

# FCC RF Test Report

APPLICANT : Brightstar Corporation  
EQUIPMENT : mobile phone  
BRAND NAME : Avvio  
MODEL NAME : Avvio 510 / Avvio 520  
FCC ID : WVBA510X  
STANDARD : FCC 47 CFR Part 2, 22(H), 24(E)  
CLASSIFICATION : PCS Licensed Transmitter Held to Ear (PCE)

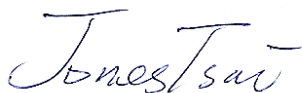
The product was received on Jan. 07, 2014 and testing was completed on Jan. 13, 2014. We, SPORTON INTERNATIONAL (SHENZHEN) INC., would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI / TIA / EIA-603-C-2004 and shown to be compliant with the applicable 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.



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Reviewed by: Joseph Lin / Supervisor



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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

REVISION HISTORY.....	3
SUMMARY OF TEST RESULT .....	4
<b>1 GENERAL DESCRIPTION .....</b>	<b>5</b>
1.1 Applicant.....	5
1.2 Manufacturer .....	5
1.3 Feature of Equipment Under Test.....	5
1.4 Product Specification of Equipment Under Test .....	5
1.5 Modification of EUT .....	6
1.6 Maximum ERP/EIRP Power, Frequency Tolerance, and Emission Designator .....	6
1.7 Testing Site .....	7
1.8 Applied Standards .....	8
<b>2 TEST CONFIGURATION OF EQUIPMENT UNDER TEST .....</b>	<b>9</b>
2.1 Test Mode.....	9
2.2 Connection Diagram of Test System .....	10
2.3 Support Unit used in test configuration and system.....	10
2.4 Measurement Results Explanation Example .....	11
<b>3 TEST RESULT .....</b>	<b>12</b>
3.1 Conducted Output Power Measurement.....	12
3.2 Peak-to-Average Ratio .....	14
3.3 Effective Radiated Power and Effective Isotropic Radiated Power Measurement .....	18
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 .....	41
3.8 Frequency Stability Measurement.....	47
<b>4 LIST OF MEASURING EQUIPMENT .....</b>	<b>51</b>
<b>5 UNCERTAINTY OF EVALUATION .....</b>	<b>52</b>
<b>APPENDIX A. SETUP PHOTOGRAPHS</b>	

## REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FG410702	Rev. 01	Initial issue of report	Jan. 23, 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	§22.913(a)(2)	Effective Radiated Power	< 7 Watts	PASS	-
3.3	§24.232(c)	Equivalent Isotropic Radiated Power	< 2 Watts	PASS	-
3.4	§2.1049 §22.917(a) §24.238(b)	Occupied Bandwidth	N/A	PASS	-
3.5	§2.1051 §22.917(a) §24.238(a)	Band Edge Measurement	< 43+10log <sub>10</sub> (P[Watts])	PASS	-
3.6	§2.1051 §22.917(a) §24.238(a)	Conducted Spurious Emission	< 43+10log <sub>10</sub> (P[Watts])	PASS	-
3.7	§2.1053 §22.917(a) §24.238(a)	Field Strength of Spurious Radiation	< 43+10log <sub>10</sub> (P[Watts])	PASS	Under limit 5.58 dB at 3344.000 MHz
3.8	§2.1055 §22.355 §24.235	Frequency Stability for Temperature & Voltage	< 2.5 ppm	PASS	-

# 1 General Description

## 1.1 Applicant

**Brightstar Corporation**

9725 NW 117th Ave., Miami, Florida, FL 33178, United States

## 1.2 Manufacturer

**Skycom Telecommunications Co Limited**

Room 604, East Block, Shengtang Building, Futian District, Shenzhen, China

## 1.3 Feature of Equipment Under Test

Product Feature	
<b>Equipment</b>	mobile phone
<b>Brand Name</b>	Avvio
<b>Model Name</b>	Avvio 510 / Avvio 520
<b>FCC ID</b>	WVBA510X
<b>EUT supports Radios application</b>	GSM/GPRS Bluetooth v2.1 + EDR
<b>HW Version</b>	C188 V1.11
<b>SW Version</b>	AVVIO_C188_V1.0
<b>EUT Stage</b>	Identical Prototype

**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 of Equipment Under Test

Product Specification subjective to this standard	
<b>Tx Frequency</b>	GSM850: 824.2 MHz ~ 848.8 MHz GSM1900: 1850.2 MHz ~ 1909.8MHz
<b>Rx Frequency</b>	GSM850: 869.2 MHz ~ 893.8 MHz GSM1900: 1930.2 MHz ~ 1989.8 MHz
<b>Maximum Output Power to Antenna</b>	GSM850 : 33.20 dBm GSM1900 : 29.28 dBm
<b>Antenna Type</b>	PIFA Antenna
<b>Type of Modulation</b>	GSM: GMSK GPRS: GMSK

## 1.5 Modification of EUT

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

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

FCC Rule	System	Type of Modulation	Maximum ERP/EIRP (W)	Frequency Tolerance (ppm)	Emission Designator
Part 22	GSM850 GSM	GMSK	1.03	0.03 ppm	244KGXW
Part 24	GSM1900 GSM	GMSK	0.45	0.03 ppm	246KGXW

## 1.7 Testing Site

<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	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	

<b>Test Site</b>	SPORTON INTERNATIONAL (KUNSHAN) INC.	
<b>Test Site Location</b>	No. 3-2, PingXiang Road, Kunshan, Jiangsu Province, P.R.C. TEL: +86-0512-5790-0158 FAX: +86-0512-5790-0958	
<b>Test Site No.</b>	<b>Sporton Site No.</b>	<b>FCC Registration No.</b>
	03CH01-KS	149928

## 1.8 Applied Standards

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

- ♦ FCC 47 CFR Part 2, 22(H), 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

During all testing, EUT is in link mode with base station emulator at maximum power level. The spurious emission measurements were carried out in semi-anechoic chamber with 3-meter test range, and EUT was rotated on three test planes to find out the worst emission (Z plane for 22H, Y Plane for 24E).

Frequency range investigated for radiated emission is as follows:

1. 30 MHz to 9000 MHz for GSM850.
2. 30 MHz to 19000 MHz for GSM1900.

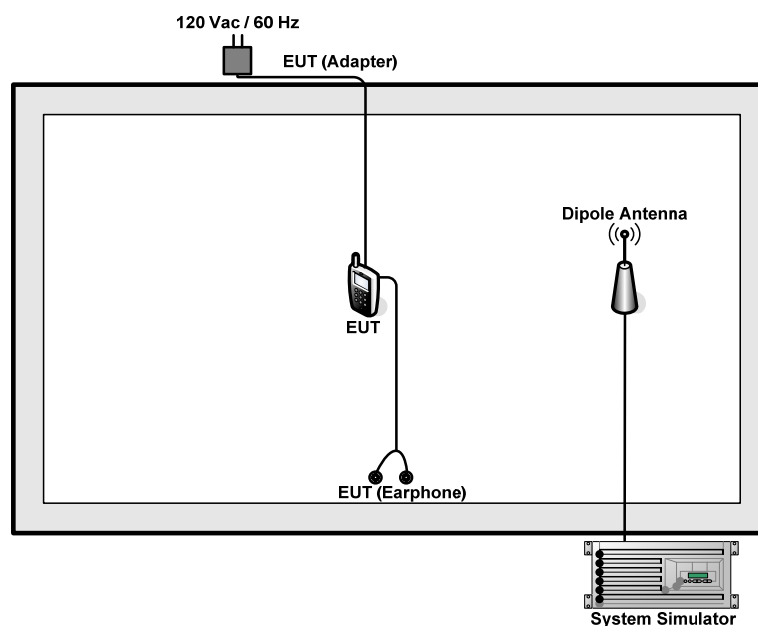
Test Modes		
Band	Radiated TCs	Conducted TCs
<b>GSM 850</b>	■ GSM Link	■ GSM Link
<b>GSM 1900</b>	■ GSM Link	■ GSM Link

**Note:** The maximum power levels are GSM mode for GMSK link, only these modes were used for all tests.

The conducted power tables are as follows:

Conducted Power (*Unit: dBm)						
Band	GSM850			GSM1900		
Channel	128	189	251	512	661	810
Frequency	824.2	836.4	848.8	1850.2	1880.0	1909.8
<b>GSM</b>	32.76	33.01	<b>33.20</b>	<b>29.28</b>	28.70	28.71
<b>GPRS class 8</b>	32.70	33.00	33.17	29.25	28.69	28.65
<b>GPRS class 10</b>	31.52	31.29	31.64	28.11	27.23	27.51
<b>GPRS class 11</b>	28.59	28.77	28.83	25.91	25.05	25.31
<b>GPRS class 12</b>	27.77	27.76	27.92	24.81	24.13	24.28

## 2.2 Connection Diagram of Test System



## 2.3 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model No.	FCC ID	Data Cable	Power Cord
1.	System Simulator	R&S	CMU200	N/A	N/A	Unshielded, 1.8 m
2.	DC Power Supply	TOPWORD	3303DR	N/A	N/A	Unshielded, 1.8 m

## 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 EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example:

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

*Offset = RF cable loss + attenuator factor.*

Following shows an offset computation example with cable loss 7 dB and 10dB attenuator.

$$\begin{aligned}\text{Offset (dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)} \\ &= 7 + 10 = 17 \text{ (dB)}\end{aligned}$$

### 3 Test Result

#### 3.1 Conducted Output Power Measurement

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

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

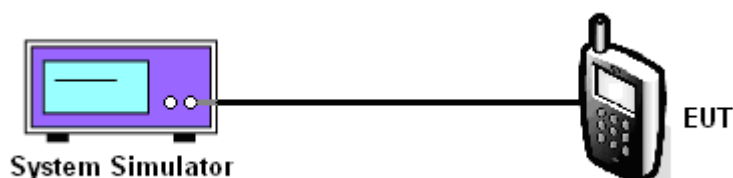
##### 3.1.2 Measuring Instruments

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 base station.
2. Set EUT at maximum power through base station.
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

Cellular Band			
Modes	GSM850 (GSM)		
Channel	128 (Low)	189 (Mid)	251 (High)
Frequency (MHz)	824.2	836.4	848.8
Conducted Power (dBm)	32.76	33.01	33.20
Conducted Power (Watts)	1.89	2.00	2.09

PCS Band			
Modes	GSM1900 (GSM)		
Channel	512 (Low)	661 (Mid)	810 (High)
Frequency (MHz)	1850.2	1880	1909.8
Conducted Power (dBm)	29.28	28.70	28.71
Conducted Power (Watts)	0.85	0.74	0.74

**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.

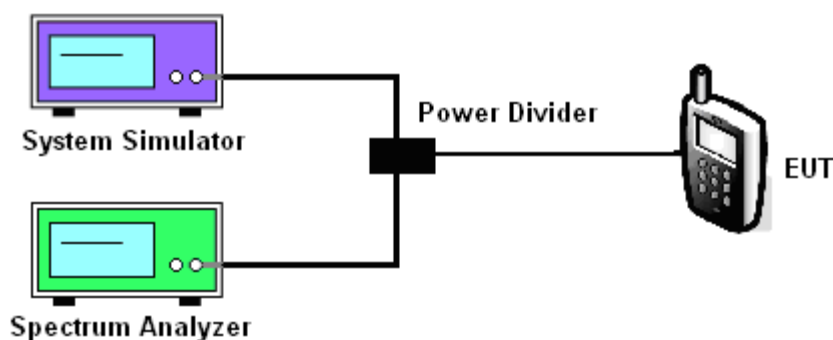
### 3.2.2 Measuring Instruments

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

### 3.2.3 Test Procedures

1. The EUT was connected to Spectrum Analyzer and System Simulator via power divider.
2. For GSM/GPRS operating modes:
  - a. Set EUT in maximum power output.
  - b. Set the RBW = 1MHz, VBW = 3MHz, Peak detector in spectrum analyzer for first trace.
  - c. Set the RBW = 1MHz, VBW = 3MHz, RMS detector in 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 synchronized with the spectrum analyzer.
3. 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)		
Channel	512 (Low)	661 (Mid)	810 (High)
Frequency (MHz)	1850.2	1880	1909.8
Peak-to-Average Ratio (dB)	0.29	0.29	0.30

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

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



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### 3.3 Effective Radiated Power and Effective Isotropic Radiated Power Measurement

#### 3.3.1 Description of the ERP/EIRP Measurement

The substitution method, in ANSI / TIA / EIA-603-C-2004, was used for ERP/EIRP measurement, and the spectrum analyzer configuration follows KDB 971168 D01 Power Meas. License Digital Systems v02r01. The ERP of mobile transmitters must not exceed 7 Watts and the EIRP of mobile transmitters are limited to 2 Watts.

