FCC TEST REPORT

Product Name	Repeater
Model Name	APEX1933
Applicant	R-tron Inc.
FCC ID	STE-APEX1933

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	ESTR1308-023(1)			
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.	APEX1933	Manufacturer	R-tron Inc.
	Serial No.	NONE	Country of origin	KOREA
Other	Issued Date	2013-07-31	Tested Date	2013-07-31 ~ 2014-01-08
Test Result	**Pass**			
Standard	**FCC PART 24 SubpartE**			
Tested by	I.K. Hong/ Engineer (Signature)			
Approved by	Jin-Mo Yang /Engineering manager (Signature)			

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Contents

1. General Information

1.1 EUT Description

FCC ID	**STE-APEX1933**
Product Name	**Repeater**
Model Name	**APEX1933**
Frequency	**Downlink : 1930.00MHz ~ 1995.00 MHz**
Duty	**100 %**
Power Rating	**Input: 110~240VAC 50~60Hz**

The APEX1933 is used to fill out areas in APEX systems, such as base station fringe areas, business and industrial building,etc

The APEX1933 receives signals from a base station, amplifies and retransmits the signals to the mobile stations It also recives, amplifies and retransmits signals in the opposite direction. It is designed to be used with the femto-cell transceivers for local communications with mobile devices.

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(Yanggi) 97-1, Hoeeok-Ri Majang-Myon, Icheon-city, 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
Band Edge	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
Modulation Characteristics	2.1047	PASS

Note : Evaluation was performed in accordance with KDB 935210 and Washington Laboratories Test Plan (Document WLL Job #13257) and Correspondence with FCC.

4. RF Output Power and CCDF

4.1 Test Procedure according to KDB971168 5.2 and 5.7

Set span to at least 1.5 times the OBW.

Set RBW = 1-5% of the OBW, not to exceed 1 MHz.

Set VBW ≥ 3 x RBW.

Set number of points in sweep ≥ 2 × span / RBW.

Sweep time = auto-couple.

Detector = RMS (power averaging).

If the EUT can be configured to transmit continuously (*i.e.*, burst duty cycle ≥ 98%), then set the trigger to free run.

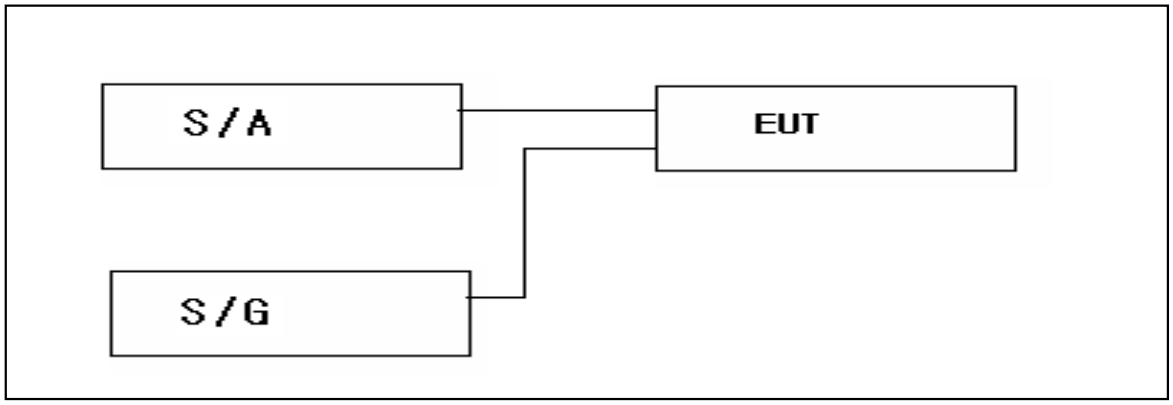
Compute the power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function, with the band limits set equal to the OBW band edges. If the instrument does not have a band power function, then sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.

Refer to instrument's analyzer instruction manual for details on how to use the power statistics/CCDF function;
Set resolution/measurement bandwidth ≥ signal's occupied bandwidth;
Set the number of counts to a value that stabilizes the measured CCDF curve;
Set the measurement interval as follows:

for continuous transmissions, set to 1 ms,

Record the maximum PAPR level associated with a probability of 0.1%.

2. Test setup for RF Conducted measurement



4.2 Test Equipments

The following test equipments are used during tests

Equipment	Manufacturer	Model	Next Cal.
Spectrum Analyzer	Agilent	E4440A	2014-01-27
Vector Signal Generator	ROHDE&SCHWARZ	SMBV100A	2014-01-25
Signal Generator	HP	E4432B	2014-01-27
Spectrum Analyzer	ROHDE&SCHWARZ	FSV	2014-01-27
Attenuator	SRT	F04-K1830-01	2014-01-27

4.3.1 Test Results

(Downlink)-CDMA

Channel	Freq (MHz)	Power Output (dBm)
Low	1931.25	33.38
Mid.	1960.00	33.78
High	1993.75	32.02

(Downlink)-WCDMA

Channel	Freq (MHz)	Power Output (dBm)
Low	1932.50	33.63
Mid.	1962.50	33.59
High	1992.50	31.92

(Downlink)-GSM

Channel	Freq (MHz)	Power Output (dBm)
Low	1930.20	33.03
Mid.	1960.00	33.75
High	1989.80	32.14

(Downlink)-LTE 5M

Channel	Freq (MHz)	Power Output (dBm)
Low	1933.00	33.65
Mid.	1960.00	33.68
High	1992.00	31.56

(Downlink)-LTE 10M

Channel	Freq (MHz)	Power Output (dBm)
Low	1935.00	33.44
Mid.	1962.50	33.53
High	1990.00	31.62

(Downlink)-LTE 15M

Channel	Freq (MHz)	Power Output (dBm)
Low	1937.50	33.51
Mid.	1962.50	33.55
High	1987.50	31.84

(Downlink)-LTE 20M

Channel	Freq (MHz)	Power Output (dBm)
Low	1940.00	33.45
Mid.	1962.50	33.12
High	1985.00	32.19

Without AGC

(Downlink)-CDMA

Channel	Freq (MHz)	Power Output (dBm)
Low	1931.25	33.38
Mid.	1960.00	33.61
High	1993.75	32.00

(Downlink)-WCDMA

Channel	Freq (MHz)	Power Output (dBm)
Low	1932.50	33.55
Mid.	1962.50	33.50
High	1992.50	31.89

(Downlink)-GSM

Channel	Freq (MHz)	Power Output (dBm)
Low	1930.20	32.64
Mid.	1960.00	33.57
High	1989.80	32.10

(Downlink)-LTE 5M

Channel	Freq (MHz)	Power Output (dBm)
Low	1933.00	33.58
Mid.	1960.00	33.41
High	1992.00	31.53

(Downlink)-LTE 10M

Channel	Freq (MHz)	Power Output (dBm)
Low	1935.00	33.35
Mid.	1962.50	33.01
High	1990.00	31.58

(Downlink)-LTE 15M

Channel	Freq (MHz)	Power Output (dBm)
Low	1937.50	33.50
Mid.	1962.50	33.45
High	1987.50	31.81

(Downlink)-LTE 20M

Channel	Freq (MHz)	Power Output (dBm)
Low	1940.00	33.24
Mid.	1962.50	32.99
High	1985.00	32.07

(Downlink)-CDMA

Channel	Freq (MHz)	PAPR(0.1%)
Mid.	1960.00	9.06

(Downlink)-WCDMA

Channel	Freq (MHz)	PAPR(0.1%)
Mid.	1962.50	4.58

(Downlink)-GSM

Channel	Freq (MHz)	PAPR(0.1%)
Mid.	1960.00	0.42

(Downlink)-LTE 5M

Channel	Freq (MHz)	PAPR(0.1%)
Mid.	1960.00	8.35

(Downlink)-LTE 10M

Channel	Freq (MHz)	PAPR(0.1%)
Mid.	1962.50	8.64

(Downlink)-LTE 15M

Channel	Freq (MHz)	PAPR(0.1%)
Mid.	1962.50	8.49

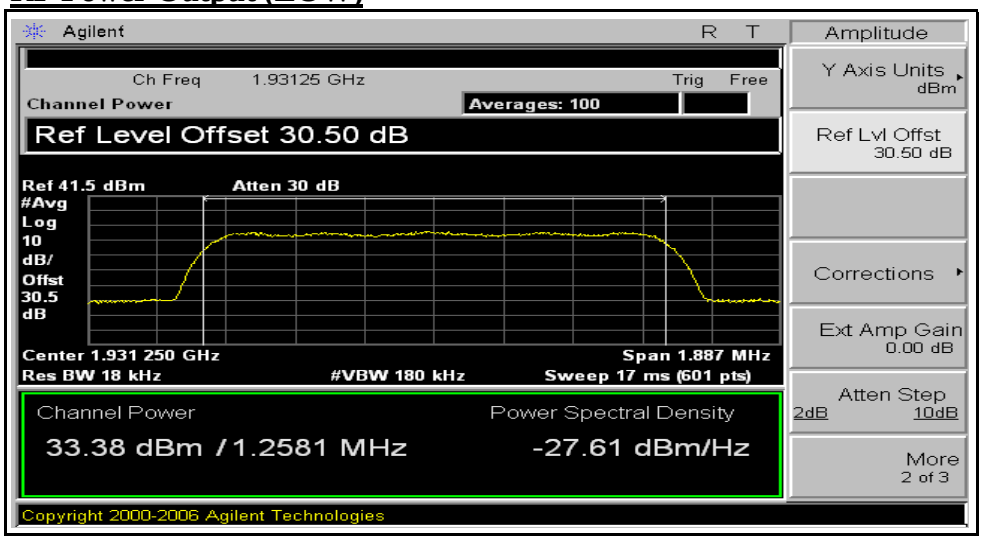
(Downlink)-LTE 20M

Channel	Freq (MHz)	PAPR(0.1%)
Mid.	1962.50	8.52

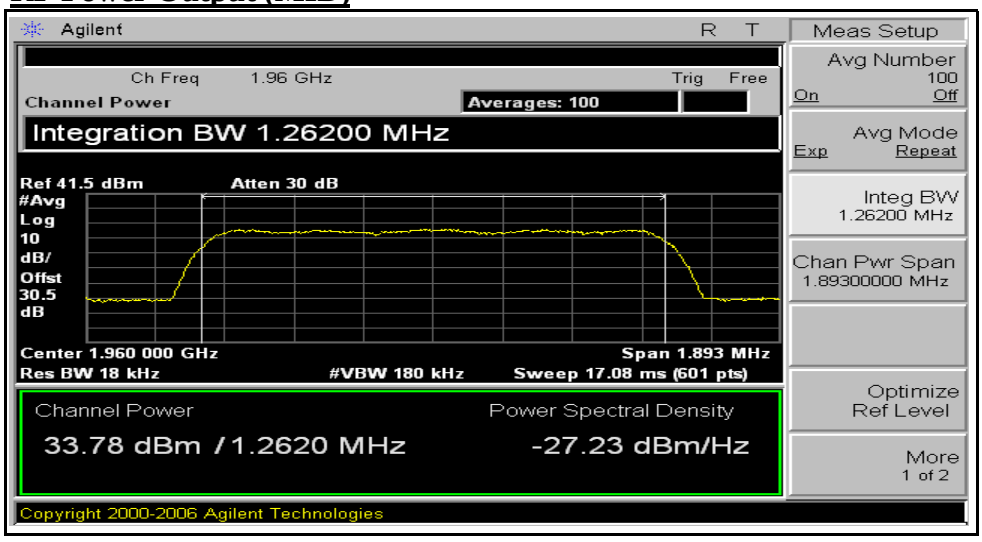
4.4 Test Plot

Downlink-CDMA

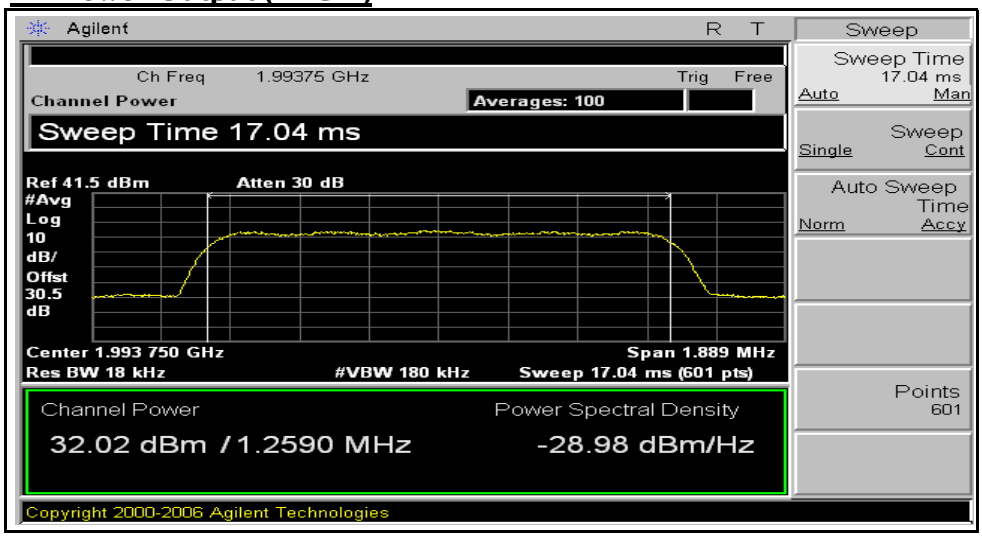
RF Power Output (LOW)



RF Power Output (MID)



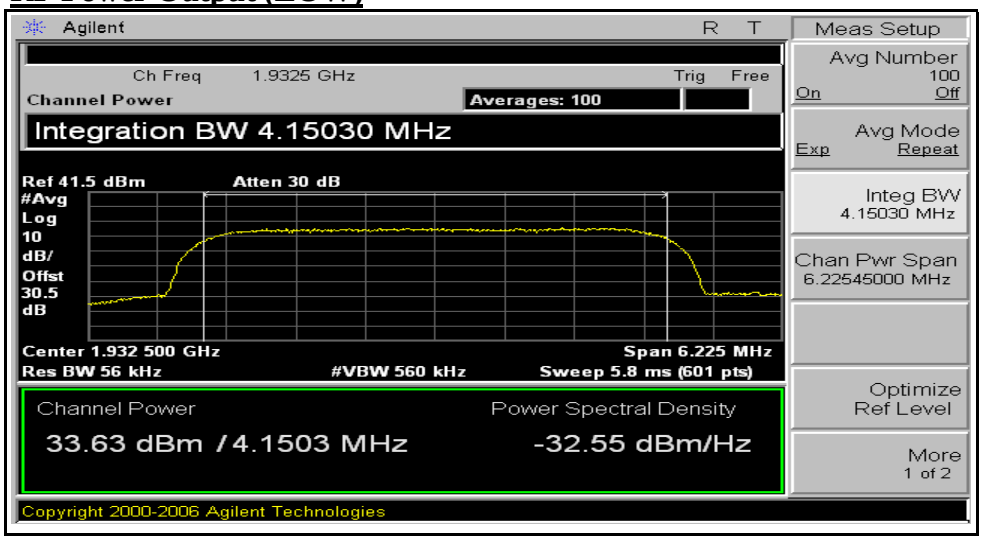
RF Power Output (HIGH)



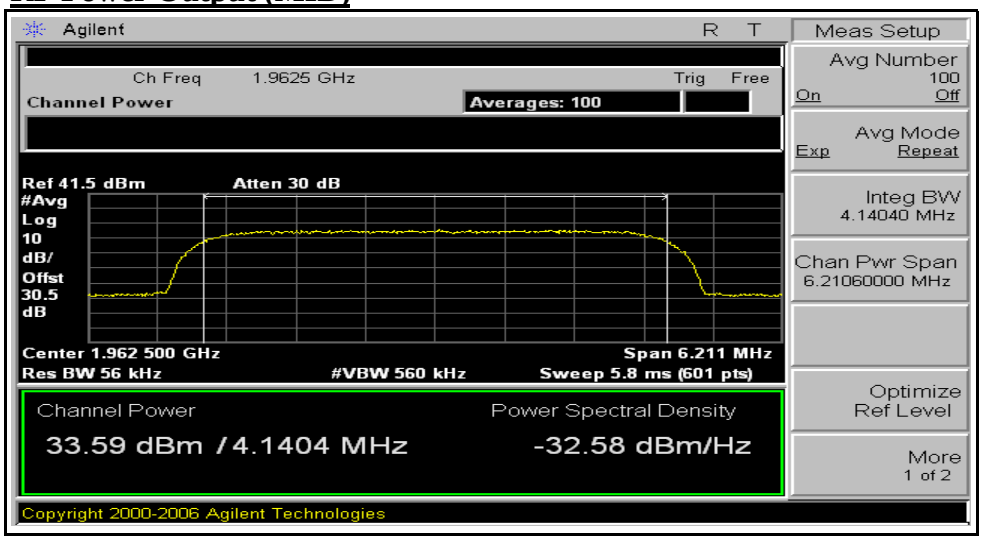
4.4 Test Plot

Downlink-WCDMA

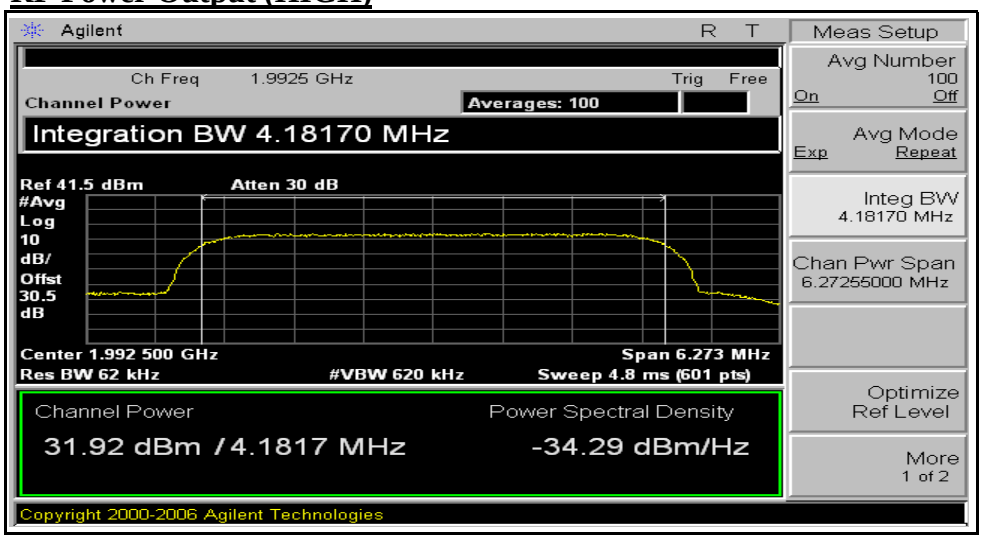
RF Power Output (LOW)



RF Power Output (MID)



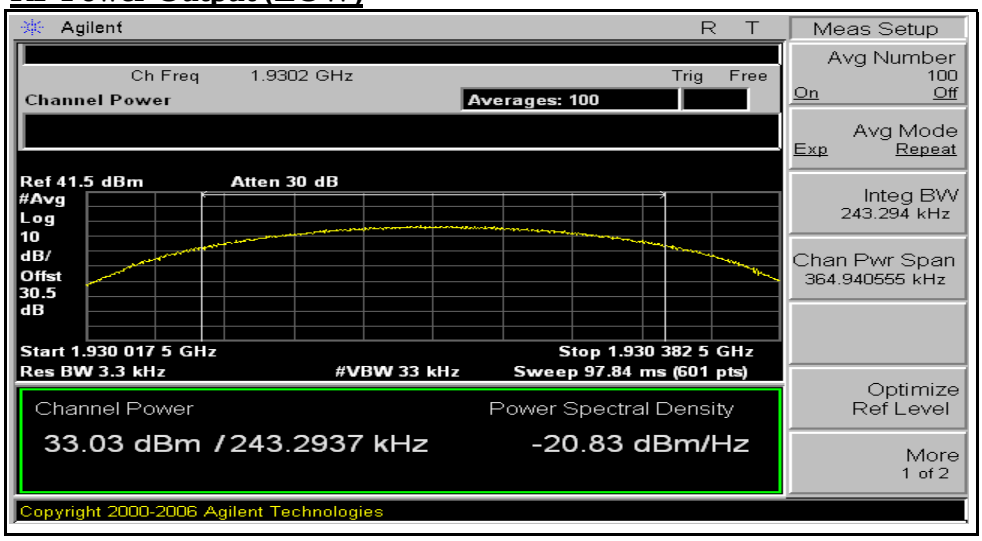
RF Power Output (HIGH)



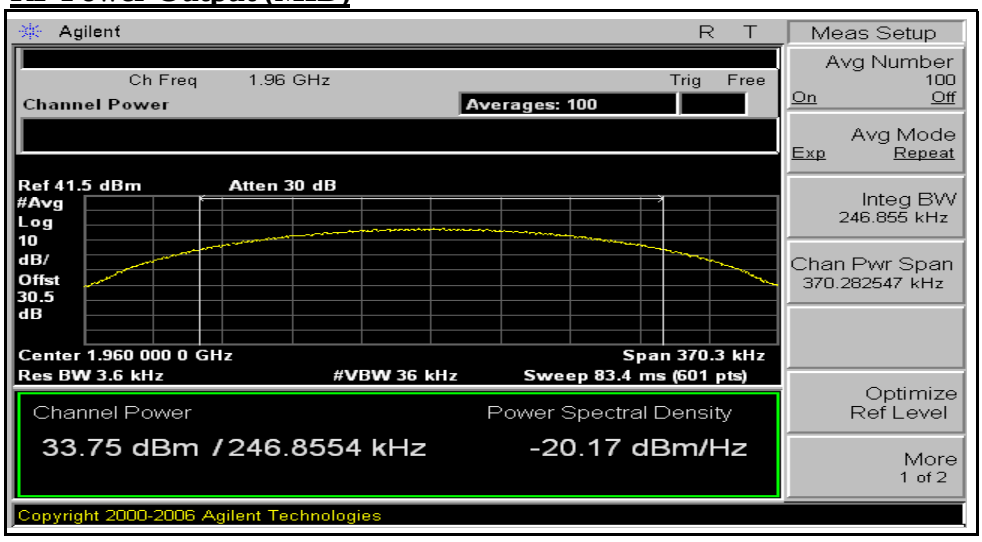
4.4 Test Plot

Downlink-GSM

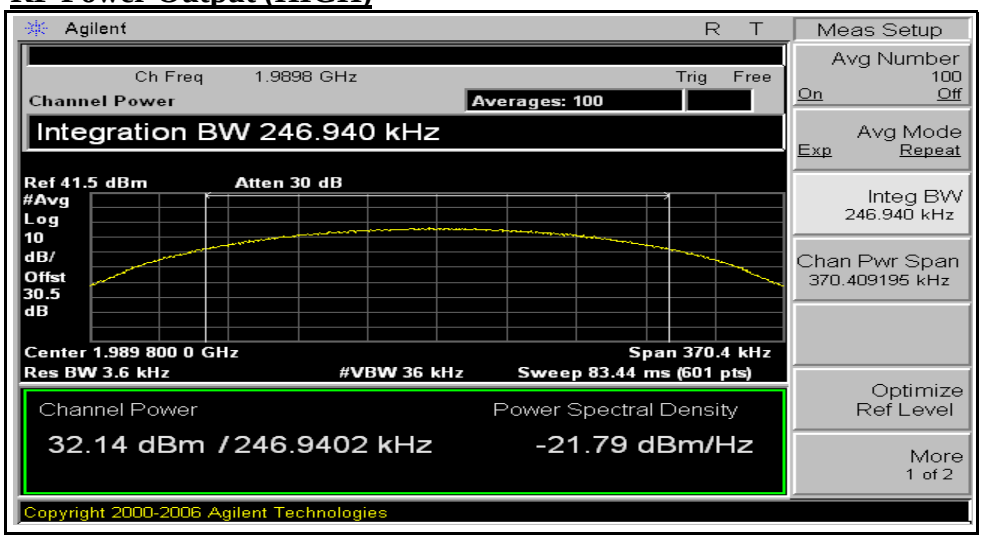
RF Power Output (LOW)



RF Power Output (MID)



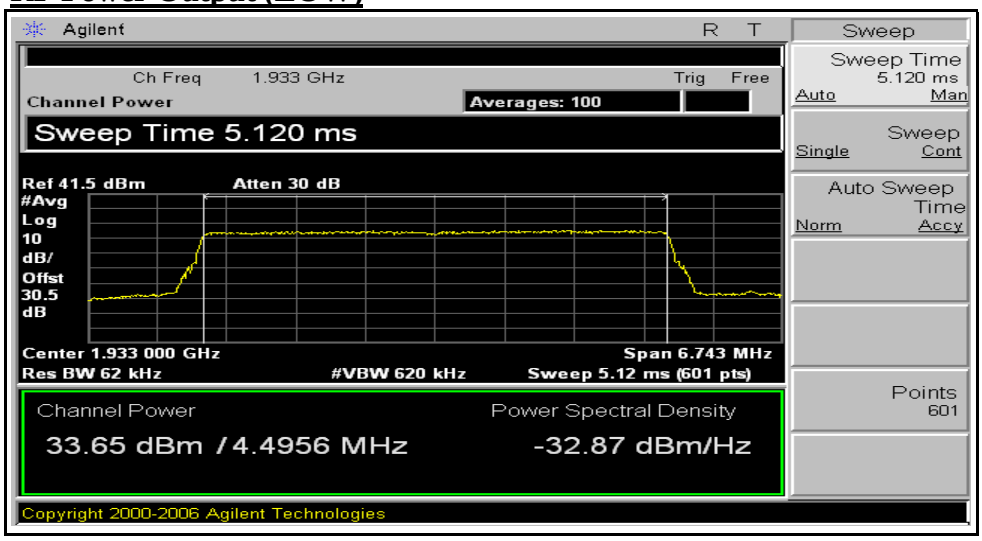
RF Power Output (HIGH)



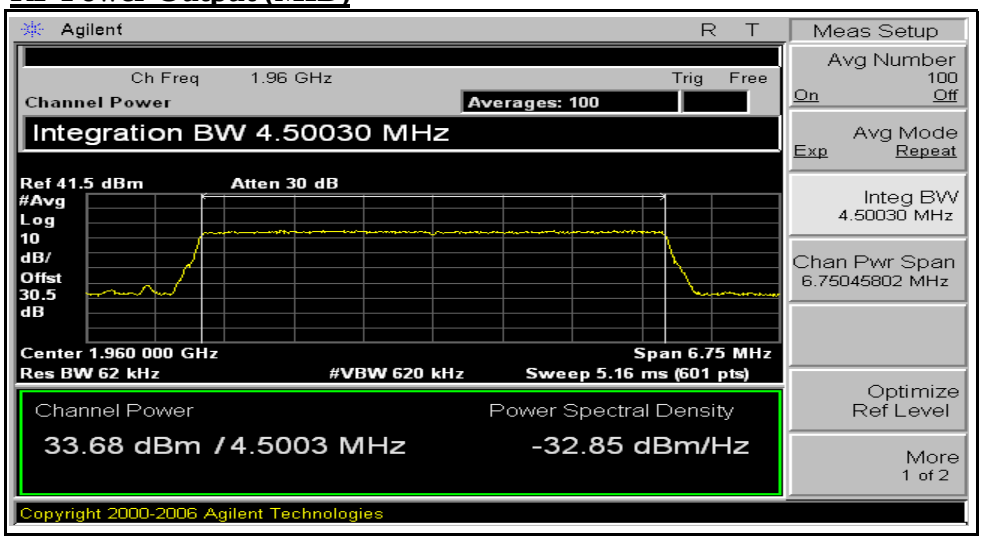
4.4 Test Plot

Downlink-LTE 5M

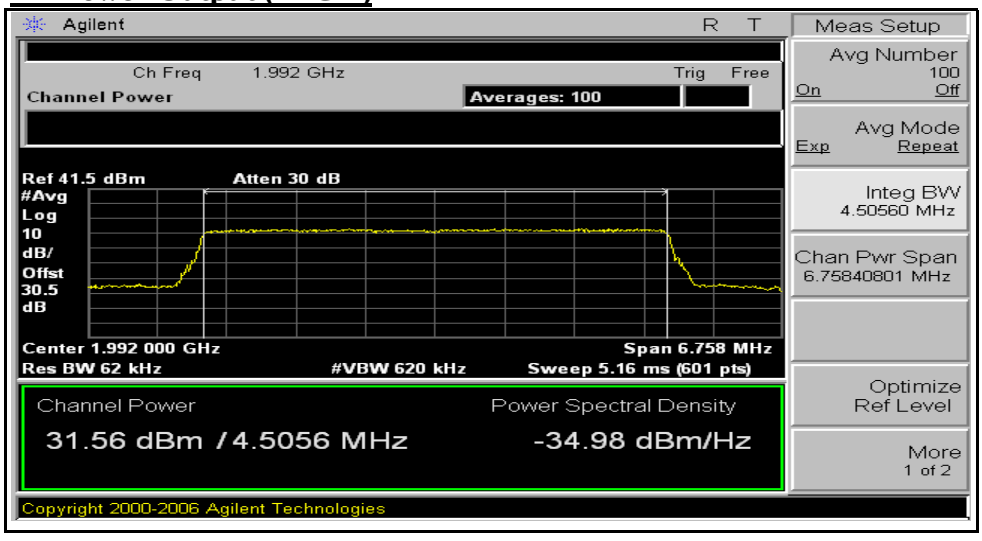
RF Power Output (LOW)



RF Power Output (MID)



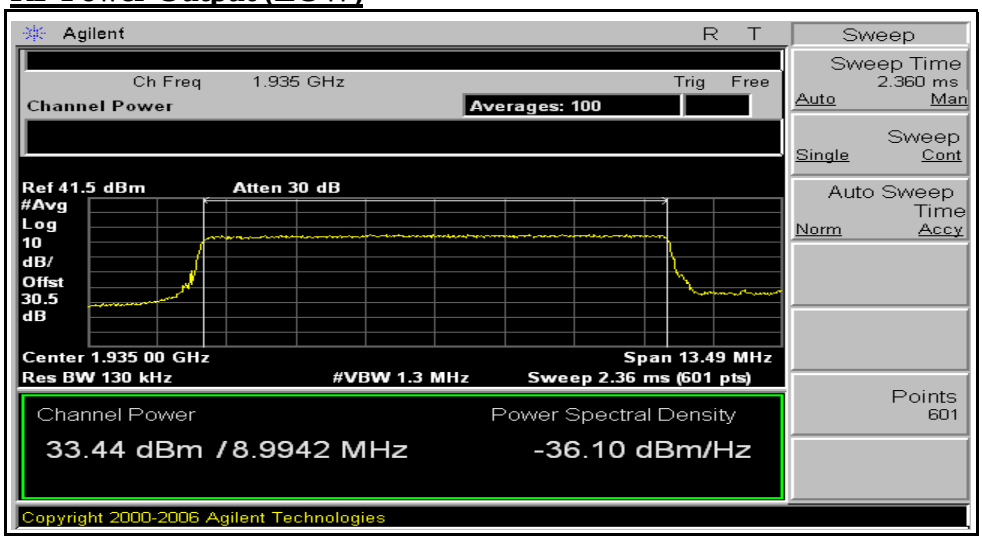
RF Power Output (HIGH)



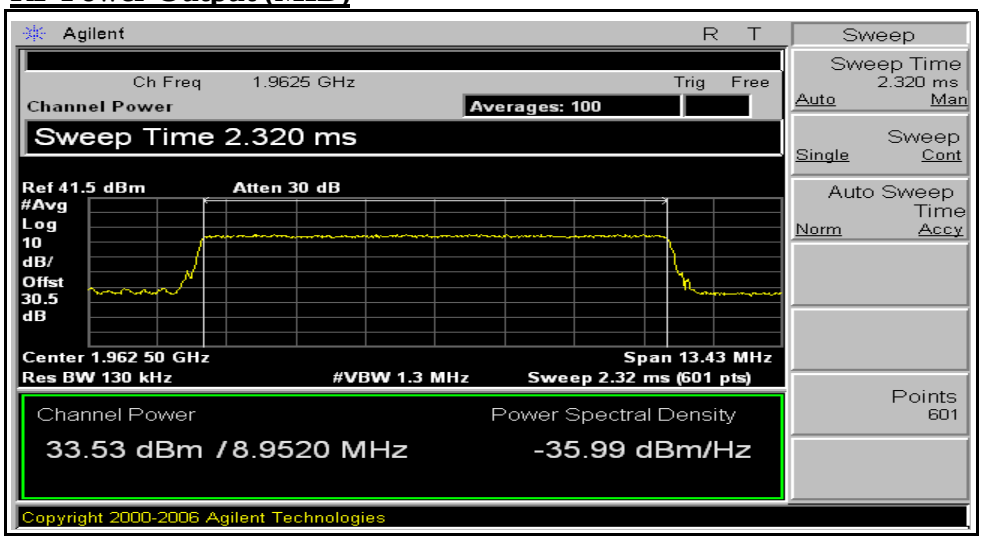
4.4 Test Plot

Downlink-LTE 10M

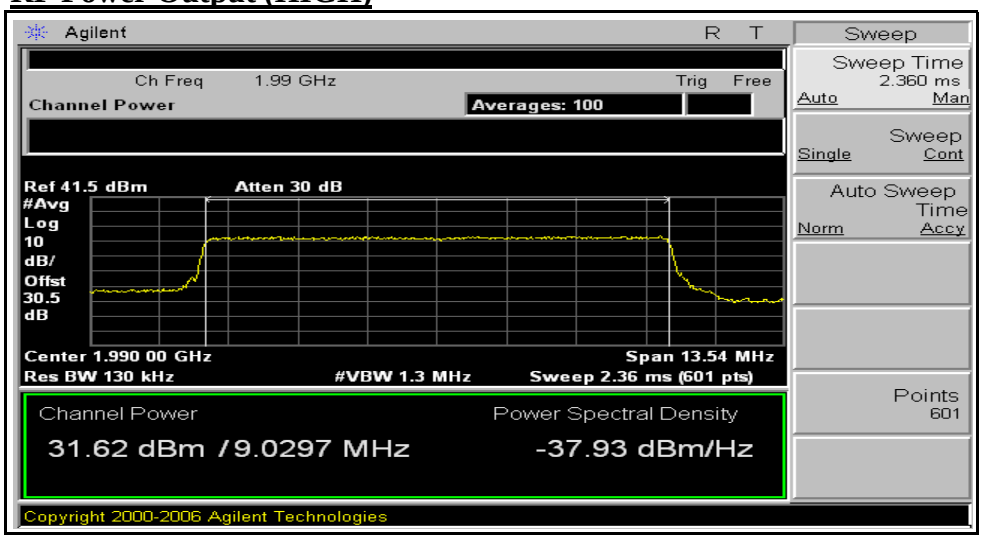
RF Power Output (LOW)



RF Power Output (MID)



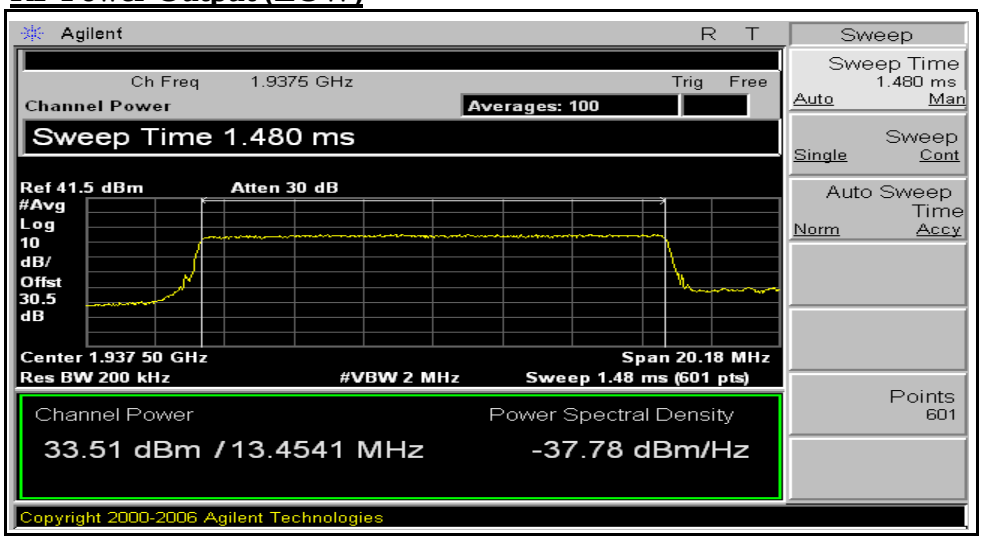
RF Power Output (HIGH)



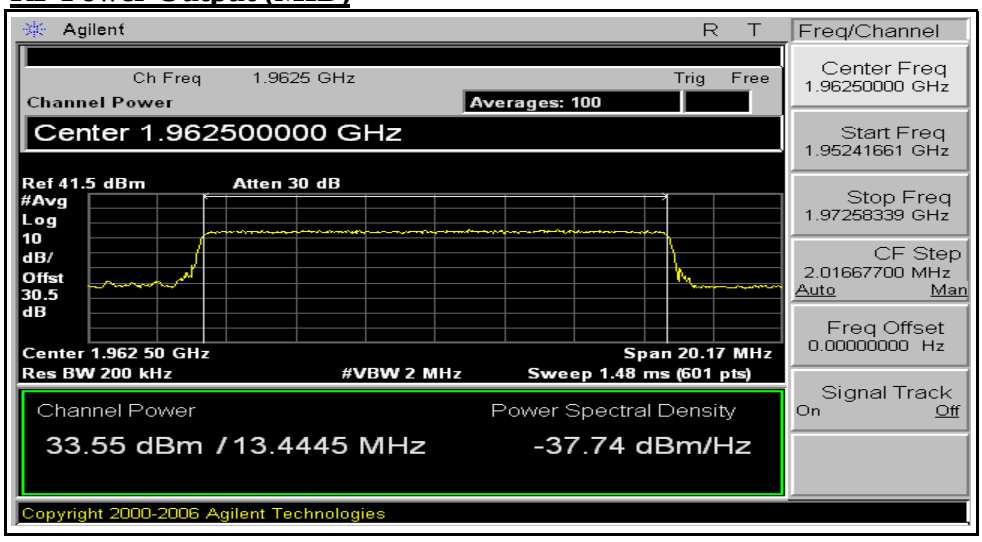
4.4 Test Plot

Downlink-LTE 15M

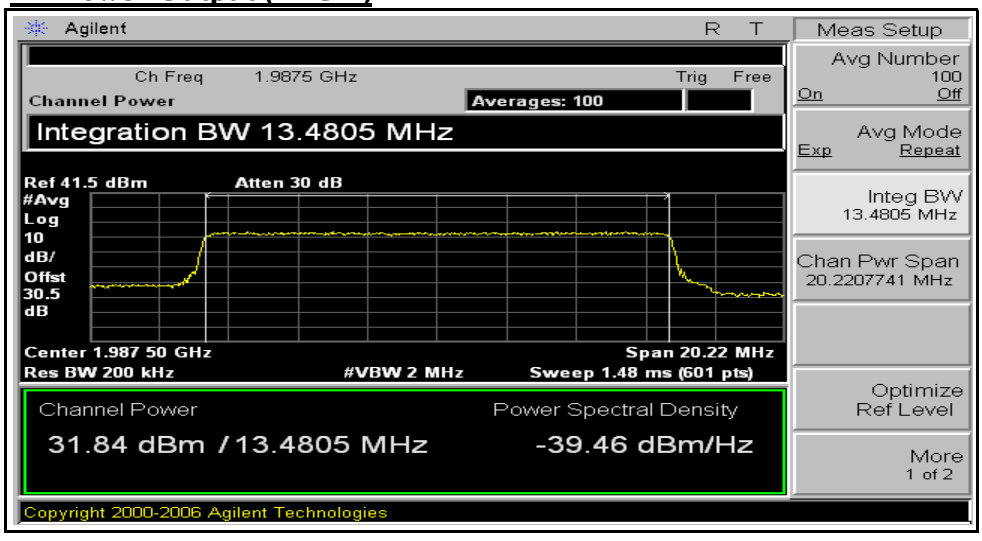
RF Power Output (LOW)



