

TEST REPORT

of

FCC Part 22 Subpart H and Part 24 Subpart E

FCC ID: TQ8-AT240A5AN

Equipment Under Test : DIGITAL CAR AVNT SYSTEM

Model Name : AT240A5AN

Applicant : HYUNDAI MOBIS CO., LTD.

Manufacturer : HYUNDAI MOBIS CO., LTD.

Date of Test(s) : 2014.06.23 ~ 2014.06.30

Date of Issue : 2014.07.11

In the configuration tested, the EUT complied with the standards specified above.

Tested By:



Date:

2014.07.11

Wonjun Sim

Approved By:



Date:

2014.07.11

Hyunchae You

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1. General information

1.1. Testing laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)

- Wireless Div. 2FL, 10-2, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 435-837

All SGS services are rendered in accordance with the applicable SGS conditions of service available on request and accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx>.

Telephone : +82 31 428 5700

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1.2. Details of applicant

Applicant : Hyundai MOBIS Co., Ltd.
Address : 203, Teheran-ro, Gangnam-gu, Seoul, 135-977, Korea
Contact Person : Choi, Seung-Hun
Phone No. : +82 31 260 0098

1.3. Description of EUT

Kind of Product	DIGITAL CAR AVNT SYSTEM
Model Name	AT240A5AN
Power Supply	DC 14.4 V (Vehicle Battery)
Rated Power	CDMA850: 24 dB m CDMA1 900: 24 dB m
Frequency Range	CDMA850: 824.70 MHz ~ 848.31 MHz CDMA1900: 1 851.25 MHz ~ 1 908.75 MHz
Antenna Gain	CDMA850: 2.99 dB i CDMA1 900: 5.09 dB i
Support Mode	1xRTT, 1xEV-DO
Emission Designator	CDMA850 (1xRTT): 1M27F9W CDMA1 900 (1xRTT): 1M28F9W CDMA850 (1xEV-DO): 1M27F9W CDMA1 900 (1xEV-DO): 1M28F9W

1.4. Declaration by the manufacturer

- N/A

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RTT5041-20(2014.01.20)(2)

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A4(210 mm x 297 mm)

1.5. Description of test mode

The transmitter has a maximum average output power as follows:

1xRTT

Cellular Band

Frequency (MHz)	Service Option (SO)	Channel	Average Output Power (dB m)
824.70	RC2 9 (Loopback)	1 013	23.15
836.52		384	23.18
848.31		777	23.17

PCS Band

Frequency (MHz)	Service Option (SO)	Channel	Average Output Power (dB m)
1 851.25	RC3 32 (+F-SCH)	25	23.17
1 880.00		600	23.18
1 908.75		1 175	23.20

1xEV-DO Release 0

Cellular Band - RTAP

Frequency (MHz)	RTAP Rate	Channel	Average Output Power (dB m)
824.70	9.6	1 013	23.32
836.52		384	23.49
848.31		777	23.74

PCS Band - RTAP

Frequency (MHz)	RTAP Rate	Channel	Average Output Power (dB m)
1 851.25	9.6	25	23.22
1 880.00		600	23.2
1 908.75		1 175	23.27

CDMA (850 / 1 900)

We found out the test mode with the highest power level after we investigated average output power of all the modulations and (or) data rates for each mode. So we chose below test mode as a representative of worst case.

- CDMA (850) 1xRTT : RC2 / 9 (Loopback), 1xEV-DO Rel0 : RTAP / 9.6
- CDMA (1 900) 1xRTT : RC3 / 32 (+F-SCH), 1xEV-DO Rel0 : RTAP / 9.6

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1.6. Sample calculation for offset

Where relevant, the following sample calculation is provided:

1.6.1. Conducted test

Offset value (dB) = Directional Coupler (dB) + Attenuator (dB) + Cable loss (dB)

1.6.2. Radiation test

E.R.P. & E.I.R.P. = [S.G level + Amp.](dB m) - Cable loss(dB) + Ant. gain (dB d/dB i)

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1.7. Test equipment list

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Interval	Cal. Due.
Signal Generator	R&S	8648D	3847M00534	Mar. 27, 2014	Annual	Mar. 27, 2015
Signal Generator	R&S	SMR40	100272	Aug. 10, 2013	Annual	Aug. 10, 2014
Spectrum Analyzer	Agilent	N9030A	US51350132	Oct. 08, 2013	Annual	Oct. 08, 2014
Mobile Test Unit	Agilent	E5515C	GB43345198	Mar. 28, 2014	Annual	Mar. 28, 2015
Directional Coupler	KRYTAR	152613	122660	Jun. 10, 2014	Annual	Jun. 10, 2015
Low Pass Filter	Mini circuits	NLP-1200+	V8979400903-2	Mar. 21, 2014	Annual	Mar. 21, 2015
High Pass Filter	Wainwright	WHK3.0/18G-10SS	344	Jun. 10, 2014	Annual	Jun. 10, 2015
High Pass Filter	Wainwright	WHKX1.5/15G-6SS	4	Mar. 18, 2014	Annual	Mar. 18, 2015
DC Power Supply	Agilent	U8002A	MY50060028	Mar. 27, 2014	Annual	Mar. 27, 2015
Preamplifier	H.P.	8447D	2944A07087	Jan. 06, 2014	Annual	Jan. 06, 2015
Preamplifier	R&S	SCU 18	1391123	Jan. 14, 2014	Annual	Jan. 14, 2015
Preamplifier	MITEQ Inc.	JS44-18004000-35-8P	1546891	Apr. 28, 2014	Annual	Apr. 28, 2015
Test Receiver	R&S	ESU26	100109	Jun. 16, 2014	Annual	Jun. 16, 2015
Bilog Antenna	SCHWARZBECK MESSELEKTRONIK	VULB9163	396	Jun. 16, 2014	Biennial	Jun. 16, 2016
Horn Antenna	R&S	HF906	100326	Apr. 10, 2013	Biennial	Apr. 10, 2015
Horn Antenna	SCHWARZBECK MESSELEKTRONIK	BBHA9170	BBHA9170431	May 15, 2014	Biennial	May 15, 2016
Dipole Antenna	SCHWARZBECK MESSELEKTRONIK	VHA 9103	9103-2817	May 09, 2013	Biennial	May 09, 2015
Dipole Antenna	SCHWARZBECK MESSELEKTRONIK	UHA 9105	9105-2514	May 09, 2013	Biennial	May 09, 2015
Antenna Master	INNCO	MM4000	N/A	N.C.R.	N/A	N.C.R.
Turn Table	INNCO	DS 1200S	N/A	N.C.R.	N/A	N.C.R.
Anechoic Chamber	SY Corporation	L × W × H (9.6 m × 6.4 m × 6.4 m)	N/A	N.C.R.	N/A	N.C.R.

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1.8. Summary of test results

The EUT has been tested according to the following specifications:

APPLIED STANDARD : FCC Part 22 Subpart H, Part 24 Subpart E		
Section in FCC part	Test Item	Result
§2.1046 §22.913(a) §24.232(c)	RF Radiated Output Power	Complied
§2.1053 §22.917(a) §24.238(a)	Spurious Radiated Emission	Complied
§2.1046	Conducted Output Power	Complied
§2.1049	Occupied Bandwidth	Complied
§24.232(d)	Peak-Average Ratio	Complied
§2.1051 §22.917(a) §24.238(a)	Spurious Emission at Antenna Terminal	Complied
§2.1055 §22.355 §24.235	Frequency Stability	Complied
§22.917(a) §24.238(a)	Band Edge	Complied

1.9. Test report revision

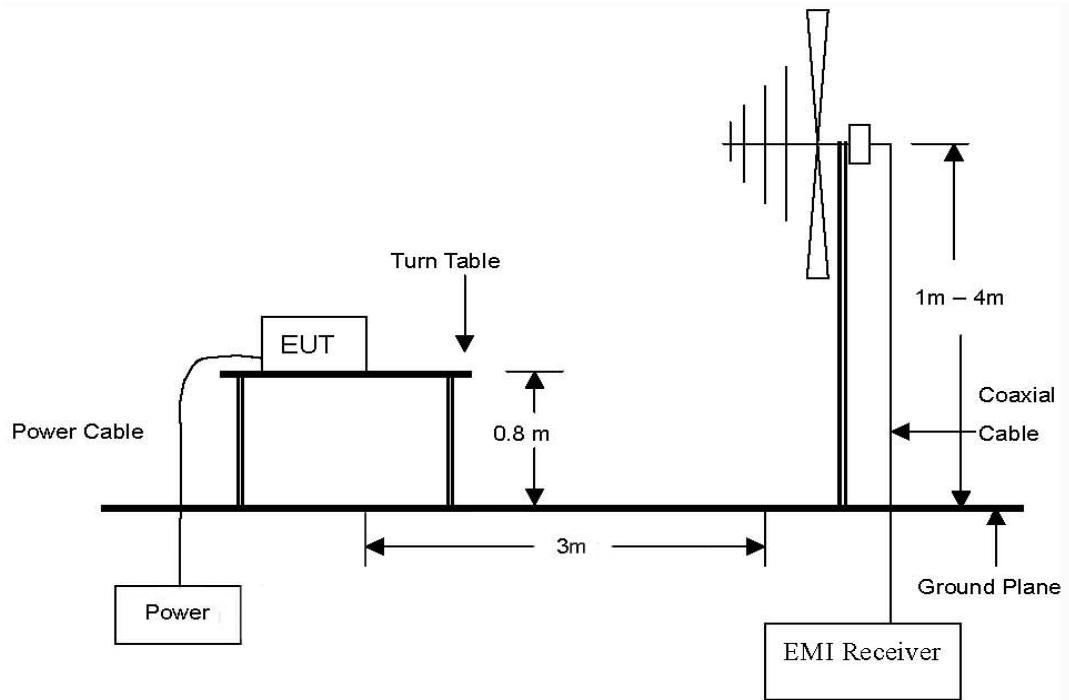
Revision	Report number	Date of Issue	Description
0	F690501/RF-RTL007791	2014.07.03	Initial
1	F690501/RF-RTL007791-1	2014.07.11	Correct Typo

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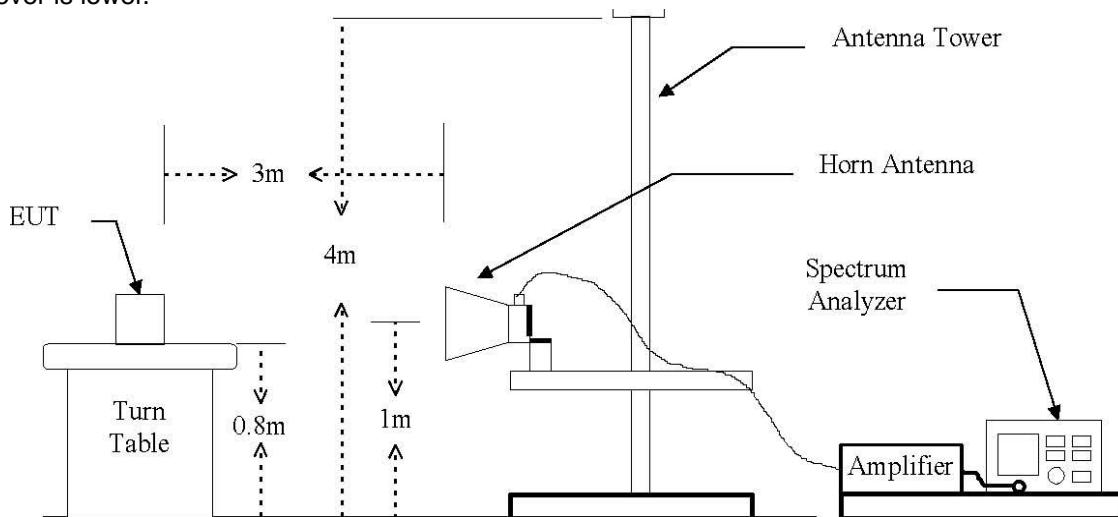
2. RF radiated output power & spurious radiated emission

2.1. Test setup

The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz Emissions.

