



TESTING
CERT #803.01, 803.02, 803.05, 803.06

POWERWAVE TECHNOLOGIES, INC. TEST REPORT
FOR THE
NEXUS FT 700 COMMERCIAL SERVICE REPEATER, RH770020/101
FCC PART 27C
TESTING

DATE OF ISSUE: NOVEMBER 17, 2009

PREPARED FOR:

Powerwave Technologies, Inc.
1801 E. St. Andrew Place
Santa Ana, CA 92705

P.O. No.: 131946
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PREPARED BY:

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Mariposa, CA 95338

Date of test: November 10-12, 2009

Report No.: FC09-197

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ADMINISTRATIVE INFORMATION

DATE OF TEST: November 10-12, 2009

DATE OF RECEIPT: November 10, 2009

REPRESENTATIVE: Charlotte Yu

MANUFACTURER:

Powerwave Technologies, Inc.
1801 E. St. Andrew Place
Santa Ana, CA 92705

TEST LOCATION:

CKC Laboratories, Inc.
110 Olinda Place
Brea, CA 92823

FREQUENCY RANGE TESTED: 9 kHz-8 GHz

TEST METHOD: FCC Part 27C

PURPOSE OF TEST: To perform the testing of the Nexus FT 700 Commercial Service Repeater, RH770020/101 with the requirements for FCC Part 27C devices.

APPROVALS

Steve Behm, Director of Engineering Services

QUALITY ASSURANCE:

TEST PERSONNEL:

A handwritten signature in black ink, appearing to read 'Eddie Wong', is written over a horizontal line.

Eddie Wong, Senior EMC Engineer

SUMMARY OF RESULTS

Test	Specification/Method	Results
RF Power Output	FCC 2.1046/27.50(b)(2)	Pass
Input and Output Plots	FCC 2.1049(i)	Pass
Spurious Emissions at Antenna Terminal	FCC 2.1051/27.53(c)(1), (f), (g)	Pass
Field Strength of Spurious Radiation	FCC 2.1053/27.52(c)(1), (f), (g)	Pass
Bandedge Plots		Pass
Intermodulation		Pass
Out of Band Rejection		Pass
Site File No.	FCC 90473	

CONDITIONS DURING TESTING

No modifications to the EUT were necessary during testing.



EQUIPMENT UNDER TEST (EUT) DESCRIPTION

The following model has been tested by CKC Laboratories: **RH770020/101**

The manufacturer states that the following additional models are identical electrically to the one which was tested, or any differences between them do not affect their EMC characteristics, and therefore they meet the level of testing equivalent to the tested models. **RH770020/102**

EQUIPMENT UNDER TEST

Nexus FT 700 Commercial Service Repeater

Manuf: Powerwave Technologies

Model: RH770020/101

Serial: NA

PERIPHERAL DEVICES

The EUT was tested with the following peripheral device(s):

Power Meter

Manuf: Agilent

Model: E4419B

Serial: GB402019/12

Pre Amp

Manuf: Mini Circuit

Model: ZHL-4240

Serial: D040405

Optical Converter

Manuf: Powerwave

Model: NA

Serial: NA

ESG

Manuf: Agilent

Model: E4438C

Serial: MY42082180

TEMPERATURE AND HUMIDITY DURING TESTING

The temperature during testing was within +15°C and + 35°C.
The relative humidity was between 20% and 75%.

FCC 2.1033(c)(3) USER'S MANUAL

The necessary information is contained in a separate document.

FCC 2.1033 (c)(4) TYPE OF EMISSIONS

GXW, G7W, F9W, D9W

FCC 2.1033 (c)(5) FREQUENCY RANGE

728-757MHz

FCC 2.1033 (c)(6) OPERATING POWER

20 watts

FCC 2.1033 (c)(8) DC VOLTAGES

The necessary information is contained in a separate document.

FCC 2.1033 (c)(9) TUNE-UP PROCEDURE

The necessary information is contained in a separate document.

FCC 2.1033(c)(10) SCHEMATICS AND CIRCUITRY DESCRIPTION

The necessary information is contained in a separate document.

FCC 2.1033(c)(11) LABEL AND PLACEMENT

The necessary information is contained in a separate document.

FCC 2.1033(c)(12) SUBMITTAL PHOTOS

The necessary information is contained in a separate document.

FCC 2.1033 (c)(13) MODULATION INFORMATION

CDMA2000, EDGE, GSM, LTE and WCDMA

MEASUREMENT UNCERTAINTIES

Uncertainty Value	Parameter
4.73 dB	Radiated Emissions
3.34 dB	Mains Conducted Emissions
3.30 dB	Disturbance Power

The reported measurement uncertainties are calculated based on the worst case of all laboratory environments from CKC Laboratories, Inc. test sites. Only those parameters which require estimation of measurement uncertainty are reported. The reported worst case measurement uncertainty is less than the maximum values derived in CISPR 16-4-2. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of $k=2$. Compliance is deemed to occur provided measurements are below the specified limits.

FCC 2.1033(c)(14)/2.1046/27.50(b)(2) - RF POWER OUTPUT

Test Equipment

Equipment	Asset #	Manufacturer	Model #	Serial #	Cal Date	Cal Due
Spectrum Analyzer	02672	Agilent	E4446A	US44300438	072308	072310
36" 40GHz cable	02945	Strolab	NA	NA	092111	092111
Programmable Power Source	01695/ 01696	Pacific Power	345AMX / UPC32	250 / 245	032309	032311

Test Conditions

The EUT is a RF amplifier operating the 728-757 MHz band under part 27. The manufacturer does not provide an antenna for sale with the product, hence EIRP is not measured nor calculated. The RF power of the EUT was measured with a power meter at the antenna port. The measurement satisfies the above requirement by demonstrating the measured power is below 1000 watts.

The EUT is placed on the wooden table. The RF Output port is connected to a load string . Optical in port is connected to a support Optical converter. Support optical converter receives RF signal converts the signal to optic and send to the EUT. The EUT decode the optical signal, and generates an RF signal.

Operating range: 728-757MHz.

Test Setup Photos



Test Data

Modulation	Frequency	Power (dBm)	Power (Watts)
GSM	728.50	43	20
GSM	742.50	43	20
GSM	756.60	43	20
EDGE	728.50	43	20
EDGE	742.50	43	20
EDGE	756.60	43	20
CDMA2000	729.50	43	20
CDMA2000	742.50	43	20
CDMA2000	755.50	43	20
WCDMA	730.75	43	20
WCDMA	742.50	43	20
WCDMA	754.25	43	20
LTE	731.00	43	20
LTE	742.50	43	20
LTE	754.00	43	20

Conclusion: Each single channel does not exceed the 1000 Watt peak power limit or 1000W/MHz at the widest bandwidth of 4.5 MHz (LTE).

AC Voltage was varied +/- 15%, no change in RF output power.

FCC 2.1033(c)(14)/2.1049(i)- INPUT AND OUTPUT PLOTS

Test Equipment

Equipment	Asset #	Manufacturer	Model #	Serial #	Cal Date	Cal Due
Spectrum Analyzer	02672	Agilent	E4446A	US44300438	072308	072310
36" 40GHz cable	02945	Strolab	NA	NA	092111	092111

Test Conditions

The EUT is placed on the wooden table. The RF Output port is connected to a load string . Optical in port is connected to a support Optical converter. Support optical converter receives RF signal converts the signal to optic and send to the EUT. The EUT decode the optical signal, and generates an RF signal. Output waveform is recorded with a spectrum analyzer at the Antenna port of the device. Input waveform is recorded with a spectrum analyzer at the RF out of the support ESG.

Operating range: 728-757MHz.

