

# Powerwave Technologies, Inc.

ADDENDUM TO TEST REPORT 93409-4A

800MHz Band Remote Radio Head, LRS08-T5022-100

Tested To The Following Standards:

FCC Part 90I

Report No.: 93409-4B

Date of issue: November 7, 2012



This test report bears the accreditation symbol indicating that the testing performed herein meets the test and reporting requirements of ISO/IEC 17025 under the applicable scope of EMC testing for CKC Laboratories, Inc.

We strive to create long-term, trust based relationships by providing sound, adaptive, customer first testing services. We embrace each of our customers' unique EMC challenges, not as an interruption to set processes, but rather as the reason we are in business.

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## ADMINISTRATIVE INFORMATION

### Test Report Information

**REPORT PREPARED FOR:**

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

Representative: Jeffrey Dale  
Customer Reference Number: 150114

**DATE OF EQUIPMENT RECEIPT:**

**DATE(S) OF TESTING:**

**REPORT PREPARED BY:**

Dianne Dudley  
CKC Laboratories, Inc.  
5046 Sierra Pines Drive  
Mariposa, CA 95338

Project Number: 93409

July 26, 2012

July 26-31, 2012

September 7-11, 2012

### Revision History

**Original:** Testing of the 800MHz Band Remote Radio Head, LRS08-T5022-100 to FCC Part 90I.

**Addendum A:** To add 3MHz LTE testing to all sections of the original report and to label all 5MHz LTE testing.

**Addendum B:** To replace 5MHz LTE\_H and MHz\_LTE\_H\_Zoom bandedge plots in Bandedge section of the report. Plot titles have been edited for clarification purposes.

### Report Authorization

The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the sample equipment tested in the agreed upon operational mode(s) and configuration(s) as identified herein. Compliance assessment remains the client's responsibility. This report may not be used to claim product endorsement by A2LA or any government agencies. This test report has been authorized for release under quality control from CKC Laboratories, Inc.



**Steve Behm**  
*Director of Quality Assurance & Engineering Services*  
*CKC Laboratories, Inc.*

## Test Facility Information



Our laboratories are configured to effectively test a wide variety of product types. CKC utilizes first class test equipment, anechoic chambers, data acquisition and information services to create accurate, repeatable and affordable test results.

TEST LOCATION(S):  
CKC Laboratories, Inc.  
110 Olinda Place  
Brea, CA 92823

## Site Registration & Accreditation Information

Location	CB #	Taiwan	Canada	FCC	Japan
Brea A	US0060	SL2-IN-E-1146R	3082D-1	90473	R-2945 C-3248 T-1572
Brea D	US0060	SL2-IN-E-1146R	3082D-2	100638	R-1256 C-1319 T-1660 G-255

## SUMMARY OF RESULTS

### Standard / Specification: FCC Part 90I

Description	Test Procedure/Method	Results
RF Power Output	FCC 2.1046 / 90.635	Pass
Occupied Bandwidth	FCC Part 2.1049(I)	Pass
Bandedge	FCC Part 90I	Pass
Spurious Emissions at Antenna Terminal	FCC 2.1051 / 90.691(a) / 2.1053	Pass
Field Strength of Spurious Radiation	FCC 2.1053 / 90.961(a)	Pass
Frequency Stability	FCC 2.1055(a) / 90.543(c)	Pass

## Conditions During Testing

This list is a summary of the conditions noted for or modifications made to the equipment during testing.

Summary of Conditions
None

## EQUIPMENT UNDER TEST (EUT)

### EQUIPMENT UNDER TEST

#### 800MHz Band Remote Radio Head

Manuf: Powerwave Technologies, Inc.  
Model: LRS08-T5022-100  
Serial: 01325

### PERIPHERAL DEVICES

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

#### Power Supply

Manuf: HP  
Model: 6032A  
Serial: NA

#### Computer

Manuf: HP  
Model: C2C3301  
Serial: NA

#### Mouse

Manuf: HP  
Model: M-S34  
Serial: LZA7130868

#### Keyboard

Manuf: HP  
Model: KB-9970  
Serial: 9L21401134B

#### Monitor

Manuf: HP  
Model: M-S34  
Serial: LZA71340868

#### TDP Test Fixture

Manuf: Powerwave Technologies, Inc.  
Model: Selhurst  
Serial: NA

#### Signal Generator

Manuf: HP  
Model: 8638C  
Serial: 3642001264

## FCC PART 90I

This report contains EMC emissions test results under United States Federal Communications Commission (FCC) requirements for licensed devices.

### 2.1046 / 90.635 - RF Power Output

#### Test Conditions / Setup

The EUT containing two identical RF circuit with independent RF output port is placed on the test bench. The two Optical ports of each RF circuit, one receiving CDMA signal and the other receiving LTE signal are connected to a remote TDP Test Fixture via a pair of optical cables. The received Optical signal are demodulated and regenerated as RF signal. Both RF ports of identical RF circuitries are connected to RF load. USB port is connected to remote computer. The EUT is set in full, constant transmit power.

(a) The effective radiated power and antenna height for base stations may not exceed 1 kilowatt (30 dBw) and 304 m. (1,000 ft.) above average terrain (AAT), respectively, or the equivalent thereof as determined from the Table. These are maximum values, and applicants will be required to justify power levels and antenna heights requested.

The EUT is rated at 20W Single channel, 20W + 20W Multichannel (Mixed Mode)

Freq 862 -869MHz

Modulation: CDMA, LTE(5MHz), LTE (3MHz), CDMA+LTE (5MHz), CDMA+LTE (3MHz)

Single channel

Modulation: LTE (5MHz)

Frequency: 864.7MHz, 866.5 MHz

Power= 20W

Modulation: LTE (3MHz)

Frequency: 863.7MHz, 867.5 MHz

Power= 20W

Multichannel (Mixed Mode)

Modulation: CDMA + LTE(5MHz), LTE(5MHz)+ CDMA

Frequency: 862.9MHz + 866.5MHz, 864.7 MHz + 868.0MHz

Power = 20W + 20W

Modulation: CDMA + LTE(3MHz), LTE(3MHz)+ CDMA

Frequency: 862.9MHz + 867.5MHz, 863.7 MHz + 868.0MHz

Power = 20W + 20W

Engineer Name: E. Wong

Test Equipment					
Asset/Serial #	Description	Model	Manufacturer	Cal Date	Cal Due
AN02778	Power Meter	E4418A	HP	1/31/2012	1/31/2014
AN02945	Cable	32022-2-2909K-36TC	Astrolab	10/19/2011	10/19/2013
ANP06139	Cable	Sucoflex 104A	Huber & Suhner	8/8/2011	8/8/2013

**Test Data**

**Antenna Port A**

Frequency	Power (dBm)	Power (Watt)
LTE(3MHz)		
863.7MHz	43	20
867.5MHz	43	20
LTE(3MHz)+CDMA		
862.9MHz + 867.5MHz	46	40

Frequency	Power (dBm)	Power (Watt)
LTE(5MHz)		
864.7MHz	43	20
866.5MHz	43	20
LTE(5MHz)+CDMA		
862.9MHz + 866.5MHz	46	40

**Antenna Port B**

Frequency	Power (dBm)	Power (Watt)
LTE(3MHz)		
863.7MHz	43	20
867.5MHz	43	20
LTE(3MHz)+CDMA		
862.9MHz + 867.5MHz	46	40

Frequency	Power (dBm)	Power (Watt)
LTE (5MHz)		
864.7MHz	43	20
866.5MHz	43	20
LTE(5MHz)+CDMA		
862.9MHz + 866.5MHz	46	40

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

**Test Setup Photos**



## 2.1049 (I) Occupied Bandwidth

### Test Conditions / Setup

The EUT containing two identical RF circuit with independent RF output port is placed on the test bench. The two Optical ports of each RF circuit, one receiving CDMA signal and the other receiving LTE signal are connected to a remote TDP Test Fixture via a pair of optical cable. The received Optical signal are demodulated and regenerated as RF signal. Both RF ports of identical RF circuitries are connected to RF load. USB port is connected to remote computer. The EUT is set in full, constant transmit power.

The EUT is rated at 20W Single channel, 20W + 20W Multichannel (Mixed Mode)

Emission profile evaluated at Antenna Port A

Freq 862 -869MHz

Modulation: CDMA, LTE(5MHz), LTE (3MHz), CDMA+LTE (5MHz), CDMA+LTE (3MHz)

Single channel

Modulation: LTE (5MHz)

Frequency: 864.7MHz, 866.5 MHz

Power= 20W

Modulation: LTE (3MHz)

Frequency: 863.7MHz, 867.5 MHz

Power= 20W

Multichannel (Mixed Mode)

Modulation: CDMA + LTE(5MHz), LTE(5MHz)+ CDMA

Frequency: 862.9MHz + 866.5MHz, 864.7 MHz + 868.0MHz

Power = 20W + 20W

Modulation: CDMA + LTE(3MHz), LTE(3MHz)+ CDMA

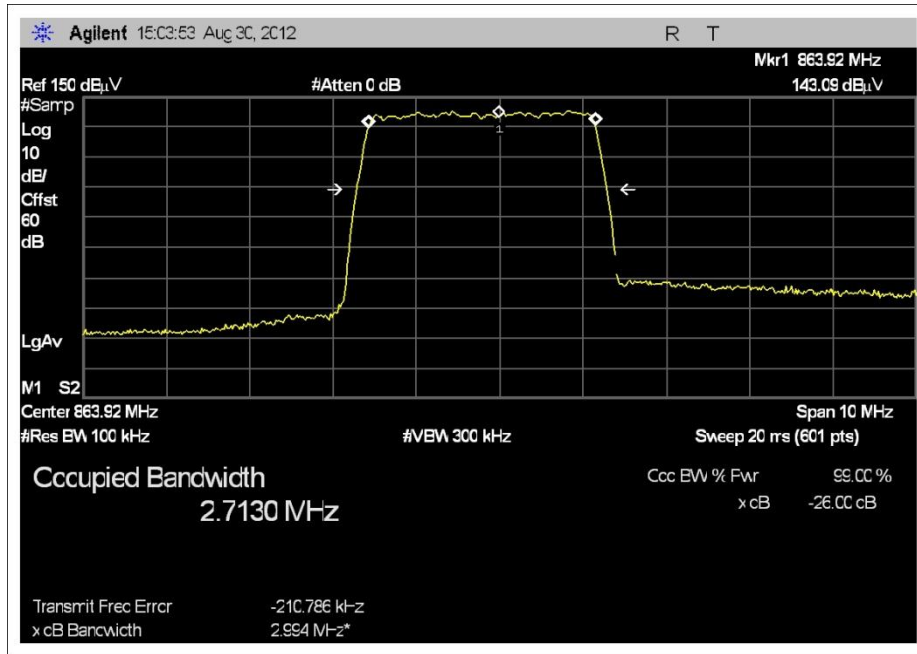
Frequency: 862.9MHz + 867.5MHz, 863.7 MHz + 868.0MHz

