7 - TWO-TONE TEST

7.1 Applicable Standards

According to IS-138A (3.4.4), Intermodulation products must be attenuated below the rated power of the EUT by at least 43 +10log (P), equivalent to –13 dBm.

7.2 Test Procedure

The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. 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 10^{th} harmonic. Two input signals are equal in level (and can be raised equally), were send to the EUT.

7.3 Test Equipment

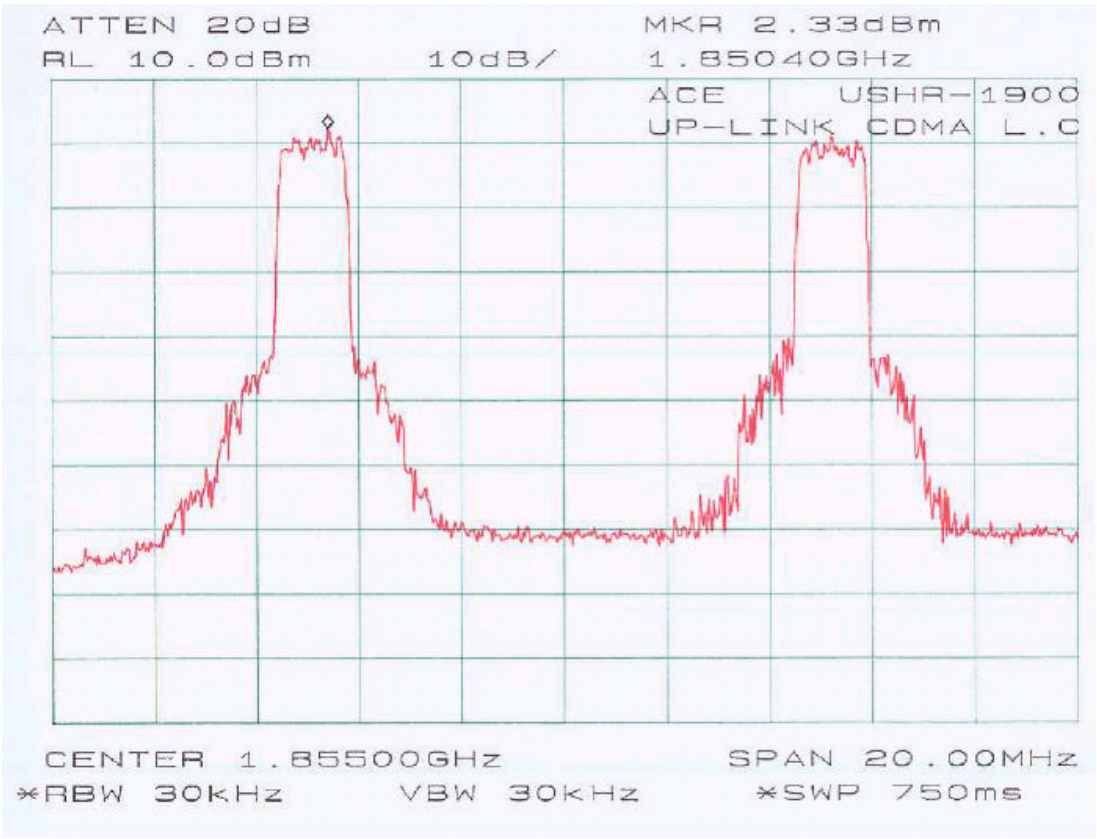
Hewlett Packard HP8566B Spectrum Analyzer
Hewlett Packard HP 7470A Plotter
Rohde & Schwarz SMIQ03B Signal Generator
Rohde & Schwarz AMIQ I/Q Modulation Generator

7.4 Test Results

Modulation	Mode	Channel	Measured
CDMA	Up-link	Low	< -13dBm
		Mid	< -13dBm
		High	< -13dBm
	Down-link	Low	< -13dBm
		Mid	< -13dBm
		High	< -13dBm

