



FCC TEST REPORT

Product Name	Repeater
Model Name	APEX8930
Applicant	R-tron Inc.
FCC ID	STE-APEX8930

ESTECH CO., LTD

Rm. 1015 World Venture Center, 426-5 Gasan-dong, Geumcheon-gu,
Seoul, 153-803, Korea. Tel:82-2-867-3201, Fax:82-2-867-3204



FCC Test Report

Report Number	ESTR1111-002			
Applicant	Company Name	R-tron Inc.		
	Address	Jisan IT Venture Center 7F, 1004-9 Doksan-Dong, Gumcheon-Gu, Seoul, Korea		
Product	Product Name	Repeater		
	Model No.	APEX8930	Manufacturer	R-tron Inc.
	Serial No.	NONE	Country of origin	KOREA
Other	Issued Date	2011-11-04	Tested Date	2010-09-14~2010-11-04
Test Result	Pass			
Standard	FCC PART 90 Subpart I			
Tested by	I.K. Hong/ Engineer (Signature) 			
Approved by	Tag-Sun Park/Engineering manager (Signature) 			
ESTECH CO., LTD Rm. 1015 World Venture Center, 426-5 Gasan-dong, Geumcheon-gu, Seoul, 153-803, Korea. Tel:82-2-867-3201, Fax:82-2-867-3204				
o This is certified that the above mentioned products have been tested for the sample provided by client. o No part of this document may not be duplicated or reproduced by any means without the express written permission of Estech Co., Ltd.				



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1. General Information

1.1 EUT Description

FCC ID	STE-APEX8930
Product Name	Repeater
Model Name	APEX8930
Frequency	Uplink :(806MHz - 824MHz, 896MHz - 901MHz)
	Downlink :(851MHz - 869MHz, 935MHz - 940MHz)
Modulation Type	iDen(QAM)
Power Rating	AC 110 V



2. Laboratory Information

2.1 Laboratory Name Estech Co., Ltd.

2.2 Location

Head Office Rm. 1015, World Venture Center II, 426-5 Gasan-dong
Geumcheon-gu, Seoul, 153-803. Korea.

EMC Lab(Ichon) 58-1, Osan-Ri, GaNam-Myon, YeoJoo-Gun, KyungKi-Do, Korea

2.3 Quality System Accredited by KOLAS(ISO/IEC 17025)

2.4 Major Accredited Mark



3. Summary of Test Results

Test Item	Standard	Result
RF Output Power	2.1046	PASS
Occupied Bandwidth	2.1049	PASS
Spurious and Harmonic Emission at Antenna Terminal	2.1051	PASS
Field Strength of Spurious Radiation	2.1053	PASS
Frequency stability	2.1055	PASS
Emission mask	2.1049	PASS

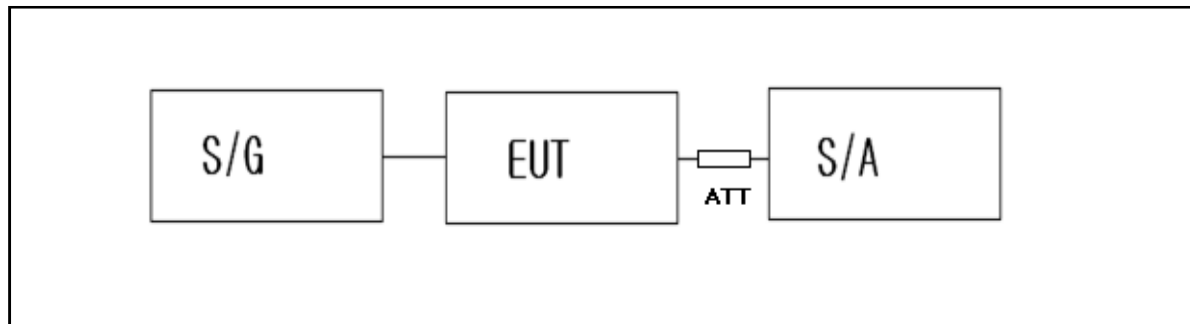


4. RF Output Power

4.1 Test Procedure according to ANSI/TIA/EIA 603 Clause 2.2.17

The RF output port of the EUT was connected to the dual directional coupler and Wireless communications test set connected dual directional coupler
The RF Power is measured Power meter This test was performed three channels (Low, High, Middle)

Test setup for RF Conducted measurement



4.2 Test Equipments

The following test equipments are used during tests

Equipment	Manufacturer	Model	Cal. Due Date
Spectrum Analyzer	Agilent	E4440A	2012-09-05
Signal Generator	HP	E4438C	2012-01-04

4.3.1 Test Results (800MHz Uplink)

Freq (MHz)	Measured Output power(dBm)	Rated Output power(dBm)
806.00	29.93	30.00
815.00	30.00	30.00
824.00	29.88	30.00



4.3.2 Test Results (900MHz Uplink)

Freq (MHz)	Measured Output power(dBm)	Rated Output power(dBm)
896.00	29.98	30.00
899.00	29.97	30.00
901.00	29.93	30.00

4.3.3 Test Results (800MHz Downlink)

Freq (MHz)	Measured Output power(dBm)	Rated Output power(dBm)
851.00	29.91	30.00
860.00	29.98	30.00
869.00	29.97	30.00

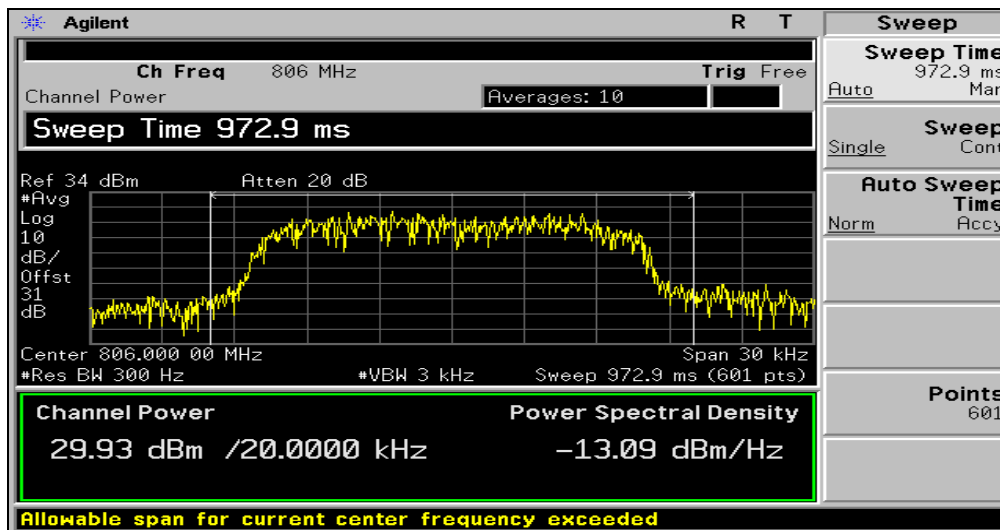
4.3.4 Test Results (900MHz Downlink)

Freq (MHz)	Measured Output power(dBm)	Rated Output power(dBm)
935.00	29.93	30.00
938.00	29.90	30.00
940.00	29.97	30.00

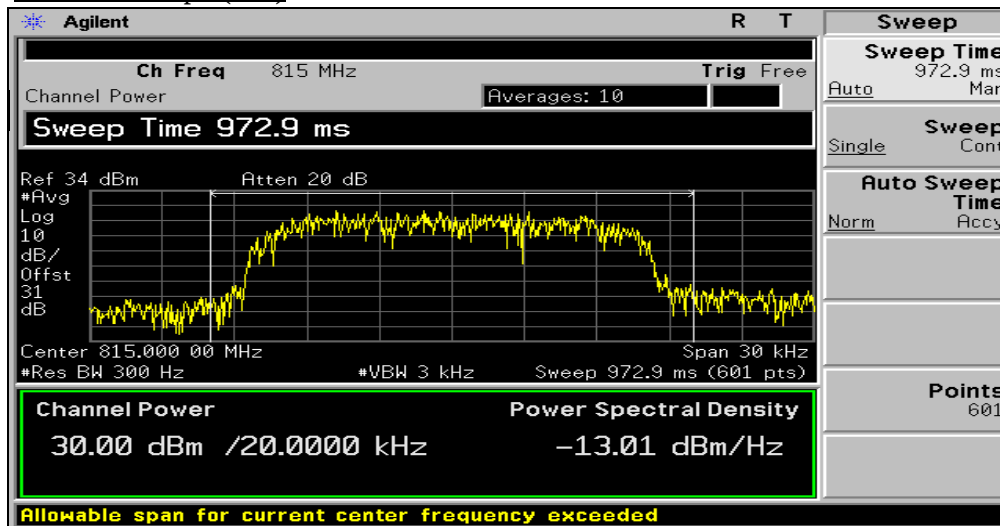


(800MHz Uplink)

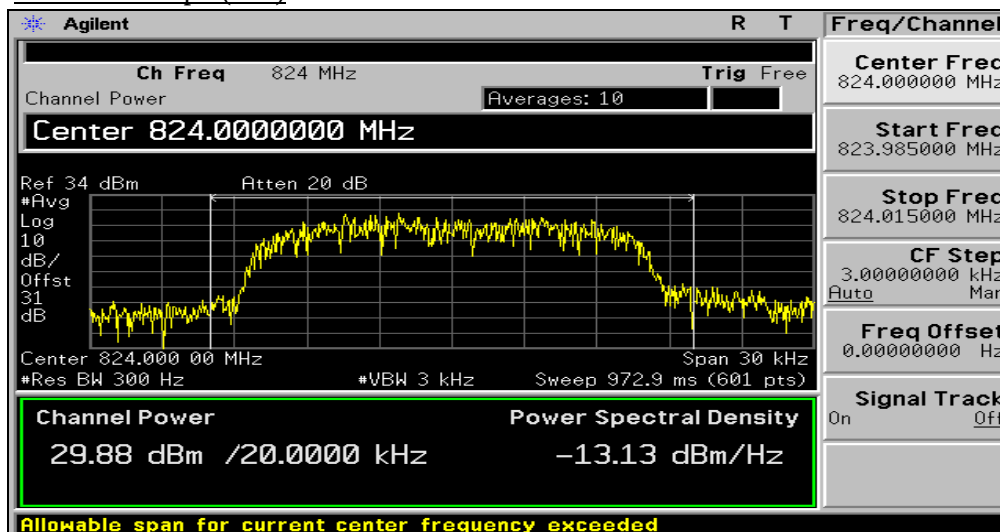
RF Power Output(806)



RF Power Output(815)



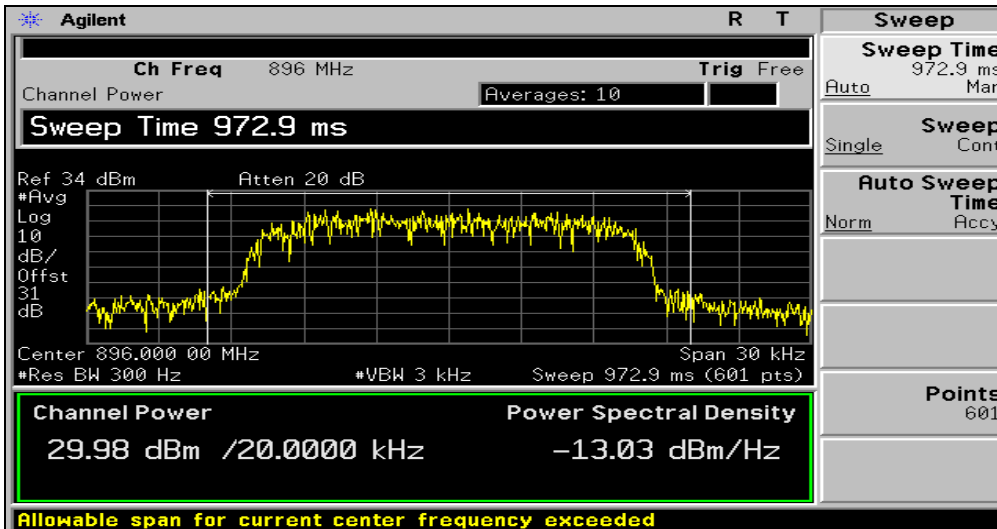
RF Power Output(824)



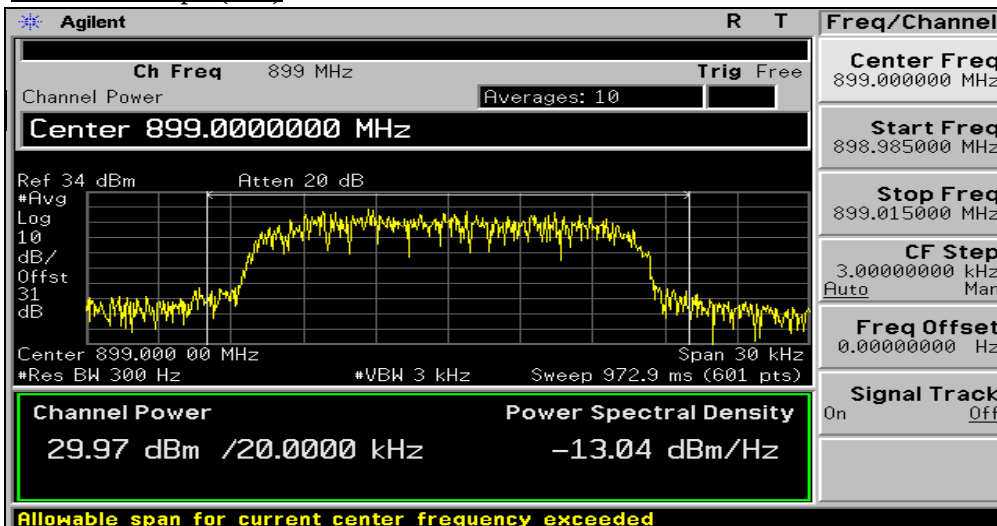


(900MHz Uplink)

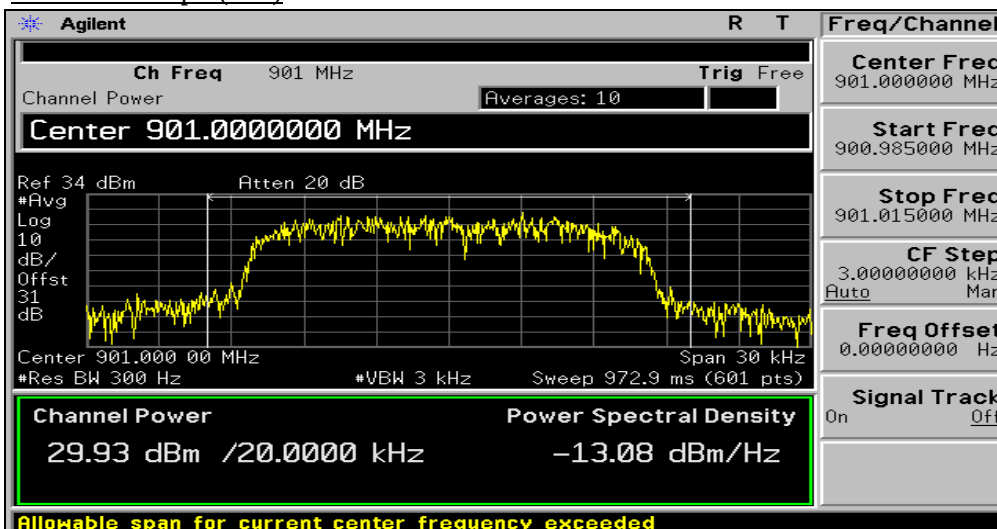
RF Power Output(896)



RF Power Output(899)



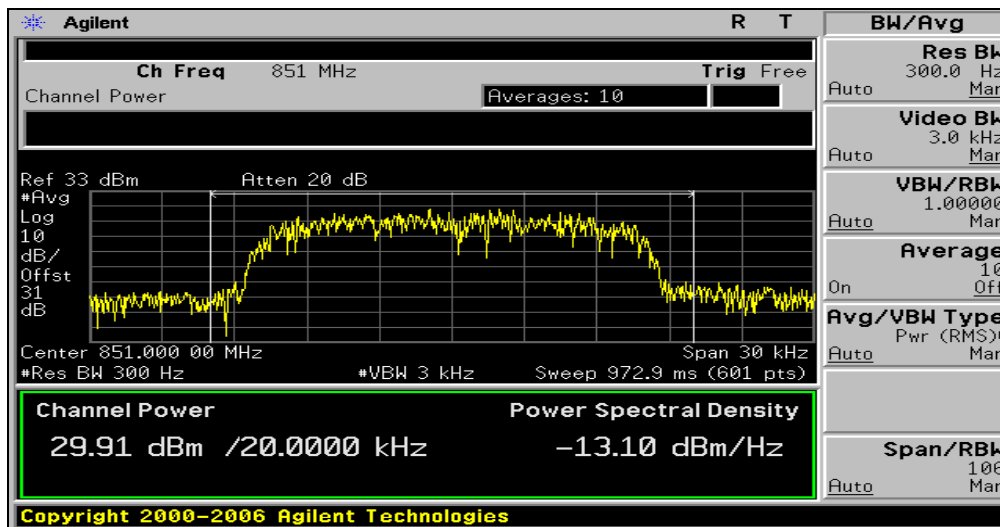
RF Power Output(901)



