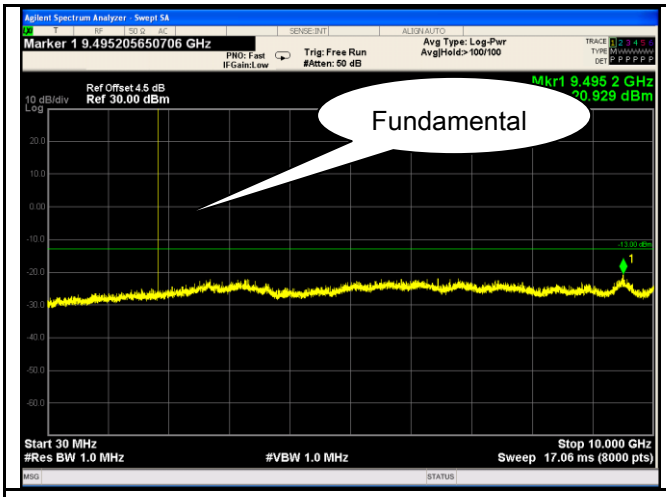
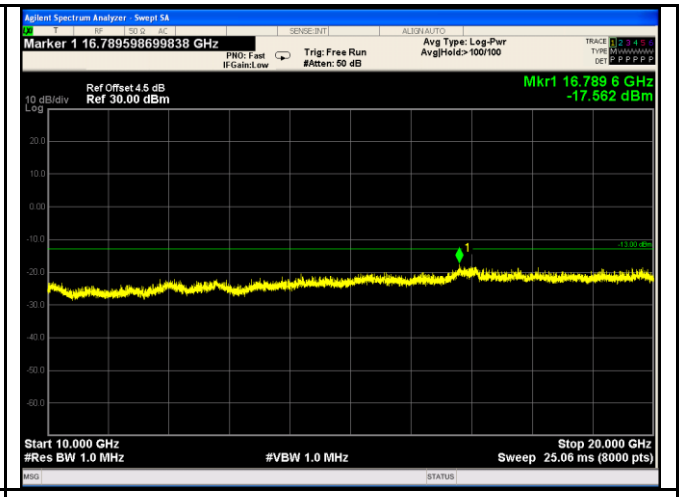
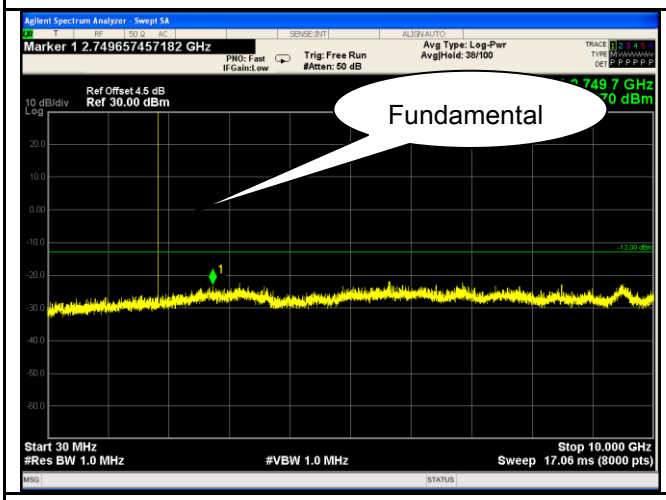
UMTS-FDD Band II (Part 24E)



