NORTHWEST EMC

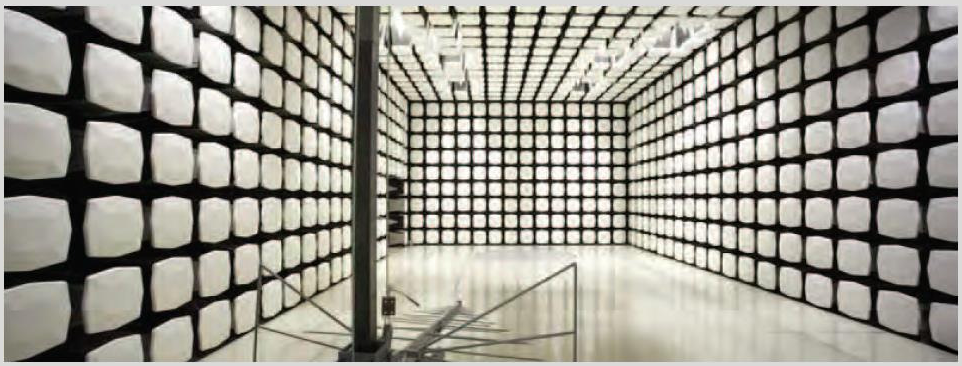
Parallel Wireless Inc.

CWS-3050-14

FCC 90R:2016

Converged Wireless System

Report # KMWC0070



NVLAP TESTING

NVLAP Lab Code: 200676-0

CERTIFICATE OF TEST

NORTHWEST EMC
2014-12-10

Last Date of Test: August 11, 2016
Parallel Wireless Inc.
Model: CWS-3050-14

Radio Equipment Testing

Standards

Specification	Method
FCC 90R:2016	ANSI/TIA/EIA-603-D-2010

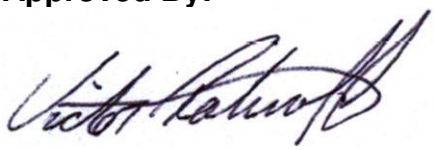
Results

Method Clause	Test Description	Applied	Results	Comments
2.2.1	Effective Radiated Power (ERP)	Yes	Pass	
2.2.1	Peak To Average Ratio	Yes	Pass	
2.2.2	Frequency Stability	Yes	Pass	
2.2.3	Occupied Bandwidth	Yes	Pass	
2.2.12	Out of Band Emissions - LTE Band 14	Yes	Pass	
2.2.13	Band Edge Compliance	Yes	Pass	
2.2.13	Spurious Emissions at the Antenna Terminals	Yes	Pass	
2.2.13	Intermodulation	No	N/A	Not required for single channel band
2.2.17.2	ERP of Fundamental - LTE Band 14	No	N/A	Not required since taking direct connect

Deviations From Test Standards

None

Approved By:



Victor Ratinoff, Operations Manager

Product compliance is the responsibility of the client; therefore, the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. The results of this test pertain only to the sample(s) tested. The specific description is noted in each of the individual sections of the test report supporting this certificate of test. This report reflects only those tests from the referenced standards shown in the certificate of test. It does not include inspection or verification of labels, identification, marking or user information.

REVISION HISTORY

NORTHWEST EMC
REV 2014.10.14

Revision Number	Description	Date	Page Number
00	None		

ACCREDITATIONS AND AUTHORIZATIONS

REV 2016.7.25

United States

FCC - Designated by the FCC as a Telecommunications Certification Body (TCB). Certification chambers, Open Area Test Sites, and conducted measurement facilities are listed with the FCC.

A2LA - Accredited by A2LA to ISO / IEC 17065 as a product certifier. This allows Northwest EMC to certify transmitters to FCC and IC specifications.

NVLAP - Each laboratory is accredited by NVLAP to ISO 17025

Canada

ISED - Recognized by Innovation, Science and Economic Development Canada as a Certification Body (CB). Certification chambers and Open Area Test Sites are filed with ISED.

European Union

European Commission – Validated by the European Commission as a Notified Body under the R&TTE Directive.

Australia/New Zealand

ACMA - Recognized by ACMA as a CAB for the acceptance of test data.

Korea

MSIP / RRA - Recognized by KCC's RRA as a CAB for the acceptance of test data.

Japan

VCCI - Associate Member of the VCCI. Conducted and radiated measurement facilities are registered.

Taiwan

BSMI – Recognized by BSMI as a CAB for the acceptance of test data.

NCC - Recognized by NCC as a CAB for the acceptance of test data.

Singapore

IDA – Recognized by IDA as a CAB for the acceptance of test data.

Israel

MOC – Recognized by MOC as a CAB for the acceptance of test data.

Hong Kong

OFCA – Recognized by OFCA as a CAB for the acceptance of test data.

Vietnam

MIC – Recognized by MIC as a CAB for the acceptance of test data.

SCOPE

For details on the Scopes of our Accreditations, please visit:
http://www.nwemc.com/accreditations/
http://gsi.nist.gov/global/docs/cabs/designations.html

MEASUREMENT UNCERTAINTY

TMU.2015.07.10

Measurement Uncertainty

When a measurement is made, the result will be different from the true or theoretically correct value. The difference is the result of tolerances in the measurement system that cannot be completely eliminated. To the extent that technology allows us, it has been our aim to minimize this error. Measurement uncertainty is a statistical expression of measurement error qualified by a probability distribution.

A measurement uncertainty estimation has been performed for each test per our internal quality document WP 342. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) for each test is on each data sheet. Our measurement data meets or exceeds the measurement uncertainty requirements of the applicable specification; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for estimating measurement uncertainty are based upon ETSI TR 100 028 (or CISPR 16-4-2 as applicable), and are available upon request.

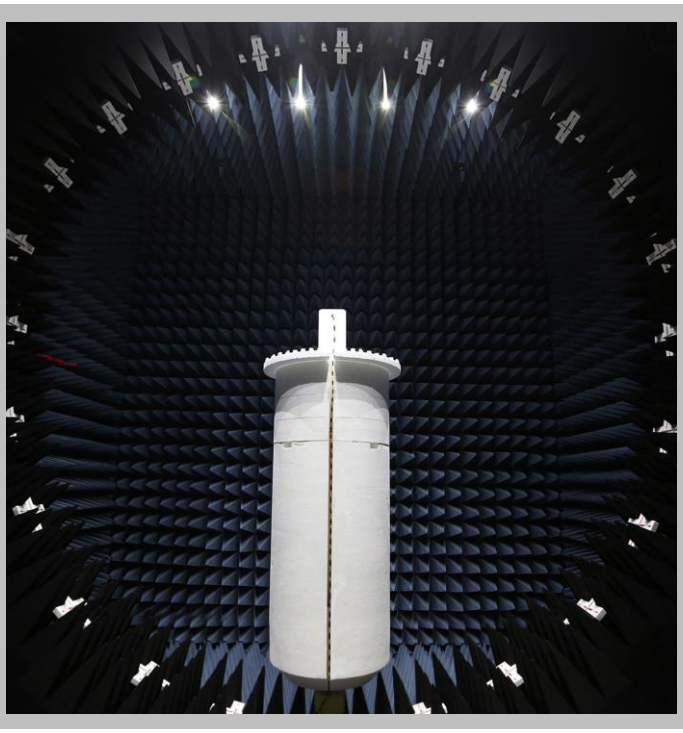
The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

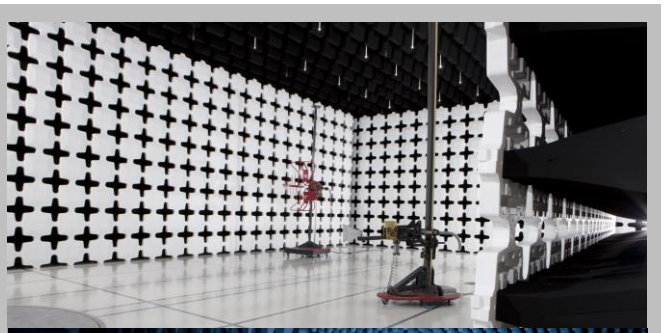
Test	+ MU	- MU
Frequency Accuracy (Hz)	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	0.3 dB	-0.3 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field Strength (dB)	5.2 dB	-5.2 dB
AC Powerline Conducted Emissions (dB)	2.4 dB	-2.4 dB

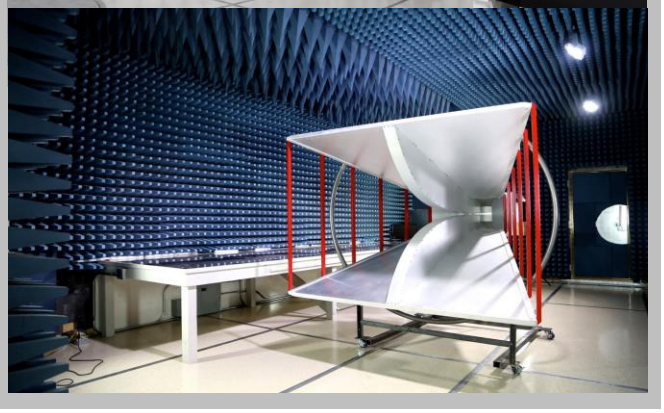
FACILITIES

NORTHWEST EMC
REV 2016.7.25

California	Minnesota	New York	Oregon	Texas	Washington
Labs OC01-13 41 Tesla Irvine, CA 92618 (949) 861-8918	Labs MN01-08, MN10 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	Labs NY01-04 4939 Jordan Rd. Elbridge, NY 13060 (315) 554-8214	Labs EV01-12 22975 NW Evergreen Pkwy Hillsboro, OR 97124 (503) 844-4066	Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Labs NC01-05 19201 120th Ave NE Bothell, WA 98011 (425)984-6600
NVLAP					
NVLAP Lab Code: 200676-0	NVLAP Lab Code: 200881-0	NVLAP Lab Code: 200761-0	NVLAP Lab Code: 200630-0	NVLAP Lab Code:201049-0	NVLAP Lab Code: 200629-0
Innovation, Science and Economic Development Canada					
2834B-1, 2834B-3	2834E-1	N/A	2834D-1, 2834D-*2*	2834G-1	2834F-1
BSMI					
SL2-IN-E-1154R	SL2-IN-E-1152R	N/A	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R
VCCI					
A-0029	A-0109	N/A	A-0108	A-0201	A-0110
Recognized Phase I CAB for ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA					
US0158	US0175	N/A	US0017	US0191	US0157







PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	Parallel Wireless Inc.
Address:	1 Tara Blvd, Suite #404
City, State, Zip:	Nashua, NH 03062
Test Requested By:	Edward Lee
Model:	CWS-3050-14
First Date of Test:	August 10, 2016
Last Date of Test:	August 11, 2016
Receipt Date of Samples:	August 10, 2016
Equipment Design Stage:	Production
Equipment Condition:	No Damage

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
Tower based Converged Wireless System Base Station operating in LTE Band 14 with 10 MHz channel bandwidth.

Testing Objective:
To demonstrate compliance of the Cellular radio to FCC 90R requirements.

CONFIGURATIONS

NORTHWEST EMC 2014-12-10

Configuration KMWC0070- 1

Software/Firmware Running during test	
Description	**Version**
eNB2440_20160729_v0_1_41.pkg	41

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Converged Wireless System Base Station	Parallel Wireless Inc.	CWS-3050-14	K162300007

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
High Power Terminator	Telcon	KTMO400800060	1111-0064
Laptop	Samsung	NP300V5A	HGHS93-JBA00674K
Laptop Power Supply	Delta Electronics, Inc.	SADP-90FH D	CNBA4400215ABZ040C18685

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
DC Cable	No	5m	No	CWS-3050 Tower	DC Mains
RF Output Cable x2	Yes	5m	No	CWS-3050 Tower	High Power Terminator
Ethernet Cable	No	2.5m	No	CWS-3050 Tower	Laptop
AC Cable	No	1.5m	No	AC Mains	Laptop Power Supply
DC Cable	No	2.0m	Yes	Laptop	Laptop Power Supply

Configuration KMWC0070- 2

Software/Firmware Running during test	
Description	**Version**
eNB2440_20160729_v0_1_41.pkg	41

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Converged Wireless System Base Station	Parallel Wireless Inc.	CWS-3050-14	K162300007

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
High Power Terminator	Telcon	KTMO400800060	1111-0064
High Power Terminator	Telcon	KTMO400800060	1111-0004

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
DC Cable	No	5m	No	CWS-3050 Tower	DC Mains
Ethernet Cable	No	2.5m	No	CWS-3050 Tower	Unterminated
AISG Cable	Yes	3m	No	CWS-3050 Tower	Unterminated
AISG (ALM) Cable	Yes	6.1m	No	CWS-3050 Tower	Unterminated
RF Output Cable x2	Yes	5m	No	CWS-3050 Tower	High Power Terminator
Optical Cable	No	10m	No	CWS-3050 Tower	Unterminated
Ground Braid	No	2m	No	CWS-3050 Tower	Ground

MODIFICATIONS

NORTHWEST EMC
2014-12-10

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	8/10/2016	Equivalent Isotropic Radiated Power (EIRP)	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
2	8/10/2016	Peak To Average Ratio	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
3	8/10/2016	Band Edge Compliance	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
4	8/10/2016	Occupied Bandwidth	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
5	8/10/2016	Spurious Emissions at the Antenna Terminals	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
6	8/10/2016	Frequency Stability	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
7	8/11/2016	Out of Band Emissions - LTE Band 14	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

OUT OF BAND EMISSIONS - LTE BAND 14

PSA-ESCI 2016.04.26.1

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

MODES OF OPERATION

Transmitting at 763MHz, LTE10, Band 14

POWER SETTINGS INVESTIGATED

48VDC

CONFIGURATIONS INVESTIGATED

KMWC0070 - 2

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	8000 MHz

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Attenuator	S.M. Electronics	SA18H-10	REN	3/28/2016	12 mo
Attenuator	S.M. Electronics	SA6-20	REO	3/28/2016	12 mo
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	PAD	3/28/2016	12 mo
Cable	ESM Cable Corp.	1-8GHz cables	OCX	3/28/2016	12 mo
Cable	ESM Cable Corp.	30-1GHz cables	OCW	3/28/2016	12 mo
Filter - High Pass	Micro-Tronics	HPM50108	HGP	3/28/2016	12 mo
Filter - Low Pass	Micro-Tronics	LPM50004	HGK	3/28/2016	12 mo
Filter - Band Pass/Notch	K&L Microwave	3TNF-500/1000-N/N	HFR	3/3/2016	12 mo
Antenna - Biconilog	EMCO	3142	AXB	11/6/2015	24 mo
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVJ	3/28/2016	12 mo
Antenna - Double Ridge	ETS Lindgren	3115	AIR	6/23/2016	24 mo
Analyzer - Spectrum Analyzer	Agilent	E4446A	AAY	11/5/2015	12 mo

TEST DESCRIPTION

The EUT was tested with shielded terminations on the RF output ports instead of antennas..

For licensed transmitters, the FCC references TIA/EIA-603 as the measurement procedure standard. TIA/EIA-603 Section 2.2.12 describes a method for measuring radiated spurious emissions that utilizes an antenna substitution method:

At an approved test site, the transmitter is place on a remotely controlled turntable, and the measurement antenna is placed 3 meters from the transmitter. The turntable azimuth is varied to maximize the level of spurious emissions. The height of the measurement antenna is also varied from 1 to 4 meters. The amplitude and frequency of the highest emissions are noted. The transmitter is then replaced with a ½ wave dipole that is successively tuned to each of the highest spurious emissions for emissions below 1 GHz, and a horn antenna for emissions above 1 GHz. A signal generator is connected to the dipole (horn antenna for frequencies above 1 GHz), and its output is adjusted to match the level previously noted for each frequency. The output of the signal generator is recorded, and by factoring in the cable loss to the antenna and its gain; the power (dBm) into an ideal ½ wave dipole antenna is determined for each radiated spurious emission.

