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**Electromagnetic
Emission
Compliance
Test Report**



**Equipment Under Test
(EUT)
Applicant** 800MHz 2x50W RRH
RF101017
Andrew Corporation

In Accordance With FCC Part 90 & Part 2 & Part 15

Tested by Advanced Compliance Laboratory, Inc.
6 Randolph Way
Hillsborough, New Jersey 08844

Authorized by Wei Li
Lab Manager

Signature

Date August 2, 2011

**AC Lab Report
Number** 0048-110627-01



Lab Code:200101-0

**The test result in this report is supported and
covered by the NVLAP accreditation.**

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Section 1. Summary of Test Results

Manufacturer: Andrew Corporation
Product Name.: 800MHz 2x50W RRH
Model/Parts No. : RF101017
S/N: YF11800044

General: **All measurements are traceable to national standards**

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 2, Part 15 & Part 90.

New Submission Production Unit
 Class II Permissive Change Pre-Production Unit

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE TEST SPECIFICATIONS HAVE BEEN MADE.

“See Summary of Test Data”



NVLAP LAB CODE: 200101-0

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Summary of Test Data

Test Description	FCC Part Sec.	Limit	Result
RF Power Output	2.1046 90.635	1000W ERP	Complies
Occupied Bandwidth (Digital)	2.1049(i)	*	Complies
Spurious Emissions at Antenna Terminals	2.1051 90.691	-20dBm@bandedge -13dBm@out-of-band	Complies
Field Strength of Spurious Emissions	2.1053 90.691	-13dBm	Complies*
Frequency Stability	2.1055 90.213	1.5ppm	Complies

* See Sprint's waiver letter for 90.209's 25KHz bandwidth limitation.

The estimated uncertainty of the test result is given as following. The method of uncertainty calculation is provided in Advanced Compliance Lab. Doc. No. 0048-01-01.

	Prob. Dist.	Uncertainty(dB)	Uncertainty(dB)	Uncertainty(dB)
		30-1000MHz	1-6.5GHz	Conducted
Combined Std. Uncertainty u_c	norm.	± 2.36	± 2.99	± 1.83



Wei Li
 Lab Manager
 Advanced Compliance Lab

Date: August 2, 2011

Section 2. General Equipment Specification

Supply Voltage	-48VDC (extend -37V to -57V)				
Frequency Range	800MHz Band	TX/ 862MHz- 869MHz			
		RX/ 817MHz-824MHz			
Modulation	<input type="checkbox"/> LTE	<input checked="" type="checkbox"/> CDMA	<input type="checkbox"/> GSM	<input type="checkbox"/> EDGE	<input type="checkbox"/> TDMA
Type of Emissions	F9W	F9W	GXW	G7W	DXW
Rated Power	50W (+47dBm) average @ each Tx Port Total two Individual Tx Ports presented with total output power: 100W (non-MIMO)				
Output Impedance /Nominal OCBW	50ohm / 1.27MHz				
Frequency Translation	F1-F1 <input type="checkbox"/>	F1-F2 <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>		
	Software <input checked="" type="checkbox"/>	Duplexer Change <input type="checkbox"/>	Full Band Coverage <input type="checkbox"/>		

DC voltages and DC currents per 2.1033(c)(8)

The input supply to the transmitter was set at -48 Volts DC. The RF power output was measured with the indicated voltage and current applied into the final RF amplifying device(s).

RF101017 RRH

RF Output, DC Current and RF Input Power are all average values.

Measured Rated RF output: 47dBm (41.2W)

Measured DC voltage: -48.0V

Measured DC current: 7.95A.

Measured Minimum RF output: -16.09dBm (0.025mW)

Measured DC voltage: -48.0V

Measured DC current: 2.84A

Tune-up procedure per 2.1033(c) (9)

There are no user accessible adjustments or tuning in this EUT. All necessary adjustments and tuning are performed during manufacture of the product. Any adjustments or tuning after service or repair are done as part of that process as special equipment is required to perform such adjustments.

Description of Operation

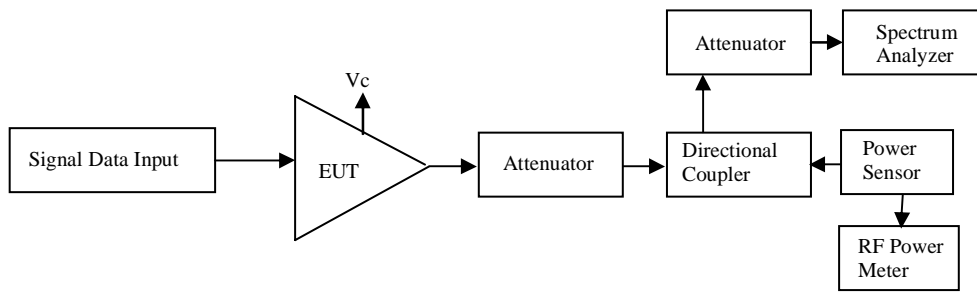
The EUT operated in FCC 800MHz band, has two identical sections, each has one RF transmitter & one receiver, and a double duplex filter.

All measurements shall be made at room temperature and at nominal DC input voltage.

System Diagram

See Attachment.

General EUT Setup



Operational Tx Frequency channel(s) for testing:

CDMA Channels	Tx Frequency (MHz)	Testing CH Description
476	862.90	L (Low)
526	964.15	L1
576	865.40	M (Middle)
626	866.65	H1
676	867.90	H (High)

Section 3. RF Output Power

Name of Test:	<i>RF Output Power</i>	Test Standard:	<i>2.1046 90.635(a)</i>
Tested By:	WEI LI	Test Date:	7/5/2011-7/22/2011

Minimum Standard: Para. No. 90.635(a)
(a) The effective radiated power and antenna height for base stations may not exceed 1 kilowatt (30dBw) 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.

Method of Measurement: The EUT is a RF amplifier (RRH). The manufacturer does not provide an antenna for sale with the product, hence EIRP/ERP is not measured nor calculated.

Per 2.1046: The RF Power Output shall be measured at the output connector of the EUT. The output level shall be rated P with +1 dB, - 3 dB over the TX frequency band. The tolerance range is per TIA/EIA-97-D, Section 4.3.1.3.

Using power meter, power measurements shall be taken at the low band edge, mid, and high band edge frequencies for all selected modulations.

Test Result:

Complies

Test Data:

Date Sheet

Rated Output Power – Normal Condition

The inputs are set to generate rated average output power. Two individual TX ports are measured at L,M,H channels.

TX1 Port

OPERATION Band	Channel	Modulation	Power Output (dBm)	Rated Power (dBm)	Tolerance
TX	L	CDMA	46.88	47.0	-0.12
	M	CDMA	46.90	47.0	-0.10
	H	CDMA	46.84	47.0	-0.16
Ref Offset	Ref offset=Cable&Attenuator&Coupler Attenuation=40.30dB				

TX2 Port

OPERATION Band	Channel	Modulation	Power Output (dBm)	Rated Power (dBm)	Tolerance
TX	L	CDMA	46.86	47.0	-0.14
	M	CDMA	47.10	47.0	+0.10
	H	CDMA	47.13	47.0	+0.13
Ref Offset	Ref offset=Cable&Attenuator&Coupler Attenuation=40.30dB				

Conclusion:

The two individual TX ports delivered the same output RF power level, 50W each & 100W total, which meets FCC power limit requirement. Considering the identical design between TX1 and TX2 RF paths, one of TX ports, TX2, was chosen for the related conducted tests.

