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Compliance Laboratory**

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**Electromagnetic
Emission
Compliance
Test Report**



**Equipment Under Test
(EUT)
Applicant**

RRH 2x40W 700MHz
RF101002
CommScope Corporation
(Formerly Andrew Corporation)

In Accordance With

FCC Part 27 & Part 2

Tested by

Advanced Compliance Laboratory, Inc.
210 Cougar Court
Hillsborough, New Jersey 08844

Authorized by

Wei Li
Lab Manager

Signature

Date

October 8, 2018

**AC Lab Report
Number**

0048-181008-01



Lab Code:200101-0

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

Table of Contents

Section 1. Summary of Test Results 3

Section 2. General Equipment Specification 5

Section 4. Occupied Bandwidth..... 10

Section 5. Spurious Emissions at Antenna Terminals 15

Section 6. Field Strength of Spurious 31

Section 7. ACL Test Equipment List..... 35

Section 8. FCC ID Labeling..... 36

Section 9. Setup Photos..... 37

Section 10. EUT Photos 41

Section 1. Summary of Test Results

Manufacturer: CommScope Corporation
(Formerly Andrew Corporation)

Product Name: RRH 2x40W 700MHz

Model/Parts No. : RF101002

S/N: LBALLUASZ1423P0092

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 27. Test Method complies with the requirement in Document, ANSI/TIA-603-D-2010.

☐ 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

RF Power Output	27.50(c)	1000W/MHz ERP	Complies
Occupied Bandwidth (Digital)	2.1049(i)	Mask	Complies
Emissions	27.53(c)	27.53(c)(1)(3)(5)(6)	Complies
Emissions	27.53(f)	27.53(f)	*

* This item is NOT applied to the EUT.

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: October 8, 2018

Section 2. General Equipment Specification

Supply Voltage	-48V(extended: -39.5V to -57V)				
Frequency Range	700MHz Band /Block upper C	TX/ 746 MHz- 756MHz			
		RX/ 777MHz-787MHz			
Modulation	☒ LTE	☐ CDMA	☐ GSM	☐ EDGE	☐ TDMA
Type of Emissions	F9W	F9W	GXW	G7W	DXW
Rated Power	40W (46.02dBm) average @ each Tx Port Total two Tx Ports presented with total combined output power: 80W				
Output Impedance /Nominal OCBW	50ohm / 9MHz				
Frequency Translation	F1-F1 ☐	F1-F2 ☐	N/A ☒		
	Software ☒	Duplexer Change ☐	Full Band Coverage ☐		

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).

RF101002 RRH

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

Measured Rated RF output per Tx port: 46.01dBm (39.90W)

Measured DC voltage: -48.0V

Measured DC current: 7.29A.

Measured Minimum RF output per Tx port: -17.31dBm (0.019mW)

Measured DC voltage: -48.0V

Measured DC current: 2.74A

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

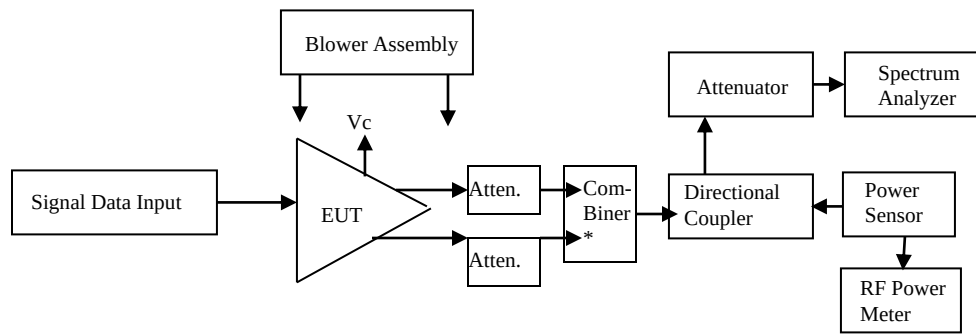
The EUT operated in FCC 700MHz band, has two identical sections, each has one RF transmitter & one receiver, and a double duplex filter.

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

System Diagram

See Attachment.

General EUT Setup



* Combiner is for TX1+Tx2 testing mode. No need for each individual Tx port testing mode.

Operational Frequency channel(s) for testing:

- One CH: 751MHz
- Channel BW: 10MHz.

Section 3. RF Output Power

Name of Test:	<i>RF Output Power</i>	Test Standard:	<i>27.50 (c)</i>
Tested By:	WEI LI	Test Date:	6/11/2018

Minimum Standard: Para. No. 27.50(c) (3):
Fixed and base stations transmitting a signal with an emission bandwidth greater than 1 MHz must not exceed an ERP of 1000 watts/MHz and an antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 1000 watts/MHz ERP in accordance with Table 3 of this section.

Method of Measurement: The EUT is a RF amplifier. 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 +46.02 dBm (40 watts) +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 (if applicable) for all selected modulations listed on Page 5.

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 central frequency, 751MHz.

TX1 Port

OPERATION Band	DC Voltage	Modulation	Power Output (dBm)	Rated Power (dBm)	Tolerance
TX	-48V	LTE	45.85 (38.46W)	46.02	-0.17
	-39.5V	LTE	45.85	46.02	-0.17
	-57V	LTE	45.83	46.02	-0.19
Ref Offset	Ref offset=Cable&Attenuator&Coupler Attenuation=39.1dB				

TX2 Port

OPERATION Band	DC Voltage	Modulation	Power Output (dBm)	Rated Power (dBm)	Tolerance
TX	-48V	LTE	46.01 (39.90W)	46.02	-0.01
	-39.5V	LTE	46.01	46.02	-0.01
	-57V	LTE	46.00	46.02	-0.02
Ref Offset	Ref offset=Cable&Attenuator&Coupler Attenuation=39.1dB				

TX1 +Tx2 Ports

Max. combined output power (calculated): 38.46W+39.9W=78.36W, i. e. 48.94dBm.

Conclusion:

Each TX port delivered the same output RF power level, 40W. Combined output power for two Tx ports is 79.53 (calculated). Both meet 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:	6/11/2018-6/28/2018

Minimum Standard: Not defined by FCC. Input vs. Output.
Or defined Mask

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 specification
RF level: Rated, recommended by manufacturer

Test Result:

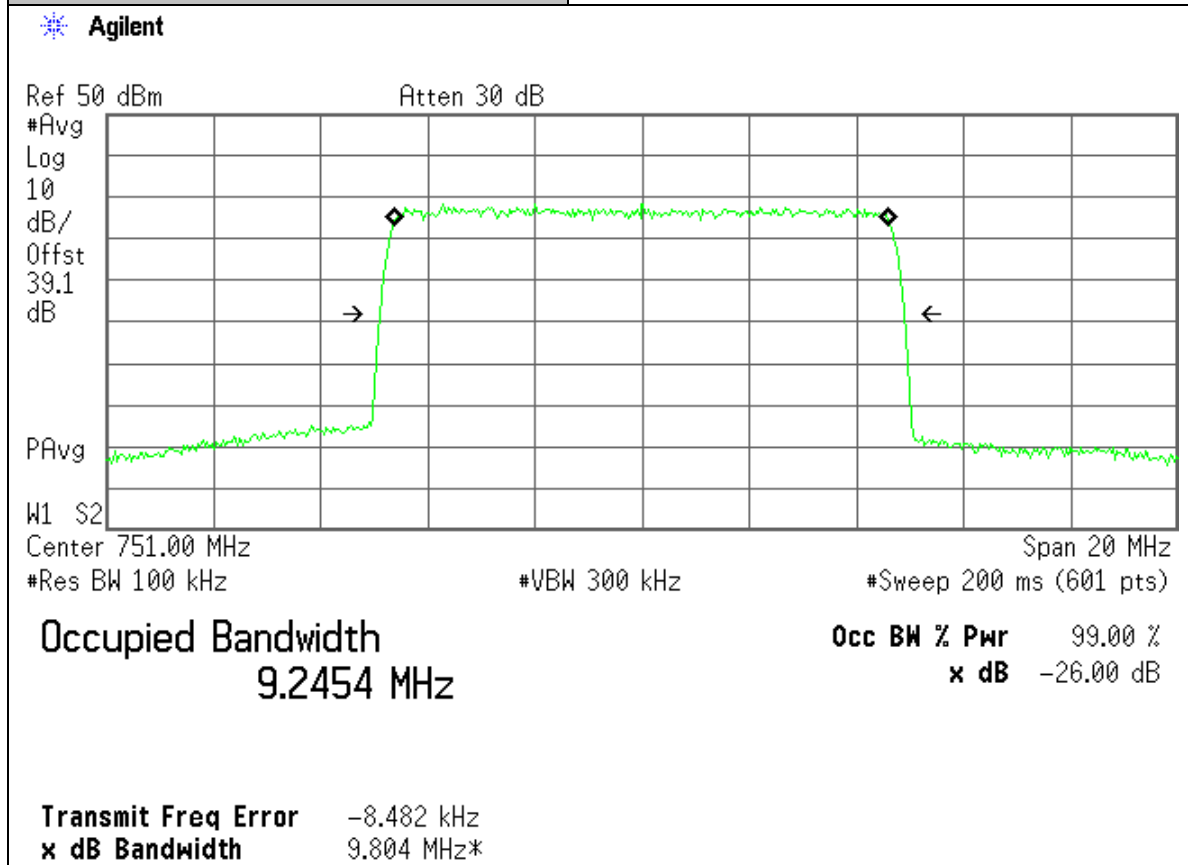
Complies

Test Data:

