Testing Tomorrow's Technology

Application for Certification

Per

Title 47 USC Part 2, Subpart J, Equipment Authorization Procedures, Paragraph 2.907, Certification and Part 15, Subpart C, Intentional Radiators, Paragraph 15.231, Periodic Operation in the band 40.66 MHz to 40.70 MHz and above 70 MHz

For the

WINK, Inc.

Model:
HUB

UST Project: 14-0073
Issue Date: May 28, 2014

Number of Pages in this report: 19

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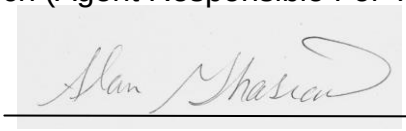
I certify that I am authorized to sign for the test facility and that all of the statements in this report and in the Exhibits attached hereto are true and correct to the best of my knowledge and belief:

US Tech (Agent Responsible For Test):

By: 

Name: Alan Ghasiani

Title: President – Consulting Engineer

Date: May 28, 2014

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MEASUREMENT/TECHNICAL REPORT

COMPANY NAME: **Wink, Inc.**

MODEL: **HUB**

FCC ID: **2ACAJ-WINK22**

DATE: **May 28, 2014**

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

Equipment type: 433 MHz band transmitter module

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

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1. General Information

The information contained in this report is presented for the FCC Equipment Authorization of Certification of the Equipment Under Test (EUT).

1.1 Product Description

The Equipment under Test (EUT) is the WINK INC home automation transmitter 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 transmitters share one antenna and the other transmitters each have their own antennas.

This report will cover in detail the test results for the Lutron transmitter, which is a 431 MHz transmitter. The test results for the other transmitters will be covered in separate reports.

Because the periodic rate does not exceed the requirement of paragraph (a), paragraph (e) is not invoked.

1.2 Characterization of Test Sample

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

1.3 Related Submittal(s)/Grant(s)

The EUT is subject to the following FCC Equipment Authorizations:

a) Certification of the transmitter.

b) Verification as a class B digital device.

2. Tests and Measurements

2.1 Configuration of Tested System

The Test sample was tested per *ANSI C63.4, Methods of Measurement from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (2003).* Radiated emissions data were taken according to paragraph 8.0 with the 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. There were no interconnecting cables to manipulate in an attempt to maximize emissions; however, the physical position of the EUT was varied through the three mutually exclusive orthogonal planes in an attempt to maximize the emissions. The worse case position is the position used for final measurements and is gathered in this test report. A block diagram of the tested system is shown in Figure 1.

2.2 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 and is also a NVLAP accredited test lab; lab code 200162-0.

2.3 Test Equipment

Table 1. EUT and Peripherals

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

Table 2. Test Instruments

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 are 12 months unless stated otherwise and all calibrations are traceable to NIST/USA.

2.4 Modifications to Equipment

No modifications were needed to bring the EUT into compliance with the FCC Part 15.209, radiated emissions limits for an intentional radiator, 15.231, *Periodic Operation in the Band 40.66 – 40.70 MHz and above 70 MHz.*

2.5 Test Procedure

The EUT was configured as shown in the following block diagram(s) and photograph(s). The sample was tested per ANSI C63.4, Methods of Measurement for Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (2003) following US Tech's procedures paragraph 7 for conducted and paragraph 8 for radiated. Conducted and radiated emissions data were taken with the 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 on the spectrum analyzer was OFF throughout the evaluation process. Interconnecting cables were manipulated as necessary to maximize emissions. The EUT was rotated 360 degrees with the turntable to maximize emissions. The physical position of the EUT was varied through the three mutually exclusive orthogonal planes in an attempt to maximize the emissions. The final setup description is found in the test section of this report.

