

FCC Test Report

Report No.: RF170202C15

FCC ID: A8J-EMR3000V2

Test Model: EMR3000v2

Received Date: Feb. 02, 2017

Test Date: Feb. 08 ~ Feb. 22, 2017

Issued Date: Mar. 07, 2017

Applicant: EnGenius Technologies

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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.....	7
3.2 Description of Test Modes.....	9
3.2.1 Test Mode Applicability and Tested Channel Detail.....	10
3.3 Duty Cycle of Test Signal.....	12
3.4 Description of Support Units.....	13
3.4.1 Configuration of System under Test.....	13
3.5 General Description of Applied Standards.....	14
4 Test Types and Results	15
4.1 Radiated Emission and Bandedge Measurement.....	15
4.1.1 Limits of Radiated Emission and Bandedge Measurement.....	15
4.1.2 Test Instruments.....	16
4.1.3 Test Procedures.....	17
4.1.4 Deviation from Test Standard.....	17
4.1.5 Test Set Up.....	18
4.1.6 EUT Operating Conditions.....	19
4.1.7 Test Results.....	20
4.2 Conducted Emission Measurement.....	33
4.2.1 Limits of Conducted Emission Measurement.....	33
4.2.2 Test Instruments.....	33
4.2.3 Test Procedures.....	33
4.2.4 Deviation from Test Standard.....	33
4.2.5 Test Setup.....	34
4.2.6 EUT Operating Conditions.....	34
4.2.7 Test Results.....	35
4.3 6dB Bandwidth Measurement.....	37
4.3.1 Limits of 6dB Bandwidth Measurement.....	37
4.3.2 Test Setup.....	37
4.3.3 Test Instruments.....	37
4.3.4 Test Procedure.....	37
4.3.5 Deviation from Test Standard.....	37
4.3.6 EUT Operating Conditions.....	37
4.3.7 Test Result.....	38
4.4 Conducted Output Power Measurement.....	40
4.4.1 Limits of Conducted Output Power Measurement.....	40
4.4.2 Test Setup.....	40
4.4.3 Test Instruments.....	40
4.4.4 Test Procedures.....	40
4.4.5 Deviation from Test Standard.....	40
4.4.6 EUT Operating Conditions.....	40
4.4.7 Test Results.....	41
4.5 Power Spectral Density Measurement.....	42
4.5.1 Limits of Power Spectral Density Measurement.....	42
4.5.2 Test Setup.....	42
4.5.3 Test Instruments.....	42
4.5.4 Test Procedure.....	42
4.5.5 Deviation from Test Standard.....	43
4.5.6 EUT Operating Condition.....	43

4.5.7 Test Results	44
4.6 Conducted Out of Band Emission Measurement.....	47
4.6.1 Limits of Conducted Out of Band Emission Measurement	47
4.6.2 Test Setup.....	47
4.6.3 Test Instruments	47
4.6.4 Test Procedure	47
4.6.5 Deviation from Test Standard	47
4.6.6 EUT Operating Condition	48
4.6.7 Test Results	48
5 Pictures of Test Arrangements.....	57
Appendix – Information on the Testing Laboratories	58

Release Control Record

Issue No.	Description	Date Issued
RF170202C15	Original release.	Mar. 07, 2017

1 Certificate of Conformity

Product: AC1200 Mesh Router

Brand: EnGenius

Test Model: EMR3000v2

Sample Status: Engineering sample

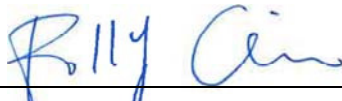
Applicant: EnGenius Technologies

Test Date: Feb. 08 ~ Feb. 22, 2017

Standards: 47 CFR FCC Part 15, Subpart C (Section 15.247)
ANSI C63.10:2013

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


Prepared by :


Polly Chien / Specialist

Date:

Mar. 07, 2017

Approved by :


Ken Liu / Senior Manager

Date:

Mar. 07, 2017

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (SECTION 15.247)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	Pass	Meet the requirement of limit. Minimum passing margin is -18.11dB at 0.65439MHz.
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -1.0dB at 2390.00MHz.
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 IPEX 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	2.44 dB
Radiated Emissions up to 1 GHz	30MHz ~ 200MHz	3.86 dB
	200MHz ~ 1000MHz	3.87 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	2.29 dB
	18GHz ~ 40GHz	2.29 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	AC1200 Mesh Router
Brand	EnGenius
Test Model	EMR3000v2
Status of EUT	Engineering sample
Power Supply Rating	12Vdc from adapter
Modulation Type	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
Modulation Technology	DSSS, OFDM
Transfer Rate	802.11b: 11.0/ 5.5/ 2.0/ 1.0Mbps 802.11g: 54.0/ 48.0/ 36.0/ 24.0/ 18.0/ 12.0/ 9.0/ 6.0Mbps 802.11n: up to 300.0Mbps
Operating Frequency	2412 ~ 2462MHz
Number of Channel	11 for 802.11b, 802.11g, 802.11n (HT20) 7 for 802.11n (HT40)
Output Power	326.681mW
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	Adapter
Data Cable Supplied	0.45m RJ45 non-shielded cable without core

Note:

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

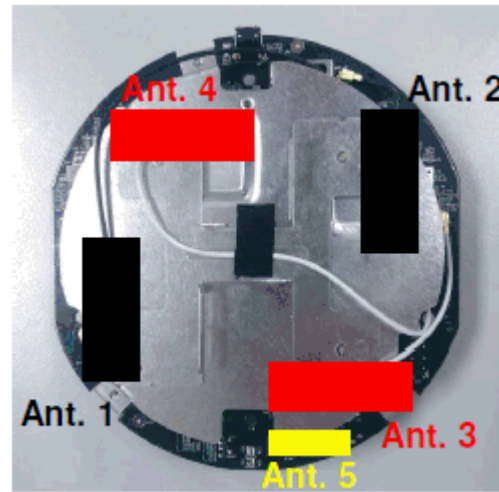
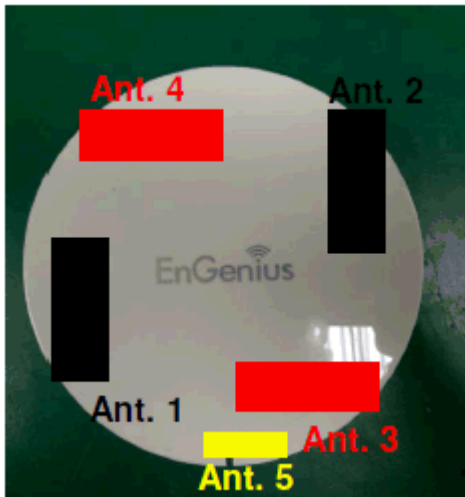
Modulation Mode	TX Function
802.11b	2TX
802.11g	2TX
802.11n (HT20)	2TX
802.11n (HT40)	2TX

2. The EUT uses following adapter.

Brand	Skypowercom
Model	ZZU1588-150120-2A
Input Power	100-240Vac, 1.5A Max, 50-60Hz
Output Power	12Vdc, 1.5A
Power Line	1.5m cable without core attached on adapter

3. The following antennas were provided to the EUT.

Ant. No.	1	2	3	4	5 (BT)
Ant. Type	PIFA				
Frequency (MHz)	2400-2500		5150-5850		2400-2500
Pesk Gain (dBi)	3.1	4.7	5.5	5.5	1.4
Connector	IPEX				NA



- Spurious emission of the simultaneous operation (2.4GHz, 5GHz and BT) has been evaluated and no non-compliance was found.
- 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		

7 channels are provided for 802.11n (HT40):

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

Note: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **Z-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.

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	802.11b	1 to 11	1, 6, 11	DSSS	DBPSK	1.0
-	802.11g	1 to 11	1, 6, 11	OFDM	BPSK	6.0
-	802.11n (HT20)	1 to 11	1, 6, 11	OFDM	BPSK	7.2
-	802.11n (HT40)	3 to 9	3, 6, 9	OFDM	BPSK	15.0

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	6	DSSS	DBPSK	1.0

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	6	DSSS	DBPSK	1.0

Antenna Port Conducted Measurement:

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

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	802.11b	1 to 11	1, 6, 11	DSSS	DBPSK	1.0
-	802.11g	1 to 11	1, 6, 11	OFDM	BPSK	6.0
-	802.11n (HT20)	1 to 11	1, 6, 11	OFDM	BPSK	7.2
-	802.11n (HT40)	3 to 9	3, 6, 9	OFDM	BPSK	15.0

Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE \geq 1G	20deg. C, 66%RH	120Vac, 60Hz	James Yang, Jones Chang
RE<1G	19deg. C, 64%RH	120Vac, 60Hz	Jones Chang
PLC	20deg. C, 67%RH	120Vac, 60Hz	Jones Chang
APCM	25deg. C, 60%RH	120Vac, 60Hz	Leo Tsai

3.3 Duty Cycle of Test Signal

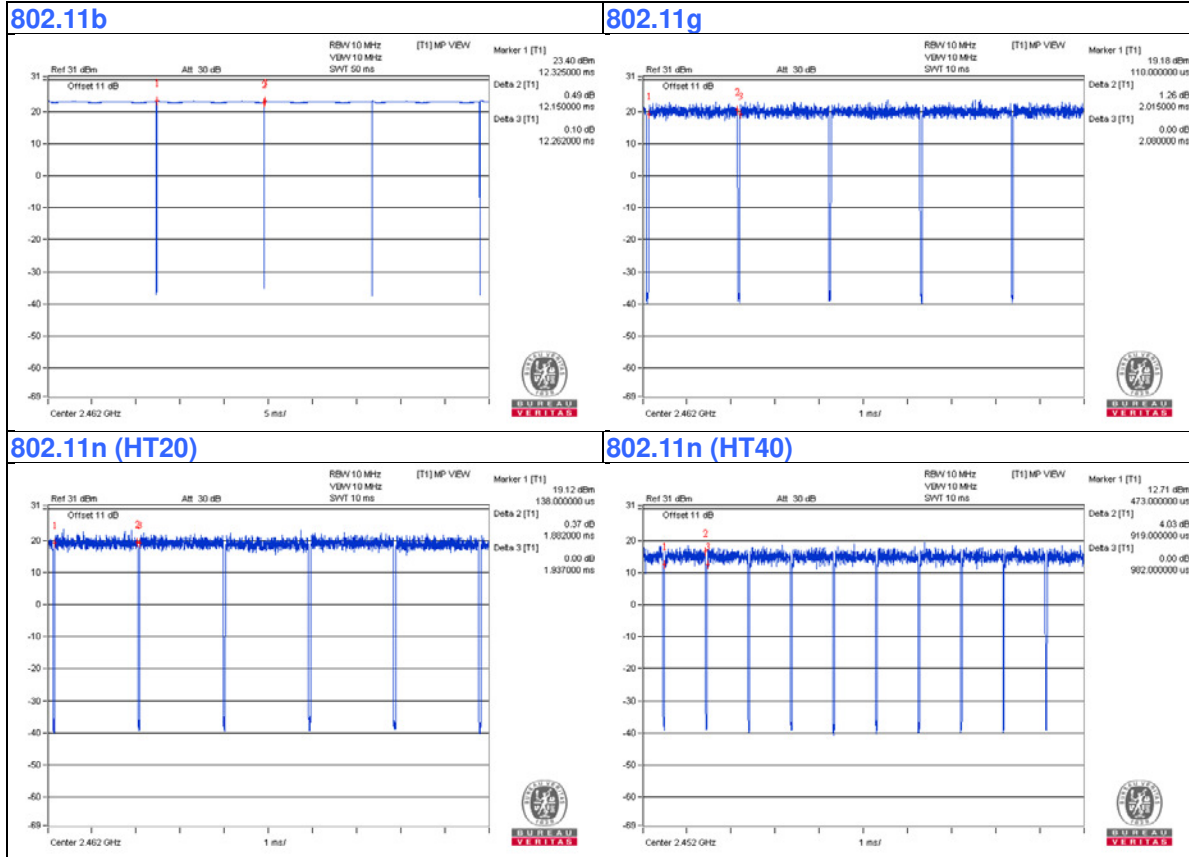
Duty cycle of test signal is $\geq 98\%$, duty factor is not required.
 Duty cycle of test signal is $< 98\%$, duty factor shall be considered.

802.11b: Duty cycle = $12.150/12.262 = 0.991$

802.11g: Duty cycle = $2.015/2.080 = 0.969$, Duty factor = $10 * \log(1/0.969) = 0.14$

802.11n (HT20): Duty cycle = $1.882/1.937 = 0.972$, Duty factor = $10 * \log(1/0.972) = 0.13$

802.11n (HT40): Duty cycle = $0.919/0.982 = 0.936$, Duty factor = $10 * \log(1/0.936) = 0.29$



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.

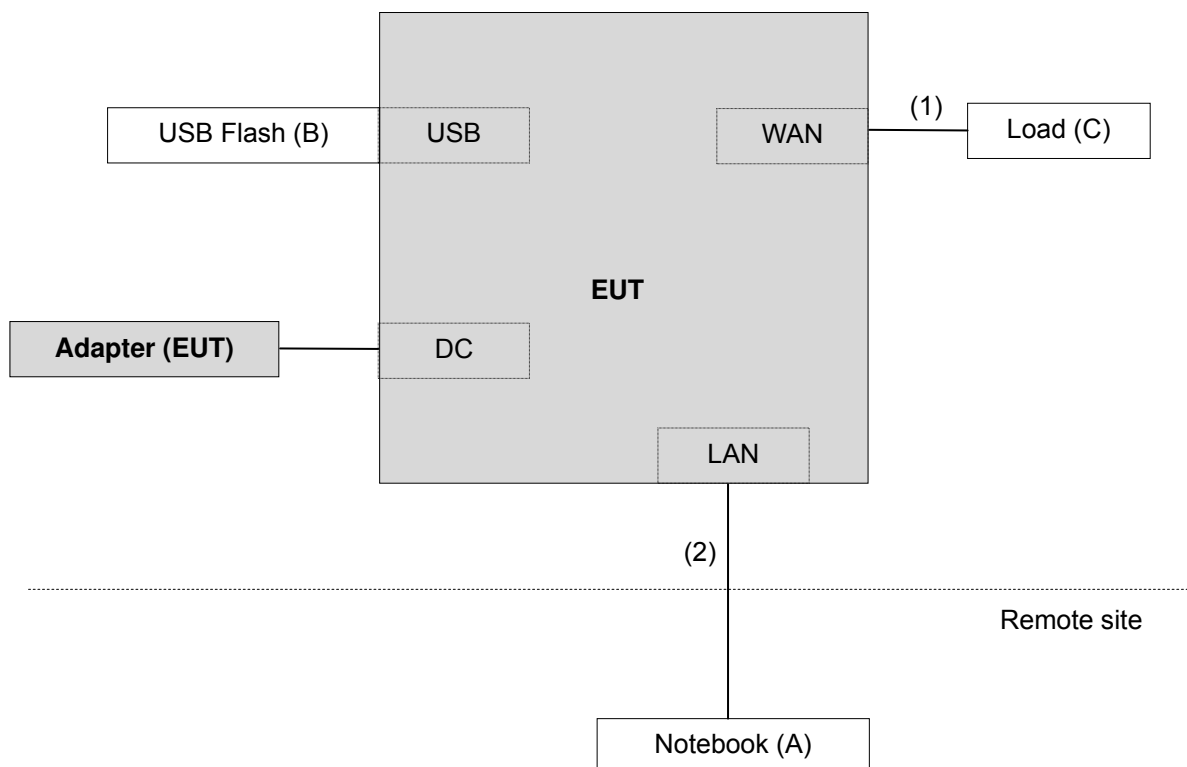
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Notebook	DELL	E5410	1HC2XM1	FCC DoC Approved	-
B.	USB Flash	HP	v250W	01	N/A	-
C.	Load	N/A	N/A	N/A	N/A	-

Note:

1. All power cords of the above support units are non-shielded (1.8m).
2. Item A acted as a communication partner to transfer data.

