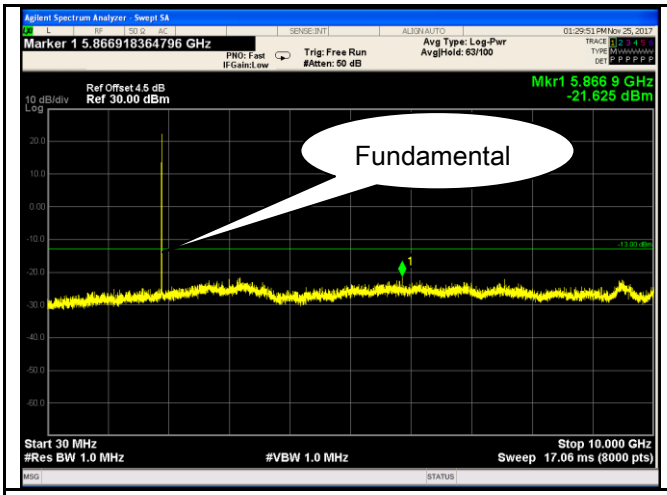
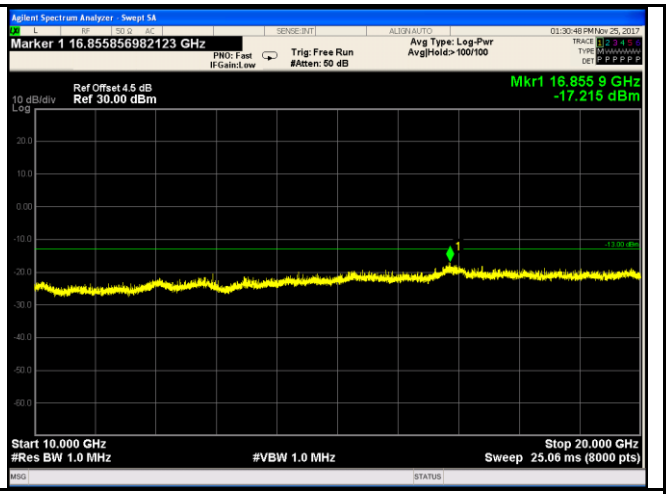
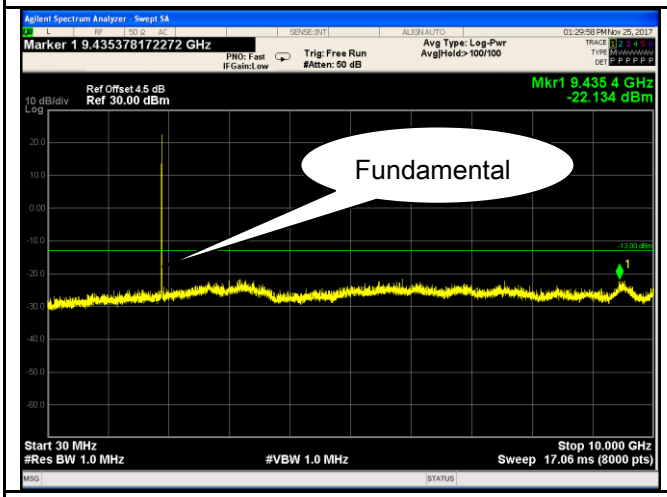
UMTS-FDD Band II (Part 24E)



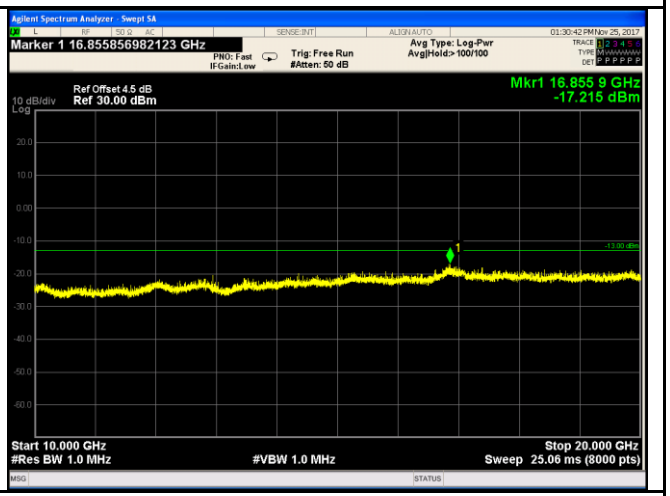
Band II - Low Channel-1



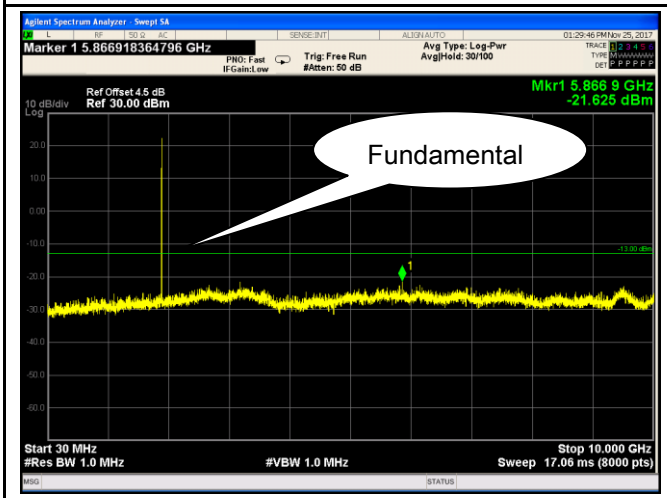
Band II - Low Channel-2



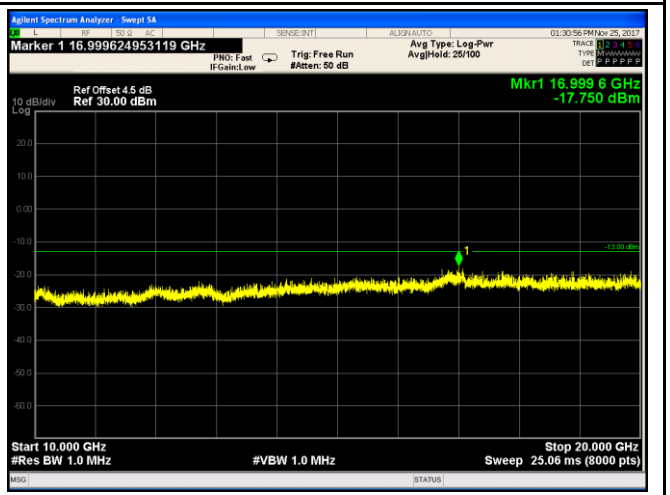
Band II - Middle Channel-1



Band II - Middle Channel-2



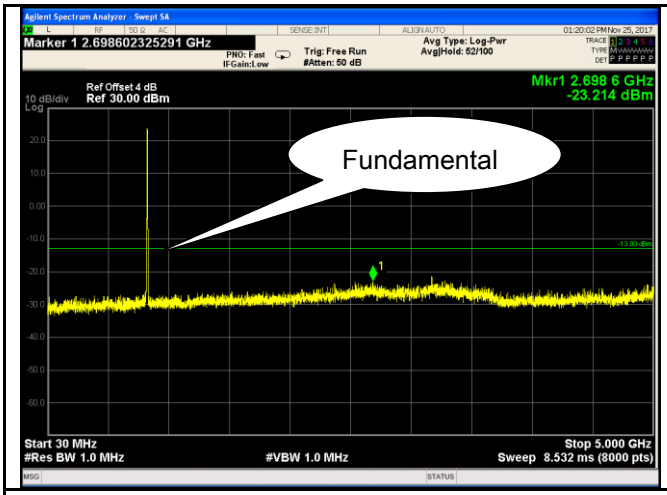
Band II - High Channel-1



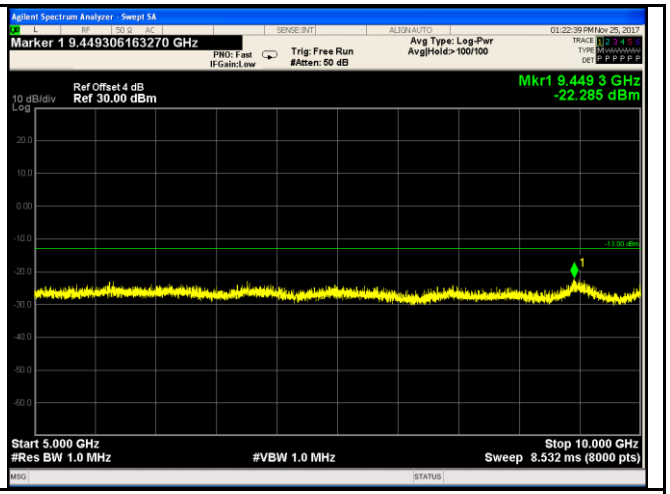
Band II - High Channel-2

HSDPA:

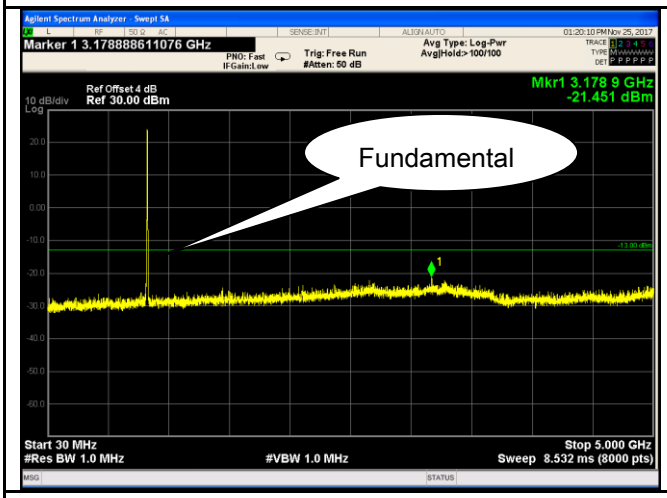
UMTS-FDD Band V (Part 22H)