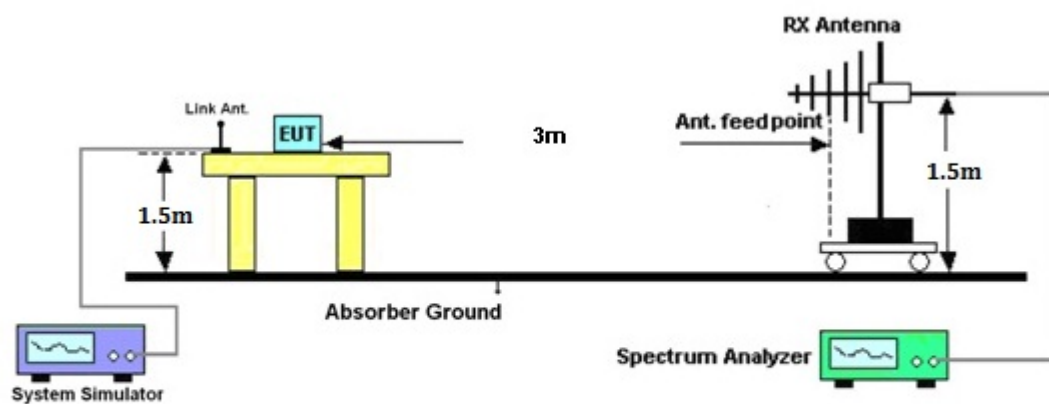
#### 3.3.2 Measuring Instruments

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

#### 3.3.3 Test Procedures

1. The EUT was placed on a turntable with 1.5 meter height in a fully anechoic chamber.
2. The EUT was set at 3 meters from the receiving antenna, which was mounted on the antenna tower.
3. GSM operating modes: Set RBW= 1MHz, VBW= 3MHz, RMS detector over burst, RMS detector over frame, and use channel power option with bandwidth=5MHz, per KDB 971168 D01.
4. The table was rotated 360 degrees to determine the position of the highest radiated power.
5. The height of the receiving antenna is adjusted to look for the maximum ERP/EIRP.
6. Taking the record of maximum ERP/EIRP.
7. A dipole antenna was substituted in place of the EUT and was driven by a signal generator.
8. The conducted power at the terminal of the dipole antenna is measured.
9. Repeat step 3 to step 5 to get the maximum ERP/EIRP of the substitution antenna.
10.  $ERP/EIRP = P_s + E_t - E_s + G_s = P_s + R_t - R_s + G_s$   
     $P_s$  (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 ERP

<b>GSM850 (GSM) Radiated Power ERP</b>						
Horizontal Polarization						
<b>Frequency (MHz)</b>	<b>Rt (dBm)</b>	<b>Rs (dBm)</b>	<b>Ps (dBm)</b>	<b>Gs (dBd)</b>	<b>ERP (dBm)</b>	<b>ERP (W)</b>
824.20	-16.89	-48.12	0.00	-1.08	30.15	1.03
836.40	-19.21	-48.28	0.00	-0.93	28.14	0.65
848.80	-20.44	-48.35	0.00	-0.76	27.15	0.52
Vertical Polarization						
<b>Frequency (MHz)</b>	<b>Rt (dBm)</b>	<b>Rs (dBm)</b>	<b>Ps (dBm)</b>	<b>Gs (dBd)</b>	<b>ERP (dBm)</b>	<b>ERP (W)</b>
824.20	-30.12	-47.97	0.00	-1.08	16.77	0.05
836.40	-32.36	-48.01	0.00	-0.93	14.72	0.03
848.80	-34.19	-48.05	0.00	-0.76	13.10	0.02

### 3.3.6 Test Result of EIRP

<b>GSM1900 (GSM) Radiated Power EIRP</b>						
Horizontal Polarization						
<b>Frequency (MHz)</b>	<b>Rt (dBm)</b>	<b>Rs (dBm)</b>	<b>Ps (dBm)</b>	<b>Gs (dBi)</b>	<b>EIRP (dBm)</b>	<b>EIRP (W)</b>
1850.20	-27.30	-51.88	0.00	1.96	26.54	0.45
1880.00	-28.89	-52.99	0.00	2.00	26.10	0.41
1909.80	-30.76	-54.28	0.00	1.98	25.50	0.35
Vertical Polarization						
<b>Frequency (MHz)</b>	<b>Rt (dBm)</b>	<b>Rs (dBm)</b>	<b>Ps (dBm)</b>	<b>Gs (dBi)</b>	<b>EIRP (dBm)</b>	<b>EIRP (W)</b>
1850.20	-30.77	-52.13	0.00	1.96	23.32	0.21
1880.00	-32.21	-53.17	0.00	2.00	22.96	0.20
1909.80	-34.31	-54.13	0.00	1.98	21.80	0.15

### 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.

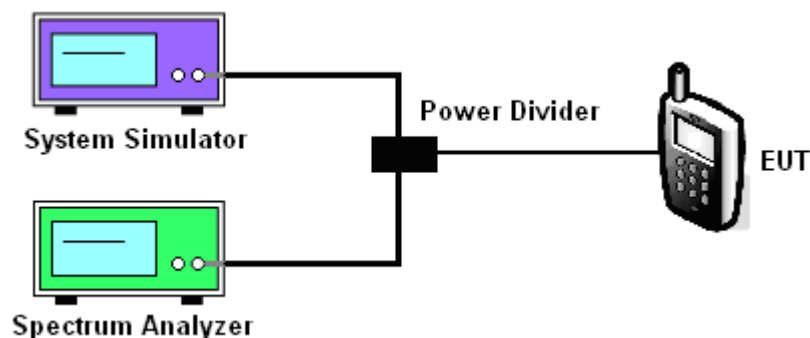
#### 3.4.2 Measuring Instruments

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

#### 3.4.3 Test Procedures

1. The EUT was connected to Spectrum Analyzer and Base Station via power divider.
2. 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.
3. The 99% occupied bandwidth were measured, set RBW= 1% of span, VBW= 3\*RBW, sample detector, trace maximum hold.
4. 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 99% Occupied Bandwidth and 26dB Bandwidth**

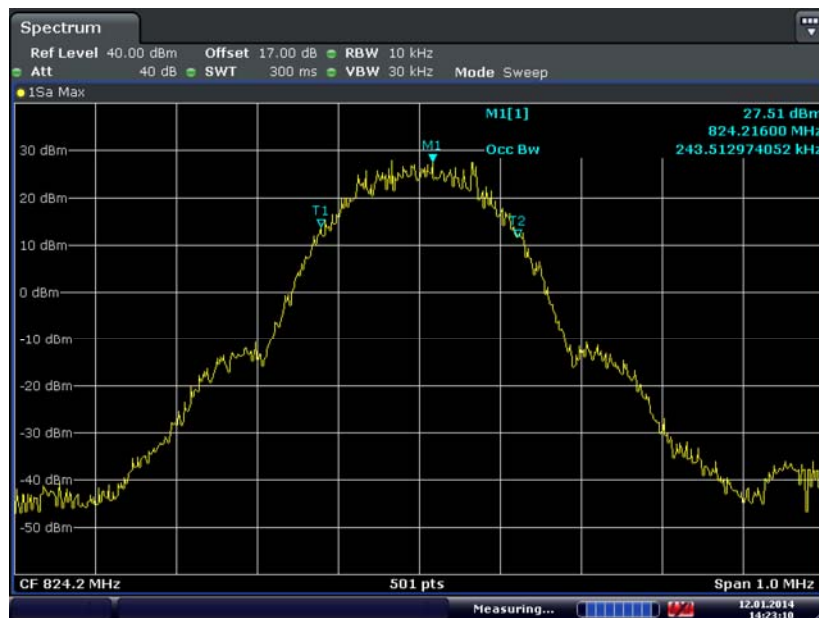
Cellular Band			
Modes	GSM850 (GSM)		
Channel	128 (Low)	189 (Mid)	251 (High)
Frequency (MHz)	824.2	836.4	848.8
99% OBW (kHz)	243.51	241.52	243.51
26dB BW (kHz)	305.40	301.40	303.40

PCS Band			
Modes	GSM1900 (GSM)		
Channel	512 (Low)	661 (Mid)	810 (High)
Frequency (MHz)	1850.2	1880	1909.8
99% OBW (kHz)	243.13	246.02	246.02
26dB BW (kHz)	311.10	318.40	315.50

### 3.4.6 Test Result (Plots) of 99% Occupied Bandwidth and 26dB Bandwidth

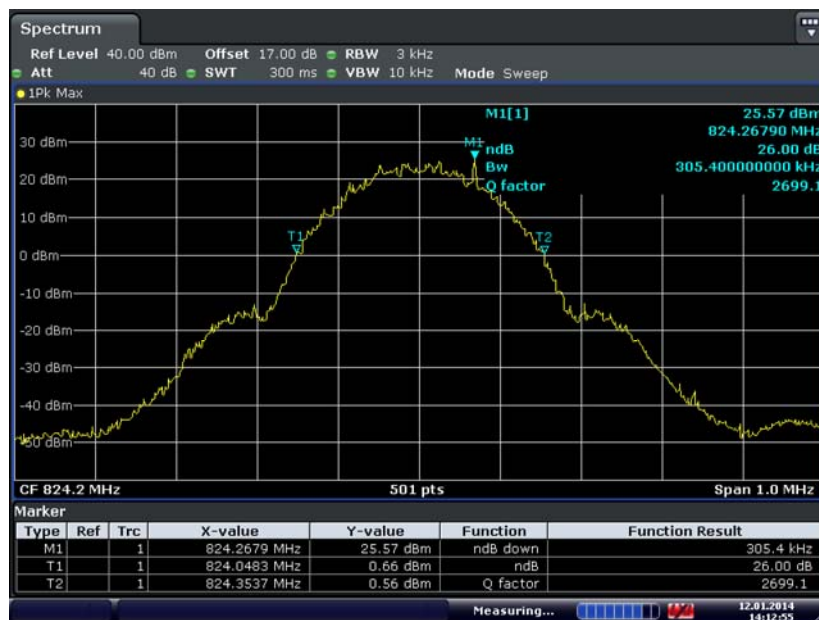
<b>Band :</b>	GSM 850	<b>Test Mode :</b>	GSM Link (GMSK)
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**99% Occupied Bandwidth Plot on Channel 128 (824.2 MHz)**



