



# TEST REPORT

**No. I19D00153-SRD04**

*For*

**Client: Doro AB**

**Production: 2G Clamshell Feature Phone**

**Model Name: DFC-0240**

**Brand Name: Doro**

**FCC ID : WS5DFC0240**

**Hardware Version: V01(HW code:3021/3051)**

**Software Version: DFC0250\_0240\_UF290\_N\_S01A\_V01\_M190906\_SMP**

**Issued date: 2019-09-29**

## NOTE

1. The test results in this test report relate only to the devices specified in this report.
2. This report shall not be reproduced except in full without the written approval of China Telecommunication Technology Labs.
3. KDB 971168 D01 has not been accredited by A2LA.
4. For the test results, the uncertainty of measurement is not taken into account when judging the compliance with specification, and the results of measurement or the average value of measurement results are taken as the criterion of the compliance with specification directly.

**Test Laboratory:**

East China Institute of Telecommunications

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**Revision Version**

Report Number	Revision	Date	Memo
I19D00153-SRD04	00	2019-09-29	Initial creation of test report

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## 1. Test Laboratory

### 1.1. Testing Location

Company Name	East China Institute of Telecommunications
Address	7-8/F., Area G, No.668, Beijing East Road, Shanghai, China
Postal Code	200001
Telephone	+86 21 63843300
Fax	+86 21 63843301
FCC registration No	958356

### 1.2. Testing Environment

Normal Temperature	15℃-35℃
Relative Humidity	20%-75%

### 1.3. Project Data

Project Leader	Xu Yuting
Testing Start Date	2019-05-18
Testing End Date	2019-09-27

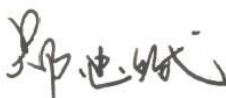
### 1.4. Signature



**Wang Liang**  
(Prepared this test report)



**Fan Songyan**  
(Reviewed this test report)



**Zheng Zhongbin**  
(Approved this test report)

## 2. Client Information

### 2.1. Applicant Information

Company Name	Doro AB
Address	Doro AB, Jörgen Kocksgatan 1B, SE 211 20 MALMÖ, SWEDEN
Telephone	+46 46 280 50 76
Postcode	/

### 2.2. Manufacturer Information

Company Name	Doro AB
Address	Doro AB, Jörgen Kocksgatan 1B, SE 211 20 MALMÖ, SWEDEN
Telephone	+46 46 280 50 76
Postcode	/

### 3. Equipment Under Test (EUT) and Ancillary Equipment (AE)

#### 3.1. About EUT

Production	2G Clamshell Feature Phone
Model name	DFC-0240
FCC ID	WS5DFC0240
GSM Frequency Band	GSM1900
Additional Communication Function	BT
Extreme Temperature	-10/+55°C
Nominal Voltage	3.7V
Extreme High Voltage	4.2V
Extreme Low Voltage	3.6V
Maximum of Antenna Gain	PCS1900: -1 dBi;

Note:

- Photographs of EUT are shown in ANNEX A of this test report.
- The value of the antenna gain is provided by the customer. For specific antenna information, please check the antenna specifications of the customer.

#### 3.2. Internal Identification of EUT used during the test

EUT ID*	SN or IMEI	HW Version	SW Version	Date of receipt
N06 Main supply (I19D00066)	357508100008342 357508100008359	V01(HW code: 3021)	DFC0250_0240_UF290_N_S 01A_V01_M190505_SMP	2019-05-18
N03 Main supply	357507100011926 357507100011934	V01(HW code: 3021)	DFC0250_0240_UF290_N_S 01A_V01_M190906_SMP	2019-09-20
N04 Main supply	357507100015760 357507100015778	V01(HW code: 3021)	DFC0250_0240_UF290_N_S 01A_V01_M190906_SMP	2019-09-29
N06 Secondary supply	357507100015588 357507100015596	V01(HW code: 3051)	DFC0250_0240_UF290_N_S 01A_V01_M190906_SMP	2019-09-29
N09 Secondary supply	357507100015661 357507100015679	V01(HW code: 3051)	DFC0250_0240_UF290_N_S 01A_V01_M190906_SMP	2019-09-24

\*EUT ID: is used to identify the test sample in the lab internally.

#### 3.3. Internal Identification of AE used during the test

AE ID*	Description	Type	Manufacturer
AE1	RF cable	---	AE1

\*AE ID: is used to identify the test sample in the lab internally.



### 3.4. Difference Between Main Supply and Secondary supply

Item	Configure 1	Configure 2
HW code	3021	3051
LCD	LCD SANLONG(28LS124-04)	LCD Holitech(QTB2D8096)
FLASH	Flash GD(GD25LQ128)	Flash DOS(FM25M4AA)
Note: Customer declaration, two configures is the same, except for LCD and FLASH. There are more than one Configure, each one should be applied throughout the compliance test respectively, however, only the worst case (Configure 1) will be recorded in this report.		

#### Main Supply

Part Name	Model Name	supplier	Remark
ZIF connector	FP270H-025T1DM	JXT	/
Earphone jack	11-0561136-A	LETCON	/
Memory card socket	T11-BB09F150	HRD	/
Micro USB	U11-1B05G252	HRD	/
Battery connector	BAC5540306	VELA	/

#### Secondary Supply

Part Name	Model Name	supplier	Remark
ZIF connector	4.001A0-025-1R0	HAIWEISI	/
Earphone jack	PH20-0A38F38M JAF00-05382-010101	HRD LCN	/
Micro USB	UBM9250516 UAF95-05254-S135-A	VELA LCN	/
Memory card socket	TFJ1150903	VELA	/
Battery connector	B29-BB03F540 02-032116B	HRD LETCON	/

## 4. Reference Documents

### 4.1. Documents supplied by applicant

All technical documents are supplied by the client or manufacturer, which is the basis of testing.

### 4.2. Reference Documents for testing

The following documents listed in this section are referred for testing.

Reference	Title	Version
FCC Part 24	PERSONAL COMMUNICATIONS SERVICES	2018-10-01
FCC Part 2	FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS	2018-10-01
ANSI-TIA-603-E	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards	2016
ANSI C63.26	American National Standard of Procedures for Compliance Testing of Licensed Transmitters Used in Licensed Radio	2015
KDB 971168 D01	Measurement Guidance for Certification of Licensed Digital Transmitters	v03r01

## 5. Test Results

### 5.1. Summary of Test Results

Measurement Items	Sub-clause	Verdict
Output Power	2.1046/24.232(c)	P
Peak-to-Average Ratio	24.232(d)	P
99%Occupied Bandwidth	2.1049(h)(i)	P
-26dB Emission Bandwidth	24.238(b)	P
Band Edge at antenna terminals	24.238(a)	P
Frequency stability	2.1055/24.235	P
Conducted Spurious mission	2.1053/24.238(a)	P
Emission Limit	2.1051/24.238/24.232	P

Note: please refer to Annex A in this test report for the detailed test results.

The following terms are used in the above table.

P	Pass, the EUT complies with the essential requirements in the standard.
NP	Not Perform, the test was not performed by ECIT.
NA	Not Applicable, the test was not applicable.
F	Fail, the EUT does not comply with the essential requirements in the standard.

### 5.2. Statements

The DFC-0240 is manufactured by Doro AB is a variant model for testing.

ECIT only performed test cases which identified with Pass/Fail/Inc result in section 5.1

We confirmed the difference between the two versions of main supply sample and secondary supply sample about EIRP and spurious emissions results. ECIT only performed worst of the test cases with secondary supply.

ECIT has verified that the compliance of the tested device specified in section 3 of this test report is successfully evaluated according to the procedure and test methods as defined in type certification requirement listed in section 4 of this test report.

Note: This report covers two parts of data, the radiation data and the conducted data. The conducted test data refer to the I19D00066-SRD04-2G report of original Main Supply, which was prepared by East China Institute of Telecommunications.

## 6. Test Equipments Utilized

### 6.1. Conducted Test System

No.	Equipment	Model	SN	Manufacturer	Cal. date	Cal.interval
1	Spectrum Analyzer	FSQ26	101096	R&S	2019-05-10	1 year
2	Universal Radio Communicatio	CMU200	123124	R&S	2019-05-10	1 year
3	DC Power Supply	ZUP60-14	LOC-220Z 006 -0007	TDL-Lambda	2019-05-10	1 year

### 6.2. Radiated Emission Test System

The test equipment and ancillaries used are as follows.

