FCC Test Report

Report No.:	RF170808C06-2
FCC ID:	2AJOTTA-1005
Test Model:	TA-1005
Received Date:	Aug. 08, 2017
Test Date:	Sep. 04, 2017 ~ Oct. 05, 2017
Issued Date:	Nov. 16, 2017
Applicant:	HMD Global Oy
Address:	Karaportti 2, 02610 Espoo, Finland
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
Lab Address:	No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan (R.O.C)
Test Location (1):	No. 19, Hwa Ya 2nd Rd, Wen Hwa Tsuen, Kwei Shan Hsiang, Taoyuan Hsien 333, Taiwan, R.O.C.
Test Location (2):	No.215, Sec. 3, Beixin Rd., Xindian Dist., New Taipei City 231, Taiwan, R.O.C
FCC Registration / Designation Number:	427177 / TW0011

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Release Control Record

Issue No.	Description	Date Issued
RF170808C06-2	Original Release	Nov. 16, 2017

1 Certificate of Conformity

Product:	Smart Phone
Brand:	Nokia
Test Model:	TA-1005
Sample Status:	Identical Prototype
Applicant:	HMD Global Oy
Test Date:	Sep. 04, 2017 ~ Oct. 05, 2017
Standards:	47 CFR FCC Part 15, Subpart C (Section 15.247) ANSI C63.10:2013

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by : _____ , **Date:** Nov. 16, 2017

Ivonne Wu / Supervisor

Approved by : _____ , **Date:** Nov. 16, 2017

Dylan Chiou / Project Engineer

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.247)			
FCC Clause	**Test Item**	**Result**	**Remarks**
15.207	AC Power Conducted Emission	Pass	Meet the requirement of limit. Minimum passing margin is -18.56 dB at 0.17374 MHz.
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -5.41 dB at 64.02 MHz.
15.247(d)	Antenna Port Emission	Pass	Meet the requirement of limit.
15.247(a)(2)	6 dB Bandwidth	Pass	Meet the requirement of limit.
---	Occupied Bandwidth Measurement	Pass	Reference only
15.247(b)	Conducted power	Pass	Meet the requirement of limit.
15.247(e)	Power Spectral Density	Pass	Meet the requirement of limit.
15.203	Antenna Requirement	Pass	No antenna connector is used.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT:

The listed uncertainties are the worst case uncertainty for the entire range of measurement. Please note that the uncertainty values are provided for informational purposes only and are not used in determining the PASS/FAIL results.

Measurement	**Frequency**	**Expended Uncertainty (k=2) (±)**
Conducted Emissions at mains ports	150 kHz ~ 30 MHz	2.44 dB
Radiated Emissions up to 1 GHz	30 MHz ~ 200 MHz	2.0153 dB
	200 MHz ~1000 MHz	2.0224 dB
Radiated Emissions above 1 GHz	1 GHz ~ 18 GHz	1.0121 dB
	18 GHz ~ 40 GHz	1.1508 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Smart Phone
Brand	Nokia
Test Model	TA-1005
Status of EUT	Identical Prototype
Power Supply Rating	5 Vdc or 9 Vdc or 12 Vdc (adapter) 5 Vdc (host equipment) 3.85 Vdc (battery)
Modulation Type	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
Modulation Technology	DSSS, OFDM
Transfer Rate	802.11b: 11.0 / 5.5 / 2.0 / 1.0 Mbps 802.11g: 54.0 / 48.0 / 36.0 / 24.0 / 18.0 / 12.0 / 9.0 / 6.0 Mbps 802.11n: up to MCS15
Operating Frequency	2412 ~ 2462 MHz
Number of Channel	11 for 802.11b, 802.11g, 802.11n (HT20) 7 for 802.11n (HT40)
Output Power	312.415 mW
Antenna Type	PIFA antenna with -2 dBi gain (Main) PIFA antenna with -3 dBi gain (Aux.)
Antenna Connector	N/A
Accessory Device	Refer to Note as below
Data Cable Supplied	Refer to Note as below

Note:

1. The EUT incorporates a MIMO function. Physically, the EUT provides two completed transmitters and two receivers.

Modulation Mode	Tx Function
802.11b	2TX
802.11g	2TX
802.11n (HT20)	2TX
802.11n (HT40)	2TX

2. The EUT contains following accessory devices.

Product	Brand	Model	Description
Adapter 1	Salcomp	FC0302	I/P: 100-240 Vac, 0.5 A O/P: 5 Vdc, 2.5 A or 9 Vdc, 2 A or 12 Vdc, 1.5 A
Adapter 2	DVE	AD-18WU	I/P: 100-240 Vac, 0.5 A O/P: 5 Vdc, 3 A or 9 Vdc, 2 A or 12 Vdc, 1.5 A
Battery	SCUD	HE333	3.85 Vdc, 3250 mAh
Earphone 1	NOKIA	HS-A01	1.15 meter
Earphone 2	NOKIA	HS-A01C	1.15 meter
USB Cable 1	Foxconn	CUDT01E-FA210-EH	0.95 meter Manufacturer: FIT
USB Cable 2	Foxconn	CA-18W	0.95 meter Manufacturer: YinRun
LCD Panel	LG Display	LH546QH1-EDD1-QG1	5.5" OLED
Front Camera	Chicony	CBFH51020005020LH	5M
Main Camera	Primay	FCDC1N	12+13M
eMMC 1 (=ROM 1)	SAMSUNG	IC_UFS2.1_128G	128G
Main Board	AT&S	FIH1883	--
BT/WLAN Module	murata	LBDD5QA1MS-119	--
WWAN Module	Qualcomm	MSM8998	--

3. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

3.2 Description of Test Modes

11 channels are provided for 802.11b, 802.11g and 802.11n (HT20):

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2412	7	2442
2	2417	8	2447
3	2422	9	2452
4	2427	10	2457
5	2432	11	2462
6	2437		

7 channels are provided for 802.11n (HT40):

Channel	Frequency (MHz)	Channel	Frequency (MHz)
3	2422	7	2442
4	2427	8	2447
5	2432	9	2452
6	2437		

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable To				Description
	RE≥1G	RE<1G	PLC	APCM	
-	√	√	√	√	-

Where **RE≥1G:** Radiated Emission above 1 GHz **RE<1G:** Radiated Emission below 1 GHz
PLC: Power Line Conducted Emission **APCM:** Antenna Port Conducted Measurement

NOTE: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **X-plane**.
NOTE: "-"means no effect.

Radiated Emission Test (Above 1 GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	802.11b	1 to 11	1, 6, 11	DSSS	DBPSK	1.0
-	802.11g	1 to 11	1, 6, 11	OFDM	BPSK	6.0
-	802.11n (HT20)	1 to 11	1, 6, 11	OFDM	BPSK	MCS0
-	802.11n (HT40)	3 to 9	3, 6, 9	OFDM	BPSK	MCS0

Radiated Emission Test (Below 1 GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	802.11n (HT40)	1 to 11	6	OFDM	BPSK	MCS0

Power Line Conducted Emission Test:

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	802.11n (HT40)	1 to 11	6	OFDM	BPSK	MCS0

Bandedge Measurement:

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	802.11b	1 to 11	1, 11	DSSS	DBPSK	1.0
-	802.11g	1 to 11	1, 11	OFDM	BPSK	6.0
-	802.11n (HT20)	1 to 11	1, 11	OFDM	BPSK	MCS0
-	802.11n (HT40)	3 to 9	3, 9	OFDM	BPSK	MCS0

Antenna Port Conducted Measurement:

☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	802.11b	1 to 11	1, 6, 11	DSSS	DBPSK	1.0
-	802.11g	1 to 11	1, 6, 11	OFDM	BPSK	6.0
-	802.11n (HT20)	1 to 11	1, 6, 11	OFDM	BPSK	MCS0
-	802.11n (HT40)	3 to 9	3, 6, 9	OFDM	BPSK	MCS0

Test Condition:

Applicable To	Environmental Conditions	Input Power	Tested by
RE≥1G	25 deg. C, 65 % RH	120 Vac, 60 Hz	Harry Hsueh
RE<1G	25 deg. C, 65 % RH	120 Vac, 60 Hz	Harry Hsueh
PLC	25 deg. C, 65 % RH	120 Vac, 60 Hz	Getaz Yang
APCM	25 deg. C, 65 % RH	3.85 Vdc	Carlos Chen

3.3 Duty Cycle of Test Signal

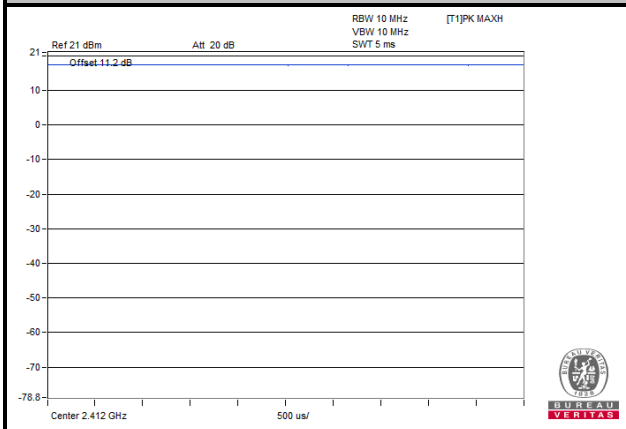
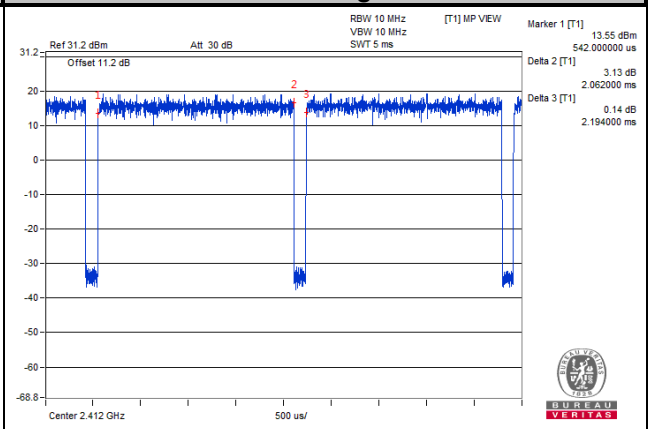
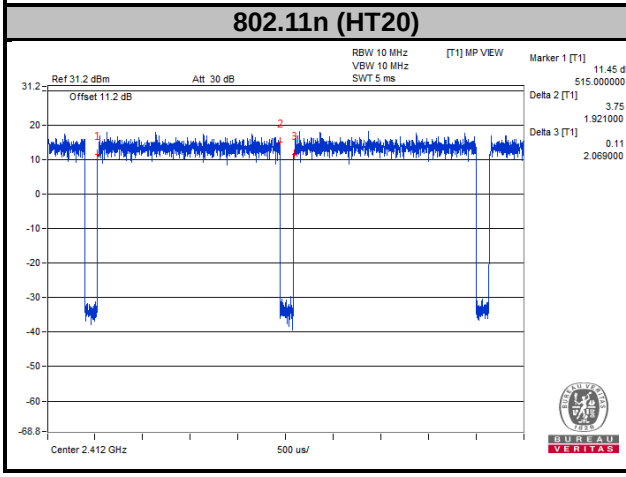
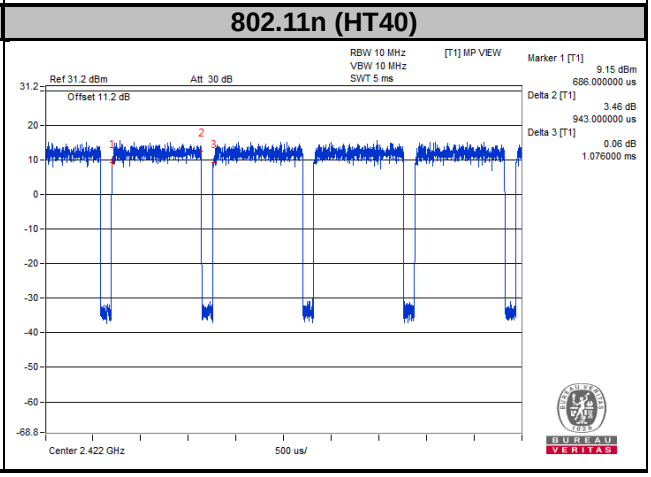
Duty cycle of test signal is < 98 %

802.11b: Duty cycle of test signal is 100 %, duty factor is not required.

802.11g: Duty cycle = 2.062/2.194 = 0.940, Duty factor = 10 * log(1/0.940) = 0.27

802.11n (HT20): Duty cycle = 1.921/2.069 = 0.928, Duty factor = 10 * log(1/0.928) = 0.32

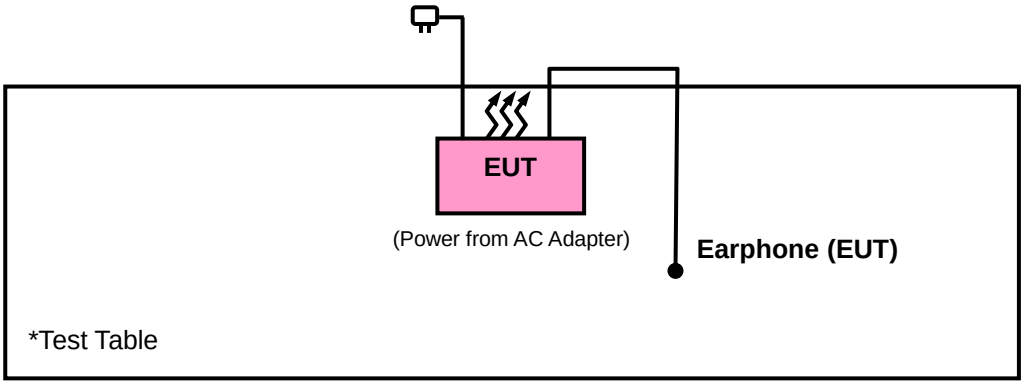
802.11n (HT40): Duty cycle = 0.943/1.076 = 0.876, Duty factor = 10 * log(1/0.876) = 0.57

802.11b	802.11g
	
802.11n (HT20)	**802.11n (HT40)**
	

3.4 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units.

3.4.1 Configuration of System under Test



3.5 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

FCC Part 15, Subpart C (15.247)
558074 D01 DTS Meas Guidance v04
662911 D01 Multiple Transmitter Output v02r01
ANSI C63.10-2013

All test items have been performed and recorded as per the above standards.

NOTE: The EUT has been verified to comply with the requirements of FCC Part 15, Subpart B, Class B (DoC). The test report has been issued separately.

4 Test Types and Results

4.1 Radiated Emission and Bandedge Measurement

4.1.1 Limits of Radiated Emission and Bandedge Measurement

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20 dB below the highest level of the desired power:

Frequencies (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

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any condition of modulation.

4.1.2 Test Instruments

Description & Manaufacturer	Model No.	Serial No.	Date of Calibration	Due Date of Calibration
Test Receiver Agilent Technologies	N9038A	MY52260177	Jul. 05, 2017	Jul. 04, 2018
Spectrum Analyzer ROHDE & SCHWARZ	FSU43	101261	Dec. 13, 2016	Dec. 12, 2017
BILOG Antenna SCHWARZBECK	VULB9168	9168-472	Dec. 13, 2016	Dec. 12, 2017
HORN Antenna ETS-Lindgren	3117	00143293	Jun. 26, 2017	Jun. 25, 2018
HORN Antenna SCHWARZBECK	BBHA 9170	9170-480	Dec. 14, 2016	Dec. 13, 2017
Fixed Attenuator Mini-Circuits	BW-N10W5+	NA	Jul. 07, 2017	Jul. 06, 2018
Bluetooth Tester	CBT	100980	Jun. 28, 2017	Jun. 27, 2019
Loop Antenna	EM-6879	269	Aug. 11, 2017	Aug. 10, 2018
Preamplifier Agilent	310N	187226	Jun. 23, 2017	Jun. 22, 2018
Preamplifier Agilent	83017A	MY39501357	Jun. 23, 2017	Jun. 22, 2018
Power Meter Anritsu	ML2495A	1012010	Aug. 15, 2017	Aug. 14, 2018
Power Sensor Anritsu	MA2411B	1315050	Aug. 15, 2017	Aug. 14, 2018
RF signal cable ETS-LINDGREN	5D-FB	Cable-CH1-01(RFC-SMS-100-SMS-120+RFC-SMS-100-SMS-400)	Jun. 26, 2017	Jun. 25, 2018
RF signal cable ETS-LINDGREN	8D-FB	Cable-CH1-02(RFC-SMS-100-SMS-24)	Jun. 26, 2017	Jun. 25, 2018
Software BV ADT	E3 8.130425b	NA	NA	NA
Antenna Tower MF	NA	NA	NA	NA
Turn Table MF	NA	NA	NA	NA
Antenna Tower &Turn Table Controller MF	MF-7802	NA	NA	NA

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

2. The test was performed in HsinTien Chamber 1.

3. The horn antenna and preamplifier (model: 83017A) are used only for the measurement of emission frequency above 1 GHz if tested.

