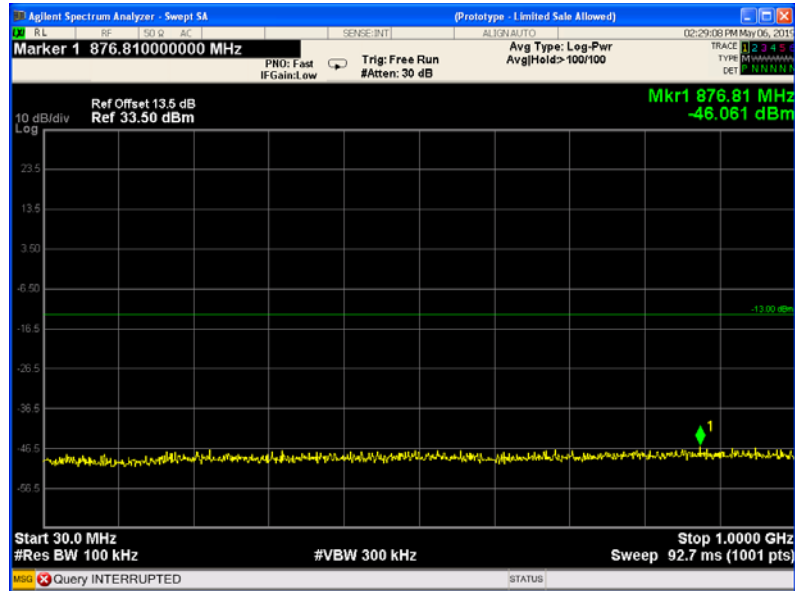


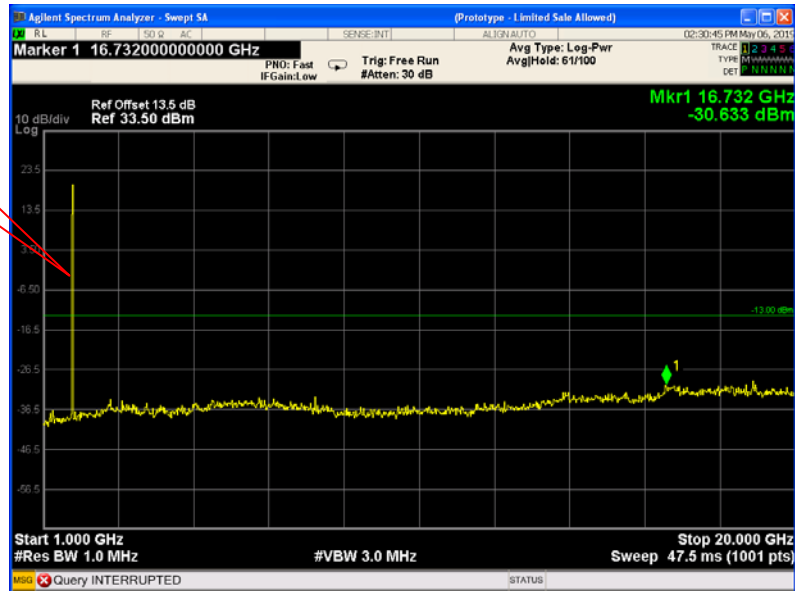
WCDMA band IV - channel 1413 (HSUPA)

