3 meters from the receiving antenna, which was mounted on the antenna tower.
4. The table was rotated 360 degrees to determine the position of the highest spurious emission.
5. The height of the receiving antenna is varied between one meter and four meters to search for the maximum spurious emission for both horizontal and vertical polarizations.
6. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, taking record of maximum spurious emission.
7. A horn antenna was substituted in place of the EUT and was driven by a signal generator.
8. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission.
9. Taking the record of output power at antenna port.
10. Repeat step 7 to step 8 for another polarization.
11.  $EIRP \text{ (dBm)} = S.G. \text{ Power} - Tx \text{ Cable Loss} + Tx \text{ Antenna Gain}$
12. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
13. The limit line is derived from  $43 + 10\log(P)$  dB below the transmitter power P(Watts)  
 $= P(W) - [43 + 10\log(P)] \text{ (dB)}$   
 $= [30 + 10\log(P)] \text{ (dBm)} - [43 + 10\log(P)] \text{ (dB)}$   
 $= -13\text{dBm}.$

### 3.7.4 Test Setup

For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



**3.7.5 Test Result of Field Strength of Spurious Radiated**

Band :	GSM1900 for CH512					Temperature :	24~25°C		
Test Mode :	GSM Link (GMSK)					Relative Humidity :	48~49%		
Test Engineer :	Kare Huang					Polarization :	Horizontal		
Remark :	Spurious emissions within 30-1000MHz were found more than 20dB below limit line.								
Frequency	EIRP	Limit	Over	SPA	S.G.	TX Cable	TX Antenna	Polarization	Result
( MHz )	( dBm )	( dBm )	Limit ( dB )	Reading ( dBm )	Power ( dBm )	loss ( dB )	Gain ( dBi )	(H/V)	
3700.4	-54.18	-13	-41.18	-65.73	-60.93	1.2	7.95	H	Pass
5550.6	-53.76	-13	-40.76	-71.15	-61.86	1.5	9.60	H	Pass
7400.8	-49.25	-13	-36.25	-70.83	-59.44	1.7	11.89	H	Pass

Band :	GSM1900 for CH512					Temperature :	24~25°C		
Test Mode :	GSM Link (GMSK)					Relative Humidity :	48~49%		
Test Engineer :	Kare Huang					Polarization :	Vertical		
Remark :	Spurious emissions within 30-1000MHz were found more than 20dB below limit line.								
Frequency	EIRP	Limit	Over	SPA	S.G.	TX Cable	TX Antenna	Polarization	Result
( MHz )	( dBm )	( dBm )	Limit ( dB )	Reading ( dBm )	Power ( dBm )	loss ( dB )	Gain ( dBi )	(H/V)	
3700.4	-58.46	-13	-45.46	-72.89	-65.21	1.2	7.95	V	Pass
5550.6	-56.86	-13	-43.86	-73.34	-64.96	1.5	9.6	V	Pass
7400.8	-53.73	-13	-40.73	-75.62	-63.92	1.7	11.89	V	Pass



Band :	GSM1900 for CH661					Temperature :	24~25°C		
Test Mode :	GSM Link (GMSK)					Relative Humidity :	48~49%		
Test Engineer :	Kare Huang					Polarization :	Horizontal		
Remark :	Spurious emissions within 30-1000MHz were found more than 20dB below limit line.								
Frequency	EIRP	Limit	Over	SPA	S.G.	TX Cable	TX Antenna	Polarization	Result
( MHz )	( dBm )	( dBm )	Limit ( dB )	Reading (dBm)	Power ( dBm )	loss ( dB )	Gain (dBi)	(H/V)	
3760	-54.08	-13	-41.08	-66.23	-60.82	1.28	8.02	H	Pass
5640	-53.23	-13	-40.23	-71.22	-61.65	1.58	10.00	H	Pass
7520	-50.42	-13	-37.42	-72.36	-60.74	1.78	12.10	H	Pass

