

6. Spurious Emissions at Antenna Terminal

6.1. Limit

FCC

- §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 $43 + 10\log(P)$ dB.

- §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 $43 + 10 \log(P)$ dB.

- §27.53(h)(1), for operations in the 1 695-1 710 MHz, 1 710-1 755 MHz, 1 755-1 780 MHz, 1 915-1 920 MHz, 1 995-2 000 MHz, 2 000-2 020 MHz, 2 110-2 155 MHz, 2 155-2 180 MHz, 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 $43 + 10 \log_{10} (P)$ dB.

IC

- RSS-132 Issue 3

5.5, Mobile and base station equipment shall comply with the limits in (i) and (ii) below.

(i) In the first 1.0 MHz band immediately outside and adjacent to each of the sub-bands specified in Section 5.1, the power of emissions per any 1 % of the occupied bandwidth shall be attenuated (in dB) below the transmitter output power P (dB W) by at least $43 + 10 \log_{10} p$ (watts).

(ii) After the first 1.0 MHz immediately outside and adjacent to each of the sub-bands, the power of emissions in any 100 kHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dB W) by at least $43 + 10 \log_{10} p$ (watts). If the measurement is performed using 1 % of the occupied bandwidth, power integration over 100 kHz is required.

- RSS-133 Issue 6

6.5, Equipment shall comply with the limits in (i) and (ii) below.

(i) In the 1.0 MHz bands immediately outside and adjacent to the equipment's operating frequency block, the emission power per any 1 % of the emission bandwidth shall be attenuated (in dB) below the transmitter output power P (dB W) by at least $43 + 10 \log_{10} p$ (watts).

(ii) After the first 1.0 MHz, the emission power in any 1 MHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dB W) by at least $43 + 10 \log_{10} p$ (watts). If the measurement is performed using 1 % of the emission bandwidth, power integration over 1.0 MHz is required.

- RSS-139 Issue 3

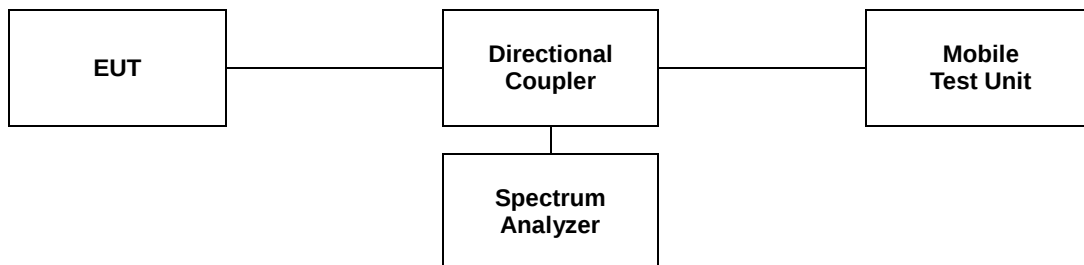
6.6, (i) In the first 1.0 MHz bands immediately outside and adjacent to the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power per any 1 % of the emission bandwidth shall be attenuated below the transmitter output power P (in dB W) by at least $43 + 10 \log_{10} p$ (watts) dB.

(ii) After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in dB W) by at least $43 + 10 \log_{10} p$ (watts) dB.

6.2. Test Procedure

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

1. Start frequency was set to 9 kHz and stop frequency was set to at least 10* the fundamental frequency.
2. Detector = Peak.
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 kHz to 20 GHz, 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 kHz or greater for frequencies less than 1 GHz and frequencies greater than 1 GHz. However, in the 1 MHz 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 dB below the transmitter power.

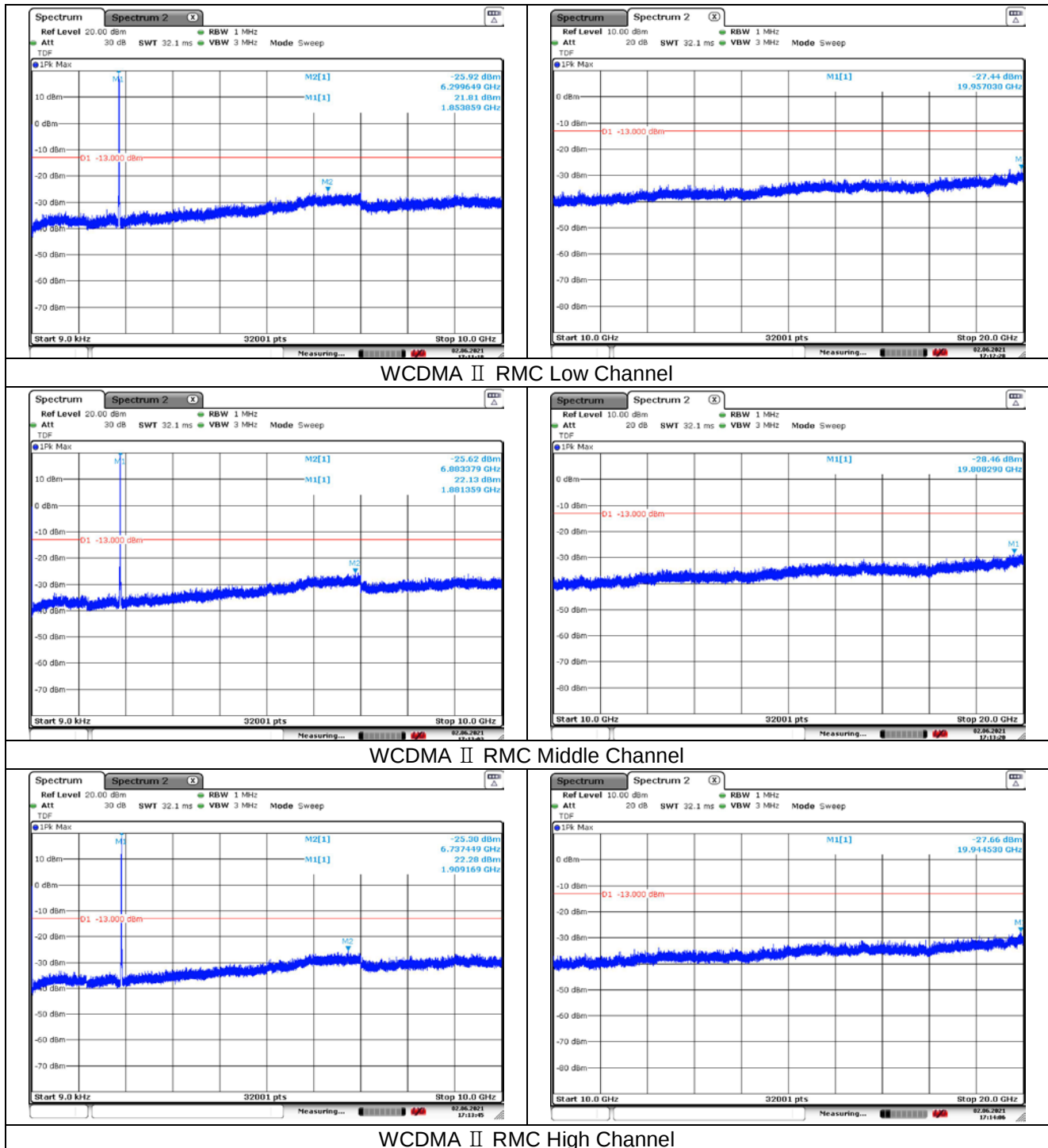
6.3. Test Results

Ambient temperature : $(23 \pm 1) ^\circ\text{C}$
 Relative humidity : 47 % R.H.

