FCC Test Report (WLAN)

Report No.:	RF171130C26-5
FCC ID:	HD5-660W
Test Model:	SOM660W
Received Date:	Nov. 30, 2017
Test Date:	Jan. 18 to 20, 2018
Issued Date:	Jan. 29, 2018
Applicant:	Honeywell International Inc.
Address:	9680 Old Bailes Road, Fort Mill, SC 29707 USA
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory
Lab Address:	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan R.O.C.
Test Location :	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan R.O.C.
FCC Registration / Designation Number:	723255 / TW2022

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Table of Contents

Release Control Record 4

1 Certificate of Conformity 5

2 Summary of Test Results 6

2.1 Measurement Uncertainty 6
2.2 Modification Record 6

3 General Information 7

3.1 General Description of EUT (WLAN) 7
3.2 Description of Test Modes 10
3.2.1 Test Mode Applicability and Tested Channel Detail 11
3.3 Duty Cycle of Test Signal 13
3.4 Description of Support Units 14
3.4.1 Configuration of System under Test 14
3.5 General Description of Applied Standards 15

4 Test Types and Results 16

4.1 Radiated Emission and Bandedge Measurement 16
4.1.1 Limits of Radiated Emission and Bandedge Measurement 16
4.1.2 Test Instruments 17
4.1.3 Test Procedures 18
4.1.4 Deviation from Test Standard 18
4.1.5 Test Setup 19
4.1.6 EUT Operating Conditions 20
4.1.7 Test Results 21
4.2 Conducted Emission Measurement 31
4.2.1 Limits of Conducted Emission Measurement 31
4.2.2 Test Instruments 31
4.2.3 Test Procedures 32
4.2.4 Deviation from Test Standard 32
4.2.5 Test Setup 32
4.2.6 EUT Operating Conditions 32
4.2.7 Test Results 33
4.3 6dB Bandwidth Measurement 35
4.3.1 Limits of 6dB Bandwidth Measurement 35
4.3.2 Test Setup 35
4.3.3 Test Instruments 35
4.3.4 Test Procedure 35
4.3.5 Deviation from Test Standard 35
4.3.6 EUT Operating Conditions 35
4.3.7 Test Result 36
4.4 Conducted Output Power Measurement 38
4.4.1 Limits of Conducted Output Power Measurement 38
4.4.2 Test Setup 38
4.4.3 Test Instruments 38
4.4.4 Test Procedures 38
4.4.5 Deviation from Test Standard 38
4.4.6 EUT Operating Conditions 38
4.4.7 Test Results 39
4.5 Power Spectral Density Measurement 41
4.5.1 Limits of Power Spectral Density Measurement 41
4.5.2 Test Setup 41
4.5.3 Test Instruments 41
4.5.4 Test Procedure 41
4.5.5 Deviation from Test Standard 41
4.5.6 EUT Operating Condition 41

4.5.7 Test Results 42
4.6 Conducted Out of Band Emission Measurement 45
4.6.1 Limits of Conducted Out of Band Emission Measurement 45
4.6.2 Test Setup 45
4.6.3 Test Instruments 45
4.6.4 Test Procedure 45
4.6.5 Deviation from Test Standard 45
4.6.6 EUT Operating Condition 45
4.6.7 Test Results 45
5 Pictures of Test Arrangements 52
Appendix – Information on the Testing Laboratories 53

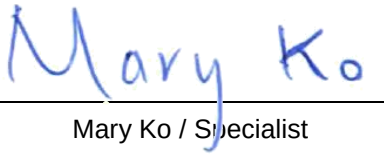
Release Control Record

Issue No.	Description	Date Issued
RF171130C26-5	Original release.	Jan. 29, 2018

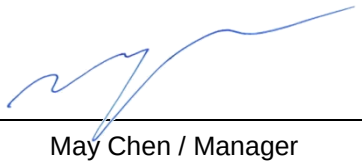
1 Certificate of Conformity

Product:	HSOM660
Brand:	Honeywell
Test Model:	SOM660W
Sample Status:	ENGINEERING SAMPLE
Applicant:	Honeywell International Inc.
Test Date:	Jan. 18 to 20, 2018
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:** Jan. 29, 2018

Mary Ko / Specialist

Approved by :  , **Date:** Jan. 29, 2018

May Chen / Manager

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 -10.55dB at 0.18359MHz.
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -2.8dB at 2483.50MHz.
15.247(d)	Antenna Port Emission	PASS	Meet the requirement of limit.
15.247(a)(2)	6dB bandwidth	PASS	Meet the requirement of limit.
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	Antenna connector is PIFA not a standard connector.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	1.84 dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	5.33 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	5.10 dB
	6GHz ~ 18GHz	4.85 dB
	18GHz ~ 40GHz	5.24 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT (WLAN)

Product	HSOM660
Brand	Honeywell
Test Model	SOM660W
Status of EUT	ENGINEERING SAMPLE
HW Version	V2.0
HW P/N	22
SW Version	HON.01.004
SW P/N	351D
Power Supply Rating	3.85Vdc
Modulation Type	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM 256QAM for OFDM in 11ac mode only
Modulation Technology	DSSS,OFDM
Transfer Rate	802.11b: up to 11Mbps 802.11a/g: up to 54Mbps 802.11n: up to 300Mbps 802.11ac: up to 866.7Mbps
Operating Frequency	**2.4GHz**: 2.412 ~ 2.462GHz **5GHz:** 5.18 ~ 5.24GHz, 5.26 ~ 5.32GHz, 5.50 ~ 5.72GHz, 5.745 ~ 5.825GHz
Number of Channel	**2.4GHz:** 802.11b, 802.11g, 802.11n (HT20): 11 **5GHz:** 802.11a, 802.11n (HT20), 802.11ac (VHT20): 25 802.11n (HT40), 802.11ac (VHT40): 12 802.11ac (VHT80): 6
Output Power	**2.4GHz**: 403.711mW **5GHz:** **5.18 ~ 5.24GHz:** 65.906mW **5.26 ~ 5.32GHz:** 66.125mW **5.50 ~ 5.72GHz:** 85.088mW **5.745 ~ 5.825GHz:** 84.701mW
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	NA
Data Cable Supplied	NA

Note:

1. There are WWAN, WLAN and Bluetooth technology used for the EUT.

2. Simultaneously transmission condition.

Condition	Technology	
1	WLAN 2.4GHz	WWAN
2	WLAN 5GHz	WWAN
3	Bluetooth	WWAN
Note: The emission of the simultaneous operation has been evaluated and no non-compliance was found.		

3. The antennas provided to the EUT, please refer to the following table:

WLAN Antenna Spec.

Chain No.	Brand	Model	Antenna Gain include trace loss and cable l oss (dBi)	Frequency range (GHz)	Antenna type	Connector type	Trace loss and cable loss (dB)
Chain 0	USI	SOM-WLAN0	-0.38	2.4~2.4835	PIFA	POGO pin	2
			0.46	5.15~5.25			3.7
			0.46	5.25~5.35			
			0.46	5.47~5.725			
			0.46	5.725~5.85			
Chain 1	USI	SOM-WLAN1	3.2	2.4~2.4835	PIFA	POGO pin	1
			3.8	5.15~5.25			1.9
			3.8	5.25~5.35			
			3.8	5.47~5.725			
			3.8	5.725~5.85			

WWAN Antenna Spec.

Chain No.	Brand	Model	Antenna Gain include trace loss (dBi)	Frequency range	Antenna type	Connector type	Trace loss (dB)
Chain 0	USI	SOM-WAN main	1.23	700~960 MHz	PIFA	POGO pin	0.7
			3.08	1.70~2.0 GHz			1
			5.28	2.1~2.4 GHz			1.3
			2.66	2.4~2.7 GHz			1.4
Chain 1	USI	SOM-WAN Aux	2.15	700~960 MHz	PIFA	POGO pin	0.7
			3.13	1.70~2.0 GHz			1
			1.78	2.1~2.4 GHz			1.3
			3.01	2.4~2.7 GHz			1.4

Bluetooth Antenna Spec.

Brand	Model	Antenna Gain include trace loss and cable l oss (dBi)	Frequency range (GHz)	Antenna type	Connector type	Trace loss and cable loss (dB)
USI	SOM-WLAN0	-0.38	2.4~2.4835	PIFA	POGO pin	2
		0.46	5.15~5.25			3.7
		0.46	5.25~5.35			
		0.46	5.47~5.725			
		0.46	5.725~5.85			

4. The EUT incorporates a MIMO function.

2.4GHz Band			
MODULATION MODE	**DATA RATE (MCS)**	**TX & RX CONFIGURATION**	
802.11b	1 ~ 11Mbps	2TX	2RX
802.11g	6 ~ 54Mbps	2TX	2RX
802.11n (HT20)	MCS 0~7	2TX	2RX
	MCS 8~15	2TX	2RX
5GHz Band			
MODULATION MODE	**DATA RATE (MCS)**	**TX & RX CONFIGURATION**	
802.11a	6 ~ 54Mbps	2TX	2RX
802.11n (HT20)	MCS 0~7	2TX	2RX
	MCS 8~15	2TX	2RX
802.11n (HT40)	MCS 0~7	2TX	2RX
	MCS 8~15	2TX	2RX
802.11ac (VHT20)	MCS0~8 Nss=1	2TX	2RX
	MCS0~8 Nss=2	2TX	2RX
802.11ac (VHT40)	MCS0~9 Nss=1	2TX	2RX
	MCS0~9 Nss=2	2TX	2RX
802.11ac (VHT80)	MCS0~9 Nss=1	2TX	2RX
	MCS0~9 Nss=2	2TX	2RX

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

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 1GHz & Bandedge Measurement **RE<1G:** Radiated Emission below 1GHz

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**.

Radiated Emission Test (Above 1GHz):

☒ 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.

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
802.11b	1 to 11	1, 6, 11	DSSS	DBPSK	1
802.11g	1 to 11	1, 6, 11	OFDM	BPSK	6
802.11n (HT20)	1 to 11	1, 6, 11	OFDM	BPSK	6.5

Radiated Emission Test (Below 1GHz):

☒ 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.

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
802.11n (HT20)	1 to 11	11	OFDM	BPSK	6.5

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.

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
802.11n (HT20)	1 to 11	11	OFDM	BPSK	6.5

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.

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
802.11b	1 to 11	1, 6, 11	DSSS	DBPSK	1
802.11g	1 to 11	1, 6, 11	OFDM	BPSK	6
802.11n (HT20)	1 to 11	1, 6, 11	OFDM	BPSK	6.5

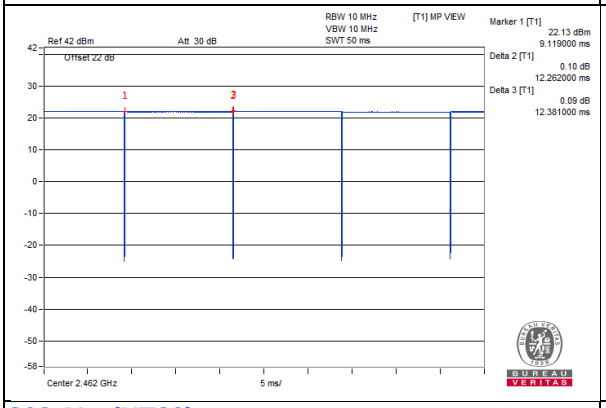
Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER (System)	TESTED BY
RE≥1G	23deg. C, 69%RH	120Vac, 60Hz	Andy Ho
RE<1G	23deg. C, 70%RH	120Vac, 60Hz	Andy Ho
PLC	25deg. C, 75%RH	120Vac, 60Hz	Andy Ho
APCM	25deg. C, 60%RH	120Vac, 60Hz	Jyunchun Lin

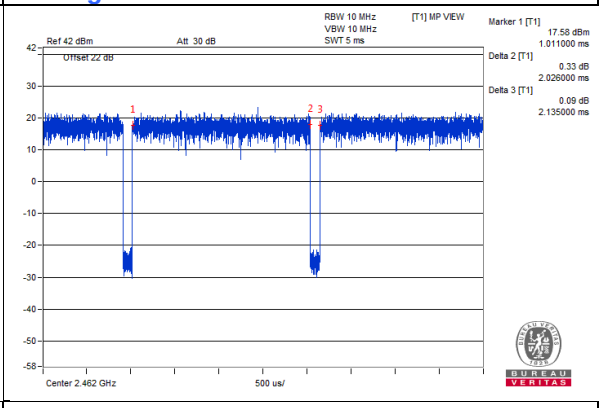
3.3 Duty Cycle of Test Signal

If duty cycle of test signal is ≥ 98 %, duty factor is not required.
If duty cycle of test signal is < 98%, duty factor shall be considered.
802.11b: Duty cycle = 12.262/12.381 = 0.99
802.11g: Duty cycle = 2.026/2.135 = 0.949, Duty factor = 10 * log(1/0.949) = 0.23
802.11n (HT20): Duty cycle = 1.889/1.996 = 0.946, Duty factor = 10 * log(1/0.946) = 0.24

