



SPORTON International Inc.

No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.
Ph: 886-3-327-3456 / FAX: 886-3-327-0973 / www.sporton.com.tw

FCC RADIO TEST REPORT

Applicant's company	CyberTAN Technology Inc.
Applicant Address	No. 99, Park Avenue III, Science-based Industrial Park, Hsinchu, 308 Taiwan
FCC ID	N89-WD114
Manufacturer's company	CyberTAN Technology Inc.
Manufacturer Address	No. 99, Park Avenue III, Science-based Industrial Park, Hsinchu, 308 Taiwan

Product Name	Smart Control Module
Brand Name	CyberTAN
Model No.	WD114
Test Rule	47 CFR FCC Part 15 Subpart C § 15.247
Test Freq. Range	2400 ~ 2483.5MHz
Received Date	Feb. 17, 2016
Final Test Date	Mar. 08, 2016
Submission Type	Class II Change

Statement

Test result included in this report is for the IEEE 802.11n and IEEE 802.11b/g of the product.

The test result in this report refers exclusively to the presented test model / sample.

Without written approval of SPORTON International Inc., the test report shall not be reproduced except in full.

The measurements and test results shown in this test report were made in accordance with the procedures and found in compliance with the limit given in ANSI C63.10-2013, 47 CFR FCC Part 15 Subpart C, KDB558074 D01 v03r04 and KDB 662911 D01 v02r01.

The test equipment used to perform the test is calibrated and traceable to NML/ROC.



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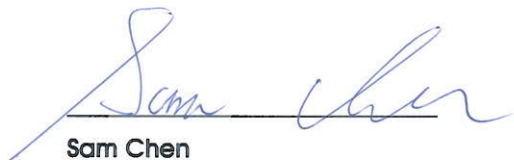
History of This Test Report

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR5N0423-01	Rev. 01	Initial issue of report	May 27, 2016

1. VERIFICATION OF COMPLIANCE

Product Name : Smart Control Module
Brand Name : CyberTAN
Model No. : WD114
Applicant : CyberTAN Technology Inc.
Test Rule Part(s) : 47 CFR FCC Part 15 Subpart C § 15.247

Sporton International as requested by the applicant to evaluate the EMC performance of the product sample received on Feb. 17, 2016 would like to declare that the tested sample has been evaluated and found to be in compliance with the tested rule parts. The data recorded as well as the test configuration specified is true and accurate for showing the sample's EMC nature.



Sam Chen

SPORTON INTERNATIONAL INC.

2. SUMMARY OF THE TEST RESULT

Applied Standard: 47 CFR FCC Part 15 Subpart C				
Part	Rule Section	Description of Test	Result	Under Limit
4.1	15.207	AC Power Line Conducted Emissions	Complies	3.17 dB
4.2	15.247(d)	Radiated Emissions	Complies	0.77 dB
4.3	15.247(d)	Band Edge Emissions	Complies	2.80 dB
4.4	15.203	Antenna Requirements	Complies	-

3. GENERAL INFORMATION

3.1. Product Details

Items	Description
Product Type	WLAN (2TX, 2RX)
Radio Type	Intentional Transceiver
Power Type	From host system
Modulation	IEEE 802.11b: DSSS IEEE 802.11g: OFDM IEEE 802.11n: see the below table
Data Modulation	IEEE 802.11b: DSSS (BPSK / QPSK / CCK) IEEE 802.11g/n: OFDM (BPSK / QPSK / 16QAM / 64QAM)
Data Rate (Mbps)	IEEE 802.11b: DSSS (1/ 2/ 5.5/11) IEEE 802.11g: OFDM (6/9/12/18/24/36/48/54) IEEE 802.11n: see the below table
Frequency Range	2400 ~ 2483.5MHz
Channel Number	11 for 20MHz bandwidth ; 7 for 40MHz bandwidth
Carrier Frequencies	Please refer to section 3.4
Antenna	Please refer to section 3.3

Items	Description
Beamforming Function	☐ With beamforming ☒ Without beamforming

Antenna and Band width

Antenna	Two (TX)	
Band width Mode	20 MHz	40 MHz
IEEE 802.11b	V	X
IEEE 802.11g	V	X
IEEE 802.11n	V	V

Note: The MIMO transmission mode is correlated.

IEEE 11n Spec.

Protocol	Number of Transmit Chains (NTX)	Data Rate / MCS
802.11n (HT20)	2	MCS 0-15
802.11n (HT40)	2	MCS 0-15
Note 1: IEEE Std. 802.11n modulation consists of HT20 and HT40 (HT: High Throughput). Then EUT supports HT20 and HT40. Note 2: Modulation modes consist of below configuration: HT20/HT40: IEEE 802.11n		

3.2. Accessories

N/A

3.3. Table for Filed Antenna

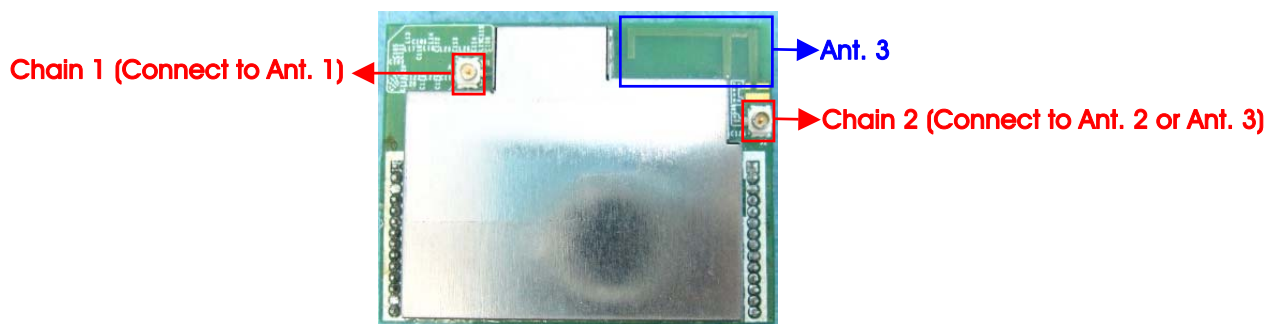
Ant.	Brand	Part No.	Antenna Type	Connector	Gain (dBi)	Loss of Cable (dB)	True Gain (dBi)
1	TONGDA	T-543-2020003-2	Dipole Antenna	Reversed SMA	5.00	0.70	4.30
2	TONGDA	T-543-2020003-2	Dipole Antenna	Reversed SMA	5.00	0.70	4.30
3	-	-	Printed Antenna	N/A	4.32	-	4.32

Note: The EUT has three antennas (2TX, 2RX).

Chain 1 (Connect to Ant. 1)

Chain 2 (Connect to Ant. 2 or Ant. 3), only the higher gain antenna "Ant. 3" was tested and recorded in the report.

Chain 1 and Chain 2 could both transmit/receive simultaneously.



3.4. Table for Carrier Frequencies

There are two bandwidth systems.

For 20MHz bandwidth systems, use Channel 1~Channel 11.

For 40MHz bandwidth systems, use Channel 3~Channel 9.

Frequency Band	Channel No.	Frequency	Channel No.	Frequency
2400~2483.5MHz	1	2412 MHz	7	2442 MHz
	2	2417 MHz	8	2447 MHz
	3	2422 MHz	9	2452 MHz
	4	2427 MHz	10	2457 MHz
	5	2432 MHz	11	2462 MHz
	6	2437 MHz	-	-

3.5. Table for Test Modes

Preliminary tests were performed in different data rate to find the worst radiated emission. The data rate shown in the table below is the worst-case rate with respect to the specific test item. Investigation has been done on all the possible configurations for searching the worst cases. The following table is a list of the test modes shown in this test report.

Test Items	Mode	Data Rate	Channel	Chain
AC Power Line Conducted Emissions	CTX	-	-	-
Radiated Emissions 9kHz~1GHz	CTX	-	-	-
Radiated Emissions 1GHz~10 th Harmonic	11g/BPSK	6 Mbps	6	1+2
Band Edge Emissions	11g/BPSK	6 Mbps	1/6/11	1+2

Note: 1. All the specification of test configurations and test modes were based on customer's request.

2. For AC Power Line Conducted Emissions and Radiated Emissions 9kHz~1GHz test:

EUT use Ant. 1 + Ant. 3 for measurement.

3. For Other tests:

EUT use Ant. 3 for measurement, only the higher gain antenna was tested and recorded in the report.

The following test modes were performed for all tests:

For Radiated Emissions and Band Edge Emissions test:

The EUT can be placed in X axis, Y axis and Z axis. The worst case was found at Z axis for original test report, so it's recorded in this report.

For Radiated Emissions 1GHz~10th Harmonic and Band Edge Emissions test:

After evaluating, the worst case is found at 802.11g, and retest this mode only.

3.6. Table for Testing Locations

Test Site Location				
Address:	No.8, Lane 724, Bo-ai St., Jhubei City, Hsinchu County 302, Taiwan, R.O.C.			
TEL:	886-3-656-9065			
FAX:	886-3-656-9085			
Test Site No.	Site Category	Location	FCC Reg. No.	IC File No.
03CH01-CB	SAC	Hsin Chu	262045	IC 4086D
CO01-CB	Conduction	Hsin Chu	262045	IC 4086D

Open Area Test Site (OATS); Semi Anechoic Chamber (SAC).

3.7. Table for EUT Type

The EUT has three types which are identical to each other in all aspects except for the following table:

Type	SKU	DDR (U2)	Mainchip (U1)	IC RF switch (SW1, SW2)	XTAL (Y1)
1	SKU A	EM68512WQCA-25H	QCA4531-BL3A	RTC6603SP	7M25000013
		0°C~95°C	0°C~70°C	-40°C~85°C	-20°C~75°C
2	SKU B	EM68512WQCA-25IH	QCA4531-BL3B1	GW1179	7M25090007
		-40°C~95°C	-40°C~85°C	-40°C~85°C	-40°C~100°C
3	SKU C	Description			
		The difference with SKU B as below: 1. Changing the 4Mbit Nor flash i-temp to "Brand Name: winbond Flash, Model No.: W25X40CLSNI" from "Brand Name: GigaDevice, Model No.: MD25D40TIG". 2. Changing the 1Gbit Nand flash i-temp to "Brand Name: winbond Flash, Model No.: W25N01GVZEIG" from "Brand Name: GigaDevice, Model No.: GD5F1GQ4UCYIG".			

3.8. Table for Class II Change

This product is an extension of original one reported under Sporton project number: FR5N0423

Below is the table for the change of the product with respect to the original one.

Modifications					
Adding two types of EUT (SKU B, SKU C). The difference between original EUT (SKU A) and new EUT (SKU B, SKU C) as below:					
Type	SKU	DDR (U2)	Mainchip (U1)	IC RF switch (SW1, SW2)	XTAL (Y1)
1	SKU A (original)	EM68512WQCA-25H	QCA4531-BL3A	RTC6603SP	7M25000013
		0°C~95°C	0°C~70°C	-40°C~85°C	-20°C~75°C
2	SKU B (new)	EM68512WQCA-25IH	QCA4531-BL3B1	GW1179	7M25090007
		-40°C~95°C	-40°C~85°C	-40°C~85°C	-40°C~100°C
3	SKU C (new)	Description			
		The difference with SKU B as below: 1. Changing the 4Mbit Nor flash i-temp to “Brand Name: winbond Flash, Model No.: W25X40CLSNIG” from “Brand Name: GigaDevice, Model No.: MD25D40TIG”. 2. Changing the 1Gbit Nand flash i-temp to “Brand Name: winbond Flash, Model No.: W25N01GVZEIG” from “Brand Name: GigaDevice, Model No.: GD5F1GQ4UCYIG”.			
Performance Checking					
1. AC Power Line Conducted Emissions.					
2. Radiated Emissions 9kHz~1GHz.					
3. Radiated Emissions 1GHz~10 th Harmonic. After evaluating, the worst case is found at 802.11g, and retest this mode only.					
4. Band Edge Emissions. After evaluating, the worst case is found at 802.11g , and retest this mode only.					

Note: 1. SKU B was selected as representative model for the test and its data was recorded in this report.

2. Radiated Emissions 1GHz~10th Harmonic and Band Edge Emissions tests will be based on original output power to re-test.

