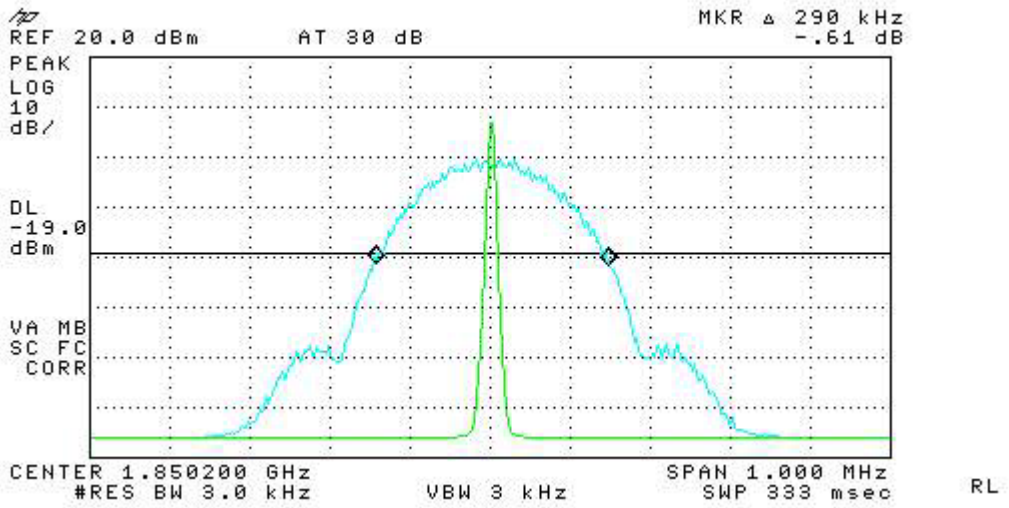
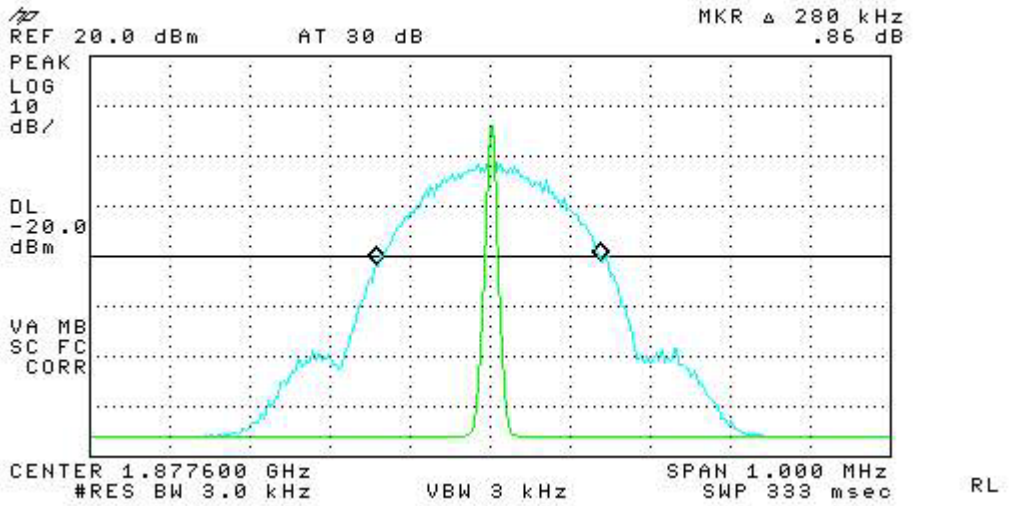
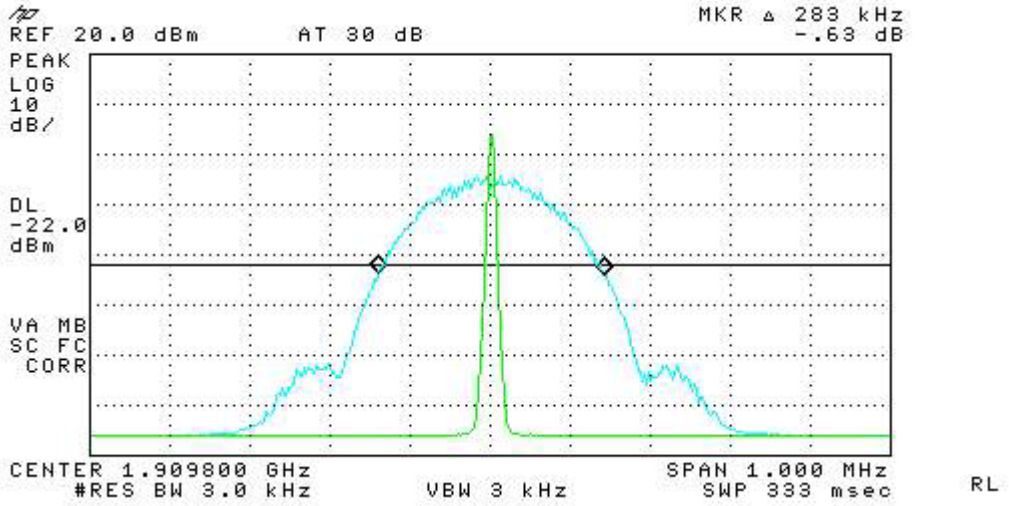
GSM Reverse Plot

Low Channel 1850.2 MHz 290 kHz	
Middle Channel 1877.6 MHz 280 kHz	
High Channel 1989.8 MHz 283 kHz	

7.3 Spurious Emission at Antenna Termianal

Test Standard	:	FCC Part 24.238 & 2.1051
Operating Frequency	:	Forward 1930 - 1990 MHz Reverse 1850 - 1910 MHz
Channel	:	Low / Mid/ High
RF Power Output	:	10 mW CDMA - Single Channel NADC - Composite Multiple Channel GSM - Composite Multiple Channel

Downlink (Forward)