RF Power Output (MID)



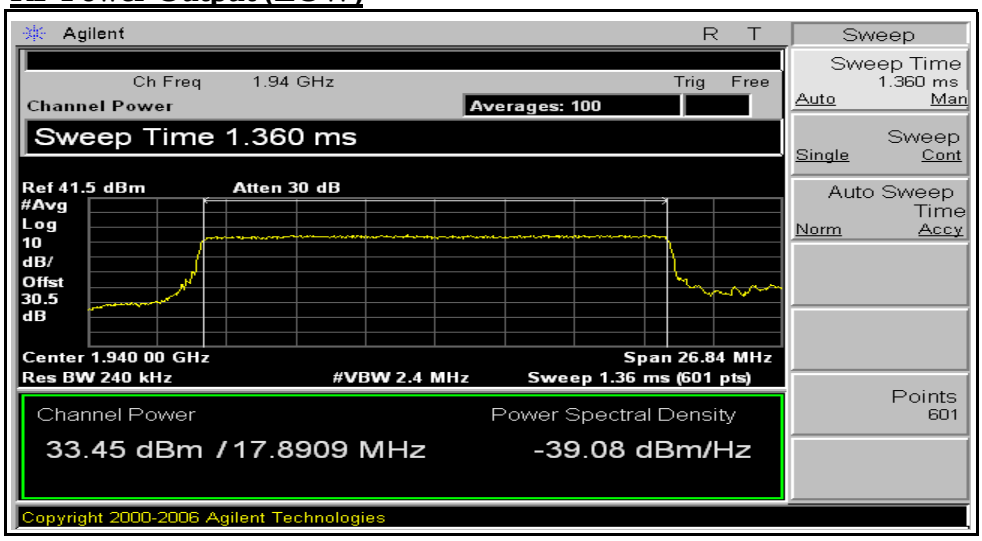
RF Power Output (HIGH)



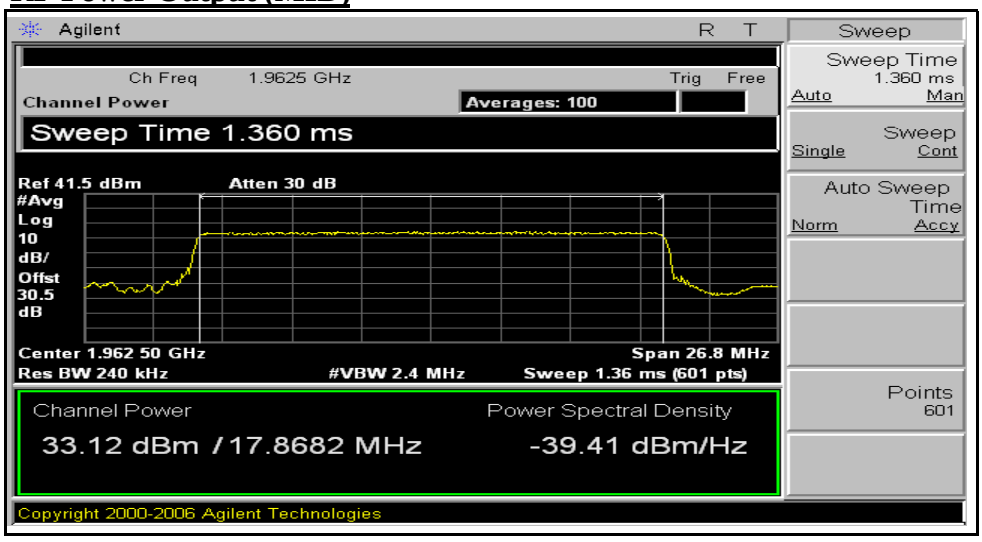
4.4 Test Plot

Downlink-LTE 20M

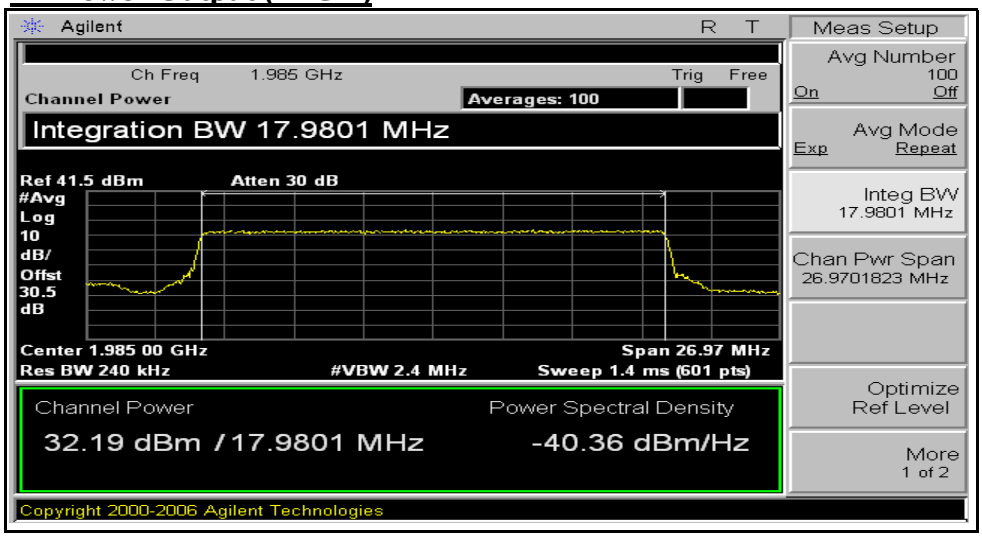
RF Power Output (LOW)



RF Power Output (MID)



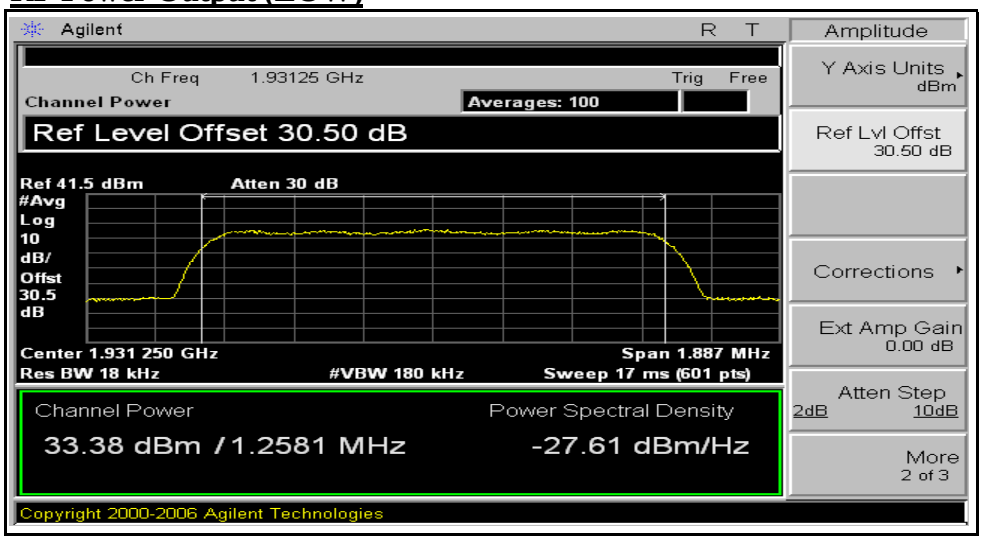
RF Power Output (HIGH)



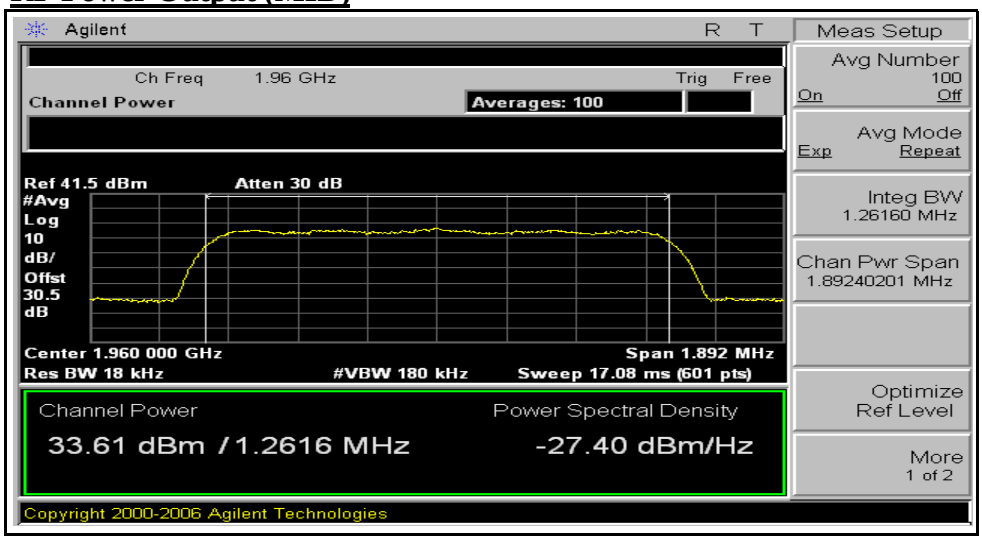
4.4 Test Plot (Without AGC)

Downlink-CDMA

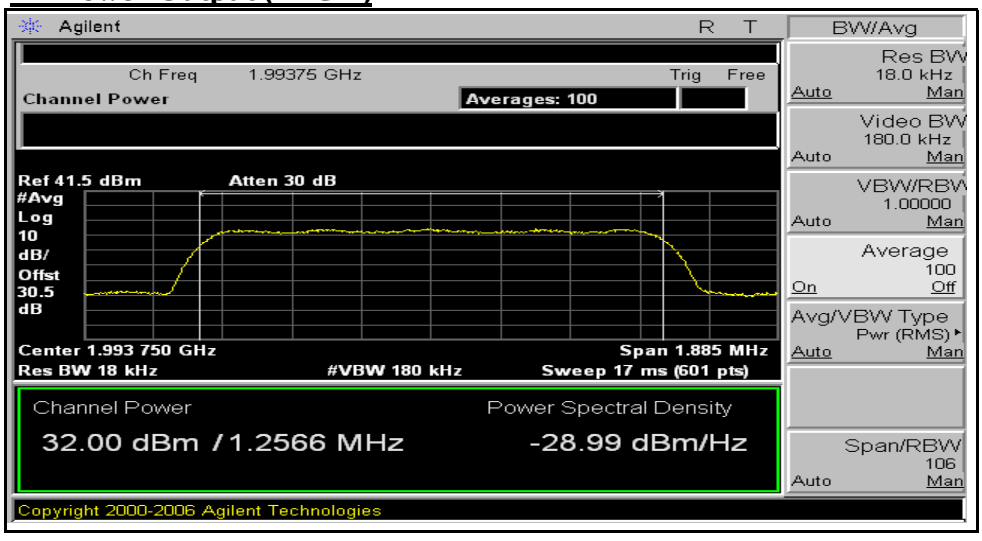
RF Power Output (LOW)



RF Power Output (MID)



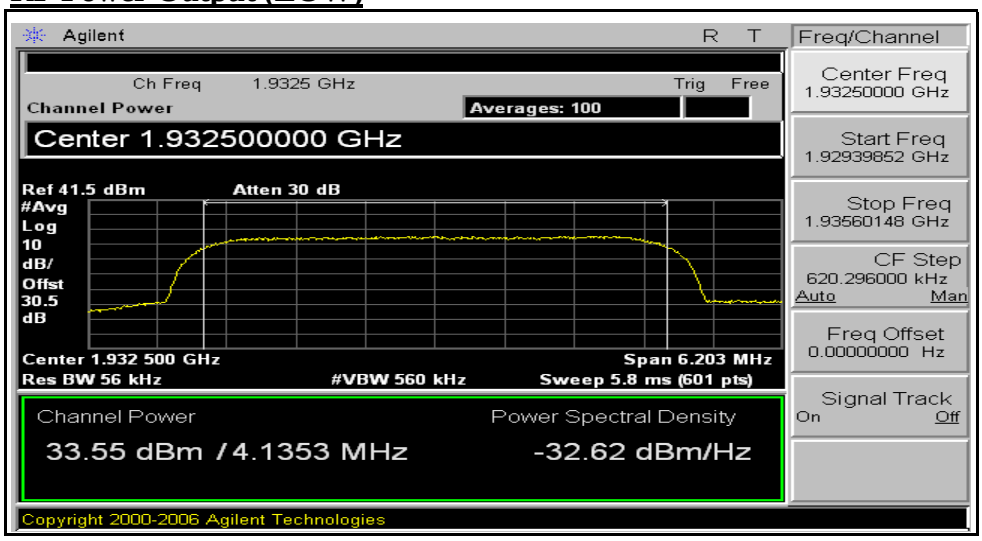
RF Power Output (HIGH)



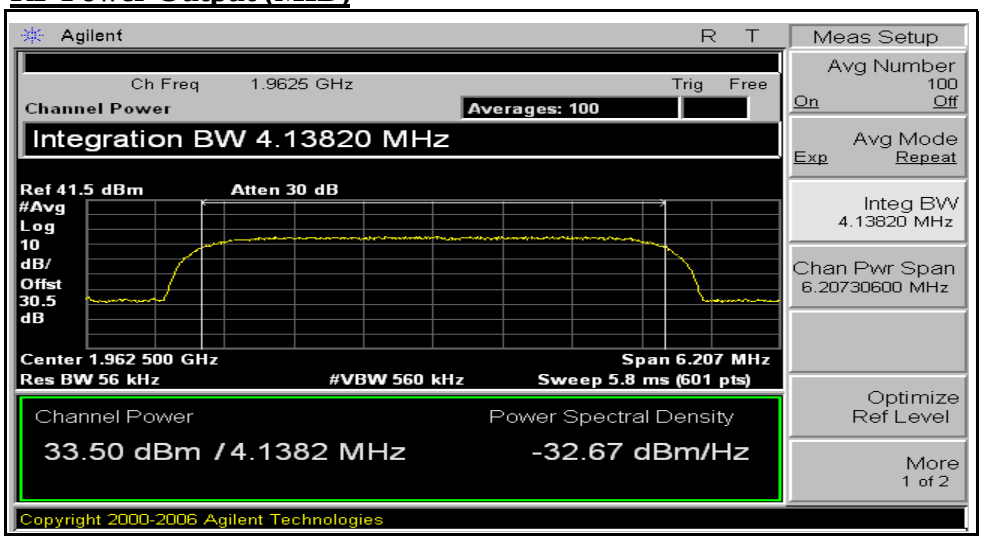
4.4 Test Plot (Without AGC)

Downlink-WCDMA

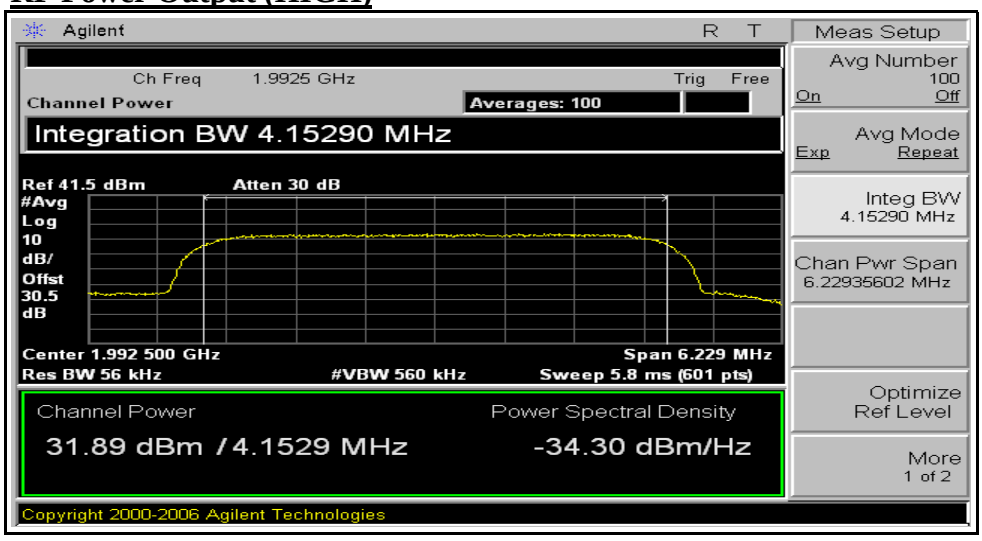
RF Power Output (LOW)



RF Power Output (MID)



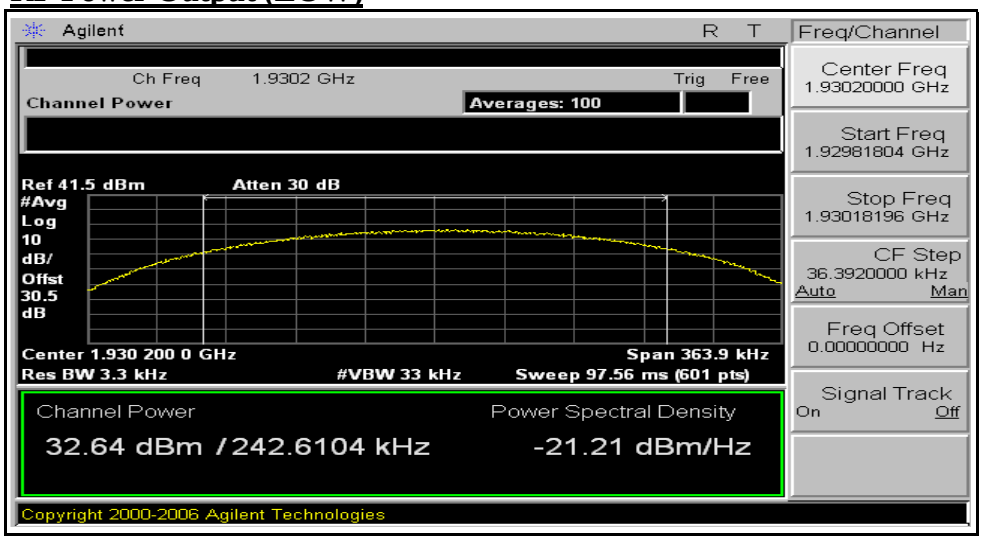
RF Power Output (HIGH)



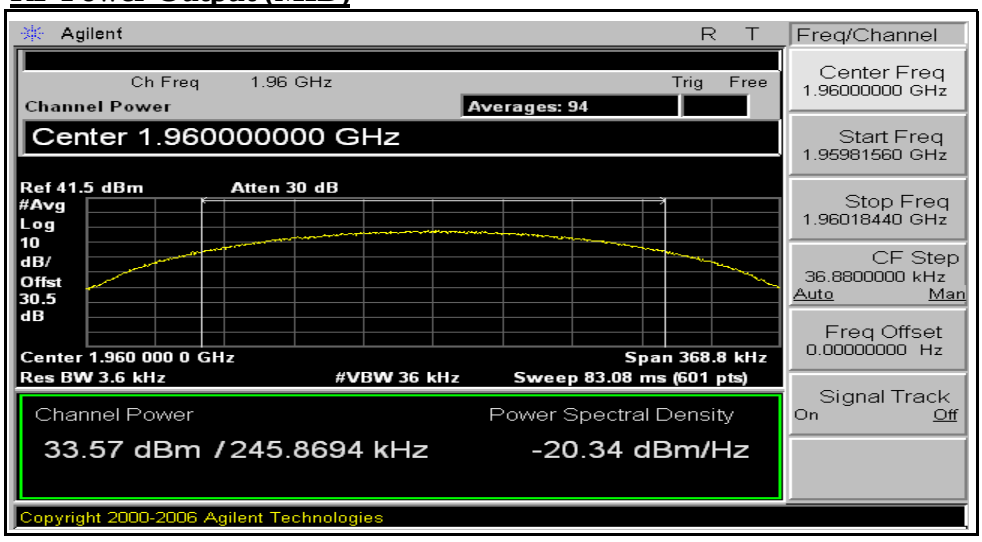
4.4 Test Plot (Without AGC)

Downlink-GSM

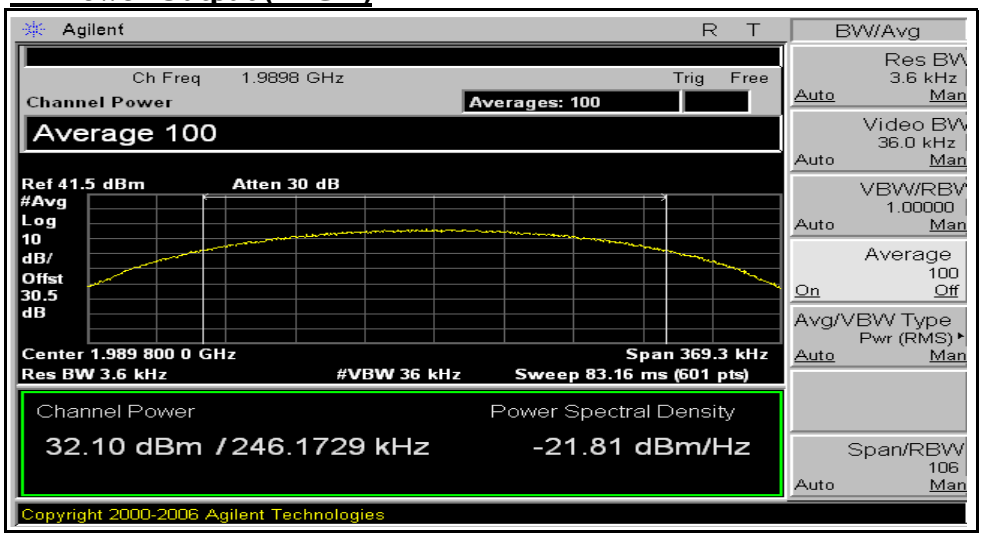
RF Power Output (LOW)



RF Power Output (MID)



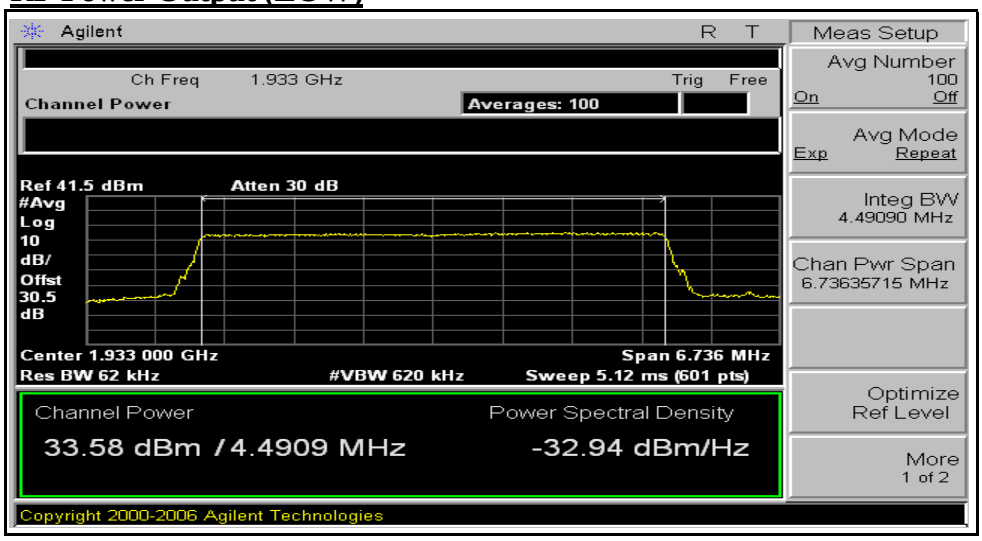
RF Power Output (HIGH)



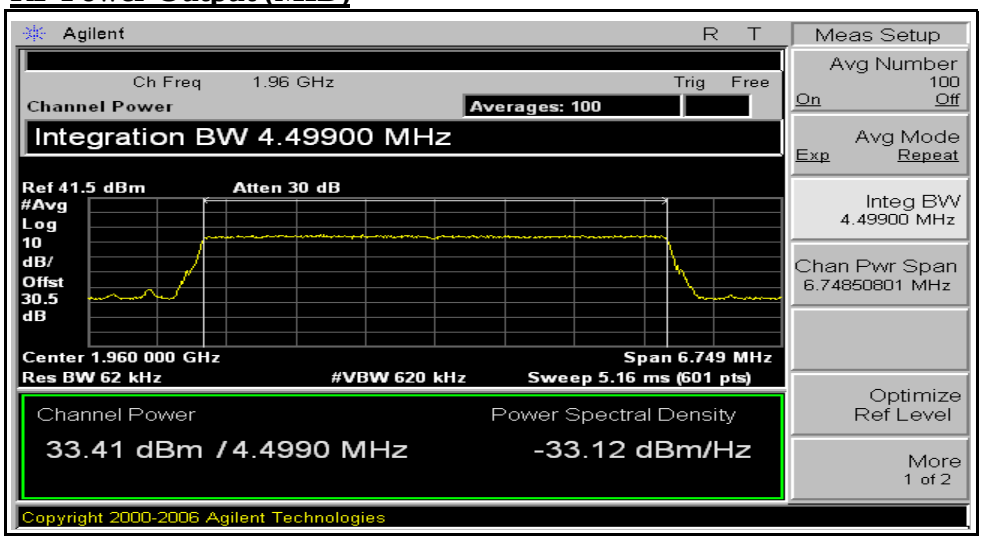
4.4 Test Plot (Without AGC)

Downlink-LTE 5M

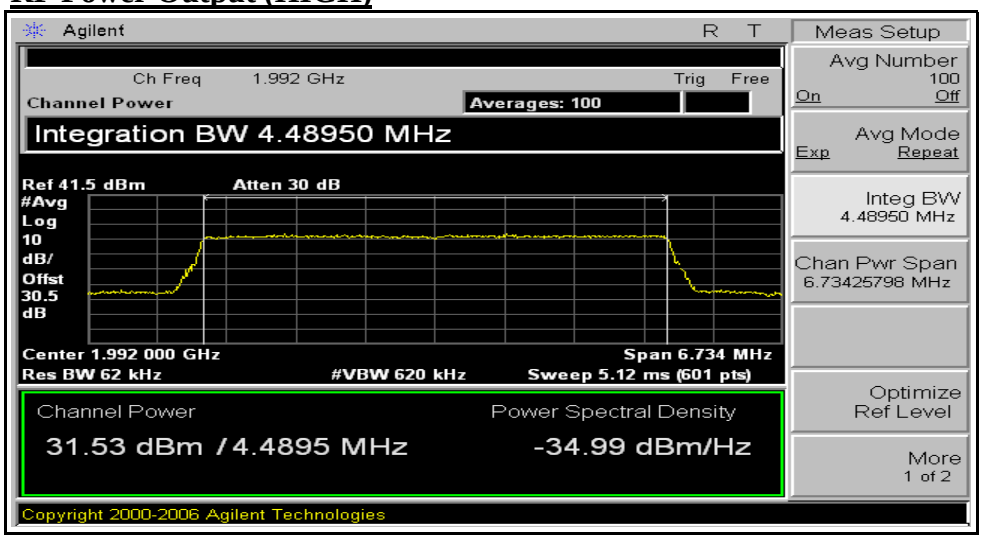
RF Power Output (LOW)



RF Power Output (MID)



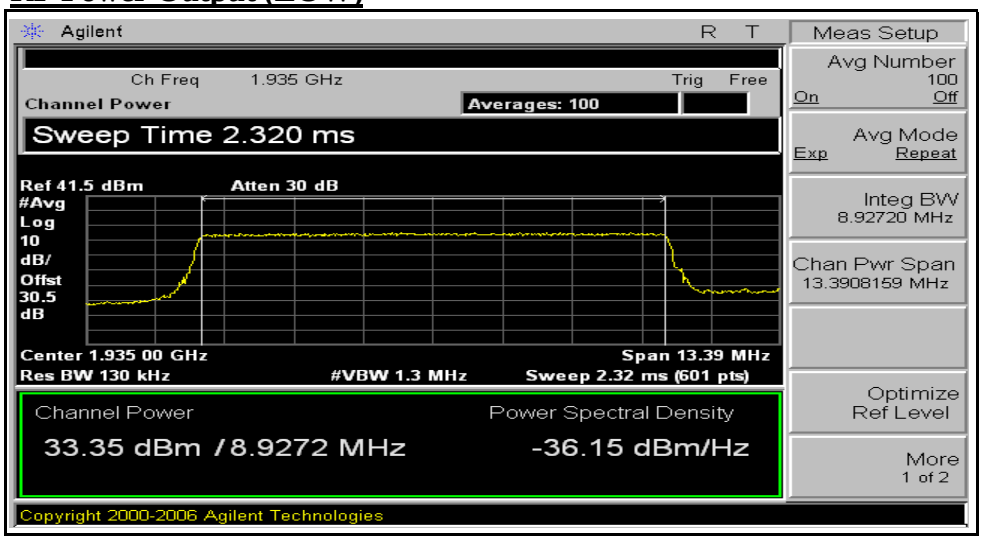
RF Power Output (HIGH)



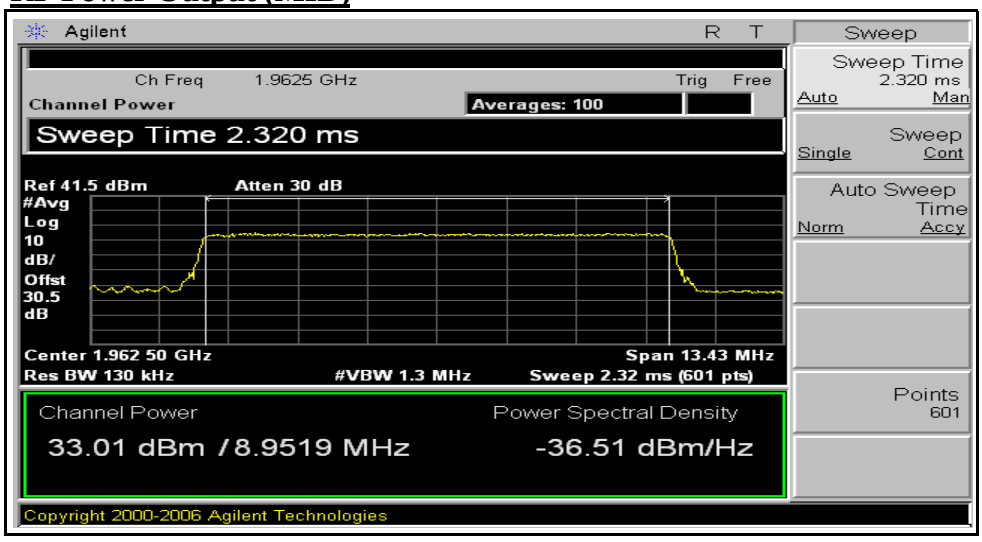
4.4 Test Plot (Without AGC)

Downlink-LTE 10M

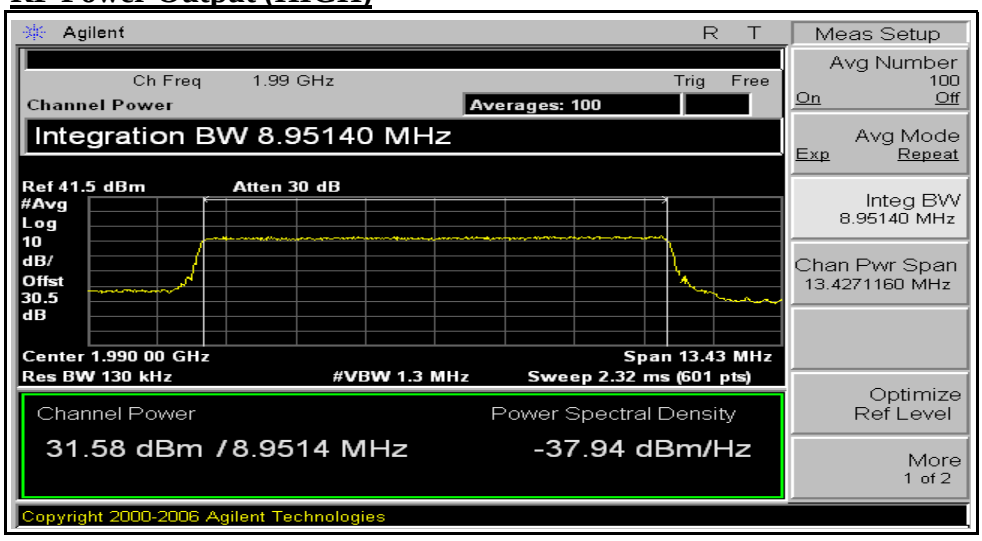
RF Power Output (LOW)



RF Power Output (MID)



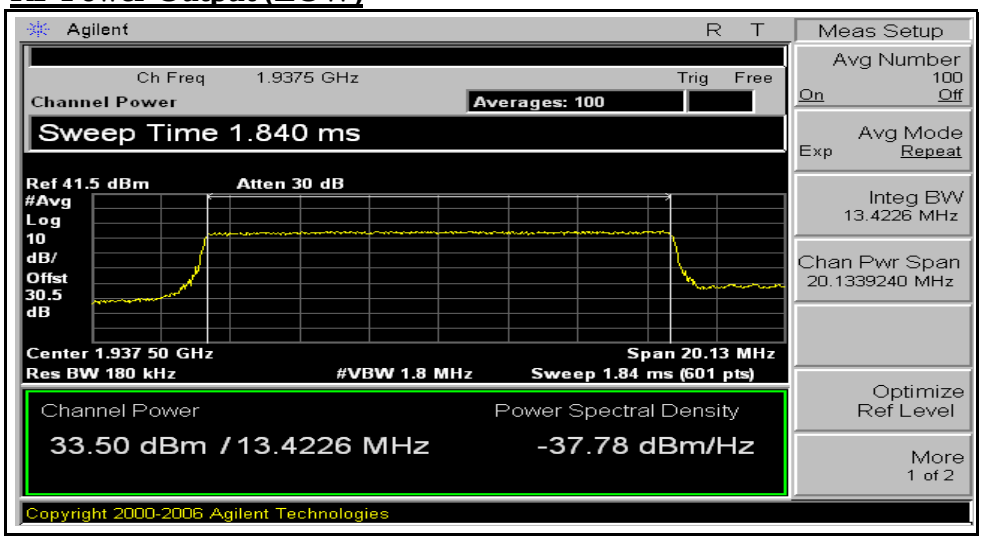
RF Power Output (HIGH)



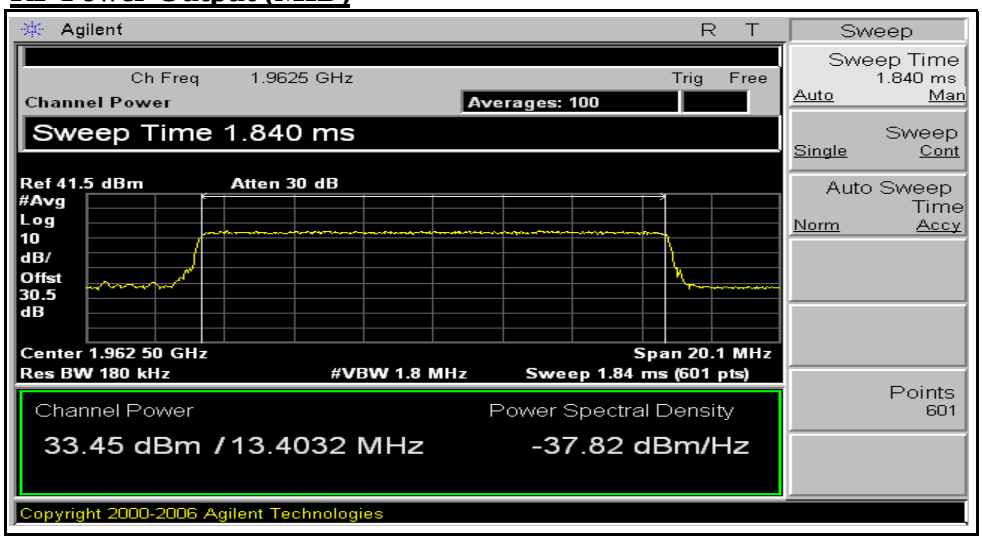
4.4 Test Plot (Without AGC)

Downlink-LTE 15M

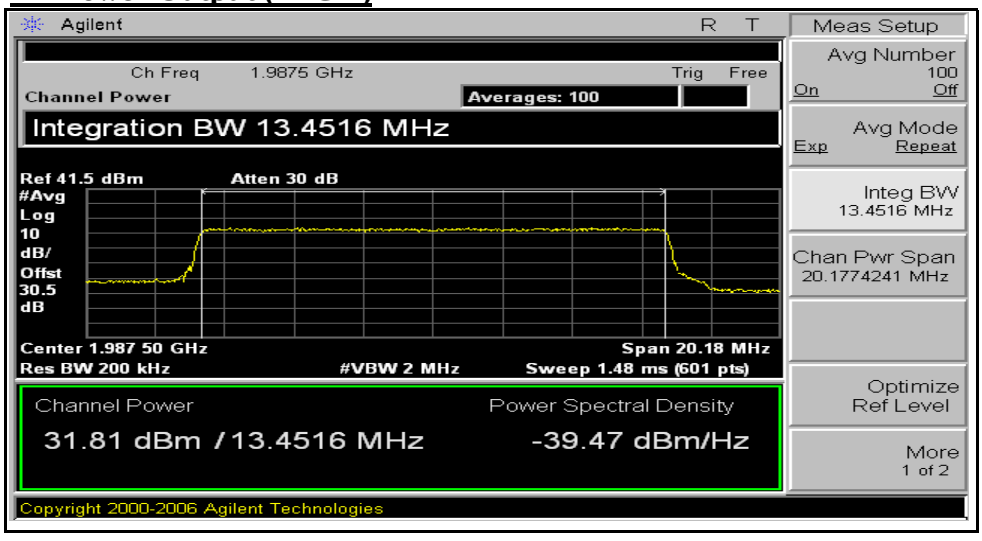
RF Power Output (LOW)



RF Power Output (MID)



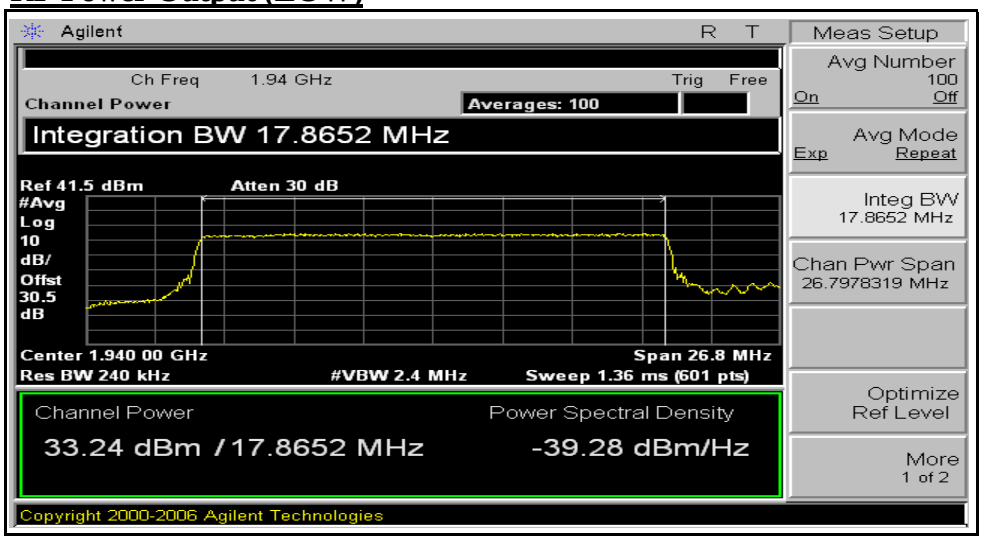
RF Power Output (HIGH)