Power = 20W + 20W

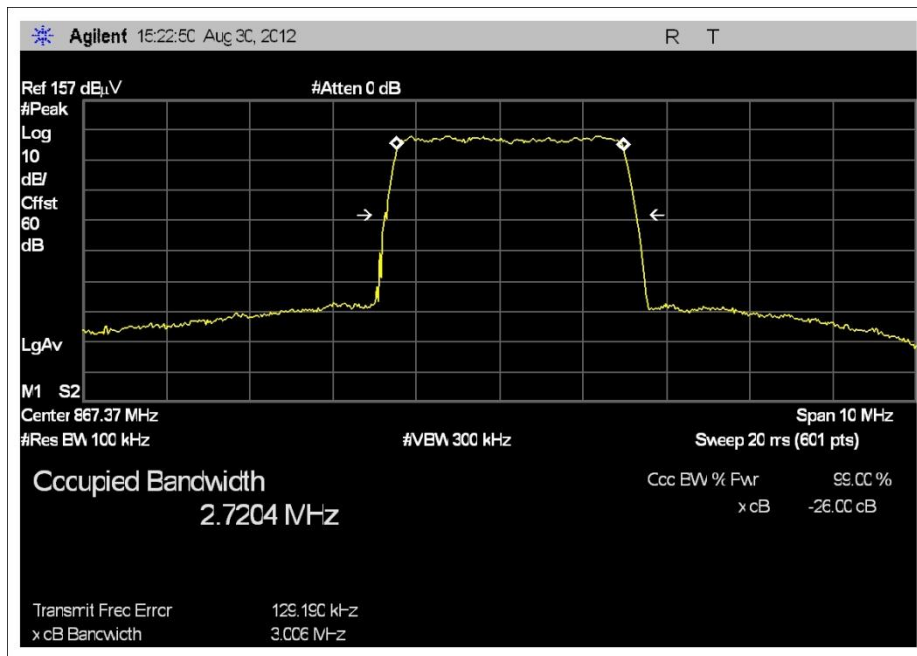
Engineer Name: E. Wong

Test Equipment					
Asset/Serial #	Description	Model	Manufacturer	Cal Date	Cal Due
AN02869	Spectrum Analyzer	E4440A	Agilent	2/12/2011	2/12/2013
AN02945	Cable	32022-2-2909K-36TC	Astrolab	10/19/2011	10/19/2013
ANP06139	Cable	Sucoflex 104A	Huber & Suhner	8/8/2011	8/8/2013

