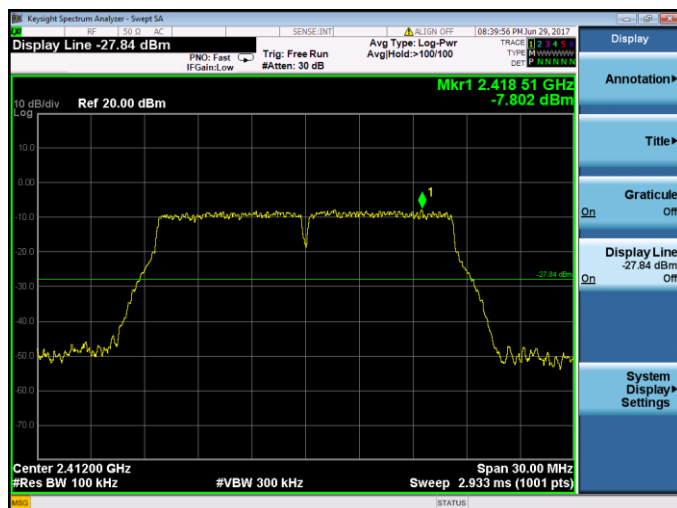
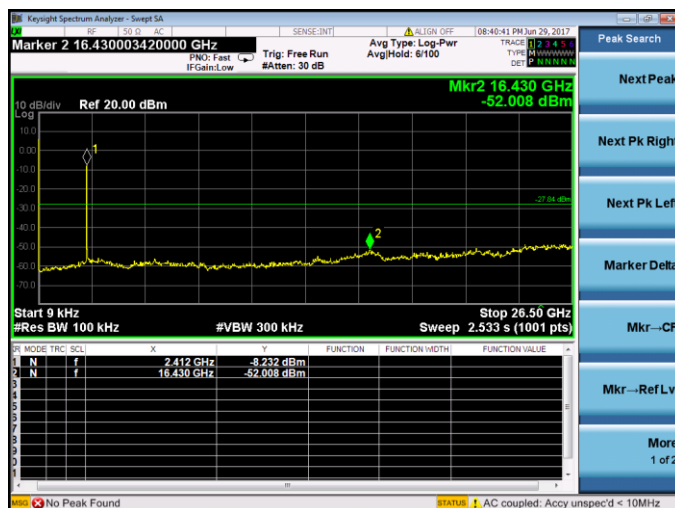


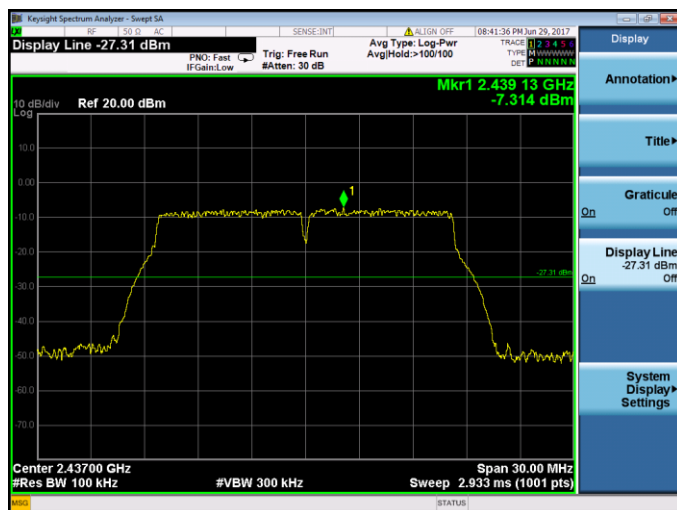
Test plot of Conducted Spurious Emission



