

NORTHWEST EMC

TE Connectivity / ADC Telecommunications

Spectrum 2300 MHz WCS Secondary RAU

FCC 27:2015

Report # TECO0024



NVLAP Lab Code: 200881-0

This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government of the United States of America. This Report may only be duplicated in its entirety

CERTIFICATE OF TEST

Last Date of Test: February 25, 2015
TE Connectivity / ADC Telecommunications
Model: Spectrum 2300 MHz WCS Secondary RAU

Radio Equipment Testing

Standards

Specification	Method
FCC 27:2015, FCC 2.1046	ANSI/TIA/EIA-603-C-2004
FCC 27:2015, FCC 2.1049	
FCC 27:2015, FCC 2.1051	
FCC 27:2015, FCC 2.1053	
FCC 27:2015, FCC 2.1055	

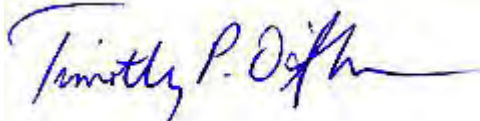
Results

Test Description	Applied	Results	Comments
Equivalent Isotropic Radiated Power (EIRP)	Yes	Pass	
Emissions Bandwidth	Yes	Pass	
Spurious Conducted Emissions	Yes	Pass	
Band Edge Compliance	Yes	Pass	
Intermodulation	Yes	Pass	
Frequency Stability	Yes	Pass	
Field Strength of Spurious Emissions	Yes	Pass	
Peak to Average Ratio	Yes	Pass	

Deviations From Test Standards

None

Approved By:



Tim O'Shea, 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.

REVISION HISTORY

Revision Number		Description	Date	Page Number
00		None		

ACCREDITATIONS AND AUTHORIZATIONS

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

IC - Recognized by Industry Canada as a Certification Body (CB). Certification chambers and Open Area Test Sites are filed with IC.

European Union

European Commission – Validated by the European Commission as a Conformity Assessment Body (CAB) under the EMC directive and 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

Measurement Uncertainty

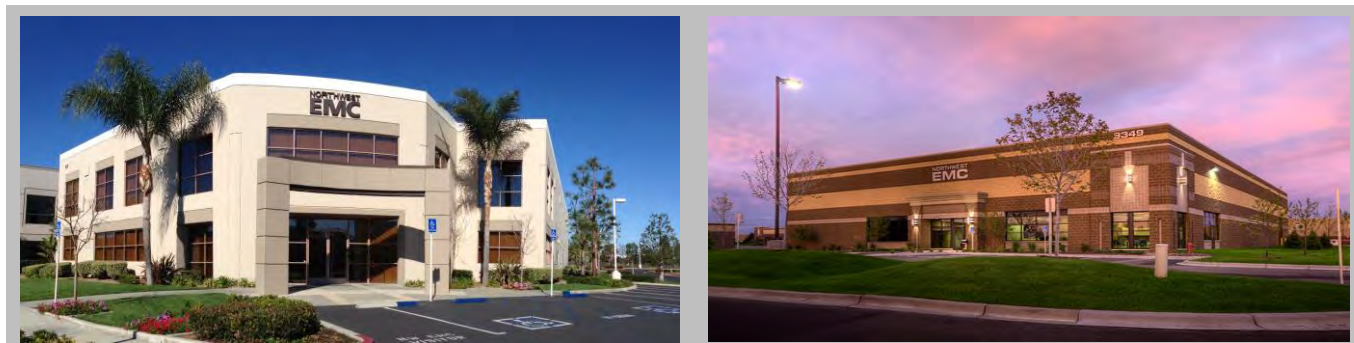
When a measurement is made, the result will be different from the true or theoretically correct value. The difference is the result of tolerances in the measurement system that cannot be completely eliminated. To the extent that technology allows us, it has been our aim to minimize this error. Measurement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

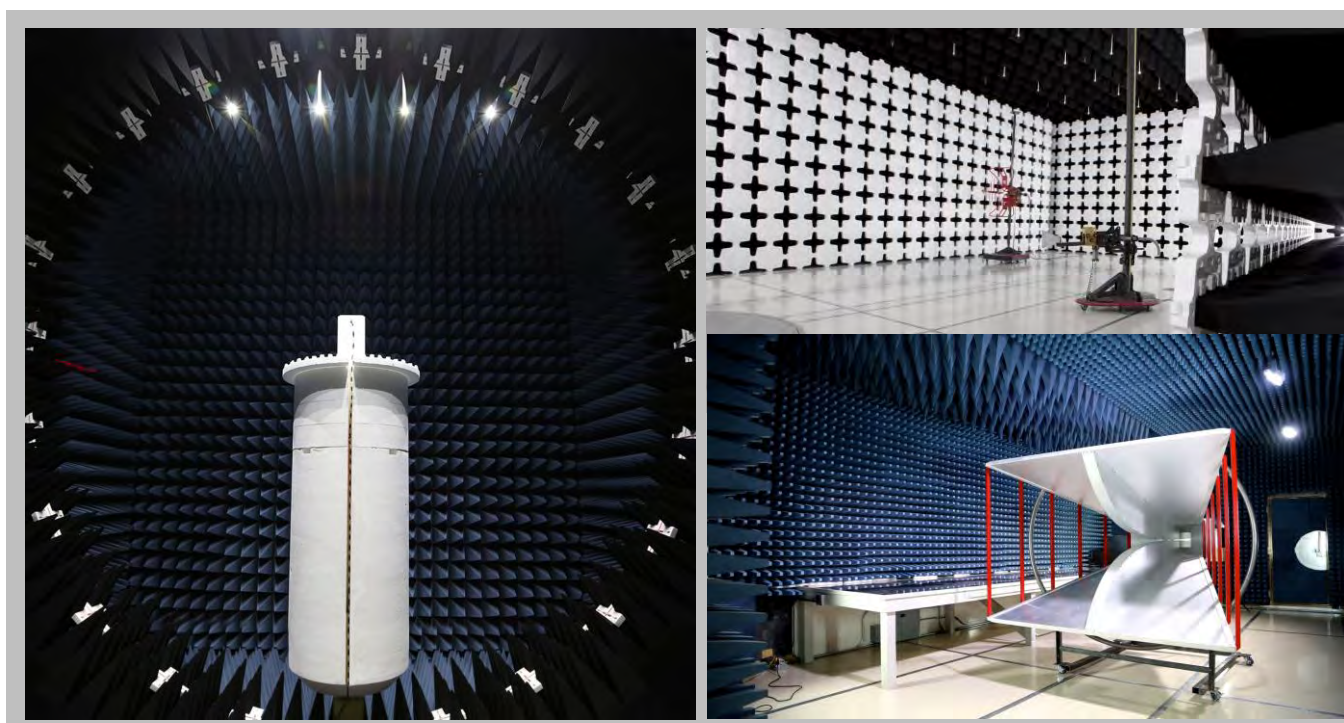
The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

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)	4.7 dB	-4.7 dB
AC Powerline Conducted Emissions (dB)	2.9 dB	-2.9 dB

FACILITIES



California Labs OC01-13 41 Tesla Irvine, CA 92618 (949) 861-8918	Minnesota Labs MN01-08, MN10 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	New York Labs NY01-04 4939 Jordan Rd. Elbridge, NY 13060 (315) 554-8214	Oregon Labs EV01-12 22975 NW Evergreen Pkwy Hillsboro, OR 97124 (503) 844-4066	Texas Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Washington Labs NC01-05 19201 120 th Ave NE Bothell, WA 9801 (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
Industry 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/RRR, MIC, MOC, NCC, OFCA					
US0158	US0175	N/A	US0017	US0191	US0157



PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	TE Connectivity / ADC Telecommunications
Address:	1187 Park Place
City, State, Zip:	Shakopee, MN 55379
Test Requested By:	Joshua Wittman
Model:	Spectrum 2300 MHz WCS Secondary RAU
First Date of Test:	February 12, 2015
Last Date of Test:	February 25, 2015
Receipt Date of Samples:	February 12, 2015
Equipment Design Stage:	Production
Equipment Condition:	No Damage

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
Industrial Signal Booster.
Testing Objective:
To demonstrate compliance to FCC Part 27.

CONFIGURATIONS

Configuration TECO0024- 1

Software/Firmware Running during test					
Description				Version	
Remote Firmware				8.1.9.1dev5	

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Spectrum 2300 MHz WCS Secondary RAU	TE Connectivity / ADC Telecommunications	SP-S3-2323-12-HP	GR223E8E

Peripherals in test setup boundary			
Description	Manufacturer	Model/Part Number	Serial Number
RF Signal Generator	Aeroflex	IFR 3413	341006/252
Laptop	Lenovo	T400	L3-A9994 08/09
Laptop Supply	Lenovo	42T4418	11S42T4418Z1ZGWG19659N
Power Supply	Xantrex	HPD 60-5	MC27884
IO Control Device	TE Connectivity / ADC Telecommunications	Various	None
IO Control Device	TE Connectivity / ADC Telecommunications	Various	None
54V Power Supply	TE Connectivity / ADC Telecommunications	SPT-2400 SCDC-1	6211-00006
Power to Coax Converter	TE Connectivity / ADC Telecommunications	SPT-0000000REV-1, SPT-00000MICRO-1, SPT0000000FWD-1	MR2217AS, MR2250C2, MR2266Y9
Main Controller	TE Connectivity / ADC Telecommunications	SPT-M3-8519-11-HP	MR2289F3
Attenuator	Not Listed	None	A1164
Attenuator	Not Listed	None	A1153

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
AC Power	No	1.8m	No	RF Signal Generator	AC Mains
AC Power x2	No	1.8m	No	54V Power Supply	AC Mains
AC Power	No	1.8m	No	Power Supply	AC Mains
AC Power	No	1.8m	No	Laptop Supply	AC Mains
DC Power	No	1.8m	Yes	Laptop	Laptop Supply
DC Power	No	1.8m	No	IO Control Device	Power Supply
Ethernet	No	1.8m	No	IO Control Device	Laptop
Coax x3	Yes	0.3m	No	IO Control Device	Power to Coax Converter
Coax x2	Yes	2.0m	No	Power to Coax Converter	Main Controller
Coax x2 to Coax via combiner	Yes	3.0m	No	IO Control Device	RF Signal Generator
Fiber	No	1.8m	No	IO Control Device	IO Control Device
DC Power	No	>3.0m	Yes	54V Power Supply	Power to Coax Converter
Coax x2	Yes	3.05m	No	Main Controller	Spectrum 2300 MHz WCS Secondary RAU

CONFIGURATIONS

Configuration TECO0024- 2

Software/Firmware Running during test					
Description				Version	
Remote Firmware				8.1.9.1dev5	

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Spectrum 2300 MHz WCS Secondary RAU	TE Connectivity / ADC Telecommunications	SP-S3-2323-12-HP	GR223E8E

Peripherals in test setup boundary			
Description	Manufacturer	Model/Part Number	Serial Number
RF Signal Generator	Aeroflex	IFR 3413	341006/252
Laptop	Lenovo	T400	L3-A9994 08/09
Laptop Supply	Lenovo	42T4418	11S42T4418Z1ZGWG19659N
Power Supply	Xantrex	HPD 60-5	MC27884
IO Control Device	TE Connectivity / ADC Telecommunications	Various	None
IO Control Device	TE Connectivity / ADC Telecommunications	Various	None
54V Power Supply	TE Connectivity / ADC Telecommunications	SPT-2400 SCDC-1	6211-00006
Power to Coax Converter	TE Connectivity / ADC Telecommunications	SPT-0000000REV-1, SPT-00000MICRO-1, SPT0000000FWD-1	MR2217AS, MR2250C2, MR2266Y9
Main Controller	TE Connectivity / ADC Telecommunications	SPT-M3-8519-11-HP	MR2289F3
Attenuator	Not Listed	None	A1164
Attenuator	Not Listed	None	A1153

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
AC Power	No	1.8m	No	RF Signal Generator	AC Mains
AC Power x2	No	1.8m	No	54V Power Supply	AC Mains
AC Power	No	1.8m	No	Power Supply	AC Mains
AC Power	No	1.8m	No	Laptop Supply	AC Mains
DC Power	No	1.8m	Yes	Laptop	Laptop Supply
DC Power	No	1.8m	No	IO Control Device	Power Supply
Ethernet	No	1.8m	No	IO Control Device	Laptop
Coax x3	Yes	0.3m	No	IO Control Device	Power to Coax Converter
Coax x2	Yes	2.0m	No	Power to Coax Converter	Main Controller
Coax x2	Yes	>3.0m	No	Main Controller	Spectrum 2300 MHz WCS Secondary RAU
Coax x2 to Coax via combiner	Yes	3.0m	No	IO Control Device	RF Signal Generator
Fiber	No	1.8m	No	IO Control Device	IO Control Device
DC Power	No	>3.0m	Yes	54V Power Supply	Power to Coax Converter

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2/12/2015	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.
2	2/18/2015	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.
3	2/18/2015	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.
4	2/19/2015	Spurious Conducted Emissions	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	2/19/2015	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.
6	2/19/2015	Emissions 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.
7	2/19/2015	Intermodulation	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.
8	2/25/2015	Field Strength of Spurious Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)



XMit 2015.01.14

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.	Interval (mo)
MN08 Direct Connect Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	10/2/2014	12
40 GHz DC Block	Fairview Microwave	SD3379	AMI	10/2/2014	12
Signal Generator MXG	Agilent	N5183A	TIK	10/17/2014	36
EMPower USB RF Power Sensors	ETS	7002-006	SRA	4/17/2014	12
EMPower USB RF Power Sensor	ETS	7002-006	SRE	8/8/2014	12

TEST DESCRIPTION

The RF output power was measured with the EUT set to the frequencies listed 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 EIRP.

$EiRP = \text{Max Measured Power} + \text{Antenna gain (dBi)}$

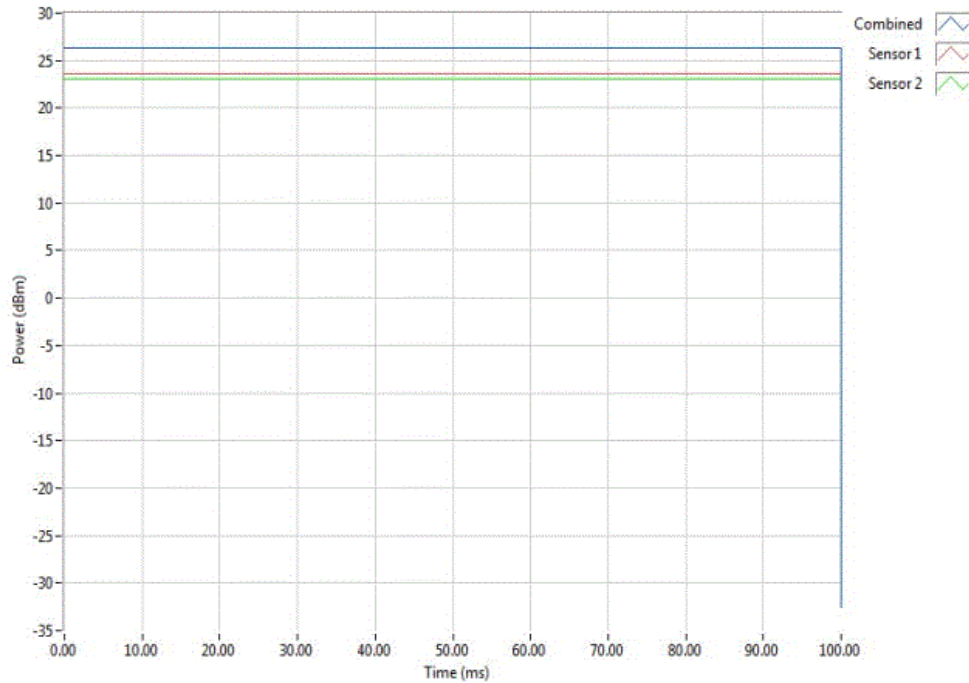
The measurements from port 1 and port 2 were summed to determine the total average power in EIRP.

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

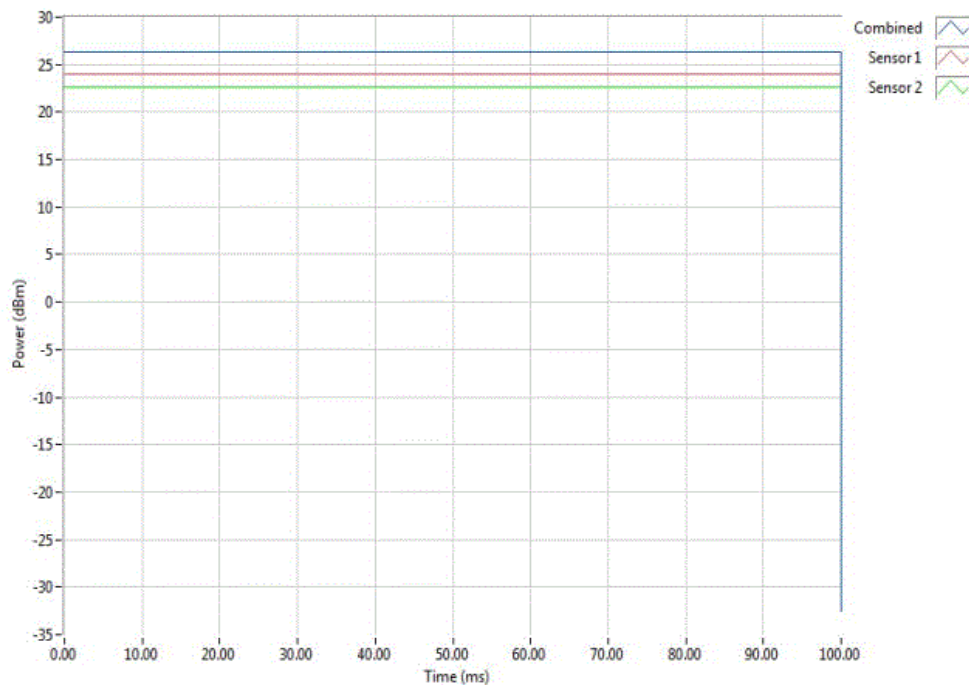
EUT: Spectrum 2300 MHz WCS Secondary RAU		Work Order: TECO0024	
Serial Number: GR223E8E		Date: 02/18/15	
Customer: TE Connectivity / ADC Telecommunications		Temperature: 22.7°C	
Attendees: None		Humidity: 9%	
Project: None		Barometric Pres.: 1023.7	
Tested by: Trevor Buls	Power: 110VAC/60Hz	Job Site: MN08	
TEST SPECIFICATIONS			
FCC 27:2015		Test Method: ANSI/TIA/EIA-603-C-2004	
COMMENTS			
High wattage attenuator was provided by the customer. Antenna gain is assumed to be 0, per customer the antenna gain will be reevaluated during installation. System is rated at 200mW (+23 dBm) per port. Limit is 2kW, (63 dBm).			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	1	Signature: <i>Trevor Buls</i>	
		Avg Pwr Port 1 (dBm)	Avg Pwr Port 2 (dBm)
		Duty Cycle (%)	Avg Pwr Sum (dBm)
		EIRP (dBm)	Limit (dBm)
		Results	
LTE 5 MHz			
	Low channel, 2352.5 MHz	24.17	22.37
	High channel, 2357.5 MHz	23.53	23.06
		100	26.3
		100	26.4
			26.3
			26.4
			63
			63
			Pass
			Pass

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

LTE 5 MHz, Low channel, 2352.5 MHz						
Avg Pwr Port 1 (dBm)	Avg Pwr Port 2 (dBm)	Duty Cycle (%)	Avg Pwr Sum (dBm)	EIRP (dBm)	Limit (dBm)	Results
24.17	22.37	100	26.3	26.3	63	Pass



LTE 5 MHz, High channel, 2357.5 MHz						
Avg Pwr Port 1 (dBm)	Avg Pwr Port 2 (dBm)	Duty Cycle (%)	Avg Pwr Sum (dBm)	EIRP (dBm)	Limit (dBm)	Results
23.53	23.06	100	26.4	26.4	63	Pass



EMISSIONS BANDWIDTH

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.	Interval (mo)
MN08 Direct Connect Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	10/2/2014	12
Attenuator - 20db, 'SMA'	SM Electronics	SA26B-20	RFW	4/3/2014	12
40 GHz DC Block	Fairview Microwave	SD3379	AMI	10/2/2014	12
Signal Generator MXG	Agilent	N5183A	TIK	10/17/2014	36
Spectrum Analyzer	Agilent	E4440A	AAX	4/28/2014	12

TEST DESCRIPTION

A direct connection was made between the RF output of the EUT and a spectrum analyzer. Attenuation and a DC block were used. The reference level offset on the spectrum analyzer was adjusted to compensate for cable loss and the external attenuation used between the RF output and the spectrum analyzer input.

