

## ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

### INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 24 SUBPART E REQUIREMENT

OF

**Product Name:** Bar phone

**Brand Name:** Doro

**Model No.:** DFB-0060

**Model Difference:** N/A

**FCC ID:** WS5DFB0060

**Report No.:** E2/2016/40047

**Issue Date:** May 12, 2016

**FCC Rule Part:** 2 , 24E

**Prepared for:** Doro AB  
Doro AB Magistratsvägen 10, SE-22643 Lund,  
Sweden

**Prepared by:** SGS Taiwan Ltd.  
Electronics & Communication Laboratory  
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Taiwan 333

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## VERIFICATION OF COMPLIANCE

**Applicant:** Doro AB  
Doro AB Magistratsvägen 10, SE-22643 Lund, Sweden

**Product Name:** Bar phone

**Brand Name:** Doro

**Model No.:** DFB-0060

**Model Difference:** N/A

**FCC ID:** WS5DFB0060

**Report Number:** E2/2016/40047

**Date of test:** Apr. 20, 2016 ~ May 06, 2016

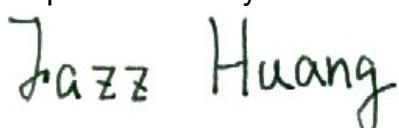
**Date of EUT Received:** Apr. 20, 2016

**We hereby certify that:**

The above equipment was tested by SGS Taiwan Ltd. Electronics & Communication Laboratory  
The test data, data evaluation, test procedures, and equipment configurations shown in this report  
were made in accordance with the procedures given in TIA/EIA-603-C-2004 and the energy  
emitted by the sample EUT tested as described in this report is in compliance with conducted  
and radiated emission limits.

The test results of this report relate only to the tested sample identified in this report.

**Test By:**



**Date:**

May 12, 2016

*Jazz Huang / Asst. Supervisor*

**Prepared By:**



**Date:**

May 12, 2016

*Violetta Tang / Clerk*

**Approved By:**



**Date:**

May 12, 2016

*Jim Chang / Asst. Manager*

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## Revision History

Report Number	Revision	Description	Issue Date
E2/2016/40047	Rev.00	Initial creation of document	May 12, 2016

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## 1. GENERAL PRODUCT INFORMATION

### 1.1. Product Description

General:

Product Name:	Bar phone		
Brand Name:	Doro		
Model No.:	DFB-0060		
Model Difference:	N/A		
SW Version:	5030_DL08_S01A_V03_M0160122_GCF		
HW Version:	V02		
Docking:	Model No.: DFB-0060; Supplier: Shenzhen Bajunda Electronic Co., Ltd		
Data Cable (USB):	1. Model No.: M039B0800150; Supplier: SHENZHEN FKY-QY HARDWARE ELECTRONIC CO., LTD 2. Model No.: PLU00000780F; Supplier: Dongguan Ming Electronics Co., Ltd.		
Earphone:	1. Model No.: JWEP0782-M01; Supplier: Huizhou Ju Wei Electronics Co., Ltd. 2. Model No.: 150C-333E-3.5MM-19; Supplier: BOLUO COUNTY QUANCHENG ELECTRONIC CO., LTD		
Power Supply:	3.7Vdc from Rechargeable Li-ion Battery		
	Battery:	Model No.: DBC-800D; Supplier: NINGBO VEKEN BATTERY CO., LTD	

GSM:

Cellular Phone Standards Frequency Range and Power:	Operating Frequency		Rated Power
	GSM 1900	1850.2MHz – 1909.8MHz	30dBm
Type of Emission:	GSM 1900		246KGXW
IMEI:	357088070003904		
Antenna Type / Gain:	PIFA Antenna; Model No.: RT039-X183; Supplier: RayTech, Gain: -1dBi		

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Max ERP/EIRP measurement result:

	dBm	W
GSM 1900 Band	31.10	EIRP 1.288

## 1.2. Product Feature of Equipment Under Test

The equipment under Test (Hereafter Called: EUT) is Bar phone supporting GSM & BT features, and below is details of information.

Product Feature	
Product Name:	Bar phone
Brand Name:	Doro
Model No.:	DFB-0060
Model Difference:	N/A
FCC ID:	WS5DFB0060
GSM Operating Band(s):	GSM 1900MHz
GRPS / EGPRS Multi Slot Class:	Class 8
Bluetooth Version:	V3.0 single mode
Receiver Difference:	1. Model No.: RECEIVER-615-2-SC-FRANKLIN; Supplier: Knowles 2. Model No.: RR150620LM08; Supplier: Gettop

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

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### 1.3. Test Methodology of Applied Standards

FCC 47 CFR Part 2, 24.

ANSI / TIA / EIA 603C-C-2004

KDB971168 D01 Power Meas license Digital System

KDB941225 of the Output power Procedure of (SAR Measurement Procedures for 3G Devices, WCDMA / HSPA) was used for EUT and Base station setting.

TS 151 010-1 is used to set, and measure the output power.

Note:

1. All test items have been performed and record as per the above standards.
2. The composite system is compliance with FCC Subpart B is authorized under the certification procedure.

### 1.4. Test Facility

SGS Taiwan Ltd. Electronics & Communication Laboratory No.2, Keji 1st Rd., Guishan District, Taoyuan City, Taiwan 333. (TAF code 0513)

FCC Registration Numbers are: 735305

Canada Registration Number: 4620A-5.

### 1.5. Special Accessories

No special accessories were used during testing.

### 1.6. Equipment Modifications

There were no modifications incorporated into the EUT.

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## 2. SYSTEM TEST CONFIGURATION

### 2.1. EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

### 2.2. EUT Exercise

The EUT (Transmitter) was operated in the continuous transmission mode employed with the simulator of the Base Station that fixates at test default channels to fix the Tx frequency which was for the purpose of the measurements.

### 2.3. Test Procedure

#### 2.3.1 Conducted Measurement at Antenna Port

According to measurement procured TIA/EIA 603C, the EUT is placed on a turn table which is 0.8 m above ground plane. A low loss of RF cable was used to connect the antenna port of EUT to measurement equipment.

#### 2.3.2 Radiated Emissions (ERP/EIRP)

According to measurement procured TIA/EIA 603C, The EUT is a placed on as turn table which is 0.8 m above ground plane. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both Horizontal and Vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna according to the requirements in Section 8 and 13.

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

#### Note:

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

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

Low Band: Offset = RF cable loss (dB) + attenuation factor (dB) = N/A

High Band: Offset = RF cable loss (dB) + attenuation factor (dB) = 14.7(dB)

## 2.5. Final Amplifier Voltage and Current Information:

Test Mode	DC voltage (V)	DC current (mA)
GSM 1900	3.7V	286

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## 2.6. Configuration of Tested System

Fig. 2-1 Configuration of Tested System (Fixed Channel-Conducted & Radiated)

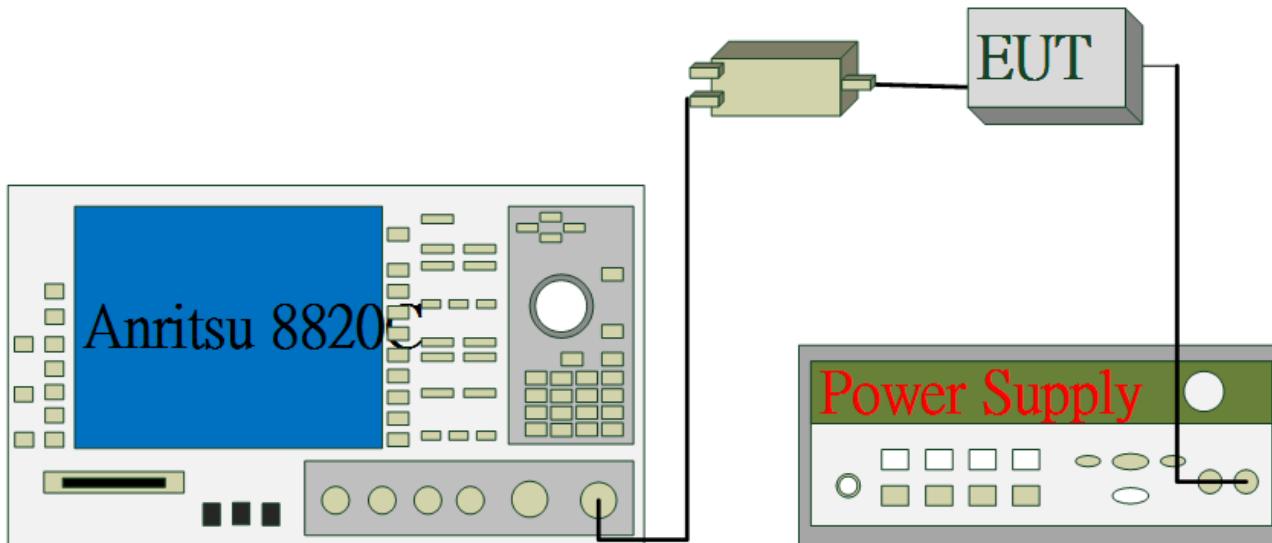


Table 2-1 Equipment Used in

Item	Equipment	Mfr/Brand	Model/ Type No.	Series No.	Data Cable	Power Cord
1.	Universal Radio Communication Tester	Anritsu	MT8820C	6201107337	shielded	Un-shielded
2.	DC Power Supply	Agilent	E3640A	MY53140006	shielded	Un-shielded
3.	Adapter	doro	A31-500550	N/A	N/A	N/A
4.	Adapter	doro	A85-501000	N/A	N/A	N/A
5.	Adapter	doro	A2-501000	N/A	N/A	N/A

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### 3. SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§2.1046(a)	RF Power Output	Compliant
§2.1046(a) §24.232(c)	ERP/ EIRP measurement	Compliant
§2.1049(h)	Occupied Bandwidth	Compliant
§2.1051 §24.238(a)	Out of Band Emissions at Antenna Terminals and Band Edge	Compliant
§2.1053 §24.238(a)	Field Strength of Spurious Radiation	Compliant
§24.232(d)	Peak to Average Ratio	Compliant
§2.1055(a)(1) §24.235	Frequency Stability	Compliant

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## 4. DESCRIPTION OF TEST MODES

### 4.1. The Worst Test Modes and Channel Details

1. The EUT has been tested under operating condition.
2. Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis and antenna ports.

Following channel(s) was (were) selected for the final test as listed below:

BAND	ERP/EIRP	RADIATED EMISSION
GSM 1900	E2-plan	E2-plan

### GSM MODE

TEST ITEM	AVAILABLE CHANNEL	TESTED CHANNEL	MODE
EIRP	512 to 810	512, 661, 810	GSM 1900
FREQUENCY STABILITY	512 to 810	661	GSM 1900
OCCUPIED BANDWIDTH	512 to 810	512, 661, 810	GSM 1900
PEAK TO AVERAGE RATIO	512 to 810	512, 661, 810	GSM 1900
BAND EDGE	512 to 810	512, 810	GSM 1900
CONDUCTED EMISSION	512 to 810	512, 661, 810	GSM 1900
RADIATED EMISSION	512 to 810	512, 661, 810	GSM 1900

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## 5. MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
RF Power Output	+/- 1.10 dB
ERP/ EIRP measurement	Vertical Polarization = +/- 4.74dB Horizontal Polarization = +/- 4.62dB
99% Occupied Bandwidth	+/- 5.19 Hz
Out of Band Emissions at Antenna Terminals and Band Edge	+/- 0.70 dB
Peak to Average Ratio	+/- 0.70 dB
Frequency Stability vs. Temperature	+/- 5.19 Hz
Frequency Stability vs. Voltage	+/- 5.19 Hz
Temperature	+/- 0.65 °C
Humidity	+/- 4.6 %
DC / AC Power Source	DC= +/- 0.13%, AC=+/- 0.2%

### Radiated Spurious Emission:

Measurement uncertainty (Polarization : <b>Vertical</b> )	9kHz - 30MHz: +/- 2.87dB
	30MHz - 180MHz: +/- 3.37dB
	180MHz -417MHz: +/- 3.19dB
	0.417GHz-1GHz: +/- 3.19dB
	1GHz - 18GHz: +/- 4.04dB
	18GHz - 40GHz: +/- 4.04dB

Measurement uncertainty (Polarization : <b>Horizontal</b> )	9kHz - 30MHz: +/- 2.87dB
	30MHz - 167MHz: +/- 4.22dB
	167MHz -500MHz: +/- 3.44dB
	0.5GHz-1GHz: +/- 3.39dB
	1GHz - 18GHz: +/- 4.08dB
	18GHz - 40GHz: +/- 4.08dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

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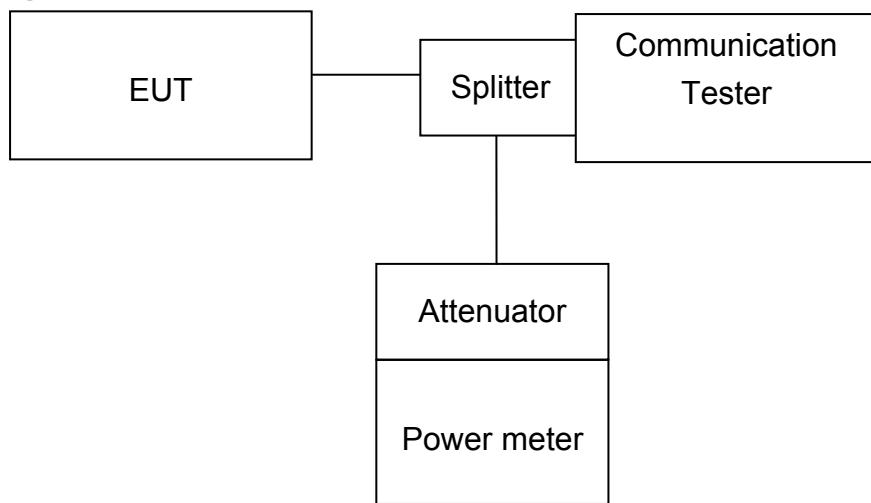
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## 6. RF CONDUCTED OUTPUT POWER MEASUREMENT

### 6.1. Standard Applicable

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.