3.9. Table for Supporting Units

For Test Site No: 03CH01-CB and TH01-CB

Support Unit	Brand	Model	FCC ID
NB	DELL	E4300	DoC
Fixture	Qualcomm	Y9350	MB-CUS531
Adapter	PSE	MU12AF050200-A1	N/A

For Test Site No: CO01-CB

Support Unit	Brand	Model	FCC ID
NB	DELL	E6430	DoC
Fixture	Qualcomm	Y9350	MB-CUS531
Adapter	PSE	MU12AF050200-A1	N/A

3.10. EUT Operation during Test

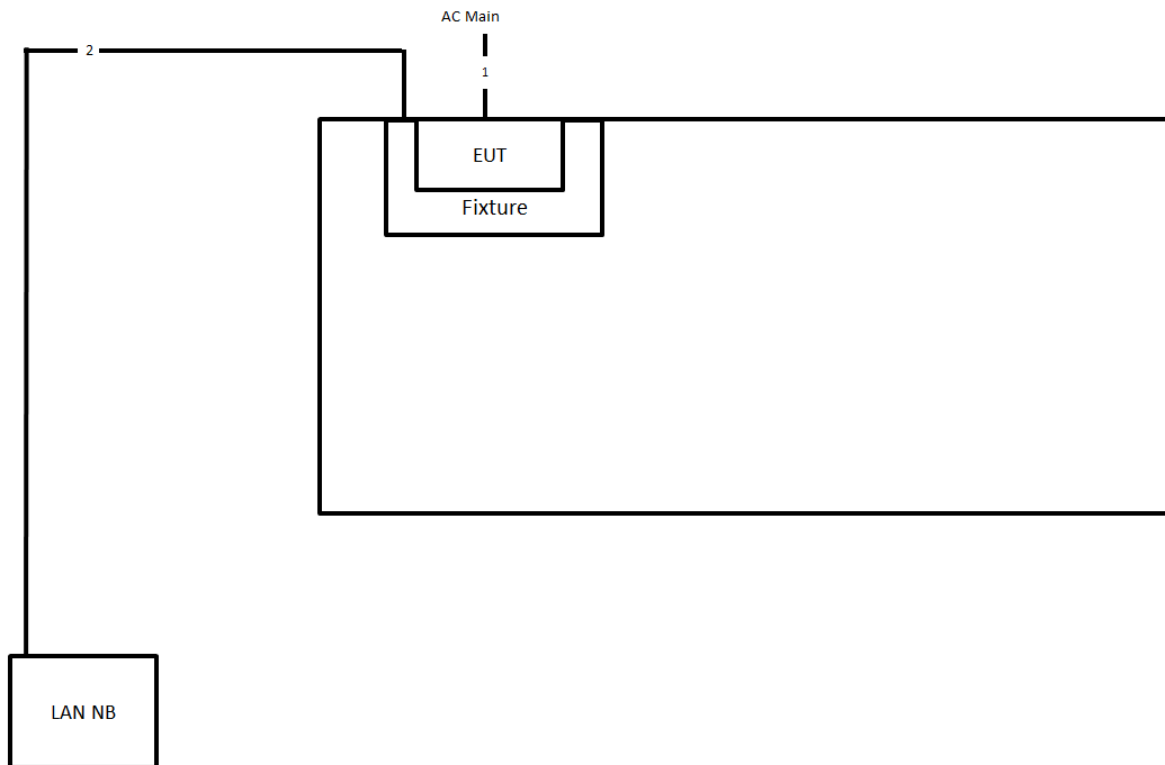
The EUT was programmed to be in continuously transmitting mode.

3.11. Duty Cycle

Mode	On Time (ms)	On+Off Time (ms)	Duty Cycle (%)	Duty Factor (dB)	1/T Minimum VBW (kHz)
802.11g	2.014	2.072	97.20	0.12	0.50

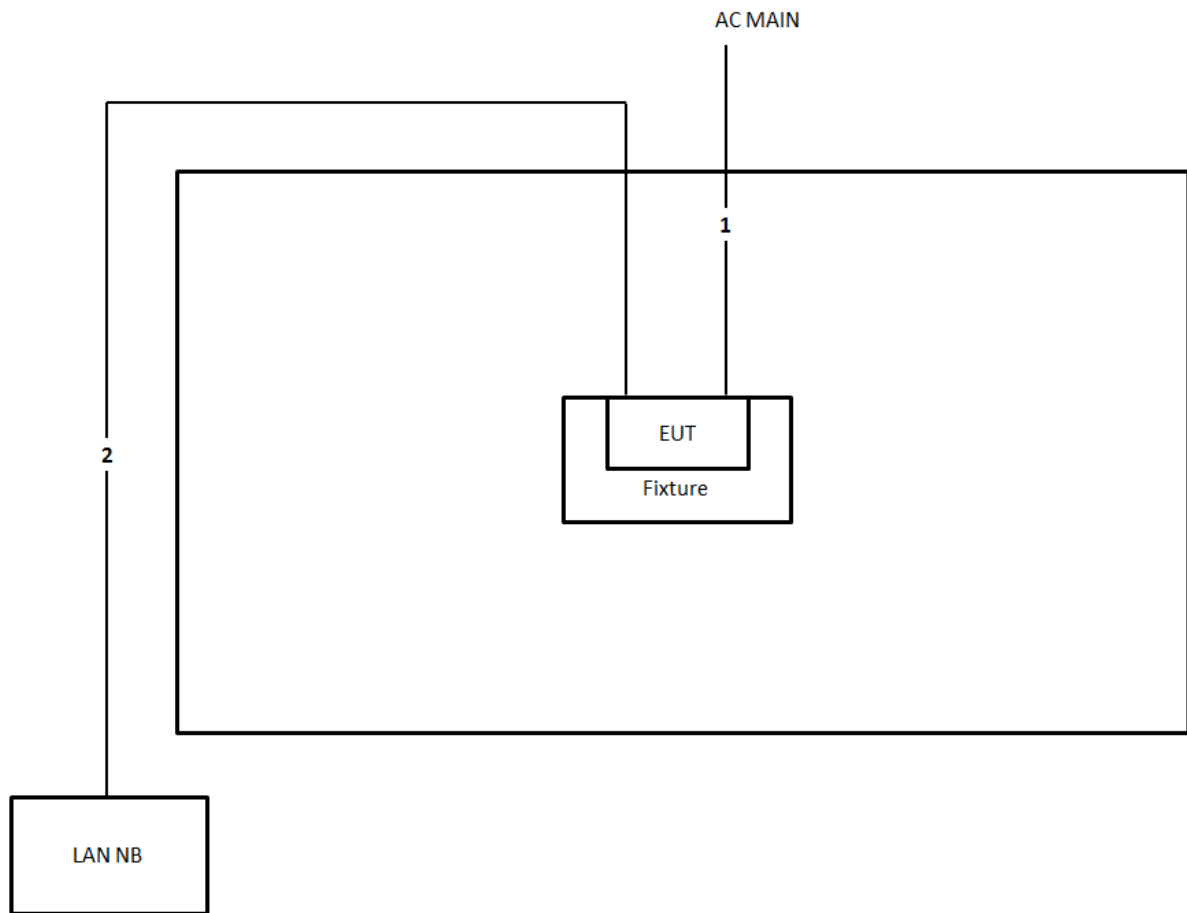
3.12. Test Configurations

3.12.1. AC Power Line Conduction Emissions Test Configuration



Item	Connection	Shielded	Length
1	Power cable	No	1.5m
2	RJ-45 cable	No	10m

3.12.2. Radiation Emissions Test Configuration



Item	Connection	Shielded	Length
1	Power cable	No	1.5m
2	RJ-45 cable	No	10m

4. TEST RESULT

4.1. AC Power Line Conducted Emissions Measurement

4.1.1. Limit

For this product which is designed to be connected to the AC power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed below limits table.

Frequency (MHz)	QP Limit (dBuV)	AV Limit (dBuV)
0.15~0.5	66~56	56~46
0.5~5	56	46
5~30	60	50

4.1.2. Measuring Instruments and Setting

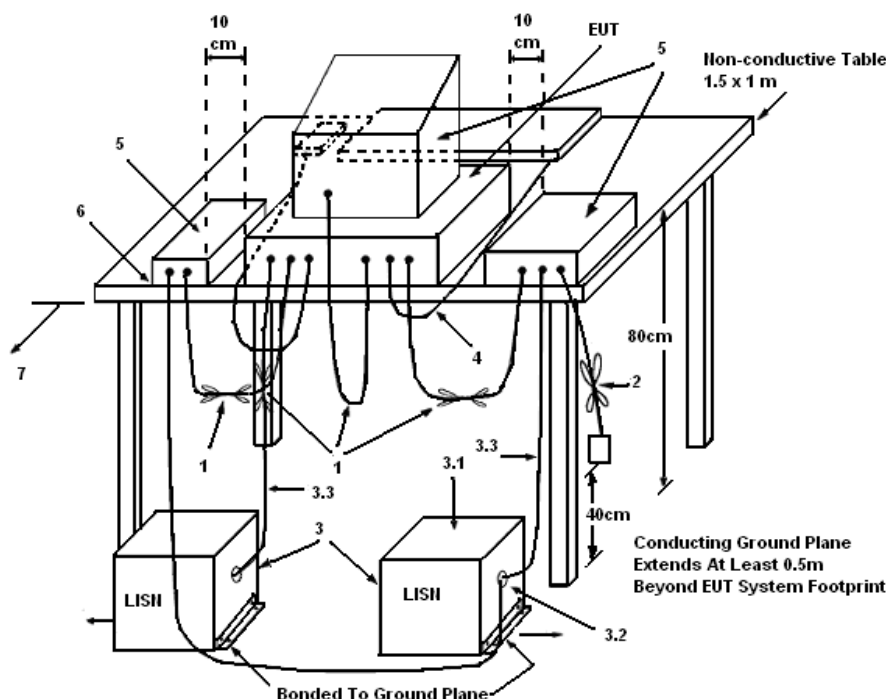
Please refer to section 5 of equipments list in this report. The following table is the setting of the receiver.

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

4.1.3. Test Procedures

1. Configure the EUT according to ANSI C63.10. The EUT or host of EUT has to be placed 0.4 meter far from the conducting wall of the shielding room and at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT or host of EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connected to the other LISNs. The LISN should provide 50uH/50ohms coupling impedance.
4. The frequency range from 150 kHz to 30 MHz was searched.
5. Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. The measurement has to be done between each power line and ground at the power terminal.

4.1.4. Test Setup Layout



LEGEND:

- (1) Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- (2) I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- (3) EUT connected to one LISN. Unused LISN measuring port connectors shall be terminated in 50 Ω . LISN can be placed on top of, or immediately beneath, reference ground plane.
- (3.1) All other equipment powered from additional LISN(s).
- (3.2) Multiple outlet strip can be used for multiple power cords of non-EUT equipment.
- (3.3) LISN at least 80 cm from nearest part of EUT chassis.
- (4) Cables of hand-operated devices, such as keyboards, mice, etc., shall be placed as for normal use.
- (5) Non-EUT components of EUT system being tested.
- (6) Rear of EUT, including peripherals, shall all be aligned and flush with rear of tabletop.
- (7) Rear of tabletop shall be 40 cm removed from a vertical conducting plane that is bonded to the ground plane.

4.1.5. Test Deviation

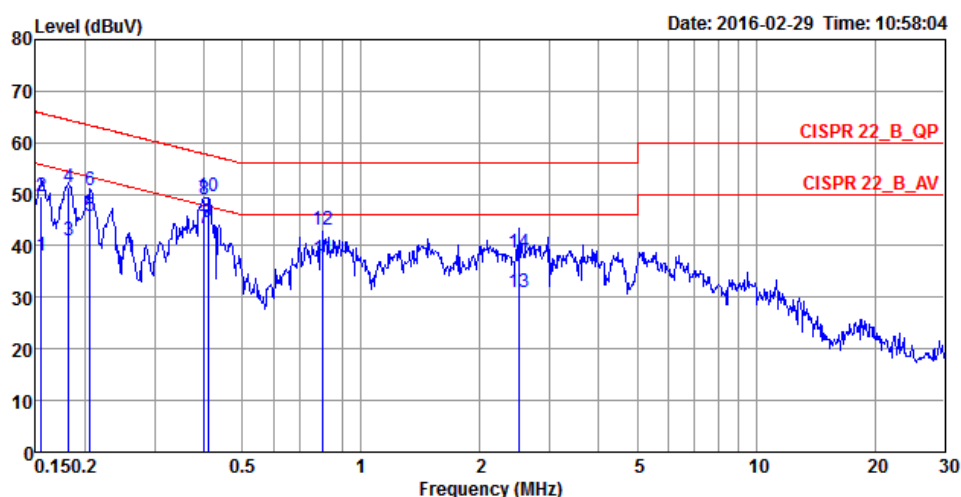
There is no deviation with the original standard.

4.1.6. EUT Operation during Test

The EUT was placed on the test table and programmed in normal function.

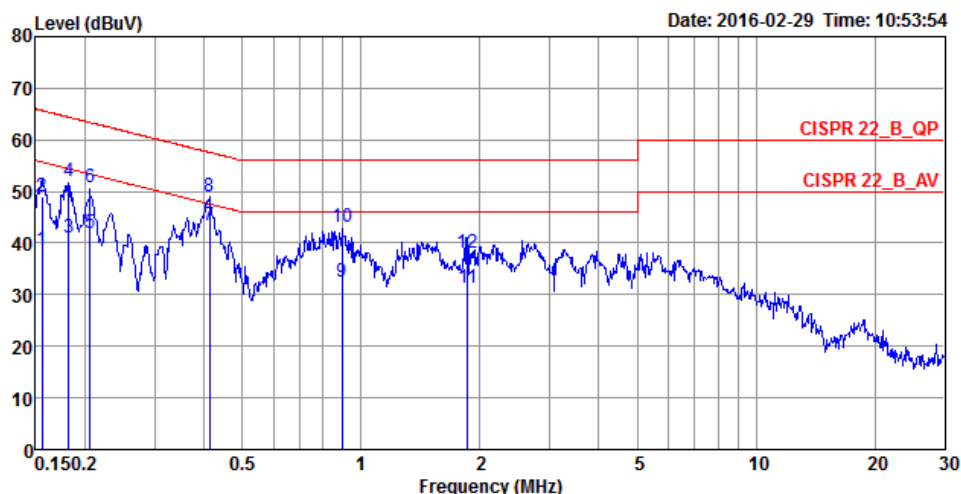
4.1.7. Results of AC Power Line Conducted Emissions Measurement

Temperature	22°C	Humidity	58%
Test Engineer	Deven Huang	Phase	Line
Configuration	CTX		



	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Pol/Phase	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB		
1	0.1548	38.06	-17.68	55.74	28.08	9.96	0.02	LINE	Average
2	0.1548	49.69	-16.05	65.74	39.71	9.96	0.02	LINE	QP
3	0.1815	41.15	-13.27	54.42	31.17	9.96	0.02	LINE	Average
4	0.1815	51.22	-13.20	64.42	41.24	9.96	0.02	LINE	QP
5	0.2061	45.75	-7.61	53.36	35.77	9.96	0.02	LINE	Average
6	0.2061	50.68	-12.68	63.36	40.70	9.96	0.02	LINE	QP
7	0.3997	43.50	-4.36	47.86	33.51	9.95	0.04	LINE	Average
8	0.3997	48.88	-8.98	57.86	38.89	9.95	0.04	LINE	QP
9	0.4105	44.47	-3.17	47.64	34.48	9.95	0.04	LINE	Average
10	0.4105	49.64	-8.00	57.64	39.65	9.95	0.04	LINE	QP
11	0.8002	37.49	-8.51	46.00	27.50	9.96	0.03	LINE	Average
12	0.8002	43.07	-12.93	56.00	33.08	9.96	0.03	LINE	QP
13	2.5000	31.10	-14.90	46.00	21.04	10.01	0.05	LINE	Average
14	2.5000	38.63	-17.37	56.00	28.57	10.01	0.05	LINE	QP