30MHz-1GHz



Above 1GHz

Fundamental



## 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 :

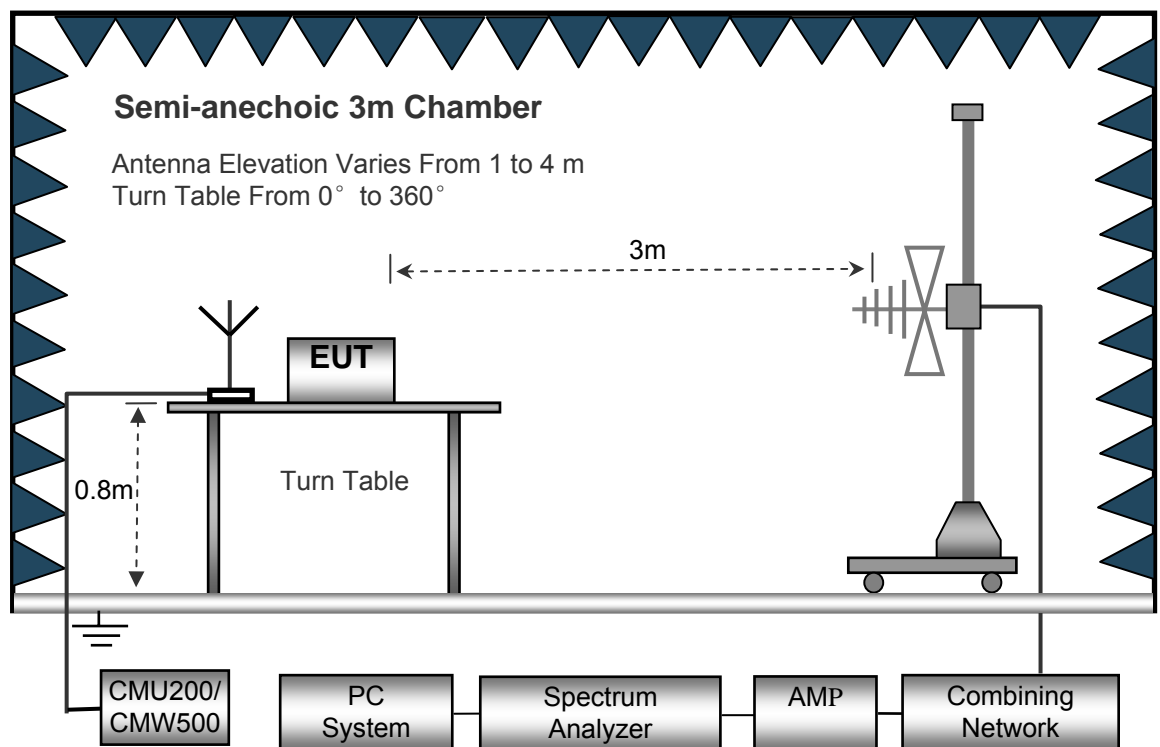
Temperature: 23.5 °C

Humidity: 52.1 % RH

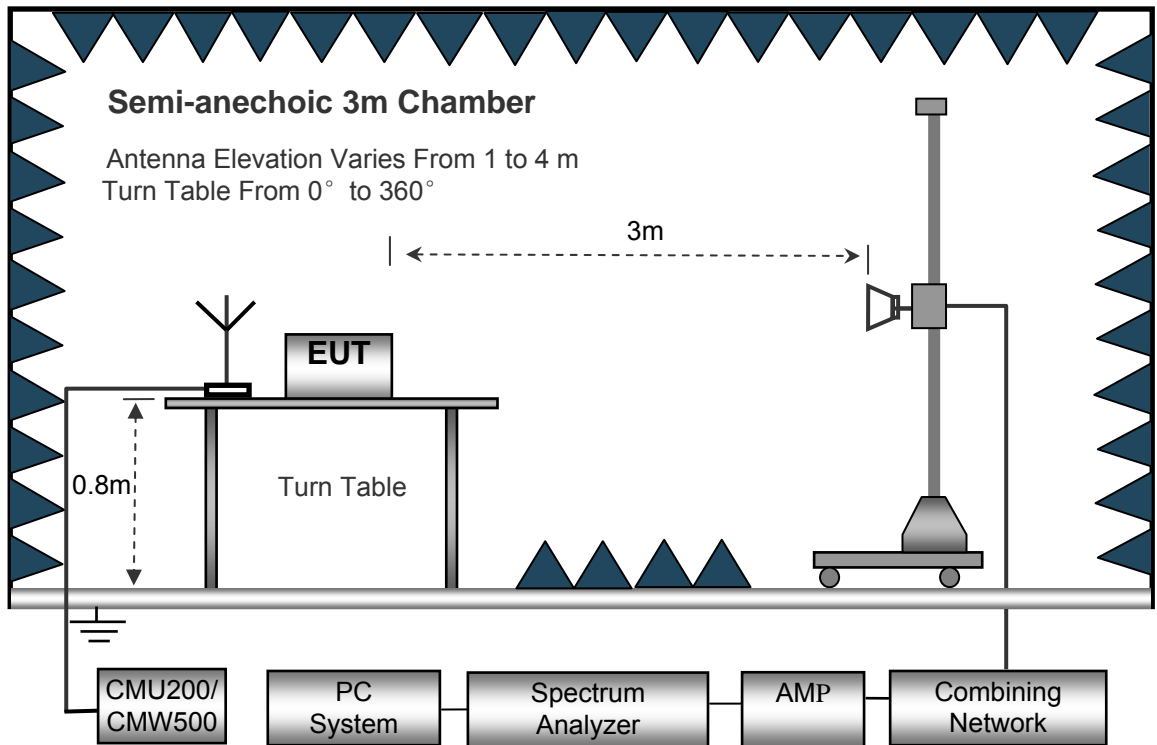
Atmospheric Pressure: 101.2kPa

### 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 =  $10 \lg (\text{TXpwr in Watts}/0.001)$  – the absolute level  
Spurious attenuation limit in dB =  $43 + 10 \text{Log}10 (\text{power out in Watts})$
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 10<sup>th</sup> 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	41.40	23	1.9	H	-69.11	0.15	0.00	-69.26	-13.00	-56.26
223.12	42.88	271	1.6	V	-64.71	0.15	0.00	-64.86	-13.00	-51.86
1648.40	66.37	35	1.1	H	-47.60	0.30	9.40	-38.50	-13.00	-25.50
1648.40	58.17	301	1.2	V	-55.36	0.30	9.40	-46.26	-13.00	-33.26
2472.60	59.29	184	1.1	H	-54.71	0.43	10.60	-44.54	-13.00	-31.54
2472.60	47.14	294	1.1	V	-63.14	0.43	10.60	-52.97	-13.00	-39.97
WCDMA Band V Channel 4233										
223.12	40.99	159	1.8	H	-69.52	0.15	0.00	-69.67	-13.00	-56.67
223.12	42.04	203	2.0	V	-65.55	0.15	0.00	-65.70	-13.00	-52.70
1652.80	57.07	326	1.2	H	-56.90	0.30	9.40	-47.80	-13.00	-34.80
1652.80	48.79	291	2.1	V	-64.74	0.30	9.40	-55.64	-13.00	-42.64
2479.20	50.96	354	1.2	H	-63.04	0.43	10.60	-52.87	-13.00	-39.87
2479.20	37.35	111	1.1	V	-72.93	0.43	10.60	-62.76	-13.00	-49.76

## 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	51.92	278	1.2	H	-58.59	0.15	0.00	-58.74	-13.00	-45.74
223.12	36.74	184	1.4	V	-70.85	0.15	0.00	-71.00	-13.00	-58.00
3700.40	65.95	269	1.2	H	-45.59	2.37	12.50	-35.46	-13.00	-22.46
3700.40	59.98	293	1.7	V	-49.83	2.37	12.50	-39.70	-13.00	-26.70
5550.60	53.58	278	1.1	H	-56.03	2.86	12.90	-45.99	-13.00	-32.99
5550.60	44.73	152	2.2	V	-64.15	2.86	12.90	-54.11	-13.00	-41.11
WCDMA Band II Channel 9400										
199.38	48.94	302	2.2	H	-61.57	0.15	0.00	-61.72	-13.00	-48.72
199.38	39.18	58	1.3	V	-68.41	0.15	0.00	-68.56	-13.00	-55.56
3760.00	59.53	47	1.2	H	-52.01	2.37	12.50	-41.88	-13.00	-28.88
3760.00	53.88	148	1.8	V	-55.93	2.37	12.50	-45.80	-13.00	-32.80
5640.00	45.95	17	1.5	H	-63.66	2.86	12.90	-53.62	-13.00	-40.62
5640.00	36.78	31	1.2	V	-72.10	2.86	12.90	-62.06	-13.00	-49.06
WCDMA Band IV Channel 1313										
223.12	53.30	78	1.3	H	-57.21	0.15	0.00	-57.36	-13.00	-44.36
223.12	37.86	223	1.1	V	-69.73	0.15	0.00	-69.88	-13.00	-56.88
3424.80	53.71	163	1.7	H	-57.83	2.37	12.50	-47.70	-13.00	-34.70
3424.80	45.06	354	1.9	V	-64.75	2.37	12.50	-54.62	-13.00	-41.62
5137.20	39.53	90	2.0	H	-70.08	2.86	12.90	-60.04	-13.00	-47.04
5137.20	30.29	73	1.2	V	-78.59	2.86	12.90	-68.55	-13.00	-55.55

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

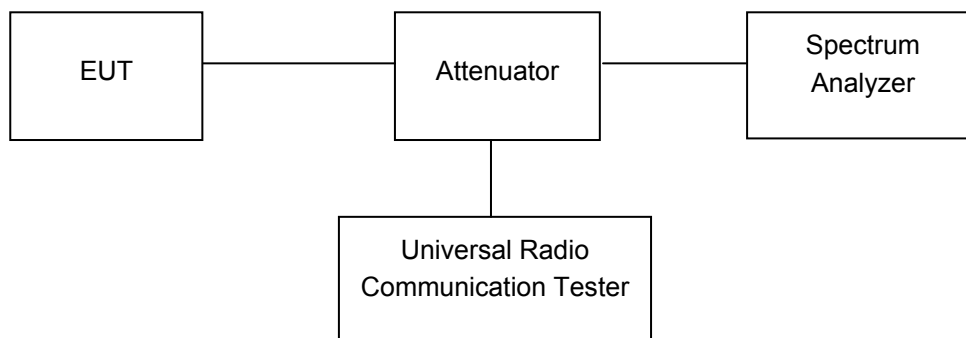
The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