No.	Equipment	Model	SN	Manufacturer	Cal. date	Cal.interval
1	Universal Radio Communication Tester	CMU200	123123	R&S	2019-05-10	1 year
2	EMI Test Receiver	ESU40	100307	R&S	2019-05-10	1 year
3	TRILOG Broadband Antenna	VULB9163	VULB9163-515	Schwarzbeck	2019-05-10	3 years
4	Double-ridged Waveguide Antenna	ETS-3117	00135890	ETS	2019-05-10	3 years
5	2-Line V-Network	ENV216	101380	R&S	2019-05-10	1 Year
6	Substitution Antenna	ETS-3117	00135890	ETS	2019-05-10	3 years

7	RF Signal Generator	SMF100A	102314	R&S	2019-05-10	1 year
8	Substitution Antenna	VUBA9117	9117-266	Schwarzbeck	2019-05-10	3 years
9	Amplifier	SCU08	10146	R&S	2019-05-10	1 year

#### Climate chamber

No.	Equipment	Model	SN	Manufacturer	Cal. date	Cal.interval
1	Climate chamber	SH-641	92012011	ESPEC	2017-12-25	2 Years

## 7. Measurement Uncertainty

Measurement uncertainty for all the testing in this report are within the limit specified in ECIT documents .  
The detailed measurement uncertainty is defined in ECIT documents.

Measurement Items	Range	Confidence Level	Calculated Uncertainty
Maximum Peak Output Power	30MHz-3600MHz	95%	$\pm 0.544\text{dB}$
EBW and VBW	30MHz-3600MHz	95%	$\pm 62.04\text{Hz}$
Transmitter Spurious Emission-Conducted	30MHz-2GHz	95%	$\pm 0.90\text{dB}$
Transmitter Spurious Emission-Conducted	2GHz-3.6GHz	95%	$\pm 0.88\text{dB}$
Transmitter Spurious Emission-Conducted	3.6GHz-8GHz	95%	$\pm 0.96\text{dB}$
Transmitter Spurious Emission-Conducted	8GHz-20GHz	95%	$\pm 0.94\text{dB}$
Transmitter Spurious Emission-Radiated	9KHz-30MHz	95%	$\pm 5.66\text{dB}$
Transmitter Spurious Emission-Radiated	30MHz-1000MHz	95%	$\pm 4.98\text{dB}$
Transmitter Spurious Emission-Radiated	1000MHz -18000MHz	95%	$\pm 5.06\text{dB}$
Transmitter Spurious Emission-Radiated	18000MHz -40000MHz	95%	$\pm 5.20\text{dB}$
Frequency stability	1MHz-16GHz	95%	$\pm 62.04\text{Hz}$

## 8. Test Environment

**Shielding Room1** (6.0 meters×3.0 meters×2.7 meters) did not exceed following limits along the conducted RF performance testing:

Temperature	Min. = 15 °C, Max. = 35 °C
Relative humidity	Min. = 20 %, Max. = 75 %
Shielding effectiveness	> 100 dB
Ground system resistance	< 0.5 Ω

**Control room** did not exceed following limits along the EMC testing:

Temperature	Min. = 15 °C, Max. = 35 °C
Relative humidity	Min. =25 %, Max. = 75 %
Shielding effectiveness	> 100 dB
Electrical insulation	> 10 kΩ
Ground system resistance	< 0.5 Ω

**Fully-anechoic chamber1** (6.9 meters×10.9 meters×5.4 meters) did not exceed following limits along the EMC testing:

Temperature	Min. = 15 °C, Max. = 35 °C
Relative humidity	Min. = 25 %, Max. = 75 %
Shielding effectiveness	> 100 dB
Electrical insulation	> 10 kΩ
Ground system resistance	< 0.5 Ω
VSWR	Between 0 and 6 dB, from 1GHz to 18GHz
Site Attenuation Deviation	Between -4 and 4 dB,30MHz to 1GHz
Uniformity of field strength	Between 0 and 6 dB, from 80MHz to 3000 MHz

## **ANNEX A. Detailed Test Results**

### **ANNEX A.1. OUTPUT POWER**

#### **A.1.1. Summary**

During the process of testing, the EUT was controlled Rhode & Schwarz Digital Radio.

Communication tester (CMU-200) to ensure max power transmission and proper modulation.

This result contains peak output power and EIRP measurements for the EUT. In all cases, output power is within the specified limits.

#### **A.1.2. Conducted**

##### **A.1.2.1. Method of Measurements**

Method of measurements please refer to KDB 971168 D01 v03 clause 5.

The EUT was set up for the max output power with pseudo random data modulation.

The power was measured with Rhode & Schwarz Spectrum Analyzer FSQ(peak).

These measurements were done at 3 frequencies, 1850.2 MHz, 1880.0MHz and 1909.8MHz for PCS1900 band.(bottom, middle and top of operational frequency range).

##### **A.1.2.2 Test procedures:**

1. The transmitter output port was connected to base station.
2. Set the 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.

##### **A.1.2.3 Limit:**

22.913(a) Mobile stations are limited to 7watts.

24.232(c) Mobile and portable stations are limited to 2 watts.

##### **A.1.2.4 Test Procedure:**

The transmitter output power was connected to calibrated attenuator, the other end of which was connected to signal analyzer. Transmitter output power was read off the power in dBm. The power outputs at the transmitter antenna port was determined by adding the value of attenuator to the signal analyzer reading.

##### **A.1.2.5 GSM Test Condition:**

RBW	VBW	Sweep time	Span
3MHz	10MHz	Auto	50MHz

##### **A.1.2.6 WCDMA Test Condition:**

RBW	VBW	Sweep time	Span
10MHz	30MHz	Auto	50MHz



**A.1.2.7 Measurement results:**

GSM 1900(GMSK)		
Channel/fc(MHz)	Peak power (dBm)	AV power (dBm)
Mid 661/1880	29.64	29.23
Low 512/1850.2	29.67	29.37
High 810/1909.8	29.42	29.07
GPRS 1900 (GMSK 1 Slot)		
Channel/fc(MHz)	Peak power (dBm)	AV power (dBm)
Mid 661/1880	29.62	29.34
Low 512/1850.2	29.65	29.46
High 810/1909.8	29.41	29.18

**Conclusion: PASS**

**ANNEX A.2. Peak-to-Average Power Ratio**

Method of test measurements please refer to KDB 971168 D01 v03 clause 5.7.

**A.2.1 PAPR Limit**

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

**A.2.2 Test procedures**

1. The EUT was connected to the spectrum analyzer and system simulator via a power divider.
2.
  - 1) Select the spectrum analyzer CCDF function.
  - 2) Set  $RBW \geq$  signal's occupied bandwidth.
  - 3) Set the number of counts to a value that stabilizes the measured CCDF curve;
  - 4) Sweep time  $\geq$  1s.
3. Record the maximum PAPR level associated with a probability of 0.1%.

**A.2.3 Test results:**

GSM1900			
Channel	512	661	810
Frequency (MHz)	1850.2	1880	1909.8
PAPR(dB)	8.46	8.56	8.53
GPRS1900			
Channel	512	661	810
Frequency (MHz)	1850.2	1880	1909.8
PAPR(dB)	8.43	8.46	8.43

**Conclusion: PASS**

### ANNEX A.3. Occupied Bandwidth

Method of test please refer to KDB 971168 D01 v03 clause 4.0.

#### A.3.1. Occupied Bandwidth

Similar to conducted emissions; occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the extreme and mid frequencies of PCS1900.

#### A.3.2 Test Procedure:

1. The EUT output RF connector was connected with a short cable to the signal analyzer.
2. RBW was set to about 1% of emission BW, VBW  $\geq$  3 times RBW,.
3. 99% bandwidth were measured, the occupied bandwidth is delta frequency between the two points where the display line intersects the signal trace.

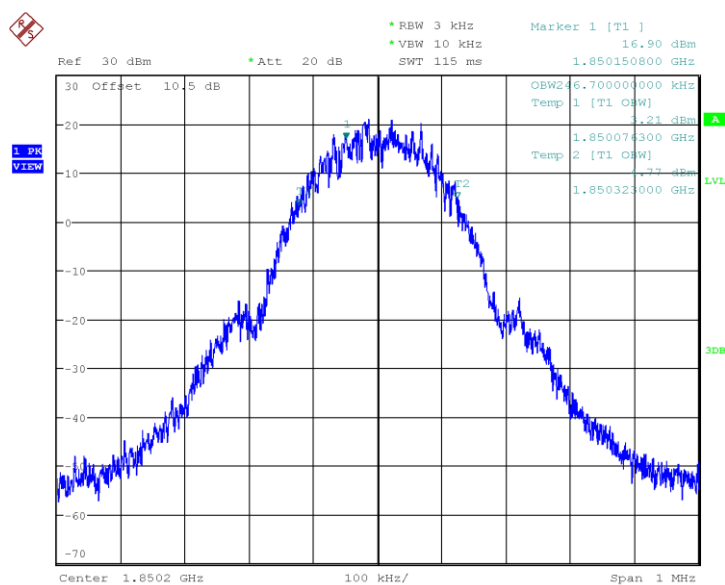
#### A.3.3 Test result:

**Conclusion: PASS**

GSM1900		
Test channel	Frequency (MHz)	99% Occupied Bandwidth(kHz)
Mid 661	1880	246.70
Low 512	1850.2	242.00
High 810	1909.8	243.70
GPRS1900		
Test channel	Frequency (MHz)	99% Occupied Bandwidth(kHz)
Mid 661	1880	241.60
Low 512	1850.2	244.80
High 810	1909.8	244.70

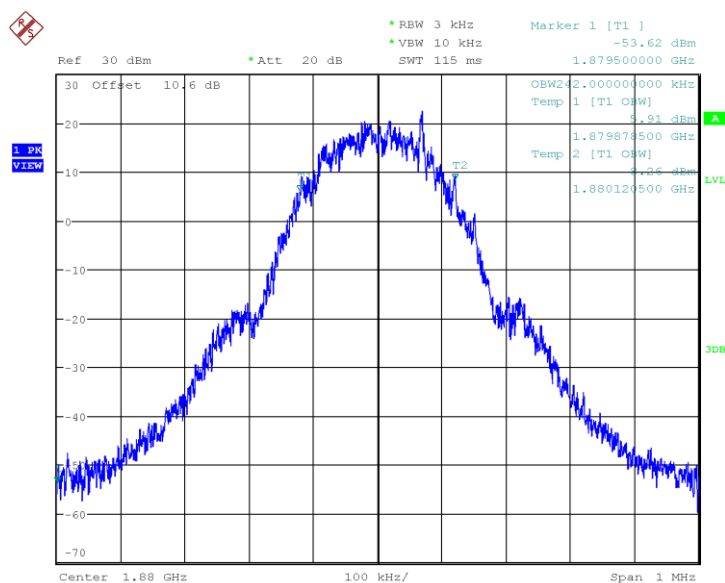
**Conclusion: PASS**

## GSM 1900



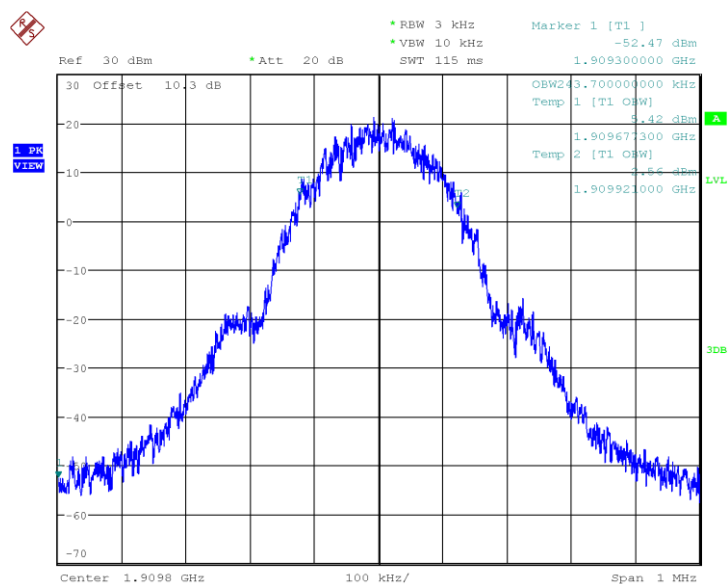
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Fig.1 Channel 661-Occupied Bandwidth (99%)



Date: 20.MAY.2019 10:01:39

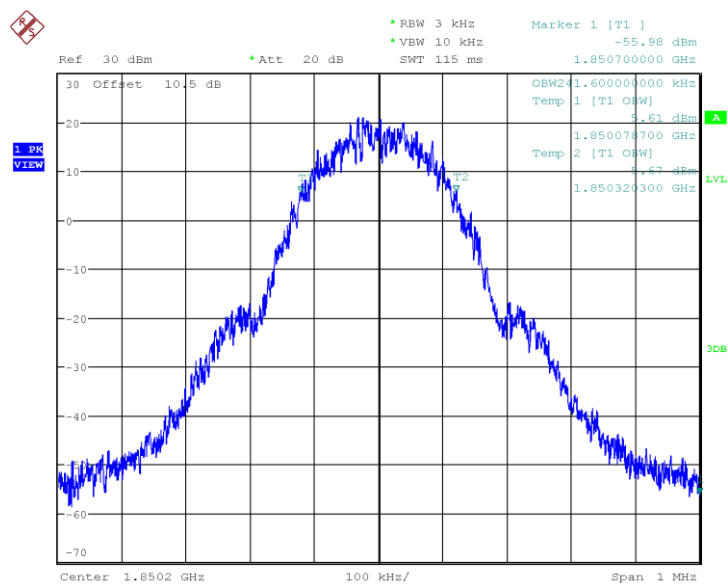
Fig.2 Channel 512-Occupied Bandwidth (99%)



Date: 20.MAY.2019 10:02:44

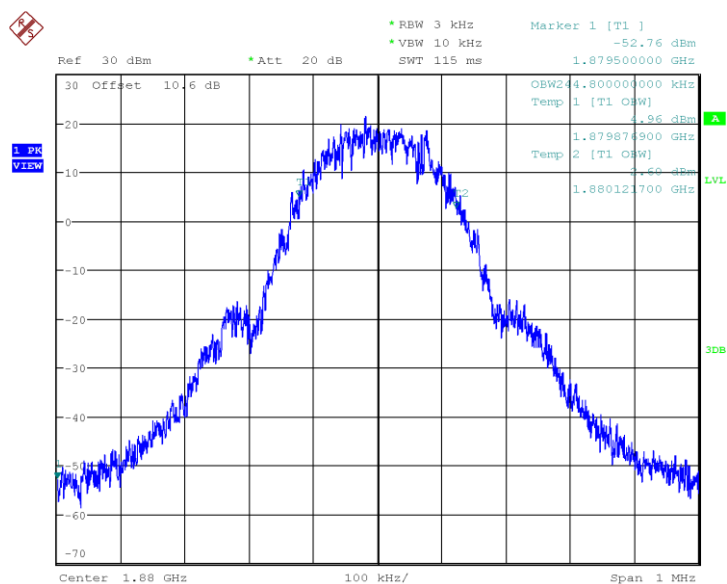
Fig.3 Channel 810-Occupied Bandwidth (99%)

## GPRS 1900



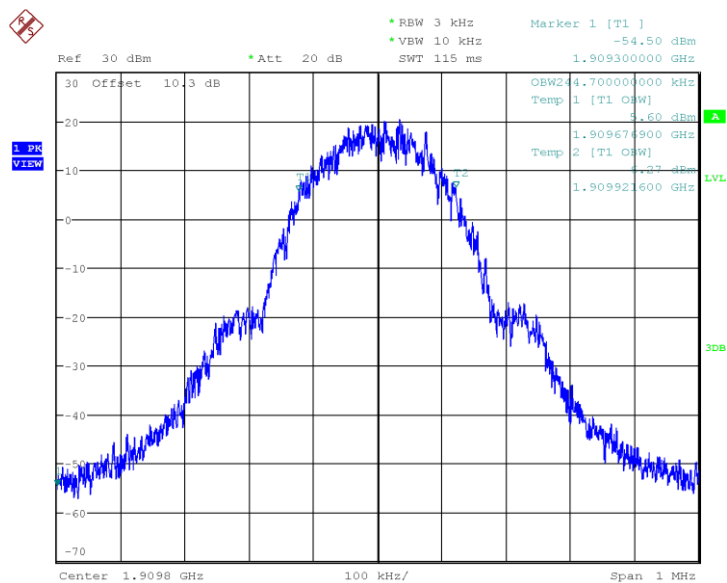
Date: 20.MAY.2019 10:03:45

Fig.4 Channel 661-Occupied Bandwidth (99%)



Date: 20.MAY.2019 10:04:39

Fig.5 Channel 512-Occupied Bandwidth (99%)



Date: 20.MAY.2019 10:05:33

Fig.6 Channel 810-Occupied Bandwidth (99%)

**ANNEX A.4. -26dB Emission Bandwidth**

Method of test please refer to KDB 971168 D01 v03 clause 4.0.

**A.4.1. -26dB Emission Bandwidth**

Similar to conducted emissions; occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the extreme and mid frequencies of PCS1900.

**A.4.2 Test Procedure:**

1. The EUT output RF connector was connected with a short cable to the signal analyzer.
2. RBW was set to about 1% of emission BW, VBW  $\geq$  3 times RBW,.
3. 26dB bandwidth were measured, the occupied bandwidth is delta frequency between the two points where the display line intersects the signal trace.

**A.4.3 Measurement methods:**

For GSM: signal analyzer setting as: RBW=3KHz;VBW=10KHz;Span=1MHz.