Section 4. Occupied Bandwidth

Name of Test:	<i>Occupied Bandwidth</i>	Test Standard:	<i>2.1049(i)</i>
Tested By:	WEI LI	Test Date:	7/5/2011-7/22/2011

Minimum Standard: NA (or Mask reference)
* See Sprint's waiver letter for 90.209's 25KHz bandwidth limitation

Method of Measurement: Spectrum Analyzer Settings:
RBW: WCDMA (100KHz), CDMA(30KHz), GSM (3 kHz), EDGE (3KHz), NADC (1 kHz) and CDPD (1 kHz), LTE(100KHz)
VBW: \geq RBW
Span: As required
Sweep: Auto
Input Signal Characteristics: Generated from Signal Generator or digital input design sepc.
RF level: Rated, recommended by manufacturer

Test Result:

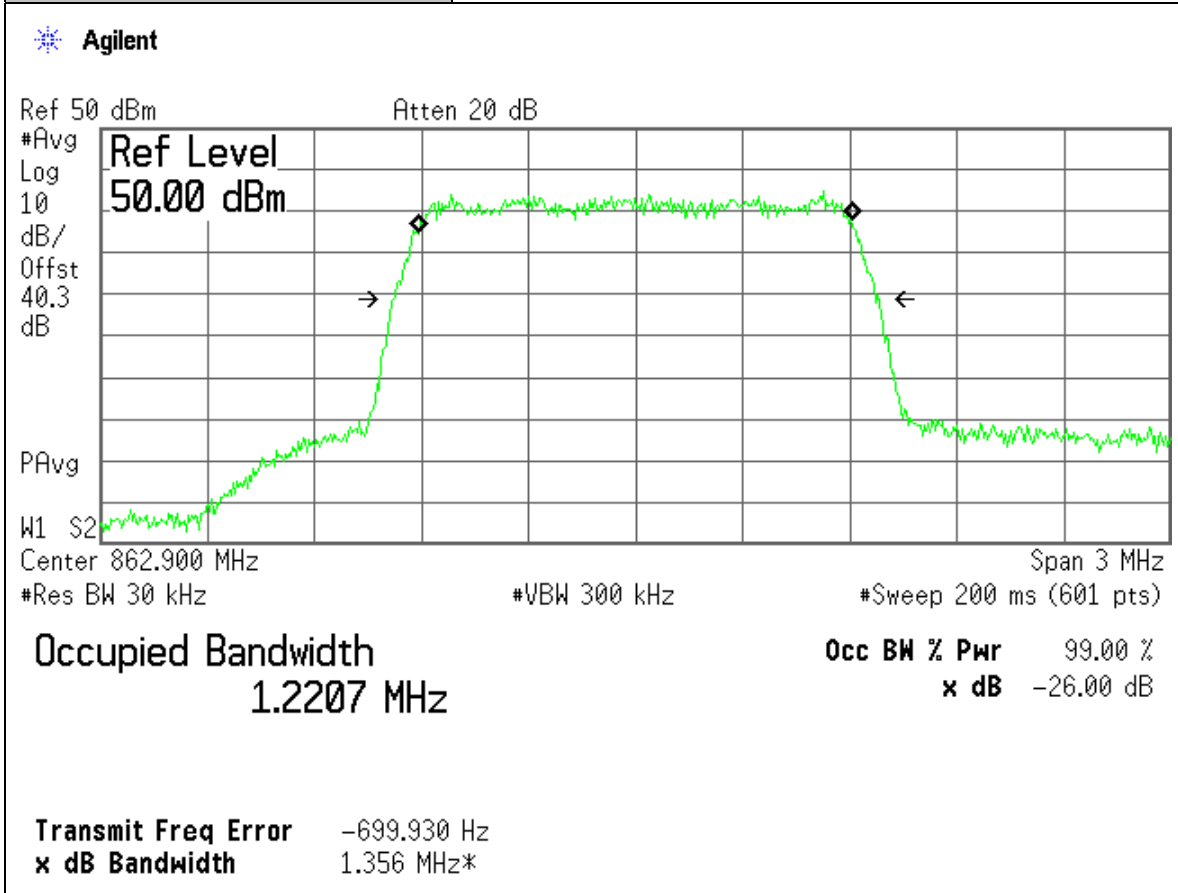
Complies

Test Data:

Attached Plots

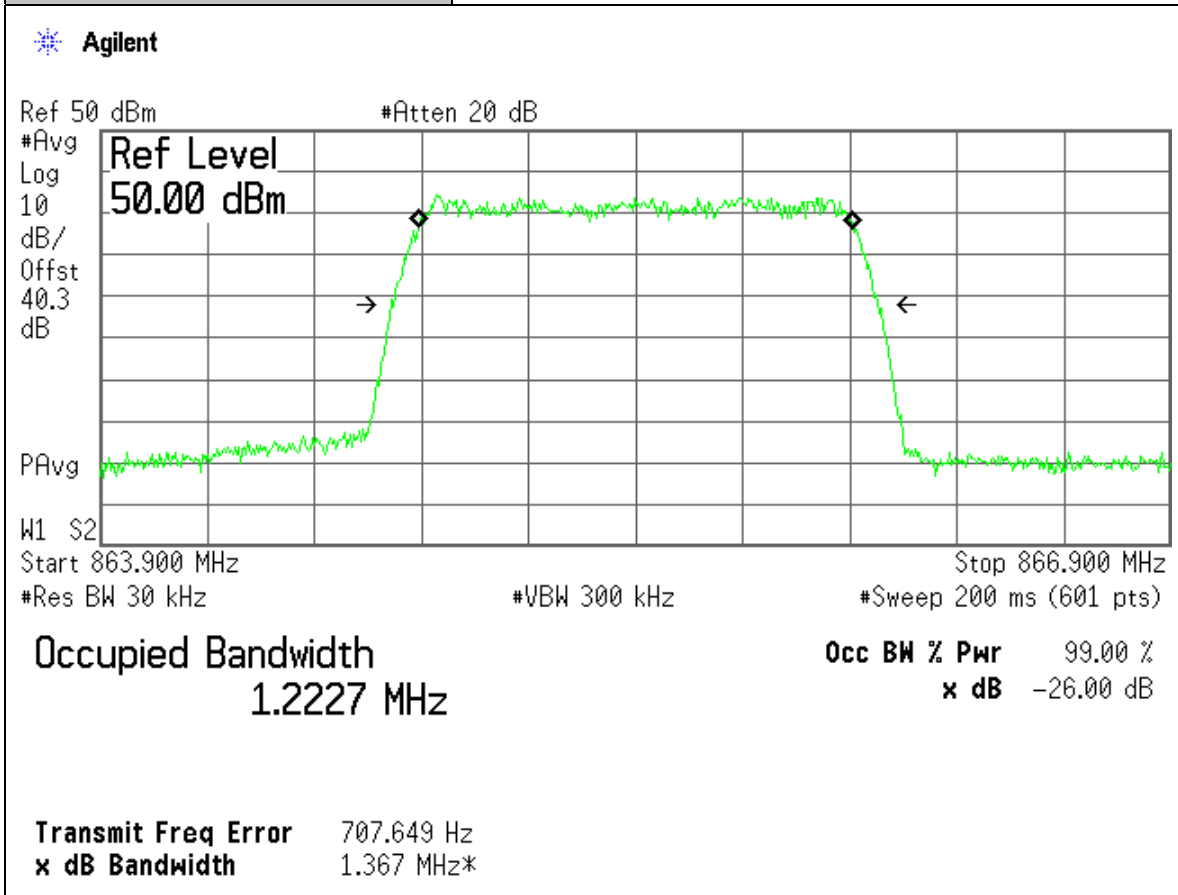
Project Number:	0048-110627-01
EUT:	ANDREW 800MHz 2x50W RRH RF101017
S/N:	YF11800044
Tested By:	Wei Li
Temperature:	70°F
Humidity:	30%

Section:	Occupied Bandwidth: 800MHz Band
Plot Name:	TX, Low-Channel, CDMA Modulation
Configuration:	Input: DIGITAL, Output Port: EUT RF OUTPUT



