FCC 47 CFR PART 15 SUBPART E AND ANSI C63.4:2009
TEST REPORT

For

Nuvola

Model : NP-1

Trade Name : NANOTECH

Issued for

NanoTech Entertainment

2450 Kruse Drive. San Jose, CA 95131

Issued by

Compliance Certification Services Inc.
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Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	04/02/2014	Initial Issue	All Page 75	Michelle Chiu

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1. TEST REPORT CERTIFICATION

Applicant	：	NanoTech Entertainment
Address	：	2450 Kruse Drive. San Jose, CA 95131
Equipment Under Test	：	Nuvola
Model	：	NP-1
Trade Name	：	NANOTECH
Tested Date	：	November 05 ~ 18, 2013 ; March 26 ~ April 02,2014

APPLICABLE STANDARD	
Standard	**Test Result**
FCC Part 15 Subpart E AND ANSI C63.4:2009	PASS

WE HEREBY CERTIFY THAT: The above equipment has been tested by Compliance Certification Services Inc., and found compliance with the requirements set forth in the technical standards mentioned above. The results of testing in this report apply only to the product/system, which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Approved by:

Sb. Lu
Sr. Engineer

Reviewed by:

Gundam Lin
Sr. Engineer

2. EUT DESCRIPTION

Product Name	Nuvola
Model Number	NP-1
Identify Number	T140326D06-B
Received Date	November 05, 2013
Frequency Range	IEEE 802.11a, 802.11n HT20 : 5180MHz ~ 5240MHz IEEE 802.11n HT40 : 5190MHz ~ 5230MHz
Transmit Power	IEEE 802.11a : 14.84dBm (0.0304W) IEEE 802.11n HT20 : 14.91dBm (0.0310W) IEEE 802.11n HT40 : 16.63dBm (0.0460W)
Channel Spacing	IEEE 802.11a, 802.11n HT20 : 20MHz IEEE 802.11n HT40 : 40MHz
Channel Number	IEEE 802.11a, 802.11n HT20 : 4 Channels IEEE 802.11n HT40 : 2 Channels
Transmit Data Rate	IEEE 802.11a : 54, 48, 36, 24, 18, 12, 9, 6 Mbps IEEE 802.11n HT20 : 144.4, 130, 117, 115.6, 104, 86.7, 78, 72.2, 65.0, 58.5, 57.8, 52, 43.3, 39, 28.9, 26, 21.7, 19.5, 14.4, 13, 7.2, 6.5 Mbps IEEE 802.11n HT40 : 300, 270, 243, 240, 216, 180, 162, 150, 135, 121.5, 120, 108, 90, 81, 60, 54, 45, 40.5, 30, 27, 15, 13.5 Mbps
Type of Modulation	IEEE 802.11a : OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n HT20/40 : OFDM (64QAM, 16QAM, QPSK, BPSK)
Frequency Selection	by software / firmware
Antenna Type	PCB Antenna × 2, Ant 1 (Chain 1), Antenna Gain 3.20 dBi, Ant 2 (Chain 2), Antenna Gain 3.17 dBi
Power Rating	5.2Vdc
Test Voltage	120Vac, 60Hz
DC Power Cable Type	Non-shielded cable 1.5m (Non-detachable)
I/O Port	Micro SD Port × 1, HDMI Port × 1, RJ-45 Port × 1, USB 2.0 Port × 1, USB 3.0 Port × 1, Power Port × 1

Power Adapter :

No.	Manufacturer	Model No.	Power Input	Power Output
1	DVE	DSA-24CA-05 052300	100-240Vac, 50/60Hz, 0.8A	+5.2Vdc, 3A

Operation Frequency :

UNLICENSED NATIONAL INFORMATION INFRASTRUCTURE (U-NII)					
CHANNEL	**MHz**	**CHANNEL**	**MHz**	**CHANNEL**	**MHz**
36	5180	40	5200	46	5230
38	5190	44	5220	48	5240

Remark :

1. The sample selected for test was engineering sample that approximated to production product and was provided by manufacturer.

2. For more details, please refer to the User's manual of the EUT.

3.This submittal(s) (test report) is intended for FCC ID: 2AB5MNP-11001 filing to comply with Section 15.207, 15.209 and 15.407 of the FCC Part 15, Subpart E Rules.

4. This report is modified from T131106D02-RP1-2.

5. The EUT has two appearence, one for hanging on the wall, the other one for flat. The detail please refer to photos.

3. DESCRIPTION OF TEST MODES

The EUT is an 802.11n MIMO transceiver in Nuvola form factor.

For IEEE 802.11a mode (1TX / 1RX) : Chain 1(Ant 1) transmit/receive.

For IEEE 802.11n HT20/HT40 mode (2TX / 2RX) :

Chain 1(Ant 1) & Chain 2(Ant 2) transmit/receive.

Conducted Emission / Radiated Emission Test (Below 1 GHz)

1. The following test modes were scanned during the preliminary test:

No.	Pre-Test Mode
1	TX Mode

2. After the preliminary scan, the following test mode was found to produce the highest emission level.

Final Test Mode		
Emission	Radiated Emission	TX Mode
	Conducted Emission	TX Mode

Remark : *Then, the above highest emission mode of the configuration of the EUT and cable was chosen for all final test items.*

Conducted / Radiated Emission Test (Above 1 GHz)

IEEE 802.11a, 802.11n HT20 mode

The EUT had been tested under operating condition.

There are three channels have been tested as following :

Channel	Frequency (MHz)
Low	5180
Middle	5220
High	5240

IEEE 802.11a mode : 6Mbps data rate (worst case) were chosen for full testing.

IEEE 802.11n HT20 mode : 13Mbps data rate (worst case) were chosen for full testing.

IEEE 802.11n HT40 mode

The EUT had been tested under operating condition.

There are two channels have been tested as following :

Channel	Frequency (MHz)
Low	5190
High	5230

IEEE 802.11n HT40 mode : 27Mbps data rate (worst case) were chosen for full testing.

4. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4: 2009 and FCC CFR 47, 15.207, 15.209 and 15. 407.

5. FACILITIES AND ACCREDITATION

5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

NO. 989-1 Wen Shan Rd., Shang Shan Village,
Qionglin Shiang Hsinchu County 30741, Taiwan, R.O.C

The sites are constructed in conformance with the requirements of ANSI C63.4:2009 and CISPR 22. All receiving equipment conforms to CISPR 16-1-1, CISPR 16-1-2, CISPR 16-1-3, CISPR 16-1-4, CISPR 16-1-5.

5.2 ACCREDITATIONS

Our laboratories are accredited and approved by the following approval agencies according to ISO/IEC 17025.

Taiwan	TAF

The measuring facility of laboratories has been authorized or registered by the following approval agencies.

Canada	INDUSTRY CANADA
Japan	VCCI
Taiwan	BSMI
USA	FCC MRA

Copies of granted accreditation certificates are available for downloading from our web site, http:///www.ccsrf.com

5.3 MEASUREMENT UNCERTAINTY

The following table is for the measurement uncertainty, which is calculated as per the document CISPR 16-4-2.

PARAMETER	UNCERTAINTY
Semi Anechoic Chamber (966 Chamber_B) / Radiated Emission, 30 to 1000 MHz	+/- 3.97
Semi Anechoic Chamber (966 Chamber_B) / Radiated Emission, 1 to 18GHz	+/- 3.58
Semi Anechoic Chamber (966 Chamber_B) / Radiated Emission, 18 to 26 GHz	+/- 3.59
Semi Anechoic Chamber (966 Chamber_B) / Radiated Emission, 26 to 40 GHz	+/- 3.81
Conducted Emission (Mains Terminals), 9kHz to 30MHz	+/- 2.48

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Consistent with industry standard (e.g. CISPR 22, clause 11, Measurement Uncertainty) determining compliance with the limits shall be base on the results of the compliance measurement. Consequently the measure emissions being less than the maximum allowed emission result in this be a compliant test or passing test.

The acceptable measurement uncertainty value without requiring revision of the compliance statement is base on conducted and radiated emissions being less than U_{CISPR} which is 3.6dB and 5.2dB respectively. CCS values (called U_{Lab} in CISPR 16-4-2) is less than U_{CISPR} as shown in the table above. Therefore, MU need not be considered for compliance.

6. SETUP OF EQUIPMENT UNDER TEST

SUPPORT EQUIPMENT

No.	Product	Manufacturer	Model No.	Serial No.	FCC ID
1	Notebook PC	HP	ProBook 4421s	CNF03242PJ	DoC

SETUP DIAGRAM FOR TESTS

EUT & peripherals setup diagram is shown in appendix setup photos.

EUT OPERATING CONDITION

1. EUT & peripherals setup diagram is shown in appendix setup photos.
2. Run MS-DOS➔C: foxconn\adb
3. Keyin:adb shell
4. Keyin:ifconfig wlan0 up
5. Run MS-DOS➔C: foxconn> Enter the command
6. TX Mode:

```
adb shell wl pkteng_stop tx
adb shell wl ver
adb shell wl mpc 0
adb shell wl country ALL
adb shell wl up
adb shell wl phy_oclscdenable 0
adb shell wl interference 0
adb shell wl scansuppress 1
adb shell wl isup
adb shell wl down
adb shell wl band xx                          # b=2G, a=5G
adb shell wl mimo_preamble 0
adb shell wl mimo_bw_cap xx                   # 2=2G&5G for HT40
adb shell wl mimo_txbw xx
adb shell wl chanspec -c xx -b xx -w 20       # c xx=channel ,b xx= band
adb shell wl up
adb shell wl phy_watchdog 0
adb shell wl sgi_tx 0
adb shell wl nrate -m xx -s 3                 # r xx=b/g rate,m xx=n rate
adb shell wl down
adb shell wl up
adb shell wl txchain xx                       # 1=ant1,2=ant2,3=2TX
adb shell wl rxchain xx                       # 1=ant1,2=ant2,3=2RX
adb shell wl txpwr1 -o -q xx                  # power set 4=1dBm
```

adb shell wl phy_forcecal 1

adb shell wl pkteng_start 10:20:30:40:50:60 tx 100 1500 0

⇨ **Tx Data Rate:** 6Mbps Bandwidth 20 (IEEE 802.11a mode)

6.5Mbps Bandwidth 20 (IEEE 802.11n HT20 mode)

27Mbps Bandwidth 40 (IEEE 802.11n HT40 mode)

⇨ **Power control**

IEEE 802.11a Channel Low (5180MHz) TX Power 58

IEEE 802.11a Channel Mid (5220MHz) TX Power 58

IEEE 802.11a Channel High (5240MHz) TX Power 58

IEEE 802.11n HT20 Cannel Low (5180MHz) TX Power 46/46

IEEE 802.11n HT20 Channel Mid (5220MHz) TX Power 48/48

IEEE 802.11n HT20 Channel High (5240MHz) TX Power 48/48

IEEE 802.11n HT40 Channel Low (5190MHz) TX Power 52/52

IEEE 802.11n HT40 Channel High (5230MHz) TX Power 56/56

8. All of the functions are under run.
9. Start test.

7. FCC PART 15.407 REQUIREMENTS

7.1 26dB BANDWIDTH

LIMITS

§ 15.303 (c), For purposes of this subpart, the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Determination of the emissions bandwidth is based on the use of measurement instrumentation employing a peak detector function with an instrument resolutions bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

TEST EQUIPMENT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	MY43360132	06/10/2014

Remark: *Each piece of equipment is scheduled for calibration once a year.*

TEST SETUP

TEST PROCEDURE

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low-loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW > 1%EBW, VBW > RBW, Span = 50MHz and Sweep = auto.
4. Mark the –26dBc (upper and lower) frequency of the peak value.
5. Repeat until all the rest channels were investigated.

TEST RESULTS

IEEE 802.11a Mode

Channel	Channel Frequency (MHz)	26dB Bandwidth (MHz)
		Chain 1
Low	5180	20.04
Middle	5220	19.72
High	5240	19.88

IEEE 802.11n HT20 Mode (Two TX)

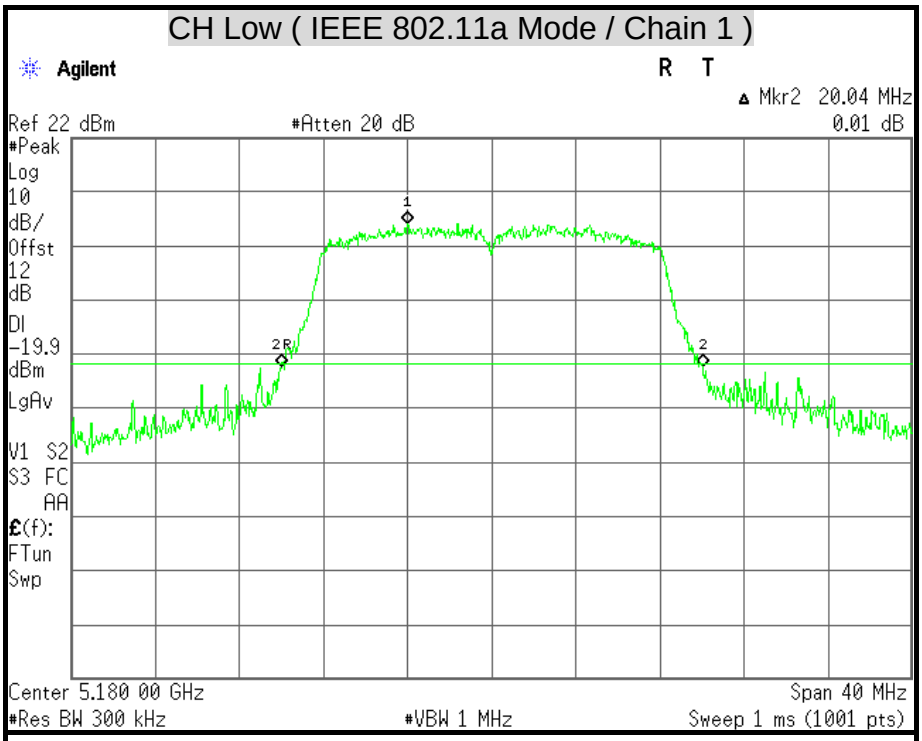
Channel	Channel Frequency (MHz)	26dB Bandwidth (MHz)	
		Chain 1	Chain 2
Low	5180	20.24	19.92
Middle	5220	20.52	20.12
High	5240	20.48	20.00

IEEE 802.11n HT40 Mode (Two TX)

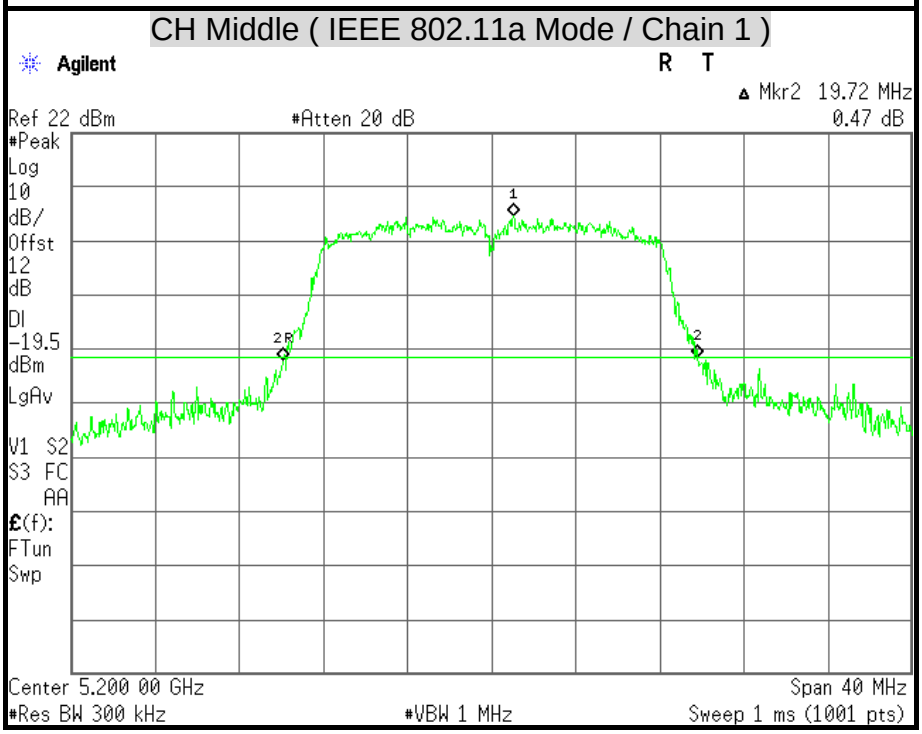
Channel	Channel Frequency (MHz)	26dB Bandwidth (MHz)	
		Chain 1	Chain 2
Low	5190	45.92	45.52
High	5230	45.76	45.76

26dB BANDWIDTH

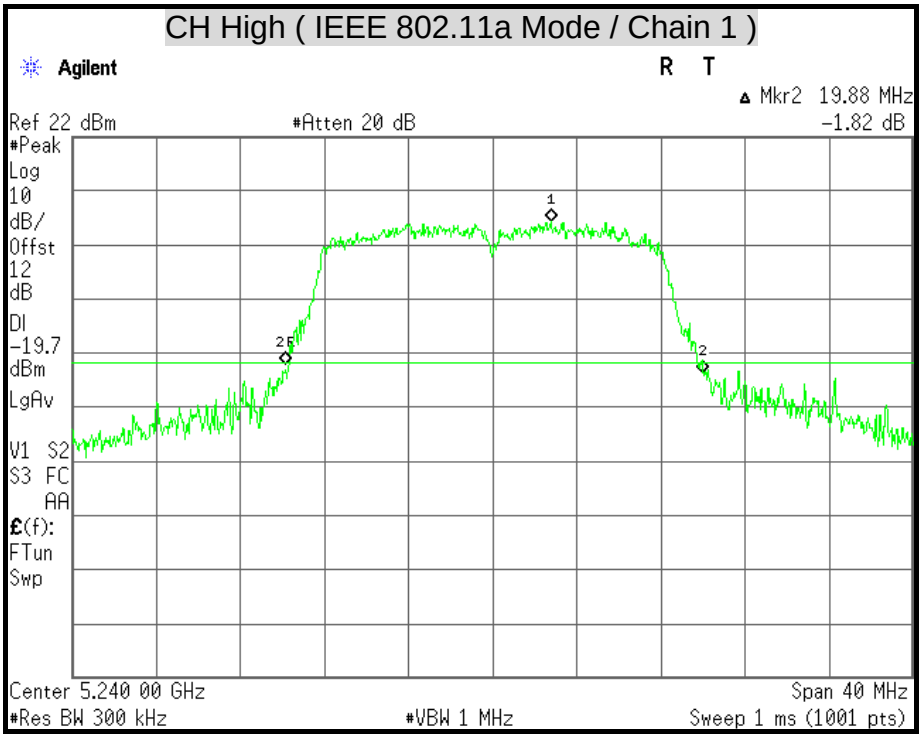
CH Low (IEEE 802.11a Mode / Chain 1)



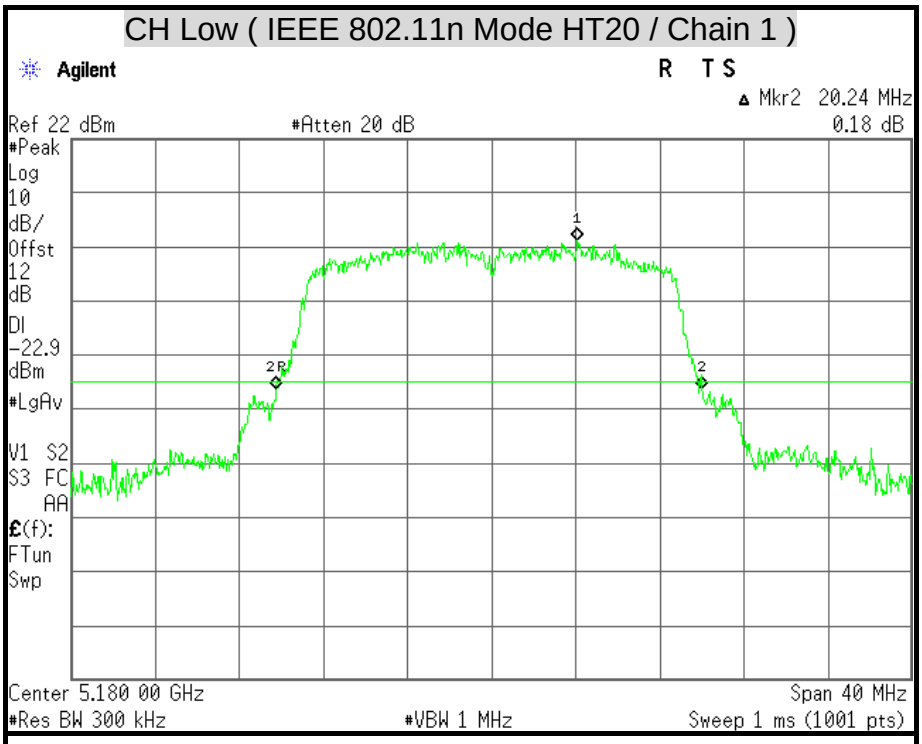
CH Middle (IEEE 802.11a Mode / Chain 1)



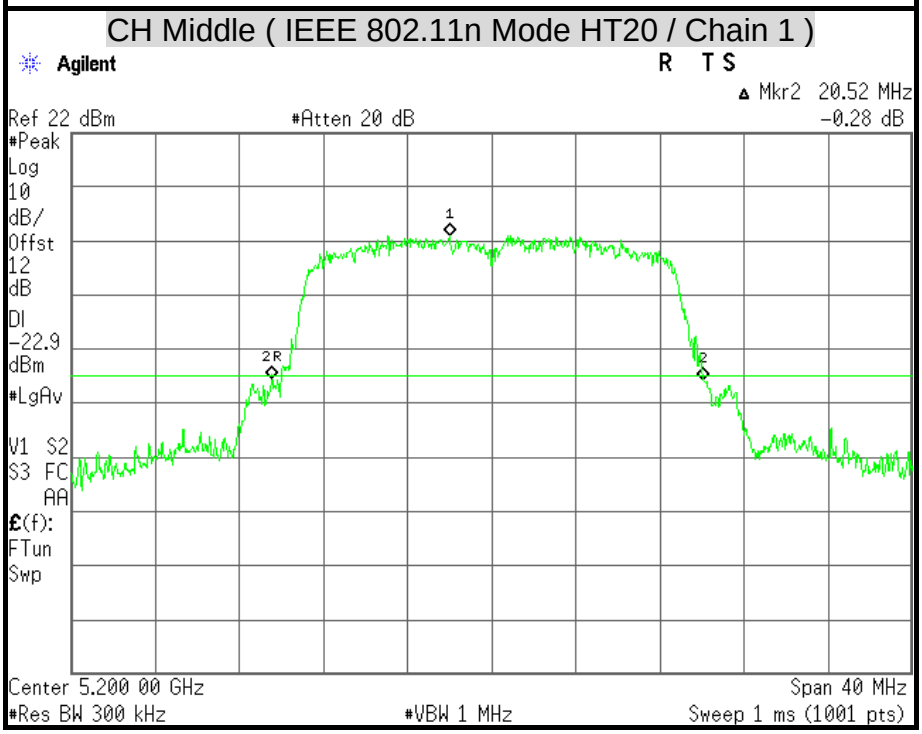
CH High (IEEE 802.11a Mode / Chain 1)