Temperature	22°C	Humidity	58%
Test Engineer	Deven Huang	Phase	Neutral
Configuration	CTX		



	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Pol/Phase	Remark
	MHz	dBUV	dB	dBUV	dBUV	dB	dB		
1	0.1557	38.69	-17.00	55.69	28.60	10.07	0.02	NEUTRAL	Average
2	0.1557	48.99	-16.70	65.69	38.90	10.07	0.02	NEUTRAL	QP
3	0.1815	40.93	-13.49	54.42	30.94	9.97	0.02	NEUTRAL	Average
4	0.1815	51.87	-12.55	64.42	41.88	9.97	0.02	NEUTRAL	QP
5	0.2061	41.99	-11.37	53.36	32.00	9.97	0.02	NEUTRAL	Average
6	0.2061	50.67	-12.69	63.36	40.68	9.97	0.02	NEUTRAL	QP
7	0.4127	43.40	-4.19	47.59	33.40	9.96	0.04	NEUTRAL	Average
8	0.4127	49.09	-8.50	57.59	39.09	9.96	0.04	NEUTRAL	QP
9	0.8944	32.43	-13.57	46.00	22.40	9.98	0.05	NEUTRAL	Average
10	0.8944	43.08	-12.92	56.00	33.05	9.98	0.05	NEUTRAL	QP
11	1.8581	31.31	-14.69	46.00	21.25	10.00	0.06	NEUTRAL	Average
12	1.8581	38.08	-17.92	56.00	28.02	10.00	0.06	NEUTRAL	QP

Note:

Level = Read Level + LISN Factor + Cable Loss.

4.2. Radiated Emissions Measurement

4.2.1. Limit

30dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequencies (MHz)	Field Strength (micorvolts/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

4.2.2. Measuring Instruments and Setting

Please refer to section 5 of equipments list in this report. The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RBW / VBW (Emission in restricted band)	1MHz / 3MHz for Peak, 1MHz / 1/T for Average
RBW / VBW (Emission in non-restricted band)	100kHz / 300kHz for peak

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RBW 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RBW 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RBW 120kHz for QP

4.2.3. Test Procedures

For Radiated measurement:

1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 1m & 3m far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 m to 4 m) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz VBW and 3MHz RBW for peak reading. Then 1MHz RBW and 1/T VBW for average reading in spectrum analyzer.
7. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
8. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
9. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High – Low scan is not required in this case.

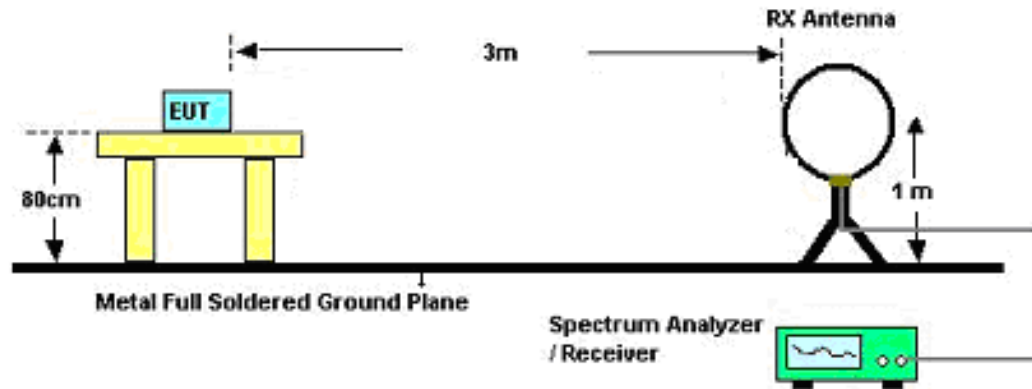
For Conducted measurement:

1. Configure the EUT according to KDB558074 D01 v03r04. The EUT was perform conducted measurement and measurement level added antenna gain shall be comply to section 4.2.1.

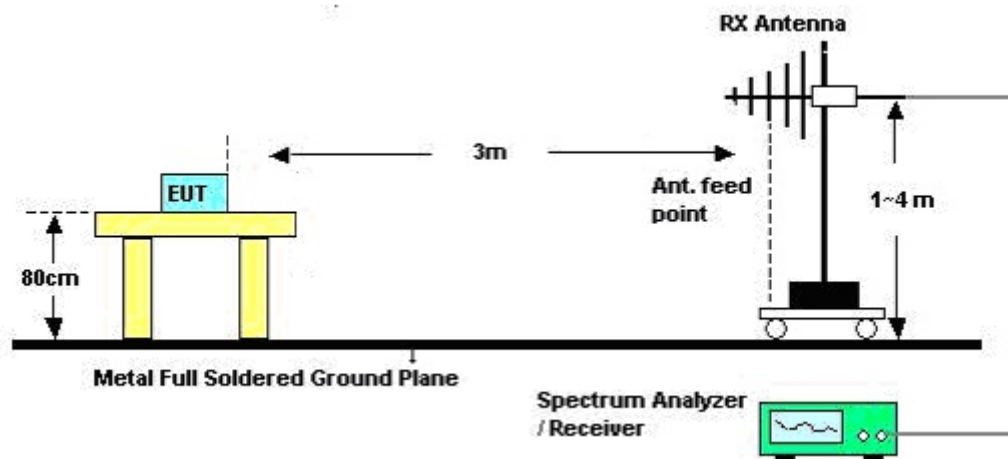
4.2.4. Test Setup Layout

For Radiated measurement:

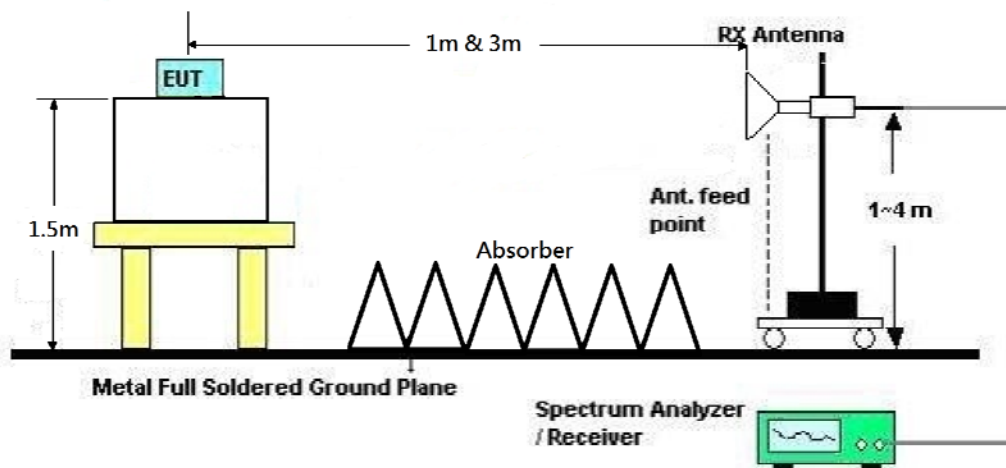
For 9kHz ~30MHz:



For 30MHz~1GHz:

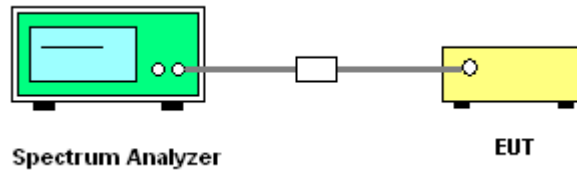


For Above 1GHz:



For Conducted measurement:

For Above 1GHz only:



4.2.5. Test Deviation

There is no deviation with the original standard.

4.2.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

4.2.7. Results of Radiated Emissions (9kHz~30MHz)

Temperature	21°C	Humidity	51%
Test Engineer	Paul Chen	Configurations	CTX
Test Date	Feb. 25, 2016		

Freq. (MHz)	Level (dBuV)	Over Limit (dB)	Limit Line (dBuV)	Remark
-	-	-	-	See Note

Note:

The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.

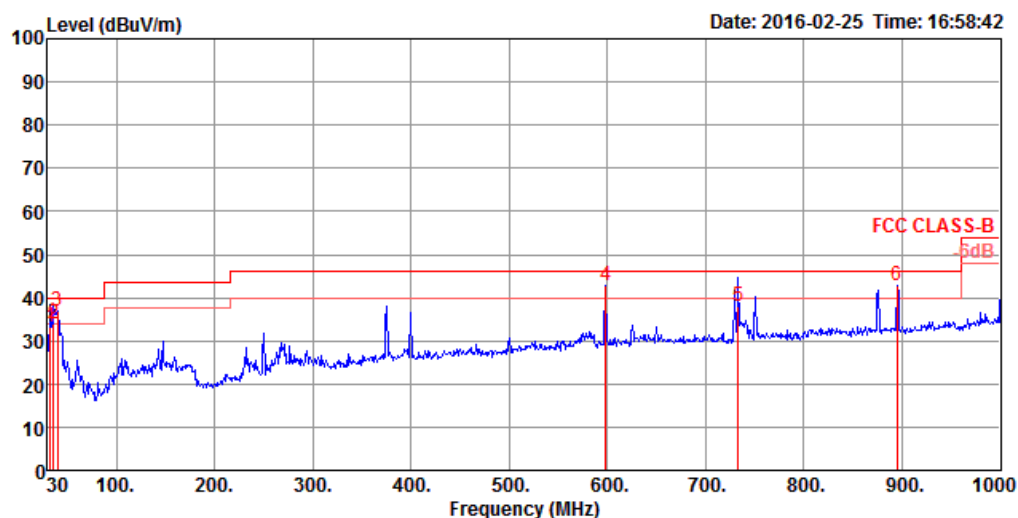
Distance extrapolation factor = $40 \log (\text{specific distance} / \text{test distance})$ (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor.

4.2.8. Results of Radiated Emissions (30MHz~1GHz)

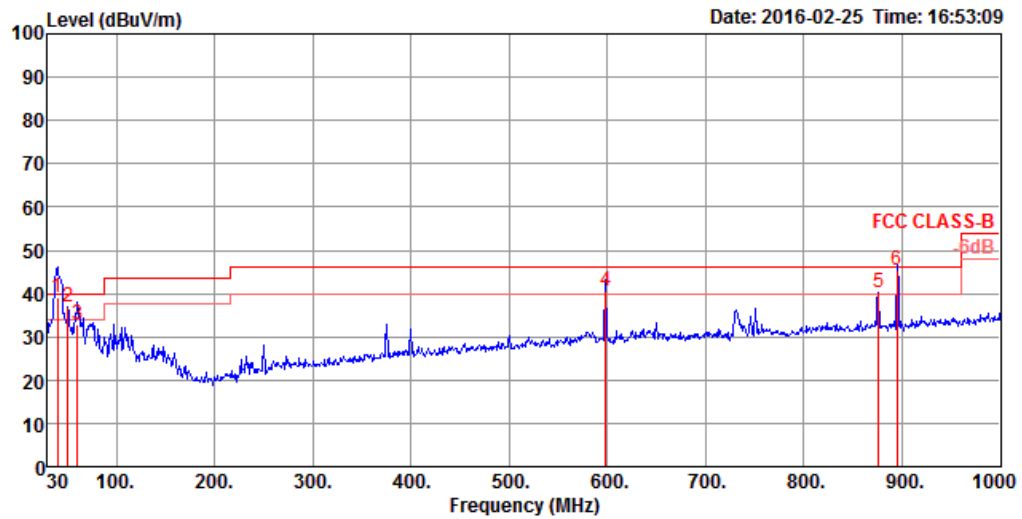
Temperature	21°C	Humidity	51%
Test Engineer	Paul Chen	Configurations	CTX

Horizontal



	Freq	Level	Limit	Over	Read	CableAntenna	Preamp	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg	
1	32.91	33.11	40.00	-6.89	40.76	0.51	24.24	32.40	100	155 QP	HORIZONTAL
2	35.82	33.98	40.00	-6.02	43.13	0.52	22.73	32.40	150	219 QP	HORIZONTAL
3	39.70	36.75	40.00	-3.25	48.26	0.54	20.36	32.41	200	310 Peak	HORIZONTAL
4	598.42	42.63	46.00	-3.37	47.52	2.12	25.40	32.41	150	64 Peak	HORIZONTAL
5	733.25	37.88	46.00	-8.12	41.61	2.34	26.25	32.32	100	190 QP	HORIZONTAL
6	895.24	42.67	46.00	-3.33	44.21	2.56	27.66	31.76	200	319 Peak	HORIZONTAL

Vertical



	Freq	Level	Limit	Over	Read	CableAntenna	Preamp	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg	
1	39.70	39.18	40.00	-0.82	50.69	0.54	20.36	32.41	100	165 QP	VERTICAL
2	50.37	36.88	40.00	-3.12	53.83	0.61	14.85	32.41	150	167 Peak	VERTICAL
3	60.07	32.86	40.00	-7.14	50.87	0.69	13.70	32.40	150	1 QP	VERTICAL
4	598.42	40.67	46.00	-5.33	45.56	2.12	25.40	32.41	100	248 QP	VERTICAL
5	875.84	40.20	46.00	-5.80	41.96	2.55	27.55	31.86	100	312 Peak	VERTICAL
6	895.24	45.23	46.00	-0.77	46.77	2.56	27.66	31.76	100	222 QP	VERTICAL

Note:

The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.

