12 SPURIOUS RADIATED EMISSIONS

Test Requirement:	FCC Part 2.1053, 22.917, 24.238, 27.53(h)
Test Method:	TIA/EIA-603-E:2016
	ANSI C63.26:2015
Test Mode:	TX transmitting

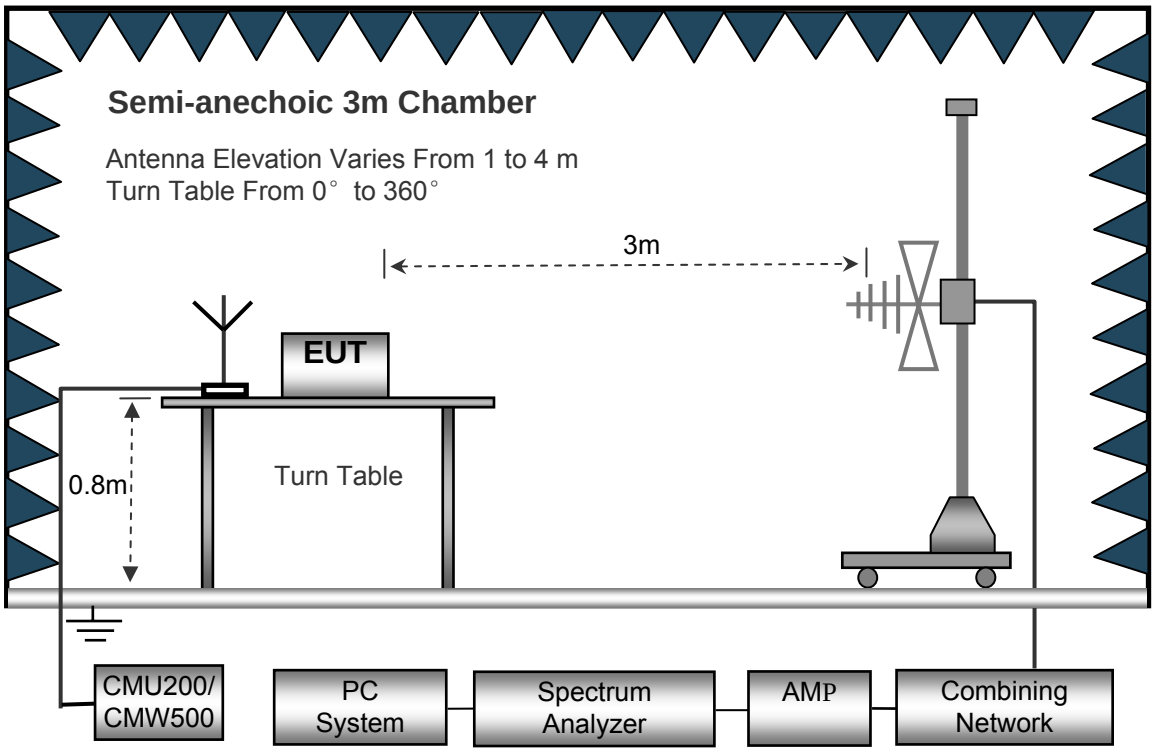
12.1 EUT Operation

Operating Environment **:**

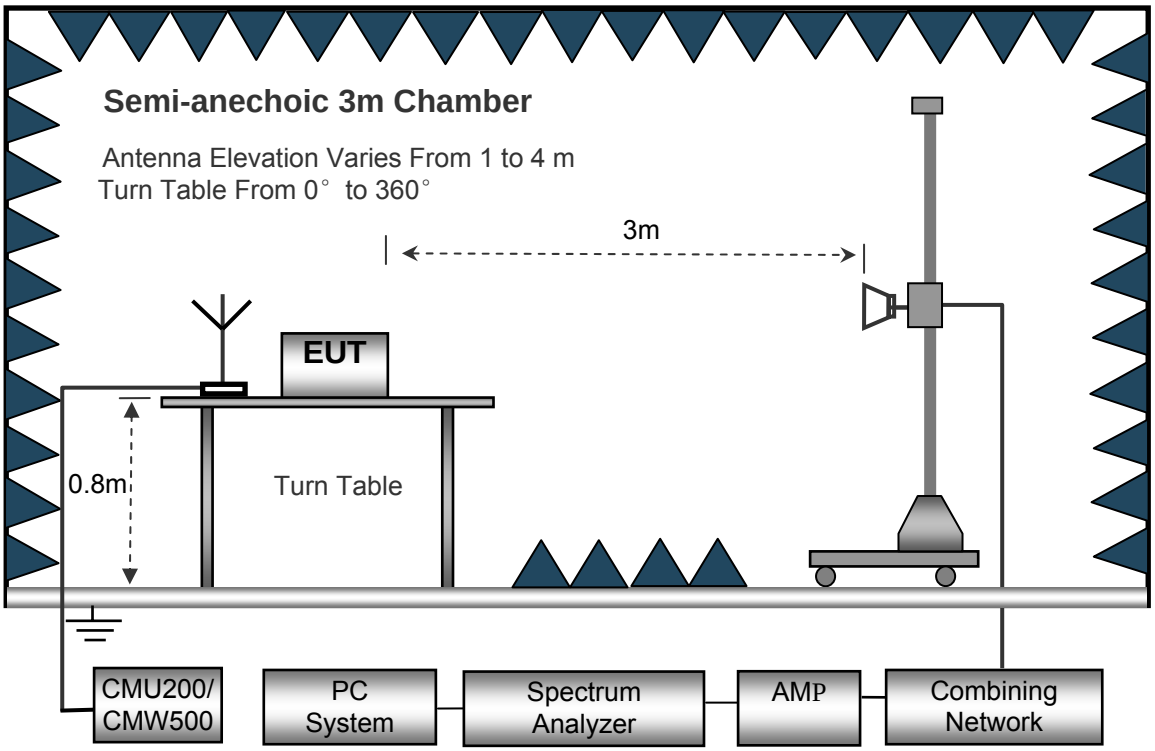
Temperature:	23.5 °C
Humidity:	52.1 % RH
Atmospheric Pressure:	101.2kPa

12.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz.



12.3 Spectrum Analyzer Setup

30MHz ~ 1GHz

Sweep Speed ..... Auto
Detector ..... PK
Resolution Bandwidth..... 100kHz
Video Bandwidth..... 300kHz

Above 1GHz

Sweep Speed ..... Auto
Detector ..... PK
Resolution Bandwidth..... 1MHz
Video Bandwidth..... 3MHz
Detector ..... Ave.
Resolution Bandwidth..... 1MHz
Video Bandwidth..... 10Hz

12.4 Test Procedure

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions. The spectrum was investigated from 30MHz up to the tenth harmonic of the highest fundamental frequency.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. The radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the Z position. So the data shown was the Z position only.
7. Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.
   Spurious emissions in dB = 10 lg (TXpwr in Watts/0.001) – the absolute level
   Spurious attenuation limit in dB = 43 + 10 Log10 (power out in Watts)
8. Repeat above procedures until the measurements for all frequencies are completed.

12.5 Summary of Test Results

For 26MHz~30MHz,

The measurements were more than 20 dB below the limit and not reported.

Remark: Test performed from 30MHz to 10th harmonics with low/middle/high channels, only the worst data were recorded.

Cellular Band (Part 22H)

Frequency	Receiver Reading	Turn table Angle	RX Antenna		Substituted			Absolute Level	Result	
			Height	Polar	SG Level	Cable	Antenna Gain		Limit	Margin
(MHz)	(dBμV)	Degree	(m)	(H/V)	(dBm)	(dB)	(dB)	(dBm)	(dBm)	(dB)
GSM 850 Channel 128										
223.12	40.88	223	1.2	H	-69.63	0.15	0.00	-69.78	-13.00	-56.78
223.12	43.32	221	1.9	V	-64.27	0.15	0.00	-64.42	-13.00	-51.42
1648.40	65.04	279	2.1	H	-48.93	0.30	9.40	-39.83	-13.00	-26.83
1648.40	56.53	57	1.8	V	-57.00	0.30	9.40	-47.90	-13.00	-34.90
2472.60	61.13	52	1.1	H	-52.87	0.43	10.60	-42.70	-13.00	-29.70
2472.60	46.83	210	2.2	V	-63.45	0.43	10.60	-53.28	-13.00	-40.28
WCDMA Band V Channel 4233										
199.38	41.65	355	1.9	H	-68.86	0.15	0.00	-69.01	-13.00	-56.01
199.38	45.17	299	1.5	V	-62.42	0.15	0.00	-62.57	-13.00	-49.57
1693.20	57.87	240	1.8	H	-56.10	0.30	9.40	-47.00	-13.00	-34.00
1693.20	49.50	299	1.9	V	-64.03	0.30	9.40	-54.93	-13.00	-41.93
2539.80	48.39	335	1.5	H	-65.61	0.43	10.60	-55.44	-13.00	-42.44
2539.80	38.98	1	1.2	V	-71.30	0.43	10.60	-61.13	-13.00	-48.13

Cellular Band (Part 24E/27)

