Test Report

Product Name : 1900 MHz Dual-Band Selective Repeater
Model No : TS-OR16RD2-30
FCC ID : U5TTS-OR16RD2

Applicant : Beijing Telestone Technology Co., Ltd.
Address : 6F, Saiou Plaza, NO. 5 Haiying Road ,Fengtai Science Park, Beijing 100070, China

Date of Receipt : 2007/07/03
Issued Date : 2007/08/16
Report No. : 077078R-HPUSP05V01

Test Report Certification

Issued Date: 2007/08/166

Report No.:077078R-HPUSP05V01

Accredited by NIST (NVLAP)
NVLAP Lab Code: 200533-0

Product Name	:	1900 MHz Dual-Band Selective Repeater
Applicant	:	Beijing Telestone Technology Co., Ltd.
Address	:	6F, Saiou Plaza, NO. 5 Haiying Road, Fengtai Science Park, Beijing 100070, China
Manufacturer	:	Beijing Telestone Technology Co., Ltd.
Model No.	:	TS-OR16RD2-30
Rated Voltage	:	AC 120V/60Hz
Trade Name	:	Telestone
Measurement Standard	:	FCC CFR Title 47 Part 2 Part24
Measurement Reference	:	TIA/EIA 603-A
Test Result	:	Complied

Test results relate only to the samples tested.
The test report shall not be reproduced except in full without the written approval of QuieTek Corporation.
This report must not be used to claim product endorsement by NVLAP any agency of the U.S. Government.

Documented By : Nicole Huang
(Engineering Adm. Assistant / Nicole Huang)

Tested By : Shine Hsu
(Senior Engineer / Shine Hsu)

Approved By :
(President / Gene Chang)

註解 [u1]: Refe "TestDate"
註解 [u2]: Refer "RptNo"
註解 [u3]:
註解 [u4]: Refer "Applicant"
註解 [u5]: Refer "ApplyAAdress"
註解 [u6]: Model

TABLE OF CONTENTS

1. GENERAL INFORMATION

1.1. EUT Description

Product Name	:	1900 MHz Dual-Band Selective Repeater
Trade Name	:	Telestone
Model No.	:	TS-OR16RD2-30
FCC ID.	:	U5TTS-OR16RD2
TX Frequency	:	1850 ~ 1910 MHz (WCDMA)
RX Frequency	:	1930 ~ 1990 MHz (WCDMA)
Antenna Type	:	Fixed
Rated Voltage	:	AC 120V/60Hz

1.2. Operational Description

The information contained within this report is intended to show verification of compliance of the WCDMA 1900MHz Repeater to the requirements of 47CFR2 and CFR 24.
The signal from the base station is received via the repeater donor (BS) antenna and is then forwarded through a directional coupler (DC). The signal passes a duplex filter (DPX), is amplified in a low noise amplifier (LNA), and enters the band selective amplifier (BSA), which has two parallel bands.
The first mixer stage on the BSA amplifier, which is controlled by a synthesizer, converts the received frequency down to the IF frequency. The signal is then filtered by a SAW band pass filter and amplified before it is fed to the second mixer stage, controlled by the same synthesizer as the previous one, for converting back to the original frequency. The SAW filter can be adjustable for each BSA has adjustable bandwidth.
A detector on the PA measures continuously the output level. The signal from this detector is used by the automatic level control, ALC, to supervise and, if necessary, reduce the output power to keep it under a setting level.
The output signal passes duplex filter (DPX) and fed to the repeater service (MS) antenna. The uplink signal path, i.e. from the mobile station through the repeater to the base station, is identical to the downlink path the other way round. Only some levels and component values differ.

Frequency Band Range:
1850 – 1910 MHz, Uplink
1930 – 1990 MHz, Downlink
Bandwidth: 0.5 – 20 MHz, Programmable
Gain Adjustment Range: 55 – 85 dB

QuieTek has verified the construction and function in typical operation. All the test modes were carried out with the EUT in normal operation, which was shown in this test report and defined as:
We have pre-tested WCDMA 12.2Kbps RMC and 12.2Kbps AMC modes and found that 12.2Kbps RMC mode is the worst case.
So we define WCDMA 12.2Kbps RMC as the final test mode for WCDMA measurement.

Test Mode:	WCDMA (12.2Kbps RMC)

Pre-tested data at table1 for WCDMA testing mode.

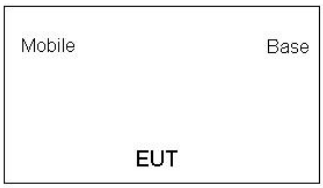
The setup configuration is shown on Figure 1 at section 2.2..
For figure 1, MS output was connected to EUT uplink port through conducted RF cable with an attenuator in between to adjust the maximum input level of EUT to be 13dBm.
For figure 2, CMU-200 output was connected to EUT downlink port and also was adjusted to equal to 13dBm at EUT downlink port.
We set the output power of the EUT for both at uplink and downlink port equaled to 30dBm during the testing, which is maximum output and the worst case for spurious emission and band edge.
From the test measured results on each mode shown on table 1, we found that the spurious emission and band edge were not much difference, which are independent of input power level of the EUT while output power of EUT was fixed at 30dBm by ALC(Auto Level Control) function.
The measured results on radiated emission and band edge at table 1 to 3 show that there are no much difference for input at -55dBm, 0dBm and 13dBm for each different testing mode, which are independent of EUT input power level while output power of EUT was fixed at 30dBm by ALC(Auto Level Control) function.
Based on the measured results, we chose Figure 3 & 4 at section 2.2 as the setup configuration for measuring radiated emission and band edge, since the normal operation should be MS to communicate with Repeater through antenna and also we control the input level received by the Repeater through antenna is between -10 to 10 dBm as long as the received level is in between 13dBm to -55dBm, the measurement results would be no much difference.

Table 1: WCDMA , Channel 1960MHz, 12.2Kbps RMC

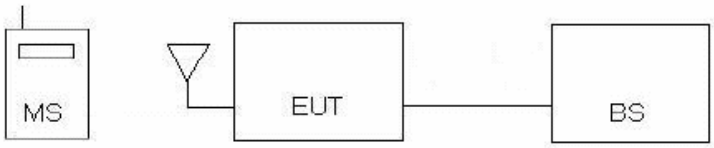
EUT Input level (dBm)	13.1	0	-55
EUT Output Level (dBm)	29.58	29.98	29.53
Highest radiated emission (dBm)	-19.54	-19.32	-19.86
Band edge level at antenna terminal (dBm)	-16.32	-16.99	-16.69

1.3. Configuration of Signal System

(a) Block Diagram



(b) Configuration of measurement



1.4. EUT Setup Procedures

(1) Setup the EUT and simulators as shown on 1.3
(2) Turn on the power of all equipments.
(3) The EUT was set to communicate with BS and MS.
(4) Repeat the above procedure (3).

1.5. Test Facility

Ambient conditions in the laboratory:

Items	Required (IEC 68-1)	Actual
Temperature (°C)	15-35	20-35
Humidity (%RH)	25-75	50-65
Barometric pressure (mbar)	860-1060	950-1000

Site Description: June 22, 2001 File on
Federal Communications Commission
FCC Engineering Laboratory
7435 Oakland Mills Road
Columbia, MD 21046
Reference 31040/SIT1300F2

July 03, 2001 Accreditation on NVLAP
NVLAP Lab Code: 200533-0

Site Name: Quietek Corporation

Site Address: No. 5-22, Ruei-Shu Valley, Ruei-Ping Tsuen,
Lin-Kou Shiang, Taipei,
Taiwan, R.O.C.
TEL: 886-2-8601-3788 / FAX : 886-2-8601-3789
E-Mail : service@quietek.com

1.6. Type of Emission

1M25F9W

2. RF Power Output

2.1. Test Equipment

The following test equipments are used during the RF power output tests:

Equipment	Manufacturer	Model No./ Serial No.	Last Cal.
Spectrum Analyzer	Advantest	R3182/ 100803470	May, 2007
Universal Radio Communication Tester	R & S	CMU200/ 104846	May, 2007
Directional coupler	Agilent	87300C/ 3239A01864	N/A
Directional coupler	Agilent	778D-012/ 50550	N/A

Note: All equipments upon which need to be calibrated are with calibration period of 1 year.