Emission level (dBuV/m) = 20 log Emission level (uV/m).

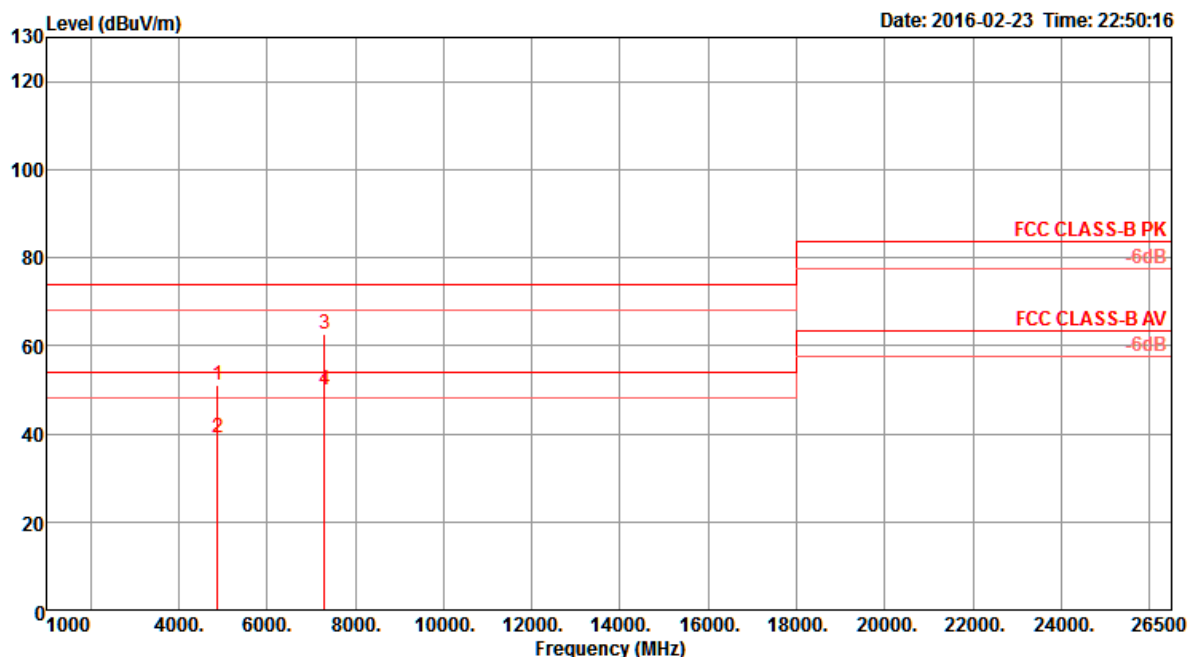
Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

4.2.9. Results for Radiated Emissions (1GHz~10th Harmonic)

For Radiated measurement: EUT (without antenna) with 50Ω load

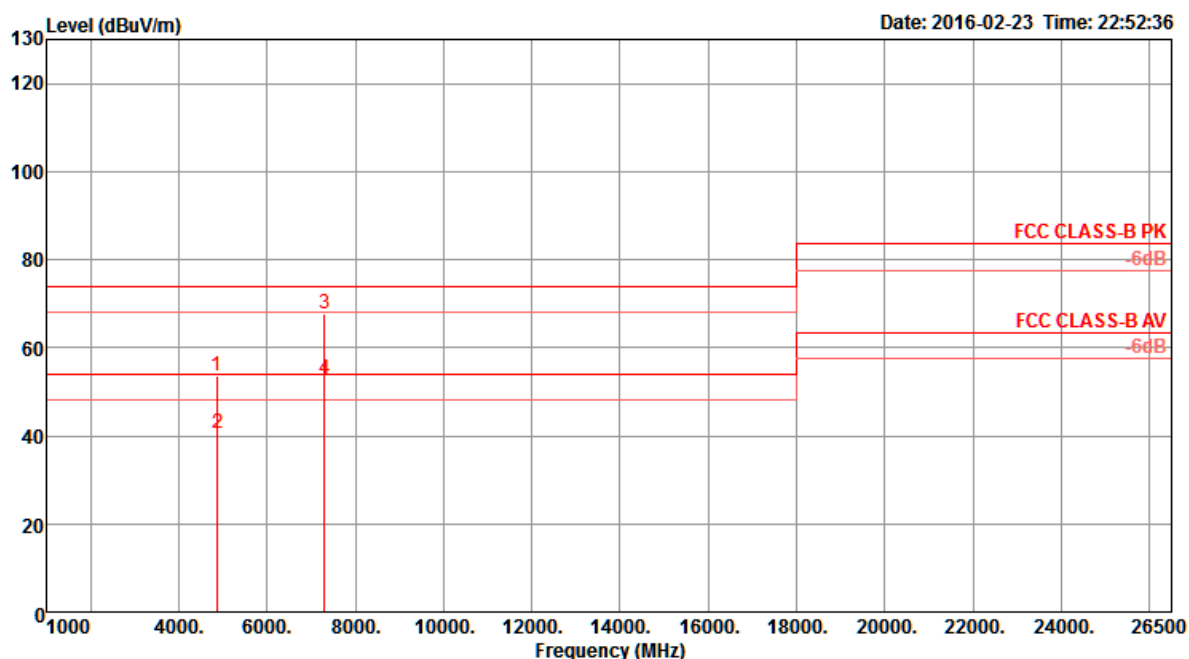
Temperature	21°C	Humidity	51%
Test Engineer	Paul Chen	Configurations	IEEE 802.11g CH 6 / Chain 1 + Chain 2
Test Date	Feb. 23, 2016		

Horizontal



	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	4870.40	51.15	74.00	-22.85	46.69	6.06	32.91	34.51	14	139	Peak	HORIZONTAL
2	4874.92	39.04	54.00	-14.96	34.58	6.06	32.91	34.51	14	139	Average	HORIZONTAL
3	7306.68	62.73	74.00	-11.27	52.82	7.50	37.17	34.76	254	112	Peak	HORIZONTAL
4	7311.20	49.79	54.00	-4.21	39.88	7.50	37.17	34.76	254	112	Average	HORIZONTAL

Vertical



	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	4868.76	53.44	74.00	-20.56	48.98	6.06	32.91	34.51	83	107	Peak	VERTICAL
2	4873.40	40.70	54.00	-13.30	36.24	6.06	32.91	34.51	83	107	Average	VERTICAL
3	7310.48	67.89	74.00	-6.11	57.98	7.50	37.17	34.76	337	109	Peak	VERTICAL
4	7310.72	52.77	54.00	-1.23	42.86	7.50	37.17	34.76	337	109	Average	VERTICAL

Note:

The amplitude of spurious emissions that are attenuated by more than 20dB below the permissible value has no need to be reported.

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

For Conducted measurement:

Temperature	24°C	Humidity	42%
Test Engineer	Clemens Fang		

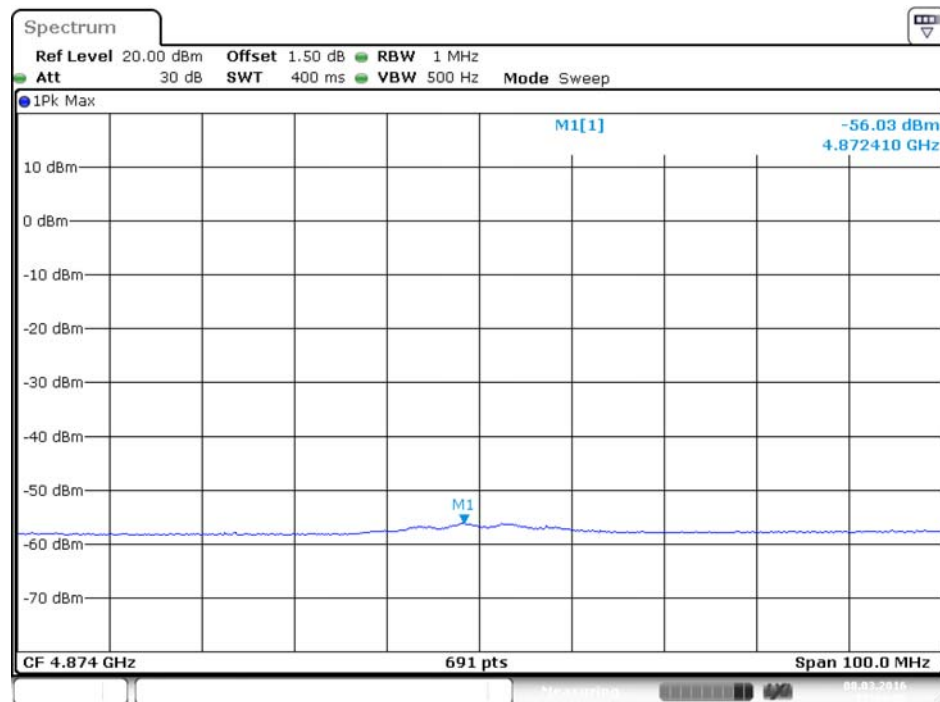
Average

Mode	Frequency	Antenna Gain (dBi)	Spurious Level (dBm)			Limit (dBm)	Margin (dB)
			Chain 1	Chain 2	Total		
802.11g	2437 MHz	4.32	-56.03	-55.82	-48.59	-41.20	7.39

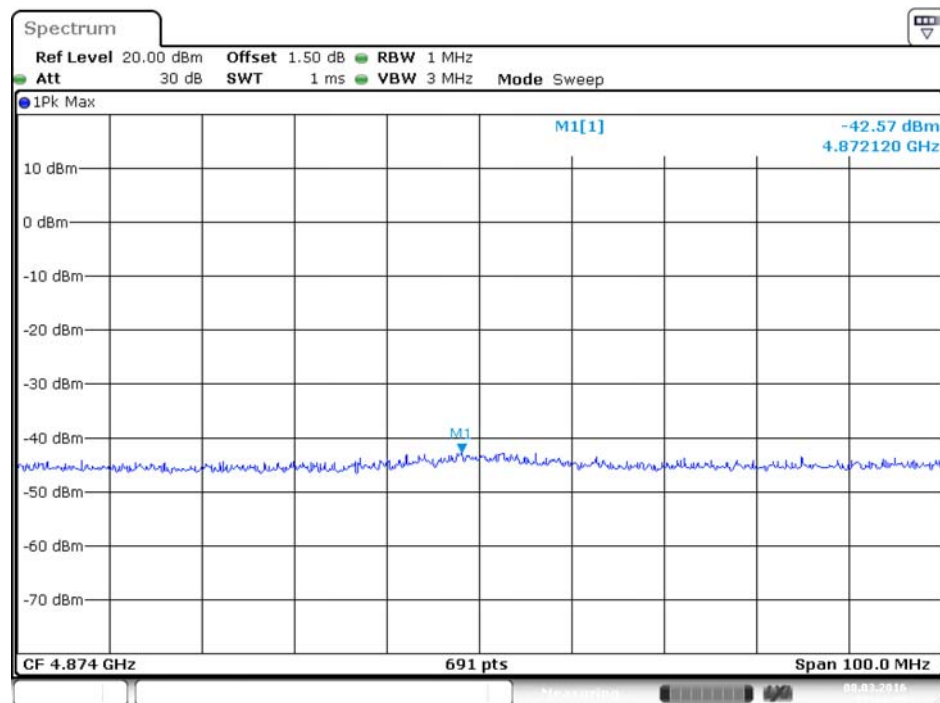
Peak

Mode	Frequency	Antenna Gain (dBi)	Spurious Level (dBm)			Limit (dBm)	Margin (dB)
			Chain 1	Chain 2	Total		
802.11g	2437 MHz	4.32	-42.57	-41.52	-34.68	-21.20	13.48

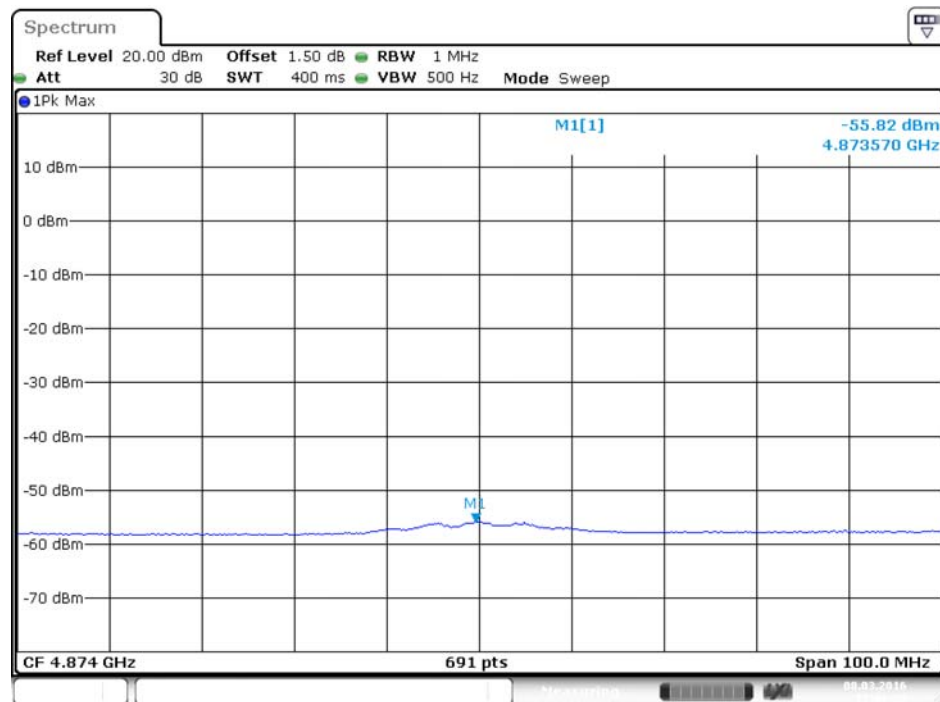
Plot on Configuration IEEE 802.11g / 2437 MHz / Average / Chain 1