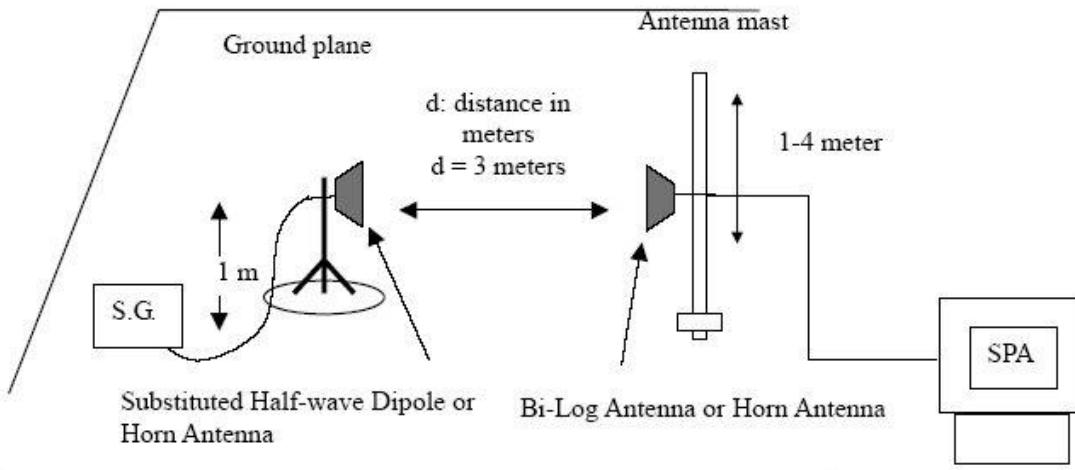


The diagram below shows the test setup that is utilized to make the measurements for emission .The spurious emissions were investigated from 1 GHz to the 10th harmonic of the highest fundamental frequency or 40 GHz, whichever is lower.



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The diagram below shows the test setup for substituted method



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A4(210 mm x 297 mm)

2.2. Limit

2.2.1. RF radiated output power

FCC §22.913(a), The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.FCC §24.232(c) Mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.

2.2.2. Spurious Radiated emission

§ 22.917(a) and §24.238 (a) Out of band emissions. The power of any emission outside of the authorized operating frequency must be attenuated below the transmitting (P) by a factor of at least $43+10\log(P)$ dB.

2.3. Test procedure : Based on ANSI/TIA 603C: 2004

1. On a test site, the EUT shall be placed at 80cm height on a turn table, and in the position close to normal use as declared by the applicant.
2. The test antenna shall be oriented initially for vertical polarization located 3 m from EUT to correspond to the fundamental frequency of the transmitter.
3. The output of the test antenna shall be connected to the measuring receiver and the peak detector is used for the measurement.
4. During the measurement of the EUT, the resolution bandwidth was to 3 MHz and the video bandwidth was set to 3 MHz.
5. The transmitter shall be switched on, the measuring receiver shall be tuned to the frequency of the transmitter under test.
6. The test antenna shall be raised and lowered through the specified range of height until the maximum signal level is detected by the measuring receiver.
7. The transmitter shall be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
8. The test antenna shall be raised and lowered again through the specified range of height until the maximum signal level is detected by the measuring receiver.
9. The maximum signal level detected by the measuring receiver shall be noted.
10. The EUT was replaced by half-wave dipole (824 ~ 849 MHz) or horn antenna (1 850 ~ 1 910 MHz) connected to a signal generator.
11. In necessary, the input attenuator setting on the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
12. The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
13. The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring received, which is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuator setting of the measuring receiver.
14. The input level to the substitution antenna shall be recorded as power level in dB m, corrected for any change of input attenuator setting of the measuring receiver.
15. The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization.

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2.4. Test result for RF radiated output power

Ambient temperature : (24 ± 1) °C

Relative humidity : 46 % R.H.

CDMA850 1xRTT mode

Frequency (MHz)	Ant. Pol. (H/V)	S.G level + Amp. (dB m)	Cable loss (dB)	Ant. gain (dB d)	E.R.P.	
					(dB m)	(mW)
824.70	V	22.16	3.28	-0.95	17.93	62.06
824.70	H	29.69	3.28	-0.95	25.46	351.44
836.52	V	21.25	3.31	-0.95	16.99	49.99
836.52	H	27.53	3.31	-0.95	23.27	212.30
848.31	V	23.51	3.35	-0.94	19.22	83.57
848.31	H	29.11	3.35	-0.94	24.82	303.17

CDMA1 900 1xRTT mode

Frequency (MHz)	Ant. Pol. (H/V)	S.G level + Amp. (dB m)	Cable loss (dB)	Ant. gain (dB i)	E.I.R.P.	
					(dB m)	(mW)
1 851.25	V	24.66	5.90	7.87	26.63	460.52
1 851.25	H	16.58	5.90	7.87	18.55	71.54
1 880.00	V	25.65	5.83	7.86	27.68	585.80
1 880.00	H	18.74	5.83	7.86	20.77	119.29
1 908.75	V	24.76	5.77	7.84	26.83	482.35
1 908.75	H	16.94	5.77	7.84	19.01	79.53

Remark:

1. E.R.P. & E.I.R.P. = S.G level (dB m) - Cable loss (dB) + Ant. gain (dB d/dB i)

CDMA850 1xEV-DO mode

Frequency (MHz)	Ant. Pol. (H/V)	S.G level + Amp. (dB m)	Cable loss (dB)	Ant. gain (dB d)	E.R.P.	
					(dB m)	(mW)
824.70	V	21.91	3.28	-0.95	17.68	58.59
824.70	H	28.22	3.28	-0.95	23.99	250.53
836.52	V	21.46	3.31	-0.95	17.20	52.47
836.52	H	27.69	3.31	-0.95	23.43	220.27
848.31	V	23.39	3.35	-0.94	19.10	81.29
848.31	H	28.97	3.35	-0.94	24.68	293.56

CDMA1 900 1xEV-DO mode

Frequency (MHz)	Ant. Pol. (H/V)	S.G level + Amp. (dB m)	Cable loss (dB)	Ant. gain (dB i)	E.I.R.P.	
					(dB m)	(mW)
1 851.25	V	24.67	5.90	7.87	26.64	461.47
1 851.25	H	13.94	5.90	7.87	15.91	39.01
1 880.00	V	25.55	5.83	7.86	27.58	572.60
1 880.00	H	16.68	5.83	7.86	18.71	74.35
1 908.75	V	24.76	5.77	7.84	26.83	482.02
1 908.75	H	14.46	5.77	7.84	16.53	44.98

Remark:

1. E.R.P. & E.I.R.P. = S.G level (dB m) - Cable loss (dB) + Ant. gain (dB d/dB i)

2.5. Spurious radiated emission

- Measured output Power : 25.46 dB m = 0.351 6 W
- Modulation Signal : CDMA850 1xRTT
- Distance : 3 meters
- Limit : $43 + 10\log_{10}(W) = 38.46$ dB c

Frequency (MHz)	Ant. Pol. (H/V)	S.G level + Amp. (dB m)	Cable loss (dB)	Ant. gain (dB d)	E.R.P. (dB m)	dB c	Margin (dB)
Low Channel (824.70 MHz)							
1 649.15	V	-36.62	5.92	7.93	-34.61	60.07	21.61
1 649.60	H	-41.32	5.92	7.93	-39.31	64.77	26.31
Middle Channel (836.52 MHz)							
1 672.22	V	-42.74	6.00	7.93	-40.81	66.27	27.81
1 673.04	H	-47.72	6.01	7.93	-45.80	71.26	32.80
High Channel (848.31 MHz)							
1 696.62	V	-38.68	6.09	7.93	-36.84	62.30	23.84
1 697.26	H	-44.66	6.09	7.93	-42.82	68.28	29.82

Remark:

1. E.R.P. & E.I.R.P. = S.G level (dB m) - Cable loss (dB) + Ant. gain (dB d/dB i)
2. No more harmonic above 2nd harmonic for all channel.

- Measured output Power : 24.68 dB m = 0.293 8 W
- Modulation Signal : CDMA1 900 1xRTT
- Distance : 3 meters
- Limit : $43 + 10\log_{10}(W) = 37.68$ dB c

Frequency (MHz)	Ant. Pol. (H/V)	S.G level + Amp. (dB m)	Cable loss (dB)	Ant. gain (dB i)	E.I.R.P. (dB m)	dB c	Margin (dB)
Low Channel(1 851.25 MHz)							
5 553.75	V	-21.79	9.11	10.45	-20.45	45.13	7.45
5 553.62	H	-30.17	9.11	10.45	-28.83	53.51	15.83
Middle Channel(1 880.00 MHz)							
5 640.00	V	-31.06	9.15	10.55	-29.66	54.34	16.66
5 640.06	H	-23.22	9.15	10.55	-21.82	46.50	8.82
High Channel(1 908.75 MHz)							
5 725.97	V	-31.96	9.22	10.63	-30.55	55.23	17.55
5 726.67	H	-27.08	9.22	10.63	-25.67	50.35	12.67

Remark:

1. E.R.P. & E.I.R.P. = S.G level (dB m) - Cable loss (dB) + Ant. gain (dB d/dB i)
2. No more harmonic above 3rd harmonic for all channel.

- Measured output Power : 27.68 dB m = 0.586 1 W
- Modulation Signal : CDMA850 1xEV-DO
- Distance : 3 meters
- Limit : $43 + 10\log_{10}(W) = 40.68$ dB c

Frequency (MHz)	Ant. Pol. (H/V)	S.G level + Amp. (dB m)	Cable loss (dB)	Ant. gain (dB d)	E.R.P. (dB m)	dB c	Margin (dB)
Low Channel (824.70 MHz)							
1 649.91	V	-37.23	5.92	7.93	-35.22	62.90	22.22
1 649.38	H	-43.34	5.92	7.93	-41.33	69.01	28.33
Middle Channel (836.52 MHz)							
1 673.32	V	-42.19	6.01	7.93	-40.27	67.95	27.27
1 673.16	H	-42.13	6.01	7.93	-40.21	67.89	27.21
High Channel (848.31 MHz)							
1 696.66	V	-38.20	6.09	7.93	-36.36	64.04	23.36
1 696.38	H	-44.81	6.09	7.93	-42.97	70.65	29.97

Remark:

1. E.R.P. & E.I.R.P. = S.G level (dB m) - Cable loss (dB) + Ant. gain (dB d/dB i)
2. No more harmonic above 2nd harmonic for all channel.

- Measured output Power : 27.58 dB m = 0.572 8 W
- Modulation Signal : CDMA1 900 1xEV-DO
- Distance : 3 meters
- Limit : $43 + 10\log_{10}(W) = 40.58$ dB c

Frequency (MHz)	Ant. Pol. (H/V)	S.G level + Amp. (dB m)	Cable loss (dB)	Ant. gain (dB i)	E.I.R.P. (dB m)	dB c	Margin (dB)
Low Channel(1 851.25 MHz)							
5 553.64	V	-22.11	9.11	10.45	-20.77	48.35	7.77
5 554.02	H	-29.37	9.11	10.45	-28.03	55.61	15.03
Middle Channel(1 880.00 MHz)							
5 640.34	V	-30.86	9.15	10.55	-29.46	57.04	16.46
5 639.96	H	-23.38	9.15	10.55	-21.98	49.56	8.98
High Channel(1 908.75 MHz)							
5 726.13	V	-31.62	9.22	10.63	-30.21	57.79	17.21
5 726.26	H	-26.82	9.22	10.63	-25.41	52.99	12.41

Remark:

1. E.R.P. & E.I.R.P. = S.G level (dB m) - Cable loss (dB) + Ant. gain (dB d/dB i)
2. No more harmonic above 3rd harmonic for all channel.

3. Conducted Output Power

3.1. Limit

Requirements: CFR 47, Section §2.1046

3.2. Test Procedure

1. The RF output of the transmitter was connected to the input of the Mobile Communication Test Unit through sufficient attenuation.
2. The EUT was set up for the max. output power with pseudo random data modulation.
3. The power was measured with Mobile Communication Test unit.