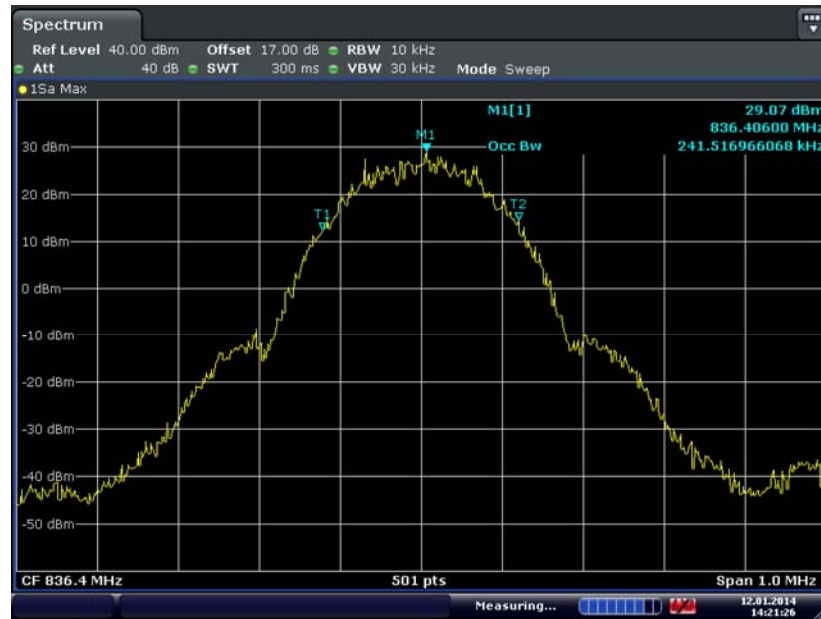
Date: 12.JAN.2014 14:23:10

**26dB Bandwidth Plot on Channel 128 (824.2 MHz)**

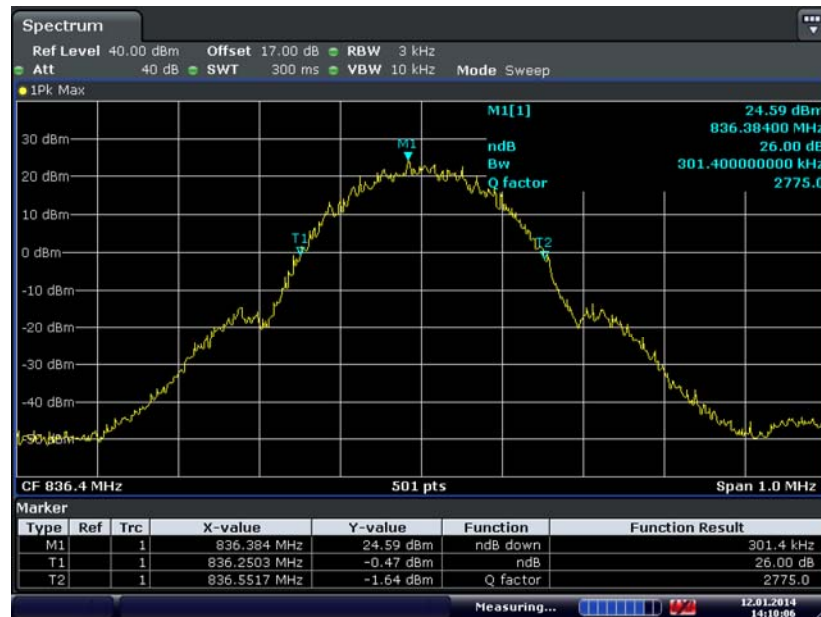


Date: 12.JAN.2014 14:12:55



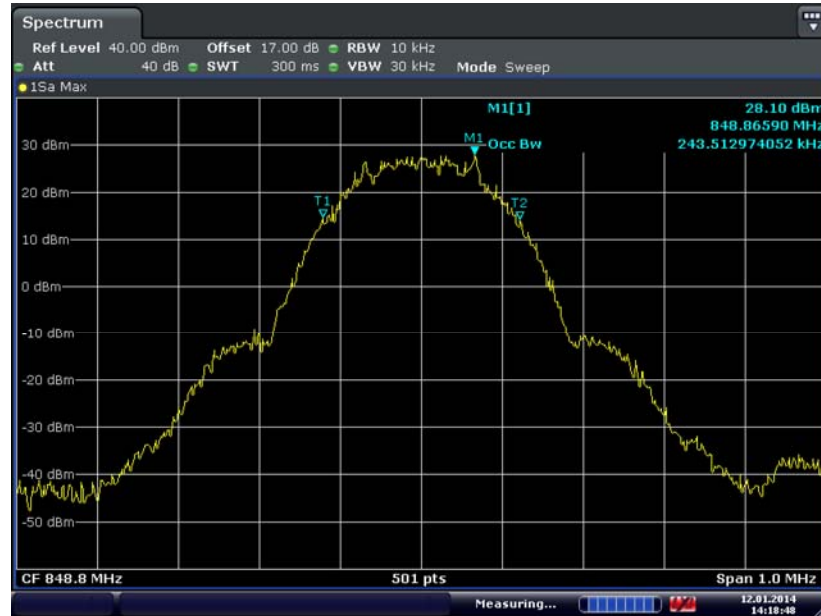
**99% Occupied Bandwidth Plot on Channel 189 (836.4 MHz)**


Date: 12.JAN.2014 14:21:26

**26dB Bandwidth Plot on Channel 189 (836.4 MHz)**


Date: 12.JAN.2014 14:10:06

99% Occupied Bandwidth Plot on Channel 251 (848.8 MHz)



Date: 12.JAN.2014 14:18:48

26dB Bandwidth Plot on Channel 251 (848.8 MHz)

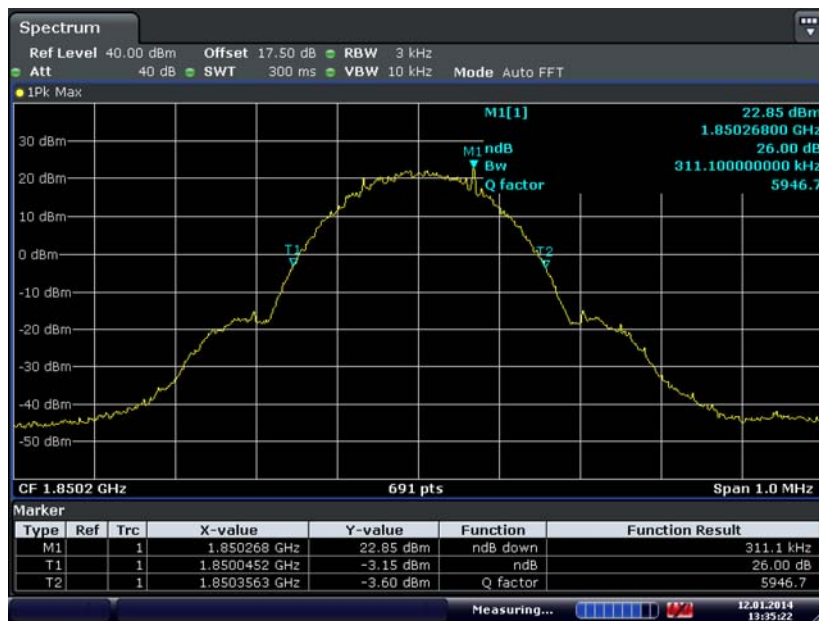


Date: 12.JAN.2014 14:14:12

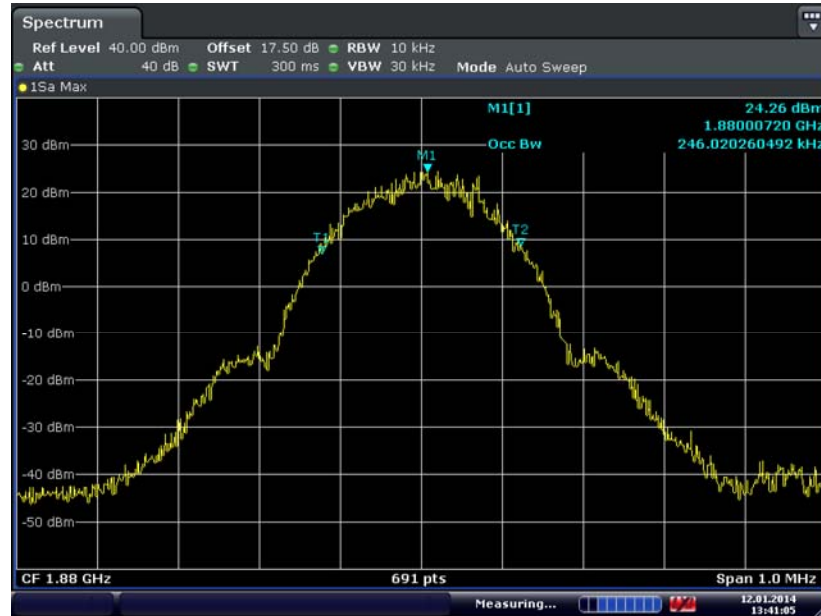
<b>Band :</b>	GSM 1900	<b>Test Mode :</b>	GSM Link (GMSK)
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**99% Occupied Bandwidth Plot on Channel 512 (1850.2 MHz)**

