FCC TEST REPORT

Product Name	Repeater
Model Name	APEX730
Applicant	R-tron Inc.
FCC ID	STE-APEX730

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	ESTR1108-006			
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.	APEX730	Manufacturer	R-tron Inc.
	Serial No.	NONE	Country of origin	KOREA
Other	Issued Date	2011-08-16	Tested Date	2011-08-01 ~ 2011-08-16
Test Result	**Pass**			
Standard	**FCC PART 27**			
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

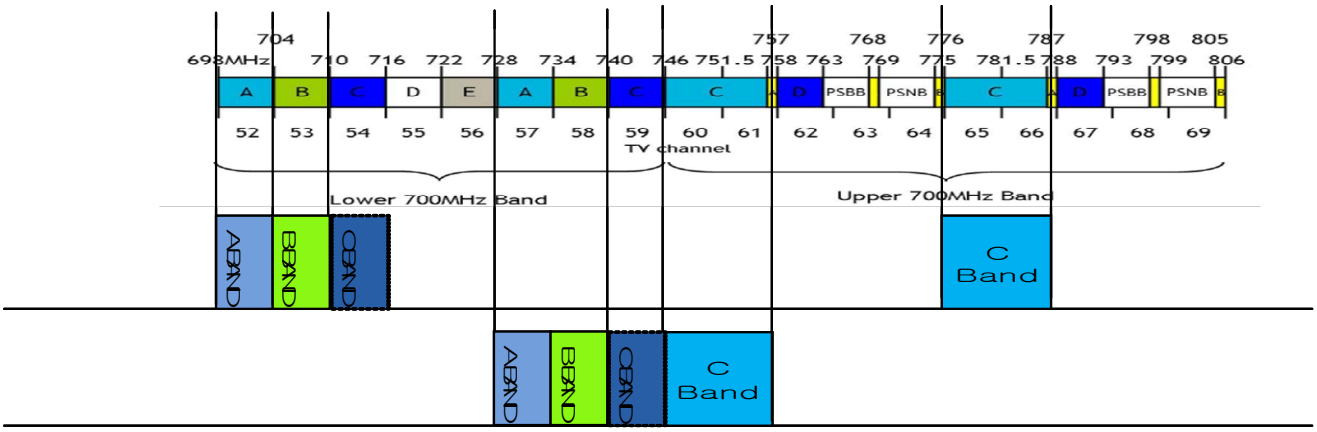
Contents

1. General Information

1.1 EUT Description

FCC ID	**STE-APEX730**
Product Name	**Repeater**
Model Name	**APEX730**
Frequency	**Uplink BW(5MHz) 698MHz ~ 716MHz** **Downlink BW(5MHz) 728MHz ~ 746MHz**
	Uplink BW(10MHz) 776MHz ~ 787MHz
	Downlink BW(10MHz) 746MHz ~ 757MHz
Power Rating	**Input: 110~240VAC 50~60Hz**

700M Band			Down Link				Up Link			
No	Block	Channel	Center	Start	Stop	BW	Center	Start	Stop	BW
1	A		731.000	728.7425	733.2575	4.515	701.000	698.7425	703.2575	4.515
2	B		737.000	734.7425	739.2575	4.515	707.000	704.7425	709.2575	4.515
3	C(L)		743.000	740.7425	745.2575	4.515	713.000	710.7425	715.2575	4.515
4	C(U)		751.000	746.4925	755.5075	9.015	782.000	777.4925	786.5075	9.015



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

EMC Lab(Yanggi) 97-1, Hoiuk-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 & 27.50	PASS
Occupied Bandwidth	2.1049	PASS
Band Edge / Spurious and Harmonic Emission at Antenna Terminal	27.53(c) & 27.53(f) & 27.53(g)	PASS
Field Strength of Spurious Radiation	27.53(c) & 27.53(f) & 27.53(g)	PASS
Frequency stability	27.54	PASS

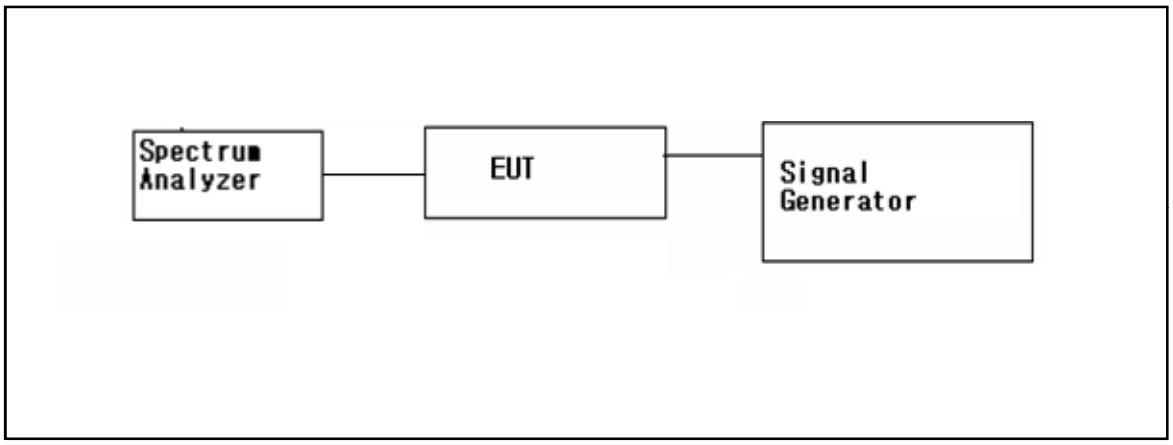
4. RF Output Power

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

1. The EUT was placed on a wooden turn table 3 meters from the receive antenna. The receive antenna height and turn table rotation was adjusted for the highest reading on the receive spectrum analyzer. For CDMA signals, a peak detector is used, with RBW = VBW = 3MHz. For AMPS, GSM, and NADC TDMA signals, a peak detector is used, with RBW = VBW = 1MHz, A Horn antenna was substituted in place of the EUT. This Horn antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same receive spectrum analyzer reading. This spurious level is recorded. For reading 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.

2. The RF output port of the EUT was connected to the
S/A This test was performed three channels (Low, High, Middle)

3. 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	2012-09-05
Spectrum Analyzer	Agilent	E4402B	2012-02-24
Vector Signal Generator	ROHDE&SCHWARZ	SMBV100A	2012-02-15
Signal Generator	HP	E4432B	2012-02-24

4.3.1 Test Results (Uplink)-BW5MHz

Conducted power

Block	Freq (MHz)	Power Output (dBm)
A	701.00	30.05
B	707.00	30.09
C(L)	713.00	30.07

* (L)=Lower 700MHz band)

4.3.2 Test Results (Downlink)-BW5MHz

Block	Freq (MHz)	Power Output (dBm)
A	731.00	30.00
B	737.00	30.04
C(L)	743.00	30.01

* (L)=Lower 700MHz band)

4.3.3 Test Results (Uplink)-BW10MHz

Block	Freq (MHz)	Power Output (dBm)
C(U)	782.00	30.08

* (U)=Upper 700MHz band)

4.3.4 Test Results (Downlink)-BW10MHz

Block	Freq (MHz)	Power Output (dBm)
C(U)	751.00	30.11

* (U)=Upper 700MHz band)

Multiple signals

Test Results (Uplink)-BW5MHz

Block	Freq (MHz)	Power Output (dBm)
A	701.00	30.02
B	707.00	30.20
C(L)	713.00	30.19

Test Results (Downlink)-BW5MHz

Block	Freq (MHz)	Power Output (dBm)
A	731.00	31.01
B	737.00	30.92
C(L)	743.00	31.40

* (L)=Lower 700MHz band)

Test Results (Uplink)-BW10MHz

Block	Freq (MHz)	Power Output (dBm)
C(U)	782.00	30.73

* (U)=Upper 700MHz band)

Test Results (Downlink)-BW10MHz

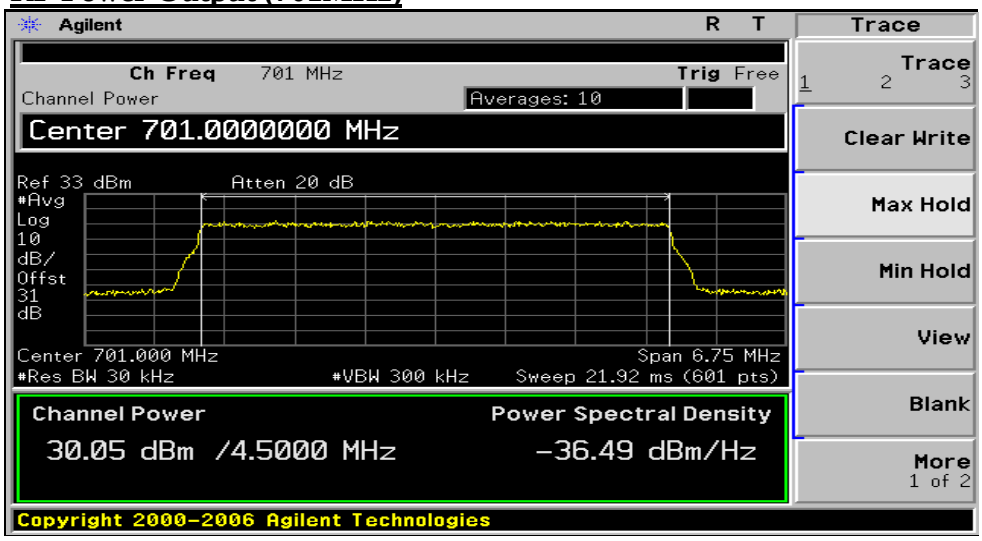
Block	Freq (MHz)	Power Output (dBm)
C(U)	751.00	30.24

* (U)=Upper 700MHz band)

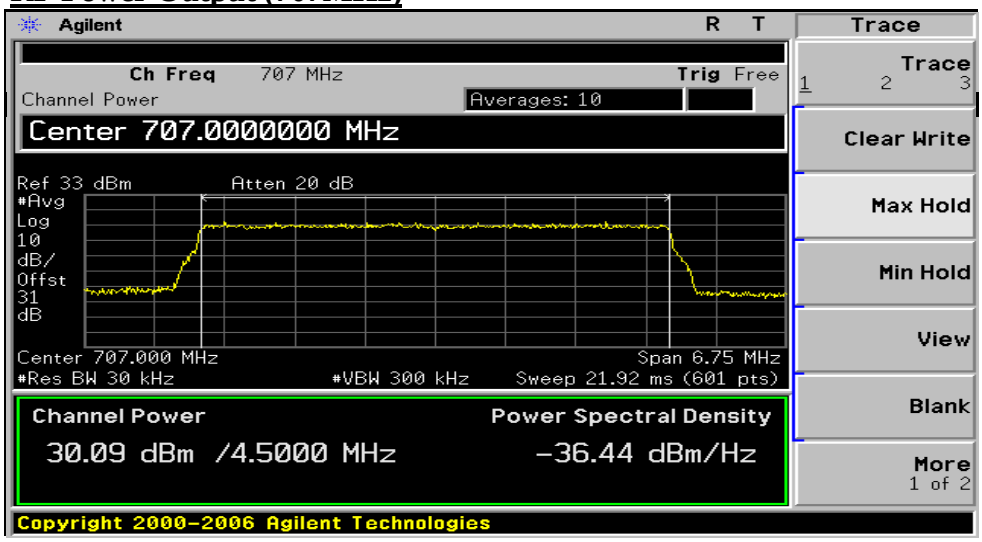
4.4 Test Plot

Uplink

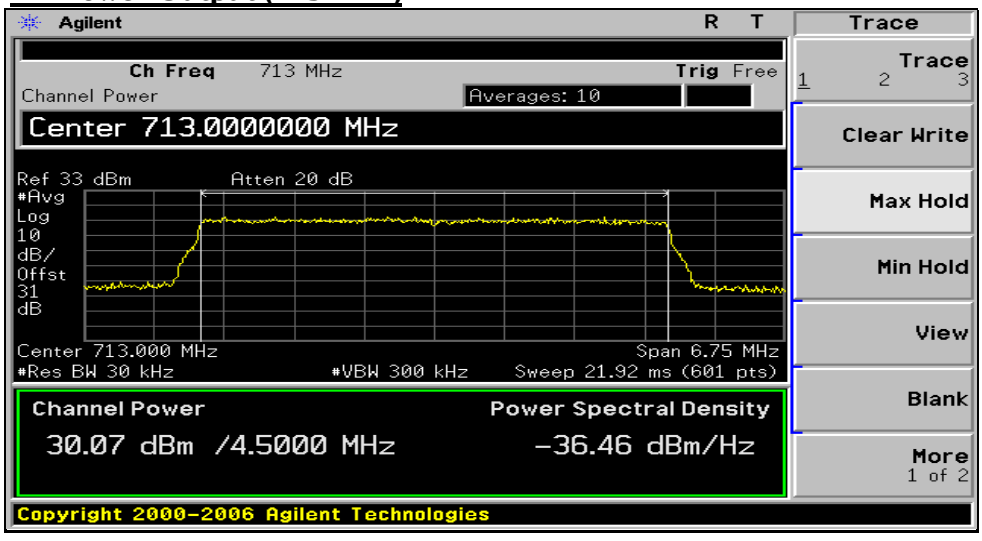
RF Power Output (701MHz)



RF Power Output (707MHz)

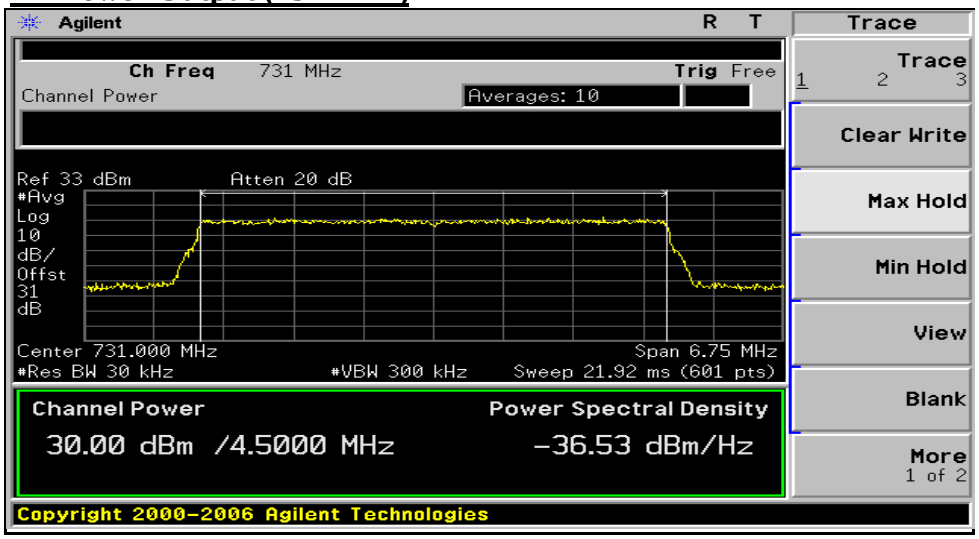


RF Power Output (713MHz)

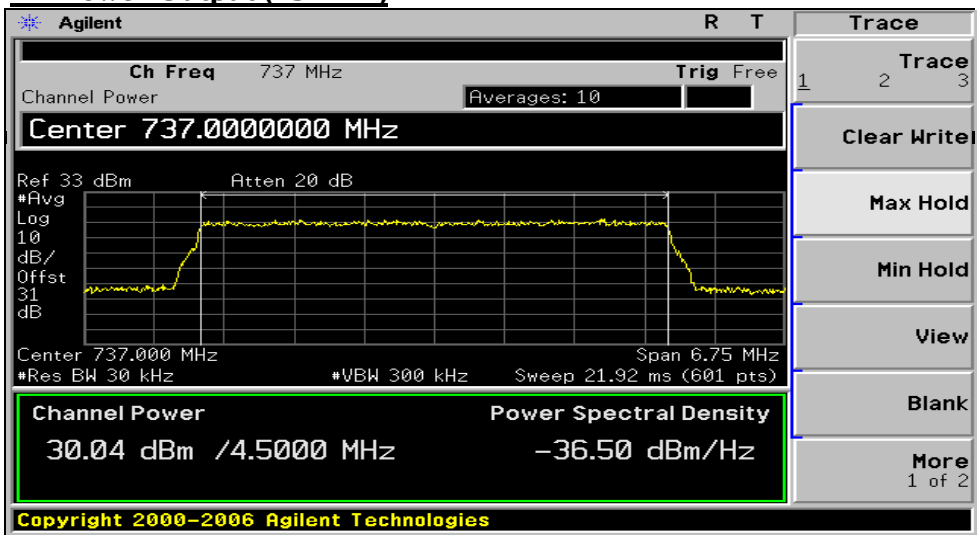


Downlink

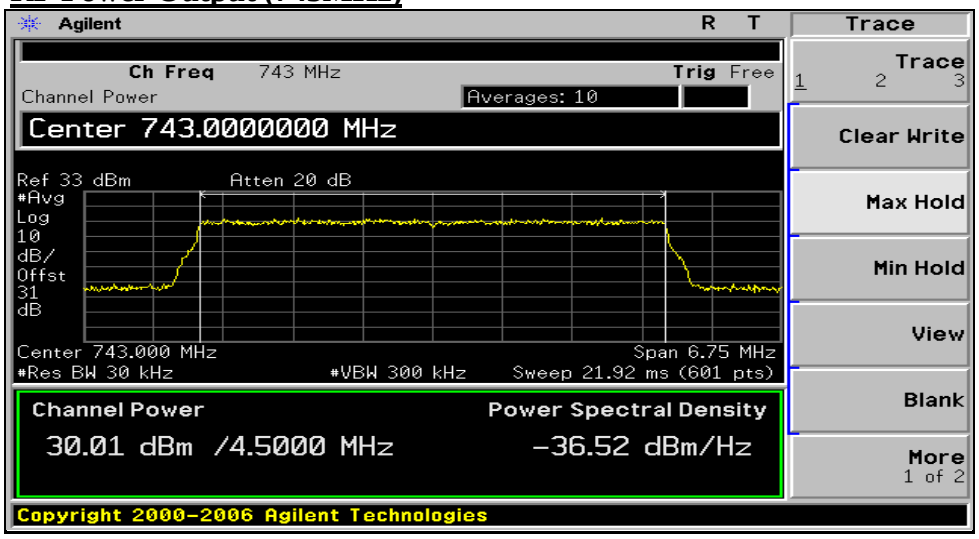
RF Power Output (731MHZ)