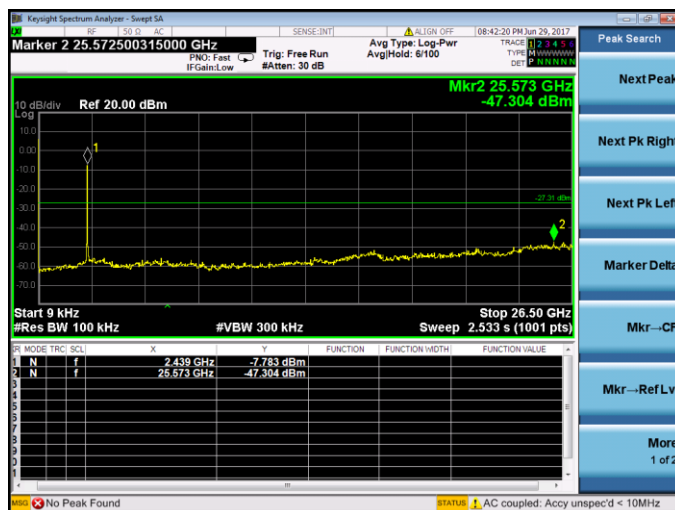
802.11g-Low channel Reference



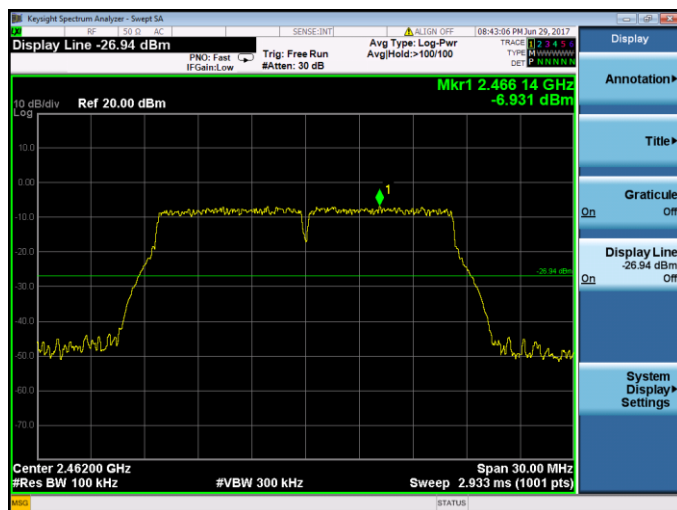
802.11g-Low channel



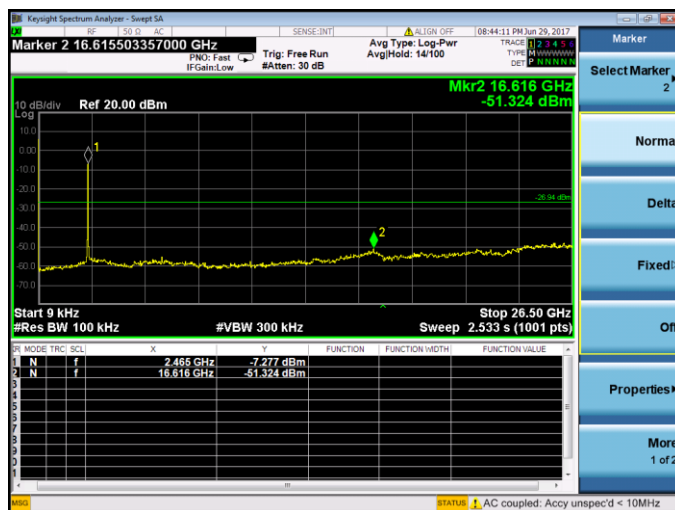
802.11g-Middle channel Reference



802.11g-Middle channel

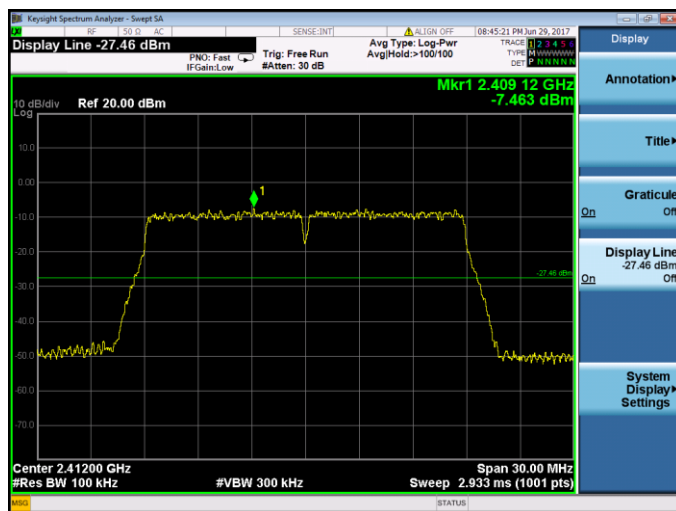


802.11g-High channel Reference

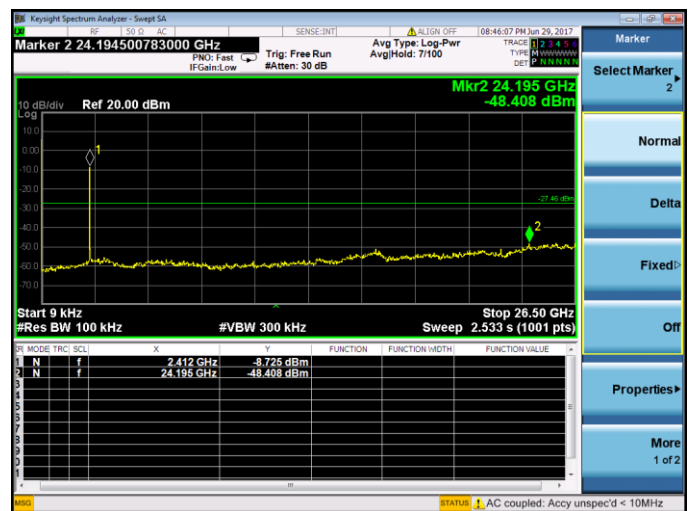


802.11g-High channel

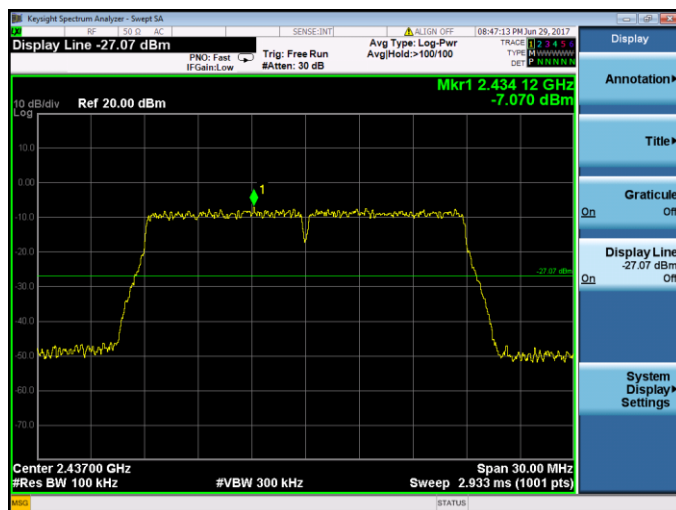
Test plot of Conducted Spurious Emission



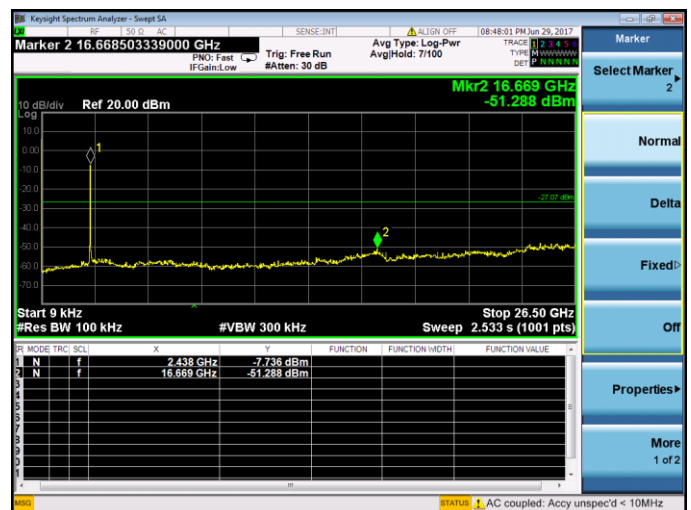
802.11n-HT20-Low channel Reference



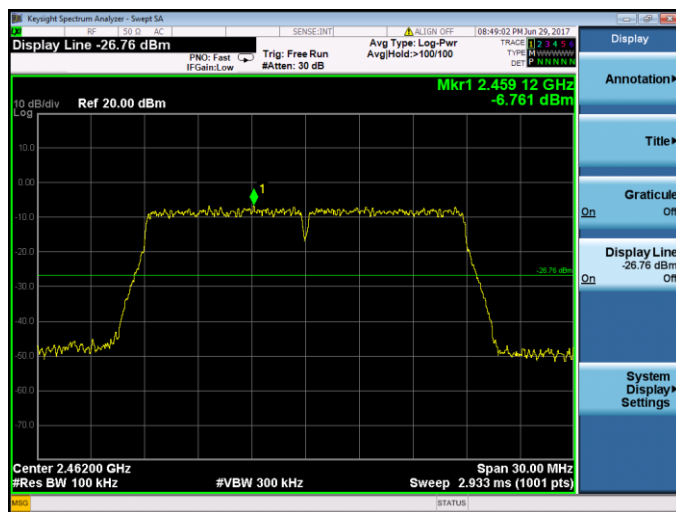
802.11n-HT20-Low channel



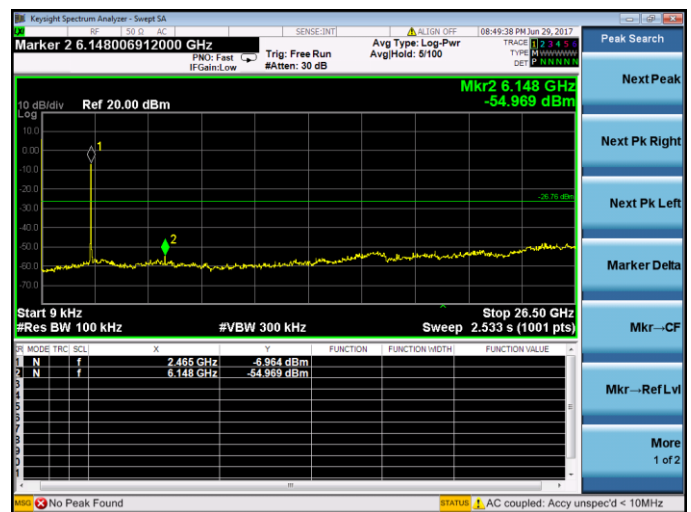
802.11n-HT20-Middle channel Reference



802.11n-HT20-Middle channel

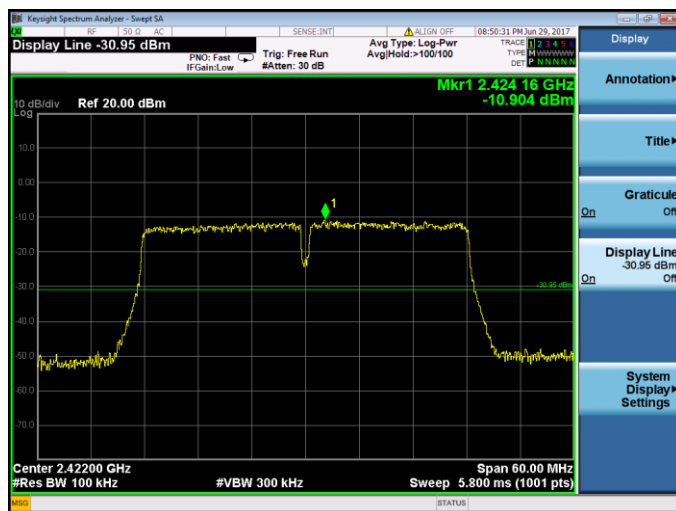


802.11n-HT20-High channel Reference

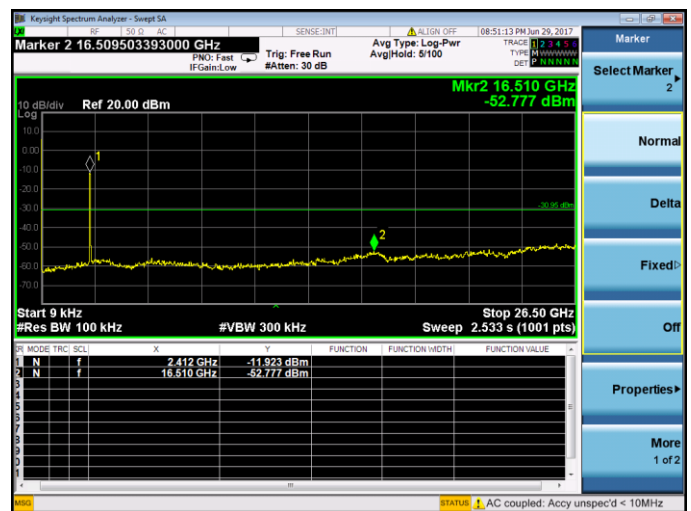


802.11n-HT20-High channel

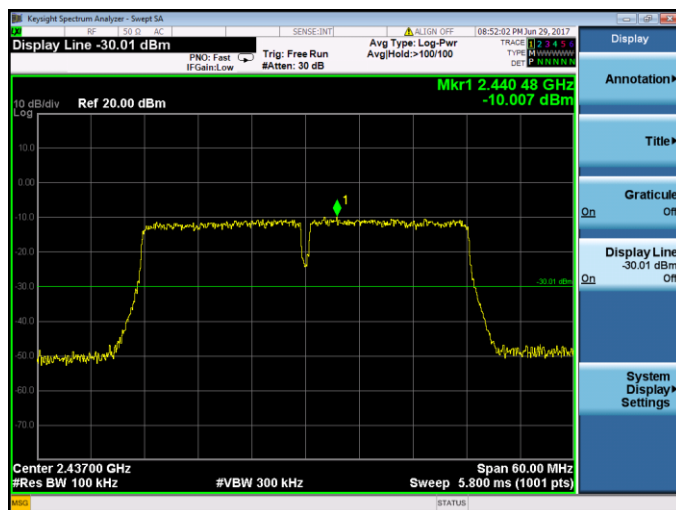
Test plot of Conducted Spurious Emission



