

FCC Test Report

Report No.: RF180919D02

FCC ID: P27-SOR4105T

Test Model: SOR4105T

Received Date: Sep. 19, 2018

Test Date: Oct. 2 ~ Nov. 1, 2018

Issued Date: Dec. 12, 2018

Applicant: Sercomm Corp.

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Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch

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**FCC Registration /
Designation Number:** 198487 / TW2021



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Release Control Record

Issue No.	Description	Date Issued
RF180919D02	Original release.	Dec. 12, 2018

1 Certificate of Conformity

Product: Harman Magic Box
Brand: Sprint & Harman Kardon
Test Model: SOR4105T
Sample Status: Engineering sample
Applicant: Sercomm Corp.
Test Date: Oct. 2 ~ Nov. 1, 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 RF characteristics under the conditions specified in this report.

Prepared by :

Annie Chang

Date:

Dec. 12, 2018

Annie Chang / Senior Specialist

Approved by :

Rex Lai

Date:

Dec. 12, 2018

Rex Lai / Associate Technical 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 -14.94 dB at 3.04150 MHz
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -1.03dB 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 I-PEX 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) (\pm)
Conducted Emissions at mains ports	150kHz ~ 30MHz	2.79 dB
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	2.38 dB
	30MHz ~ 1000MHz	5.54 dB
Radiated Emissions above 1 GHz	Above 1GHz	5.48 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Harman Magic Box
Brand	Sprint & Harman Kardon
Test Model	SOR4105T
Status of EUT	Engineering sample
Power Supply Rating	12Vdc form Adapter
Modulation Type	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
Modulation Technology	DSSS, OFDM
Transfer Rate	802.11b: up to 11Mbps 802.11g: up to 54Mbps 802.11n: up to 300Mbps
Operating Frequency	2.412 ~ 2.462GHz
Number of Channel	11 for 802.11b, 802.11g, 802.11n (20MHz) 7 for 802.11n (40MHz)
Output Power	403.211mW
Antenna Type	Ant.1: Dipole antenna with 2.76dBi gain Ant.2: Dipole antenna with 3.63dBi gain
Antenna Connector	I-PEX
Accessory Device	Refer to user's manual
Data Cable Supplied	N/A

Note:

- 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 (20MHz)	2TX
802.11n (40MHz)	2TX

- The EUT uses following adapter.

Brand	CWT
Model	2ABF060F
AC Input Power	100-240V, 50/60H, 1.7A
DC Output Power	12V, 5A
Power Line	Non-shielded AC 3-Pin cable (3.5m) Non-shielded DC cable (1.5m)

- The directional gain table:

Frequency Band (MHz)	Max. Gain (dBi)
2412-2462	6.22

Note:

- If transmit signals are *correlated*, then

Directional gain = $10 \log[(10^{G_1/20} + 10^{G_2/20} + \dots + 10^{G_N/20})^2 / N_{ANT}]$ dBi [Note the "20"s in the denominator of each exponent and the square of the sum of terms; the object is to combine the signal levels coherently.]

- 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 (20MHz):

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		

7 channels are provided for 802.11n (40MHz):

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

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE \geq 1G	RE<1G	PLC	APCM	
-	√	√	√	√	-

Where RE \geq 1G: Radiated Emission above 1GHz & Bandedge Measurement
 RE<1G: Radiated Emission below 1GHz
 PLC: Power Line Conducted Emission
 APCM: Antenna Port Conducted Measurement

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.

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
-	802.11g	1 to 11	1, 6, 11	OFDM	BPSK	6
-	802.11n (20MHz)	1 to 11	1, 6, 11	OFDM	BPSK	6.5
-	802.11n (40MHz)	3 to 9	3, 6, 9	OFDM	BPSK	13.5

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.

EUT Configure Mode	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	802.11b	1 to 11	1	DSSS	DBPSK	1

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)
-	802.11b	1 to 11	1	DSSS	DBPSK	1

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
-	802.11g	1 to 11	1, 6, 11	OFDM	BPSK	6
-	802.11n (20MHz)	1 to 11	1, 6, 11	OFDM	BPSK	6.5
-	802.11n (40MHz)	3 to 9	3, 6, 9	OFDM	BPSK	13.5

Test Condition:

Applicable To	Environmental Conditions	Input Power	Tested by
RE\geq1G	27deg. C, 75%RH	120Vac, 60Hz	Dalen Dai
RE$<$1G	24deg. C, 67%RH	120Vac, 60Hz	Dalen Dai
PLC	23deg. C, 77%RH	120Vac, 60Hz	Justin Liu W
APCM	25deg. C, 76%RH	120Vac, 60Hz	Saxon Lee

3.3 Duty Cycle of Test Signal

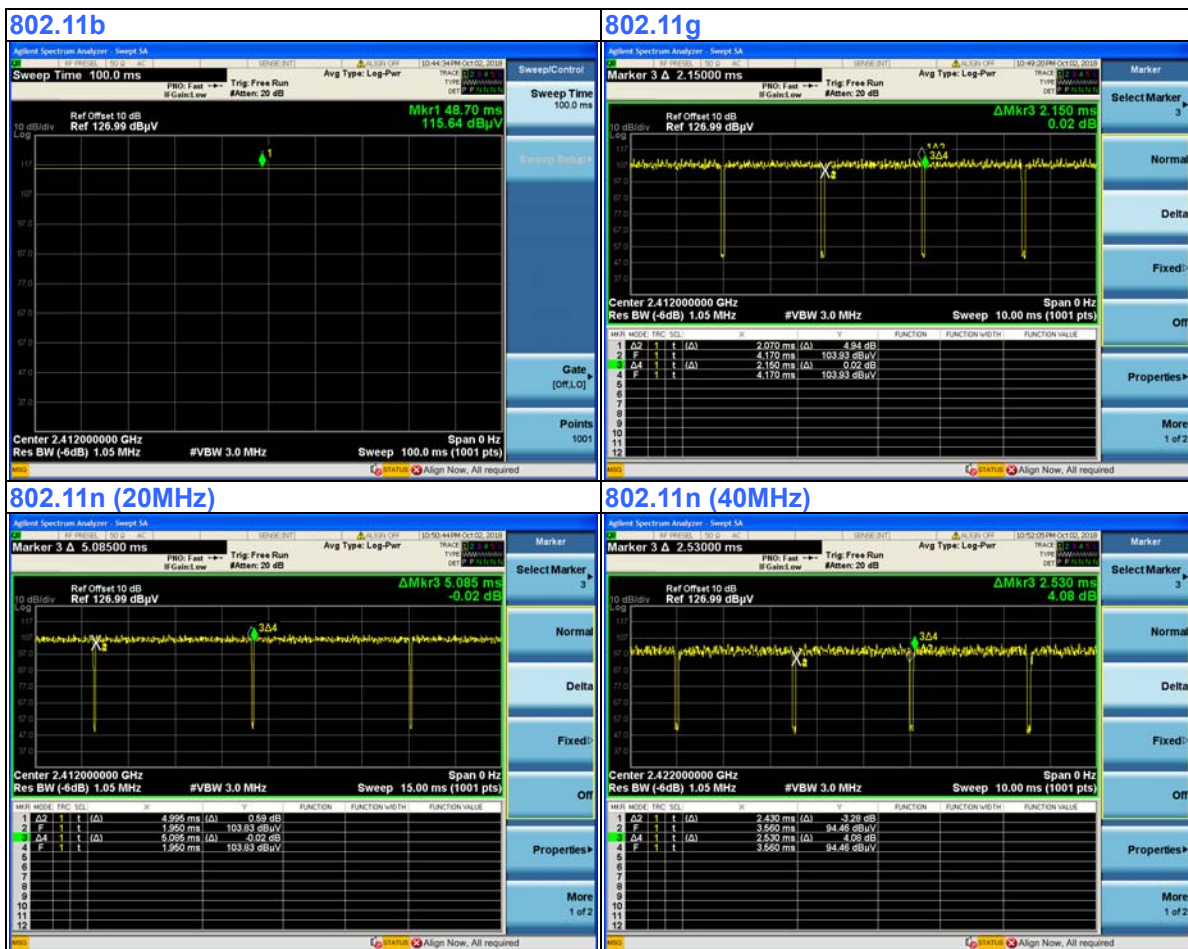
If duty cycle of test signal is $\geq 98\%$, duty factor is not required.
 If duty cycle of test signal is $< 98\%$, duty factor shall be considered.

802.11b: Duty cycle = 100%

802.11g: Duty cycle = $2.07/2.15 = 0.963$, Duty factor = $10 * \log(1/0.963) = 0.16$

802.11n (20MHz): Duty cycle = $4.995/5.085 = 0.982$

802.11n (40MHz): Duty cycle = $2.43/2.53 = 0.960$, Duty factor = $10 * \log(1/0.960) = 0.18$



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.	Notebook PC	SONY	SVS151A12P	275548477001024	FCC DoC Approved	Provided by Lab
B.	Notebook PC	DELL	PP27L	8SNZ12S	FCC DoC Approved	Provided by Lab
C.	Notebook PC	ASUS	PU401L	ECNXBC012528528	FCC DoC Approved	Provided by Lab

Note:

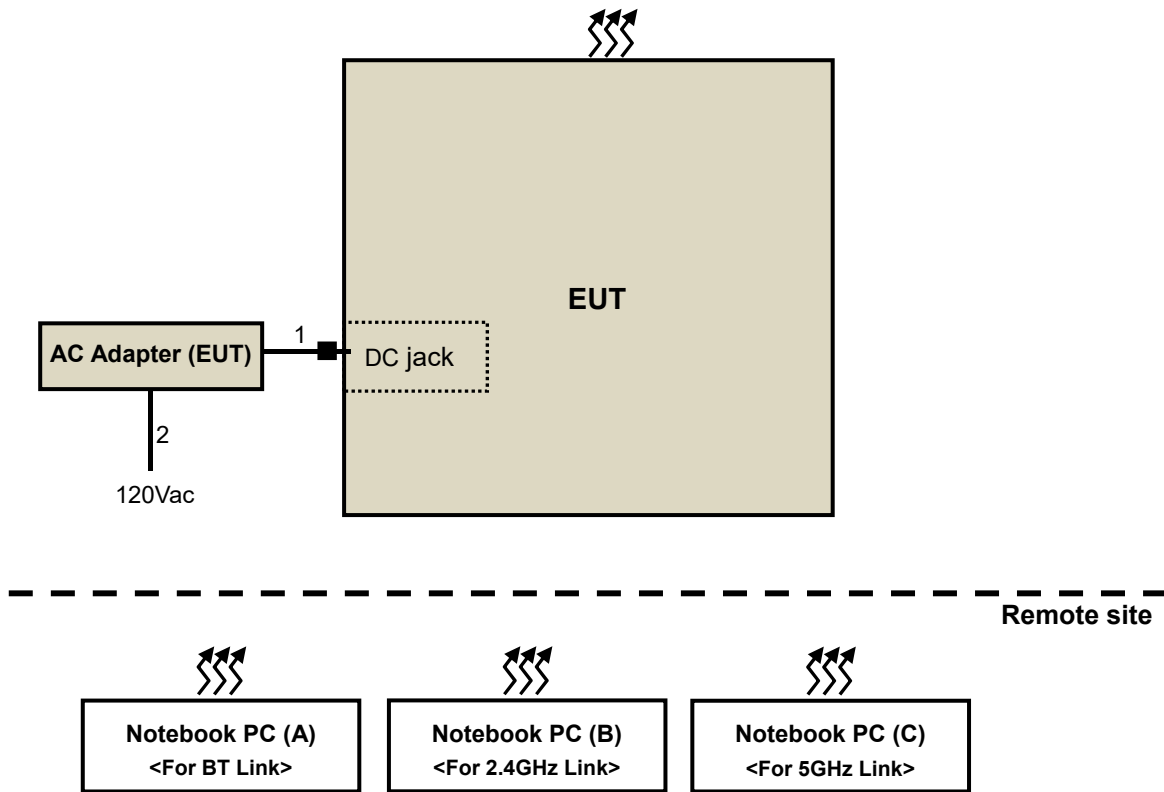
1. All power cords of the above support units are non-shielded (1.8m).
2. Items A~C acted as communication partners to transfer data.

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	DC cable	1	1.5	N	1	Supplied by client
2.	AC cable	1	3.5	N	0	Supplied by client

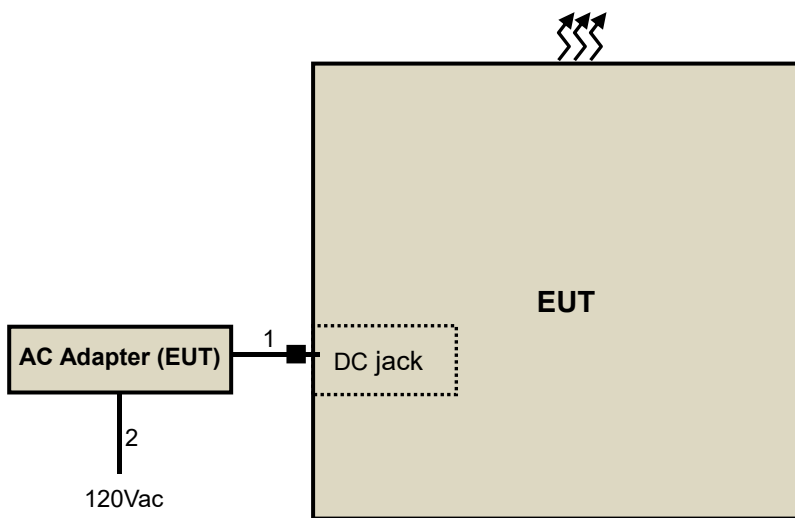
Note: The core(s) is(are) originally attached to the cable(s).