4. The IC Site Registration No. is IC7450I-1.

4.1.3 Test Procedures

a. The EUT was placed on the top of a rotating table 0.8 meters (for below 1 GHz) / 1.5 meters (for above 1 GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. 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 rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
f. The test-receiver system was set to peak and average detected function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

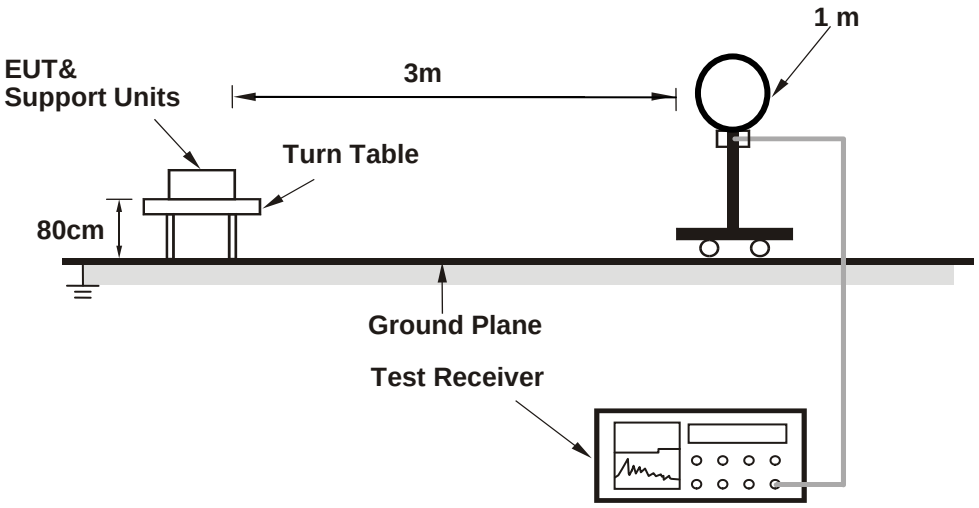
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz & 360 KHz for Quasi-peak detection (QP) at frequency below 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1 GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 1/T for Average (Duty cycle < 98 %) detection at frequency above 1 GHz.
4. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10 Hz (Duty cycle ≥ 98 %) for Average detection (AV) at frequency above 1 GHz.
5. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

No deviation.

4.1.5 Test Set Up

<Radiated emission below 30 MHz>



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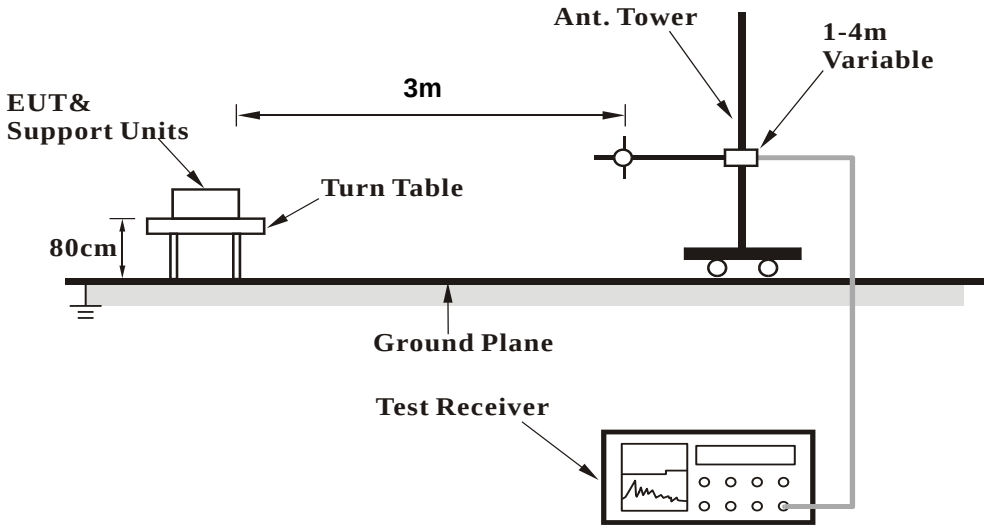

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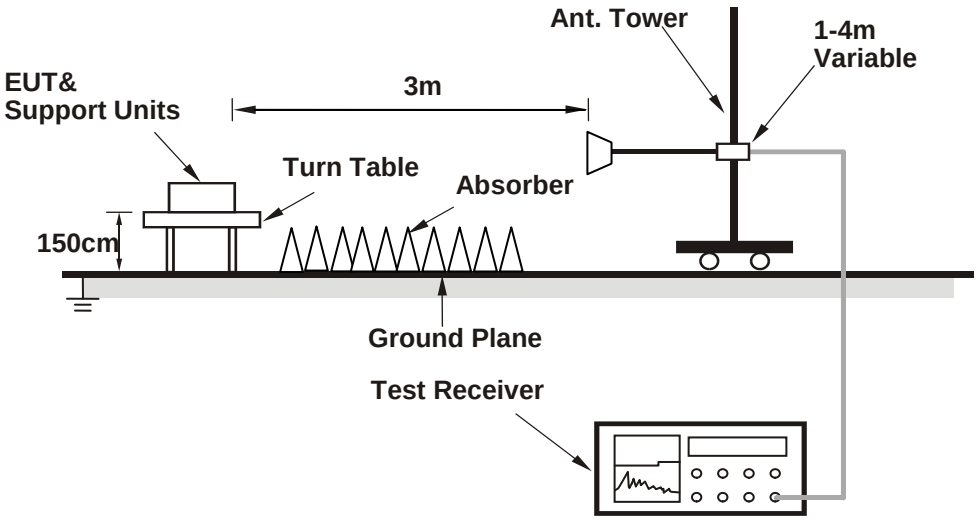


For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.1.6 EUT Operating Conditions

a. Placed the EUT on a testing table.
b. Use the software to control the EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

Above 1 GHz Data：

802.11b

EUT Test Condition		Measurement Detail	
Channel	Channel 1	**Frequency Range**	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Harry Hsueh

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Factor (dB/m)**	**Cable Loss (dB)**	**Preamp Factor (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2314.68	40.51	39.02	54	-13.49	31.71	5.3	35.52	270	0	Average
2314.68	51.47	49.98	74	-22.53	31.71	5.3	35.52	270	0	Peak
2412	90.5	88.73			31.81	5.43	35.47	270	0	Average
2412	93.38	91.61			31.81	5.43	35.47	270	0	Peak
4824	38.16	30.03	54	-15.84	33.97	8.26	34.1	108	273	Average
4824	47.55	39.42	74	-26.45	33.97	8.26	34.1	108	273	Peak
Antenna Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Factor (dB/m)**	**Cable Loss (dB)**	**Preamp Factor (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2342.4	40.35	38.78	54	-13.65	31.74	5.33	35.5	108	47	Average
2342.4	51.91	50.34	74	-22.09	31.74	5.33	35.5	108	47	Peak
2412	88.4	86.63			31.81	5.43	35.47	108	47	Average
2412	91.21	89.44			31.81	5.43	35.47	108	47	Peak
4824	38.59	30.46	54	-15.41	33.97	8.26	34.1	148	164	Average
4824	47.71	39.58	74	-26.29	33.97	8.26	34.1	148	164	Peak

Remarks:

1. Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
   Margin value = Emission level – Limit value
2. 2412 MHz: Fundamental frequency.

EUT Test Condition		Measurement Detail	
Channel	Channel 6	**Frequency Range**	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Harry Hsueh

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Factor (dB/m)**	**Cable Loss (dB)**	**Preamp Factor (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2370.57	40.47	38.81	54	-13.53	31.78	5.37	35.49	270	0	Average
2370.57	51.95	50.29	74	-22.05	31.78	5.37	35.49	270	0	Peak
2437	89.6	87.75			31.85	5.46	35.46	270	0	Average
2437	93.06	91.21			31.85	5.46	35.46	270	0	Peak
2485.92	41.07	39.08	54	-12.93	31.88	5.53	35.42	270	0	Average
2485.92	52.15	50.16	74	-21.85	31.88	5.53	35.42	270	0	Peak
Antenna Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Factor (dB/m)**	**Cable Loss (dB)**	**Preamp Factor (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2362.65	40.54	38.91	54	-13.46	31.76	5.37	35.5	108	47	Average
2362.65	51.9	50.27	74	-22.1	31.76	5.37	35.5	108	47	Peak
2437	88.54	86.69			31.85	5.46	35.46	108	47	Average
2437	91.6	89.75			31.85	5.46	35.46	108	47	Peak
2488.76	41.07	39.06	54	-12.93	31.9	5.53	35.42	108	47	Average
2488.76	52.02	50.01	74	-21.98	31.9	5.53	35.42	108	47	Peak

Remarks:

1. Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
   Margin value = Emission level – Limit value
2. 2437 MHz: Fundamental frequency.

EUT Test Condition		Measurement Detail	
Channel	Channel 11	**Frequency Range**	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Harry Hsueh

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Factor (dB/m)**	**Cable Loss (dB)**	**Preamp Factor (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2462	91.4	89.47			31.87	5.5	35.44	269	0	Average
2462	93.87	91.94			31.87	5.5	35.44	269	0	Peak
2495.36	41.36	39.34	54	-12.64	31.9	5.53	35.41	269	0	Average
2495.36	52.37	50.35	74	-21.63	31.9	5.53	35.41	269	0	Peak
4924	39.41	31.16	54	-14.59	33.99	8.28	34.02	196	324	Average
4924	48.74	40.49	74	-25.26	33.99	8.28	34.02	196	324	Peak
Antenna Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Factor (dB/m)**	**Cable Loss (dB)**	**Preamp Factor (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2462	88.11	86.18			31.87	5.5	35.44	100	20	Average
2462	91.68	89.75			31.87	5.5	35.44	100	20	Peak
2492.4	41.5	39.48	54	-12.5	31.9	5.53	35.41	100	20	Average
2492.4	52.13	50.11	74	-21.87	31.9	5.53	35.41	100	20	Peak
4924	39.24	30.99	54	-14.76	33.99	8.28	34.02	153	118	Average
4924	48.64	40.39	74	-25.36	33.99	8.28	34.02	153	118	Peak

Remarks:

1. Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
   Margin value = Emission level – Limit value
2. 2462 MHz: Fundamental frequency.

802.11g

EUT Test Condition		Measurement Detail	
Channel	Channel 1	**Frequency Range**	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Harry Hsueh

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Factor (dB/m)**	**Cable Loss (dB)**	**Preamp Factor (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2350.32	40.64	39.07	54	-13.36	31.74	5.33	35.5	270	0	Average
2350.32	51.62	50.05	74	-22.38	31.74	5.33	35.5	270	0	Peak
2412	84.24	82.47			31.81	5.43	35.47	270	0	Average
2412	92.4	90.63			31.81	5.43	35.47	270	0	Peak
4824	38.47	30.34	54	-15.53	33.97	8.26	34.1	115	261	Average
4824	47.37	39.24	74	-26.63	33.97	8.26	34.1	115	261	Peak
Antenna Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Factor (dB/m)**	**Cable Loss (dB)**	**Preamp Factor (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2382.09	40.88	39.19	54	-13.12	31.78	5.4	35.49	108	47	Average
2382.09	51.4	49.71	74	-22.6	31.78	5.4	35.49	108	47	Peak
2412	82.1	80.33			31.81	5.43	35.47	108	47	Average
2412	89.77	88			31.81	5.43	35.47	108	47	Peak
4824	38.84	30.71	54	-15.16	33.97	8.26	34.1	129	136	Average
4824	47.94	39.81	74	-26.06	33.97	8.26	34.1	129	136	Peak

Remarks:

1. Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
   Margin value = Emission level – Limit value
2. 2412 MHz: Fundamental frequency.

EUT Test Condition		Measurement Detail	
Channel	Channel 6	**Frequency Range**	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Harry Hsueh

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Factor (dB/m)**	**Cable Loss (dB)**	**Preamp Factor (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2360.04	40.51	38.88	54	-13.49	31.76	5.37	35.5	270	0	Average
2360.04	51.64	50.01	74	-22.36	31.76	5.37	35.5	270	0	Peak
2437	84.59	82.74			31.85	5.46	35.46	270	0	Average
2437	92.96	91.11			31.85	5.46	35.46	270	0	Peak
2484.28	40.95	38.96	54	-13.05	31.88	5.53	35.42	270	0	Average
2484.28	52.07	50.08	74	-21.93	31.88	5.53	35.42	270	0	Peak
Antenna Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Factor (dB/m)**	**Cable Loss (dB)**	**Preamp Factor (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2336.1	40.41	38.86	54	-13.59	31.74	5.33	35.52	108	47	Average
2336.1	51.52	49.97	74	-22.48	31.74	5.33	35.52	108	47	Peak
2437	82.99	81.14			31.85	5.46	35.46	108	47	Average
2437	90.9	89.05			31.85	5.46	35.46	108	47	Peak
2493.68	41.04	39.02	54	-12.96	31.9	5.53	35.41	108	47	Average
2493.68	52.34	50.32	74	-21.66	31.9	5.53	35.41	108	47	Peak

Remarks:

1. Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
   Margin value = Emission level – Limit value
2. 2437 MHz: Fundamental frequency.

EUT Test Condition		Measurement Detail	
Channel	Channel 11	**Frequency Range**	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Harry Hsueh

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Factor (dB/m)**	**Cable Loss (dB)**	**Preamp Factor (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2462	85.22	83.29			31.87	5.5	35.44	269	0	Average
2462	92.31	90.38			31.87	5.5	35.44	269	0	Peak
2483.52	41.18	39.22	54	-12.82	31.88	5.5	35.42	269	0	Average
2483.52	52.87	50.91	74	-21.13	31.88	5.5	35.42	269	0	Peak
4924	39.47	31.22	54	-14.53	33.99	8.28	34.02	126	188	Average
4924	48.82	40.57	74	-25.18	33.99	8.28	34.02	126	188	Peak
Antenna Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Factor (dB/m)**	**Cable Loss (dB)**	**Preamp Factor (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2462	82.89	80.96			31.87	5.5	35.44	100	20	Average
2462	90.01	88.08			31.87	5.5	35.44	100	20	Peak
2492.6	40.94	38.92	54	-13.06	31.9	5.53	35.41	100	20	Average
2492.6	52.14	50.12	74	-21.86	31.9	5.53	35.41	100	20	Peak
4924	38.79	30.54	54	-15.21	33.99	8.28	34.02	192	103	Average
4924	48.34	40.09	74	-25.66	33.99	8.28	34.02	192	103	Peak

Remarks:

1. Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
   Margin value = Emission level – Limit value
2. 2462 MHz: Fundamental frequency.

802.11n (HT20)

EUT Test Condition		Measurement Detail	
Channel	Channel 1	**Frequency Range**	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Harry Hsueh

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Factor (dB/m)**	**Cable Loss (dB)**	**Preamp Factor (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2378.13	40.45	38.79	54	-13.55	31.78	5.37	35.49	108	47	Average
2378.13	51.7	50.04	74	-22.3	31.78	5.37	35.49	108	47	Peak
2412	81.22	79.45			31.81	5.43	35.47	108	47	Average
2412	88.1	86.33			31.81	5.43	35.47	108	47	Peak
4824	38.26	30.13	54	-15.74	33.97	8.26	34.1	152	118	Average
4824	47.13	39	74	-26.87	33.97	8.26	34.1	152	118	Peak
Antenna Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Factor (dB/m)**	**Cable Loss (dB)**	**Preamp Factor (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2364	40.54	38.91	54	-13.46	31.76	5.37	35.5	270	0	Average
2364	52.15	50.52	74	-21.85	31.76	5.37	35.5	270	0	Peak
2412	83.21	81.44			31.81	5.43	35.47	270	0	Average
2412	90.18	88.41			31.81	5.43	35.47	270	0	Peak
4824	38.52	30.39	54	-15.48	33.97	8.26	34.1	196	321	Average
4824	47.67	39.54	74	-26.33	33.97	8.26	34.1	196	321	Peak

Remarks:

1. Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
   Margin value = Emission level – Limit value
2. 2412 MHz: Fundamental frequency.