Band :	GSM1900 for CH661	Temperature :	24~25°C						
Test Mode :	GSM Link (GMSK)	Relative Humidity :	48~49%						
Test Engineer :	Kare Huang	Polarization :	Vertical						
Remark :	Spurious emissions within 30-1000MHz were found more than 20dB below limit line.								
Frequency	EIRP	Limit	Over	SPA	S.G.	TX Cable	TX Antenna	Polarization	Result
( MHz )	( dBm )	( dBm )	Limit ( dB )	Reading (dBm)	Power ( dBm )	loss ( dB )	Gain (dBi)	(H/V)	
3760	-58.51	-13	-45.51	-73.54	-65.25	1.28	8.02	V	Pass
5640	-54.59	-13	-41.59	-71.67	-63.01	1.58	10	V	Pass
7520	-52.88	-13	-39.88	-75.13	-63.20	1.78	12.1	V	Pass



Band :	GSM1900 for CH810					Temperature :	24~25°C		
Test Mode :	GSM Link (GMSK)					Relative Humidity :	48~49%		
Test Engineer :	Kare Huang					Polarization :	Horizontal		
Remark :	Spurious emissions within 30-1000MHz were found more than 20dB below limit line.								
Frequency	EIRP	Limit	Over	SPA	S.G.	TX Cable	TX Antenna	Polarization	Result
( MHz )	( dBm )	( dBm )	Limit ( dB )	Reading (dBm)	Power ( dBm )	loss ( dB )	Gain (dBi)	(H/V)	
3819.6	-54.99	-13	-41.99	-66.56	-61.76	1.23	8.00	H	Pass
5729.4	-52.96	-13	-39.96	-70.76	-61.09	1.52	9.65	H	Pass
7639.2	-51.24	-13	-38.24	-73.48	-61.42	1.82	12.00	H	Pass

Band :	GSM1900 for CH810	Temperature :	24~25°C						
Test Mode :	GSM Link (GMSK)	Relative Humidity :	48~49%						
Test Engineer :	Kare Huang	Polarization :	Vertical						
Remark :	Spurious emissions within 30-1000MHz were found more than 20dB below limit line.								
Frequency	EIRP	Limit	Over	SPA	S.G.	TX Cable	TX Antenna	Polarization	Result
( MHz )	( dBm )	( dBm )	Limit ( dB )	Reading (dBm)	Power ( dBm )	loss ( dB )	Gain (dBi)	(H/V)	
3819.6	-58.78	-13	-45.78	-73.23	-65.55	1.23	8	V	Pass
5729.4	-55.40	-13	-42.40	-72.29	-63.53	1.52	9.65	V	Pass
7639.2	-52.08	-13	-39.08	-74.63	-62.26	1.82	12	V	Pass



Band :	GSM1900 for CH512	Temperature :	24~25°C						
Test Mode :	EDGE class 8 Link (8PSK)	Relative Humidity :	48~49%						
Test Engineer :	Kare Huang	Polarization :	Horizontal						
Remark :	Spurious emissions within 30-1000MHz were found more than 20dB below limit line.								
Frequency	EIRP	Limit	Over	SPA	S.G.	TX Cable	TX Antenna	Polarization	Result
( MHz )	( dBm )	( dBm )	Limit ( dB )	Reading ( dBm )	Power ( dBm )	loss ( dB )	Gain ( dBi )	(H/V)	
3700.4	-56.42	-13	-43.42	-67.97	-63.17	1.2	7.95	H	Pass
5550.6	-55.67	-13	-42.67	-73.06	-63.77	1.5	9.60	H	Pass
7400.8	-52.90	-13	-39.90	-74.48	-63.09	1.7	11.89	H	Pass

