



Test Report

Prepared for: Freewave Technologies, Inc.

Model: ZumLink Z9-C or Z9-T

Description: Digital Transmission System Radio Transceiver

Serial Number: N/A

FCC ID: KNYPMT0101AB
IC: 2329B-PMT0101AB

To

FCC Part 15.247 FHSS
IC RSS-247

Date of Issue: September 20, 2017

On the behalf of the applicant:

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Attention of:

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Poona Saber
Project Test Engineer

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Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	August 31, 2017	Poona Saber	Original Document
2.0	September 8, 2017	Poona Saber	Revised occupied bandwidth measurements
3.0	September 12, 2017	Amanda Reed	Updated model name
4.0	September 19, 2017	Poona Saber	Added frequency range and channels on page 6

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The tests results contained within this test report all fall within our scope of accreditation, unless noted in the table below.

Please refer to <http://www.compliancetesting.com/labscope.html> for current scope of accreditation.

Testing Certificate Number: **2152.01**



FCC Site Reg. #349717

IC Site Reg. #2044A-2

Non-accredited tests contained in this report:

N/A

The applicant has been cautioned as to the following

15.21 - Information to User

The user's manual or instruction manual for an intentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

15.27(a) - Special Accessories

Equipment marketed to a consumer must be capable of complying with the necessary regulations in the configuration in which the equipment is marketed. Where special accessories, such as shielded cables and/or special connectors are required to enable an unintentional or intentional radiator to comply with the emission limits in this part, the equipment must be marketed with, i.e. shipped and sold with, those special accessories. However, in lieu of shipping or packaging the special accessories with the unintentional or intentional radiator, the responsible party may employ other methods of ensuring that the special accessories are provided to the consumer, without an additional charge.

Information detailing any alternative method used to supply the special accessories for a grant of equipment authorization or retained in the verification records, as appropriate. The party responsible for the equipment, as detailed in 2.909 of this chapter, shall ensure that these special accessories are provided with the equipment. The instruction manual for such devices shall include appropriate instructions on the first page of text concerned with the installation of the device that these special accessories must be used with the device. It is the responsibility of the user to use the needed special accessories supplied with the equipment.

Standard Test Conditions and Engineering Practices

All tests and measurement data shown were performed in accordance with FCC Rules and Regulations, Volume II; Part 2 and the following individual Part 15.247 Operation within bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.

Except as noted herein, the following conditions and procedures were observed during the testing:

In accordance with ANSI C63.4-2014, ANSI C63.10-2013, FCC DA 00-705, and unless otherwise indicated in the specific measurement results, the ambient temperature of the actual EUT was maintained within the range of 10 to 40C (50 to 104°F) unless the particular equipment requirements specified testing over a different temperature range. Also, unless otherwise indicated, the humidity levels were in the range of 10% to 90% relative humidity.

Environmental Conditions		
Temperature (°C)	Humidity (%)	Pressure (mbar)
23.2 – 4.4	27.2 – 32.6	965 - 967

Measurement results, unless otherwise noted, are worst case measurements.

EUT Description

Model: ZumLink Z9-T or Z9-C

Description: Digital Transmission System Radio Transceiver

Firmware: N/A

Software: N/A

Serial Number: N/A

Additional Information:

This is a Report for Class II permissive change on the device with FCC ID: KNYPM0101AB

Manufacturer has improved the 250 Kbps data rate on the ZumLink unit. Testing has been done conducted on Power, PSD, OBW, Band edge and 15.247 Spurious emissions up to 10 GHz to make sure that unit is meeting the limits for data rate addition and improvement.

For radiated testing please refer to original DTS Report on the FCC ID: KNYPM0101AB

All tests are performed with a 6 dBi antenna in mind and Frequency Hopping ability stopped. All tests are performed with a 6 dBi antenna in mind and the frequency range of testing is 902-928 on low, Mid and High frequencies as following: 903.3 MHz, 914.5 MHz and 926.8 MHz

EUT Operation during Tests

The EUT was controlled with test commands provided by the manufacturer.