EUT Test Condition		Measurement Detail	
Channel	Channel 6	**Frequency Range**	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Harry Hsueh

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Factor (dB/m)**	**Cable Loss (dB)**	**Preamp Factor (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2364.72	40.32	38.68	54	-13.68	31.76	5.37	35.49	270	0	Average
2364.72	51.76	50.12	74	-22.24	31.76	5.37	35.49	270	0	Peak
2437	82.38	80.53			31.85	5.46	35.46	270	0	Average
2437	90.24	88.39			31.85	5.46	35.46	270	0	Peak
2495.72	41.02	39	54	-12.98	31.9	5.53	35.41	270	0	Average
2495.72	52.33	50.31	74	-21.67	31.9	5.53	35.41	270	0	Peak
Antenna Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Factor (dB/m)**	**Cable Loss (dB)**	**Preamp Factor (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2389.11	40.43	38.72	54	-13.57	31.8	5.4	35.49	108	47	Average
2389.11	52.53	50.82	74	-21.47	31.8	5.4	35.49	108	47	Peak
2437	79.98	78.13			31.85	5.46	35.46	108	47	Average
2437	88.41	86.56			31.85	5.46	35.46	108	47	Peak
2496.72	41.15	39.13	54	-12.85	31.9	5.53	35.41	108	47	Average
2496.72	53.22	51.2	74	-20.78	31.9	5.53	35.41	108	47	Peak

Remarks:

1. Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
   Margin value = Emission level – Limit value
2. 2437 MHz: Fundamental frequency.

EUT Test Condition		Measurement Detail	
Channel	Channel 11	**Frequency Range**	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Harry Hsueh

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Factor (dB/m)**	**Cable Loss (dB)**	**Preamp Factor (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2462	82.36	80.43			31.87	5.5	35.44	269	0	Average
2462	90.68	88.75			31.87	5.5	35.44	269	0	Peak
2486.08	41.12	39.13	54	-12.88	31.88	5.53	35.42	269	0	Average
2486.08	52.28	50.29	74	-21.72	31.88	5.53	35.42	269	0	Peak
4924	39.21	30.96	54	-14.79	33.99	8.28	34.02	158	236	Average
4924	48.5	40.25	74	-25.5	33.99	8.28	34.02	158	236	Peak
Antenna Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Factor (dB/m)**	**Cable Loss (dB)**	**Preamp Factor (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2462	80.96	79.03			31.87	5.5	35.44	100	20	Average
2462	88.66	86.73			31.87	5.5	35.44	100	20	Peak
2490.04	41.04	39.03	54	-12.96	31.9	5.53	35.42	100	20	Average
2490.04	51.99	49.98	74	-22.01	31.9	5.53	35.42	100	20	Peak
4924	38.43	30.18	54	-15.57	33.99	8.28	34.02	128	174	Average
4924	47.56	39.31	74	-26.44	33.99	8.28	34.02	128	174	Peak

Remarks:

1. Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
   Margin value = Emission level – Limit value
2. 2462 MHz: Fundamental frequency.

802.11n (HT40)

EUT Test Condition		Measurement Detail	
Channel	Channel 3	**Frequency Range**	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Harry Hsueh

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Factor (dB/m)**	**Cable Loss (dB)**	**Preamp Factor (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2389.83	40.94	39.21	54	-13.06	31.8	5.4	35.47	270	0	Average
2389.83	51.96	50.23	74	-22.04	31.8	5.4	35.47	270	0	Peak
2422	80.24	78.44			31.83	5.43	35.46	270	0	Average
2422	87.89	86.09			31.83	5.43	35.46	270	0	Peak
2487.8	40.97	38.96	54	-13.03	31.9	5.53	35.42	270	0	Average
2487.8	52.42	50.41	74	-21.58	31.9	5.53	35.42	270	0	Peak
Antenna Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Factor (dB/m)**	**Cable Loss (dB)**	**Preamp Factor (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2315.94	40.46	38.97	54	-13.54	31.71	5.3	35.52	108	47	Average
2315.94	51.51	50.02	74	-22.49	31.71	5.3	35.52	108	47	Peak
2422	77.94	76.14			31.83	5.43	35.46	108	47	Average
2422	85.32	83.52			31.83	5.43	35.46	108	47	Peak
2484.52	41	39.01	54	-13	31.88	5.53	35.42	108	47	Average
2484.52	51.82	49.83	74	-22.18	31.88	5.53	35.42	108	47	Peak

Remarks:

1. Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
   Margin value = Emission level – Limit value
2. 2422 MHz: Fundamental frequency.

EUT Test Condition		Measurement Detail	
Channel	Channel 6	**Frequency Range**	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Harry Hsueh

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Factor (dB/m)**	**Cable Loss (dB)**	**Preamp Factor (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2385.42	40.89	39.2	54	-13.11	31.78	5.4	35.49	270	0	Average
2385.42	51.85	50.16	74	-22.15	31.78	5.4	35.49	270	0	Peak
2437	79.8	77.95			31.85	5.46	35.46	270	0	Average
2437	87.41	85.56			31.85	5.46	35.46	270	0	Peak
2493.24	41.57	39.55	54	-12.43	31.9	5.53	35.41	270	0	Average
2493.24	51.91	49.89	74	-22.09	31.9	5.53	35.41	270	0	Peak
Antenna Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Factor (dB/m)**	**Cable Loss (dB)**	**Preamp Factor (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2365.08	40.84	39.2	54	-13.16	31.76	5.37	35.49	108	47	Average
2365.08	52.05	50.41	74	-21.95	31.76	5.37	35.49	108	47	Peak
2437	77.66	75.81			31.85	5.46	35.46	108	47	Average
2437	85.19	83.34			31.85	5.46	35.46	108	47	Peak
2486.48	41.59	39.6	54	-12.41	31.88	5.53	35.42	108	47	Average
2486.48	52.94	50.95	74	-21.06	31.88	5.53	35.42	108	47	Peak

Remarks:

1. Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
   Margin value = Emission level – Limit value
2. 2437 MHz: Fundamental frequency.

EUT Test Condition		Measurement Detail	
Channel	Channel 9	**Frequency Range**	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Harry Hsueh

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Factor (dB/m)**	**Cable Loss (dB)**	**Preamp Factor (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2356.62	40.46	38.83	54	-13.54	31.76	5.37	35.5	269	0	Average
2356.62	51.58	49.95	74	-22.42	31.76	5.37	35.5	269	0	Peak
2452	80.06	78.19			31.85	5.46	35.44	269	0	Average
2452	87.31	85.44			31.85	5.46	35.44	269	0	Peak
2484.36	41.09	39.1	54	-12.91	31.88	5.53	35.42	269	0	Average
2484.36	52.23	50.24	74	-21.77	31.88	5.53	35.42	269	0	Peak
Antenna Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Factor (dB/m)**	**Cable Loss (dB)**	**Preamp Factor (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2329.17	40.41	38.87	54	-13.59	31.73	5.33	35.52	100	20	Average
2329.17	51.77	50.23	74	-22.23	31.73	5.33	35.52	100	20	Peak
2452	77.54	75.67			31.85	5.46	35.44	100	20	Average
2452	85.28	83.41			31.85	5.46	35.44	100	20	Peak
2494.44	41.04	39.02	54	-12.96	31.9	5.53	35.41	100	20	Average
2494.44	52.39	50.37	74	-21.61	31.9	5.53	35.41	100	20	Peak

Remarks:

1. Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
   Margin value = Emission level – Limit value
2. 2452 MHz: Fundamental frequency.

9 kHz ~ 30 MHz Data:

The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

30 MHz ~ 1 GHz Worst-Case Data:

802.11n (HT40)

EUT Test Condition		Measurement Detail	
Channel	Channel 6	**Frequency Range**	30 MHz ~ 1 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Quasi-peak (QP)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Harry Hsueh

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Factor (dB/m)**	**Cable Loss (dB)**	**Preamp Factor (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
77.79	21.88	44.66	40	-18.12	8.33	1.11	32.22	144	184	Peak
185.25	21.03	41.46	43.5	-22.47	10.2	1.61	32.24	132	169	Peak
210.63	20.58	40.03	43.5	-22.92	11.16	1.65	32.26	188	175	Peak
422.5	15.31	29.83	46	-30.69	15.26	2.41	32.19	105	184	Peak
562.5	17.96	30.01	46	-28.04	17.33	2.82	32.2	112	162	Peak
783.7	22.1	30.75	46	-23.9	20.17	3.27	32.09	126	148	Peak
Antenna Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Factor (dB/m)**	**Cable Loss (dB)**	**Preamp Factor (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
64.02	34.59	53.57	40	-5.41	12.35	0.9	32.23	108	195	Peak
74.01	25.39	47.72	40	-14.61	8.78	1.11	32.22	116	152	Peak
206.04	18.1	37.6	43.5	-25.4	11.12	1.65	32.27	162	195	Peak
396.6	14.85	29.8	46	-31.15	14.93	2.34	32.22	114	154	Peak
663.3	19.37	29.85	46	-26.63	18.66	2.99	32.13	125	154	Peak
849.5	23.68	31.02	46	-22.32	21.02	3.44	31.8	166	195	Peak

Remarks:

1. Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
   Margin value = Emission level – Limit value

4.2 Conducted Emission Measurement

4.2.1 Limits of Conducted Emission Measurement

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

Note: 1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.

4.2.2 Test Instruments

Description & Manaufacturer	Model No.	Serial No.	Date of Calibration	Due Date of Calibration
Test Receiver ROHDE & SCHWARZ	ESCI	100613	Nov. 21, 2016	Nov. 20, 2017
RF signal cable (with 10dB PAD) Woken	5D-FB	Cable-cond1-01	Sep. 05, 2017	Sep. 04, 2018
LISN/AMN ROHDE & SCHWARZ (EUT)	ESH3-Z5	835239/001	Mar. 10, 2017	Mar. 09, 2018
LISN/AMN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Aug. 15, 2017	Aug. 14, 2018
Software ADT	BV ADT_Cond_ V7.3.7.3	NA	NA	NA

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HwaYa Shielded Room 1.
3. The VCCI Site Registration No. is C-2040.

4.2.3 Test Procedures

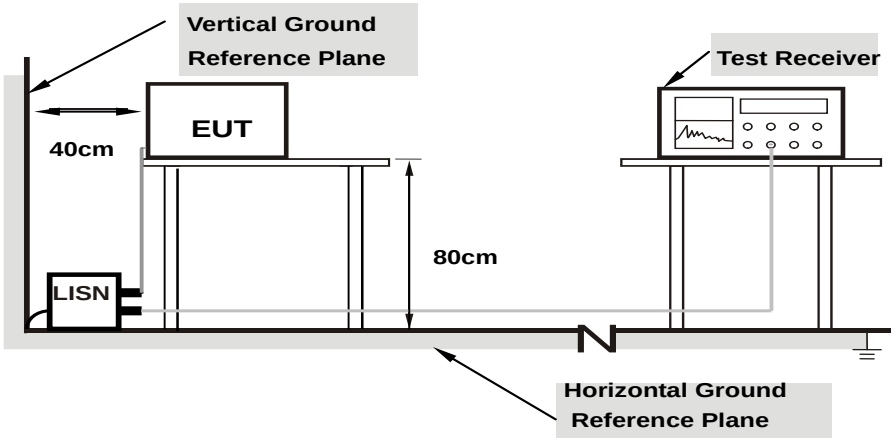
a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/50 uH of coupling impedance for the measuring instrument.
b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
c. The frequency range from 150 kHz to 30 MHz was searched. Emission levels under (Limit – 20 dB) was not recorded.

NOTE: All modes of operation were investigated and the worst-case emissions are reported.

4.2.4 Deviation from Test Standard

No deviation.

4.2.5 Test Setup



Note: 1.Support units were connected to second LISN.

For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.2.6 EUT Operating Conditions

a. Placed the EUT on a testing table.
b. Use the software to control the EUT under transmission condition continuously at specific channel frequency.

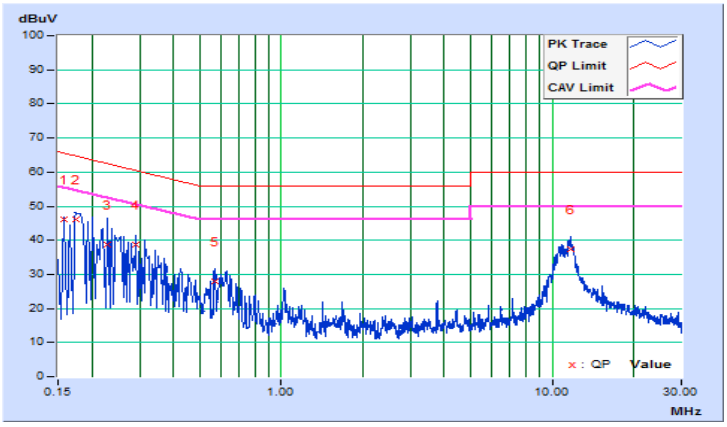
4.2.7 Test Results

Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	Environmental Conditions	25℃, 65%RH
Tested by	Getaz Yang	Test Date	2017/10/4

Phase Of Power : Line (L)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15782	10.10	35.89	22.06	45.99	32.16	65.58	55.58	-19.59	-23.42
2	0.17374	10.10	36.12	21.36	46.22	31.46	64.78	54.78	-18.56	-23.32
3	0.22820	10.11	28.66	14.37	38.77	24.48	62.51	52.51	-23.74	-28.03
4	0.29076	10.11	28.62	11.62	38.73	21.73	60.50	50.50	-21.77	-28.77
5	0.57228	10.12	17.93	4.29	28.05	14.41	56.00	46.00	-27.95	-31.59
6	11.65713	10.72	26.61	18.71	37.33	29.43	60.00	50.00	-22.67	-20.57

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

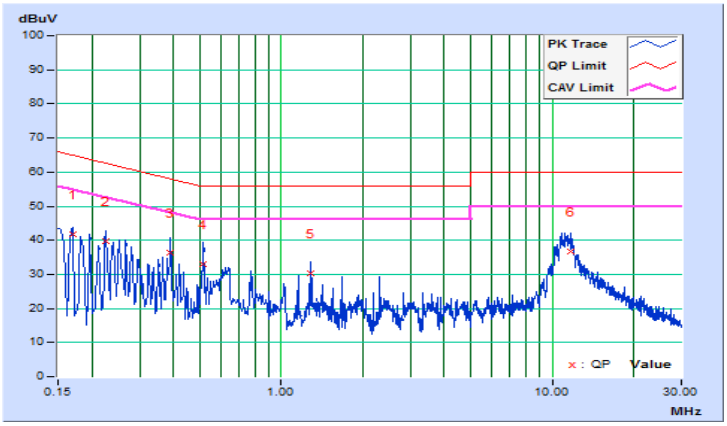


Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	Environmental Conditions	25℃, 65%RH
Tested by	Getaz Yang	Test Date	2017/10/4

Phase Of Power : Neutral (N)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16955	10.10	31.63	16.43	41.73	26.53	64.98	54.98	-23.25	-28.45
2	0.22434	10.11	29.56	15.77	39.67	25.88	62.66	52.66	-22.99	-26.78
3	0.38851	10.12	26.34	11.94	36.46	22.06	58.10	48.10	-21.64	-26.04
4	0.51754	10.12	23.01	8.99	33.13	19.11	56.00	46.00	-22.87	-26.89
5	1.29172	10.14	20.15	6.65	30.29	16.79	56.00	46.00	-25.71	-29.21
6	11.76661	10.59	26.23	18.56	36.82	29.15	60.00	50.00	-23.18	-20.85

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

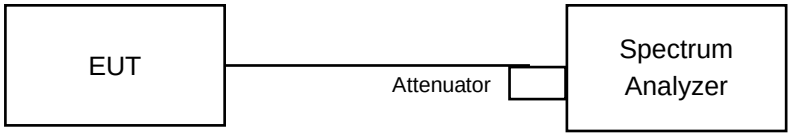


4.3 6 dB Bandwidth Measurement

4.3.1 Limits of 6 dB Bandwidth Measurement

The minimum of 6 dB Bandwidth Measurement is 0.5 MHz.

4.3.2 Test Setup



4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.3.4 Test Procedure

a. Set resolution bandwidth (RBW) = 100 kHz
b. Set the video bandwidth (VBW) ≥ 3 x RBW, Detector = Peak.
c. Trace mode = max hold.
d. Sweep = auto couple.
e. Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission

4.3.5 Deviation fromTest Standard

No deviation.