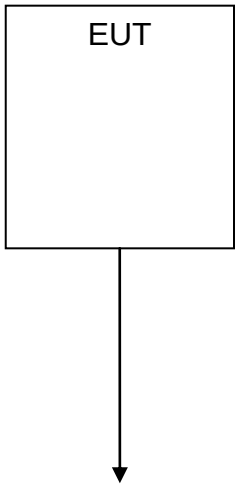


Figure 1. Test Configuration

2.6 Compliance to CFR 15.231(a) Transmitter activation/deactivation

According to CFR 15.231(a) The provisions of this section are restricted to periodic operation within the band 40.66-40.70 MHz and above 70 MHz. Except as shown in paragraph (e) of this section, the intentional radiator is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Continuous transmissions, voice, video and the radio control of toys are not permitted. Data is permitted to be sent with a control signal. The following conditions shall be met to comply with the provisions for this periodic operation:

(1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

(2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.

(3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.

(4) Intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm condition

(5) Transmission of set-up information for security systems may exceed the transmission duration limits in paragraphs (a)(1) and (a)(2) of this section, provided such transmissions are under the control of a professional installer and do not exceed ten seconds after a manually operated switch is released or a transmitter is activated automatically. Such set-up information may include data.

The transmitter is classified as an automatically activated transmitter and the transmitter does comply with transmissions ceasing after 5 seconds. See the plot provide below.

Item (3) does not apply to the transmitter. The transmitter does not have periodic transmissions at pre-determined intervals, and does not have polling or supervision transmissions to determine system integrity. Transmissions from the Clear Connect transmitter in this product are always initiated by a user initiated event, such as a button press on a product in the system or a user interaction in a smart-phone app to adjust the position of the light dimmer or window shade. The transmitter will not transmit without a user initiated event, and thus item (3) referring to the 2 second per hour for polling or supervision transmissions does not apply (there are no polling or supervision transmissions).

Also, items (4) and (5) do not apply to the transmitter in this application.

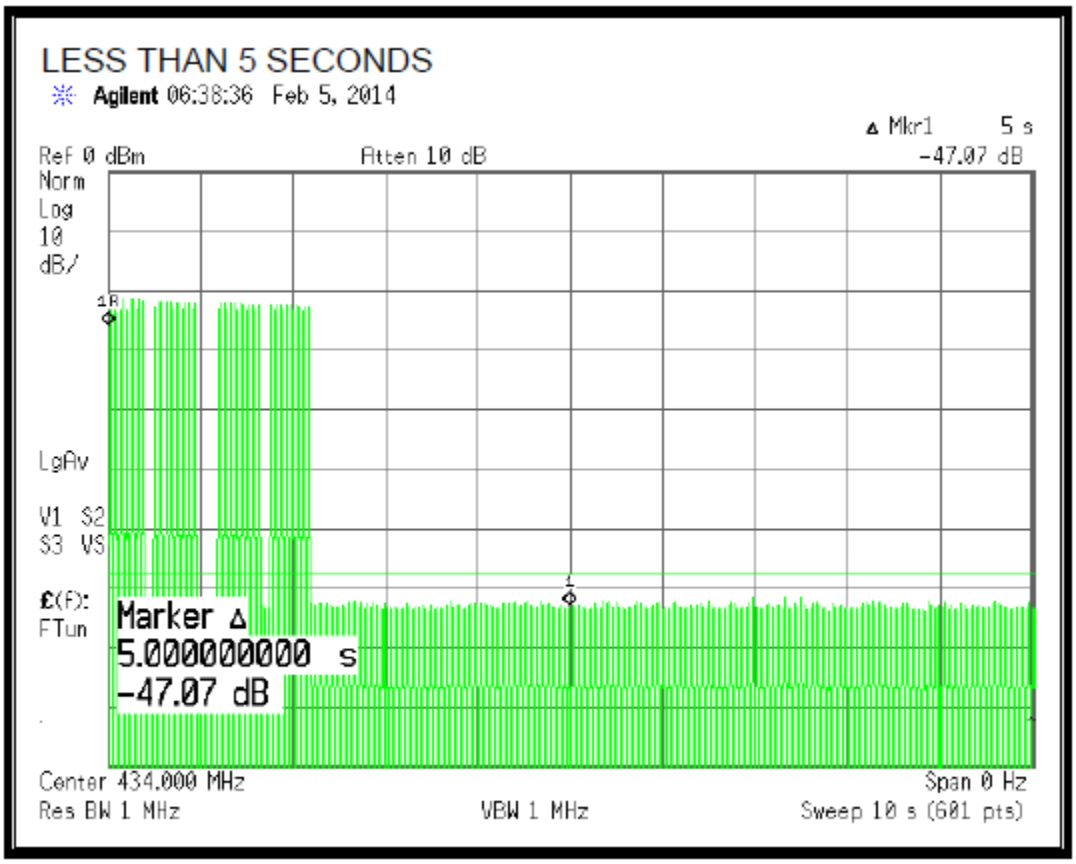


Figure 2. Deactivation per 15.231(a)(1)

Note 1: The EUT deactivates within 5 seconds.

