5. Peak-Average Ratio

5.1. Limit

- §22.913(d) Measurement of the ERP of Cellular base transmitters and repeaters must be made using an average power measurement technique. The peak-to-average ratio (PAR) of the transmission must not exceed 13 ㏈.

- §24.232(d), power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (e) of this section. In both instances, equipment employed must be authorized in accordance with the provisions of §24.51. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 ㏈.

- §27.50(d)(5), power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (d)(6) of this section. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 ㏈.

5.2. Test Procedure

The test follows section 5.2.3.4 of ANSI C63.26-2015.

See instrumentation-specific application literature for further guidance regarding use of the CCDF capability. The following guidelines are offered for performing a CCDF measurement.

a. Set resolution/measurement bandwidth ≥ OBW or specified reference bandwidth.

b. Set the number of counts to a value that stabilizes the measured CCDF curve.

c. Set the measurement interval as follows:

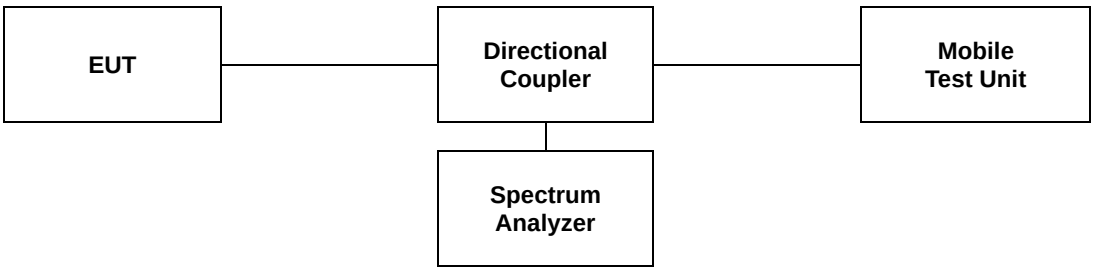
1) For continuous transmissions, set to greater of [10 x (number of points in sweep) x (transmission symbol period)] or 1 ㎳.

2) For burst transmissions, employ an external trigger that is synchronized with the EUT burst timing sequence, or use the internal burst trigger with a trigger level that allows the burst to stabilize. Set the measurement interval to a time that is less than or equal to the burst duration.

3) If there are several carriers in a single antenna port, the peak power shall be determined for each individual carrier (by disabling the other carriers while measuring the required carrier) and the total peak power calculated from the sum of the individual carrier peak powers.

d. Record the maximum PAPR level associated with a probability of 0.1 %.

e. The peak power level is calculated form the sum of the PAPR value from step d) to the measured average power.



5.3 Test Results

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

SIM 1

Band	Mode	Frequency (㎒)	PAR (㏈)
WCDMA Ⅱ	RMC	1 852.4	2.99
		1 880.0	2.99
		1 907.6	2.99
	HSDPA	1 852.4	3.30
		1 880.0	3.30
		1 907.6	3.28
WCDMA Ⅳ	RMC	1 712.4	3.01
		1 732.6	2.99
		1 752.6	2.96
	HSDPA	1 712.4	3.28
		1 732.6	3.33
		1 752.6	3.25
WCDMA Ⅴ	RMC	826.4	2.93
		836.6	2.87
		846.6	3.45
	HSDPA	826.4	3.19
		836.6	3.16
		846.6	3.28

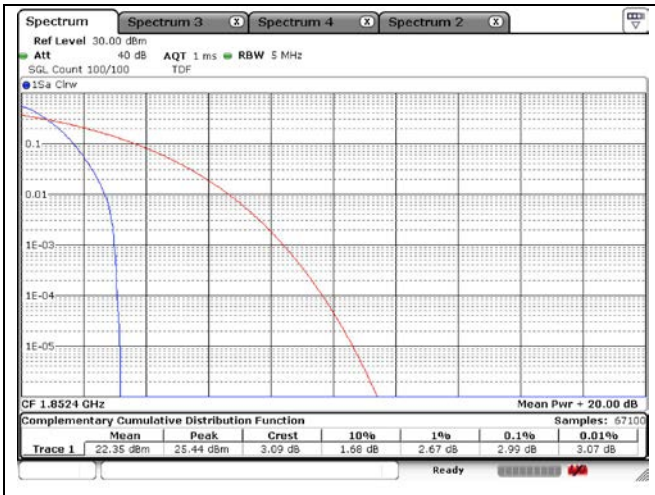
Band	Mode	Frequency (㎒)	PAR (㏈)
GSM 850	VOICE	824.2	3.01
		836.6	3.01
		848.8	3.04
	EDGE	824.2	3.01
		836.6	3.01
		848.8	3.01
GSM 1900	VOICE	1 850.2	2.99
		1 880.0	2.99
		1 909.8	2.99
	EDGE	1 850.2	2.99
		1 880.0	2.99
		1 909.8	2.96

SIM 2

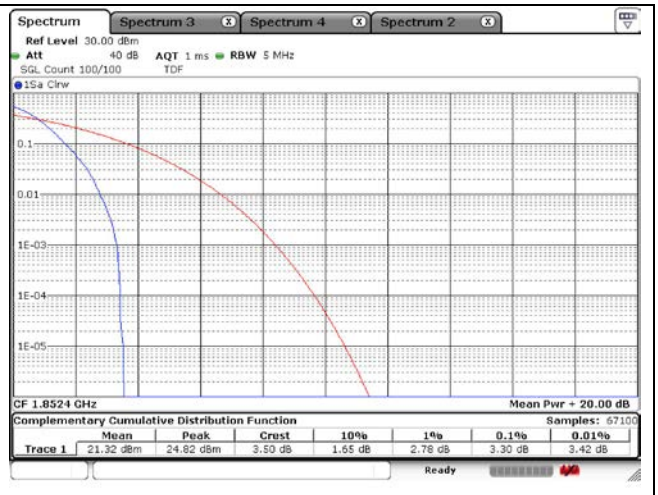
Band	Mode	Frequency (㎒)	PAR (㏈)
GSM 850	VOICE	824.2	3.01
		836.6	3.01
		848.8	2.99
	EDGE	824.2	2.96
		836.6	2.99
		848.8	2.96
GSM 1900	VOICE	1 850.2	3.04
		1 880.0	3.04
		1 909.8	3.04
	EDGE	1 850.2	3.04
		1 880.0	3.07
		1 909.8	3.04

