



CERT #803.01, 803.02, 803.05, 803.06

POWERWAVE TECHNOLOGIES, INC. TEST REPORT
FOR THE
WIDE BAND RADIO HEAD, RH700030/101
FCC PART 90
TESTING

DATE OF ISSUE: FEBRUARY 24, 2009

PREPARED FOR:

Powerwave Technologies, Inc.
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Santa Ana, CA 92705

P.O. No.: 125203
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PREPARED BY:

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Date of test: December 10, 2008 –
February 10, 2009

Report No.: FC09-010

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ADMINISTRATIVE INFORMATION

DATE OF TEST: December 10, 2008 -
February 10, 2009

DATE OF RECEIPT: December 10, 2008

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 90


PURPOSE OF TEST: To perform the testing of the Wide Band Radio Head, RH700030/101 with the requirements for FCC Part 90 devices.

APPROVALS

QUALITY ASSURANCE:

TEST PERSONNEL:

Steve Behm, Director of Engineering Services



Eddie Wong, Senior EMC Engineer



Septimiu Apahidean, EMC Engineer

SUMMARY OF RESULTS

Test	Specification/Method	Results
RF Power Output	FCC 90.205	Pass
Occupied Bandwidth	FCC 90.543(a)	Pass
Spurious Emissions at Antenna Terminal	FCC 90.543(c)	Pass
Field Strength of Spurious Radiation	FCC 90.543(c)	Pass
Bandedge		Pass
Intermodulation		Pass
Out of Band Rejection		Pass
Site File No.	FCC 90473 IC 3082D-1	

CONDITIONS DURING TESTING

No modifications to the EUT were necessary during testing.



EQUIPMENT UNDER TEST (EUT) DESCRIPTION

The customer declares the EUT tested by CKC Laboratories was representative of a production unit.

The following model has been tested by CKC Laboratories: **RH700030/101**

The customer states that the following additional model is identical electrically to the one which was tested, or any differences between them do not affect their EMC characteristics, and therefore it meets the level of testing equivalent to the tested model: **RH007003/001**.

EQUIPMENT UNDER TEST

Wide Band Radio Head

Manuf: Powerwave Technologies, Inc.
Model: RH700030/101
Serial: NA
FCC ID: E675JS0108

PERIPHERAL DEVICES

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

Optical Converter

Manuf: Powerwave
Model: NA
Serial: NA

Power Meter

Manuf: Agilent
Model: E4419B
Serial: GB402019/12

Pre Amp

Manuf: Mini Circuit
Model: ZHL-4240
Serial: D040405

ESG

Manuf: Agilent
Model: E4433C
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

G9W

FCC 2.1033 (c)(5) FREQUENCY RANGE

763 MHz – 775 MHz.

FCC 2.1033 (c)(6) OPERATING POWER

763MHz-773MHz: 20 Watts (43 dBm)

773MHz-775MHz: 12.6 Watts (41 dBm)

FCC 2.1033 (c)(7) MAXIMUM POWER RATING

1000 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

APC025_4CFM & APC025_CQPSK

FCC 2.1033(c)(14)/2.1046/90.205 - RF POWER OUTPUT

Test Equipment

Equipment	Asset #	Manufacturer	Model #	Serial #	Cal Date	Cal Due
RF Power meter	02778	HP	EPM-441A	GB37170458	021508	021510
Power Sensor	02777	HP	E4412A	MY41499662	021508	021510

Test Setup Photos



Test Data

90.205 Power and antenna height limits.

(j) 763-775 MHz and 793-805 MHz. Power and height limitations are specified in Sec. Sec. 90.541 and 90.542.

Sec. 90.541 Transmitting power limits.

The transmitting power of base, mobile, portable and control stations operating in the 769-775 MHz and 799-805 MHz frequency bands must not exceed the maximum limits in this section, and must also comply with any applicable effective radiated power limits in Sec. 90.545.

PART 90_PRIVATE LAND MOBILE RADIO SERVICES--Table of Contents

Subpart R_Regulations Governing the Licensing and Use of Frequencies in the 763-775 and 793-805 MHz Bands 90.545 (b) Maximum ERP and HAAT. The maximum effective radiated power (ERP) and the antenna height above average terrain (HAAT) of the proposed land mobile base station, the associated control station, and the mobile transmitters shall be determined using the methods described in this section.

(1) Each base station is limited to a maximum ERP of **1000** watts.

The EUT is a RF amplifier operating the 763-775 MHz band under Part 90. The manufacturer does not provide an antenna for sale with the product, hence EIRP is not measured nor calculated. The end user of this product is to exercise proper engineering judgment to select the appropriate antenna to comply with the EIRP limitation set forth by 90.205.

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 peak to Average ration was captured with a spectrum analyzer.

Test setup: 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 the RF signal, converts the signal to optic and sends it to the EUT. The EUT decodes the optical signal, and generates an RF signal.

Operating range: 763-775MHz.

Modulation	Frequency	Power (dBm)	Power (Watts)
APCO25/4CFM	763.050MHz	43	20.0
APCO25/4CFM	769.000MHz	43	20.0
APCO25/4CFM	774.950MHz	41	12.6
APC025/CQPSK	763.025MHz	43	20.0
APC025/CQPSK	769.000MHz	43	20.0
APC025/CQPSK	774.975MHz	41	12.6

Conclusion: As indicated below, each single channel does not exceed the 1000 Watt power limit. The device is designed not to produce power level exceeding 12.6 Watts under any input signal level at 774.95MHz, and not to exceed 20 Watts at 763.05MHz and 769MHz.

FCC 2.1033(c)(14)/2.1049(i)/90.543(a)- OCCUPIED BANDWIDTH

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	091807	091809

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 the RF signal, converts the signal to optic and sends it to the EUT. The EUT decodes the optical signal, and generates an RF signal.

Operating range: 763-775 MHz.

Power = 20 watts

Power. 12.6W at 775 MHz.

Modulation: APCO25/4CFM,

Frequency = 763.05MHz, 769MHz, 774.95 MHz

Modulation: APC025/CQPSK

Frequency = 763.025MHz, 769MHz, 774.975MHz

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.

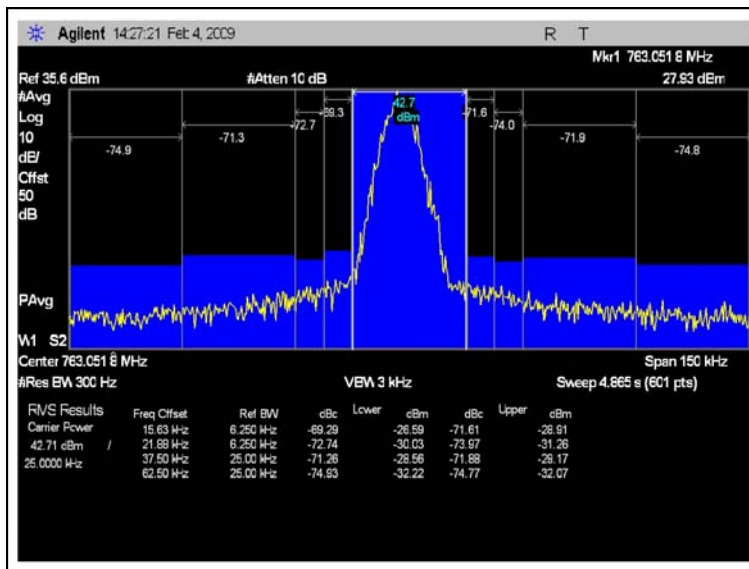
In addition, the Adjacent Channel power ratio for Narrow band signal was analyzed per FCC Requirement as requested by KDB 846944.