3.3. Test Settings

- CDMA2000 1xRTT

- Protocol Rev > 6 (IS-2000-0)
- System ID: 14655; NID:1; Reg. Ch. #. 384(Cell) & 600(PCS)
- Radio Config (RC) > Please see following table for details
- FCH Service Option (SO) Setup > Please see following table for details
- Traffic Data Rate > Full
- TDSO SCH info > F-SCH parameters > F-SCH Data Rate > 153.6kbps
 > R-SCH Parameters > R-SCH Data Rate > 153.6kbps
- RVS Power Ctrl > All Up bits (Maximum TxPout)

- CDMA2000 1xEV-DO

FTAP

- Protocol Rev > 0 (1xEVDO)
- Application Config > Enhanced Test Application Protocol > FTAP
- FTAP Rate > 307.2 kbps (2 slot, QPSK)
- Access Network Info > Termination Parameters > Sector ID > 00000000 > Subnet Mask > 0
- Generator Info > Termination Parameters > Max Forward Packet Duration > 16 slots
- RVS Power Ctrl > All Up bits (Maximum TxPout)

RTAP

- Protocol Rev > 0 (1xEVDO)
- Application Config > Enhanced Test Application Protocol > RTAP
- RTAP Rate > 153.6 kbps
- Access Network Info > Termination Parameters > Sector ID > 00000000 > Subnet Mask > 0
- Generator Info > Termination Parameters > Max Forward Packet Duration > 16 slots
- RVS Power Ctrl > All Up bits (Maximum TxPout)

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3.4. Test Result

Ambient temperature : (24 ± 1) °C

Relative humidity : 47 % R.H.

CDMA2000 1xRTT

- Cellular Band

Radio Configuration (RC)	Service Option (SO)	Average Output Power (dB m)		
		Ch. 1 013 / 824.70 MHz	Ch. 384 / 836.52 MHz	Ch. 777 / 848.31 MHz
RC1 (Fwd1, Rvs1)	1 (Voice)	-	-	-
	2 (Loopback)	23.10	23.03	23.03
	3 (Voice)	-	-	-
	6 (SMS)	-	-	-
	55 (Loopback)	23.01	23.04	23.03
	68 (Voice)	-	-	-
	70 (Voice)	-	-	-
RC2 (Fwd2, Rvs2)	9 (Loopback)	23.15	23.18	23.17
	14 (SMS)	-	-	-
	17 (Voice)	-	-	-
	55 (Loopback)	23.07	23.11	23.12
	32768 (Voice)	-	-	-
RC3 (Fwd3, Rvs3)	1 (Voice)	-	-	-
	2 (Loopback)	23.05	23.09	23.04
	3 (Voice)	-	-	-
	6 (SMS)	-	-	-
	55 (Loopback)	22.99	23.06	23.01
	32 (+F-SCH)	23.12	23.17	23.16
	32 (+SCH)	23.10	23.02	23.08
	68 (Voice)	-	-	-
	70 (Voice)	-	-	-
RC4 (Fwd4, Rvs3)	1 (Voice)	-	-	-
	2 (Loopback)	23.04	23.12	23.07
	3 (Voice)	-	-	-
	6 (SMS)	-	-	-
	55 (Loopback)	23.14	23.09	23.06
	32 (+F-SCH)	23.04	23.03	23.12
	32 (+SCH)	23.06	23.02	23.05
	68 (Voice)	-	-	-
RC5 (Fwd5, Rvs4)	70 (Voice)	-	-	-
	9 (Loopback)	23.04	23.08	23.16
	14 (SMS)	-	-	-
	17 (Voice)	-	-	-
	55 (Loopback)	23.09	23.08	23.14
	32768 (Voice)	-	-	-

- The service option 9 of RC2 of worst case is bigger than other power compared with each service option.

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- PCS Band

Radio Configuration (RC)	Service Option (SO)	Average Output Power (dB m)		
		Ch. 25 / 1 851.25 MHz	Ch. 600 / 1 880.00 MHz	Ch. 1 175 / 1 908.75 MHz
RC1 (Fwd1, Rvs1)	1 (Voice)	-	-	-
	2 (Loopback)	23.16	23.06	23.18
	3 (Voice)	-	-	-
	6 (SMS)	-	-	-
	55 (Loopback)	23.14	23.03	23.12
	68 (Voice)	-	-	-
	70 (Voice)	-	-	-
RC2 (Fwd2, Rvs2)	9 (Loopback)	23.05	23.04	23.08
	14 (SMS)	-	-	-
	17 (Voice)	-	-	-
	55 (Loopback)	23.15	23.07	23.18
	32768 (Voice)	-	-	-
RC3 (Fwd3, Rvs3)	1 (Voice)	-	-	-
	2 (Loopback)	23.05	23.14	23.03
	3 (Voice)	-	-	-
	6 (SMS)	-	-	-
	55 (Loopback)	23.06	23.05	23.07
	32 (+F-SCH)	23.17	23.18	23.20
	32 (+SCH)	23.09	23.14	23.19
	68 (Voice)	-	-	-
	70 (Voice)	-	-	-
RC4 (Fwd4, Rvs3)	1 (Voice)	-	-	-
	2 (Loopback)	23.10	23.16	23.09
	3 (Voice)	-	-	-
	6 (SMS)	-	-	-
	55 (Loopback)	23.09	23.14	23.16
	32 (+F-SCH)	22.98	22.98	23.09
	32 (+SCH)	23.11	23.16	23.10
	68 (Voice)	-	-	-
RC5 (Fwd5, Rvs4)	70 (Voice)	-	-	-
	9 (Loopback)	23.10	23.17	23.02
	14 (SMS)	-	-	-
	17 (Voice)	-	-	-
	55 (Loopback)	23.04	23.06	23.15
	32768 (Voice)	-	-	-

- The service option 32 of RC3 of worst case is bigger than other power compared with each service option.

CDMA2000 1xEV-DO Release 0 (Rel 0)**- Cellular Band**

Application Protocol	Rate	Average Output Power (dB m)		
		Ch. 1 013 / 824.70 MHz	Ch. 384 / 836.52 MHz	Ch. 777 / 848.31 MHz
RTAP	9.6	23.32	23.49	23.74
	19.2	23.29	23.28	23.52
	38.4	23.23	23.42	23.22
	76.8	23.12	23.06	23.24
	153.6	23.16	23.15	23.02
FTAP	307.2 kbps (2 slot, QPSK)	22.91	22.94	22.62

- The rate 9.6 of RTAP of worst case is bigger than other power compared with each rate.

- PCS Band

Application Protocol	Rate	Average Output Power (dB m)		
		Ch. 25 / 1 851.25 MHz	Ch. 600 / 1 880.00 MHz	Ch. 1 175 / 1 908.75 MHz
RTAP	9.6	23.22	23.26	23.27
	19.2	23.21	23.16	23.25
	38.4	23.16	23.07	23.19
	76.8	23.20	23.04	23.22
	153.6	23.11	23.13	23.08
FTAP	307.2 kbps (2 slot, QPSK)	22.84	22.72	22.79

- The rate 9.6 of RTAP of worst case is bigger than other power compared with each rate.

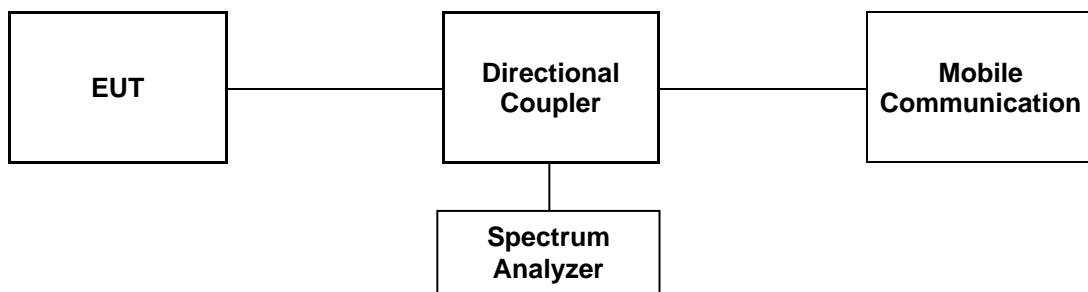
4. Occupied Bandwidth 99 %

4.1. Limit

Requirements: CFR 47, Section §2.1049.

4.2. Test Procedure

1. The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.
2. The resolution bandwidth of the spectrum analyzer was set.
3. OBW was measured with Mobile Communication Test unit for each channel.



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4.3 Test Results

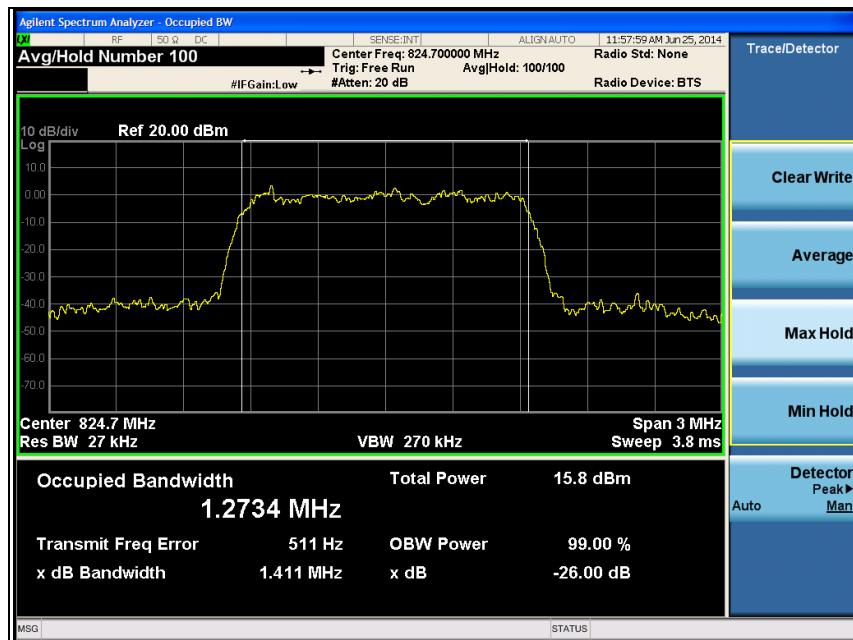
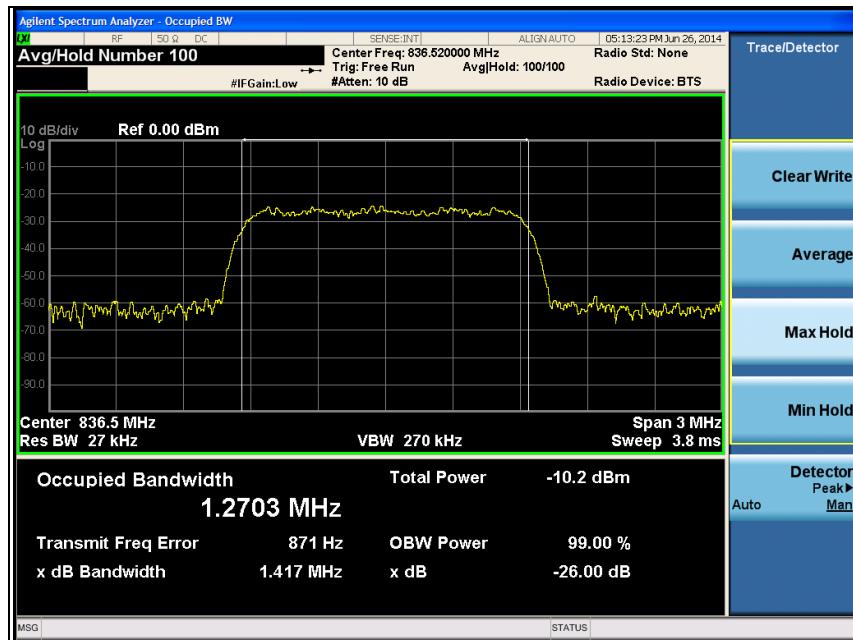
Ambient temperature : (24 ± 1) °C

Relative humidity : 47 % R.H.