2.2. Test Setup

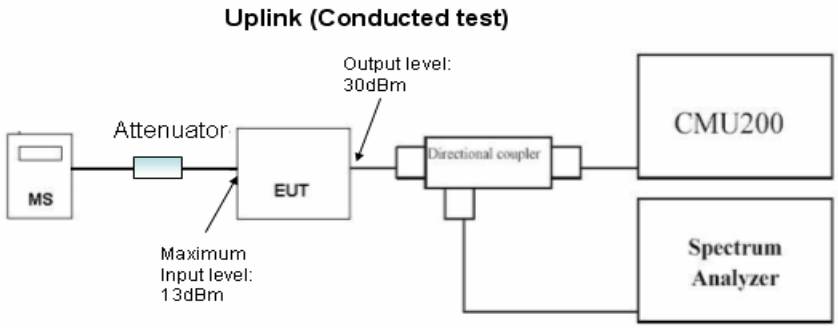


Figure 1.

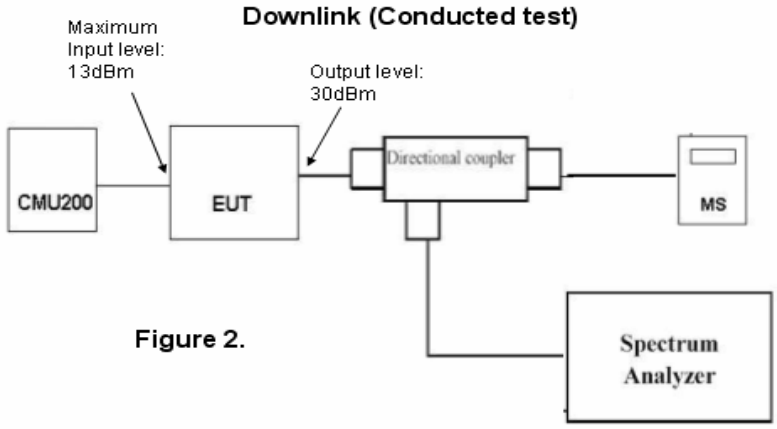
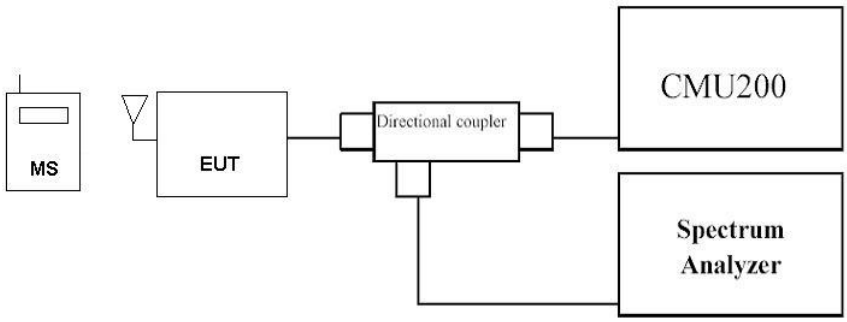
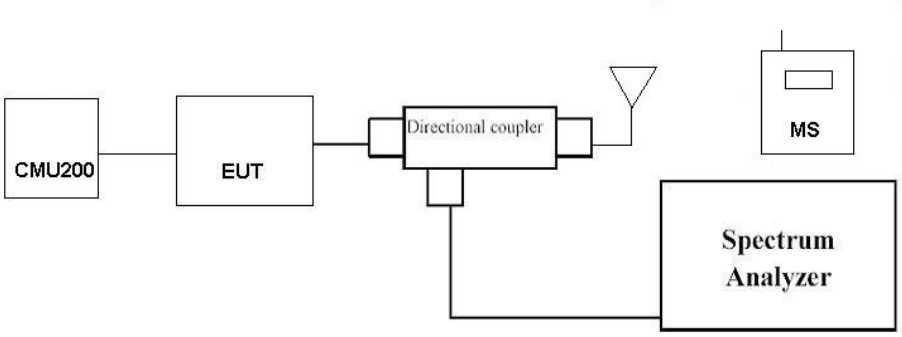


Figure 2.

UPLINK (Figure 3)



DOWNLINK (Figure 4)



2.3. Limits

Limit	**< 500 W ERP**

2.4. Test Procedure

As required by 47 CFR 2.1046, RF power output measurements were made at the RF output terminals using an attenuator and spectrum analyzer. This test was performed with carrier modulated by a WCDMA, modulated signal.

The spectrum analyser RBW and VBW were set to 3MHz and the path loss measured and entered as a reference level offset.

Plots of the RF output Power level of the Digitally modulated carrier, as measured at the RF

output of the signal generator and at the RF output terminals of the EUT appear on the following pages.

2.5. Test Specification

According to Part 2.1046, 24.232.

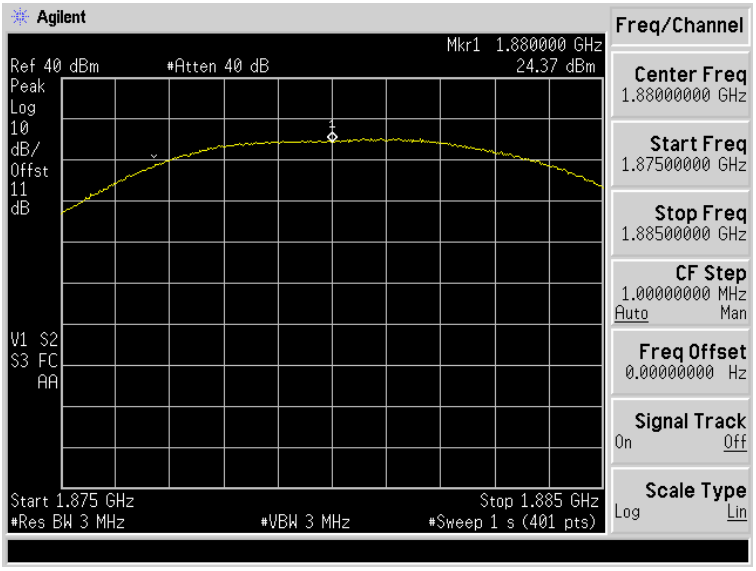
2.6. Test Result of RF Power Output

Product	1900 MHz Dual-Band Selective Repeater		
Test Mode	RF Output Power		
Date of Test	2007/08/14	Test Site	CB4
Test Configuration	WCDMA (12.2Kbps RMC)		

註解 [u7]: Refer “Product”

註解 [u8]: Refer “Testdate”

UPLINK



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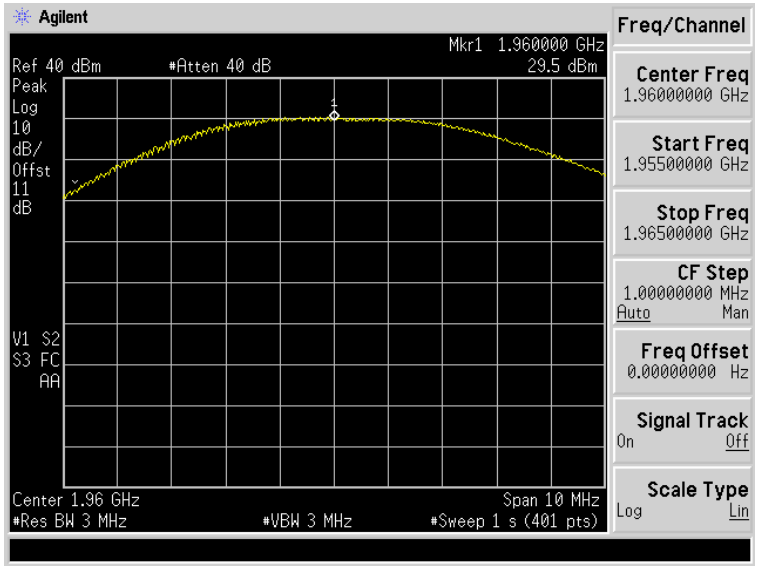


3. Occupied Bandwidth

3.1. Test Equipment

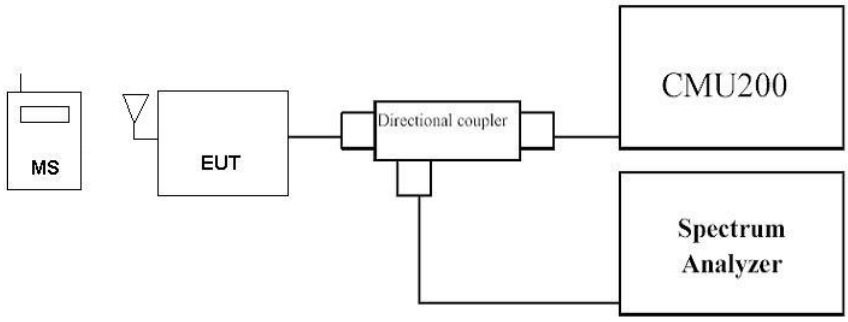
The following test equipments are used during the occupied bandwidth tests:

Equipment	Manufacturer	Model No./ Serial No.	Last Cal.
Spectrum Analyzer	Advantest	R3182/ 100803470	May, 2007
Universal Radio Communication Tester	R & S	CMU200/ 104846	May, 2007
Directional coupler	Agilent	87300C/ 3239A01864	N/A
Directional coupler	Agilent	778D-012/ 50550	N/A

Note: All equipments upon which need to be calibrated are with calibration period of 1 year.