7.5 Plots of Two-Tone Test Result

Please refer to plots hereinafter.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RL 10.0dBm
10dB/
MKR 2.33dBm
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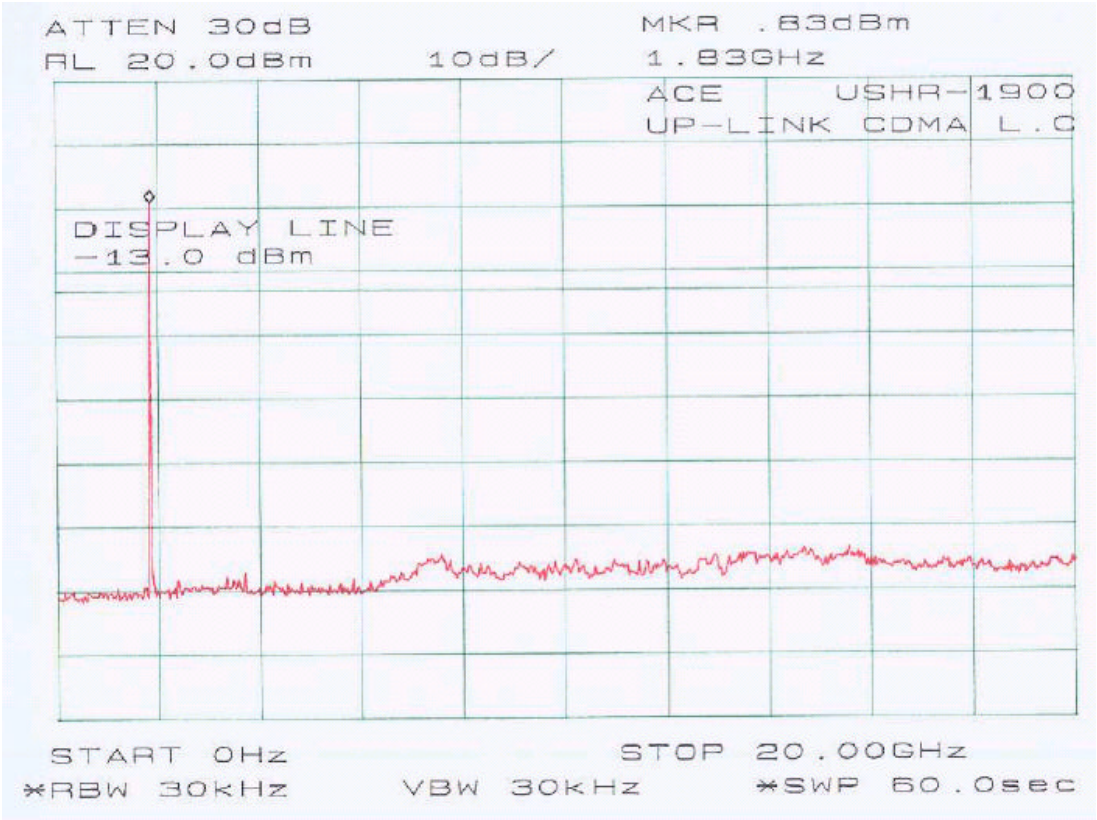
ACE USHR-1900
UP-LINK CDMA L.C
CENTER 1.85500GHz
SPAN 20.00MHz
*RBW 30kHz
VBW 30kHz
*SWP 750ms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10dB/
MKR .83dBm
1.83GHz
ACE USHR-1900
UP-LINK CDMA L.C
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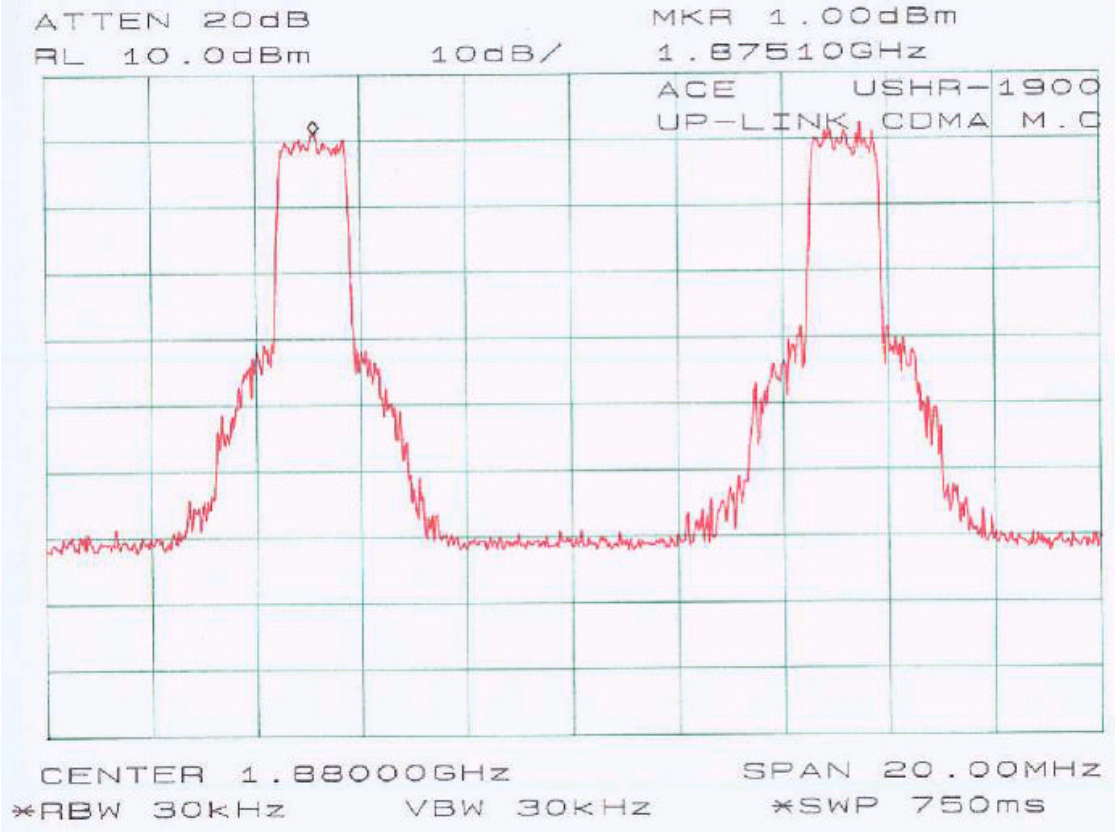
-13.0 dBm
START 0Hz
STOP 20.00GHz
*RBW 30kHz
VBW 30kHz
*SWP 60.0sec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10dB/
MKR 1.00dBm
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ACE USHR-1900
UP-LINK CDMA M.C
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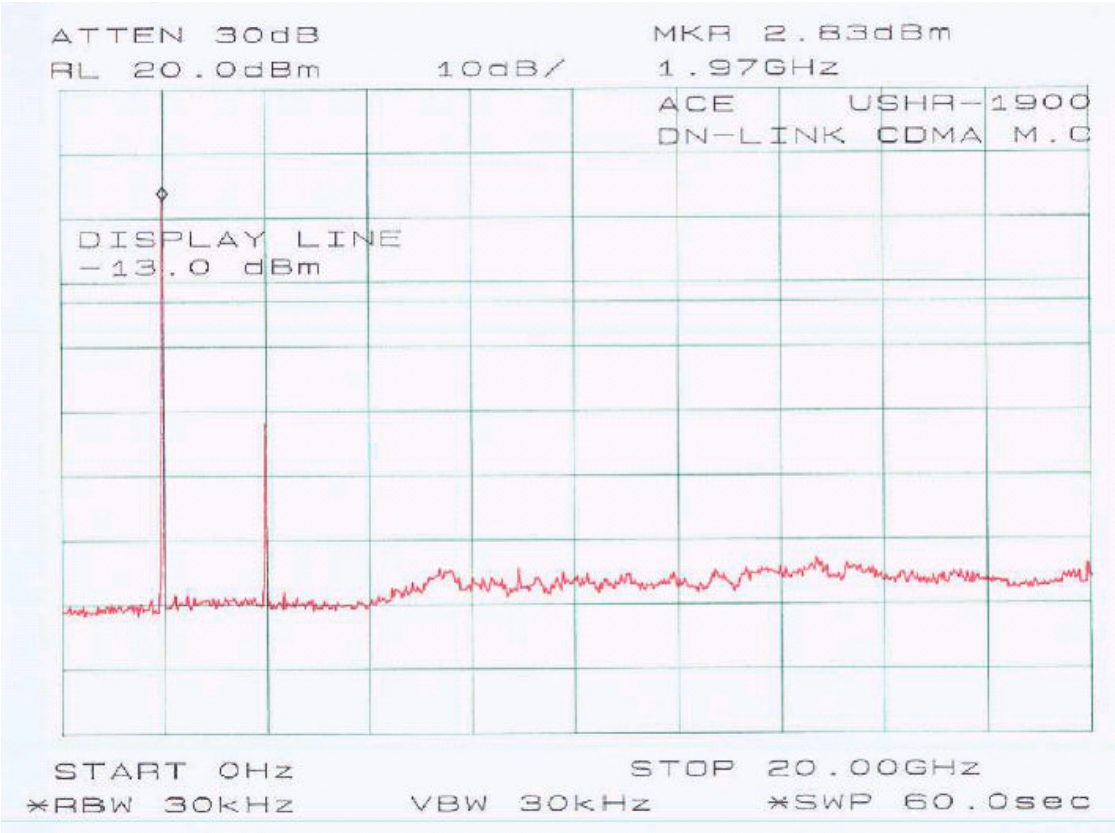
SPAN 20.00MHz
*RBW 30kHz
VBW 30kHz
*SWP 750ms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DN-LINK CDMA M.C
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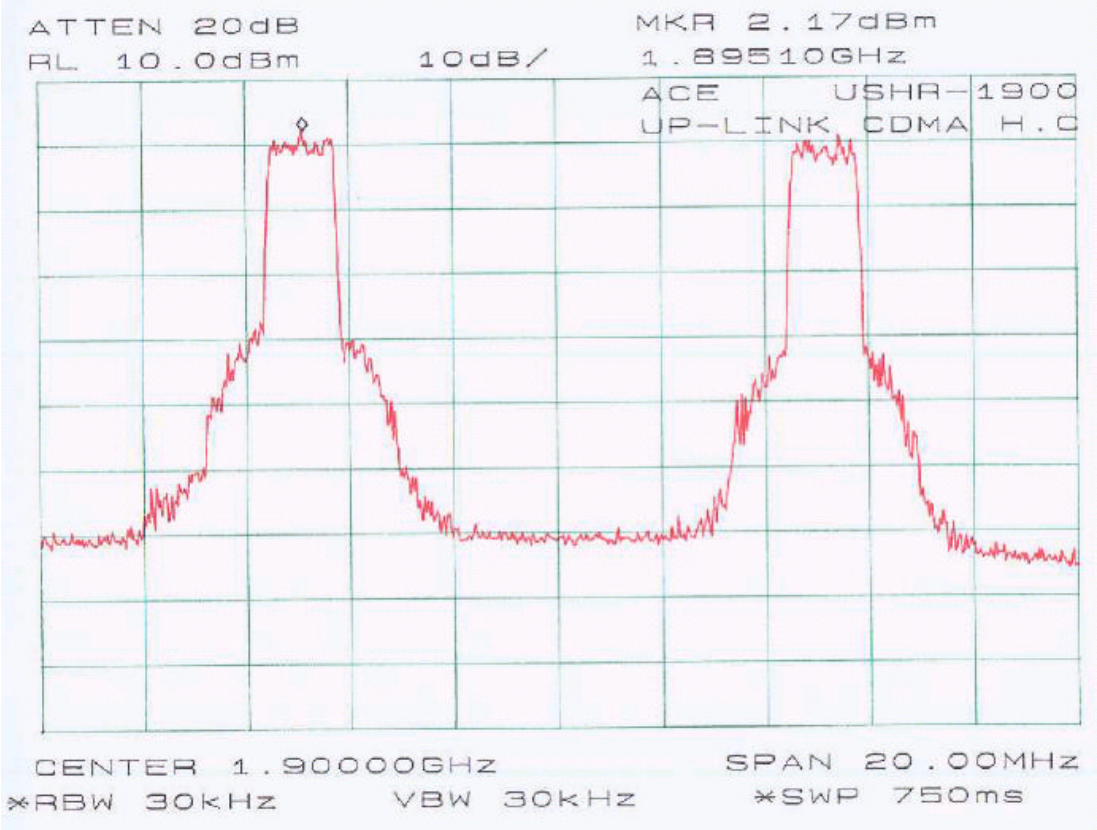
START 0Hz
STOP 20.00GHz
*RBW 30kHz
VBW 30kHz
*SWP 60.0sec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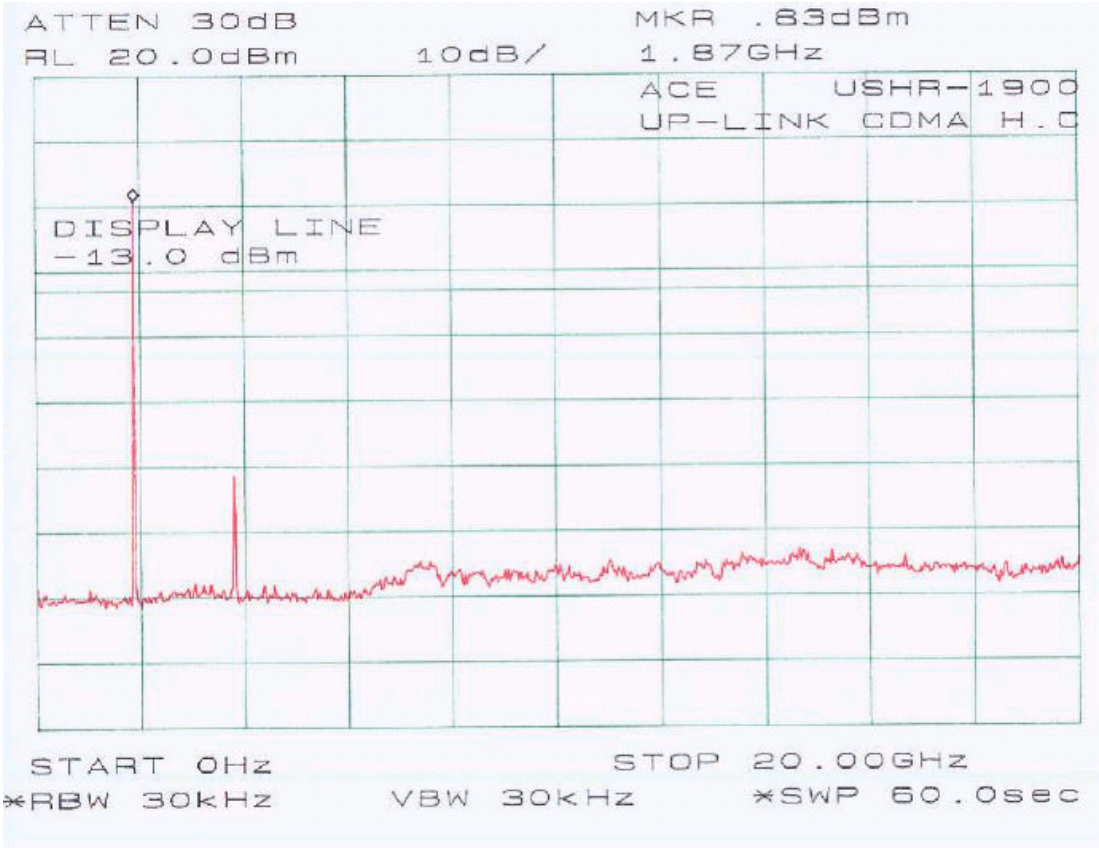