### 6.2. Test Set-up



**Note:** Measurement setup for testing on Antenna connector

### 6.3. Measurement Procedure

The transmitter output was connected to a calibrated attenuator, the other end of which was connected to a power meter. Transmitter output was read off the power meter in dBm. The power output at the transmitter antenna port was determined by adding the value of the attenuator to the power meter reading. TS 151 010-1 is reference to conduct the test measurement of output power.

The Procedure of KDB941225 (SAR Measurement Procedures for 3G devices, (WCDMA/HSPA) was used for EUT and Base station setting. RMC 12.2kps is used for this testing, and KDB 971168 D01 Power Meas License Digital System as the supplemental test methodology to adjust the proper setting obtaining the measurement results

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## 6.4. Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	KEYSIGHT	N9010A	MY54510568	04/14/2016	04/13/2017
Power Meter	Anritsu	ML2496A	1326001	06/23/2015	06/22/2016
Power Sensor	Anritsu	MA2411B	1315048	06/23/2015	06/22/2016
Power Sensor	Anritsu	MA2411B	1315049	06/23/2015	06/22/2016
Coaxial Cable 30cm	WOKEN	00100A1F1A195C	RF01	12/12/2015	12/11/2016
DC Block	PASTERNACK	PE8210	RF29	12/12/2015	12/11/2016
Splitter	RF-LAMBAD	RFLT2W1G18G	RF35	12/12/2015	12/11/2016
Attenuator	WOKEN	218FS-10	RF23	12/12/2015	12/11/2016
Temperature Chamber	TERCHY	MHK-120LK	1020582	06/23/2015	06/22/2016
Communication Tester	Anritsu	MT8820C	6201107337	05/27/2015	05/26/2016

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## 6.5. Measurement Result

### RF Conducted Output Power

#### GSM (GMSK; 8-PSK) Result:

EUT Mode	Frequency (MHz)	CH	Peak Power (4DN 1UP) Class 8 (dBm)	Average Burst Power (4DN 1UP) Class 8 (dBm)
GSM 1900	1850.2	512	29.55	29.35
	1880.0	661	<b>29.65</b>	29.45
	1909.8	810	29.49	29.38

### Minimum Communications Power Measurement

#### PCS 1900 band

PCL	0	1	2	3	4	5	6	7	8
Output power (dBm)	29.4	27.2	25.7	23.7	21.8	19.9	18	16.1	14.1

PCL	9	10	11	12	13	14	15
Output power (dBm)	12.2	10.2	8.1	6.3	4.5	2.8	0.8

Note: The EUT output power was controlled by simulator. Set Communication Tester CMU200 PCL as above, and get the mobile phone output power reading.

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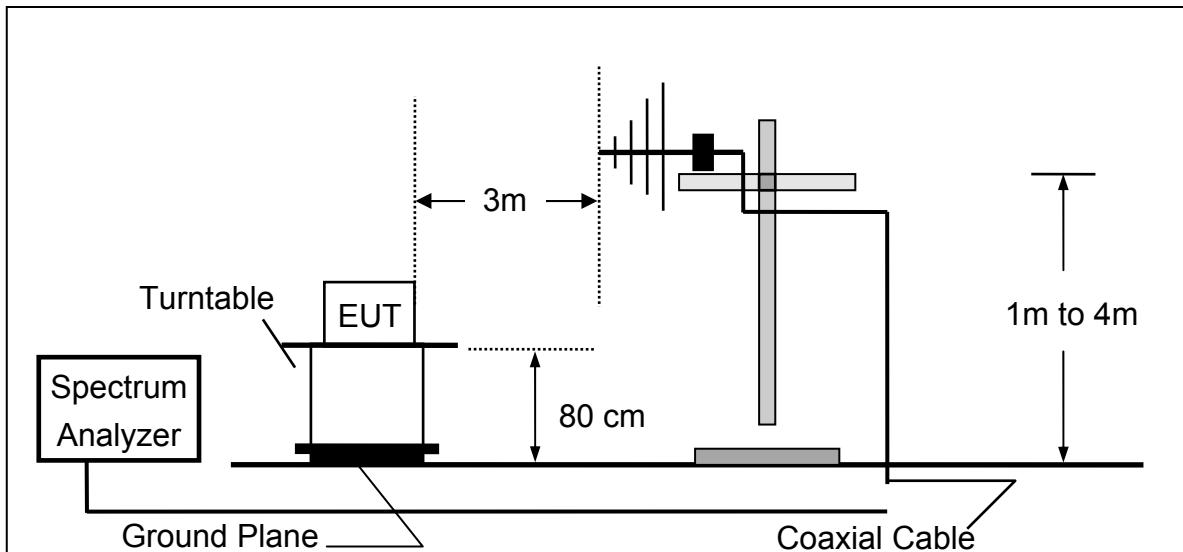
## 7. EFFECTIVE RADIATED POWER AND EQUIVALENT ISOTROPIC RADIATED POWER MEASUREMENT

### 7.1. Standard Applicable

FCC 24.232(b) Mobile station is limited to 2W.

### 7.2. Test SET-UP

(A) Radiated Power Test Set-Up, Frequency Below 1000MHz

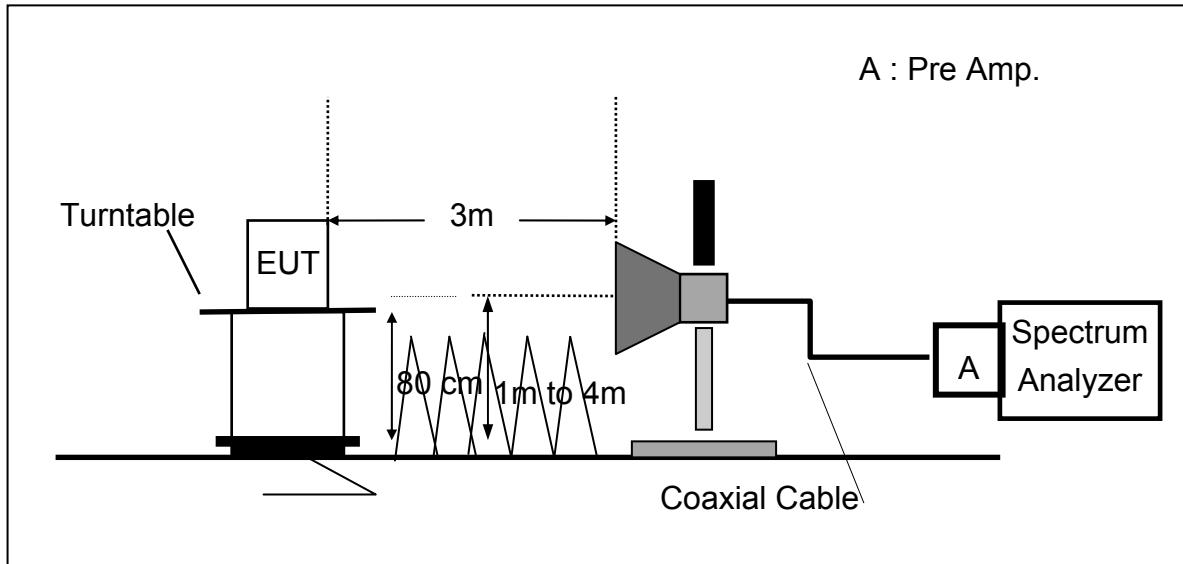


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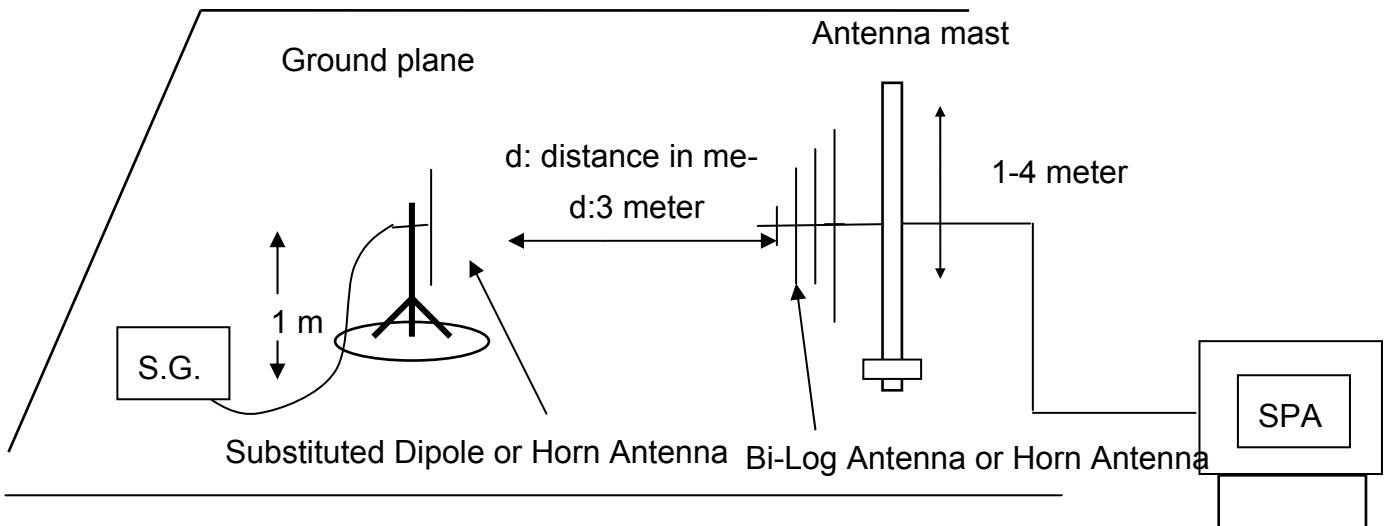
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## (B) Radiated Power Test Set-UP Frequency Over 1 GHz



## (C) Substituted Method Test Set-UP



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### 7.3. Measurement Procedure

1. The testing follows the Measurement Procedure of FCC KDB 971168 D01
2. The EUT was placed on a non-conductive turntable using a non-conductive support. The radiated emission at the fundamental frequency was measured at 3 m with a test antenna and EMI spectrum analyzer.
3. During the measurement, the EUT was communication with the station. The highest emission was recorded with the rotation of the turntable and the lowering of the test antenna from 4m to 1m. The reading was recorded and the field strength (E in dBuV/m) was calculated
4. The testing follows the Measurement Procedure of FCC KDB 971168 D01
5. The substitution horn antenna is substituted for EUT at the same position and signals generator export the CW signal to the substitution antenna via a tx cable. Rotated the Turn Table and moved receiving antenna to find the maximum radiation power. Adjust output power level of S.G to get a Value of spectrum reading equal to "Read Value" of step b. Record the power level of S.G.
6.  $ERP = S.G. \text{ output (dBm)} + \text{Antenna Gain (dBD)} - \text{Cable Loss (dB)}$
7.  $ERP = S.G. \text{ output (dBm)} + \text{Antenna Gain (dBD)} - \text{Cable Loss (dB)}$
8. Spectrum setting:
  - (1) Detector = Peak, marker the highest value of the detector by maximum hold, set RBW wide enough to capture the entire signal of emission, and  $VBW > =3 \times RBW$ .
  - (2) KDB 971168 D01 is adopted, and the procedure as lists under item 4, Measurement of the Average Power over the Fundamental Signal Bandwidth, is followed to set correspondingly for the acquisition of proper measurement data.

Set frequency = nominal signal center frequency;  
Set span = 2 X occupied BW;  
Set RBW  $\approx 1\sim 5\%$  of the span, not to exceed 1 MHz  
Set VBW = 3 x RBW;  
Select average power (RMS) detector  
Set sweep time and number of measurement points to achieve a minimum of 1 millisecond/pt integration time (ex. Point = 601points, then sweep time =  $601 \times 10^{-3} = 6$  s).

Activate trace averaging routine over a minimum of 10 sweeps;  
Activate marker/span pair and set span = signal or channel bandwidth;  
Activate the band/interval power marker function;  
Record the band power level;

Record adjusted value as the average signal power level. Then activate the occupied bandwidth measurement function.

The proper adjustment due to limitation of spectrum capability is given compensated to spectrum with conversion factor of  $10 \times \log(TBW/RBW)$ , where TBW is the transmission of UE exceeding the maximum BW UE can extends, and RBW is the resolution BW in UE.