Frequency	Receiver Reading	Turn table Angle	RX Antenna		Substituted			Absolute Level	Result	
			Height	Polar	SG Level	Cable	Antenna Gain		Limit	Margin
(MHz)	(dBμV)	Degree	(m)	(H/V)	(dBm)	(dB)	(dB)	(dBm)	(dBm)	(dB)
PCS 1900 Channel 512										
223.12	51.81	155	1.4	H	-58.70	0.15	0.00	-58.85	-13.00	-45.85
223.12	37.41	44	1.2	V	-70.18	0.15	0.00	-70.33	-13.00	-57.33
3700.40	65.95	28	1.3	H	-45.59	2.37	12.50	-35.46	-13.00	-22.46
3700.40	59.98	281	2.0	V	-49.83	2.37	12.50	-39.70	-13.00	-26.70
5550.60	53.58	348	1.5	H	-56.03	2.86	12.90	-45.99	-13.00	-32.99
5550.60	44.73	38	1.1	V	-64.15	2.86	12.90	-54.11	-13.00	-41.11
WCDMA Band II Channel 9400										
199.38	48.40	302	2.1	H	-62.11	0.15	0.00	-62.26	-13.00	-49.26
199.38	40.10	144	1.1	V	-67.49	0.15	0.00	-67.64	-13.00	-54.64
3760.00	59.05	292	1.9	H	-52.49	2.37	12.50	-42.36	-13.00	-29.36
3760.00	52.79	271	1.6	V	-57.02	2.37	12.50	-46.89	-13.00	-33.89
5640.00	47.39	346	1.3	H	-62.22	2.86	12.90	-52.18	-13.00	-39.18
5640.00	38.13	190	1.4	V	-70.75	2.86	12.90	-60.71	-13.00	-47.71
WCDMA Band IV Channel 1313										
223.12	53.40	68	1.2	H	-57.11	0.15	0.00	-57.26	-13.00	-44.26
223.12	36.89	359	1.4	V	-70.70	0.15	0.00	-70.85	-13.00	-57.85
3424.80	52.53	359	1.3	H	-59.01	2.37	12.50	-48.88	-13.00	-35.88
3424.80	45.87	279	2.0	V	-63.94	2.37	12.50	-53.81	-13.00	-40.81
5137.20	39.35	136	1.8	H	-70.26	2.86	12.90	-60.22	-13.00	-47.22
5137.20	31.89	314	1.6	V	-76.99	2.86	12.90	-66.95	-13.00	-53.95

Note: 1) Absolute Level = SG Level - Cable loss + Antenna Gain

2) Margin = Absolute Level - Limit

13 Band Edge Measurement

Test Requirement:	FCC Part 2.1051, 22.917(a), 24.238(a), 27.53(h)
Test Method:	TIA/EIA-603-E:2016
	ANSI C63.26:2015
Test Mode:	TX transmitting

13.1 EUT Operation

Operating Environment **:**

Temperature:	23.5 °C
Humidity:	52.3 % RH
Atmospheric Pressure:	101.3kPa

13.2 Test Procedure

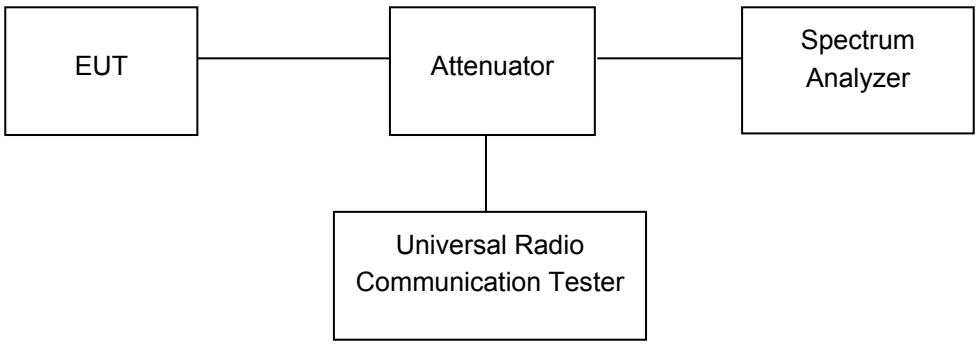
The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

According to FCC Part 22.917(a), the power of any emissions 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.

According to FCC Part 24.238(a), the power of any emissions 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.

According to FCC Part 27.53(h), Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 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.

The center of the spectrum analyzer was set to block edge frequency

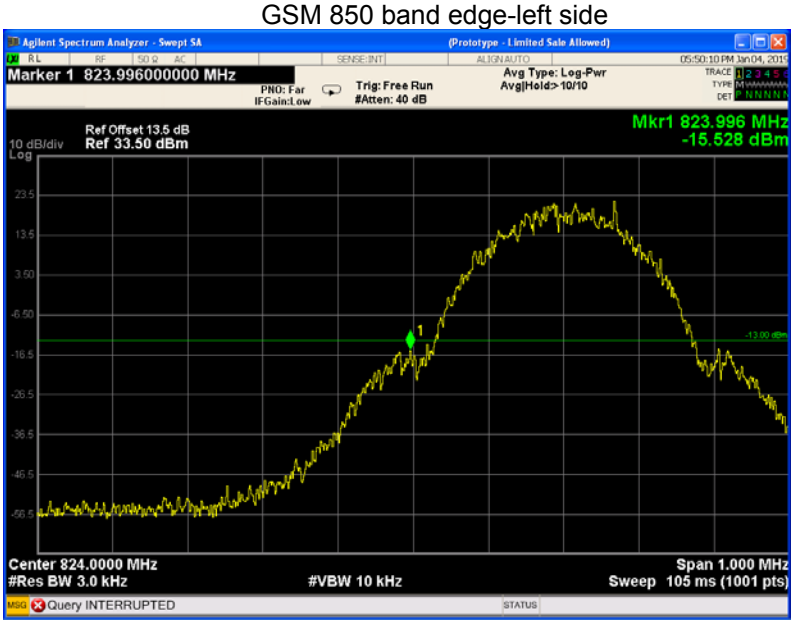


13.3 Test Result

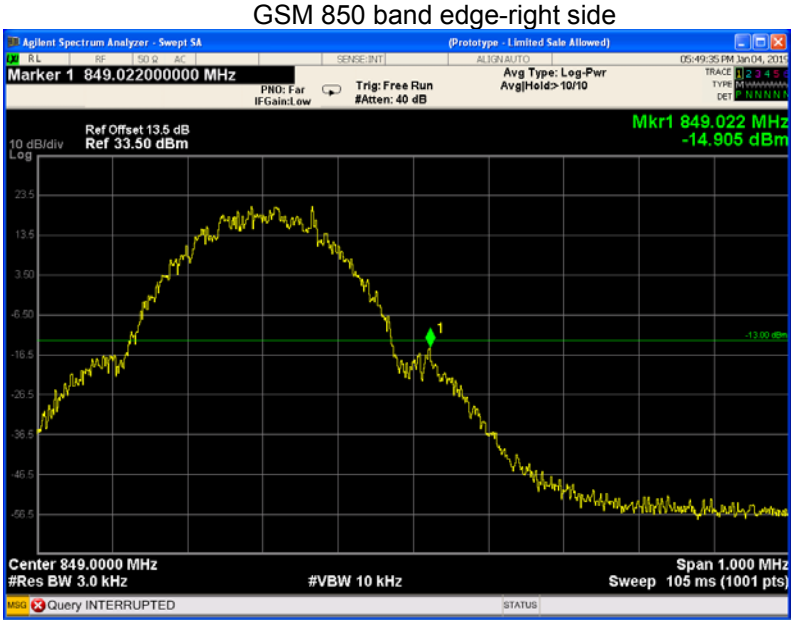
Test plots

Cellular Band (Part 22H)