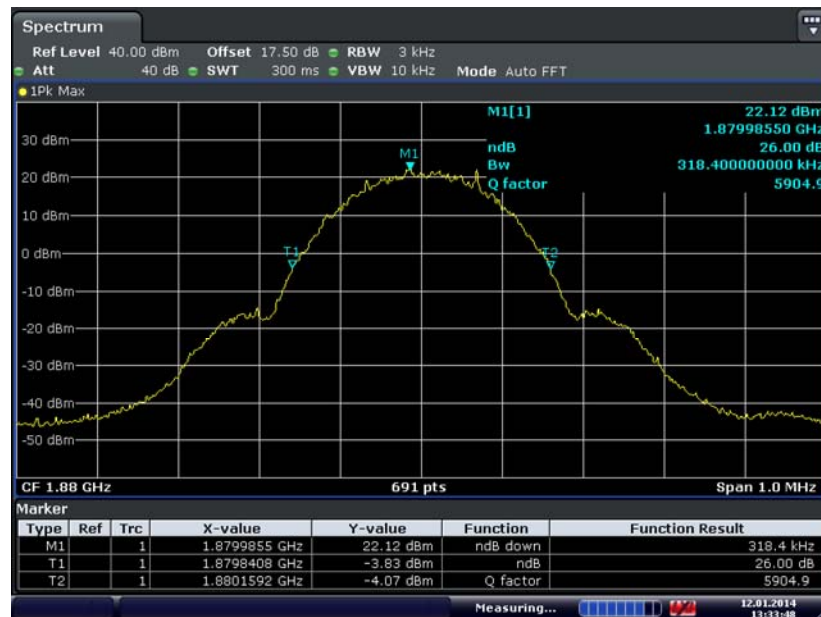

Date: 12.JAN.2014 13:42:32

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


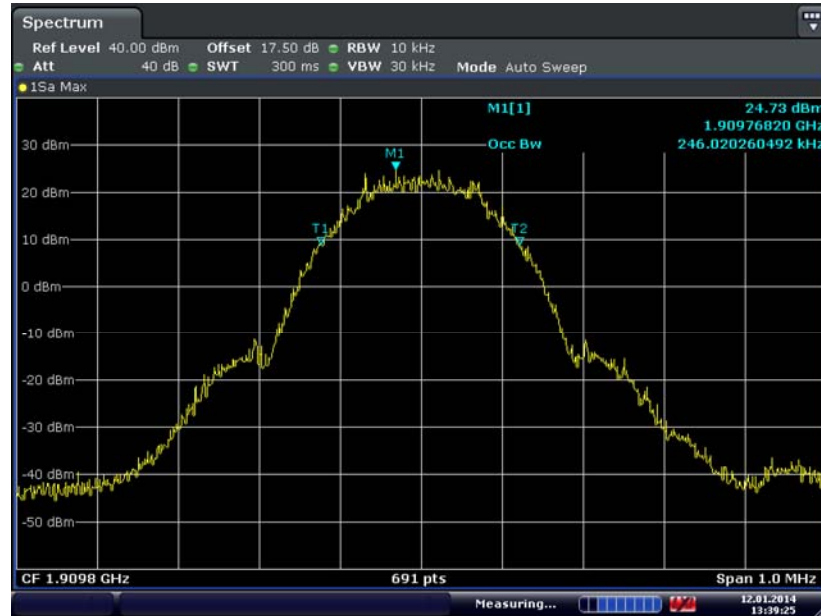
Date: 12.JAN.2014 13:35:22

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


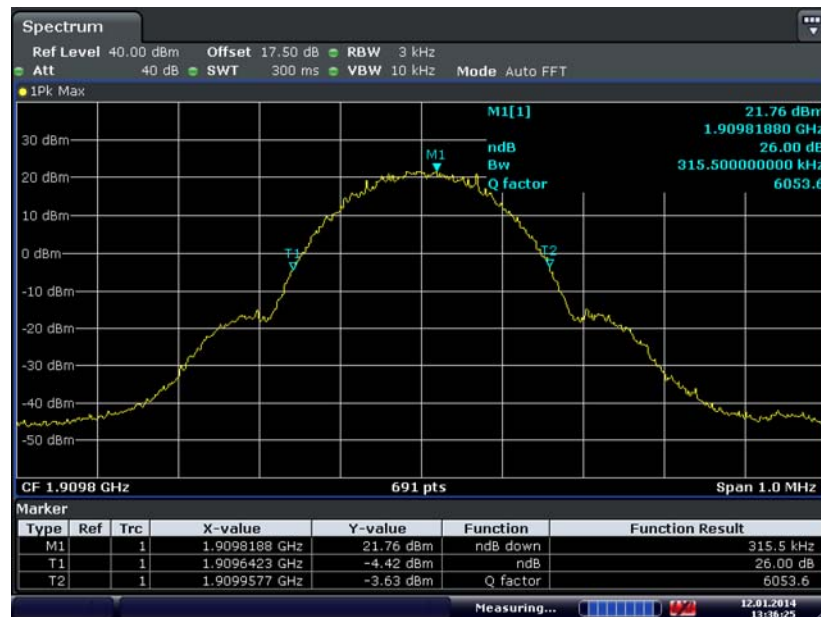
Date: 12.JAN.2014 13:41:05

**26dB Bandwidth Plot on Channel 661 (1880.0 MHz)**


Date: 12.JAN.2014 13:33:48

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


Date: 12.JAN.2014 13:39:24

**26dB Bandwidth Plot on Channel 810 (1909.8 MHz)**


Date: 12.JAN.2014 13:36:25

### 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.

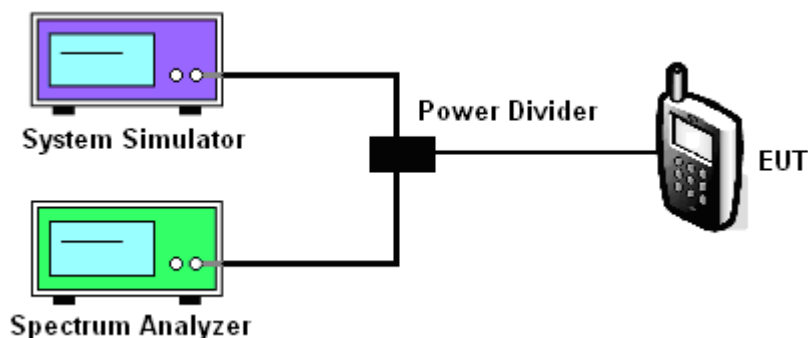
#### 3.5.2 Measuring Instruments

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

#### 3.5.3 Test Procedures

1. The EUT was connected to Spectrum Analyzer and Base Station via power divider.
2. 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.
3. The band edges of low and high channels for the highest RF powers were measured. Setting RBW as roughly BW/100.
4. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
5. The limit line is derived from  $43 + 10\log(P)$  dB below the transmitter power P(Watts)  
 $= P(W) - [43 + 10\log(P)] \text{ (dB)}$   
 $= [30 + 10\log(P)] \text{ (dBm)} - [43 + 10\log(P)] \text{ (dB)}$   
 $= -13\text{dBm}.$

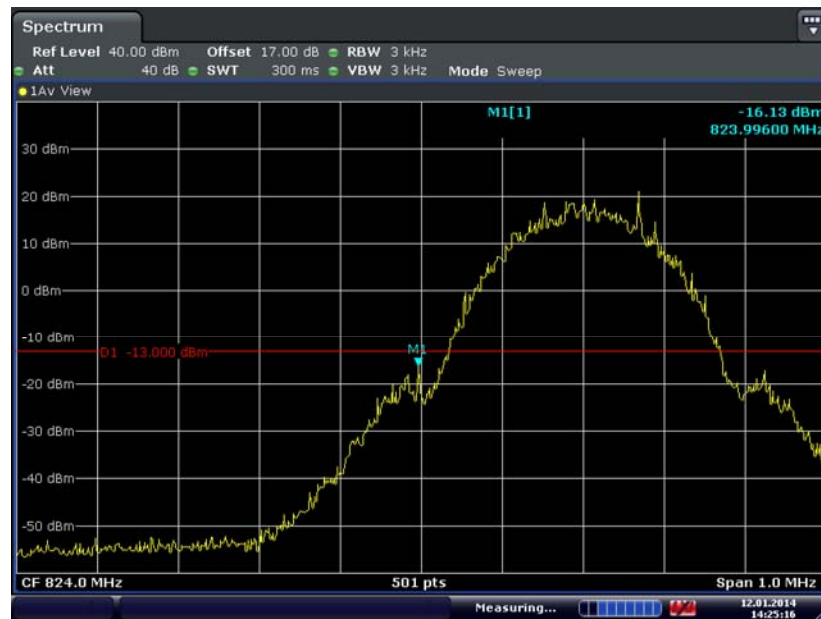
#### 3.5.4 Test Setup



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

Band :	GSM850	Test Mode :	GSM Link (GMSK)
Correction Factor :	0.08dB	Maximum 26dB Bandwidth :	0.305MHz
Band Edge :	-16.05dBm	Measurement Value :	-16.13dBm

**Lower Band Edge Plot on Channel 128 (824.2 MHz)**



Date: 12.JAN.2014 14:25:16

1. Correction Factor(dB)=  $10\log(1\% \text{ Emission BW/RBW})$
2. Band Edge= Measurement Value + Correction Factor(dB)  
For example,  $-16.13\text{dBm} + 0.08\text{dB} = -16.05\text{dBm}$



<b>Band :</b>	GSM850	<b>Test Mode :</b>	GSM Link (GMSK)
<b>Correction Factor :</b>	0.08dB	<b>Maximum 26dB Bandwidth :</b>	0.305MHz
<b>Band Edge :</b>	-19.61dBm	<b>Measurement Value :</b>	-19.69dBm

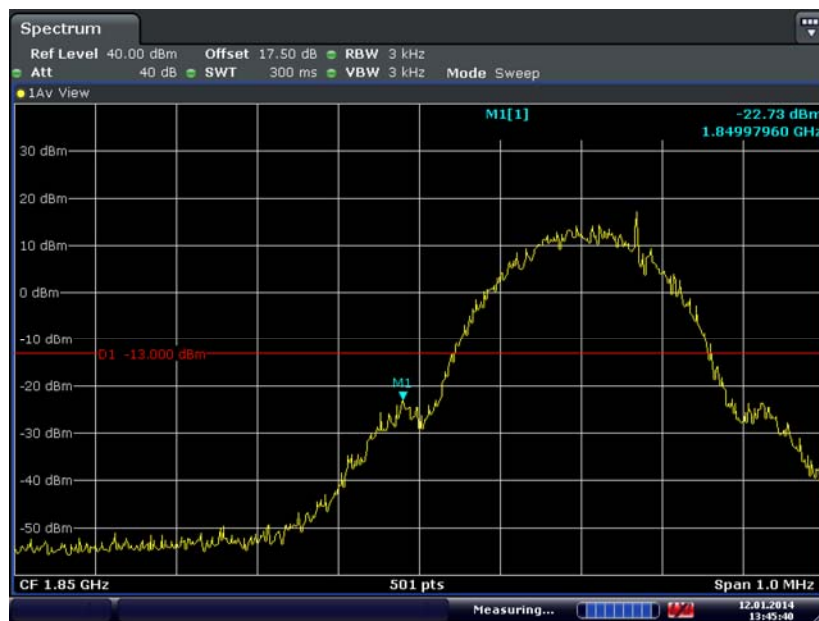
**Higher Band Edge Plot on Channel 251 (848.8 MHz)**


Date: 12.JAN.2014 14:26:42

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



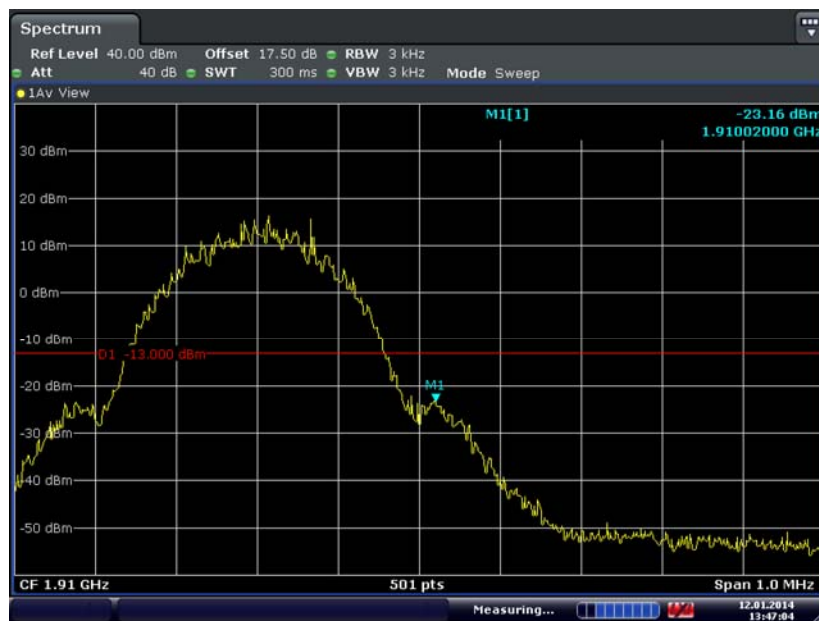
<b>Band :</b>	GSM1900	<b>Test Mode :</b>	GSM Link (GMSK)
<b>Correction Factor :</b>	0.26dB	<b>Maximum 26dB Bandwidth :</b>	0.318MHz
<b>Band Edge :</b>	-22.47dBm	<b>Measurement Value :</b>	-22.73dBm

