

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 $43 + 10\log(P)$, 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 30 kHz. Sufficient scans were taken to show any out of band emissions up to 10th harmonic. Two input signals are equal in level (and can be raised equally), were send to the EUT.

7.3 Test Equipment

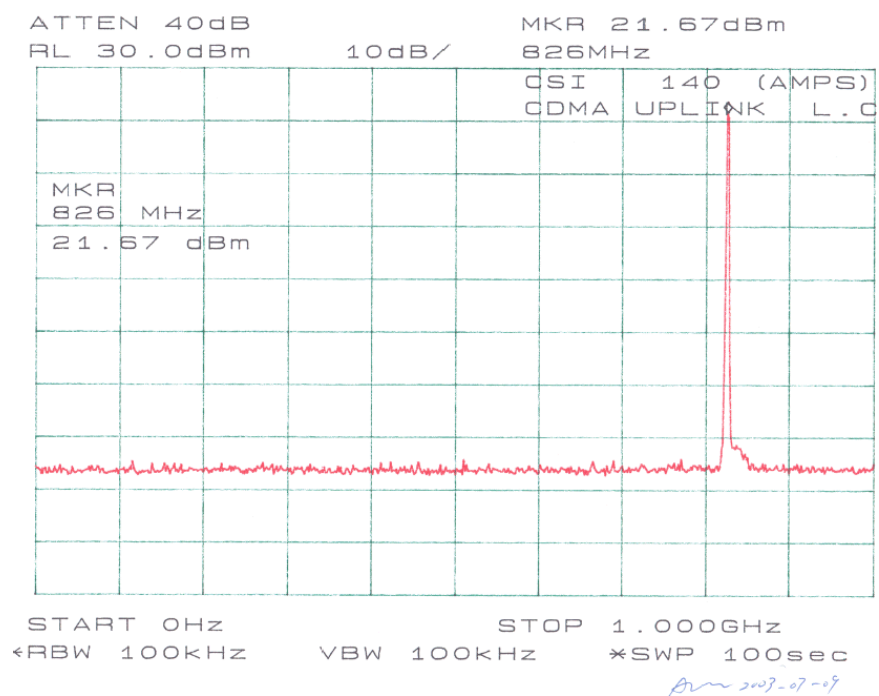
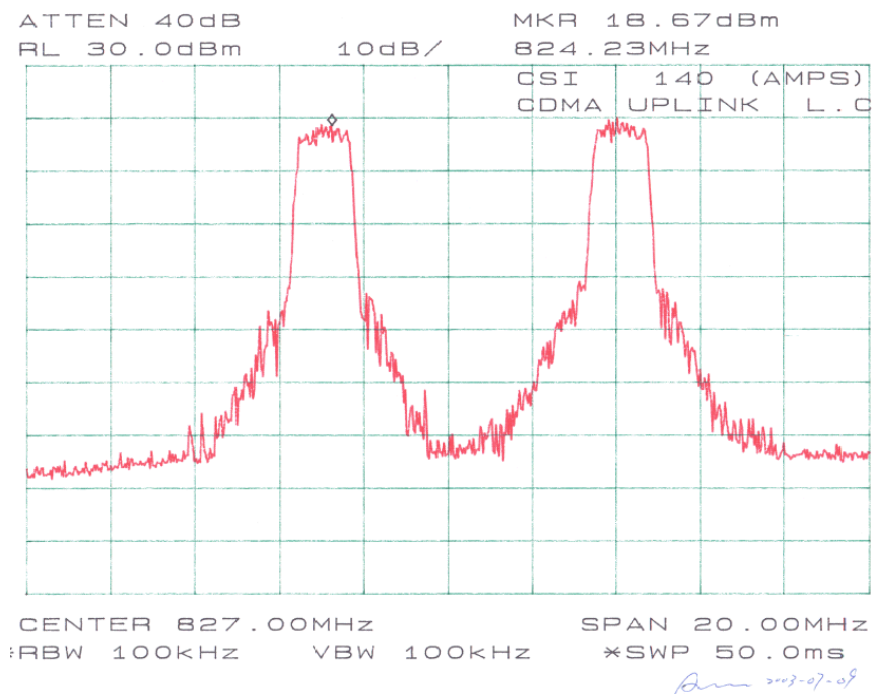
Hewlett Packard HP8566B Spectrum Analyzer
Hewlett Packard HP 7470A Plotter
Rohde & Schwarz SMIQ03B Signal Generator
Rohde & Schwarz AMIQ I/Q Modulation Generator