4.3.6 EUT Operating Conditions

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.3.7 Test Result

802.11b

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
1	2412	7.09	8.05	0.5	Pass
6	2437	8.10	7.13	0.5	Pass
11	2462	7.06	8.05	0.5	Pass

802.11g

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
1	2412	15.75	16.37	0.5	Pass
6	2437	16.11	15.80	0.5	Pass
11	2462	15.71	16.36	0.5	Pass

802.11n (HT20)

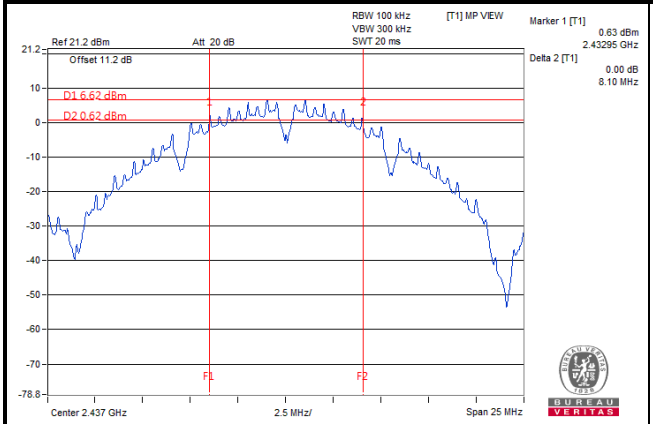
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
1	2412	16.37	17.61	0.5	Pass
6	2437	17.63	16.41	0.5	Pass
11	2462	16.10	17.21	0.5	Pass

802.11n (HT40)

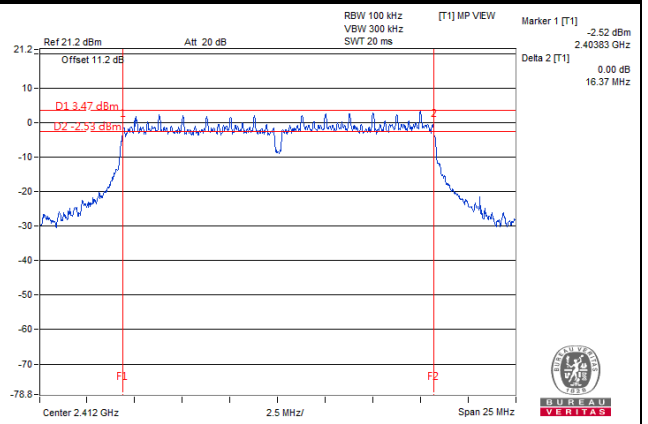
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
3	2422	28.86	35.36	0.5	Pass
6	2437	35.82	35.83	0.5	Pass
9	2452	35.21	36.37	0.5	Pass

Spectrum Plot of Worst Value

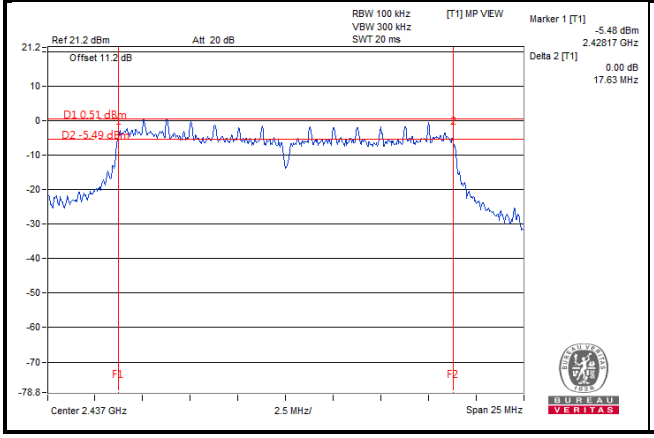
802.11b



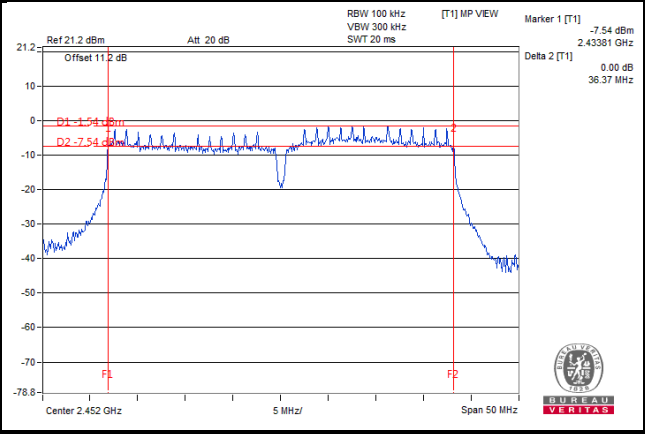
802.11g



802.11n (HT20)

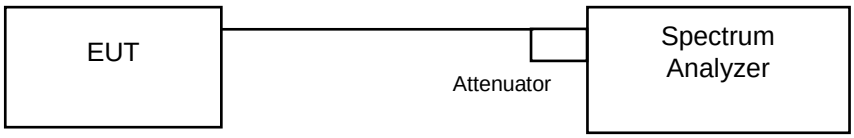


802.11n (HT40)



4.4 Occupied Bandwidth Measurement

4.4.1 Test Setup



4.4.2 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.4.3 Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with resolution bandwidth in the range of 1 % to 5 % of the anticipated emission bandwidth, and a video bandwidth at least 3x the resolution bandwidth and set the detector to PEAK. The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5 % of the total mean power of a given emission.

4.4.4 Deviation from Test Standard

No deviation.

4.4.5 EUT Operating Conditions

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.4.6 Test Results

802.11b

Channel	Frequency (MHz)	Occupied Bandwidth (MHz)		Pass / Fail
		Chain 0	Chain 1	
1	2412	12.75	12.72	Pass
6	2437	14.50	12.90	Pass
11	2462	12.20	12.70	Pass

802.11g

Channel	Frequency (MHz)	Occupied Bandwidth (MHz)		Pass / Fail
		Chain 0	Chain 1	
1	2412	16.86	16.80	Pass
6	2437	18.36	16.90	Pass
11	2462	16.65	16.60	Pass

802.11n (HT20)

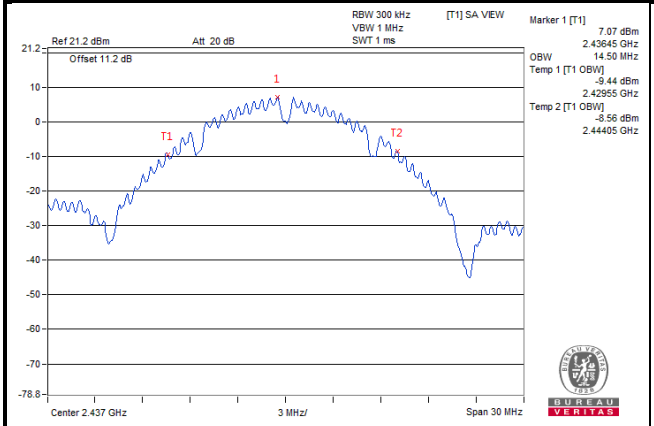
Channel	Frequency (MHz)	Occupied Bandwidth (MHz)		Pass / Fail
		Chain 0	Chain 1	
1	2412	17.97	18.12	Pass
6	2437	19.15	18.15	Pass
11	2462	17.80	17.85	Pass

802.11n (HT40)

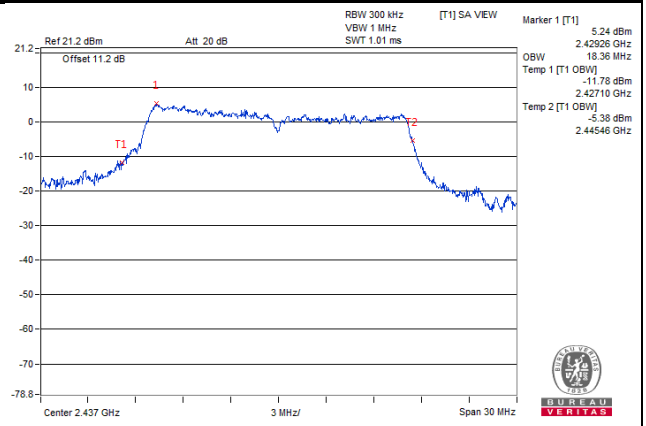
Channel	Frequency (MHz)	Occupied Bandwidth (MHz)		Pass / Fail
		Chain 0	Chain 1	
3	2422	36.30	36.70	Pass
6	2437	37.66	37.00	Pass
9	2452	36.60	37.00	Pass

Spectrum Plot of Worst Value

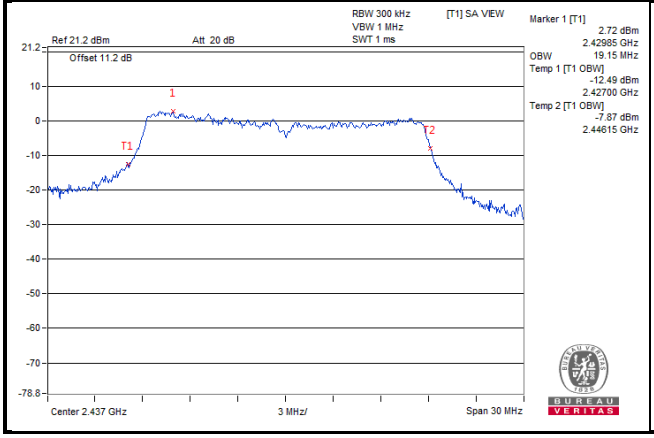
802.11b



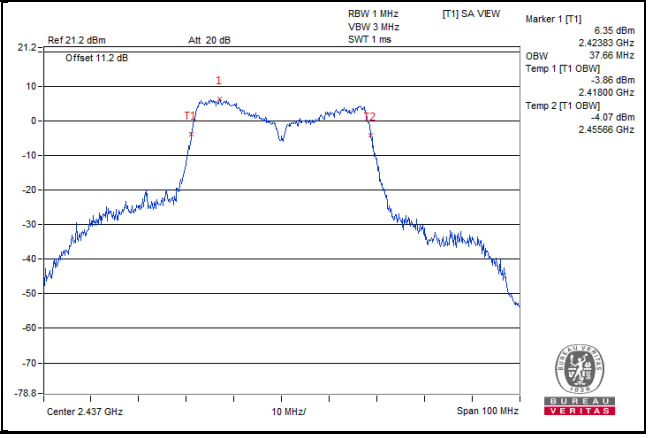
802.11g



802.11n (HT20)



802.11n (HT40)



4.5 Conducted Output Power Measurement

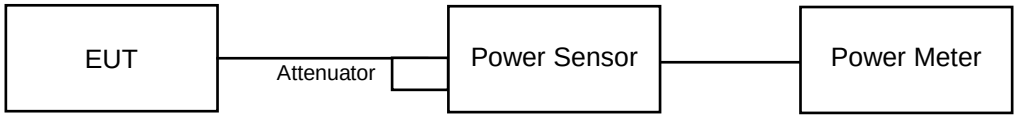
4.5.1 Limits of Conducted Output Power Measurement

For systems using digital modulation in the 2400–2483.5 MHz bands: 1 Watt (30 dBm)
Per KDB 662911 D01 Multiple Transmitter Output Method of conducted output power measurement on IEEE 802.11 devices,

Array Gain = 0 dB (i.e., no array gain) for NANT ≤ 4;
Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any NANT;
Array Gain = 5 log(NANT/NSS) dB or 3 dB, whichever is less for 20 MHz channel widths with NANT ≥ 5.

For power measurements on all other devices: Array Gain = 10 log(NANT/NSS) dB.

4.5.2 Test Setup



4.5.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.5.4 Test Procedures

A peak power sensor was used on the output port of the EUT. A power meter was used to read the response of the peak power sensor. Record the power level.

4.5.5 Deviation from Test Standard

No deviation.

4.5.6 EUT Operating Conditions

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.5.7 Test Results

802.11b

Channel	Frequency (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	17.88	19.32	146.883	21.67	30	Pass
6	2437	17.11	19.22	134.964	21.30	30	Pass
11	2462	17.32	19.22	137.511	21.38	30	Pass

802.11g

Channel	Frequency (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	20.89	22.78	312.415	24.95	30	Pass
6	2437	20.83	22.45	296.852	24.73	30	Pass
11	2462	20.48	22.71	298.324	24.75	30	Pass

802.11n (HT20)

Channel	Frequency (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	20.23	22.03	265.027	24.23	30	Pass
6	2437	18.87	20.97	202.116	23.06	30	Pass
11	2462	19.62	21.07	219.56	23.42	30	Pass

802.11n (HT40)

Channel	Frequency (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
3	2422	20.41	21.64	255.782	24.08	30	Pass
6	2437	20.39	21.54	251.957	24.01	30	Pass
9	2452	19.97	21.79	250.32	23.98	30	Pass

4.6 Power Spectral Density Measurement

4.6.1 Limits of Power Spectral Density Measurement

The Maximum of Power Spectral Density Measurement is 8 dBm.

4.6.2 Test Setup

4.6.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.6.4 Test Procedure

a. Set analyzer center frequency to DTS channel center frequency.
b. Set the span to 1.5 times the DTS bandwidth.
c. Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
d. Set the VBW ≥ 3 × RBW.
e. Detector = peak.
f. Sweep time = auto couple.
g. Trace mode = max hold.
h. Allow trace to fully stabilize.
i. Use the peak marker function to determine the maximum amplitude level within the RBW.

4.6.5 Deviation from Test Standard

No deviation.

4.6.6 EUT Operating Condition

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.6.7 Test Results

802.11b

TX Chain	Channel	Freq. (MHz)	PSD (dBm/3 kHz)	10 log (N=2) dB	Total PSD (dBm/3 kHz)	Limit (dBm/3 kHz)	Pass / Fail
0	1	2412	-9.52	3.01	-6.51	8	Pass
	6	2437	-9.70	3.01	-6.69	8	Pass
	11	2462	-9.25	3.01	-6.24	8	Pass
1	1	2412	-8.39	3.01	-5.38	8	Pass
	6	2437	-8.88	3.01	-5.87	8	Pass
	11	2462	-8.09	3.01	-5.08	8	Pass

NOTE: Directional gain = $10\log[(10^{G1/20} + 10^{G2/20} + \ldots. + 10^{GN/20})^2 / N_{ANT}] = 0.52$ dBi < 6 dBi, so the does not need to be reduced.

802.11g

TX Chain	Channel	Freq. (MHz)	PSD (dBm/3 kHz)	10 log (N=2) dB	Total PSD (dBm/3 kHz)	Limit (dBm/3 kHz)	Pass / Fail
0	1	2412	-13.54	3.01	-10.53	8	Pass
	6	2437	-14.01	3.01	-11.00	8	Pass
	11	2462	-14.85	3.01	-11.84	8	Pass
1	1	2412	-12.48	3.01	-9.47	8	Pass
	6	2437	-13.08	3.01	-10.07	8	Pass
	11	2462	-12.92	3.01	-9.91	8	Pass

NOTE: Directional gain = $10\log[(10^{G1/20} + 10^{G2/20} + \ldots. + 10^{GN/20})^2 / N_{ANT}] = 0.52$ dBi < 6 dBi, so the does not need to be reduced.

802.11n (HT20)

TX Chain	Channel	Freq. (MHz)	PSD (dBm/3 kHz)	10 log (N=2) dB	Total PSD (dBm/3 kHz)	Limit (dBm/3 kHz)	Pass / Fail
0	1	2412	-15.55	3.01	-12.54	8	Pass
	6	2437	-16.72	3.01	-13.71	8	Pass
	11	2462	-16.19	3.01	-13.18	8	Pass
1	1	2412	-14.33	3.01	-11.32	8	Pass
	6	2437	-15.68	3.01	-12.67	8	Pass
	11	2462	-15.12	3.01	-12.11	8	Pass

NOTE: Directional gain = $10\log[(10^{G1/20} + 10^{G2/20} + \ldots. + 10^{GN/20})^2 / N_{ANT}] = 0.52$ dBi < 6 dBi, so the does not need to be reduced.