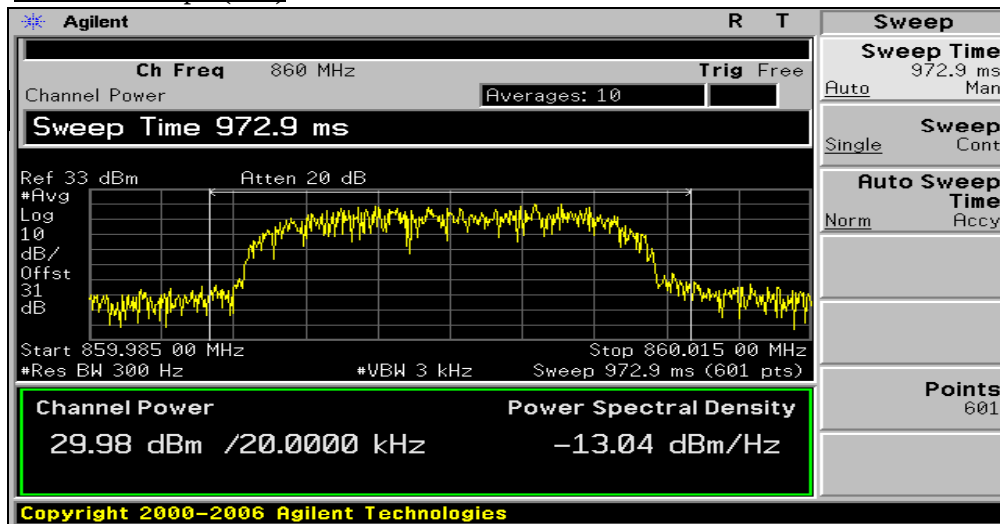


(800MHz Downlink)

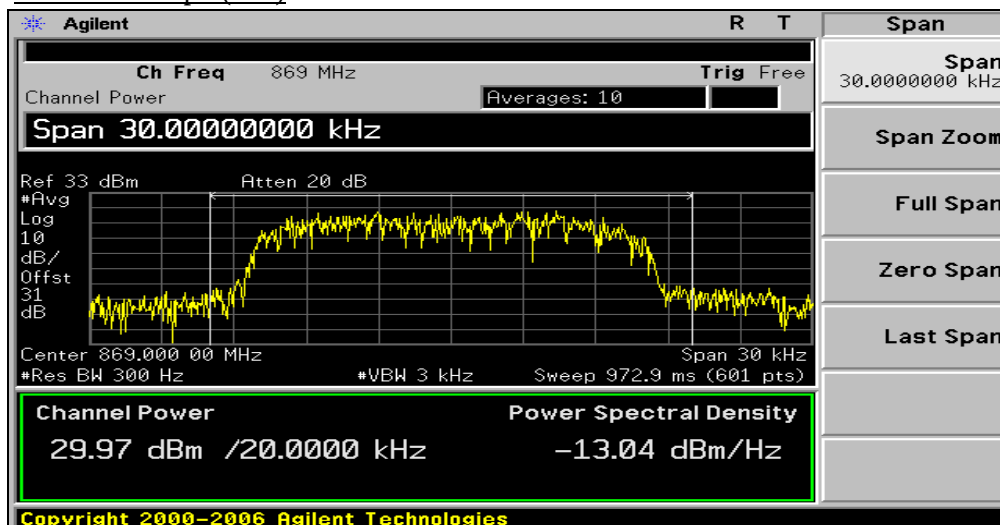
RF Power Output(851)



RF Power Output(860)



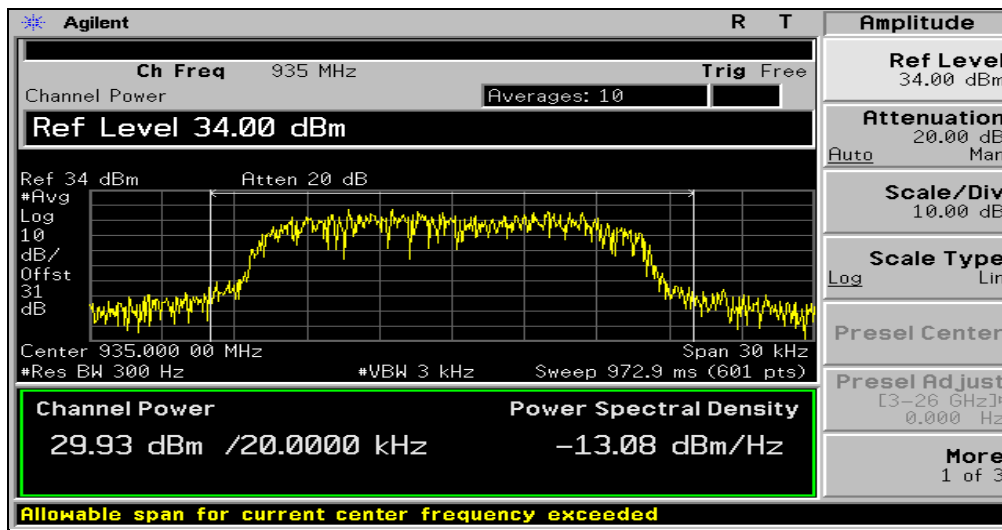
RF Power Output(869)



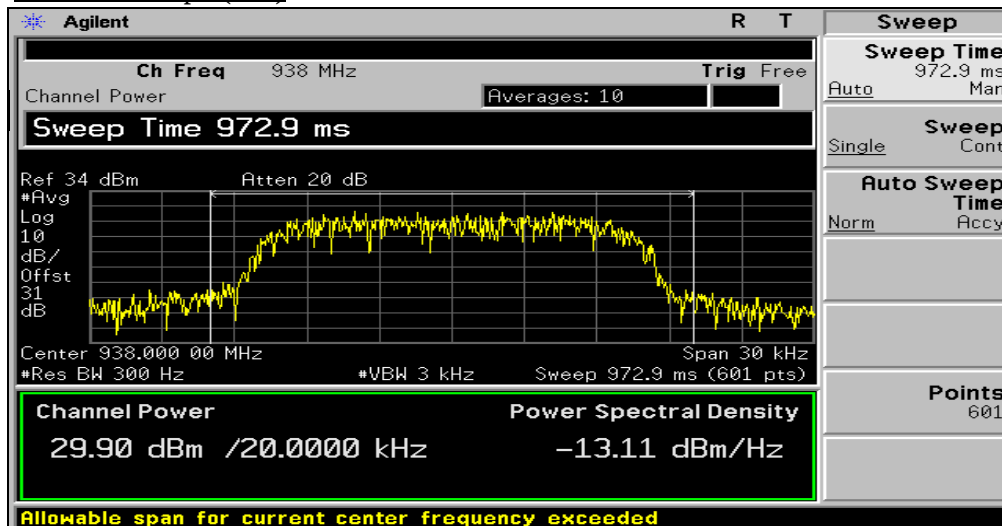


(900MHz Downlink)

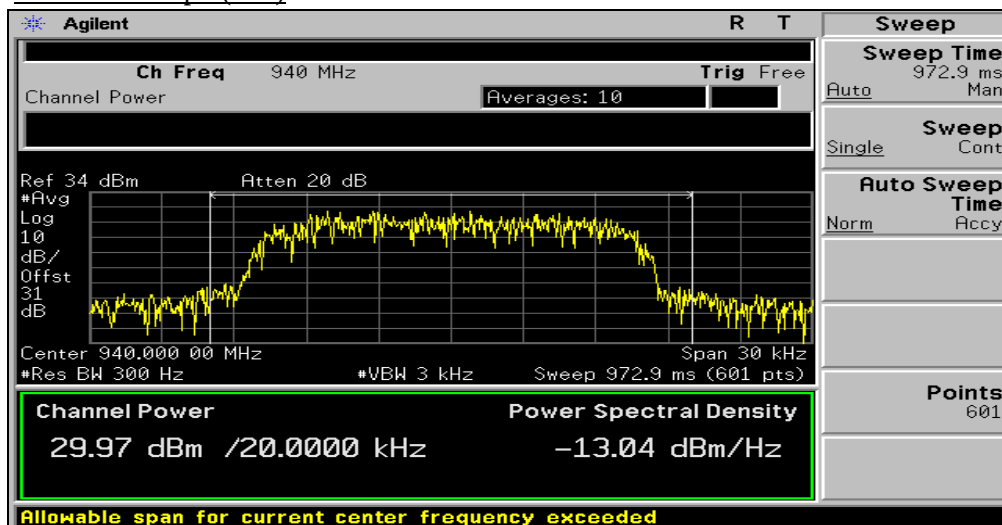
RF Power Output(935)



RF Power Output(938)



RF Power Output(940)

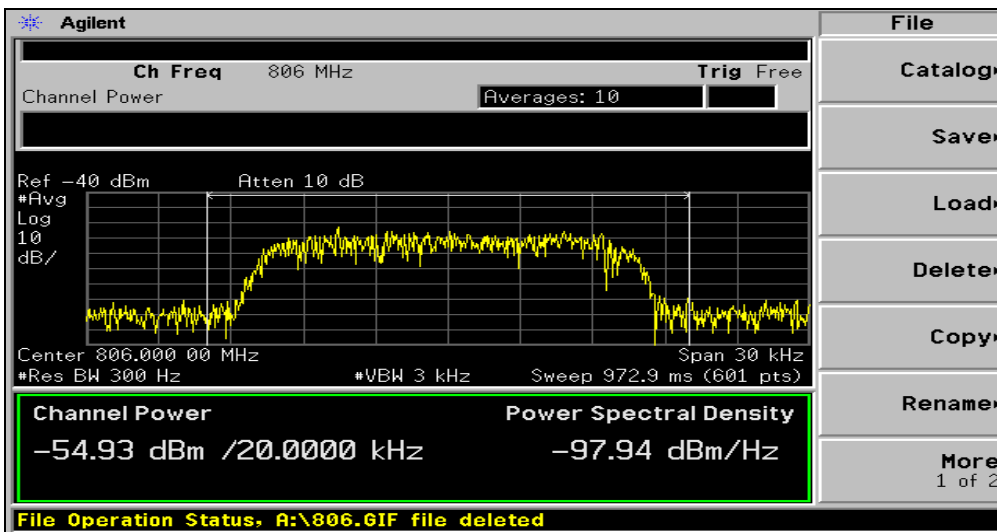




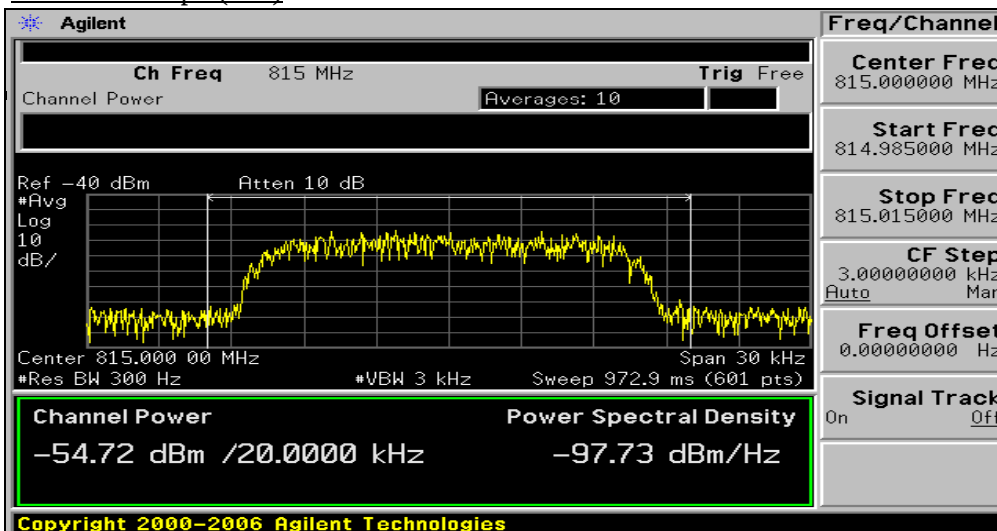
Input Signal Output Power

(800MHz Uplink)

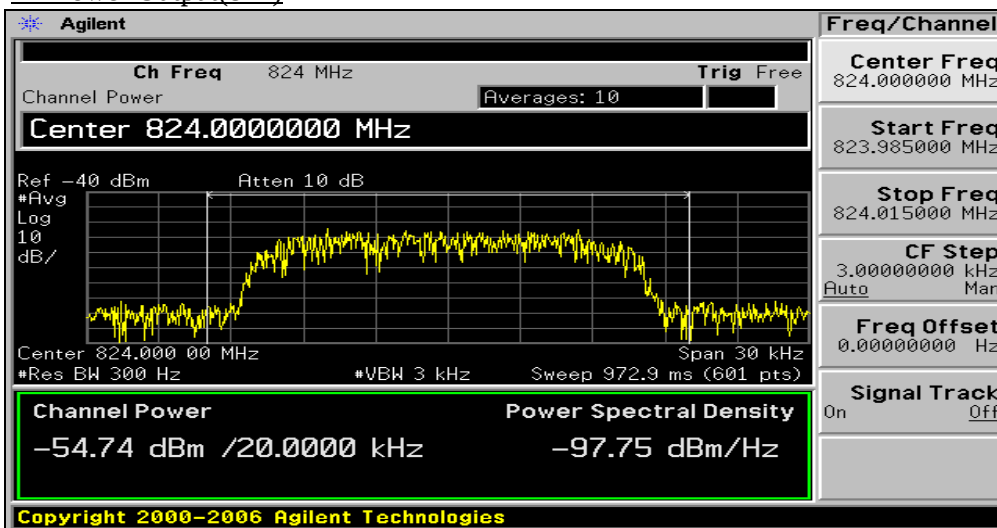
RF Power Output(806)



RF Power Output(815)



RF Power Output(824)

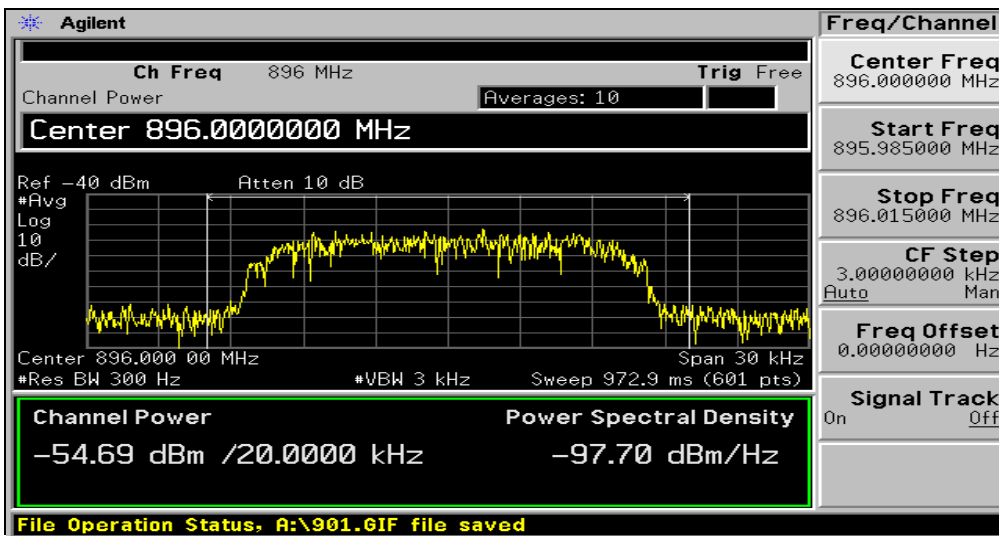




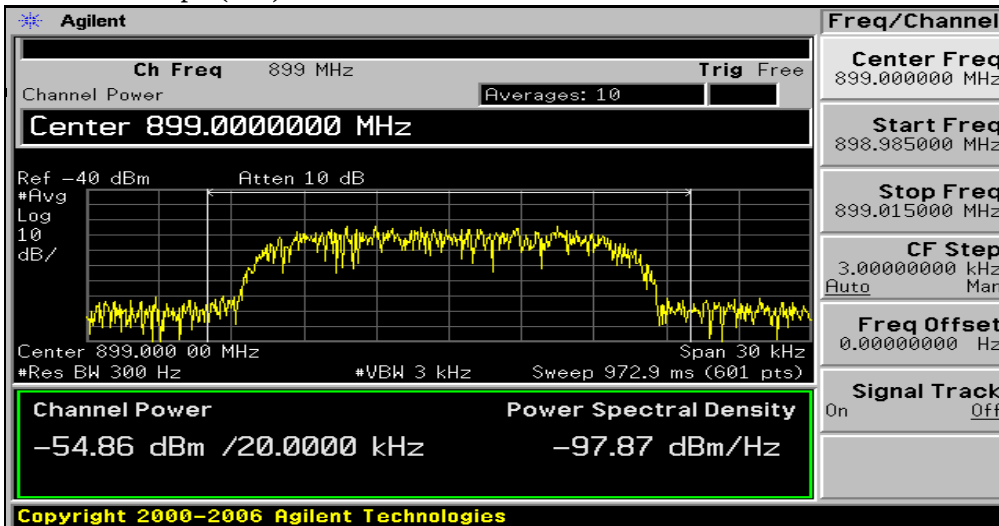
Input Signal Output Power

(900MHz Uplink)