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## 7.4. Measurement Equipment Used

SGS 966 Chamber No.C					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
EMI Test Receiver	R&S	ESU 40	100363	04/09/2016	04/08/2017
Loop Antenna	ETS-Lindgren	6502	143303	12/23/2015	12/22/2016
Broadband Antenna	TESEQ	CBL 6112D	35240	10/28/2015	10/27/2016
Horn Antenna	ETS-Lindgren	3117	143272	12/16/2015	12/15/2016
Horn Antenna	Schwarzbeck	BBHA9170	185	07/24/2015	07/23/2016
Pre Amplifier	EMC Instruments	EMC330	980096	12/12/2015	12/11/2016
Pre Amplifier	EMC Instruments	EMC0011830	980199	12/12/2015	12/11/2016
Pre Amplifier	EMC Instruments	EMC184045B	980135	12/12/2015	12/11/2016
Coaxial Cable	Huber+Suhner	RG 214/U	966Rx 9K-30M	12/12/2015	12/11/2016
Coaxial Cable	Huber+Suhner	RG 214/U+SUCAFLEX 104	966Rx 30M-3G	12/12/2015	12/11/2016
Coaxial Cable	Huber+Suhner	SUCAFLEX 104	966Rx 1G-18G	12/12/2015	12/11/2016
Coaxial Cable	Huber+Suhner	SUCAFLEX 104	966Tx 30M-18G	12/12/2015	12/11/2016
Coaxial Cable	Huber+Suhner	SUCAFLEX 102	966Tx 18G-40G	12/12/2015	12/11/2016
Coaxial Cable	Huber+Suhner	mini 141-12+SUCAFLEX X 104	966Rx 18G-40G	12/12/2015	12/11/2016
Attenuator	WOKEN	218FS-10	RF27	12/12/2015	12/11/2016
Site NSA	SGS	966 Chamber C	SAC-C	03/04/2016	03/03/2017
Site VSWR	SGS	966 Chamber C	SAC-C	03/04/2016	03/03/2017
Controller	MF	MF-7802	N/A	N.C.R.	N.C.R.
Antenna Master	MF	N/A	N/A	N.C.R.	N.C.R.
Turn Table	MF	N/A	N/A	N.C.R.	N.C.R.
Test Software	World-Pallas	Dr. E	V 3.0 Lite	N.C.R.	N.C.R.
Communication Tester	Anritsu	MT8820C	6.201E+09	05/27/2015	05/26/2016

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## 7.5. Measurement Result: (Peak) –using option of peak measurement

EUT			Measurement					
Operation Band	Fundamental Frequency	CH	Antenna Pol.	S.G. Output	Antenna Gain	Cable Loss	EIRP	Limit
	MHz		V/H	dBm	dBi	dB	dBm	dBm
GSM 1900	1850.2	512	V	16.73	9.59	-5.04	21.28	33.01
			H	24.97	9.59	-5.04	29.52	33.01
	1880.0	661	V	18.62	9.69	-5.15	23.16	33.01
			H	26.56	9.69	-5.15	<b>31.10</b>	33.01
	1909.8	810	V	12.30	9.79	-5.12	16.97	33.01
			H	24.18	9.79	-5.12	28.85	33.01

Remark :

(1) The RBW,VBW of SPA for frequency RBW=300 KHz, VBW=1MHz

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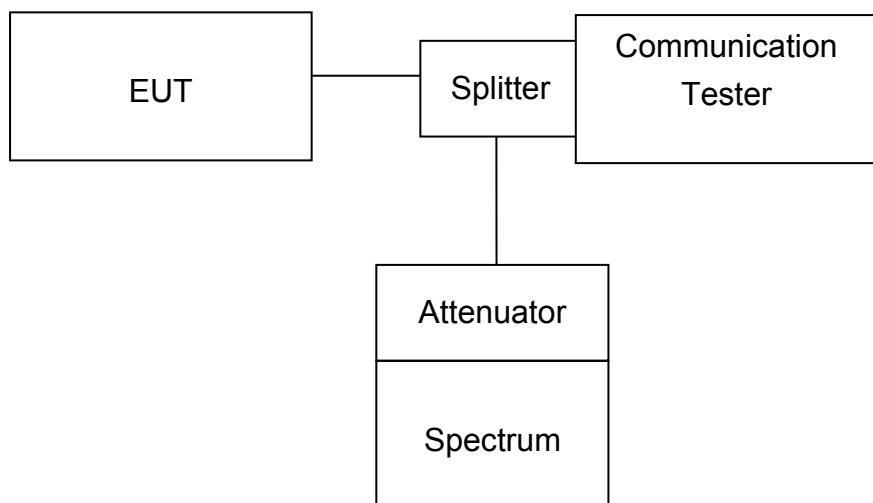
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## 8. OCCUPIED BANDWIDTH MEASUREMENT

### 8.1. Standard Applicable

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power.

### 8.2. Test Set-up



### 8.3. Measurement Procedure

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

***NOTE: For the plot of bandwidth measurement, the marker of the 99% bandwidth is diamond-shape while the marker of the 26dB BW is arrow-mark***

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## 8.4. Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	KEYSIGHT	N9010A	MY54510568	04/14/2016	04/13/2017
Power Meter	Anritsu	ML2496A	1326001	06/23/2015	06/22/2016
Power Sensor	Anritsu	MA2411B	1315048	06/23/2015	06/22/2016
Power Sensor	Anritsu	MA2411B	1315049	06/23/2015	06/22/2016
Coaxial Cable 30cm	WOKEN	00100A1F1A195C	RF01	12/12/2015	12/11/2016
DC Block	PASTERNACK	PE8210	RF29	12/12/2015	12/11/2016
Splitter	RF-LAMBAD	RFLT2W1G18G	RF35	12/12/2015	12/11/2016
Attenuator	WOKEN	218FS-10	RF23	12/12/2015	12/11/2016
Temperature Chamber	TERCHY	MHK-120LK	1020582	06/23/2015	06/22/2016
Communication Tester	Anritsu	MT8820C	6201107337	05/27/2015	05/26/2016

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## 8.5. Measurement Result

### 99% Bandwidth

Frequency (MHz)	CH	99% Bandwidth (kHz)
		GSM 1900
1850.20	512	244.42
1880.00	661	244.15
1909.80	810	<b>245.90</b>

### 26dB Bandwidth

Frequency (MHz)	CH	26dB Bandwidth (kHz)
		GSM 1900
1850.20	512	<b>318.3</b>
1880.00	661	315.9
1909.80	810	316.4

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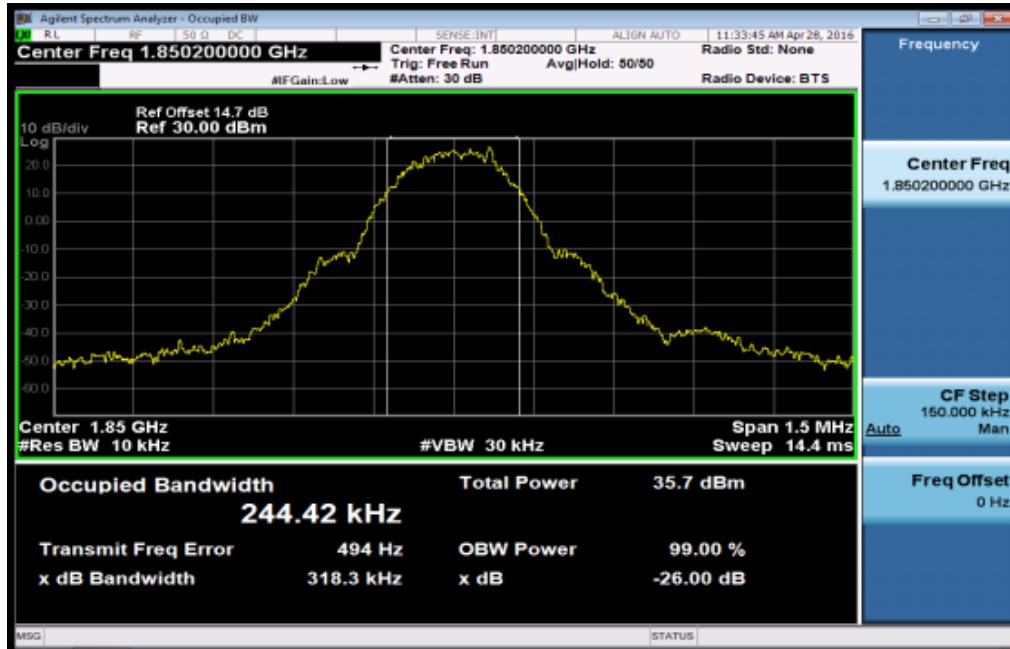
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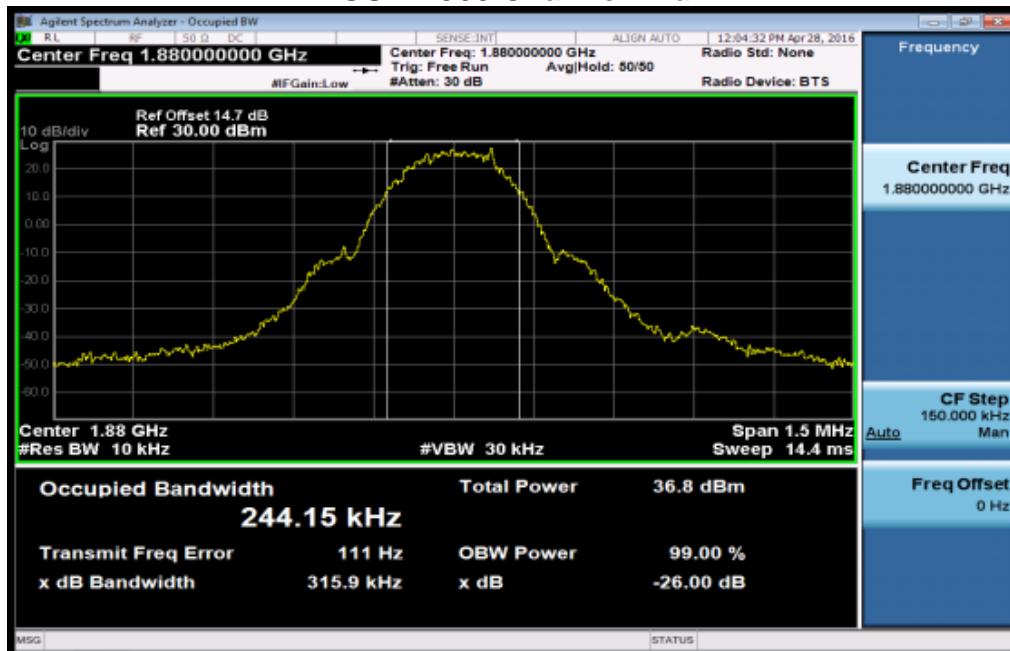
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## 99% & 26dB Bandwidth Test Data

### GSM 1900 Channel Low



### GSM 1900 Channel Mid

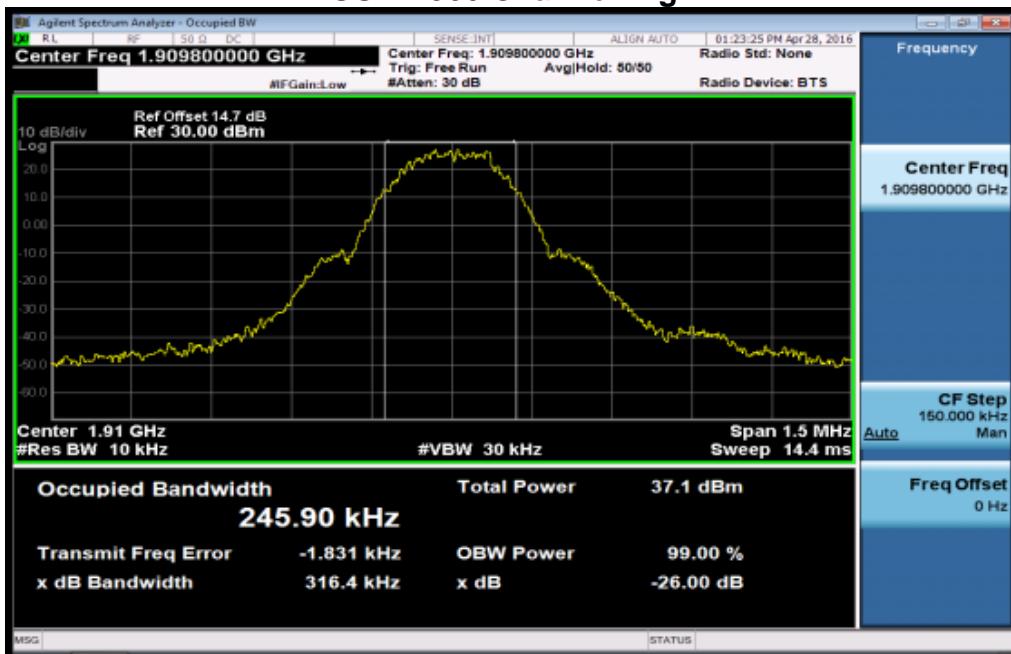


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## GSM 1900 Channel High



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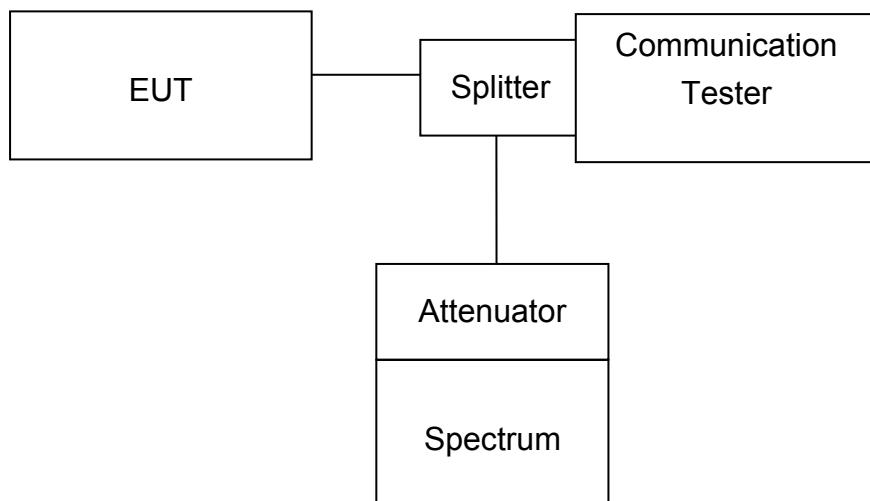
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## 9. OUT OF BAND EMISSION AT ANTENNA TERMINALS

### 9.1. Standard Applicable

FCC §24.238(a) the magnitude of each spurious and harmonic emission that can be detected when the equipment is operated under the conditions specified in the instruction manual and/or alignment procedure, shall not be less than  $43 + 10 \log$  (mean output power in watts) dBc below the mean power output outside a license's frequency block (-13dBm).