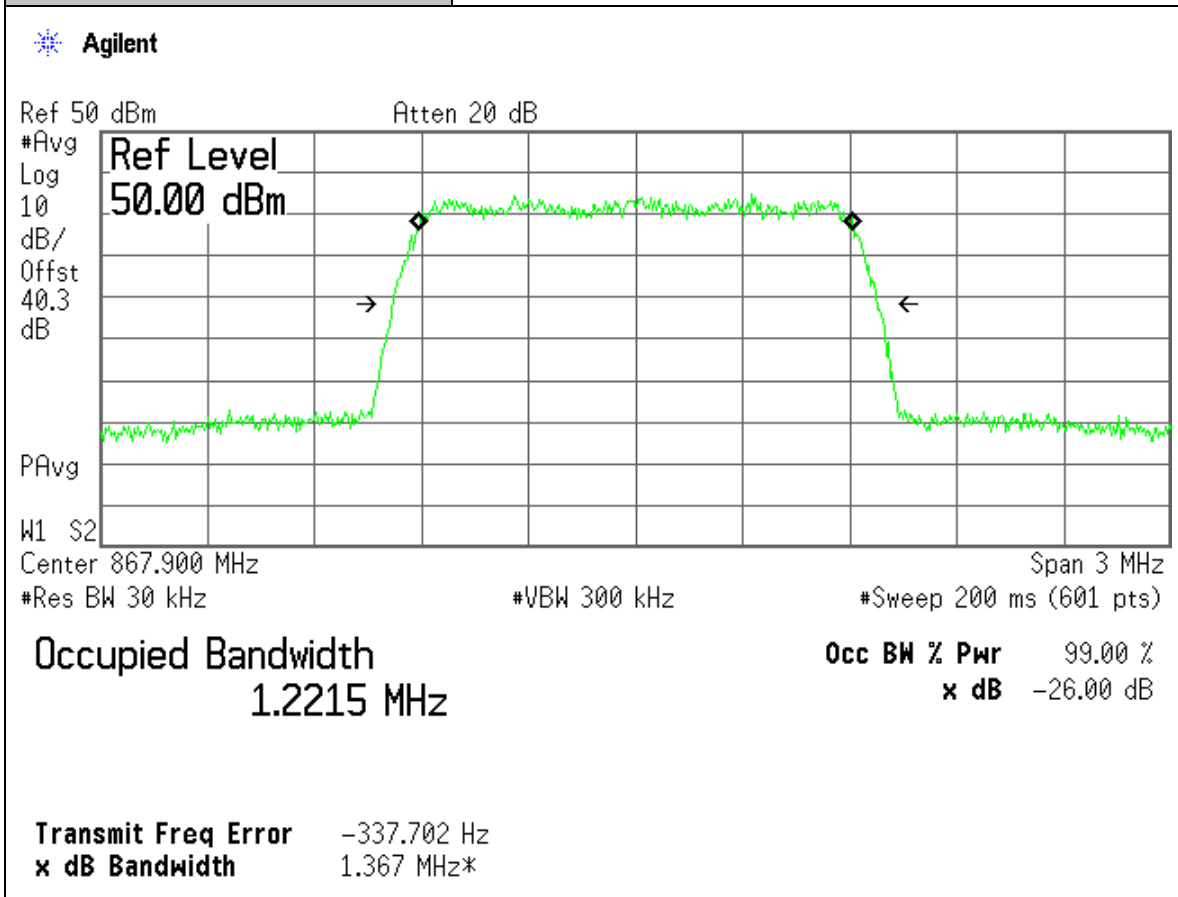
Project Number:	0048-110627-01
EUT:	ANDREW 800MHz 2x50W RRH RF101017
S/N:	YF11800044
Tested By:	Wei Li
Temperature:	70°F
Humidity:	30%

Section:	Occupied Bandwidth: 800MHz Band
Plot Name:	TX, Mid-Channel, CDMA Modulation
Configuration:	Input: DIGITAL, Output Port: EUT RF OUTPUT



Project Number:	0048-110627-01
EUT:	ANDREW 800MHz 2x50W RRH RF101017
S/N:	YF11800044
Tested By:	Wei Li
Temperature:	70°F
Humidity:	30%

Section:	Occupied Bandwidth: 800MHz Band
Plot Name:	TX, High-Channel, CDMA Modulation
Configuration:	Input: DIGITAL, Output Port: EUT RF OUTPUT



Section 5. Spurious Emissions at Antenna Terminals

Name of Test:	<i>Spurious Emissions at Antenna Terminals</i>	Test Standard:	2.1051 90.691
Tested By:	WEI LI DAVID TU	Test Date:	7/5/2011-7/22/2011

Minimum Per FCC Part 90.691:

Standard: (a) Out-of-band emission requirement shall apply only to the “outer” channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:

(1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $116 \text{ Log}_{10}(f/6.1)$ decibels or $50 + 10 \text{ Log}_{10}(P)$ decibels (*-20dBm) or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.

(2) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \text{ Log}_{10}(P)$ decibels (*-13dBm) or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

Method of Spectrum Analyzer Settings:

Measurement: RBW: 100 kHz or 30KHz. As required for digital modulations.*

VBW: \geq RBW

Start Frequency: 9KHz or Lowest Clock Frequency

Stop Frequency: 12.75GHz

Sweep: Auto

Using in-band filter if needed.

* Band Edge measurements use a RBW & VBW of at least 1% of occupied bandwidth, i.e. $\geq 12.5\text{KHz}$. Absolute limit line (-20dBm or -13dBm) is used for this CDMA application.

Test Result:

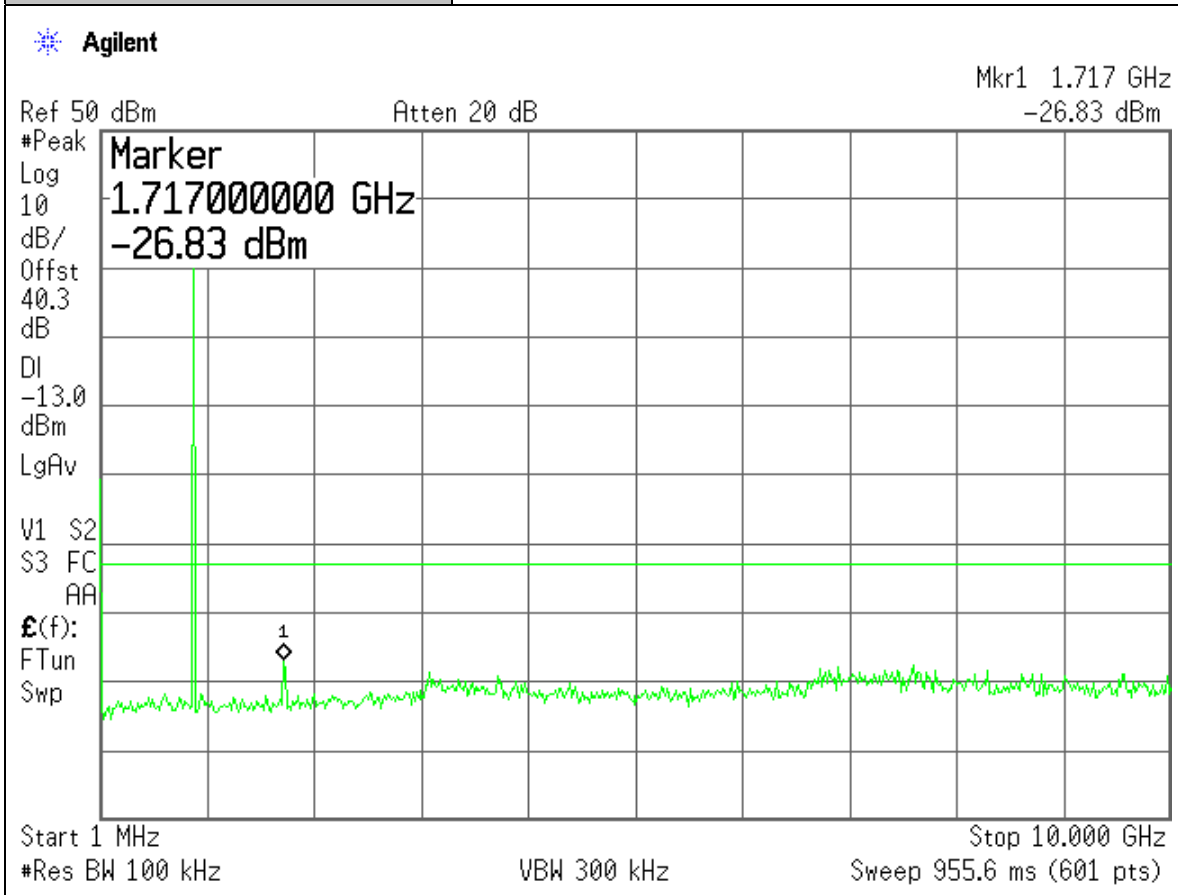
Complies

Test Data:

Attached Plots

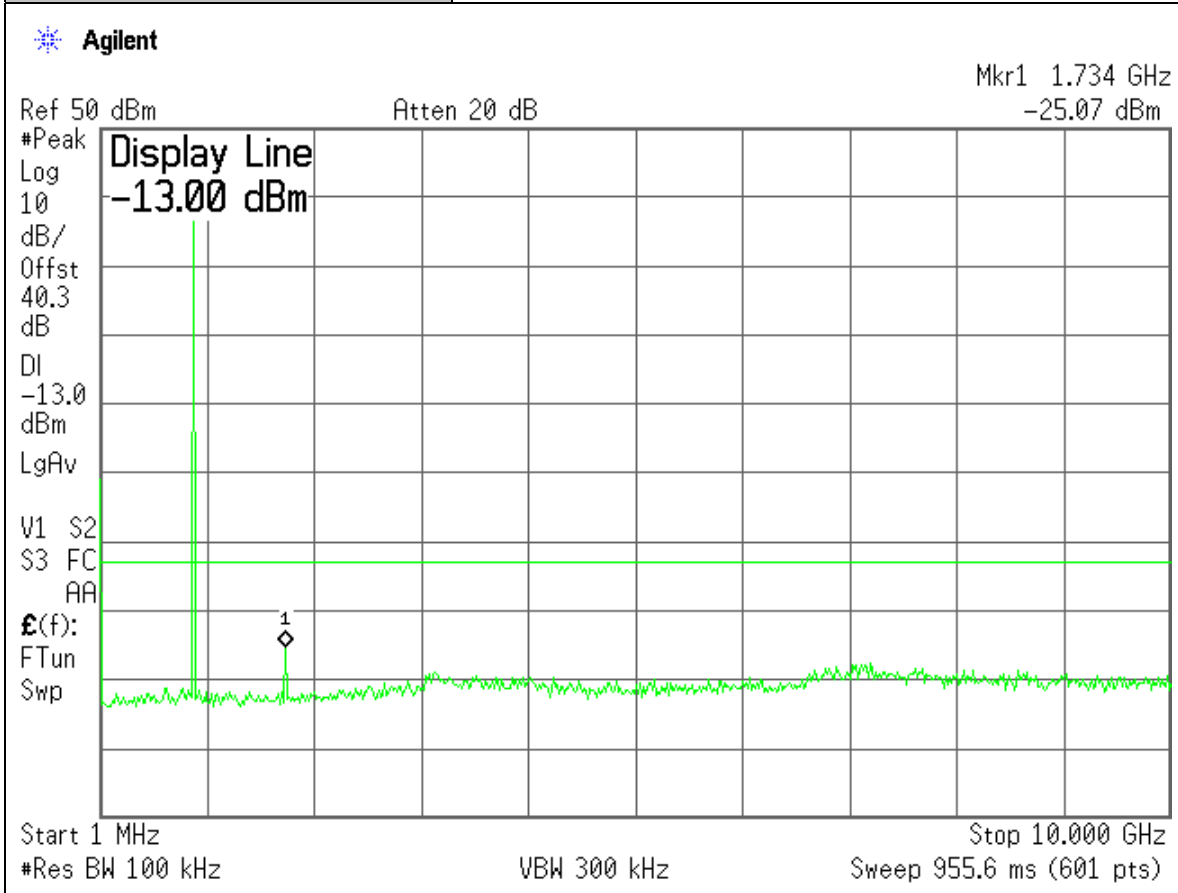
Project Number:	0048-110627-01
EUT:	ANDREW 800MHz 2x50W RRH RF101017
S/N:	YF11800044
Tested By:	Wei Li
Temperature:	70°F
Humidity:	30%

Section:	Spurious Emissions at RF Output Port: 800MHz Band / CDMA Modulation
Plot Name:	TX, Low-Ch, One Carrier
Configuration:	Input: DIGITAL, Output Port: EUT RF OUTPUT



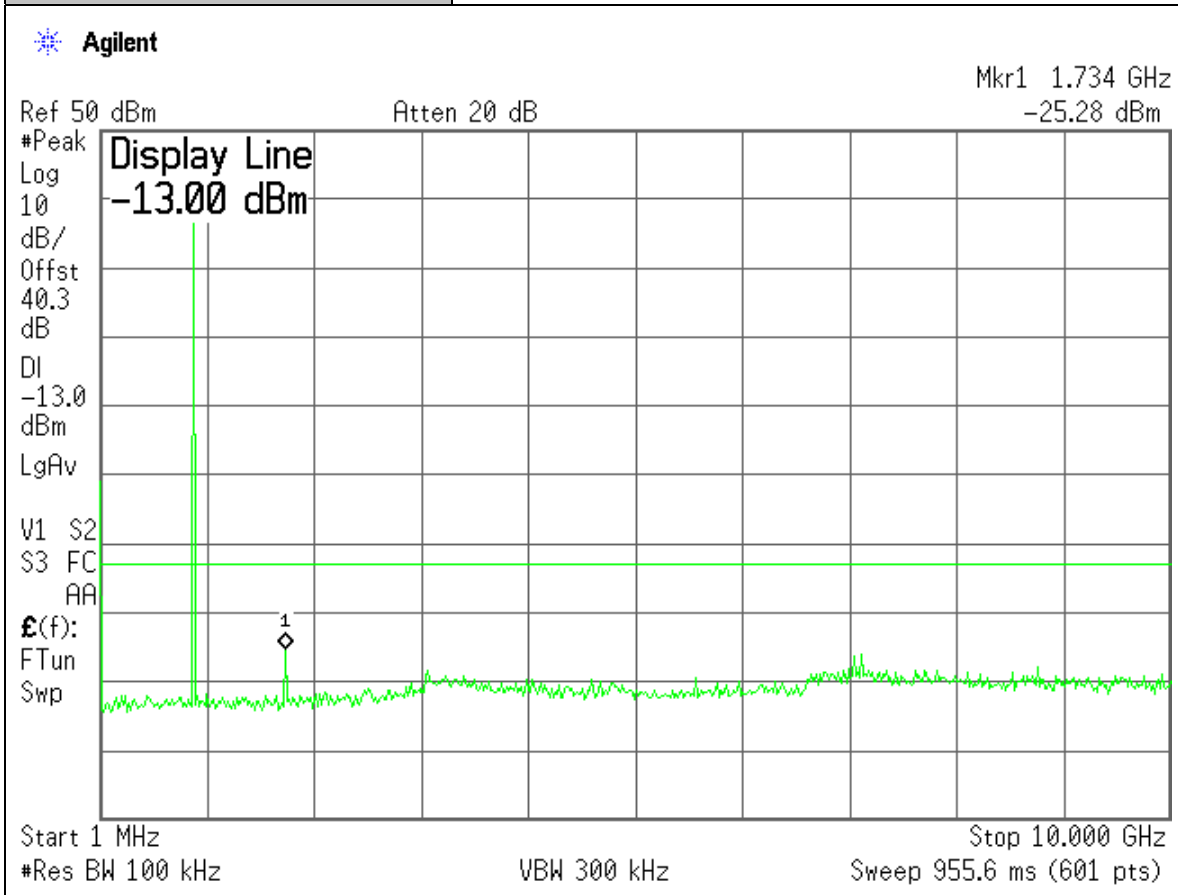
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EUT:	ANDREW 800MHz 2x50W RRH RF101017
S/N:	YF11800044
Tested By:	Wei Li
Temperature:	70°F
Humidity:	30%

Section:	Spurious Emissions at RF Output Port: 800MHz Band / CDMA Modulation
Plot Name:	TX, Mid-Ch, One Carrier
Configuration:	Input: DIGITAL, Output Port: EUT RF OUTPUT



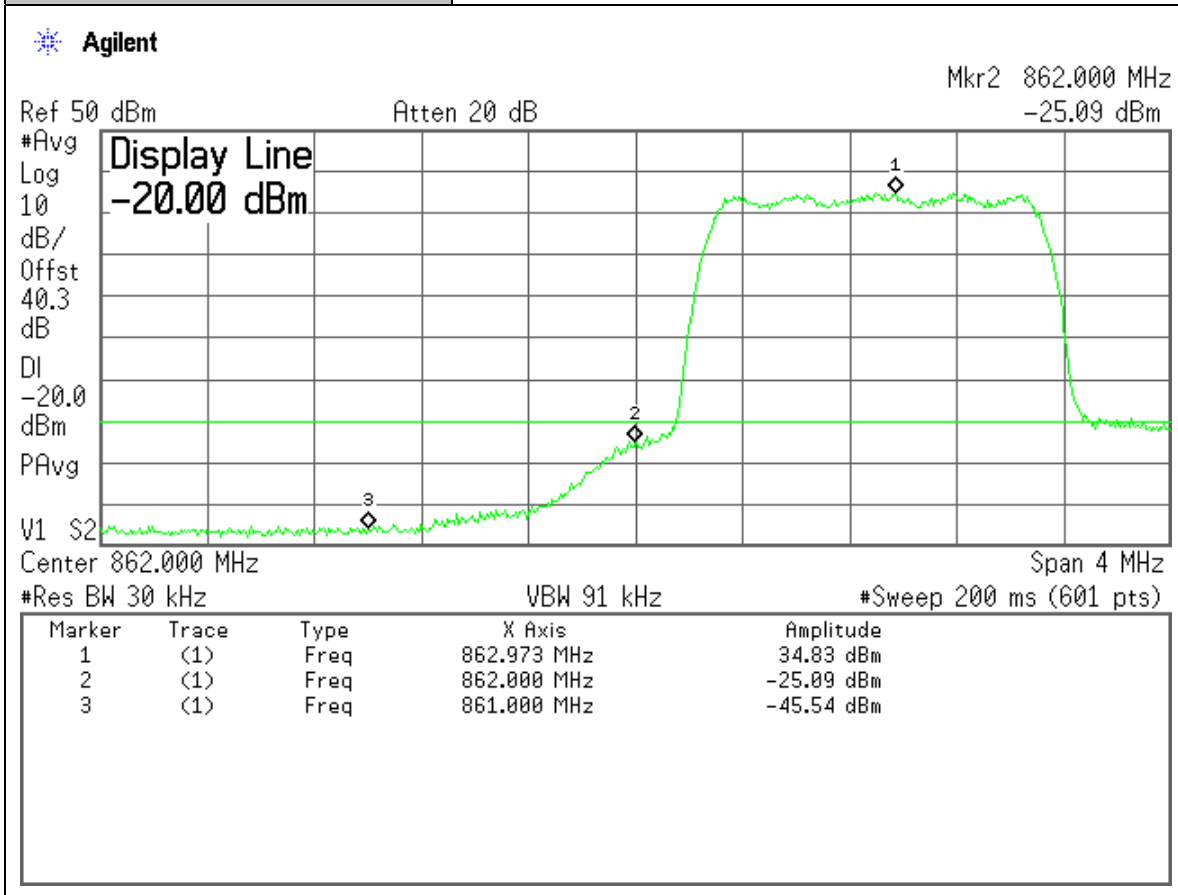
Project Number:	0048-110627-01
EUT:	ANDREW 800MHz 2x50W RRH RF101017
S/N:	YF11800044
Tested By:	Wei Li
Temperature:	70°F
Humidity:	30%