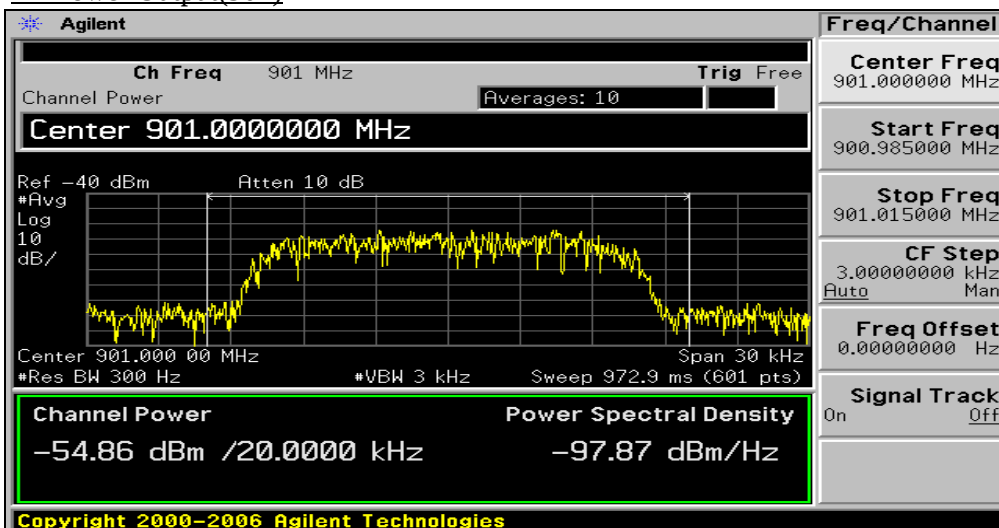
RF Power Output(896)



RF Power Output(899)



RF Power Output(901)

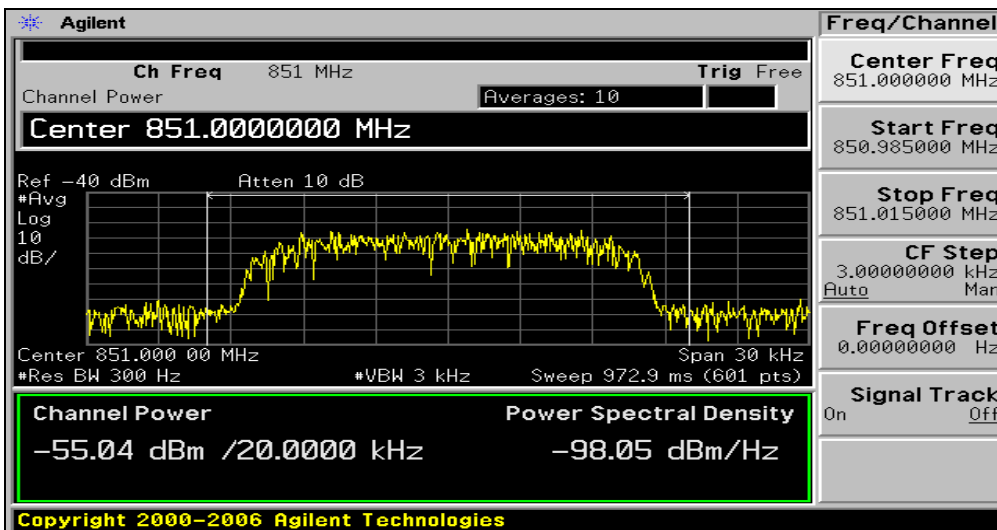




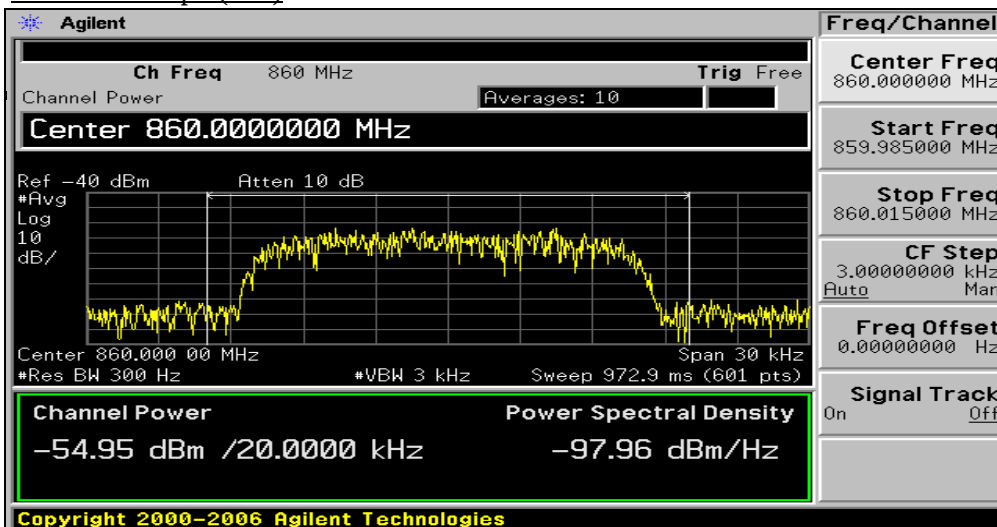
Input Signal Output Power

(800MHz Downlink)

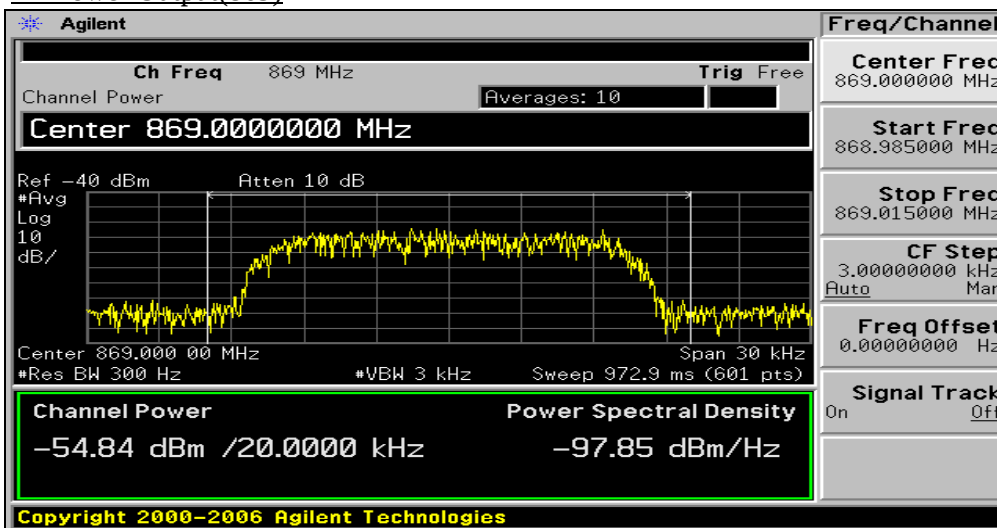
RF Power Output(851)



RF Power Output(860)



RF Power Output(869)

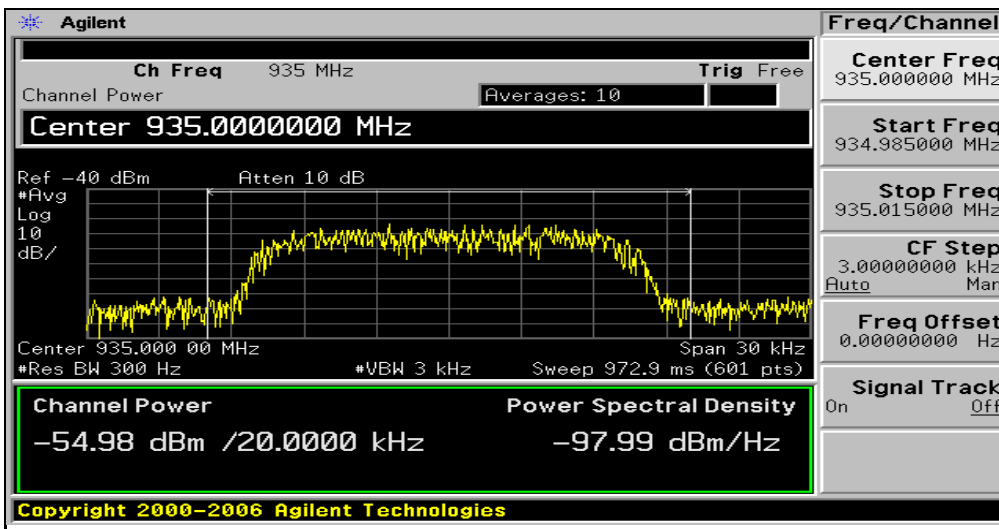




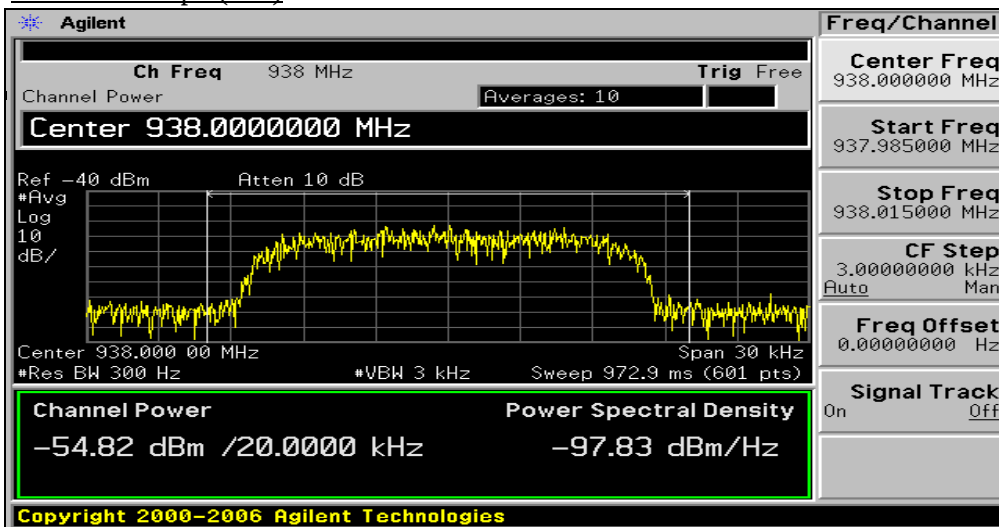
Input Signal Output Power

(900MHz Downlink)

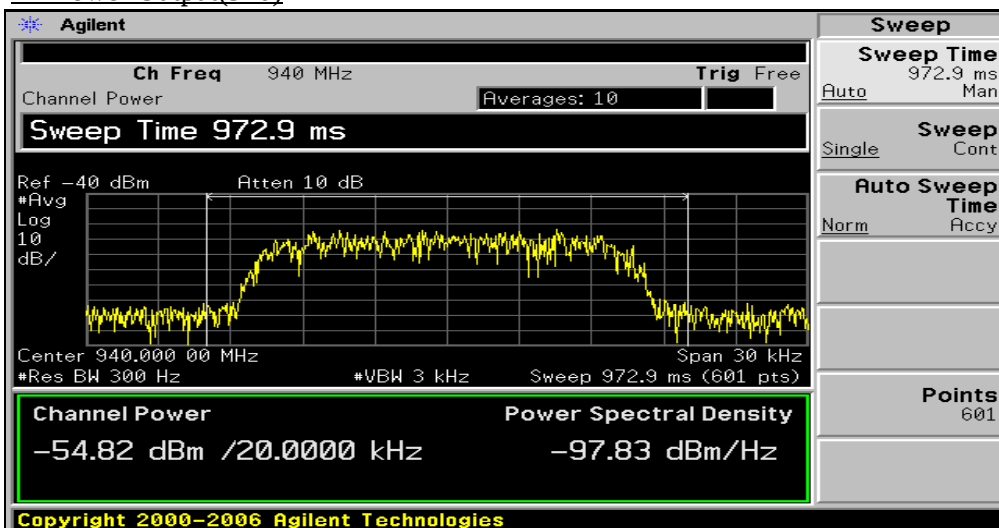
RF Power Output(935)



RF Power Output(938)



RF Power Output(940)



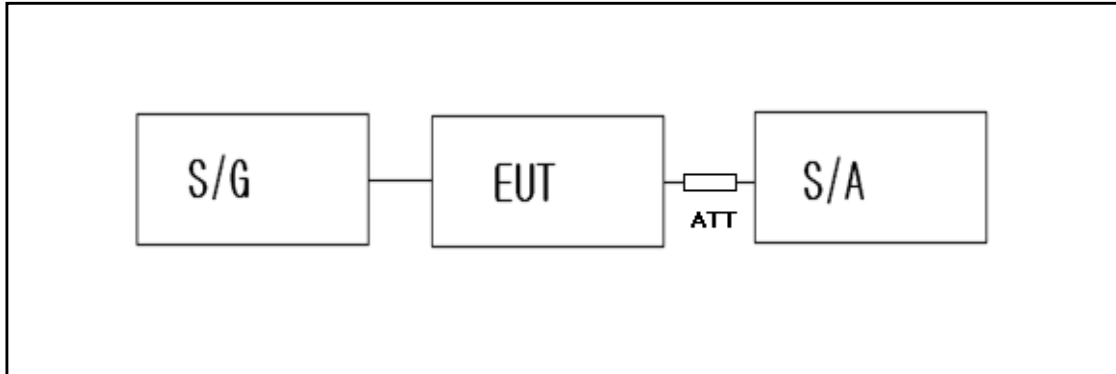


5. Occupied Bandwidth

5.1 Test Procedure

The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% of the Emission bandwidth.

The VBW is set to 3 times the RBW. The sweep time is coupled.



5.2 Test Equipments

The following test equipments are used during tests

Equipment	Manufacturer	Model	Cal. Due Date
Spectrum Analyzer	Agilent	E4440A	2012-09-05
Signal Generator	HP	E4438C	2012-01-04

5.3.1 Test Results (800MHz Uplink)

Freq (MHz)	26dB Bandwidth(MHz)
806.00	16.32
815.00	16.32
824.00	16.27

5.3.2 Test Results (900MHz Uplink)

Freq (MHz)	26dB Bandwidth(MHz)
896.00	16.34
899.00	16.34
901.00	16.29



5.3.3 Test Results (800MHz Downlink)

Freq (MHz)	26dB Bandwidth(MHz)
851.00	16.28
860.00	16.32
869.00	16.30

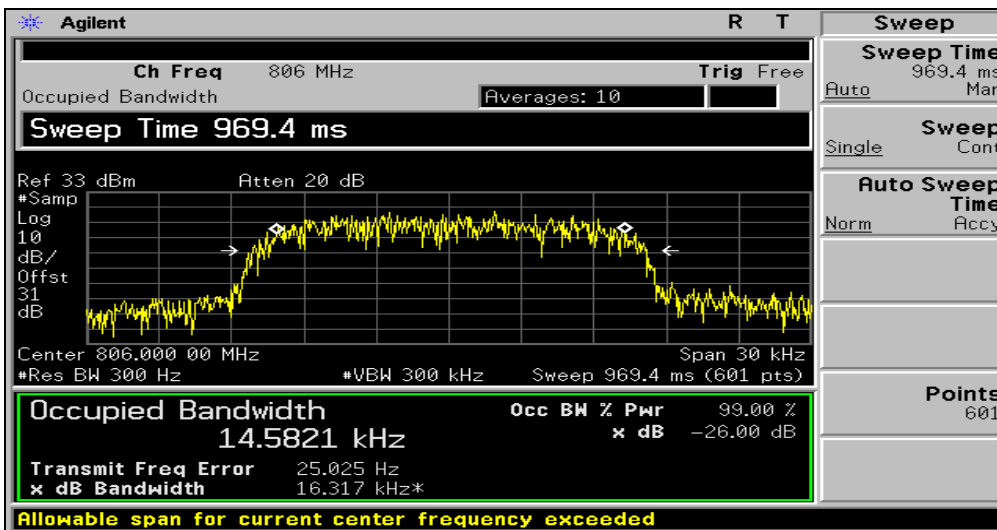
5.3.4 Test Results (900MHz Downlink)

Freq (MHz)	26dB Bandwidth(MHz)
935.00	16.39
938.00	16.32
940.00	16.30

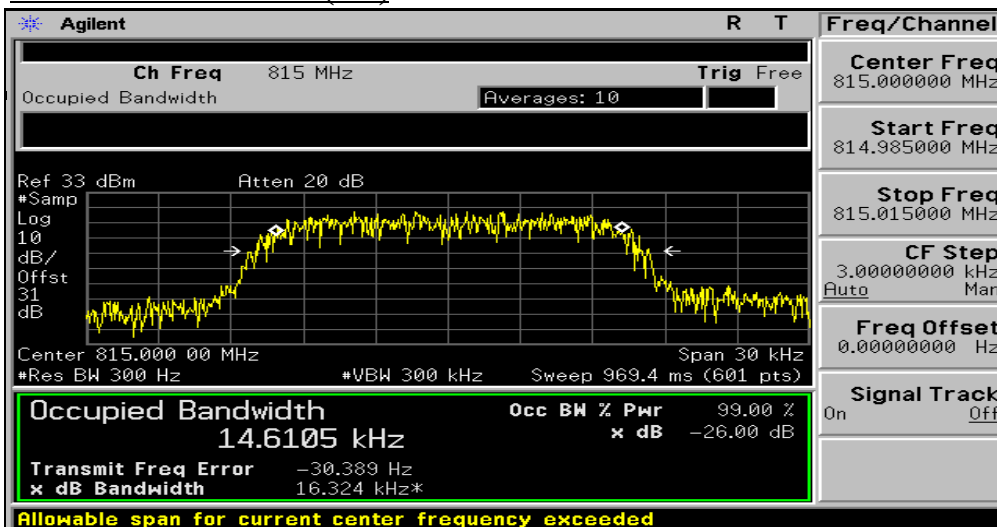


(800MHz Uplink)