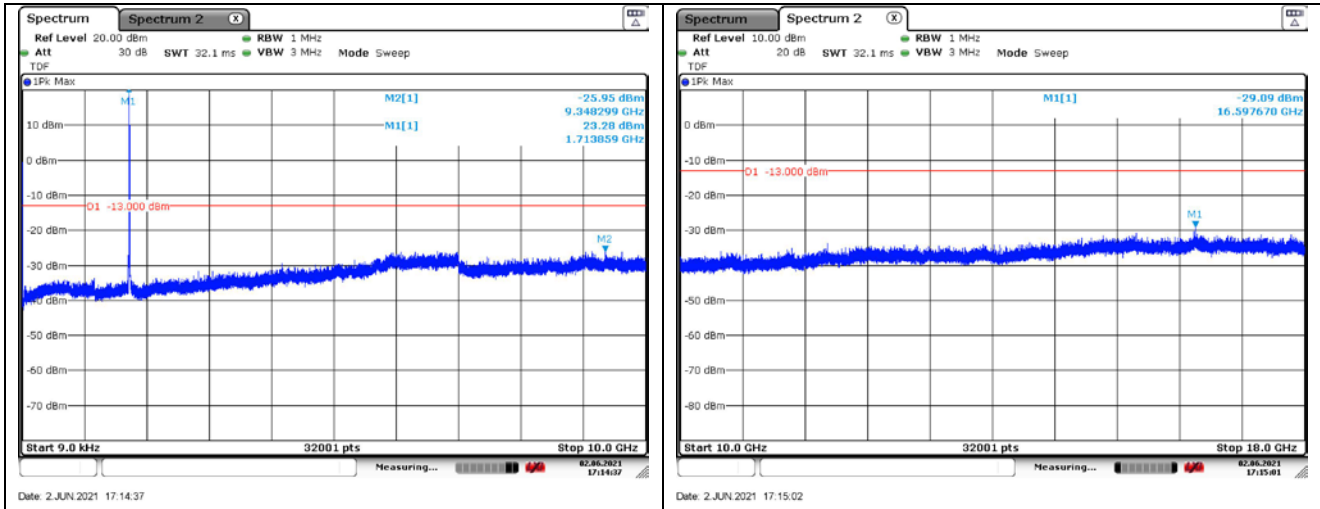
- Test plots

SIM 1

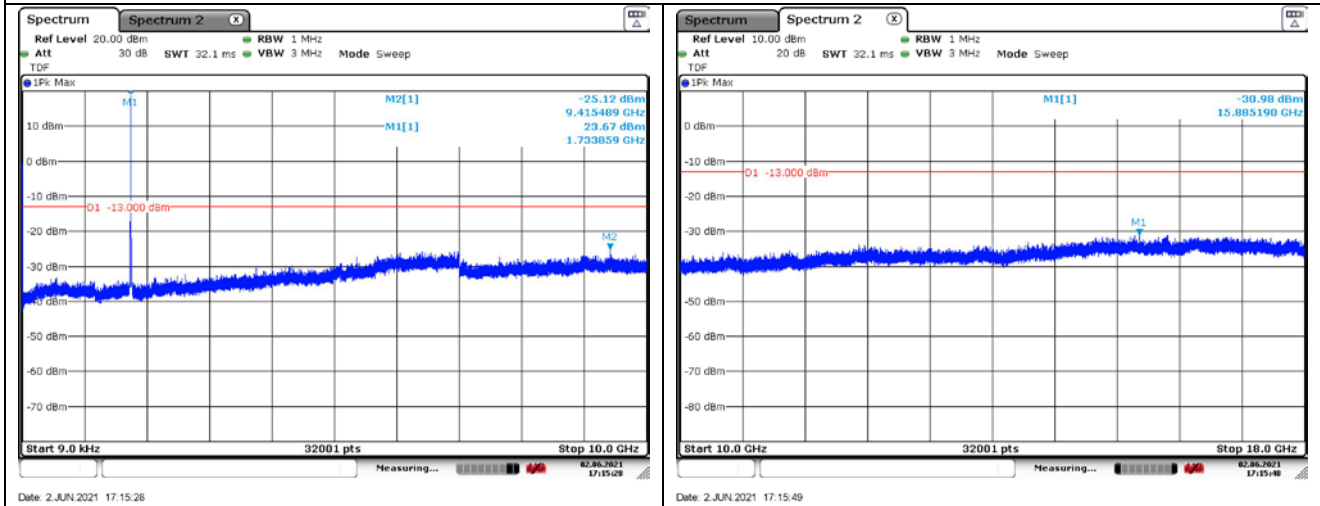
WCDMA II



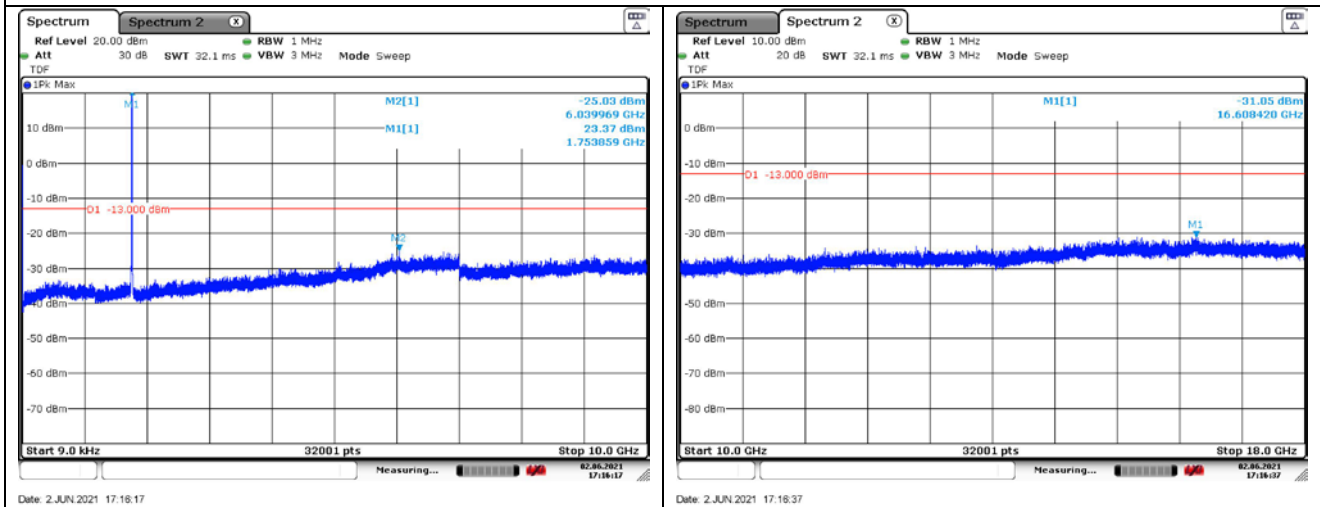
WCDMA IV



WCDMA IV RMC Low Channel

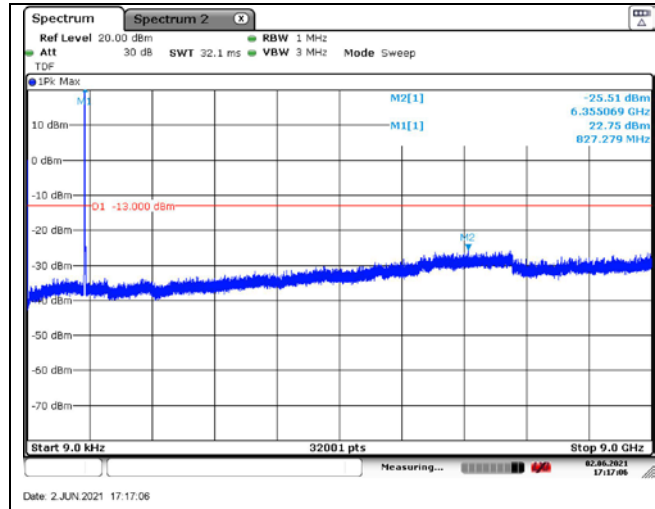


WCDMA IV RMC Middle Channel

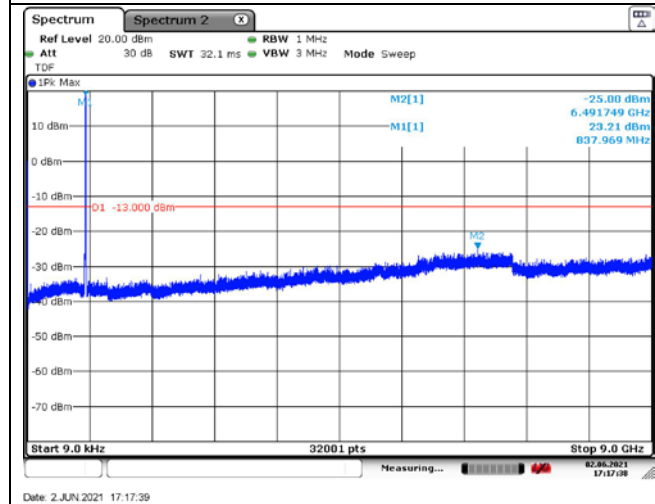


WCDMA IV RMC High Channel

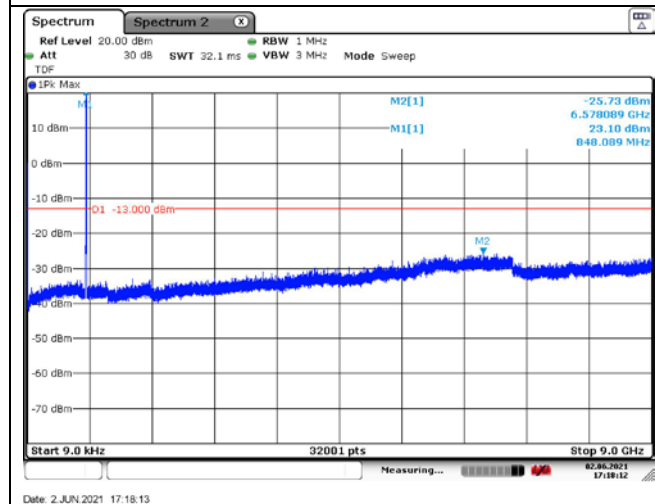
WCDMA V



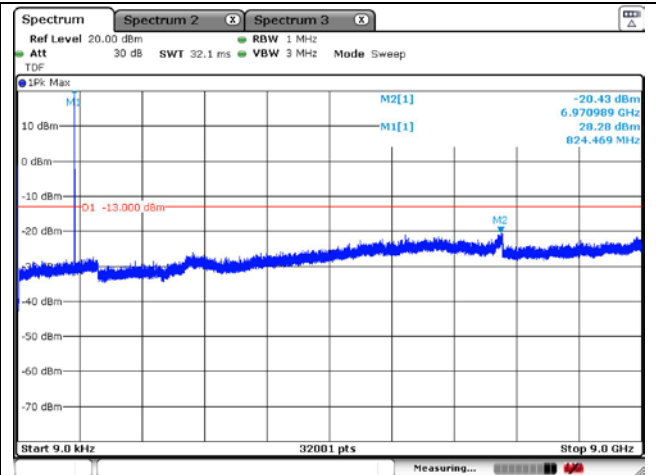
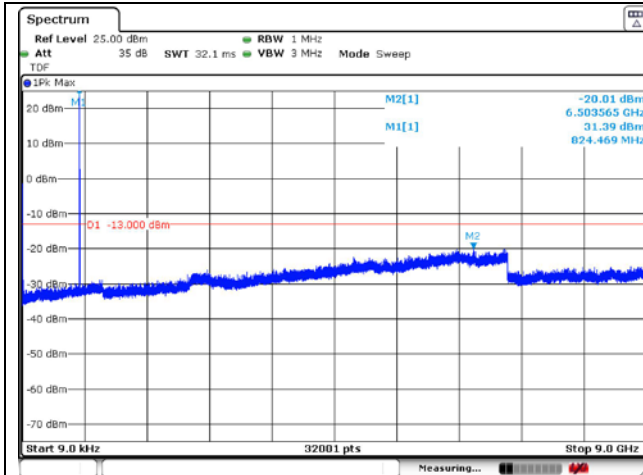
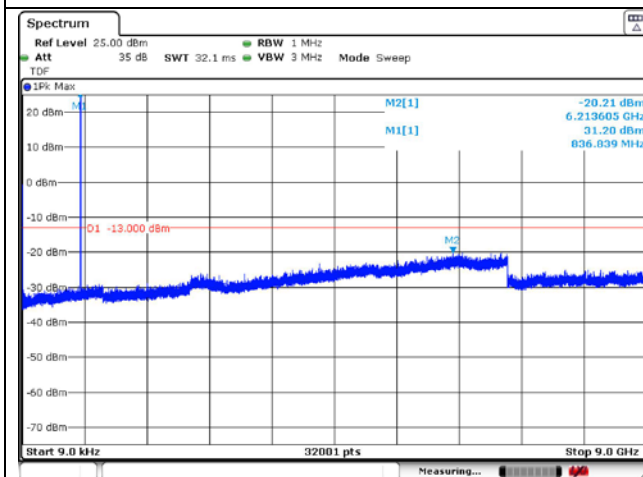
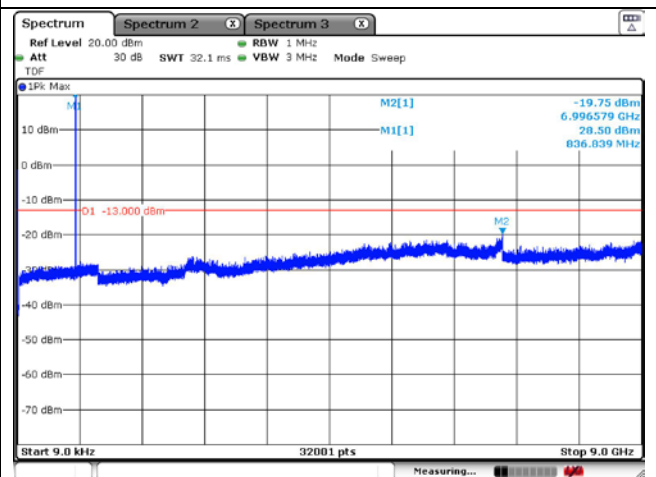
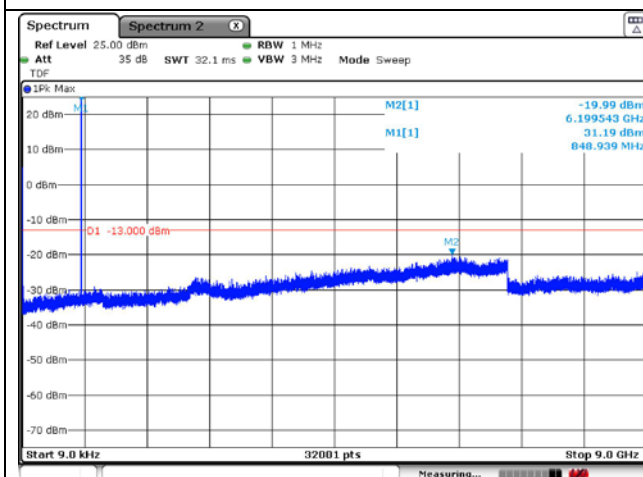
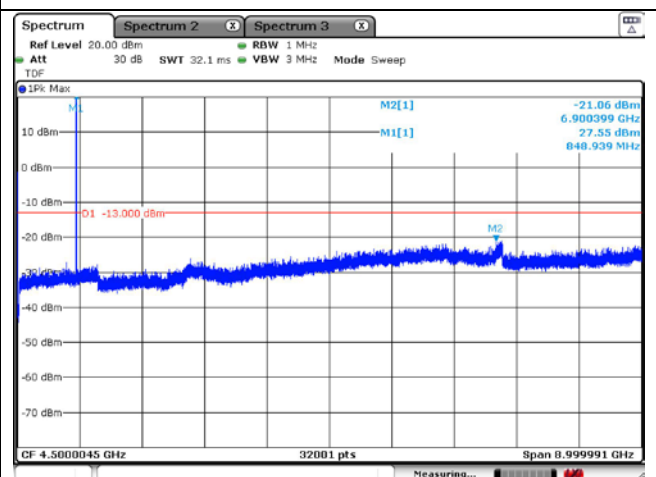
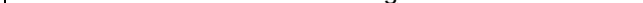
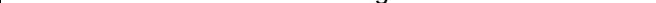
WCDMA V RMC Low channel