RF Power Output (737MH)

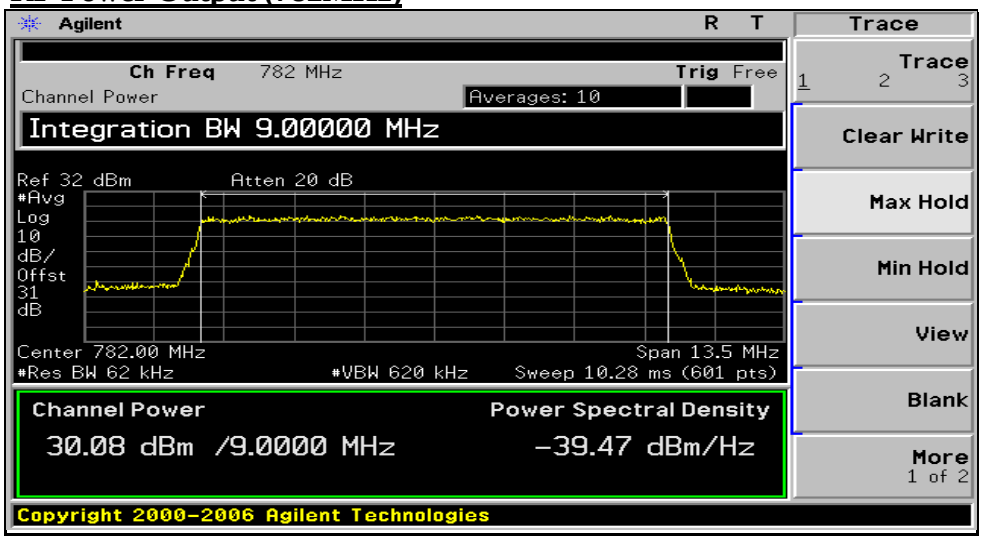


RF Power Output (743MHz)



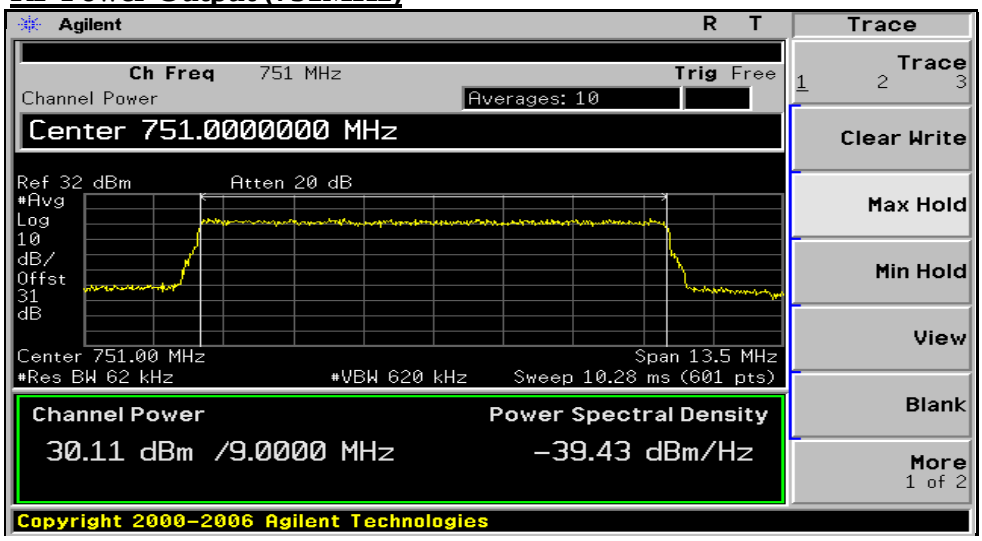
Uplink

RF Power Output (782MHz)



Downlink

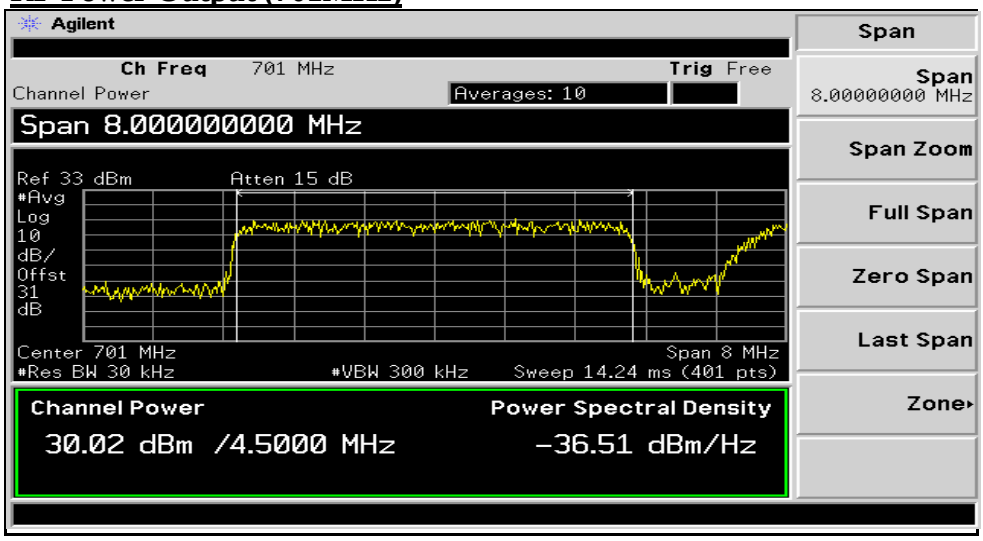
RF Power Output (751MHz)



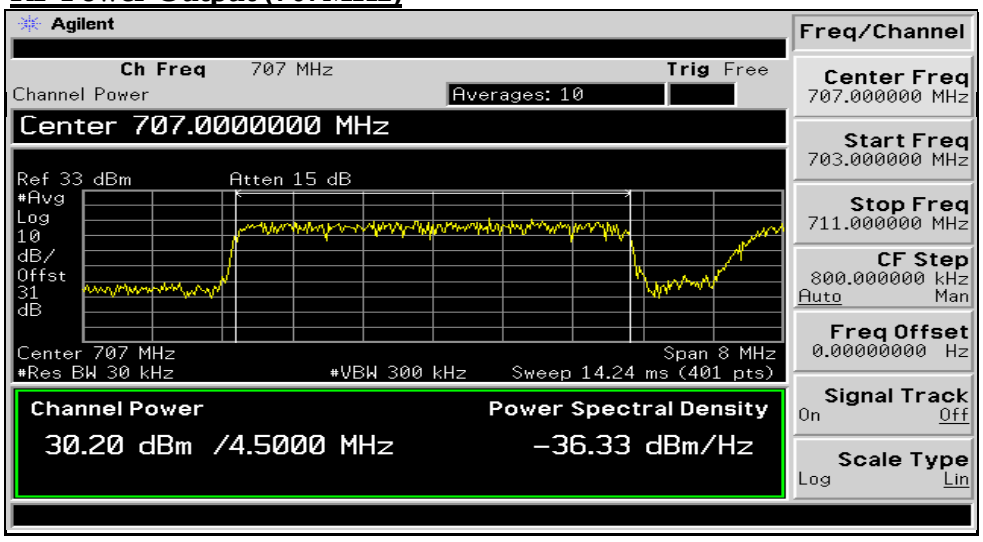
Multiple signals

Uplink

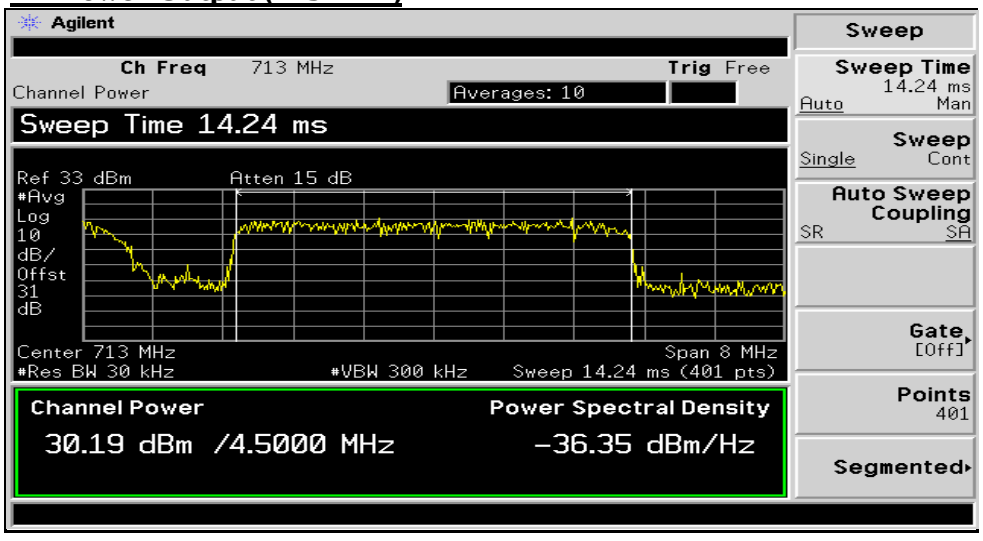
RF Power Output (701MHz)



RF Power Output (707MHz)

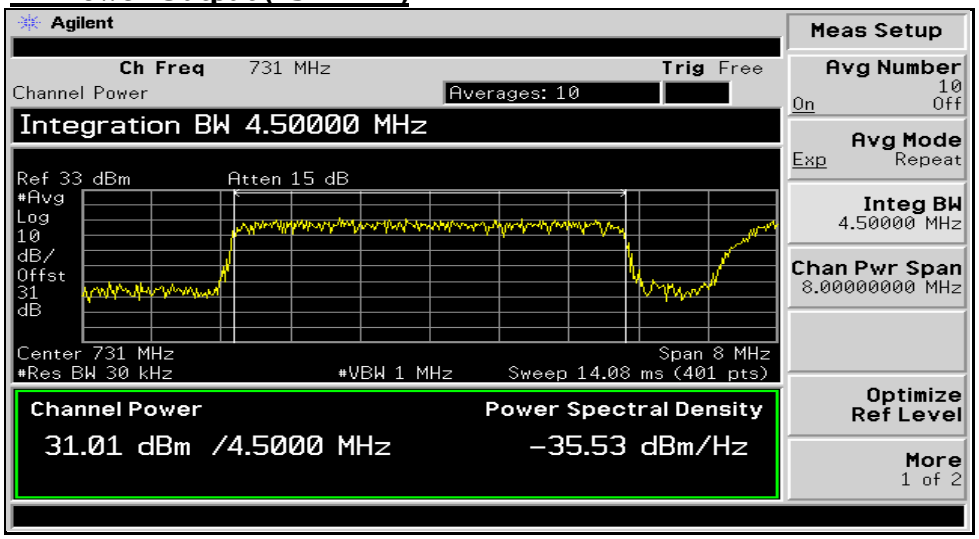


RF Power Output (713MHz)

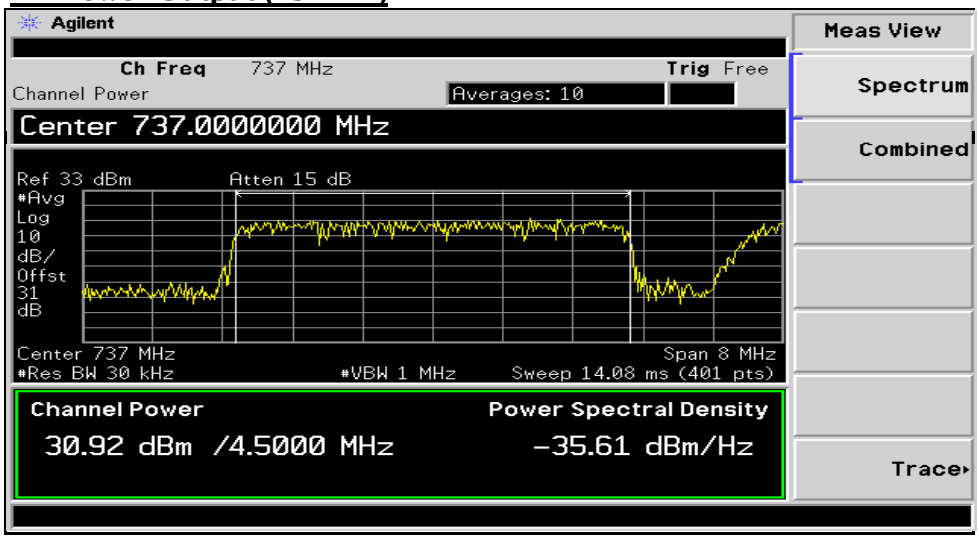


Downlink

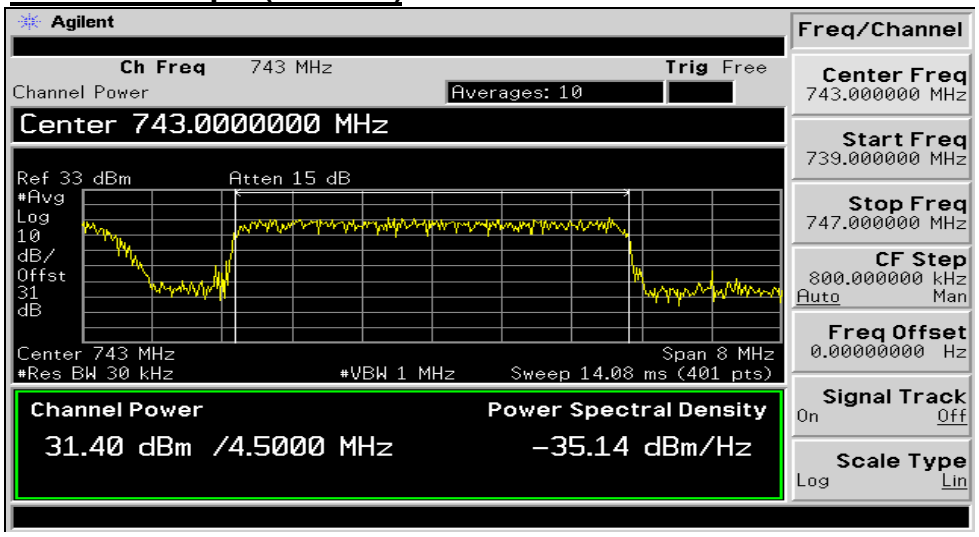
RF Power Output (731MHZ)



RF Power Output (737MH)

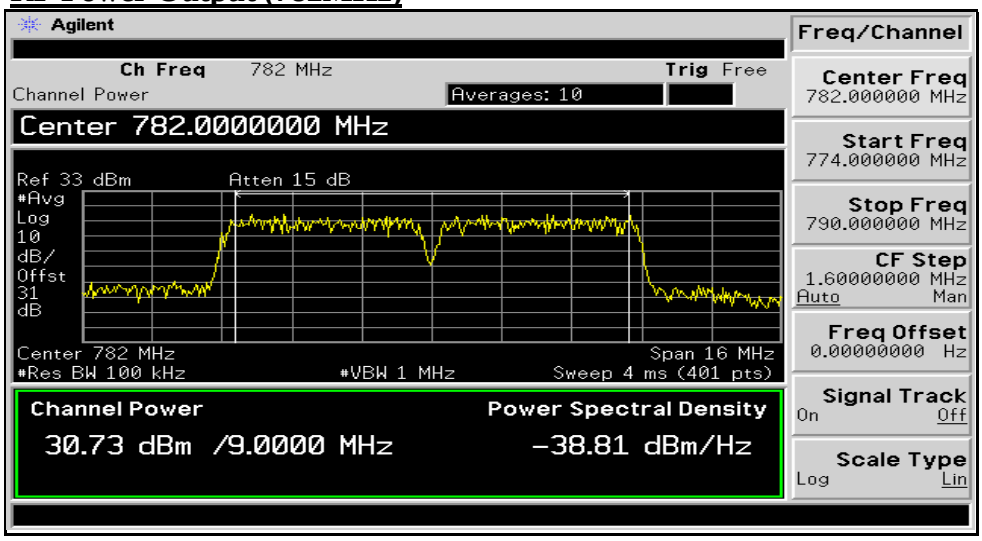


RF Power Output (743MHz)



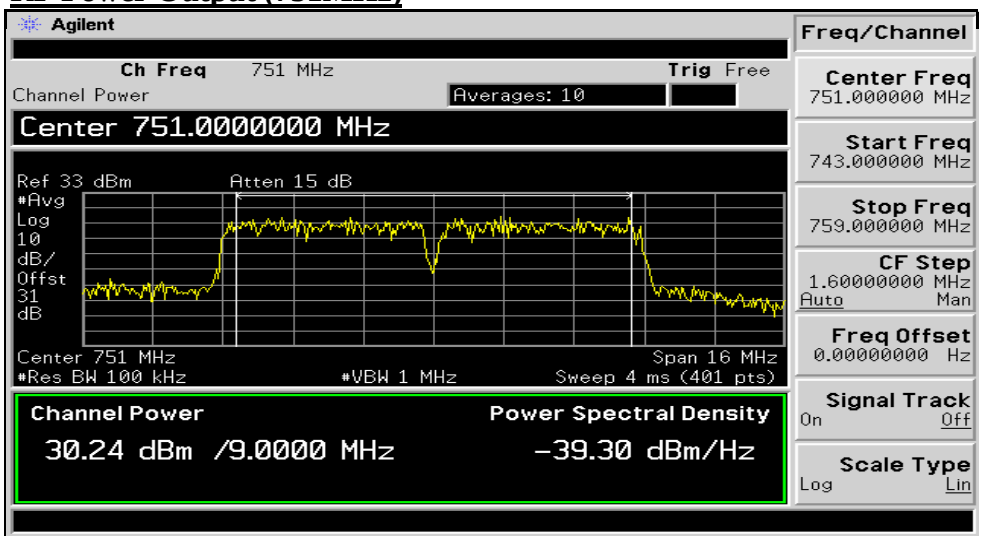
Uplink

RF Power Output (782MHz)



Downlink

RF Power Output (751MHz)

