

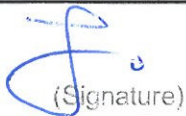
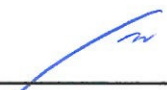
TEST REPORT



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1. Report No : DRTFCC1701-0009(1)
2. Customer
 - Name : LG Electronics USA
 - Address : 1000 Sylvan Avenue, Englewood Cliffs, New Jersey 07632
3. Use of Report : Class II Permissive change
4. Product Name / Model Name : RF Module / LGSWFAC73
FCC ID : BEJLGSWFAC73
5. Test Method Used : KDB 558074, KDB 662911, ANSI C63.10-2013, RSS-GEN
Test Specification : FCC Part 15.247
6. Date of Test : 2016-11-21 ~ 2016-11-28
7. Testing Environment : See appended test report.
8. Test Result : Refer to the attached test result.

Affirmation	Tested by	 (Signature)	Technical Manager
	Name : Jaejin Lee		Name : Geunki Son  (Signature)

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2017 . 01 . 26 .

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If this report is required to confirmation of authenticity, please contact to report@dtnc.net

Test Report Version

Test Report No.	Date	Description
DRTFCC1701-0009	Jan. 12, 2017	Initial issue
DRTFCC1701-0009(1)	Jan. 26, 2017	Separated the report for FCC and IC(Delete the IC).

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1. EUT DESCRIPTION

FCC Equipment Class	Digital Transmission System(DTS)
Product	RF Module
Model Name	LGSWFAC73
Add Model Name	N/A
Software version	1.0
Hardware version	1.0
Host product	Flat Panel Digital X-ray Detector
Host Marketing Name	14HJ701D
Power Supply	DC 7.5 V
Frequency Range	<ul style="list-style-type: none"> ▪ 802.11b/g/n(20 MHz) : 2412 MHz ~ 2462 MHz
Max. RF Output Power	2.4GHz Band <ul style="list-style-type: none"> ▪ 802.11b : 19.63 dBm ▪ 802.11g : 23.93 dBm ▪ 802.11n (HT20) : 23.77 dBm
Modulation Type	<ul style="list-style-type: none"> ▪ 802.11b: CCK, DSSS ▪ 802.11g/n: OFDM
Transmissions category	Completely uncorrelated signal
Antenna Specification	<p>Antenna type: FPCB wireless Antenna</p> <p>Antenna gain</p> <ul style="list-style-type: none"> ▪ 2.4 GHz Band: ANT 1 : 1.200 dBi & ANT 2 : 3.170 dBi <p>Antenna configuration</p> <ul style="list-style-type: none"> ▪ 802.11b/g: Single Transmitting (ANT 1 or ANT 2) ▪ 802.11g: Multiple Transmitting (ANT 1 and ANT 2) ▪ 802.11n(MCS 0 ~ 7): Single Transmitting (ANT 1 or ANT 2) ▪ 802.11n(MCS 8 ~ 15): Multiple Transmitting (ANT 1 and ANT 2)

2. INFORMATION ABOUT TESTING

2.1 Test mode

Test mode	Worst case data rate	Tested Frequency(MHz)		
		Lowest	Middle	Highest
TM 1	802.11b 1 Mbps (Single transmitting)	2412	2437	2462
TM 2	802.11g 6 Mbps (Multiple transmitting)	2412	2437	2462
TM 3	802.11n(HT20) MCS 8 (Multiple transmitting)	2412	2437	2462

Note 1: The worst case data rate is determined as above test mode according to the power measurements. And radiated spurious emission was performed at the worst case data rate.

Note 2: In case of radiated test, we have done all tx case. We attached the result of Ant1(Worst case) for 802.11b SISO mode. And in case of 802.11g/n mode, we attached the result of only MIMO mode(Worst case).

2.2 Auxiliary equipment

Equipment	Model No.	Serial No.	Manufacturer	Note
Control Box	LG Control Box	-	LG	-
-	-	-	-	-

2.3 Tested environment

Temperature	: 20 ~ 23 °C
Relative humidity content	: 41 ~ 48 % R.H..
Details of power supply	: DC 7.5 V

2.4 EMI suppression Device(s) / Modifications

EMI suppression device(s) added and/or modifications made during testing
→ None

2.5 Measurement Uncertainty

Test items	Measurement uncertainty
Transmitter Output Power	0.71 dB (The confidence level is about 95 %, k = 2)
AC conducted emission	2.4 dB (The confidence level is about 95 %, k = 2)
Radiated spurious emission (1 GHz Below)	5.1 dB (The confidence level is about 95 %, k = 2)
Radiated spurious emission (1 GHz ~ 18 GHz)	5.4 dB (The confidence level is about 95 %, k = 2)
Radiated spurious emission (18 GHz Above)	5.3 dB (The confidence level is about 95 %, k = 2)

3. SUMMARY OF TESTS

FCC Part Section(s)	Parameter	Limit	Test Condition	Status Note 1
15.247(a)	6 dB Bandwidth	> 500 kHz	Conducted	NT Note 2
15.247(b)	Transmitter Output Power	< 1 Watt		C
15.247(d)	Out of Band Emissions / Band Edge	20 dBc in any 100 kHz BW		NT Note 2
15.247(e)	Transmitter Power Spectral Density	< 8 dBm/3 kHz		NT Note 2
15.247(d) 15.205 15.209	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	FCC 15.209 limits	Radiated	C
15.207	AC Line Conducted Emissions	FCC 15.207 limits	AC Line Conducted	C
15.203	Antenna Requirements	FCC 15.203	-	C

Note 1: **C**=Comply **NC**=Not Comply **NT**=Not Tested **NA**=Not Applicable

Note 2: Please refer to original test report.

(Report number: DRTFCC1607-0103)

Note 3: The module was installed into host product during test. (Model name: 14HJ701D)

4. TEST METHODOLOGY

Generally the tests were performed according to the KDB558074 v03r05, KDB662911 D01 v02r01 And ANSI C63.10-2013 was used to reference appropriate EUT setup and maximizing procedures of radiated spurious emission and AC line conducted emission testing

4.1 EUT configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

4.2 EUT exercise

The EUT was operated in the test mode to fix the Tx frequency that was for the purpose of the measurements. According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C.

4.3 General test procedures

Conducted Emissions

The power-line conducted emission test procedure is not described on the KDB 558074. So this test was fulfilled with the requirements in Section 6.2 of ANSI C63.10.

The EUT is placed on the wooden table, which is 0.8 m above ground plane and the conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-peak and Average detector

Radiated Emissions

Basically the radiated tests were performed with KDB 558074. But some requirements and procedures like test site requirements, EUT setup and maximizing procedure were fulfilled with the requirements in Section 5 and 6 of the ANSI C63.10 as stated on section 12.1 of the KDB 558074.

The EUT is placed on a non-conductive table. For emission measurements at or below 1 GHz, the table height is 80 cm. For emission measurements above 1 GHz, the table height is 1.5 m. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3 m away from the receiving antenna, which varied from 1 m to 4 m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the highest emission, the relative positions of the EUT were rotated through three orthogonal axes.

4.4 Description of test modes

The EUT has been tested with all modes of operating conditions to determine the worst case emission characteristics. A test program is used to control the EUT for staying in continuous transmitting mode.

5. INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipments, which is traceable to recognized national standards.

6. FACILITIES AND ACCREDITATIONS

6.1 Facilities

The open area test site(OATS) or semi anechoic chamber and conducted measurement facility used to collect the radiated and conducted test data are located at the 42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 449-935. The site is constructed in conformance with the requirements.

- Semi anechoic chamber registration Number: 165783(FCC)

6.2 Equipment

Radiated emissions are measured with one or more of the following types of Linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, loop, horn. Spectrum analyzers with pre-selectors and peak, quasi-peak detectors are used to perform radiated measurements. Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers. Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

7. ANTENNA REQUIREMENTS

7.1 According to FCC 47 CFR §15.203

An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can 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 EUT used unique antenna connector.

Therefore this module complies with the requirement of §15.203.