10dB/
MKR 2.17dBm
1.89510GHz
ACE USHR-1900
UP-LINK CDMA H.C
CENTER 1.90000GHz
SPAN 20.00MHz
*RBW 30kHz
VBW 30kHz
*SWP 750ms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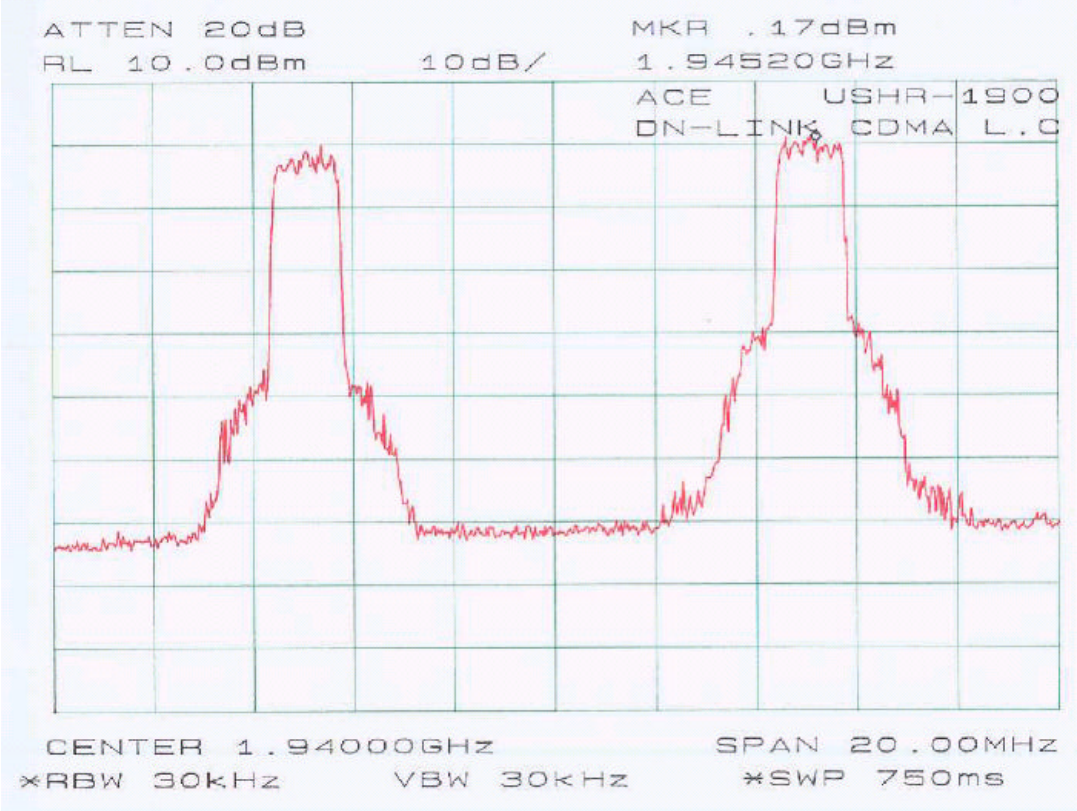
10dB/
MKR .83dBm
1.87GHz
ACE USHR-1900
UP-LINK CDMA H.C
DISPLAY LINE
-13.0 dBm
START 0Hz
STOP 20.00GHz
*RBW 30kHz
VBW 30kHz
*SWP 60.0sec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MKR .17dBm
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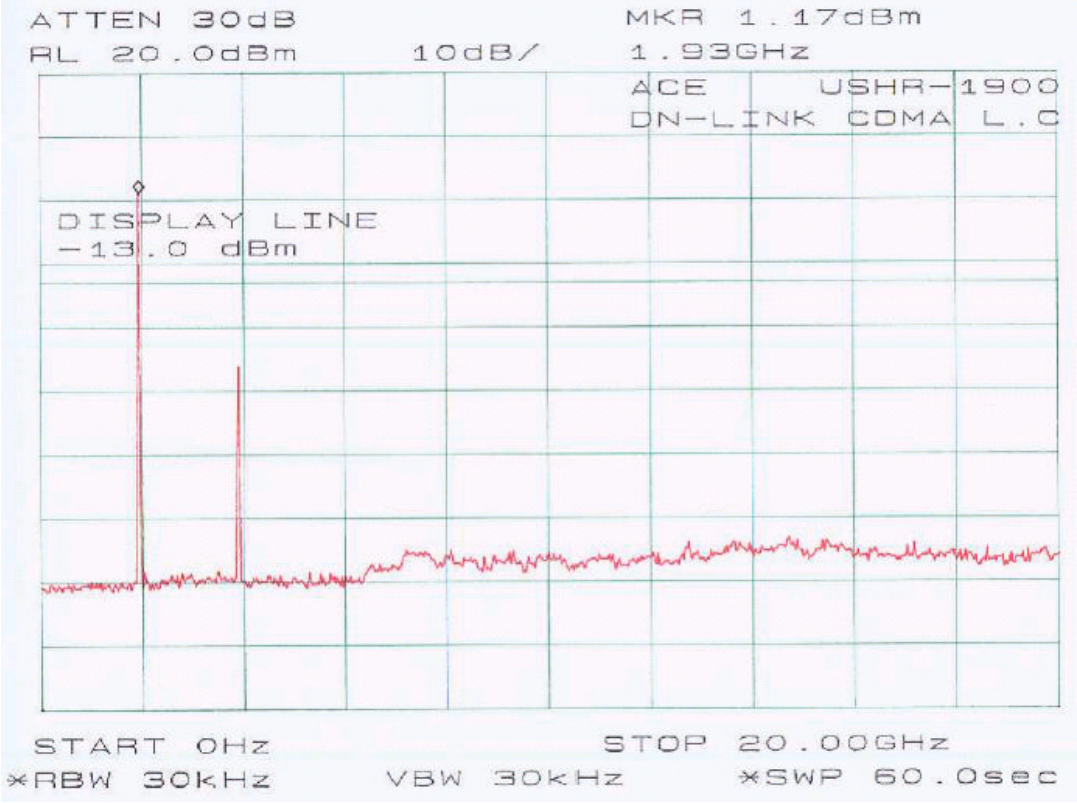
DN-LINK CDMA L.C
CENTER 1.94000GHz
SPAN 20.00MHz
*RBW 30kHz
VBW 30kHz
*SWP 750ms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10dB/
MKR 1.17dBm
1.93GHz
ACE USHR-1900
DN-LINK CDMA L.C
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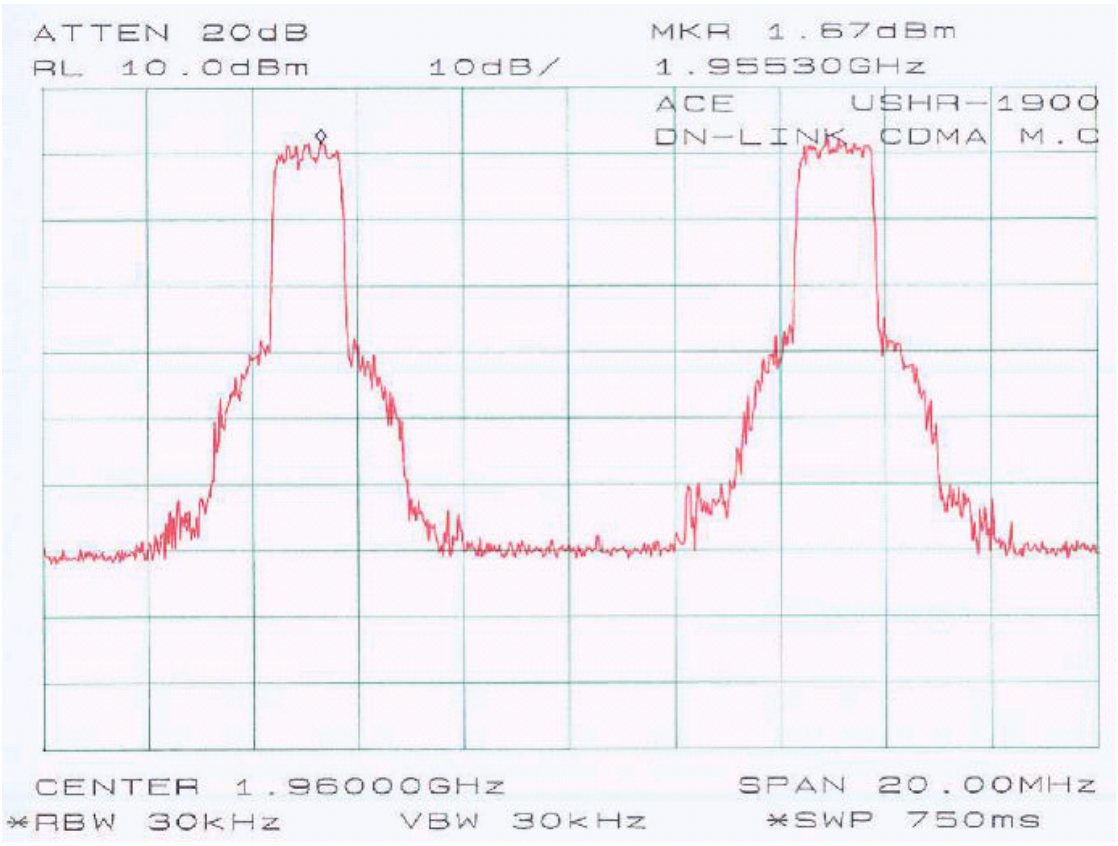
START 0Hz
STOP 20.00GHz
*RBW 30kHz
VBW 30kHz
*SWP 60.0sec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MKR 1.67dBm
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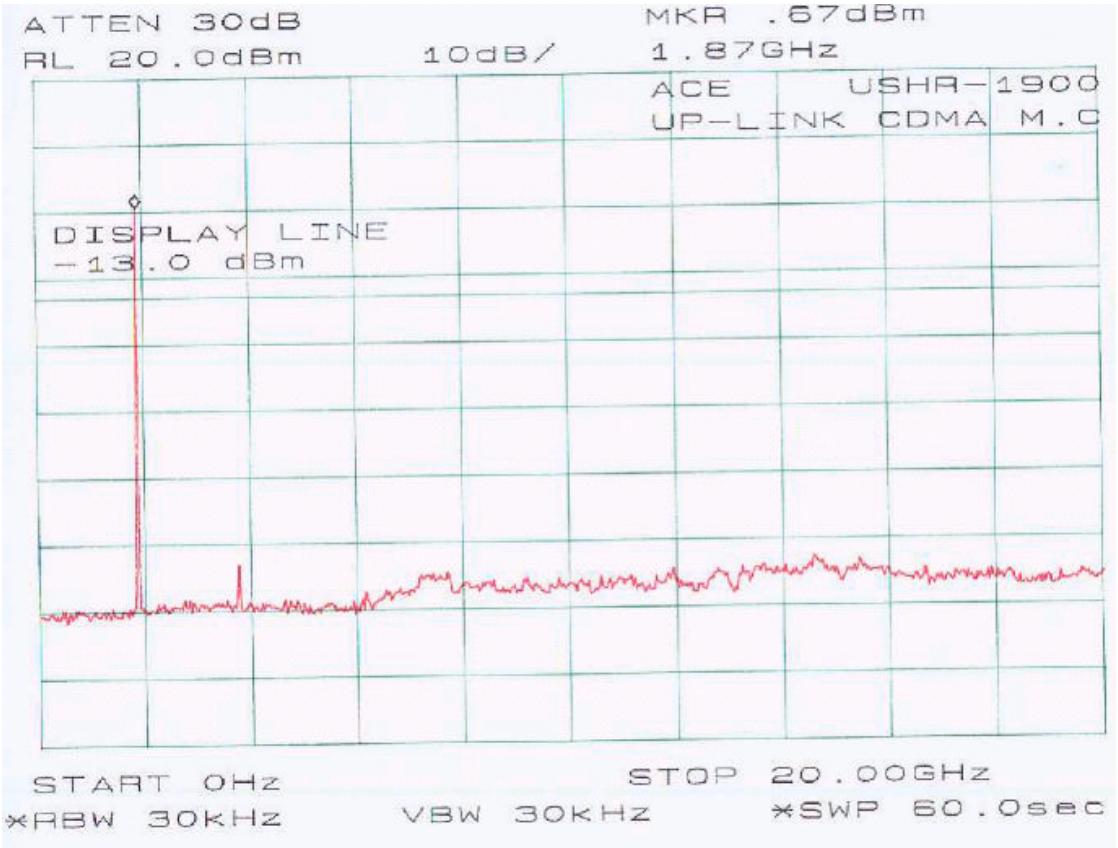
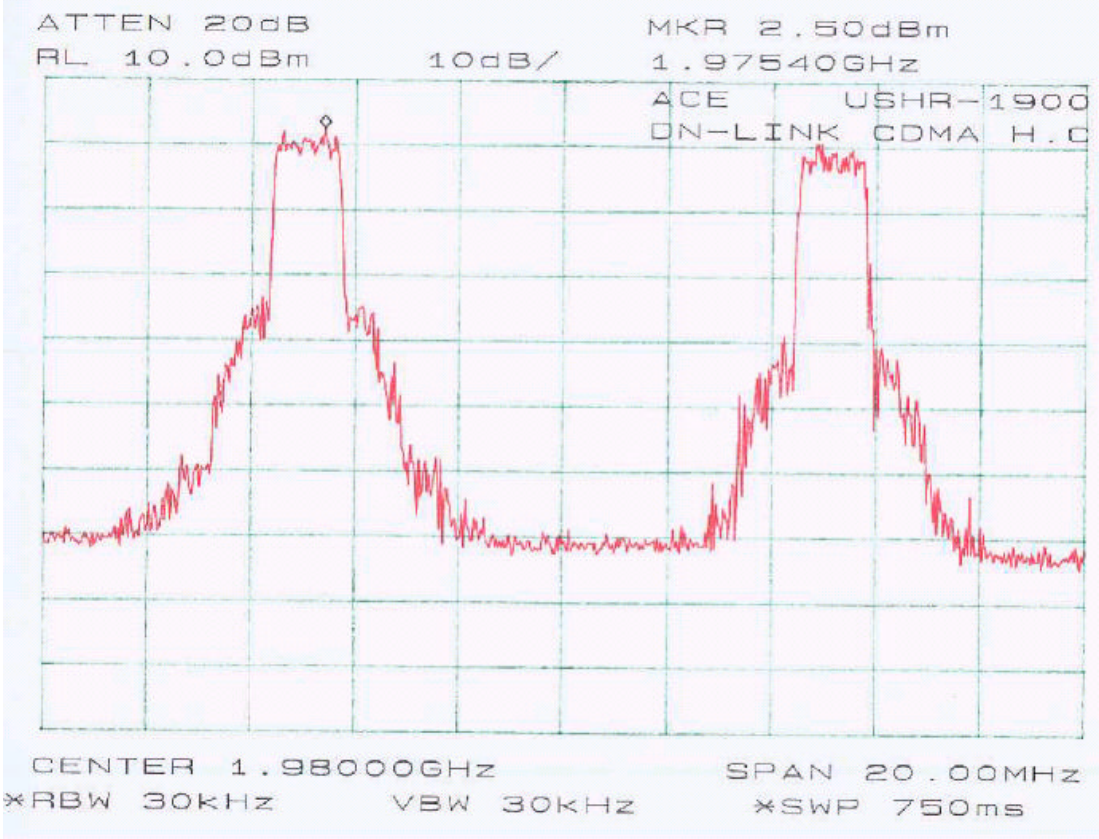
ACE USHR-1900
DN-LINK CDMA M.C
CENTER 1.96000GHz
SPAN 20.00MHz
*RBW 30kHz
VBW 30kHz
*SWP 750ms