Modulation: GSM, EDGE, CDMA2000, WCDMA, LTE

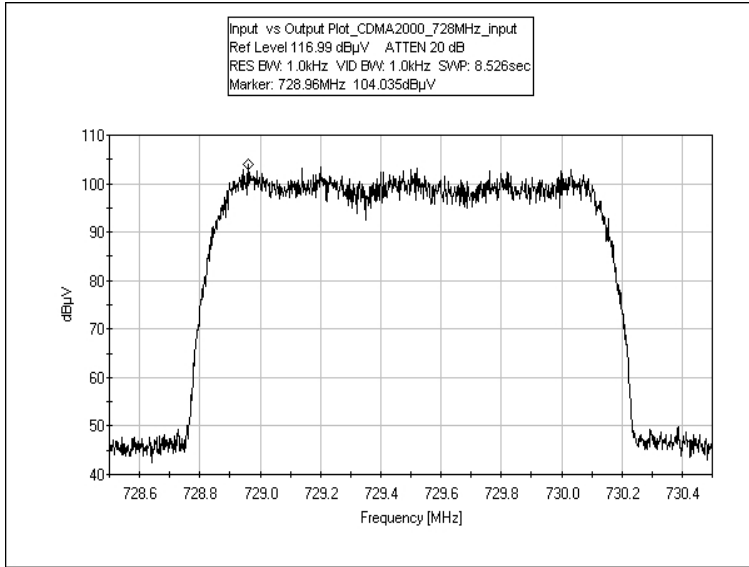
Power = 20 watts

Test Setup Photos

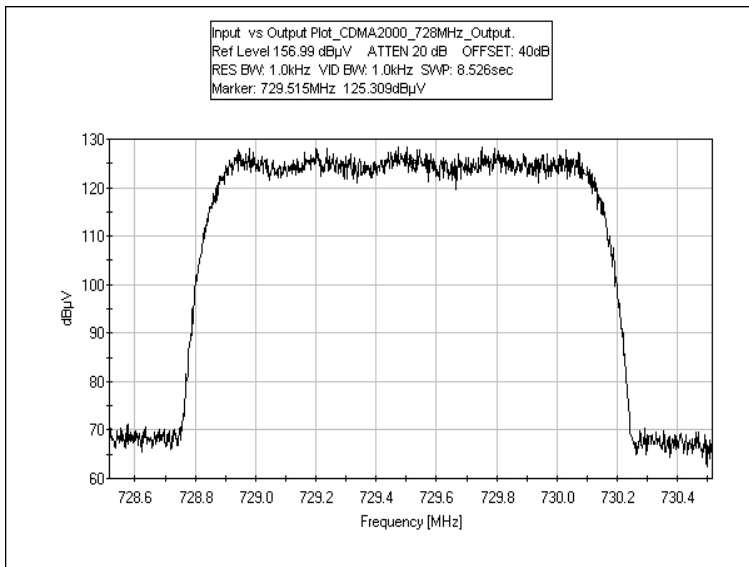


Test Plots

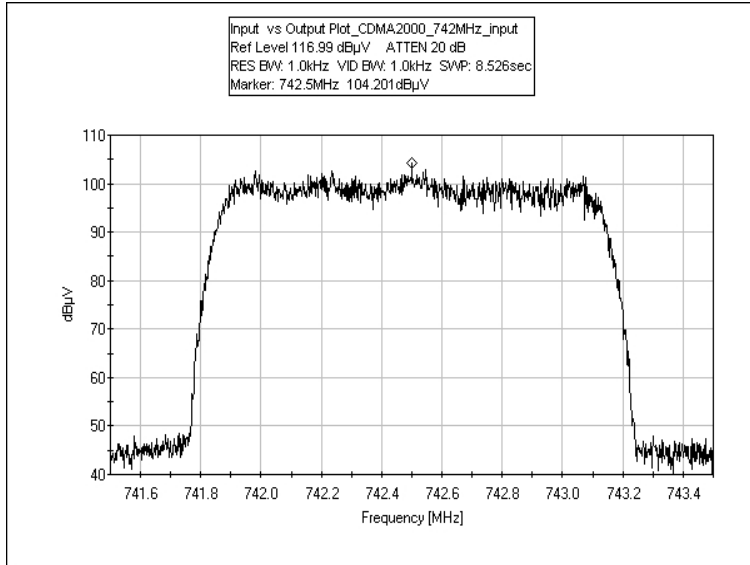
INPUT PLOT - CDMA2000 728MHz



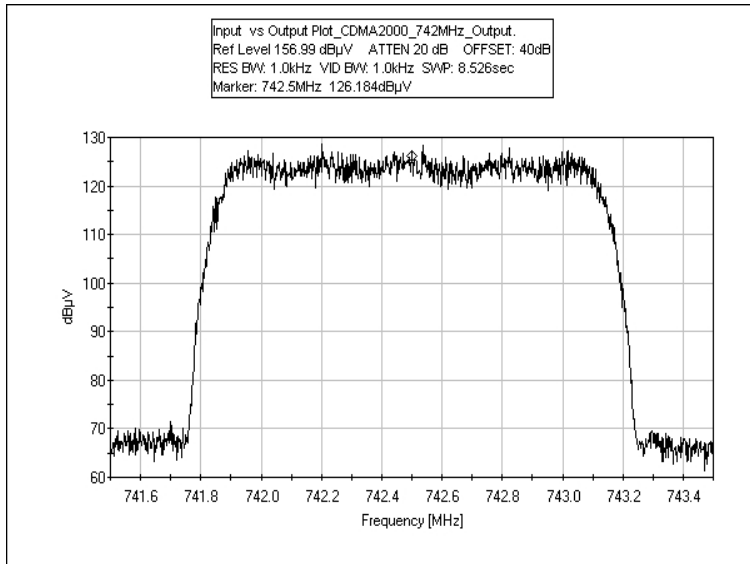
OUTPUT PLOT - CDMA2000 728MHz



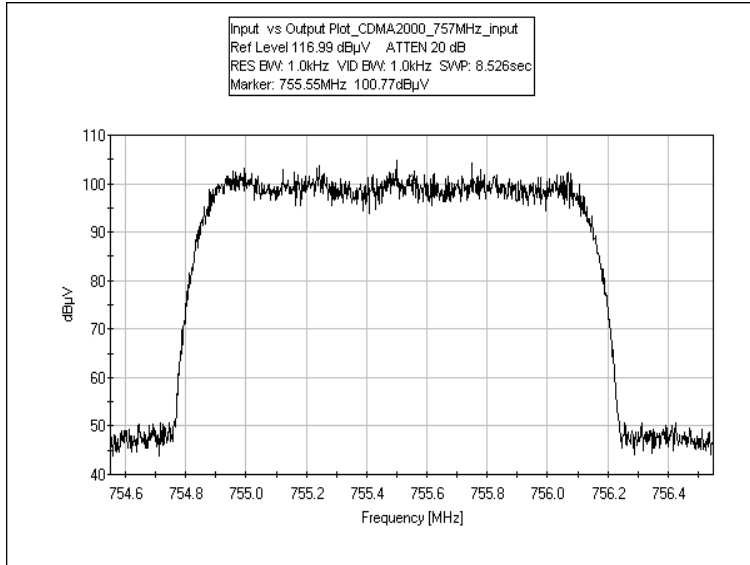
INPUT PLOT - CDMA2000 742MHz



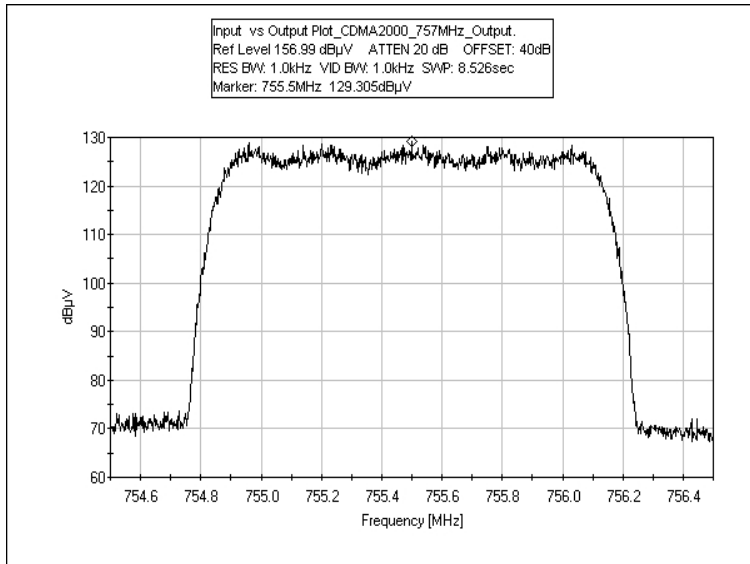
OUTPUT PLOT - CDMA2000 742MHz



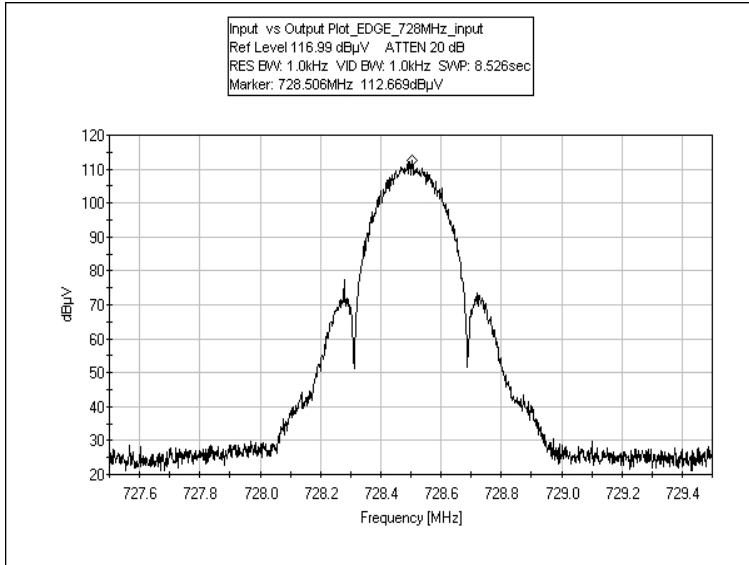
INPUT PLOT - CDMA2000 757MHz



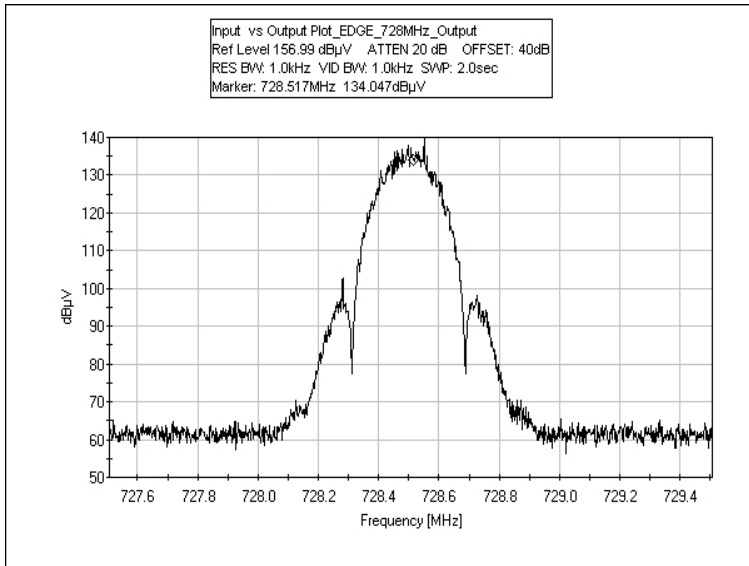
OUTPUT PLOT - CDMA2000 757MHz



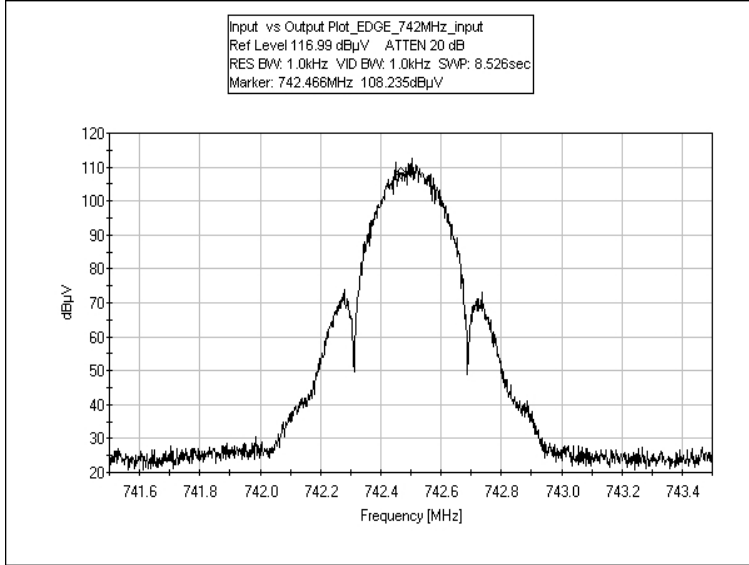
INPUT PLOT - EDGE 728MHz



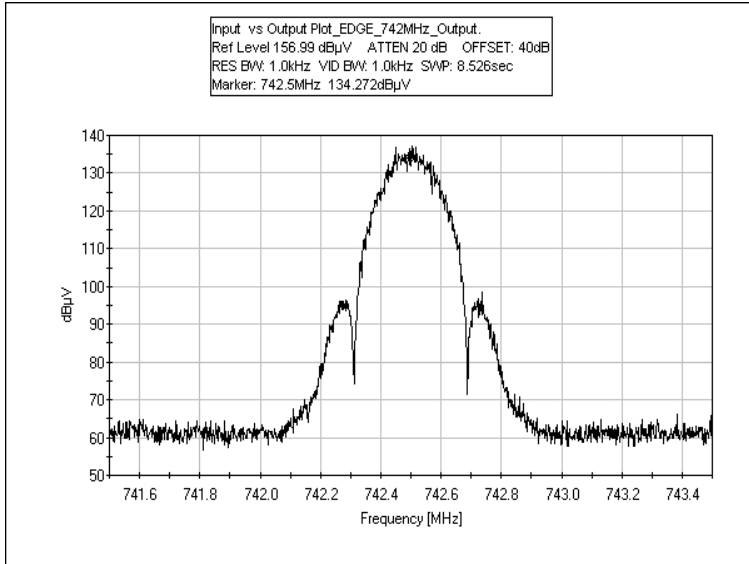
OUTPUT PLOT - EDGE 728MHz



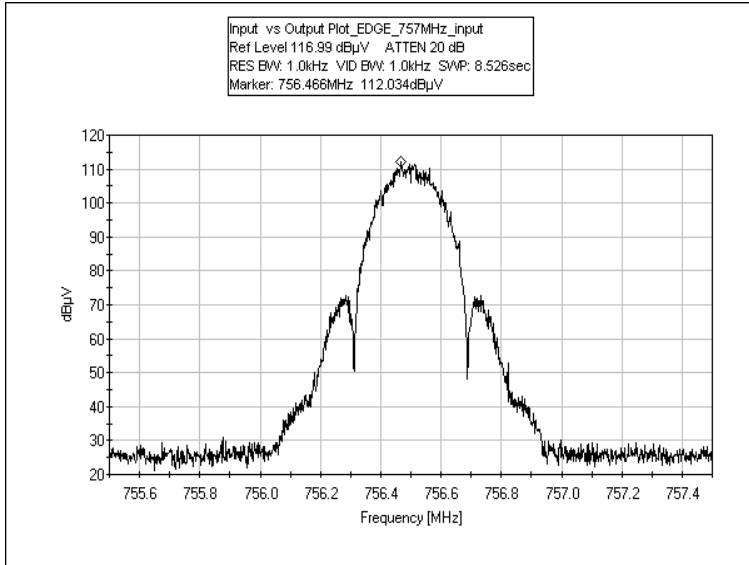
INPUT PLOT - EDGE 742MHz



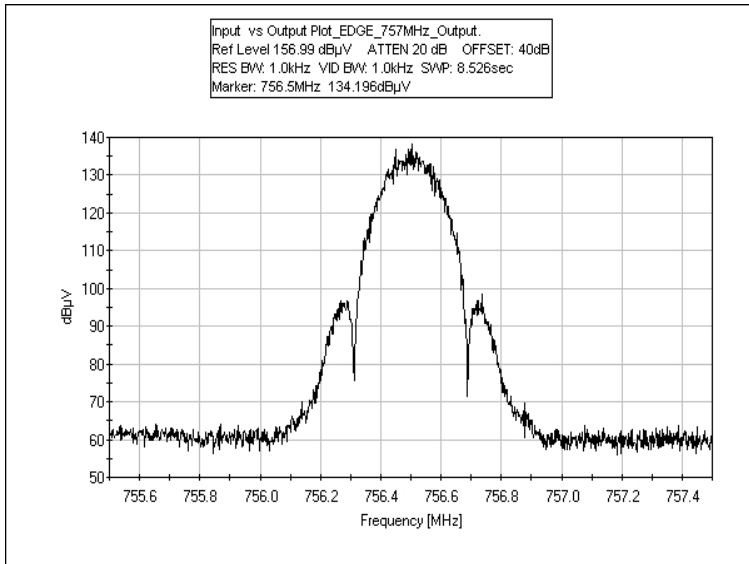
OUTPUT PLOT - EDGE 742MHz



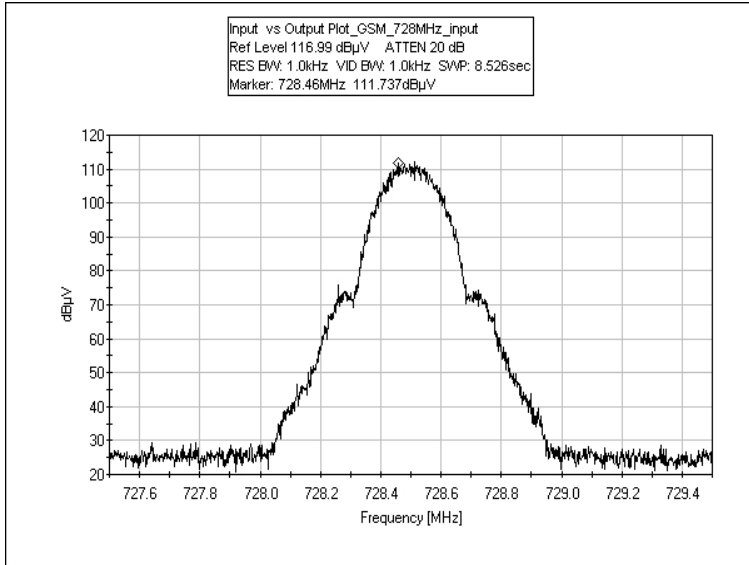
INPUT PLOT - EDGE 757MHz



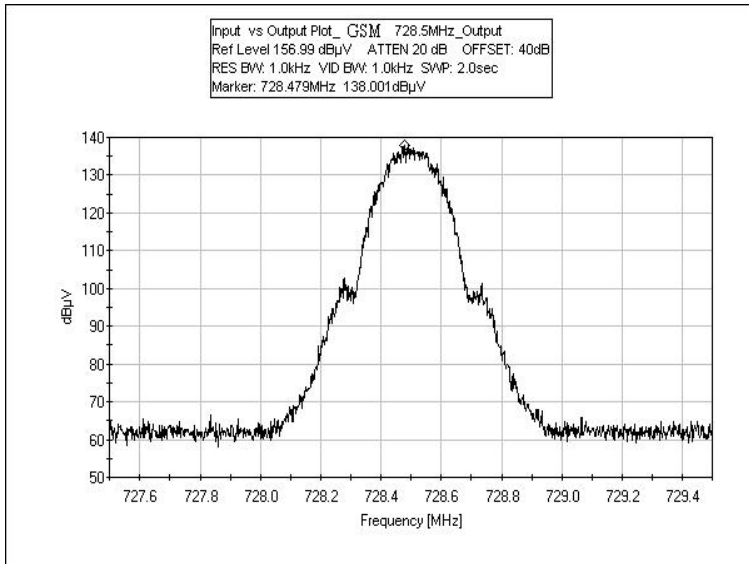
OUTPUT PLOT - EDGE 757MHz



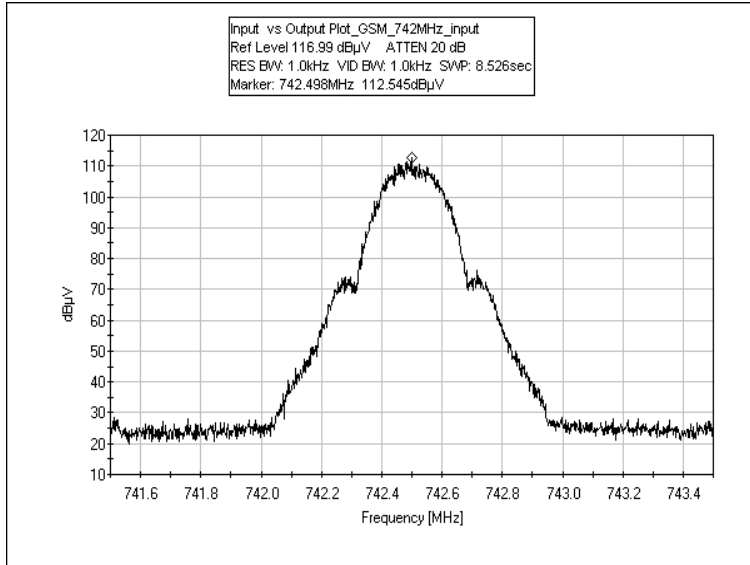
INPUT PLOT - GSM 728.5MHz



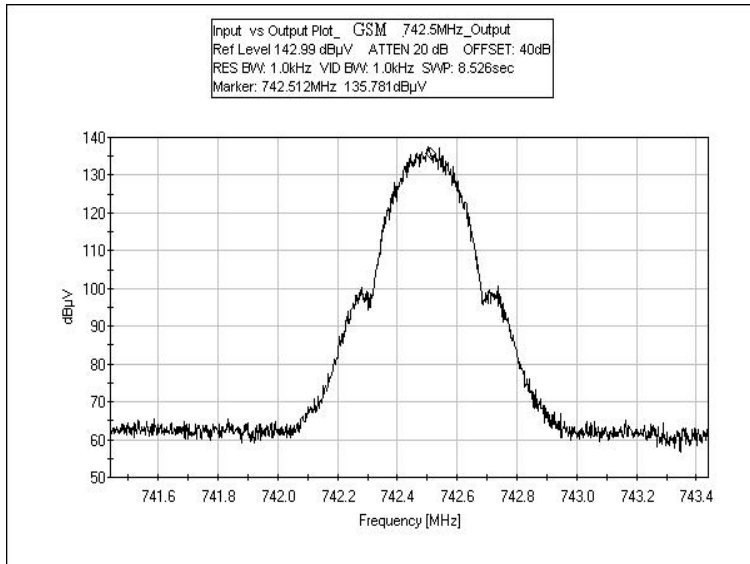
OUTPUT PLOT - GSM 728.5MHz



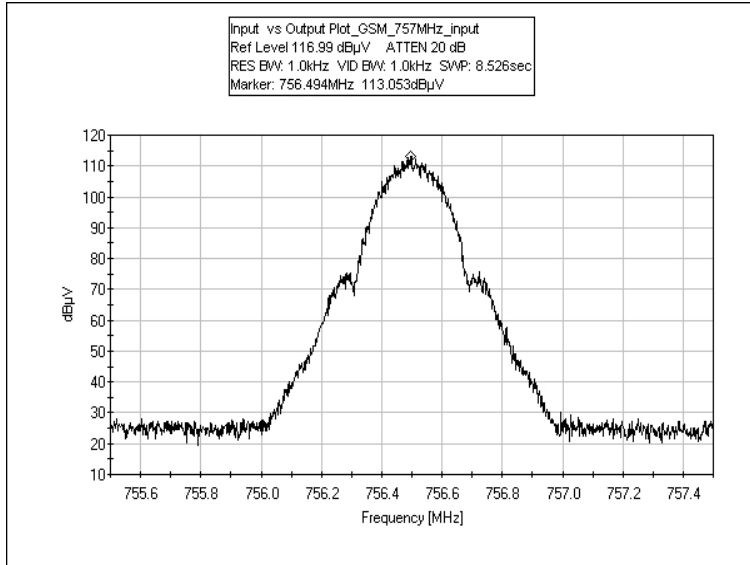
INPUT PLOT - GSM 742.5MHz



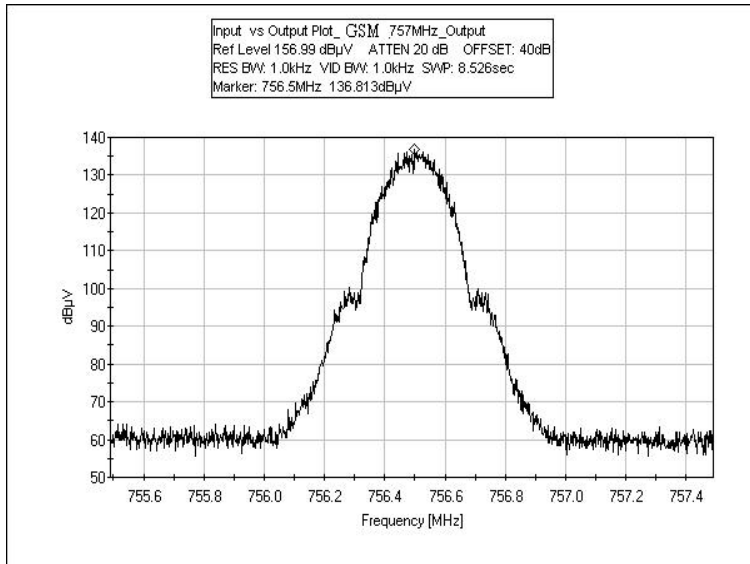
OUTPUT PLOT - GSM 742.5MHz



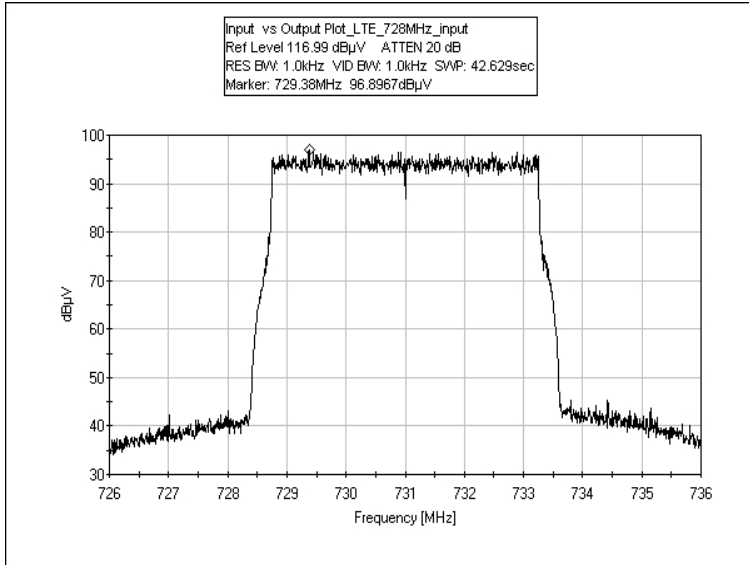
INPUT PLOT - GSM 757MHz



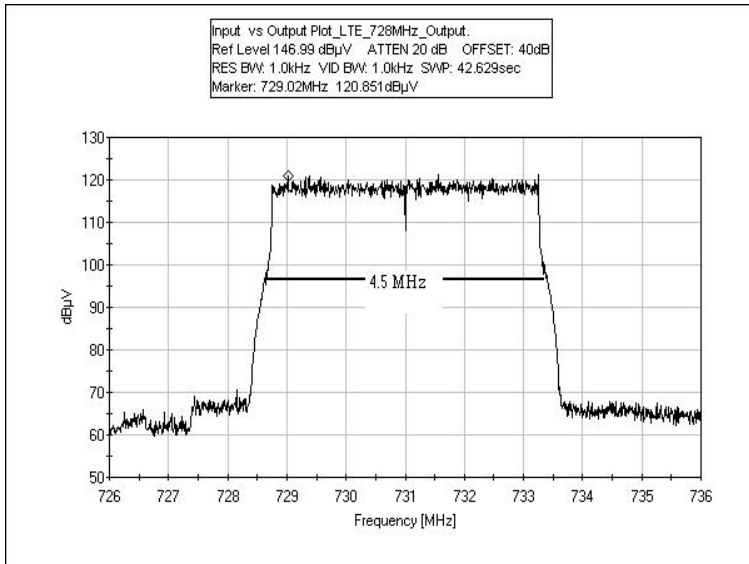
OUTPUT PLOT - GSM 757MHz



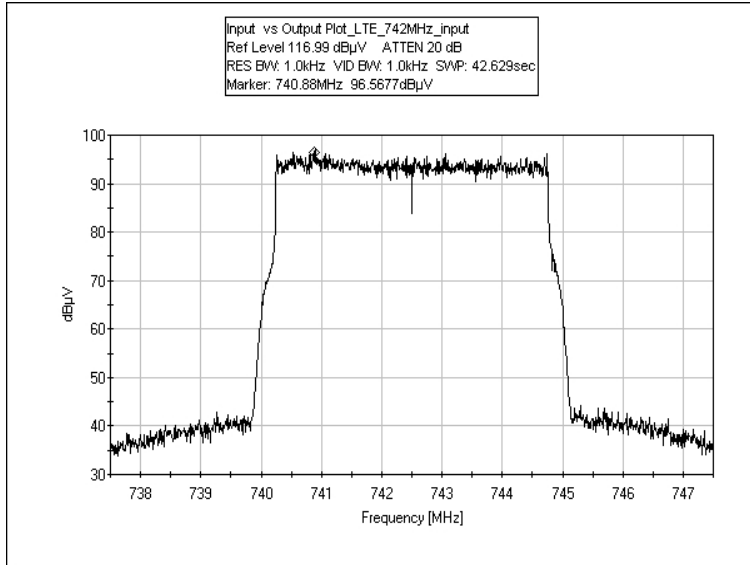
INPUT PLOT - LTE 728MHz



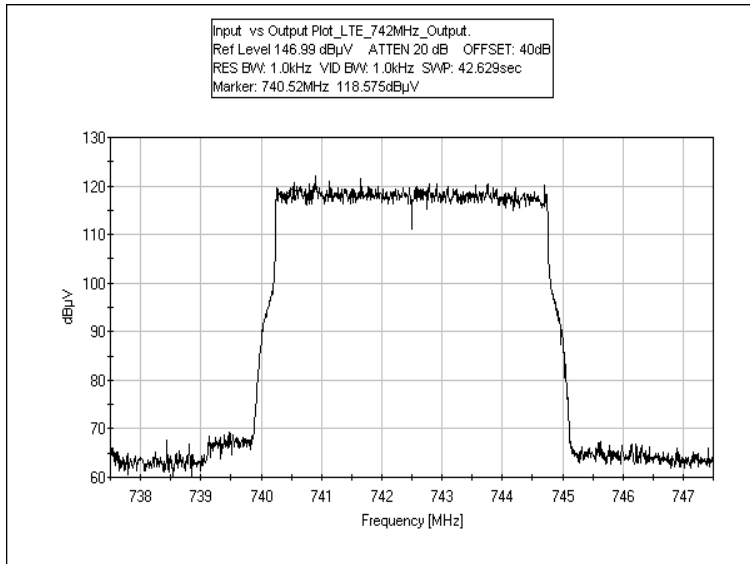
OUTPUT PLOT - LTE 728MHz



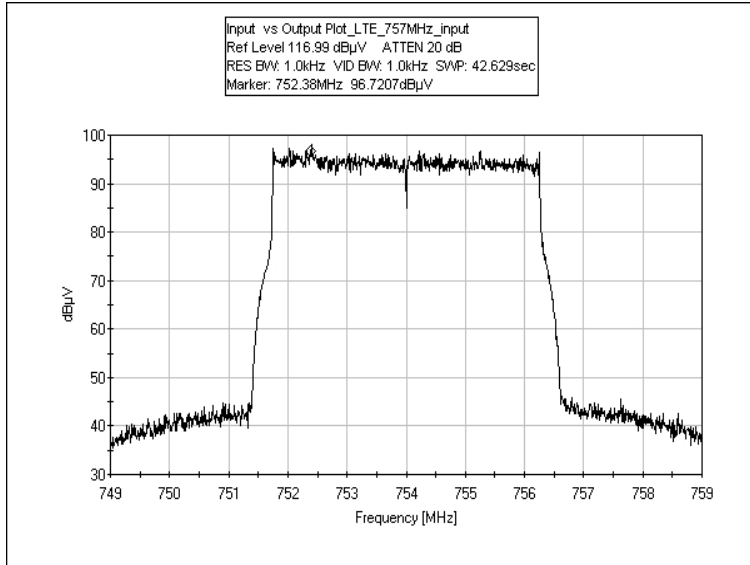
INPUT PLOT - LTE 742MHz



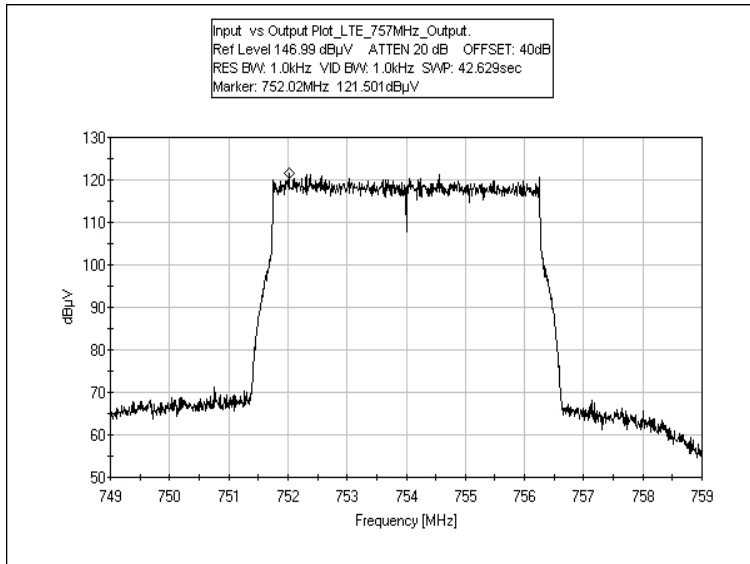
OUTPUT PLOT - LTE 742MHz



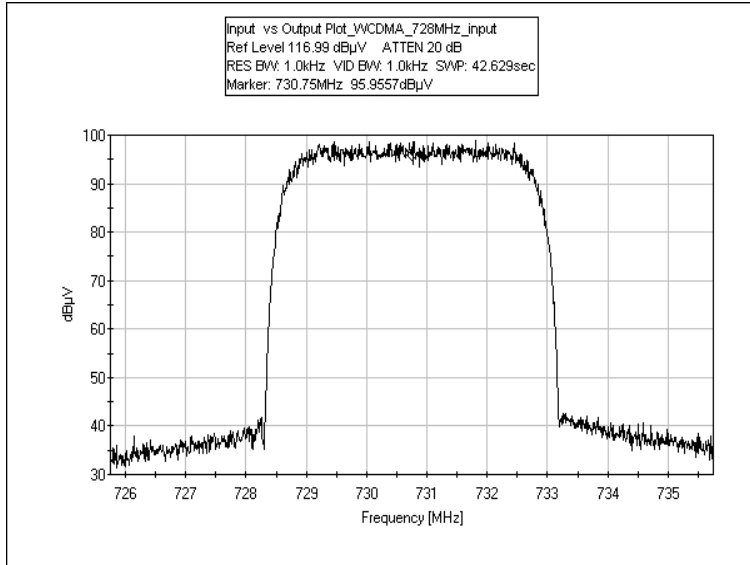
INPUT PLOT - LTE 757MHz



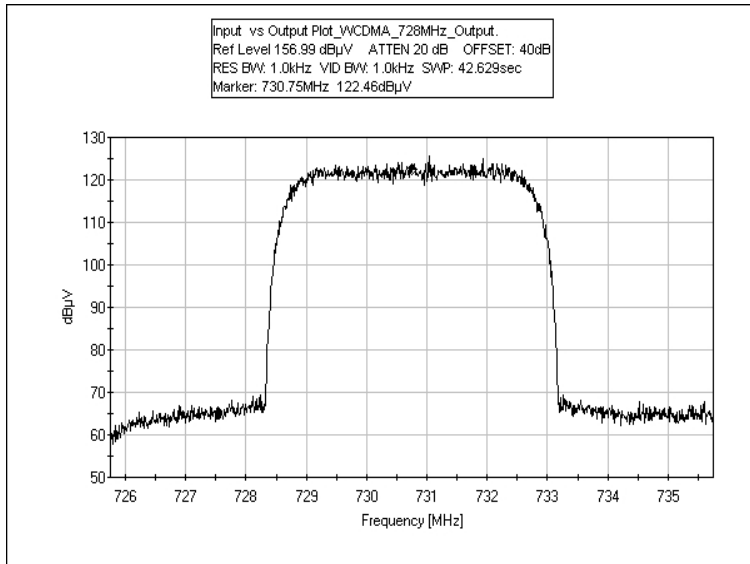
OUTPUT PLOT - LTE 757MHz



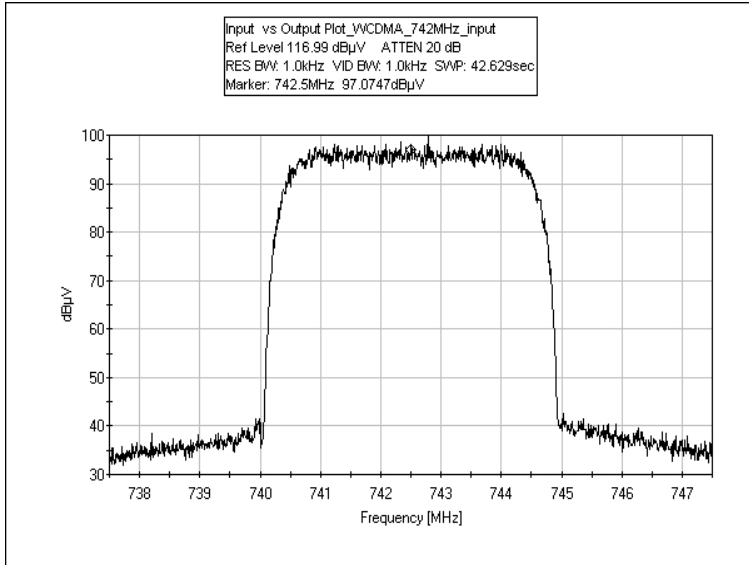
INPUT PLOT - WCDMA 728MHz



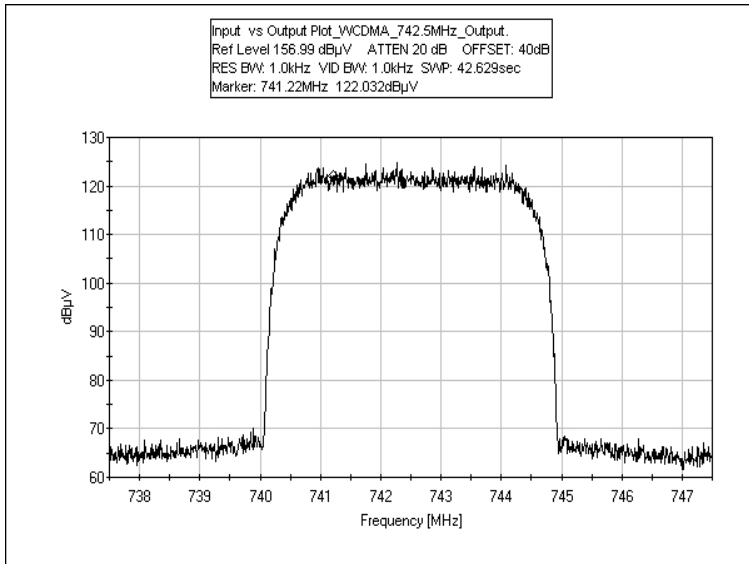
OUTPUT PLOT - WCDMA 728MHz