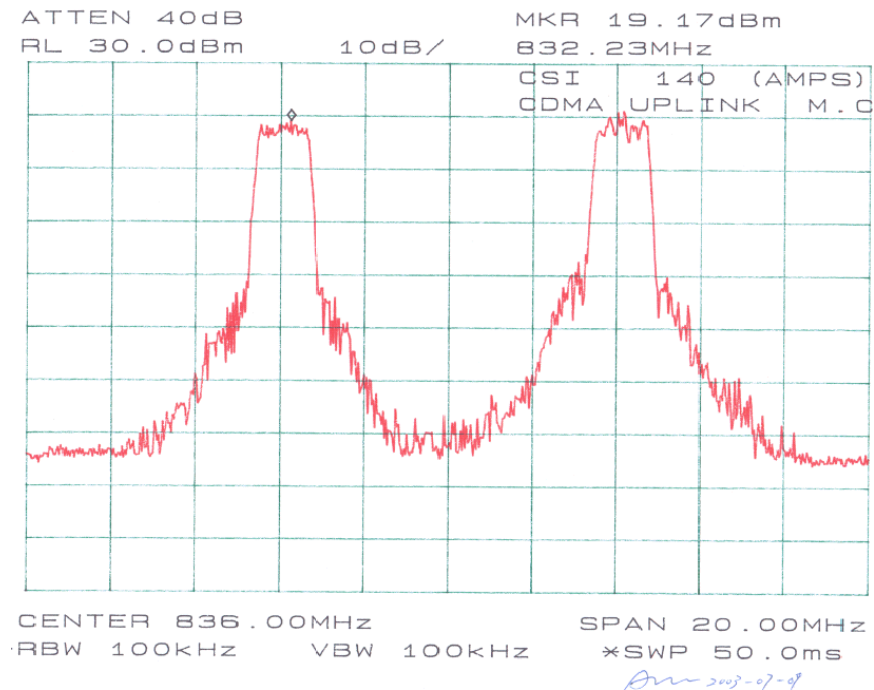
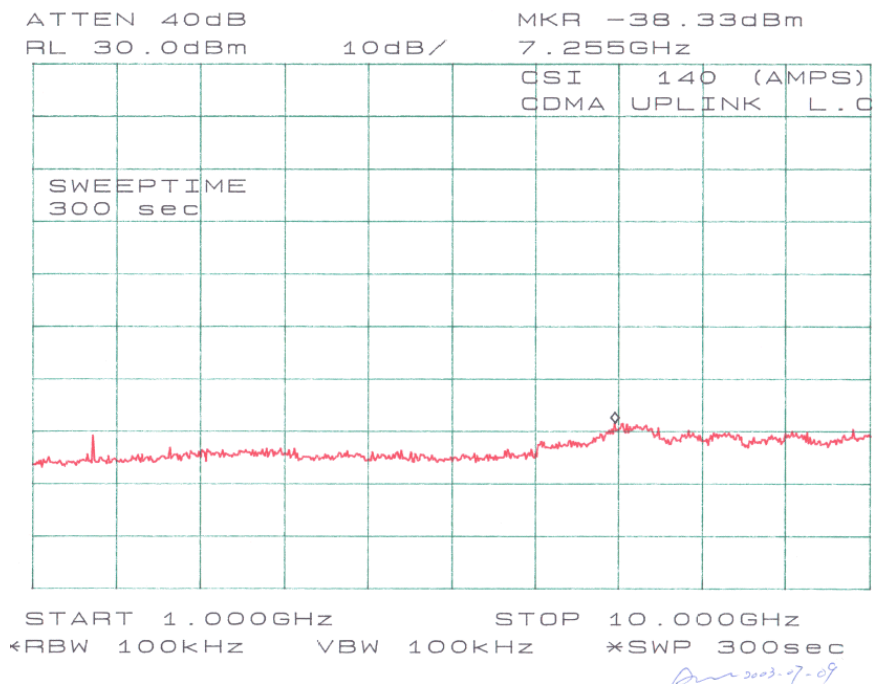
7.4 Test Results

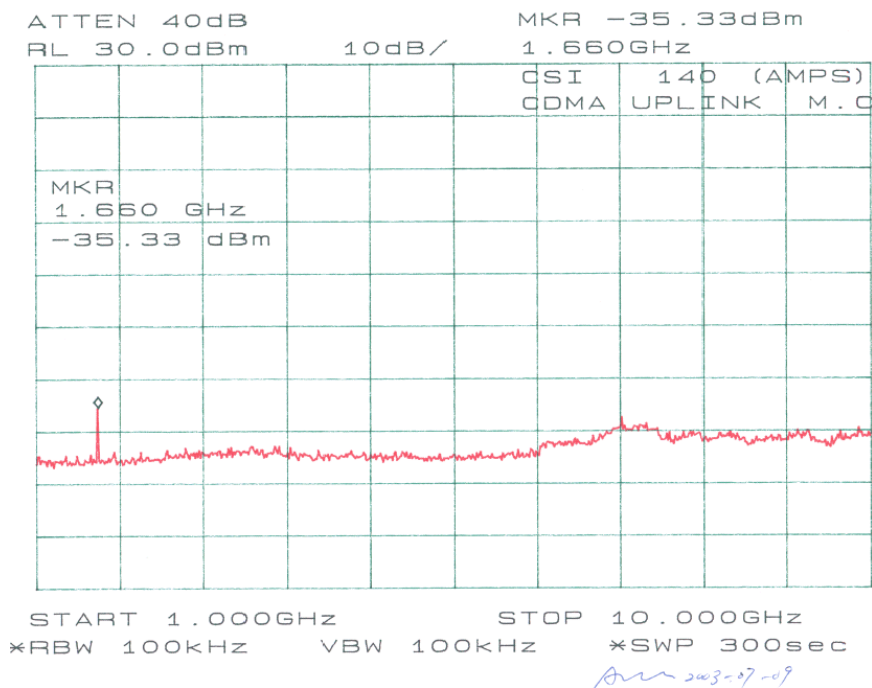
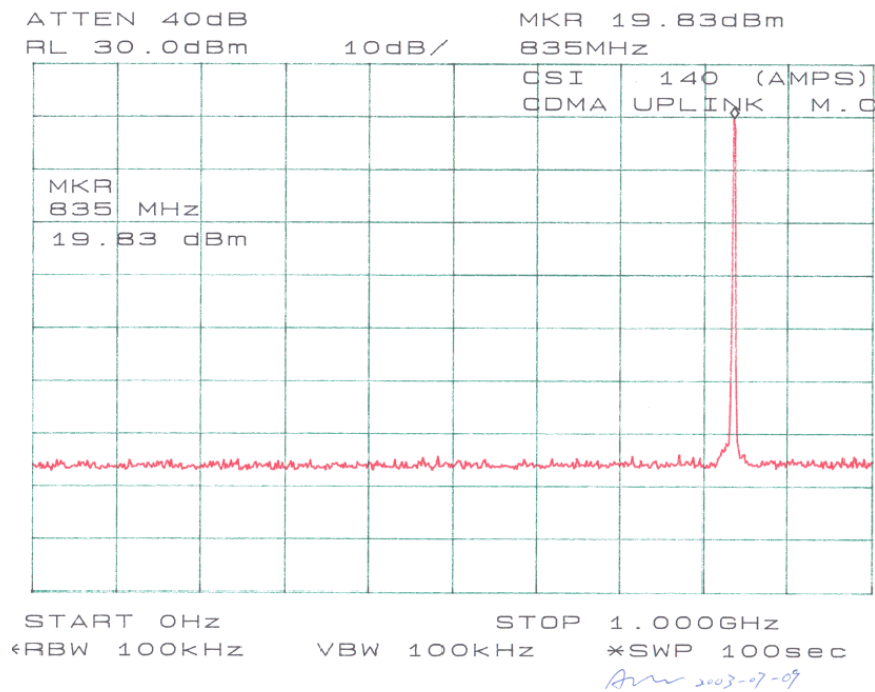
Modulation	Mode	Channel	Measured
CDMA	Up-link	Low	< -13dBm
	Down-link	Low	< -13dBm
	Up-link	Mid	< -13dBm
	Down-link	Mid	< -13dBm
	Up-link	High	< -13dBm
	Down-link	High	< -13dBm