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


Date: 12.JAN.2014 13:45:40

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>	0.26dB	<b>Maximum 26dB Bandwidth :</b>	0.318MHz
<b>Band Edge :</b>	-22.90dBm	<b>Measurement Value :</b>	-23.16dBm

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


Date: 12.JAN.2014 13:47:04

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

## 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.

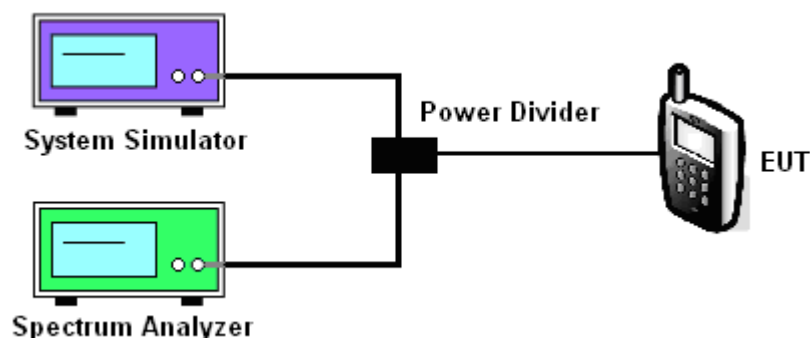
### 3.6.2 Measuring Instruments

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

### 3.6.3 Test Procedures

1. The EUT was connected to spectrum analyzer and base station via power divider.
2. 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.
3. The middle channel for the highest RF power within the transmitting frequency was measured.
4. The conducted spurious emission for the whole frequency range was taken.
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)  
 $= P(W) - [43 + 10\log(P)]$  (dB)  
 $= [30 + 10\log(P)]$  (dBm) -  $[43 + 10\log(P)]$  (dB)  
 $= -13\text{dBm}$

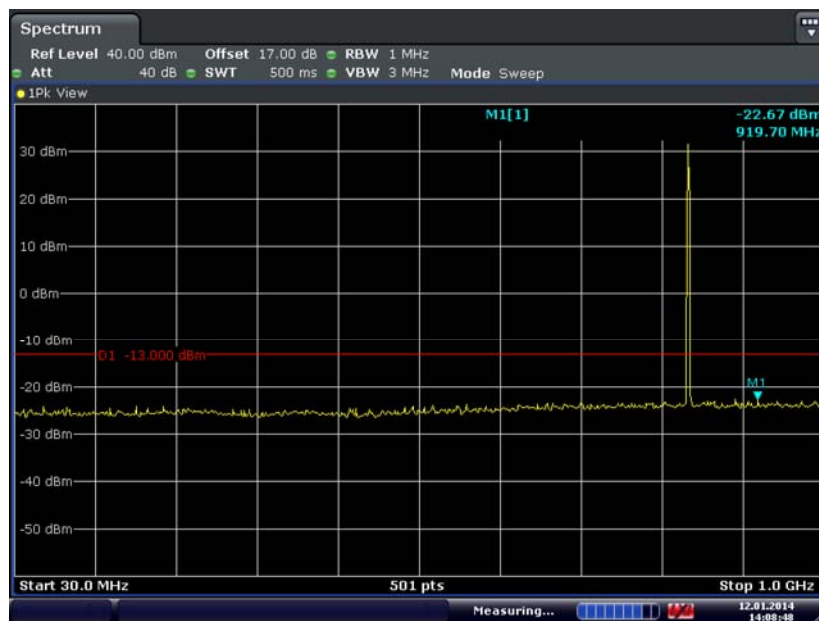
### 3.6.4 Test Setup



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

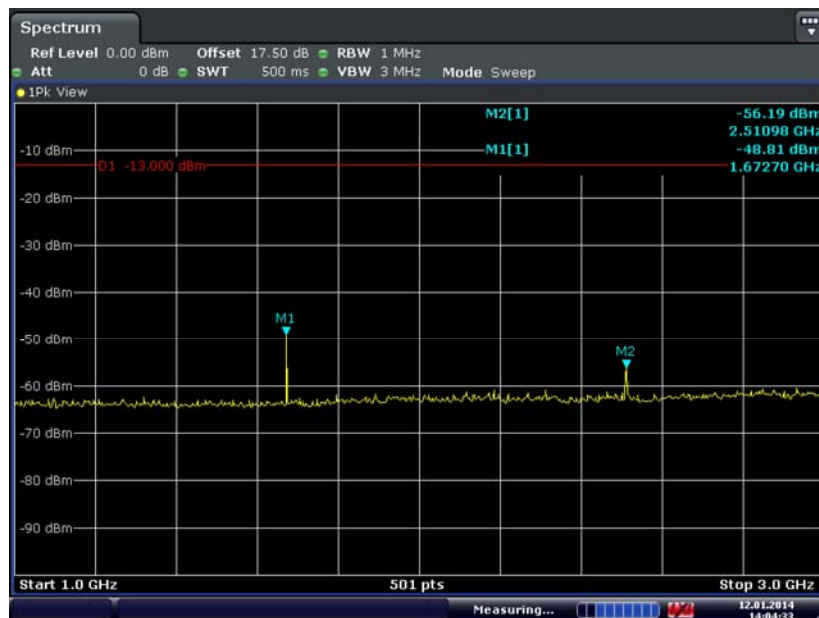
<b>Band :</b>	GSM850	<b>Channel :</b>	CH189
<b>Test Mode :</b>	GSM Link (GMSK)	<b>Frequency :</b>	836.4 MHz

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

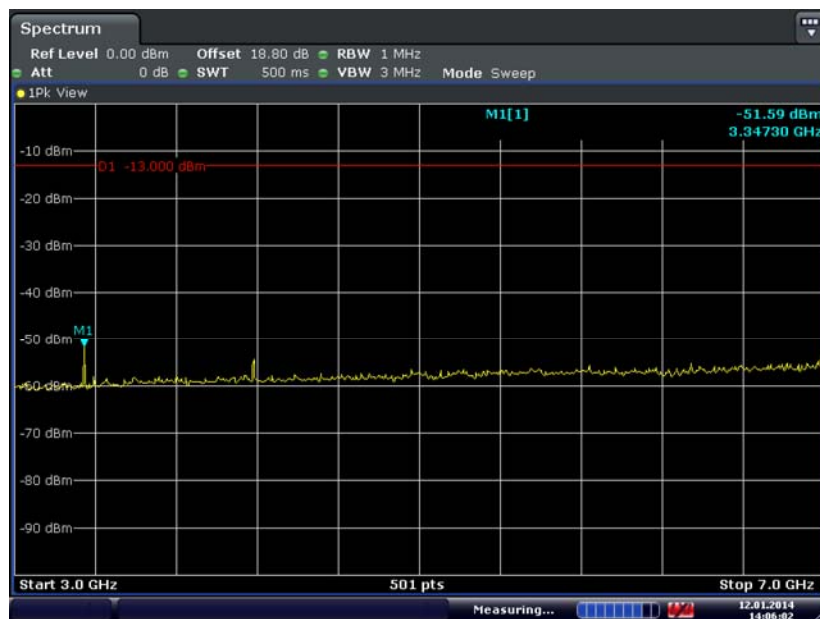


Date: 12.JAN.2014 14:08:48

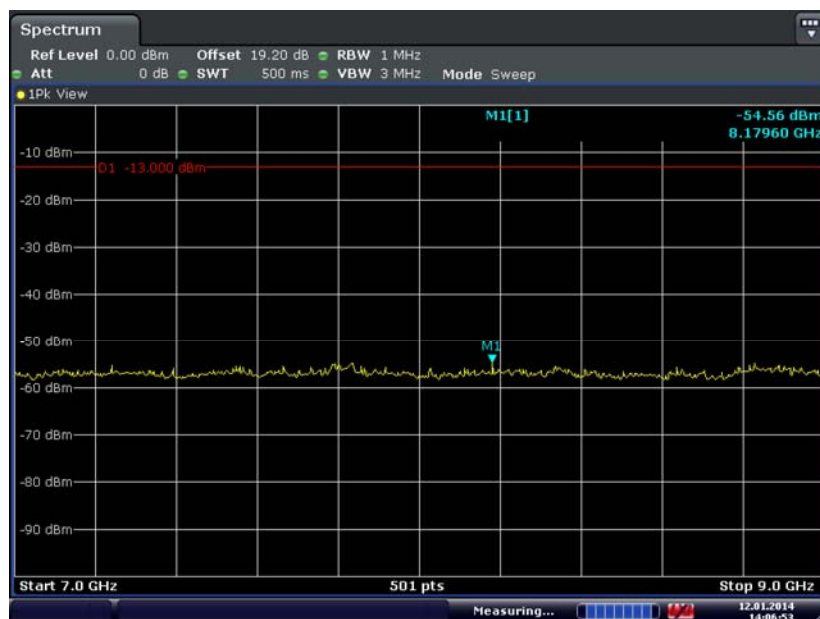
**Conducted Spurious Emission Plot between 1GHz ~ 3GHz**



Date: 12.JAN.2014 14:04:33

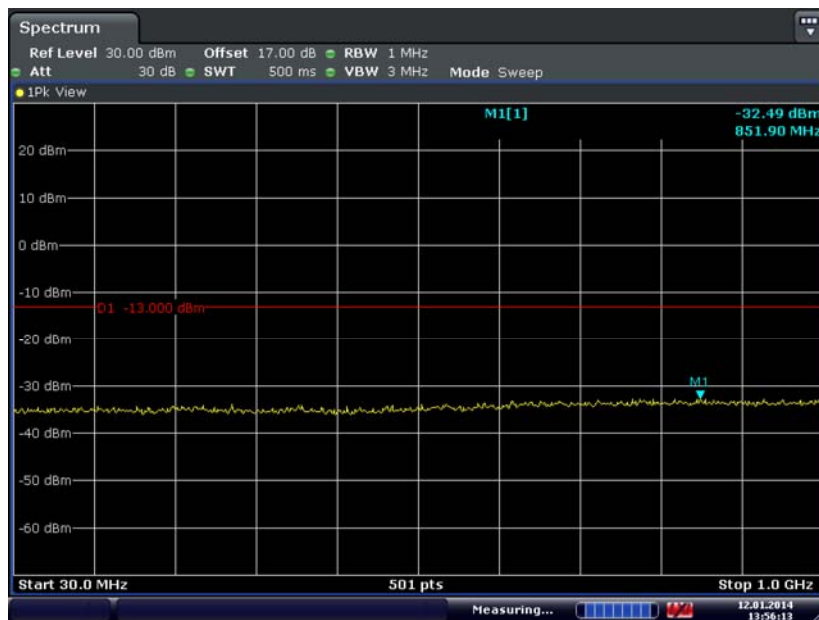
**Conducted Spurious Emission Plot between 3GHz ~ 7GHz**