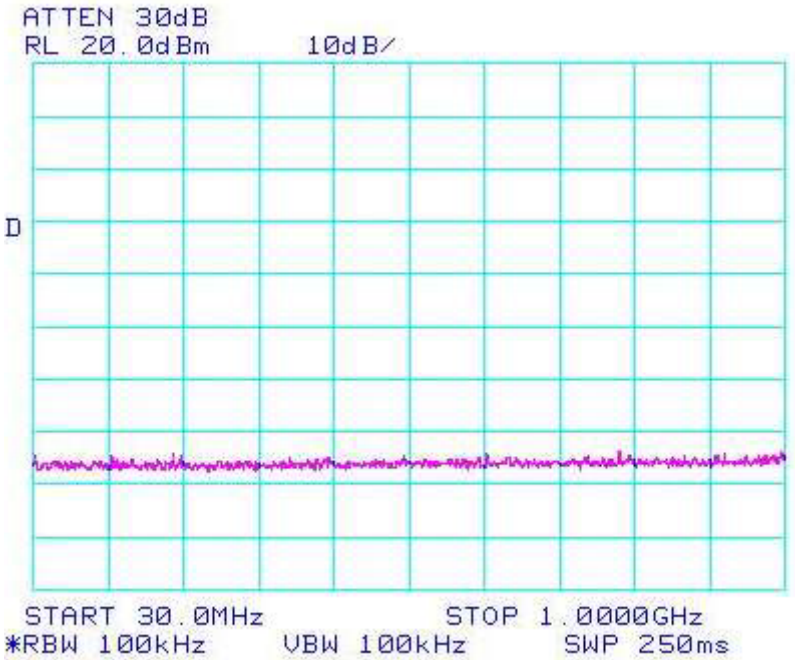
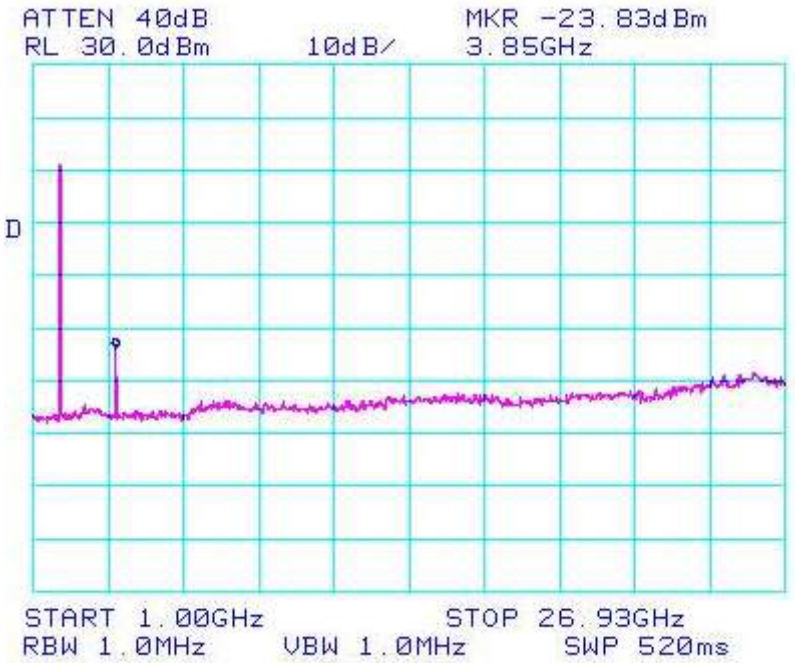
Frequency Range	Limit (dBm)	Measured Emission Level (dBm)		
		Low	Mid	High
30MHz < f_0 < 1GHz	< -13 dBm	-	-	-
1GHz < f_0 < 12.5GHz	< -13 dBm	-23.83	-31.50	-39.33
Intermodulation (CDMA)	< -13 dBm	-32.67		
Intermodulation (NADC)	< -13 dBm	-35.83		
Intermodulation (GSM)	< -13 dBm	-40.50		

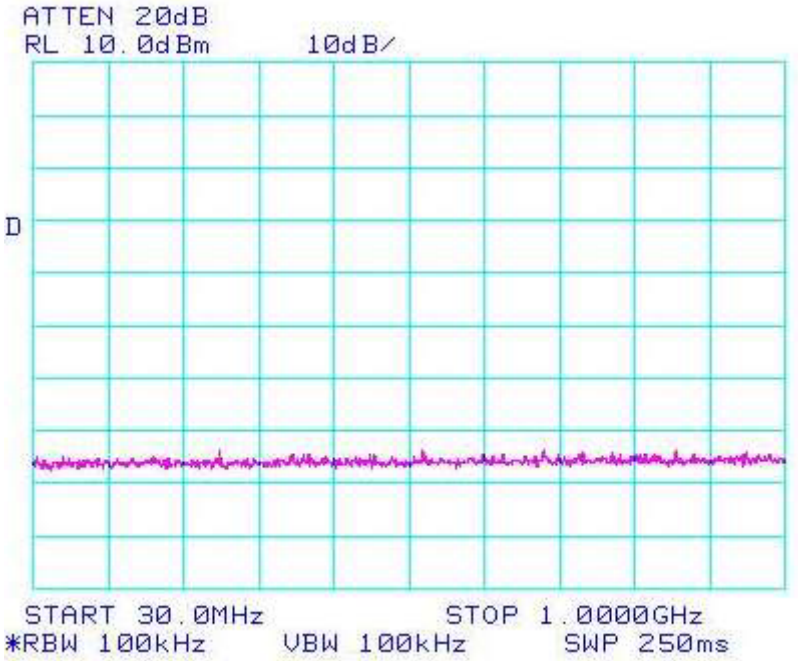
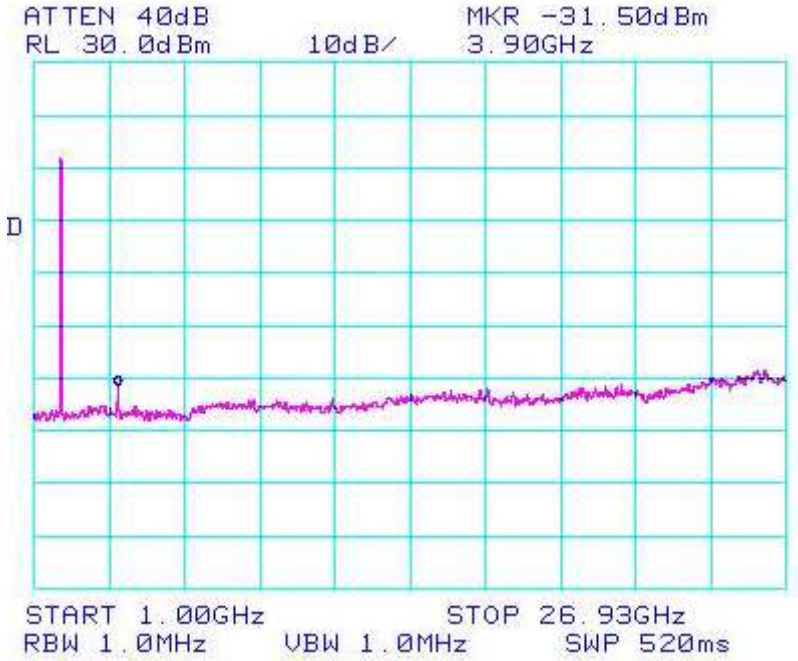
Uplink (Reverse)

