

FCC TEST REPORT

Test report No.: EMC- FCC- R0152
FCC ID: TQ8-AT240C2AN
Type of equipment: DIGITAL CAR AVN SYSTEM
Basic Model Name: AT240C2AN
Applicant: Hyundai Mobis Co., Ltd.
FCC Rule Part(s): FCC Part 22 Subpart H and Part 24 Subpart E
Frequency Range: CDMA800 (824.70 MHz ~ 848.31 MHz)
CDMA1 900 (1 851.25 MHz ~ 1 908.75 MHz)
Test result: Complied

The above equipment was tested by EMC compliance Testing Laboratory for compliance with the requirements of FCC Rules and Regulations.

The results of testing in this report apply to the product/system which was tested only. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Date of test: 2014. 01. 06 ~ 08

Issued date: 2014. 02. 18

Tested by:



SON, MIN GI

Approved by:



YU, SANG HOON

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1. Client information

Applicant: Hyundai Mobis Co., Ltd.
Address: 203, Teheran-ro, Gangnam-gu, Seoul, Korea (135-977)
Telephone number: +82-31-260-0098
Facsimile number: +82-31-899-1788
Contact person: Seung-Hoon Choe / csh@mobis.co.kr

Manufacturer: Hyundai Mobis Co., Ltd.
Address: 723, Mundeok-Ri, Munbaek-Myeon, Jincheon-Gun,
Chungcheongbuk-Do 365-862 Korea

2. Laboratory information

Address

EMC compliance Ltd.

65, Sinwon-ro, Yeongtong-gu, Suwon- si, Gyeonggi-do, 443-390, Korea

Telephone Number: 82-31-336-9919 Facsimile Number: 82-505-299-8311

Certificate

KOLAS No.: 231

FCC Site Registration No.: 687132

VCCI Site Registration No.: R-3327, G-198, C-3706, T-1849

IC Site Registration No.:8035A-2

SITE MAP



EMC compliance Ltd.

65, Sinwon-ro, Yeongtong-gu, Suwon- si, Gyeonggi-do, 443-390, Korea

82-31-336-9919 (Main) 82-505-299-8311 (Fax)

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3. Description of E.U.T.

3.1 Basic description

Applicant:	Hyundai Mobis Co., Ltd.
Address of Applicant	203, Teheran-ro, Gangnam-gu, Seoul, Korea (135-977)
Manufacturer	Hyundai Mobis Co., Ltd.
Address of Manufacturer	723, Mundeok-Ri, Munbaek-Myeon, Jincheon-Gun, Chungcheongbuk-Do 365-862 Korea
Type of equipment	DIGITAL CAR AVN SYSTEM
Basic Model	AT240C2AN
Serial number	Proto Type

3.2 General description

Frequency Range	CDMA800: 824.70 MHz ~ 848.31 MHz CDMA1 900: 1 851.25 MHz ~ 1 908.75 MHz
Antenna Gain	CDMA800: 2.99 dBi CDMA1 900: 5.09 dBi
Transmit Power	CDMA800: 20.7 dBm CDMA1 900: 17.9 dBm
Support Mode	1xRTT, 1xEV-DO(Rel.A)
Power supply	DC 12 V

3.3 Test frequency Test mode

The transmitter has a maximum average output power as follows:

* 1xRTT

-Cellular Band-

Frequency (MHz)	Service Option (SO)	Channel
824.70 MHz	RC5 9 (Loopback)	1 013
836.52 MHz		384
848.31 MHz		777

-PCS Band-

Frequency (MHz)	Service Option (SO)	Channel
1 851.25 MHz	RC5 55 (Loopback)	25
1 880.00 MHz		600
1 908.75 MHz		1 175

* 1xEV-DO

-Cellular Band-

Frequency (MHz)	RTAP Rate	Channel
824.70 MHz	1xEV-DO(RelA) RETAP 128	1 013
836.52 MHz		384
848.31 MHz		777

-PCS Band-

Frequency (MHz)	RTAP Rate	Channel
1 851.25 MHz	1xEV-DO(RelA) RETAP 128	25
1 880.00 MHz		600
1 908.75 MHz		1 175

CDMA (800 / 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 (800) 1xRTT : RC5 / 9 (Loopback), 1xEV-DO Rel.A : RETAP / 128
- CDMA (1 900) 1xRTT : RC1 / 55 (Loopback), 1xEV-DO Rel.A : RETAP / 128

3.4 Test Voltage

mode	Voltage
Norminal voltage	DC 12 V

4. Summary of test results

4.1 Standards & results

FCC Part 22 Subpart H and Part 24 Subpart E			
FCC Rule Reference	Parameter	Report Section	Test Result
§2.1046 §22.913(a) §24.232(c)	RF Radiated Output Power	5.1	C
§2.1053 §22.917(a) §24.238(a)	Spurious Radiated Emission	5.2	C
§2.1046	Conducted Output Power	5.3	C
§2.1049	26 dB Bandwidth	5.4	C
§24.232(d)	Peak-Average Ratio	5.5	C
§2.1051 §22.917(a) §24.238(a)	Spurious Emission at Antenna Terminal	5.6	C
§2.1055 §22.355 §24.235	Frequency Stability	5.7	C
§22.917(a) §24.238(a)	Band Edge	5.8	C
§1.1307 §2.1091	RF Exposure	5.9	C
Note: C = complies NC = Not complies NT = Not tested NA = Not Applicable			

4.2 Uncertainty

Measurement Item	Combined Standard Uncertainty U _c	Expanded Uncertainty U = KU _c (K = 2)
Conducted RF power	± 0.29 dB	± 0.58 dB
Radiated disturbance	30 MHz ~ 300 MHz : + 2.43 dB, - 2.44 dB 300 MHz ~ 1 000 MHz : + 2.49 dB, - 2.50 dB 1 GHz ~ 6 GHz : + 3.10 dB, - 3.10 dB 6 GHz ~ 18 GHz : + 3.21 dB, - 3.27 dB	30 MHz ~ 300 MHz : + 4.86 dB, - 4.88 dB 300 MHz ~ 1 000 MHz : + 4.98 dB, - 4.99 dB 1 GHz ~ 6 GHz : + 6.19 dB, - 6.20 dB 6 GHz ~ 18 GHz : + 6.41 dB, - 6.53 dB

5. Test results

5.1 RF Radiated Output Power

5.1.1 Measurement Procedure

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 receiver, 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.

5.1.2 Limit

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.

5.1.3 Test Result

CDMA 800 1xRTT mode

Frequency (MHz)	Ant. Pol. (H/V)	E.R.P.		Limit (mW)
		(dBm)	(mW)	
824.70	H	19.7	93.33	7 000
824.70	V	18.8	75.86	7 000
836.52	H	19.9	97.72	7 000
836.52	V	19.7	93.33	7 000
848.31	H	20.1	102.33	7 000
848.31	V	19.8	95.50	7 000

CDMA 1 900 1xRTT mode

Frequency (MHz)	Ant. Pol. (H/V)	E.R.P.		Limit (mW)
		(dBm)	(mW)	
1 851.25	H	25.9	389.05	2 000
1 851.25	V	22.6	181.97	2 000
1 880.00	H	21.9	154.88	2 000
1 880.00	V	25.2	331.13	2 000
1 908.75	H	21.1	128.82	2 000
1 908.75	V	25.0	316.23	2 000

CDMA 800 1xEV-DO mode

Frequency (MHz)	Ant. Pol. (H/V)	E.R.P.		Limit (mW)
		(dBm)	(mW)	
824.70	H	19.6	91.20	7 000
824.70	V	19.4	87.10	7 000
836.52	H	19.7	93.33	7 000
836.52	V	19.6	91.20	7 000
848.31	H	20.0	100.00	7 000
848.31	V	19.7	93.33	7 000

CDMA 1 900 1xEV-DO mode

Frequency (MHz)	Ant. Pol. (H/V)	E.R.P.		Limit (mW)
		(dBm)	(mW)	
1 851.25	H	23.8	239.88	2 000
1 851.25	V	26.0	398.11	2 000
1 880.00	H	22.3	169.82	2 000
1 880.00	V	25.4	346.74	2 000
1 908.75	H	21.5	141.25	2 000
1 908.75	V	25.2	331.13	2 000

5.2 Spurious radiated emission

5.2.1 Measurement Procedure

1. On a test site, the EUT shall be placed at 80 cm 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 receiver, 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 dBm, 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.

5.1.2 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.

5.1.3 Test Result

CDMA 800 1xRTT mode

Limit = $43+10\log(P)$ dB = 33.68 dBc

(P = 20.7 dBm = 0.117 W)

Low Channel (824.70 MHz)

Frequency (MHz)	Ant. Pol. (H/V)	Operation Frequency Power level (dBm)	Spurious Level (dBm)	*Result (dBc)	Limit (dBm)	*Margin
66.133	H	20.7	-45.9	66.6	-13.0	32.9
212.966	H	20.7	-42.1	62.8	-13.0	29.1
1 648.125	V	20.7	-40.9	61.6	-13.0	27.9

Middle Channel (836.52 MHz)

Frequency (MHz)	Ant. Pol. (H/V)	Operation Frequency Power level (dBm)	Spurious Level (dBm)	*Result (dBc)	Limit (dBc)	*Margin
63.708	H	20.5	-48.5	69.0	-13.0	35.5
210.784	V	20.5	-39.5	60.0	-13.0	26.5
1 671.500	V	20.5	-39.8	60.3	-13.0	26.8
2 508.750	V	20.5	-44.9	65.4	-13.0	31.9

High Channel (848.31 MHz)

Frequency (MHz)	Ant. Pol. (H/V)	Operation Frequency Power level (dBm)	Spurious Level (dBm)	*Result (dBc)	Limit (dBc)	*Margin
65.163	H	20.5	-41.6	62.1	-13.0	28.6
265.346	V	20.5	-39.8	60.3	-13.0	32.1
1 697.000	V	20.5	-39.6	60.1	-13.0	33.9
2 544.875	V	20.5	-45.1	65.6	-13.0	31.1