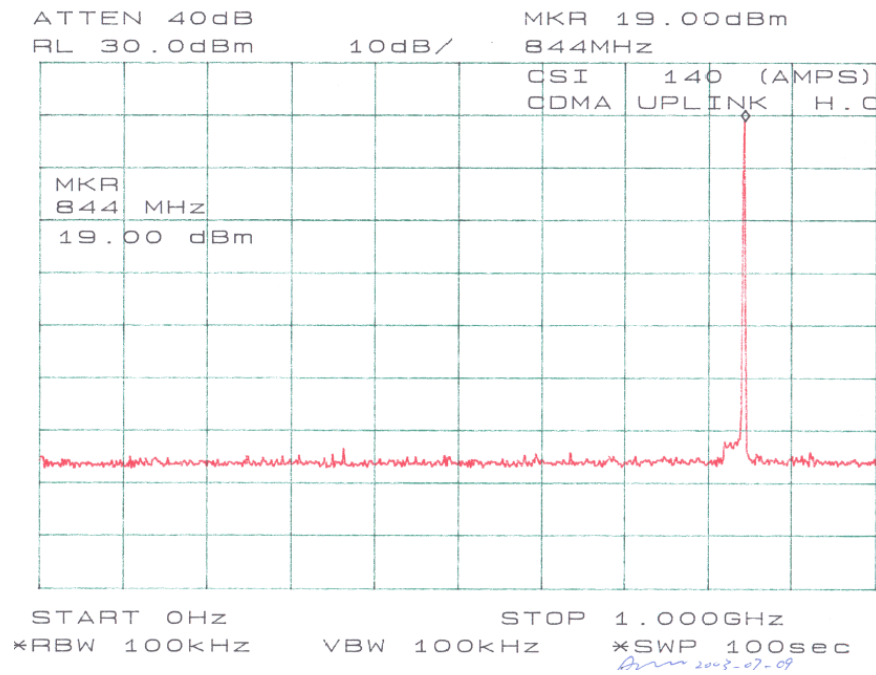
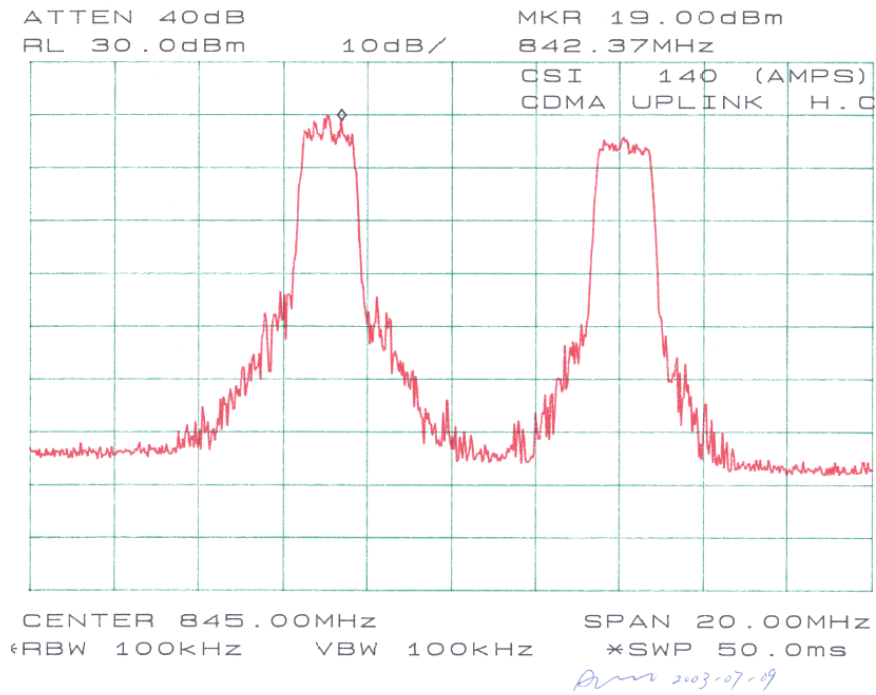
7.5 Plots of Two-Tone Test Result