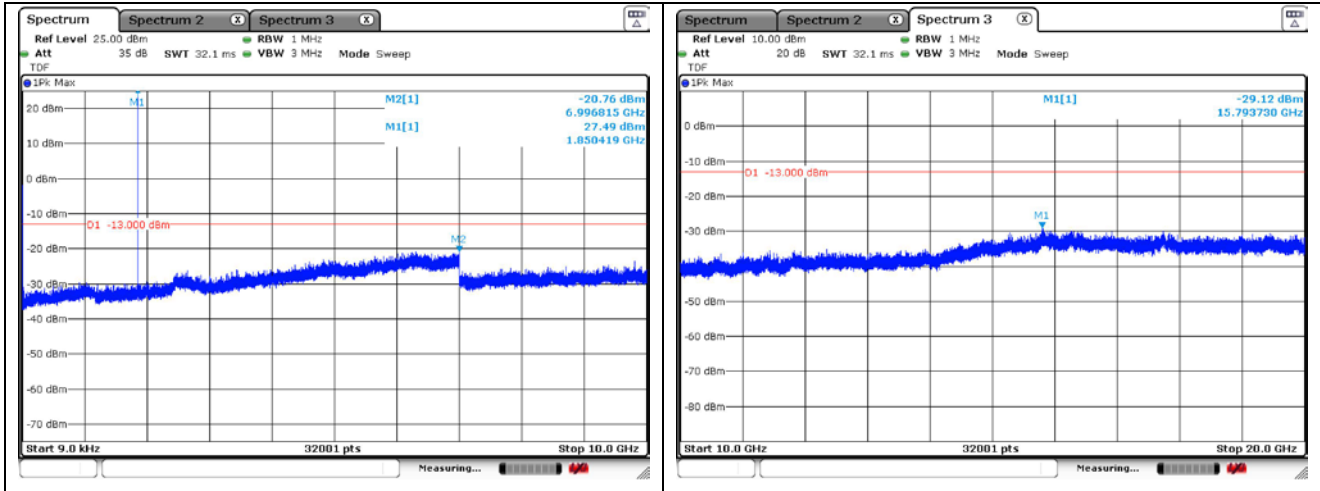
WCDMA V RMC Middle channel



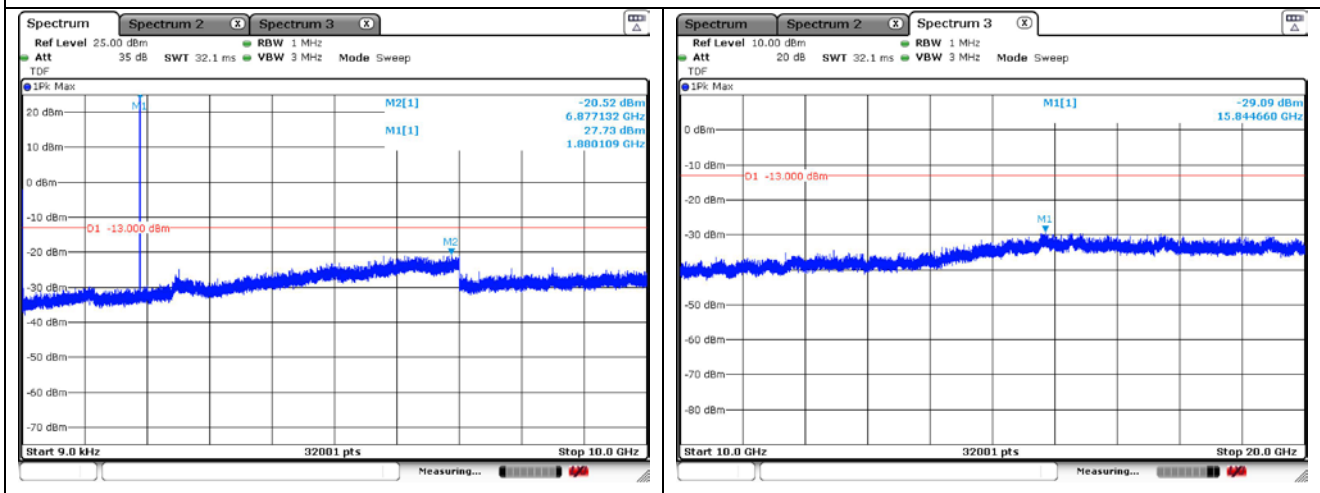
WCDMA V RMC High channel

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


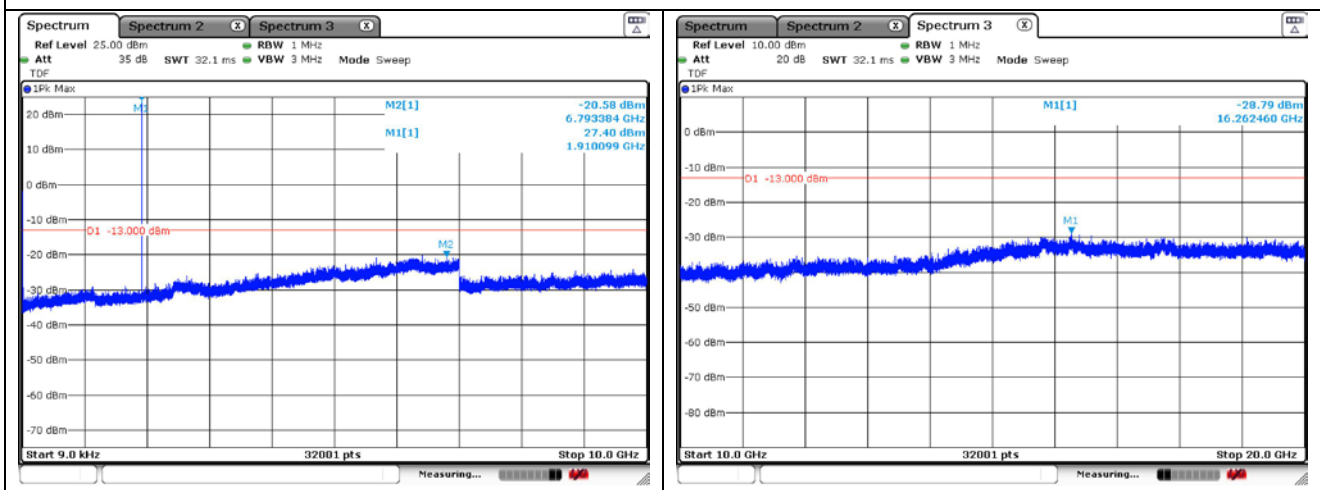
GSM 1900



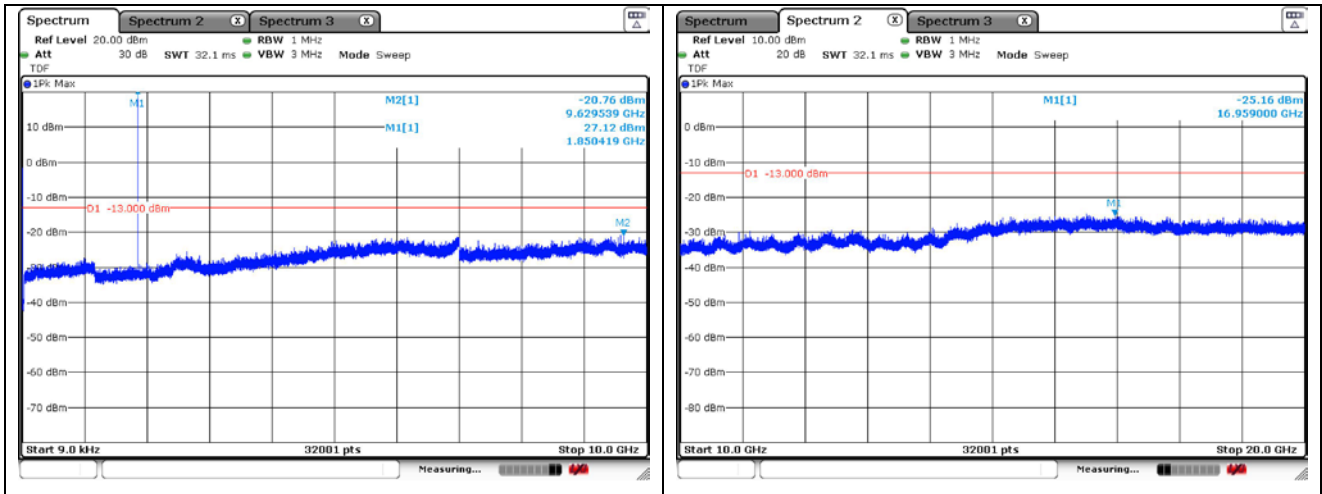
GSM 1900 VOICE Low Channel



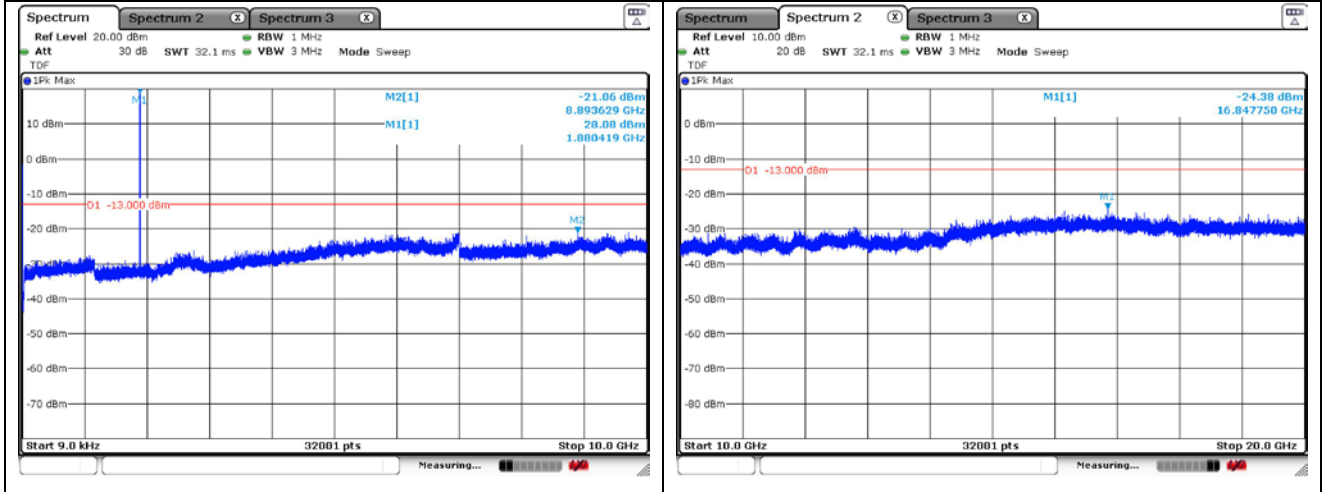
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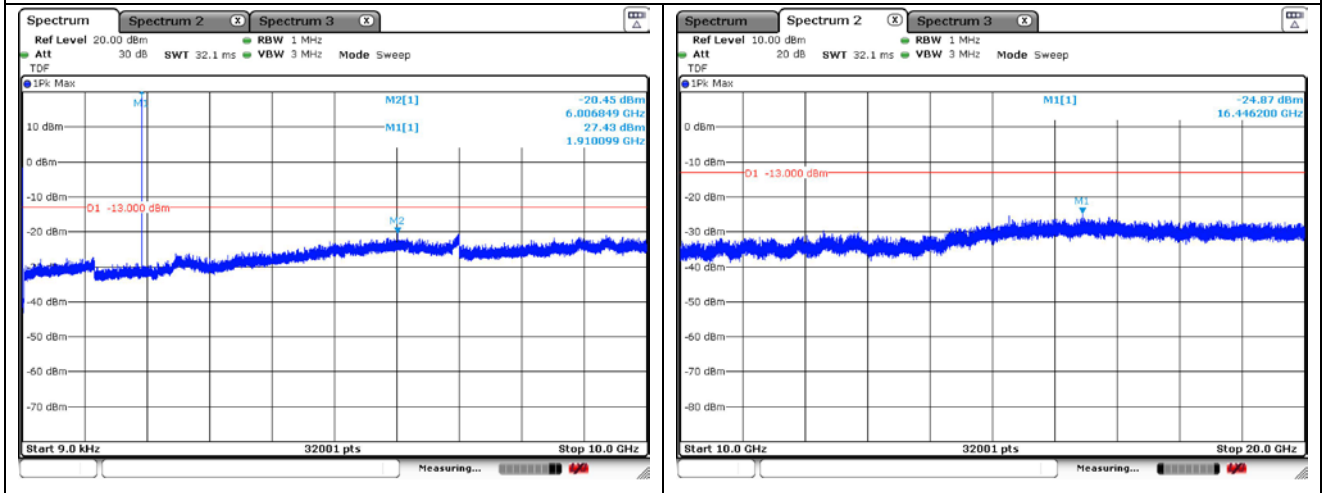
GSM 1900 VOICE High Channel