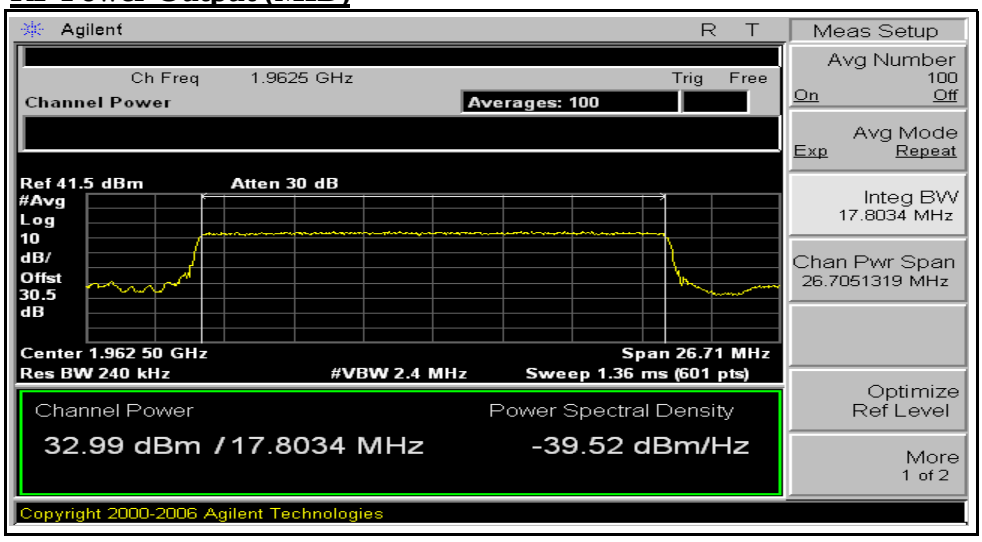
4.4 Test Plot (Without AGC)

Downlink-LTE 20M

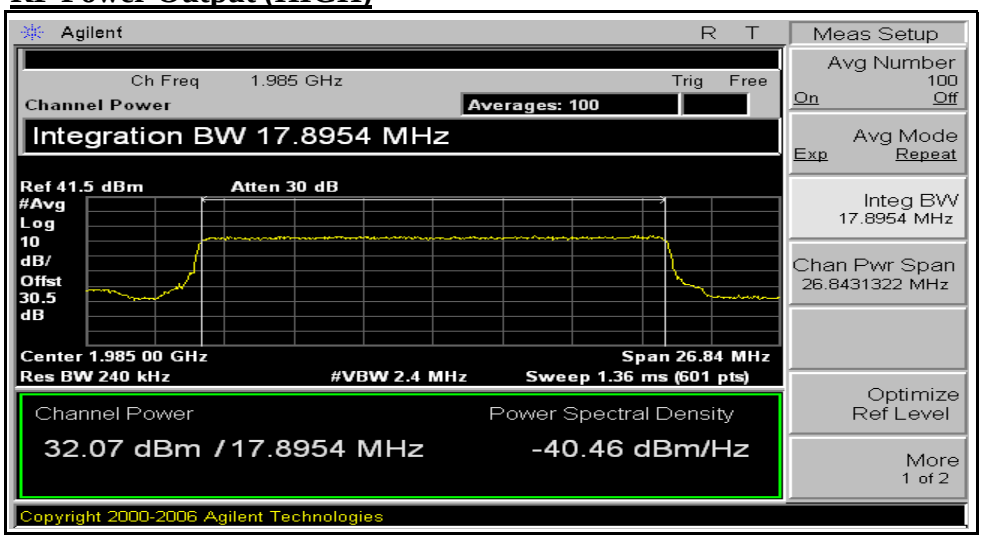
RF Power Output (LOW)



RF Power Output (MID)

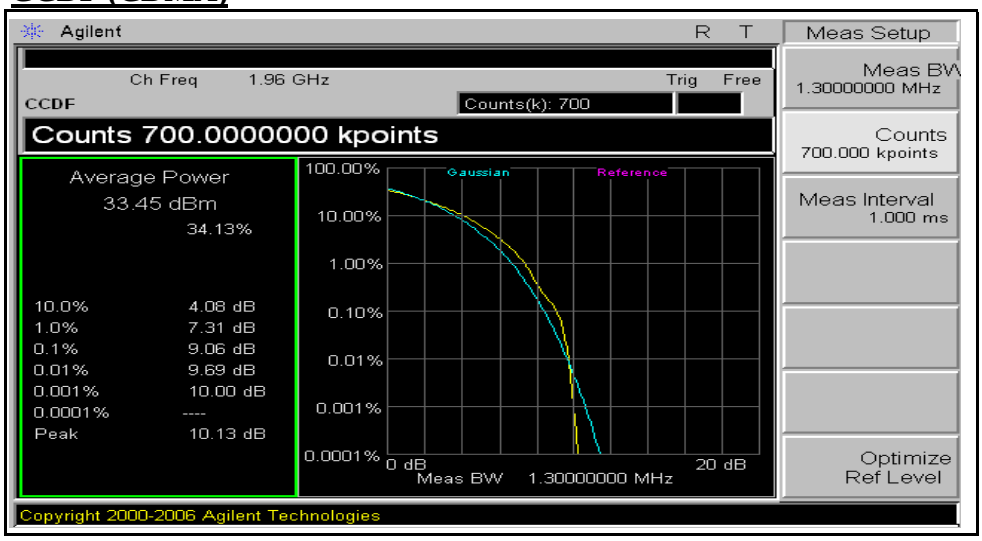


RF Power Output (HIGH)

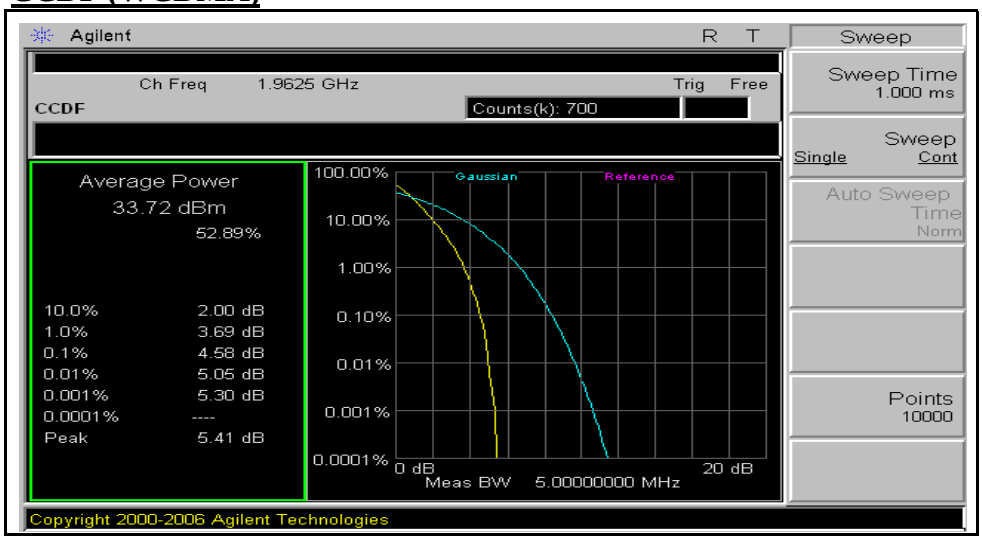


4.4 Test Plot

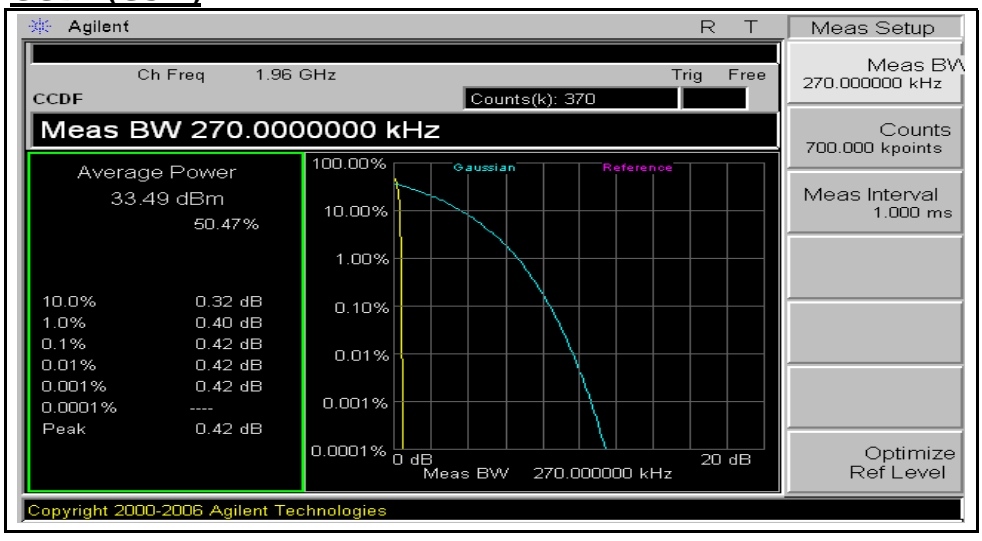
CCDF (CDMA)



CCDF (WCDMA)

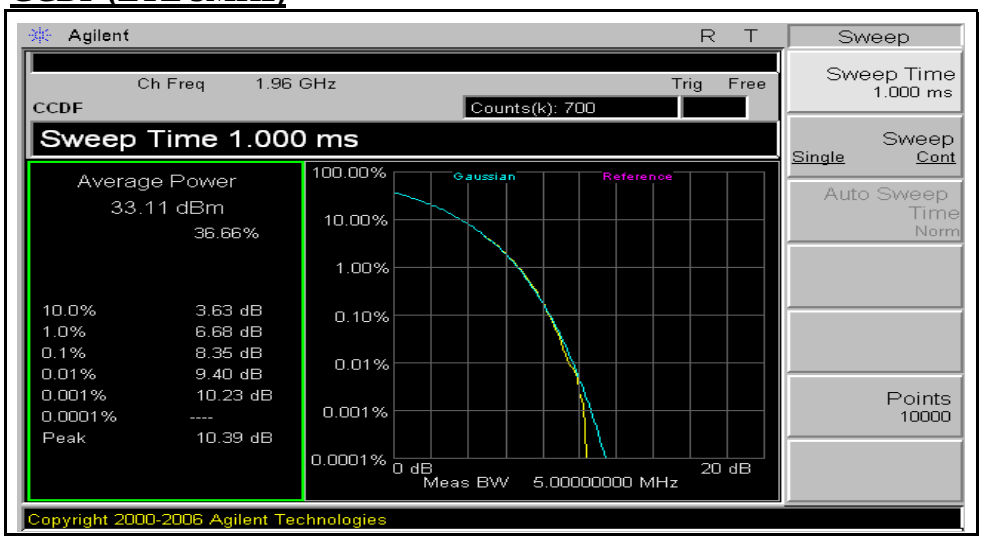


CCDF (GSM)

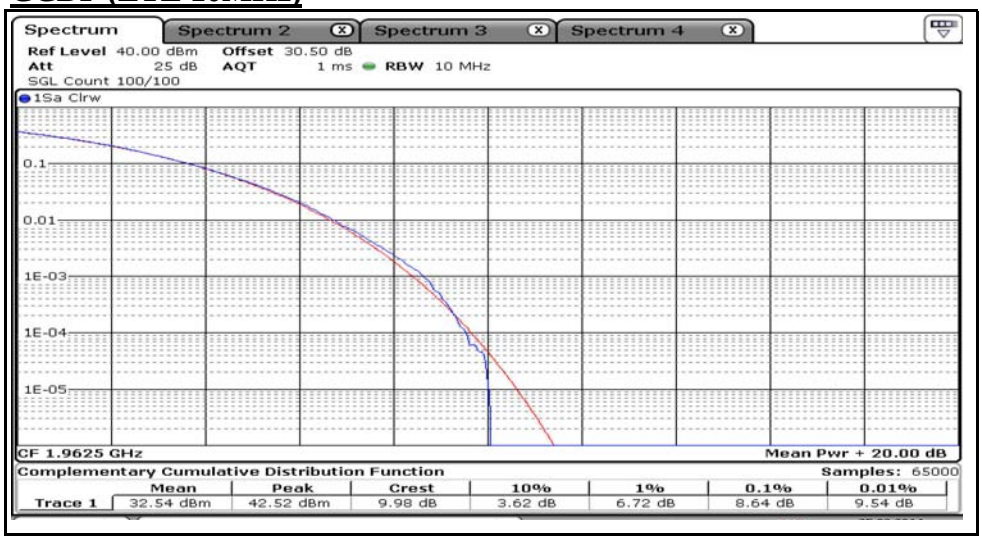


4.4 Test Plot

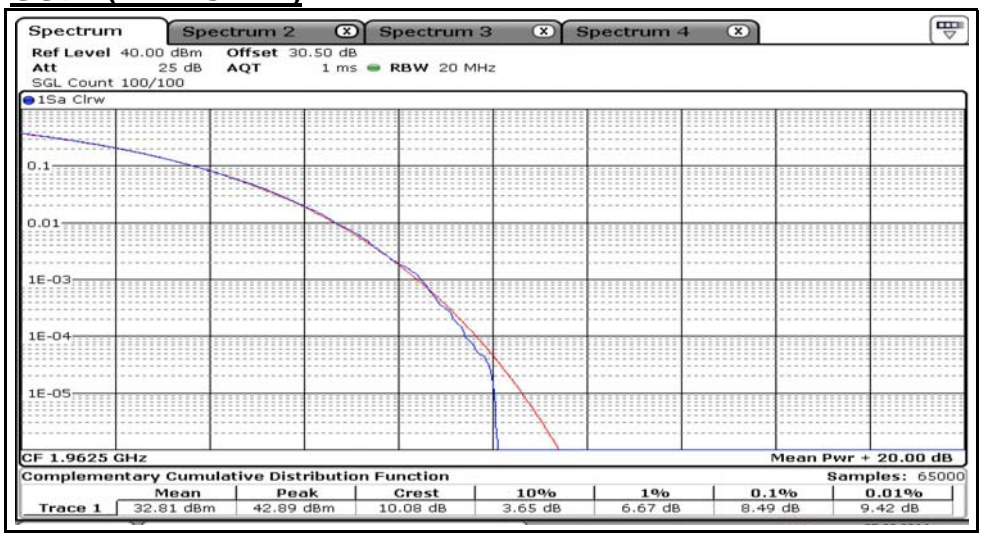
CCDF (LTE 5MHz)



CCDF (LTE 10MHz)



CCDF (LTE 15MHz)



4.4 Test Plot

CCDF (LTE 20MHz)

5. Occupied Bandwidth

5.1 Test Procedure according to KDB971168 4.2

The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation products including the emission skirts (*i.e.*, two to five times the OBW).

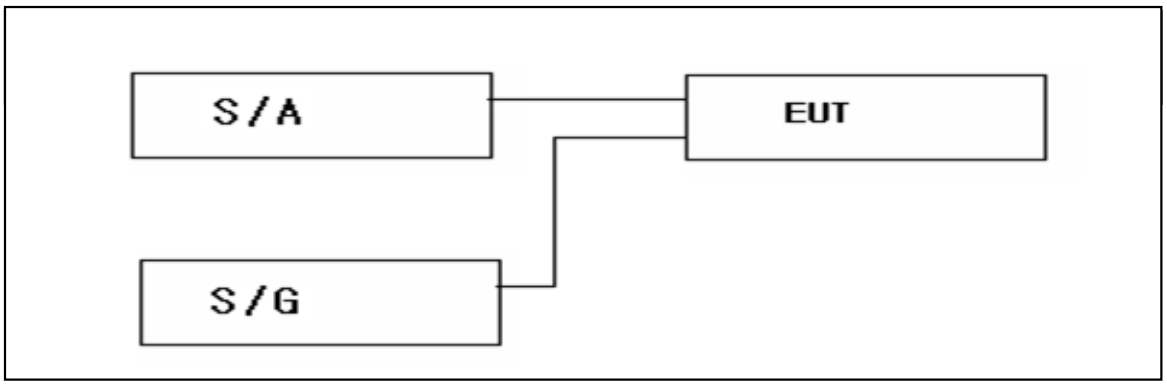
The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1 to 5 % of the anticipated OBW, and the VBW shall be at least 3 times the RBW.

Set the reference level of the instrument as required to keep the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope must be at least 10log (OBW / RBW) below the reference level.

NOTE—*Steps a) through c) may require iteration to adjust within the specified tolerances.*

Set the detection mode to peak, and the trace mode to max hold..

Use the 99 % power bandwidth function of the spectrum analyzer (if available) and report the measured bandwidth.



5.2 Test Equipments

The following test equipments are used during tests

Equipment	Manufacturer	Model	Next Cal.
Spectrum Analyzer	Agilent	E4440A	2014-01-27
Vector Signal Generator	ROHDE&SCHWARZ	SMBV100A	2014-01-25
Signal Generator	HP	E4432B	2014-01-27
Attenuator	SRT	F04-K1830-01	2014-01-27

5.2 Test Results

(Downlink)-CDMA

Channel	Frequency(MHz)	26dB Bandwidth(MHz)
LOW	1931.25	1.403
MID	1960.00	1.407
HIGH	1993.75	1.401

(Downlink)-WCDMA

Channel	Frequency(MHz)	26dB Bandwidth(MHz)
LOW	1932.50	4.683
MID	1962.50	4.670
HIGH	1992.50	4.645

(Downlink)-GSM

Channel	Frequency(MHz)	26dB Bandwidth(MHz)
LOW	1930.20	0.311
MID	1960.00	0.316
HIGH	1989.80	0.321

(Downlink)-LTE 5M

Channel	Frequency(MHz)	26dB Bandwidth(MHz)
LOW	1933.00	4.904
MID	1960.00	4.915
HIGH	1992.00	4.959

(Downlink)-LTE 10M

Channel	Frequency(MHz)	26dB Bandwidth(MHz)
LOW	1935.00	9.701
MID	1962.50	9.750
HIGH	1990.00	9.752

(Downlink)-LTE 15M

Channel	Frequency(MHz)	26dB Bandwidth(MHz)
LOW	1937.50	14.299
MID	1962.50	14.627
HIGH	1987.50	14.688

(Downlink)-LTE 20M

Channel	Frequency(MHz)	26dB Bandwidth(MHz)
LOW	1940.00	19.583
MID	1962.50	19.548
HIGH	1985.00	19.506

Without AGC

(Downlink)-CDMA

Channel	Frequency(MHz)	26dB Bandwidth(MHz)
LOW	1931.25	1.392
MID	1960.00	1.404
HIGH	1993.75	1.392

(Downlink)-WCDMA

Channel	Frequency(MHz)	26dB Bandwidth(MHz)
LOW	1932.50	4.682
MID	1962.50	4.640
HIGH	1992.50	4.683

(Downlink)-GSM

Channel	Frequency(MHz)	26dB Bandwidth(MHz)
LOW	1930.20	0.315
MID	1960.00	0.316
HIGH	1989.80	0.315

(Downlink)-LTE 5M

Channel	Frequency(MHz)	26dB Bandwidth(MHz)
LOW	1933.00	4.899
MID	1960.00	4.827
HIGH	1992.00	4.871

(Downlink)-LTE 10M

Channel	Frequency(MHz)	26dB Bandwidth(MHz)
LOW	1935.00	9.615
MID	1962.50	9.490
HIGH	1990.00	9.866

(Downlink)-LTE 15M

Channel	Frequency(MHz)	26dB Bandwidth(MHz)
LOW	1937.50	14.629
MID	1962.50	14.570
HIGH	1987.50	14.556

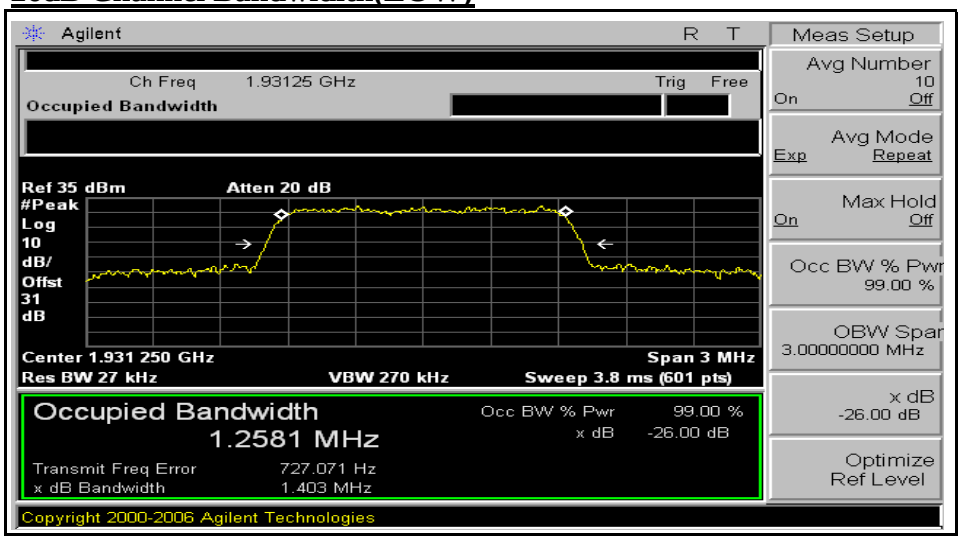
(Downlink)-LTE 20M

Channel	Frequency(MHz)	26dB Bandwidth(MHz)
LOW	1940.00	19.594
MID	1962.50	19.009
HIGH	1985.00	19.554

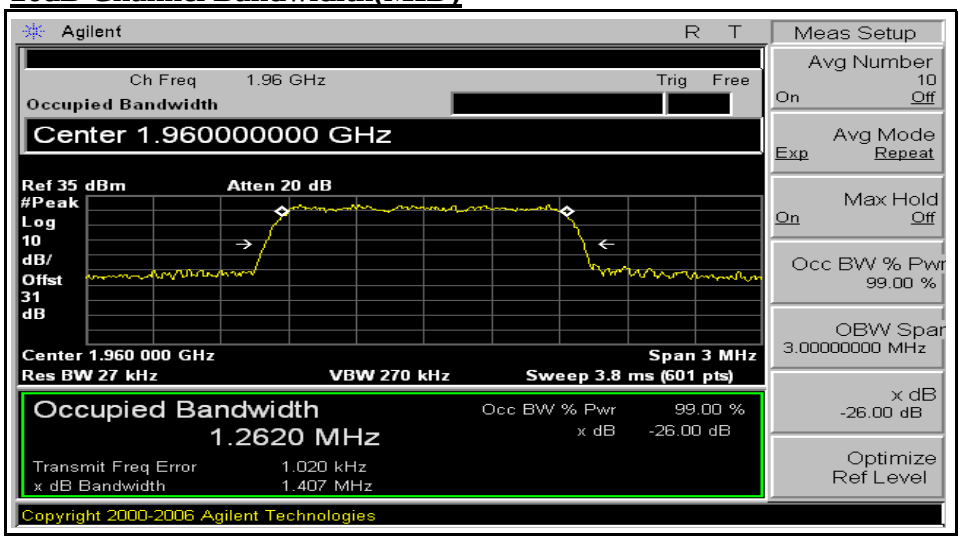
5.4 Test Plot

Downlink-CDMA

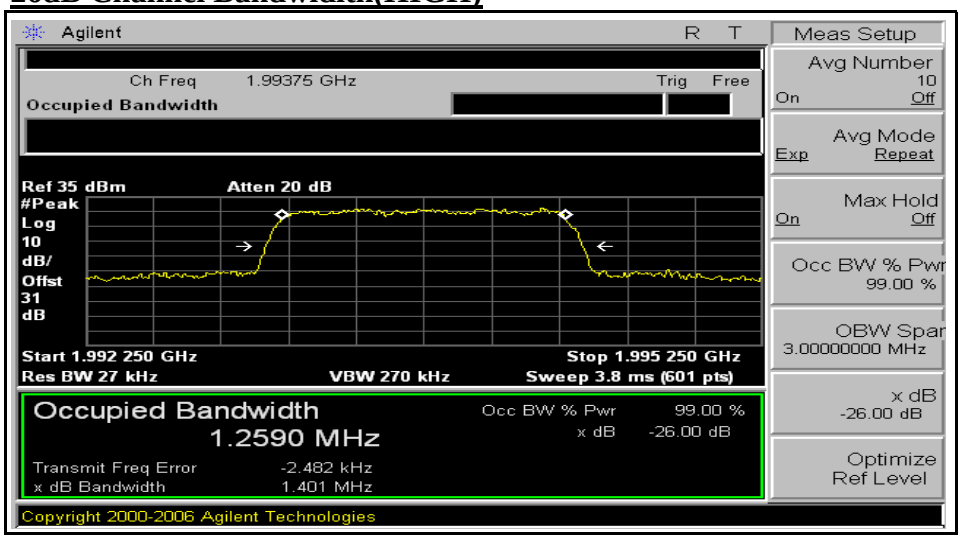
26dB Channel Bandwidith(LOW)



26dB Channel Bandwidith(MID)

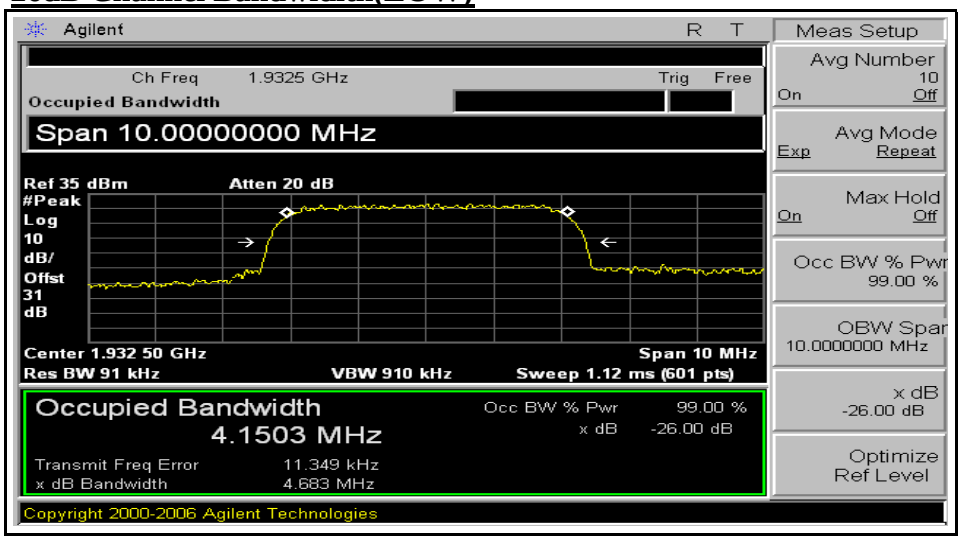


26dB Channel Bandwidith(HIGH)

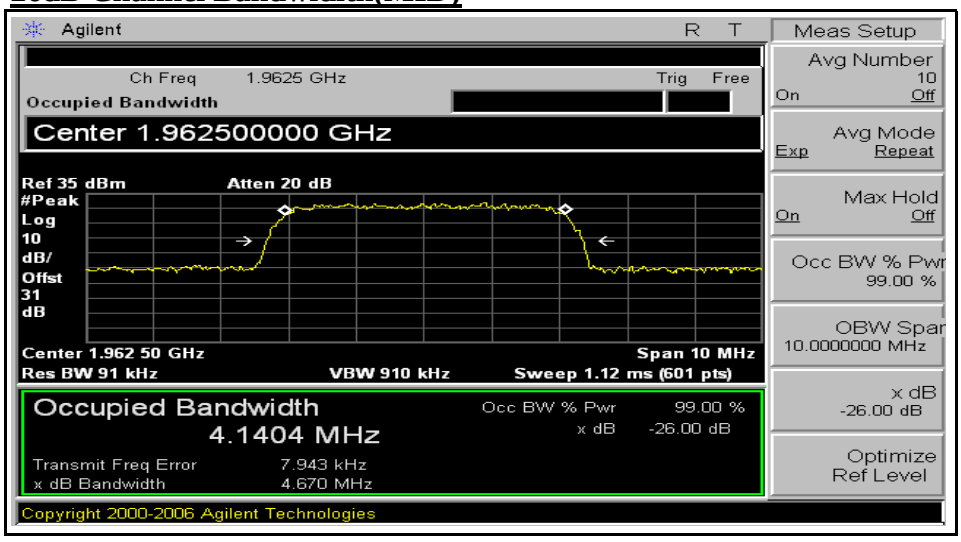


Downlink-WCDMA

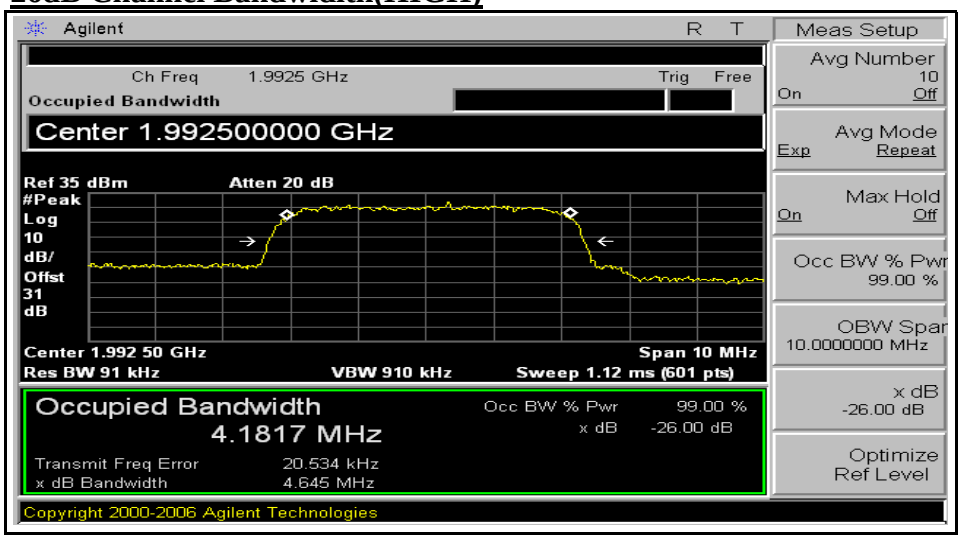
26dB Channel Bandwidith(LOW)



26dB Channel Bandwidith(MID)

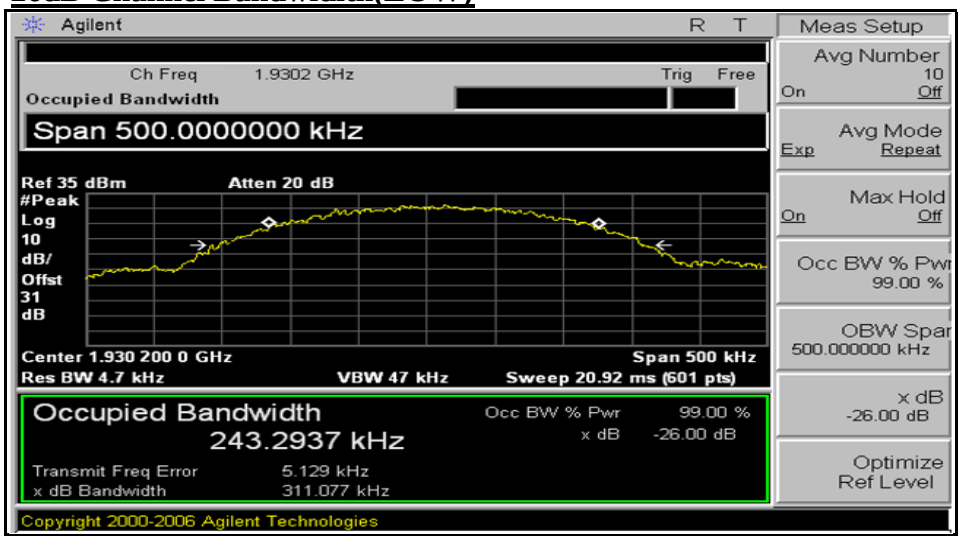


26dB Channel Bandwidith(HIGH)

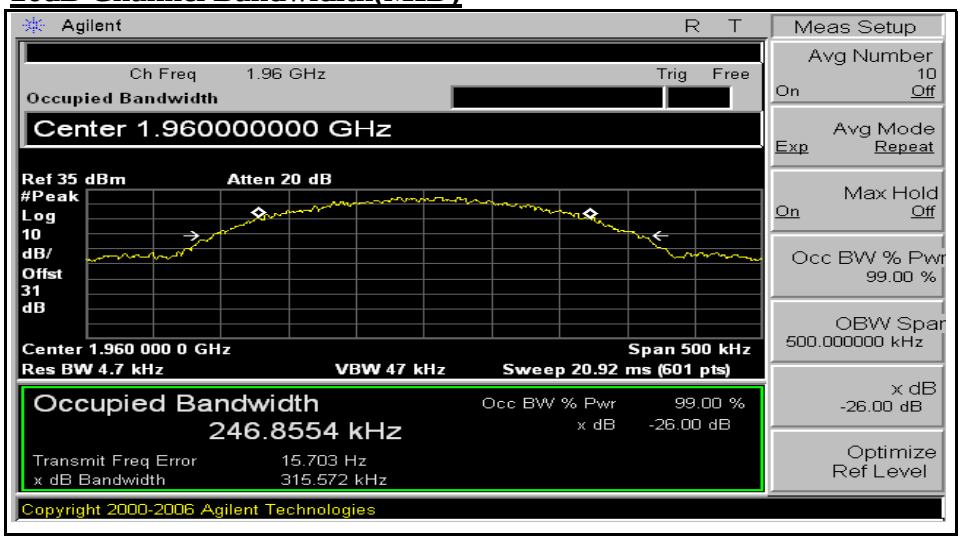


Downlink-GSM

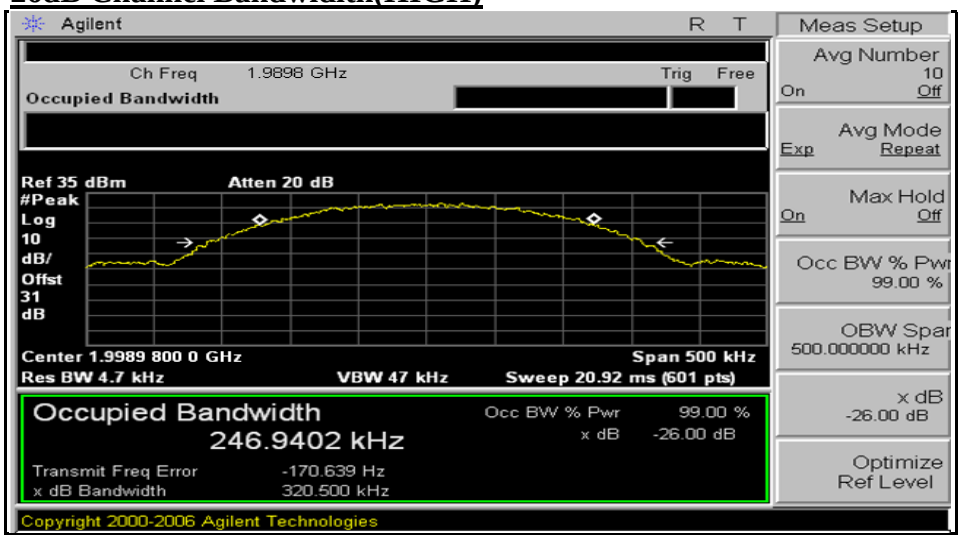
26dB Channel Bandwidith(LOW)



26dB Channel Bandwidith(MID)

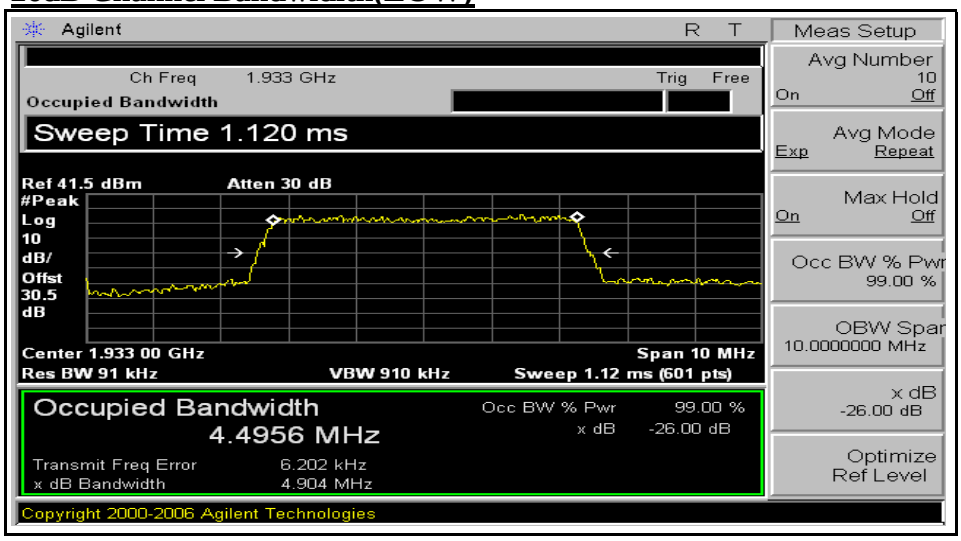


26dB Channel Bandwidith(HIGH)

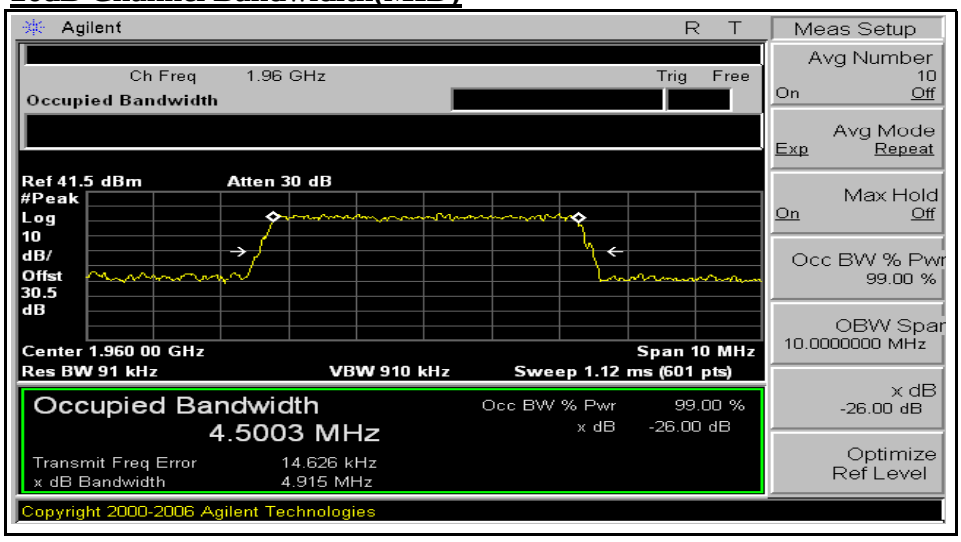


Downlink-LTE 5M

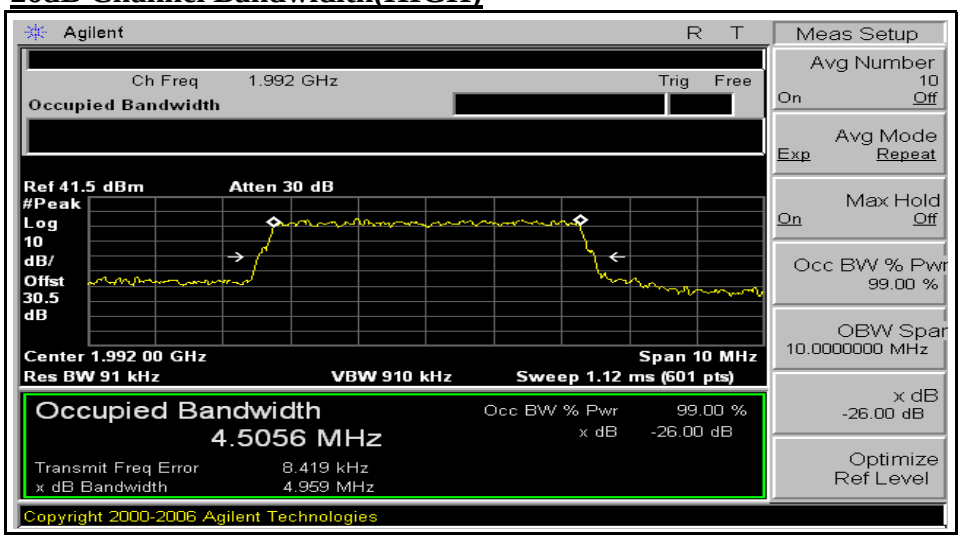
26dB Channel Bandwidith(LOW)