Attached Plots

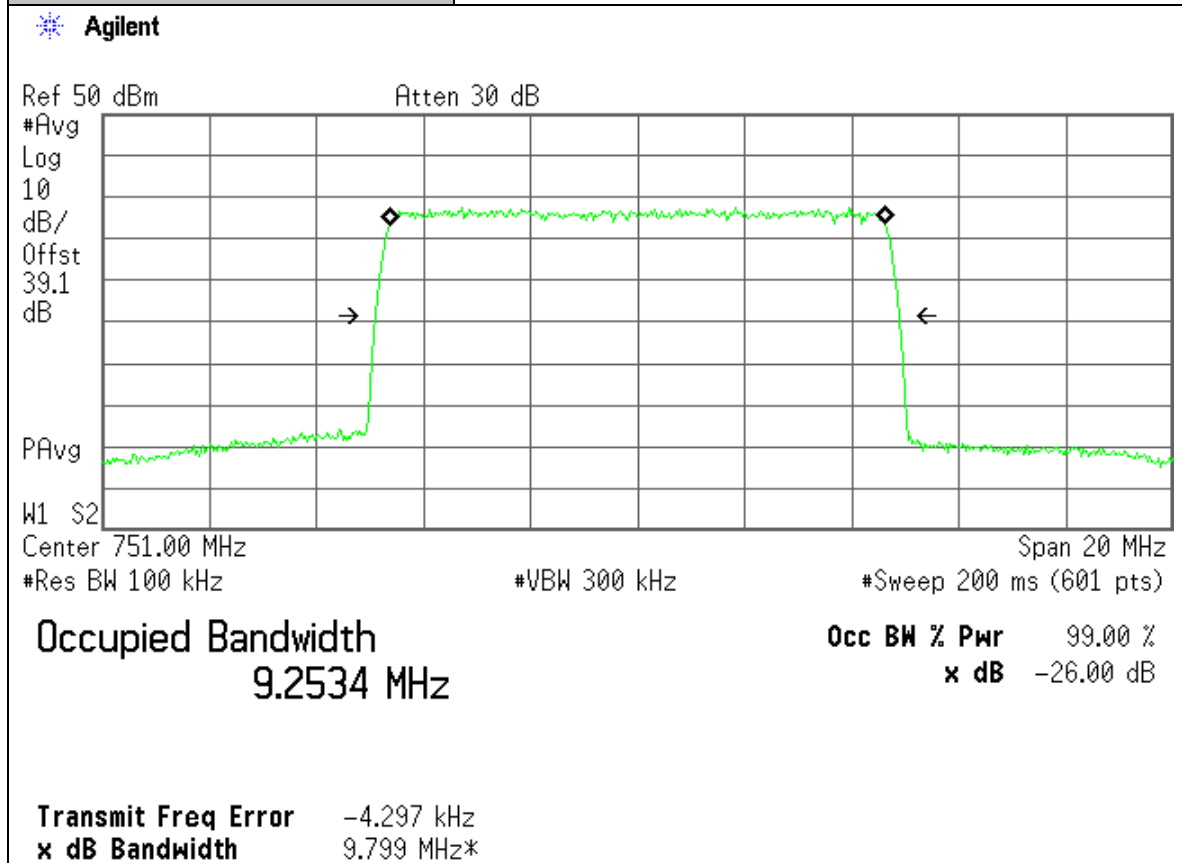
Project Number:	0048-100315-01R
EUT:	ANDREW RRH 2x40W 700MHz RF101002
S/N:	LBALLUASZ1423P0092
Tested By:	Wei Li
Temperature:	70° F
Humidity:	30%

Section:	Occupied Bandwidth: 700MHz Upper C Band
Plot Name:	One TX, Mid-Channel, LTE Modulation
Configuration:	Input: DIGITAL, Output Port: EUT RF OUTPUT



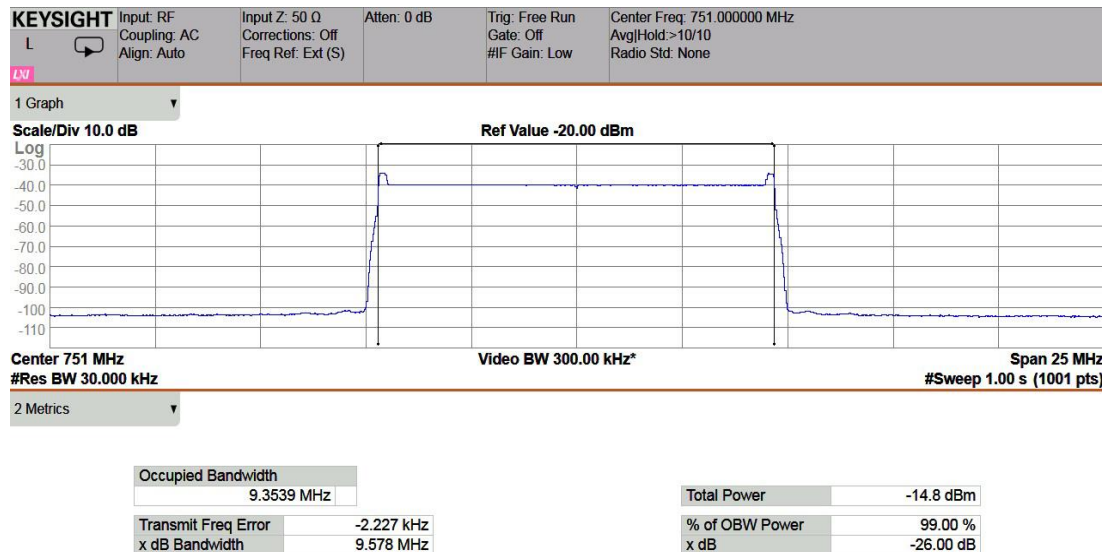
Project Number:	0048-100315-01R
EUT:	ANDREW RRH 2x40W 700MHz RF101002
S/N:	YF100900062
Tested By:	Wei Li
Temperature:	70° F
Humidity:	30%

Section:	Occupied Bandwidth: 700MHz Upper C Band
Plot Name:	Two TX combined, Mid-Channel, LTE Modulation
Configuration:	Input: DIGITAL, Output Port: EUT RF OUTPUT



Project Number:	0048-100315-01R
EUT:	ANDREW RRH 2x40W 700MHz RF101002
S/N:	LBALLUASZ1423P0092
Tested By:	Wei Li
Temperature:	70° F
Humidity:	30%

Section:	Occupied Bandwidth: 700MHz Upper C Band
Plot Name:	TX, Mid-Channel, LTE Modulation
Configuration:	Input: Transceiver Board



Section 5. Spurious Emissions at Antenna Terminals

Name of Test:	<i>Spurious Emissions at Antenna Terminals</i>	Test Standard:	27.53(c)
Tested By:	WEI LI DAVID TU	Test Date:	6/11/2018-6/28/2018

Minimum Per FCC Part 27.53 (c)

Standard: (1) On any frequency outside the 746–758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log (P)$ dB; (equivalent absolute limit: -13dBm).
(3) On all frequencies between 763–775 MHz and 793–805 MHz, by a factor not less than $76 + 10 \log (P)$ dB in a 6.25 kHz band segment, for base and fixed stations; (equivalent absolute limit: -46dBm).
(5) Compliance with the provisions of paragraphs (c)(1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed;
(6) Compliance with the provisions of paragraphs (c)(3) and (c)(4) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.

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.

* When operation is confined to a particular block, then the RRH must meet FCC limits at all block edges. If operation involves two or three blocks simultaneously, then the RRH must meet FCC limits at the edges of the combined blocks.