Accessories:

Qty	Description	Manufacturer	Model	S/N
1	AC DC power supply	Spectre Power	S036CQ1200300	N/A
1	Laptop	Dell	Latitude E6520	N/A

Cables:

Qty	Description	Length (M)	Shielding Y/N	Shielded Hood Y/N	Ferrite Y/N
1	Serial to USB	<3m	N	N	N
1	Power	<3m	N	N	N

15.203: Antenna Requirement:

- The antenna is permanently attached to the EUT
- The antenna uses a unique coupling
- The EUT must be professionally installed
- The antenna requirement does not apply

Test Results Summary

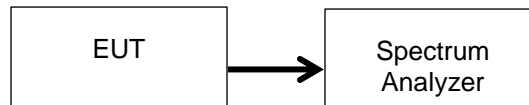
FCC 15.247 Specification	Test Name	Pass, Fail, N/A	Comments
15.247(b)	Peak Output Power	Pass	
15.247(b)	Conducted Spurious Emissions	Pass	
15.247(d)	Emissions At Band Edges	Pass	
15.247(a)(2)	Occupied Bandwidth	Pass	
15.247(e)	Transmitter Power Spectral Density	Pass	

Peak Output Power
Engineer: Poona Saber

Test Date: 8/31/17

Test Procedure

The EUT was connected directly to the input of a spectrum analyzer. The peak readings were taken and the result was then compared to the limit.

Test Setup

Transmitter Peak Output Power

Channel	250 kb		
	Recorded Measurement (dBm)	Specification Limit (W)	Result
Low	29.18	1	Pass
Mid	29.34	1	Pass
High	28.91	1	Pass

Note: For all antenna gains greater than 6dBi the output power must be reduced per above table.

Conducted Spurious Emissions

Engineer: Poona Saber

Test Date: 8/31/2017

Test Procedure

The EUT was connected directly to a spectrum analyzer. The Spectrum Analyzer was set to the following:

RBW = 100 kHz

VBW $\geq 3 \times$ RBW

Peak Detector

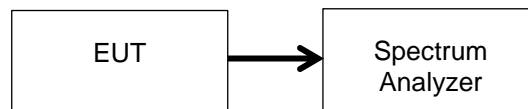
Trace mode = max hold

Sweep = auto couple

Frequency Range = 30MHz – 10th Harmonic of the fundamental

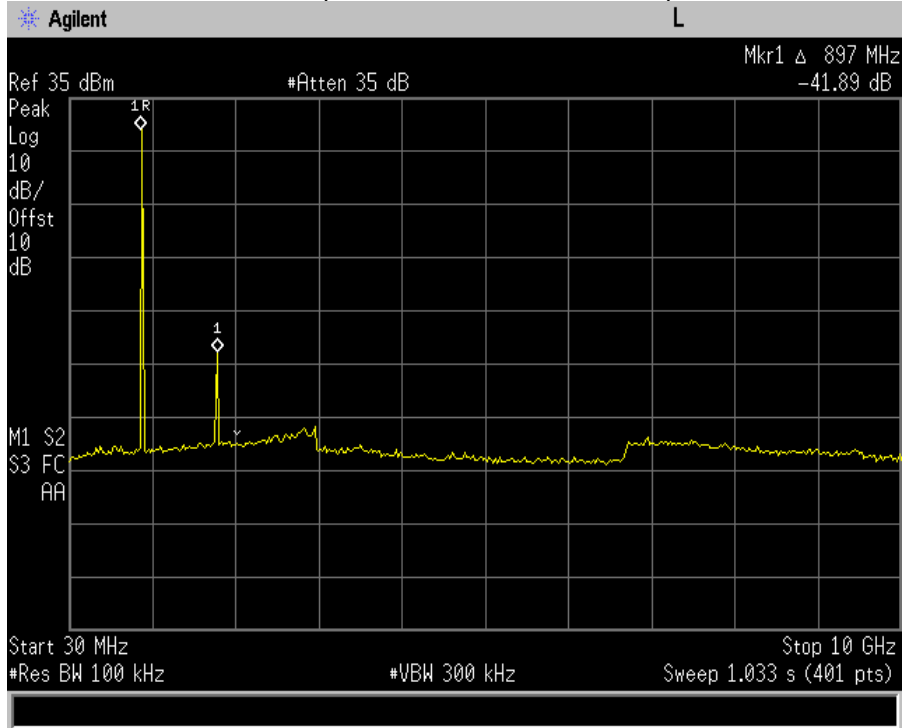
The EUT was set to transmit on the lowest, middle and highest frequencies at the maximum power level. The trace was allowed to stabilize. All emission were investigated to insure they were attenuated from the peak fundamental by at least 20dB. If the average power levels were measured then the out-of-band emissions needed to be attenuated by 30dB. In addition emissions were investigated at the band edges to insure all out-of-band emissions were attenuated 20 or 30dB as necessary.