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	LAN cable	1	1.2	N	0	-
2.	LAN cable	1	3	N	0	-

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
KDB 662911 D01 Multiple Transmitter Output v02r01
ANSI C63.10-2013

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

Note: The EUT is also considered as a kind of computer peripheral, because the connection to computer is necessary for typical use. It 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 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 30dB under any condition of modulation.

4.1.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
Test Receiver ROHDE & SCHWARZ	ESIB7	100187	Apr. 18, 2016	Apr. 17, 2017
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100041	Nov. 16, 2016	Nov. 15, 2017
BILOG Antenna SCHWARZBECK	VULB9168	9168-171	Dec. 28, 2016	Dec. 27, 2017
HORN Antenna SCHWARZBECK	9120D	209	Dec. 27, 2016	Dec. 26, 2017
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Dec. 14, 2016	Dec. 13, 2017
Loop Antenna	EM-6879	269	Aug. 11, 2016	Aug. 10, 2017
Preamplifier Agilent	8447D	2944A10738	Aug. 22, 2016	Aug. 21, 2017
Preamplifier Agilent	8449B	3008A01922	Sep. 18, 2016	Sep. 17, 2017
RF signal cable HUBER+SUHNER	SUCOFLEX 104	Cable-CH3-03 (214378)	Aug. 22, 2016	Aug. 21, 2017
RF signal cable HUBER+SUHNER	SUCOFLEX 106	Cable-CH3-03 (309224+12738)	Aug. 22, 2016	Aug. 21, 2017
Software BV ADT	ADT_Radiated_ V7.6.15.9.4	NA	NA	NA
Antenna Tower inn-co GmbH	MA 4000	013303	NA	NA
Antenna Tower Controller BV ADT	AT100	AT93021702	NA	NA
Turn Table BV ADT	TT100	TT93021702	NA	NA
Turn Table Controller BV ADT	SC100	SC93021702	NA	NA
High Speed Peak Power Meter	ML2495A	0824011	Jul. 09, 2016	Jul. 08, 2017
Power Sensor	MA2411B	0738171	Aug. 11, 2016	Aug. 10, 2017

- Note:
1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 2. The test was performed in HwaYa Chamber 3.
 3. The horn antenna and preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
 4. The FCC Site Registration No. is 988962.
 5. The IC Site Registration No. is IC 7450F-3.

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:

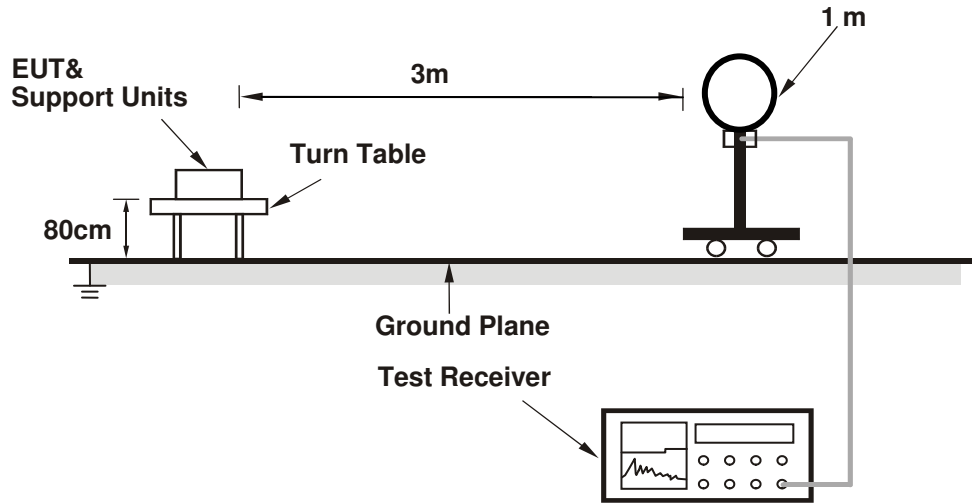
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.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

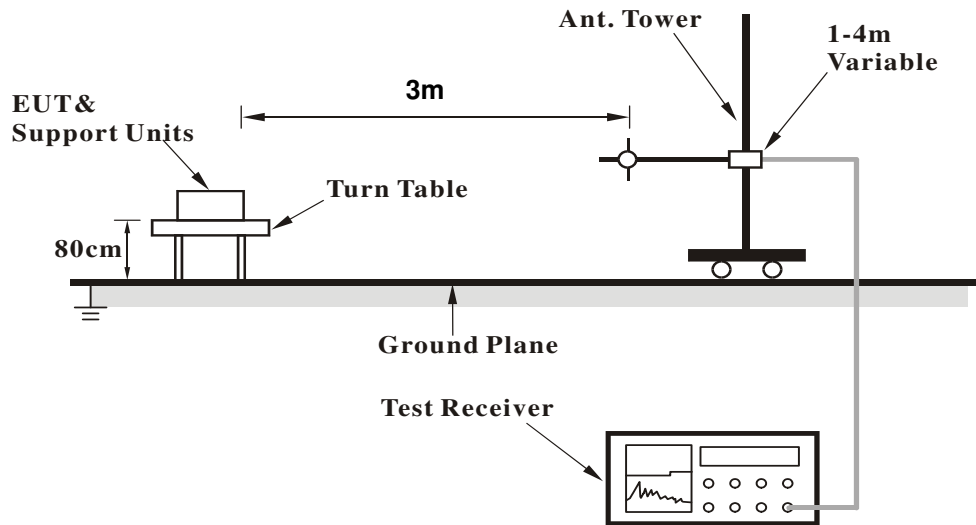
No deviation.

4.1.5 Test Set Up

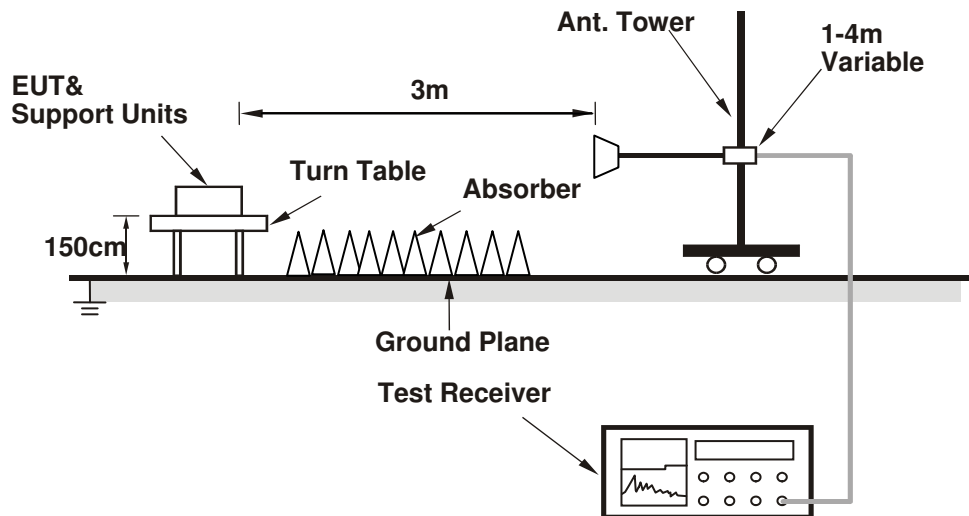
For Radiated emission below 30MHz



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. Placed the EUT on the testing table.
- b. Prepared notebook to act as a communication partner and placed it outside of testing area.
- c. The communication partner connected with EUT via a RJ45 cable and ran a test program (provided by manufacturer) to enable EUT under transmission condition continuously at specific channel frequency.
- d. The communication partner sent data to EUT by command "PING".
- e. The necessary accessories enable the system in full functions.

4.1.7 Test Results

Above 1GHz Worst-case 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	56.7 PK	74.0	-17.3	1.33 H	285	25.70	31.00
2	2390.00	45.0 AV	54.0	-9.0	1.33 H	285	14.00	31.00
3	*2412.00	104.8 PK			1.23 H	283	73.60	31.20
4	*2412.00	101.1 AV			1.23 H	283	69.90	31.20
5	4824.00	50.7 PK	74.0	-23.3	2.52 H	231	50.20	0.50
6	4824.00	45.6 AV	54.0	-8.4	2.52 H	231	45.10	0.50
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	60.8 PK	74.0	-13.2	1.52 V	9	29.80	31.00
2	2390.00	52.8 AV	54.0	-1.2	1.52 V	9	21.80	31.00
3	*2412.00	110.1 PK			1.87 V	9	78.90	31.20
4	*2412.00	106.4 AV			1.87 V	9	75.20	31.20
5	4824.00	49.1 PK	74.0	-24.9	1.49 V	196	48.60	0.50
6	4824.00	46.0 AV	54.0	-8.0	1.49 V	196	45.50	0.50

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	109.1 PK			2.96 H	275	77.80	31.30
2	*2437.00	105.3 AV			2.96 H	275	74.00	31.30
3	4874.00	50.5 PK	74.0	-23.5	2.95 H	180	49.90	0.60
4	4874.00	45.4 AV	54.0	-8.6	2.95 H	180	44.80	0.60

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	111.3 PK			2.65 V	13	80.00	31.30
2	*2437.00	107.5 AV			2.65 V	13	76.20	31.30
3	4874.00	49.7 PK	74.0	-24.3	2.76 V	355	49.10	0.60
4	4874.00	44.6 AV	54.0	-9.4	2.76 V	355	44.00	0.60

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	107.7 PK			2.65 H	298	76.30	31.40
2	*2462.00	104.0 AV			2.65 H	298	72.60	31.40
3	2483.50	56.6 PK	74.0	-17.4	2.65 H	243	25.10	31.50
4	2483.50	48.9 AV	54.0	-5.1	2.65 H	243	17.40	31.50
5	4924.00	49.8 PK	74.0	-24.2	2.80 H	282	49.20	0.60
6	4924.00	43.1 AV	54.0	-10.9	2.80 H	282	42.50	0.60

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	109.1 PK			1.67 V	8	77.70	31.40
2	*2462.00	105.4 AV			1.67 V	8	74.00	31.40
3	2483.50	60.4 PK	74.0	-13.6	2.75 V	3	28.90	31.50
4	2483.50	52.6 AV	54.0	-1.4	2.75 V	3	21.10	31.50
5	4924.00	48.8 PK	74.0	-25.2	3.06 V	350	48.20	0.60
6	4924.00	42.8 AV	54.0	-11.2	3.06 V	350	42.20	0.60

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.

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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	64.3 PK	74.0	-9.7	1.67 H	275	33.30	31.00
2	2390.00	48.1 AV	54.0	-5.9	1.67 H	275	17.10	31.00
3	*2412.00	107.2 PK			3.50 H	231	76.00	31.20
4	*2412.00	97.7 AV			3.50 H	231	66.50	31.20
5	4824.00	47.1 PK	74.0	-26.9	2.22 H	177	46.60	0.50
6	4824.00	33.8 AV	54.0	-20.2	2.22 H	177	33.30	0.50

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	71.1 PK	74.0	-2.9	1.51 V	341	40.10	31.00
2	2390.00	52.3 AV	54.0	-1.7	1.51 V	341	21.30	31.00
3	*2412.00	110.4 PK			1.57 V	1	79.20	31.20
4	*2412.00	100.9 AV			1.57 V	1	69.70	31.20
5	4824.00	46.6 PK	74.0	-27.4	2.26 V	8	46.10	0.50
6	4824.00	34.4 AV	54.0	-19.6	2.26 V	8	33.90	0.50

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	#2309.00	66.0 PK	74.0	-8.0	3.23 H	132	35.10	30.90
2	#2309.00	48.2 AV	54.0	-5.8	3.23 H	132	17.30	30.90
3	*2437.00	111.0 PK			3.49 H	232	79.70	31.30
4	*2437.00	101.6 AV			3.49 H	232	70.30	31.30
5	2483.50	63.8 PK	74.0	-10.2	1.67 H	22	32.30	31.50
6	2483.50	48.3 AV	54.0	-5.7	1.67 H	22	16.80	31.50
7	4874.00	55.6 PK	74.0	-18.4	3.42 H	261	55.00	0.60
8	4874.00	40.7 AV	54.0	-13.3	3.42 H	261	40.10	0.60

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	68.6 PK	74.0	-5.4	1.52 V	9	37.60	31.00
2	2390.00	51.7 AV	54.0	-2.3	1.52 V	9	20.70	31.00
3	*2437.00	115.7 PK			2.14 V	0	84.40	31.30
4	*2437.00	105.8 AV			2.14 V	0	74.50	31.30
5	2483.50	67.0 PK	74.0	-7.0	2.79 V	7	35.50	31.50
6	2483.50	49.1 AV	54.0	-4.9	2.79 V	7	17.60	31.50
7	4874.00	51.4 PK	74.0	-22.6	1.77 V	11	50.80	0.60
8	4874.00	38.4 AV	54.0	-15.6	1.77 V	11	37.80	0.60