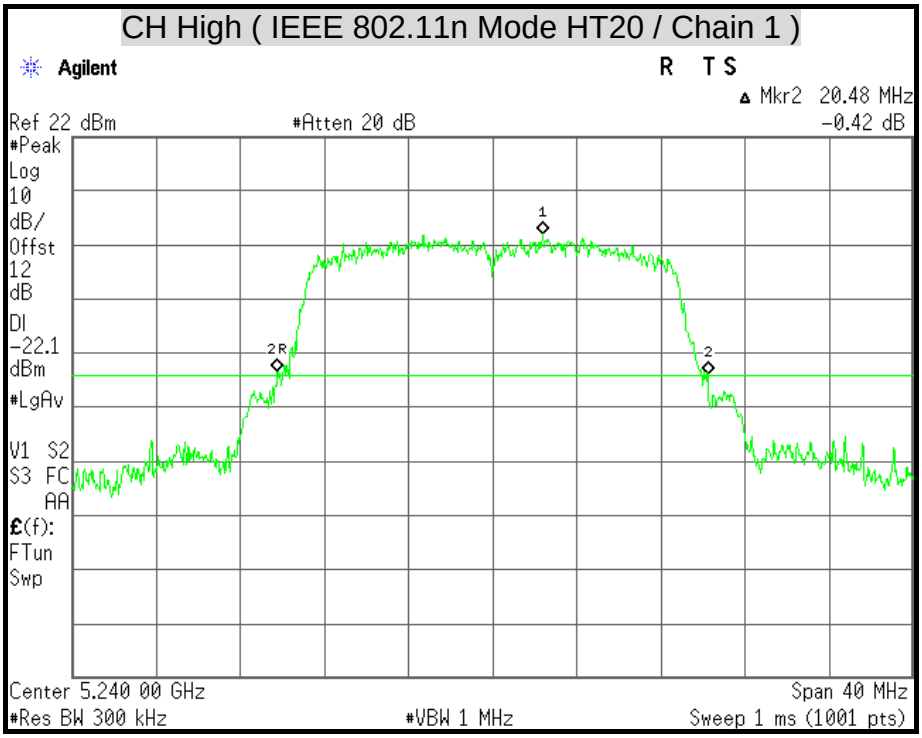
CH Low (IEEE 802.11n Mode HT20 / Chain 1)



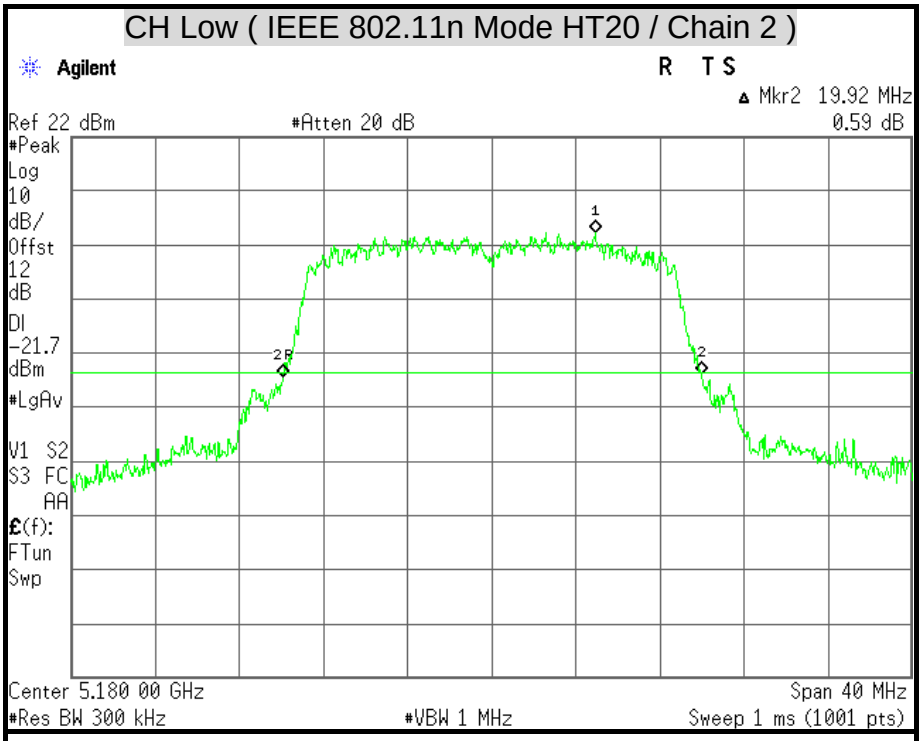
CH Middle (IEEE 802.11n Mode HT20 / Chain 1)



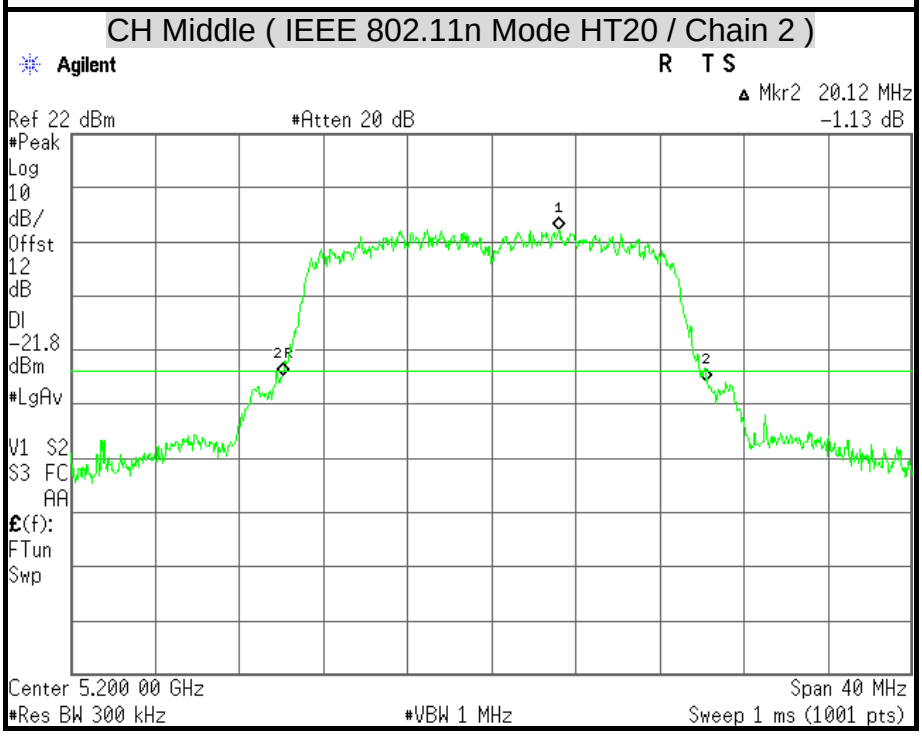
CH High (IEEE 802.11n Mode HT20 / Chain 1)



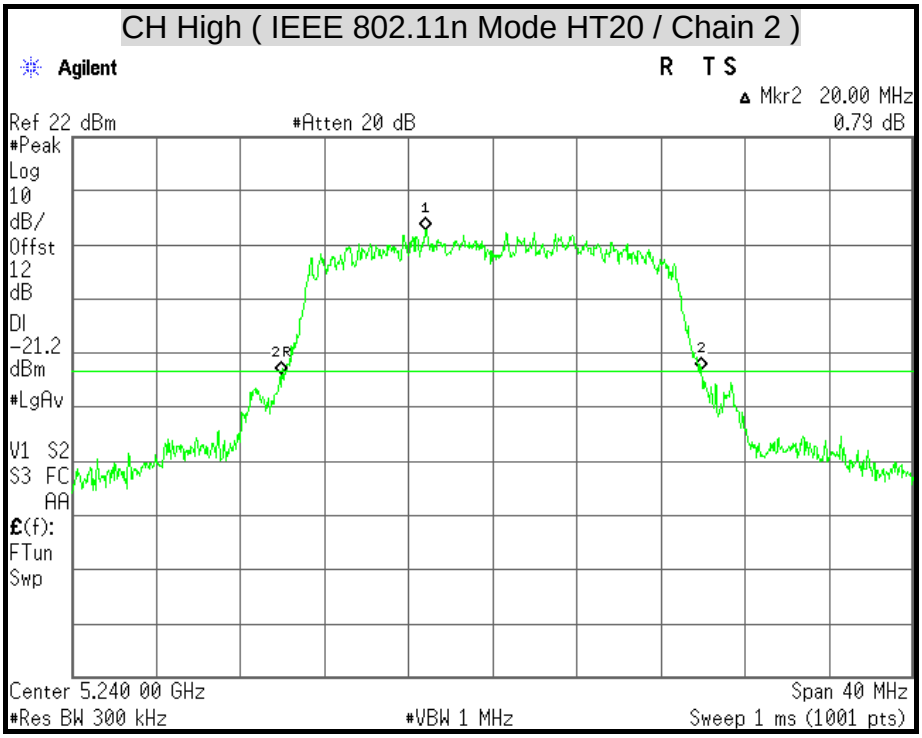
CH Low (IEEE 802.11n Mode HT20 / Chain 2)



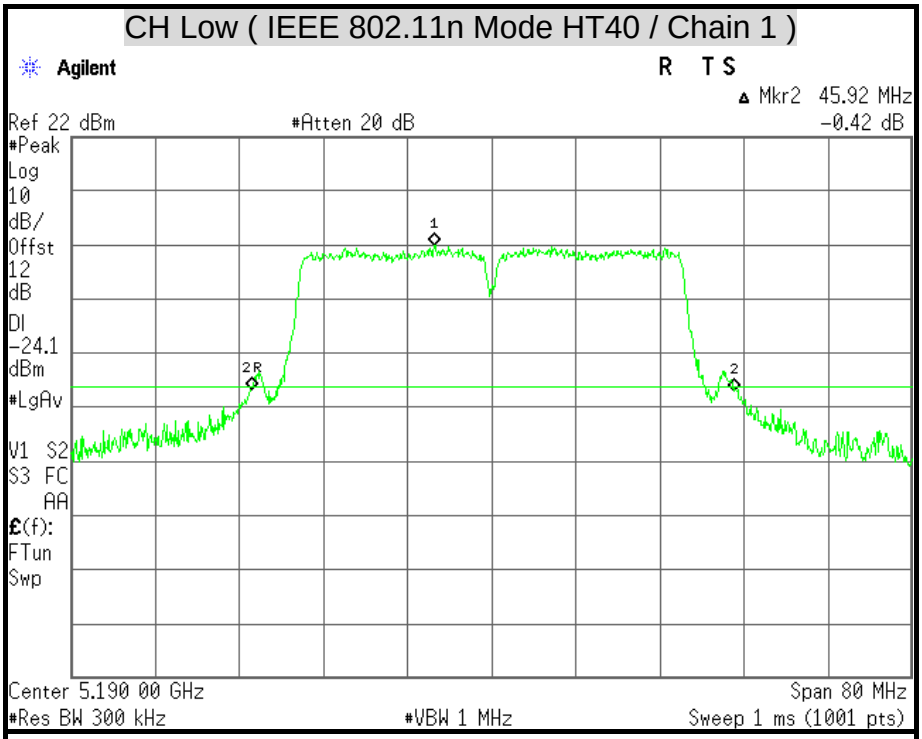
CH Middle (IEEE 802.11n Mode HT20 / Chain 2)



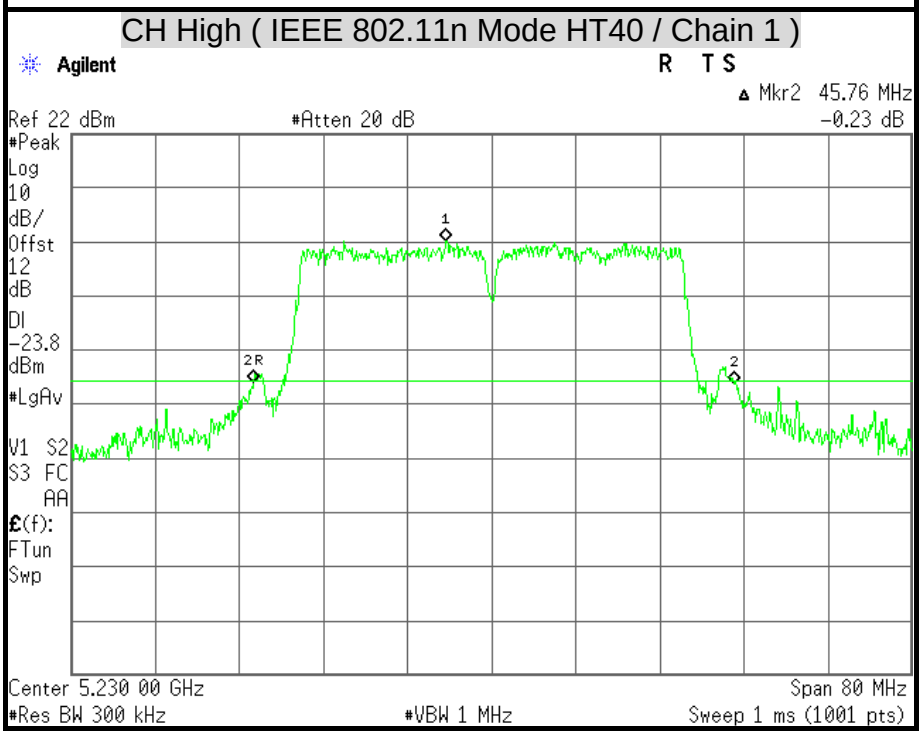
CH High (IEEE 802.11n Mode HT20 / Chain 2)



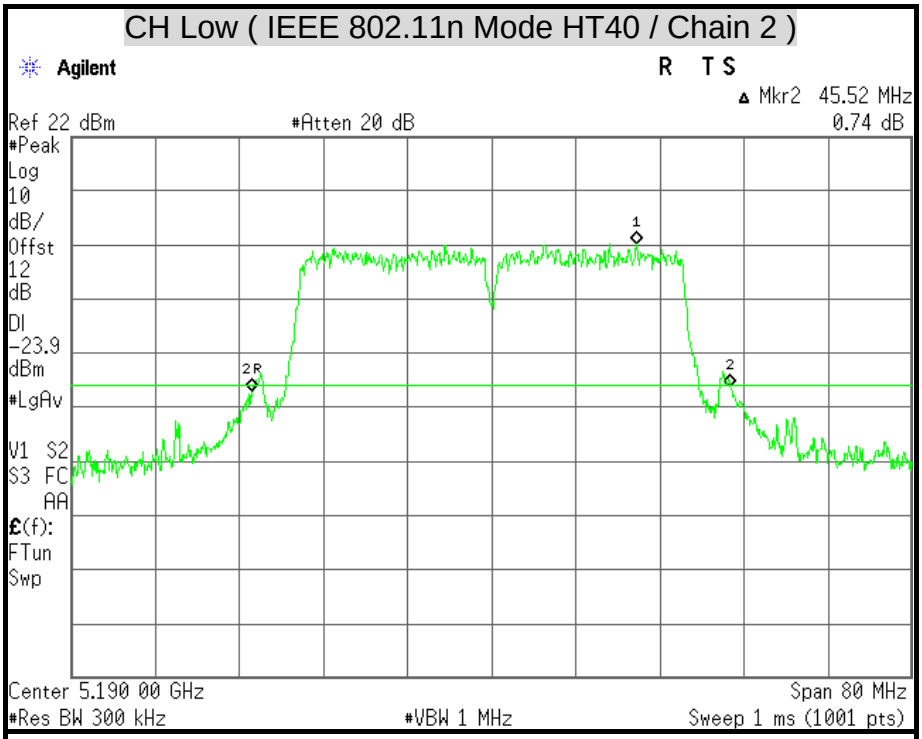
CH Low (IEEE 802.11n Mode HT40 / Chain 1)



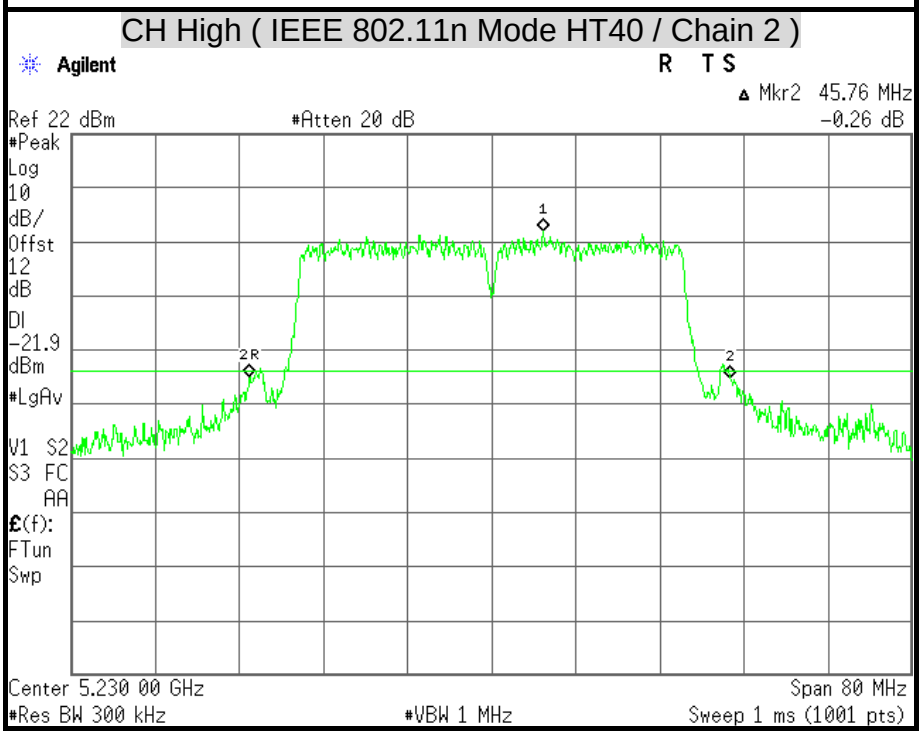
CH High (IEEE 802.11n Mode HT40 / Chain 1)



CH Low (IEEE 802.11n Mode HT40 / Chain 2)



CH High (IEEE 802.11n Mode HT40 / Chain 2)



7.2 MAXIMUM CONDUCTED OUTPUT POWER

LIMITS

§ 15.407(a)

(1) For the band 5.15-5.25 GHz, the peak transmit power over the frequency band of operation shall not exceed the lesser of 50mW (17dBm) or 4dBm + 10log B, where B is the 26dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4dBm in any 1 MHz band.

(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10log B, where B is the 26 dB emission bandwidth in MHz.

If transmitting antennas of directional gain greater than 6dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

The peak power shall not exceeded the limit as follows:

IEEE 802.11a Mode

Channel	Channel Frequency (MHz)	26dB Bandwidth (B) (MHz)	10 Log B (dB)	4dBm + 10 Log B (dBm)	Maximum Conducted Output Power Limit (dBm)
		Chain 1			
Low	5180	20.04	13.01898	17.01898	17
Middle	5220	19.72	12.94907	16.94907	17
High	5240	19.88	12.98416	16.98416	17

IEEE 802.11n HT20 Mode (Two TX)

Channel	Channel Frequency (MHz)	26dB Bandwidth (B) (MHz)	10 Log B (dB)	4dBm + 10 Log B (dBm)	Maximum Conducted Output Power Limit (dBm)
		Chain 1			
Low	5180	20.24	13.06211	17.06211	17
Middle	5220	20.52	13.12177	17.12177	17
High	5240	20.48	13.11330	17.11330	17

Channel	Channel Frequency (MHz)	26dB Bandwidth (B) (MHz)	10 Log B (dB)	4dBm + 10 Log B (dBm)	Maximum Conducted Output Power Limit (dBm)
		Chain 2			
Low	5180	19.92	12.99289	16.99289	17
Middle	5220	20.12	13.03628	17.03628	17
High	5240	20.00	13.01030	17.01030	17

IEEE 802.11n HT40 Mode (Two TX)

Channel	Channel Frequency (MHz)	26dB Bandwidth (B) (MHz)	10 Log B (dB)	4dBm + 10 Log B (dBm)	Maximum Conducted Output Power Limit (dBm)
		Chain 1			
Low	5190	45.92	16.62002	20.62002	17
High	5230	45.76	16.60486	20.60486	17

Channel	Channel Frequency (MHz)	26dB Bandwidth (B) (MHz)	10 Log B (dB)	4dBm + 10 Log B (dBm)	Maximum Conducted Output Power Limit (dBm)
		Chain 2			
Low	5190	45.52	16.58202	20.58202	17
High	5230	45.76	16.60486	20.60486	17

TEST EQUIPMENT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Power Meter	ANRITSU	ML2495A	1149001	12/06/2013
Power Sensor	ANRITSU	MA2411B	1126148	12/07/2013

Remark: *Each piece of equipment is scheduled for calibration once a year.*

TEST SETUP

TEST PROCEDURE

The transmitter output is connected to the Power Meter. The Power Meter is set to the power detection.