Test Setup Photos

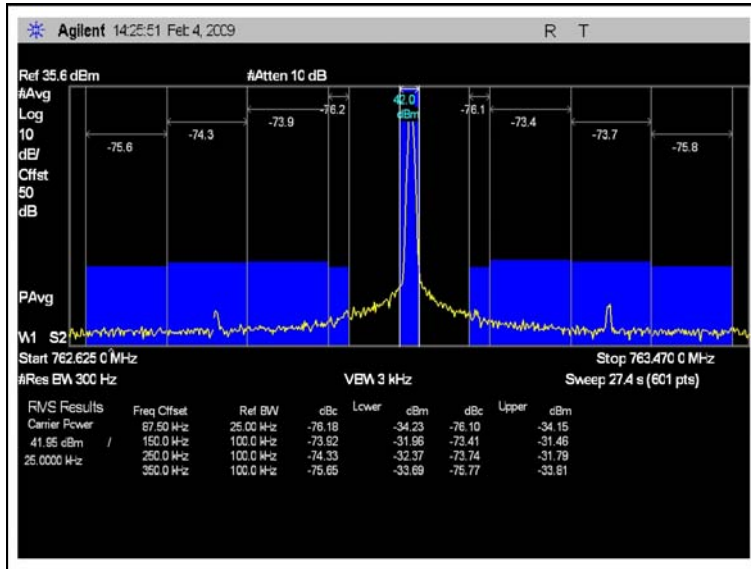


Test Plots

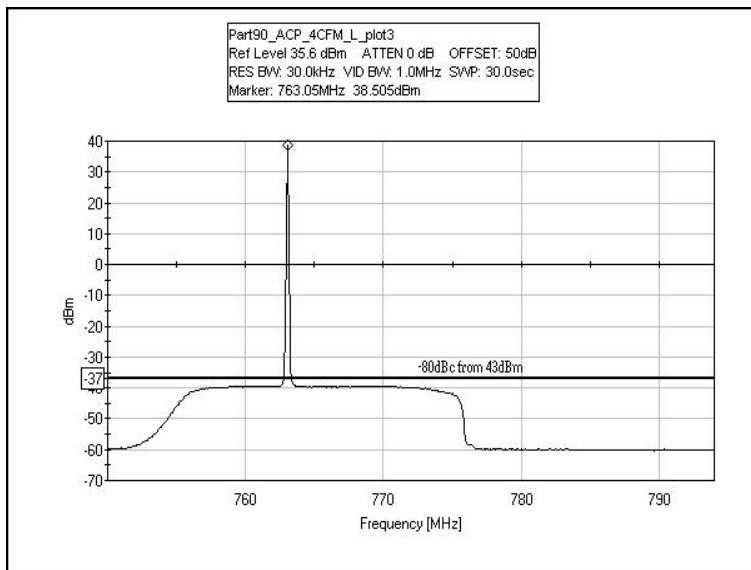
FCC 90.543(c) OCCUPIED BANDWIDTH - ACP_4CFM – LOW CHANNEL PLOT 1



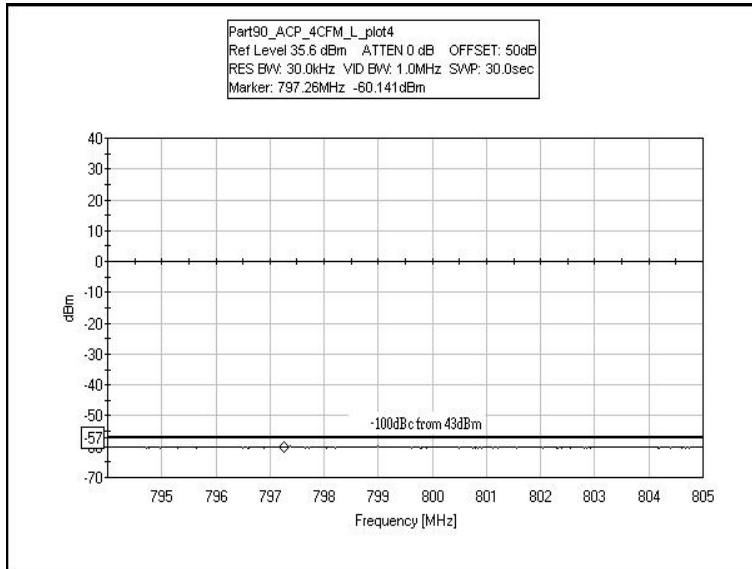
FCC 90.543(c) OCCUPIED BANDWIDTH - ACP_4CFM – LOW CHANNEL PLOT 2



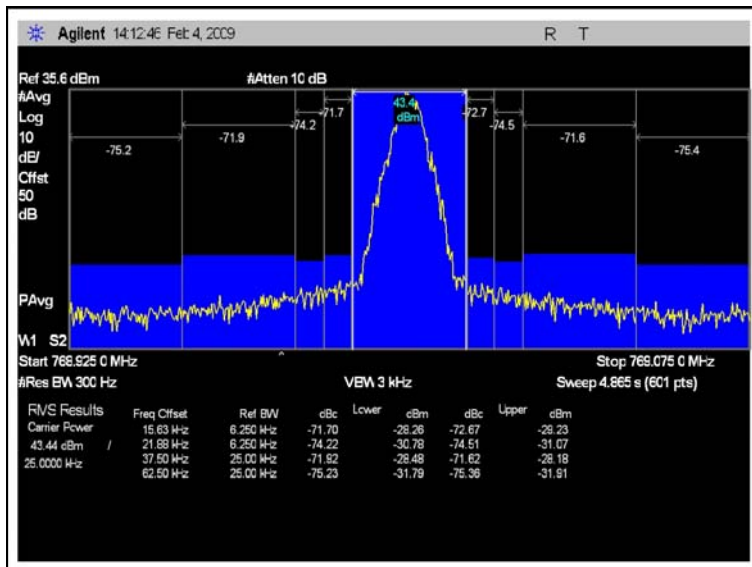
FCC 90.543(c) OCCUPIED BANDWIDTH - ACP_4CFM – LOW CHANNEL PLOT 3



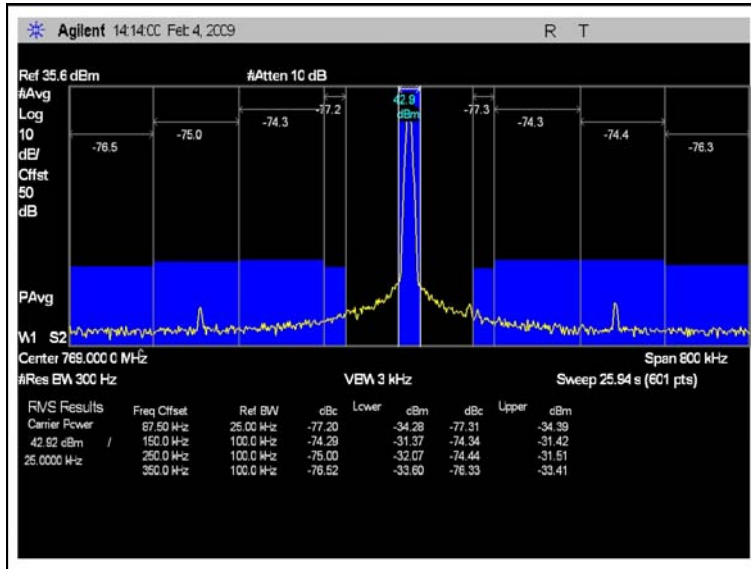
FCC 90.543(c) OCCUPIED BANDWIDTH - ACP_4CFM – LOW CHANNEL PLOT 4



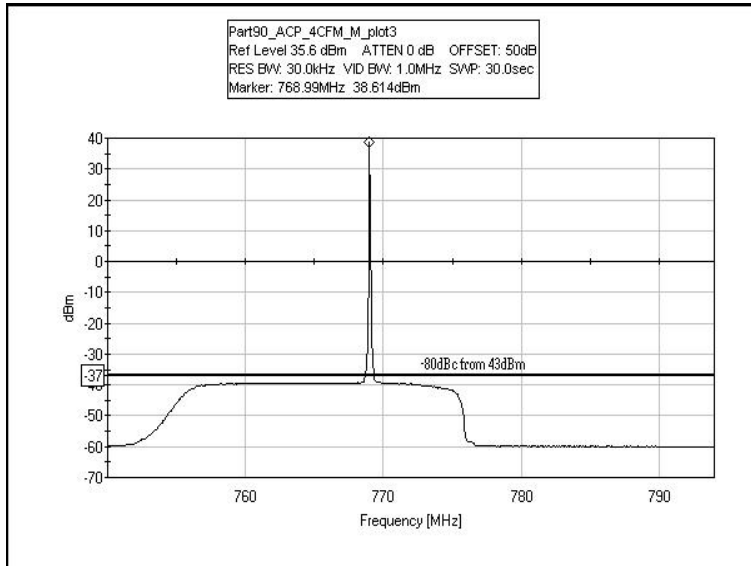
FCC 90.543(c) OCCUPIED BANDWIDTH - ACP_4CFM – MID CHANNEL PLOT 1



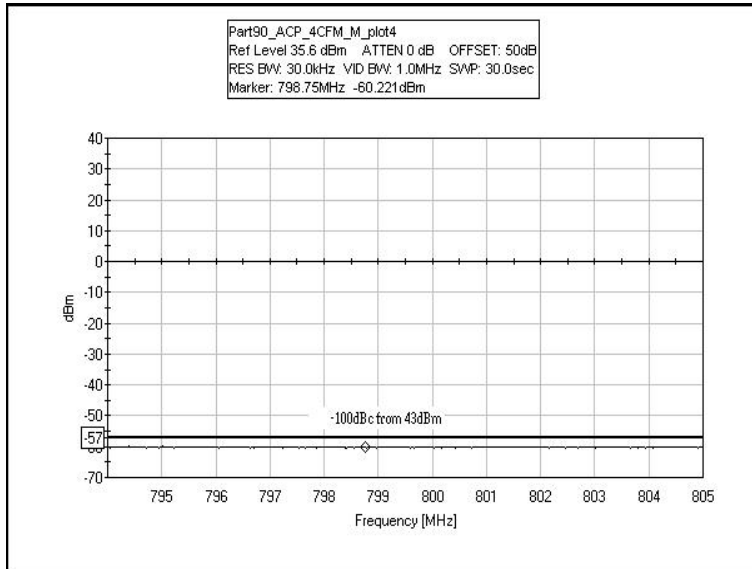
FCC 90.543(c) OCCUPIED BANDWIDTH - ACP_4CFM – MID CHANNEL PLOT 2