ATTEN 30dB
RL 20.0dBm
10dB/
MKR .67dBm
1.87GHz
ACE USHR-1900
UP-LINK CDMA M.C
DISPLAY LINE
-13.0 dBm
START 0Hz
STOP 20.00GHz
*RBW 30kHz
VBW 30kHz
*SWP 60.0sec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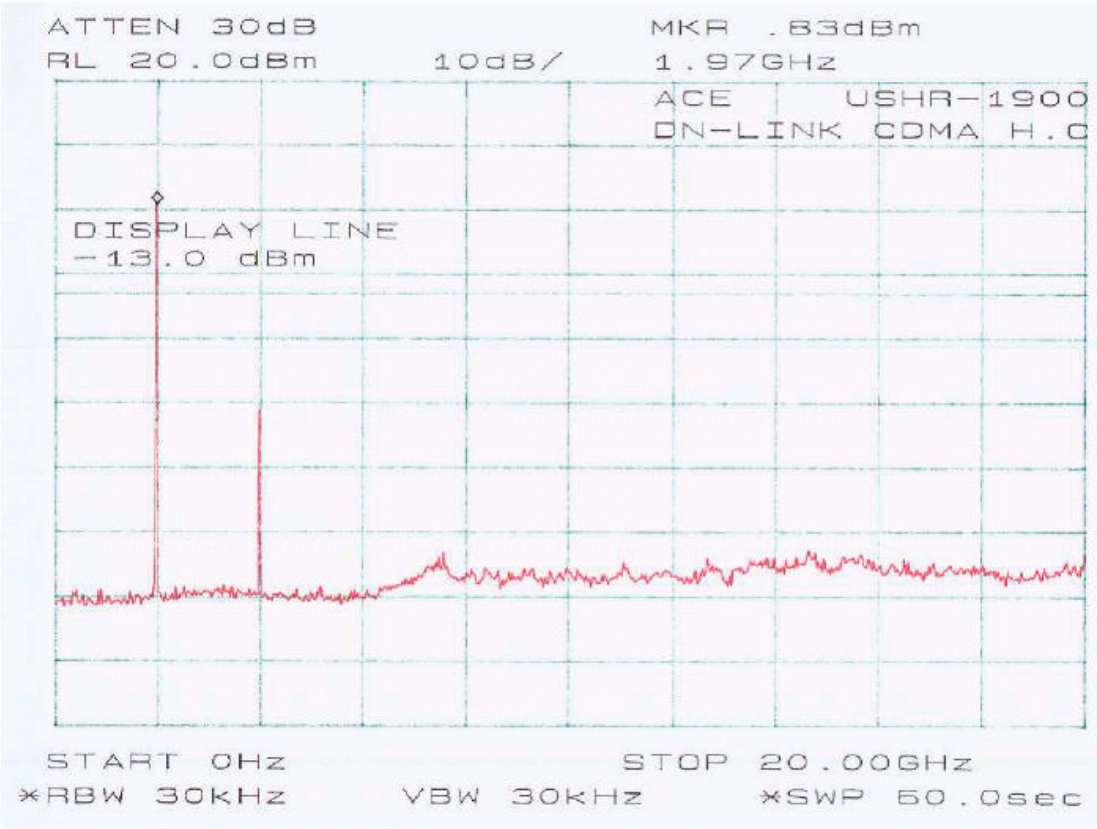
RL 10.0dBm
10dB/
MKR 2.50dBm
1.97540GHz
ACE USHR-1900
DN-LINK CDMA H.C
CENTER 1.98000GHz
SPAN 20.00MHz
*RBW 30kHz
VBW 30kHz
*SWP 750ms