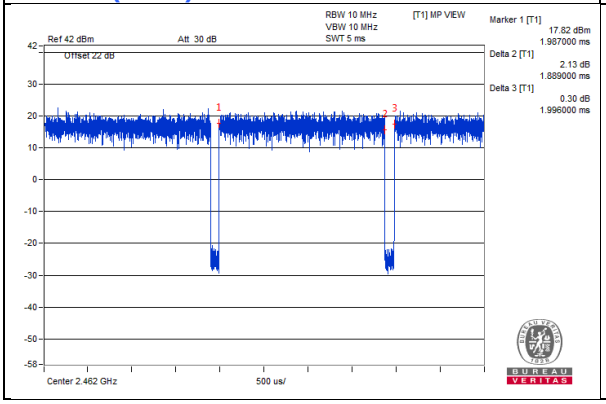
802.11b



802.11g



802.11n (HT20)



3.4 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Laptop	DELL	P54G	NA	NA	Supplied by client
B.	Test Tool	NA	NA	NA	NA	Supplied by client
C.	Battery	Inventus Power, Inc.	CW-BAT	CX80-BAT-EXT-WRLS1	NA	Supplied by client

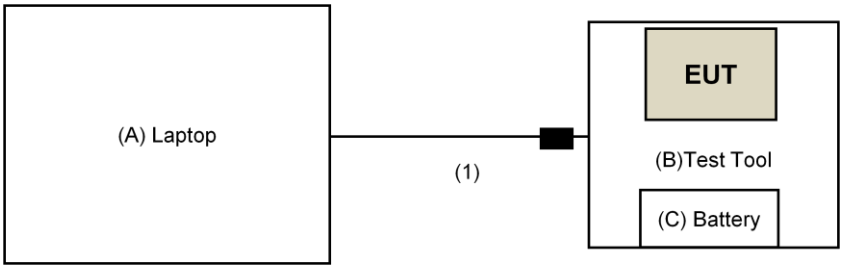
Note:

1. All power cords of the above support units are non-shielded (1.8m).

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	USB Cable	1	1	Yes	1	Supplied by client

Note: The core(s) is(are) originally attached to the cable(s).

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)
KDB 558074 D01 DTS Meas Guidance v04
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 20dB 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 1000MHz, 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 20dB under any condition of modulation.

4.1.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver Keysight	N9038A	MY54450088	July 08, 2017	July 07, 2018
Loop Antenna(*) TESEQ	HLA 6121	45745	May 19, 2017	May 18, 2018
Pre-Amplifier Mini-Circuits	ZFL-1000VH2B	AMP-ZFL-01	Nov. 09, 2017	Nov. 08, 2018
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-406	Nov. 29, 2017	Nov. 28, 2018
RF Cable	8D	966-4-1 966-4-2 966-4-3	Apr. 01, 2017	Mar. 31, 2018
Fixed attenuator Mini-Circuits	UNAT-5+	PAD-3m-4-01	Oct. 03, 2017	Oct. 02, 2018
Horn_Antenna SCHWARZBECK	BBHA 9120D	9120D-783	Dec. 12, 2017	Dec. 11, 2018
Pre-Amplifier EMCI	EMC12630SE	980385	Feb. 02, 2017	Feb. 01, 2018
RF Cable	EMC104-SM-SM-1200 EMC104-SM-SM-2000 EMC104-SM-SM-5000	160923 150318 150321	Feb. 02, 2017 Mar. 29, 2017 Mar. 29, 2017	Feb. 01, 2018 Mar. 28, 2018 Mar. 28, 2018
Pre-Amplifier EMCI	EMC184045SE	980387	Feb. 02, 2017	Feb. 01, 2018
Horn_Antenna SCHWARZBECK	BBHA 9170	BBHA9170608	Dec. 14, 2017	Dec. 13, 2018
RF Cable	SUCOFLEX 102	36432/2 36433/2	Jan. 11, 2018	Jan. 10, 2019
Software	ADT_Radiated_V8.7.08	NA	NA	NA
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208410	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP02	NA	NA
Spectrum Analyzer R&S	FSV40	100964	July 1, 2017	June 30, 2018
Power meter Anritsu	ML2495A	1014008	May 11, 2017	May 10, 2018
Power sensor Anritsu	MA2411B	0917122	May 11, 2017	May 10, 2018

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 calibration interval of the above test instruments is 24 months and the calibrations are traceable to NML/ROC and NIST/USA.
3. The test was performed in 966 Chamber No. 4.
4 Loop antenna was used for all emissions below 30 MHz.
5. The CANADA Site Registration No. is 20331-2
6. Tested Date: Jan. 18 to 20, 2018

4.1.3 Test Procedures

For Radiated emission below 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. 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. Both X and Y axes of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case 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.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

For Radiated emission above 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) 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 detect 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:

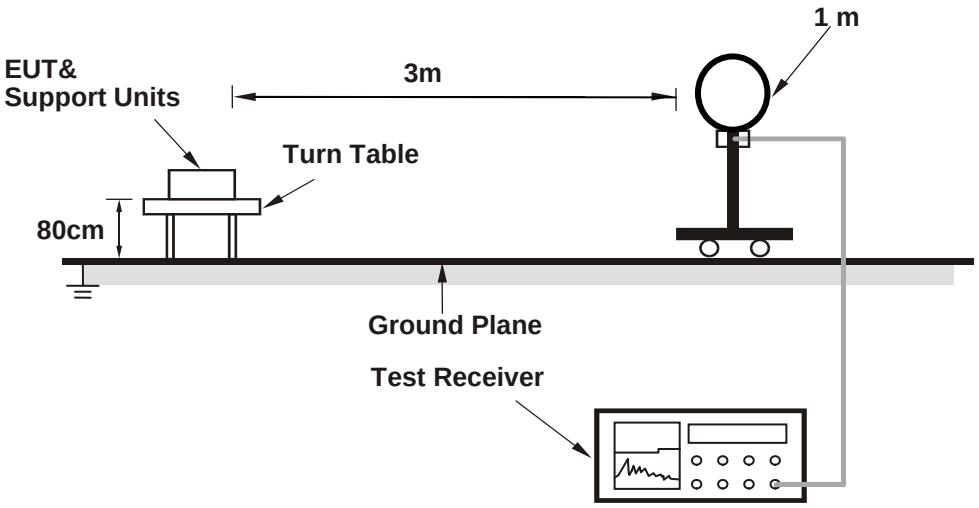
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.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

4.1.4 Deviation from Test Standard

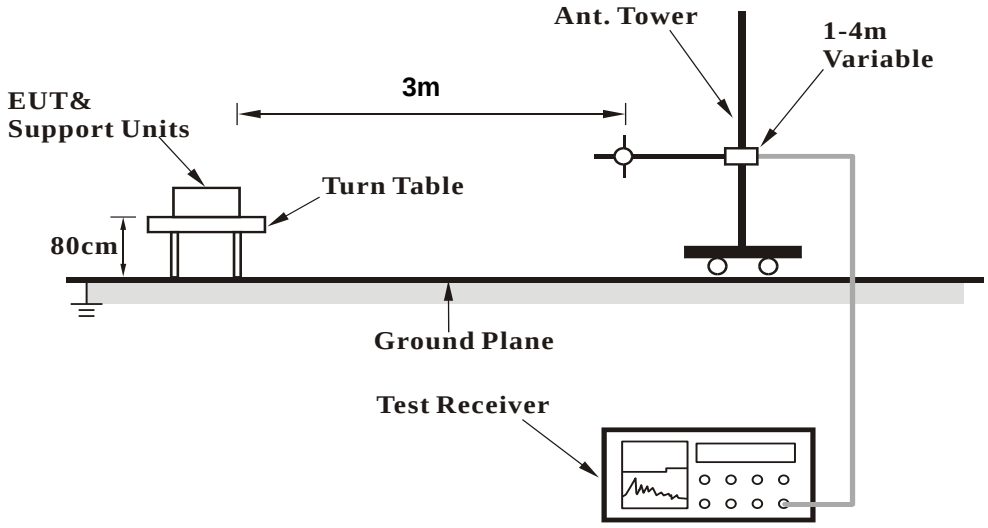
No deviation.

4.1.5 Test Setup

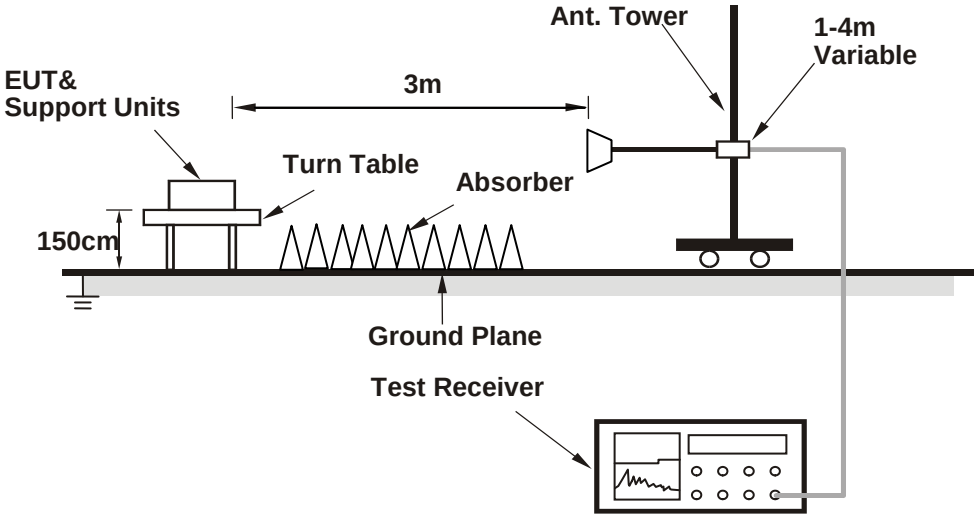
For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



For Radiated emission above 1GHz



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

4.1.6 EUT Operating Conditions

a. Connected the EUT with the Laptop.
b. Controlling software (QRCT.exe V3.0.268.0) has been activated to set the EUT on specific status.

4.1.7 Test Results

Above 1GHz Data:

802.11b

CHANNEL	TX Channel 1	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	53.4 PK	74.0	-20.6	1.64 H	219	54.4	-1.0
2	2390.00	33.1 AV	54.0	-20.9	1.64 H	219	34.1	-1.0
3	*2412.00	104.7 PK			1.64 H	219	105.7	-1.0
4	*2412.00	100.8 AV			1.64 H	219	101.8	-1.0
5	4824.00	49.8 PK	74.0	-24.2	1.79 H	213	46.7	3.1
6	4824.00	48.2 AV	54.0	-5.8	1.79 H	213	45.1	3.1
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	56.8 PK	74.0	-17.2	1.47 V	279	57.8	-1.0
2	2390.00	36.2 AV	54.0	-17.8	1.47 V	279	37.2	-1.0
3	*2412.00	107.6 PK			1.47 V	279	108.6	-1.0
4	*2412.00	104.3 AV			1.47 V	279	105.3	-1.0
5	4824.00	52.6 PK	74.0	-21.4	1.40 V	77	49.5	3.1
6	4824.00	50.5 AV	54.0	-3.5	1.40 V	77	47.4	3.1

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 6	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	41.5 PK	74.0	-32.5	1.59 H	222	42.5	-1.0
2	2390.00	30.6 AV	54.0	-23.4	1.59 H	222	31.6	-1.0
3	*2437.00	104.5 PK			1.59 H	222	105.9	-1.4
4	*2437.00	100.4 AV			1.59 H	222	101.8	-1.4
5	2483.50	41.8 PK	74.0	-32.2	1.59 H	222	43.0	-1.2
6	2483.50	30.1 AV	54.0	-23.9	1.59 H	222	31.3	-1.2
7	4874.00	49.5 PK	74.0	-24.5	1.76 H	205	46.2	3.3
8	4874.00	47.9 AV	54.0	-6.1	1.76 H	205	44.6	3.3
9	7311.00	43.0 PK	74.0	-31.0	2.24 H	219	33.0	10.0
10	7311.00	33.8 AV	54.0	-20.2	2.24 H	219	23.8	10.0
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	44.9 PK	74.0	-29.1	1.41 V	342	45.9	-1.0
2	2390.00	33.7 AV	54.0	-20.3	1.41 V	342	34.7	-1.0
3	*2437.00	107.4 PK			1.41 V	342	108.8	-1.4
4	*2437.00	103.9 AV			1.41 V	342	105.3	-1.4
5	2483.50	45.2 PK	74.0	-28.8	1.41 V	342	46.4	-1.2
6	2483.50	33.2 AV	54.0	-20.8	1.41 V	342	34.4	-1.2
7	4874.00	52.4 PK	74.0	-21.6	1.38 V	83	49.1	3.3
8	4874.00	50.5 AV	54.0	-3.5	1.38 V	83	47.2	3.3
9	7311.00	42.4 PK	74.0	-31.6	1.62 V	319	32.4	10.0
10	7311.00	30.2 AV	54.0	-23.8	1.62 V	319	20.2	10.0