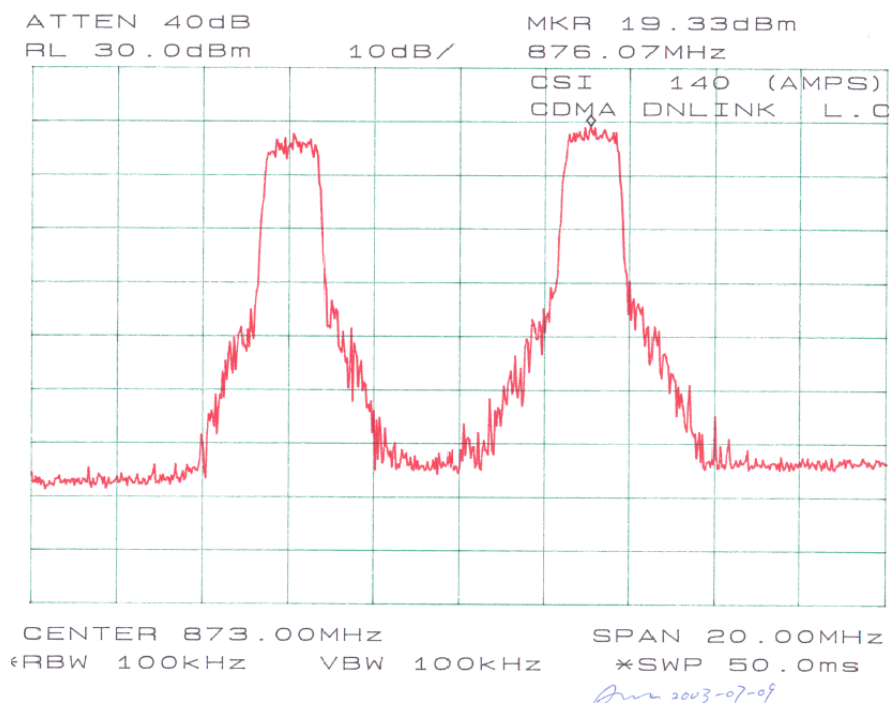
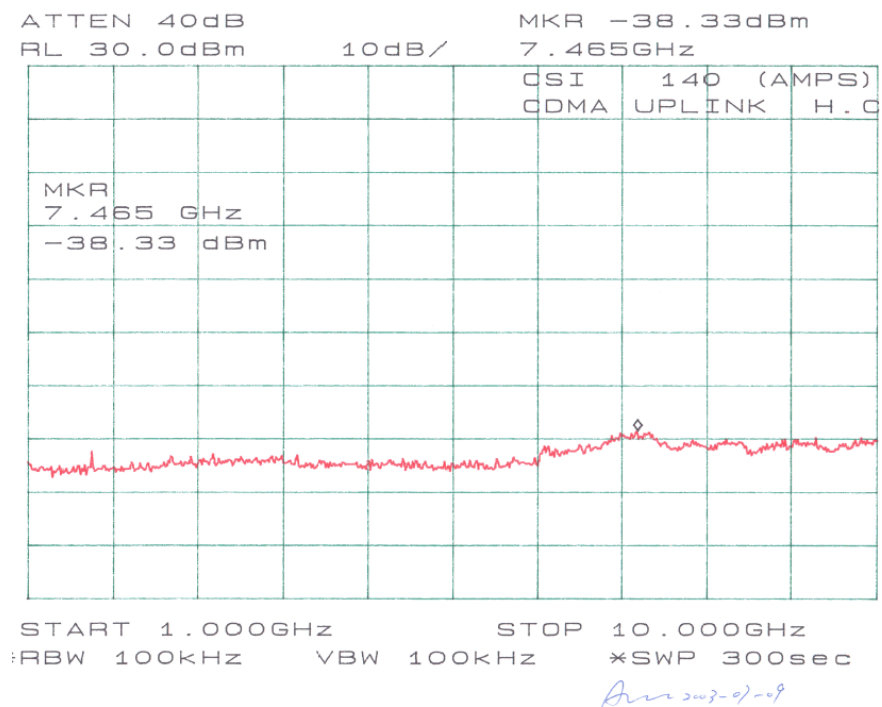
Please refer to plots hereinafter.

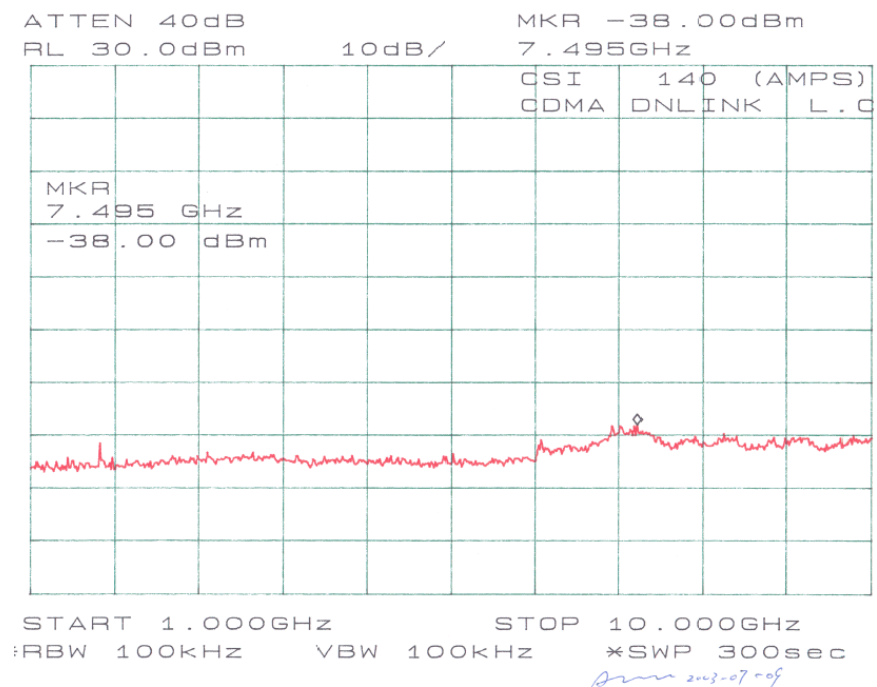
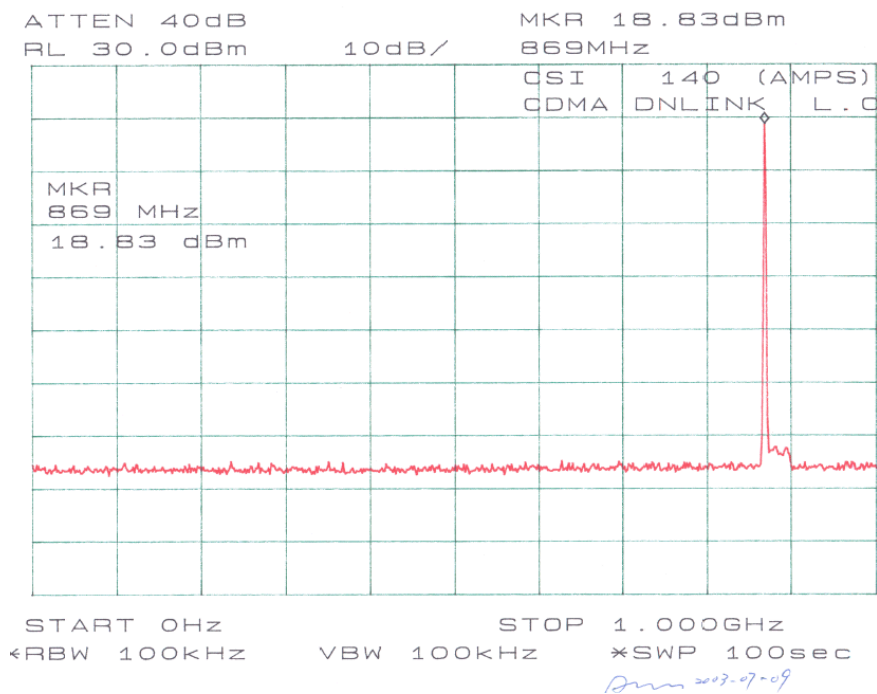