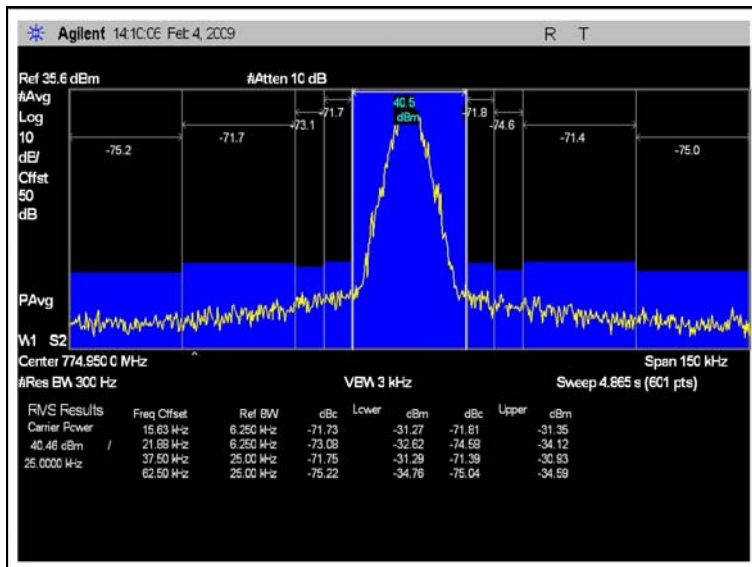
FCC 90.543(c) OCCUPIED BANDWIDTH - ACP_4CFM – MID CHANNEL PLOT 3



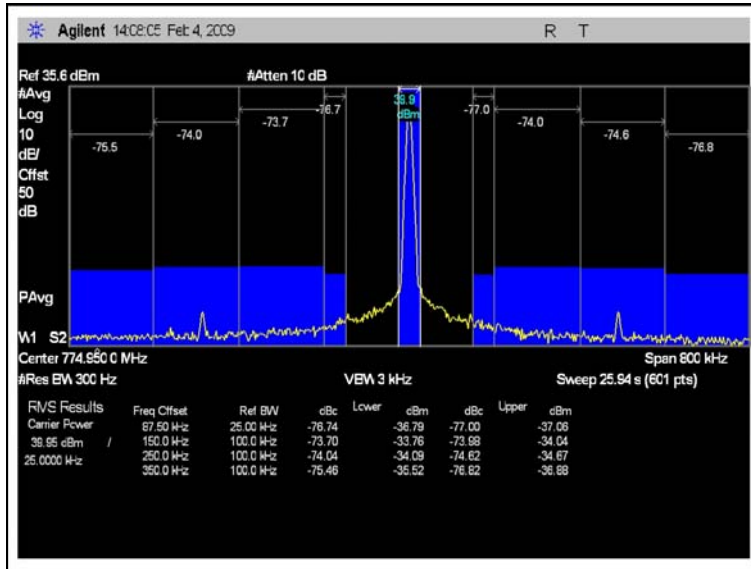
FCC 90.543(c) OCCUPIED BANDWIDTH - ACP_4CFM – MID CHANNEL PLOT 4



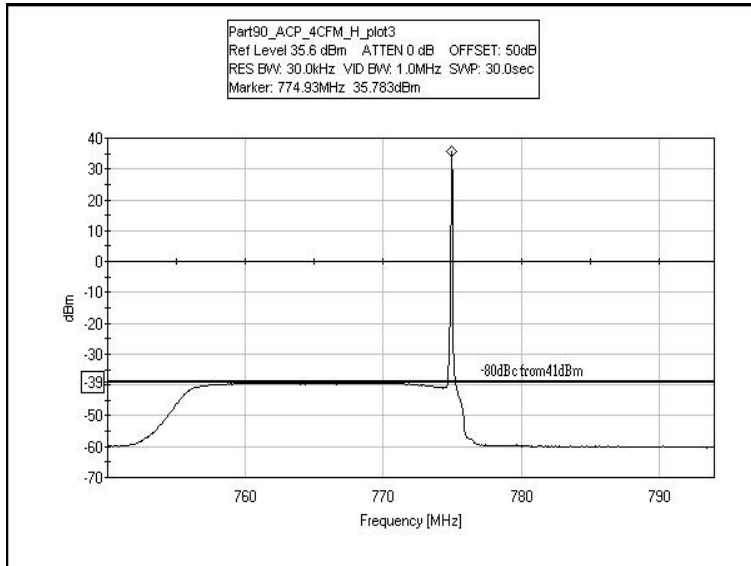
FCC 90.543(c) OCCUPIED BANDWIDTH - ACP_4CFM – HIGH CHANNEL PLOT 1



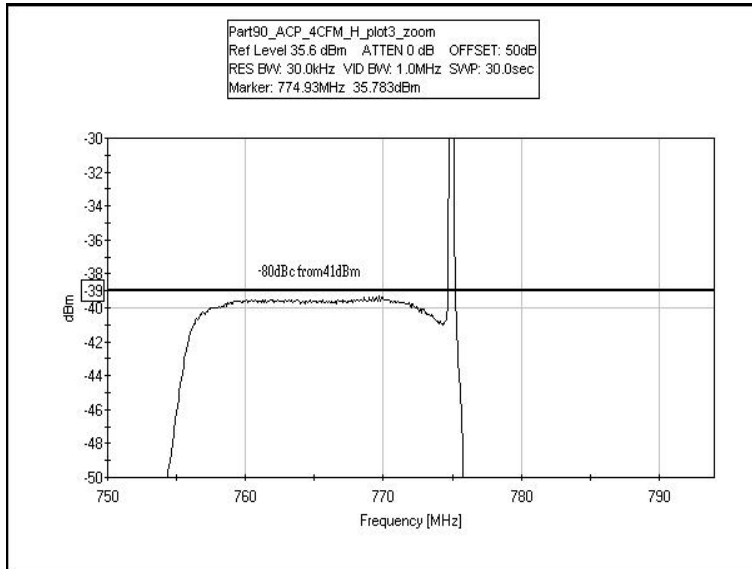
FCC 90.543(c) OCCUPIED BANDWIDTH - ACP_4CFM – HIGH CHANNEL PLOT 2



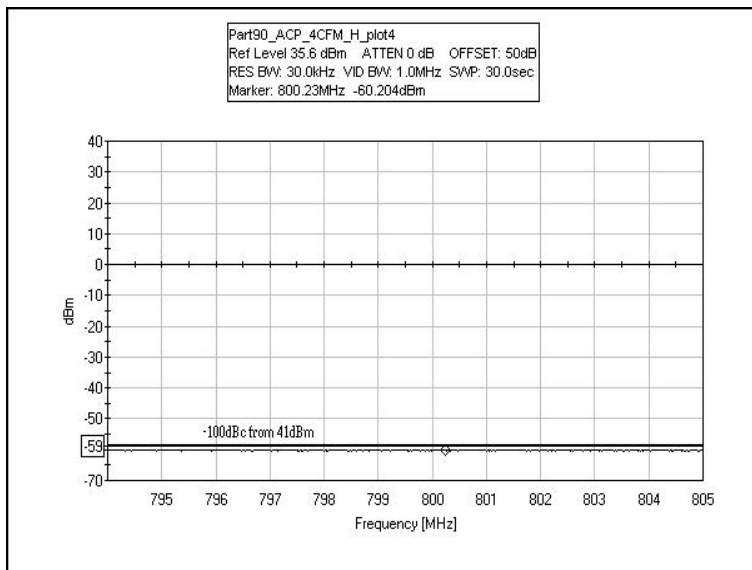
FCC 90.543(c) OCCUPIED BANDWIDTH - ACP_4CFM – HIGH CHANNEL PLOT 3