3.2. Test Setup

UPLINK



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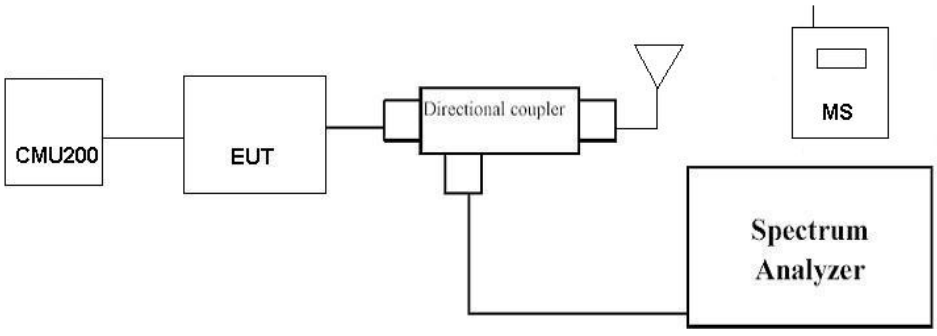


3.3. Test Procedure

The EUT was set to transmit on maximum power, using a resolution bandwidth of 100kHz and a video bandwidth of 300kHz, the -26dBc points were established and the emission bandwidth determined.

The plots below show the resultant display from the Spectrum Analyser.

3.4. Test Specification

According to Part 2.1049, 24.238.

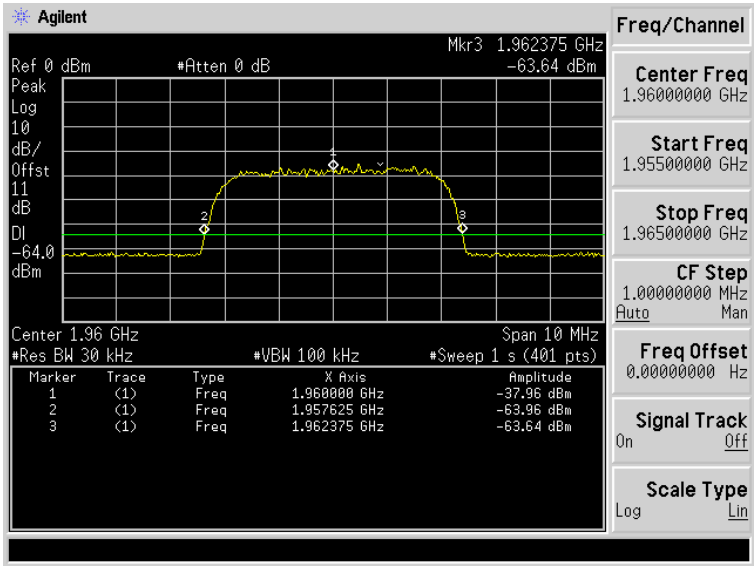
3.5. Test Result of Occupied Bandwidth

Product	1900 MHz Dual-Band Selective Repeater		
Test Mode	Occupied Bandwidth		
Date of Test	2007/08/14	Test Site	CB4
Test Configuration	WCDMA (12.2Kbps RMC)		

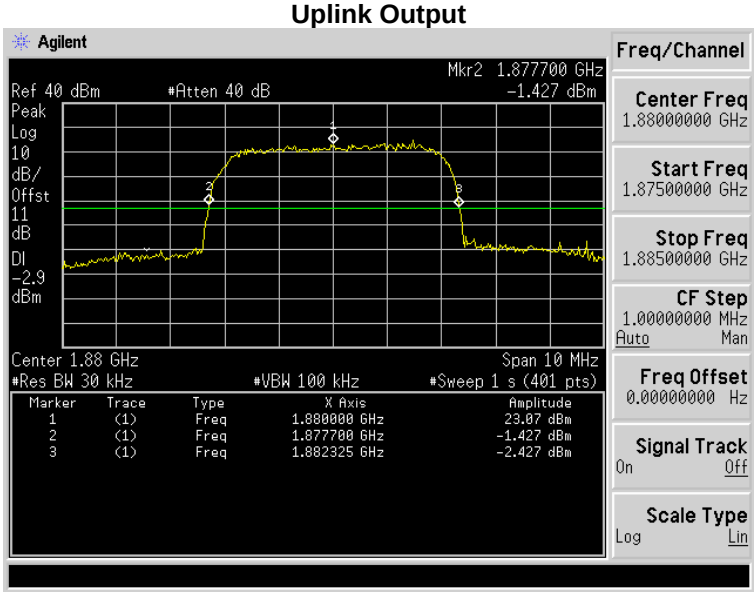
註解 [u9]: Refer “Product”

註解 [u10]: Refer “Testdate”

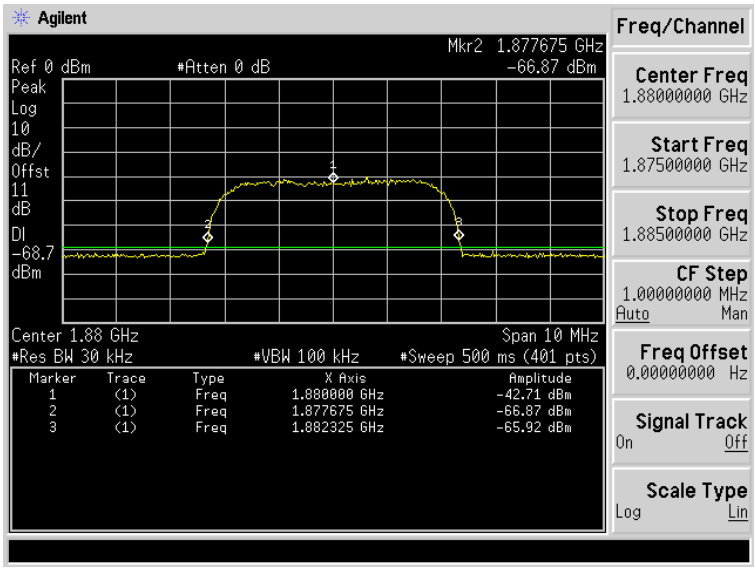
Uplink Input



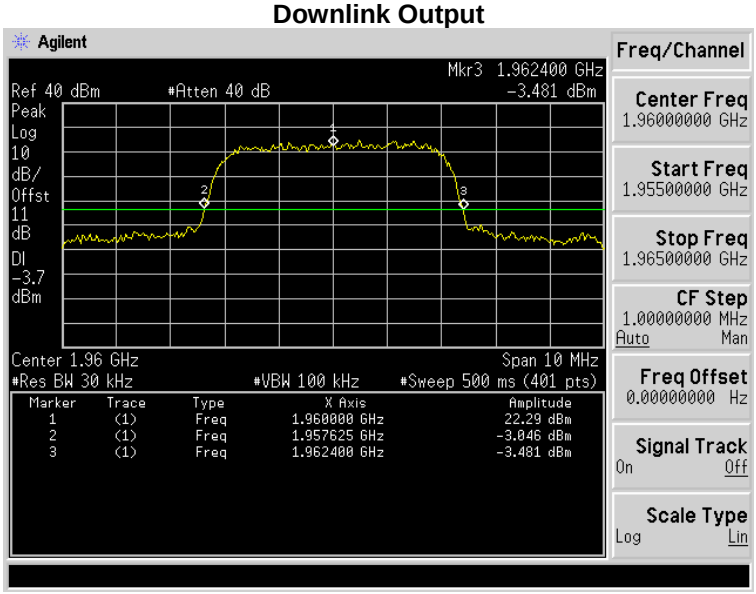
Uplink Output



Downlink Input



Downlink Output



4. Spurious Emission At Antenna Terminals

4.1. Test Equipment

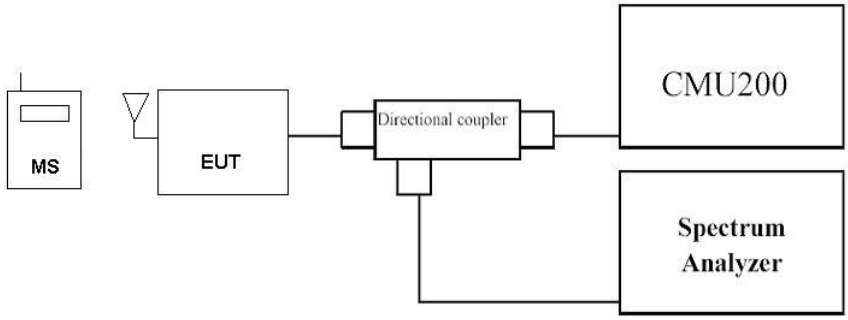
The following test equipments are used during the spurious emission test