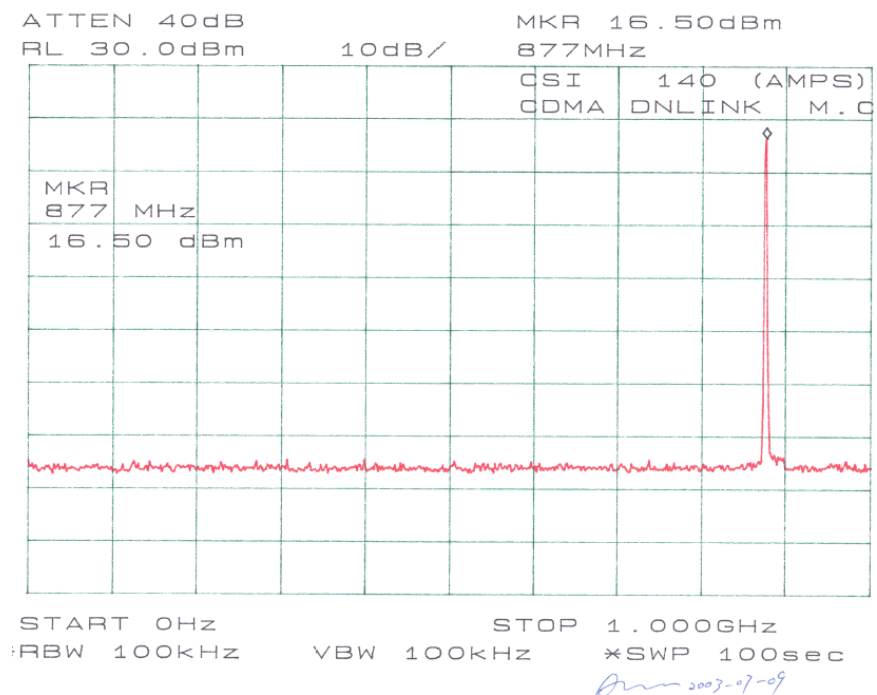
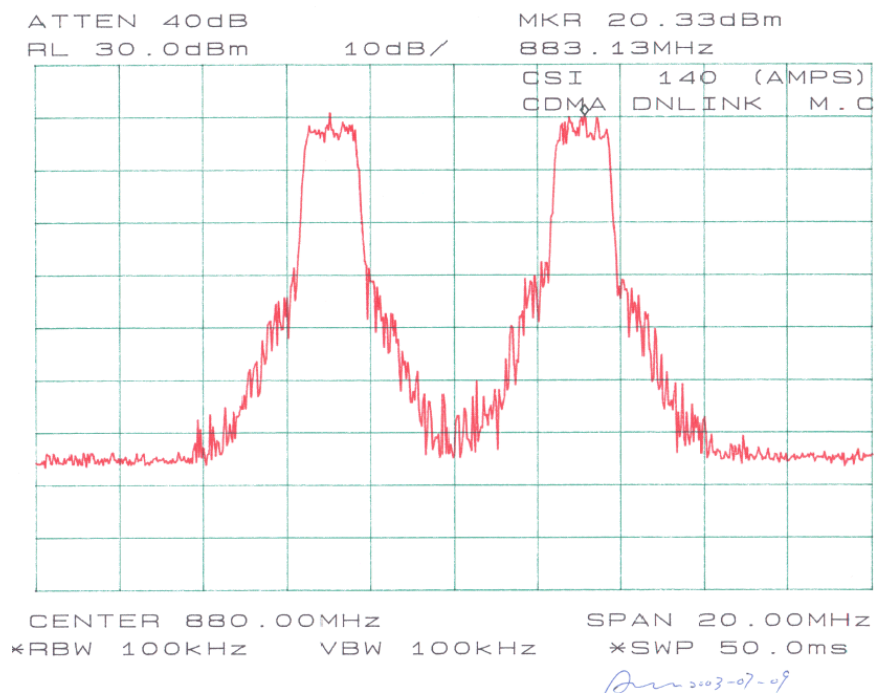