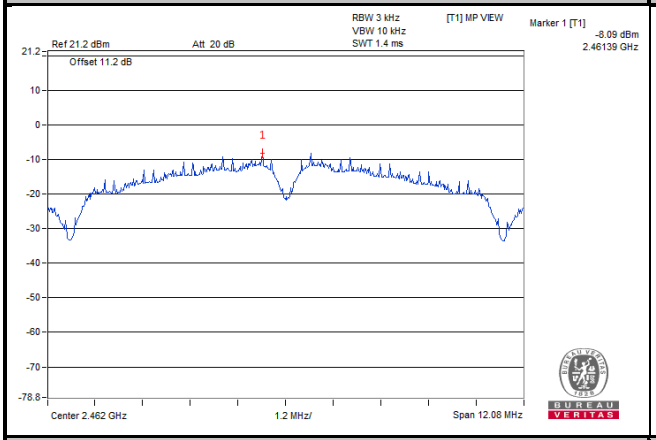
802.11n (HT40)

TX Chain	Channel	Freq. (MHz)	PSD (dBm/3 kHz)	10 log (N=2) dB	Total PSD (dBm/3 kHz)	Limit (dBm/3 kHz)	Pass / Fail
0	3	2422	-17.16	3.01	-14.15	8	Pass
	6	2437	-17.72	3.01	-14.71	8	Pass
	9	2452	-17.37	3.01	-14.36	8	Pass
1	3	2422	-16.72	3.01	-13.71	8	Pass
	6	2437	-17.12	3.01	-14.11	8	Pass
	9	2452	-17.54	3.01	-14.53	8	Pass

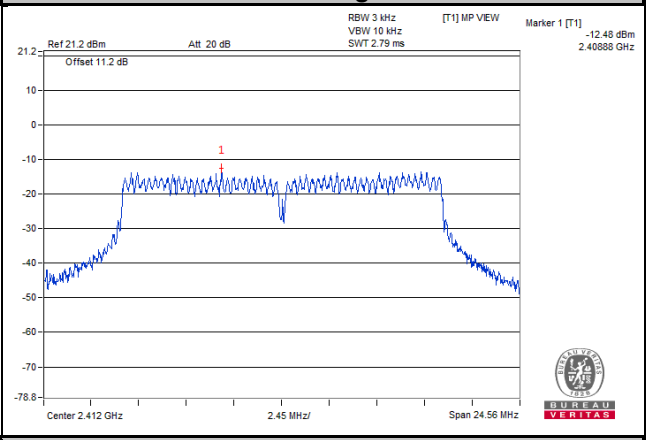
NOTE: Directional gain = $10\log[(10^{G1/20} + 10^{G2/20} + \ldots. + 10^{GN/20})^2 / N_{ANT}] = 0.52$ dBi < 6 dBi, so the does not need to be reduced.

Spectrum Plot of Worst Value

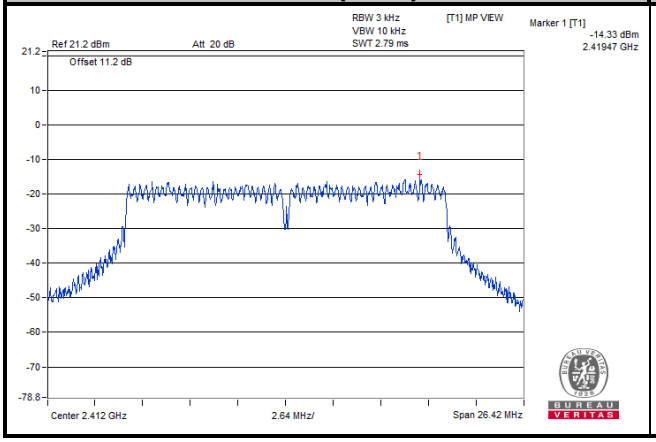
802.11b



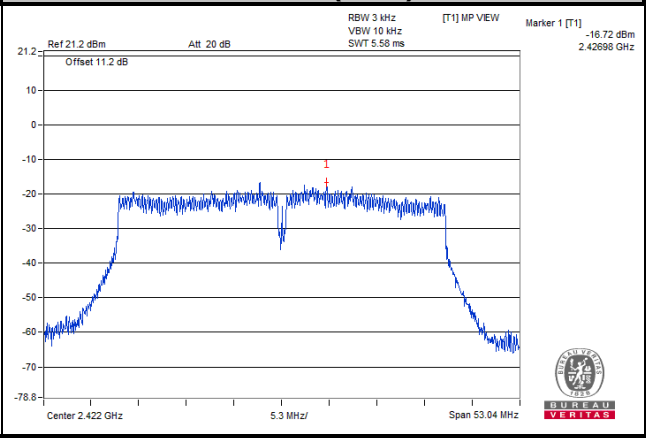
802.11g



802.11n (HT20)



802.11n (HT40)

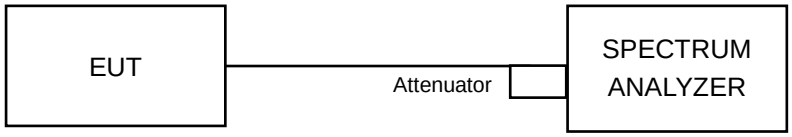


4.7 Conducted Out of Band Emission Measurement

4.7.1 Limits of Conducted Out of Band Emission Measurement

Below 20 dB of the highest emission level of operating band (in 100 kHz Resolution Bandwidth).

4.7.2 Test Setup



4.7.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.7.4 Test Procedure

MEASUREMENT PROCEDURE REF

1. Set the RBW = 100 kHz.
2. Set the VBW ≥ 300 kHz.
3. Detector = peak.
4. Sweep time = auto couple.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

MEASUREMENT PROCEDURE OOBE

1. Set RBW = 100 kHz.
2. Set VBW ≥ 300 kHz.
3. Detector = peak.
4. Sweep = auto couple.
5. Trace Mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum amplitude level.

4.7.5 Deviation from Test Standard

No deviation.

4.7.6 EUT Operating Condition

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

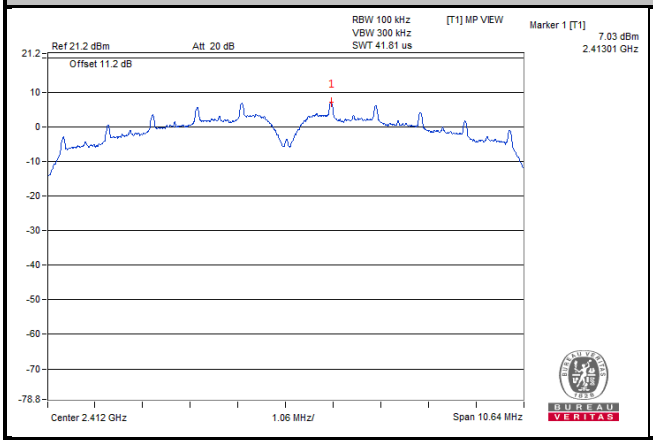
4.7.7 Test Results

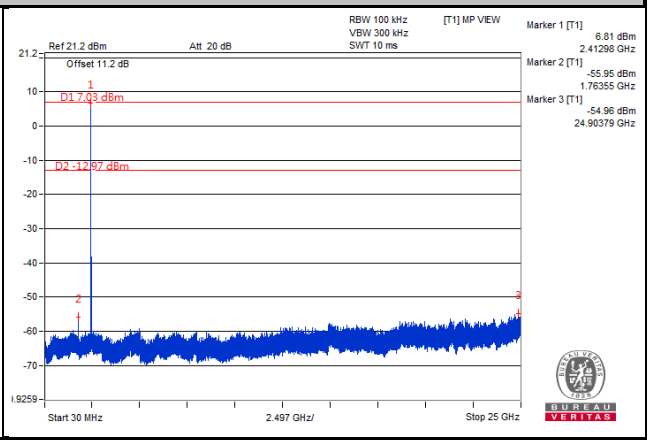
The spectrum plots are attached on the following images. D1 line indicates the highest level, and D2 line indicates the 20 dB offset below D1. It shows compliance with the requirement.

802.11b

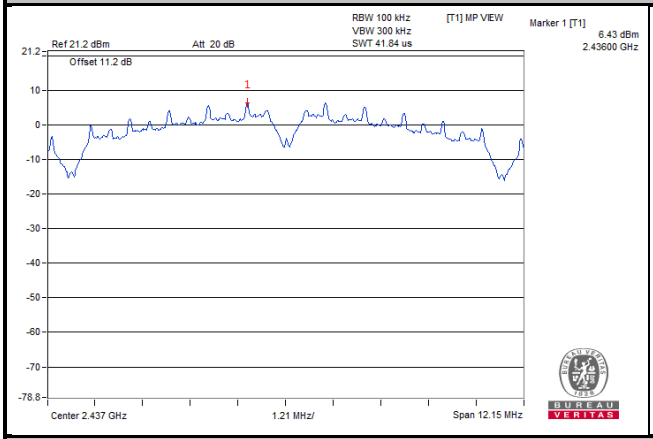
CHAIN 0

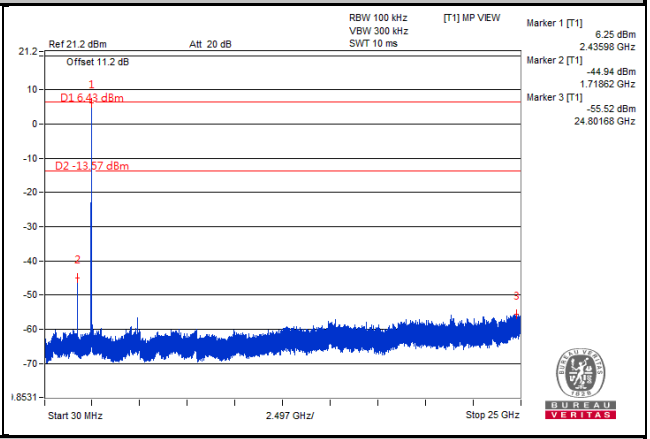
Ch 1



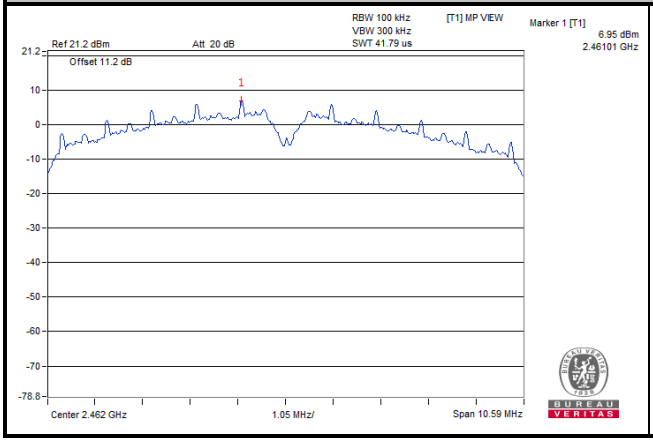


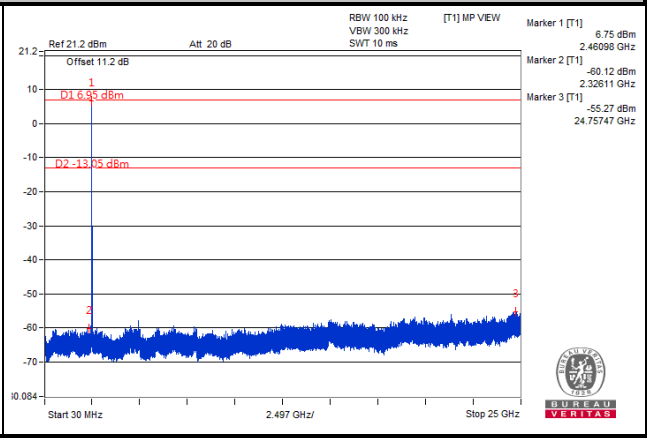
Ch 6

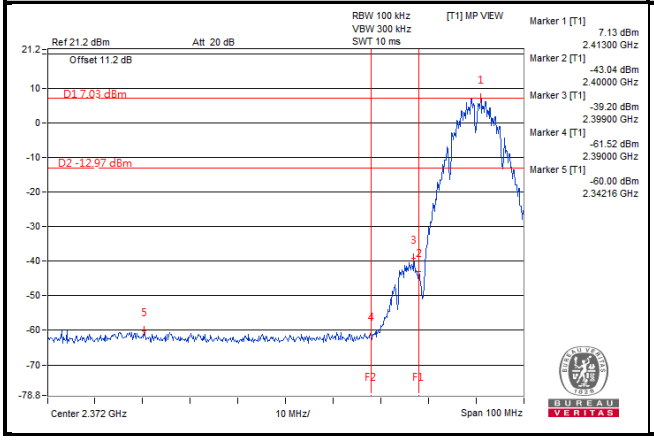
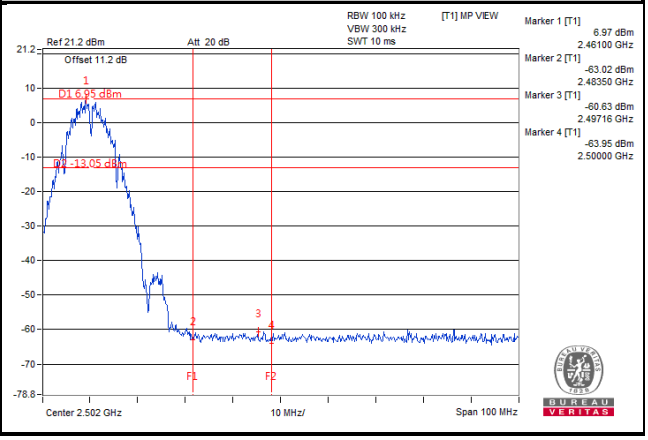




