



# TEST REPORT

<p><b>KCTL Inc.</b> 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea TEL: 82-31-285-0894 FAX: 82-505-299-8311 <a href="http://www.kctl.co.kr">www.kctl.co.kr</a></p>	<p>Report No.: KR20-SRF0017 Page (1) of (40)</p>	
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**1. Client**

- Name : Samsung Electronics Co., Ltd.
- Address : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
- Date of Receipt : 2019-12-26

**2. Use of Report** : -

**3. Name of Product and Model** : Mobile phone / SM-M315F/DS

**4. Manufacturer and Country of Origin** : Samsung Electronics Co., Ltd. / Korea

**5. FCC ID** : A3LSMM315F

**6. Date of Test** : 2020-01-14 to 2020-01-27

**7. Test Standards** : FCC Part 2  
FCC Part 22 Subpart H  
FCC Part 24 Subpart E

**8. Test Results** : Refer to the test result in the test report

Affirmation	Tested by	Technical Manager
	Name : Kwonse Kim (Signature)	Name : Bobae Lee (Signature)

2020-01-30

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As a test result of the sample which was submitted from the client, this report does not guarantee the whole product quality. This test report should not be used and copied without a written agreement by KCTL Inc.

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**Report revision history**

Date	Revision	Page No
2020-01-30	Initial report	-

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# KCTL

## 1. General information

Client : Samsung Electronics Co., Ltd.  
Address : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677,  
Rep. of Korea  
Manufacturer : Samsung Electronics Co., Ltd.  
Address : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677,  
Rep. of Korea  
Factory : Samsung Electronics Vietnam Thai Nguyen Co., Ltd  
Address : 506-723 16000 Yen Phong 1 Industrial Zone, Yen Trung Commu Yen Phong  
District Bac Ninh Province Vietnam  
Factory : Samsung India Electronics PVT. Ltd  
Address : B-1, Sector-8 NOIDA Uttar Pradeshe, India 201-305  
Factory : Samsung Electronics Co., Ltd.  
Address : 94-1, Imsu-dong, Gumi-si, Gyengsangbuk-do, 730-722, Republic of Korea  
Laboratory : KCTL Inc.  
Address : 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea  
Accreditations : FCC Site Designation No: KR0040, FCC Site Registration No: 687132  
VCCI Registration No. : R-20080, G-20078, C-20059, T-20056  
Industry Canada Registration No. : 8035A  
KOLAS No.: KT231

## 2. Device information

Equipment under test : Mobile Phone  
Model : SM-M315F/DS  
Modulation technique : Bluetooth(BDR/EDR)\_GFSK,  $\pi/4$ DQPSK, 8DPSK  
Bluetooth(BLE)\_GFSK  
WIFI(802.11b/g/n20/n40/ac20/ac40/ac80)\_DSSS, OFDM  
LTE\_QPSK, 16QAM  
WCDMA\_QPSK  
GSM\_GMSK, 8-PSK  
Number of channels : Bluetooth(BDR/EDR)\_79ch / Bluetooth(BLE)\_40ch  
802.11b/g/n\_HT20 : 11 ch  
UNII-1: 4 ch (20 MHz), 2 ch (40 MHz), 1 ch (80 MHz)  
UNII-2A: 4 ch (20 MHz), 2 ch (40 MHz), 1 ch (80 MHz)  
UNII-2C: 12 ch (20 MHz), 6 ch (40 MHz), 3 ch (80 MHz)  
UNII-3: 5 ch (20 MHz), 2 ch (40 MHz), 1 ch (80 MHz)  
Power source : DC 3.85 V  
Antenna specification : LTE/GSM/WCDMA\_LDS Antenna  
WIFI/Bluetooth(BDR/EDR/BLE)\_LDS Antenna