- Test plots

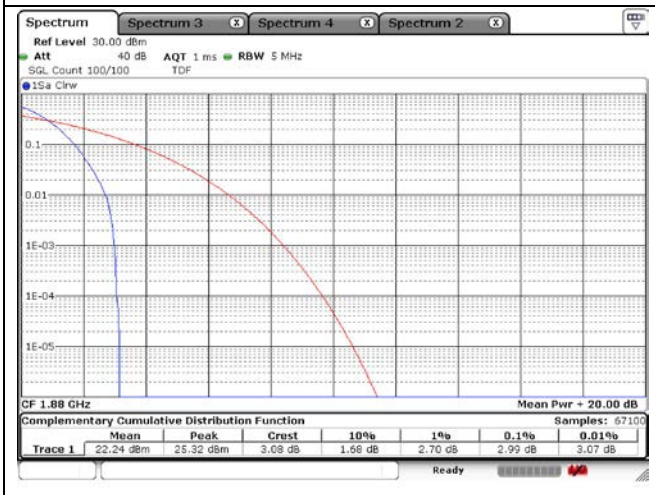
SIM1
WCDMA Ⅱ



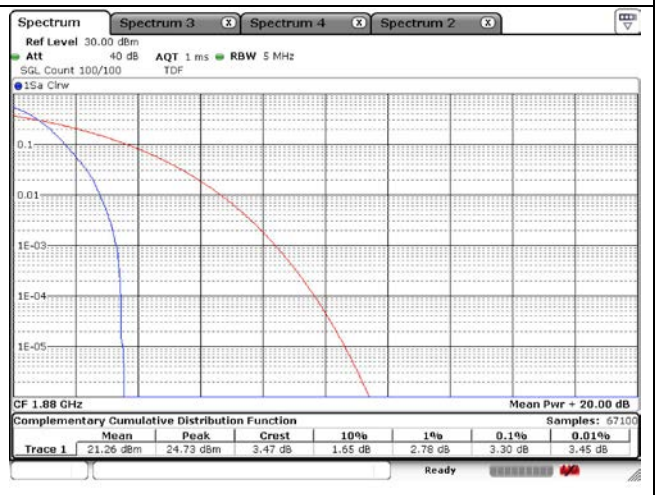
WCDMA Ⅱ RMC Low Channel



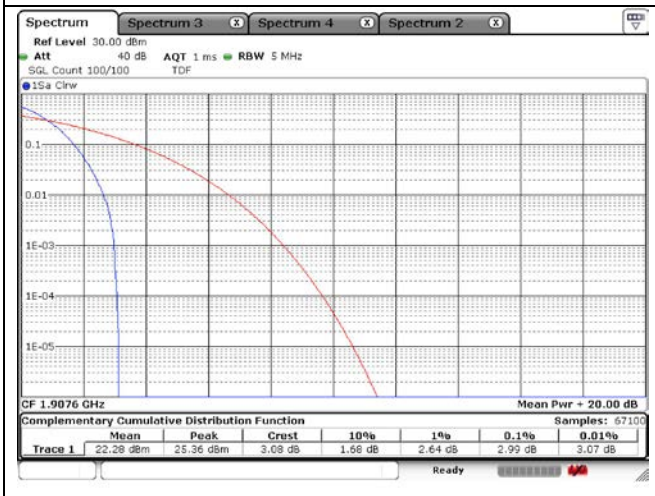
WCDMA Ⅱ HSDPA Low Channel



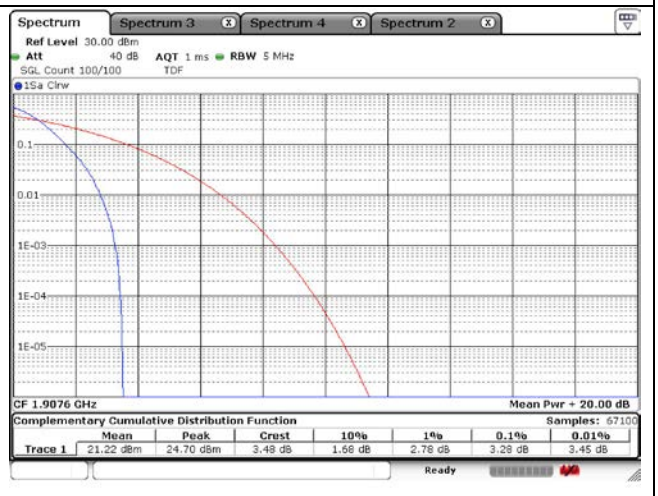
WCDMA Ⅱ RMC Middle Channel



WCDMA Ⅱ HSDPA Middle Channel

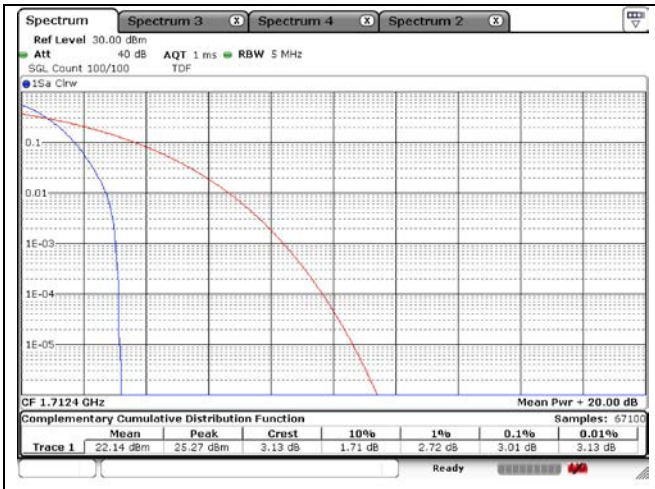


WCDMA Ⅱ RMC High Channel

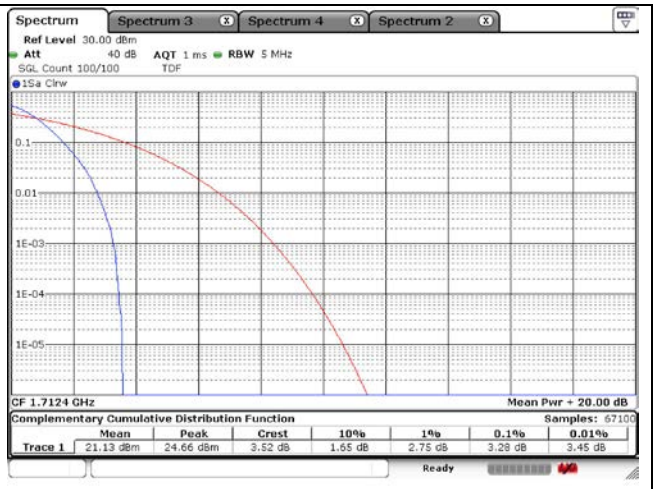


WCDMA Ⅱ HSDPA High Channel

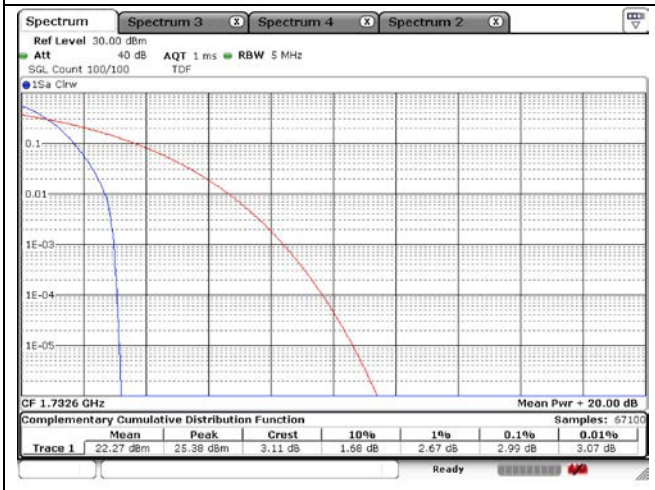
WCDMA Ⅳ



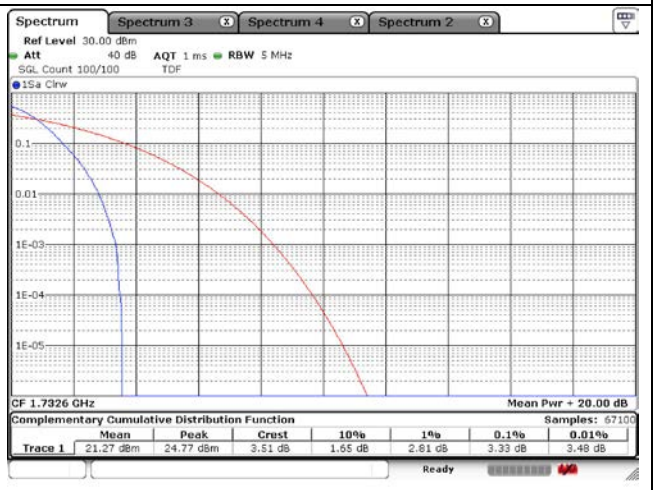
WCDMA Ⅳ RMC Low Channel



WCDMA Ⅳ HSDPA Low Channel

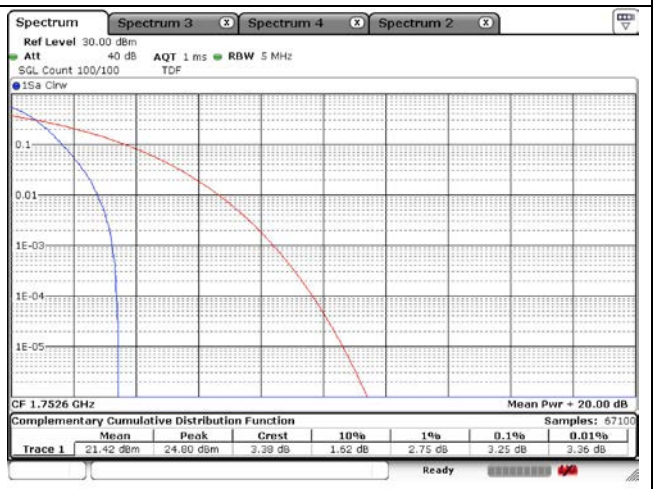


WCDMA Ⅳ RMC Middle Channel



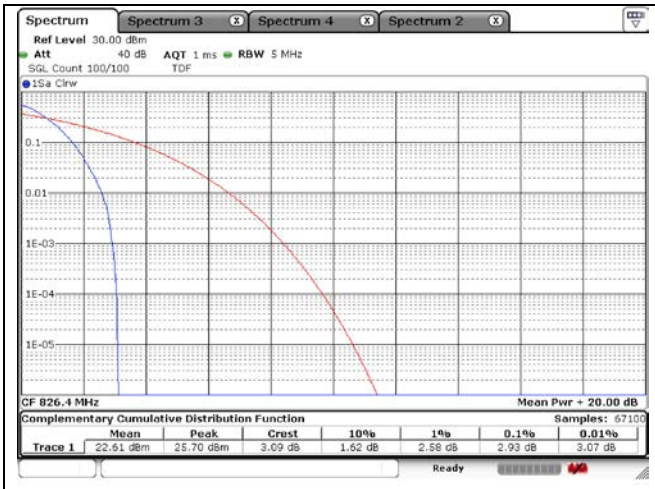
WCDMA Ⅳ HSDPA Middle Channel

WCDMA Ⅳ RMC High Channel

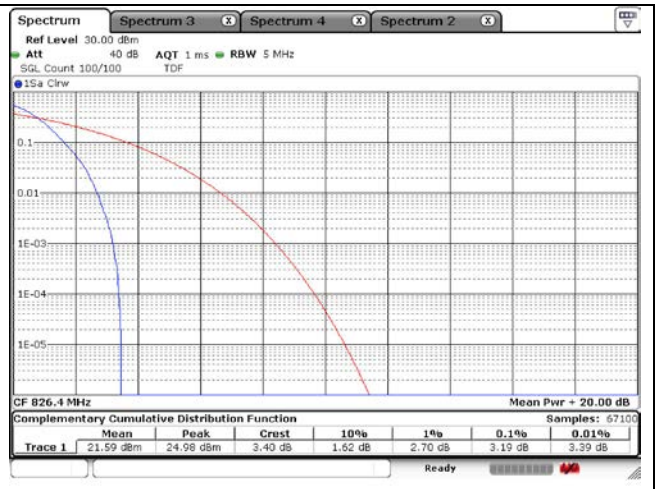


WCDMA Ⅳ HSDPA High Channel

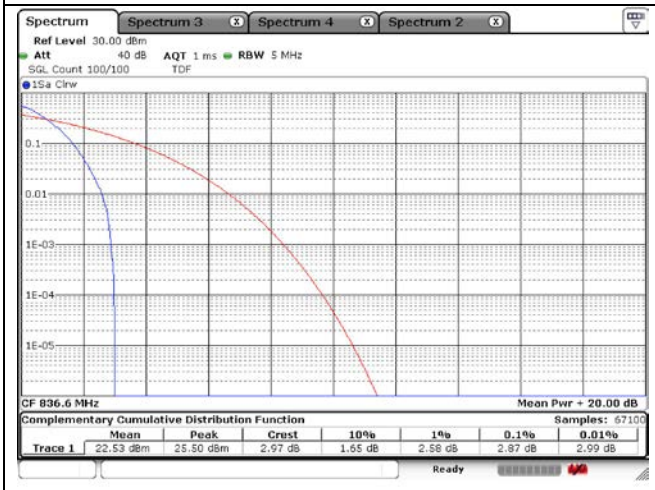
WCDMA Ⅴ



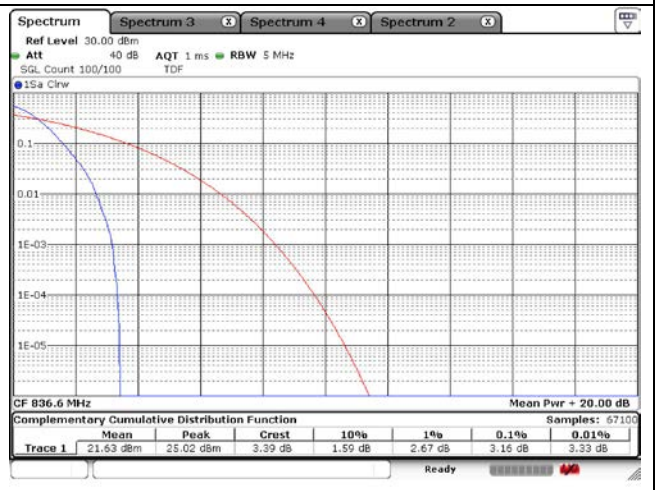
WCDMA Ⅴ RMC Low Channel



WCDMA Ⅴ HSDPA Low Channel

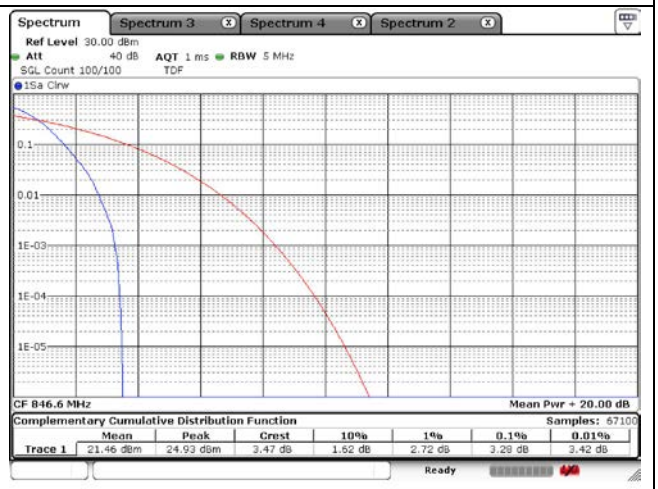


WCDMA Ⅴ RMC Middle Channel



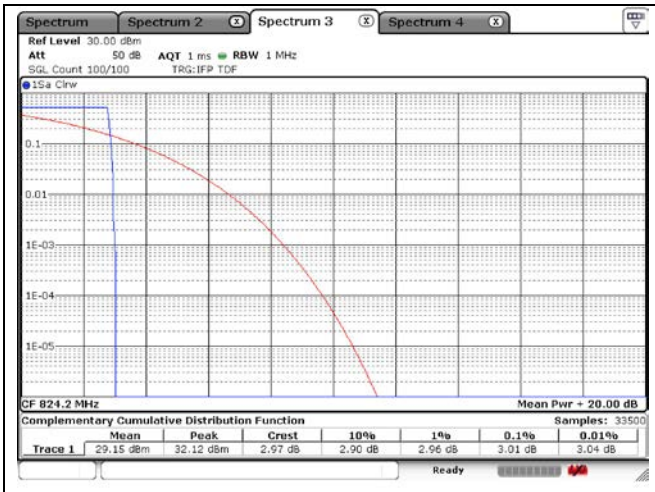
WCDMA Ⅴ HSDPA Middle Channel

WCDMA Ⅴ RMC High Channel

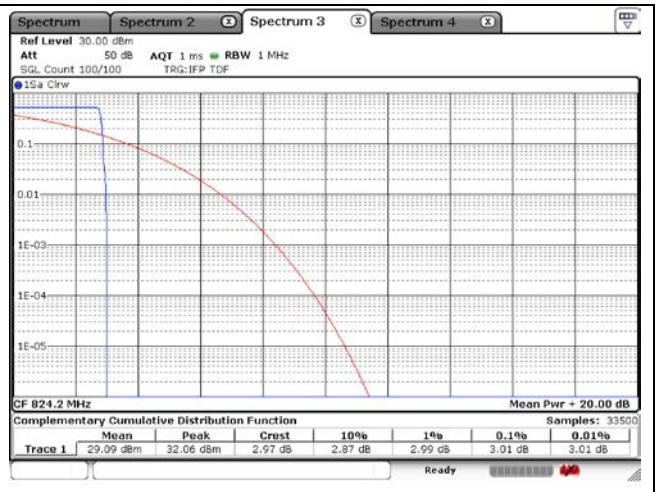


WCDMA Ⅴ HSDPA High Channel

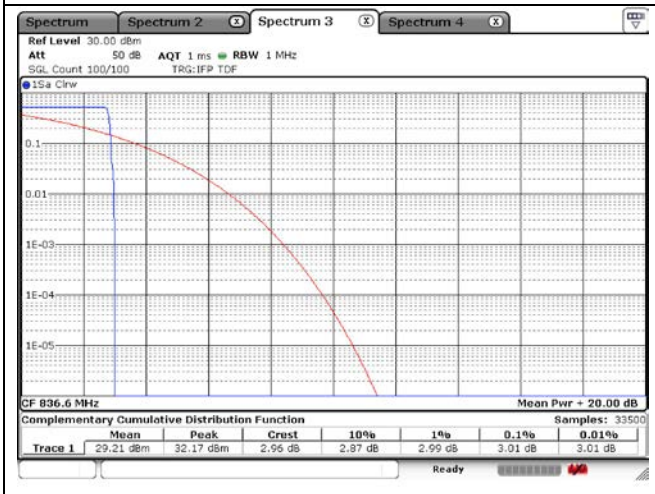
GSM 850



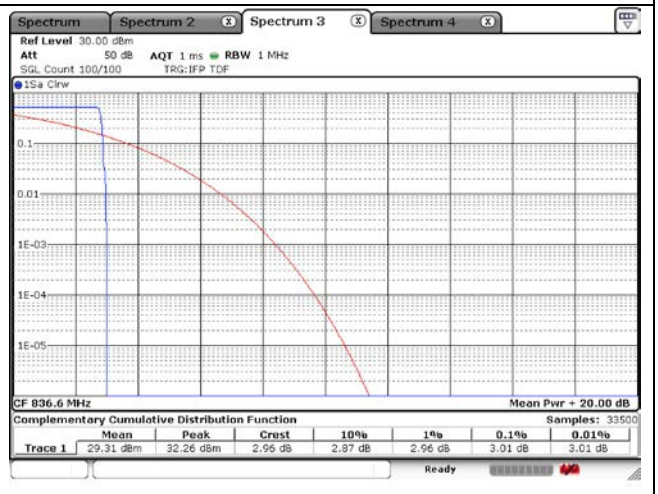
GSM 850 VOICE Low Channel



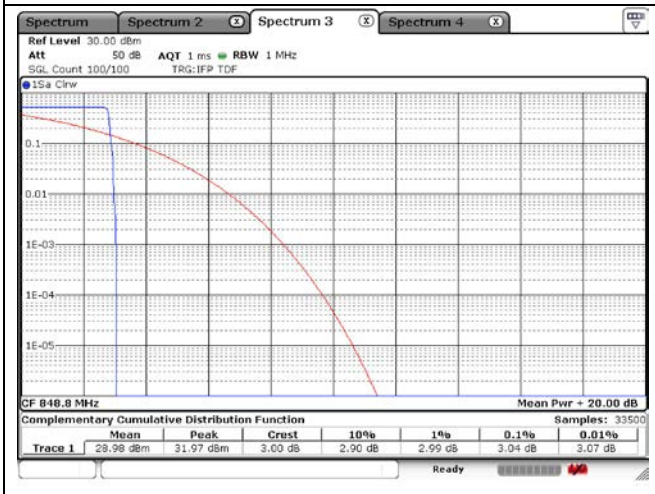
GSM 850 EDGE Low Channel



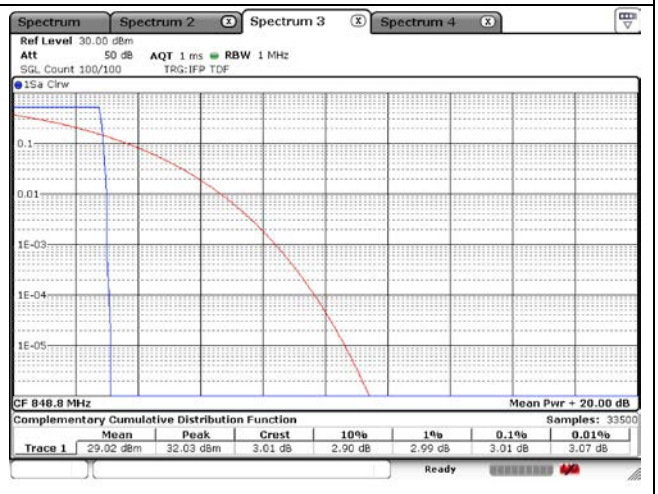
GSM 850 VOICE Middle Channel



GSM 850 EDGE Middle Channel

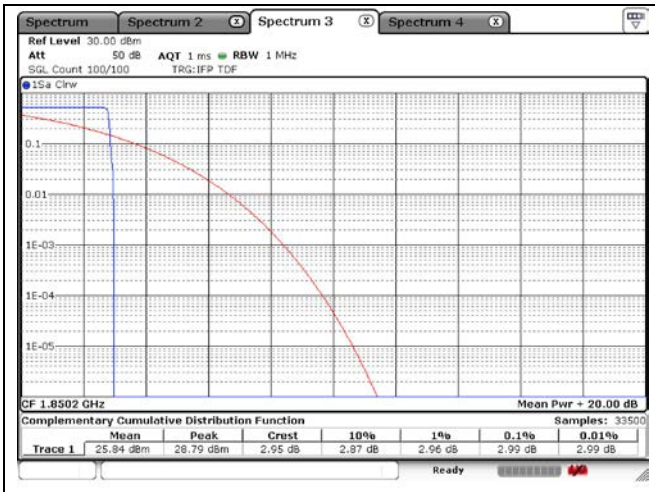


GSM 850 VOICE High Channel

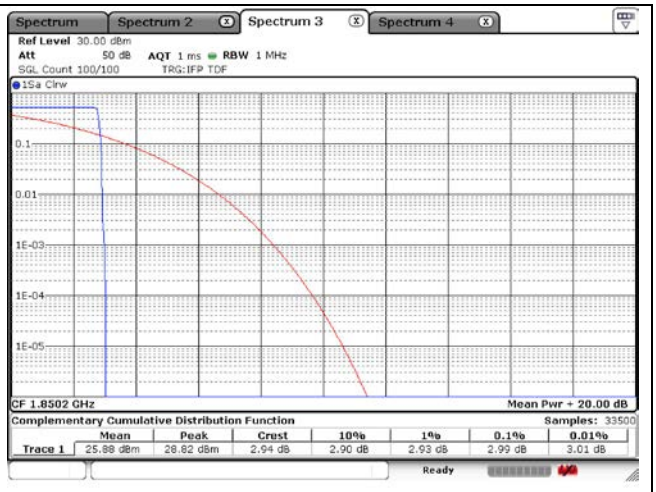


GSM 850 EDGE High Channel

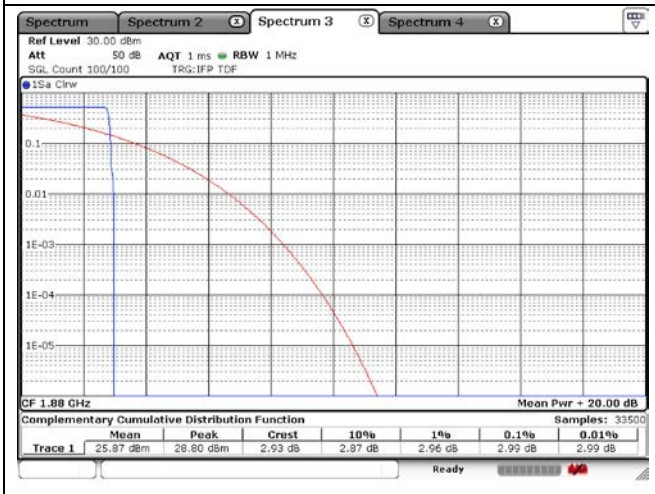