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	106.5 PK			2.61 H	112	75.10	31.40
2	*2462.00	96.9 AV			2.61 H	112	65.50	31.40
3	2483.50	65.5 PK	74.0	-8.5	1.43 H	100	34.00	31.50
4	2483.50	49.0 AV	54.0	-5.0	1.43 H	100	17.50	31.50
5	4924.00	45.5 PK	74.0	-28.5	2.10 H	184	44.90	0.60
6	4924.00	32.9 AV	54.0	-21.1	2.10 H	184	32.30	0.60

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	108.4 PK			1.44 V	352	77.00	31.40
2	*2462.00	99.0 AV			1.44 V	352	67.60	31.40
3	2483.50	72.3 PK	74.0	-1.7	1.59 V	347	40.80	31.50
4	2483.50	49.8 AV	54.0	-4.2	1.59 V	347	18.30	31.50
5	4924.00	46.0 PK	74.0	-28.0	2.30 V	11	45.40	0.60
6	4924.00	33.2 AV	54.0	-20.8	2.30 V	11	32.60	0.60

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)
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	63.8 PK	74.0	-10.2	2.12 H	266	32.80	31.00
2	2390.00	49.3 AV	54.0	-4.7	2.12 H	266	18.30	31.00
3	*2412.00	105.9 PK			3.50 H	247	74.70	31.20
4	*2412.00	96.2 AV			3.50 H	247	65.00	31.20
5	4824.00	46.7 PK	74.0	-27.3	2.29 H	189	46.20	0.50
6	4824.00	33.9 AV	54.0	-20.1	2.29 H	189	33.40	0.50

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	71.6 PK	74.0	-2.4	2.45 V	19	40.60	31.00
2	2390.00	52.8 AV	54.0	-1.2	2.45 V	19	21.80	31.00
3	*2412.00	109.9 PK			1.58 V	1	78.70	31.20
4	*2412.00	99.6 AV			1.58 V	1	68.40	31.20
5	4824.00	46.0 PK	74.0	-28.0	2.20 V	33	45.50	0.50
6	4824.00	33.5 AV	54.0	-20.5	2.20 V	33	33.00	0.50

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	63.6 PK	74.0	-10.4	2.99 H	134	32.60	31.00
2	2390.00	48.8 AV	54.0	-5.2	2.99 H	134	17.80	31.00
3	*2437.00	111.9 PK			3.41 H	231	80.60	31.30
4	*2437.00	102.5 AV			3.41 H	231	71.20	31.30
5	2483.50	64.6 PK	74.0	-9.4	2.94 H	244	33.10	31.50
6	2483.50	49.4 AV	54.0	-4.6	2.94 H	244	17.90	31.50
7	4874.00	54.4 PK	74.0	-19.6	3.42 H	264	53.80	0.60
8	4874.00	41.2 AV	54.0	-12.8	3.42 H	264	40.60	0.60

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	70.0 PK	74.0	-4.0	1.29 V	332	39.00	31.00
2	2390.00	51.4 AV	54.0	-2.6	1.29 V	332	20.40	31.00
3	*2437.00	114.8 PK			1.26 V	353	83.50	31.30
4	*2437.00	105.4 AV			1.26 V	353	74.10	31.30
5	2483.50	69.0 PK	74.0	-5.0	2.36 V	346	37.50	31.50
6	2483.50	52.3 AV	54.0	-1.7	2.36 V	346	20.80	31.50
7	4874.00	51.5 PK	74.0	-22.5	2.28 V	0	50.90	0.60
8	4874.00	38.2 AV	54.0	-15.8	2.28 V	0	37.60	0.60

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	106.7 PK			2.64 H	128	75.30	31.40
2	*2462.00	96.8 AV			2.64 H	128	65.40	31.40
3	2483.50	67.0 PK	74.0	-7.0	1.43 H	100	35.50	31.50
4	2483.50	48.4 AV	54.0	-5.6	1.43 H	100	16.90	31.50
5	4924.00	46.6 PK	74.0	-27.4	2.06 H	199	46.00	0.60
6	4924.00	32.7 AV	54.0	-21.3	2.06 H	199	32.10	0.60

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	108.7 PK			1.88 V	349	77.30	31.40
2	*2462.00	99.3 AV			1.88 V	349	67.90	31.40
3	2483.50	72.2 PK	74.0	-1.8	1.58 V	340	40.70	31.50
4	2483.50	48.5 AV	54.0	-5.5	1.58 V	340	17.00	31.50
5	4924.00	45.9 PK	74.0	-28.1	2.19 V	11	45.30	0.60
6	4924.00	33.4 AV	54.0	-20.6	2.19 V	11	32.80	0.60

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 (HT40)

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	58.6 PK	74.0	-15.4	2.87 H	132	27.60	31.00
2	2390.00	47.1 AV	54.0	-6.9	2.87 H	132	16.10	31.00
3	*2422.00	98.1 PK			3.06 H	297	66.90	31.20
4	*2422.00	89.0 AV			3.06 H	297	57.80	31.20
5	4844.00	45.8 PK	74.0	-28.2	2.10 H	167	45.40	0.40
6	4844.00	33.1 AV	54.0	-20.9	2.10 H	167	32.70	0.40

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	68.8 PK	74.0	-5.2	1.54 V	348	37.80	31.00
2	2390.00	53.0 AV	54.0	-1.0	1.54 V	348	22.00	31.00
3	*2422.00	102.6 PK			1.74 V	350	71.40	31.20
4	*2422.00	92.9 AV			1.74 V	350	61.70	31.20
5	4844.00	46.3 PK	74.0	-27.7	2.29 V	23	45.90	0.40
6	4844.00	33.1 AV	54.0	-20.9	2.29 V	23	32.70	0.40

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. " * ": 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	59.8 PK	74.0	-14.2	2.99 H	140	28.80	31.00
2	2390.00	46.6 AV	54.0	-7.4	2.99 H	140	15.60	31.00
3	*2437.00	103.0 PK			3.52 H	232	71.70	31.30
4	*2437.00	93.7 AV			3.52 H	232	62.40	31.30
5	2483.50	57.6 PK	74.0	-16.4	2.90 H	245	26.10	31.50
6	2483.50	46.4 AV	54.0	-7.6	2.90 H	245	14.90	31.50
7	4874.00	46.9 PK	74.0	-27.1	2.73 H	280	46.30	0.60
8	4874.00	34.5 AV	54.0	-19.5	2.73 H	280	33.90	0.60

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	70.6 PK	74.0	-3.4	1.42 V	349	39.60	31.00
2	2390.00	53.0 AV	54.0	-1.0	1.42 V	349	22.00	31.00
3	*2437.00	106.1 PK			1.49 V	7	74.80	31.30
4	*2437.00	96.7 AV			1.49 V	7	65.40	31.30
5	2483.50	71.6 PK	74.0	-2.4	1.43 V	352	40.10	31.50
6	2483.50	52.2 AV	54.0	-1.8	1.43 V	352	20.70	31.50
7	4874.00	47.2 PK	74.0	-26.8	2.44 V	177	46.60	0.60
8	4874.00	33.7 AV	54.0	-20.3	2.44 V	177	33.10	0.60

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	101.0 PK			2.82 H	257	69.60	31.40
2	*2452.00	92.5 AV			2.82 H	257	61.10	31.40
3	2483.50	62.1 PK	74.0	-11.9	2.77 H	333	30.60	31.50
4	2483.50	48.1 AV	54.0	-5.9	2.77 H	333	16.60	31.50
5	4904.00	46.0 PK	74.0	-28.0	2.00 H	180	45.50	0.50
6	4904.00	33.5 AV	54.0	-20.5	2.00 H	180	33.00	0.50

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	105.4 PK			1.45 V	357	74.00	31.40
2	*2452.00	95.5 AV			1.45 V	357	64.10	31.40
3	2483.50	69.8 PK	74.0	-4.2	1.80 V	360	38.30	31.50
4	2483.50	52.5 AV	54.0	-1.5	1.80 V	360	21.00	31.50
5	4904.00	46.8 PK	74.0	-27.2	1.82 V	288	46.30	0.50
6	4904.00	35.6 AV	54.0	-18.4	1.82 V	288	35.10	0.50

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 Worst-case Data: 802.11b

CHANNEL	TX Channel 6	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	43.51	29.9 QP	40.0	-10.1	1.01 H	143	44.50	-14.60
2	171.83	30.4 QP	43.5	-13.1	1.50 H	93	44.40	-14.00
3	249.60	32.4 QP	46.0	-13.6	1.01 H	117	46.30	-13.90
4	348.76	33.3 QP	46.0	-12.7	1.01 H	216	44.50	-11.20
5	500.42	32.9 QP	46.0	-13.1	1.50 H	181	40.70	-7.80
6	900.94	37.7 QP	46.0	-8.3	1.50 H	152	37.30	0.40

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	35.73	36.7 QP	40.0	-3.3	1.49 V	16	52.40	-15.70
2	53.23	37.7 QP	40.0	-2.3	1.01 V	336	51.90	-14.20
3	146.56	27.9 QP	43.5	-15.6	1.01 V	303	41.80	-13.90
4	348.76	33.1 QP	46.0	-12.9	1.49 V	208	44.30	-11.20
5	624.85	35.6 QP	46.0	-10.4	1.49 V	174	40.40	-4.80
6	900.94	36.1 QP	46.0	-9.9	1.49 V	159	35.70	0.40

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

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

Tested date: Feb. 16, 2017

Description & Manufacturer	Model No.	Serial No.	Date Of Calibration	Due Date Of Calibration
Test Receiver ROHDE & SCHWARZ	ESCI	100613	Nov. 21, 2016	Nov. 20, 2017
RF signal cable Woken	5D-FB	Cable-cond1-01	Dec. 22, 2016	Dec. 21, 2017
LISN ROHDE & SCHWARZ (EUT)	ESH3-Z5	835239/001	Feb. 26, 2016	Feb. 25, 2017
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Jul. 28, 2016	Jul. 27, 2017
Software ADT	BV ADT_Cond_ V7.3.7.3	NA	NA	NA

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

2. The test was performed in HwaYa Shielded Room 1.

3. The VCCI Site Registration No. is C-2040.

4.2.3 Test Procedures

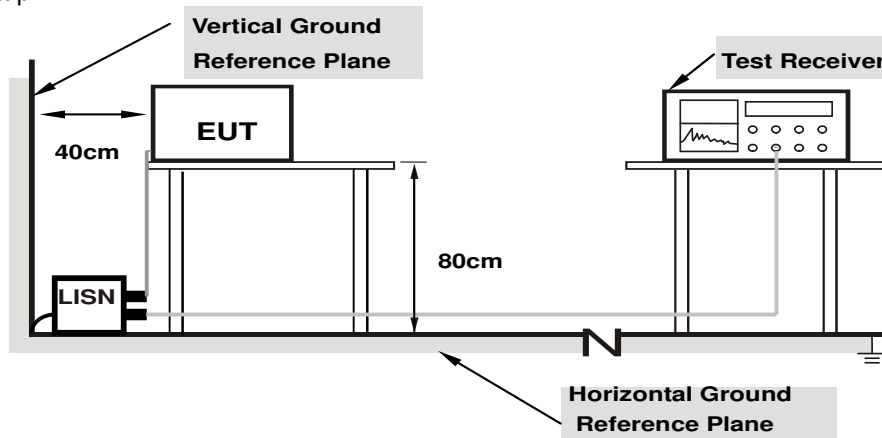
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance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

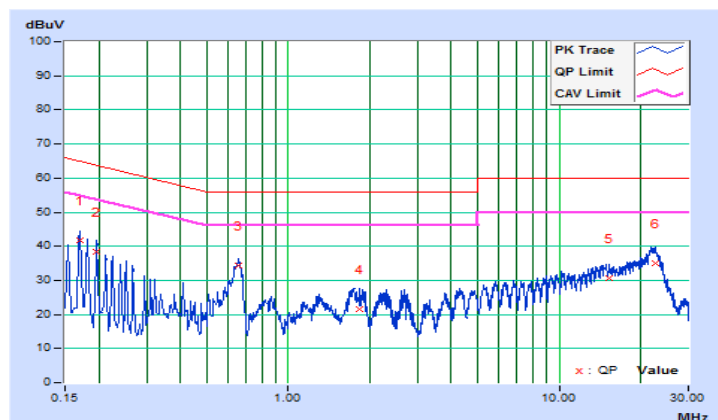
4.2.7 Test Results

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

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
	1	0.16955	10.18	31.41	11.12	41.59	21.30	64.98	54.98	-23.39
2	0.19692	10.19	28.17	8.89	38.36	19.08	63.74	53.74	-25.38	-34.66
3	0.65560	10.24	24.10	17.05	34.34	27.29	56.00	46.00	-21.66	-18.71
4	1.84303	10.34	11.13	4.64	21.47	14.98	56.00	46.00	-34.53	-31.02
5	15.26606	11.14	19.66	12.06	30.80	23.20	60.00	50.00	-29.20	-26.80
6	22.64032	11.65	23.38	15.67	35.03	27.32	60.00	50.00	-24.97	-22.68

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.