Section:	Spurious Emissions at RF Output Port: 800MHz Band / CDMA Modulation
Plot Name:	TX, High-Ch, One Carrier
Configuration:	Input: DIGITAL, Output Port: EUT RF OUTPUT



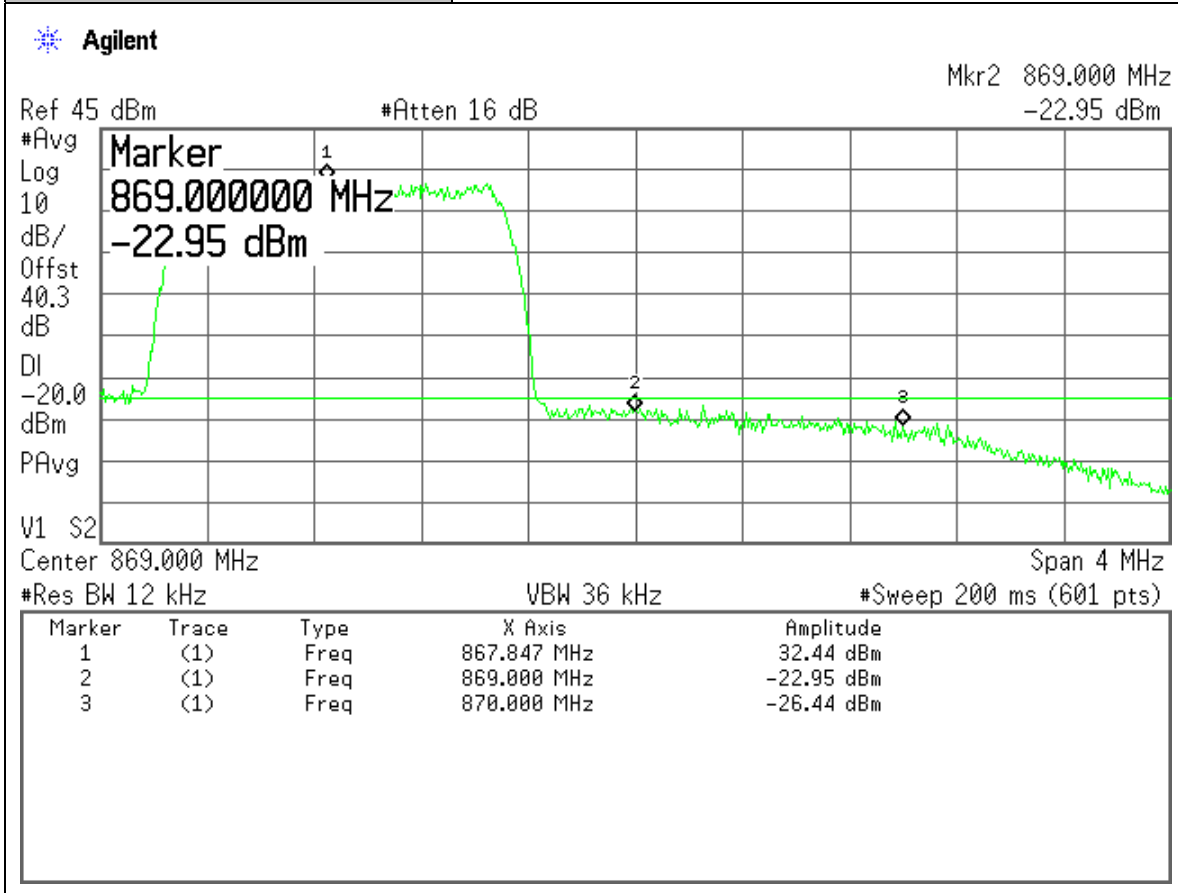
Project Number:	0048-110627-01
EUT:	ANDREW 800MHz 2x50W RRH RF101017
S/N:	YF11800044
Tested By:	David Tu
Temperature:	70°F
Humidity:	30%

Section:	Spurious Emissions at RF Output Port: 800MHz Band / CDMA Modulation
Plot Name:	TX, L-CH, Lower Bandedge
Configuration:	Input: DIGITAL, Output Port: EUT RF OUTPUT



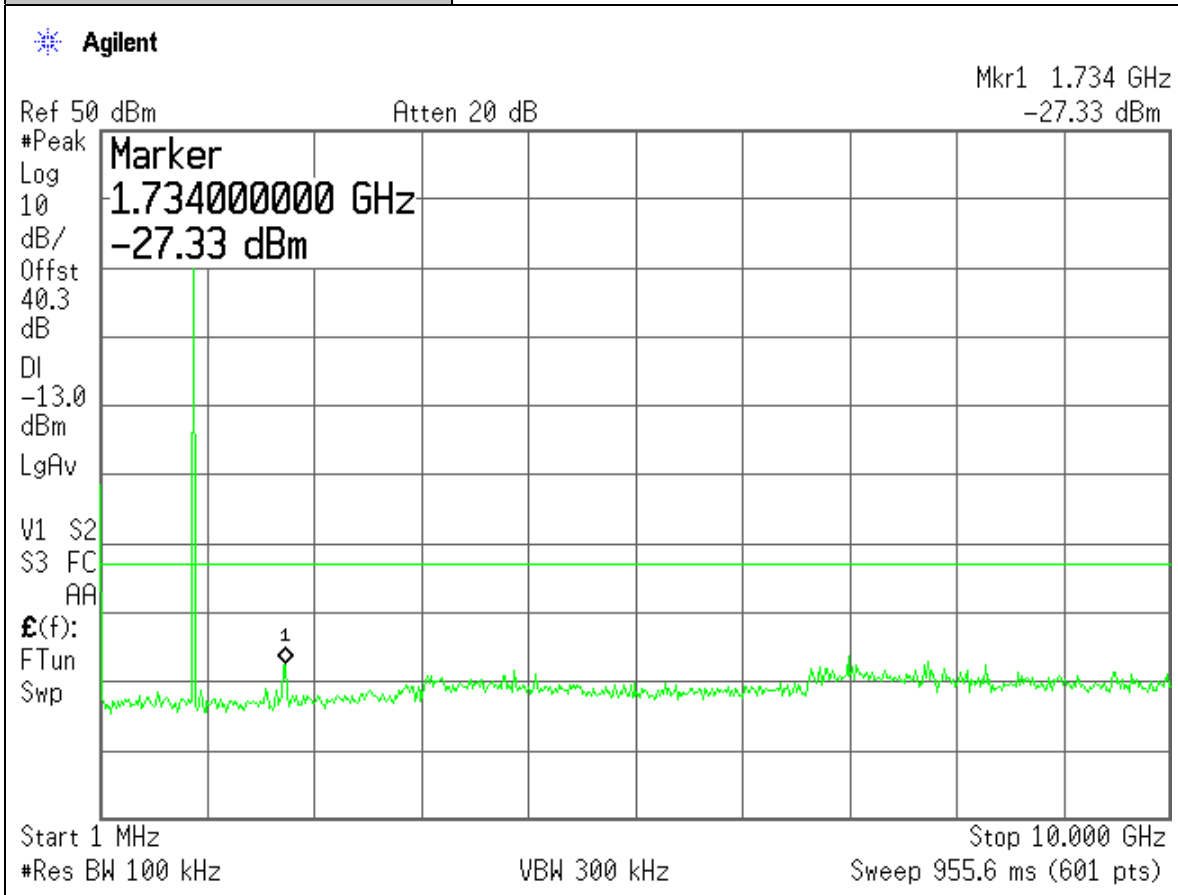
Project Number:	0048-110627-01
EUT:	ANDREW 800MHz 2x50W RRH RF101017
S/N:	YF11800044
Tested By:	David Tu
Temperature:	70°F
Humidity:	30%