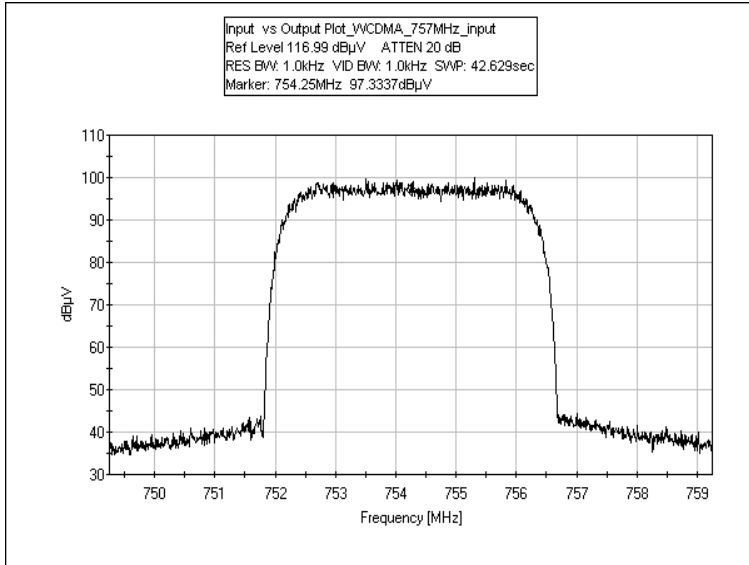
INPUT PLOT - WCDMA 742.5MHz



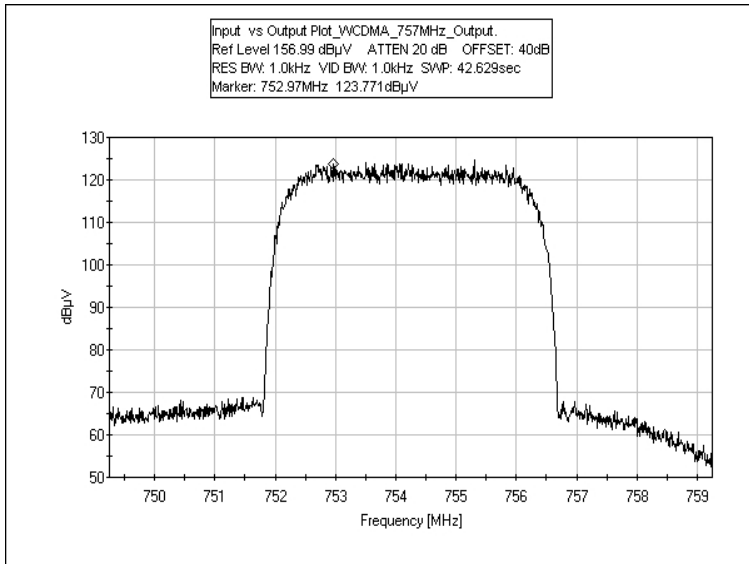
OUTPUT PLOT - WCDMA 742.5MHz



INPUT PLOT - WCDMA 757MHz



OUTPUT PLOT - WCDMA 757MHz



FCC 2.1033(c)(14)/2.1051/27.53(c)(1), (f), (g) - SPURIOUS EMISSIONS AT ANTENNA TERMINAL

Test Setup Photos



Test Data

Limit line for Spurious Conducted Emission

Required Attenuation = 43+10 Log P dB

Limit line (dBuV) = $V_{dBuV} - \text{Attenuation}$

$$\begin{aligned}
 V_{dBuV} &= 20 \text{ Log } \frac{V}{1 \times 10^{-6}} \\
 &= 20 (\text{Log } V - \text{Log } 1 \times 10^{-6}) \\
 &= 20 \text{ Log } V - 20 \text{ Log } 1 \times 10^{-6} \\
 &= 20 \text{ Log } V - 20 (-6) \\
 &= 20 \text{ Log } V + 120
 \end{aligned}$$

$$\begin{aligned}
 \text{Attenuation} &= 43 + 10 \text{ Log } P \\
 &= 43 + 10 \text{ Log } \frac{V^2}{R} \\
 &= 43 + 10 (\text{Log } V^2 - \text{Log } R) \\
 &= 43 + 10 (2 \text{ Log } V - \text{Log } R) \\
 &= 43 + 20 \text{ Log } V - 10 \text{ Log } R
 \end{aligned}$$

$$\begin{aligned}
 \text{Limit line} &= V_{dBuV} - \text{Attenuation} \\
 &= 20 \text{ Log } V + 120 - (43 + 20 \text{ Log } V - 10 \text{ Log } R) \\
 &= 20 \text{ Log } V + 120 - 43 - 20 \text{ Log } V + 10 \text{ Log } R \\
 &= 20 \text{ Log } V + 120 - 43 - 20 \text{ Log } V + 10 \text{ Log } R \\
 &= 120 - 43 + 10 \text{ Log } 50 \quad \text{Note : } R = 50 \Omega \\
 &= 120 - 43 + 16.897 \\
 &= 94 \text{ dBuV at any power level}
 \end{aligned}$$



Test Location: CKC Laboratories, Inc. • 110. N. Olinda Place. • Brea, CA 92821 • (714) 993-6112

Customer: **Powerwave Technologies, Inc.**
 Specification: **FCC Part 27.53(c)(1), (f), (g) Conducted Spurious Emission**
 Work Order #: **90007** Date: 11/11/2009
 Test Type: **Conducted Emissions** Time: 13:55:58
 Equipment: **Nexus FT 700 Commercial Service Repeater** Sequence#: 5
 Manufacturer: Powerwave Technologies Tested By: E. Wong
 Model: RH770020/101 110V 60Hz
 S/N: NA

Test Equipment:

Function	S/N	Calibration Date	Cal Due Date	Asset #