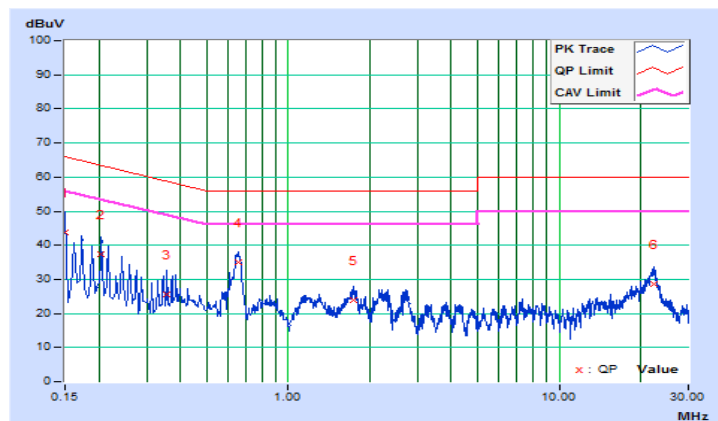


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
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No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
	[MHz]		[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	10.18	33.70	13.67	43.88	23.85	66.00	56.00	-22.12	-32.15
2	0.20474	10.19	27.10	10.17	37.29	20.36	63.42	53.42	-26.13	-33.06
3	0.35723	10.27	15.34	5.04	25.61	15.31	58.79	48.79	-33.18	-33.48
4	0.65439	10.28	24.71	17.61	34.99	27.89	56.00	46.00	-21.01	-18.11
5	1.75310	10.35	13.43	6.47	23.78	16.82	56.00	46.00	-32.22	-29.18
6	22.37835	11.81	16.89	9.62	28.70	21.43	60.00	50.00	-31.30	-28.57

REMARKS:

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

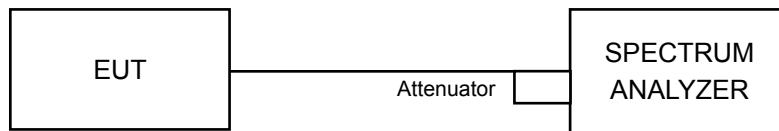


4.3 6dB Bandwidth Measurement

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	10.13	10.14	0.5	PASS
6	2437	10.12	10.11	0.5	PASS
11	2462	10.12	10.12	0.5	PASS

802.11g

Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
1	2412	16.41	16.41	0.5	PASS
6	2437	16.38	16.39	0.5	PASS
11	2462	16.40	16.40	0.5	PASS

802.11n (HT20)

Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
1	2412	17.64	17.61	0.5	PASS
6	2437	17.56	17.57	0.5	PASS
11	2462	17.61	17.62	0.5	PASS

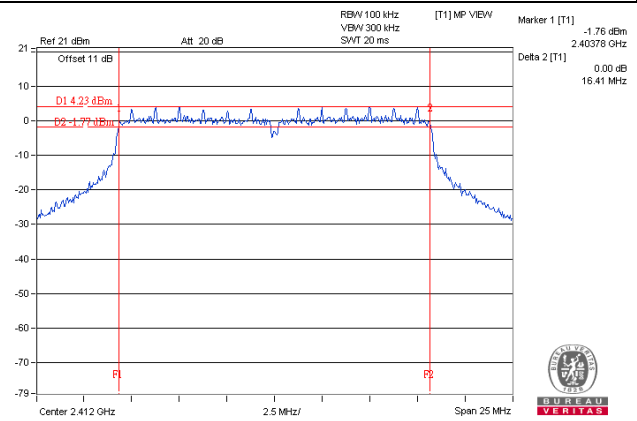
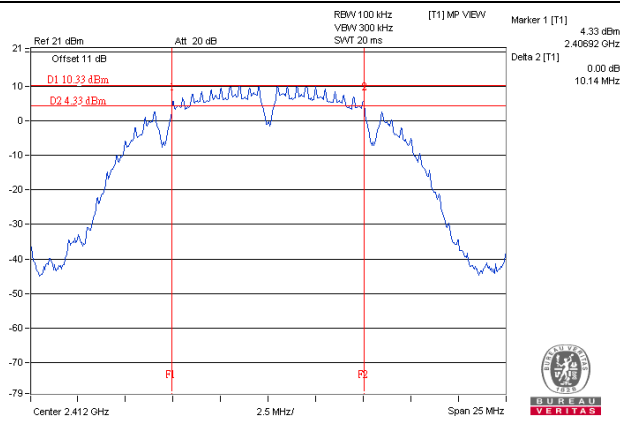
802.11n (HT40)

Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
3	2422	36.17	36.42	0.5	PASS
6	2437	36.35	36.35	0.5	PASS
9	2452	36.37	36.37	0.5	PASS

Spectrum Plot of Worst Value

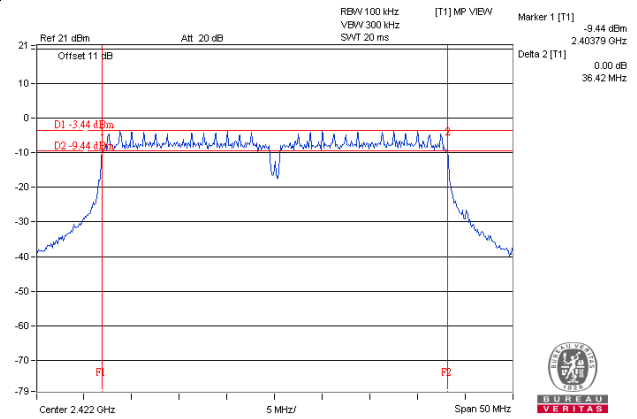
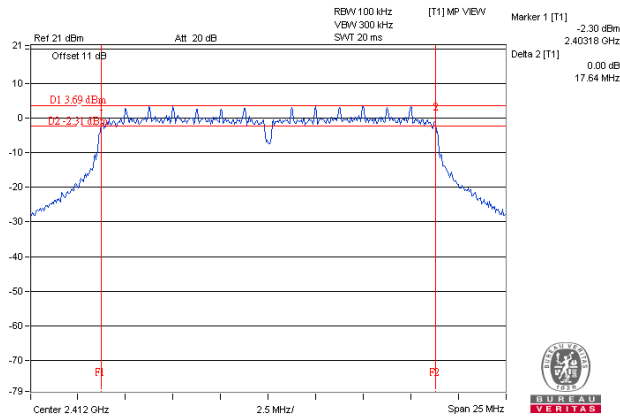
802.11b

802.11g



802.11n (HT20)

802.11n (HT40)



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,

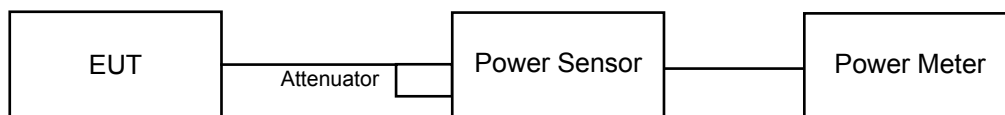
Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;

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

An average power sensor was used on the output port of the EUT. A power meter was used to read the response of the 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 AVERAGE POWER

802.11b

Chan.	Freq. (MHz)	Avg. Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	20.02	20.34	208.605	23.19	30	Pass
6	2437	22.04	22.22	326.681	25.14	30	Pass
11	2462	21.12	20.76	248.544	23.95	30	Pass

802.11g

Chan.	Freq. (MHz)	Avg. Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	16.03	16.21	81.870	19.13	30	Pass
6	2437	21.93	21.94	312.270	24.95	30	Pass
11	2462	15.73	15.69	74.479	18.72	30	Pass

802.11n (HT20)

Chan.	Freq. (MHz)	Avg. Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	15.40	15.33	68.793	18.38	30	Pass
6	2437	21.81	22.09	313.513	24.96	30	Pass
11	2462	15.76	15.71	74.909	18.75	30	Pass

802.11n (HT40)

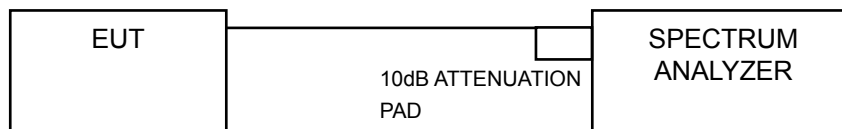
Chan.	Freq. (MHz)	Avg. Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
3	2422	11.12	11.01	25.560	14.08	30	Pass
6	2437	15.70	15.81	75.261	18.77	30	Pass
9	2452	15.04	15.26	65.489	18.16	30	Pass

4.5 Power Spectral Density Measurement

4.5.1 Limits of Power Spectral Density Measurement

The Maximum of Power Spectral Density Measurement is 8dBm.

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 duty cycle $\geq 98\%$

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

For duty cycle $< 98\%$

- a. Measure the duty cycle (x).
- b. Set instrument center frequency to DTS channel center frequency.
- c. Set span to at least 1.5 times the OBW.
- d. Set RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- e. Set VBW $\geq 3 \times \text{RBW}$.
- f. Detector = power averaging (RMS) or sample detector (when RMS not available).
- g. Ensure that the number of measurement points in the sweep $\geq 2 \times \text{span}/\text{RBW}$.
- h. Sweep time = auto couple.
- i. Do not use sweep triggering. Allow sweep to "free run".
- j. Employ trace averaging (RMS) mode over a minimum of 100 traces.
- k. Use the peak marker function to determine the maximum amplitude level.
- l. 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/3kHz)	Pass /Fail
0	1	2412	-9.59	3.01	-6.58	7.05	Pass
	6	2437	-7.84	3.01	-4.83	7.05	Pass
	11	2462	-8.40	3.01	-5.39	7.05	Pass
1	1	2412	-9.37	3.01	-6.36	7.05	Pass
	6	2437	-7.30	3.01	-4.29	7.05	Pass
	11	2462	-8.77	3.01	-5.76	7.05	Pass

NOTE: Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2/2] = 6.95 \text{ dBi} > 6\text{dBi}$, so the power density limit shall be reduced to $8 - (6.95 - 6) = 7.05\text{dBm}$.

802.11g

TX chain	Channel	Freq. (MHz)	PSD (dBm/10kHz)	10 log (N=2) dB	Duty Factor (dB)	Total PSD with Duty Factor (dBm/10kHz)	Limit (dBm/3kHz)	Pass /Fail
0	1	2412	-13.69	3.01	0.14	-10.54	7.05	Pass
	6	2437	-9.70	3.01	0.14	-6.55	7.05	Pass
	11	2462	-16.20	3.01	0.14	-13.05	7.05	Pass
1	1	2412	-15.37	3.01	0.14	-12.22	7.05	Pass
	6	2437	-9.95	3.01	0.14	-6.80	7.05	Pass
	11	2462	-16.20	3.01	0.14	-13.05	7.05	Pass

NOTE:

- Method 1 of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
- Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2/2] = 6.95 \text{ dBi} > 6\text{dBi}$, so the power density limit shall be reduced to $8 - (6.95 - 6) = 7.05\text{dBm}$.
- Refer to section 3.3 for duty cycle spectrum plot.

802.11n (HT20)

TX chain	Channel	Freq. (MHz)	PSD (dBm/10kHz)	10 log (N=2) dB	Duty Factor (dB)	Total PSD with Duty Factor (dBm/10kHz)	Limit (dBm/3kHz)	Pass /Fail
0	1	2412	-16.38	3.01	0.13	-13.24	7.05	Pass
	6	2437	-10.50	3.01	0.13	-7.36	7.05	Pass
	11	2462	-16.65	3.01	0.13	-13.51	7.05	Pass
1	1	2412	-16.47	3.01	0.13	-13.33	7.05	Pass
	6	2437	-9.94	3.01	0.13	-6.80	7.05	Pass
	11	2462	-16.93	3.01	0.13	-13.79	7.05	Pass

NOTE:

- Method 1 of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
- Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2/2] = 6.95 \text{ dBi} > 6 \text{ dBi}$, so the power density limit shall be reduced to $8 - (6.95 - 6) = 7.05 \text{ dBm}$.
- Refer to section 3.3 for duty cycle spectrum plot.

802.11n (HT40)

TX chain	Channel	Freq. (MHz)	PSD (dBm/10kHz)	10 log (N=2) dB	Duty Factor (dB)	Total PSD with Duty Factor (dBm/10kHz)	Limit (dBm/3kHz)	Pass /Fail
0	3	2422	-20.40	3.01	0.29	-17.10	7.05	Pass
	6	2437	-19.51	3.01	0.29	-16.21	7.05	Pass
	9	2452	-19.85	3.01	0.29	-16.55	7.05	Pass
1	3	2422	-24.21	3.01	0.29	-20.91	7.05	Pass
	6	2437	-19.20	3.01	0.29	-15.90	7.05	Pass
	9	2452	-20.01	3.01	0.29	-16.71	7.05	Pass

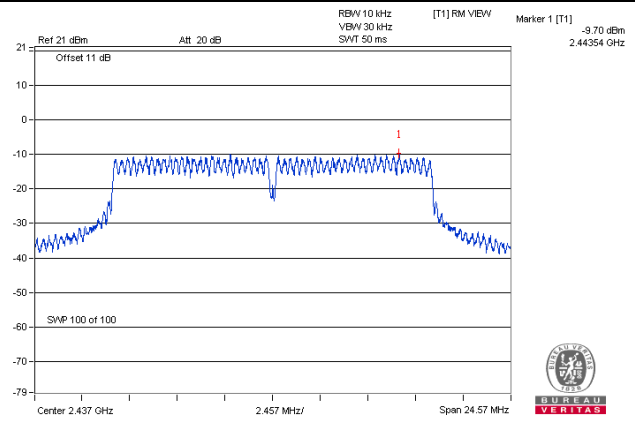
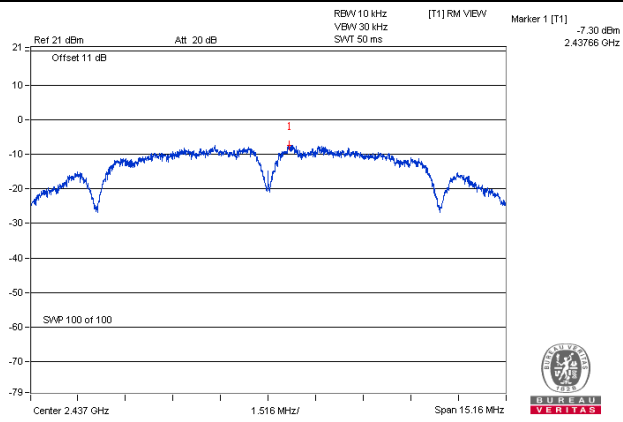
NOTE:

- Method 1 of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
- Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2/2] = 6.95 \text{ dBi} > 6 \text{ dBi}$, so the power density limit shall be reduced to $8 - (6.95 - 6) = 7.05 \text{ dBm}$.
- Refer to section 3.3 for duty cycle spectrum plot.