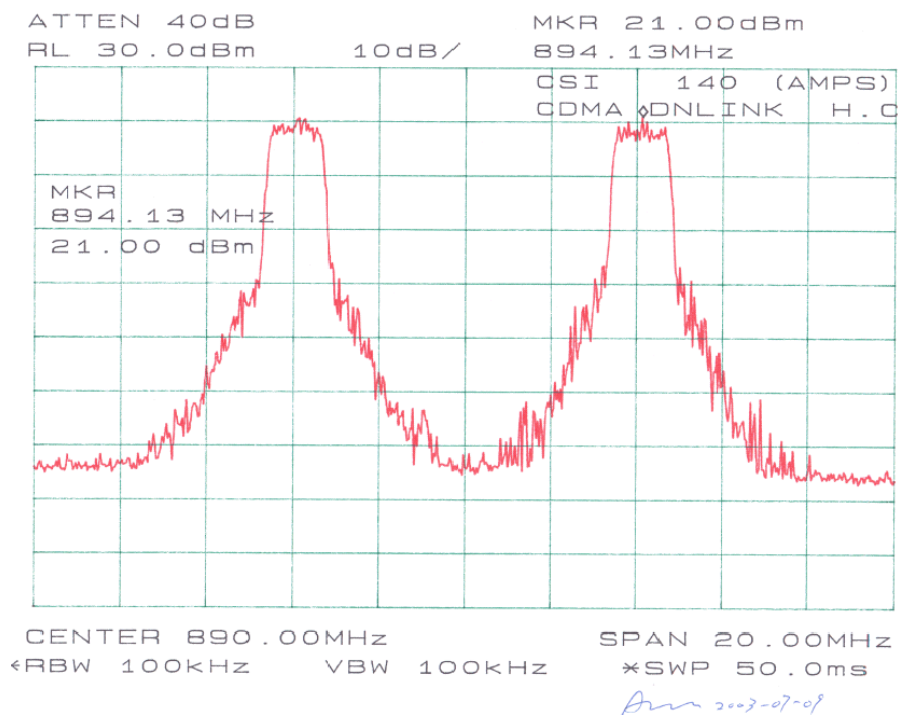
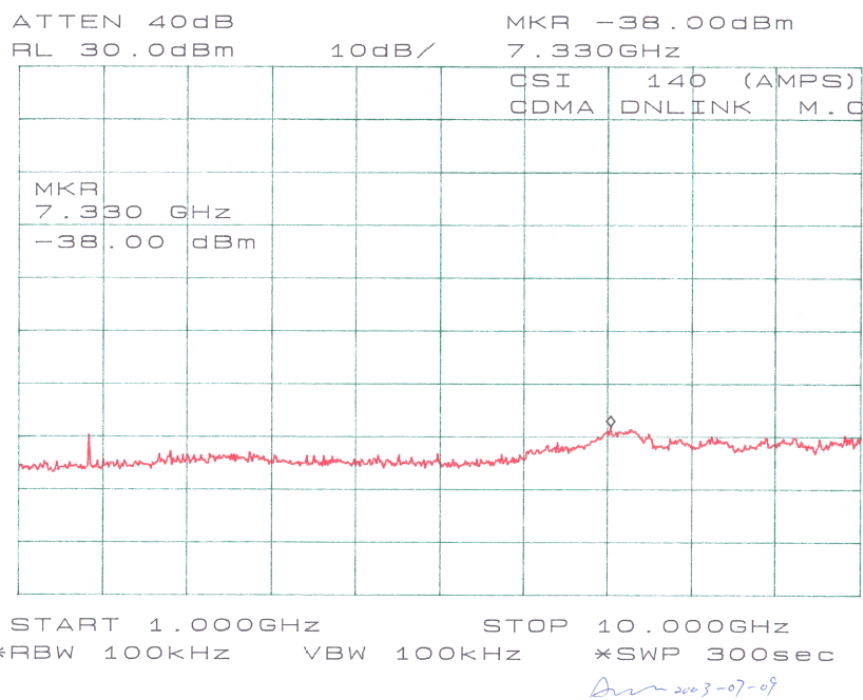


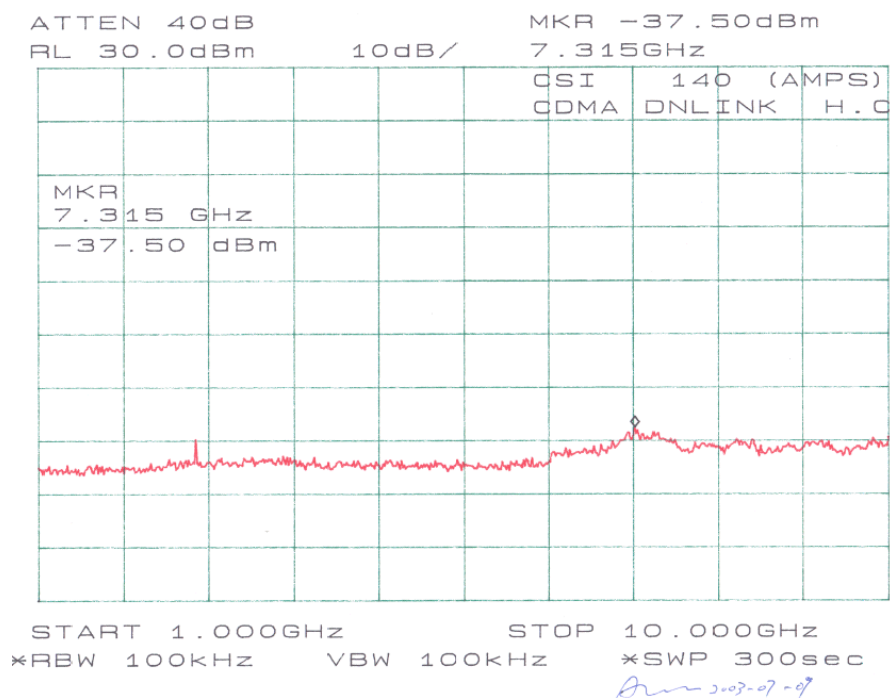
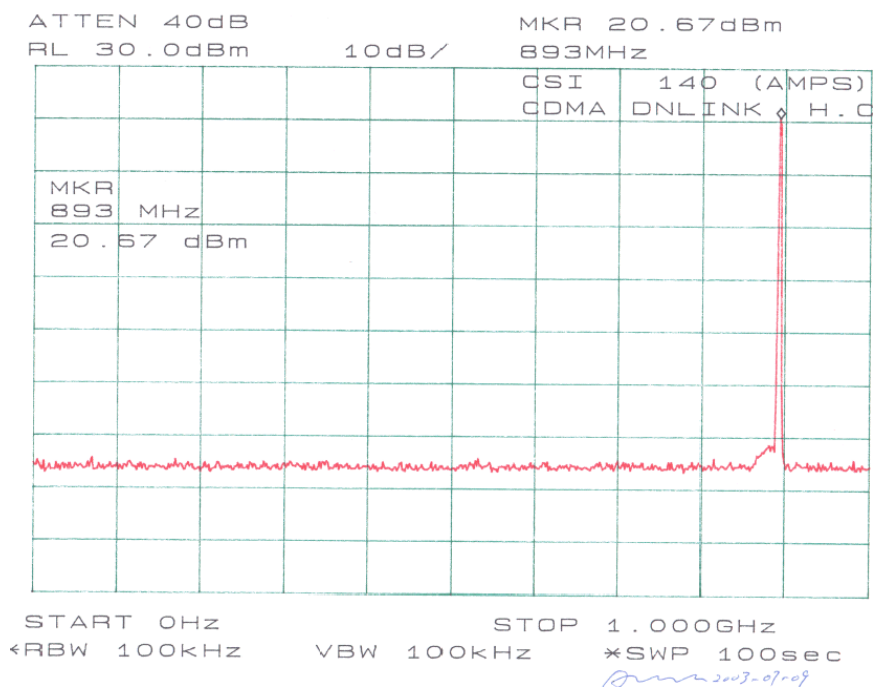












8 – RADIATED SPURIOUS EMISSION

8.1 Test Procedure

Requirements: CFR 47, § 2.1053, § 22.917 and § 90.210.