For WCDMA: signal analyzer setting as: RBW=50KHz;VBW=200KHz;Span=10MHz.

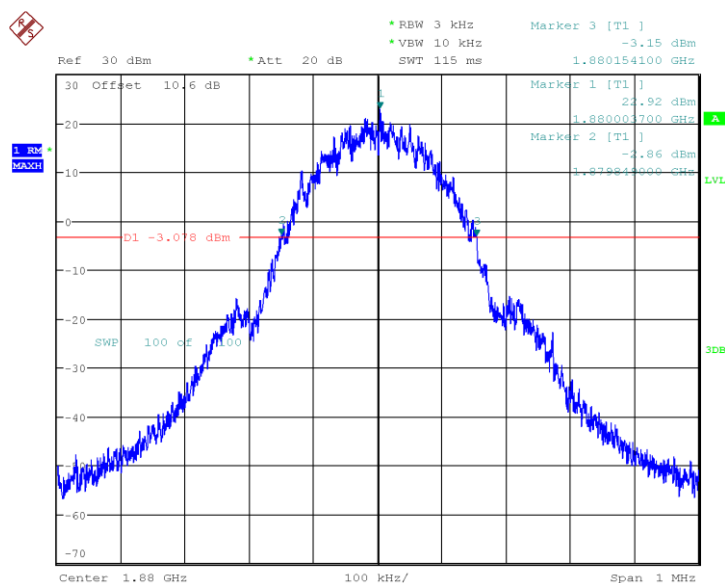
**A.4.4 Test results:**

**Conclusion: PASS**

GSM1900		
Test channel	Frequency (MHz)	-26dBc Emission Bandwidth(kHz)
Mid 661	1880	305.00
Low 512	1850.2	310.00
High 810	1909.8	313.00
GPRS1900		
Test channel	Frequency (MHz)	-26dBc Emission Bandwidth(kHz)
Mid 661	1880	309.00
Low 512	1850.2	313.00
High 810	1909.8	313.00

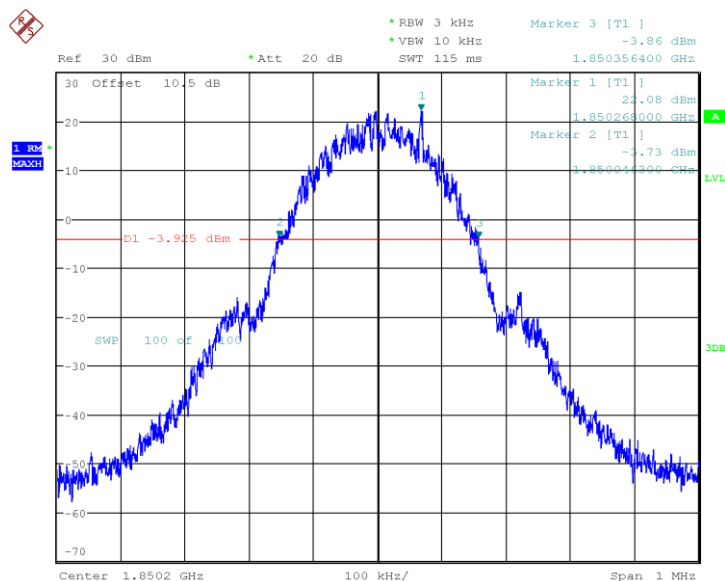
**Conclusion: PASS**

**GSM 1900**



Date: 20.MAY.2019 10:33:49

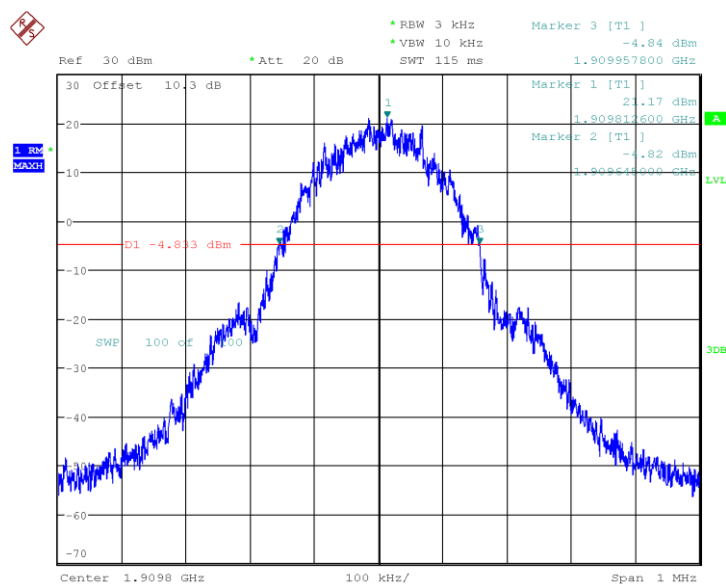
**Fig.7 Channel 661- Emission Bandwidth (-26dBc BW)**



Date: 20.MAY.2019 10:32:38

**Fig.8 Channel 512- Emission Bandwidth (-26dBc BW)**

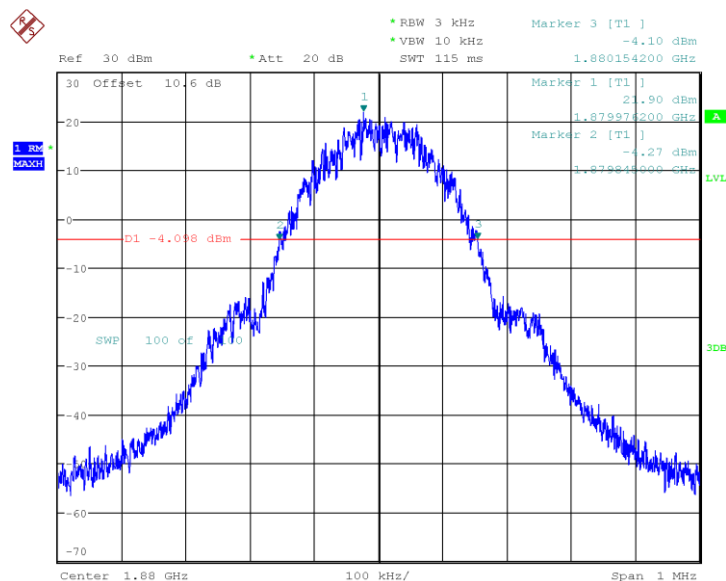




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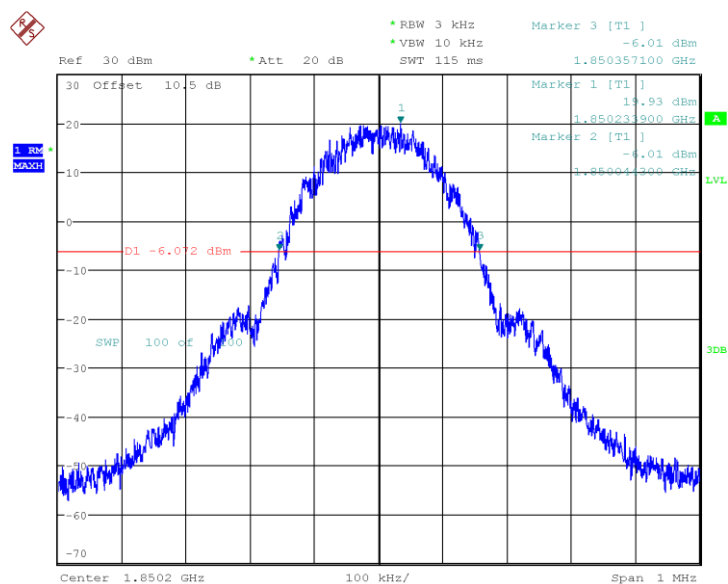
Fig.9 Channel 810- Emission Bandwidth (-26dBc BW)

## GPRS 1900



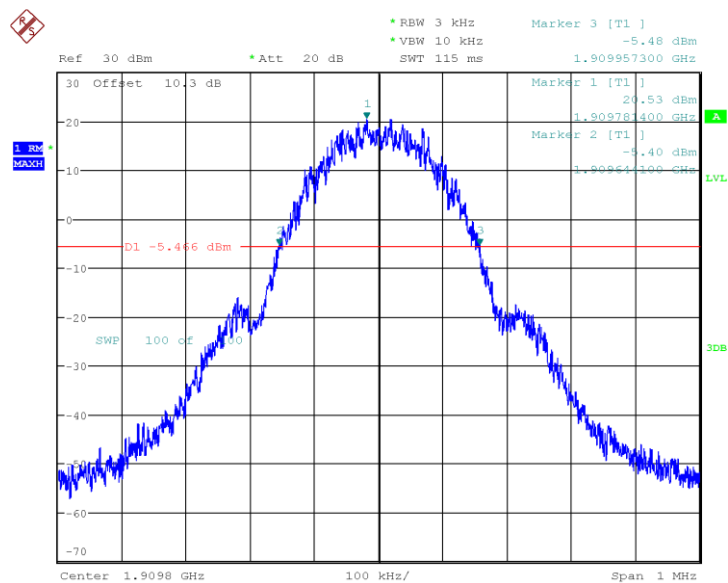
Date: 20.MAY.2019 10:37:09

Fig.10 Channel 661- Emission Bandwidth (-26dBc BW)