TEST RESULTS

IEEE 802.11a Mode

Channel	Channel Frequency (MHz)	Average Power Chain 1		Average Power Limit		Pass / Fail
		(dBm)	(W)	(dBm)	(W)	
Low	5180	14.75	0.0299	17	0.0501	PASS
Middle	5220	14.68	0.0294	16.94907	0.0495	PASS
High	5240	14.84	0.0304	16.98416	0.0499	PASS

Remark:
1. *At finial test to get the worst-case emission at 6Mbps.*
2. *The cable assembly insertion loss of 12 dB (including 10 dB pad and 2 dB cable) was Entered as an offset in the power meter to allow for direct reading of power.*

IEEE 802.11n HT20 Mode (Two TX)

Channel	Channel Frequency (MHz)	Average Power (dBm)		Total Power		Average Power Limit		Pass / Fail
		Chain 1	Chain 2	(dBm)	(W)	(dBm)	(W)	
Low	5180	11.64	11.56	14.61	0.0289	16.99289	0.0500	PASS
Middle	5220	11.79	11.78	14.79	0.0301	17	0.0501	PASS
High	5240	11.93	11.86	14.91	0.0310	17	0.0501	PASS

Remark:
1. *At finial test to get the worst-case emission at 13Mbps.*
2. *The cable assembly insertion loss of 12 dB (including 10 dB pad and 2 dB cable) was Entered as an offset in the power meter to allow for direct reading of power.*
3. *Array gain = 0 dB for $N_{ANT} \leq 4$, power limit do not reduce.*
4. *Total peak power = Chain 1 + Chain 2.*

IEEE 802.11n HT40 Mode (Two TX)

Channel	Channel Frequency (MHz)	Average Power (dBm)		Total Power		Average Power Limit		Pass / Fail
		Chain 1	Chain 2	(dBm)	(W)	(dBm)	(W)	
Low	5190	12.47	12.30	15.40	0.0347	17	0.0501	PASS
High	5230	13.68	13.56	16.63	0.0460	17	0.0501	PASS

Remark:
1. *At finial test to get the worst-case emission at 27Mbps.*
2. *The cable assembly insertion loss of 12 dB (including 10 dB pad and 2 dB cable) was Entered as an offset in the power meter to allow for direct reading of power.*
3. *Array gain = 0 dB for $N_{ANT} \leq 4$, power limit do not reduce.*
4. *Total peak power = Chain 1 + Chain 2.*

7.3 PEAK POWER SPECTRAL DENSITY

LIMITS

§ 15.407 (a)

(1) For the band 5.15-5.25 GHz, the peak power spectral density shall not exceed 4dBm in any 1MHz band.

(2) For the band 5.25-5.35 GHz and 5.47-5725 GHz, the peak power spectral density shall not exceed 11dBm in any 1MHz band.

If transmitting antennas of directional gain greater than 6dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

TEST EQUIPMENT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	MY43360132	06/10/2014

Remark: *Each piece of equipment is scheduled for calibration once a year.*

TEST SETUP

TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
   Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
2. Set the spectrum analyzer as RBW = 1MHz, VBW = 3MHz, Span = Sweep= AUTO
3. Record the max. reading.
4. Repeat the above procedure until the measurements for all frequencies are completed.

TEST RESULTS

IEEE 802.11a Mode

Channel	Channel Frequency (MHz)	PPSD (dBm)	Minimum Limit (dBm)	Pass / Fail
		Chain 1		
Low	5180	3.54	4	PASS
Middle	5220	3.37	4	PASS
High	5240	3.66	4	PASS

Remark:

1. *At finial test to get the worst-case emission at 6Mbps.*
2. *The cable assembly insertion loss of 12 dB (including 10 dB pad and 2dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.*

IEEE 802.11n HT20 Mode (Two TX)

Channel	Channel Frequency (MHz)	PPSD (dBm)		Total PPSD (dBm)	Minimum Limit (dBm)	Pass / Fail
		Chain 1	Chain 2			
Low	5180	0.26	0.40	3.34	3.8	PASS
Middle	5220	0.60	0.71	3.67	3.8	PASS
High	5240	0.81	0.69	3.76	3.8	PASS

Remark:

1. *At finial test to get the worst-case emission at 13Mbps.*
2. *The cable assembly insertion loss of 12 dB (including 10 dB pad and 2dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.*
3. *The maximum antenna gain is 6.2dBi which is more than 6dBi, the limit should be 3.8dBm.*
4. *Total power spectral density = Chain 1 + Chain 2.*

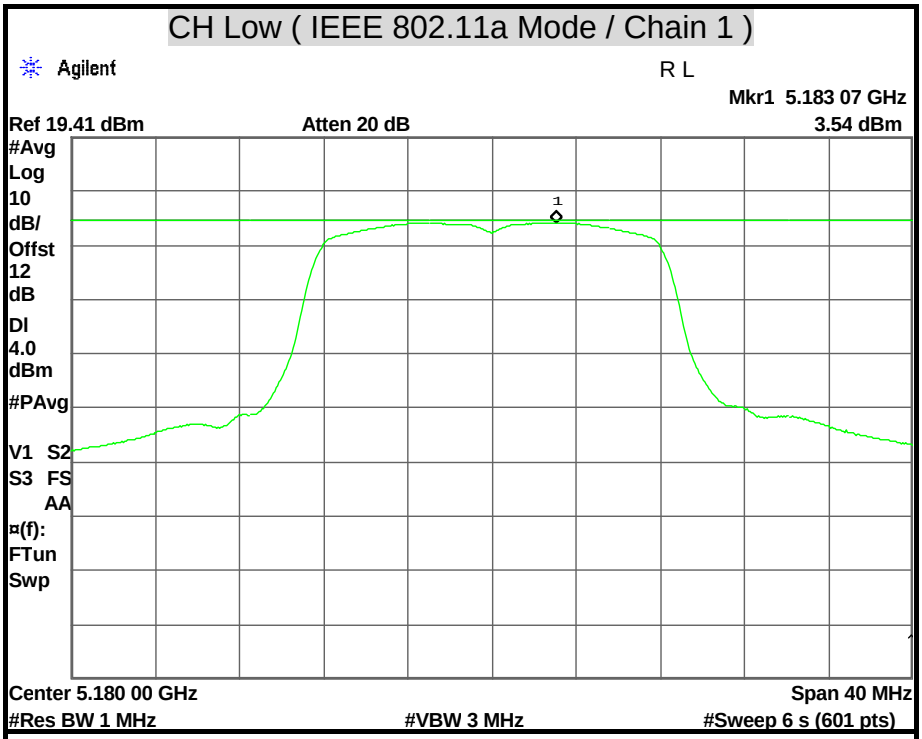
IEEE 802.11n HT40 Mode (Two TX)

Channel	Channel Frequency (MHz)	PPSD (dBm)		Total PPSD (dBm)	Minimum Limit (dBm)	Pass / Fail
		Chain 1	Chain 2			
Low	5190	-2.36	-2.16	0.75	3.8	PASS
High	5230	-0.95	-1.00	2.04	3.8	PASS

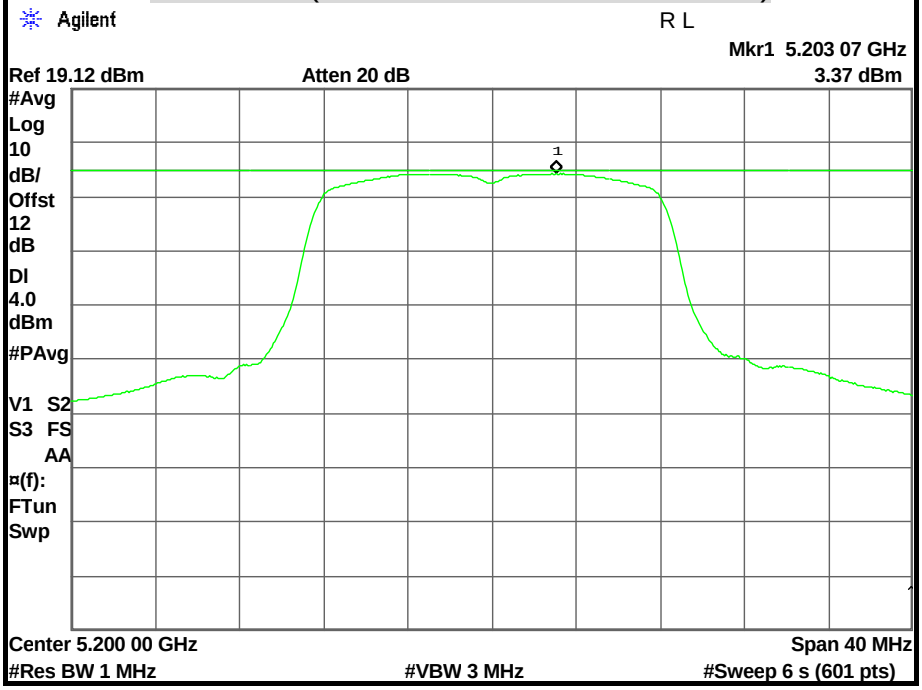
Remark:

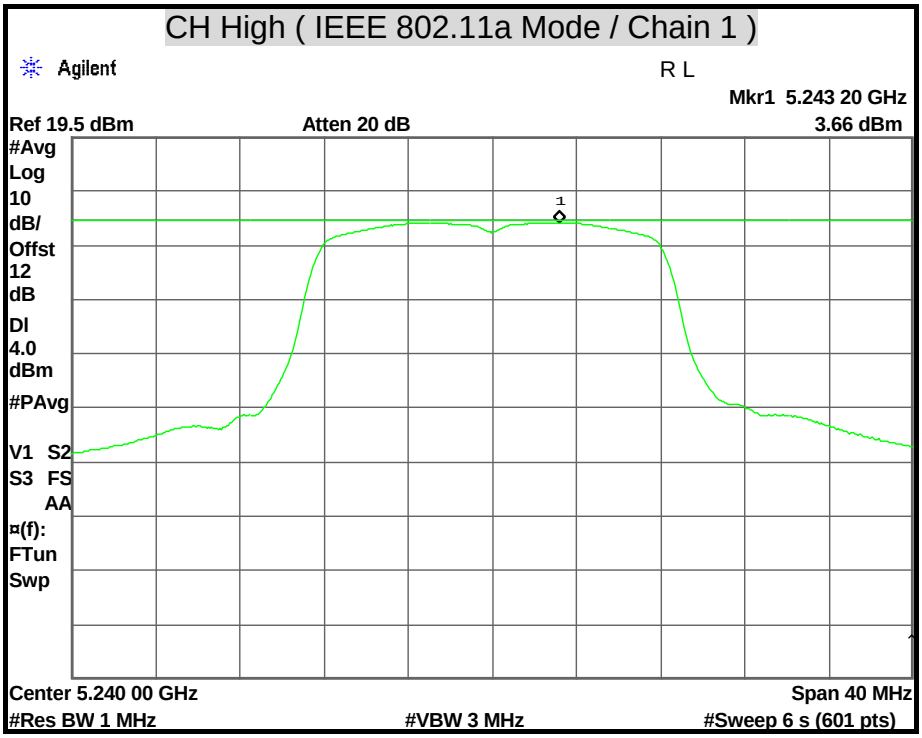
1. *At finial test to get the worst-case emission at 27Mbps.*
2. *The cable assembly insertion loss of 12 dB (including 10 dB pad and 2dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.*
3. *The maximum antenna gain is 6.2dBi which is more than 6dBi, the limit should be 3.8dBm.*
4. *Total power spectral density = Chain 1 + Chain 2.*

CH Low (IEEE 802.11a Mode / Chain 1)

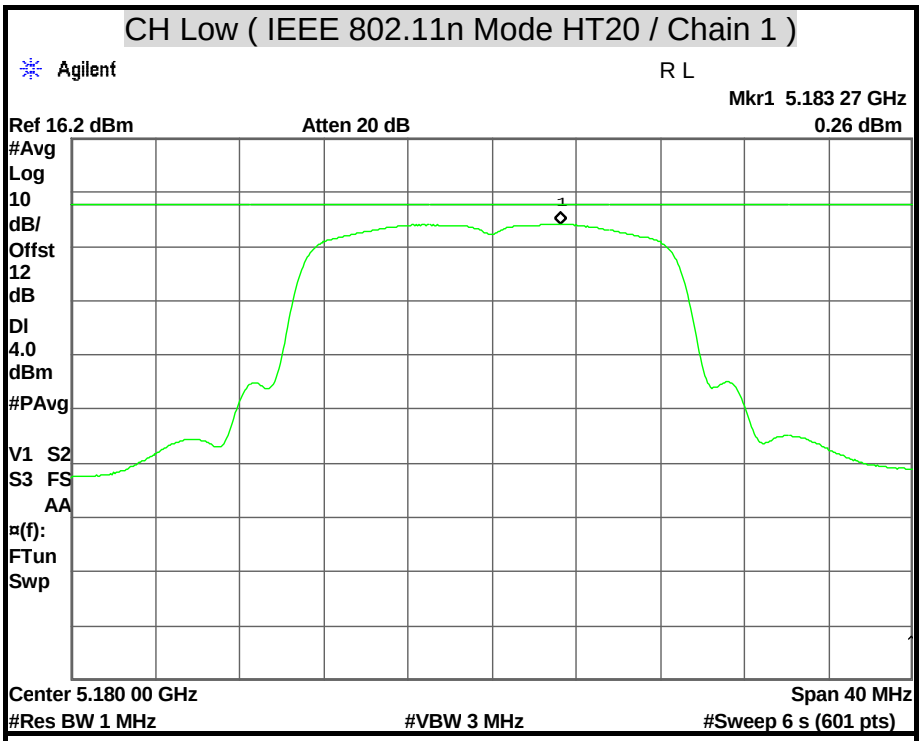


CH Middle (IEEE 802.11a Mode / Chain 1)

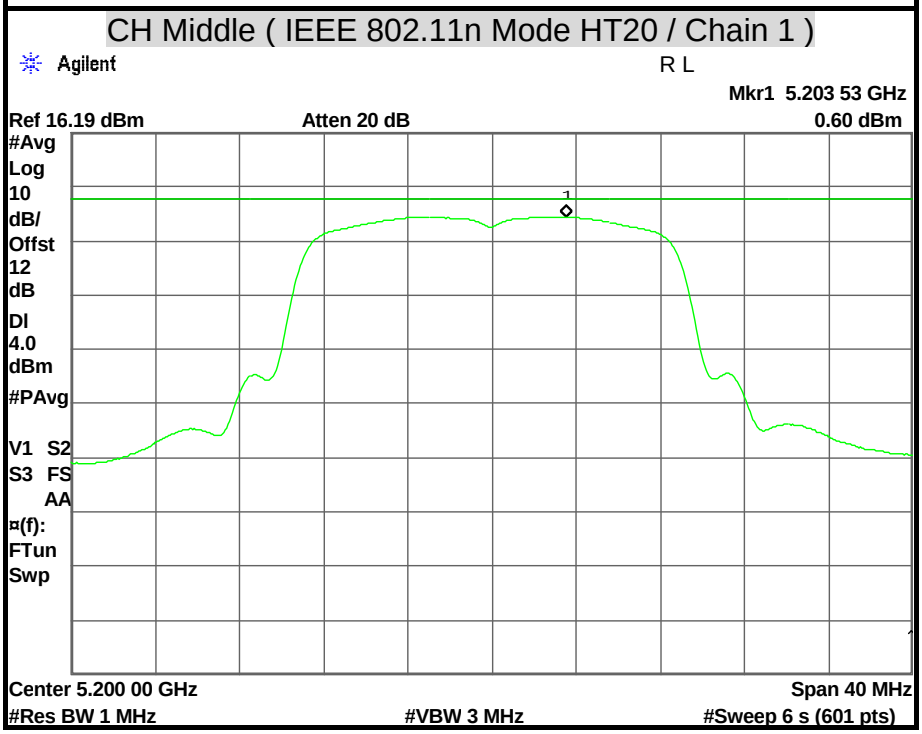




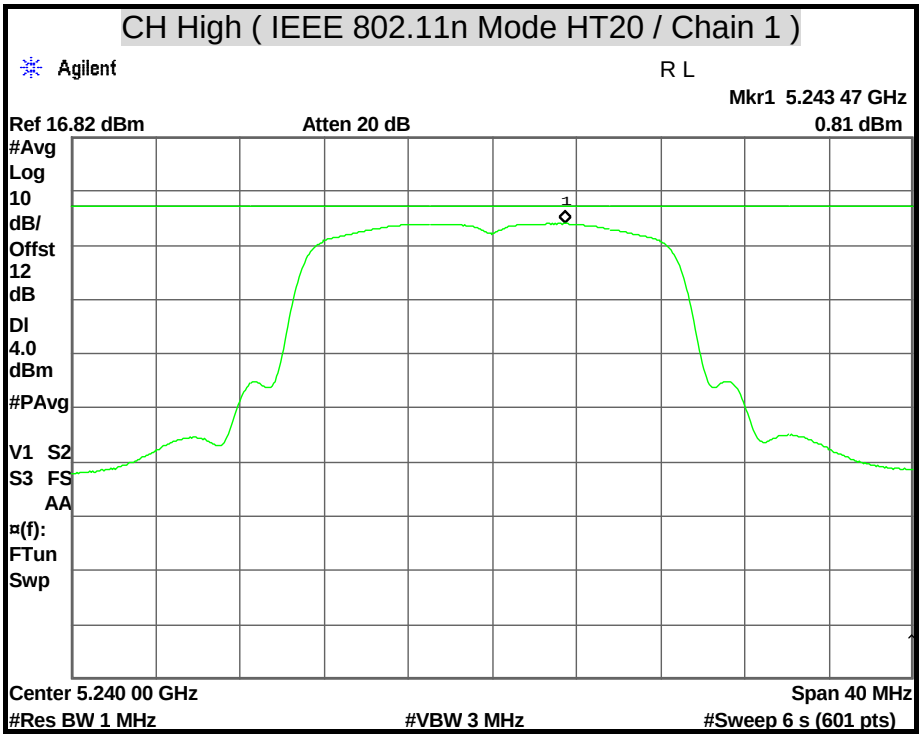
CH Low (IEEE 802.11n Mode HT20 / Chain 1)



CH Middle (IEEE 802.11n Mode HT20 / Chain 1)



CH High (IEEE 802.11n Mode HT20 / Chain 1)



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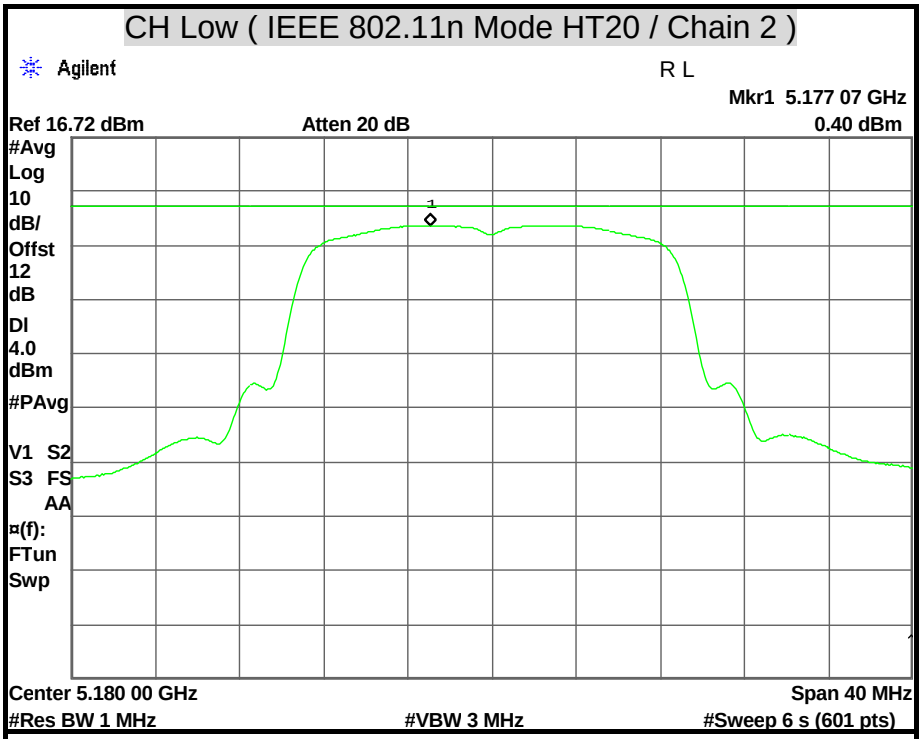

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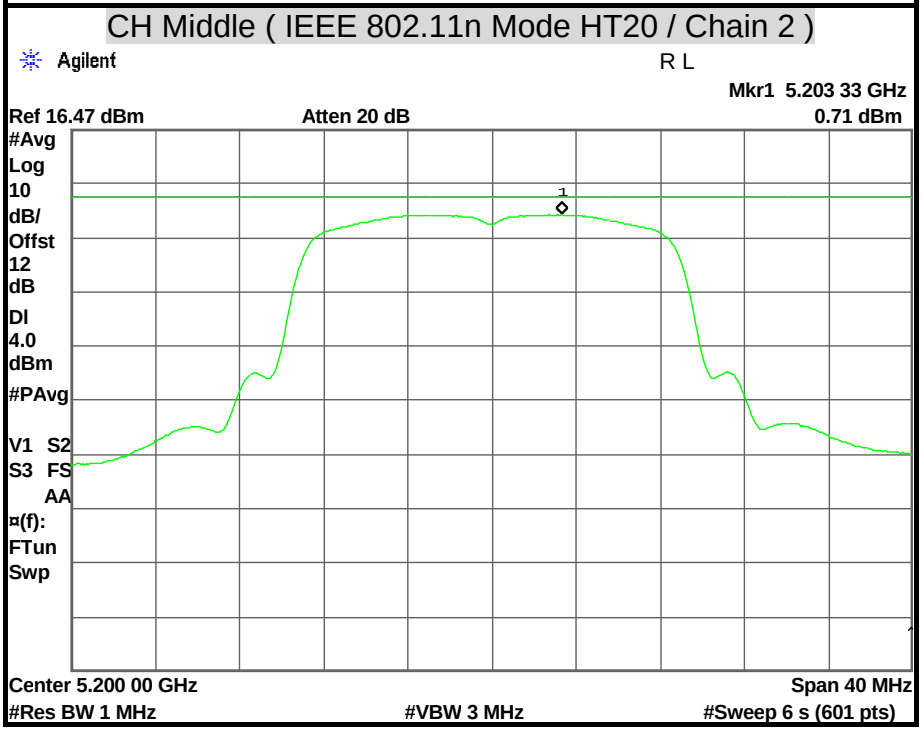