3.4.1 Configuration of System under Test

For Conducted Emission test:



For Radiated Emission 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 15.247 Meas Guidance v05

KDB 662911 D01 Multiple Transmitter Output v02r01

ANSI C63.10-2013

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

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 30dB 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
HP Preamplifier	8447D	2432A03504	Feb. 21, 2018	Feb. 20, 2019
HP Preamplifier	8449B	3008A01201	Feb. 22, 2018	Feb. 21, 2019
MITEQ Preamplifier	AMF-6F-260400-33-8P	892164	Feb. 21, 2018	Feb. 20, 2019
Agilent TEST RECEIVER	N9038A	MY51210129	Feb. 6, 2018	Feb. 5, 2019
Schwarzbeck Antenna	VULB 9168	139	Nov. 29, 2017	Nov. 28, 2018
Schwarzbeck Antenna	VHBA 9123	480	May 19, 2017	May 18, 2019
Schwarzbeck Horn Antenna	BBHA-9170	212	Dec. 1, 2017	Nov. 30, 2018
Schwarzbeck Horn Antenna	BBHA 9120-D1	D130	Dec. 1, 2017	Nov. 30, 2018
ADT. Turn Table	TT100	0306	NA	NA
ADT. Tower	AT100	0306	NA	NA
Software	Radiated_V7.6.15.9.5	NA	NA	NA
SUHNER RF cable With 4dB PAD	SF102	Cable-CH6-01	Aug. 13, 2018	Aug. 12, 2019
SUHNER RF cable With 3/4dB PAD	SF102	Cable-CH8-3.6m	Aug. 13, 2018	Aug. 12, 2019
KEYSIGHT MIMO Powermeasurement Test set	U2021XA	U2021XA-001	Jun. 4, 2018	Jun. 3, 2019
KEYSIGHT Spectrum Analyzer	N9030A	MY54490260	Aug. 3, 2018	Aug. 2, 2019
Loop Antenna EMCI	LPA600	270	Aug. 11, 2017	Aug. 10, 2019
EMCO Horn Antenna	3115	00028257	Nov. 30, 2017	Nov. 29, 2018
Highpass filter Wainwright Instruments	WHK 3.1/18G-10SS	SN 8	NA	NA
ROHDE & SCHWARZ Spectrum Analyzer	FSV40	101042	Sep. 27, 2018	Sep. 26, 2019
Anritsu Power Sensor	MA2411B	0738404	Apr. 26, 2018	Apr. 25, 2019
Anritsu Power Meter	ML2495A	0842014	Apr. 26, 2018	Apr. 25, 2019

- NOTE:** 1. The calibration interval of the above test instruments is 12/24 months. And the calibrations are traceable to NML/ROC and NIST/USA.
2. The horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
3. The test was performed in Chamber No. 6.
4. The Industry Canada Reference No. IC 7450E-6.

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. Parallel, perpendicular, and ground-parallel orientations 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 detects 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:

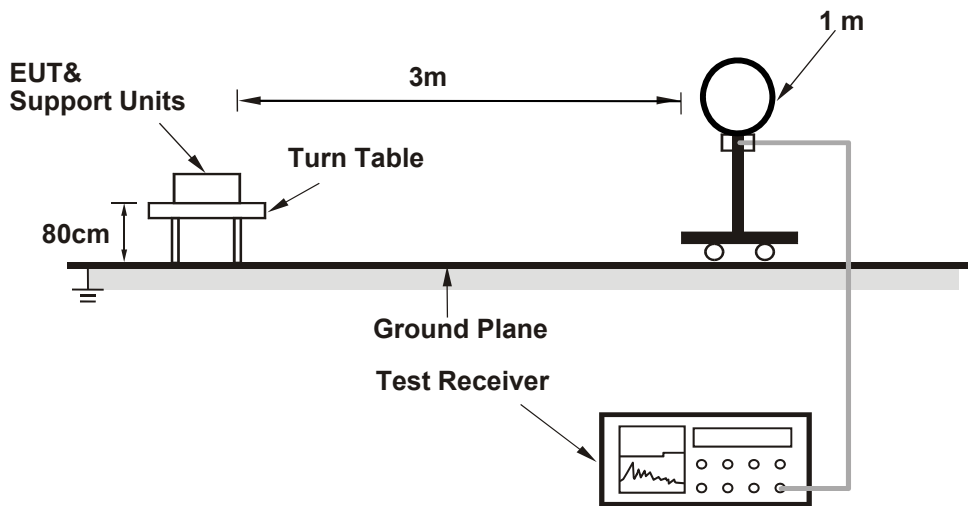
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is $\geq 1/T$ (Duty cycle < 98%) or 10Hz (Duty cycle $\geq 98\%$) 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

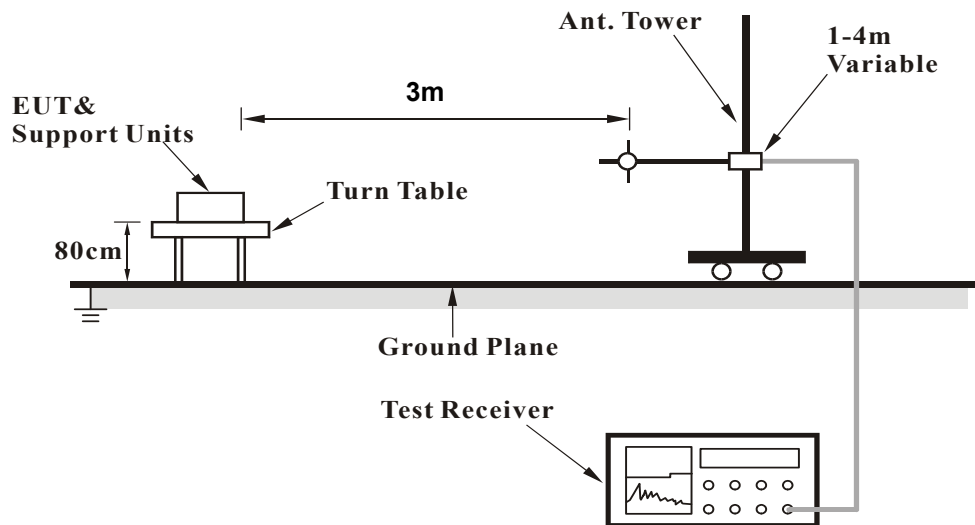
No deviation.

4.1.5 Test Setup

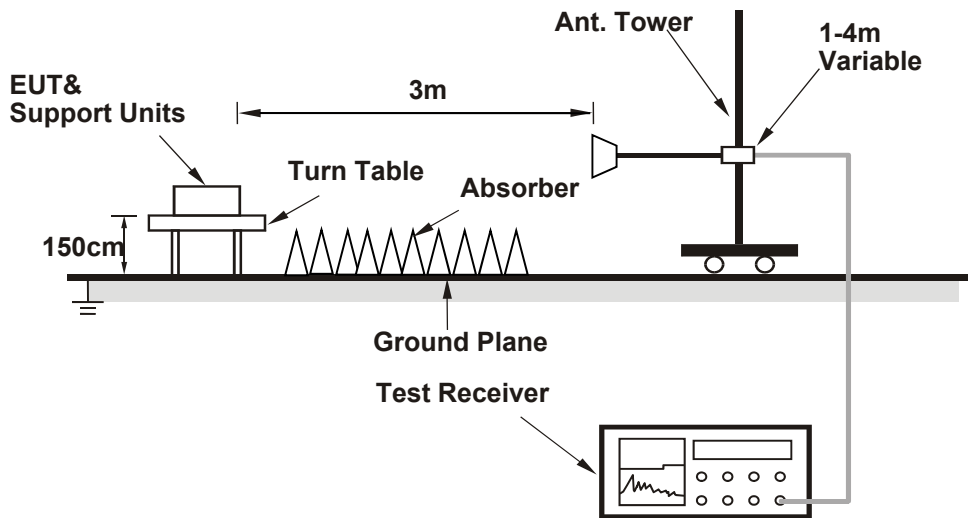
For Radiated emission below 30MHz



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

Set the EUT under transmission condition continuously at specific channel frequency continuously.

4.1.7 Test Results

Above 1GHz Data:

802.11b

CHANNEL	TX Channel 1	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	56.77 PK	74.00	-17.23	1.19 H	24	58.27	-1.50
2	2390.00	45.83 AV	54.00	-8.17	1.19 H	24	47.33	-1.50
3	*2412.00	108.99 PK			1.19 H	24	110.61	-1.62
4	*2412.00	106.20 AV			1.19 H	24	107.82	-1.62
5	4824.00	42.82 PK	74.00	-31.18	2.59 H	301	38.03	4.79
6	4824.00	32.30 AV	54.00	-21.70	2.59 H	301	27.51	4.79

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	57.44 PK	74.00	-16.56	2.07 V	8	58.94	-1.50
2	2390.00	47.76 AV	54.00	-6.24	2.07 V	8	49.26	-1.50
3	*2412.00	114.34 PK			2.07 V	8	115.96	-1.62
4	*2412.00	111.50 AV			2.07 V	8	113.12	-1.62
5	4824.00	43.94 PK	74.00	-30.06	1.67 V	181	39.15	4.79
6	4824.00	33.73 AV	54.00	-20.27	1.67 V	181	28.94	4.79

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	*2437.00	110.14 PK			1.31 H	178	111.88	-1.74
2	*2437.00	107.91 AV			1.31 H	178	109.65	-1.74
3	4874.00	43.06 PK	74.00	-30.94	2.63 H	309	38.19	4.87
4	4874.00	32.53 AV	54.00	-21.47	2.63 H	309	27.66	4.87

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	*2437.00	113.18 PK			1.86 V	9	114.92	-1.74
2	*2437.00	110.69 AV			1.86 V	9	112.43	-1.74
3	4874.00	44.85 PK	74.00	-29.15	1.53 V	194	39.98	4.87
4	4874.00	34.23 AV	54.00	-19.77	1.53 V	194	29.36	4.87

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)
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	*2462.00	107.92 PK			1.24 H	136	109.54	-1.62
2	*2462.00	104.71 AV			1.24 H	136	106.33	-1.62
3	2483.50	58.81 PK	74.00	-15.19	1.24 H	136	60.13	-1.32
4	2483.50	49.60 AV	54.00	-4.40	1.24 H	136	50.92	-1.32
5	4924.00	42.49 PK	74.00	-31.51	2.55 H	298	37.69	4.80
6	4924.00	31.91 AV	54.00	-22.09	2.55 H	298	27.11	4.80

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	112.37 PK			1.92 V	11	113.99	-1.62
2	*2462.00	110.14 AV			1.92 V	11	111.76	-1.62
3	2483.50	60.33 PK	74.00	-13.67	1.92 V	11	61.65	-1.32
4	2483.50	52.42 AV	54.00	-1.58	1.92 V	11	53.74	-1.32
5	4924.00	43.30 PK	74.00	-30.70	1.61 V	188	38.50	4.80
6	4924.00	33.32 AV	54.00	-20.68	1.61 V	188	28.52	4.80

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)
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	70.16 PK	74.00	-3.84	1.78 H	44	71.66	-1.50
2	2390.00	51.79 AV	54.00	-2.21	1.78 H	44	53.29	-1.50
3	*2412.00	110.00 PK			1.78 H	44	111.62	-1.62
4	*2412.00	100.21 AV			1.78 H	44	101.83	-1.62
5	4824.00	42.06 PK	74.00	-31.94	2.27 H	306	37.27	4.79
6	4824.00	31.94 AV	54.00	-22.06	2.27 H	306	27.15	4.79

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	71.47 PK	74.00	-2.53	1.87 V	359	72.97	-1.50
2	2390.00	52.71 AV	54.00	-1.29	1.87 V	359	54.21	-1.50
3	*2412.00	113.20 PK			1.87 V	359	114.82	-1.62
4	*2412.00	103.97 AV			1.87 V	359	105.59	-1.62
5	4824.00	42.33 PK	74.00	-31.67	2.81 V	33	37.54	4.79
6	4824.00	32.41 AV	54.00	-21.59	2.81 V	33	27.62	4.79

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	*2437.00	109.19 PK			1.71 H	52	110.93	-1.74
2	*2437.00	99.53 AV			1.71 H	52	101.27	-1.74
3	4874.00	42.45 PK	74.00	-31.55	2.30 H	315	37.58	4.87
4	4874.00	32.31 AV	54.00	-21.69	2.30 H	315	27.44	4.87

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	*2437.00	113.08 PK			1.82 V	319	114.82	-1.74
2	*2437.00	103.19 AV			1.82 V	319	104.93	-1.74
3	4874.00	43.13 PK	74.00	-30.87	2.92 V	27	38.26	4.87
4	4874.00	33.00 AV	54.00	-21.00	2.92 V	27	28.13	4.87

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)
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	*2462.00	106.61 PK			1.86 H	49	108.23	-1.62
2	*2462.00	97.22 AV			1.86 H	49	98.84	-1.62
3	2483.50	67.23 PK	74.00	-6.77	1.86 H	49	68.55	-1.32
4	2483.50	51.31 AV	54.00	-2.69	1.86 H	49	52.63	-1.32
5	4924.00	41.89 PK	74.00	-32.11	2.16 H	310	37.09	4.80
6	4924.00	31.86 AV	54.00	-22.14	2.16 H	310	27.06	4.80

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	109.39 PK			1.52 V	325	111.01	-1.62
2	*2462.00	100.04 AV			1.52 V	325	101.66	-1.62
3	2483.50	69.49 PK	74.00	-4.51	1.52 V	325	70.81	-1.32
4	2483.50	52.79 AV	54.00	-1.21	1.52 V	325	54.11	-1.32
5	4924.00	42.18 PK	74.00	-31.82	2.77 V	40	37.38	4.80
6	4924.00	32.21 AV	54.00	-21.79	2.77 V	40	27.41	4.80

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 (20MHz)

CHANNEL	TX Channel 1	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	68.55 PK	74.00	-5.45	1.73 H	48	70.05	-1.50
2	2390.00	49.99 AV	54.00	-4.01	1.73 H	48	51.49	-1.50
3	*2412.00	109.62 PK			1.73 H	48	111.24	-1.62
4	*2412.00	100.07 AV			1.73 H	48	101.69	-1.62
5	4824.00	42.10 PK	74.00	-31.90	1.88 H	299	37.31	4.79
6	4824.00	32.01 AV	54.00	-21.99	1.88 H	299	27.22	4.79

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	70.69 PK	74.00	-3.31	2.07 V	0	72.19	-1.50
2	2390.00	52.39 AV	54.00	-1.61	2.07 V	0	53.89	-1.50
3	*2412.00	113.03 PK			2.07 V	0	114.65	-1.62
4	*2412.00	102.77 AV			2.07 V	0	104.39	-1.62
5	4824.00	42.59 PK	74.00	-31.41	2.96 V	113	37.80	4.79
6	4824.00	32.74 AV	54.00	-21.26	2.96 V	113	27.95	4.79

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	*2437.00	109.20 PK			1.77 H	40	110.94	-1.74
2	*2437.00	99.53 AV			1.77 H	40	101.27	-1.74
3	4874.00	42.69 PK	74.00	-31.31	1.90 H	303	37.82	4.87
4	4874.00	32.42 AV	54.00	-21.58	1.90 H	303	27.55	4.87

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	*2437.00	113.38 PK			2.11 V	357	115.12	-1.74
2	*2437.00	103.29 AV			2.11 V	357	105.03	-1.74
3	4874.00	43.53 PK	74.00	-30.47	2.90 V	121	38.66	4.87
4	4874.00	33.44 AV	54.00	-20.56	2.90 V	121	28.57	4.87