Equipment	Manufacturer	Model No./ Serial No.	Last Cal.
Spectrum Analyzer	Advantest	R3182/ 100803470	May, 2007
Universal Radio Communication Tester	R & S	CMU200/ 104846	May, 2007
Directional coupler	Agilent	87300C/ 3239A01864	N/A
Directional coupler	Agilent	778D-012/ 50550	N/A

Note: All equipments upon which need to be calibrated are with calibration period of 1 year.

4.2. Setup

UPLINK



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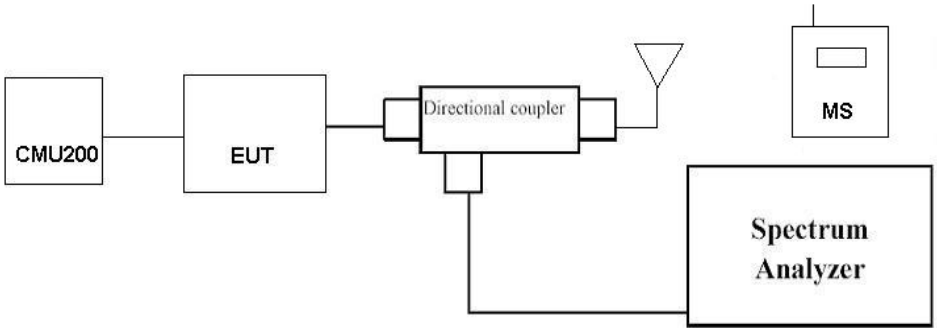


4.3. Limits

The mean power of emissions must be attenuated below the mean power of the unmodulated carrier on any frequency twice or more than twice the fundamental emission by at least 43 + 10 log P. This is equivalent to -13 dBm absolute power.

4.4. Test Procedure

As required by 47 CFR 2.1051, spurious emissions at antenna terminal measurements were made at the RF output terminals using a attenuator and spectrum analyzer set for a 30kHz bandwidth. This test was performed with digitally modulated carrier signals. The digital signal generator was adjusted for continuous transmit on frequencies in both the uplink and downlink frequency bands. The frequency spectrum was investigated from 9 KHz to 20 GHz. For measuring emissions above 2 GHz, a high-pass filter was used to eliminate the fundamental transmit frequency to prevent possible saturation effects on the front end of the spectrum analyzer.

4.5. Test Specification

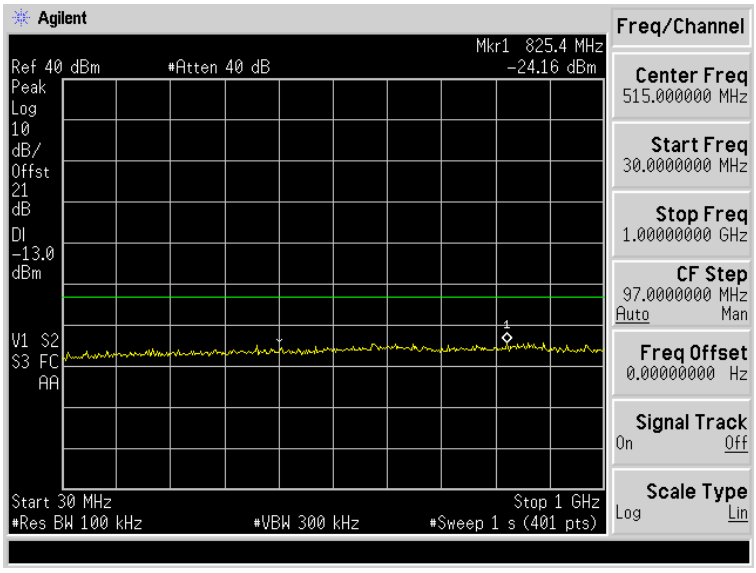
According to Part 2.1051, 24.238.

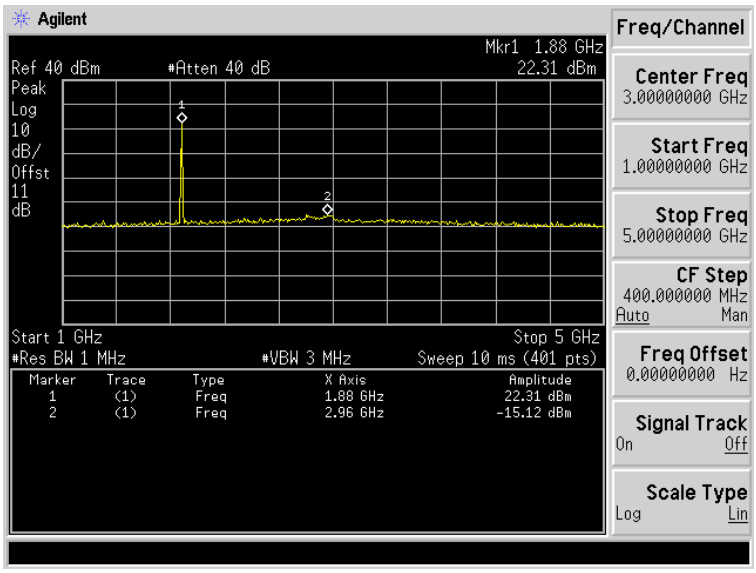
4.6. Test Result of Spurious Emission At Antenna Terminals

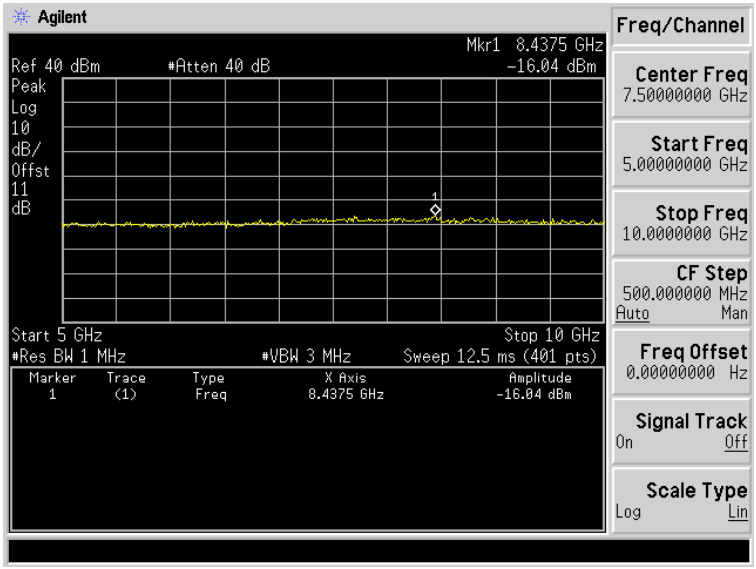
Product	1900 MHz Dual-Band Selective Repeater		
Test Mode	Spurious Emission At Antenna Terminals		
Date of Test	2007/08/14	Test Site	CB4
Test Configuration	WCDMA (12.2Kbps RMC)		

