Testing Tomorrow's Technology

Application for

US Code Title 47, Part 2, Subpart J, Section 2.947, Certification
Per
Part 15, Subpart C, for Intentional Radiators, Section 15.249, Intentional Radiator Operating within the Band 902 MHz to 928 MHz

For the

Wink, Inc.

Model: HUB

UST Project: 14-0074
Test Date(s): April 16- May 14, 2014
Issue Date: May 16, 2014

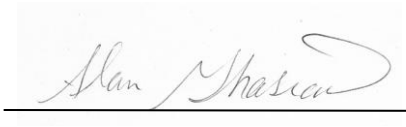
Total Pages in this Report: 21

3505 Francis Circle Alpharetta, GA 30004
PH: 770-740-0717 Fax: 770-740-1508
www.ustech-lab.com

Testing Tomorrow's Technology

I certify that I am authorized to sign for the test facility and that all of the statements in this report and in the Exhibits attached hereto are true and correct to the best of my knowledge and belief:

US TECH (Agent Responsible For Test):

By: 

Name: Alan Ghasiani

Title: Consulting Engineer - President

Date: May 16, 2014

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3505 Francis Circle Alpharetta, GA 30004
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MEASUREMENT/TECHNICAL REPORT

COMPANY NAME: WINK Inc.

MODEL: HUB

FCC ID: 2ACAJ-WINK22

DATE: May 16, 2014

This report concerns (check one): Original grant_X
Class II change_____

Equipment type: **Intentional Radiator Operating within the band 902-928 MHz**

Deferred grant requested per 47 CFR 0.457(d) (1) (ii)? yes_____ No_X

If yes, defer until:_____
date

__N.A.__ agrees to notify the Commission by__N.A.
date
of the intended date of announcement of the product so that the grant can be issued on that date.

Report prepared by:

US Tech
3505 Francis Circle
Alpharetta, GA 30004

Phone Number: (770) 740-0717
Fax Number: (770) 740-1508

SUMMARY OF TEST REQUIREMENTS

FCC Requirement	Title	Disposition
15.205	Restricted Bands	Pass
15.207	Intentional Radiator Power Line Conducted Emissions	Pass
15.209	Intentional Radiator Radiated Emissions	Pass
15.249(a)	Fundamental Field Strength	Pass

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1 General Information

1.1 Purpose of this Report

This report is prepared as a means of presenting test data to be used by a Telecom Certification Body in determination of whether this product is permitted for unlicensed dissemination to the general public according to the FCC Rules and Regulations for RF Devices Intentional Radiators.

1.2 Product Description

The Equipment Under Test (EUT) is the WINK Inc. home automation radio module, model HUB. The HUB has five transmitters, including: three 2.4 GHZ transmitters (Wifi, Bluetooth, and Zigbee), one 908 MHz transmitter (Zwave), and one 431 MHz transmitter (Lutron). The circuit board uses four trace antennas. The Bluetooth and Wifi radios share one antenna and the other transmitters each have their own antennas.

This report will cover in detail the test results for the 908 MHz transmitter, which is a 2.4 902-928 MHz radio. The test results for the other transmitters will be covered in separate reports.

The transmitter operates only on a single channel, 908.42 MHz. The radio utilizes GFSK modulation with a data rate set to 100kb/s data rate. Proprietary firmware developed by the manufacture was used to set the radio into an FCC test mode.

1.3 Related Submittal(s)/Grant(s)

1.3.1 The EUT is subject to the following FCC authorizations:

a) Certification under section 15.249 as a transmitter

b) Verification under 15.101 as a digital device and receiver

1.3.2 Certification of the Transmitter

The EUT is not being certified under CFR 15.247 because its minimum 6 dB bandwidth is less than 500 kHz therefore does not meet the CFR 15.247 6 dB bandwidth requirement of 500 kHz or greater. It is instead being presented under the requirements of CFR 15.249. The EUT will operate at 908 MHz within the 902-928 MHz band.