### 9.2. Test SET-UP



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### 9.3. Measurement Procedure

#### Conducted Emission

The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 1MHz, sufficient scans were taken to show the out of band Emissions if any up to 10th harmonic.

1. To connect Antenna Port of EUT to Spectrum.
2. Set RBW = 1MHz & VBW = 1MHz on Spectrum.
3. Allow trace to fully stabilize
4. Repeat above procedures until all default test channel measured were complete.

#### Band Edge

1. To connect Antenna Port of EUT to Spectrum.
2. The band edge of low and high channels for the highest RF powers was measured. Setting RBW  $\geq$  1% EBW.
3. Allow trace to fully stabilize
4. Repeat above procedures until all default test channel measured were complete.

### 9.4. Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	KEYSIGHT	N9010A	MY54510568	04/14/2016	04/13/2017
Power Meter	Anritsu	ML2496A	1326001	06/23/2015	06/22/2016
Power Sensor	Anritsu	MA2411B	1315048	06/23/2015	06/22/2016
Power Sensor	Anritsu	MA2411B	1315049	06/23/2015	06/22/2016
Coaxial Cable 30cm	WOKEN	00100A1F1A195C	RF01	12/12/2015	12/11/2016
DC Block	PASTERNACK	PE8210	RF29	12/12/2015	12/11/2016
Splitter	RF-LAMBAD	RFLT2W1G18G	RF35	12/12/2015	12/11/2016
Attenuator	WOKEN	218FS-10	RF23	12/12/2015	12/11/2016
Temperature Chamber	TERCHY	MHK-120LK	1020582	06/23/2015	06/22/2016
Communication Tester	Anritsu	MT8820C	6201107337	05/27/2015	05/26/2016

### 9.5. Measurement Result:

Refer to next pages.

**NOTE: The occurrence of the spike on the conducted emission is the signal of the fundamental emission.**

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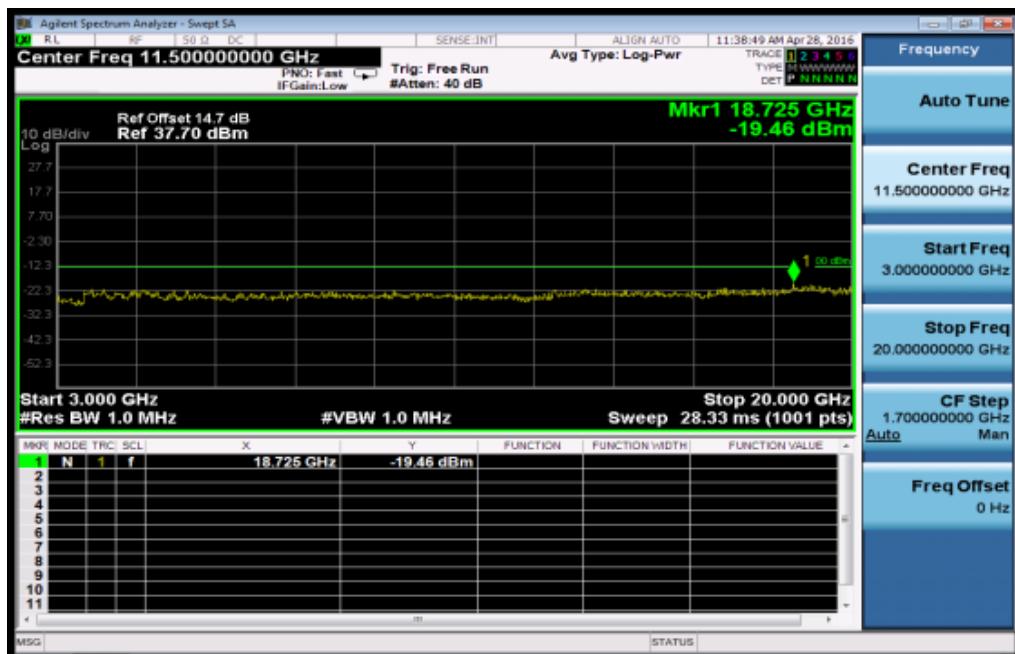
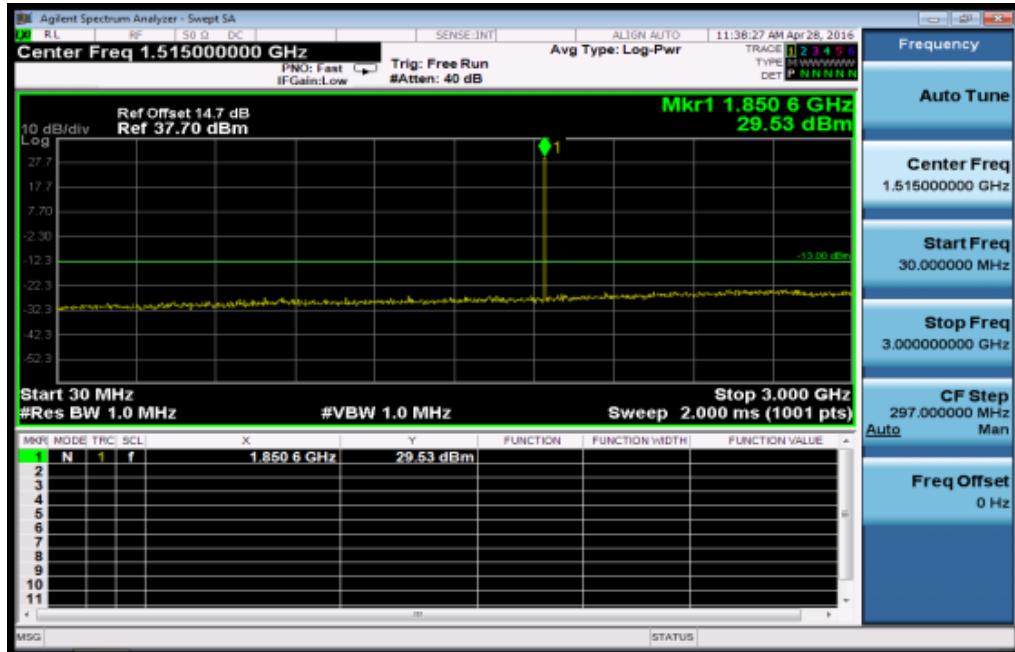
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## **Out of Band emission at antenna terminals – GSM 1900 Channel Lowest**



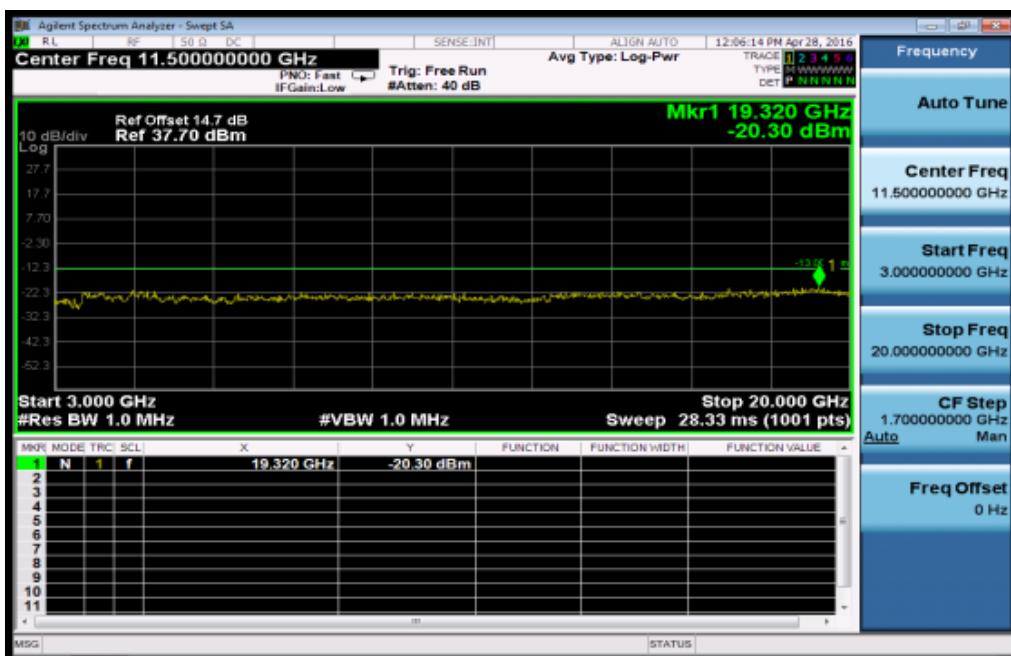
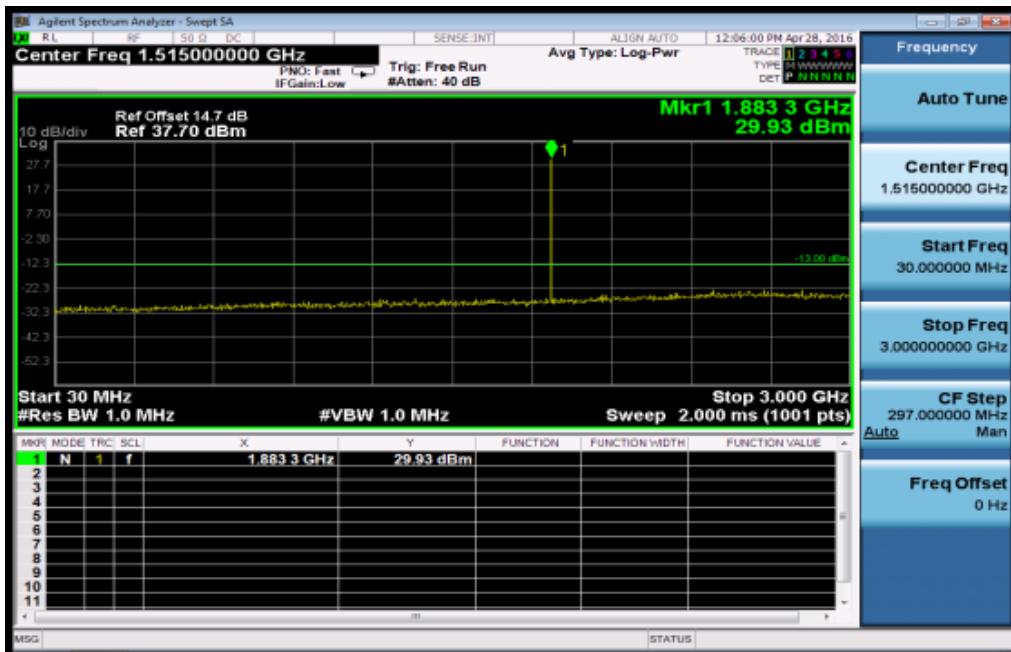
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## Out of Band emission at antenna terminals – GSM 1900 Channel Mid