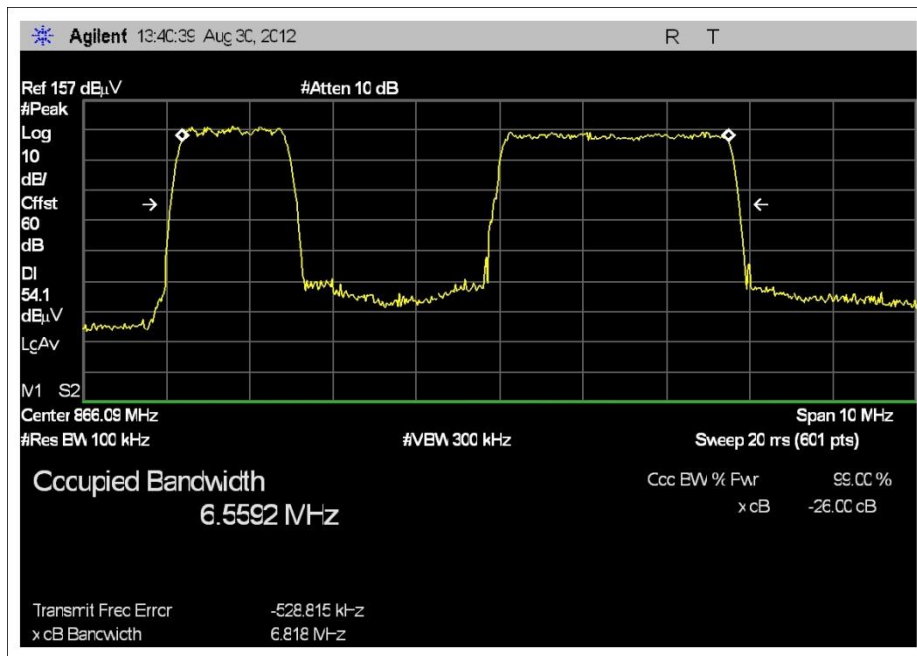
**Test Data**



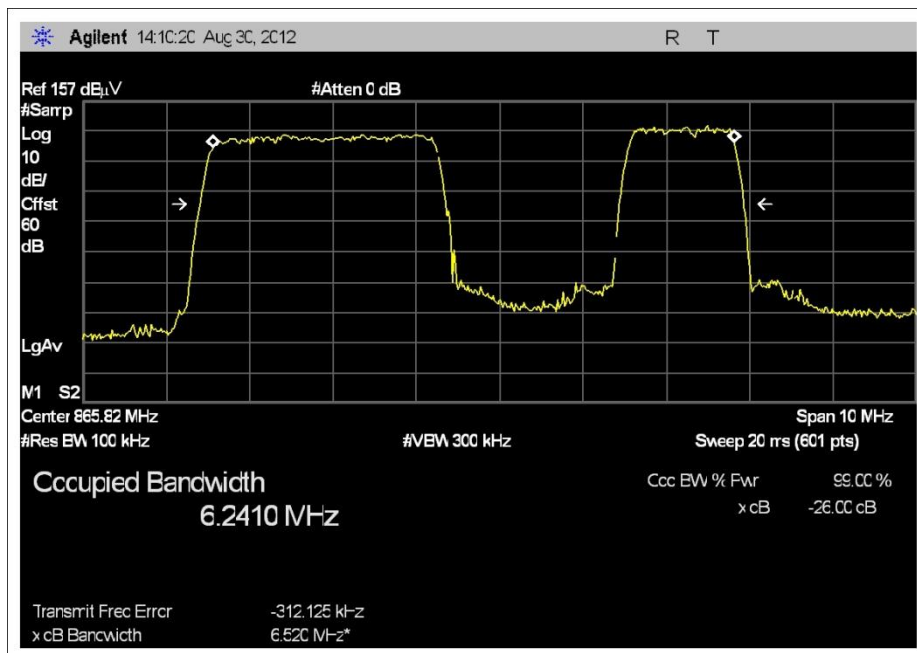
3MHz LTE\_L



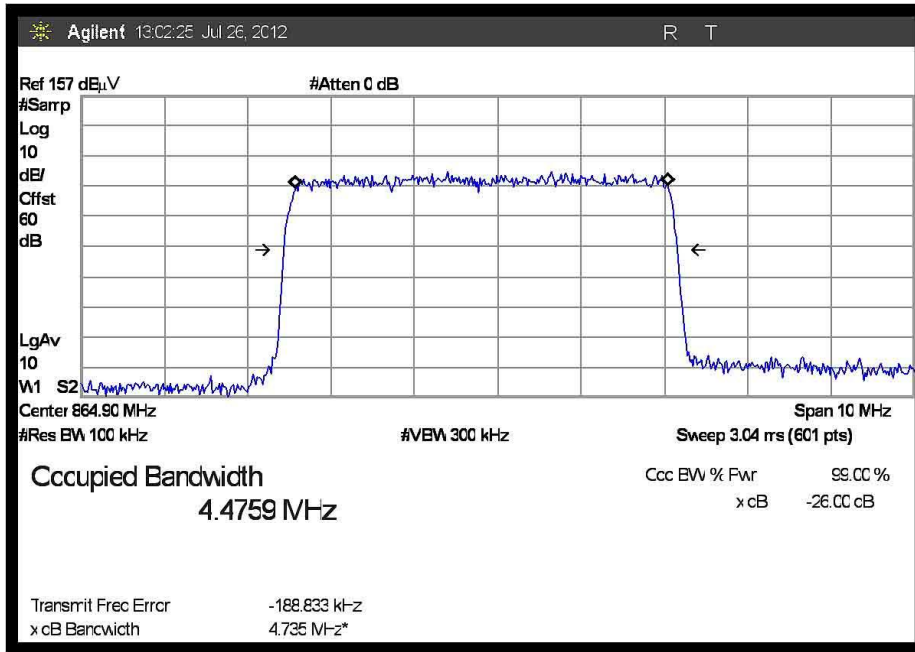
3MHz LTE\_H



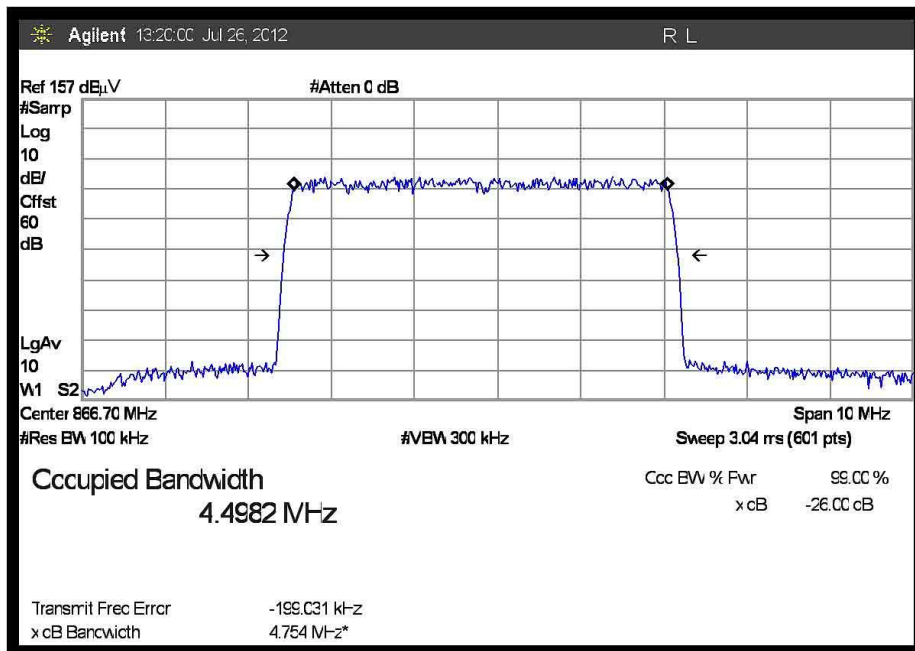
CDMA+3MHz LTE



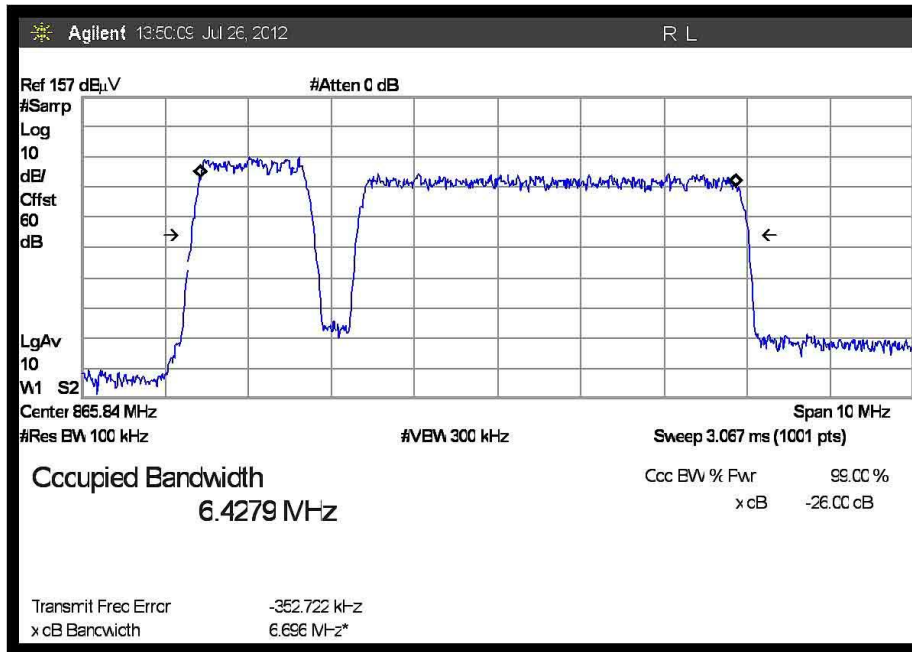
3MHz LTE +CDMA



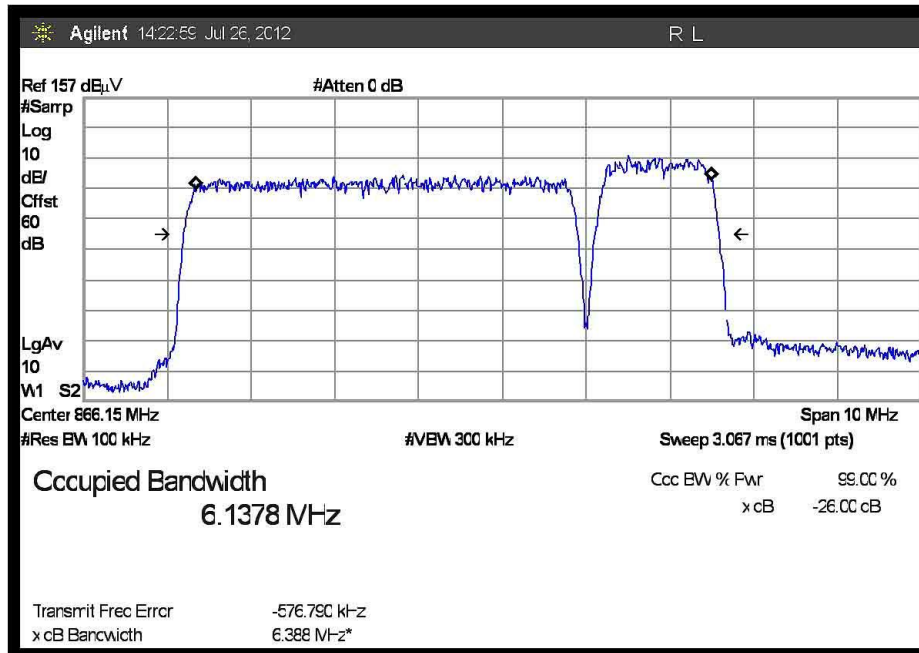
5MHz LTE\_L



5MHz LTE\_H



CDMA+5MHz LTE



5MHz LTE +CDMA

**Test Setup Photos**



## Bandedge

### Test Conditions / Setup

The EUT containing two identical RF circuit with independent RF output port is placed on the test bench. The two Optical ports of each RF circuit, one receiving CDMA signal and the other receiving LTE signal are connected to a remote TDP Test Fixture via a pair of optical cable. The received Optical signal are demodulated and regenerated as RF signal. Both RF ports of identical RF circuitries are connected to RF load. USB port is connected to remote computer. The EUT is set in full, constant transmit power.

The EUT is rated at 20W Single channel, 20W + 20W Multichannel (Mixed Mode)

Emission profile evaluated at Antenna Port A

Freq 862 -869MHz

Modulation: CDMA, LTE(5MHz), LTE (3MHz), CDMA+LTE (5MHz), CDMA+LTE (3MHz)

Single channel

Modulation: LTE (5MHz)

Frequency: 864.7MHz, 866.5 MHz

Power= 20W

Modulation: LTE (3MHz)

Frequency: 863.7MHz, 867.5 MHz

Power= 20W

Multichannel (Mixed Mode)

Modulation: CDMA + LTE(5MHz), LTE(5MHz)+ CDMA

Frequency: 862.9MHz + 866.5MHz, 864.7 MHz + 868.0MHz

Power = 20W + 20W

Modulation: CDMA + LTE(3MHz), LTE(3MHz)+ CDMA

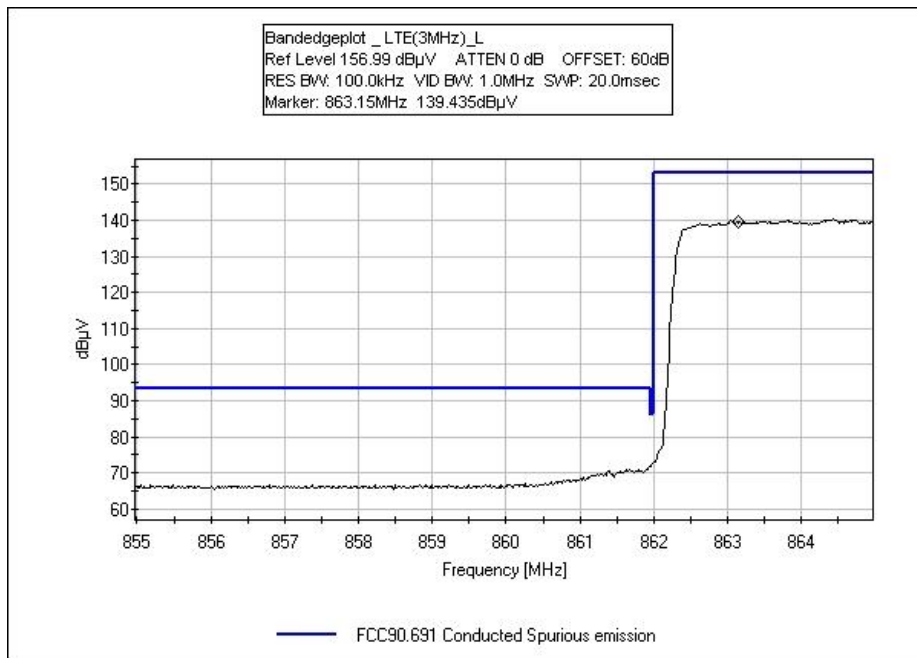
Frequency: 862.9MHz + 867.5MHz, 863.7 MHz + 868.0MHz

Power = 20W + 20W

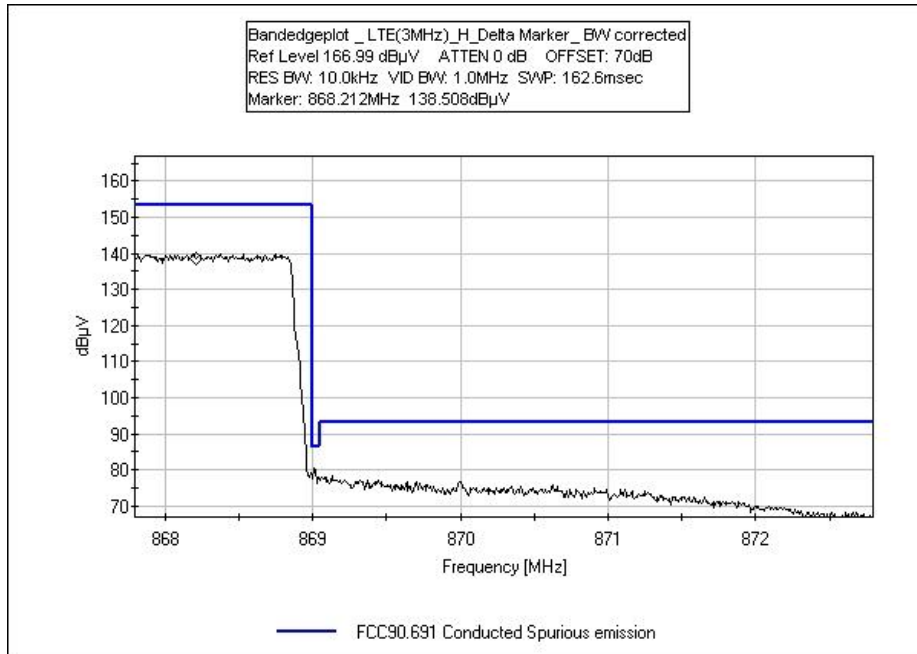
Engineer Name: E. Wong

Test Equipment					
Asset/Serial #	Description	Model	Manufacturer	Cal Date	Cal Due
AN02869	Spectrum Analyzer	E4440A	Agilent	2/12/2011	2/12/2013
AN02945	Cable	32022-2-2909K-36TC	Astrolab	10/19/2011	10/19/2013
ANP06139	Cable	Sucoflex 104A	Huber & Suhner	8/8/2011	8/8/2013