1.3.3 Verification of the Digital apparatus

The digital apparatus has been tested to meet the verification requirements of Part 15.107 and Part 15.109. The test results for these measurements are not included in this test report as this test report is meant to show only the compliance test data for the 908 MHz intentional radiator. Please see US Tech test report 14-0072 for the digital verification test data.

2 Tests and Measurements

2.1 Configuration of Tested System

The sample was setup and tested per ANSI C63.4, *Methods of Measurement from Low-Voltage Electrical and Electronic Equipment in the Frequency Range of 9 kHz to 40 GHz (2003).* Conducted and radiated emissions data were taken with the EMC test receiver (or spectrum analyzer's) resolution bandwidth adjusted to 9 kHz and 120 kHz, respectively. All measurements are peak unless stated otherwise. The video filter associated with the spectrum analyzer was off throughout the evaluation process. A Block diagram of the tested system is shown in Figure 1. A listing of the EUT and its test peripherals is found in Table 1 below. Test configuration photographs for spurious and fundamental emissions measurements are in the attached appendices.

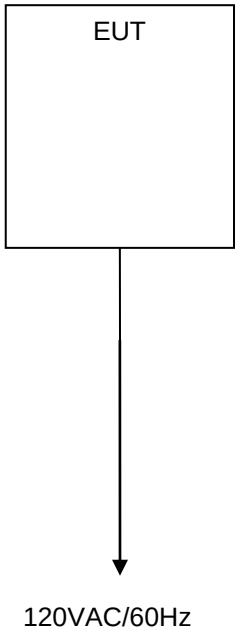

Figure 1. Test Configuration

Table 1. EUT and Peripherals

PERIPHERAL MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC ID:	CABLES P/D
Home Gateway WINK Inc. (EUT)	HUB	Engineering Sample	2ACAJ-WINK22	1.5 m U Power cable
Antenna See antenna details	--	--	--	--

2.2 EUT Characterization

The sample used for testing was received by US Tech on April 14, 2014 in good operating condition.

2.3 Test Facility

Testing was performed at US Tech's measurement facility at 3505 Francis Circle, Alpharetta, GA. This site has been fully described and registered with the FCC under designation number US5117. Additionally this site has also been fully described and submitted to Industry Canada (IC), and has been approved under file number 2982A-1.

2.4 Test Equipment

Table 2. Test Instruments used for Evaluation.

TEST INSTRUMENT	MODEL NUMBER	MANUFACTURER	SERIAL NUMBER	DATE OF LAST CALIBRATION
SPECTRUM ANALYZER	E4407B	AGILENT	US41442935	11/8/2013
SPECTRUM ANALYZER	8566B	HEWLETT-PACKARD	2410A00109	2/03/2014
RF PREAMP 100 kHz to 1.3 GHz	8447D	HEWLETT-PACKARD	2944A06291	2/06/2014
LOOP ANTENNA	SAS-200/562	A. H. Systems	142	9/12/2013 2 yr cycle
BICONICAL ANTENNA	3110B	EMCO	9306-1708	7/02/2012 2 yr cycle
LOG PERIODIC ANTENNA	3146	EMCO	3110-3236	6/05/12 2 yr cycle
HORN ANTENNA	SAS-571	A. H. Systems	605	7/23/2013 2 yr cycle
PREAMP 1.0 GHz to 26.0 GHz	8449B	HEWLETT-PACKARD	3008A00480	2/06/14
LISN	8028-50-TS24-BNC	Solar Electronics	910495 & 910496	3/19/2014
CALCULATION PROGRAM	N/A	N/A	Ver. 6.0	N/A

Note: The calibration interval of the above test instruments is 12 months unless stated otherwise, and all calibrations are traceable to NIST/USA.

2.5 Modifications to EUT

No modifications were made by US Tech to bring the EUT into compliance with FCC Part 15, Subpart B, Class B Limits for the receiver and digital portion of the EUT or the Subpart C, Transmitter requirements.