Spectrum Plot of Worst Value

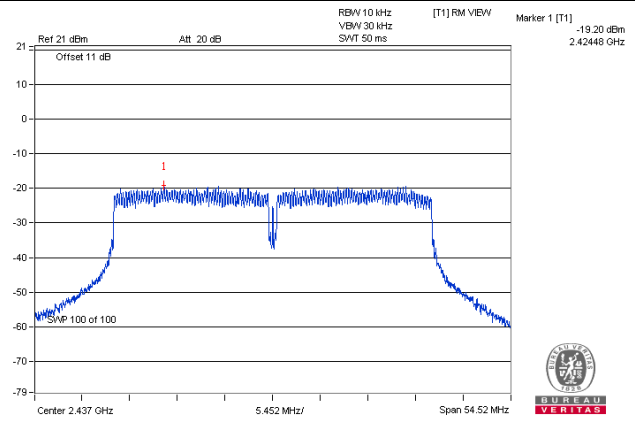
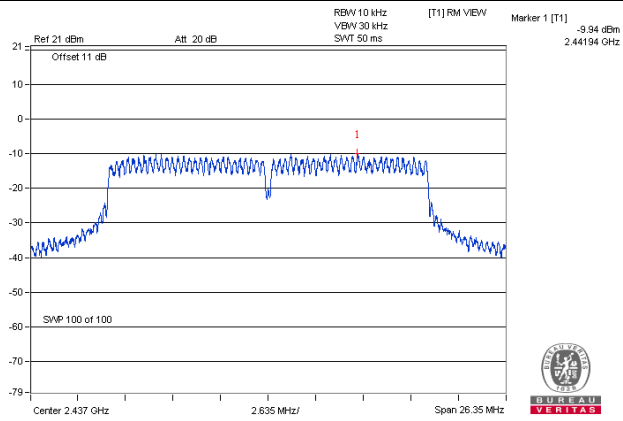
802.11b

802.11g



802.11n (HT20)

802.11n (HT40)

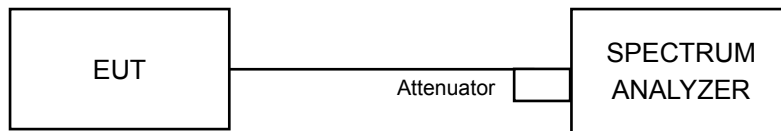


4.6 Conducted Out of Band Emission Measurement

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

- Set the RBW = 100 kHz.
- Set the VBW \geq 300 kHz.
- Detector = average.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

MEASUREMENT PROCEDURE OOB

- Set RBW = 100 kHz.
- Set VBW \geq 300 kHz.
- Ensure that the number of measurement points \geq span/RBW
- According to measurement points to set differ measurement span.
- Detector = average.
- Trace Mode = max hold.
- Sweep = auto couple.

4.6.5 Deviation from Test Standard

No deviation.

4.6.6 EUT Operating Condition

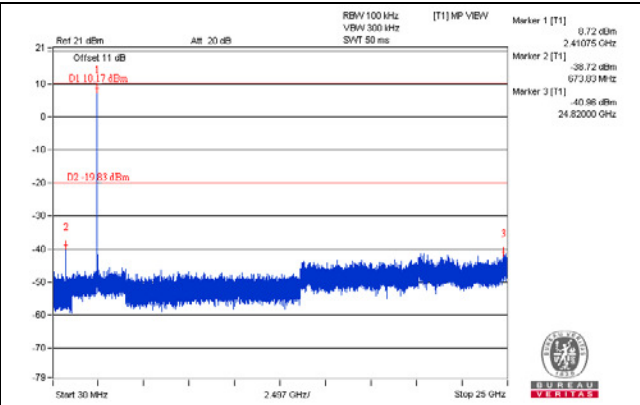
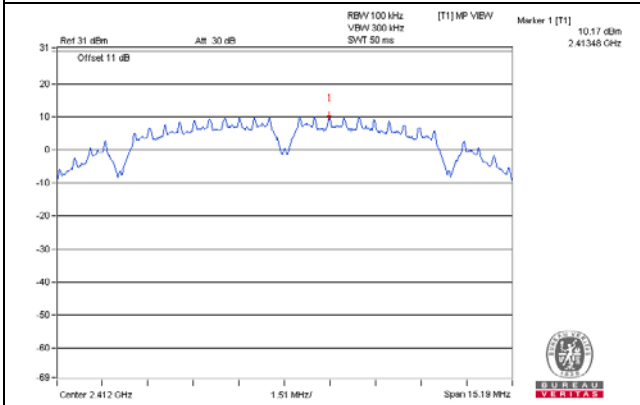
Same as Item 4.3.6

4.6.7 Test Results

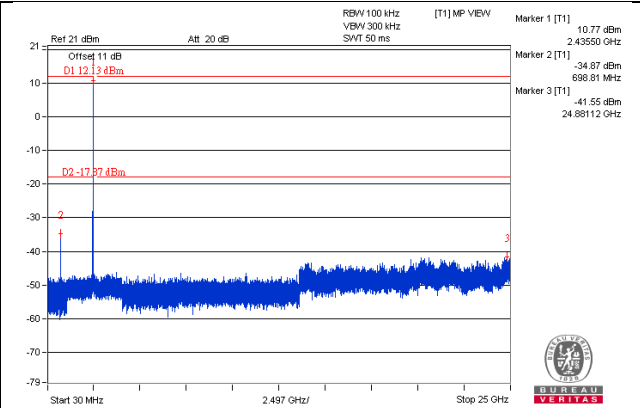
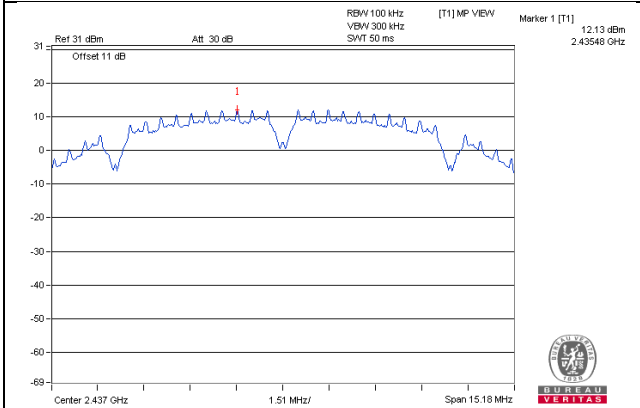
The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 30dB offset below D1. It shows compliance with the requirement.

**802.11b
CHAIN 0**

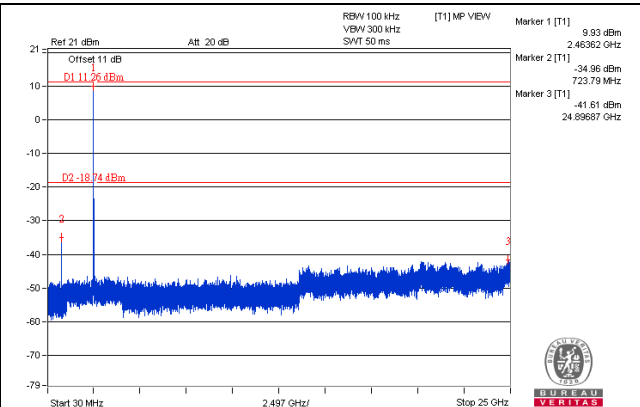
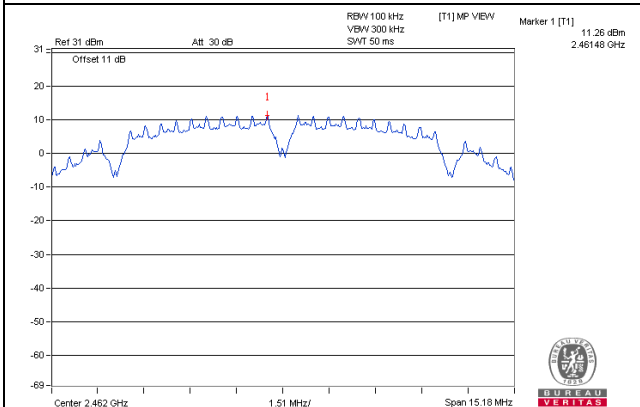
CH 1



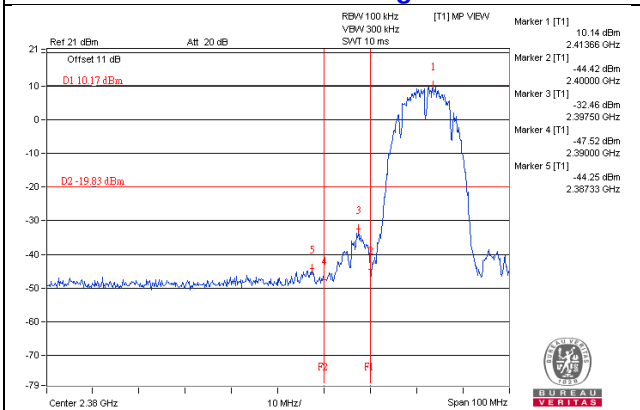
CH 6



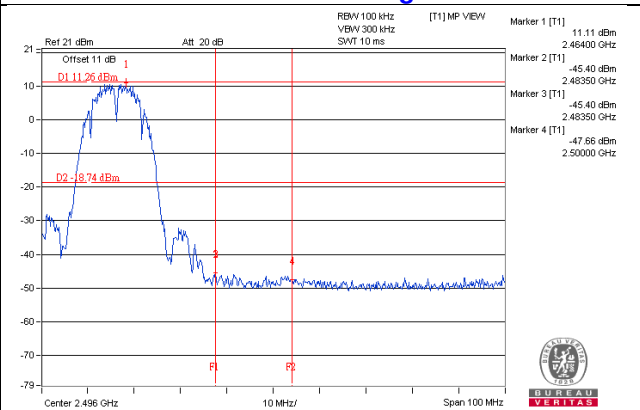
CH 11



CH 1 Band edge

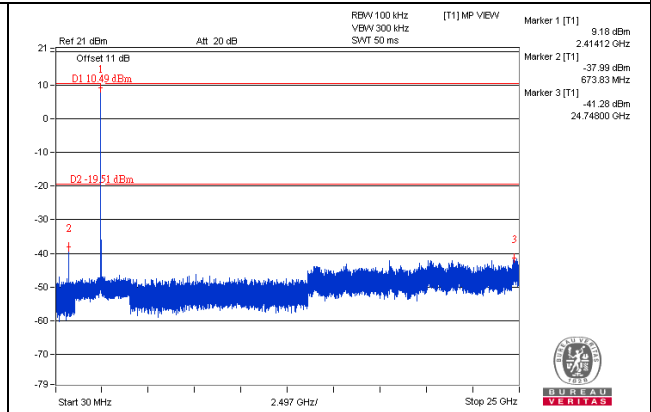
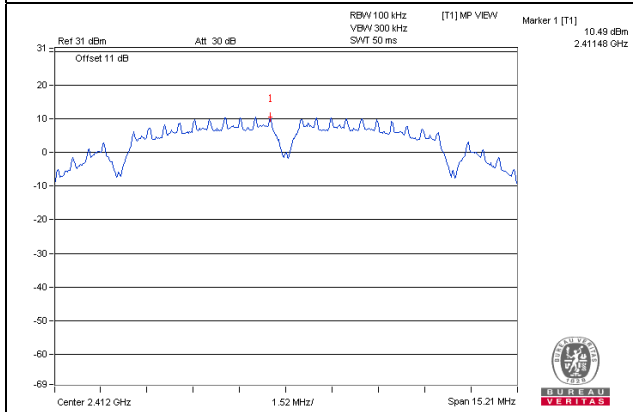


CH 11 Band edge

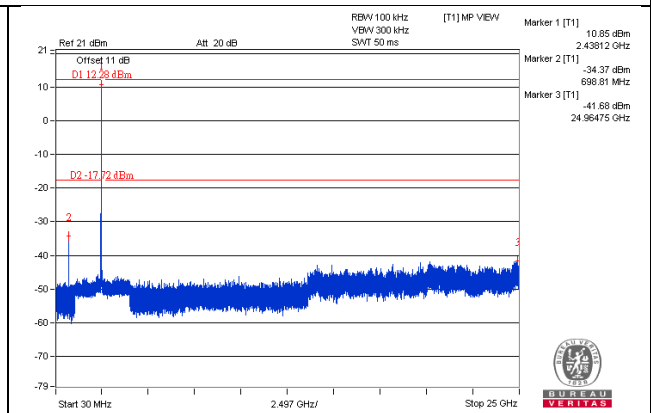
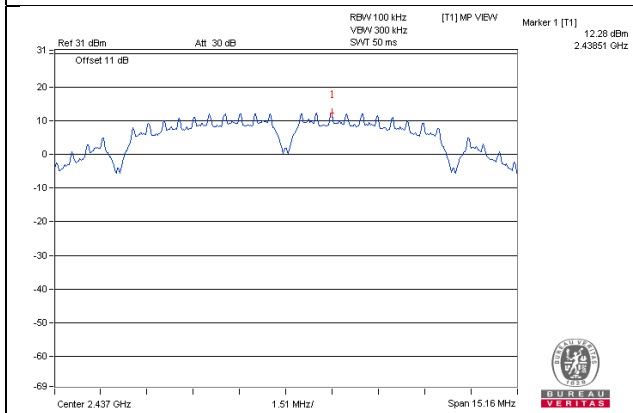


CHAIN 1

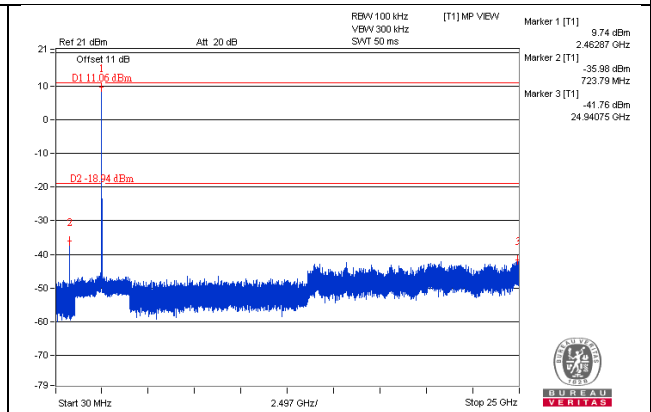
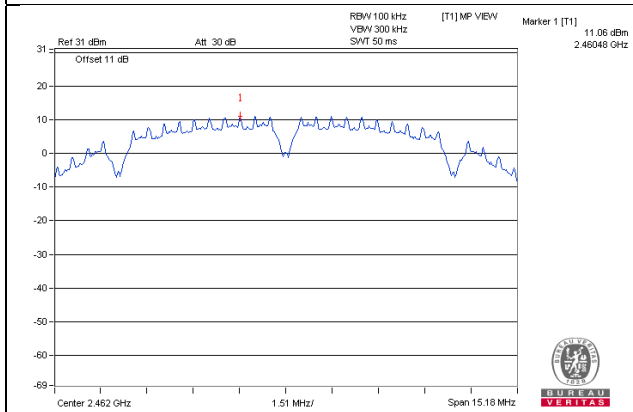
CH 1