Ch 11

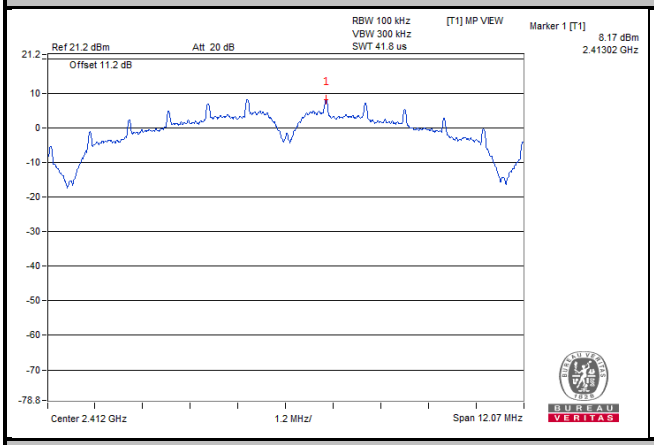


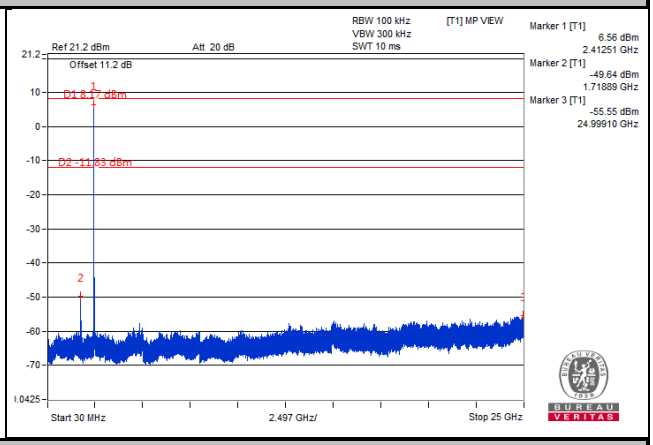


Ch 1 Band Edge	Ch 11 Band Edge
	

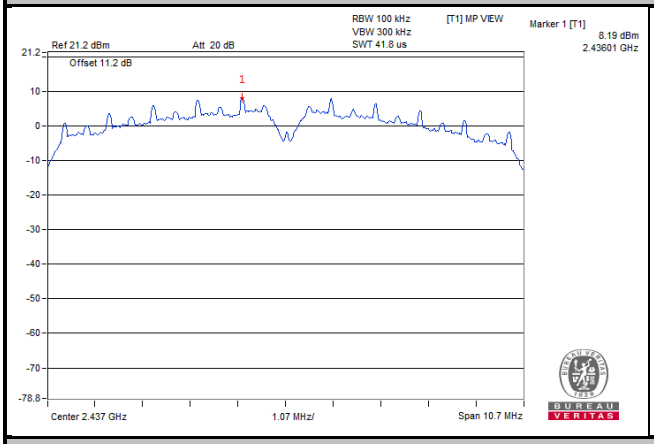
CHAIN 1

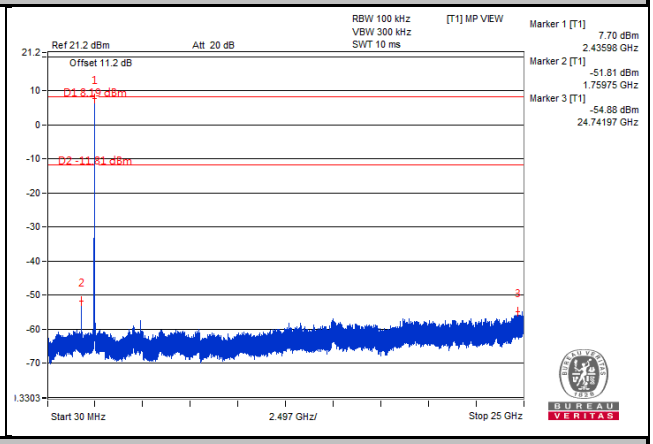
Ch 1



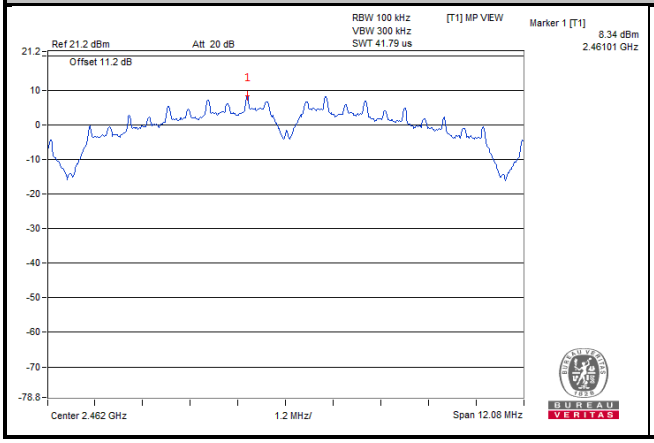


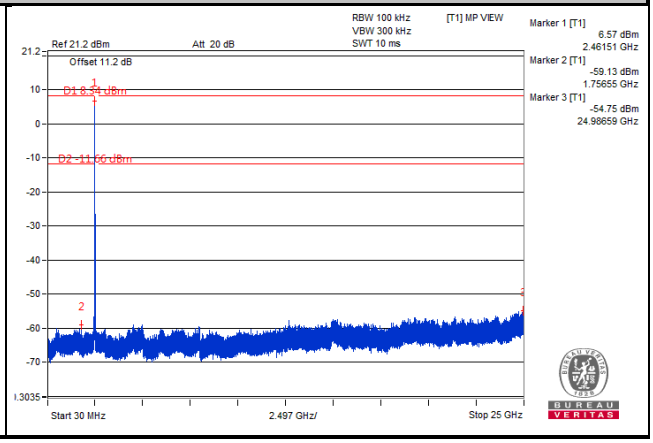
Ch 6

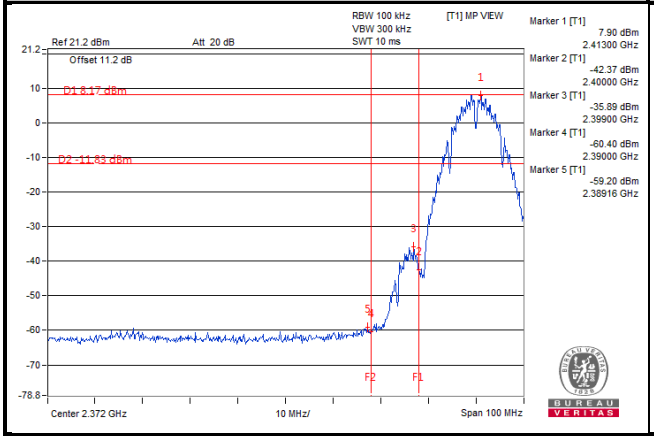
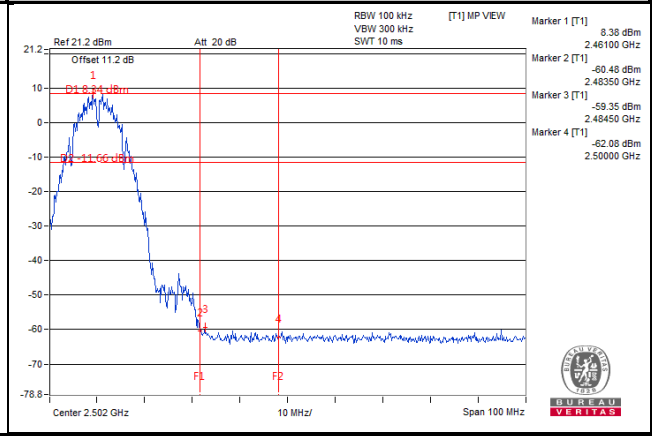




Ch 11



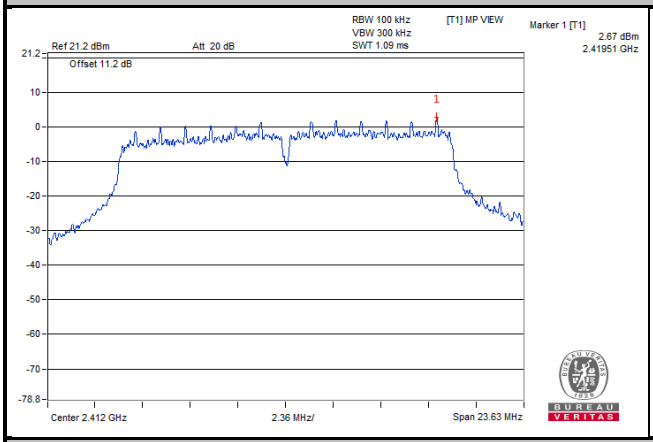


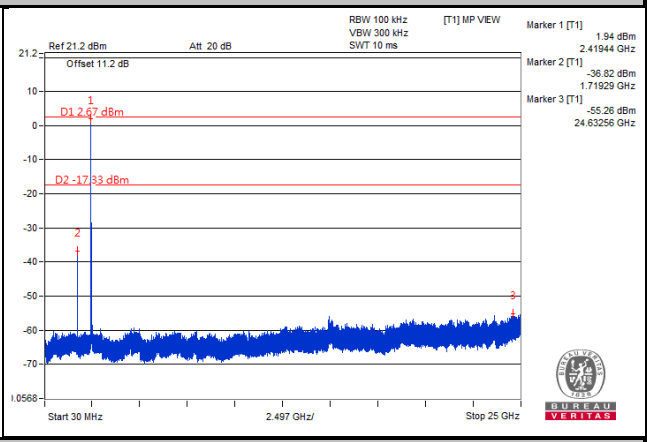
Ch 1 Band Edge	Ch 11 Band Edge
	

802.11g

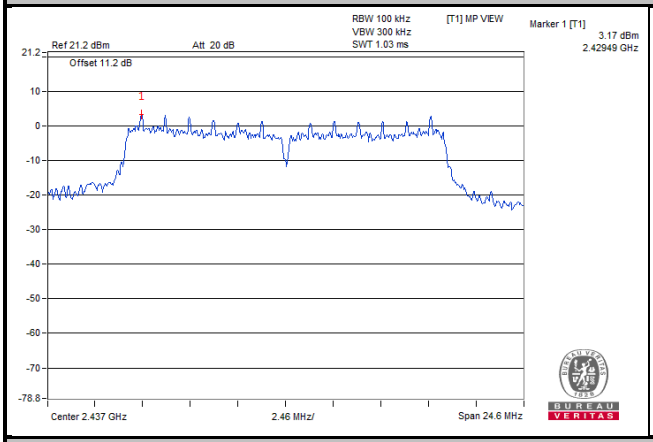
CHAIN 0

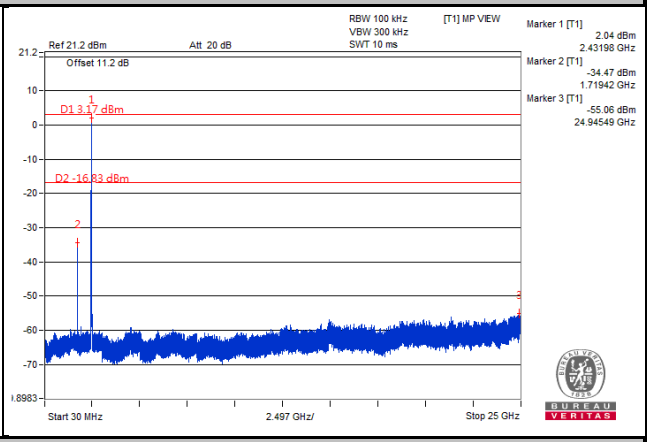
Ch 1



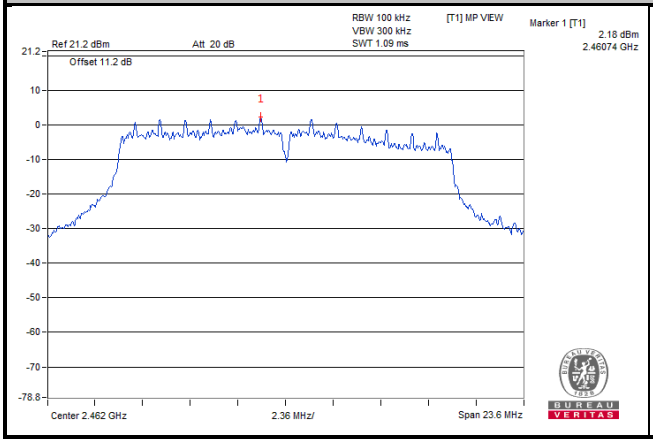


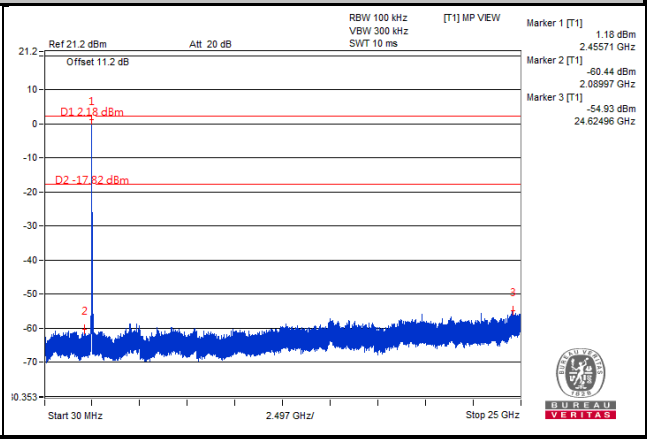
Ch 6

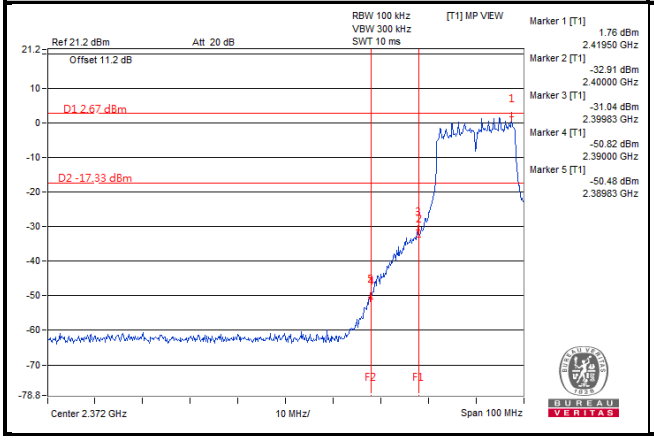
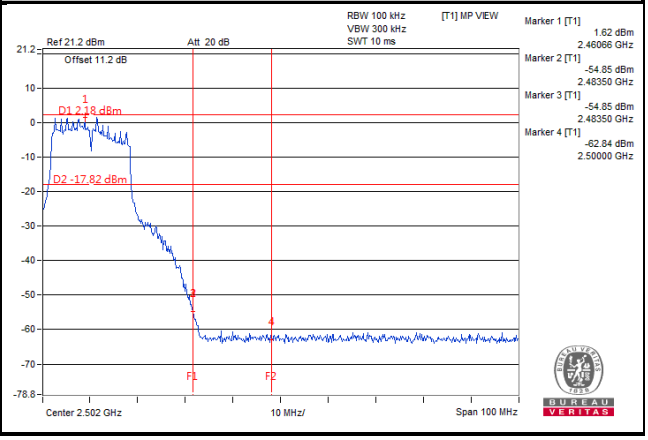




Ch 11

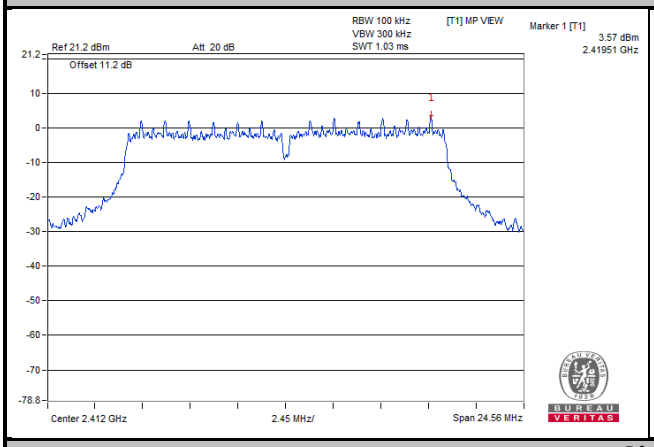


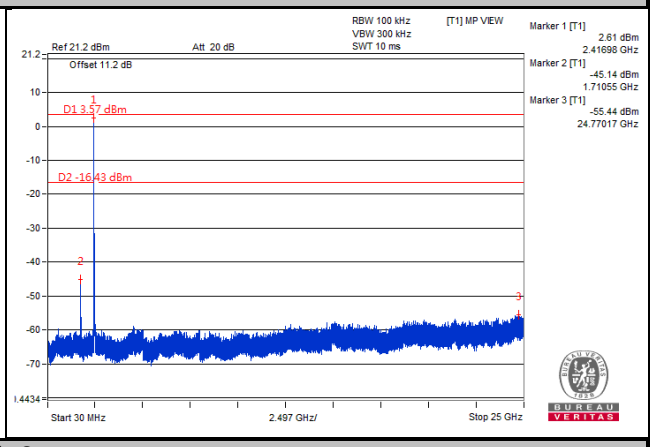


Ch 1 Band Edge	Ch 11 Band Edge
	

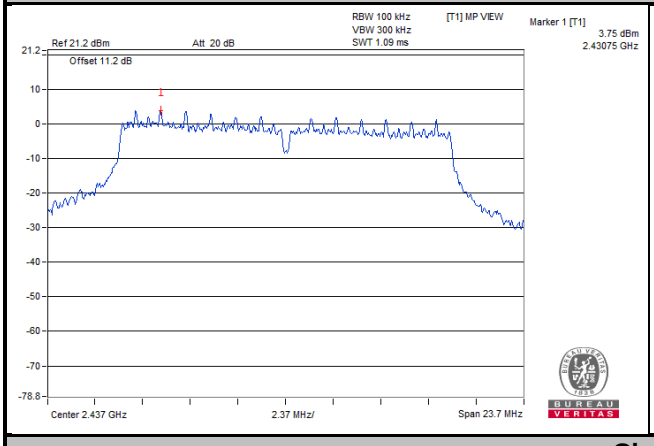
CHAIN 1

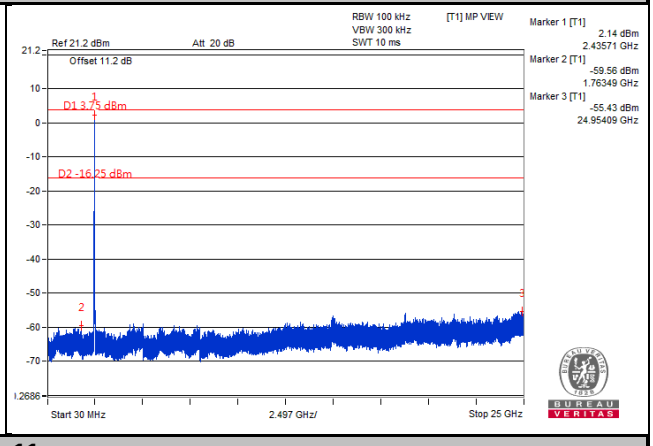
Ch 1



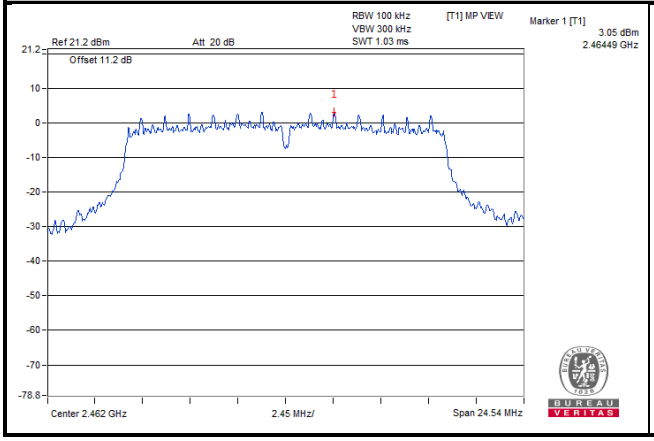


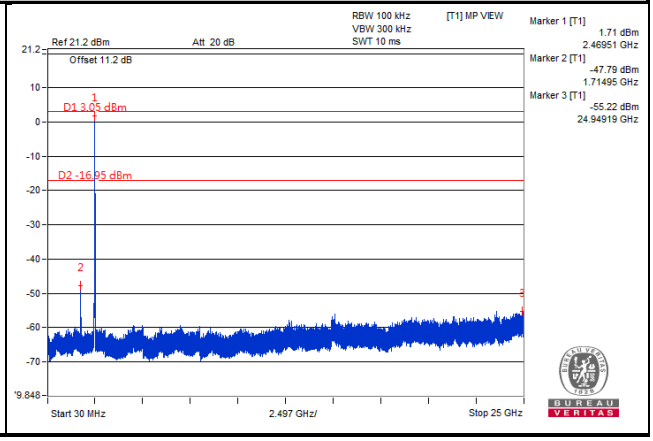
Ch 6

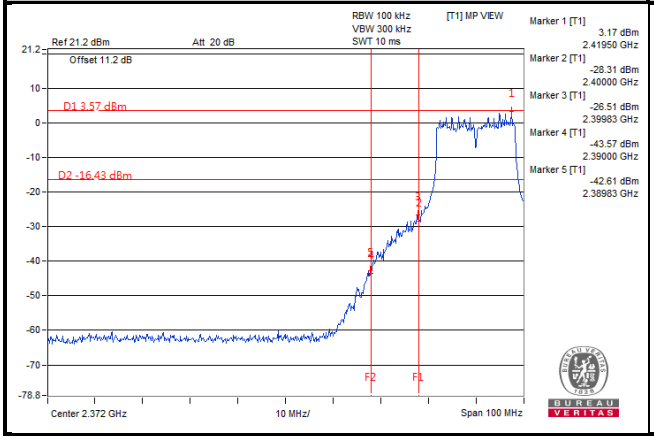
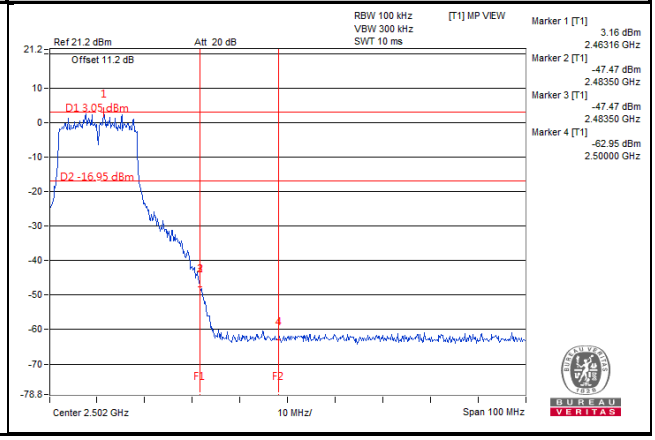