Note 2: The screen shot above was taken from the report prepared by UL LLC of Melville, NewYork, NVLAP code 100255-0. FCC ID: JPZ0105. These two transmitters are identical.

2.6 EUT Antenna Description (FCC Sec. 15.203)

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

The Wink, Inc., Model HUB incorporates the following antenna(s) for the Lutron transmitter:

Table 3. Antenna Description

REPORT REFERENCE	MANUFACTURER	TYPE OF ANTENNA	MODEL	GAIN dB_i	TYPE OF CONNECTOR
Antenna 1	WINK INC.	Helical	N/A	2.9	Helical coil solder

2.7 Field Strength of Fundamental (47 CFR 15.231(b))

The results of the measurements for peak fundamental emissions are given in Table 5. The EUT emissions measurement was started by setting up the Log-periodic Antenna (L-pA) or generally, any antenna, in the vertical orientation at a distance of 3 meters from the EUT and at a height of 1.0 meters above the ground. The EUT packages' major axis was set normal to the direction of the measuring antenna.

The Spectrum Analyzer (SA) displays were set to: Channel A free-running, Channel B to Max-Hold. Choose a frequency or frequency range and scan it at a coupled rate. When a suspicious signal is found, center the signal on the screen and raise the L-pA to the 4-meter height while observing the SA display for changes to the max-hold and free-running display. Next, the antenna is lowered to 1 meter height above the ground plane while observing the channel A and B displays. The display having max-hold shows the maximum signal seen across the height range of 1 to 4 meters. The next action is to raise or lower the antenna until the free-running display matches the Max-hold display's magnitude on the SA screen. When this occurs, the signal is maximized for antenna height. Record the antenna height on the data sheet corresponding to the present frequency.

When the antenna height has been maximized, the next step in the measurement process is to maximize the EUT direction with respect to the receiving antenna. Rotate the turn-table through 360 degrees with one SA channel set for max-hold and the other channel in free-run mode. The object is to find that azimuth direction where the free-running indication just matches the greatest max-hold indication. This is the direction where the signal is peaked for azimuth. Record the direction on the data sheet next to the frequency.

When all signals have been maximized for antenna height and direction, the EUT case is carefully maneuvered in each of the three mutually exclusive orthogonal planes while observing the same Max-hold/free-running SA display indication. When the EUT position is found that allows a maximized signal to be read from the display, then that signals' magnitude is recorded on the data sheet for that particular frequency.

Next, re-orient the measurement antenna to Horizontal polarization at 1 meter height and repeat the above antenna and directional maximization processes for the greatest signals found across the frequency spectrum of interest. Record all signals within 6 dB of the limit.

Finally, input the collected data into the calculation spread sheet. The spread sheet is designed to calculate for the true value that is collected. The spread sheet takes into account the SA reading, the antenna correction factor, cable losses and duty cycle factors. See the data tables herein.

2.8 Limits for Operation in the Band above 70 MHz (CFR15.231 (b))

This limit versus frequency table is as follows (test distance = 3.0 meters):

Fundamental Frequency (MHz)	Limit Fundamental (Average) uV/m	Limit Harmonics and other spurious (Average) uV/m
260 to 470	3750 to 12500[*, 1]	375 to 1250[*,2]
* Linear Interpolation		

Note: formula 1: $limit_1 = Y = 41.667X - 7083.5$
2: $limit_2 = Y = 4.1667X - 708.35$

The frequency spectrum above the fundamental to its 10^{th} harmonic shall be examined and measured for signals falling into the restricted bands of 15.205. If average emissions measurements are employed, the provisions in 15.35 for averaging pulsed emissions and for limiting peak emissions apply. Spurious and harmonics shall meet the requirements of the above table or the requirements of 15.209, whichever requirement permits a higher field strength.