7.2 Directional antenna gain(worst case):

Bands	ANT 1 [dBi]	ANT 2 [dBi]	Directional Gain [dBi]
2.4 GHz	1.200	3.170	2.296 ^{Note 2.}

Note 1. Directional gain(correlated signal with unequal antenna gain and equal transmit power)

$$10 \log [(10^{G_1/20} + 10^{G_2/20} + \dots + 10^{G_N/20})^2 / N^{ANT}] \text{ dBi}$$

Note 2. Directional gain(completely uncorrelated signal with unequal antenna gain and equal transmit power)

$$10 \log [(10^{G_1/10} + 10^{G_2/10} + \dots + 10^{G_N/10}) / N^{ANT}] \text{ dBi}$$

Note 3. Directional gain(spatial multiplexing)

$$G_{ANT \text{ MAX}} + 10 \log (N_{ANT} / N_{SS}) \text{ dBi}$$

8. TEST RESULT

8.1 6dB bandwidth

■ Test Requirements and limit, §15.247(a)

The bandwidth at 6 dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the receive antenna while the EUT is operating in transmission mode at the appropriate frequencies.

The minimum permissible 6 dB bandwidth is 500 kHz.

■ Test Configuration: **NA**

■ Test Procedure:

The transmitter output is connected to the Spectrum Analyzer and used following test procedure of **KDB558074**

1. Set resolution bandwidth (RBW) = 100 kHz.
2. Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
(RBW : 100 kHz / VBW : 300 kHz)
3. Detector = **Peak**.
4. Trace mode = **Max hold**.
5. Sweep = **Auto couple**.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

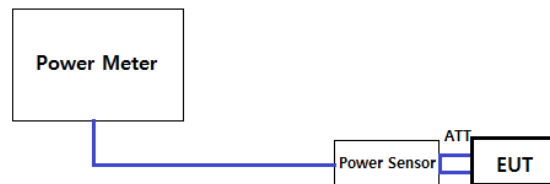
■ Test Results: **NT**

8.2 Maximum peak conducted output power

■ Test Requirements and limit, §15.247(b)

The maximum permissible conducted output power is **1 Watt**.

■ Test Configuration



■ Test Procedure

1. PKPM1 Peak power meter method of KDB558074

The maximum conducted output powers were measured using a broadband peak RF power meter which has greater video bandwidth than DUT's DTS bandwidth and utilize a fast-responding diode detector.

2. Method AVGPM-G (Measurement using a gated RF average power meter) of KDB558074

The average conducted output powers were measured using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since this measurement is made only during the ON time of the transmitter, no duty cycle correction is required.

Note: The measure-and-sum technique is used for test mode with multiple transmitting.

■ Test Results: **Comply**

▪ Single transmitting

ANT	Freq. (MHz)	Det.	Maximum Peak Conducted Output Power (dBm) for <u>802.11b</u>							
			Data Rate [Mbps]							
			1	2	5.5	11	-	-	-	-
ANT 1	2412	PK	19.310	19.180	19.110	19.240	-	-	-	-
		AV	16.370	16.200	16.320	16.240	-	-	-	-
	2437	PK	18.450	18.270	18.360	18.420	-	-	-	-
		AV	15.330	15.120	15.250	15.190	-	-	-	-
	2462	PK	19.630	19.560	19.540	19.610	-	-	-	-
		AV	16.410	16.220	16.360	16.370	-	-	-	-
ANT 2	2412	PK	18.770	18.730	18.600	18.750	-	-	-	-
		AV	15.710	15.660	15.600	15.470	-	-	-	-
	2437	PK	17.890	17.670	17.720	17.650	-	-	-	-
		AV	14.590	14.500	14.390	14.390	-	-	-	-
	2462	PK	18.470	18.270	18.460	18.290	-	-	-	-
		AV	15.350	15.240	15.210	15.110	-	-	-	-

ANT	Freq. (MHz)	Det.	Maximum Peak Conducted Output Power (dBm) for <u>802.11n(HT20)</u>							
			Data Rate [MCS]							
			0	1	2	3	4	5	6	7
ANT 1	2412	PK	17.350	17.200	17.130	17.200	17.180	17.190	17.310	17.280
		AV	10.490	10.390	10.410	10.450	10.450	10.450	10.440	10.480
	2437	PK	21.020	20.820	20.960	20.840	20.990	20.970	20.970	20.960
		AV	14.410	14.230	14.380	14.250	14.310	14.170	14.380	14.220
	2462	PK	17.650	17.590	17.590	17.470	17.640	17.410	17.470	17.620
		AV	10.520	10.450	10.380	10.300	10.330	10.380	10.470	10.300
ANT 2	2412	PK	17.150	17.050	16.970	16.930	17.130	16.930	16.960	17.100
		AV	10.330	10.300	10.290	10.160	10.250	10.130	10.160	10.320
	2437	PK	20.590	20.480	20.570	20.380	20.350	20.560	20.480	20.440
		AV	13.850	13.810	13.720	13.700	13.830	13.620	13.840	13.670
	2462	PK	17.020	16.940	16.920	16.940	16.840	16.970	16.950	16.940
		AV	10.120	9.900	9.930	9.910	10.100	9.920	10.100	10.020

Multiple transmitting

ANT	Freq. (MHz)	Det.	Maximum Peak Conducted Output Power (dBm) for <u>802.11g</u>							
			Data Rate [Mbps]							
			6	9	12	18	24	36	48	54
ANT 1	2412	PK	18.310	18.160	18.240	18.120	18.140	18.210	18.150	18.210
		AV	11.690	11.480	11.670	11.630	11.490	11.540	11.640	11.510
	2437	PK	21.310	21.160	21.240	21.110	21.100	21.290	21.240	21.210
		AV	14.530	14.420	14.440	14.490	14.500	14.460	14.290	14.370
	2462	PK	18.330	18.110	18.150	18.160	18.280	18.240	18.120	18.310
		AV	11.730	11.700	11.720	11.620	11.540	11.590	11.610	11.560
ANT 2	2412	PK	17.970	17.960	17.810	17.790	17.900	17.900	17.790	17.790
		AV	11.290	11.140	11.110	11.060	11.140	11.190	11.150	11.150
	2437	PK	20.490	20.300	20.290	20.340	20.250	20.270	20.260	20.260
		AV	13.970	13.840	13.930	13.820	13.830	13.910	13.900	13.900
	2462	PK	18.020	17.840	17.820	17.840	18.010	17.960	17.830	17.830
		AV	11.310	11.220	11.140	11.250	11.240	11.250	11.200	11.200
Sum (ANT 1+2)	2412	PK	21.154	21.072	21.041	20.969	21.032	21.069	20.985	21.016
	2437	PK	23.930	23.762	23.802	23.753	23.707	23.821	23.788	23.772
	2462	PK	21.189	20.988	20.999	21.014	21.158	21.113	20.988	21.087

ANT	Freq. (MHz)	Det.	Maximum Peak Conducted Output Power (dBm) for <u>802.11n(HT20)</u>							
			Data Rate [MCS]							
			8	9	10	11	12	13	14	15
ANT 1	2412	PK	17.380	17.170	17.310	17.350	17.270	17.350	17.310	17.140
		AV	10.510	10.400	10.280	10.280	10.460	10.440	10.420	10.360
	2437	PK	21.050	20.960	20.980	21.030	20.820	20.910	20.940	20.930
		AV	14.430	14.220	14.320	14.340	14.380	14.370	14.300	14.330
	2462	PK	17.690	17.500	17.610	17.590	17.630	17.620	17.450	17.560
		AV	10.550	10.330	10.400	10.370	10.400	10.480	10.490	10.480
ANT 2	2412	PK	17.040	16.800	16.810	16.940	16.980	16.960	16.810	16.980
		AV	10.380	10.280	10.140	10.190	10.150	10.150	10.340	10.210
	2437	PK	20.450	20.320	20.260	20.320	20.300	20.340	20.280	20.270
		AV	13.870	13.840	13.700	13.840	13.740	13.710	13.850	13.750
	2462	PK	17.020	16.990	16.870	16.990	16.940	17.010	16.830	16.990
		AV	10.140	10.100	10.000	10.000	9.930	9.970	10.120	10.080
Sum (ANT 1+2)	2412	PK	20.224	20.000	20.078	20.161	20.138	20.170	20.078	20.072
	2437	PK	23.771	23.663	23.646	23.700	23.579	23.645	23.633	23.623
	2462	PK	20.379	20.263	20.267	20.311	20.309	20.337	20.162	20.295

8.3 Maximum power spectral density

■ Test requirements and limit, §15.247(e)

The power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

■ Test Configuration: **NA**

■ Test Procedure

Method PKPSD of KDB558074 is used.