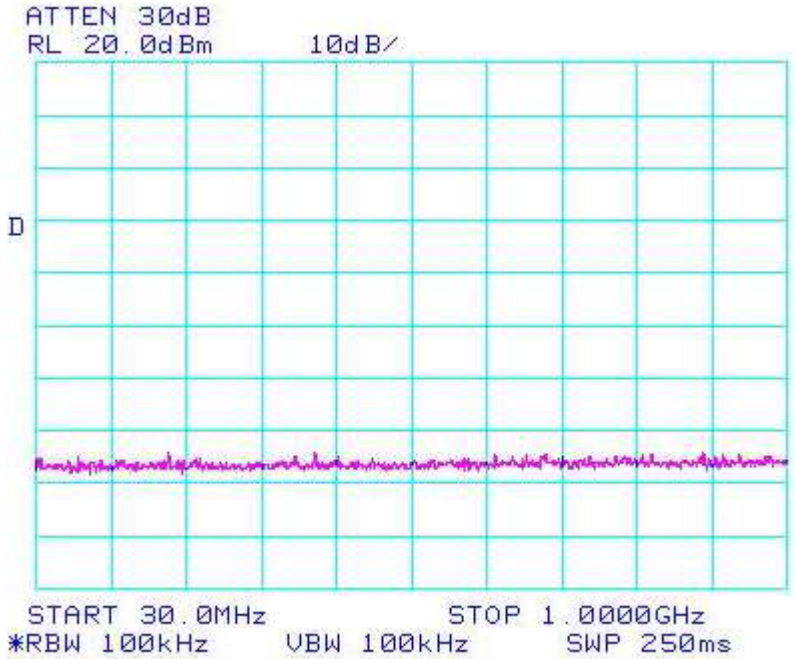
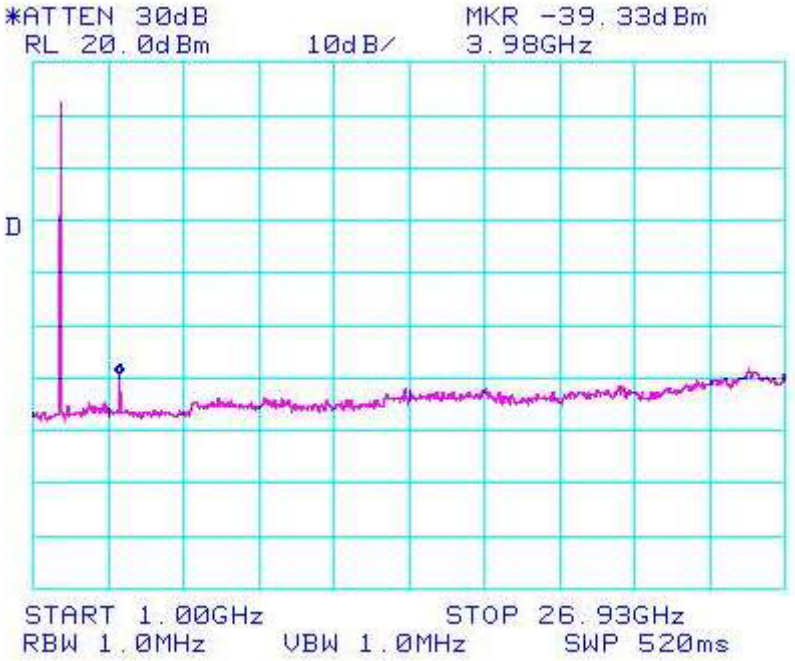
Frequency Range	Limit (dBm)	Measured Emission Level (dBm)		
		Low	Mid	High
30MHz < f_0 < 1GHz	< -13 dBm	-	-	-
1GHz < f_0 < 12.5GHz	< -13 dBm	-22.33	-22.33	-33.50
Intermodulation (CDMA)	< -13 dBm	-28.00		
Intermodulation (NADC)	< -13 dBm	-39.67		
Intermodulation (GSM)	< -13 dBm	-42.00		

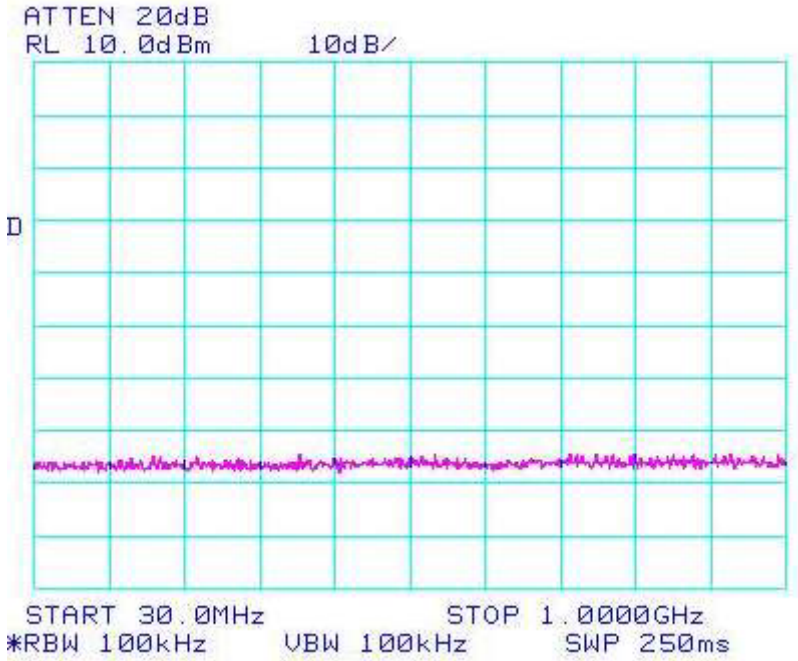
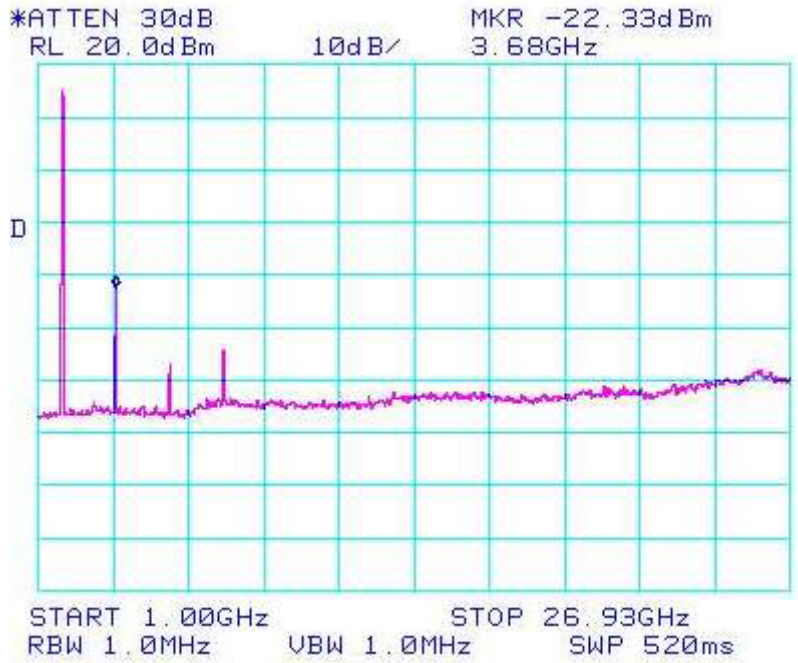
Note :