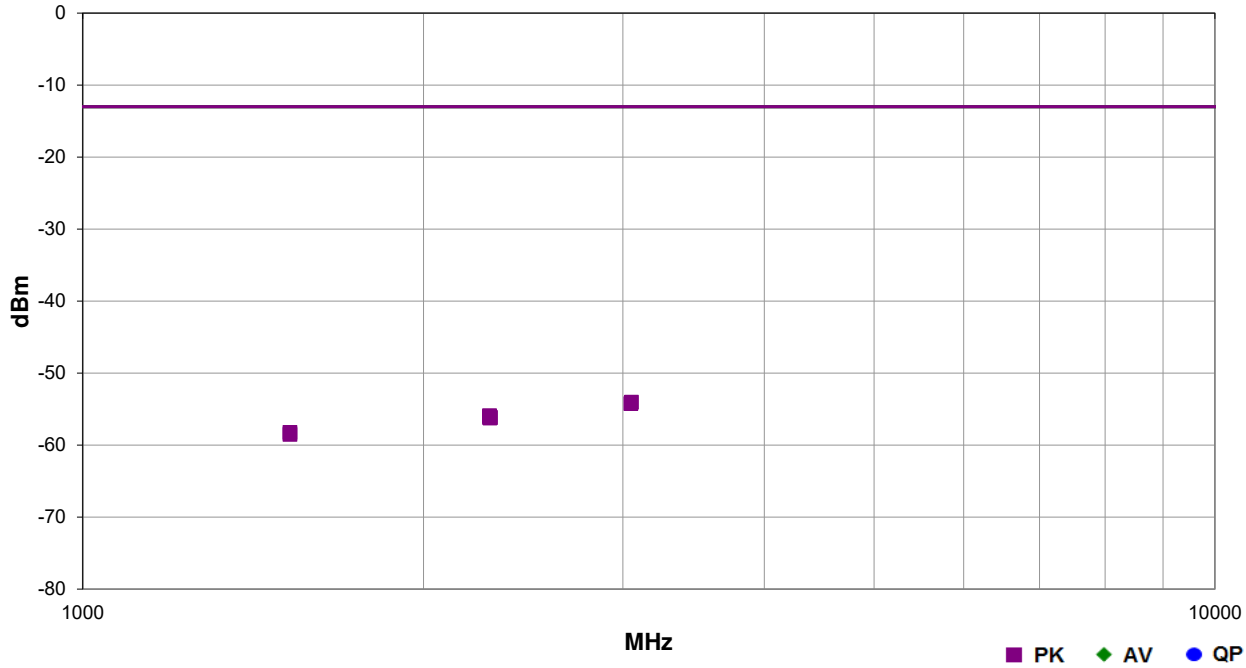
OUT OF BAND EMISSIONS - LTE BAND 14

PSA-ESCI 2016.04.26.1
EmiR5 2016.04.26.1

Work Order:	KMWC0070	**Date:**	08/11/16		
Project:	None	**Temperature:**	21.8 °C		
Job Site:	OC07	**Humidity:**	45.6% RH		
Serial Number:	K162300007	**Barometric Pres.:**	1019 mbar	**Tested by:**	Mike Tran
EUT:	CWS-3050-14				
Configuration:	2				
Customer:	Parallel Wireless Inc.				
Attendees:	Edward Lee				
EUT Power:	48VDC				
Operating Mode:	Transmitting at 763MHz, LTE10, Band 14				
Deviations:	None				
Comments:	None				

Test Specifications	**Test Method**
FCC 90R:2016	ANSI/TIA/EIA-603-D-2010

Run #	3	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



	Freq (MHz)	Antenna Height (meters)	Azimuth (degrees)	Polarity/ Transducer Type	Detector	EIRP (Watts)	EIRP (dBm)	Spec. Limit (dBm)	Compared to Spec. (dB)	Comments
	3052.975	1.0	25.0	Vert	PK	3.95E-09	-54.0	-13.0	-41.0	EUT Vert
	3050.025	1.0	30.0	Horz	PK	3.78E-09	-54.2	-13.0	-41.2	EUT Vert
	2287.717	1.0	327.0	Horz	PK	2.55E-09	-55.9	-13.0	-42.9	EUT on Side
	2287.283	1.3	127.0	Vert	PK	2.50E-09	-56.0	-13.0	-43.0	EUT Vert
	2291.000	1.7	119.0	Horz	PK	2.44E-09	-56.1	-13.0	-43.1	EUT Vert
	2288.333	1.0	3.0	Vert	PK	2.44E-09	-56.1	-13.0	-43.1	EUT Horz
	2289.342	1.0	151.0	Vert	PK	2.38E-09	-56.2	-13.0	-43.2	EUT on Side
	2290.258	1.0	0.0	Horz	PK	2.38E-09	-56.2	-13.0	-43.2	EUT Horz
	1524.517	1.0	69.0	Vert	PK	1.50E-09	-58.2	-13.0	-45.2	EUT Vert
	1524.467	2.9	326.0	Horz	PK	1.40E-09	-58.5	-13.0	-45.5	EUT Vert

EFFECTIVE RADIATED POWER (ERP)

XMit 2016.05.06

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Power Supply - DC	Hewlett Packard	6574A	TPX	NCR	NCR
Generator - Signal	Keysight	N5182B	TFX	4/16/2015	4/16/2018
Cable	Fairview Microwave	SCA1814-0101-120	OCZ	NCR	NCR
Block - DC	Aeroflex	INMET 8535	AMO	4/4/2016	4/4/2017
Meter - Power	ETS Lindgren	7002-006	SRB	12/14/2015	12/14/2016

CLIENT PROVIDED EQUIPMENT

Description	Manufacturer	Model		Last Cal.	Cal. Due
High Power Attenuator - 30dB	Aeroflex/Weinschel	53-30-43		NCR	NCR
Attenuator - 20dB	N/A	N/A		NCR	NCR
Power Divider	Fairview Microwave	MP8748-2		NCR	NCR
50Ohm Terminator	Aeroflex/Weinschel	1455-4		NCR	NCR
High Power Terminator	Telcon	KTMO400800060		NCR	NCR

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a Power Meter.

The RF output power was measured with the EUT set to the modes called out in the datasheet. The power measurement was made using a direct connection between the RF output of the EUT and an RF Power Sensor which only measures across the high time of the burst of the carrier.

The observed duty cycle was noted but not needed to calculate the ERP.

ERP = Max Measured Power + Antenna gain (dBi)

The measurements from Port 1 and Port 2 were summed to determine the total average power in ERP.

EFFECTIVE RADIATED POWER (ERP)

NORTHWEST EMC

XMit 2016.05.06

EUT:	CWS-3050-14			**Work Order:**	KMWC0070
Serial Number:	K162300007			**Date:**	08/10/16
Customer:	Parallel Wireless Inc.			**Temperature:**	22.7 °C
Attendees:	Edward Lee			**Humidity:**	50.8% RH
Project:	None			**Barometric Pres.:**	1016 mbar
Tested by:	Johnny Candelas	**Power:**	48VDC	**Job Site:**	OC13

TEST SPECIFICATIONS	**Test Method**
FCC 90R:2016	ANSI/TIA/EIA-603-D-2010

COMMENTS

Power Level Setting 40W. Reference Level Offset: DC Block + 30dB Attenuator + 20dB Attenuator + Power Divider + Cable Loss = 54.85dB total.
Antenna Gain is assumed to be 0, per specification antenna gain will be re-evaluated during final installation taking height into account.
MIMO measurements taken separately and a linear summation was performed below.

DEVIATIONS FROM TEST STANDARD

None

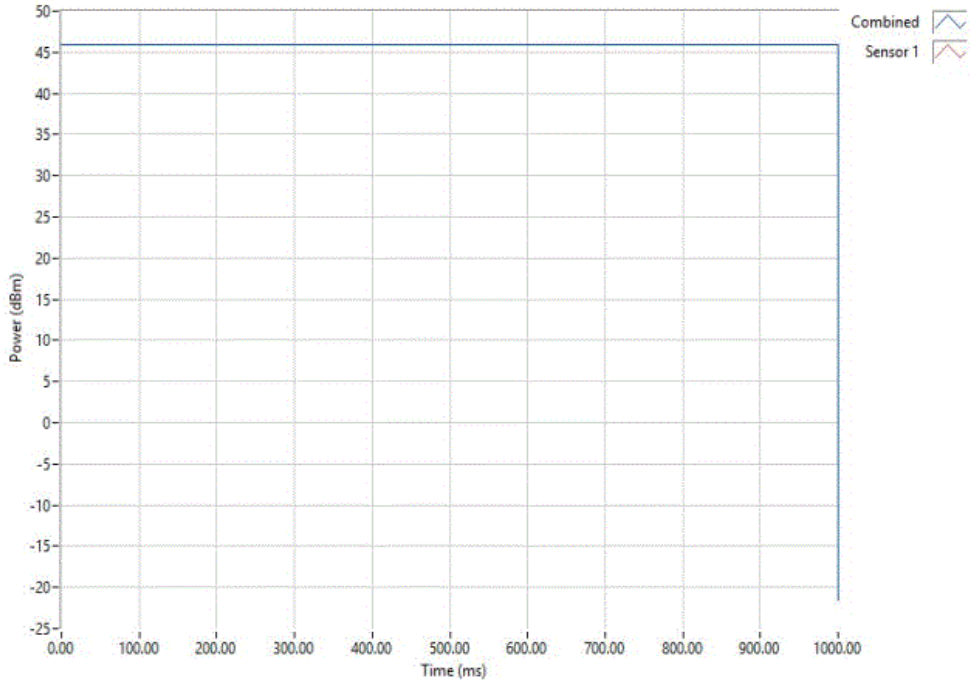
Configuration #	1	*Signature*

				Avg Cond Pwr (dBm)	Duty Cycle (%)	Antenna Gain (dBi)	ERP (dBm)	Limit (dBm)	Results
SISO									
	Antenna Port 1								
	Single Channel LTE10, 763 MHz			45.95	100	0	46.0	60	Pass
	Antenna Port 2								
	Single Channel LTE10, 763 MHz			45.75	100	0	45.8	60	Pass
MIMO									
	Antenna Port 1								
	Single Channel LTE10, 763 MHz			45.90	100	0	45.9	60	Pass
	Antenna Port 2								
	Single Channel LTE10, 763 MHz			45.69	100	0	45.7	60	Pass
Linear Sum of the Power									
		Port 1 (mW)	**Port 2 (mW)**	**Sum (mW)**	**Sum (dBm)**				
	Single Channel LTE10, 763 MHz	38904.5	37068.1	75972.6	48.80	0	48.8	60	Pass

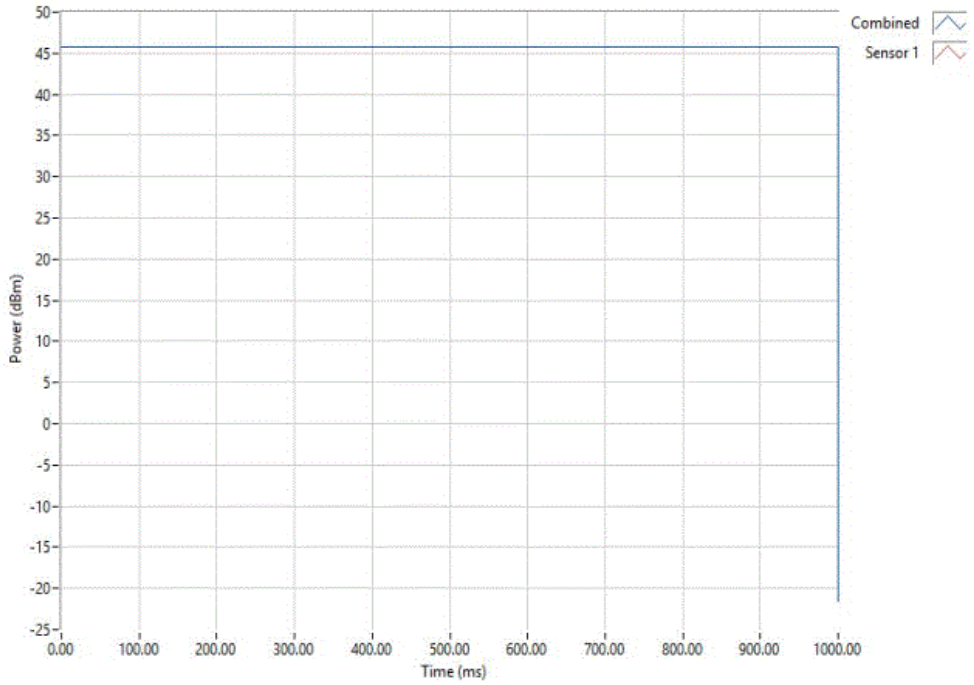
EFFECTIVE RADIATED POWER (ERP)

NORTHWEST EMC
XMit 2016.05.06

SISO, Antenna Port 1, Single Channel LTE10, 763 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle (%)	Antenna Gain (dBi)	ERP (dBm)	Limit (dBm)	Results
	45.95	100	0	46.0	60	Pass



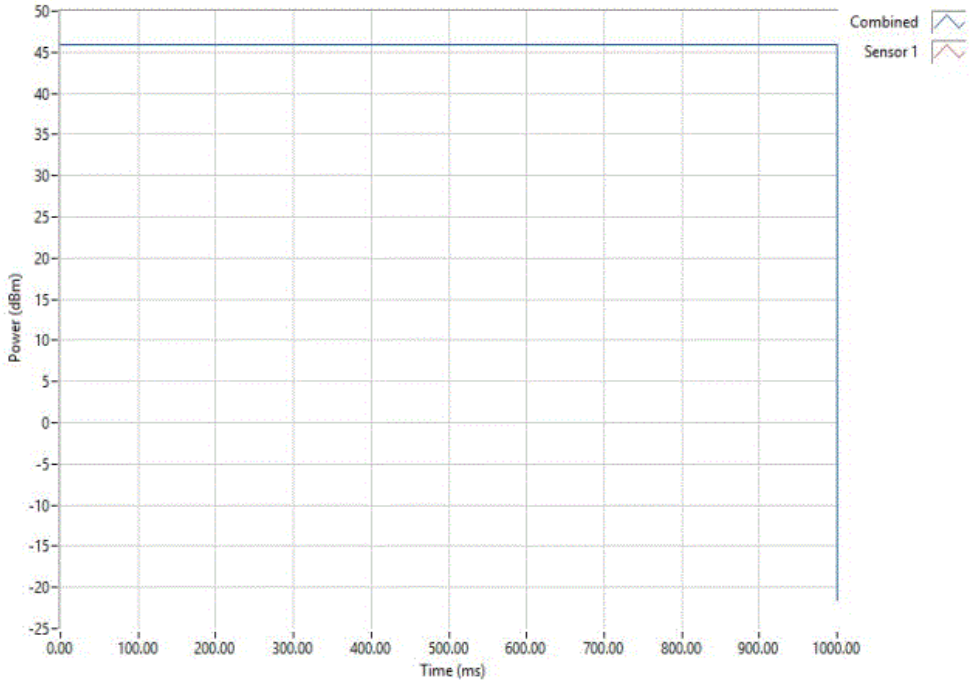
SISO, Antenna Port 2, Single Channel LTE10, 763 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle (%)	Antenna Gain (dBi)	ERP (dBm)	Limit (dBm)	Results
	45.75	100	0	45.8	60	Pass



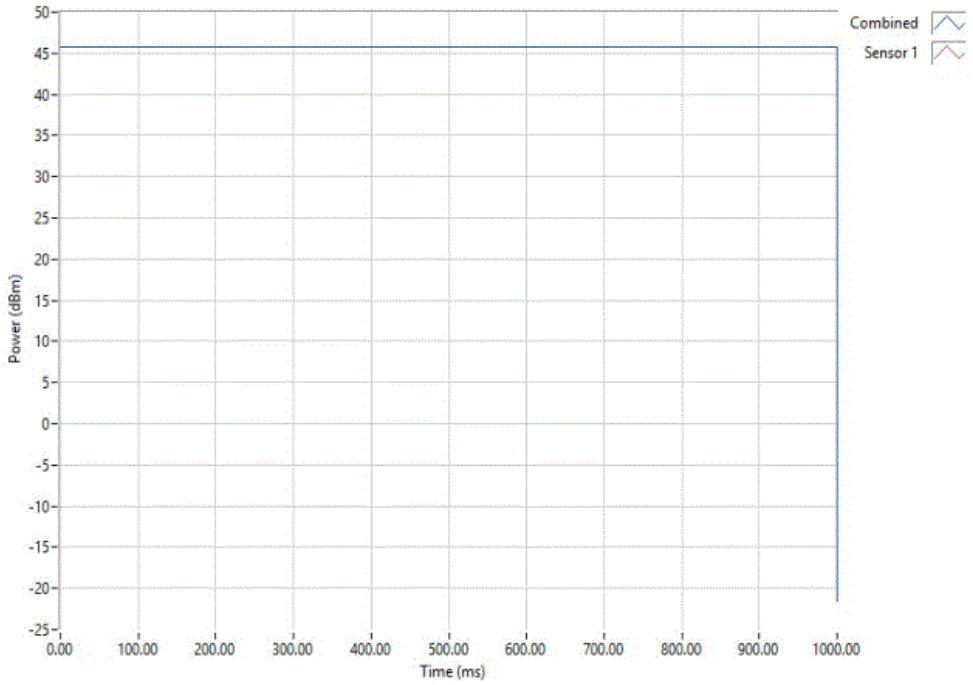
EFFECTIVE RADIATED POWER (ERP)

XMit 2016.05.06

MIMO, Antenna Port 1, Single Channel LTE10, 763 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle (%)	Antenna Gain (dBi)	ERP (dBm)	Limit (dBm)	Results
	45.90	100	0	45.9	60	Pass



MIMO, Antenna Port 2, Single Channel LTE10, 763 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle (%)	Antenna Gain (dBi)	ERP (dBm)	Limit (dBm)	Results
	45.69	100	0	45.7	60	Pass



PEAK TO AVERAGE RATIO

XMit 2016.05.06

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Power Supply - DC	Hewlett Packard	6574A	TPX	NCR	NCR
Generator - Signal	Keysight	N5182B	TFX	4/16/2015	4/16/2018
Cable	Fairview Microwave	SCA1814-0101-120	OCZ	NCR	NCR
Block - DC	Aeroflex	INMET 8535	AMO	4/4/2016	4/4/2017
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFA	11/19/2015	11/19/2016

CLIENT PROVIDED EQUIPMENT

Description	Manufacturer	Model		Last Cal.	Cal. Due
High Power Attenuator - 30dB	Aeroflex/Weinschel	53-30-43		NCR	NCR
Attenuator - 20dB	N/A	N/A		NCR	NCR
Power Divider	Fairview Microwave	MP8748-2		NCR	NCR
50Ohm Terminator	Aeroflex/Weinschel	1455-4		NCR	NCR
High Power Terminator	Telcon	KTMO400800060		NCR	NCR

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

Because the conducted Output Power was measured using a RMS Average detector, the Peak to Average Ratio was measured to show that the maximum peak-max-hold spectrum to the maximum of the average spectrum does not exceed 13 dB.