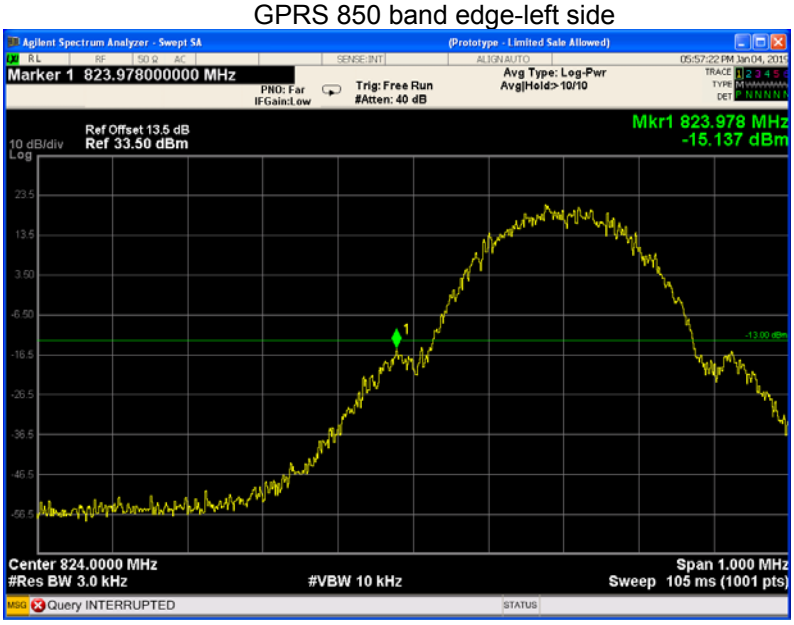
GSM 850 band edge-left side



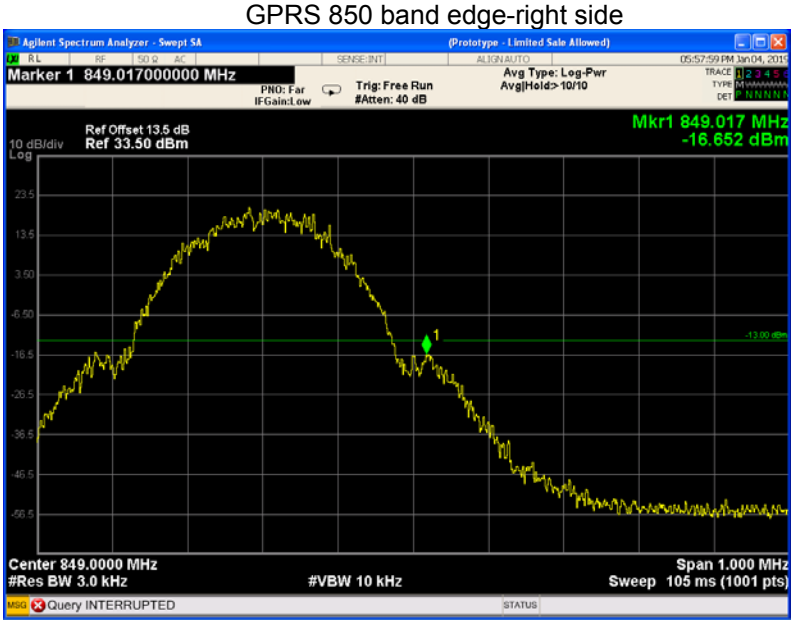
GSM 850 band edge-right side



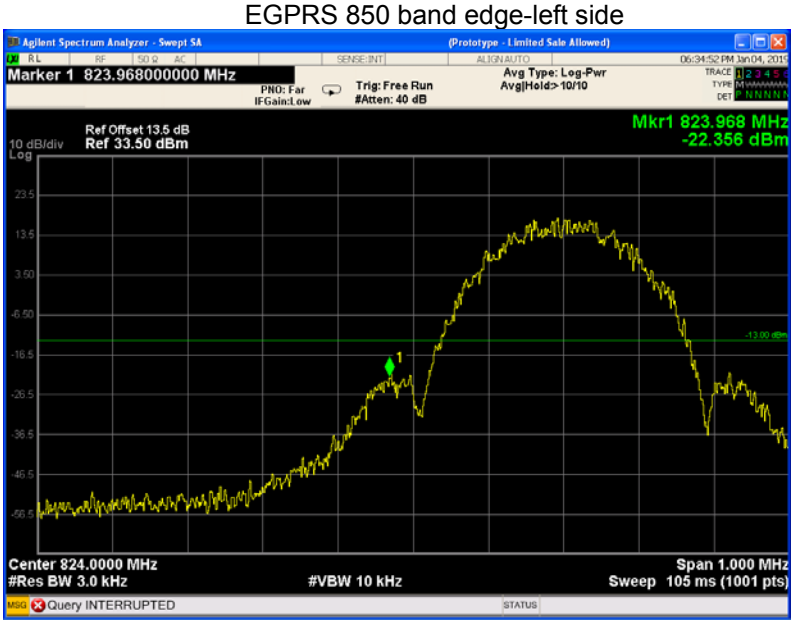
GPRS 850 band edge-left side



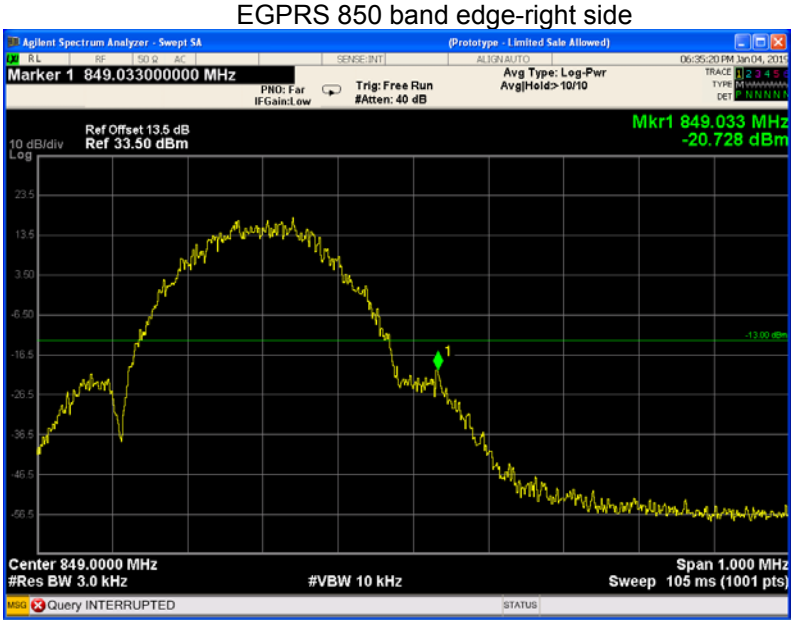
GPRS 850 band edge-right side



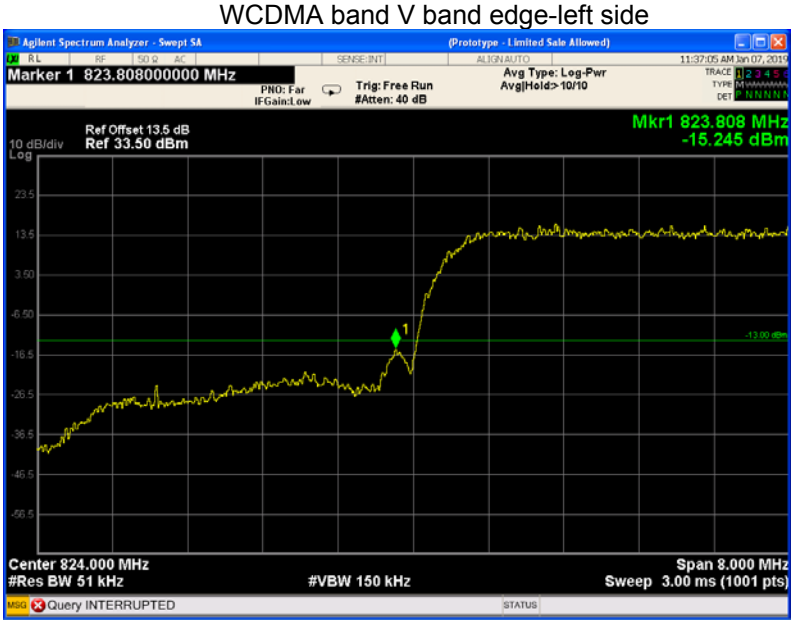
EGPRS 850 band edge-left side



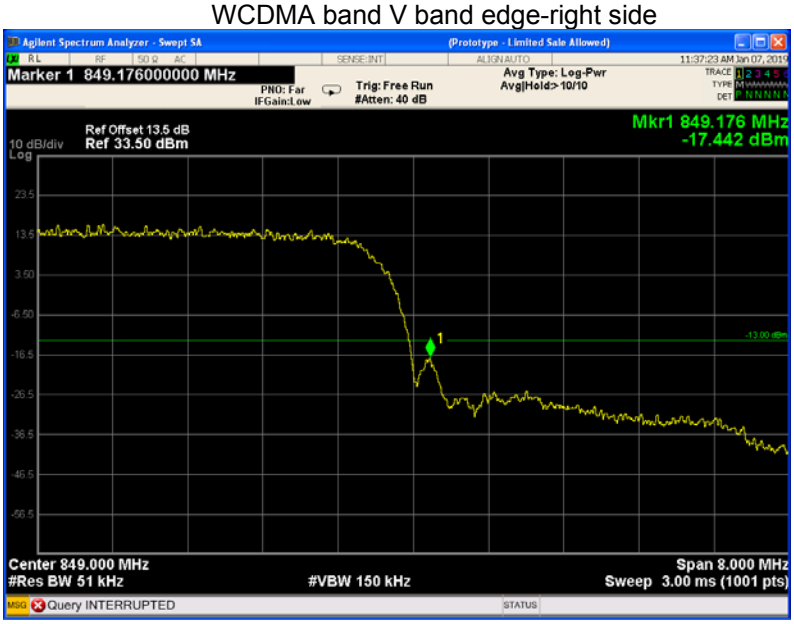
EGPRS 850 band edge-right side



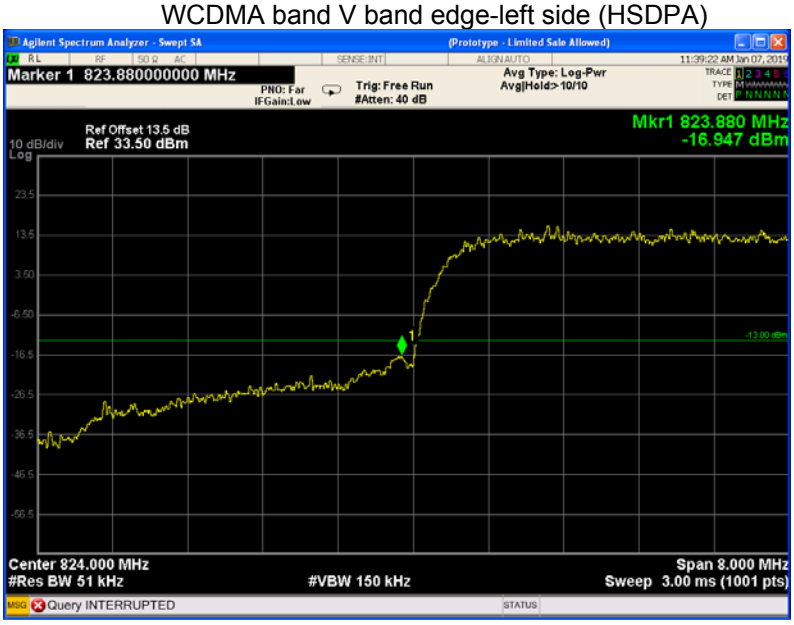