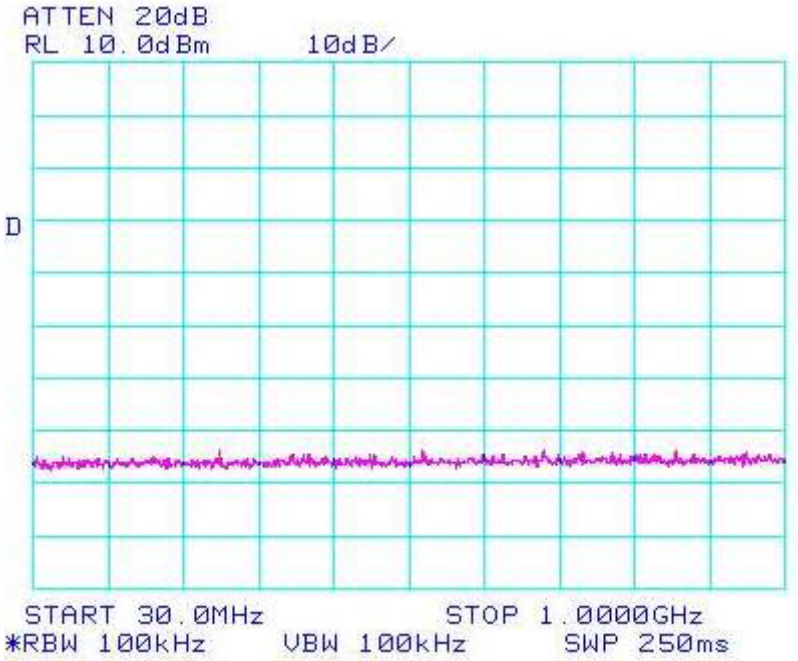
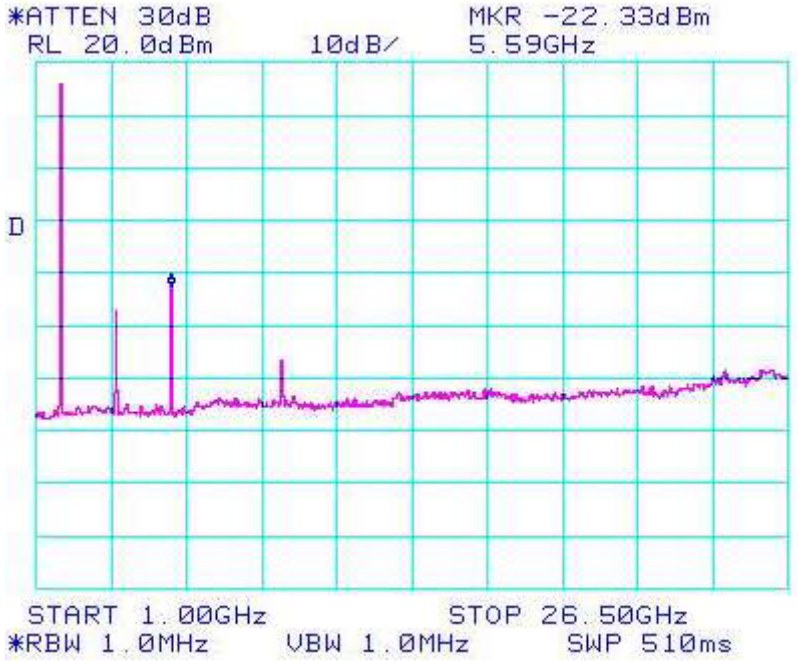
1. *The input to the amplifier is CDMA, NADC, GSM modulated signal tuned such that the output power is set to its maximum rated output power.*
2. *The RF output ports were properly terminated by the RF load and were connected to the RF Power Meter and Spectrum analyzer through the directional coupler.*
3. *The spectrum analyzer for this measurement was set with the RBW 100kHz in the range of 30MHz ~1GHz, and RBW 1MHz in the range of 1GHz~26.5GHz, as recorded in the plots. The VBW was set the same as RBW.*
4. *The measurements were performed at the shielded room.with environmental conditions of 23.9℃, 55%RH*
5. *Plots were taken with single input at low, mid, and high of the band. Plots were taken of the out-of-band emissions from 30MHz to the 10th harmonic of the carrier frequency.*
6. *For measuring emissions above 0.9 GHz, a high-pass filter was used to eliminate the fundamental transmit frequency to prevent possible saturation effects on the front end of the spectrum analyzer.*
7. *The emissions shall not be more than 43 + 10 log (P) dBc below the mean power output, which is equivalent to –13 dBm.*
8. *Frequency Table*

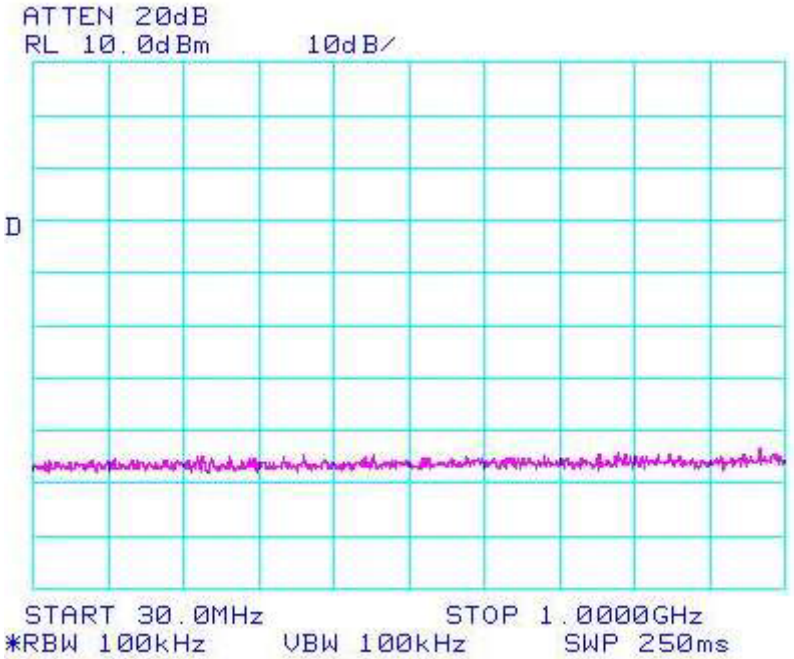
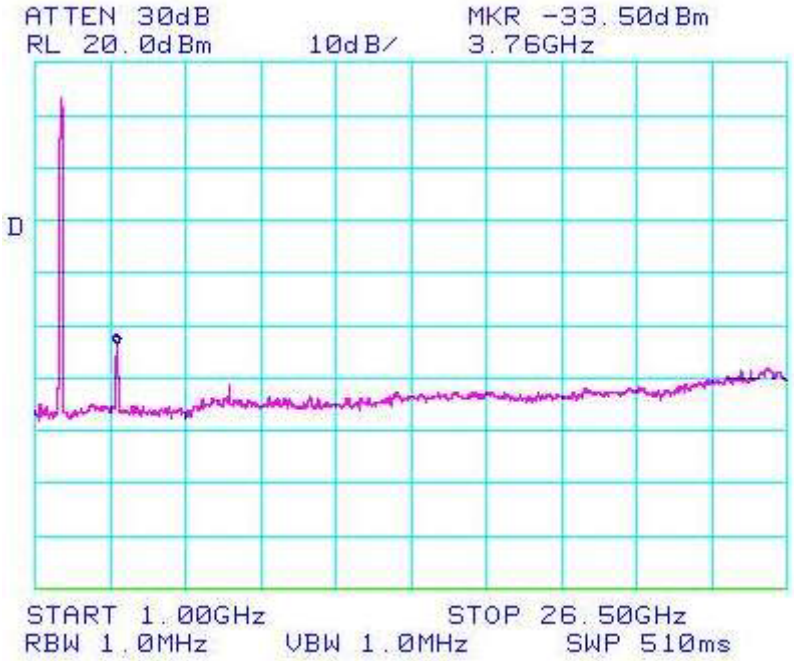
Low Channel / Forward	
30 MHz ~ 1 GHz Nothing	
1 GHz ~ 26.5 GHz -23.83 dBm	