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)
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	*2462.00	105.43 PK			1.75 H	43	107.05	-1.62
2	*2462.00	95.31 AV			1.75 H	43	96.93	-1.62
3	2483.50	67.00 PK	74.00	-7.00	1.75 H	43	68.32	-1.32
4	2483.50	50.79 AV	54.00	-3.21	1.75 H	43	52.11	-1.32
5	4924.00	42.02 PK	74.00	-31.98	1.92 H	295	37.22	4.80
6	4924.00	31.85 AV	54.00	-22.15	1.92 H	295	27.05	4.80

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	108.57 PK			2.09 V	2	110.19	-1.62
2	*2462.00	98.26 AV			2.09 V	2	99.88	-1.62
3	2483.50	69.21 PK	74.00	-4.79	2.09 V	2	70.53	-1.32
4	2483.50	52.97 AV	54.00	-1.03	2.09 V	2	54.29	-1.32
5	4924.00	42.32 PK	74.00	-31.68	2.93 V	118	37.52	4.80
6	4924.00	32.00 AV	54.00	-22.00	2.93 V	118	27.20	4.80

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 (40MHz)

CHANNEL	TX Channel 3	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	63.83 PK	74.00	-10.17	1.83 H	117	65.33	-1.50
2	2390.00	50.69 AV	54.00	-3.31	1.83 H	117	52.19	-1.50
3	*2422.00	104.87 PK			1.83 H	117	106.54	-1.67
4	*2422.00	95.45 AV			1.83 H	117	97.12	-1.67
5	4844.00	42.09 PK	74.00	-31.91	2.06 H	308	37.22	4.87
6	4844.00	32.02 AV	54.00	-21.98	2.06 H	308	27.15	4.87

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	67.15 PK	74.00	-6.85	1.27 V	33	68.65	-1.50
2	2390.00	52.39 AV	54.00	-1.61	1.27 V	33	53.89	-1.50
3	*2422.00	108.82 PK			1.27 V	33	110.49	-1.67
4	*2422.00	98.85 AV			1.27 V	33	100.52	-1.67
5	4844.00	42.81 PK	74.00	-31.19	2.56 V	128	37.94	4.87
6	4844.00	32.76 AV	54.00	-21.24	2.56 V	128	27.89	4.87

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	*2437.00	105.11 PK			1.90 H	108	106.85	-1.74
2	*2437.00	95.54 AV			1.90 H	108	97.28	-1.74
3	2483.50	67.42 PK	74.00	-6.58	1.90 H	108	68.74	-1.32
4	2483.50	50.81 AV	54.00	-3.19	1.90 H	108	52.13	-1.32
5	4874.00	42.40 PK	74.00	-31.60	1.67 H	327	37.53	4.87
6	4874.00	32.25 AV	54.00	-21.75	1.67 H	327	27.38	4.87

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	*2437.00	108.65 PK			1.23 V	88	110.39	-1.74
2	*2437.00	99.89 AV			1.23 V	88	101.63	-1.74
3	2483.50	69.29 PK	74.00	-4.71	1.23 V	88	70.61	-1.32
4	2483.50	52.96 AV	54.00	-1.04	1.23 V	88	54.28	-1.32
5	4874.00	43.08 PK	74.00	-30.92	2.73 V	152	38.21	4.87
6	4874.00	33.00 AV	54.00	-21.00	2.73 V	152	28.13	4.87

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 9	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	*2452.00	103.66 PK			1.85 H	111	105.43	-1.77
2	*2452.00	95.00 AV			1.85 H	111	96.77	-1.77
3	2483.50	65.63 PK	74.00	-8.37	1.85 H	111	66.95	-1.32
4	2483.50	50.64 AV	54.00	-3.36	1.85 H	111	51.96	-1.32
5	4904.00	42.12 PK	74.00	-31.88	1.95 H	313	37.27	4.85
6	4904.00	31.70 AV	54.00	-22.30	1.95 H	313	26.85	4.85

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	*2452.00	106.56 PK			1.29 V	74	108.33	-1.77
2	*2452.00	97.85 AV			1.29 V	74	99.62	-1.77
3	2483.50	68.39 PK	74.00	-5.61	1.29 V	74	69.71	-1.32
4	2483.50	52.90 AV	54.00	-1.10	1.29 V	74	54.22	-1.32
5	4904.00	42.23 PK	74.00	-31.77	2.66 V	134	37.38	4.85
6	4904.00	31.94 AV	54.00	-22.06	2.66 V	134	27.09	4.85

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:

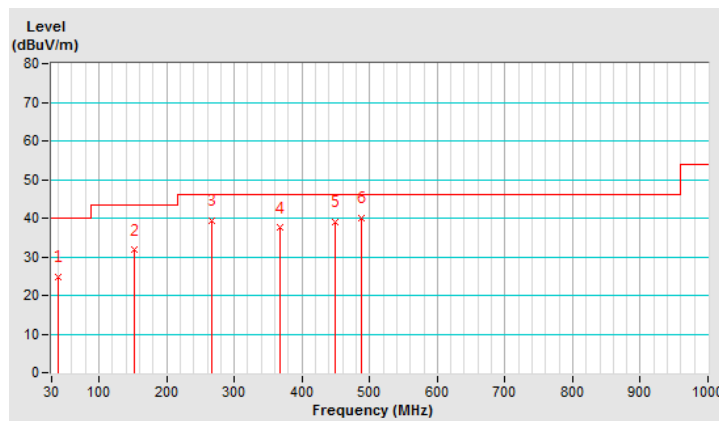
802.11b

CHANNEL	TX Channel 1	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	39.17	24.77 QP	40.00	-15.23	1.86 H	313	32.66	-7.89
2	152.71	31.70 QP	43.50	-11.80	1.24 H	135	38.62	-6.92
3	265.95	39.24 QP	46.00	-6.76	1.71 H	219	45.74	-6.50
4	366.93	37.50 QP	46.00	-8.50	2.27 H	204	41.44	-3.94
5	449.28	39.10 QP	46.00	-6.90	1.54 H	247	41.11	-2.01
6	488.62	39.98 QP	46.00	-6.02	1.63 H	197	41.38	-1.40

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. The emission levels were very low against the limit of frequency range 9kHz ~ 30MHz :the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.



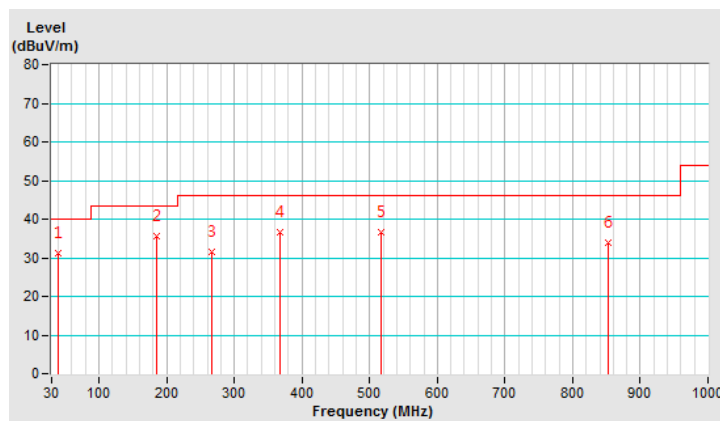
CHANNEL	TX Channel 1	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

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	38.78	31.32 QP	40.00	-8.68	1.37 V	341	39.28	-7.96
2	184.57	35.52 QP	43.50	-7.98	1.45 V	230	44.40	-8.88
3	266.10	31.68 QP	46.00	-14.32	1.93 V	360	38.17	-6.49
4	367.12	36.77 QP	46.00	-9.23	1.81 V	169	40.70	-3.93
5	517.33	36.62 QP	46.00	-9.38	2.17 V	115	37.56	-0.94
6	853.00	33.84 QP	46.00	-12.16	1.74 V	279	28.83	5.01

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. The emission levels were very low against the limit of frequency range 9kHz ~ 30MHz :the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.



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.	Cal. Date	Cal. Due
ROHDE & SCHWARZ TEST RECEIVER	ESR3	102413	Feb. 8, 2018	Feb. 7, 2019
ROHDE & SCHWARZ Artificial Mains Network (for EUT)	ESH2-Z5	100104	Dec. 6, 2017	Dec. 5, 2018
LISN With Adapter (for EUT)	AD10	C09Ada-001	Dec. 6, 2017	Dec. 5, 2018
ROHDE & SCHWARZ Artificial Mains Network (for peripherals)	ESH3-Z5	847265/023	Nov. 3, 2017	Nov. 2, 2018
SCHWARZBECK Artificial Mains Network (For EUT)	NNLK8129	8129229	May 3, 2018	May 2, 2019
SCHWARZBECK Artificial Mains Network (For EUT)	NNLK 8121	8121-808	Mar. 5, 2018	Mar. 4, 2019
Software	Cond_V7.3.7.4	NA	NA	NA
RF cable (JYEBAO) With 10dB PAD	5D-FB	Cable-C09.01	Feb. 21, 2018	Feb. 20, 2019
SUHNER Terminator (For ROHDE & SCHWARZ LISN)	65BNC-5001	E1-010789	May 8, 2018	May 7, 2019

Notes: 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 Shielded Room No. 9.

3. The VCCI Site Registration No. C-1312.

4.2.3 Test Procedures

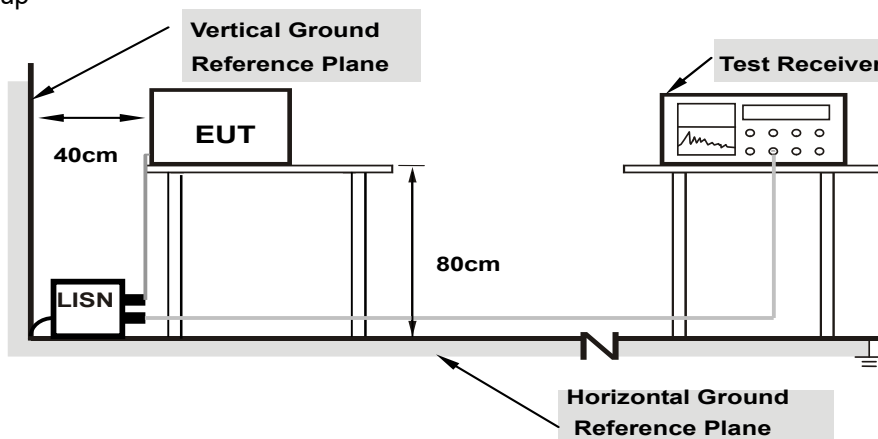
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- 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

Same as 4.1.6.

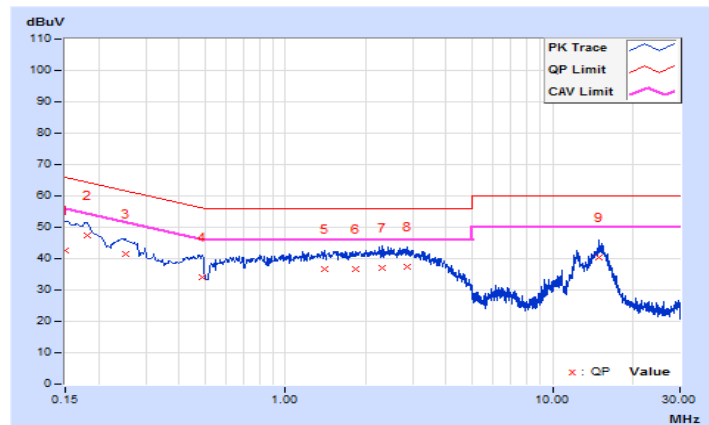
4.2.7 Test Results

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
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No	Freq. [MHz]	Corr.	Reading Value		Emission Level		Limit		Margin	
		Factor	[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
		(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	10.11	32.44	17.51	42.55	27.62	66.00	56.00	-23.45	-28.38
2	0.18128	10.12	37.15	23.11	47.27	33.23	64.43	54.43	-17.16	-21.20
3	0.25125	10.13	31.25	18.03	41.38	28.16	61.72	51.72	-20.34	-23.56
4	0.48806	10.16	23.99	12.49	34.15	22.65	56.20	46.20	-22.05	-23.55
5	1.40321	10.28	26.40	16.34	36.68	26.62	56.00	46.00	-19.32	-19.38
6	1.82549	10.31	26.28	17.03	36.59	27.34	56.00	46.00	-19.41	-18.66
7	2.31815	10.34	26.77	18.79	37.11	29.13	56.00	46.00	-18.89	-16.87
8	2.84209	10.38	26.97	19.84	37.35	30.22	56.00	46.00	-18.65	-15.78
9	14.92358	10.88	29.37	23.06	40.25	33.94	60.00	50.00	-19.75	-16.06

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.

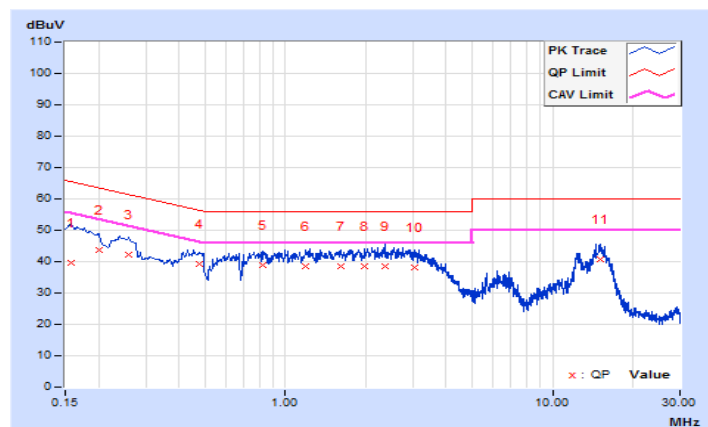


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
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No	Freq. [MHz]	Corr.	Reading Value		Emission Level		Limit		Margin	
		Factor	[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
		(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15760	10.12	29.43	7.40	39.55	17.52	65.59	55.59	-26.04	-38.07
2	0.19978	10.14	33.51	14.69	43.65	24.83	63.62	53.62	-19.97	-28.79
3	0.25932	10.15	32.06	17.74	42.21	27.89	61.45	51.45	-19.24	-23.56
4	0.47453	10.17	28.93	15.33	39.10	25.50	56.43	46.43	-17.33	-20.93
5	0.82449	10.24	28.54	15.61	38.78	25.85	56.00	46.00	-17.22	-20.15
6	1.19546	10.28	28.31	17.25	38.59	27.53	56.00	46.00	-17.41	-18.47
7	1.60653	10.31	28.24	18.52	38.55	28.83	56.00	46.00	-17.45	-17.17
8	1.98971	10.33	28.09	19.49	38.42	29.82	56.00	46.00	-17.58	-16.18
9	2.34943	10.36	27.99	20.27	38.35	30.63	56.00	46.00	-17.65	-15.37
10	3.04150	10.41	27.69	20.65	38.10	31.06	56.00	46.00	-17.90	-14.94
11	15.02133	10.77	29.93	23.62	40.70	34.39	60.00	50.00	-19.30	-15.61

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.