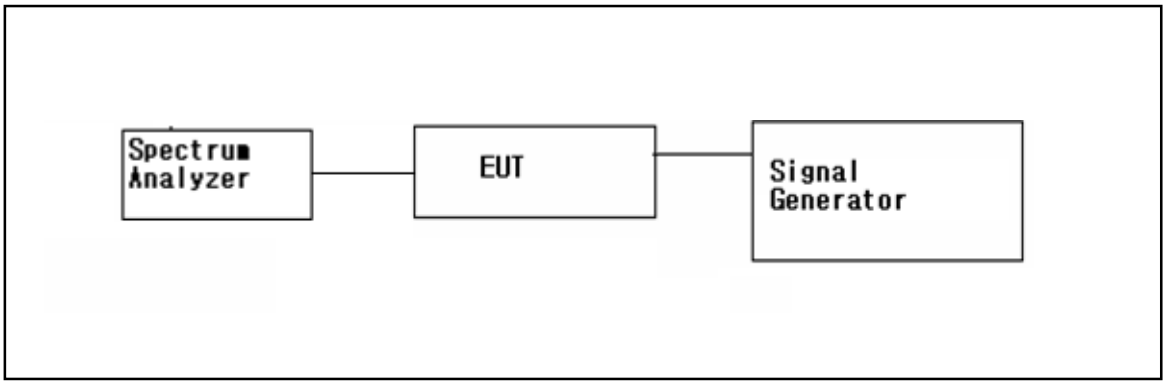


5. Occupied Bandwidth

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	Next Cal.
Spectrum Analyzer	Agilent	E4440A	2012-09-05
Spectrum Analyzer	Agilent	E4402B	2012-02-24
Vector Signal Generator	ROHDE&SCHWARZ	SMBV100A	2012-02-15
Signal Generator	HP	E4432B	2012-02-24

5.3 Test Results

(Uplink)-BW5MHz

Block	Frequency(MHz)	26dB Bandwidth(MHz)
A	701.00	4.901
B	707.00	4.872
C(L)	713.00	4.899

* (L)=Lower 700MHz band)

(Downlink)-BW5MHz

Block	Frequency(MHz)	26dB Bandwidth(MHz)
A	731.00	4.835
B	737.00	4.922
C(L)	743.00	4.919

* (L)=Lower 700MHz band)

(Uplink)-BW10MHz

Block	Frequency(MHz)	26dB Bandwidth(MHz)
C(U)	782.00	9.351

* (U)=Upper 700MHz band)

(Downlink)-BW10MHz

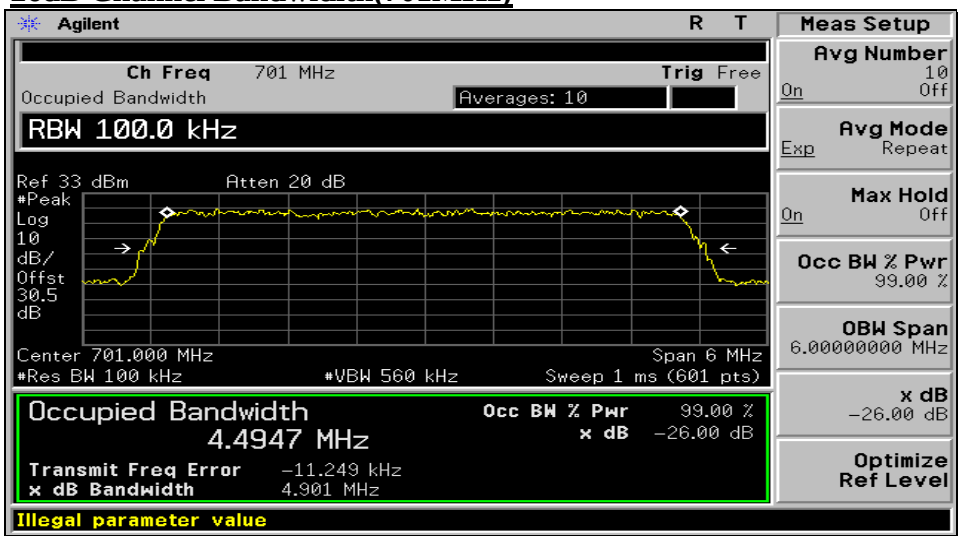
Block	Frequency(MHz)	26dB Bandwidth(MHz)
C(U)	751.00	9.442

* (U)=Upper 700MHz band)

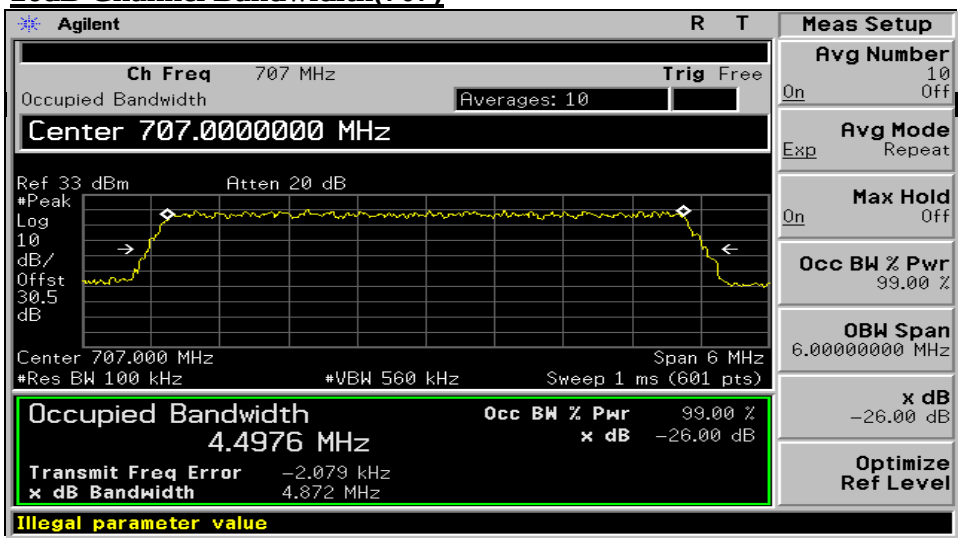
5.4 Test Plot

Uplink-BW5MHz

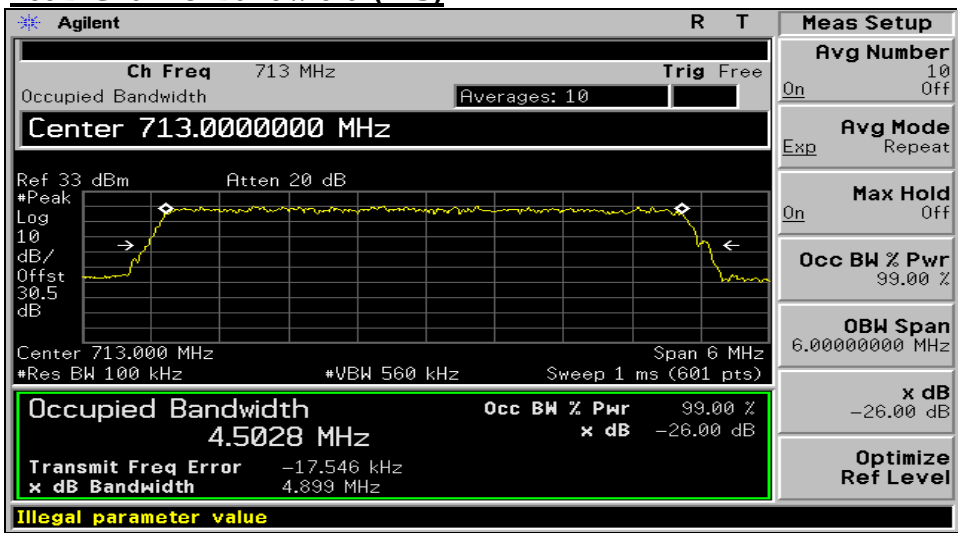
26dB Channel Bandwidith(701MHz)



26dB Channel Bandwidith(707)

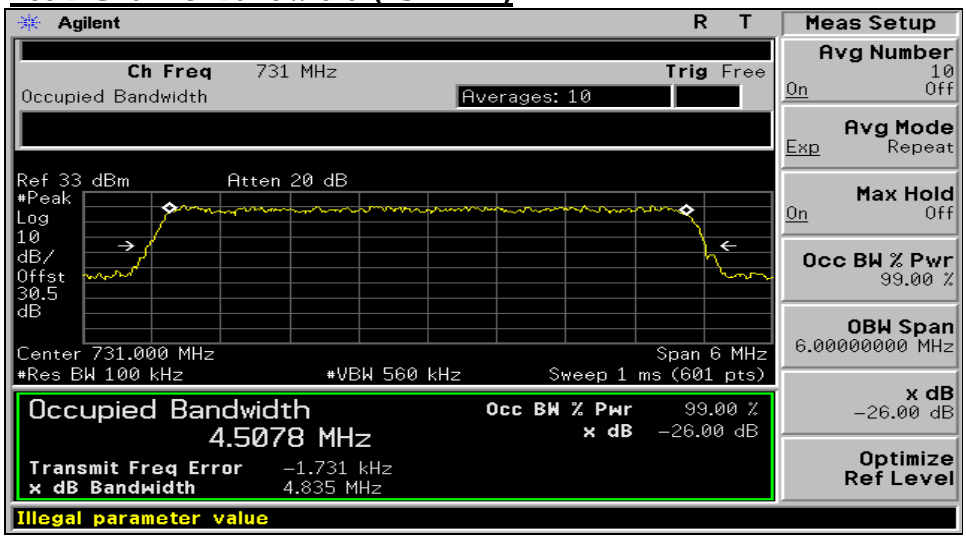


26dB Channel Bandwidith(713)

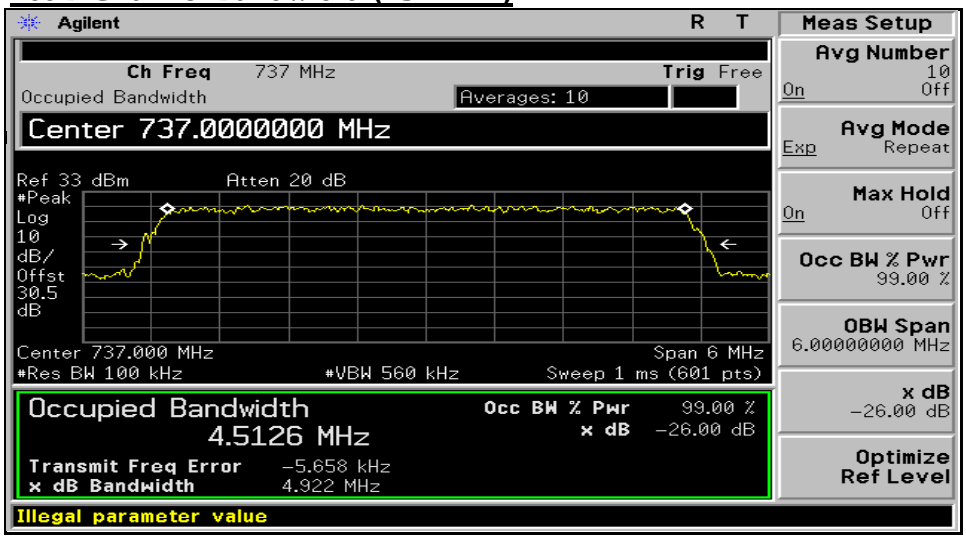


Downlink-BW5MHz

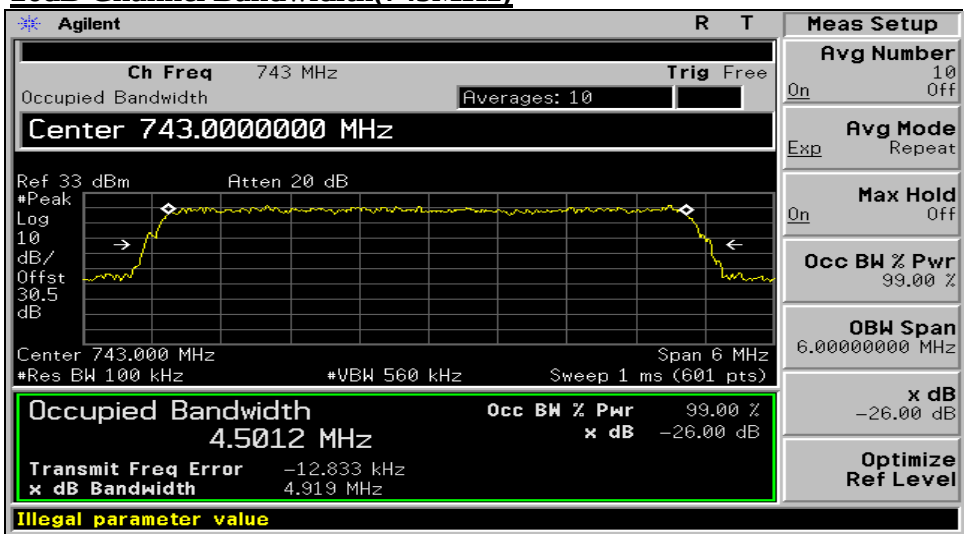
26dB Channel Bandwidth(731MHz)



26dB Channel Bandwidth(737MHz)

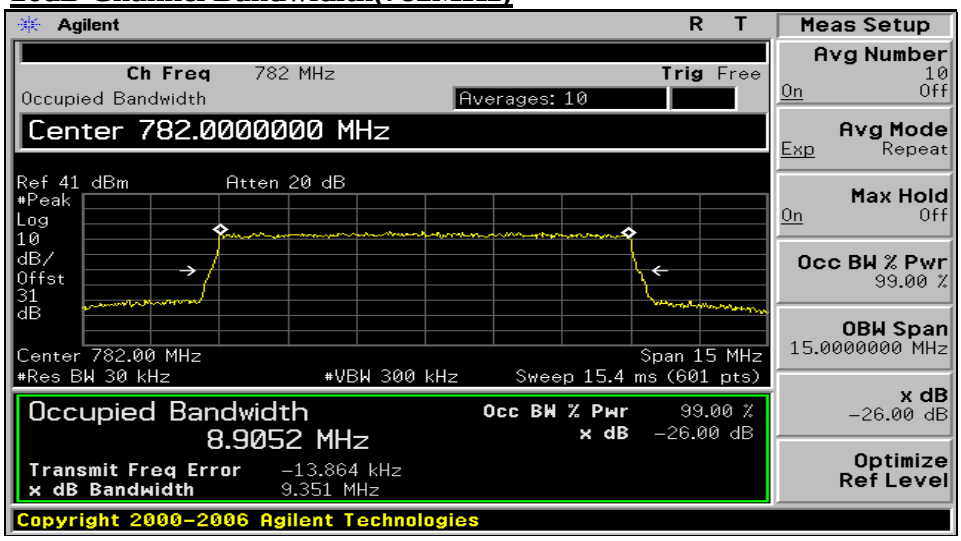


26dB Channel Bandwidth(743MHz)



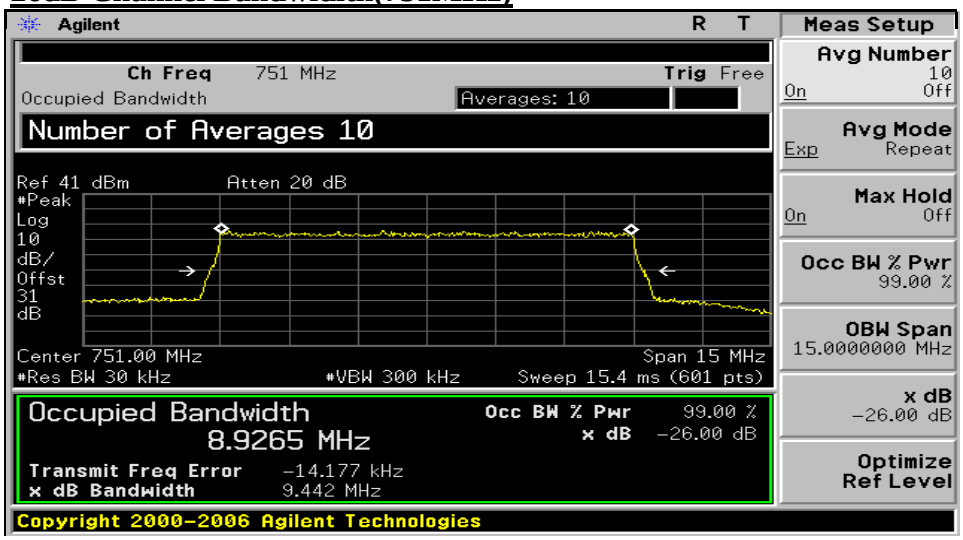
Uplink-BW10MHz

26dB Channel Bandwidth(782MHz)



Downlink-BW10MHz

26dB Channel Bandwidth(751MHz)



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.