26dB Channel Bandwidith(MID)

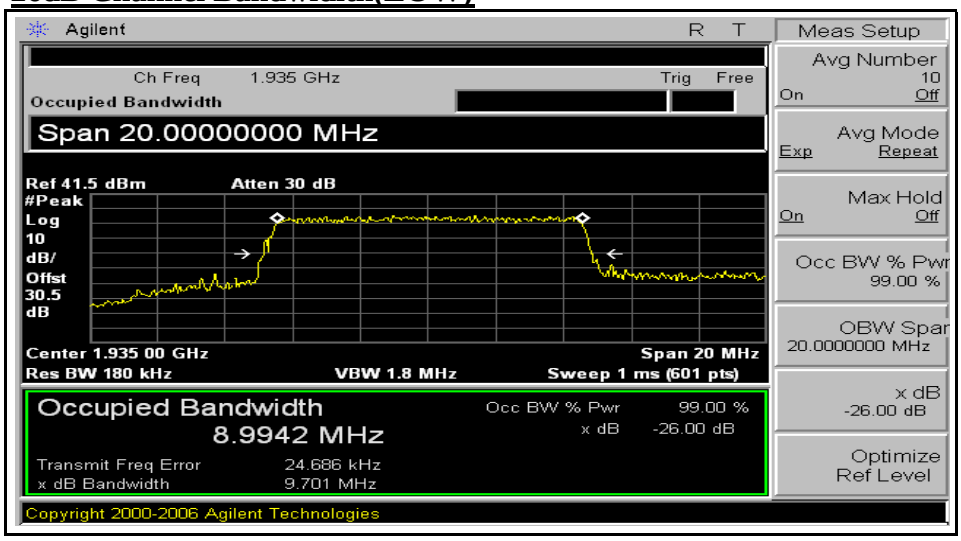


26dB Channel Bandwidith(HIGH)

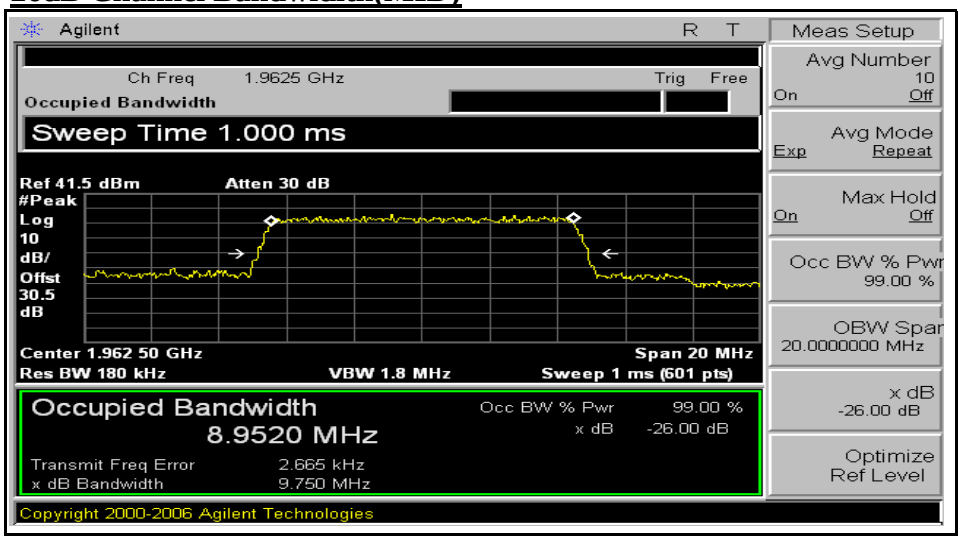


Downlink-LTE 10M

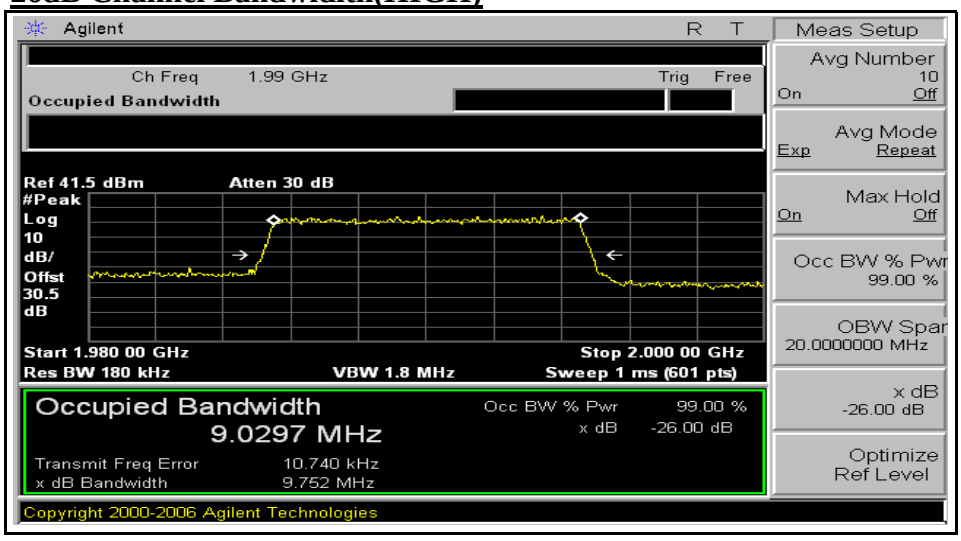
26dB Channel Bandwidith(LOW)



26dB Channel Bandwidith(MID)

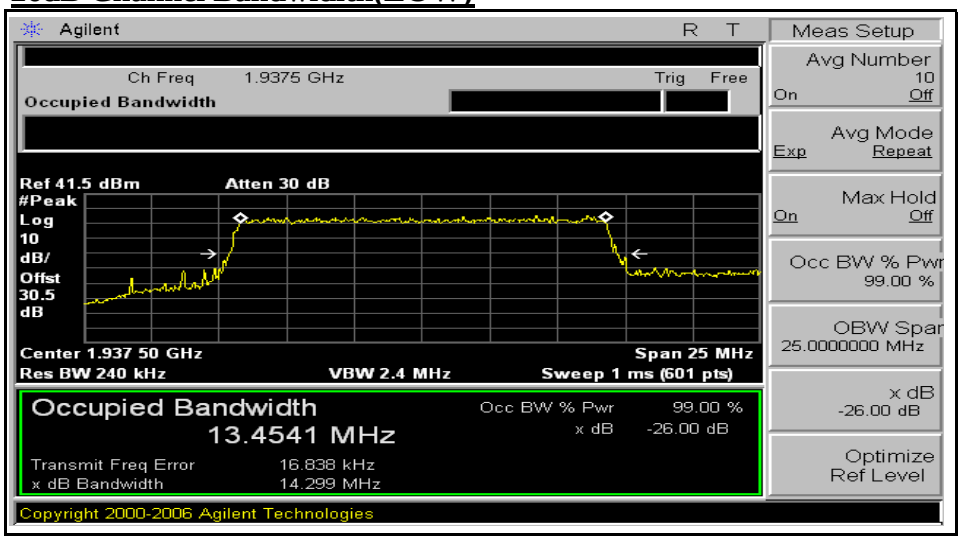


26dB Channel Bandwidith(HIGH)

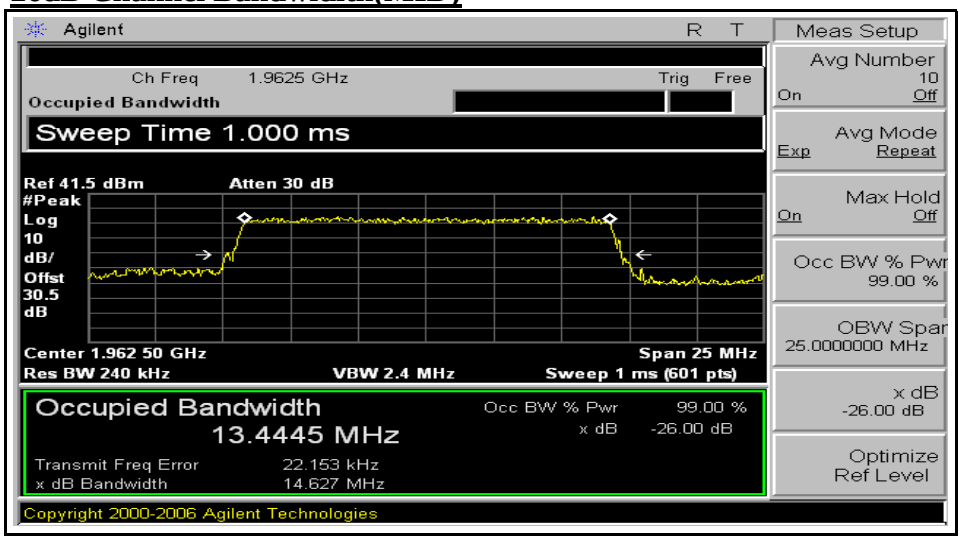


Downlink-LTE 15M

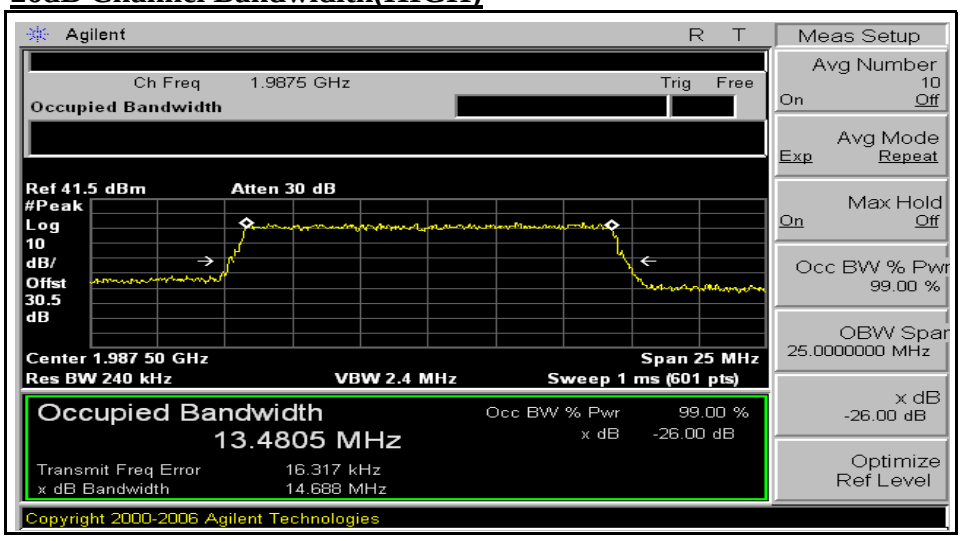
26dB Channel Bandwidith(LOW)



26dB Channel Bandwidith(MID)

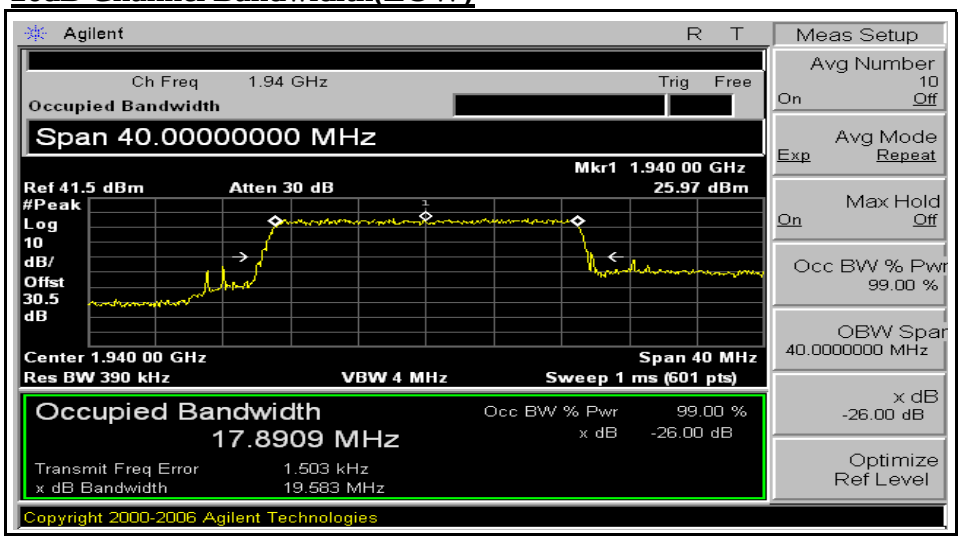


26dB Channel Bandwidith(HIGH)

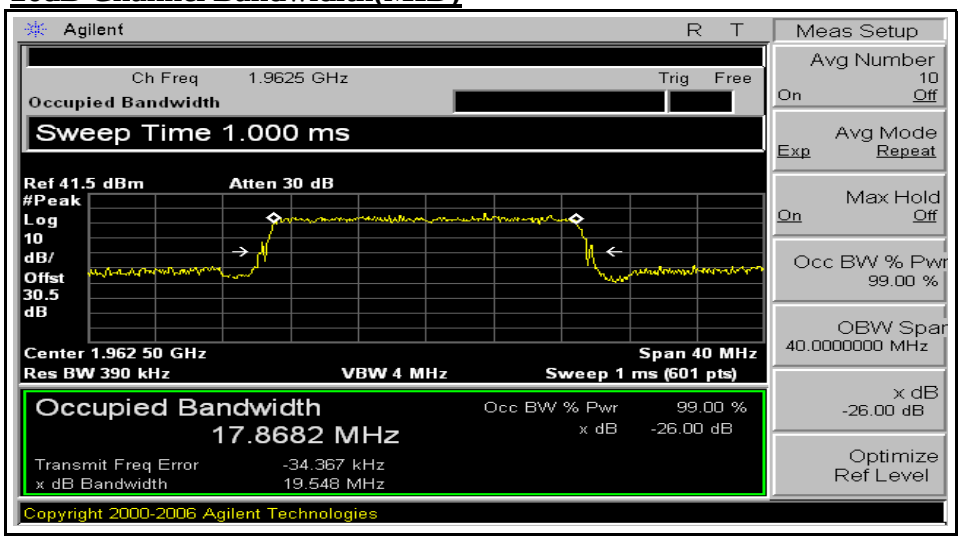


Downlink-LTE 20M

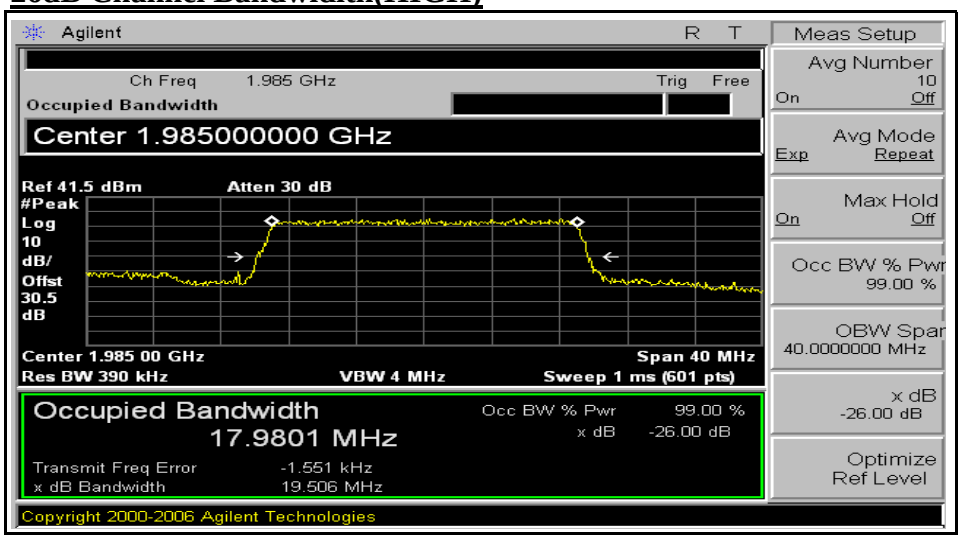
26dB Channel Bandwidith(LOW)



26dB Channel Bandwidith(MID)



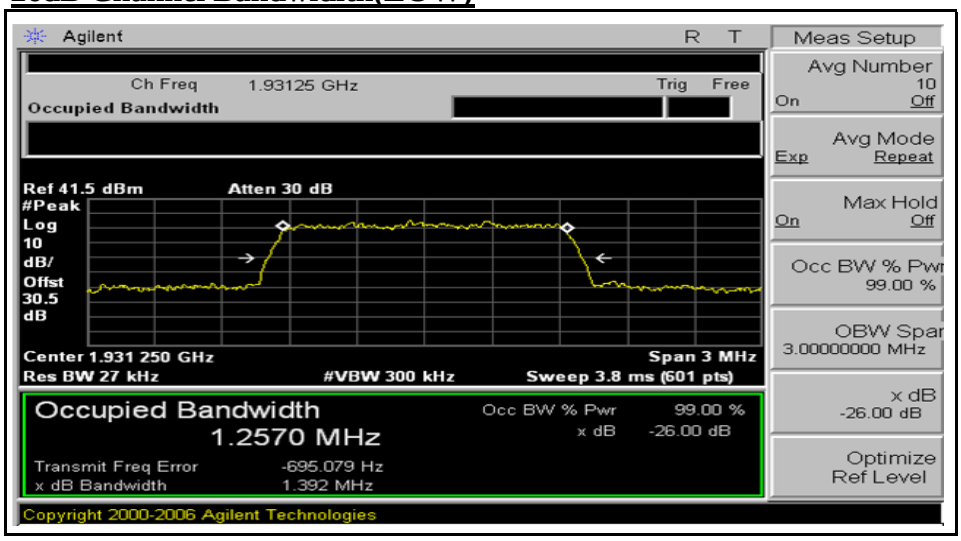
26dB Channel Bandwidith(HIGH)



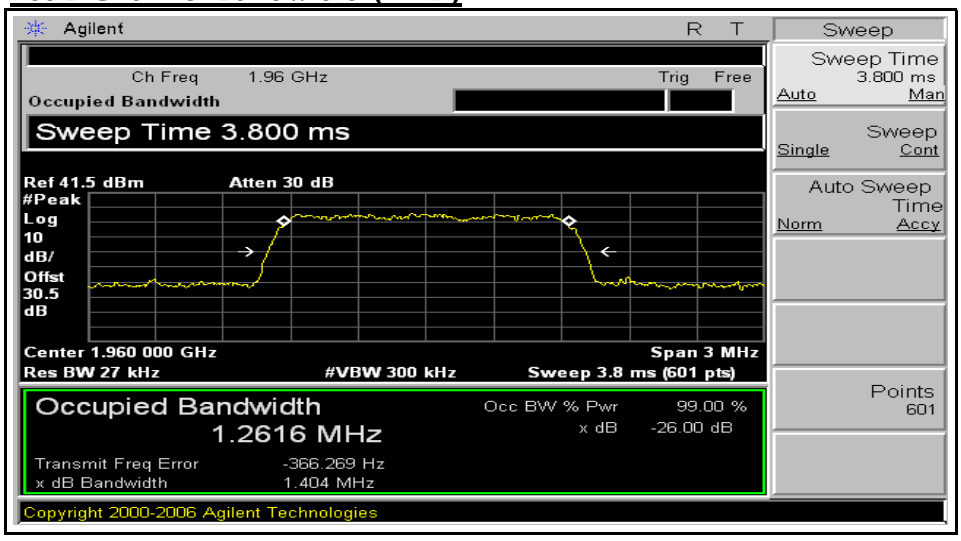
5.4 Test Plot(Without AGC)

Downlink-CDMA

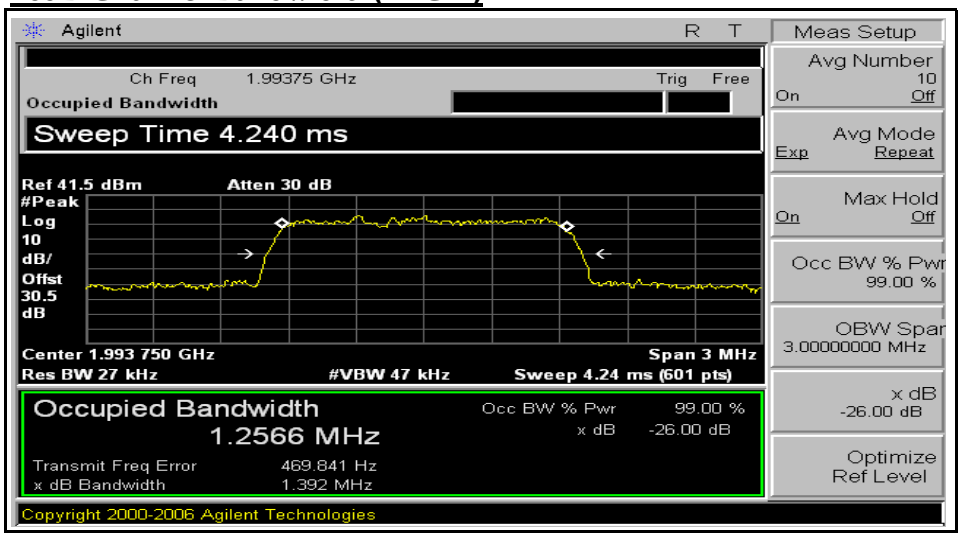
26dB Channel Bandwidth(LOW)



26dB Channel Bandwidth(MID)

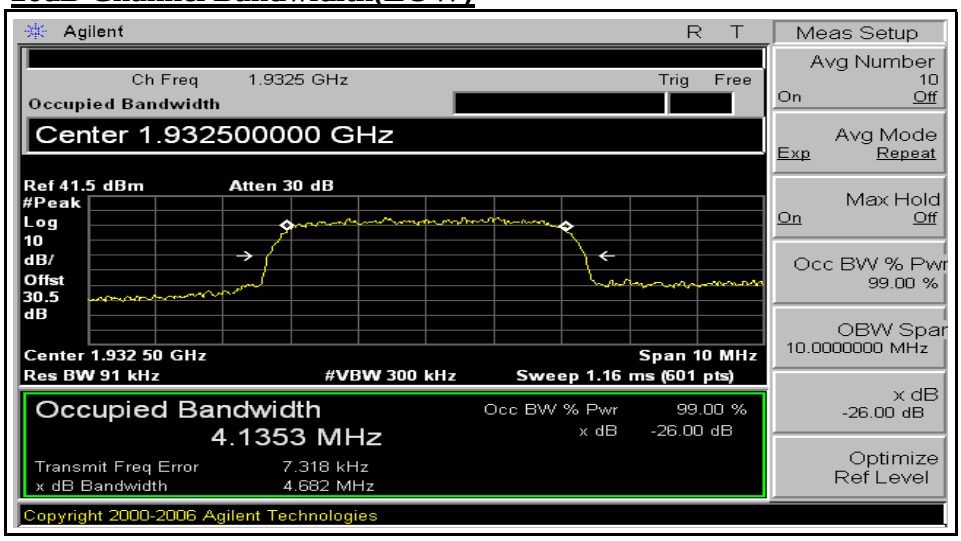


26dB Channel Bandwidth(HIGH)

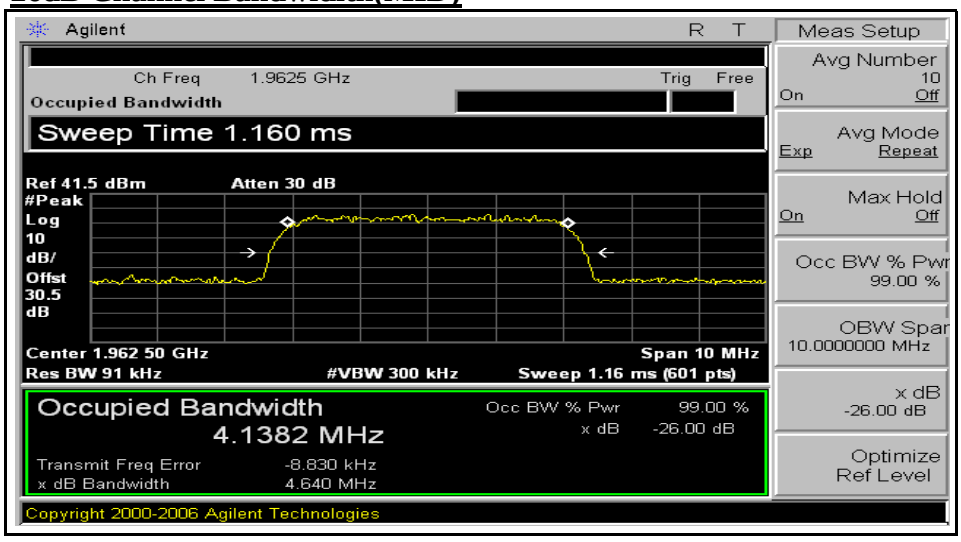


Downlink-WCDMA

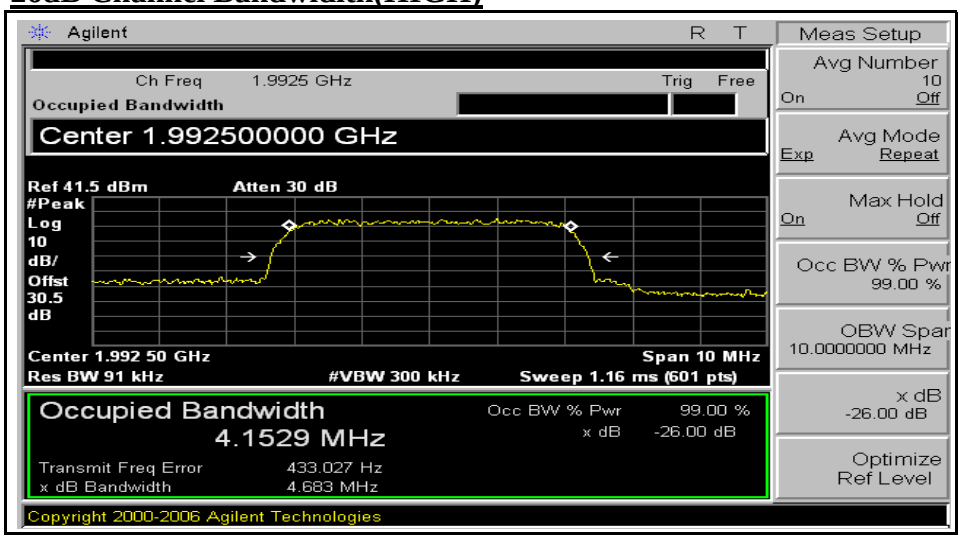
26dB Channel Bandwidith(LOW)



26dB Channel Bandwidith(MID)

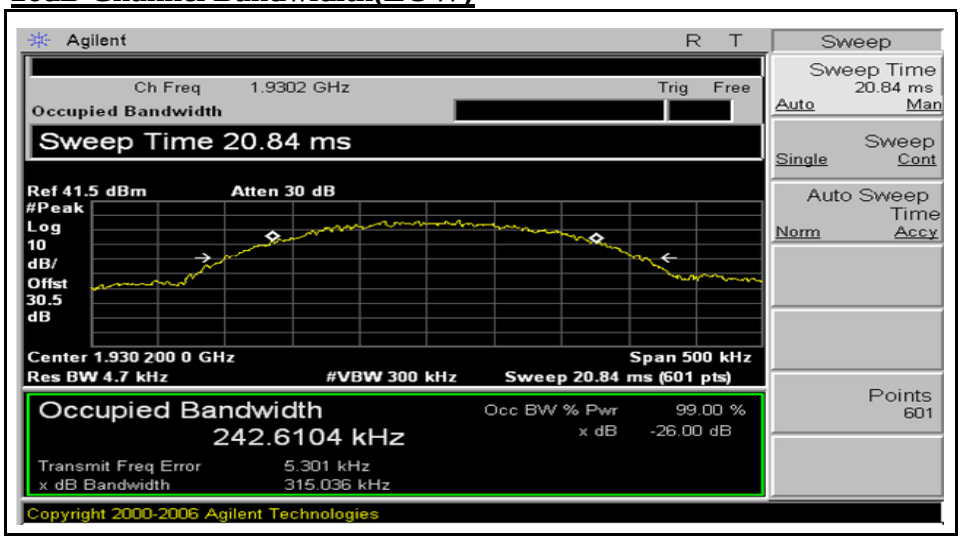


26dB Channel Bandwidith(HIGH)

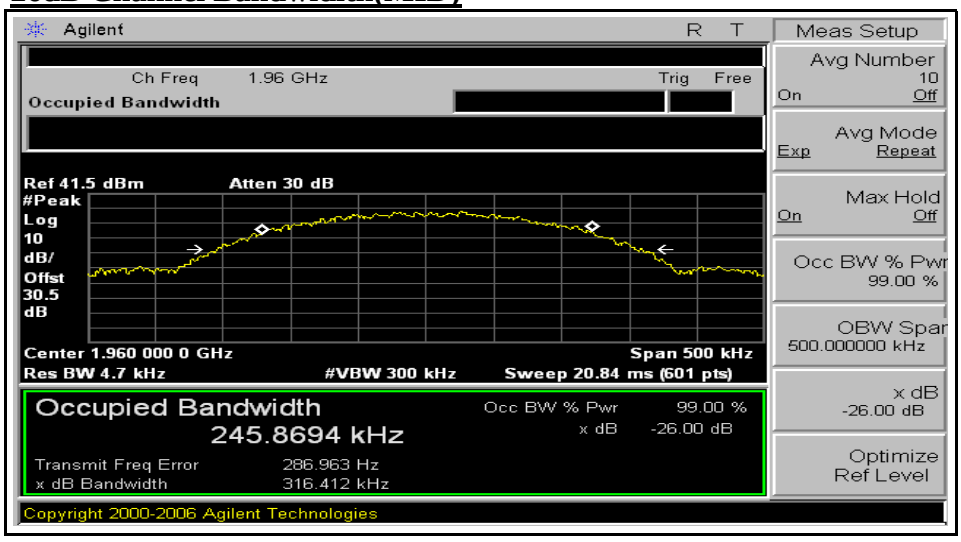


Downlink-GSM

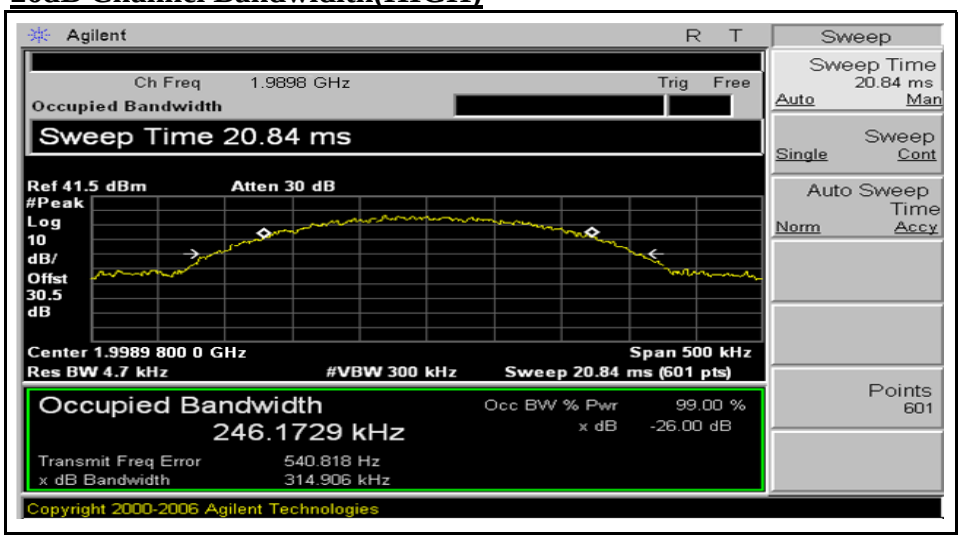
26dB Channel Bandwidith(LOW)



26dB Channel Bandwidith(MID)

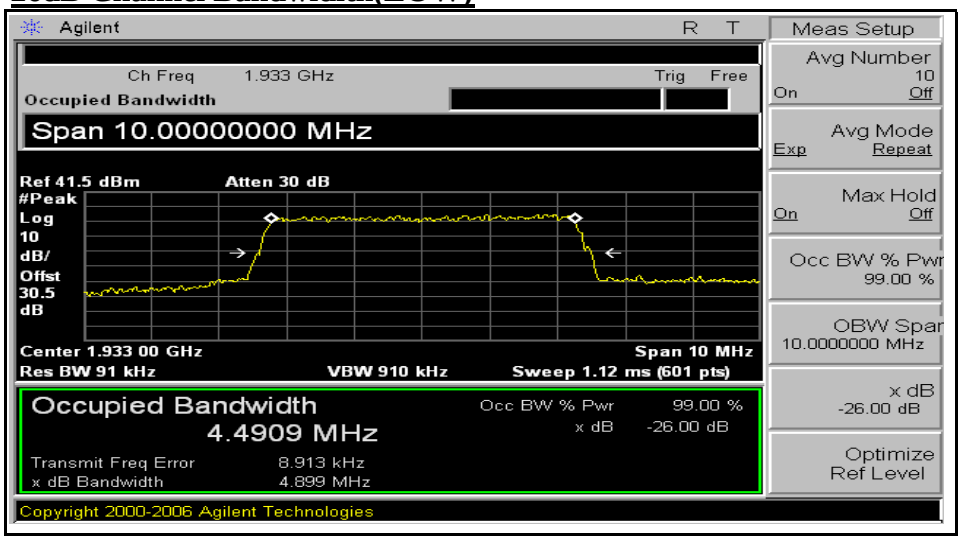


26dB Channel Bandwidith(HIGH)

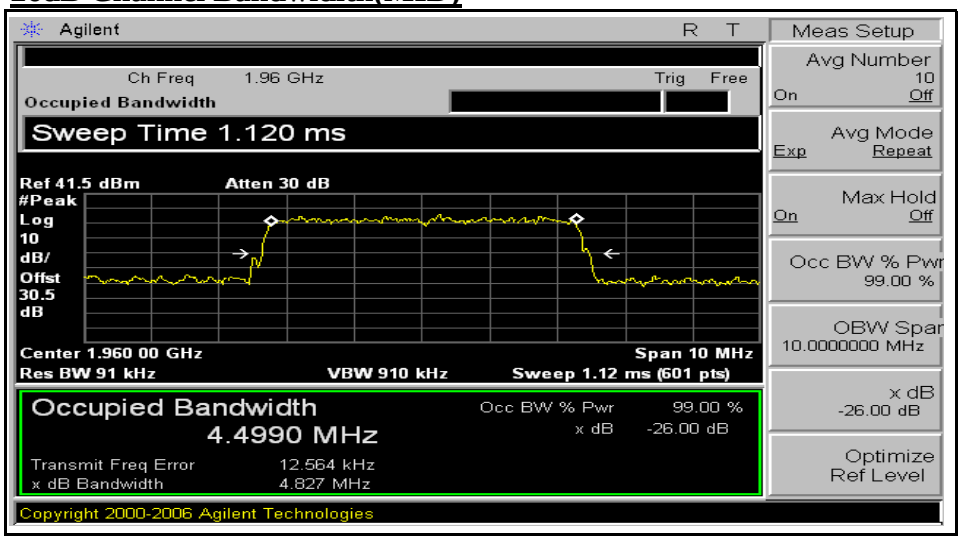


Downlink-LTE 5M

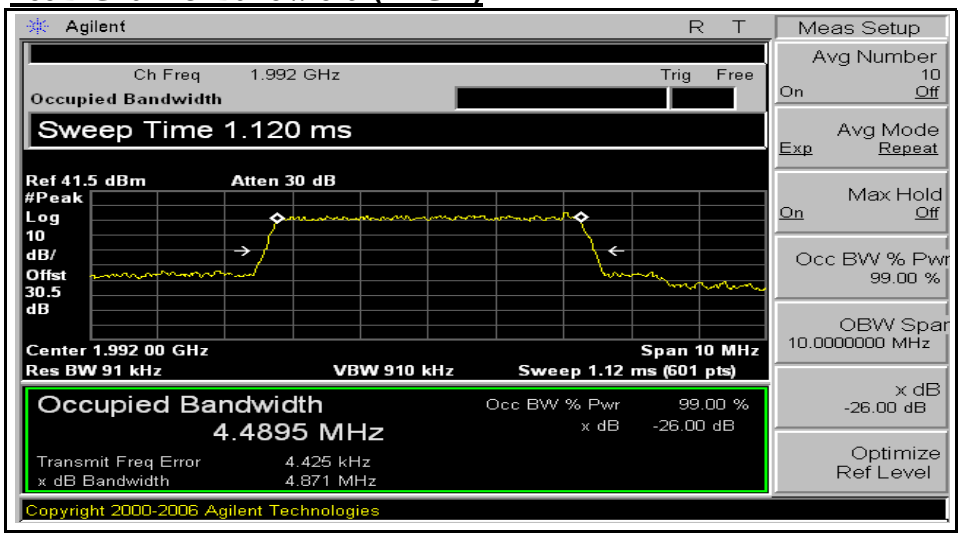
26dB Channel Bandwidith(LOW)



26dB Channel Bandwidith(MID)

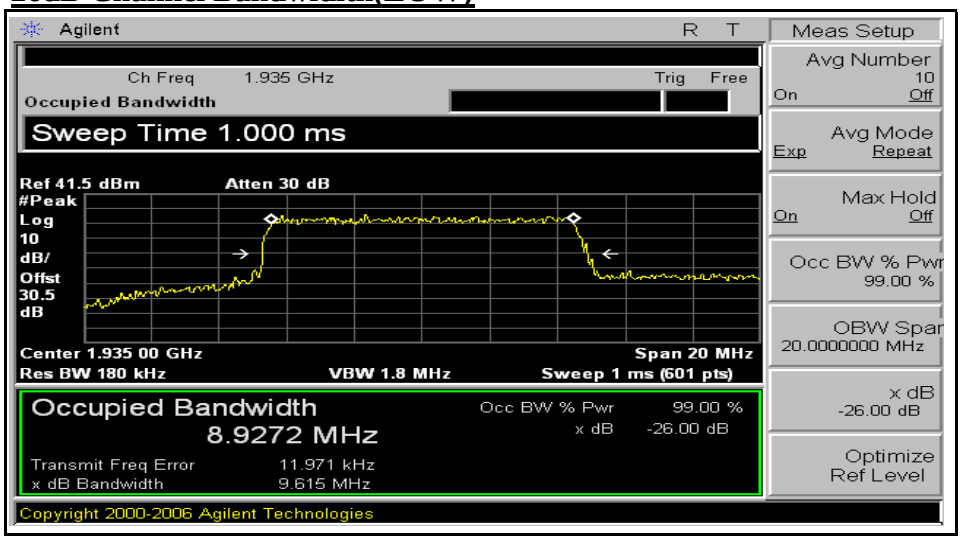


26dB Channel Bandwidith(HIGH)