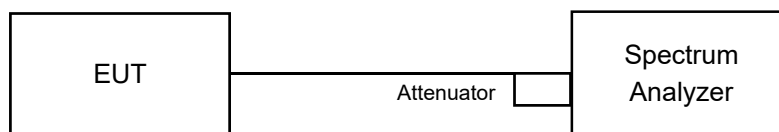


4.3 6dB Bandwidth Measurement

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) $\geq 3 \times$ 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	9.09	9.10	0.5	PASS
6	2437	11.10	11.08	0.5	PASS
11	2462	9.11	9.11	0.5	PASS

802.11g

Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
1	2412	15.97	15.95	0.5	PASS
6	2437	16.40	16.38	0.5	PASS
11	2462	16.40	16.39	0.5	PASS

802.11n (20MHz)

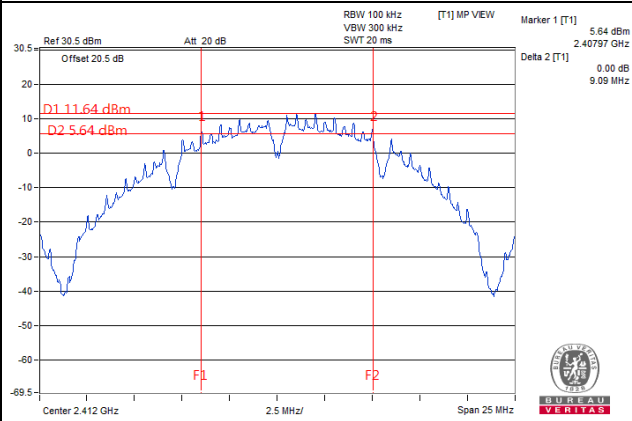
Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
1	2412	17.59	17.59	0.5	PASS
6	2437	17.64	17.63	0.5	PASS
11	2462	17.61	17.61	0.5	PASS

802.11n (40MHz)

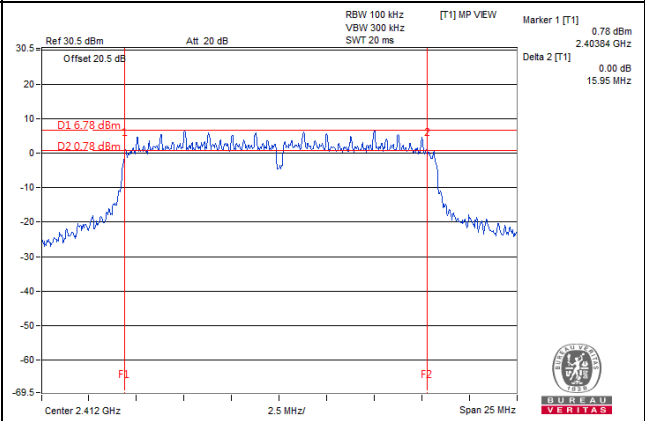
Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
3	2422	35.23	35.23	0.5	PASS
6	2437	35.20	35.23	0.5	PASS
9	2452	35.23	35.15	0.5	PASS

Spectrum Plot of Worst Value

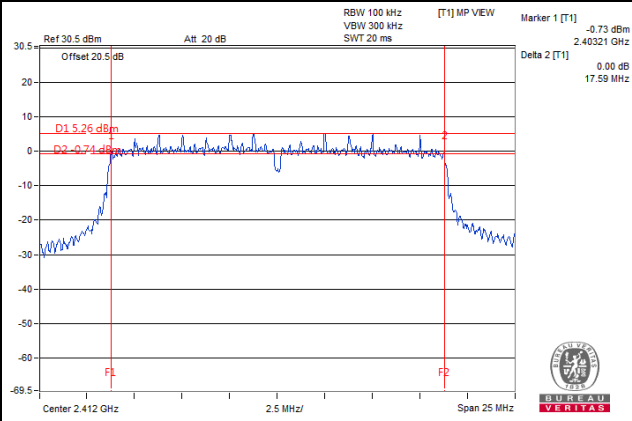
802.11b / Chain 0 : CH1



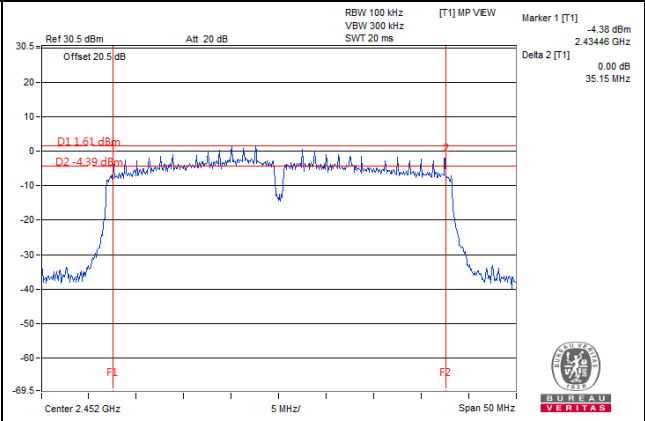
802.11g / Chain 1 : CH1



802.11n (20MHz) / Chain 0 : CH1



802.11n (40MHz) / Chain 1 : CH9



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)

Per KDB 662911 D01 Multiple Transmitter Output Method of conducted output power measurement on IEEE 802.11 devices,

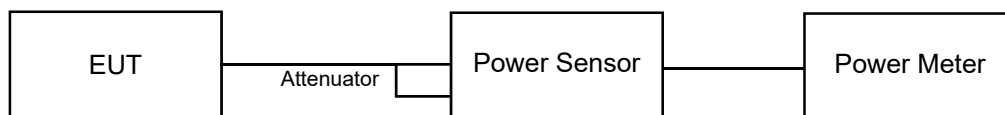
Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;

Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any N_{ANT} ;

Array Gain = $5 \log(N_{ANT}/N_{SS})$ dB or 3 dB, whichever is less for 20-MHz channel widths with $N_{ANT} \geq 5$.

For power measurements on all other devices: Array Gain = $10 \log(N_{ANT}/N_{SS})$ dB.

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

Average power sensor was used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of TX on burst. Duty factor is not added to measured value.

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

802.11b

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	21.13	20.53	242.698	23.85	30	Pass
6	2437	23.06	23.03	403.211	26.06	30	Pass
11	2462	21.08	20.27	234.647	23.70	30	Pass

802.11g

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	18.06	17.85	124.927	20.97	30	Pass
6	2437	20.32	20.94	231.812	23.65	30	Pass
11	2462	16.98	16.19	91.479	19.61	30	Pass

802.11n (20MHz)

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	17.84	17.19	113.174	20.54	30	Pass
6	2437	20.65	21.37	253.233	24.04	30	Pass
11	2462	17.95	17.28	115.829	20.64	30	Pass

802.11n (40MHz)

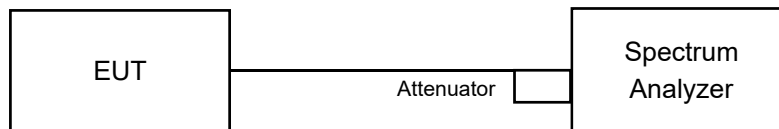
Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
3	2422	17.08	16.17	92.450	19.66	30	Pass
6	2437	17.96	17.49	118.622	20.74	30	Pass
9	2452	15.31	14.79	64.093	18.07	30	Pass

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

For AVG. power (duty cycle $\geq 98\%$)

- Set instrument center frequency to DTS channel center frequency.
- Set span to at least 1.5 times the OBW.
- Set RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- Set VBW $\geq 3 \times \text{RBW}$.
- Detector = power averaging (RMS) or sample detector (when RMS not available).
- Ensure that the number of measurement points in the sweep $\geq 2 \times \text{span}/\text{RBW}$.
- Sweep time = auto couple.
- Employ trace averaging (RMS) mode over a minimum of 100 traces.
- Use the peak marker function to determine the maximum amplitude level.

For AVG. power (duty cycle $< 98\%$)

- Measure the duty cycle (x).
- Set instrument center frequency to DTS channel center frequency.
- Set span to at least 1.5 times the OBW.
- Set RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- Set VBW $\geq 3 \times \text{RBW}$.
- Detector = power averaging (RMS) or sample detector (when RMS not available).
- Ensure that the number of measurement points in the sweep $\geq 2 \times \text{span}/\text{RBW}$.
- Sweep time = auto couple.
- Do not use sweep triggering. Allow sweep to "free run".
- Employ trace averaging (RMS) mode over a minimum of 100 traces.
- Use the peak marker function to determine the maximum amplitude level.
- Add $10 \log (1/x)$, where x is the duty cycle measured in step (a), to the measured PSD to compute the average PSD during the actual transmission time.

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/10kHz)	10 log (N=2) dB	TOTAL PSD (dBm/10kHz)	Limit (dBm/10kHz)	Pass /Fail
0	1	2412	-7.75	3.01	-4.74	7.78	Pass
	6	2437	-6.80	3.01	-3.79	7.78	Pass
	11	2462	-7.38	3.01	-4.37	7.78	Pass
1	1	2412	-7.96	3.01	-4.95	7.78	Pass
	6	2437	-7.22	3.01	-4.21	7.78	Pass
	11	2462	-7.81	3.01	-4.80	7.78	Pass

Note: Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / 2]$ = 6.22dBi >6dBi, so the Power Spectral Density limit shall be reduced to $8-(6.22-6) = 7.78$ dBm.

802.11g

TX chain	Channel	Freq. (MHz)	PSD W/O Duty Factor (dBm/10kHz)	10 log (N=2) dB	Duty Factor (dB)	TOTAL PSD With Duty Factor (dBm/10kHz)	Limit (dBm/10kHz)	Pass /Fail
0	1	2412	-12.82	3.01	0.16	-9.65	7.78	Pass
	6	2437	-8.78	3.01	0.16	-5.61	7.78	Pass
	11	2462	-14.43	3.01	0.16	-11.26	7.78	Pass
1	1	2412	-13.10	3.01	0.16	-9.93	7.78	Pass
	6	2437	-8.33	3.01	0.16	-5.16	7.78	Pass
	11	2462	-14.42	3.01	0.16	-11.25	7.78	Pass

Note: 1. Refer to section 3.3 for duty cycle spectrum plot.

2 Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / 2]$ = 6.22dBi >6dBi, so the Power Spectral Density limit shall be reduced to $8-(6.22-6) = 7.78$ dBm.

802.11n (20MHz)

TX chain	Channel	Freq. (MHz)	PSD (dBm/10kHz)	10 log (N=2) dB	TOTAL PSD (dBm/10kHz)	Limit (dBm/10kHz)	Pass /Fail
0	1	2412	-13.48	3.01	-10.47	7.78	Pass
	6	2437	-8.24	3.01	-5.23	7.78	Pass
	11	2462	-12.96	3.01	-9.95	7.78	Pass
1	1	2412	-13.53	3.01	-10.52	7.78	Pass
	6	2437	-8.85	3.01	-5.84	7.78	Pass
	11	2462	-13.31	3.01	-10.30	7.78	Pass

Note: Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / 2] = 6.22\text{dBi} > 6\text{dBi}$, so the Power Spectral Density limit shall be reduced to $8 - (6.22 - 6) = 7.78\text{dBm}$.

802.11n (40MHz)

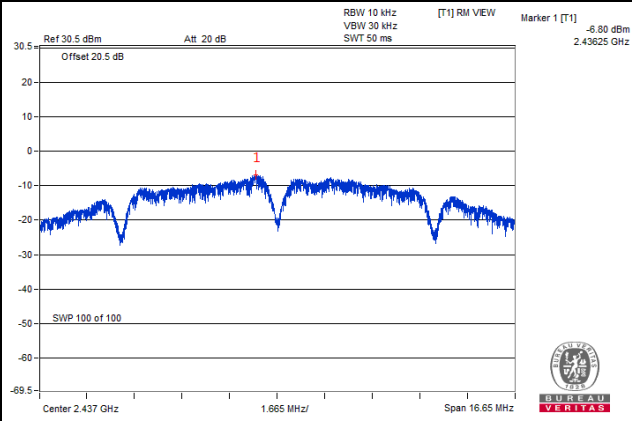
TX chain	Channel	Freq. (MHz)	PSD W/O Duty Factor (dBm/10kHz)	10 log (N=2) dB	Duty Factor (dB)	TOTAL PSD With Duty Factor (dBm/10kHz)	Limit (dBm/10kHz)	Pass /Fail
0	3	2422	-17.52	3.01	0.18	-14.33	7.78	Pass
	6	2437	-14.96	3.01	0.18	-11.77	7.78	Pass
	9	2452	-18.16	3.01	0.18	-14.97	7.78	Pass
1	3	2422	-17.82	3.01	0.18	-14.63	7.78	Pass
	6	2437	-15.04	3.01	0.18	-11.85	7.78	Pass
	9	2452	-18.06	3.01	0.18	-14.87	7.78	Pass

Note: 1. Refer to section 3.3 for duty cycle spectrum plot.

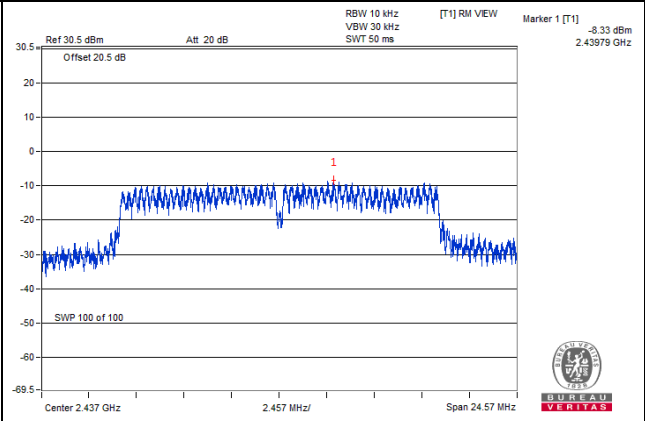
2 Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / 2] = 6.22\text{dBi} > 6\text{dBi}$, so the Power Spectral Density limit shall be reduced to $8 - (6.22 - 6) = 7.78\text{dBm}$.