Date: 20.MAY.2019 10:36:07

Fig.11 Channel 512- Emission Bandwidth (-26dBc BW)



Date: 20.MAY.2019 10:38:11

Fig.12 Channel 810- Emission Bandwidth (-26dBc BW)

## ANNEX A.5. Band Edge at antenna terminals

Method of test measurements please refer to KDB 971168 D01 v03 clause 6

### A.5.1 Limit:

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

### A.5.2 Test procedure:

1. The RF output of the transceiver was connected to a signal analyzer through appropriate attenuation.
2. In the 1MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.
3. The RF fundamental frequency should be excluded against the limit line in the operating frequency band
4. The limit line is derived from  $43+10\log(P)$  Db below the transmitter power P(Watts)  
 $=P(W)-[43+10\log(P)](Db)$   
 $=[30+10\log(P)](dBm)-[43+10\log(P)](Db)$   
 $=-13dBm$

### A.5.3 Test Result:

#### GSM 1900

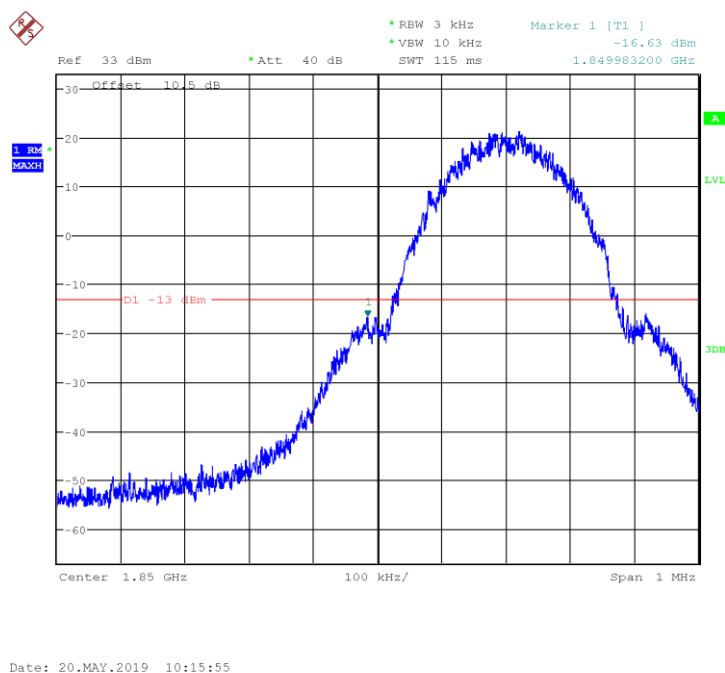
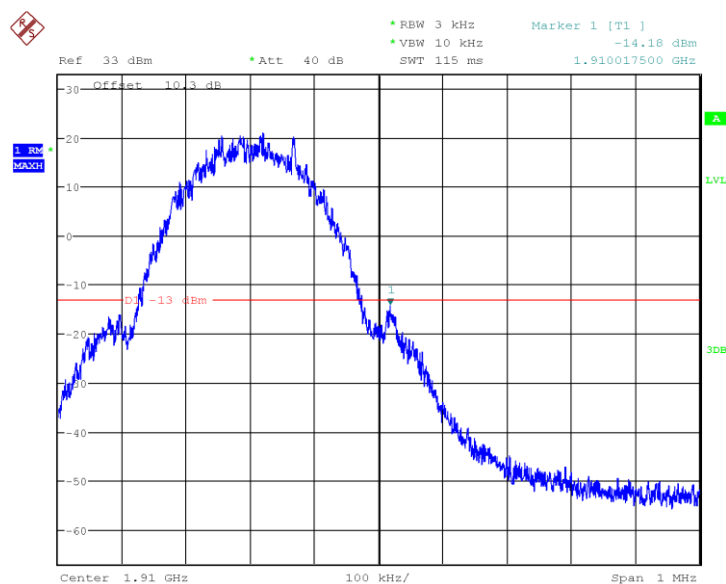


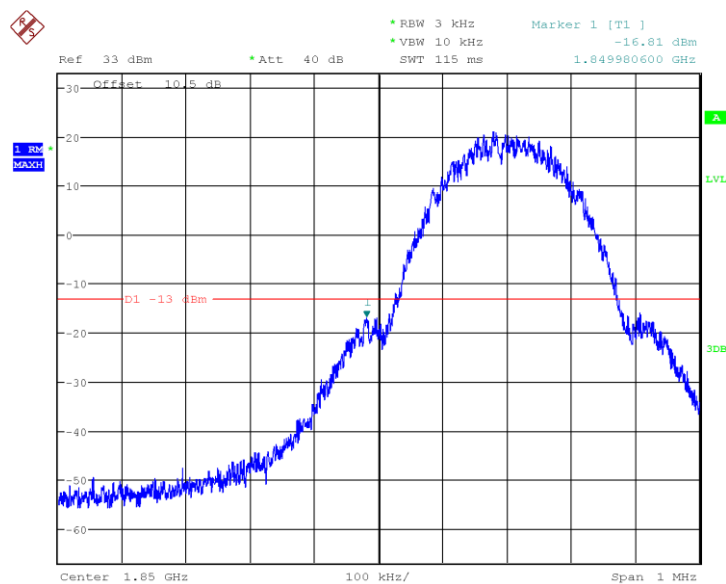
Fig.13 Channel 512- LOW BAND EDGE BLOCK



Date: 20.MAY.2019 10:17:31

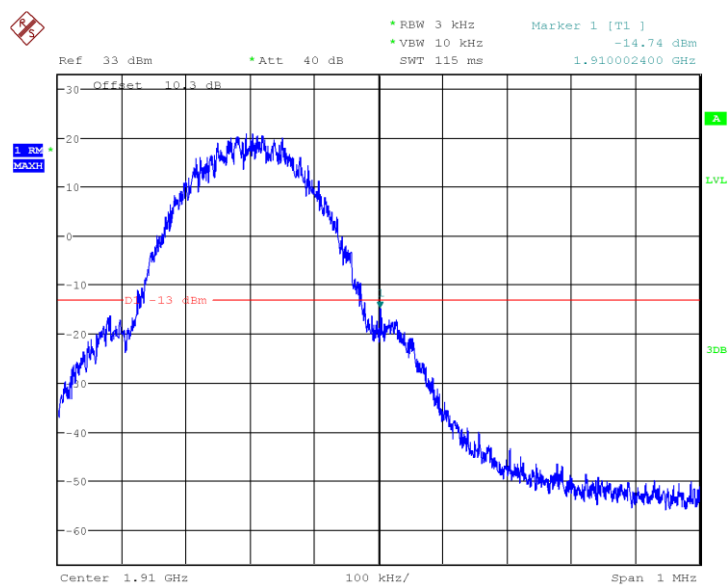
Fig.14 Channel 810- HIGH BAND EDGE BLOCK

## GPRS 1900



Date: 20.MAY.2019 10:18:55

Fig.15 Channel 512- LOW BAND EDGE BLOCK



Date: 20.MAY.2019 10:20:17

Fig.16 Channel 810- HIGH BAND EDGE BLOCK

**Conclusion: PASS**

## **ANNEX A.6. FREQUENCY STABILITY**

Method of test measurements please refer to KDB 971168 D01 v03 clause 9

### **A.6.1.Method of Measurement and test procedures**

In order to measure the carrier frequency under the condition of AFC lock, it is necessary to make measurements with the EUT in a "call mode". This is accomplished with the use of R&S CMU200 DIGITAL RADIO COMMUNICATION TESTER.

1. Measure the carrier frequency at room temperature.
2. Subject the EUT to overnight soak at -30°C.
3. With the EUT, powered via nominal voltage, connected to the CMU200 and in a simulated call on mid channel of GSM850, PCS1900, WCDMA BANDII, WCDMA BANDIV and WCDMA BANDV, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.
4. Repeat the above measurements at 10°C increments from -30°C to +50°C. Allow at least 1 1/2 hours at each temperature, unpowered, before making measurements.
5. Re-measure carrier frequency at room temperature with nominal voltage. Vary supply voltage from minimum voltage to maximum voltage, in 0.1Volt increments re-measuring carrier frequency at each voltage. Pause at nominal voltage for 1 1/2 hours unpowered, to allow any self-heating to stabilize, before continuing.
6. Subject the EUT to overnight soak at +50°C.
7. With the EUT, powered via nominal voltage, connected to the CMU200 and in a simulated call on the centre channel, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.
8. Repeat the above measurements at 10 C increments from +50°C to -30°C. Allow at least 1.5 hours at each temperature, unpowered, before making measurements.
9. At all temperature levels hold the temperature to +/- 0.5°C during the measurement procedure.