Spectrum Analyzer	US44300438	07/23/2008	07/23/2010	02672
1.0 GHz HPF	002	09/14/2009	09/14/2011	03169
3'-37GHz cable	NA	09/21/2009	09/21/2011	P02945

Equipment Under Test (* = EUT):

Function	Manufacturer	Model #	S/N
Nexus FT 700 Commercial Service Repeater*	Powerwave Technologies	RH770020/101	NA

Support Devices:

Function	Manufacturer	Model #	S/N
Power Meter	Agilent	E4419B	GB402019/12
Pre Amp	Mini Circuit	ZHL-4240	D040405
Optical Converter	Powerwave	NA	NA
ESG	Agilent	E4438C	MY42082180

Test Conditions / Notes:

The EUT is placed on the wooden table. The RF Output port is connected to a load string . Optical in port is connected to a support Optical converter. Support optical converter receives RF signal converts the signal to optic and send to the EUT. The EUT decode the optical signal, and generates an RF signal.

Operating range: 728- 757MHz.
Power = 43dBm=20 watt

Modulation: GSM
Frequency = 728.5 MHz, 742.5MHz, 756.5MHz

Modulation: EDGE
Frequency = 728.5 MHz, 742.5MHz, 756.5MHz

Modulation: CDMA2000
729.5MHz, 742.5Mhz, 755.5MHz

Modulation: WCDMA
Frequency= 730.75MHz, 742.5 MHz, 754.25MHz

Modulation = LTE
731.0MHz, 742.5MHz, 754.0MHz

24°C, 30% relative humidity

Frequency range of measurement = 9 kHz - 8 GHz.
Frequency 9 kHz - 150 kHz RBW=200 Hz, VBW=200 Hz; 150 kHz - 30 MHz RBW=9 kHz, VBW=9 kHz; 30 MHz - 1000 MHz RBW=120 kHz, VBW=120 kHz; 1000 MHz - 8,000 MHz RBW=1 MHz, VBW=1 MHz.

No emission found. recorded data represent noise floor level.
FCC 27.53 (f) : detailed investigation was performed in the band 1559-1610 MHz, no emission was detected.

Transducer Legend:

T1=Hi Freq_37GHz_3ft_CAB-AN02945-092111

#	Freq MHz	Rdng dBμV	Reading listed by margin.				Test Lead: Antenna Terminal				
			T1 dB				Dist Table	Corr dBμV	Spec dBμV	Margin dB	Polar Ant
1	1457.200M	70.1	+0.5				+0.0	70.6	94.0	-23.4	Anten

FCC 2.1033(c)(14)/2.1053/27.53(c)(1), (f), (g) - FIELD STRENGTH OF SPURIOUS RADIATION

Test Setup Photos



Test Data Sheets