2.6 Measurement Standards (CFR 15.31)

Intentional and unintentional radiators are to use the methods of ANSI C63.4 – 2003. Measurements were made on an Open Area Test Site (OATS) wherever possible. For battery powered equipment, new (or fully charged) batteries are used. Section 15.31(m) indicates that if the EUT System operates at 906 MHz ISM band, measurements must be made near the bottom of the band (around 902 MHz for example) and near the top of the band (908 MHz). However this EUT only operates at 906 MHz therefore only one channel, 906 MHz, was evaluated.

2.7 Frequency Range of Radiated Measurements (CFR 15.33)

The frequency range is detailed below for intentional and unintentional radiators.

2.7.1 Frequency Range for Intentional Radiators

The spectrum was investigated from the lowest RF signal generated without going below 9 kHz to the 10th harmonic of the highest fundamental transmitter frequency.

2.7.2 Frequency Range for Unintentional Radiators

The spectrum was investigated from the lowest RF signal generated without going below the lowest frequency for which an emissions limit is specified (30 MHz) to the 5th harmonic of the highest fundamental frequency of the digital device (5 GHz maximum).

2.7.3 Measurement Detector Function and Bandwidth (CFR 15.35)

On any frequency below 1000 MHz, the limits shown are based upon measuring equipment employing a CISPR quasi-peak detector function and related measurement bandwidths. On frequencies above 1000 MHz, the radiation limits are based upon the use of measuring instrumentation employing an average detector function.

When average detector measurements are specified for use, including emission measurements below 1000 MHz, there is also a corresponding limit for Peak detector measurements having a limit of 20 dB above the corresponding average limit unless a different peak emission limit is specified. Measurements above 1000 MHz utilize a minimum resolution bandwidth of 1 MHz.

When radiated emissions limits are expressed in terms of the average value of the emission and pulsed operation is employed, the measurement field strength is determined by averaging over one complete pulse train (Duty Cycle) including blanking intervals for pulse trains up to 0.1 second in duration. The exact method of calculating the average field strength is included in paragraph 2.11 of this report.

Manufacturer stated duty cycle correction:

This radio module is identical to the radio module bearing the following FCC ID: KJ8-0003177 and the manufacturer of this product has not changed the radio parameters.

The worst case duty cycle was determined to be 60% or 60ms within a 100ms period. The duty cycle correction factor is determined using the following formula: 20 log (0.60) = -4.44 dB.

The duty cycle correction factor therefore is -4.44 dB.

Note: The transmitter was programmed to transmit at >98% during all testing. Therefore where applicable (when using AVG detection) the duty cycle factor calculated above was applied.

2.8 Antenna Requirement (CFR 15.203)

The intentional radiator is designed to assure that no antenna other than that furnished by the manufacturer is used with the device. The use of a permanently attached antenna is considered sufficient to comply with this requirement. Below is a table of the permanently attached antenna used with this system and its characteristics. If, in the future, additional antennas are contemplated for use, they must be formally evaluated and approved for suitability to these requirements.

Table 3. Hub Antennas

Manufacturer	Model Number	Antenna Type	Frequency Range	Peak Gain dBi	Impedance Ohms
WINK Inc.	None	Printed “F”	902-928 MHz	1.2	50

2.9 Intentional Radiator, Radiated and Power Line Conducted Emissions (CFR 15.207, CFR 15.209)

The end product along with the intentional radiator has been tested to meet the verification requirements of Part 15.207 and Part 15.209. The test results for these measurements are not included in this test report as this test report is meant to show only the compliance test data for the 908 MHz intentional radiator. Please see US Tech test report 14-0072 for the digital verification test data.

2.10 Intentional Radiator, Radiated Emissions (CFR 15.249 (a), (e))

The EUT was placed into a continuous transmit mode of operation (> 98% duty cycle). A preliminary scan was performed on the EUT to find signal frequencies that were caused by the transmitter part of the product and to obtain the worse case result the EUT was tested in all X, Y and Z axis. Radiated measurements below 1 GHz were tested with a RBW = 120 kHz. Radiated measurements above 1 GHz were measured using a RBW =1 MHz VBW = 3 MHz.