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 11	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2462.00	105.1 PK			1.58 H	238	106.5	-1.4
2	*2462.00	101.2 AV			1.58 H	238	102.6	-1.4
3	2483.50	53.5 PK	74.0	-20.5	1.58 H	238	54.7	-1.2
4	2483.50	36.1 AV	54.0	-17.9	1.58 H	238	37.3	-1.2
5	4924.00	49.8 PK	74.0	-24.2	1.74 H	208	46.3	3.5
6	4924.00	48.3 AV	54.0	-5.7	1.74 H	208	44.8	3.5
7	7386.00	42.9 PK	74.0	-31.1	2.25 H	219	32.7	10.2
8	7386.00	33.8 AV	54.0	-20.2	2.25 H	219	23.6	10.2
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2462.00	108.0 PK			1.22 V	313	109.4	-1.4
2	*2462.00	104.7 AV			1.22 V	313	106.1	-1.4
3	2483.50	56.9 PK	74.0	-17.1	1.22 V	313	58.1	-1.2
4	2483.50	39.5 AV	54.0	-14.5	1.22 V	313	40.7	-1.2
5	4924.00	52.4 PK	74.0	-21.6	1.36 V	93	48.9	3.5
6	4924.00	50.6 AV	54.0	-3.4	1.36 V	93	47.1	3.5
7	7386.00	42.3 PK	74.0	-31.7	1.65 V	320	32.1	10.2
8	7386.00	30.3 AV	54.0	-23.7	1.65 V	320	20.1	10.2

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

802.11g

CHANNEL	TX Channel 1	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	65.7 PK	74.0	-8.3	1.63 H	248	66.7	-1.0
2	2390.00	42.5 AV	54.0	-11.5	1.63 H	248	43.5	-1.0
3	*2412.00	105.0 PK			1.63 H	248	106.0	-1.0
4	*2412.00	94.6 AV			1.63 H	248	95.6	-1.0
5	4824.00	43.5 PK	74.0	-30.5	1.19 H	40	40.4	3.1
6	4824.00	31.0 AV	54.0	-23.0	1.19 H	40	27.9	3.1
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	69.1 PK	74.0	-4.9	1.89 V	284	70.1	-1.0
2	2390.00	49.5 AV	54.0	-4.5	1.89 V	284	50.5	-1.0
3	*2412.00	107.9 PK			1.89 V	284	108.9	-1.0
4	*2412.00	98.1 AV			1.89 V	284	99.1	-1.0
5	4824.00	45.8 PK	74.0	-28.2	2.07 V	299	42.7	3.1
6	4824.00	34.3 AV	54.0	-19.7	2.07 V	299	31.2	3.1

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 6	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	45.4 PK	74.0	-28.6	1.59 H	239	46.4	-1.0
2	2390.00	32.4 AV	54.0	-21.6	1.59 H	239	33.4	-1.0
3	*2437.00	104.7 PK			1.59 H	239	106.1	-1.4
4	*2437.00	94.3 AV			1.59 H	239	95.7	-1.4
5	2483.50	49.8 PK	74.0	-24.2	1.59 H	239	51.0	-1.2
6	2483.50	31.2 AV	54.0	-22.8	1.59 H	239	32.4	-1.2
7	4874.00	43.5 PK	74.0	-30.5	1.18 H	50	40.2	3.3
8	4874.00	30.9 AV	54.0	-23.1	1.18 H	50	27.6	3.3
9	7311.00	42.0 PK	74.0	-32.0	1.58 H	199	32.0	10.0
10	7311.00	30.6 AV	54.0	-23.4	1.58 H	199	20.6	10.0
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	48.8 PK	74.0	-25.2	1.88 V	296	49.8	-1.0
2	2390.00	35.5 AV	54.0	-18.5	1.88 V	296	36.5	-1.0
3	*2437.00	107.6 PK			1.88 V	296	109.0	-1.4
4	*2437.00	97.8 AV			1.88 V	296	99.2	-1.4
5	2483.50	53.2 PK	74.0	-20.8	1.88 V	296	54.4	-1.2
6	2483.50	34.3 AV	54.0	-19.7	1.88 V	296	35.5	-1.2
7	4874.00	45.4 PK	74.0	-28.6	2.08 V	312	42.1	3.3
8	4874.00	34.2 AV	54.0	-19.8	2.08 V	312	30.9	3.3
9	7311.00	41.6 PK	74.0	-32.4	1.61 V	122	31.6	10.0
10	7311.00	30.1 AV	54.0	-23.9	1.61 V	122	20.1	10.0

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 11	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2462.00	104.1 PK			1.59 H	243	105.5	-1.4
2	*2462.00	93.8 AV			1.59 H	243	95.2	-1.4
3	2483.50	63.2 PK	74.0	-10.8	1.59 H	243	64.4	-1.2
4	2483.50	38.7 AV	54.0	-15.3	1.59 H	243	39.9	-1.2
5	4924.00	43.6 PK	74.0	-30.4	1.17 H	36	40.1	3.5
6	4924.00	30.9 AV	54.0	-23.1	1.17 H	36	27.4	3.5
7	7386.00	41.5 PK	74.0	-32.5	1.56 H	212	31.3	10.2
8	7386.00	30.3 AV	54.0	-23.7	1.56 H	212	20.1	10.2
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2462.00	107.0 PK			1.87 V	312	108.4	-1.4
2	*2462.00	97.3 AV			1.87 V	312	98.7	-1.4
3	2483.50	66.6 PK	74.0	-7.4	1.87 V	312	67.8	-1.2
4	2483.50	45.7 AV	54.0	-8.3	1.87 V	312	46.9	-1.2
5	4924.00	45.6 PK	74.0	-28.4	2.02 V	308	42.1	3.5
6	4924.00	34.6 AV	54.0	-19.4	2.02 V	308	31.1	3.5
7	7386.00	41.6 PK	74.0	-32.4	1.66 V	122	31.4	10.2
8	7386.00	30.1 AV	54.0	-23.9	1.66 V	122	19.9	10.2

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

802.11n (HT20)

CHANNEL	TX Channel 1	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	67.5 PK	74.0	-6.5	1.53 H	234	68.5	-1.0
2	2390.00	43.9 AV	54.0	-10.1	1.53 H	234	44.9	-1.0
3	*2412.00	104.4 PK			1.53 H	234	105.4	-1.0
4	*2412.00	94.2 AV			1.53 H	234	95.2	-1.0
5	4824.00	43.2 PK	74.0	-30.8	1.22 H	21	40.1	3.1
6	4824.00	30.5 AV	54.0	-23.5	1.22 H	21	27.4	3.1
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	70.4 PK	74.0	-3.6	1.48 V	268	71.4	-1.0
2	2390.00	50.9 AV	54.0	-3.1	1.48 V	268	51.9	-1.0
3	*2412.00	107.3 PK			1.48 V	268	108.3	-1.0
4	*2412.00	97.7 AV			1.48 V	268	98.7	-1.0
5	4824.00	45.7 PK	74.0	-28.3	1.99 V	299	42.6	3.1
6	4824.00	34.6 AV	54.0	-19.4	1.99 V	299	31.5	3.1

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 6	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	52.3 PK	74.0	-21.7	1.57 H	241	53.3	-1.0
2	2390.00	30.2 AV	54.0	-23.8	1.57 H	241	31.2	-1.0
3	*2437.00	104.3 PK			1.57 H	241	105.7	-1.4
4	*2437.00	93.4 AV			1.57 H	241	94.8	-1.4
5	2483.50	55.9 PK	74.0	-18.1	1.57 H	241	57.1	-1.2
6	2483.50	31.7 AV	54.0	-22.3	1.57 H	241	32.9	-1.2
7	4874.00	44.3 PK	74.0	-29.7	1.13 H	26	41.0	3.3
8	4874.00	31.3 AV	54.0	-22.7	1.13 H	26	28.0	3.3
9	7311.00	41.2 PK	74.0	-32.8	1.56 H	207	31.2	10.0
10	7311.00	30.2 AV	54.0	-23.8	1.56 H	207	20.2	10.0
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	55.3 PK	74.0	-18.7	1.52 V	272	56.3	-1.0
2	2390.00	34.7 AV	54.0	-19.3	1.52 V	272	35.7	-1.0
3	*2437.00	107.2 PK			1.52 V	272	108.6	-1.4
4	*2437.00	96.9 AV			1.52 V	272	98.3	-1.4
5	2483.50	58.9 PK	74.0	-15.1	1.52 V	272	60.1	-1.2
6	2483.50	34.7 AV	54.0	-19.3	1.52 V	272	35.9	-1.2
7	4874.00	45.3 PK	74.0	-28.7	2.08 V	312	42.0	3.3
8	4874.00	34.5 AV	54.0	-19.5	2.08 V	312	31.2	3.3
9	7311.00	42.0 PK	74.0	-32.0	1.62 V	110	32.0	10.0
10	7311.00	30.4 AV	54.0	-23.6	1.62 V	110	20.4	10.0

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 11	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2462.00	104.6 PK			1.59 H	239	106.0	-1.4
2	*2462.00	93.9 AV			1.59 H	239	95.3	-1.4
3	2483.50	68.2 PK	74.0	-5.8	1.59 H	239	69.4	-1.2
4	2483.50	45.7 AV	54.0	-8.3	1.59 H	239	46.9	-1.2
5	4924.00	43.7 PK	74.0	-30.3	1.21 H	32	40.2	3.5
6	4924.00	31.0 AV	54.0	-23.0	1.21 H	32	27.5	3.5
7	7386.00	41.4 PK	74.0	-32.6	1.55 H	227	31.2	10.2
8	7386.00	30.2 AV	54.0	-23.8	1.55 H	227	20.0	10.2
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2462.00	107.5 PK			1.60 V	270	108.9	-1.4
2	*2462.00	97.4 AV			1.60 V	270	98.8	-1.4
3	**2483.50**	**71.2 PK**	**74.0**	**-2.8**	**1.60 V**	**270**	**72.4**	**-1.2**
4	2483.50	49.1 AV	54.0	-4.9	1.60 V	270	50.3	-1.2
5	4924.00	45.5 PK	74.0	-28.5	2.04 V	306	42.0	3.5
6	4924.00	34.5 AV	54.0	-19.5	2.04 V	306	31.0	3.5
7	7386.00	41.6 PK	74.0	-32.4	1.70 V	126	31.4	10.2
8	7386.00	30.1 AV	54.0	-23.9	1.70 V	126	19.9	10.2

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

Below 1GHz Data:

802.11n (HT20)

CHANNEL	TX Channel 11	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	37.49	29.9 QP	40.0	-10.1	2.50 H	113	38.4	-8.5
2	71.03	34.5 QP	40.0	-5.5	2.50 H	314	44.7	-10.2
3	159.62	30.8 QP	43.5	-12.7	2.50 H	269	38.5	-7.7
4	300.00	39.1 QP	46.0	-6.9	2.00 H	241	46.3	-7.2
5	350.00	34.1 QP	46.0	-11.9	2.00 H	119	40.1	-6.0
6	927.74	33.2 QP	46.0	-12.8	1.50 H	274	28.3	4.9
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	31.09	33.5 QP	40.0	-6.5	1.00 V	224	42.4	-8.9
2	71.20	33.3 QP	40.0	-6.7	1.00 V	305	43.6	-10.3
3	158.57	27.6 QP	43.5	-15.9	1.00 V	269	35.2	-7.6
4	350.00	33.8 QP	46.0	-12.2	1.00 V	247	39.8	-6.0
5	399.98	32.0 QP	46.0	-14.0	1.50 V	109	36.6	-4.6
6	850.86	32.4 QP	46.0	-13.6	1.50 V	87	28.7	3.7

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. 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 0.50MHz.