Antenna gain	: WIFI/Bluetooth(BDR/EDR/BLE) : -3.4 dBi UNII-1 -5.9 dBi UNII-2A -6.3 dBi UNII-2C -5.3 dBi UNII-3 -6.6 dBi
Frequency range	: Bluetooth(BDR/EDR/BLE)_2 402 MHz ~ 2 480 MHz 2 412 MHz ~ 2 462 MHz (802.11b/g/n_HT20) UNII-1: 5 180 MHz ~ 5 240 MHz (802.11a/n_HT20/ac_VHT20) UNII-1: 5 190 MHz ~ 5 230 MHz (802.11n_HT40/ac_VHT40) UNII-1: 5 210 MHz (802.11ac_VHT80) UNII-2A: 5 260 MHz ~ 5 320 MHz (802.11a/n_HT20/ac_VHT20) UNII-2A: 5 270 MHz ~ 5 310 MHz (802.11n_HT40/ac_VHT40) UNII-2A: 5 290 MHz (802.11ac_VHT80) UNII-2C: 5 500 MHz ~ 5 720 MHz (802.11a/n_HT20/ac_VHT20) UNII-2C: 5 510 MHz ~ 5 710 MHz (802.11n_HT40/ac_VHT40) UNII-2C: 5 530 MHz ~ 5 690 MHz (802.11ac_VHT80) UNII-3: 5 745 MHz ~ 5 825 MHz (802.11a/n_HT20/ac_VHT20) UNII-3: 5 755 MHz ~ 5 795 MHz (802.11n_HT40/ac_VHT40) UNII-3: 5 775 MHz (802.11ac_VHT80) LTE Band 2_1 850.7 MHz ~ 1 909.3 MHz LTE Band 4_1 710.7 MHz ~ 1 754.3 MHz LTE Band 5_824.7 MHz ~ 848.3 MHz LTE Band 12_699.7 MHz ~ 715.3 MHz LTE Band 13_779.5 MHz ~ 784.5 MHz LTE Band 17_706.5 MHz ~ 713.5 MHz LTE Band 26_824.7 MHz ~ 848.3 MHz, 814.7 MHz ~ 823.3 MHz LTE Band 41_2 498.5 MHz ~ 2 687.5 MHz LTE Band 66_1 710.7 MHz ~ 1 779.3 MHz GSM 850_824.2 MHz ~ 848.8 MHz GSM 1900_1 850.2 MHz ~ 1 909.8 MHz WCDMA 850_826.4 MHz ~ 846.6 MHz WCDMA 1700_1 712.4 MHz ~ 1 752.6 MHz WCDMA 1910_1 852.4 MHz ~ 1 907.6 MHz
Software version	: M315F.001
Hardware version	: REV1.0
Test device serial No.	: Conducted(R38MC0ANYKB, R38MC0ANZKH, R38MC0AP17A, R38MC0ANXTJ) Radiated(R38MC0ANYWL, R38MC0ANZHK)
Operation temperature	: -30 °C ~ 50 °C

## 2.1. Accessory information

Equipment	Manufacturer	Model	Serial No.	Power source
Travel Adapter	Samsung Electronics Co., Ltd.	EP-TA200	R37M4NR27T1SE3	AC 100-240V 50-60 Hz, 0.5A, 9.0V-1.67A, 5.0V-2.0A
Micro USB Data Cable	Samsung Electronics Co., Ltd.	-	-	-

## 2.2. Frequency/channel operations

This device contains the following capabilities:

WIFI(2.4GHz band 802.11b/g/n(HT20), 5GHz band 802.11a/n(HT20/HT40)/ac(VHT/20/40/80)),  
 Bluetooth(BDR/EDR/BLE),

LTE Band 2, LTE Band 4, LTE Band 5, LTE Band 12, LTE Band 13, LTE Band 17, LTE Band 26,  
 LTE Band 41, LTE Band 66, WCDMA 850, WCDMA 1700, WCDMA 1900, GSM 850, GSM 1900

### GSM 850

Ch.	Frequency (MHz)
128	824.2
190	836.6
251	848.8

Table 2.2.1.  
GSM/GPRS/EDGE

### GSM 1900

Ch.	Frequency (MHz)
512	1 850.2
661	1 880.0
810	1 909.8

Table 2.2.2.  
GSM/GPRS/EDGE

## 3. Maximum ERP/EIRP power

### GSM 850

Mode	Tx frequency (MHz)	Emission designator	ERP	
			Max. power (dBm)	Max. power (W)
GSM 850 (GPRS)	824.2 ~ 848.8	242KGXW	31.28	1.340
GSM 850 (EDGE)	824.2 ~ 848.8	238KG7W	31.05	1.274

### GSM 1900

Mode	Tx frequency (MHz)	Emission designator	EIRP	
			Max. power (dBm)	Max. power (W)
GSM 1900 (GPRS)	1 850.2 ~ 1 909.8	240KGXW	28.35	0.684
GSM 1900 (EDGE)	1 850.2 ~ 1 909.8	238KG7W	27.35	0.543

#### 4. Summary of tests

FCC Part Section(s)	Parameter	Test Limit	Test Condition	Test results
2.1046 22.913(a)(5) 24.232(c)	Conducted Output Power	N/A	Conducted	Pass
2.1049	Occupied Bandwidth & 26 dB Bandwidth	N/A		Pass
2.1051 22.917(a) 24.238(a)	Band Edge Emissions at Antenna Terminal	<43 + 10Log <sub>10</sub> (P) dB		Pass
	Spurious Emissions at Antenna Terminal			Pass
24.232(d)	Peak to Average Power Ratio	< 13 dB		Pass
2.1055 22.355 24.235	Frequency stability	< 2.5 ppm (Part 22) Emission must remain in band (Part 24)		Pass
22.913(a)(5)	Effective Radiated Power	< 7 Watts max. ERP		Radiated
24.232(c)	Equivalent Isotropic Radiated Power	< 2 Watts max. EIRP	Pass	
			Pass	
2.1053 22.917(a) 24.238(a)	Radiated Spurious Emissions	<43 + 10Log <sub>10</sub> (P) dB	Pass	