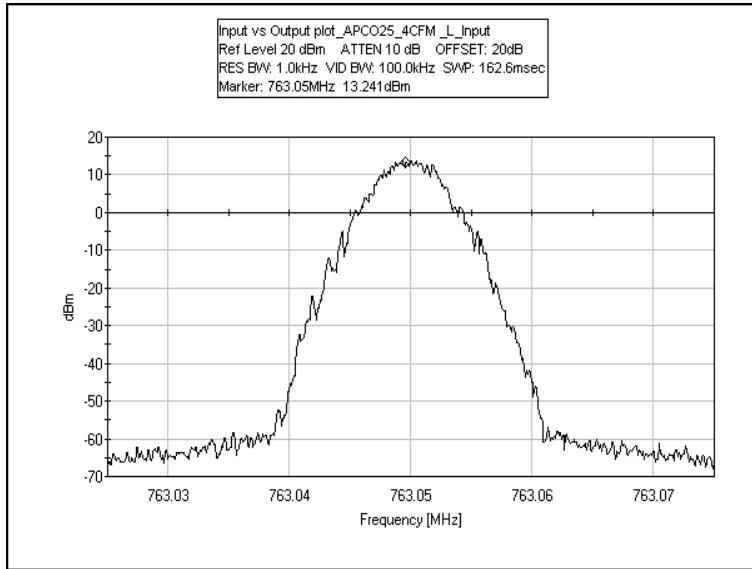
FCC 90.543(c) OCCUPIED BANDWIDTH - ACP_4CFM – HIGH CHANNEL PLOT 3 ZOOM



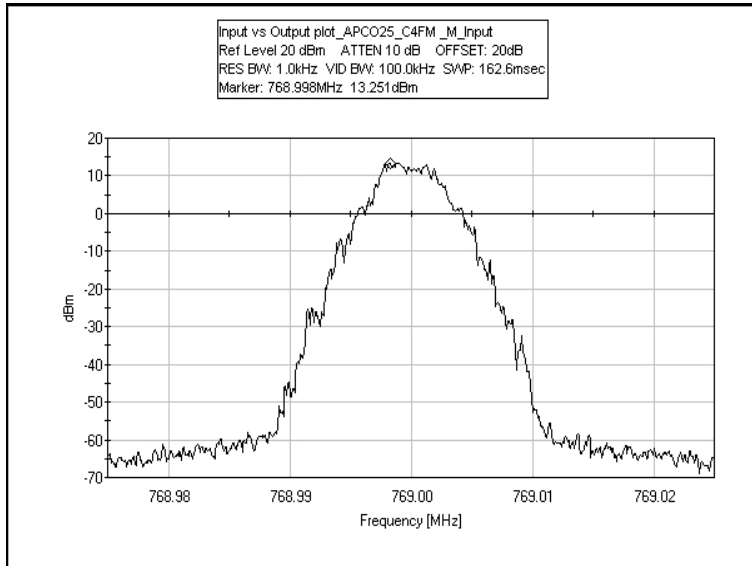
FCC 90.543(c) OCCUPIED BANDWIDTH - ACP_4CFM – HIGH CHANNEL PLOT 4