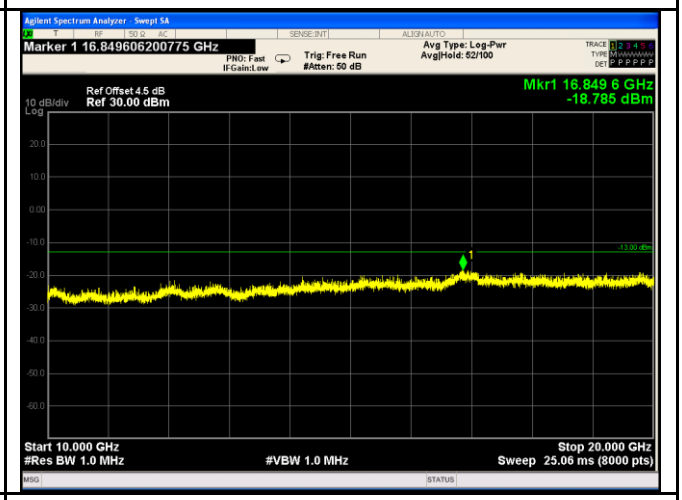
Band II - Low Channel-1



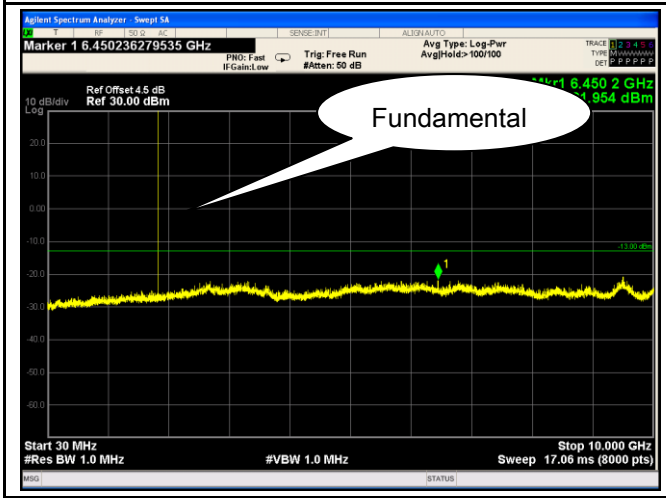
Band II - Low Channel-2



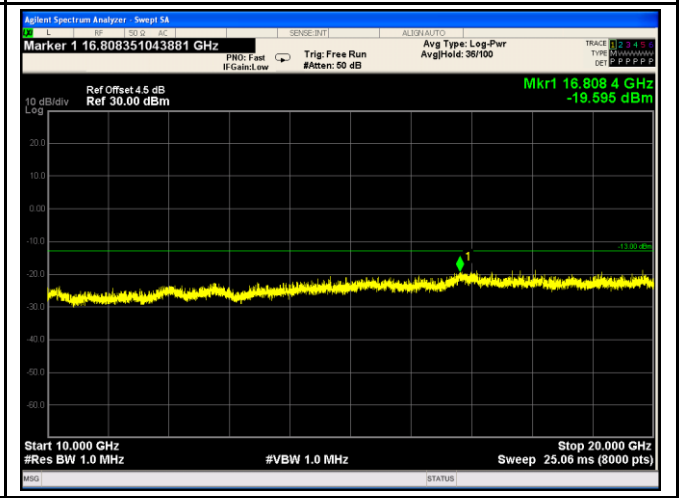
Band II - Middle Channel-1



Band II - Middle Channel-2



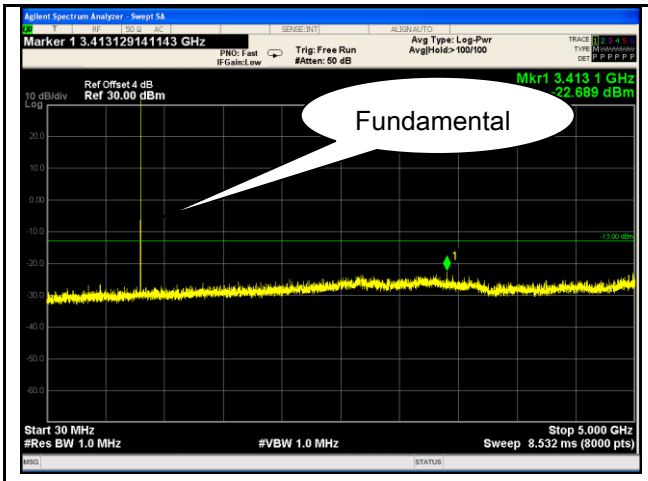
Band II - High Channel-1



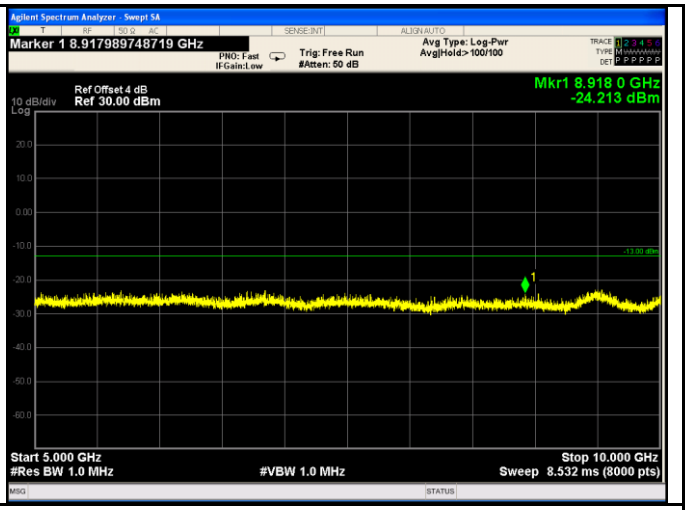
Band II - High Channel-2

HSUPA:

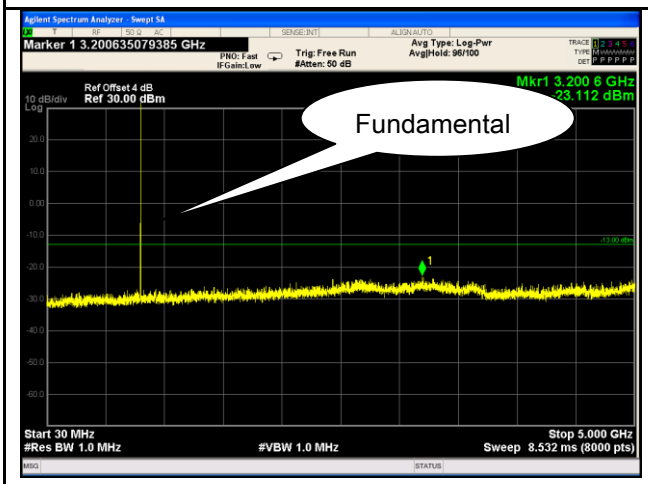
UMTS-FDD Band V (Part 22H)