4.2.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver R&S	ESCS 30	847124/029	Nov. 01, 2017	Oct. 31, 2018
Line-Impedance Stabilization Network (for EUT) R&S	ESH3-Z5	848773/004	Nov. 15, 2017	Nov. 14, 2018
Line-Impedance Stabilization Network (for Peripheral) R&S	ENV216	100072	June 03, 2017	June 02, 2018
50 ohms Terminator	N/A	EMC-02	Sep. 22, 2017	Sep. 21, 2018
RF Cable	5D-FB	COCCAB-001	Sep. 29, 2017	Sep. 28, 2018
10 dB PAD Mini-Circuits	HAT-10+	CONATT-004	June 18, 2017	June 17, 2018
Software BVADT	BVADT_Cond_ V7.3.7.4	NA	NA	NA

Note:
1. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Shielded Room No. 1.
3 Tested Date: Jan. 20, 2018

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/ 50uH of coupling impedance for the measuring instrument.

b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

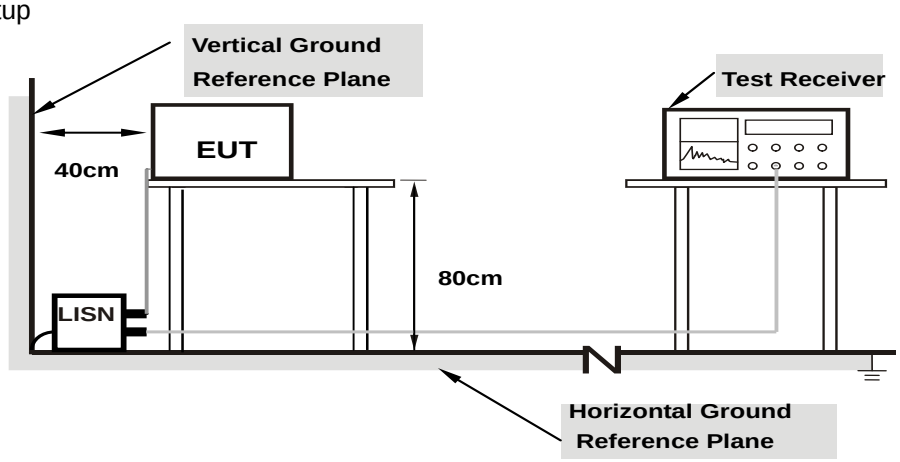
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

NOTE: The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.

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

Controlling software (QRCT.exe V3.0.268.0) has been activated to set the EUT on specific status.

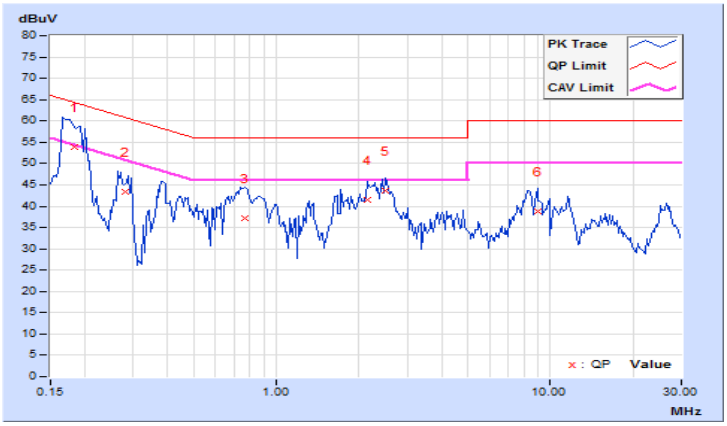
4.2.7 Test Results

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	**0.18359**	**10.14**	**43.63**	**28.72**	**53.77**	**38.86**	**64.32**	**54.32**	**-10.55**	**-15.46**
2	0.28253	10.16	33.24	14.33	43.40	24.49	60.74	50.74	-17.34	-26.25
3	0.77109	10.21	26.91	11.52	37.12	21.73	56.00	46.00	-18.88	-24.27
4	2.15625	10.28	31.13	18.37	41.41	28.65	56.00	46.00	-14.59	-17.35
5	2.49219	10.29	33.47	20.66	43.76	30.95	56.00	46.00	-12.24	-15.05
6	8.96875	10.59	28.14	16.80	38.73	27.39	60.00	50.00	-21.27	-22.61

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.

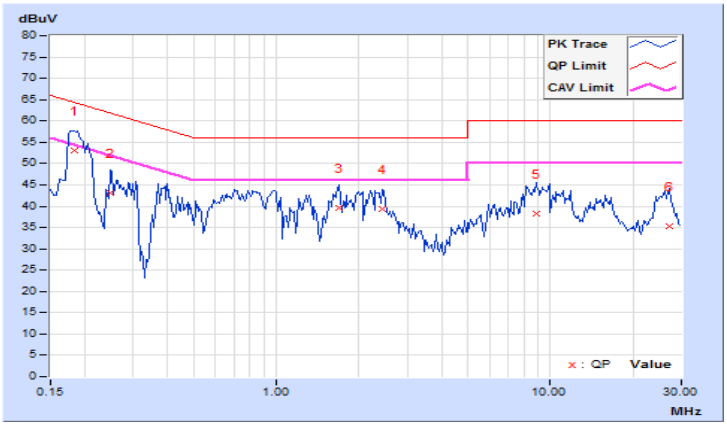


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.18281	10.04	43.15	27.22	53.19	37.26	64.36	54.36	-11.17	-17.10
2	0.24766	10.05	32.93	17.60	42.98	27.65	61.84	51.84	-18.86	-24.19
3	1.68750	10.14	29.53	15.93	39.67	26.07	56.00	46.00	-16.33	-19.93
4	2.44531	10.17	29.09	16.37	39.26	26.54	56.00	46.00	-16.74	-19.46
5	8.85156	10.44	27.73	18.15	38.17	28.59	60.00	50.00	-21.83	-21.41
6	27.00000	11.06	24.18	17.07	35.24	28.13	60.00	50.00	-24.76	-21.87

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.

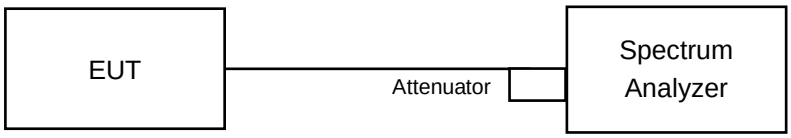


4.3 6dB Bandwidth Measurement

4.3.1 Limits of 6dB Bandwidth Measurement

The minimum of 6dB 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) = 100kHz
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 from Test 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

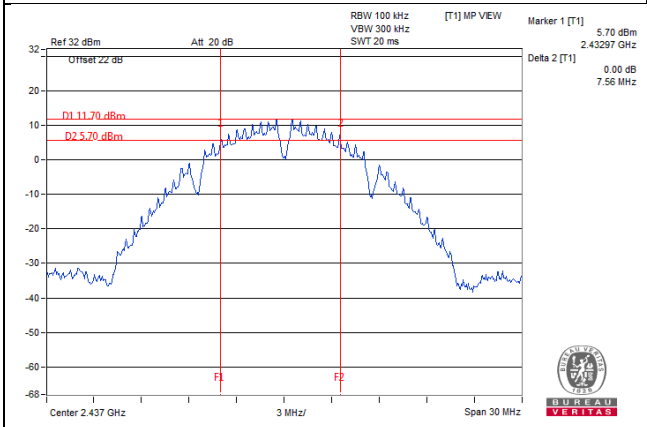
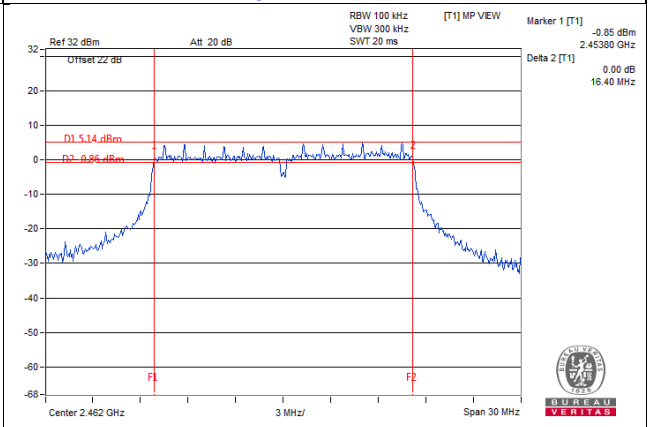
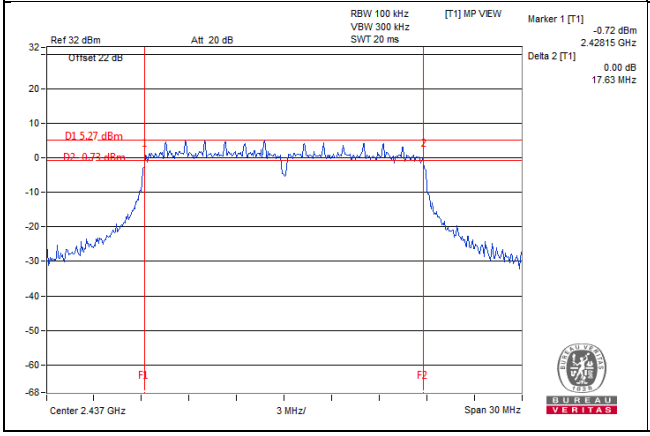
Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
1	2412	8.05	8.07	0.5	Pass
6	2437	7.56	7.59	0.5	Pass
11	2462	8.06	7.61	0.5	Pass

802.11g

Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
1	2412	16.44	16.44	0.5	Pass
6	2437	16.41	16.43	0.5	Pass
11	2462	16.40	16.43	0.5	Pass

802.11n (HT20)

Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
1	2412	17.67	17.64	0.5	Pass
6	2437	17.63	17.64	0.5	Pass
11	2462	17.69	17.69	0.5	Pass

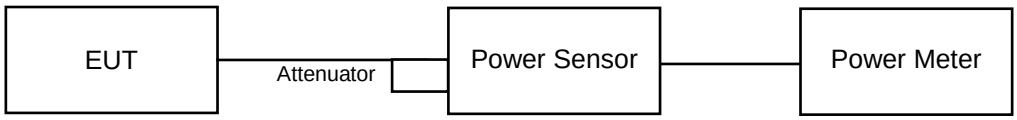
Spectrum Plot of Worst Value	
802.11b / Chain 0 : CH6	**802.11g / Chain 0 : CH11**
	
802.11n (HT20) / Chain 0 : CH6	
	

4.4 Conducted Output Power Measurement

4.4.1 Limits of Conducted Output Power Measurement

For systems using digital modulation in the 2400–2483.5 MHz bands: 1 Watt (30dBm)

4.4.2 Test Setup



4.4.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.4.4 Test Procedures

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

4.4.5 Deviation from Test Standard

No deviation.

4.4.6 EUT Operating Conditions

Same as Item 4.3.6.

4.4.7 Test Results

FOR PEAK POWER

802.11b

Chan.	Freq. (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	21.55	21.71	291.141	24.64	30.00	Pass
6	2437	21.56	21.65	289.437	24.62	30.00	Pass
11	2462	21.66	21.42	285.231	24.55	30.00	Pass

802.11g

Chan.	Freq. (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	22.98	22.93	394.945	25.97	30.00	Pass
6	2437	23.01	22.95	397.228	25.99	30.00	Pass
11	2462	23.04	22.88	395.461	25.97	30.00	Pass

802.11n (HT20)

Chan.	Freq. (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	22.99	22.91	394.501	25.96	30.00	Pass
6	2437	23.10	22.98	402.783	26.05	30.00	Pass
11	2462	23.11	22.99	403.711	26.06	30.00	Pass

FOR AVERAGE POWER - reference only

802.11b

Chan.	Frequency (MHz)	Avg. Power (dBm)		Total Power (mW)	Total Power (dBm)
		Chain 0	Chain 1		
1	2412	18.97	19.12	160.544	22.06
6	2437	19.02	19.04	159.967	22.04
11	2462	19.15	18.84	158.784	22.01

802.11g

Chan.	Frequency (MHz)	Avg. Power (dBm)		Total Power (mW)	Total Power (dBm)
		Chain 0	Chain 1		
1	2412	16.13	16.03	81.107	19.09
6	2437	16.12	16.08	81.477	19.11
11	2462	16.16	15.86	79.853	19.02

802.11n (HT20)

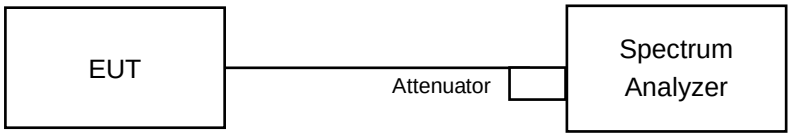
Chan.	Frequency (MHz)	Avg. Power (dBm)		Total Power (mW)	Total Power (dBm)
		Chain 0	Chain 1		
1	2412	16.12	15.98	80.554	19.06
6	2437	16.23	16.02	81.97	19.14
11	2462	16.22	15.96	81.325	19.10

4.5 Power Spectral Density Measurement

4.5.1 Limits of Power Spectral Density Measurement

The Maximum of Power Spectral Density Measurement is 8dBm in any 3 kHz.