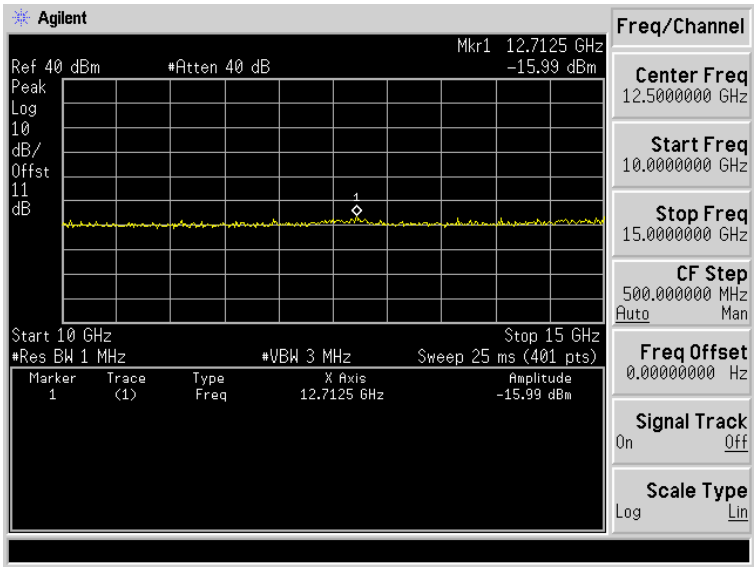
註解 [u11]: Refer “Testdate”

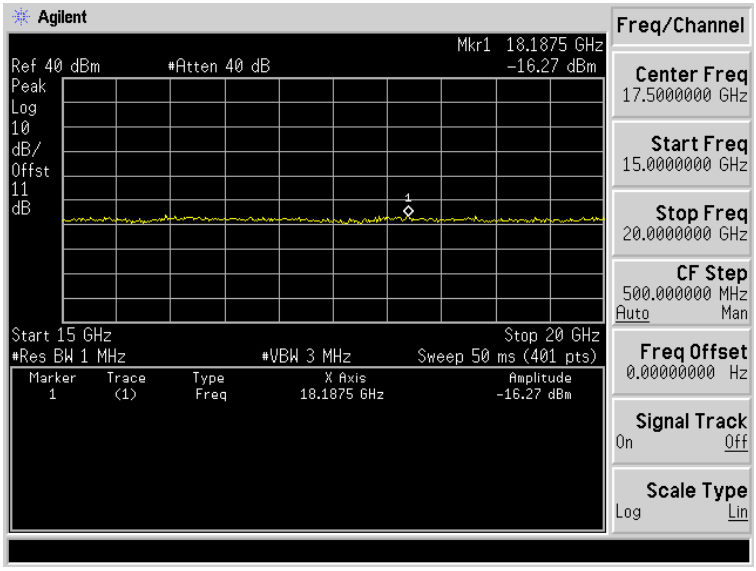
Uplink



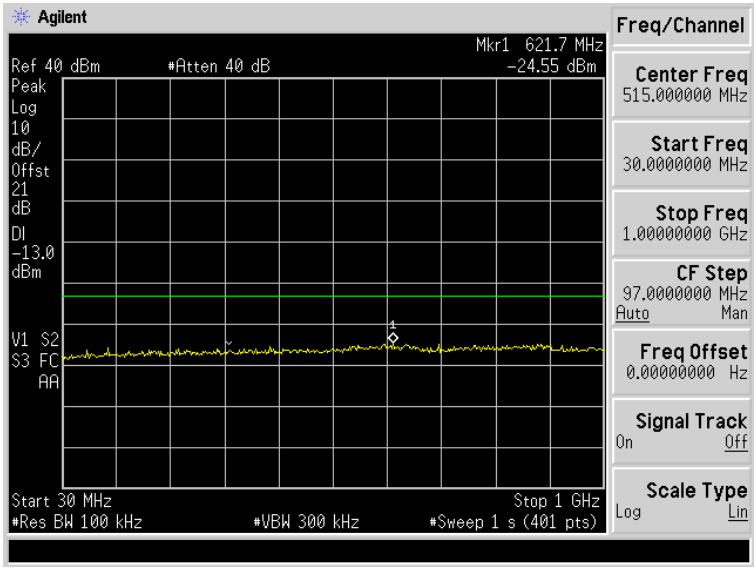


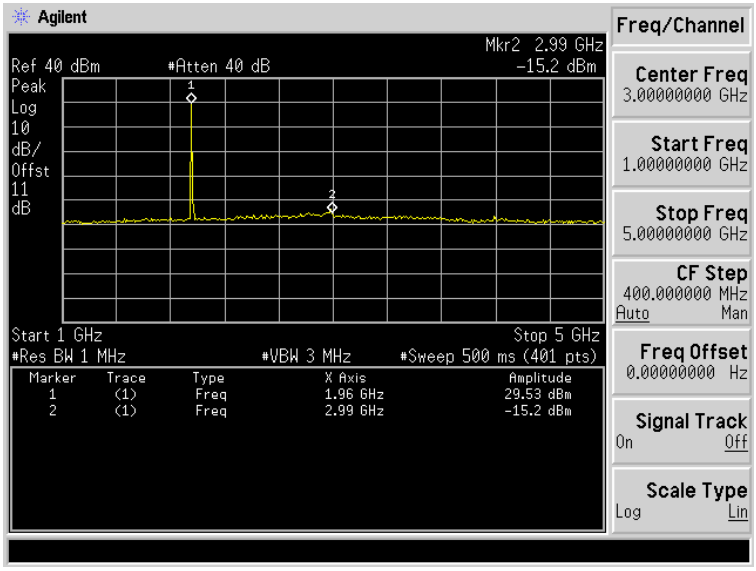

Agilent
Mkr1 8.4375 GHz
Ref 40 dBm
#Atten 40 dB
-16.04 dBm
Peak
Log
10
dB/
Offst
11
dB
Start 5 GHz
Stop 10 GHz
#Res BW 1 MHz
#VBW 3 MHz
Sweep 12.5 ms (401 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 8.4375 GHz -16.04 dBm
Freq/Channel
Center Freq
7.50000000 GHz
Start Freq
5.00000000 GHz
Stop Freq
10.0000000 GHz
CF Step
500.000000 MHz
Auto Man
Freq Offset
0.00000000 Hz
Signal Track
On Off
Scale Type
Log Lin

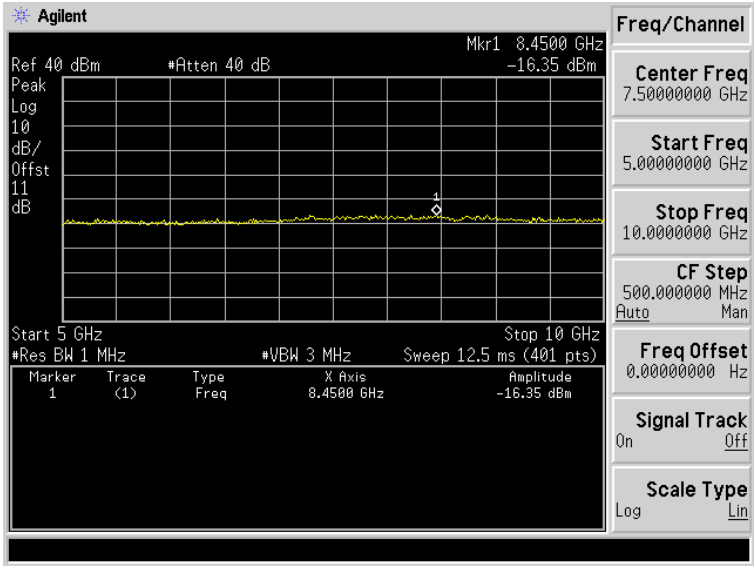

Agilent
Mkr1 12.7125 GHz
Ref 40 dBm
#Atten 40 dB
-15.99 dBm
Peak
Log
10
dB/
Offst
11
dB
Start 10 GHz
Stop 15 GHz
#Res BW 1 MHz
#VBW 3 MHz
Sweep 25 ms (401 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 12.7125 GHz -15.99 dBm
Freq/Channel
Center Freq
12.5000000 GHz
Start Freq
10.0000000 GHz
Stop Freq
15.0000000 GHz
CF Step
500.000000 MHz
Auto Man
Freq Offset
0.00000000 Hz
Signal Track
On Off
Scale Type
Log Lin