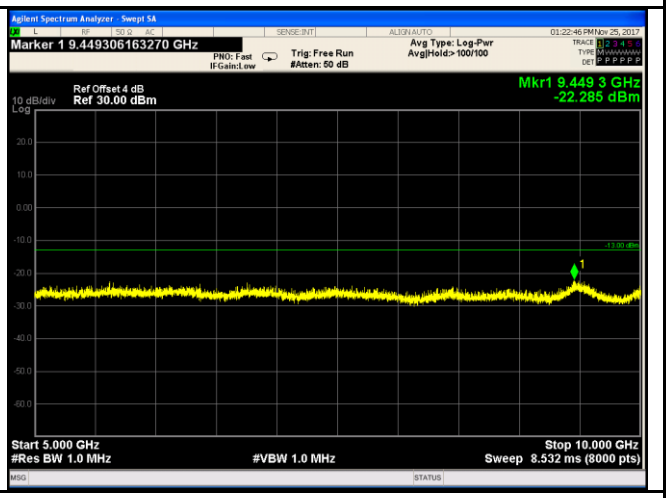
Band V - Low Channel-1



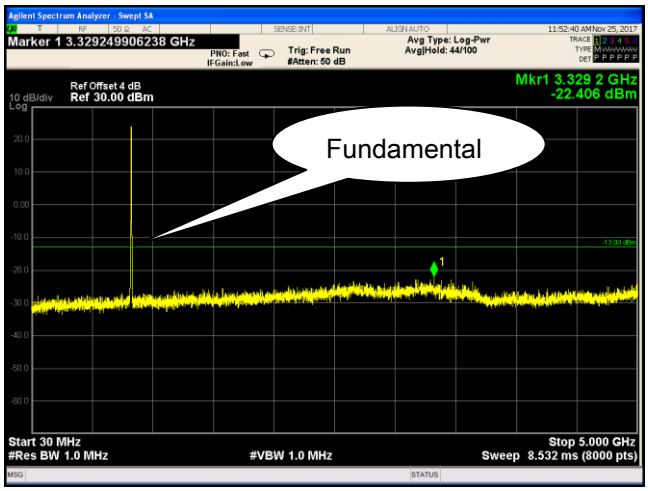
Band V - Low Channel-2



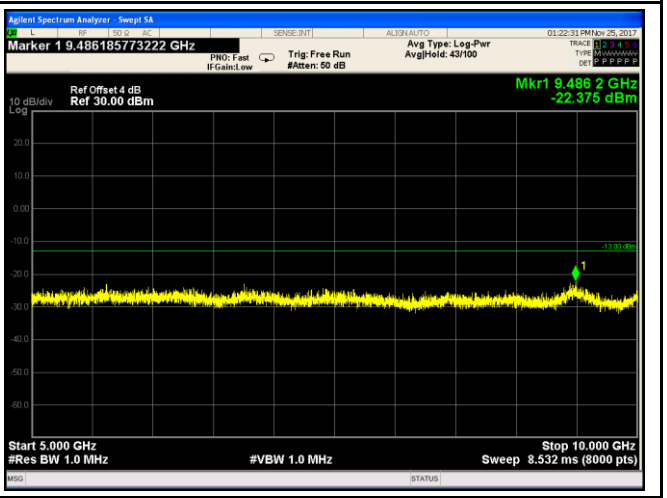
Band V - Middle Channel-1



Band V - Middle Channel-2

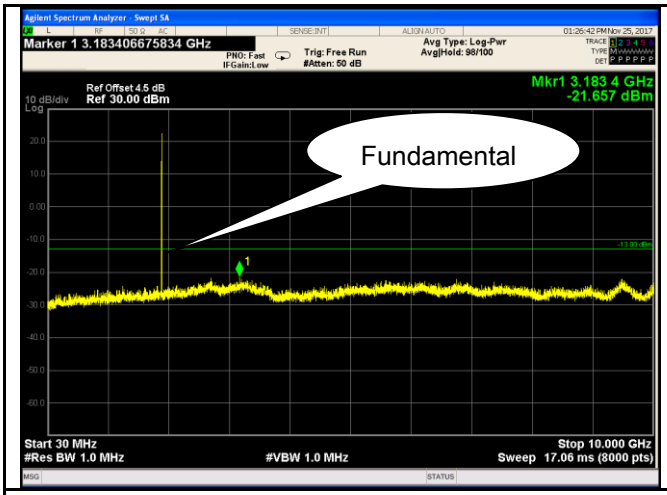


Band V - High Channel-1

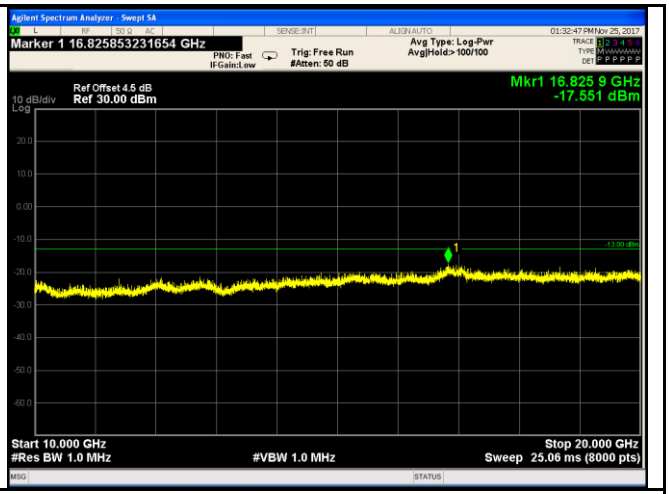


Band V - High Channel-2

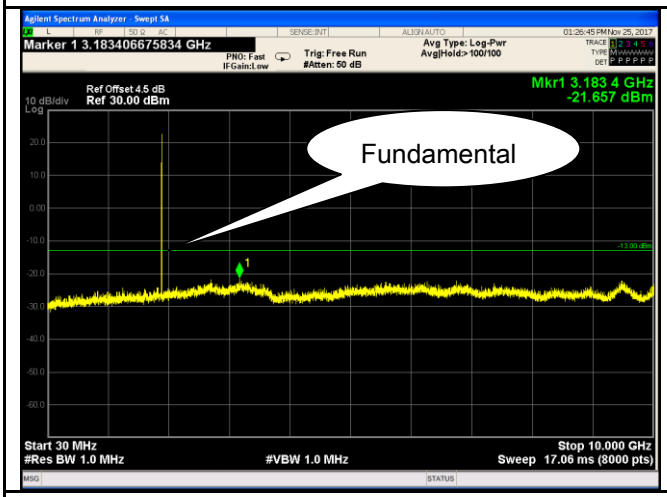
UMTS-FDD Band II (Part 24E)