Test Result:

Complies

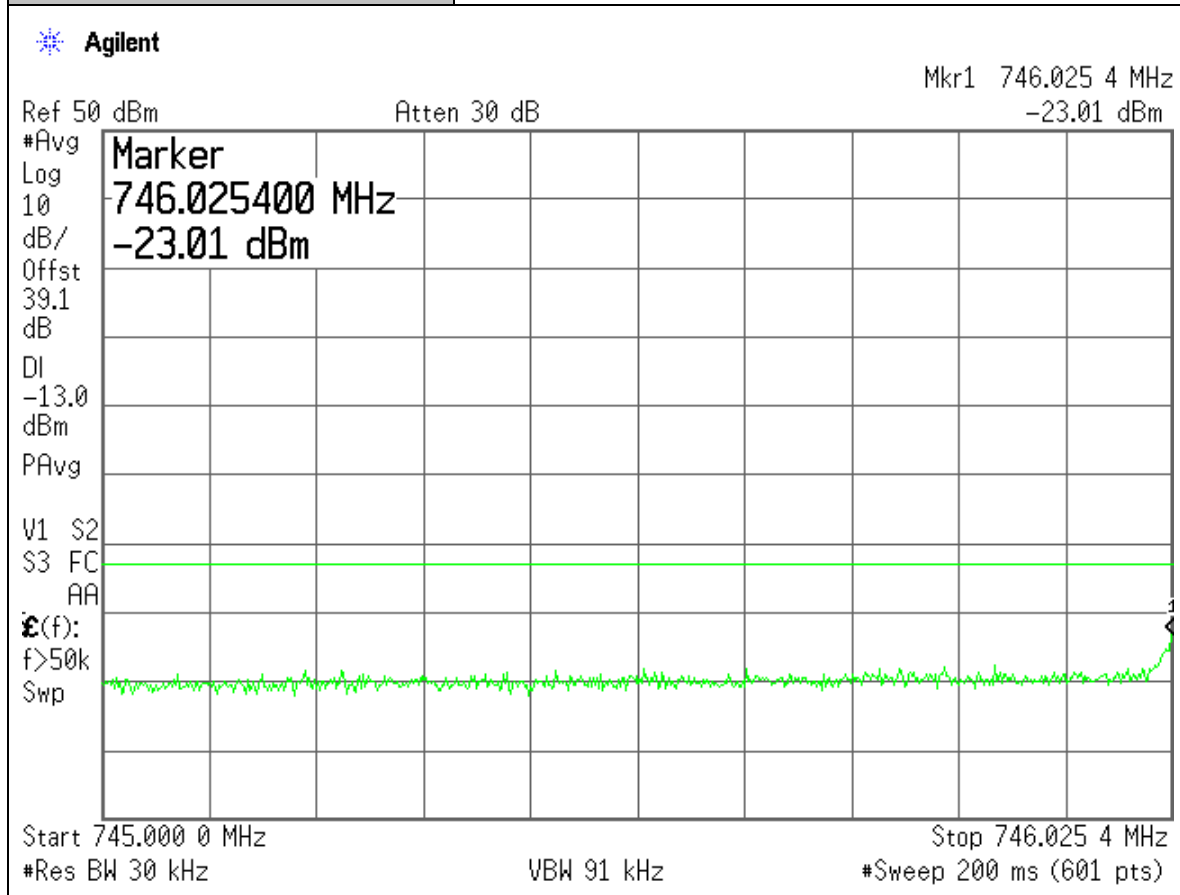
Test Data:

Attached Plots

1. Compliance to 27.53 (c) (1) & (3) for one Tx port

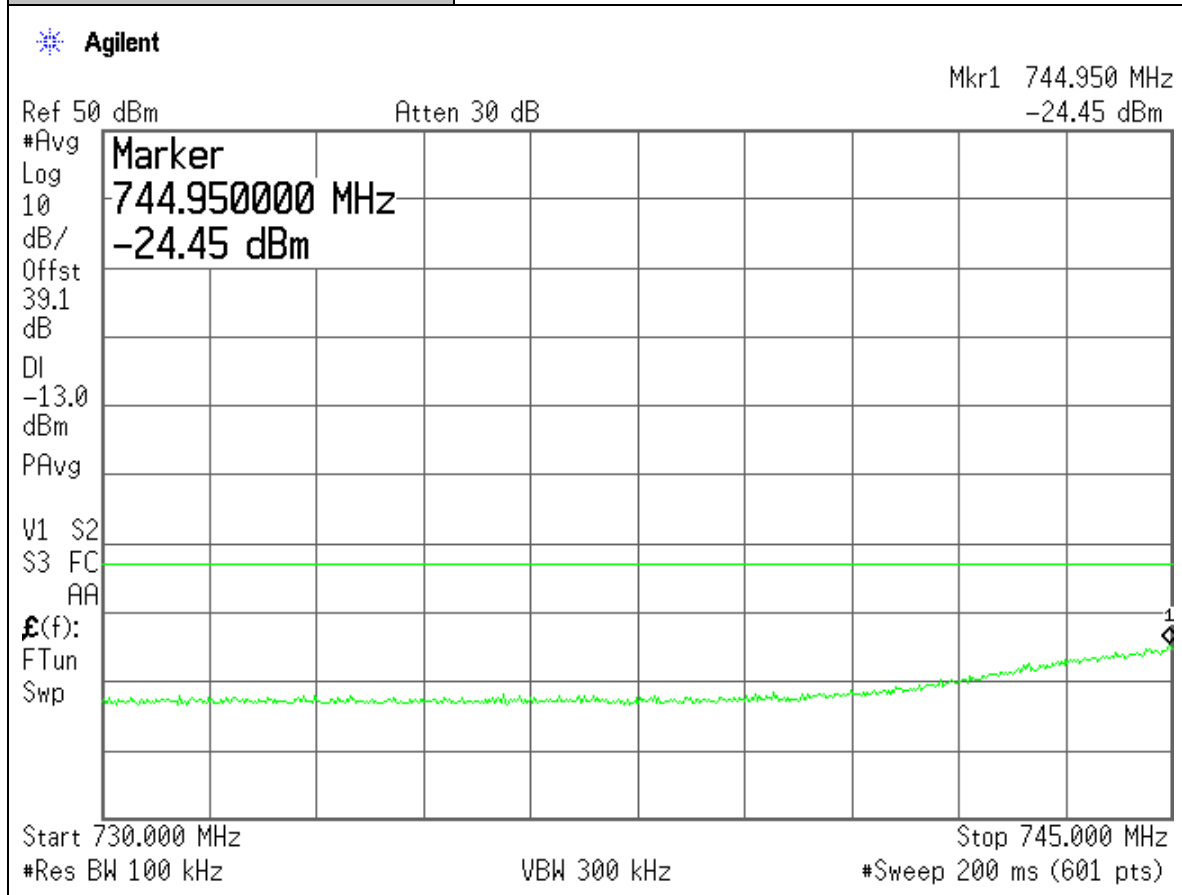
Project Number:	0048-100315-01R
EUT:	ANDREW RRH 2x40W 700MHz RF101002
S/N:	LBALLUASZ1423P0092
Tested By:	David Tu
Temperature:	70° F
Humidity:	30%

Section:	Spurious Emissions at RF Output Port: 700MHz Upper C Band / LTE Modulation
Plot Name:	TX, Mid-Ch, 100KHz outside & adjacent to Lower Band Edge
Configuration:	Input: DIGITAL, Output Port: EUT RF OUTPUT



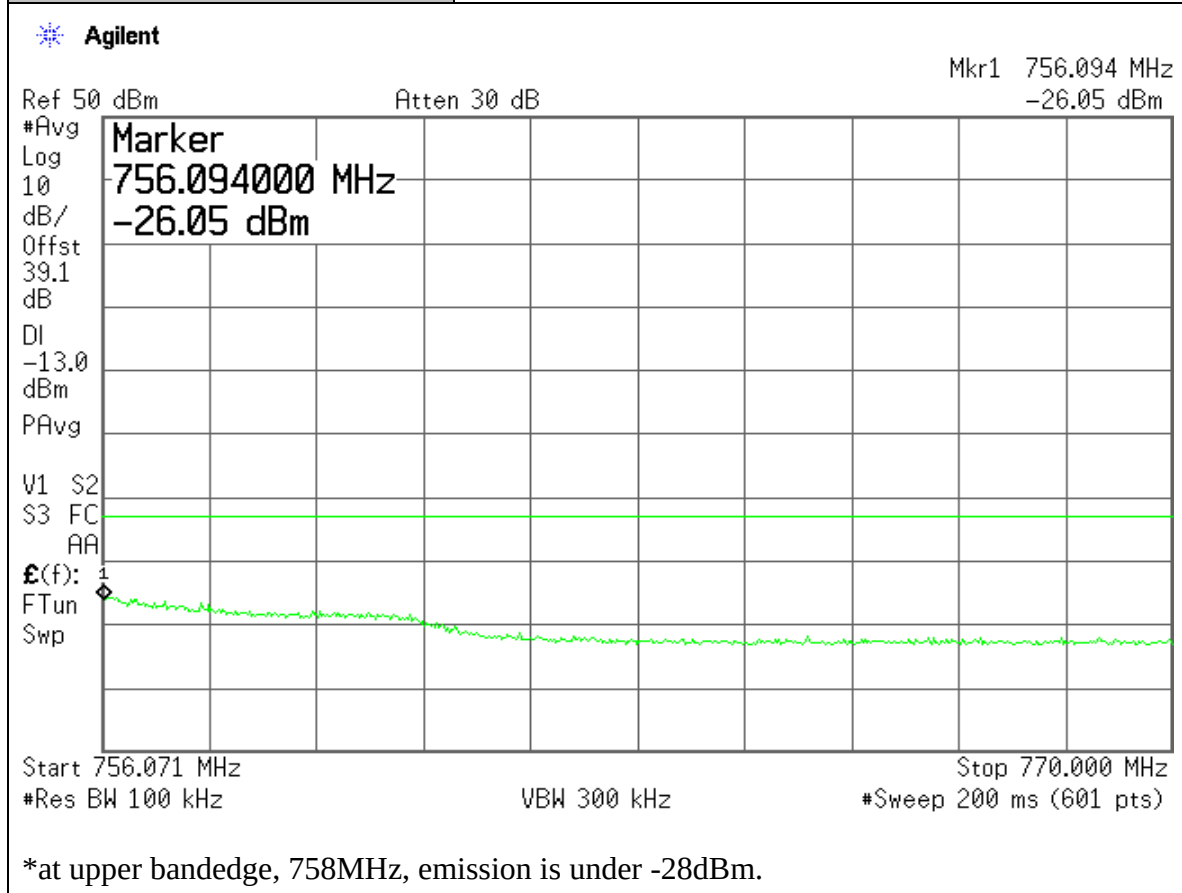
Project Number:	0048-100315-01R
EUT:	ANDREW RRH 2x40W 700MHz RF101002
S/N:	LBALLUASZ1423P0092
Tested By:	David Tu
Temperature:	70° F
Humidity:	30%