The spectrum analyzer settings were as follows:
Span set to encompass the entire emission bandwidth, centered on the transmit channel.

The largest difference between the following two traces was calculated:
- 1st Trace: Peak detector and trace max-hold.
- 2nd Trace: The same procedure and settings as was used for conducted Output Power.

PEAK TO AVERAGE RATIO

NORTHWEST EMC

XMit 2016.05.06

EUT:	CWS-3050-14			**Work Order:**	KMWC0070
Serial Number:	K162300007			**Date:**	08/10/16
Customer:	Parallel Wireless Inc.			**Temperature:**	22.7 °C
Attendees:	Edward Lee			**Humidity:**	50.8% RH
Project:	None			**Barometric Pres.:**	1016 mbar
Tested by:	Johnny Candelas	**Power:**	48VDC	**Job Site:**	OC13

TEST SPECIFICATIONS	Test Method
FCC 90R:2016	ANSI/TIA/EIA-603-D-2010

COMMENTS

Power Level Setting 40W. Reference Level Offset: DC Block + 30dB Attenuator + 20dB Attenuator + Power Divider + Cable Loss = 54.85dB total.

DEVIATIONS FROM TEST STANDARD

None

Configuration #	1	Signature

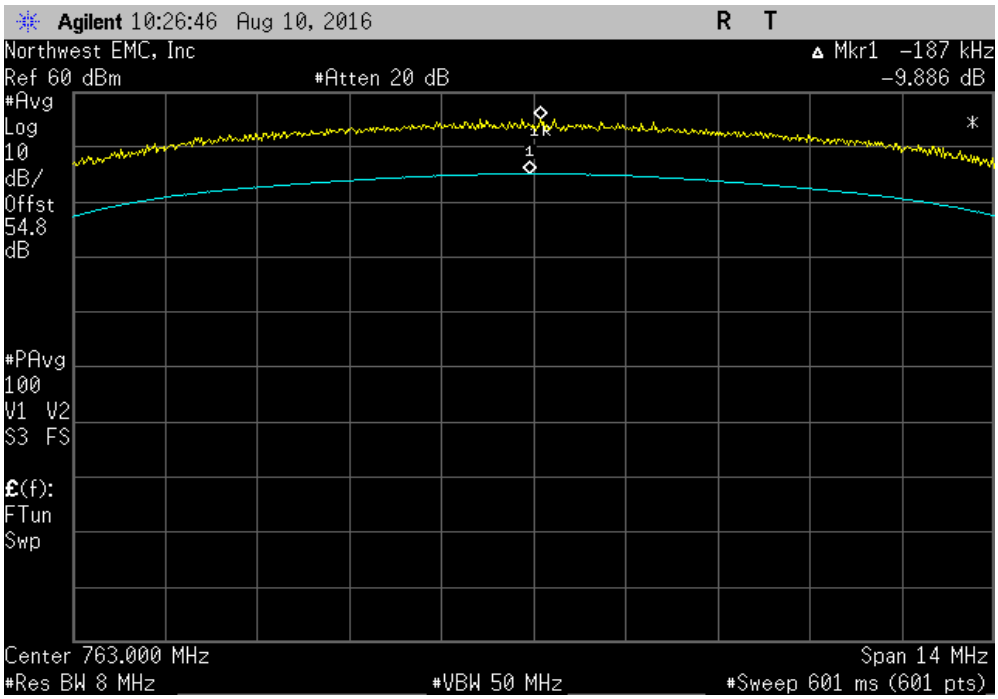
		Value (dB)	Limit < (dB)	Results
Antenna Port 1				
	Single Channel LTE10, 763 MHz	9.886	13	Pass
Antenna Port 2				
	Single Channel LTE10, 763 MHz	10.474	13	Pass

PEAK TO AVERAGE RATIO

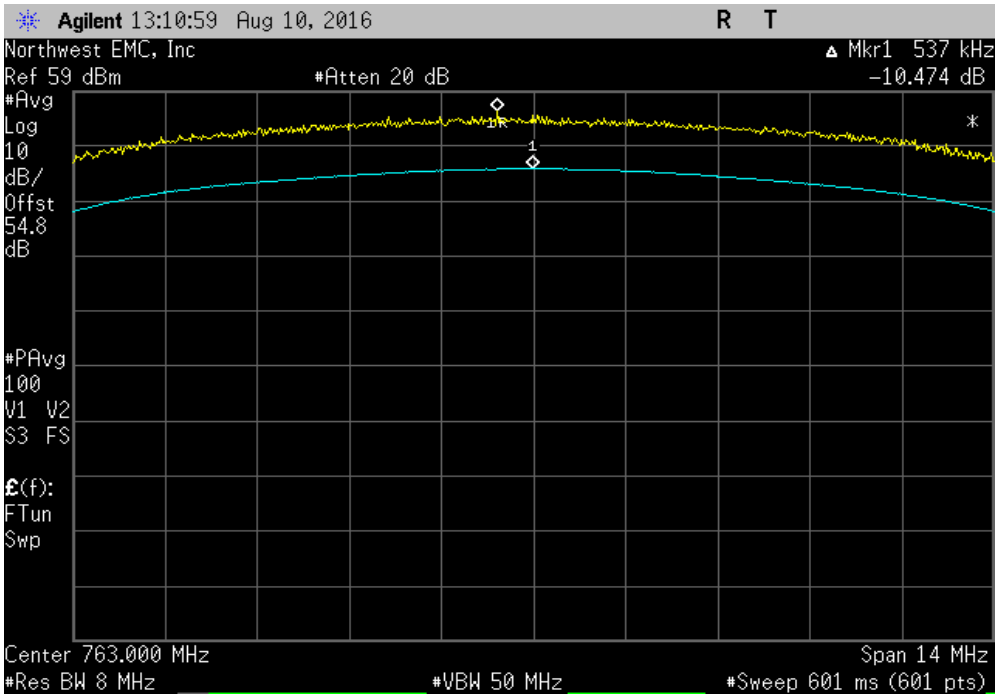
NORTHWEST EMC

XMit 2016.05.06

Antenna Port 1, Single Channel LTE10, 763 MHz						
				Value (dB)	Limit < (dB)	Results
				9.886	13	Pass



Antenna Port 2, Single Channel LTE10, 763 MHz						
				Value (dB)	Limit < (dB)	Results
				10.474	13	Pass



BAND EDGE COMPLIANCE

XMit 2016.05.06

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Power Supply - DC	Hewlett Packard	6574A	TPX	NCR	NCR
Generator - Signal	Keysight	N5182B	TFX	4/16/2015	4/16/2018
Cable	Fairview Microwave	SCA1814-0101-120	OCZ	NCR	NCR
Block - DC	Aeroflex	INMET 8535	AMO	4/4/2016	4/4/2017
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFA	11/19/2015	11/19/2016

CLIENT PROVIDED EQUIPMENT

Description	Manufacturer	Model		Last Cal.	Cal. Due
High Power Attenuator - 30dB	Aeroflex/Weinschel	53-30-43		NCR	NCR
Attenuator - 20dB	N/A	N/A		NCR	NCR
Power Divider	Fairview Microwave	MP8748-2		NCR	NCR
50Ohm Terminator	Aeroflex/Weinschel	1455-4		NCR	NCR
High Power Terminator	Telcon	KTMO400800060		NCR	NCR

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

The spurious RF conducted emissions at the authorized bands per FCC 90.543(e)(1) were measured with the EUT transmitting at the data rate(s) listed in the datasheet.

An average RMS detector was used to match the method used during Output Power. The screen capture shows the margin between the measured value and the limit at the band edge.

BAND EDGE COMPLIANCE

NORTHWEST EMC

XMit 2016.05.06

EUT:	CWS-3050-14			**Work Order:**	KMWC0070
Serial Number:	K162300007			**Date:**	08/10/16
Customer:	Parallel Wireless Inc.			**Temperature:**	22.7 °C
Attendees:	Edward Lee			**Humidity:**	50.8% RH
Project:	None			**Barometric Pres.:**	1016 mbar
Tested by:	Johnny Candelas	**Power:**	48VDC	**Job Site:**	OC13

TEST SPECIFICATIONS	Test Method
FCC 90R:2016	ANSI/TIA/EIA-603-D-2010

COMMENTS

Power Level Setting 40W. Reference Level Offset: DC Block + 30dB Attenuator + 20dB Attenuator + Power Divider + Cable Loss = 54.85dB total.

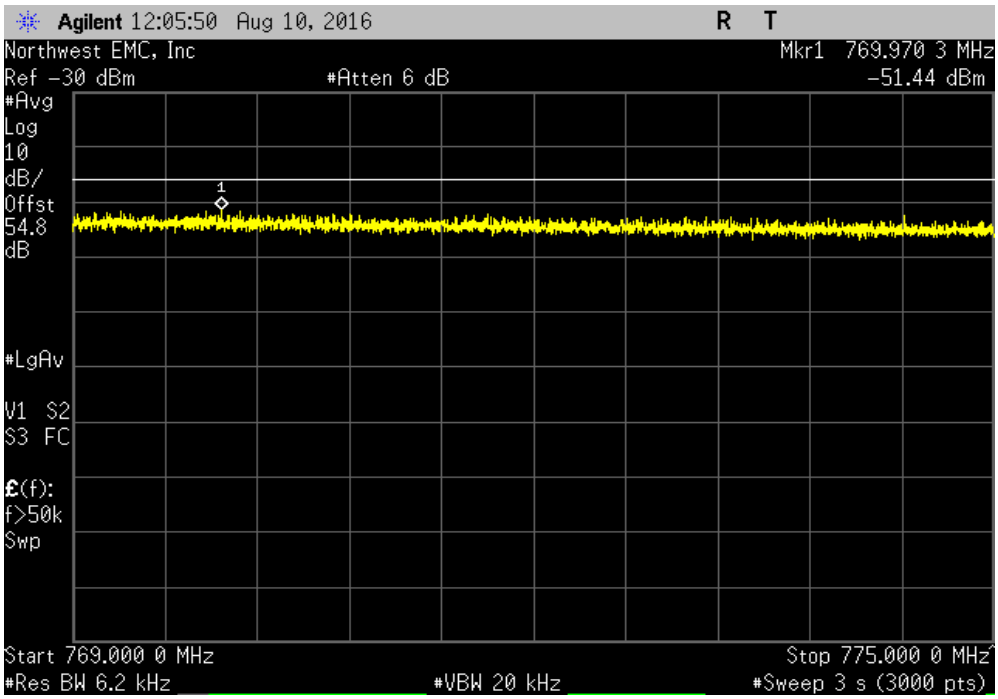
DEVIATIONS FROM TEST STANDARD

None

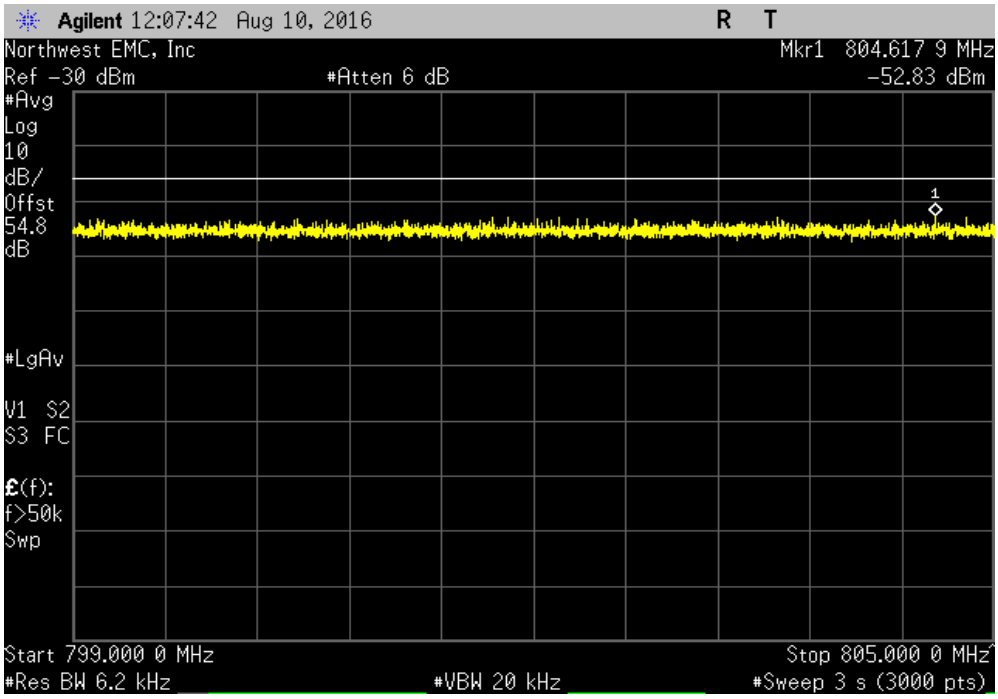
Configuration #	1	Signature

		Frequency Range	Max Value (dBm)	Limit ≤ (dBm)	Result
Antenna Port 1					
	Single Channel LTE10, 763 MHz	769 MHz - 775 MHz	-51.44	-46	Pass
	Single Channel LTE10, 763 MHz	799 MHz - 805 MHz	-52.83	-46	Pass
Antenna Port 2					
	Single Channel LTE10, 763 MHz	769 MHz - 775 MHz	-51.32	-46	Pass
	Single Channel LTE10, 763 MHz	799 MHz - 805 MHz	-52.7	-46	Pass

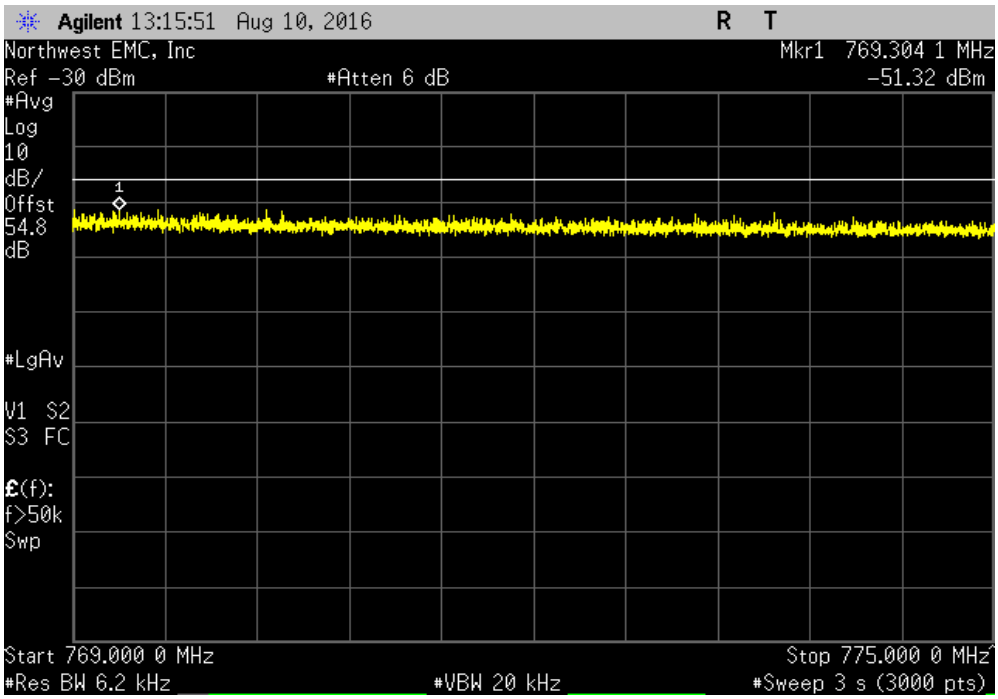
Antenna Port 1, Single Channel LTE10, 763 MHz				
Frequency Range		Max Value (dBm)	Limit ≤ (dBm)	Result
769 MHz - 775 MHz		-51.44	-46	Pass