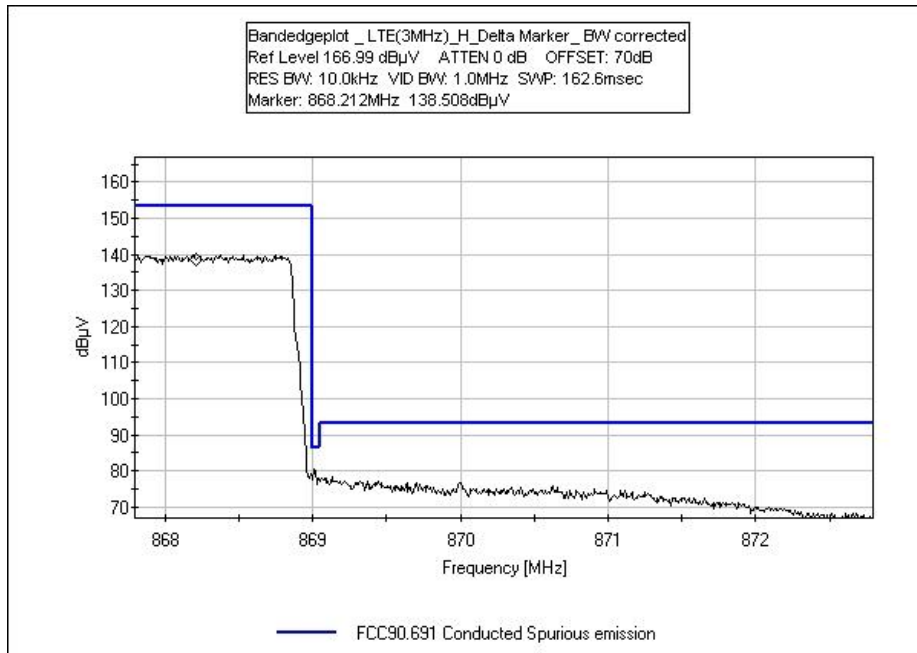
***Test Data***



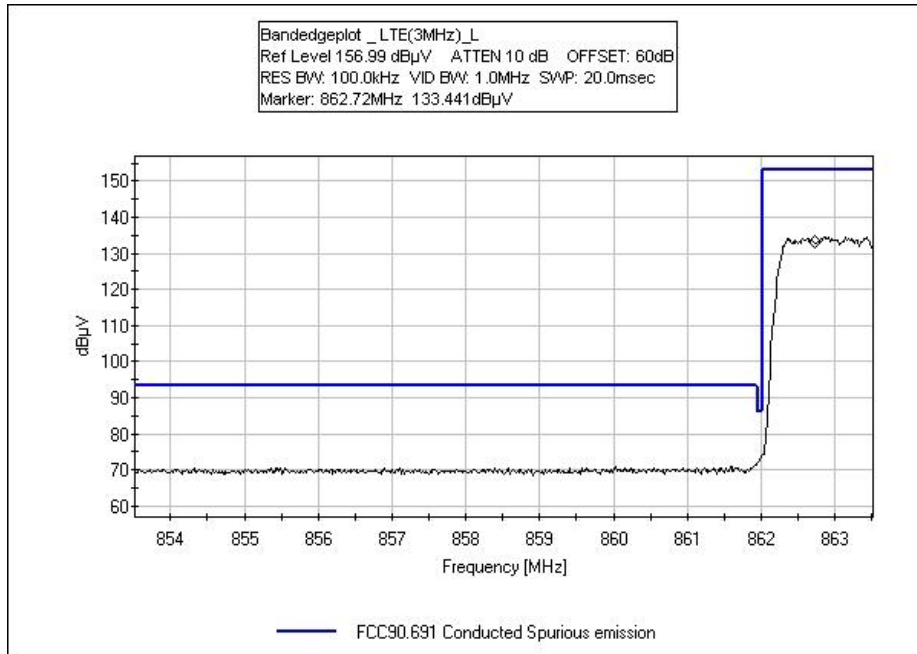
3MHz LTE \_L



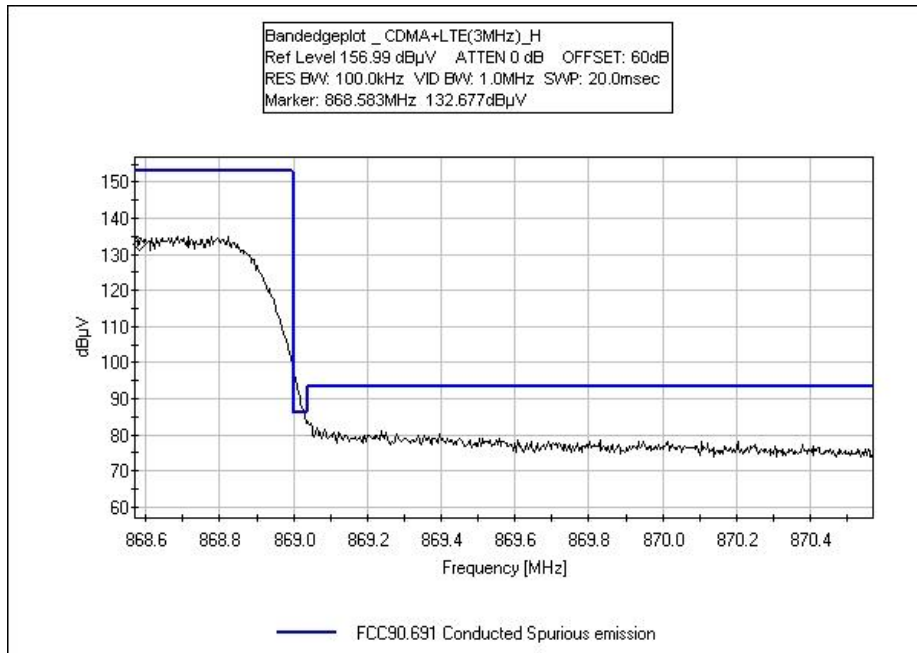
3MHz LTE\_H



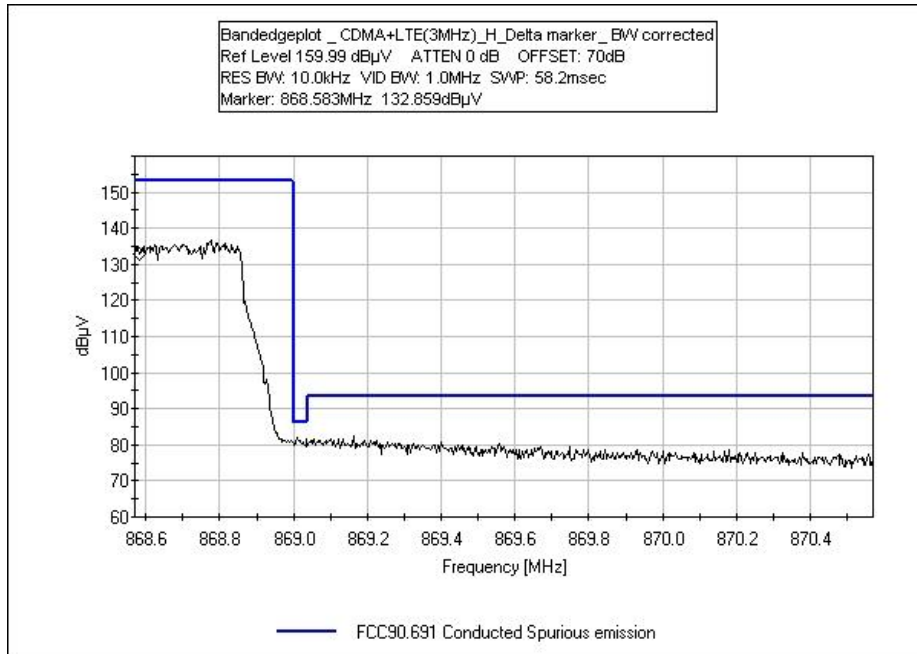
3MHz LTE\_H CORRECTED



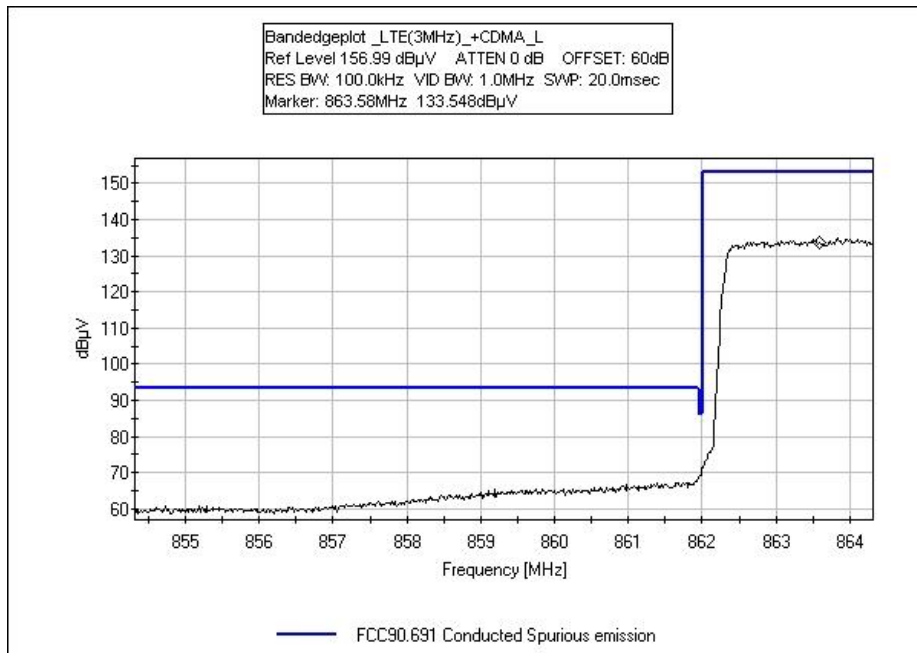
CDMA+3MHz\_LTE\_L



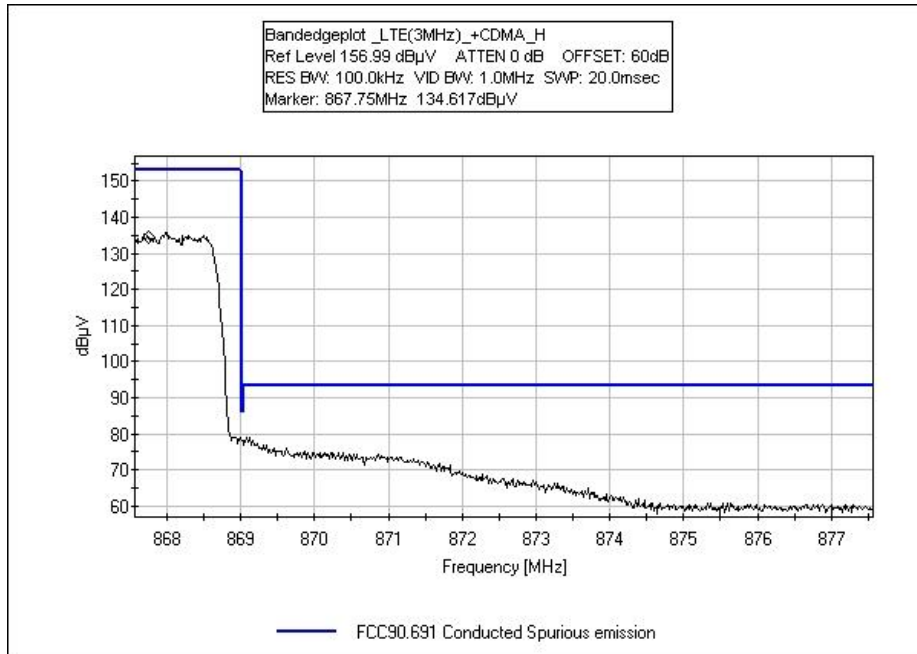
CDMA+3MHz\_LTE\_H



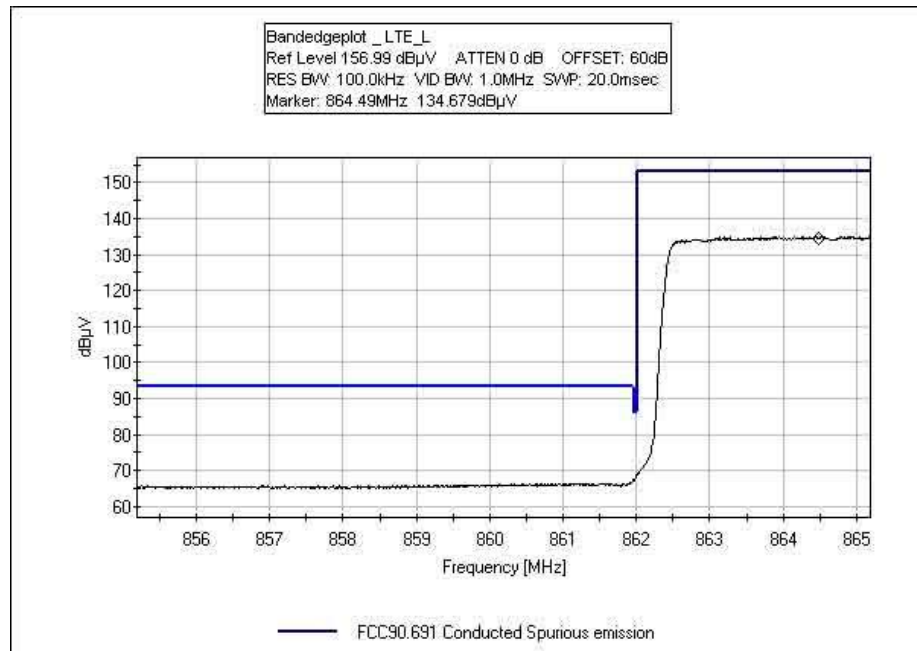
CDMA+3MHz\_LTE\_H CORRECTED



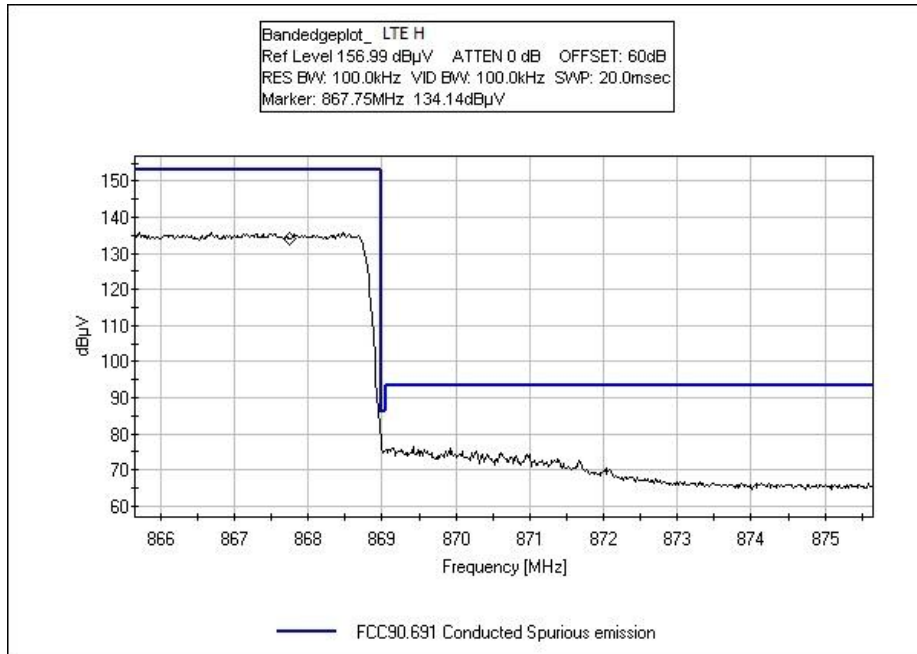
3MHz LTE CDMA\_L



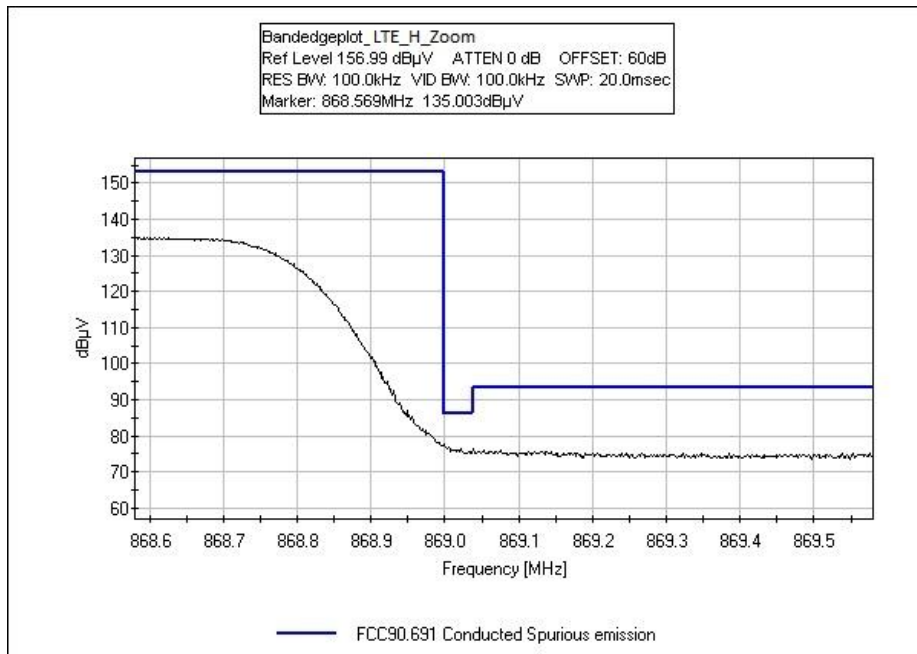
3MHz LTE CDMA\_H



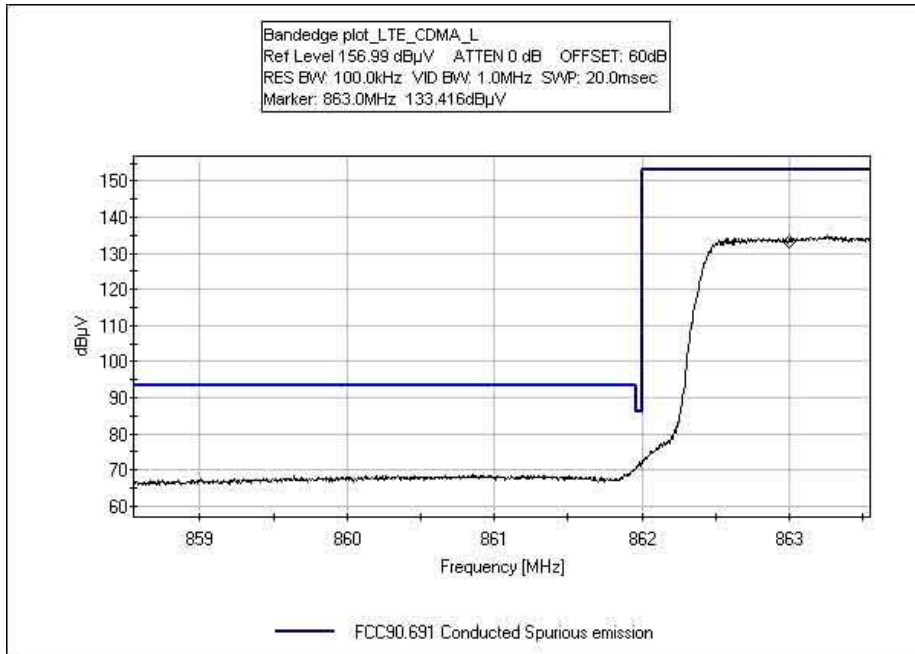
5 MHz LTE\_L



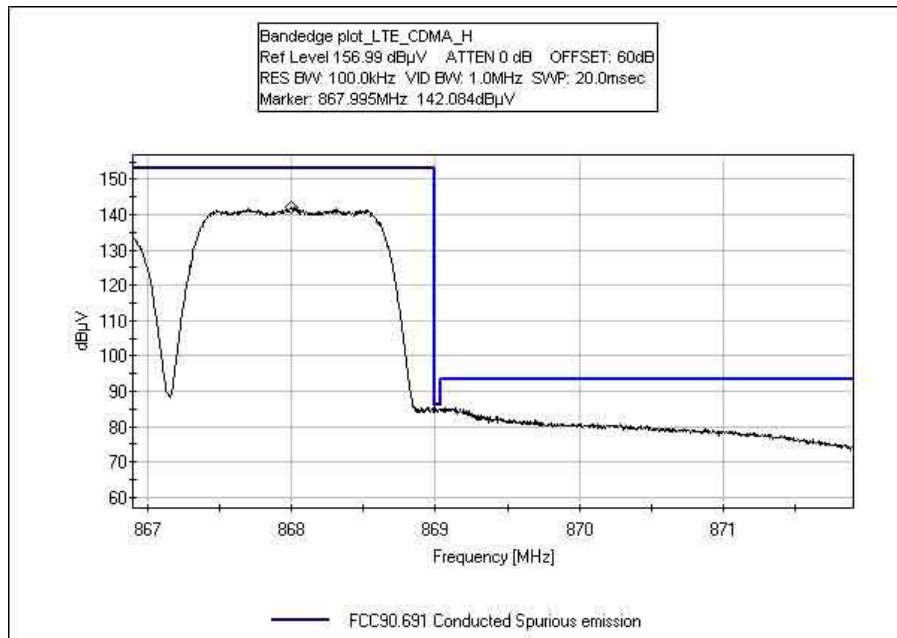
5MHz LTE\_H



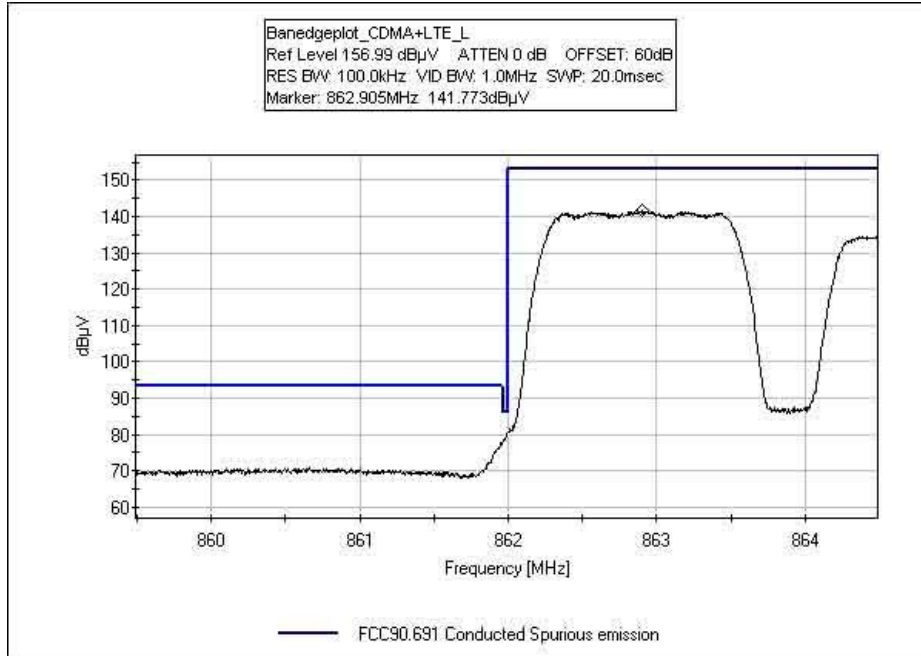
5 MHz LTE\_H\_ZOOM



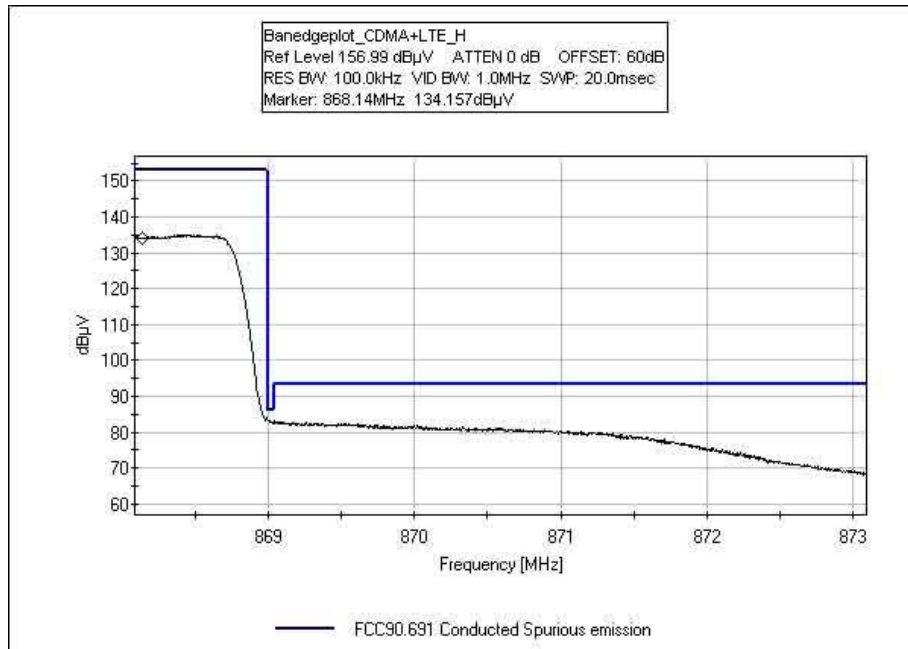
5MHz LTE\_CDMA\_L



5 MHz LTE\_CDMA\_H



CDMA+ 5MHz LTE\_L



CDMA+ 5MHz LTE\_H

**Test Setup Photos**



**2.1051 / 90.691(a) / 2.1053 - Spurious Emissions at Antenna Terminal**

**Test Data**

Test Location: CKC Laboratories • 110 N. Olinda Place. • Brea, CA 92823 • (714) 993-6112

Customer: **Powerwave Technologies, Inc.**  
 Specification: **FCC90.691 Conducted Spurious emission**  