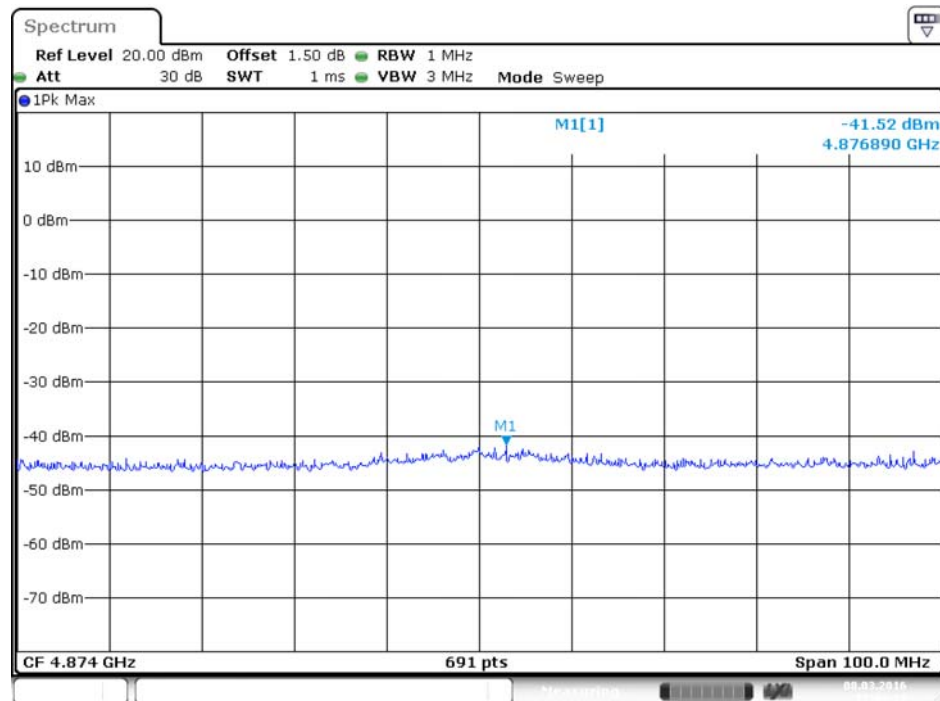
Plot on Configuration IEEE 802.11g / 2437 MHz / Peak / Chain 1



Plot on Configuration IEEE 802.11g / 2437 MHz / Average / Chain 2



Plot on Configuration IEEE 802.11g / 2437 MHz / Peak / Chain 2



4.3. Emissions Measurement

4.3.1. Limit

30dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequencies (MHz)	Field Strength (micorvolts/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

4.3.2. Measuring Instruments and Setting

Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	100 MHz
RBW / VBW (Emission in restricted band)	1 MHz / 3 MHz for Peak, 1 MHz / 1/T for Average
RBW / VBW (30dBc in any 100 kHz bandwidth emission)	100 kHz / 300 kHz for Peak

4.3.3. Test Procedures

Configure the EUT according to KDB558074 D01 v03r04. The EUT was perform conducted measurement and measurement level added antenna gain shall be comply to section 4.3.1.

4.3.4. Test Setup Layout

This test setup layout is the same as that shown in section 4.2.4.

4.3.5. Test Deviation

There is no deviation with the original standard.

4.3.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

4.3.7. Test Result of Band Edge and Fundamental Emissions

Temperature	24°C	Humidity	42%
Test Engineer	Clemens Fang		

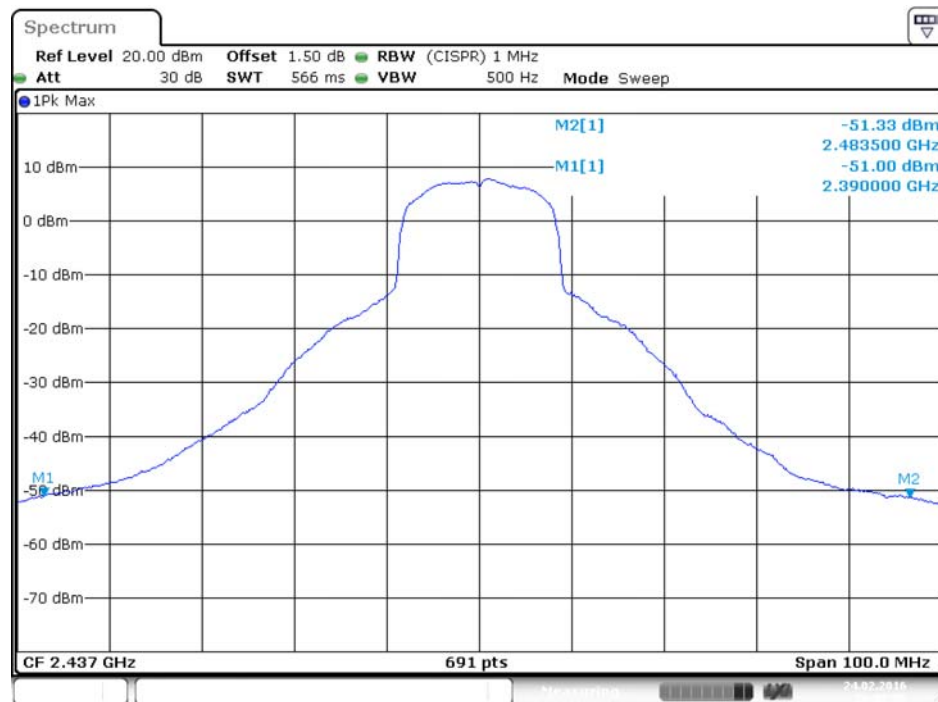
Average

Mode	Frequency	Antenna Gain (dBi)	Bandedge Level (dBm)			Limit (dBm)	Margin (dB)
			Chain 1	Chain 2	Total		
802.11g	2437 MHz	4.32	-51.00	-51.69	-44.00	-41.20	2.80

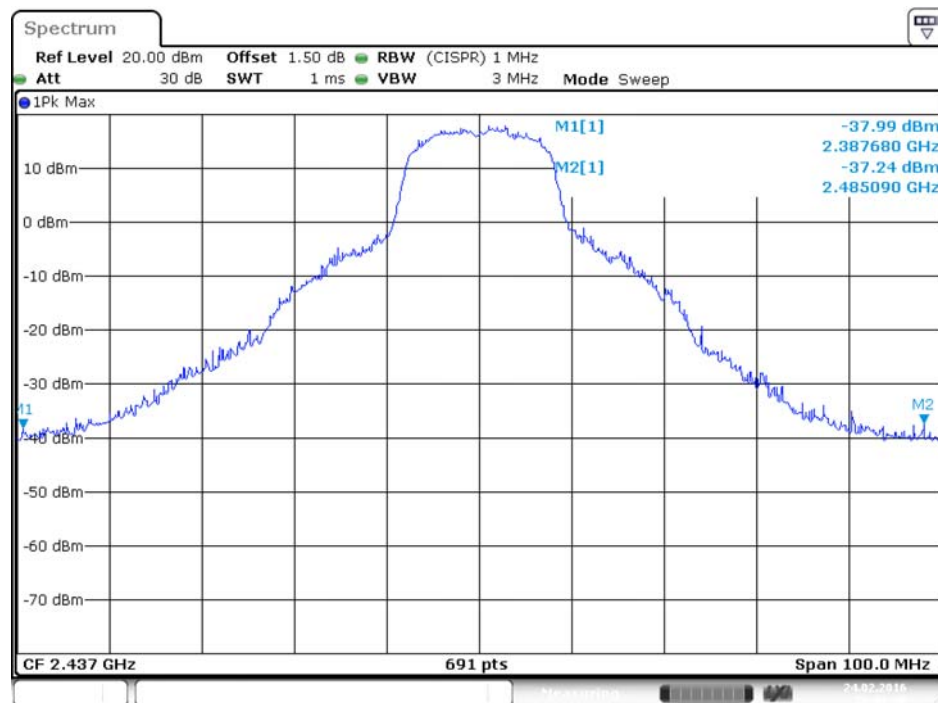
Peak

Mode	Frequency	Antenna Gain (dBi)	Bandedge Level (dBm)			Limit (dBm)	Margin (dB)
			Chain 1	Chain 2	Total		
802.11g	2437 MHz	4.32	-37.24	-36.71	-29.64	-21.20	8.44

Plot on Configuration IEEE 802.11g / 2437 MHz / Average / Chain 1



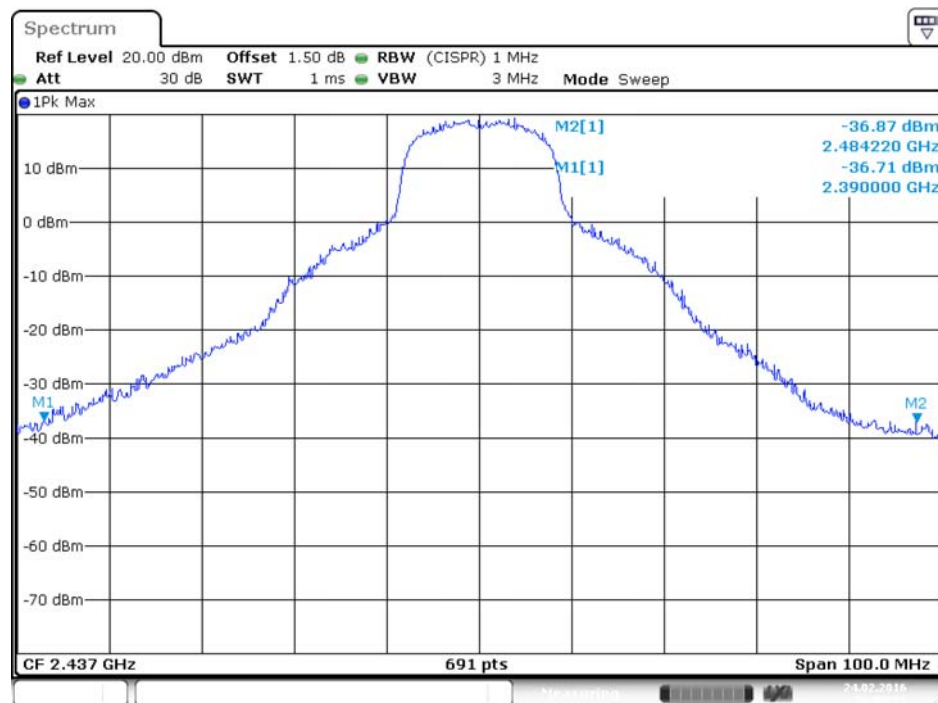
Plot on Configuration IEEE 802.11g / 2437 MHz / Peak / Chain 1



Plot on Configuration IEEE 802.11g / 2437 MHz / Average / Chain 2



Plot on Configuration IEEE 802.11g / 2437 MHz / Peak / Chain 2



For Emission not in Restricted Band

Temperature	24°C	Humidity	42%
Test Engineer	Clemens Fang		

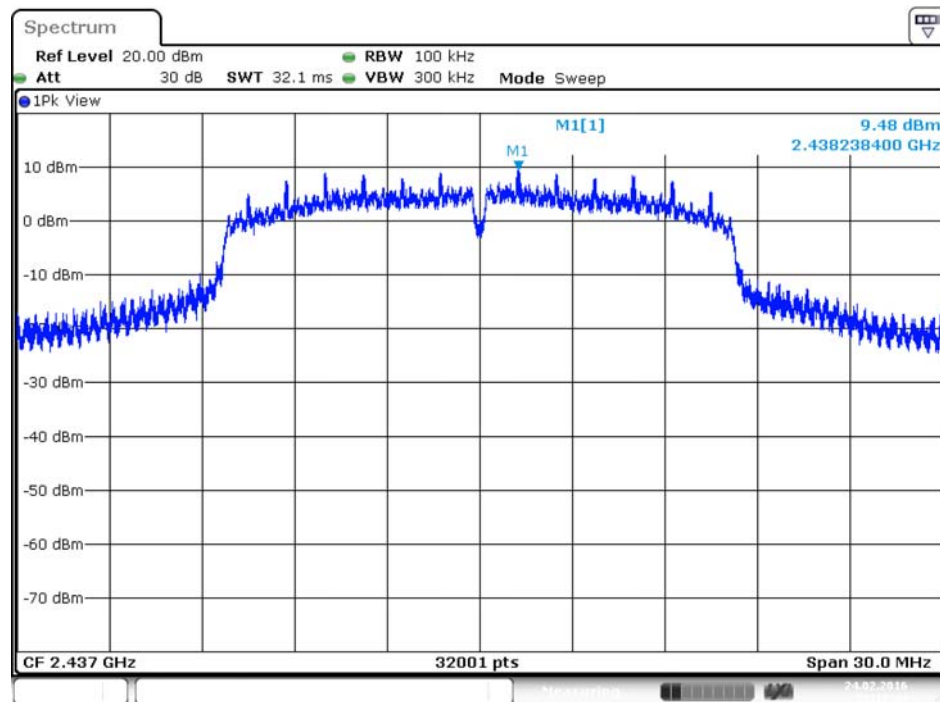
Chain 1

Mode	Frequency		Measurement Level (dBm)	Limit (dBc)	Margin (dB)
802.11g	2412 MHz	30MHz~2400MHz	-34.86	-20.52	14.34
		2390MHz~2400MHz	-30.82	-20.52	10.30
		2483.5MHz~2500MHz	-55.15	-20.52	34.63
		2500MHz~26500MHz	-48.41	-20.52	27.89
	2462 MHz	30MHz~2400MHz	-55.82	-20.52	35.3
		2390MHz~2400MHz	-54.48	-20.52	33.96
		2483.5MHz~2500MHz	-46.8	-20.52	26.28
		2500MHz~26500MHz	-47.94	-20.52	27.42