*Result = Operation Frequency Power level – Spurious level

*Margin=Limit – Spurious Level

CDMA 1 900 1xRTT mode

Limit = $43+10\log(P)$ dB = 30.08 dBc

(P = 17.1 dBm = 0.051 W)

Low Channel (1 851.25 MHz)

Frequency (MHz)	Ant. Pol. (H/V)	Operation Frequency Power level (dBm)	Spurious Level (dBm)	*Result (dBc)	Limit (dBc)	*Margin
31.698	V	16.5	-45.1	61.6	-13.0	32.1
152.948	H	16.5	-46.9	63.4	-13.0	33.9
304.874	V	16.5	-44.1	60.6	-13.0	31.1
3 701.250	V	16.5	-26.4	42.9	-13.0	13.4

Middle Channel (1 880.00 MHz)

Frequency (MHz)	Ant. Pol. (H/V)	Operation Frequency Power level (dBm)	Spurious Level (dBm)	*Result (dBc)	Limit (dBc)	*Margin
60.434	V	15.7	-49.2	64.9	-13.0	36.2
188.353	H	15.7	-46.1	61.8	-13.0	33.1
264.861	V	15.7	-47.6	63.3	-13.0	34.6
3 759.375	V	15.7	-25.4	41.1	-13.0	12.4

High Channel (1 908.75 MHz)

Frequency (MHz)	Ant. Pol. (H/V)	Operation Frequency Power level (dBm)	Spurious Level (dBm)	*Result (dBc)	Limit (dBc)	*Margin
62.010	V	17.1	-37.4	54.5	-13.0	24.4
133.426	H	17.1	-43.6	60.7	-13.0	30.6
315.908	V	17.1	-44.9	62.0	-13.0	31.9
3 817.500	H	17.1	-29.1	46.2	-13.0	16.1

*Result = Operation Frequency Power level – Spurious level

*Margin=Limit – Spurious Level

CDMA 800 1xEV-DO mode

Limit = $43 + 10 \log(P)$ dB = 33.41 dBc

(P = 20.4 dBm = 0.110 W)

Low Channel (824.70 MHz)

Frequency (MHz)	Ant. Pol. (H/V)	Operation Frequency Power level (dBm)	Spurious Level (dBm)	*Result (dBc)	Limit (dBc)	*Margin
64.314	V	20.0	-43.8	63.8	-13.0	30.8
256.737	H	20.0	-26.2	46.2	-13.0	13.2
778.476	H	20.0	-23.7	43.7	-13.0	10.7
1 648.125	V	20.0	-40.7	60.7	-13.0	27.7

Middle Channel (836.52 MHz)

Frequency (MHz)	Ant. Pol. (H/V)	Operation Frequency Power level (dBm)	Spurious Level (dBm)	*Result (dBc)	Limit (dBc)	*Margin
158.768	V	20.2	-38.4	58.4	-13.0	25.4
1 671.500	V	20.2	-39.9	60.1	-13.0	26.9
2 508.750	V	20.2	-42.6	62.8	-13.0	29.6

High Channel (848.31 MHz)

Frequency (MHz)	Ant. Pol. (H/V)	Operation Frequency Power level (dBm)	Spurious Level (dBm)	*Result (dBc)	Limit (dBc)	*Margin
39.458	V	20.4	-39.3	59.7	-13.0	26.3
60.555	V	20.4	-39.6	60.0	-13.0	26.6
1 697.000	V	20.4	-39.8	60.2	-13.0	26.8
2 542.750	V	20.4	-46.6	67.0	-13.0	33.6

*Result = Operation Frequency Power level – Spurious level

*Margin = Limit – Spurious Level

CDMA 1 900 1xEV-DO mode

Limit = $43+10\log(P)$ dB = 30.92 dBc

(P = 17.9 dBm = 0.062 W)

Low Channel (1 851.25 MHz)

Frequency (MHz)	Ant. Pol. (H/V)	Operation Frequency Power level (dBm)	Spurious Level (dBm)	*Result (dBc)	Limit (dBc)	*Margin
31.698	V	17.6	-45.6	63.2	-13.0	32.6
60.434	H	17.6	-39.7	57.3	-13.0	26.7
166.043	H	17.6	-35.3	52.9	-13.0	22.3
1 772.000	V	17.6	-47.2	64.8	-13.0	34.2
3 701.250	V	17.6	-20.5	38.1	-13.0	7.5
5 553.750	V	17.6	-26.0	43.6	-13.0	13.0

Middle Channel (1 880.00 MHz)

Frequency (MHz)	Ant. Pol. (H/V)	Operation Frequency Power level (dBm)	Spurious Level (dBm)	*Result (dBc)	Limit (dBc)	*Margin
46.854	V	17.4	-46.8	64.2	-13.0	33.8
136.821	H	17.4	-43.5	60.9	-13.0	30.5
243.764	H	17.4	-43.7	61.1	-13.0	30.7
1 798.250	V	17.4	-47.3	64.7	-13.0	34.3
3 759.375	V	17.4	-17.8	35.2	-13.0	4.8
5 638.125	V	17.4	-28.2	45.6	-13.0	15.2

High Channel (1 908.75 MHz)

Frequency (MHz)	Ant. Pol. (H/V)	Operation Frequency Power level (dBm)	Spurious Level (dBm)	*Result (dBc)	Limit (dBc)	*Margin
50.613	V	17.9	-46.0	63.9	-13.0	33.0
163.981	V	17.9	-41.7	59.6	-13.0	28.7
289.233	H	17.9	-42.4	60.3	-13.0	29.4
1 828.750	V	17.9	-39.8	57.7	-13.0	26.8
3 817.500	V	17.9	-16.5	34.4	-13.0	3.5
5 724.375	V	17.9	-25.1	43.0	-13.0	12.1

*Result = Operation Frequency Power level – Spurious level

*Margin=Limit – Spurious Level

5.3 Conducted Output Power

5.3.1 Measurement 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.

5.3.2 Limit

Requirements: CFR 47, Section §2.1046

5.3.3 Test Result

CDMA 800 1xRTT mode (Preliminary Measurement Results @ Middle channel)

Radio Configuration (RC)	Service Option (SO)	Average Output Power (dBm)		
		Ch. 1 013 / 824.70 MHz	Ch. 384 / 836.52 MHz	Ch. 777 / 848.31 MHz
RC1 (Fwd1, Rvs1)	1 (Voice)			
	2 (Loopback)		24.18	
	3 (Voice)			
	6 (SMS)			
	55 (Loopback)		24.29	
	68 (Voice)			
	70 (Voice)			
RC2 (Fwd2, Rvs2)	9 (Loopback)		24.21	
	14 (SMS)			
	17 (Voice)			
	55 (Loopback)		24.20	
	32768 (Voice)			
RC3 (Fwd3, Rvs3)	1 (Voice)			
	2 (Loopback)		24.26	
	3 (Voice)			
	6 (SMS)			
	55 (Loopback)		24.25	
	32 (+F-SCH)		24.23	
	32 (+SCH)		24.24	
	68 (Voice)			
	70 (Voice)			
RC4 (Fwd4, Rvs3)	1 (Voice)			
	2 (Loopback)		24.32	
	3 (Voice)			
	6 (SMS)			
	55 (Loopback)		24.34	
	32 (+F-SCH)		24.31	
	32 (+SCH)		24.33	
	68 (Voice)			
	70 (Voice)			
RC5 (Fwd5, Rvs4)	9 (Loopback)	24.54	24.33	24.35
	14 (SMS)			
	17 (Voice)			
	55 (Loopback)		24.32	
	32768 (Voice)			

5.3.2 Test Result

CDMA 1 900 1xRTT mode (Preliminary Measurement Results @ Middle channel)

Radio Configuration (RC)	Service Option (SO)	Average Output Power (dBm)		
		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)		23.86	
	3 (Voice)			
	6 (SMS)			
	55 (Loopback)		24.81	
	68 (Voice)			
	70 (Voice)			
RC2 (Fwd2, Rvs2)	9 (Loopback)		23.89	
	14 (SMS)			
	17 (Voice)			
	55 (Loopback)		23.90	
	32768 (Voice)			
RC3 (Fwd3, Rvs3)	1 (Voice)			
	2 (Loopback)		23.78	
	3 (Voice)			
	6 (SMS)			
	55 (Loopback)		23.91	
	32 (+F-SCH)		23.90	
	32 (+SCH)		23.89	
	68 (Voice)			
	70 (Voice)			
RC4 (Fwd4, Rvs3)	1 (Voice)			
	2 (Loopback)		23.88	
	3 (Voice)			
	6 (SMS)			
	55 (Loopback)		23.89	
	32 (+F-SCH)		23.90	
	32 (+SCH)		23.97	
	68 (Voice)			
	70 (Voice)			
RC5 (Fwd5, Rvs4)	9 (Loopback)		23.97	
	14 (SMS)			
	17 (Voice)			
	55 (Loopback)	23.92	23.98	23.6
	32768 (Voice)			

CDMA 800 1xEV-DO mode (Preliminary Measurement Results @ Middle channel)

Application Protocol	Rate	Average Output Power (dBm)		
		Ch. 1 013 / 824.70 MHz	Ch. 384 / 836.52 MHz	Ch. 777 / 848.31 MHz
RETAP	128	24.81	24.48	24.46
	256		24.46	
	512		24.43	
	768		24.40	
	1024		24.46	
	1536		24.47	
	2048		24.42	
	3072		24.45	
	4096		24.43	
	6144		24.44	
	8192		24.45	
	12288		24.46	
FETAP	4(1024,2,128)	24.86	24.47	24.53

CDMA 1 900 1xEV-DO mode (Preliminary Measurement Results @ Middle channel)

Application Protocol	Rate	Average Output Power (dBm)		
		Ch. 25 / 1 851.25 MHz	Ch. 600 / 1 880.00 MHz	Ch. 1 175 / 1 908.75 MHz
RETAP	128	24.21	24.44	23.37
	256		24.42	
	512		24.41	
	768		24.33	
	1024		24.39	
	1536		24.38	
	2048		24.39	
	3072		24.38	
	4096		24.39	
	6144		24.38	
	8192		24.39	
	12288		24.33	
FETAP	4(1024,2,128)	24.08	24.09	23.62

5.4 26 dB Bandwidth

5.4.1 Measurement 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. 26 dB bandwidth was measured with Mobile Communication Test unit for each channel.