 Work Order #: **93409** Date: 9/10/2012  
 Test Type: **Conducted Emissions** Time: 11:45:50  
 Equipment: **800MHz Band Remote Radio Head** Sequence#: 2  
 Manufacturer: Powerwave Technologies, Inc. Tested By: E. Wong  
 Model: LRS08-T5022-100 48V DC  
 S/N: 01325

***Test Equipment:***

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02869	Spectrum Analyzer	E4440A	2/12/2011	2/12/2013
T2	AN02945	Cable	32022-2-2909K-36TC	10/19/2011	10/19/2013
T3	ANP06139	Cable	Sucoflex 104A	8/8/2011	8/8/2013
T4	AN03169	High Pass Filter	HM1155-11SS	9/22/2011	9/22/2013

***Equipment Under Test (\* = EUT):***

Function	Manufacturer	Model #	S/N
800MHz Band Remote Radio Head*	Powerwave Technologies, Inc.	LRS08-T5022-100	01325

***Support Devices:***

Function	Manufacturer	Model #	S/N
PowerSupply	HP	6032A	NA
Computer	HP	C2C3301	NA
Mouse	HP	M-S34	LZA7130868
Keyboard	HP	KB-9970	9L21401134B
Monitor	HP	M-S34	LZA71340868
TDP Test Fixture	Powerwave Technologies, Inc.	Selhurst	NA
Signal generator	HP	8638C	3642001264