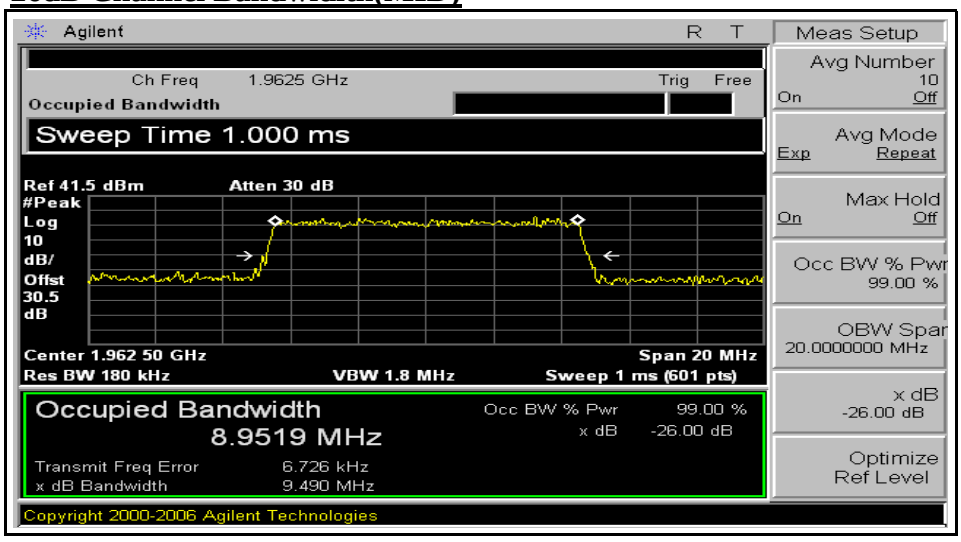


Downlink-LTE 10M

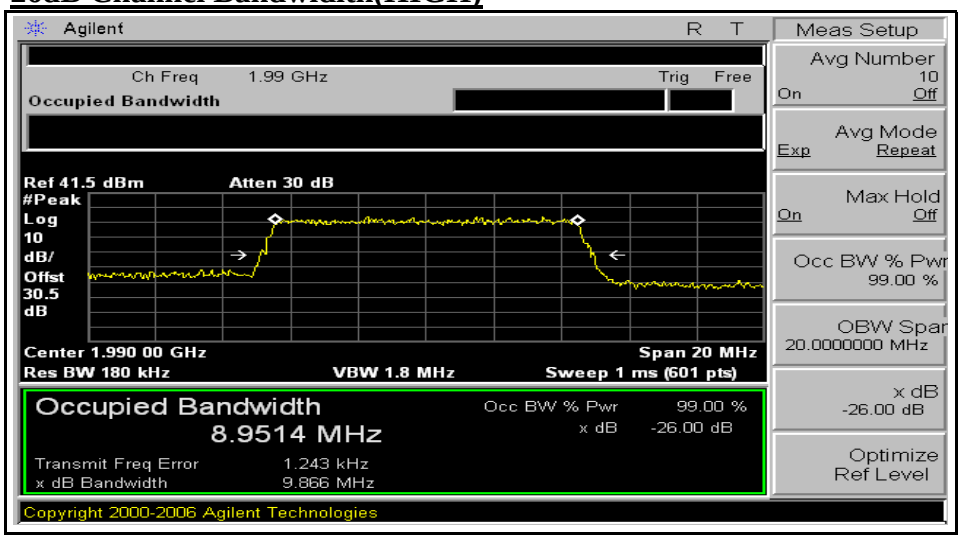
26dB Channel Bandwidith(LOW)



26dB Channel Bandwidith(MID)

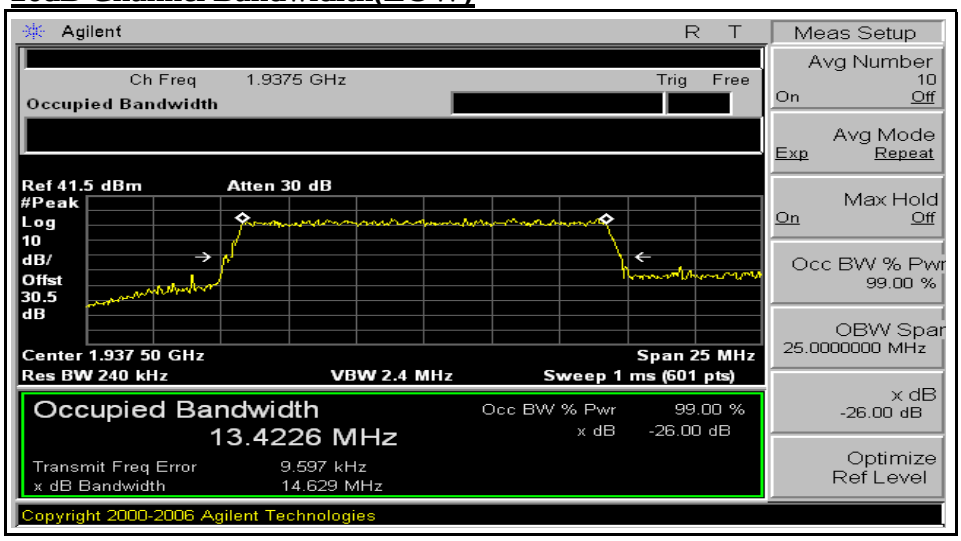


26dB Channel Bandwidith(HIGH)

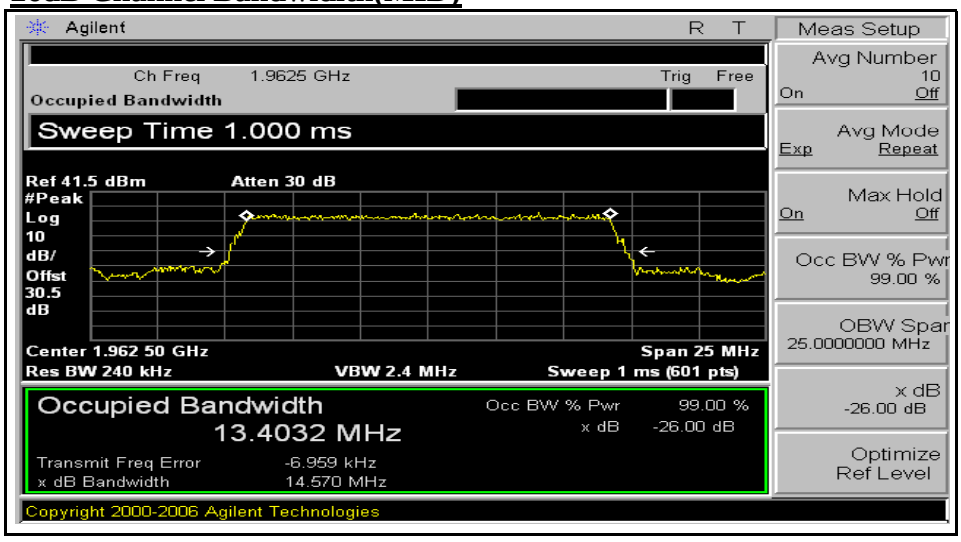


Downlink-LTE 15M

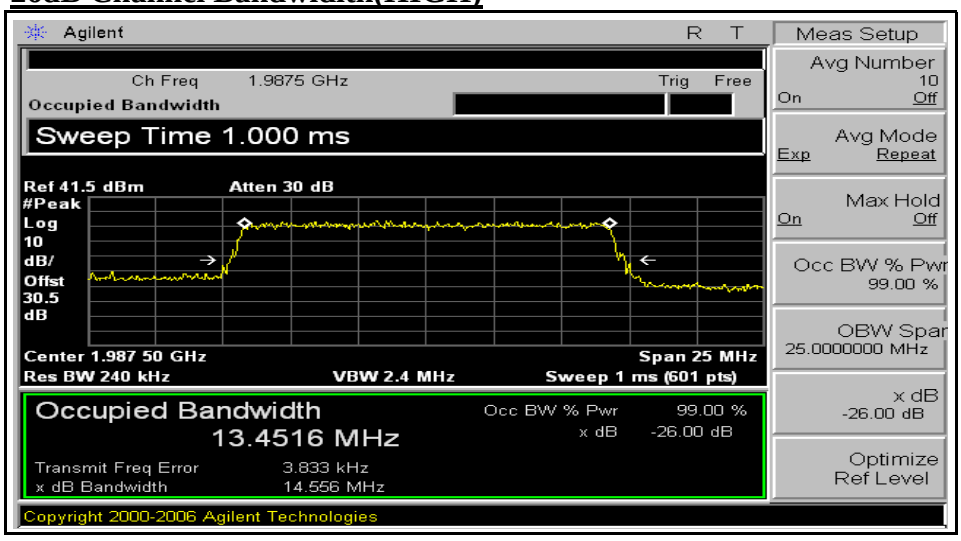
26dB Channel Bandwidith(LOW)



26dB Channel Bandwidith(MID)

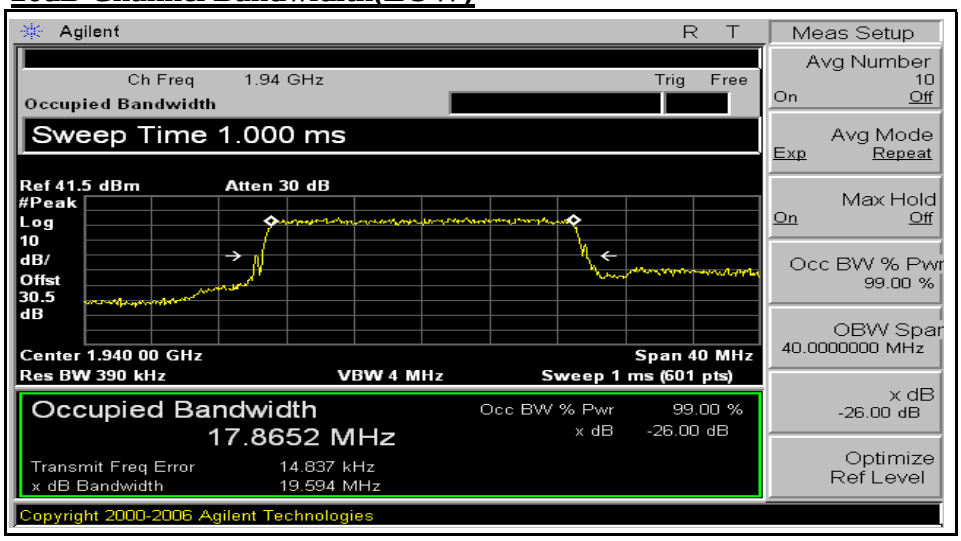


26dB Channel Bandwidith(HIGH)

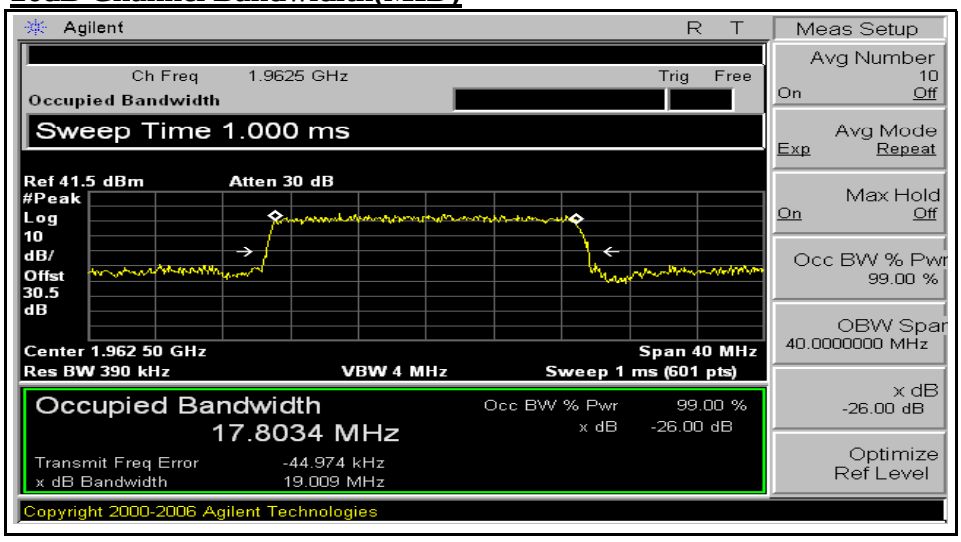


Downlink-LTE 20M

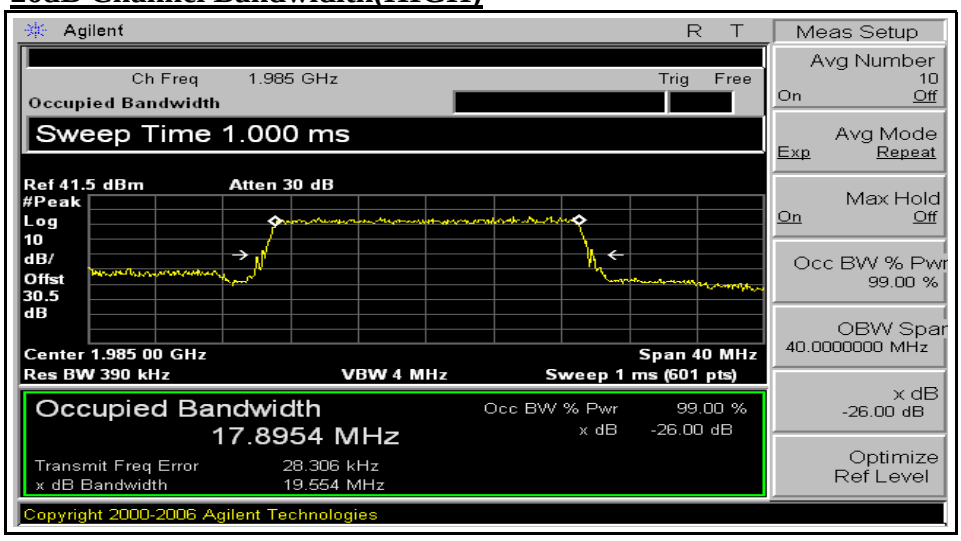
26dB Channel Bandwidth(LOW)



26dB Channel Bandwidth(MID)



26dB Channel Bandwidth(HIGH)



6. Out of Band , Band Edge Emission , Intermodulation

6.1 Test Procedure

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of acalibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment upto 20GHz. Set the RES BW to 1% of the emission bandwidth to show compliance with the -13dBm, limit, in the1MHz bands immediately outside and adjacent to the top and bottom edges of the frequency block

6.2 Test Equipments

The following test equipments are used during tests

Equipment	Manufacturer	Model	Next Cal.
Spectrum Analyzer	Agilent	E4440A	2014-01-27
Vector Signal Generator	ROHDE&SCHWARZ	SMBV100A	2014-01-25
Signal Generator	HP	E4432B	2014-01-27
Attenuator	SRT	F04-K1830-01	2014-01-27
Power divider	PULSAR	PS4-24-452/10S	2014-01-27

6.3 Test Results (Downlink)

	Channel	Frequency	Result	Limit	Margin
Band Edge (CDMA)	LOW	1931.25	-23.47	-13.00	10.47
	HIGH	1993.75	-23.27	-13.00	10.27
Out of Band (CDMA)	LOW	1931.25	-36.76	-13.00	23.76
	MID	1960.00	-36.97	-13.00	23.97
	HIGH	1993.75	-36.57	-13.00	23.57

Intermodulation (CDMA)	Result	Limit	Margin
	-23.24	-13.00	10.24

	Channel	Frequency	Result	Limit	Margin
Band Edge (WCDMA)	LOW	1932.50	-23.47	-13.00	10.47
	HIGH	1992.50	-23.27	-13.00	10.27
Out of Band (WCDMA)	LOW	1932.50	-36.76	-13.00	23.76
	MID	1962.50	-36.97	-13.00	23.97
	HIGH	1992.50	-36.57	-13.00	23.57

Intermodulation (WCDMA)	Result	Limit	Margin
	-23.44	-13.00	10.44

	Channel	Frequency	Result	Limit	Margin
Band Edge (GSM)	LOW	1930.20	-23.47	-13.00	10.47
	HIGH	1989.80	-23.27	-13.00	10.27
Out of Band (GSM)	LOW	1930.20	-36.76	-13.00	23.76
	MID	1960.00	-36.97	-13.00	23.97
	HIGH	1989.80	-36.57	-13.00	23.57

Intermodulation (GSM)	Result	Limit	Margin
	-23.64	-13.00	10.64

	Channel	Frequency	Result	Limit	Margin
Band Edge (LTE 5M)	LOW	1933.00	-23.47	-13.00	10.47
	HIGH	1992.00	-23.27	-13.00	10.27
Out of Band (LTE 5M)	LOW	1933.00	-36.76	-13.00	23.76
	MID	1960.00	-36.97	-13.00	23.97
	HIGH	1992.00	-36.57	-13.00	23.57

Intermodulation (LTE 5M)	Result	Limit	Margin
	-22.77	-13.00	9.77

Note : Measurements made with 100 kHz RBW. Correction factor of 10log(1 MHz/100 kHz) will lead to a 10 dB conservative increase in the measured power.

	Channel	Frequency	Result	Limit	Margin
Band Edge (LTE 10M)	LOW	1935.00	-27.17	-13.00	14.17
	HIGH	1990.00	-23.58	-13.00	10.58
Out of Band (LTE 10M)	LOW	1935.00	-35.70	-13.00	22.70
	MID	1962.50	-35.57	-13.00	22.57
	HIGH	1990.00	-38.14	-13.00	25.14

Intermodulation (LTE 10M)	Result	Limit	Margin
	-22.35	-13.00	9.35

	Channel	Frequency	Result	Limit	Margin
Band Edge (LTE 15M)	LOW	1937.50	-28.28	-13.00	15.28
	HIGH	1987.50	-23.77	-13.00	10.77
Out of Band (LTE 15M)	LOW	1937.50	-36.97	-13.00	23.97
	MID	1962.50	-38.81	-13.00	25.81
	HIGH	1987.50	-36.14	-13.00	23.14

Intermodulation (LTE 15M)	Result	Limit	Margin
	-23.49	-13.00	10.49

	Channel	Frequency	Result	Limit	Margin
Band Edge (LTE 20M)	LOW	1940.00	-27.10	-13.00	14.10
	HIGH	1985.00	-25.36	-13.00	12.36
Out of Band (LTE 20M)	LOW	1940.00	-37.82	-13.00	24.82
	MID	1962.50	-35.10	-13.00	22.10
	HIGH	1985.00	-36.37	-13.00	23.37

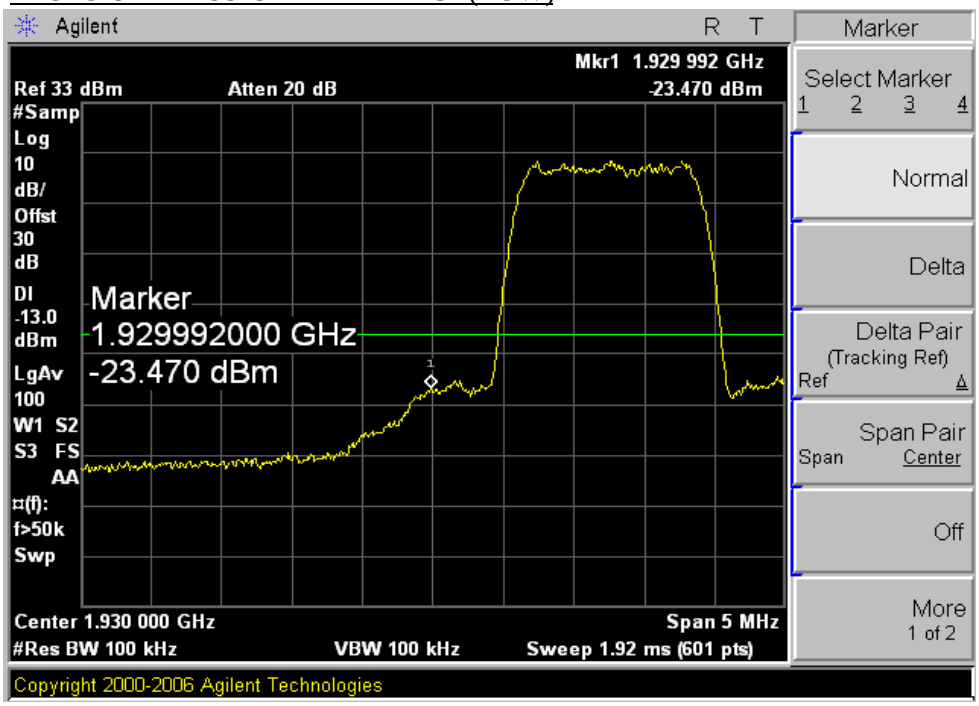
Intermodulation (LTE 20M)	Result	Limit	Margin
	-23.65	-13.00	10.65

Note : Measurements made with 100 kHz RBW. Correction factor of 10log(1 MHz/100 kHz) will lead to a 10 dB conservative increase in the measured power.

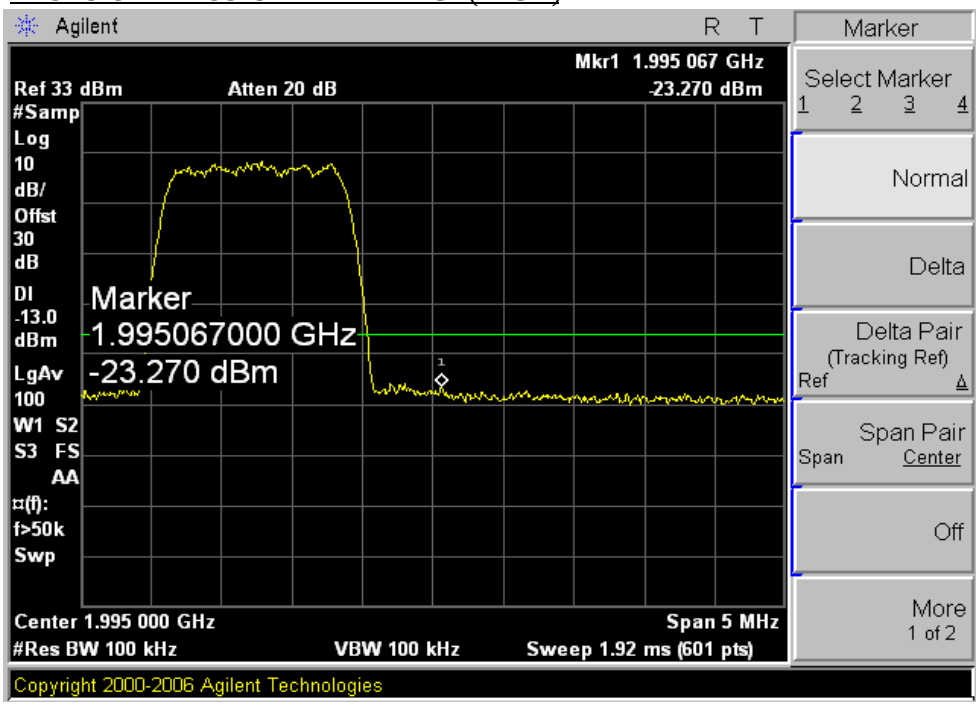
6.4 Test Plot (Band Edge)

Downlink CDMA

PLOTS OF EMISSION BAND EDGE(LOW)

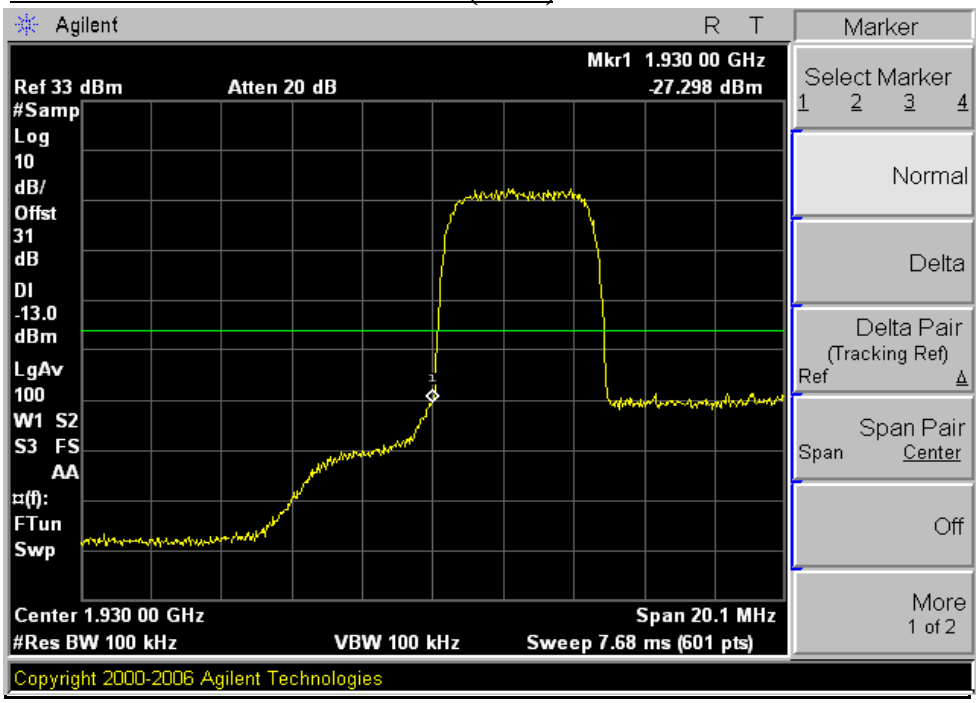


PLOTS OF EMISSION BAND EDGE(HIGH)

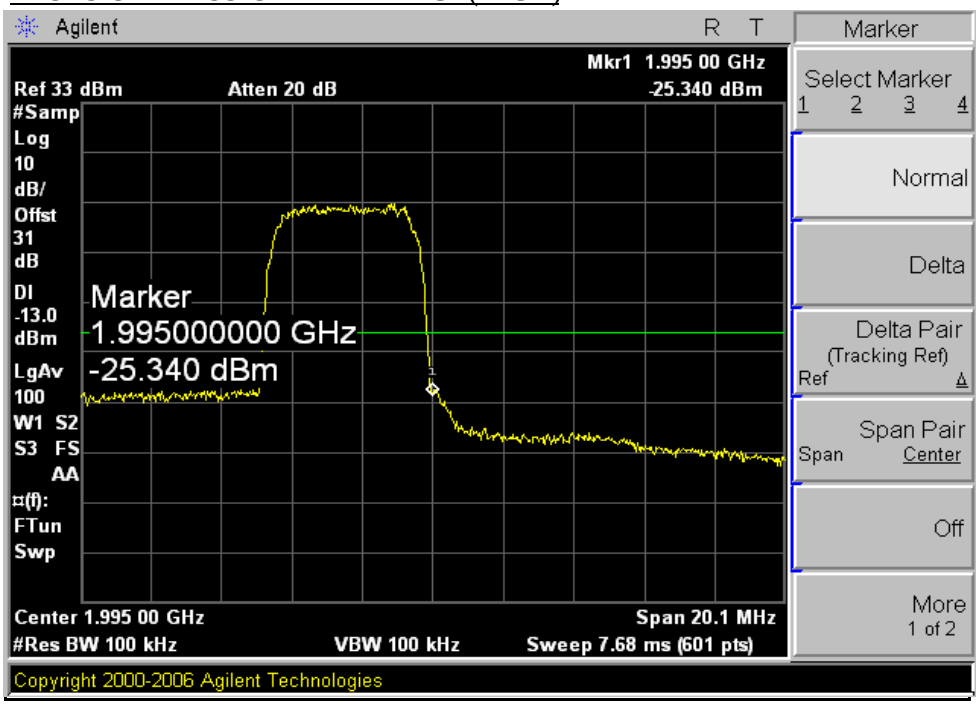


Downlink WCDMA

PLOTS OF EMISSION BAND EDGE(LOW)

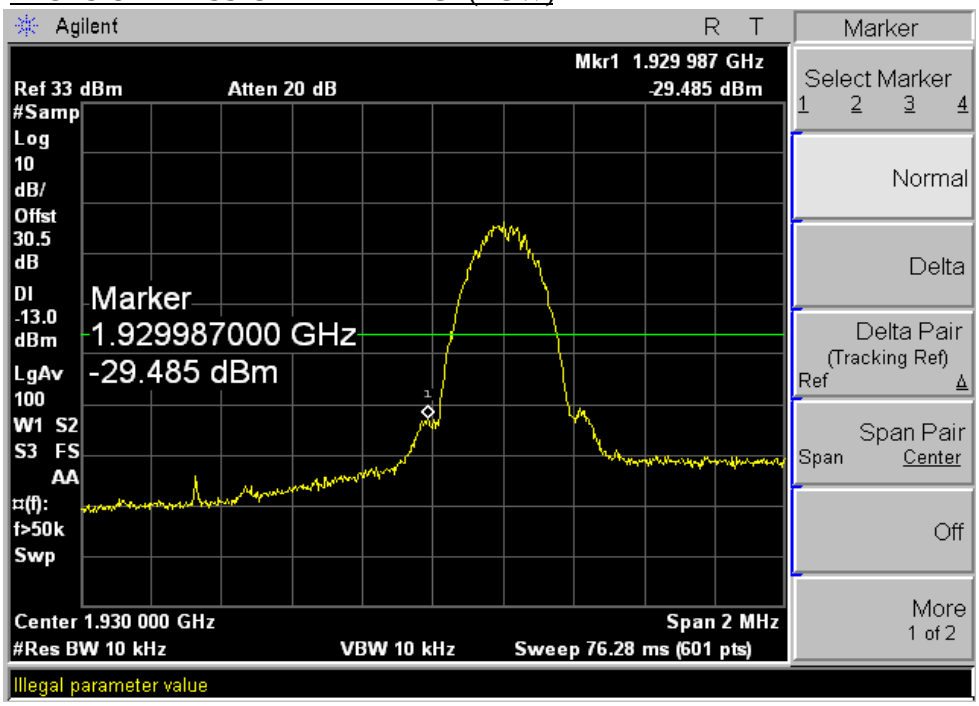


PLOTS OF EMISSION BAND EDGE(HIGH)

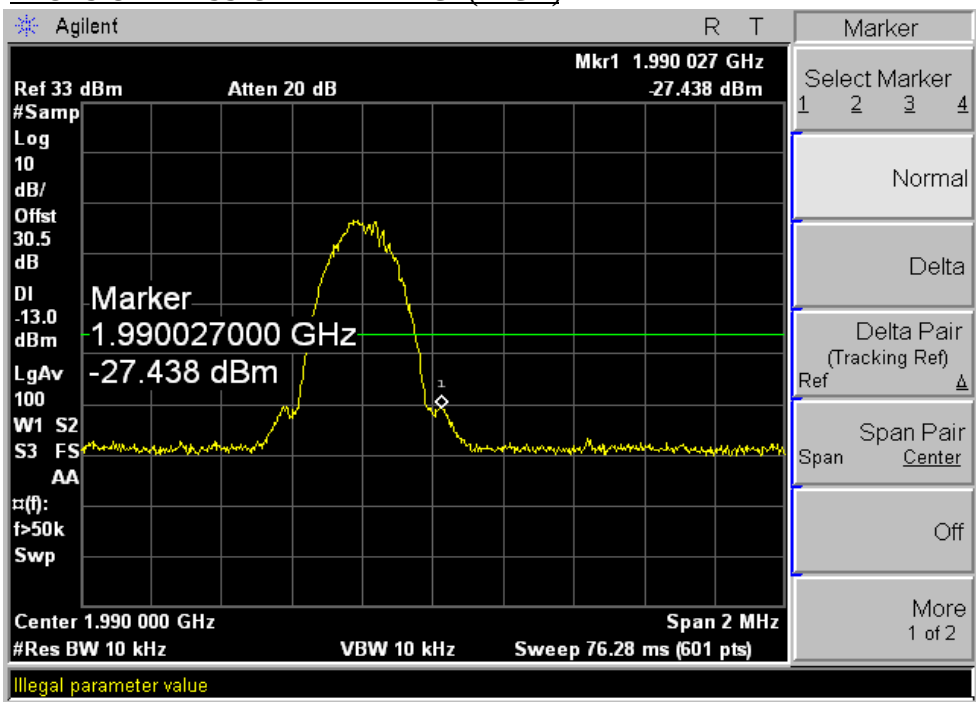


Downlink GSM

PLOTS OF EMISSION BAND EDGE(LOW)

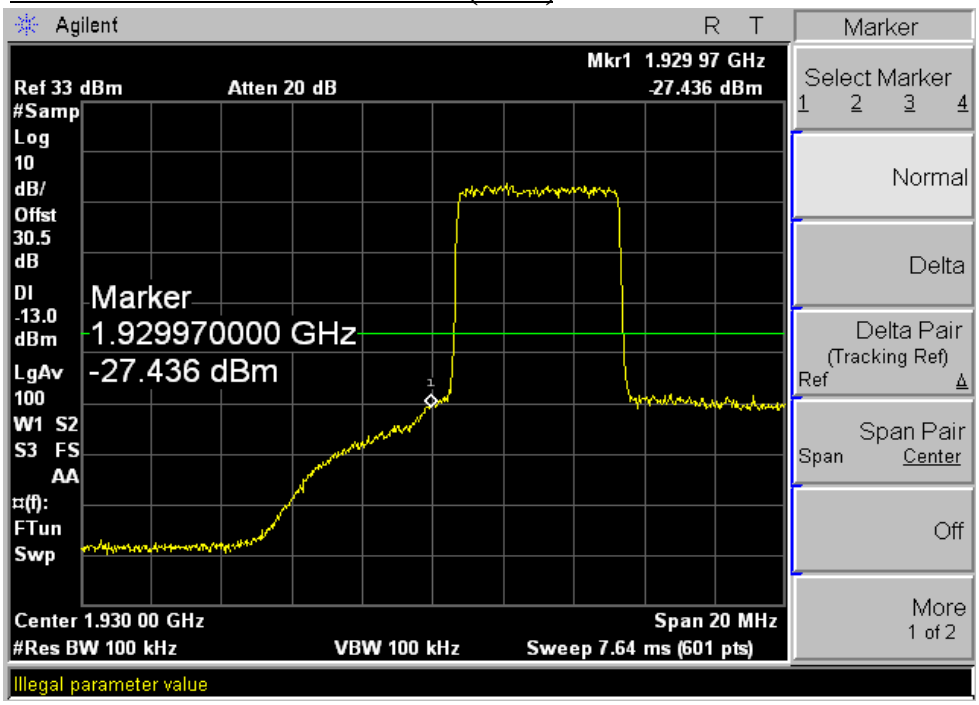


PLOTS OF EMISSION BAND EDGE(HIGH)

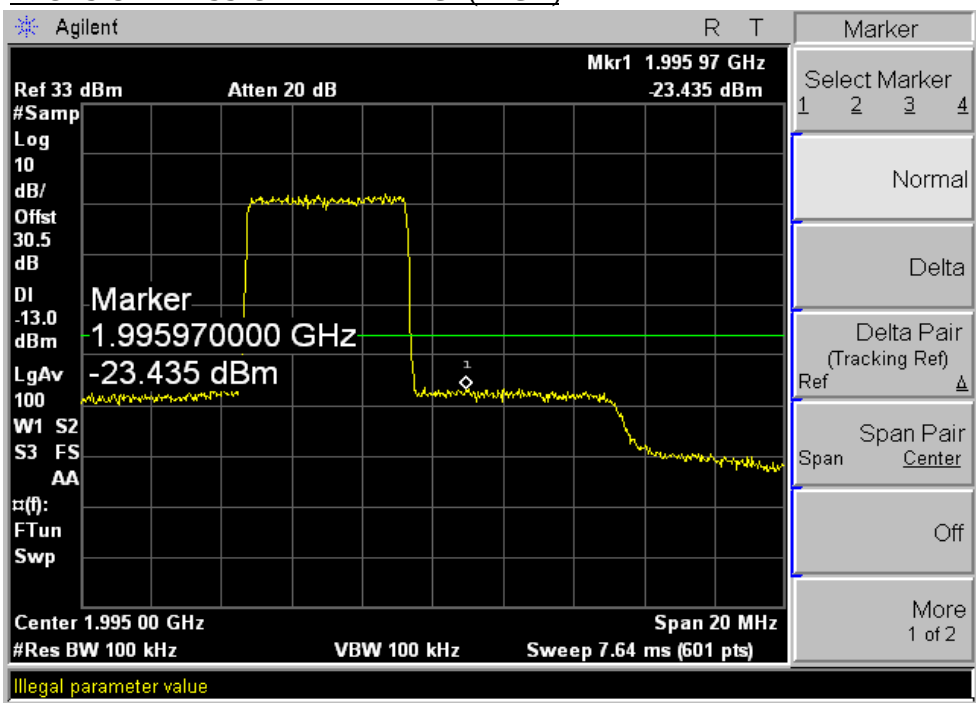


Downlink LTE 5M

PLOTS OF EMISSION BAND EDGE(LOW)

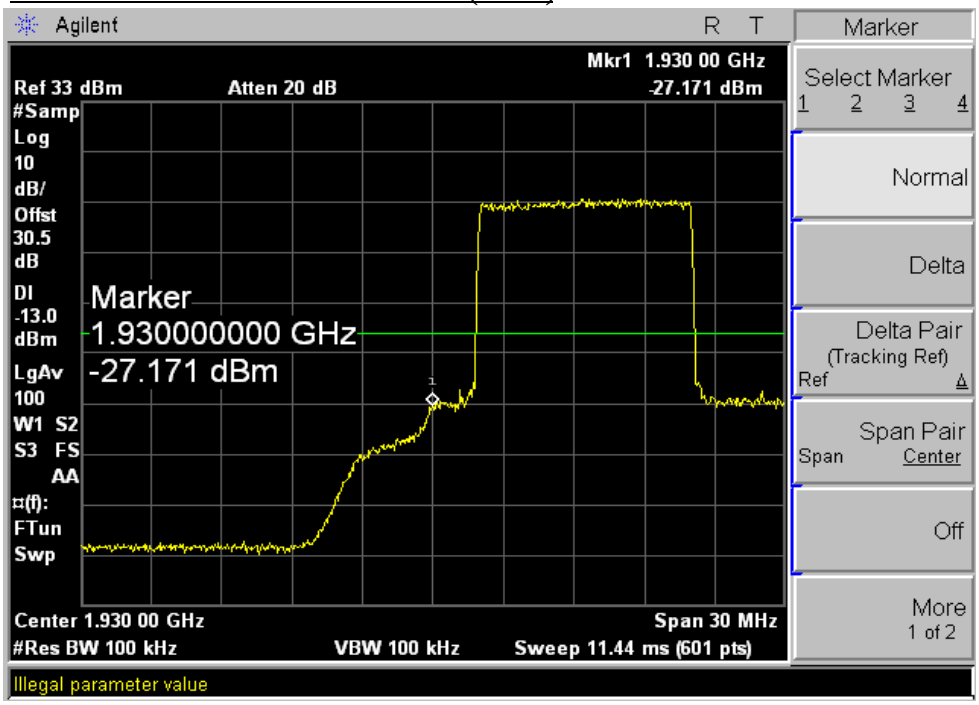


PLOTS OF EMISSION BAND EDGE(HIGH)