2.11 Restricted Bands of Operation (CFR 15.205)

Only radiated harmonics and other spurious signals can be permitted to fall into the restricted bands of 15.205. All signals found in paragraph 2.7 above shall be examined for this requirement. Limits are based upon the limits of paragraph 15.209. Above 1 GHz, the limits are for Average value. See Tables 4 and 5 below for peak and Average measurements. According to CFR 15.35, the peak limits can exceed the average limits by 20 dB. For emissions below 1 GHz the limits are QP limits.

Table 4. Intentional Radiated Emissions (Peak)

Tested By: JW	Test: Part 15B, Para 15.249			Client: WINK Inc.			
	Project: 14-0074			Model: Hub			
Frequency (MHz)	**Test Data (dBuV)**	**AF+CL-PA (dB/m)**	**Corrected Results (dBuV/m)**	**Limits (dBuV/m)**	**Distance / Polarization**	**Margin (dB)**	**Detection Mode**
908.40	68.90	23.01	91.91	94.0	3M/Vert.	2.1	QP
1816.87	53.34	-6.70	46.64	54.0	3M/Vert.	27.4	PK
2725.20	55.34	-1.82	53.52	54.0	3M/Vert.	20.5	PK
3633.55	54.19	-0.97	53.22	54.0	3M/Vert.	20.8	PK
4542.05	52.20	1.21	53.41	54.0	3M/Vert.	20.6	PK

1. (*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 & 20 dB relaxation for peak measurements of CFR 15.35.
2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic (25GHz using EMCO 3116 Horn Antenna)

Sample Calculation at 908.4MHz:

Magnitude of Measured Frequency	68.90	dBuV
+Antenna Factor + Cable Loss+ Amplifier Gain	23.01	dB/m
Corrected Result	91.91	dBuV/m

Test Date: April 22, 2014 and May 21, 2014
Tested By
Signature: _____ Name: John Wynn

Table 5. Intentional Radiated Emissions (Average)

Tested By: JW	Test: Part 15B, Para 15.249			Client: WINK Inc.			
	Project: 14-0074			Model: Hub			
Frequency (MHz)	**Test Data (dBuV)**	**AF+CL-PA -DC (dB/m)**	**Corrected Results (dBuV/m)**	**Limits (dBuV/m)**	**Distance / Polarization**	**Margin (dB)**	**Detection Mode**
908.40	68.90	23.01	91.91	94.0	3M/Vert.	2.1	QP
1816.87	42.05	-11.14	30.91	54.0	3M/Vert.	23.1	AVG
2725.20	49.09	-6.26	42.83	54.0	3M/Vert.	11.2	AVG
3633.55	45.45	-5.41	40.04	54.0	3M/Vert.	14.0	AVG
4542.05	33.70	-3.23	30.47	54.0	3M/Vert.	23.5	AVG

1. (*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 & 20 dB relaxation for peak measurements of CFR 15.35.
2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic (25GHz using EMCO 3116 Horn Antenna)

Sample Calculation at 908.4MHz:

Magnitude of Measured Frequency	71.60	dBuV
+Antenna Factor + Cable Loss+ Amplifier Gain	20.28	dB/m
Corrected Result	91.88	dBuV/m

Test Date: April 22, 2014
Tested By
Signature: _____ Name: John Wynn

2.12 6 dB Bandwidth Measurement & Channel Spacing per CFR 15.249

2.12.1 6 dB Bandwidth Measurements

The EUT antenna port was connected to a spectrum analyzer having a 50 Ω input impedance. Measurements were performed similar to the method of FCC, KDB Publication No. 558074 for a bandwidth of 6 dB. The RBW was set to approximately 1/100 of the manufacturers claimed RBW and with the VBW ≥ RBW. The results of this test are given in the table and figure below.

The above method was not possible because the EUT does not have an antenna port; the test was performed using the alternate radiated method per KDB publication No. 558074.