WCDMA band V band edge-left side



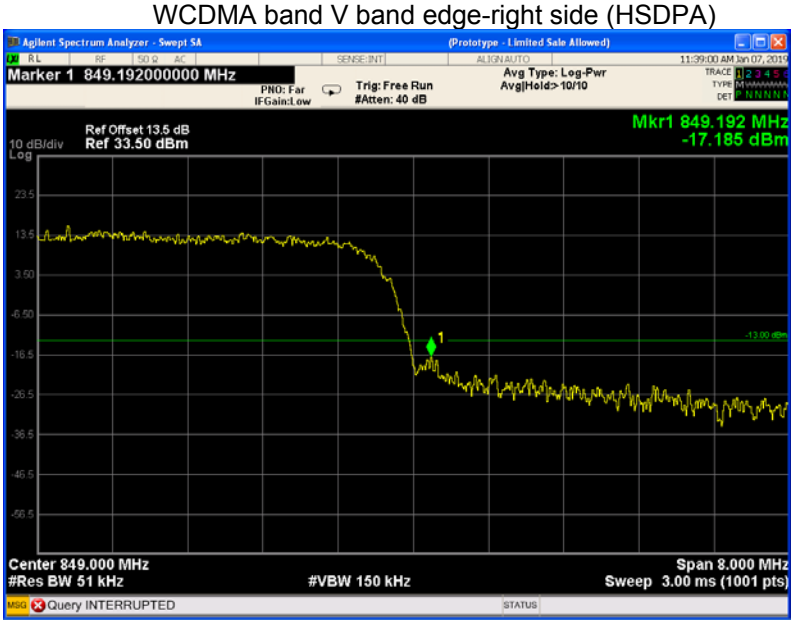
WCDMA band V band edge-right side



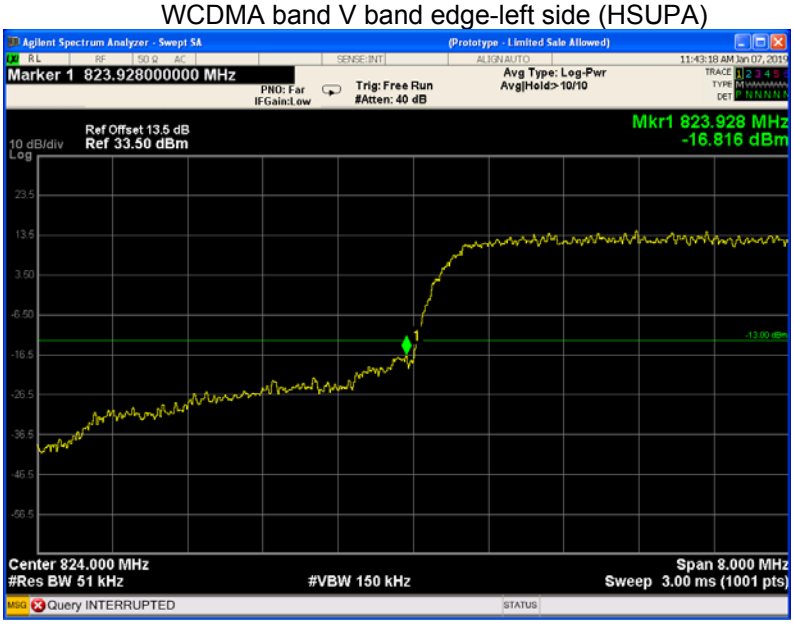
WCDMA band V band edge-left side (HSDPA)



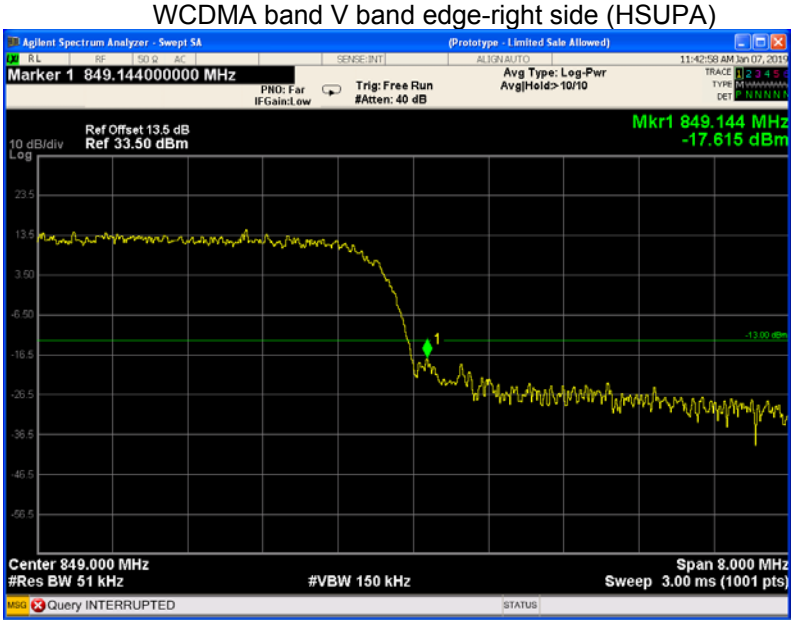
WCDMA band V band edge-right side (HSDPA)



WCDMA band V band edge-left side (HSUPA)

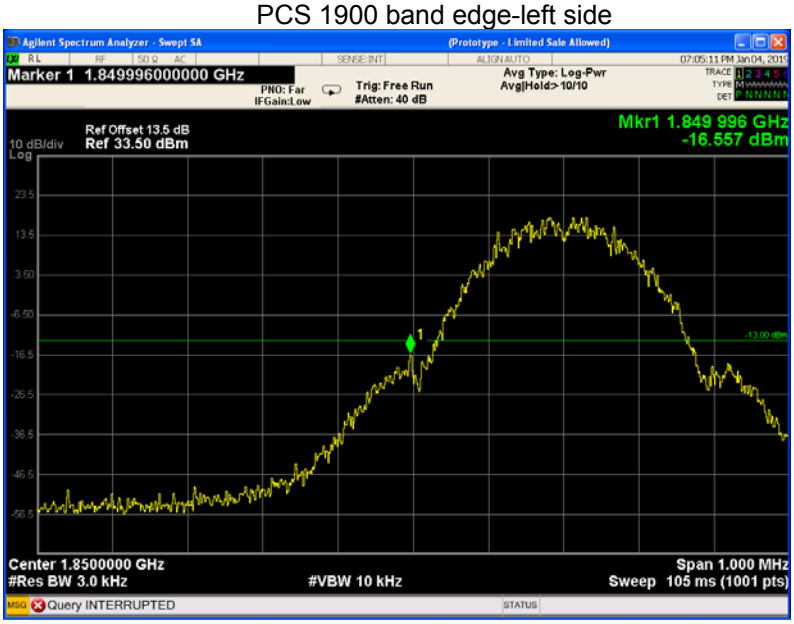


WCDMA band V band edge-right side (HSUPA)

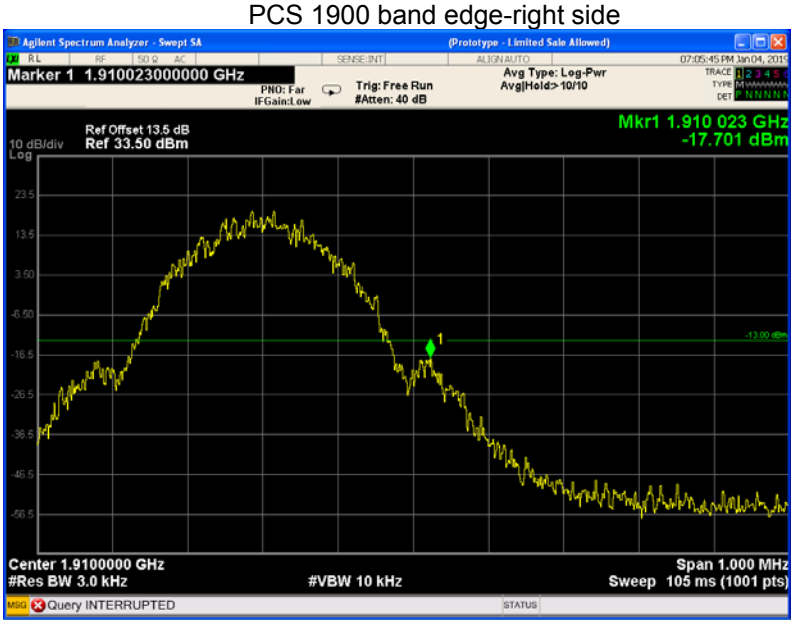


Cellular Band (Part 24E)