ATTEN 30dB
RL 20.0dBm
10dB/
MKR .83dBm
1.97GHz
ACE USHR-1900
DN-LINK CDMA H.C
DISPLAY LINE
-13.0 dBm
START 0Hz
STOP 20.00GHz
*RBW 30kHz
VBW 30kHz
*SWP 50.0sec

8 - FIELD STRENGTH OF SPURIOUS RADIATION

8.1 Test Procedure

Requirements: CFR 47, § 2.1053, § 22.917 and § 24.238 (a).

8.2 Test Procedure

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious emissions in dB = 10 lg (TXpwr in Watts/0.001) – the absolute level

Spurious attenuation limit in dB = 43 + 10 Log_{10} (power out in Watts)

8.3 Test Equipment

CDI B100/200/300 Biconical Antennas
EMCO Bi-logcon Antenna
EMCO 3115 Horn Antenna
HP 8566B Spectrum Analyzer
Preamplifiers
HP8640 Generator
Non-radiating Load

8.4 Test Result

Up-link:

Low Frequency: -11.9dBm at 3710MHz
Middle Frequency: -11.6dBm at 3760MHz
High Frequency: -10.5dBm at 3810MHz

Down-link:

Low Frequency: -11.2dBm at 3870MHz
Middle Frequency: -12.2dBm at 3920MHz
High Frequency: -12.9dBm at 3970MHz

Primary scan at 1855MHz (Low CH.) Up-link

Indicated		Table	Test Antenna		Substituted			Antenna	Cable	Absolute	Limit	Margin
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Polar H/V	Gain Correction	Loss dB	Level dBm	dBm	dB
1855	104.1	330	1.2	v	1855	-0.2	v	6.6	0.5	5.9		
1855	103.2	270	1.2	h	1855	-1.4	h	6.6	0.5	4.7		
3710	55.8	0	1.2	v	3710	-33.1	v	8.9	0.7	-24.9	-13	-11.9
3710	55.4	0	1.2	h	3710	-34.4	h	8.9	0.7	-26.2	-13	-13.2
5565	41.3	160	1.2	v	5565	-39.5	v	9.2	0.9	-31.2	-13	-18.2
5565	41.1	90	1.2	h	5565	-40.2	h	9.2	0.9	-31.9	-13	-18.9
7420	44.6	60	1.2	v	7420	-36.7	v	9.5	1.1	-28.3	-13	-15.3
7420	42.5	30	1.2	h	7420	-37.9	h	9.5	1.1	-29.5	-13	-16.5