5.4.2 Limit

Requirements: CFR 47, Section §2.1049.

5.4.3 Test Result

CDMA 800 1xRTT mode

Band	Mode	Frequency (MHz)	Occupied Bandwidth (MHz)
CDMA 800	1xRTT	824.70	1.420
	RC5	836.52	1.420
	9 (Loopback)	848.31	1.415

CDMA 1 900 1xRTT mode

Band	Mode	Frequency (MHz)	Occupied Bandwidth (MHz)
CDMA 1 900	1xRTT	1 851.25	1.424
	RC5	1 880.00	1.428
	55 (Loopback)	1 908.75	1.415

CDMA 800 1xEV-DO mode

Band	Mode	Frequency (MHz)	Occupied Bandwidth (MHz)
CDMA 800	1xEV-DO(RelA)	824.70	1.424
	RETAP	836.52	1.424
	128	848.31	1.415

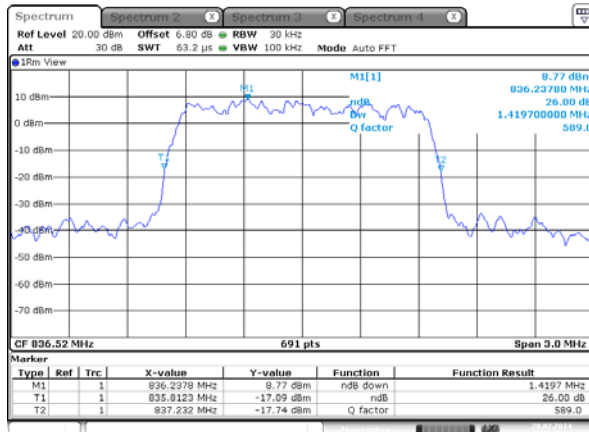
CDMA 1 900 1xRTT mode

Band	Mode	Frequency (MHz)	Occupied Bandwidth (MHz)
CDMA 1 900	1xEV-DO(RelA)	1 851.25	1.420
	RETAP	1 880.00	1.420
	128	1 908.75	1.428

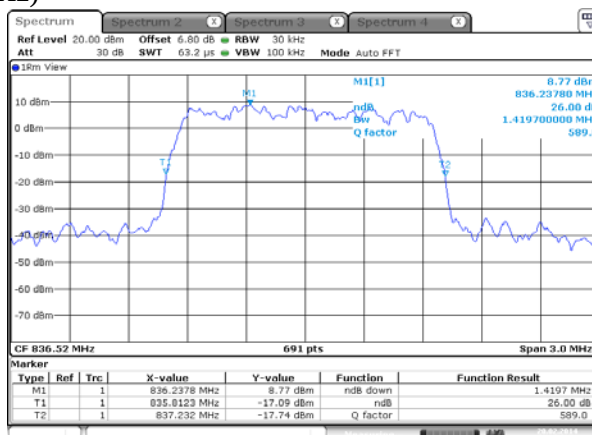
5.4.4 Test Plot

CDMA 800 1xRTT mode

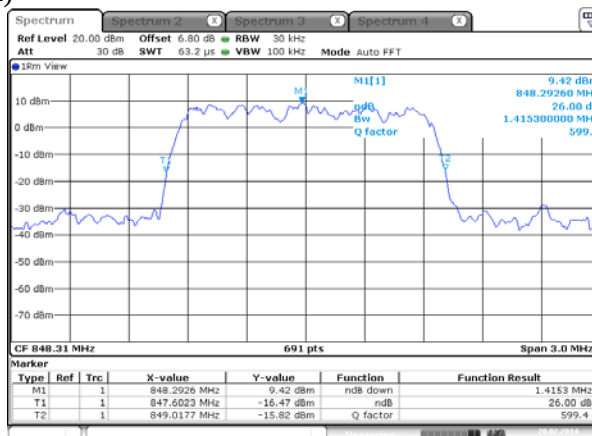
Low Channel (824.70 MHz)



Middle Channel (836.52 MHz)

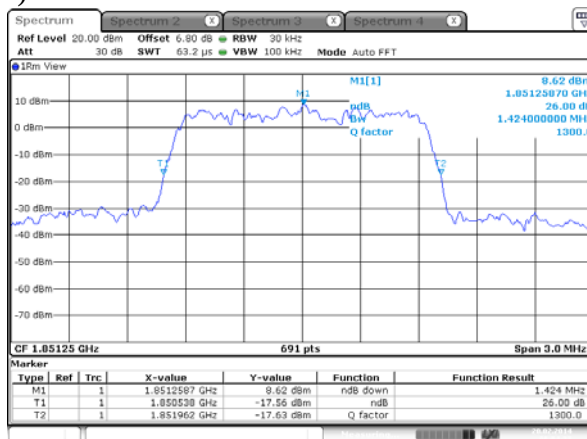


High Channel (848.31 MHz)

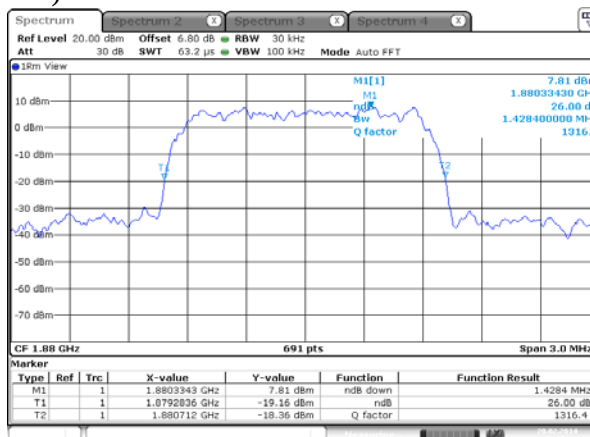


CDMA 1 900 1xRTT mode

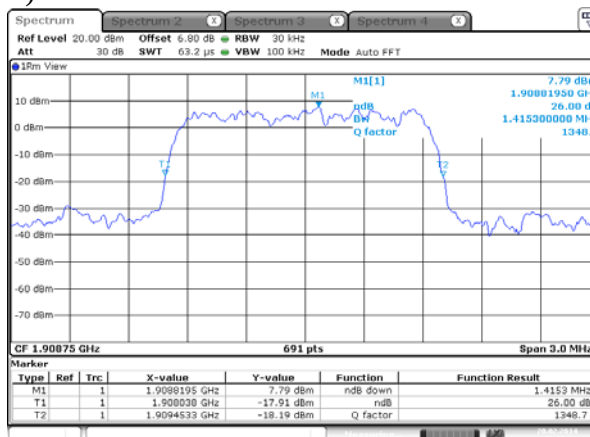
Low Channel (1 851.25 MHz)



Middle Channel (1 880.00 MHz)

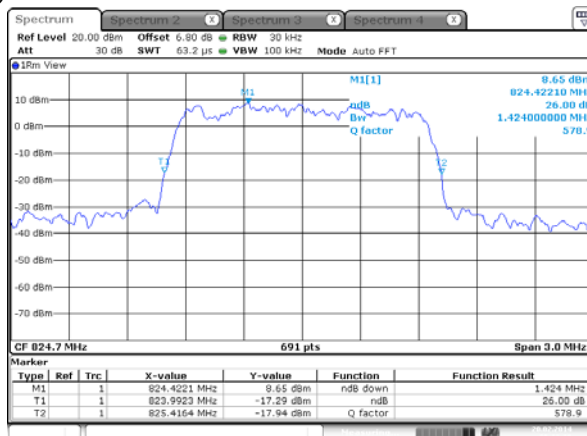


High Channel (1 908.75 MHz)

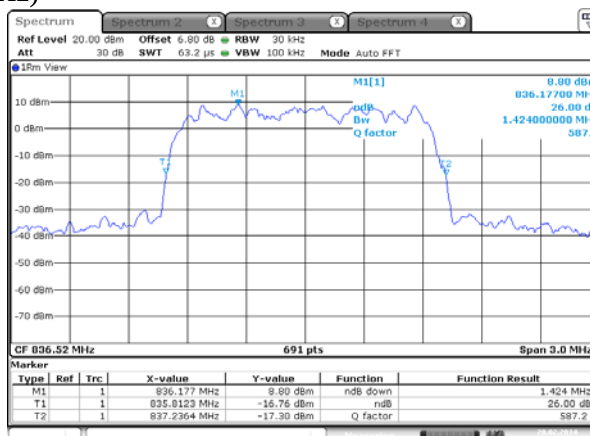


CDMA 800 1xEV-DO mode

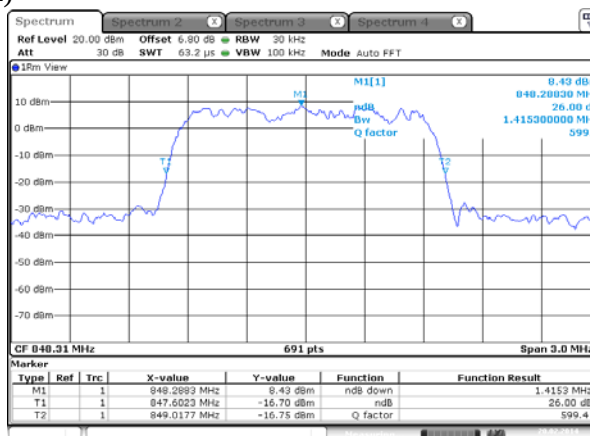
Low Channel (824.70 MHz)



Middle Channel (836.52 MHz)