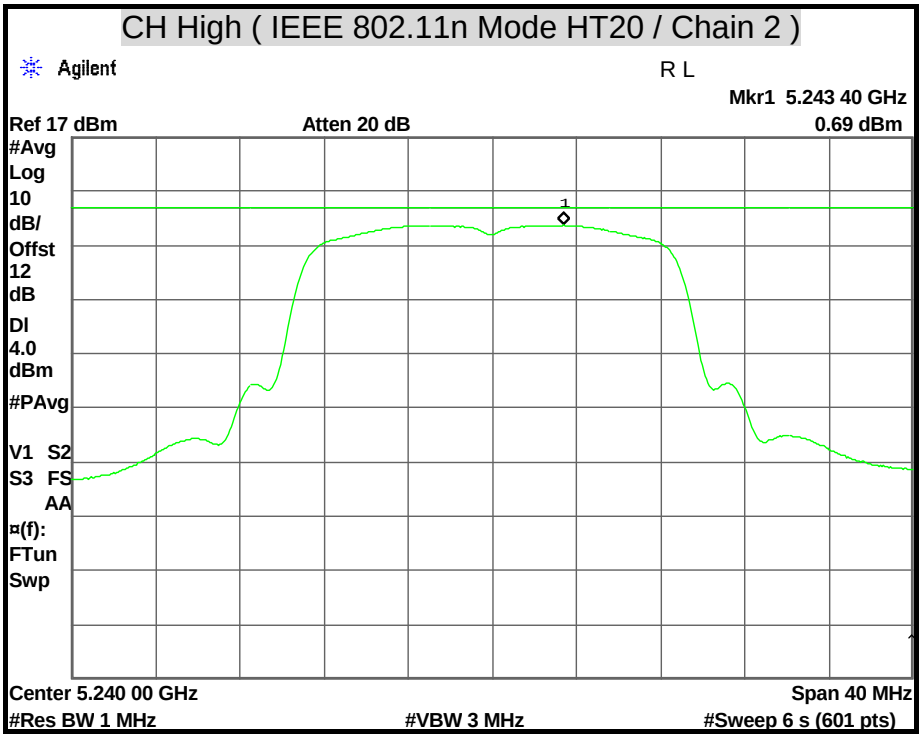

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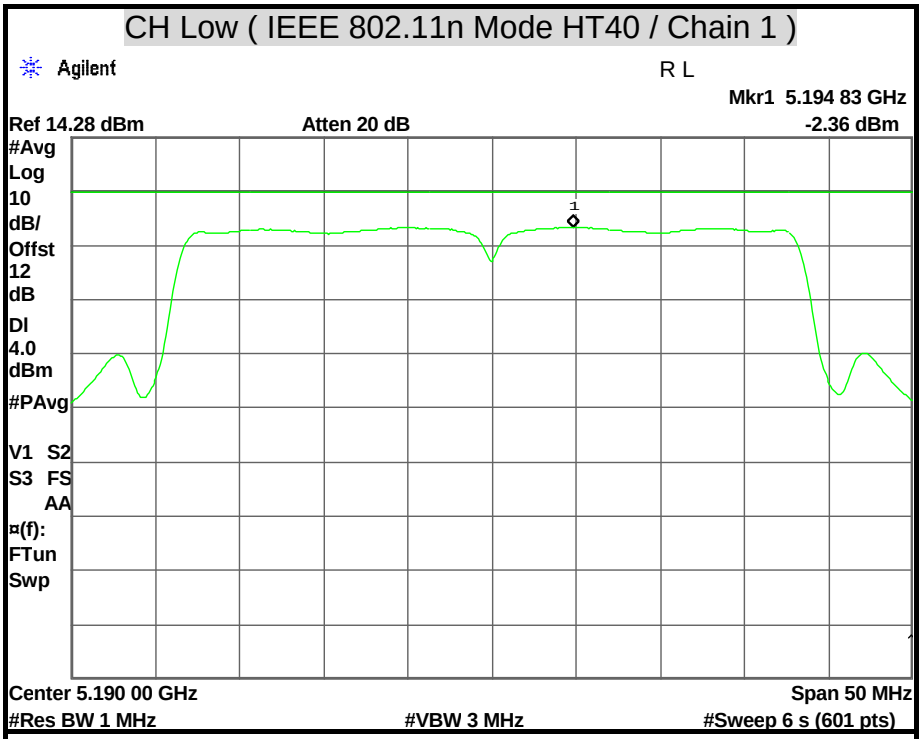
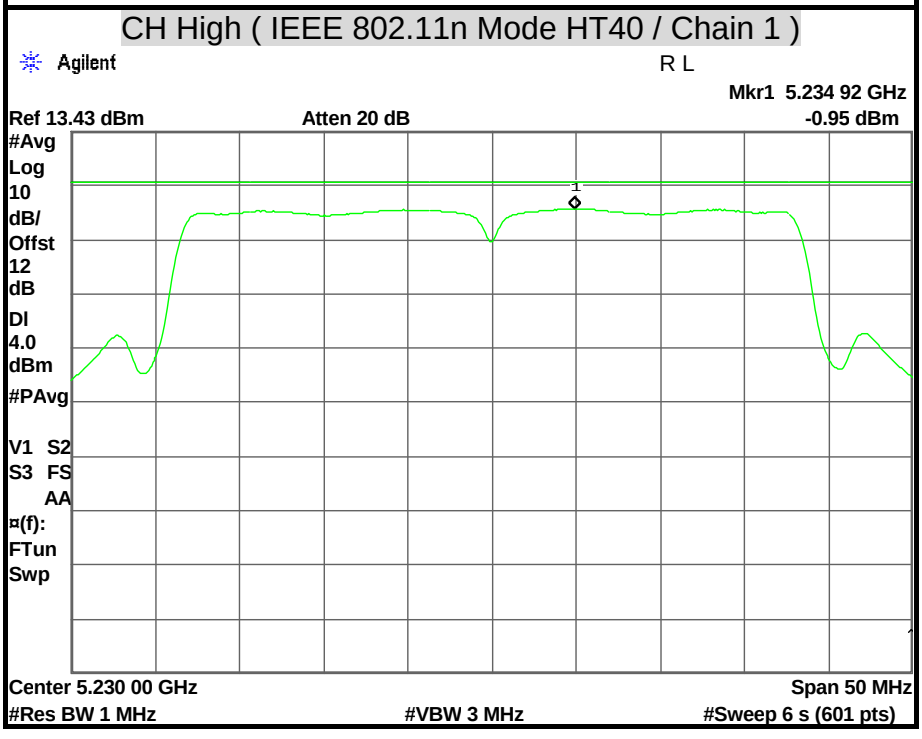
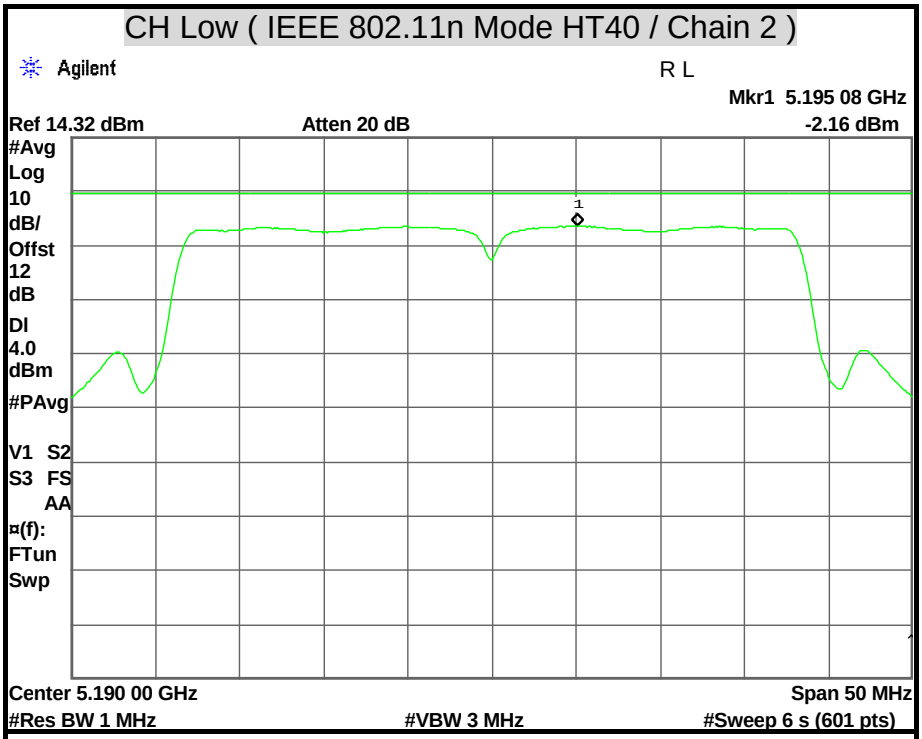


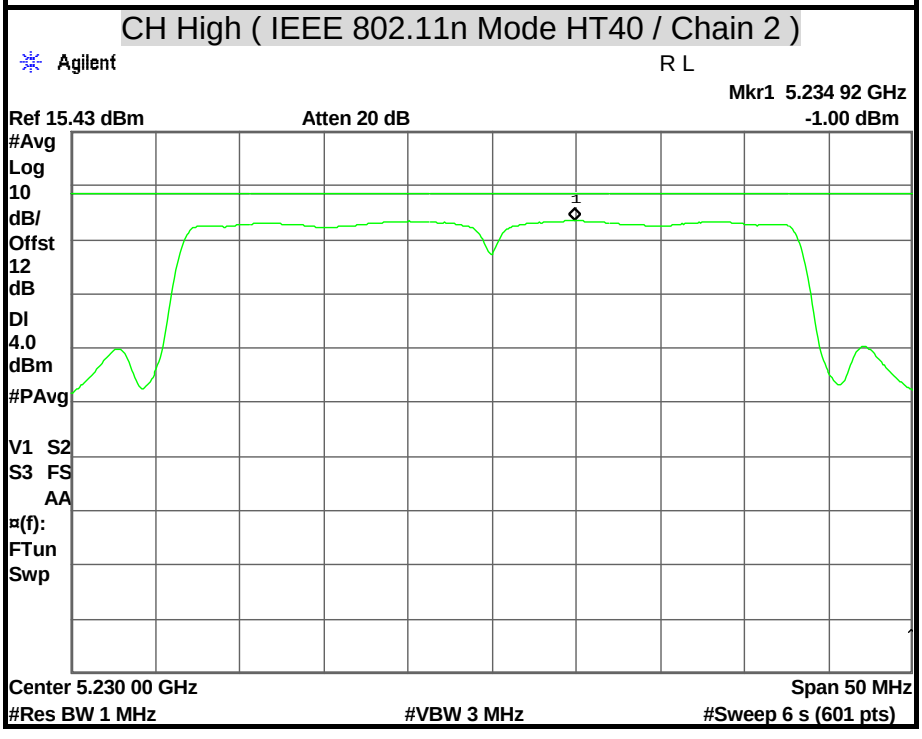
CH High (IEEE 802.11n Mode HT40 / Chain 1)



CH Low (IEEE 802.11n Mode HT40 / Chain 2)



CH High (IEEE 802.11n Mode HT40 / Chain 2)



7.4 PEAK EXCURSION

LIMITS

§ 15.407 (a) (6), the ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

TEST EQUIPMENT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	MY43360132	06/10/2014

Remark: *Each piece of equipment is scheduled for calibration once a year.*

TEST SETUP

TEST PROCEDURE

The test is performed in accordance with <FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices> – Part 15, Subpart E, August 2002.

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to spectrum.
3. Trace A, Set RBW =1MHz, VBW = 3MHz, Span > 26dB Bandwidth, Max. hold.
   Trace B, Set RBW =1MHz, VBW = 3MHz, Span > 26dB Bandwidth, Setup sample detector and power average mode, to scan 100 times with average.
4. Delta Mark trace A Maximum frequency and trace B same frequency.
5. Repeat the above procedure until measurements for all frequencies were complete.

TEST RESULTS

IEEE 802.11a Mode

Channel	Channel Frequency (MHz)	Peak Excursion (dB)	Limit (dBm)	Margin (dB)	Pass / Fail
		Chain 1			
Low	5180	9.98	13	-3.02	PASS
Middle	5220	9.97	13	-3.03	PASS
High	5240	9.43	13	3.57	PASS

Remark: *At finial test to get the worst-case emission at 6Mbps.*

IEEE 802.11n HT20 Mode (Two TX)

Channel	Channel Frequency (MHz)	Peak Excursion (dB)		Limit (dBm)	Margin (dB)		Pass / Fail
		Chain 1	Chain 2		Chain 1	Chain 2	
Low	5180	10.01	10.64	13	-2.99	-2.36	PASS
Middle	5220	10.31	10.69	13	-2.69	-2.31	PASS
High	5240	10.05	10.04	13	-2.95	-2.96	PASS

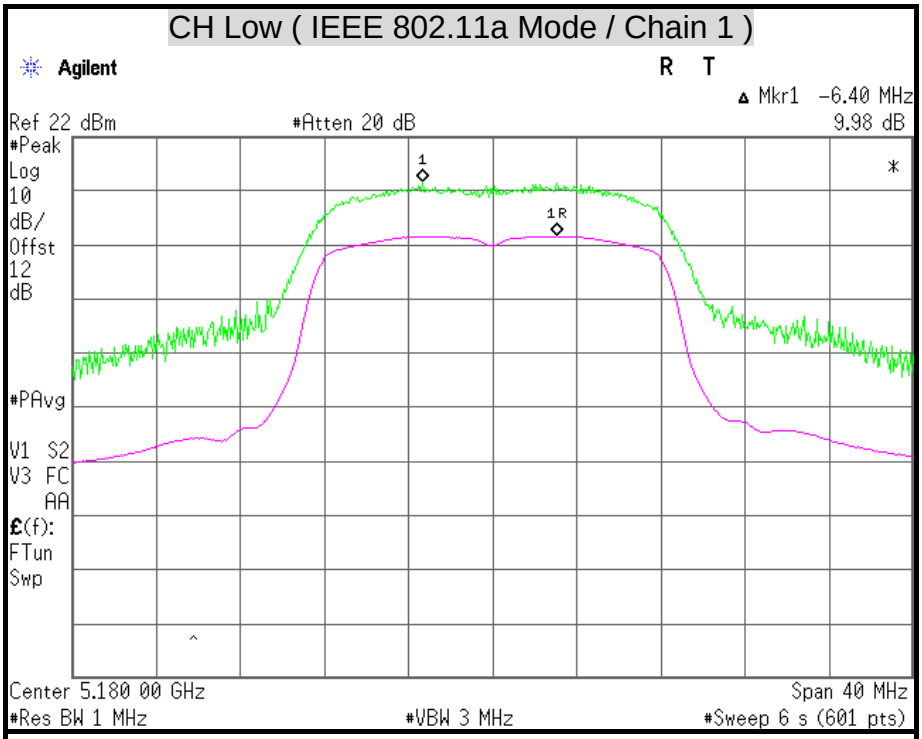
Remark: *At finial test to get the worst-case emission at 13Mbps.*

IEEE 802.11n HT40 Mode (Two TX)

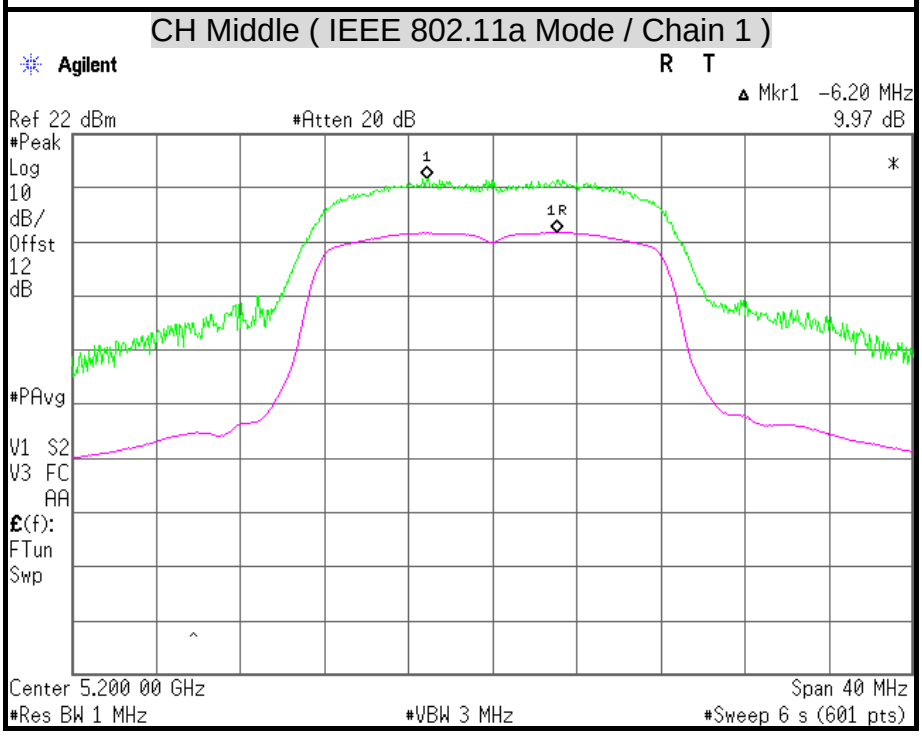
Channel	Channel Frequency (MHz)	Peak Excursion (dB)		Limit (dBm)	Margin (dB)		Pass / Fail
		Chain 1	Chain 2		Chain 1	Chain 2	
Low	5190	10.99	10.64	13	-2.01	-2.36	PASS
High	5230	10.75	10.43	13	-2.25	-2.57	PASS

Remark: *At finial test to get the worst-case emission at 27Mbps.*

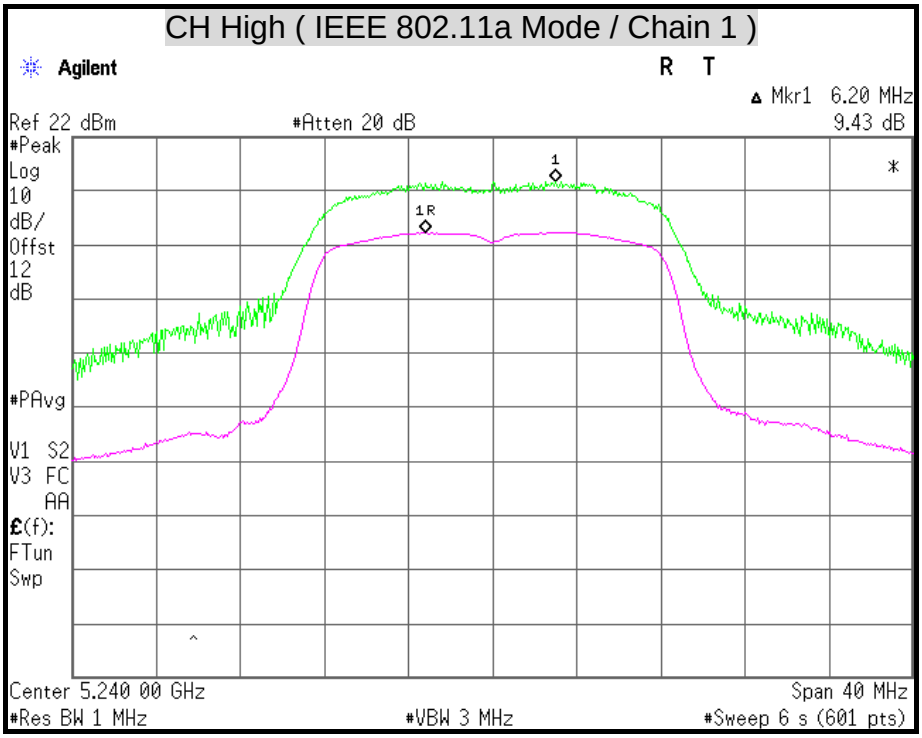
CH Low (IEEE 802.11a Mode / Chain 1)



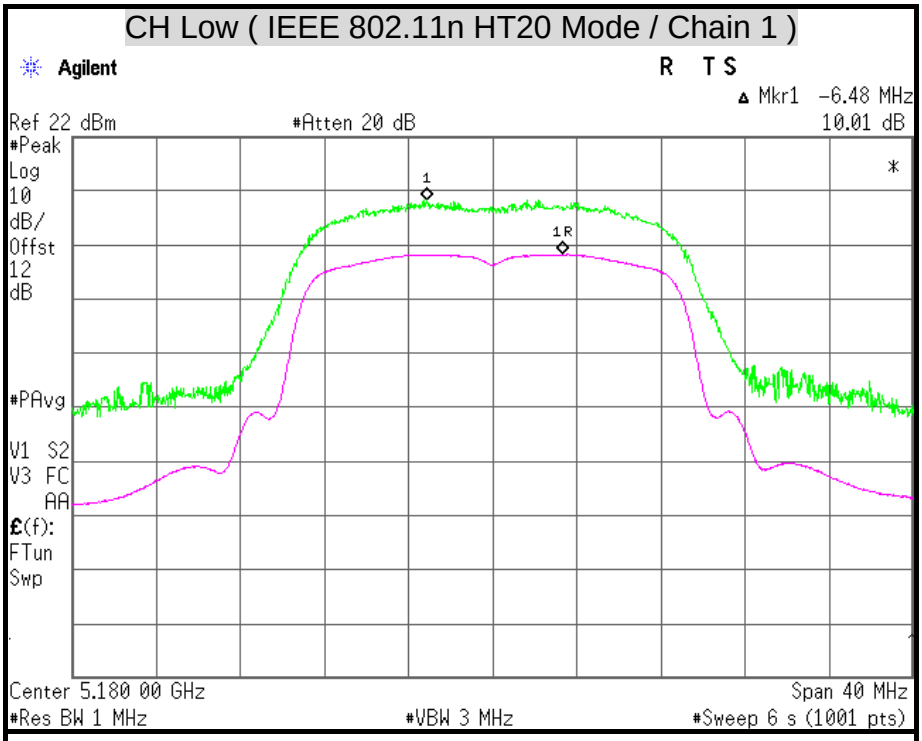
CH Middle (IEEE 802.11a Mode / Chain 1)



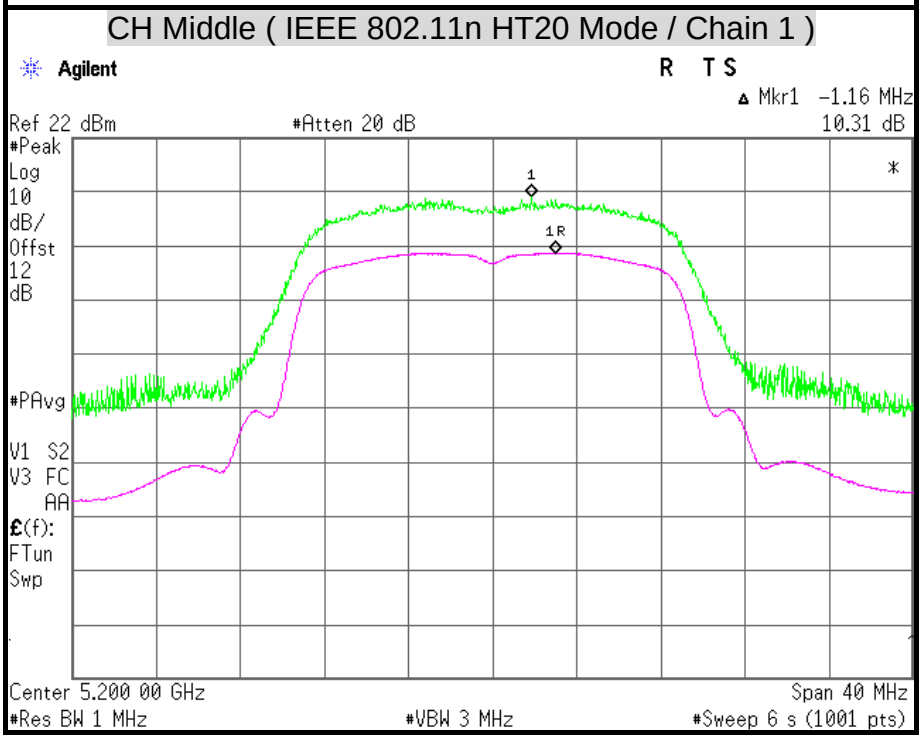
CH High (IEEE 802.11a Mode / Chain 1)