Band	Mode	Frequency (MHz)	Occupied Bandwidth (MHz)
CDMA850	1xRTT RC2 9 (Loopback)	824.70	1.273
		836.52	1.270
		848.31	1.271
CDMA1 900	1xRTT RC4 32 (+SCH)	1 851.25	1.270
		1 880.00	1.281
		1 908.75	1.266

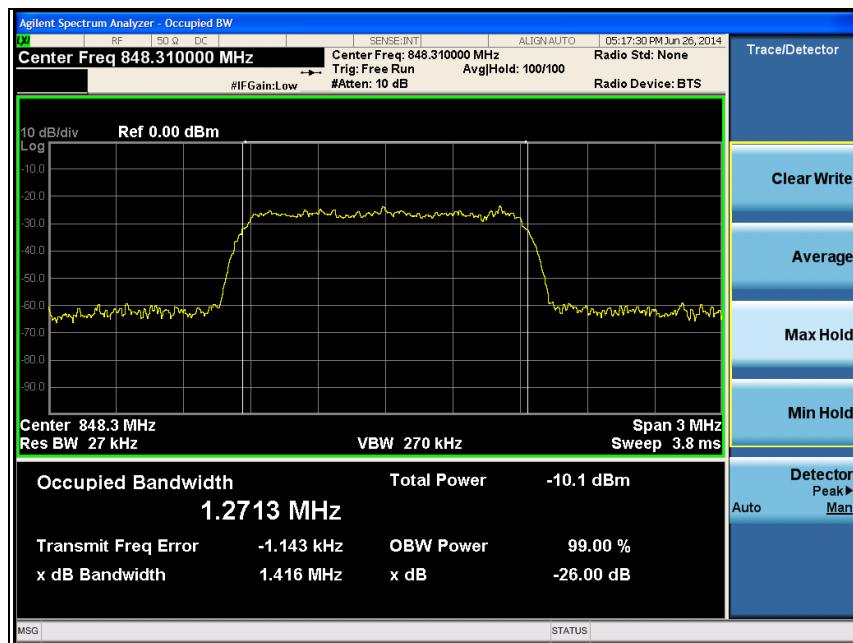
Band	Mode	Frequency (MHz)	Occupied Bandwidth (MHz)
CDMA850	1xEV-DO(Rev0) RTAP 9.6	824.70	1.273
		836.52	1.271
		848.31	1.269
CDMA1 900	1xEV-DO(Rev0) RTAP 9.6	1 851.25	1.271
		1 880.00	1.276
		1 908.75	1.270

Please refer to the following plots.

CDMA850
1xRTT
Low Channel

Middle Channel


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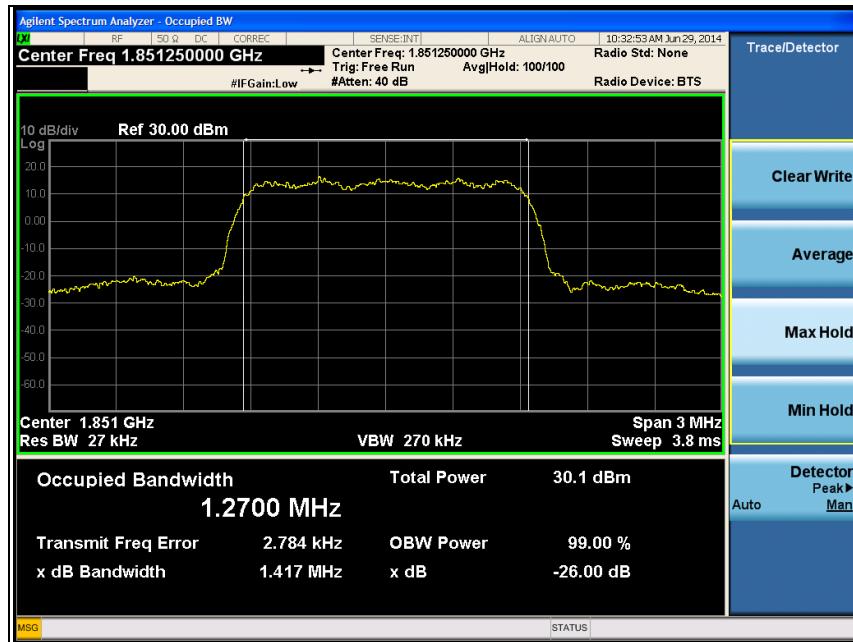
High Channel



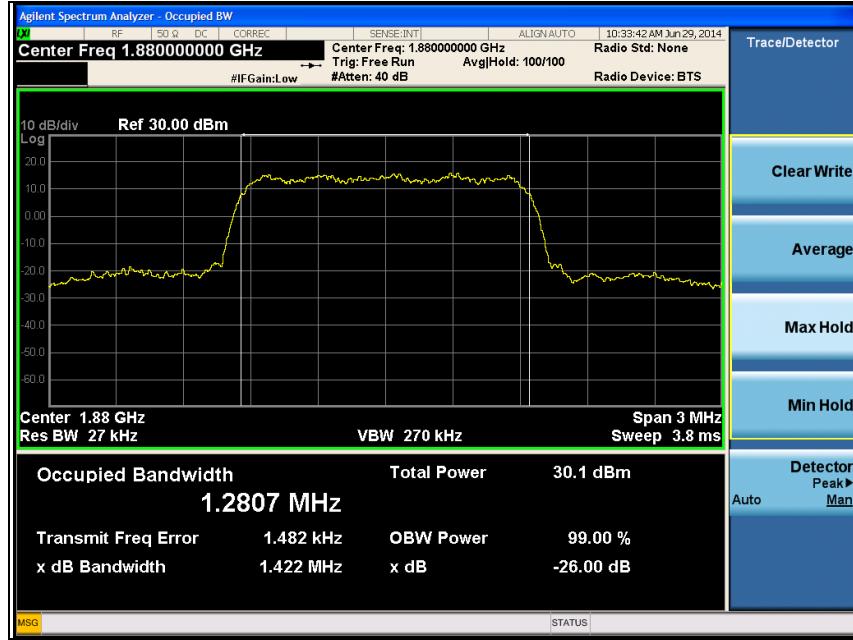
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CDMA1 900**1xRTT**

Low Channel

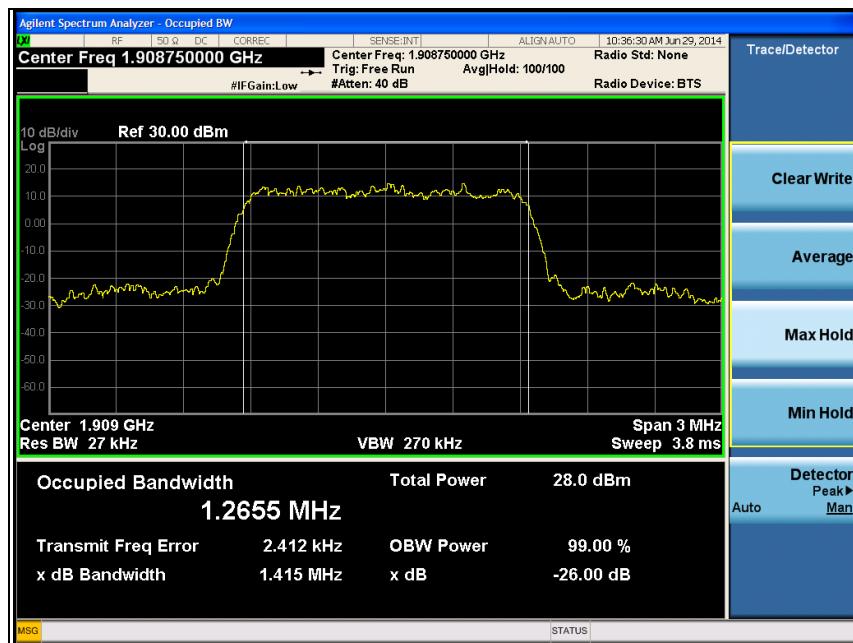


Middle Channel



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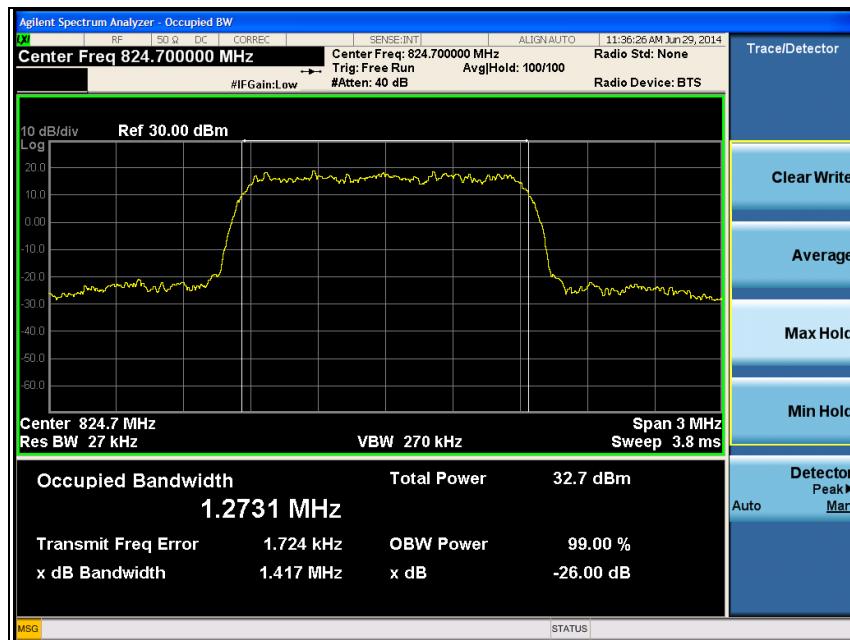
High Channel



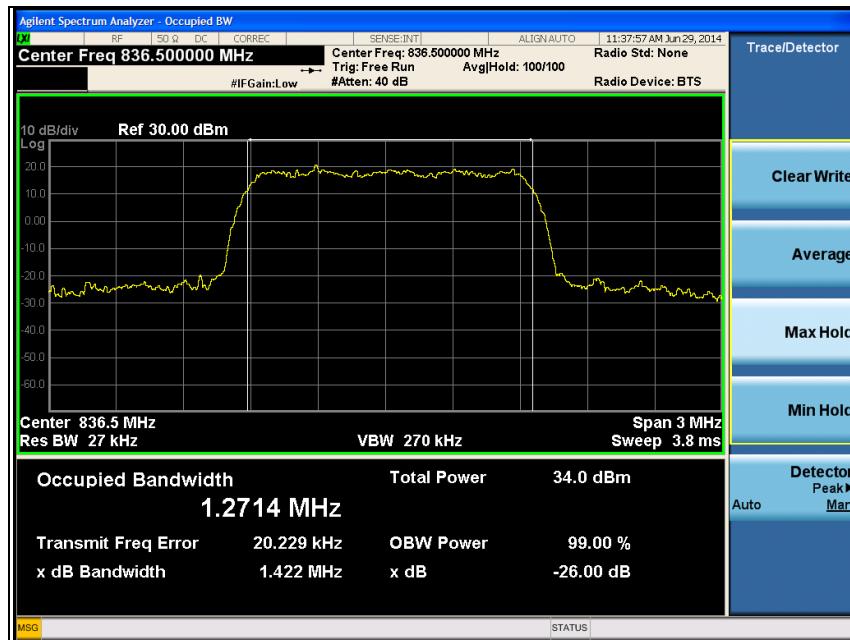
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CDMA850**1xEV-DO**