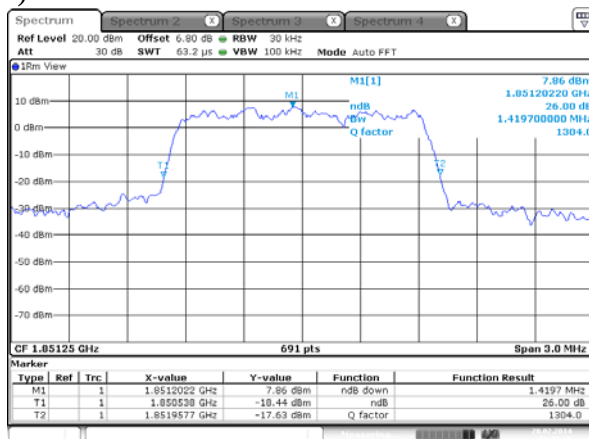


High Channel (848.31 MHz)

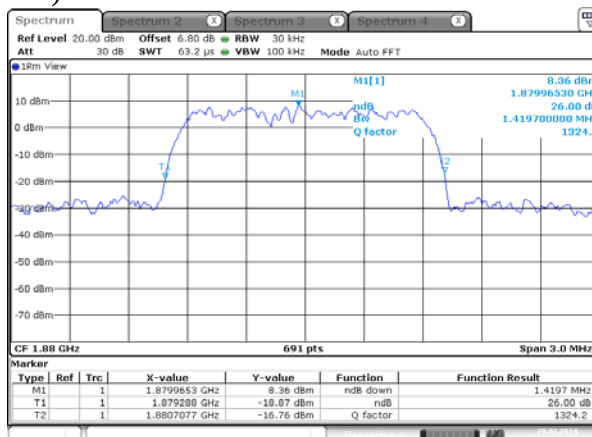


CDMA 1 900 1xEV-DO mode

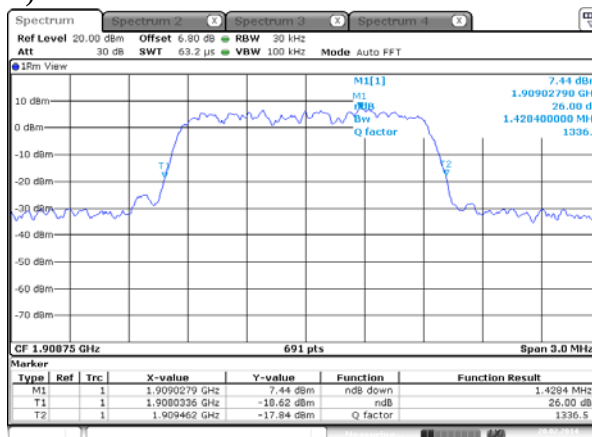
Low Channel (1 851.25 MHz)



Middle Channel (1 880.00 MHz)



High Channel (1 908.75 MHz)



5.5 Peak-Average Ratio

5.5.1 Measurement 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.

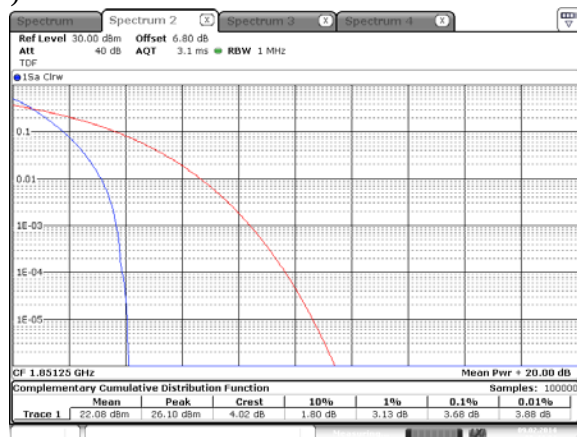
5.5.2 Limit

§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.

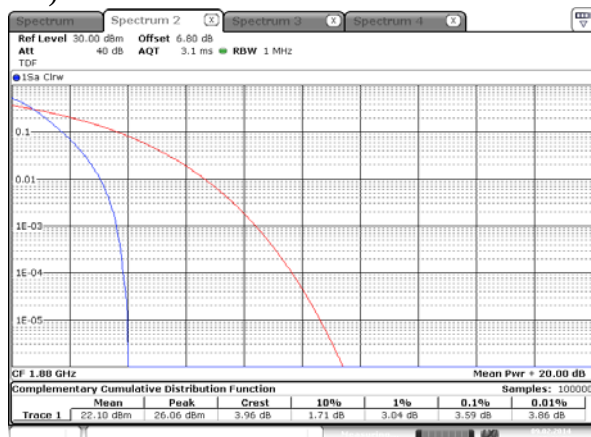
5.5.3 Test Result

CDMA 1 900 1xRTT mode

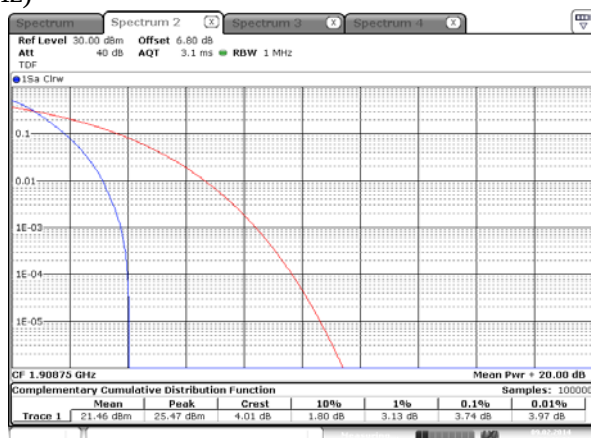
Low Channel (1 851.25 MHz)



Middle Channel (1 880.00 MHz)

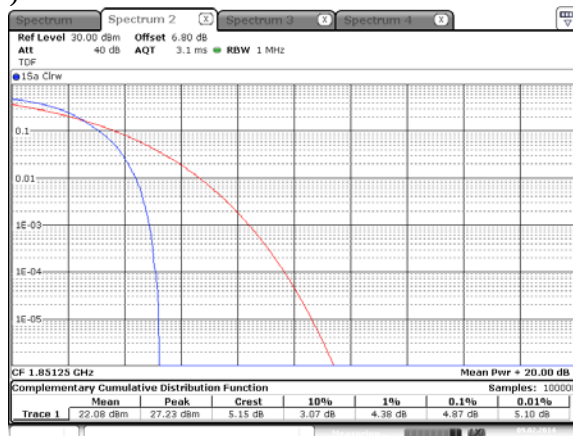


High Channel (1 908.75 MHz)

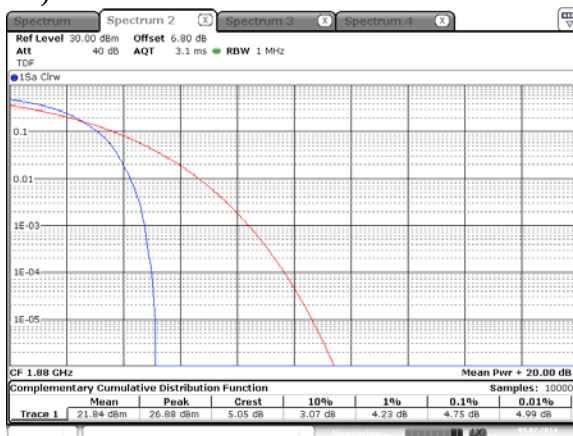


CDMA 1 900 1xEV-DO mode

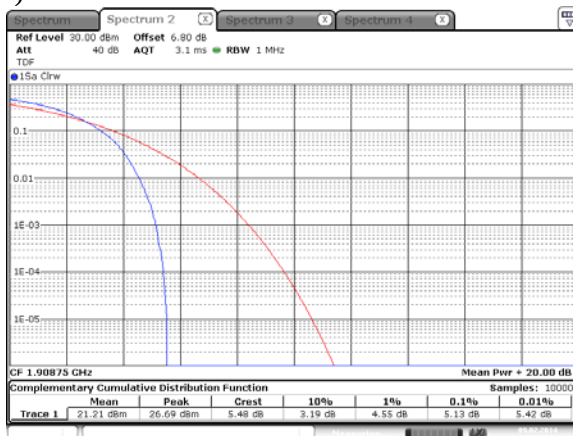
Low Channel (1 851.25 MHz)



Middle Channel (1 880.00 MHz)



High Channel (1 908.75 MHz)



5.6 Spurious Emissions at Antenna Terminal

5.6.1 Measurement 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.

5.6.2 Limit

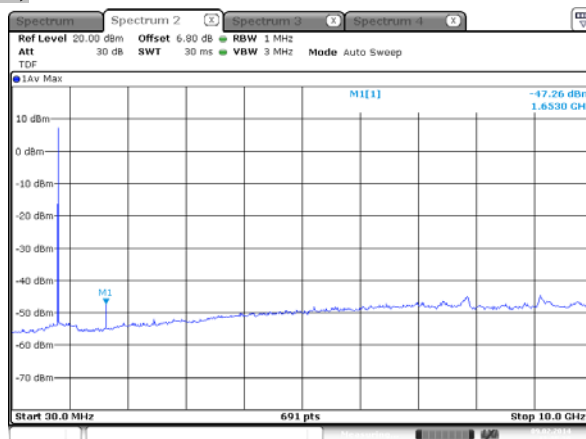
§22.917(a) and §24.238 (a) Out of band emissions. The power of any emission outside of the authorized operating frequency must be attenuated below the transmitting (P) by a factor of at least $43 + 10\log(P)$ dB.