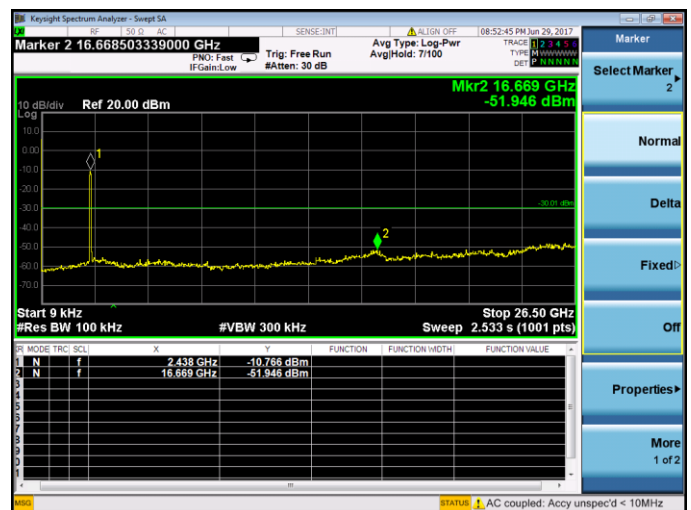
802.11n-HT40-Low channel Reference



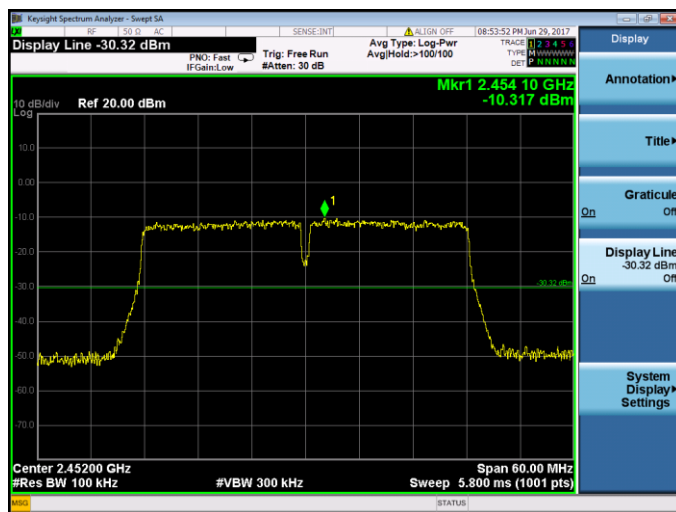
802.11n-HT40-Low channel



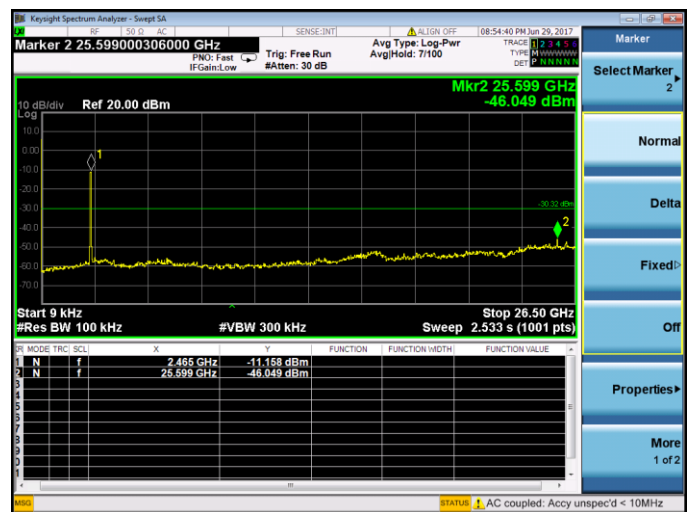
802.11n-HT40-Middle channel Reference



802.11n-HT40-Middle channel

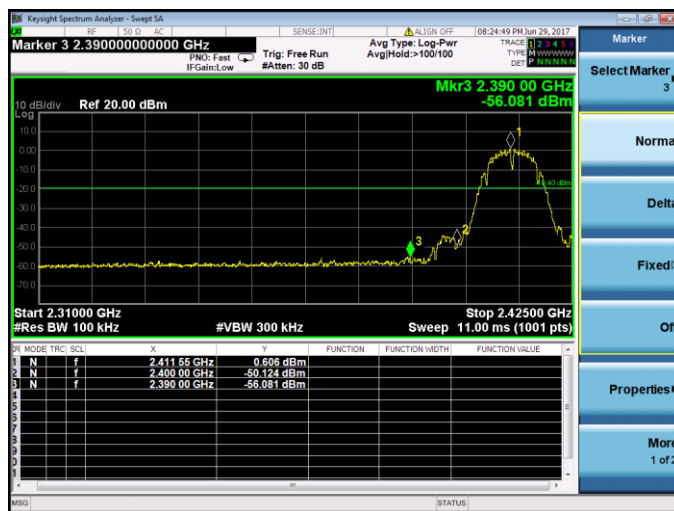


802.11n-HT40-High channel Reference



802.11n-HT40-High channel

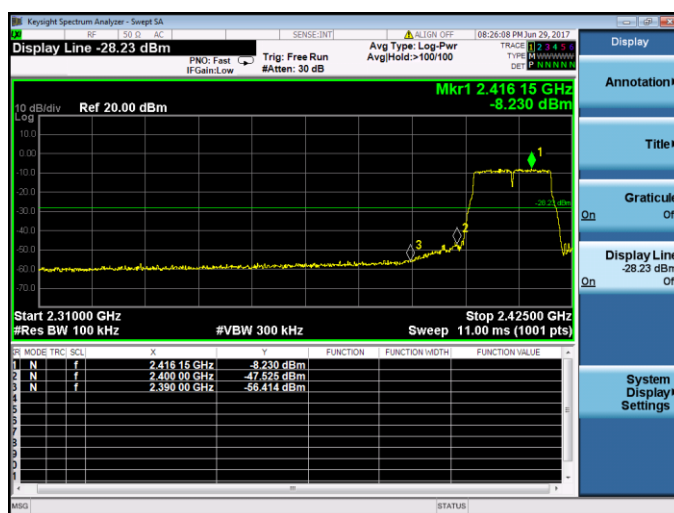
Test plot of Band Edges Test



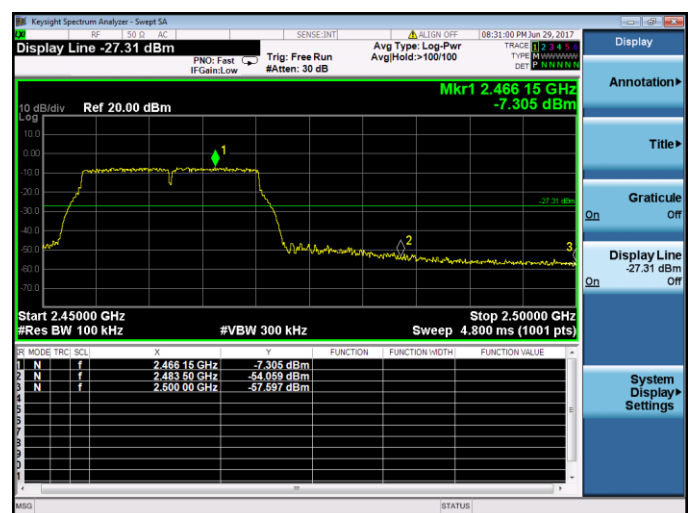
802.11b-Low channel



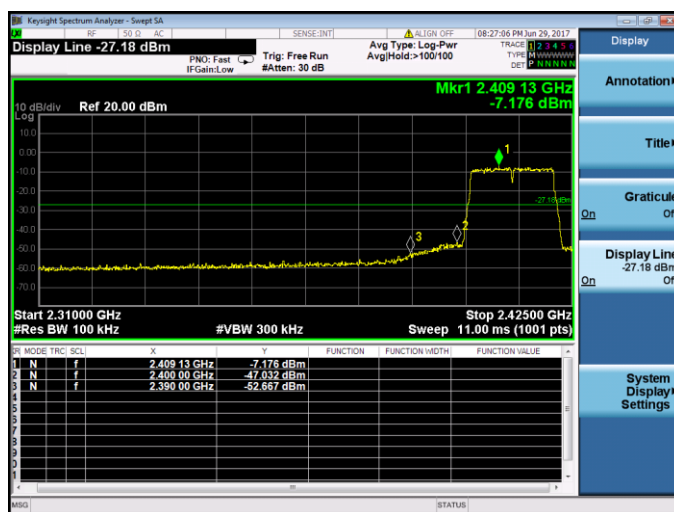
802.11b-High channel



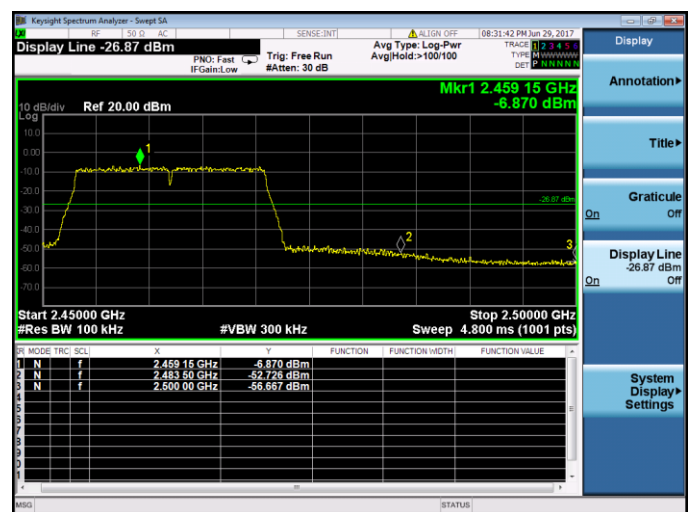
802.11g-Low channel



802.11g-High channel

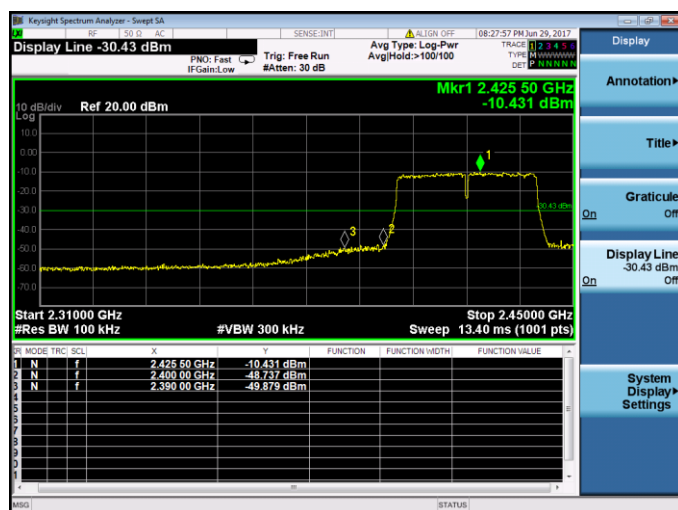


802.11n-HT20-Low channel

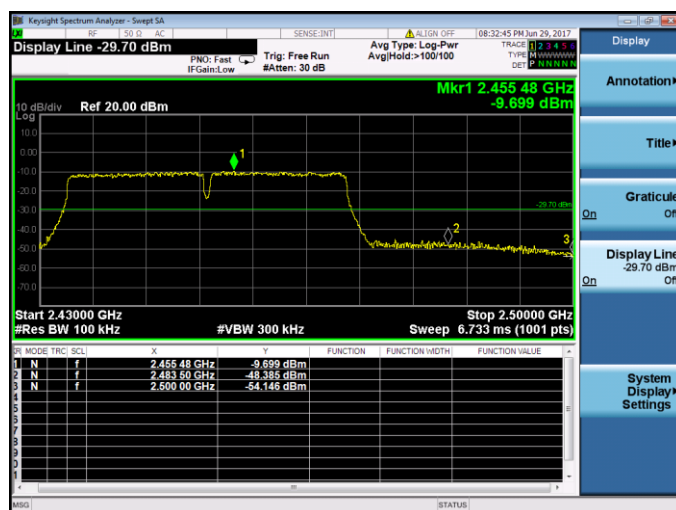


802.11n-HT20-High channel

Test plot of Band Edges Test



802.11n-HT40-Low channel



802.11n-HT40-High channel

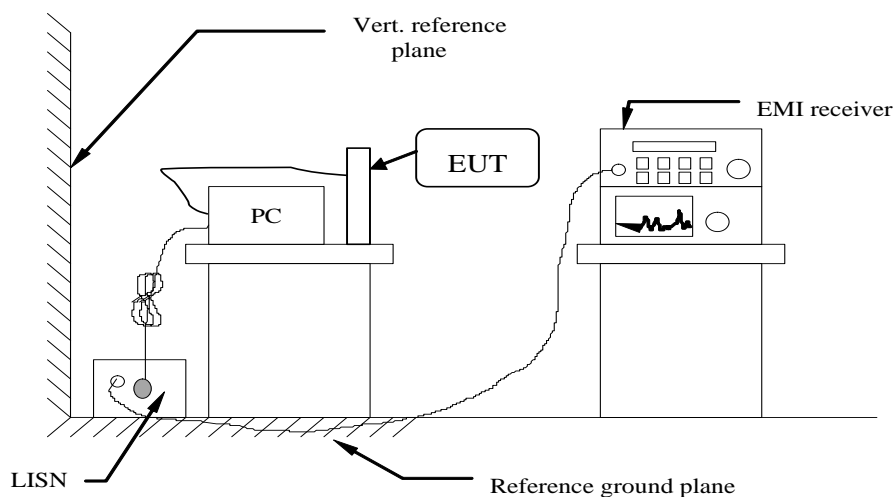
5.7. AC Power line conducted emissions

5.7.1 Standard Applicable

According to §15.207 (a): 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 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range is listed as follows:

Frequency Range (MHz)	Limits (dB μ V)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