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 26 dB emission bandwidth.

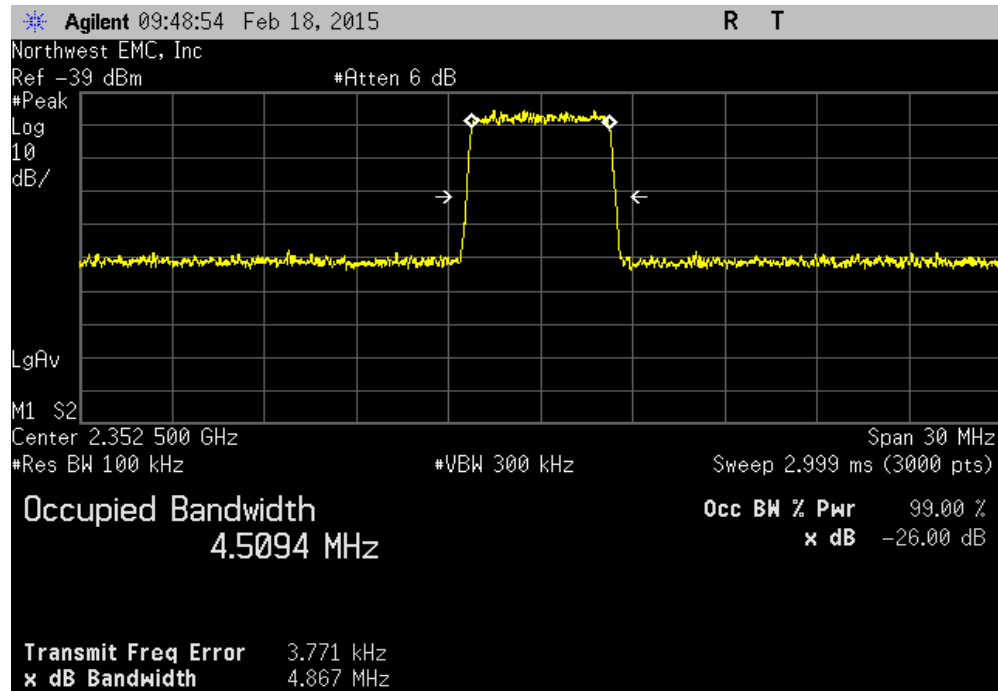
There is no required limit to be met in the rule part for this test. The purpose of the test is to both report the results and to utilize the emission bandwidth for setting the channel power integration bandwidth during conducted output power testing.

EMISSIONS BANDWIDTH

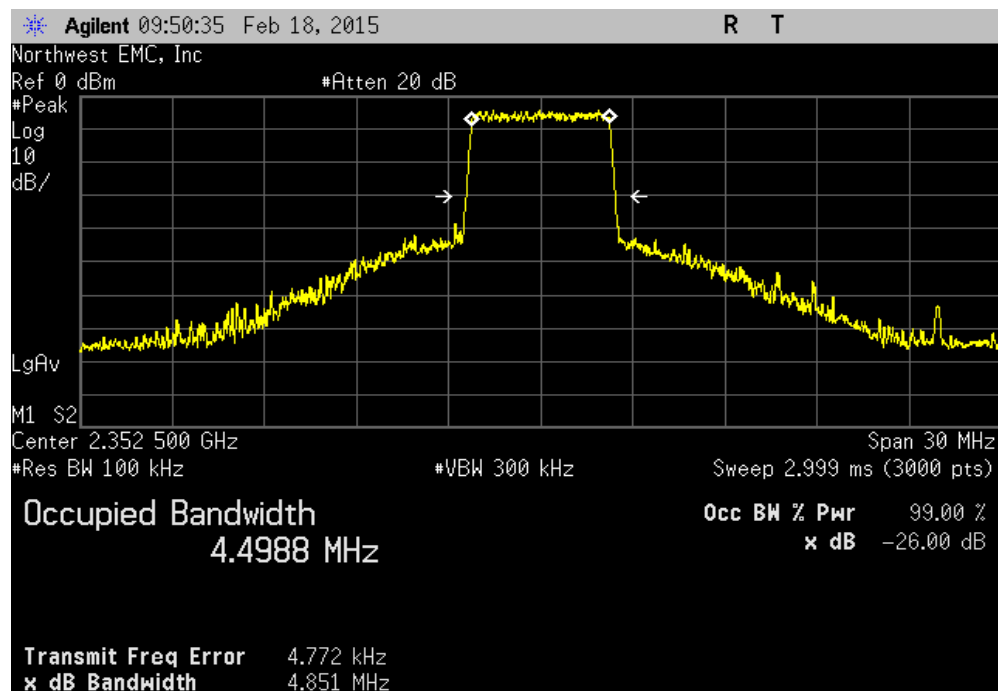
EUT: Spectrum 2300 MHz WCS Secondary RAU		Work Order: TECO0024	
Serial Number: GR223E8E		Date: 02/19/15	
Customer: TE Connectivity / ADC Telecommunications		Temperature: 23.1°C	
Attendees: None		Humidity: 9%	
Project: None		Barometric Pres.: 1031.8	
Tested by: Trevor Buls	Power: 110VAC/60Hz	Job Site: MN08	
TEST SPECIFICATIONS			
FCC 27:2015		Test Method: ANSI/TIA/EIA-603-C-2004	
COMMENTS			
Port 1 was determined to be worst case.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	1	Signature: <i>Trevor Buls</i>	
		Value (MHz)	Limit
LTE 5 MHz			Result
Input Signal		4.867	N/A
Low Channel, 2352.5 MHz		4.851	N/A
High Channel, 2357.5 MHz		4.871	N/A

EMISSIONS BANDWIDTH

LTE 5 MHz, Input Signal					Value	Limit	Result
					(MHz)		
					4.867	N/A	N/A

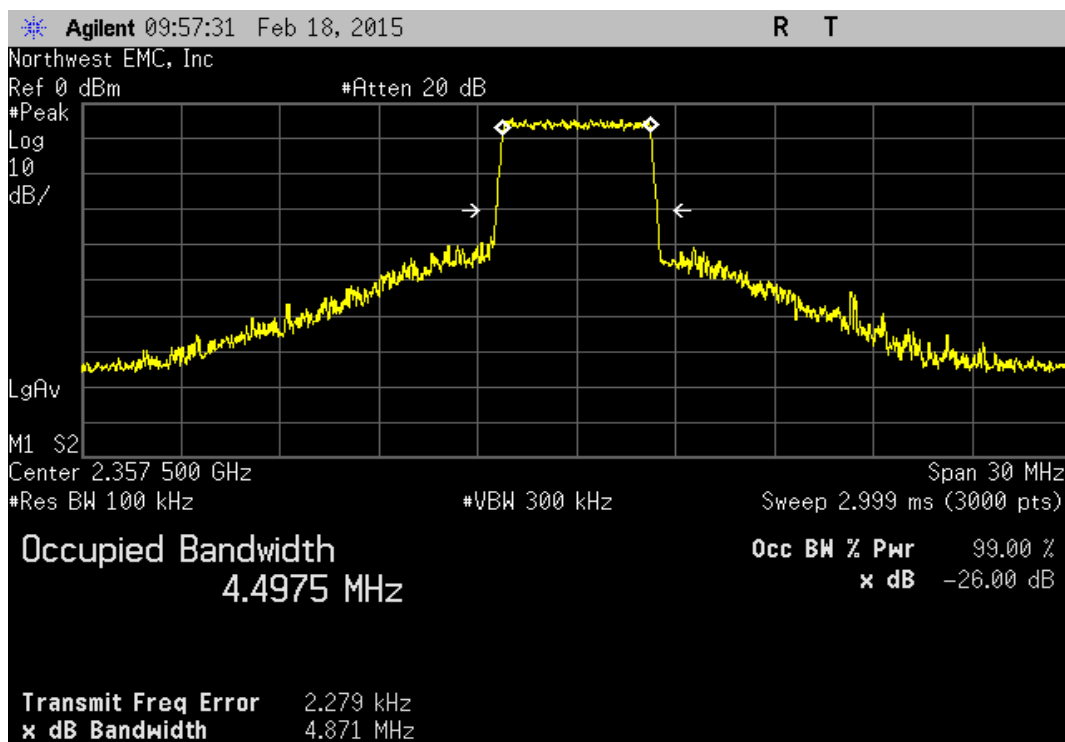


LTE 5 MHz, Low Channel, 2352.5 MHz					Value	Limit	Result
					(MHz)		
					4.851	N/A	N/A



EMISSIONS BANDWIDTH

LTE 5 MHz, High Channel, 2357.5 MHz						
				Value (MHz)	Limit	Result
				4.871	N/A	N/A



SPURIOUS CONDUCTED EMISSIONS

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.	Interval (mo)
Low Pass Filter 0-1000 MHz	Micro-Tronics	LPM50004	HGV	9/24/2014	12
High Pass Filter	K&L Microwave	11SH10-18000/T50000-2.4	HIC	2/16/2015	12
High Pass Filter 2.8-18 GHz	Micro-Tronics	HPM50111	HGY	10/2/2014	12
MN08 Direct Connect Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	10/2/2014	12
Attenuator - 20db, 'SMA'	SM Electronics	SA26B-20	RFW	4/3/2014	12
40 GHz DC Block	Fairview Microwave	SD3379	AMI	10/2/2014	12
Signal Generator MXG	Agilent	N5183A	TIK	10/17/2014	36
Spectrum Analyzer	Agilent	E4440A	AAX	4/28/2014	12

TEST DESCRIPTION

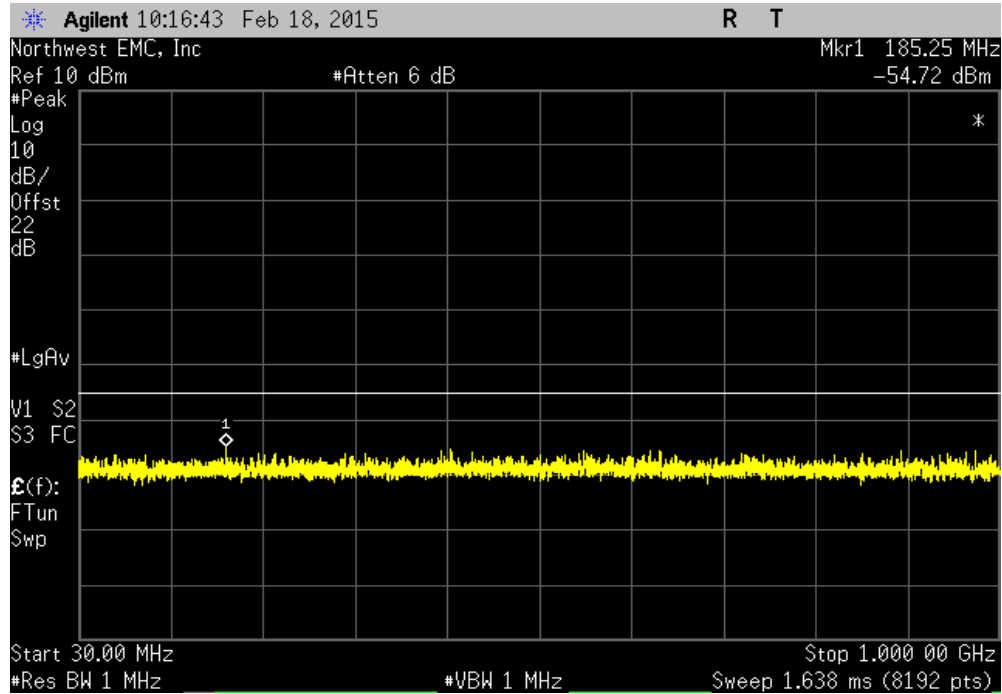
The antenna port spurious emissions were measured at the RF output terminal of the EUT with external attenuation on the RF input of the spectrum analyzer. Analyzer plots utilizing a 1 MHz resolution bandwidth and no video filtering were made for each modulation type from 30 MHz to 24 GHz. The peak conducted 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. Emissions close to the limit were remeasured using an RMS Average detector.

SPURIOUS CONDUCTED EMISSIONS

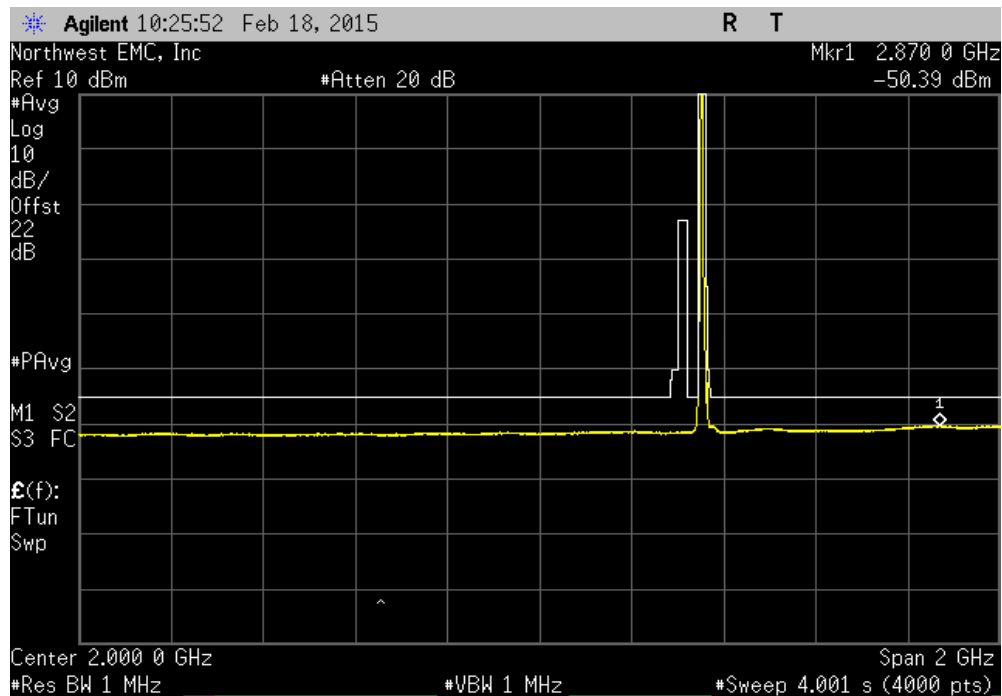
EUT: Spectrum 2300 MHz WCS Secondary RAU		Work Order: TECO0024	
Serial Number: GR223E8E		Date: 02/19/15	
Customer: TE Connectivity / ADC Telecommunications		Temperature: 23.1°C	
Attendees: None		Humidity: 9%	
Project: None		Barometric Pres.: 1031.8	
Tested by: Trevor Buls	Power: 110VAC/60Hz	Job Site: MN08	
TEST SPECIFICATIONS			
FCC 27:2015		Test Method: ANSI/TIA/EIA-603-C-2004	
COMMENTS			
Port 1 was determined to be worst case.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	1	Signature: <i>Trevor Buls</i>	
		Frequency Range	Value (dBm)
			Limit (dBm)
			Result
LTE 5 MHz			
	Low channel, 2352.5 MHz	30 MHz - 1 GHz	-54.72
	Low channel, 2352.5 MHz	1 GHz - 3 GHz	-50.39
	Low channel, 2352.5 MHz	3 GHz - 18 GHz	-53.81
	Low channel, 2352.5 MHz	RMS	-53.42
	Low channel, 2352.5 MHz	18 GHz - 24 GHz	-58.08
	High channel, 2357.5 MHz	30 MHz - 1 GHz	-54.93
	High channel, 2357.5 MHz	1 GHz - 3 GHz	-50.38
	High channel, 2357.5 MHz	3 GHz - 18 GHz	-54.45
	High channel, 2357.5 MHz	RMS	-51.77
	High channel, 2357.5 MHz	18 GHz - 24 GHz	-58.06

SPURIOUS CONDUCTED EMISSIONS

LTE 5 MHz, Low channel, 2352.5 MHz				
Frequency Range	Value (dBm)	Limit (dBm)	Result	
30 MHz - 1 GHz	-54.72	-45	Pass	

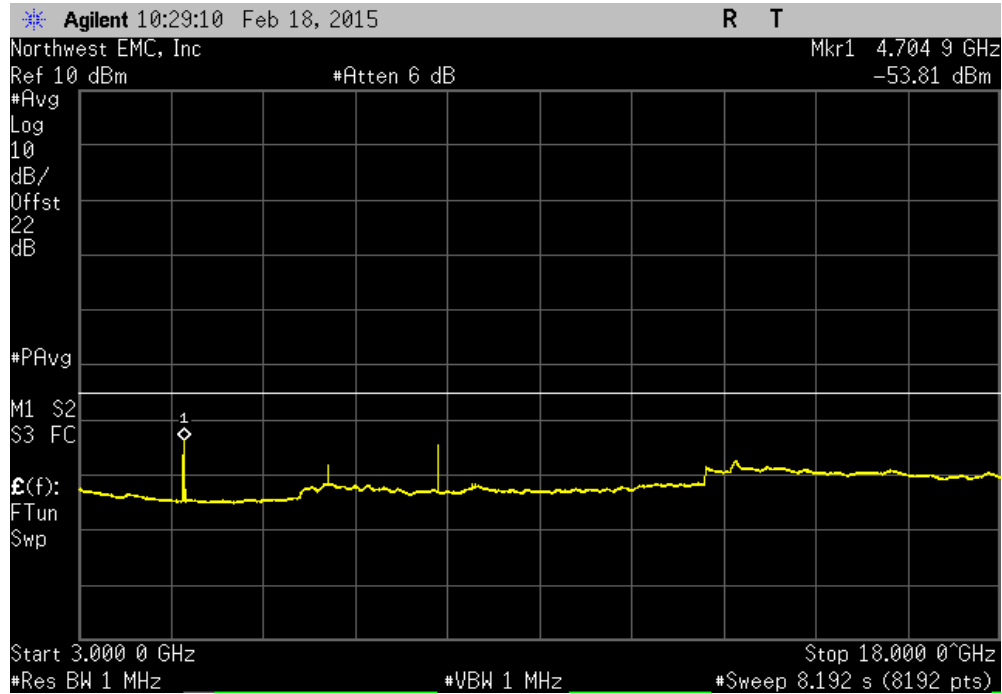


LTE 5 MHz, Low channel, 2352.5 MHz				
Frequency Range	Value (dBm)	Limit (dBm)	Result	
1 GHz - 3 GHz	-50.39	-45	Pass	