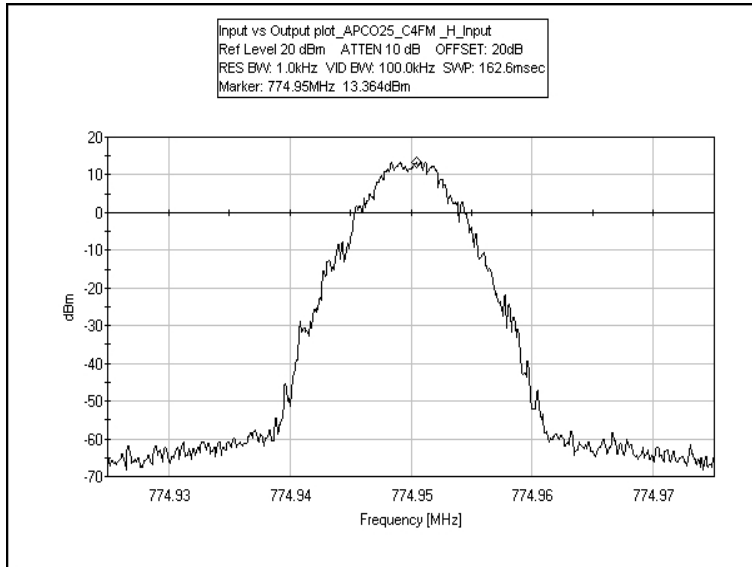
INPUT PLOT – APC025_4CFM – LOW CHANNEL



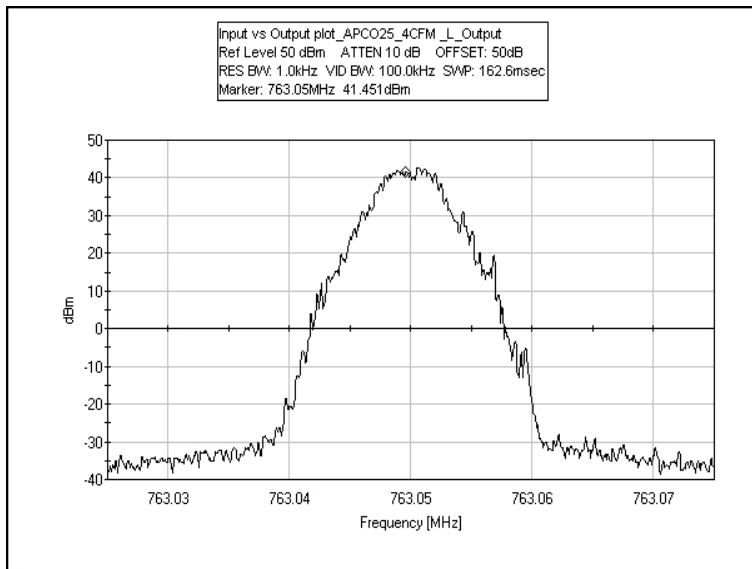
INPUT PLOT – APC025_4CFM – MID CHANNEL



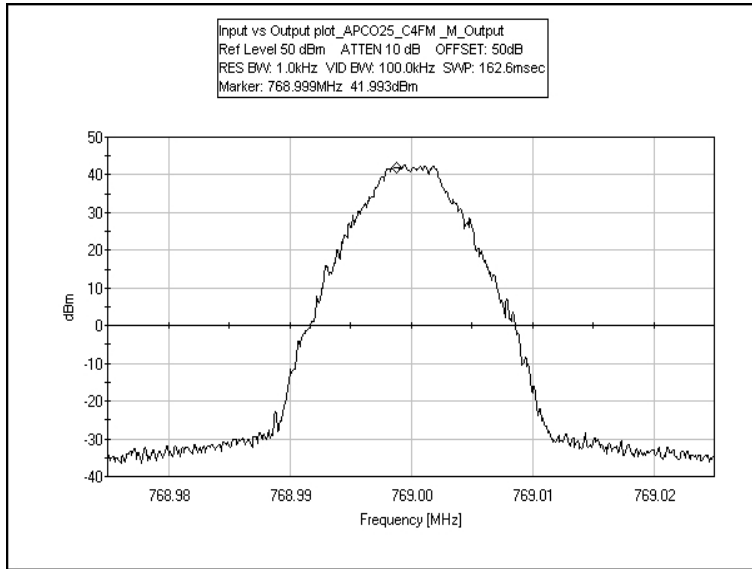
INPUT PLOT – APC025_4CFM – HIGH CHANNEL



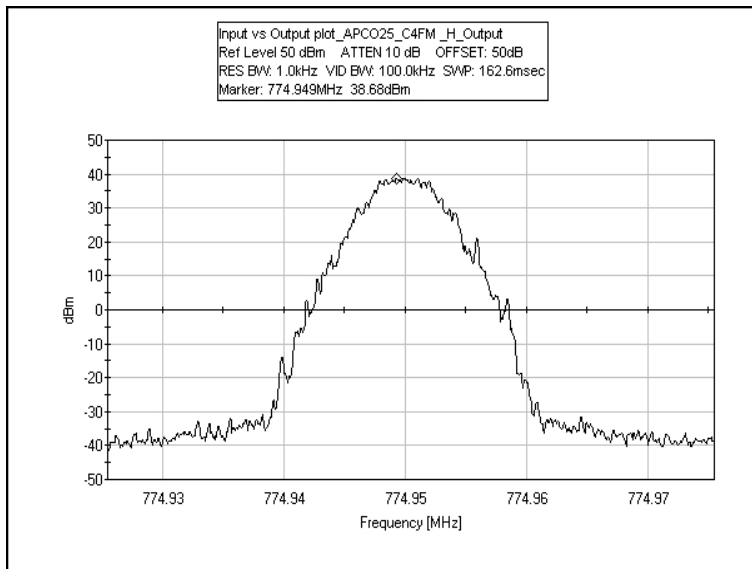
OUTPUT PLOT – APC025_4CFM – LOW CHANNEL



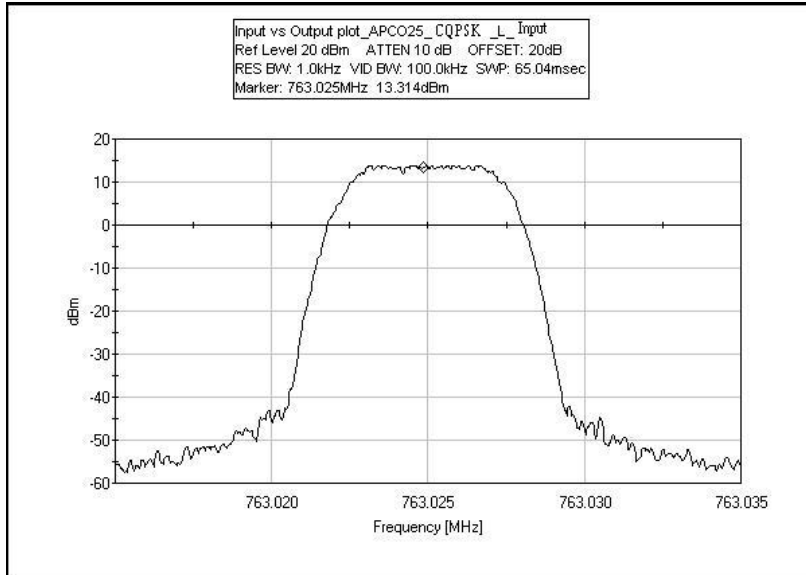
OUTPUT PLOT – APC025_4CFM – MID CHANNEL



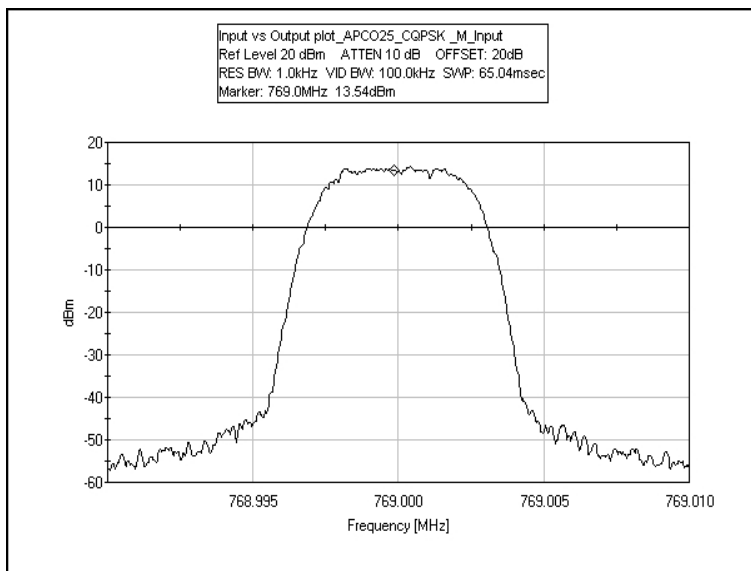
OUTPUT PLOT – APC025_4CFM – HIGH CHANNEL



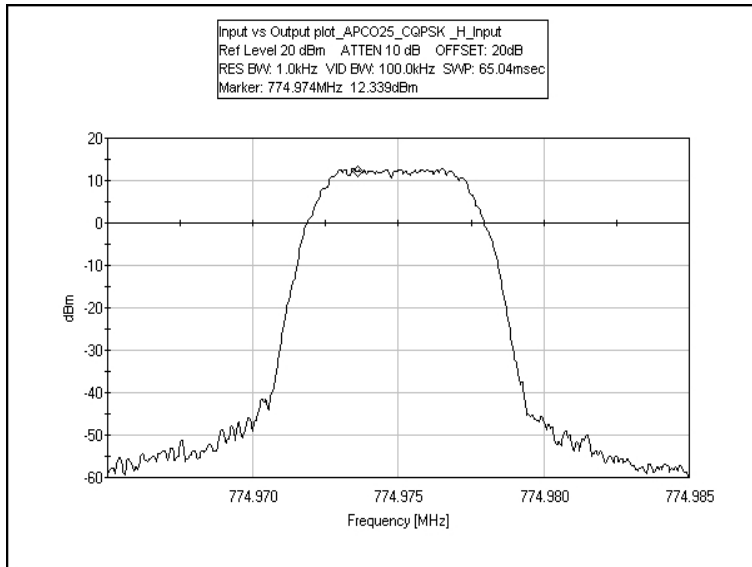
INPUT PLOT – APC025_CQPSK – LOW CHANNEL



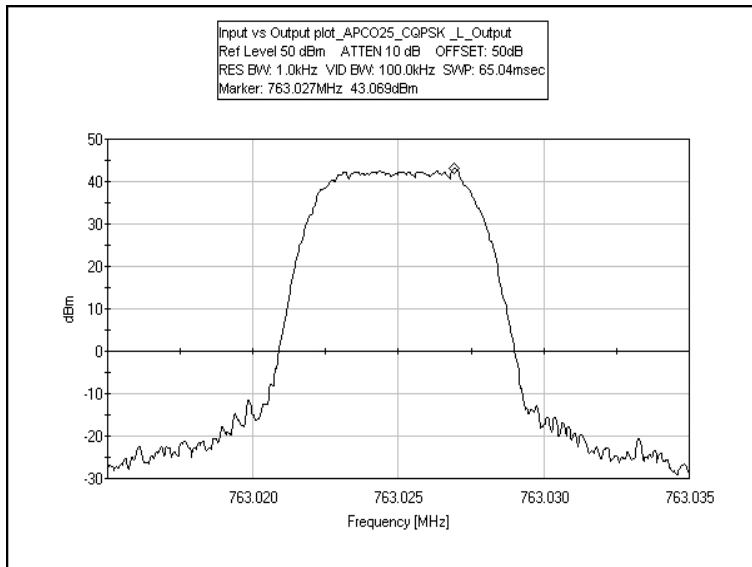
INPUT PLOT – APC025_CQPSK – MID CHANNEL



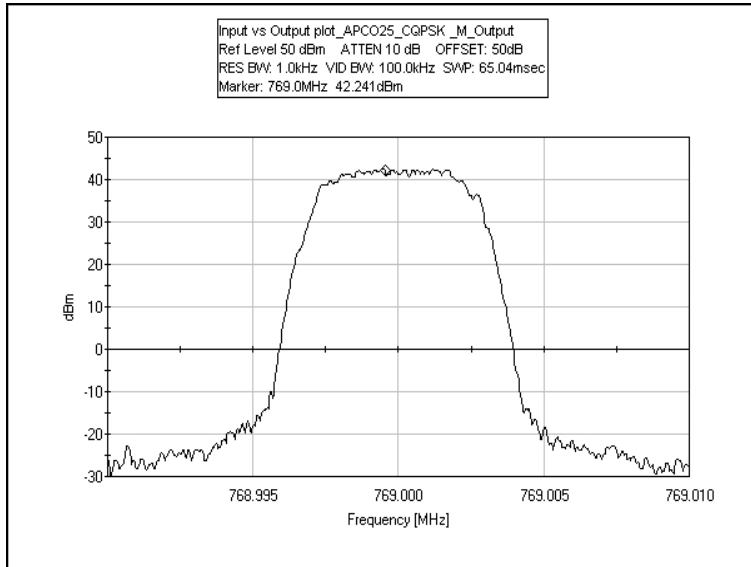
INPUT PLOT – APC025_CQPSK – HIGH CHANNEL



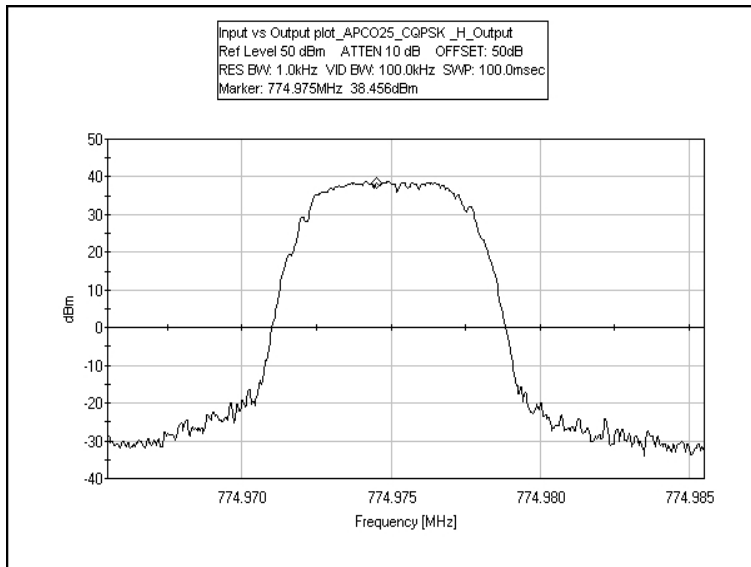
OUTPUT PLOT – APC025_CQPSK – LOW CHANNEL



OUTPUT PLOT – APC025_CQPSK – MID CHANNEL



OUTPUT PLOT – APC025_CQPSK – HIGH CHANNEL



FCC 2.1033(c)(14)/2.1051/90.543(c) - SPURIOUS EMISSIONS AT ANTENNA TERMINAL

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: **FCC90.543 (c) Conducted Spurious emission**
 Work Order #: **88851** Date: 2/4/2009
 Test Type: **Conducted Emissions** Time: 11:05:12
 Equipment: **Nexus FT 700MHz Repeater** Sequence#: 31
 Manufacturer: **Powerwave Technologies, Inc.** Tested By: E. Wong
 Model: **RH700030/101** 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
3'-40GHz cable	NA	09/18/2007	09/18/2009	P02945

Equipment Under Test (* = EUT):

Function	Manufacturer	Model #	S/N
Nexus FT 700MHz Repeater*	Powerwave Technologies, Inc.	RH700030/101	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 a RF signal, converts the signal to optic and sends it to the EUT. The EUT decodes the optical signal and generates an RF signal.