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 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.

4.5.5 Deviation from Test Standard

No deviation.

4.5.6 EUT Operating Condition

Same as Item 4.3.6

4.5.7 Test Results

802.11b

TX chain	Channel	Freq. (MHz)	PSD (dBm/3kHz)	10 log (N=2) dB	Total PSD (dBm/3kHz)	Limit (dBm/3kHz)	Pass /Fail
0	1	2412	-2.40	3.01	0.61	8.00	Pass
	6	2437	-3.13	3.01	-0.12	8.00	Pass
	11	2462	-3.57	3.01	-0.56	8.00	Pass
1	1	2412	-2.90	3.01	0.11	8.00	Pass
	6	2437	-3.08	3.01	-0.07	8.00	Pass
	11	2462	-2.85	3.01	0.16	8.00	Pass

Note: 1. Directional gain = 10 log[$(10^{G0/20} + 10^{G1/20})^2$ / 2] = 4.6dBi < 6dBi , so the power density limit shall not be reduced.

802.11g

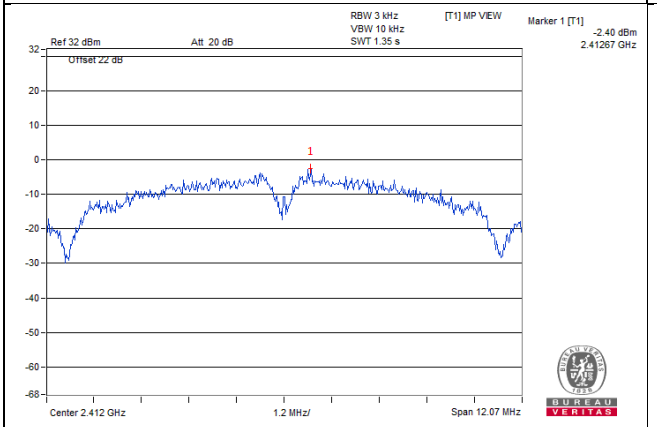
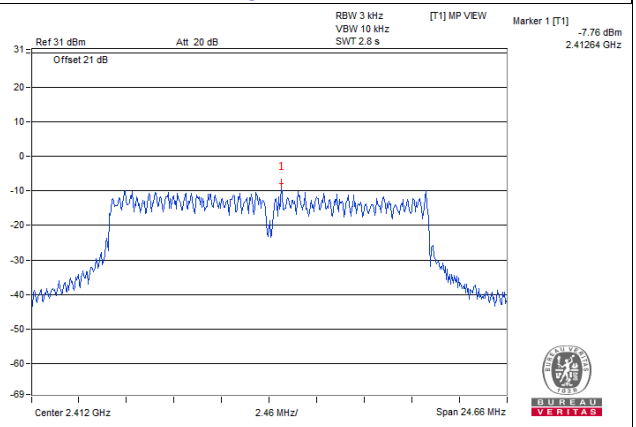
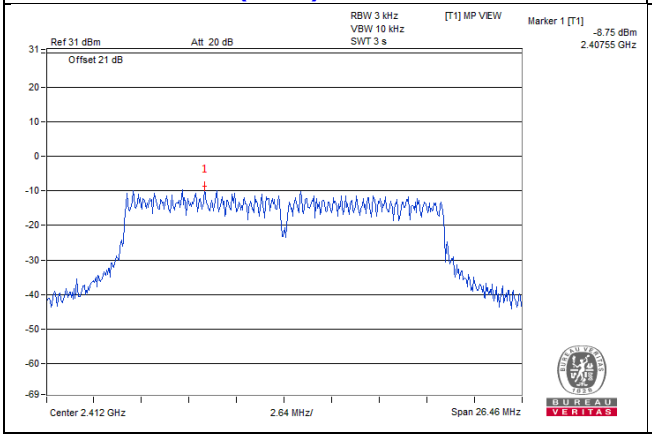
TX chain	Channel	Freq. (MHz)	PSD (dBm/3kHz)	10 log (N=2) dB	Total PSD (dBm/3kHz)	Limit (dBm/3kHz)	Pass /Fail
0	1	2412	-8.56	3.01	-5.55	8.00	Pass
	6	2437	-10.02	3.01	-7.01	8.00	Pass
	11	2462	-9.22	3.01	-6.21	8.00	Pass
1	1	2412	-7.76	3.01	-4.75	8.00	Pass
	6	2437	-9.47	3.01	-6.46	8.00	Pass
	11	2462	-8.44	3.01	-5.43	8.00	Pass

Note: 1. Directional gain = 10 log[$(10^{G0/20} + 10^{G1/20})^2$ / 2] = 4.6dBi < 6dBi , so the power density limit shall not be reduced.

802.11n (HT20)

TX chain	Channel	Freq. (MHz)	PSD (dBm/3kHz)	10 log (N=2) dB	Total PSD (dBm/3kHz)	Limit (dBm/3kHz)	Pass /Fail
0	1	2412	-10.07	3.01	-7.06	8.00	Pass
	6	2437	-9.85	3.01	-6.84	8.00	Pass
	11	2462	-9.74	3.01	-6.73	8.00	Pass
1	1	2412	-8.75	3.01	-5.74	8.00	Pass
	6	2437	-9.30	3.01	-6.29	8.00	Pass
	11	2462	-10.06	3.01	-7.05	8.00	Pass

Note: 1. Directional gain = 10 log[$(10^{G0/20} + 10^{G1/20})^2$ / 2] = 4.6dBi < 6dBi , so the power density limit shall not be reduced.

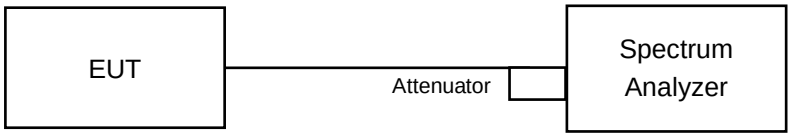
Spectrum Plot of Worst Value	
802.11b / Chain 0 : CH1	**802.11g / Chain 1 : CH1**
	
802.11n (HT20) / Chain 1 : CH1	
	

4.6 Conducted Out of Band Emission Measurement

4.6.1 Limits of Conducted Out of Band Emission Measurement

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

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

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.

4.6.5 Deviation from Test Standard

No deviation.

4.6.6 EUT Operating Condition

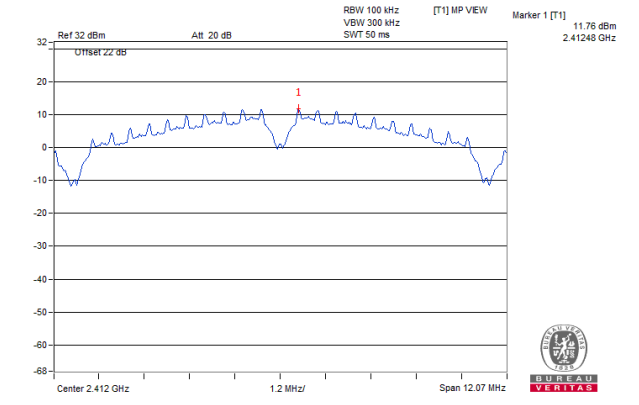
Same as Item 4.3.6

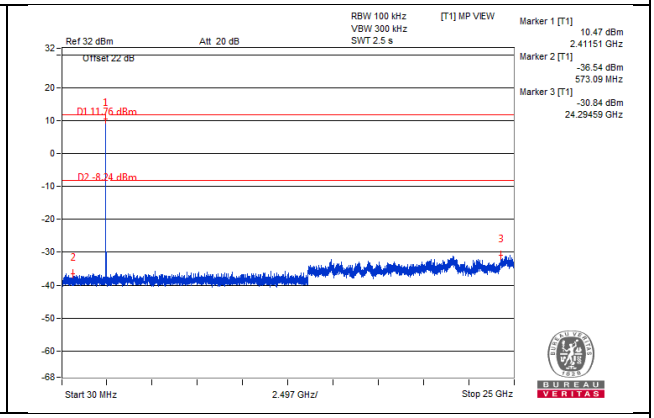
4.6.7 Test Results

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

802.11b
Chain 0

CH 1





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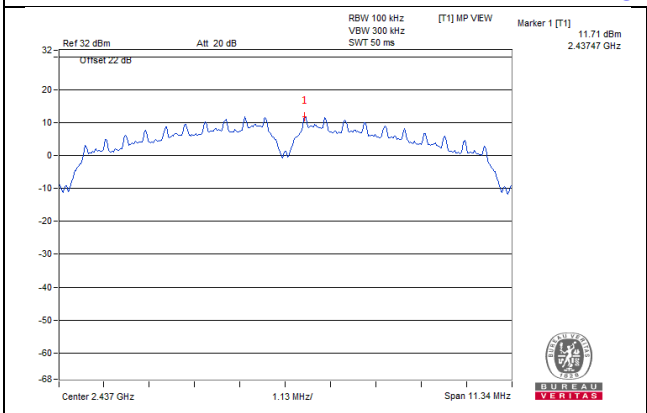

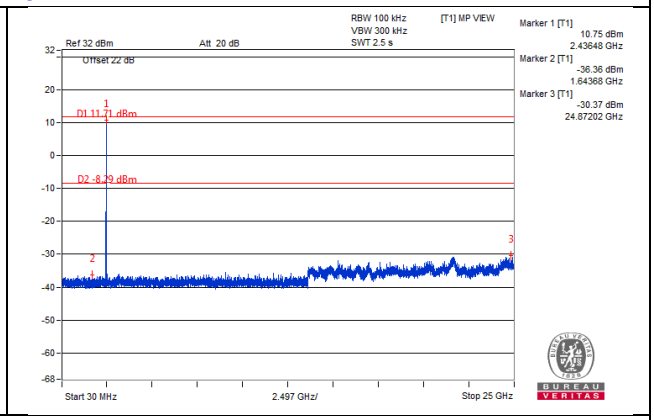

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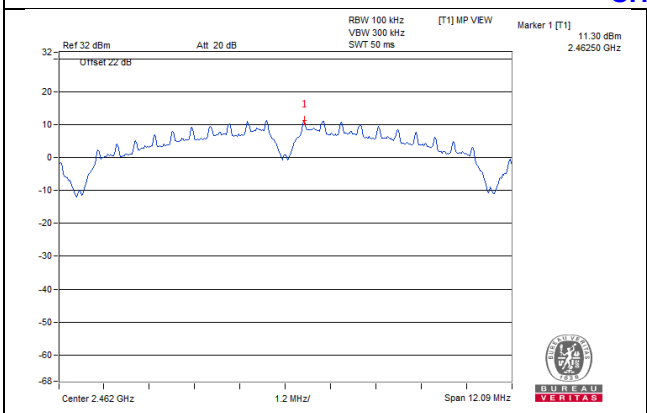

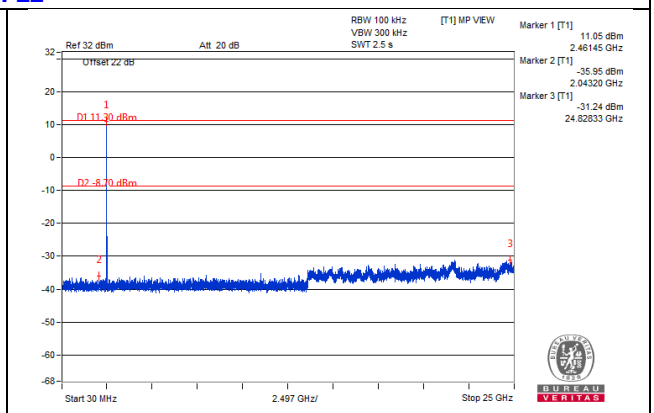

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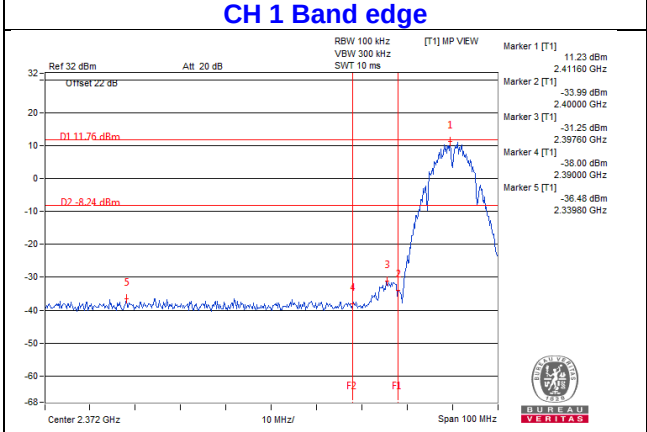