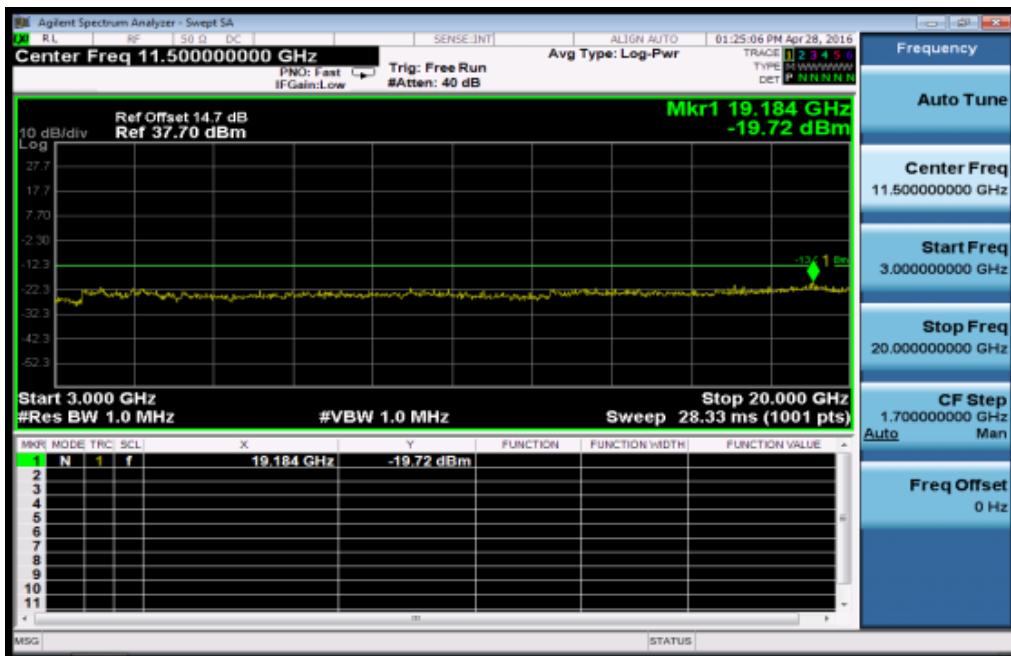
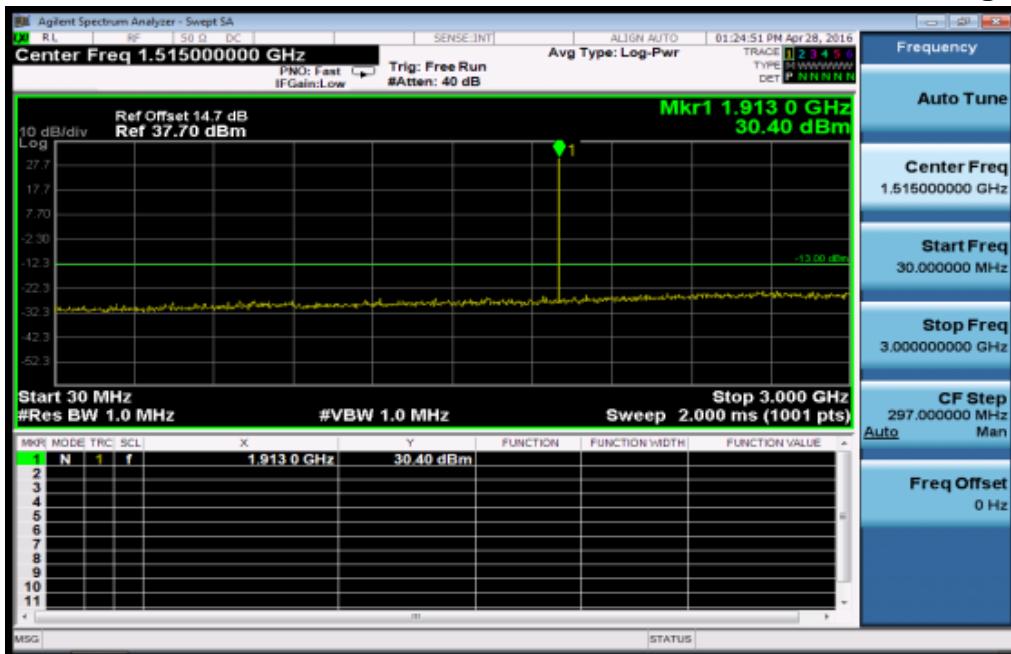


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## Out of Band emission at antenna terminals – GSM 1900 Channel Highest

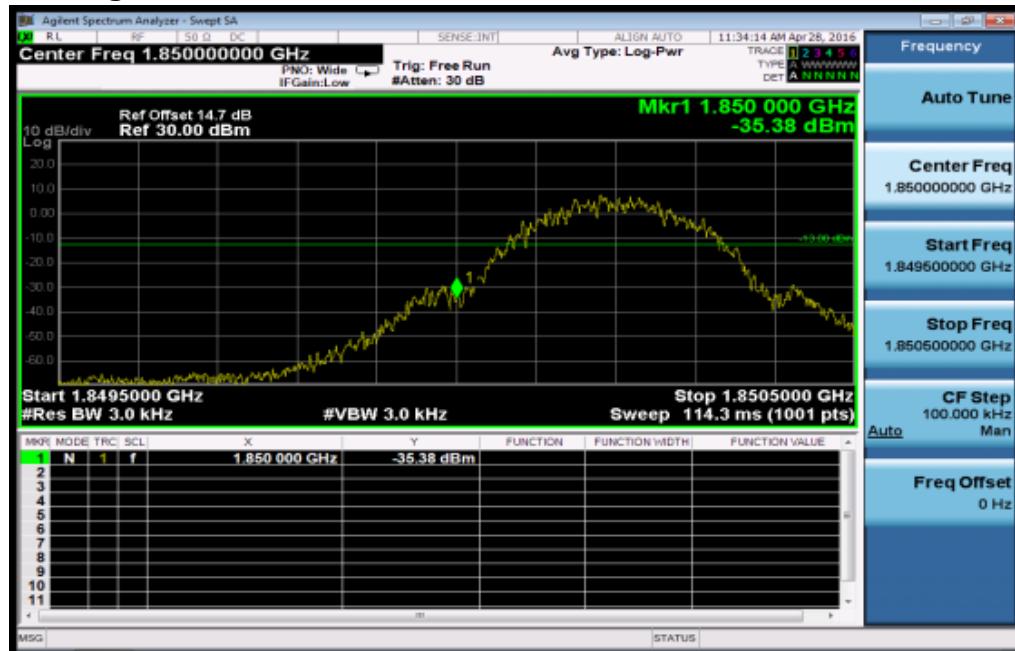


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## Band edge emission at antenna terminals – GSM 1900 Channel Lowest



## Band edge emission at antenna terminals – GSM 1900 Channel Highest



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## 10. FIELD STRENGTH OF SPURIOUS RADIATION MEASUREMENT

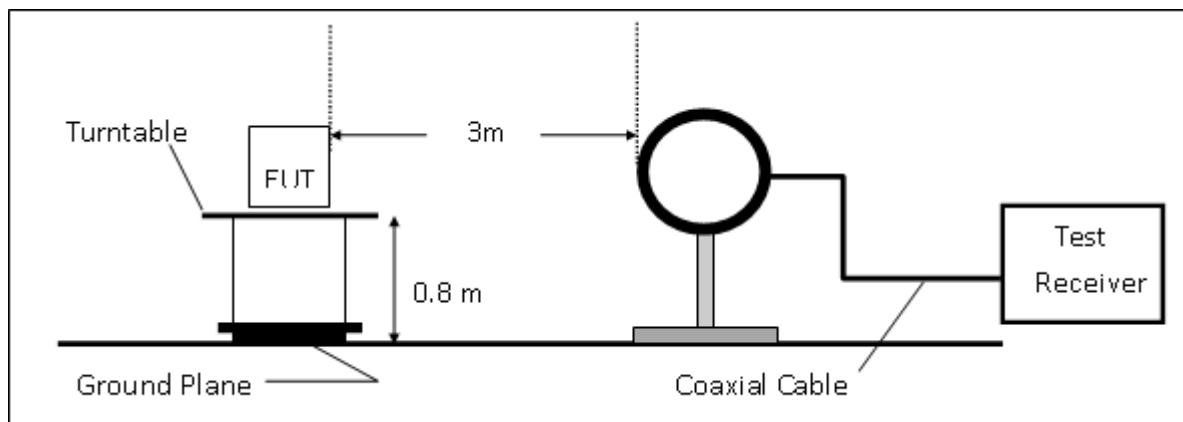
### 10.1. Standard Applicable

According to FCC §2.1053,

FCC§24.238(a) the magnitude of each spurious and harmonic emission that can be detected when the equipment is operated under the conditions specified in the instruction manual and/ or alignment procedure, shall not be less than  $43 + 10 \log$  (mean output power in watts) dBc below the mean power output outside a license's frequency block (-13dBm).

### 10.2. EUT Setup

(A) Radiated Emission Test Set-UP Frequency Below 30MHz.

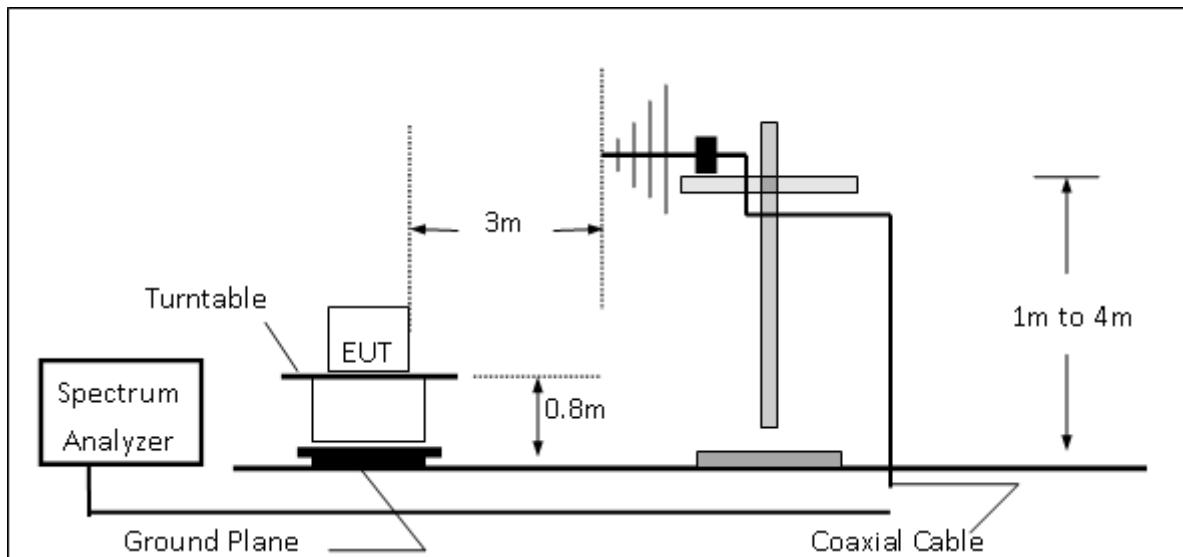


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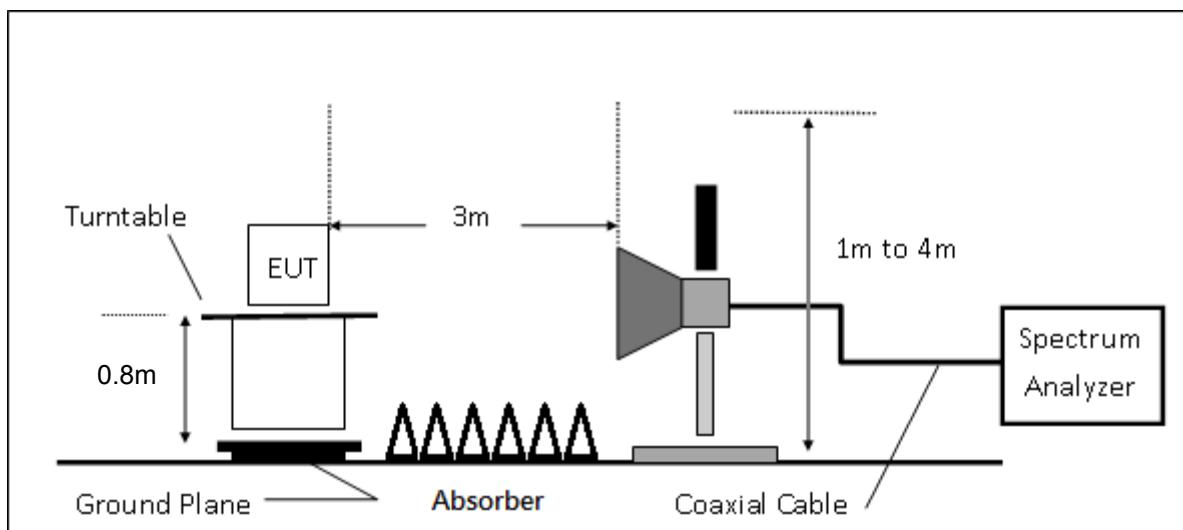
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(B) Radiated Emission Test Set-Up, Frequency form 30MHz to 1000MHz



(C) Radiated Emission Test Set-UP Frequency Over 1 GHz



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### 10.3. Measurement Procedure:

The EUT was placed on a non-conductive; the measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and the EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. This maximization process was repeated with the EUT positioned in each of its three orthogonal orientations.

The frequency range up to tenth harmonic was investigated for each of three fundamental frequencies (low, middle and high channels). Once spurious emission was identified, the power of the emission was determined using the substitution method.

The spurious emissions attenuation was calculated as the difference between radiated power at the fundamental frequency and the spurious emissions frequency.