***Test Conditions / Notes:***

The EUT containing two identical RF circuit with independent RF output port is placed on the test bench. The two Optical ports of each RF circuit, one receiving CDMA signal and the other receiving LTE signal are connected to a remote TDP Test Fixture via a pair of optical cables. The received Optical signal are demodulated and regenerated as RF signal. Both RF ports of identical RF circuitries are connected to RF load. USB port is connected to remote computer. The EUT is set in full, constant transmit power.

The EUT is rated at 20W Single channel , 20W + 20W Multichannel (Mixed Mode)

Emission profile evaluated at Antenna Port A

Freq 862 -869MHz

Modulation: CDMA, LTE(5MHz), LTE (3MHz), CDMA+LTE (5MHz), CDMA+LTE (3MHz)

Single channel

Modulation: LTE (5MHz)

Frequency: 864.7MHz, 866.5 MHz

Power= 20W

Modulation: LTE (3MHz)

Frequency: 863.7MHz, 867.5 MHz

Power= 20W

Multichannel (Mixed Mode)

Modulation: CDMA + LTE(5MHz), LTE(5MHz)+ CDMA

Frequency: 862.9MHz + 866.5MHz, 864.7 MHz + 868.0MHz

Power = 20W + 20W

Modulation: CDMA + LTE(3MHz), LTE(3MHz)+ CDMA

Frequency: 862.9MHz + 867.5MHz, 863.7 MHz + 868.0MHz

Power = 20W + 20W

Frequency range of measurement = 9 kHz- 9 GHz.

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-9000 MHz; RBW=1 MHz, VBW=1 MHz.