Low Channel

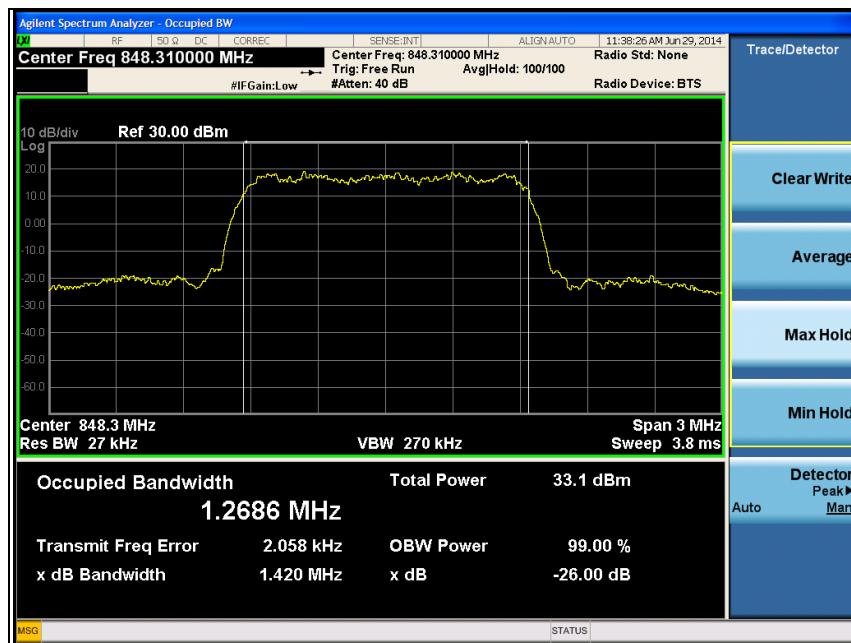


Middle Channel



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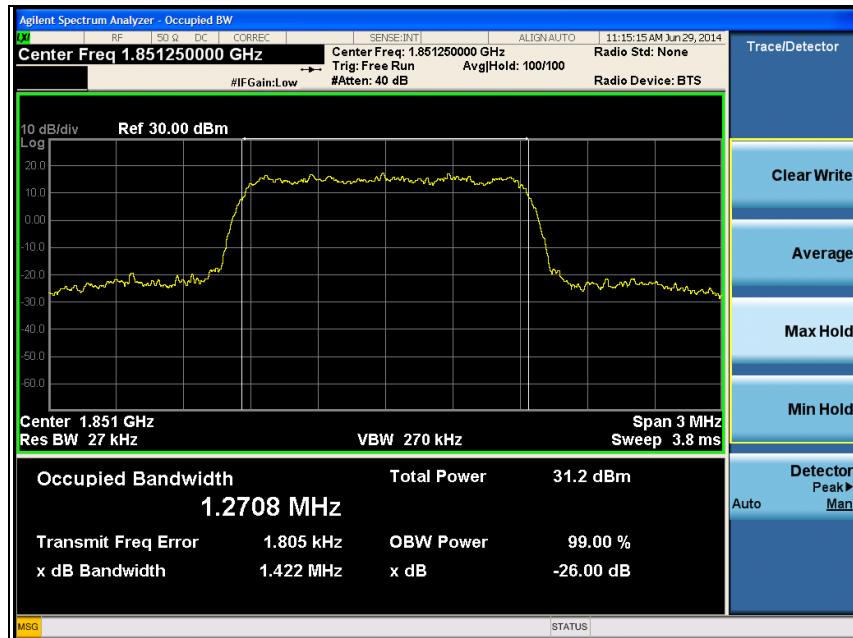
High Channel



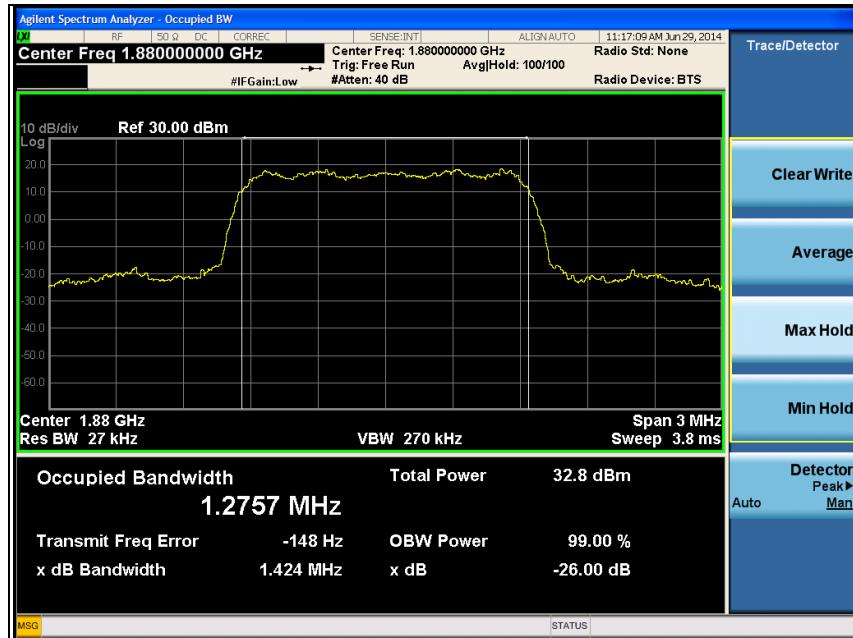
The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.

CDMA1 900**1xEV-DO**

Low Channel

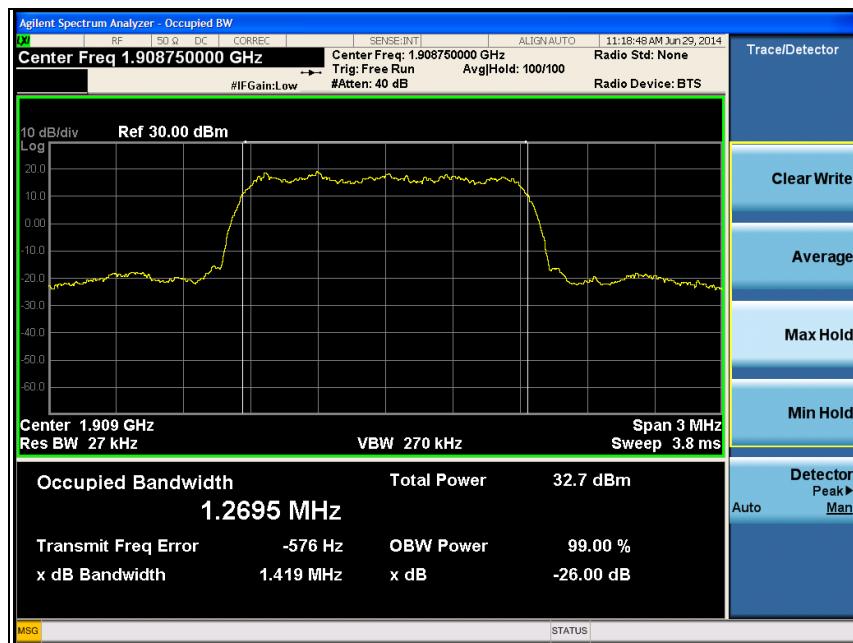


Middle Channel



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High Channel



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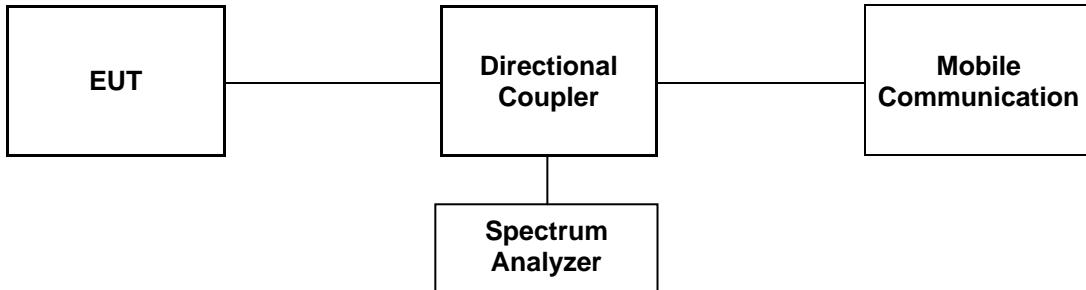
5. Peak-Average Ratio

5.1. Limit

§24.232(d) Power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (e) of this section. In both instances, equipment employed must be authorized in accordance with the provisions of §24.51. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

5.2. Test Procedure

1. The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.
2. The CCDF function of the spectrum analyzer was set.
3. PAR was measured with spectrum analyzer for each channel.



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4.3 Test Results

Ambient temperature : (24 ± 1) °C

Relative humidity : 47 % R.H.

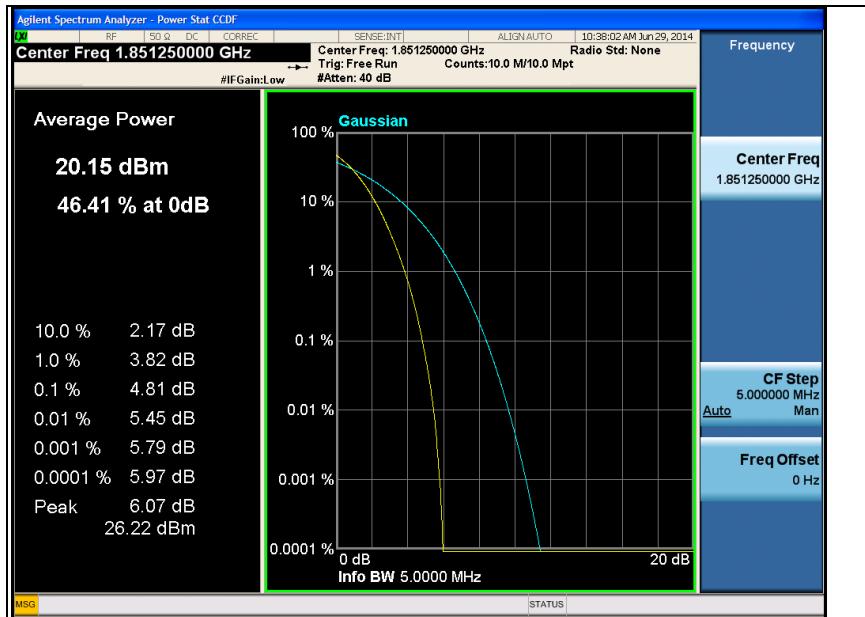
Band	Mode	Frequency (MHz)	PAR (dB)
CDMA1 900	1xRTT RC4 32 (+SCH)	1 851.25	4.81
		1 880.00	4.87
		1 908.75	4.81
CDMA1 900	1xEV-DO(Rev0) RTAP 9.6	1 851.25	4.32
		1 880.00	4.45
		1 908.75	4.43

Please refer to the following plots.

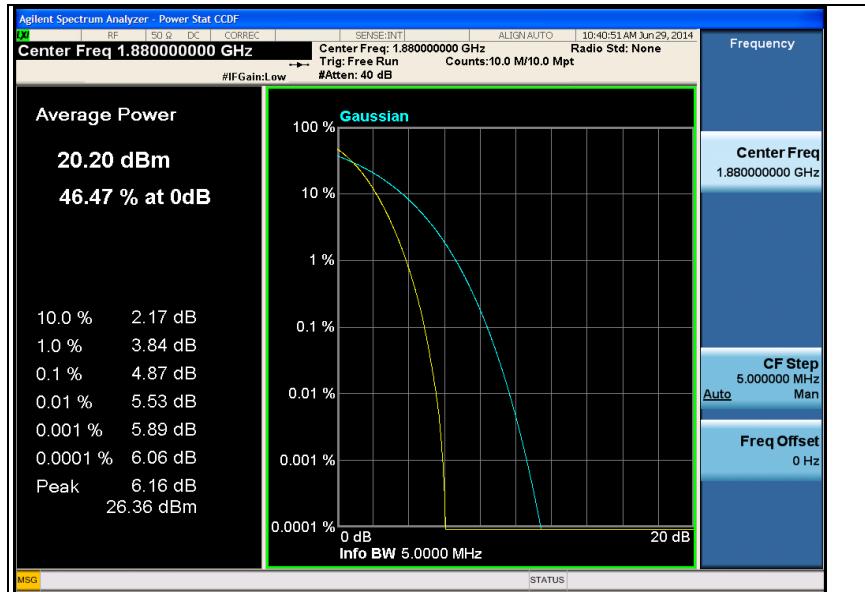
The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.