27.53(C)(1)(3) , 27.53(F) , 27.53.(G): For operations in the 746–763 MHz, 775–793 MHz, and 805–806 MHz bands, emissions in the band 1559–1610 MHz shall be limited to −70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and −80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation

6.2 Test Equipments

The following test equipments are used during tests

Equipment	Manufacturer	Model	Next Cal.
Spectrum Analyzer	Agilent	E4440A	2012-09-05
Spectrum Analyzer	Agilent	E4402B	2012-02-24
Spectrum Analyzer	Agilent	N9020A	2011-05-16
Vector Signal Generator	Agilent	N5182A	2011-05-16
Vector Signal Generator	ROHDE&SCHWARZ	SMBV100A	2012-02-15
Signal Generator	HP	E4432B	2012-02-24

6.3 Test Results (Uplink)

(Spurious Emission: Band Edge)-BW5MHz

Block	Frequency	Result	Limit	Margin
A	697.98	-23.98	-13.00	10.98
C(L)	716.65	-24.06	-13.00	11.06

(Spurious Emission: Out of Band)-BW5MHz

Block	Frequency	Result	Limit	Margin
A	7500.00	-28.44	-13.00	15.44
B	7112.00	-28.34	-13.00	15.34
C(L)	7588.00	-28.60	-13.00	15.60

Test Results (Downlink)

(Spurious Emission: Band Edge)-BW5MHz

Block	Frequency	Result	Limit	Margin
A	727.52	-22.92	-13.00	9.92
C(L)	749.98	-19.34	-13.00	6.34

* (L)=Lower 700MHz band)

(Spurious Emission: Out of Band)-BW5MHz

Block	Frequency	Result	Limit	Margin
A	7786.00	-27.92	-13.00	14.92
B	7089.00	-27.56	-13.00	14.56
C(L)	3085.00	-27.65	-13.00	14.65

* (L)=Lower 700MHz band)

Test Results (Upnlink)

(Spurious Emission: Band Edge)-BW10MHz

Block	Frequency	Result	Limit	Margin
C(U)	775.52	-24.47	-13.00	11.47
C(U)	787.72	-25.60	-13.00	12.60

* (U)=Upper 700MHz band)

(Spurious Emission: Out of Band)-BW10MHz

Block	Frequency	Result	Limit	Margin
C(U)	3078.00	-24.43	-13.00	11.43

* (U)=Upper 700MHz band)

Test Results (Downlink)

(Spurious Emission: Band Edge)-BW10MHz

Channel	Frequency	Result	Limit	Margin
C(U)	744.88	-20.74	-13.00	7.74
C(U)	757.22	-24.44	-13.00	11.44

* (U)=Upper 700MHz band)

(Spurious Emission: Out of Band)-BW10MHz

Channel	Frequency	Result	Limit	Margin
C(U)	3061.00	-25.38	-13.00	12.38

* (U)=Upper 700MHz band)

Test Results

(Spurious Emission)763-775MHz-BW10MHz

Block	Frequency	Result	Limit	Margin
*C(U)	774.88	-50.04	-46.00	4.04

* (U)=Upper 700MHz band Uplink)
*RBW 6.25KHz => 10KHz : 10log10(10kHz/6.25KHz) = 2.04dB

(Spurious Emission)793-805MHz-BW10MHz

Block	Frequency	Result	Limit	Margin
*C(U)	799.46	-71.18	-46.00	25.18

* (U)=Upper 700MHz band Uplink)
*RBW 6.25KHz => 10KHz : 10log10(10kHz/6.25KHz) = 2.04dB

(Spurious Emission)1559-1610MHz-BW10MHz

Block	Frequency	Result	**Limit	Margin	Ant Gain(dBi)
*C(U)	1606.94	-45.67	-40.00	5.67	0.85

* (U)=Upper 700MHz band Uplink)
** limit=-70dBW/MHz=-40dBm/MHz

(Spurious Emission)763-775MHz-BW10MHz

Block	Frequency	Result	Limit	Margin
*C(U)	763.12	-71.04	-46.00	25.04

* (U)=Upper 700MHz band Downlink)
*RBW 6.25KHz => 10KHz : 10log10(10kHz/6.25KHz) = 2.04dB

(Spurious Emission)793-805MHz-BW10MHz

Block	Frequency	Result	Limit	Margin
*C(U)	798.08	-71.77	-46.00	25.77

* (U)=Upper 700MHz band Downlink)
*RBW 6.25KHz => 10KHz : 10log10(10kHz/6.25KHz) = 2.04dB

(Spurious Emission)1559-1610MHz-BW10MHz

Block	Frequency	Result	**Limit	Margin	Ant Gain(dBi)
*C(U)	1589.60	-45.79	-40.00	5.79	0.85

* (U)=Upper 700MHz band Downlink)
** limit=-70dBW/MHz=-40dBm/MHz

multiple signals

Uplimk

(Spurious Emission: Band Edge)

Block	Frequency	Result	Limit	Margin
A	697.15	-21.33	-13.00	8.33
C(L)	716.55	-21.17	-13.00	8.17

Downlink

(Spurious Emission: Band Edge)

Block	Frequency	Result	Limit	Margin
A	727.55	-16.08	-13.00	3.08
C(L)	746.30	-17.58	-13.00	4.58

Uplink

(Spurious Emission: Band Edge)

Block	Frequency	Result	Limit	Margin
A	775.85	-20.62	-13.00	7.62
C(L)	787.40	-16.04	-13.00	3.04

Downlink

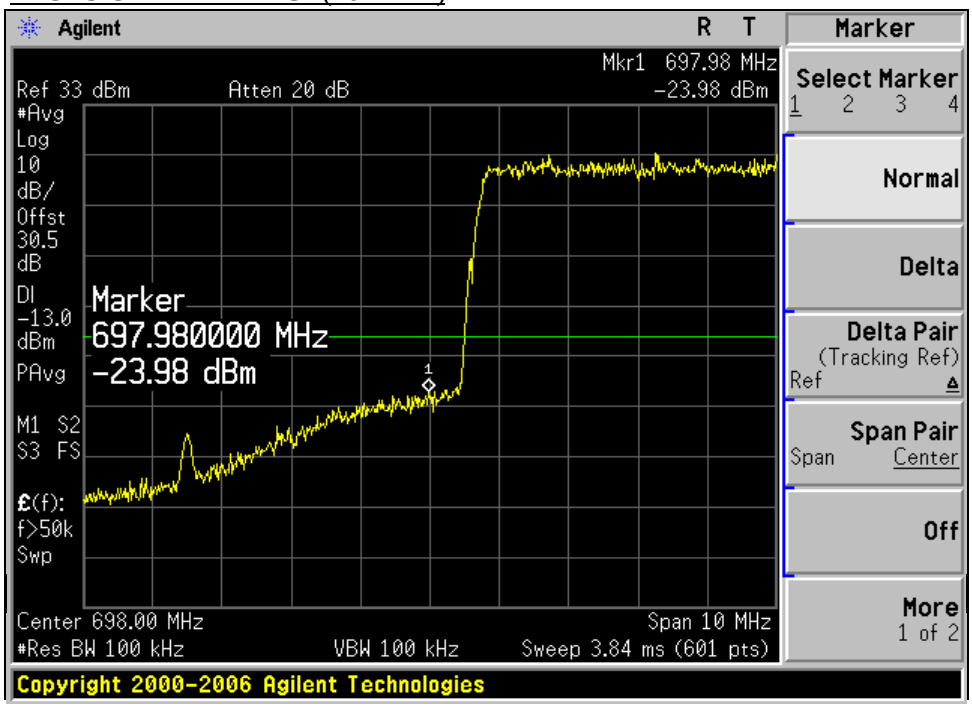
(Spurious Emission: Band Edge)

Block	Frequency	Result	Limit	Margin
A	744.80	-20.12	-13.00	7.12
C(L)	756.20	-24.83	-13.00	11.83

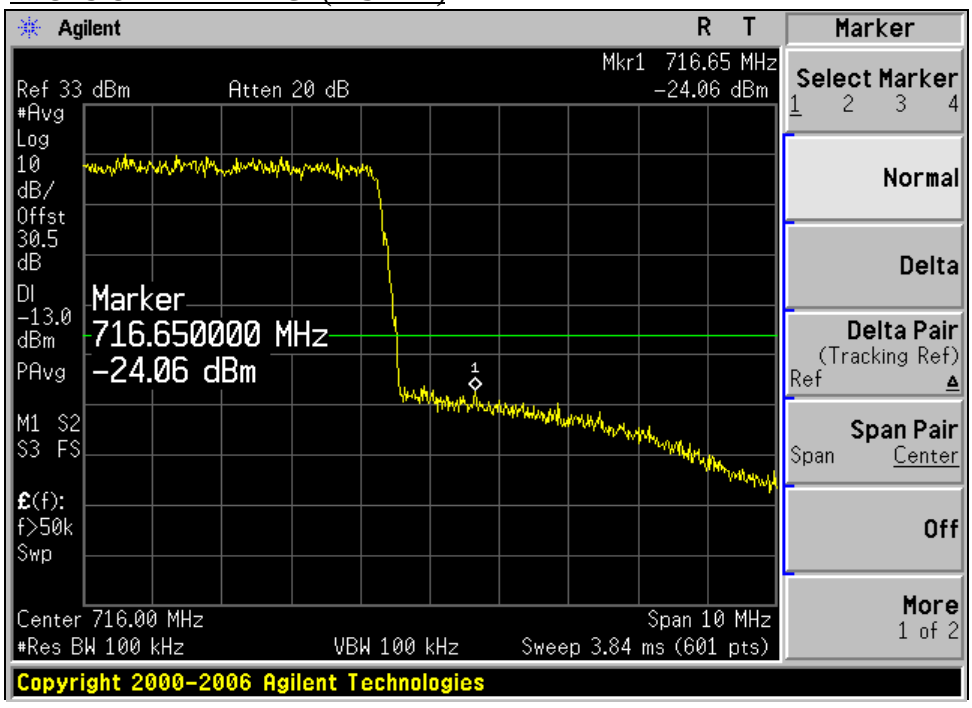
6.4 Test Plot

Uplink-BW5MHz

PLOTS OF BAND EDGE(701MHz)

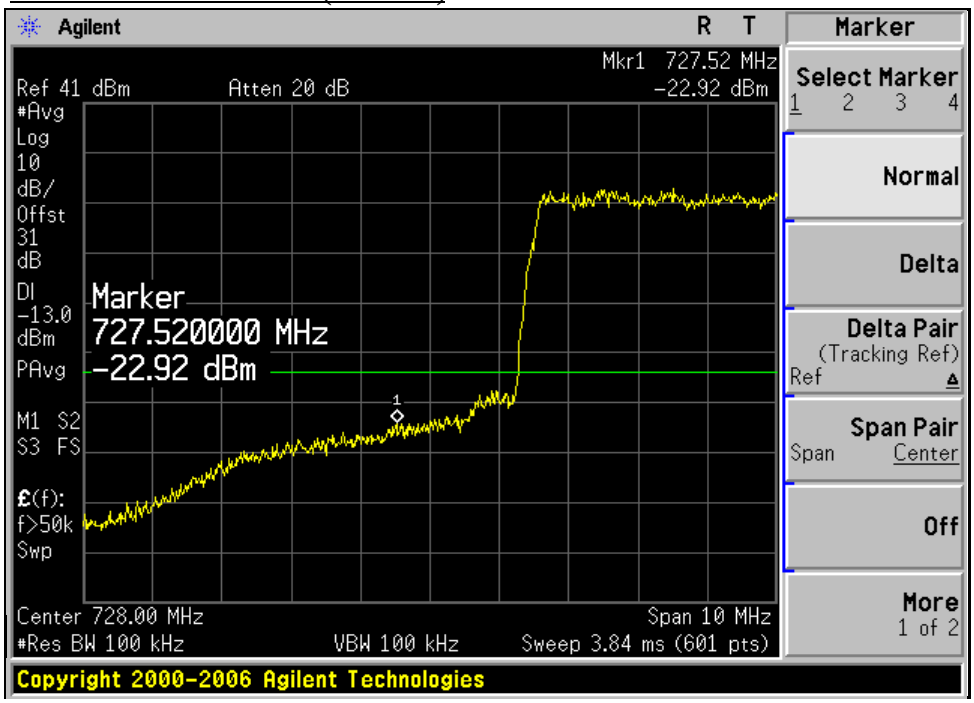


PLOTS OF BAND EDGE(713MHz)

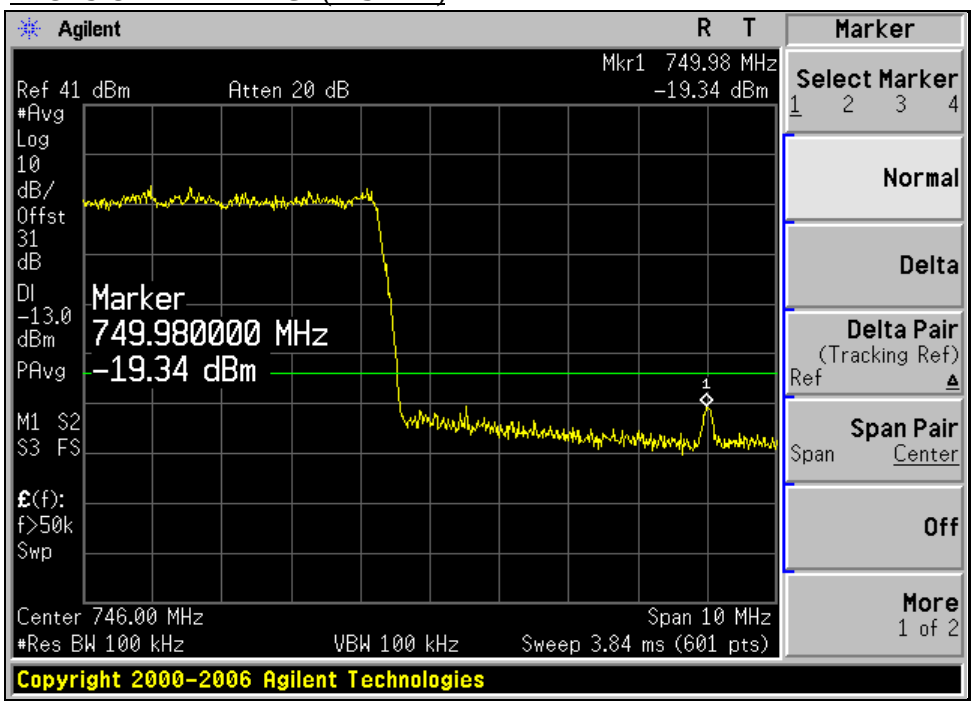


Downlink-BW5MHz

PLOTS OF BAND EDGE(731MHz)

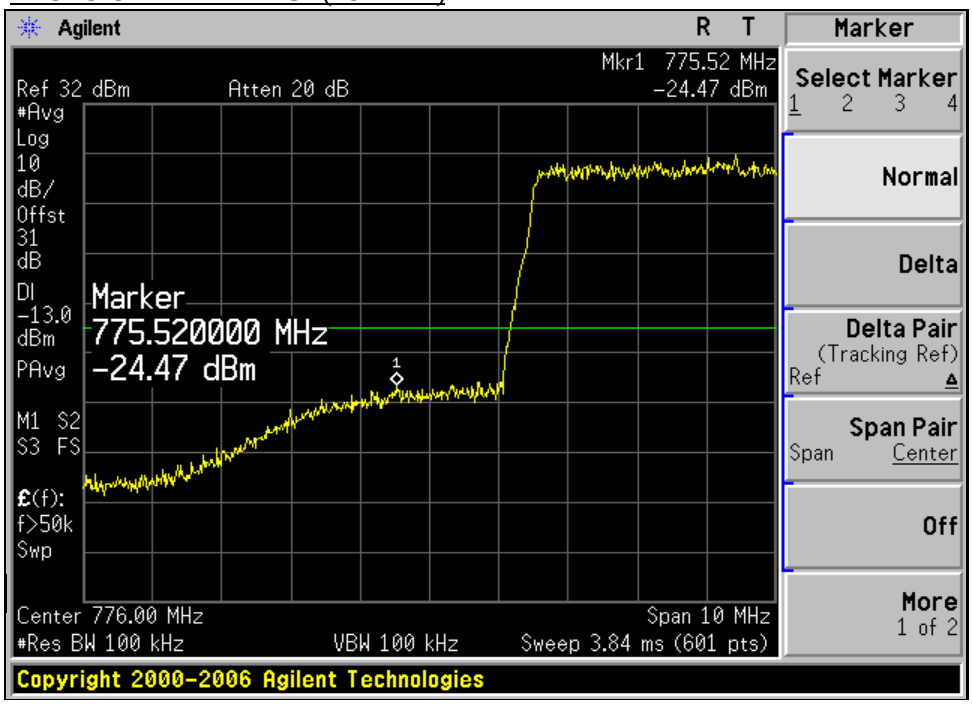


PLOTS OF BAND EDGE(743MHz)

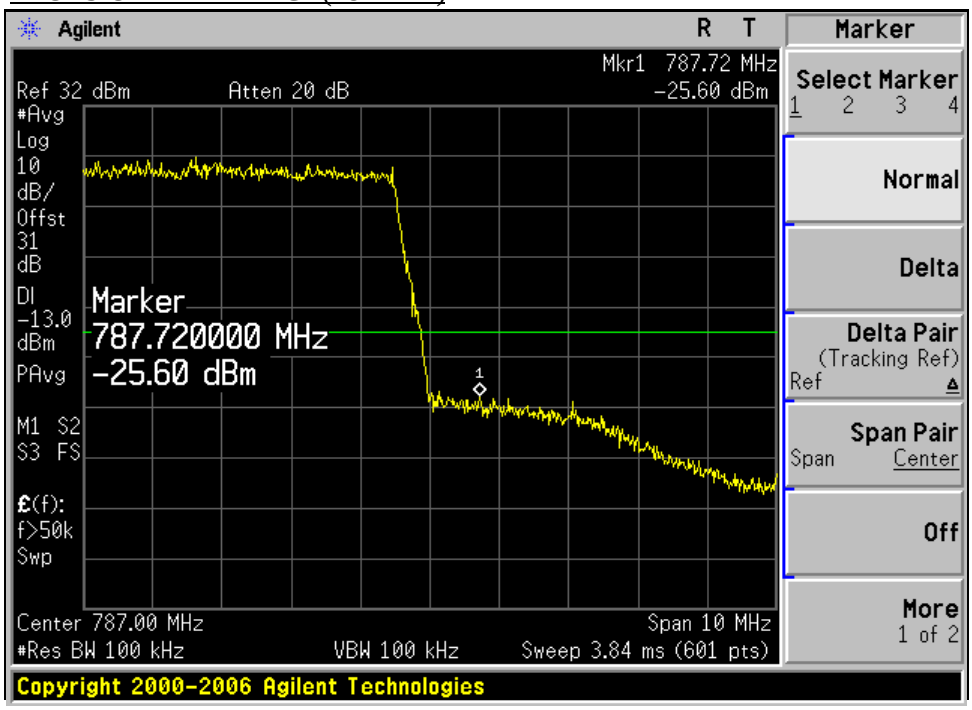


Uplink-BW10MHz

PLOTS OF BAND EDGE(782MHz)