Section:	Spurious Emissions at RF Output Port: 800MHz Band / CDMA Modulation
Plot Name:	TX, H-Ch, Higher Bandedge
Configuration:	Input: DIGITAL, Output Port: EUT RF OUTPUT



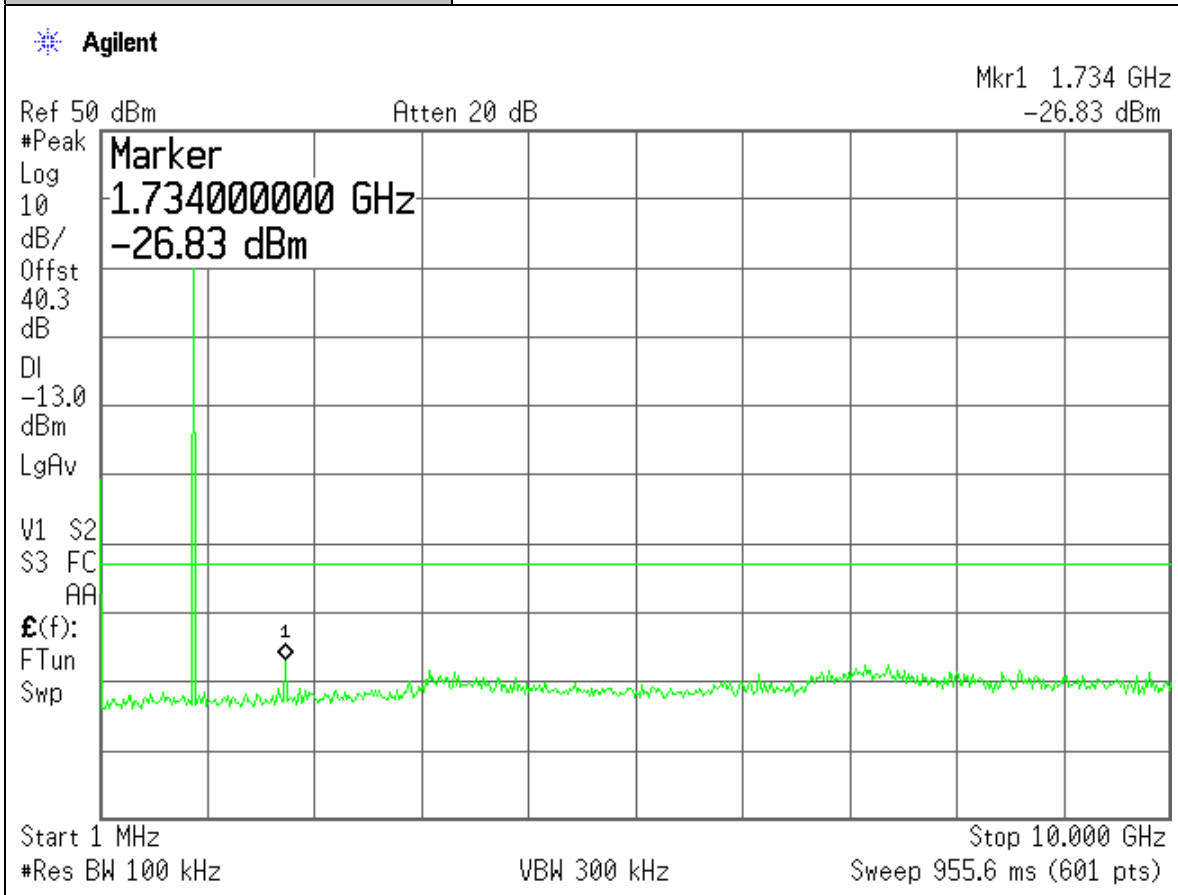
Project Number:	0048-110627-01
EUT:	ANDREW 800MHz 2x50W RRH RF101017
S/N:	YF11800044
Tested By:	Wei Li
Temperature:	70°F
Humidity:	30%

Section:	Spurious Emissions at RF Output Port: 800MHz Band / CDMA Modulation
Plot Name:	TX, Low-Ch, Multi-Carriers
Configuration:	Input: DIGITAL, Output Port: EUT RF OUTPUT



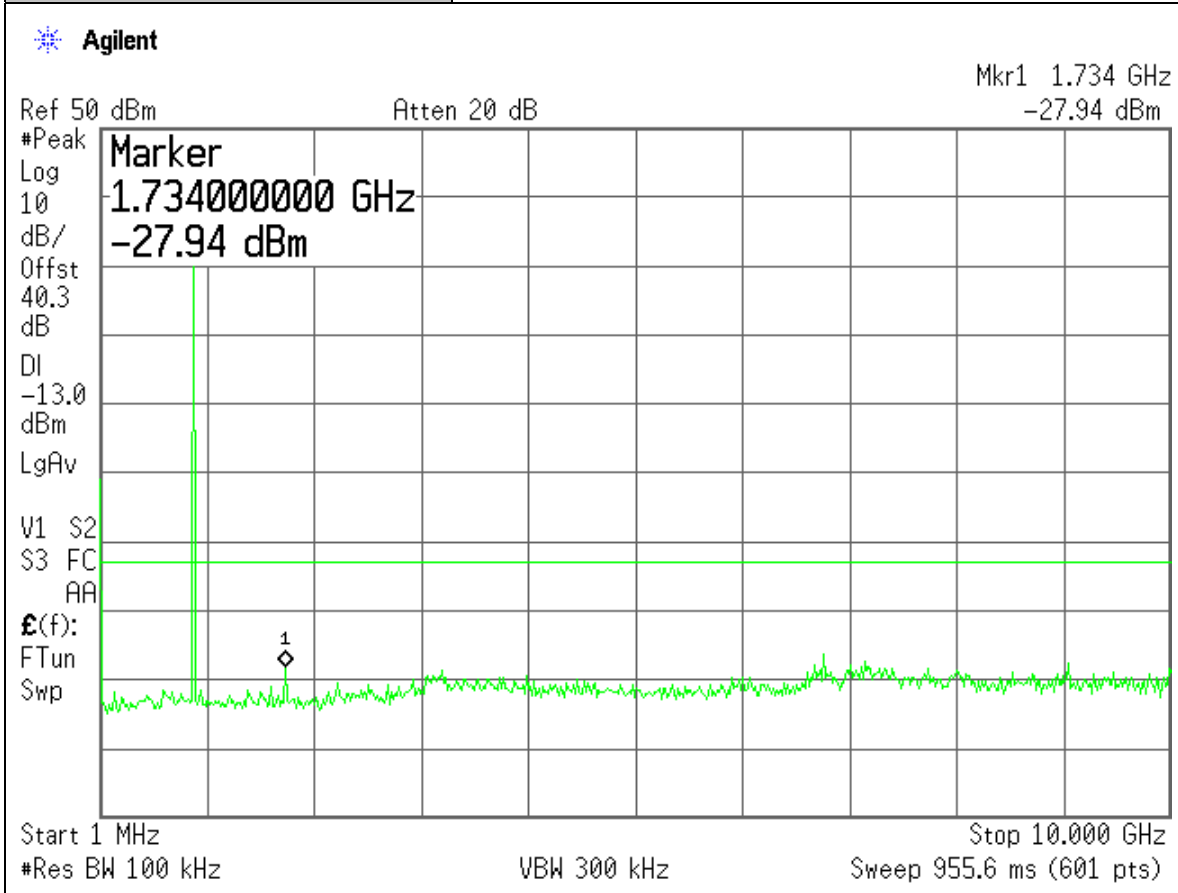
Project Number:	0048-110627-01
EUT:	ANDREW 800MHz 2x50W RRH RF101017
S/N:	YF11800044
Tested By:	Wei Li
Temperature:	70°F
Humidity:	30%

Section:	Spurious Emissions at RF Output Port: 800MHz Band / CDMA Modulation
Plot Name:	TX, Mid-Ch, Multi-Carriers
Configuration:	Input: DIGITAL, Output Port: EUT RF OUTPUT