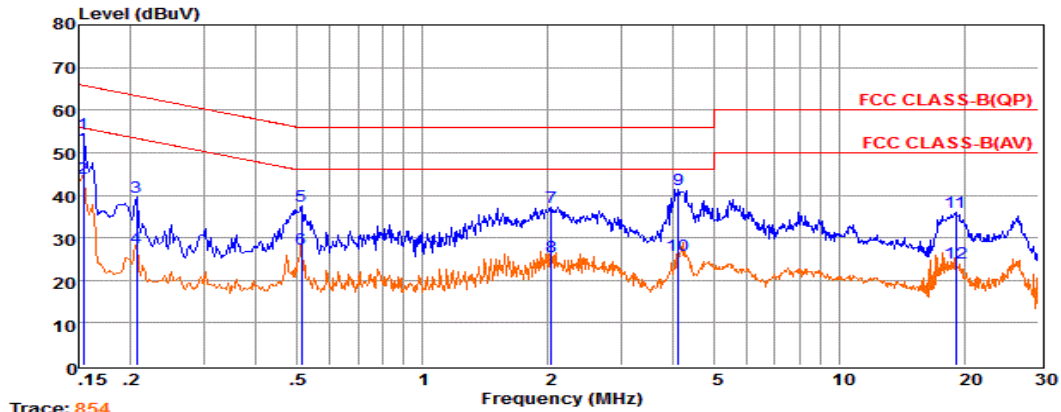
5.7.2 Block Diagram of Test Setup



5.7.3 Test Results

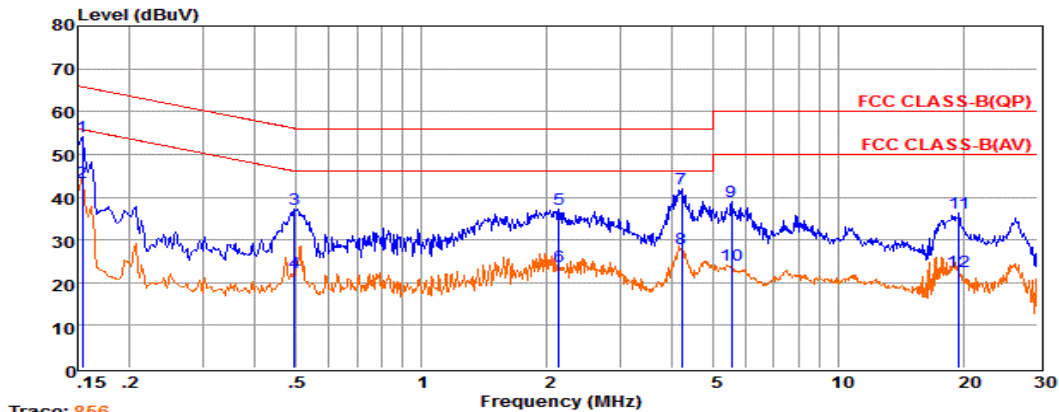
PASS.

The test data please refer to following page.

AC Conducted Emission of power adapter @ AC 120V/60Hz @ IEEE 802.11b (worst case)

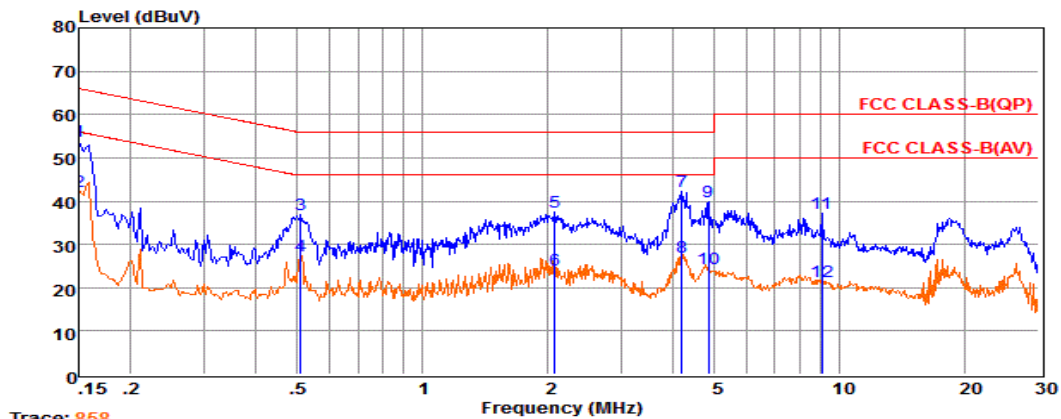
		LINE							
	Freq	Reading	LISNFac	CabLos	Aux2Fac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB	dB	dB	dBuV	dBuV	dB
1	0.15	34.77	9.58	0.02	10.00	54.37	65.78	-11.41	QP
2	0.15	24.50	9.58	0.02	10.00	44.10	55.77	-11.67	Average
3	0.21	19.98	9.63	0.03	10.00	39.64	63.36	-23.72	QP
4	0.21	7.95	9.63	0.03	10.00	27.61	53.36	-25.75	Average
5	0.51	17.71	9.62	0.04	10.00	37.37	56.00	-18.63	QP
6	0.51	7.65	9.62	0.04	10.00	27.31	46.00	-18.69	Average
7	2.03	17.63	9.64	0.05	10.00	37.32	56.00	-18.68	QP
8	2.03	6.02	9.64	0.05	10.00	25.71	46.00	-20.29	Average
9	4.11	21.78	9.65	0.06	10.00	41.49	56.00	-14.51	QP
10	4.11	6.04	9.65	0.06	10.00	25.75	46.00	-20.25	Average
11	19.02	16.20	9.75	0.12	10.00	36.07	60.00	-23.93	QP
12	19.02	4.27	9.75	0.12	10.00	24.14	50.00	-25.86	Average

Remarks: 1. Measured = Reading +Cable Loss +Aux2 Fac.
 2. The emission levels that are 20dB below the official limit are not reported.