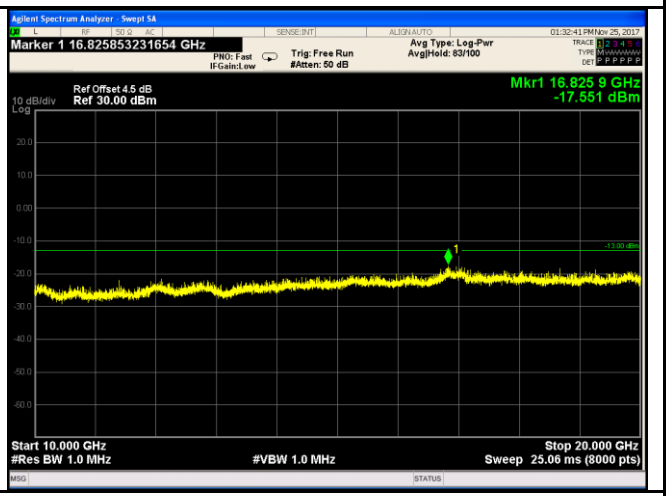
Band II - Low Channel-1



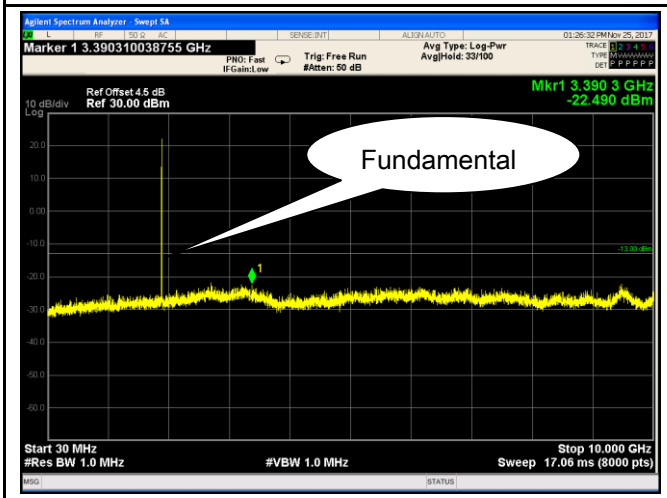
Band II - Low Channel-2



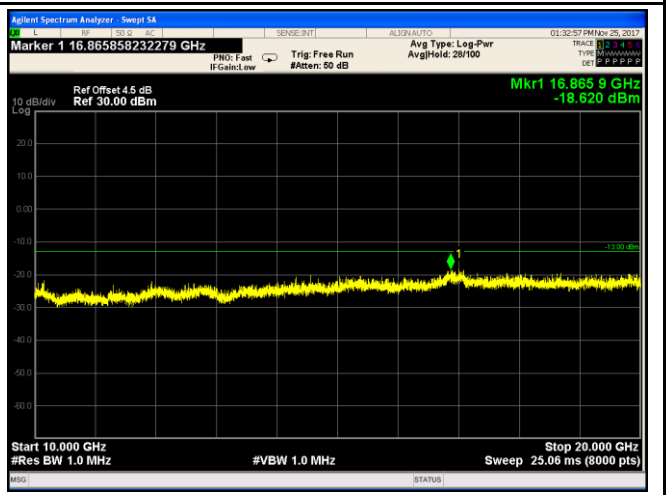
Band II - Middle Channel-1



Band II - Middle Channel-2



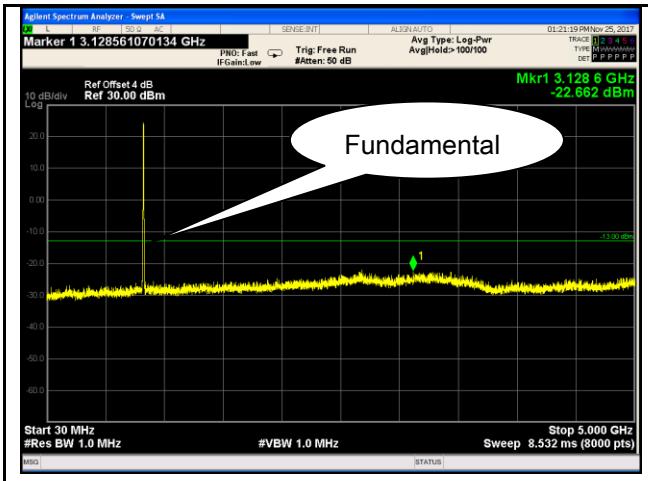
Band II - High Channel-1



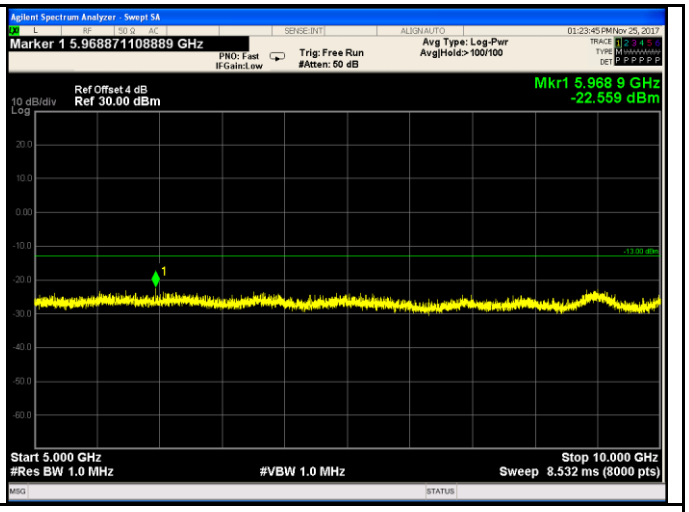
Band II - High Channel-2

HSUPA:

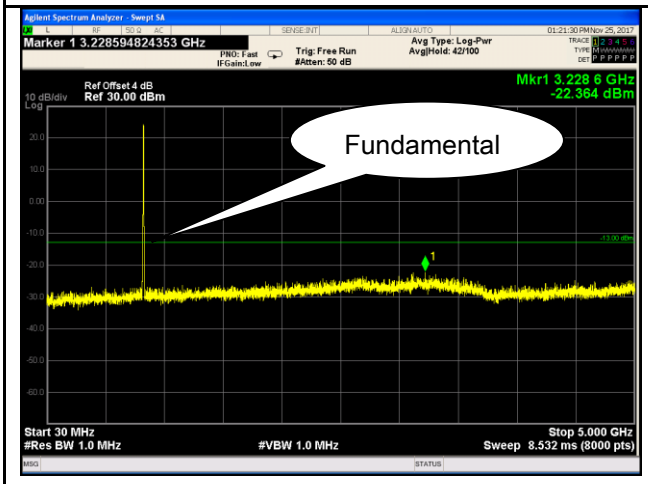
UMTS-FDD Band V (Part 22H)