GSM 1900



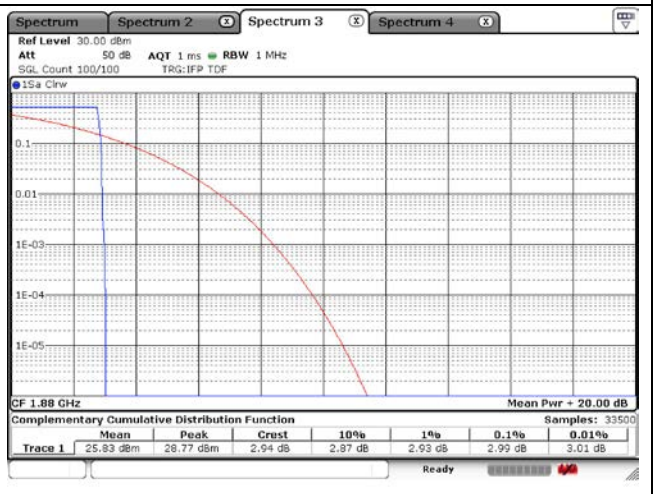
GSM 1900 VOICE Low Channel



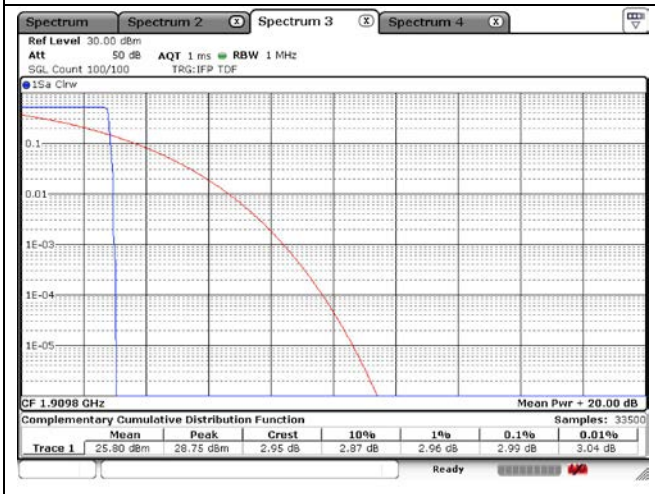
GSM 1900 EDGE Low Channel



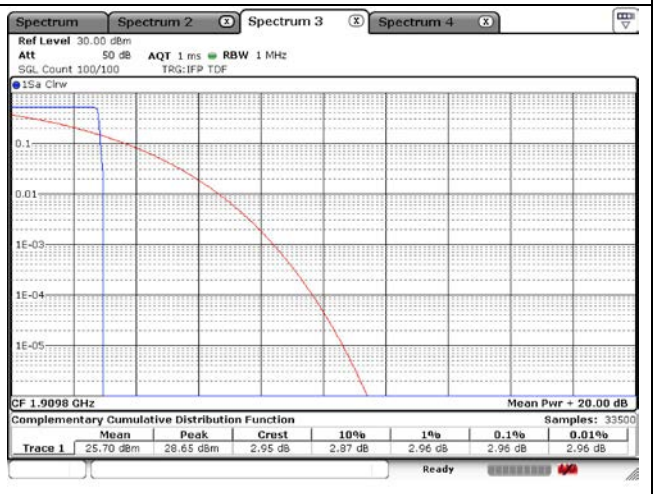
GSM 1900 VOICE Middle Channel



GSM 1900 EDGE Middle Channel

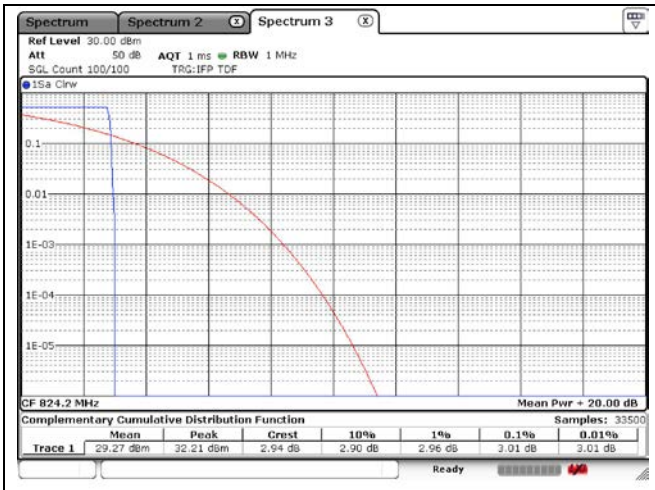


GSM 1900 VOICE High Channel

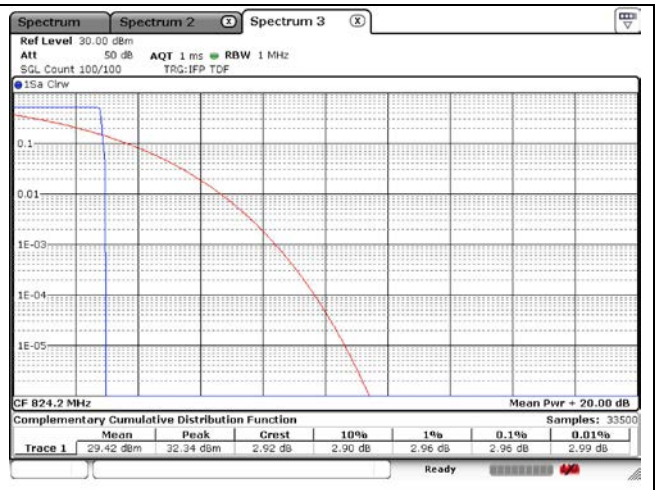


GSM 1900 EDGE High Channel

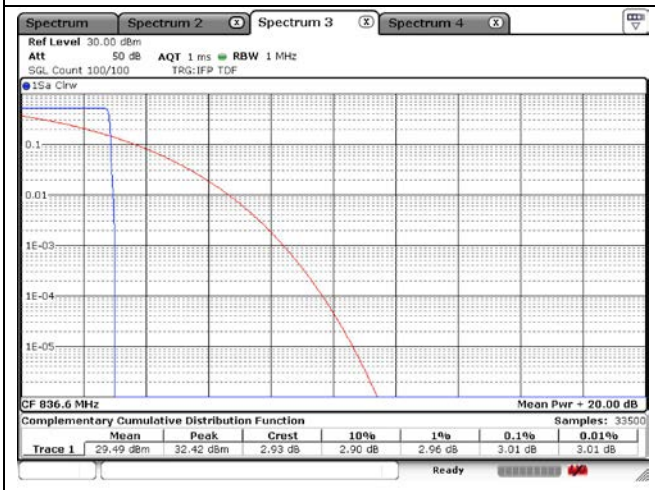
SIM 2
GSM 850



GSM 850 VOICE Low Channel

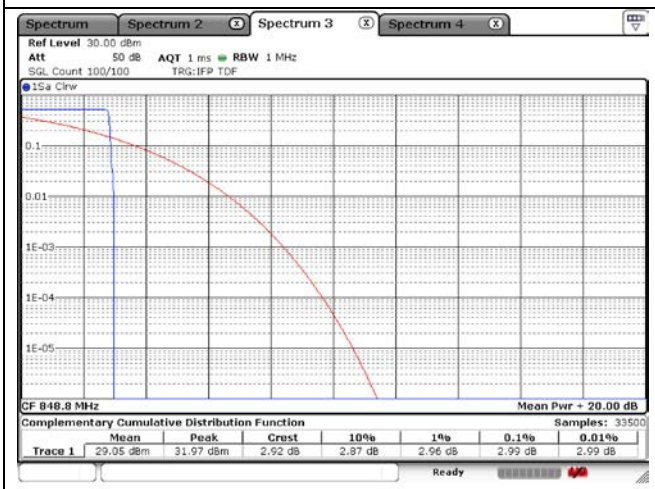


GSM 850 EDGE Low Channel

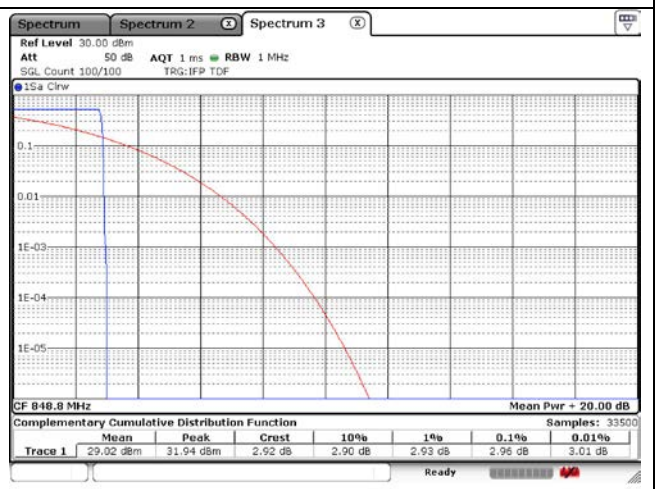


GSM 850 VOICE Middle Channel

GSM 850 EDGE Middle Channel

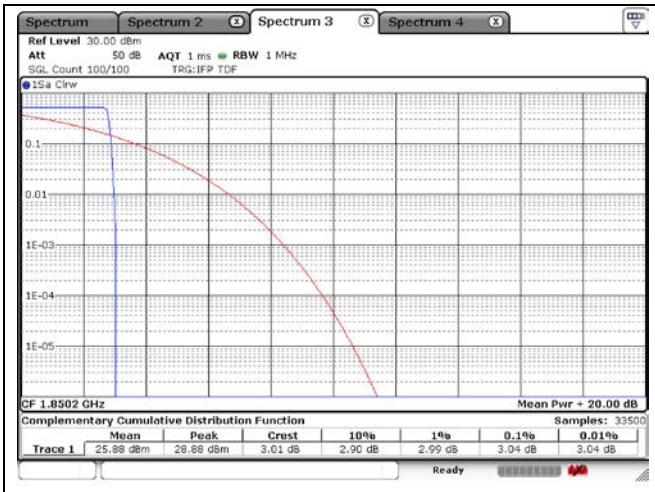


GSM 850 VOICE High Channel

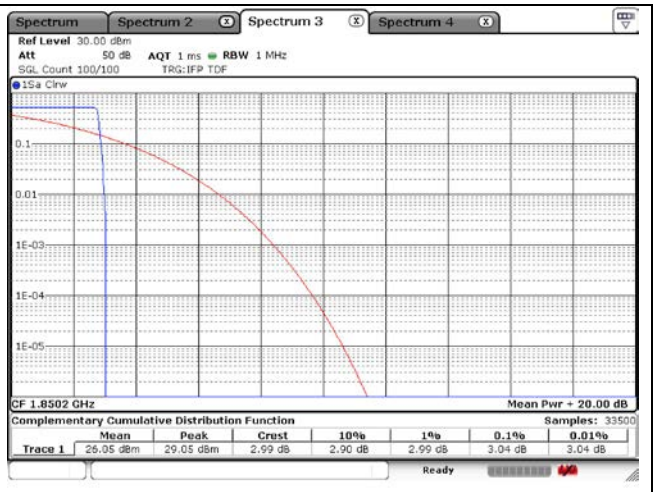


GSM 850 EDGE High Channel

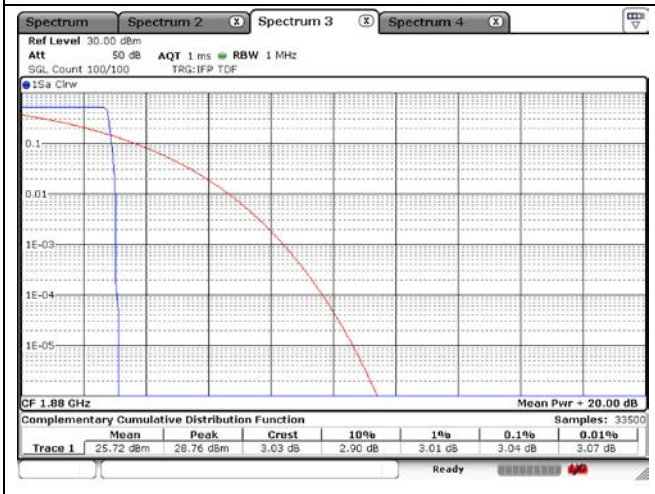
GSM 1900



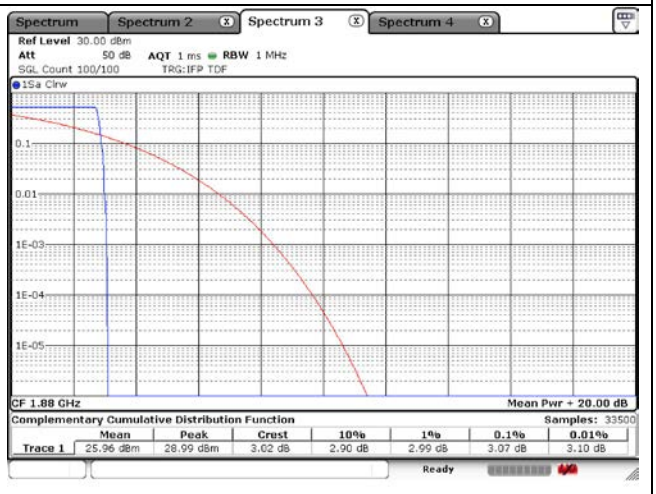
GSM 1900 VOICE Low Channel



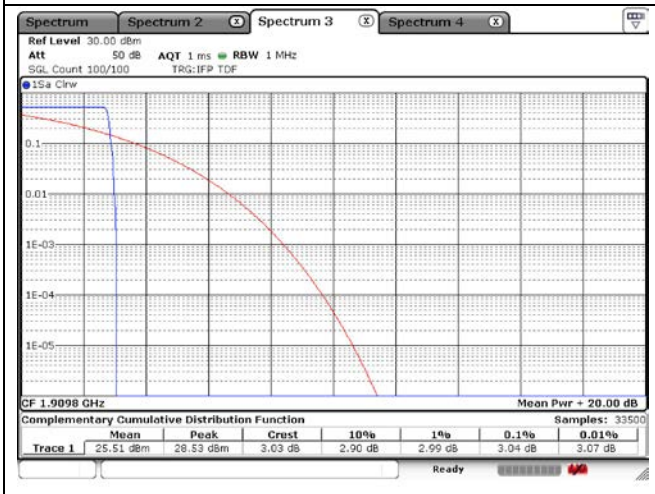
GSM 1900 EDGE Low Channel



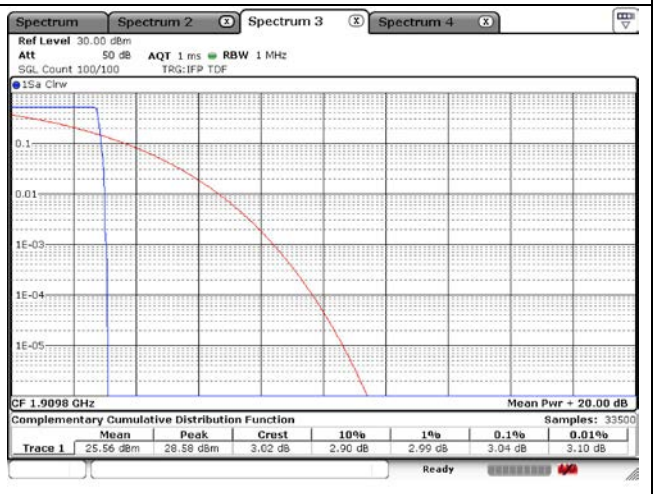
GSM 1900 VOICE Middle Channel



GSM 1900 EDGE Middle Channel



GSM 1900 VOICE High Channel



GSM 1900 EDGE High Channel

6. Spurious Emissions at Antenna Terminal

6.1. Limit

- §22.917(a), 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 + 10log(P) ㏈.

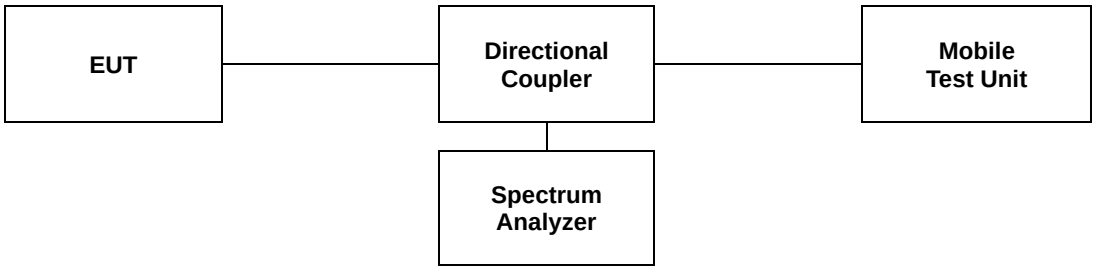
- §24.238(a), the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) ㏈.

- §27.53(h)(1), for operations in the 1 695-1 710 ㎒, 1 710-1 755 ㎒, 1 755-1 780 ㎒, 1 915-1 920 ㎒, 1 995-2 000 ㎒, 2 000-2 020 ㎒, 2 110-2 155 ㎒, 2 155-2 180 ㎒, and 2 180-2 200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least 43 + 10 $\log_{10}$ (P) ㏈.