GSM 1900 EDGE Low Channel



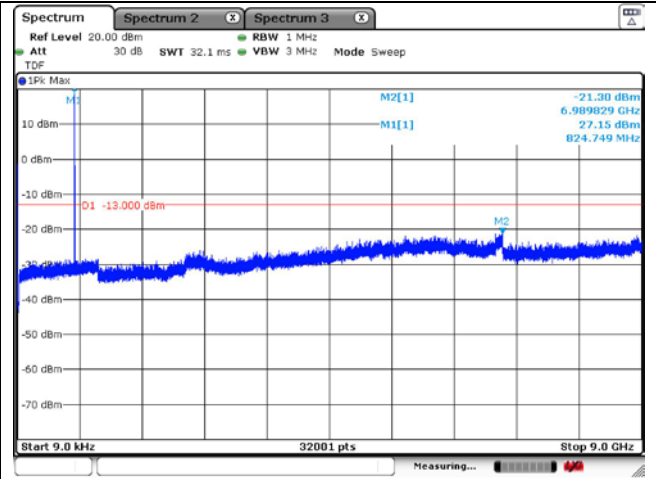
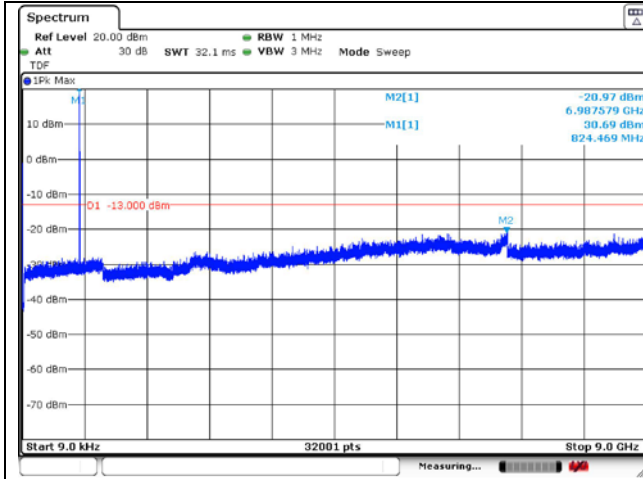
GSM 1900 EDGE Middle Channel



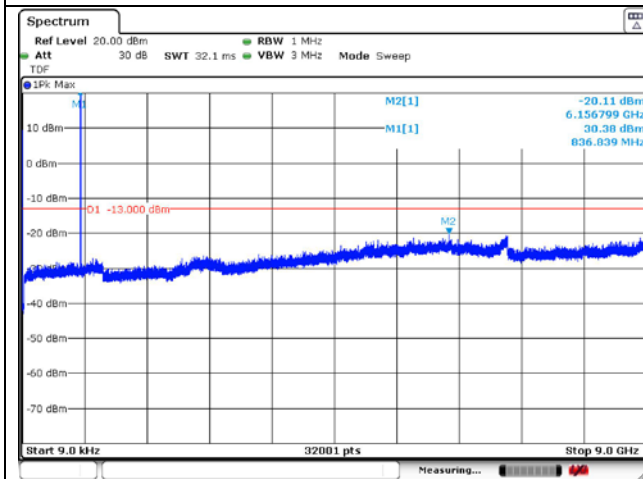
GSM 1900 EDGE High Channel

SIM 2

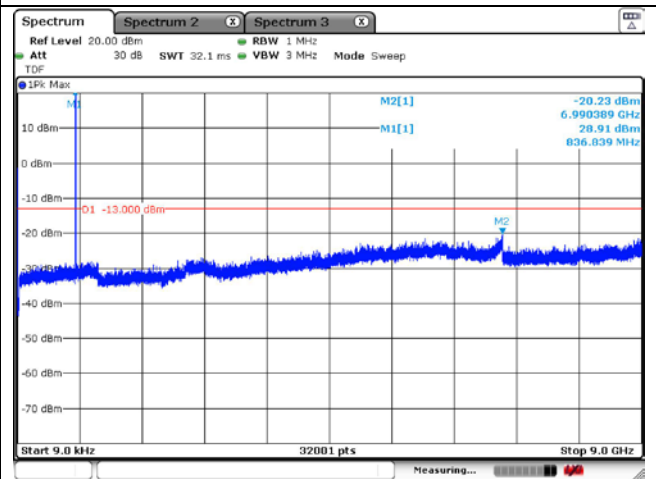
GSM 850



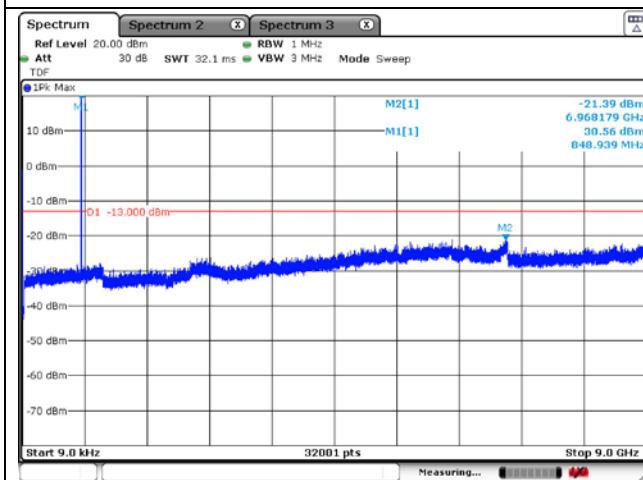
GSM 850 VOICE Low Channel



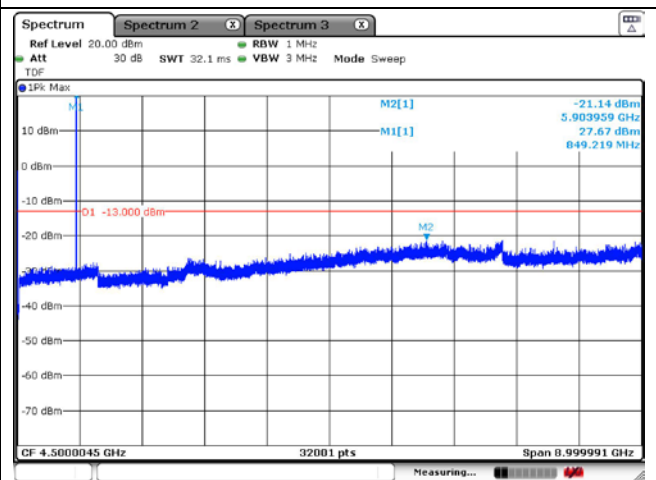
GSM 850 EDGE Low Channel



GSM 850 VOICE Middle Channel

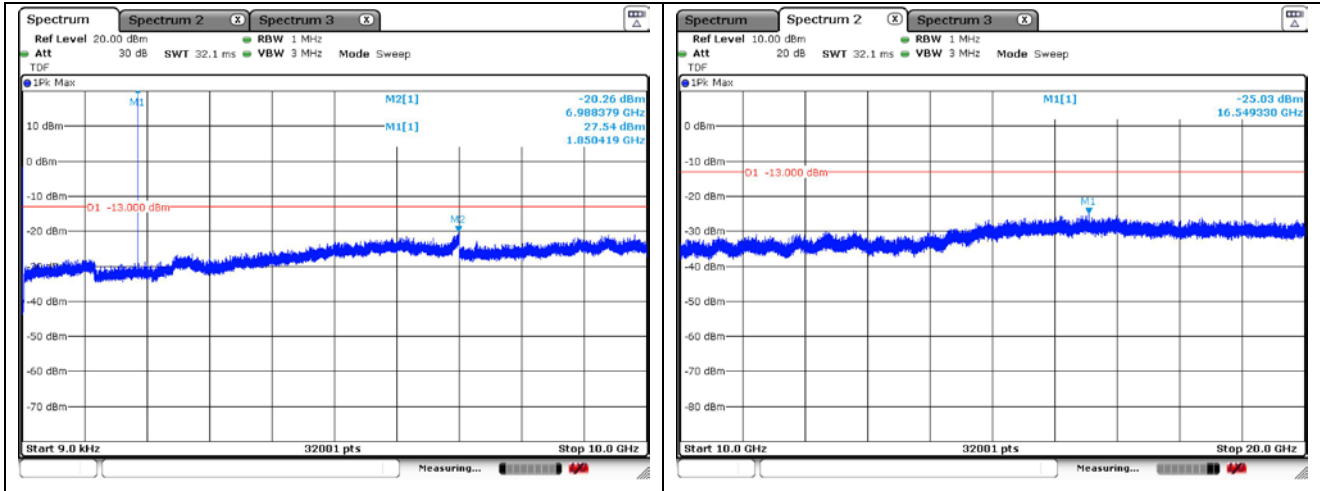
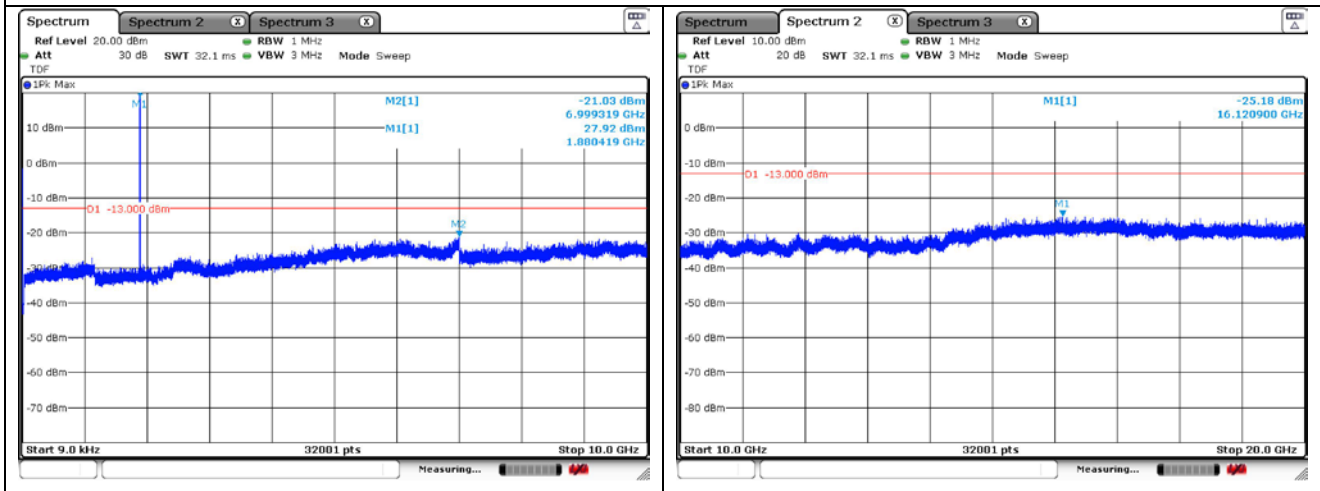
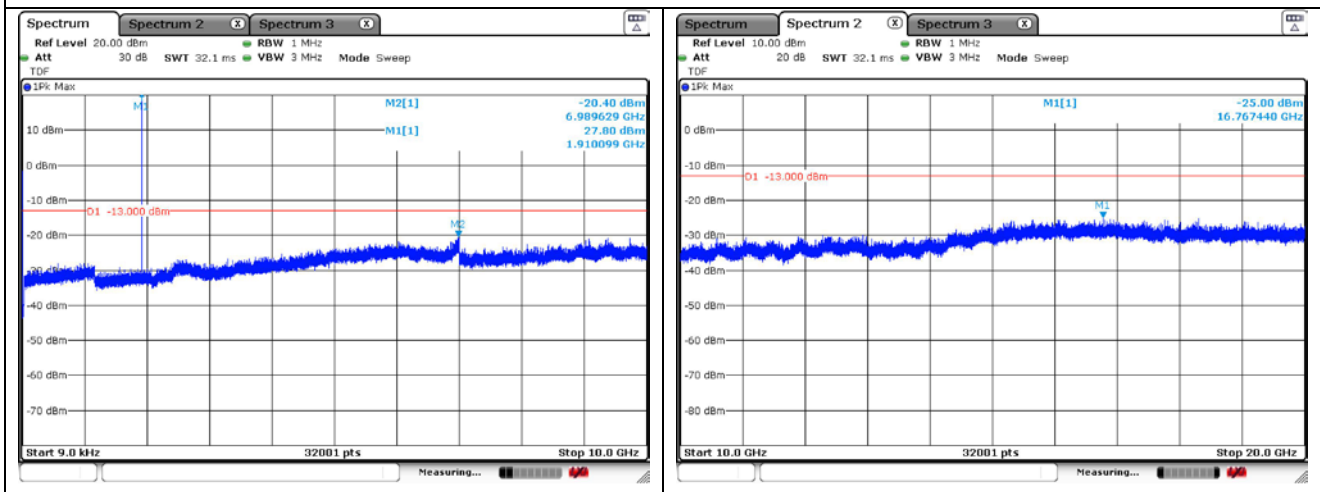