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

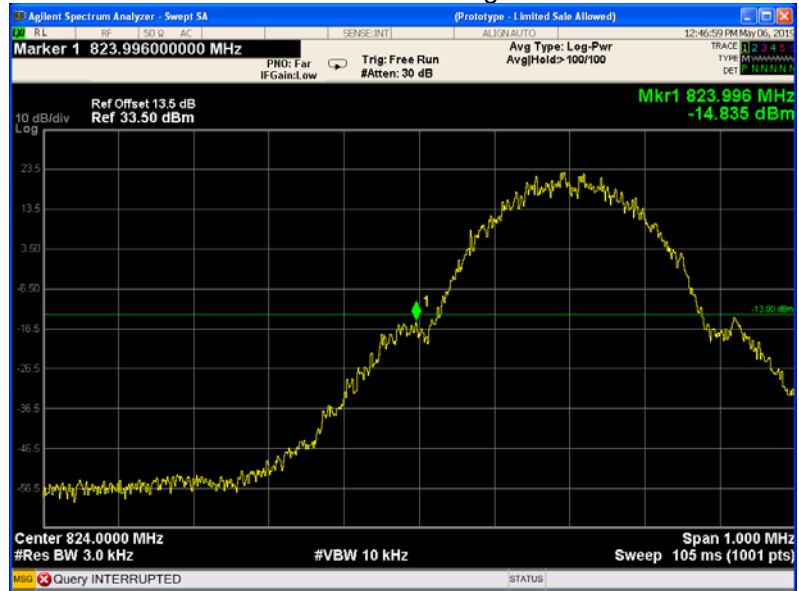


### 13.3 Test Result

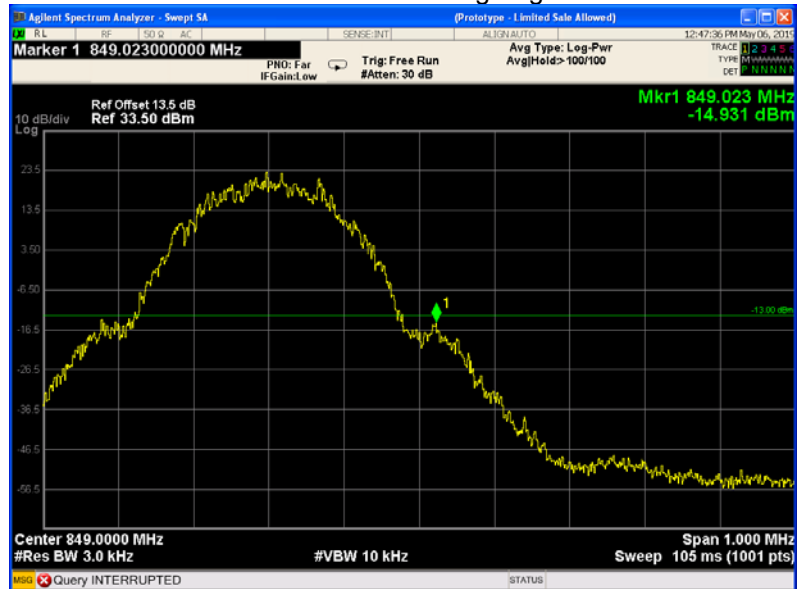
Test plots

Cellular Band (Part 22H)