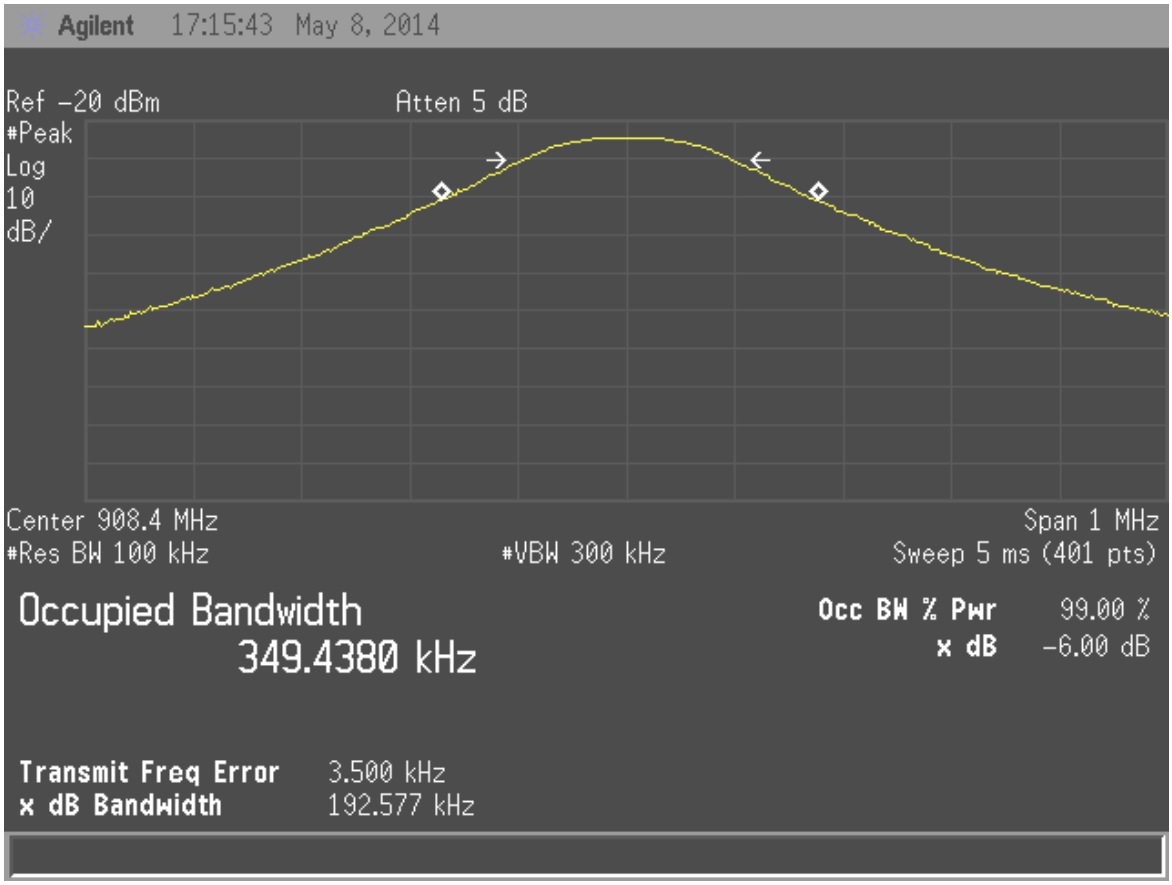

Figure 2. 6 dB Bandwidth Measurement

2.13 Band Edge Measurements (CFR15.249(d))

The EUT has only one fundamental frequency. Therefore the Band Edge measurements were made at one frequency. A measurement was made of the fundamental and the emission was measured using a quasi peak setting. A Resolution Bandwidth of > 1% of the emission bandwidth was used. This procedure was repeated for the high side. The limits were derived in the following sections.

2.13.1 High Band Edge

Above 908 MHz the limit per section 15.249(d) is 50 db below the fundamental or the value expressed by CFR 15.209 (46 dBuV/m) whichever is the lesser attenuation.