Ch 11



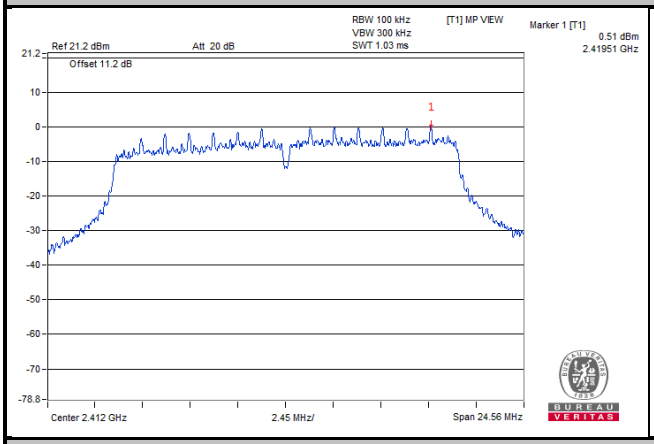


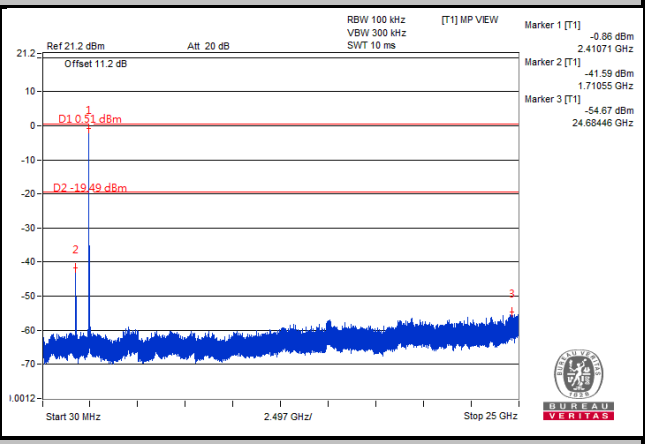
Ch 1 Band Edge	Ch 11 Band Edge
	

802.11n (HT20)

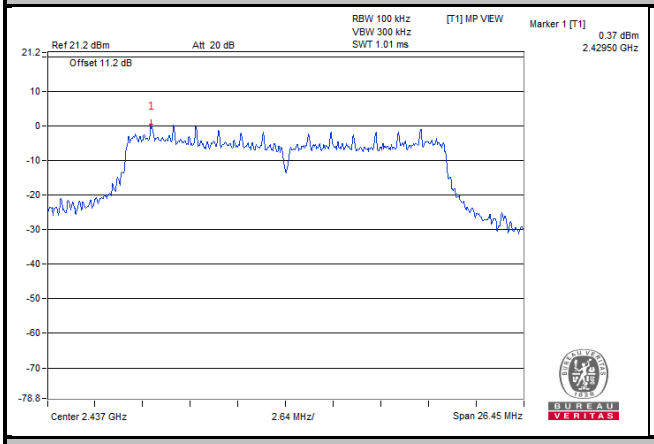
CHAIN 0

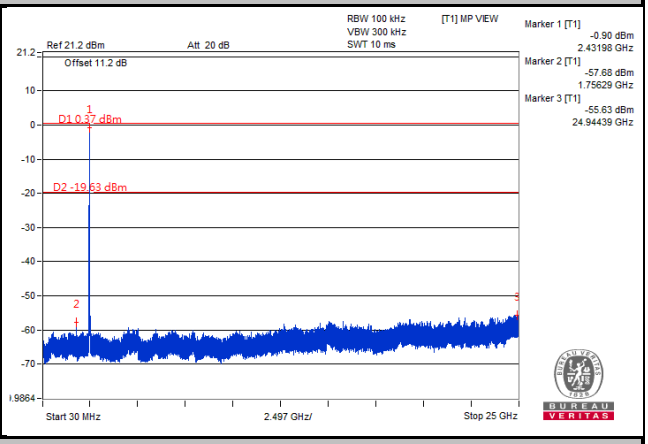
Ch 1



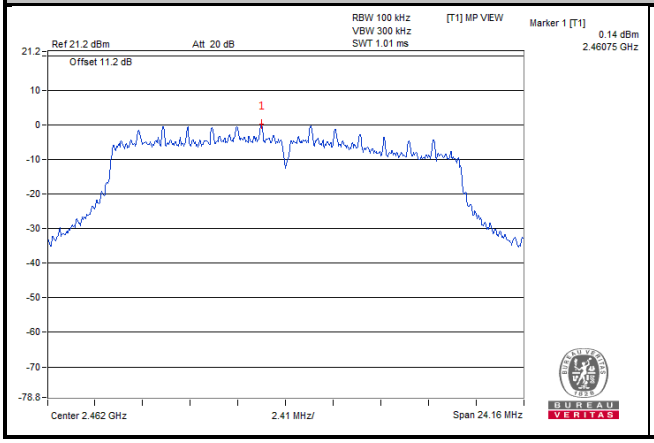


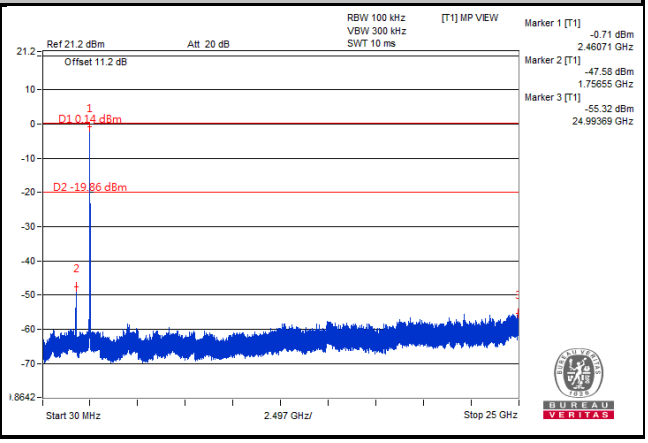
Ch 6

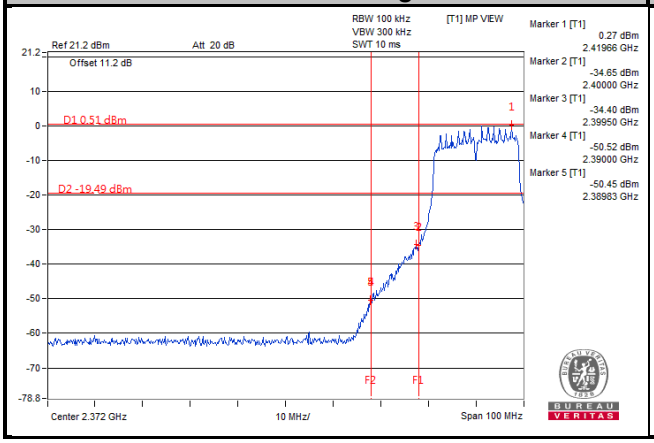
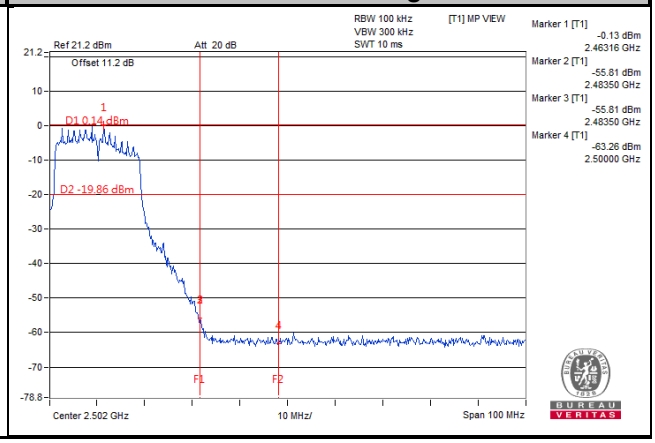




Ch 11

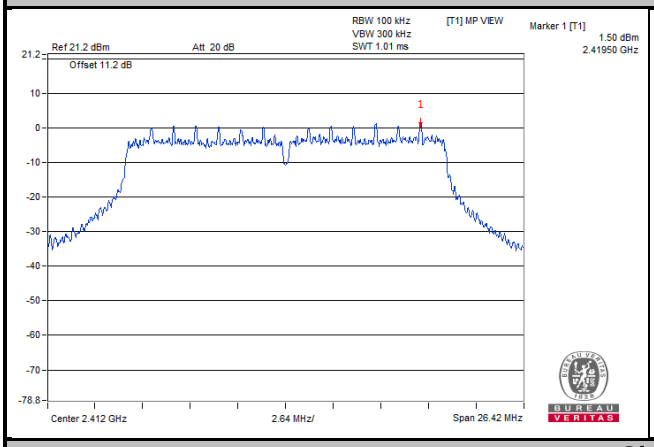


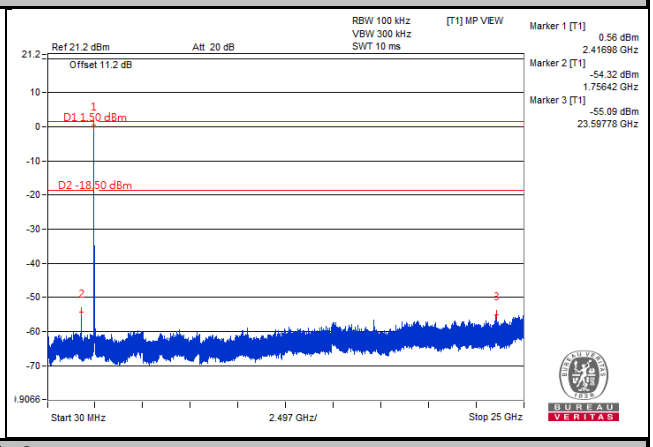


Ch 1 Band Edge	Ch 11 Band Edge
	

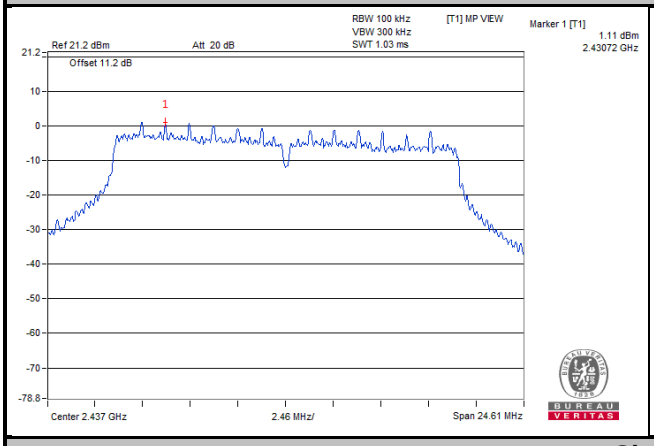
CHAIN 1

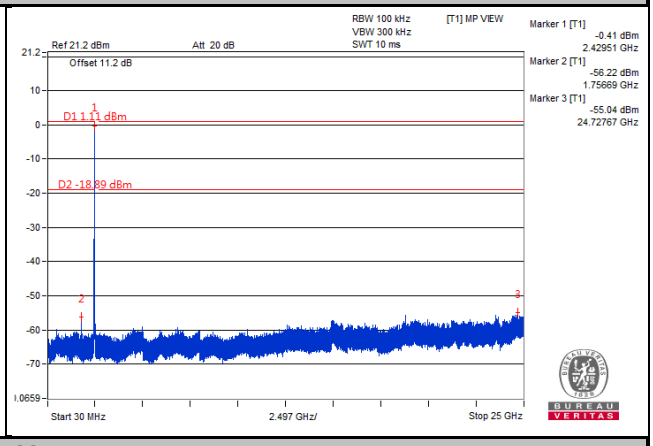
Ch 1



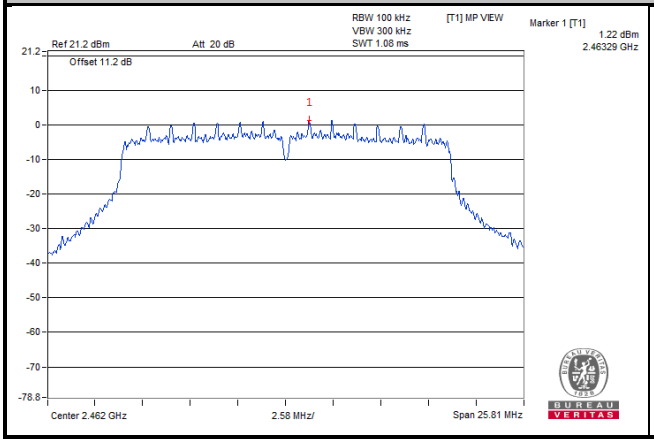


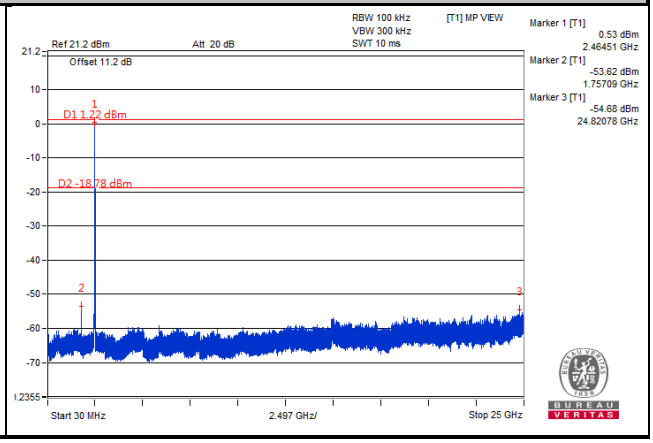
Ch 6

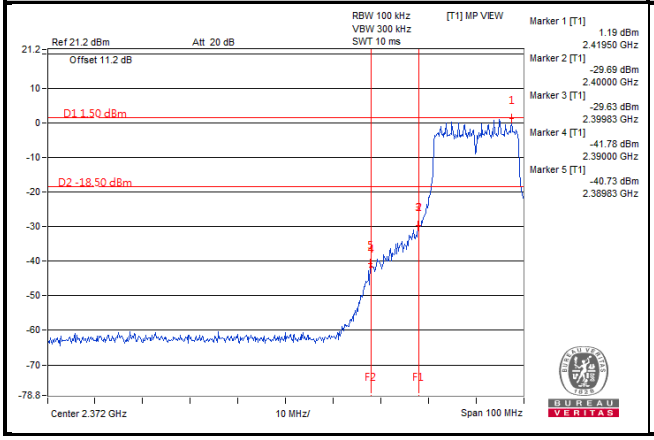
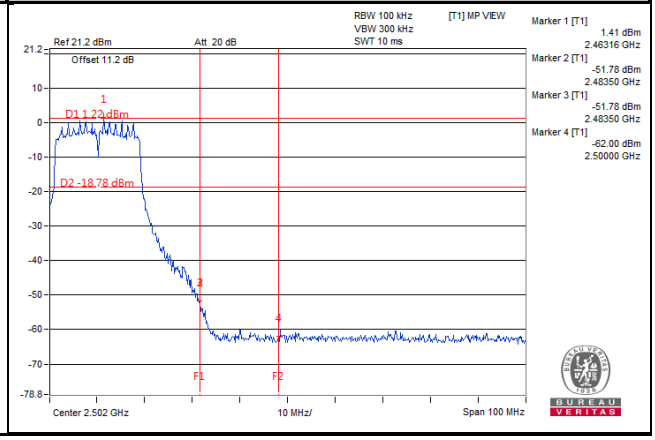