Operating range: 763-775MHz.

Power = 20 watts

Power. 12.6Watts at 775 MHz.

Modulation: APCO25/4CFM,

Frequency = 763.05MHz, 769MHz, 774.95 MHz

Modulation: APCO25/CQPSK

Frequency = 763.025MHz, 769MHz, 774.975MHz

20 °C, 41% 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 - 10,000 MHz RBW=1 MHz, VBW=1 MHz.

No emission found. Detection was performed with reduced resolution bandwidth or with at the aid of High Pass Filter at the required resolution bandwidth. No Emission found.

Transducer Legend:

T1=Hi Freq_40GHz_3ft_CAB-ANP02945-091809

Measurement Data:

Reading listed by margin.

Test Lead: Antenna Port

#	Freq MHz	Rdng dB μ V	T1 dB	Reading listed by margin.			Dist Table	Corr dB μ V	Spec dB μ V	Margin dB	Polar Ant
1	1229.800M	15.5	+0.4				+0.0	15.9	94.0	-78.1	Anten

FCC 2.1033(c)(14)/2.1053/90.543(c) - 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 90.543(c) Radiated Spurious Emission**
 Work Order #: **88851** Date: 2/10/2009
 Test Type: **Radiated Scan** Time: 13:42:49
 Equipment: **Nexus FT 700MHz Repeater** Sequence#: 7
 Manufacturer: Powerwave Technologies, Inc. Tested By: E. Wong
 Model: RH700030/101
 S/N: NA

Test Equipment:

Function	S/N	Calibration Date	Cal Due Date	Asset #
Bilog Antenna	2451	01/21/2008	01/21/2010	01995
Pre Amp	1937A02548	05/02/2008	05/02/2010	00309
Pre amp to SA Cable	Cable #10	05/16/2007	05/16/2009	P05050
Cable	Cable15	01/05/2009	01/05/2011	P05198
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	09/18/2007	09/18/2009	P2948
Heliac Antenna Cable	P5565	09/04/2008	09/04/2010	P05565
Loop Antenna	2014	06/16/2008	06/16/2010	00314
Spectrum Analyzer	US44300438	07/23/2008	07/23/2010	02672
1.0 GHz HPF	1	01/11/2008	01/11/2010	02749

Equipment Under Test (* = EUT):

Function	Manufacturer	Model #	S/N
Nexus FT 700MHz Repeater*	Powerwave Technologies, Inc.	RH700030/101	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 a RF signal, converts the signal to optic and sends it to the EUT. The EUT decodes the optical signal and generates an RF signal.

Operating range: 763-775MHz.
 Power = 20 watts
 Power. 12.6Watts at 775 MHz.

Modulation: APC025/4CFM,
 Frequency = 763.05MHz, 769MHz, 774.95 MHz
 Modulation: APC025/CQPSK
 Frequency = 763.025MHz, 769MHz, 774.975MHz

21°C, 26% 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 - 10,000 MHz RBW=1 MHz, VBW=1 MHz.

No emission found, recorded data represents noise floor level.

Detection was performed with reduced resolution bandwidth or with the aid of High Pass Filter at the required resolution bandwidth. No Emission found.

Transducer Legend:

T1=Heliac Cable 54' ANP05565 090410	T2=HF_pre AMP-1-26GHz_AN00786-072810.TRN
T3=Hi Freq_40GHz_2ft-ANP02948-091809	T4=Horn Ant AN00849 060610
T5=K&L 1GHz HPF AN02749_011110	

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dBµV/m	Spec dBµV/m	Margin dB	Polar Ant
1	1526.000M	51.2	+2.9 +0.6	-38.4	+0.3	+25.1	+0.0	41.7	82.2 4CFM_L	-40.5	Horiz
2	1526.000M	50.2	+2.9 +0.6	-38.4	+0.3	+25.1	+0.0	40.7	82.2 CQPSK_L	-41.5	Horiz
3	1550.000M	49.5	+3.0 +0.6	-38.3	+0.3	+25.3	+0.0	40.4	82.2 4CFM_H	-41.8	Horiz
4	1538.000M	49.6	+2.9 +0.6	-38.3	+0.3	+25.2	+0.0	40.3	82.2 4CFM_M	-41.9	Horiz
5	1526.000M	49.5	+2.9 +0.6	-38.4	+0.3	+25.1	+0.0	40.0	82.2 CQPSK_L	-42.2	Vert
6	1550.000M	48.5	+3.0 +0.6	-38.3	+0.3	+25.3	+0.0	39.4	82.2 CQPSK_H	-42.8	Vert
7	1538.000M	48.7	+2.9 +0.6	-38.3	+0.3	+25.2	+0.0	39.4	82.2 CQOSK_M	-42.8	Vert
8	1537.833M	48.3	+2.9 +0.6	-38.3	+0.3	+25.2	+0.0	39.0	82.2 4CFM_M	-43.2	Vert
9	1538.000M	48.1	+2.9 +0.6	-38.3	+0.3	+25.2	+0.0	38.8	82.2 CQOSK_M	-43.4	Vert
10	1550.000M	47.4	+3.0 +0.6	-38.3	+0.3	+25.3	+0.0	38.3	82.2 4CFM_H	-43.9	Vert
11	1526.000M	47.2	+2.9 +0.6	-38.4	+0.3	+25.1	+0.0	37.7	82.2 4CFM_L	-44.5	Vert
12	1550.000M	46.6	+3.0 +0.6	-38.3	+0.3	+25.3	+0.0	37.5	82.2 CQPSK_H	-44.7	Vert

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	091807	091809

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 the RF signal, converts the signal to optic and sends it to the EUT. The EUT decodes 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: 758-764MHz.

Power = 20 watts, 12.6 Watt.

Modulation: APCO25/4CFM,

Frequency = 763.05MHz , 774.95 MHz

Modulation: APC025/CQPSK

Frequency = 763.025MHz, 774.975MHz

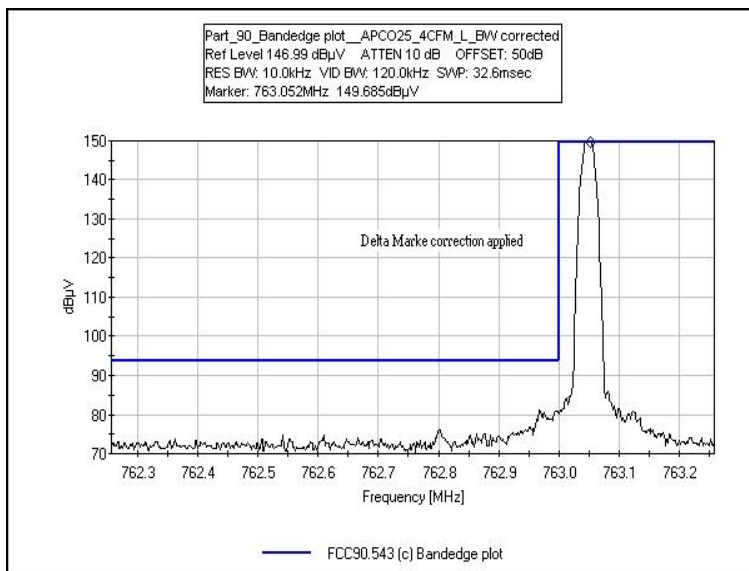
Due to the nature of the signal, a delta marker correction was applied to APCO25/4CFM and APC025/CQPSK modulation to eliminated erroneous trace reading due to larger resolution used.