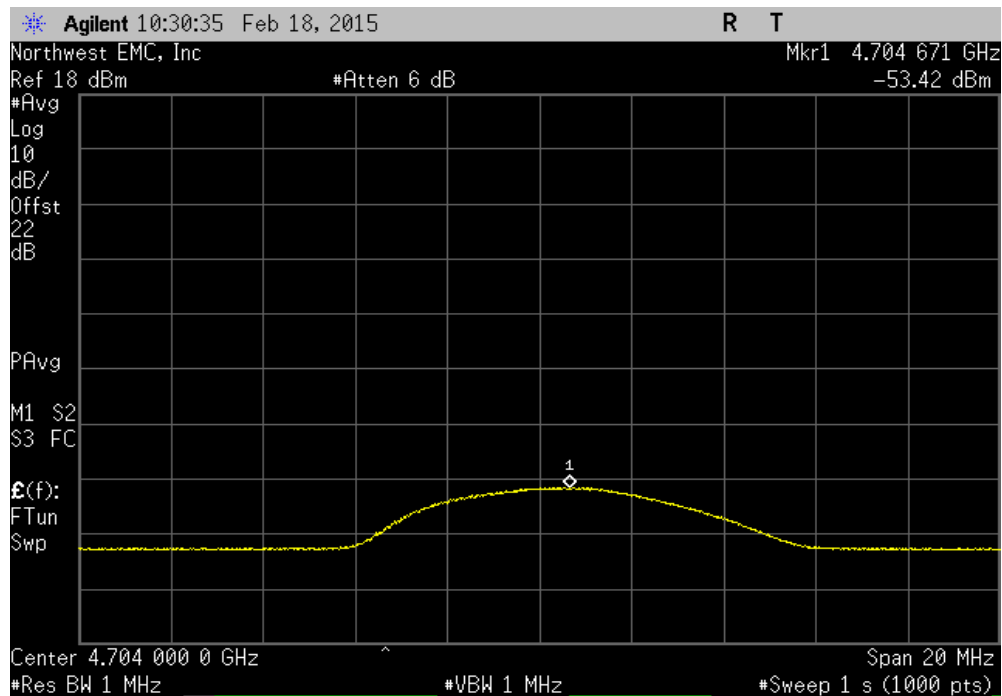


SPURIOUS CONDUCTED EMISSIONS

LTE 5 MHz, Low channel, 2352.5 MHz					
Frequency Range	Value (dBm)	Limit (dBm)	Result		
3 GHz - 18 GHz	-53.81	-45	Pass		

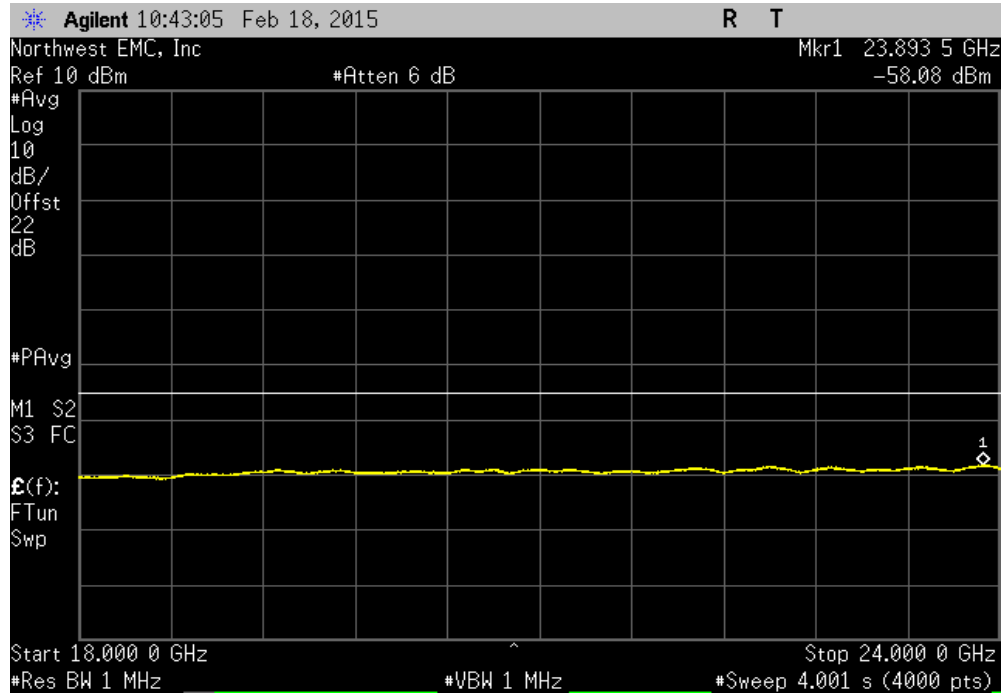


LTE 5 MHz, Low channel, 2352.5 MHz					
Frequency Range	Value (dBm)	Limit (dBm)	Result		
RMS	-53.42	-45	Pass		

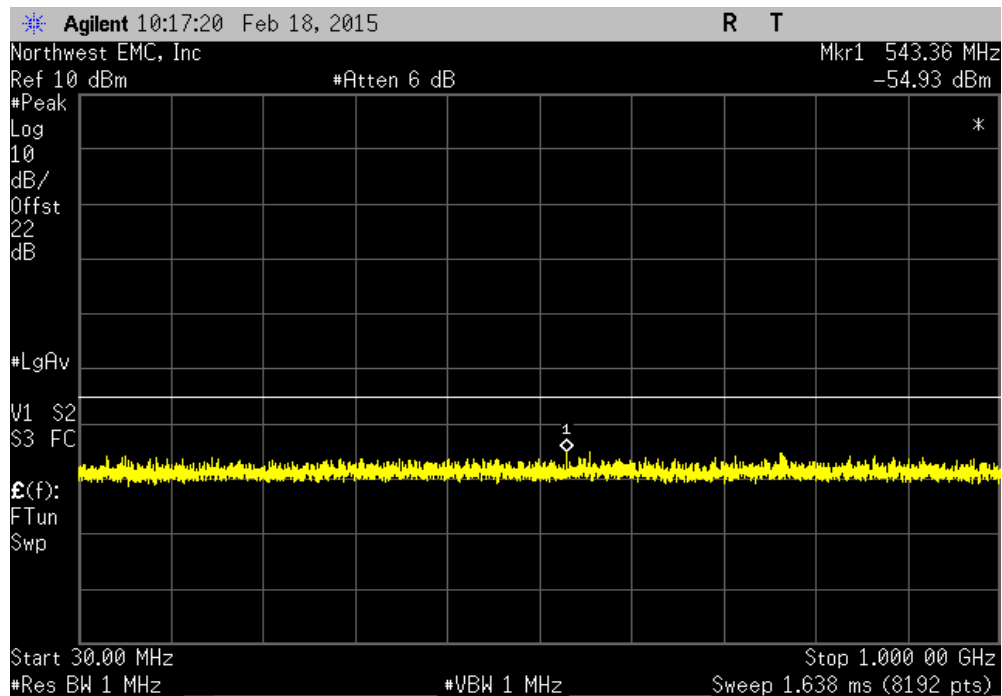


SPURIOUS CONDUCTED EMISSIONS

LTE 5 MHz, Low channel, 2352.5 MHz				
Frequency Range	Value (dBm)	Limit (dBm)	Result	
18 GHz - 24 GHz	-58.08	-45	Pass	

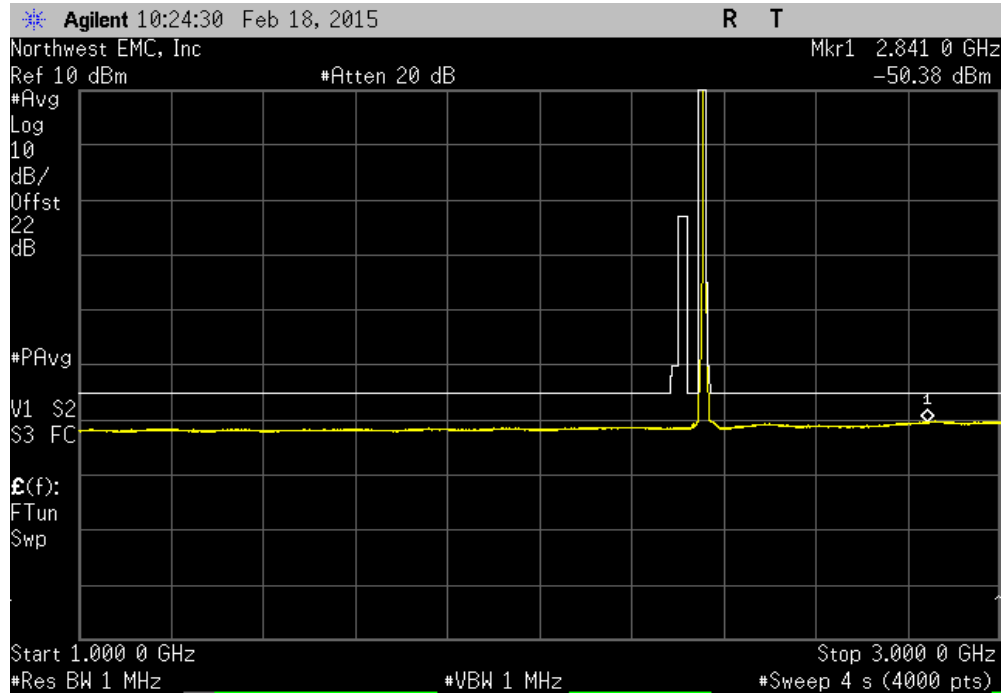


LTE 5 MHz, High channel, 2357.5 MHz				
Frequency Range	Value (dBm)	Limit (dBm)	Result	
30 MHz - 1 GHz	-54.93	-45	Pass	

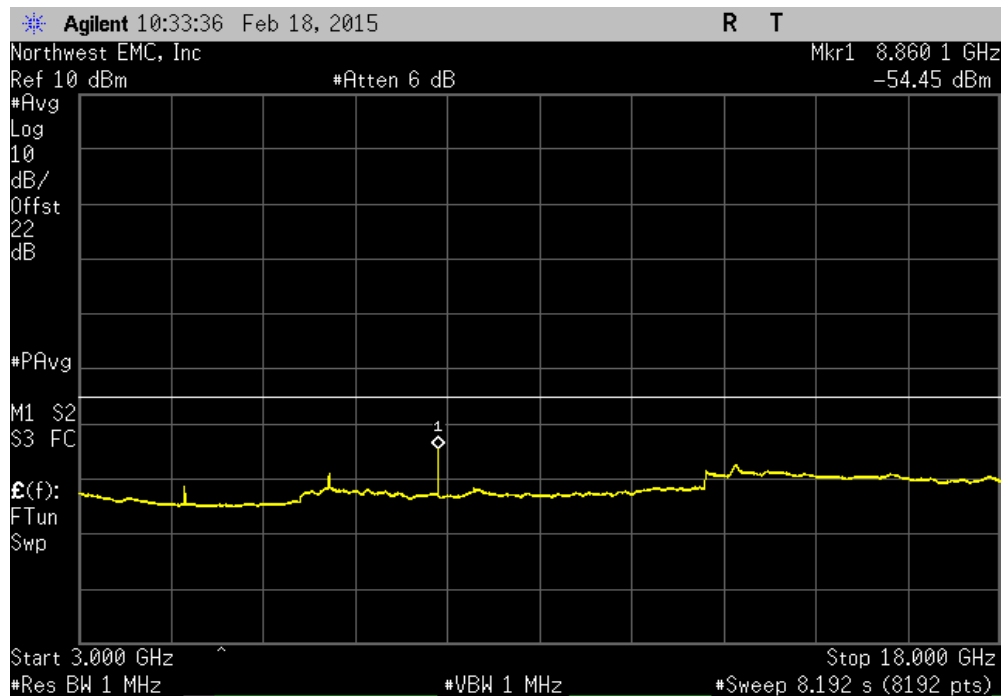


SPURIOUS CONDUCTED EMISSIONS

LTE 5 MHz, High channel, 2357.5 MHz					
Frequency Range	Value (dBm)	Limit (dBm)	Result		
1 GHz - 3 GHz	-50.38	-45	Pass		

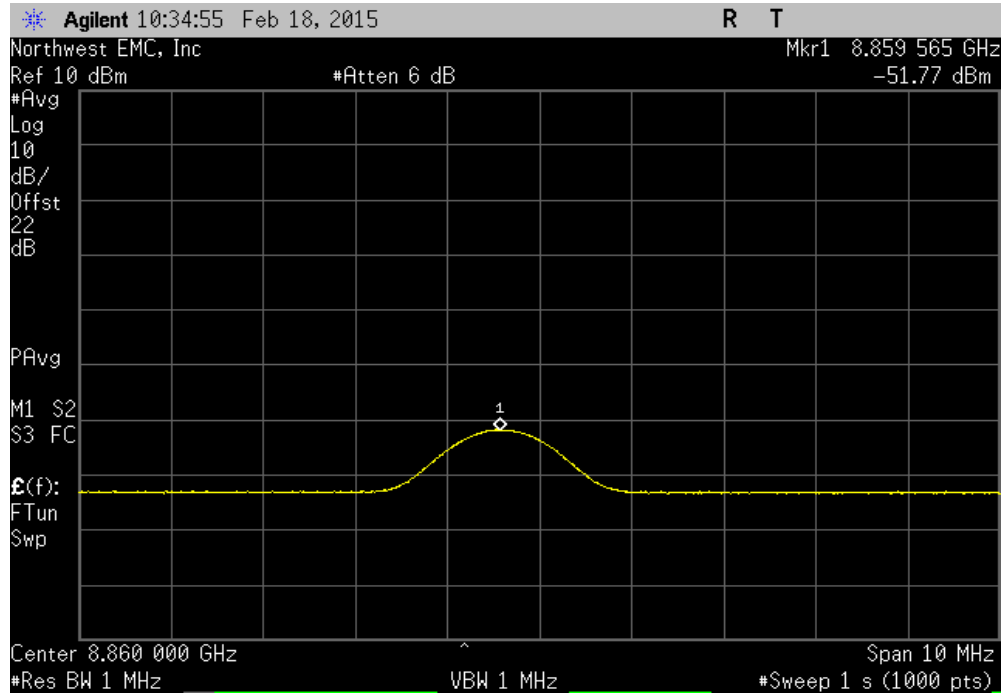


LTE 5 MHz, High channel, 2357.5 MHz					
Frequency Range	Value (dBm)	Limit (dBm)	Result		
3 GHz - 18 GHz	-54.45	-45	Pass		

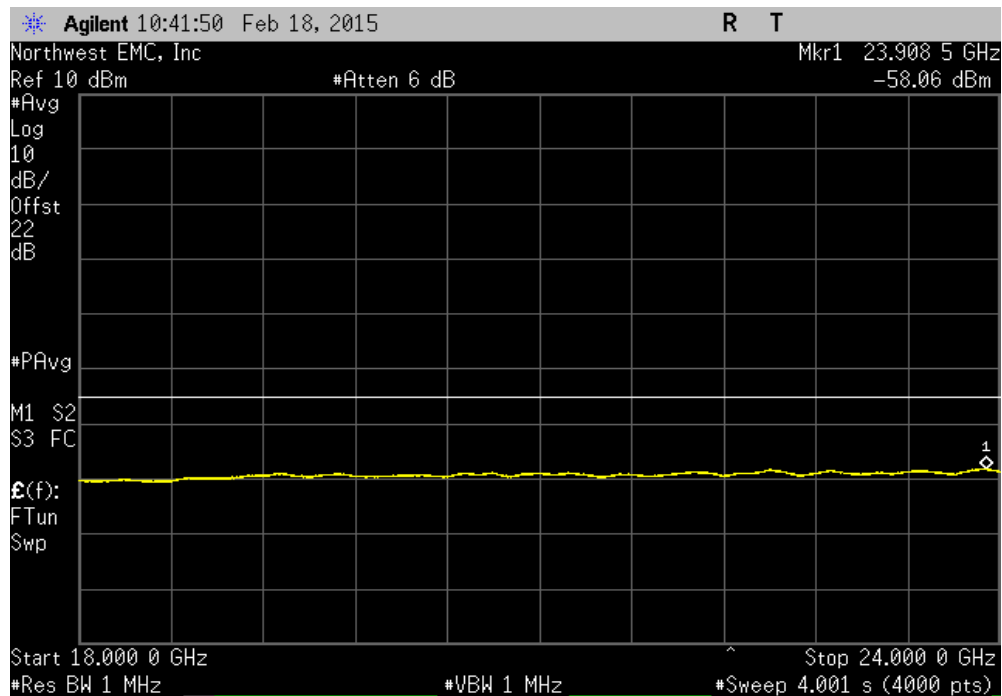


SPURIOUS CONDUCTED EMISSIONS

LTE 5 MHz, High channel, 2357.5 MHz						
Frequency Range		Value (dBm)	Limit (dBm)	Result		
	RMS	-51.77	-45	Pass		



LTE 5 MHz, High channel, 2357.5 MHz						
Frequency Range		Value (dBm)	Limit (dBm)	Result		
	18 GHz - 24 GHz	-58.06	-45	Pass		



BAND EDGE COMPLIANCE

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.	Interval (mo)
MN08 Direct Connect Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	10/2/2014	12
Attenuator - 20db, 'SMA'	SM Electronics	SA26B-20	RFW	4/3/2014	12
40 GHz DC Block	Fairview Microwave	SD3379	AMI	10/2/2014	12
Signal Generator MXG	Agilent	N5183A	TIK	10/17/2014	36
Spectrum Analyzer	Agilent	E4440A	AAX	4/28/2014	12

TEST DESCRIPTION

The spurious RF conducted emissions at the edges of the authorized bands were measured with the EUT set to low and high transmit frequencies in the available band. The channels closest to the band edges were selected. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting at the data rate(s) listed in the datasheet.

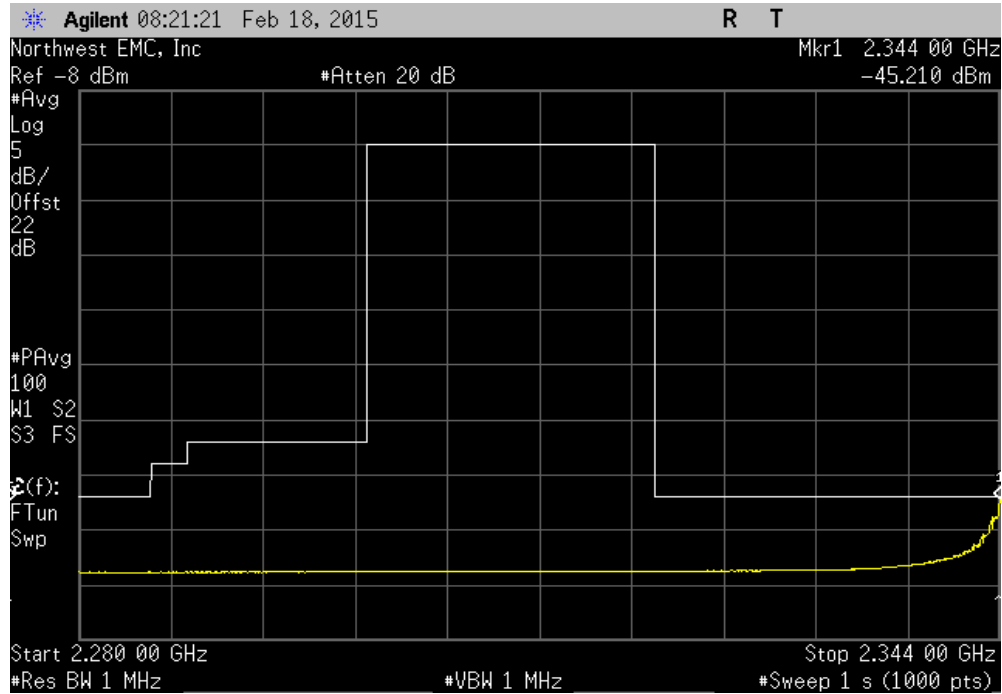
The spectrum was scanned below the lower band edge and above the higher band edge. The resolution bandwidth was set to approximately 1% of the measured emissions bandwidth within the first 1 MHz block adjacent to the transmit band. An average RMS detector was used to match the method used during Output Power. The screen capture shows the margin between the measured value and the limit at the band edge.