Band :	GSM1900 for CH512	Temperature :	24~25°C						
Test Mode :	EDGE class 8 Link (8PSK)	Relative Humidity :	48~49%						
Test Engineer :	Kare Huang	Polarization :	Vertical						
Remark :	Spurious emissions within 30-1000MHz were found more than 20dB below limit line.								
Frequency	EIRP	Limit	Over	SPA	S.G.	TX Cable	TX Antenna	Polarization	Result
( MHz )	( dBm )	( dBm )	Limit	Reading	Power	loss	Gain	(H/V)	
( dB )	( dB )	( dB )	( dB )	( dBm )	( dBm )	( dB )	( dBi )		
3700.4	-58.45	-13	-45.45	-72.88	-65.20	1.2	7.95	V	Pass
5550.6	-57.61	-13	-44.61	-74.09	-65.71	1.5	9.6	V	Pass
7400.8	-53.06	-13	-40.06	-74.95	-63.25	1.7	11.89	V	Pass



Band :	GSM1900 for CH661	Temperature :	24~25°C						
Test Mode :	EDGE class 8 Link (8PSK)	Relative Humidity :	48~49%						
Test Engineer :	Kare Huang	Polarization :	Horizontal						
Remark :	Spurious emissions within 30-1000MHz were found more than 20dB below limit line.								
Frequency	EIRP	Limit	Over	SPA	S.G.	TX Cable	TX Antenna	Polarization	Result
( MHz )	( dBm )	( dBm )	Limit ( dB )	Reading ( dBm )	Power ( dBm )	loss ( dB )	Gain ( dBi )	(H/V)	
3760	-55.35	-13	-42.35	-67.50	-62.09	1.28	8.02	H	Pass
5640	-55.82	-13	-42.82	-73.81	-64.24	1.58	10.00	H	Pass
7520	-53.41	-13	-40.41	-75.35	-63.73	1.78	12.10	H	Pass

Band :	GSM1900 for CH661	Temperature :	24~25°C						
Test Mode :	EDGE class 8 Link (8PSK)	Relative Humidity :	48~49%						
Test Engineer :	Kare Huang	Polarization :	Vertical						
Remark :	Spurious emissions within 30-1000MHz were found more than 20dB below limit line.								
Frequency	EIRP	Limit	Over	SPA	S.G.	TX Cable	TX Antenna	Polarization	Result
( MHz )	( dBm )	( dBm )	Limit ( dB )	Reading ( dBm )	Power ( dBm )	loss ( dB )	Gain ( dBi )	(H/V)	
3760	-58.49	-13	-45.49	-73.52	-65.23	1.28	8.02	V	Pass
5640	-56.31	-13	-43.31	-73.39	-64.73	1.58	10	V	Pass
7520	-52.79	-13	-39.79	-75.04	-63.11	1.78	12.1	V	Pass





Band :	GSM1900 for CH810	Temperature :	24~25°C						
Test Mode :	EDGE class 8 Link (8PSK)	Relative Humidity :	48~49%						
Test Engineer :	Kare Huang	Polarization :	Horizontal						
Remark :	Spurious emissions within 30-1000MHz were found more than 20dB below limit line.								
Frequency	EIRP	Limit	Over	SPA	S.G.	TX Cable	TX Antenna	Polarization	Result
( MHz )	( dBm )	( dBm )	Limit	Reading	Power	loss	Gain	(H/V)	
( dB )	( dB )	( dB )	( dB )	( dBm )	( dBm )	( dB )	( dBi )		
3819.6	-59.34	-13	-46.34	-70.91	-66.11	1.23	8.00	H	Pass
5729.4	-54.52	-13	-41.52	-72.32	-62.65	1.52	9.65	H	Pass
7639.2	-53.17	-13	-40.17	-75.41	-63.35	1.82	12.00	H	Pass

Band :	GSM1900 for CH810	Temperature :	24~25°C						
Test Mode :	EDGE class 8 Link (8PSK)	Relative Humidity :	48~49%						
Test Engineer :	Kare Huang	Polarization :	Vertical						
Remark :	Spurious emissions within 30-1000MHz were found more than 20dB below limit line.								
Frequency	EIRP	Limit	Over	SPA	S.G.	TX Cable	TX Antenna	Polarization	Result
( MHz )	( dBm )	( dBm )	Limit	Reading	Power	loss	Gain	(H/V)	
			( dB )	(dBm)	( dBm )	( dB )	(dBi)		
3819.6	-58.79	-13	-45.79	-73.24	-65.56	1.23	8	V	Pass
5729.4	-55.91	-13	-42.91	-72.80	-64.04	1.52	9.65	V	Pass
7639.2	-52.88	-13	-39.88	-75.43	-63.06	1.82	12	V	Pass