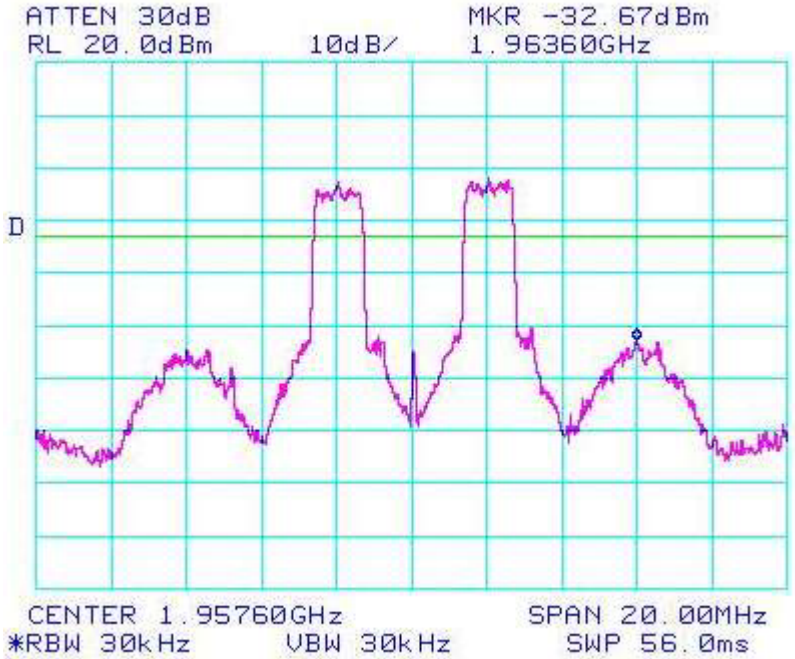
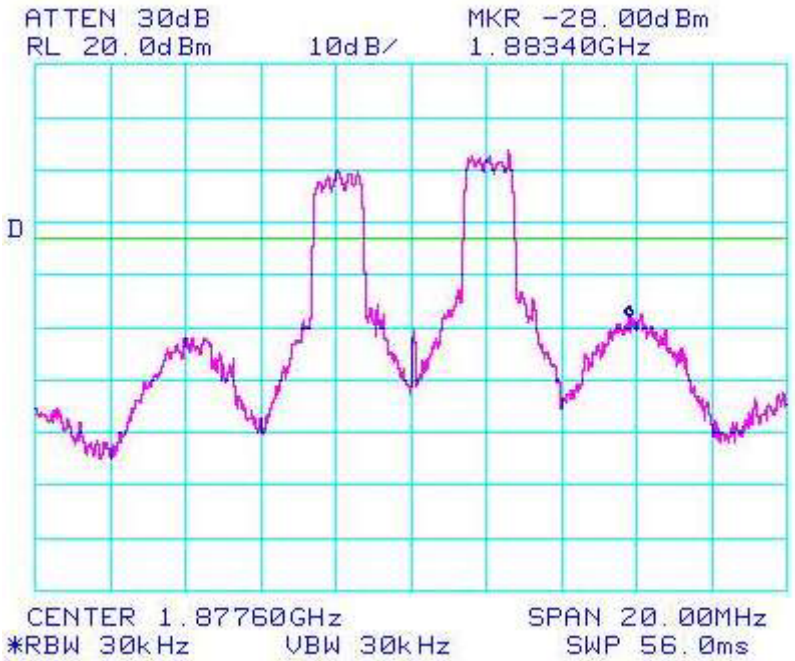
Middle Channel / Forward	
30 MHz ~ 1 GHz Nothing	
1 GHz ~ 26.5 GHz -31.50 dBm	

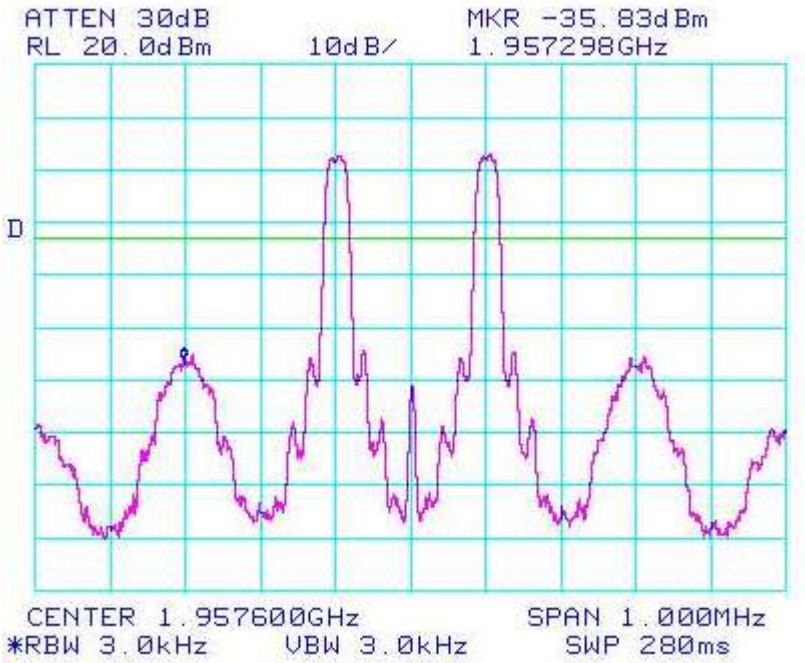
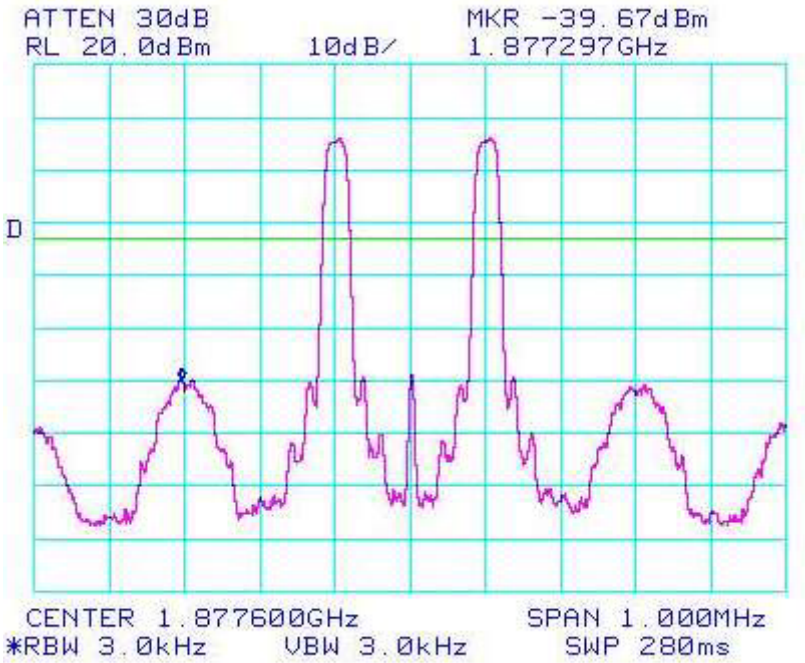
High Channel / Forward	
30 MHz ~ 1 GHz Nothing	
1 GHz ~ 26.5 GHz -39.33 dBm	