Spectrum Plot of Worst Value

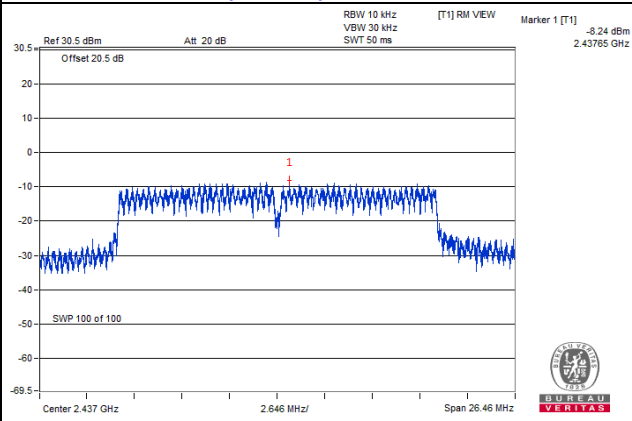
802.11b / Chain 0 : CH6



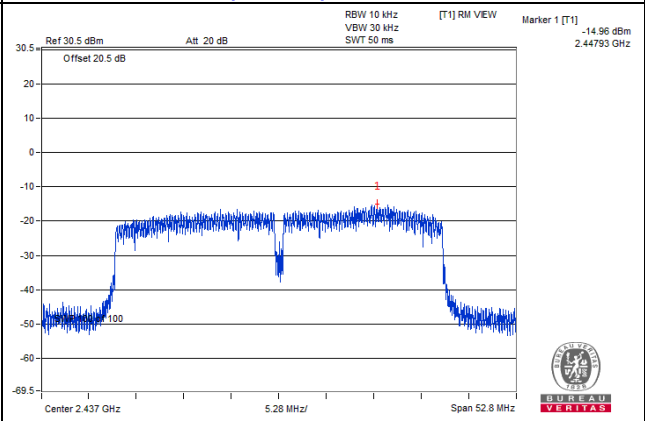
802.11g / Chain 1 : CH6



802.11n (20MHz) / Chain 0 : CH6



802.11n (40MHz) / Chain 0 : CH6

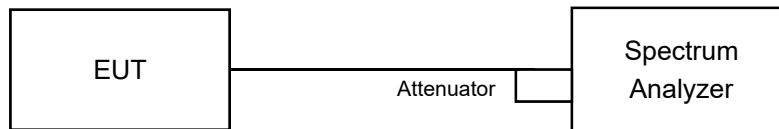


4.6 Conducted Out of Band Emission Measurement

4.6.1 Limits of Conducted Out of Band Emission Measurement

Below -30dB 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 \geq 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 OOB

1. Set RBW = 100 kHz.
2. Set VBW \geq 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

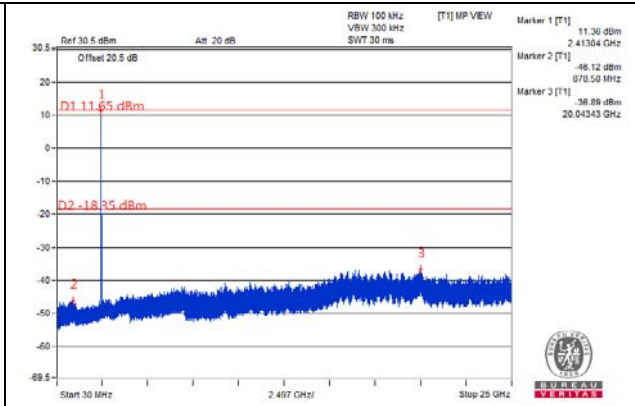
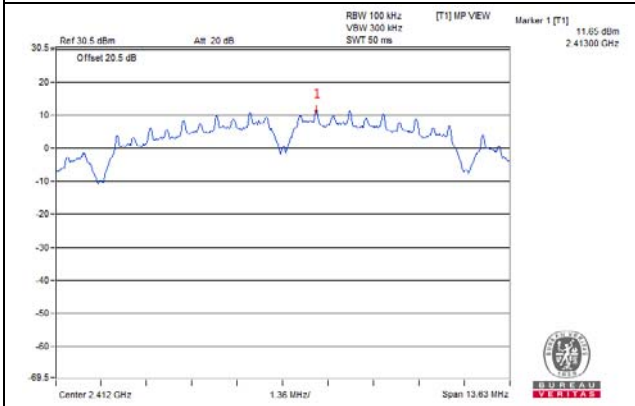
Same as Item 4.3.6

4.6.7 Test Results

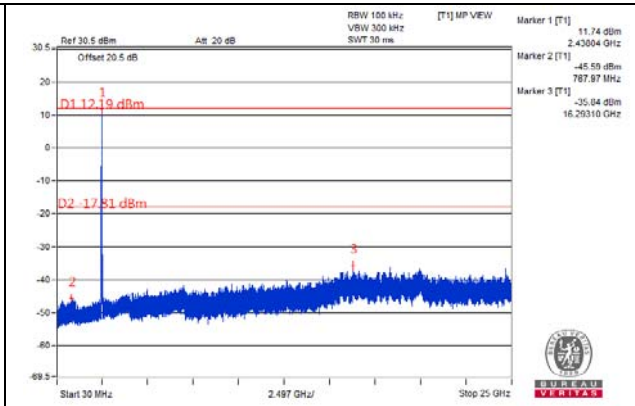
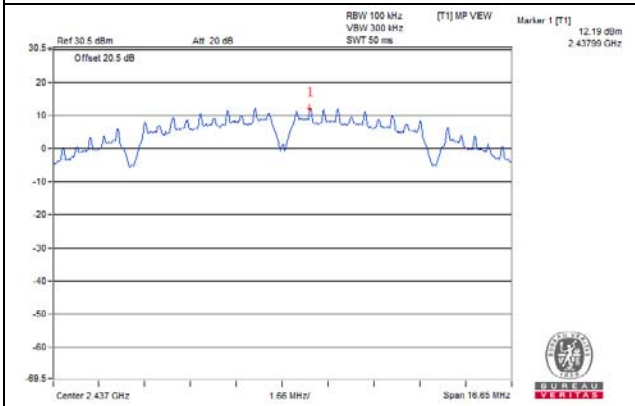
The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 30dB offset below D1. It shows compliance with the requirement.

802.11b: Chain 0

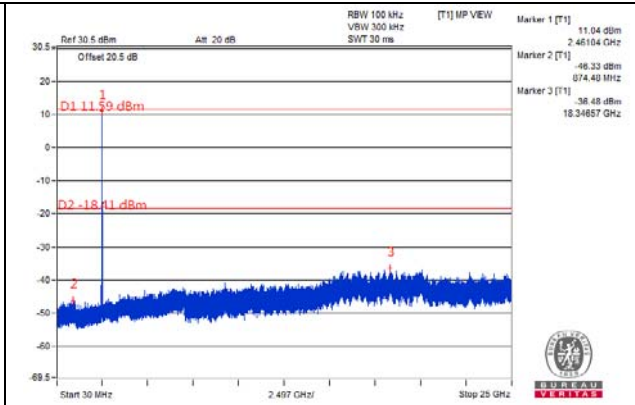
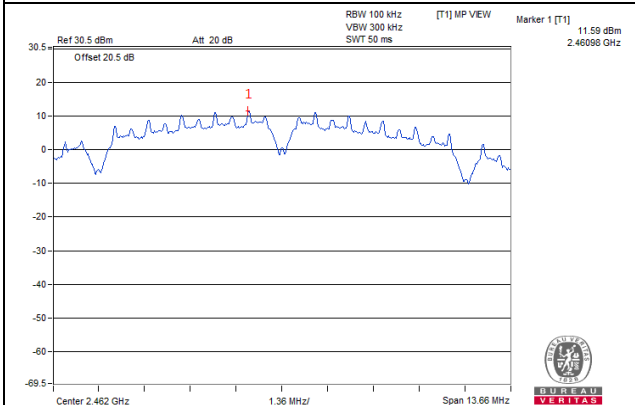
CH 1



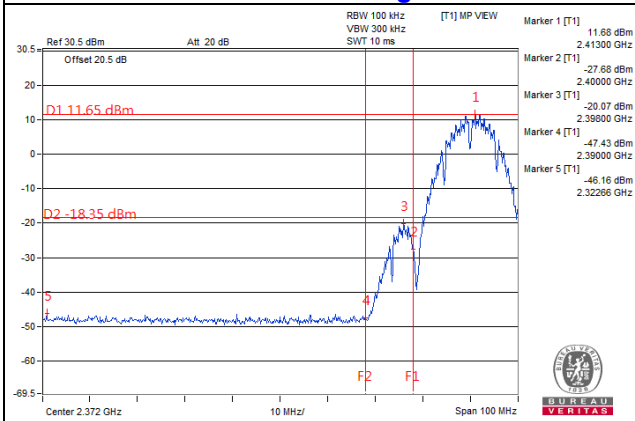
CH 6



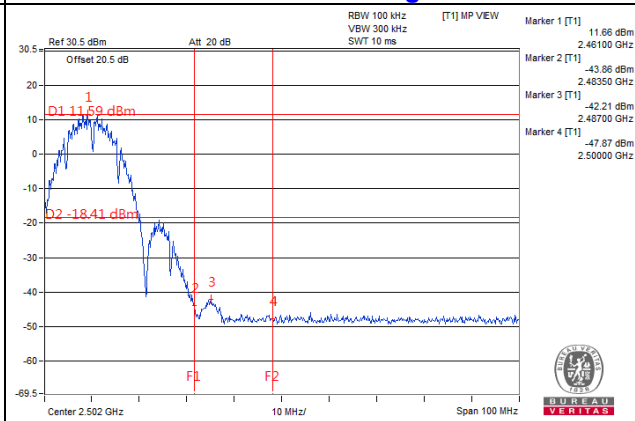
CH 11



CH 1 Band edge

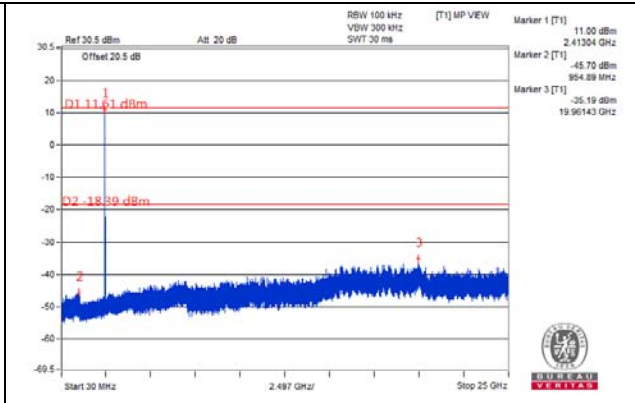
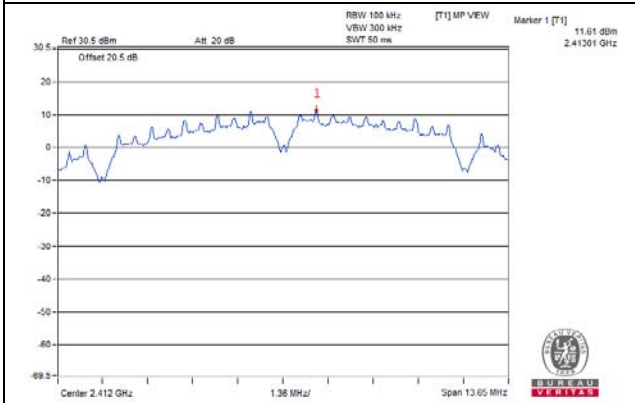


CH 11 Band edge

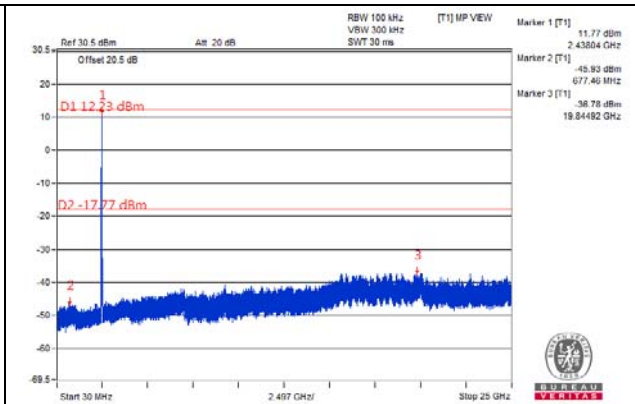
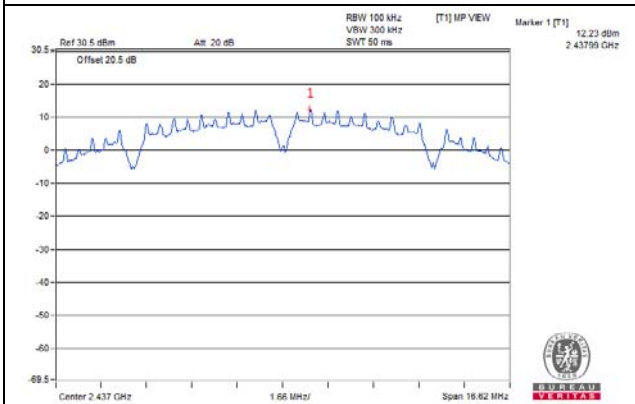


Chain 1

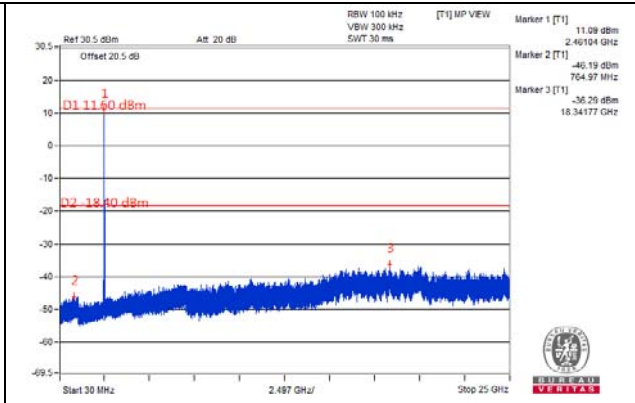
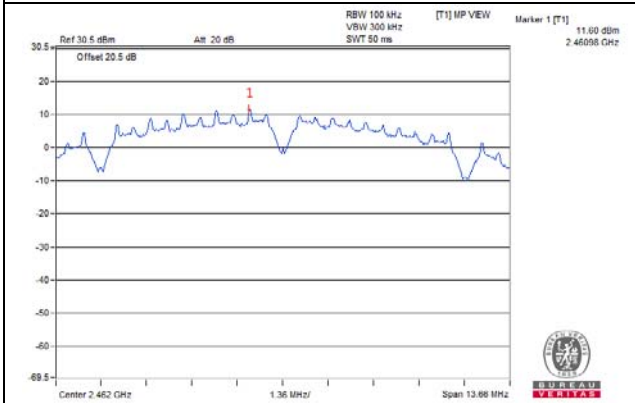
CH 1