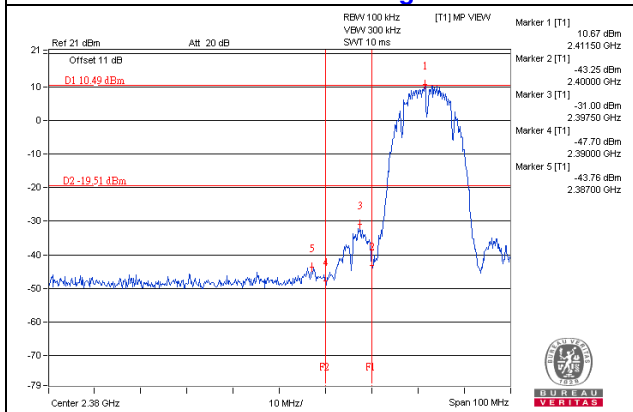
CH 6



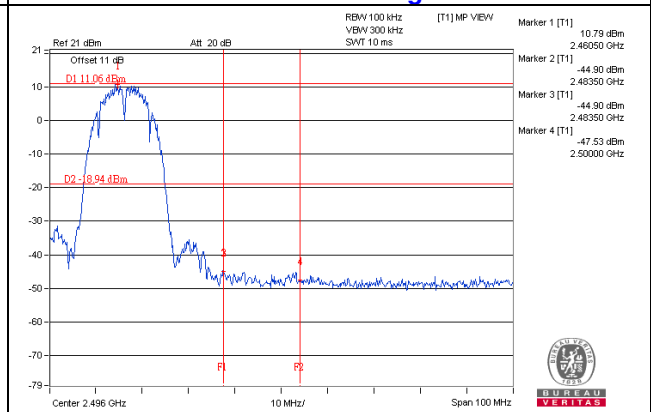
CH 11



CH 1 Band edge

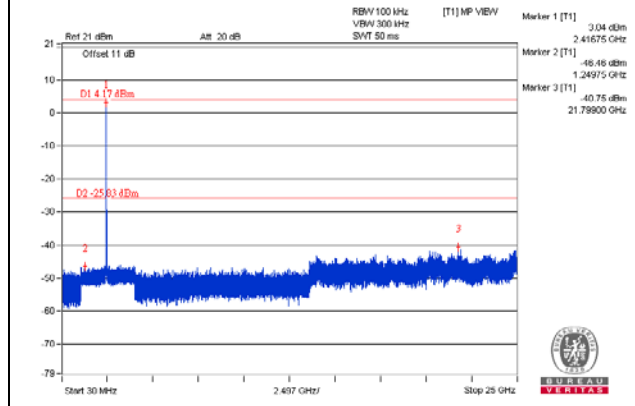
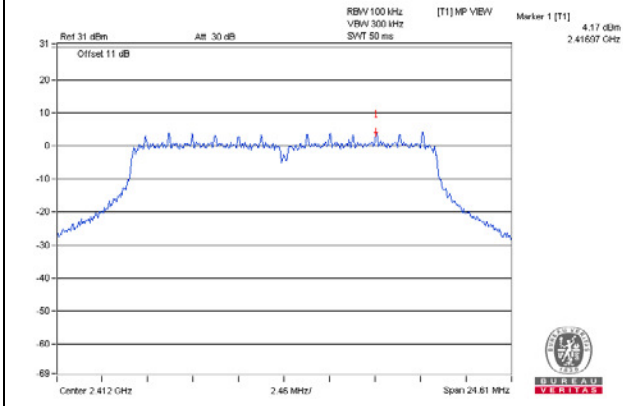


CH 11 Band edge

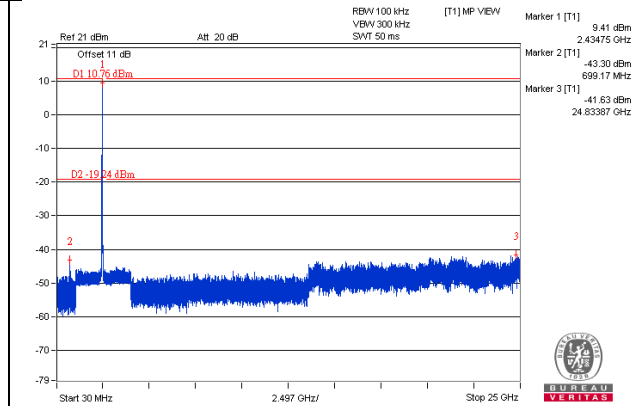
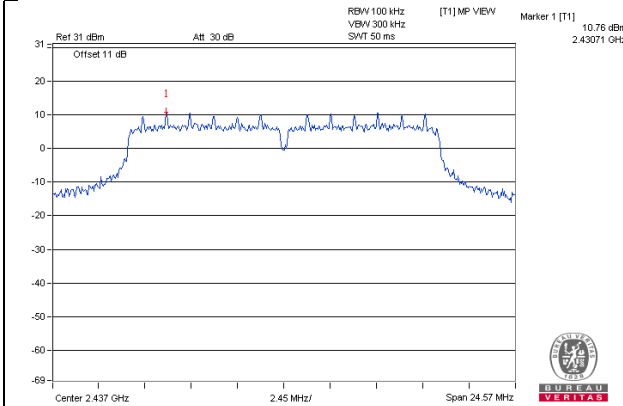


802.11g
CHAIN 0

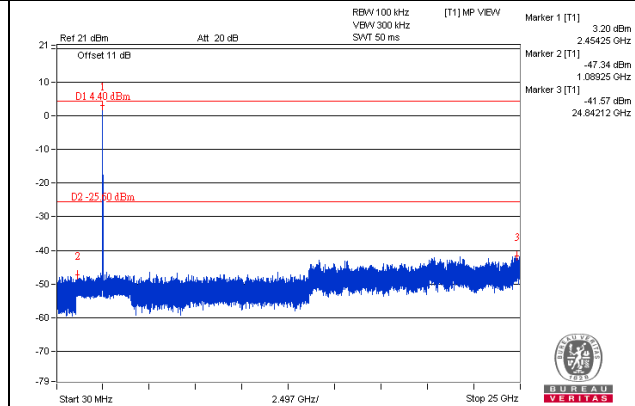
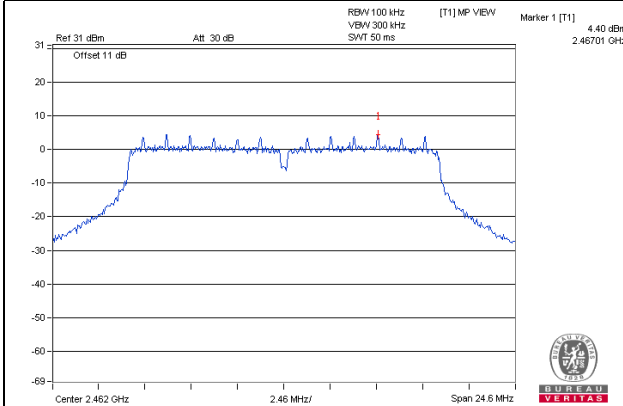
CH 1



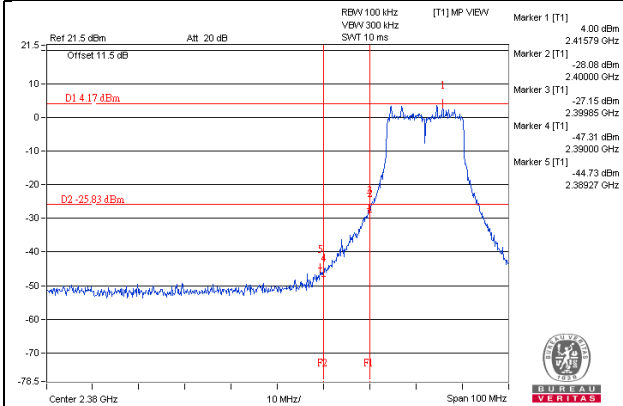
CH 6



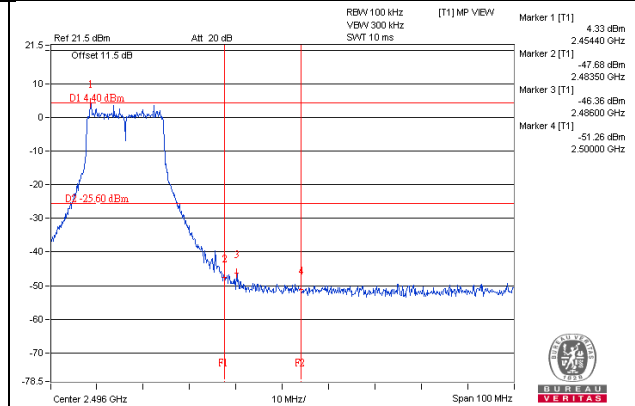
CH 11



CH 1 Band edge

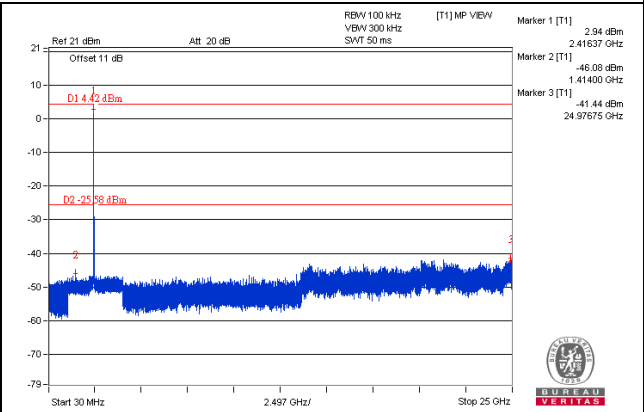
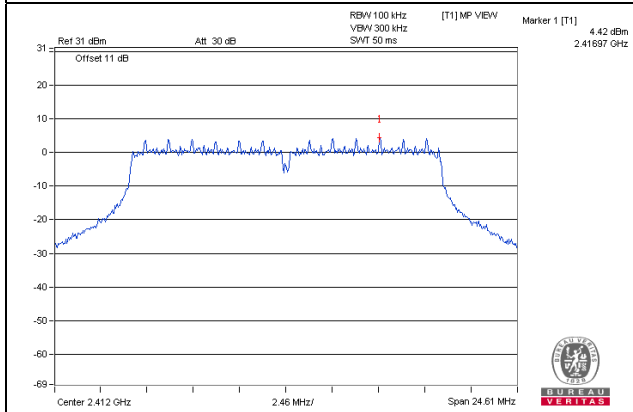


CH 11 Band edge

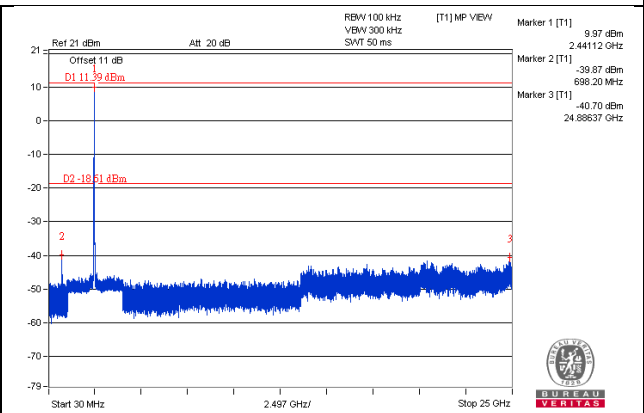
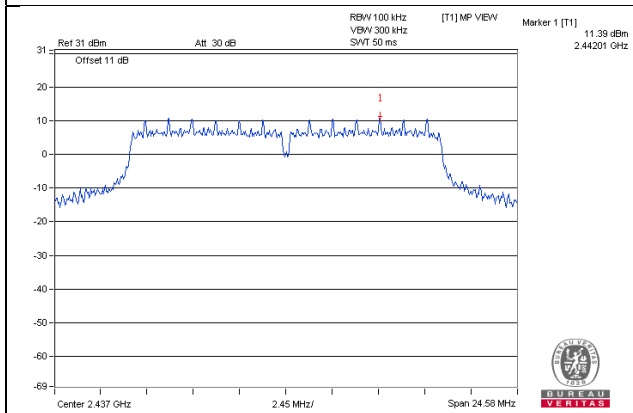


CHAIN 1

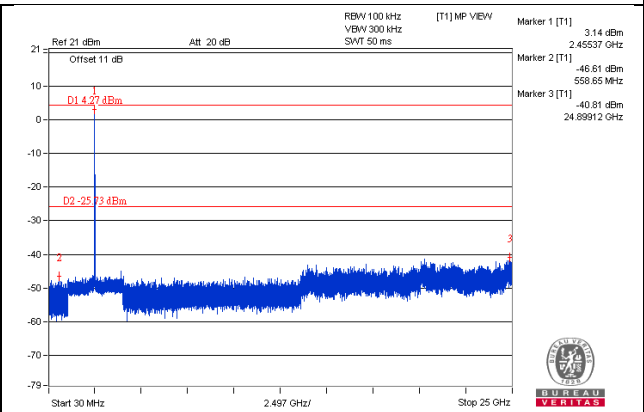
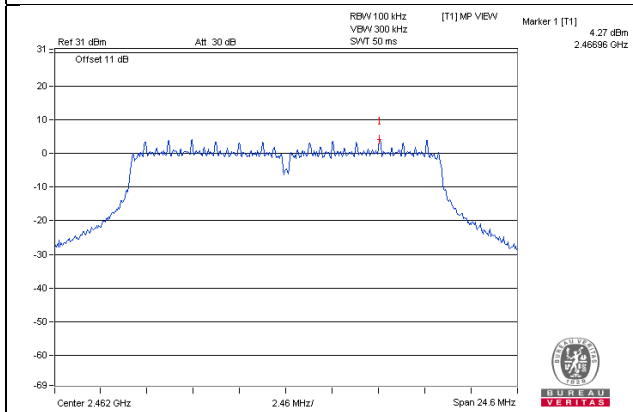
CH 1