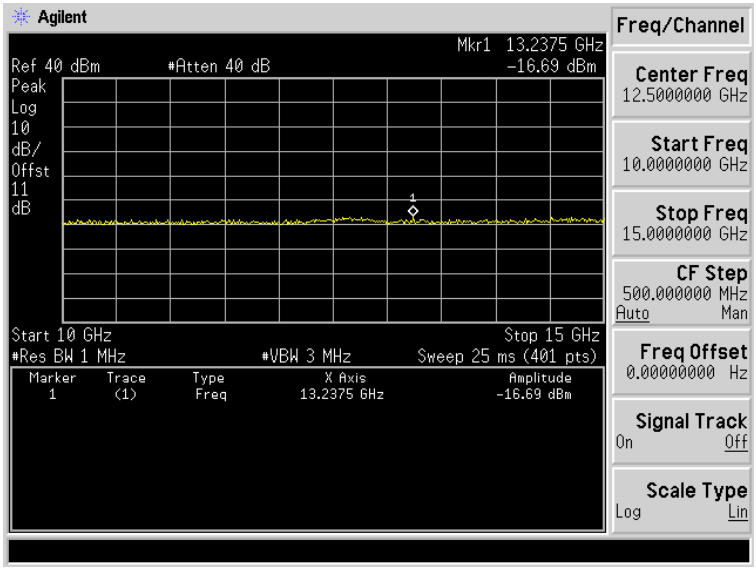

Agilent
Mkr1 18.1875 GHz
Ref 40 dBm
#Atten 40 dB
-16.27 dBm
Peak
Log
10
dB/
Offst
11
dB
Start 15 GHz
#Res BW 1 MHz
#VBW 3 MHz
Stop 20 GHz
Sweep 50 ms (401 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 18.1875 GHz -16.27 dBm
Freq/Channel
Center Freq
17.5000000 GHz
Start Freq
15.0000000 GHz
Stop Freq
20.0000000 GHz
CF Step
500.000000 MHz
Auto Man
Freq Offset
0.00000000 Hz
Signal Track
On Off
Scale Type
Log Lin

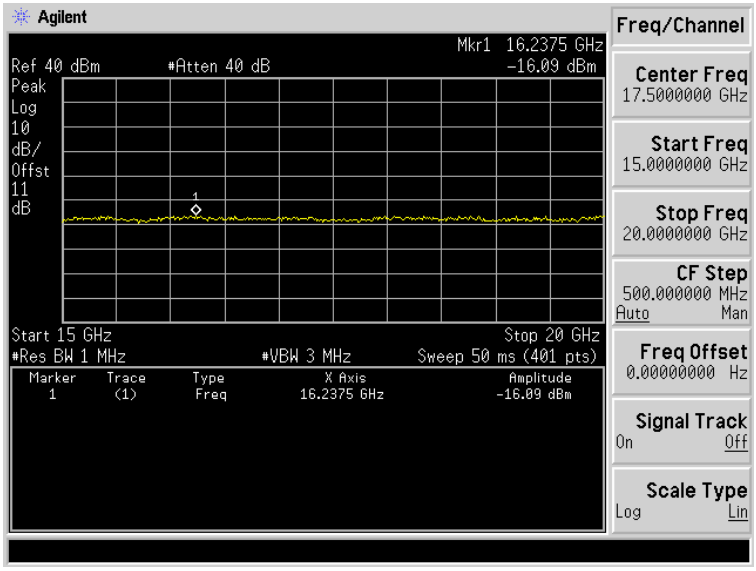
Downlink


Agilent
Mkr1 621.7 MHz
Ref 40 dBm
#Atten 40 dB
-24.55 dBm
Peak
Log
10
dB/
Offst
21
dB
Dl
-13.0
dBm
V1 S2
S3 FC
AA
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 1 GHz
#Sweep 1 s (401 pts)
Freq/Channel
Center Freq
515.000000 MHz
Start Freq
30.0000000 MHz
Stop Freq
1.00000000 GHz
CF Step
97.0000000 MHz
Auto Man
Freq Offset
0.00000000 Hz
Signal Track
On Off
Scale Type
Log Lin


Agilent
Mkr2 2.99 GHz
Ref 40 dBm
#Atten 40 dB
-15.2 dBm
Peak
Log
10
dB/
Offst
11
dB
Start 1 GHz
#Res BW 1 MHz
#VBW 3 MHz
Stop 5 GHz
#Sweep 500 ms (401 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 1.96 GHz 29.53 dBm
2 (1) Freq 2.99 GHz -15.2 dBm
Freq/Channel
Center Freq
3.00000000 GHz
Start Freq
1.00000000 GHz
Stop Freq
5.00000000 GHz
CF Step
400.000000 MHz
Auto Man
Freq Offset
0.00000000 Hz
Signal Track
On Off
Scale Type
Log Lin


Agilent
Mkr1 8.4500 GHz
Ref 40 dBm
#Atten 40 dB
-16.35 dBm
Peak
Log
10
dB/
Offst
11
dB
Start 5 GHz
#Res BW 1 MHz
#VBW 3 MHz
Stop 10 GHz
Sweep 12.5 ms (401 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 8.4500 GHz -16.35 dBm
Freq/Channel
Center Freq
7.50000000 GHz
Start Freq
5.00000000 GHz
Stop Freq
10.0000000 GHz
CF Step
500.000000 MHz
Auto Man
Freq Offset
0.00000000 Hz
Signal Track
On Off
Scale Type
Log Lin

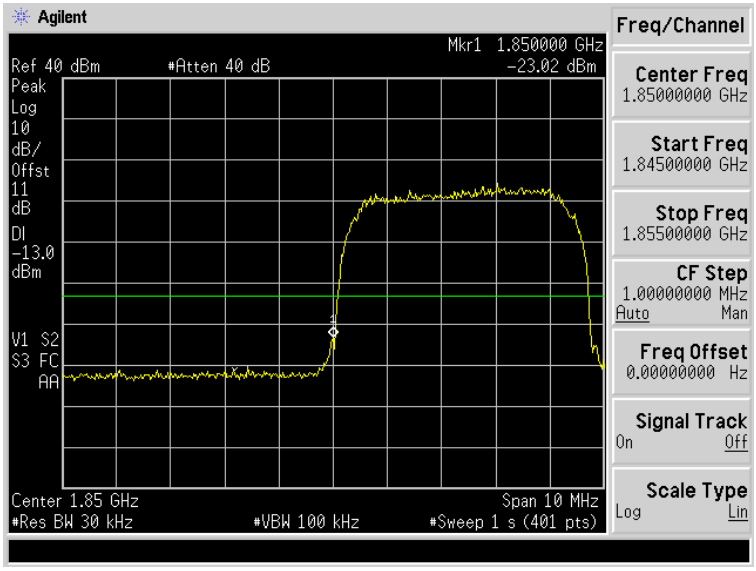

Agilent
Mkr1 13.2375 GHz
Ref 40 dBm
#Atten 40 dB
-16.69 dBm
Peak
Log
10
dB/
Offst
11
dB
Start 10 GHz
Stop 15 GHz
#Res BW 1 MHz
#VBW 3 MHz
Sweep 25 ms (401 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 13.2375 GHz -16.69 dBm
Freq/Channel
Center Freq
12.5000000 GHz
Start Freq
10.0000000 GHz
Stop Freq
15.0000000 GHz
CF Step
500.000000 MHz
Auto Man
Freq Offset
0.00000000 Hz
Signal Track
On Off
Scale Type
Log Lin


Agilent
Mkr1 16.2375 GHz
Ref 40 dBm
#Atten 40 dB
-16.09 dBm
Peak
Log
10
dB/
Offst
11
dB
Start 15 GHz
Stop 20 GHz
#Res BW 1 MHz
#VBW 3 MHz
Sweep 50 ms (401 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 16.2375 GHz -16.09 dBm
Freq/Channel
Center Freq
17.5000000 GHz
Start Freq
15.0000000 GHz
Stop Freq
20.0000000 GHz
CF Step
500.000000 MHz
Auto Man
Freq Offset
0.00000000 Hz
Signal Track
On Off
Scale Type
Log Lin