#### Notes:

- The test procedure(s) in this report were performed in accordance as following.
  - ANSI C63.26-2015
  - ANSI/TIA-603-E-2016
  - KDB 971168 D01 v03r01

#### 4.1. Worst case orientation

- All modes of operation were investigated and the worst case emissions are reported with the EUT positioning, modulations in the test data.
- For GSM850, the fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z. It was determined that **X** orientation was worst-case orientation. Therefore, all final radiated testing was performed with the EUT in **X** orientation.
- For GSM1900, the fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z. It was determined that **Z** orientation was worst-case orientation. Therefore, all final radiated testing was performed with the EUT in **Z** orientation.

Test condition	Modulation	Mode
Radiated	GMSK	GPRS (1 Tx Slot)
Conducted	GMSK 8-PSK	GPRS & EDGE (1 Tx Slot)

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**KCTL****5. Measurement uncertainty**

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4-2014.

All measurement uncertainty values are shown with a coverage factor of  $k=2$  to indicate a 95 % level of confidence. The measurement data shown herein meets or exceeds the  $U_{\text{CISPR}}$  measurement uncertainty values specified in CISPR 16-4-2 and thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded uncertainty ( $\pm$ )	
Conducted RF power	1.23 dB	
Conducted spurious emissions	1.24 dB	
Radiated spurious emissions	30 MHz ~ 1 GHz	3.66 dB
	Above 1 GHz	3.32 dB

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**6. Measurement results explanation example**

The offset level is set in the spectrum analyzer to compensate the RF cable loss 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.

Frequency (MHz)	Factor(dB)	Frequency (MHz)	Factor(dB)
30	5.69	11 000	7.34
50	5.83	12 000	7.48
100	6.00	13 000	7.54
200	6.10	14 000	7.61
300	6.19	15 000	7.53
400	6.28	16 000	7.63
500	6.30	17 000	6.29
600	6.32	18 000	7.80
700	6.35	19 000	7.90
800	6.37	20 000	8.14
900	6.42	21 000	7.99
1 000	6.41	22 000	8.67
2 000	6.52	23 000	8.06
3 000	6.55	24 000	8.68
4 000	6.73	25 000	8.57
5 000	6.84	26 000	8.63
6 000	6.90	26 500	9.22
7 000	6.89	27 000	9.33
8 000	7.00	28 000	8.46
9 000	6.82	29 000	8.10
10 000	7.21	30 000	8.11

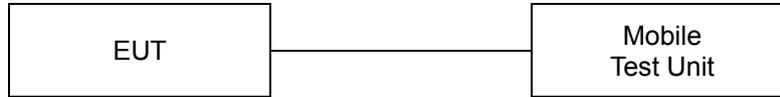
**Note.**

Offset(dB) = RF cable loss(dB) + Divider (dB)

## 7. Test results

### 7.1. Conducted output power

#### Test setup



#### Test procedure

971168 D01 v03r01 – Section 5.2  
ANSI C63.26-2015 – Section 5.2.4.2  
CFR 47, - Section §2.1046

#### Test settings

When an average power meter is used to perform RF output power measurements, the fundamental condition that measurement be performed only over durations of active transmissions at maximum output power level applies. Thus, an average power meter can always be used to perform the measurement when the EUT can be configured to transmit continuously.

If the EUT cannot be configured to transmit continuously (i.e., burst duty cycle < 98%), then the following options can be implemented to facilitate measurement of the average power with an average power meter:

- a) A gated average power meter can be used to perform the measurement if the gating parameters can be adjusted such that the power is measured only during active transmission bursts at maximum output power levels.
- b) A conventional average power meter with no signal gating capability can also be used if the measured burst duty cycle is constant (i.e., duty cycle variations are less than or equal to  $\pm 2\%$ ) by performing the measurement over the on/off burst cycles and then correcting (increasing) the measured level by a factor equal to  $[10\log (1/\text{duty cycle})]$ . See 5.2.4.3.4 for guidance with respect to measuring the transmitter duty cycle.

See item r) of 4.1 for more information regarding power meter functional requirements and limitations, and consult the instrumentation-specific application literature for proper set-up and use.