Test Location: CKC Laboratories, Inc. • 110. N. Olinda Place. • Brea, CA 92821 • (714) 993-6112

Customer: **Powerwave Technologies, Inc.**
 Specification: **FCC 27.53 (c)(1), (g), (f) Radiated Spurious Emission**
 Work Order #: **90007** Date: 11/11/2009
 Test Type: **Radiated Scan** Time: 08:50:04
 Equipment: **Nexus FT 700 Commercial Service Repeater** Sequence#: 4
 Manufacturer: Powerwave Technologies Tested By: E. Wong
 Model: RH770020/101
 S/N: NA

Test Equipment:

Function	S/N	Calibration Date	Cal Due Date	Asset #
Spectrum Analyzer	US44300438	07/23/2008	07/23/2010	02672
Bilog Antenna	2451	01/21/2008	01/21/2010	01995
Pre amp to SA Cable	Cable #10	04/16/2009	04/16/2011	P05050
Pre Amp	1937A02548	05/02/2008	05/02/2010	00309
Horn Antenna	6246	06/06/2008	06/06/2010	00849
Microwave Pre-amp	3123A00281	07/28/2008	07/28/2010	00786
2'-40GHz cable	NA	09/21/2009	09/21/2011	P2948
Heliastax Antenna Cable	P5565	09/04/2008	09/04/2010	P05565
Loop Antenna	2014	06/16/2008	06/16/2010	00314
1.0 GHz HPF	002	09/14/2009	09/14/2011	03169

Equipment Under Test (* = EUT):

Function	Manufacturer	Model #	S/N
Nexus FT 700 Commercial Service Repeater*	Powerwave Technologies	RH770020/101	NA

Support Devices:

Function	Manufacturer	Model #	S/N
Power Meter	Agilent	E4419B	GB402019/12
Pre Amp	Mini Circuit	ZHL-4240	D040405
Optical Converter	Powerwave	NA	NA
ESG	Agilent	E4438C	MY42082180

Test Conditions / Notes:

The EUT is placed on the wooden table. The RF Output port is connected to a load string . Optical in port is connected to a support Optical converter.

Support optical converter receives RF signal converts the signal to optic and send to the EUT. The EUT decode the optical signal, and generates an RF signal.

Operating range: 728- 757MHz.

Power = 43dBm=20 watt

Modulation: EDGE

Frequency = 728.5 MHz, 742.5MHz, 756.5MHz

Modulation: WCDMA

Frequency= 730.75MHz, 742.5 MHz, 754.25MHz

Modulation= LTE

731.0MHz, 742.5MHz, 754.0MHz

24°C, 30% relative humidity

Frequency range of measurement = 9 kHz - 8 GHz.