Primary scan at 1880MHz (Mid. CH.) Up-link

Indicated		Table	Test Antenna		Substituted			Antenna	Cable	Absolute	Limit	Margin
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Polar H/V	Gain Correction	Loss dB	Level dBm	dBm	dB
1880	106.5	60	1.5	v	1880	0.2	v	6.6	0.5	6.3		
1880	103.7	110	1.5	h	1880	-0.9	h	6.6	0.5	5.2		
3760	55.9	30	1.2	v	3760	-32.8	v	8.9	0.7	-24.6	-13	-11.6
3760	55.6	0	1.2	h	3760	-33.9	h	8.9	0.7	-25.7	-13	-12.7
5640	41.5	270	1.5	v	5640	-39.1	v	9.2	0.9	-30.8	-13	-17.8
5640	41.3	220	1.2	h	5640	-39.9	h	9.2	0.9	-31.6	-13	-18.6
7520	44.7	180	1	v	7520	-36.2	v	9.5	1.1	-27.8	-13	-14.8
7520	42.6	150	1.2	h	7520	-37.8	h	9.5	1.1	-29.4	-13	-16.4

Primary scan at 1905MHz (High CH.) Up-link

Indicated		Table	Test Antenna		Substituted			Antenna	Cable	Absolute	Limit	Margin
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Polar H/V	Gain Correction	Loss dB	Level dBm	dBm	dB
1905	105.2	310	1.2	v	1905	0.1	v	6.6	0.5	6.2		
1905	103.4	0	1.2	h	1905	-1.2	h	6.6	0.5	4.9		
3810	56.1	180	1.5	v	3810	-31.7	v	8.9	0.7	-23.5	-13	-10.5
3810	55.7	160	1.2	h	3810	-33.4	h	8.9	0.7	-25.2	-13	-12.2
5715	41.2	210	1	v	5715	-39.3	v	9.2	0.9	-31	-13	-18
5715	40.6	230	1.2	h	5715	-41.1	h	9.2	0.9	-32.8	-13	-19.8
7620	44.5	0	1.5	v	7620	-36.9	v	9.5	1.1	-28.5	-13	-15.5
7620	41.4	30	1.5	h	7620	-38.9	h	9.5	1.1	-30.5	-13	-17.5

Primary scan at 1935MHz (Low CH.) Down-link

Indicated		Table	Test Antenna		Substituted			Antenna	Cable	Absolute	Limit	Margin
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Polar H/V	Gain Correction	Loss dB	Leval dBm	dBm	dB
1935	103.9	180	1.5	v	1935	-0.3	v	6.6	0.5	5.8		
1935	102.6	160	1.5	h	1935	-0.8	h	6.6	0.5	5.3		
3870	54.9	30	1.2	v	3870	-33.8	v	8.9	0.7	-24.2	-13	-11.2
3870	53.6	0	1.5	h	3870	-35.2	h	8.9	0.7	-27	-13	-14
5805	41.7	310	1	v	5805	-40.4	v	9.2	0.9	-32.1	-13	-19.1
5805	40.4	270	1.2	h	5805	-41.2	h	9.2	0.9	-32.9	-13	-19.9
7740	41.2	150	1.2	v	7740	-40.9	v	9.5	1.1	-32.5	-13	-19.5
7740	39.5	90	1.5	h	7740	-42.5	h	9.5	1.1	-34.1	-13	-21.1

Primary scan at 1960MHz (Mid. CH.) Down-link

Indicated		Table	Test Antenna		Substituted			Antenna	Cable	Absolute	Limit	Margin
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Polar H/V	Gain Correction	Loss dB	Leval dBm	dBm	dB
1960	105.4	270	1.2	v	1960	-0.1	v	6.6	0.5	6		
1960	103.8	290	1.2	h	1960	-0.6	h	6.6	0.5	5.5		
3920	55.2	30	1.5	v	3920	-33.4	v	8.9	0.7	-25.2	-13	-12.2
3920	54.7	60	1.2	h	3920	-34.7	h	8.9	0.7	-26.5	-13	-13.5
5880	42.1	0	1.5	v	5880	-39.9	v	9.2	0.9	-31.6	-13	-18.6
5880	40.7	330	1.5	h	5880	-40.8	h	9.2	0.9	-32.5	-13	-19.5
7840	41.6	180	1.2	v	7840	-40.2	v	9.5	1.1	-31.8	-13	-18.8
7840	39.9	150	1.2	h	7840	-41.6	h	9.5	1.1	-33.2	-13	-20.2

Primary scan at 1985MHz (High CH.) Down-Link

Indicated		Table	Test Antenna		Substituted			Antenna	Cable	Absolute	Limit	Margin
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Polar H/V	Gain Correction	Loss dB	Leval dBm	dBm	dB
1985	102.7	310	1.5	v	1985	-0.5	v	6.6	0.5	5.6		
1985	101.6	0	1.5	h	1985	-1	h	6.6	0.5	5.1		
3970	54.3	90	1	v	3970	-34.1	v	8.9	0.7	-25.9	-13	-12.9
3970	53.1	60	1.2	h	3970	-35.9	h	8.9	0.7	-27.7	-13	-14.7
5955	41.4	230	1.2	v	5955	-40.8	v	9.2	0.9	-32.5	-13	-19.5
5955	40.1	250	1.5	h	5955	-41.5	h	9.2	0.9	-33.2	-13	-20.2
7940	40.9	180	1.2	v	7940	-41.3	v	9.5	1.1	-32.9	-13	-19.9
7940	39.2	140	1.2	h	7940	-42.8	h	9.5	1.1	-34.4	-13	-21.4

Compliance Statement:

According to FCC Part 15, at 3-meter distance the emission from an intentional radiator shall not exceed the field strength level 40dBuV/m within 30-88MHz, 43.5dBuV/m within 88-216 MHz, 46dBuV/m within 226-960MHz, 54dBuV/m above 960MHz. The level of any unwanted emissions shall not exceed the level of the fundamental frequency.

The levels of unwanted emission of this device were below the above limits. This device was compliant with the FCC Part 15.

9 – BAND EDGE TEST

9.1 Applicable Standards

According to FCC §2.1049 and §24.238, when measuring the emission limits, carrier frequency shall be adjusted as close to the frequency block edges, both upper and lower.

9.2 Test Procedure

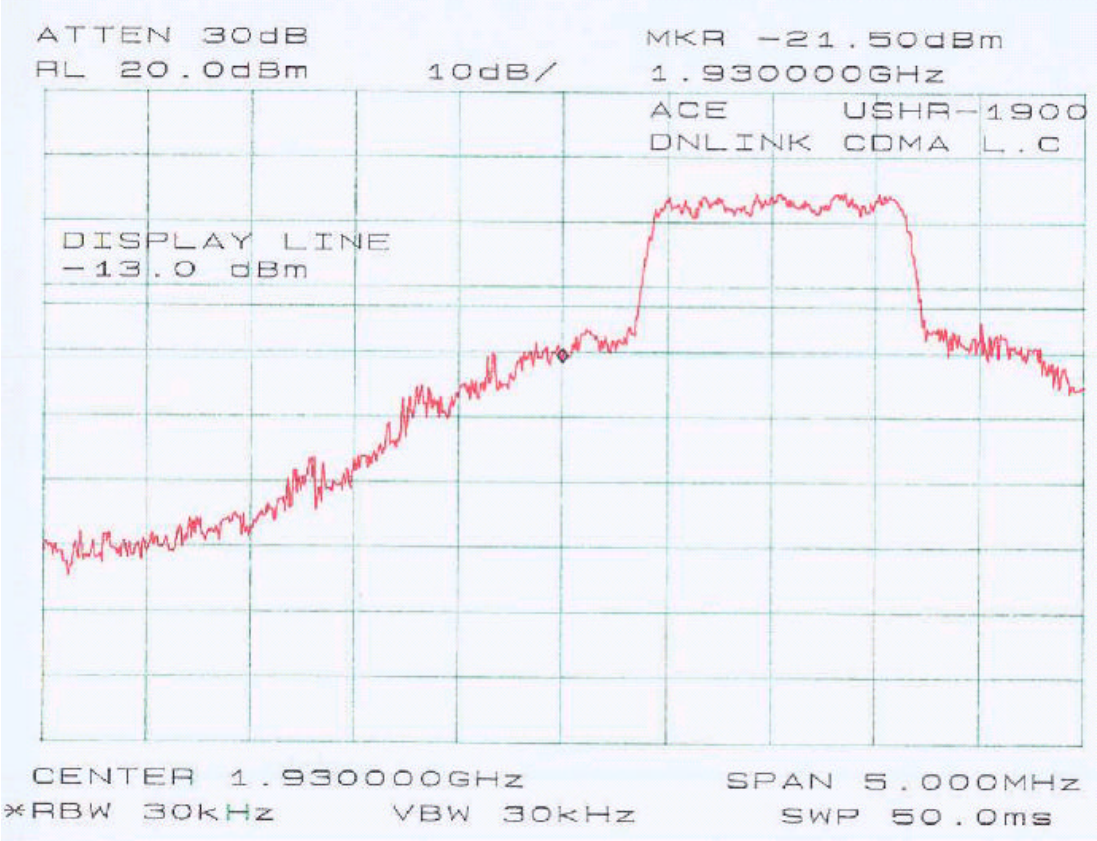
The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation. Adjust the carrier frequency as close to the frequency block edges both upper and lower. Sufficient scans were taken to show any out of band-edge emission.