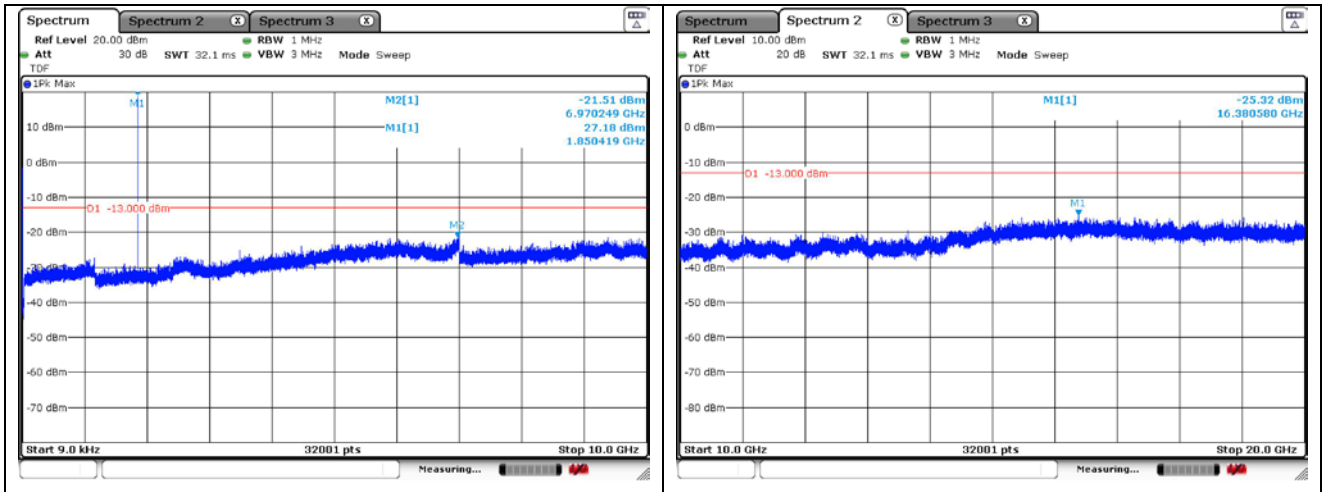
GSM 850 EDGE Middle Channel



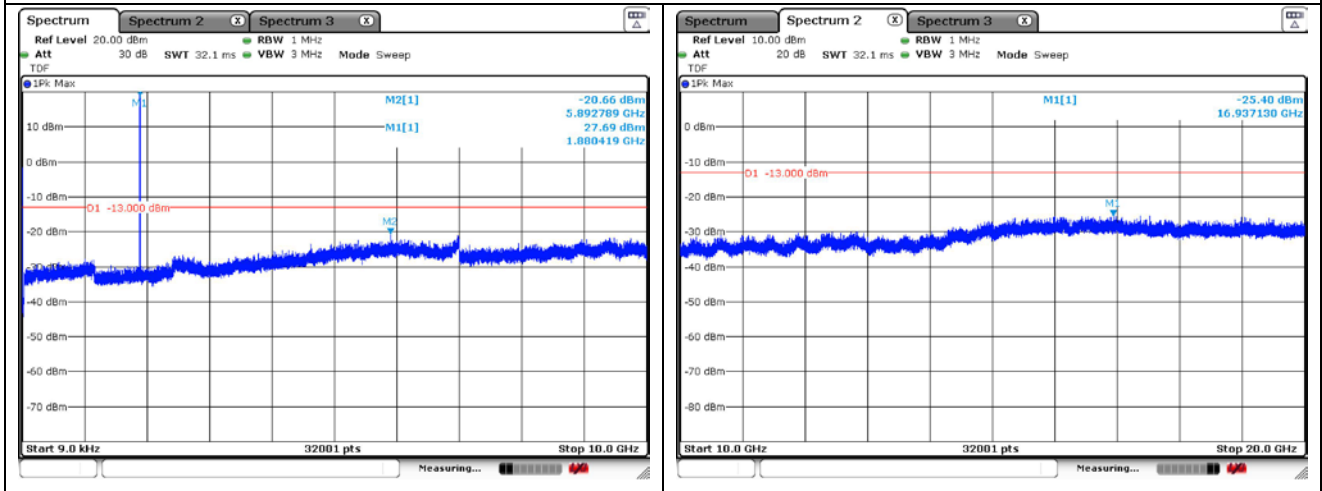
GSM 850 VOICE High Channel

GSM 850 EDGE High Channel

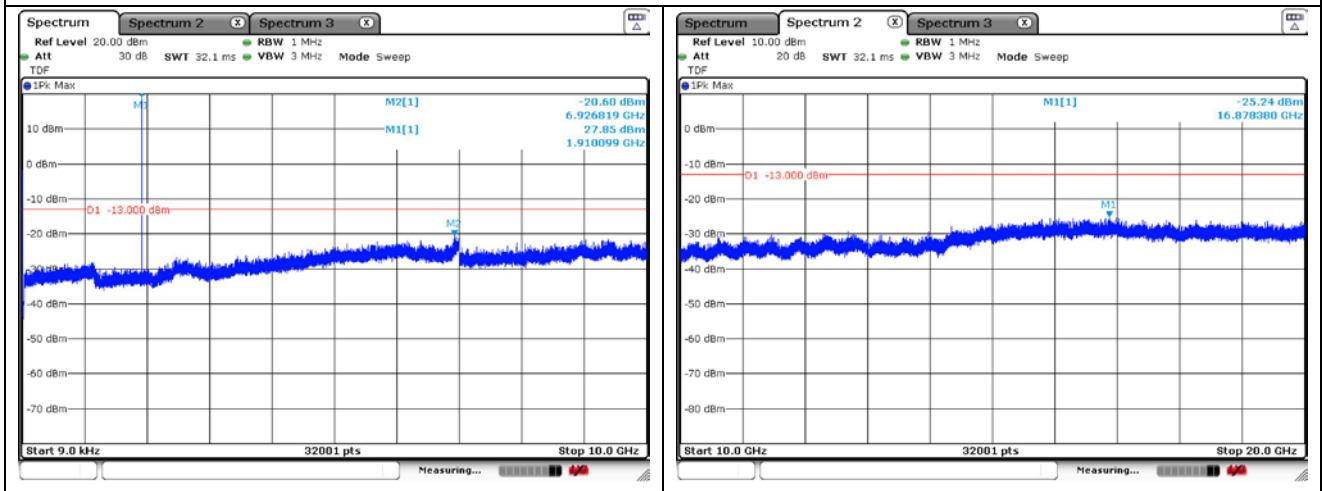
GSM 1900

GSM 1900 VOICE Low Channel

GSM 1900 VOICE Middle Channel

GSM 1900 VOICE High Channel



GSM 1900 EDGE Low Channel



GSM 1900 EDGE Middle Channel



GSM 1900 EDGE High Channel

7. Band Edge

7.1. Limit

FCC

- §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 $43 + 10\log(P)$ dB.

- §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 $43 + 10\log(P)$ dB.

- §27.53(h)(1), for operations in the 1 695-1 710 MHz, 1 710-1 755 MHz, 1 755-1 780 MHz, 1 915-1 920 MHz, 1 995-2 000 MHz, 2 000-2 020 MHz, 2 110-2 155 MHz, 2 155-2 180 MHz, 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 $43 + 10\log_{10}(P)$ dB.

IC

- RSS-132 Issue 3

5.5, Mobile and base station equipment shall comply with the limits in (i) and (ii) below.

(i) In the first 1.0 MHz band immediately outside and adjacent to each of the sub-bands specified in Section 5.1, the power of emissions per any 1 % of the occupied bandwidth shall be attenuated (in dB) below the transmitter output power P (dB W) by at least $43 + 10\log_{10} p$ (watts).

(ii) After the first 1.0 MHz immediately outside and adjacent to each of the sub-bands, the power of emissions in any 100 kHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dB W) by at least $43 + 10\log_{10} p$ (watts). If the measurement is performed using 1 % of the occupied bandwidth, power integration over 100 kHz is required.

- RSS-133 Issue 6

6.5, Equipment shall comply with the limits in (i) and (ii) below.

(i) In the 1.0 MHz bands immediately outside and adjacent to the equipment's operating frequency block, the emission power per any 1 % of the emission bandwidth shall be attenuated (in dB) below the transmitter output power P (dB W) by at least $43 + 10\log_{10} p$ (watts).

(ii) After the first 1.0 MHz, the emission power in any 1 MHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dB W) by at least $43 + 10\log_{10} p$ (watts). If the measurement is performed using 1 % of the emission bandwidth, power integration over 1.0 MHz is required.

- RSS-139 Issue 3

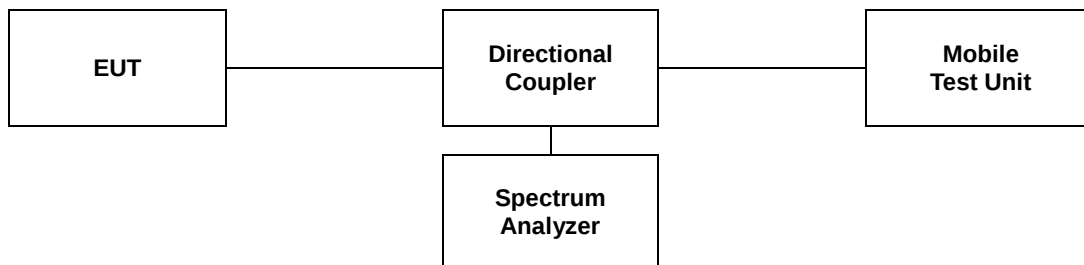
6.6, (i) In the first 1.0 MHz bands immediately outside and adjacent to the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power per any 1 % of the emission bandwidth shall be attenuated below the transmitter output power P (in dB W) by at least $43 + 10\log_{10} p$ (watts) dB.