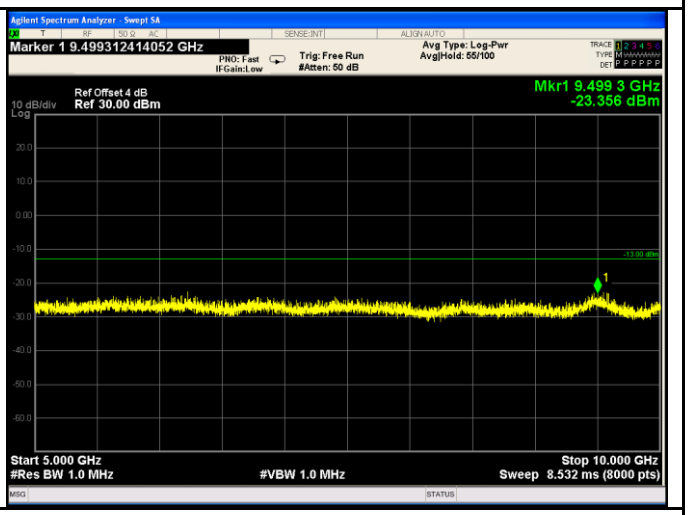
Band V - Low Channel-1



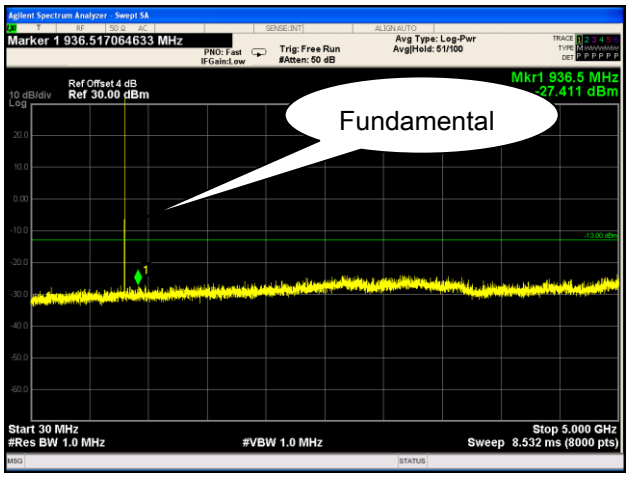
Band V - Low Channel-2



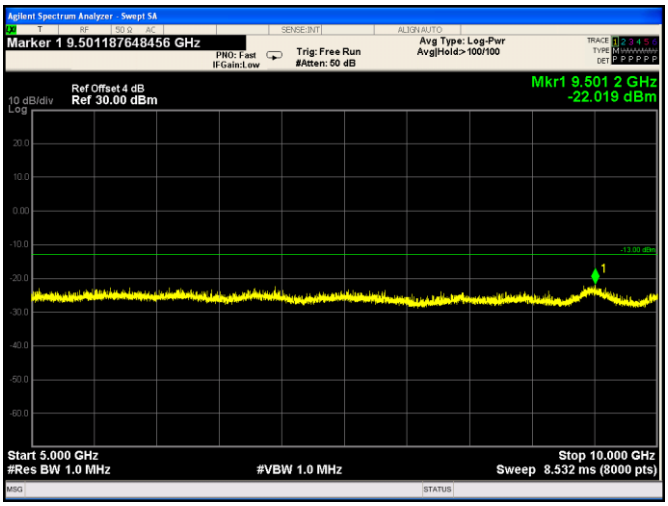
Band V - Middle Channel-1



Band V - Middle Channel-2

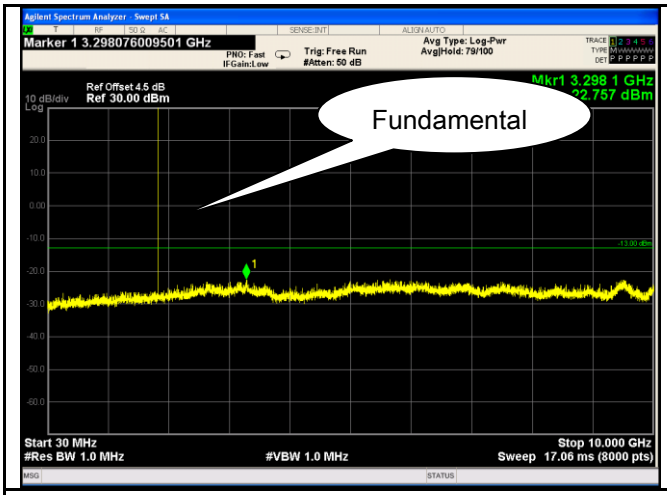


Band V - High Channel-1

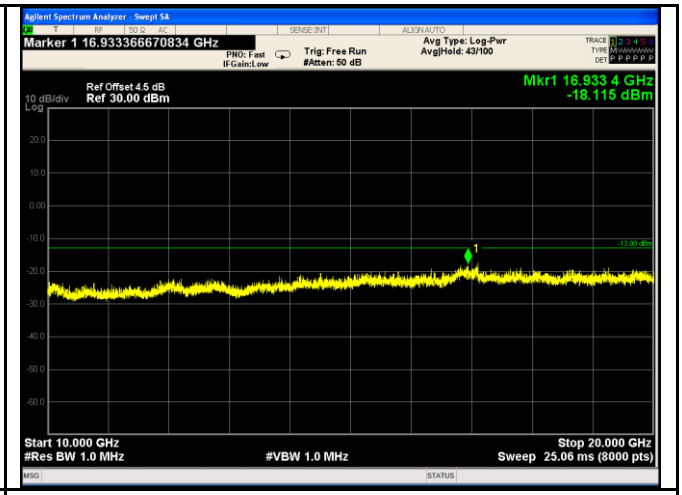


Band V - High Channel-2

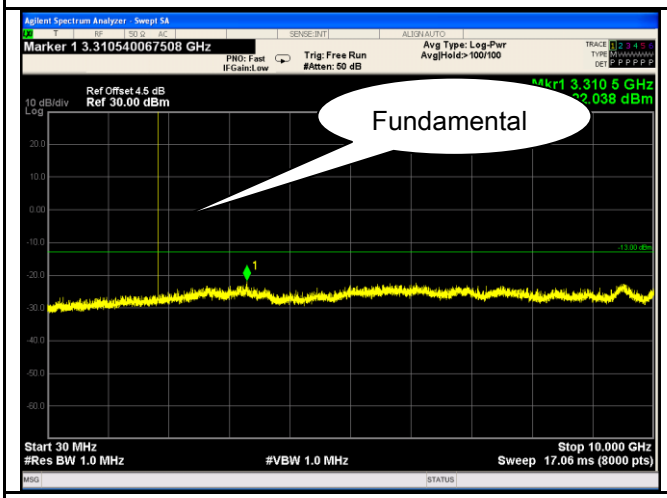
UMTS-FDD Band II (Part 24E)



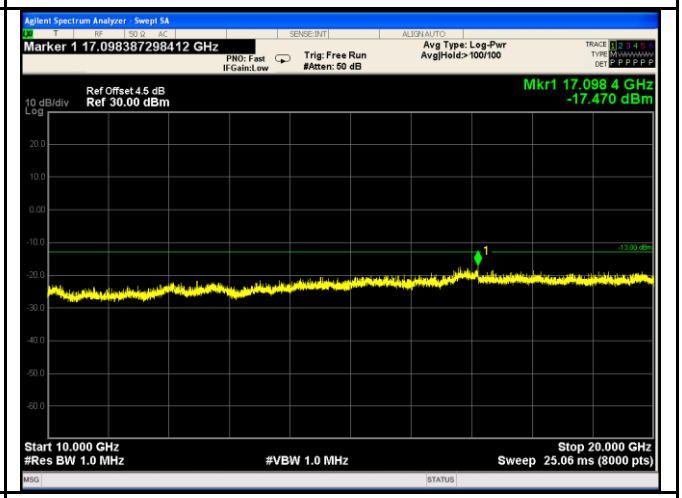
Band II - Low Channel-1



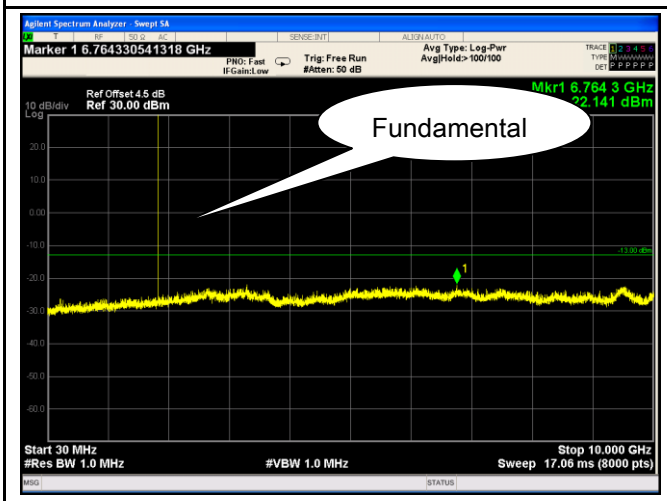
Band II - Low Channel-2



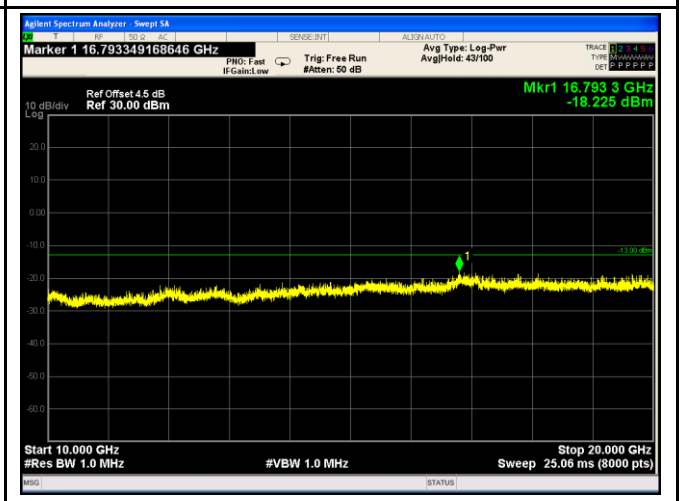
Band II - Middle Channel-1



Band II - Middle Channel-2



Band II - High Channel-1



Band II - High Channel-2

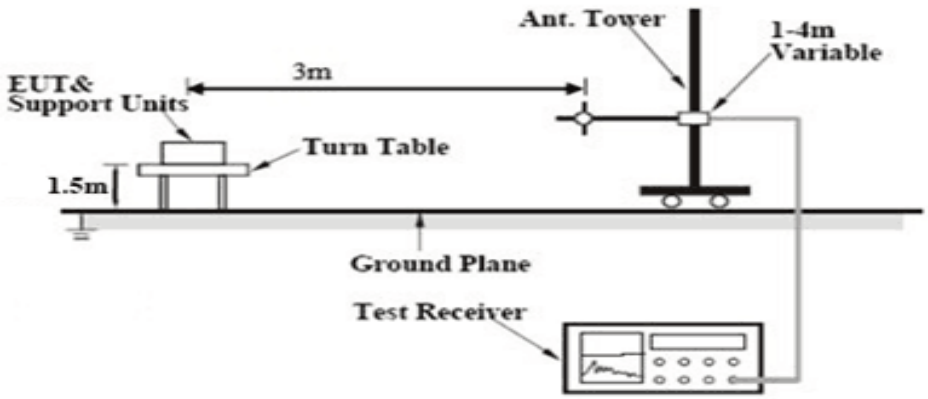
6.6 Spurious Radiated Emissions

Temperature	26 °C
Relative Humidity	59%
Atmospheric Pressure	1015mbar
Test date :	December 03, 2018
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)	Antenna Polarization (H/V)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
1648.4	V	-20.62	-13	-7.62
1648.4	H	-25.09	-13	-12.09
328.9	V	-29.01	-13	-16.01
603.6	H	-29.14	-13	-16.14

Middle channel

Frequency (MHz)	Antenna Polarization (H/V)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
1673.2	V	-23.17	-13	-10.17
1673.2	H	-25.22	-13	-12.22
328.6	V	-29.91	-13	-16.91
603.7	H	-34.63	-13	-21.63

High channel

Frequency (MHz)	Antenna Polarization (H/V)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
1697.6	V	-18.28	-13	-5.28
1697.6	H	-21.2	-13	-8.2
328.1	V	-28.77	-13	-15.77
603.9	H	-34.5	-13	-21.5

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 and GPRS 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 Bureau Veritas Shenzhen Co., Ltd. Dongguan Branch Laboratories and found 30dB below the limit at least.