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to **1.5 times** the DTS bandwidth.
3. Set the RBW to : **3 kHz ≤ RBW ≤ 100 kHz**
4. Set the VBW ≥ **3 x RBW**
5. Detector = **Peak**
6. Sweep time = **Auto couple**
7. Trace mode = **Max hold.**
8. Allow trace to fully stabilize.
9. Use the **peak marker function** to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

■ Test Results: **NT**

8.4 Out of band emissions at the band edge / conducted spurious emissions

■ Test requirements and limit, §15.247(d)

§15.247(d) specifies that in any 100 kHz bandwidth outside of the authorized frequency band, the power shall be attenuated according to the following conditions:

If the **peak output power procedure** is used to measure the fundamental emission power to demonstrate compliance to **15.247(b)(3)** requirements, then the peak conducted output power measured within any 100 kHz outside the authorized frequency band shall be attenuated **by at least 20 dB** relative to the maximum measured in-band peak PSD level.

If the average output power procedure is used to measure the fundamental emission power to demonstrate compliance to **15.247(b)(3)** requirements, then the power in any 100 kHz outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum measured in band average PSD level.

In either case, attenuation to levels below the general emission limits specified in **§15.209(a)** is not required.

■ Test Configuration: **NA**

■ Test Procedure

The transmitter output is connected to a spectrum analyzer.

- Measurement Procedure 1 – Reference Level

1. Set instrument center frequency to DTS channel center frequency.
2. Set the span to ≥ 1.5 times the DTS bandwidth.
3. Set the RBW = **100 kHz**.
4. Set the VBW $\geq 3 \times$ RBW.
5. Detector = **Peak**.
6. Sweep time = **Auto couple**.
7. Trace mode = **Max hold**.
8. **Allow trace to fully stabilize**.
9. Use the peak marker function to determine the maximum PSD level.

- Measurement Procedure 2 - Unwanted Emissions

1. Set the center frequency and span to encompass frequency range to be measured.
2. Set the RBW = **100 kHz. (Actual 1 MHz, See below note)**
3. Set the VBW $\geq 3 \times$ RBW. **(Actual 3 MHz, See below note)**
4. Detector = **Peak**.
5. Ensure that the number of measurement points \geq Span / RBW.
6. Sweep time = **Auto couple**.
7. Trace mode = **Max hold**.
8. **Allow the trace to stabilize**. (this may take some time, depending on the extent of the span)
9. Use the peak marker function to determine the maximum amplitude level.

Note : The conducted spurious emission was tested with below settings.

Frequency range: 9 kHz ~ 30 MHz

RBW = 100 kHz, VBW = 300 kHz, SWEEP TIME = AUTO, DETECTOR = PEAK, TRACE = MAX HOLD, SWEEP POINT : 40001

Frequency range: 30 MHz ~ 10 GHz, 10 GHz ~25 GHz

RBW = 1 MHz, VBW = 3 MHz, SWEEP TIME = AUTO, DETECTOR = PEAK, TRACE = MAX HOLD, SWEEP POINT : 40001

LIMIT LINE = 20 dB below of the reference level of above measurement procedure Step 2. (RBW = 100 kHz, VBW = 300 kHz)

If the emission level with above setting was close to the limit (ie, less than 3 dB margin) then zoom scan is required using RBW = 100 kHz, VBW = 300 kHz, SPAN = 100 MHz and BINS = 2001 to get accurate emission level within 100 kHz BW.

■ Test Results: **NT**

8.5 Radiated spurious emissions

■ Test Requirements and limit, §15.247(d), §15.205, §15.209

In any 100 kHz bandwidth outside the operating frequency band, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 KHz bandwidth within the band. In case the emission fall within the restricted band specified on 15.205(a) and (b), then the 15.209(a) limit in the table below has to be followed

▪ FCC Part 15.209(a) and (b)

Frequency (MHz)	Limit (uV/m)	Measurement Distance (meter)
0.009 – 0.490	2400/F (kHz)	300
0.490 – 1.705	24000/F (kHz)	30
1.705 – 30.0	30	30
30 ~ 88	100 **	3
88 ~ 216	150 **	3
216 ~ 960	200 **	3
Above 960	500	3

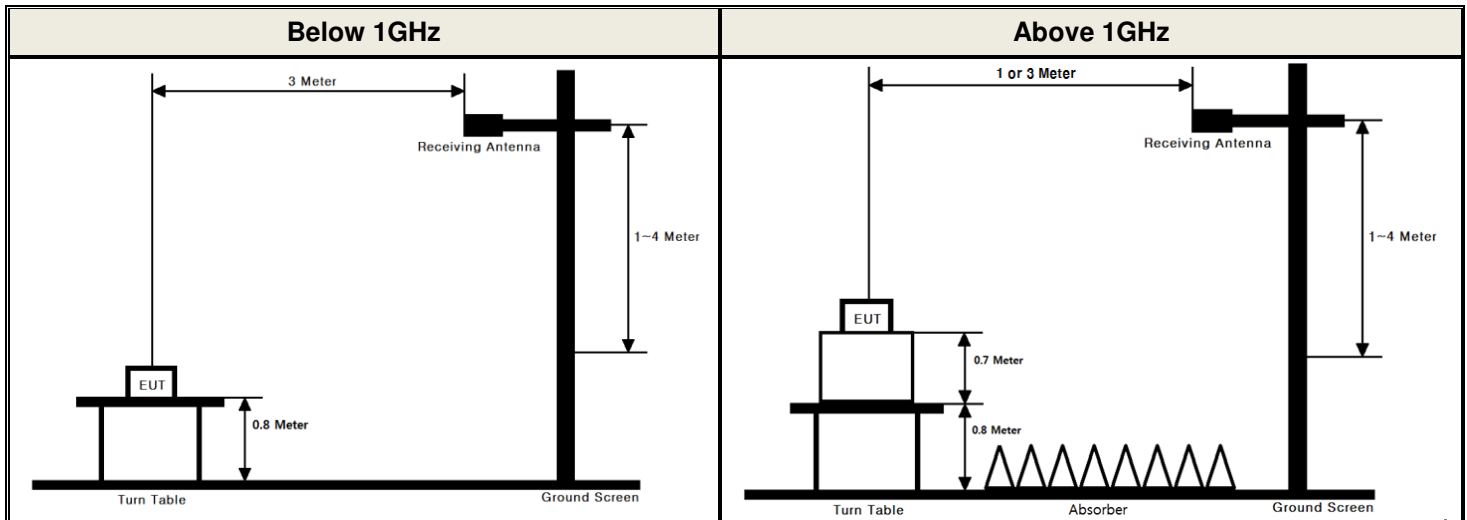
** Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

▪ FCC Part 15.205 (a): Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	MHz	GHz	GHz
0.009 ~ 0.110	8.41425 ~ 8.41475	108 ~ 121.94	1300 ~ 1427	4.5 ~ 5.15	14.47 ~ 14.5
0.495 ~ 0.505	12.29 ~ 12.293	123 ~ 138	1435 ~ 1626.5	5.35 ~ 5.46	15.35 ~ 16.2
2.1735 ~ 2.1905	12.51975 ~ 12.52025	149.9 ~ 150.05	1645.5 ~ 1646.5	7.25 ~ 7.75	17.7 ~ 21.4
4.125 ~ 4.128	12.57675 ~ 12.57725	156.52475 ~	1660 ~ 1710	8.025 ~ 8.5	22.01 ~ 23.12
4.17725 ~ 4.17775	13.36 ~ 13.41	156.52525	1718.8 ~ 1722.2	9.0 ~ 9.2	23.6 ~ 24.0
4.20725 ~ 4.20775	16.42 ~ 16.423	156.7 ~ 156.9	2200 ~ 2300	9.3 ~ 9.5	31.2 ~ 31.8
6.215 ~ 6.218	16.69475 ~ 16.69525	162.0125 ~ 167.17	2310 ~ 2390	10.6 ~ 12.7	36.43 ~ 36.5
6.26775 ~ 6.26825	16.80425 ~ 16.80475	167.72 ~ 173.2	2483.5 ~ 2500	13.25 ~ 13.4	Above 38.6
6.31175 ~ 6.31225	25.5 ~ 25.67	240 ~ 285	2655 ~ 2900		
8.291 ~ 8.294	37.5 ~ 38.25	322 ~ 335.4	3260 ~ 3267		
8.362 ~ 8.366	73 ~ 74.6	399.90 ~ 410	3332 ~ 3339		
8.37625 ~ 8.38675	74.8 ~ 75.2	608 ~ 614	3345.8 ~ 3358		
		960 ~ 1240	3600 ~ 4400		

▪ **FCC Part 15.205(b):** The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

■ Test Configuration



■ Test Procedure

1. The EUT is placed on a non-conductive table, emission measurements at below 1 GHz, the table height is 80 cm and above 1 GHz, the table height is 1.5 m.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 1 or 3 m away from the receiving antenna, which is varied from 1 m to 4 m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.