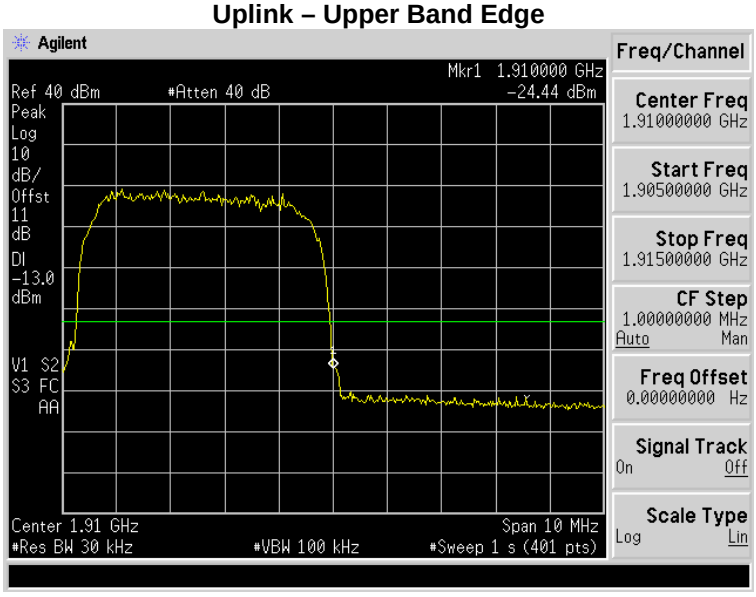
Product	1900 MHz Dual-Band Selective Repeater		
Test Mode	Spurious Emission At Antenna Terminals		
Date of Test	2007/08/14	Test Site	CB4
Test Configuration	WCDMA (12.2Kbps RMC), Band Edge Test		

註解 [u12]: Refer “Testdate”

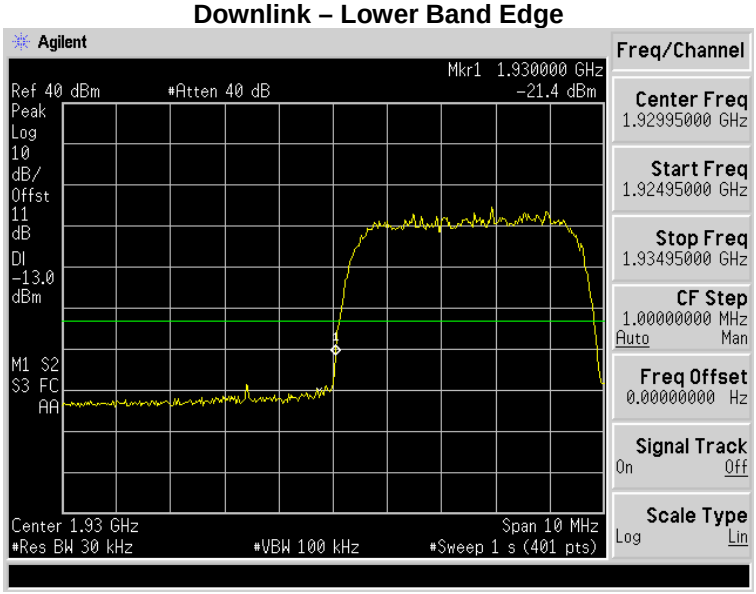
Uplink – Lower Band Edge



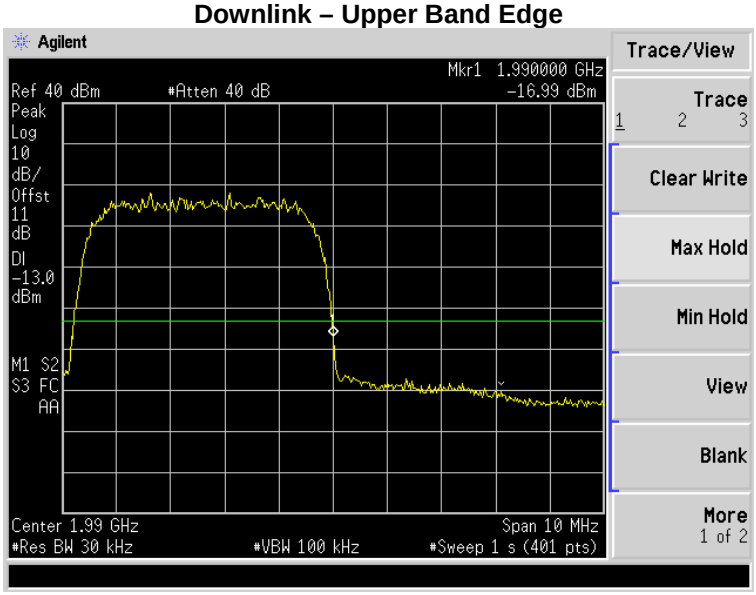
Uplink – Upper Band Edge



Downlink – Lower Band Edge



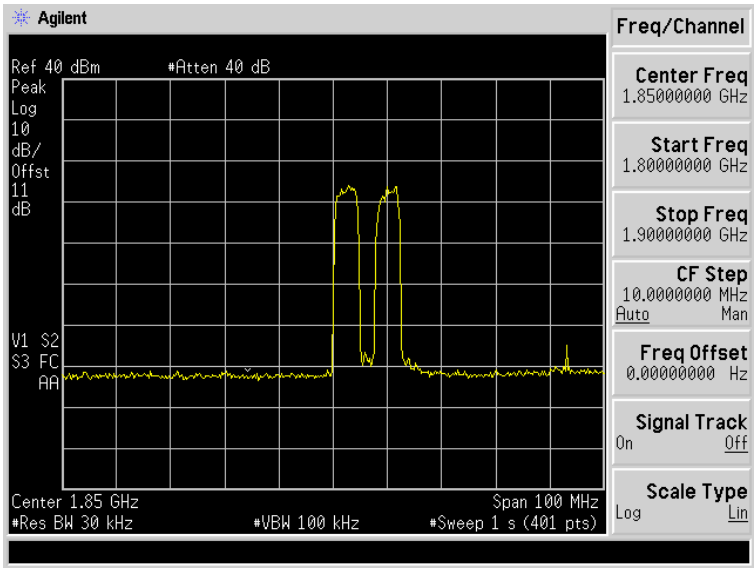
Downlink – Upper Band Edge



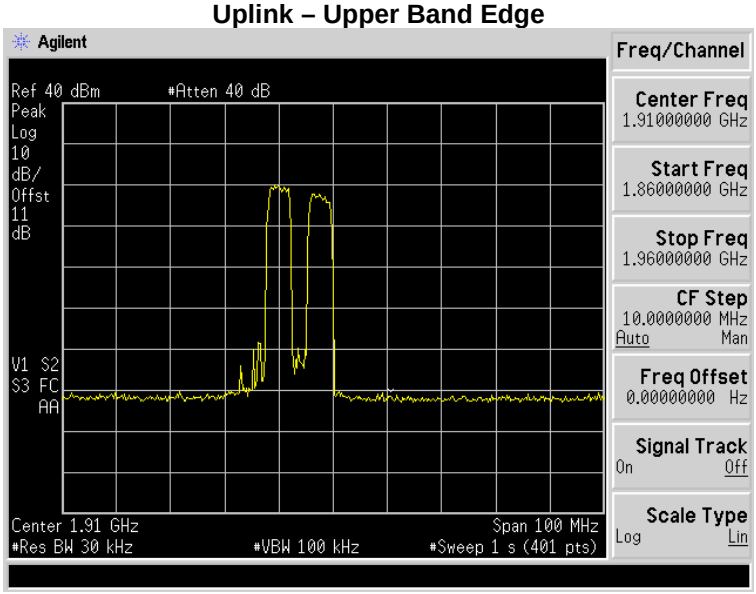
Product	1900 MHz Dual-Band Selective Repeater		
Test Mode	Spurious Emission At Antenna Terminals		
Date of Test	2007/08/14	Test Site	CB4
Test Configuration	WCDMA (12.2Kbps RMC), Intermodulation Characteristics		

註解 [u13]: Refer “Testdate”