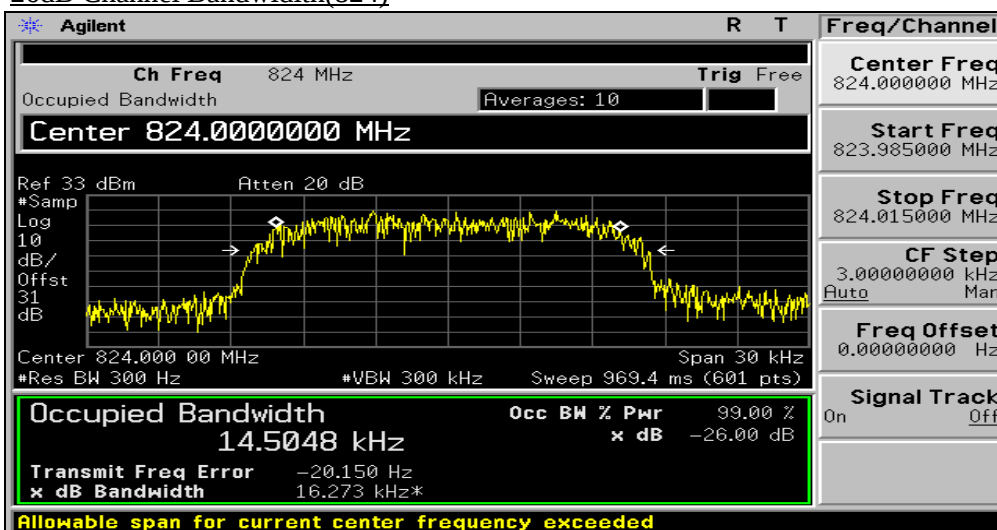
26dB Channel Bandwidth(806)



26dB Channel Bandwidth(815)



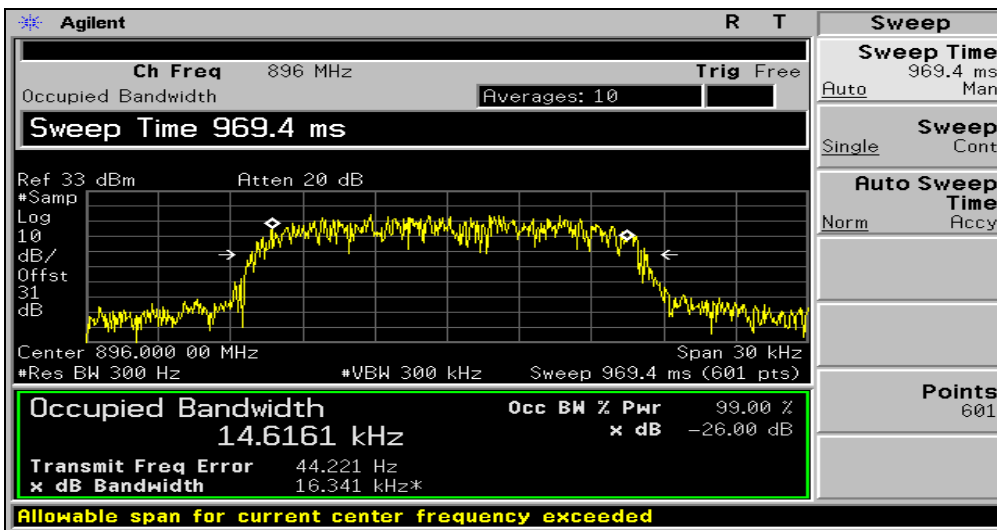
26dB Channel Bandwidth(824)



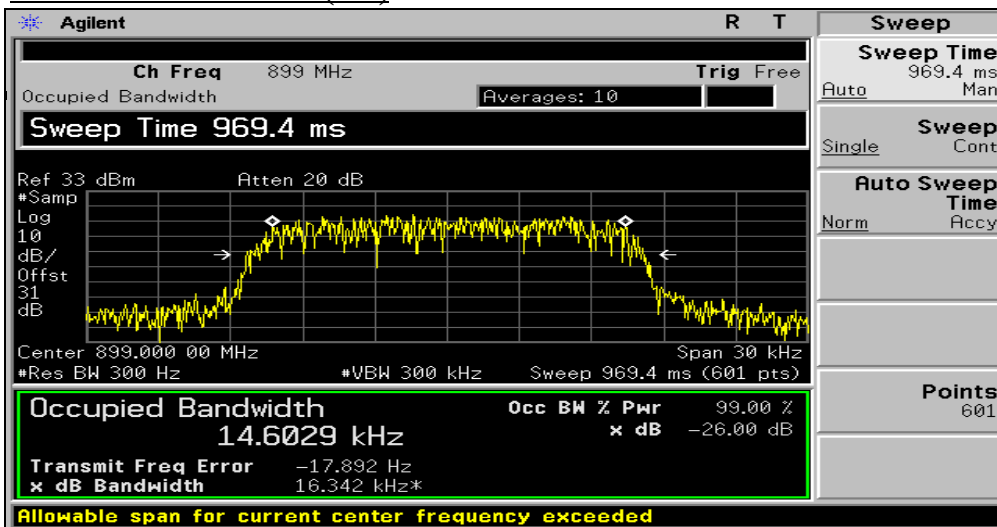


(900MHz Uplink)

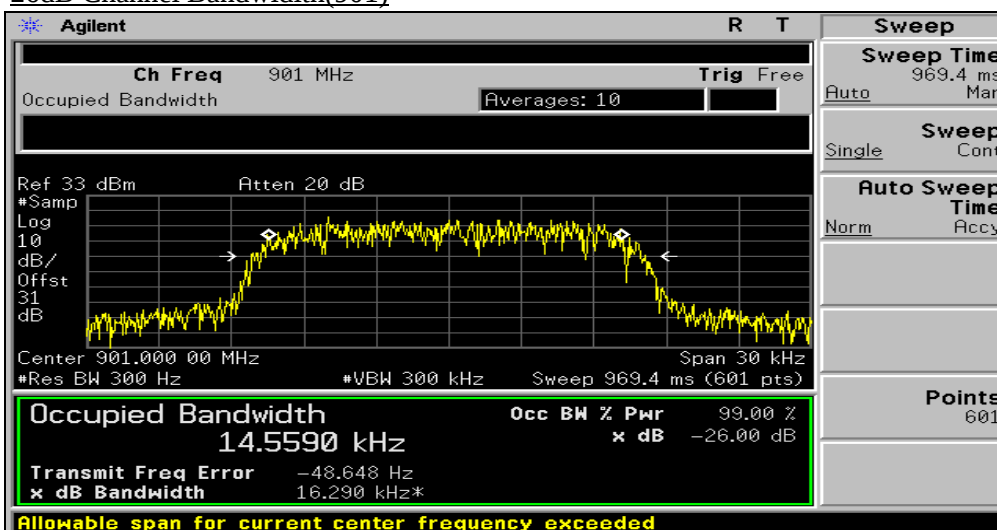
26dB Channel Bandwidth(896)



26dB Channel Bandwidth(899)



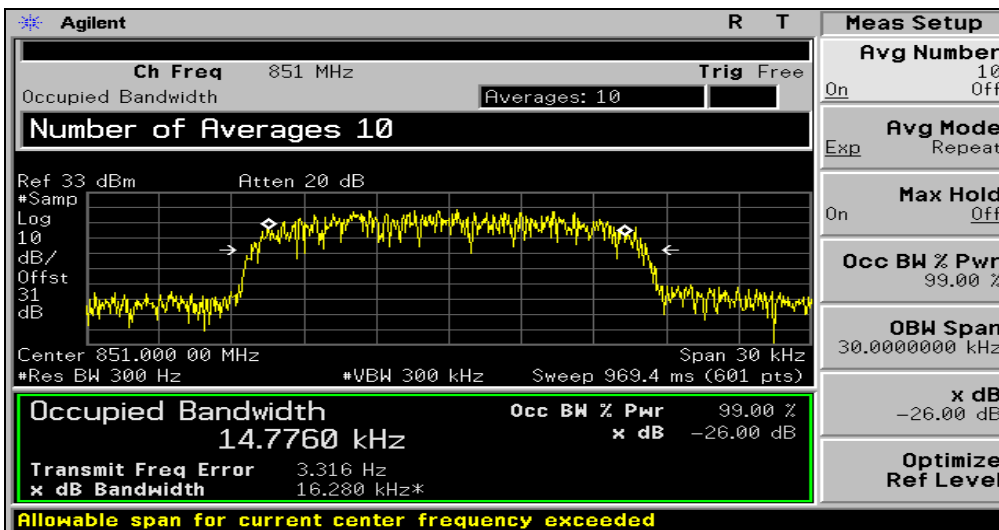
26dB Channel Bandwidth(901)



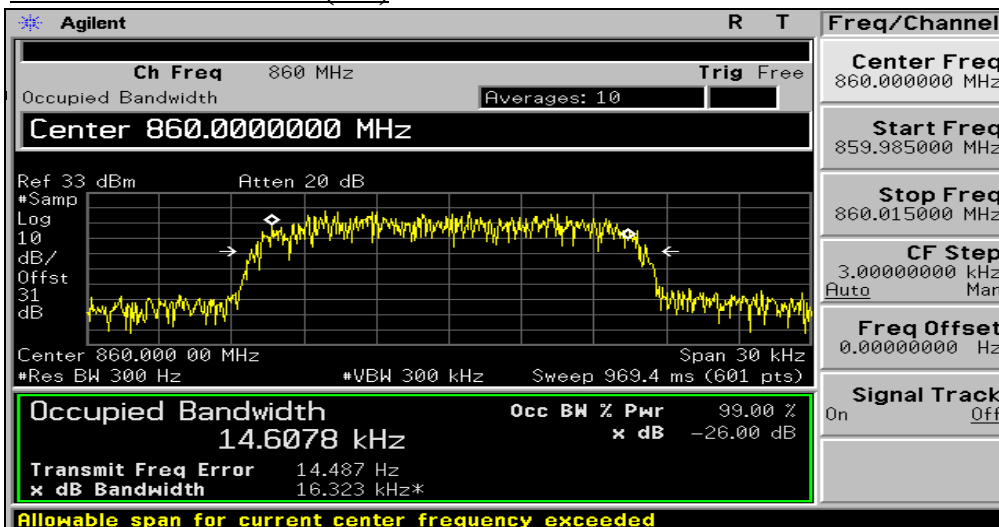


(800MHz Downlink)

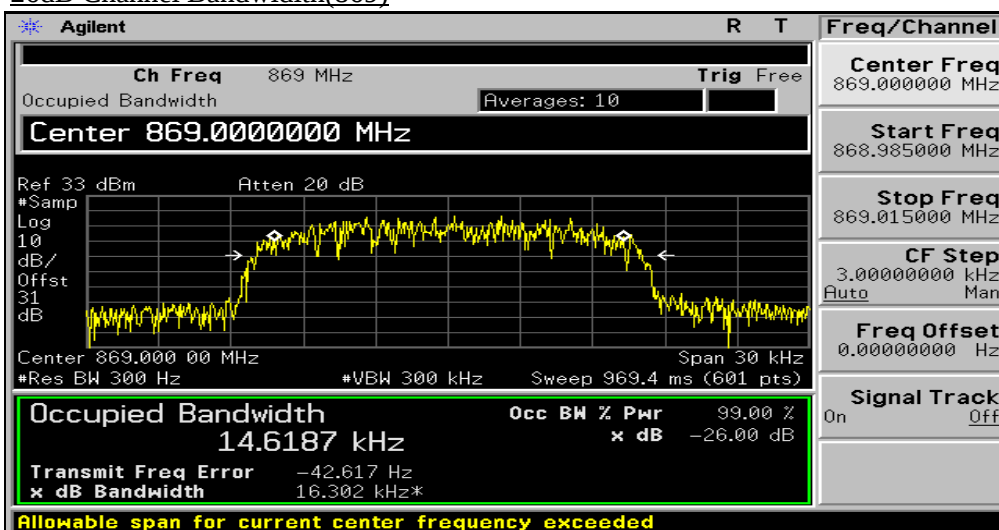
26dB Channel Bandwidth(851)



26dB Channel Bandwidth(860)



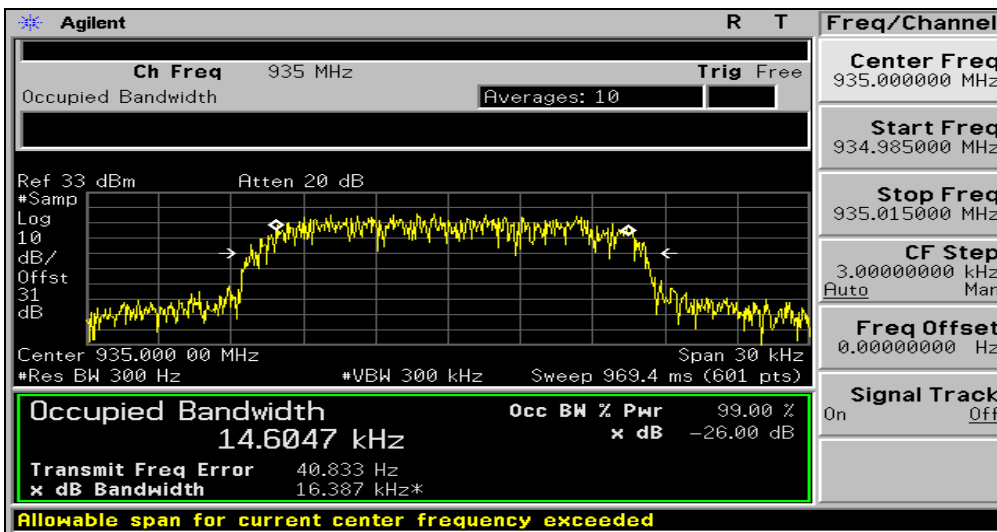
26dB Channel Bandwidth(869)



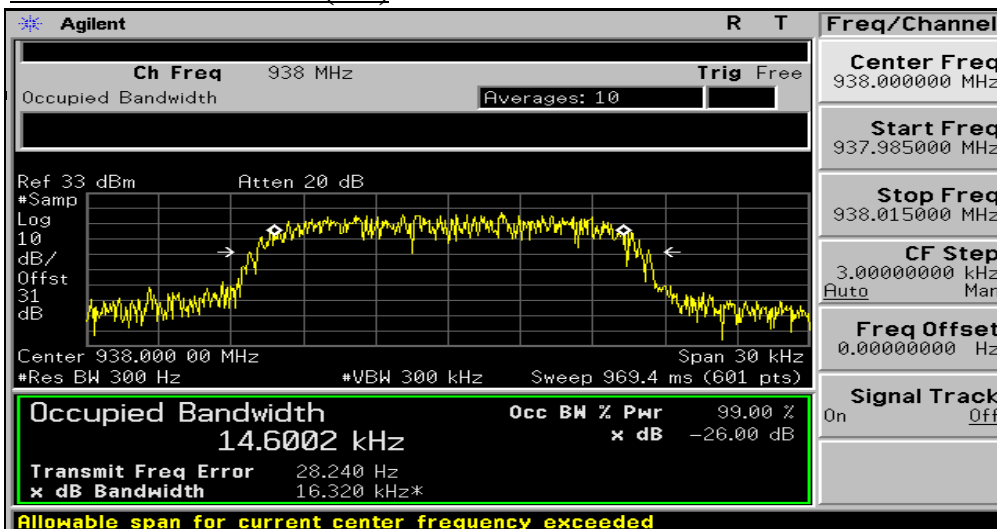


(900MHz Downlink)

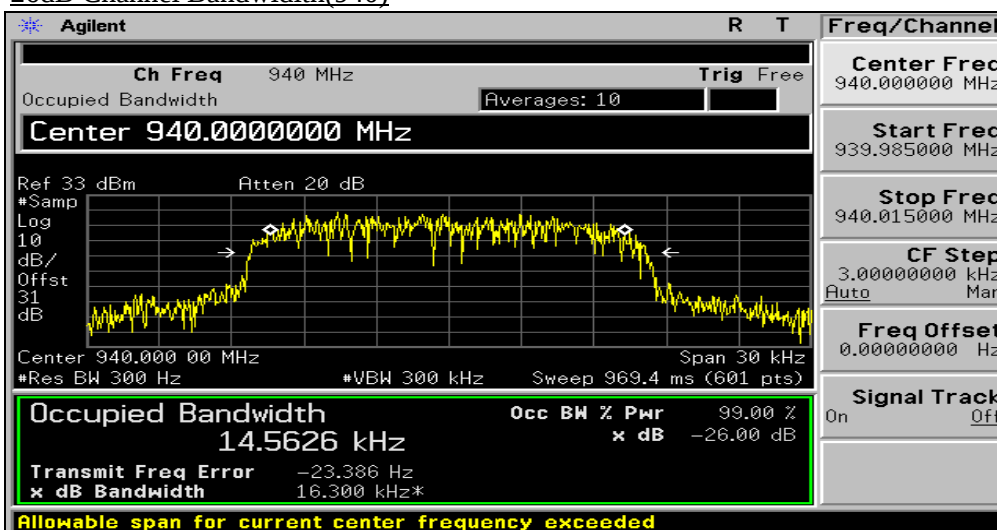
26dB Channel Bandwidth(935)



26dB Channel Bandwidth(938)



26dB Channel Bandwidth(940)





6. Spurious and Harmonic Emission at Antenna Terminal

6.1 Test Procedure

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to 10GHz. Set the RES BW to 1% of the emission bandwidth to show compliance with the -13dBm, limit, in the 1MHz bands immediately outside and adjacent to the top and bottom edges of the frequency block.