BAND EDGE COMPLIANCE

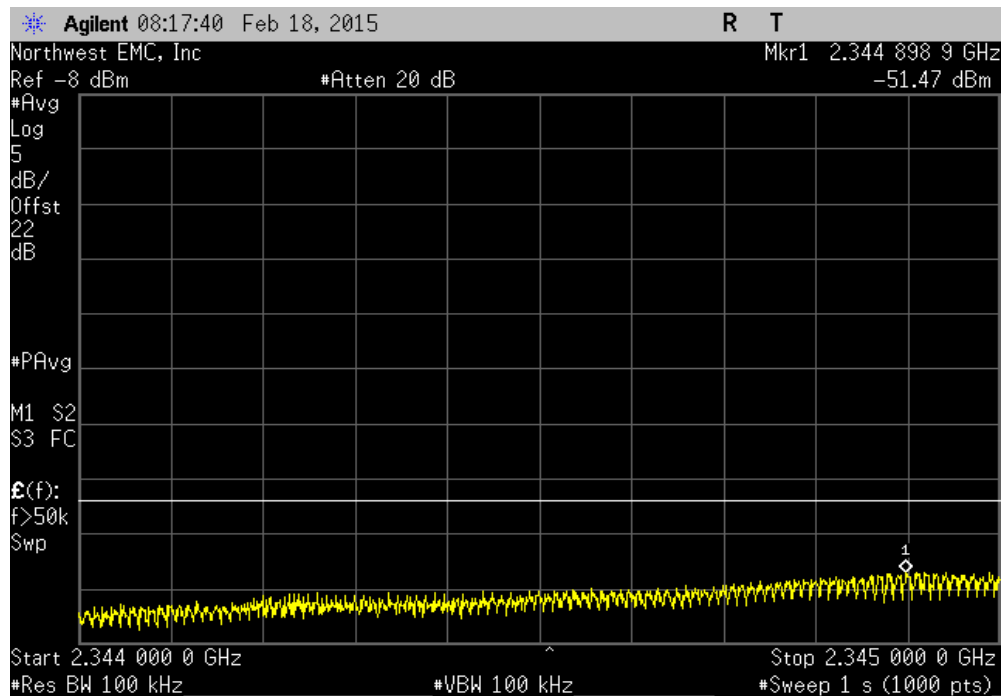
EUT: Spectrum 2300 MHz WCS Secondary RAU		Work Order: TECO0024	
Serial Number: GR223E8E		Date: 02/18/15	
Customer: TE Connectivity / ADC Telecommunications		Temperature: 22.7°C	
Attendees: None		Humidity: 9%	
Project: None		Barometric Pres.: 1023.7	
Tested by: Trevor Buls	Power: 110VAC/60Hz	Job Site: MN08	
TEST SPECIFICATIONS			
FCC 27:2015		Test Method: ANSI/TIA/EIA-603-C-2004	
COMMENTS			
Port 1 was determined to be worst case.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	1	Signature	<i>Trevor Buls</i>
		Value (dBm)	Limit (dBm) Result
LTE 5 MHz			
Low Channel, 2352.5 MHz			
Greater Than 1 MHz from Low Band Edge		-45.21	-45 Pass
Less Than 1 MHz from Low Band Edge		-51.47	-45 Pass
High Channel, 2357.5 MHz			
Less Than 1 MHz from High Band Edge		-28.54	-13 Pass
Greater Than 1 MHz from High Band Edge		-40.304	-40 Pass

BAND EDGE COMPLIANCE

LTE 5 MHz, Low Channel, 2352.5 MHz, Greater Than 1 MHz from Low Band Edge						
				Value (dBm)	Limit (dBm)	Result
				-45.21	-45	Pass

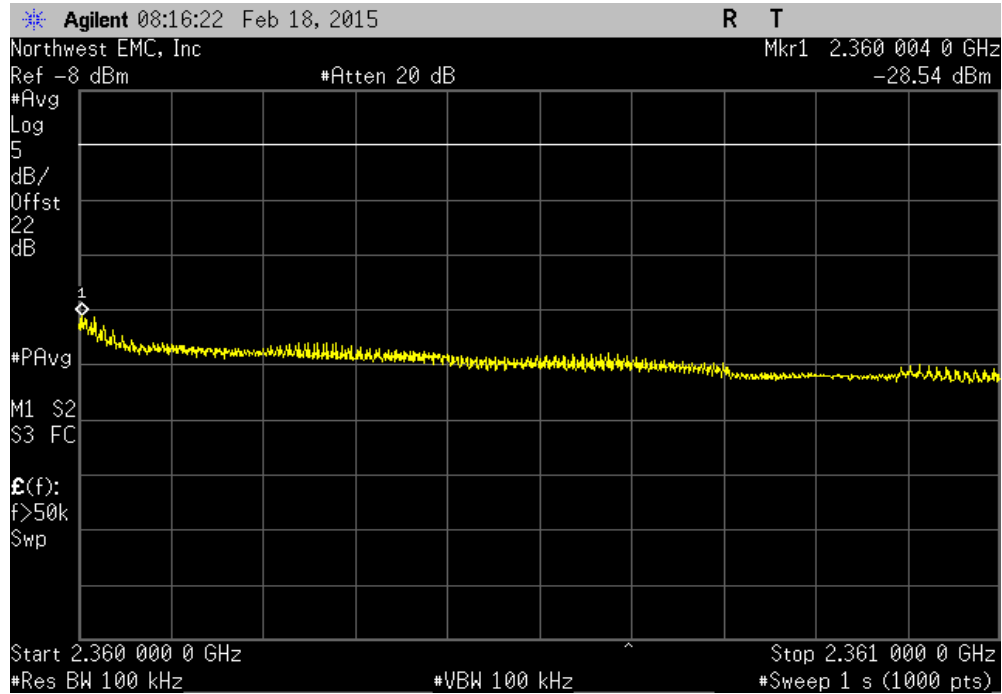


LTE 5 MHz, Low Channel, 2352.5 MHz, Less Than 1 MHz from Low Band Edge						
				Value (dBm)	Limit (dBm)	Result
				-51.47	-45	Pass

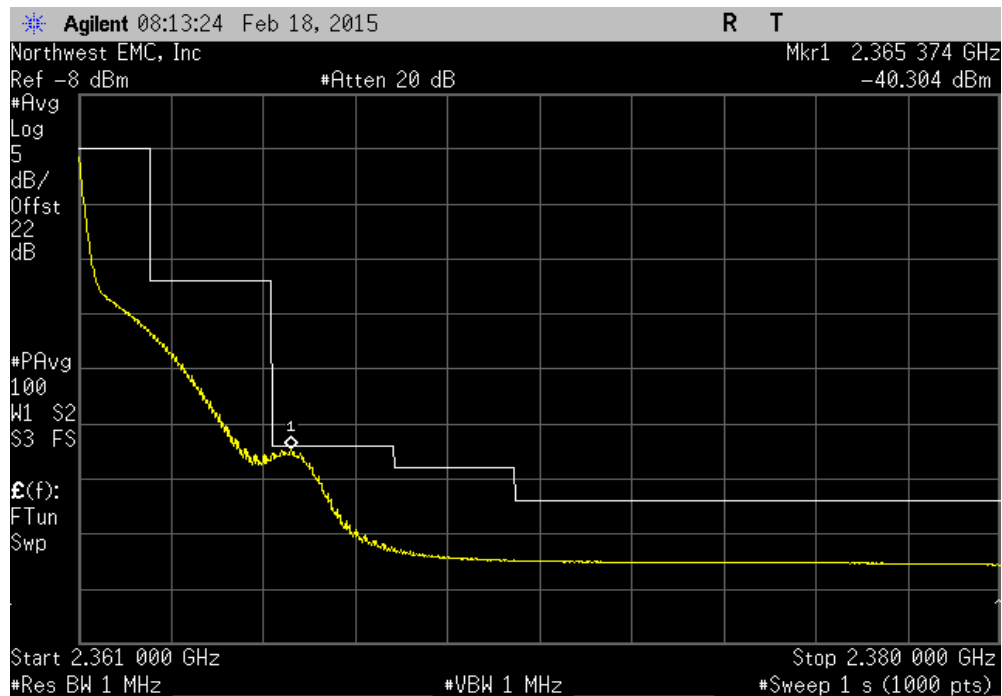


BAND EDGE COMPLIANCE

LTE 5 MHz, High Channel, 2357.5 MHz, Less Than 1 MHz from High Band Edge						
				Value (dBm)	Limit (dBm)	Result
				-28.54	-13	Pass



LTE 5 MHz, High Channel, 2357.5 MHz, Greater Than 1 MHz from High Band Edge						
				Value (dBm)	Limit (dBm)	Result
				-40.304	-40	Pass



INTERMODULATION

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.	Interval (mo)
Power Divider/Combiner	Fairview Microwave	MP0208-2	IAF	NCR	0
Power Divider/Combiner	Fairview Microwave	MP0208-2	IAE	NCR	0
High Pass Filter	K&L Microwave	11SH10-18000/T50000-2.4	HIC	2/16/2015	12
High Pass Filter 2.8-18 GHz	Micro-Tronics	HPM50111	HGY	10/2/2014	12
Low Pass Filter 0-1000 MHz	Micro-Tronics	LPM50004	HGV	9/24/2014	12
MN08 Direct Connect Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	10/2/2014	12
Attenuator - 20db, 'SMA'	SM Electronics	SA26B-20	RFW	4/3/2014	12
40 GHz DC Block	Fairview Microwave	SD3379	AMI	10/2/2014	12
Signal Generator MXG	Agilent	N5183A	TIK	10/17/2014	36
Spectrum Analyzer	Agilent	E4440A	AAX	4/28/2014	12

TEST DESCRIPTION

The EUT was configured with an input of two CW pulses at the top of the band and a modulated pulse near the bottom edge of the band.

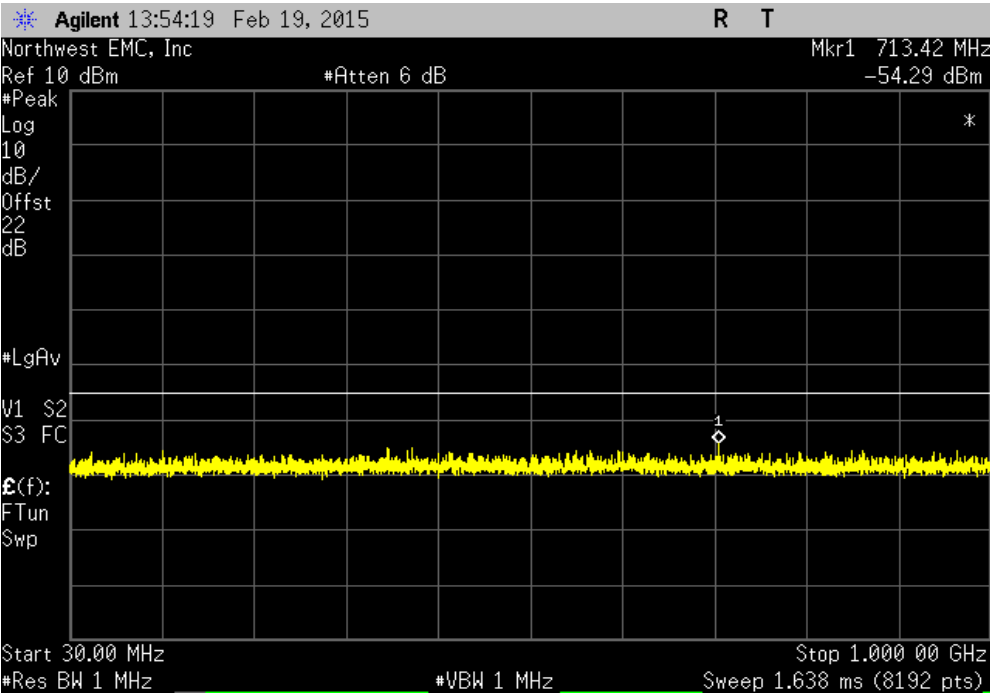
The antenna port spurious emissions were measured at the RF output terminal of the EUT with external attenuation on the RF input of the spectrum analyzer. Analyzer plots utilizing a 1MHz resolution bandwidth and no video filtering were made for each modulation type from 30 MHz to 24 GHz. The peak conducted 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 spurious conducted emissions limits. Measurements close to the limit were remeasured using a RMS average detector.

INTERMODULATION

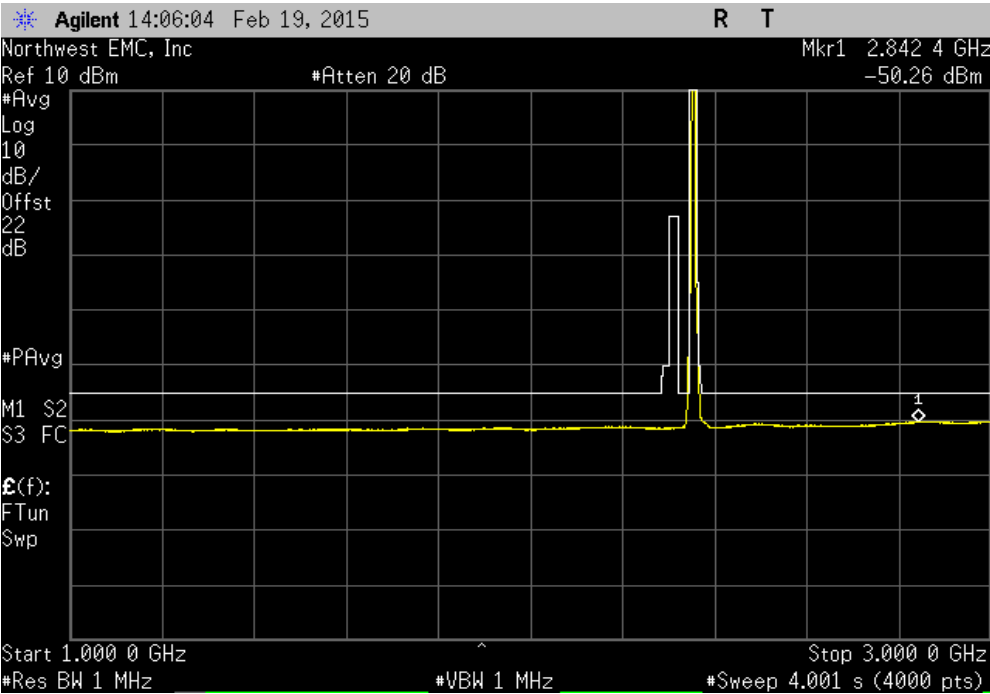
EUT: Spectrum 2300 MHz WCS Secondary RAU		Work Order: TECO0024			
Serial Number: GR223E8E		Date: 02/19/15			
Customer: TE Connectivity / ADC Telecommunications		Temperature: 23.1°C			
Attendees: None		Humidity: 9%			
Project: None		Barometric Pres.: 1031.8			
Tested by: Trevor Buls	Power: 110VAC/60Hz	Job Site: MN08			
TEST SPECIFICATIONS					
FCC 27:2015		Test Method: ANSI/TIA/EIA-603-C-2004			
COMMENTS					
Port 1 was determined to be worst case.					
DEVIATIONS FROM TEST STANDARD					
None					
Configuration #	1	Signature: <i>Trevor Buls</i>			
		Frequency Range	Value (dBm)	Limit ≤ (dBm)	Result
LTE		30 MHz - 1 GHz	-54.29	-45	Pass
LTE		1 GHz - 3 GHz	-50.26	-45	Pass
LTE		3 GHz - 18 GHz	-55.01	-45	Pass
LTE		RMS	-55.01	-45	Pass
LTE		18 GHz - 24 GHz	-58.11	-45	Pass

INTERMODULATION

LTE				
Frequency Range	Value (dBm)	Limit ≤ (dBm)	Result	
30 MHz - 1 GHz	-54.29	-45	Pass	

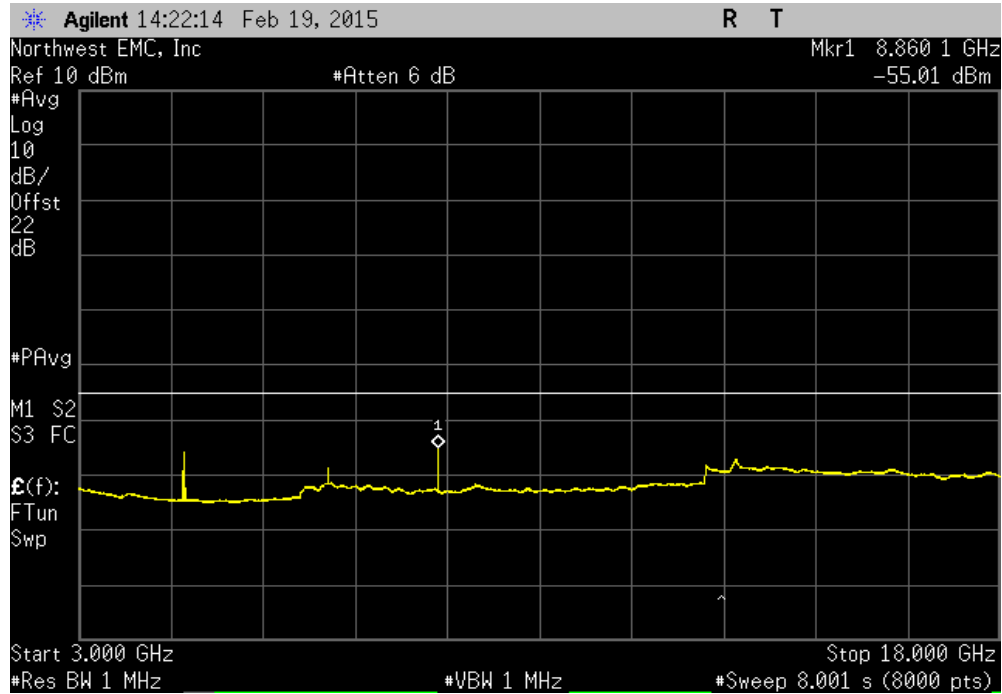


LTE				
Frequency Range	Value (dBm)	Limit ≤ (dBm)	Result	
1 GHz - 3 GHz	-50.26	-45	Pass	

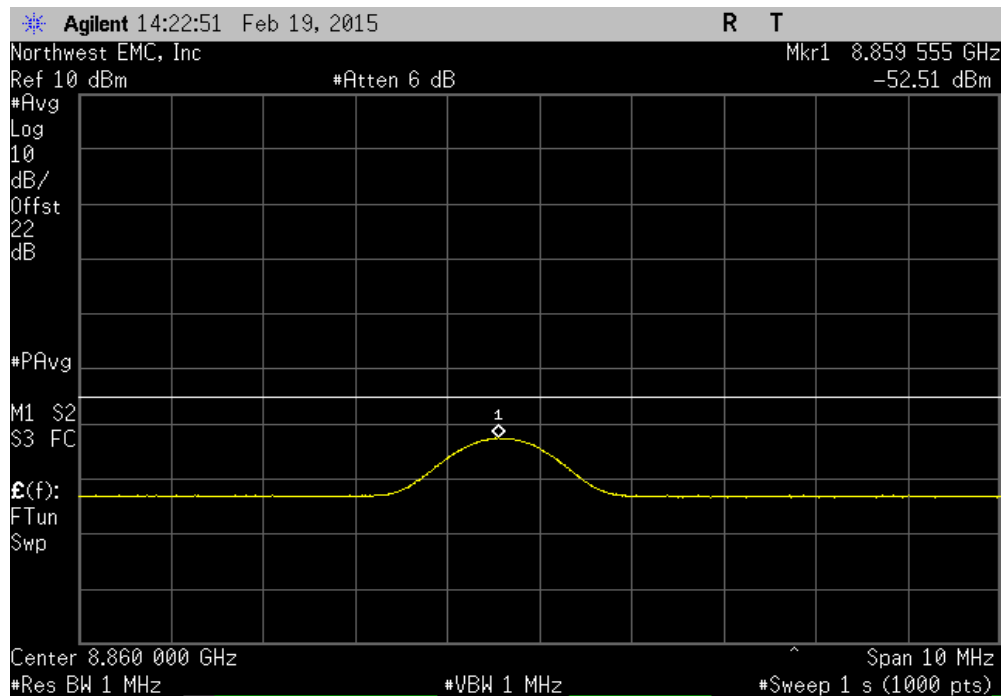


INTERMODULATION

LTE				
Frequency Range	Value (dBm)	Limit ≤ (dBm)	Result	
3 GHz - 18 GHz	-55.01	-45	Pass	