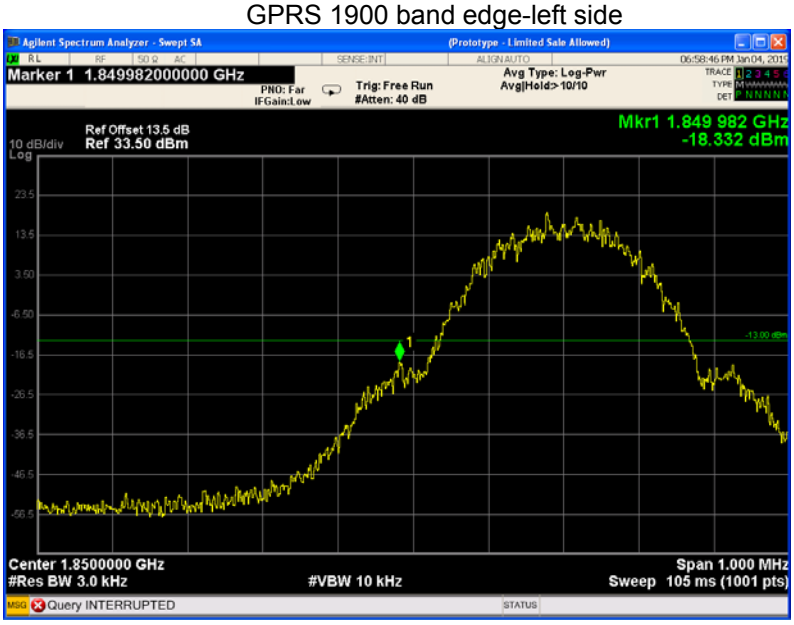
PCS 1900 band edge-left side



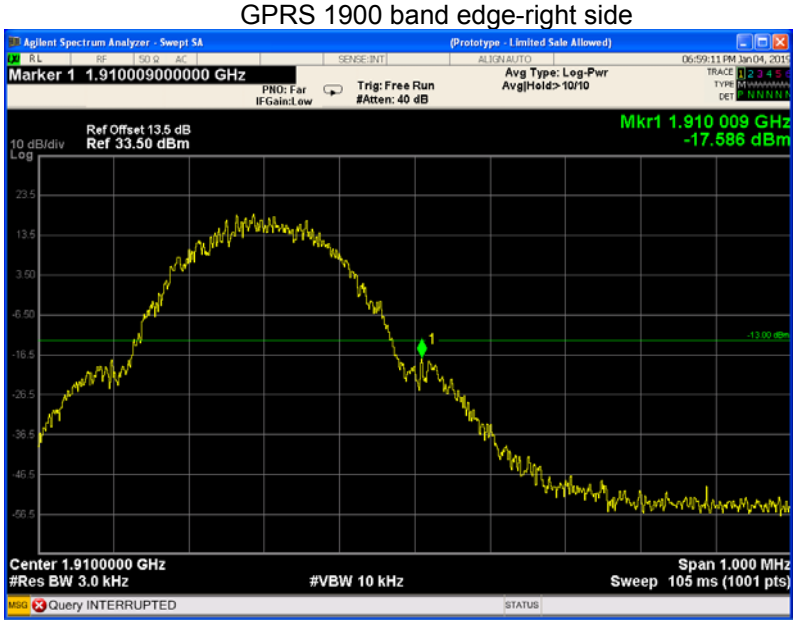
PCS 1900 band edge-right side



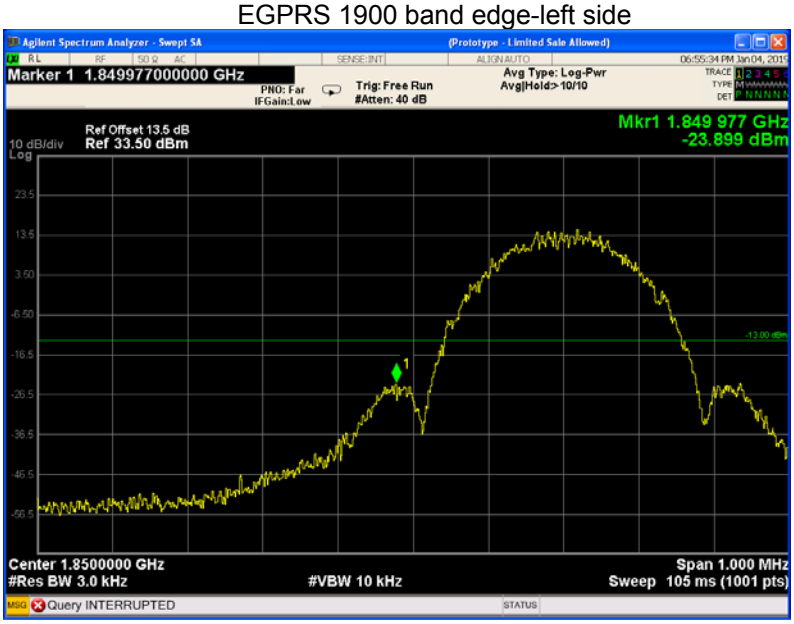
GPRS 1900 band edge-left side



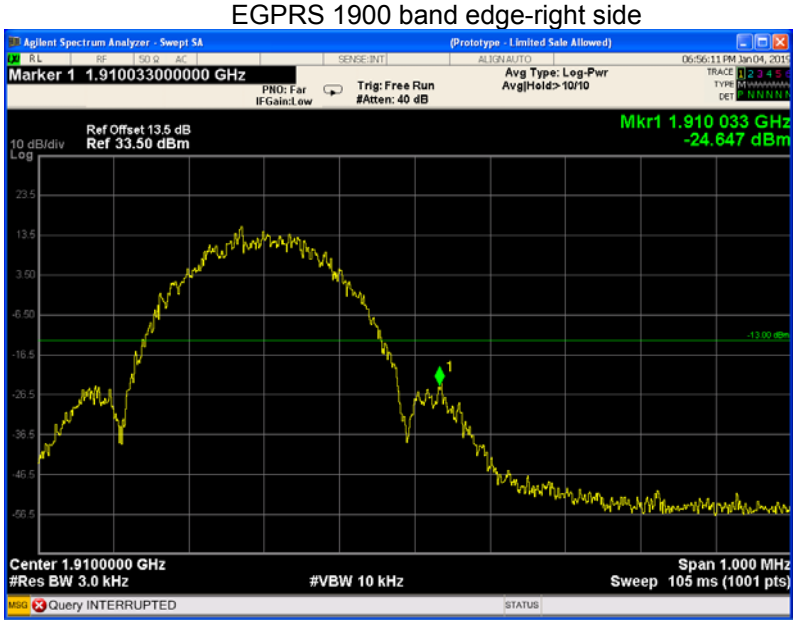
GPRS 1900 band edge-right side



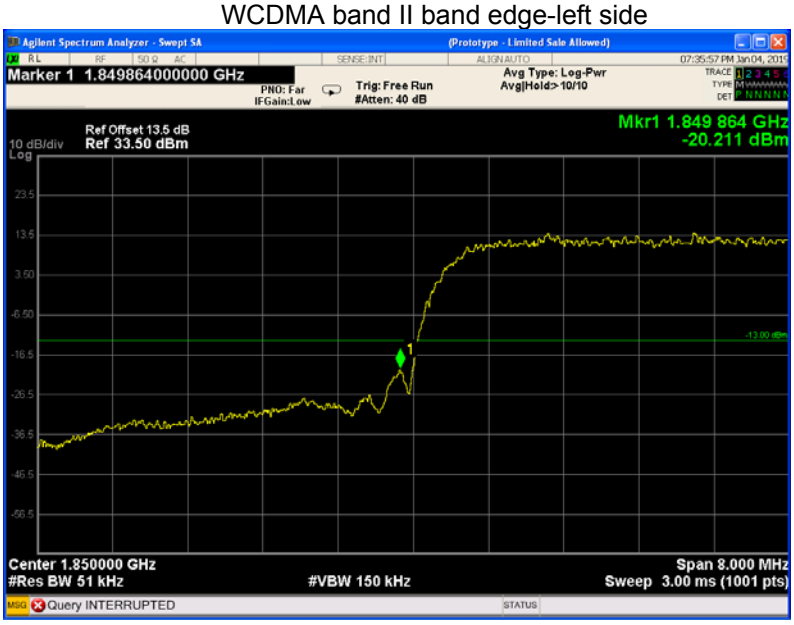
EGPRS 1900 band edge-left side



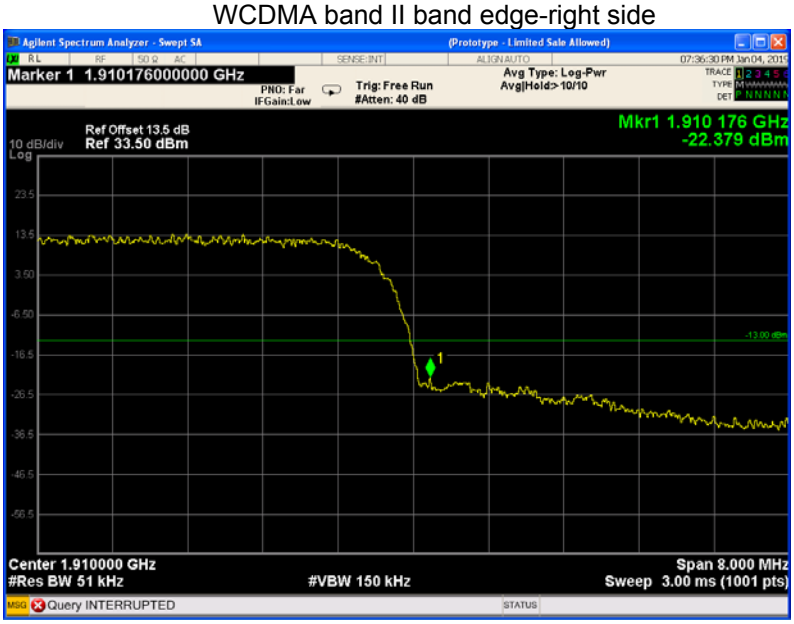
EGPRS 1900 band edge-right side