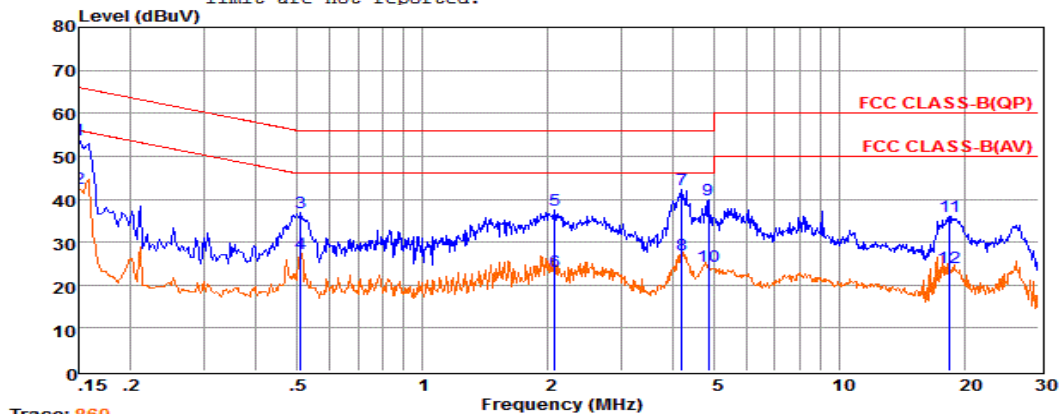
		LINE							
	Freq	Reading	LISNFac	CabLos	Aux2Fac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB	dB	dB	dBuV	dBuV	dB
1	0.15	34.67	9.58	0.02	10.00	54.27	65.78	-11.51	QP
2	0.15	23.95	9.58	0.02	10.00	43.55	55.77	-12.22	Average
3	0.50	17.61	9.62	0.04	10.00	37.27	56.05	-18.78	QP
4	0.50	2.51	9.62	0.04	10.00	22.17	46.05	-23.88	Average
5	2.13	17.42	9.64	0.05	10.00	37.11	56.00	-18.89	QP
6	2.13	3.98	9.64	0.05	10.00	23.67	46.00	-22.33	Average
7	4.20	22.25	9.65	0.06	10.00	41.96	56.00	-14.04	QP
8	4.20	8.26	9.65	0.06	10.00	27.97	46.00	-18.03	Average
9	5.53	19.26	9.66	0.06	10.00	38.98	60.00	-21.02	QP
10	5.54	4.43	9.66	0.06	10.00	24.15	50.00	-25.85	Average
11	19.43	16.37	9.75	0.12	10.00	36.24	60.00	-23.76	QP
12	19.43	2.88	9.75	0.12	10.00	22.75	50.00	-27.25	Average

Remarks: 1. Measured = Reading +Cable Loss +Aux2 Fac.
 2. The emission levels that are 20dB below the official limit are not reported.

AC Conducted Emission of power adapter @ AC 240V/60Hz @ IEEE 802.11b (worst case)

LINE									
	Freq	Reading	LISNFac	CabLos	Aux2Fac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB	dB	dB	dBuV	dBuV	dB
1	0.15	34.12	9.57	0.02	10.00	53.71	66.00	-12.29	QP
2	0.15	22.78	9.57	0.02	10.00	42.37	55.99	-13.62	Average
3	0.51	17.17	9.62	0.04	10.00	36.83	56.00	-19.17	QP
4	0.51	7.62	9.62	0.04	10.00	27.28	46.00	-18.72	Average
5	2.08	17.71	9.64	0.05	10.00	37.40	56.00	-18.60	QP
6	2.08	4.51	9.64	0.05	10.00	24.20	46.00	-21.80	Average
7	4.18	22.50	9.65	0.06	10.00	42.21	56.00	-13.79	QP
8	4.18	7.42	9.65	0.06	10.00	27.13	46.00	-18.87	Average
9	4.85	20.10	9.65	0.06	10.00	39.81	56.00	-16.19	QP
10	4.85	4.79	9.65	0.06	10.00	24.50	46.00	-21.50	Average
11	9.06	17.44	9.69	0.08	10.00	37.21	60.00	-22.79	QP
12	9.06	1.57	9.69	0.08	10.00	21.34	50.00	-28.66	Average

Remarks: 1. Measured = Reading +Cable Loss +Aux2 Fac.
 2. The emission levels that are 20dB below the official limit are not reported.



NEUTRAL									
	Freq	Reading	LISNFac	CabLos	Aux2Fac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB	dB	dB	dBuV	dBuV	dB
1	0.15	34.12	9.70	0.02	10.00	53.84	66.00	-12.16	QP
2	0.15	22.78	9.70	0.02	10.00	42.50	55.99	-13.49	Average
3	0.51	17.17	9.62	0.04	10.00	36.83	56.00	-19.17	QP
4	0.51	7.62	9.62	0.04	10.00	27.28	46.00	-18.72	Average
5	2.08	17.71	9.63	0.05	10.00	37.39	56.00	-18.61	QP
6	2.08	3.51	9.63	0.05	10.00	23.19	46.00	-22.81	Average
7	4.18	22.51	9.65	0.06	10.00	42.22	56.00	-13.78	QP
8	4.18	7.42	9.65	0.06	10.00	27.13	46.00	-18.87	Average
9	4.85	20.10	9.66	0.06	10.00	39.82	56.00	-16.18	QP
10	4.85	4.78	9.66	0.06	10.00	24.50	46.00	-21.50	Average
11	18.33	16.15	9.82	0.11	10.00	36.08	60.00	-23.92	QP
12	18.33	4.09	9.82	0.11	10.00	24.02	50.00	-25.98	Average

Remarks: 1. Measured = Reading +Cable Loss +Aux2 Fac.
 2. The emission levels that are 20dB below the official limit are not reported.

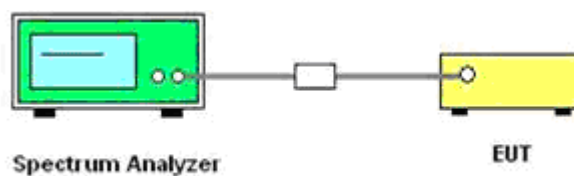
***Note: Pre-scan all mode and recorded the worst case results in this report (802.11b).

5.8. Band-edge measurements for radiated emissions

5.8.1 Standard Applicable

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

5.8.2. Test Setup Layout



5.8.3. Measuring Instruments and Setting

Please refer to section 6 of equipment list in this report. The following table is the setting of Spectrum Analyzer.

5.8.4. Test Procedures

According to KDB 558074 D01 V03R05 for Antenna-port conducted measurement. Antenna-port conducted measurements may also be used as an alternative to radiated measurements for demonstrating compliance in the restricted frequency bands. If conducted measurements are performed, then proper impedance matching must be ensured and an additional radiated test for cabinet/case spurious emissions is required.

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge, for Radiated emissions restricted band RBW=1MHz, VBW=3MHz for peak detector and RBW=1MHz, VBW=1/B for AV detector.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.
6. Measure the conducted output power (in dBm) using the detector specified by the appropriate regulatory agency (see 12.2.2, 12.2.3, and 12.2.4 for guidance regarding measurement procedures for determining quasi-peak, peak, and average conducted output power, respectively).
7. Add the maximum transmit antenna gain (in dBi) to the measured output power level to determine the EIRP level (see 12.2.5 for guidance on determining the applicable antenna gain)
8. Add the appropriate maximum ground reflection factor to the EIRP level (6 dB for frequencies ≤ 30 MHz, 4.7 dB for frequencies between 30 MHz and 1000 MHz, inclusive and 0 dB for frequencies > 1000 MHz).

9. For devices with multiple antenna-ports, measure the power of each individual chain and sum the EIRP of all chains in linear terms (e.g., Watts, mW).
10. Convert the resultant EIRP level to an equivalent electric field strength using the following relationship:
 $E = \text{EIRP} - 20 \log D + 104.77 = \text{EIRP} + 95.23$

Where:

E = electric field strength in dB μ V/m,

EIRP = equivalent isotropic radiated power in dBm

D = specified measurement distance in meters.