Ch 11



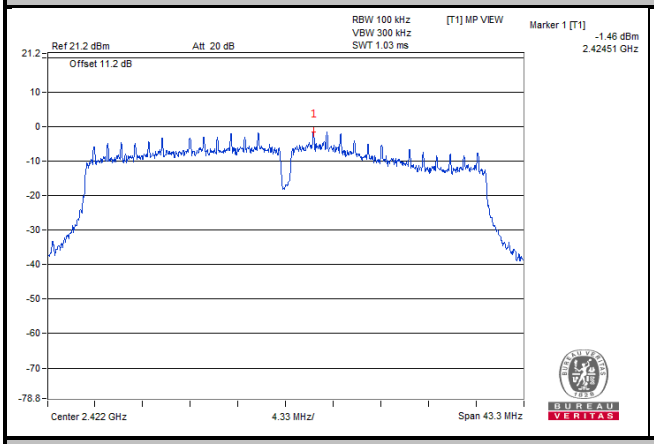


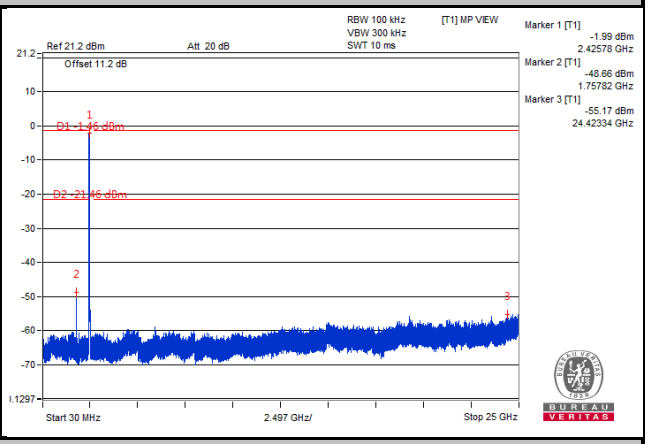
Ch 1 Band Edge	Ch 11 Band Edge
	

802.11n (HT40)

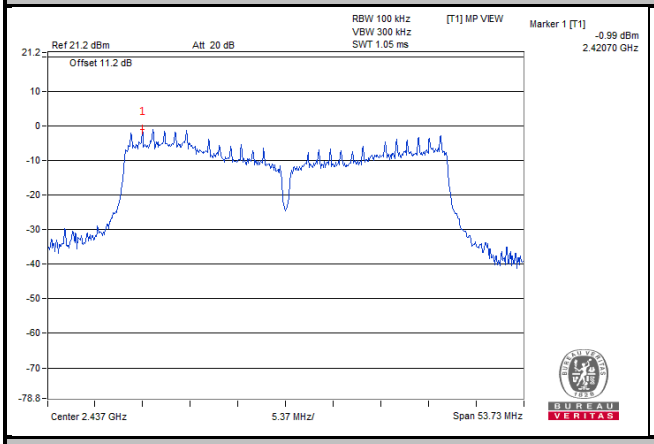
CHAIN 0

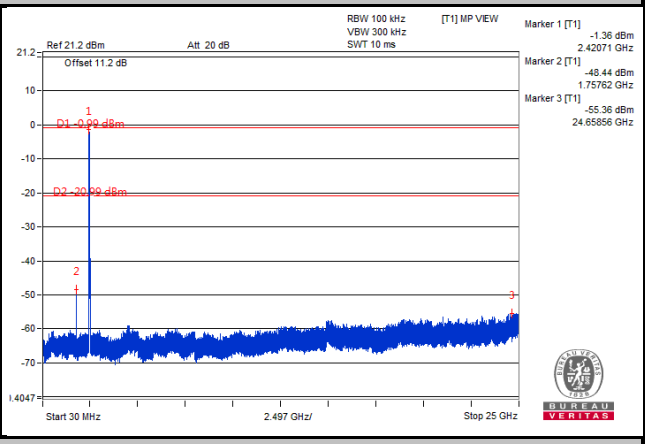
Ch 3



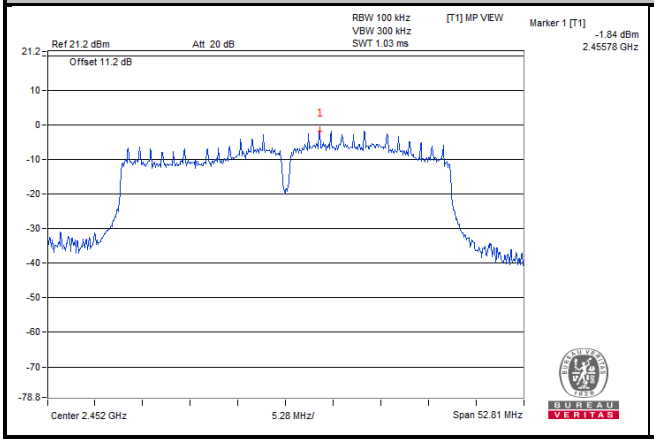


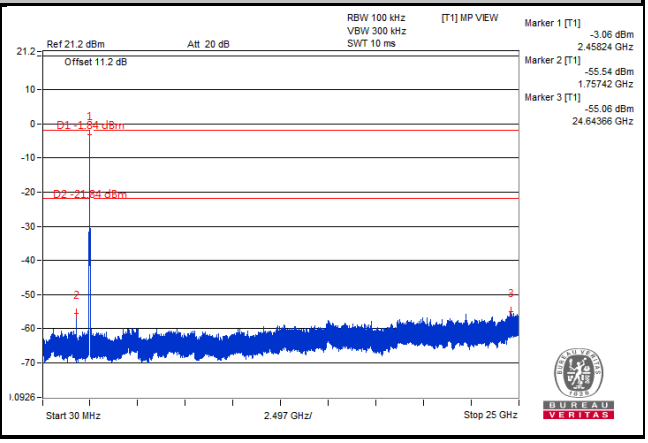
Ch 6

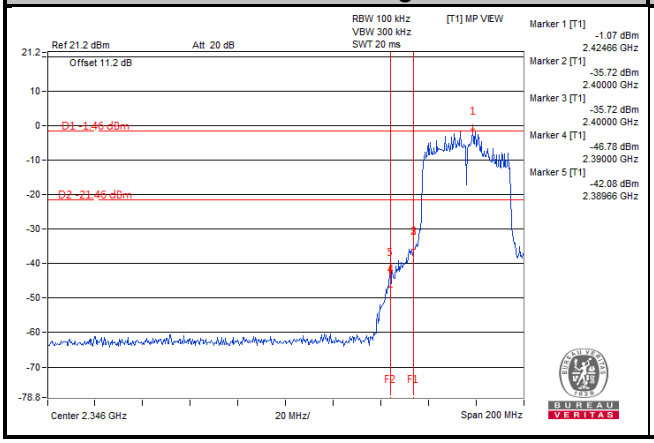
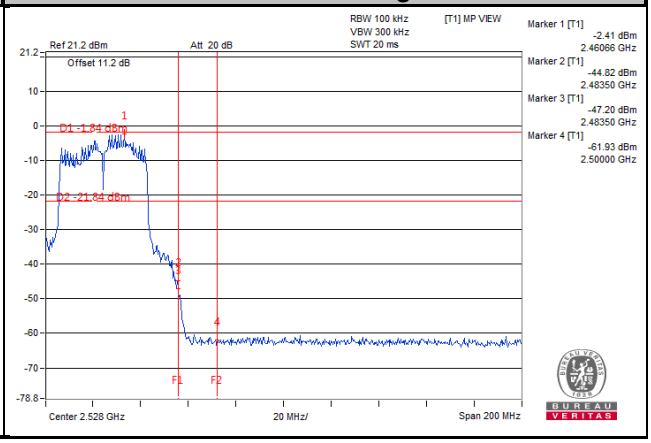




Ch 9

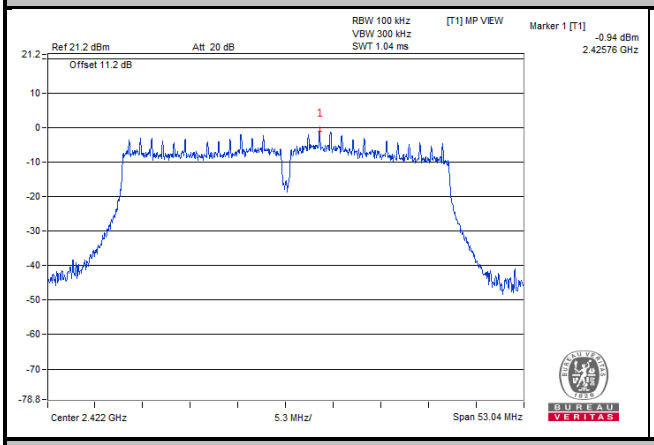


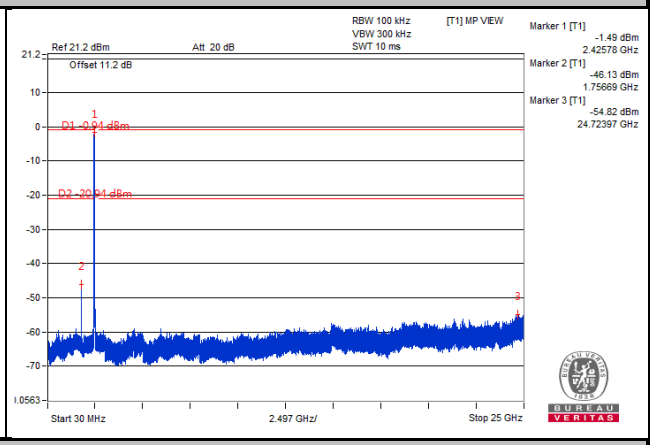


Ch 3 Band Edge	Ch 9 Band Edge
	

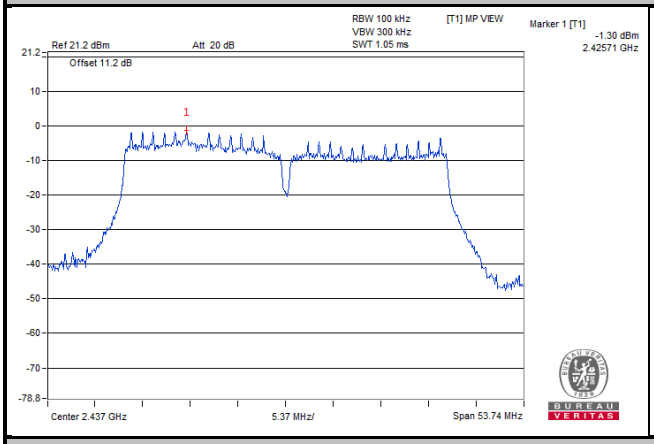
CHAIN 1

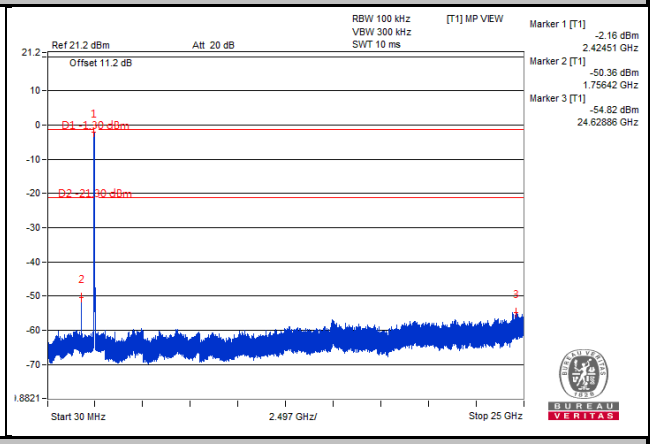
Ch 3



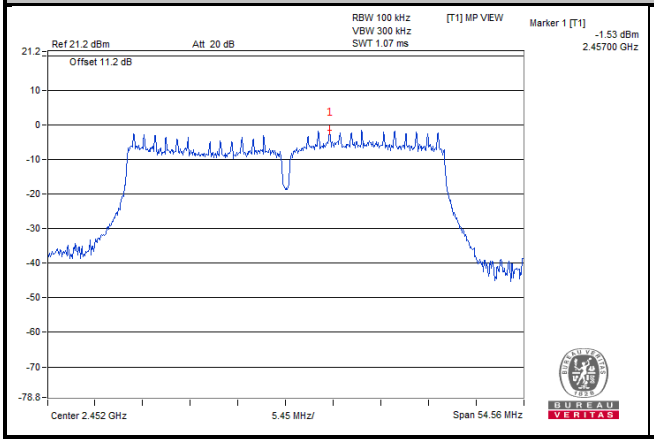


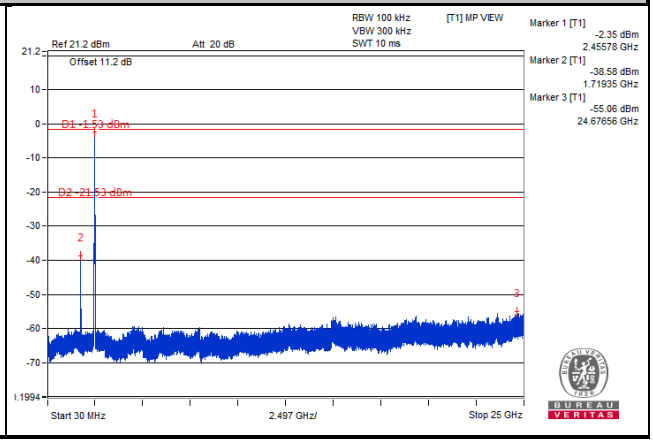
Ch 6

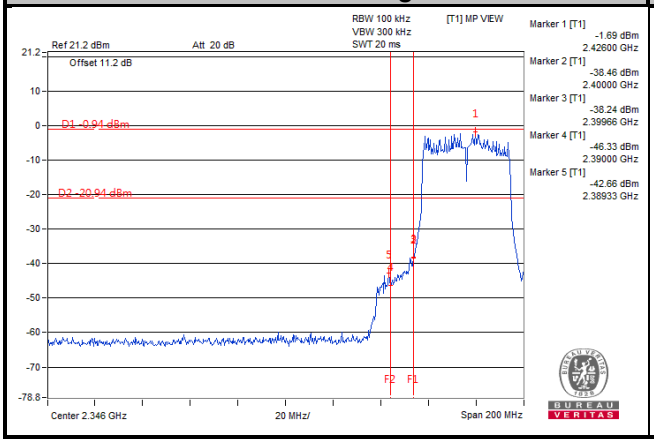
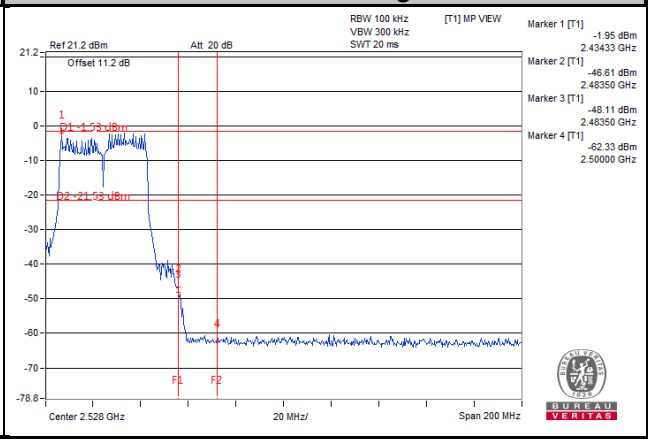




Ch 9





Ch 3 Band Edge	Ch 9 Band Edge
	

5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

Appendix – Information on the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited according to ISO/IEC 17025.

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Web Site: www.bureauveritas-adt.com

The address and road map of all our labs can be found in our web site also.

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