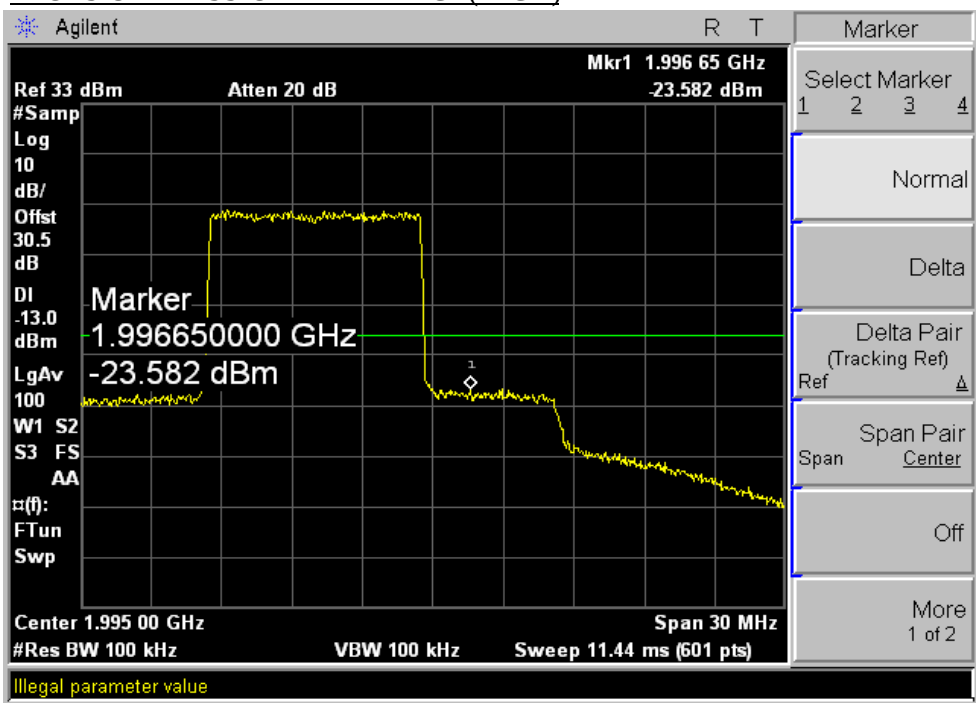


Downlink LTE 10M

PLOTS OF EMISSION BAND EDGE(LOW)

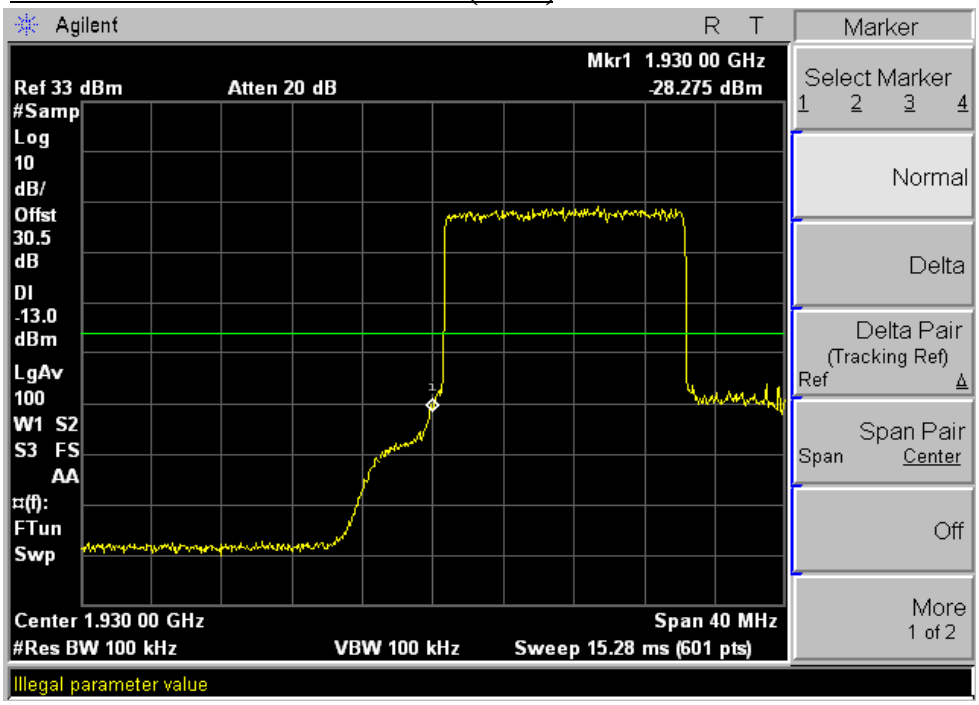


PLOTS OF EMISSION BAND EDGE(HIGH)

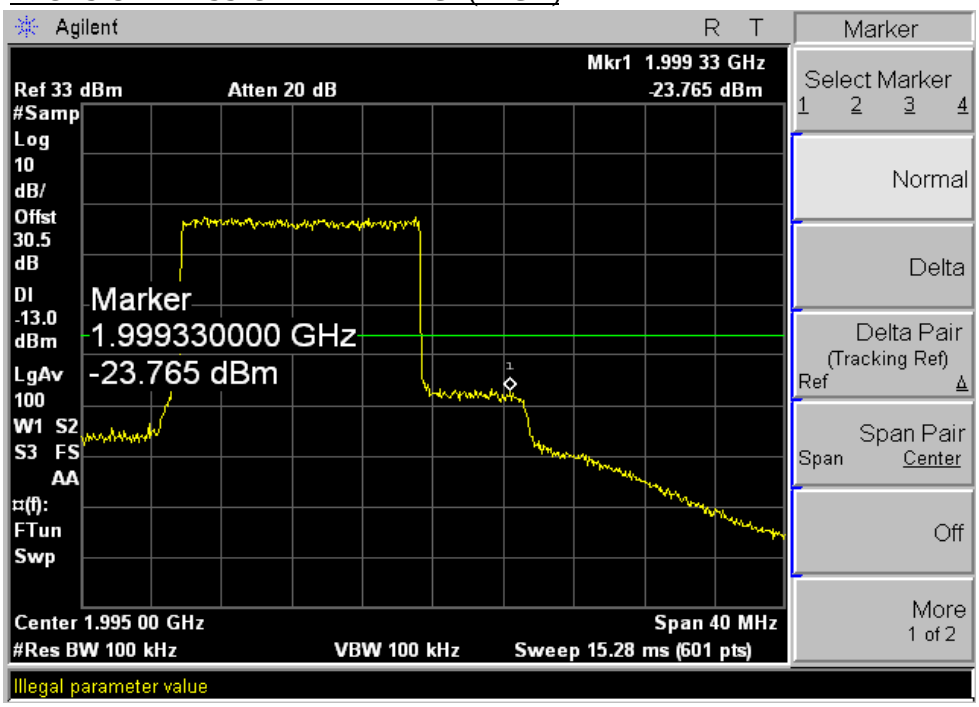


Downlink LTE 15M

PLOTS OF EMISSION BAND EDGE(LOW)

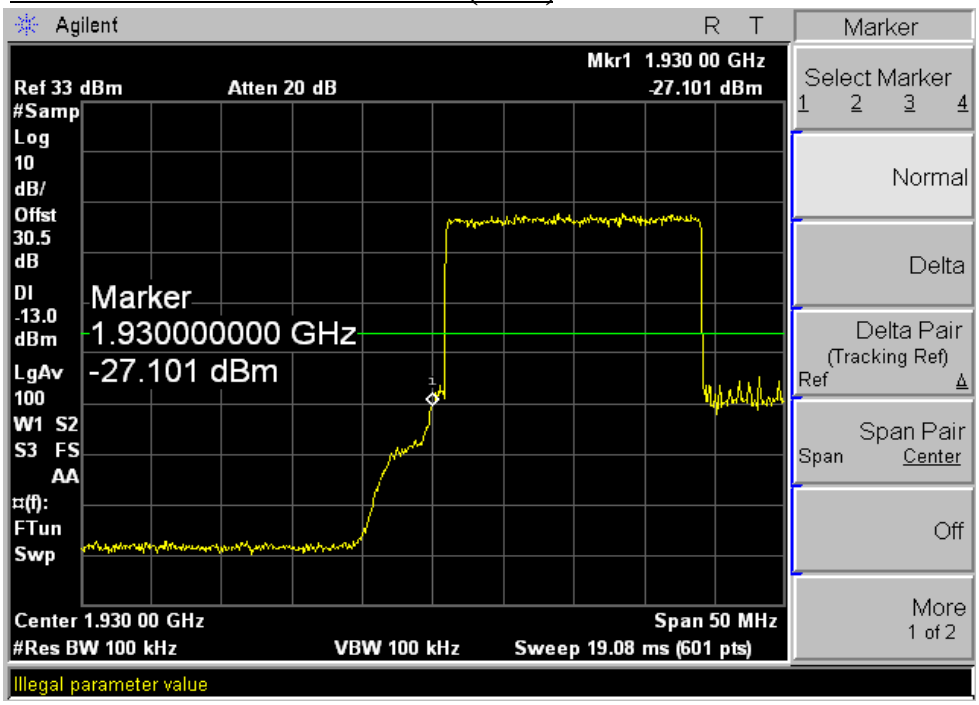


PLOTS OF EMISSION BAND EDGE(HIGH)

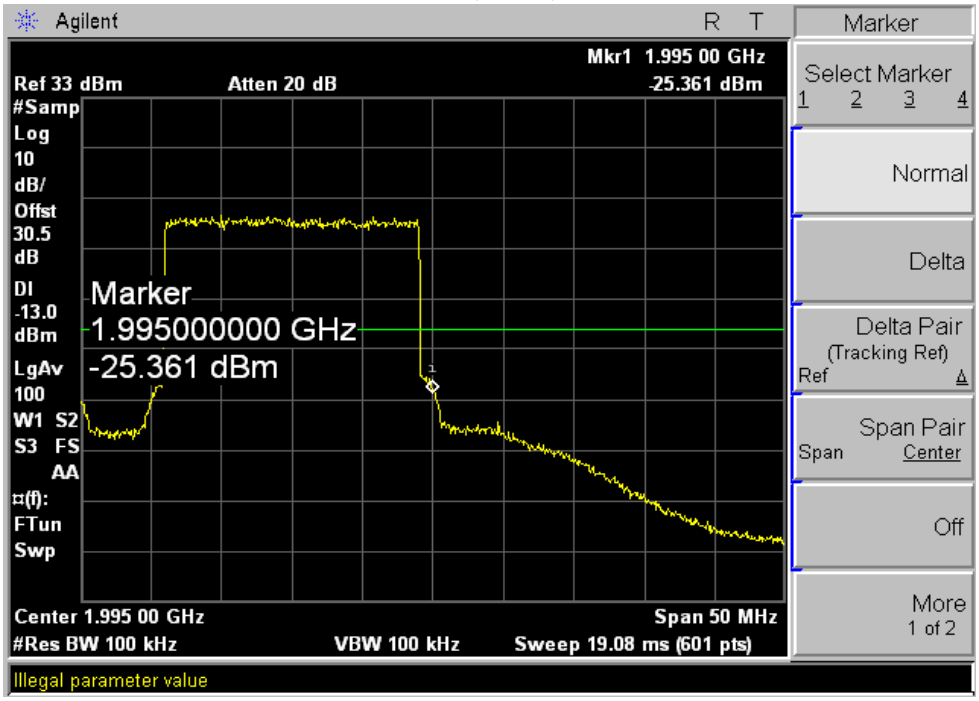


Downlink LTE 20M

PLOTS OF EMISSION BAND EDGE(LOW)



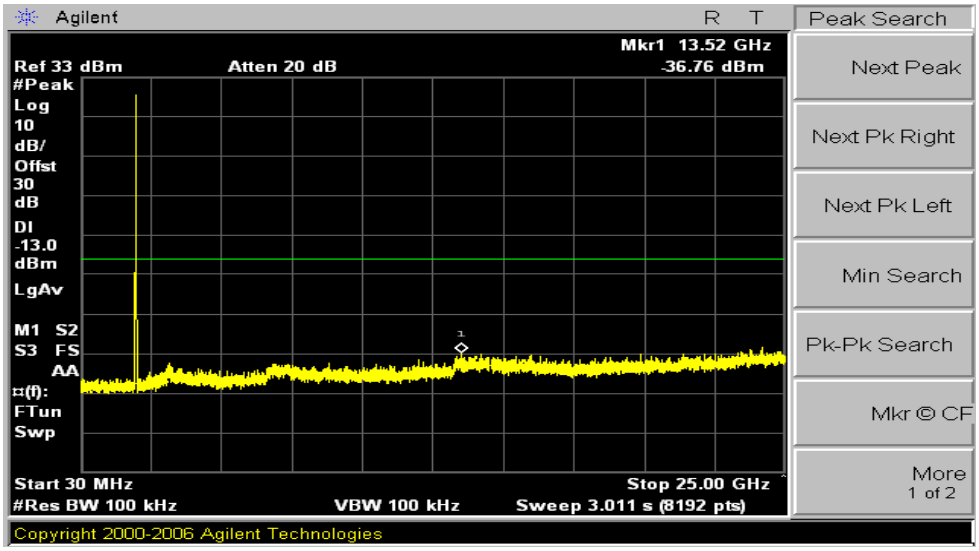
PLOTS OF EMISSION BAND EDGE(HIGH)



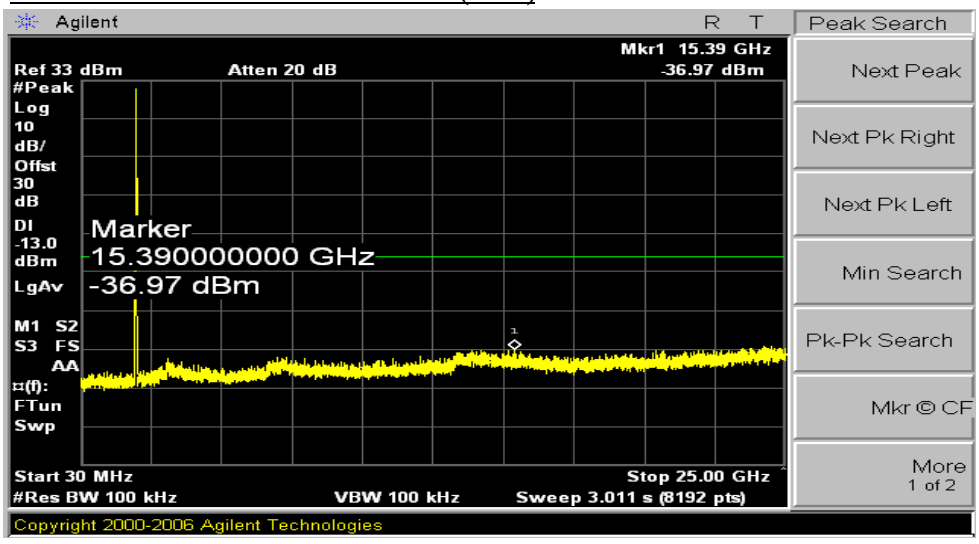
6.4 Test Plot (Out of Band)

Downlink CDMA

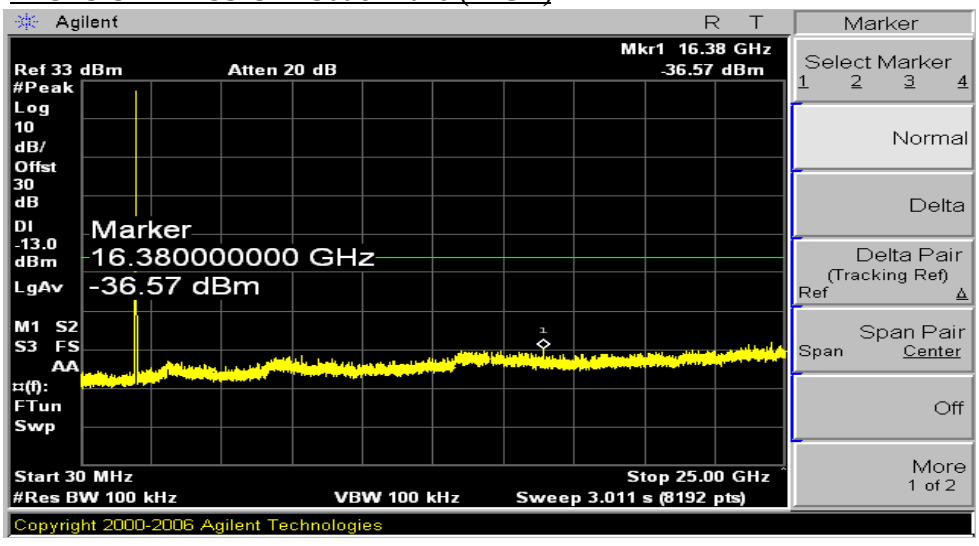
PLOTS OF EMISSION Out of Band (LOW)



PLOTS OF EMISSION Out of Band (MID)

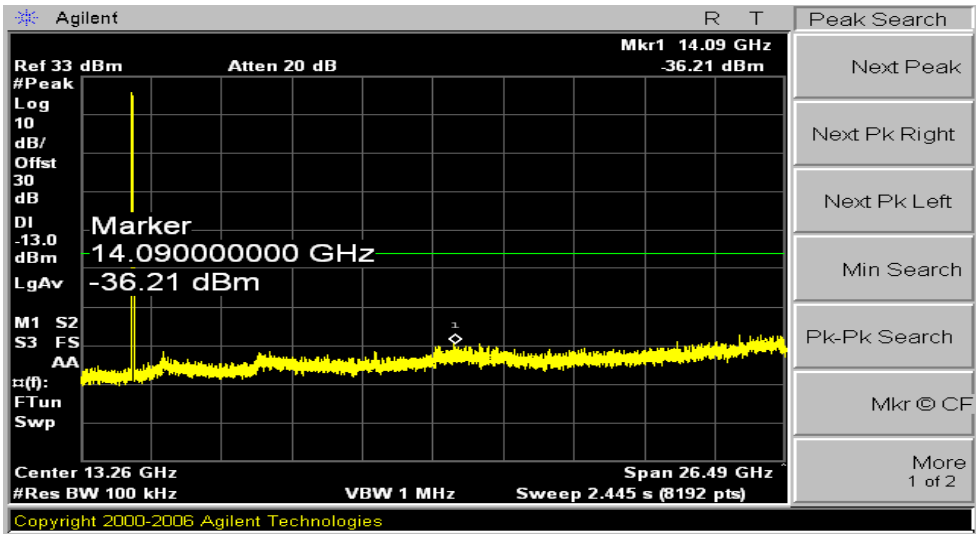


PLOTS OF EMISSION Out of Band (HIGH)

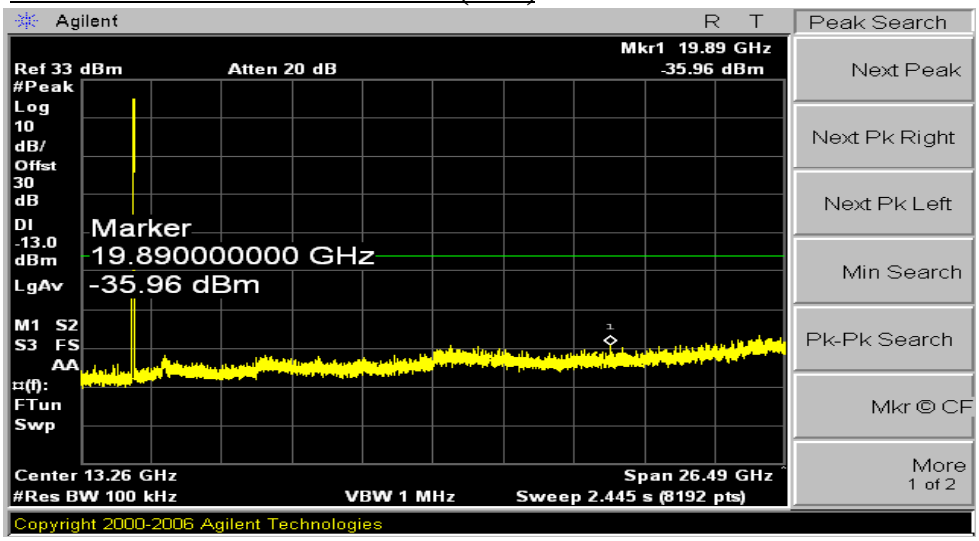


Downlink WCDMA

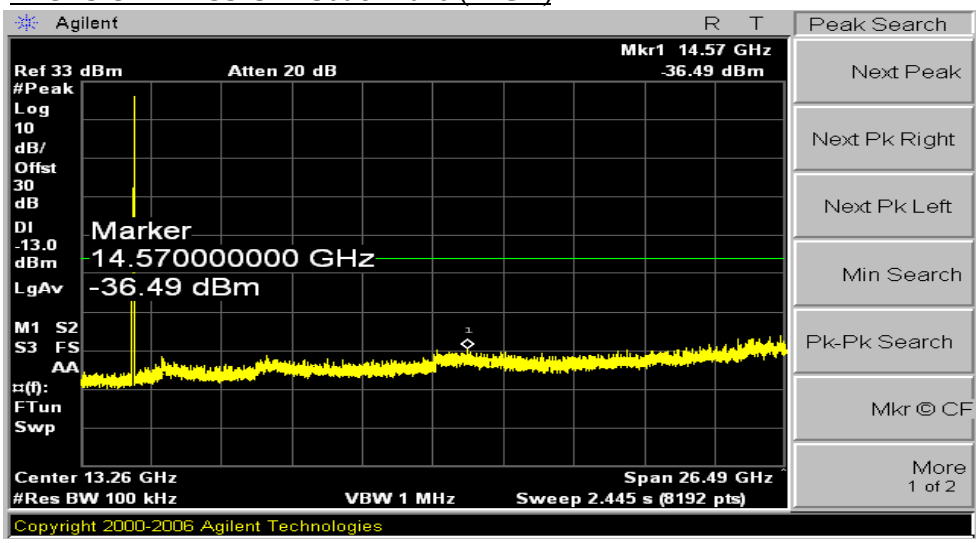
PLOTS OF EMISSION Out of Band (LOW)



PLOTS OF EMISSION Out of Band (MID)

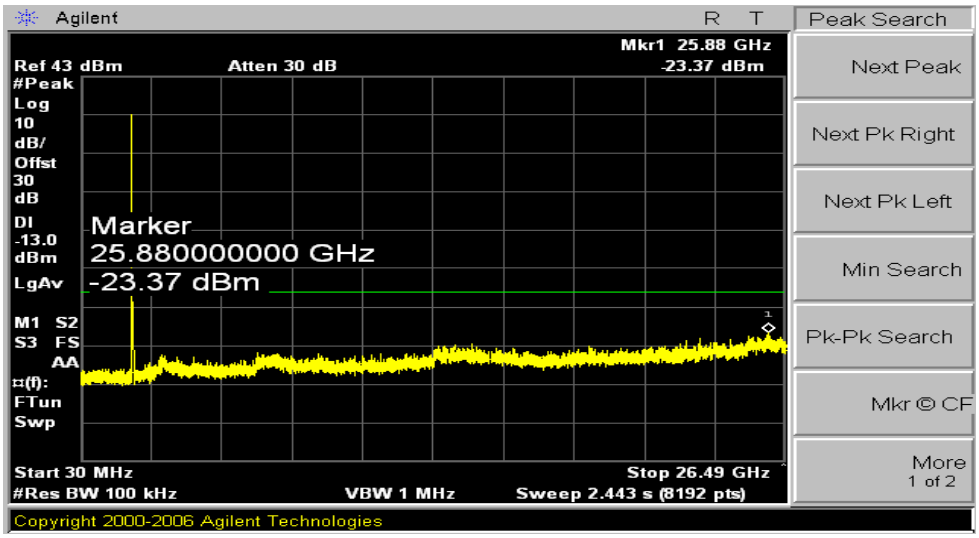


PLOTS OF EMISSION Out of Band (HIGH)

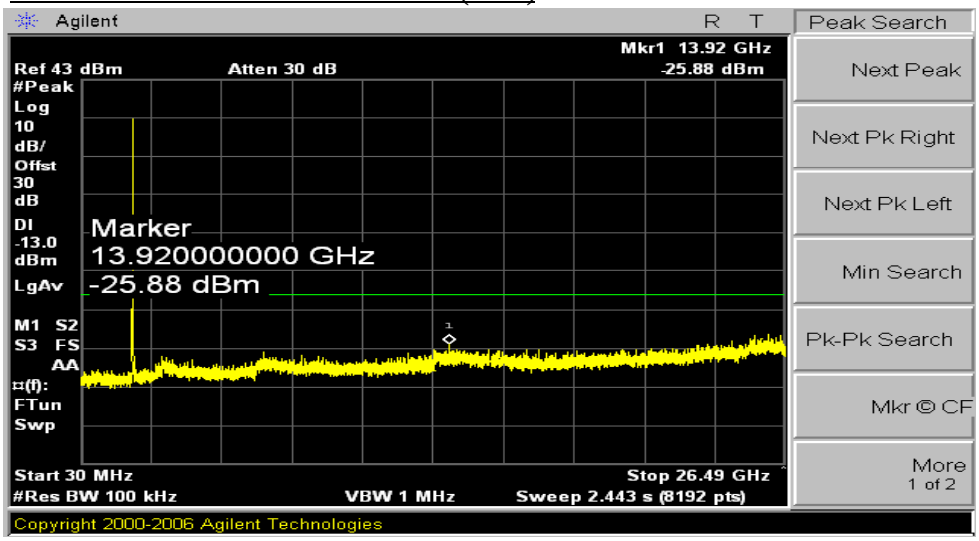


Downlink GSM

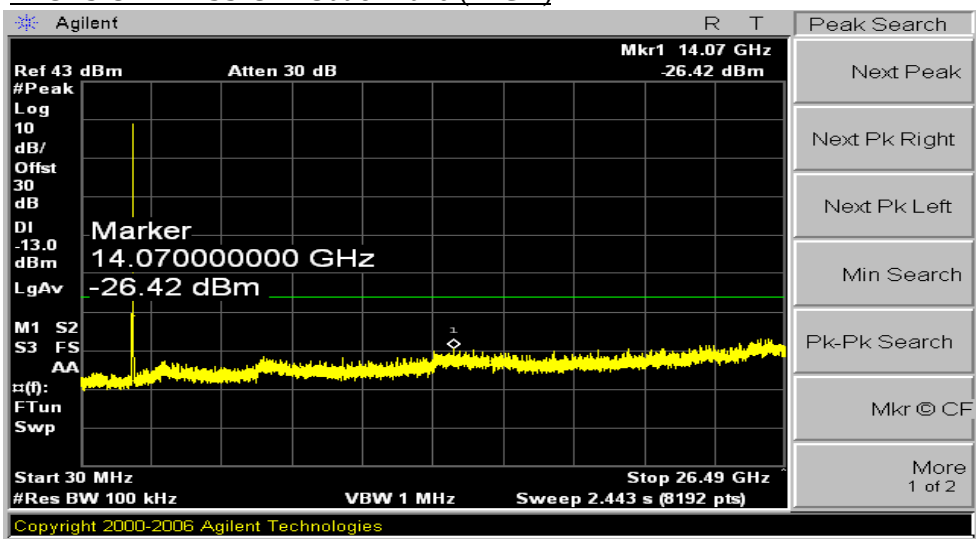
PLOTS OF EMISSION Out of Band (LOW)



PLOTS OF EMISSION Out of Band (MID)

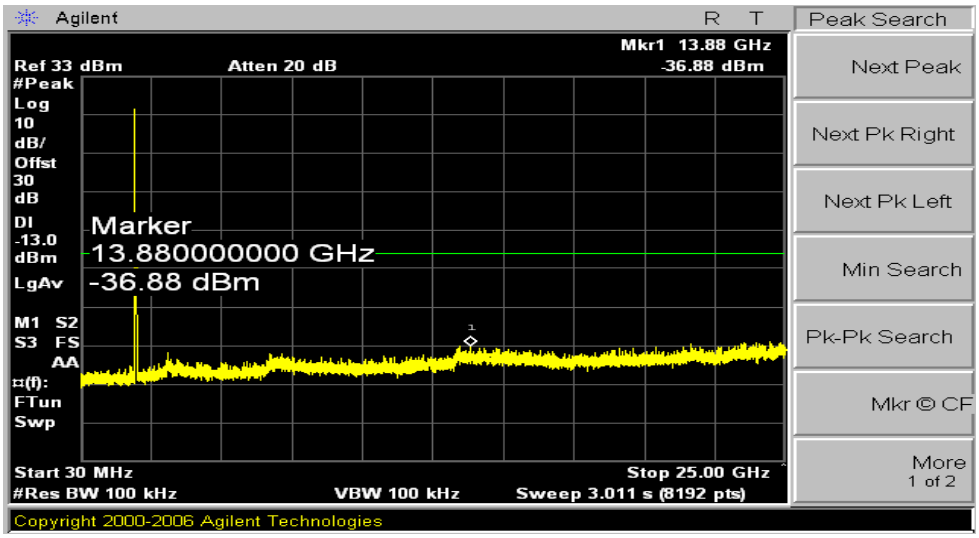


PLOTS OF EMISSION Out of Band (HIGH)

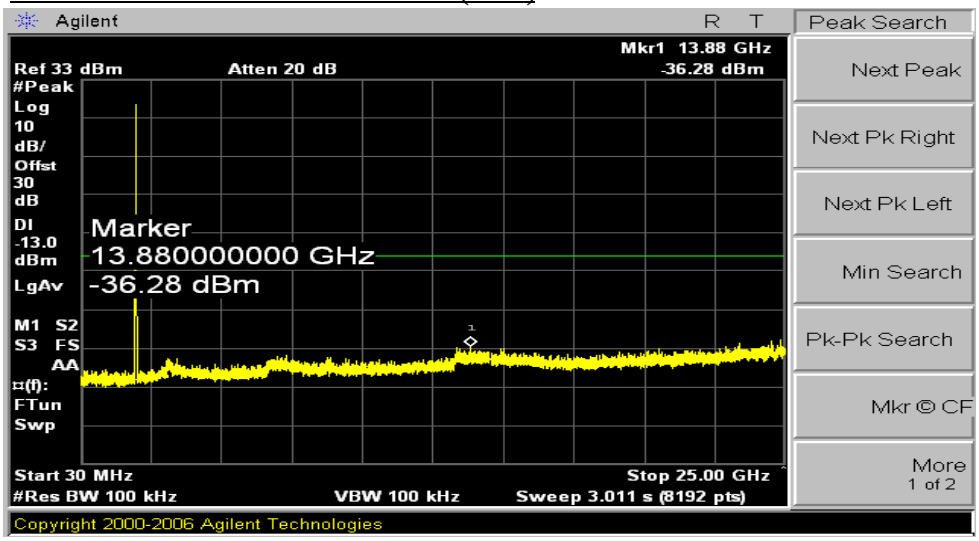


Downlink LTE 5M

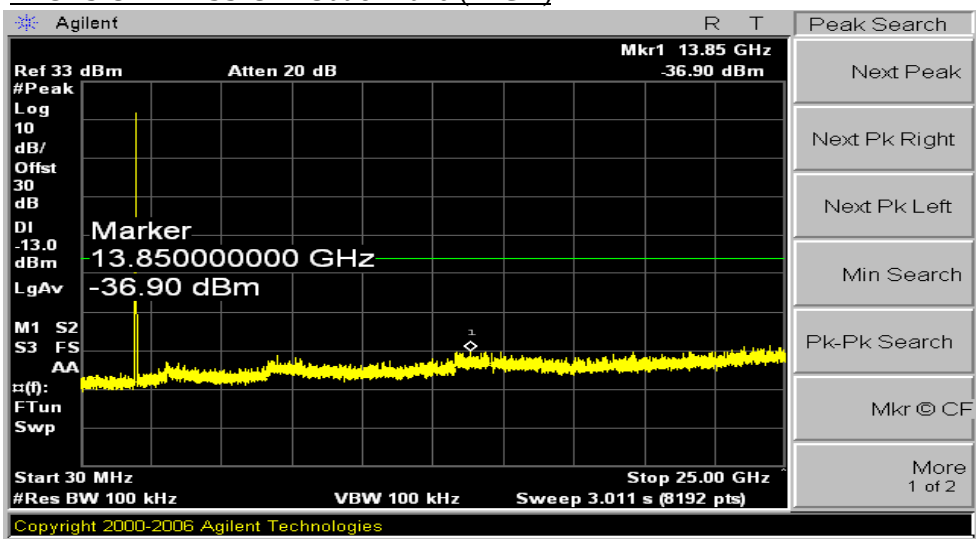
PLOTS OF EMISSION Out of Band (LOW)



PLOTS OF EMISSION Out of Band (MID)

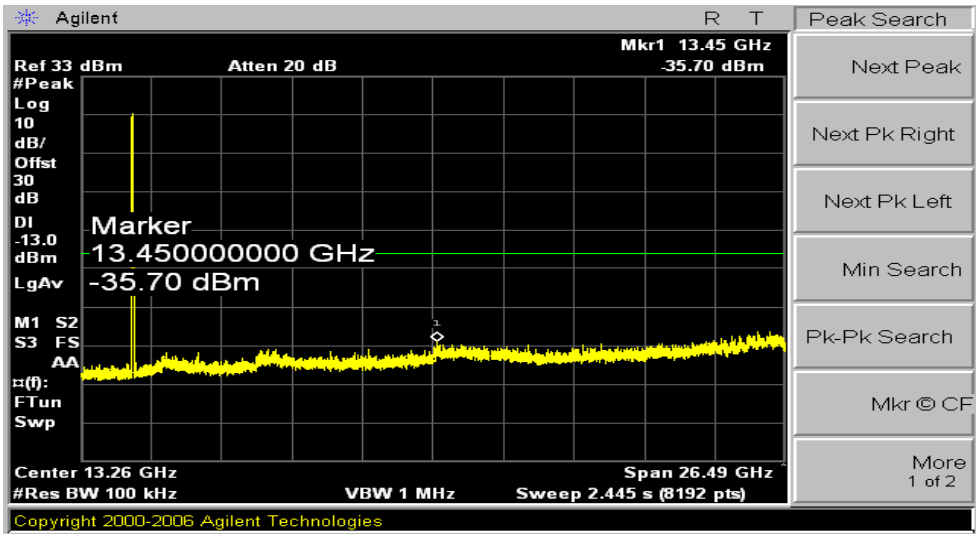


PLOTS OF EMISSION Out of Band (HIGH)

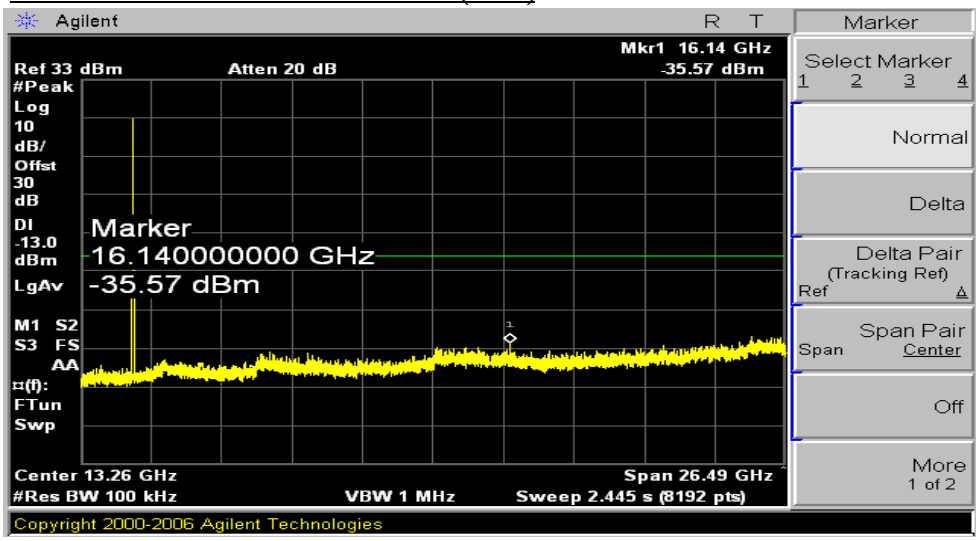


Downlink LTE 10M

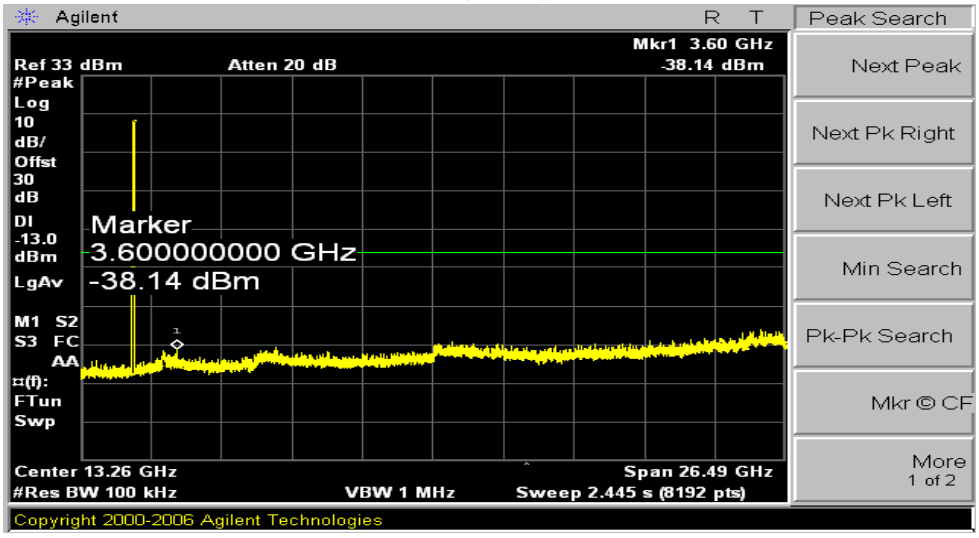
PLOTS OF EMISSION Out of Band (LOW)



PLOTS OF EMISSION Out of Band (MID)

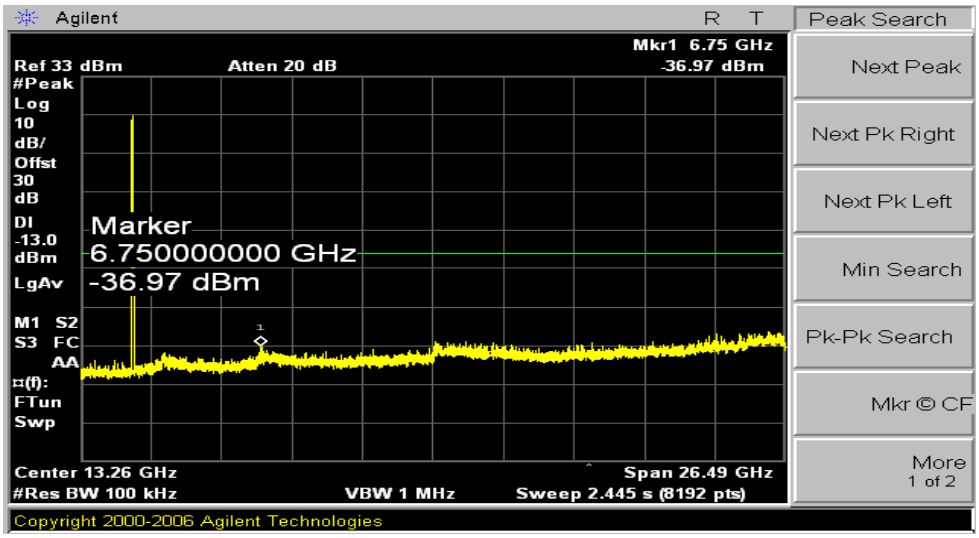


PLOTS OF EMISSION Out of Band (HIGH)