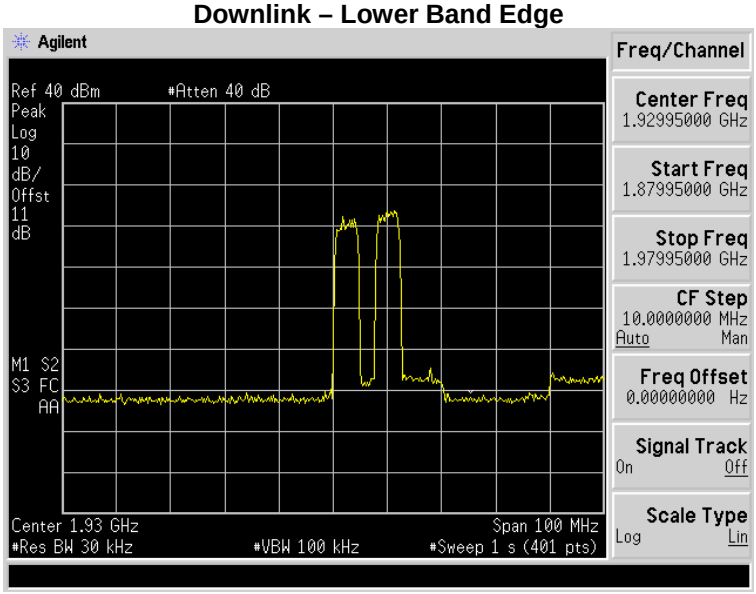
Uplink – Lower Band Edge



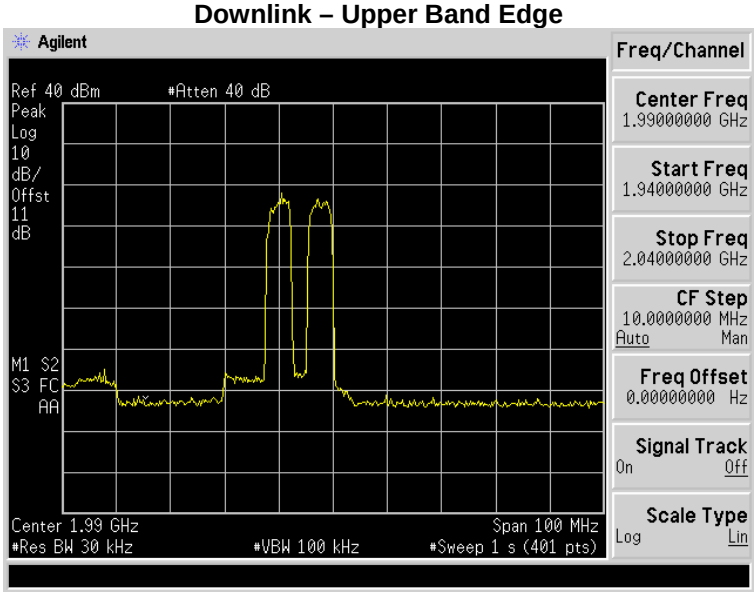
Uplink – Upper Band Edge



Downlink – Lower Band Edge



Downlink – Upper Band Edge



Note:

Inband and Out of band Intermodulation

5. Spurious Emission

5.1. Test Equipment

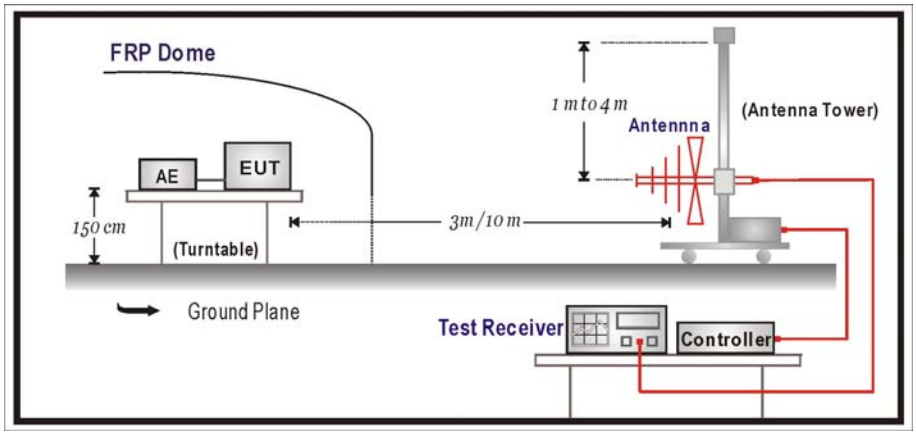
The following test equipments are used during the radiated emission test:

Test Site	Equipment	Manufacturer	Model No./ Serial No.	Last Cal.
☒OATS 3	Test Receiver	R & S	ESCS 30/ 100122	Feb., 2007
	Universal Radio Communication Tester	R & S	CMU200/ 104846	May, 2007
	Spectrum Analyzer	Advantest	R3162/ 120300652	Feb., 2007
	Pre-Amplifier	QTK	QTK-AMP-03/ 0003	May, 2007
	Bilog Antenna	SCHAFFNER	CBL6112B/ 2697	May, 2007
	Horn Antenna	ETS	3115/ 0005-6160	Jul., 2007
	Pre-Amplifier	QTK	QTK-AMP-01/ 0001	Jul., 2007

Note: 1. All equipments that need to be calibrated are with calibration period of 1 year.
2. Mark "X" test instruments are used to measure the final test results.

5.2. Test Setup

Field strength of spurious radiation.



5.3. Limits

Limit	**<-13dBm**

43 + 10Log(P) down on the carrier where P is the power in Watts.

5.4. Test Procedure

In accordance with Part 2.1051, the spurious emissions from the antenna terminal were measured. The transmitter output power was attenuated using a combination of filters and attenuators and the frequency spectrum investigated from 9 kHz to 20 GHz. The EUT was set to transmit on full power. The resolution and video bandwidth was set to 1MHz in accordance with Part 24.238. The spectrum analyzer detector was set to Max Hold. In addition, measurements were made up to the 10th harmonic of the fundamental.

The EUT is placed on a turn table which is 1.5 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters. The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level.
Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to TIA/EIA 603-A on radiated measurement.
A log-periodic antenna or double-ridged waveguide horn antenna is substituted in place of the EUT. The log-periodic antenna is driven by a signal generator and the level will be adjusted till the same power value on the spectrum analyzer or receiver. The EIRP of the EUT can be calculated through the level of the signal generator, cable loss, the gain of the substitution antenna and the reading of the spectrum analyzer or receiver.
Calculation procedure:
The radiated spurious emissions is calculated by adding antenna gain and reducing cable loss to the signal generator level. The basic equation with a sample calculation is as followed:
P=SL - CL + G Where
P: Radiated Spurious Emissions (dBm)
SL: Signal generator level (dBm),
CL: Cable Lose (dB) ,
G: Antenna Gain (dBi)

5.5. Test Specification

According to Part 2.1051, 2.1053, 24.238.

5.6. Test Result of Spurious Emission

Product	1900 MHz Dual-Band Selective Repeater		
Test Mode	Spurious Emission		
Date of Test	2007/08/14	Test Site	No.3 OATS
Test Configuration	WCDMA (12.2Kbps RMC)	Test Range	9KHz ~20GHz

註解 [u14]: Refer "Product"

註解 [u15]: Refer "Testdate"

Frequency	Reading Level	Signal Generator Level	Cable Loss	Antenna Gain	ERP Value	Limit
(MHz)	(dBm)	(dBm)	(dB)	(dBi)	(dBm)	(dBm)

Horizontal Emissions

3760	-65.55	-65.15	1.41	12.6	-53.96	-13
5640	-67.26	-65.82	1.56	13.1	-54.28	-13
7520	-67.03	-65.47	2.01	11.5	-55.98	-13
9400	-66.01	-65.65	2.74	12	-56.39	-13
11287.5	-65.4	-65.78	2.64	12	-56.42	-13
13160	-66.51	-65.18	2.36	13.3	-54.24	-13
15040	-61.55	-44.74	3.16	13.7	-34.20	-13
16925	-63.03	-53.73	3.3	15.3	-41.74	-13
18800	-61.71	-25.59	3.16	8.9	-19.86	-13

Vertical Emissions

3760	-65.86	-65.72	1.41	12.6	-54.53	-13
5640	-66.44	-65.67	1.56	13.1	-54.13	-13
7520	-66.33	-65.28	2.01	11.5	-55.79	-13
9400	-66.07	-65.41	2.74	12	-56.15	-13
11287.5	-66.62	-65.82	2.64	12	-56.46	-13
13160	-66.07	-65.08	2.36	13.3	-54.14	-13
15040	-62.6	-52.18	3.16	13.7	-41.64	-13
16925	-63.1	-55.03	3.3	15.3	-43.04	-13
18800	-62.16	-29.00	3.16	8.9	-23.27	-13

Note:

1. Receiver setting (Peak Detector) : RBW:1MHz; VBW:3MHz。

2. ERP Value = Signal Generator Level + Antenna Gain - Cable Loss

6. EMI Reduction Method During Compliance Testing

No modification was made during testing.

Attachment 1: EUT Test Photographs
Attachment 2: EUT Detailed Photographs