For the Out-of-Band measurements a 1MHz RBW was used to scan from 10MHz to 10xfo of the fundamental carrier for all frequency block. A display line was placed at -13dBm to show compliance for spurious, and harmonics.

6.2 Test Equipments

The following test equipments are used during tests

Equipment	Manufacturer	Model	Cal. Due Date
Spectrum Analyzer	Agilent	E4440A	2012-09-05
Spectrum Analyzer	Agilent	E4402B	2012-02-24
Signal Generator	HP	E4432B	2012-02-24
Signal Generator	HP	E4438C	2012-01-12

6.3 Test Results Spurious

(800MHz Uplink)

Channel	Frequency	Result	Limit	Margin
Fist Ch	806.00	-31.01	-13.00	18.01
Middle Ch	815.00	-31.37	-13.00	18.37
Last Ch	824.00	-29.73	-13.00	16.73

(900MHz Uplink)

Channel	Frequency	Result	Limit	Margin
Fist Ch	896.00	-38.53	-13.00	25.53
Middle Ch	899.00	-38.19	-13.00	25.19
Last Ch	901.00	-36.54	-13.00	23.54



6.4 Test Results Spurious

(800MHz Downlink)

Channel	Frequency	Result	Limit	Margin
Fist Ch	851.00	-37.59	-13.00	24.59
Middle Ch	860.00	-37.14	-13.00	24.14
Last Ch	869.00	-37.83	-13.00	24.83

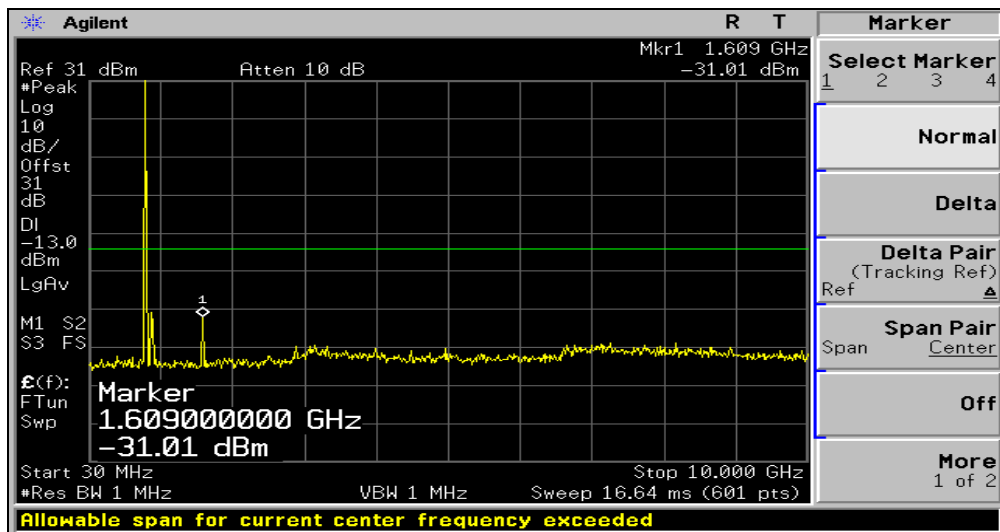
(900MHz Downlink)

Channel	Frequency	Result	Limit	Margin
Fist Ch	935.00	-38.31	-13.00	25.31
Middle Ch	938.00	-36.40	-13.00	23.40
Last Ch	940.00	-36.69	-13.00	23.69

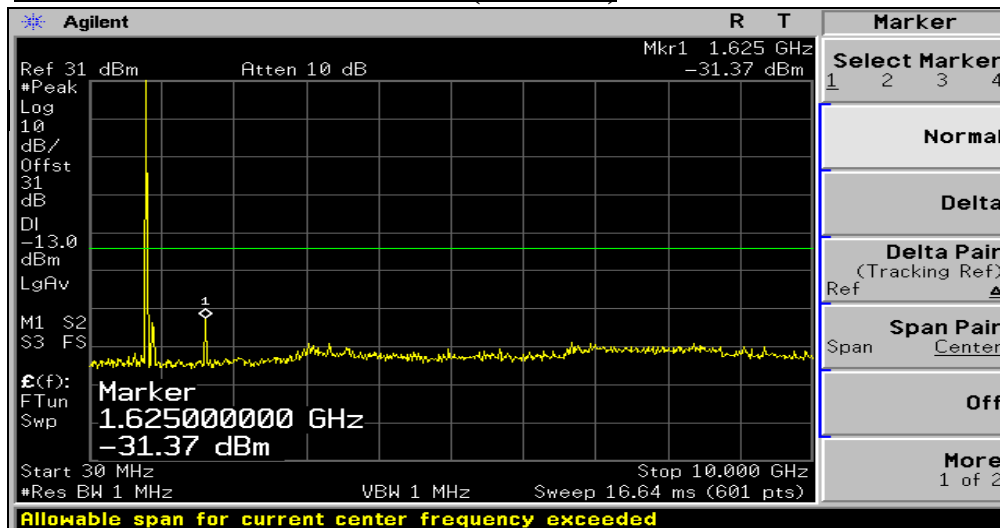


(800MHz Uplink)

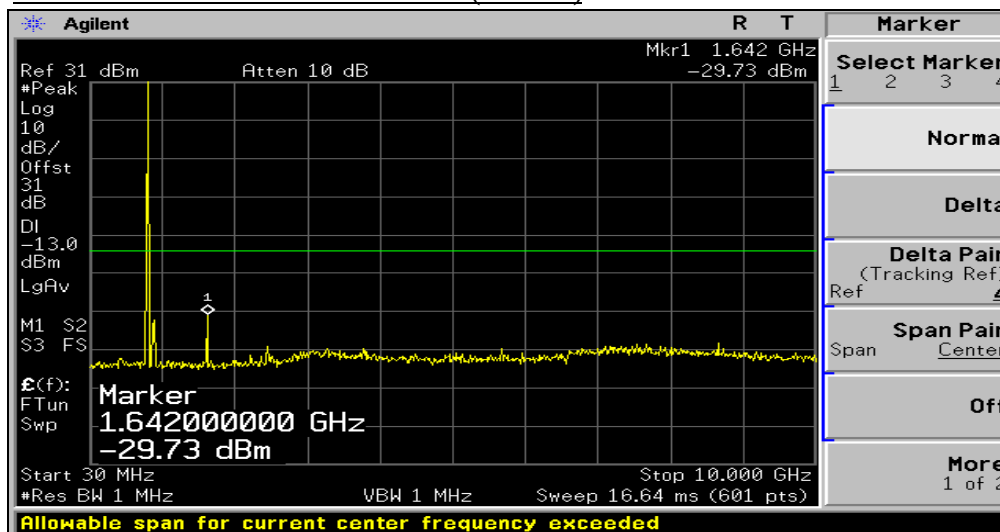
PLOTS OF EMISSION : Out of Band (First Ch)



PLOTS OF EMISSION : Out of Band (Middle Ch)



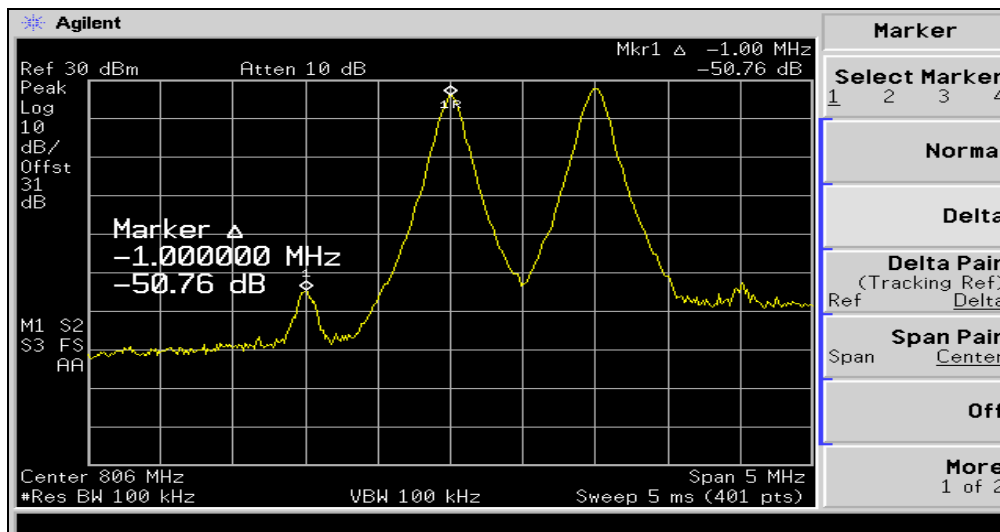
PLOTS OF EMISSION : Out of Band (Last Ch)



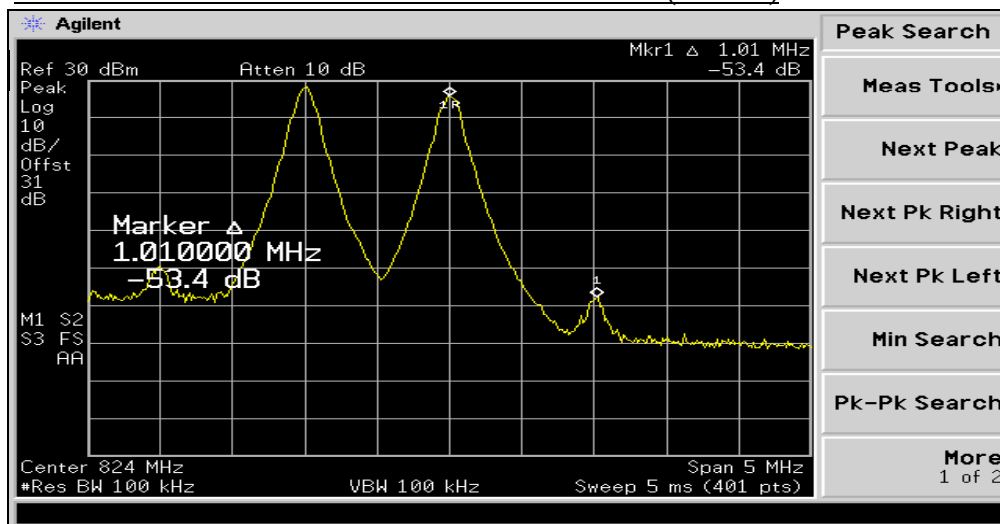


(800MHz Uplink)

PLOTS OF EMISSION : Two carrier intermodulation (First Ch)



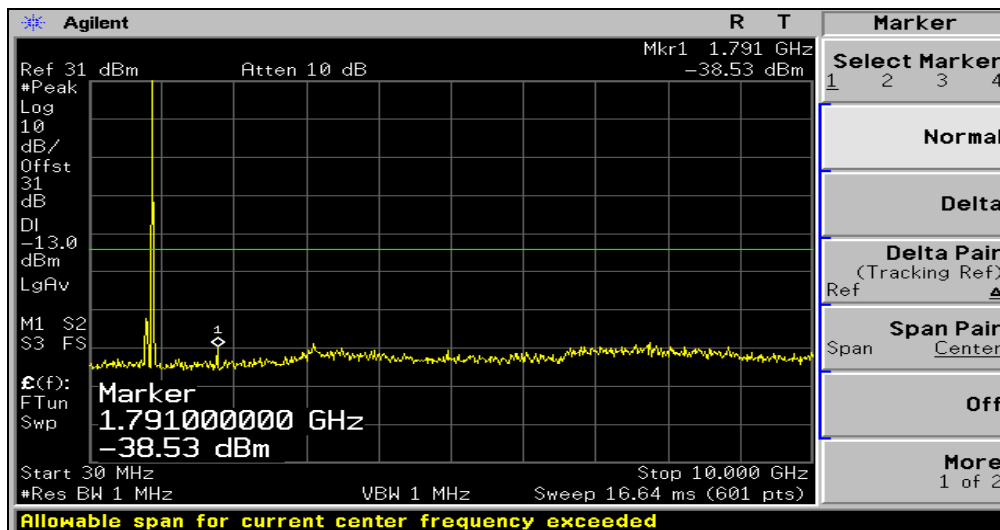
PLOTS OF EMISSION : Two carrier intermodulation (Last Ch)



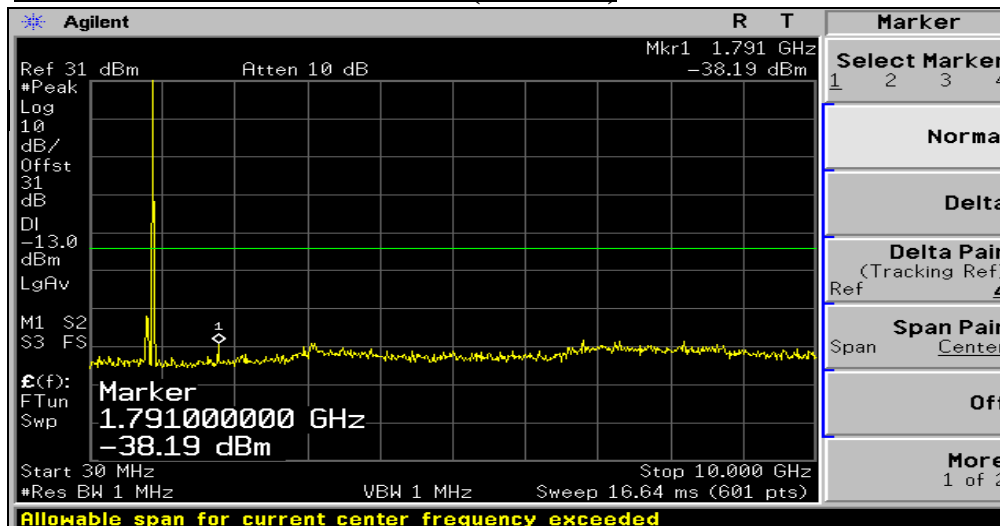


(900MHz Uplink)

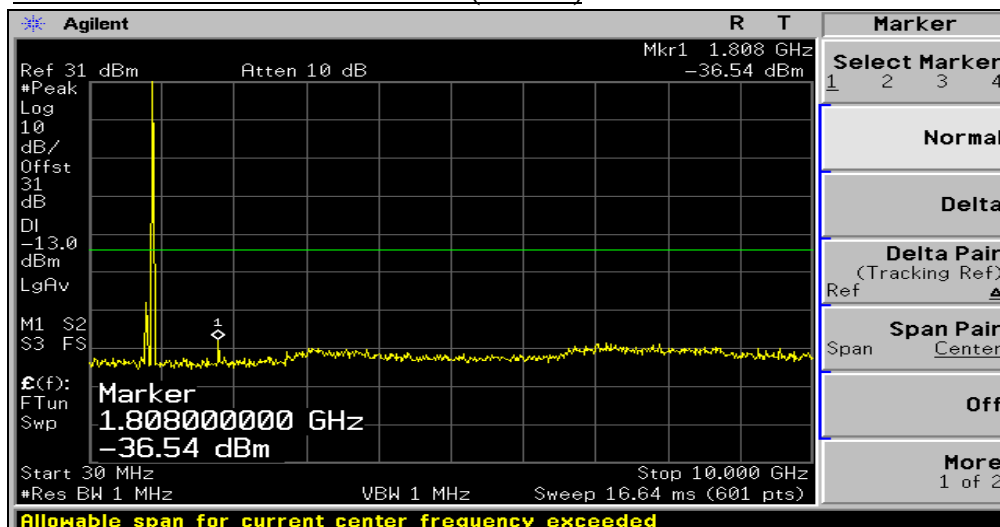
PLOTS OF EMISSION : Out of Band (First Ch)



PLOTS OF EMISSION : Out of Band (Middle Ch)



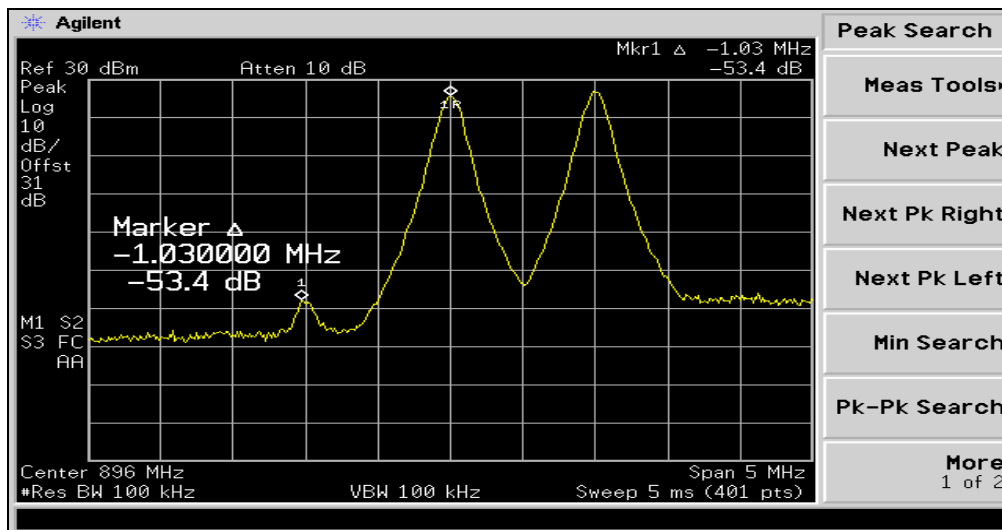
PLOTS OF EMISSION : Out of Band (Last Ch)