Test Setup Photos

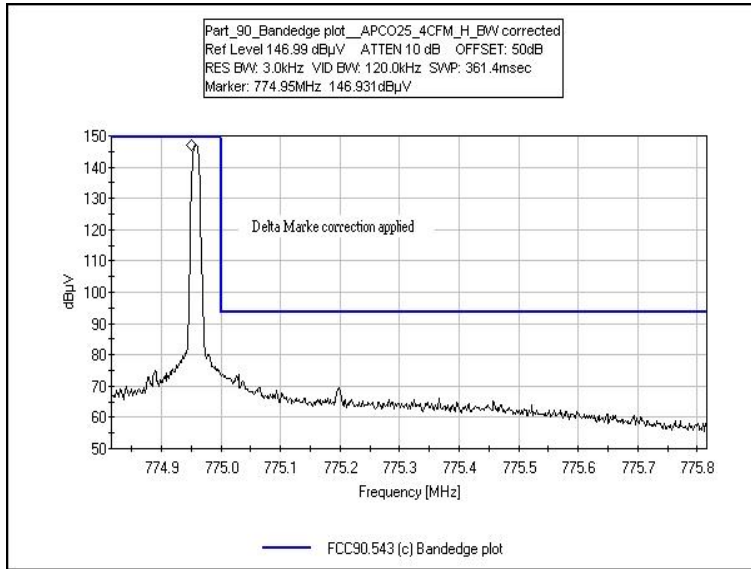


Test Plots

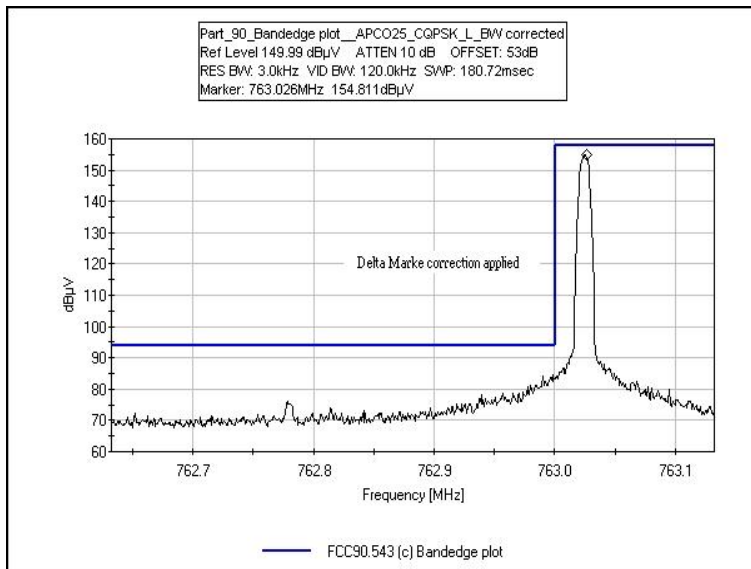
BANDEDGE - APC025_4CFM - LOW CHANNEL



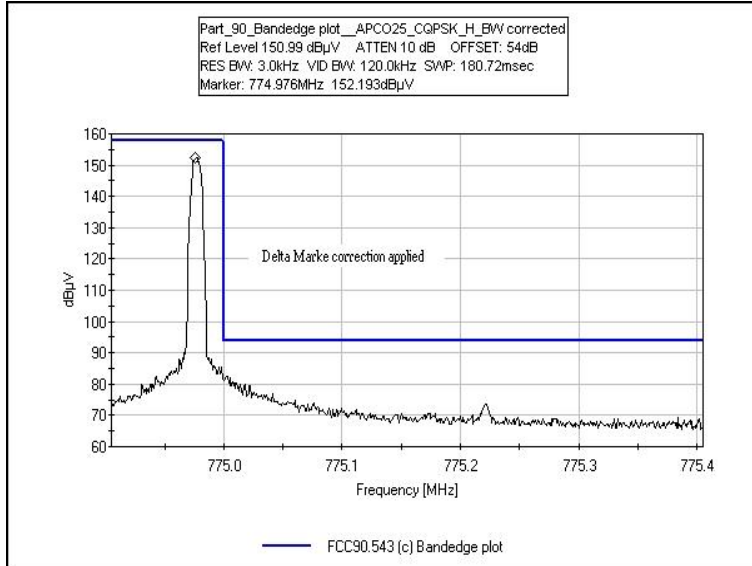
BANEDGE - APC025_4CFM - HIGH CHANNEL



BANEDGE - APC025_CQPSK - LOW CHANNEL



BANDEDGE - APC025_CQPSK - HIGH CHANNEL



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	091807	091809

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 the RF signal, converts the signal to optic and sends it to the EUT. The EUT decodes the optical signal, and generates an RF signal.

Operating range: 763-775MHz.
Power = 20 watt, 12.6 watt(775 MHz)

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

Operating range: 763-775MHz.
Power = 20 watt, 12.6 watt(775 MHz)
Modulation: APC025/4CFM,
Modulation: APC025/CQPSK

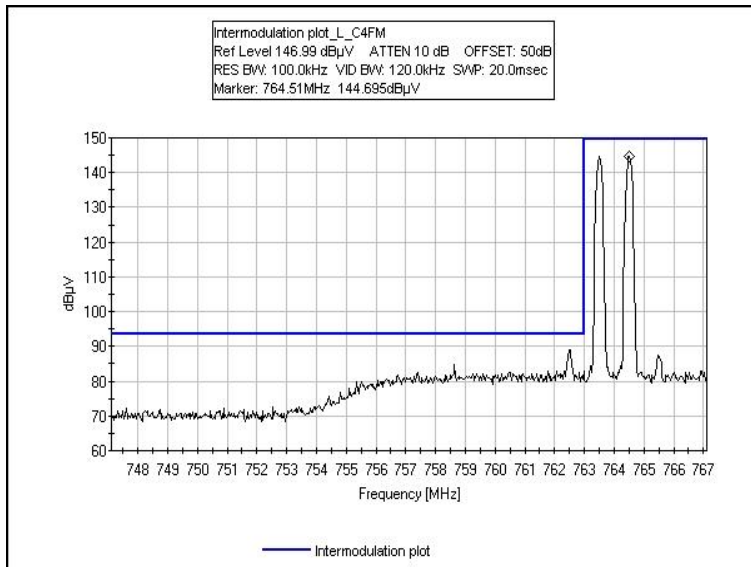
Note: Only Narrow band signal APC025/4CFM, APC025/CQPSK are allowed to operate in multichannel configuration for the device.