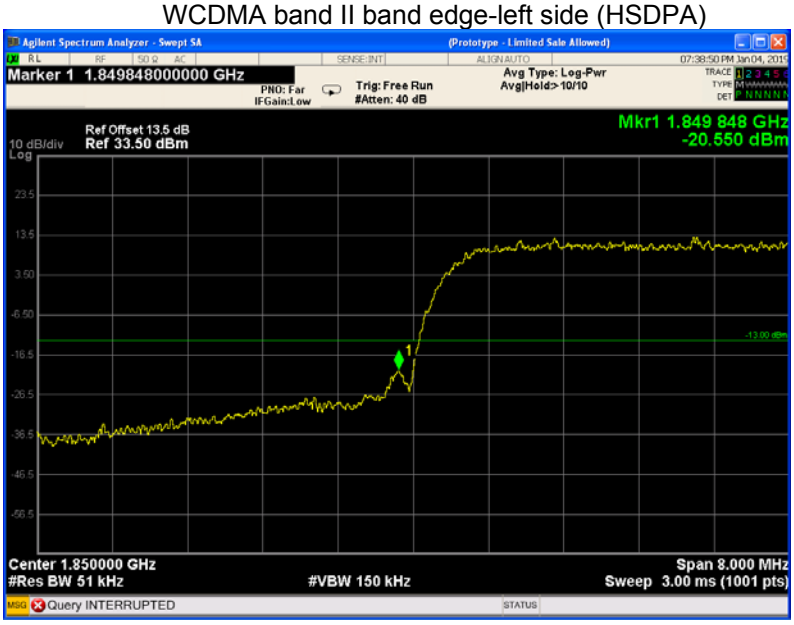
WCDMA band II band edge-left side



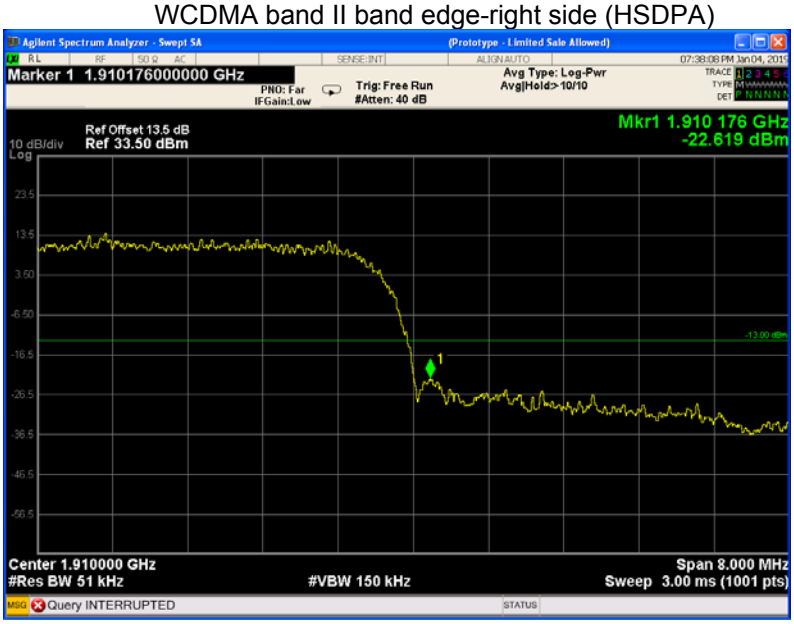
WCDMA band II band edge-right side



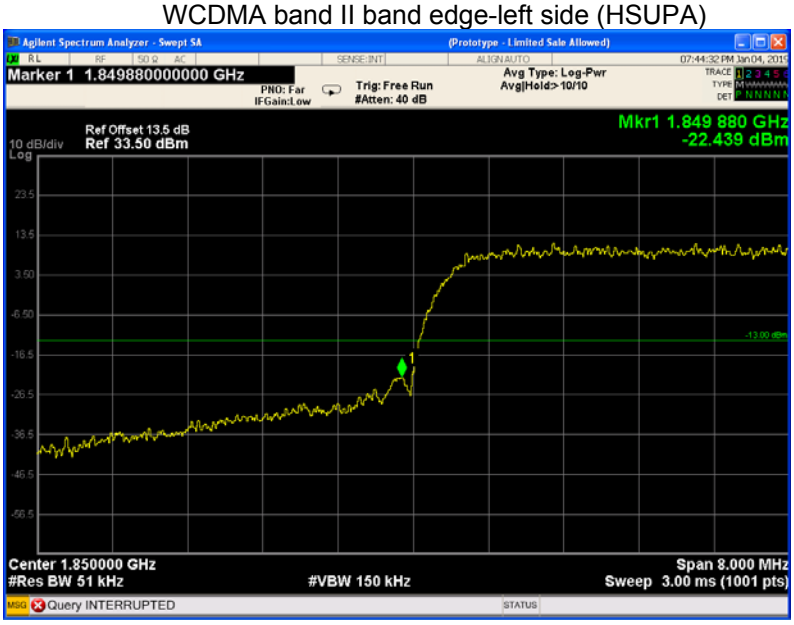
WCDMA band II band edge-left side (HSDPA)



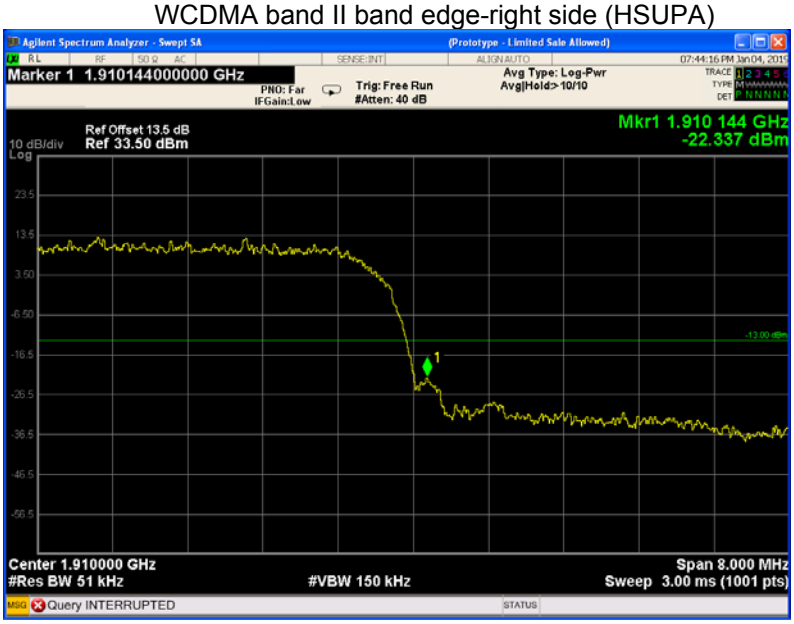
WCDMA band II band edge-right side (HSDPA)



WCDMA band II band edge-left side (HSUPA)

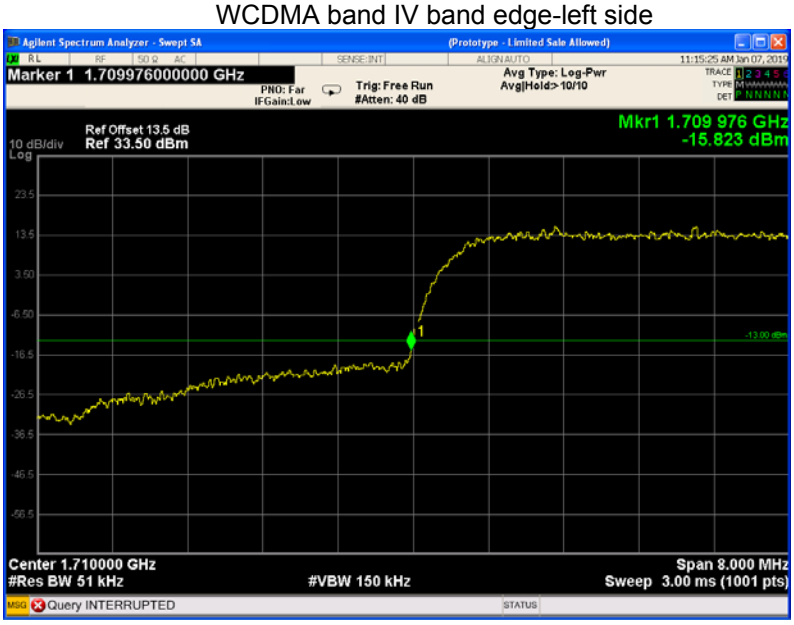


WCDMA band II band edge-right side (HSUPA)