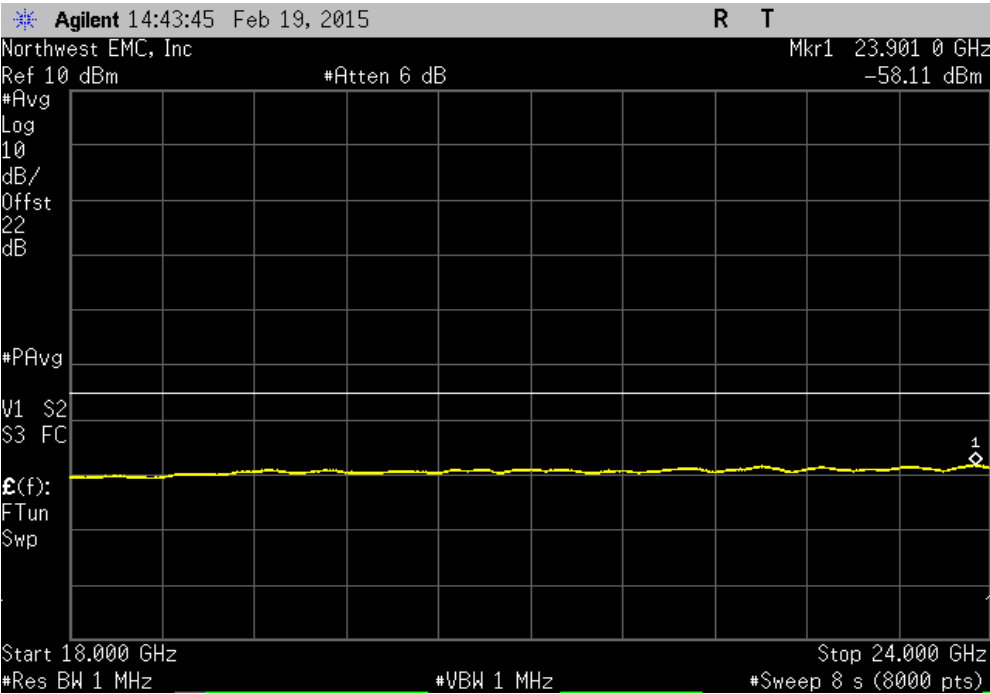


LTE				
Frequency Range	Value (dBm)	Limit ≤ (dBm)	Result	
RMS	-55.01	-45	Pass	



INTERMODULATION

LTE				
Frequency Range	Value (dBm)	Limit ≤ (dBm)	Result	
18 GHz - 24 GHz	-58.11	-45	Pass	



FREQUENCY STABILITY

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.	Interval
Thermometer	Omega Engineering, Inc.	HH311	DUB	11/3/2014	36
Humidity Temperature Chamber	Cincinnati Sub Zero (CSZ)	ZPH-32-3.5-SCT/AC	TBF	NCR	0
Variable Transformer	Powerstat	246	XFR	NCR	0
Multimeter	Fluke	117	MNN	1/20/2014	36
Attenuator - 26dB SMA	Fairview Microwave	18B5W-26	RFY	7/22/2014	12
40 GHz DC Block	Fairview Microwave	SD3379	AMI	10/2/2014	12
Signal Generator MXG	Agilent	N5183A	TIK	10/17/2014	36
Spectrum Analyzer	Agilent	E4440A	AAX	4/28/2014	12

TEST DESCRIPTION

A direct connect measurement was made between the EUT's antenna cable and a spectrum analyzer. The spectrum analyzer is equipped with a precision frequency reference that exceeds the stability requirement of the EUT.

Measurements were made at the edges of the main transmit bands as called out on the data sheets. Testing was done with an absence of modulation in a CW mode of operation.

The primary supply voltage was varied from 85 % to 115% of the nominal voltage Using a temperature chamber, the transmit frequency was recorded at the extremes of the specified temperature range (-30 ° to +50° C) and at 10°C intervals.

Per the requirements of FCC Part 27.54:

"The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation."

No specific limits are provided in either FCC 27.54, the product specific rule part, or FCC 2.1055, the equipment authorization procedure for testing frequency stability. While there are no limits called out, any results less than 1ppm will still allow the radio to be operating within the band.

FREQUENCY STABILITY

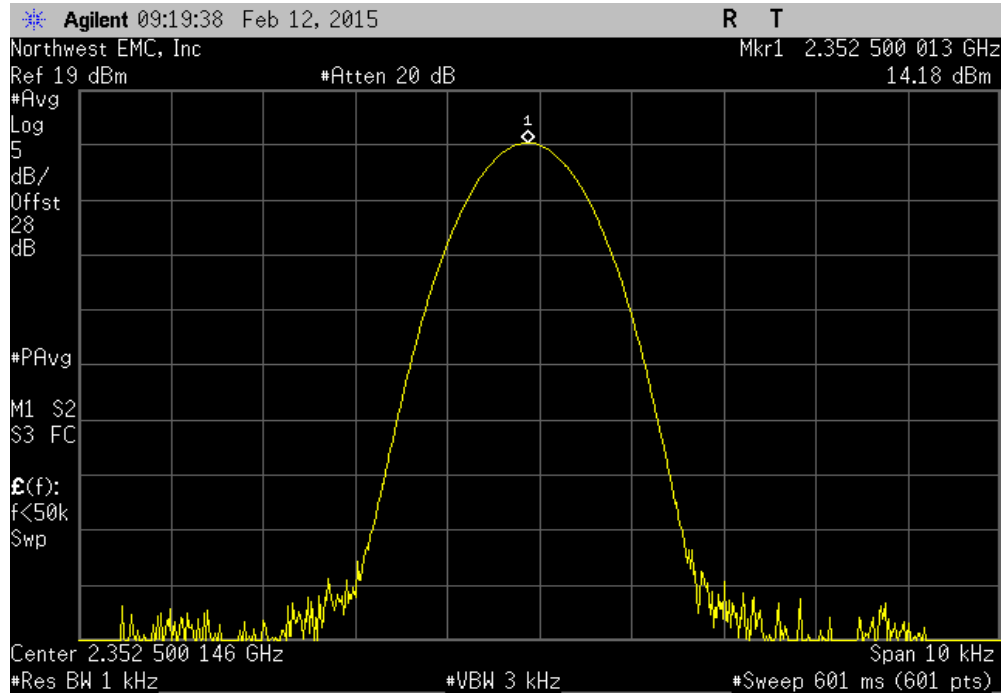


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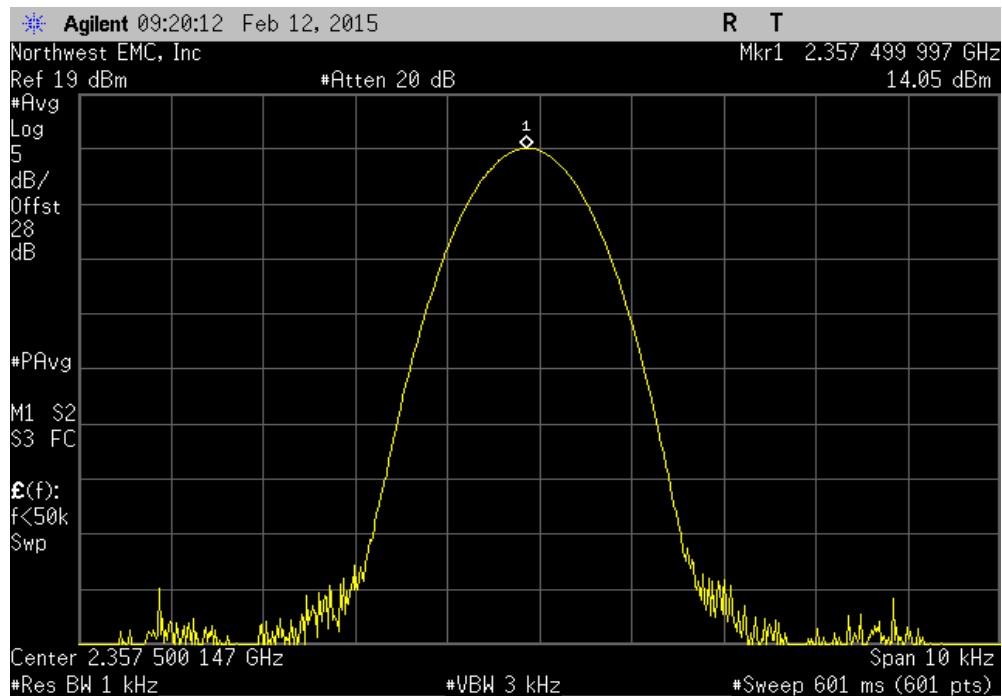
EUT: Spectrum 2300 MHz WCS Secondary RAU		Work Order: TECO0024	
Serial Number: GR223E8E		Date: 02/13/15	
Customer: TE Connectivity		Temperature: 22.3°C	
Attendees: None		Humidity: 13%	
Project: None		Barometric Pres.: 1021	
Tested by: Trevor Buls	Power: 110VAC/60Hz	Job Site: MN08	
TEST SPECIFICATIONS			
FCC 27:2015		Test Method: ANSI/TIA/EIA-603-C-2004	
COMMENTS			
None			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	1	Signature: <i>Trevor Buls</i>	
		Measured Value (MHz)	Assigned Value (MHz)
Voltage: 115%			Error (ppm)
			Limit (ppm)
			Results
Low Channel 2352.5 MHz	2352.500013	2352.5	0.0055
High Channel 2357.5 MHz	2357.499997	2357.5	0.0013
Voltage: 100%			
Low Channel 2352.5 MHz	2352.500013	2352.5	0.0055
High Channel 2357.5 MHz	2357.500017	2357.5	0.0072
Voltage: 85%			
Low Channel 2352.5 MHz	2352.500013	2352.5	0.0055
High Channel 2357.5 MHz	2357.5	2357.5	0.0000
Temperature: +50°			
Low Channel 2352.5 MHz	2352.500017	2352.5	0.0072
High Channel 2357.5 MHz	2357.500014	2357.5	0.0059
Temperature: +40°			
Low Channel 2352.5 MHz	2352.500013	2352.5	0.0055
High Channel 2357.5 MHz	2357.500034	2357.5	0.0144
Temperature: +30°			
Low Channel 2352.5 MHz	2352.500034	2352.5	0.0145
High Channel 2357.5 MHz	2357.500034	2357.5	0.0144
Temperature: +20°			
Low Channel 2352.5 MHz	2352.500029	2352.5	0.0123
High Channel 2357.5 MHz	2357.500034	2357.5	0.0144
Temperature: +10°			
Low Channel 2352.5 MHz	2352.500034	2352.5	0.0145
High Channel 2357.5 MHz	2357.500034	2357.5	0.0144
Temperature: 0°			
Low Channel 2352.5 MHz	2352.500046	2352.5	0.0196
High Channel 2357.5 MHz	2357.500034	2357.5	0.0144
Temperature: -10°			
Low Channel 2352.5 MHz	2352.500029	2352.5	0.0123
High Channel 2357.5 MHz	2357.500034	2357.5	0.0144
Temperature: -20°			
Low Channel 2352.5 MHz	2352.500034	2352.5	0.0145
High Channel 2357.5 MHz	2357.500014	2357.5	0.0059
Temperature: -30°			
Low Channel 2352.5 MHz	2352.500029	2352.5	0.0123
High Channel 2357.5 MHz	2357.500034	2357.5	0.0144

FREQUENCY STABILITY

Voltage: 115%, Low Channel 2352.5 MHz						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	2352.500013	2352.5	0	1	Pass	

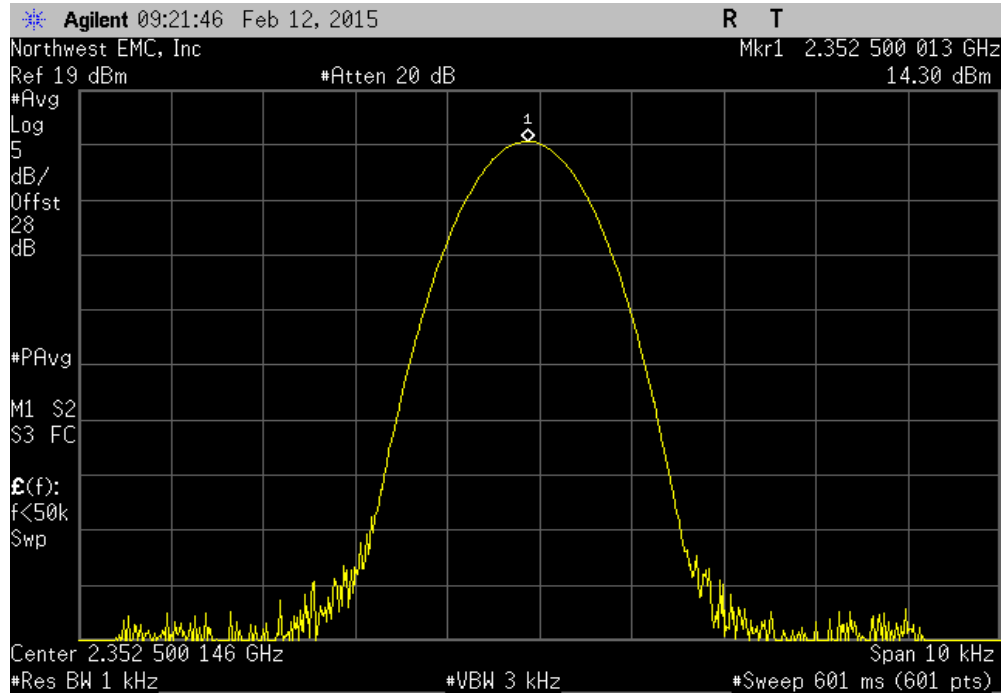


Voltage: 115%, High Channel 2357.5 MHz						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	2357.499997	2357.5	0	1	Pass	

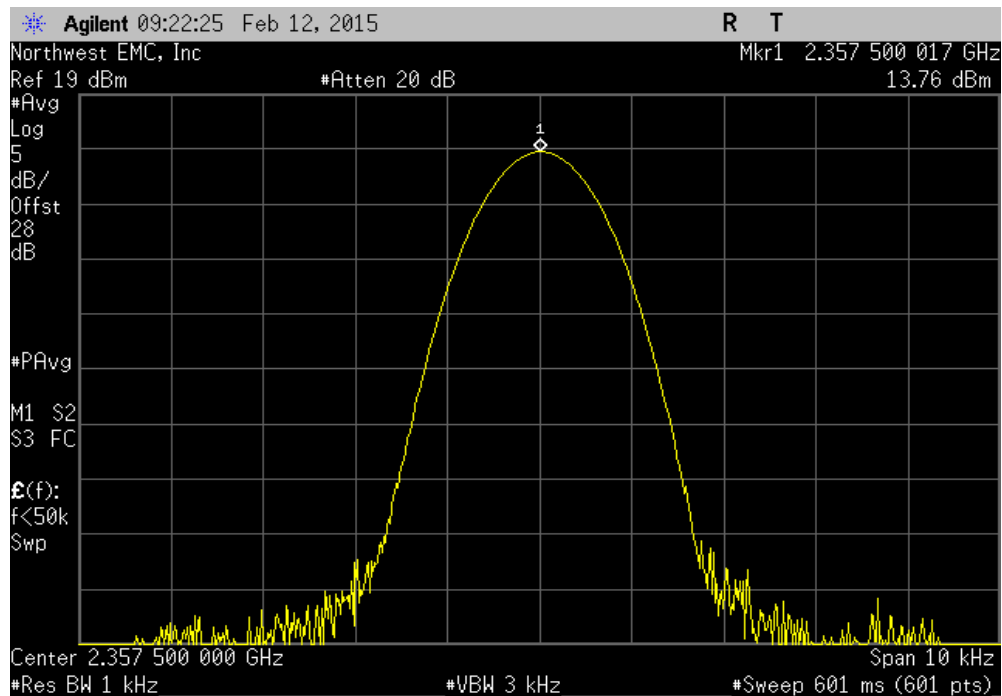


FREQUENCY STABILITY

Voltage: 100%, Low Channel 2352.5 MHz						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	2352.500013	2352.5	0	1	Pass	

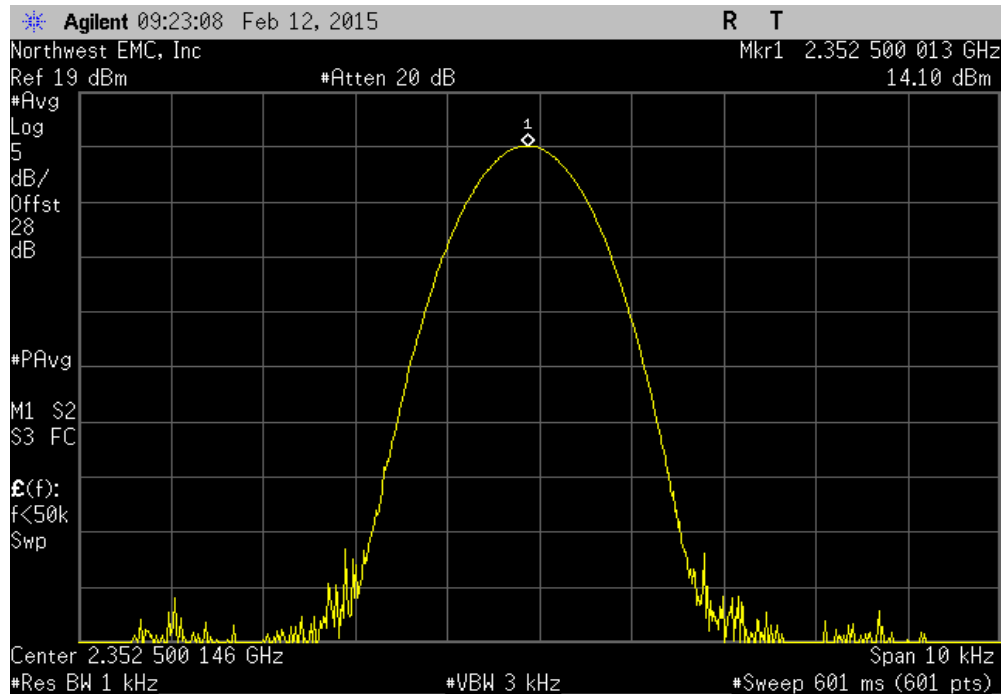


Voltage: 100%, High Channel 2357.5 MHz						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	2357.500017	2357.5	0	1	Pass	