2.8.1. Radiated Spurious Emissions

The radiated spurious emissions were measured over the frequency range of 30 MHz to the 10th harmonic of the fundamental frequency of the intentional transmitter. The test results are shown below.

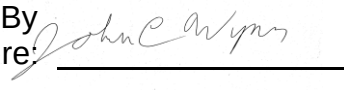
Table 4. Intentional Radiated Emissions, Peak Measurements

Tested By: JW	Test: Part 15B, Para 15.231		Client: WINK Inc.				
	Project: 14-0073		Model: HUB				
Frequency (MHz)	**Test Data (dBuV)**	**AF+CL-PA (dB/m)**	**Corrected Results (dBuV/m)**	**Limits (dBuV/m)**	**Distance / Polarization**	**Margin (dB)**	**Detection Method**
431.00	80.06	17.92	97.98	100.7	3M/Hor.	2.4	PK
862.00	43.84	13.04	56.88	80.7	3M/Hor.	23.82	PK
1292.89	51.27	5.66	56.93	80.7	3M/Hor.	23.77	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
3. (~)Measurements taken at 1 meter were extrapolated to 3 meter using a factor of (-9.5 dB).

Sample Calculation at 431.00:

Magnitude of Measured Frequency	80.06	dBuV
+Antenna Factor + Cable Loss+ Amplifier Gain	17.92	dB/m
1 meter to 3 meter extrapolation	0	dB
Corrected Result	97.98	dBuV/m

Test Date: April 18, 2014
Tested By
Signature:  Name: John Wynn

Note: The transmitter was programmed to transmit at >98% duty cycle, therefore wherever applicable the duty cycle factor calculated above was applied to correct for the actual duty cycle of the transmitter.

Table 5. Intentional Radiated Emissions, AVG Measurements

Tested By: JW	Test: Part 15B, Para 15.231					Client: WINK Inc.			
	Project: 14-0073					Model: HUB			
Frequency (MHz)	**Test Data (dBuV)**	**AF+CL-PA -DC**	**Corrected Results (dBuV/m)**	**Duty Cycle Factor**	**Corrected Results (dBuV/m)**	**Limits (dBuV/m)**	**Distance / Polarization**	**Margin (dB)**	**Detection Method**
431.00	80.06	17.92	97.98	-18.47	79.51	80.7	3M/Hor.	1.2	PK
862.00	43.84	13.04	56.88	-18.47	38.41	60.7	3M/Hor.	22.2	PK
1292.89	51.27	5.66	56.93	-18.47	38.46	60.7	3M/Hor.	22.2	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
4. All measurements are corrected with a -18.47dB duty. See section 2.8

Sample Calculation at 431.00MHz:

Magnitude of Measured Frequency	80.60	dBuV
+Antenna Factor + Cable Loss+ Amplifier Gain	17.92	dB/m
-Duty Cycle	18.47	dB
Corrected Result	79.51	dBuV/m

Test Date: April 18, 2014
Tested By
Signature: _____ Name: John Wynn

Note: The transmitter was programmed to transmit at >98% duty cycle, therefore wherever applicable the duty cycle factor calculated above was applied to correct for the actual duty cycle of the transmitter.

2.9 Transmitter Duty Cycle (47 CFR 15.35 (c))

The duty cycle de-rating factor used in the calculation of average radiated limits (per CFR 15.209 and 15.35(c)) is described below. This factor was calculated by first determining the worst case scenario for system operation. With the worst case operating scenario the transmission duty cycle is calculated as:

Total Time On from Figure 3. = 12.0mS

(12.0mS Total Time On)/(100mS FCC Standard) = 0.0225 Numeric Duty Cycle
Duty Cycle = 20 Log (.0225) = -18.42dB