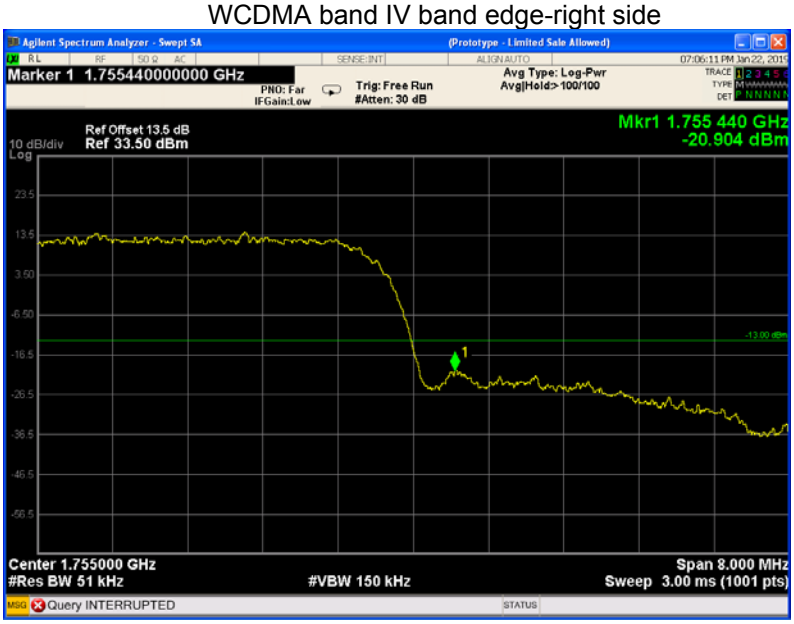


Part 27

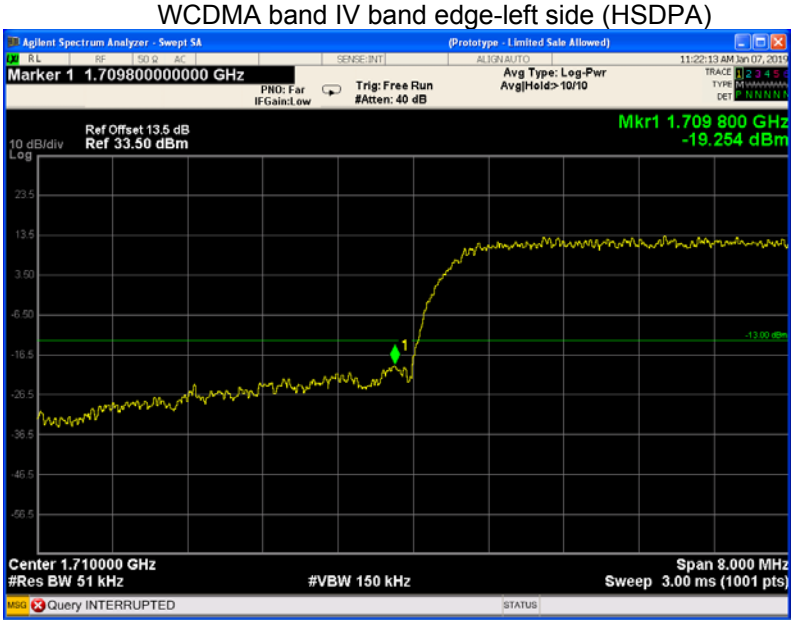
WCDMA band IV band edge-left side



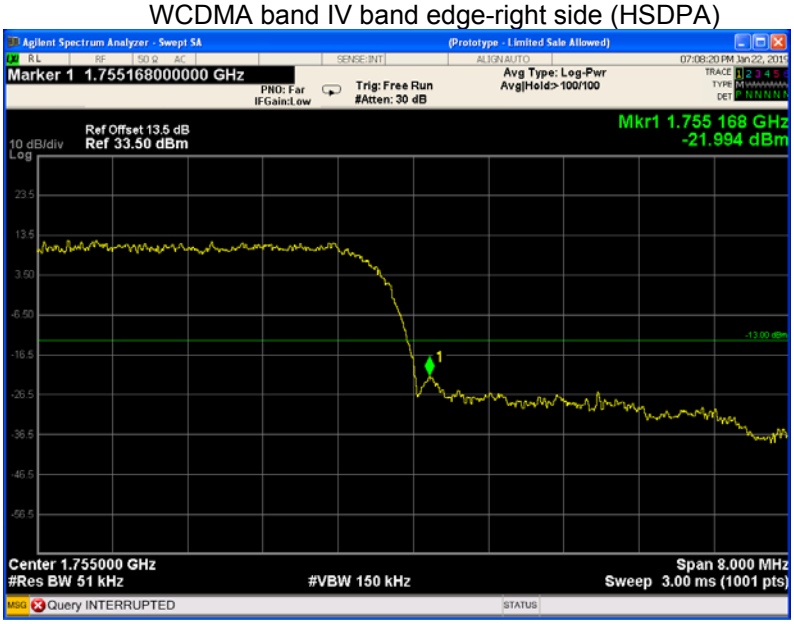
WCDMA band IV band edge-right side



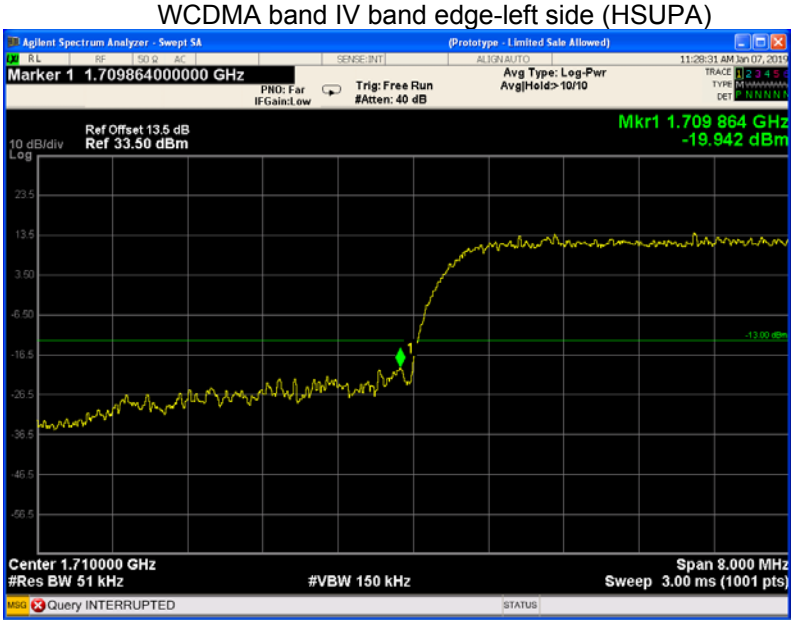
WCDMA band IV band edge-left side (HSDPA)



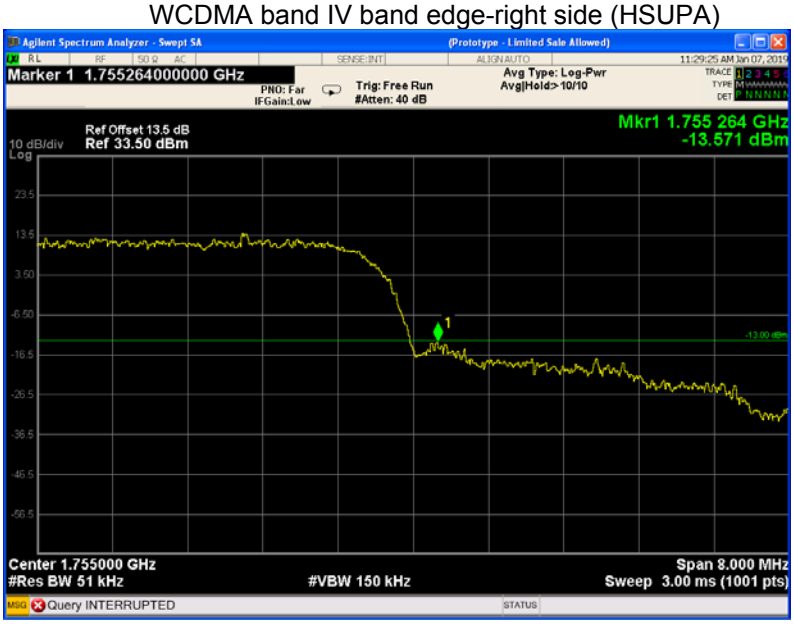
WCDMA band IV band edge-right side (HSDPA)



WCDMA band IV band edge-left side (HSUPA)



WCDMA band IV band edge-right side (HSUPA)