Section:	Spurious Emissions at RF Output Port: 700MHz Upper C Band / LTE Modulation
Plot Name:	TX, Mid-Ch, Lower Band Edge
Configuration:	Input: DIGITAL, Output Port: EUT RF OUTPUT



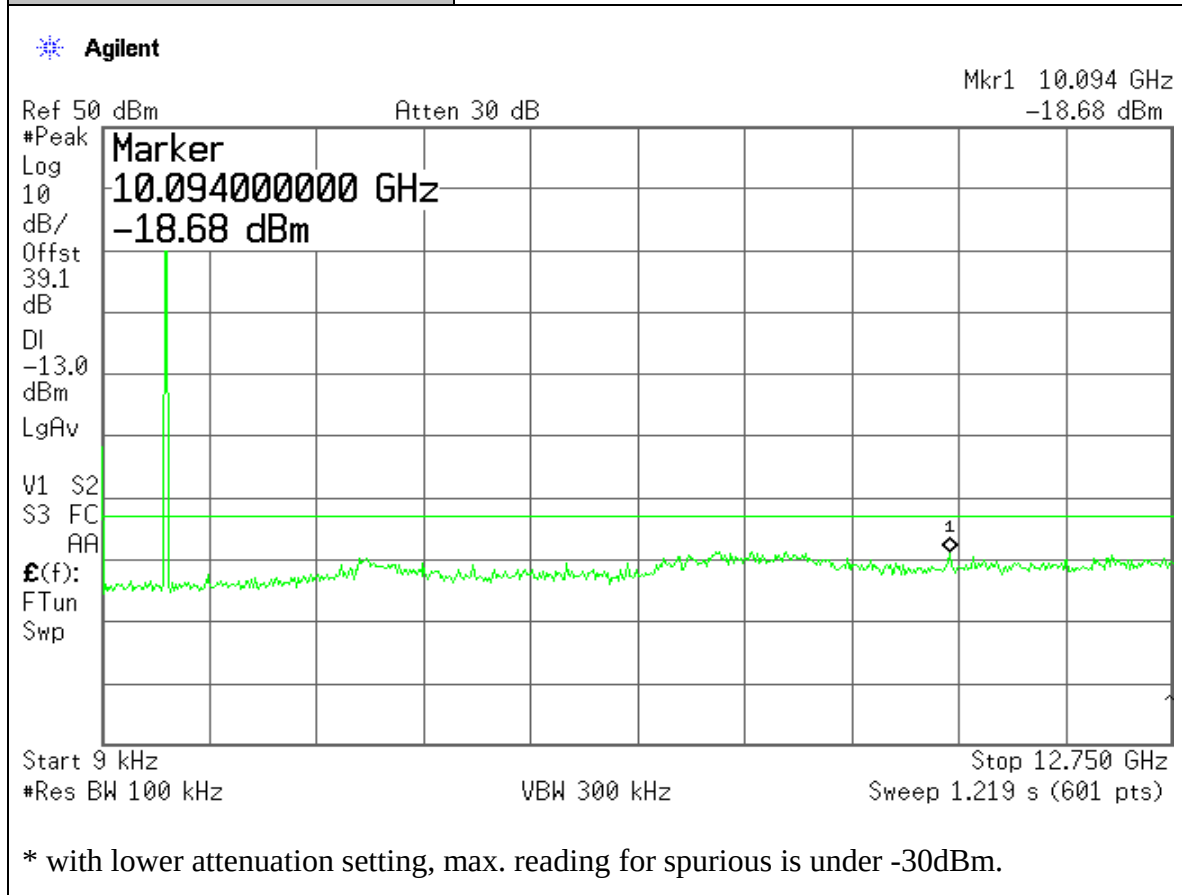
Project Number:	0048-100315-01R
EUT:	ANDREW RRH 2x40W 700MHz RF101002
S/N:	LBALLUASZ1423P0092
Tested By:	David Tu
Temperature:	70° F
Humidity:	30%

Section:	Spurious Emissions at RF Output Port: 700MHz Upper C Band / LTE Modulation
Plot Name:	TX, Mid-Ch, Upper Band Edge
Configuration:	Input: DIGITAL, Output Port: EUT RF OUTPUT



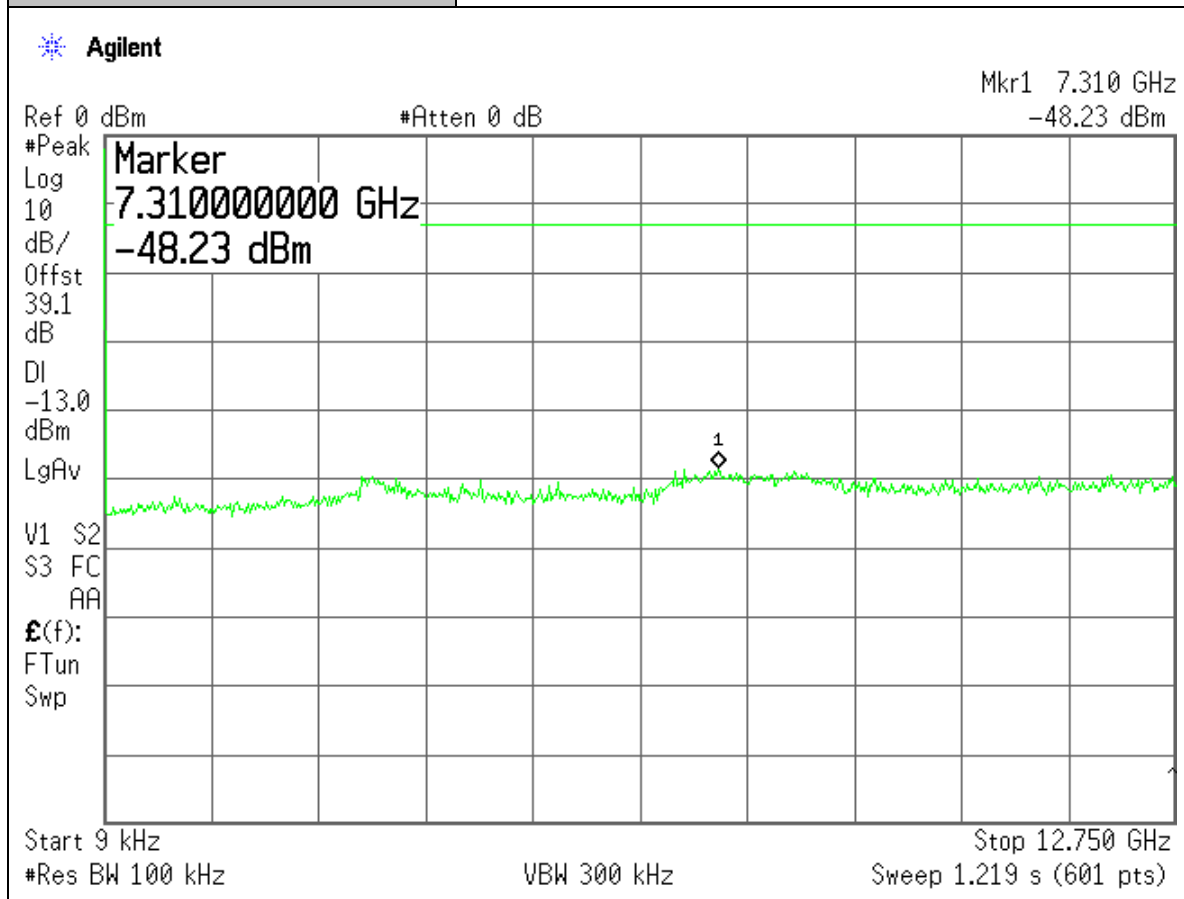
Project Number:	0048-100315-01R
EUT:	ANDREW RRH 2x40W 700MHz RF101002
S/N:	LBALLUASZ1423P0092
Tested By:	Wei Li
Temperature:	70° F
Humidity:	30%