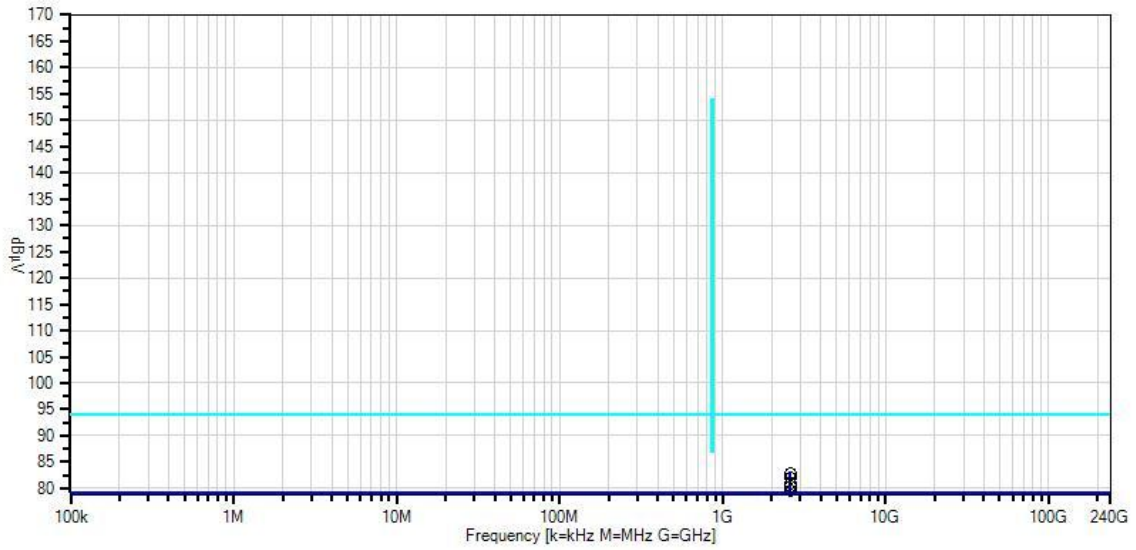
21°C, 65% Relative Humidity

48V DC Power obtained from support DC power supply

Ext Attn: 0 dB

<b>Measurement Data:</b>		Reading listed by margin.						Test Lead: Antenna Port				
#	Freq MHz	Rdng dB $\mu$ V	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dB $\mu$ V	Spec dB $\mu$ V	Margin dB	Polar Ant	
1	2602.320M	81.2	+0.0	+0.7	+0.7	+0.3	+0.0	82.9	94.0	-11.1	Anten LTE(3MHz)_H	
2	2594.440M	80.3	+0.0	+0.7	+0.7	+0.3	+0.0	82.0	94.0	-12.0	Anten LTE(3MHz)_CDM A	
3	2588.520M	80.3	+0.0	+0.7	+0.7	+0.3	+0.0	82.0	94.0	-12.0	Anten CDMA_LTE(5MH z)	
4	2594.200M	80.2	+0.0	+0.7	+0.7	+0.3	+0.0	81.9	94.0	-12.1	Anten LTE(5MHz)_L	
5	2603.000M	79.3	+0.0	+0.7	+0.7	+0.3	+0.0	81.0	94.0	-13.0	Anten LTE(5MHz)_CDM A	
6	2591.500M	79.1	+0.0	+0.7	+0.7	+0.3	+0.0	80.8	94.0	-13.2	Anten LTE(3MHz)_L	
7	2600.240M	78.6	+0.0	+0.7	+0.7	+0.3	+0.0	80.3	94.0	-13.7	Anten LTE(5MHz)_H	
8	2597.550M	77.9	+0.0	+0.7	+0.7	+0.3	+0.0	79.6	94.0	-14.4	Anten CDMA_LTE(3MH z)	
9	1728.300M	73.9	+0.0	+0.6	+0.6	+0.4	+0.0	75.5	94.0	-18.5	Anten LTE(5MHz)_L	
10	1734.300M	73.3	+0.0	+0.6	+0.6	+0.4	+0.0	74.9	94.0	-19.1	Anten LTE(5MHz)_H	
11	1727.800M	67.0	+0.0	+0.6	+0.6	+0.4	+0.0	68.6	94.0	-25.4	Anten LTE(3MHz)_L	
12	1725.460M	66.9	+0.0	+0.6	+0.6	+0.4	+0.0	68.5	94.0	-25.5	Anten CDMA_LTE(5MH z)	
13	1734.590M	66.7	+0.0	+0.6	+0.6	+0.4	+0.0	68.3	94.0	-25.7	Anten LTE(3MHz)_H	
14	1732.050M	65.7	+0.0	+0.6	+0.6	+0.4	+0.0	67.3	94.0	-26.7	Anten LTE(3MHz)_CDM A	
15	1736.000M	65.0	+0.0	+0.6	+0.6	+0.4	+0.0	66.6	94.0	-27.4	Anten LTE(5MHz)_CDM A	
16	1730.610M	63.6	+0.0	+0.6	+0.6	+0.4	+0.0	65.2	94.0	-28.8	Anten CDMA_LTE(3MH z)	

Date: 9/10/2012 Time: 11:45:50 Powerwave Technologies, Inc. WO#: 93409  
 FCC90.691 Conducted Spurious emission Test Lead: Antenna Port 48V DC Sequence#: 2 Ext ATTN: 0 dB



- Sweep Data
- Peak Readings
- \* Average Readings
- Readings
- × QP Readings
- ▼ Ambient
- 1 - FCC90.691 Conducted Spurious emission

LIMIT LINE FOR SPURIOUS CONDUCTED EMISSION

**REQUIRED ATTENUATION = 43+10 LOG P DB**

Limit line (dBuV) =  $V_{dBuV}$  - 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 Setup Photos**



**2.1053 / 90.961(a) - Field Strength of Spurious Radiation**

Customer: **Powerwave Technologies, Inc.**  
 Specification: **90.691(a) Radiated Spurious Emission**  
 Work Order #: **93409** Date: 9/7/2012  
 Test Type: **Radiated Scan** Time: 11:02:31  
 Equipment: **800MHz Band Remote Radio Head** Sequence#: 1  
 Manufacturer: **Powerwave Technologies, Inc.** Tested By: E. Wong  
 Model: **LRS08-T5022-100**  
 S/N: **01325**

**Test Equipment: LTE(3MHz), CDMA+LTE (3MHz)**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02869	Spectrum Analyzer	E4440A	2/12/2011	2/12/2013
	AN00010	Preamp	8447D	3/29/2012	3/29/2014
	AN00851	Biconilog Antenna	CBL6111C	5/16/2012	5/16/2014
	AN00314	Loop Antenna	6502	6/29/2012	6/29/2014
	ANP05555	Cable	RG223/U	6/19/2012	6/19/2014
	ANP05569	Cable	RG-214/U	6/19/2012	6/19/2014
T2	AN00787	Preamp	83017A	4/8/2011	4/8/2013
T3	ANP04382	Cable	LDF-50	8/30/2012	8/30/2014
T4	AN01646	Horn Antenna	3115	4/13/2012	4/13/2014
T5	AN02947	Cable	32022-29094K-29094K-72TC	8/8/2011	8/8/2013
T6	ANP05988	Cable	LDF1-50	3/12/2012	3/12/2014
T7	AN03169	High Pass Filter	HM1155-11SS	9/22/2011	9/22/2013

**Test Equipment: LTE(5MHz), CDMA+LTE (5MHz)**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02869	Spectrum Analyzer	E4440A	2/12/2011	2/12/2013
T2	AN00010	Preamp	8447D	3/29/2012	3/29/2014
T3	AN00851	Biconilog Antenna	CBL6111C	5/16/2012	5/16/2014
T4	ANP04382	Cable	LDF-50	9/3/2010	9/3/2012
T5	ANP05555	Cable	RG223/U	8/18/2010	8/18/2012
T6	ANP05569	Cable	RG-214/U	8/18/2010	8/18/2012
	AN00314	Loop Antenna	6502	6/29/2012	6/29/2014
T7	AN00787	Preamp	83017A	4/8/2011	4/8/2013
T8	AN01646	Horn Antenna	3115	4/13/2012	4/13/2014
T9	AN02947	Cable	32022-29094K-29094K-72TC	8/8/2011	8/8/2013
T10	ANP05988	Cable	LDF1-50	3/12/2012	3/12/2014
T11	AN03169	High Pass Filter	HM1155-11SS	9/22/2011	9/22/2013

**Equipment Under Test (\* = EUT):**

Function	Manufacturer	Model #	S/N
800MHz Band Remote Radio Head*	Powerwave Technologies, Inc.	LRS08-T5022-100	01325

**Support Devices:**

Function	Manufacturer	Model #	S/N
Power Supply	HP	6032A	NA
Computer	HP	C2C3301	NA
Mouse	HP	M-S34	LZA7130868
Keyboard	HP	KB-9970	9L21401134B
Monitor	HP	M-S34	LZA71340868
TDP Test Fixture	Powerwave Technologies, Inc.	Selhurst	NA
Signal generator	HP	8638C	3642001264

**Test Conditions / Notes:**

The EUT containing two identical RF circuit with independent RF output port is placed on the test bench. The two Optical ports of each RF circuit, one receiving CDMA signal and the other receiving LTE signal are connected to a remote TDP Test Fixture via a pair of optical cable. The received Optical signal are demodulated and regenerated as RF signal. Both RF ports of identical RF circuitries are connected to RF load. USB port is connected to remote computer. The EUT is set in full, constant transmit power.

The EUT is rated at 20W Single channel , 20W + 20W Multichannel (Mixed Mode)

Freq: 862 -869MHz

Modulation: CDMA, LTE(5MHz), LTE (3MHz), CDMA+LTE (5MHz), CDMA+LTE (3MHz)

Single channel

Modulation: LTE (5MHz)

Frequency: 864.7MHz, 866.5 MHz

Power= 20W

Modulation: LTE (3MHz)

Frequency: 863.7MHz, 867.5 MHz

Power= 20W

Multichannel (Mixed Mode)

Modulation: CDMA + LTE(5MHz), LTE(5MHz)+ CDMA

Frequency: 862.9MHz + 866.5MHz, 864.7 MHz + 868.0MHz

Power = 20W + 20W

Modulation: CDMA + LTE(3MHz), LTE(3MHz)+ CDMA

Frequency: 862.9MHz + 867.5MHz, 863.7 MHz + 868.0MHz

Power = 20W + 20W

Frequency range of measurement = 9 kHz- 9 GHz.

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-9000 MHz; RBW=1 MHz, VBW=1 MHz.

21°C, 65% Relative Humidity

48V DC Power obtained from support DC power supply

LIMIT LINE FOR SPURIOUS RADIATED EMISSION

**REQUIRED ATTENUATION = 43+10 LOG P (DB)**

For radiated spurious emission measured at 3 meter test distance,

Required attenuation = 43+10 Log P<sub>t at 3 meter</sub> dB  
 Limit line (dBuV) = E<sub>dBuV</sub> - Attenuation

E<sub>dBuV</sub> = Measured field strength at 3 meter in dBuV/m

**Power Density (Isotropic)**

$$P_D = \frac{P_t}{4\pi r^2}$$

P<sub>D</sub> = Power Density in Watts /m<sup>2</sup>

P<sub>t</sub> = Average Transmit Power

r = Test distance

**Field Intensity E (V/m)**

$$E = \sqrt{P_D \times 377}$$

$$E = \frac{\sqrt{P_t \times 377}}{4\pi r^2}$$

$$E = \sqrt{\frac{P_t \times 30}{r^2}}$$

$$P_t = \left( \frac{E^2 \times r^2}{30} \right)$$

$$10 \text{ Log } P_t = 10 \text{ Log } E^2 (\text{V/m}) + 10 \text{ Log } r^2 - 10 \text{ Log } 30$$

$$10 \text{ Log } P_t = 20 \text{ Log } E (\text{V/m}) + 20 \text{ Log } r - 10 \text{ Log } 30$$

At 3 meter,  $r = 3 \text{ m}$

$$10 \text{ Log } P_t = 20 \text{ Log } E (\text{V/m}) + 20 \text{ Log } 3 - 10 \text{ Log } 30$$

$$10 \text{ Log } P_t = 20 \text{ Log } E (\text{V/m}) + 9.54 - 14.77$$

$$10 \text{ Log } P_t = 20 \text{ Log } E (\text{V/m}) - 5.23$$

Since  $20 \text{ Log } E (\text{V/m}) = 20 \text{ Log } E (\mu\text{V/m}) - 120$

$$10 \text{ Log } P_t = 20 \text{ Log } E (\mu\text{V/m}) - 120 - 5.23$$

$$10 \text{ Log } P_t = 20 \text{ Log } E (\mu\text{V/m}) - 125.23$$

$$\begin{aligned} \text{Limit line (dBuV) at 3 meter} &= E_{\text{dBuV}} - \text{Attenuation} \\ &= E_{\text{dBuV}} - (43 + 10 \text{ Log } P_{t \text{ at 3 meter}}) \\ &= E_{\text{dBuV}} - 43 - 10 \text{ Log } P_{t \text{ at 3 meter}} \\ &= E_{\text{dBuV}} - 43 - (20 \text{ Log } E (\mu\text{V/m}) - 125.23) \\ &= E_{\text{dBuV}} - 43 - 20 \text{ Log } E (\mu\text{V/m}) + 125.23 \\ &= E_{\text{dBuV}} - 20 \text{ Log } E (\mu\text{V/m}) + 82.23 \end{aligned}$$