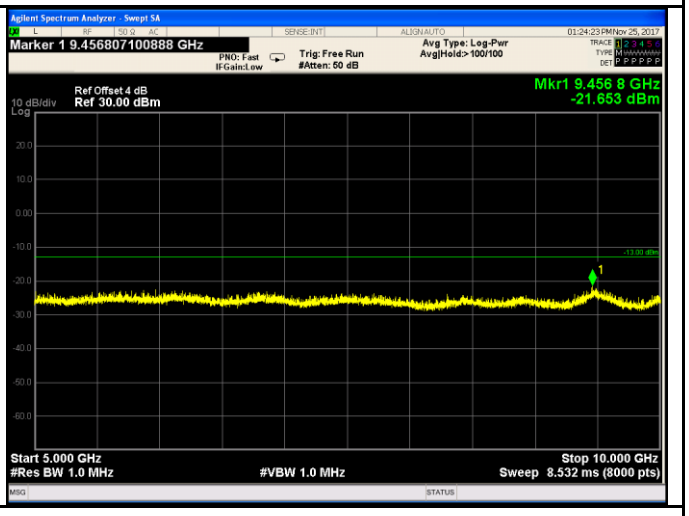
Band V - Low Channel-1



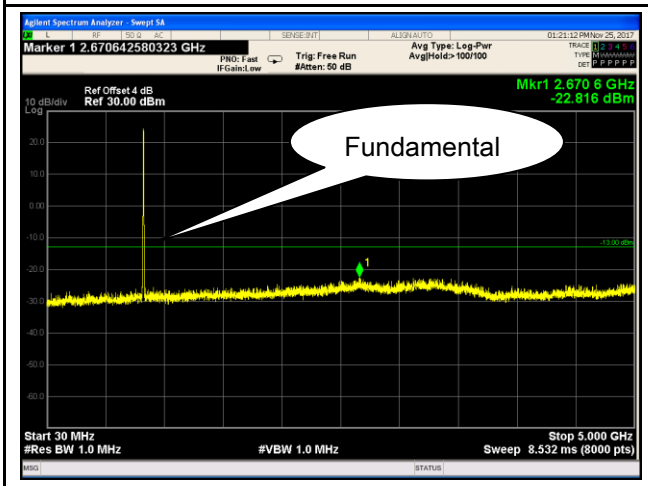
Band V - Low Channel-2



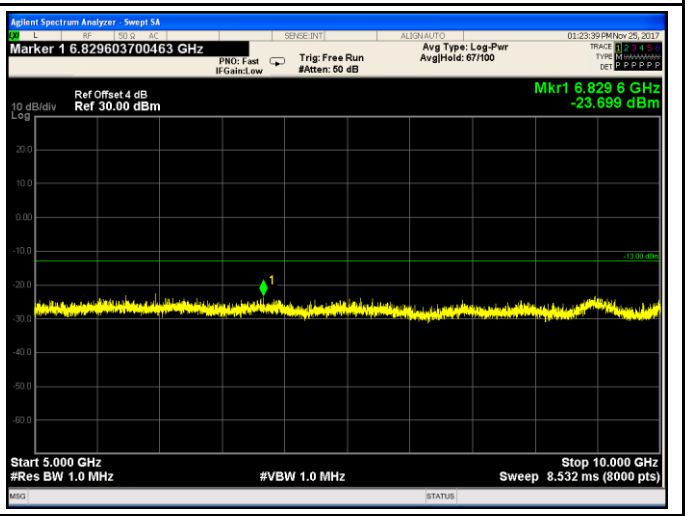
Band V - Middle Channel-1



Band V - Middle Channel-2

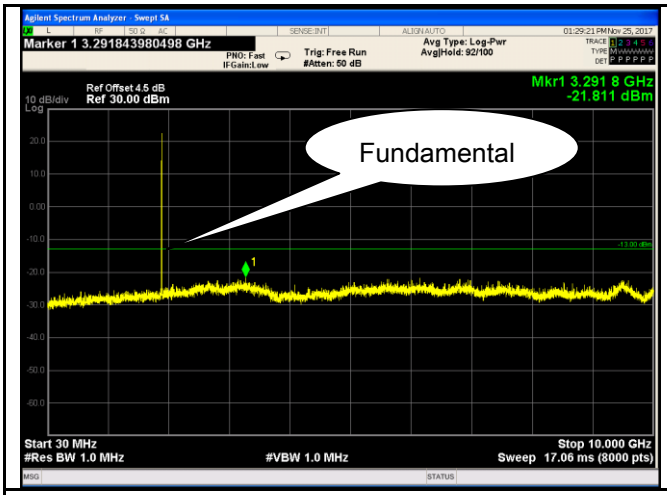


Band V - High Channel-1

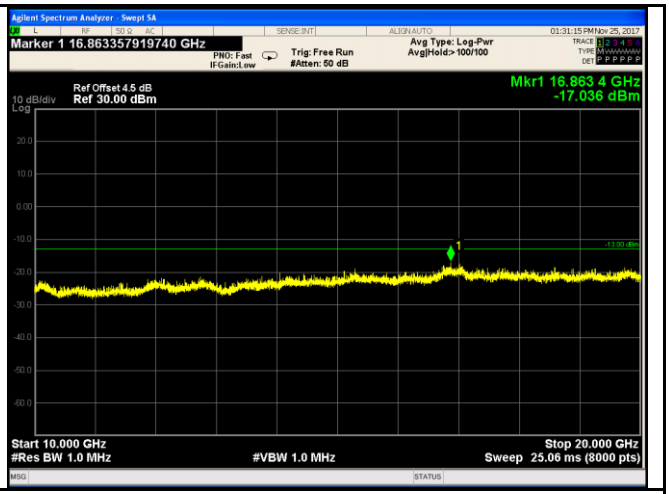


Band V - High Channel-2

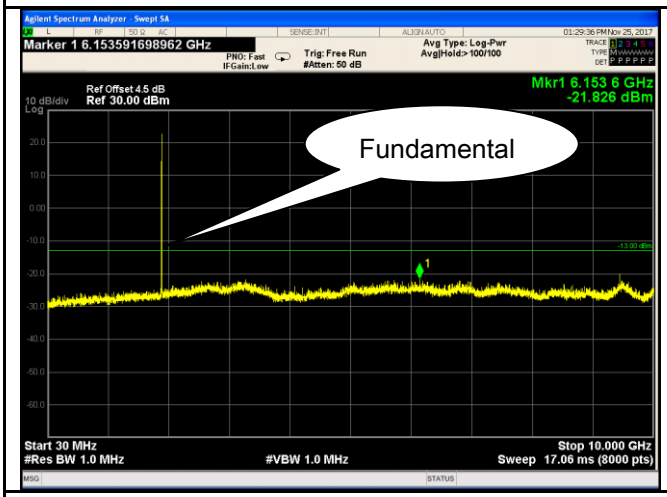
UMTS-FDD Band II (Part 24E)



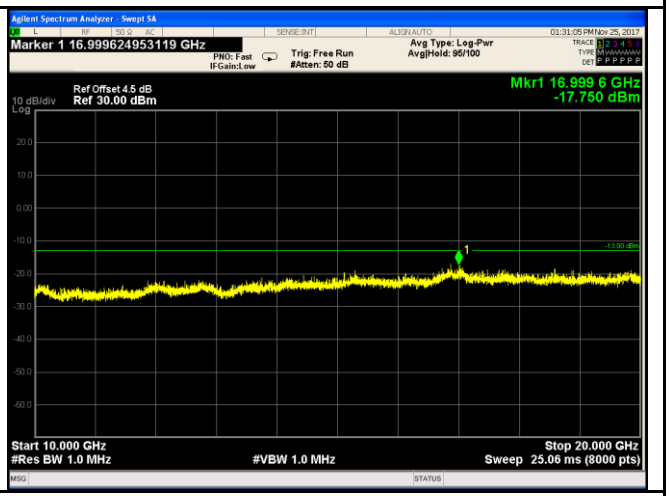
Band II - Low Channel-1



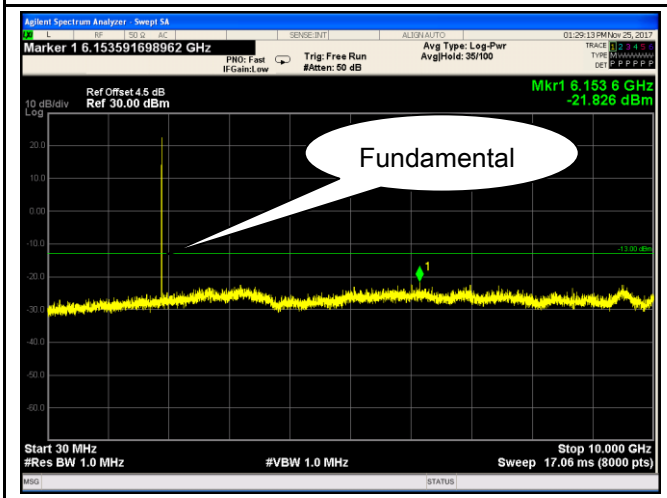
Band II - Low Channel-2



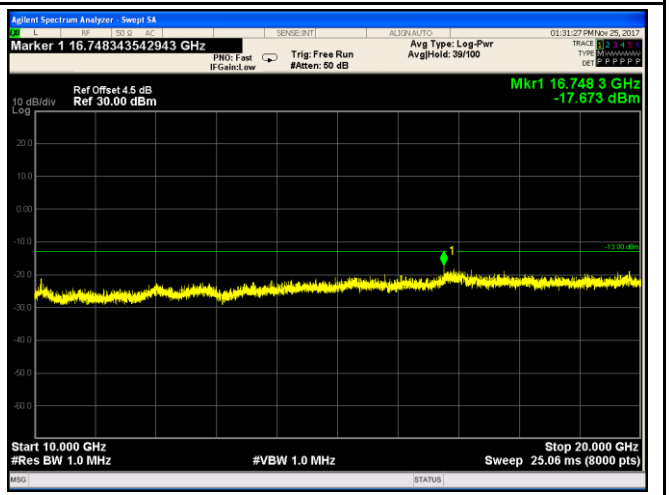
Band II - Middle Channel-1



Band II - Middle Channel-2



Band II - High Channel-1

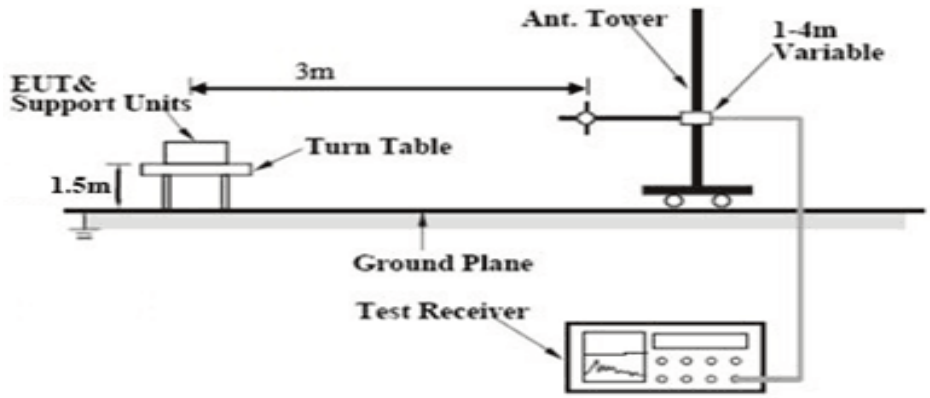


Band II - High Channel-2

6.6 Spurious Radiated Emissions

Temperature	23 °C
Relative Humidity	55%
Atmospheric Pressure	1012mbar
Test date :	December 04, 2017
Tested By :	Aaron Liang

Requirement(s):

Spec	Item	Requirement	Applicable
§2.1053, §22.917 & §24.238	a)	The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitter power (P) by a factor of at least 43 + 10 log (P) dB. The spectrum is scanned from 30 MHz up to a frequency including its 10th harmonic.	☑
Test setup			
Test Procedure	1. The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load which was also placed on the turntable. 2. The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis. 3. 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. Sample Calculation: EUT Field Strength = Raw Amplitude (dBμV/m) – Amplifier Gain (dB) + Antenna Factor (dB) + Cable Loss (dB) + Filter Attenuation (dB, if used)		

Remark	
Result	☑ Pass ☐ Fail

Test Data ☑ Yes ☐ N/A

Test Plot ☐ Yes (See below) ☑ N/A

Cellular Band (Part 22H) result

Low channel

Frequency (MHz)	Substituted level (dBm)	Polarity (H/V)	Antenna Gain Correction (dB)	Cable Loss (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
1648.4	-43.84	V	7.95	0.67	-36.56	-13	-23.56
1648.4	-44.26	H	7.95	0.67	-36.98	-13	-23.98
847.8	-53.62	V	6.16	0.46	-47.92	-13	-34.92
919.8	-53.79	H	6.21	0.43	-48.01	-13	-35.01

Middle channel

Frequency (MHz)	Substituted level (dBm)	Polarity (H/V)	Antenna Gain Correction (dB)	Cable Loss (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
1673.2	-42.74	V	7.95	0.67	-35.46	-13	-22.46
1673.2	-44.85	H	7.95	0.67	-37.57	-13	-24.57
452.1	-52.75	V	6	0.29	-47.04	-13	-34.04
494.9	-52.08	H	5.96	0.32	-46.44	-13	-33.44

High channel

Frequency (MHz)	Substituted level (dBm)	Polarity (H/V)	Antenna Gain Correction (dB)	Cable Loss (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
1697.6	-42.88	V	7.95	0.68	-35.61	-13	-22.61
1697.6	-44.81	H	7.95	0.68	-37.54	-13	-24.54
723.7	-52.44	V	6.17	0.45	-46.72	-13	-33.72
534	-53.54	H	5.99	0.28	-47.83	-13	-34.83

Note:

*1, The testing has been conformed to 10*848.8MHz=8,488MHz*
2, All other emissions more than 30 dB below the limit
3,GSM voice , GPRS and EGPRS mode were investigated. The results above show only the worse cases
4, X-Axis, Y-Axis and Z-Axis were investigated. The results above show only the worst case.
5, The radiated spurious test above 18GHz is subcontracted to SIEMIC (Nanjing-China) Laboratories. and found 30dB below the limit at least.