Section:	Spurious Emissions at RF Output Port: 700MHz Upper C Band / LTE Modulation
Plot Name:	TX, Mid-Ch, RF ON
Configuration:	Input: DIGITAL, Output Port: EUT RF OUTPUT



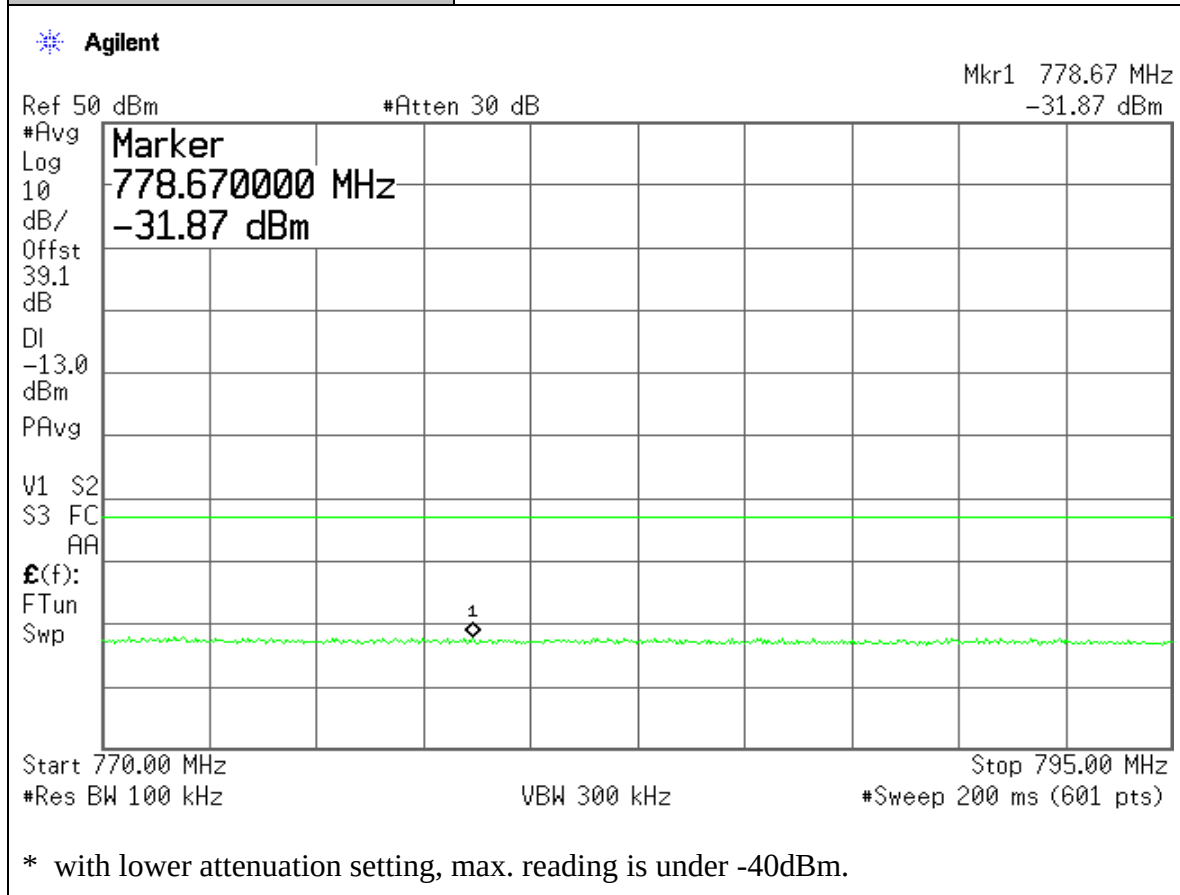
Project Number:	0048-100315-01R
EUT:	ANDREW RRH 2x40W 700MHz RF101002
S/N:	LBALLUASZ1423P0092
Tested By:	Wei Li
Temperature:	70°F
Humidity:	30%

Section:	Spurious Emissions at RF Output Port: 700MHz Upper C Band / LTE Modulation
Plot Name:	TX, Mid-Ch, RF OFF
Configuration:	Input: DIGITAL, Output Port: EUT RF OUTPUT



Project Number:	0048-100315-01R
EUT:	ANDREW RRH 2x40W 700MHz RF101002
S/N:	LBALLUASZ1423P0092
Tested By:	Wei Li
Temperature:	70° F
Humidity:	30%

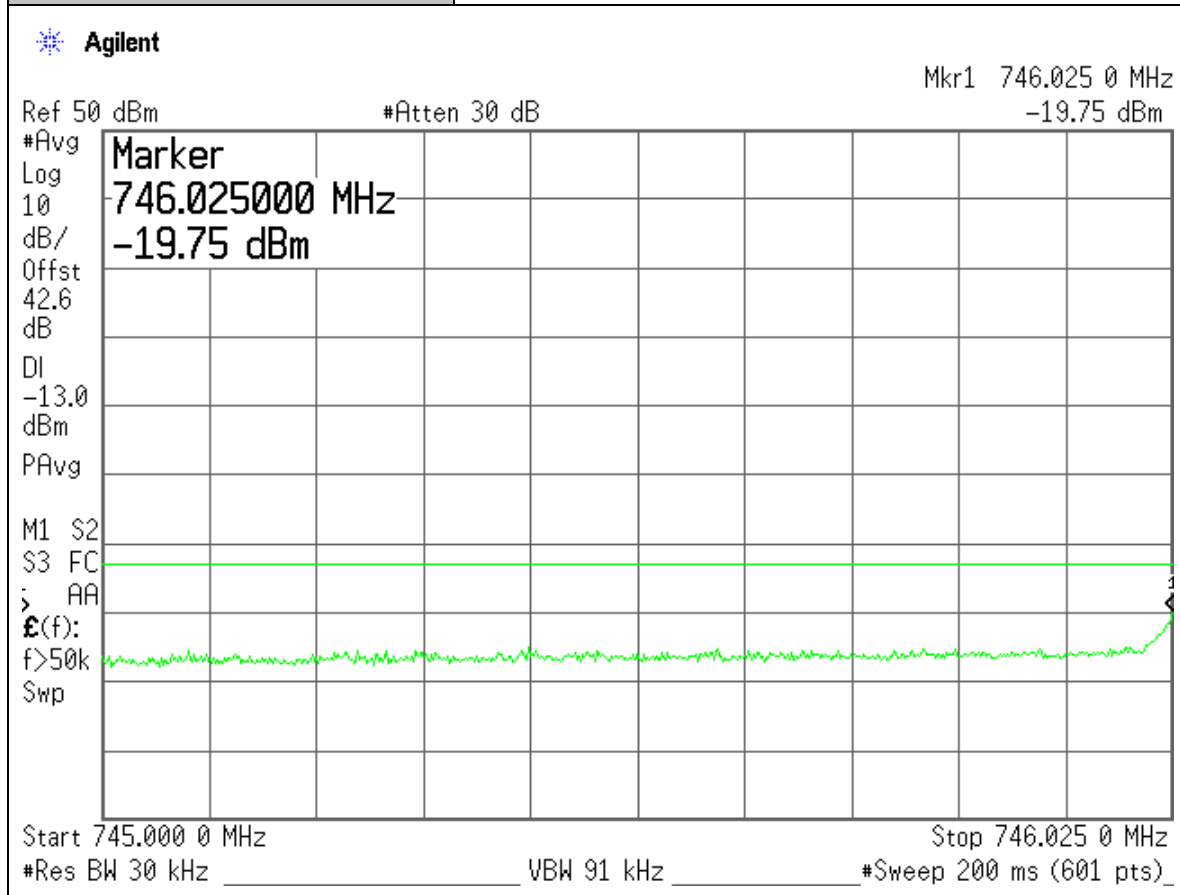
Section:	Spurious Emissions at RF Output Port: 700MHz Upper C Band / LTE Modulation
Plot Name:	RX Band
Configuration:	Output Port: EUT RF OUTPUT