5.6.3 Test Result

Limit = $43 + 10\log(P)$ dB

CDMA 800 1xRTT mode

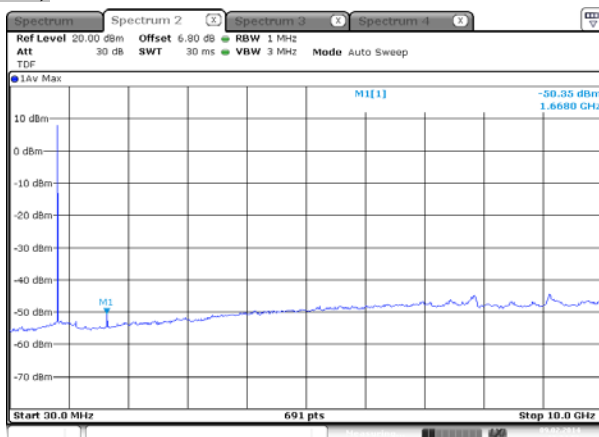
Low Channel (824.70 MHz)



Frequency [MHz]	Operation Frequency Power level [dBm]	Spurious level [dBm]	Result [dBc]	Limit [dBm]	Margin
1 653.00	20.7	-47.26	67.96	-13.0	34.26

Result = Operation Frequency Power level – Spurious level

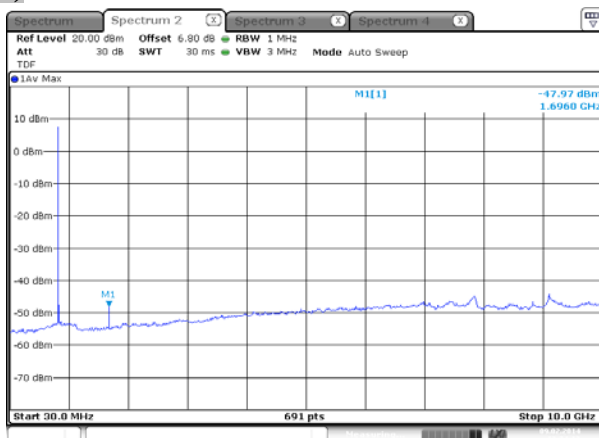
Middle Channel (836.52 MHz)



Frequency [MHz]	Operation Frequency Power level [dBm]	Spurious level [dBm]	Result [dBc]	Limit [dBm]	Margin
1 668.00	20.5	-50.35	70.85	-13.0	37.35

Result = Operation Frequency Power level – Spurious level

High Channel (848.31 MHz)

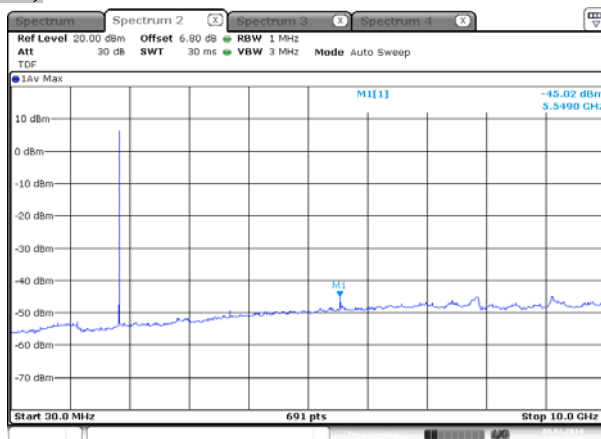


Frequency [MHz]	Operation Frequency Power level [dBm]	Spurious level [dBm]	Result [dBc]	Limit [dBm]	Margin
1 696.00	20.5	-47.97	68.47	-13.0	34.97

Result = Operation Frequency Power level – Spurious level

CDMA 1 900 1xRTT mode

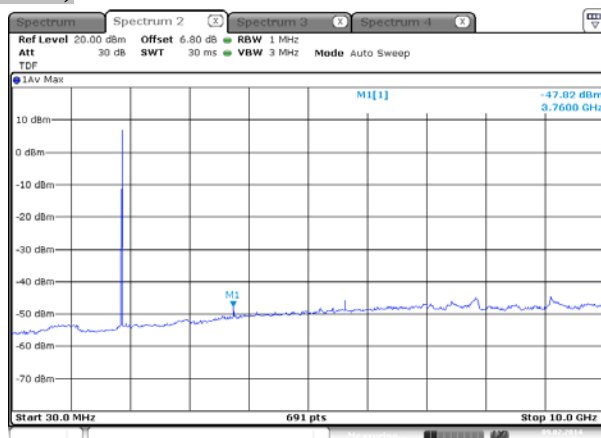
Low Channel (1 851.25 MHz)



Frequency [MHz]	Operation Frequency Power level [dBm]	Spurious level [dBm]	Result [dBc]	Limit [dBm]	Margin
5 549.00	16.5	-45.02	61.52	-13.0	32.02

Result = Operation Frequency Power level – Spurious level

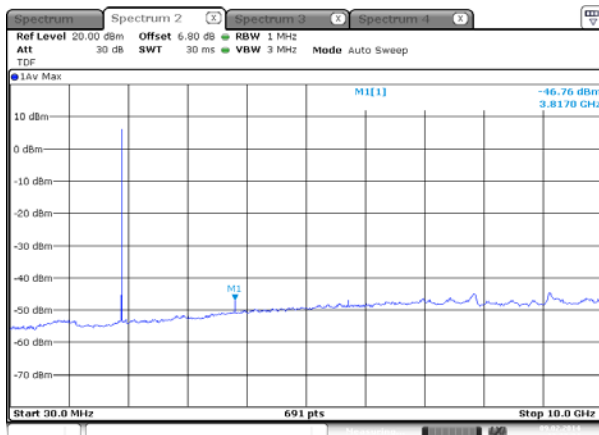
Middle Channel (1 880.00 MHz)



Frequency [MHz]	Operation Frequency Power level [dBm]	Spurious level [dBm]	Result [dBc]	Limit [dBm]	Margin
3 760.00	15.7	-47.82	63.52	-13.0	34.82

Result = Operation Frequency Power level – Spurious level

High Channel (1 908.75 MHz)

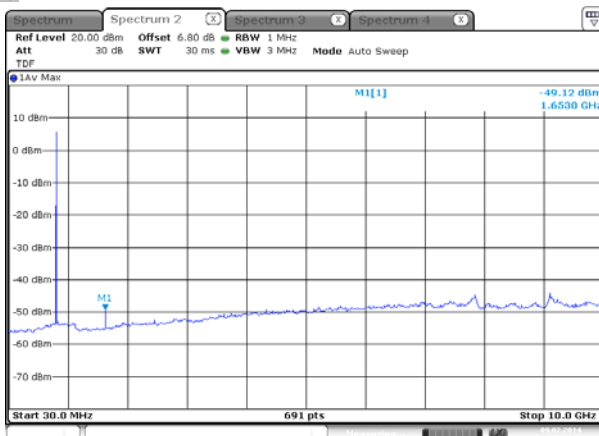


Frequency [MHz]	Operation Frequency Power level [dBm]	Spurious level [dBm]	Result [dBc]	Limit [dBm]	Margin
3 817.00	17.1	-46.76	63.86	-13.0	33.76

Result = Operation Frequency Power level – Spurious level

CDMA 800 1xEV-DO mode

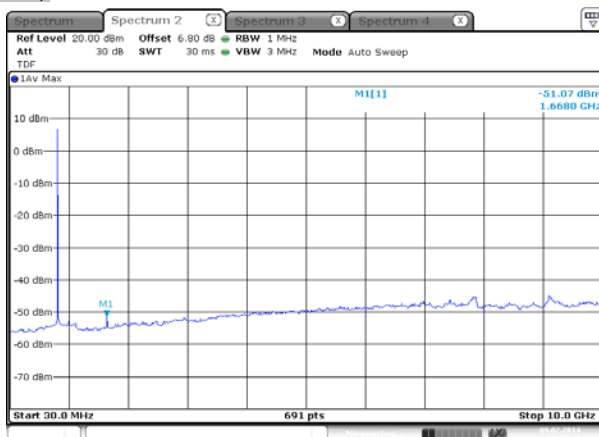
Low Channel (824.70 MHz)



Frequency [MHz]	Operation Frequency Power level [dBm]	Spurious level [dBm]	Result [dBc]	Limit [dBm]	Margin
1 653.00	20.0	-49.12	69.12	-13.0	36.12

Result = Operation Frequency Power level – Spurious level

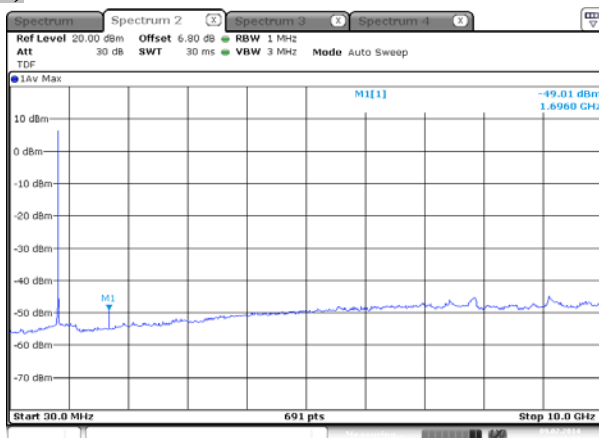
Middle Channel (836.52 MHz)



Frequency [MHz]	Operation Frequency Power level [dBm]	Spurious level [dBm]	Result [dBc]	Limit [dBm]	Margin
1 668.00	20.2	-51.07	71.27	-13.0	38.07

Result = Operation Frequency Power level – Spurious level

High Channel (848.31 MHz)

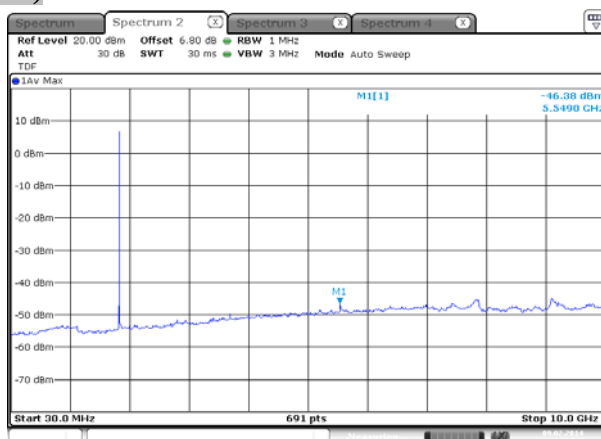


Frequency [MHz]	Operation Frequency Power level [dBm]	Spurious level [dBm]	Result [dBc]	Limit [dBm]	Margin
1 696.00	20.4	-49.01	69.41	-13.0	36.01