ERP= S.G. output (dBm) + Antenna Gain (dBd) – Cable Loss (dB)

EIRP = S.G. output (dBm) + Antenna Gain (dBi) – Cable Loss (dB)

EIRP (dBm) = SG Level(dBm) + Antenna Gain(dBi) + Cable Loss(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

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#### 10.4. Measurement Equipment Used:

SGS 966 Chamber No.C					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
EMI Test Receiver	R&S	ESU 40	100363	04/09/2016	04/08/2017
Loop Antenna	ETS-Lindgren	6502	143303	12/23/2015	12/22/2016
Broadband Antenna	TESEQ	CBL 6112D	35240	10/28/2015	10/27/2016
Horn Antenna	ETS-Lindgren	3117	143272	12/16/2015	12/15/2016
Horn Antenna	Schwarzbeck	BBHA9170	185	07/24/2015	07/23/2016
Pre Amplifier	EMC Instruments	EMC330	980096	12/12/2015	12/11/2016
Pre Amplifier	EMC Instruments	EMC0011830	980199	12/12/2015	12/11/2016
Pre Amplifier	EMC Instruments	EMC184045B	980135	12/12/2015	12/11/2016
Coaxial Cable	Huber+Suhner	RG 214/U	966Rx 9K-30M	12/12/2015	12/11/2016
Coaxial Cable	Huber+Suhner	RG 214/U+SUCAFLEX 104	966Rx 30M-3G	12/12/2015	12/11/2016
Coaxial Cable	Huber+Suhner	SUCAFLEX 104	966Rx 1G-18G	12/12/2015	12/11/2016
Coaxial Cable	Huber+Suhner	SUCAFLEX 104	966Tx 30M-18G	12/12/2015	12/11/2016
Coaxial Cable	Huber+Suhner	SUCAFLEX 102	966Tx 18G-40G	12/12/2015	12/11/2016
Coaxial Cable	Huber+Suhner	mini 141-12+SUCAFLEX X 104	966Rx 18G-40G	12/12/2015	12/11/2016
Attenuator	WOKEN	218FS-10	RF27	12/12/2015	12/11/2016
Site NSA	SGS	966 Chamber C	SAC-C	03/04/2016	03/03/2017
Site VSWR	SGS	966 Chamber C	SAC-C	03/04/2016	03/03/2017
Controller	MF	MF-7802	N/A	N.C.R.	N.C.R.
Antenna Master	MF	N/A	N/A	N.C.R.	N.C.R.
Turn Table	MF	N/A	N/A	N.C.R.	N.C.R.
Test Software	World-Pallas	Dr. E	V 3.0 Lite	N.C.R.	N.C.R.
Communication Tester	Anritsu	MT8820C	6.201E+09	05/27/2015	05/26/2016

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台灣檢驗科技股份有限公司 t (886-2) 2299-3279

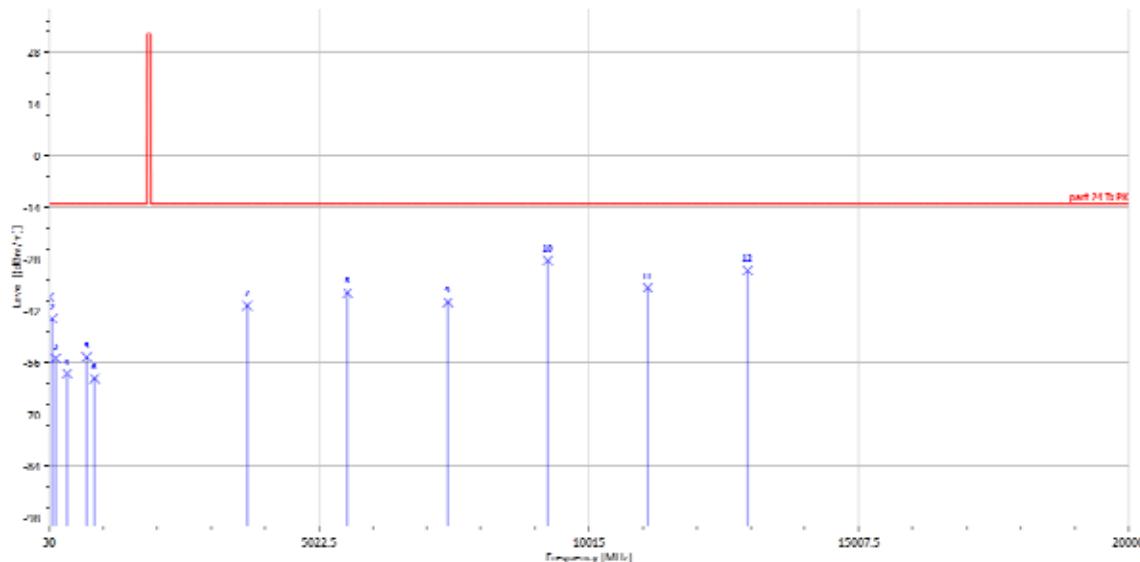
f (886-2) 2298-0488

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**10.5. Measurement Result:****Radiated Spurious Emission Measurement Result: GSM 1900 Mode**

Operation Mode :	GSM_1900	Test Date :	2016/4/25
Fundamental Frequency :	1850.2 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	Tx CH Low	Test Engineer :	Pony
EUT Pol. :	E2	Measurement Antenna Pol. :	Vertical



Freq. MHz	Note F/H/E/S	EIRP dBm	SG Output Level dBm		Antenna Gain dBi	Cable Loss dB	Limit dBm	Margin dB
			SG Output Level dBm	Antenna Gain dBi				
37.76	S	-38.24	-23.87	-13.67	-0.70	-13.01	-25.23	
91.11	S	-44.02	-42.79	-0.10	-1.12	-13.01	-31.01	
152.22	S	-54.85	-56.26	2.77	-1.36	-13.01	-41.84	
362.71	S	-58.95	-62.57	5.86	-2.24	-13.01	-45.94	
722.58	S	-54.54	-59.20	7.61	-2.95	-13.01	-41.53	
866.14	S	-60.27	-64.70	7.66	-3.23	-13.01	-47.26	
3700.40	H	-40.50	-45.65	12.30	-7.15	-13.01	-27.49	
5550.60	H	-37.01	-40.93	12.62	-8.70	-13.01	-24.00	
7400.80	H	-39.55	-40.31	10.82	-10.05	-13.01	-26.54	
9251.00	H	-28.35	-28.79	11.75	-11.31	-13.01	-15.34	
11101.20	H	-35.70	-34.21	10.76	-12.25	-13.01	-22.69	
12951.40	H	-31.03	-31.07	13.14	-13.10	-13.01	-18.02	

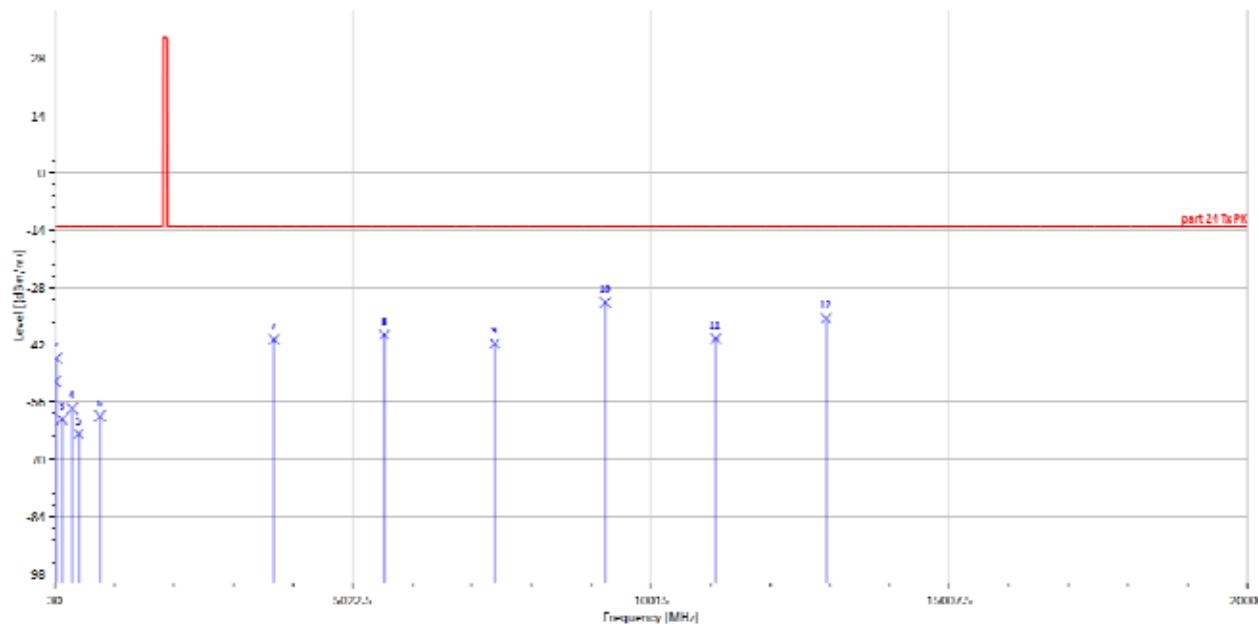
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Operation Mode : GSM\_1900  
 Fundamental Frequency : 1850.2 MHz  
 Operation Band : Tx CH Low  
 EUT Pol. : E2

Test Date : 2016/4/25  
 Temp. / Humi. : 22.7deg\_C/57RH  
 Test Engineer : Pony  
 Measurement Antenna Pol. : Horizontal



Freq. MHz	Note F/H/E/S	EIRP dBm	SG Output Level dBm		Antenna Gain dBi	Cable Loss dB	Limit dBm	Margin dB
			SG Output Level dBm	Antenna Gain dBi				
38.73	S	-50.95	-37.36	-12.88	-0.70	-13.01	-37.94	
59.10	S	-45.29	-43.14	-1.29	-0.87	-13.01	-32.28	
152.22	S	-60.19	-61.60	2.77	-1.36	-13.01	-47.18	
321.97	S	-57.61	-61.44	5.93	-2.09	-13.01	-44.60	
433.52	S	-63.78	-67.70	6.10	-2.18	-13.01	-50.77	
788.54	S	-59.46	-63.87	7.66	-3.25	-13.01	-46.45	
3700.40	H	-40.70	-45.85	12.30	-7.15	-13.01	-27.69	
5550.60	H	-39.56	-43.48	12.62	-8.70	-13.01	-26.55	
7400.80	H	-41.70	-42.46	10.82	-10.05	-13.01	-28.69	
9251.00	H	-31.68	-32.12	11.75	-11.31	-13.01	-18.67	
11101.20	H	-40.49	-39.00	10.76	-12.25	-13.01	-27.48	
12951.40	H	-35.57	-35.61	13.14	-13.10	-13.01	-22.56	

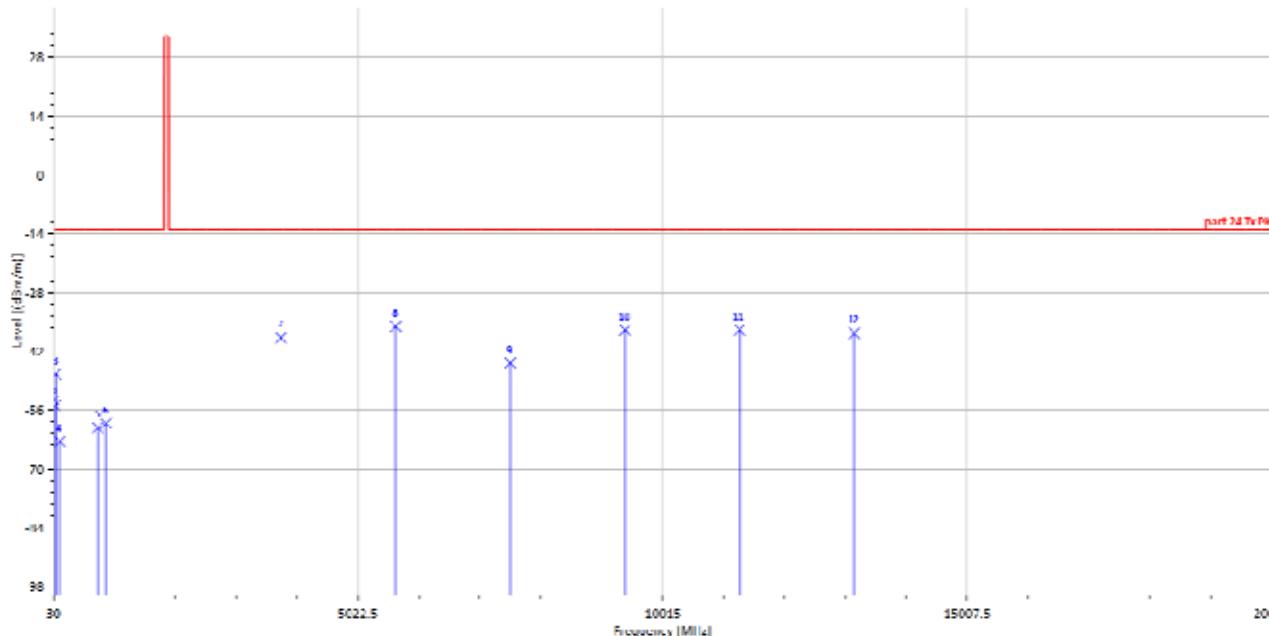
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Operation Mode : GSM\_1900  
 Fundamental Frequency : 1880 MHz  
 Operation Band : Tx CH Mid  
 EUT Pol. : E2