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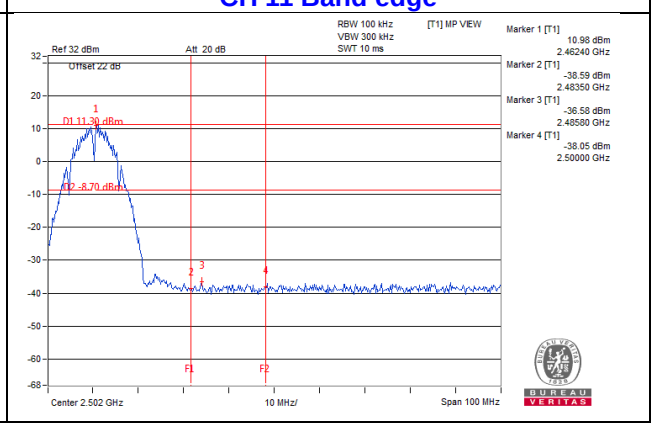
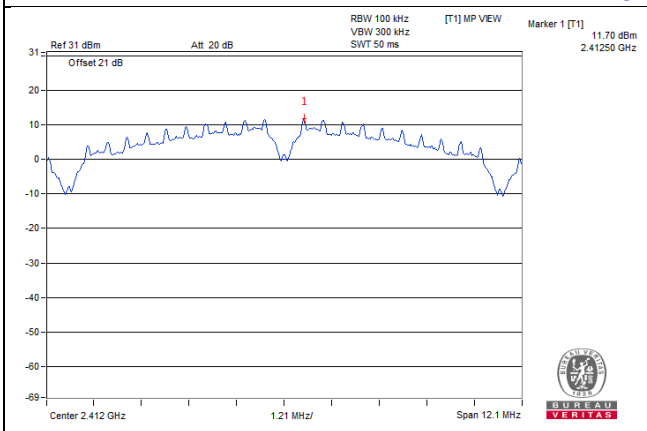
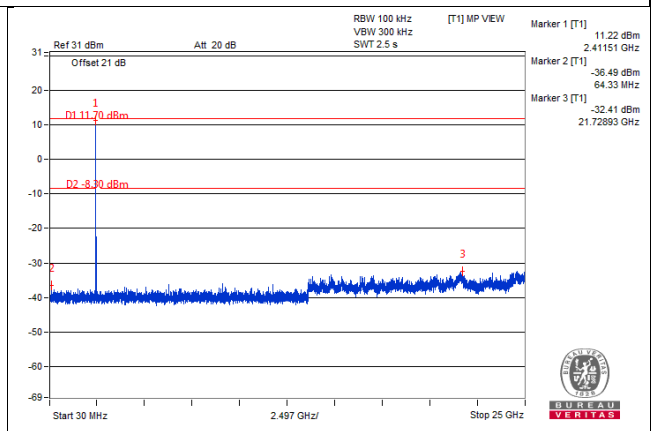


Chain 1

CH 1





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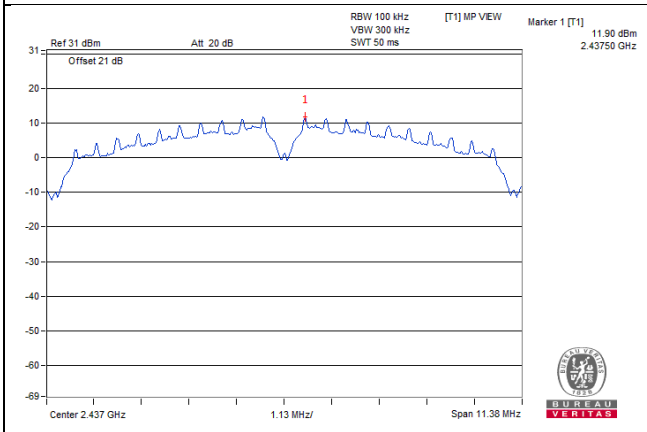

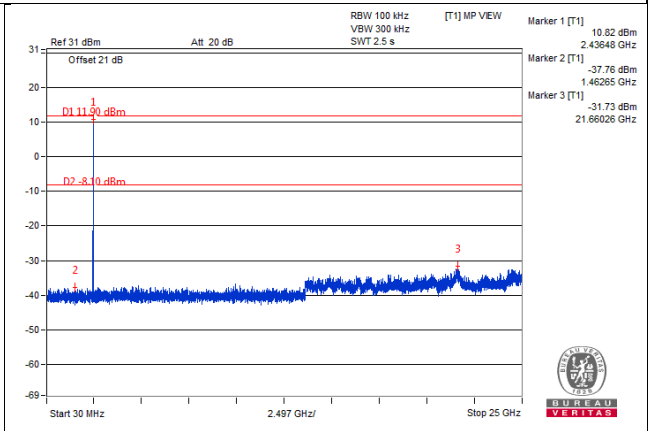

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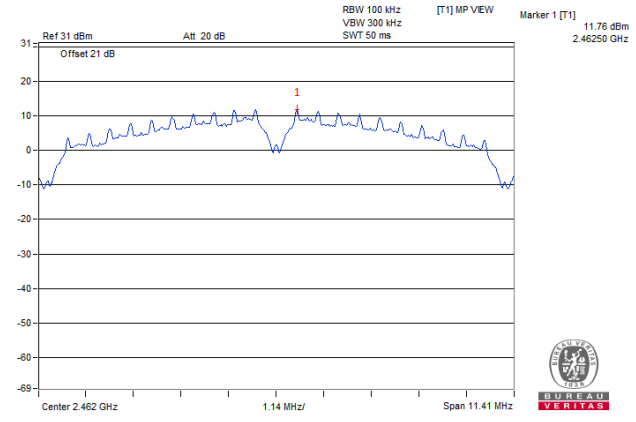

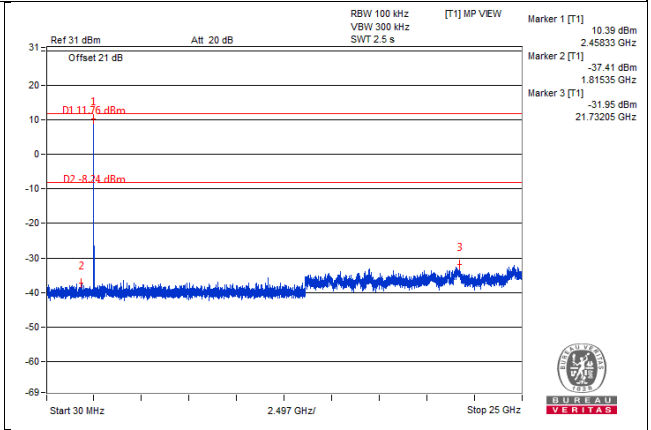

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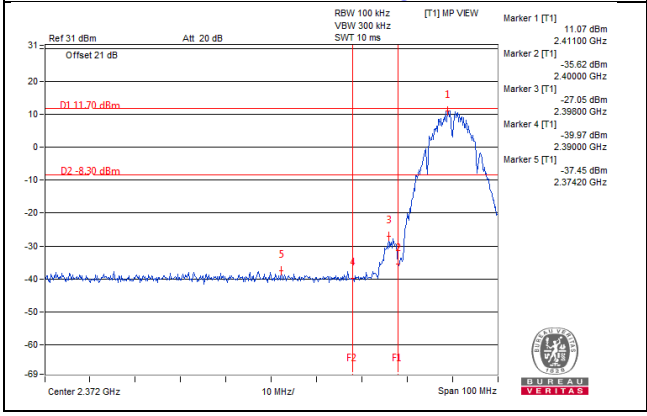

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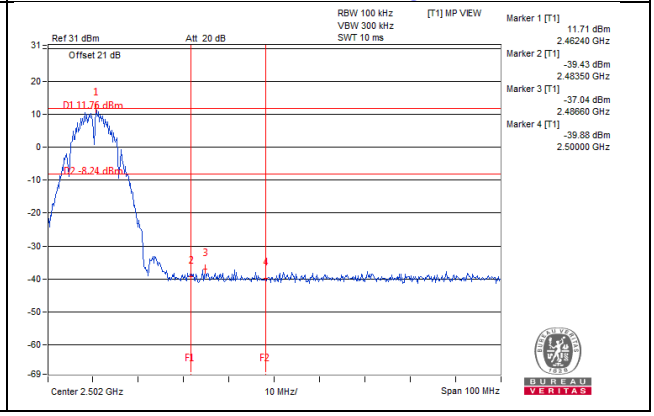
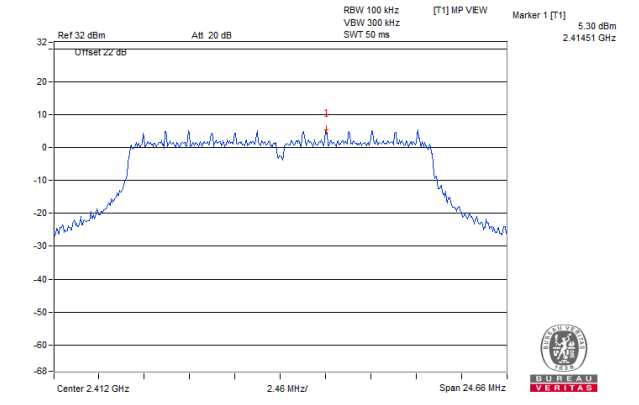
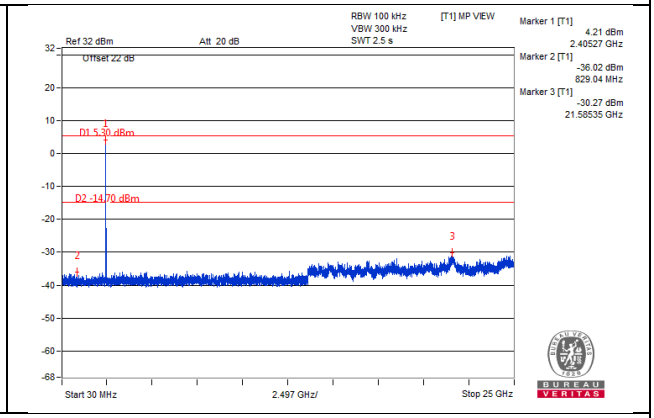


802.11g
Chain 0

CH 1





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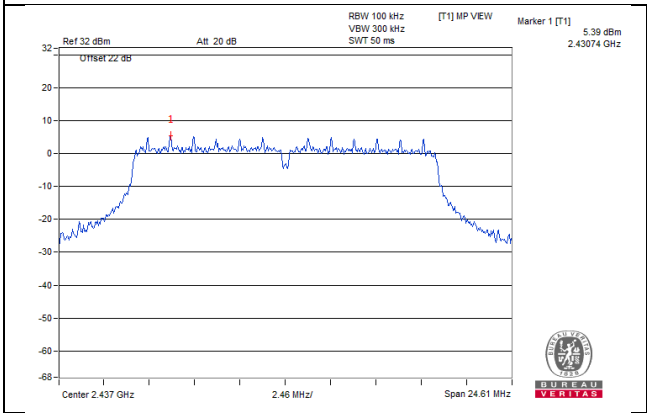

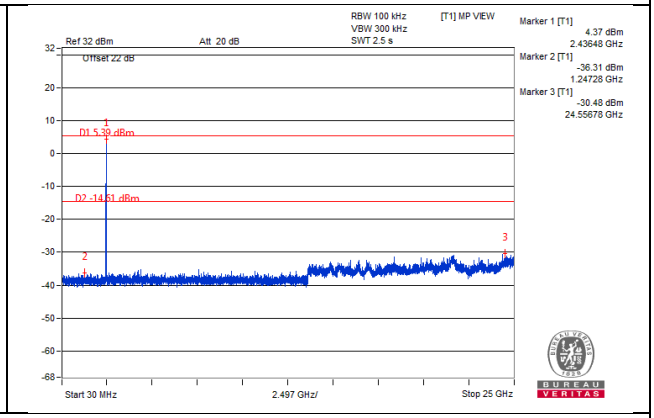

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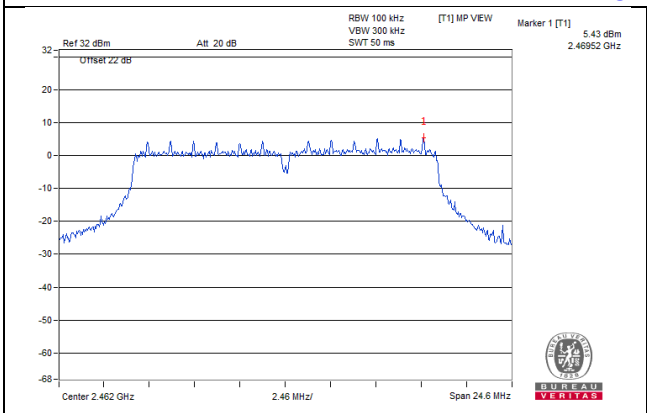