14 FREQUENCY STABILITY

Test Requirement: FCC Part 2.1055, 22.355, 24.235, 27.5(h),27.54

Test Method: TIA/EIA-603-E:2016

ANSI C63.26:2015

Test Mode: TX transmitting

14.1 EUT Operation

Operating Environment **:**

Temperature: 22.9 °C

Humidity: 52.0 % RH

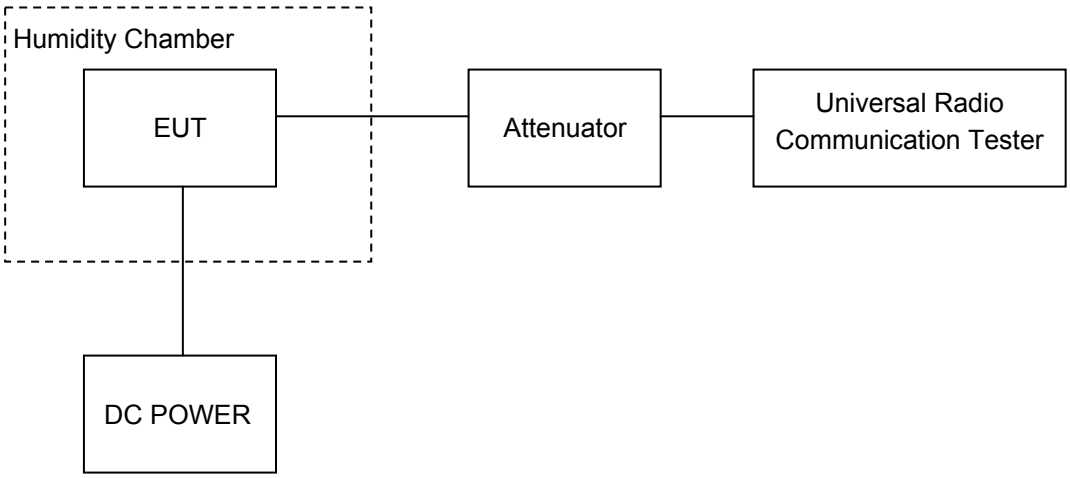
Atmospheric Pressure: 101.3kPa

14.2 Test Procedure

Frequency Stability vs. Temperature: The equipment under test was connected to an external DC power supply and the RF output was connected to communication test set via feed-through attenuators. The EUT was placed inside the temperature chamber. The DC leads and RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the communication test set.

Frequency Stability vs. Voltage: For hand carried, battery powered equipment; reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.



14.3 Test Result

Cellular Band (Part 22H)

GSM 850 Test Frequency:836.6MHz				
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	3.85	7	0.0084	2.5
40		4	0.0048	2.5
30		2	0.0024	2.5
20		4	0.0048	2.5
10		8	0.0096	2.5
0		0	0.0000	2.5
-10		-4	-0.0048	2.5
-20		7	0.0084	2.5
-30		6	0.0072	2.5
20	3.3	-1	-0.0012	2.5
20	4.2	4	0.0048	2.5

GPRS 850 Test Frequency:836.6MHz				
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	3.85	23	0.0275	2.5
40		17	0.0203	2.5
30		17	0.0203	2.5
20		21	0.0251	2.5
10		13	0.0155	2.5
0		22	0.0263	2.5
-10		26	0.0311	2.5
-20		26	0.0311	2.5
-30		20	0.0239	2.5
20	3.3	21	0.0251	2.5
20	4.2	14	0.0167	2.5

EGPRS 850 Test Frequency:836.6MHz				
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	3.85	24	0.0287	2.5
40		21	0.0251	2.5
30		13	0.0155	2.5
20		18	0.0215	2.5
10		17	0.0203	2.5
0		19	0.0227	2.5
-10		13	0.0155	2.5
-20		20	0.0239	2.5
-30		10	0.0120	2.5
20	3.3	19	0.0227	2.5
20	4.2	22	0.0263	2.5

WCDMA Band V Test Frequency:836.6MHz				
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	3.85	-7	-0.0037	2.5
40		1	0.0005	2.5
30		3	0.0016	2.5
20		-2	-0.0011	2.5
10		-5	-0.0027	2.5
0		4	0.0021	2.5
-10		-6	-0.0032	2.5
-20		2	0.0011	2.5
-30		-4	-0.0021	2.5
20	3.3	-5	-0.0027	2.5
20	4.2	-3	-0.0016	2.5

WCDMA Band V Test Frequency:836.6MHz(HSDPA)				
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	3.85	6	0.0072	2.5
40		4	0.0048	2.5
30		5	0.0060	2.5
20		9	0.0108	2.5
10		16	0.0191	2.5
0		5	0.0060	2.5
-10		6	0.0072	2.5
-20		9	0.0108	2.5
-30		11	0.0131	2.5
20	3.3	14	0.0167	2.5
20	4.2	5	0.0060	2.5

WCDMA Band V Test Frequency:836.6MHz(HSUPA)				
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	3.85	-2	-0.0024	2.5
40		-11	-0.0132	2.5
30		-2	-0.0024	2.5
20		-4	-0.0048	2.5
10		-4	-0.0048	2.5
0		-6	-0.0072	2.5
-10		-11	-0.0132	2.5
-20		3	0.0036	2.5
-30		-9	-0.0108	2.5
20	3.3	-5	-0.0060	2.5
20	4.2	3	0.0036	2.5

PCS Band (Part 24E)

PCS 1900 Test Frequency:1880.0MHz				
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	3.85	12	0.0064	2.5
40		9	0.0048	2.5
30		14	0.0074	2.5
20		9	0.0048	2.5
10		6	0.0032	2.5
0		13	0.0069	2.5
-10		9	0.0048	2.5
-20		5	0.0027	2.5
-30		17	0.0090	2.5
20	3.3	15	0.0080	2.5
20	4.2	13	0.0069	2.5

GPRS 1900 Test Frequency:1880.0MHz				
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	3.85	12	0.0069	2.5
40		12	0.0069	2.5
30		2	0.0012	2.5
20		9	0.0052	2.5
10		15	0.0087	2.5
0		17	0.0098	2.5
-10		4	0.0023	2.5
-20		10	0.0058	2.5
-30		4	0.0023	2.5
20	3.3	1	0.0006	2.5
20	4.2	9	0.0052	2.5

EGPRS 1900 Test Frequency:1880.0MHz				
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	3.85	6	0.0072	2.5
40		4	0.0048	2.5
30		5	0.0060	2.5
20		9	0.0108	2.5
10		16	0.0191	2.5
0		5	0.0060	2.5
-10		6	0.0072	2.5
-20		9	0.0108	2.5
-30		11	0.0131	2.5
20	3.3	14	0.0167	2.5
20	4.2	5	0.0060	2.5

WCDMA Band II Test Frequency:1880.0MHz				
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	3.85	12	0.0064	2.5
40		9	0.0048	2.5
30		14	0.0074	2.5
20		9	0.0048	2.5
10		6	0.0032	2.5
0		13	0.0069	2.5
-10		9	0.0048	2.5
-20		5	0.0027	2.5
-30		17	0.0090	2.5
20	3.3	15	0.0080	2.5
20	4.2	13	0.0069	2.5

WCDMA Band II Test Frequency:1880.0MHz(HSDPA)				
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	3.85	-1	-0.0005	2.5
40		5	0.0027	2.5
30		-3	-0.0016	2.5
20		-3	-0.0016	2.5
10		3	0.0016	2.5
0		-5	-0.0027	2.5
-10		1	0.0005	2.5
-20		-3	-0.0016	2.5
-30		2	0.0011	2.5
20	3.3	3	0.0016	2.5
20	4.2	-11	-0.0059	2.5

WCDMA Band II Test Frequency:1880.0MHz(HSUPA)				
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	3.85	5	0.0027	2.5
40		-7	-0.0037	2.5
30		3	0.0016	2.5
20		-2	-0.0011	2.5
10		-9	-0.0048	2.5
0		-6	-0.0032	2.5
-10		-2	-0.0011	2.5
-20		-3	-0.0016	2.5
-30		1	0.0005	2.5
20	3.3	-8	-0.0043	2.5
20	4.2	4	0.0021	2.5

Part 27

WCDMA Band IV Test Frequency:1732.6MHz				
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	3.85	12	0.0069	2.5
40		12	0.0069	2.5
30		2	0.0012	2.5
20		9	0.0052	2.5
10		15	0.0087	2.5
0		17	0.0098	2.5
-10		4	0.0023	2.5
-20		10	0.0058	2.5
-30		4	0.0023	2.5
20	3.3	1	0.0006	2.5
20	4.2	9	0.0052	2.5

WCDMA Band IV Test Frequency:1732.6MHz (HSDPA)				
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	3.85	4	0.0023	2.5
40		-5	-0.0029	2.5
30		9	0.0052	2.5
20		3	0.0017	2.5
10		6	0.0035	2.5
0		3	0.0017	2.5
-10		5	0.0029	2.5
-20		7	0.0040	2.5
-30		9	0.0052	2.5
20	3.3	10	0.0058	2.5
20	4.2	11	0.0063	2.5

WCDMA Band IV Test Frequency:1732.6MHz (HSUPA)				
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	3.85	4	0.0023	2.5
40		-5	-0.0029	2.5
30		9	0.0052	2.5
20		3	0.0017	2.5
10		6	0.0035	2.5
0		3	0.0017	2.5
-10		5	0.0029	2.5
-20		7	0.0040	2.5
-30		9	0.0052	2.5
20	3.3	10	0.0058	2.5
20	4.2	11	0.0063	2.5

15 RF Exposure

Remark: refer to SAR test report: WTS18S12133823-1W.

16 Photographs of test setup and EUT.

Note: Please refer to appendix: WTS18S12133823W_Photo.

====== End of Report ======