Date: 12.JAN.2014 14:06:02

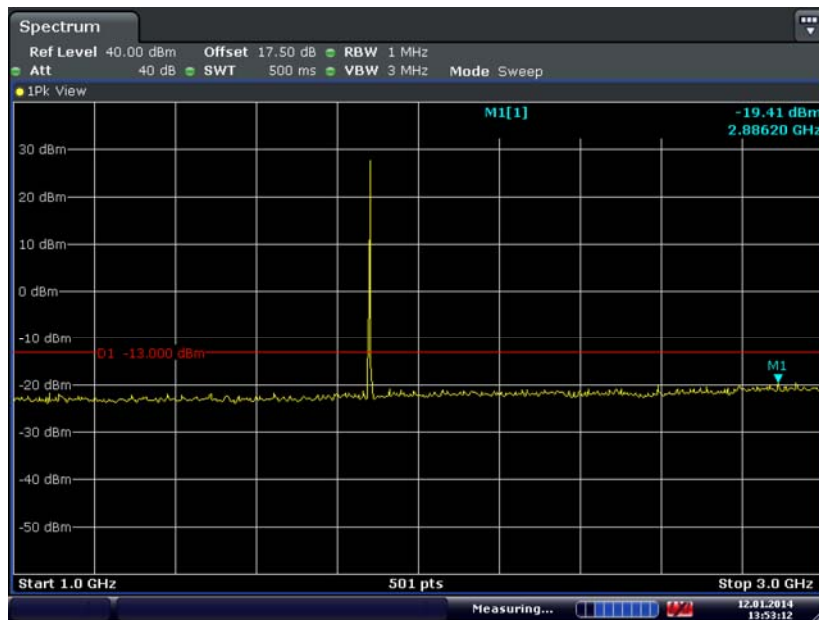
**Conducted Spurious Emission Plot between 7GHz ~ 9GHz**


Date: 12.JAN.2014 14:06:52

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

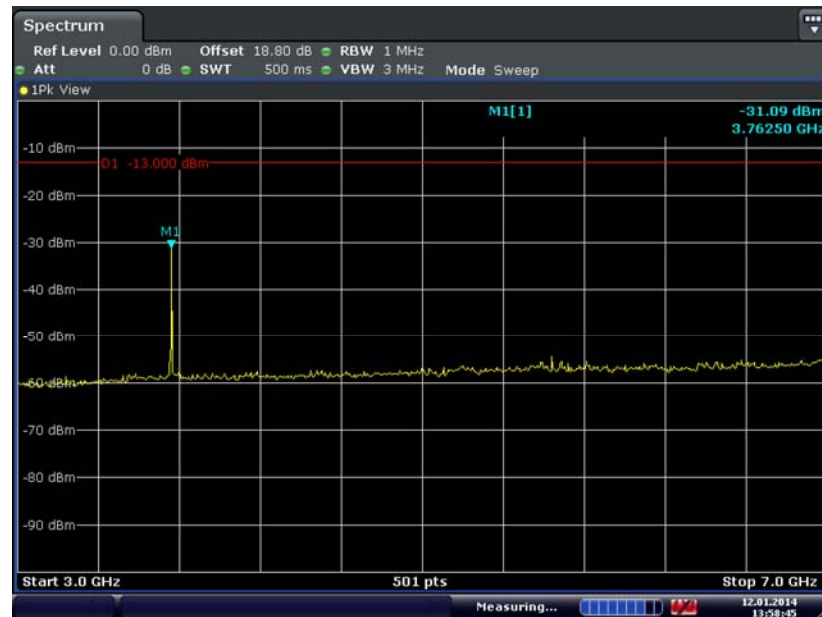
**Conducted Spurious Emission Plot between 30MHz ~ 1GHz**


Date: 12.JAN.2014 13:56:13

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


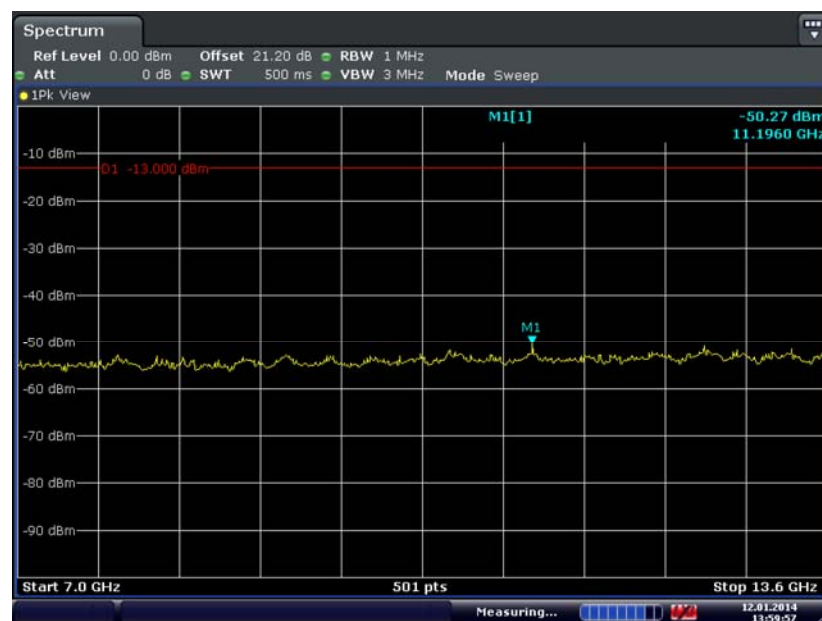
Date: 12.JAN.2014 13:53:12

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



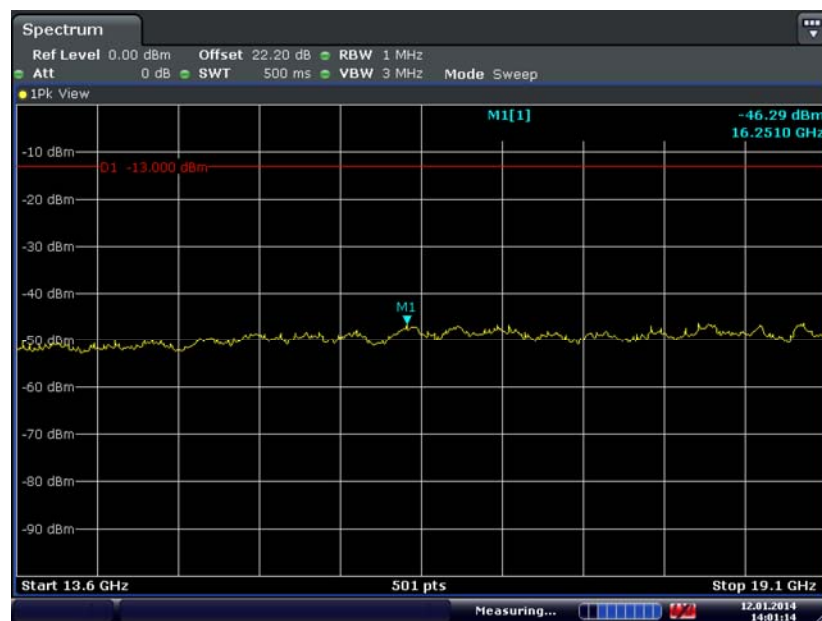
Date: 12.JAN.2014 13:58:45

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



Date: 12.JAN.2014 13:59:57

## Conducted Spurious Emission Plot between 13.6GHz ~ 19.1GHz



Date: 12.JAN.2014 14:01:14



### 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

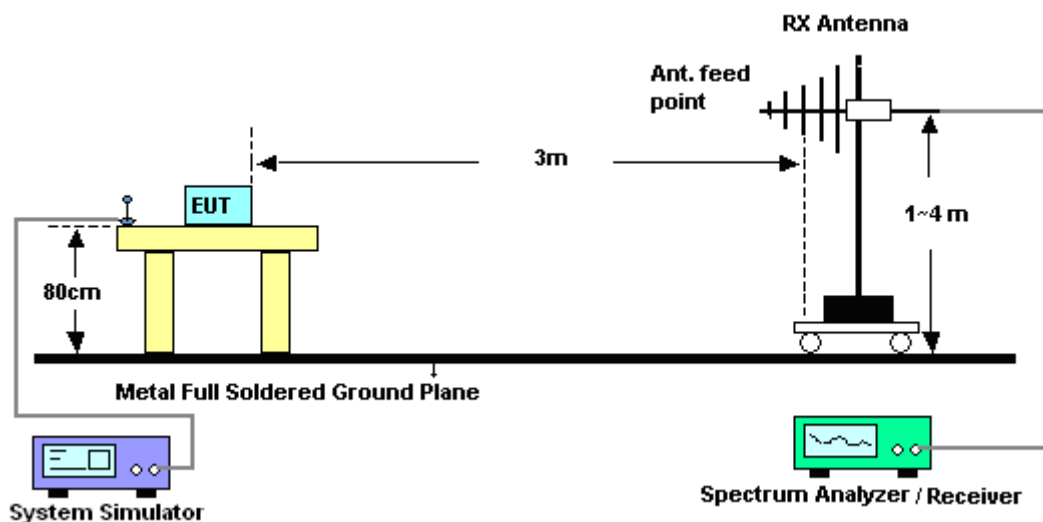
The measuring equipment is listed in the section 4 of this test report.

#### 3.7.3 Test Procedures

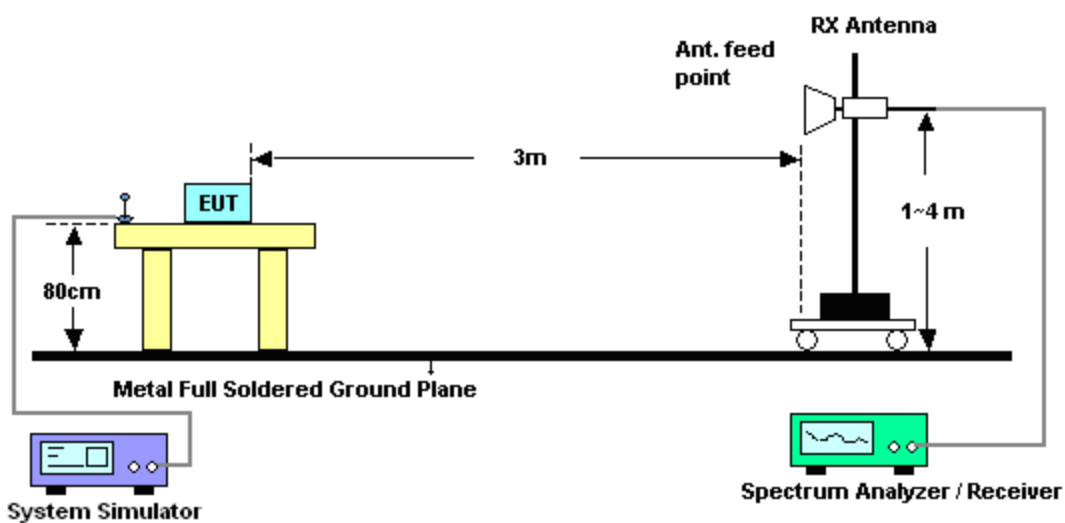
1. The EUT was placed on a rotatable wooden table with 0.8 meter above ground.
2. The EUT was set 3 meters from the receiving antenna, which was mounted on the antenna tower.
3. The table was rotated 360 degrees to determine the position of the highest spurious emission.
4. The height of the receiving antenna is varied between one meter and four meters to search the maximum spurious emission for both horizontal and vertical polarizations.
5. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, taking the record of maximum spurious emission.
6. A horn antenna was substituted in place of the EUT and was driven by a signal generator.
7. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission.
8. Taking the record of output power at antenna port.
9. Repeat step 7 to step 8 for another polarization.
10. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
11. The limit line is derived from  $43 + 10\log(P)$  dB below the transmitter power P(Watts)  
 $= P(W) - [43 + 10\log(P)] \text{ (dB)}$   
 $= [30 + 10\log(P)] \text{ (dBm)} - [43 + 10\log(P)] \text{ (dB)}$   
 $= -13\text{dBm}.$
12.  $\text{EIRP (dBm)} = \text{S.G. Power} - \text{Tx Cable Loss} + \text{Tx Antenna Gain}$
13.  $\text{ERP (dBm)} = \text{EIRP} - 2.15$