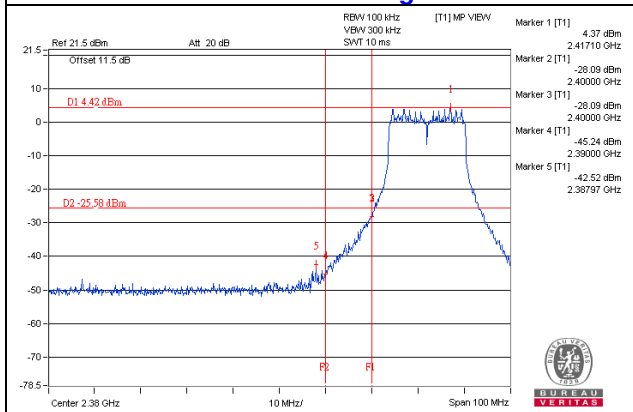
CH 6



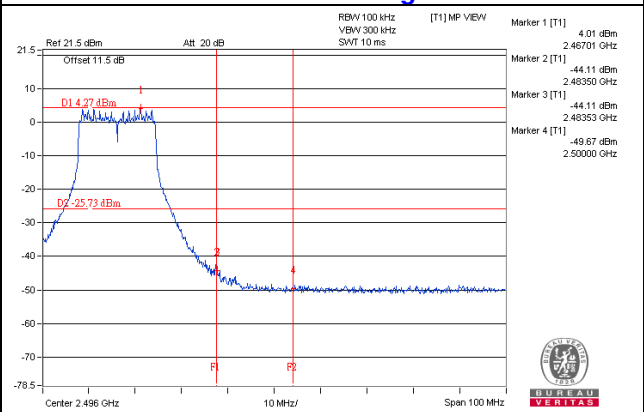
CH 11



CH 1 Band edge

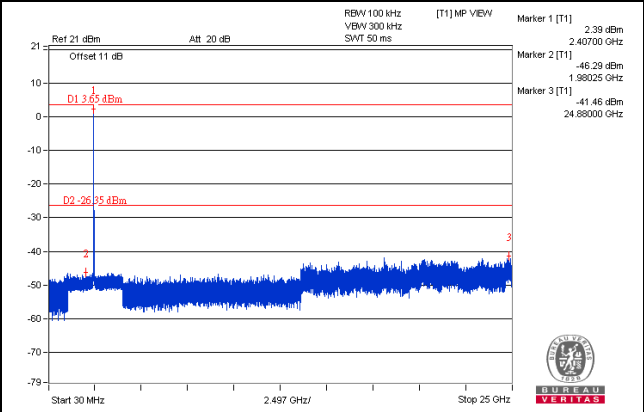
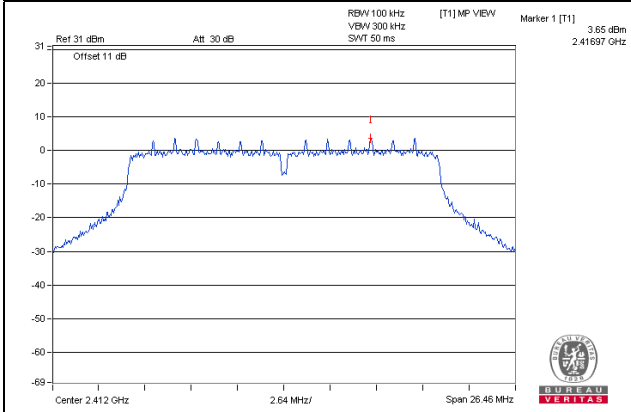


CH 11 Band edge

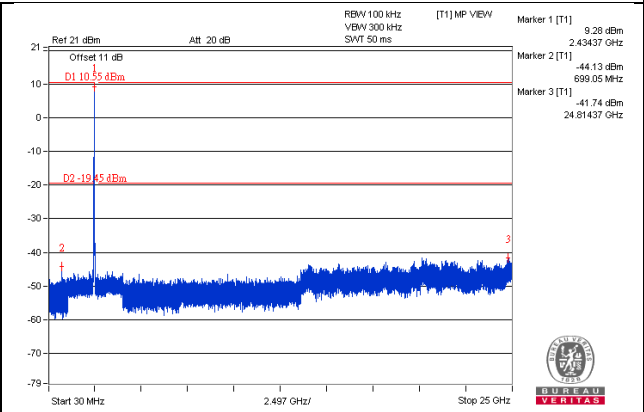
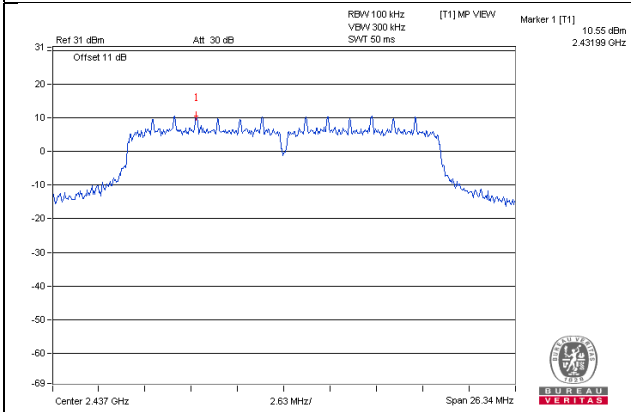


802.11n (HT20) CHAIN 0

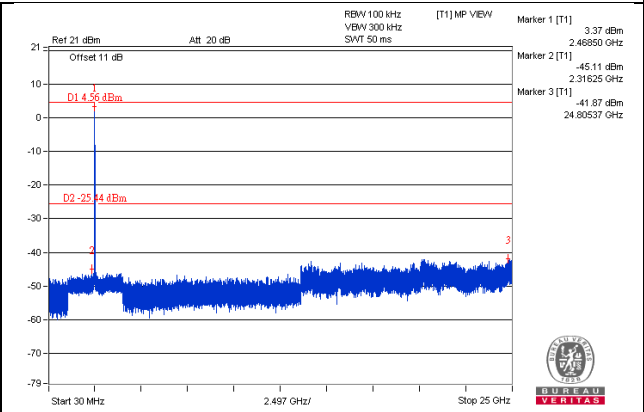
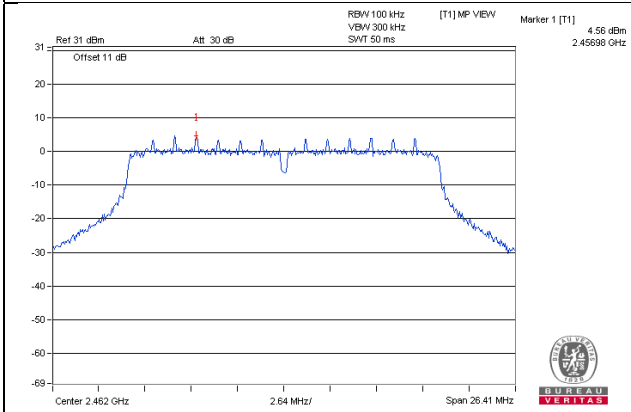
CH 1



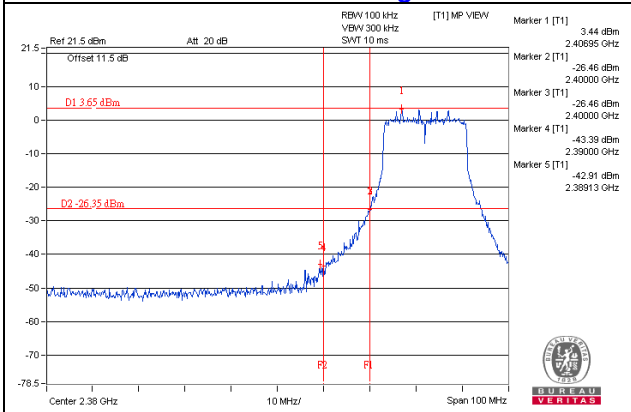
CH 6



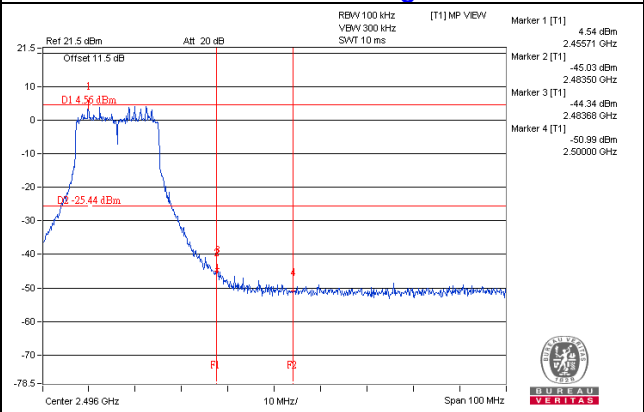
CH 11



CH 1 Band edge

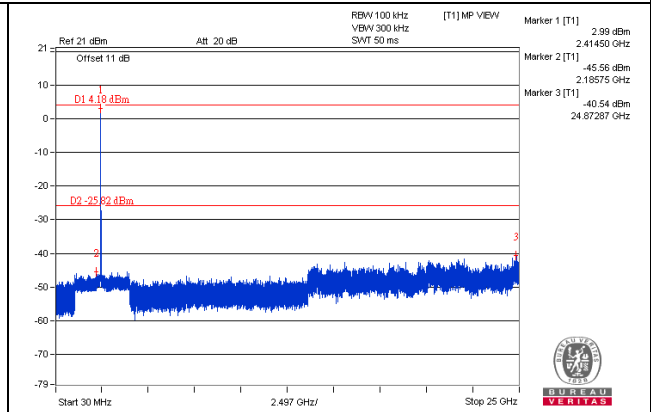
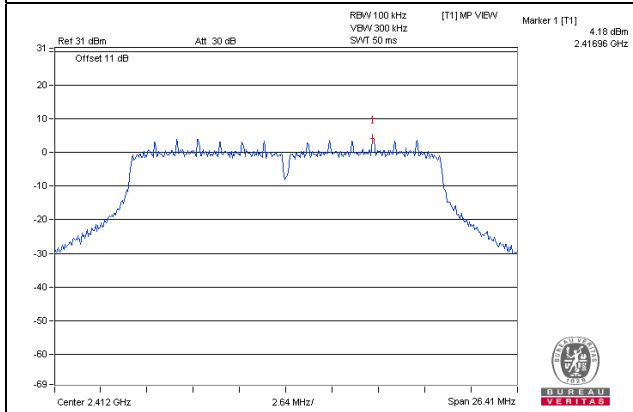


CH 11 Band edge

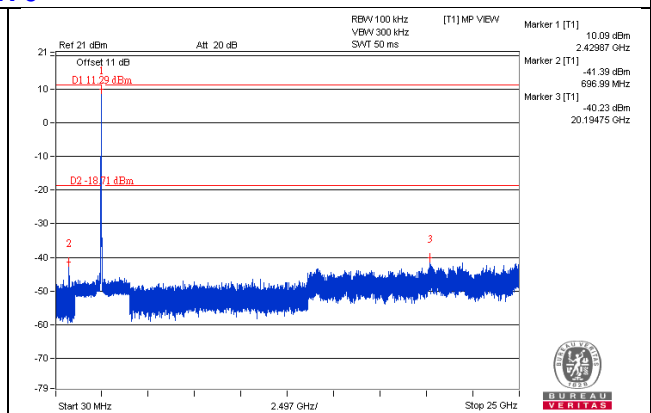
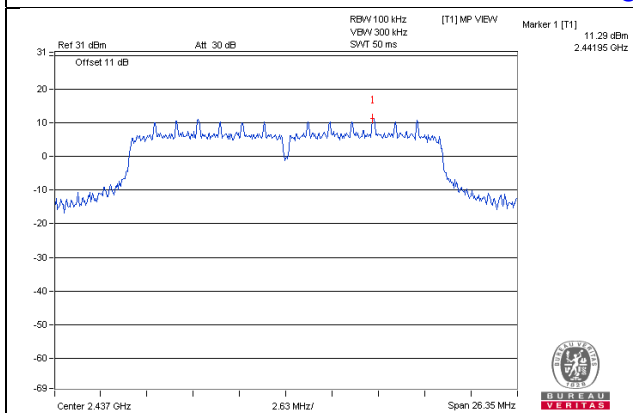


CHAIN 1

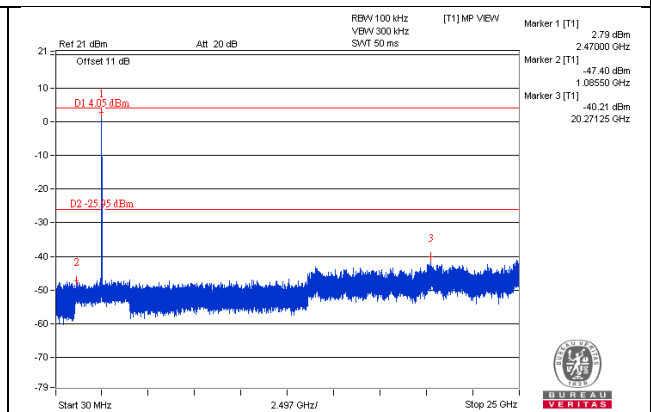
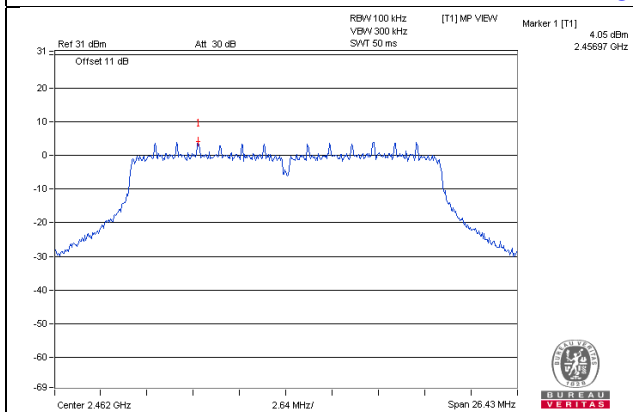
CH 1