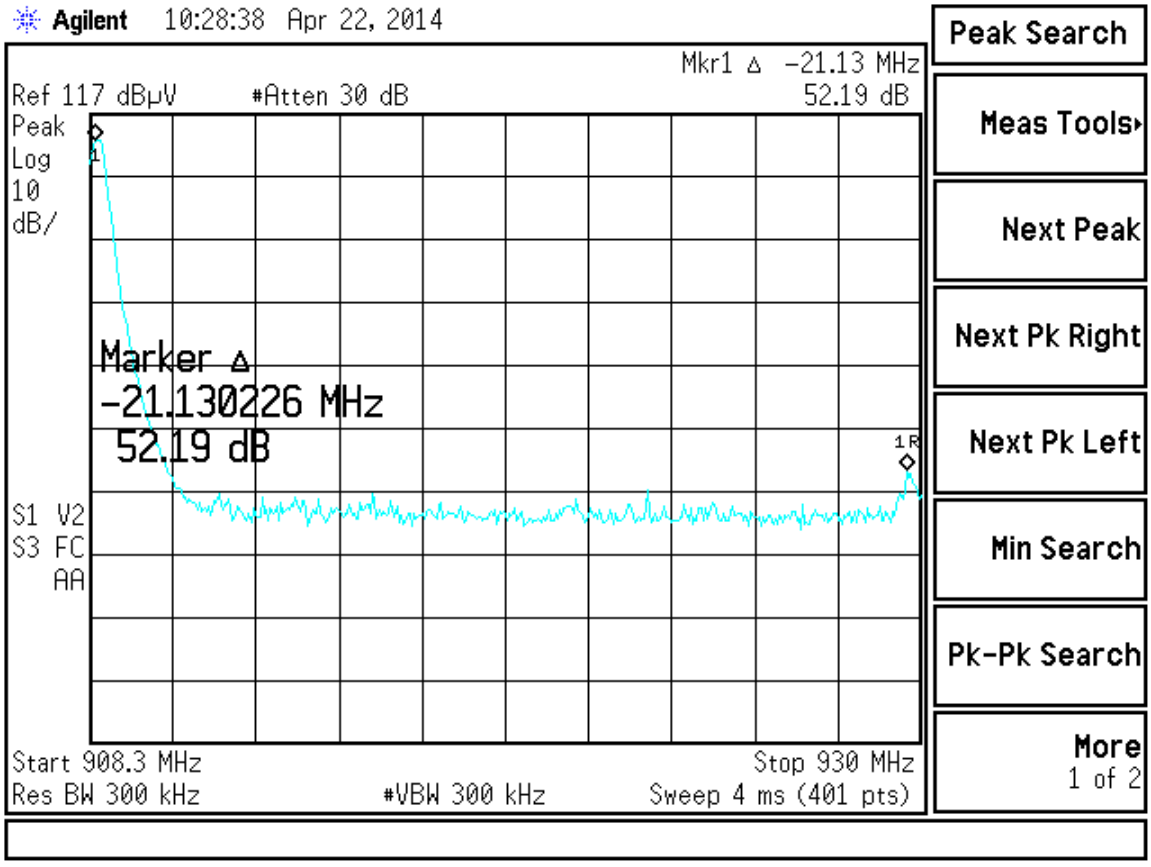

Figure 3. Conducted Band Edge Compliance – High Channel

Calculation of worst case 802.11b PEAK upper band edge measurement:

High Channel Corrected Measured Value from Table 5	96.52	dBuV
High Channel Band Edge Delta from Figure 4	-50.0	dB
Calculated Result	46.52	dBuV/m
Average Limit + 20dB Relaxation for PEAK	74.00	dBuV/m
Calculated Result	-46.52	dBuV/m
Band Edge Margin	27.48	dBuV/m

Calculation of worst case 802.11b AVERAGE upper band edge measurement:

High Channel Corrected Measured Value from Table 6	91.88	dBuV
High Channel Band Edge Delta from Figure 4	-50.0	dB
Calculated Result	41.88	dBuV/m
Peak Limit	54.00	dBuV/m
Calculated Result	-41.88	dBuV/m
Band Edge Margin	12.12	dBuV/m