Frequency 9 kHz - 150 kHz RBW=200 Hz, VBW=200 Hz; 150 kHz- 30 MHz RBW=9 kHz, VBW=9 kHz;

30 MHz- 1000 MHz RBW=120 kHz, VBW=120 kHz; 1000 MHz-8,000 MHz RBW=1 MHz, VBW=1 MHz.

No emission found. FCC 27.53 (f) : detailed investigation was performed in the band 1559-1610 MHz, no emission was detected.

BANDEDGE

Test Equipment

Equipment	Asset #	Manufacturer	Model #	Serial #	Cal Date	Cal Due
Spectrum Analyzer	02672	Agilent	E4446A	US44300438	072308	072310
36" 40GHz cable	02945	Strolab	NA	NA	092111	092111

Test Conditions

The EUT is placed on the wooden table. The RF Output port is connected to a load string . Optical in port is connected to a support Optical converter. Support optical converter receives RF signal converts the signal to optical and send to the EUT. The EUT decode the optical signal, and generates an RF signal. Blockedge plot is recorded with a spectrum analyzer at the Antenna port of the device.

Operating range: 728-757MHz.

Modulation: GSM, EDGE, CDMA2000, WCDMA, LTE

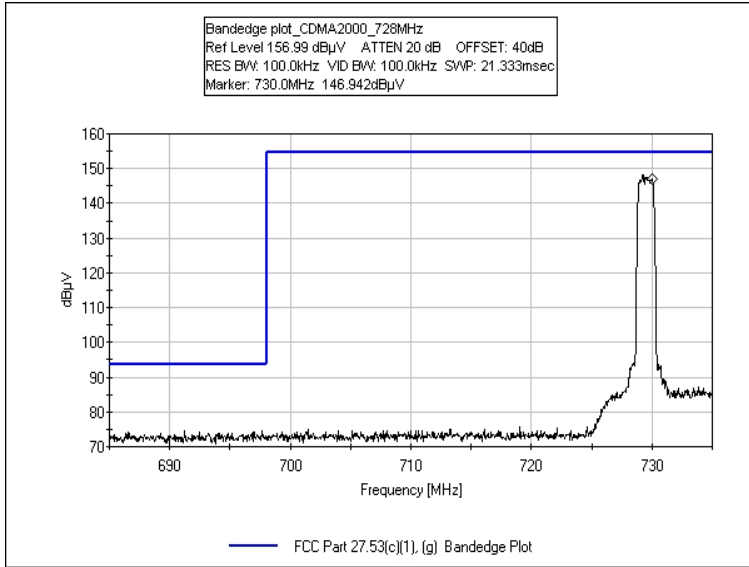
Power = 20 watts

Test Setup Photos

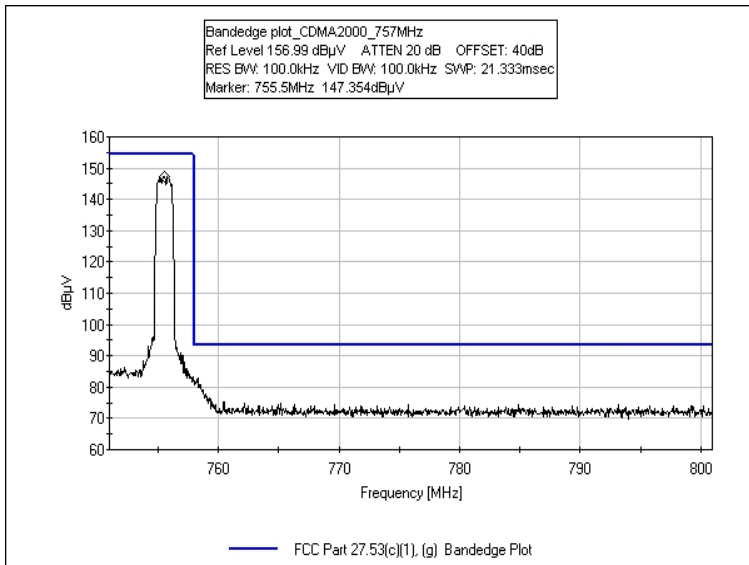


Test Plots

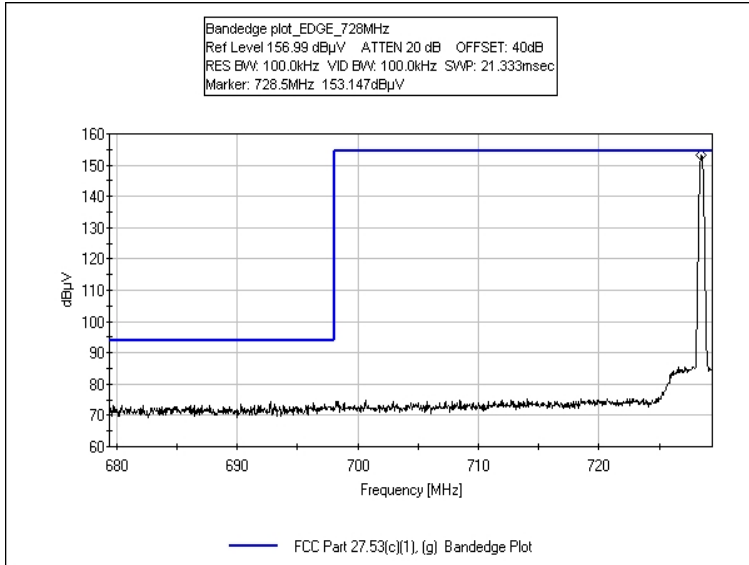
BANDEDGE PLOT - CDMA2000 728MHz



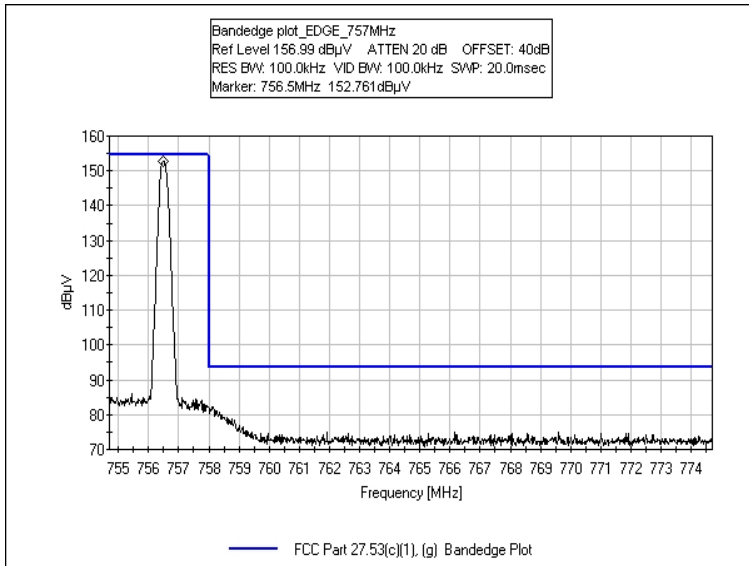
BANDEDGE PLOT - CDMA2000 757MHz



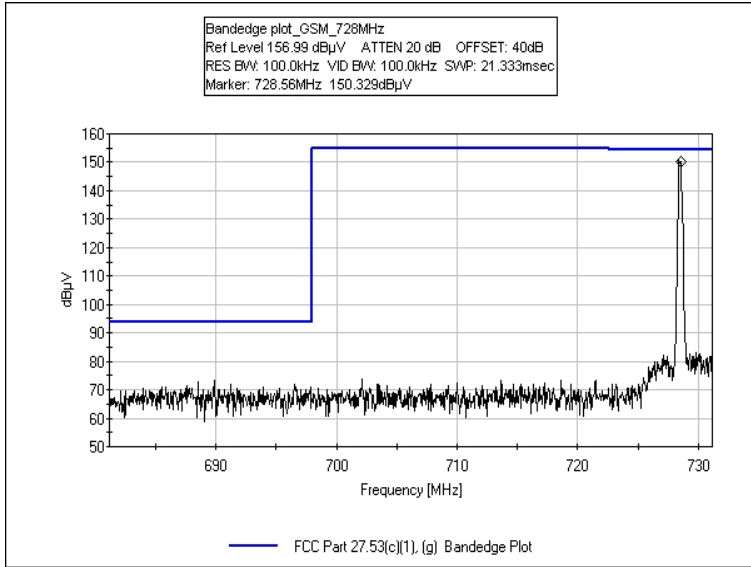
BANDEDGE PLOT - EDGE 728MHz



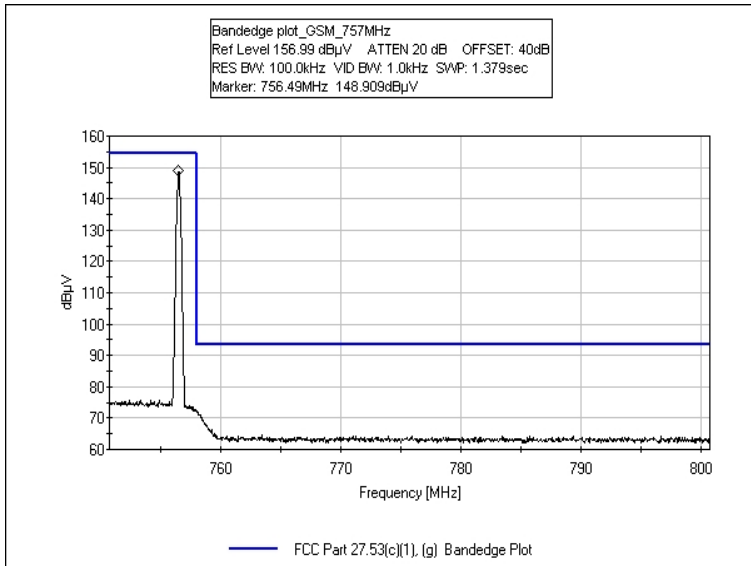
BANDEDGE PLOT - EDGE 757MHz