### **A.6.2. Measurement Limit**

#### **A.6.2.1. For Hand carried battery powered equipment**

According to the JTC standard the GSM frequency stability of the carrier shall be accurate to within 0.1ppm of the received frequency from the base station. And the WCDMA is 2.5ppm. This accuracy is sufficient to meet Sec.24.235, Frequency Stability. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. As this transceiver is considered "Hand carried, battery powered equipment" Section 2.1055(d)(2) applies. This requires that the lower voltage for frequency stability testing be specified by the manufacturer. This transceiver is specified to operate with an input voltage of between 3.6VDC and 4.35VDC, with a nominal voltage of 3.8VDC. Operation above or below these voltage limits is prohibited by transceiver software in order to prevent improper operation as well as to protect components from overstress. These voltages was varied from 85% to 115%.

#### A.6.2.2. For equipment powered by primary supply voltage

According to the JTC standard the GSM frequency stability of the carrier shall be accurate to within 0.1ppm of the received frequency from the base station. This accuracy is sufficient to meet Sec.24.235, Frequency Stability. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. For this EUT section 2.1055(d)(1) applies. This requires varying primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

#### A.6.3 Test results

##### PCS1900 Mid Channel/fc(MHz) 661/1880

##### Frequency Error VS Temperature

Power Supply (VDC)	Environment Temperature(°C)	Frequency error(Hz)	Limit (Hz)
3.7	-30	6.01	196
3.7	-20	-7.68	196
3.7	-10	-7.33	196
3.7	0	-21.08	196
3.7	10	-25.09	196
3.7	20	0.58	196
3.7	30	-29.38	196
3.7	40	-8.75	196
3.7	50	-9.69	196

##### Frequency Error VS Voltage

Power Supply (VDC)	Environment Temperature(°C)	Frequency error(Hz)	Limit (Hz)
3.6	25	-7.55	196
3.7	25	-15.08	196
4.2	25	-4.62	196

**Conclusion: PASS**

## **ANNEX A.7. CONDUCTED SPURIOUS EMISSION**

### **A.7.1. GSM Measurement Method and test procedures**

The following steps outline the procedure used to measure the conducted emissions from the EUT.

1. Determine frequency range for measurements: From CFR 2.1057 the spectrum should be investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency. For the equipment of PCS1900 band, this equates to a frequency range of 30 MHz to 19.1 GHz, data taken from 30 MHz to 20 GHz.
2. The sweep time is set automatically by instrument itself. That should be the optimal sweep time for the span and the RBW. If the sweep time is too short, that is sweep is too fast, the sweep result is not accurate; If the sweep time is too long, that is sweep is too low, some frequency components may be lost. The instrument will give a optimal sweep time according the selected span and RBW.
3. The procedure to get the conducted spurious emission is as follows:  
The trace mode is set to MaxHold to get the highest signal at each frequency;  
Wait 25 seconds;Get the result.
4. Determine EUT transmit frequencies: below outlines the band edge frequencies pertinent to conducted emissions testing.

#### **PCS 1900 Transmitter**

Channel	Frequency(MHz)
512	1850.2
661	1880.0
810	1909.8



### A.7.1.1. Measurement Limit

Part 24.238 specifies that the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB.

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

### A.7.1.2. Measurement result

**Spurious emission limit -13dBm.**

**Note: peak above the limit line is the carrier frequency.**

#### A.7.1.2.2. GSM1900

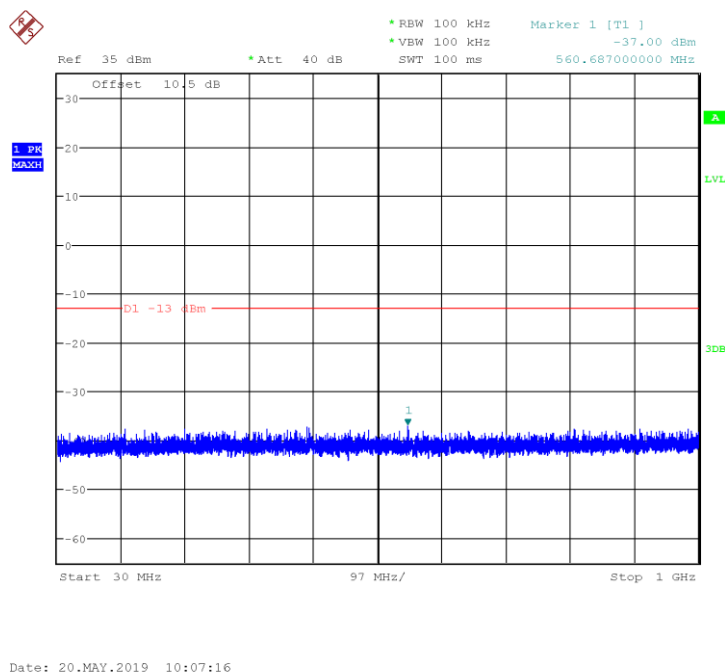
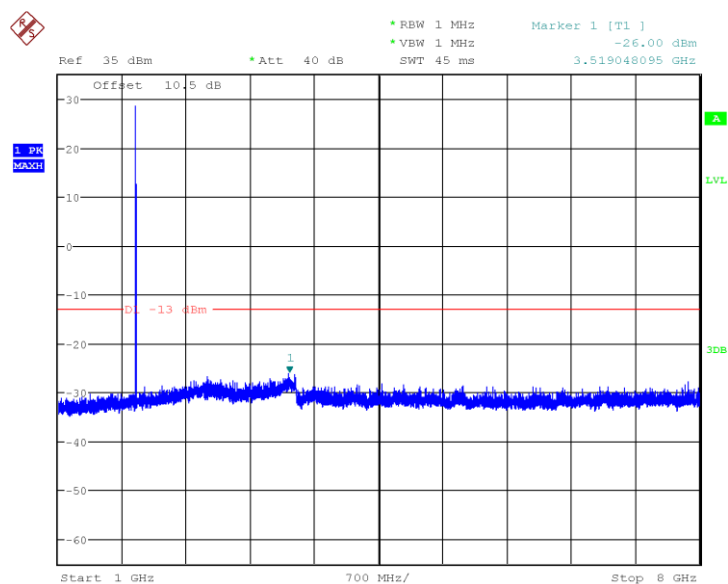
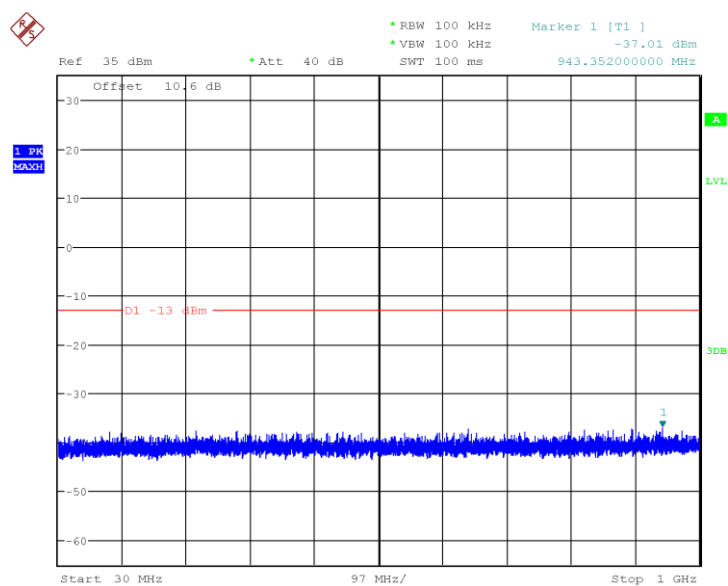