PCS Band (Part24E) result

Low channel

Frequency (MHz)	Antenna Polarization (H/V)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
3700.4	V	-23.64	-13	-10.64
3700.4	H	-21.03	-13	-8.03
327.8	V	-28.33	-13	-15.33
603.5	H	-28.18	-13	-15.18

Middle channel

Frequency (MHz)	Antenna Polarization (H/V)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
3760	V	-23.35	-13	-10.35
3760	H	-21.36	-13	-8.36
327.6	V	-30.64	-13	-17.64
602.9	H	-28.38	-13	-15.38

High channel

Frequency (MHz)	Antenna Polarization (H/V)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
3819.6	V	-27.99	-13	-14.99
3819.6	H	-26.89	-13	-13.89
327.1	V	-27.4	-13	-14.4
602.8	H	-25.87	-13	-12.87

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 and GPRS 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 Bureau Veritas Shenzhen Co., Ltd. Dongguan Branch Laboratories and found 30dB below the limit at least.

UMTS-FDD Band V (Part 22H)

Low channel

Frequency (MHz)	Antenna Polarization (H/V)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
1652.8	V	-21.9	-13	-8.9
1652.8	H	-23.34	-13	-10.34
328.3	V	-35.05	-13	-22.05
603.7	H	-27.97	-13	-14.97

Middle channel

Frequency (MHz)	Antenna Polarization (H/V)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
1670	V	-21.71	-13	-8.71
1670	H	-24.32	-13	-11.32
328.4	V	-34.78	-13	-21.78
603.8	H	-26.86	-13	-13.86

High channel

Frequency (MHz)	Antenna Polarization (H/V)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
1693.2	V	-28.64	-13	-15.64
1693.2	H	-26.8	-13	-13.8
328.6	V	-26.57	-13	-13.57
603.3	H	-27.44	-13	-14.44

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 Bureau Veritas Shenzhen Co., Ltd. Dongguan Branch Laboratories and found 30dB below the limit at least.

UMTS-FDD Band II (Part 24E)

Low channel

Frequency (MHz)	Antenna Polarization (H/V)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
3704.8	V	-22.1	-13	-9.1
3704.8	H	-28.71	-13	-15.71
329.1	V	-32.66	-13	-19.66
602.5	H	-31.39	-13	-18.39

Middle channel

Frequency (MHz)	Antenna Polarization (H/V)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
3760	V	-26.09	-13	-13.09
3760	H	-24.77	-13	-11.77
329.6	V	-30.39	-13	-17.39
602.2	H	-32.66	-13	-19.66

High channel

Frequency (MHz)	Antenna Polarization (H/V)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
3815.2	V	-28.33	-13	-15.33
3815.2	H	-20.72	-13	-7.72
329.4	V	-35.23	-13	-22.23
603.8	H	-34.61	-13	-21.61

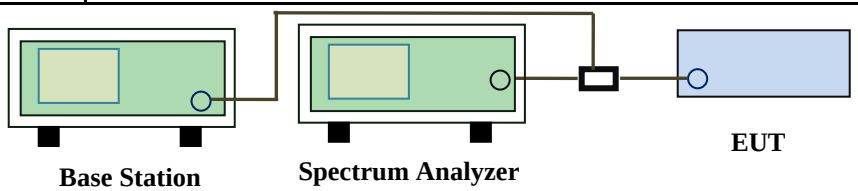
Note:

*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 Bureau Veritas Shenzhen Co., Ltd. Dongguan Branch Laboratories and found 30dB below the limit at least.

6.7 Band Edge

Temperature	26 °C
Relative Humidity	59%
Atmospheric Pressure	1015mbar
Test date :	December 03, 2018
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)
823.990	-15.835	-13
849.023	-17.728	-13

PCS Band (Part24E) result

Frequency (MHz)	Emission (dBm)	Limit (dBm)
1849.994	-15.603	-13
1910.003	-14.092	-13

GPRS:

Cellular Band (Part 22H) result

Frequency (MHz)	Emission (dBm)	Limit (dBm)
823.996	-15.318	-13
849.024	-15.320	-13

PCS Band (Part24E) result

Frequency (MHz)	Emission (dBm)	Limit (dBm)
1849.987	-16.232	-13
1910.022	-16.233	-13

RMC:

UMTS-FDD Band V (Part 22H)

Frequency (MHz)	Emission (dBm)	Limit (dBm)
823.75	-16.110	-13
850.83	-26.931	-13

UMTS-FDD Band II (Part 24E)

Frequency (MHz)	Emission (dBm)	Limit (dBm)
1849.99	-23.362	-13
1910.40	-28.888	-13

HSDPA:

UMTS-FDD Band V (Part 22H)

Frequency (MHz)	Emission (dBm)	Limit (dBm)
823.51	-21.327	-13
849.02	-26.898	-13

UMTS-FDD Band II (Part 24E)

Frequency (MHz)	Emission (dBm)	Limit (dBm)
1849.98	-22.286	-13
1910.03	-28.177	-13

HSUPA:

UMTS-FDD Band V (Part 22H)

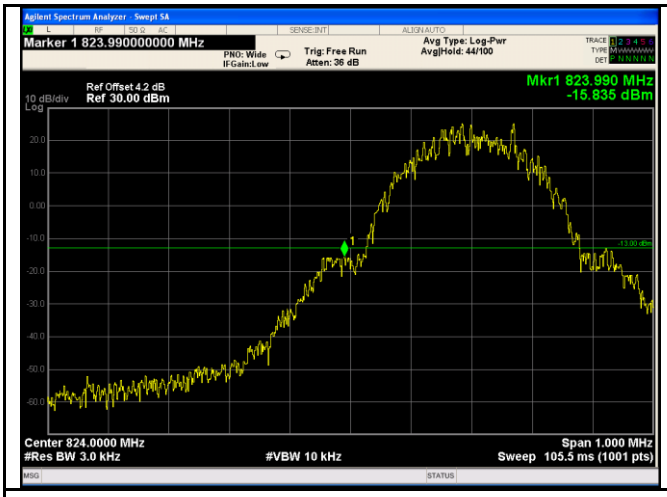
Frequency (MHz)	Emission (dBm)	Limit (dBm)
823.99	-20.732	-13
849.01	-25.160	-13