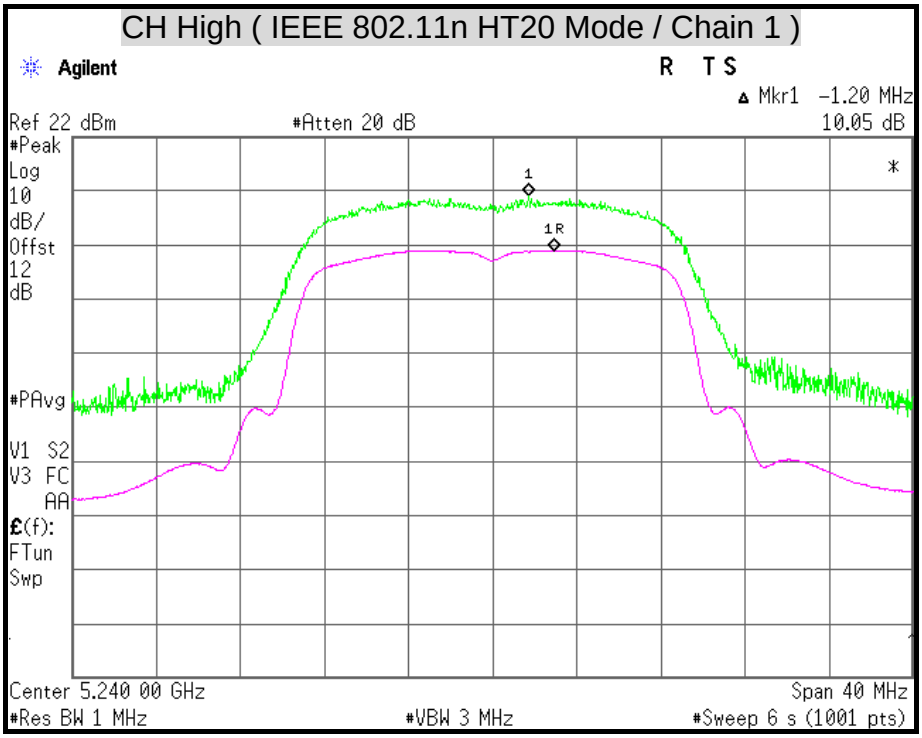
CH Low (IEEE 802.11n HT20 Mode / Chain 1)



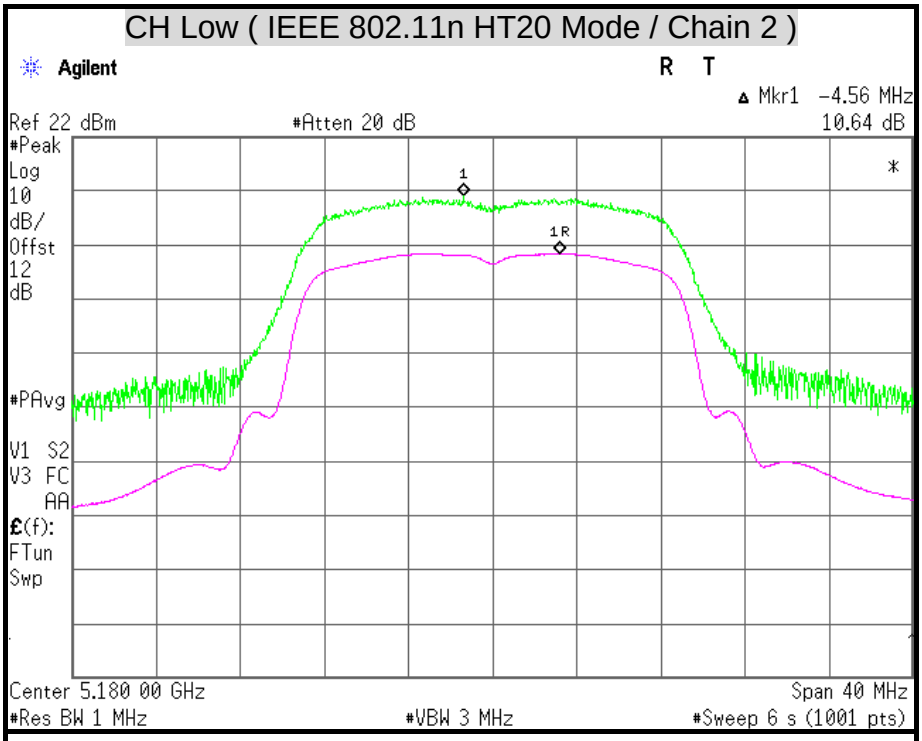
CH Middle (IEEE 802.11n HT20 Mode / Chain 1)



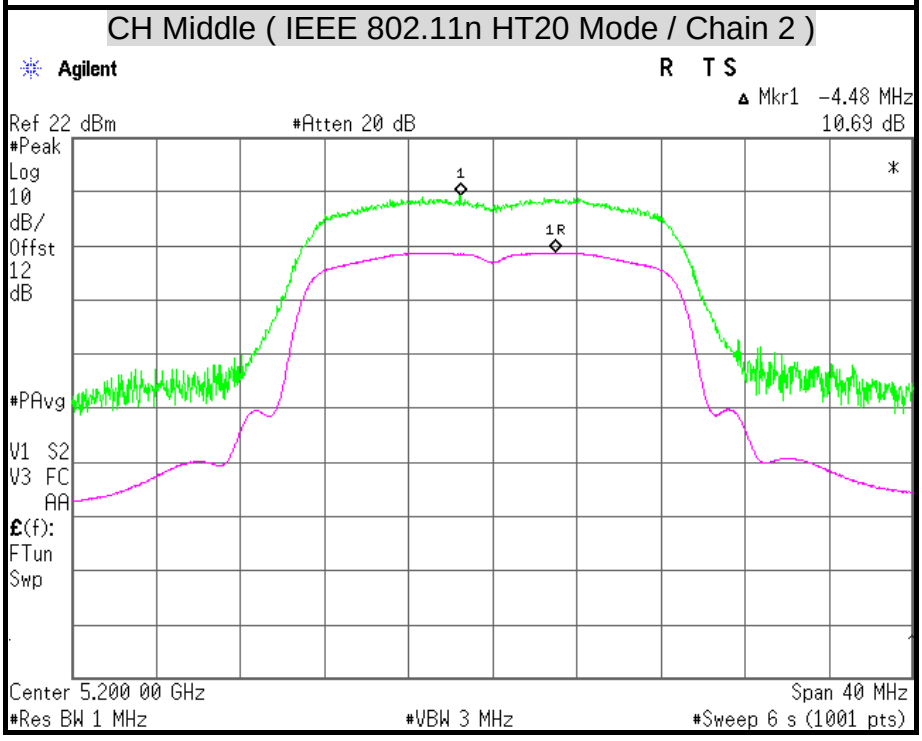
CH High (IEEE 802.11n HT20 Mode / Chain 1)



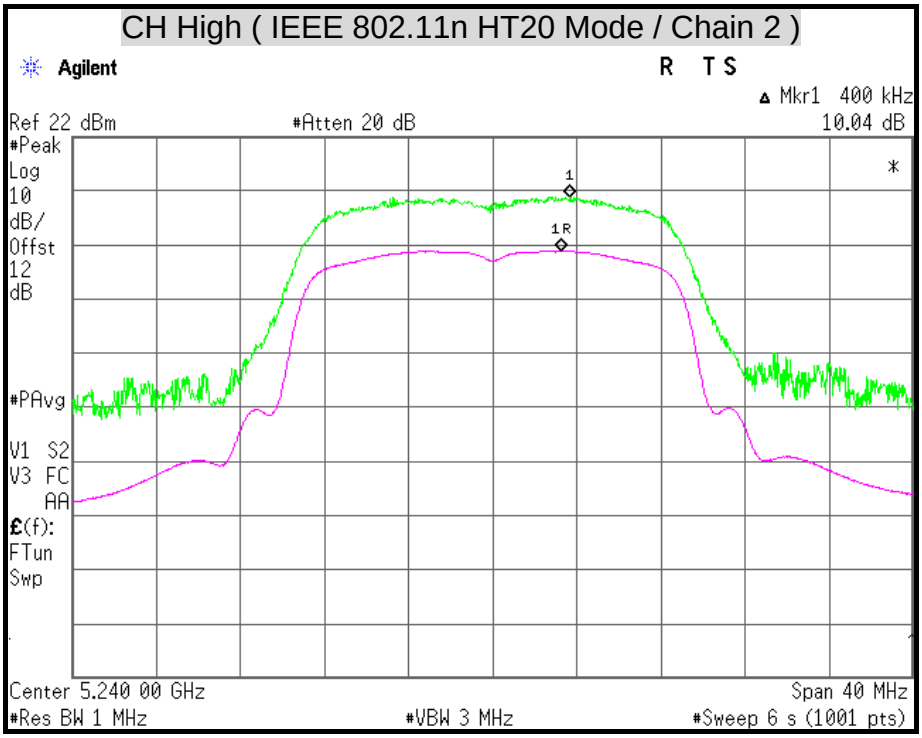
CH Low (IEEE 802.11n HT20 Mode / Chain 2)



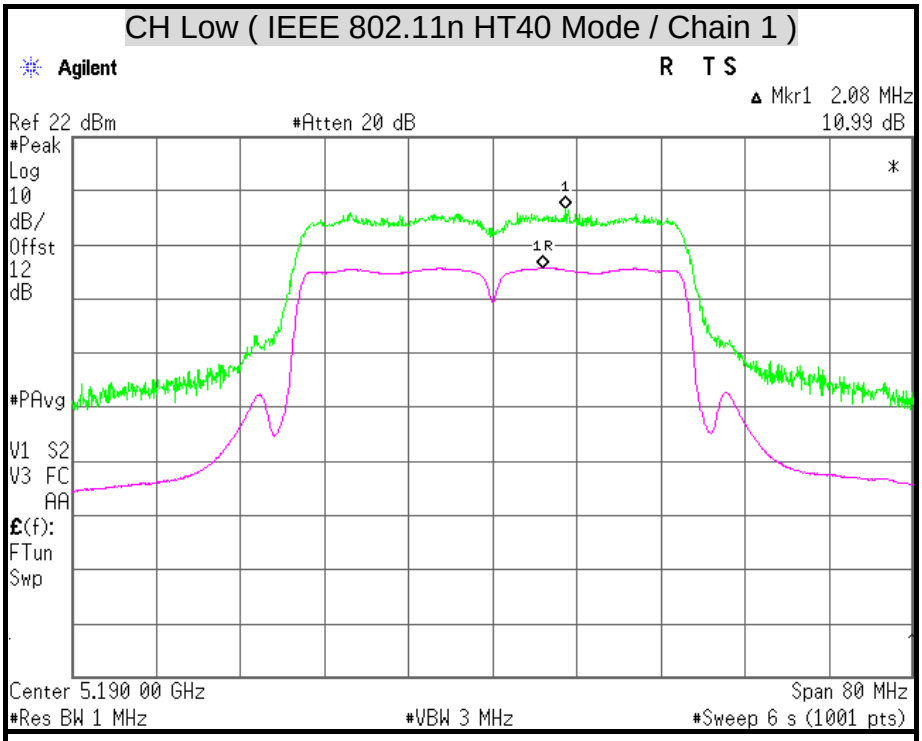
CH Middle (IEEE 802.11n HT20 Mode / Chain 2)



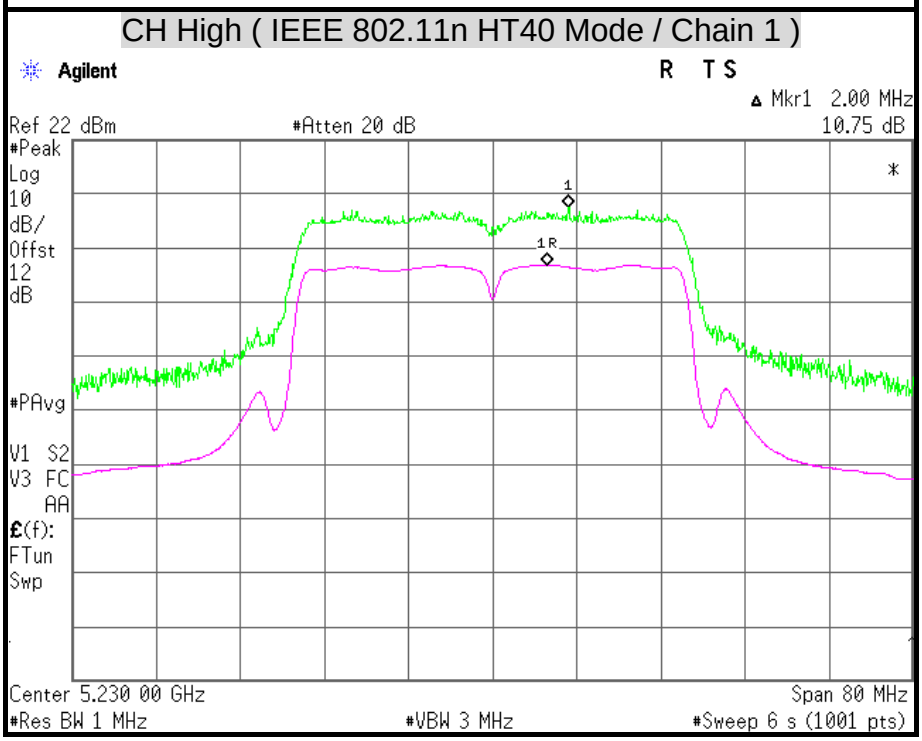
CH High (IEEE 802.11n HT20 Mode / Chain 2)



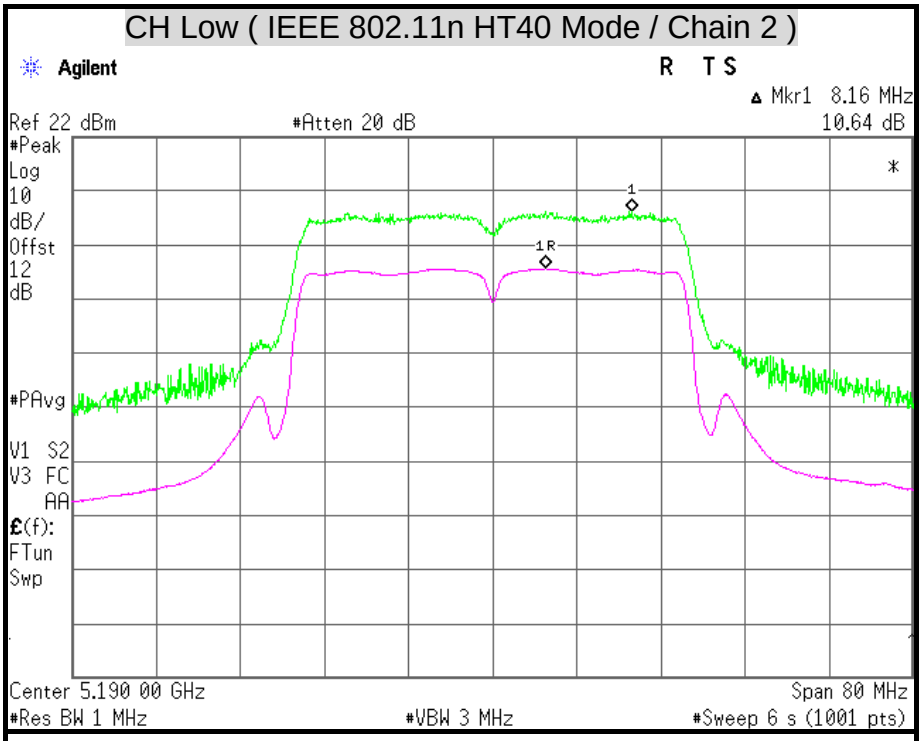
CH Low (IEEE 802.11n HT40 Mode / Chain 1)



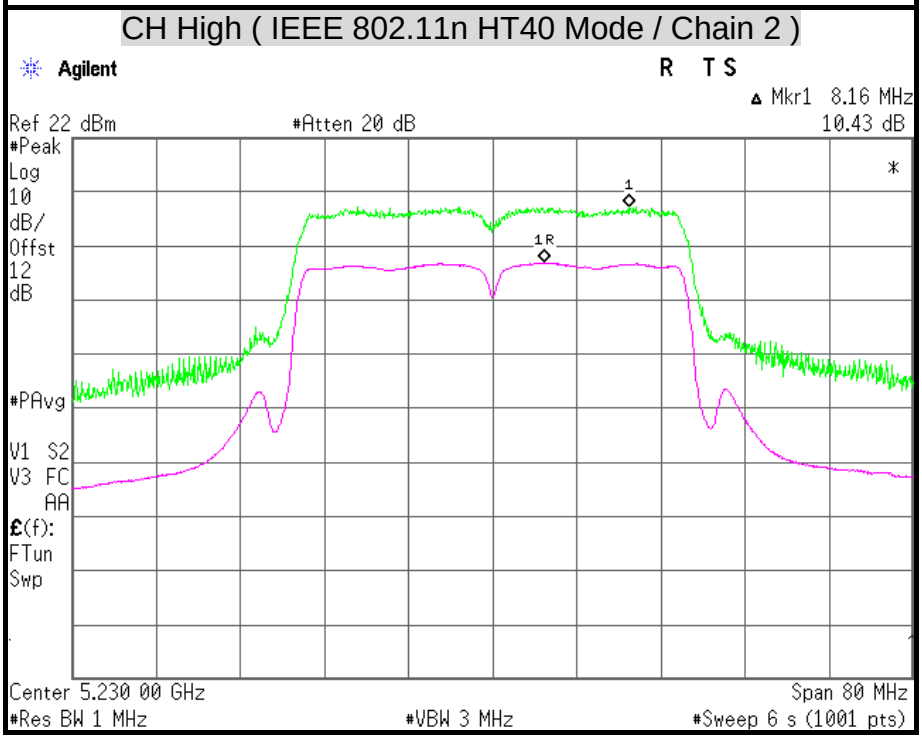
CH High (IEEE 802.11n HT40 Mode / Chain 1)



CH Low (IEEE 802.11n HT40 Mode / Chain 2)



CH High (IEEE 802.11n HT40 Mode / Chain 2)



7.5 RADIATED EMISSION

LIMITS

(1) According to § 15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 -1710	10.6 -12.7
6.26775 - 6.26825	108 -121.94	1718.8 - 1722.2	13.25 -13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 – 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 -16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3338	36.43 - 36.5
12.57675 - 12.57725	322 -335.4	3600 - 4400	([2])
13.36 - 13.41			

Remark:
1. *[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.*
2. *[2] Above 38.6*

(2) According to § 15.205 (b) Except as provided in paragraphs (d) and (e) of this section, 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.

(3) According to § 15.209 (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table :

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
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

Remark: ***Except as provided in paragraph (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., Sections 15.231 and 15.241.*

(4) According to § 15.209 (b) In the emission table above, the tighter limit applies at the band edges.

TEST EQUIPMENT

Radiated Emission / 966Chamber_B

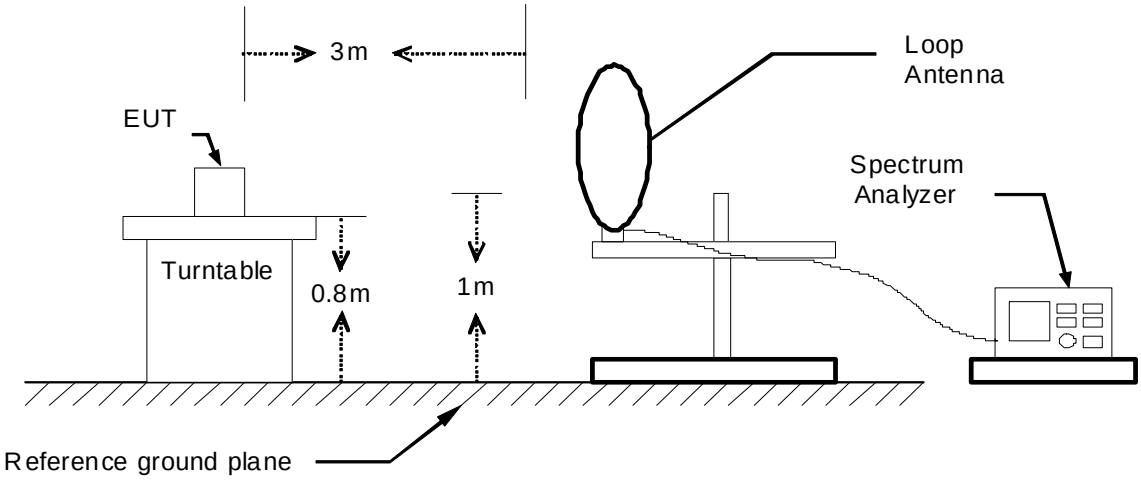
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	MY46180323	04/15/2014
EMI Test Receiver	ROHDE & SCHWARZ	ESCI	101131	01/14/2014
Bi-log Antenna	SCHWARZBECK	VULB 9168	9168-250	09/12/2014
Broad-Band Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-778	09/12/2014
Double-Ridged Waveguide Horn	ETS-LINDGREN	3117	00078733	12/11/2013
Horn Antenna	COM-POWER	AH-840	03077	12/20/2013
Pre-Amplifier	Agilent	8447D	2944A10052	07/16/2014
Pre-Amplifier	Agilent	8449B	3008A01916	07/16/2014
LOOP Antenna	EMCO	6502	8905-2356	08/20/2014
Notch Filters Band Reject	Micro-Tronics	BRM05702-01	026	N.C.R

Remark: *1. Each piece of equipment is scheduled for calibration once a year.*
2. N.C.R = No Calibration Request.