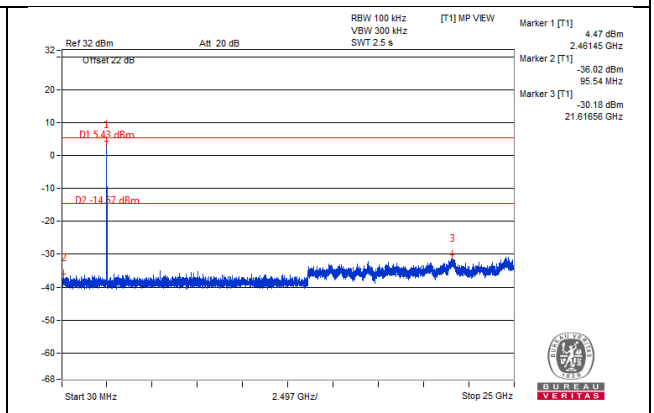

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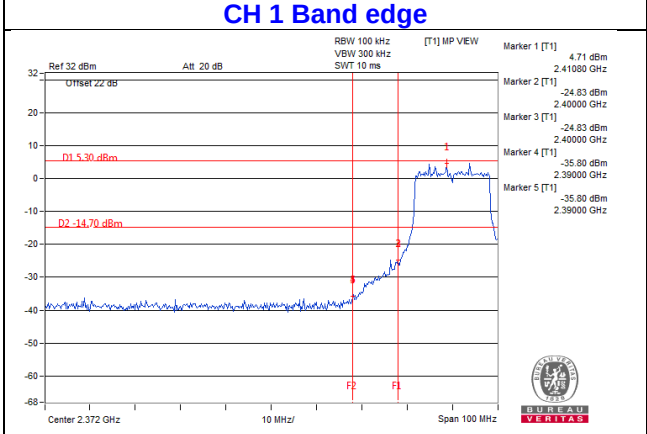

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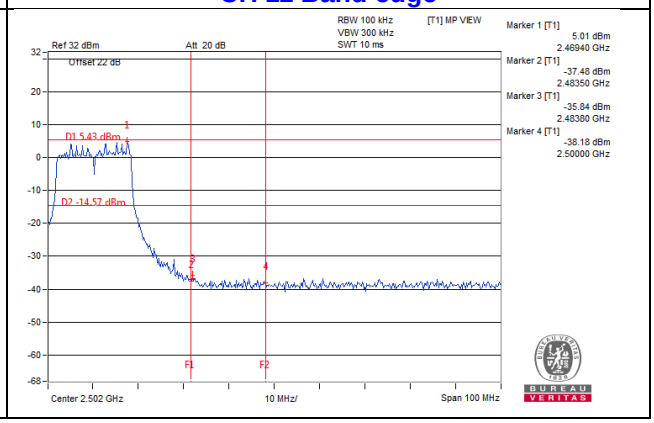
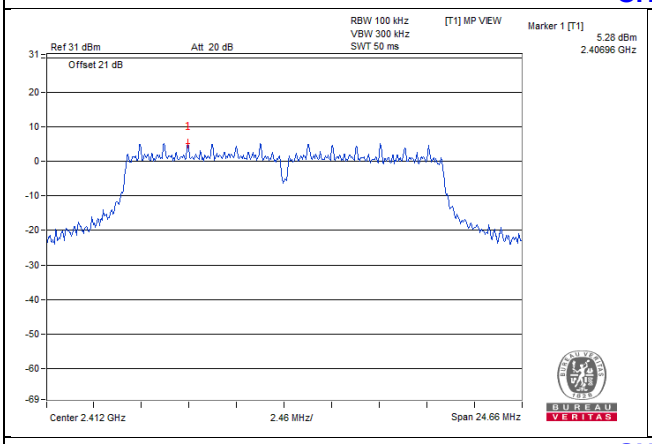
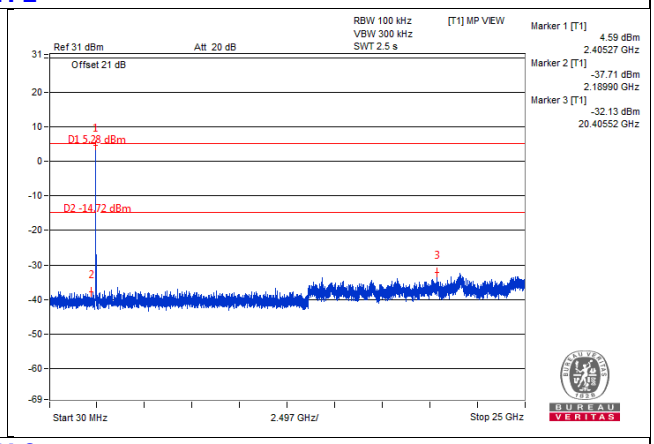


Chain 1

CH 1





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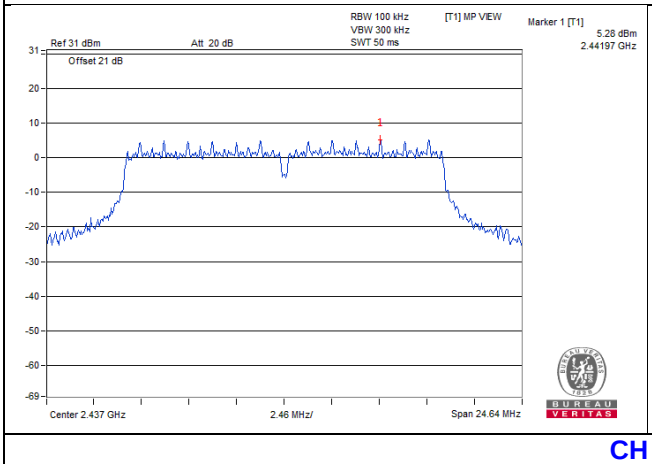

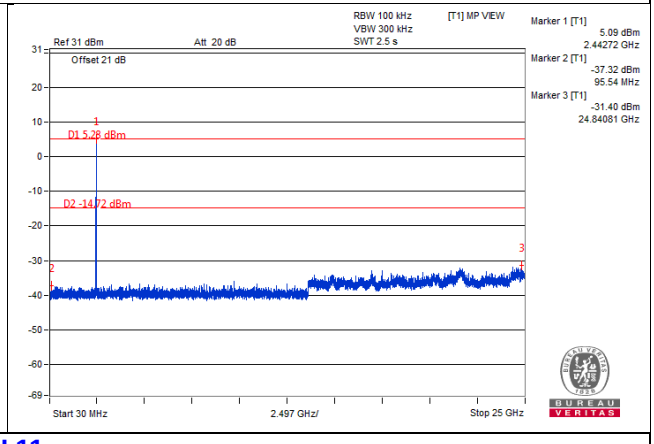

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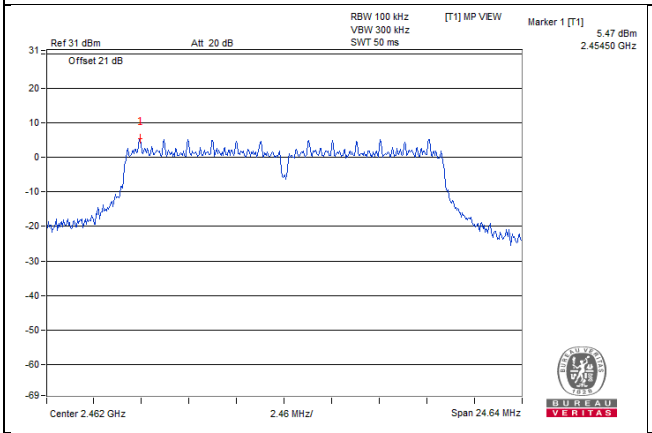

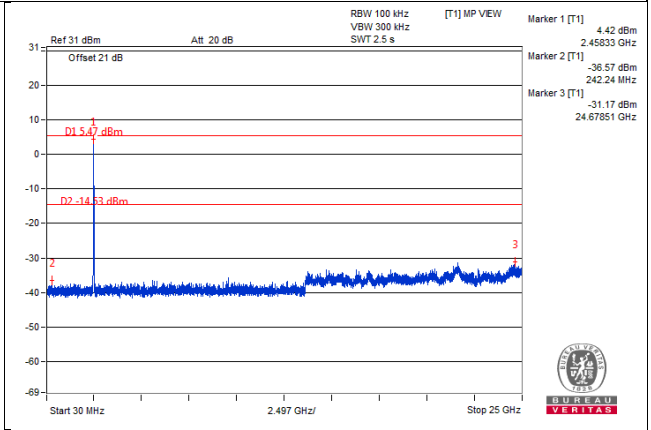

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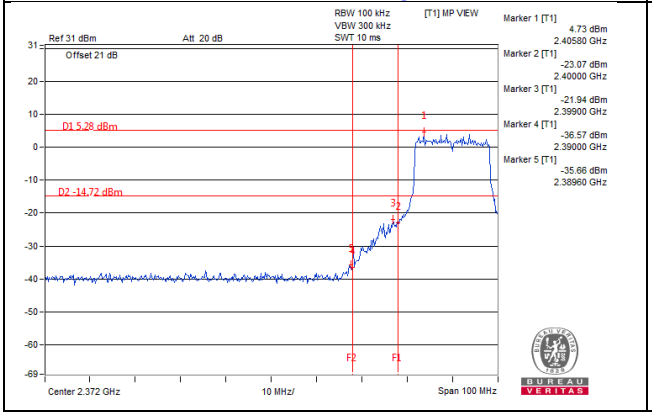

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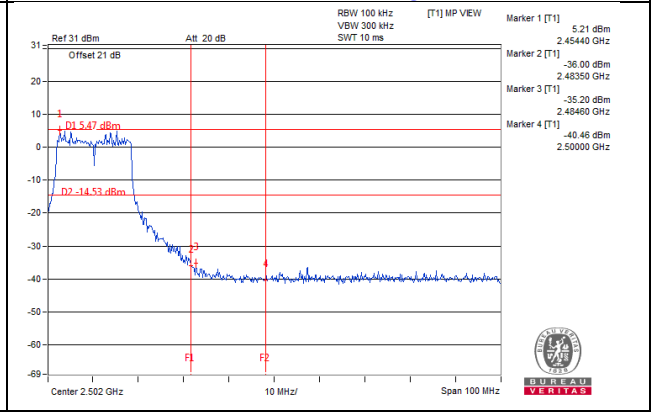
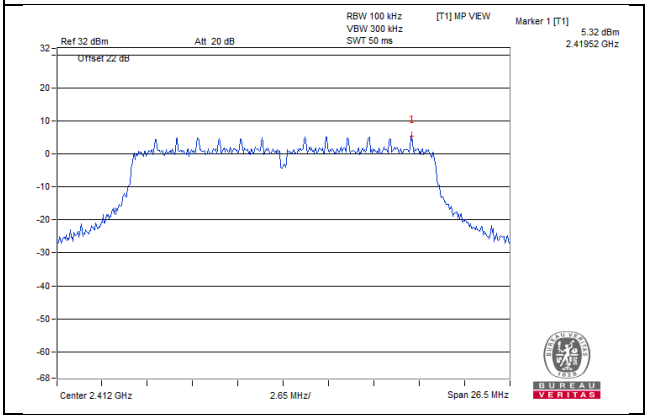
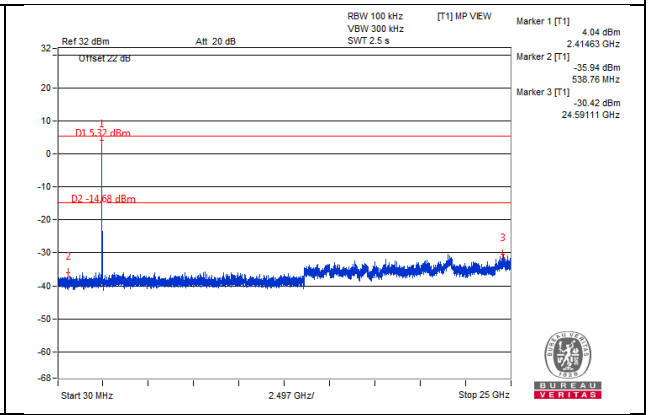