6.2. Test Procedure

The test follows section 5.7 of ANSI C63.26-2015.

1. Start frequency was set to 9 ㎑ and stop frequency was set to at least 10* the fundamental frequency.
2. Detector = RMS.
3. Trace mode = Max hold.
4. Sweep time = Auto couple.
5. The trace was allowed to stabilize.
6. Please see notes below for RBW and VBW settings.
7. For plots showing conducted spurious emissions from 9 ㎑ to 20 ㎓, all path loss of wide frequency range was investigated and compensated to spectrum analyzer as TDF function.



Note;

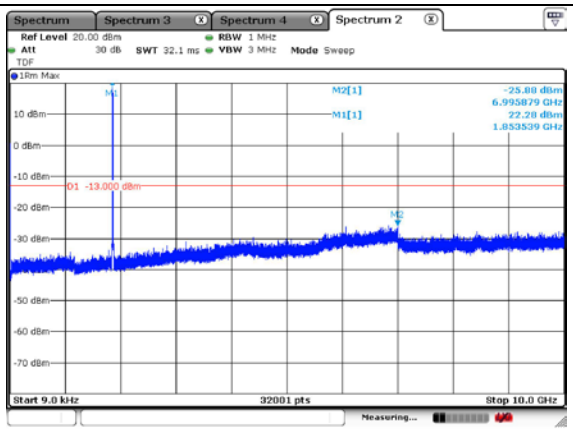
Compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth of 100 ㎑ or greater for frequencies less than 1 ㎓ and frequencies greater than 1 ㎓. However, in the 1 ㎒ bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two point, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 ㏈ below the transmitter power.

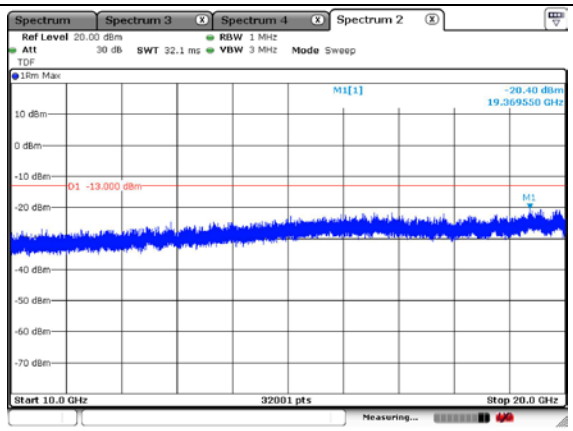
6.3. Test Results

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

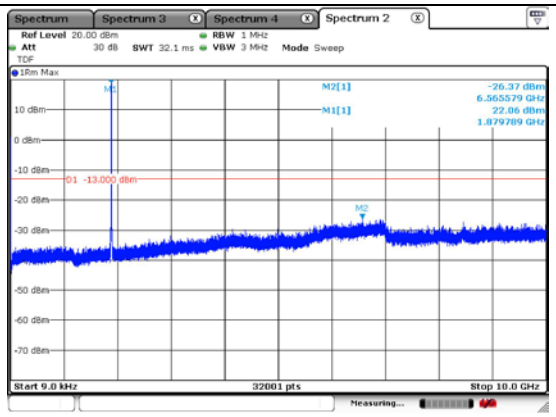
- Test plots

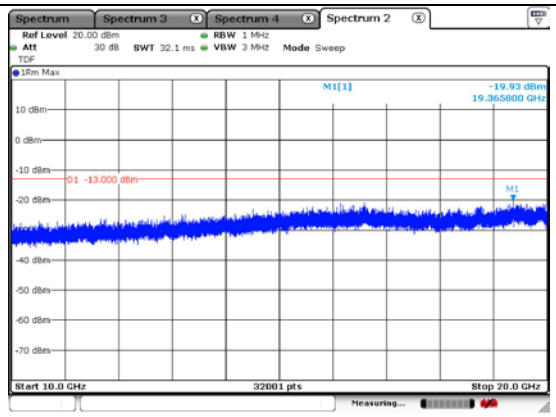
SIM 1
WCDMA Ⅱ



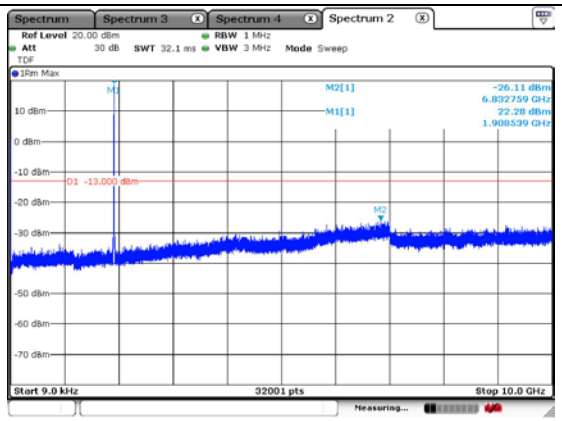


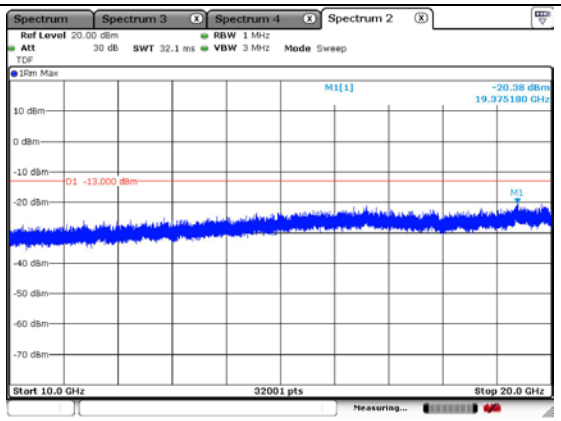
WCDMA Ⅱ RMC Low Channel





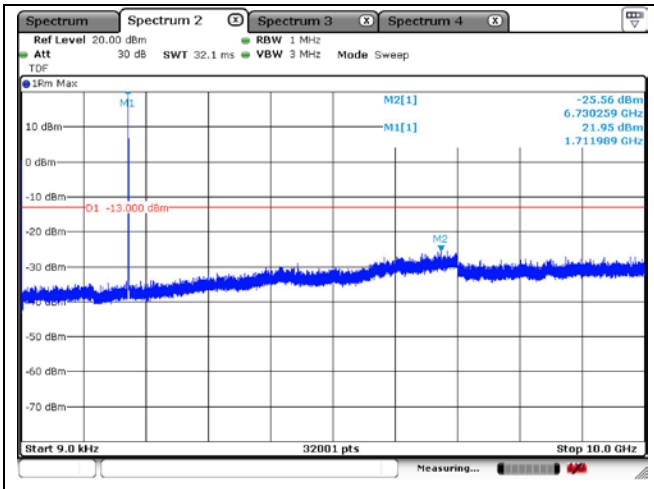
WCDMA Ⅱ RMC Middle Channel

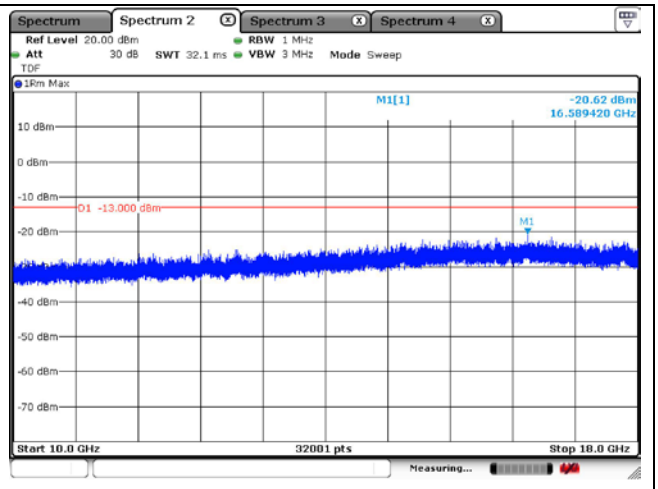




WCDMA Ⅱ RMC High Channel

WCDMA Ⅳ





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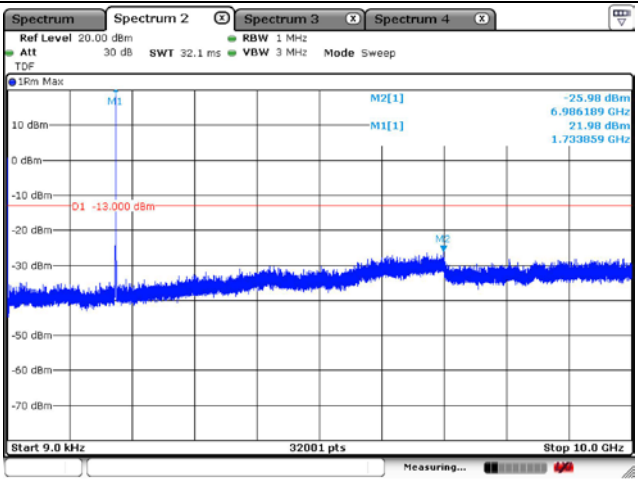

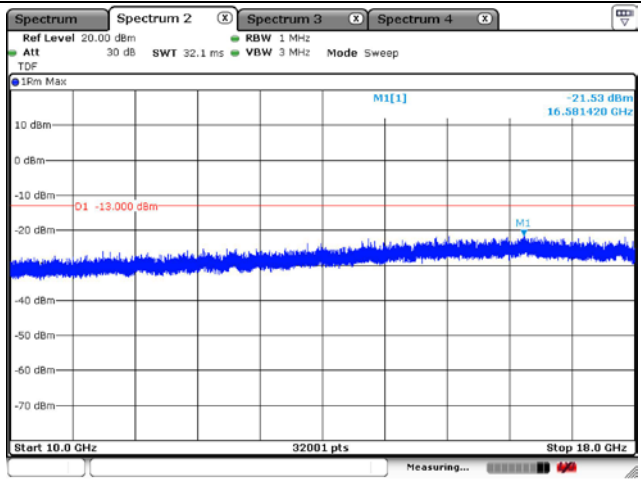

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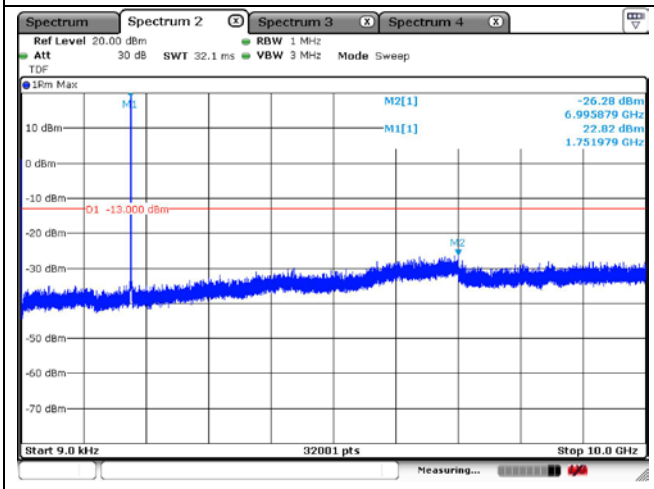
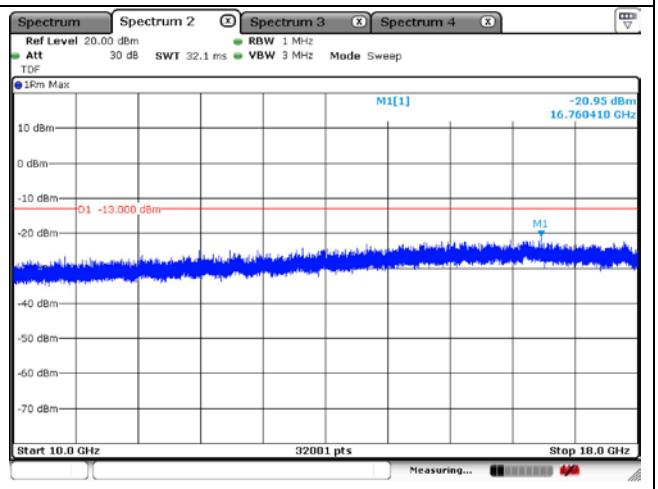
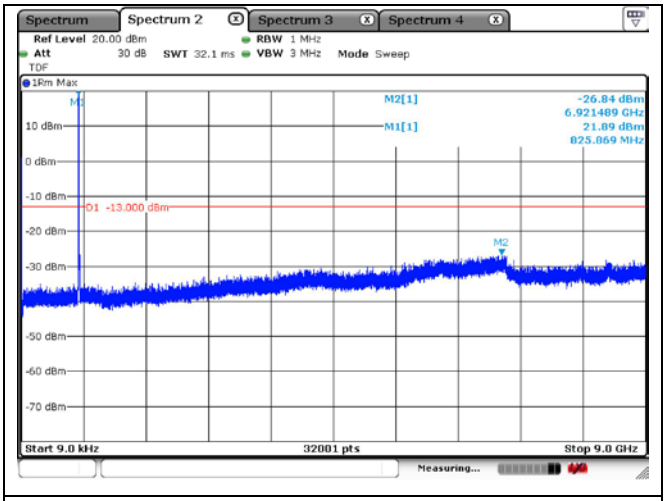