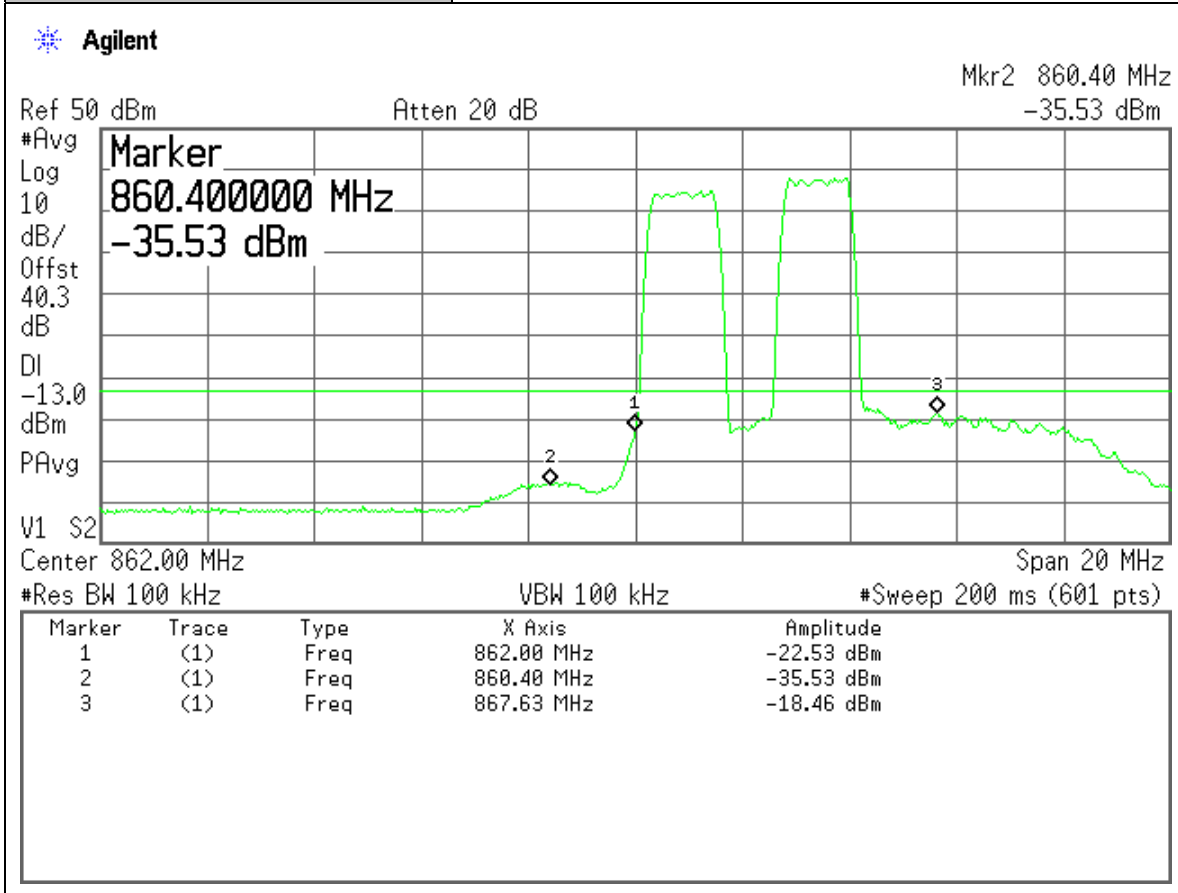
Project Number:	0048-110627-01
EUT:	ANDREW 800MHz 2x50W RRH RF101017
S/N:	YF11800044
Tested By:	Wei Li
Temperature:	70°F
Humidity:	30%

Section:	Spurious Emissions at RF Output Port: 800MHz Band / CDMA Modulation
Plot Name:	TX, High-Ch, Multi-Carriers
Configuration:	Input: DIGITAL, Output Port: EUT RF OUTPUT



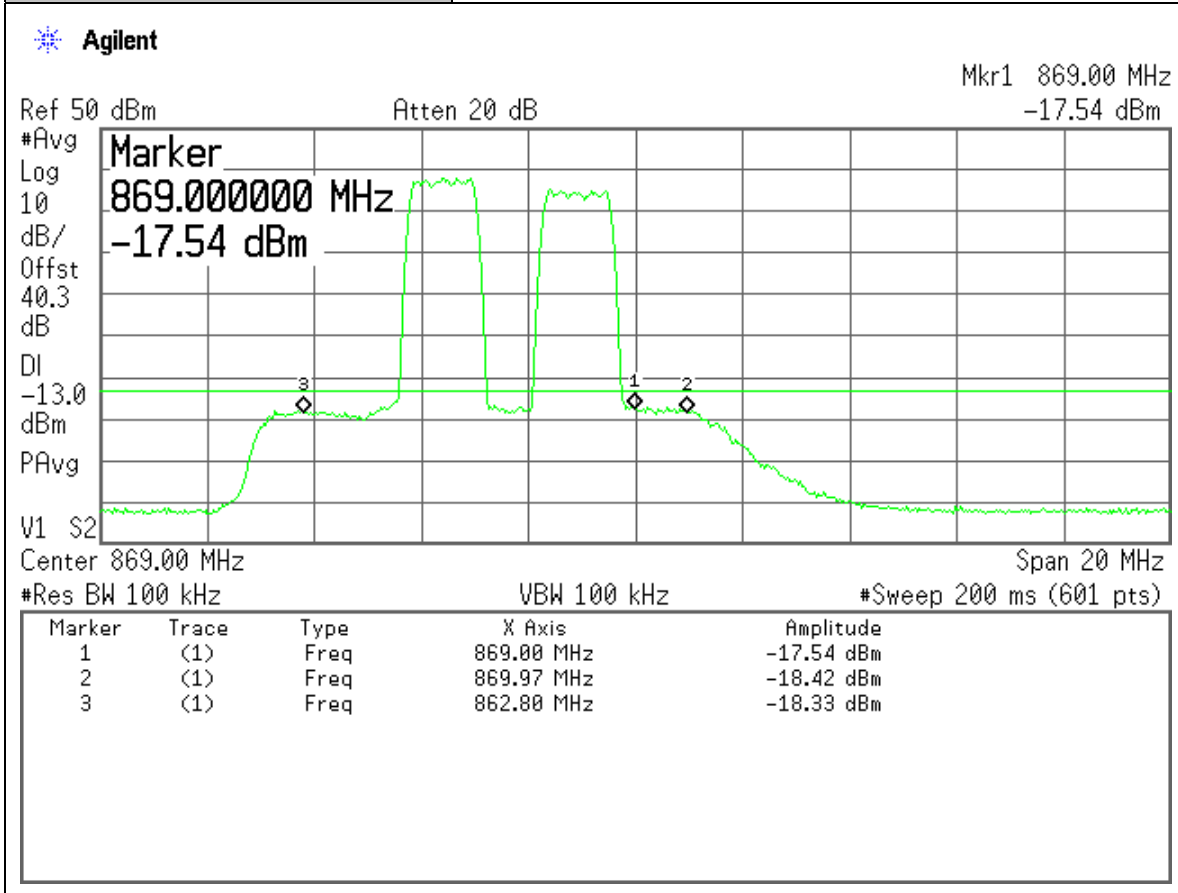
Project Number:	0048-110627-01
EUT:	ANDREW 800MHz 2x50W RRH RF101017
S/N:	YF11800044
Tested By:	David Tu
Temperature:	70°F
Humidity:	30%

Section:	Spurious Emissions at RF Output Port: 800MHz Band / CDMA Modulation
Plot Name:	TX, L-CH, Multi-Carriers, Inter-modulation
Configuration:	Input: DIGITAL, Output Port: EUT RF OUTPUT



Project Number:	0048-110627-01
EUT:	ANDREW 800MHz 2x50W RRH RF101017
S/N:	YF11800044
Tested By:	David Tu
Temperature:	70°F
Humidity:	30%

Section:	Spurious Emissions at RF Output Port: 800MHz Band / CDMA Modulation
Plot Name:	TX, H-CH, Multi-Carriers, Inter-modulation
Configuration:	Input: DIGITAL, Output Port: EUT RF OUTPUT



Section 6. Field Strength of Spurious

Name of Test:	<i>Field Strength of Spurious</i>	Test Standard:	2.1053 90.691
Tested By:	DAVID TU	Test Date:	7/5/2011-7/22/2011

Minimum Per FCC Part 90.691:

Standard: For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $43 + 10\text{Log}_{10}(P)$ decibels (-13dBm) or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

Method of TIA/EIA-603, Section 2.2.12

Measurement: The antenna substitution method was used to determine the equivalent radiated power at spurious frequencies. The spurious emissions were measured at a distance of 3 meters. The EUT was then replaced with a reference substitution antenna with a known gain referenced to a dipole. This antenna was fed with a signal at the spurious frequency. The level of the signal was adjusted to repeat the previously measured level. The resulting ERP is the signal level fed to the reference antenna corrected for gain referenced to a dipole.