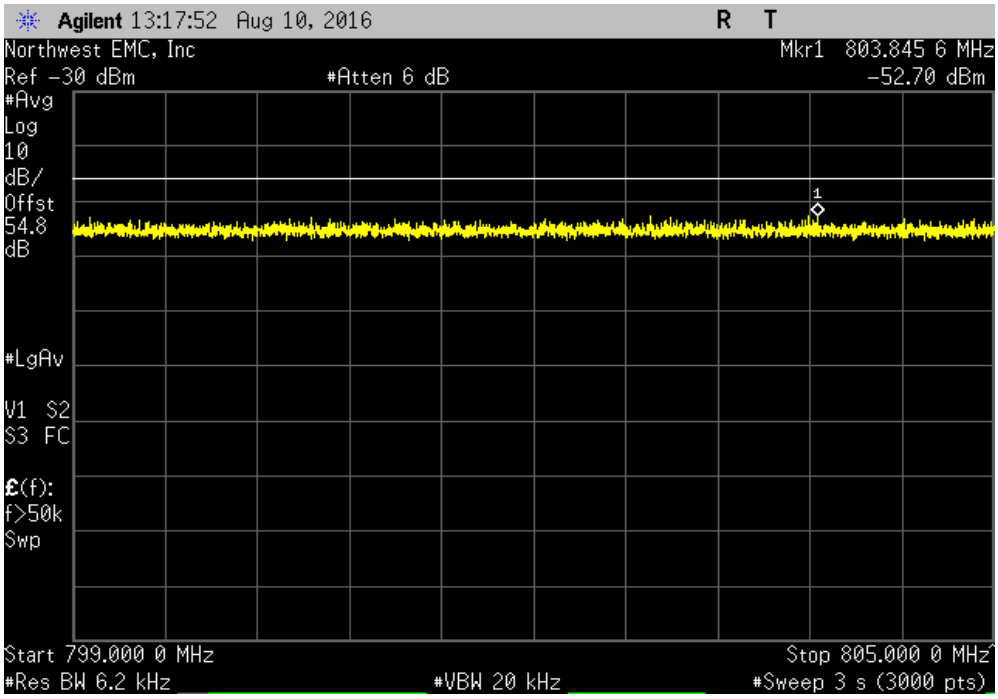
Antenna Port 1, Single Channel LTE10, 763 MHz				
Frequency Range		Max Value (dBm)	Limit ≤ (dBm)	Result
799 MHz - 805 MHz		-52.83	-46	Pass



Antenna Port 2, Single Channel LTE10, 763 MHz				
Frequency Range		Max Value (dBm)	Limit ≤ (dBm)	Result
769 MHz - 775 MHz		-51.32	-46	Pass



Antenna Port 2, Single Channel LTE10, 763 MHz				
Frequency Range		Max Value (dBm)	Limit ≤ (dBm)	Result
799 MHz - 805 MHz		-52.7	-46	Pass



OCCUPIED BANDWIDTH

XMit 2016.05.06

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Power Supply - DC	Hewlett Packard	6574A	TPX	NCR	NCR
Generator - Signal	Keysight	N5182B	TFX	4/16/2015	4/16/2018
Cable	Fairview Microwave	SCA1814-0101-120	OCZ	NCR	NCR
Block - DC	Aeroflex	INMET 8535	AMO	4/4/2016	4/4/2017
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFA	11/19/2015	11/19/2016

CLIENT PROVIDED EQUIPMENT

Description	Manufacturer	Model		Last Cal.	Cal. Due
High Power Attenuator - 30dB	Aeroflex/Weinschel	53-30-43		NCR	NCR
Attenuator - 20dB	N/A	N/A		NCR	NCR
Power Divider	Fairview Microwave	MP8748-2		NCR	NCR
50Ohm Terminator	Aeroflex/Weinschel	1455-4		NCR	NCR
High Power Terminator	Telcon	KTMO400800060		NCR	NCR

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

The spectrum analyzer settings were as follows:
- RBW = Approx. 1% of the emission bandwidth (B). This was an iterative process to determine the RBW based on the emissions bandwidth (B).
- VBW= > RBW
- A peak detector was used
- Trace max hold.

The spectrum analyzer occupied bandwidth measurement function was then used to measure the 26 dB emission bandwidth.

There is no required limit to be met in the rule part for this test. The purpose of the test is to report the results.

OCCUPIED BANDWIDTH

NORTHWEST EMC

XMit 2016.05.06

EUT:	CWS-3050-14			**Work Order:**	KMWC0070
Serial Number:	K162300007			**Date:**	08/10/16
Customer:	Parallel Wireless Inc.			**Temperature:**	22.7 °C
Attendees:	Edward Lee			**Humidity:**	50.8% RH
Project:	None			**Barometric Pres.:**	1016 mbar
Tested by:	Johnny Candelas	**Power:**	48VDC	**Job Site:**	OC13

TEST SPECIFICATIONS	Test Method
FCC 90R:2016	ANSI/TIA/EIA-603-D-2010

COMMENTS

Power Level Setting 40W. Reference Level Offset: DC Block + 30dB Attenuator + 20dB Attenuator + Power Divider + Cable Loss = 54.85dB total.

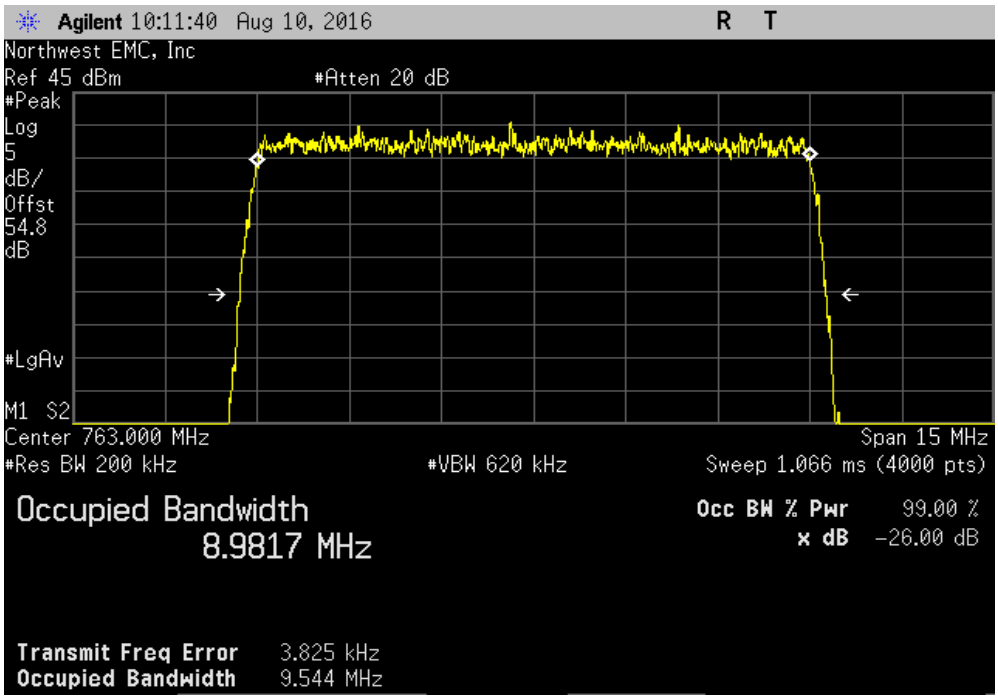
DEVIATIONS FROM TEST STANDARD

None

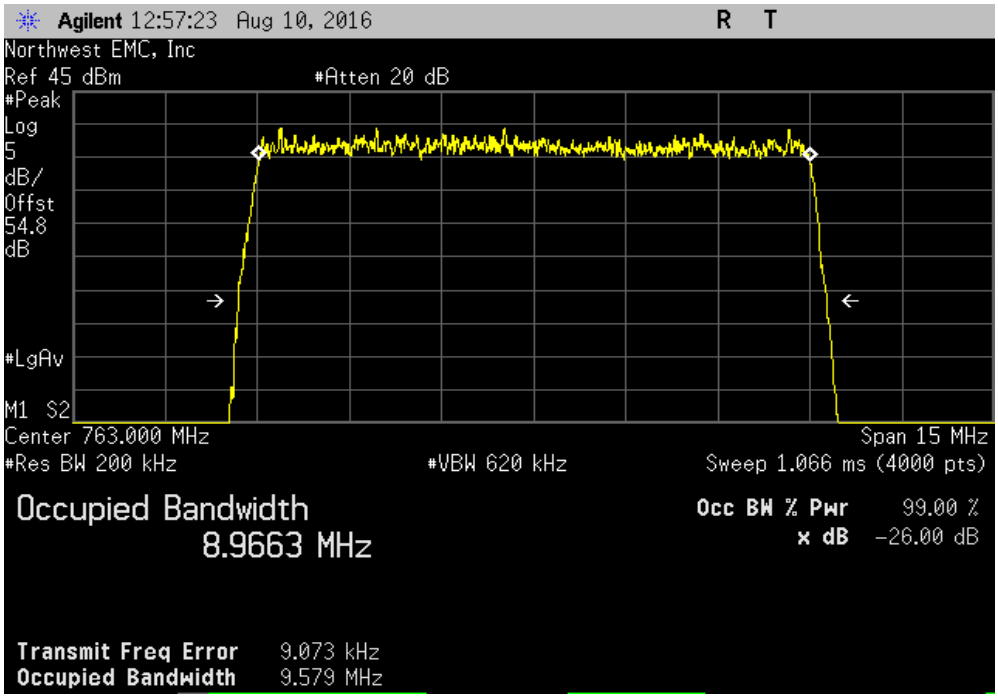
Configuration #	1	Signature

		Value	Limit	Result
Antenna Port 1				
	Single Channel LTE10, 763 MHz	9.544 MHz	N/A	N/A
Antenna Port 2				
	Single Channel LTE10, 763 MHz	9.579 MHz	N/A	N/A

Antenna Port 1, Single Channel LTE10, 763 MHz						
				Value	Limit	Result
				9.544 MHz	N/A	N/A



Antenna Port 2, Single Channel LTE10, 763 MHz						
				Value	Limit	Result
				9.579 MHz	N/A	N/A



SPURIOUS EMISSIONS AT THE ANTENNA TERMINALS

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Power Supply - DC	Hewlett Packard	6574A	TPX	NCR	NCR
Generator - Signal	Keysight	N5182B	TFX	4/16/2015	4/16/2018
Cable	Fairview Microwave	SCA1814-0101-120	OCZ	NCR	NCR
Block - DC	Aeroflex	INMET 8535	AMO	4/4/2016	4/4/2017
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFA	11/19/2015	11/19/2016

CLIENT PROVIDED EQUIPMENT

Description	Manufacturer	Model		Last Cal.	Cal. Due
High Power Attenuator - 30dB	Aeroflex/Weinschel	53-30-43		NCR	NCR
Attenuator - 20dB	N/A	N/A		NCR	NCR
Power Divider	Fairview Microwave	MP8748-2		NCR	NCR
50Ohm Terminator	Aeroflex/Weinschel	1455-4		NCR	NCR
High Power Terminator	Telcon	KTMO400800060		NCR	NCR

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. Analyzer plots utilizing appropriate resolution bandwidth (frequency dependant) and no video filtering were made for each mode listed in the datasheet.

The peak conducted power of spurious emissions, up to the 10th harmonic of the transmit frequency, were investigated to ensure they were less than or equal to the limit.

SPURIOUS EMISSIONS AT THE ANTENNA TERMINALS

NORTHWEST EMC

XMit 2016.05.06

EUT:	CWS-3050-14			**Work Order:**	KMWC0070
Serial Number:	K162300007			**Date:**	08/10/16
Customer:	Parallel Wireless Inc.			**Temperature:**	22.7 °C
Attendees:	Edward Lee			**Humidity:**	50.8% RH
Project:	None			**Barometric Pres.:**	1016 mbar
Tested by:	Johnny Candelas	**Power:**	48VDC	**Job Site:**	OC13

TEST SPECIFICATIONS	**Test Method**
FCC 90R:2016	ANSI/TIA/EIA-603-D-2010

COMMENTS

Transmitting at 763MHz, Single Channel LTE10

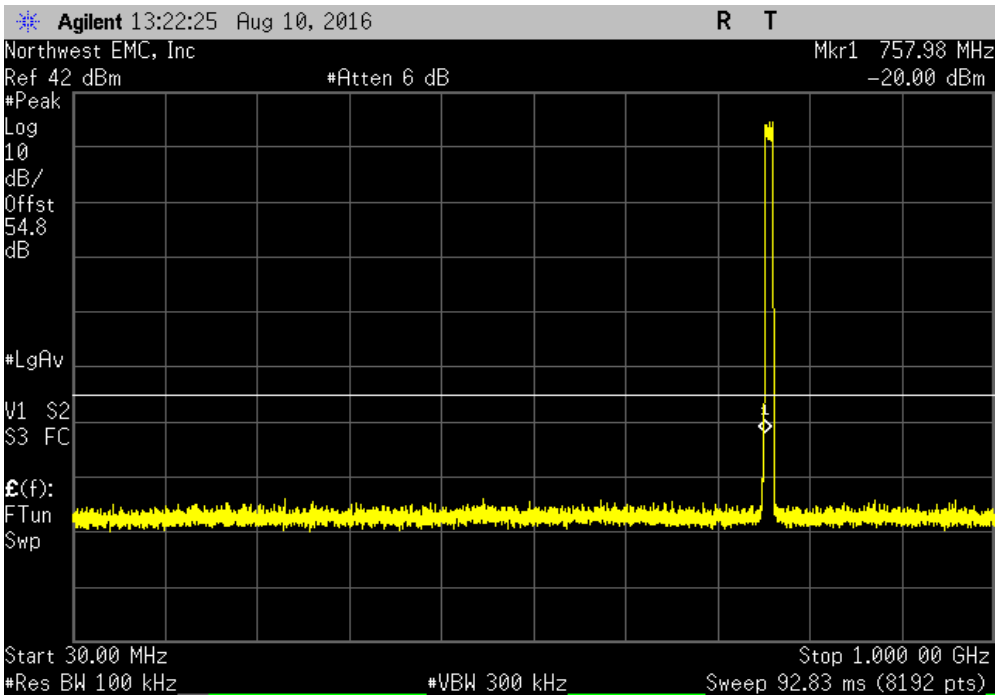
DEVIATIONS FROM TEST STANDARD

None

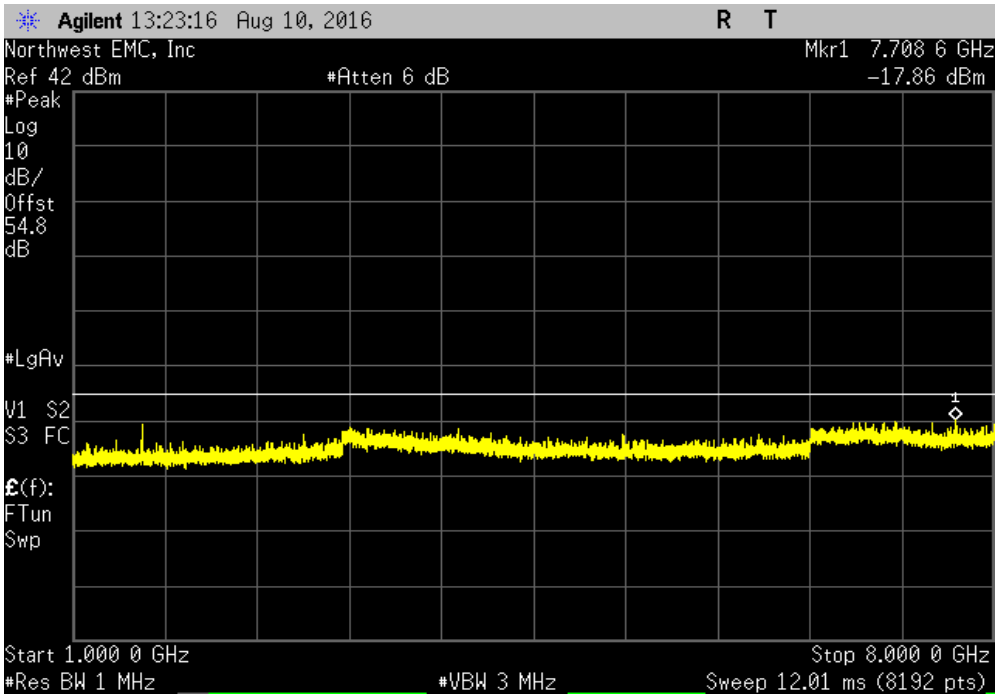
Configuration #	**1**	*Signature*

		Frequency Range	Max Value (dBm)	Limit ≤ (dBm)	Result
Antenna Port 1					
	Single Channel LTE10, 763 MHz	30 MHz - 1 GHz	-20.01	-13	Pass
	Single Channel LTE10, 763 MHz	1 GHz - 8 GHz	-17.86	-13	Pass
Antenna Port 2					
	Single Channel LTE10, 763 MHz	30 MHz - 1 GHz	-17.74	-13	Pass
	Single Channel LTE10, 763 MHz	1 GHz - 8 GHz	-17.9	-13	Pass