■ Measurement Instrument Setting for Radiated Emission Measurements.

The radiated emission was tested according to the section 6.3, 6.4, 6.5 and 6.6 of the ANSI C63.10-2013 with following settings.

Peak Measurement

RBW = As specified in below table, VBW \geq 3 x RBW, Sweep = Auto, Detector = Peak, Trace mode = Max Hold until the trace stabilizes.

Frequency	RBW
9-150 kHz	200-300 Hz
0.15-30 MHz	9-10 kHz
30-1000 MHz	100-120 kHz
> 1000 MHz	1 MHz

Average Measurement:

1. RBW = 1 MHz (unless otherwise specified).
2. VBW \geq 3 x RBW.
3. Detector = RMS (Number of points \geq 2 x Span / RBW)
4. Averaging type = power. (i.e., RMS)
5. Sweep time = auto.
6. Perform a trace average of at least 100 traces.
7. A correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 percent duty cycle. The correction factor is computed as follows:
 - 1) If power averaging (RMS) mode was used in step 4, then the applicable correction factor is $10 \log(1/x)$, where x is the duty cycle.
 - 2) If linear voltage averaging mode was used in step 4, then the applicable correction factor is $20 \log(1/x)$, where x is the duty cycle.
 - 3) If a specific emission is demonstrated to be continuous (\geq 98 percent duty cycle) rather than turning on and off with the transmit cycle, then no duty cycle correction is required for that emission.

Duty Cycle Correction factor

Test Mode	Date rate	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
TM 1	1 Mbps	95.02	0.23
TM 2	6 Mbps	95.39	0.21
TM 3	MCS 8	90.78	0.42

Note: Please refer to the test report of the granted module.

■ Test Results: **Comply**

Please refer to next page for data table and the appendix I for worst data plots.

Radiated Spurious Emissions data(9 kHz ~ 25 GHz) : Test Mode 1(TM 1)

Tested Frequency	Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
Lowest	2389.89	H	Z	PK	55.18	0.75	N/A	N/A	55.93	74.00	18.07
	2390.00	H	Z	AV	46.74	0.75	0.23	N/A	47.72	54.00	6.28
	4823.65	H	Z	PK	46.34	7.36	N/A	N/A	53.70	74.00	20.30
	4823.98	H	Z	AV	37.97	7.36	0.23	N/A	45.56	54.00	8.44
Middle	4874.04	H	Z	PK	45.29	7.52	N/A	N/A	52.81	74.00	21.19
	4873.98	H	Z	AV	36.78	7.52	0.23	N/A	44.53	54.00	9.47
Highest	2484.35	H	Z	PK	54.73	1.22	N/A	N/A	55.95	74.00	18.05
	2483.50	H	Z	AV	48.23	1.22	0.23	N/A	49.68	54.00	4.32
	4924.14	H	Z	PK	46.86	7.69	N/A	N/A	54.55	74.00	19.45
	4924.02	H	Z	AV	37.27	7.69	0.23	N/A	45.19	54.00	8.81

Note.

- No other spurious and harmonic emissions were found greater than listed emissions on above table.
- This device was tested under single transmitting (Ant 1, 2) and the worst case data are reported in the table above.
- Sample Calculation.
 $Margin = Limit - Result$ / $Result = Reading + T.F + DCCF + DCF$ / $T.F = AF + CL - AG$
 Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,
 DCCF = Duty Cycle Correction Factor, DCF = Distance Correction Factor
- Measurement Distance = 3 m for below 10 GHz, Measurement Distance = 1 m for above 10 GHz.
 Therefore Distance Correction Factor(DCF) : $- 9.54 \text{ dB} = 20 \cdot \log(1\text{m}/3\text{m})$

Radiated Spurious Emissions data(9 kHz ~ 25 GHz) : Test Mode 2(TM 2)

Tested Frequency	Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
Lowest	2388.81	H	Z	PK	56.18	0.75	N/A	N/A	56.93	74.00	17.07
	2388.92	H	Z	AV	43.05	0.75	0.21	N/A	44.01	54.00	9.99
	4824.57	H	Z	PK	43.80	7.36	N/A	N/A	51.16	74.00	22.84
	4825.08	H	Z	AV	33.30	7.36	0.21	N/A	40.87	54.00	13.13
Middle	4875.59	H	Z	PK	44.11	7.52	N/A	N/A	51.63	74.00	22.37
	4876.67	H	Z	AV	33.14	7.52	0.21	N/A	40.87	54.00	13.13
Highest	2483.63	H	Z	PK	58.75	1.22	N/A	N/A	59.97	74.00	14.03
	2483.50	H	Z	AV	46.20	1.22	0.21	N/A	47.63	54.00	6.37
	4919.56	H	Z	PK	44.56	7.69	N/A	N/A	52.25	74.00	21.75
	4919.71	H	Z	AV	32.90	7.69	0.21	N/A	40.80	54.00	13.20

Note.

- No other spurious and harmonic emissions were found greater than listed emissions on above table.
- This device was tested under single transmitting (Ant 1, 2) and the worst case data are reported in the table above.
- Sample Calculation.

$$\text{Margin} = \text{Limit} - \text{Result} \quad / \quad \text{Result} = \text{Reading} + \text{T.F} + \text{DCCF} + \text{DCF} \quad / \quad \text{T.F} = \text{AF} + \text{CL} - \text{AG}$$
 Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,
 DCCF = Duty Cycle Correction Factor, DCF = Distance Correction Factor
- Measurement Distance = 3 m for below 10 GHz, Measurement Distance = 1 m for above 10 GHz.
 Therefore Distance Correction Factor(DCF) : - 9.54 dB = $20 \cdot \log(1\text{m}/3\text{m})$

Radiated Spurious Emissions data(9 kHz ~ 25 GHz) : Test Mode 3(TM 3)

Tested Frequency	Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
Lowest	2389.10	H	Z	PK	56.29	0.75	N/A	N/A	57.04	74.00	16.96
	2389.78	H	Z	AV	44.00	0.75	0.42	N/A	45.17	54.00	8.83
	4826.73	H	Z	PK	43.88	7.36	N/A	N/A	51.24	74.00	22.76
	4826.85	H	Z	AV	33.17	7.36	0.42	N/A	40.95	54.00	13.05
Middle	4880.48	H	Z	PK	43.92	7.52	N/A	N/A	51.44	74.00	22.56
	4879.64	H	Z	AV	32.90	7.52	0.42	N/A	40.84	54.00	13.16
Highest	2483.50	H	Z	PK	58.88	1.22	N/A	N/A	60.10	74.00	13.90
	2483.50	H	Z	AV	44.44	1.22	0.42	N/A	46.08	54.00	7.92
	4922.44	H	Z	PK	43.86	7.69	N/A	N/A	51.55	74.00	22.45
	4921.78	H	Z	AV	33.05	7.69	0.42	N/A	41.16	54.00	12.84

Note.

- No other spurious and harmonic emissions were found greater than listed emissions on above table.
- This device was tested under single transmitting (Ant 1, 2) and the worst case data are reported in the table above.
- Sample Calculation.

$$\text{Margin} = \text{Limit} - \text{Result} \quad / \quad \text{Result} = \text{Reading} + \text{T.F} + \text{DCCF} + \text{DCF} \quad / \quad \text{T.F} = \text{AF} + \text{CL} - \text{AG}$$
 Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,
 DCCF = Duty Cycle Correction Factor, DCF = Distance Correction Factor
- Measurement Distance = 3 m for below 10 GHz, Measurement Distance = 1 m for above 10 GHz.
 Therefore Distance Correction Factor(DCF) : $- 9.54 \text{ dB} = 20 \cdot \log(1\text{m}/3\text{m})$

8.6 Power-line conducted emissions

■ Test Requirements and limit, §15.207

For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 uH/50 ohm line impedance stabilization network(LISN).

Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequency ranges.

Frequency Range (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15 ~ 0.5	66 to 56 *	56 to 46 *
0.5 ~ 5	56	46
5 ~ 30	60	50

* Decreases with the logarithm of the frequency

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

■ Test Procedure

1. The EUT is placed on a wooden table 80 cm above the reference ground plane.
2. The EUT is connected via LISN to the test power supply.
3. The measurement results are obtained as described below:
4. Detectors – Quasi Peak and Average Detector.

■ Test Results: **Comply**(Refer to next page.)

The worst data was reported.

RESULT PLOTS

AC Line Conducted Emissions (Graph)

Test mode 2(TM 2) & Middle

Results of Conducted Emission

DTNC

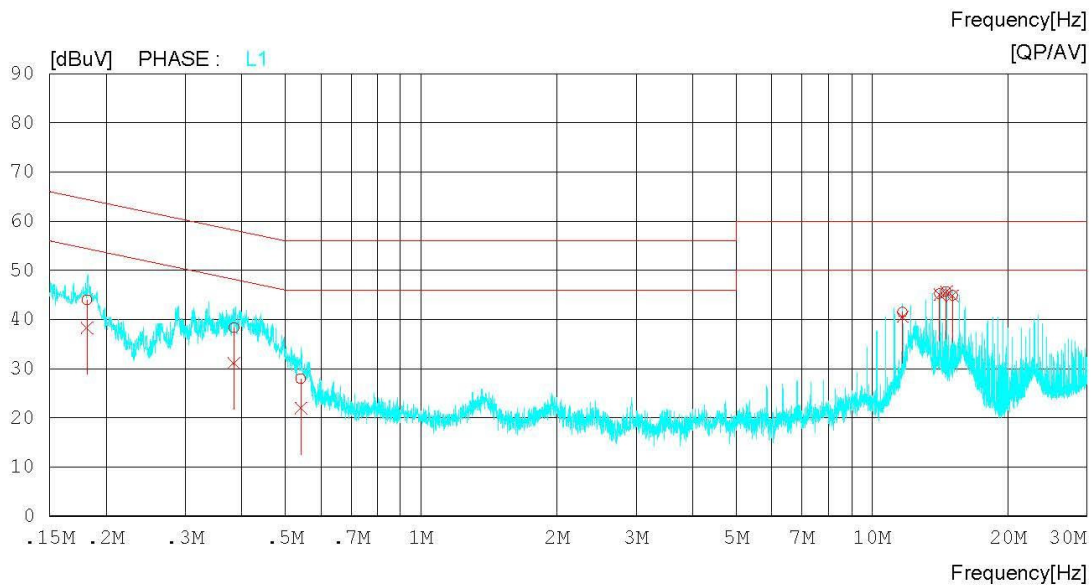
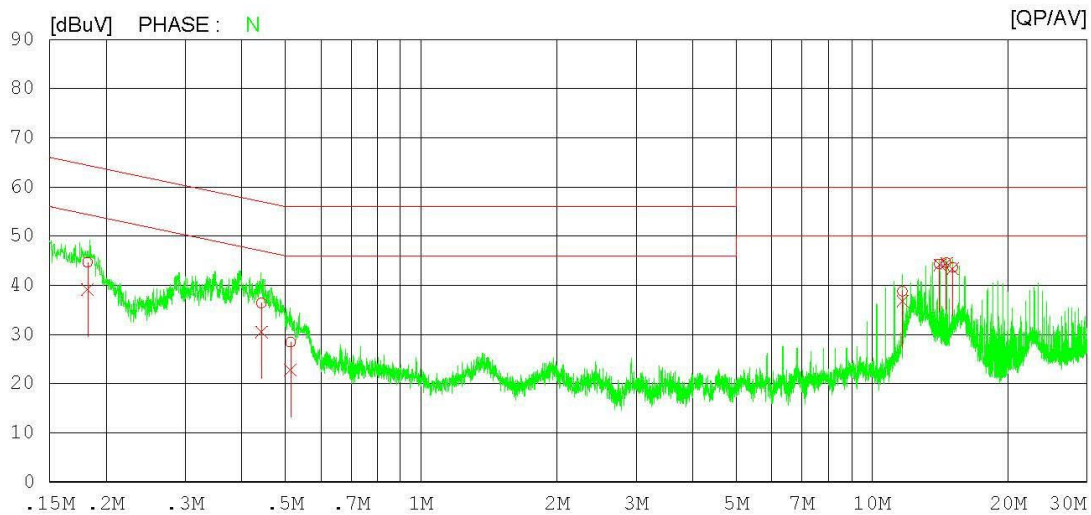
Date : 2016-11-28

Order No. :
 Model No. : 14HJ701D
 Serial No. : Identical prototype
 Test Condition : WLAN(2.4GHz)

Reference No. :
 Power Supply : 120 V 60 Hz
 Temp/Humi. : 23 °C 41 %
 Operator : J.J.LEE

Memo : 802.11g / 2437MHz

LIMIT : FCC P15.207 QP
 FCC P15.207 AV



AC Line Conducted Emissions (List)

Test mode 2(TM 2) & Middle

Results of Conducted Emission

DTNC

Date : 2016-11-28

Order No.	:		Reference No.	:	
Model No.	:	14HJ701D	Power Supply	:	120 V 60 Hz
Serial No.	:	Identical prototype	Temp/Humi.	:	23 °C 41 %
Test Condition	:	WLAN(2.4GHz)	Operator	:	J.J.LEE

Memo : 802.11g / 2437MHz

 LIMIT : FCC P15.207 QP
 FCC P15.207 AV

NO	FREQ [MHz]	READING		C.FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.18185	34.5	29.1	10.1	44.6	39.2	64.4	54.4	19.8	15.2	N
2	0.44327	26.3	20.4	10.1	36.4	30.5	57.0	47.0	20.6	16.5	N
3	0.51350	18.3	12.7	10.1	28.4	22.8	56.0	46.0	27.6	23.2	N
4	11.68920	28.0	26.1	10.7	38.7	36.8	60.0	50.0	21.3	13.2	N
5	14.13120	33.3	33.2	11.0	44.3	44.2	60.0	50.0	15.7	5.8	N
6	14.61780	33.5	33.5	11.0	44.5	44.5	60.0	50.0	15.5	5.5	N
7	15.10140	32.7	32.4	11.0	43.7	43.4	60.0	50.0	16.3	6.6	N
8	0.18159	33.9	28.3	10.0	43.9	38.3	64.4	54.4	20.5	16.1	L1
9	0.38485	28.2	21.0	10.1	38.3	31.1	58.2	48.2	19.9	17.1	L1
10	0.54123	17.9	11.9	10.1	28.0	22.0	56.0	46.0	28.0	24.0	L1
11	11.69060	30.6	29.7	10.8	41.4	40.5	60.0	50.0	18.6	9.5	L1
12	14.12960	34.2	34.0	11.0	45.2	45.0	60.0	50.0	14.8	5.0	L1
13	14.61760	34.6	34.6	11.0	45.6	45.6	60.0	50.0	14.4	4.4	L1
14	15.10260	33.8	33.7	11.1	44.9	44.8	60.0	50.0	15.1	5.2	L1