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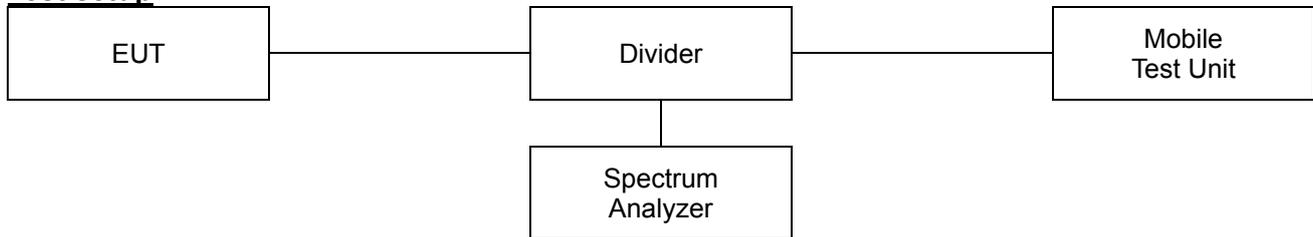
**KCTL****Test results**

Maximum Burst-Average Output Power (dBm)										
Test Band	Channel	GSM	GPRS				EDGE			
		Voice	1Tx	2Tx	3Tx	4Tx	1Tx	2Tx	3Tx	4Tx
GSM850	128	32.82	<b>32.90</b>	30.45	28.93	27.89	26.20	24.46	22.81	21.39
	190	32.68	<b>32.73</b>	30.29	28.75	27.93	26.10	24.31	22.65	21.24
	251	32.72	<b>32.74</b>	30.27	28.73	27.89	26.10	24.26	22.60	21.14
GSM1900	512	30.05	<b>30.09</b>	27.52	25.92	24.89	25.88	23.81	22.34	20.79
	661	30.13	<b>30.17</b>	27.66	26.23	24.99	26.00	23.97	22.44	20.93
	810	29.97	<b>30.02</b>	27.43	26.03	24.80	25.86	23.82	22.27	20.99

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## 7.2. 99% Occupied Bandwidth & 26dB Bandwidth

### Test setup



### Limit

According to §2.1049, the occupied bandwidth, that 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 radiated by a given emission shall be measured.

### Test procedure

971168 D01 v03r01 – Section 4.2 and 4.3  
ANSI C63.26-2015 – Section 5.4.3 and 5.4.4

### Test settings

#### ◆ 26dB Bandwidth

- a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the spectrum analyzer shall be wide enough to see sufficient roll off of the signal to make the measurement.
- b) The nominal RBW shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set  $\geq 3 \times$  RBW.
- c) Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation. See guidance provided in 4.2.3.
- d) The dynamic range of the spectrum analyzer at the selected RBW shall be more than 10 dB below the target “-X dB” requirement, i.e., if the requirement calls for measuring the -26 dB OBW, the spectrum analyzer noise floor at the selected RBW shall be at least 36 dB below the reference level.
- e) Set spectrum analyzer detection mode to peak, and the trace mode to max hold.
- f) Determine the reference value by either of the following:
  - 1) Set the EUT to transmit a modulated signal. Allow the trace to stabilize. Set the spectrum analyzer marker to the highest level of the displayed trace (this is the reference value).
  - 2) Set the EUT to transmit an unmodulated carrier. Set the spectrum analyzer marker to the level of the carrier.
- g) Determine the “-X dB amplitude” as equal to (Reference Value - X). Alternatively, this calculation can be performed on the spectrum analyzer using the delta-marker measurement function.
- h) If the reference value was determined using an unmodulated carrier, turn the EUT modulation on, then either clear the existing trace or start a new trace on the spectrum analyzer and allow the new trace to stabilize. Otherwise the trace from step f) shall be used for step i).

- i) Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display such that each marker is at or slightly below the “-X dB amplitude” determined in step f). If a marker is below this “-X dB amplitude” value it should be as close as possible to this value. The OBW is the positive frequency difference between the two markers.
- j) The spectral envelope can cross the “-X dB amplitude” at multiple points. The lowest or highest frequency shall be selected as the frequencies that are the farthest away from the center frequency at which the spectral envelope crosses the “-X dB amplitude.”
- k) The OBW shall be reported by providing plot(s) of the measuring instrument display, to include markers depicting the relevant frequency and amplitude information (e.g., marker table). The frequency and amplitude axis and scale shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

#### ◆ 99% Occupied Bandwidth

- a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation products including the emission skirts (typically a span of  $1.5 \times \text{OBW}$  is sufficient).
- b) The nominal IF filter 3 dB bandwidth (RBW) shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set  $\geq 3 \times \text{RBW}$ .
- c) Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation. See guidance provided in 4.2.3.
- d) Set the detection mode to peak, and the trace mode to max-hold.
- e) If the instrument does not have a 99% OBW function, recover the trace data points and sum directly in linear power terms. Place the recovered amplitude data points, beginning at the lowest frequency, in a running sum until 0.5% of the total is reached. Record that frequency as the lower OBW frequency. Repeat the process until 99.5% of the total is reached and record that frequency as the upper OBW frequency. The 99% power OBW can be determined by computing the difference these two frequencies.
- f) The OBW shall be reported and plot(s) of the measuring instrument display shall be provided with the test report. The frequency and amplitude axis and scale shall be clearly labeled. Tabular data can be reported in addition to the plot(s).