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 = $10 \lg (\text{TXpwr in Watts}/0.001)$ – the absolute level

Spurious attenuation limit in dB = $43 + 10 \text{Log}_{10} (\text{power out in Watts})$

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

For Part 22, 824 – 849 MHz Uplink, 869 – 894 MHz Downlink

Up-link:

Low Frequency: -23.2 dBm at 1650 MHz
 Middle Frequency: -22.8 dBm at 1670 MHz
 High Frequency: -23.1 dBm at 1690 MHz

Down-link:

Low Frequency: -23.6 dBm at 1740 MHz
 Middle Frequency: -23 dBm at 1760 MHz
 High Frequency: -23.2 dBm at 1780 MHz

For Part 90, 806 – 824 MHz Uplink, 851 – 869 MHz Downlink

Up-link:

Low Frequency: -37.3 dBm at 1620 MHz
 Middle Frequency: -36.8 dBm at 1630 MHz
 High Frequency: -35.1 dBm at 1640 MHz

Down-link:

Low Frequency: -37.4 dBm at 1710 MHz
 Middle Frequency: -37.6 dBm at 1720 MHz
 High Frequency: -37.1 dBm at 1730 MHz

8.4.1 Test Data for Part 22, 824 – 849 MHz Uplink, 869 – 894 MHz Downlink

Up-Link, Low Channel at 825 MHz

EUT					Generator						Standard	
Indicated		Table	Test Antenna		Substitution			Antenna	Cable	Absolute	FCC	FCC
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Polar H/V	Gain Corrected	Loss dBm	Level dB	Limit dBm	Margin DBm
825	107.3	270	1.5	V	825	12.2	V	0	0.1	12.1		
825	106.9	180	1.5	H	825	11.9	H	0	0.1	11.8		
1650	63.9	110	1.5	H	1650	-42.7	H	6.8	0.3	-36.2	-13	-23.2
1650	59.8	30	1.2	V	1650	-46.5	V	6.8	0.3	-40	-13	-27
2475	46.7	180	1.2	V	2475	-49.9	V	7.6	0.5	-42.8	-13	-29.8
2475	43.2	270	1.5	H	2475	-51.4	H	7.6	0.5	-44.3	-13	-31.3

Up-link, Mid. Channel at 835 MHz

EUT					Generator						Standard	
Indicated		Table	Test Antenna		Substitution			Antenna	Cable	Absolute	FCC	FCC
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Polar H/V	Gain Corrected	Loss dBm	Level dB	Limit dBm	Margin DBm
835	109.9	270	1.5	V	835	12.7	V	0	0.1	12.6		
835	109.5	60	1.2	H	835	12.3	H	0	0.1	12.2		
1670	64.6	110	1.5	H	1670	-42.3	H	6.8	0.3	-35.8	-13	-22.8
1670	60.5	30	1.2	V	1670	-46.2	V	6.8	0.3	-39.7	-13	-26.7
2505	47.5	180	1.5	V	2505	-49.6	V	7.6	0.5	-42.5	-13	-29.5
2505	43.1	230	1.2	H	2505	-51.2	H	7.6	0.5	-44.1	-13	-31.1

Up-Link, High Channel at 845 MHz

EUT					Generator						Standard	
Indicated		Table	Test Antenna		Substitution			Antenna	Cable	Absolute	FCC	FCC
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Polar H/V	Gain Corrected	Loss dBm	Level dB	Limit dBm	Margin DBm
845	108.2	330	1.5	V	845	12.4	V	0	0.1	12.3		
845	106.7	60	1.5	H	845	11.8	H	0	0.1	11.7		
1690	63.7	180	1.2	H	1690	-42.6	H	6.8	0.3	-36.1	-13	-23.1
1690	60.1	150	1.2	V	1690	-46.7	V	6.8	0.3	-40.2	-13	-27.2
2535	47.1	90	2	V	2535	-49.8	V	7.6	0.5	-42.7	-13	-29.7
2535	42.9	0	1.5	H	2535	-51.5	H	7.6	0.5	-44.4	-13	-31.4

Down-Link, Low Channel at 870 MHz

EUT					Generator						Standard	
Indicated		Table	Test Antenna		Substitution			Antenna	Cable	Absolute	FCC	FCC
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Polar H/V	Gain Corrected	Loss dBm	Level dB	Limit dBm	Margin DBm
870	105.6	60	1.2	V	870	11.8	V	0	0.1	11.7		
870	104.5	30	1.5	H	870	11.5	H	0	0.1	11.4		
1740	62.7	120	1.5	H	1740	-43.1	H	6.8	0.3	-36.6	-13	-23.6
1740	59.3	0	1.2	V	1740	-46.9	V	6.8	0.3	-40.4	-13	-27.4
2610	46.6	230	1.2	V	2610	-50.3	V	7.6	0.5	-43.2	-13	-30.2
2610	42.3	150	1.3	H	2610	-51.8	H	7.6	0.5	-44.7	-13	-31.7

Down-Link, Mid. Channel at 880 MHz

EUT					Generator						Standard	
Indicated		Table	Test Antenna		Substitution			Antenna	Cable	Absolute	FCC	FCC
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Polar H/V	Gain Corrected	Loss dBm	Level dB	Limit dBm	Margin DBm
880	110.8	180	1.5	V	880	12.9	V	0	0.1	12.8		
880	109.2	90	1.5	H	880	12.2	H	0	0.1	12.1		
1760	64.5	110	1.6	H	1760	-42.5	H	6.8	0.3	-36	-13	-23
1760	60.8	180	1.6	V	1760	-46.3	V	6.8	0.3	-39.8	-13	-26.8
2640	47.5	270	1.5	V	2640	-49.8	V	7.6	0.5	-42.7	-13	-29.7
2640	43.4	160	1.2	H	2640	-51.2	H	7.6	0.5	-44.1	-13	-31.1