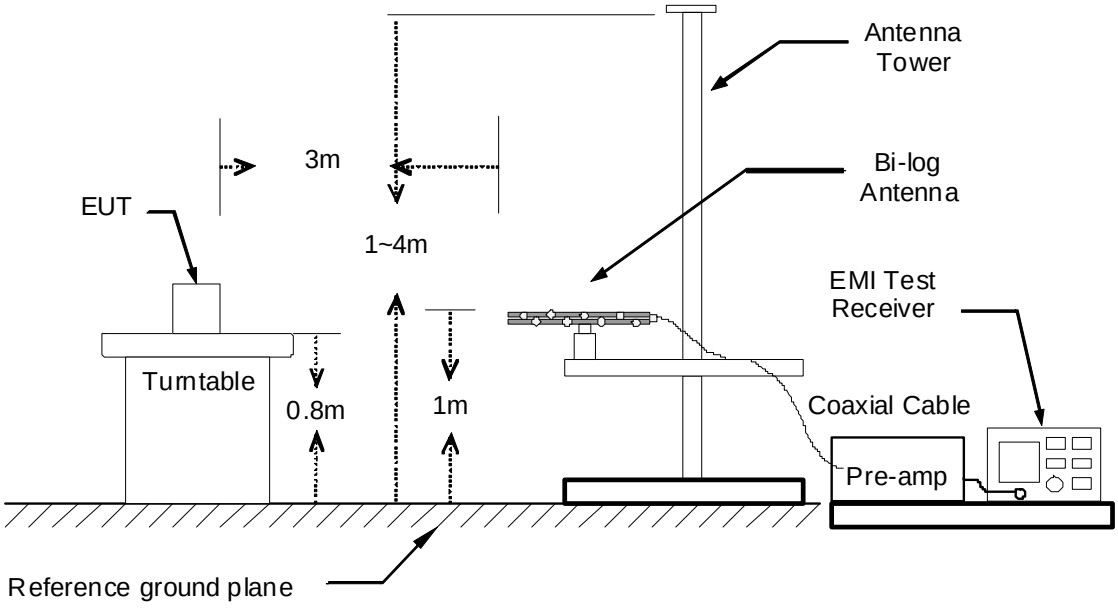
TEST SETUP

The diagram below shows the test setup that is utilized to make the measurements for emission from below 1GHz.

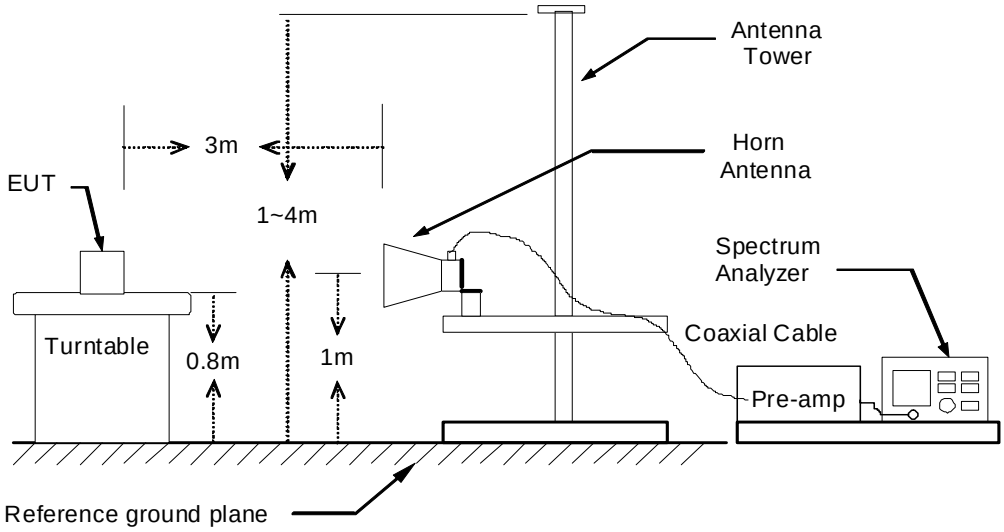
9kHz ~ 30MHz



30MHz ~ 1GHz



The diagram below shows the test setup that is utilized to make the measurements for emission above 1GHz.



TEST PROCEDURE

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground. The table was rotated 360 degrees to determine the position of the highest radiation.
2. While measuring the radiated emission below 1GHz, the EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. While measuring the radiated emission above 1GHz, the EUT was set 3 meters away from the interference-receiving antenna.
3. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarization of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

Remark：

1. *The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 KHz for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1GHz.*
2. *The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection and frequency above 1GHz.*
3. *The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10 Hz for Average detection (AV) at frequency above 1GHz.*

TEST RESULTS

Below 1 GHz (9kHz ~ 30MHz)

No emission found between lowest internal used/generated frequency to 30MHz.

Below 1 GHz (30MHz ~ 1GHz)

Product Name	Nuvola	Test By	Rueyyan Lin
Test Model	NP-1	Test Date	2013/11/09
Test Mode	IEEE 802.11a TX / CH Low	Temp. & Humidity	26°C, 48%

966 Chamber_B at 3Meter / Horizontal						
Frequency (MHz)	Reading (dBμV)	Correction Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Remark
94.02	49.84	-19.43	30.41	43.50	-13.09	Peak
189.08	47.33	-15.30	32.03	43.50	-11.47	Peak
250.19	48.77	-13.71	35.05	46.00	-10.95	Peak
408.30	41.62	-9.75	31.87	46.00	-14.13	Peak
491.72	43.93	-8.31	35.62	46.00	-10.38	Peak
741.98	38.07	-3.76	34.32	46.00	-11.68	Peak
858.38	42.94	-1.96	40.98	46.00	-5.02	QP
1000.00	34.31	0.37	34.68	74.00	-39.32	Peak

966 Chamber_B at 3Meter / Vertical						
Frequency (MHz)	Reading (dBμV)	Correction Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Remark
32.91	51.91	-15.23	36.69	40.00	-3.31	Peak
122.15	53.65	-15.88	37.78	43.50	-5.72	Peak
306.45	43.30	-11.78	31.52	46.00	-14.48	Peak
491.72	42.77	-8.31	34.46	46.00	-11.54	Peak
534.40	41.60	-7.66	33.93	46.00	-12.07	Peak
741.98	36.07	-3.76	32.31	46.00	-13.69	Peak
859.35	37.74	-1.94	35.80	46.00	-10.20	Peak
1000.00	33.33	0.37	33.70	74.00	-40.30	Peak

Remark:

1. *Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit.*
2. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
3. *Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Loss (dB) – PreAmp.Gain (dB)*
4. *Result (dBuV/m) = Reading (dBuV) + Correction Factor (dB/m)*
5. *Margin (dB) = Remark result (dBuV/m) - Quasi-peak limit (dBuV/m).*

Above 1 GHz

Product Name	Nuvola	Test By	Rueyyan Lin
Test Model	NP-1	Test Date	2013/11/06
Test Mode	IEEE 802.11a TX / CH Low	Temp. & Humidity	25°C, 43%

966 Chamber_B at 3Meter / Horizontal									
Frequency (MHz)	Reading-PK (dBuV)	Reading-AV (dBuV)	Correction Factor (dB/m)	Result-PK (dBuV/m)	Result-AV (dBuV/m)	Limit-PK (dBuV/m)	Limit-AV (dBuV/m)	Margin (dB)	Remark
1125.00	53.98	---	-4.18	49.79	---	74.00	54.00	-4.21	Peak
1425.00	54.06	---	-3.48	50.59	---	74.00	54.00	-3.41	Peak
1550.00	52.62	---	-2.75	49.88	---	74.00	54.00	-4.12	Peak
1755.00	52.16	---	-0.48	51.67	---	74.00	54.00	-2.33	Peak
5150.00	60.06	43.45	9.44	69.50	52.89	74.00	54.00	-1.11	AVG
6264.00	37.16	---	11.82	48.98	---	74.00	54.00	-5.02	Peak
6744.00	39.05	---	12.40	51.45	---	74.00	54.00	-2.55	Peak
7728.00	37.78	---	13.74	51.52	---	74.00	54.00	-2.48	Peak

966 Chamber_B at 3Meter / Vertical									
Frequency (MHz)	Reading-PK (dBuV)	Reading-AV (dBuV)	Correction Factor (dB/m)	Result-PK (dBuV/m)	Result-AV (dBuV/m)	Limit-PK (dBuV/m)	Limit-AV (dBuV/m)	Margin (dB)	Remark
1090.00	57.42	---	-4.27	53.15	---	74.00	54.00	-0.85	Peak
1255.00	53.45	---	-3.88	49.57	---	74.00	54.00	-4.43	Peak
1380.00	53.16	---	-3.58	49.58	---	74.00	54.00	-4.42	Peak
1720.00	51.78	---	-0.87	50.91	---	74.00	54.00	-3.09	Peak
5150.00	57.71	43.33	9.44	67.15	52.77	74.00	54.00	-1.23	AVG
6192.00	36.82	---	11.63	48.45	---	74.00	54.00	-5.55	Peak
6660.00	37.68	---	12.43	50.11	---	74.00	54.00	-3.89	Peak
7560.00	38.26	---	13.84	52.10	---	74.00	54.00	-1.90	Peak

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Average test would be performed if the peak result were greater than the average limit.*
3. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
4. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
5. *Result = Reading + Correction Factor*
   Margin = Result – Limit
   Remark Peak = Result(PK) – Limit(AV)
   Remark AVG = Result(AV) – Limit(AV)

Product Name	Nuvola	Test By	Rueyyan Lin
Test Model	NP-1	Test Date	2013/11/06
Test Mode	IEEE 802.11a TX / CH Middle	Temp. & Humidity	25°C, 43%

966 Chamber_B at 3Meter / Horizontal

Frequency (MHz)	Reading-PK (dBuV)	Reading-AV (dBuV)	Correction Factor (dB/m)	Result-PK (dBuV/m)	Result-AV (dBuV/m)	Limit-PK (dBuV/m)	Limit-AV (dBuV/m)	Margin (dB)	Remark
1005.00	54.38	---	-4.47	49.91	---	74.00	54.00	-4.09	Peak
1310.00	53.34	---	-3.75	49.59	---	74.00	54.00	-4.41	Peak
1505.00	53.64	---	-3.24	50.40	---	74.00	54.00	-3.60	Peak
1705.00	51.66	---	-1.04	50.63	---	74.00	54.00	-3.37	Peak
6108.00	37.91	---	11.40	49.31	---	74.00	54.00	-4.69	Peak
6540.00	37.80	---	12.46	50.26	---	74.00	54.00	-3.74	Peak
7584.00	38.35	---	13.83	52.18	---	74.00	54.00	-1.82	Peak

966 Chamber_B at 3Meter / Vertical

Frequency (MHz)	Reading-PK (dBuV)	Reading-AV (dBuV)	Correction Factor (dB/m)	Result-PK (dBuV/m)	Result-AV (dBuV/m)	Limit-PK (dBuV/m)	Limit-AV (dBuV/m)	Margin (dB)	Remark
1065.00	55.10	---	-4.33	50.77	---	74.00	54.00	-3.23	Peak
1205.00	53.39	---	-4.00	49.40	---	74.00	54.00	-4.60	Peak
1330.00	52.93	---	-3.70	49.23	---	74.00	54.00	-4.77	Peak
1725.00	52.44	---	-0.82	51.63	---	74.00	54.00	-2.37	Peak
6228.00	37.33	---	11.72	49.05	---	74.00	54.00	-4.95	Peak
6804.00	38.74	---	12.38	51.13	---	74.00	54.00	-2.87	Peak
7620.00	38.11	---	13.81	51.92	---	74.00	54.00	-2.08	Peak

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Average test would be performed if the peak result were greater than the average limit.*
3. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
4. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
5. *Result = Reading + Correction Factor*
   Margin = Result – Limit
   Remark Peak = Result(PK) – Limit(AV)
   Remark AVG = Result(AV) – Limit(AV)

Product Name	Nuvola	Test By	Rueyyan Lin
Test Model	NP-1	Test Date	2013/11/07
Test Mode	IEEE 802.11a TX / CH High	Temp. & Humidity	25°C, 43%

966 Chamber_B at 3Meter / Horizontal

Frequency (MHz)	Reading-PK (dBuV)	Reading-AV (dBuV)	Correction Factor (dB/m)	Result-PK (dBuV/m)	Result-AV (dBuV/m)	Limit-PK (dBuV/m)	Limit-AV (dBuV/m)	Margin (dB)	Remark
1035.00	54.19	---	-4.40	49.79	---	74.00	54.00	-4.21	Peak
1185.00	54.33	---	-4.04	50.29	---	74.00	54.00	-3.71	Peak
1400.00	53.30	---	-3.54	49.76	---	74.00	54.00	-4.24	Peak
1615.00	51.88	---	-2.03	49.85	---	74.00	54.00	-4.15	Peak
6156.00	36.99	---	11.53	48.52	---	74.00	54.00	-5.48	Peak
6732.00	38.22	---	12.41	50.62	---	74.00	54.00	-3.38	Peak
7620.00	38.24	---	13.81	52.05	---	74.00	54.00	-1.95	Peak

966 Chamber_B at 3Meter / Vertical

Frequency (MHz)	Reading-PK (dBuV)	Reading-AV (dBuV)	Correction Factor (dB/m)	Result-PK (dBuV/m)	Result-AV (dBuV/m)	Limit-PK (dBuV/m)	Limit-AV (dBuV/m)	Margin (dB)	Remark
1045.00	53.72	---	-4.37	49.34	---	74.00	54.00	-4.66	Peak
1420.00	52.81	---	-3.49	49.32	---	74.00	54.00	-4.68	Peak
1595.00	53.41	---	-2.25	51.16	---	74.00	54.00	-2.84	Peak
1825.00	51.43	---	0.29	51.71	---	74.00	54.00	-2.29	Peak
6144.00	38.84	---	11.49	50.34	---	74.00	54.00	-3.66	Peak
6744.00	38.00	---	12.40	50.40	---	74.00	54.00	-3.60	Peak
7620.00	38.62	---	13.81	52.43	---	74.00	54.00	-1.57	Peak

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Average test would be performed if the peak result were greater than the average limit.*
3. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
4. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
5. *Result = Reading + Correction Factor*
   Margin = Result – Limit
   Remark Peak = Result(PK) – Limit(AV)
   Remark AVG = Result(AV) – Limit(AV)

Product Name	Nuvola	Test By	Rueyyan Lin
Test Model	NP-1	Test Date	2013/11/06
Test Mode	IEEE 802.11n HT20 TX / CH Low	Temp. & Humidity	25°C, 43%

966 Chamber_B at 3Meter / Horizontal

Frequency (MHz)	Reading-PK (dBuV)	Reading-AV (dBuV)	Correction Factor (dB/m)	Result-PK (dBuV/m)	Result-AV (dBuV/m)	Limit-PK (dBuV/m)	Limit-AV (dBuV/m)	Margin (dB)	Remark
1080.00	54.93	---	-4.29	50.64	---	74.00	54.00	-3.36	Peak
1240.00	53.77	---	-3.91	49.86	---	74.00	54.00	-4.14	Peak
1345.00	53.96	---	-3.67	50.29	---	74.00	54.00	-3.71	Peak
1615.00	53.50	---	-2.03	51.47	---	74.00	54.00	-2.53	Peak
5150.00	60.03	43.24	9.44	69.47	52.68	74.00	54.00	-1.32	AVG
6192.00	37.70	---	11.63	49.33	---	74.00	54.00	-4.67	Peak
6696.00	37.65	---	12.42	50.06	---	74.00	54.00	-3.94	Peak
7416.00	37.65	---	13.62	51.27	---	74.00	54.00	-2.73	Peak

966 Chamber_B at 3Meter / Vertical

Frequency (MHz)	Reading-PK (dBuV)	Reading-AV (dBuV)	Correction Factor (dB/m)	Result-PK (dBuV/m)	Result-AV (dBuV/m)	Limit-PK (dBuV/m)	Limit-AV (dBuV/m)	Margin (dB)	Remark
1095.00	62.32	44.20	-4.26	58.06	39.94	74.00	54.00	-14.06	AVG
1170.00	54.73	---	-4.08	50.66	---	74.00	54.00	-3.34	Peak
1310.00	54.62	---	-3.75	50.87	---	74.00	54.00	-3.13	Peak
1610.00	53.23	---	-2.09	51.14	---	74.00	54.00	-2.86	Peak
5150.00	58.15	43.16	9.44	67.59	52.60	74.00	54.00	-1.40	AVG
6120.00	36.74	---	11.43	48.17	---	74.00	54.00	-5.83	Peak
6732.00	37.94	---	12.41	50.34	---	74.00	54.00	-3.66	Peak
7488.00	38.90	---	13.84	52.74	---	74.00	54.00	-1.26	Peak

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Average test would be performed if the peak result were greater than the average limit.*
3. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
4. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
5. *Result = Reading + Correction Factor*
   Margin = Result – Limit
   Remark Peak = Result(PK) – Limit(AV)
   Remark AVG = Result(AV) – Limit(AV)

Product Name	Nuvola	Test By	Rueyyan Lin
Test Model	NP-1	Test Date	2013/11/06
Test Mode	IEEE 802.11n HT20 TX / CH Middle	Temp. & Humidity	25°C, 43%

966 Chamber_B at 3Meter / Horizontal									
Frequency (MHz)	Reading-PK (dBuV)	Reading-AV (dBuV)	Correction Factor (dB/m)	Result-PK (dBuV/m)	Result-AV (dBuV/m)	Limit-PK (dBuV/m)	Limit-AV (dBuV/m)	Margin (dB)	Remark
1015.00	54.65	---	-4.44	50.20	---	74.00	54.00	-3.80	Peak
1220.00	54.28	---	-3.96	50.32	---	74.00	54.00	-3.68	Peak
1440.00	53.66	---	-3.44	50.22	---	74.00	54.00	-3.78	Peak
3065.00	54.42	40.60	4.83	59.25	45.43	74.00	54.00	-8.57	AVG
6372.00	38.17	---	12.12	50.29	---	74.00	54.00	-3.71	Peak
6840.00	37.99	---	12.37	50.36	---	74.00	54.00	-3.64	Peak
7668.00	38.27	---	13.78	52.04	---	74.00	54.00	-1.96	Peak

966 Chamber_B at 3Meter / Vertical									
Frequency (MHz)	Reading-PK (dBuV)	Reading-AV (dBuV)	Correction Factor (dB/m)	Result-PK (dBuV/m)	Result-AV (dBuV/m)	Limit-PK (dBuV/m)	Limit-AV (dBuV/m)	Margin (dB)	Remark
1015.00	55.58	---	-4.44	51.14	---	74.00	54.00	-2.86	Peak
1190.00	54.42	---	-4.03	50.39	---	74.00	54.00	-3.61	Peak
1400.00	53.35	---	-3.54	49.82	---	74.00	54.00	-4.18	Peak
1565.00	53.48	---	-2.58	50.90	---	74.00	54.00	-3.10	Peak
6168.00	37.21	---	11.56	48.77	---	74.00	54.00	-5.23	Peak
6876.00	37.46	---	12.36	49.83	---	74.00	54.00	-4.17	Peak
7524.00	37.88	---	13.87	51.74	---	74.00	54.00	-2.26	Peak

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Average test would be performed if the peak result were greater than the average limit.*
3. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
4. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
5. *Result = Reading + Correction Factor*
   Margin = Result – Limit
   Remark Peak = Result(PK) – Limit(AV)
   Remark AVG = Result(AV) – Limit(AV)

Product Name	Nuvola	Test By	Rueyyan Lin
Test Model	NP-1	Test Date	2013/11/06
Test Mode	IEEE 802.11n HT20 TX / CH High	Temp. & Humidity	25°C, 43%

966 Chamber_B at 3Meter / Horizontal									
Frequency (MHz)	Reading-PK (dBuV)	Reading-AV (dBuV)	Correction Factor (dB/m)	Result-PK (dBuV/m)	Result-AV (dBuV/m)	Limit-PK (dBuV/m)	Limit-AV (dBuV/m)	Margin (dB)	Remark
1015.00	53.92	---	-4.44	49.47	---	74.00	54.00	-4.53	Peak
1200.00	54.21	---	-4.01	50.21	---	74.00	54.00	-3.79	Peak
1470.00	53.38	---	-3.37	50.01	---	74.00	54.00	-3.99	Peak
3105.00	53.50	40.68	4.87	58.37	45.55	74.00	54.00	-8.45	AVG
6396.00	37.81	---	12.19	49.99	---	74.00	54.00	-4.01	Peak
6852.00	38.23	---	12.37	50.60	---	74.00	54.00	-3.40	Peak
7740.00	37.71	---	13.73	51.44	---	74.00	54.00	-2.56	Peak

966 Chamber_B at 3Meter / Vertical									
Frequency (MHz)	Reading-PK (dBuV)	Reading-AV (dBuV)	Correction Factor (dB/m)	Result-PK (dBuV/m)	Result-AV (dBuV/m)	Limit-PK (dBuV/m)	Limit-AV (dBuV/m)	Margin (dB)	Remark
1090.00	66.33	46.31	-4.27	62.06	42.04	74.00	54.00	-11.96	AVG
1185.00	54.75	---	-4.04	50.71	---	74.00	54.00	-3.29	Peak
1500.00	53.77	---	-3.30	50.47	---	74.00	54.00	-3.53	Peak
1670.00	53.06	---	-1.42	51.63	---	74.00	54.00	-2.37	Peak
6192.00	37.67	---	11.63	49.30	---	74.00	54.00	-4.70	Peak
6672.00	38.01	---	12.42	50.44	---	74.00	54.00	-3.56	Peak
7764.00	38.50	---	13.72	52.21	---	74.00	54.00	-1.79	Peak

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Average test would be performed if the peak result were greater than the average limit.*
3. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
4. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
5. *Result = Reading + Correction Factor*
   Margin = Result – Limit
   Remark Peak = Result(PK) – Limit(AV)
   Remark AVG = Result(AV) – Limit(AV)

Product Name	Nuvola	Test By	Rueyyan Lin
Test Model	NP-1	Test Date	2013/11/06
Test Mode	IEEE 802.11n HT40 TX / CH Low	Temp. & Humidity	25°C, 43%

966 Chamber_B at 3Meter / Horizontal									
Frequency (MHz)	Reading-PK (dBuV)	Reading-AV (dBuV)	Correction Factor (dB/m)	Result-PK (dBuV/m)	Result-AV (dBuV/m)	Limit-PK (dBuV/m)	Limit-AV (dBuV/m)	Margin (dB)	Remark
1070.00	55.42	---	-4.31	51.10	---	74.00	54.00	-2.90	Peak
1375.00	54.36	---	-3.60	50.76	---	74.00	54.00	-3.24	Peak
1615.00	53.71	---	-2.03	51.68	---	74.00	54.00	-2.32	Peak
5150.00	63.50	44.30	9.44	72.94	53.74	74.00	54.00	-0.26	AVG
6060.00	37.44	---	11.26	48.70	---	74.00	54.00	-5.30	Peak
6600.00	37.66	---	12.44	50.10	---	74.00	54.00	-3.90	Peak
7644.00	37.68	---	13.79	51.47	---	74.00	54.00	-2.53	Peak