2. Compliance to 27.53 (c) (1) & (3) for combined two Tx Ports

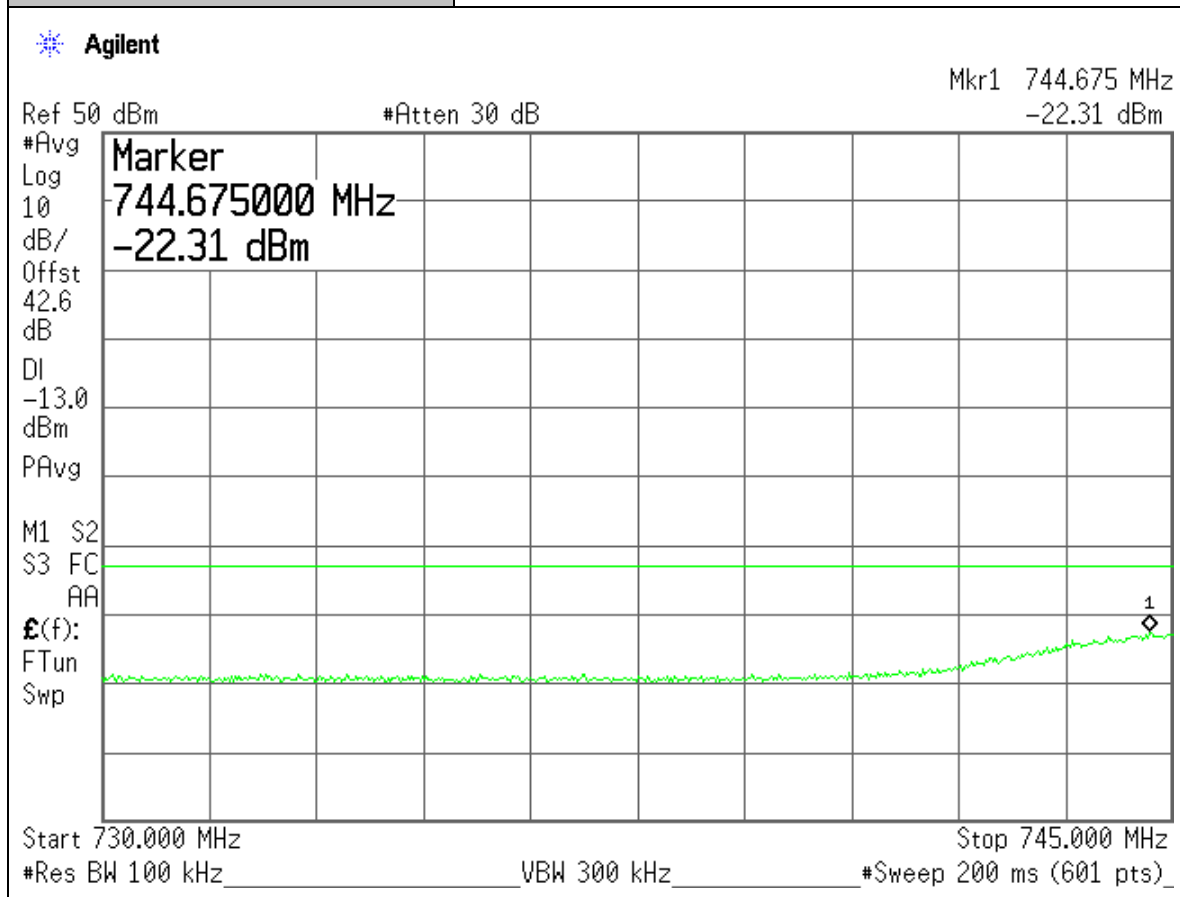
Project Number:	0048-100315-01R
EUT:	ANDREW RRH 2x40W 700MHz RF101002
S/N:	LBALLUASZ1423P0092
Tested By:	David Tu
Temperature:	70° F
Humidity:	30%

Section:	Spurious Emissions at RF Output Port: 700MHz Upper C Band / LTE Modulation
Plot Name:	TX, Mid-Ch, 100KHz outside & adjacent to Lower Bandedge
Configuration:	Input: DIGITAL, Output Port: EUT RF OUTPUT



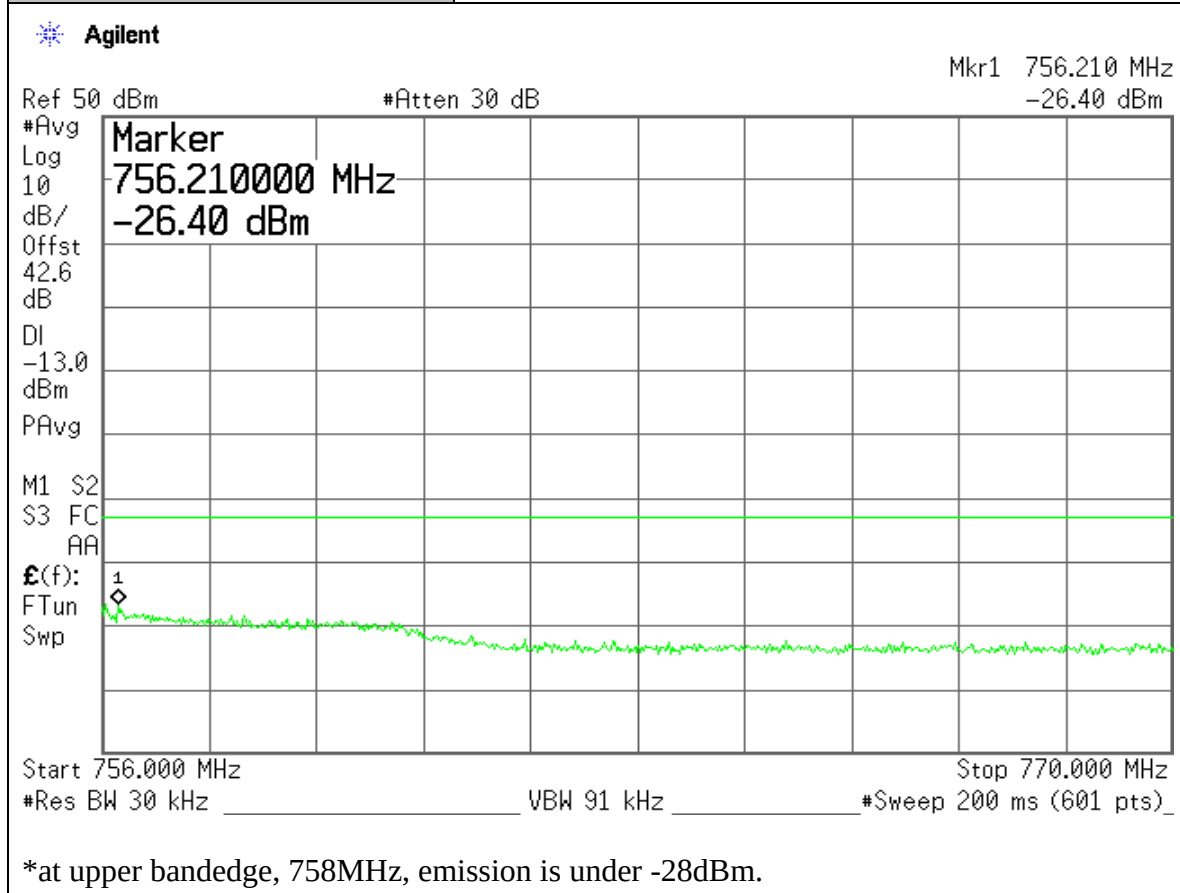
Project Number:	0048-100315-01R
EUT:	ANDREW RRH 2x40W 700MHz RF101002
S/N:	LBALLUASZ1423P0092
Tested By:	David Tu
Temperature:	70° F
Humidity:	30%

Section:	Spurious Emissions at RF Output Port: 700MHz Upper C Band / LTE Modulation
Plot Name:	TX, Mid-Ch, Lower Bandedge
Configuration:	Input: DIGITAL, Output Port: EUT RF OUTPUT



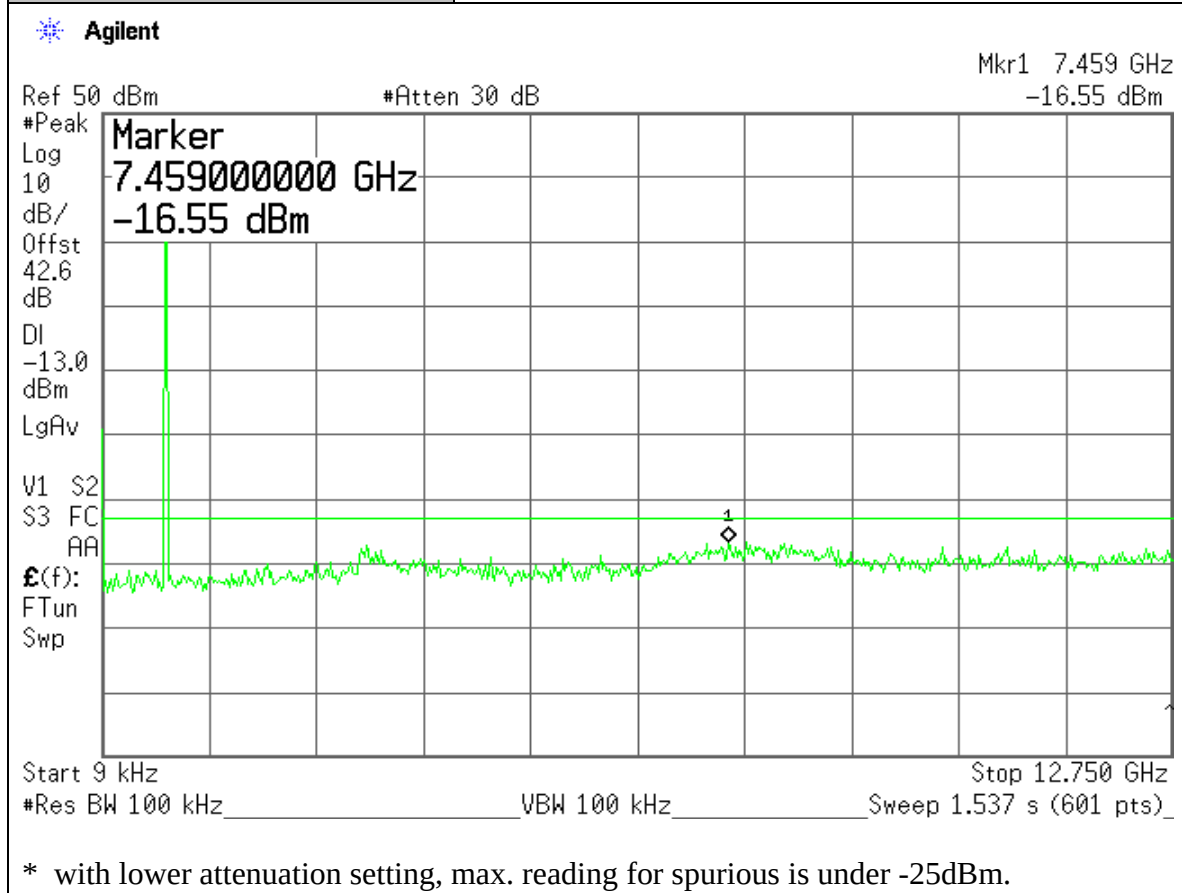
Project Number:	0048-100315-01R
EUT:	ANDREW RRH 2x40W 700MHz RF101002
S/N:	LBALLUASZ1423P0092
Tested By:	David Tu
Temperature:	70° F
Humidity:	30%