Test Date : 2016/4/25  
 Temp. / Humi. : 22.7deg\_C/57RH  
 Test Engineer : Pony  
 Measurement Antenna Pol. : Vertical



Freq. MHz	Note F/H/E/S	EIRP dBm	SG Output Level dBm		Antenna Gain dBi	Cable Loss dB	Limit dBm	Margin dB
			SG Output Level dBm	Antenna Gain dBi				
36.79	S	-53.68	-38.51	-14.46	-0.71	-13.01	-40.67	
58.13	S	-54.99	-52.44	-1.67	-0.88	-13.01	-41.98	
66.86	S	-47.44	-46.48	-0.01	-0.95	-13.01	-34.43	
131.85	S	-63.46	-62.24	0.12	-1.34	-13.01	-50.45	
756.53	S	-60.21	-64.87	7.62	-2.96	-13.01	-47.20	
889.42	S	-59.18	-63.72	7.75	-3.22	-13.01	-46.17	
3760.00	H	-38.76	-43.86	12.30	-7.21	-13.01	-25.75	
5640.00	H	-36.11	-39.96	12.66	-8.81	-13.01	-23.10	
7520.00	H	-44.79	-45.27	10.70	-10.22	-13.01	-31.78	
9400.00	H	-36.94	-37.22	11.66	-11.38	-13.01	-23.93	
11280.00	H	-36.90	-35.41	10.87	-12.35	-13.01	-23.89	
13160.00	H	-37.72	-37.26	12.84	-13.30	-13.01	-24.71	

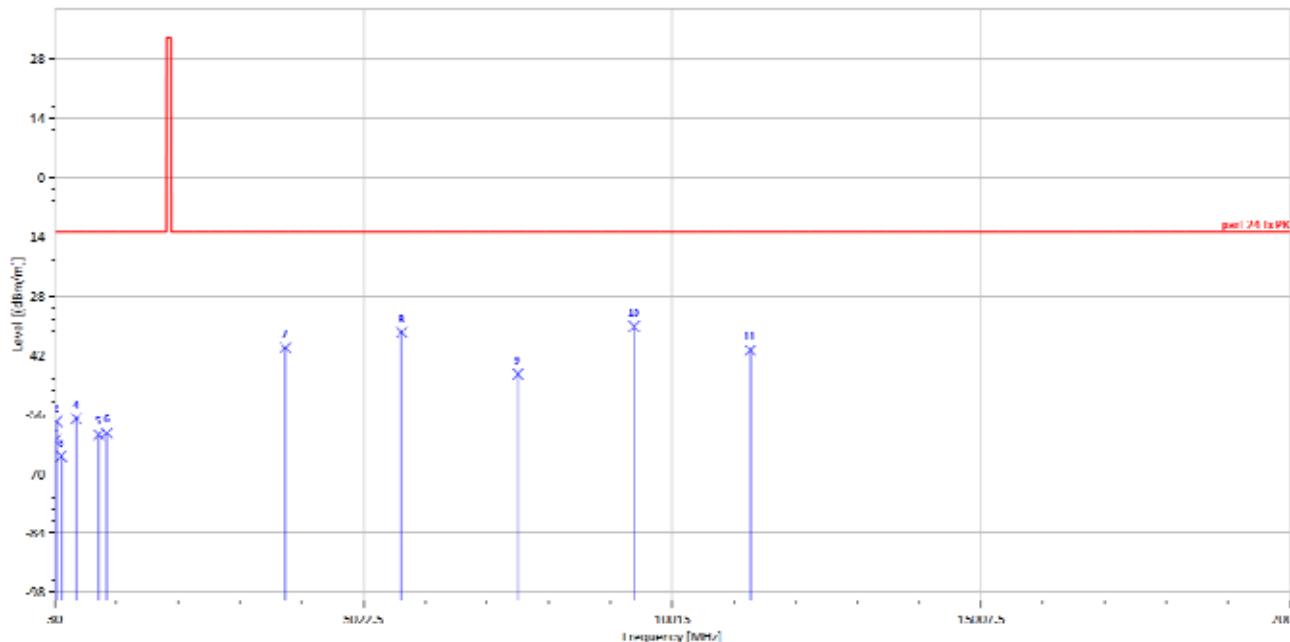
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Operation Mode : GSM\_1900  
 Fundamental Frequency : 1880 MHz  
 Operation Band : Tx CH Mid  
 EUT Pol. : E2

Test Date : 2016/4/25  
 Temp. / Humi. : 22.7deg\_C/57RH  
 Test Engineer : Pony  
 Measurement Antenna Pol. : Horizontal



Freq. MHz	Note F/H/E/S	EIRP dBm	SG Output Level dBm		Antenna Gain dBi	Cable Loss dB	Limit dBm	Margin dB
			Output Level dBm	SG Output Level dBm				
35.82	S	-62.18	-46.21	-46.21	-15.24	-0.73	-13.01	-49.17
58.13	S	-57.69	-55.14	-55.14	-1.67	-0.88	-13.01	-44.68
135.73	S	-65.90	-65.04	-65.04	0.60	-1.46	-13.01	-52.89
377.26	S	-57.04	-60.60	-60.60	5.81	-2.25	-13.01	-44.03
742.95	S	-60.82	-65.40	-65.40	7.61	-3.03	-13.01	-47.81
869.05	S	-60.43	-64.91	-64.91	7.67	-3.19	-13.01	-47.42
3760.00	H	-40.28	-45.38	-45.38	12.30	-7.21	-13.01	-27.27
5640.00	H	-36.65	-40.50	-40.50	12.66	-8.81	-13.01	-23.64
7520.00	H	-46.48	-46.96	-46.96	10.70	-10.22	-13.01	-33.47
9400.00	H	-35.24	-35.51	-35.51	11.66	-11.38	-13.01	-22.23
11280.00	H	-40.86	-39.37	-39.37	10.87	-12.35	-13.01	-27.85

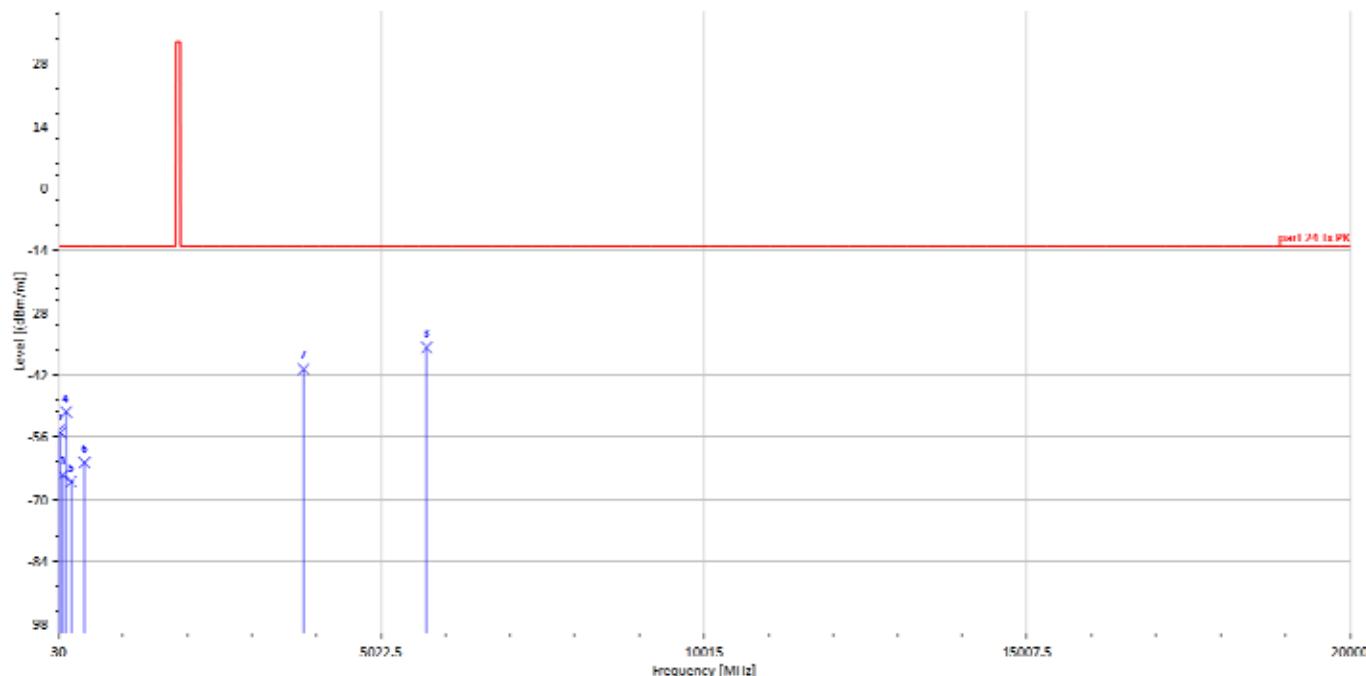
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Operation Mode : GSM\_1900  
 Fundamental Frequency : 1909.8 MHz  
 Operation Band : Tx CH High  
 EUT Pol. : E2

Test Date : 2016/4/25  
 Temp. / Humi. : 22.7deg\_C/57RH  
 Test Engineer : Pony  
 Measurement Antenna Pol. : Vertical



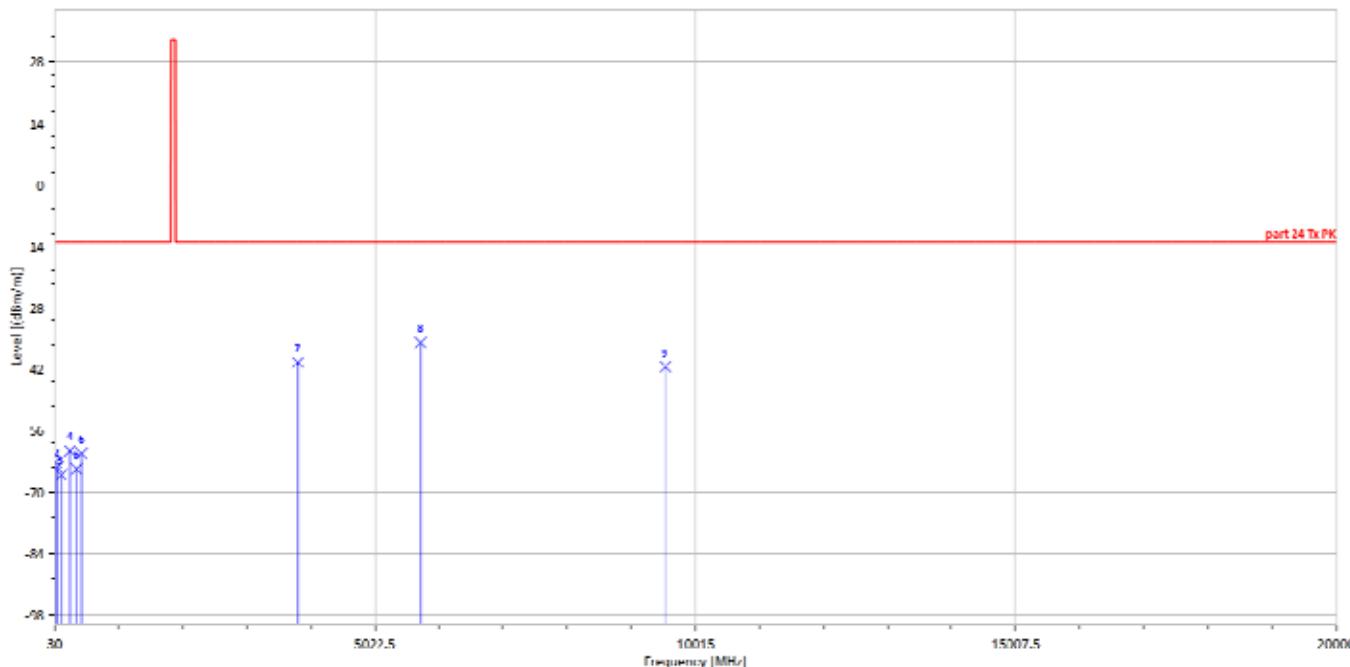
Freq. MHz	Note F/H/E/S	EIRP dBm	SG	Antenna Gain dBi	Cable Loss dB	Limit dBm	Margin dB
			Output Level dBm				
30.97	S	-54.61	-34.56	-19.41	-0.65	-13.01	-41.60
59.10	S	-55.09	-52.94	-1.29	-0.87	-13.01	-42.08
97.90	S	-64.56	-62.70	-0.70	-1.16	-13.01	-51.55
147.37	S	-50.46	-51.23	2.16	-1.40	-13.01	-37.45
229.82	S	-66.04	-70.49	6.25	-1.80	-13.01	-53.03
442.25	S	-61.80	-65.73	6.19	-2.26	-13.01	-48.79
3819.60	H	-40.71	-45.74	12.30	-7.27	-13.01	-27.70
5729.40	H	-35.90	-39.69	12.69	-8.90	-13.01	-22.89

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Operation Mode : GSM\_1900      Test Date : 2016/4/25  
 Fundamental Frequency : 1909.8 MHz      Temp. / Humi. : 22.7deg\_C/57RH  
 Operation Band : Tx CH High      Test Engineer : Pony  
 EUT Pol. : E2      Measurement Antenna Pol. : Horizontal