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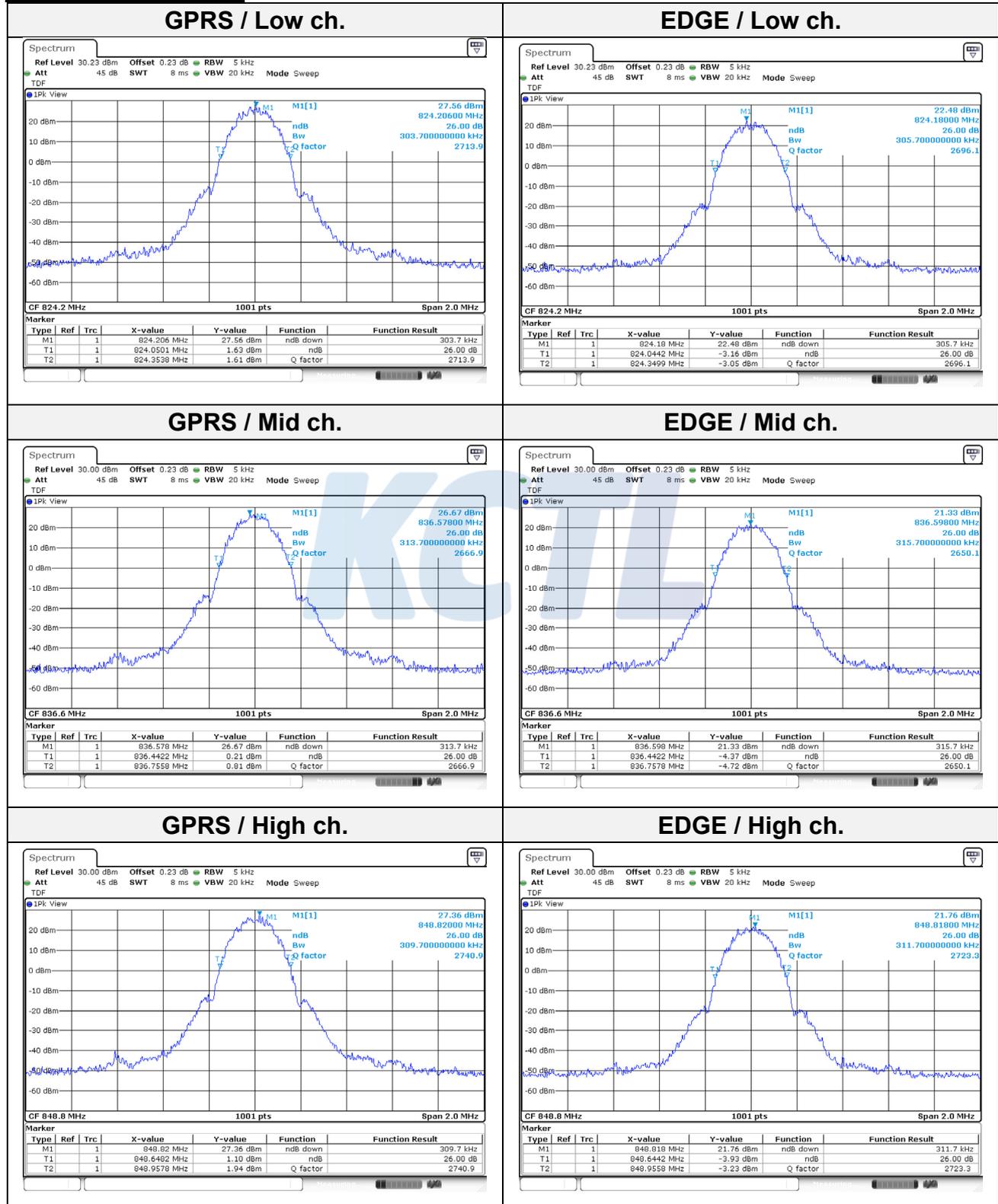
**Test results**

Test mode		Frequency (MHz)	26 dB bandwidth (MHz)	99 % bandwidth (MHz)
GSM 850	GPRS	824.2	0.304	0.242
		836.6	0.314	0.236
		848.8	0.310	0.238
	EDGE	824.2	0.306	0.238
		836.6	0.316	0.240
		848.8	0.312	0.240
GSM 1900	GPRS	1 850.2	0.310	0.240
		1 880.0	0.310	0.236
		1 909.8	0.310	0.234
	EDGE	1 850.2	0.292	0.238
		1 880.0	0.310	0.240
		1 909.8	0.310	0.240