Test Setup Photos

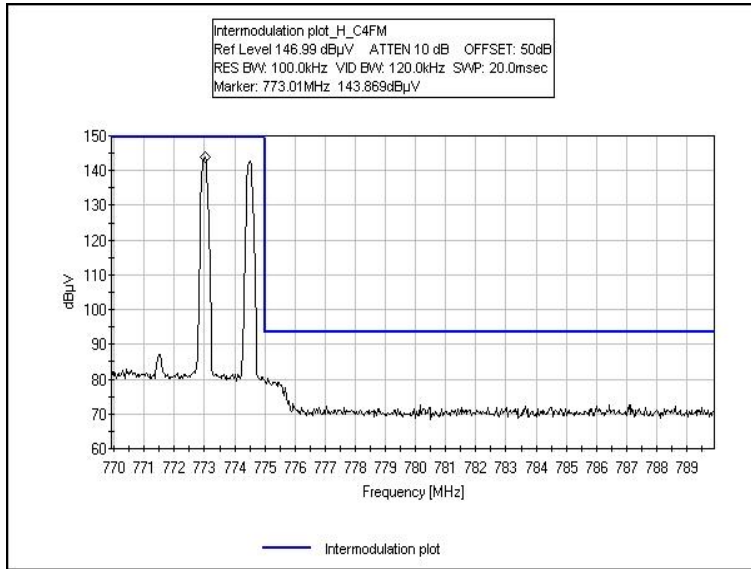


Test Plots

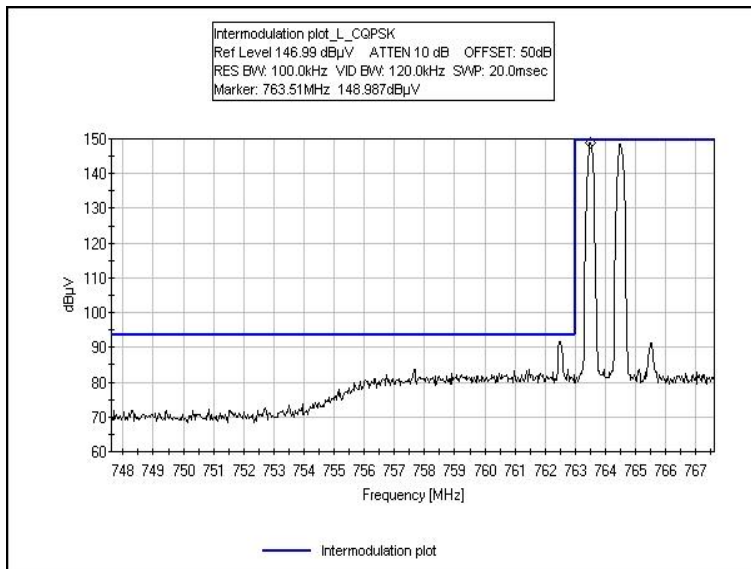
INTERMODULATION - 4CFM - LOW CHANNEL



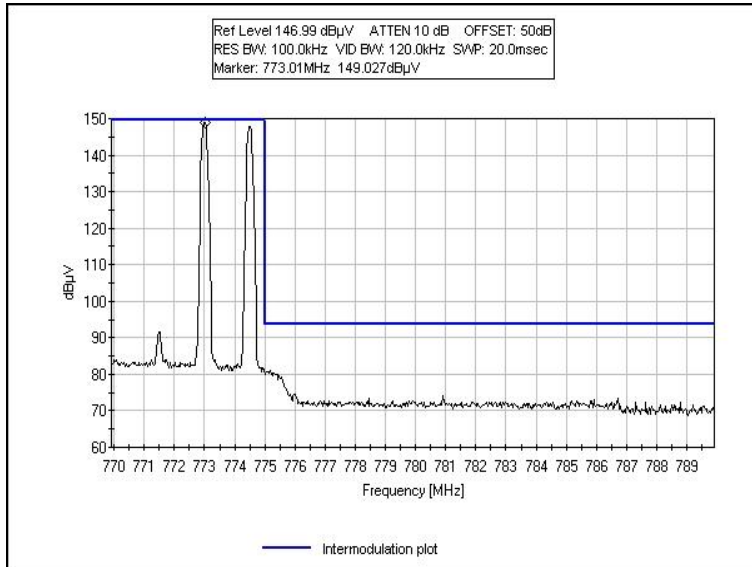
INTERMODULATION - C4FM - HIGH CHANNEL



INTERMODULATION - CQPSK - LOW CHANNEL



INTERMODULATION - CQPSK - HIGH CHANNEL



OUT OF BAND REJECTION

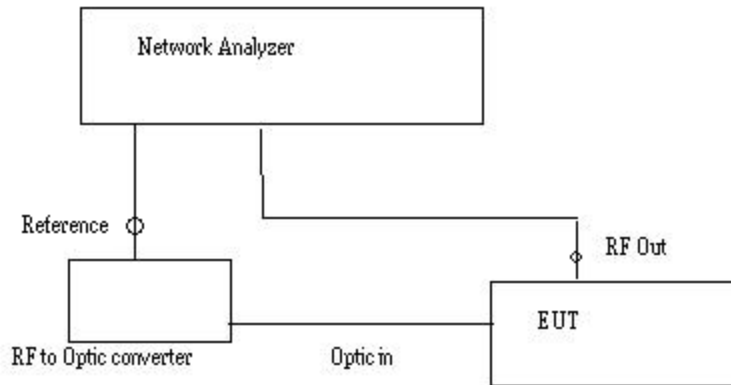
Test Equipment

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

Test Setup Photos



Test Data



Measured gain = Output – Reference (dB)

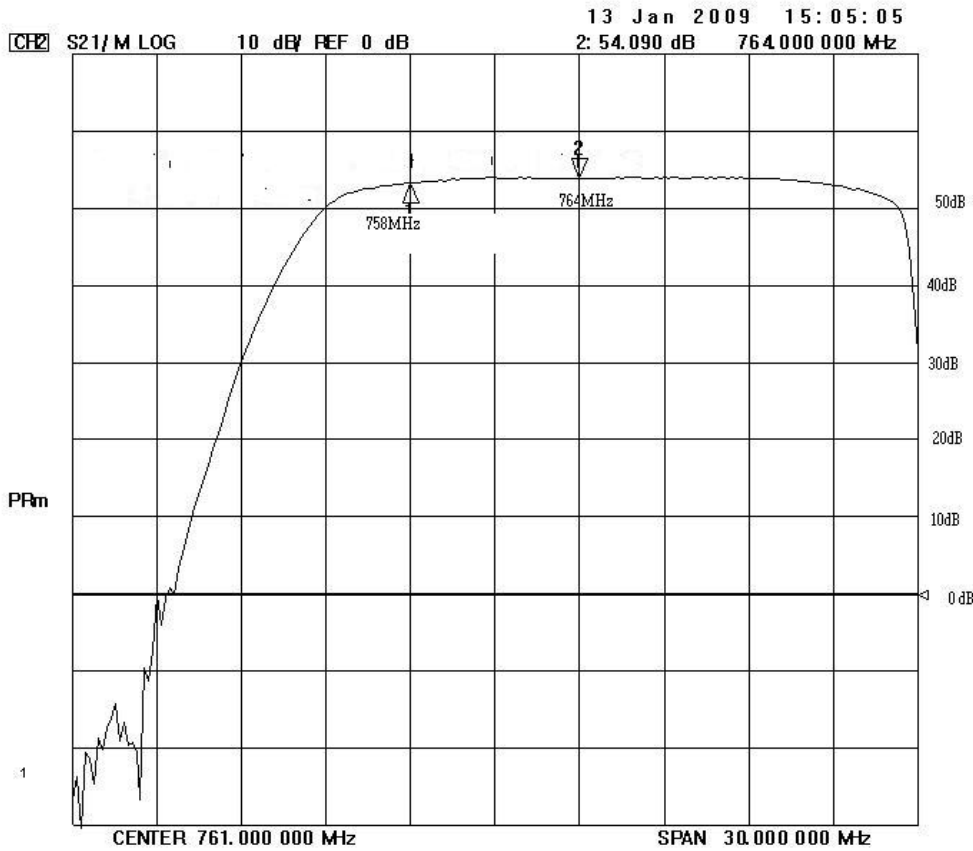
The nominal bandwidth and nominal pass band gain (dB) of the RF enhancer or translator shall be stated by the manufacturer or equipment certification applicant and indicated in the test report.

Manufacturer stated gain = 55 dB

The internal control is adjusted to the nominal gain for which equipment certification is sought.

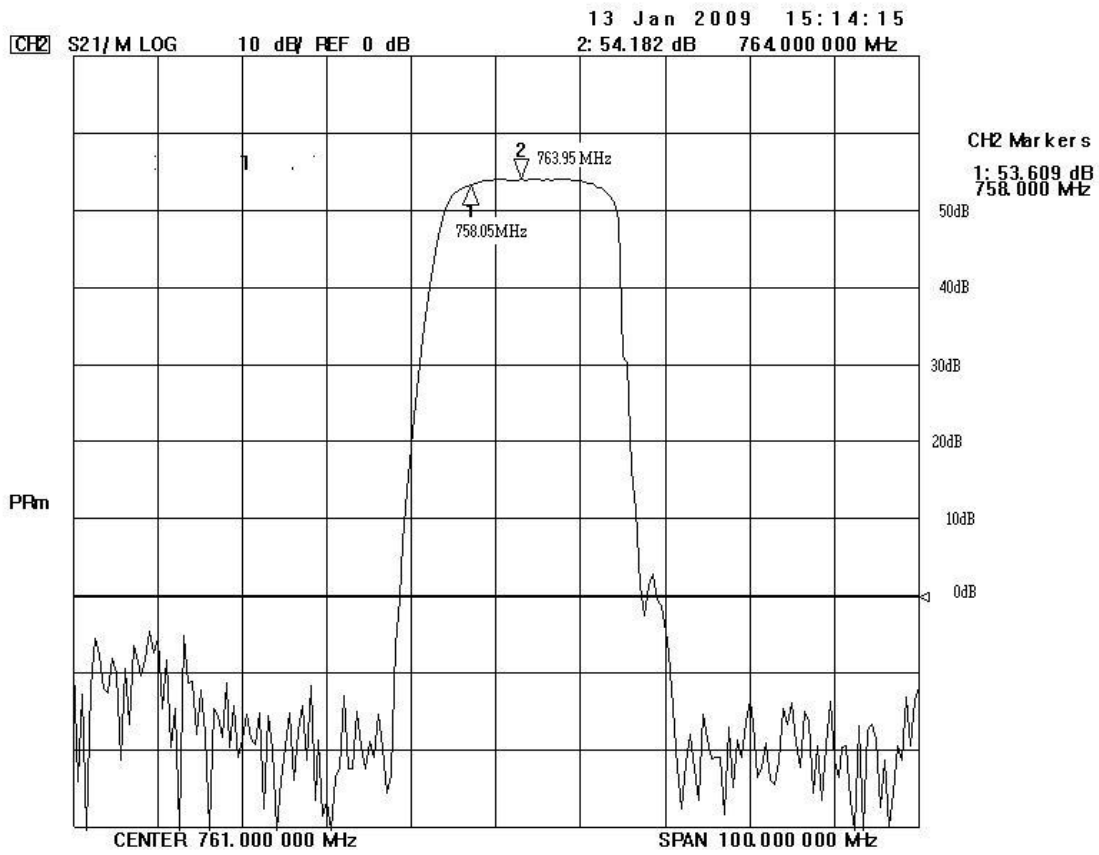
Maximum measured gain = 53 dB

With the aid of a Vector Network analyzer, the Out of band rejection ratio of the device was measured.



Out of band rejection plot

The device is designed to operate in frequency range of 758-775MHz. Operating frequency range under Part 27 is 758-763MHz. Operating frequency range under Part 90 is 763-775MHz. (Note, marker 2 on the plot is set at 764MHz however does not impact the presentation of the gain plot over the entire operating range of Part 27 and Part 90.)



Out of band rejection plot (wide span)