UMTS-FDD Band II (Part 24E)

Frequency (MHz)	Emission (dBm)	Limit (dBm)
1849.97	-25.568	-13
1910.02	-26.387	-13

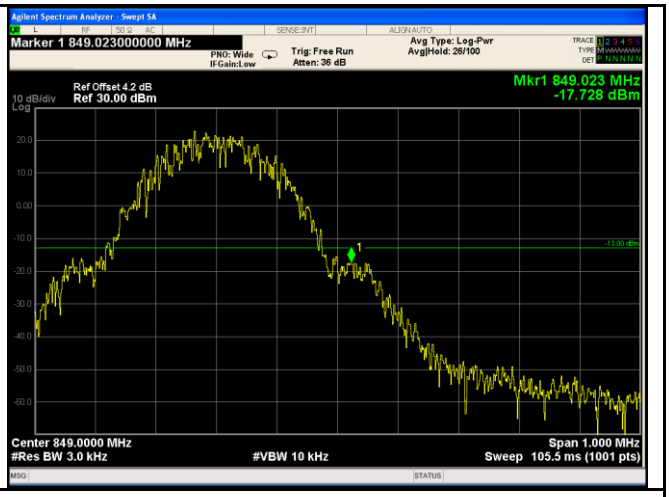
GSM Voice:

Test Plots



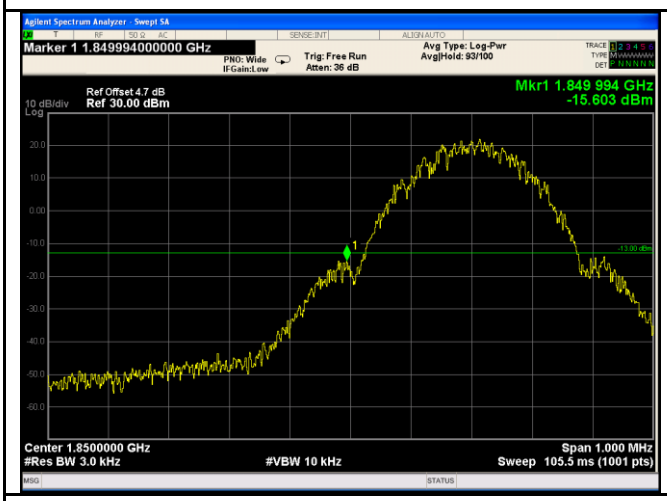
Cellular Band - Low Channel

Note: Offset=Cable loss (4.0) + 10log (3.17/3)=4.0+0.2=4.2dB



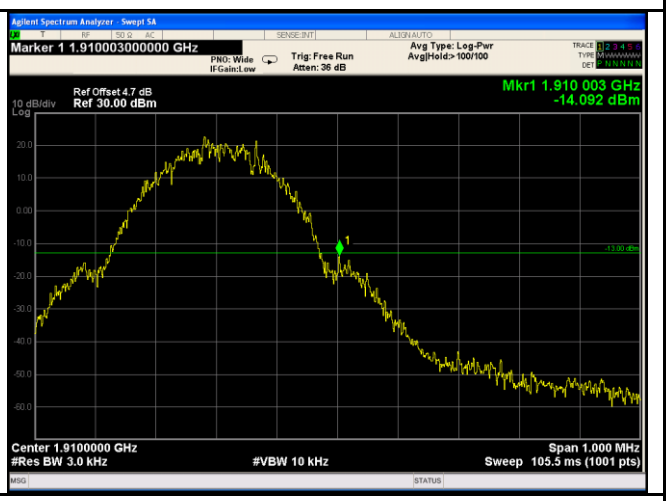
Cellular Band - High Channel

Note: Offset=Cable loss (4.0) + 10log (3.16/3)=4.0+0.2=4.2dB



PCS Band - Low Channel

Note: Offset=Cable loss (4.0) + 10log (3.16/3)=4.5+0.2=4.7dB

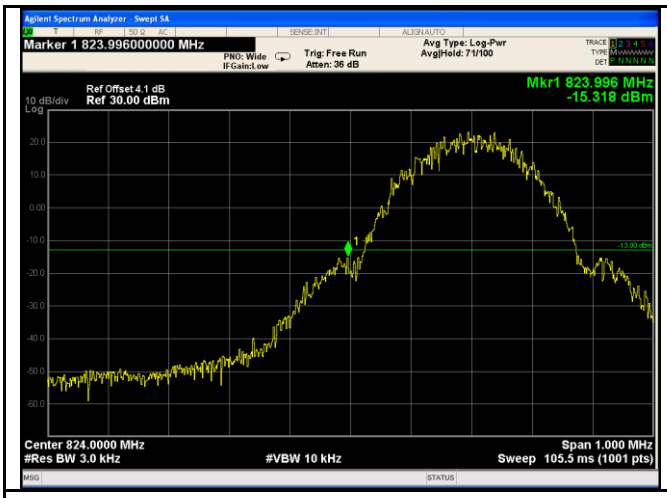


PCS Band - High Channel

Note: Offset=Cable loss (4.0) + 10log (3.17/3)=4.5+0.2=4.7dB

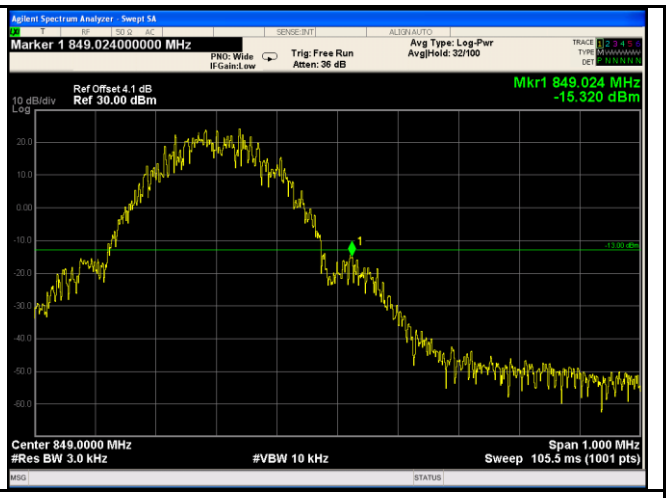
GPRS:

Test Plots



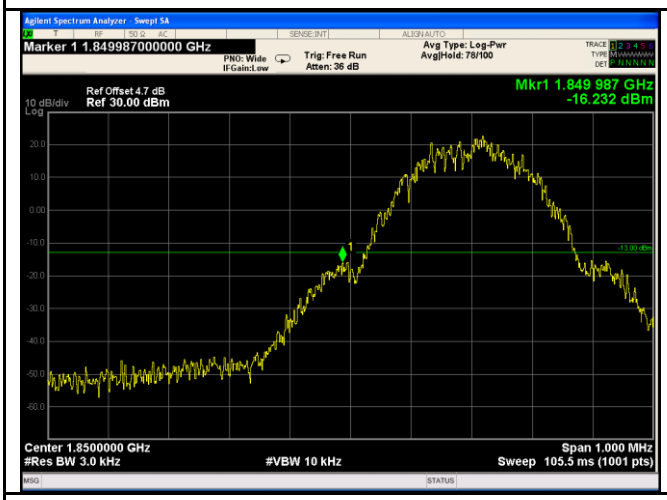
Cellular Band - Low Channel

Note: Offset=Cable loss (4.0) + 10log (3.18/3)=4.0+0.1=4.1dB



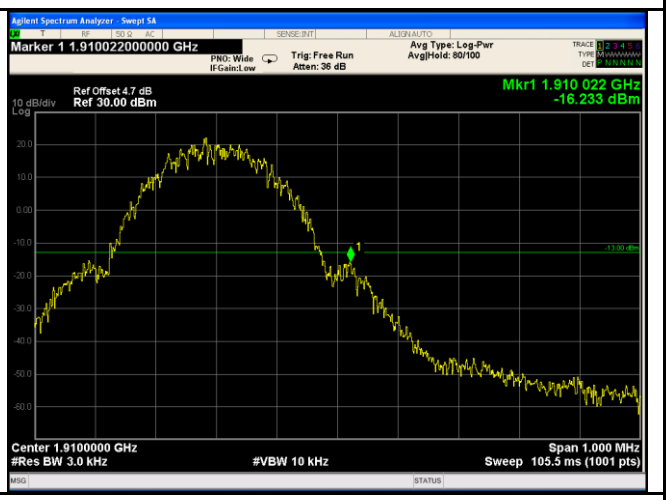
Cellular Band - High Channel

Note: Offset=Cable loss (4.0) + 10log (3.19/3)=4.0+0.1=4.1dB



PCS Band - Low Channel

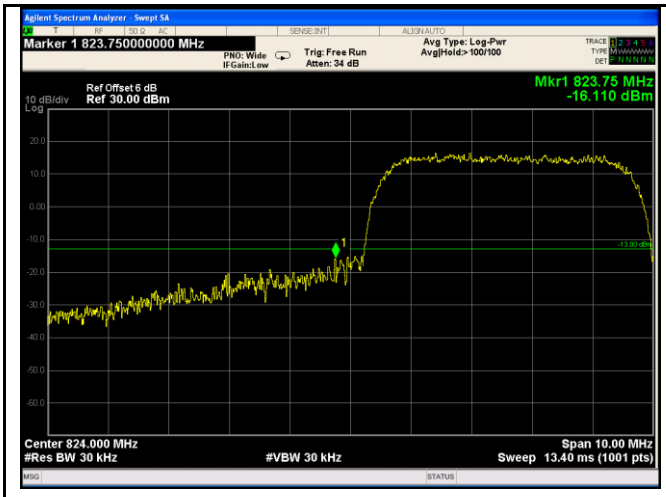
Note: Offset=Cable loss (4.5) + 10log (3.11/3)=4.5+0.2=4.7dB



PCS Band - High Channel

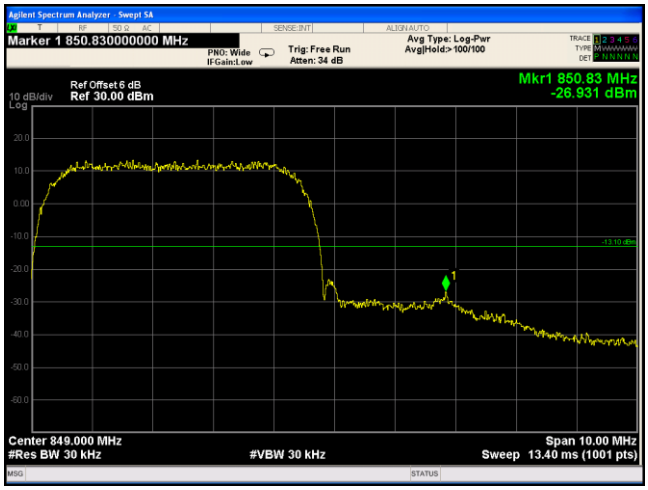
Note: Offset=Cable loss (4.5) + 10log (3.17/3)=4.5+0.2=4.7dB

RMC:



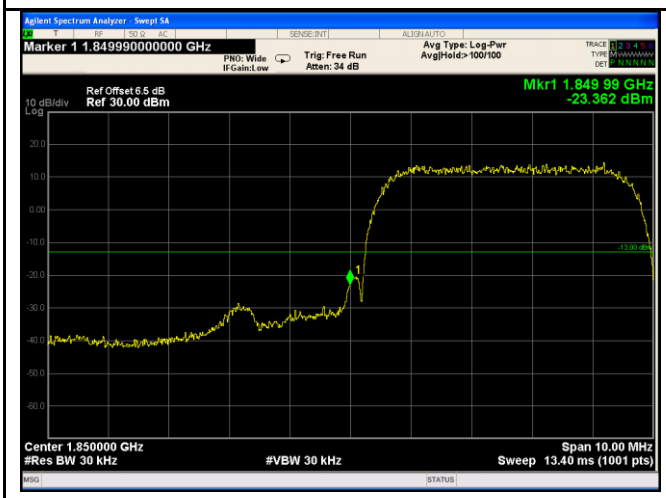
UMTS-FDD Band V - Low Channel

Note: Offset=Cable loss (4.0) + 10log (47.01/30)=4.0+2.0=6.0 dB



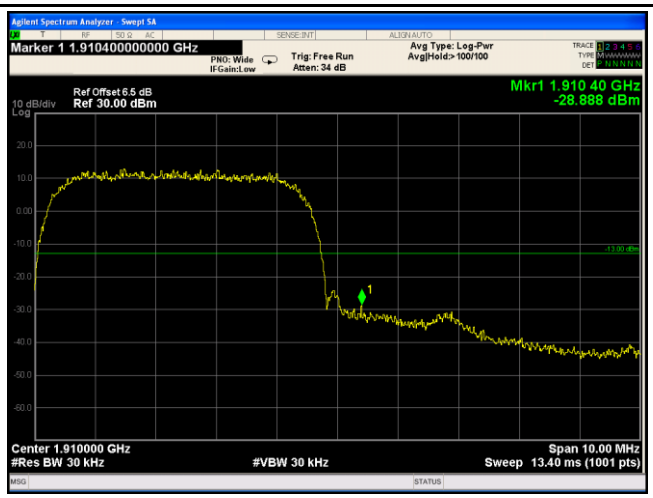
UMTS-FDD Band V - High Channel

Note: Offset=Cable loss (4.0) + 10log (46.91/30)=4.0+2.0 =6.0dB



UMTS-FDD Band II - Low Channel

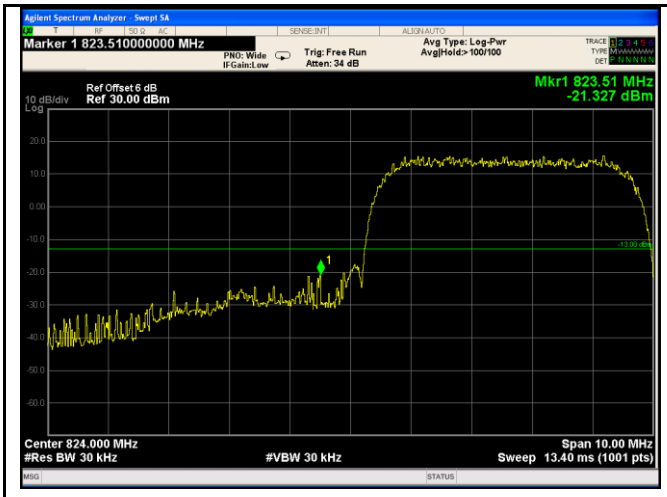
Note: Offset=Cable loss (4.5) + 10log (46.98 /30)=4.5+2.0 =6.5dB