Test Setup

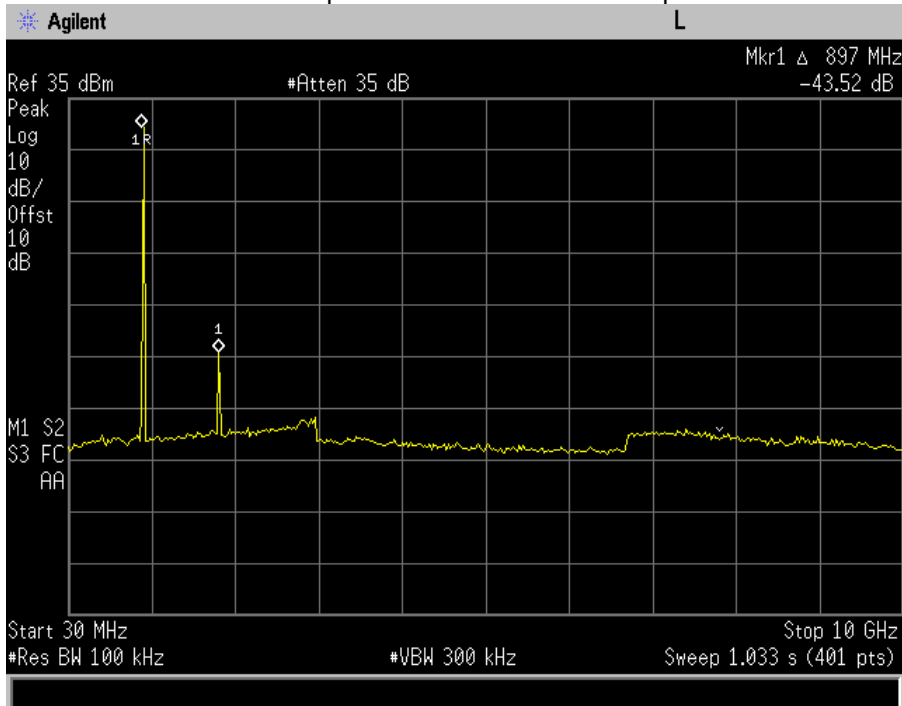




30 dBc Spurious Low Channel 250 Kbps

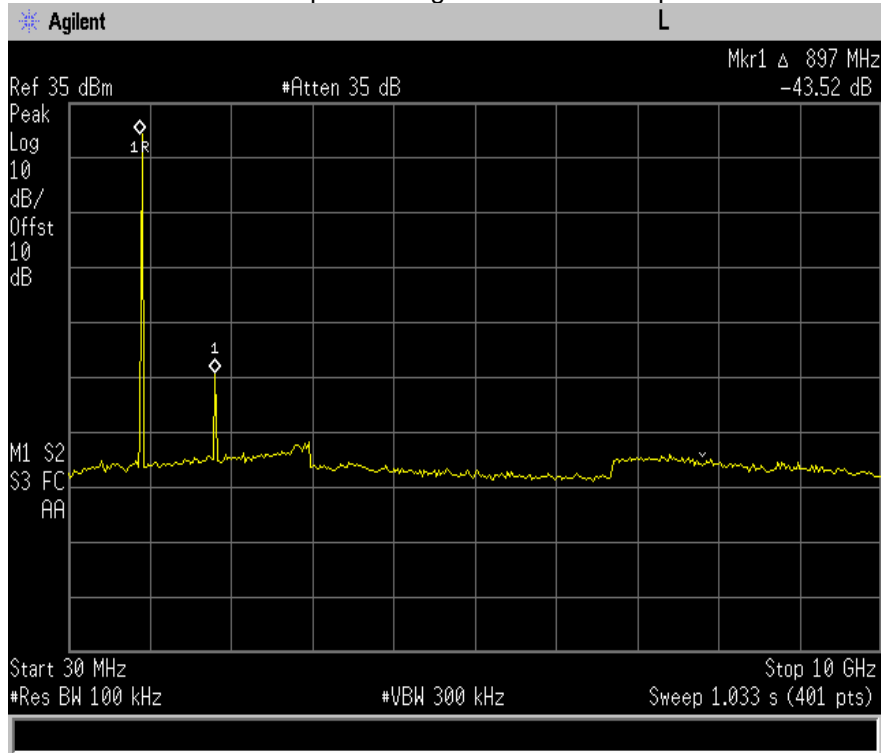


30 dBc Spurious Mid Channel 250 Kbps

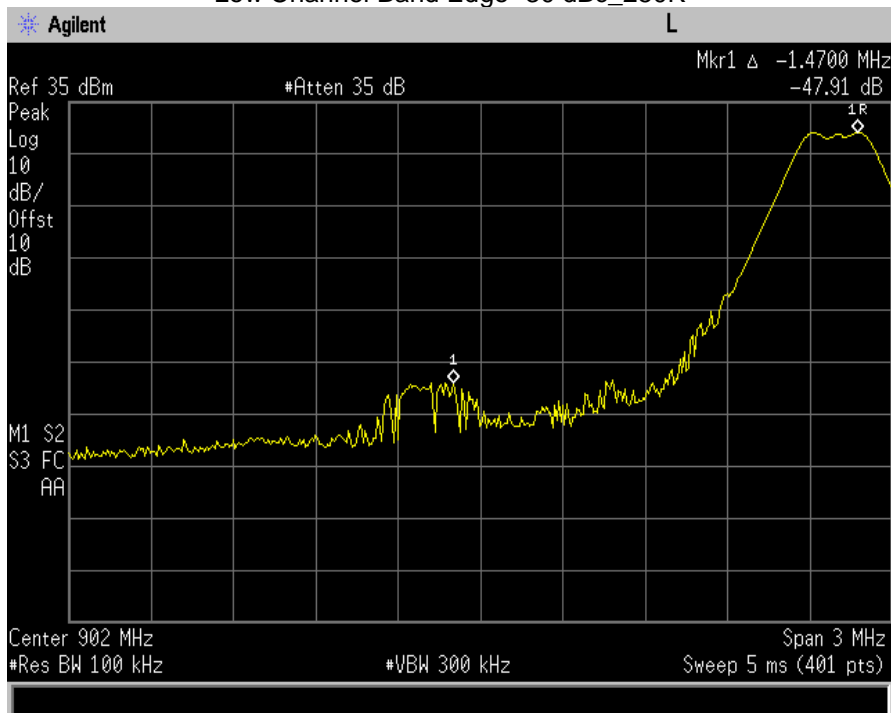




30 dBc Spurious High Channel 250 Kbps

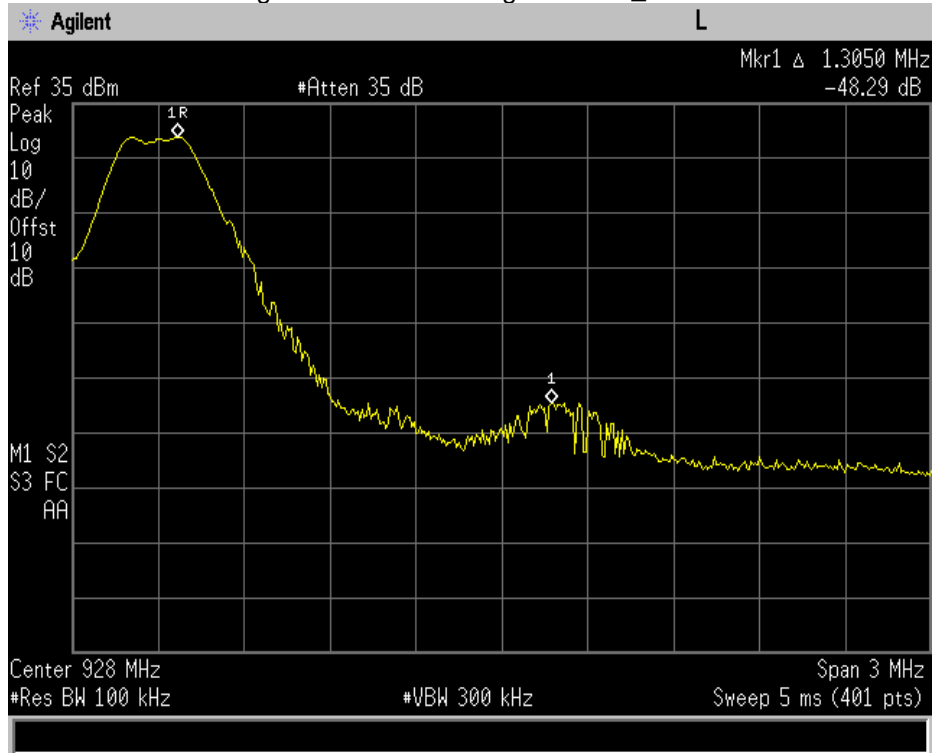