### **3.8 Frequency Stability Measurement**

#### **3.8.1 Description of Frequency Stability Measurement**

The frequency stability shall be measured by variation of ambient temperature and variation of primary supply voltage to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within  $\pm 0.00025\%$  ( $\pm 2.5\text{ppm}$ ) of the center frequency.

#### **3.8.2 Measuring Instruments**

The measuring equipment is listed in the section 4 of this test report.

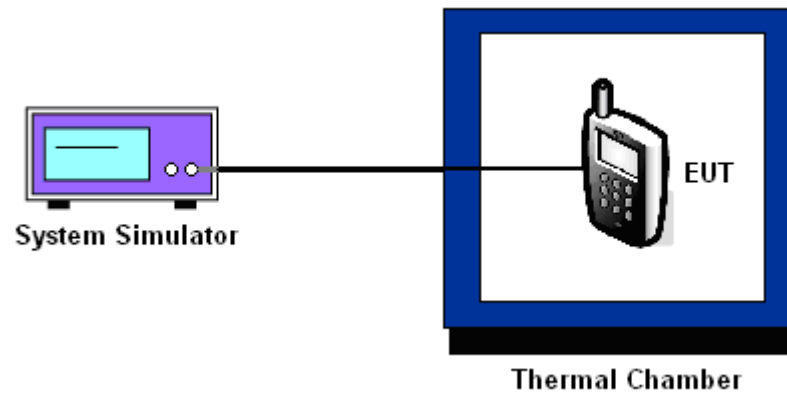
#### **3.8.3 Test Procedures for Temperature Variation**

1. The testing follows FCC KDB 971168 v02r01 Section 9.0.
2. The EUT was set up in the thermal chamber and connected with the system simulator.
3. With power OFF, the temperature was decreased to  $-30^{\circ}\text{C}$  and the EUT was stabilized before testing. Power was applied and the maximum change in frequency was recorded within one minute.
4. With power OFF, the temperature was raised in  $10^{\circ}\text{C}$  steps up to  $50^{\circ}\text{C}$ . The EUT was stabilized at each step for at least half an hour. Power was applied and the maximum frequency change was recorded within one minute.

#### **3.8.4 Test Procedures for Voltage Variation**

1. The testing follows FCC KDB 971168 v02r01 Section 9.0.
2. The EUT was placed in a temperature chamber at  $25\pm 5^{\circ}\text{C}$  and connected with the system simulator.
3. The power supply voltage to the EUT was varied from BEP to 115% of the nominal value measured at the input to the EUT.
4. The variation in frequency was measured for the worst case.

### 3.8.5 Test Setup



### 3.8.6 Test Result of Temperature Variation

<b>Band :</b>	GSM 1900	<b>Channel :</b>	661
<b>Limit (ppm) :</b>	within authorized band	<b>Frequency :</b>	1880.0 MHz

Temperature (°C)	GSM		EDGE class 8		Result
	Freq. Dev. (Hz)	Deviation (ppm)	Freq. Dev. (Hz)	Deviation (ppm)	
-30	64	+0.03	63	+0.03	PASS
-20	62	+0.03	61	+0.03	
-10	65	+0.03	58	+0.03	
0	63	+0.03	51	+0.03	
10	62	+0.03	53	+0.03	
20(Ref.)	60	+0.03	61	+0.03	
30	65	+0.03	56	+0.03	
40	62	+0.03	63	+0.03	
50	68	+0.04	66	+0.03	

Note: The frequency fundamental emissions stay within the authorized frequency block based on the frequency deviation measured is small.