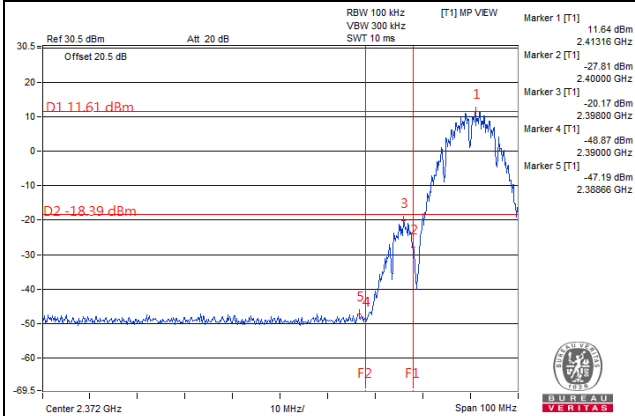
CH 6



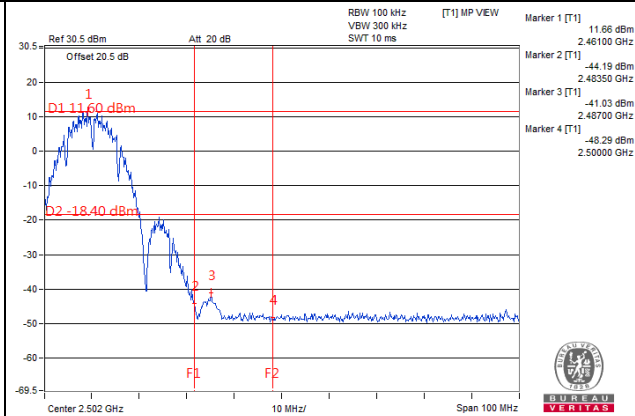
CH 11



CH 11 Band edge

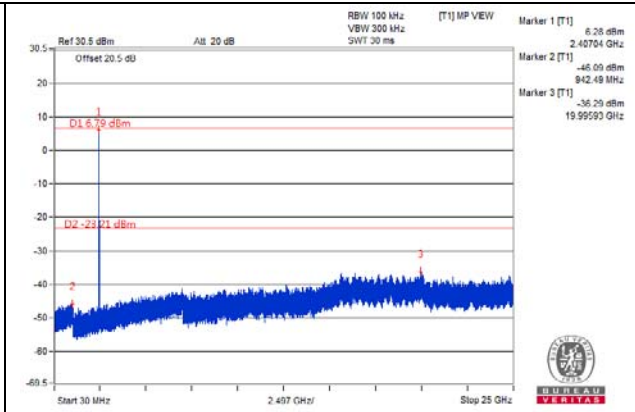
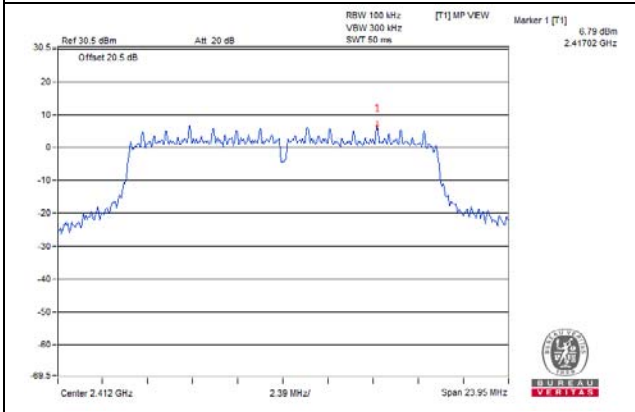


CH 11 Band edge

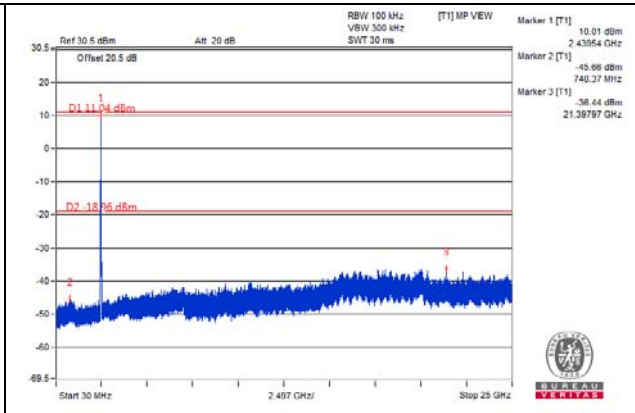
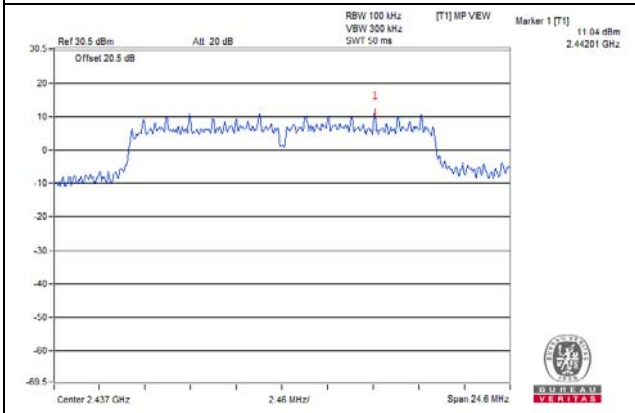


802.11g: Chain 0

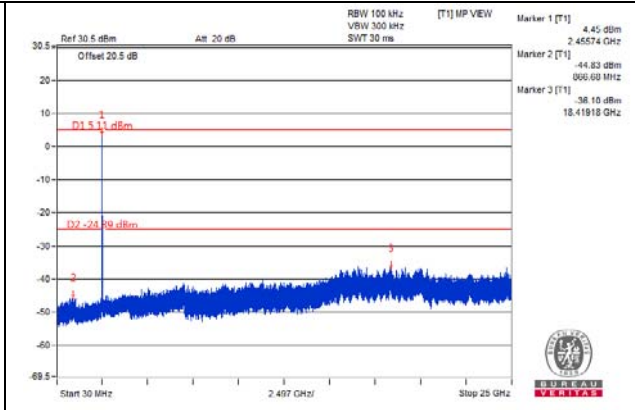
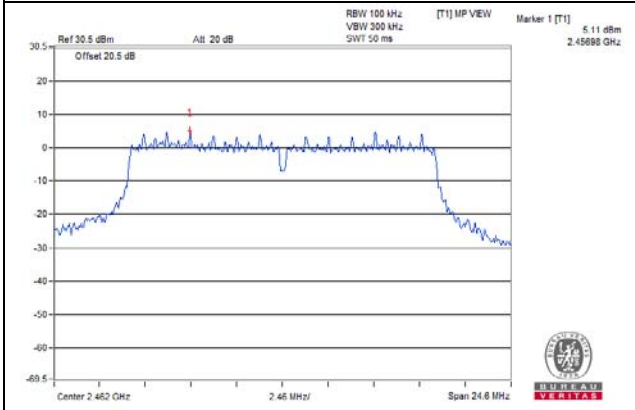
CH 1



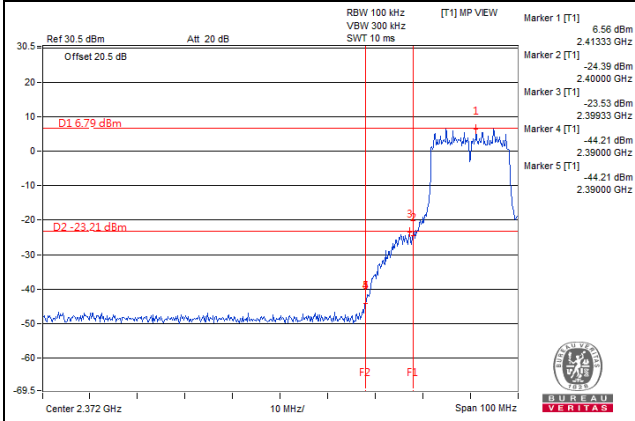
CH 6



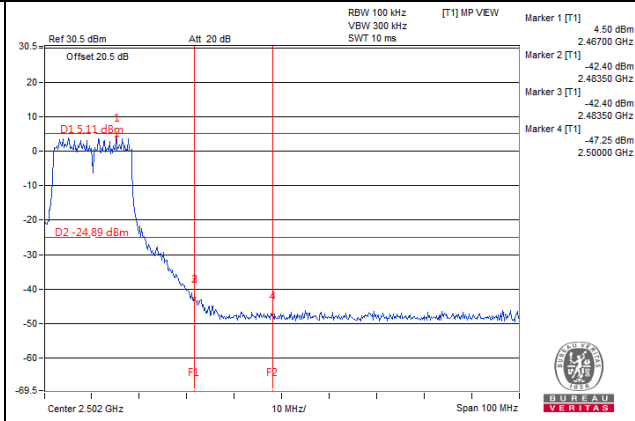
CH 11



CH 1 Band edge

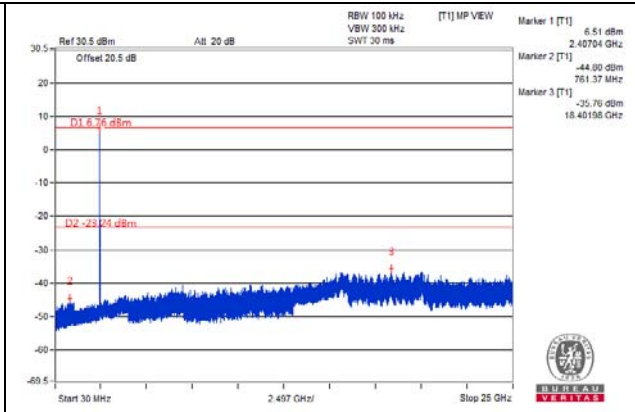
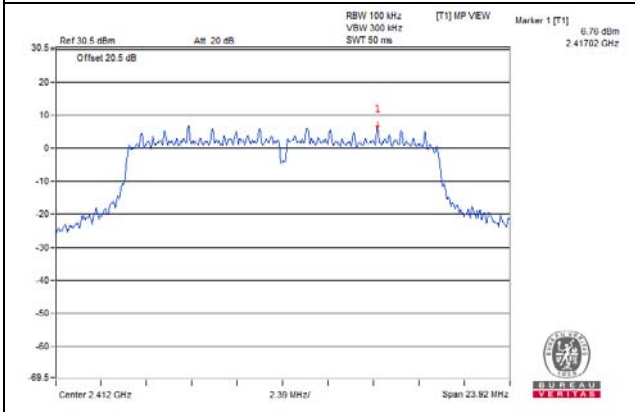


CH 11 Band edge

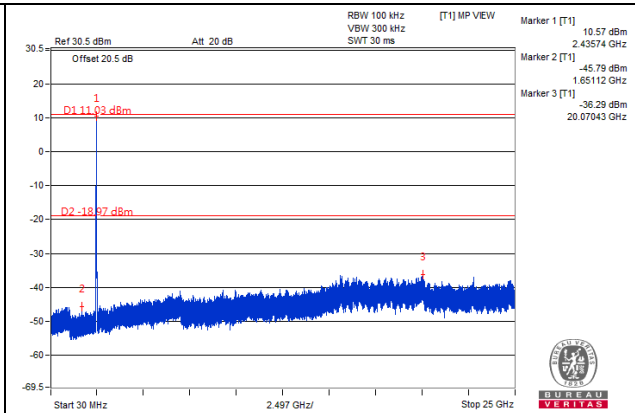
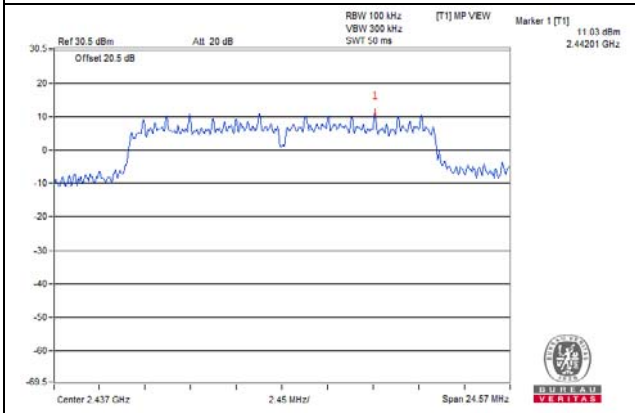


Chain 1

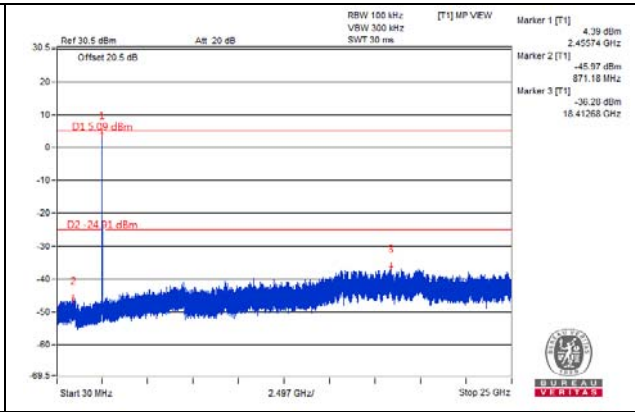
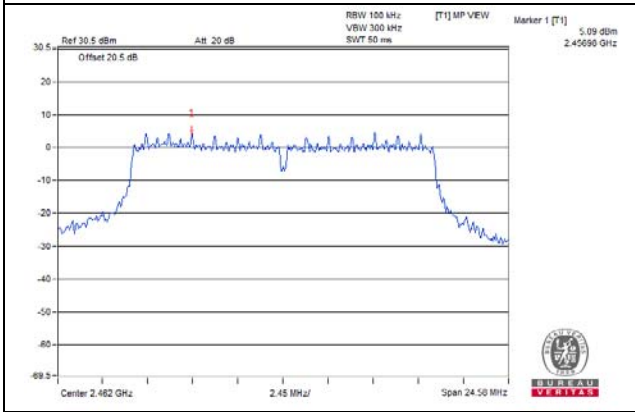
CH 1