(ii) After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in dB W) by at least $43 + 10\log_{10} p$ (watts) dB.

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 $\geq 3 \times$ 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.



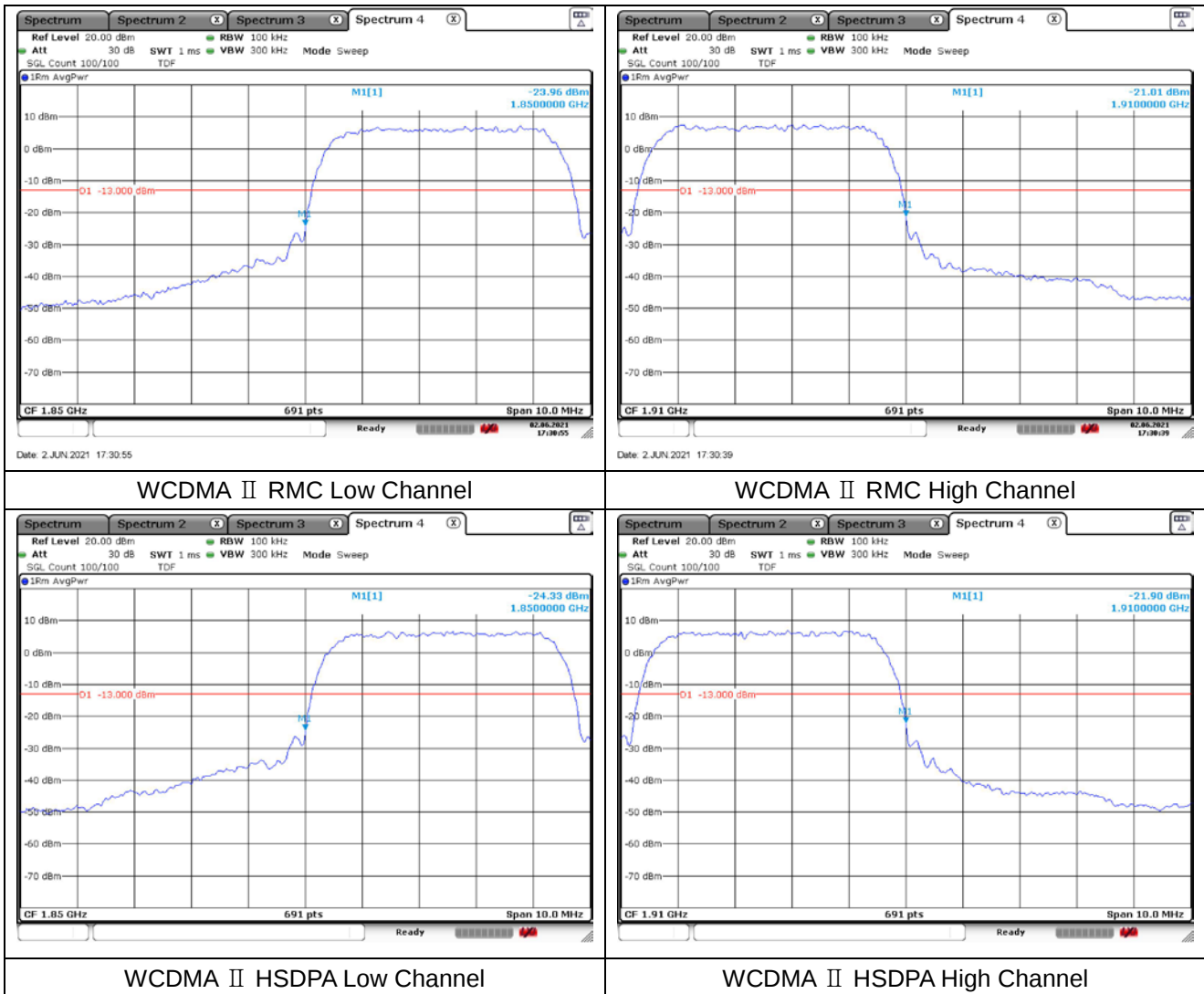
7.3. Test Results

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

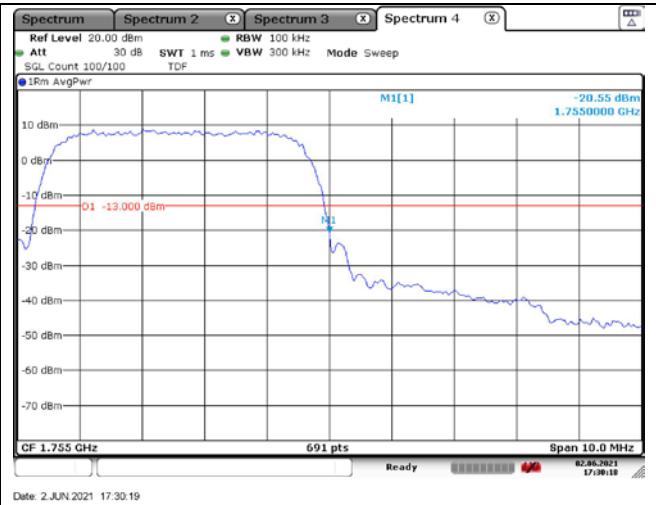
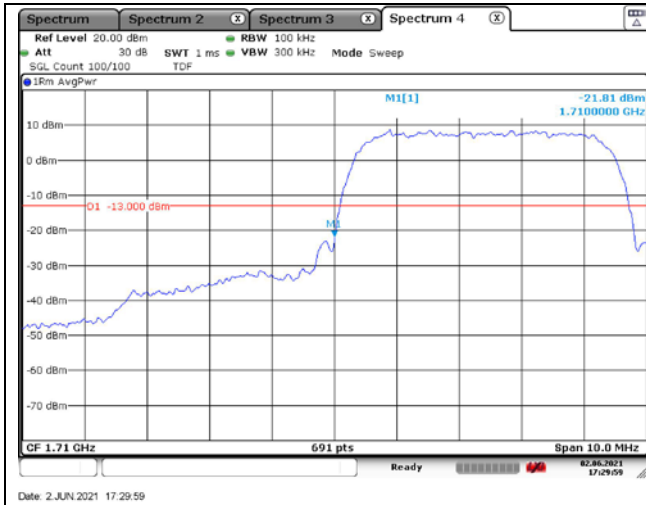
- Test plots

SIM 1

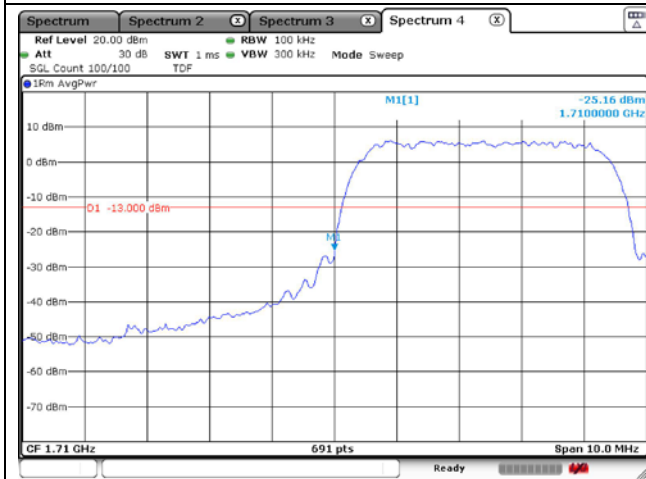
WCDMA II



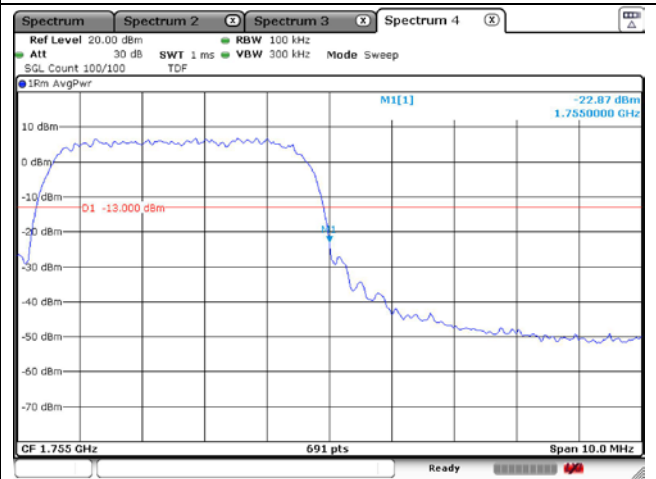
WCDMA IV



WCDMA IV RMC Low Channel

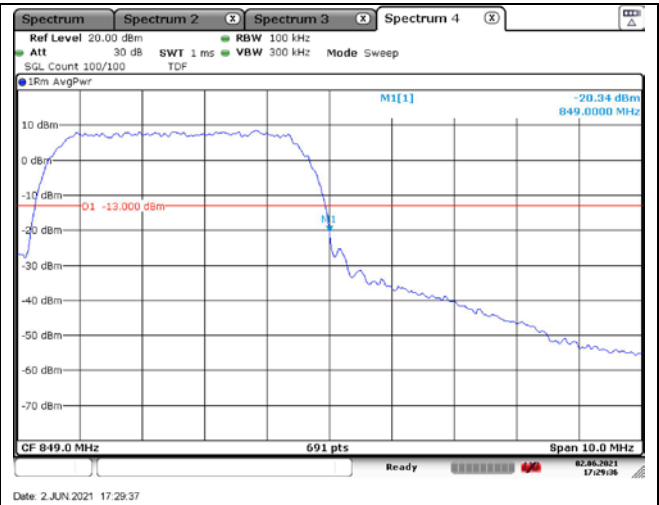
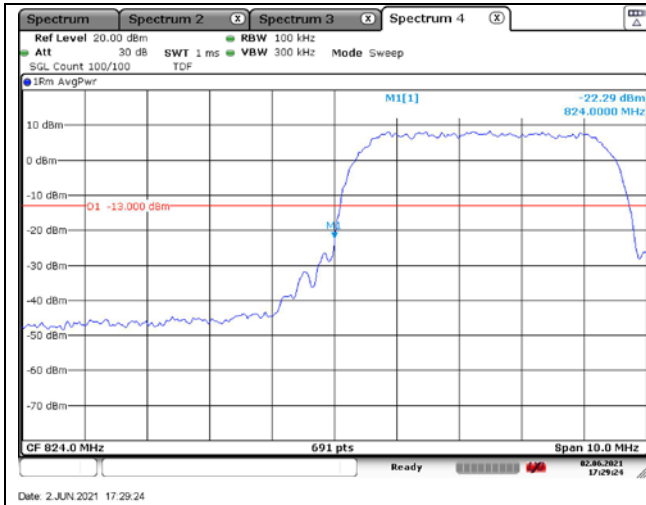
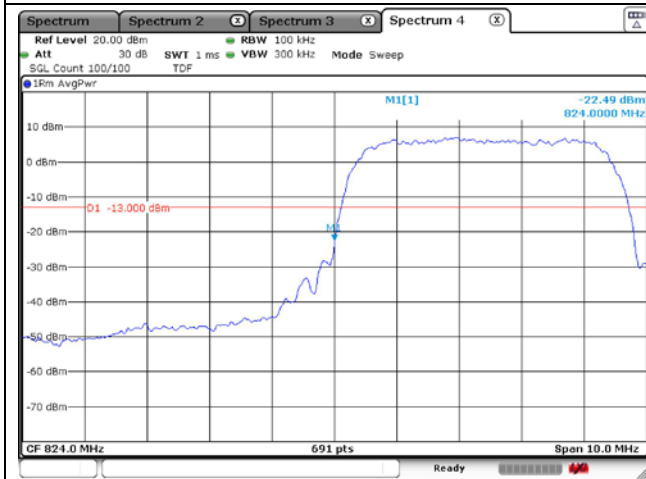
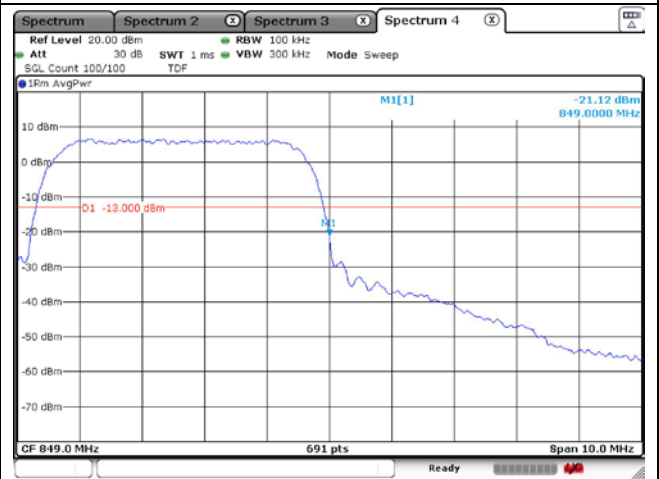