Low Channel Band Edge- 30 dBc_250K





High Channel Band Edge- 30 dBc_250K

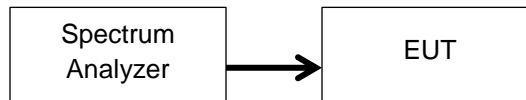


Occupied Bandwidth
Engineer: Poona Saber

Test Date: 8/31/2017

Test Procedure

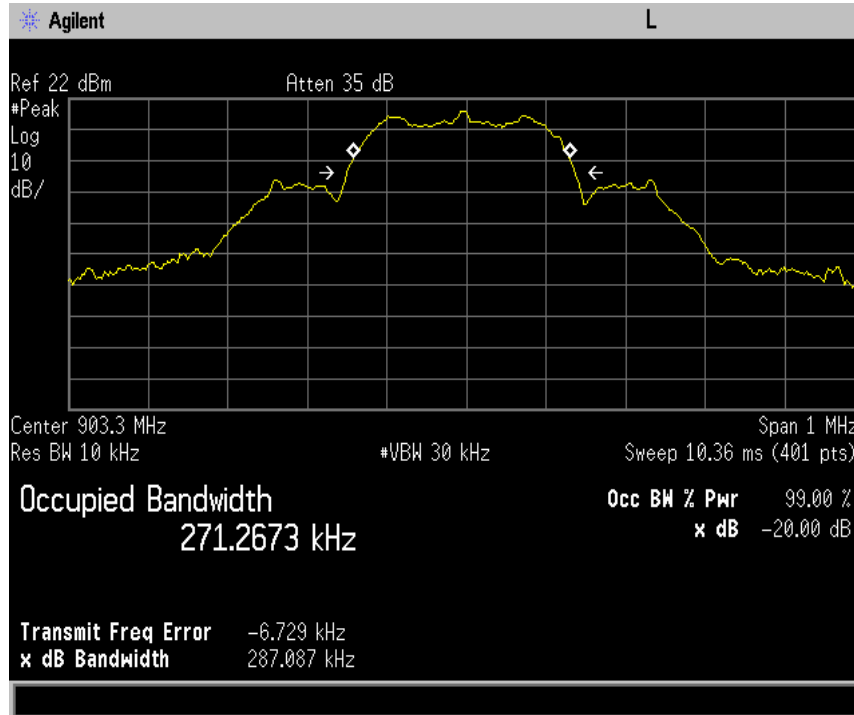
The EUT was connected directly to a spectrum analyzer. The Span was set wide enough to capture the entire transmitting spectrum and the resolution bandwidth was set to at least 1% of the span. The analyzer was set to max hold and when the entire spectrum was captured, the 99% bandwidth was measured to verify that the bandwidth met the specification.