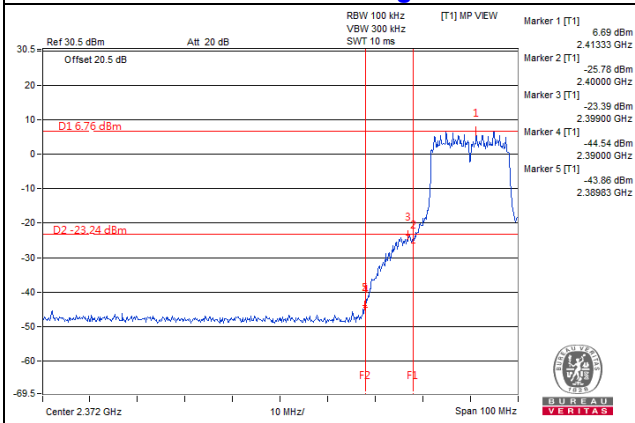
CH 6



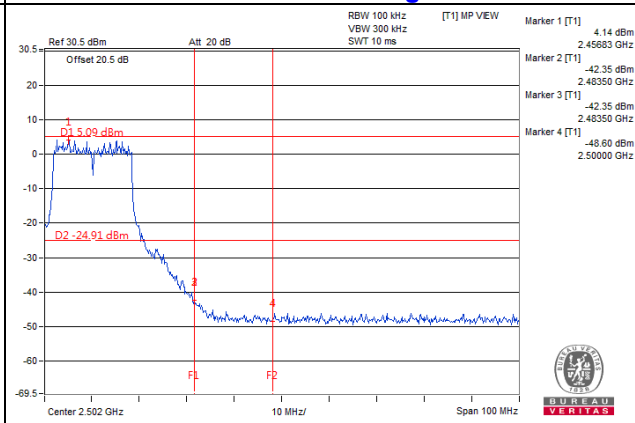
CH 11



CH 1 Band edge

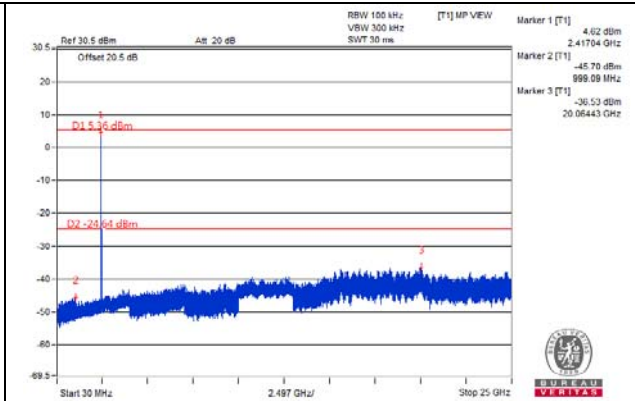
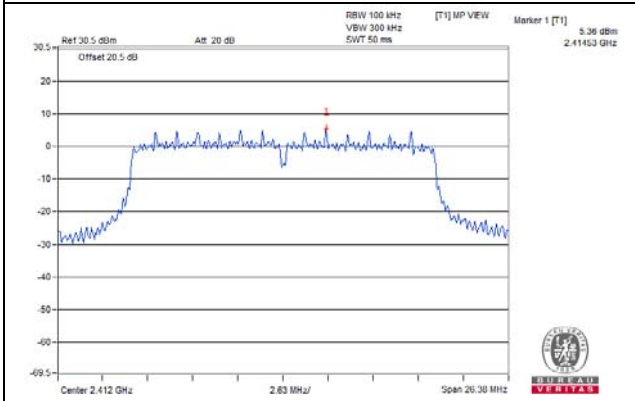


CH 11 Band edge

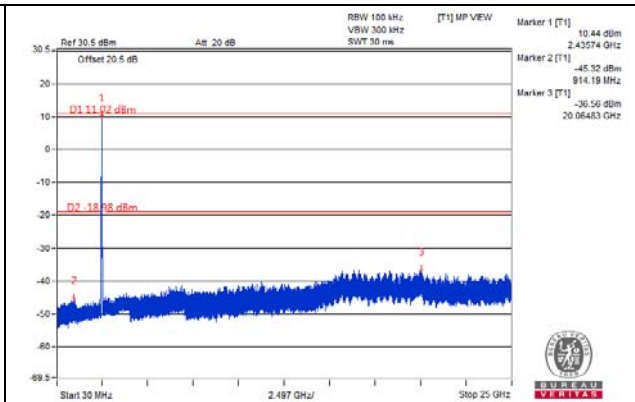
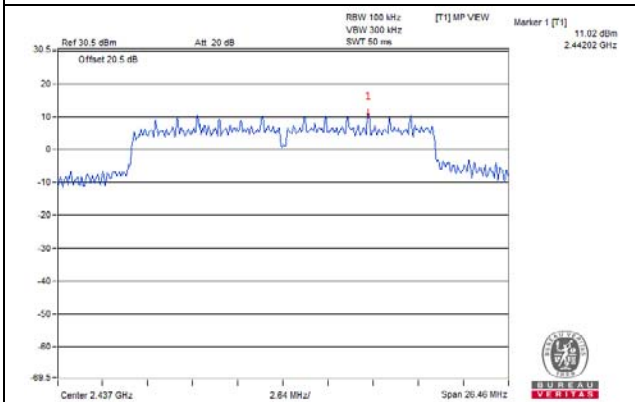


802.11n (20MHz): Chain 0

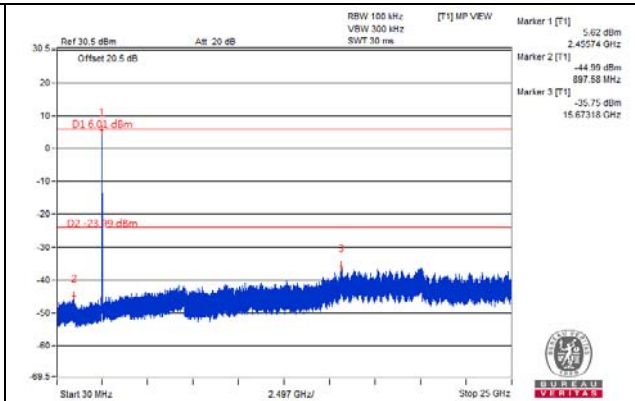
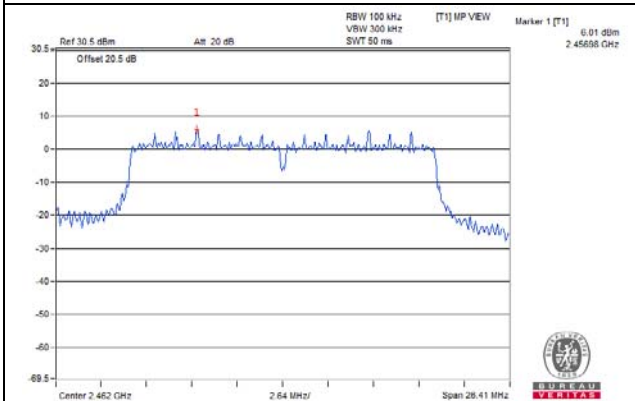
CH 1



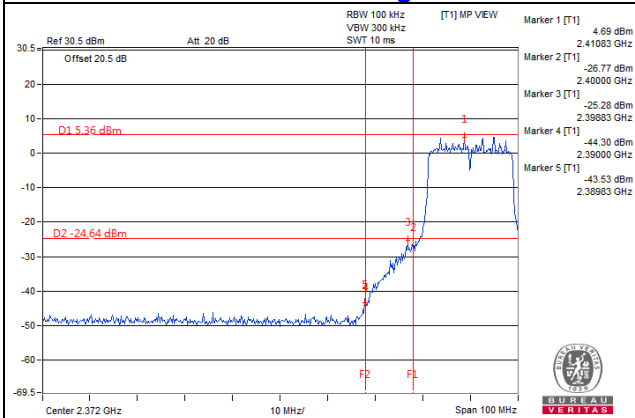
CH 6



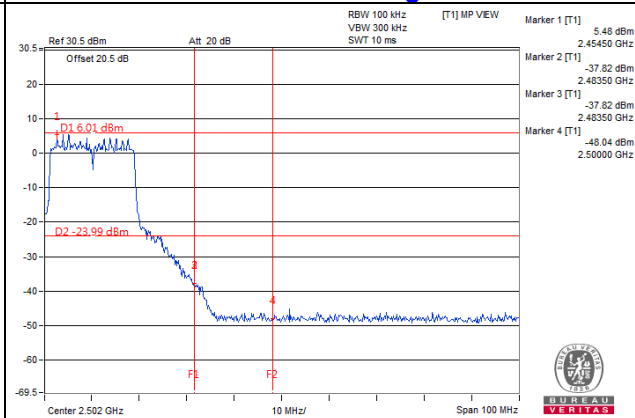
CH 11



CH 11 Band edge

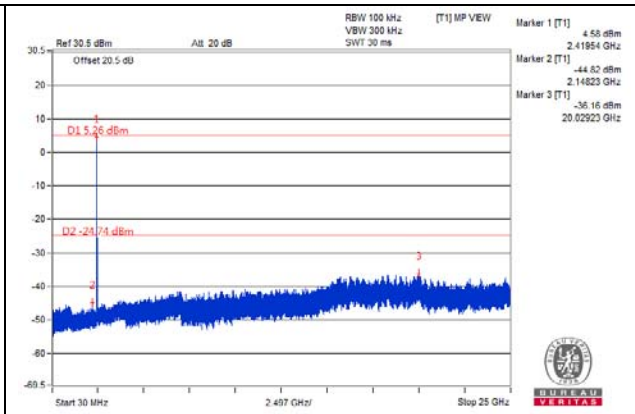
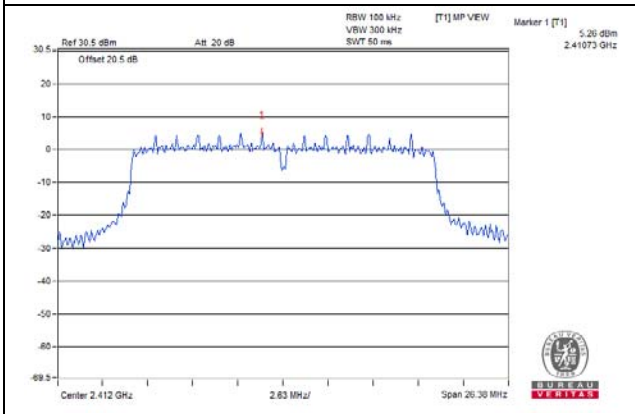


CH 11 Band edge

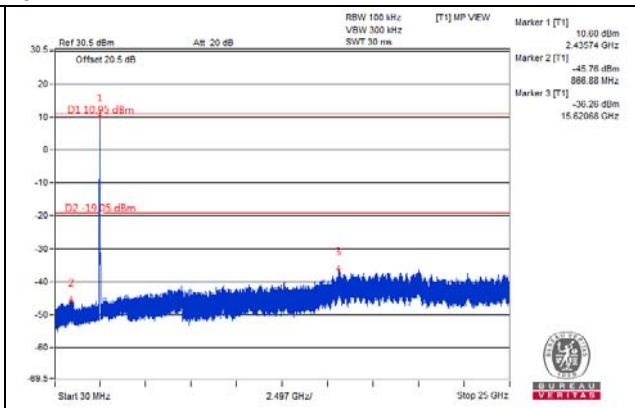
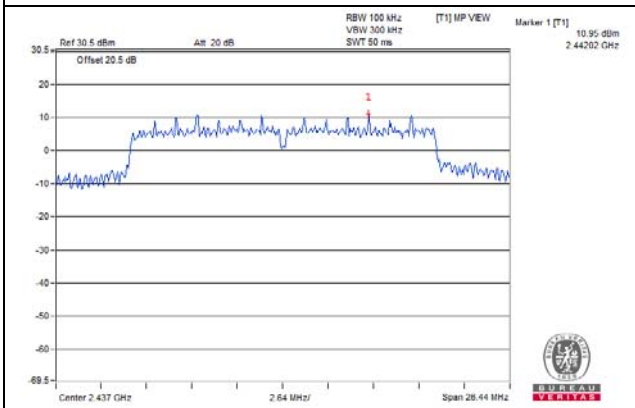


Chain 1

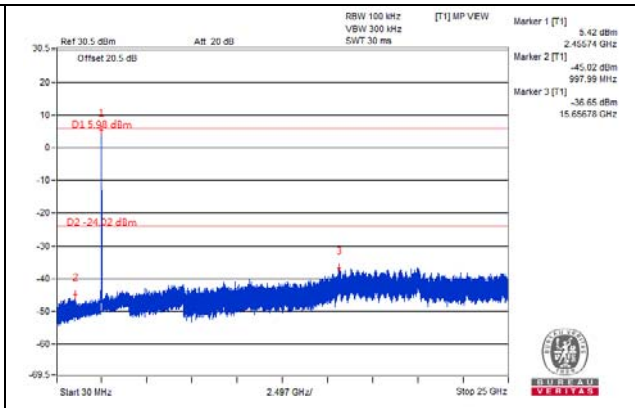
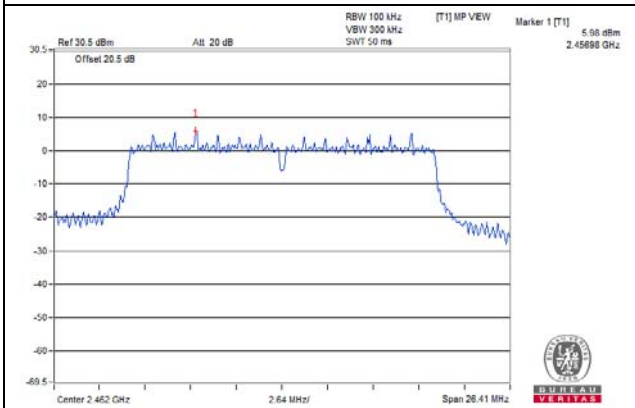
CH 1