11. Since the out-of-band characteristics of the EUT transmit antenna will often be unknown, the use of a conservative antenna gain value is necessary. Thus, when determining the EIRP based on the measured conducted power, the upper bound on antenna gain for a device with a single RF output shall be selected as the maximum in-band gain of the antenna across all operating bands, or 2 dBi, whichever is greater. However, for devices that operate in multiple frequency bands while using the same transmit antenna, the highest gain of the antenna within the operating band nearest in frequency to the restricted band emission being measured may be used in lieu of the overall highest gain when the emission is at a frequency that is within 20 percent of the nearest band edge frequency, but in no case shall a value less than 2 dBi be used.
12. Compare the resultant electric field strength level to the applicable regulatory limit.
13. Perform radiated spurious emission test duress until all measured frequencies were complete.

5.8.5 Test Results

IEEE 802.11b						
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	Covert Radiated E Level At 3m (dBuV/m)	Detector	Limit (dBuV/m)	Verdict
2310.000	-50.086	3.3	48.444	Peak	74.00	PASS
2310.000	-62.722	3.3	35.808	AV	54.00	PASS
2390.000	-46.903	3.3	51.627	Peak	74.00	PASS
2390.000	-59.235	3.3	39.295	AV	54.00	PASS
2483.500	-49.359	3.3	49.171	Peak	74.00	PASS
2483.500	-61.467	3.3	37.063	AV	54.00	PASS
2500.000	-50.352	3.3	48.178	Peak	74.00	PASS
2500.000	-61.927	3.3	36.603	AV	54.00	PASS

IEEE 802.11g						
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	Covert Radiated E Level At 3m (dBuV/m)	Detector	Limit (dBuV/m)	Verdict
2310.000	-51.205	3.3	47.325	Peak	74.00	PASS
2310.000	-62.587	3.3	35.943	AV	54.00	PASS
2390.000	-43.838	3.3	54.692	Peak	74.00	PASS
2390.000	-57.729	3.3	40.801	AV	54.00	PASS
2483.500	-42.106	3.3	56.424	Peak	74.00	PASS
2483.500	-55.105	3.3	43.425	AV	54.00	PASS
2500.000	-47.204	3.3	51.326	Peak	74.00	PASS
2500.000	-58.326	3.3	40.204	AV	54.00	PASS

IEEE 802.11n-HT20						
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	Covert Radiated E Level At 3m (dBuV/m)	Detector	Limit (dBuV/m)	Verdict
2310.000	-49.631	3.3	48.899	Peak	74.00	PASS
2310.000	-62.602	3.3	35.928	AV	54.00	PASS
2390.000	-41.330	3.3	57.200	Peak	74.00	PASS
2390.000	-56.945	3.3	41.585	AV	54.00	PASS
2483.500	-40.373	3.3	58.157	Peak	74.00	PASS
2483.500	-54.212	3.3	44.318	AV	54.00	PASS
2500.000	-46.975	3.3	51.555	Peak	74.00	PASS
2500.000	-58.302	3.3	40.228	AV	54.00	PASS

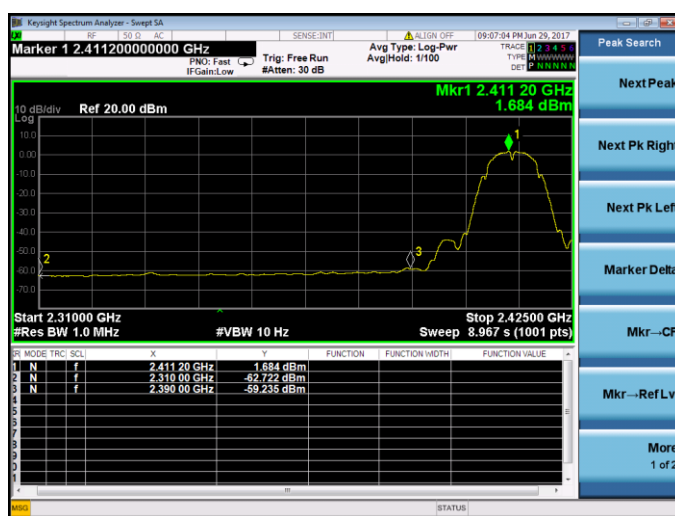
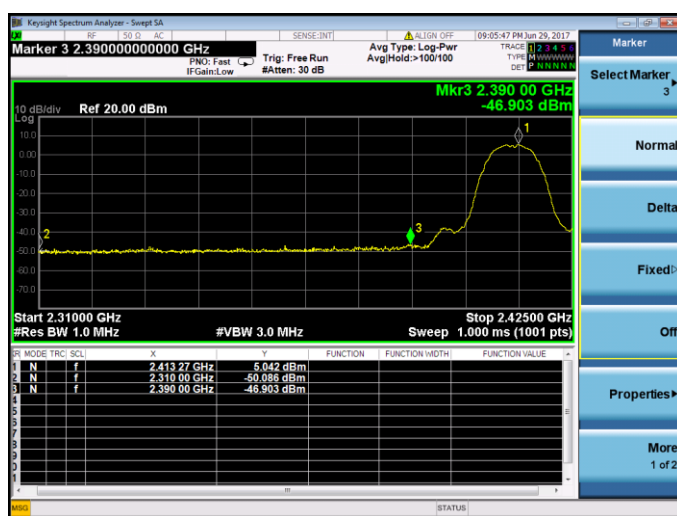
IEEE 802.11n-HT40						
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	Covert Radiated E Level At 3m (dBuV/m)	Detector	Limit (dBuV/m)	Verdict
2310.000	-50.750	3.3	47.780	Peak	74.00	PASS
2310.000	-62.748	3.3	35.782	AV	54.00	PASS
2390.000	-40.701	3.3	57.829	Peak	74.00	PASS
2390.000	-53.970	3.3	44.560	AV	54.00	PASS
2483.500	-38.663	3.3	59.867	Peak	74.00	PASS
2483.500	-50.444	3.3	48.086	AV	54.00	PASS
2500.000	-43.737	3.3	54.793	Peak	74.00	PASS
2500.000	-56.086	3.3	42.444	AV	54.00	PASS

Remark:

1. Measured output power at difference data rate for each mode and recorded worst case for each mode.
2. Test results including cable loss;
3. Worst case data at 1Mbps at IEEE 802.11b; 6Mbps at IEEE 802.11g; 6.5Mbps at IEEE 802.11n HT20; 13.5Mbps at IEEE 802.11n HT40;
4. “---“means that the fundamental frequency not for 15.209 limits requirement.
5. please refer to following plots;

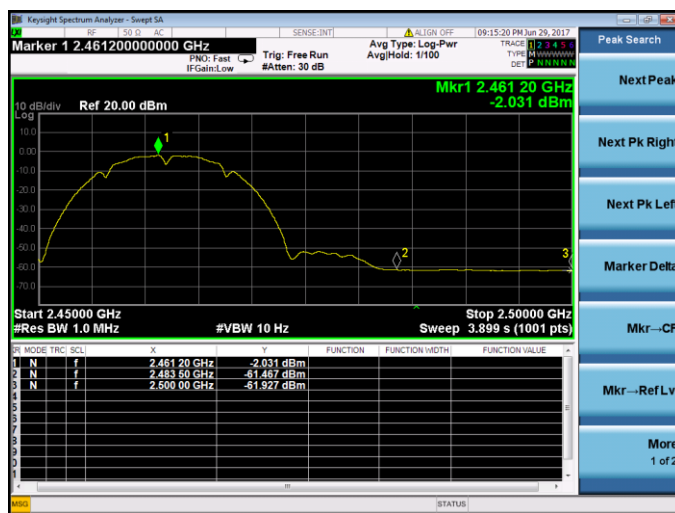
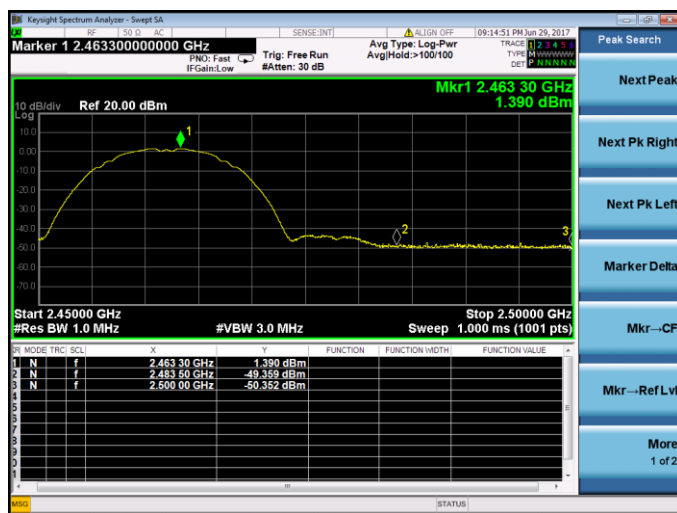
Band-edge measurements for conducted emissions