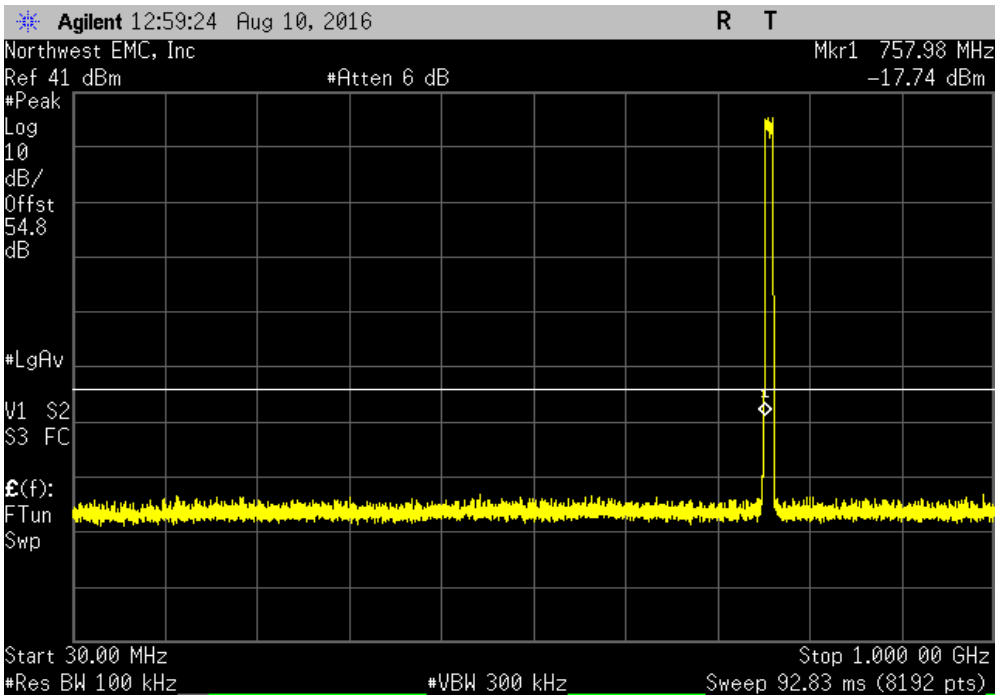
Antenna Port 1, Single Channel LTE10, 763 MHz						
	Frequency Range			Max Value (dBm)	Limit ≤ (dBm)	Result
	30 MHz - 1 GHz			-20.01	-13	Pass



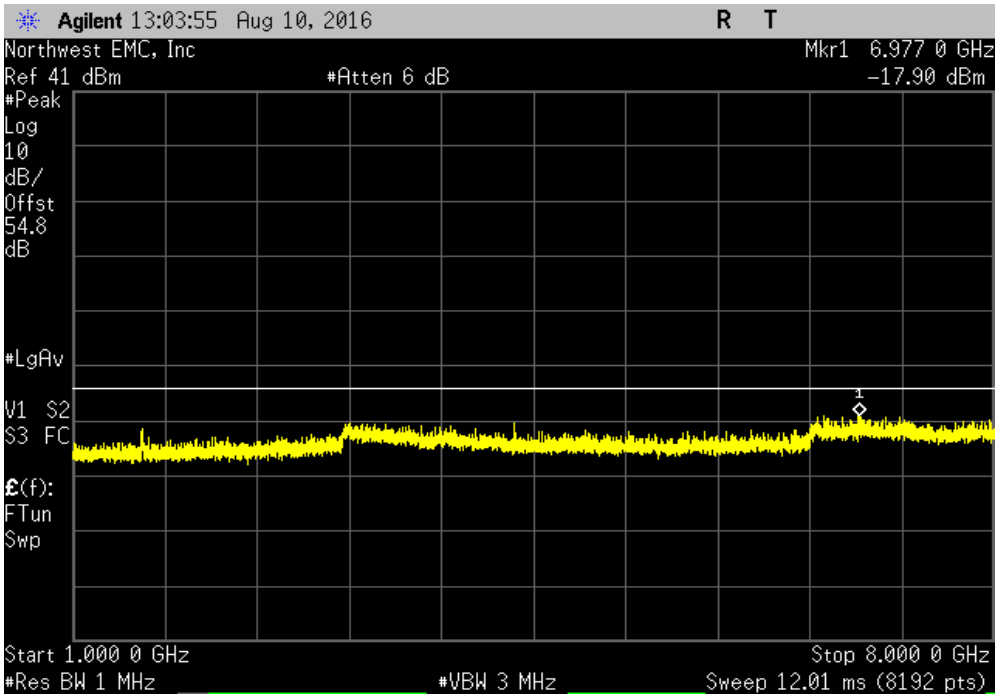
Antenna Port 1, Single Channel LTE10, 763 MHz						
	Frequency Range			Max Value (dBm)	Limit ≤ (dBm)	Result
	1 GHz - 8 GHz			-17.86	-13	Pass



Antenna Port 2, Single Channel LTE10, 763 MHz						
	Frequency Range			Max Value (dBm)	Limit ≤ (dBm)	Result
	30 MHz - 1 GHz			-17.74	-13	Pass



Antenna Port 2, Single Channel LTE10, 763 MHz						
	Frequency Range			Max Value (dBm)	Limit ≤ (dBm)	Result
	1 GHz - 8 GHz			-17.9	-13	Pass



FREQUENCY STABILITY

XMit 2016.05.06

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Chamber - Temperature/Humidity	Cincinnati Sub Zero (CSZ)	ZPHS-32-3.5-SCT/AC	TBE	NCR	NCR
Thermometer	Omega Engineering, Inc.	HH311	DUC	10/3/2014	10/3/2017
Cable	Fairview Microwave	SCA1814-0101-120	OCZ	NCR	NCR
Block - DC	Aeroflex	INMET 8535	AMO	4/4/2016	4/4/2017
Generator - Signal	Keysight	N5182B	TFX	4/16/2015	4/16/2018
Power Supply - DC	Hewlett Packard	6574A	TPX	NCR	NCR
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFA	11/19/2015	11/19/2016

CLIENT PROVIDED EQUIPMENT

Description	Manufacturer	Model		Last Cal.	Cal. Due
High Power Attenuator - 30dB	Aeroflex/Weinschel	53-30-43		NCR	NCR
Attenuator - 20dB	N/A	N/A		NCR	NCR
Power Divider	Fairview Microwave	MP8748-2		NCR	NCR
50Ohm Terminator	Aeroflex/Weinschel	1455-4		NCR	NCR
High Power Terminator	Telcon	KTMO400800060		NCR	NCR

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The spectrum analyzer is configured with a precision frequency reference that exceeds the stability requirement of the transmitter. The EUT was placed inside a temperature / humidity chamber.

Variation of Supply Voltage

The primary supply voltage was varied from 85% to 115% of the nominal voltage. A DC lab supply was used to vary the supply voltage.

Variation of Ambient Temperature

Using a temperature chamber, the transmit frequency was recorded at the extremes of the specified temperature range

FREQUENCY STABILITY

NORTHWEST EMC

XMit 2016.05.06

EUT:	CWS-3050-14			**Work Order:**	KMWC0070
Serial Number:	K162300007			**Date:**	08/10/16
Customer:	Parallel Wireless Inc.			**Temperature:**	22.7 °C
Attendees:	Edward Lee			**Humidity:**	50.8% RH
Project:	None			**Barometric Pres.:**	1016 mbar
Tested by:	Johnny Candelas	**Power:**	48VDC	**Job Site:**	OC13

TEST SPECIFICATIONS	**Test Method**
FCC 90R:2016	ANSI/TIA/EIA-603-D-2010

COMMENTS

Transmitting at 763MHz, Single Channel LTE10

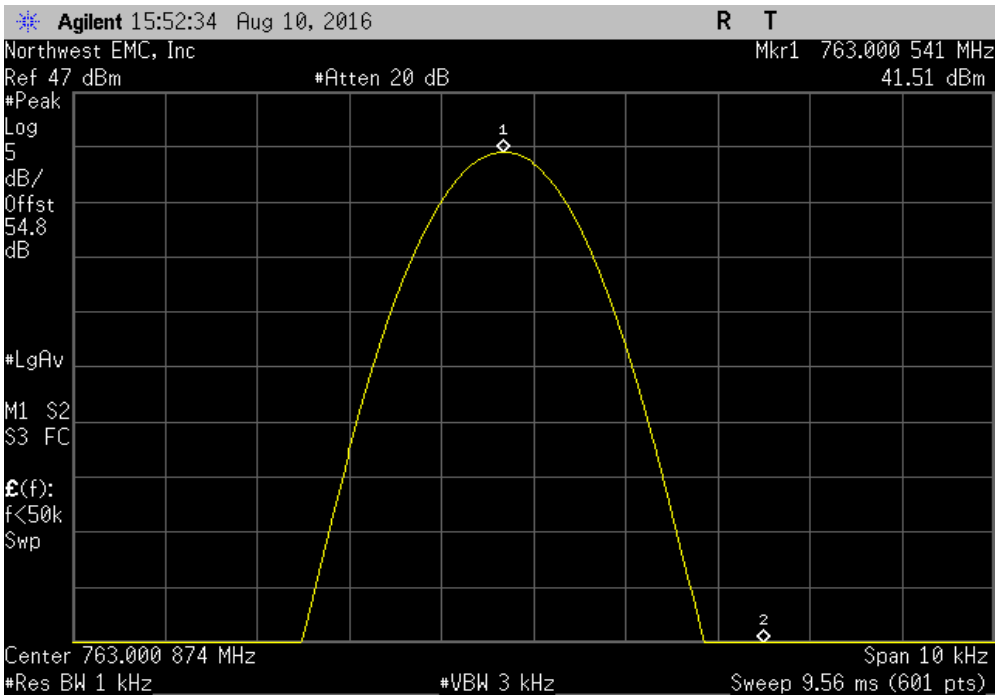
DEVIATIONS FROM TEST STANDARD

None

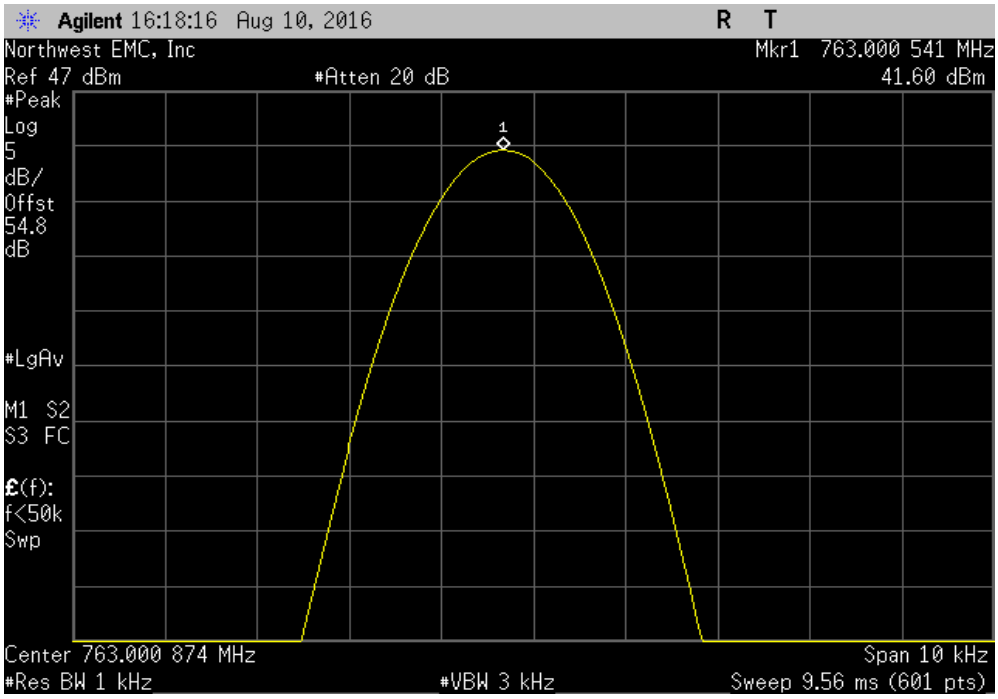
Configuration #	1	*Signature*

		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
Port 1						
	Normal Temperature and Voltage					
	Single Channel LTE10, 763MHz	763.000541	763	0.7	1	Pass
	Extreme Voltage, 55.2 VDC					
	Single Channel LTE10, 763MHz	763.000541	763	0.7	1	Pass
	Extreme Voltage, 40.8 VDC					
	Single Channel LTE10, 763MHz	763.000541	763	0.7	1	Pass
	Extreme Temperature, -30°C					
	Single Channel LTE10, 763MHz	763.000223	763	0.3	1	Pass
	Extreme Temperature, -20°C					
	Single Channel LTE10, 763MHz	763.00039	763	0.5	1	Pass
	Extreme Temperature, -10°C					
	Single Channel LTE10, 763MHz	763.000557	763	0.7	1	Pass
	Extreme Temperature, 0°C					
	Single Channel LTE10, 763MHz	763.00064	763	0.8	1	Pass
	Extreme Temperature, +10°C					
	Single Channel LTE10, 763MHz	763.000657	763	0.9	1	Pass
	Extreme Temperature, +20°C					
	Single Channel LTE10, 763MHz	763.000624	763	0.8	1	Pass
	Extreme Temperature, +30°C					
	Single Channel LTE10, 763MHz	763.000623	763	0.8	1	Pass
	Extreme Temperature, +40°C					
	Single Channel LTE10, 763MHz	763.000592	763	0.8	1	Pass
	Extreme Temperature, +50°C					
	Single Channel LTE10, 763MHz	763.000623	763	0.8	1	Pass
Port 2						
	Normal Temperature and Voltage					
	Single Channel LTE10, 763MHz	763.000541	763	0.7	1	Pass
	Extreme Voltage, 55.2 VDC					
	Single Channel LTE10, 763MHz	763.000541	763	0.7	1	Pass
	Extreme Voltage, 40.8 VDC					
	Single Channel LTE10, 763MHz	763.000541	763	0.7	1	Pass
	Extreme Temperature, -30°C					
	Single Channel LTE10, 763MHz	763.00019	763	0.3	1	Pass
	Extreme Temperature, -20°C					
	Single Channel LTE10, 763MHz	763.00039	763	0.5	1	Pass
	Extreme Temperature, -10°C					
	Single Channel LTE10, 763MHz	763.000559	763	0.7	1	Pass
	Extreme Temperature, 0°C					
	Single Channel LTE10, 763MHz	763.000642	763	0.8	1	Pass
	Extreme Temperature, +10°C					
	Single Channel LTE10, 763MHz	763.000659	763	0.9	1	Pass
	Extreme Temperature, +20°C					
	Single Channel LTE10, 763MHz	763.000623	763	0.8	1	Pass
	Extreme Temperature, +30°C					
	Single Channel LTE10, 763MHz	763.000623	763	0.8	1	Pass
	Extreme Temperature, +40°C					
	Single Channel LTE10, 763MHz	763.000607	763	0.8	1	Pass
	Extreme Temperature, +50°C					
	Single Channel LTE10, 763MHz	763.000623	763	0.8	1	Pass