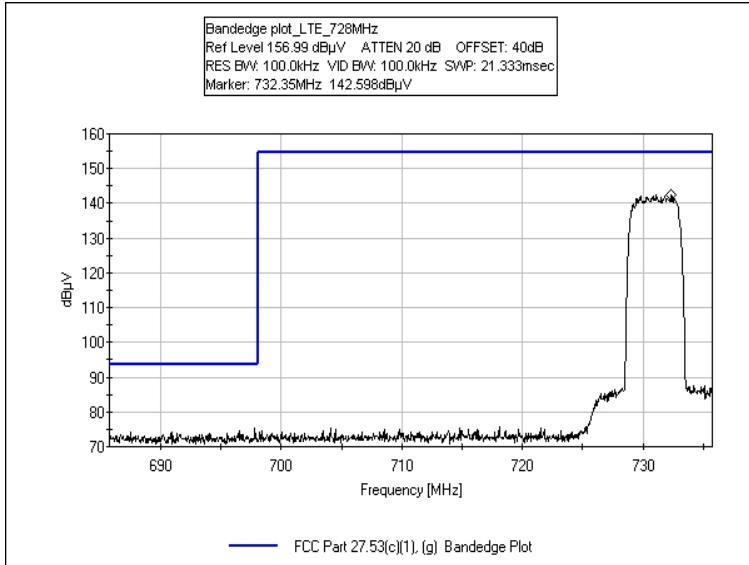
BANDEDGE PLOT - GSM 728MHz



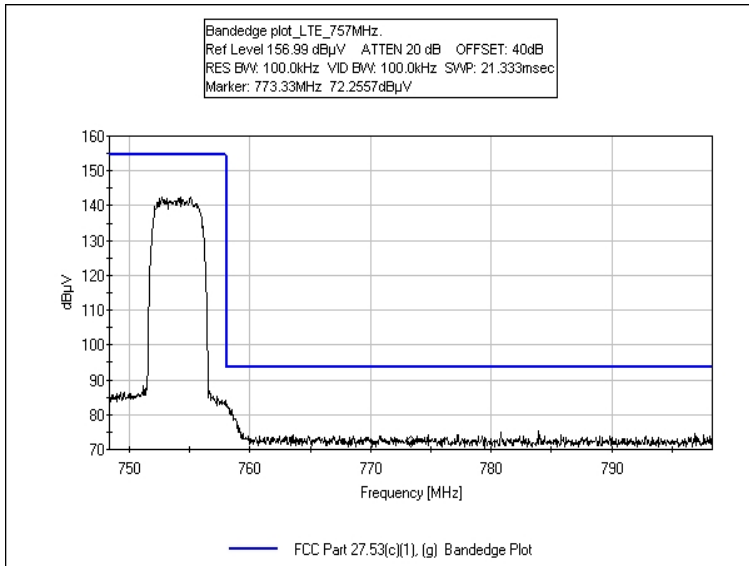
BANDEDGE PLOT - GSM 757MHz



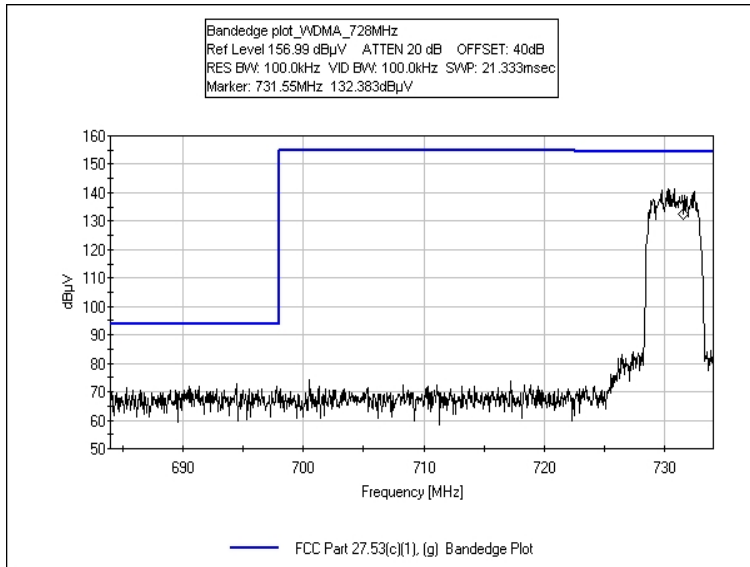
BANDEDGE PLOT - LTE 728MHz



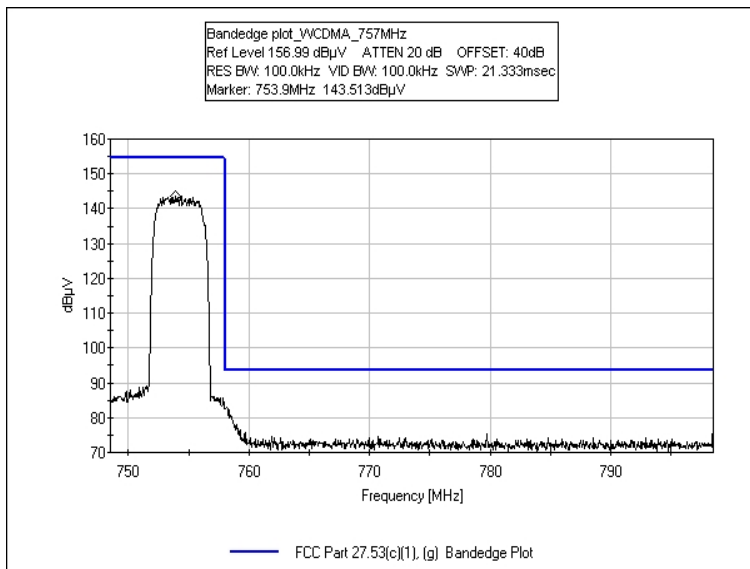
BANDEDGE PLOT - LTE 757MHz



BANDEDGE PLOT - WCDMA 728MHz



BANDEDGE PLOT - WCDMA 757MHz



INTERMODULATION

Test Equipment

Equipment	Asset #	Manufacturer	Model #	Serial #	Cal Date	Cal Due
Spectrum Analyzer	02672	Agilent	E4446A	US44300438	072308	072310
36" 40GHz cable	02945	Strolab	NA	NA	092111	092111

Test Conditions

The EUT is placed on the wooden table. The RF Output port is connected to a load string . Optical in port is connected to a support Optical converter. Support optical converter receives RF signal converts the signal to optic and send to the EUT. The EUT decode the optical signal, and generates an RF signal.

Operating range: 728-757MHz.

Modulation: GSM, EDGE, CDMA2000, WCDMA, LTE

Power = 20 watts

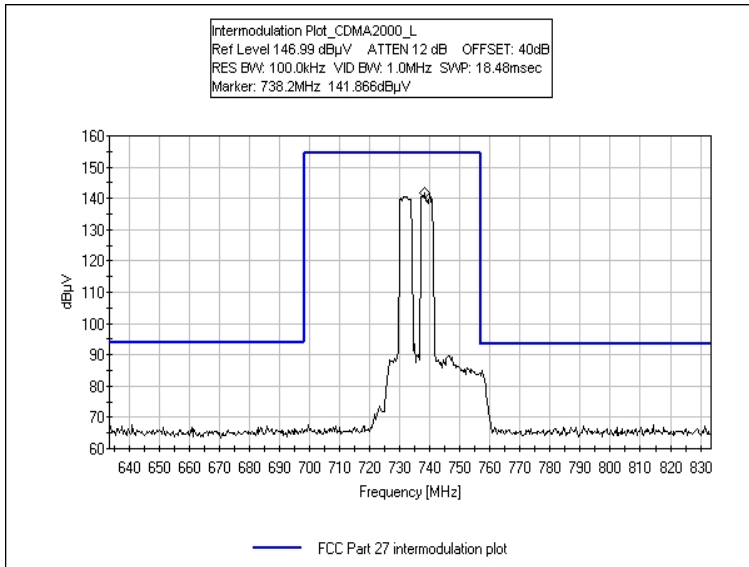
Two modulated signals from the support ESG are injected into the device and the intermodulation product is measured at the RF antenna port under investigation.

Test Setup Photos

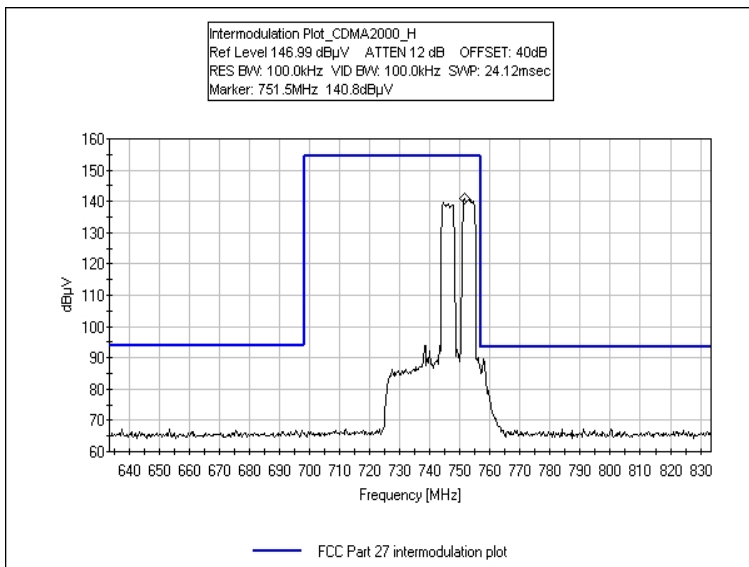


Test Plots

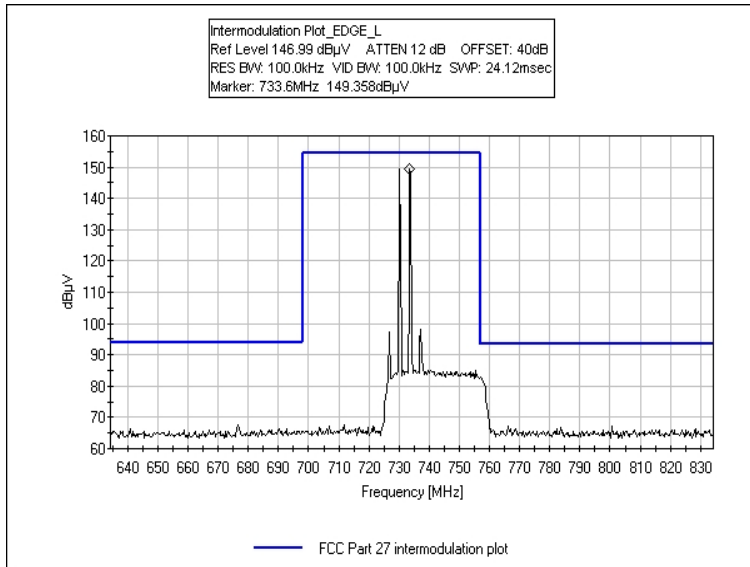
INTERMODULATION PLOT - CDMA2000 LOW CHANNEL



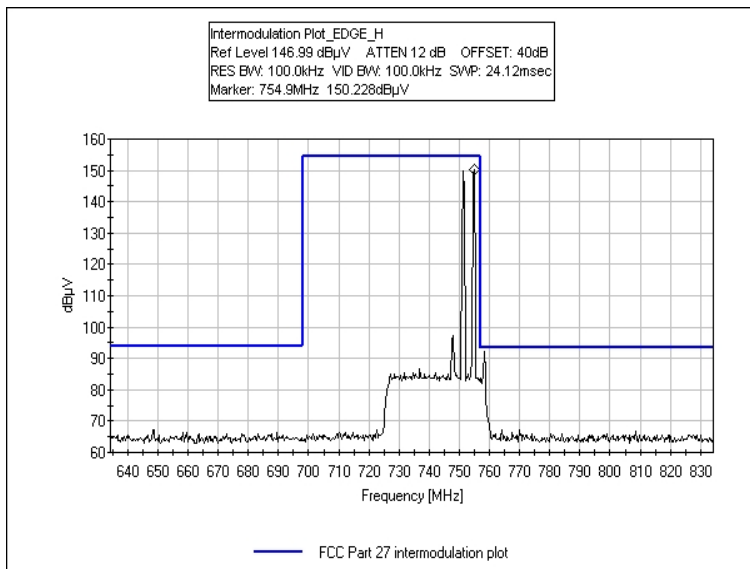
INTERMODULATION PLOT - CDMA2000 HIGH CHANNEL