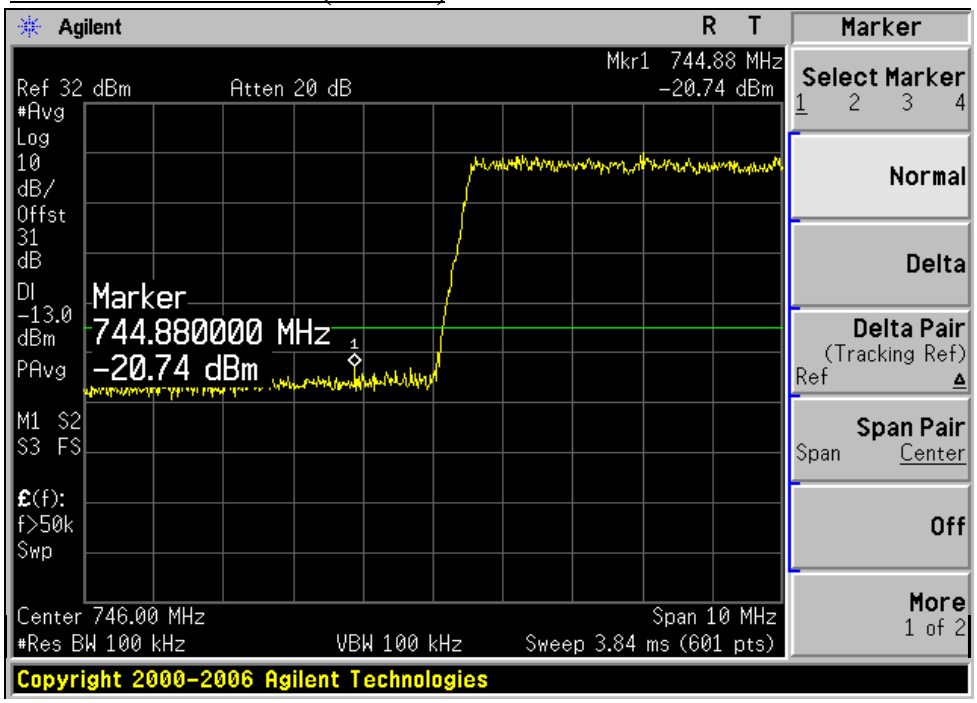


PLOTS OF BAND EDGE(782MHz)

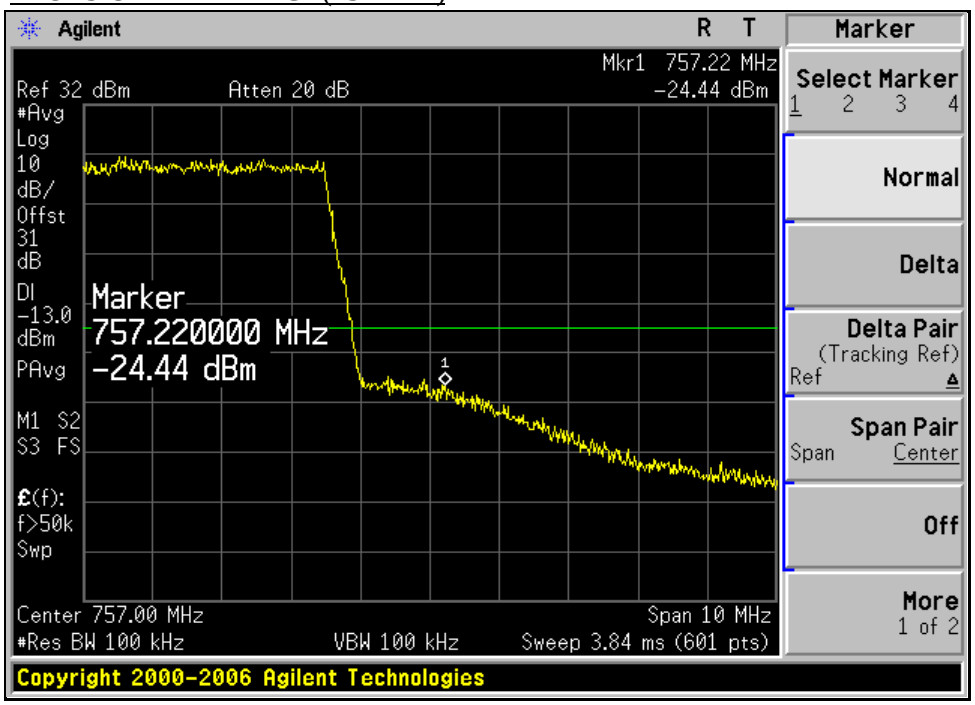


Downlink-BW10MHz

PLOTS OF BAND EDGE(751MHz)

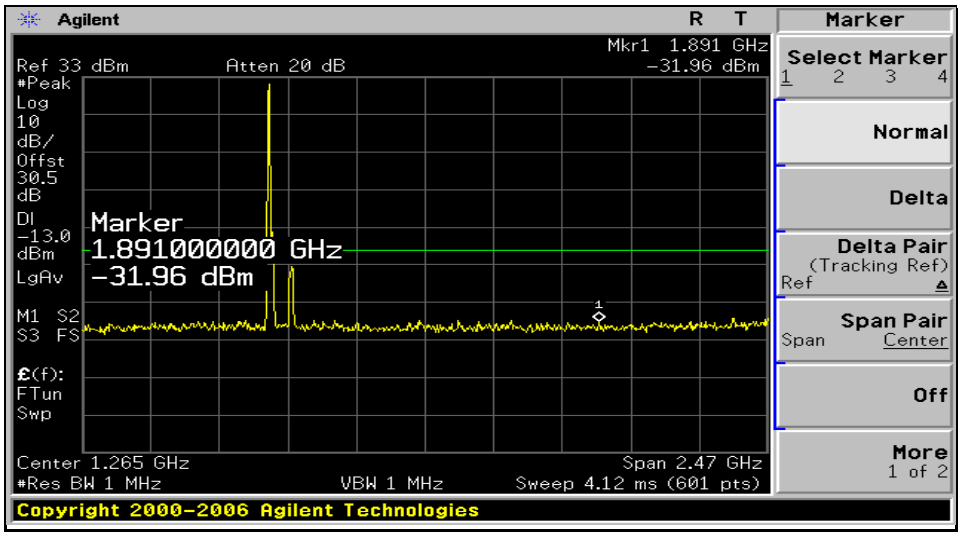


PLOTS OF BAND EDGE(751MHz)

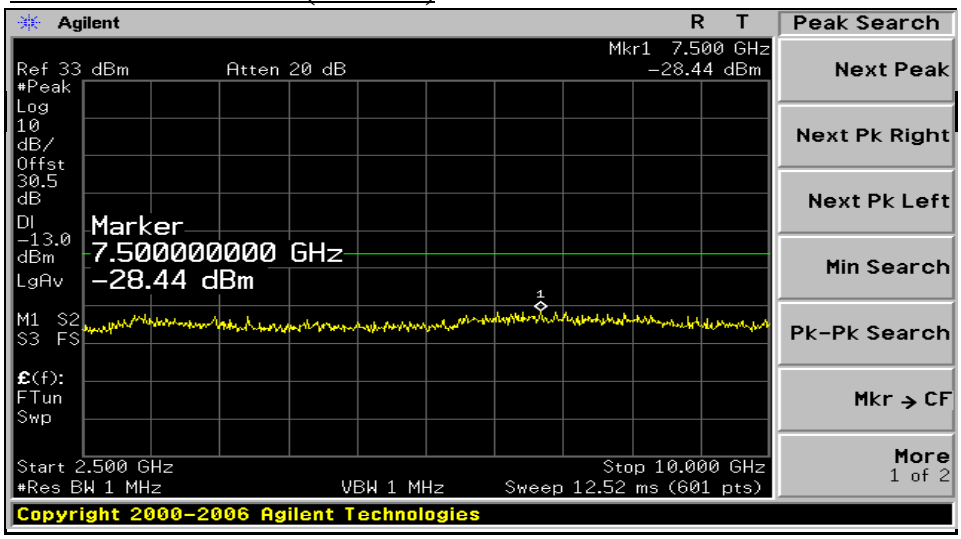


Uplink-BW5MHz

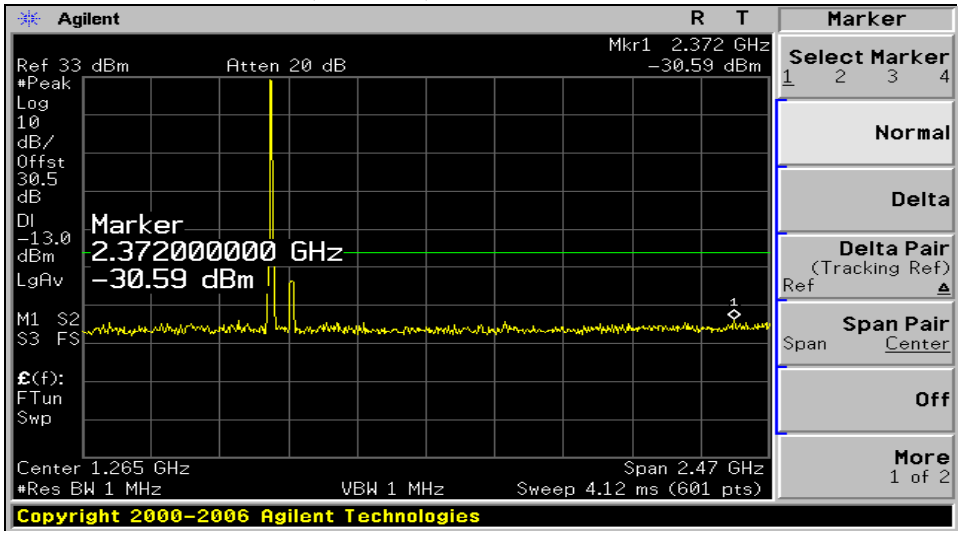
PLOTS OF Out of Band (701MHZ)



PLOTS OF Out of Band (701MHZ)

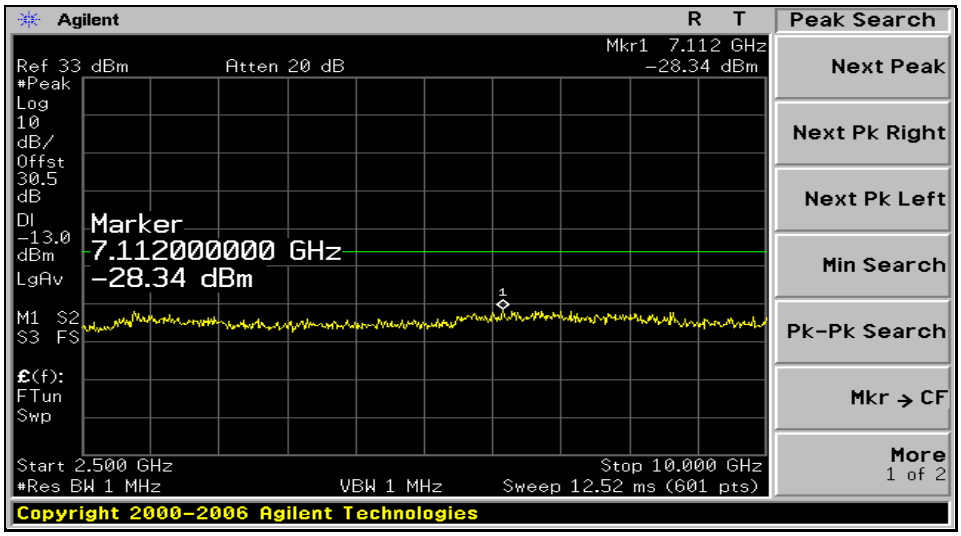


PLOTS OF Out of Band (707MHZ)

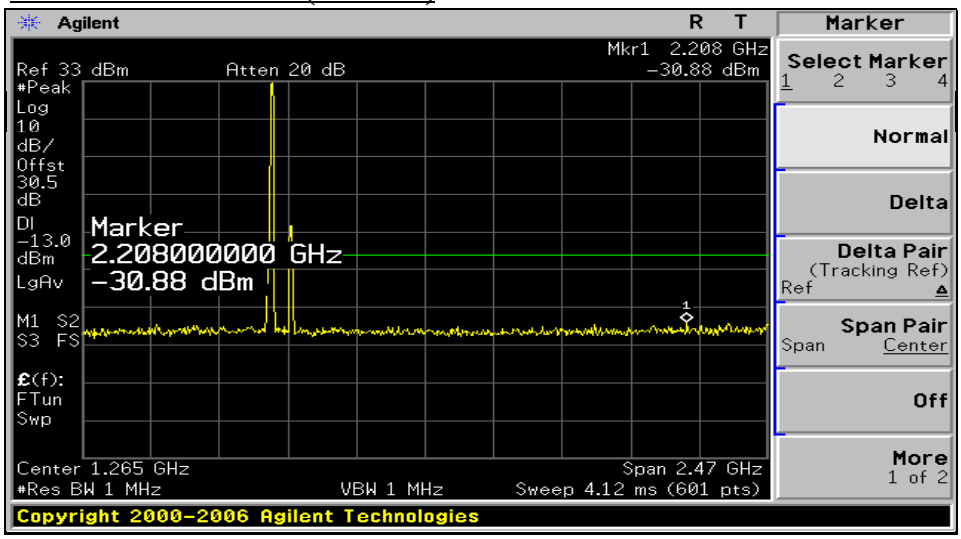


Uplink-BW5MHz

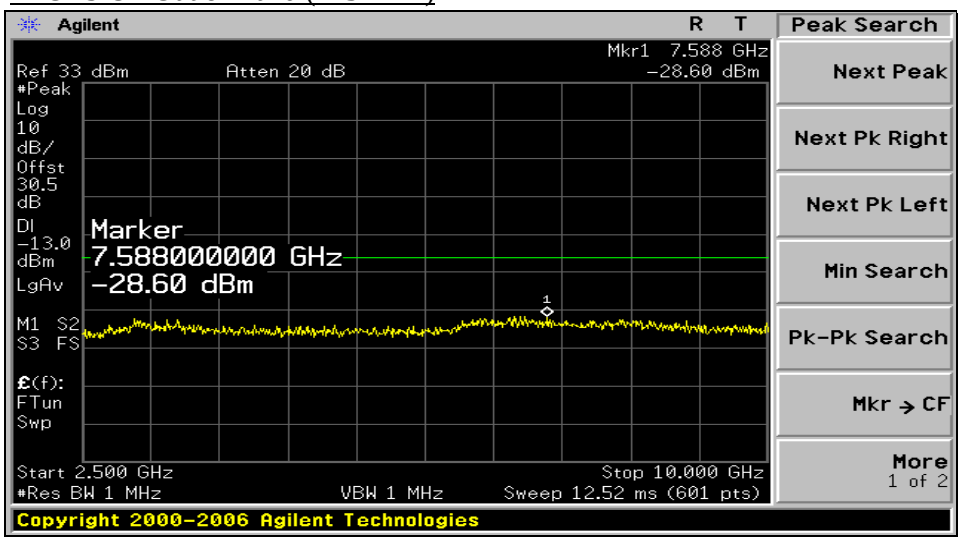
PLOTS OF Out of Band (707MHZ)



PLOTS OF Out of Band (713MHZ)

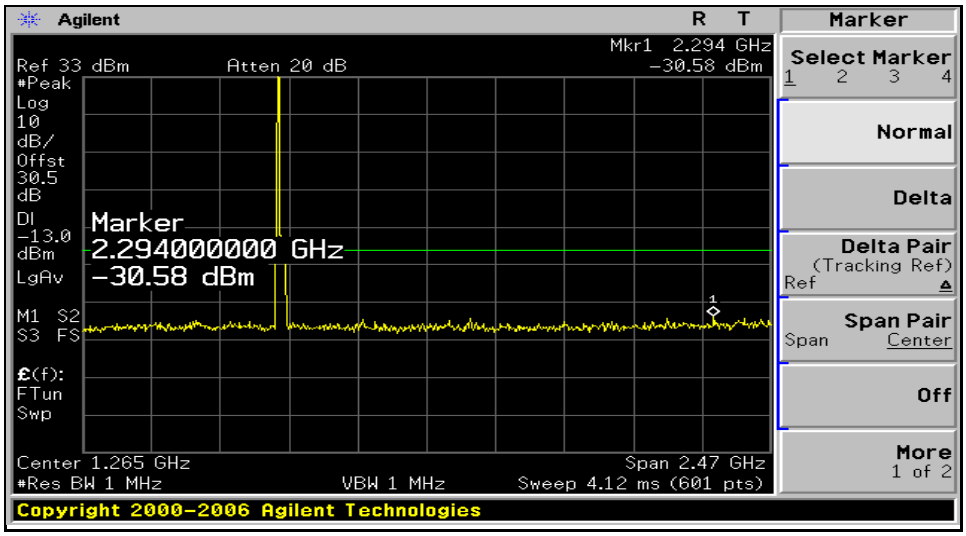


PLOTS OF Out of Band (713MHZ)

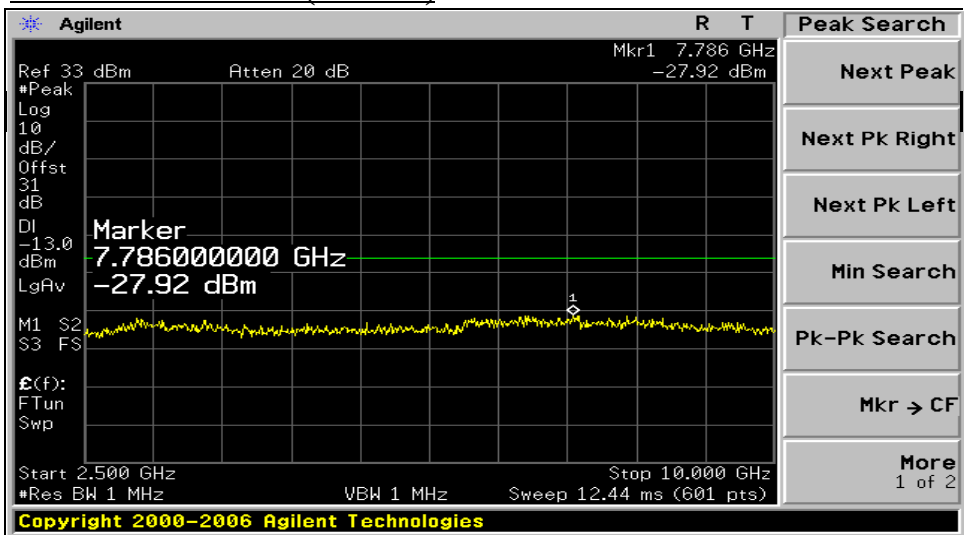


Downlink-BW5MHz

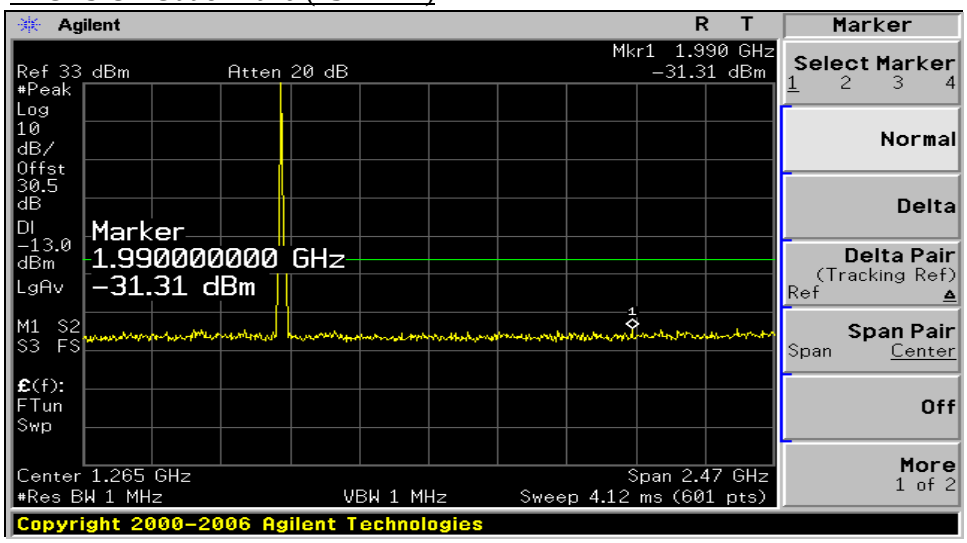
PLOTS OF Out of Band (731MHZ)