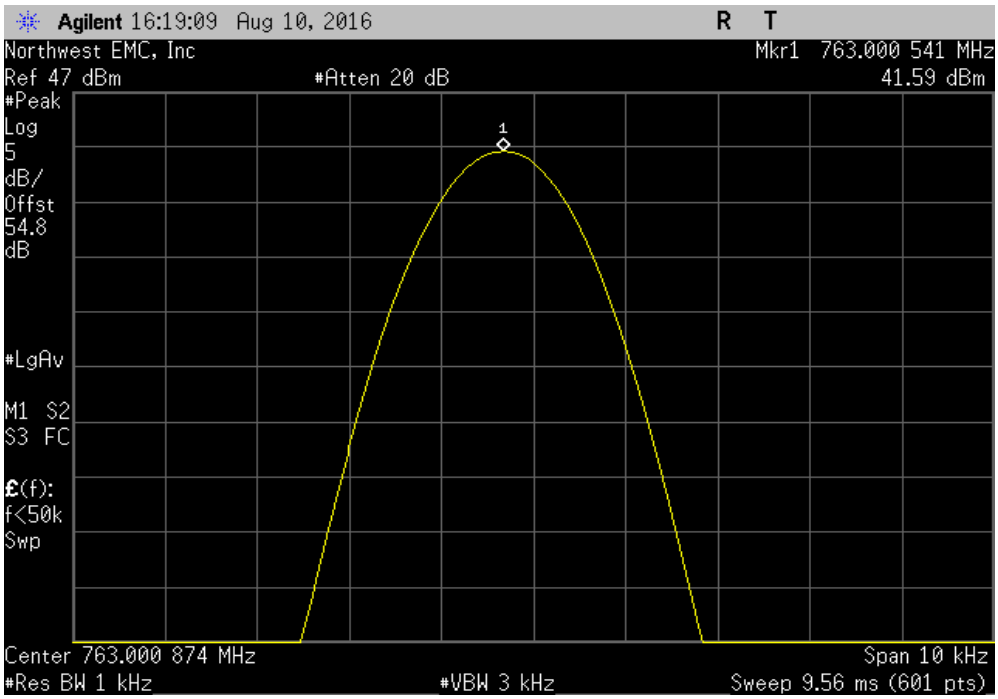
Port 1, Normal Temperature and Voltage, Single Channel LTE10, 763MHz						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		763.000541	763	0.7	1	Pass



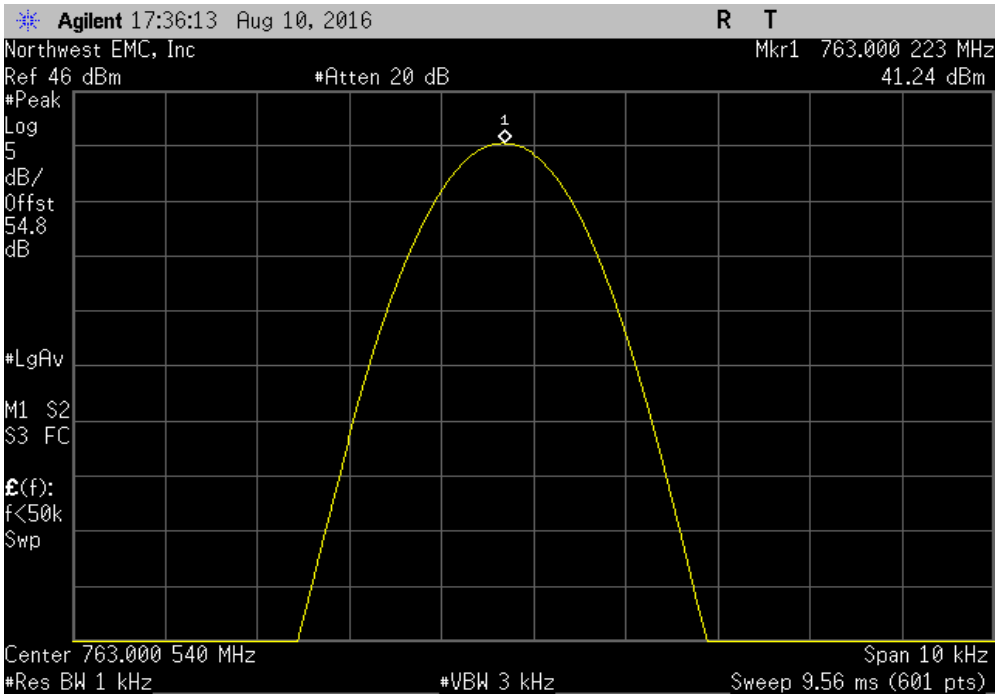
Port 1, Extreme Voltage, 55.2 VDC, Single Channel LTE10, 763MHz						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		763.000541	763	0.7	1	Pass



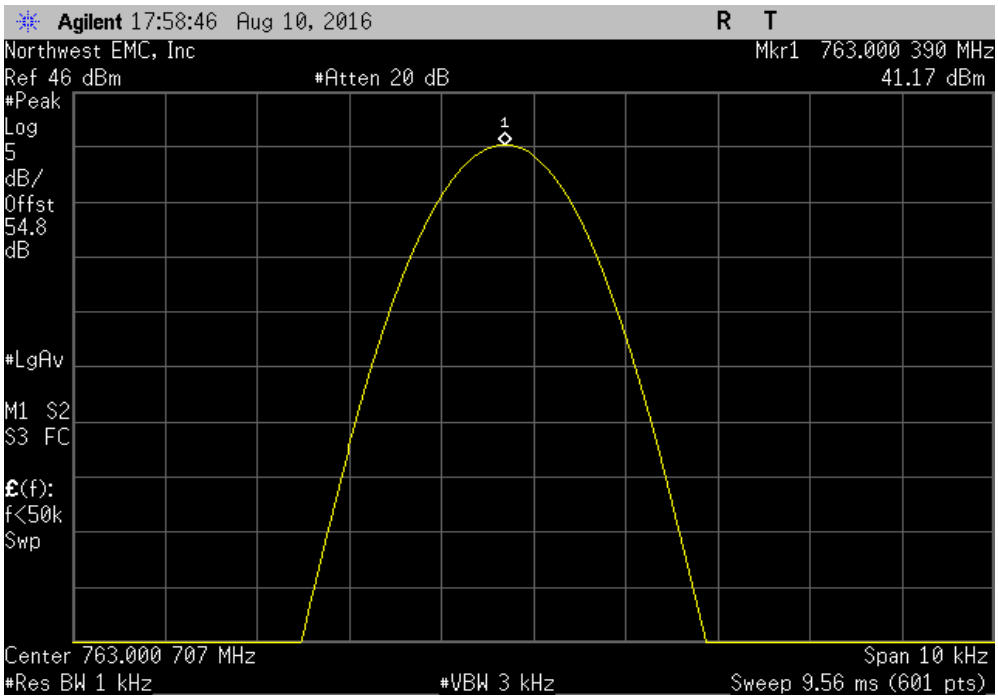
Port 1, Extreme Voltage, 40.8 VDC, Single Channel LTE10, 763MHz						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		763.000541	763	0.7	1	Pass



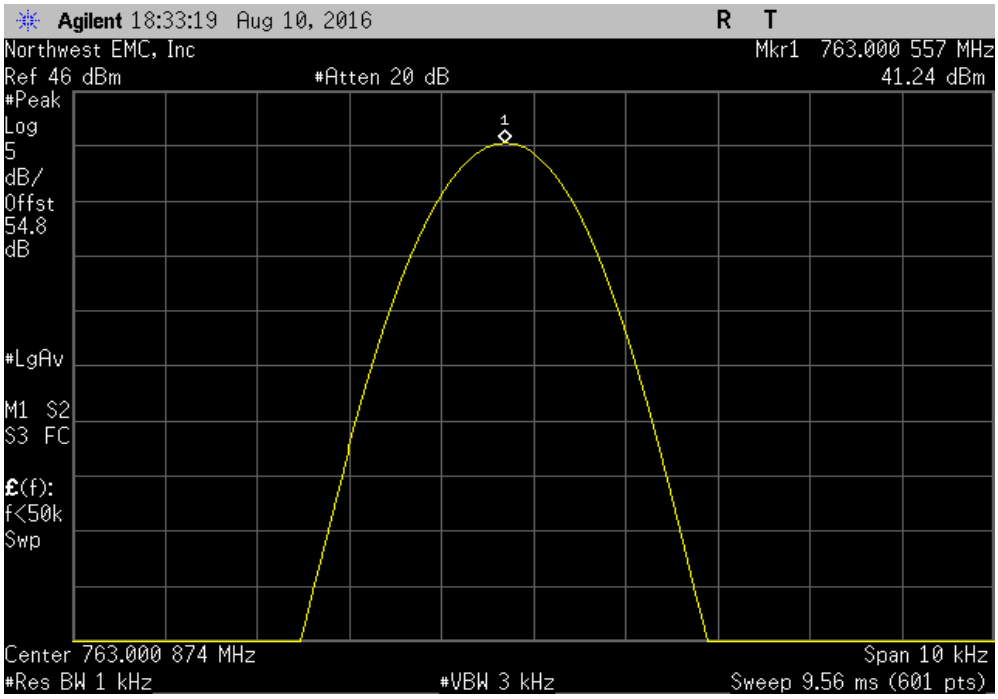
Port 1, Extreme Temperature, -30°C, Single Channel LTE10, 763MHz						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		763.000223	763	0.3	1	Pass



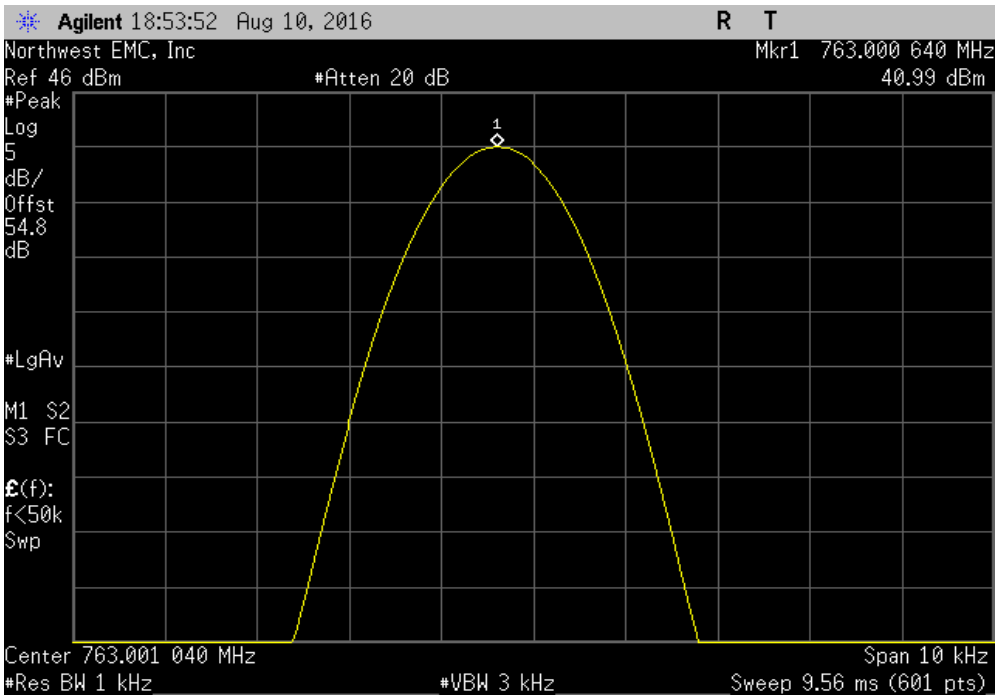
Port 1, Extreme Temperature, -20°C, Single Channel LTE10, 763MHz						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		763.00039	763	0.5	1	Pass



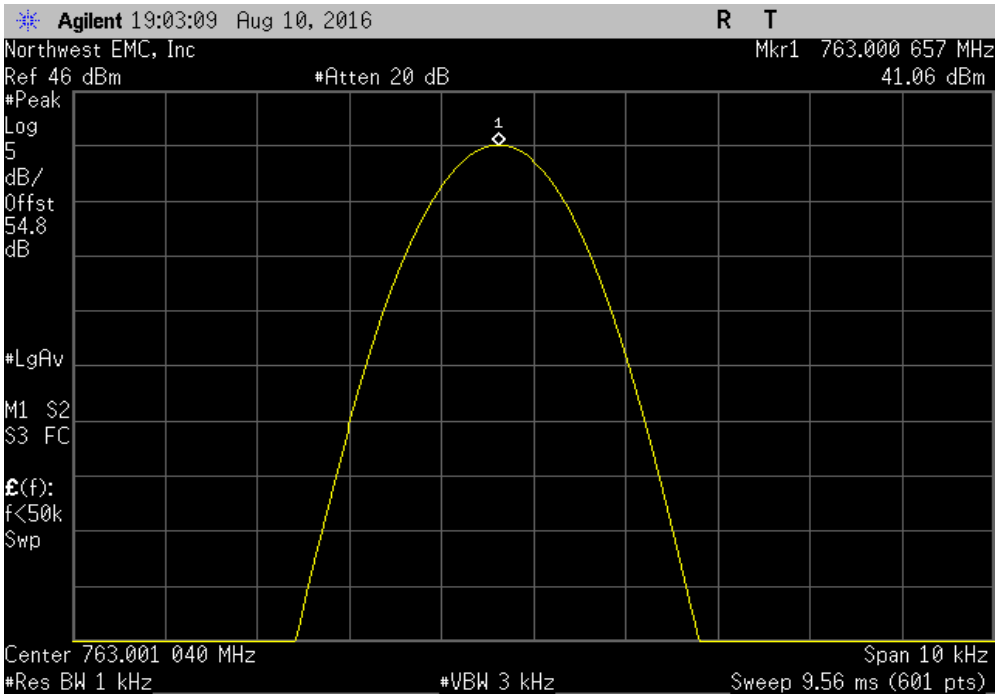
Port 1, Extreme Temperature, -10°C, Single Channel LTE10, 763MHz						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		763.000557	763	0.7	1	Pass



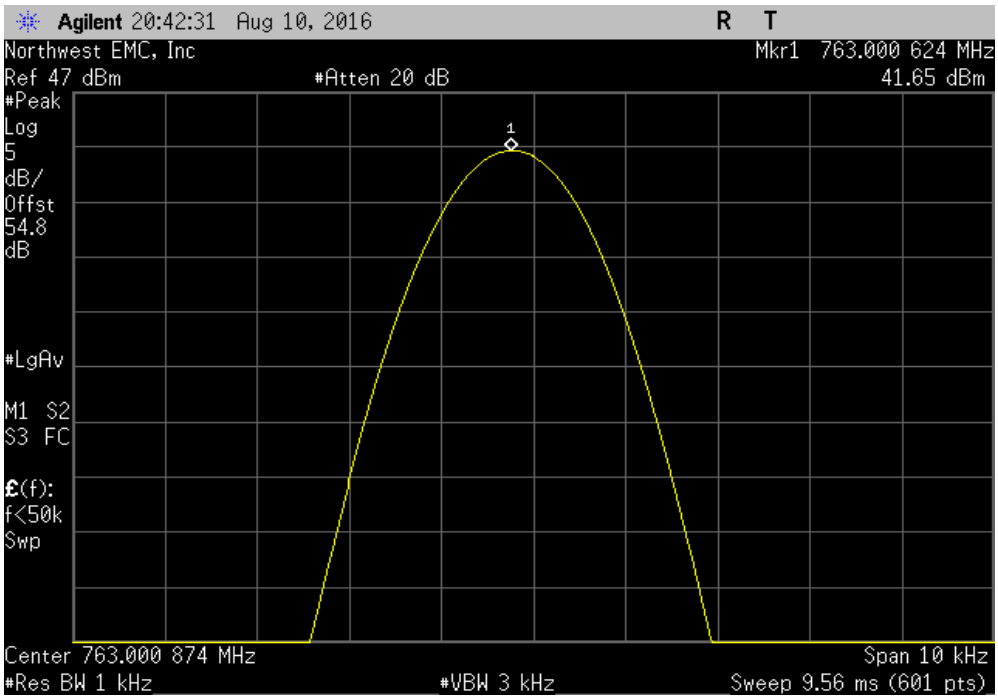
Port 1, Extreme Temperature, 0°C, Single Channel LTE10, 763MHz						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		763.00064	763	0.8	1	Pass