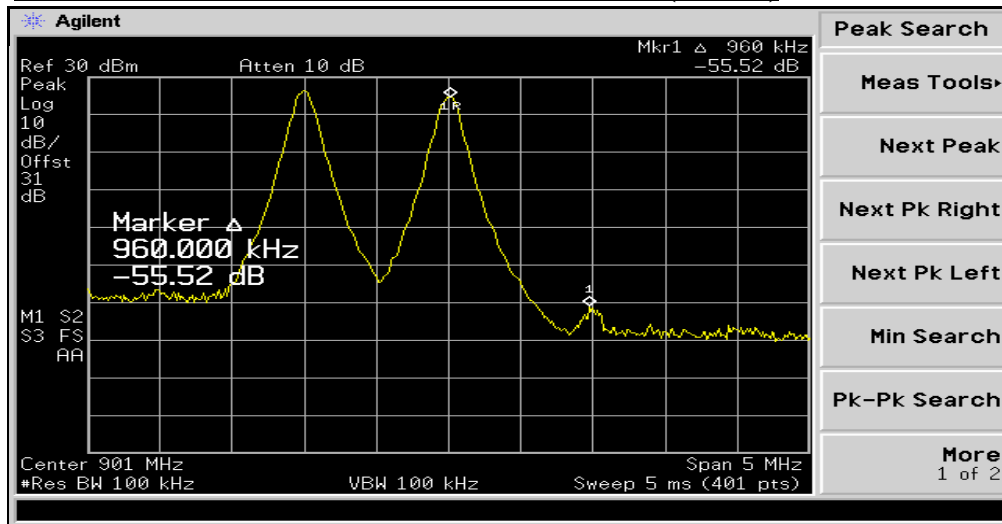


(900MHz Uplink)

PLOTS OF EMISSION : Two carrier intermodulation (First Ch)



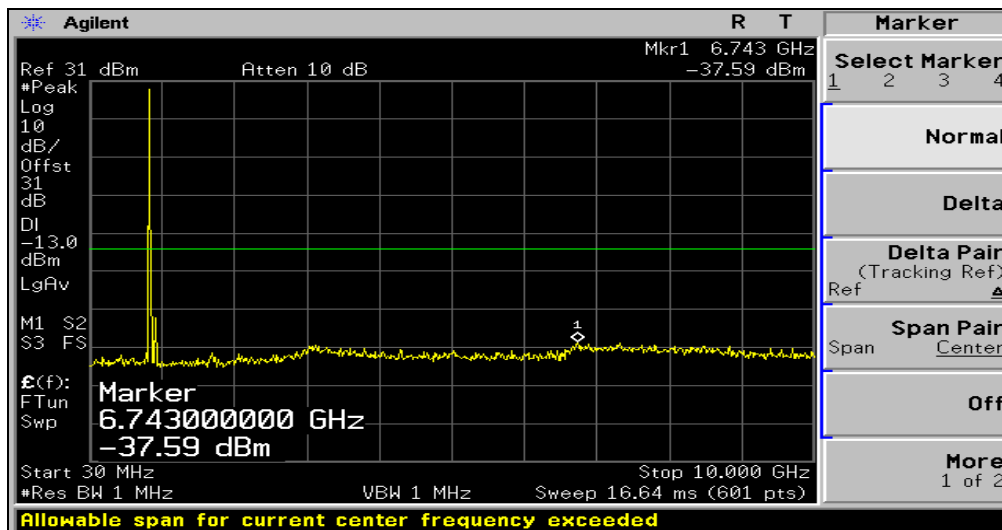
PLOTS OF EMISSION : Two carrier intermodulation (Last Ch)



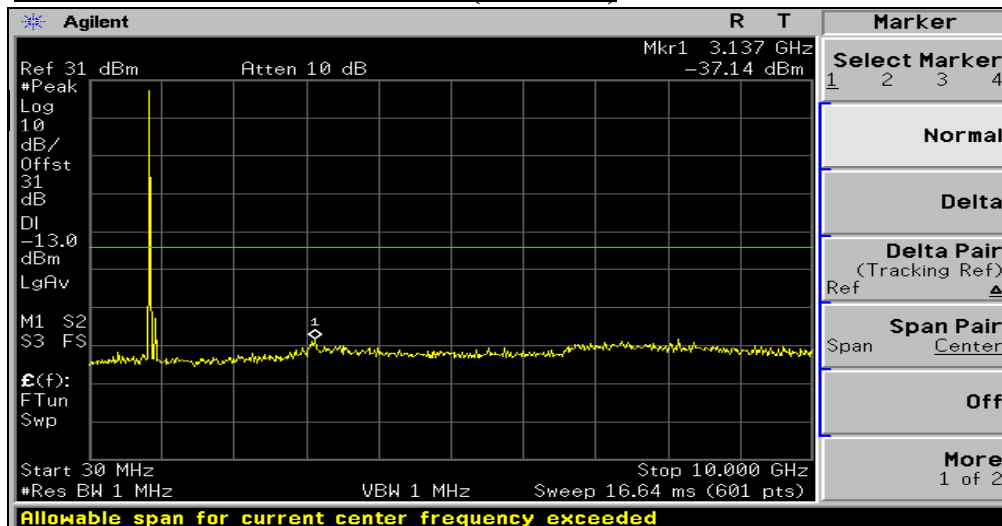


(800MHz Downlink)

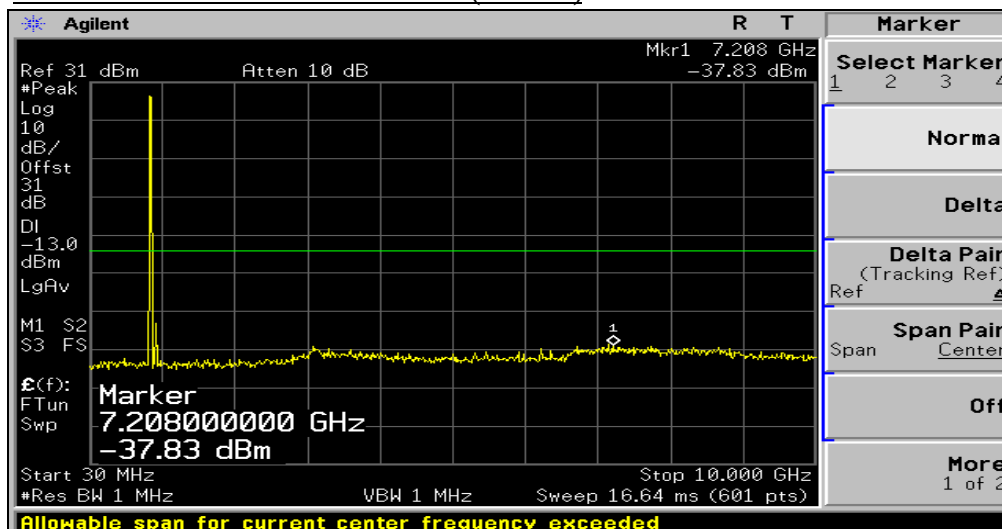
PLOTS OF EMISSION : Out of Band (First Ch)



PLOTS OF EMISSION : Out of Band (Middle Ch)



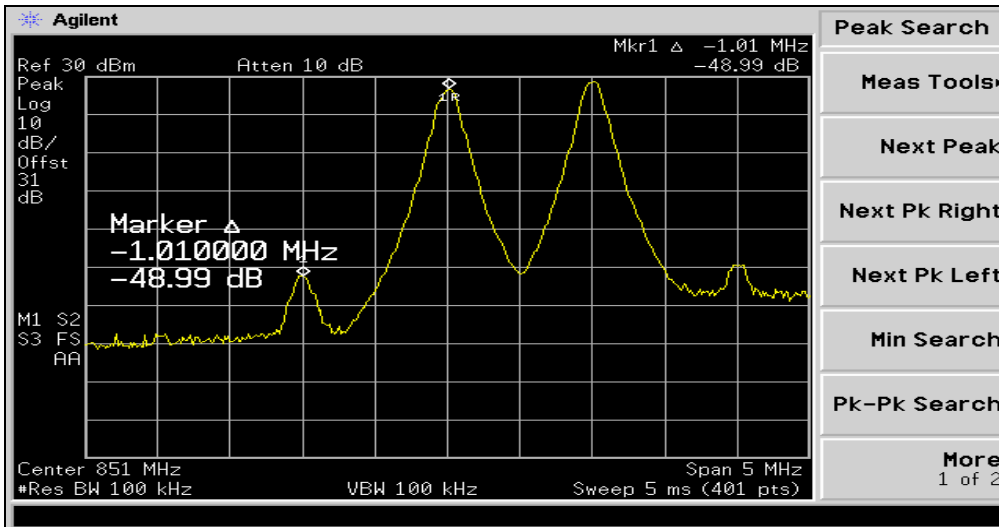
PLOTS OF EMISSION : Out of Band (Last Ch)



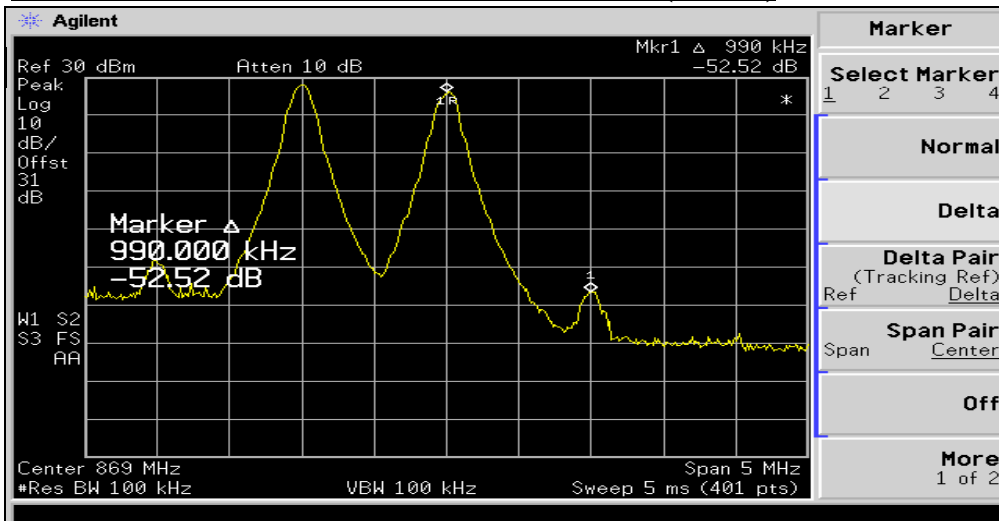


(800MHz Downlink)

PLOTS OF EMISSION : Two carrier intermodulation (First Ch)



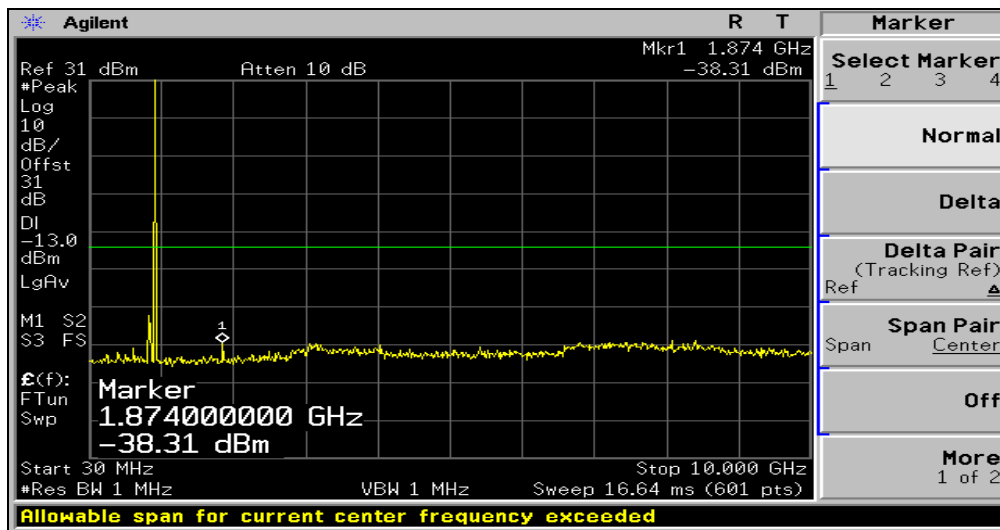
PLOTS OF EMISSION : Two carrier intermodulation (Last Ch)



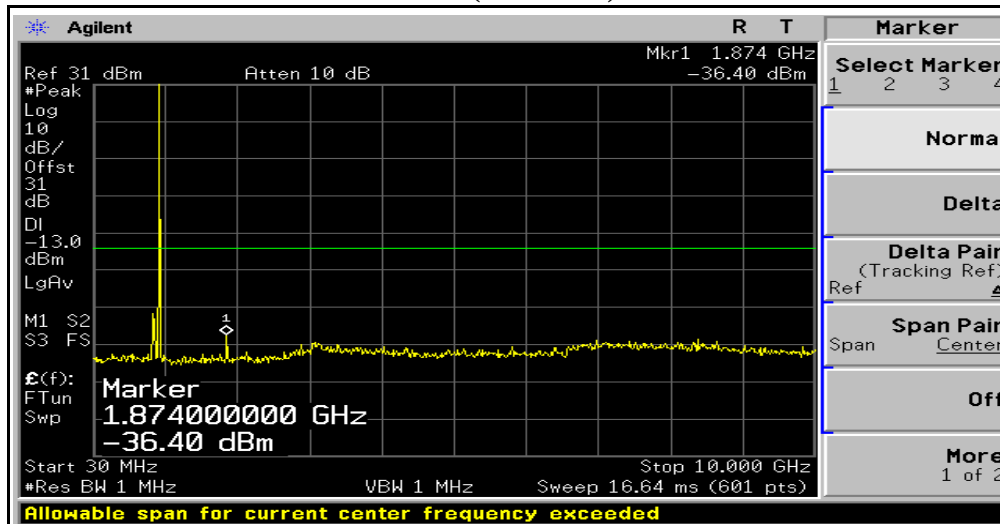


(900MHz Downlink)

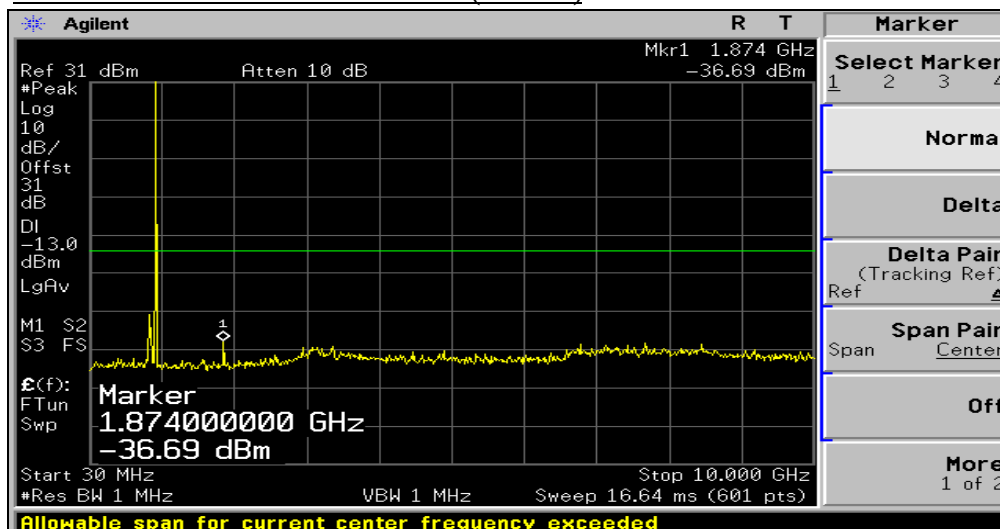
PLOTS OF EMISSION : Out of Band (First Ch)



PLOTS OF EMISSION : Out of Band (Middle Ch)



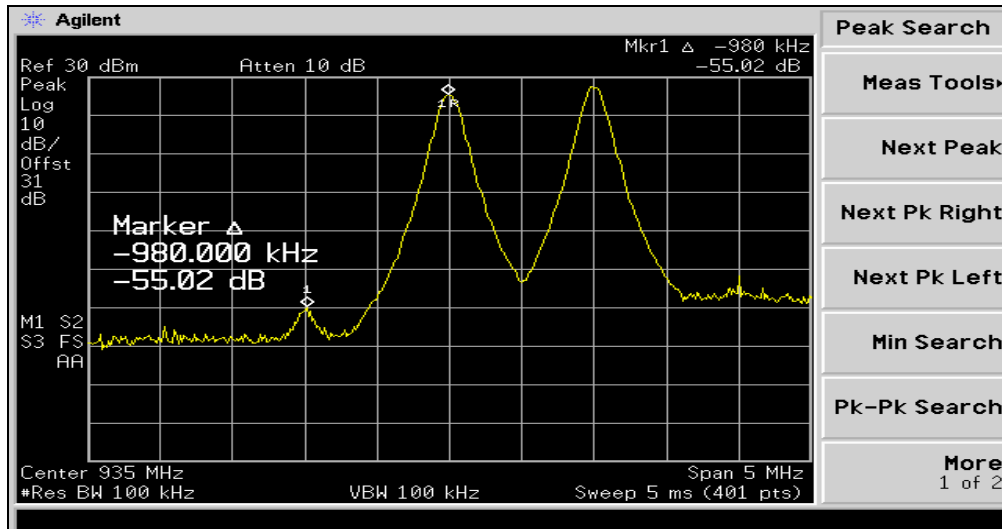
PLOTS OF EMISSION : Out of Band (Last Ch)