Test Setup

20 dB Bandwidth Summary

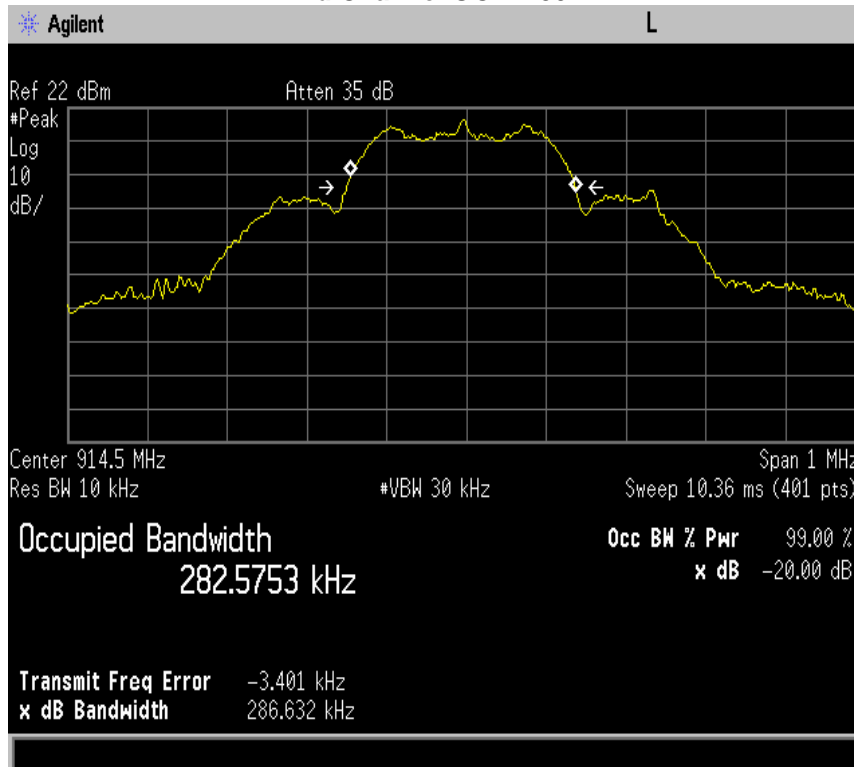
Frequency (MHz)	Recorded Measurement (kHz)	Specification Limit	Result
Low	287.08	<500k	Pass
Mid	286.63	<500k	Pass
High	283.88	<500k	Pass



Low Channel OCW 250K

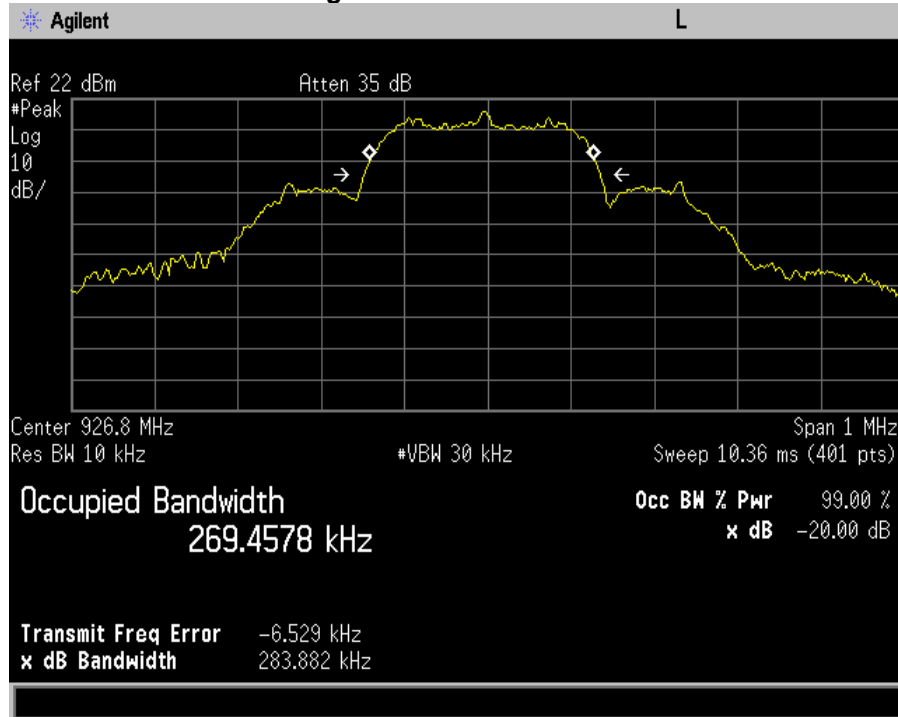


Mid Channel OCW 250K





High Channel OCW 250K





Test Equipment Utilized

Description	Manufacturer	Model #	CT Asset #	Last Cal Date	Cal Due Date
Spectrum Analyzer	Agilent	E4407B	i00331	10/19/16	10/19/17

In addition to the above listed equipment standard RF connectors and cables were utilized in the testing of the described equipment. Prior to testing these components were tested to verify proper operation.

END OF TEST REPORT