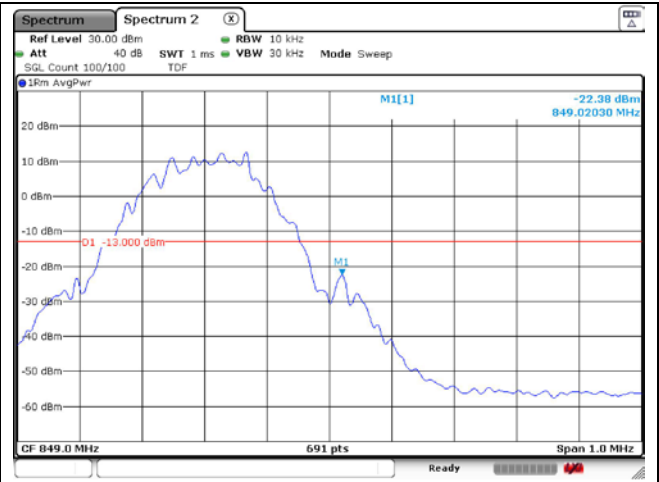
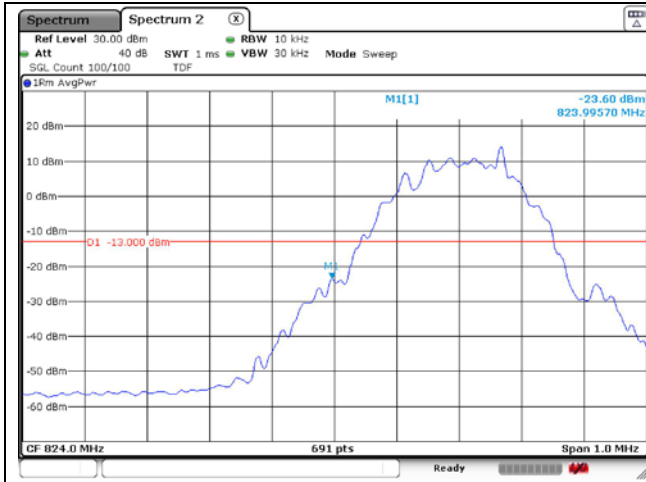
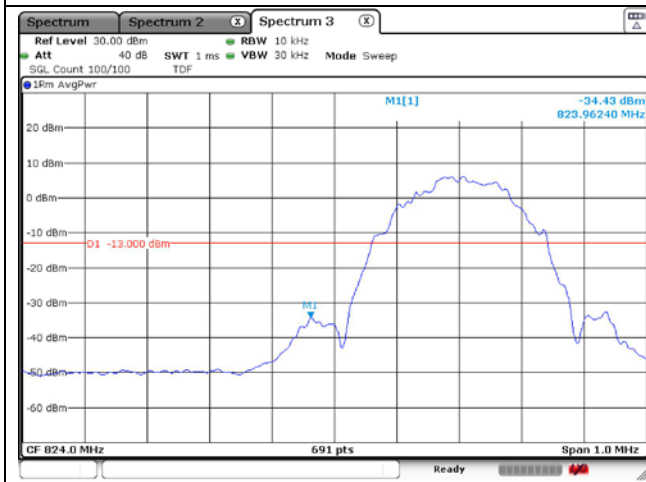
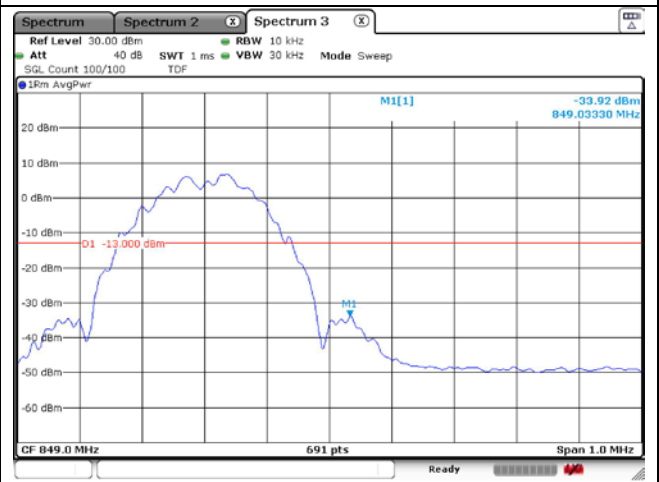
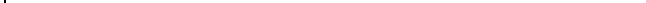
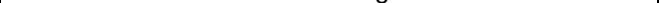
WCDMA IV RMC High Channel