966 Chamber_B at 3Meter / Vertical									
Frequency (MHz)	Reading-PK (dBuV)	Reading-AV (dBuV)	Correction Factor (dB/m)	Result-PK (dBuV/m)	Result-AV (dBuV/m)	Limit-PK (dBuV/m)	Limit-AV (dBuV/m)	Margin (dB)	Remark
1135.00	54.88	---	-4.16	50.72	---	74.00	54.00	-3.28	Peak
1595.00	54.29	---	-2.25	52.04	---	74.00	54.00	-1.96	Peak
1835.00	52.30	---	0.40	52.70	---	74.00	54.00	-1.30	Peak
5150.00	63.77	44.20	9.44	73.21	53.64	74.00	54.00	-0.36	AVG
6060.00	37.16	---	11.26	48.42	---	74.00	54.00	-5.58	Peak
6684.00	38.03	---	12.42	50.45	---	74.00	54.00	-3.55	Peak
7644.00	37.96	---	13.79	51.75	---	74.00	54.00	-2.25	Peak

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Average test would be performed if the peak result were greater than the average limit.*
3. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
4. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
5. *Result = Reading + Correction Factor*
   Margin = Result – Limit
   Remark Peak = Result(PK) – Limit(AV)
   Remark AVG = Result(AV) – Limit(AV)

Product Name	Nuvola	Test By	Rueyyan Lin
Test Model	NP-1	Test Date	2013/11/06
Test Mode	IEEE 802.11n HT40 TX / CH High	Temp. & Humidity	25°C, 43%

966 Chamber_B at 3Meter / Horizontal									
Frequency (MHz)	Reading-PK (dBuV)	Reading-AV (dBuV)	Correction Factor (dB/m)	Result-PK (dBuV/m)	Result-AV (dBuV/m)	Limit-PK (dBuV/m)	Limit-AV (dBuV/m)	Margin (dB)	Remark
1015.00	55.39	---	-4.44	50.95	---	74.00	54.00	-3.05	Peak
1345.00	54.64	---	-3.67	50.97	---	74.00	54.00	-3.03	Peak
1770.00	52.35	---	-0.32	52.04	---	74.00	54.00	-1.96	Peak
5150.00	54.96	39.61	9.45	64.41	49.06	74.00	54.00	-4.94	AVG
6156.00	38.28	---	11.53	49.81	---	74.00	54.00	-4.19	Peak
6696.00	38.53	---	12.42	50.95	---	74.00	54.00	-3.05	Peak
7548.00	37.23	---	13.85	51.08	---	74.00	54.00	-2.92	Peak

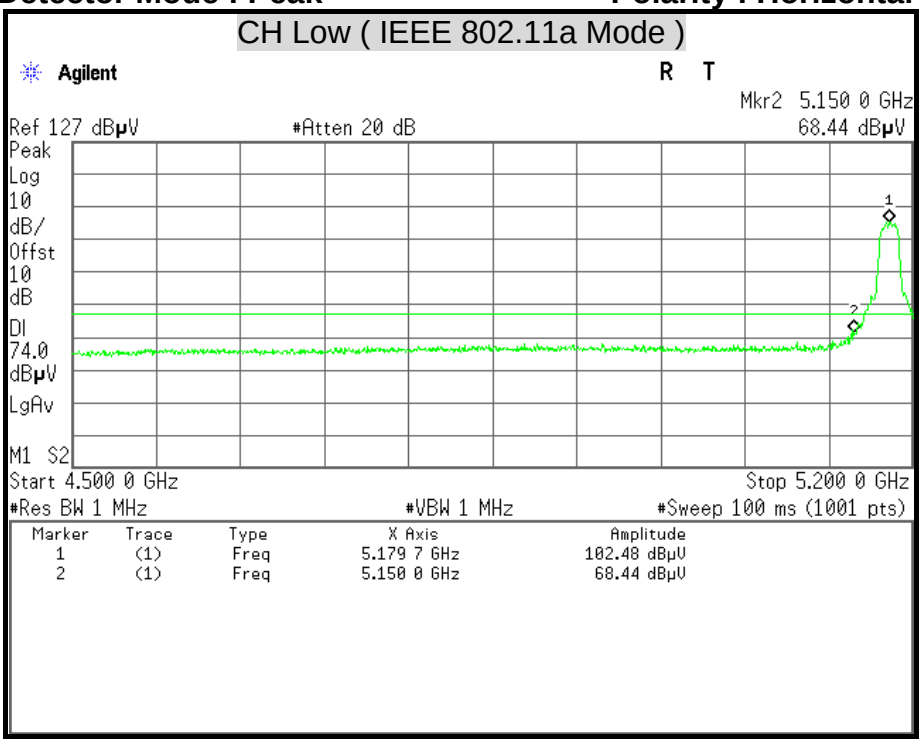
966 Chamber_B at 3Meter / Vertical									
Frequency (MHz)	Reading-PK (dBuV)	Reading-AV (dBuV)	Correction Factor (dB/m)	Result-PK (dBuV/m)	Result-AV (dBuV/m)	Limit-PK (dBuV/m)	Limit-AV (dBuV/m)	Margin (dB)	Remark
1080.00	55.09	---	-4.29	50.80	---	74.00	54.00	-3.20	Peak
1405.00	54.51	---	-3.52	50.98	---	74.00	54.00	-3.02	Peak
1835.00	52.27	---	0.40	52.67	---	74.00	54.00	-1.33	Peak
5150.00	54.36	39.24	9.44	63.80	48.68	74.00	54.00	-5.32	AVG
6060.00	36.84	---	11.26	48.11	---	74.00	54.00	-5.89	Peak
6576.00	38.06	---	12.45	50.51	---	74.00	54.00	-3.49	Peak
7548.00	38.22	---	13.85	52.07	---	74.00	54.00	-1.93	Peak

Remark:

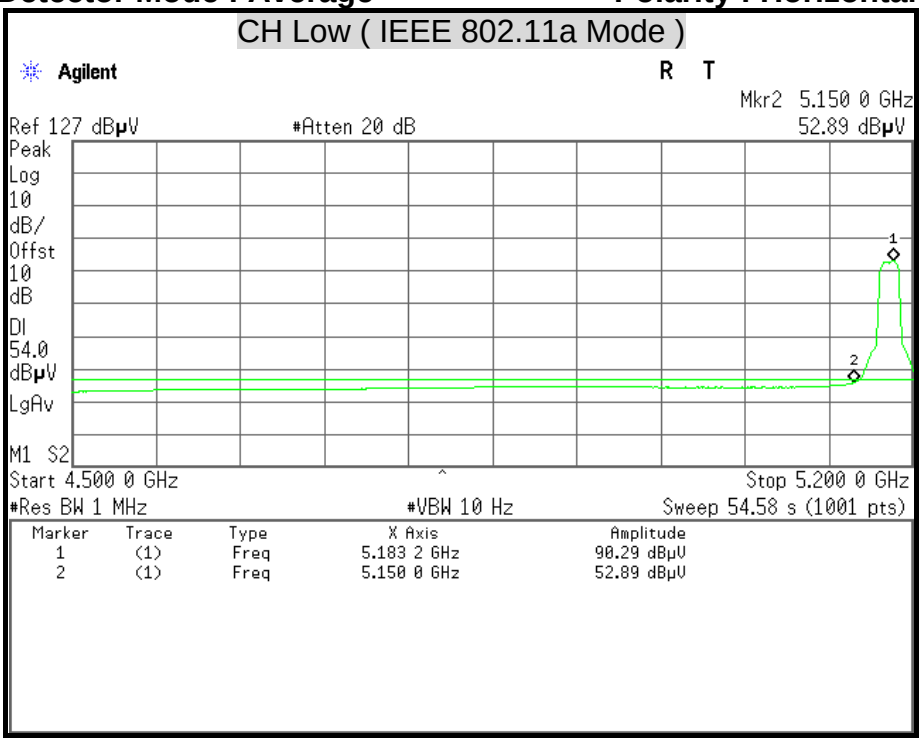
1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Average test would be performed if the peak result were greater than the average limit.*
3. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
4. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
5. *Result = Reading + Correction Factor*
   Margin = Result – Limit
   Remark Peak = Result(PK) – Limit(AV)
   Remark AVG = Result(AV) – Limit(AV)

Restricted Band Edges

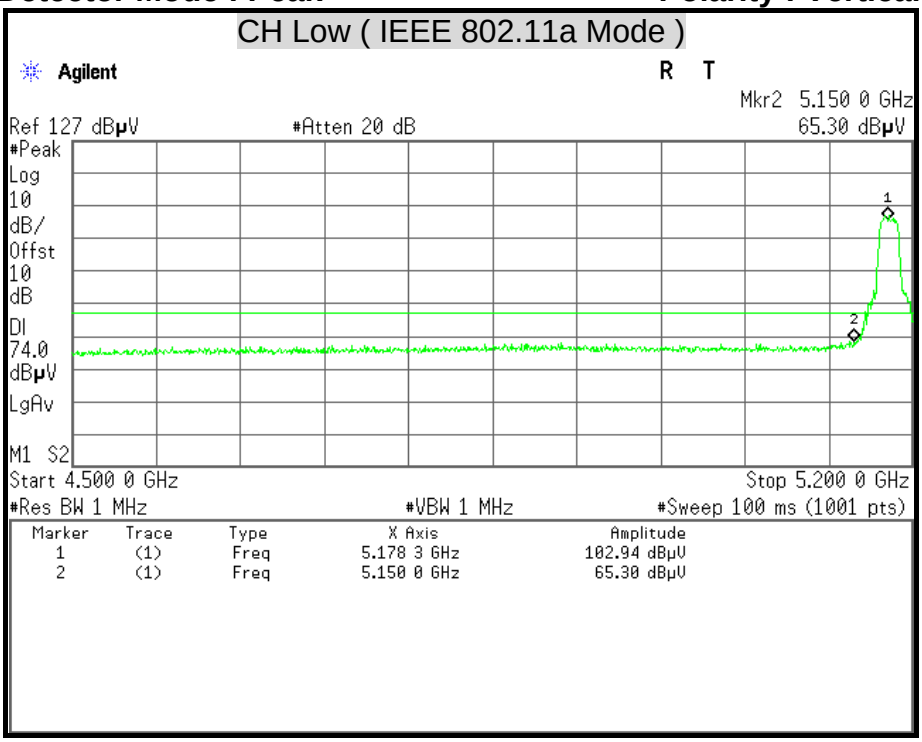
Detector Mode : Peak **Polarity : Horizontal**



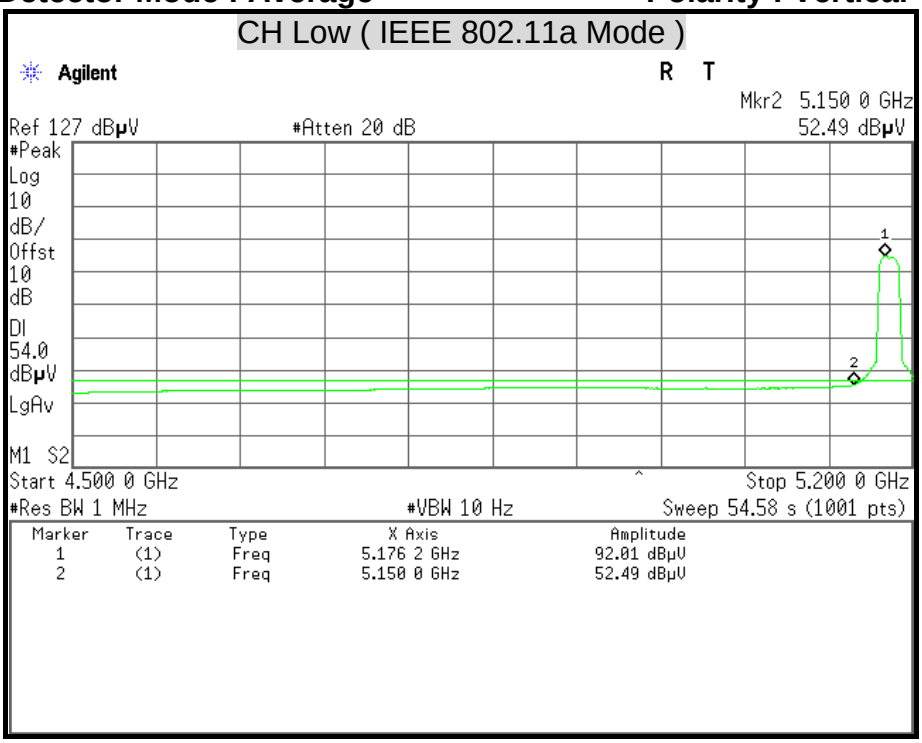
Detector Mode : Average **Polarity : Horizontal**



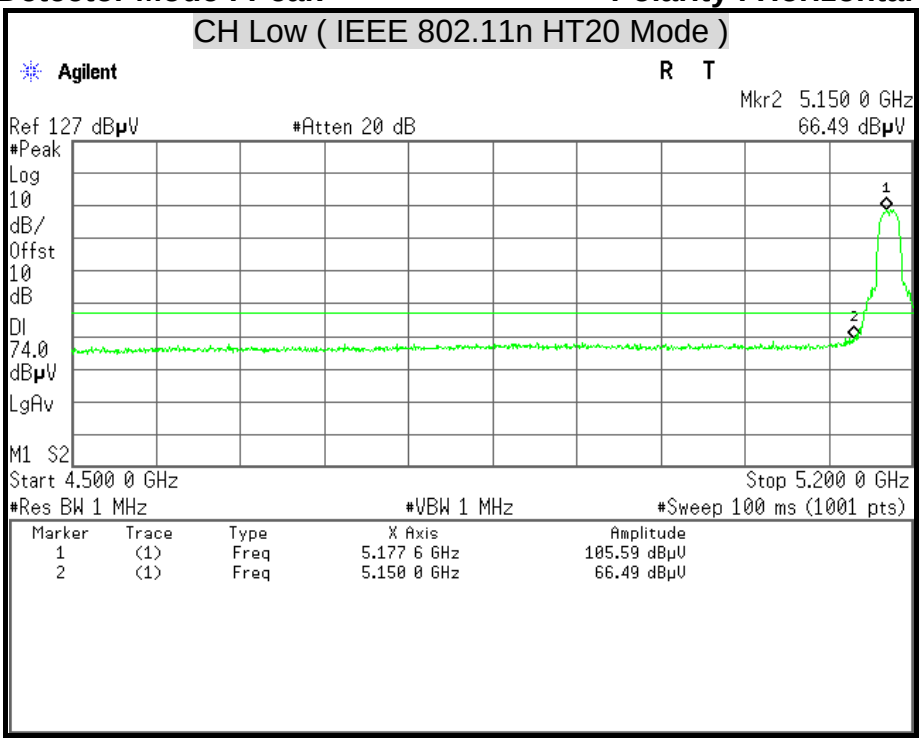
Detector Mode : Peak **Polarity : Vertical**



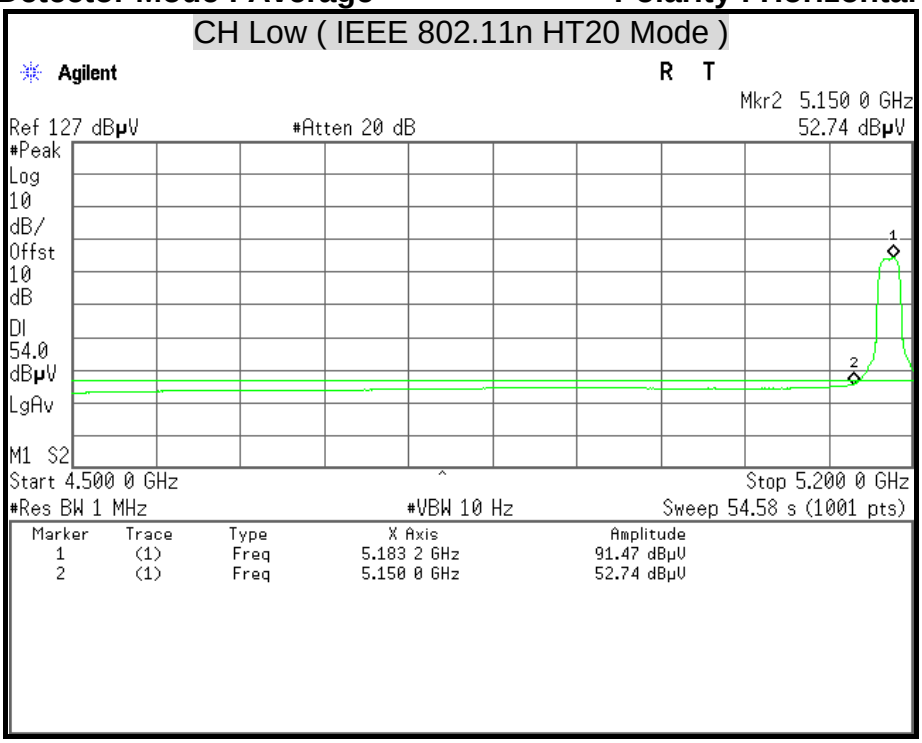
Detector Mode : Average **Polarity : Vertical**



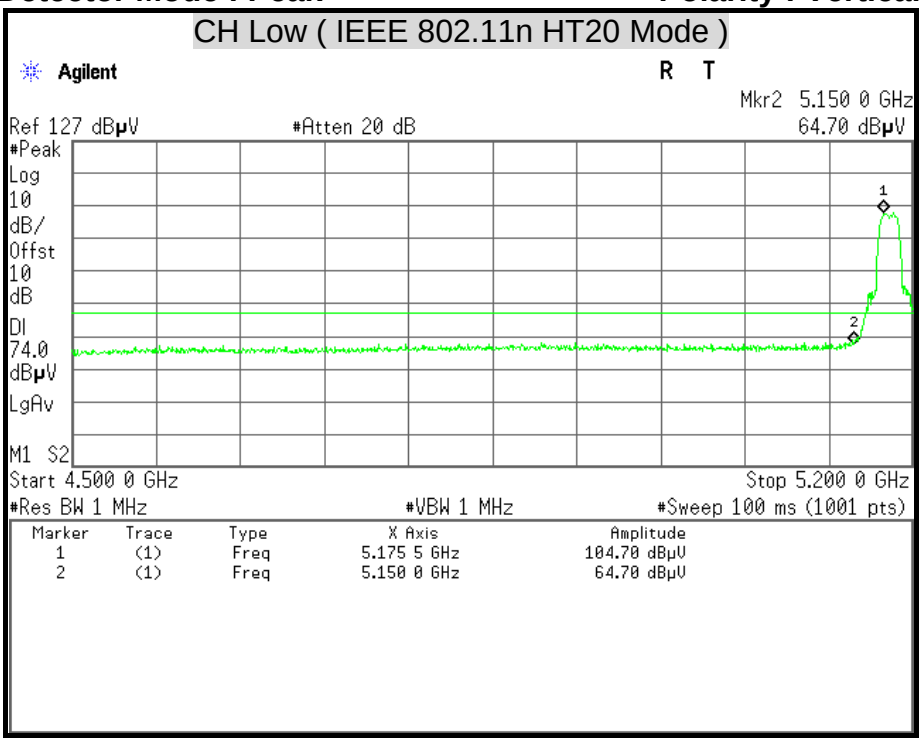
Detector Mode : Peak **Polarity : Horizontal**



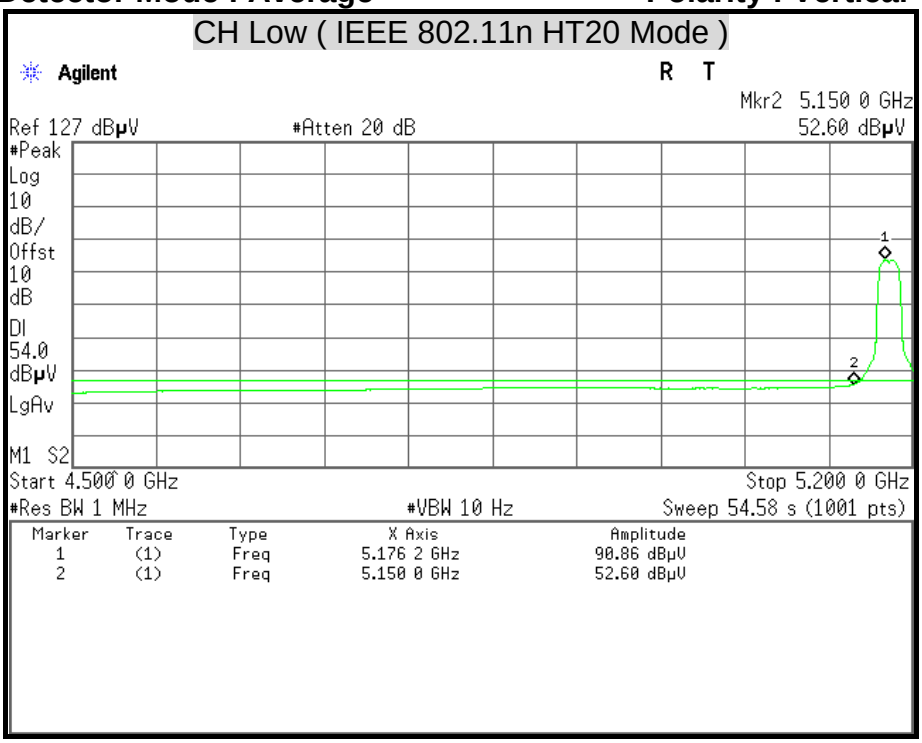
Detector Mode : Average **Polarity : Horizontal**



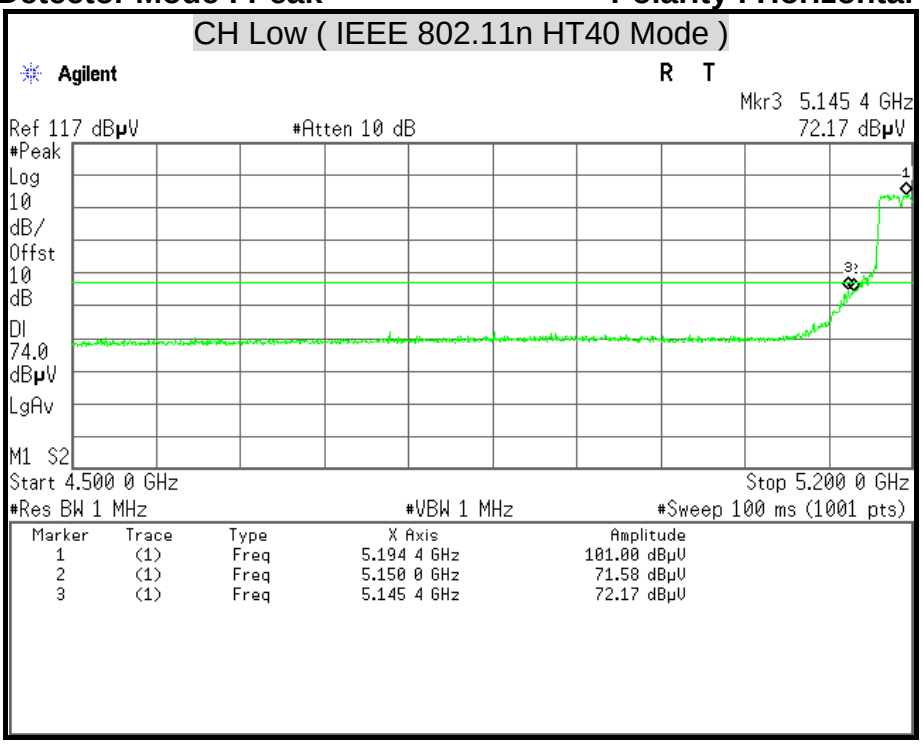
Detector Mode : Peak **Polarity : Vertical**