GSM 850 band edge-left side

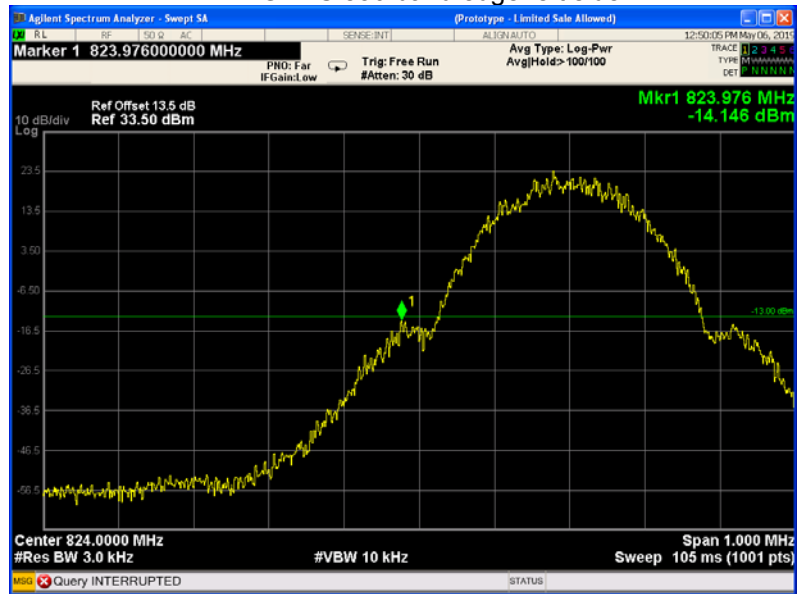


GSM 850 band edge-right side

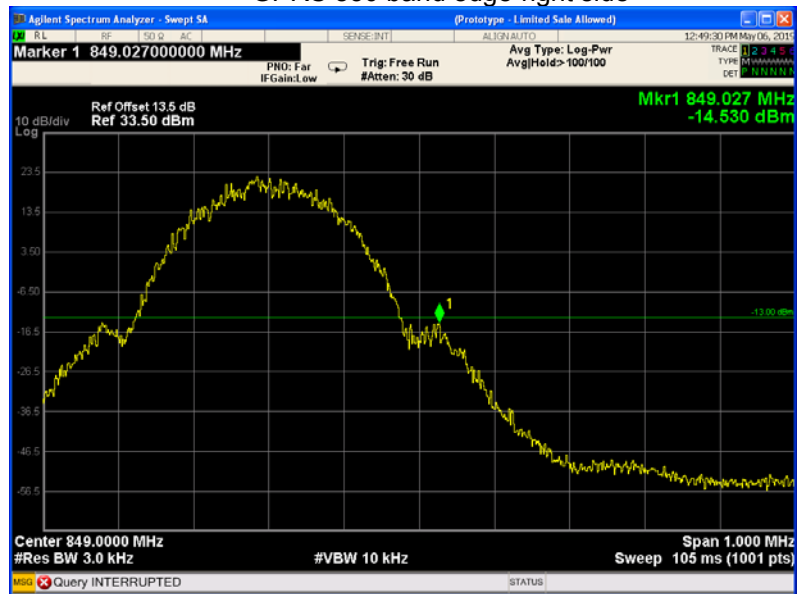




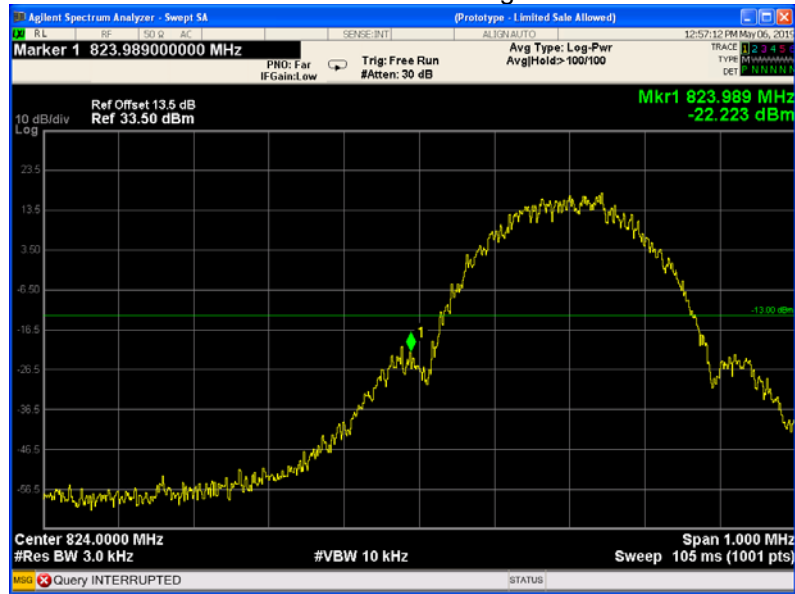
GPRS 850 band edge-left side



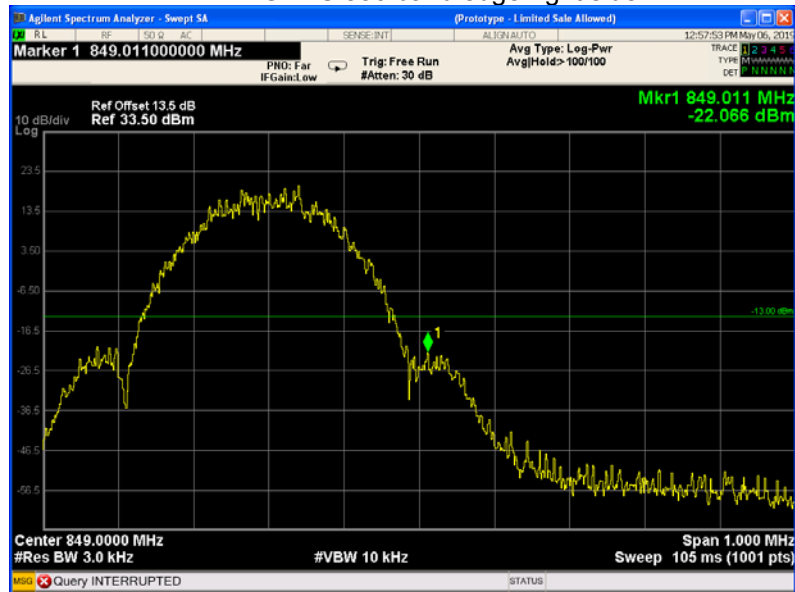
GPRS 850 band edge-right side



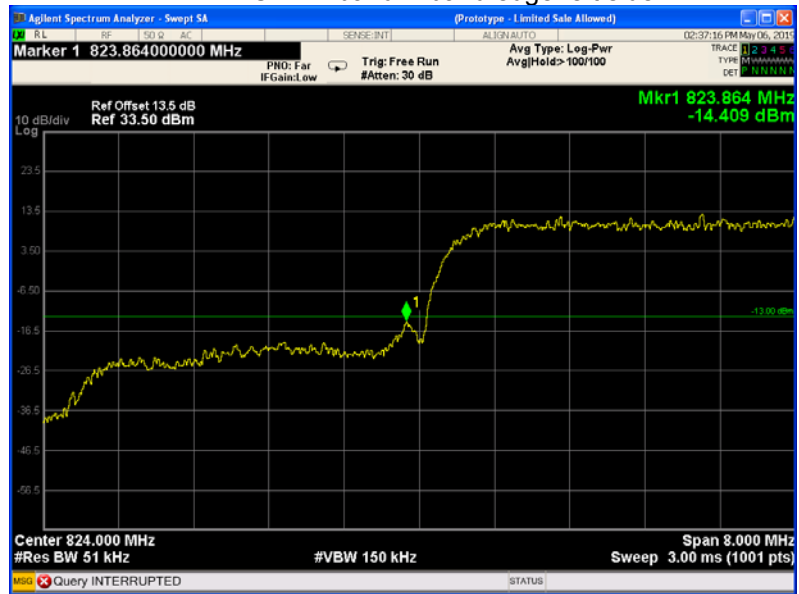
### EGPRS 850 band edge-left side



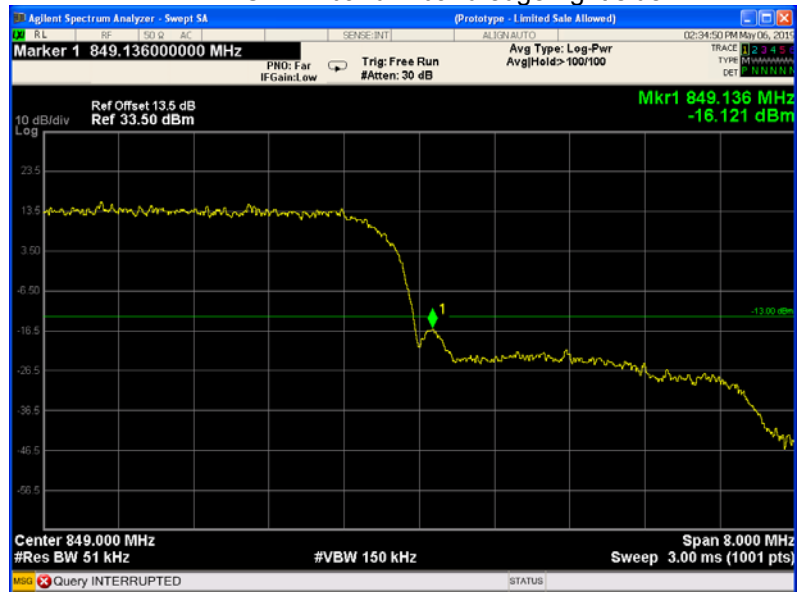
### EGPRS 850 band edge-right side



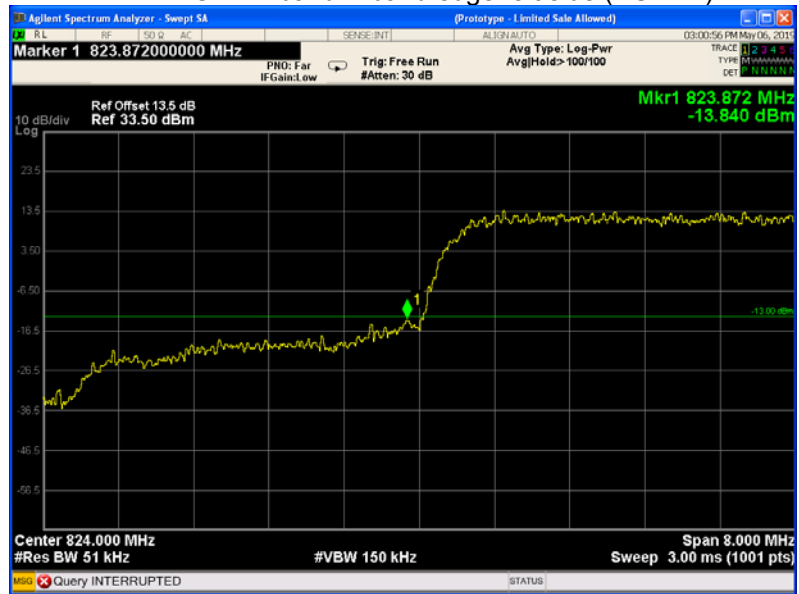