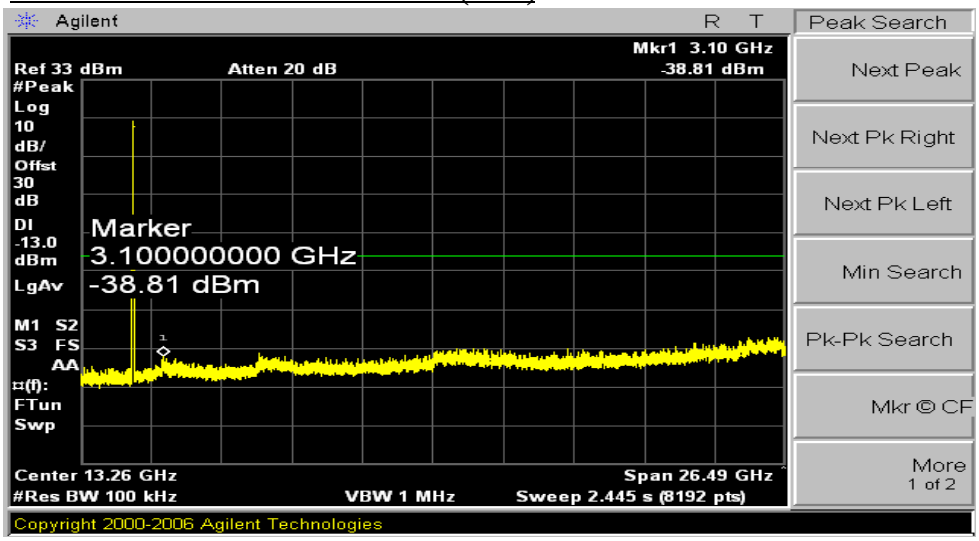


Downlink LTE 15M

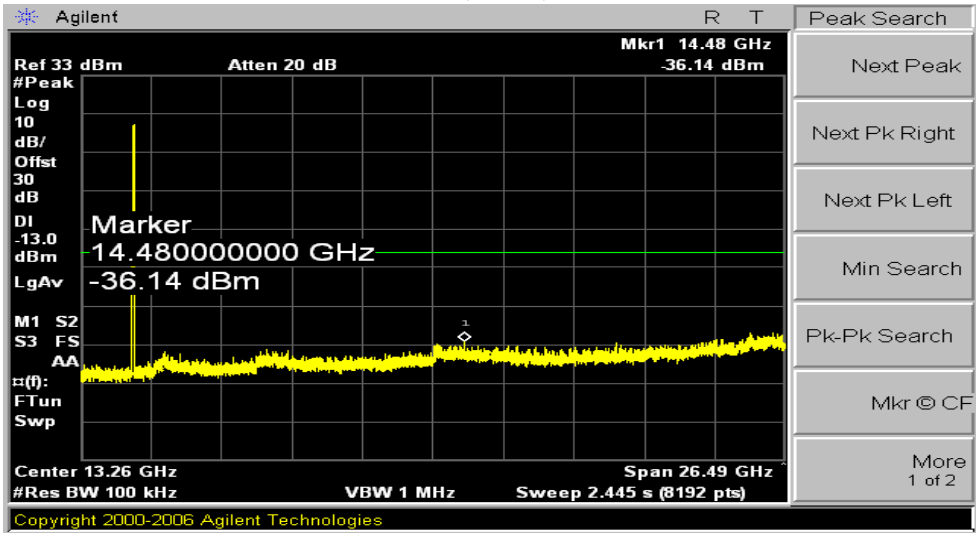
PLOTS OF EMISSION Out of Band (LOW)



PLOTS OF EMISSION Out of Band (MID)

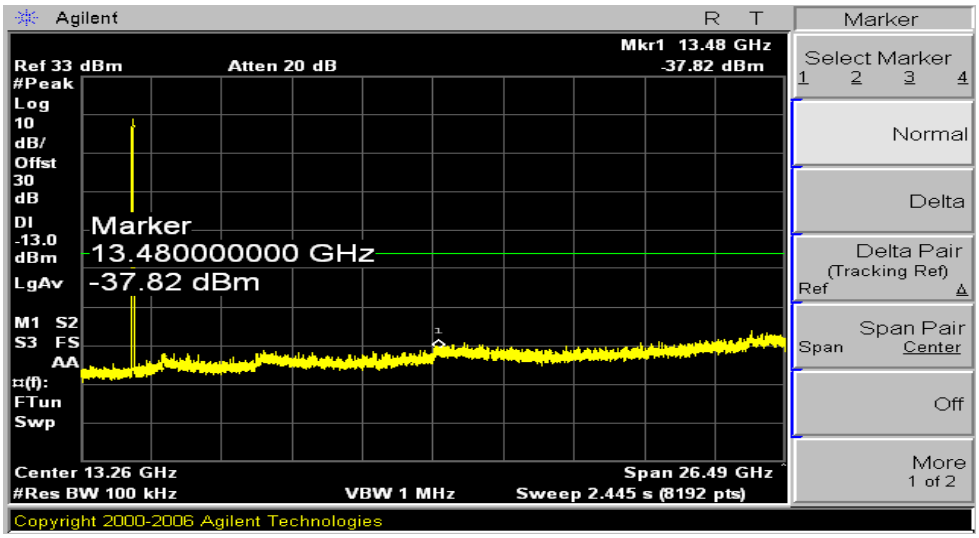


PLOTS OF EMISSION Out of Band (HIGH)

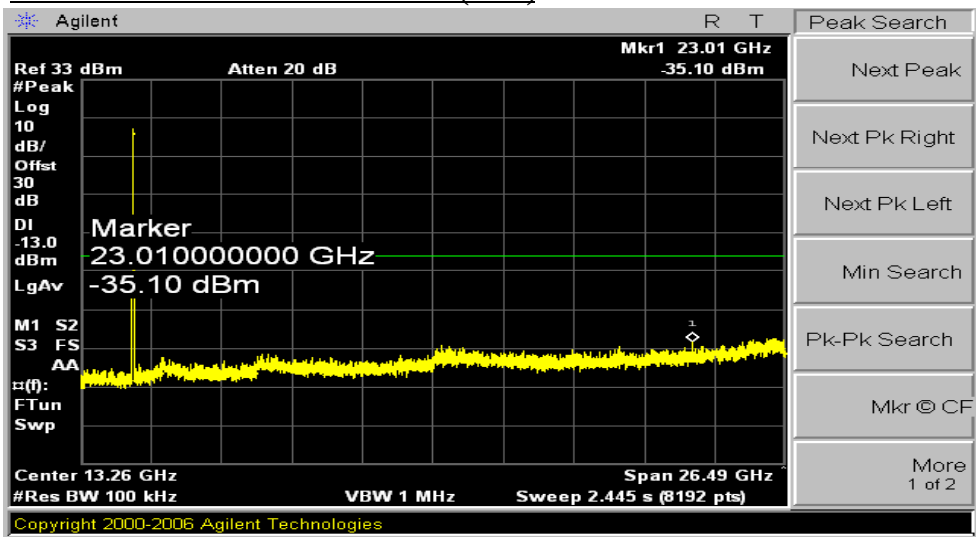


Downlink LTE 20M

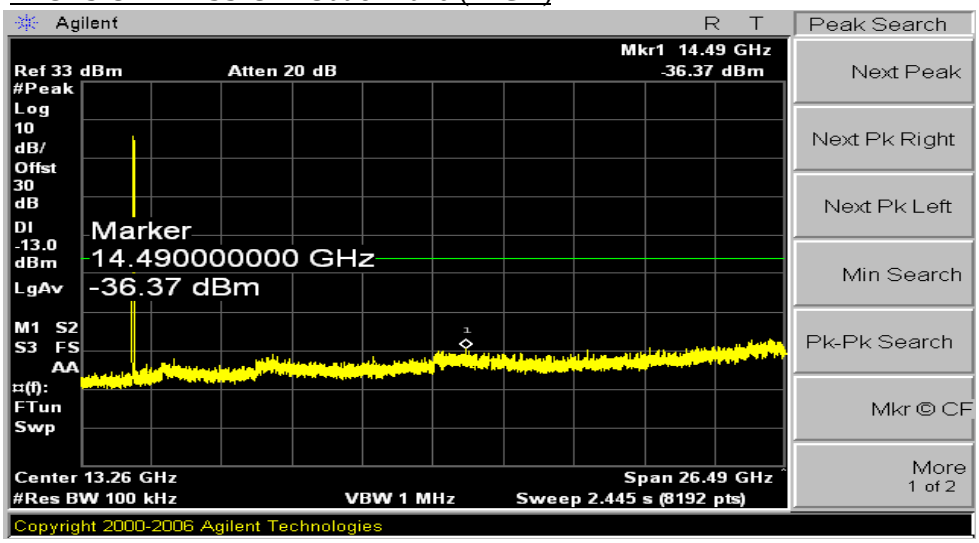
PLOTS OF EMISSION Out of Band (LOW)



PLOTS OF EMISSION Out of Band (MID)

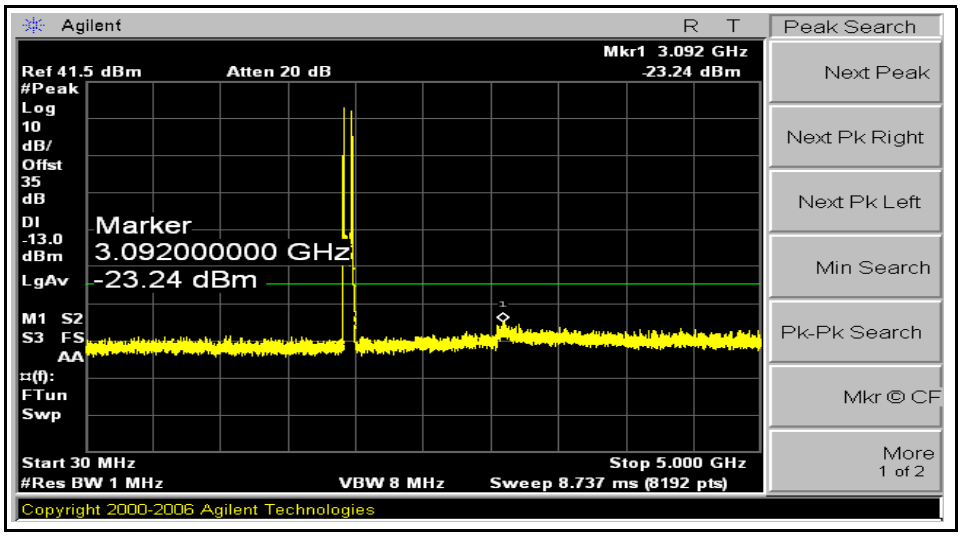


PLOTS OF EMISSION Out of Band (HIGH)

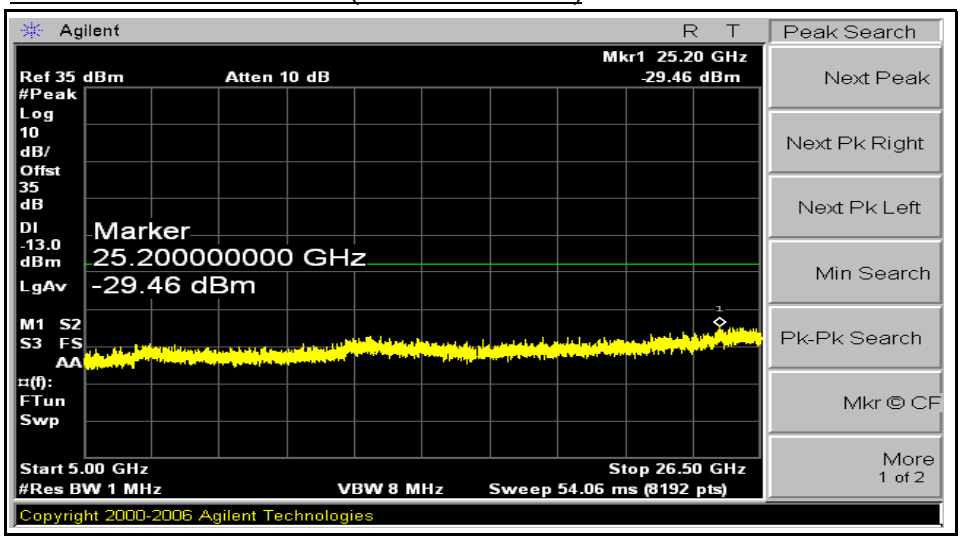


6.4 Test Plot (Intermodulation)

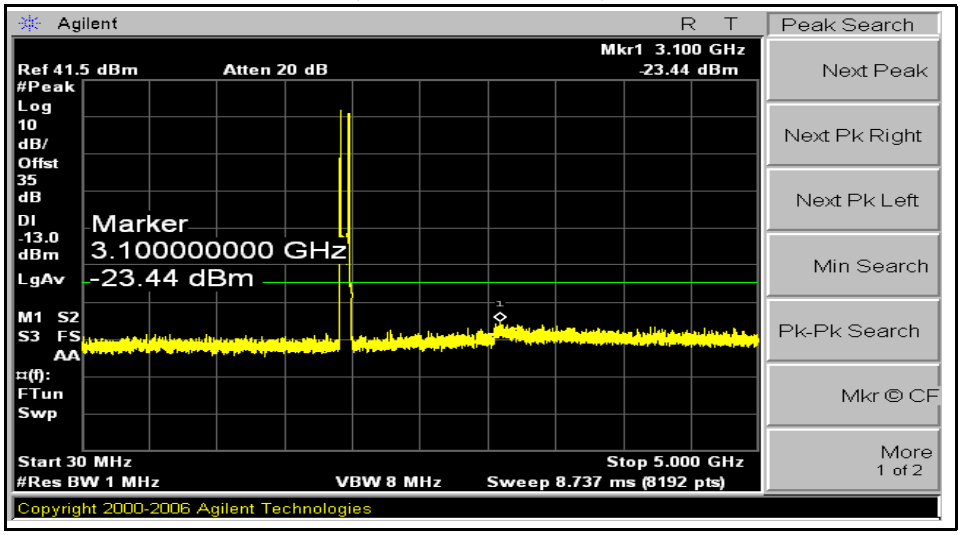
PLOTS OF Intermodulation (Downlink CDMA)



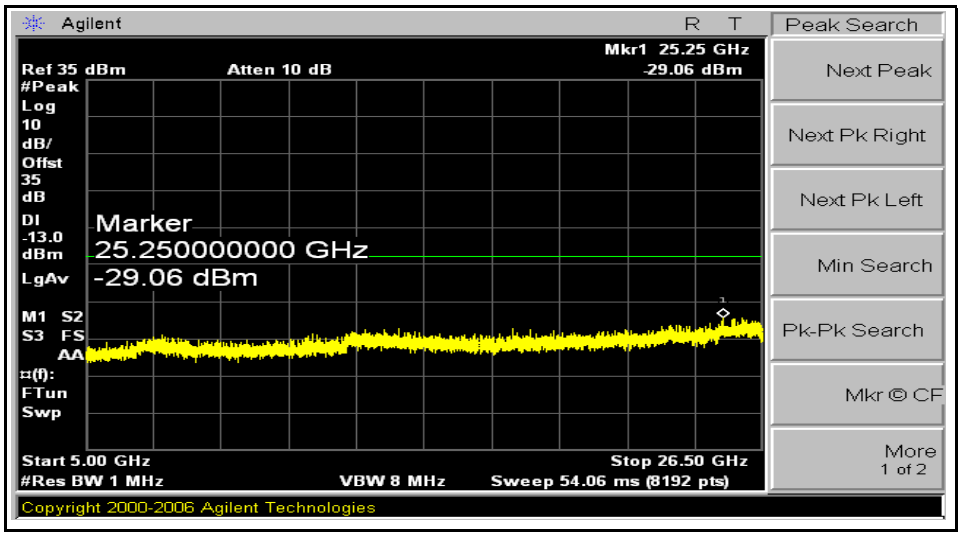
PLOTS OF Intermodulation (Downlink CDMA)



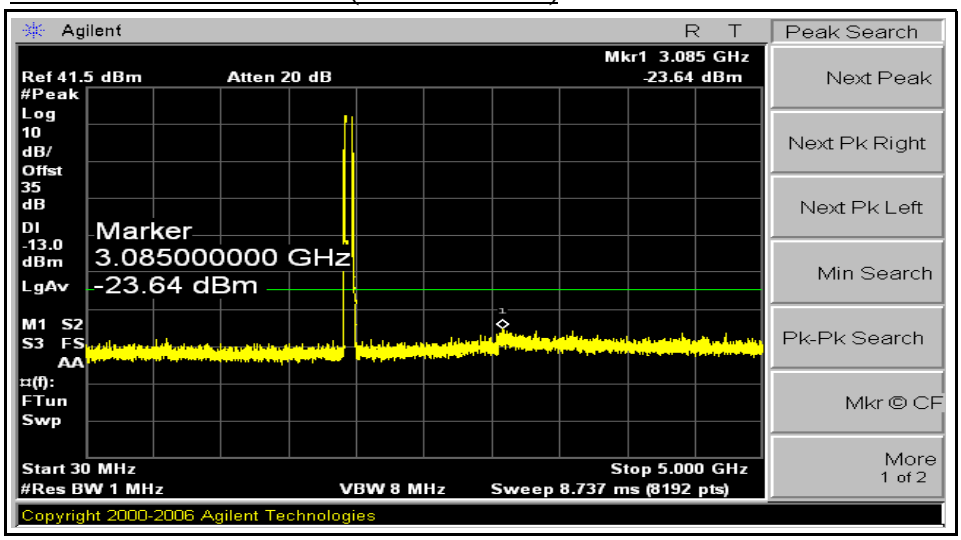
PLOTS OF Intermodulation (Downlink WCDMA)



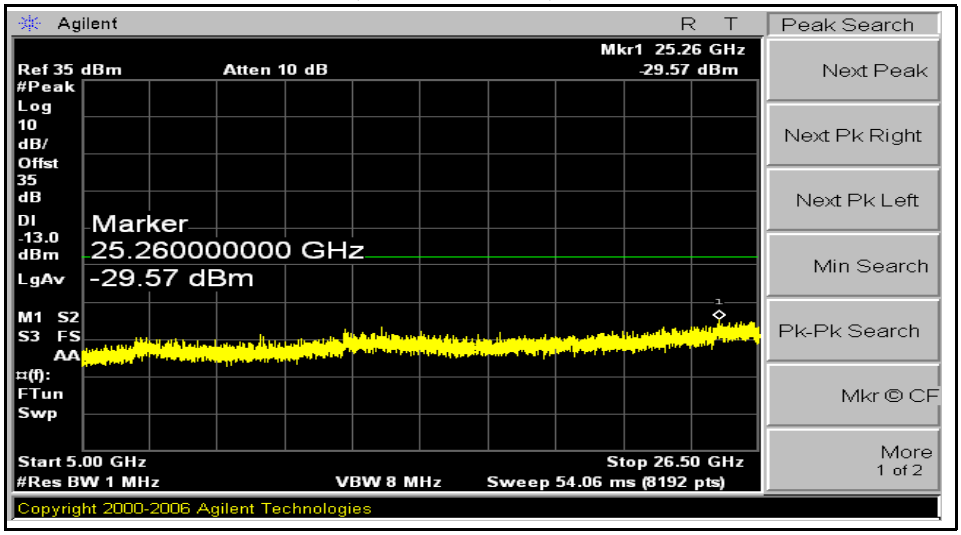
PLOTS OF Intermodulation (Downlink WCDMA)



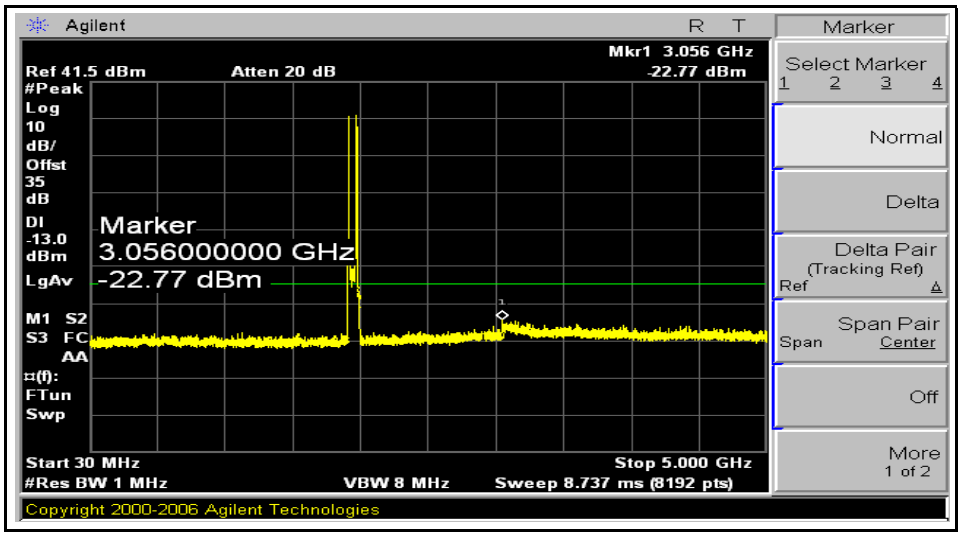
PLOTS OF Intermodulation (Downlink GSM)



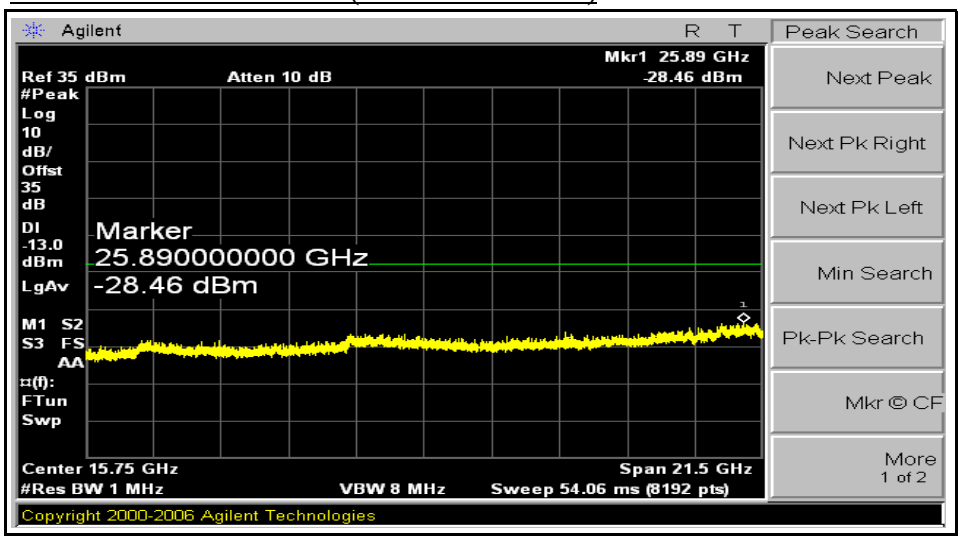
PLOTS OF Intermodulation (Downlink GSM)



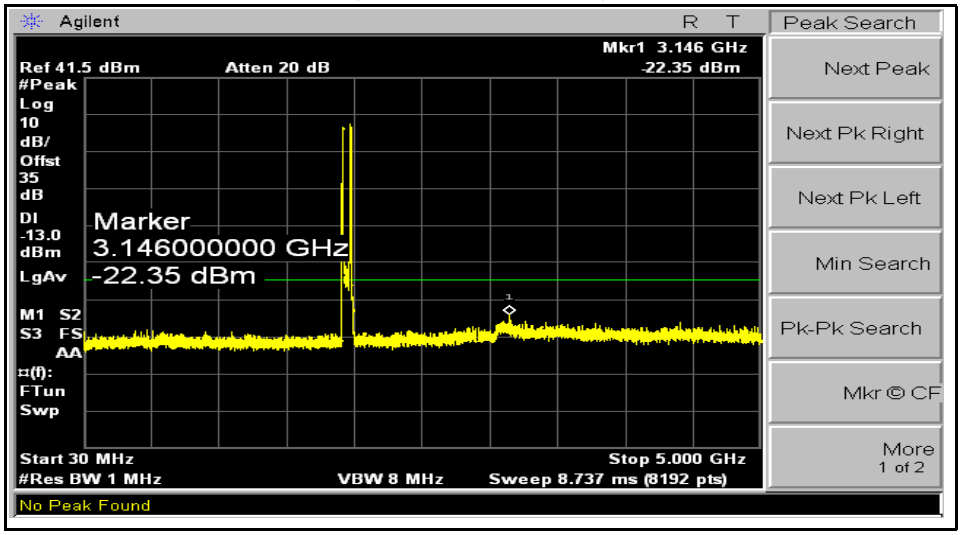
PLOTS OF Intermodulation (Downlink LTE 5M)



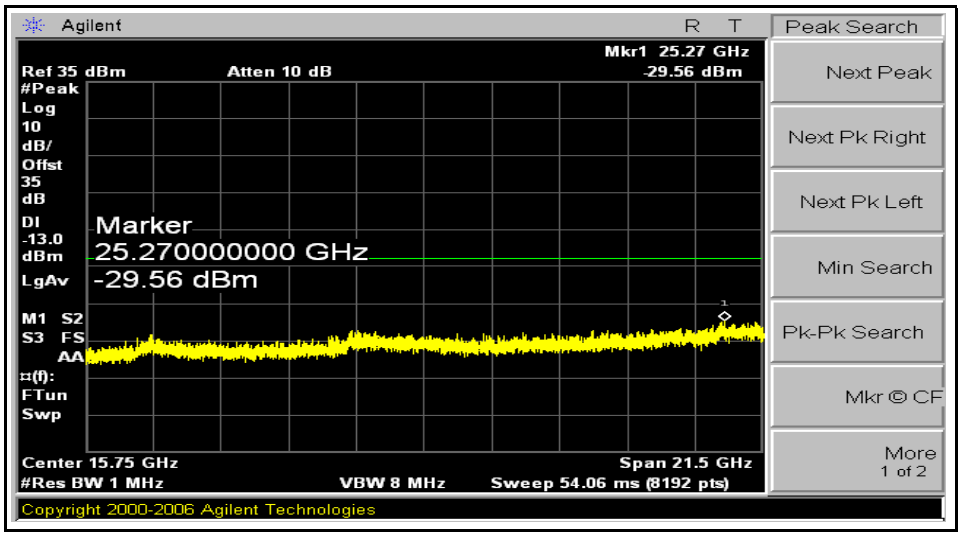
PLOTS OF Intermodulation (Downlink LTE 5M)



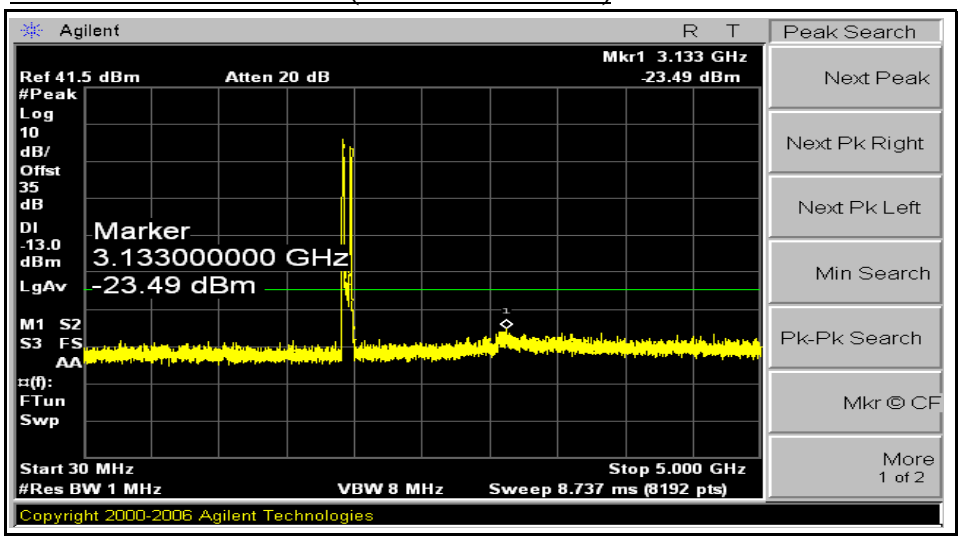
PLOTS OF Intermodulation (Downlink LTE 10M)



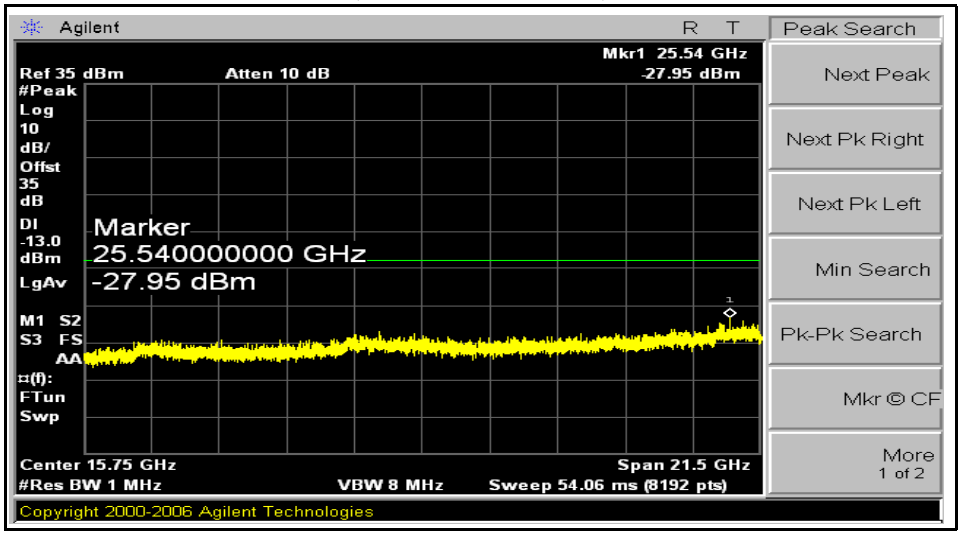
PLOTS OF Intermodulation (Downlink LTE 10M)



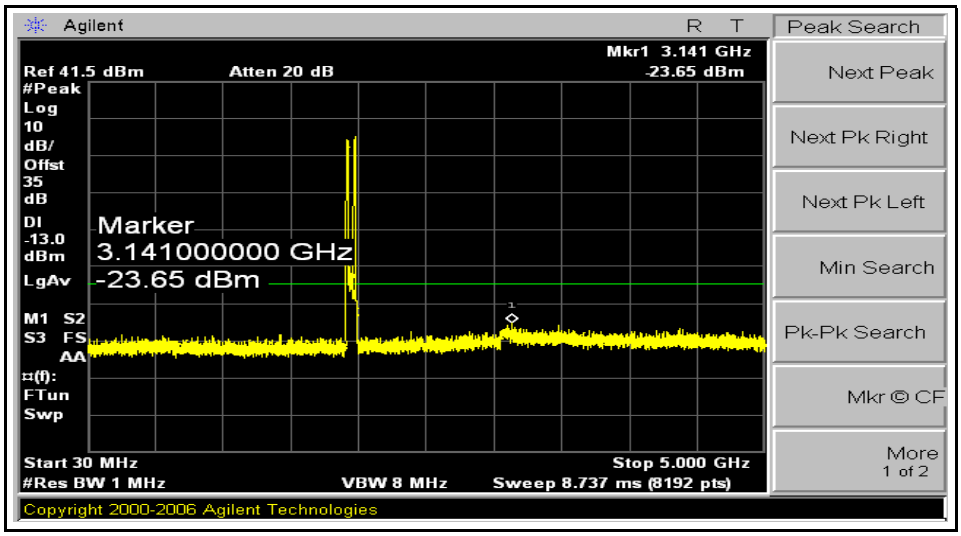
PLOTS OF Intermodulation (Downlink LTE 15M)



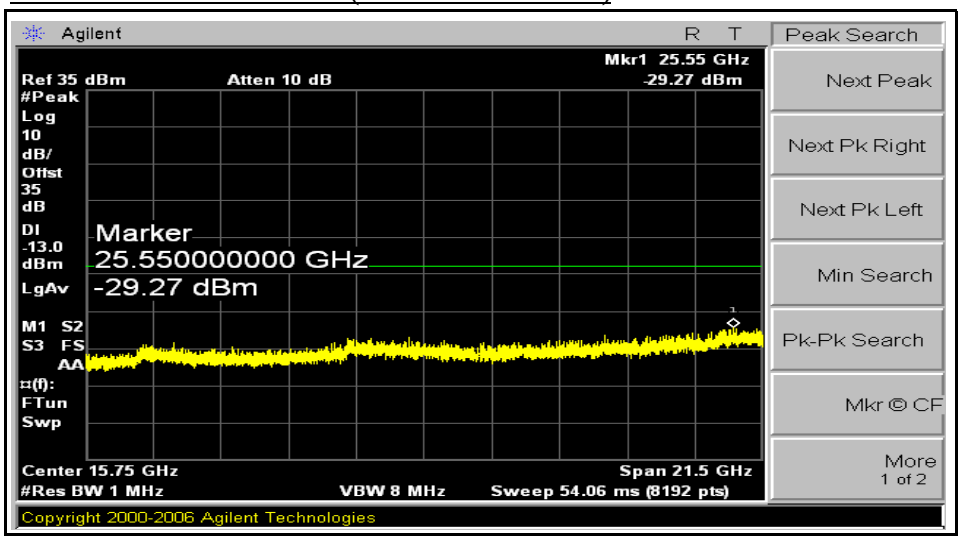
PLOTS OF Intermodulation (Downlink LTE 15M)



PLOTS OF Intermodulation (Downlink LTE 20M)

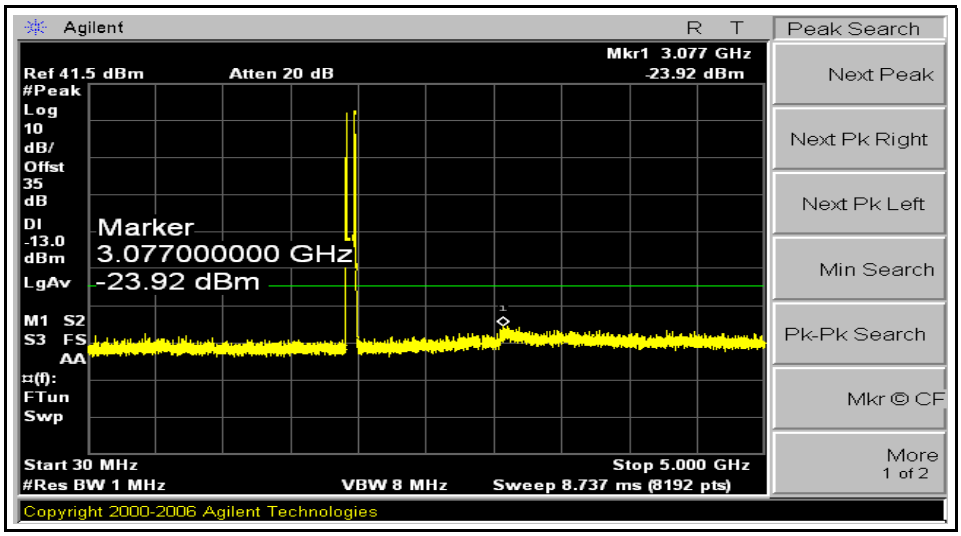


PLOTS OF Intermodulation (Downlink LTE 20M)

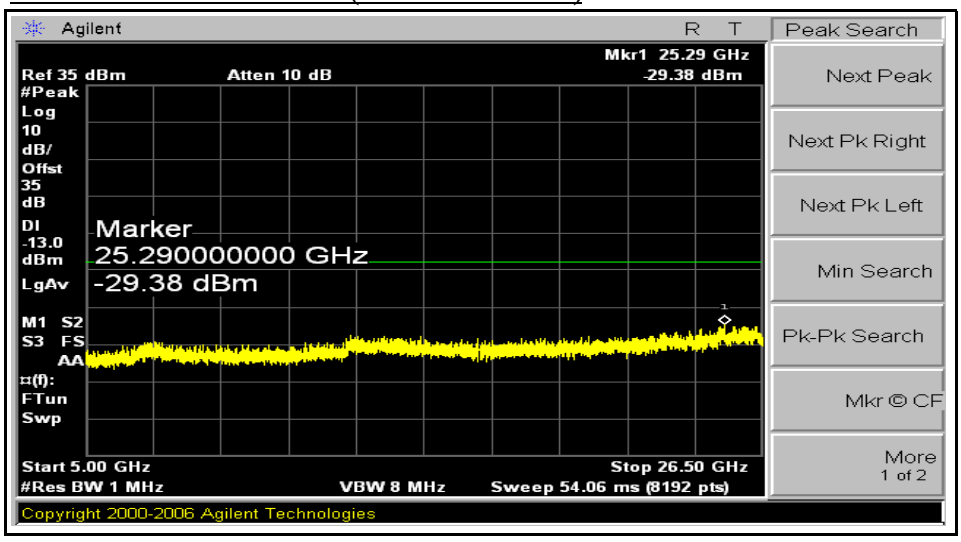


Without AGC

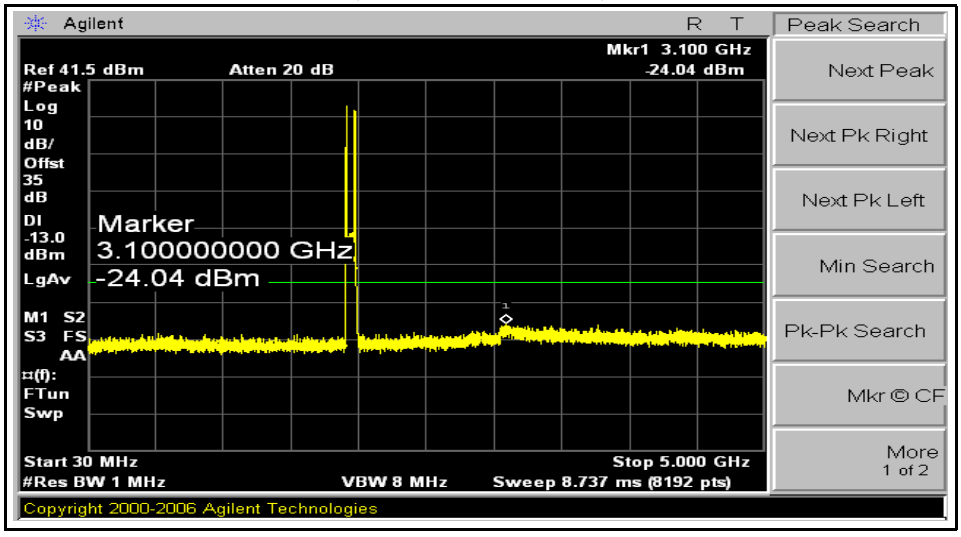
PLOTS OF Intermodulation (Downlink CDMA)