PCS Band (Part24E) result

Low channel

Frequency (MHz)	Substituted level (dBm)	Polarity (H/V)	Antenna Gain Correction (dB)	Cable Loss (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
3700.4	-48.93	V	10.25	1	-39.68	-13	-26.68
3700.4	-49.83	H	10.25	1	-40.58	-13	-27.58
840	-52.37	V	6.23	0.42	-46.56	-13	-33.56
953.7	-53.58	H	6.21	0.45	-47.82	-13	-34.82

Middle channel

Frequency (MHz)	Substituted level (dBm)	Polarity (H/V)	Antenna Gain Correction (dB)	Cable Loss (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
3760	-47.78	V	10.25	1.01	-38.54	-13	-25.54
3760	-49.65	H	10.25	1.01	-40.41	-13	-27.41
329	-53.75	V	3.69	0.2	-50.26	-13	-37.26
607.7	-54.41	H	6.14	0.38	-48.65	-13	-35.65

High channel

Frequency (MHz)	Substituted level (dBm)	Polarity (H/V)	Antenna Gain Correction (dB)	Cable Loss (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
3819.6	-48.75	V	10.36	1.02	-39.41	-13	-26.41
3819.6	-49.47	H	10.36	1.02	-40.13	-13	-27.13
571.6	-52.88	V	6.12	0.41	-47.17	-13	-34.17
562.3	-52.57	H	6.09	0.38	-46.86	-13	-33.86

Note:

*1, The testing has been conformed to 10*1909.8MHz=19,098MHz*
2, All other emissions more than 30 dB below the limit
3,GSM voice , GPRS and EGPRS mode were investigated. The results above show only the worse cases
4, X-Axis, Y-Axis and Z-Axis were investigated. The results above show only the worst case.
5, The radiated spurious test above 18GHz is subcontracted to SIEMIC (Nanjing-China) Laboratories. and found 30dB below the limit at least.

UMTS-FDD Band V (Part 22H)

Low channel

Frequency (MHz)	Substituted level (dBm)	Polarity (H/V)	Antenna Gain Correction (dB)	Cable Loss (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
1652.8	-47.29	V	7.95	0.67	-40.01	-13	-27.01
1652.8	-46.1	H	7.95	0.67	-38.82	-13	-25.82
144.8	-52.92	V	3.71	0.21	-49.42	-13	-36.42
232.3	-52.82	H	3.68	0.18	-49.32	-13	-36.32

Middle channel

Frequency (MHz)	Substituted level (dBm)	Polarity (H/V)	Antenna Gain Correction (dB)	Cable Loss (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
1670	-45.49	V	7.95	0.67	-38.21	-13	-25.21
1670	-45.51	H	7.95	0.67	-38.23	-13	-25.23
710.6	-53.35	V	6.13	0.35	-47.57	-13	-34.57
253.4	-52.91	H	3.72	0.17	-49.36	-13	-36.36

High channel

Frequency (MHz)	Substituted level (dBm)	Polarity (H/V)	Antenna Gain Correction (dB)	Cable Loss (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
1693.2	-47.35	V	7.95	0.68	-40.08	-13	-27.08
1693.2	-46.06	H	7.95	0.68	-38.79	-13	-25.79
680.5	-52.46	V	6.14	0.39	-46.71	-13	-33.71
530.6	-53.32	H	5.99	0.32	-47.65	-13	-34.65

Note:

*1, The testing has been conformed to 10*846.6MHz=8,466MHz*
2, All other emissions more than 30 dB below the limit
3,RMC , HSUPA and HSDPA mode were investigated. The results above show only the worse cases
4, X-Axis, Y-Axis and Z-Axis were investigated. The results above show only the worst case.
5, The radiated spurious test above 18GHz is subcontracted to SIEMIC (Nanjing-China) Laboratories. and found 30dB below the limit at least.

UMTS-FDD Band II (Part 24E)

Low channel

Frequency (MHz)	Substituted level (dBm)	Polarity (H/V)	Antenna Gain Correction (dB)	Cable Loss (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
3704.8	-48.98	V	10.25	1	-39.73	-13	-26.73
3704.8	-50.29	H	10.25	1	-41.04	-13	-28.04
873.7	-54	V	6.15	0.44	-48.29	-13	-35.29
555.2	-52.27	H	5.98	0.33	-46.62	-13	-33.62

Middle channel

Frequency (MHz)	Substituted level (dBm)	Polarity (H/V)	Antenna Gain Correction (dB)	Cable Loss (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
3760	-49.84	V	10.25	1.01	-40.6	-13	-27.6
3760	-50.28	H	10.25	1.01	-41.04	-13	-28.04
583.7	-52.75	V	5.95	0.33	-47.13	-13	-34.13
752.4	-54.26	H	6.21	0.45	-48.5	-13	-35.5

High channel

Frequency (MHz)	Substituted level (dBm)	Polarity (H/V)	Antenna Gain Correction (dB)	Cable Loss (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
3815.2	-48.78	V	10.36	1.02	-39.44	-13	-26.44
3815.2	-49.69	H	10.36	1.02	-40.35	-13	-27.35
593.7	-54.32	V	5.97	0.34	-48.69	-13	-35.69
361.8	-53.5	H	6.01	0.33	-47.82	-13	-34.82

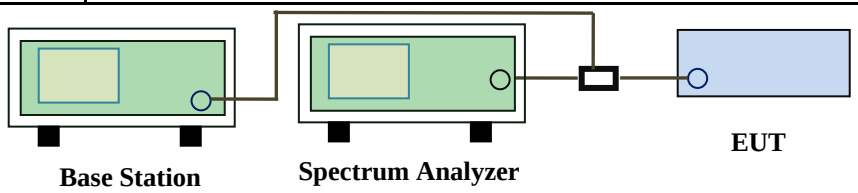
Note:

*1, The testing has been conformed to 10*1907.6MHz=19,076MHz*
2, All other emissions more than 30 dB below the limit
3,RMC , HSUPA and HSDPA mode were investigated. The results above show only the worse cases
4, X-Axis, Y-Axis and Z-Axis were investigated. The results above show only the worst case
5, The radiated spurious test above 18GHz is subcontracted to SIEMIC (Nanjing-China) Laboratories. and found 30dB below the limit at least.

6.7 Band Edge

Temperature	26 °C
Relative Humidity	57%
Atmospheric Pressure	1025mbar
Test date :	November 25, 2017
Tested By :	Aaron Liang

Requirement(s):

Spec	Item	Requirement	Applicable
§22.917(a) §24.238(a)	a)	The power of any emission outside of the authorized operating frequency ranges must be lower than the transmitter power (P) by a factor of at least 43 + 10 log (P) dB.	☑
Test setup			
Procedure	- The EUT was connected to Spectrum Analyzer and Base Station via power divider. - The Band Edges of low and high channels for the highest RF powers were measured. Setting RBW as roughly BW/100.		
Remark			
Result	☑ Pass ☐ Fail		

Test Data ☑ Yes ☐ N/A

Test Plot ☑ Yes (See below) ☐ N/A

GSM Voice:

Cellular Band (Part 22H) result

Frequency (MHz)	Emission (dBm)	Limit (dBm)
823.997	-20.055	-13
849.005	-18.888	-13

PCS Band (Part24E) result

Frequency (MHz)	Emission (dBm)	Limit (dBm)
1849.997	-17.660	-13
1910.003	-17.900	-13

GPRS:

Cellular Band (Part 22H) result

Frequency (MHz)	Emission (dBm)	Limit (dBm)
823.992	-16.894	-13
849.012	-17.764	-13

PCS Band (Part24E) result

Frequency (MHz)	Emission (dBm)	Limit (dBm)
1849.997	-16.831	-13
1910.008	-17.592	-13

EGPRS (MSC5):

Cellular Band (Part 22H) result

Frequency (MHz)	Emission (dBm)	Limit (dBm)
823.997	-18.897	-13
849.003	-19.219	-13

PCS Band (Part24E) result

Frequency (MHz)	Emission (dBm)	Limit (dBm)
1849.996	-16.076	-13
1910.003	-17.592	-13

RMC:

UMTS-FDD Band V (Part 22H)

Frequency (MHz)	Emission (dBm)	Limit (dBm)
823.19	-20.820	-13
849.02	-26.870	-13

UMTS-FDD Band II (Part 24E)

Frequency (MHz)	Emission (dBm)	Limit (dBm)
1849.02	-26.147	-13
1910.01	-24.269	-13

HSDPA:

UMTS-FDD Band V (Part 22H)

Frequency (MHz)	Emission (dBm)	Limit (dBm)
822.83	-21.543	-13
849.89	-25.910	-13

UMTS-FDD Band II (Part 24E)

Frequency (MHz)	Emission (dBm)	Limit (dBm)
1849.06	-25.915	-13
1910.01	-24.643	-13

HSUPA:

UMTS-FDD Band V (Part 22H)

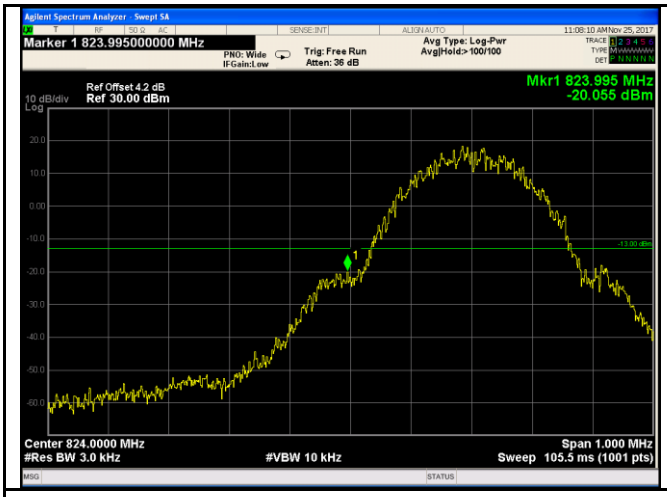
Frequency (MHz)	Emission (dBm)	Limit (dBm)
822.83	-20.813	-13
849.02	-27.150	-13

UMTS-FDD Band II (Part 24E)

Frequency (MHz)	Emission (dBm)	Limit (dBm)
1849.13	-24.131	-13
1910.01	-24.765	-13