WCDMA Ⅳ RMC High Channel

WCDMA Ⅴ



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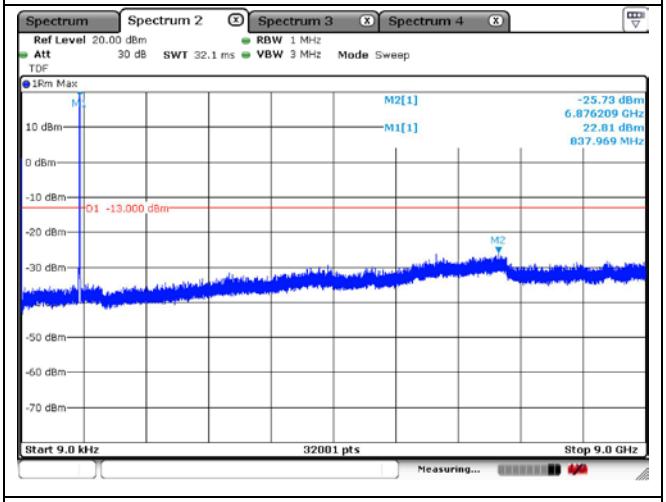

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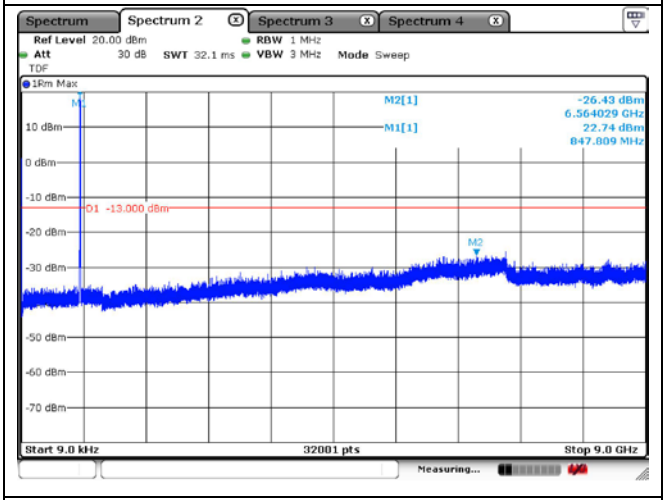
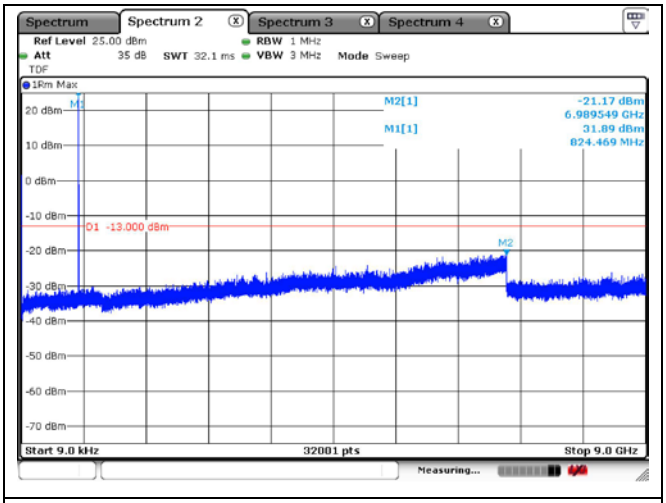
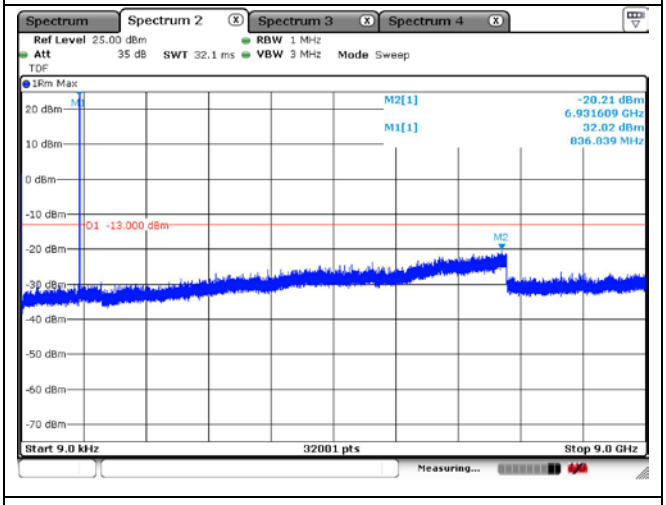