802.11n (HT20)
Chain 0

CH 1





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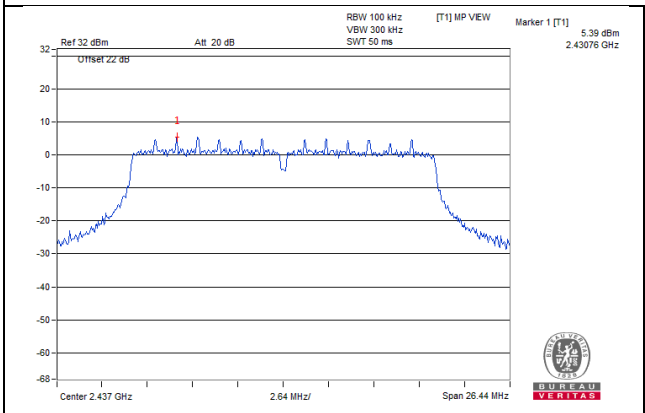

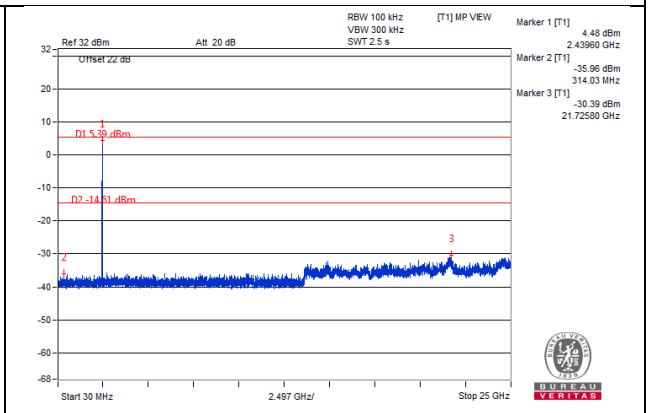

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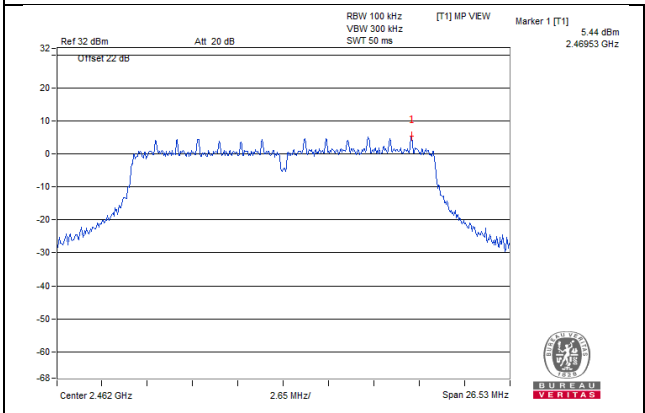

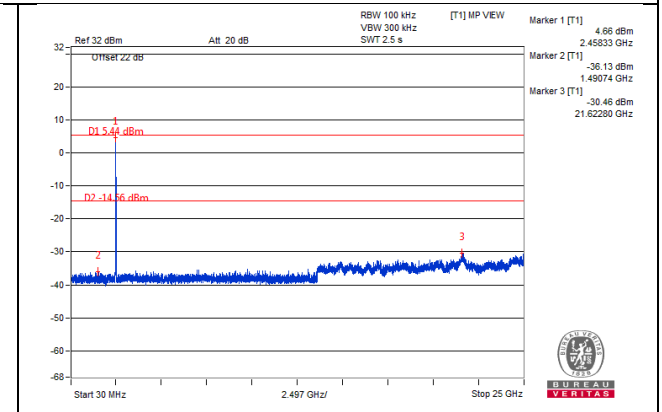

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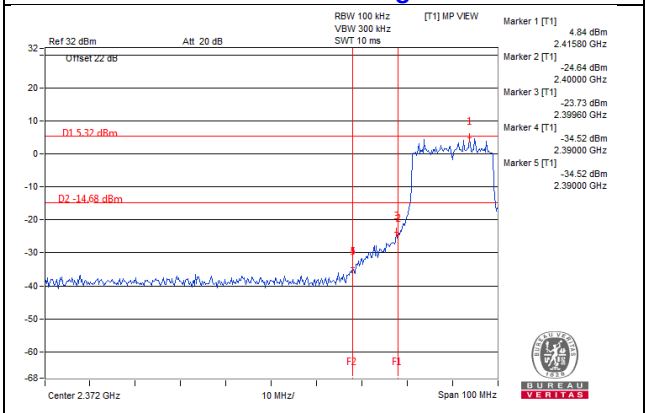

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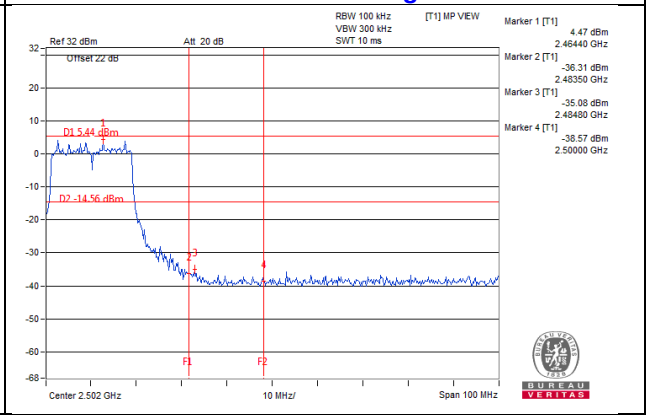
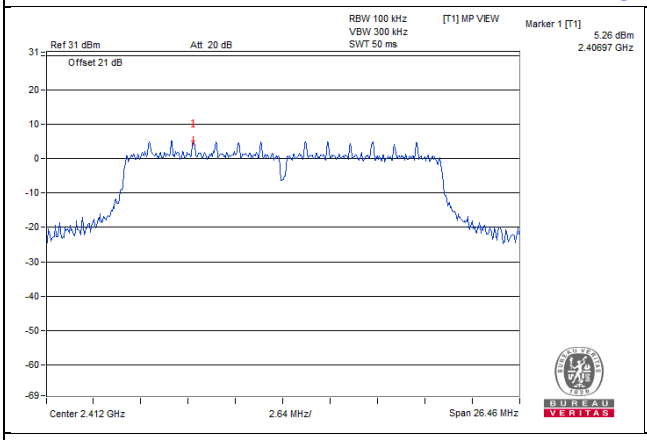
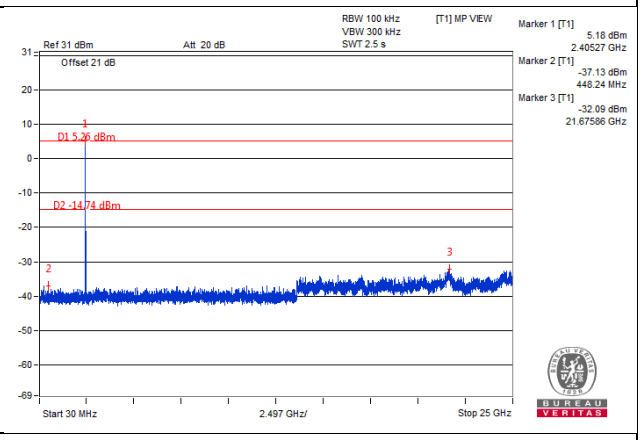


Chain 1

CH 1





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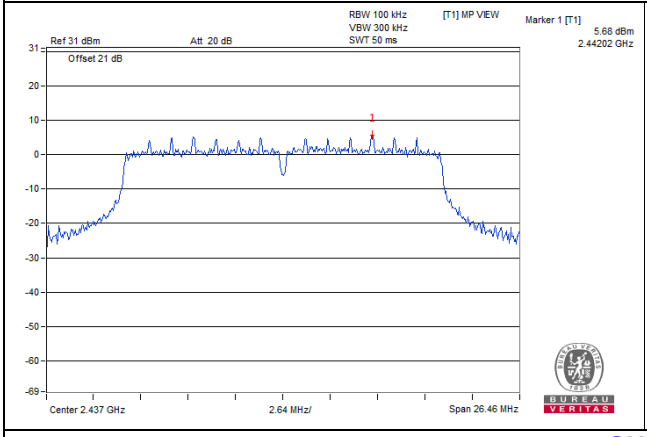

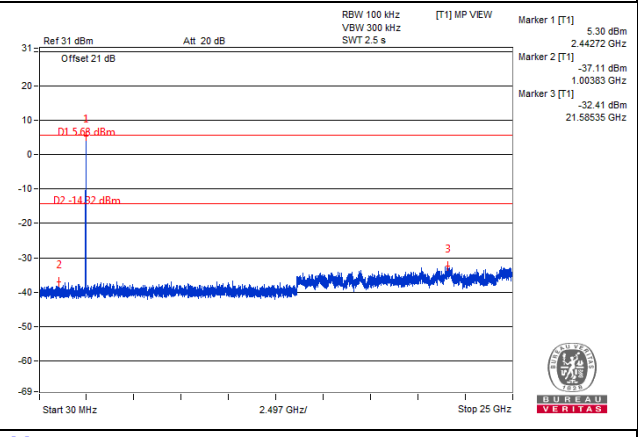

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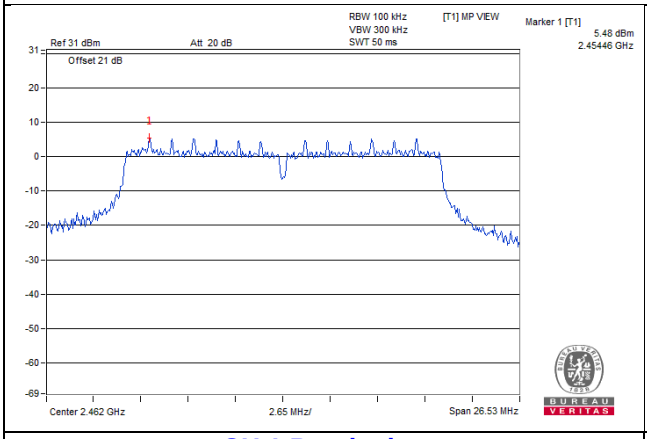
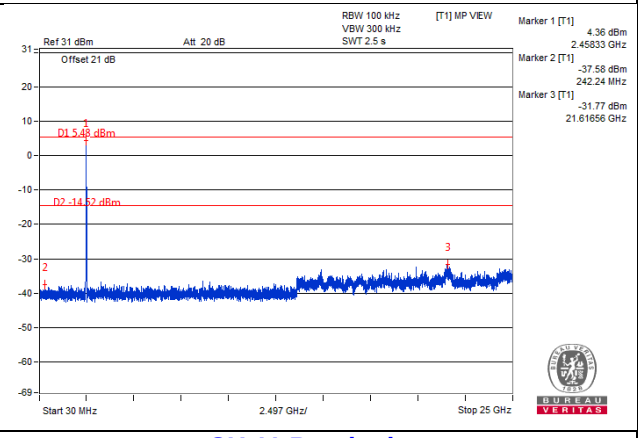
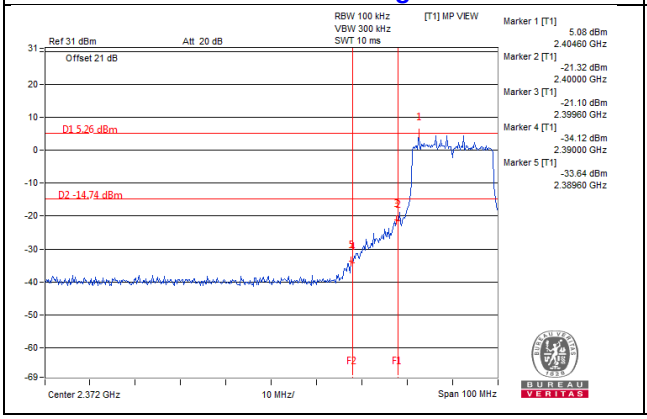




CH 1 Band edge



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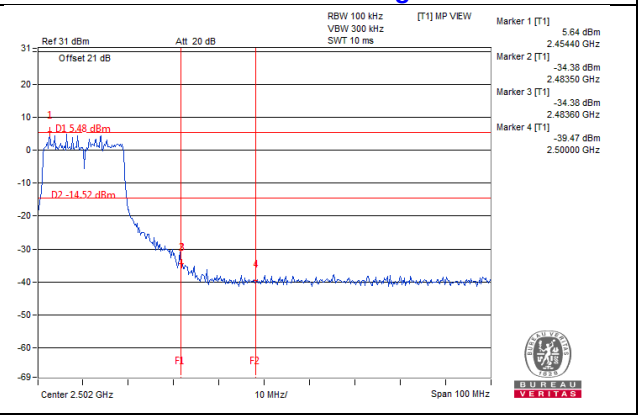

5 Pictures of Test Arrangements

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.

If you have any comments, please feel free to contact us at the following:

Linko EMC/RF Lab
Tel: 886-2-26052180
Fax: 886-2-26051924

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Email: service.adt@tw.bureauveritas.com
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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