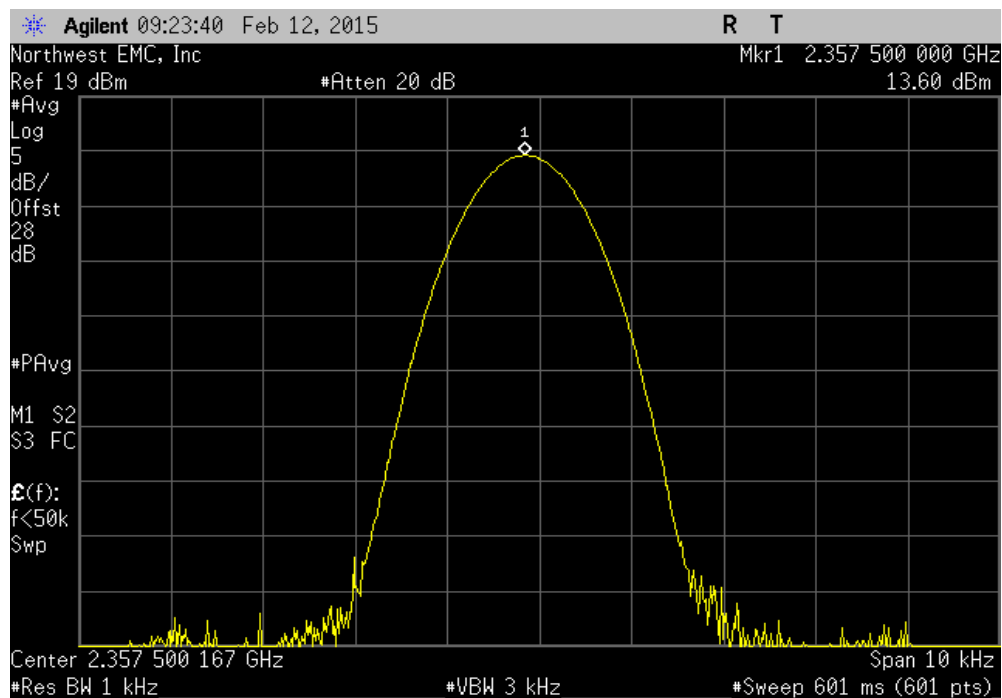


FREQUENCY STABILITY

Voltage: 85%, Low Channel 2352.5 MHz						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	2352.500013	2352.5	0	1	Pass	

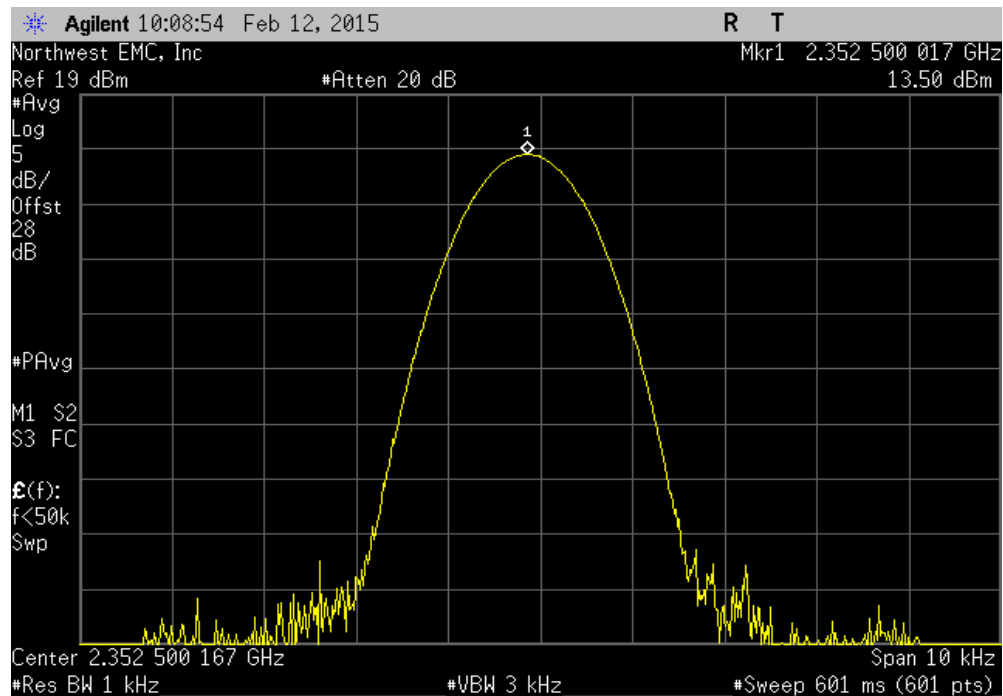


Voltage: 85%, High Channel 2357.5 MHz						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	2357.5	2357.5	0	1	Pass	

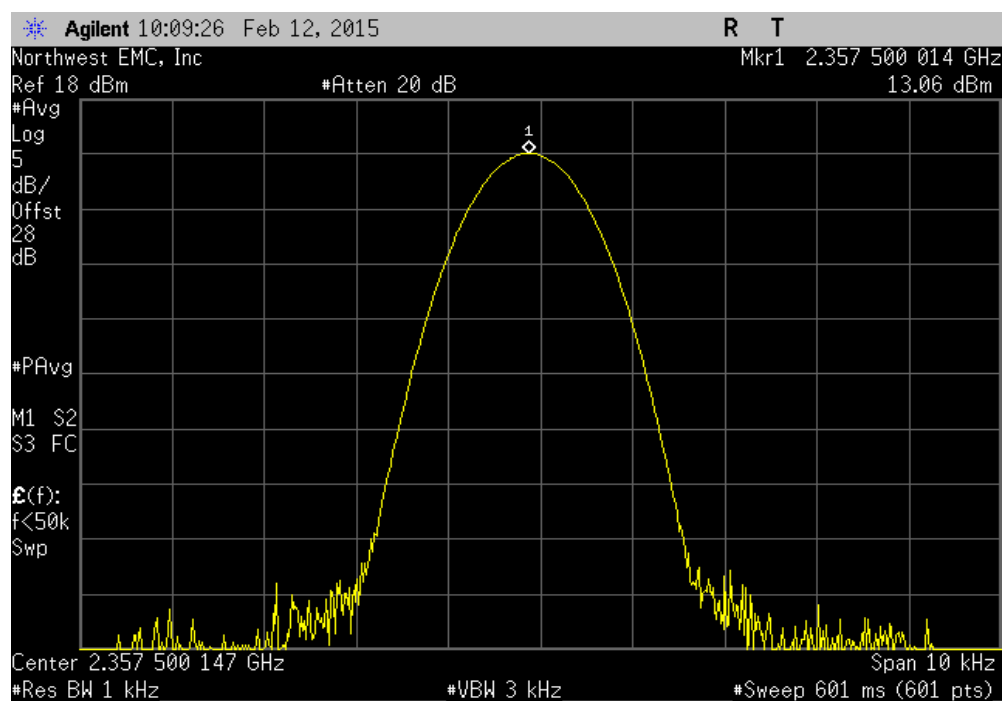


FREQUENCY STABILITY

Temperature: +50°, Low Channel 2352.5 MHz						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	2352.500017	2352.5	0	1	Pass	

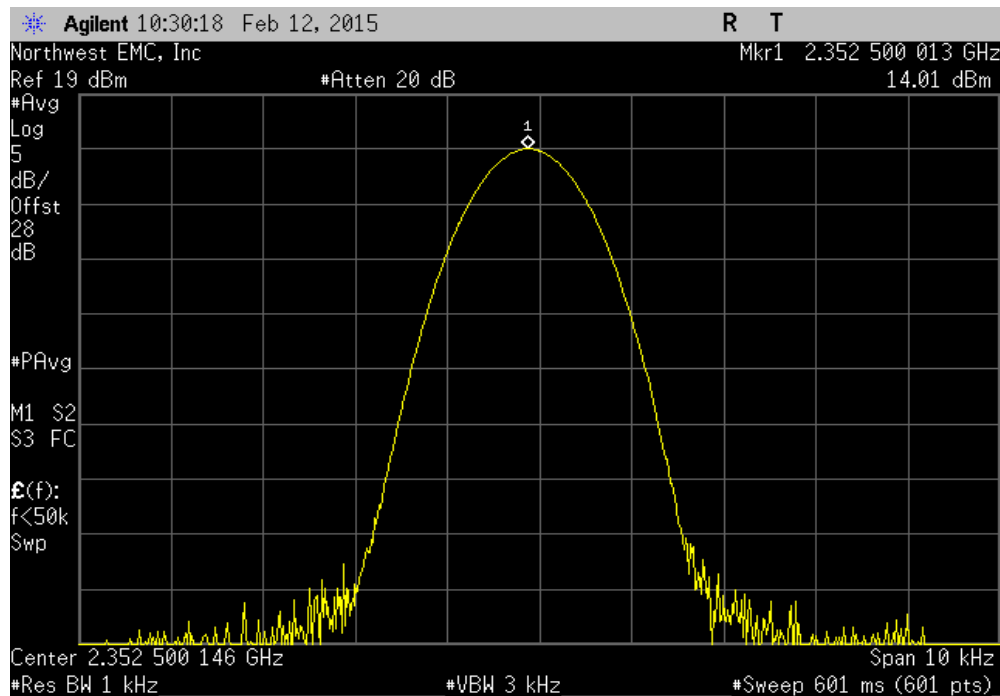


Temperature: +50°, High Channel 2357.5 MHz						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	2357.500014	2357.5	0	1	Pass	

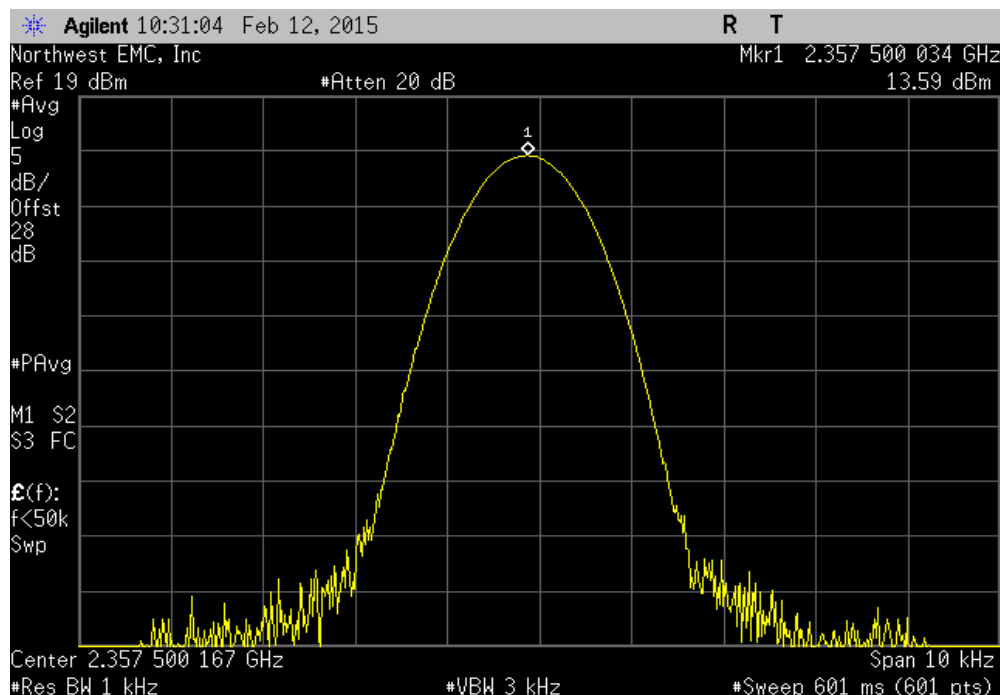


FREQUENCY STABILITY

Temperature: +40°, Low Channel 2352.5 MHz						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	2352.500013	2352.5	0	1	Pass	

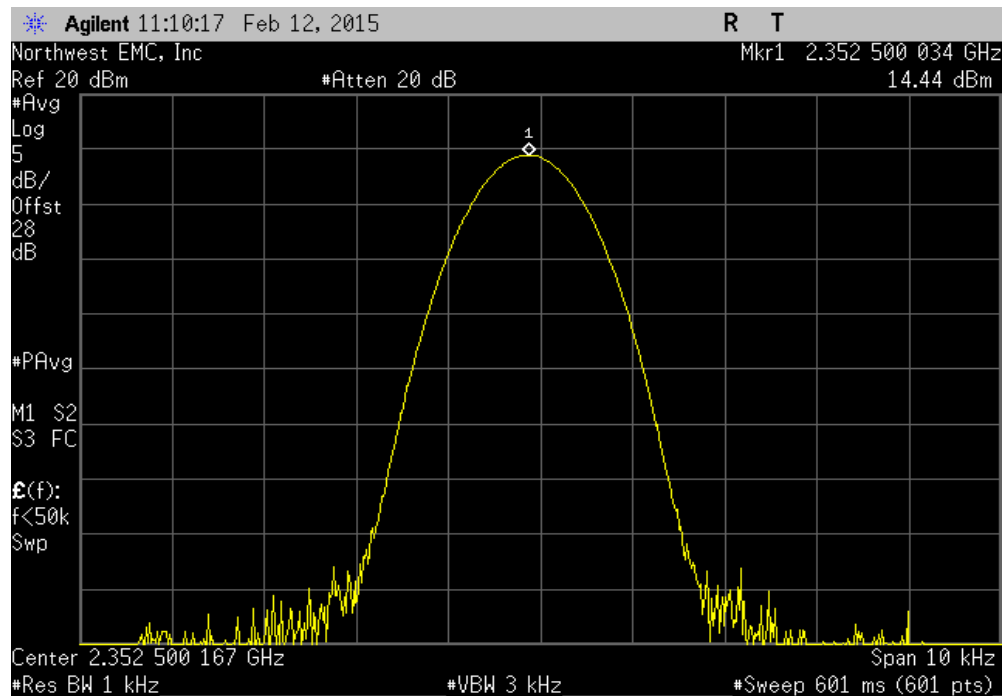


Temperature: +40°, High Channel 2357.5 MHz						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	2357.500034	2357.5	0	1	Pass	

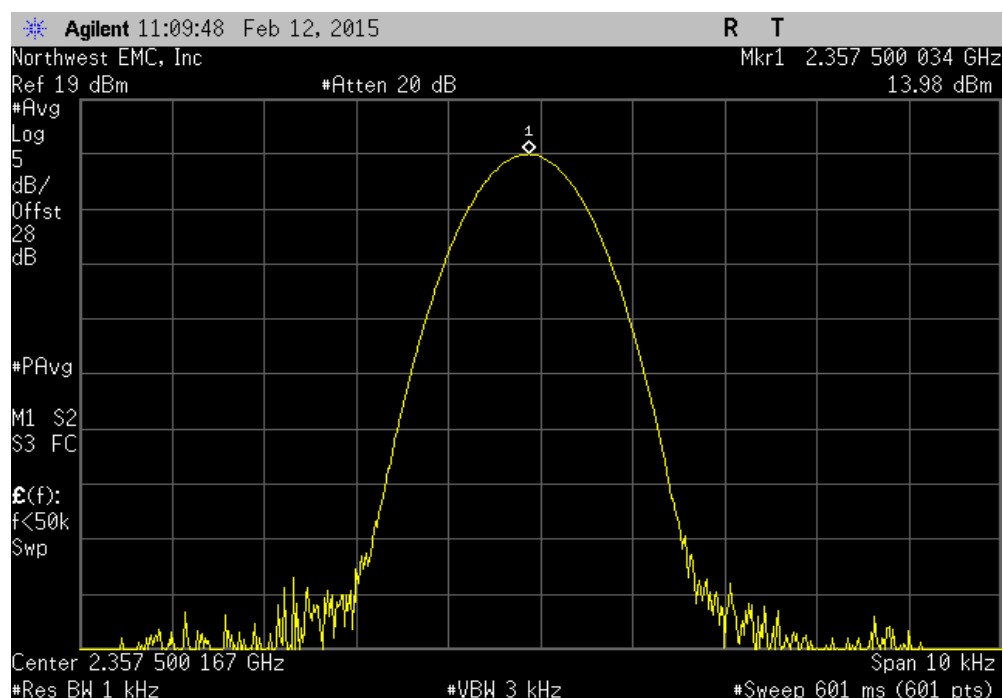


FREQUENCY STABILITY

Temperature: +30°, Low Channel 2352.5 MHz						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	2352.500034	2352.5	0	1	Pass	

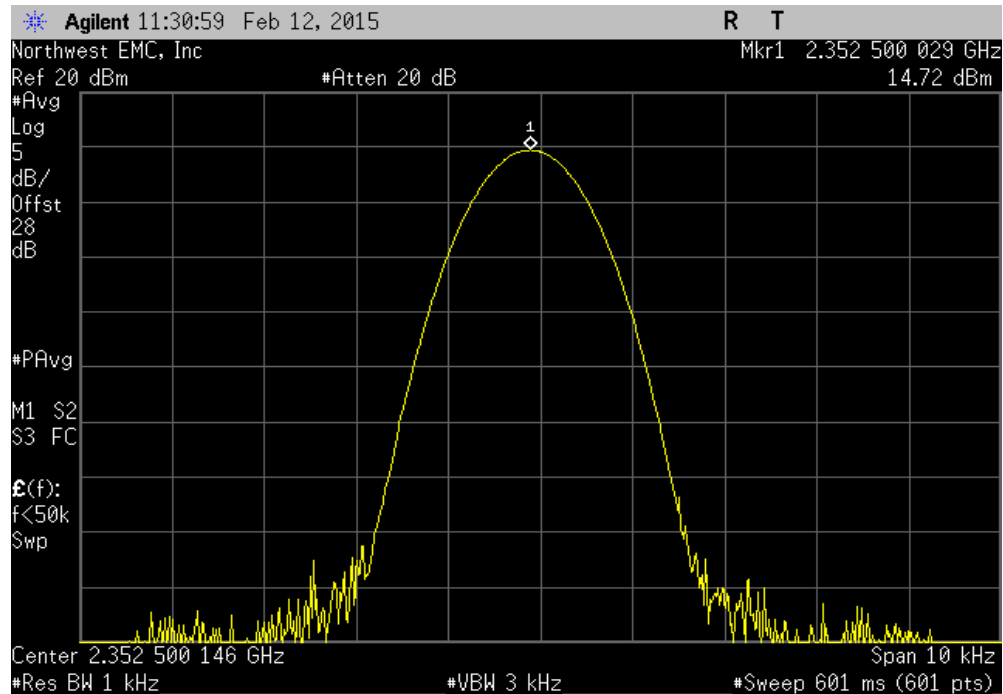


Temperature: +30°, High Channel 2357.5 MHz						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	2357.500034	2357.5	0	1	Pass	

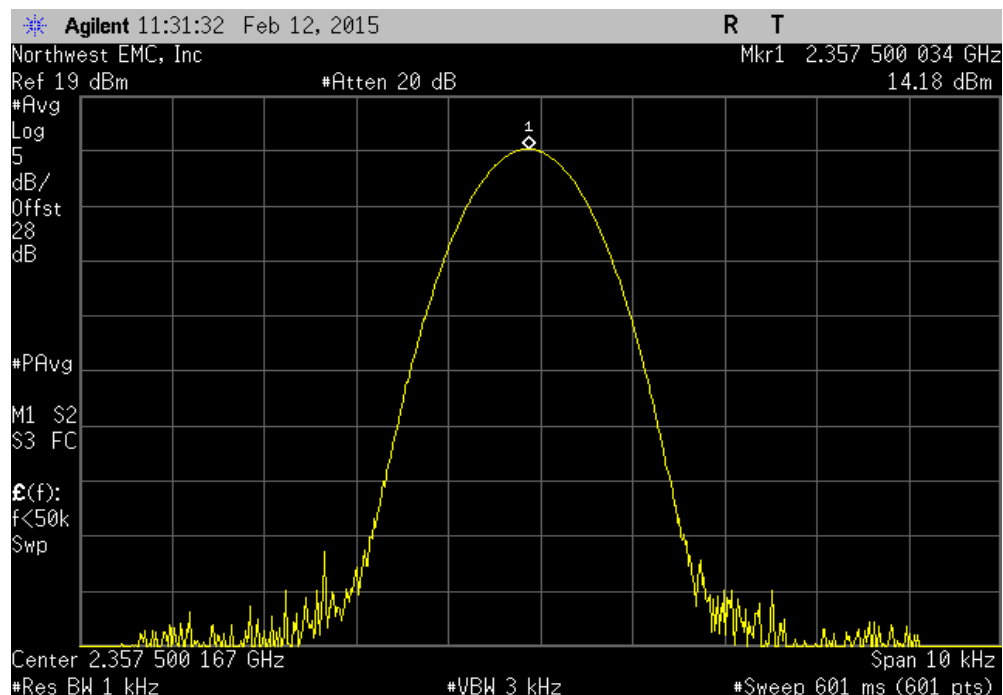


FREQUENCY STABILITY

Temperature: +20°, Low Channel 2352.5 MHz						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	2352.500029	2352.5	0	1	Pass	