### WCDMA band V band edge-left side



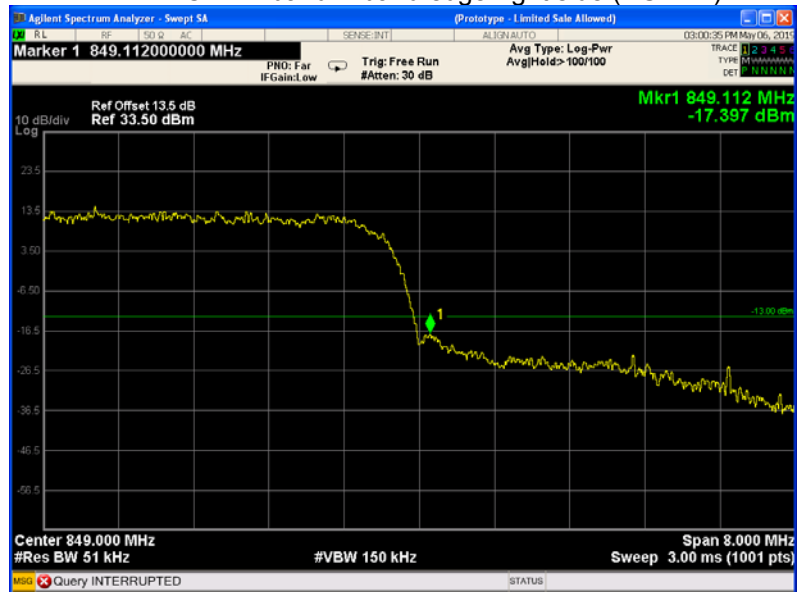
### WCDMA band V band edge-right side



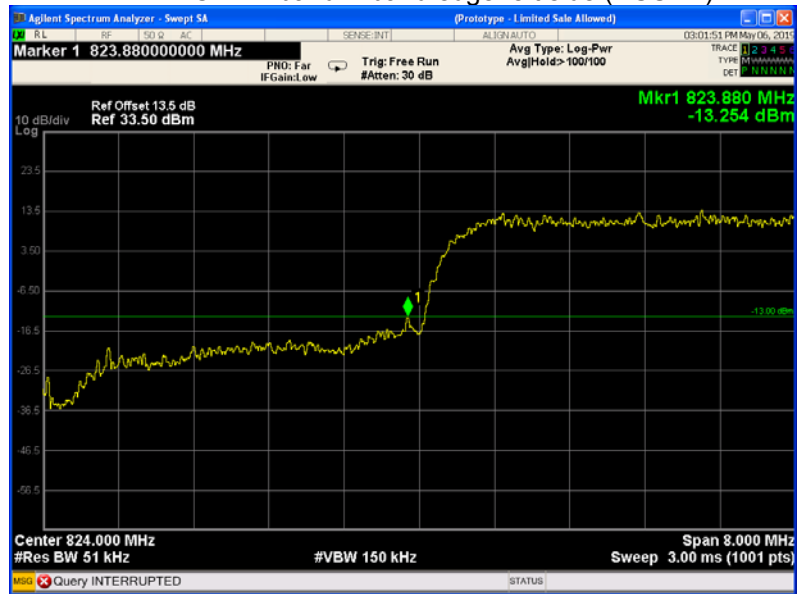
WCDMA band V band edge-left side (HSDPA)



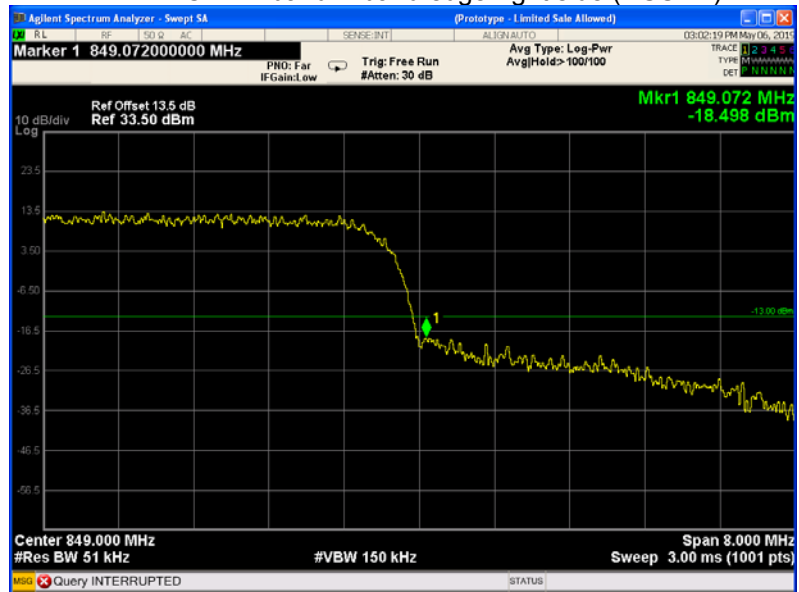
WCDMA band V band edge-right side (HSDPA)



WCDMA band V band edge-left side (HSUPA)

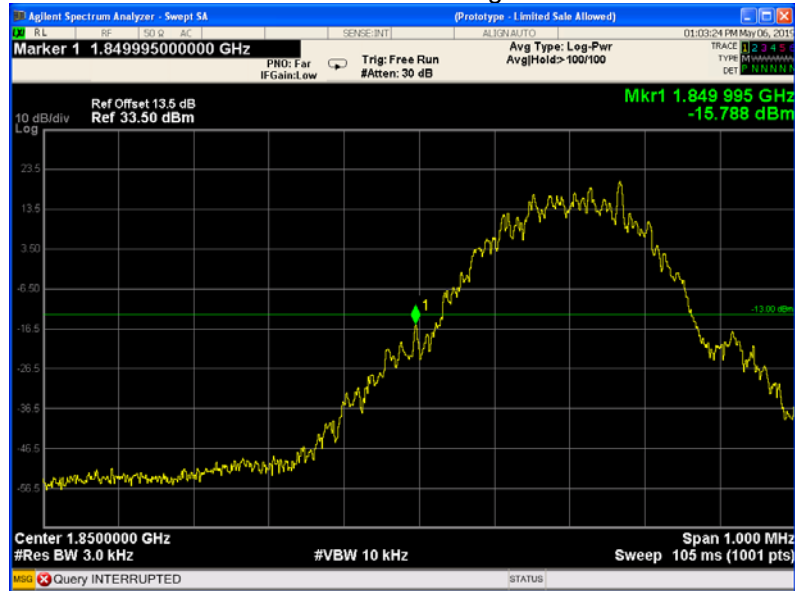


WCDMA band V band edge-right side (HSUPA)