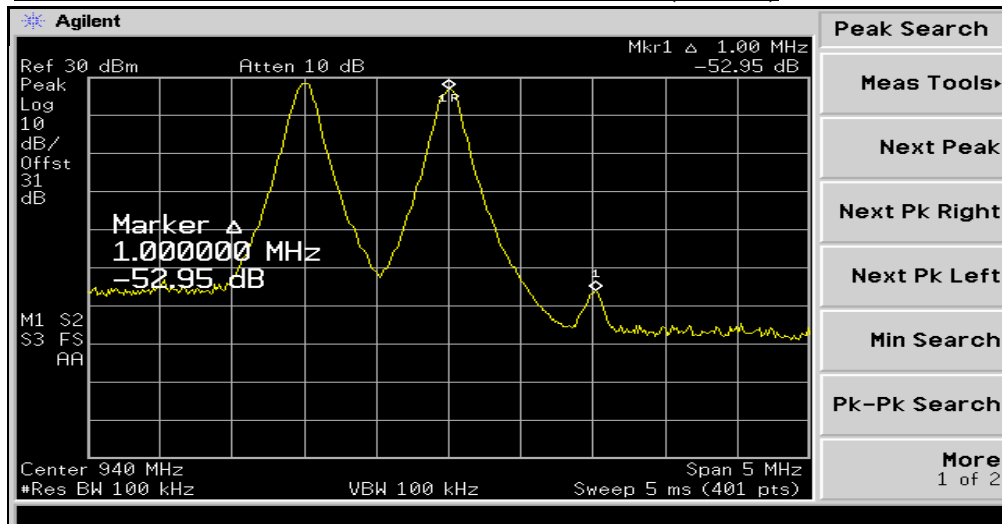


(900MHz Downlink)

PLOTS OF EMISSION : Two carrier intermodulation (First Ch)



PLOTS OF EMISSION : Two carrier intermodulation (Last Ch)



7. Field Strength of Spurious Radiation

7.1 Test Procedure according to ANSI/TIA/EIA 603 Clause 3.2.12 & FCC PART 90 Subpart I

Radiation and harmonic emission are measured outdoors at our 3 meters test range. The equipment under test is placed on a wooden turntable 3 meters from the receive antenna. The receive antenna height and turntable rotations were adjusted for the highest reading on the receive spectrum analyzer (or receiver). A half wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator with the level of the signal generator being adjusted to obtain the same receive spectrum analyzer reading. This level is recorded. For readings above 1GHz, the above procedure is repeated using horn antennas and the difference between the gain of the horn and an isotropic or dipole antenna are taken into consideration.

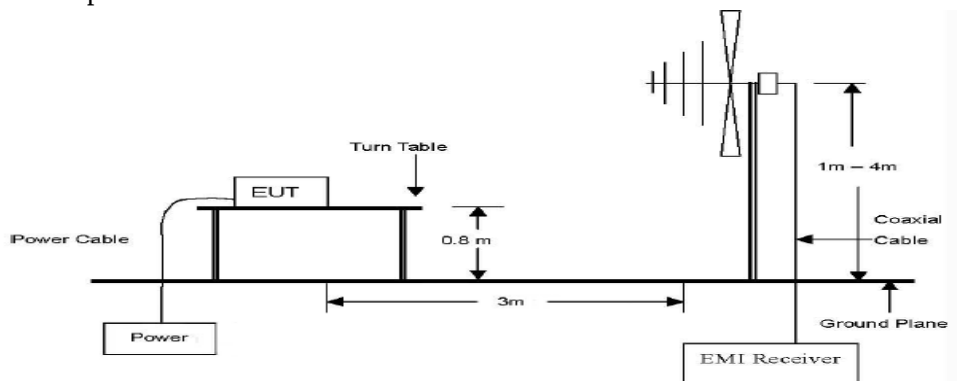
7.2 Test Equipments

The following test equipments are used during tests

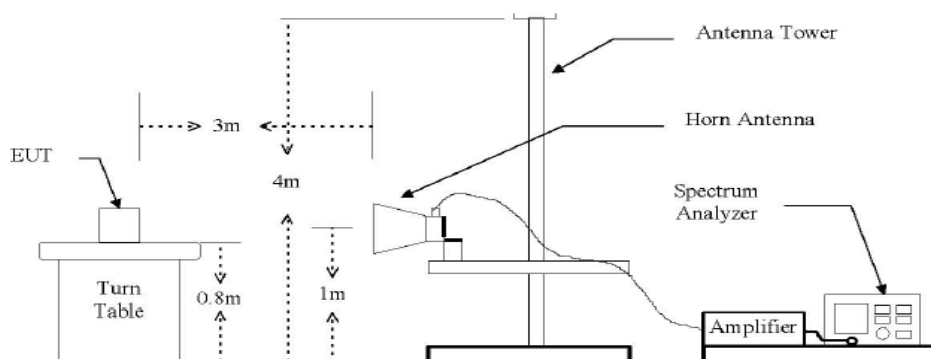
Equipment	Manufacturer	Model	Cal. Due Date
Spectrum Analyzer	ADVANTEST	R3273	2012-09-21
Signal Generator	HP	83618B	2012-09-21
Power Meter	HP	EPM-442A	2012-01-27
Power Sensor	HP	8481A	2012-01-27
Pre Amplifier	HP	8449B	2012-01-27
Attenuator	JFW	50FH-010-5	2012-01-27
Attenuator	HP	8491B	2012-01-27
Horn Antenna	SCHWARZBECK	BBHA 9120 D	2012-03-22
Horn Antenna	SCHWARZBECK	BBHA 9120 D	2012-09-06

7.3 Test Setup

Test setup for 30MHz to 1GHz



Test setup for above 1GHz





7.3 Test Results

Uplink(800MHz)

Fundamental (MHz)	Harmonic (MHz)	Receiver Reading(dBuV)	Correction Factor(dB)		ERP(dBm)		Limit (dBm)	Polarity
			AG(dBd)	CL(dB)	SG Reading	Result		
806(Low)	1612.00	49.10	7.36	-11.00	-53.30	-56.94	-13.00	V
815(Middle)	1630.00	48.97	7.50	-11.10	-53.30	-56.90	-13.00	V
824(High)	1648.00	49.25	7.63	-11.10	-52.30	-55.77	-13.00	V

Uplink(900MHz)

Fundamental (MHz)	Harmonic (MHz)	Receiver Reading(dBuV)	Correction Factor(dB)		ERP(dBm)		Limit (dBm)	Polarity
			AG(dBd)	CL(dB)	SG Reading	Result		
896(Low)	1792.00	48.58	8.18	-11.50	-51.30	-54.62	-13.00	V
899(Middle)	1798.00	49.18	8.19	-11.60	-53.30	-56.71	-13.00	V
901(High)	1802.00	49.85	8.20	-11.60	-52.30	-55.70	-13.00	V

Downlink(800MHz)

Fundamental (MHz)	Harmonic (MHz)	Receiver Reading(dBu)	Correction Factor(dB)		ERP(dBm)		Limit (dBm)	Polarity
			AG(dBd)	CL(dB)	SG Reading	Result		
851(Low)	1702.00	48.21	7.98	-11.30	-54.70	-58.02	-13.00	V
860(Middle)	1720.00	46.56	8.00	-11.40	-51.80	-55.20	-13.00	V
869(High)	1738.00	48.77	8.06	-11.40	-51.80	-55.14	-13.00	V

Downlink(900MHz)

Fundamental (MHz)	Harmonic (MHz)	Receiver Reading(dBu V)	Correction Factor(dB)		ERP(dBm)		Limit (dBm)	Polarity
			AG(dBd)	CL(dB)	SG Reading	Result		
935(Low)	1870.00	49.20	8.20	-12.00	-48.40	-52.20	-13.00	V
938(Middle)	1876.00	48.17	8.30	-12.00	-47.50	-51.20	-13.00	V
940(High)	1880.00	49.19	8.30	-12.00	-46.30	-50.00	-13.00	V

8. Frequency stability

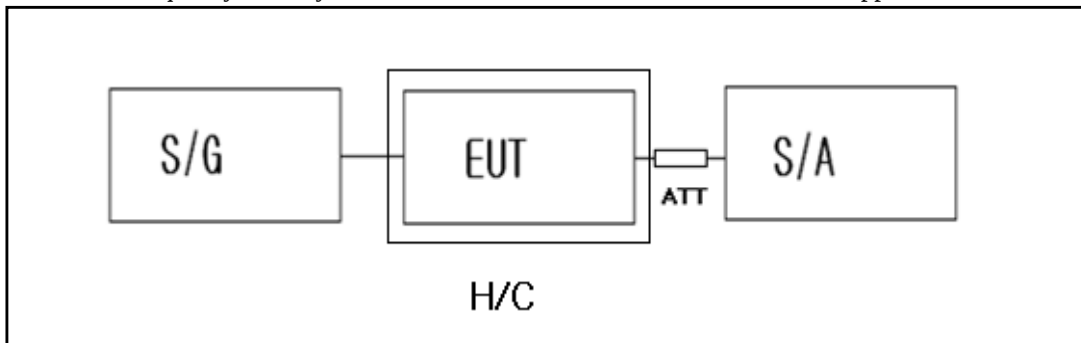
8.1 Test Procedure

The frequency stability of the transmitter is measured by:

a) **Temperature:** The temperature is varied from -30 °C to +60 °C using an environmental chamber.

b) **Primary Supply Voltage:** The primary supply voltage is varied from 85% to 115% of the voltage normally at the input to the device or at the power supply terminals if cables are not normally supplied.

※ The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within ± 2.5 ppm of the center frequency.



8.2 Test Equipments

The following test equipments are used during tests

Equipment	Manufacturer	Model	Cal. Due Date
Spectrum Analyzer	Agilent	E4440A	2012-09-05
Tem/Hum Chamber	Myung Technology	SM-150-2	2012-04-21
Signal Generator	HP	E4438C	2012-01-04



8.3 Test Results

800MHz Uplink

Operating Frequency :	815,000,000	Hz
Reference Voltage :	110.00	VAC
Limit :	1	ppm
Limit Frequency :	± 815	Hz

Voltage (%)	Power (VAC)	Temperature (°C)	Frequency (Hz)	Test result ppm	Test result Frequency (Hz)
100	110.0	+20 °C (Ref)	814,999,993	0.01	-7
100		-30	814,999,995	0.01	-5
100		-20	814,999,994	0.01	-6
100		-10	814,999,996	0.00	-4
100		0	814,999,991	0.01	-9
100		10	814,999,997	0.00	-3
100		20	814,999,993	0.01	-7
100		25	814,999,994	0.01	-6
100		30	814,999,998	0.00	-2
100		40	814,999,993	0.01	-7
100		50	814,999,995	0.01	-5
100		60	814,999,994	0.01	-6
85	93.5	20	814,999,990	0.01	-10
115	126.5	20	814,999,985	0.02	-15
EndPoint	85.0	20	814,999,984	0.02	-16



8.3 Test Results

900MHz Uplink

Operating Frequency :	899,000,000	Hz
Reference Voltage :	110.00	VAC
Limit :	1	ppm
Limit Frequency :	± 899	Hz

Voltage (%)	Power (VAC)	Temperature (°C)	Frequency (Hz)	Test result ppm	Test result Frequency (Hz)
100	110.0	+20 °C (Ref)	898,999,992	0.01	-8
100		-30	898,999,988	0.01	-12
100		-20	898,999,985	0.02	-15
100		-10	898,999,986	0.02	-14
100		0	898,999,990	0.01	-10
100		10	898,999,992	0.01	-8
100		20	898,999,992	0.01	-8
100		25	898,999,991	0.01	-9
100		30	898,999,985	0.02	-15
100		40	898,999,984	0.02	-16
100		50	898,999,988	0.01	-12
100		60	898,999,989	0.01	-11
85	93.5	20	898,999,990	0.01	-10
115	126.5	20	898,999,995	0.01	-5
EndPoint	85.0	20	898,999,996	0.00	-4



8.3 Test Results

800MHz Downlink

Operating Frequency :	851,000,000	Hz
Reference Voltage :	110.00	VAC
Limit :	1	ppm
Limit Frequency :	± 851	Hz

Voltage (%)	Power (VAC)	Temperature (°C)	Frequency (Hz)	Test result ppm	Test result Frequency (Hz)
100	110.0	+20 °C (Ref)	850,999,989	0.01	-11
100		-30	850,999,992	0.01	-8
100		-20	850,999,993	0.01	-7
100		-10	850,999,995	0.01	-5
100		0	850,999,994	0.01	-6
100		10	850,999,991	0.01	-9
100		20	850,999,989	0.01	-11
100		25	850,999,985	0.02	-15
100		30	850,999,988	0.01	-12
100		40	850,999,990	0.01	-10
100		50	850,999,984	0.02	-16
100		60	850,999,983	0.02	-17
85	93.5	20	850,999,987	0.02	-13
115	126.5	20	850,999,985	0.02	-15
EndPoint	85.0	20	850,999,989	0.01	-11



8.3 Test Results

900MHz Downlink

Operating Frequency :	938,000,000	Hz
Reference Voltage :	110.00	VAC
Limit :	1	ppm
Limit Frequency :	± 938	Hz

Voltage (%)	Power (VAC)	Temperature (°C)	Frequency (Hz)	Test result ppm	Test result Frequency (Hz)
100	110.0	+20 °C (Ref)	937,999,981	0.02	-19
100		-30	937,999,985	0.02	-15
100		-20	937,999,989	0.01	-11
100		-10	937,999,986	0.01	-14
100		0	937,999,987	0.01	-13
100		10	937,999,989	0.01	-11
100		20	937,999,981	0.02	-19
100		25	937,999,984	0.02	-16
100		30	937,999,990	0.01	-10
100		40	937,999,985	0.02	-15
100		50	937,999,983	0.02	-17
100		60	937,999,990	0.01	-10
85	93.5	20	937,999,989	0.01	-11
115	126.5	20	937,999,985	0.02	-15
EndPoint	85.0	20	937,999,988	0.01	-12



9. Emission mask Test

9.1 Test Procedure

Measurements were made in the laboratory environment. Emission mask measurement was made using a direct connection between RF output of the EUT and spectrum analyzer.

Measurement has been performed with the EUT set to maximum output level at low , mid and high channel frequencies

9.2 Test Equipments

The following test equipments are used during tests

Equipment	Manufacturer	Model	Cal. Due Date
Spectrum Analyzer	Agilent	E4440A	2012-09-05
Signal Generator	HP	E4438C	2012-01-04

9.3 Test Results

800 (Upwnlink)

Carrier Band	Frequency	Emission mask	Result
iDEN800	806.00	§90.210	Pass
	815.00	§90.210	Pass
	824.00	§90.210	Pass

900(Upwnlink)

Carrier Band	Frequency	Emission mask	Result
iDEN900	896.00	§90.210	Pass
	899.00	§90.210	Pass
	901.00	§90.210	Pass



9.3 Test Results

800 (Downlink)

Carrier Band	Frequency	Emission mask	Result
iDEN800	851.00	§90.210	Pass
	860.00	§90.210	Pass
	869.00	§90.210	Pass

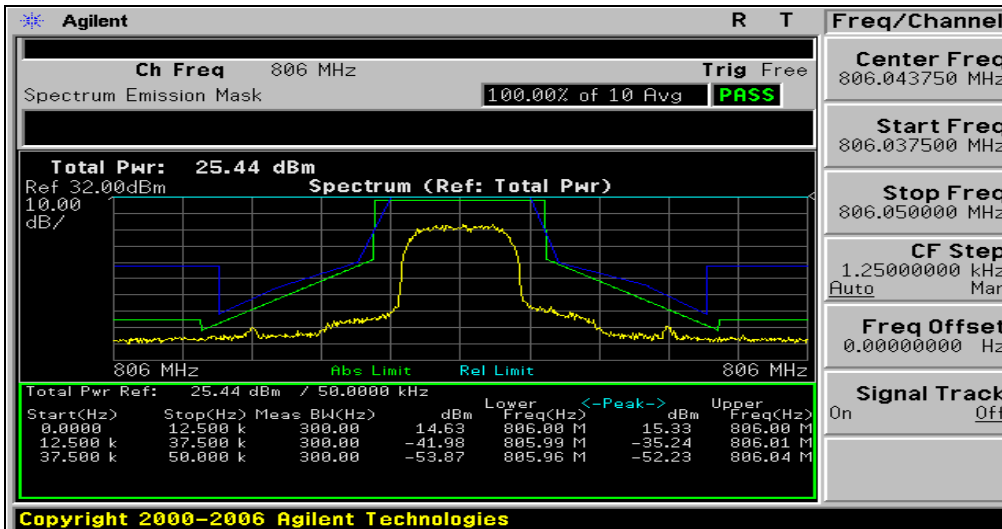
900(Downlink)

Carrier Band	Frequency	Emission mask	Result
iDEN900	935.00	§90.210	Pass
	938.00	§90.210	Pass
	940.00	§90.210	Pass