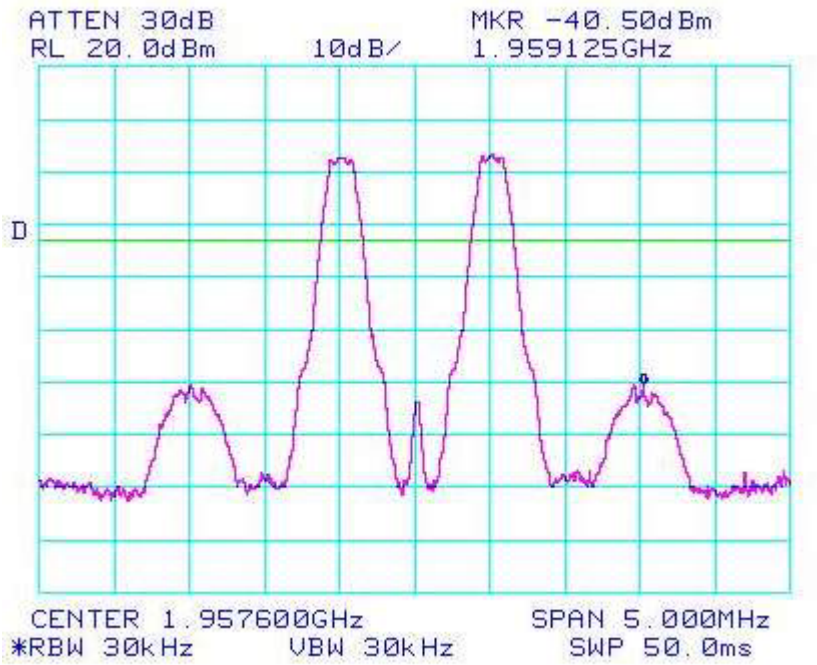
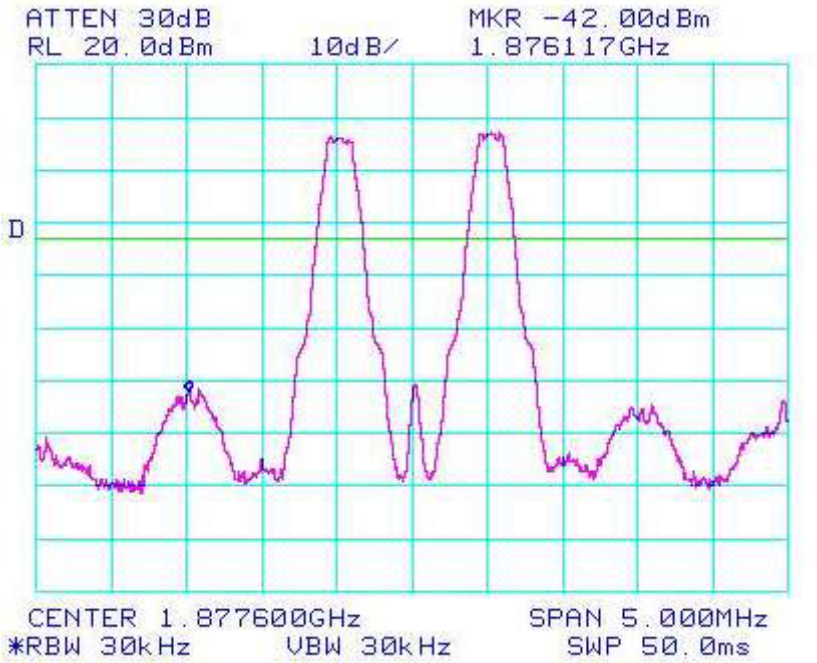
Low Channel / Reverse	
30 MHz ~ 1 GHz Nothing	
1 GHz ~ 26.5 GHz -22.33 dBm	

Middle Channel / Reverse	
30 MHz ~ 1 GHz Nothing	
1 GHz ~ 26.5 GHz -22.33 dBm	

High Channel / Reverse	
30 MHz ~ 1 GHz Nothing	
1 GHz ~ 26.5 GHz -33.50 dBm	

CDMA Intermodulation Plot	
Forward 1957.6 MHz -32.67 dBm	
Reverse 1877.6 MHz -28.00 dBm	

NADC Intermodulation Plot	
Forward 1957.6 MHz -35.83 dBm	
Reverse 1877.6 MHz -39.67 dBm	

GSM Intermodulation Plot	
Forward 1957.6 MHz -40.50 dBm	
Reverse 1877.6 MHz -42.00 dBm	

7.4 Field Strength of Spurious Radiation

7.4.1 Forward / Low Channel / 1930.2 MHz

Test Standard	:	FCC Part 24.238 & 2.1053
Operating Frequency	:	Forward
Channel	:	Low
RF Power Output	:	10 mW CDMA – Single Channel NADC – Composite Multiple Channel GSM - Composite Multiple Channel
Distance	:	3 meters

Frequency Tuned (MHz)	Antenna Polarization (V/H)	ERP (dBm)	Limit (dBm)	Margin (dB)
3860.4	H	-32.6	-13.0	-19.6
5790.6	H	-72.2	-13.0	-59.2
7720.8	-	-	-	-
9651.0	-	-	-	-
11581.2	-	-	-	-
13511.4	-	-	-	-
15441.6	-	-	-	-
17371.8	-	-	-	-
19302.0	-	-	-	-

Note :

1. *The spectrum bandwidth was set to RBW 100 kHz (freq. up to 1GHz) and RBW 1 MHz(freq above 1GHz).*
2. *Transmitter was set to the rated power output(10 mW) condition.*
3. *The spectrum was checked from 30 MHz up to the 10th harmonic of the carrier frequency.*
4. *All emission not reported were found to be more than 30dB below the limit.*
5. *The EUT was positioned through 3 orthogonal axis and worst-case are reported.*
6. *ERP measurements were performed using the rated supply voltage condition(DC 7V).*
7. *The limit was applied according to the 43 +10log(P)dBc.*

7.4.2 Forward / Middle Channel / 1957.6 MHz

Test Standard	: FCC Part 24.238 & 2.1053
Operating Frequency	: Forward
Channel	: Middle
RF Power Output	: 10 mW CDMA – Single Channel NADC – Composite Multiple Channel GSM - Composite Multiple Channel
Distance	: 3 meters

Frequency Tuned (MHz)	Antenna Polarization (V/H)	ERP (dBm)	Limit (dBm)	Margin (dB)
3915.2	H	-40.1	-13.0	-27.1
5872.8	H	-76.3	-13.0	-63.3
7830.4	-	-	-	-
9788.0	-	-	-	-
11745.6	-	-	-	-
13703.2	-	-	-	-
15660.8	-	-	-	-
17618.4	-	-	-	-
19576.0	-	-	-	-

Note :

1. *The spectrum bandwidth was set to RBW 100 kHz (freq. up to 1GHz) and RBW 1 MHz(freq above 1GHz).*
2. *Transmitter was set to the rated power output(10 mW) condition.*
3. *The spectrum was checked from 30 MHz up to the 10th harmonic of the carrier frequency.*
4. *All emission not reported were found to be more than 30dB below the limit.*
5. *The EUT was positioned through 3 orthogonal axis and worst-case are reported.*
6. *ERP measurements were performed using the rated supply voltage condition(DC 7V).*
7. *The limit was applied according to the 43 +10log(P)dBc.*