PLOTS OF Out of Band (731MHZ)

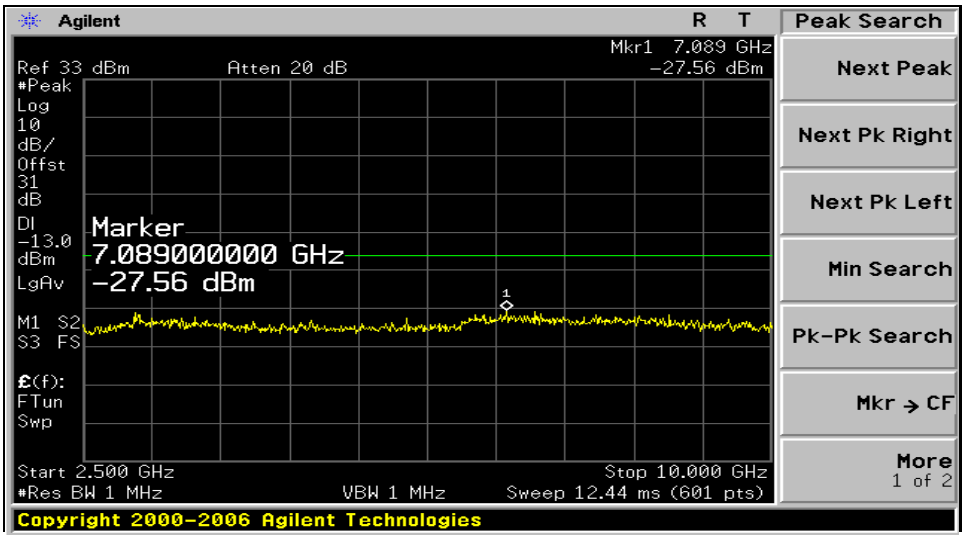


PLOTS OF Out of Band (737MHZ)

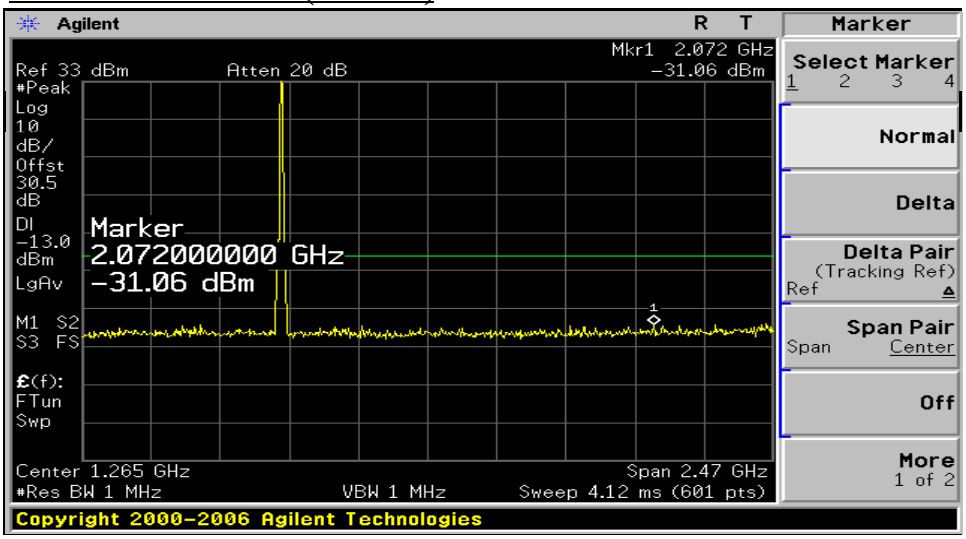


Downlink-BW5MHz

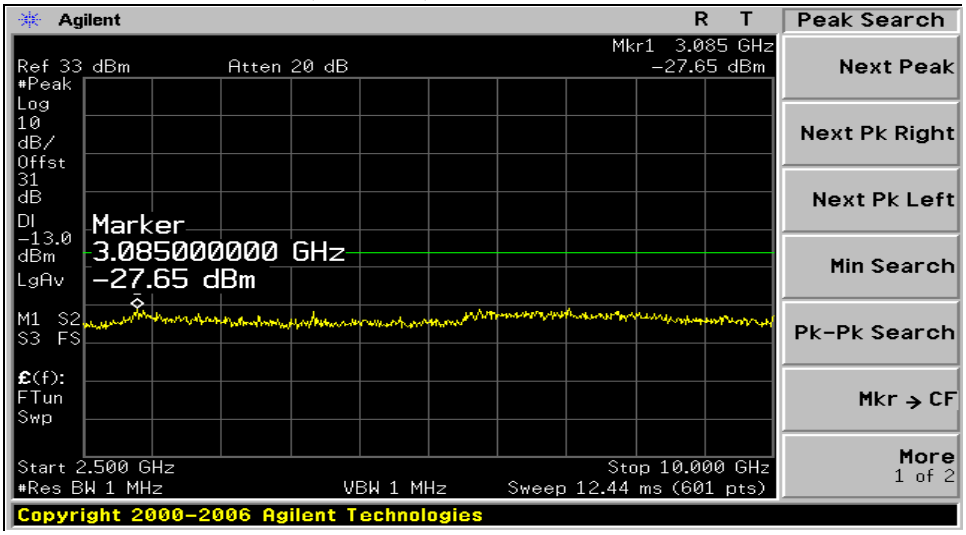
PLOTS OF Out of Band (737MHZ)



PLOTS OF Out of Band (743MHZ)

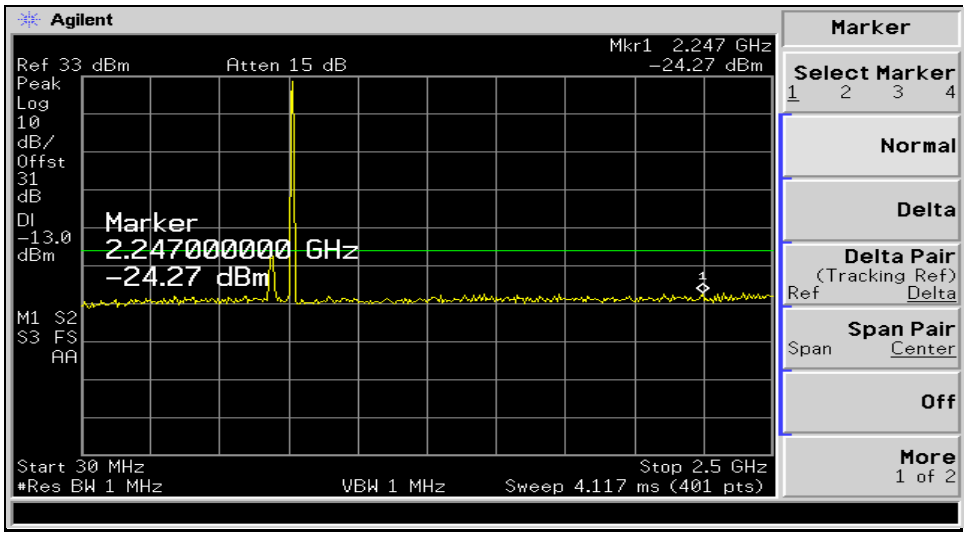


PLOTS OF Out of Band (743MHZ)

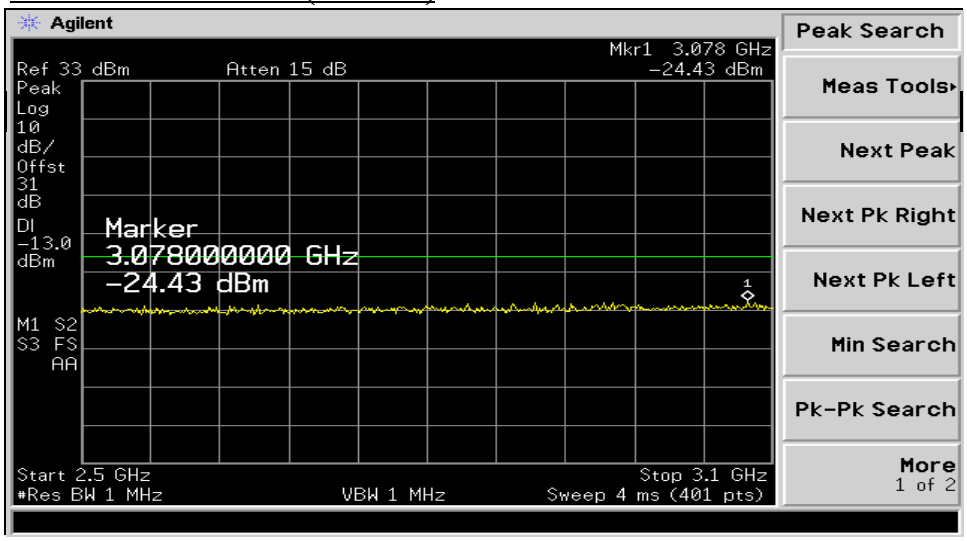


Uplink-BW10MHz

PLOTS OF Out of Band (782MHZ)

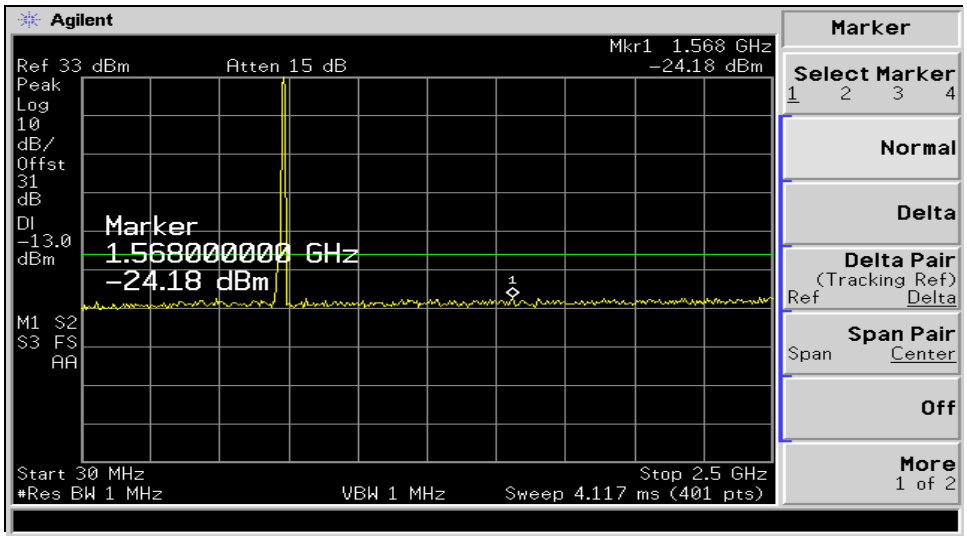


PLOTS OF Out of Band (782MHZ)

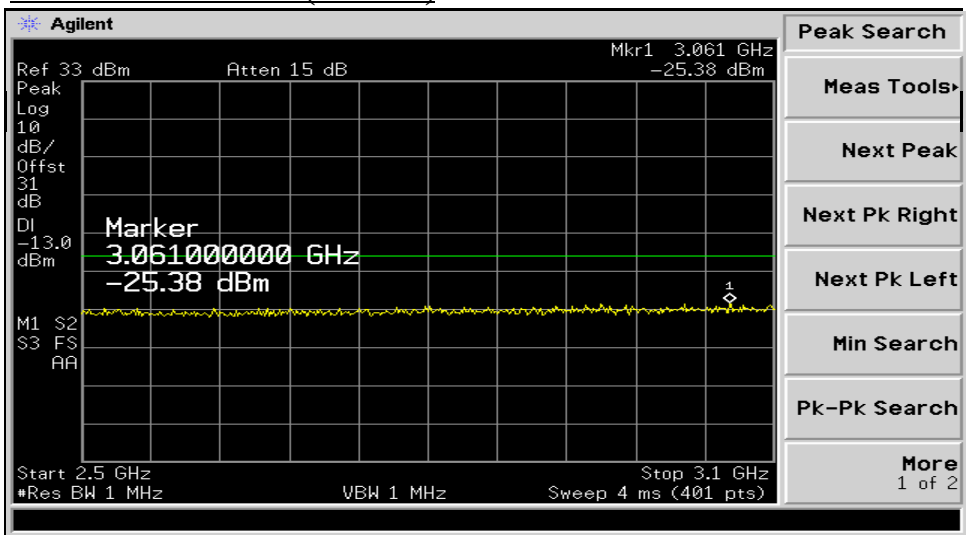


Downlink-BW10MHz

PLOTS OF Out of Band (751MHZ)

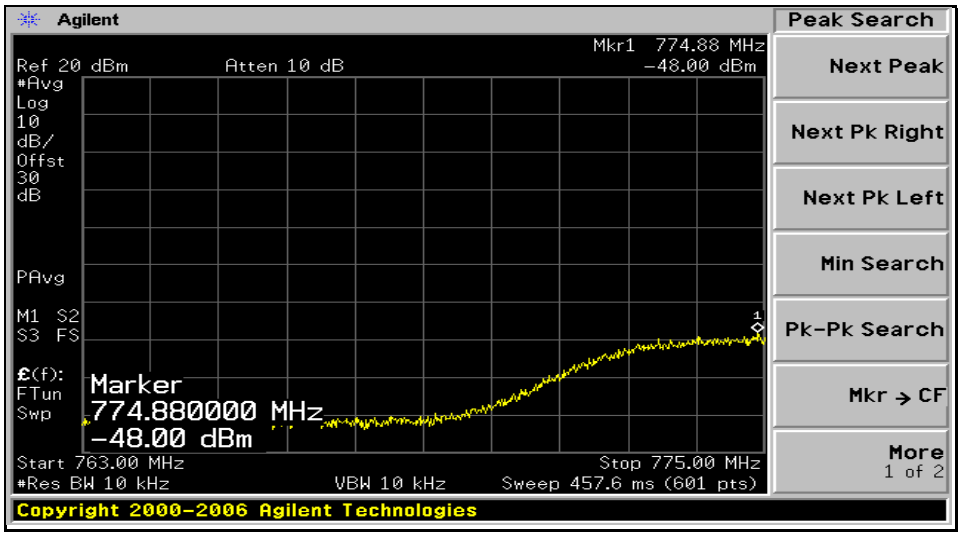


PLOTS OF Out of Band (751MHZ)

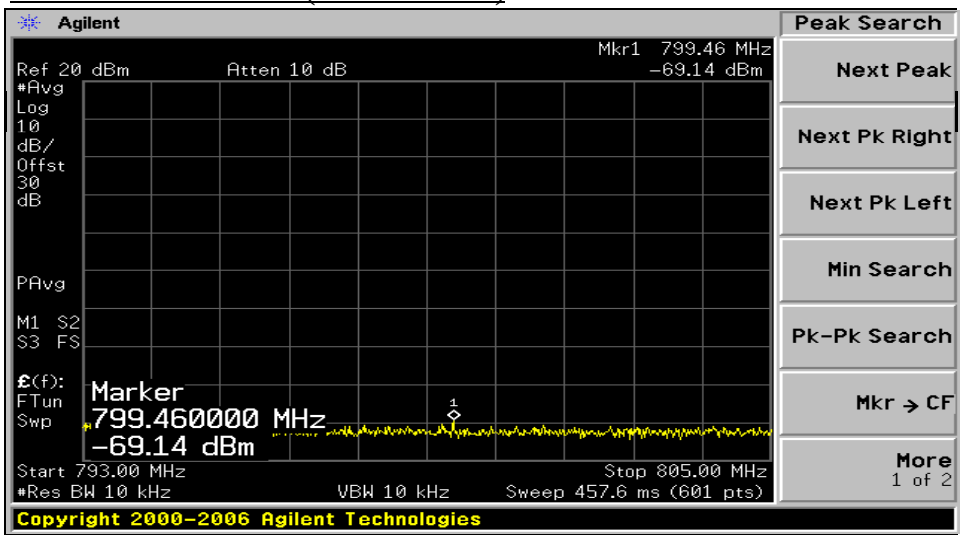


Uplink-BW10MHz

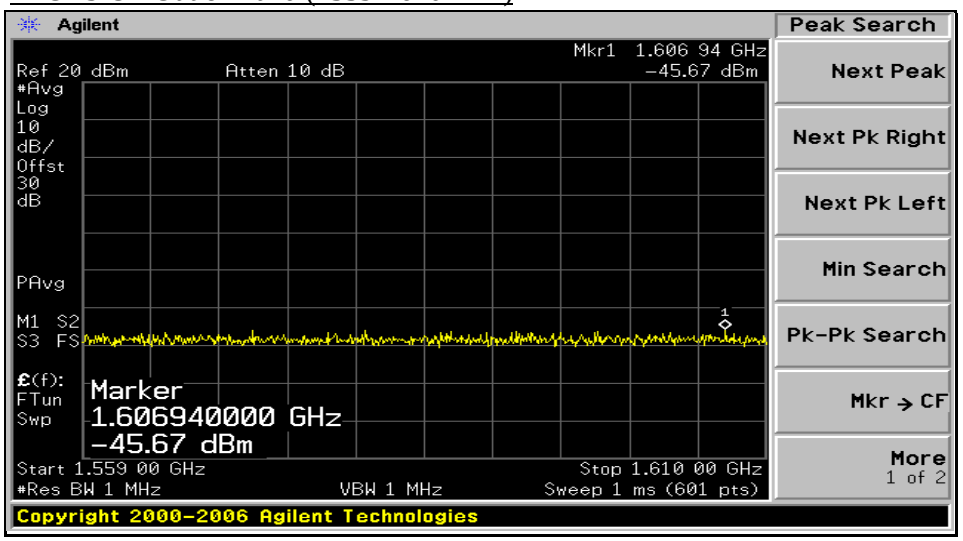
PLOTS OF Out of Band (763 ~775MHz)