Result = Operation Frequency Power level – Spurious level

CDMA 1 900 1xEV-DO mode

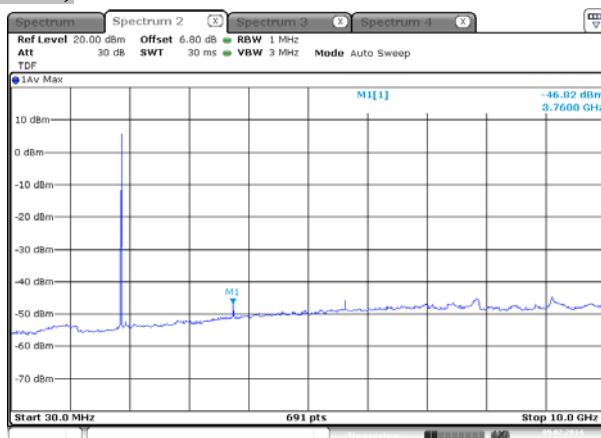
Low Channel (1 851.25 MHz)



Frequency [MHz]	Operation Frequency Power level [dBm]	Spurious level [dBm]	Result [dBc]	Limit [dBm]	Margin
5 549.00	17.6	-46.38	63.98	-13.0	33.38

Result = Operation Frequency Power level – Spurious level

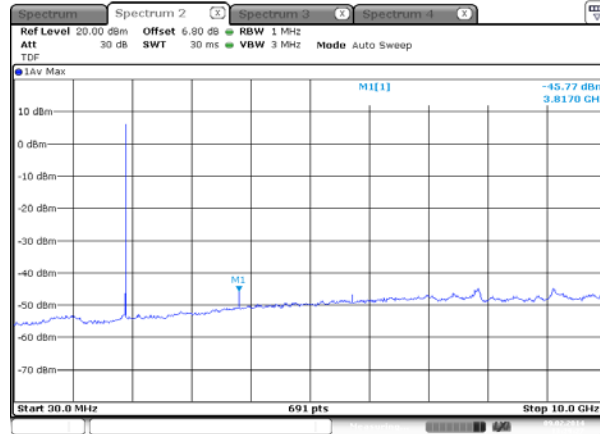
Middle Channel (1 880.00 MHz)



Frequency [MHz]	Operation Frequency Power level [dBm]	Spurious level [dBm]	Result [dBc]	Limit [dBm]	Margin
3 760.00	17.4	-46.82	64.22	-13.0	33.82

Result = Operation Frequency Power level – Spurious level

High Channel (1 908.75 MHz)



Frequency [MHz]	Operation Frequency Power level [dBm]	Spurious level [dBm]	Result [dBc]	Limit [dBm]	Margin
3 817.00	17.9	-45.77	63.67	-13.0	32.77

Result = Operation Frequency Power level – Spurious level

5.7 Band Edge

5.7.1 Measurement 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.

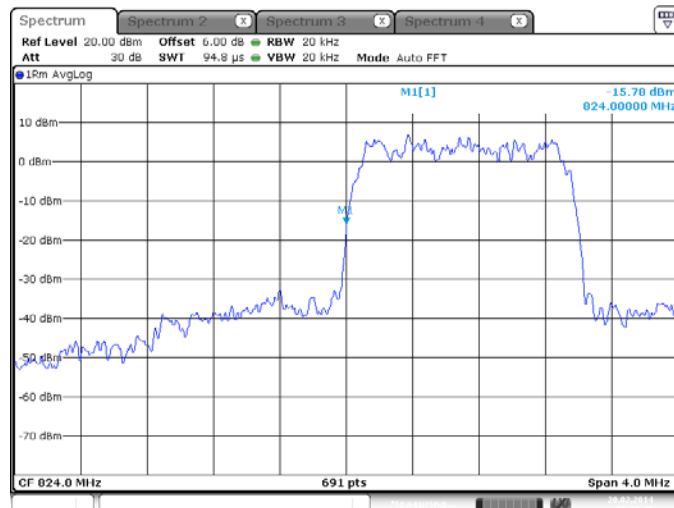
5.7.2 Limit

§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.

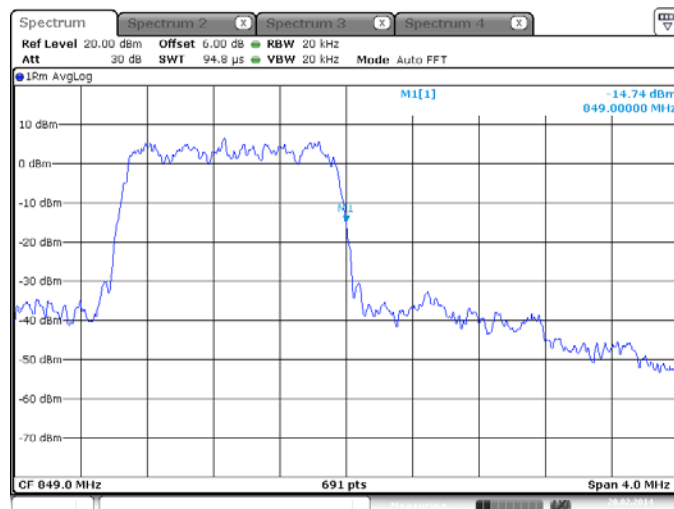
5.7.3 Test Result

CDMA 800 1xRTT mode (band edge)

Low Channel (824.70 MHz)

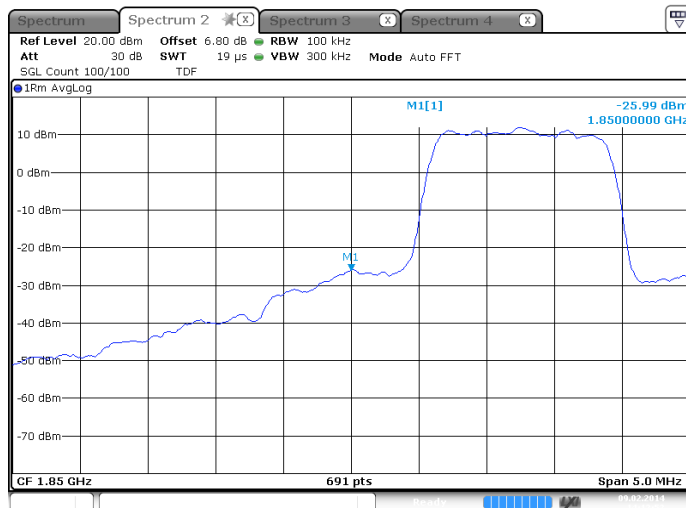


High Channel (848.31 MHz)

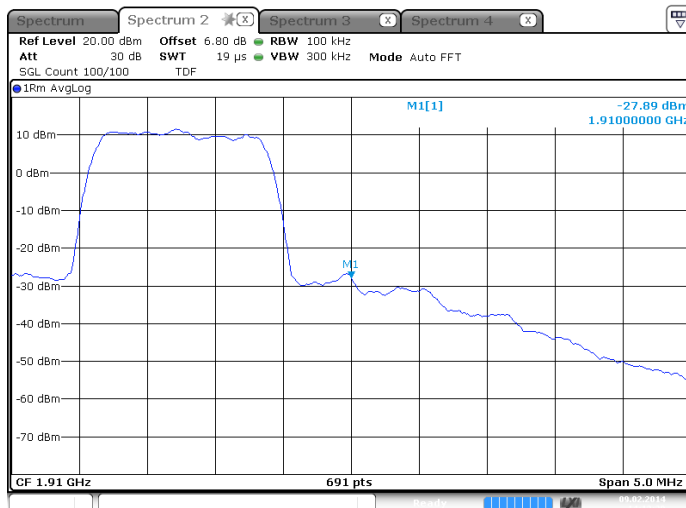


CDMA 1 900 1xRTT mode (band edge)

Low Channel (1 851.25 MHz)

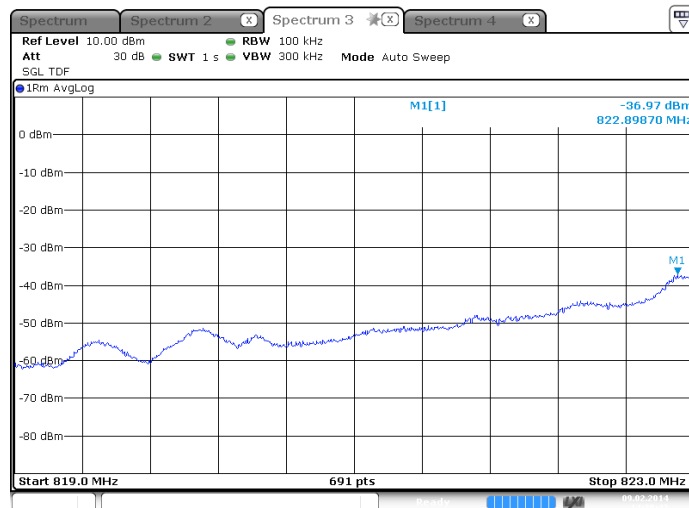


High Channel (1 908.75 MHz)

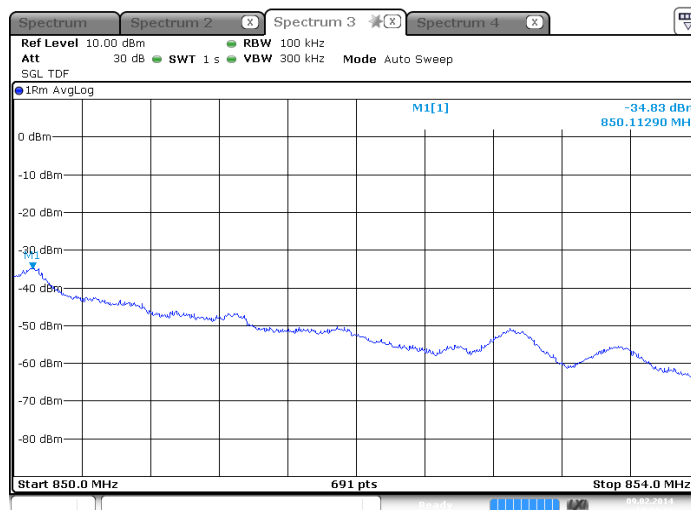


CDMA 800 1xRTT mode (4 MHz span)