Test Result:

Complies

Test Data:

See Attached Table(s)

Configuration	CDMA Modulation w/ RF Output Port Terminated
Band	800MHz Band
Channel	Low

Freq. (MHz)*	H,V	SA Reading (dBuV)	SG Reading (dBm)	CL (dB)	Gain (dBi)	ERP (dBm)	Limit (dBm)	Margin (dB)
2588.7	H	35.6	-69	1.3	9.0	-63.45	-13	-50.45
2588.5	V	34.5	-70	1.3	9.0	-64.45	-13	-51.45

***No other significant emissions were found in the rest frequency range.**

NOTE:

SA: Spectrum Analyzer

SG: Signal Generator

CL: Cable loss (6ft)

H=horizontal and V=vertical

ERP = SG reading - CL + Gain (dBi)-2.15

Margin = ERP - Limit

Configuration	CDMA Modulation w/ RF Output Port Terminated
Band	800MHz Band
Channel	Middle

Freq. (MHz)*	H,V	SA Reading (dBuV)	SG Reading (dBm)	CL (dB)	Gain (dBi)	ERP (dBm)	Limit (dBm)	Margin (dB)
2596.2	H	34.1	-71	1.3	9.0	-65.45	-13	-50.45
2596.3	V	36.8	-68	1.3	9.0	-62.45	-13	-49.45

***No other significant emissions were found in the rest frequency range.**

NOTE:

SA: Spectrum Analyzer

SG: Signal Generator

CL: Cable loss (6ft)

H=horizontal and V=vertical

ERP = SG reading - CL + Gain (dBi)-2.15

Margin = ERP - Limit

Configuration	CDMA Modulation w/ RF Output Port Terminated
Band	800MHz Band
Channel	High

Freq. (MHz)	H,V	SA Reading (dBuV)	SG Reading (dBm)	CL (dB)	Gain (dBi)	ERP (dBm)	Limit (dBm)	Margin (dB)
2603,6	H	35.2	-70	1.3	9.0	-64.45	-13	-51.45
2603.6	V	33.5	-71	1.3	9.0	-65.45	-13	-52.45
4331.0	H	38.9	-65	2.3	10.5	-58.98	-13	-49.95

***No other significant emissions were found in the rest frequency range.**

NOTE:

****SA:** Spectrum Analyzer

SG: Signal Generator

CL: Cable loss (6ft)

H=horizontal and V=vertical

ERP = SG reading - CL + Gain (dBi)-2.15

Margin = ERP - Limit

Section 7. Frequency Stability

Name of Test:	<i>Frequency Stability</i>	Test Standard:	<i>2.1055 90.213</i>
Tested By:	WEI LI	Test Date:	7/5/2011-7/22/2011

Minimum Standard: Para No. 90.213, the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.
 Defined as +/- 1.5ppm for this EUT, which would be in the range of 1.294KHz to 1.302KHz.

Method of Measurement: Para No. 2.1055:
 Frequency Stability With Voltage Variation:
 The E.U.T. is placed in an environmental chamber and allowed to stabilize at +25 degrees Celsius for at least 15 minutes. The following setup is used for frequency error measurement. In this case, input voltage range is EUT's extended operational voltage range, which is greater than +/-15% variation of S.T.V..

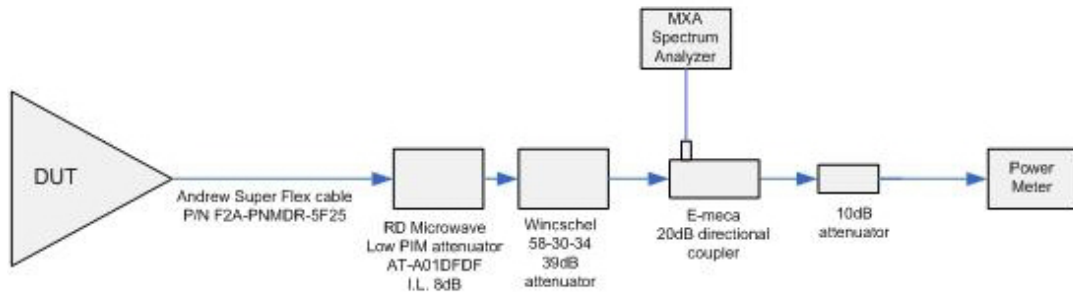
Frequency Stability With Temperature Variation:
 The input voltage to the E.U.T. is set to S.T.V. and the temperature of the environmental chamber is varied from -40 degrees C to +50 degrees C (wider than the range of -30C to 50C). The E.U.T. is allowed to stabilize at each temperature and the frequency is measured.

Test Result: **Complies**

Test Data: See Attached Table(s)

Test Setup

The EUT(DUT) was tested for Frequency Error measurements using the following setup.



Setup repeated for two outputs

Frequency Stability vs . Voltage & Temperature

The following measurements were taken using a digital input signal via the CPRI interface. Frequency Error of the RRH will be directly related to frequency accuracy of the Base-station CPRI clock. The RRH extracts the base-clock (61.44MHz) from the CPRI link and phase-locks to this base-rate.

Nominal voltage = -48 VDC

Voltage (Vac)	Current (A)	Output Pwr TX1 (dBm)	Output Pwr TX2 (dBm)	Channel	Nominal Channel Frequency (MHz)	Frequency Error(mHz)	FCC Limit in ppm	Temperature Degrees C
-48	7.99	46.69	46.72	576	865.4	24.16	1.5	25
-37	10.54	46.66	46.71	576	865.4	24.01	1.5	25
-58	6.63	46.68	46.72	576	865.4	24.01	1.5	25
-48	7.48	46.59	46.61	576	865.4	24.28	1.5	-40
-37	9.75	46.57	46.61	576	865.4	23.65	1.5	-40
-58	6.16	46.54	46.60	576	865.4	23.88	1.5	-40
-48	8.23	46.55	46.61	576	865.4	23.14	1.5	50
-37	10.85	46.65	46.62	576	865.4	23.53	1.5	50
-58	6.80	46.55	46.61	576	865.4	24.04	1.5	50

Conclusion: max. frequency error = 24.28Hz, i.e. 0.028ppm < the limit 1.5ppm

Section 8. Test Equipment List

Manufacture	Model	Serial No.	Description	Cal Due dd/mm/ yy
HP	HP8546A	3448A00290	EMI Receiver	15/09/11
HP	E4432B	US38220355	250K-3GHz Signal Generator	15/07/12
EMCO	3104C	9307-4396	20-300MHz Biconical Antenna	15/09/11
EMCO	3146	9008-2860	200-1000MHz Log-Periodic Antenna	02/09/11
Fischer Custom	LIPARTS NO.-2	900-4-0008	Line Impedance Stabilization Networks	15/09/11
Fischer Custom	LIPARTS NO.-2	900-4-0009	Line Impedance Stabilization Networks	23/08/11
EMCO	6502	2665	10KHz-30MHz Active Loop Antenna	27/02/12
EMCO	3115	4945	Double Ridge Guide Horn Antenna	13/09/11
HP	8569B	2607A02802	1GHz-22GHz Spectrum Analyzer	10/02/12
Delta Design	5900C	0-67-26	Temperature Chamber	24/03/12
HP	E8254A	US42110367	Signal Generator	23/03/12
Electro-Metrics	RGA-15	8-95	Double Ridge Guide Horn Antenna	10/02/12
EMCO	3116	4943	Double Ridge Guide Horn Antenna	11/01/12
Scientific-Atlanta	12A-18	441	Wave Guide Horn Antenna	04/08/11
HP	4419A	US37292112	RF Power Meter w/ Sensor Probe	20/07/12
Chamber	GD-32-33	LN2	Temperature Chamber	28/07/12
HP	6032A	3323A-09526	System Power Supply	01/07/12
Agilent	E4438C	US41460731	ESG Vector Signal Generator	01/07/12
Agilent	E4438C	US41460771	ESG Vector Signal Generator	01/07/12
Agilent	E4438C	US41460400	ESG Vector Signal Generator	01/07/12
Lorch Microwave	5NF- 800/1000-S	AC3	Notch Filter	
Lorch Microwave	5NF- 1800/2200-S	AE10	Notch Filter	
RES-NET	RFA500NFF 30	0108	30dB in-line Power Attenuator	
Narda	3022	80986	Directional Coupler	
General Purpose			0-60V, 50A DC Power Supply	