PLOTS OF Out of Band (793 ~ 805MHz)

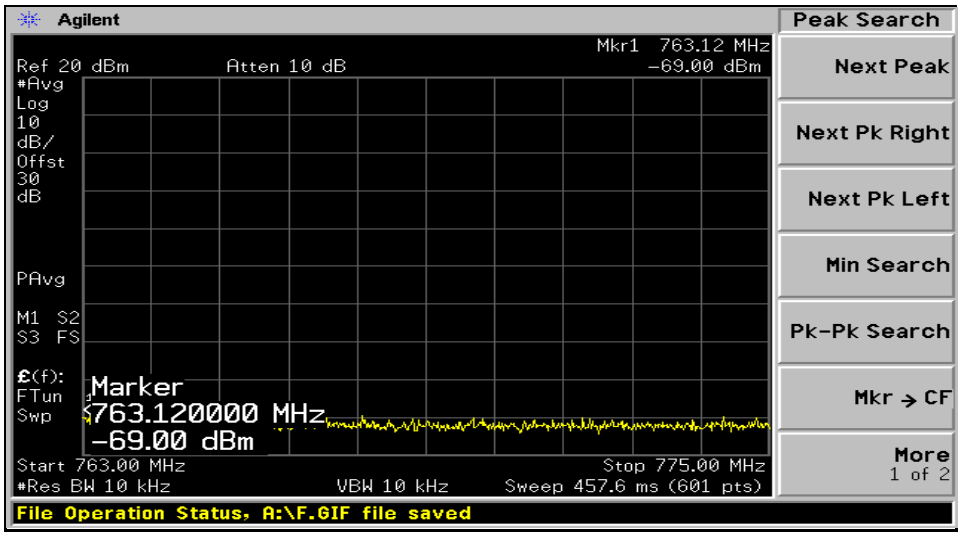


PLOTS OF Out of Band (1559-1610MHz)

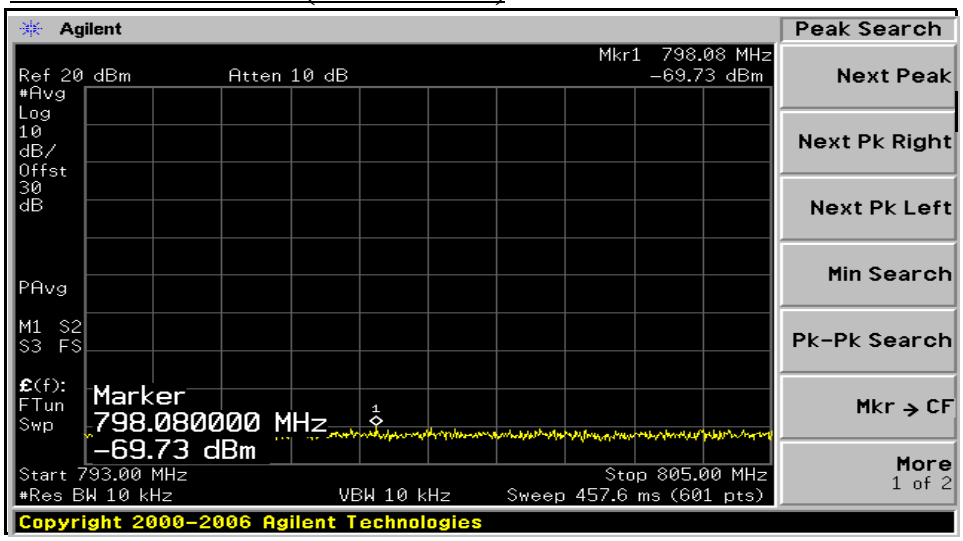


Downlink-BW10MHz

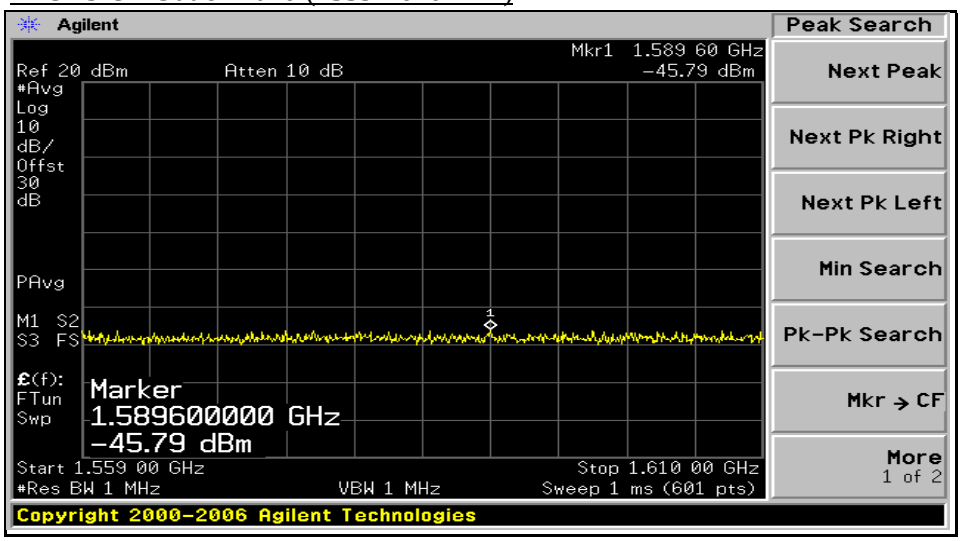
PLOTS OF Out of Band (763 ~775MHz)



PLOTS OF Out of Band (793 ~ 805MHz)

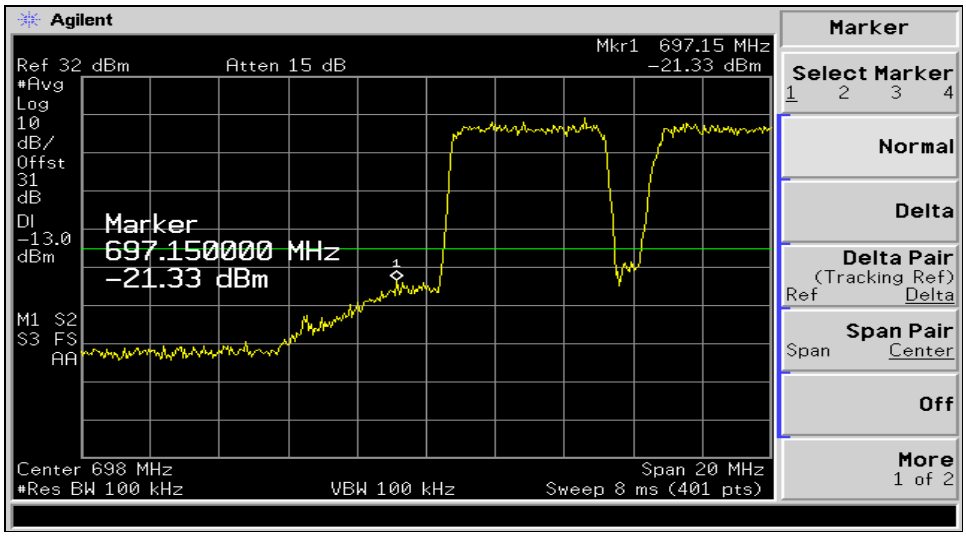


PLOTS OF Out of Band (1559-1610MHz)

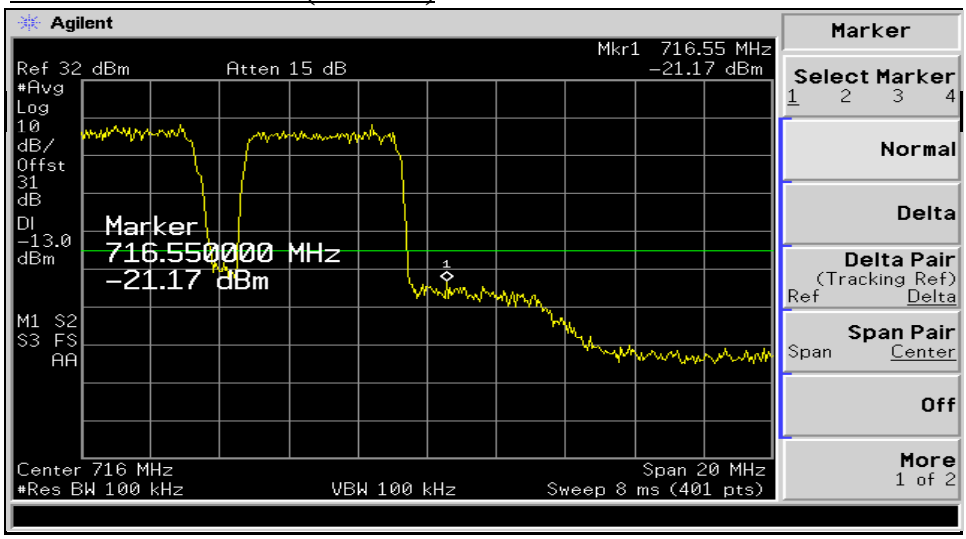


multiple signals

PLOTS OF Out of Band (701MHZ)

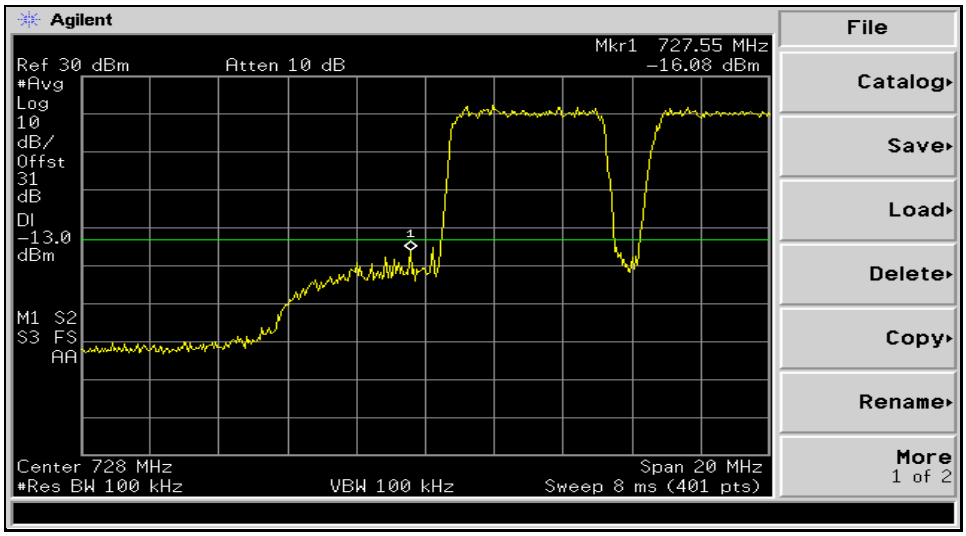


PLOTS OF Out of Band (713MHZ)

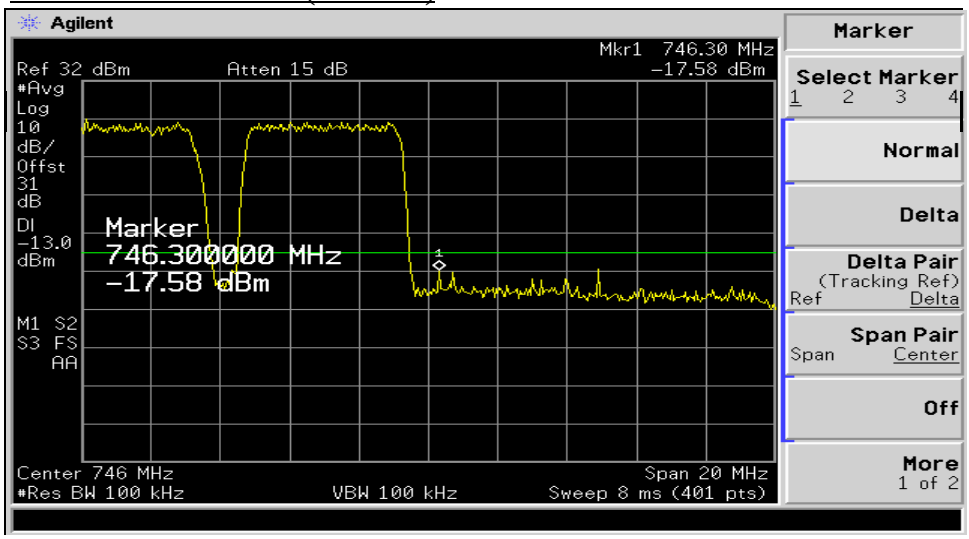


multiple signals

PLOTS OF Out of Band (737MHZ)

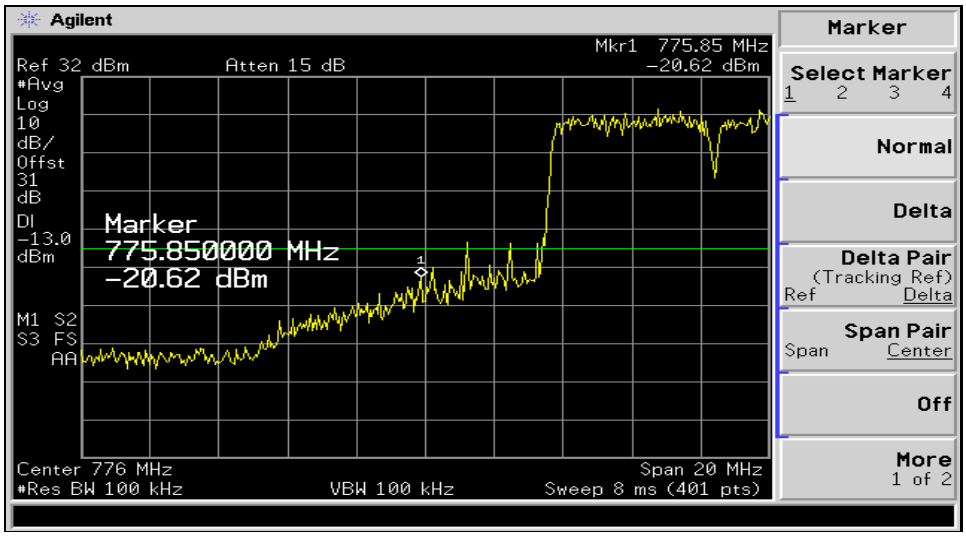


PLOTS OF Out of Band (743MHZ)

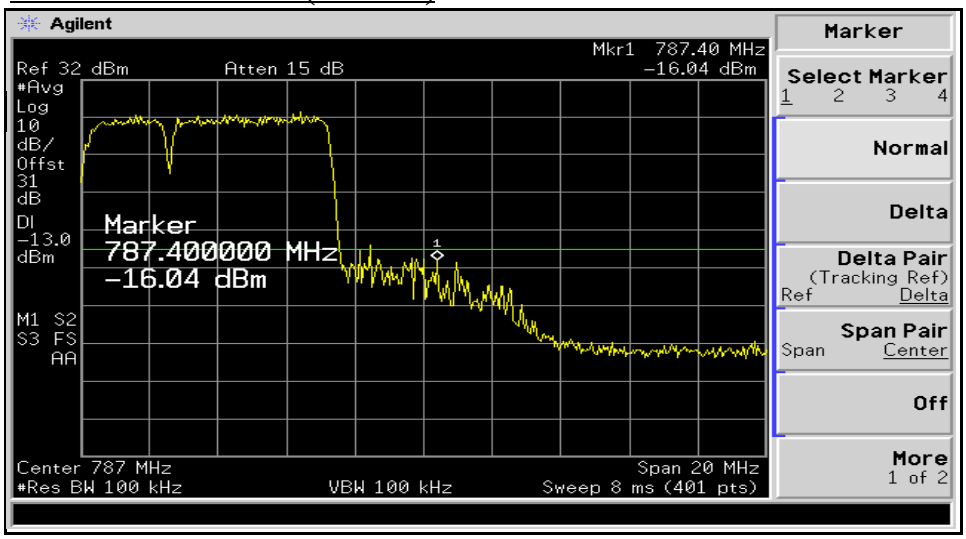


multiple signals

PLOTS OF Out of Band (782MHZ)

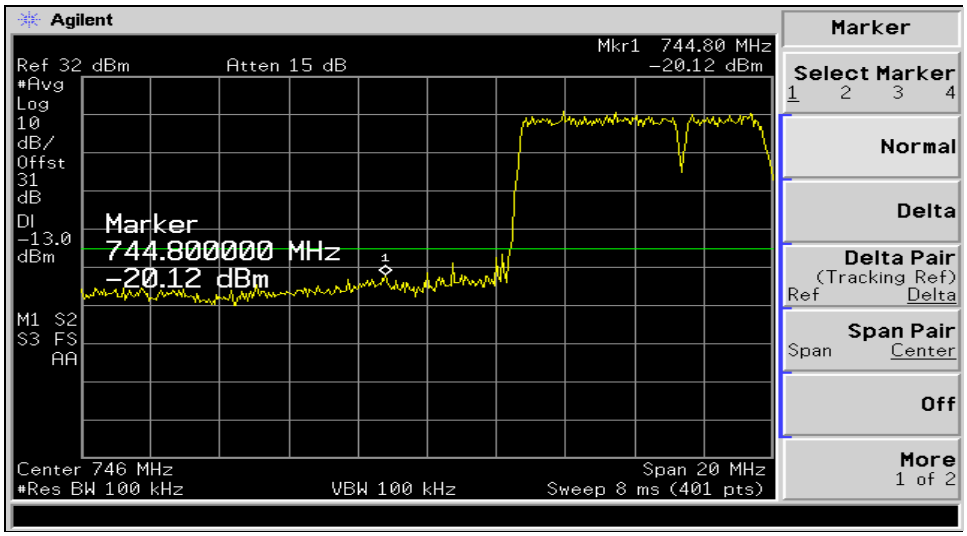


PLOTS OF Out of Band (782MHZ)