WCDMA Ⅴ RMC High channel

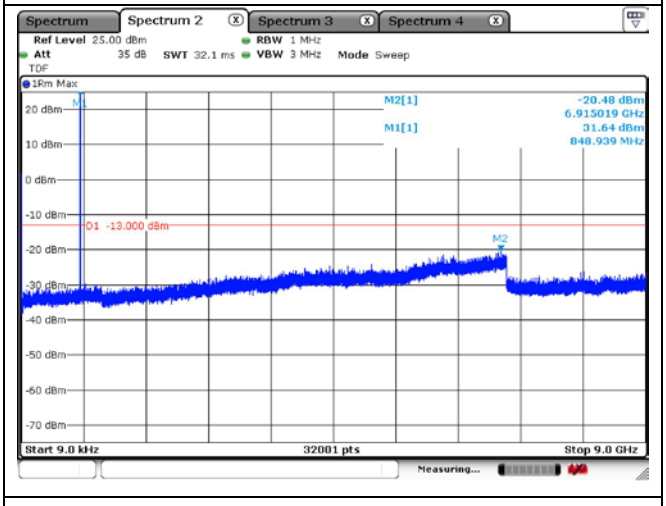
GSM 850



GSM 850 VOICE Low Channel

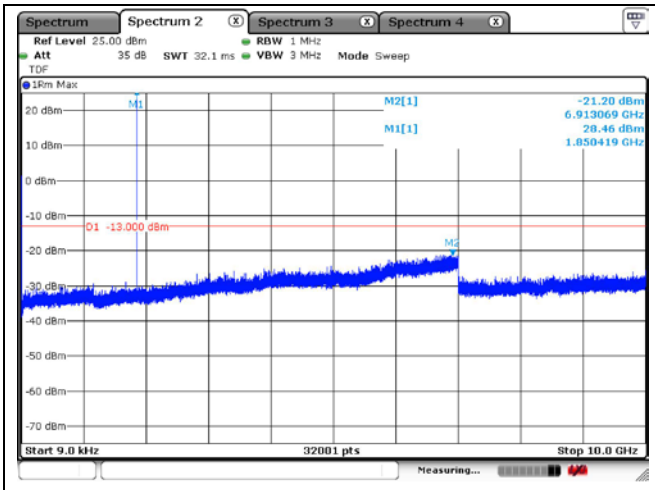


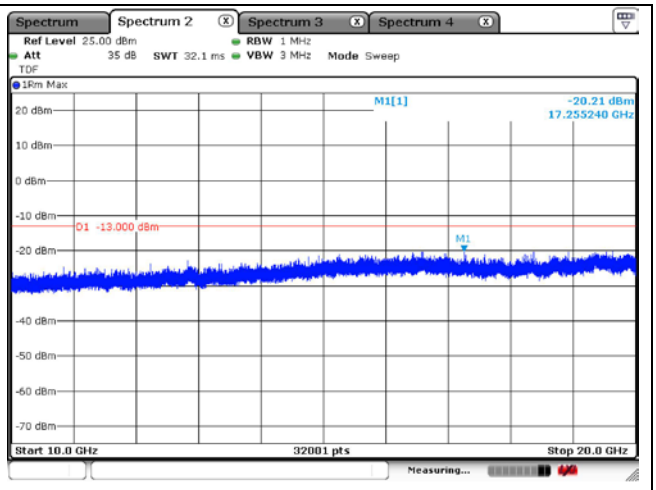
GSM 850 VOICE Middle Channel



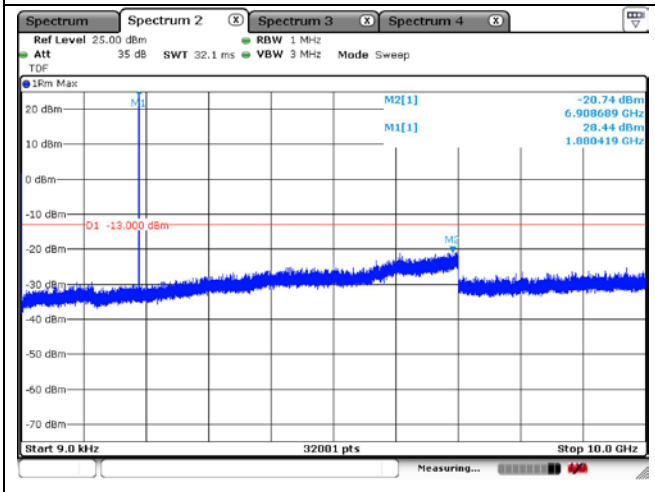
GSM 850 VOICE High Channel

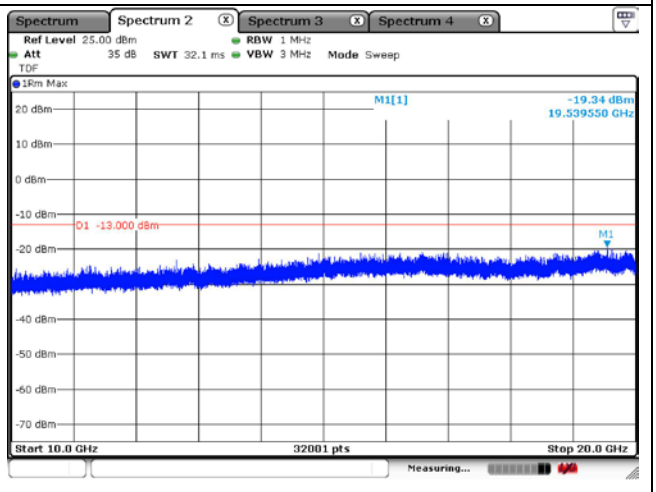
GSM 1900



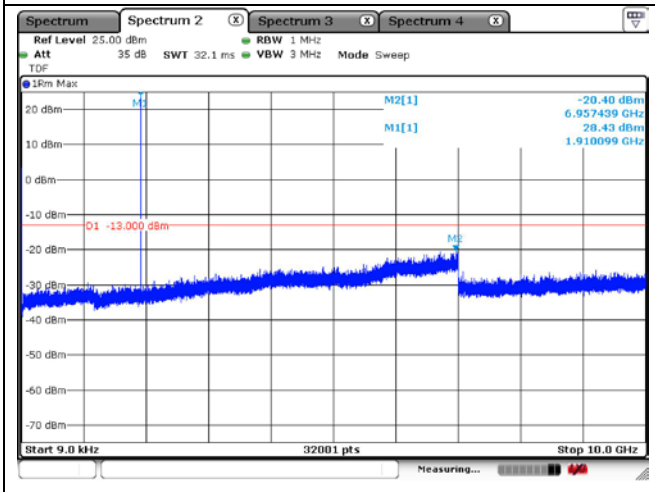


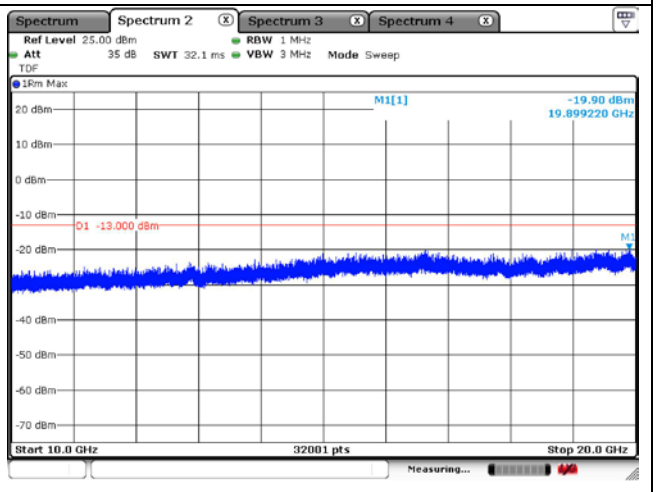
GSM 1900 VOICE Low Channel





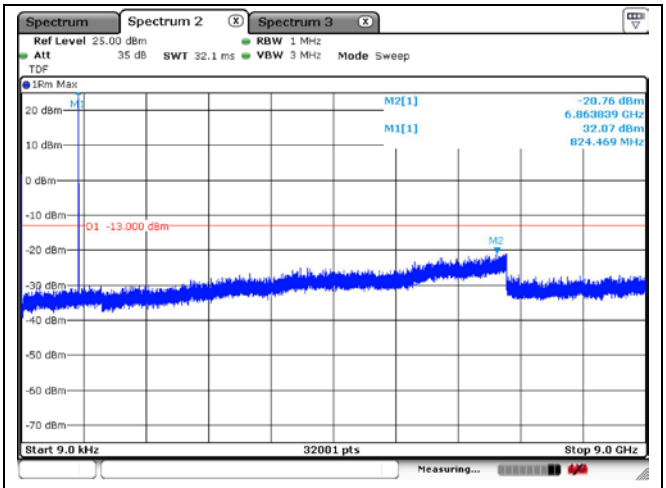
GSM 1900 VOICE Middle Channel



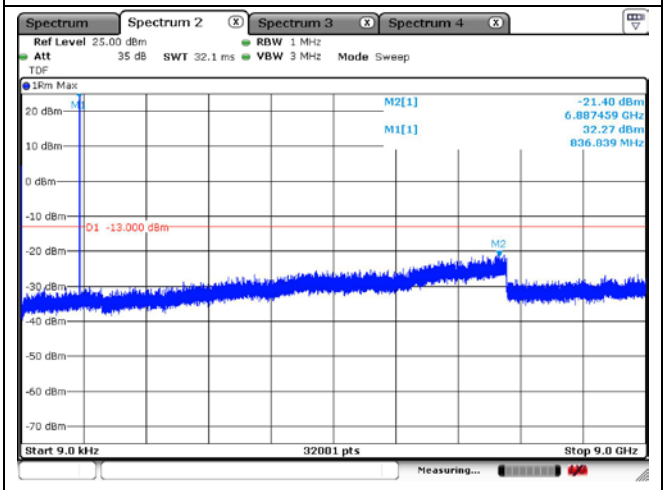


GSM 1900 VOICE High Channel

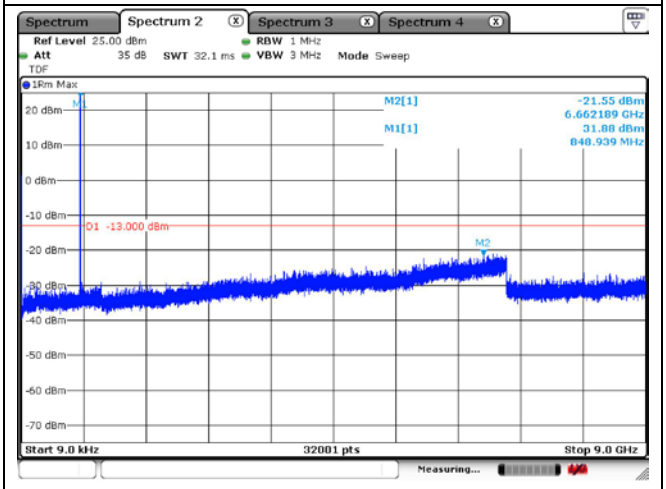
SIM2
GSM 850



GSM 850 VOICE Low Channel

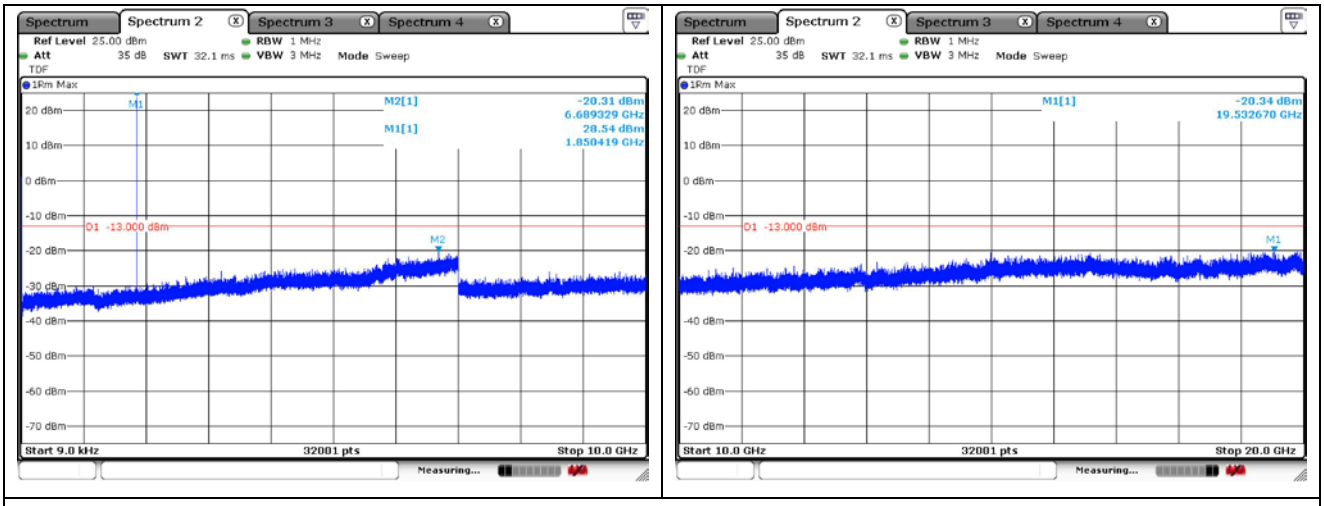


GSM 850 VOICE Middle Channel

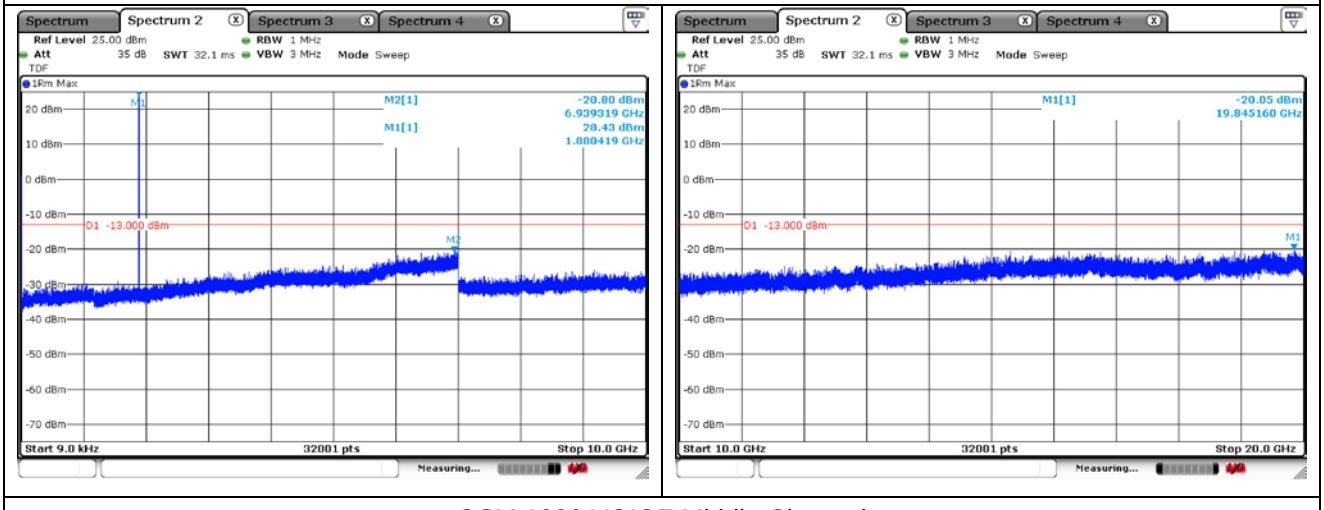


GSM 850 VOICE High Channel

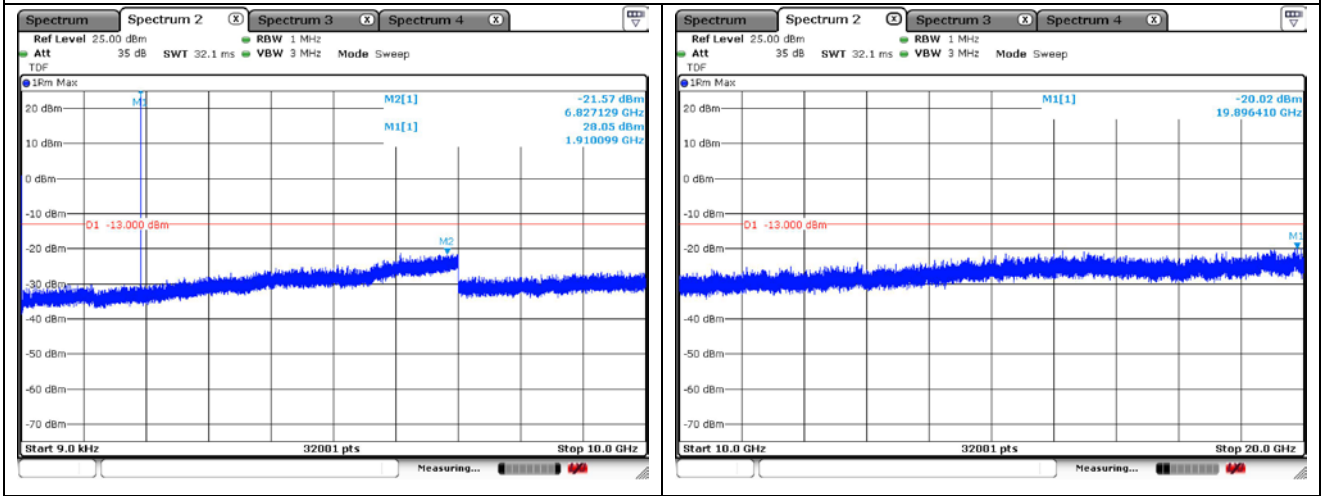
GSM 1900



GSM 1900 VOICE Low Channel



GSM 1900 VOICE Middle Channel



GSM 1900 VOICE High Channel

7. Band Edge

7.1. Limit

- §22.917(a), 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 + 10log(P) ㏈.

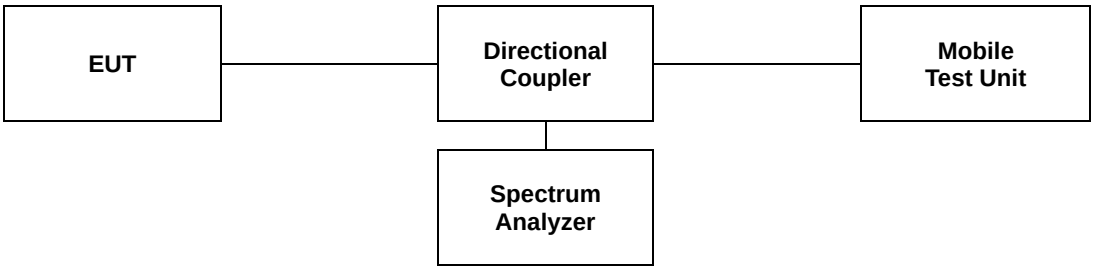
- §24.238(a), the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) ㏈.

- §27.53(h)(1), for operations in the 1 695-1 710 ㎒, 1 710-1 755 ㎒, 1 755-1 780 ㎒, 1 915-1 920 ㎒, 1 995-2 000 ㎒, 2 000-2 020 ㎒, 2 110-2 155 ㎒, 2 155-2 180 ㎒, and 2 180-2 200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least 43 + 10 $\log_{10}$ (P) ㏈.

7.2. Test Procedure

The test follows section 5.7 of ANSI C63.26-2015.

a. Span was set large enough so as to capture all out of band emissions near the band edge.
b. RBW ≥ 1 % of OBW
c. VBW ≥ 3 x RBW.
d. Detector = RMS.
e. Trace mode = Average.
f. Sweep time = Auto.
g. The trace was allowed to stabilize.
h. All path loss of frequency range was investigated and compensated to spectrum analyzer as TDF function.

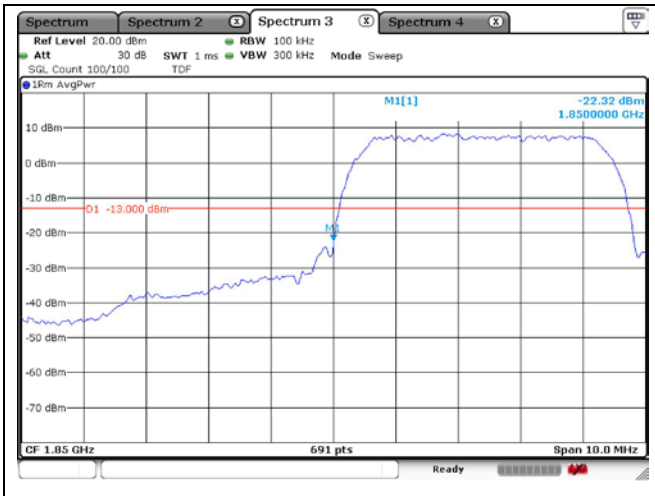


7.3. Test Results

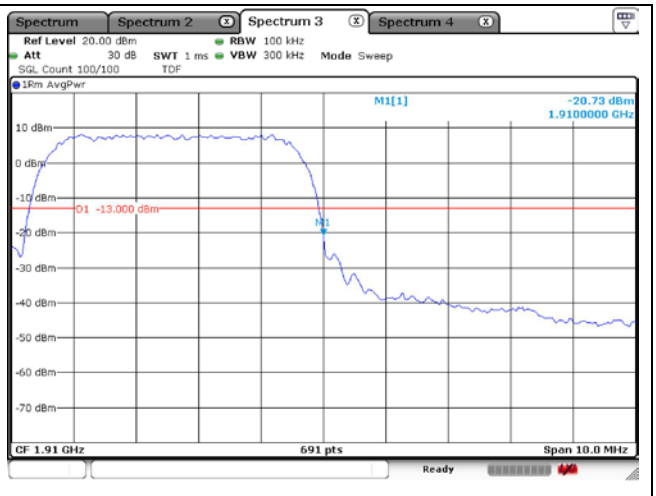
Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