9. LIST OF TEST EQUIPMENT

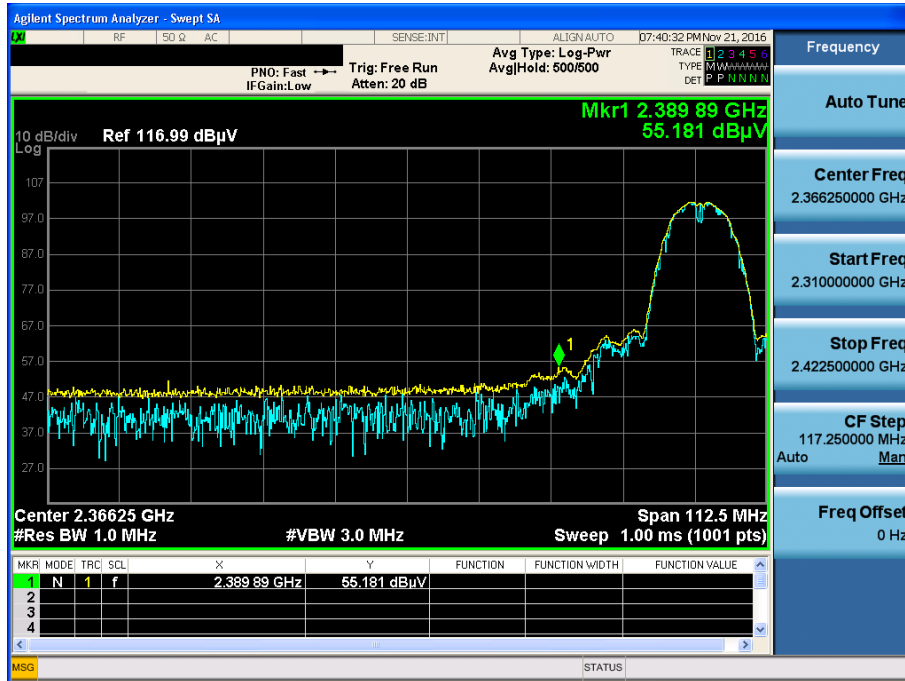
Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
MXA Signal Analyzer	Agilent Technologies	N9020A	16/10/11	17/10/11	MY46471251
DC Power Supply	Agilent Technologies	66332A	16/09/08	17/09/08	US37473422
Multimeter	FLUKE	17B	16/04/21	17/04/21	26030065WS
Vector Signal Generator	R&S	SMBV100A	16/01/05	17/01/05	255571
Signal Generator	R&S	SMF100A	16/06/23	17/06/23	102341
Power Meter & Wide Bandwidth Sensor	Anritsu	ML2496A/ MA2411B	16/06/23	17/06/23	1338004/ 1306053
50W 10dB ATT	SMAJK	SMAJK-50-10	16/10/18	17/10/18	2-50-10
Thermohyrometer	BODYCOM	BJ5478	16/02/25	17/02/25	1209
Loop Antenna	Schwarzbeck	FMZB1513	16/04/22	18/04/22	1513-128
Biglog Antenna	SCHAFFNER	CBL6112B	14/12/10	16/12/10	2737
Horn Antenna	ETS	3117	16/05/03	18/05/03	140394
Horn Antenna	A.H.Systems.	SAS-574	15/04/30	17/04/30	154
Low Noise Pre Amplifier	tsj	MLA-010K01-B01- 27	16/03/10	17/03/10	1844539
Amplifier	Agilent	8449B	16/02/24	17/02/24	3008A00370
High-pass filter	Wainwright	WHKX12-2580- 3000-18000-80SS	16/09/09	17/09/09	3
High-pass filter	Wainwright	WHNX6-6320-8000- 26500-40CC	16/09/13	17/09/13	1
EMI TEST RECEIVER	R&S	ESR7	16/02/25	17/02/25	101061
EMI TEST RECEIVER	R&S	ESCI	16/02/25	17/02/25	100364
PULSE LIMITER	Rohde Schwarz	ESH3-Z2	16/01/05	17/01/05	101334
SINGLE-PHASE MASTER	NF	4420	16/09/08	17/09/08	3049354420023
Artificial Mains Network	Narda S.T.S. / PMM	PMM L2-16B	16/06/22	17/06/22	000WX20305