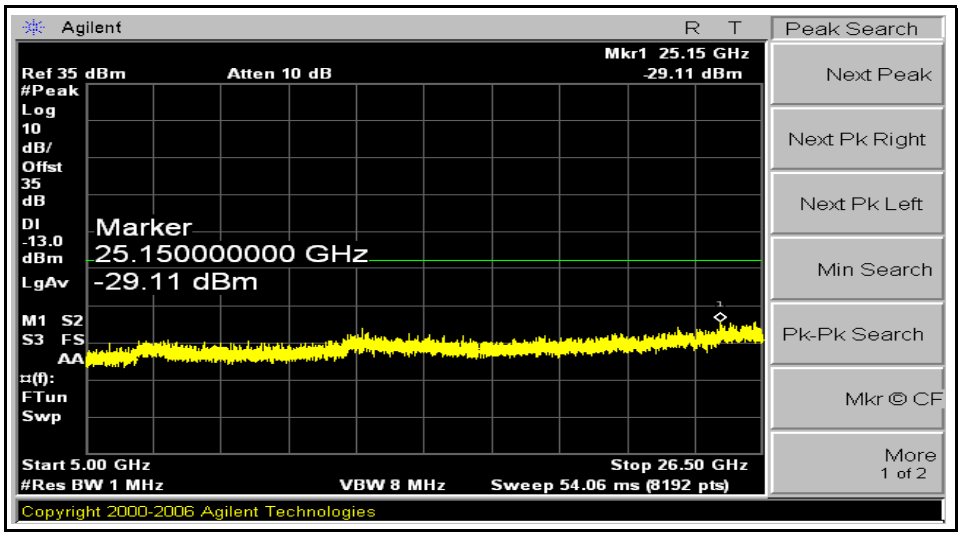
PLOTS OF Intermodulation (Downlink CDMA)



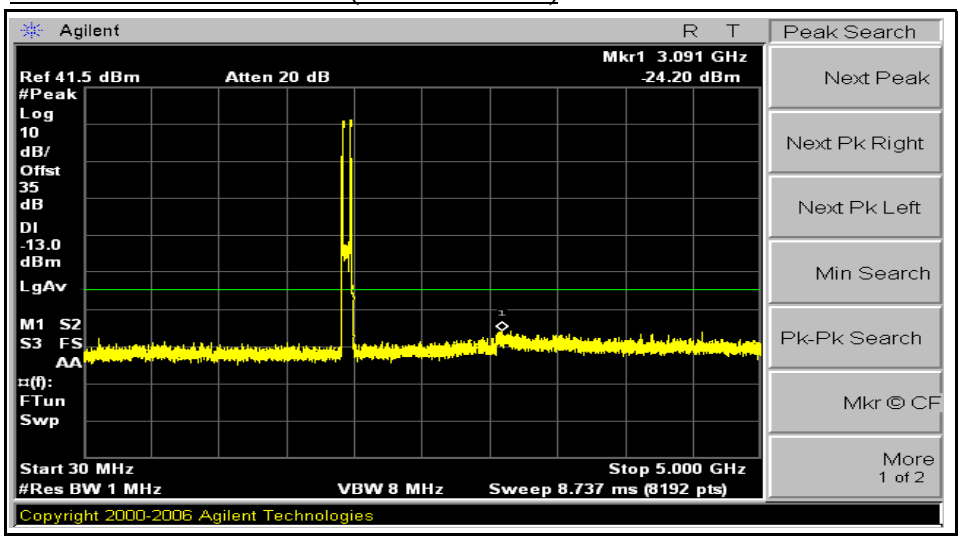
PLOTS OF Intermodulation (Downlink WCDMA)



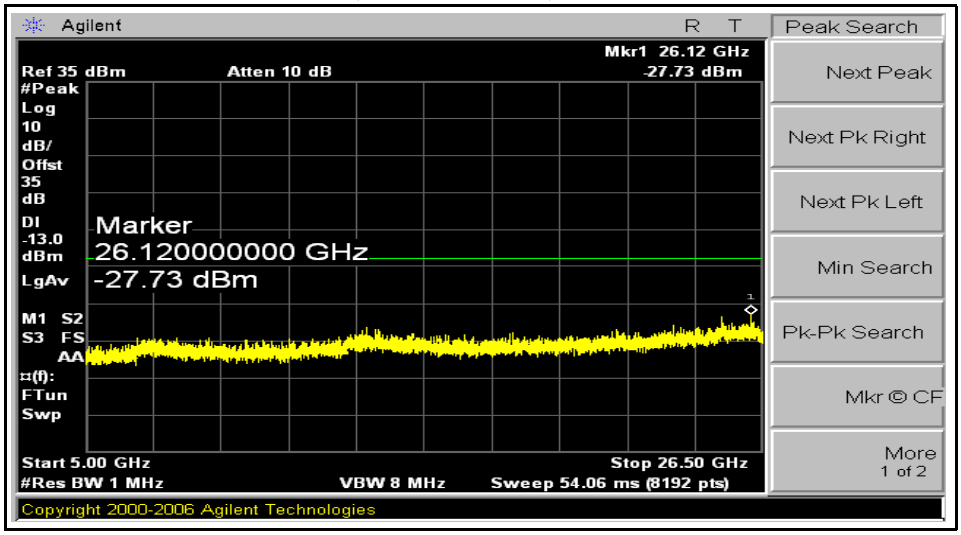
PLOTS OF Intermodulation (Downlink WCDMA)



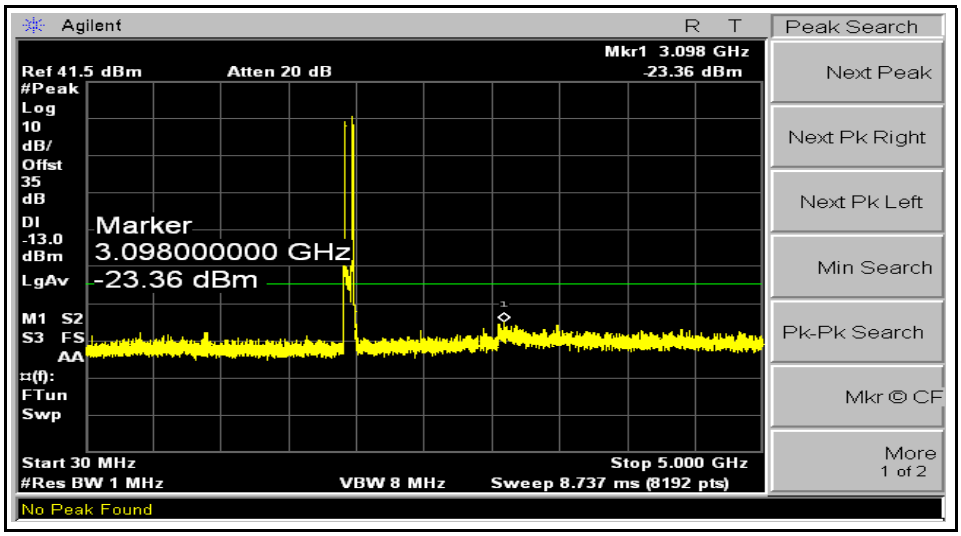
PLOTS OF Intermodulation (Downlink GSM)



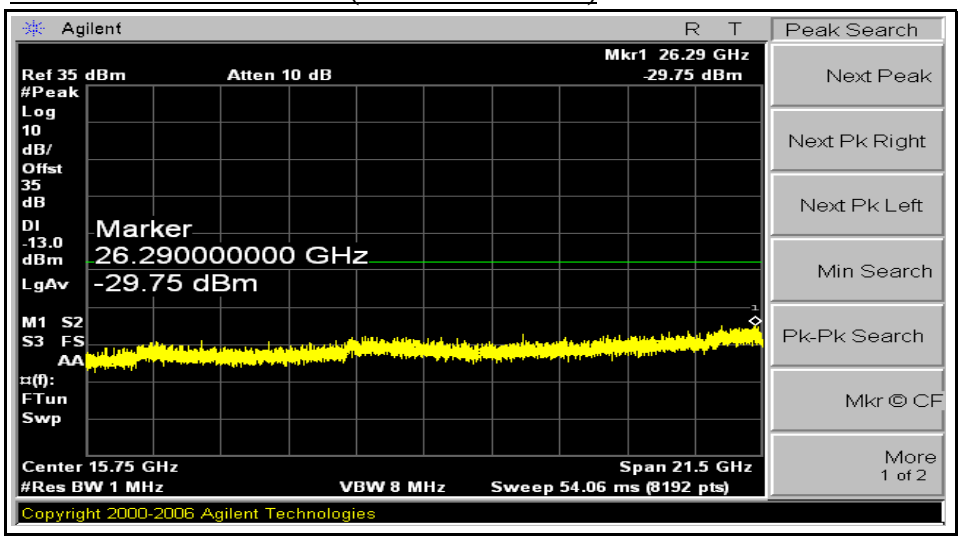
PLOTS OF Intermodulation (Downlink GSM)



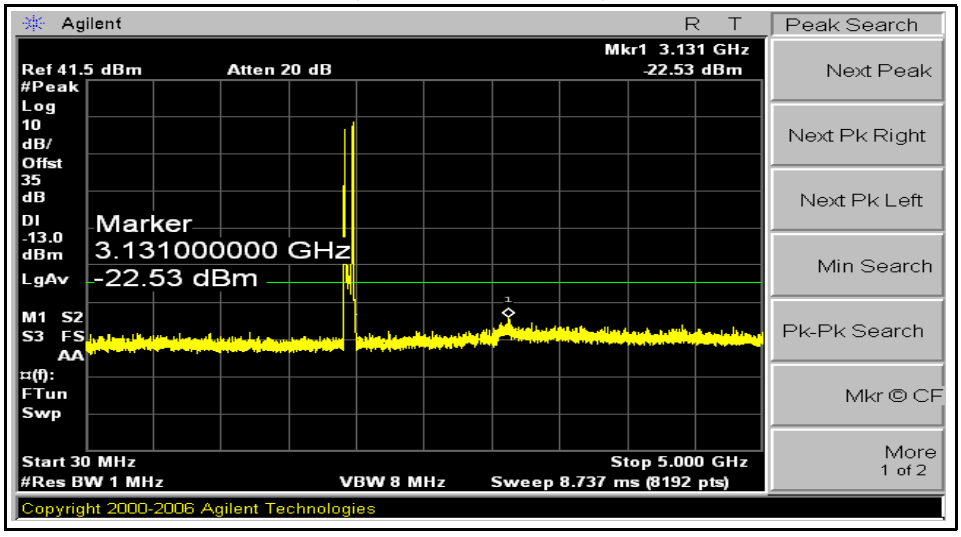
PLOTS OF Intermodulation (Downlink LTE 5M)



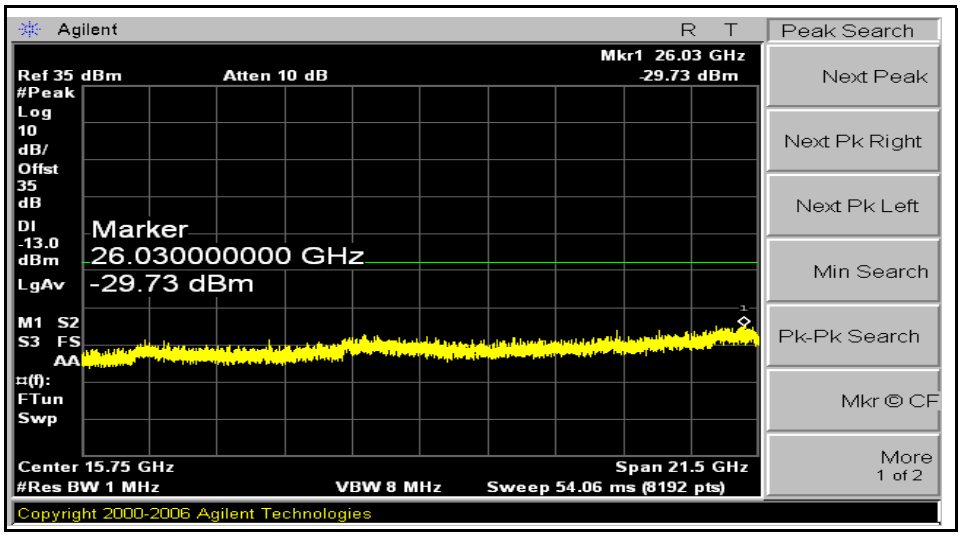
PLOTS OF Intermodulation (Downlink LTE 5M)



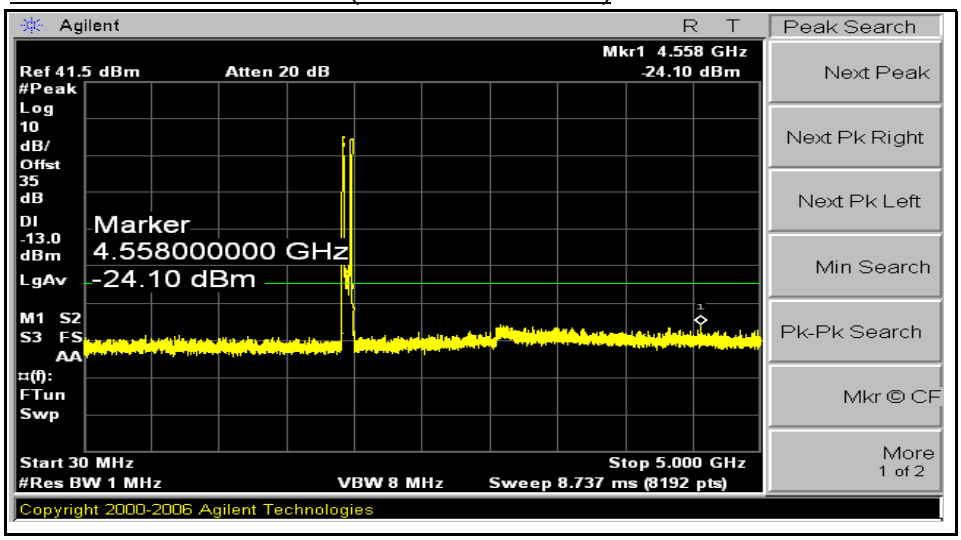
PLOTS OF Intermodulation (Downlink LTE 10M)



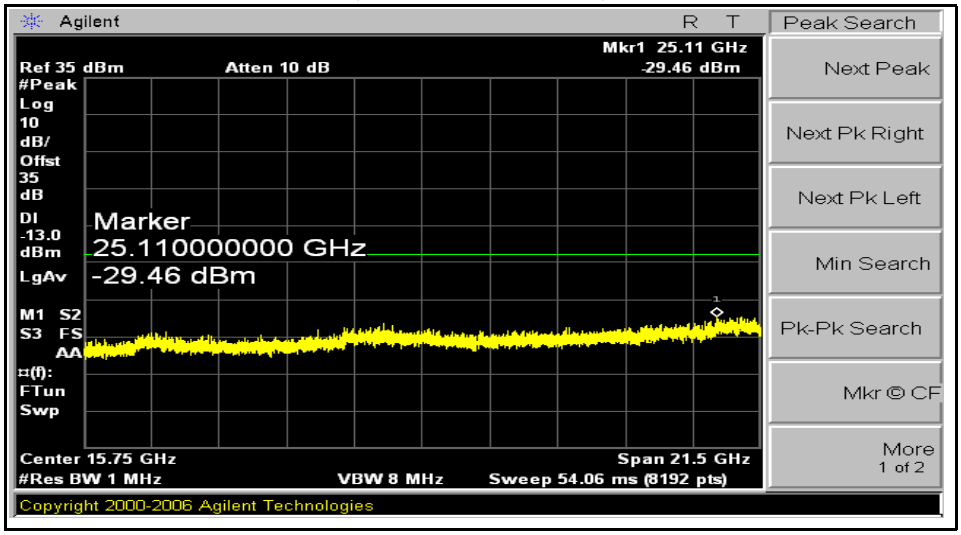
PLOTS OF Intermodulation (Downlink LTE 10M)



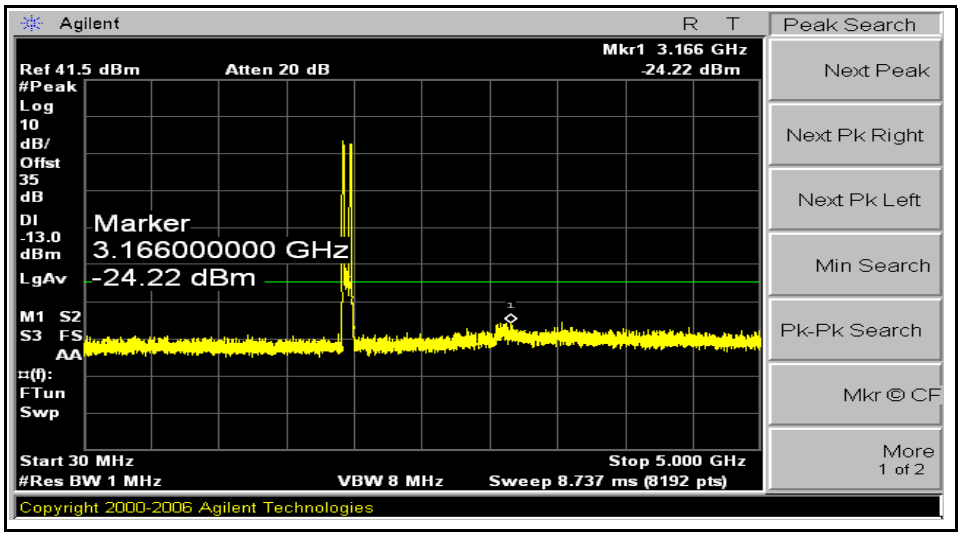
PLOTS OF Intermodulation (Downlink LTE 15M)



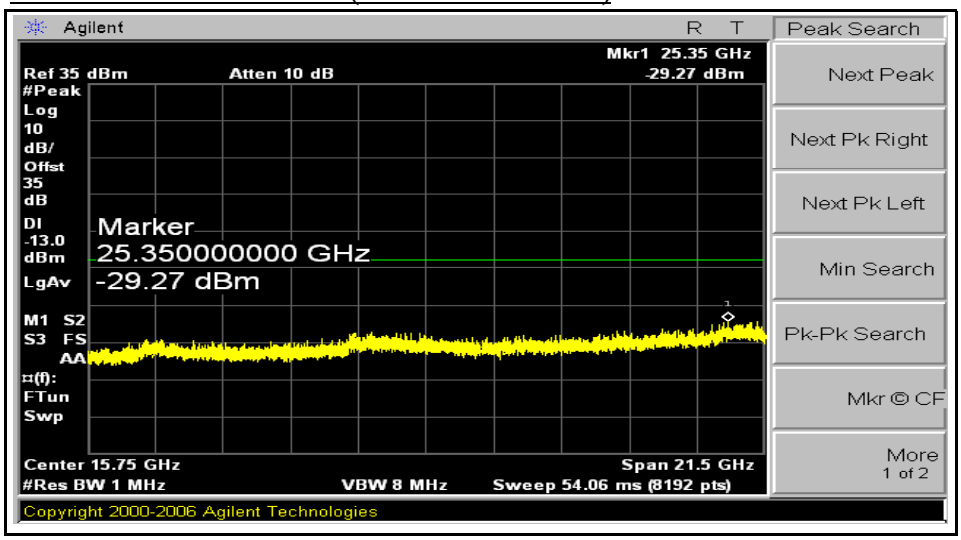
PLOTS OF Intermodulation (Downlink LTE 15M)



PLOTS OF Intermodulation (Downlink LTE 20M)



PLOTS OF Intermodulation (Downlink LTE 20M)



7. Field Strength of Spurious Radiation

7.1 Test Procedure according to ANSI/TIA/EIA 603 Clause 3.2.12 & FCC 22.917(h)

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.

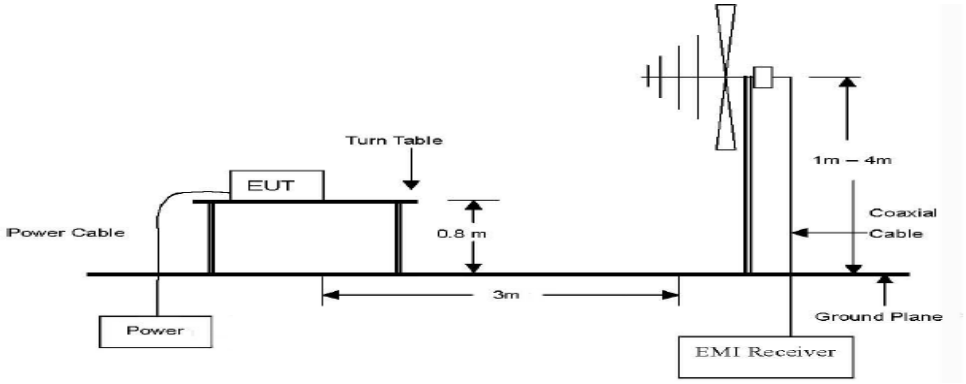
7.2 Test Equipments

The following test equipments are used during tests

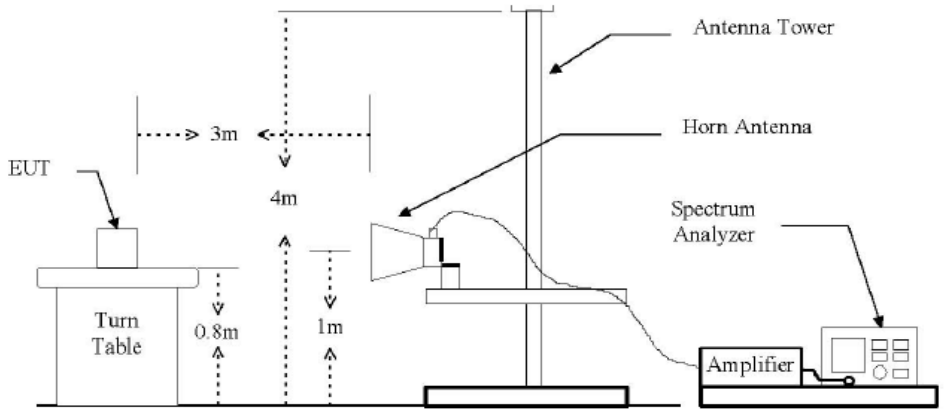
Equipment	Manufacturer	Model		Next Cal.
Spectrum Analyzer	ADVANTEST	R3273	110600592	2014-01-26
Signal Generator	HP	83620B	3722A00463	2014-01-27
TEST Receiver	ROHDE & SCHWARZ	ESCI7	1166.5950.07	2014-01-25
TEST Receiver	ROHDE & SCHWARZ	ESCI7	100185	2014-01-25
Logbicon Antenna	SCHWARZBECK	VULB 9168	237	2014-01-24
PREAMPLIFIER	AGILENT	8449B	3008A00595	2014-01-25
Signal Generator	HP	E4432B	GB40050840	2014-01-27
Signal Generator	ROHDE & SCHWARZ	SMBV100A	256663	2014-01-25
Horn Antenna	SCHWARZBECK	BBHA 9120 D	469	2013-10-21
Horn Antenna	SCHWARZBECK	BBHA 9120 D	352	2014-05-13

7.3 Test Setup

Test setup for 30 MHz to 1 GHz



Test setup for above1 GHz



7.4 Test Results

Downlink

CDMA(LOW)

Frequency (MHz)	Receiver Reading(dBuV	Correction Factor(dB)		ERP(dBm)		Limit(dBm)	Polarity
		AG(dBi)	CL(dB)	SG Reading	Result		
3862.50	42.70	12.41	13.84	-53.40	-54.83	-13.00	H
3862.50	43.27	12.41	13.84	-49.10	-50.53	-13.00	V

CDMA(MID)

Frequency (MHz)	Receiver Reading(dBuV	Correction Factor(dB)		ERP(dBm)		Limit(dBm)	Polarity
		AG(dBd)	CL(dB)	SG Reading	Result		
3920.00	42.59	12.42	13.90	-50.30	-51.78	-13.00	H
3920.00	42.16	12.42	13.90	-50.80	-52.28	-13.00	V

CDMA(HIGH)

Frequency (MHz)	Receiver Reading(dBuV	Correction Factor(dB)		ERP(dBm)		Limit(dBm)	Polarity
		AG(dBd)	CL(dB)	SG Reading	Result		
3987.50	42.80	12.43	13.68	-51.20	-52.45	-13.00	H
3987.50	42.67	12.43	13.68	-50.40	-51.65	-13.00	V

Remark

*** For GSM and WCDMA bands do not measure because the signal is noise floor.**

*** The TX signal isn't detected from 3nd harmonics.**

*** EIRP = SG Reading + AG(dBi)-CL(dB)**

*** ERP = SG Reading + AG(dBi)-CL(dB)+2.15(dB)**

Note : Measurements made with 100 kHz RBW. Correction factor of 10log(1 MHz/100 kHz) will lead to a 10 dB conservative increase in the result value.

7.4 Test Results

Downlink

LTE(LOW)

Frequency (MHz)	Receiver Reading(dBuV	Correction Factor(dB)		ERP(dBm)		Limit(dBm)	Polarity
		AG(dBi)	CL(dB)	SG Reading	Result		
3865.00	42.80	12.41	13.84	-60.70	-62.13	-13.00	H
3865.00	42.55	12.41	13.84	-50.10	-51.53	-13.00	V

LTE(MID)

Frequency (MHz)	Receiver Reading(dBuV	Correction Factor(dB)		ERP(dBm)		Limit(dBm)	Polarity
		AG(dBd)	CL(dB)	SG Reading	Result		
3920.00	43.43	12.42	13.90	-50.20	-51.68	-13.00	H
3920.00	42.60	12.42	13.90	-51.70	-53.18	-13.00	V

LTE(HIGH)

Frequency (MHz)	Receiver Reading(dBuV	Correction Factor(dB)		ERP(dBm)		Limit(dBm)	Polarity
		AG(dBd)	CL(dB)	SG Reading	Result		
3985.00	43.02	12.43	13.68	-50.40	-51.65	-13.00	H
3985.00	43.20	12.43	13.68	-50.00	-51.25	-13.00	V

Remark

*** For GSM and WCDMA bands do not measure because the signal is noise floor.**

*** The TX signal isn't detected from 3nd harmonics.**

*** EIRP = SG Reading + AG(dBi)-CL(dB)**

*** ERP = SG Reading + AG(dBi)-CL(dB)+2.15(dB)**

Note : Measurements made with 100 kHz RBW. Correction factor of 10log(1 MHz/100 kHz) will lead to a 10 dB conservative increase in the result value.

8. Frequency stability

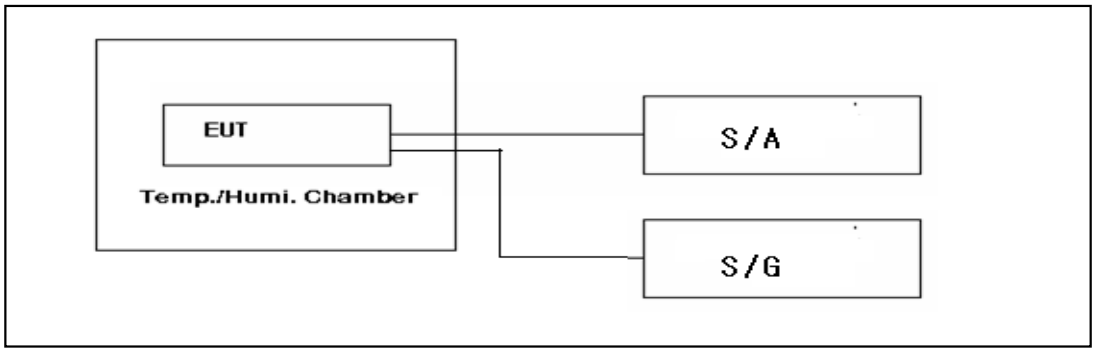
8.1 Test Procedure

The frequency stability of the transmitter is measured by:

a) Temperature: The temperature is varied from -30℃ to +60℃ 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 ±1ppm of the center frequency.



8.2 Test Equipments

The following test equipments are used during tests

Equipment	Manufacturer	Model	Next Cal.
Spectrum Analyzer	Agilent	E4440A	2014-01-27
Slidacs	Digitek power	-	N/A
Tem/Hum Chamber	TABAI ESPEC CORP	PSL-2GT	2014-01-28
Vector Signal Generator	ROHDE&SCHWARZ	SMBV100A	2014-01-25
Signal Generator	HP	E4432B	2014-01-27
Attenuator	SRT	F04-K1830-01	2014-01-27

Downlink

Operting Frequency :	1,960,000,000	
Channel :	MID	
Reference Voltage :	110.00	VAC
Deviatin Limit :	1.00000	

Voltage (%)	Power (VAC)	Temperature (℃)	Frequency (Hz)	Deviation
100	110.0	+20℃(Ref)	1,959,999,985	0.000015
100		-30	1,959,999,990	0.000010
100		-20	1,959,999,990	0.000010
100		-10	1,959,999,975	0.000025
100		**0**	1,959,999,990	0.000010
100		10	1,959,999,980	0.000020
100		20	1,959,999,985	0.000015
100		25	1,959,999,970	0.000030
100		30	1,959,999,975	0.000025
100		40	1,959,999,990	0.000010
100		50	1,959,999,985	0.000015
100		60	1,959,999,980	0.000020
85	93.5	20	1,959,999,990	0.000010
115	126.5	20	1,959,999,985	0.000015
EndPoint	85.0	20	1,959,999,980	0.000020

9. Measurement of conducted disturbance

The continuous disturbance voltage of AC Mains in the frequency from 0.15 MHz to 30 MHz was measured in accordance to FCC PART 15.207 . The test setup was made according to ANSI C 63.4 (2009) in a shielded room. The EUT was placed on a non-conductive table at least 0.8 m above the ground plan. A grounded vertical reference plane was positioned in a distance of 0.4 m from the EUT. The distance from the EUT to other metal surfaces was at least 0.8 m. The EUT was only earthen by its power cord through the line impedance stabilizing network. The power cord has been bundled to a length of 1.0 m. The test receiver with Quasi Peak detector complies with CISPR 16.

9.1 Measurement equipments

Equipment Name	Type	Manufacturer	Serial No.	Next Calibration date
TEST Receiver	ESHS 10	Rohde & Schwarz	844077/018	25-Jan-14
LISN	ENV216	Rohde & Schwarz	101231	25-Jan-14
LISN	ESH3-Z5	Rohde & Schwarz	838979/010	25-Jan-14
Pulse Limiter	ESH3Z2	Rohde & Schwarz	NONE	25-Jan-14

9.2 Environmental Condition

Test Place : Shielded Room

BT Basic Mode

Temperature (°C) : 22.1 ℃

Humidity (% R.H.) : 46.8 % R.H.

9.3 Test data

Test Date : 22-Aug-13

Frequency (MHz)	Correction Factor		Line (H/N)	Quasi-peak Value			Average Value		
	Lisn (dB)	Cable (dB)		Limit (dBμV)	Reading (dBμV)	Result (dBμV)	Limit (dBμV)	Reading (dBμV)	Result (dB)
0.15	0.12	0.17	H	66.00	55.68	55.97	56.00	42.49	42.78
0.22	0.13	0.16	N	62.82	47.39	47.68	52.82	35.82	36.11
3.14	0.15	0.26	H	56.00	43.49	43.89	46.00	41.60	42.00
3.38	0.17	0.27	N	56.00	45.40	45.83	46.00	40.66	41.09
3.72	0.17	0.28	N	56.00	42.77	43.22	46.00	39.84	40.29
3.93	0.16	0.29	H	56.00	39.53	39.97	46.00	38.14	38.58
18.90	0.69	0.44	H	60.00	33.36	34.49	50.00	27.25	28.38
19.67	0.56	0.44	N	60.00	32.56	33.56	50.00	27.55	28.55

Remark	H : Hot Line, N : Neutral Line *Correction Factor = Lisn + Cable *Result = Correction Factor + Reading

Attachment 1 : Conducted graph

ES TECH 22 Aug 2013 22:41

HOT

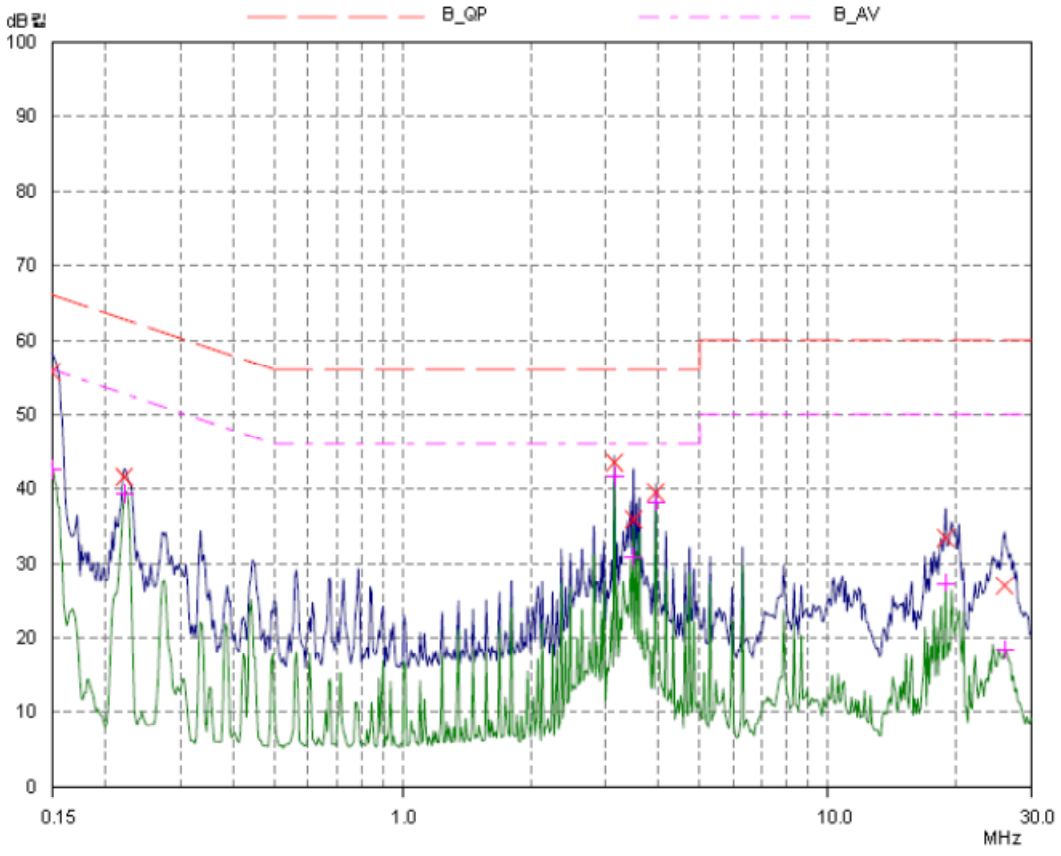
EUT:	APEX1933
Manuf:	
Op Cond:	120 Va.c.
Operator:	I,K,Hong
Test Spec:	CLASS B
Comment:	

Result File: 1255_h.dat : R-tron

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	0.8%	10kHz	PK+AV	10msec	Auto	OFF	60dB

Final Measurement: Detectors: X QP / + AV
Meas Time: 1sec
Subranges: 25
Acc Margin: 0 dB



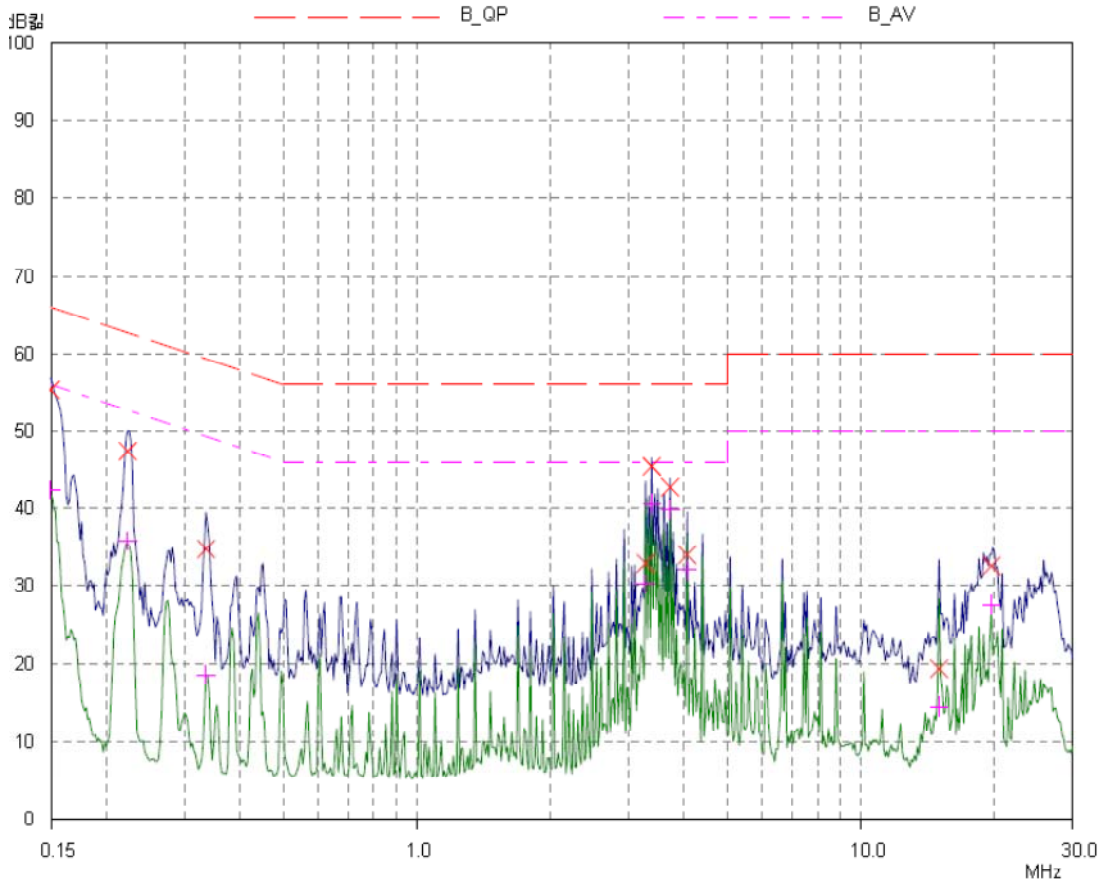
ES TECH
NEUTRAL

22 Aug 2012 22:25

EUT:	APEX1933
Manuf:	
Op Cond:	220 Va.c.
Operator:	I.K.Hong
Test Spec:	CLASS B
Comment:	
Result File:	1255_n.dat : R-tron
Scan Settings	(1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	0.8%	10kHz	PK+AV	10msec	Auto	OFF	60dB

Final Measurement:	Detectors:	X QP / + AV
	Meas Time:	1sec
	Subranges:	25
	Acc Margin:	0 dB



Attachment 2 : Peack singl power and multi power

With AGC

Mode	channel	Power(dBm)
CDMA	Singl channel	33.78
	Multi channel	33.58
WCDMA	Singl channel	33.68
	Multi channel	33.44
GSM	Singl channel	33.75
	Multi channel	33.51
LTE 5M	Singl channel	33.68
	Multi channel	33.39
LTE 10M	Singl channel	33.53
	Multi channel	33.31
LTE 15M	Singl channel	33.55
	Multi channel	33.37
LTE 20M	Singl channel	33.45
	Multi channel	33.28

Without AGC

Mode	channel	Power(dBm)
CDMA	Singl channel	33.61
	Multi channel	33.42
WCDMA	Singl channel	33.55
	Multi channel	33.37
GSM	Singl channel	33.57
	Multi channel	33.41
LTE 5M	Singl channel	33.58
	Multi channel	33.36
LTE 10M	Singl channel	33.35
	Multi channel	33.15
LTE 15M	Singl channel	33.50
	Multi channel	33.26
LTE 20M	Singl channel	33.24
	Multi channel	33.14