UMTS-FDD Band II - High Channel

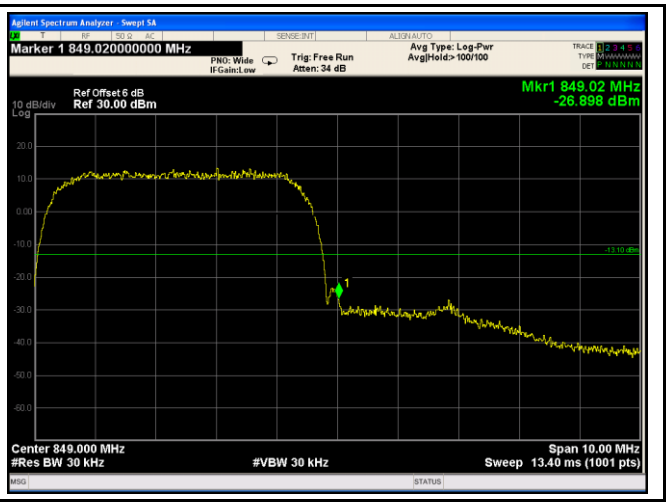
Note: Offset=Cable loss (4.5) + 10log (47.15/30)=4.5+2.0=6.5dB

HSDPA:



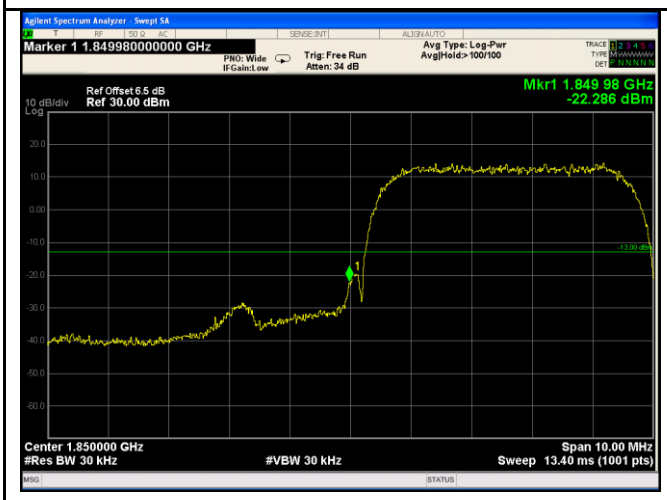
UMTS-FDD Band V - Low Channel

Note: Offset=Cable loss (4.0) + 10log (46.98 /30)=4.0+2.0=6.0dB



UMTS-FDD Band V - High Channel

Note: Offset=Cable loss (4.0) + 10log (47.15/30)=4.0+2.0=6.0dB



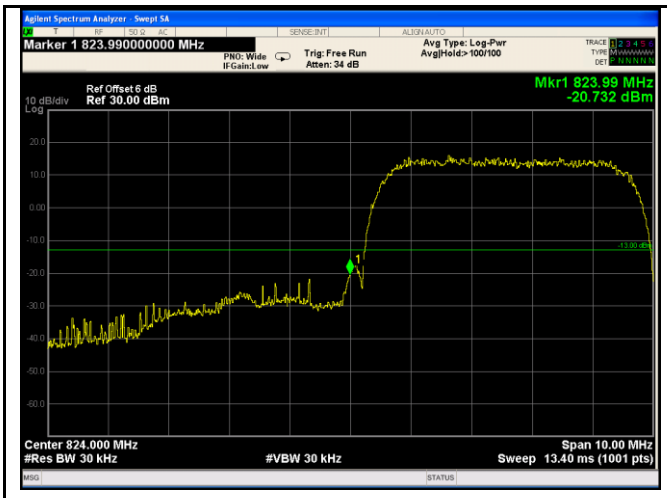
UMTS-FDD Band II - Low Channel

Note: Offset=Cable loss (4.5) + 10log (46.95/30)=4.5+2.0=6.5dB

UMTS-FDD Band II - High Channel

Note: Offset=Cable loss (4.5) + 10log (47.08/30)=4.5+2.0=6.5dB

HSUPA:

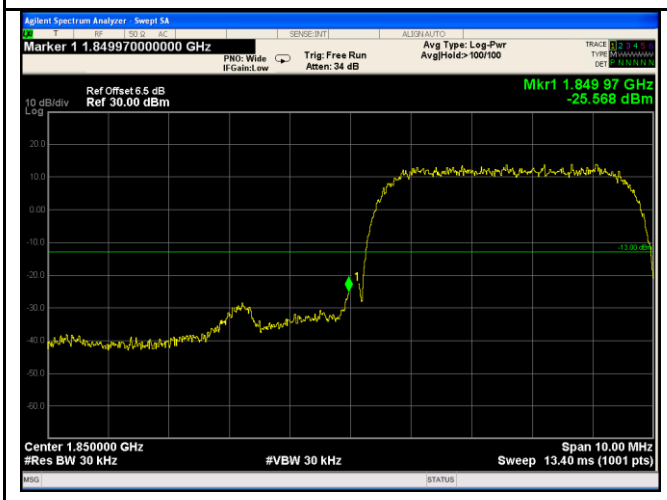


UMTS-FDD Band V - Low Channel

Note: Offset=Cable loss (4.0) + 10log (46.85/30)=4.0+2.0=6.0dB

UMTS-FDD Band V - High Channel

Note: Offset=Cable loss (4.0) + 10log (46.89/30)=4.0+2.0=6.0 dB



UMTS-FDD Band II - Low Channel

Note: Offset=Cable loss (4.5) + 10log (47.14/30)=4.5+2.0=6.5dB

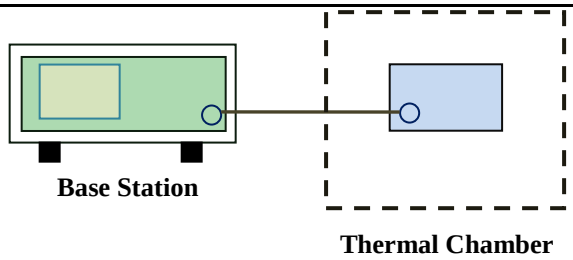
UMTS-FDD Band II - High Channel

Note: Offset=Cable loss (4.5) + 10log (47.02/30)=4.5+2.0=6.5dB

6.8 Frequency Stability

Temperature	26 °C
Relative Humidity	59%
Atmospheric Pressure	1015mbar
Test date :	December 03, 2018
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	14	0.0167	2.5
0		13	0.0155	2.5
10		17	0.0203	2.5
20		14	0.0167	2.5
30		11	0.0131	2.5
40		9	0.0108	2.5
50		17	0.0203	2.5
55		14	0.0167	2.5
25	4.2	17	0.0203	2.5
	3.2	16	0.0191	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	13	0.0069	2.5
0		14	0.0074	2.5
10		11	0.0059	2.5
20		14	0.0074	2.5
30		13	0.0069	2.5
40		15	0.0080	2.5
50		16	0.0085	2.5
55		19	0.0101	2.5
25	4.2	17	0.0090	2.5
	3.2	19	0.0101	2.5

RMC:

UMTS-FDD Band V (Part 22H)