APPENDIX I

Unwanted Emissions (Radiated) Test Plot

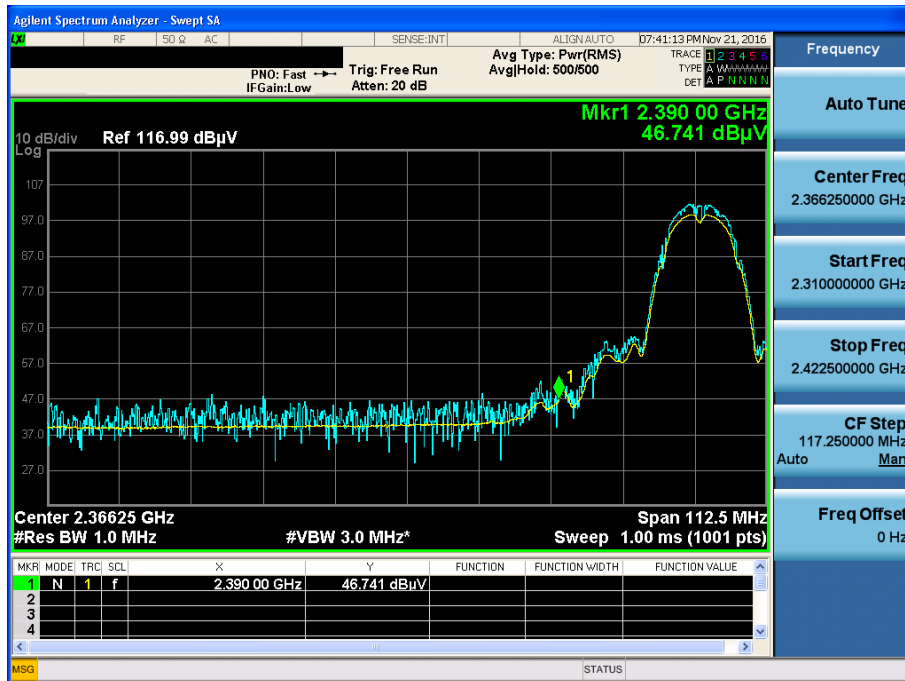
TM 1 & Lowest & Z axis & Hor

Detector Mode : PK



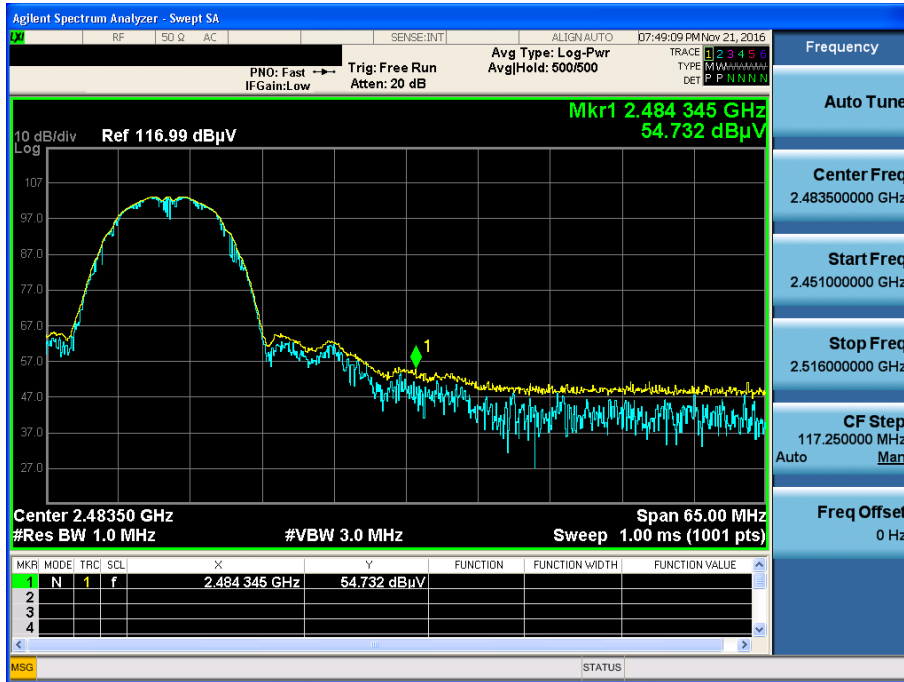
TM 1 & Lowest & Z axis & Hor

Detector Mode : AV



TM 1 & Highest & Z axis & Hor

Detector Mode : PK



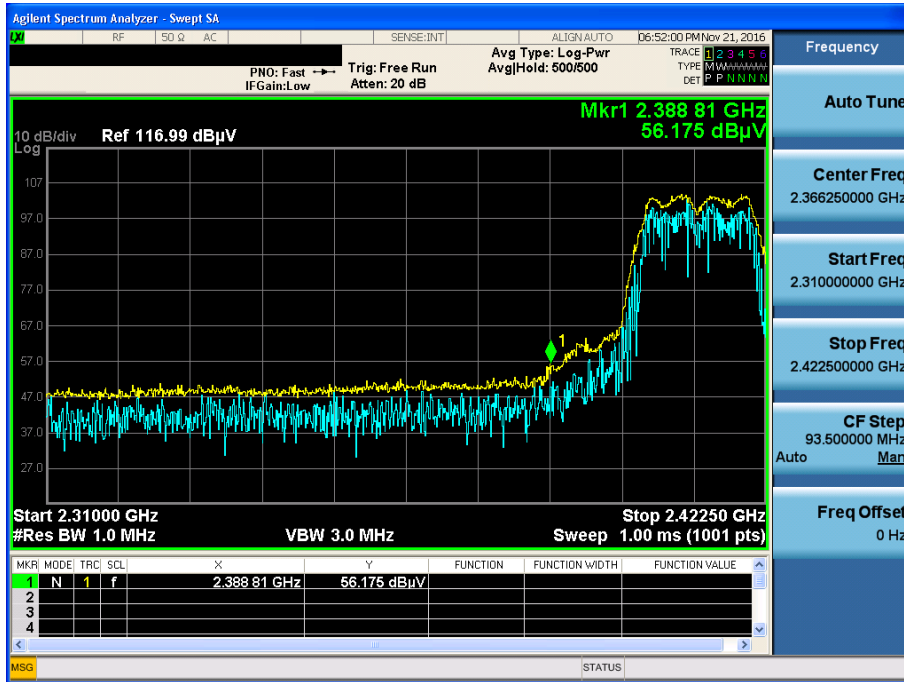
TM 1 & Highest & Z axis & Hor

Detector Mode : AV



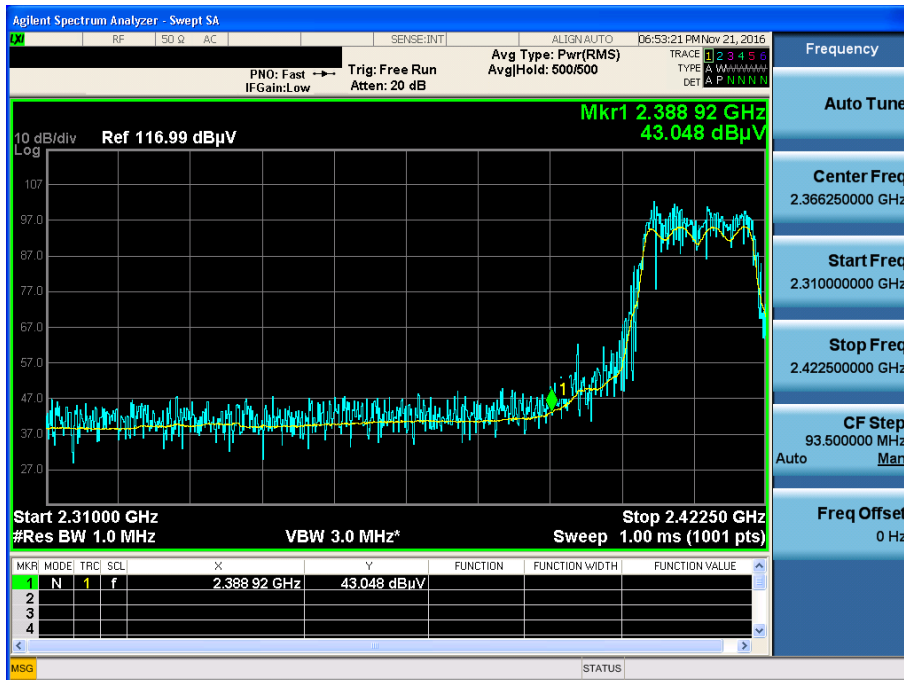
TM 2 & Lowest & Z axis & Hor

Detector Mode : PK



TM 2 & Lowest & Z axis & Hor

Detector Mode : AV



TM 2 & Highest & Z axis & Hor

Detector Mode : PK



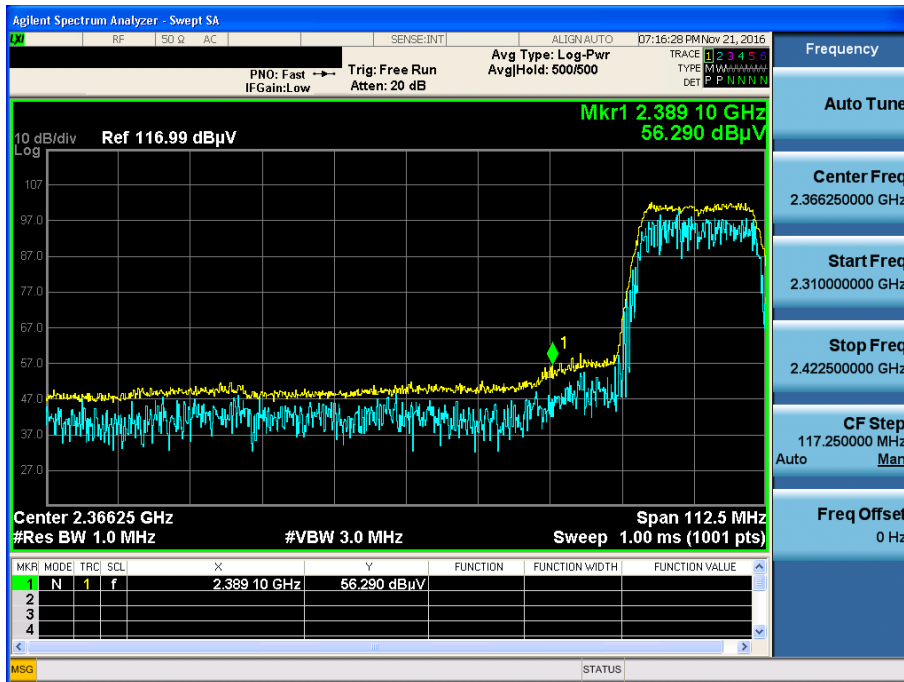