CDMA1 900**1xRTT**

Low Channel

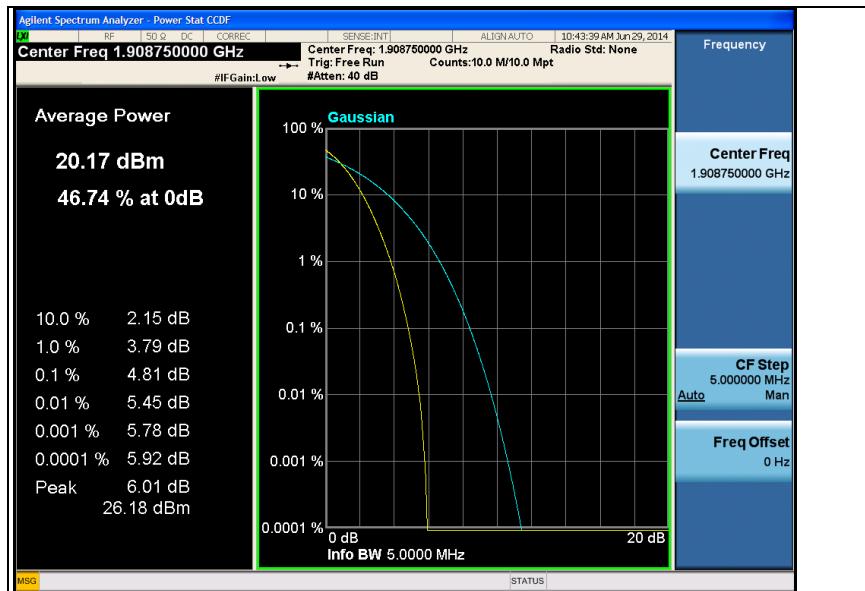


Middle Channel



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High Channel



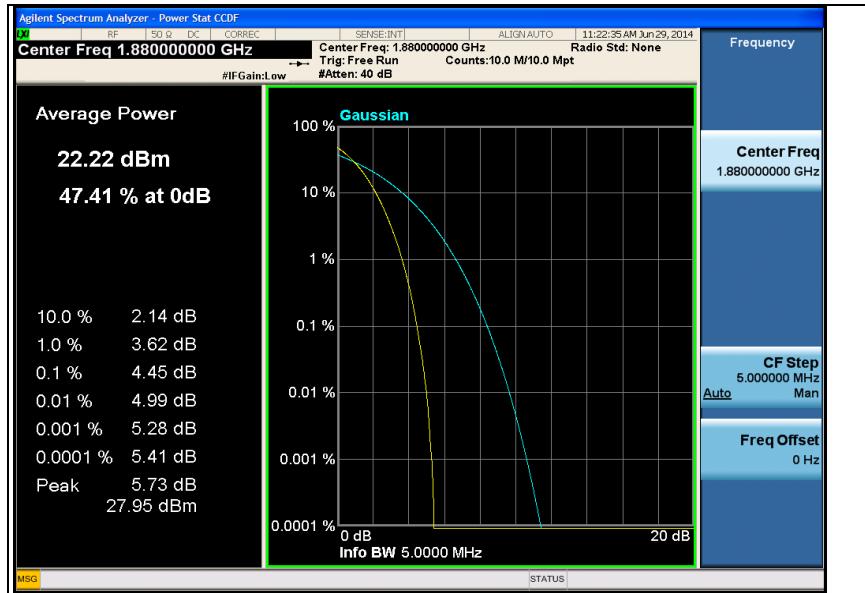
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CDMA1 900**1xEV-DO**

Low Channel

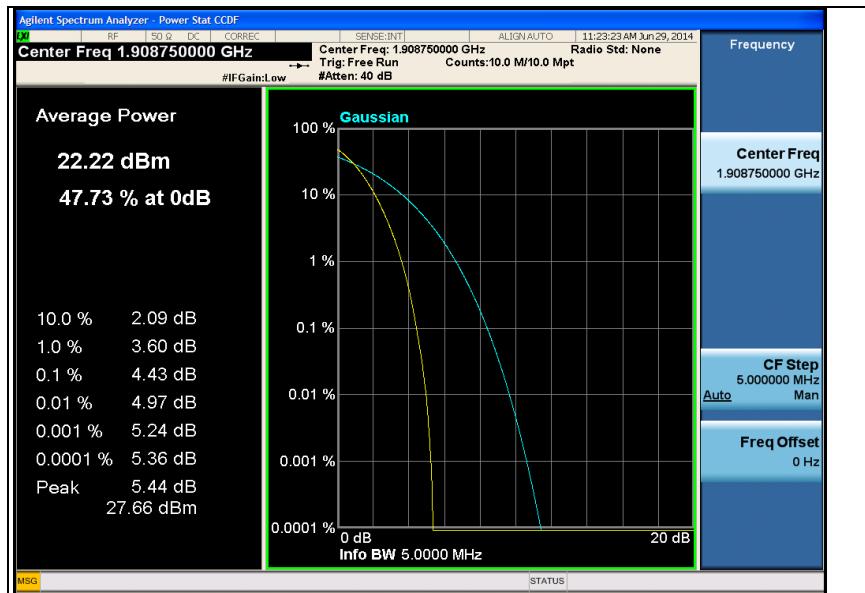


Middle Channel



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High Channel



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RTT5041-20(2014.01.20)(2)

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A4(210 mm x 297 mm)

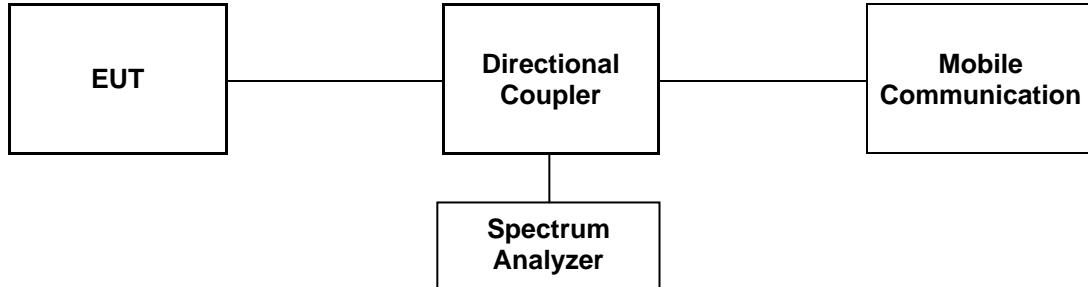
6. Spurious Emissions at Antenna Terminal

6.1. Limit

§22.917(a) and §24.238 (a) Out of band emissions. The power of any emission outside of the authorized operating frequency must be attenuated below the transmitting (P) by a factor of at least $43 + 10\log(P)$ dB.

6.2. Test Procedure

1. The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation.
2. The resolution bandwidth of the spectrum analyzer was set at 1 MHz. Sufficient scans were taken to show any out of band emissions up to 10th harmonic.



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A4(210 mm x 297 mm)

6.3. Test Results

Ambient temperature : (24 ± 1) °C

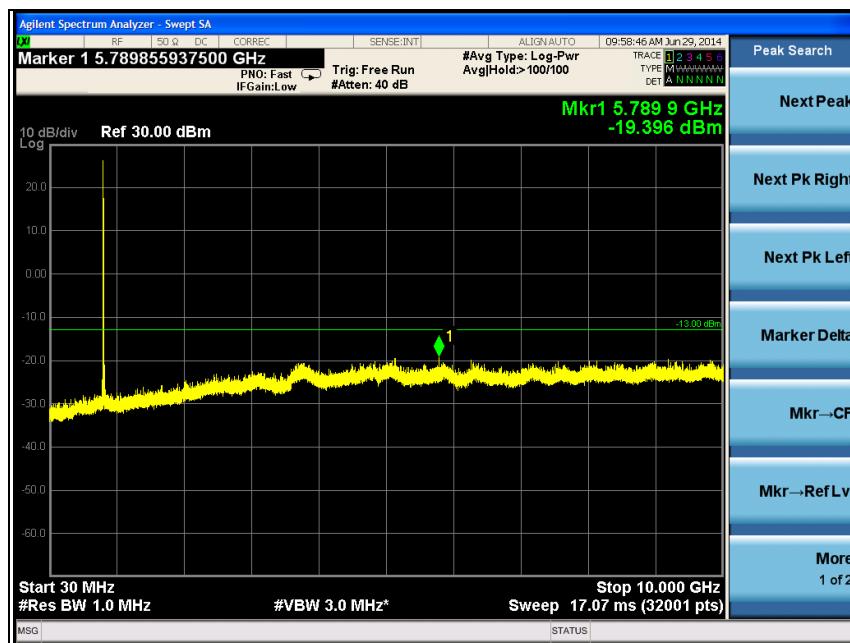
Relative humidity : 47 % R.H.

Please refer to the following plots.

CDMA850

1xRTT

Low Channel



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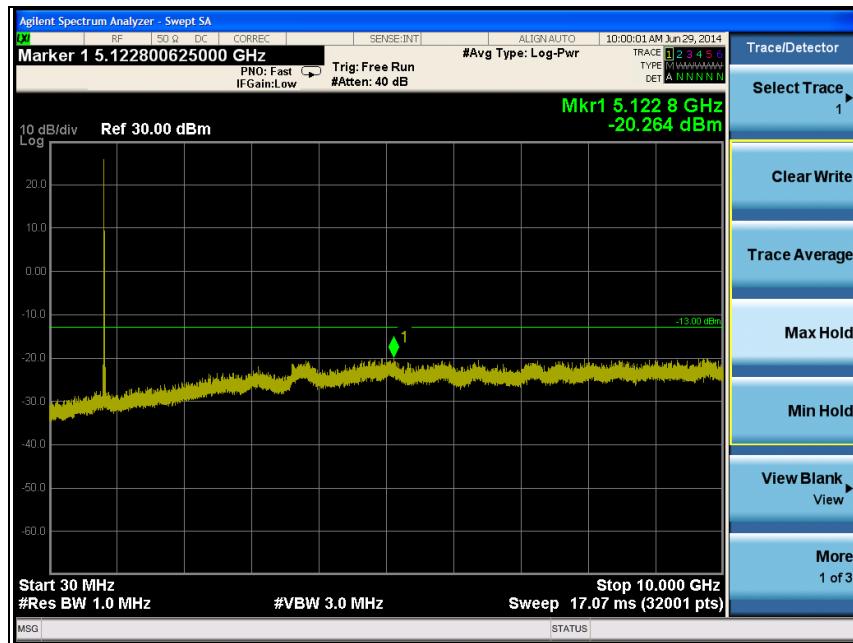
<http://www.sgsgroup.kr>

RTT5041-20(2014.01.20)(2)

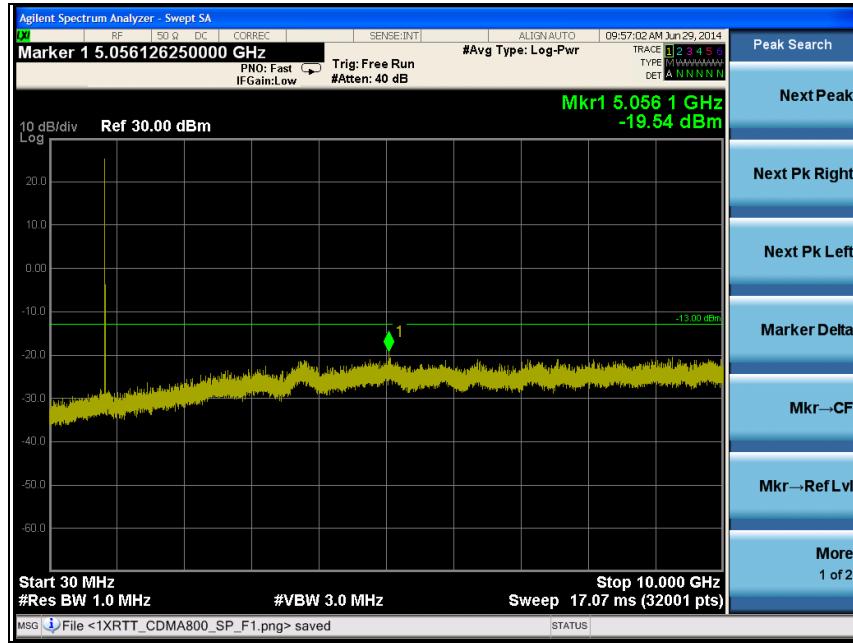
Tel. +82 31 428 5700 / Fax. +82 31 427 2370