Middle Channel, f_o = 835 MHz				
Temperature (°C)	Power Supplied (V_{DC})	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
-10	3.7	21	0.0251	2.5
0		18	0.0216	2.5
10		16	0.0192	2.5
20		17	0.0204	2.5
30		17	0.0204	2.5
40		16	0.0192	2.5
50		18	0.0216	2.5
55		18	0.0216	2.5
25	4.2	21	0.0251	2.5
	3.2	18	0.0216	2.5

UMTS-FDD Band II (Part 24E)

Middle Channel, f_o = 1880 MHz				
Temperature (°C)	Power Supplied (V_{DC})	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
-10	3.7	22	0.0117	2.5
0		14	0.0074	2.5
10		16	0.0085	2.5
20		17	0.0090	2.5
30		15	0.0080	2.5
40		15	0.0080	2.5
50		18	0.0096	2.5
55		19	0.0101	2.5
25	4.2	20	0.0106	2.5
	3.2	20	0.0106	2.5

Annex A. TEST INSTRUMENT

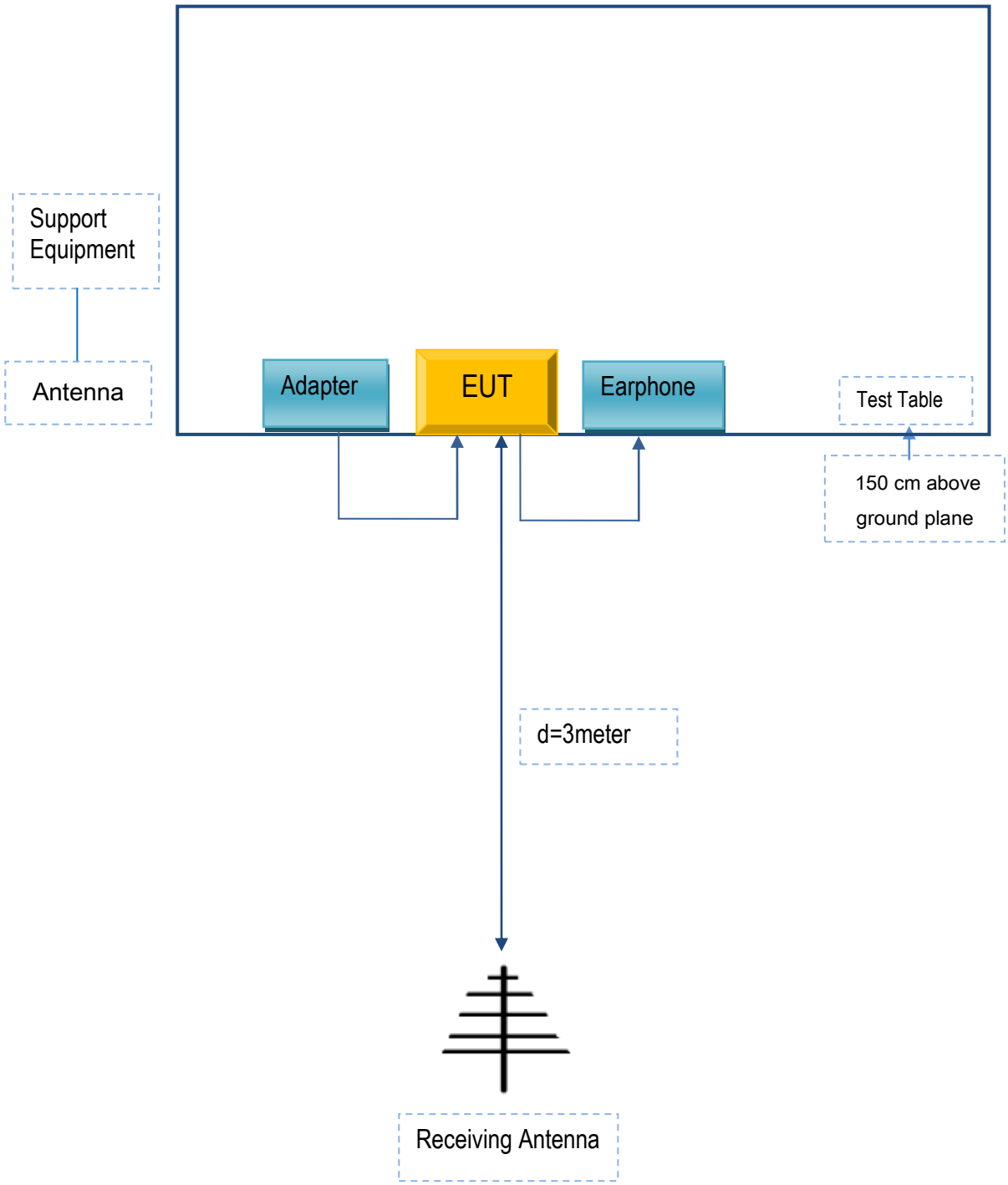
Instrument	Model	Serial #	Cal Date	Cal Due
EMI test receiver	ESL6	100262	01/05/2018	01/04/2019
Active Antenna	AL-130	121031	02/08/2018	02/07/2019
3m Semi-anechoic Chamber	9m*6m*6m	N/A	10/18/2018	10/17/2019
Signal Amplifier	8447E	443008	01/25/2018	01/24/2019
MXA signal analyzer	N9020A	MY49100060	01/05/2018	01/04/2019
Horn Antenna	HAH-118	71259	01/26/2018	01/25/2019
Horn Antenna	HAH-118	71283	02/02/2018	02/01/2019
AMPLIFIER	EM01G26G	60613	01/25/2018	01/24/2019
AMPLIFIER	Emc012645	980077	01/05/2018	01/04/2019
Bilog Antenna (30MHz~6GHz)	JB6	A110712	02/08/2018	02/07/2019
DC Power Supply	E3640A	MY40004013	01/05/2018	01/04/2019
MXA Signal Analyzer	N9020A	MY49100060	01/05/2018	01/04/2019
MXG Vector Signal Generator	N5182A	MY50140530	01/05/2018	01/04/2019
Series Signal Generator	E4421B	US40051152	05/12/2018	05/11/2019
RF control unit	JS0806-0806-2	188060112	04/25/2018	04/24/2019
Wireless Connectivity Tester	CMW270	1201.0002K75-101601-PE	04/25/2018	04/24/2019

Universal Radio Communication Tester	CMU200	121393	01/05/2018	01/04/2019
Programmable Temperature &Humidity Chamber	HYL-TH-225DH	DG-180746	07/16/2018	07/15/2019

Annex B. TEST SETUP AND SUPPORTING EQUIPMENT

Annex B.i. TEST SET UP BLOCK

Block Configuration Diagram for Radiated Emissions



Annex C. SUPPORTING EQUIPMENT DESCRIPTION

The following is a description of supporting equipment and details of cables used with the EUT.

Supporting Equipment:

Manufacturer	Equipment Description	Model	Serial No
Cedar Kingdom Corporation Limited	Adapter	VT701	N/A
Cedar Kingdom Corporation Limited	Earphone	VT701	N/A

Supporting Cable:

Cable type	Shield Type	Ferrite Core	Length	Serial No
USB Cable	Un-shielding	No	0.8m	N/A

Annex C. User Manual / Block Diagram / Schematics / Partlist/ DECLARATION OF SIMILARITY

Please see the attachment