### Cellular Band (Part 24E)

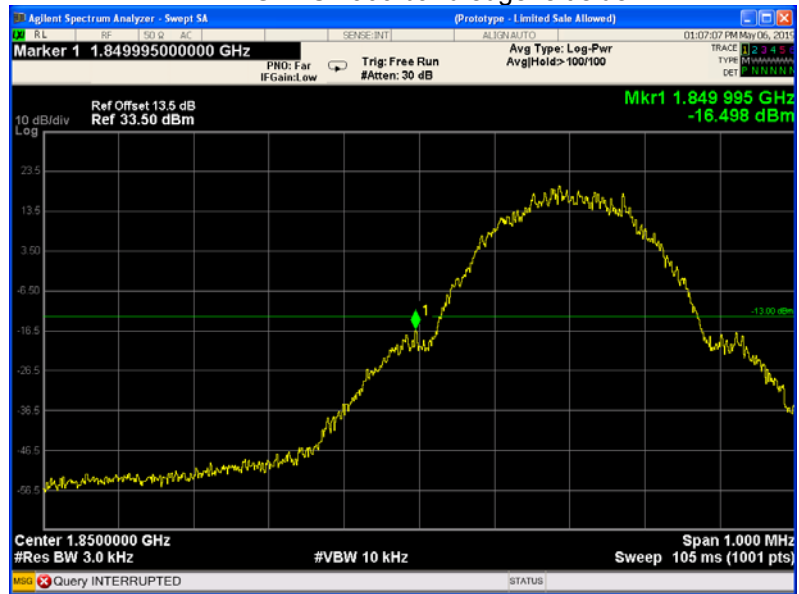
#### PCS 1900 band edge-left side



#### PCS 1900 band edge-right side



GPRS 1900 band edge-left side



GPRS 1900 band edge-right side



EGPRS 1900 band edge-left side

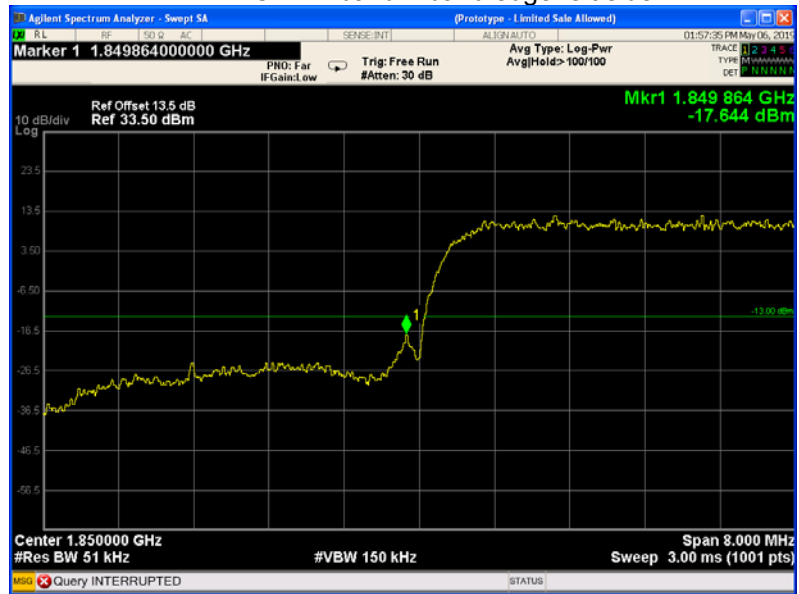


EGPRS 1900 band edge-right side

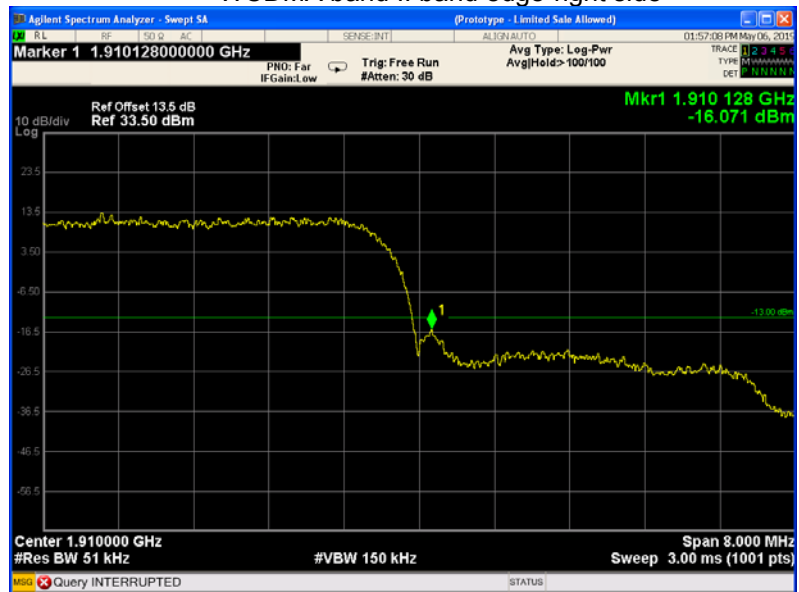




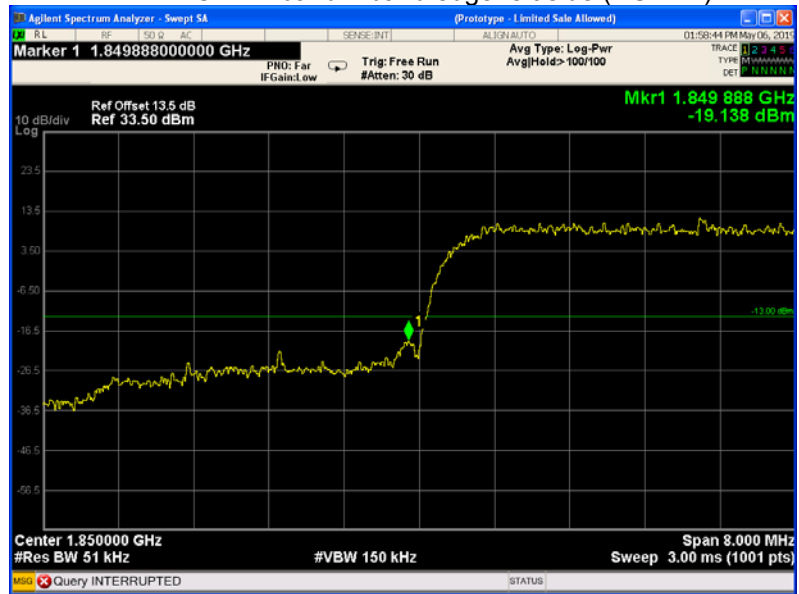
WCDMA band II band edge-left side



WCDMA band II band edge-right side



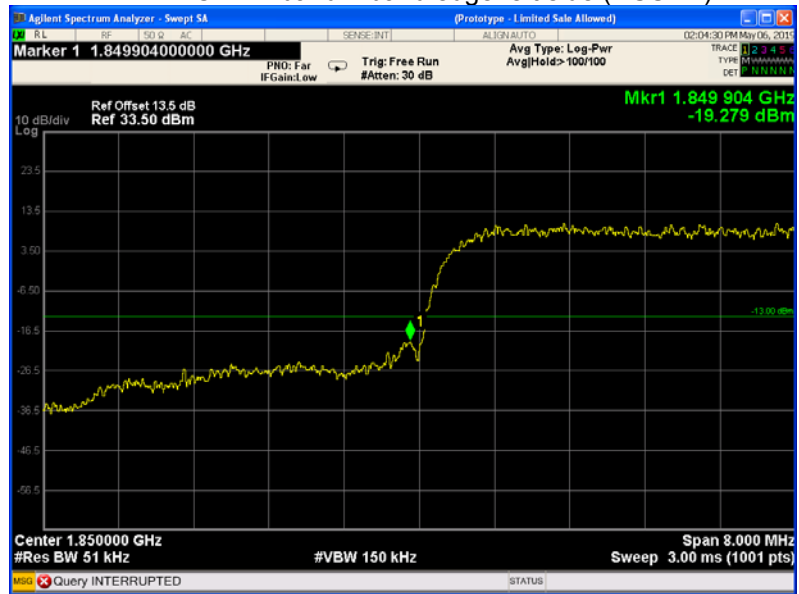
WCDMA band II band edge-left side (HSDPA)



WCDMA band II band edge-right side (HSDPA)