7.4.3 Forward / High Channel / 1989.8 MHz

Test Standard	:	FCC Part 24.238 & 2.1053
Operating Frequency	:	Forward
Channel	:	High
RF Power Output	:	10 mW CDMA – Single Channel NADC – Composite Multiple Channel GSM - Composite Multiple Channel
Distance	:	3 meters

Frequency Tuned (MHz)	Antenna Polarization (V/H)	ERP (dBm)	Limit (dBm)	Margin (dB)
3979.6	H	-47.2	-13.0	-34.2
5969.4	H	-79.0	-13.0	-66.0
7959.2	-	-	-	-
9949.0	-	-	-	-
11938.8	-	-	-	-
13928.6	-	-	-	-
15918.4	-	-	-	-
17908.2	-	-	-	-
19898.0	-	-	-	-

Note :

1. *The spectrum bandwidth was set to RBW 100 kHz (freq. up to 1GHz) and RBW 1 MHz(freq above 1GHz).*
2. *Transmitter was set to the rated power output(10 mW) condition.*
3. *The spectrum was checked from 30 MHz up to the 10th harmonic of the carrier frequency.*
4. *All emission not reported were found to be more than 30dB below the limit.*
5. *The EUT was positioned through 3 orthogonal axis and worst-case are reported.*
6. *ERP measurements were performed using the rated supply voltage condition(DC 7V).*
7. *The limit was applied according to the 43 +10log(P)dBc.*

7.4.4 Reverse / Low Channel / 1850.2 MHz

Test Standard	:	FCC Part 24.238 & 2.1053
Operating Frequency	:	Reverse
Channel	:	Low
RF Power Output	:	10 mW CDMA – Single Channel NADC – Composite Multiple Channel GSM - Composite Multiple Channel
Distance	:	3 meters

Frequency Tuned (MHz)	Antenna Polarization (V/H)	ERP (dBm)	Limit (dBm)	Margin (dB)
3700.4	H	-32.0	-13.0	-19.0
5550.6	H	-48.7	-13.0	-35.7
7400.8	H	-46.3	-13.0	-33.3
9251.0	-	-	-	-
11101.2	-	-	-	-
12951.4	-	-	-	-
14801.6	-	-	-	-
16651.8	-	-	-	-
18502.0	-	-	-	-

Note :

1. *The spectrum bandwidth was set to RBW 100 kHz (freq. up to 1GHz) and RBW 1 MHz(freq above 1GHz).*
2. *Transmitter was set to the rated power output(10 mW) condition.*
3. *The spectrum was checked from 30 MHz up to the 10th harmonic of the carrier frequency.*
4. *All emission not reported were found to be more than 30dB below the limit.*
5. *The EUT was positioned through 3 orthogonal axis and worst-case are reported.*
6. *ERP measurements were performed using the rated supply voltage condition(DC 7V).*
7. *The limit was applied according to the 43 +10log(P)dBc.*

7.4.5 Reverse / Middle Channel / 1877.6 MHz

Test Standard	:	FCC Part 24.238 & 2.1053
Operating Frequency	:	Reverse
Channel	:	Middle
RF Power Output	:	10 mW CDMA – Single Channel NADC – Composite Multiple Channel GSM - Composite Multiple Channel
Distance	:	3 meters

Frequency Tuned (MHz)	Antenna Polarization (V/H)	ERP (dBm)	Limit (dBm)	Margin (dB)
3755.2	H	-37.1	-13.0	-24.1
5632.8	H	-31.0	-13.0	-18.0
7510.4	H	-45.3	-13.0	-32.3
9388.0	–	–	–	–
11265.6	–	–	–	–
13143.2	–	–	–	–
15020.8	–	–	–	–
16898.4	–	–	–	–
18776.0	–	–	–	–

Note :

1. *The spectrum bandwidth was set to RBW 100 kHz (freq. up to 1GHz) and RBW 1 MHz(freq above 1GHz).*
2. *Transmitter was set to the rated power output(10 mW) condition.*
3. *The spectrum was checked from 30 MHz up to the 10th harmonic of the carrier frequency.*
4. *All emission not reported were found to be more than 30dB below the limit.*
5. *The EUT was positioned through 3 orthogonal axis and worst-case are reported.*
6. *ERP measurements were performed using the rated supply voltage condition(DC 7V).*
7. *The limit was applied according to the 43 +10log(P)dBc.*

7.4.6 Reverse / High Channel / 1909.8 MHz

Test Standard	:	FCC Part 24.238 & 2.1053
Operating Frequency	:	Reverse
Channel	:	High
RF Power Output	:	10 mW CDMA – Single Channel NADC – Composite Multiple Channel GSM - Composite Multiple Channel
Distance	:	3 meters

Frequency Tuned (MHz)	Antenna Polarization (V/H)	ERP (dBm)	Limit (dBm)	Margin (dB)
3819.6	H	-44.9	-13.0	-31.9
5729.4	H	-67.2	-13.0	-54.2
7639.2	H	-50.9	-13.0	-37.9
9549.0	–	–	–	–
11458.8	–	–	–	–
13368.6	–	–	–	–
15278.4	–	–	–	–
17188.2	–	–	–	–
19098.0	–	–	–	–

Note :

1. *The spectrum bandwidth was set to RBW 100 kHz (freq. up to 1GHz) and RBW 1 MHz(freq above 1GHz).*
2. *Transmitter was set to the rated power output(10 mW) condition.*
3. *The spectrum was checked from 30 MHz up to the 10th harmonic of the carrier frequency.*
4. *All emission not reported were found to be more than 30dB below the limit.*
5. *The EUT was positioned through 3 orthogonal axis and worst-case are reported.*
6. *ERP measurements were performed using the rated supply voltage condition(DC 7V).*
7. *The limit was applied according to the 43 +10log(P)dBc.*

7.5 Frequency Stability

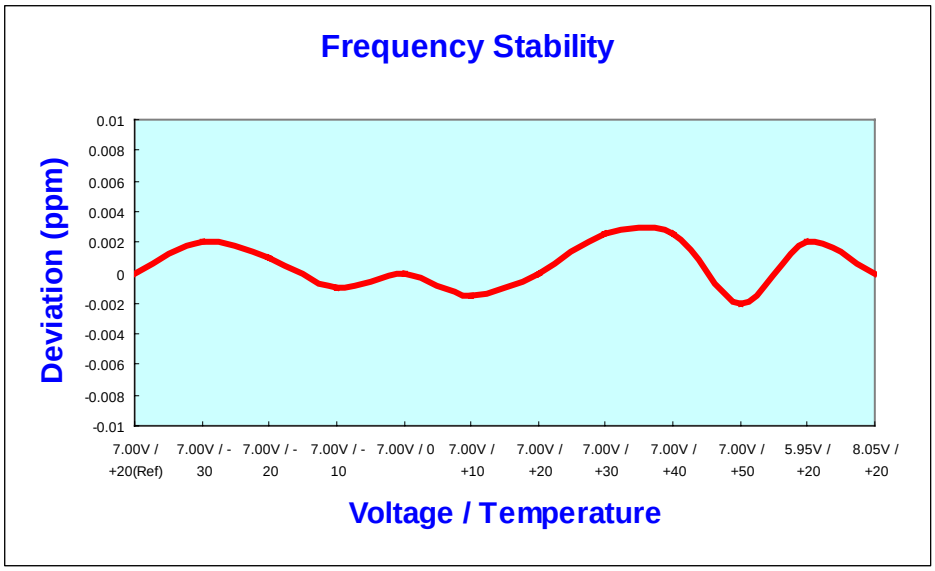
7.5.1 Forward / Middle Channel / 1957.6 MHz