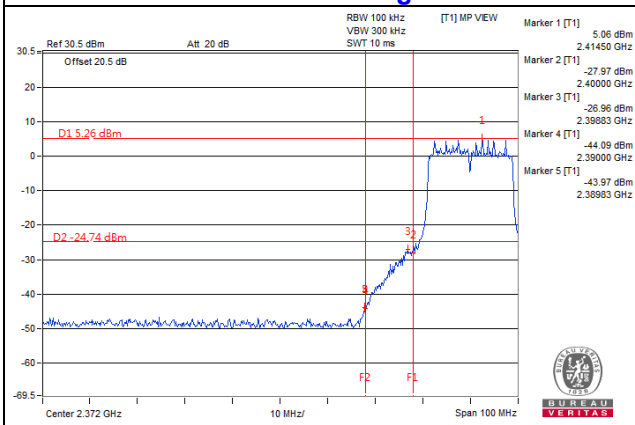
CH 6



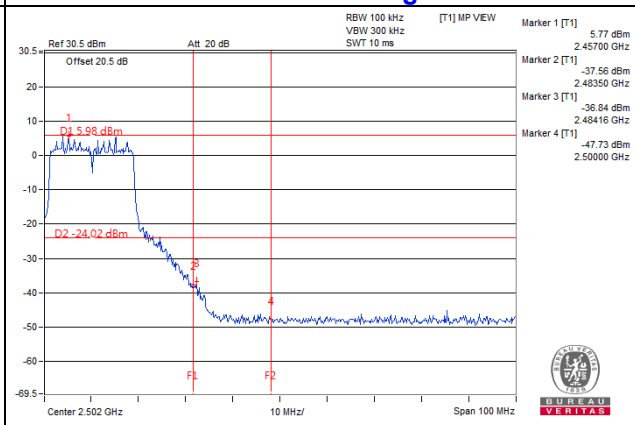
CH 11



CH 1 Band edge

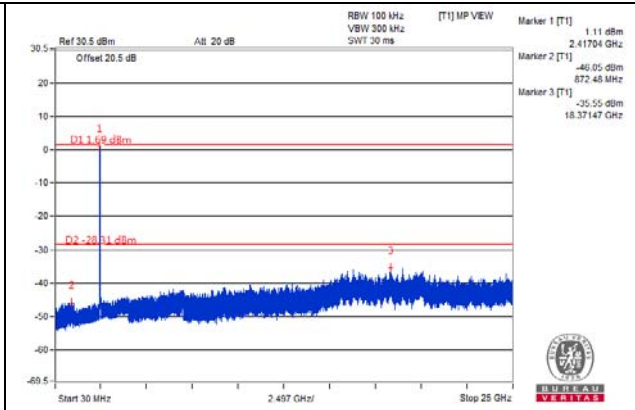
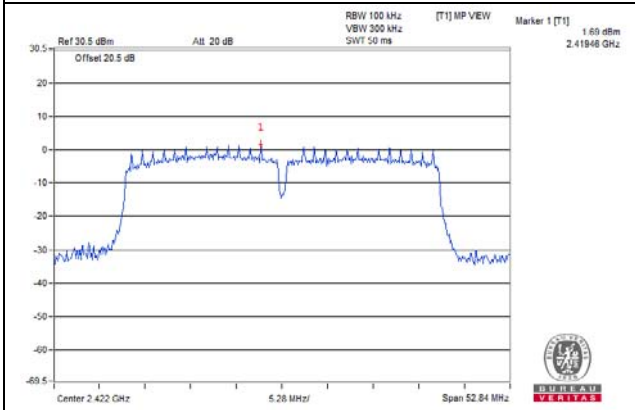


CH 11 Band edge

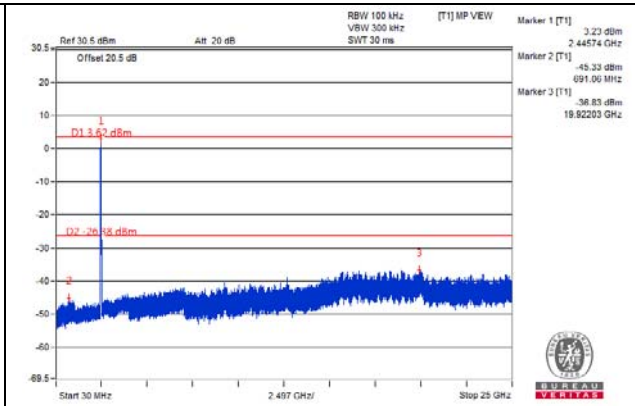
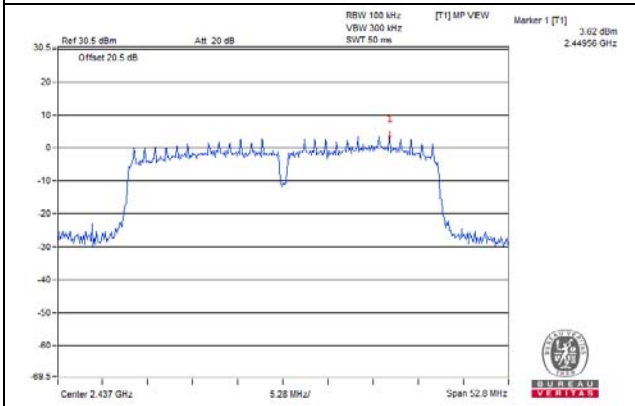


802.11n (40MHz): Chain 0

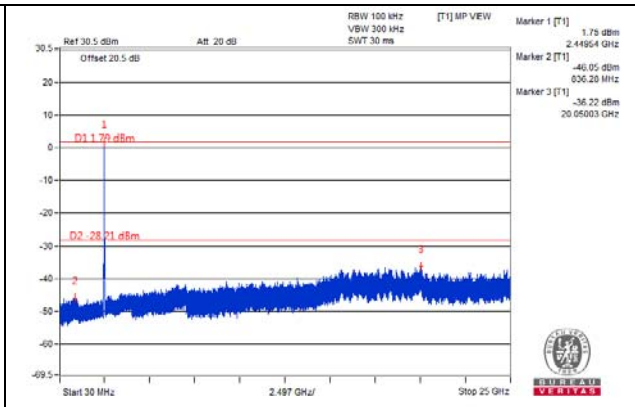
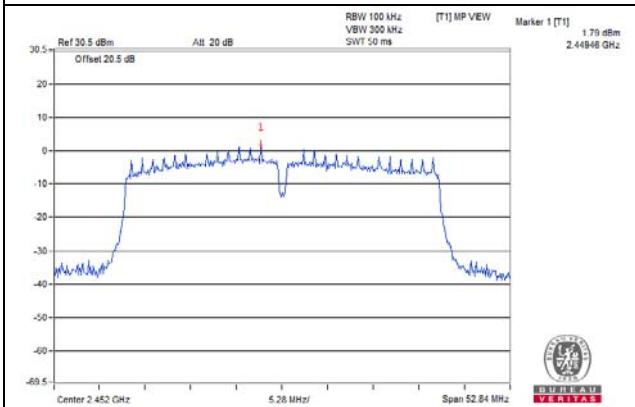
CH 3



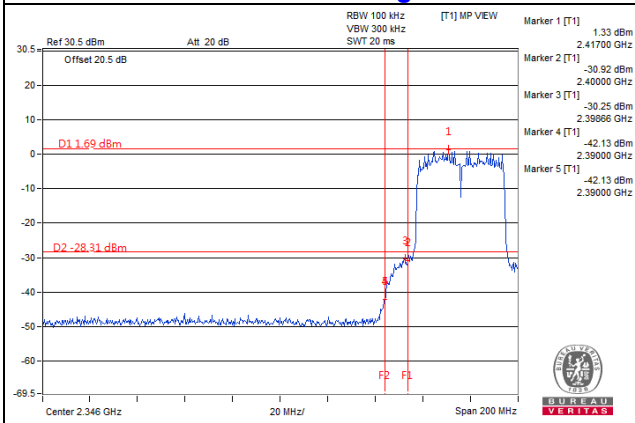
CH 6



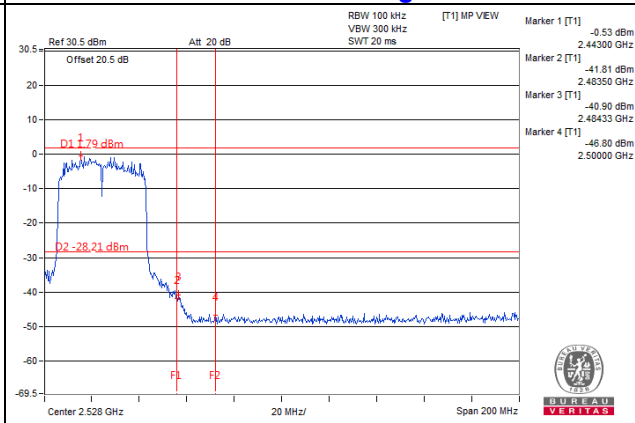
CH 9



CH 3 Band edge

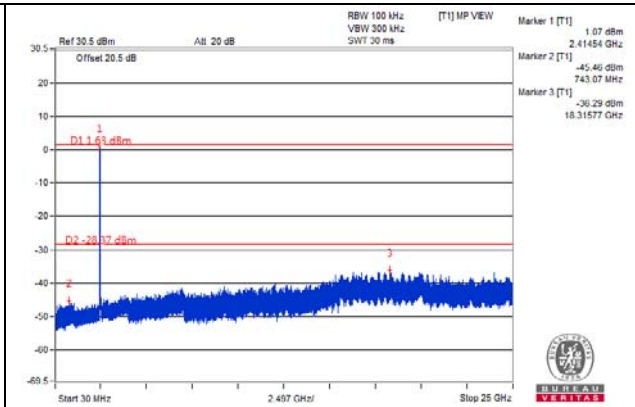
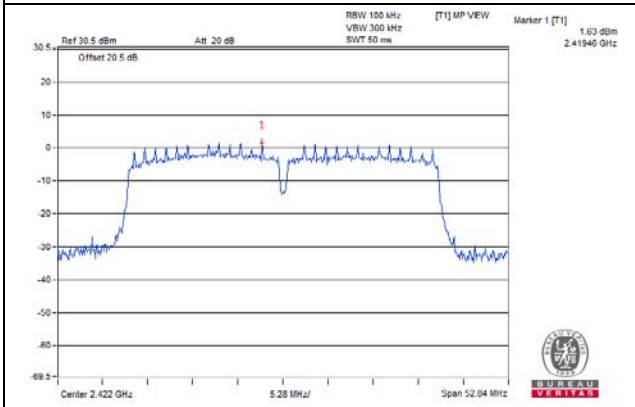


CH 9 Band edge

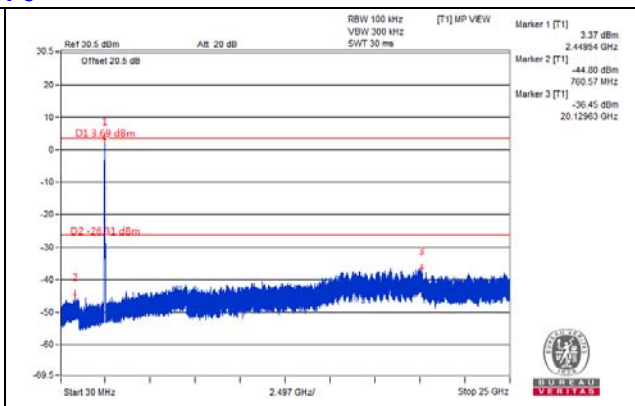
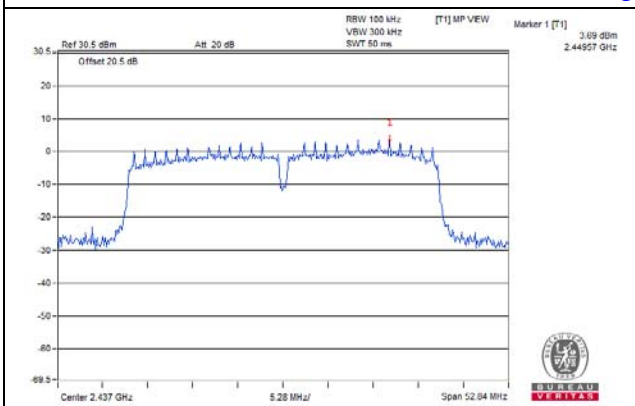


Chain 1

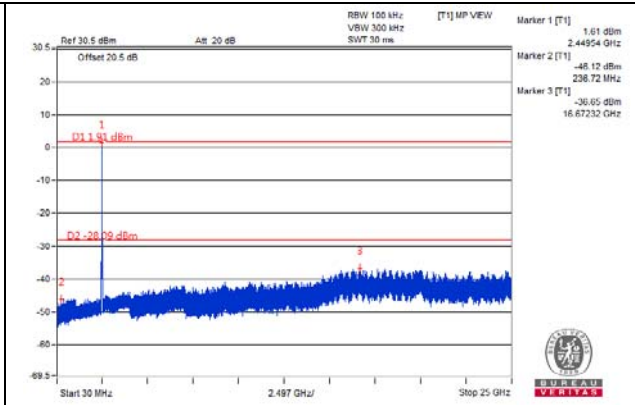
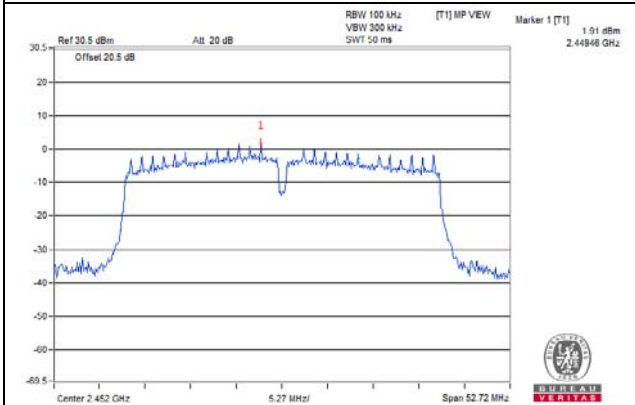
CH 3



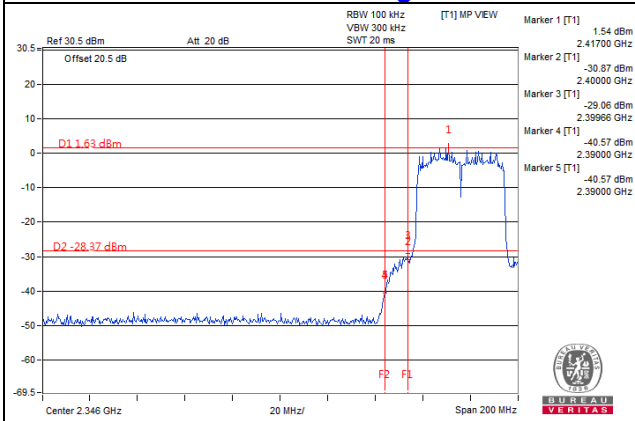
CH 6



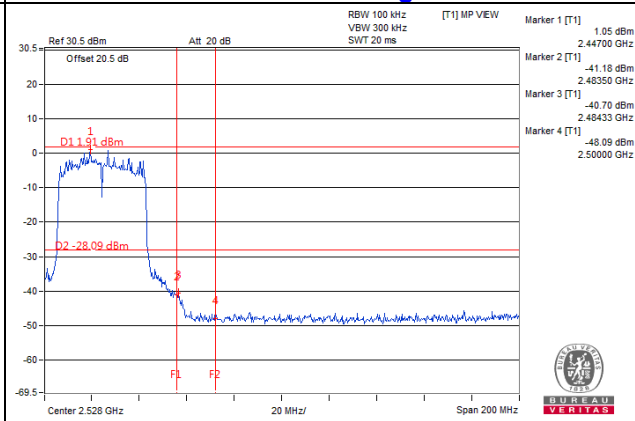
CH 9



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.

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

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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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