Freq. MHz	Note F/H/E/S	EIRP dBm	SG Output Level dBm		Antenna Gain dBi	Cable Loss dB	Limit dBm	Margin dB
			Output Level dBm	SG Output Level dBm				
44.55	S	-63.10	-53.91	-53.91	-8.37	-0.83	-13.01	-50.09
67.83	S	-64.26	-63.45	-63.45	0.12	-0.93	-13.01	-51.25
132.82	S	-65.99	-64.90	-64.90	0.24	-1.32	-13.01	-52.98
265.71	S	-60.59	-63.79	-63.79	5.08	-1.88	-13.01	-47.58
368.53	S	-64.64	-68.31	-68.31	5.84	-2.17	-13.01	-51.63
443.22	S	-61.19	-65.10	-65.10	6.20	-2.29	-13.01	-48.18
3819.60	H	-40.40	-45.43	-45.43	12.30	-7.27	-13.01	-27.39
5729.40	H	-35.92	-39.71	-39.71	12.69	-8.90	-13.01	-22.91
9549.00	H	-41.41	-41.68	-41.68	11.60	-11.33	-13.01	-28.40

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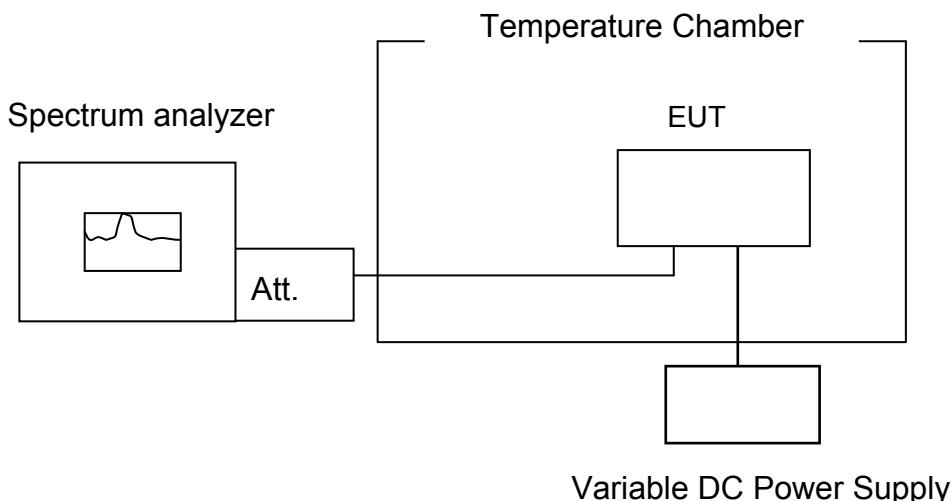
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## 11. FREQUENCY STABILITY MEASUREMENT

### 11.1. Standard Applicable:

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

### 11.2. Test Set-up:



**Note:** Measurement setup for testing on Antenna connector

### 11.3. Measurement Procedure:

The equipment under test was connected to an external AC or DC power supply and input rated voltage. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. The EUT was placed inside the temperature chamber. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 25°C operating frequency as reference frequency. Turn EUT off and set the chamber temperature to -30°C. After the temperature stabilized for approximately 30 minutes recorded the frequency. Repeat step measure with 10°C increased per stage until the highest temperature of +50°C reached.

Set chamber temperature to 25°C. Use a variable AC power supply / DC power source to power the EUT and set the voltage to rated voltage. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and recorded the frequency.

Reduce the input voltage to specify extreme voltage variation (+/- 15%) and endpoint as declared by the manufacturer, record the maximum frequency change.

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#### 11.4. Measurement Equipment Used:

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	KEYSIGHT	N9010A	MY54510568	04/14/2016	04/13/2017
Power Meter	Anritsu	ML2496A	1326001	06/23/2015	06/22/2016
Power Sensor	Anritsu	MA2411B	1315048	06/23/2015	06/22/2016
Power Sensor	Anritsu	MA2411B	1315049	06/23/2015	06/22/2016
Coaxial Cable 30cm	WOKEN	00100A1F1A195C	RF01	12/12/2015	12/11/2016
DC Block	PASTERNACK	PE8210	RF29	12/12/2015	12/11/2016
Splitter	RF-LAMBAD	RFLT2W1G18G	RF35	12/12/2015	12/11/2016
Attenuator	WOKEN	218FS-10	RF23	12/12/2015	12/11/2016
Temperature Chamber	TERCHY	MHK-120LK	1020582	06/23/2015	06/22/2016
Communication Tester	Anritsu	MT8820C	6201107337	05/27/2015	05/26/2016

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## 11.5. Measurement Result:

### FREQUENCY ERROR vs. VOLTAGE

Reference Frequency: GSM 1900 Mid Channel 1880 MHz				
Limit: +/- 2.5 ppm				
Power Supply	Environment	Frequency	Delta (Hz)	Limit (Hz)
Vdc	Temperature (°)	(MHz)		
4.2	20	1879.999946	-4	4700
3.70	20	1879.999950	0	4700
3.6	20	1879.999949	-1	4700
3.2 (End point)	20	1879.999952	2	4700

### FREQUENCY ERROR vs. TEMPERATURE

Reference Frequency: GSM 1900 Mid Channel 1880 MHz				
Limit: +/- 2.5 ppm				
Power Supply	Environment	Frequency	Delta (Hz)	Limit (Hz)
Vdc	Temperature (°)	(MHz)		
3.7	50	1879.999955	5	4700
3.7	40	1879.999952	2	4700
3.7	30	1879.999949	-1	4700
3.7	20	1879.999950	0	4700
3.7	10	1879.999948	-2	4700
3.7	0	1879.999949	-1	4700
3.7	-10	1879.999954	4	4700
3.7	-20	1879.999946	-4	4700
3.7	-30	1879.999944	-6	4700

**Note: The internal battery is rated 3.7Vdc. (The worst case)**

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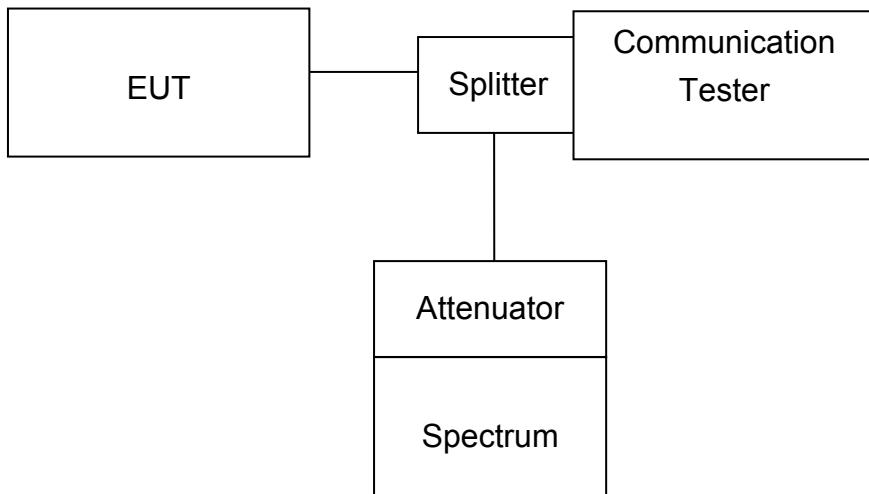
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## 12. PEAK TO AVERAGE RATIO

### 12.1. Standard Applicable

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

### 12.2. Test SET-UP



### 12.3. Measurement Procedure

1. KDB 971168 D01 is employed as the following procedure is proper adjusted accordingly:
2. Set resolution/measurement bandwidth  $\geq$  signal's occupied bandwidth; & internal =1ms
3. Set the number of counts to a value that stabilizes the measured CCDF curve.

### 12.4. Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	KEYSIGHT	N9010A	MY54510568	04/14/2016	04/13/2017
Power Meter	Anritsu	ML2496A	1326001	06/23/2015	06/22/2016
Power Sensor	Anritsu	MA2411B	1315048	06/23/2015	06/22/2016
Power Sensor	Anritsu	MA2411B	1315049	06/23/2015	06/22/2016
Coaxial Cable 30cm	WOKEN	00100A1F1A195C	RF01	12/12/2015	12/11/2016
DC Block	PASTERNACK	PE8210	RF29	12/12/2015	12/11/2016
Splitter	RF-LAMBAD	RFLT2W1G18G	RF35	12/12/2015	12/11/2016
Attenuator	WOKEN	218FS-10	RF23	12/12/2015	12/11/2016
Temperature Chamber	TERCHY	MHK-120LK	1020582	06/23/2015	06/22/2016
Communication Tester	Anritsu	MT8820C	6201107337	05/27/2015	05/26/2016

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## 12.5. Measurement Result

### Tabular Results:

Frequency (MHz)	CH	Peak-to-Average Ratio (dB)
		GSM
1850.20	512	9.87
1880.00	661	9.70
1909.80	810	9.81

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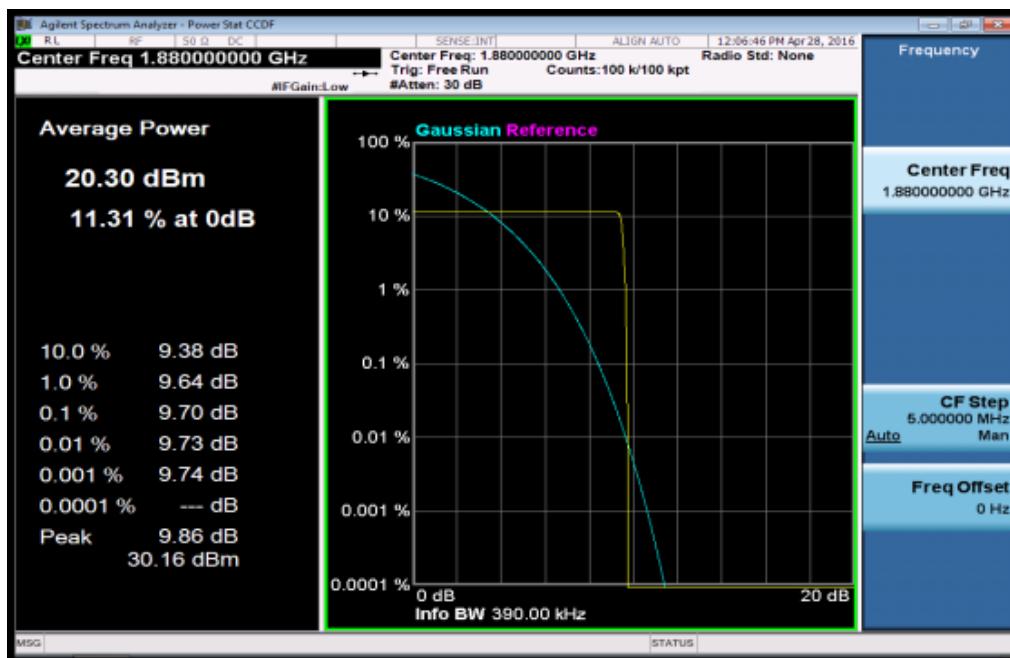
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## Measurement Results:

## GSM 1900 Channel Low



## GSM 1900 Channel Mid

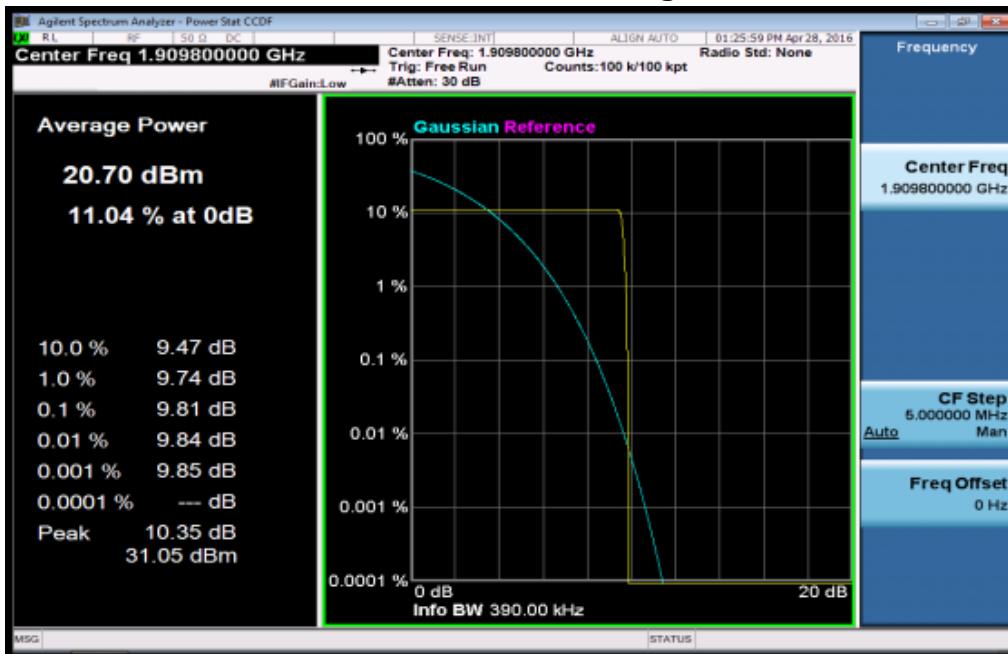


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## GSM 1900 Channel High



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