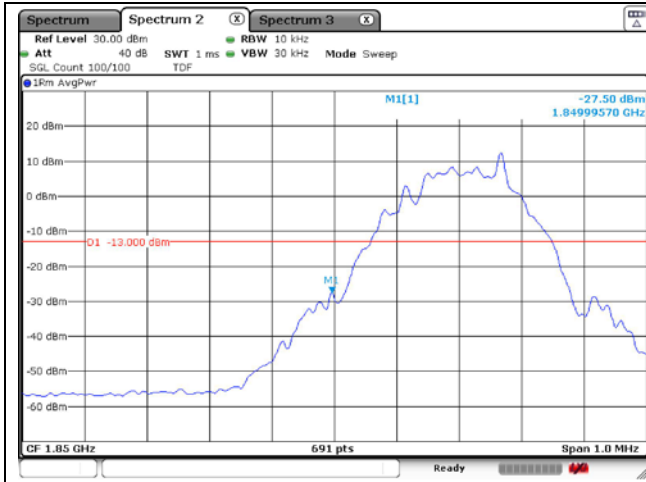


WCDMA IV HSDPA Low Channel

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

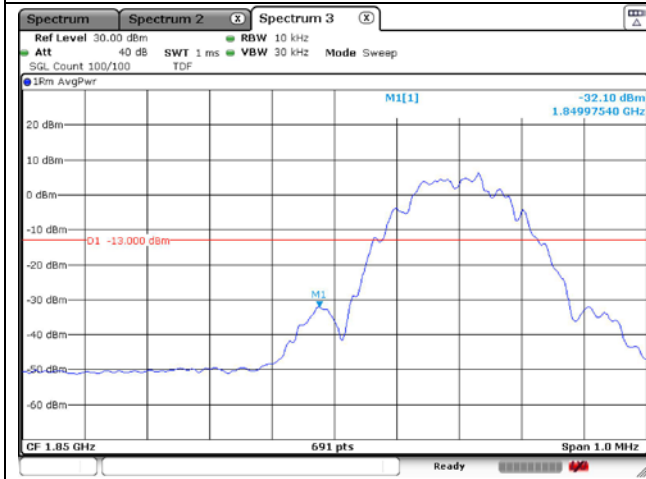
GSM 850

GSM 850 VOICE Low Channel

GSM 850 VOICE High Channel

GSM 850 EDGE Low Channel

GSM 850 EDGE High Channel


GSM 1900


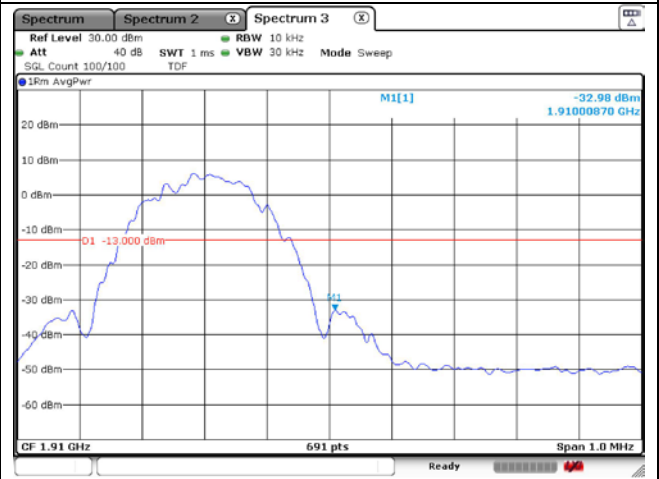
GSM 1900 VOICE Low Channel



GSM 1900 VOICE High Channel



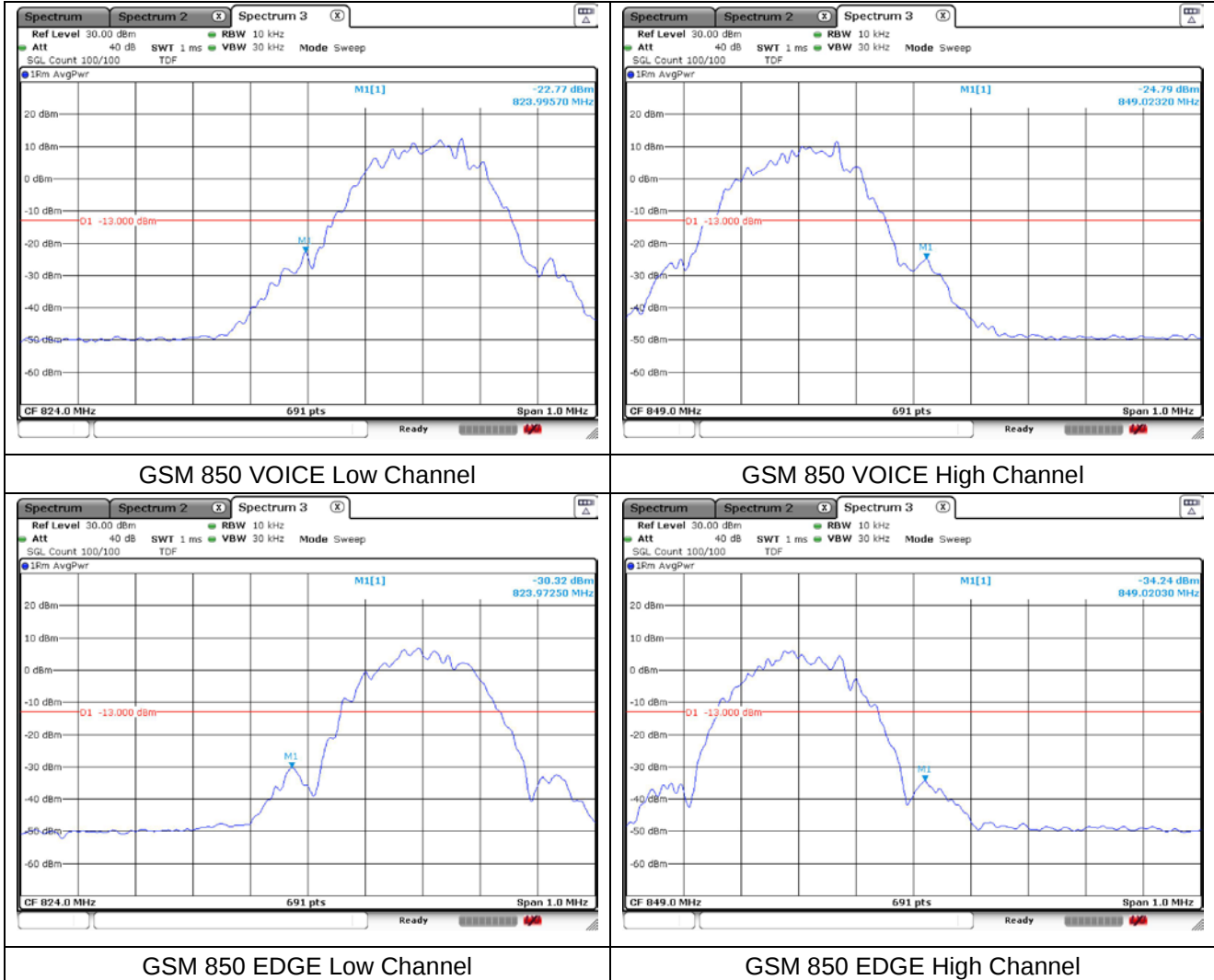
GSM 1900 EDGE Low Channel

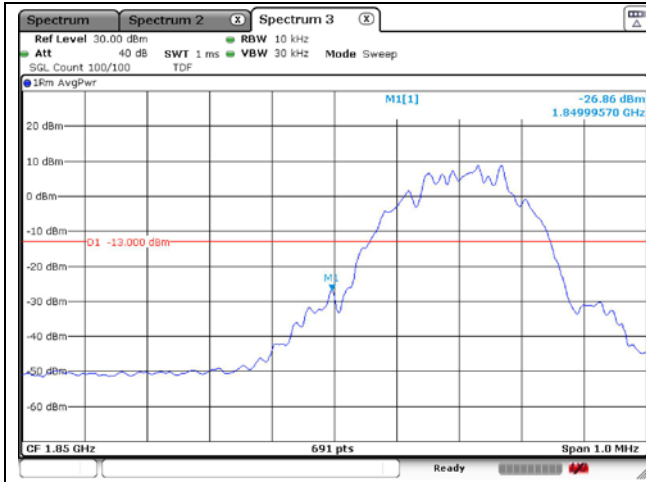


GSM 1900 EDGE High Channel

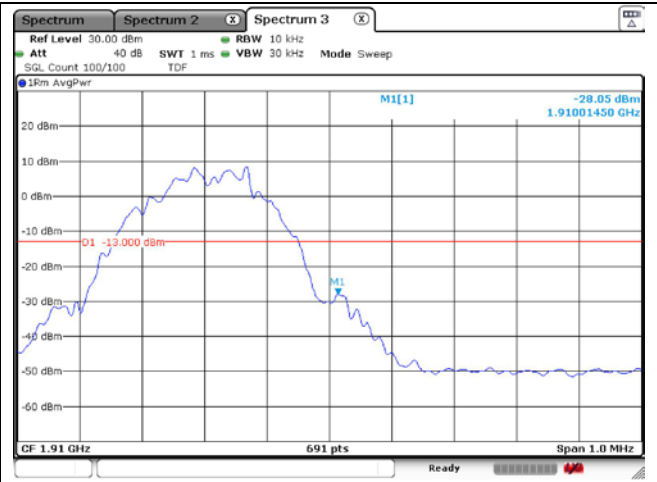
SIM 2

GSM 850

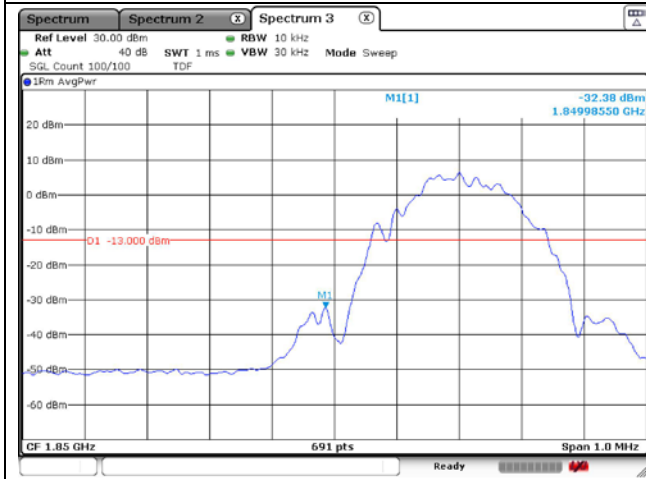


GSM 1900


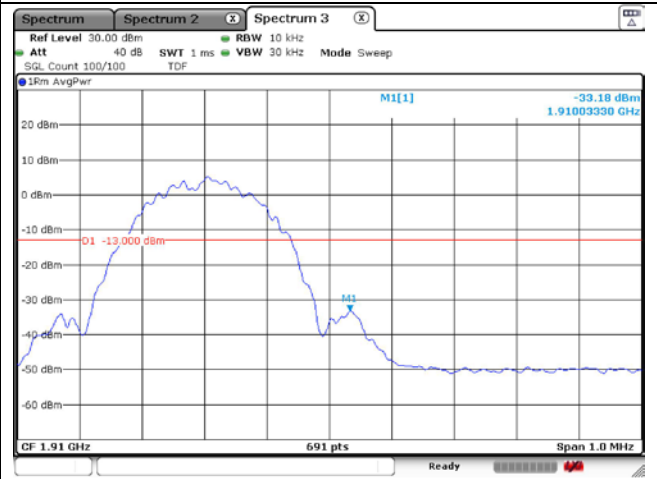
GSM 1900 VOICE Low Channel



GSM 1900 VOICE High Channel



GSM 1900 EDGE Low Channel



GSM 1900 EDGE High Channel

8. Frequency Stability

8.1. Limit

FCC

- § 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 MHz 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.

IC

- RSS-Gen Issue 5

6.11, for licensed devices, the following measurement conditions apply:

a. at the temperatures of -30°C (-22°F), +20°C (+68°F) and +50°C (+122°F), and at the manufacturer's rated supply voltage

- RSS-132 Issue 3

5.3, The carrier frequency shall not depart from the reference frequency in excess of ±2.5 ppm for mobile stations and ±1.5 ppm for base stations.

- RSS-133 Issue 6

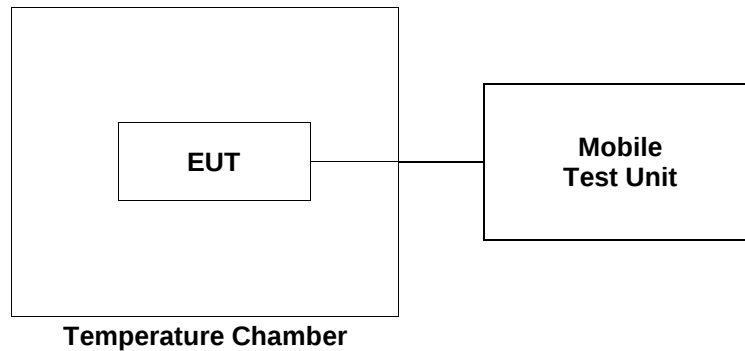
6.3, the carrier frequency shall not depart from the reference frequency, in excess of ±2.5 ppm for mobile stations and ±1.0 ppm for base stations.

- RSS-139 Issue 3

6.4, the frequency stability shall be sufficient to ensure that the occupied bandwidth stays within the operating frequency block when tested to the temperature and supply voltage variations specified in RSS-Gen.

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) °C
 Relative humidity : 47 % R.H.

SIM 1

WCDMA II mode at middle channel

Reference Frequency: 1 880.0 MHz			
Frequency Stability versus Temperature			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
50	12.5	12.57	0.000 51
40		11.96	0.000 18
30		12.34	0.000 38
20(Ref.)		11.62	-
10		11.35	-0.000 14
0		11.24	-0.000 20
-10		11.08	-0.000 29
-20		11.37	-0.000 13
-30		11.24	-0.000 20
Frequency Stability versus Power Supply			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
20	14.38 (115%)	11.28	-0.000 18
	10.63 (85%)	11.53	-0.000 05

WCDMA IV mode at middle channel

Reference Frequency: 1 732.6 MHz			
Frequency Stability versus Temperature			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
50	12.5	-11.36	0.000 27
40		-11.05	0.000 44
30		-11.79	0.000 02
20(Ref.)		-11.82	-
10		-12.51	-0.000 40
0		-11.96	-0.000 08
-10		-11.86	-0.000 02
-20		-12.36	-0.000 31
-30		-13.05	-0.000 71
Frequency Stability versus Power Supply			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
20	14.38 (115%)	-11.79	0.000 02
	10.63 (85%)	-11.59	0.000 13

WCDMA V mode at middle channel

Reference Frequency: 836.6 MHz			
Frequency Stability versus Temperature			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
50	12.5	-4.21	-0.001 86
40		-3.02	-0.000 44
30		-3.11	-0.000 55
20(Ref.)		-2.65	-
10		-3.25	-0.000 72
0		-2.77	-0.000 14
-10		-3.19	-0.000 65
-20		-2.96	-0.000 37
-30		-4.16	-0.001 80
Frequency Stability versus Power Supply			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
20	14.38 (115%)	-2.89	-0.000 29
	10.63 (85%)	-3.10	-0.000 54

GSM 850 mode at middle channel

Reference Frequency: 836.6 MHz			
Frequency Stability versus Temperature			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
50	12.5	7.10	0.001 30
40		6.24	0.000 27
30		6.36	0.000 42
20(Ref.)		6.01	-
10		6.55	0.000 65
0		6.36	0.000 42
-10		6.78	0.000 92
-20		7.51	0.001 79
-30		6.99	0.001 17
Frequency Stability versus Power Supply			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
20	14.38 (115%)	7.36	0.001 61
	10.63 (85%)	6.99	0.001 17

GSM 1900 mode at middle channel

Reference Frequency: 1 880.0 MHz			
Frequency Stability versus Temperature			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
50	12.5	-4.89	0.000 23
40		-5.11	0.000 12
30		-5.52	-0.000 10
20(Ref.)		-5.33	-
10		-5.71	-0.000 20
0		-5.91	-0.000 31
-10		-6.22	-0.000 47
-20		-5.78	-0.000 24
-30		-6.31	-0.000 52
Frequency Stability versus Power Supply			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
20	14.38 (115%)	-4.98	0.000 19
	10.63 (85%)	-5.64	-0.000 16

SIM 2

GSM 850 mode at middle channel

Reference Frequency: 836.6 MHz			
Frequency Stability versus Temperature			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
50	12.5	9.22	0.003 04
40		8.12	0.001 72
30		6.92	0.000 29
20(Ref.)		6.68	-
10		6.77	0.000 11
0		9.61	0.003 50
-10		8.74	0.002 46
-20		8.53	0.002 21
-30		9.11	0.002 90
Frequency Stability versus Power Supply			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
20	14.38 (115%)	6.36	-0.000 38
	10.63 (85%)	7.51	0.000 99

GSM 1900 mode at middle channel

Reference Frequency: 1 880.0 MHz			
Frequency Stability versus Temperature			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
50	12.5	11.53	-0.000 63
40		11.91	-0.000 43
30		11.68	-0.000 55
20(Ref.)		12.72	-
10		12.36	-0.000 19
0		12.54	-0.000 10
-10		12.84	0.000 06
-20		13.11	0.000 21
-30		13.50	0.000 41
Frequency Stability versus Power Supply			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
20	14.38 (115%)	12.54	-0.000 10
	10.63 (85%)	13.51	0.000 42

- End of the Test Report -