A4(210 mm x 297 mm)

Middle Channel



High Channel

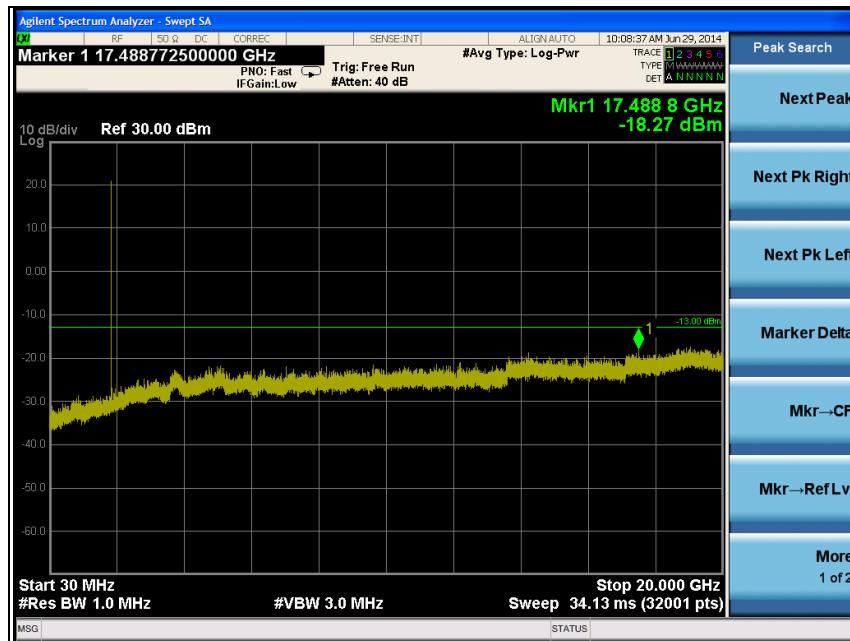


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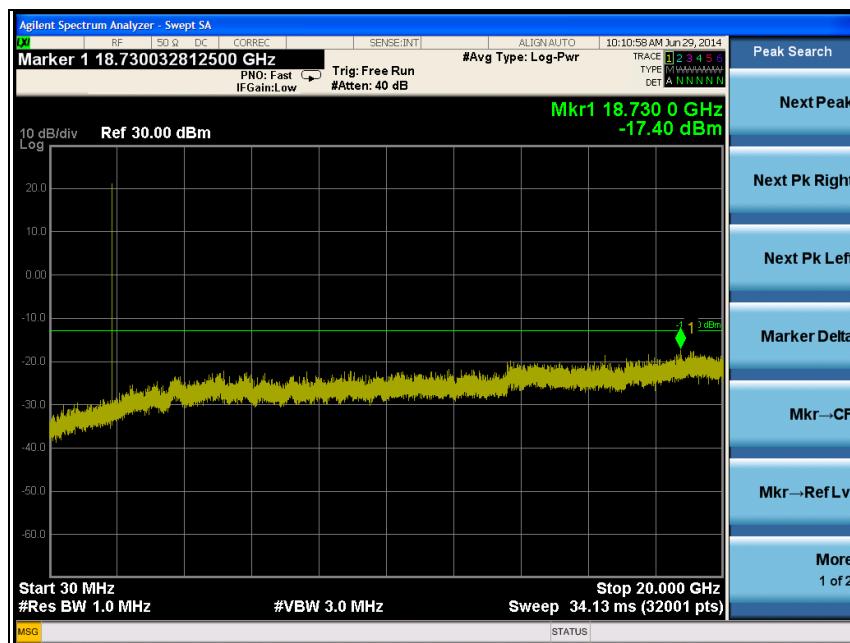
CDMA1 900

1xRTT

Low Channel

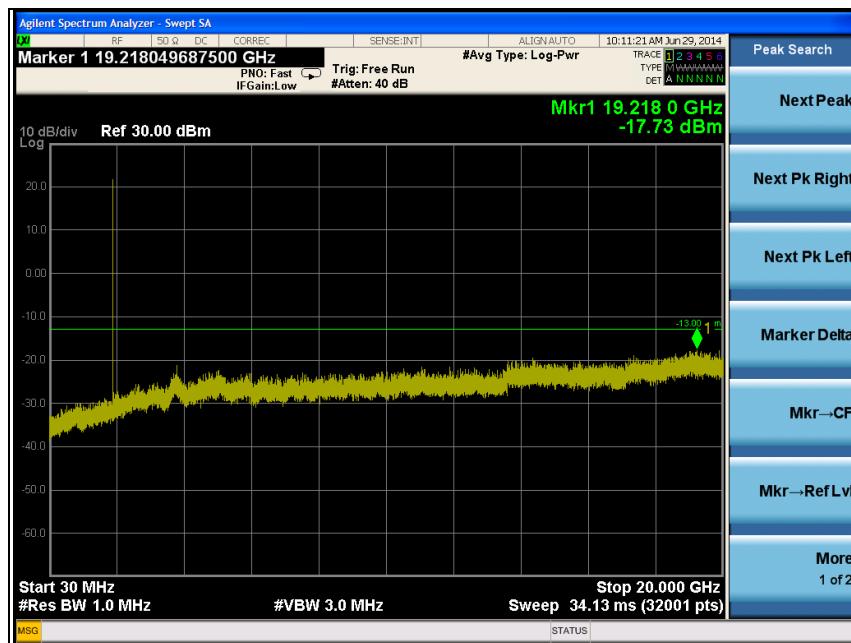


Middle Channel



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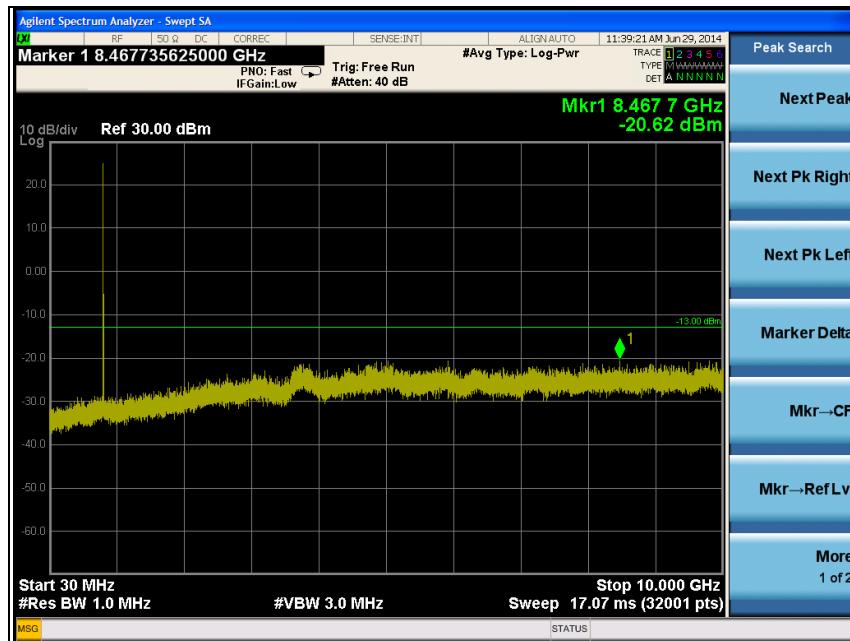
High Channel



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CDMA850**1xEV-DO**

Low Channel



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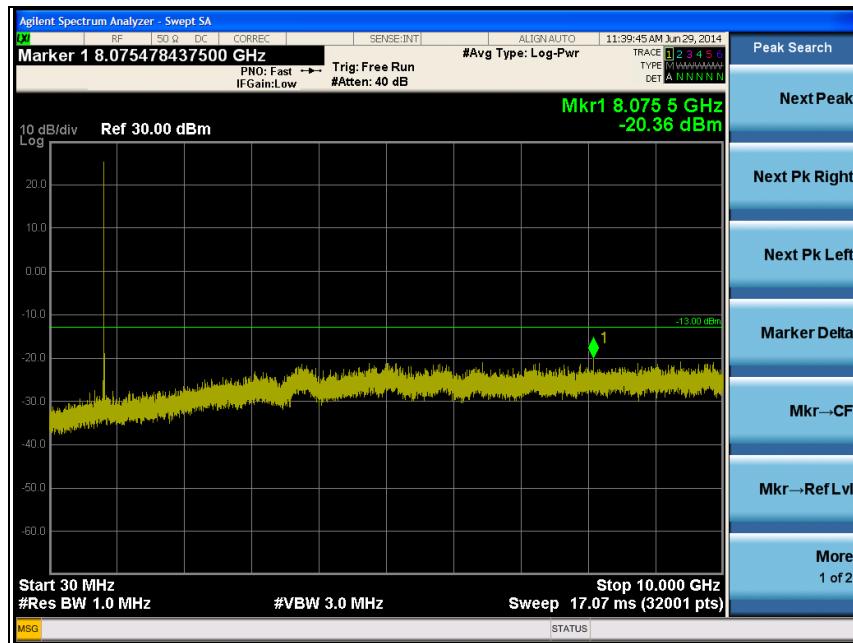
<http://www.sgsgroup.kr>

RTT5041-20(2014.01.20)(2)

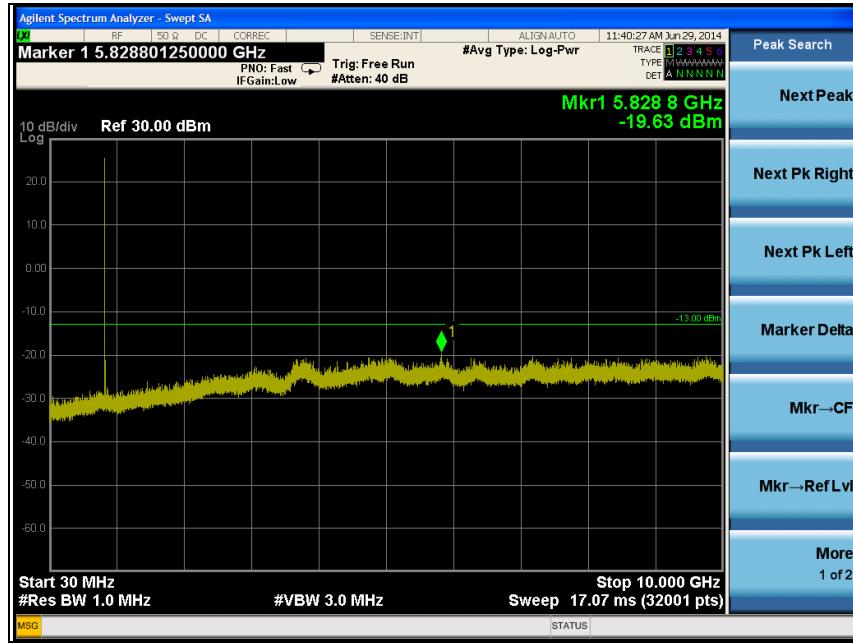
Tel. +82 31 428 5700 / Fax. +82 31 427 2370

A4(210 mm x 297 mm)