### 3.7.4 Test Setup

For radiated emissions from 30MHz to 1GHz

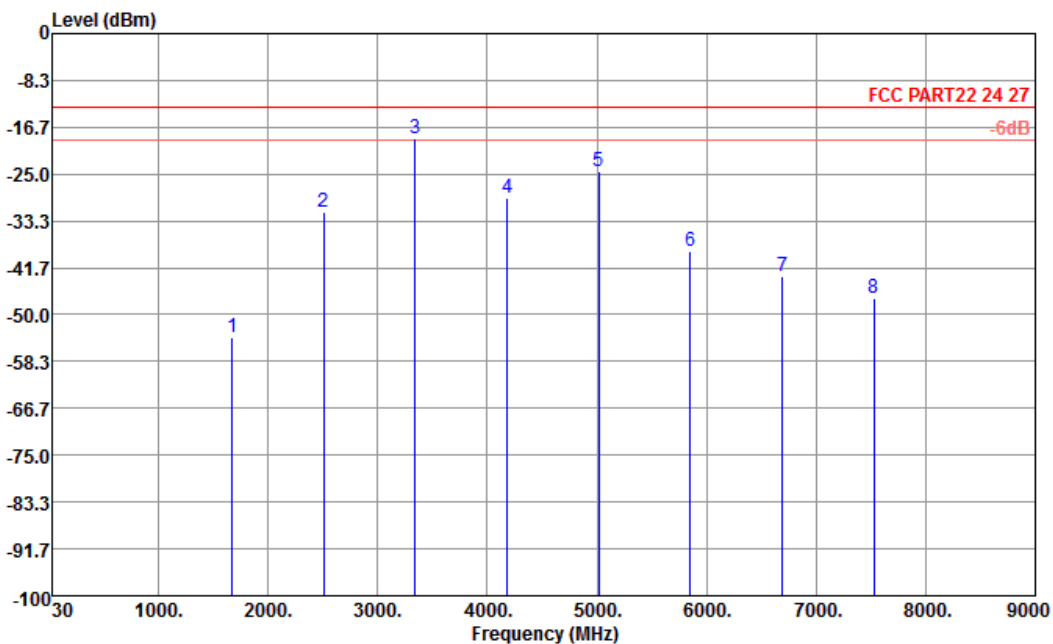


For radiated emissions above 1GHz



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

<b>Band :</b>	GSM850	<b>Temperature :</b>	22~23°C
<b>Test Mode :</b>	GSM Link (GMSK)	<b>Relative Humidity :</b>	42~43%
<b>Test Engineer :</b>	Star Wei	<b>Polarization :</b>	Horizontal
<b>Remark :</b>	Spurious emissions within 30-1000MHz were found more than 20dB below limit line.		

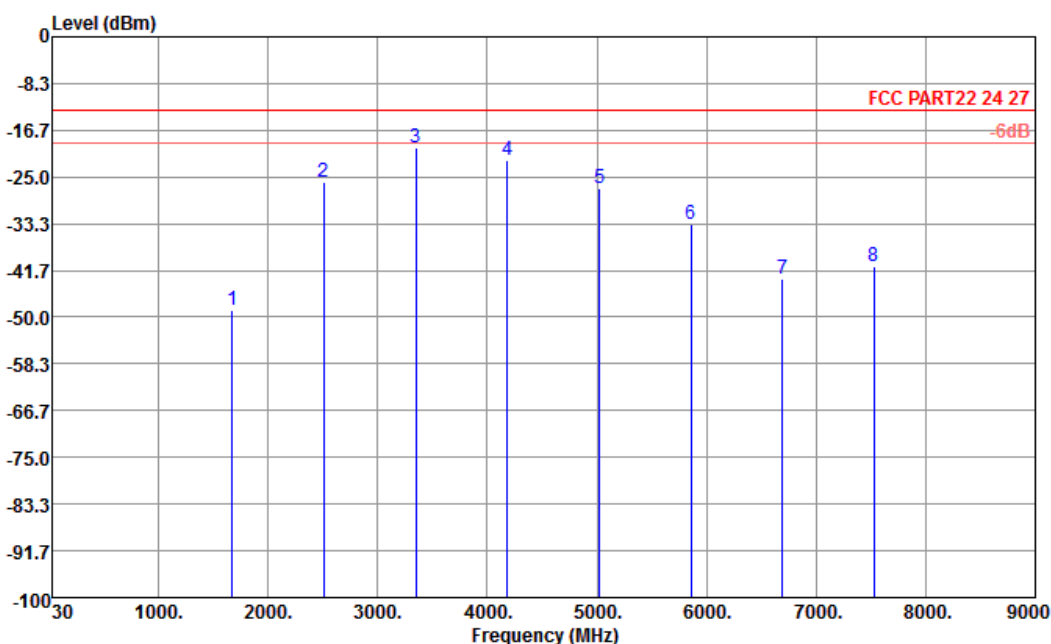


Site : 03CH01-KS  
Condition : FCC PART22 24 27 HF\_EIRP\_FACTOR130726 HORIZONTAL  
EUT : (FG) 410702

Plane : Z

Frequency ( MHz )	ERP ( dBm )	Limit ( dBm )	Over Limit ( dB )	SPA Reading ( dBm )	S.G. Power ( dBm )	TX Cable loss ( dB )	TX Antenna Gain ( dBi )	Polarization ( H/V )	Result
1674	-53.92	-13	-40.92	-51.43	-54.57	0.57	3.37	H	Pass
2510	-31.87	-13	-18.87	-36.78	-34.10	0.78	5.16	H	Pass
3344	-18.58	-13	-5.58	-24.49	-22.22	0.87	6.66	H	Pass
4182	-29.24	-13	-16.24	-36.77	-33.83	0.97	7.71	H	Pass
5018	-24.47	-13	-11.47	-35.66	-30.14	1.09	8.91	H	Pass
5854	-38.64	-13	-25.64	-50.94	-45.08	1.22	9.81	H	Pass
6692	-43.22	-13	-30.22	-55.46	-50.44	1.25	10.62	H	Pass
7526	-47.01	-13	-34.01	-57.94	-54.91	1.42	11.47	H	Pass

<b>Band :</b>	GSM850	<b>Temperature :</b>	22~23°C
<b>Test Mode :</b>	GSM Link (GMSK)	<b>Relative Humidity :</b>	42~43%
<b>Test Engineer :</b>	Star Wei	<b>Polarization :</b>	Vertical
<b>Remark :</b>	Spurious emissions within 30-1000MHz were found more than 20dB below limit line.		

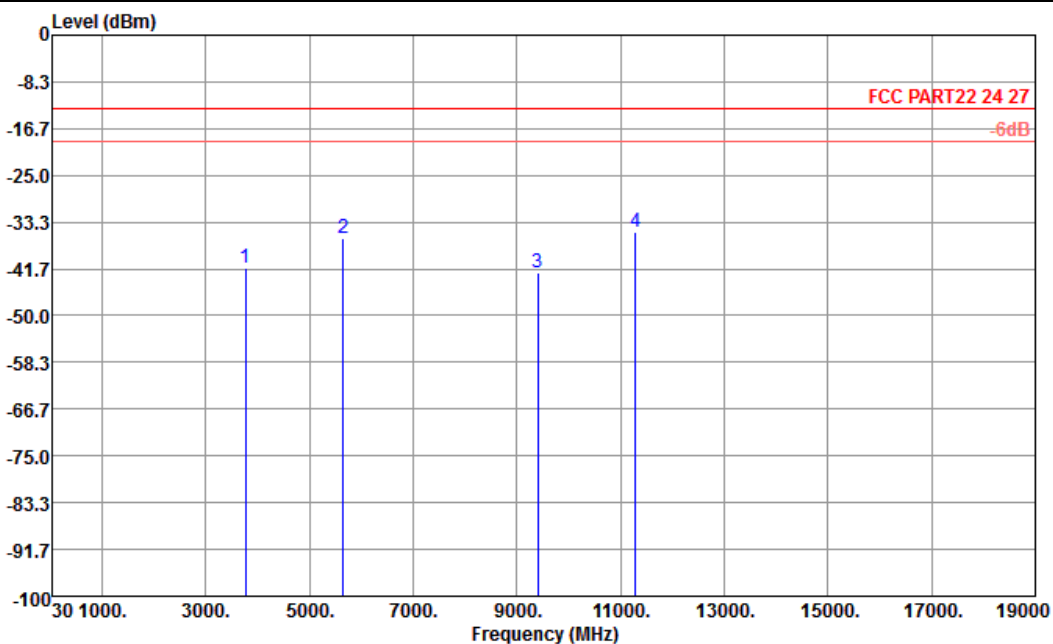


Site : 03CH01-KS  
 Condition : FCC PART22 24 27 HF\_EIRP\_FACTOR130726 VERTICAL  
 EUT : (FG) 410702  
 Plane : Z

Frequency ( MHz )	ERP ( dBm )	Limit ( dBm )	Over Limit ( dB )	SPA Reading (dBm)	S.G. Power ( dBm )	TX Cable loss ( dB )	TX Antenna Gain (dBi)	Polarization (H/V)	Result
1672	-48.88	-13	-35.88	-51.92	-49.53	0.57	3.37	V	Pass
2510	-25.98	-13	-12.98	-35.99	-28.21	0.78	5.16	V	Pass
3346	-19.68	-13	-6.68	-29.33	-23.32	0.87	6.66	V	Pass
4182	-21.96	-13	-8.96	-32.66	-26.55	0.97	7.71	V	Pass
5024	-26.96	-13	-13.96	-40.79	-32.63	1.09	8.91	V	Pass
5856	-33.44	-13	-20.44	-46.73	-39.88	1.22	9.81	V	Pass
6696	-43.18	-13	-30.18	-56.21	-50.40	1.25	10.62	V	Pass
7528	-41.01	-13	-28.01	-54.78	-48.91	1.42	11.47	V	Pass