Test plot of Restricted Bands



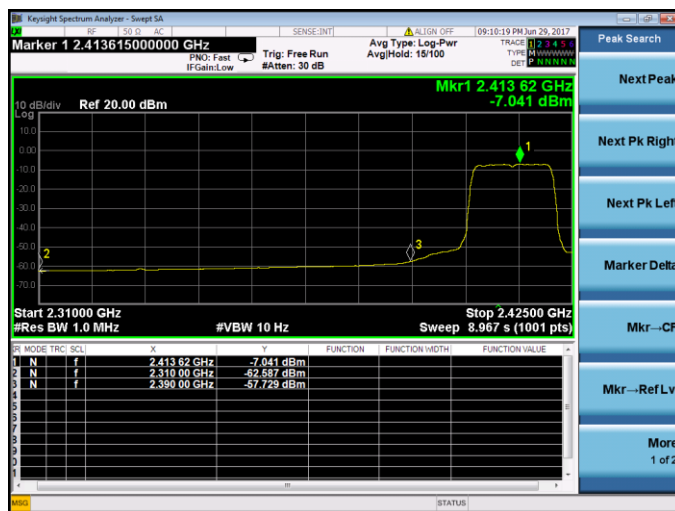
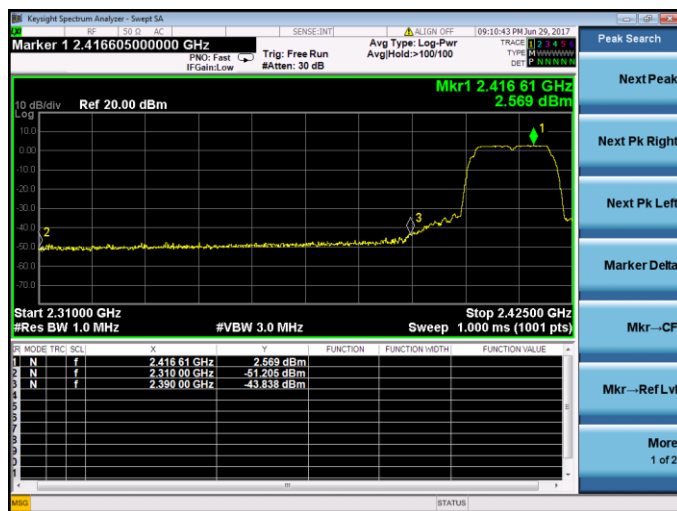
802.11b-Low channel(Peak)

802.11b-Low channel(Average)



802.11b-High channel(Peak)

802.11b-High channel(Average)

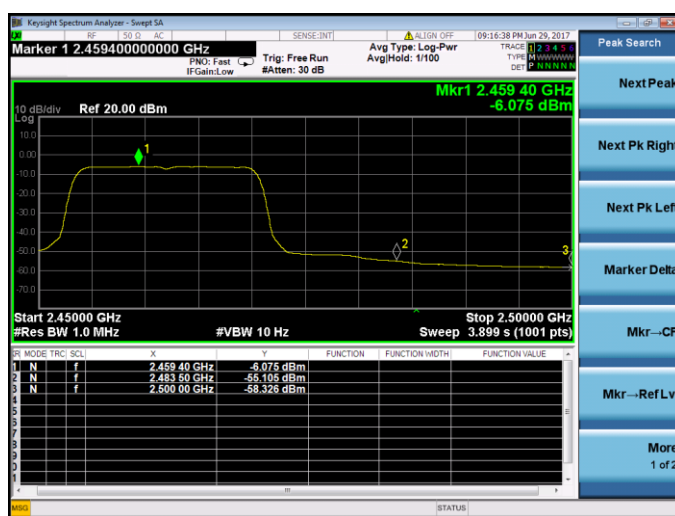
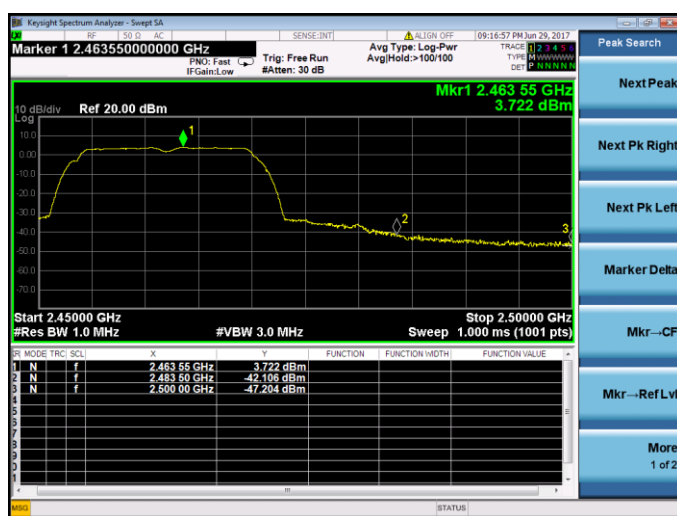


802.11g-Low channel(Peak)

802.11g-Low channel(Average)

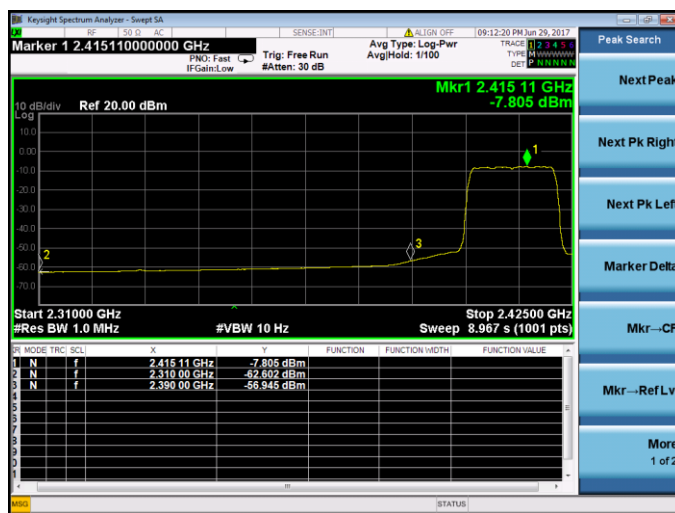
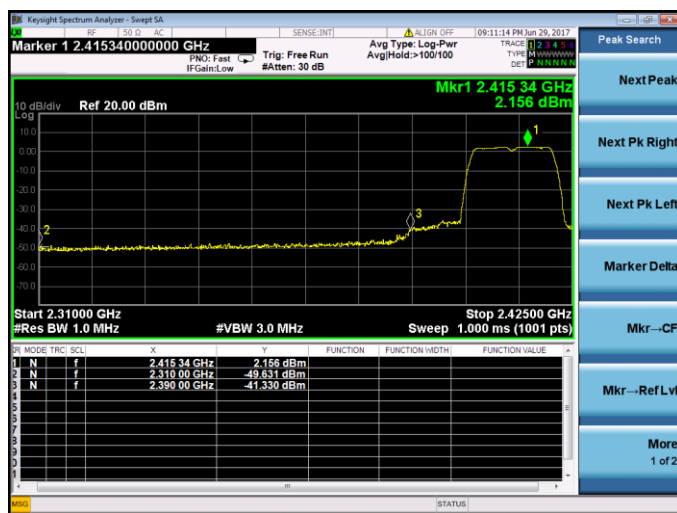
Band-edge measurements for conducted emissions

Test plot of Restricted Bands



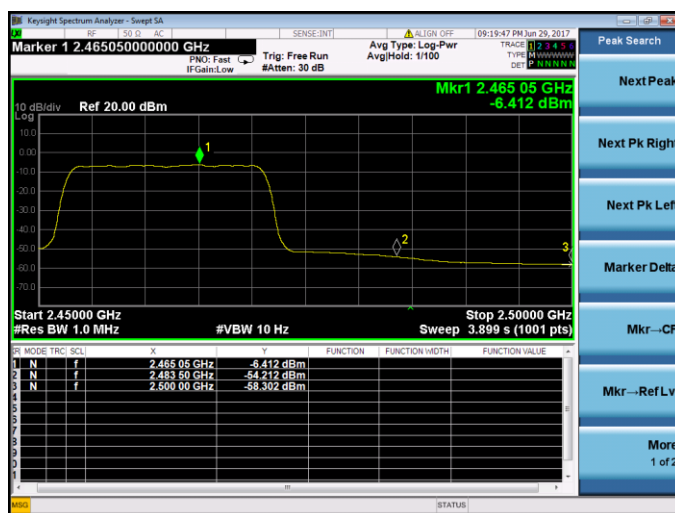
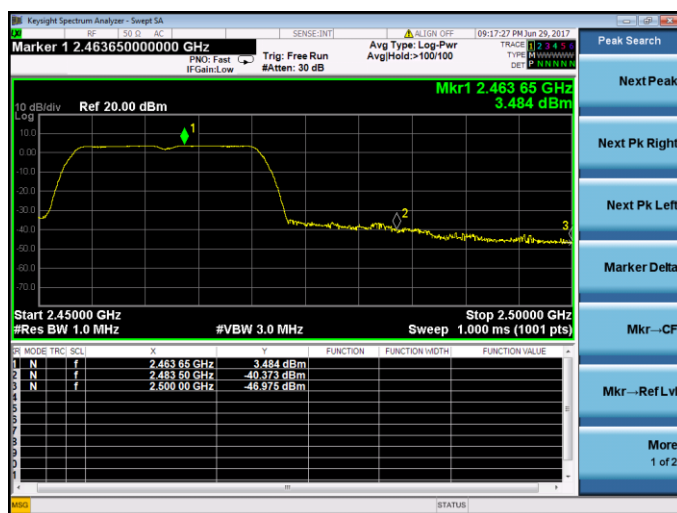
802.11g-High channel(Peak)