### WCDMA band II band edge-left side (HSUPA)

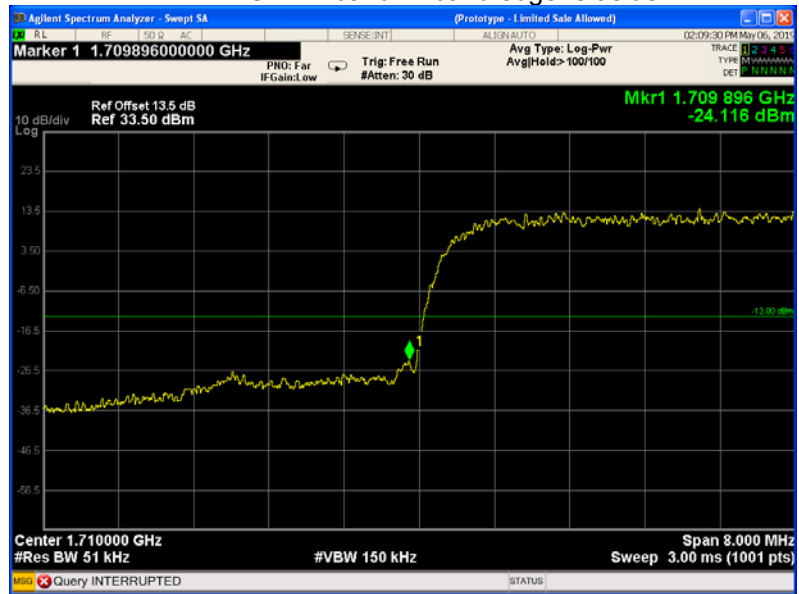


### WCDMA band II band edge-right side (HSUPA)



Part 27

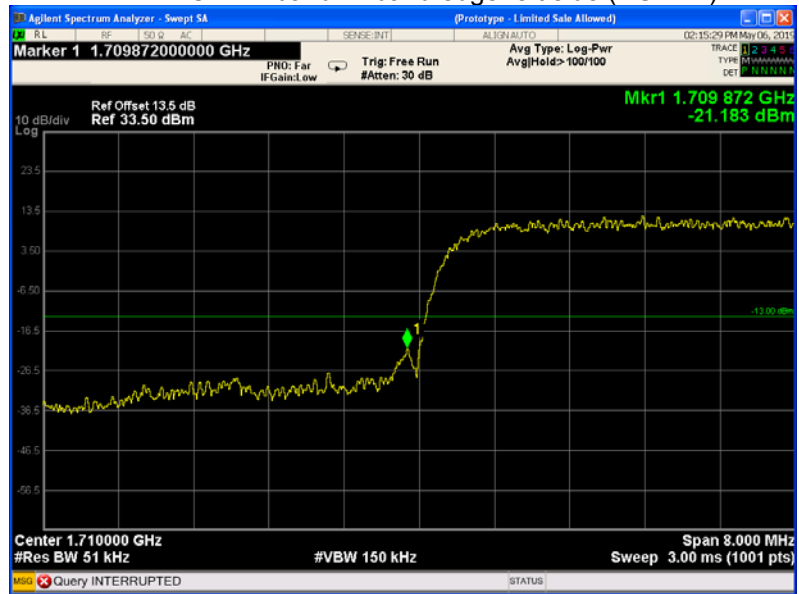
WCDMA band IV band edge-left side



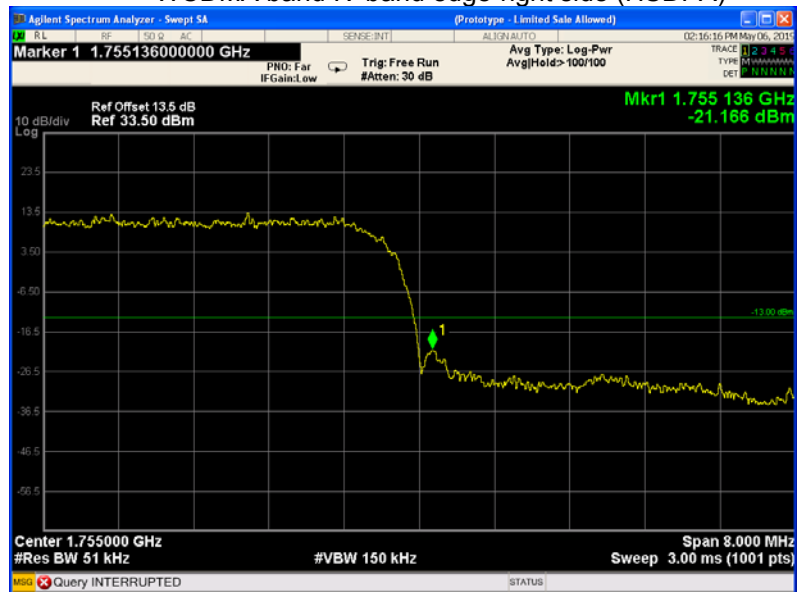
WCDMA band IV band edge-right side



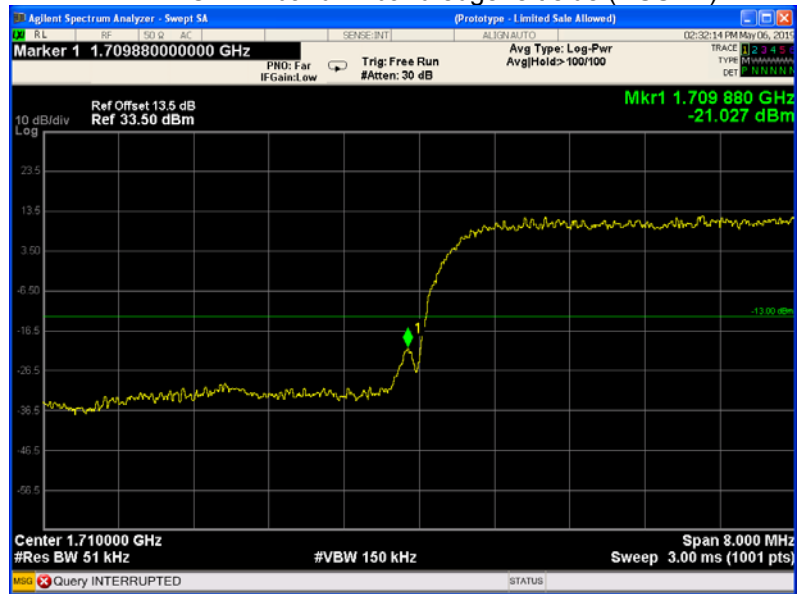
### WCDMA band IV band edge-left side (HSDPA)



### 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

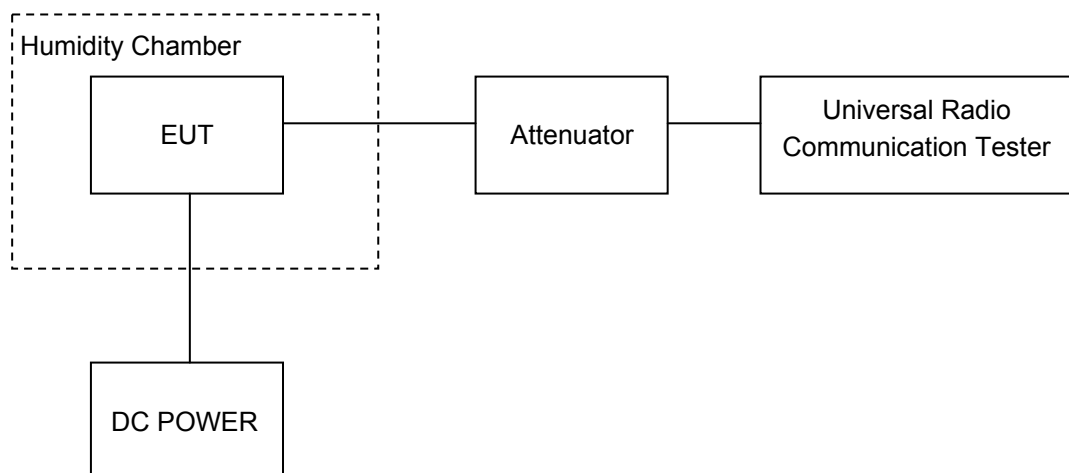
Operating Environment :	
Temperature:	22.9 °C
Humidity:	52.0 % RH
Atmospheric Pressure:	101.3kPa