Chain 2

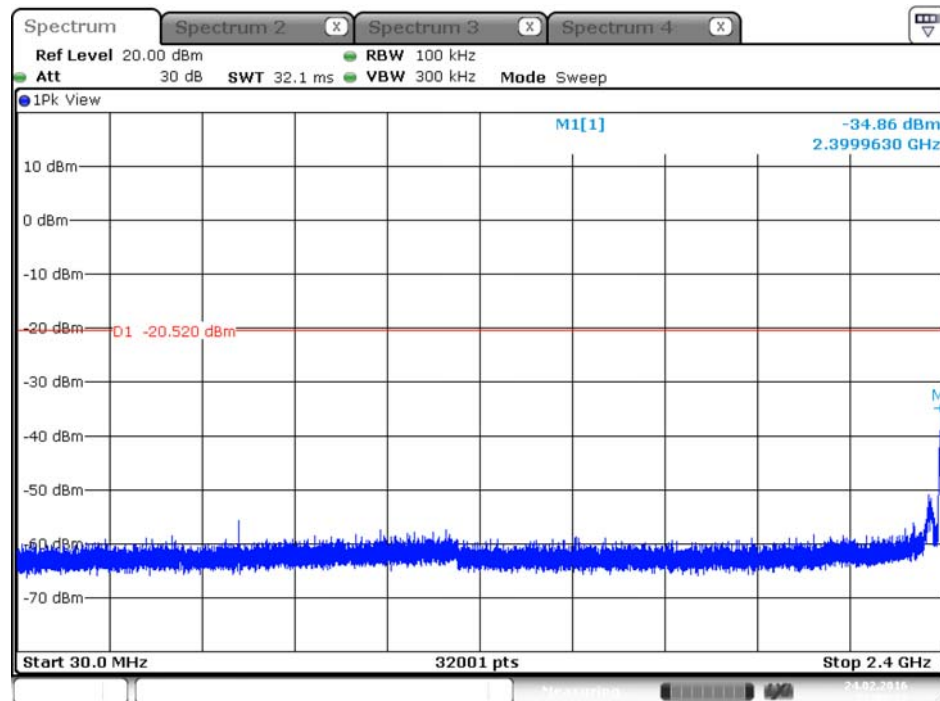
Mode	Frequency		Measurement Level (dBm)	Limit (dBc)	Margin (dB)
802.11g	2412 MHz	30MHz~2400MHz	-32.95	-20.71	12.24
		2390MHz~2400MHz	-30.65	-20.71	9.94
		2483.5MHz~2500MHz	-54.88	-20.71	34.17
		2500MHz~26500MHz	-48.12	-20.71	27.41
	2462 MHz	30MHz~2400MHz	-55.71	-20.71	35.00
		2390MHz~2400MHz	-55.34	-20.71	34.63
		2483.5MHz~2500MHz	-46.62	-20.71	25.91
		2500MHz~26500MHz	-47.32	-20.71	26.61

Plot on Configuration IEEE 802.11g / Reference Level / Chain 1



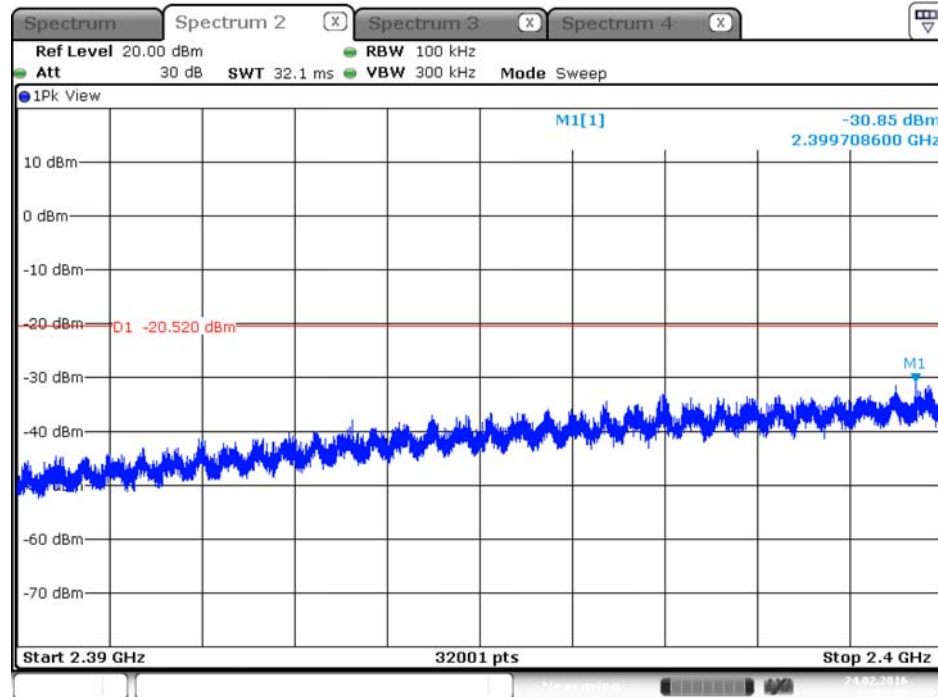
Date: 24.FEB.2016 21:17:43

Plot on Configuration IEEE 802.11g / 2412 MHz / 30MHz~2400MHz (down 30dBc) / Chain 1



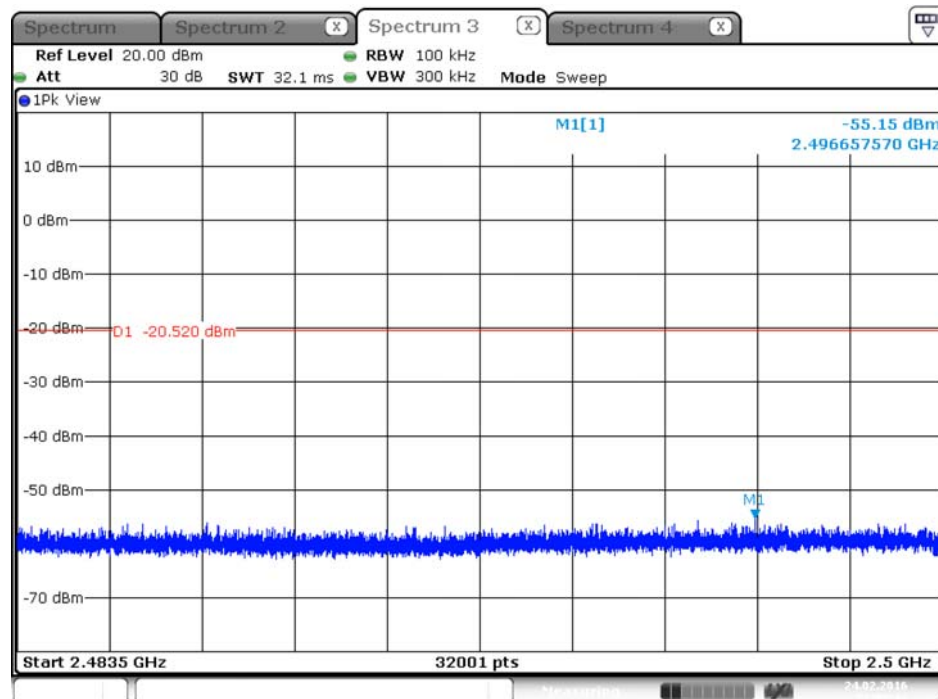
Date: 24.FEB.2016 22:05:12

Plot on Configuration IEEE 802.11g / 2412 MHz / 2390MHz~2400MHz (down 30dBc) / Chain 1



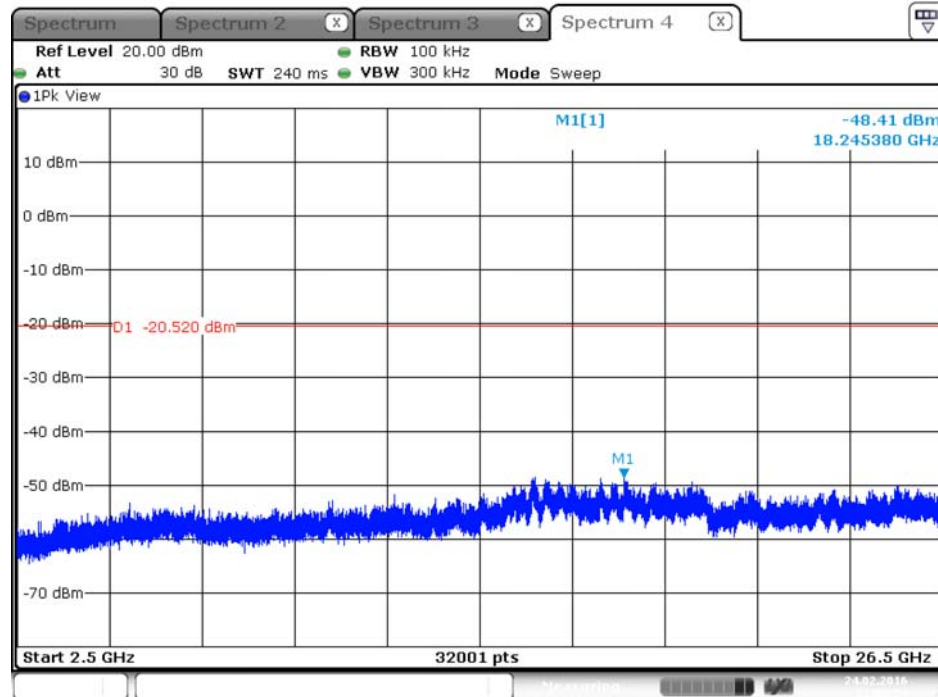
Date: 24.FEB.2016 22:05:28

Plot on Configuration IEEE 802.11g / 2412 MHz / 2483.5MHz~2500MHz (down 30dBc) / Chain 1



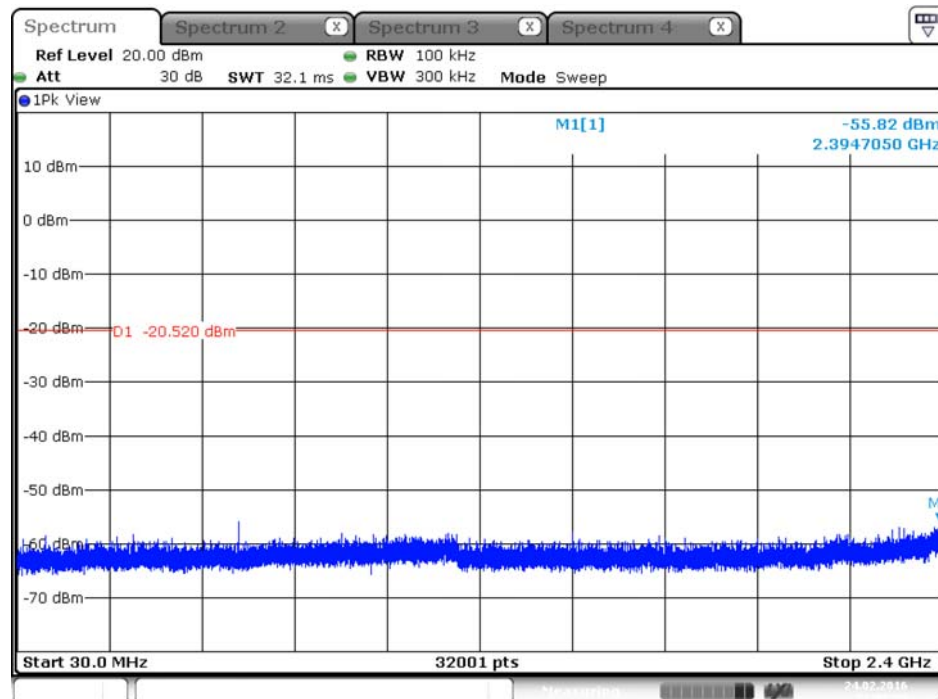
Date: 24.FEB.2016 22:05:41

Plot on Configuration IEEE 802.11g / 2412 MHz / 2500MHz~26500MHz (down 30dBc) / Chain 1



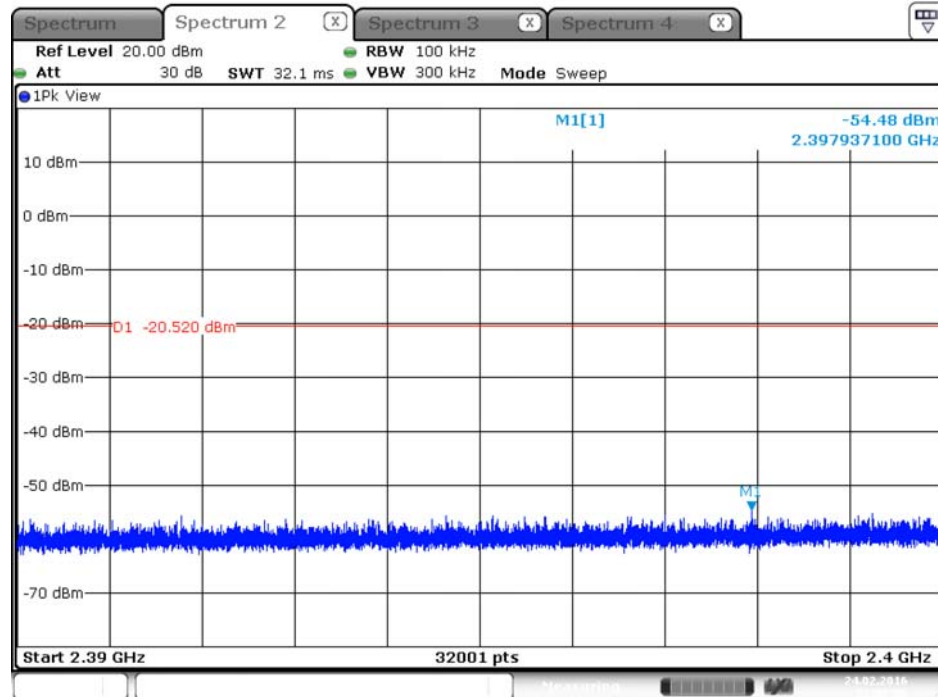
Date: 24.FEB.2016 22:05:54

Plot on Configuration IEEE 802.11g / 2462 MHz / 30MHz~2400MHz (down 30dBc) / Chain 1