GSM Voice:

Test Plots

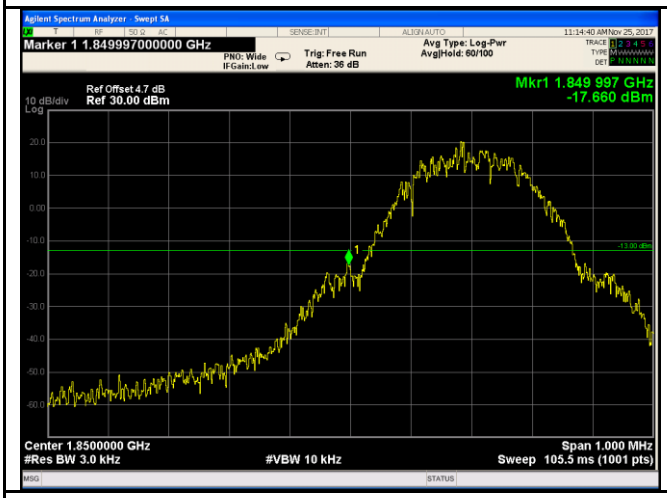


Cellular Band - Low Channel

Note: Offset=Cable loss (4.0) + 10log (3.15/3)=4.0+0.2=4.2dB

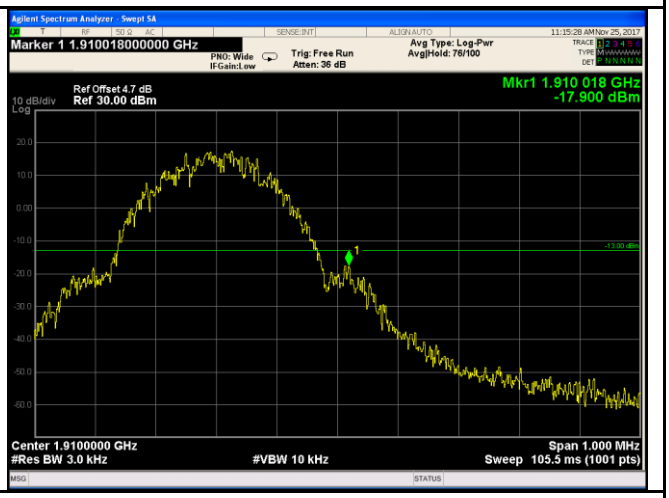
Cellular Band - High Channel

Note: Offset=Cable loss (4.0) + 10log (3.14/3)=4.0+0.2=4.2dB



PCS Band - Low Channel

Note: Offset=Cable loss (4.0) + 10log (3.14/3)=4.5+0.2=4.7dB

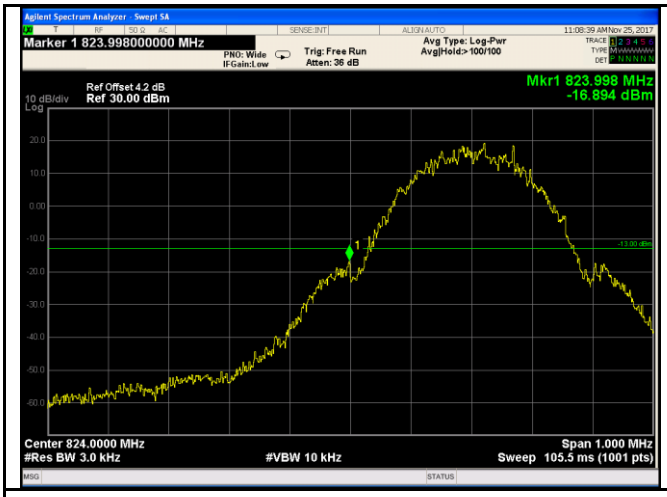
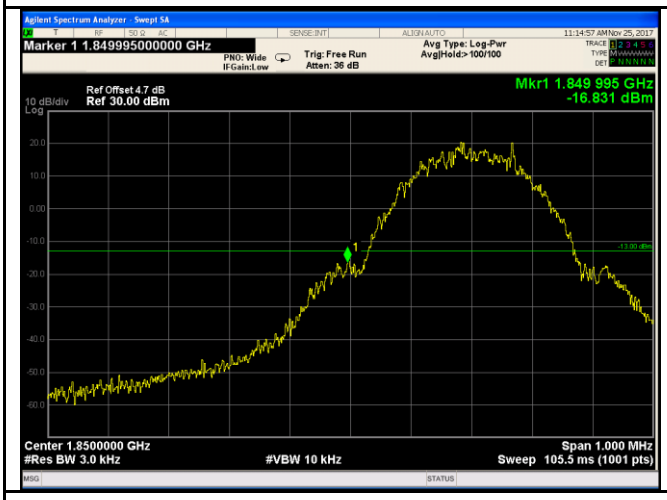
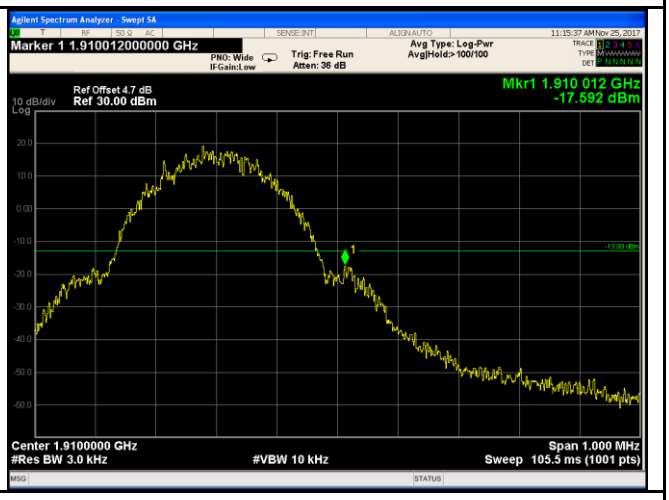


PCS Band - High Channel

Note: Offset=Cable loss (4.0) + 10log (3.15/3)=4.5+0.2=4.7dB

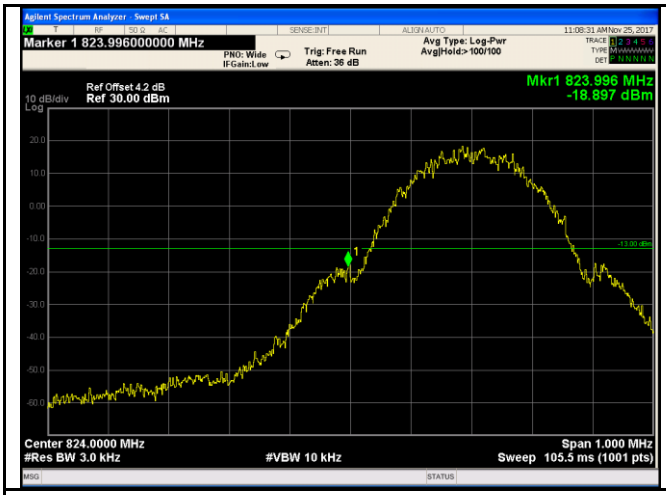
GPRS:

Test Plots

	
Cellular Band - Low Channel	Cellular Band - High Channel
Note: Offset=Cable loss (4.0) + 10log (3.16/3)=4.0+0.2=4.2dB	Note: Offset=Cable loss (4.0) + 10log (3.17/3)=4.0+0.2=4.2dB
	
PCS Band - Low Channel	PCS Band - High Channel
Note: Offset=Cable loss (4.5) + 10log (3.14/3)=4.5+0.2=4.7dB	Note: Offset=Cable loss (4.5) + 10log (3.14/3)=4.5+0.2=4.7dB

EGPRS (MSC5):