TM 2 & Highest & Z axis & Hor

Detector Mode : AV



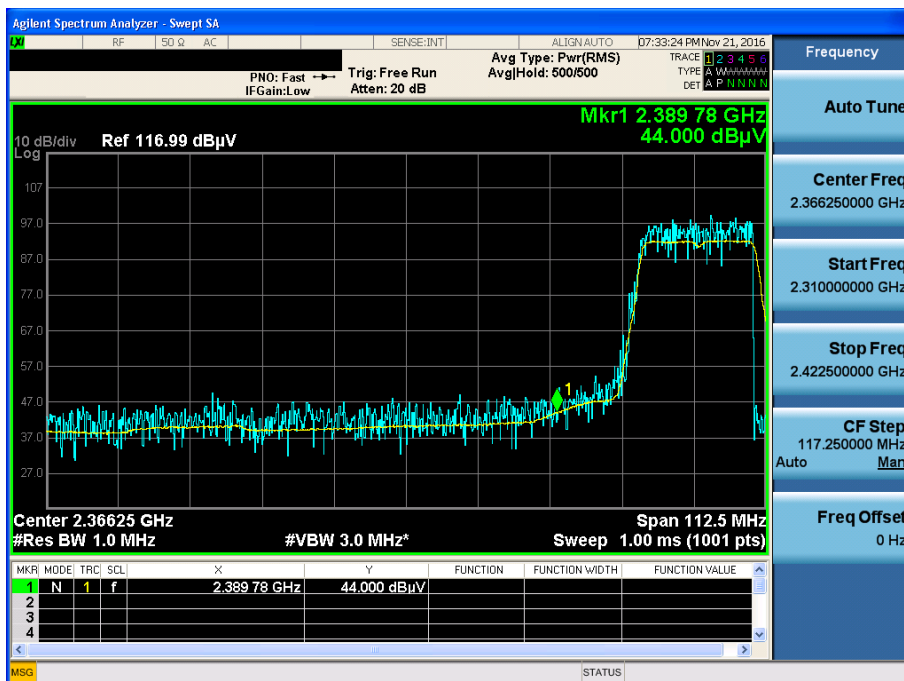
TM 3 & Lowest & Z axis & Hor

Detector Mode : PK



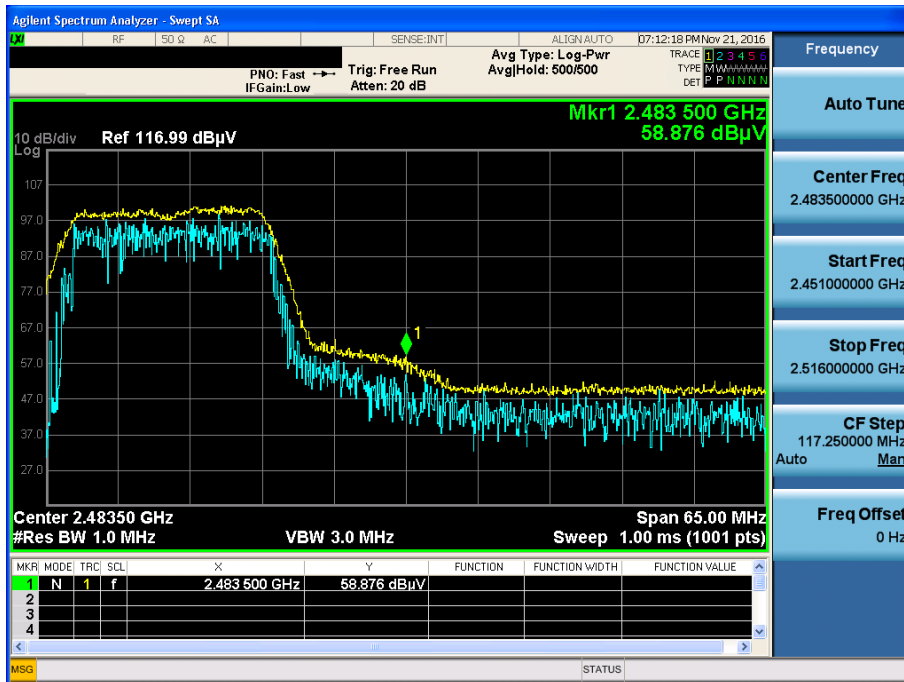
TM 3 & Lowest & Z axis & Hor

Detector Mode : AV



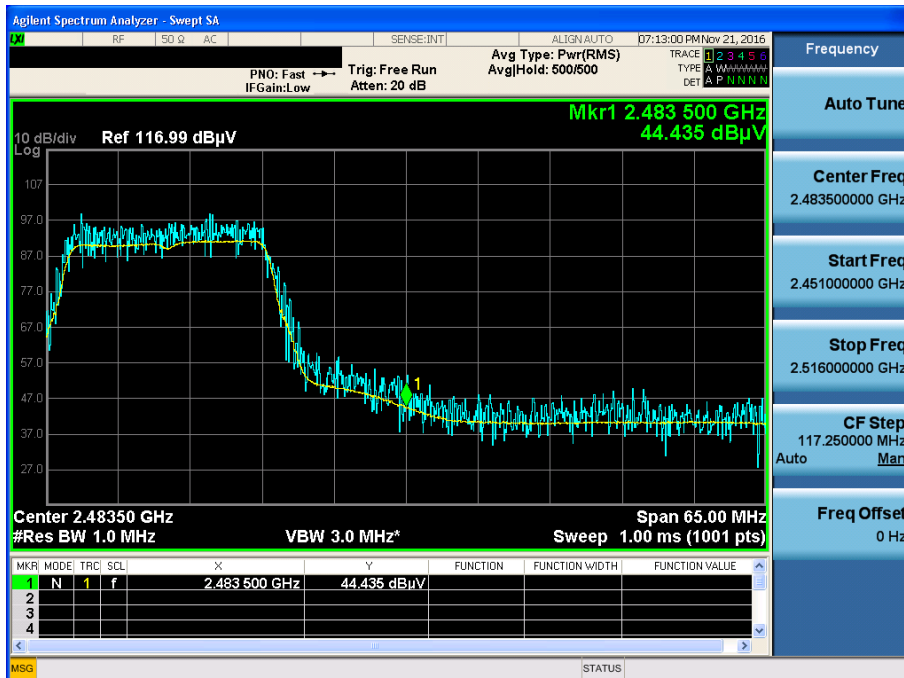
TM 3 & Highest & Z axis & Hor

Detector Mode : PK



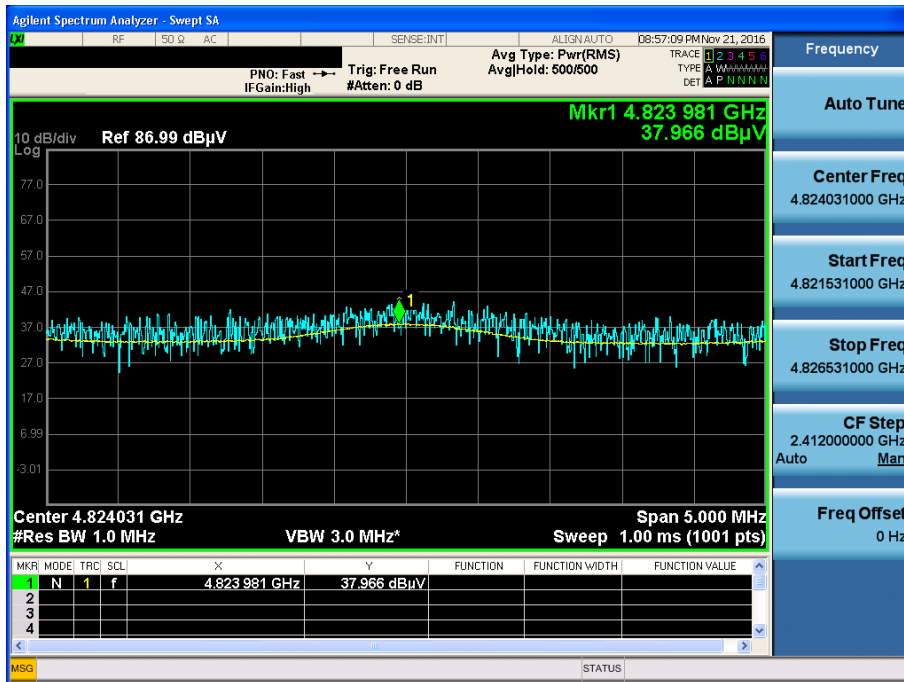
TM 3 & Highest & Z axis & Hor

Detector Mode : AV



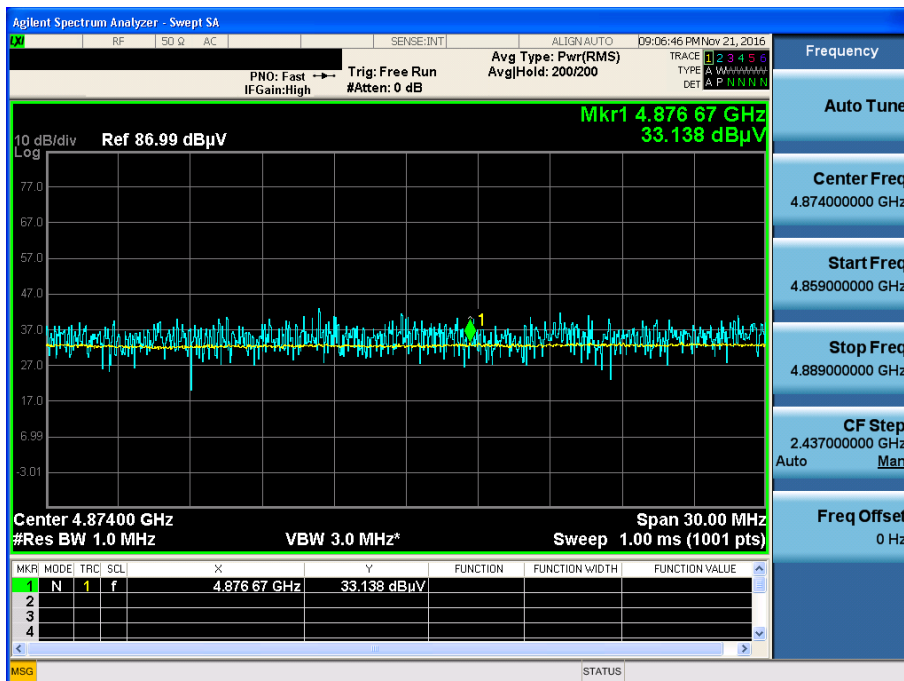
TM 1 & Lowest & Z axis & Hor

Detector Mode : AV



TM 2 & Middle & Z axis & Hor

Detector Mode : AV



TM 3 & Highest & Z axis & Hor

Detector Mode : AV