9.3 Test Equipment

HP 8566B Spectrum Analyzer
HP 7470A Plotter
Hewlett Packard HP8566B Spectrum Analyzer
Hewlett Packard HP 7470A Plotter
Rohde & Schwarz SMIQ03B Signal Generator
Rohde & Schwarz AMIQ I/Q Modulation Generator

9.4 Plots of Out-of-Band-Edge Emissions at Antenna Terminal

Please refer to plots hereinafter.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10dB/
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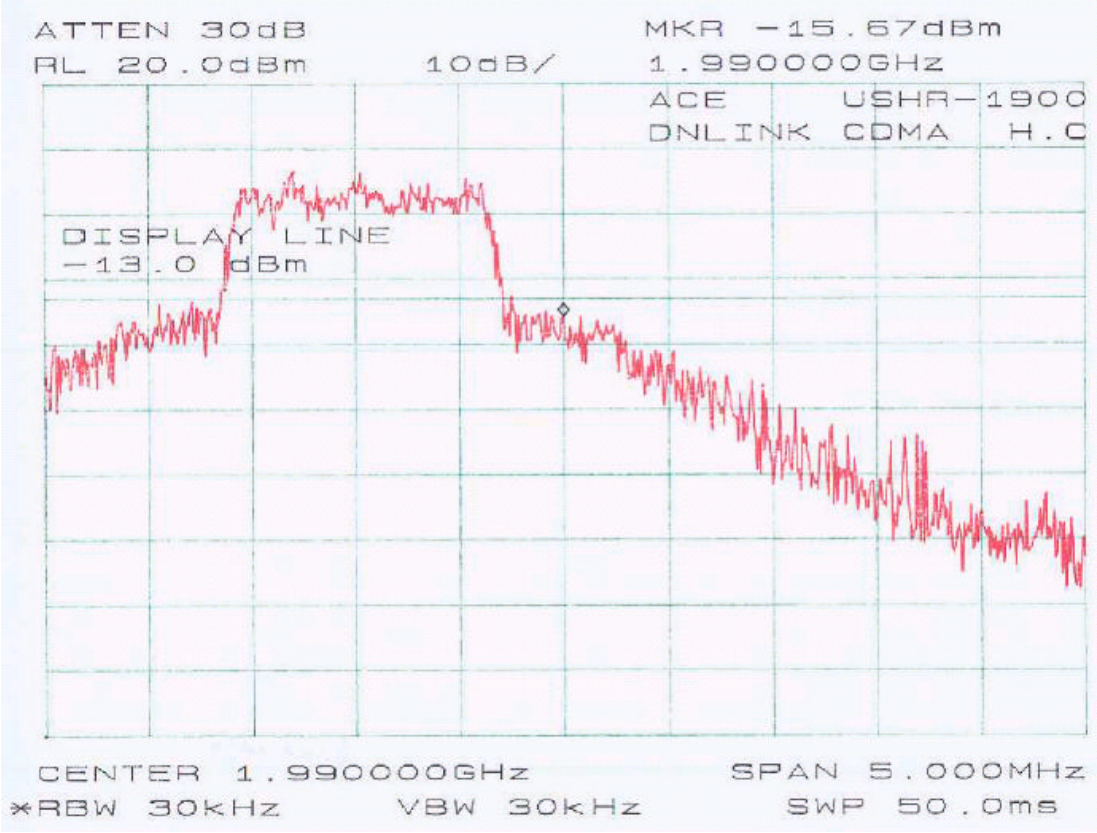
ACE USHR-1900
DNLINK CDMA L.C
DISPLAY LINE
-13.0 dBm
CENTER 1.930000GHz
SPAN 5.000MHz
*RBW 30kHz
VBW 30kHz
SWP 50.0ms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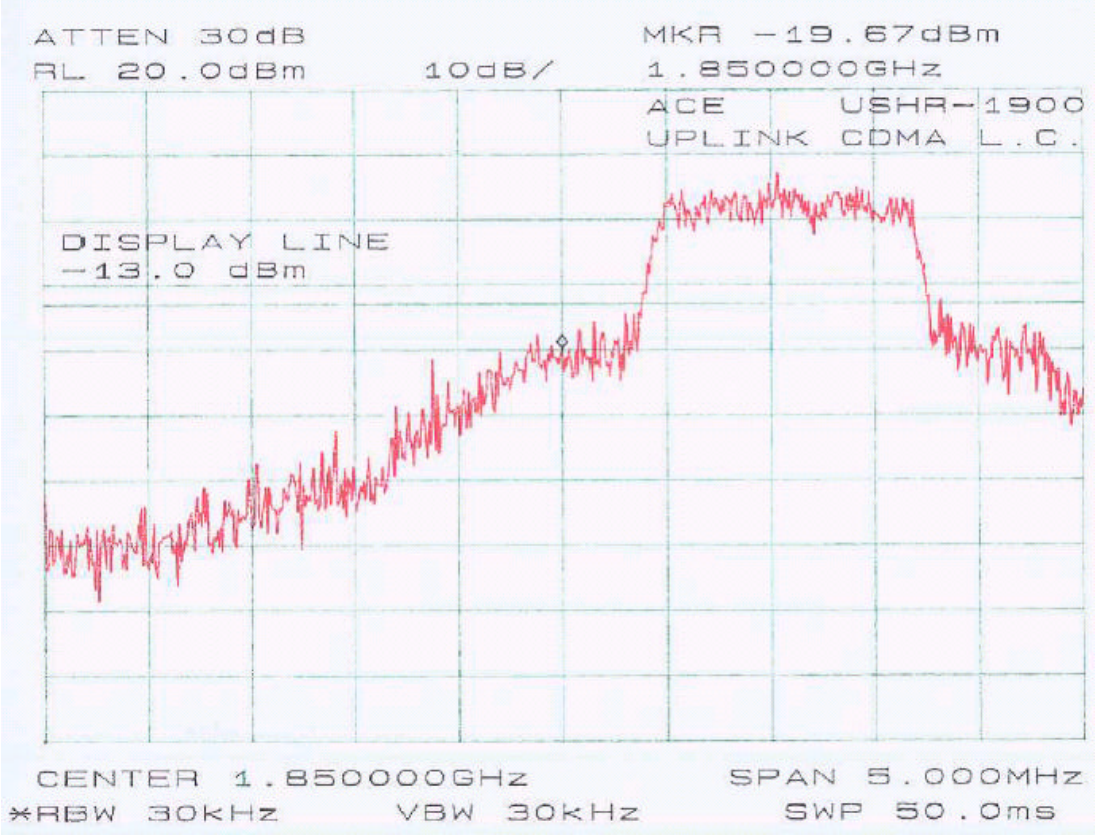
CENTER 1.990000GHz
SPAN 5.000MHz
*RBW 30kHz
VBW 30kHz
SWP 50.0ms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RL 20.0dBm
10dB/
MKR -19.67dBm
1.850000GHz
ACE USHR-1900
UPLINK CDMA L.C.
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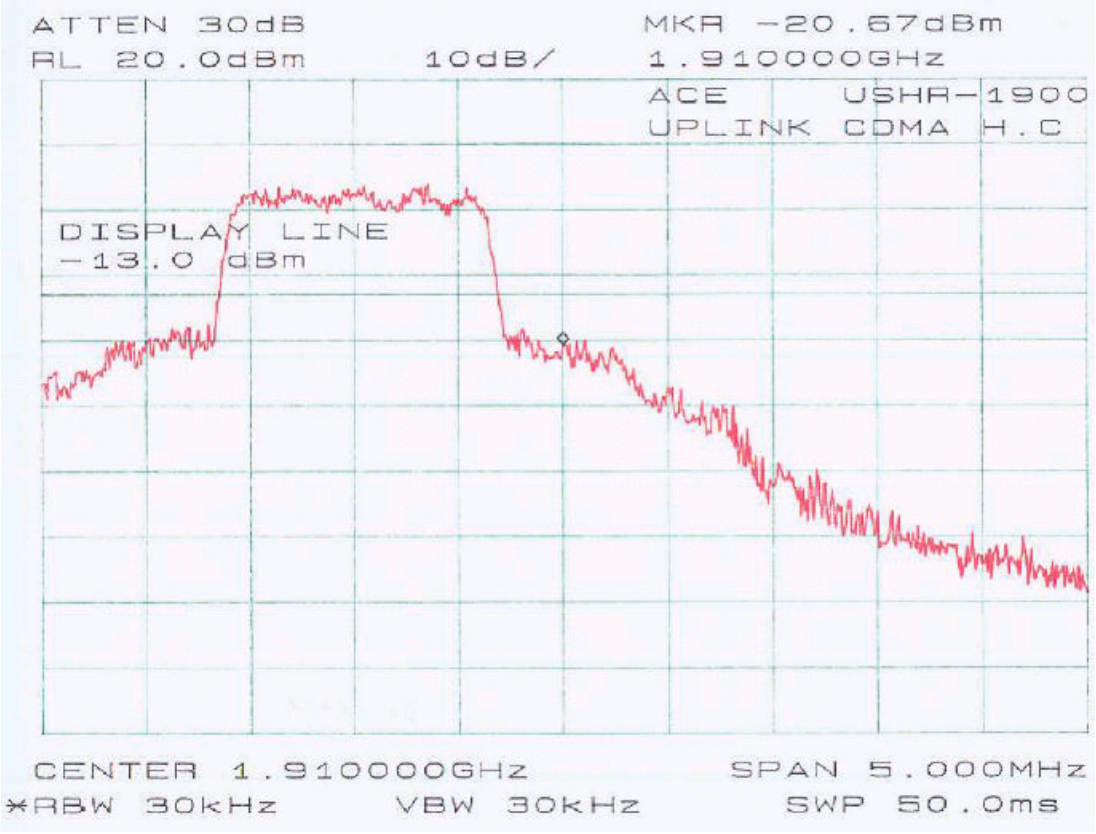
CENTER 1.850000GHz
SPAN 5.000MHz
*RBW 30kHz
VBW 30kHz
SWP 50.0ms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10dB/
MKR -20.67dBm
1.910000GHz
ACE USHR-1900
UPLINK CDMA H.C
DISPLAY LINE
-13.0 dBm
CENTER 1.910000GHz
SPAN 5.000MHz
*RBW 30kHz
VBW 30kHz
SWP 50.0ms