Down-Link, High Channel at 890 MHz

EUT					Generator						Standard	
Indicated		Table	Test Antenna		Substitution			Antenna	Cable	Absolute	FCC	FCC
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Polar H/V	Gain Corrected	Loss dBm	Level dB	Limit dBm	Margin DBm
890	109.3	150	1.2	V	890	12.6	V	0	0.1	12.5		
890	109.1	180	1.5	H	890	12.1	H	0	0.1	12		
1780	64.3	30	1.2	H	1780	-42.7	H	6.8	0.3	-36.2	-13	-23.2
1780	60.5	0	1.2	V	1780	-46.5	V	6.8	0.3	-40	-13	-27
2670	47.2	210	2	V	2670	-50.1	V	7.6	0.5	-43	-13	-30
2670	43.1	250	1.2	H	2670	-51.6	H	7.6	0.5	-44.5	-13	-31.5

8.4.2 FCC Part 90, 806 – 824 MHz Uplink, 851 – 869 MHz Downlink**Up-Link, Low Channel at 810 MHz**

EUT					Generator						Standard	
Indicated		Table	Test Antenna		Substitution			Antenna	Cable	Absolute	FCC	FCC
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Polar H/V	Gain Corrected	Loss dBm	Level dB	Limit dBm	Margin DBm
810	110.5	30	1.5	V	810	16.8	V	0	0.1	16.7		
810	109.4	60	1.5	H	810	14.9	H	0	0.1	14.8		
1620	49.8	110	1.5	H	1620	-56.8	H	6.8	0.3	-50.3	-13	-37.3
1620	47.5	30	1.2	V	1620	-57.4	V	6.8	0.3	-50.9	-13	-37.9
2430	37.1	180	1.2	V	2430	-62.7	V	7.6	0.5	-55.6	-13	-42.6
2430	35.6	270	1.5	H	2430	-63.9	H	7.6	0.5	-56.8	-13	-43.8

Up-link, Mid. Channel at 815 MHz

EUT					Generator						Standard	
Indicated		Table	Test Antenna		Substitution			Antenna	Cable	Absolute	FCC	FCC
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Polar H/V	Gain Corrected	Loss dBm	Level dB	Limit dBm	Margin DBm
815	114.9	120	1.5	V	815	17.4	V	0	0.1	17.3		
815	112.1	30	1.2	H	815	16.5	H	0	0.1	16.4		
1630	50.3	110	1.5	H	1630	-56.3	H	6.8	0.3	-49.8	-13	-36.8
1630	48.7	30	1.2	V	1630	-57.2	V	6.8	0.3	-50.7	-13	-37.7
2445	37.2	180	1.5	V	2445	-62.4	V	7.6	0.5	-55.3	-13	-42.3
2445	35.9	230	1.2	H	2445	-63.7	H	7.6	0.5	-56.6	-13	-43.6

Up-Link, High Channel at 820 MHz

EUT					Generator						Standard	
Indicated		Table	Test Antenna		Substitution			Antenna	Cable	Absolute	FCC	FCC
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Polar H/V	Gain Corrected	Loss dBm	Level dB	Limit dBm	Margin DBm
820	116.2	90	1.5	V	820	18.5	V	0	0.1	18.4		
820	114.9	30	1.5	H	820	17.1	H	0	0.1	17		
1640	51.7	30	1.2	H	1640	-54.6	H	6.8	0.3	-48.1	-13	-35.1
1640	49.5	150	1.2	V	1640	-55.1	V	6.8	0.3	-48.6	-13	-35.6
2460	37.6	180	1.5	V	2460	-60.7	V	7.6	0.5	-53.6	-13	-40.6
2460	36.4	270	1.5	H	2460	-62.1	H	7.6	0.5	-55	-13	-42

Down-Link, Low Channel at 870 MHz

EUT					Generator						Standard	
Indicated		Table	Test Antenna		Substitution			Antenna	Cable	Absolute	FCC	FCC
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Polar H/V	Gain Corrected	Loss dBm	Level dB	Limit dBm	Margin DBm
855	114.3	60	1.2	V	855	17.1	V	0	0.1	17		
855	109.1	30	1.5	H	855	14.5	H	0	0.1	14.4		
1710	49.7	120	1.5	H	1710	-56.9	H	6.8	0.3	-50.4	-13	-37.4
1710	48.5	0	1.2	V	1710	-57.6	V	6.8	0.3	-51.1	-13	-38.1
2565	37.1	230	1.2	V	2565	-62.7	V	7.6	0.5	-55.6	-13	-42.6
2565	35.4	150	1.3	H	2565	-64.1	H	7.6	0.5	-57	-13	-44

Down-Link, Mid. Channel at 880 MHz

EUT					Generator						Standard	
Indicated		Table	Test Antenna		Substitution			Antenna	Cable	Absolute	FCC	FCC
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Polar H/V	Gain Corrected	Loss dBm	Level dB	Limit dBm	Margin DBm
860	113.2	180	1.5	V	860	16.9	V	0	0.1	16.8		
860	108.8	30	1.5	H	860	14.3	H	0	0.1	14.2		
1720	49.5	110	1.2	H	1720	-57.1	H	6.8	0.3	-50.6	-13	-37.6
1720	48.1	150	1.2	V	1720	-57.8	V	6.8	0.3	-51.3	-13	-38.3
2580	37	270	1.5	V	2580	-62.9	V	7.6	0.5	-55.8	-13	-42.8
2580	35.2	230	1.2	H	2580	-64.3	H	7.6	0.5	-57.2	-13	-44.2

Down-Link, High Channel at 890 MHz

EUT					Generator						Standard	
Indicated		Table	Test Antenna		Substitution			Antenna	Cable	Absolute	FCC	FCC
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Polar H/V	Gain Corrected	Loss dBm	Level dB	Limit dBm	Margin DBm
865	112.2	150	1.5	V	865	16.5	V	0	0.1	16.4		
865	110.5	30	1.2	H	865	14.7	H	0	0.1	14.6		
1730	49.8	30	1.2	H	1730	-56.6	H	6.8	0.3	-50.1	-13	-37.1
1730	47.9	0	1.2	V	1730	-57.9	V	6.8	0.3	-51.4	-13	-38.4
2595	36.7	210	2	V	2595	-63.1	V	7.6	0.5	-56	-13	-43
2595	35.8	250	1.2	H	2595	-63.9	H	7.6	0.5	-56.8	-13	-43.8