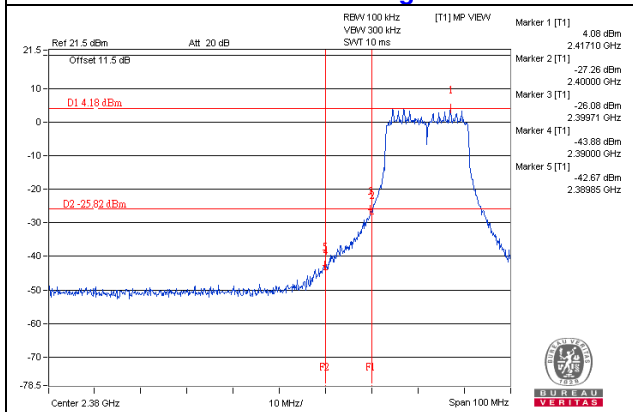
CH 6



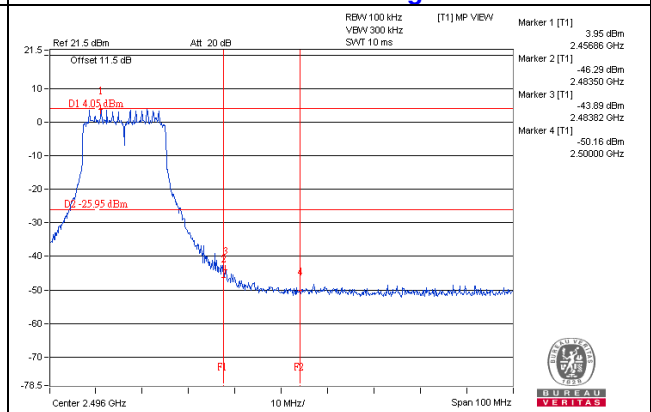
CH 11



CH 1 Band edge

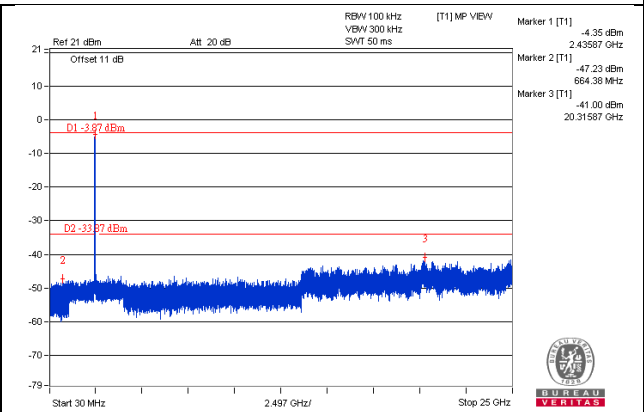
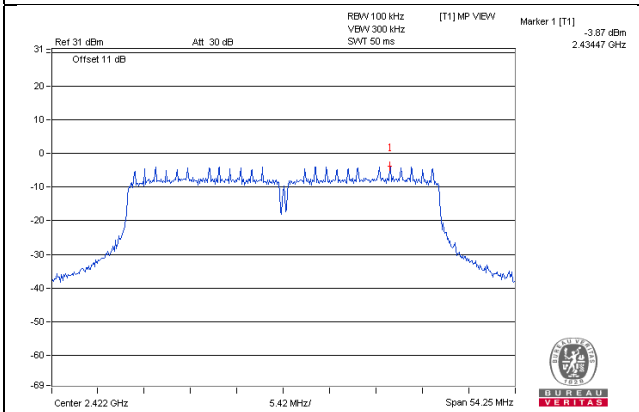


CH 11 Band edge

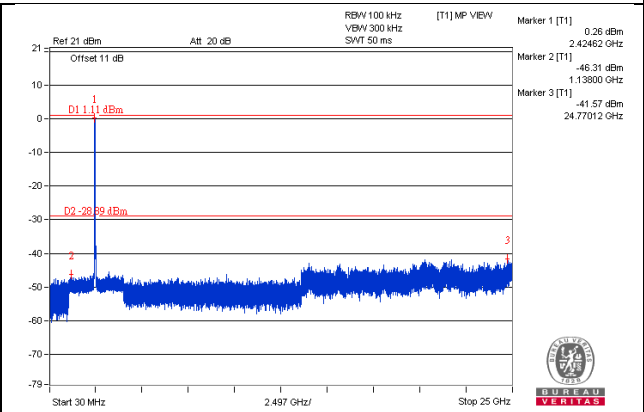
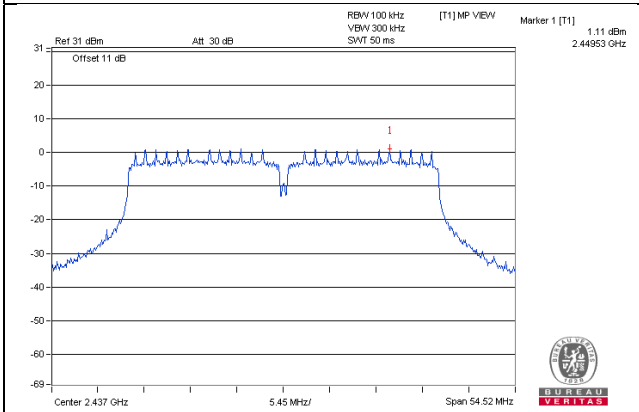


802.11n (HT40)
CHAIN 0

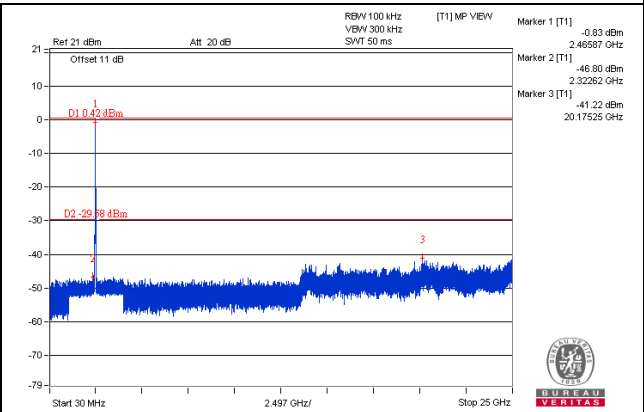
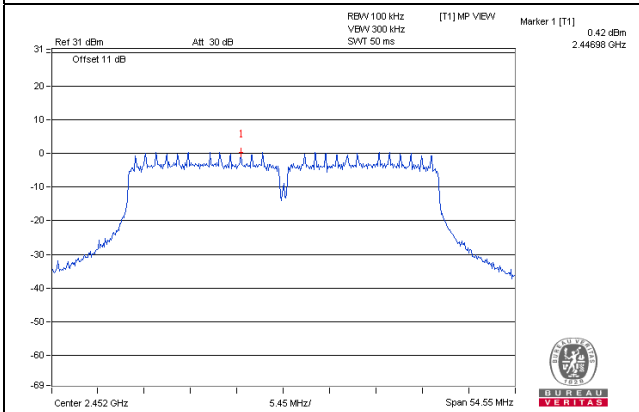
CH 3



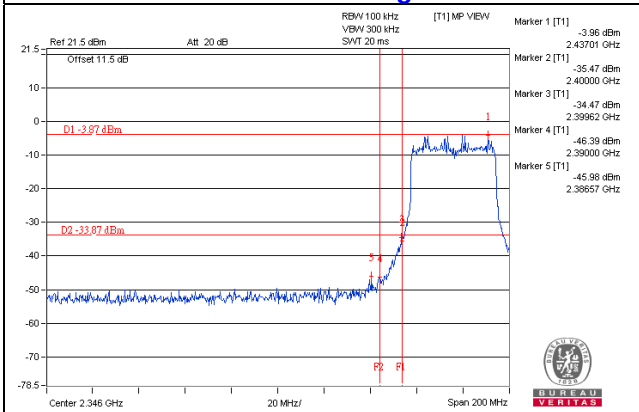
CH 6



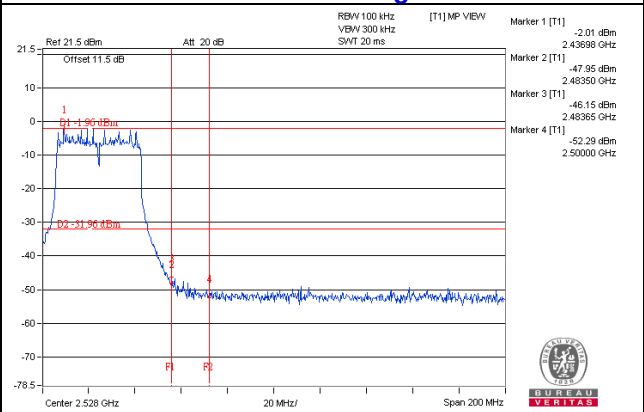
CH 9



CH 3 Band edge

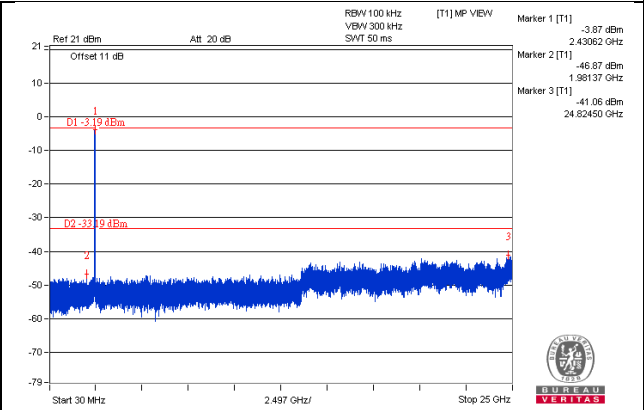
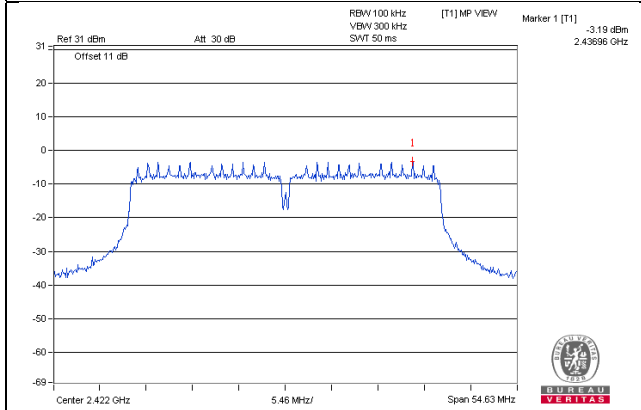


CH 9 Band edge

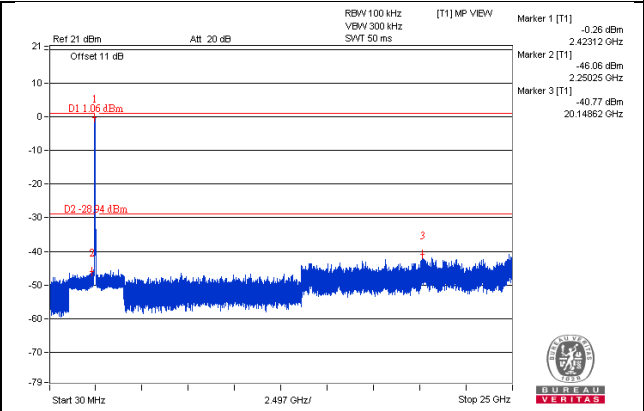
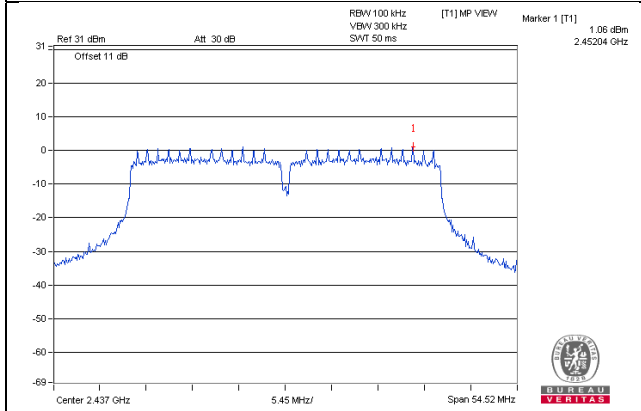


CHAIN 1

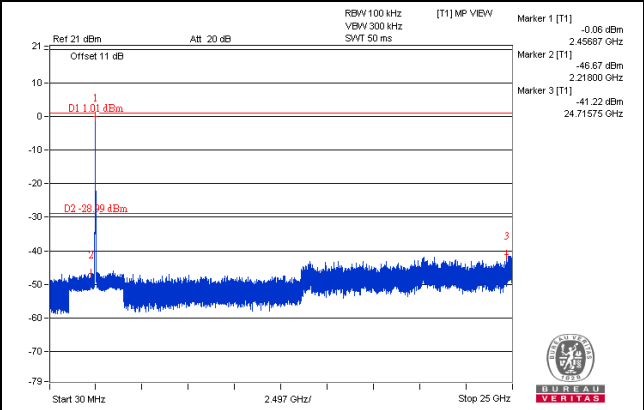
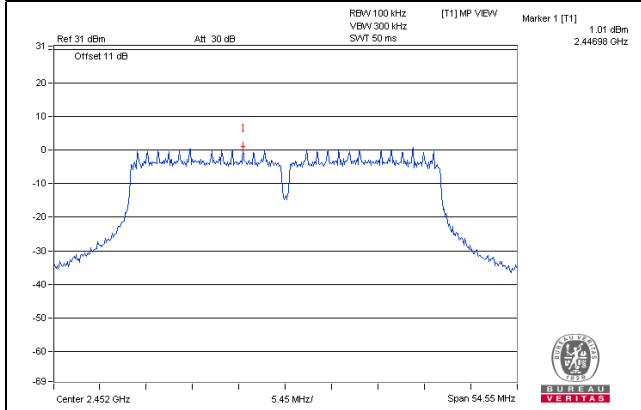
CH 3



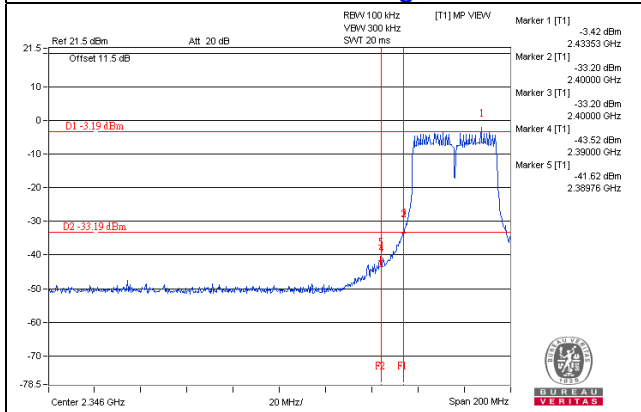
CH 6



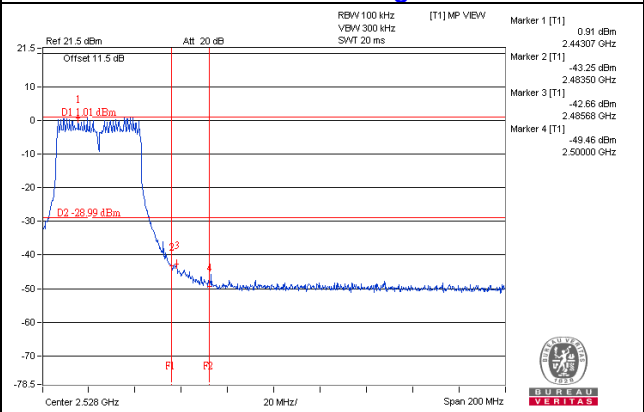
CH 9



CH 3 Band edge



CH 9 Band edge



5 Pictures of Test Arrangements

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

Appendix – Information on the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved 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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