Section:	Spurious Emissions at RF Output Port: 700MHz Upper C Band / LTE Modulation
Plot Name:	TX, Mid-Ch, Upper Bandedge
Configuration:	Input: DIGITAL, Output Port: EUT RF OUTPUT



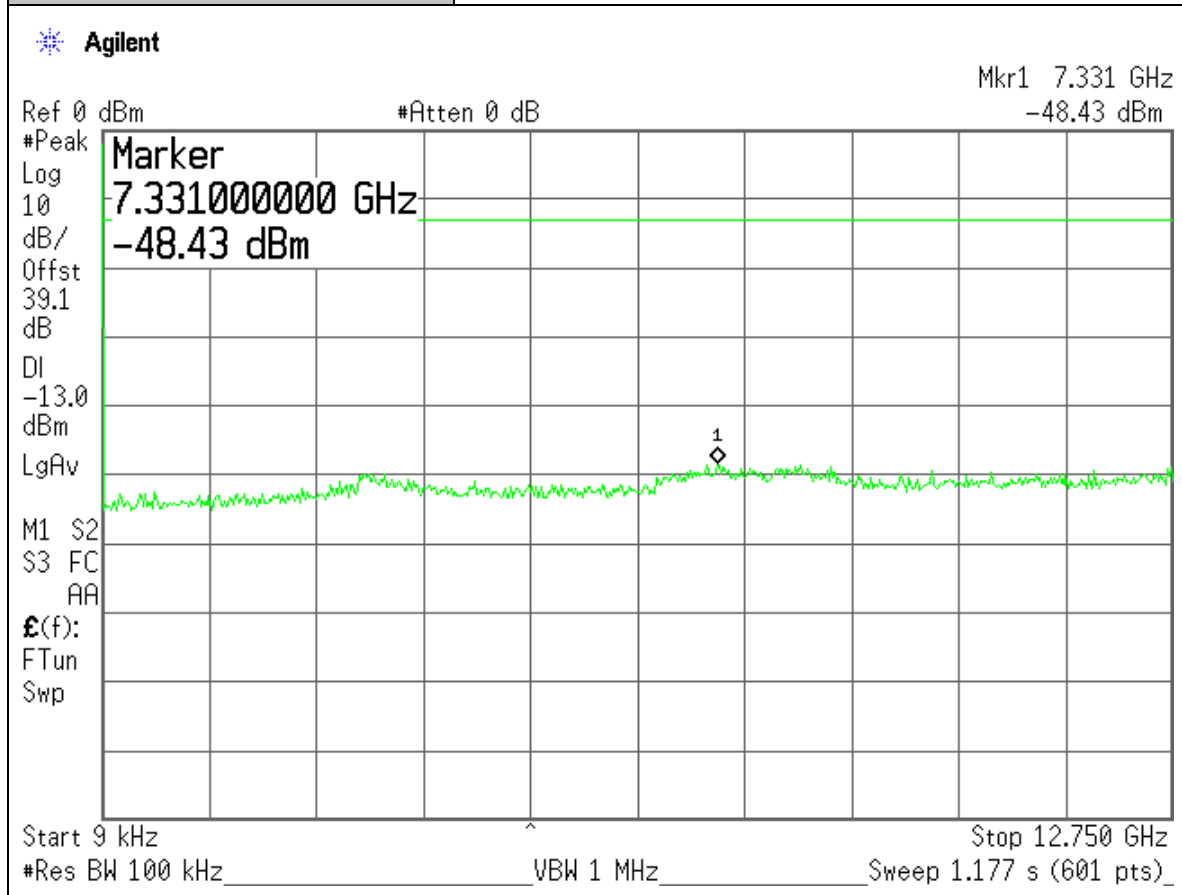
Project Number:	0048-100315-01R
EUT:	ANDREW RRH 2x40W 700MHz RF101002
S/N:	LBALLUASZ1423P0092
Tested By:	Wei Li
Temperature:	70° F
Humidity:	30%

Section:	Spurious Emissions at RF Output Port: 700MHz Upper C Band / LTE Modulation
Plot Name:	TX, Mid-Ch, RF ON
Configuration:	Input: DIGITAL, Output Port: EUT RF OUTPUT



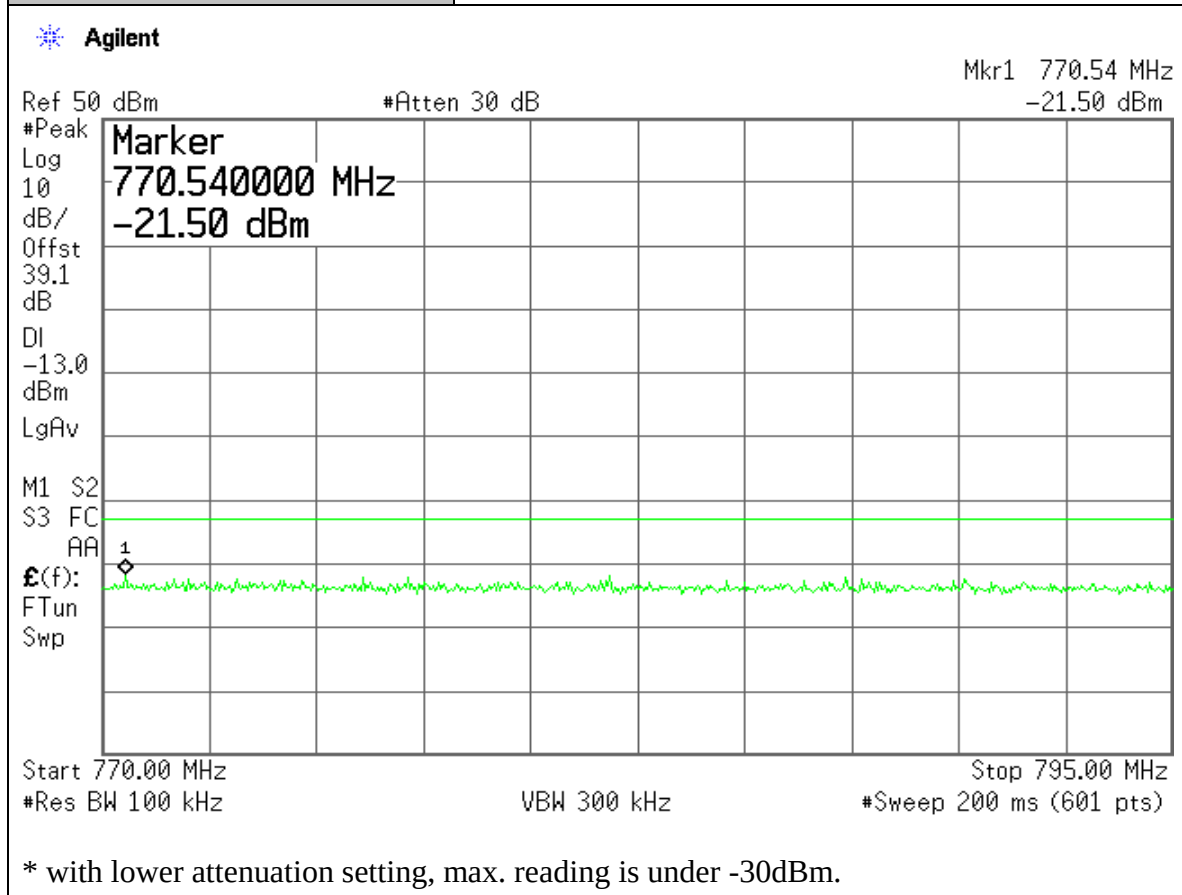
Project Number:	0048-100315-01R
EUT:	ANDREW RRH 2x40W 700MHz RF101002
S/N:	LBALLUASZ1423P0092
Tested By:	Wei Li
Temperature:	70° F
Humidity:	30%