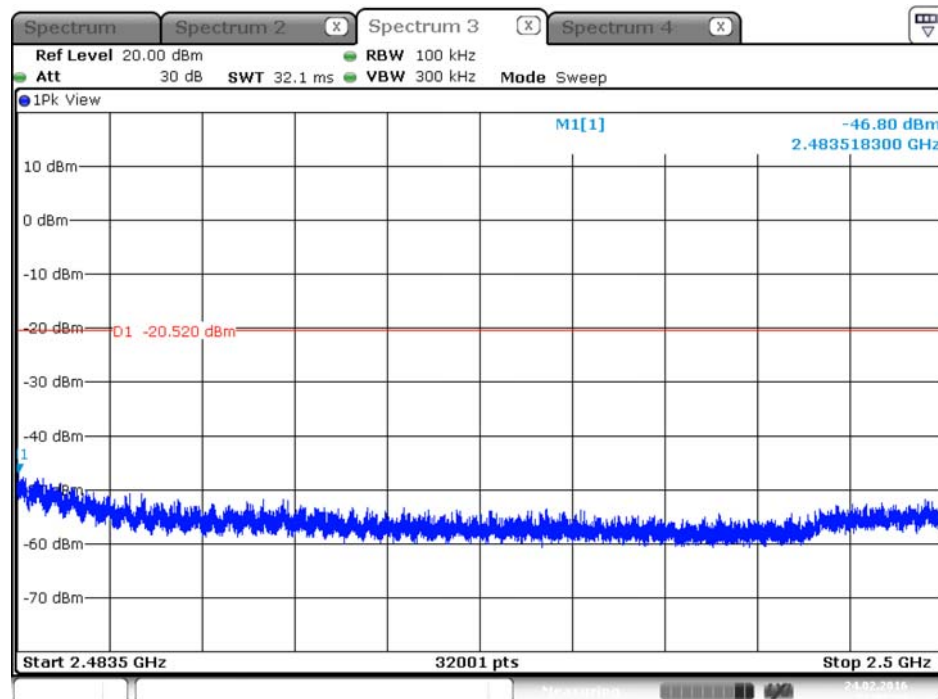
Date: 24.FEB.2016 22:07:52

Plot on Configuration IEEE 802.11g / 2462 MHz / 2390MHz~2400MHz (down 30dBc) / Chain 1



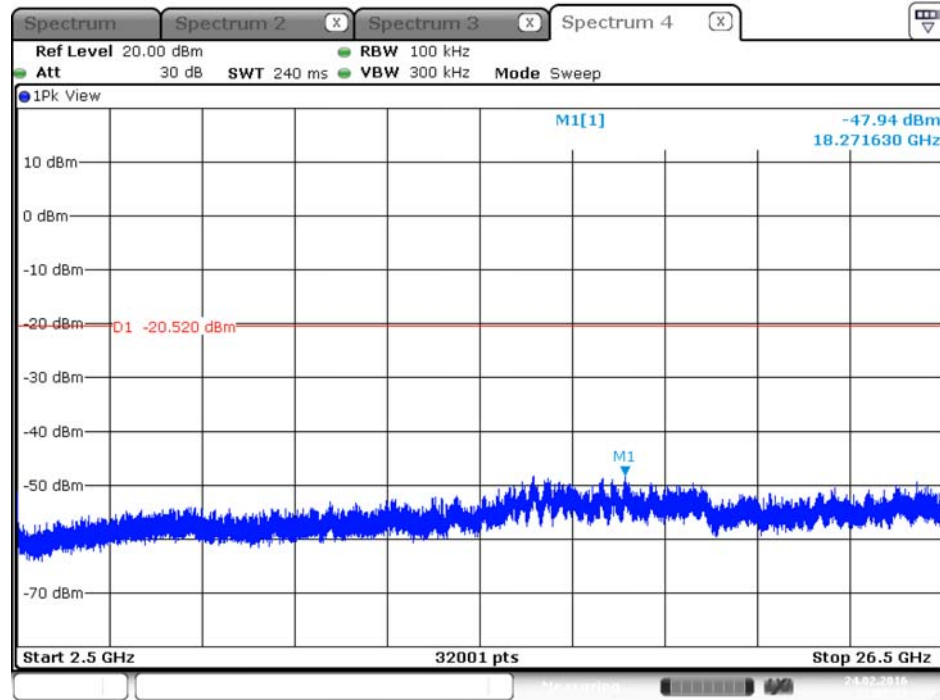
Date: 24.FEB.2016 22:07:36

Plot on Configuration IEEE 802.11g / 2462 MHz / 2483.5MHz~2500MHz (down 30dBc) / Chain 1



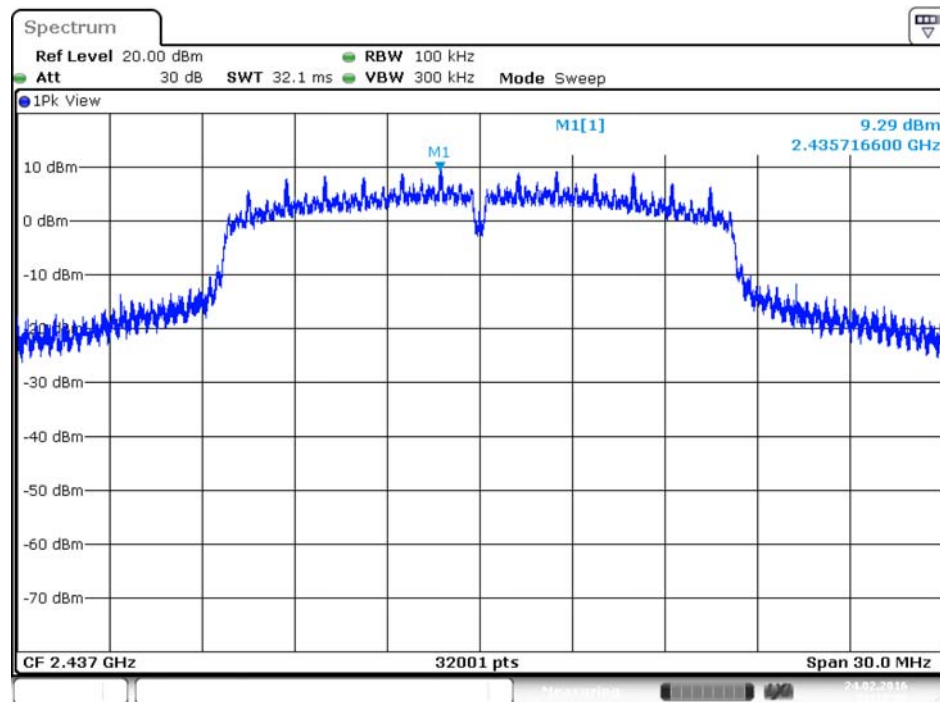
Date: 24.FEB.2016 22:07:24

Plot on Configuration IEEE 802.11g / 2462 MHz / 2500MHz~26500MHz (down 30dBc) / Chain 1



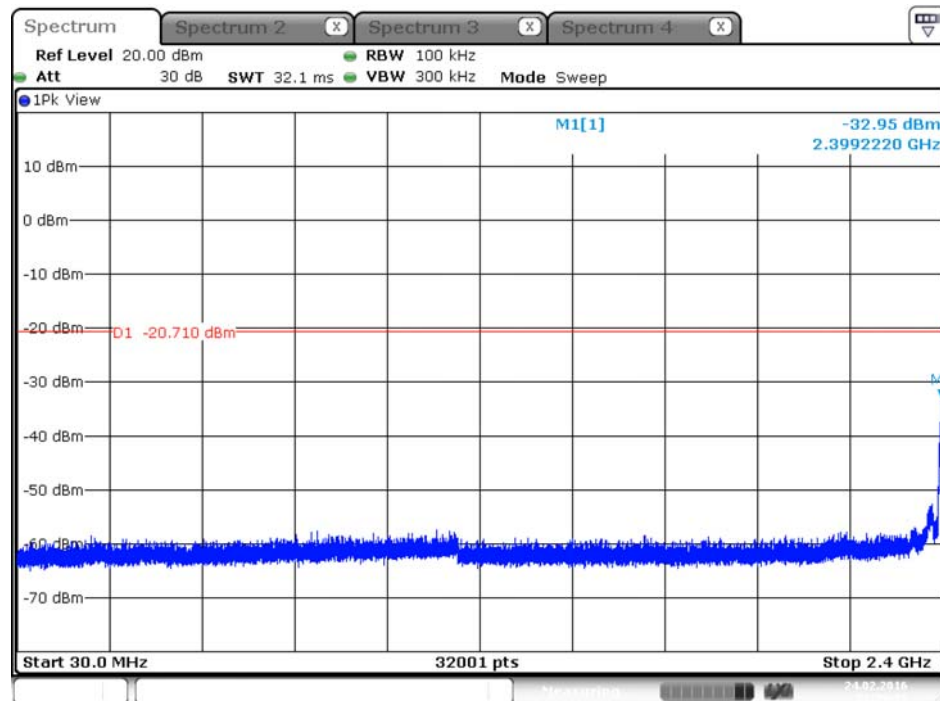
Date: 24.FEB.2016 22:07:12

Plot on Configuration IEEE 802.11g / Reference Level / Chain 2



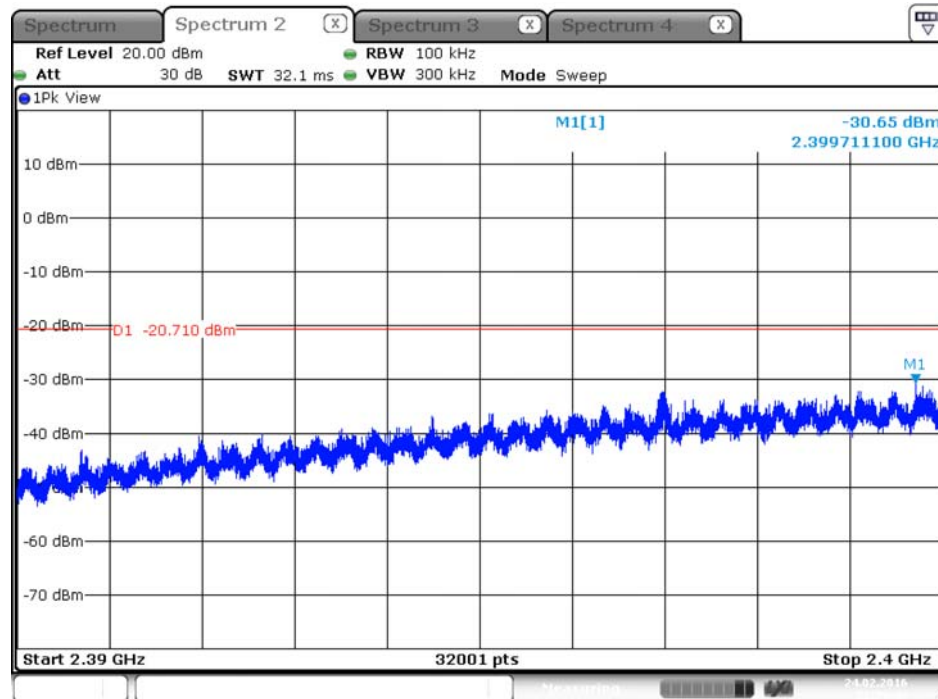
Date: 24.FEB.2016 21:17:06

Plot on Configuration IEEE 802.11g / 2412 MHz / 30MHz~2400MHz (down 30dBc) / Chain 2



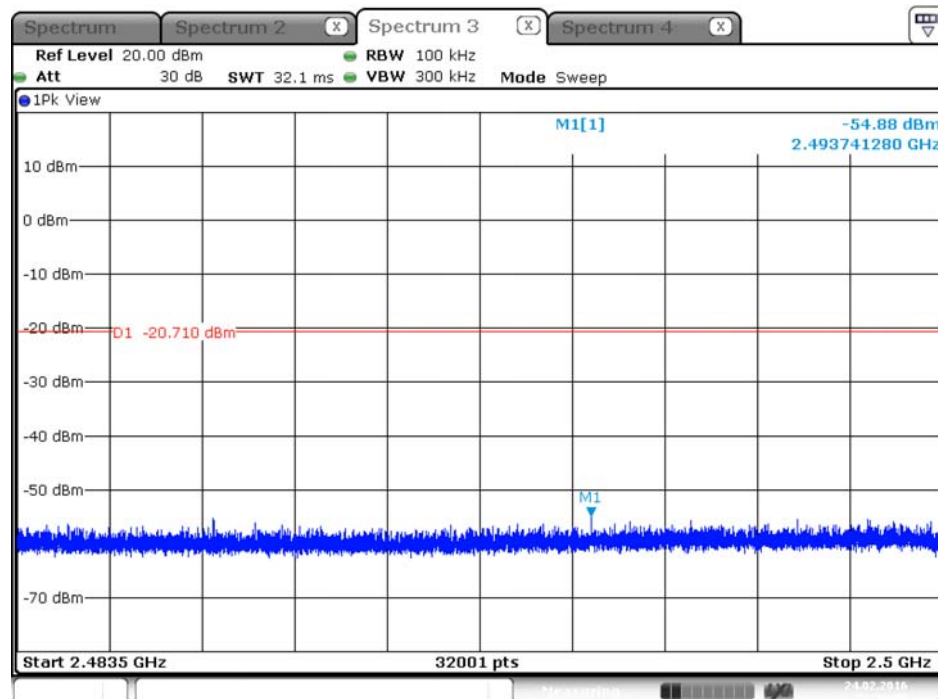
Date: 24.FEB.2016 22:29:30

Plot on Configuration IEEE 802.11g / 2412 MHz / 2390MHz~2400MHz (down 30dBc) / Chain 2