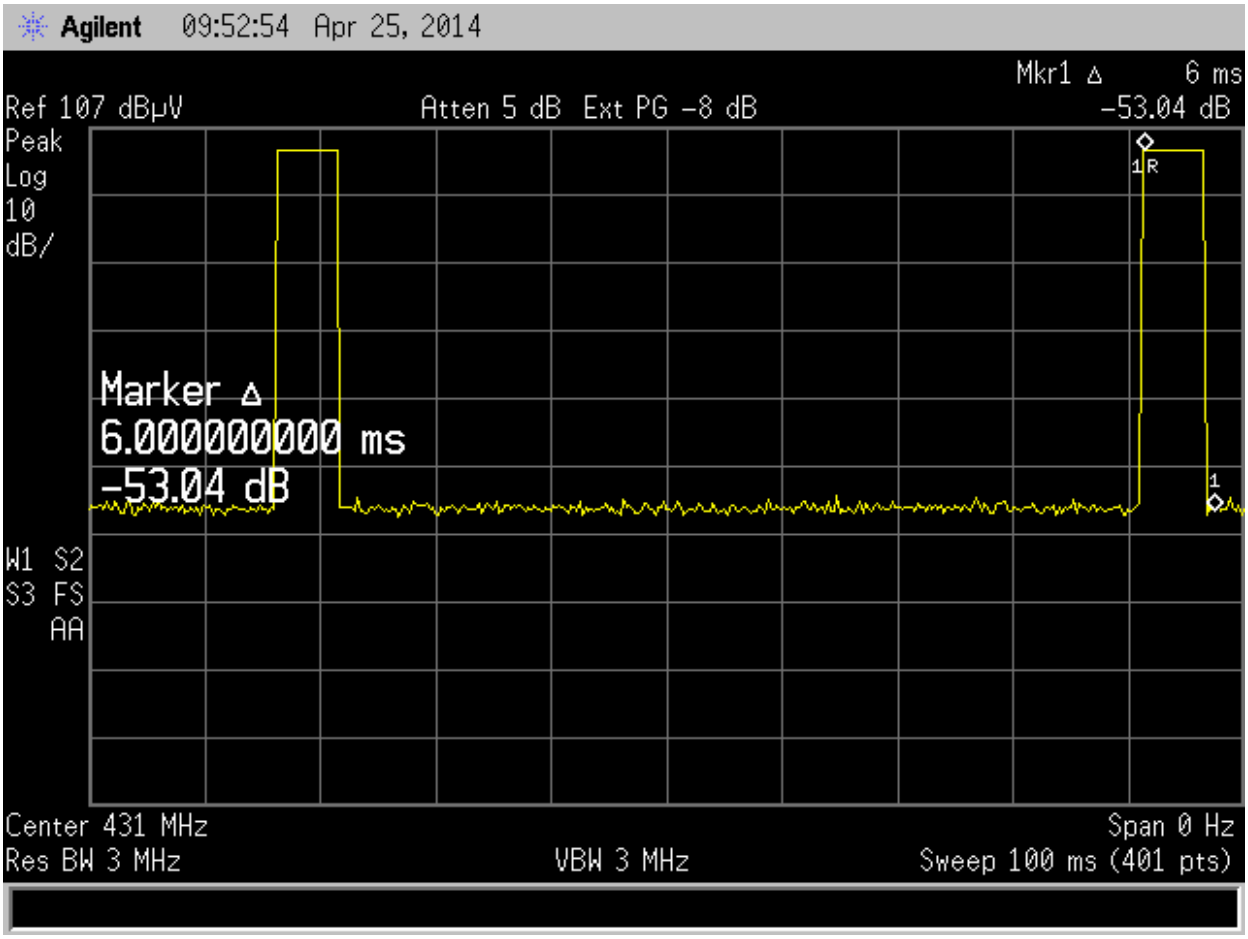


Figure 3. Figure 3. Duty Cycle

Note: The transmitter was programmed to transmit at >98% duty cycle, therefore wherever applicable the duty cycle factor calculated above was applied to correct for the actual duty cycle of the transmitter.

2.10 Bandwidth of Fundamental (CFR15.231 (c))

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. Bandwidth is determined by those frequencies that are at least 20 dB down on either side of the center frequency of the pulse.