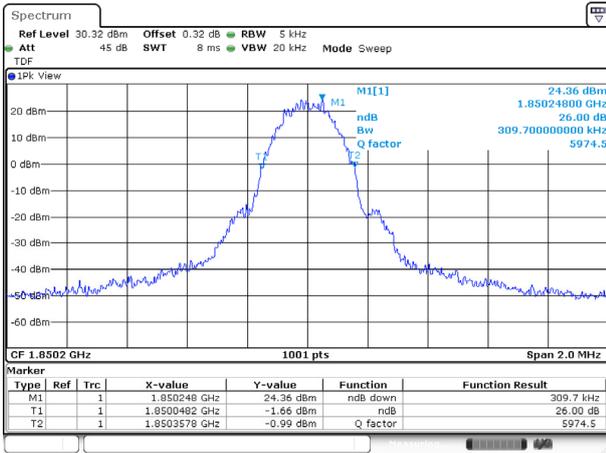
**26dB Bandwidth**

**Test mode: GSM 850**

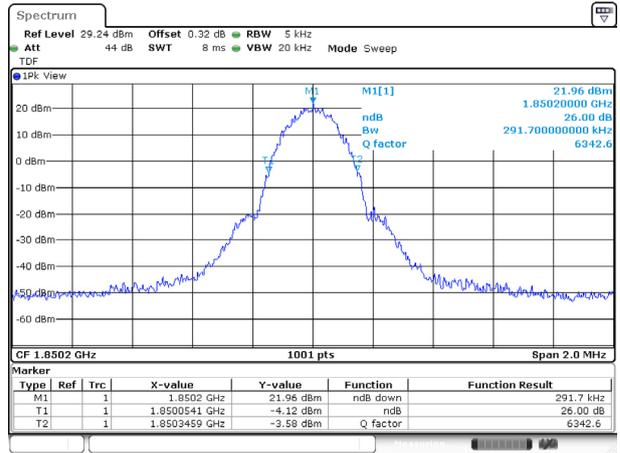


**Test mode: GSM 1900**

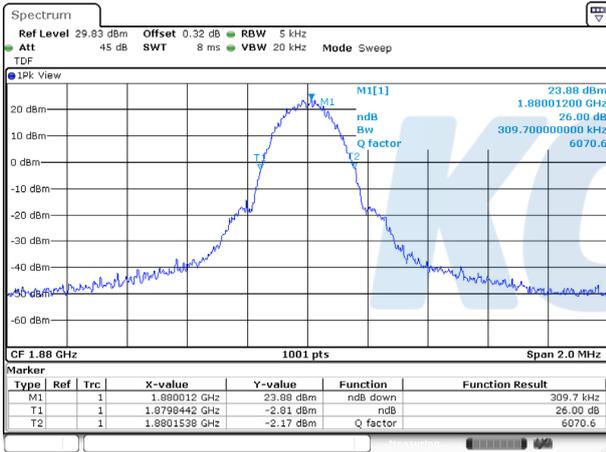
**GPRS / Low ch.**



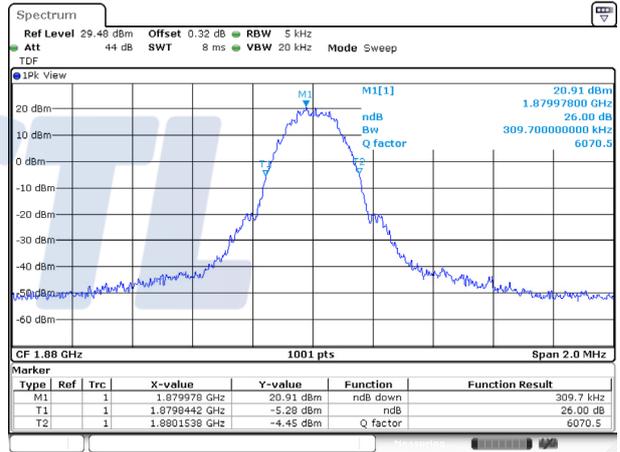
**EDGE / Low ch.**



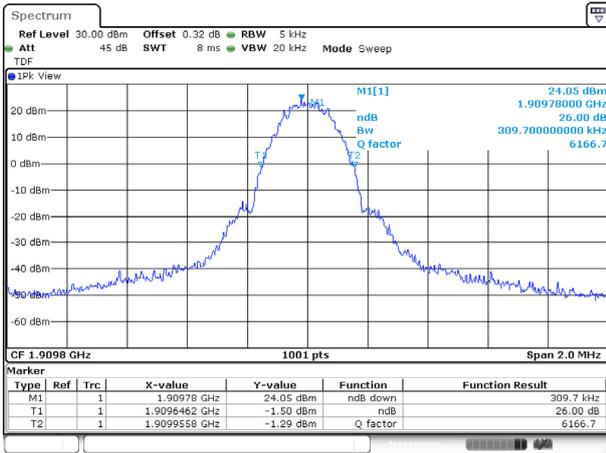