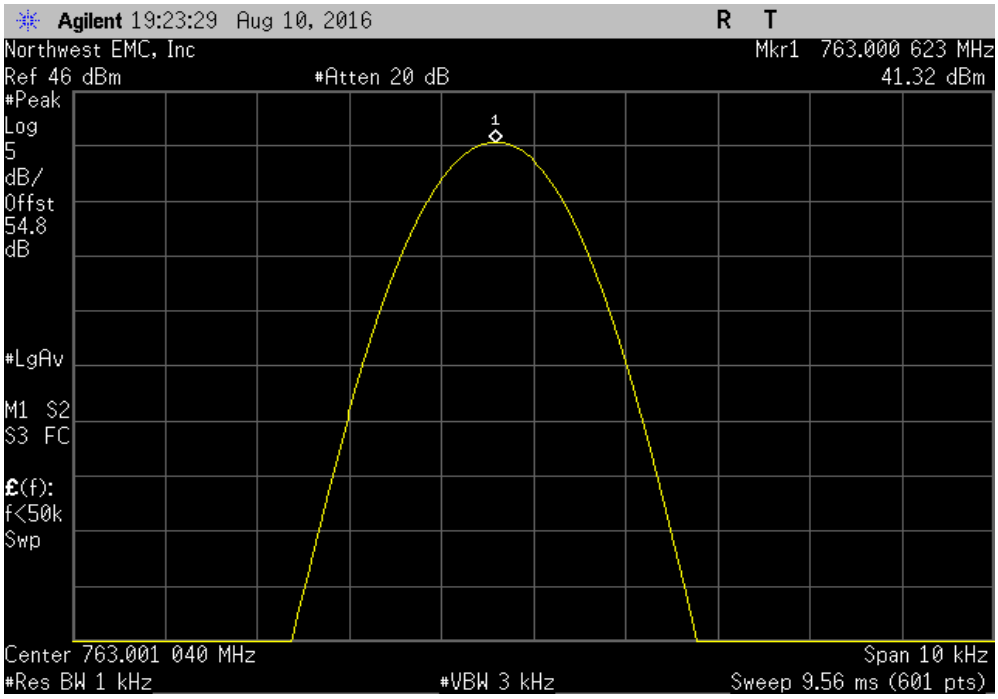
Port 1, Extreme Temperature, +10°C, Single Channel LTE10, 763MHz						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		763.000657	763	0.9	1	Pass



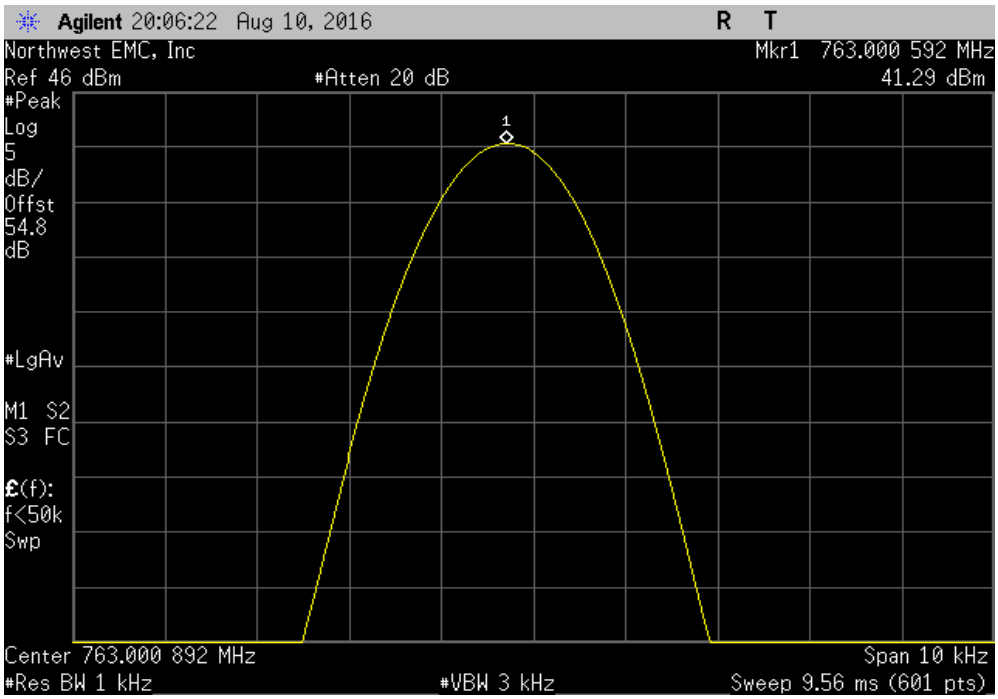
Port 1, Extreme Temperature, +20°C, Single Channel LTE10, 763MHz						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		763.000624	763	0.8	1	Pass



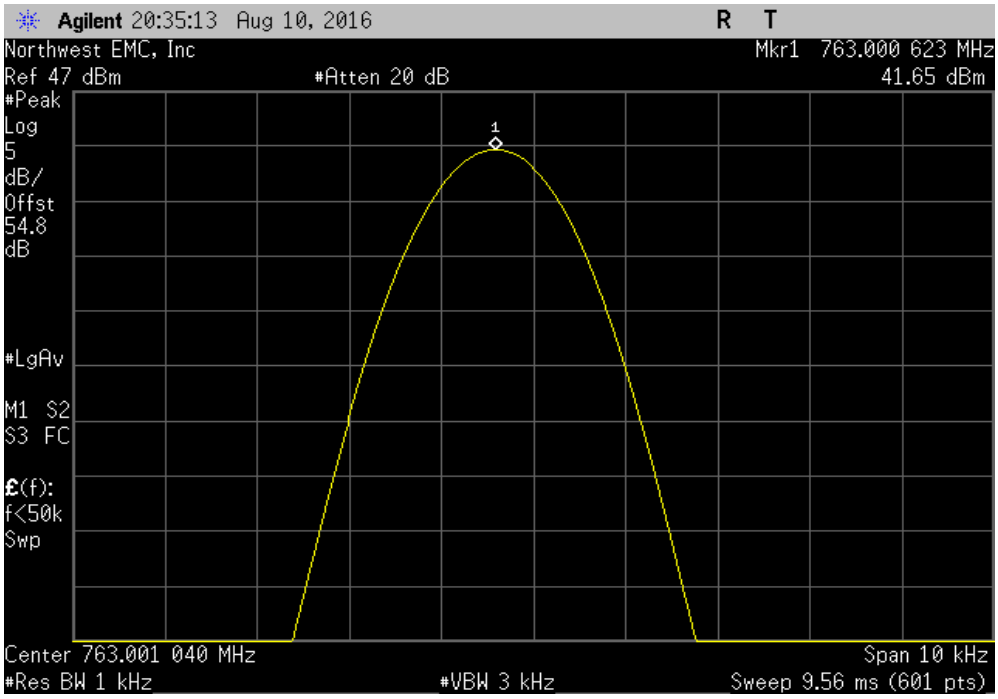
Port 1, Extreme Temperature, +30°C, Single Channel LTE10, 763MHz						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		763.000623	763	0.8	1	Pass



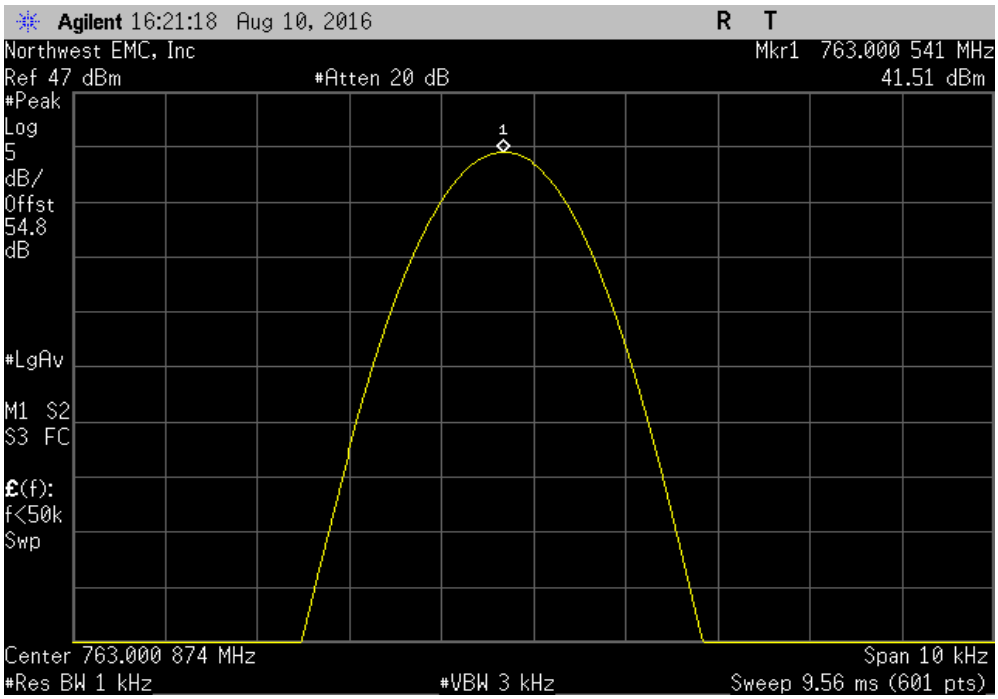
Port 1, Extreme Temperature, +40°C, Single Channel LTE10, 763MHz						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		763.000592	763	0.8	1	Pass



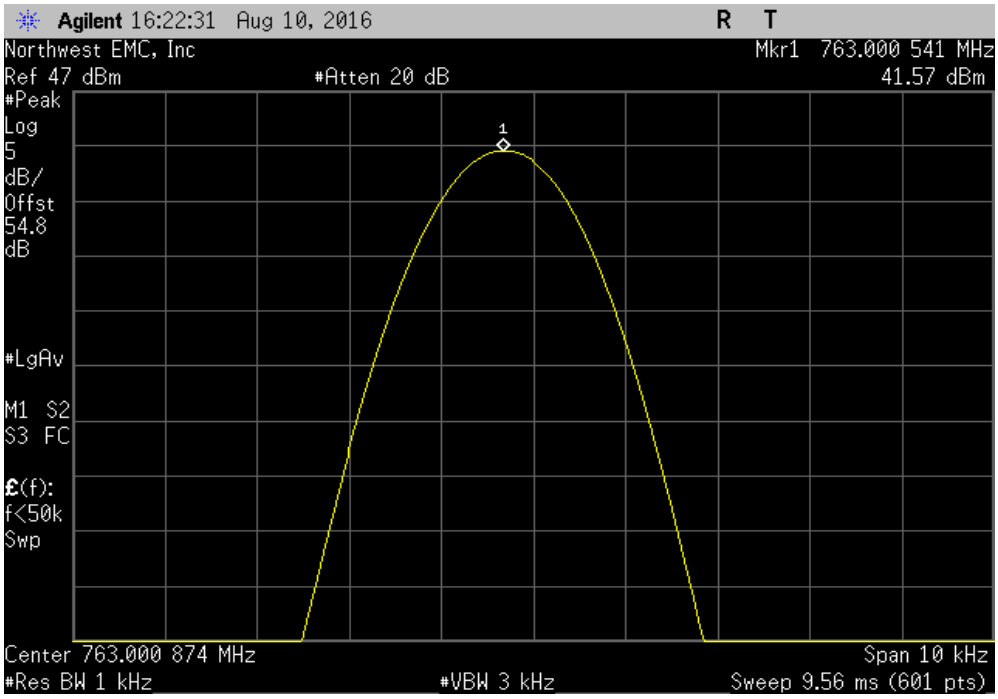
Port 1, Extreme Temperature, +50°C, Single Channel LTE10, 763MHz						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		763.000623	763	0.8	1	Pass



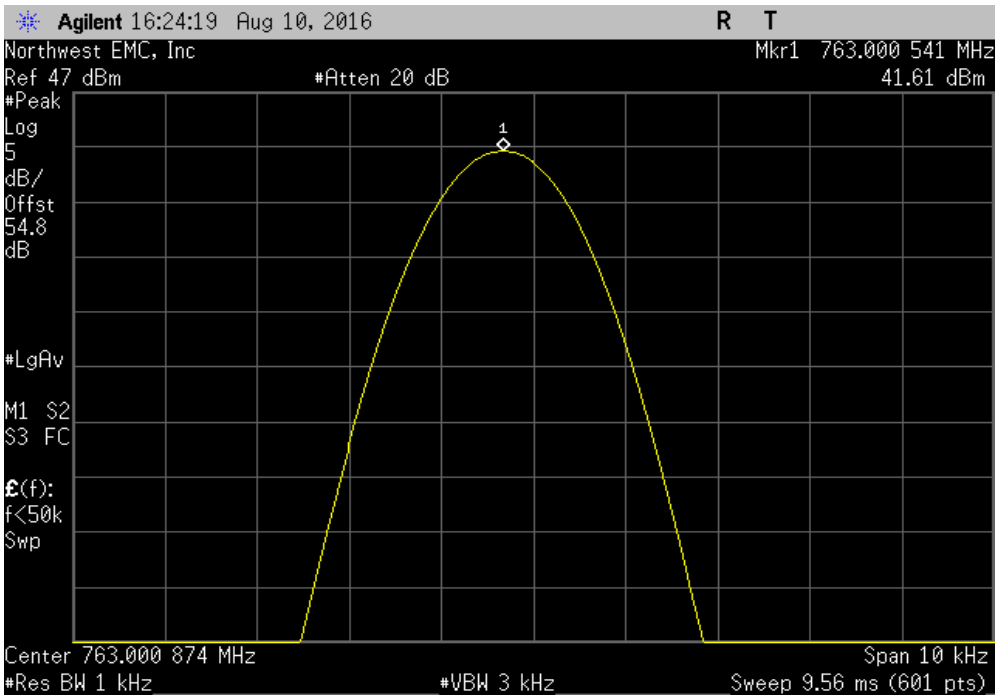
Port 2, Normal Temperature and Voltage, Single Channel LTE10, 763MHz						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		763.000541	763	0.7	1	Pass



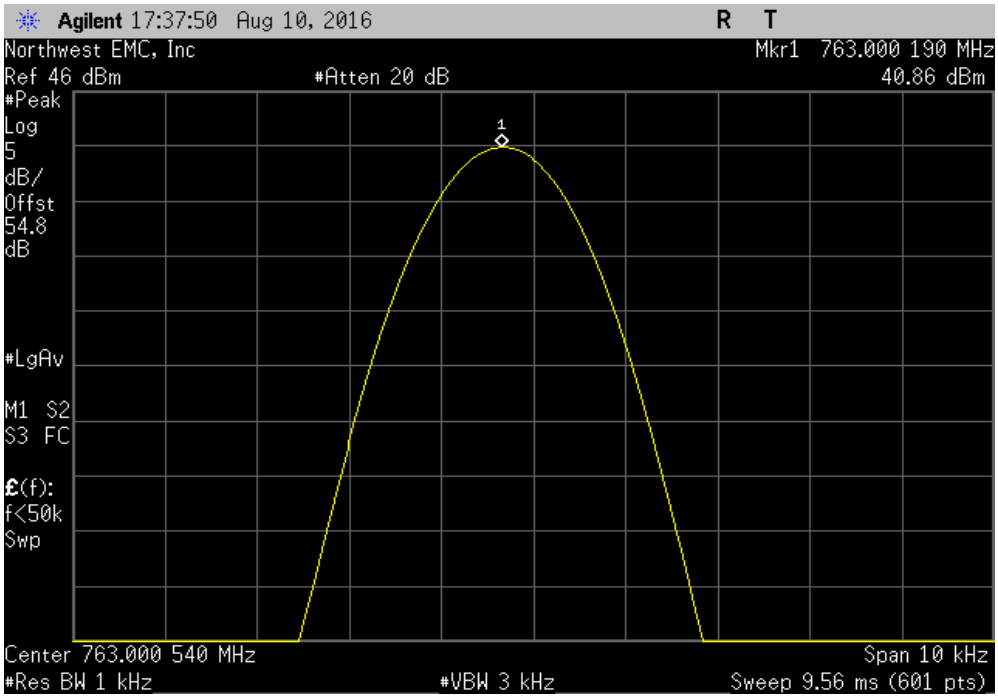
Port 2, Extreme Voltage, 55.2 VDC, Single Channel LTE10, 763MHz						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		763.000541	763	0.7	1	Pass