0.0025 x 431,000,000.00 = 1.0775 MHz

The measured bandwidth is 647.5.00 kHz, well within the limit. See the figure below.

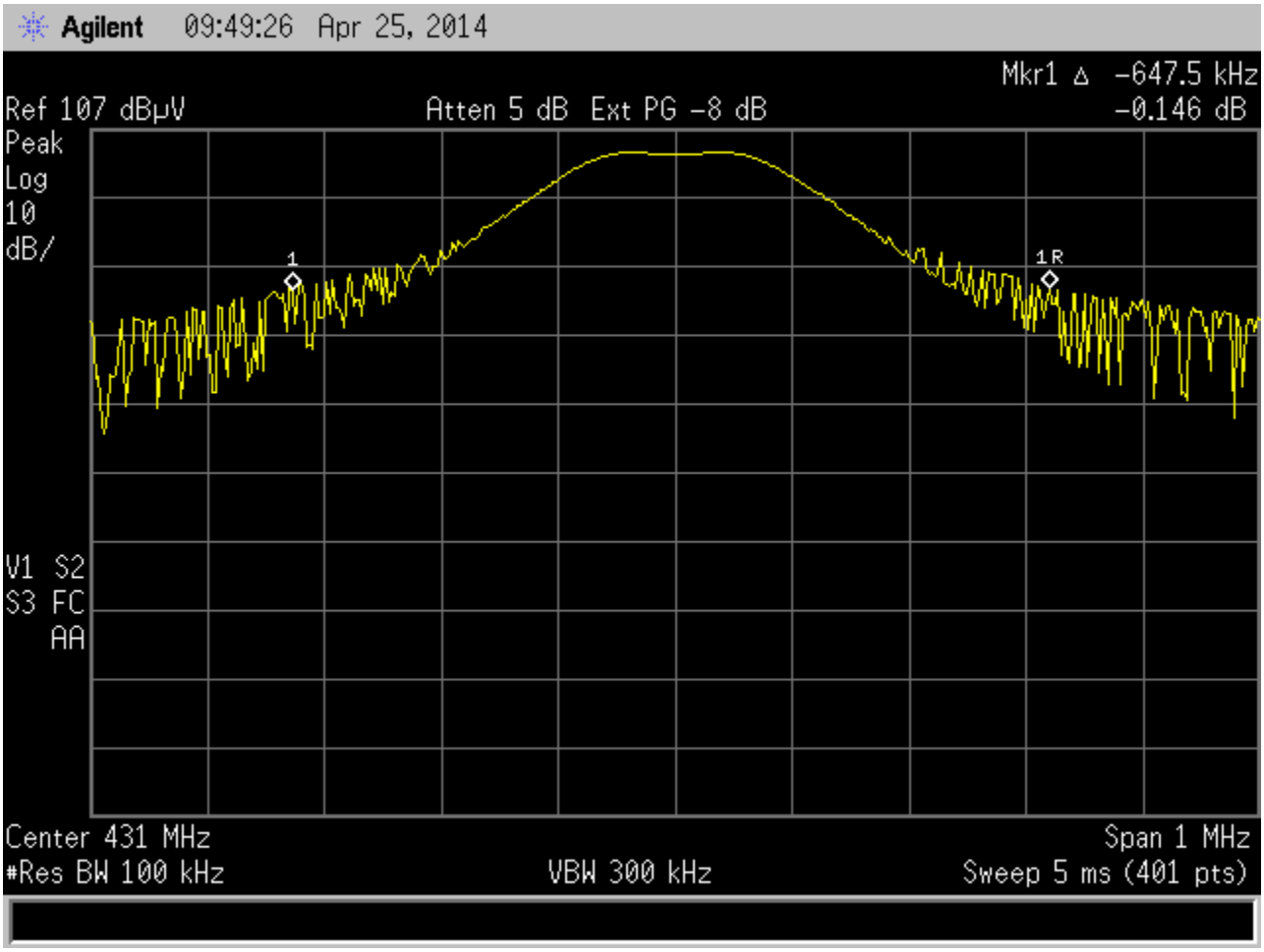


Figure 4. Occupied Bandwidth (20 dB BW)