802.11g-High channel(Average)



802.11n-HT20-Low channel(Peak)

802.11n-HT20-Low channel(Average)

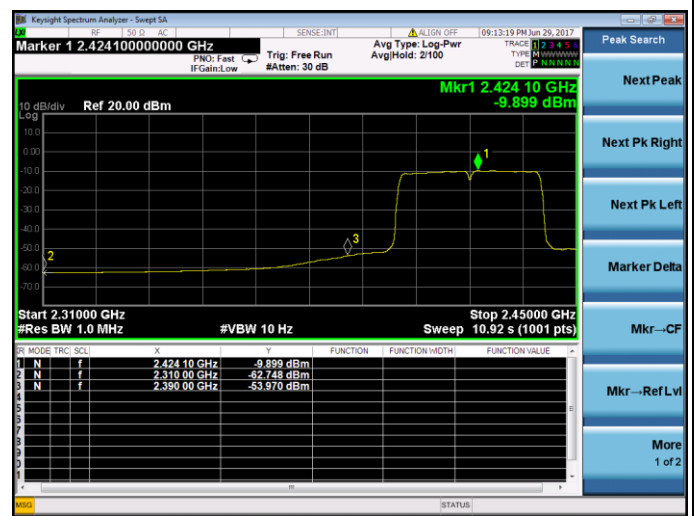
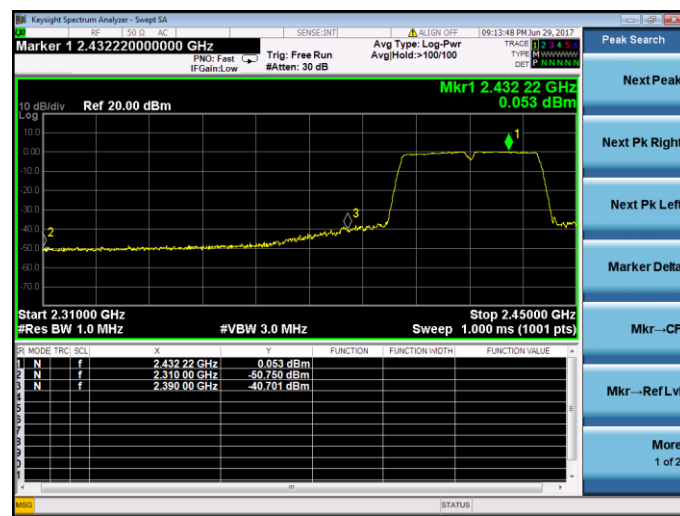


802.11n-HT20-High channel(Peak)

802.11n-HT20-High channel(Average)

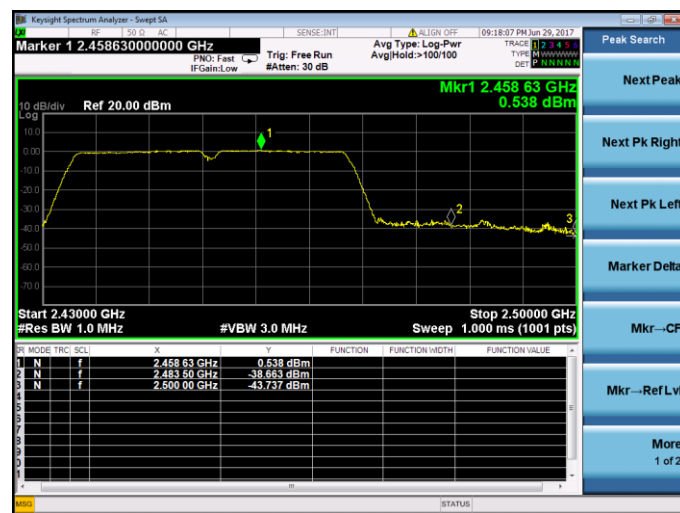
Band-edge measurements for conducted emissions

Test plot of Restricted Bands



802.11n-HT40-Low channel(Peak)

802.11n-HT40-Low channel(Average)



802.11n-HT40-High channel(Peak)

802.11n-HT40-High channel(Average)

5.9. Antenna Requirements

5.9.1 Standard Applicable

According to antenna requirement of §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 manufacturer may design the unit so that a broken antenna can be re-placed by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

And according to §15.247(4)(1), system operating in the 2400-2483.5MHz bands that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

5.9.2 Antenna Connected Construction

5.9.2.1. Standard Applicable

According to § 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.

5.9.2.2. Antenna Connector Construction

The gains of antenna used for transmitting is 3.3dBi, and the antenna is an external antenna connect to PCB board and no consideration of replacement. Please see EUT photo for details.

5.9.2.3. Results: Compliance.

Measurement parameters:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	3 MHz
Video bandwidth:	3 MHz
Trace-Mode:	Max hold

Note: The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module. For normal WLAN devices, the 802.11b mode is used.

Limits:

FCC	IC
Antenna Gain	
6.0dBi	

Tnom	Vnom	lowest channel 2412 MHz	middle channel 2437 MHz	highest channel 2462 MHz
Conducted power [dBm] Measured with 802.11b modulation		16.45	16.65	16.26
Radiated power [dBm] Measured with 802.11b modulation		19.560	19.790	19.462
Gain [dBi] Calculated		3.110	3.140	3.202
Measurement uncertainty			± 1.5 dB (cond.) / ± 3.0 dB (rad.)	

Result: -/-

6. LIST OF MEASURING EQUIPMENTS

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Cal Date	Due Date
EMC Receiver	R&S	ESCS 30	100174	9kHz – 2.75GHz	June 17, 2017	June 16, 2018
Signal analyzer	Agilent	E4448A(External mixers to 40GHz)	US44300469	9kHz~40GHz	July 15, 2017	July 14, 2018
Signal analyzer	Agilent	N9020A	MY50510140	9kHz~26.5GHz	October 27, 2016	October 27, 2017
LISN	MESS Tec	NNB-2/16Z	99079	9KHz-30MHz	June 17, 2017	June 16, 2018
LISN (Support Unit)	EMCO	3819/2NM	9703-1839	9KHz-30MHz	June 17, 2017	June 16, 2018
RF Cable-CON	UTIFLEX	3102-26886-4	CB049	9KHz-30MHz	June 17, 2017	June 16, 2018
ISN	SCHAFFNER	ISN ST08	21653	9KHz-30MHz	June 17, 2017	June 16, 2018
3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	30M-18GHz 3m	June 17, 2017	June 16, 2018
Amplifier	SCHAFFNER	COA9231A	18667	9kHz-2GHz	June 17, 2017	June 16, 2018
Amplifier	Agilent	8449B	3008A02120	1GHz-26.5GHz	July 16, 2016	July 15, 2017
Amplifier	MITEQ	AMF-6F-260400	9121372	26.5GHz-40GHz	July 16, 2016	July 15, 2017
Loop Antenna	R&S	HFH2-Z2	860004/001	9k-30MHz	June 17, 2017	June 16, 2018
By-log Antenna	SCHWARZBECK	VULB9163	9163-470	30MHz-1GHz	June 09, 2017	June 08, 2018
Horn Antenna	EMCO	3115	6741	1GHz-18GHz	June 09, 2017	June 08, 2018
Horn Antenna	SCHWARZBECK	BBHA9170	BBHA9170154	15GHz-40GHz	June 09, 2017	June 08, 2018
RF Cable-R03m	Jye Bao	RG142	CB021	30MHz-1GHz	June 17, 2017	June 16, 2018
RF Cable-HIGH	SUHNER	SUCOFLEX 106	03CH03-HY	1GHz-40GHz	June 17, 2017	June 16, 2018
Power Meter	R&S	NRVS	100444	DC-40GHz	June 17, 2017	June 16, 2018
Power Sensor	R&S	NRV-Z51	100458	DC-30GHz	June 17, 2017	June 16, 2018
Power Sensor	R&S	NRV-Z32	10057	30MHz-6GHz	June 17, 2017	June 16, 2018
AC Power Source	HPC	HPA-500E	HPA-9100024	AC 0~300V	June 17, 2017	June 16, 2018
DC power Source	GW	GPC-6030D	C671845	DC 1V-60V	June 17, 2017	June 16, 2018
Temp. and Humidity Chamber	Giant Force	GTH-225-20-S	MAB0103-00	N/A	June 17, 2017	June 16, 2018
RF CABLE-1m	JYE Bao	RG142	CB034-1m	20MHz-7GHz	June 17, 2017	June 16, 2018
RF CABLE-2m	JYE Bao	RG142	CB)35-2m	20MHz-1GHz	June 17, 2017	June 16, 2018
EMI Test Software	AUDIX	E3	N/A	N/A	N/A	N/A

Note: All equipment through GRGT EST calibration

7. TEST SETUP PHOTOGRAPHS OF EUT

Please refer to separated files for Test Setup Photos of the EUT.

8. EXTERIOR PHOTOGRAPHS OF THE EUT

Please refer to separated files for External Photos of the EUT.

9. INTERIOR PHOTOGRAPHS OF THE EUT

Please refer to separated files for Internal Photos of the EUT.

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