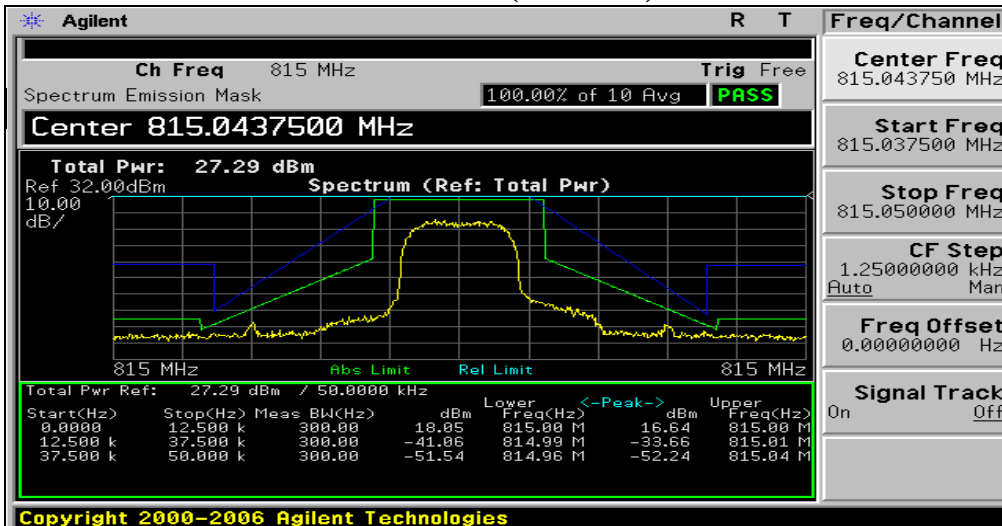


(800MHz Uplink)

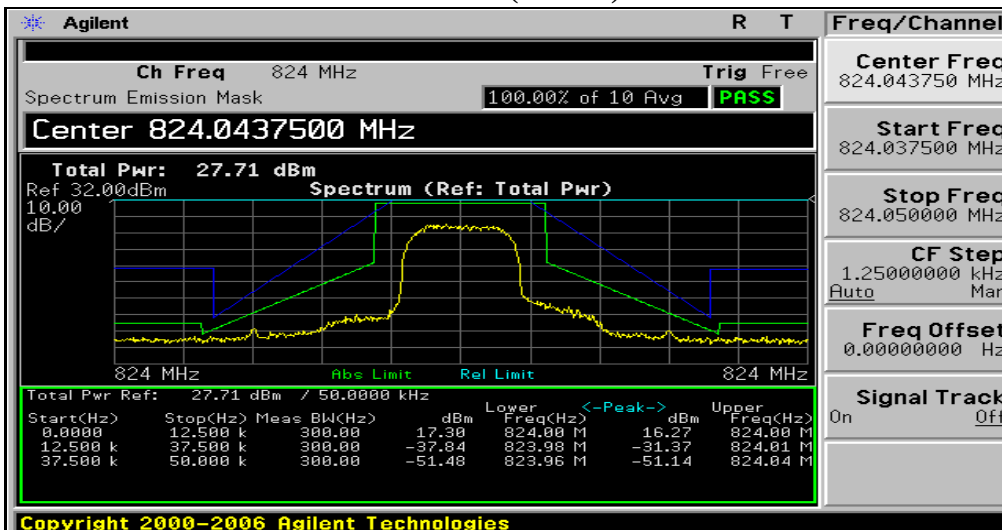
PLOTS OF EMISSION : Emission mask (First Ch)



PLOTS OF EMISSION : Emission mask (Middle Ch)



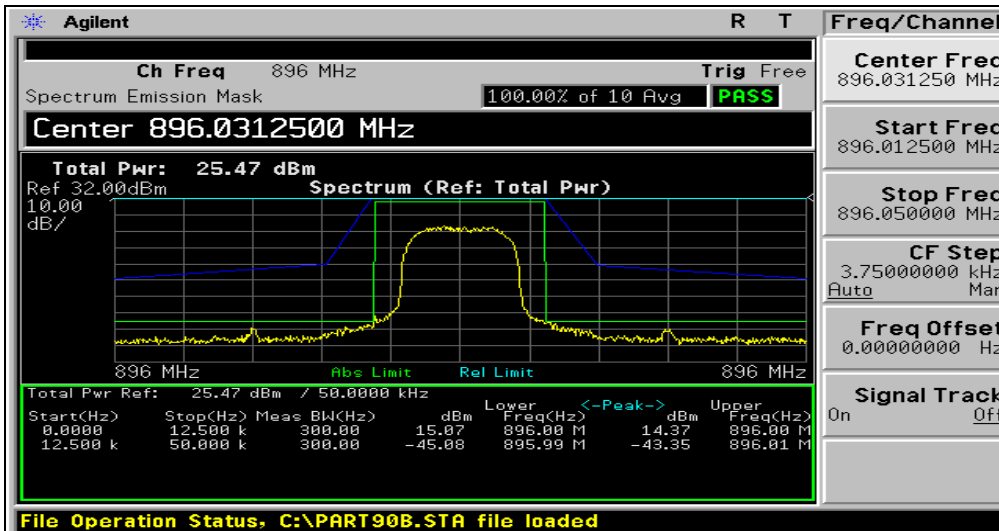
PLOTS OF EMISSION : Emission mask (Last Ch)



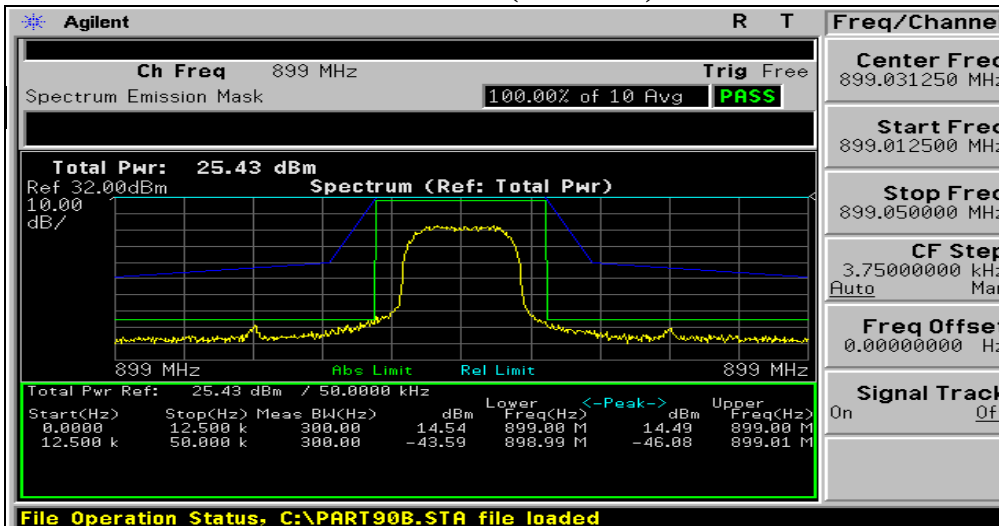


(900MHz Uplink)

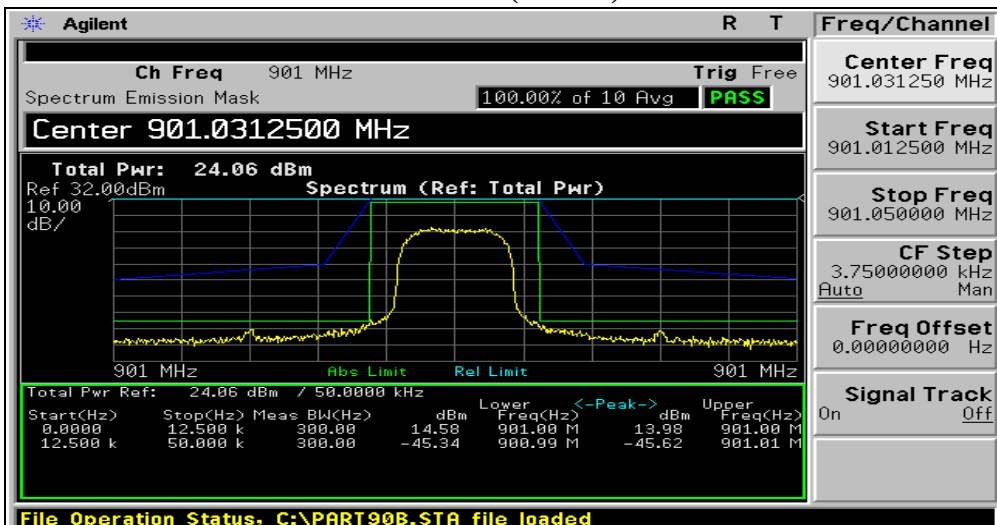
PLOTS OF EMISSION : Emission mask (First Ch)



PLOTS OF EMISSION : Emission mask (Middle Ch)



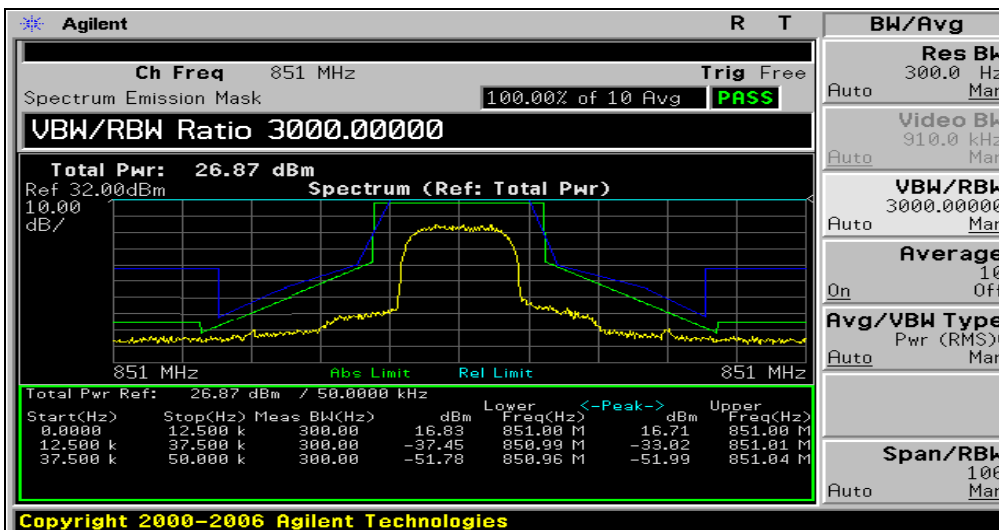
PLOTS OF EMISSION : Emission mask (Last Ch)



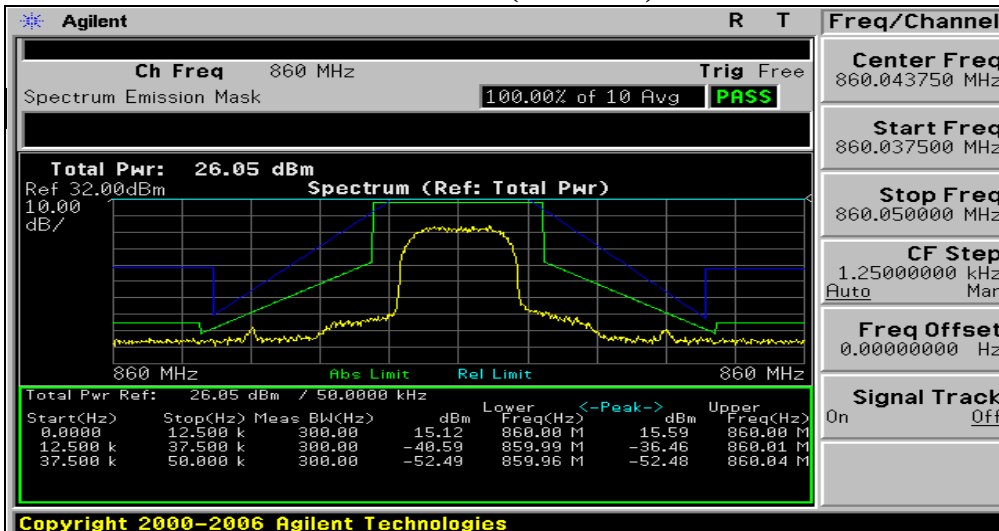


(800MHz Downlink)

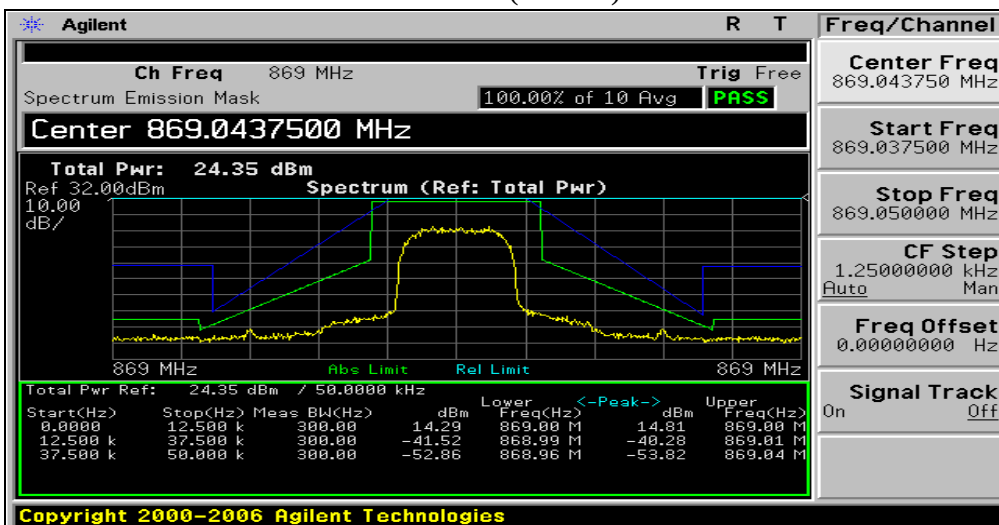
PLOTS OF EMISSION : Emission mask (First Ch)



PLOTS OF EMISSION : Emission mask (Middle Ch)



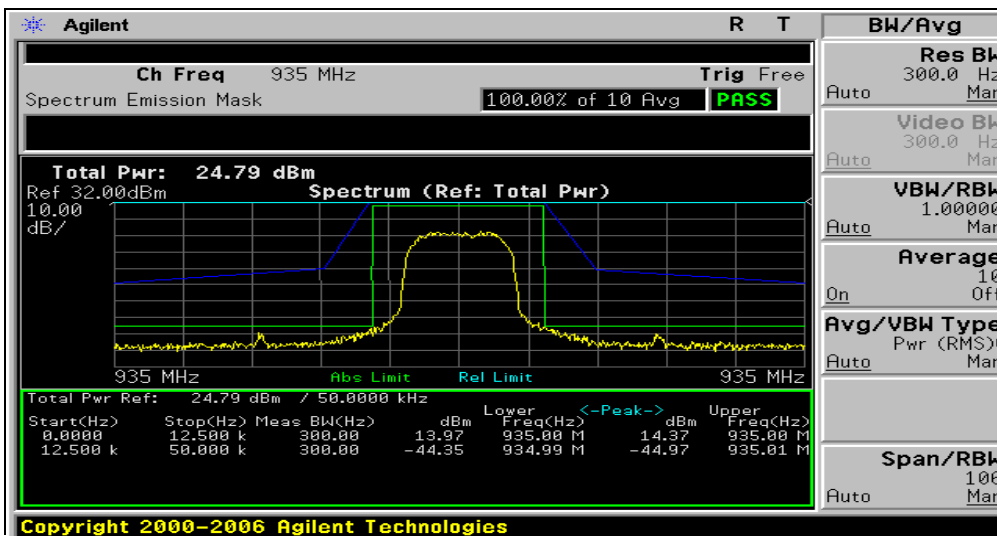
PLOTS OF EMISSION : Emission mask (Last Ch)



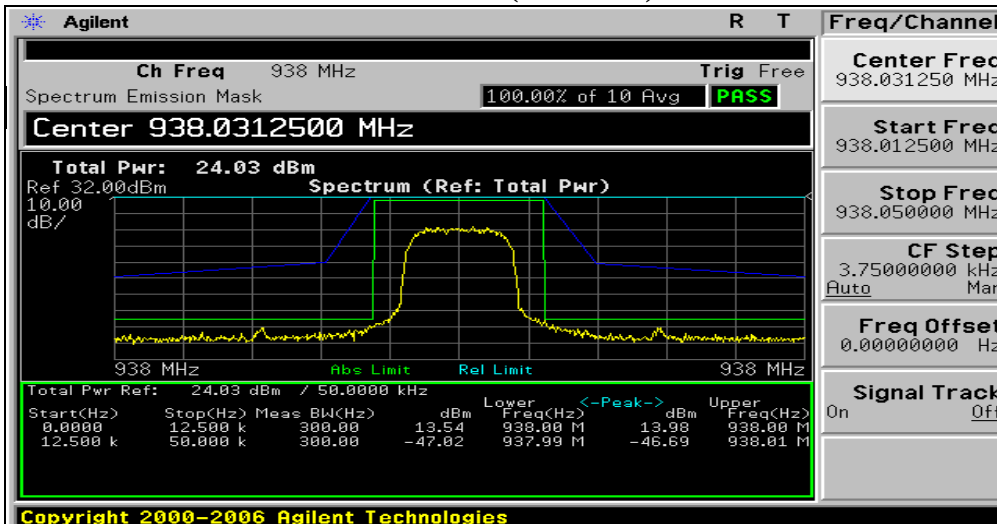


(900MHz Downlink)

PLOTS OF EMISSION : Emission mask (First Ch)



PLOTS OF EMISSION : Emission mask (Middle Ch)



PLOTS OF EMISSION : Emission mask (Last Ch)