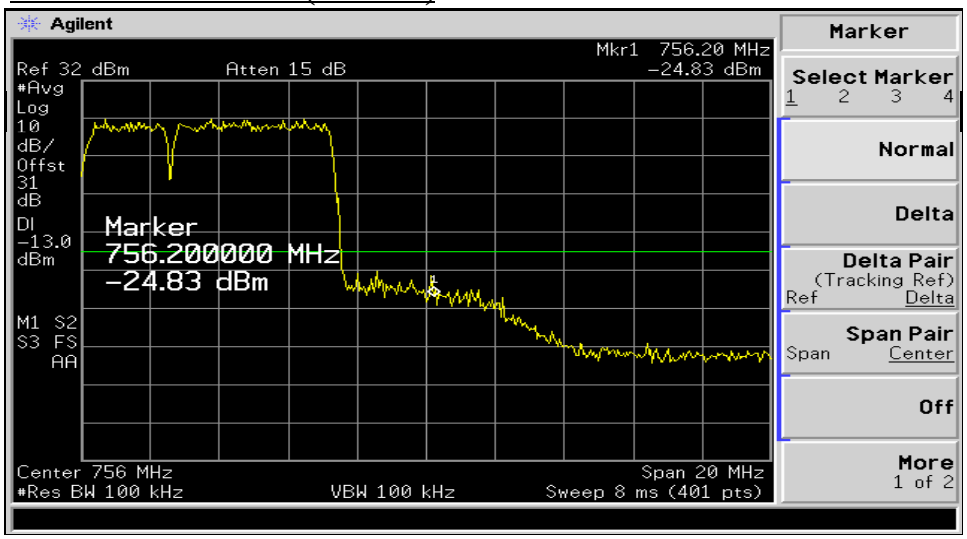


multiple signals

PLOTS OF Out of Band (751MHZ)



PLOTS OF Out of Band (751MHZ)



7. Field Strength of Spurious Radiation

7.1 Test Procedure according to ANSI/TIA/EIA 603 Clause 3.2.12 & FCC 27.53(c) & 27.53(f) & 27.53(g)

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.
For operations in the 746–763 MHz, 775–793 MHz, and 805–806 MHz bands, emissions in the band 1559–1610 MHz shall be limited to −70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and −80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation

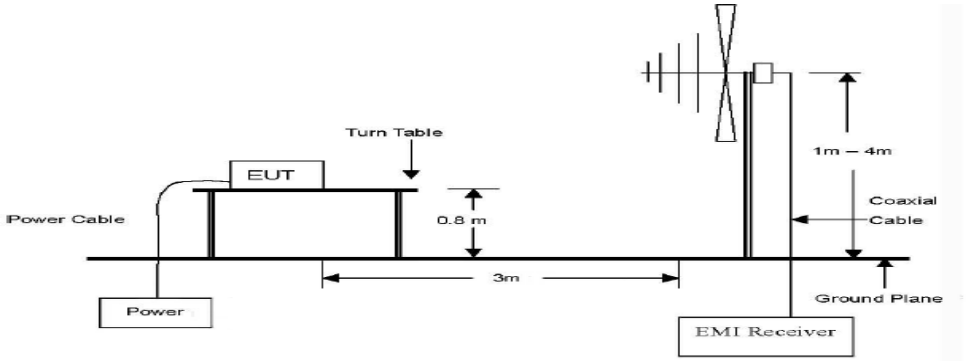
7.2 Test Equipments

The following test equipments are used during tests

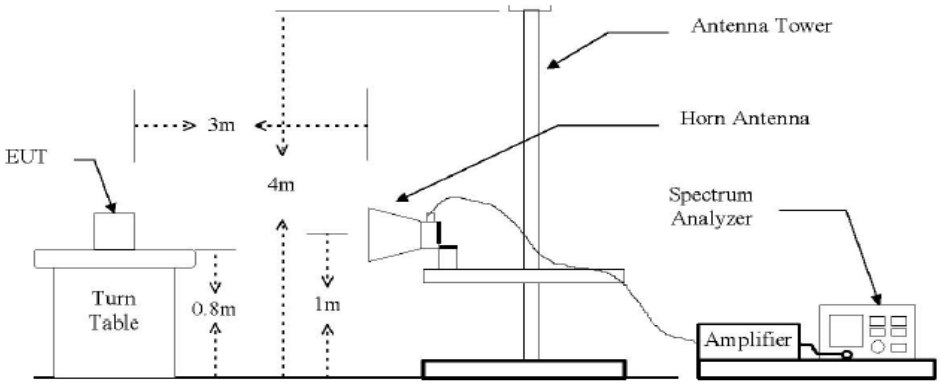
Equipment	Manufacturer	Model	Next Cal.
Spectrum Analyzer	Rohde & Schwarz	ESPI	2012-01-18
Signal Generator	HP	83620B	2012-08-30
Power Meter	HP	EPM-442A	2012-01-27
Power Sensor	HP	8481A	2012-01-27
Pre Amplifier	HP	8449B	2012-01-27
Attenuator	JFW	50FH-010-5	2012-01-27
Attenuator	HP	8491B	2012-01-27
Horn Antenna	SCHWARZBECK	BBHA 9120 D	2012-09-06
Horn Antenna	SCHWARZBECK	BBHA 9120 D	2012-03-22

7.3 Test Setup

Test setup for 30 MHz to 1 GHz



Test setup for above1 GHz



7.4 Test Results

Uplink

701MHz

Frequency (MHz)	Receiver Reading(dBuV)	Correction Factor(dB)		ERP(dBm)		Limit(dBm)	Polarity
		AG(dBd)	CL(dB)	SG Reading	Result		
1402.00	41.02	5.85	7.52	-61.00	-62.67	-13.00	H

707MHz

Frequency (MHz)	Receiver Reading(dBuV)	Correction Factor(dB)		ERP(dBm)		Limit(dBm)	Polarity
		AG(dBd)	CL(dB)	SG Reading	Result		
1414.00	41.02	5.95	7.61	-61.00	-62.66	-13.00	H

713MHz

Frequency (MHz)	Receiver Reading(dBuV)	Correction Factor(dB)		ERP(dBm)		Limit(dBm)	Polarity
		AG(dBd)	CL(dB)	SG Reading	Result		
1426.00	41.22	6.07	7.69	-61.00	-62.62	-13.00	H

Remark

*** 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)**

Downlink

731MHz

Frequency (MHz)	Receiver Reading(dBuV	Correction Factor(dB)		ERP(dBm)		Limit(dBm)	Polarity
		AG(dBd)	CL(dB)	SG Reading	Result		
1462.00	41.17	6.38	7.89	-61.00	-62.51	-13.00	H

737MHz

Frequency (MHz)	Receiver Reading(dBuV	Correction Factor(dB)		ERP(dBm)		Limit(dBm)	Polarity
		AG(dBd)	CL(dB)	SG Reading	Result		
1474.00	41.07	6.48	7.89	-61.00	-62.41	-13.00	H

743MHz

Frequency (MHz)	Receiver Reading(dBuV	Correction Factor(dB)		ERP(dBm)		Limit(dBm)	Polarity
		AG(dBd)	CL(dB)	SG Reading	Result		
1486.00	41.05	6.57	7.91	-61.00	-62.34	-13.00	H

Remark

*** 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)**

Uplink

782MHz

Frequency (MHz)	Receiver Reading(dBuV)	Correction Factor(dB)		EIRP(dBm)		Limit(dBm)	Polarity
		AG(dBi)	CL(dB)	SG Reading	Result		
1564.00	41.07	9.23	9.89	-61.00	-61.66	-40.00	V

Downlink

751MHz

Frequency (MHz)	Receiver Reading(dBuV)	Correction Factor(dB)		ERP(dBm)		Limit(dBm)	Polarity
		AG(dBd)	CL(dB)	SG Reading	Result		
1502.00	41.11	6.69	9.89	-61.00	-64.20	-13.00	H

Remark

*** 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)**

8. Frequency stability

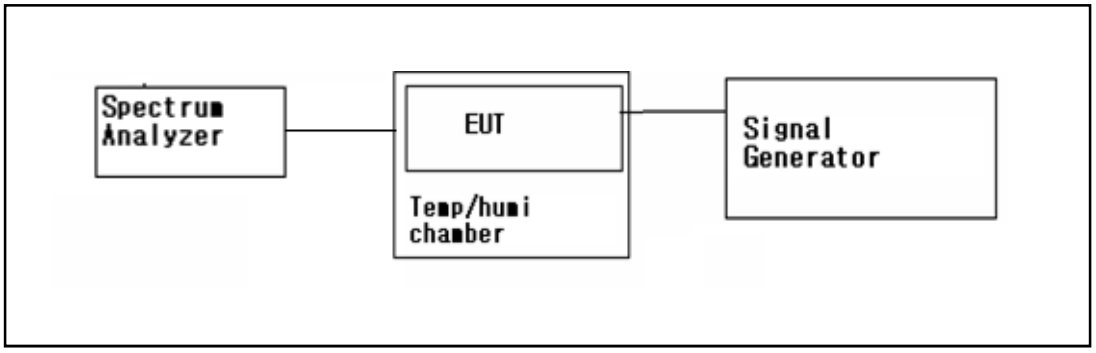
8.1 Test Procedure

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 ±2.5ppm 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	2012-09-05
Spectrum Analyzer	Agilent	E4402B	2012-02-24
Slidacs	Digitek power	-	N/A
DC Power Supply	INTERACT	AK-3010	2012-02-24
Tem/Hum Chamber	TABAI ESPEC CORP	PSL-2GT	2012-02-07
Vector Signal Generator	ROHDE&SCHWARZ	SMBV100A	2012-02-15
Signal Generator	HP	E4432B	2012-02-24

8.3 Test Results

Uplink-BW5MHz

Operting Frequency :	707,000,000	Hz
Block :	B	
Reference Voltage :	110.00	VAC
Limit :	2.5	ppm

Voltage (%)	Power (VAC)	Temperature (℃)	Frequency (Hz)	Test Result ppm	Test result Frequency(Hz)
100	110.0	+20℃(Ref)	707,000,007	0.01	-7.0
100		-30	707,000,008	0.01	-8.0
100		-20	707,000,005	0.01	-5.0
100		-10	707,000,006	0.01	-6.0
100		**0**	707,000,012	0.01	-12.0
100		10	707,000,011	0.01	-11.0
100		20	707,000,005	0.01	-5.0
100		25	707,000,007	0.01	-7.0
100		30	707,000,020	0.02	-20.0
100		40	707,000,015	0.02	-15.0
100		50	707,000,014	0.02	-14.0
100		60	707,000,016	0.02	-16.0
85	93.5	20	707,000,017	0.02	-17.0
115	126.5	20	707,000,015	0.02	-15.0
EndPoint	85.0	20	707,000,016	0.02	-16.0

Downlink-BW5MHz

Operting Frequency :	737,000,000	Hz
Block :	B	
Reference Voltage :	110.00	VAC
Limit :	2.5	ppm

Voltage (%)	Power (VAC)	Temperature (℃)	Frequency (Hz)	Test Result ppm	Test result Frequency(Hz)
100	110.0	+20℃(Ref)	737,000,015	0.02	-15.0
100		-30	737,000,010	0.01	-10.0
100		-20	737,000,011	0.01	-11.0
100		-10	737,000,016	0.02	-16.0
100		**0**	737,000,013	0.02	-13.0
100		10	737,000,018	0.02	-18.0
100		20	737,000,011	0.01	-11.0
100		25	737,000,014	0.02	-14.0
100		30	737,000,015	0.02	-15.0
100		40	737,000,014	0.02	-14.0
100		50	737,000,019	0.03	-19.0
100		60	737,000,018	0.02	-18.0
85	93.5	20	737,000,015	0.02	-15.0
115	126.5	20	737,000,016	0.02	-16.0
EndPoint	85.0	20	737,000,019	0.03	-19.0

Uplink-BW10MHz

Operting Frequency :	782,000,000	Hz
Channel :	C(U)	
Reference Voltage :	110.00	VAC
Limit :	2.5	ppm

Voltage (%)	Power (VAC)	Temperature (℃)	Frequency (Hz)	Test Result ppm	Test result Frequency(Hz)
100	110.0	+20℃(Ref)	781,999,994	0.01	6.0
100		-30	781,999,995	0.01	5.0
100		-20	781,999,996	0.01	4.0
100		-10	781,999,998	0.00	2.0
100		**0**	781,999,995	0.01	5.0
100		10	781,999,992	0.01	8.0
100		20	781,999,991	0.01	9.0
100		25	781,999,989	0.01	11.0
100		30	781,999,990	0.01	10.0
100		40	781,999,995	0.01	5.0
100		50	781,999,993	0.01	7.0
100		60	781,999,995	0.01	5.0
85	93.5	20	781,999,994	0.01	6.0
115	126.5	20	781,999,992	0.01	8.0
EndPoint	85.0	20	781,999,990	0.01	10.0

Downlink-BW10MHz

Operting Frequency :	751,000,000	Hz
Channel :	C(U)	
Reference Voltage :	110.00	VAC
Limit :	2.5	ppm

Voltage (%)	Power (VAC)	Temperature (℃)	Frequency (Hz)	Test Result ppm	Test result Frequency(Hz)
100	110.0	+20℃(Ref)	750,999,993	0.01	7.0
100		-30	750,999,994	0.01	6.0
100		-20	750,999,989	0.01	11.0
100		-10	750,999,992	0.01	8.0
100		**0**	750,999,985	0.02	15.0
100		10	750,999,986	0.02	14.0
100		20	750,999,988	0.02	12.0
100		25	750,999,987	0.02	13.0
100		30	750,999,994	0.01	6.0
100		40	750,999,993	0.01	7.0
100		50	750,999,992	0.01	8.0
100		60	750,999,989	0.01	11.0
85	93.5	20	750,999,993	0.01	7.0
115	126.5	20	750,999,995	0.01	5.0
EndPoint	85.0	20	750,999,990	0.01	10.0

Appendix 1

RF Exposure Measurement

1. Introduction

The maximum Gain measured in Fully Anechoic Chamber is 0.85dBi or 1.22 (numeric).

Because this deivce is transmitting the high power signal, it is regarded specially as a dangerous band for its heating harmfulness to the human body. The manufacturer whose product is working in this frequency band is obligatory to prove the harmfulness of his product.

In this document, we try to prove the safety of radiation harmfulness to the human body for our product. The limit for Maximum Permissible Exposure (MPE) specified in FCC 1.1310 is followed. The Gain of the antenna used in this product is measured in a Fully Anechoic Chamber (FAC), and the maximum total power input to the antenna is measured. Through the Friis transmission formula and the maximum gain of the antenna, we can calculate the distance, away from the product, where the limit of MPE is

2. Classification

MODE: LTE

The antenna of the product, under normal use condition, is at least 20cm away from the body of the user. Warning statement for keeping 20cm separation distance and the prohibition of operating next to a person has been printed on the user's manual. So, this product is classified as the Mobile Device.

3. RF Exposure Limit

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency(RF) radiation as specified in 1.1307(b).

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE) - Class A

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm^2)	Average Time (minutes)
0.3 - 3.0	614	1.63	*(100)	6
3.0 - 30	1842/f	4.89/f	*($900/f^2$)	6
30 - 300	61.4	0.163	1.0	6
300 - 1500			F/300	6
1500 - 100,000			5	6

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE) - Class B

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm^2)	Average Time (minutes)
0.3 - 1.34	614	1.63	*(100)	30
1.34 - 30	824/f	2.19/f	*($180/f^2$)	30
30 - 300	27.5	0.073	0.2	30
300 - 1500	-	-	F/1500	30
1500 - 100,000	-	-	1.0	30

Frequency in MHz

4. Friis Formula

Friis transmission formula : $P_d = (P_{out}*G) / (4*Pi*r^2)$

The maximum Gain measured in Fully Anechoic Chamber is 0.85dBi or 1.22 (numeric).

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

Pi = 3.1416

MODE: LTE

Pd is the limit of MPE, 1mW/cm^2. If we know the maximum Gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

The software provided by Manufacturer enabled the EUT to transmit with max power at lowest, middle and highest channel individually.

6. Test Results

6.1 Antenna Gain

The maximum Gain measured in Fully Anechoic Chamber is 0.85dBi or 1.22 (numeric).

6.2 Output Power into Antenna & RF Exposure value at distance 20cm:

MODE: Uplink

Band	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm2)	Limit of Power Density (mW/cm2)
A	701.00	1011.58	0.24552	0.5
B	707.00	1020.94	0.24779	0.5
C(L)	713.00	1016.25	0.24665	0.5
C(U)	782.00	1018.59	0.24722	0.5

MODE: (Down Link)

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm2)	Limit of Power Density (mW/cm2)
A	731.00	1000.00	0.24271	0.5
B	737.00	1000.93	0.24294	0.5
C(L)	743.00	1000.23	0.24277	0.5
C(U)	751.00	1025.700	0.24895	0.5

The minimum allowable distance is very close to the enclosure of the antenna and is very far away from the human beign under normal use condition.

The maximum Gain measured in Fully Anechoic Chamber is 0.85dBi or 1.22 (numeric).

6.3 Multiple signals into Antenna & RF Exposure value at distance 20cm:

MODE: Uplink

Band	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm2)	Limit of Power Density (mW/cm2)
A	701.00	1004.62	0.24383	0.5
B	707.00	1047.13	0.25415	0.5
C(L)	713.00	1044.72	0.25356	0.5
C(U)	782.00	1183.04	0.28714	0.5

MODE: (Down Link)

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm2)	Limit of Power Density (mW/cm2)
A	731.00	1261.83	0.30626	0.5
B	737.00	1235.95	0.29998	0.5
C(L)	743.00	1380.38	0.33503	0.5
C(U)	751.00	1056.82	0.25650	0.5

The minimum allowable distance is very close to the enclosure of the antenna and is very far away from the human beign under normal use condition.