- Test plots

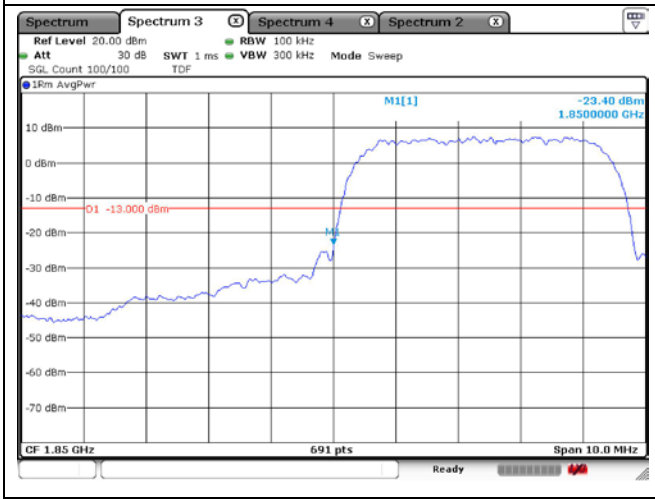
SIM 1
WCDMA Ⅱ



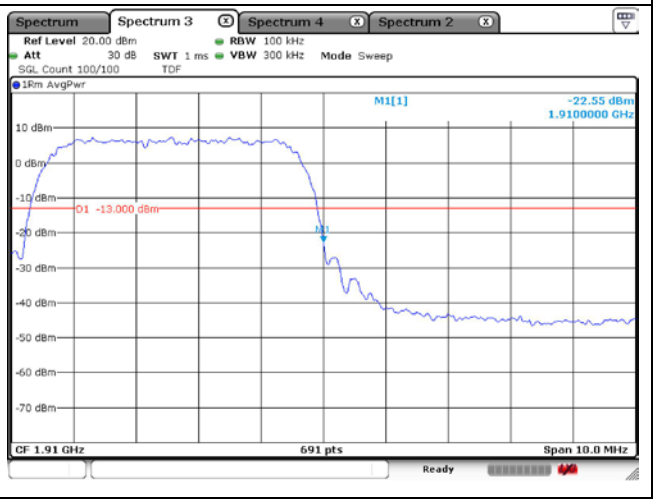
WCDMA Ⅱ RMC Low Channel



WCDMA Ⅱ RMC High Channel

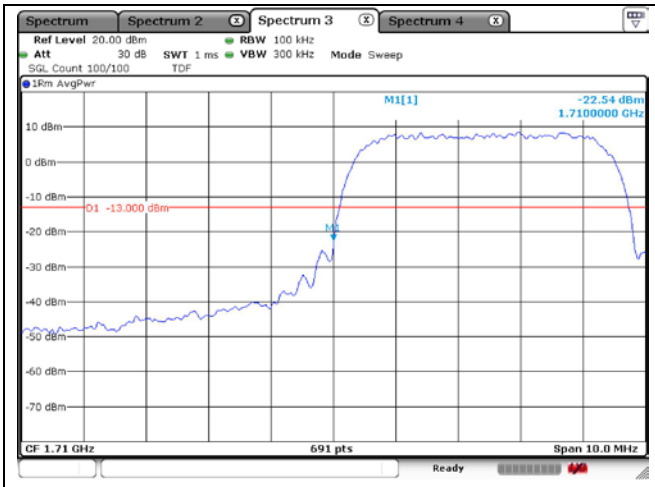


WCDMA Ⅱ HSDPA Low Channel



WCDMA Ⅱ HSDPA High Channel

WCDMA Ⅳ



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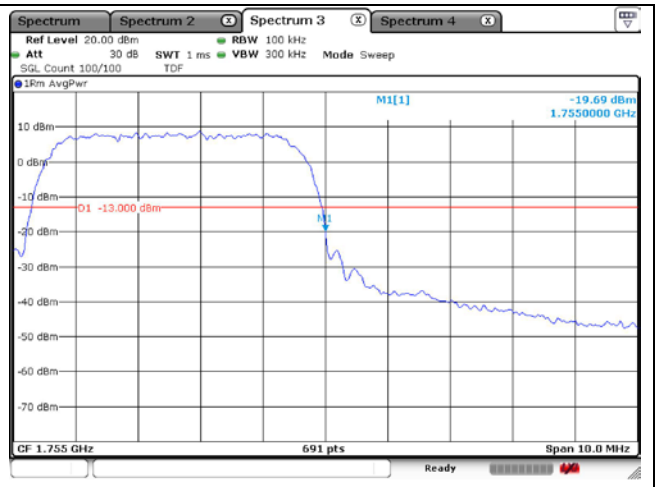

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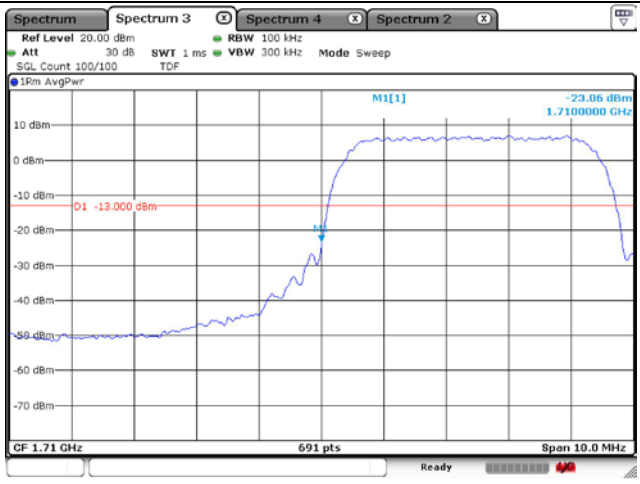

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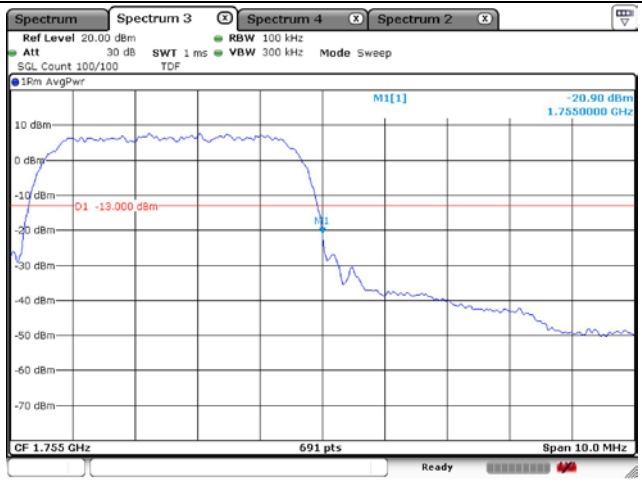
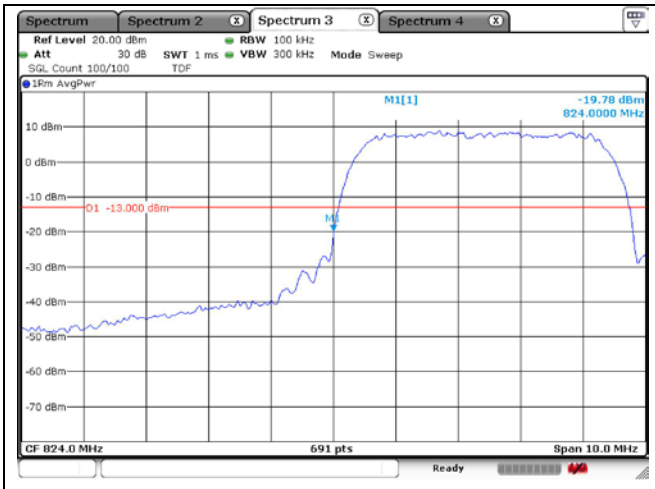
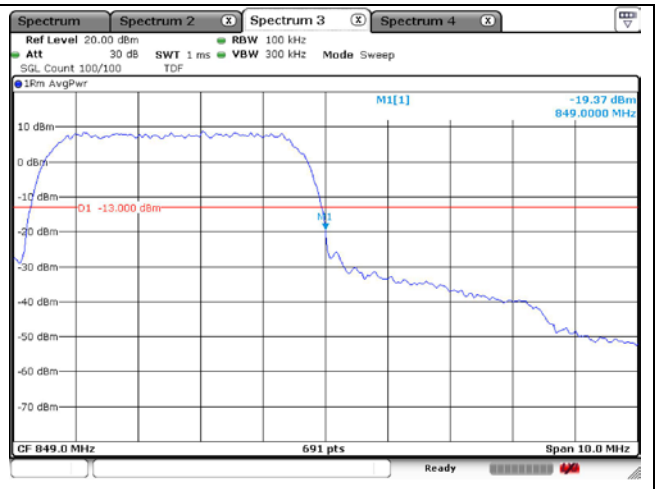