10 – Modulation Characteristics

This EUT only is an amplifier, it is not a transmitter. There is no modulating circuit in the EUT and no modulating characteristics measurement required.

11 - FREQUENCY STABILITY

This EUT only is an amplifier, it is not a transmitter. There is no oscillator circuit in the EUT, and no frequency stability measurement required.

12 - CONDUCTED EMISSION

12.1 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, and LISN.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement at BACL is $\pm$2.4 dB.

12.2 EUT Setup

The measurement was performed at the test site, using the same setup per ANSI C63.4-1992 measurement procedure. The specification used was with FCC 15.207 limits.

12.3 Spectrum Analyzer Setup

The spectrum analyzer was set with the following configurations during the conduction test:

Start Frequency	450 kHz
Stop Frequency	30 MHz
Sweep Speed	Auto
IF Bandwidth	10 kHz
Video Bandwidth	10 kHz
Quasi-Peak Adapter Bandwidth	9 kHz
Quasi-Peak Adapter Mode	Normal

12.4 Test Procedure

During the conducted emission test, the power cord of the host system was connected to the auxiliary outlet of the first LISN.

Maximizing procedure was performed on the six (6) highest emissions of each modes tested to ensure EUT is compliant with all installation combination.

All data was recorded in the peak detection mode. Quasi-peak readings were only performed when an emission was found to be marginal (within specified limits of -4 dBµV). Quasi-peak readings are distinguished with a "**Qp**".

12.5 Summary of Test Results

According to the data in section 3.6, the EUT complied with the FCC Conducted margin for a Class B device and these test results is deemed satisfactory evidence of compliance with ICES-003 of the Canadian Interference-Causing Equipment Regulations, with the *worst* margin reading of:

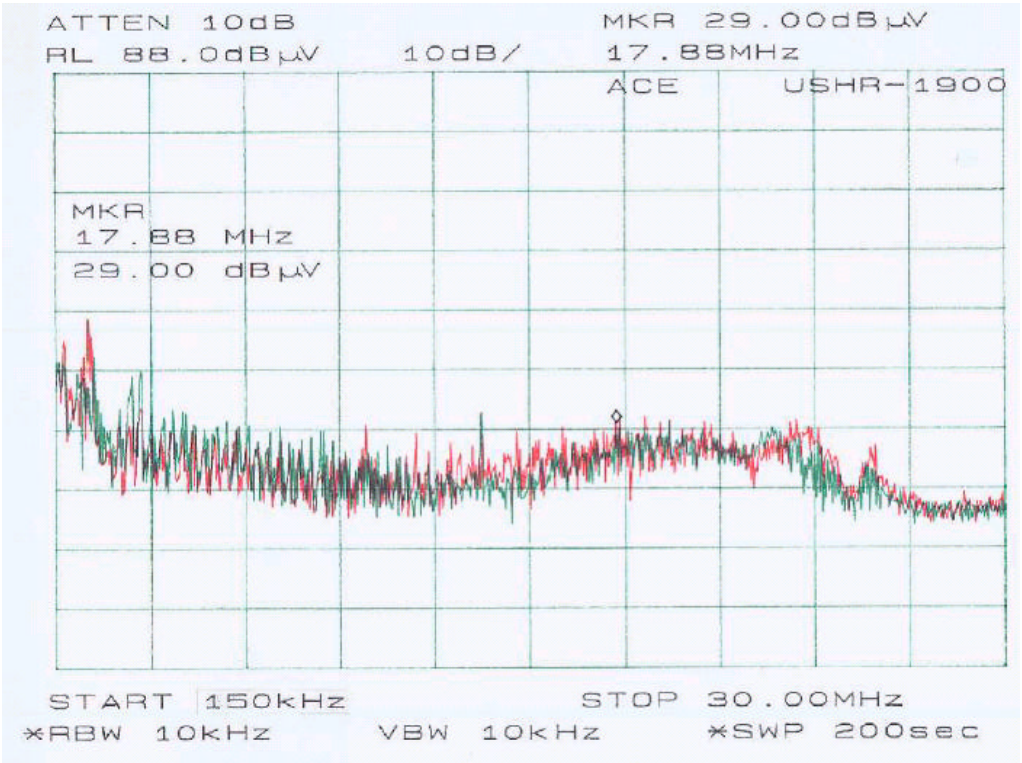
-9.5 dB at 1.44 MHz in the Neutral mode (Qp)

12.6 Conducted Emissions Test Data

LINE CONDUCTED EMISSIONS				FCC CLASS B	
Frequency MHz	Amplitude dBµV	Detector Qp/Ave/Peak	Phase Line/Neutral	Limit dBµV	Margin dB
1.44	46.5	Qp	Neutral	56	-9.5
0.71	36	AVE	Neutral	46	-10.0
0.71	43.1	Qp	Neutral	56	-12.9
1.44	33	AVE	Neutral	46	-13.0
1.63	40.7	Qp	Line	56	-15.3
0.55	39.4	Qp	Line	56	-16.6
13.75	30.8	Qp	Line	60	-25.2
17.98	30.6	Qp	Neutral	60	-25.4

12.7 Plot of Conducted Emissions Test Data

Plot(s) of Conducted Emissions Test Data is presented as reference.



13 - RF EXPOSURE

According to §15.247(b)(4) and §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

According to §1.1310 and §2.1093 RF exposure is calculated.

Limits for Maximum Permissive Exposure (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minute)
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*($180/f^2$)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-15000	/	/	1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

MPE Prediction

Predication of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$S = PG/4\pi R^2$

Where: S = power density
P = power input to antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal: 7.92 (dBm)
Maximum peak output power at antenna input terminal: 6.19 (mW)
Prediction distance: 20 (cm)
Predication frequency: 1900 (MHz)
Antenna Gain (typical): 8 (dBi)
Maximum antenna gain: 6.3 mW (numeric)
Power density at predication frequency at 20 cm: 0.008 (mW/cm^2)
MPE limit for uncontrolled exposure at prediction frequency: 1 (mW/cm^2)

Test Result

Passed