**GPRS / Mid ch.**



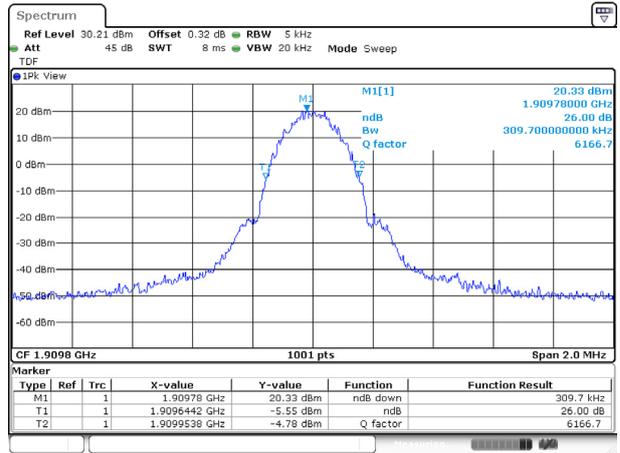
**EDGE / Mid ch.**



**GPRS / High ch.**



**EDGE / High ch.**



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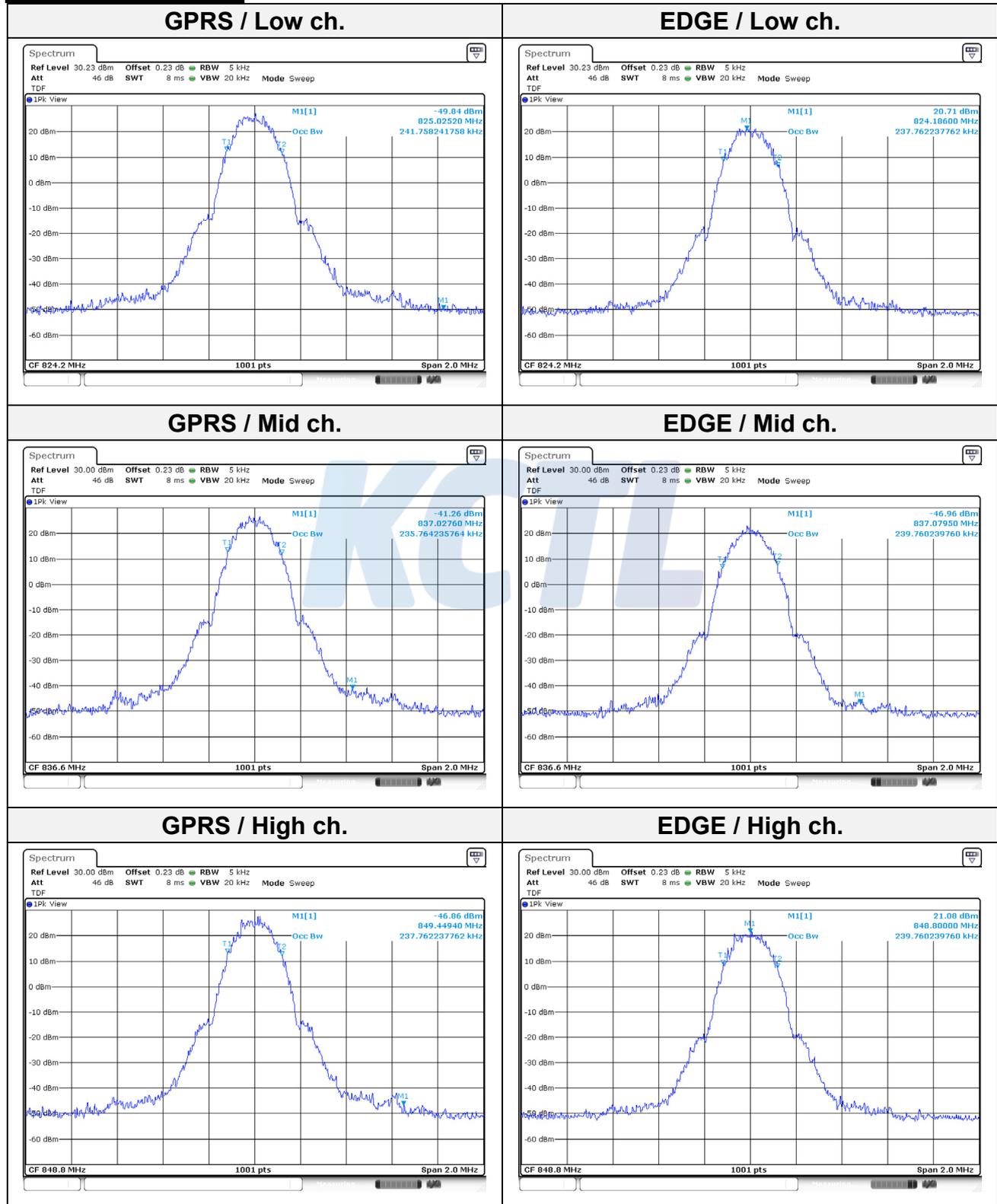
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## 99% Occupied Bandwidth