Low Channel (824.70 MHz)

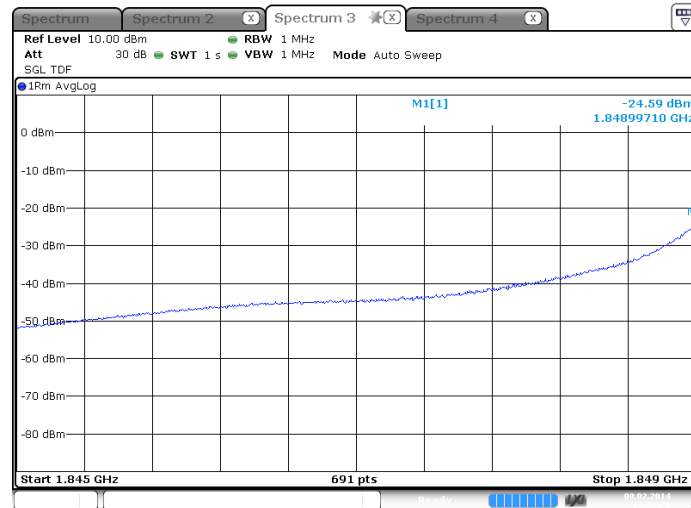


High Channel (848.31 MHz)

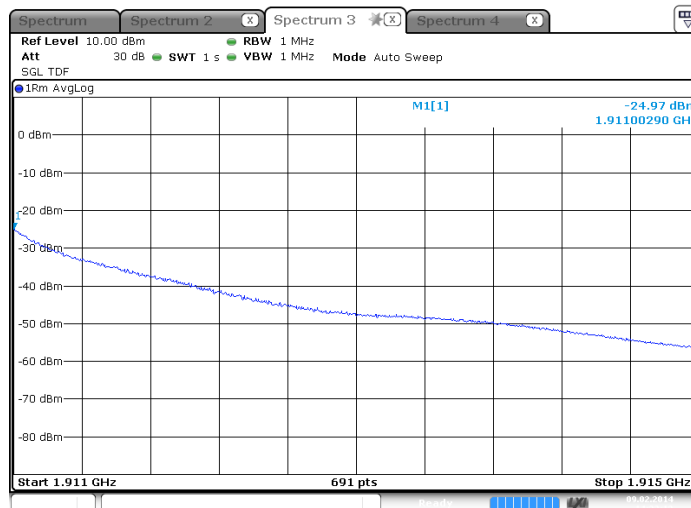


CDMA 1 900 1xRTT mode (4 MHz span)

Low Channel (1 851.25 MHz)

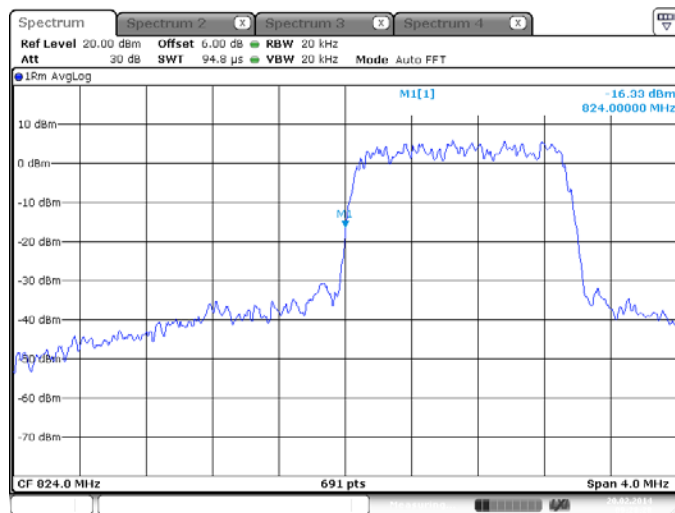


High Channel (1 908.75 MHz)

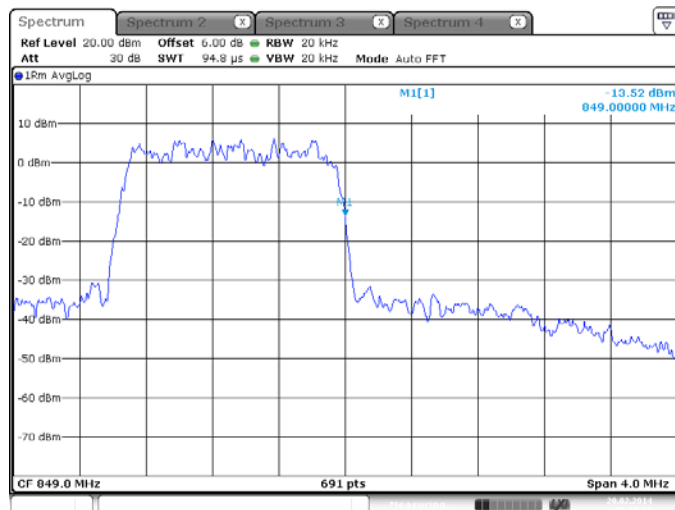


CDMA 800 1xEV-DO mode (band edge)

Low Channel (824.70 MHz)

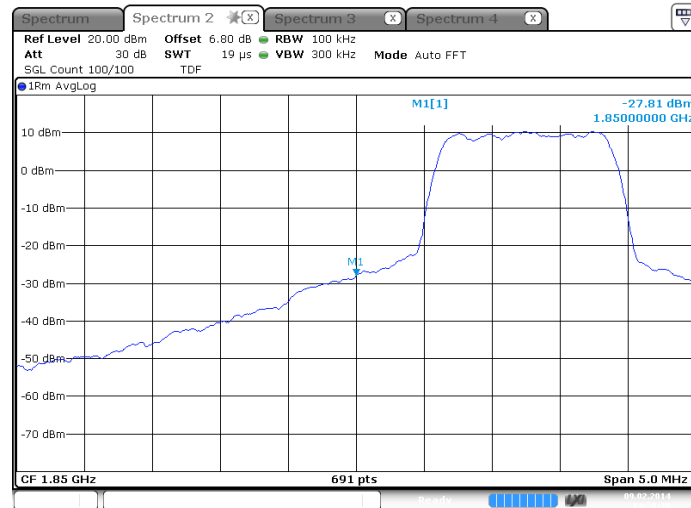


High Channel (848.31 MHz)

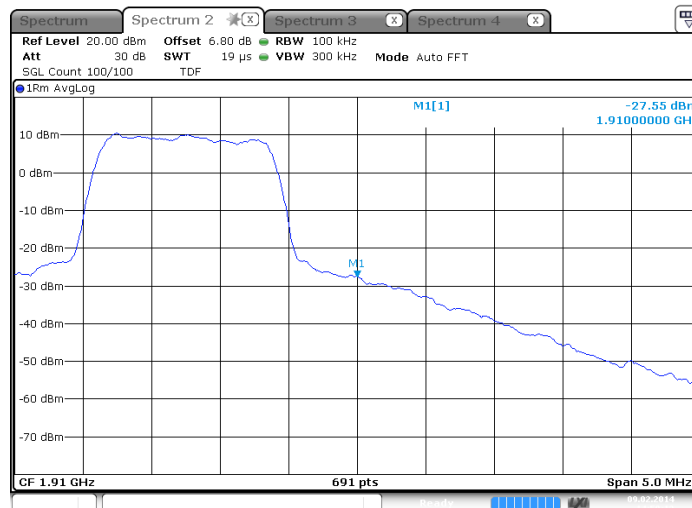


CDMA 1 900 1xEV-DO mode (band edge)

Low Channel (1 851.25 MHz)

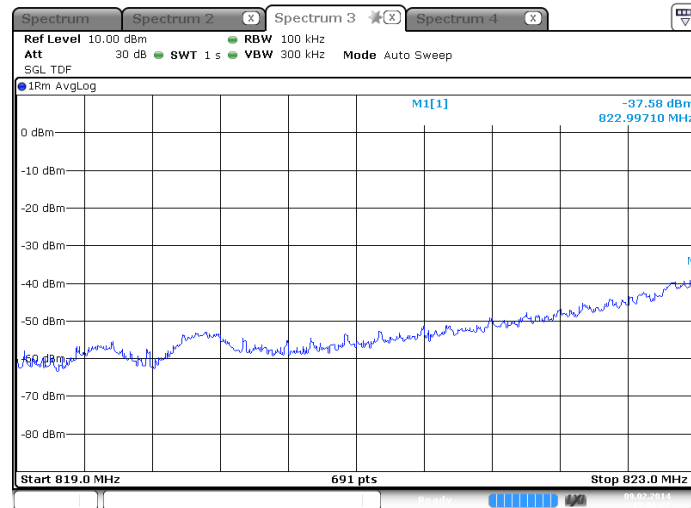


High Channel (1 908.75 MHz)