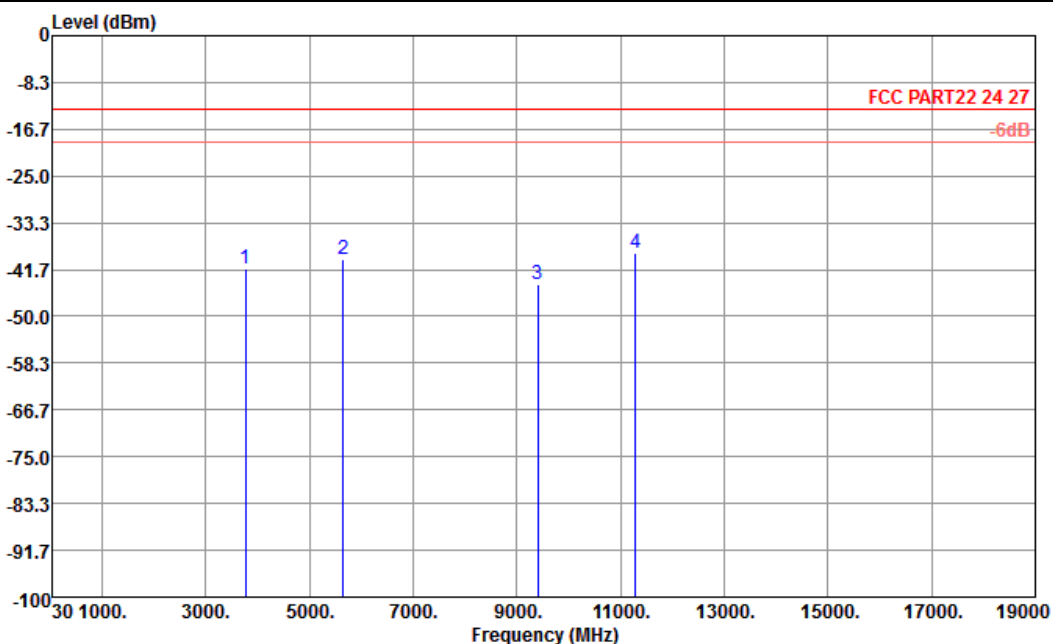
<b>Band :</b>	GSM1900	<b>Temperature :</b>	22~23°C
<b>Test Mode :</b>	GSM Link (GMSK)	<b>Relative Humidity :</b>	42~43%
<b>Test Engineer :</b>	Star Wei	<b>Polarization :</b>	Horizontal
<b>Remark :</b>	Spurious emissions within 30-1000MHz were found more than 20dB below limit line.		



Site : 03CH01-KS  
Condition : FCC PART22 24 27 HF\_EIRP\_FACTOR130726 HORIZONTAL  
EUT : (FG) 410702  
Plane : Y

Frequency ( MHz )	EIRP ( dBm )	Limit ( dBm )	Over Limit ( dB )	SPA Reading (dBm)	S.G. Power ( dBm )	TX Cable loss ( dB )	TX Antenna Gain (dBi)	Polarization (H/V)	Result
3760	-41.47	-13	-28.47	-53.50	-47.85	0.78	7.16	H	Pass
5640	-36.27	-13	-23.27	-51.06	-44.81	1.04	9.58	H	Pass
9399	-42.33	-13	-29.33	-60.12	-52.44	1.35	11.46	H	Pass
11280	-35.01	-13	-22.01	-58.24	-46.07	1.75	12.81	H	Pass

<b>Band :</b>	GSM1900	<b>Temperature :</b>	22~23°C
<b>Test Mode :</b>	GSM Link (GMSK)	<b>Relative Humidity :</b>	42~43%
<b>Test Engineer :</b>	Star Wei	<b>Polarization :</b>	Vertical
<b>Remark :</b>	Spurious emissions within 30-1000MHz were found more than 20dB below limit line.		



Site : 03CH01-KS  
Condition : FCC PART22 24 27 HF\_EIRP\_FACTOR130726 VERTICAL  
EUT : (FG) 410702  
Plane : Y

Frequency ( MHz )	EIRP ( dBm )	Limit ( dBm )	Over Limit ( dB )	SPA Reading (dBm)	S.G. Power ( dBm )	TX Cable loss ( dB )	TX Antenna Gain (dBi)	Polarization (H/V)	Result
3760	-41.61	-13	-28.61	-53.98	-47.99	0.78	7.16	V	Pass
5640	-39.70	-13	-26.70	-53.34	-48.24	1.04	9.58	V	Pass
9399	-44.19	-13	-31.19	-61.32	-54.30	1.35	11.46	V	Pass
11283	-38.60	-13	-25.60	-58.73	-49.66	1.75	12.81	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.

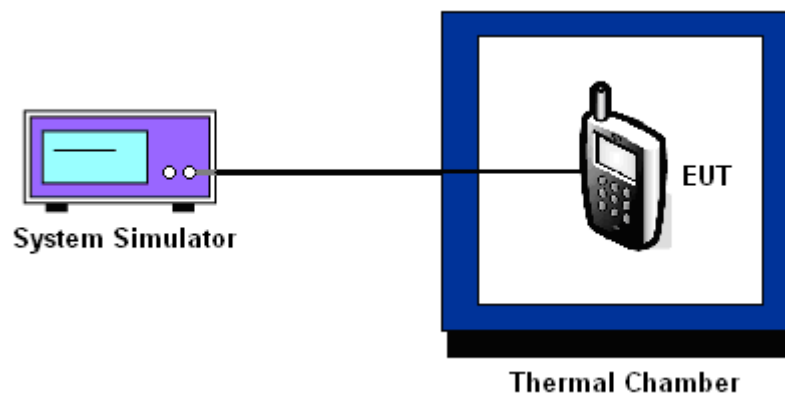
#### 3.8.3 Test Procedures for Temperature Variation

1. The EUT was set up in the thermal chamber and connected with the base station.
2. 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.
3. With power OFF, the temperature was raised in  $10^{\circ}\text{C}$  step 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 EUT was placed in a temperature chamber at  $25\pm 5^{\circ}\text{C}$  and connected with the base station.
2. The power supply voltage to the EUT was varied from BEP to 115% of the nominal value measured at the input to the EUT.
3. 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 850	<b>Channel :</b>	189
<b>Limit (ppm) :</b>	2.5	<b>Frequency :</b>	836.4 MHz

Temperature (°C)	GSM		Result
	Freq. Dev. (Hz)	Deviation (ppm)	
-30	-29	-0.03	PASS
-20	-24	-0.03	
-10	-25	-0.03	
0	-22	-0.03	
10	-27	-0.03	
20	-26	-0.03	
30	-28	-0.03	
40	-25	-0.03	
50	-27	-0.03	

<b>Band :</b>	GSM 1900	<b>Channel :</b>	661
<b>Limit (ppm) :</b>	2.5	<b>Frequency :</b>	1880.0 MHz

Temperature (°C)	GSM		Result
	Freq. Dev. (Hz)	Deviation (ppm)	
-30	-55	-0.03	PASS
-20	-52	-0.03	
-10	-57	-0.03	
0	-48	-0.03	
10	-54	-0.03	
20	-53	-0.03	
30	-51	-0.03	
40	-49	-0.03	
50	-58	-0.03	

**3.8.7 Test Result of Voltage Variation**

Band & Channel	Mode	Voltage (Volt)	Freq. Dev. (Hz)	Deviation (ppm)	Limit (ppm)	Result
GSM 850 CH189	GSM	3.8	-26	-0.03	2.5	PASS
		BEP	-25	-0.03		
		4.2	-28	-0.03		
GSM 1900 CH661	GSM	3.8	-53	-0.03		
		BEP	-51	-0.03		
		4.2	-55	-0.03		

**Note:**

1. Normal Voltage = 3.8V.
2. Battery End Point (BEP) = 3.6 V.

## 4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Spectrum Analyzer	R&S	FSP30	101400	9kHz~30GHz	Mar. 28, 2013	Jan. 12, 2014	Mar. 27, 2014	Conducted (TH01-SZ)
Spectrum Analyzer	R&S	FSV30	100845	9kHz~30GHz; Max input Power	Dec. 04, 2013	Jan. 12, 2014	Dec. 03, 2014	Conducted (TH01-SZ)
Power Meter	Anritsu	ML2495A	1218010	13dBm~-20dBm	Mar. 28, 2013	Jan. 12, 2014	Mar. 27, 2014	Conducted (TH01-SZ)
Power Sensor	Anritsu	MA2411B	1207253	0.3GHz~40GHz	Mar. 28, 2013	Jan. 12, 2014	Mar. 27, 2014	Conducted (TH01-SZ)
Thermal Chamber	Hongzhan	LP-150U	HD20120425	-40℃~150℃	Mar. 28, 2013	Jan. 12, 2014	Mar. 27, 2014	Conducted (TH01-SZ)
EMI Test Receiver	R&S	ESCI	100534	9kHz~3GHz / Max-input30dBm	Nov. 05, 2013	Jan. 13, 2014	Nov. 04, 2014	Radiation (03CH01-KS)
Spectrum Analyzer	R&S	FSP30	101399	9kHz~30GHz;Max-input 30dBm	May 23, 2013	Jan. 13, 2014	May 22, 2014	Radiation (03CH01-KS)
Bilog Antenna	SCHAFFNER	CBL6112D	23182	25MHz~2GHz	Dec. 06, 2013	Jan. 13, 2014	Dec. 05, 2014	Radiation (03CH01-KS)
Double Ridge Horn Antenna	EMCO	3117	00075959	1GHz~18GHz	Dec. 06, 2013	Jan. 13, 2014	Dec. 05, 2014	Radiation (03CH01-KS)
SHF-EHF Horn	Schwarzbeck	BBHA 9170	BBHA170249	15GHz~40GHz	Nov. 22, 2013	Jan. 13, 2014	Nov. 21, 2014	Radiation (03CH01-KS)
Active Horn Antenna	com-power	AHA-118	701030	1GHz~18GHz /AMP 25dB +/- 2	Nov. 18, 2013	Jan. 13, 2014	Nov. 17, 2014	Radiation (03CH01-KS)
Amplifier	com-power	PA-103A	161069	1MHz~1GHz /32 dB	May 23, 2013	Jan. 13, 2014	May 22, 2014	Radiation (03CH01-KS)
Amplifier	Agilent	8449B	3008A02370	1GHz~26.5GHz >23dB	Dec. 29, 2013	Jan. 13, 2014	Dec. 28, 2014	Radiation (03CH01-KS)
Turn Table	MF	MF7802	N/A	0~360 degree	NCR	Jan. 13, 2014	NCR	Radiation (03CH01-KS)
Antenna Mast	MF	MF7802	N/A	1 m~4 m	NCR	Jan. 13, 2014	NCR	Radiation (03CH01-KS)
Spectrum Analyzer	R&S	FSP 7	100818	9kHz~7GHz	Sep. 03, 2013	Jan. 12, 2014	Sep. 02, 2014	ERP/EIRP (OTA01-SZ)
Quad-Ridged Horn	ETS-Lindgren	3164-08	00102954	700MHz~10000M Hz	NCR	Jan. 12, 2014	NCR	ERP/EIRP (OTA01-SZ)
Multi-Devices Controller	ETS-Lindgren	2090-OPT1	00108147	N/A	NCR	Jan. 12, 2014	NCR	ERP/EIRP (OTA01-SZ)
Switch Control Mainframe	Agilent	3499A	MY42005451	N/A	NCR	Jan. 12, 2014	NCR	ERP/EIRP (OTA01-SZ)

## 5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	3.90
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