### Test mode: GSM 850



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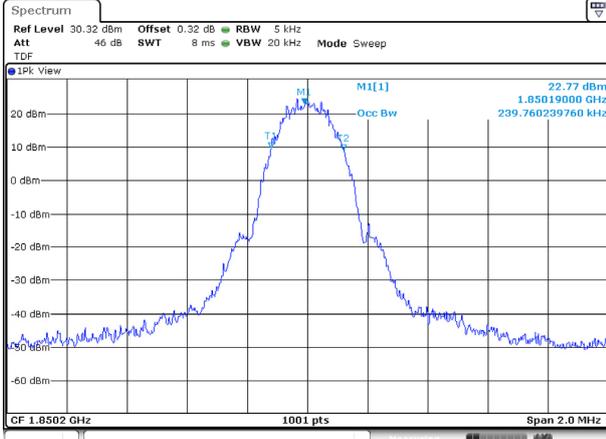
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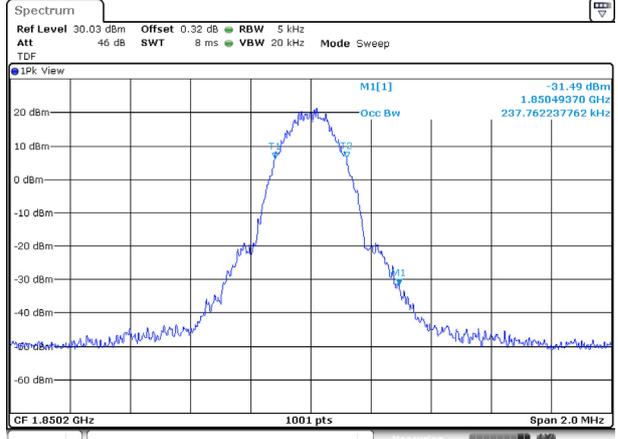


## Test mode: GSM 1900

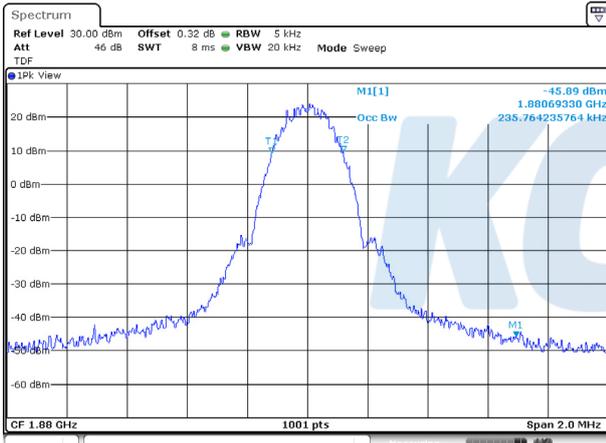
### GPRS / Low ch.



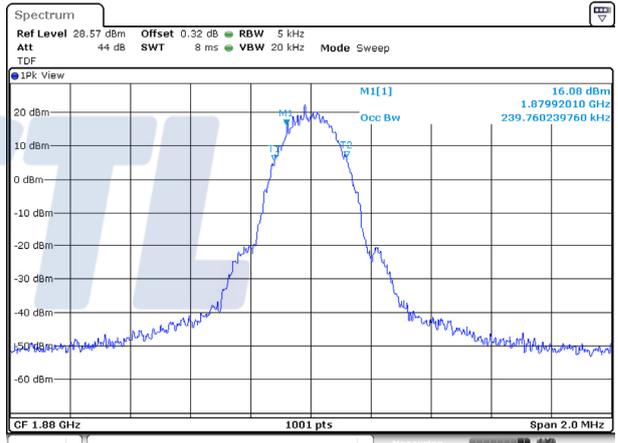
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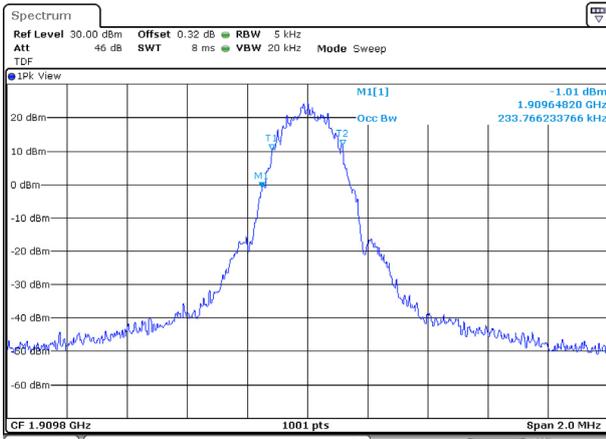
### GPRS / Mid ch.



### EDGE / Mid ch.



### GPRS / High ch.



### EDGE / High ch.