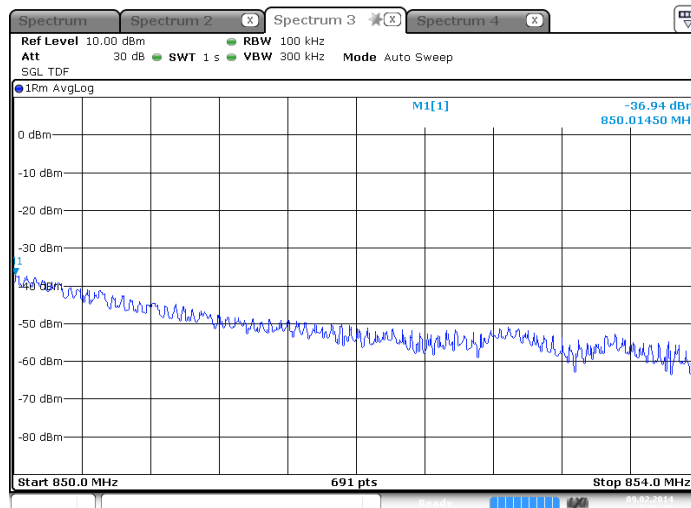


CDMA 800 1xEV-DO mode (4 MHz span)

Low Channel (824.70 MHz)

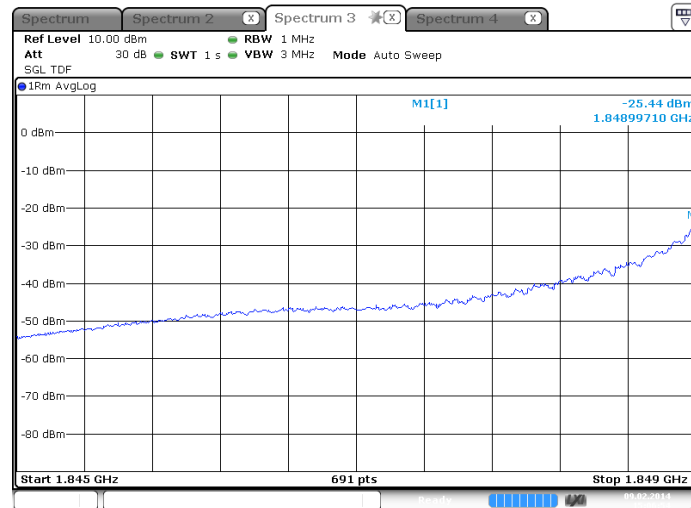


High Channel (848.31 MHz)

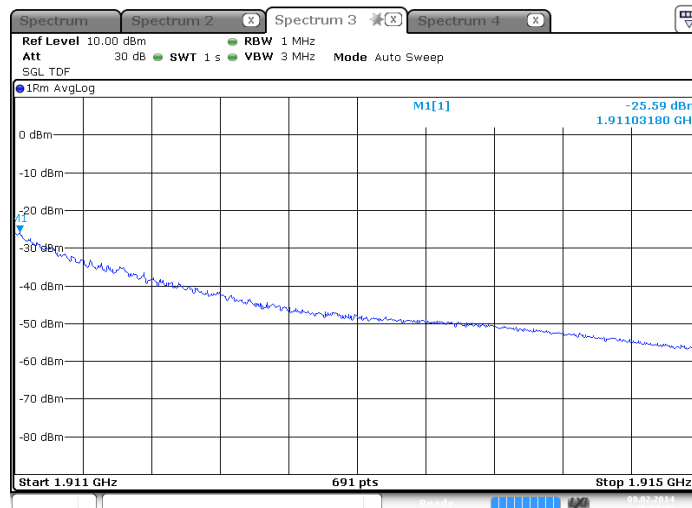


CDMA 1 900 1xEV-DO mode (4 MHz span)

Low Channel (1 851.25 MHz)



High Channel (1 908.75 MHz)



5.8 Frequency Stability

5.8.1 Measurement 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.

5.8.2 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.

5.8.3 Test Result

CDMA 800 1xRTT mode mode at middle channel

Voltage(%)	Power(V)	Temperature	Frequency Deviation	ppm
100	12	-30	1.80	-0.00167
		-20	2.40	-0.00096
		-10	4.40	0.00143
		0	3.70	0.00060
		10	3.60	0.00048
		20	3.20	Ref
		30	2.70	-0.00060
		40	2.80	-0.00048
		50	2.70	-0.00060
85	10.2	20	2.20	-0.00120
115	13.8	20	2.40	-0.00096

CDMA 1 900 1xRTT mode mode at middle channel

Voltage(%)	Power(V)	Temperature	Frequency Deviation	ppm
100	12	-30	2.10	0.00251
		-20	3.70	0.00442
		-10	4.10	0.00490
		0	2.10	0.00251
		10	2.70	0.00323
		20	3.50	Ref
		30	2.50	0.00299
		40	2.30	0.00275
		50	3.50	0.00418
85	10.2	20	3.40	0.00406
115	13.8	20	2.70	0.00323

CDMA 800 1xEV-DO mode mode at middle channel

Voltage(%)	Power(V)	Temperature	Frequency Deviation	ppm
100	12	-30	2.60	0.00311
		-20	1.30	0.00155
		-10	2.80	0.00335
		0	3.70	0.00442
		10	3.80	0.00454
		20	4.40	Ref
		30	3.20	0.00383
		40	4.80	0.00574
		50	5.30	0.00634
85	10.2	20	3.10	0.00371
115	13.8	20	2.70	0.00323

CDMA 1 900 1xEV-DO mode mode at middle channel

Voltage(%)	Power(V)	Temperature	Frequency Deviation	ppm
100	12	-30	3.20	0.00383
		-20	3.30	0.00394
		-10	3.60	0.00430
		0	4.00	0.00478
		10	3.50	0.00418
		20	3.70	Ref
		30	2.70	0.00323
		40	3.30	0.00394
		50	3.60	0.00430
85	10.2	20	3.60	0.00430
115	13.8	20	3.70	0.00442

5.9 RF Exposure Evaluation

5.9.1 Regulation

According to FCC 1.1310 : The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in §1.1307(b)

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength(V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Average Time
(A) Limits for Occupational /Control Exposures				
300 – 1 500			F/300	6
1 500 – 100 000			5	6
(B) Limits for General Population/Uncontrol Exposures				
300 – 1 500			F/1 500	30
1 500 – 100 000			1	30

Friis transmission formula: $P_d = (P_{out} * G) / (4 * \pi * R^2)$

P_d = power density in mW/cm²

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

π = 3.1416

R = distance between observation point and center of the radiator in cm

P_d the limit of MPE, 1 mW/cm². If we know the maximum gain of the antenna and the total power input to The antenna, through the calculation, we will know the distance where the MPE limit is reached.

5.6.3 Test Result of RF Exposure Evaluation

CDMA800 1xRTT

Channel	Frequency [MHz]	Ant Gain [dBm]	power [dBm]	Power Density at 20 cm [mW/cm ²]	Limit [mW/cm ²]
Low	824.70	2.99	24.54	0.112 65	0.549 80
Middle	836.52	2.99	24.33	0.107 33	0.557 68
High	848.31	2.99	24.48	0.111 10	0.565 54

Mode	Frequency [MHz]	Ant Gain [dBm]	power [dBm]	Power Density at 20 cm [mW/cm ²]	Limit [mW/cm ²]
Maximum Tune up tolerance	824.70	2.99	25.0	0.125 24	0.549 80

* CDMA1 900 1xRTT

Channel	Frequency [MHz]	Ant Gain [dBm]	power [dBm]	Power Density at 20 cm [mW/cm ²]	Limit [mW/cm ²]
Low	1 851.25	5.09	23.92	0.158 39	1
Middle	1 880.00	5.09	23.98	0.160 59	1
High	1 908.75	5.09	23.60	0.147 14	1

Mode	Frequency [MHz]	Ant Gain [dBm]	power [dBm]	Power Density at 20 cm [mW/cm ²]	Limit [mW/cm ²]
Maximum Tune up tolerance	1 880.00	5.09	25.0	0.203 11	1

*** CDMA800 1xEV-DO**

Channel	Frequency [MHz]	Ant Gain [dBm]	power [dBm]	Power Density at 20 cm [mW/cm ²]	Limit [mW/cm ²]
Low	824.70	2.99	24.81	0.119 88	0.549 80
Middle	836.52	2.99	24.48	0.111 10	0.557 68
High	848.31	2.99	24.46	0.110 59	0.565 54

Mode	Frequency [MHz]	Ant Gain [dBm]	power [dBm]	Power Density at 20 cm [mW/cm ²]	Limit [mW/cm ²]
Maximum Tune up tolerance	824.70	2.99	25.0	0.125 24	0.549 80

*** CDMA800 1xEV-DO**

Channel	Frequency [MHz]	Ant Gain [dBm]	power [dBm]	Power Density at 20 cm [mW/cm ²]	Limit [mW/cm ²]
Low	1 851.25	5.09	24.21	0.169.33	1
Middle	1 880.00	5.09	24.44	0.178 54	1
High	1 908.75	5.09	24.34	0.174 47	1

Mode	Frequency [MHz]	Ant Gain [dBm]	power [dBm]	Power Density at 20 cm [mW/cm ²]	Limit [mW/cm ²]
Maximum Tune up tolerance	1 880.00	5.09	25.0	0.203 11	1

6. Test equipment used for test

	Description	Manufacture	Model No.	Serial No.	Next Cal Date.
■	Spectrum Analyzer	R&S	FSV30	101437	14.12.31
■	DC Power Supply	Agilent	E3632A	MY51220373	14.12.24
■	Signal Generator	R&S	SMR40	100007	14.06.11
■	Test Receiver	R&S	ESC17	100732	14.02.18
■	Spectrum Analyzer	R&S	FSP40	100209	14.10.21
■	Loop Antenna	R&S	HFH2-Z2	100355	15.06.19
■	Bi-Log Antenna	Schwarzbeck	VULB9163	552	14.07.18
■	Horn Antenna	ETS-Lindgren	3115	86706	14.08.20
■	Horn Antenna	ETS-Lindgren	3116	00086632	15.11.15
■	Amplifier	Sonoma	310N	186280	15.01.27
■	Amplifier	Schwarzbeck	BBV9718	233	14.05.03
■	Amplifier	Schwarzbeck	BBV9721	2	14.05.09
■	Attenuator	HP	8491A	16861	14.07.08
■	Antenna Mast	Innco Systems	MA4000-EP	303	-
■	Turn Table	Innco Systems	DT2000S-1t	79	-