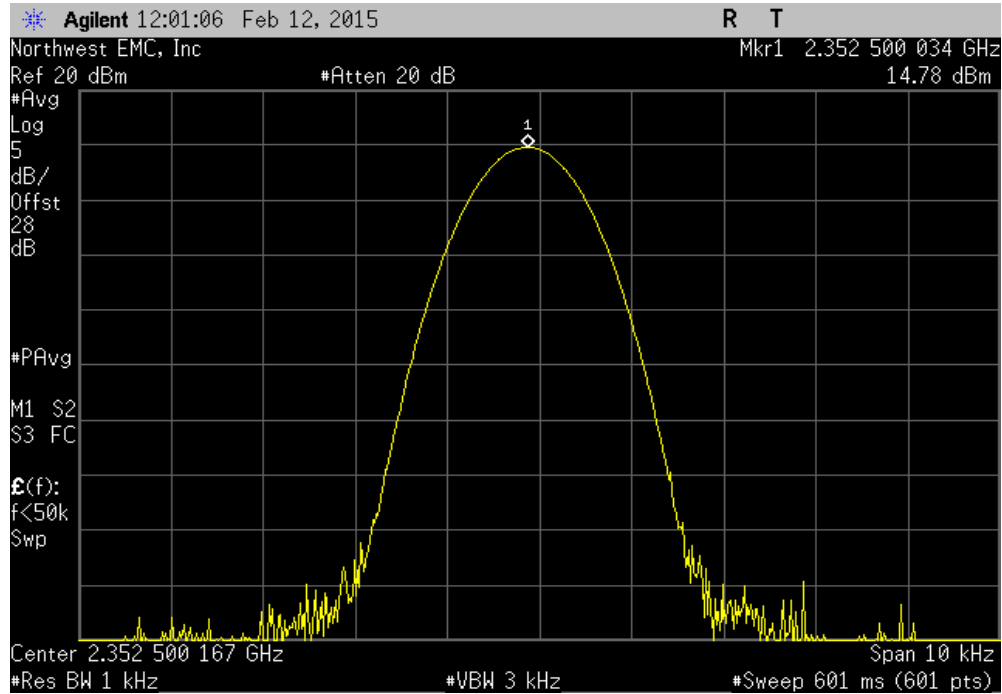


Temperature: +20°, High Channel 2357.5 MHz						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	2357.500034	2357.5	0	1	Pass	

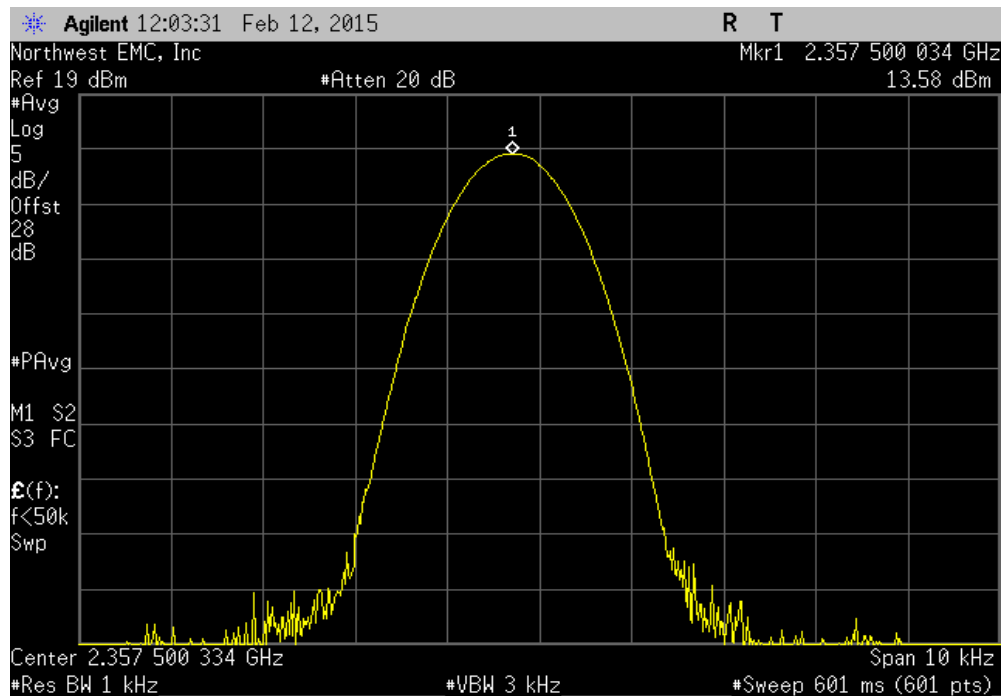


FREQUENCY STABILITY

Temperature: +10°, Low Channel 2352.5 MHz						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	2352.500034	2352.5	0	1	Pass	

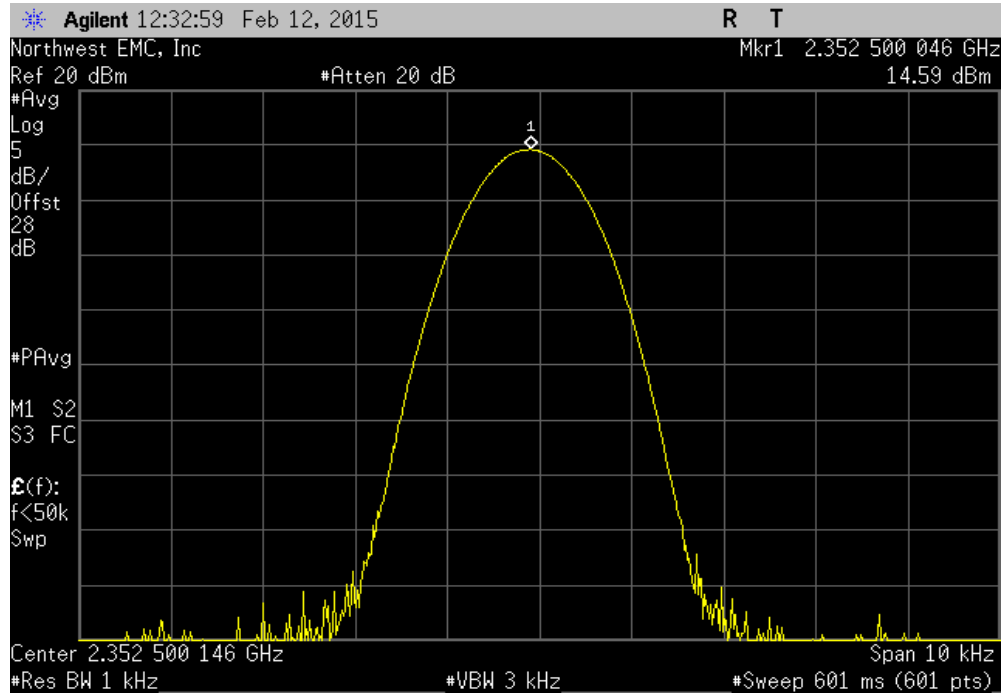


Temperature: +10°, High Channel 2357.5 MHz						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	2357.500034	2357.5	0	1	Pass	

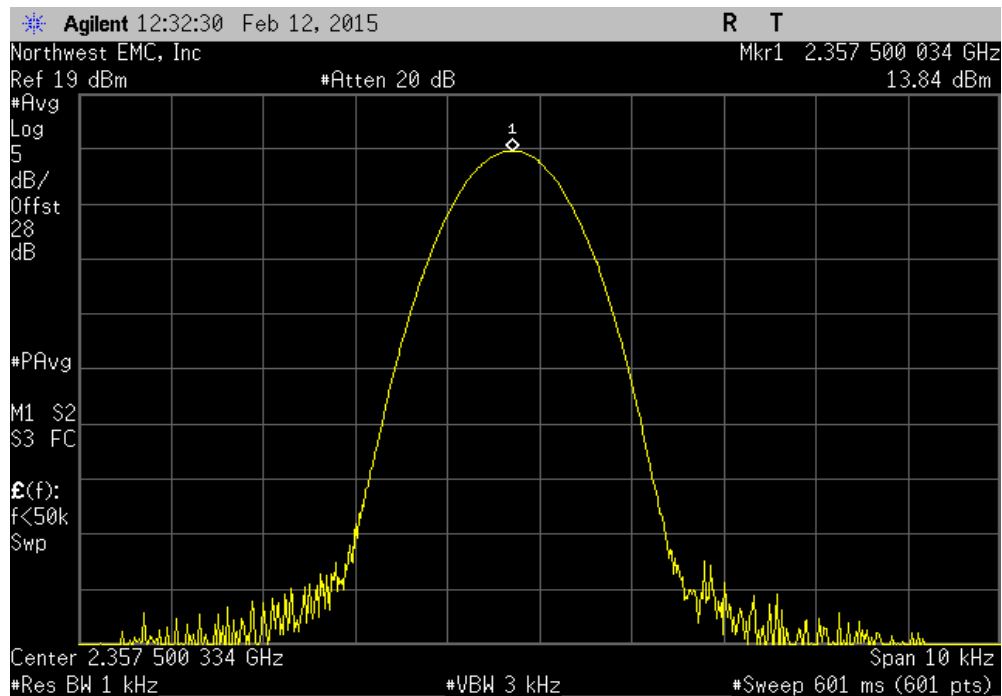


FREQUENCY STABILITY

Temperature: 0°, Low Channel 2352.5 MHz						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	2352.500046	2352.5	0	1	Pass	

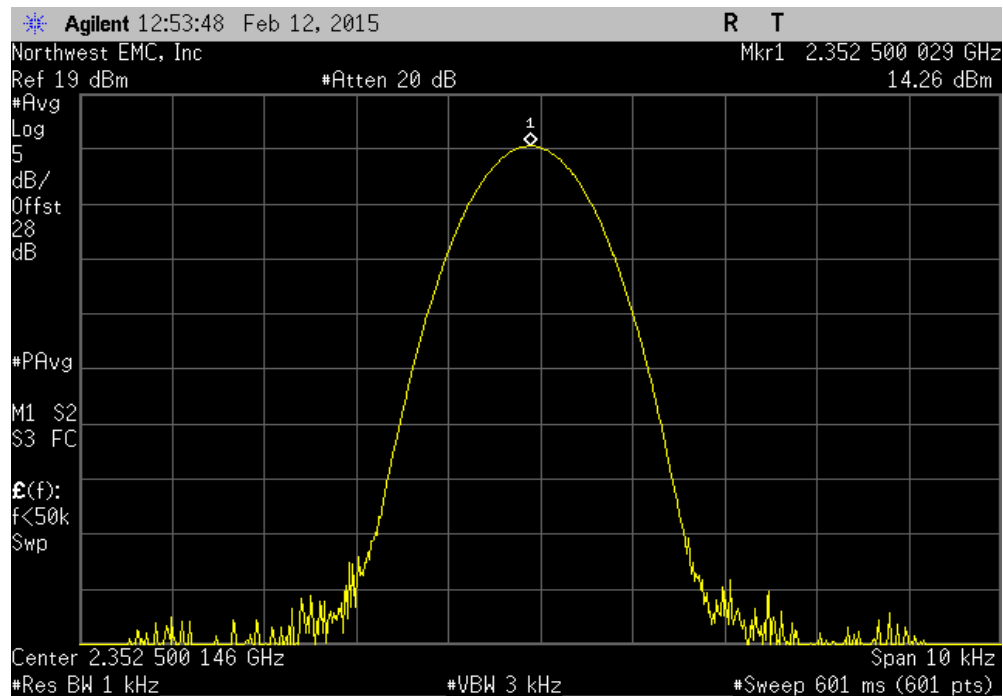


Temperature: 0°, High Channel 2357.5 MHz						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	2357.500034	2357.5	0	1	Pass	

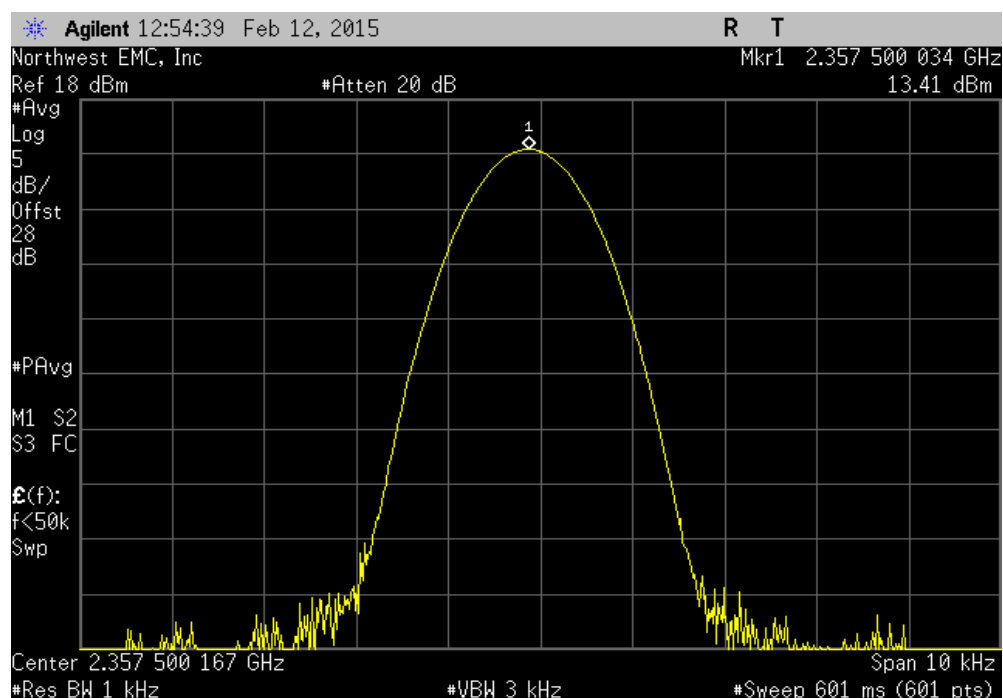


FREQUENCY STABILITY

Temperature: -10°, Low Channel 2352.5 MHz						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	2352.500029	2352.5	0	1	Pass	

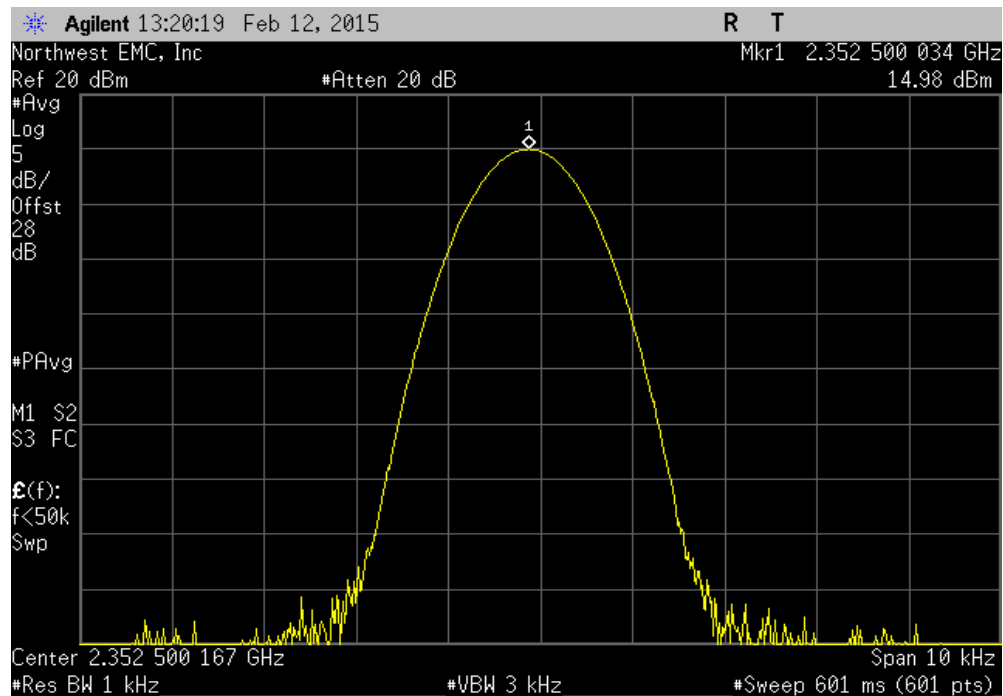


Temperature: -10°, High Channel 2357.5 MHz						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	2357.500034	2357.5	0	1	Pass	

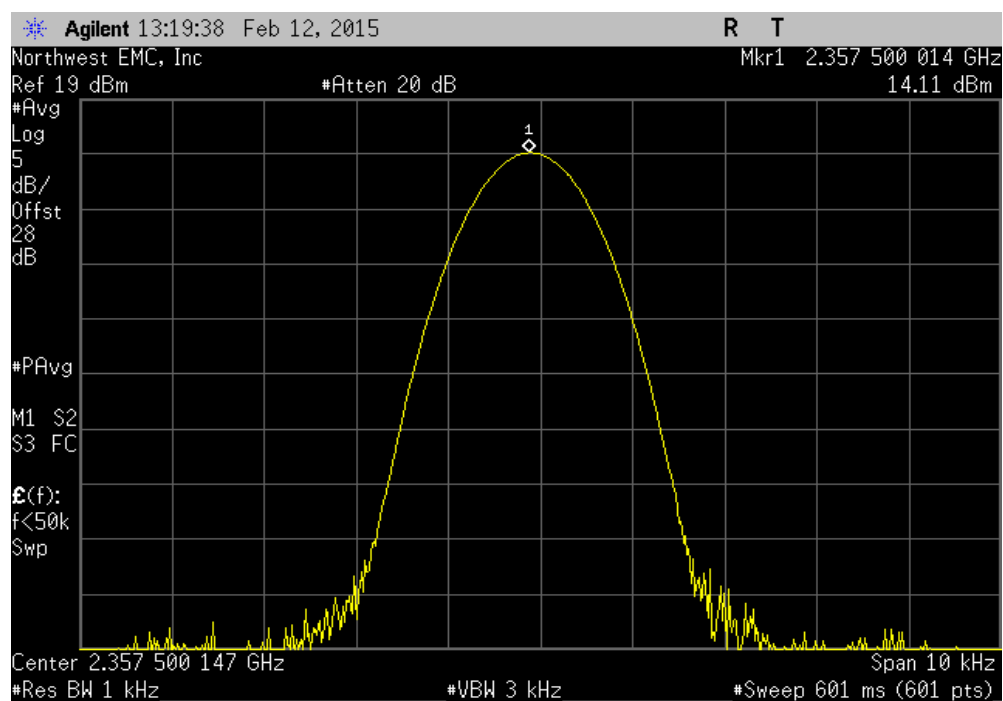


FREQUENCY STABILITY

Temperature: -20°, Low Channel 2352.5 MHz						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	2352.500034	2352.5	0	1	Pass	