Fig.17 Channel 512: 30MHz~1GHz



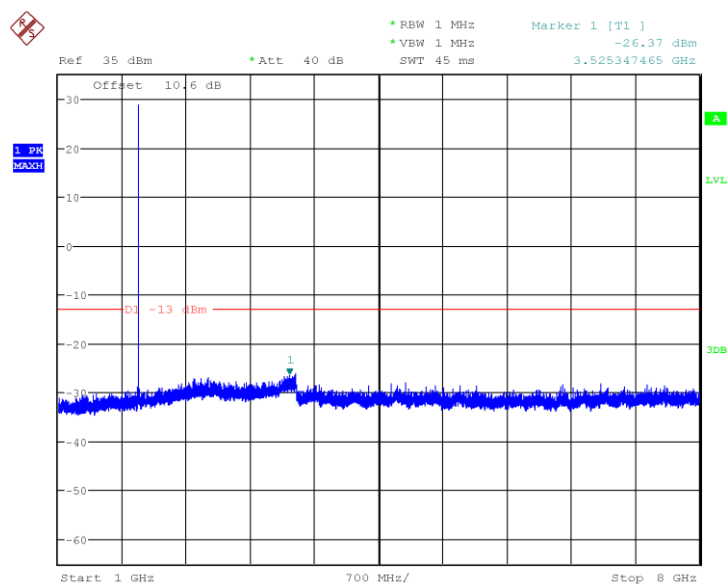
Date: 20.MAY.2019 10:07:44

Fig.18 Channel 512: 1GHz~8GHz



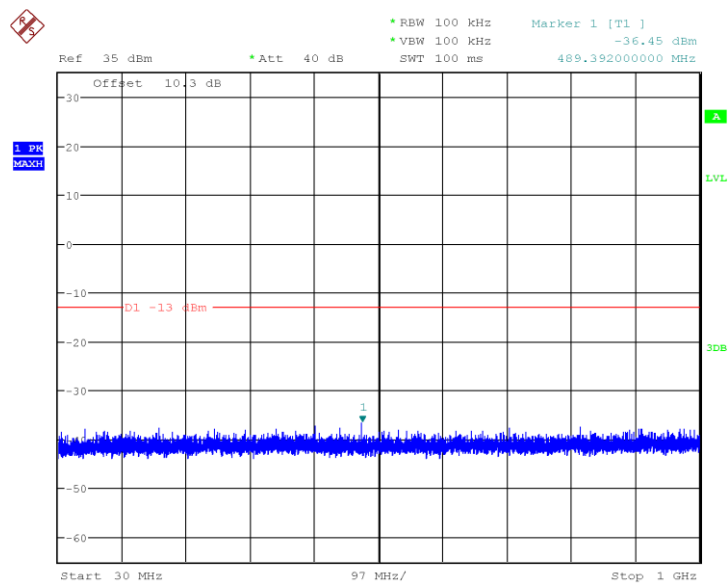
Date: 20.MAY.2019 10:08:30

Fig.19 Channel 661: 30MHz~1GHz



Date: 20.MAY.2019 10:08:59

Fig.20 Channel 661: 1GHz~8GHz



Date: 20.MAY.2019 10:09:45

Fig.21 Channel 810: 30MHz~1GHz

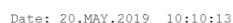


Fig.22 Channel 810: 1GHz~8GHz

**Conclusion: PASS**

### A.7.2. WCDMA Measurement Method and test procedures

The following steps outline the procedure used to measure the conducted emissions from the EUT.

1. Determine frequency range for measurements: From CFR 2.1057 the spectrum should be investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency. For the equipment of WCDMA Band II and WCDMA BANDIV, these equate to a frequency range of 30 MHz to 19.1 GHz, data taken from 30 MHz to 20 GHz. For WCDMA Band V, data taken from 30 MHz to 10GHz.
2. The sweep time is set automatically by instrument itself. That should be the optimal sweep time for the span and the RBW. If the sweep time is too short, that is sweep is too fast, the sweep result is not accurate; If the sweep time is too long, that is sweep is too low, some frequency components may be lost. The instrument will give a optimal sweep time according the selected span and RBW.
3. The procedure to get the conducted spurious emission is as follows:  
The trace mode is set to MaxHold to get the highest signal at each frequency;  
Wait 25 seconds;  
Get the result.
4. Determine EUT transmit frequencies: below outlines the band edge frequencies pertinent to conducted emissions testing.

#### A.7.2.1. Measurement Limit

Part 24.238 specify that the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB.

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

## ANNEX A.8. RADIATED

### A.8.1. EIRP

#### A.8.1.1. GSM EIRP

##### A.8.1.1.1. Description

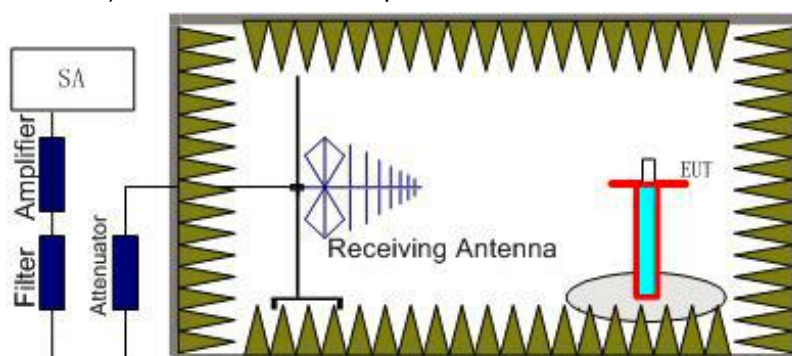
This is the test for the maximum radiated power from the EUT.

Rule Part 24.232(c) specifies, "Mobile/portable stations are limited to 2 watts e.i.r.p. Peak power" and 24.232(c) specifies that "Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage.

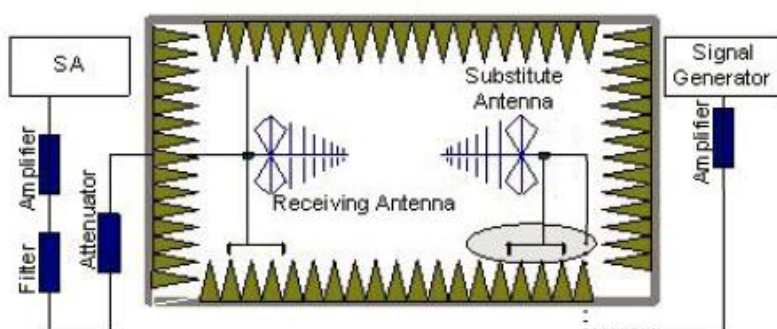
##### A.8.1.1.2. Method of Measurement

The measurements procedures in TIA-603E-2016 are used.

1. EUT was placed on a 1.5 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The height of receiving antenna is 1.5m. The test setup refers to figure below. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all transmit frequencies in three channels (High, Middle, Low) were measured with peak detector.



2. The EUT is then put into continuously transmitting mode at its maximum power level during the test. And the maximum value of the receiver should be recorded as ( $P_r$ ).
3. The EUT shall be replaced by a substitution antenna. The test setup refers to figure below.



In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power ( $P_{Mea}$ ) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded ( $P_r$ ). The power of signal source ( $P_{Mea}$ )

is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.

4. A amplifier should be connected to the Signal Source output port. And the cable should be connected between the Amplifier and the Substitution Antenna.

The cable loss ( $P_{cl}$ ), the Substitution Antenna Gain ( $G_a$ ) and the Amplifier Gain ( $P_{Ag}$ ) should be recorded after test.

The measurement results are obtained as described below:

$$\text{Power(EIRP)} = P_{\text{Mea}} + P_{\text{Ag}} - P_{\text{cl}} + G_a$$

5. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15dBi) and known input power.

6. ERP can be calculated from EIRP by subtracting the gain of the dipole,  $\text{ERP} = \text{EIRP} - 2.15\text{dBi}$ .

#### A.8.1.1.4 PCS 1900-EIRP 24.232(c)

##### A.8.1.1.4.1 Limits

	Power Step	Burst Peak EIRP (dBm)
GSM	5	$\leq 33\text{dBm}$ (2W)
GPRS	3	$\leq 33\text{dBm}$ (2W)

##### A.8.1.1.4.2 Measurement result

Main supply:

##### GSM (GMSK)

Frequency(MHz)	Peak EIRP(dBm)	Polarization
1850.2	32.00	V
1880.0	31.67	H
1909.8	30.22	V

##### GPRS (GMSK)

Frequency(MHz)	Peak EIRP(dBm)	Polarization
1850.2	32.02	V
1880.0	31.52	H
1909.8	30.49	V

## Secondary supply:

### GSM (GMSK)

Frequency(MHz)	Peak EIRP(dBm)	Polarization
1850.2	30.75	V
1880.0	31.00	H
1909.8	30.99	V

### GPRS (GMSK)

Frequency(MHz)	Peak EIRP(dBm)	Polarization
1850.2	31.32	V
1880.0	30.54	H
1909.8	31.18	V

## A.8.2 EMISSION LIMIT (§2.1051)

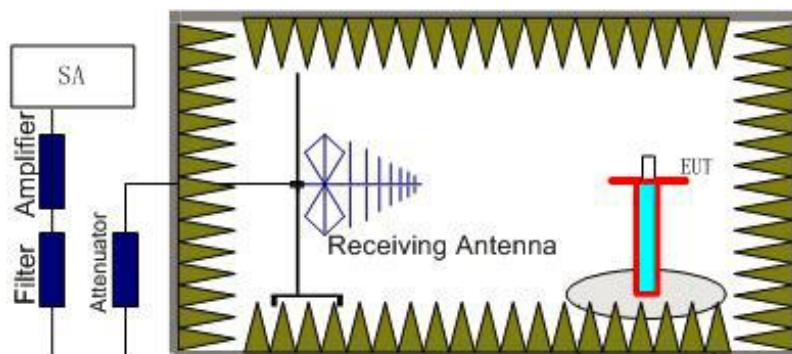
### A.8.2.1 GSM Measurement Method

The measurement procedures in TIA-603E-2016 are used.