WCDMA Ⅳ HSDPA High Channel

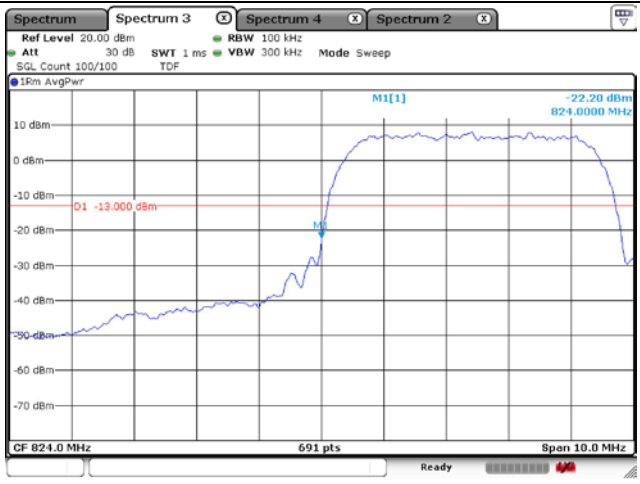
WCDMA Ⅴ



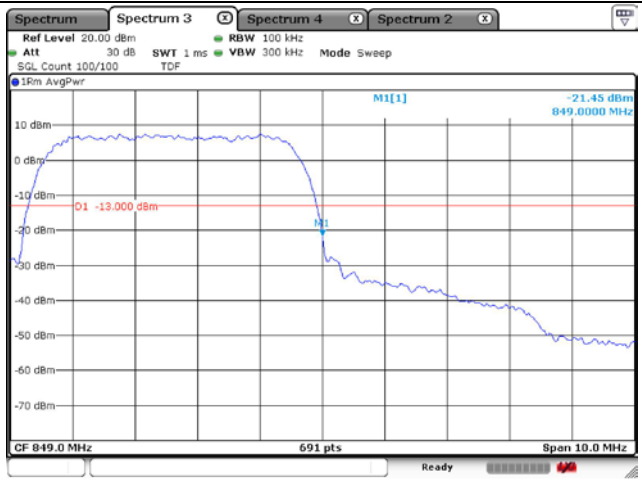
WCDMA Ⅴ RMC Low Channel



WCDMA Ⅴ RMC High Channel

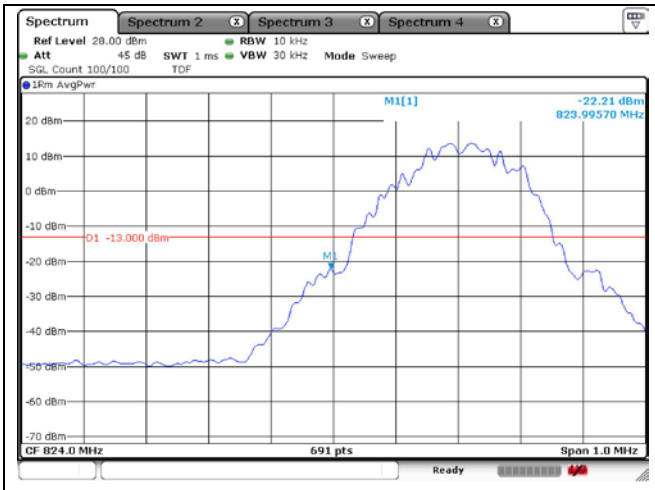


WCDMA Ⅴ HSDPA Low Channel

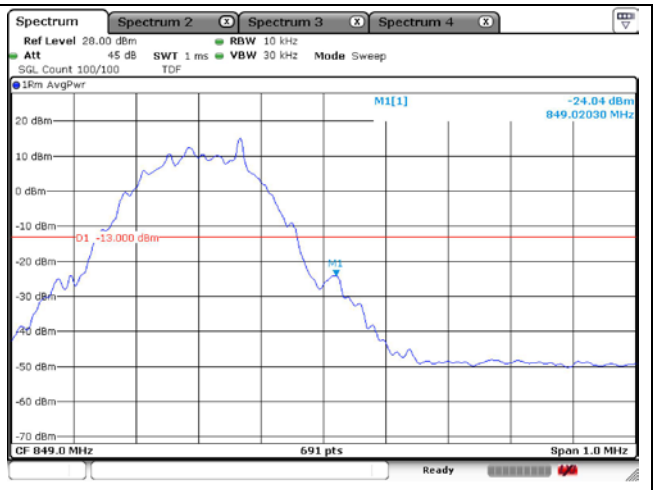


WCDMA Ⅴ HSDPA High Channel

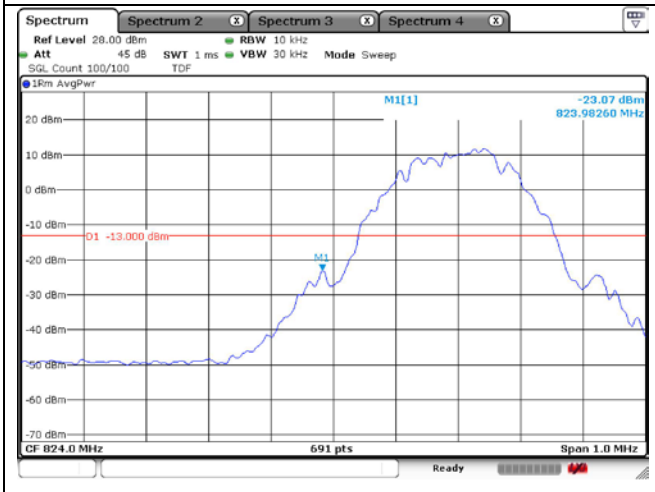
GSM 850



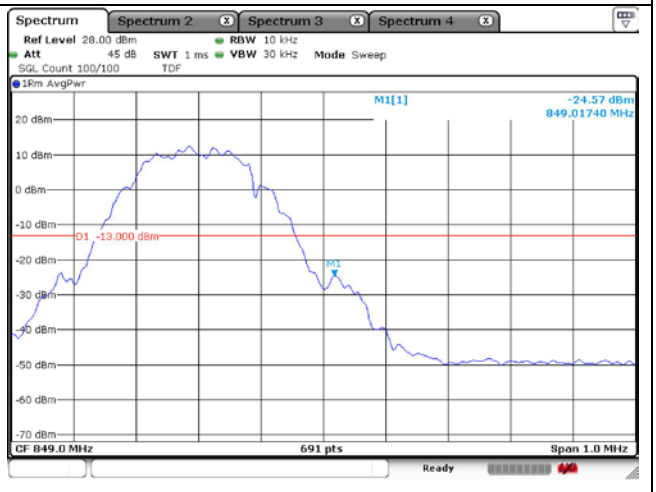
GSM 850 VOICE Low Channel



GSM 850 VOICE High Channel



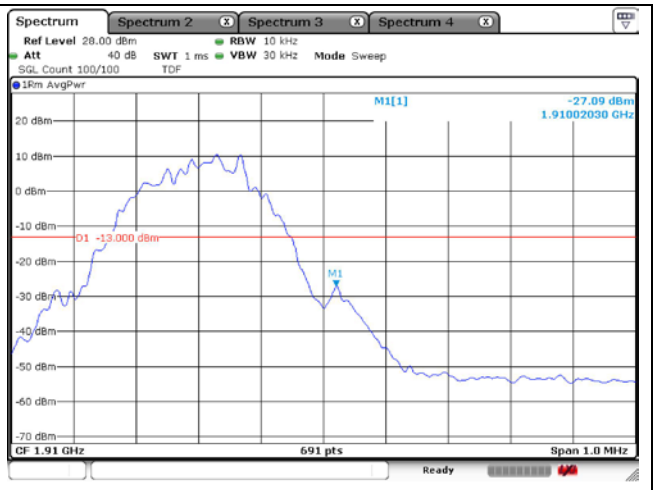
GSM 850 EDGE Low Channel



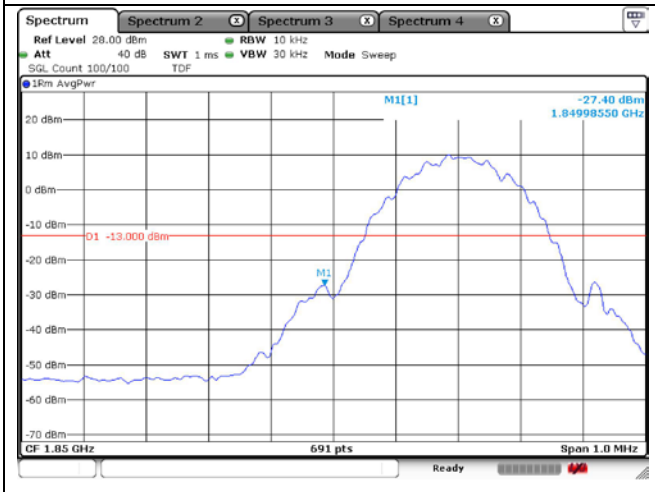
GSM 850 EDGE High Channel

GSM 1900

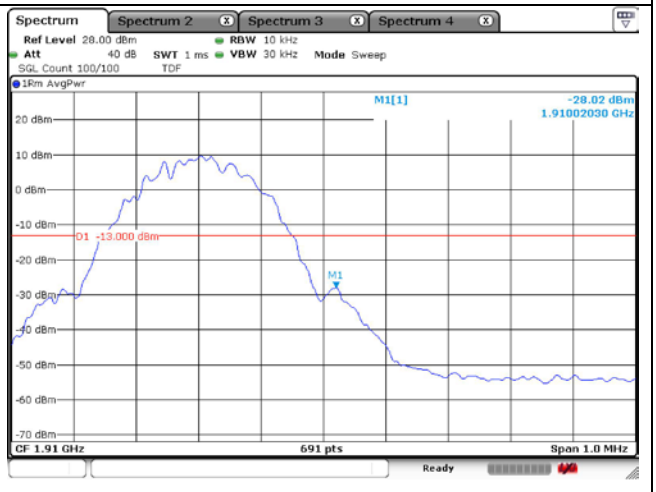
GSM 1900 VOICE Low Channel



GSM 1900 VOICE High Channel

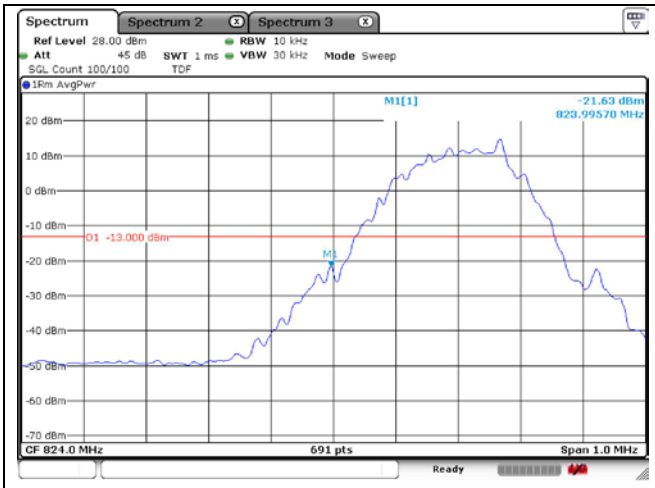


GSM 1900 EDGE Low Channel

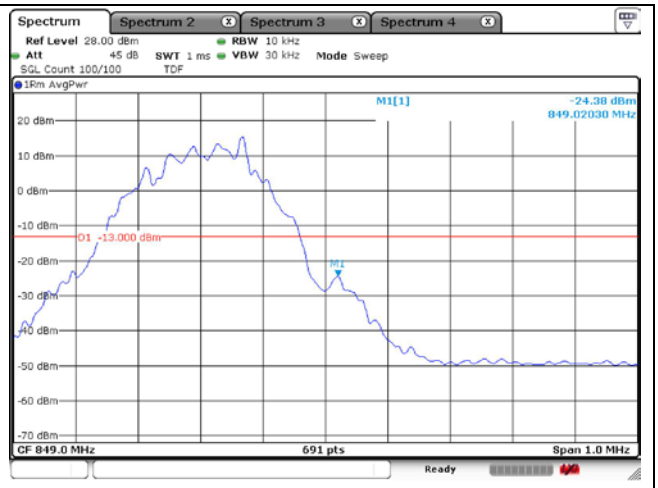


GSM 1900 EDGE High Channel

SIM 2
GSM 850



GSM 850 VOICE Low Channel



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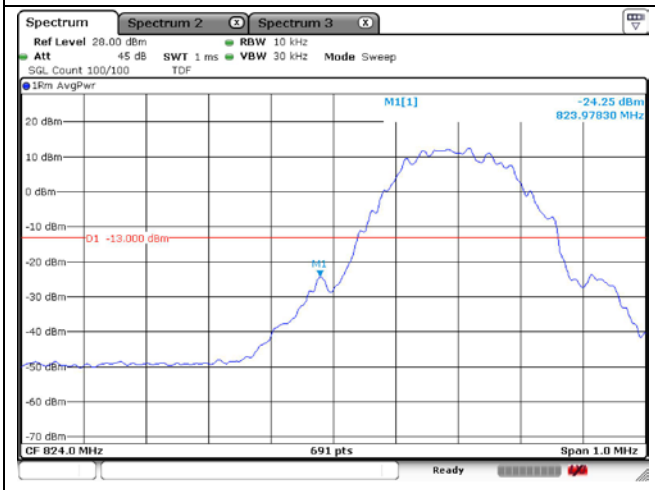
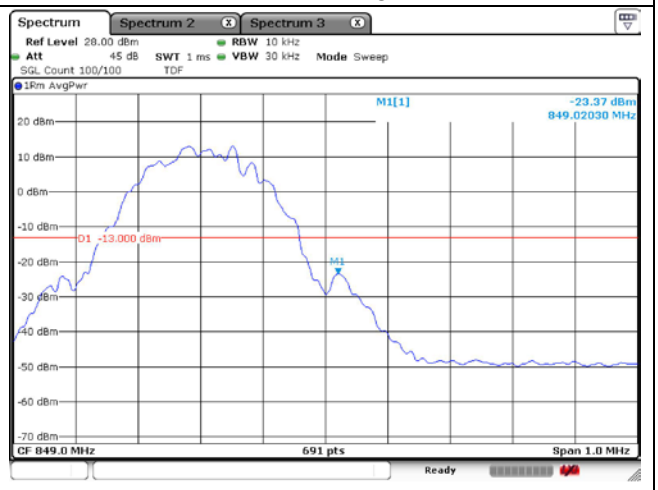
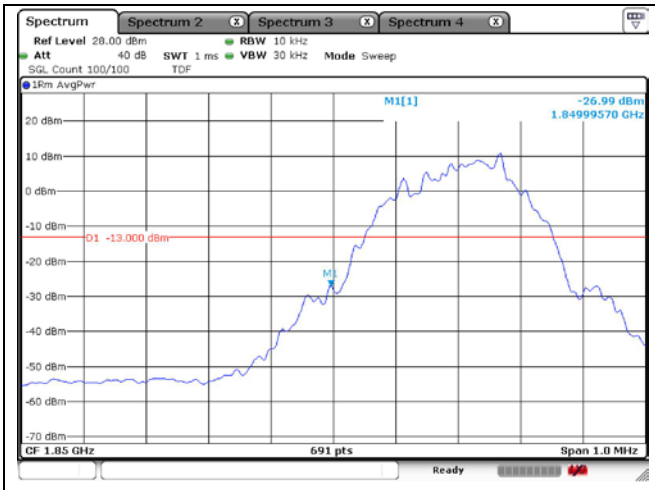


GSM 850 EDGE Low Channel



GSM 850 EDGE High Channel

GSM 1900



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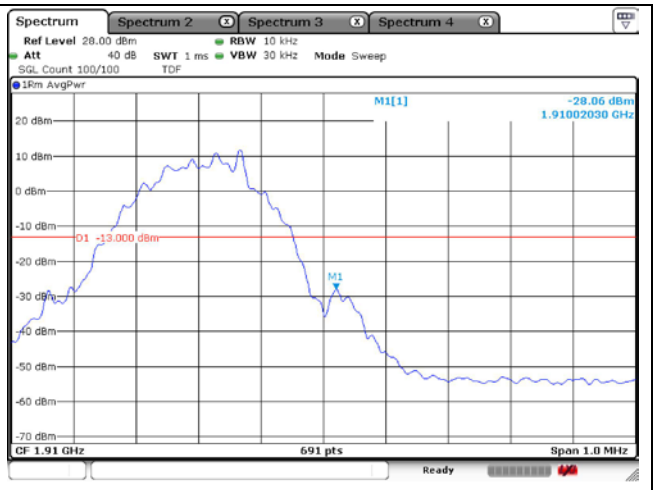
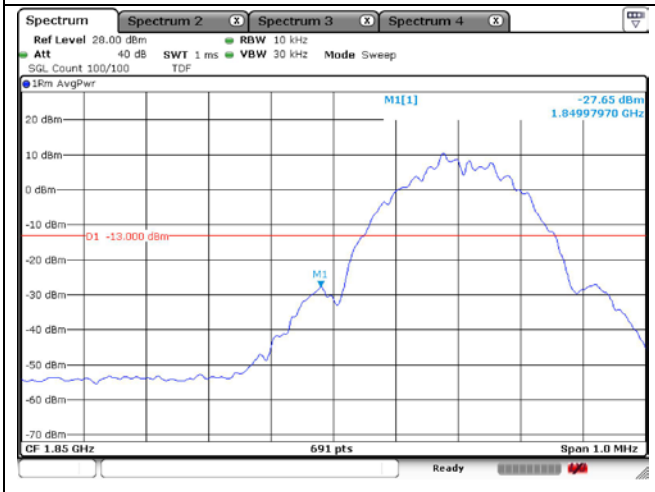
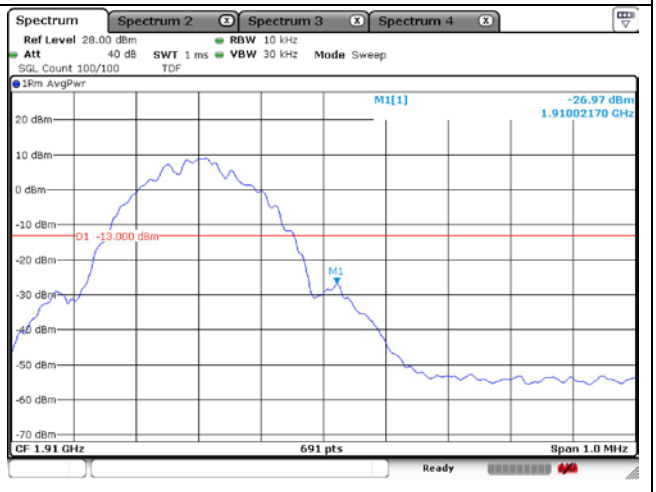


GSM 1900 VOICE High Channel



GSM 1900 EDGE Low Channel



GSM 1900 EDGE High Channel

8. Frequency Stability

8.1. Limit

- § 2.1055 (a), § 2.1055 (d) & following:

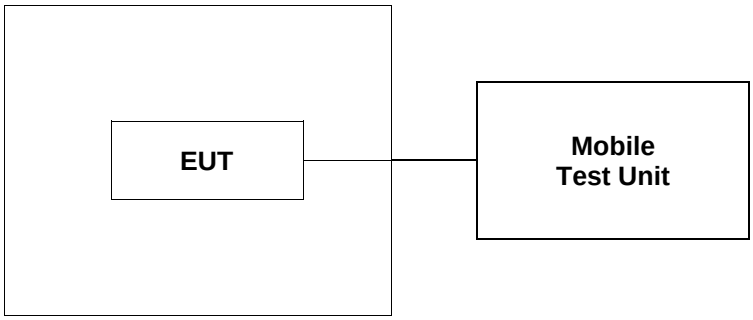
- §22.355, the carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances given in Table of this section.
For Mobile devices operating in the 824 to 849 ㎒ band at a power level less than or equal to 3 Watts, the limit specified in Table C-1 is +/- 2.5 ppm.

- §24.235, the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

- §27.54, the frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

8.2. Test Procedure

1. Frequency Stability vs. Temperature: The equipment under test was connected to an external DC power supply and the RF output was connected to a Mobile Test Unit via feed-through attenuators.
2. The EUT was placed inside the temperature chamber.
3. After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from Mobile Test Unit.



8.3. Test Results

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

SIM 1
WCDMA Ⅱ mode at middle channel

Reference Frequency: 1 880.0 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	12.5	14.60	0.013 06
40		11.07	0.011 19
30		4.33	0.007 60
20(Ref.)		-9.96	-
10		-13.39	-0.001 82
0		-2.01	0.004 23
-10		-2.48	0.003 98
-20		9.06	0.010 12
-30		-2.21	0.004 12
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
20	10.63 (85%)	3.13	0.006 96
	14.38 (115%)	-6.21	0.001 99

WCDMA Ⅳ mode at middle channel

Reference Frequency: 1 732.6 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	12.5	4.28	-0.008 17
40		1.89	-0.009 55
30		12.05	-0.003 68
20(Ref.)		18.43	-
10		-10.53	-0.016 71
0		-13.80	-0.018 60
-10		-9.07	-0.015 87
-20		14.21	-0.002 44
-30		5.57	-0.007 42
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
20	10.63 (85%)	15.25	-0.001 84
	14.38 (115%)	-5.77	-0.013 97

WCDMA Ⅴ mode at middle channel

Reference Frequency: 836.6 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	12.5	-13.50	-0.025 78
40		15.14	0.008 45
30		2.43	-0.006 74
20(Ref.)		8.07	-
10		18.53	0.012 50
0		-3.45	-0.013 77
-10		12.62	0.005 44
-20		-7.94	-0.019 14
-30		-2.90	-0.013 11
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
20	10.63 (85%)	7.35	-0.000 86
	14.38 (115%)	14.72	0.007 95

GSM 850 mode at middle channel

Reference Frequency: 836.6 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	12.5	3.79	-0.006 10
40		15.93	0.008 42
30		8.40	-0.000 59
20(Ref.)		8.89	-
10		-7.39	-0.019 46
0		17.73	0.010 57
-10		-11.14	-0.023 94
-20		2.59	-0.007 53
-30		-14.26	-0.027 67
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
20	10.63 (85%)	-5.37	-0.017 05
	14.38 (115%)	-6.59	-0.018 50

GSM 1900 mode at middle channel

Reference Frequency: 1 880.0 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	12.5	18.67	0.001 95
40		17.60	0.001 38
30		18.56	0.001 89
20(Ref.)		15.01	-
10		7.69	-0.003 89
0		5.12	-0.005 26
-10		2.23	-0.006 80
-20		-1.46	-0.008 76
-30		-12.85	-0.014 82
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
20	10.63 (85%)	-8.56	-0.012 54
	14.38 (115%)	-7.82	-0.012 14

SIM 2 GSM 850 mode at middle channel

Reference Frequency: 836.6 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	12.5	8.51	0.001 98
40		-11.28	-0.021 67
30		9.85	0.003 59
20(Ref.)		6.85	-
10		15.62	0.010 48
0		-6.85	-0.016 38
-10		-7.96	-0.017 70
-20		-10.20	-0.020 38
-30		1.19	-0.006 77
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
20	10.63 (85%)	1.80	-0.006 04
	14.38 (115%)	-2.68	-0.011 39

GSM 1900 mode at middle channel

Reference Frequency: 1 880.0 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	12.5	-7.62	-0.011 52
40		14.83	0.000 42
30		13.83	-0.000 11
20(Ref.)		14.04	-
10		-10.89	-0.013 26
0		1.94	-0.006 44
-10		6.29	-0.004 12
-20		-9.47	-0.012 51
-30		16.57	0.001 35
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
20	10.63 (85%)	3.81	-0.005 44
	14.38 (115%)	-2.64	-0.008 87

- End of the Test Report -