Test Plots

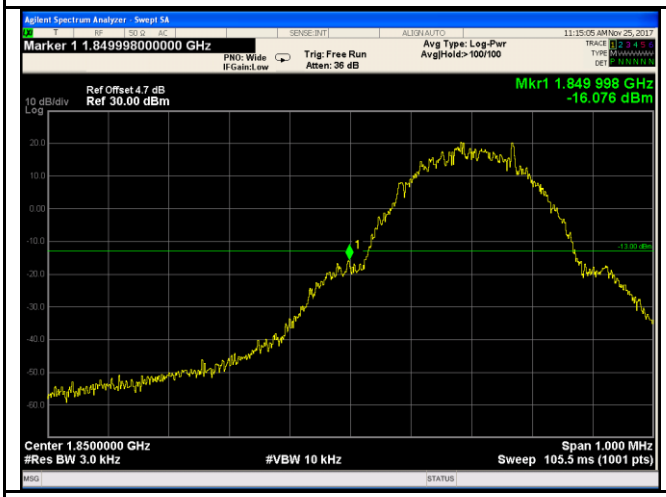


Cellular Band - Low Channel

Note: Offset=Cable loss (4.0) + 10log (3.13/3)=4.0+0.2=4.2dB

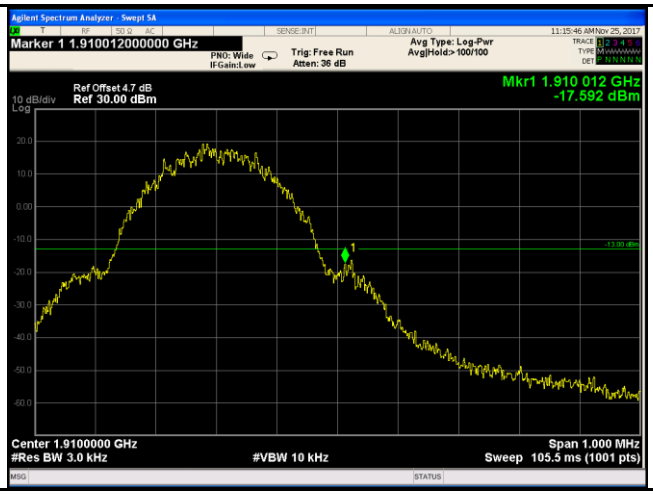
Cellular Band - High Channel

Note: Offset=Cable loss (4.0) + 10log (3.18/3)=4.0+0.2=4.2dB



PCS Band - Low Channel

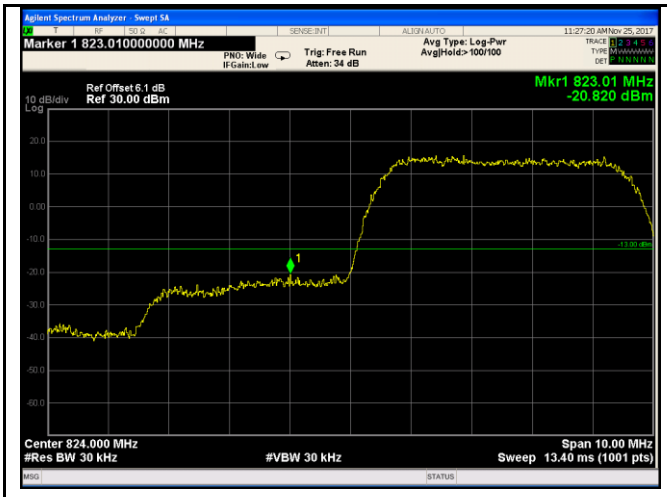
Note: Offset=Cable loss (4.5) + 10log (3.14/3)=4.5+0.2=4.7dB



PCS Band - High Channel

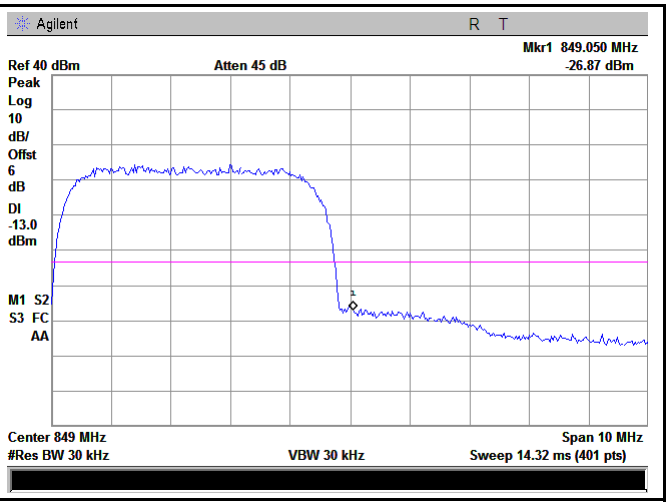
Note: Offset=Cable loss (4.5) + 10log (3.12/3)=4.5+0.2=4.7dB

RMC:



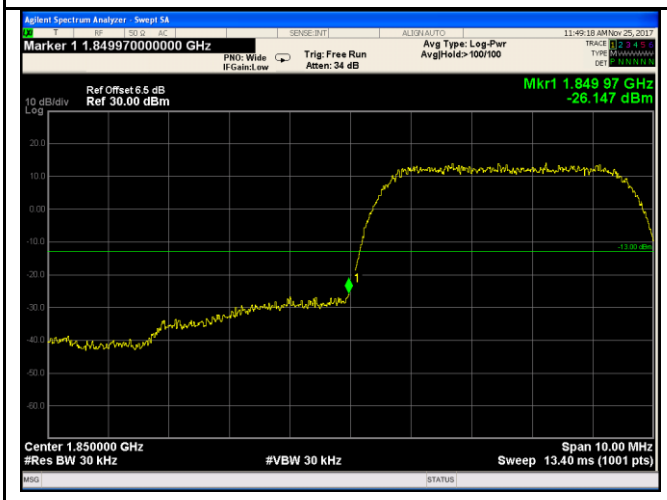
UMTS-FDD Band V - Low Channel

Note: Offset=Cable loss (4.0) + 10log (48.74 /30)=4.0+2.1=6.1dB



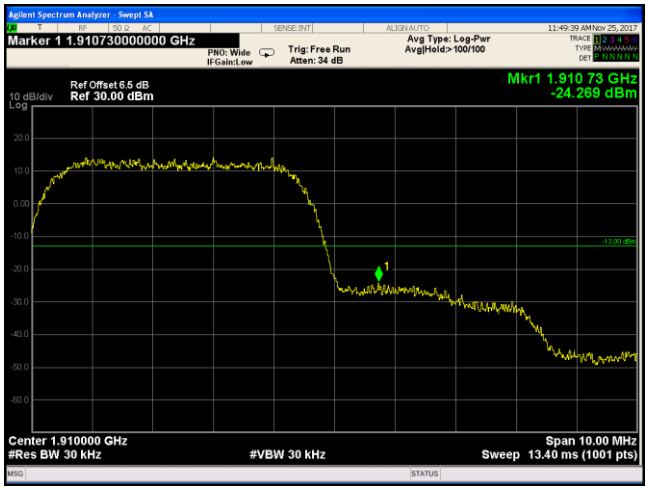
UMTS-FDD Band V - High Channel

Note: Offset=Cable loss (4.0) + 10log (49.39/30)=4.0+2.0=6.0dB



UMTS-FDD Band II - Low Channel

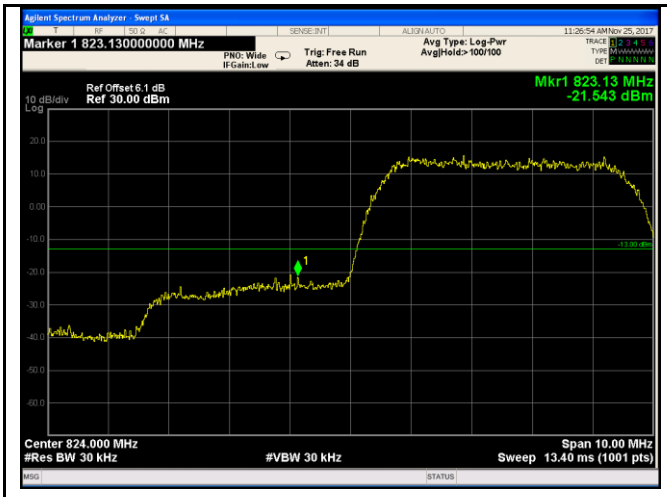
Note: Offset=Cable loss (4.5) + 10log (48.79/30)=4.5+2.0=6.5dB



UMTS-FDD Band II - High Channel

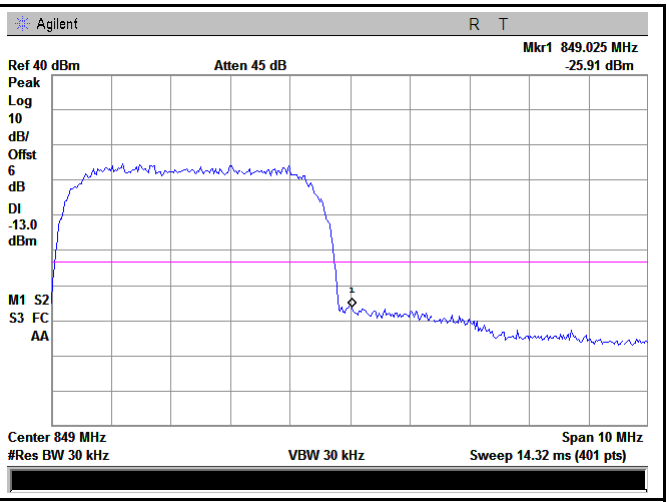
Note: Offset=Cable loss (4.5) + 10log (48.81/30)=4.5+2.0=6.5dB

HSDPA:



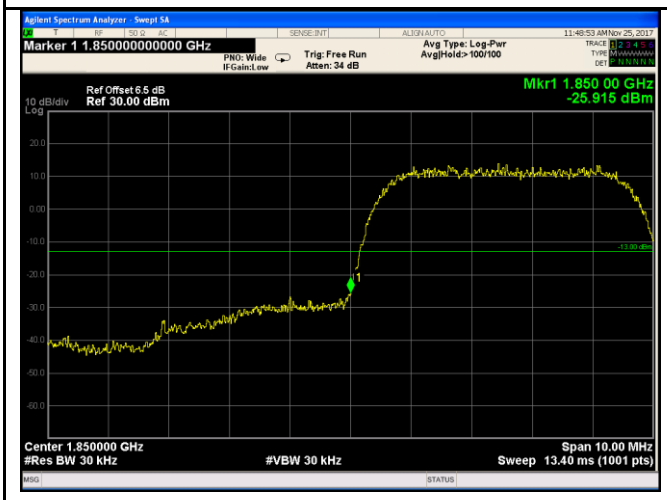
UMTS-FDD Band V - Low Channel

Note: Offset=Cable loss (4.0) + 10log (48.68/30)=4.0+2.1=6.1dB



UMTS-FDD Band V - High Channel

Note: Offset=Cable loss (4.0) + 10log (50.39/30)=4.0+2.0=6.0dB



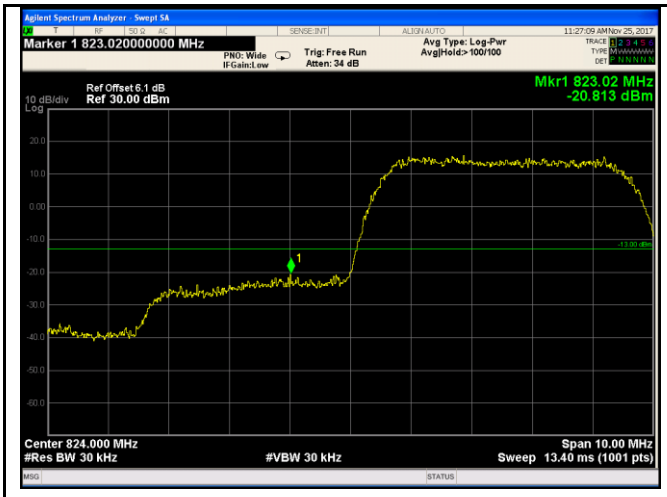
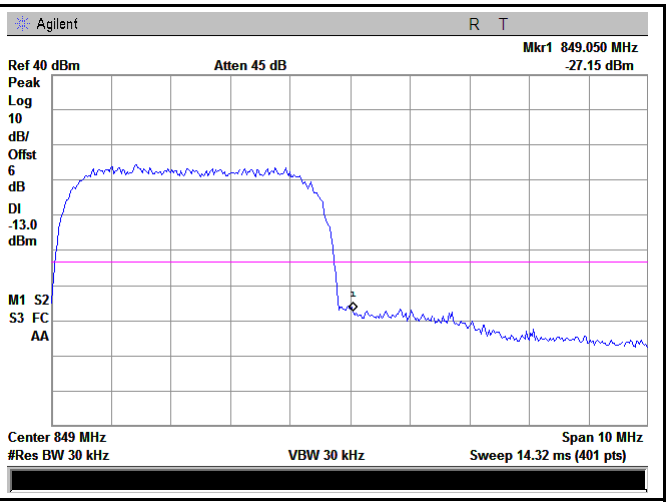
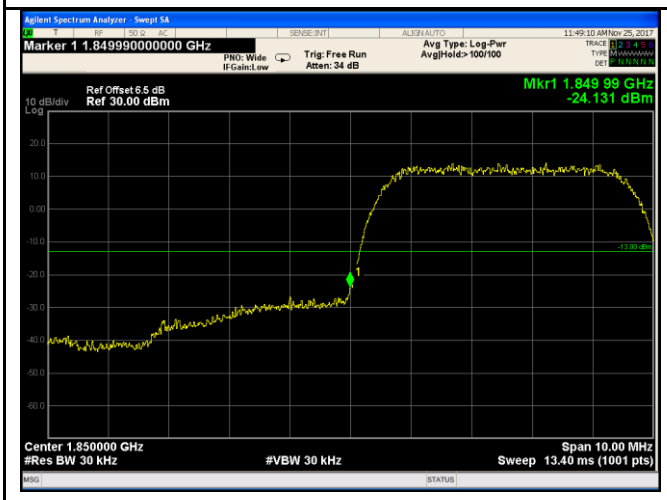
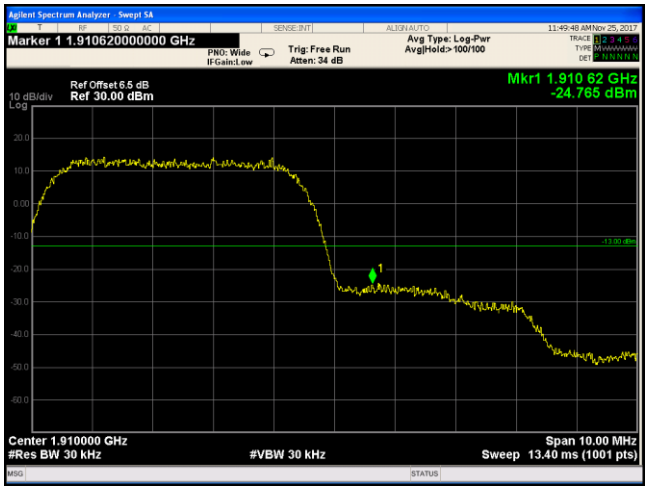
UMTS-FDD Band II - Low Channel

Note: Offset=Cable loss (4.5) + 10log (48.89/30)=4.5+2.0=6.5dB

UMTS-FDD Band II - High Channel

Note: Offset=Cable loss (4.5) + 10log (48.84/30)=4.5+2.0=6.5dB

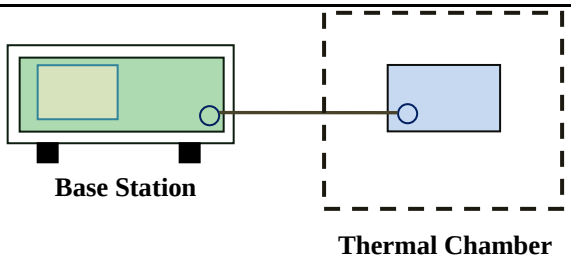
HSUPA:

<table>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>UMTS-FDD Band V - Low Channel</td><td>UMTS-FDD Band V - High Channel</td></tr>
<tr><td>Note: Offset=Cable loss (4.0) + 10log (48.74/30)=4.0+2.1=6.1dB</td><td>Note: Offset=Cable loss (4.0) + 10log (49.25/30)=4.0+2.0=6.0dB</td></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>UMTS-FDD Band II - Low Channel</td><td>UMTS-FDD Band II - High Channel</td></tr>
<tr><td>Note: Offset=Cable loss (4.5) + 10log (48.79/30)=4.5+2.0=6.5dB</td><td>Note: Offset=Cable loss (4.5) + 10log (48.81/30)=4.5+2.0=6.5dB</td></tr>
</table>

6.8 Frequency Stability

Temperature	24 °C
Relative Humidity	54%
Atmospheric Pressure	1020mbar
Test date :	November 29, 2017
Tested By :	Aaron Liang

Requirement(s):

<table>
<tr><th>Spec</th><th>Item</th><th>Requirement</th><th>Applicable</th></tr>
<tr><td>§2.1055, §22.355 & §24.235</td><td>a)</td><td>According to §22.355, the carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances given in Table below:
Frequency Tolerance for Transmitters in the Public Mobile Services
<table>
<tr><th>Frequency Range (MHz)</th><th>Base, fixed (ppm)</th><th>Mobile ≥ 3 watts (ppm)</th><th>Mobile ≤ 3 watts (ppm)</th></tr>
<tr><td>25 to 50</td><td>20.0</td><td>20.0</td><td>50.0</td></tr>
<tr><td>50 to 450</td><td>5.0</td><td>5.0</td><td>50.0</td></tr>
<tr><td>45□to 512</td><td>2.5</td><td>5.0</td><td>□5.0</td></tr>
<tr><td>821 to 896</td><td>1.5</td><td>2.5</td><td>2.5</td></tr>
<tr><td>928 to 929</td><td>5.0</td><td>N/A</td><td>N/A</td></tr>
<tr><td>929 to 960.</td><td>1.5</td><td>N/A</td><td>N/A</td></tr>
<tr><td>2110 to 2220</td><td>10.0</td><td>N/A</td><td>N/A</td></tr>
</table>
According to §24.235, the frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized frequency block.</td><td>☑</td></tr>
<tr><td>Test setup</td><td colspan="3"> 
</td></tr>
</table>

Procedure	A communication link was established between EUT and base station. The frequency error was monitored and measured by base station under variation of ambient temperature and variation of primary supply voltage. Limit: The frequency stability of the transmitter shall be maintained within ±0.00025% (±2.5ppm) of the center frequency.
Remark	
Result	☑ Pass ☐ Fail

Test Data ☑ Yes ☐ N/A

Test Plot ☐ Yes (See below) ☑ N/A

GSM Voice:

Cellular Band (Part 22H) result

Middle Channel, f_o = 836.6 MHz				
Temperature (℃)	Power Supplied (V_{DC})	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
-10	3.7	21	0.0251	2.5
0		14	0.0167	2.5
10		15	0.0179	2.5
20		15	0.0179	2.5
30		17	0.0203	2.5
40		15	0.0179	2.5
50		21	0.0251	2.5
55		19	0.0227	2.5
25	4.2	17	0.0203	2.5
	3.5	19	0.0227	2.5

PCS Band (Part 24E) result

Middle Channel, f_o = 1880 MHz				
Temperature (℃)	Power Supplied (V_{DC})	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
-10	3.7	19	0.0101	2.5
0		18	0.0096	2.5
10		15	0.0080	2.5
20		13	0.0069	2.5
30		13	0.0069	2.5
40		13	0.0069	2.5
50		22	0.0117	2.5
55		17	0.0090	2.5
25	4.2	21	0.0112	2.5
	3.5	20	0.0106	2.5

RMC:

UMTS-FDD Band V (Part 22H)

Middle Channel, f_o = 835 MHz				
Temperature (℃)	Power Supplied (V_{DC})	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
-10	3.7	20	0.0240	2.5
0		18	0.0216	2.5
10		17	0.0204	2.5
20		15	0.0180	2.5
30		14	0.0168	2.5
40		17	0.0204	2.5
50		22	0.0263	2.5
55		21	0.0251	2.5
25	4.2	18	0.0216	2.5
	3.5	18	0.0216	2.5

UMTS-FDD Band II (Part 24E)

Middle Channel, f_o = 1880 MHz				
Temperature (℃)	Power Supplied (V_{DC})	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
-10	3.7	21	0.0112	2.5
0		18	0.0096	2.5
10		17	0.0090	2.5
20		13	0.0069	2.5
30		15	0.0080	2.5
40		17	0.0090	2.5
50		20	0.0106	2.5
55		21	0.0112	2.5
25	4.2	20	0.0106	2.5
	3.5	19	0.0101	2.5