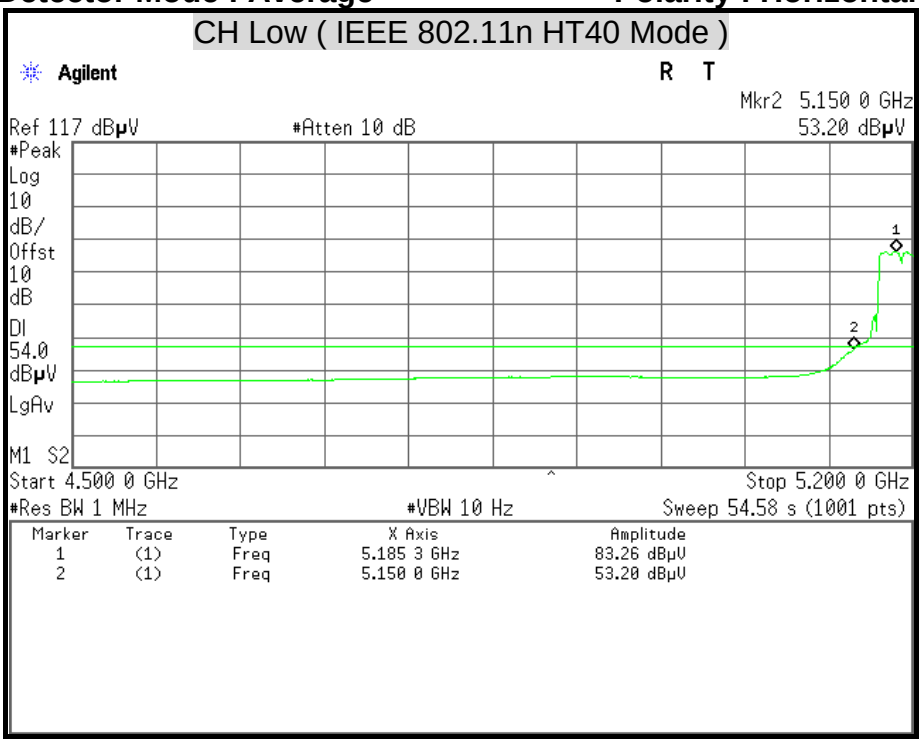
Detector Mode : Average **Polarity : Vertical**



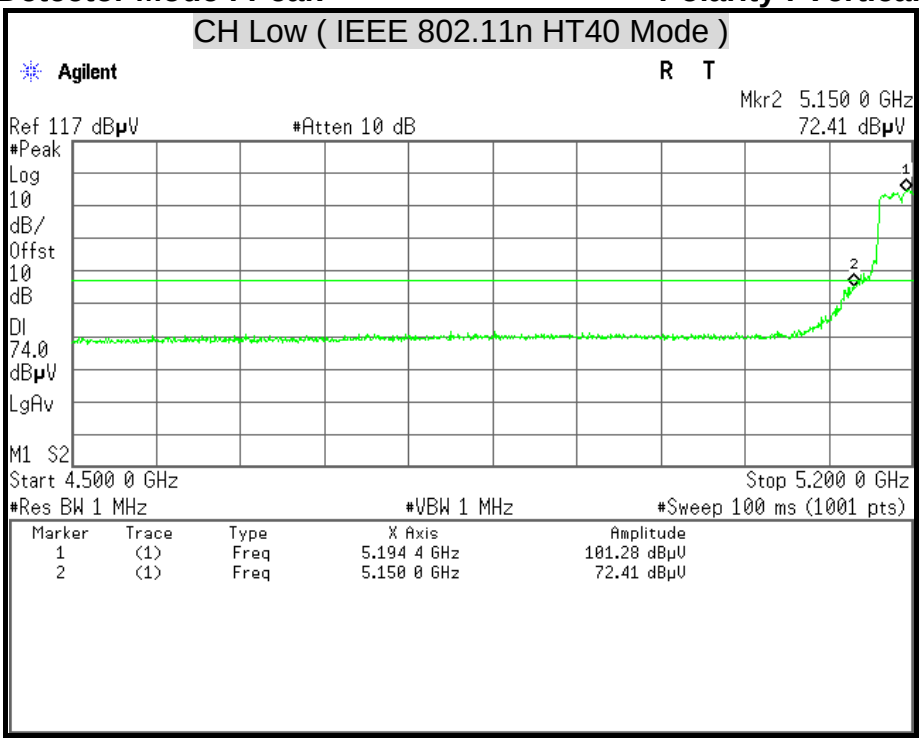
Detector Mode : Peak **Polarity : Horizontal**



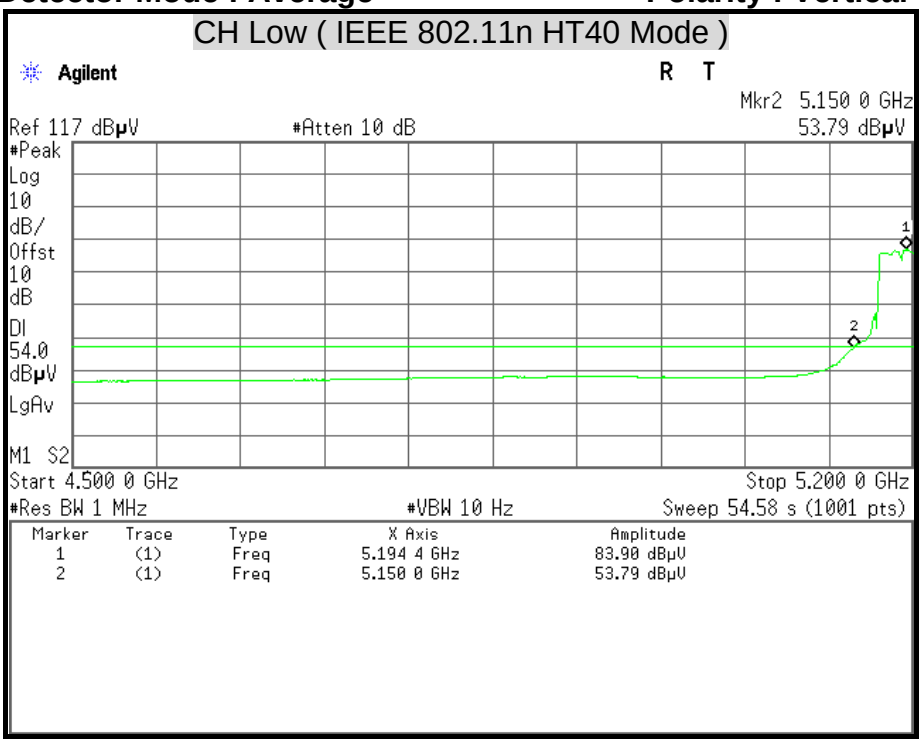
Detector Mode : Average **Polarity : Horizontal**



Detector Mode : Peak **Polarity : Vertical**



Detector Mode : Average **Polarity : Vertical**



7.6 CONDUCTED EMISSION

LIMITS

§ 15.207 (a) Except as shown in paragraph (b) and (c) this section, for an intentional radiator that 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 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

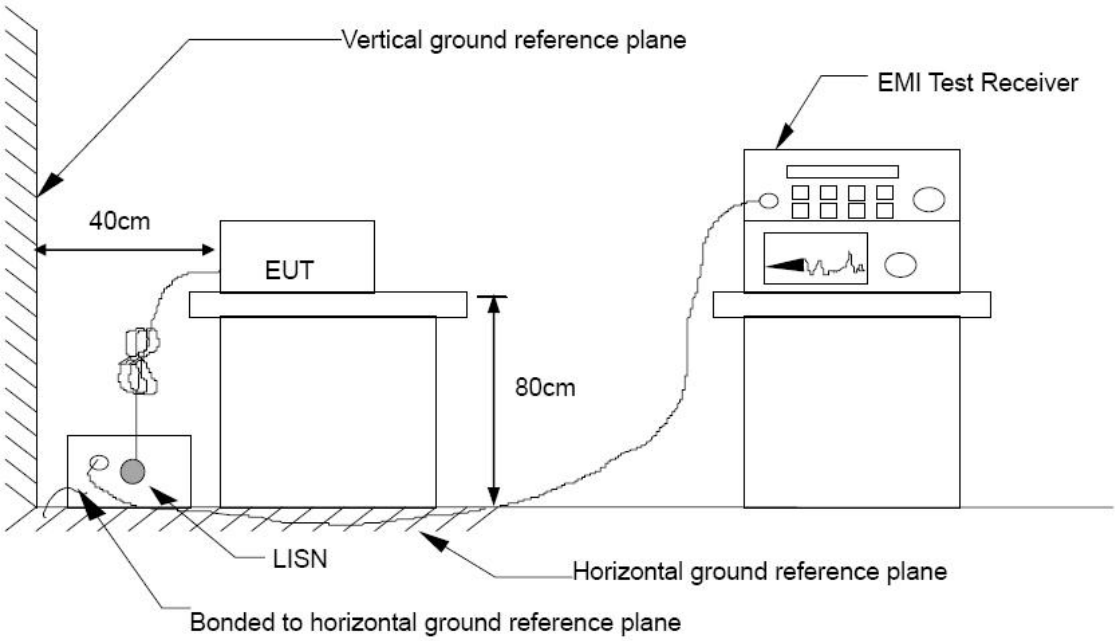
Frequency Range (MHz)	Conducted Limit (dBμv)	
	Quasi-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5.00	56	46
5.00 - 30.0	60	50

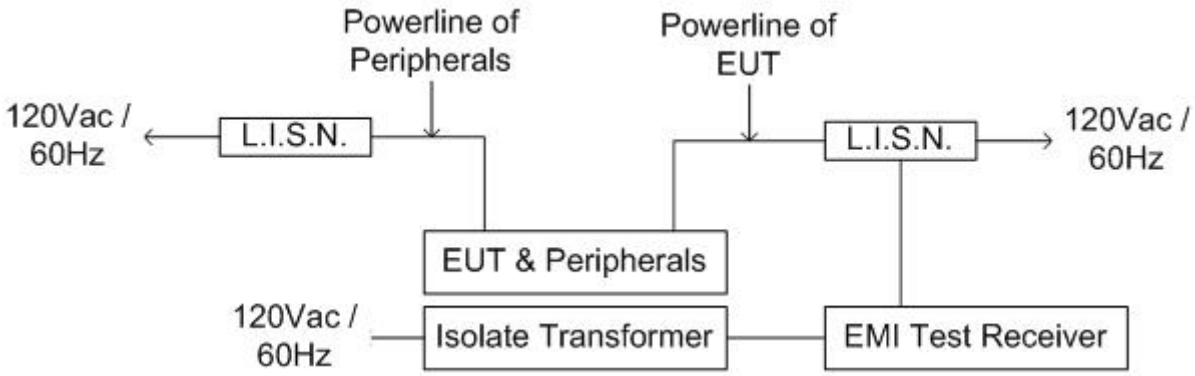
TEST EQUIPMENT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
L.I.S.N	SCHWARZBECK	NSLK 8127	8127-465	08/11/2014
L.I.S.N	SCHWARZBECK	NSLK 8127	8127-473	03/07/2014
EMI Receiver	ROHDE & SCHWARZ	ESCS 30	835418/008	10/16/2014
Pulse Limiter	ROHDE & SCHWARZ	ESH3-Z2	100117	07/01/2014

Remark: *Each piece of equipment is scheduled for calibration once a year.*

TEST SETUP





TEST PROCEDURE

The basic test procedure was in accordance with ANSI C63.4:2009.

The test procedure is performed in a 4m × 3m × 2.4m (L×W×H) shielded room.

The EUT along with its peripherals were placed on a 1.0m (W) × 1.5m (L) and 0.8m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane.

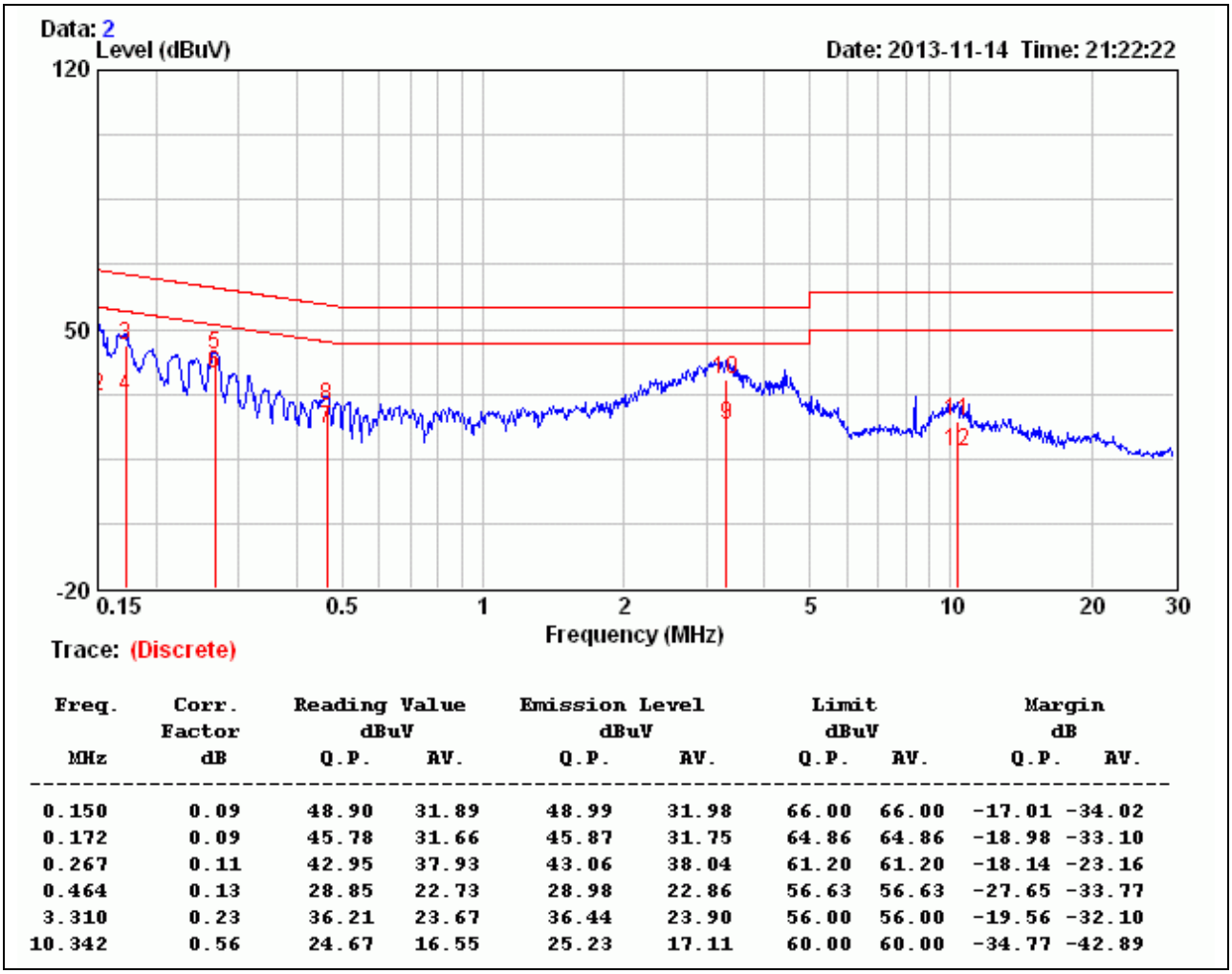
The EUT was connected to power mains through a line impedance stabilization network (LISN) which provides 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room. All peripherals were connected to the second LISN and the chassis ground also bounded to the horizontal ground plane of shielded room.

The EUT was located so that the distance between the boundary of the EUT and the closest surface of the LISN is 0.8 m. Where a mains flexible cord was provided by the manufacturer shall be 1 m long, or if in excess of 1 m, the excess cable was folded back and forth as far as possible so as to form a bundle not exceeding 0.4 m in length.

TEST RESULTS

Product Name	Nuvola	Test By	Rueyyan Lin
Test Model	NP-1	Test Date	2013/11/14
Test Mode	TX Mode	Temp. & Humidity	22°C, 52%

LINE



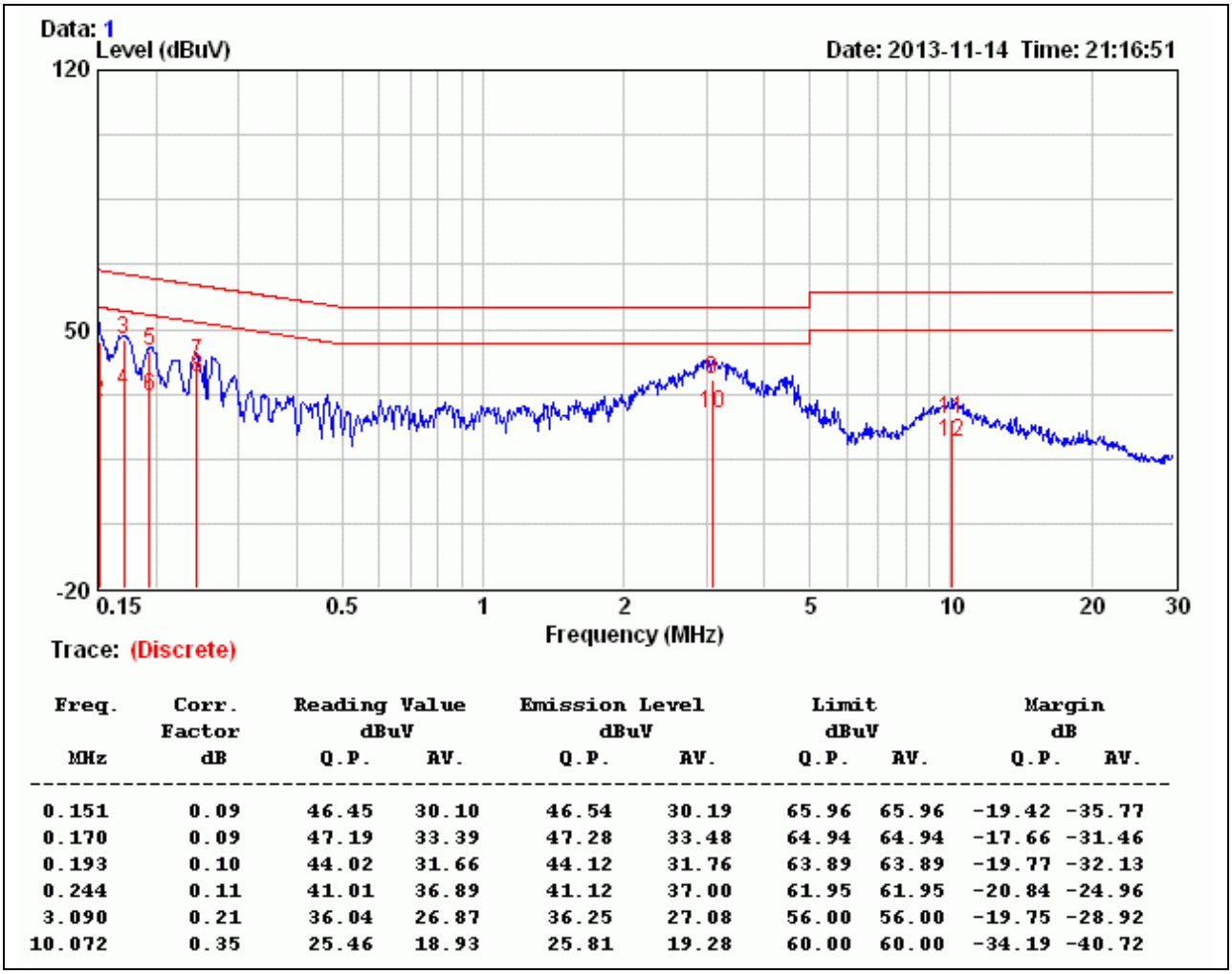
Freq. MHz	Corr. Factor dB	Reading Value dBuV Q.P.	Reading Value dBuV AV.	Emission Level dBuV Q.P.	Emission Level dBuV AV.	Limit dBuV Q.P.	Limit dBuV AV.	Margin dB Q.P.	Margin dB AV.
0.150	0.09	48.90	31.89	48.99	31.98	66.00	66.00	-17.01	-34.02
0.172	0.09	45.78	31.66	45.87	31.75	64.86	64.86	-18.98	-33.10
0.267	0.11	42.95	37.93	43.06	38.04	61.20	61.20	-18.14	-23.16
0.464	0.13	28.85	22.73	28.98	22.86	56.63	56.63	-27.65	-33.77
3.310	0.23	36.21	23.67	36.44	23.90	56.00	56.00	-19.56	-32.10
10.342	0.56	24.67	16.55	25.23	17.11	60.00	60.00	-34.77	-42.89

Remark:

1. *Correction Factor = Insertion loss + Cable loss*
2. *Emission level = Reading Value + Correction factor*
3. *Margin value = Emission level – Limit value*

Product Name	Nuvola	Test By	Rueyyan Lin
Test Model	NP-1	Test Date	2013/11/14
Test Mode	TX Mode	Temp. & Humidity	22°C, 52%

NEUTRAL



Freq. MHz	Corr. Factor dB	Reading Value dBuV Q.P.	Reading Value dBuV AV.	Emission Level dBuV Q.P.	Emission Level dBuV AV.	Limit dBuV Q.P.	Limit dBuV AV.	Margin dB Q.P.	Margin dB AV.
0.151	0.09	46.45	30.10	46.54	30.19	65.96	65.96	-19.42	-35.77
0.170	0.09	47.19	33.39	47.28	33.48	64.94	64.94	-17.66	-31.46
0.193	0.10	44.02	31.66	44.12	31.76	63.89	63.89	-19.77	-32.13
0.244	0.11	41.01	36.89	41.12	37.00	61.95	61.95	-20.84	-24.96
3.090	0.21	36.04	26.87	36.25	27.08	56.00	56.00	-19.75	-28.92
10.072	0.35	25.46	18.93	25.81	19.28	60.00	60.00	-34.19	-40.72

Remark:

1. *Correction Factor = Insertion loss + Cable loss*
2. *Emission level = Reading Value + Correction factor*
3. *Margin value = Emission level – Limit value*