The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier that can be as high as 1910 MHz. The resolution bandwidth is set as outlined in Part 24.238. The spectrum is scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of PCS1900.

### A.8.2.2 The procedure of radiated spurious emissions is as follows:

1. EUT was placed on a 1.5 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The height of receiving antenna is 1.5m. The test setup refers to figure below. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all non-harmonic and harmonics of the transmit frequency through the 10<sup>th</sup> harmonic were measured with peak detector.

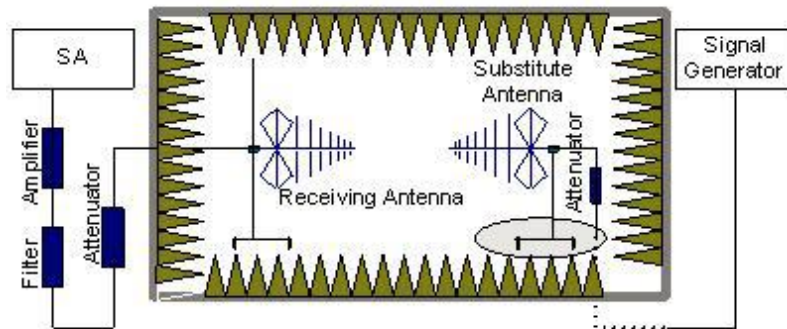


2. The EUT is then put into continuously transmitting mode at its maximum power level during



the test. And the maximum value of the receiver should be recorded as ( $P_r$ ).

3. The EUT shall be replaced by a substitution antenna. The test setup refers to figure below.



In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power ( $P_{Mea}$ ) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded ( $P_r$ ). The power of signal source ( $P_{Mea}$ ) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.

4. The Path loss ( $P_{pl}$ ) between the Signal Source with the Substitution Antenna and the Substitution Antenna Gain ( $G_a$ ) should be recorded after test.

A amplifier should be connected in for the test.

The Path loss ( $P_{pl}$ ) is the summation of the cable loss .

The measurement results are obtained as described below:

$$\text{Power(EIRP)} = P_{Mea} - P_{pl} + G_a$$

5. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power.

6. ERP can be calculated from EIRP by subtracting the gain of the dipole,  $ERP = EIRP - 2.15\text{dBi}$

#### A.8.2.3 Measurement Limit

Part 24.238 specify that the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power ( $P$ ) by a factor of at least  $43 + 10 \log(P)$  dB.

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

#### A.8.2.4 Measurement Results

Radiated emissions measurements were made only at the upper, middle, and lower carrier frequencies of the PCS1900 band (1850.2 MHz, 1880 MHz and 1909.8 MHz) . It was decided that measurements at these three carrier frequencies would be sufficient to demonstrate compliance with

emissions limits because it was seen that all the significant spurs occur well outside the band and no radiation was seen from a carrier in one block of the PCS1900. The equipment must still, however, meet emissions requirements with the carrier at all frequencies over which it is capable of operating and it is the manufacturer's responsibility to verify this.

#### A.8.2.5 Measurement Results

##### Measurements results:

Frequency	Channel	Frequency Range	Result
GSM1900	Low	30MHz~20GHz	P
	Middle	30MHz~20GHz	P
	High	30MHz~20GHz	P

##### GSM1900(Main supply)

##### GSM Mode Channel 512

##### Final result:

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit (dBm)	Polarization
3700.8	-40.99	6.6	7.7	-39.89	-13	V
5550.6	-43.25	8.2	9.5	-41.95	-13	H
7002.0	-53.16	9.3	12.9	-49.56	-13	V
9250.8	-36.25	10.6	18.5	-28.35	-13	H
12951.6	-41.13	13.2	20.2	-34.13	-13	V
14310.0	-47.39	13.6	23.5	-37.49	-13	H

##### GSM Mode Channel 661

##### Final result:

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit (dBm)	Polarization
3759.6	-44.37	6.6	7.7	-43.27	-13	H
4547.4	-51.02	7.4	7.3	-51.12	-13	H

5640.0	-41.31	8.3	10.5	-39.11	-13	V
7380.0	-54.17	9.7	14.6	-49.27	-13	H
9399.6	-43.33	10.7	18.6	-35.43	-13	V
12859.2	-45.59	13.0	19.2	-39.39	-13	V

#### GSM Mode Channel 810

##### Final result:

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit (dBm)	Polarization
3819.6	-44.9	6.7	7.7	-43.9	-13	H
4541.4	-51.57	7.4	7.3	-51.67	-13	H
5729.4	-44.57	8.5	10.5	-42.57	-13	V
6890.4	-52.84	9.3	12.9	-49.24	-13	V
9548.4	-52.83	10.7	18.6	-44.93	-13	V
12926.4	-46.47	13.0	20.2	-39.27	-13	V

#### GSM1900(Secondary supply)

##### GSM Mode Channel 512

##### Final result:

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit (dBm)	Polarization
3700.2	-39.37	6.6	7.7	-38.27	-13	V
4542.6	-50.86	7.4	7.3	-50.96	-13	H
5551.2	-39.69	8.2	9.5	-38.39	-13	V
6910.8	-52.59	9.3	12.9	-48.99	-13	V

9252.0	-39.48	10.6	18.5	-31.58	-13	V
12951.6	-43.59	13.2	20.2	-36.59	-13	V

### GSM Mode Channel 661

#### Final result:

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit (dBm)	Polarization
3759.6	-40.34	6.6	7.7	-39.24	-13	H
4471.8	-50.93	7.3	7.3	-50.93	-13	H
5640.0	-41.1	8.3	10.5	-38.9	-13	V
7520.4	-52.85	9.7	14.6	-47.95	-13	H
9399.6	-43.46	10.7	18.6	-35.56	-13	V
12861.6	-46.4	13.0	19.2	-40.2	-13	V

### GSM Mode Channel 810

#### Final result:

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit (dBm)	Polarization
3819.0	-42.03	6.7	7.7	-41.03	-13	H
4560.6	-51.03	7.4	7.3	-51.13	-13	H
5730.0	-45.43	8.5	10.5	-43.43	-13	V
9223.2	-54.1	10.5	18.5	-46.1	-13	V
11198.4	-48.68	12.1	18.5	-42.28	-13	V
14292.0	-47.93	13.6	23.5	-38.03	-13	V

#### Conclusion: PASS

Note: the EUT was displayed in several different direction, the worst cases were shown.

**Main supply****GPRS Mode Channel 512****Final result:**

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit (dBm)	Polarization
3699.6	-43.94	6.6	7.7	-42.84	-13	V
4464.6	-51.58	7.3	7.3	-51.58	-13	V
5550.6	-41.6	8.2	9.5	-40.3	-13	V
7074.0	-52.89	9.4	12.9	-49.39	-13	V
9250.8	-37.25	10.6	18.5	-29.35	-13	H
12951.6	-42.15	13.2	20.2	-35.15	-13	V

**GPRS Mode Channel 661****Final result:**

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit (dBm)	Polarization
3759.6	-45.77	6.6	7.7	-44.67	-13	H
4541.4	-51.27	7.4	7.3	-51.37	-13	H
5640.6	-42.98	8.3	10.5	-40.78	-13	V
7285.2	-53.78	9.6	13.7	-49.68	-13	V
9399.6	-44.1	10.7	18.6	-36.2	-13	H
12938.4	-46.89	13.0	20.2	-39.69	-13	V

**GPRS Mode Channel 810****Final result:**

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit (dBm)	Polarization
3819.6	-47.17	6.7	7.7	-46.17	-13	H
4548.6	-51.43	7.4	7.3	-51.53	-13	V
5729.4	-47.18	8.5	10.5	-45.18	-13	V
8247.6	-54.48	10.1	17.3	-47.28	-13	H
10273.2	-50.67	11.4	17.4	-44.67	-13	H
12812.4	-47.09	12.5	19.2	-40.39	-13	H

**Conclusion: PASS****Note: the EUT was displayed in several different direction, the worst cases were shown.**

## ANNEX B. Accreditation Certificate



\*\*\*\*\*END OF REPORT\*\*\*\*\*