### 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 (°C)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	3.85	9	0.0108	2.5
40		1	0.0012	2.5
30		-7	-0.0084	2.5
20		1	0.0012	2.5
10		5	0.0060	2.5
0		9	0.0108	2.5
-10		-8	-0.0096	2.5
-20		1	0.0012	2.5
-30		3	0.0036	2.5
20		3.3	8	0.0096
20	4.2	3	0.0036	2.5

GPRS 850 Test Frequency:836.6MHz				
Temperature (°C)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	3.85	0	0.0000	2.5
40		-1	-0.0012	2.5
30		5	0.0060	2.5
20		2	0.0024	2.5
10		-4	-0.0048	2.5
0		6	0.0072	2.5
-10		9	0.0108	2.5
-20		2	0.0024	2.5
-30		11	0.0131	2.5
20		3.3	3	0.0036
20	4.2	5	0.0060	2.5



EGPRS 850 Test Frequency:836.6MHz				
Temperature (°C)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	3.85	15	0.0179	2.5
40		5	0.0060	2.5
30		17	0.0203	2.5
20		9	0.0108	2.5
10		6	0.0072	2.5
0		9	0.0108	2.5
-10		6	0.0072	2.5
-20		6	0.0072	2.5
-30		8	0.0096	2.5
20	3.3	6	0.0072	2.5
20	4.2	9	0.0108	2.5

WCDMA Band V Test Frequency:836.6MHz				
Temperature (°C)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	3.85	-7	-0.0084	2.5
40		-8	-0.0096	2.5
30		-15	-0.0179	2.5
20		-8	-0.0096	2.5
10		-13	-0.0155	2.5
0		1	0.0012	2.5
-10		-16	-0.0191	2.5
-20		-4	-0.0048	2.5
-30		-8	-0.0096	2.5
20	3.3	-3	-0.0036	2.5
20	4.2	-4	-0.0048	2.5

WCDMA Band V Test Frequency:836.6MHz(HSDPA)				
Temperature (°C)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	3.85	-15	-0.0179	2.5
40		-13	-0.0155	2.5
30		-8	-0.0096	2.5
20		-15	-0.0179	2.5
10		-21	-0.0251	2.5
0		-14	-0.0167	2.5
-10		-14	-0.0167	2.5
-20		-8	-0.0096	2.5
-30		-24	-0.0287	2.5
20		3.3	-9	-0.0108
20	4.2	-14	-0.0167	2.5

WCDMA Band V Test Frequency:836.6MHz(HSUPA)				
Temperature (°C)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	3.85	-10	-0.0120	2.5
40		-1	-0.0012	2.5
30		-17	-0.0203	2.5
20		-8	-0.0096	2.5
10		-4	-0.0048	2.5
0		0	0.0000	2.5
-10		-10	-0.0120	2.5
-20		-2	-0.0024	2.5
-30		-4	-0.0048	2.5
20		3.3	0	0.0000
20	4.2	-1	-0.0012	2.5

## PCS Band (Part 24E)

PCS 1900 Test Frequency:1880.0MHz				
Temperature (°C)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	3.85	4	0.0021	2.5
40		7	0.0037	2.5
30		19	0.0101	2.5
20		10	0.0053	2.5
10		8	0.0043	2.5
0		9	0.0048	2.5
-10		2	0.0011	2.5
-20		3	0.0016	2.5
-30		19	0.0101	2.5
20		3.3	6	0.0032
20	4.2	15	0.0080	2.5

GPRS 1900 Test Frequency:1880.0MHz				
Temperature (°C)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	3.85	9	0.0048	2.5
40		3	0.0016	2.5
30		0	0.0000	2.5
20		6	0.0032	2.5
10		-1	-0.0005	2.5
0		6	0.0032	2.5
-10		5	0.0027	2.5
-20		6	0.0032	2.5
-30		1	0.0005	2.5
20		3.3	6	0.0032
20	4.2	12	0.0064	2.5

EGPRS 1900 Test Frequency:1880.0MHz				
Temperature (°C)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	3.85	10	0.0053	2.5
40		16	0.0085	2.5
30		11	0.0059	2.5
20		9	0.0048	2.5
10		17	0.0090	2.5
0		15	0.0080	2.5
-10		16	0.0085	2.5
-20		10	0.0053	2.5
-30		10	0.0053	2.5
20		3.3	18	0.0096
20	4.2	2	0.0011	2.5

WCDMA Band II Test Frequency:1880.0MHz				
Temperature (°C)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	3.85	-9	-0.0048	2.5
40		-6	-0.0032	2.5
30		-9	-0.0048	2.5
20		-12	-0.0064	2.5
10		-6	-0.0032	2.5
0		-19	-0.0101	2.5
-10		-3	-0.0016	2.5
-20		-17	-0.0090	2.5
-30		-6	-0.0032	2.5
20		3.3	-13	-0.0069
20	4.2	-12	-0.0064	2.5

WCDMA Band II Test Frequency:1880.0MHz(HSDPA)				
Temperature (°C)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	3.85	-14	-0.0074	2.5
40		-6	-0.0032	2.5
30		-5	-0.0027	2.5
20		-8	-0.0043	2.5
10		-17	-0.0090	2.5
0		-17	-0.0090	2.5
-10		-16	-0.0085	2.5
-20		-15	-0.0080	2.5
-30		-13	-0.0069	2.5
20		3.3	-2	-0.0011
20	4.2	-2	-0.0011	2.5

WCDMA Band II Test Frequency:1880.0MHz(HSUPA)				
Temperature (°C)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	3.85	-4	-0.0021	2.5
40		0	0.0000	2.5
30		-10	-0.0053	2.5
20		-7	-0.0037	2.5
10		-2	-0.0011	2.5
0		-2	-0.0011	2.5
-10		-4	-0.0021	2.5
-20		-2	-0.0011	2.5
-30		-8	-0.0043	2.5
20		3.3	-13	-0.0069
20	4.2	-12	-0.0064	2.5

## Part 27

WCDMA Band IV Test Frequency:1732.6MHz				
Temperature (°C)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	3.85	-8	-0.0046	2.5
40		-9	-0.0052	2.5
30		-15	-0.0087	2.5
20		-12	-0.0069	2.5
10		-4	-0.0023	2.5
0		-12	-0.0069	2.5
-10		-7	-0.0040	2.5
-20		-13	-0.0075	2.5
-30		-14	-0.0081	2.5
20		3.3	-6	-0.0035
20	4.2	-11	-0.0063	2.5

WCDMA Band IV Test Frequency:1732.6MHz (HSDPA)				
Temperature (°C)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	3.85	-9	-0.0052	2.5
40		-7	-0.0040	2.5
30		-6	-0.0035	2.5
20		-9	-0.0052	2.5
10		-2	-0.0012	2.5
0		-9	-0.0052	2.5
-10		-1	-0.0006	2.5
-20		-4	-0.0023	2.5
-30		-7	-0.0040	2.5
20		3.3	-7	-0.0040
20	4.2	-11	-0.0063	2.5

WCDMA Band IV Test Frequency:1732.6MHz (HSUPA)				
Temperature (°C)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	3.85	-19	-0.0110	2.5
40		-14	-0.0081	2.5
30		-10	-0.0058	2.5
20		-12	-0.0069	2.5
10		-19	-0.0110	2.5
0		-10	-0.0058	2.5
-10		-10	-0.0058	2.5
-20		-10	-0.0058	2.5
-30		-15	-0.0087	2.5
20		3.3	-8	-0.0046
20	4.2	-10	-0.0058	2.5

## **15 RF Exposure**

Remark: refer to SAR test report: WTS19S04025243W-1.