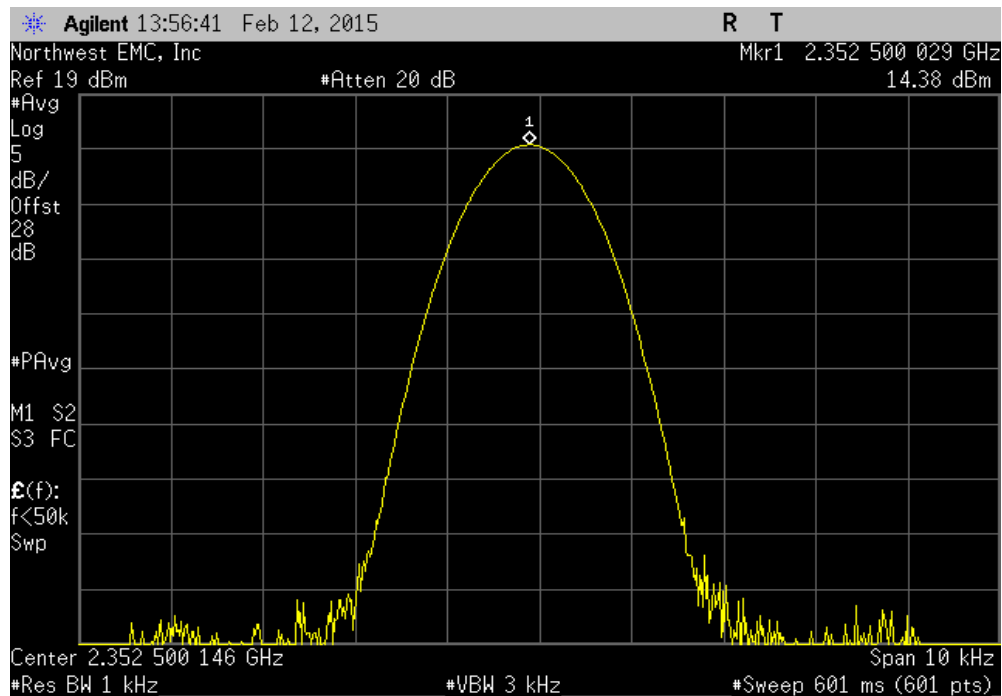


Temperature: -20°, High Channel 2357.5 MHz						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	2357.500014	2357.5	0	1	Pass	

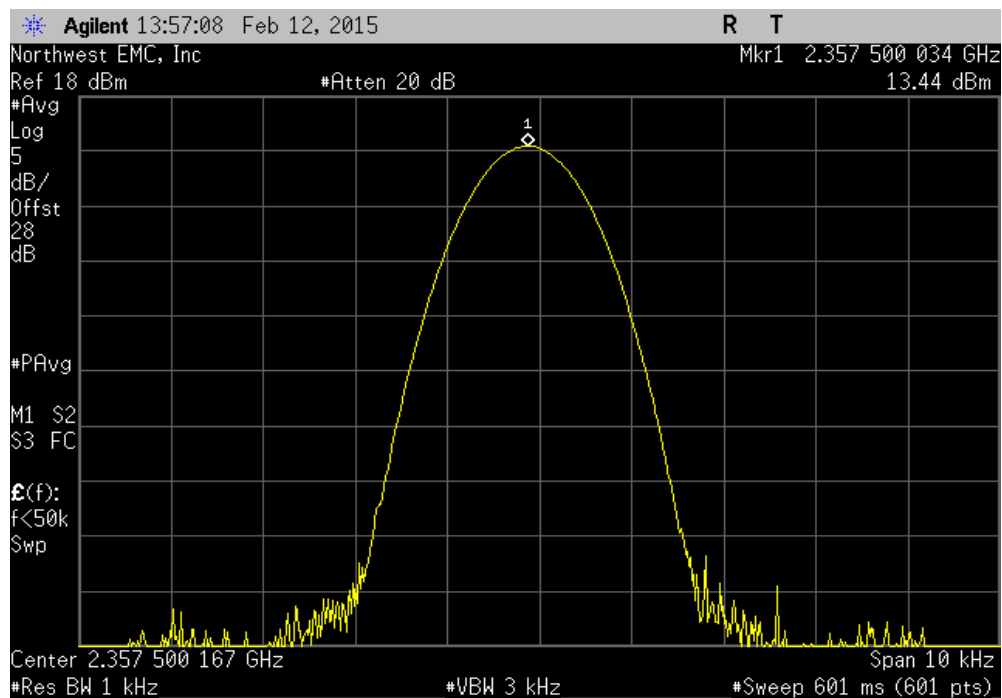


FREQUENCY STABILITY

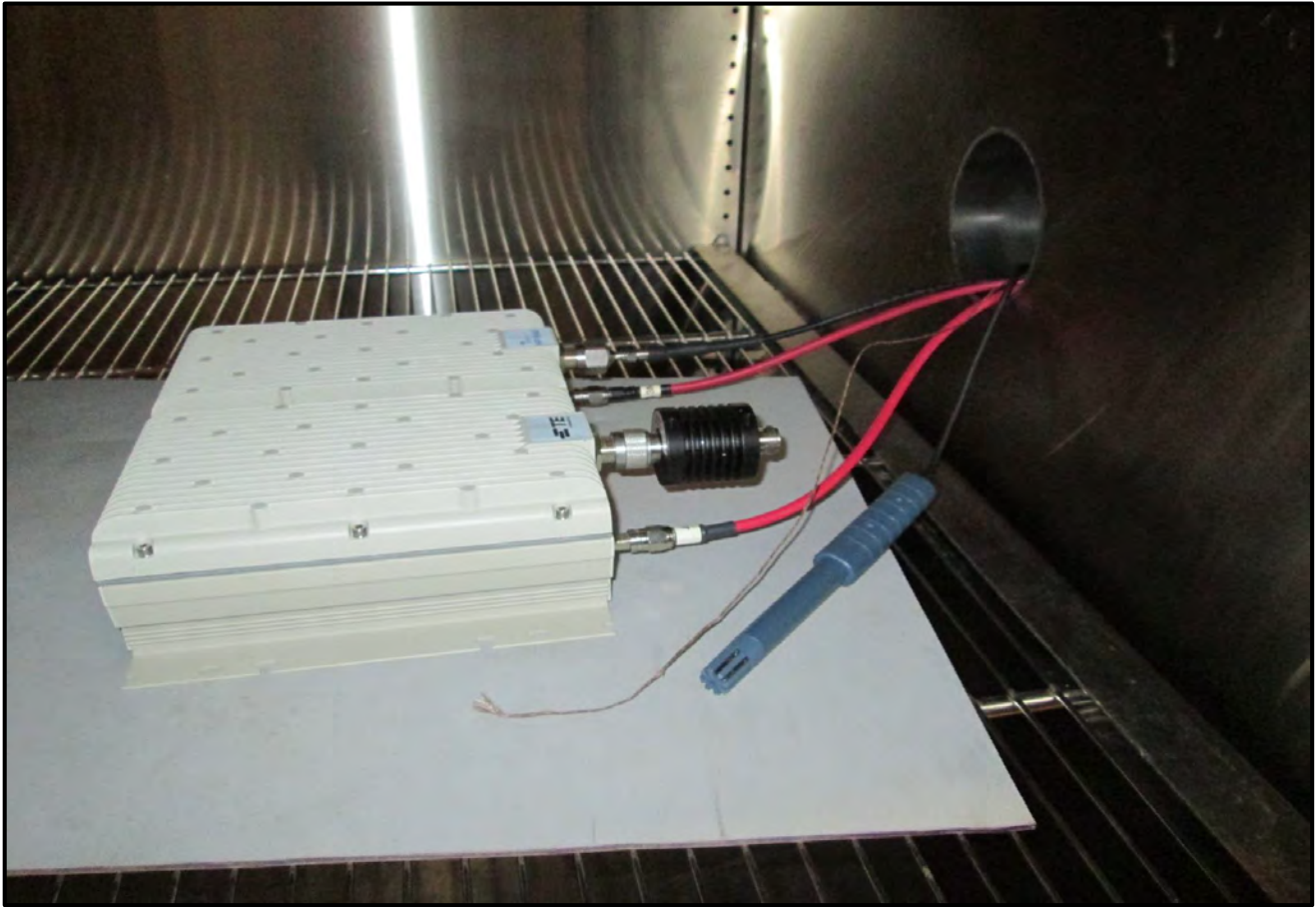
Temperature: -30°, Low Channel 2352.5 MHz						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	2352.500029	2352.5	0	1	Pass	



Temperature: -30°, High Channel 2357.5 MHz						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	2357.500034	2357.5	0	1	Pass	



FREQUENCY STABILITY



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 LTE 5MHz low channel (2352.5 MHz) and high channel (2357.5 MHz)

POWER SETTINGS INVESTIGATED

110VAC/60Hz

CONFIGURATIONS INVESTIGATED

TECO0024 - 2

FREQUENCY RANGE INVESTIGATED

Start Frequency 30 MHz Stop Frequency 26500 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
Low Pass Filter	Micro-Tronics	LPM50004	HGK	5/15/2014	12 mo
High Pass Filter	Micro-Tronics	HPM50111	HGQ	5/15/2014	12 mo
Attenuator, 10db, 'SMA'	S.M. Electronics	SA18H-10	REN	5/15/2014	12 mo
Pre-Amplifier	Miteq	JSD4-18002600-26-8P	APU	10/3/2014	12 mo
MN05 Cable	N/A	18-26GHz Standard Gain Horn Cable	MNP	10/3/2014	12 mo
Antenna, Horn	ETS	3160-09	AHG	NCR	0 mo
Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AVW	3/14/2014	12 mo
Antenna, Horn	ETS Lindgren	3160-08	AIQ	NCR	0 mo
MN05 Cables	ESM Cable Corp.	Standard Gain Horn Cables	MNJ	3/14/2014	12 mo
Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AVV	3/14/2014	12 mo
Antenna, Horn	ETS	3160-07	AXP	NCR	0 mo
Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVX	3/14/2014	12 mo
MN05 Cables	ESM Cable Corp.	Double Ridge Guide Horn Cables	MNI	3/14/2014	12 mo
Antenna, Horn	ETS	3115	AJA	6/3/2014	24 mo
Pre-Amplifier	Miteq	AM-1616-1000	PAD	3/14/2014	12 mo
MN05 Cables	ESM Cable Corp.	Bilog Cables	MNH	3/14/2014	12 mo
Antenna, Biconilog	Teseq	CBL 6141B	AYD	12/17/2013	24 mo
Signal Generator MXG	Agilent	N5183A	TIK	10/17/2014	36 mo
Power Sensor	Agilent	N8481A	SQN	8/22/2014	12 mo
Power Meter	Agilent	N1913A	SQL	8/22/2014	12 mo
Antenna, Horn (DRG)	ETS Lindgren	3115	AIP	6/26/2014	24 mo
Spectrum Analyzer	Agilent	N9010A	AFI	1/27/2015	12 mo

MEASUREMENT BANDWIDTHS

Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (kHz)
0.01 - 0.15	1.0	0.2	0.2
0.15 - 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0

TEST DESCRIPTION

The highest gain antenna to be used with the EUT was tested for final measurements. The EUT was configured for the lowest and the highest transmit frequency. For each configuration, the spectrum was scanned throughout the specified range. While scanning, emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis, and adjusting the measurement antenna height and polarization (per ANSI C63.10:2009). A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.

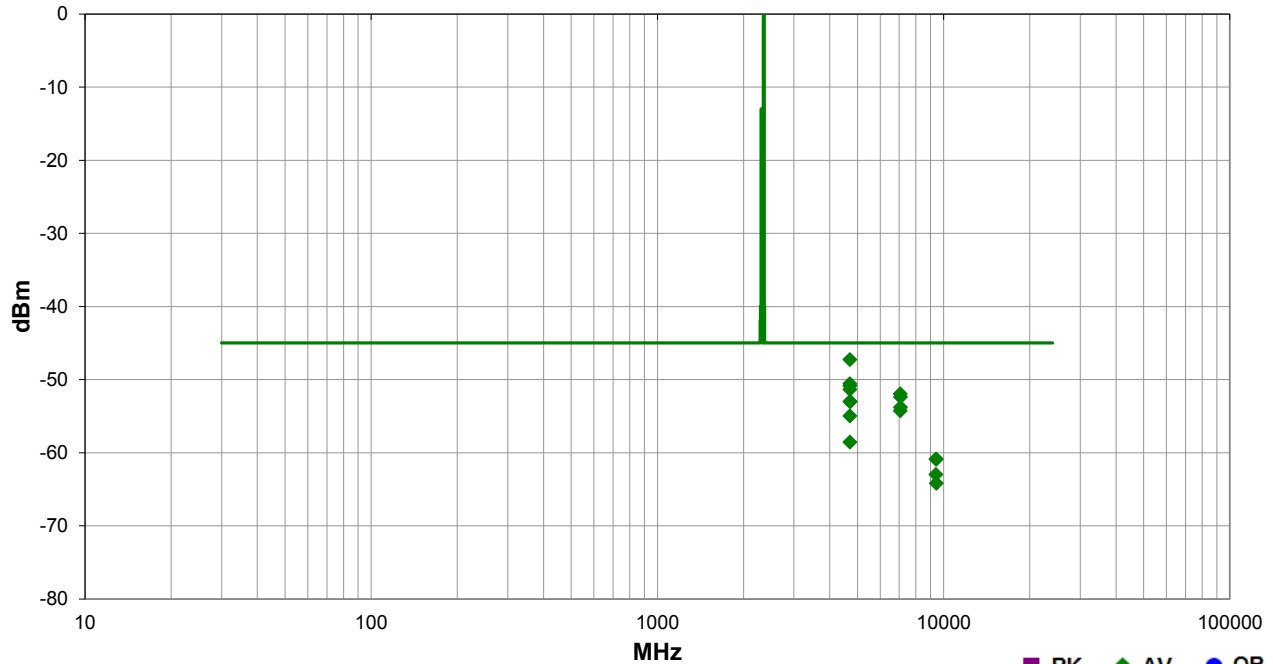
For licensed transmitters, the FCC references TIA/EIA-603 as the measurement procedure standard. TIA/EIA-603 Section 2.2.12 describes a method for measuring radiated spurious emissions that utilizes an antenna substitution method:

At an approved test site, the transmitter is placed 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.

Work Order:	TECO0024	Date:	02/25/15	
Project:	None	Temperature:	21.9 °C	
Job Site:	MN05	Humidity:	13% RH	
Serial Number:	SPT-S3-2323-12-HP	Barometric Pres.:	1018 mbar	
EUT:	Spectrum 2300 MHz WCS Secondary RAU			Tested by: Dustin Sparks
Configuration:	2			
Customer:	TE Connectivity / ADC Telecommunications			
Attendees:	None			
EUT Power:	110VAC/60Hz			
Operating Mode:	Transmitting LTE 5MHz low channel (2352.5 MHz) and high channel (2357.5 MHz)			
Deviations:	None			
Comments:	None			

Test Specifications	FCC 27:2015	Test Method	ANSI/TIA/EIA-603-C:2004
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Run #	18	Test Distance (m)	3	Antenna Height(s)	1 to 4(m)	Results	Pass
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Freq (MHz)	Antenna Height (meters)	Azimuth (degrees)	Polarity/ Transducer Type	Detector	EIRP (Watts)	EIRP (dBm)	Spec. Limit (dBm)	Compared to Spec. (dB)	Comments
4704.892	1.1	211.0	Horz	AV	1.88E-08	-47.3	-45.0	-2.3	LTE 5MHz, low ch, EUT horz
4705.083	1.0	87.1	Horz	AV	8.78E-09	-50.6	-45.0	-5.6	LTE 5MHz, low ch, EUT on side
4704.950	1.6	186.0	Vert	AV	8.19E-09	-50.9	-45.0	-5.9	LTE 5MHz, low ch, EUT horz
4704.833	1.2	97.0	Vert	AV	7.30E-09	-51.4	-45.0	-6.4	LTE 5MHz, low ch, EUT on side
7057.325	1.0	58.1	Vert	AV	6.37E-09	-52.0	-45.0	-7.0	LTE 5MHz, low ch, EUT horz
7072.508	1.0	59.1	Vert	AV	5.75E-09	-52.4	-45.0	-7.4	LTE 5MHz, high ch, EUT horz
4715.033	1.0	197.0	Horz	AV	4.99E-09	-53.0	-45.0	-8.0	LTE 5MHz, high ch, EUT horz
4714.800	1.6	192.1	Vert	AV	4.99E-09	-53.0	-45.0	-8.0	LTE 5MHz, high ch, EUT horz
7072.900	1.4	141.1	Horz	AV	4.17E-09	-53.8	-45.0	-8.8	LTE 5MHz, high ch, EUT horz
7056.550	1.6	37.1	Horz	AV	3.75E-09	-54.3	-45.0	-9.3	LTE 5MHz, low ch, EUT horz
4705.017	1.0	355.9	Vert	AV	3.19E-09	-55.0	-45.0	-10.0	LTE 5MHz, low ch, EUT vert
4704.992	1.0	289.0	Horz	AV	1.39E-09	-58.6	-45.0	-13.6	LTE 5MHz, low ch, EUT vert
9429.208	1.0	229.0	Horz	AV	8.15E-10	-60.9	-45.0	-15.9	LTE 5MHz, high ch, EUT horz
9409.192	1.2	223.0	Horz	AV	8.15E-10	-60.9	-45.0	-15.9	LTE 5MHz, low ch, EUT horz
9408.742	1.3	154.0	Vert	AV	5.02E-10	-63.0	-45.0	-18.0	LTE 5MHz, low ch, EUT horz
9428.533	1.0	24.0	Vert	AV	3.81E-10	-64.2	-45.0	-19.2	LTE 5MHz, high ch, EUT horz

PEAK TO AVERAGE RATIO

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.	Interval (mo)
MN08 Direct Connect Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	10/2/2014	12
Attenuator - 20db, 'SMA'	SM Electronics	SA26B-20	RFW	4/3/2014	12
40 GHz DC Block	Fairview Microwave	SD3379	AMI	10/2/2014	12
Signal Generator MXG	Agilent	N5183A	TIK	10/17/2014	36
Spectrum Analyzer	Agilent	E4440A	AAX	4/28/2014	12

TEST DESCRIPTION

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.

A direct connection was made between the RF output of the EUT and a spectrum analyzer. Attenuation and a DC block were used. The reference level offset on the spectrum analyzer was adjusted to compensate for cable loss and the external attenuation used between the RF output and the spectrum analyzer input.

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 screen captures/traces was calculated:

- 1st Screen Capture/Trace: Peak detector and trace max-hold.
- 2nd Screen Capture/Trace: The same procedure and settings as was used for conducted Output Power.

PEAK TO AVERAGE RATIO

EUT: Spectrum 2300 MHz WCS Secondary RAU		Work Order: TECO0024	
Serial Number: GR223E8E		Date: 02/19/15	
Customer: TE Connectivity / ADC Telecommunications		Temperature: 23.1°C	
Attendees: None		Humidity: 9%	
Project: None		Barometric Pres.: 1031.8	
Tested by: Trevor Buls	Power: 110VAC/60Hz	Job Site: MN08	
TEST SPECIFICATIONS			
FCC 27:2015		Test Method: ANSI/TIA/EIA-603-C-2004	
COMMENTS			
Port 1 was determined to be worst case.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	1	Signature: <i>Trevor Buls</i>	
		Peak (dBm)	Average (dBm)
		Delta (dB)	Limit (dB)
			Result
LTE 5 MHz	PK to AV	N/A	N/A
		10.781	13
			Pass

PEAK TO AVERAGE RATIO

LTE 5 MHz, PK to AV						
	Peak (dBm)	Average (dBm)	Delta (dB)	Limit (dB)	Result	
	N/A	N/A	10.781	13	Pass	