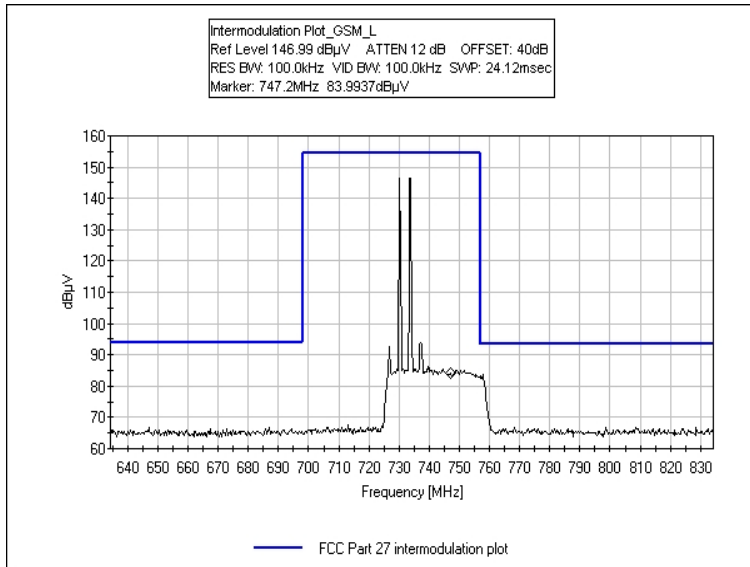
INTERMODULATION PLOT - EDGE LOW CHANNEL



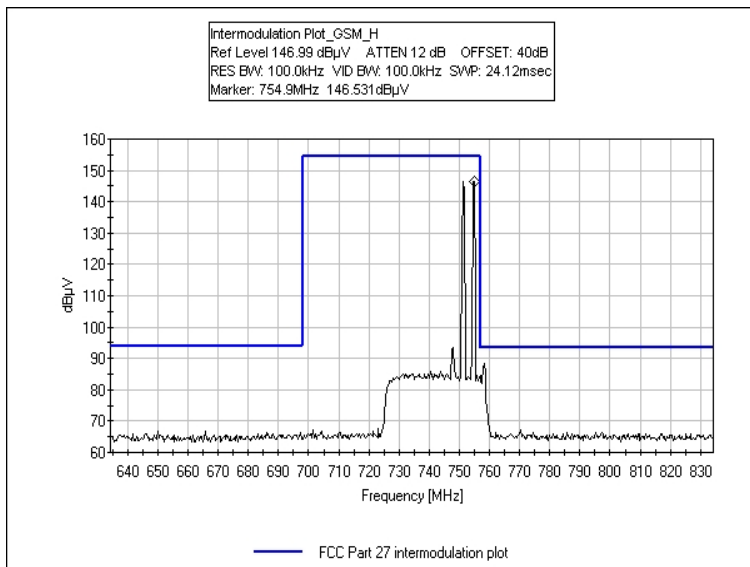
INTERMODULATION PLOT - EDGE HIGH CHANNEL



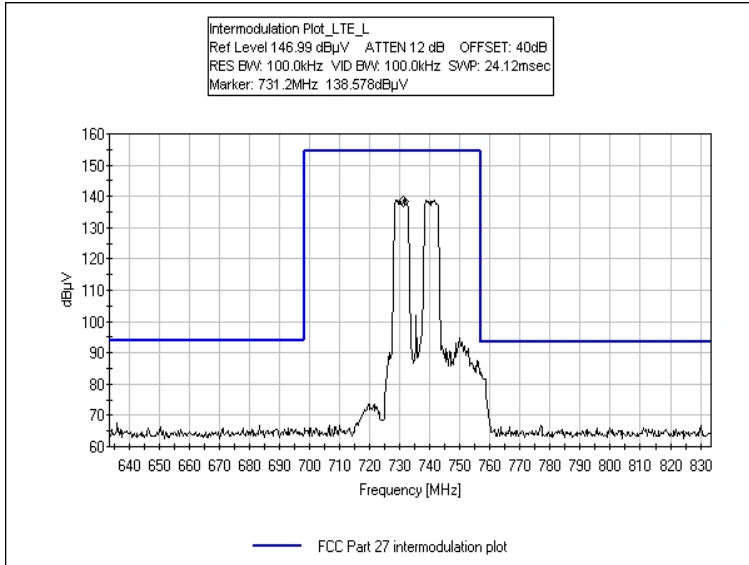
INTERMODULATION PLOT - GSM LOW CHANNEL



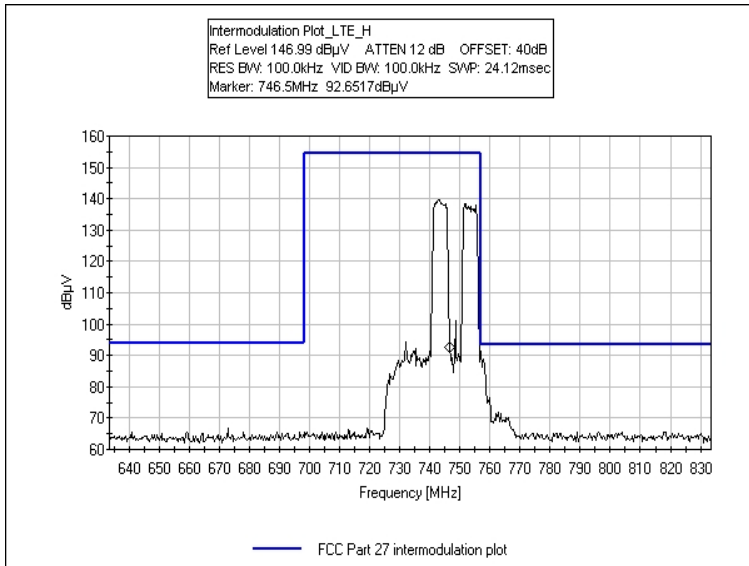
INTERMODULATION PLOT - GSM HIGH CHANNEL



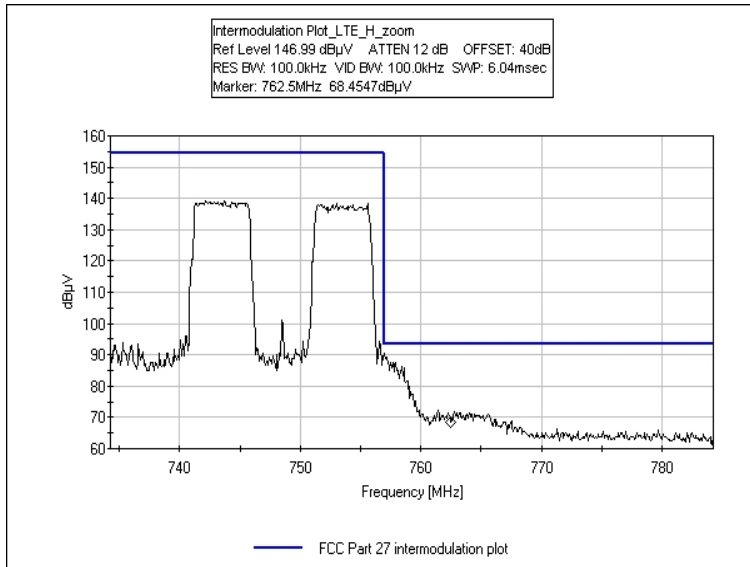
INTERMODULATION PLOT - LTE LOW CHANNEL



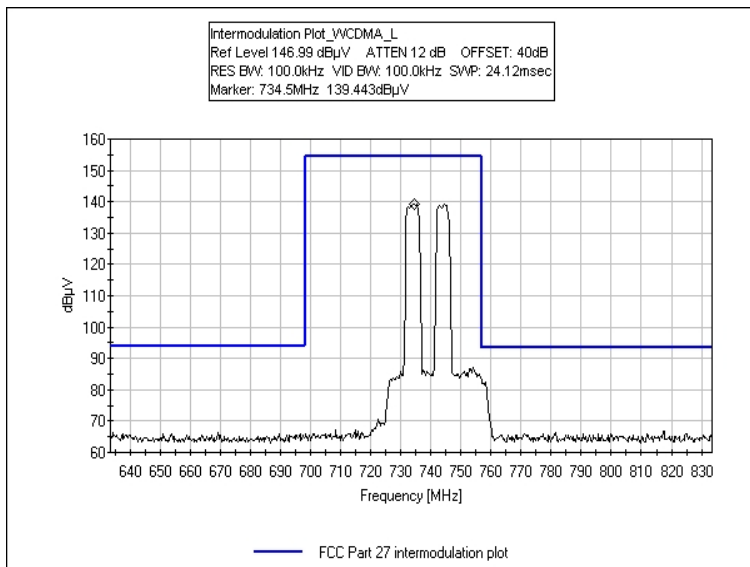
INTERMODULATION PLOT - LTE HIGH CHANNEL



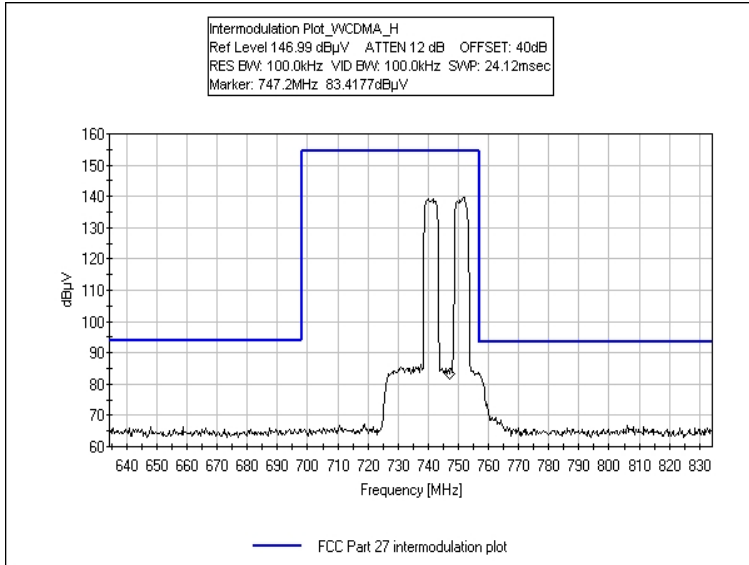
INTERMODULATION PLOT - LTE HIGH CHANNEL ZOOM



INTERMODULATION PLOT - WCDMA LOW CHANNEL



INTERMODULATION PLOT - WCDMA HIGH CHANNEL



OUT OF BAND REJECTION

Test Equipment

Equipment	Asset #	Manufacturer	Model #	Serial #	Cal Date	Cal Due
Network analyzer	C00012	HP	8753E	Us38432770	091208	091210

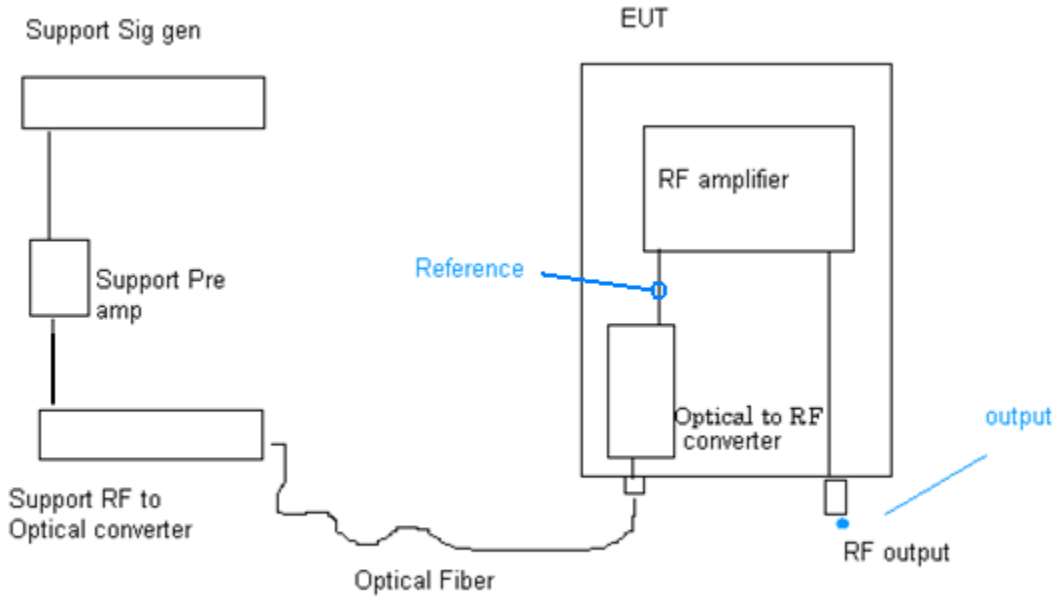
Test Conditions

The EUT is placed on the wooden table. The RF Output port is connected to a load string. The Optical port is connected to a Optical Converter. Support optical converter receives the RF signal, converts the signal to optic and sends t to the EUT. The EUT decodes the optical signal and generates a RF signal.

To measure the System RF gain, the reference was established at the input of the RF amplifier section, by- passing the optical convertor. The manufacturer declared gain is system RF gain.

The Out of band Rejection plot is captured with a Network Analyzer.

Test Setup Photos and Diagram



Test Plots