Section:	Spurious Emissions at RF Output Port: 700MHz Upper C Band / LTE Modulation
Plot Name:	TX, Mid-Ch, RF OFF
Configuration:	Input: DIGITAL, Output Port: EUT RF OUTPUT



Project Number:	0048-100315-01R
EUT:	ANDREW RRH 2x40W 700MHz RF101002
S/N:	LBALLUASZ1423P0092
Tested By:	Wei Li
Temperature:	70° F
Humidity:	30%

Section:	Spurious Emissions at RF Output Port: 700MHz Upper C Band / LTE Modulation
Plot Name:	RX Band
Configuration:	Output Port: EUT RF OUTPUT



3. Compliance to 27.53 (c) (3) & (6):

FCC Part 27.53(c) Measurement requires TX conducted emissions in the Receive band to be below a specific limit.

The limits are shown below:

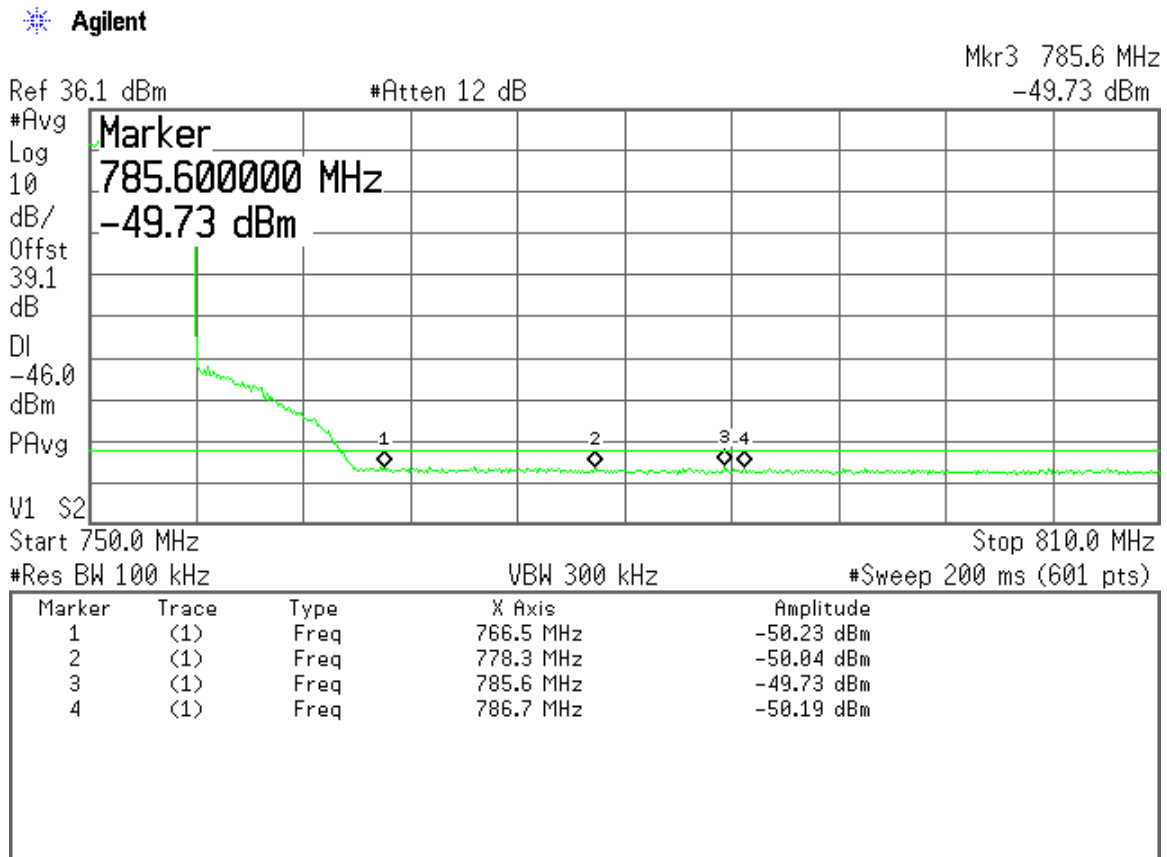
763MHz < f < 775 MHz < -46dBm / 6.25KHz (per FCC Part 27.53)

793MHz < f < 805 MHz < -46dBm / 6.25KHz (per FCC Part 27.53)

There are several ways to make this measurement. One method involves the use of an external duplexer to directly measure the amount of conducted emissions in the receiver band on the entire unit.

A second method is to measure the conducted emissions at the power amplifier level only, and then add the filter rejection performance at each specific point in the receiver band.

In this case, the 1st method was used to verify compliance.



Marker 1 was placed at 766.5 MHz. A power level of -50.23 dBm/100KHz was measured. To calculate the spectral power in 6.25KHz, the following conversion must be made:

$$10 * \text{LOG} (100\text{KHz} / 6.25\text{KHz}) = 12 \text{ dB}$$

Therefore, $-50.23 - 12 = -62.23 \text{ dBm}/6.25\text{KHz}$

Test Requirement	Measurement	Specification
FCC 27.53	-62.23 dBm/6.25KHz	-46dBm/6.25KHz

The 700MHz RRH easily meets FCC requirement 27.53.

Section 6. Field Strength of Spurious

Name of Test:	<i>Field Strength of Spurious</i>	Test Standard:	27.53(c), 27.53(f) 2.1053
Tested By:	DAVID TU	Test Date:	5/29/2014

Minimum Standard: Per FCC Part 27.53 (c) (1)
On any frequency outside the 746–758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log (P)$ dB; (equivalent absolute limit: -13dBm).
Per FCC Part 27.53 (f) *
For operations in the 746–763 MHz, 775–793 MHz, and 805–806 MHz bands, emissions in the band 1559–1610 MHz shall be limited to -70dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

* Not applicable to this EUT for no antenna present.

Method of Measurement: TIA/EIA-603, Section 2.2.12
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	LTE Modulation w/ RF Output Port Terminated & Optical CPRI cable
Band	700MHz Upper C Band
Channel	Mid

Freq. (MHz)	H,V	SA Reading** (dBuV)	SG Reading (dBm)	CL (dB)	Gain (dBi)	ERP (dBm)	Limit (dBm)	Margin (dB)
1504.0	H	37.9	-75	0.8	6.0	-71.95	-13	-58.93
2253.0*	H	32.0	-76	1.5	8.0	-71.65	-13	-58.65
3004.0*	H	35.8	-78	1.9	9.3	-72.75	-13	-59.75

NOTE:

* Measured noise floor

SA: Spectrum Analyzer

SG: Signal Generator

CL: SMA cable loss (6ft)

** Emissions from SC3 excluded

Worse case: Vertical

H=horizontal and V=vertical

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

Margin = ERP - Limit

Configuration	LTE Modulation w/ RF Output Port Terminated & Optical CPRI cable
Band	700MHz Upper C Band
Channel	Standby/RX Mode

Freq. (MHz)	H,V	SA Reading (dBuV)**	Height (m)	Angle (degree)		Refer to Part 15.109 (Class B) 3m Limit (dBm)	Margin (dB)	
50.4	V	31.50	1.2	180		40.0	-8.50	
104.8	V	34.73	1.1	045		43.5	-8.77	
500.1	V	37.09	1.1	135		46.5	-9.41	
>1GHz*								

NOTE:

* Measured noise floor above
3GHz range

H=horizontal & V=vertical

**Emissions from SC3 peripheral
excluded

SA (Spectrum Analyzer) Reading:

Average Reading for above 1GHz; 1m/3m distance factor applied

QP reading for under 1GHz; D=3m

Section 7. ACL Test Equipment List

Manufacture	Model	Serial No.	Description	Cal Due dd/mm/yy
HP	HP8546A	3448A00290	EMI Receiver	25/09/19
EMCO	3104C	9307-4396	20-300MHz Biconical Antenna	12/11/18
EMCO	3146	9008-2860	200-1000MHz Log-Periodic Antenna	13/11/18
EMCO	3115	4945	Double Ridge Guide Horn Antenna	28/11/18
Weinschel	49-30-xx	---	Loads/Attenuators	n/a
Agilent	E4440A	US41421198	1GHz-26GHz Spectrum Analyzer	29/03/19
HP	4419A	US37292112	RF Power Meter w/ Sensor Probe	28/03/19
HP	6032A	3323A-09526	System Power Supply	22/03/19
General Purpose			0-60V, 50A DC Power Supply	n/a