Since  $20 \text{ Log } E (\mu\text{V/m}) = E \text{ in dBuV/m}$

$$= E_{\text{dBuV}} - E_{\text{dBuV}} + 82.23$$

$$\text{Radiated Emission limit 3 meter} = 82.23 \text{ dBuV at any power level measured in dBuV}$$

Operating Frequency: 862 -869MHz  
 LTE(5MHz)\_L, LTE(5MHz)\_H,  
 CDMA+LTE(5MHz),  
 LTE(5MHz)+CDMA,  
 LTE(3MHz)\_L, LTE(3MHz)\_H,  
 CDMA+LTE(3MHz),  
 LTE(3MHz)+CDMA

Channels: \_\_\_\_\_

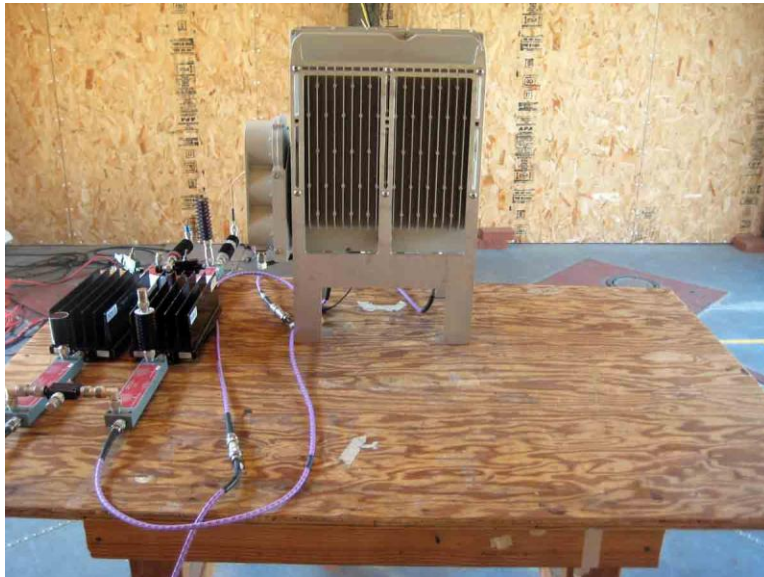
Highest Measured Output Power: 46.00 (dBm)= 40 (Watts)

Distance: 3 meters

Limit:  $43+10\text{Log}(P)=$  59.02 dBc

Freq. (MHz)	Reference Level (dBm)	Antenna Polarity (H/V)	dBc
198.37	-54.02059991	Vert	100.02
275.57	-65.12059991	Vert	111.12
218.07	-63.22059991	Vert	109.22
198.99	-51.32059991	Vert	97.32
1,730.00	-58.02059991	Vert	104.02
1,751.70	-53.42059991	Horiz	99.42
1,729.50	-59.82059991	Horiz	105.82
1,720.40	-53.42059991	Vert	99.42
1,735.07	-57.02059991	Vert	103.02
1,727.60	-58.32059991	Horiz	104.32
1,726.63	-57.82059991	Horiz	103.82

**Test Setup Photos**





## 2.1055 / 90.543(c) - Frequency Stability

### Test Conditions / Setup

The EUT containing two identical RF circuit with independent RF output port is placed on the temperature chamber. The two Optical ports of each RF circuit, one receiving CDMA signal and the other receiving LTE signal are connected to a remote TDP Test Fixture via a pair of optical cable. The received Optical signal are demodulated and regenerated as RF signal. Both RF ports of identical RF circuitries are connected to RF load. USB port is connected to remote computer. The EUT is set in full, constant transmit power.

The EUT is rated at 20W Single channel, 20W + 20W Multichannel (Mixed Mode)

Emission profile evaluated at Antenna Port A

Freq: 862 -869MHz

Modulation: CDMA, LTE(5MHz), LTE (3MHz), CDMA+LTE (5MHz), CDMA+LTE (3MHz)

Single channel

Modulation: LTE (5MHz)

Frequency: 864.7MHz, 866.5 MHz

Power= 20W

Modulation: LTE (3MHz)

Frequency: 863.7MHz, 867.5 MHz

Power= 20W

Multichannel (Mixed Mode)

Modulation: CDMA + LTE(5MHz), LTE(5MHz)+ CDMA

Frequency: 862.9MHz + 866.5MHz, 864.7 MHz + 868.0MHz

Power = 20W + 20W

Modulation: CDMA + LTE(3MHz), LTE(3MHz)+ CDMA

Frequency: 862.9MHz + 867.5MHz, 863.7 MHz + 868.0MHz

Power = 20W + 20W

Engineer Name: E. Wong

Test Equipment					
Asset/Serial #	Description	Model	Manufacturer	Cal Date	Cal Due
AN02672	Spectrum Analyzer	E4446A	Agilent	4/5/2011	4/5/2013
AN01830	Multimeter	45	Fluke	10/14/2011	10/14/2013
	Temperature chamber	AST-35-LN2		NCR	NCR
P05947	K/J Thermometer	51	Fluke	12/20/2011	12/20/2013
AN02945	Cable	32022-2-2909K-36TC	Astrolab	10/19/2011	10/19/2013
ANP06139	Cable	Sucoflex 104A	Huber & Suhner	8/8/2011	8/8/2013

NCR = No Calibration Required

Note: The temperature of the chamber is maintained at the temperature readings recorded with K/J Thermometer AN P05947.

### Test Data

#### LTE (3MHz)

Frequency Stability									
Customer:	Powerwave Technologies, Inc								
WO#:	93409								
Date:	11-Sep-12								
Test Engineer:	E. wong								
Device Model:	LRS08-T5022-100								
Operating Voltage:	48 Vdc								
Frequency Limit:	1.50E+00 ppm								
Temperature Variations									
		20W (L)	Dev (ppm)	20W (H)	Dev (ppm)	20W+20W (L)	Dev (ppm)	20W+20W (H)	Dev (ppm)
Channel Frequency:		865.0589		868.8590		865.0597		868.8590	
Temp (C)	Voltage								
-30	48	865.0585	0.46	868.8600	-1.15	865.0600	-0.35	868.8587	0.35
-20	48	865.0578	1.27	868.8597	-0.81	865.0607	-1.16	868.8578	1.38
-10	48	865.0589	0.00	868.8594	-0.46	865.0600	-0.35	868.8591	-0.12
0	48	865.0595	-0.69	868.8594	-0.46	865.0593	0.46	868.8591	-0.12
10	48	865.0592	-0.35	868.8587	0.35	865.0594	0.35	868.8594	-0.46
20	48	865.0589	0.00	868.8590	0.00	865.0597	0.00	868.8590	0.00
30	48	865.0585	0.46	868.8589	0.12	865.0590	0.81	868.8590	0.00
40	48	865.0582	0.81	868.8590	0.00	865.0597	0.00	868.8587	0.35
50	48	865.0582	0.81	868.8594	-0.46	865.0587	1.16	868.8600	-1.15
Voltage Variations (±15%)									
Temp (C)	Voltage	20W (L)	Dev. (MHz)	1.000000	Dev. (MHz)	20W+20W (L)	Dev. (MHz)	20W+20W (H)	Dev. (MHz)
20	40.8	865.0589	0.00	868.8590	0.00	865.0597	0.00	868.8590	0.00
20	48.0	865.0589	0.00	868.8590	0.00	865.0597	0.00	868.8590	0.00
20	55.2	865.0589	0.00	868.8590	0.00	865.0597	0.00	868.8590	0.00
Max Deviation (ppm)		1.27		+	0.35		+	1.16	
Max Deviation (ppm)		0.69		-	1.15		-	1.16	
		PASS			PASS			PASS	

**LTE (5MHz)**

**Frequency Stability**

<b>Customer:</b>	Powerwave Technologies, Inc
<b>WO#:</b>	93409
<b>Date:</b>	1-Aug-12
<b>Test Engineer:</b>	E. wong
<b>Device Model:</b>	RS08-T5022-100
<b>Operating Voltage:</b>	48 Vdc
<b>Frequency Limit:</b>	1.50E+00 ppm

**Temperature Variations**

Channel Frequency		20W (L)	Dev (ppm)	20W (H)	Dev (ppm)	20W+20W (L)	Dev (ppm)	20W+20 W (H)	Dev (ppm)
Temp (C) Voltage		862.4384		868.7609		862.4371		868.7610	
-30	48	862.4386	-0.23	868.7616	-0.81	862.4371	0.00	868.7608	0.23
-20	48	862.4388	-0.46	868.7613	-0.46	862.4375	-0.46	868.7615	-0.58
-10	48	862.4388	-0.46	868.7609	0.00	862.4371	0.00	868.7620	-1.15
0	48	862.4384	0.00	868.7610	-0.12	862.4372	-0.12	868.7610	0.00
10	48	862.4384	0.00	868.7609	0.00	862.4371	0.00	868.7610	0.00
20	48	862.4384	0.00	868.7609	0.00	862.4371	0.00	868.7610	0.00
30	48	862.4384	0.00	868.7603	0.69	862.4371	0.00	868.7610	0.00
40	48	862.4384	0.00	868.7613	-0.46	862.4371	0.00	868.7610	0.00
50	48	862.4389	-0.58	868.7614	-0.58	862.4376	-0.58	868.7610	0.00

**Voltage Variations (±15%)**

Temp (C)	Voltage	20W (L)	Dev. (MHz)	1.000000	Dev. (MHz)	20W+20W (L)	Dev. (MHz)	20W+20W (H)	Dev. (MHz)
20	40.8	862.4384	0.00	868.7609	0.00	862.4371	0.00	868.7610	0.00
20	48.0	862.4384	0.00	868.7609	0.00	862.4371	0.00	868.7610	0.00
20	55.2	862.4384	0.00	868.7609	0.00	862.4371	0.00	868.7610	0.00

<b>Max Deviation (ppm)</b>	<b>0.00</b>	<b>+</b>	<b>0.69</b>	<b>+</b>	<b>0.00</b>	<b>+</b>	<b>0.23</b>
<b>Max Deviation (ppm)</b>	<b>0.58</b>	<b>-</b>	<b>0.81</b>	<b>-</b>	<b>0.58</b>	<b>-</b>	<b>1.15</b>
	<b>PASS</b>		<b>PASS</b>		<b>PASS</b>		<b>PASS</b>

**Test Setup Photos**