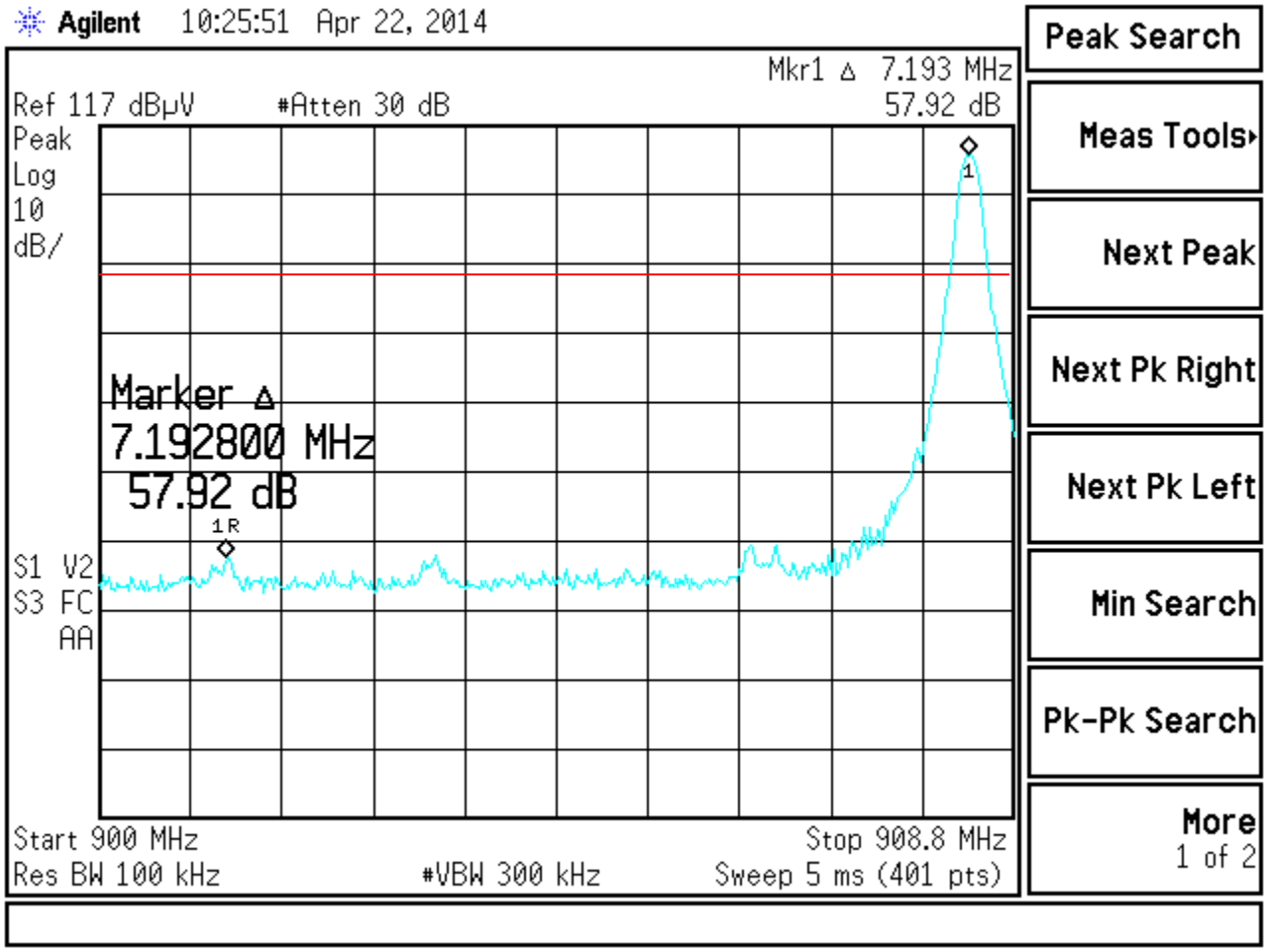

Figure 4. Conducted Band Edge Compliance – Low Channel

Note: Lower band edge delta must be 20dB or more.