**3.8.7 Test Result of Voltage Variation**

Band & Channel	Mode	Voltage (Volt)	Freq. Dev. (Hz)	Deviation (ppm)	Limit (ppm)	Result
GSM 1900 CH661	GSM	3.8	60	+0.03	2.5 (Note 3.)	Pass
		BEP	63	+0.03		
		4.35	61	+0.03		
	EDGE class 8	3.8	59	+0.03		
		BEP	61	+0.03		
		4.35	60	+0.03		

**Note:**

1. Normal Voltage = 3.8V.
2. Battery End Point (BEP) = 3.60 V.
3. The frequency fundamental emissions stay within the authorized frequency block based on the frequency deviation measured is small.



## 4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Spectrum Analyzer	R&S	FSV40	101078	10Hz~40GHz	May 08, 2014	Aug. 05, 2014~ Aug. 06, 2014	May 07, 2015	Conducted (TH01-SZ)
Thermal Chamber	Hongzhangroup	LP-150U	HD20120425	-40℃~150℃	Feb. 21, 2014	Aug. 05, 2014~ Aug. 06, 2014	Feb. 20, 2015	Conducted (TH01-SZ)
ESCIO TEST Receiver	R&S	ESCI	100724	9kHz~3GHz	Feb. 21, 2014	Aug. 11, 2014	Feb. 20, 2015	Radiation (03CH01-SZ)
Spectrum Analyzer	Agilent Technologies	N9038A	MY52260185	20Hz~26.5GHz	May 26, 2014	Aug. 11, 2014	May 25, 2015	Radiation (03CH01-SZ)
Bilog Antenna	TESEQ	CBL 6112D	23188	30MHz~2GHz	Oct. 26, 2013	Aug. 11, 2014	Oct. 25, 2014	Radiation (03CH01-SZ)
Double Ridge Horn Antenna	ETS Lindgren	3117	00119436	1GHz~18GHz	Oct. 26, 2013	Aug. 11, 2014	Oct. 25, 2014	Radiation (03CH01-SZ)
Double Ridged Horn Antenna	COM-POWER	AH-840	101073	18GHz~40GHz	Jan. 27, 2014	Aug. 11, 2014	Jan. 26, 2015	Radiation (03CH01-SZ)
Amplifier	ADVANTEST	BB525C	E9007003	9kHz~3000MHz	Feb. 21, 2014	Aug. 11, 2014	Feb. 20, 2015	Radiation (03CH01-SZ)
Amplifier	Yiai	AV3860B	04030	2GHz~26.5GHz	May 08, 2014	Aug. 11, 2014	May 07, 2015	Radiation (03CH01-SZ)
AC Source(AVR)	Chroma	61601	616010001985	100Vac~250Vac	Mar. 25, 2014	Aug. 11, 2014	Mar. 24, 2015	Radiation (03CH01-SZ)
Turn Table	EM Electronics	EM 1000	N/A	0~360 degree	NCR	Aug. 11, 2014	NCR	Radiation (03CH01-SZ)
Antenna Mast	EM Electronics	EM 1000	N/A	1 m~4 m	NCR	Aug. 11, 2014	NCR	Radiation (03CH01-SZ)
Spectrum Analyzer	R&S	FSP 7	100818	9kHz~7GHz	Sep. 03, 2013	Aug. 06, 2014	Sep. 02, 2014	EIRP (OTA01-SZ)
Quad-Ridged Horn	ETS-Lindgren	3164-08	00102954	700MHz~10000MHz	N/A	Aug. 06, 2014	N/A	EIRP (OTA01-SZ)
Multi-Devices Controller	ETS-Lindgren	2090-OPT1	00108147	N/A	N/A	Aug. 06, 2014	N/A	EIRP (OTA01-SZ)
Switch Control Mainframe	Agilent	3499A	MY42005451	N/A	N/A	Aug. 06, 2014	N/A	EIRP (OTA01-SZ)



## **5      Uncertainty of Evaluation**

### **Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)**

<b>Measuring Uncertainty for a Level of Confidence of 95% (<math>U = 2Uc(y)</math>)</b>	<b>3.9</b>
---	------------