Test Standard	:	FCC Part 24.235 & 2.1055
Operating Frequency	:	Forward
Channel	:	Middle
RF Power Output	:	10 mW CDMA – Single Channel NADC – Composite Multiple Channel GSM – Composite Multiple Channel

Forward (1957.6 MHz)

Voltage (%)	Power Supply (VDC)	Temperature (°C)	Frequency (Hz)	Deviation (ppm)
100 %	7.00	+20(Ref)	1957600038	0
100 %		-30	1957600042	+0.00204
100 %		-20	1957600040	+0.00102
100 %		-10	1957600036	-0.00102
100 %		0	1957600038	0
100 %		+10	1957600035	-0.00153
100 %		+20	1957600038	0
100 %		+30	1957600043	+0.00255
100 %		+40	1957600043	+0.00255
100 %		+50	1957600034	-0.00204
85 %	5.95	+20	1957600042	+0.00204
115 %	8.05	+20	1957600038	0

Note :
1. The worst-case temperature deviation was recorded.



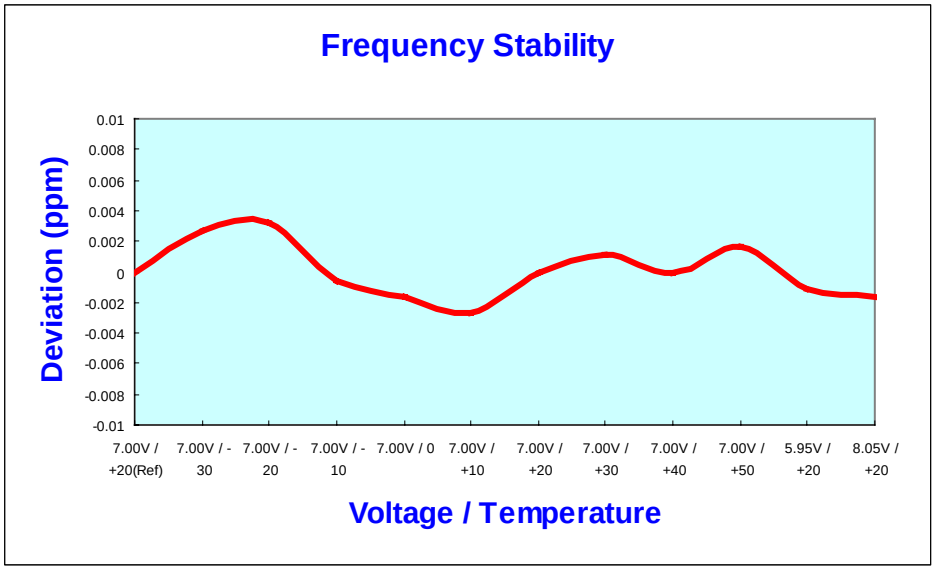
7.5.2 Reverse / Middle Channel / 1957.6 MHz

Test Standard	: FCC Part 24.235 & 2.1055
Operating Frequency	: Reverse
Channel	: Middle
RF Power Output	: 10 mW CDMA – Single Channel NADC – Composite Multiple Channel GSM – Composite Multiple Channel

Forward (1957.6 MHz)

Voltage (%)	Power Supply (VDC)	Temperature (°C)	Frequency (Hz)	Deviation (ppm)
100 %	7.00	+20(Ref)	1877600041	0
100 %		-30	1877600046	+0.00266
100 %		-20	1877600047	+0.00320
100 %		-10	1877600040	-0.00053
100 %		0	1877600038	-0.00160
100 %		+10	1877600036	-0.00266
100 %		+20	1877600041	0
100 %		+30	1877600043	+0.00107
100 %		+40	1877600041	0
100 %		+50	1877600044	+0.00160
85 %	5.95	+20	1877600039	-0.00107
115 %	8.05	+20	1877600038	-0.00160

Note :
1. The worst-case temperature deviation was recorded.



8. TEST EQUIPMENT LIST

List of Test Equipments Used for Measurements

Test Equipment	Model	Mfg.	Serial No.	Cal. Due Date
Spectrum Analyzer	8563E	H.P.	3611A05046	04-05-13
Spectrum Analyzer	8594E	H.P.	3911A08040	04-04-24
Spectrum Analyzer	E7403A	ADVANTEST	61720002	04-08-22
Receiver	ESH3	R & S	892580/014	04-05-21
Signal Generator	E4432B	H.P.	US40053157	04-05-07
Signal Generator	SGT9000	GIGATRONICS	9604010	04-04-25
Power Meter	E4418A	H.P.	GB38272621	04-04-25
Power Sensor	8481A	H.P.	3318A92101	04-04-25
Audio Analyzer	8903B	H.P.	3011A09344	04-05-07
Modulation Analyzer	8901B	H.P.	3028A03124	04-05-03
Synthesized Function Generator	SG-4111	IWATSU	35559	04-05-26
Broadband Power Amplifier	100W 10000M 11	Amplifier Research	18649	05-03-19
Broadband Power Amplifier	75A220	Amplifier Research	15326	04-12-16
Preamplifier	8447E	H.P.	2945A02712	04-08-19
Horn Antenna	BBHA 9120 D	Schwarz Beck	234	04-06-20
Horn Antenna	BBHA 9170	Schwarz Beck	157	04-06-20
Dipole Antenna	VDA6106A / UHA9105	Schaffner-chase	1277	04-09-12
Biconical Antenna	VHA9103	Schwarzbeck	-	04-09-13
Log Periodic Antenna	UPA6109	SCHAFFNER	1076	04-09-13
Attenuator	8325	BIRD	4572	04-05-14
Attenuator	RFA500NMF30	RFA500NMF30	9522	05-01-07
Termination	8173	BIRD	2501	-
Dual directional coupler	772D	H.P.	2839A00395	05-01-07
Dual directional coupler	778D	H.P.	1144A08477	04-10-14
LISN	L3-25	PMM	1110KT0403	04-10-02
LISN	KNW-242C	PMM	8-920-20	04-08-30
Digital Oscilloscope	TDS3032	Tektronix	B081558	04-05-27
Turn-Table	JAC-2	JAEMC	-	-
Antenna Master	JAC-1	Daeil EMC	-	-
Plotter	7550A	H.P	2725A 75529	-
EMC Anechoic Chamber	-	SEMITECH	000815	
Temp/Humidity Chamber	-	Seo jin	-	04-09-01
Thermo Hygrograph	PC-5000TRH-II	SATO	-	04-10-27
BaroMeter	KEIRYOKI	SATO	564021	04-07-18
Slidacs	DeaKyong Slidacs	DeaKyong	-	-