Middle Channel



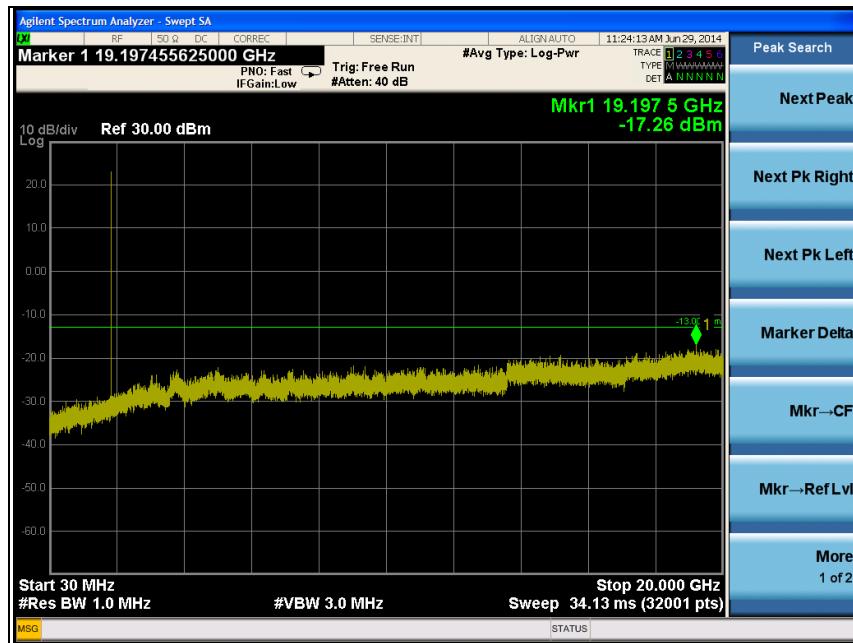
High Channel



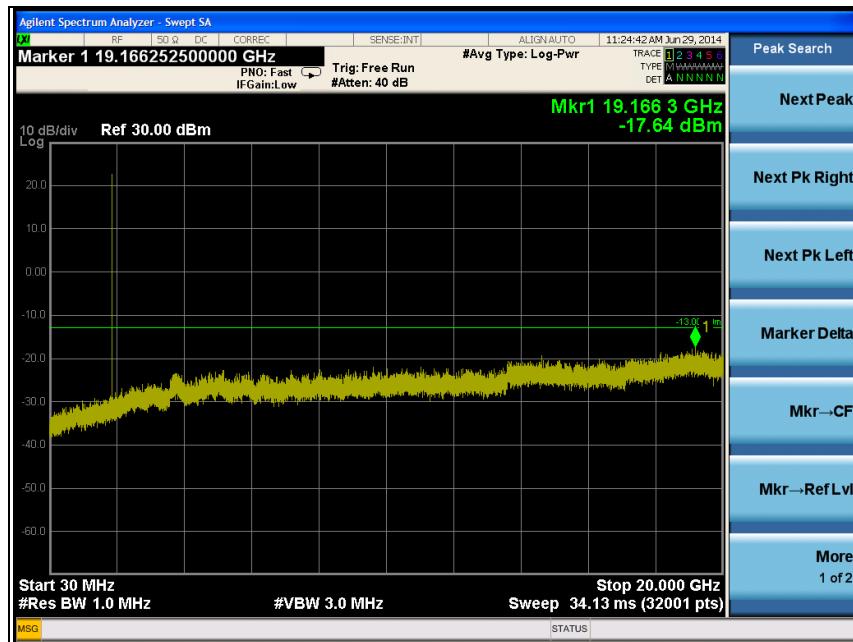
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CDMA1 900**1xEV-DO**

Low Channel

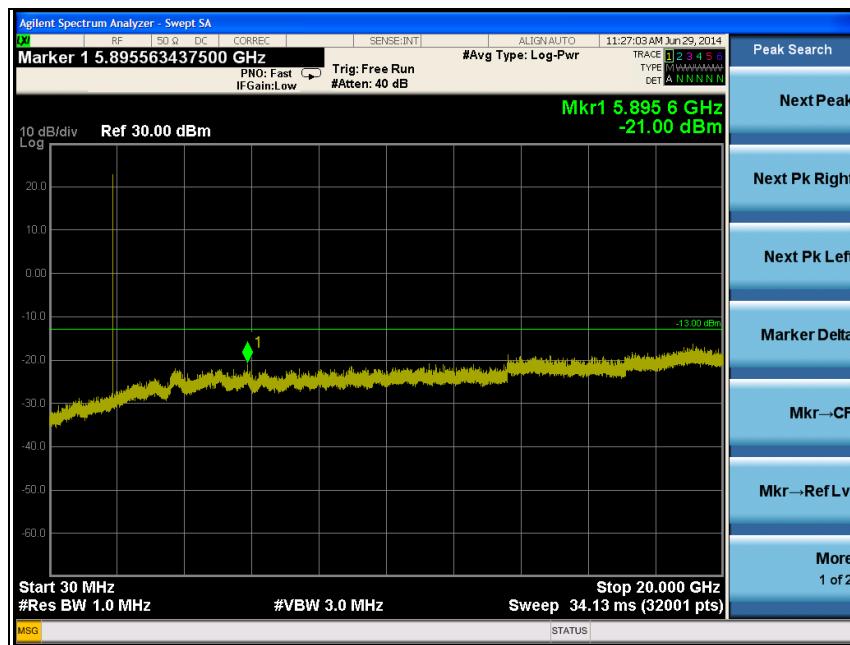


Middle Channel



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High Channel



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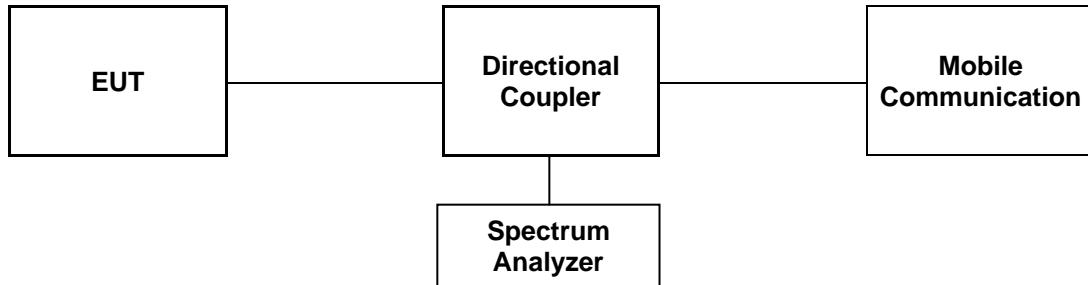
7. Band Edge

7.1. Limit

§22.917(a) and §24.238 (a) Out of band emissions. The power of any emission outside of the authorized operating frequency must be attenuated below the transmitting (P) by a factor of at least $43+10\log(P)$ dB.

7.2. Test Procedure

1. The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.
2. The center of the spectrum analyzer was set to block edge frequency.



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7.3. Test Results

Ambient temperature : (24 ± 1) °C
Relative humidity : 47 % R.H.

Please refer to the following plots.

CDMA850 (band edge)

1xRTT

Low Channel



High Channel



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CDMA1 900 (Band edge)**1xRTT****Low Channel****High Channel**

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CDMA850 (4 MHz SPAN)

1xRTT

Low Channel



High Channel



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CDMA1 900 (4 MHz SPAN)
1xRTT
Low Channel

High Channel


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A4(210 mm x 297 mm)

CDMA850 (band edge)
1xEV-DO
Low Channel

High Channel


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CDMA1 900 (Band edge)**1xEV-DO****Low Channel****High Channel**

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CDMA850 (4 MHz SPAN)**1xEV-DO****Low Channel****High Channel**

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Tel. +82 31 428 5700 / Fax. +82 31 427 2370

A4(210 mm x 297 mm)

CDMA1 900 (4 MHz SPAN)
1xEV-DO
Low Channel

High Channel


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8. Frequency Stability

8.1. Limit

Requirements: FCC § 2.1055 (a), § 2.1055 (d) & following:

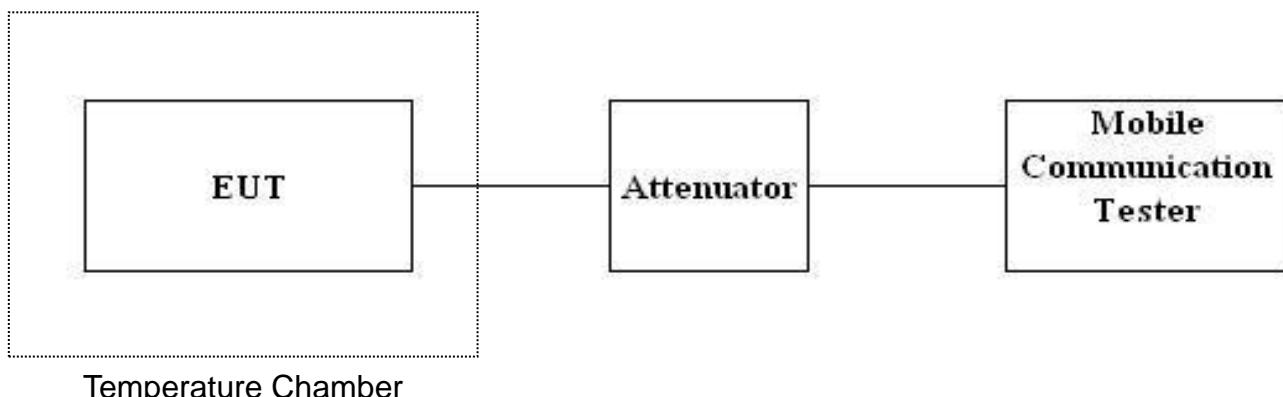
According to §22.355, the carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances given in Table of this section.

For Mobile devices operating in the 824 to 849 MHz band at a power level less than or equal to 3 Watts, the limit specified in Table C-1 is +/- 2.5 ppm.

§24.235 the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

8.2. Test Procedure

1. Frequency Stability vs. Temperature: The equipment under test was connected to an external DC power supply and the RF output was connected to a frequency counter via feed-through attenuators.
2. The EUT was placed inside the temperature chamber.
3. After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the counter.



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8.3. Test Results

Ambient temperature : (24 ± 1) °C
Relative humidity : 47 % R.H.

CDMA850 1xRTT mode at middle channel

Reference Frequency: 836.52 MHz, Limit: 2.5 ppm			
Frequency Stability versus Temperature			
Environment Temperature (°C)	Power Supplied (Vdc)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
-30	14.4	5	0.005 977
-20		-3	-0.003 586
-10		-1	-0.001 195
0		5	0.005 977
10		-4	-0.004 782
20		0	Ref
30		1	0.001 195
40		-3	-0.003 586
50		4	0.004 782
Frequency Stability versus power Supply			
Environment Temperature (°C)	Power Supplied (Vdc)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
24	16.56 (+15 %)	-3	-0.003 586
	12.24 (-15 %)	-2	-0.002 391

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CDMA1 900 1xRTT mode at middle channel

Reference Frequency: 1 880.0 MHz			
Frequency Stability versus Temperature			
Environment Temperature (°C)	Power Supplied (Vdc)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
-30	14.4	6	0.004 787
-20		4	0.003 723
-10		-1	0.001 064
0		1	0.002 128
10		-4	-0.000 532
20		-3	Ref
30		-2	0.000 532
40		2	0.002 660
50		3	0.003 191
Frequency Stability versus power Supply			
Environment Temperature (°C)	Power Supplied (Vdc)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	Ppm
24	16.56 (+15 %)	2	0.002 660
	12.24 (-15 %)	-2	0.000 532

Note:

Based on the results of the frequency stability test at the center channel the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band. When the maximum measured frequency deviation noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.

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CDMA850 1xEV-DO mode at middle channel

Reference Frequency: 836.52 MHz, Limit: 2.5 ppm			
Frequency Stability versus Temperature			
Environment Temperature (°C)	Power Supplied (Vdc)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
-30	14.4	-1	-0.010 759
-20		6	-0.002 391
-10		3	-0.005 977
0		7	-0.001 195
10		4	-0.004 782
20		8	Ref
30		5	-0.003 586
40		7	-0.001 195
50		4	-0.004 782
Frequency Stability versus power Supply			
Environment Temperature (°C)	Power Supplied (Vdc)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	Ppm
24	16.56 (+15 %)	6	-0.002 391
	12.24 (-15 %)	8	0.000 000

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CDMA1 900 1xEV-DO mode at middle channel

Reference Frequency: 1 880.0 MHz			
Frequency Stability versus Temperature			
Environment Temperature (°C)	Power Supplied (Vdc)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
-30	14.4	6	0.003 191
-20		5	0.002 660
-10		5	0.002 660
0		3	0.001 596
10		2	0.001 064
20		0	Ref
30		2	0.001 064
40		1	0.000 532
50		0	0.000 000
Frequency Stability versus power Supply			
Environment Temperature (°C)	Power Supplied (Vdc)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
24	16.56 (+15 %)	3	0.001 596
	12.24 (-15 %)	5	0.002 660

Note:

Based on the results of the frequency stability test at the center channel the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band. When the maximum measured frequency deviation noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.

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