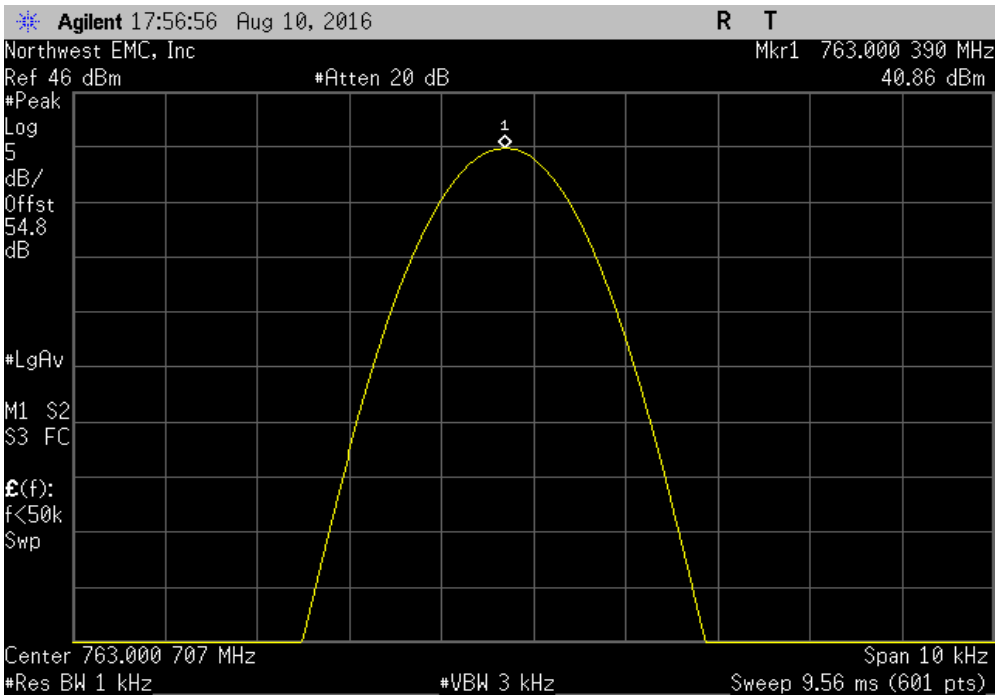
Port 2, Extreme Voltage, 40.8 VDC, Single Channel LTE10, 763MHz						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		763.000541	763	0.7	1	Pass



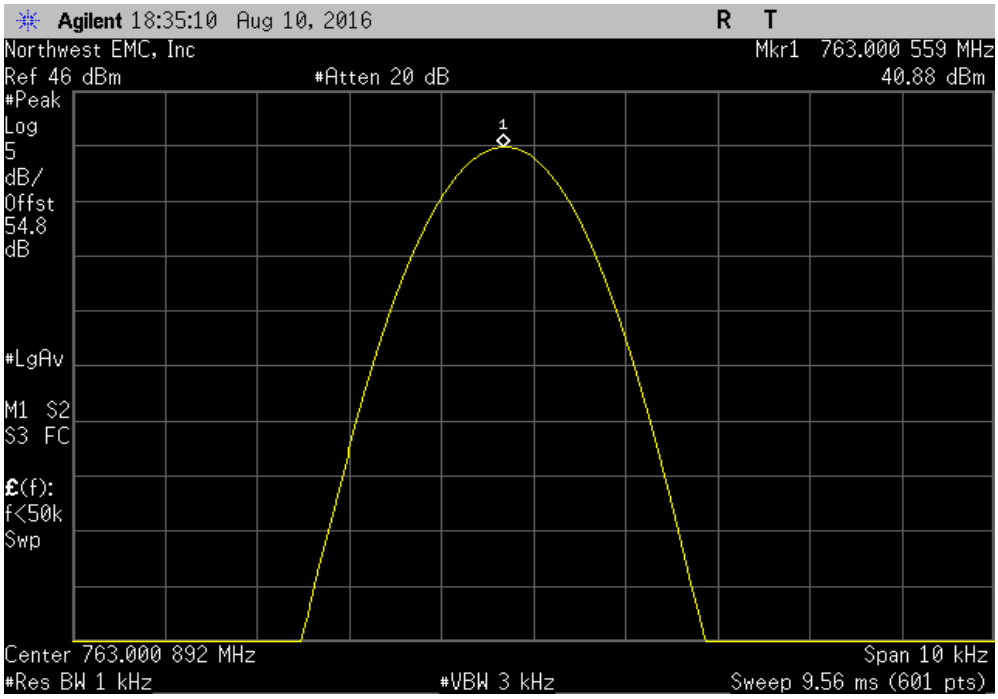
Port 2, Extreme Temperature, -30°C, Single Channel LTE10, 763MHz						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		763.00019	763	0.3	1	Pass



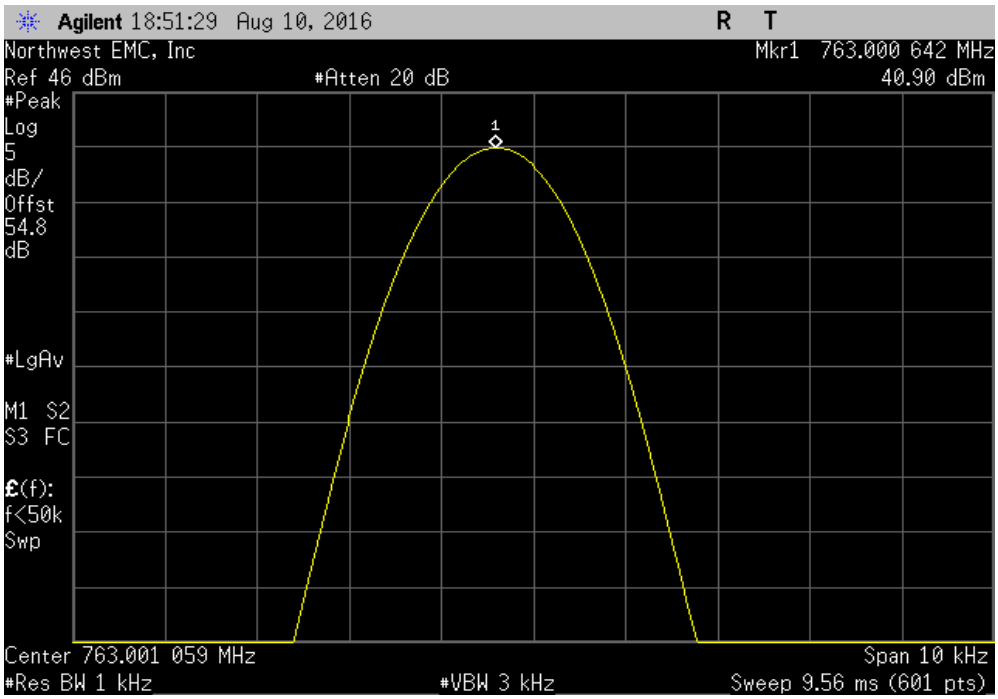
Port 2, Extreme Temperature, -20°C, Single Channel LTE10, 763MHz						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		763.00039	763	0.5	1	Pass



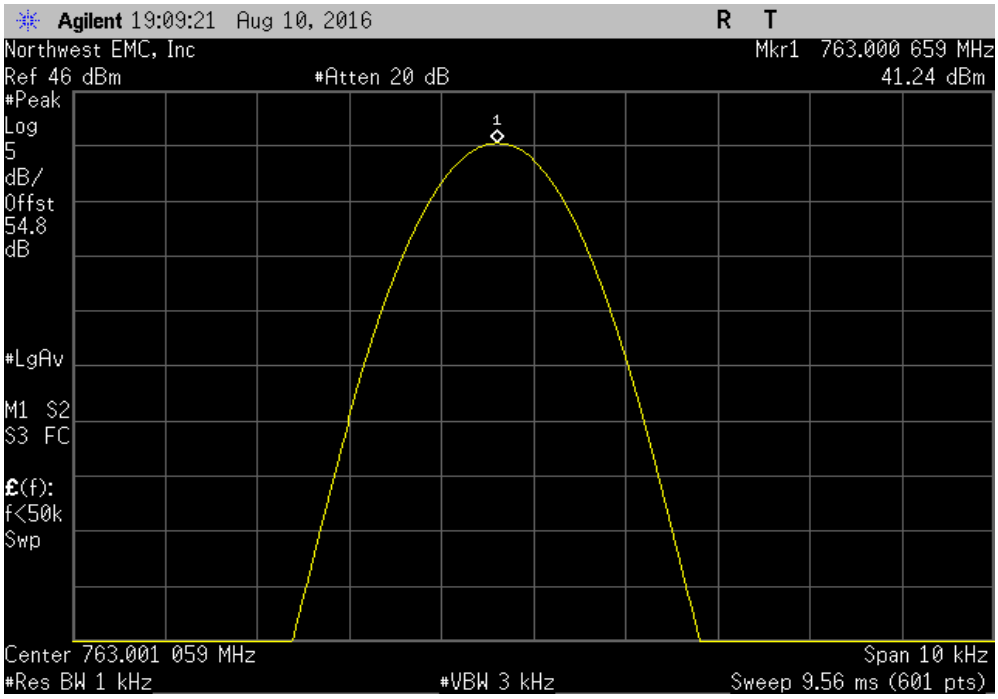
Port 2, Extreme Temperature, -10°C, Single Channel LTE10, 763MHz						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		763.000559	763	0.7	1	Pass



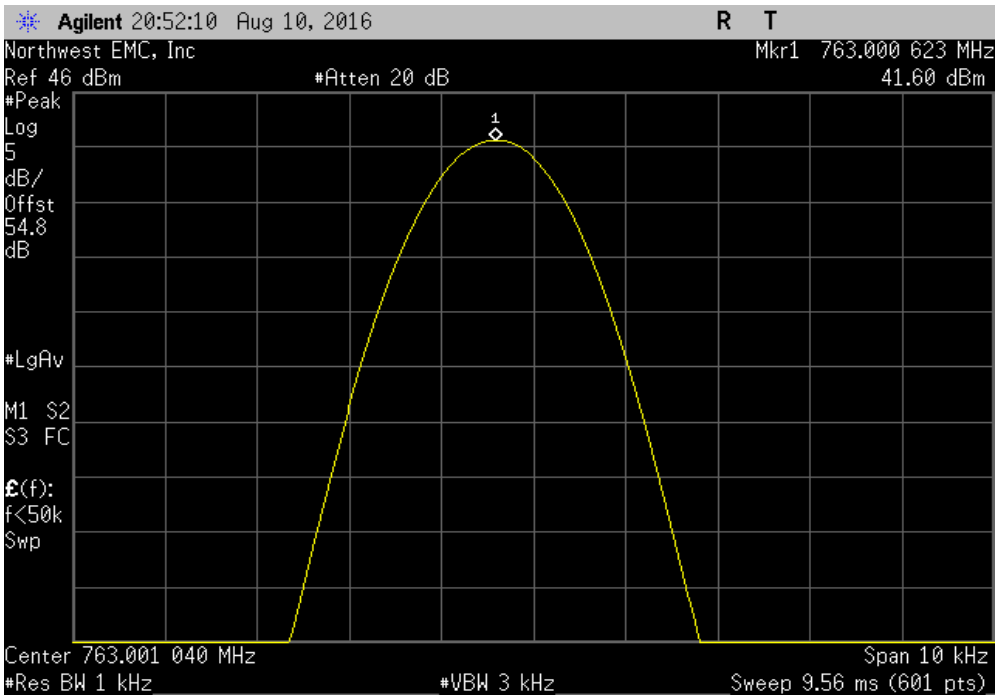
Port 2, Extreme Temperature, 0°C, Single Channel LTE10, 763MHz						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		763.000642	763	0.8	1	Pass



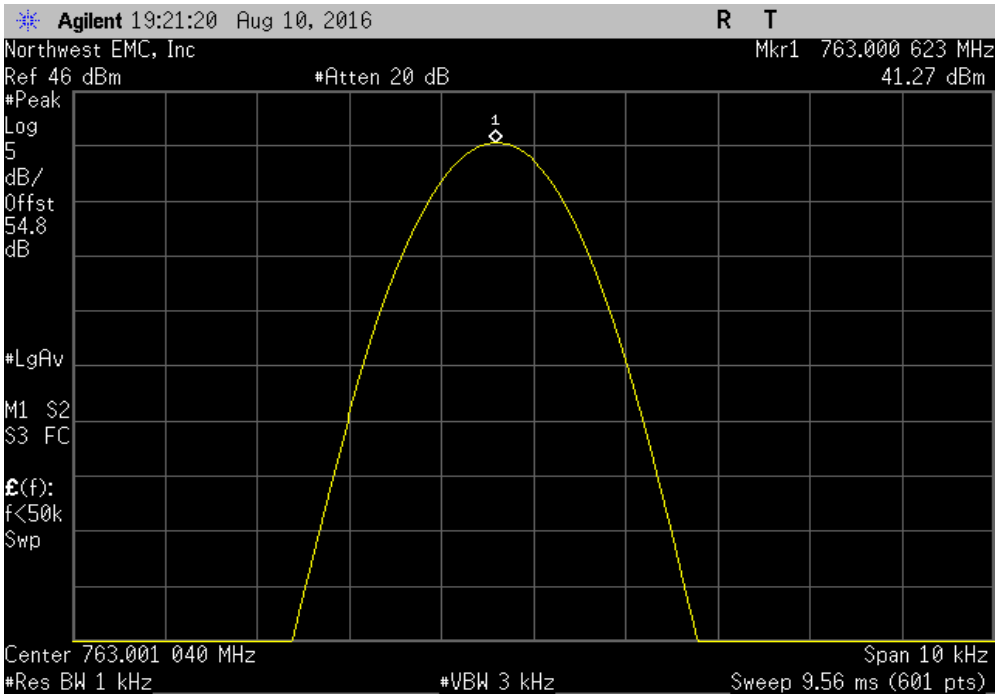
Port 2, Extreme Temperature, +10°C, Single Channel LTE10, 763MHz						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		763.000659	763	0.9	1	Pass



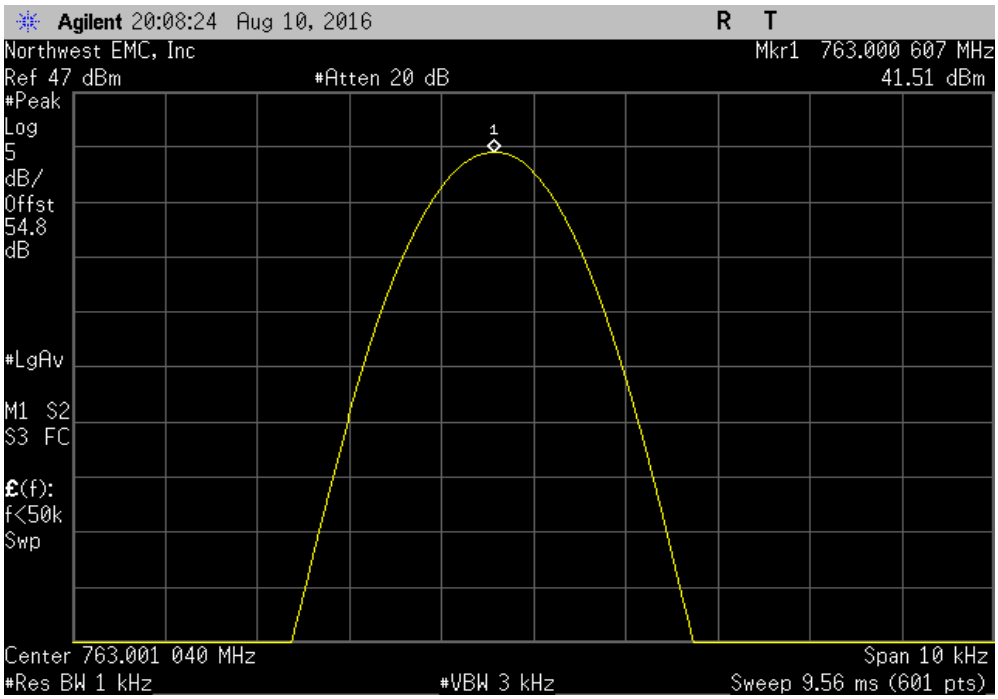
Port 2, Extreme Temperature, +20°C, Single Channel LTE10, 763MHz						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		763.000623	763	0.8	1	Pass



Port 2, Extreme Temperature, +30°C, Single Channel LTE10, 763MHz						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		763.000623	763	0.8	1	Pass



Port 2, Extreme Temperature, +40°C, Single Channel LTE10, 763MHz						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		763.000607	763	0.8	1	Pass



Port 2, Extreme Temperature, +50°C, Single Channel LTE10, 763MHz						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		763.000623	763	0.8	1	Pass