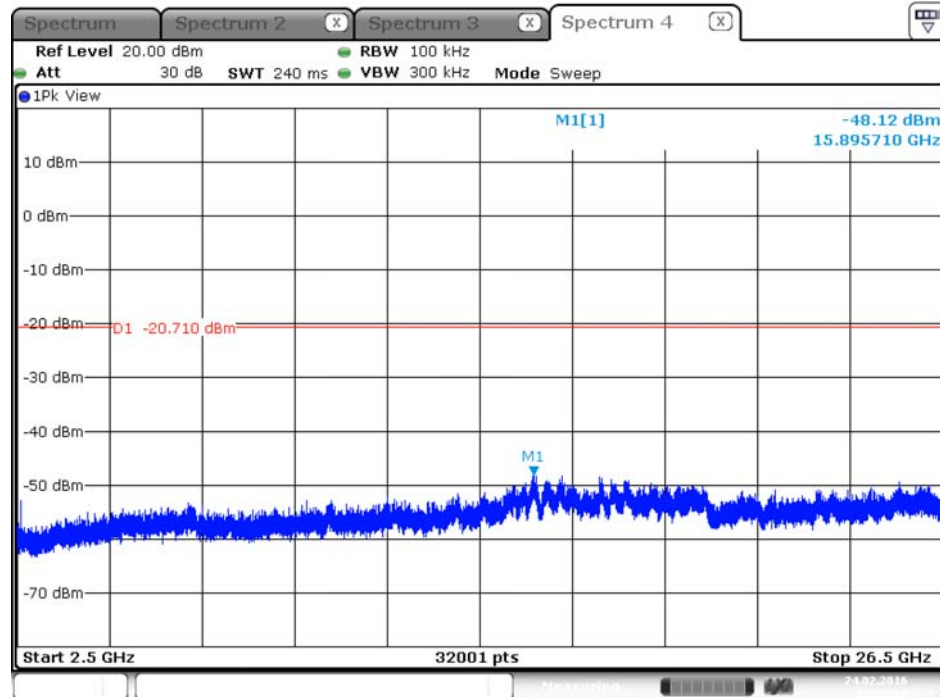
Date: 24.FEB.2016 22:29:42

Plot on Configuration IEEE 802.11g / 2412 MHz / 2483.5MHz~2500MHz (down 30dBc) / Chain 2



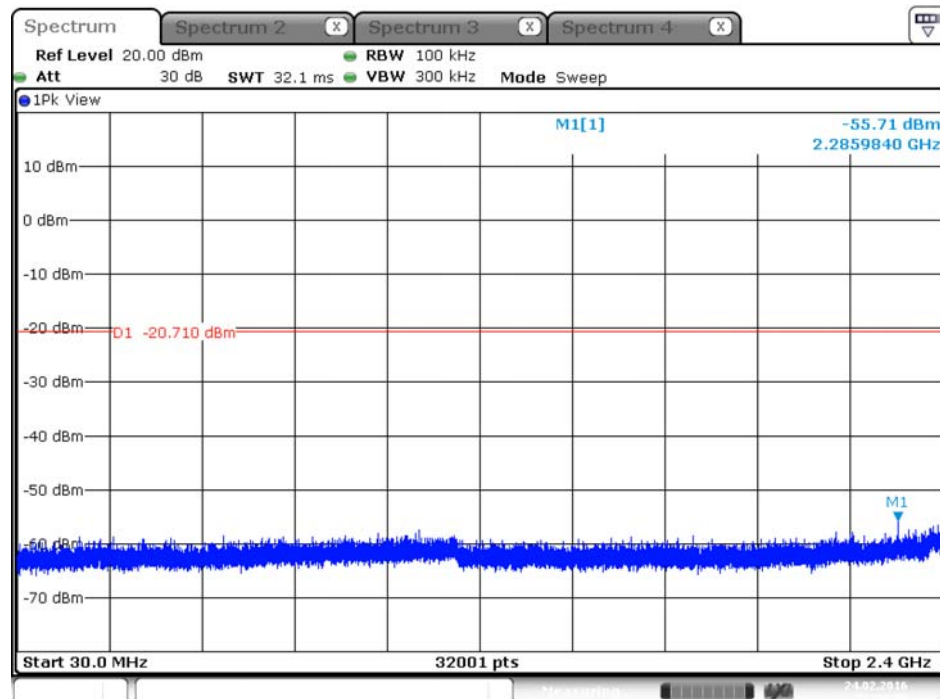
Date: 24.FEB.2016 22:29:55

Plot on Configuration IEEE 802.11g / 2412 MHz / 2500MHz~26500MHz (down 30dBc) / Chain 2



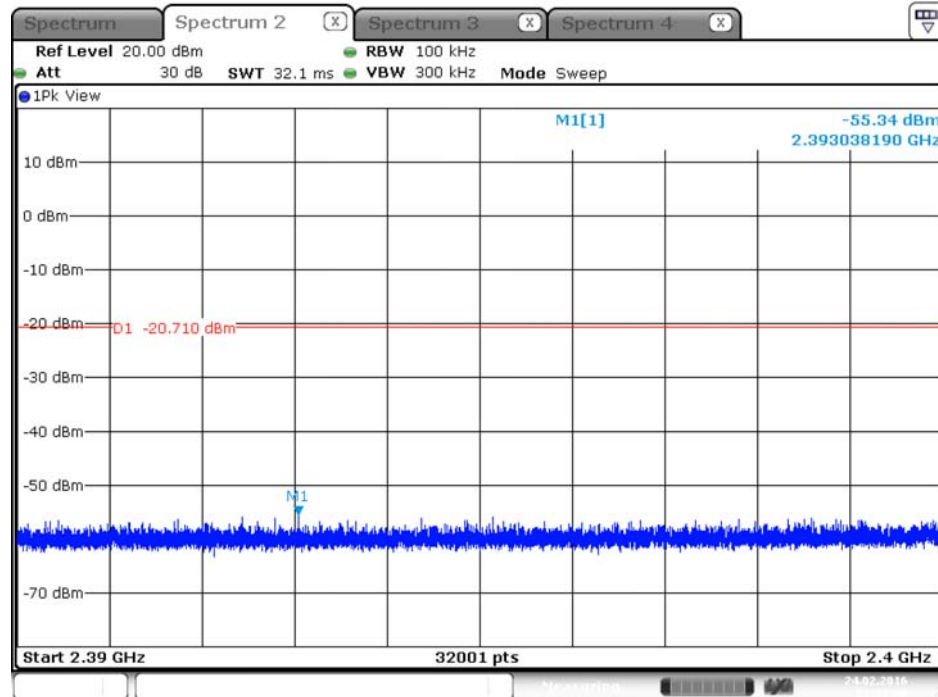
Date: 24.FEB.2016 22:30:14

Plot on Configuration IEEE 802.11g / 2462 MHz / 30MHz~2400MHz (down 30dBc) / Chain 2



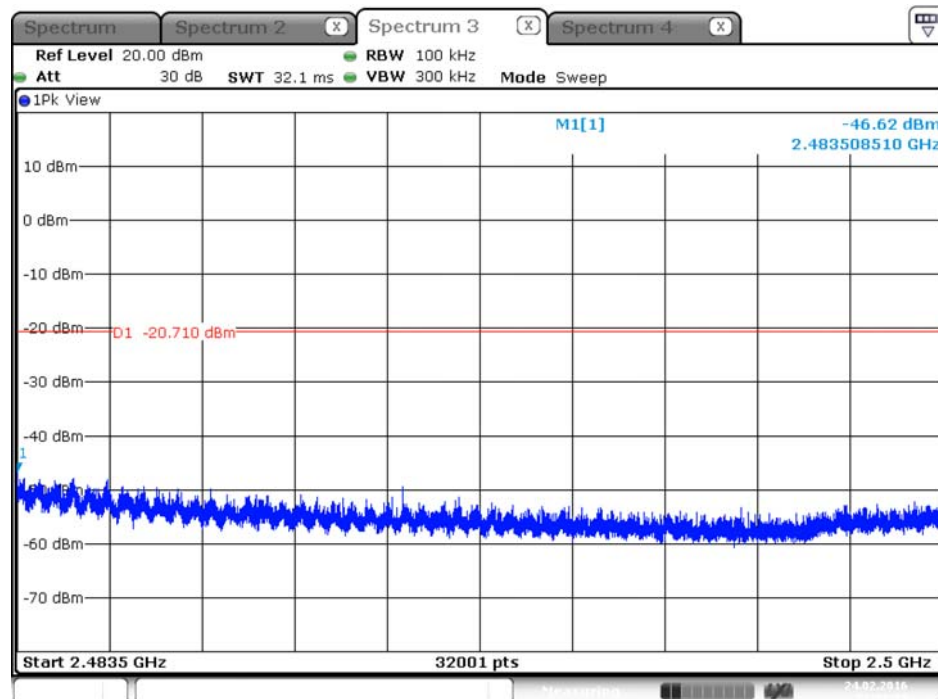
Date: 24.FEB.2016 22:33:06

Plot on Configuration IEEE 802.11g / 2462 MHz / 2390MHz~2400MHz (down 30dBc) / Chain 2



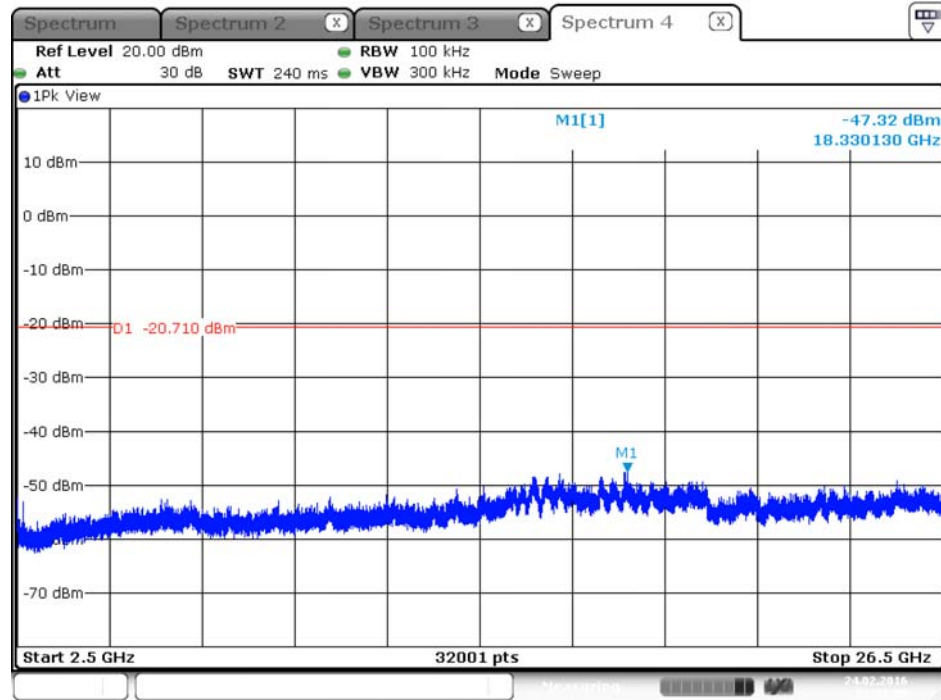
Date: 24.FEB.2016 22:32:48

Plot on Configuration IEEE 802.11g / 2462 MHz / 2483.5MHz~2500MHz (down 30dBc) / Chain 2



Date: 24.FEB.2016 22:32:33

Plot on Configuration IEEE 802.11g / 2462 MHz / 2500MHz~26500MHz (down 30dBc) / Chain 2



Date: 24.FEB.2016 22:32:20

4.4. Antenna Requirements

4.4.1. Limit

Except for special regulations, the Low-power Radio-frequency Devices must not be equipped with any jacket for installing an antenna with extension cable. An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

4.4.2. Antenna Connector Construction

Please refer to section 3.3 in this test report; antenna connector complied with the requirements.

5. LIST OF MEASURING EQUIPMENTS

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
EMI Test Receiver	R&S	ESCS 30	100355	9kHz ~ 2.75GHz	Apr. 22, 2015	Conduction (CO01-CB)
LISN	F.C.C.	FCC-LISN-50-16-2	04083	150kHz ~ 100MHz	Dec. 08, 2015	Conduction (CO01-CB)
LISN	Schwarzbeck	NSLK 8127	8127647	9kHz ~ 30MHz	Dec. 23, 2015	Conduction (CO01-CB)
COND Cable	Woken	Cable	01	150kHz ~ 30MHz	May 25, 2015	Conduction (CO01-CB)
Software	Audix	E3	6.120210n	-	N.C.R.	Conduction (CO01-CB)
BILOG ANTENNA	Schaffner	CBL6112D	37880	20MHz ~ 2GHz	Sep. 03, 2015	Radiation (03CH01-CB)
Horn Antenna	EMCO	3115	00075790	750MHz ~ 18GHz	Oct. 22, 2015	Radiation (03CH01-CB)
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Jul. 21, 2015	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8447D	2944A10940	0.1MHz ~ 1.3GHz	Feb. 24, 2016	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8449B	3008A02310	1GHz ~ 26.5GHz	Jan. 18, 2016	Radiation (03CH01-CB)
Pre-Amplifier	WM	TF-130N-R1	923365	26GHz ~ 40GHz	Nov.13, 2015	Radiation (03CH01-CB)
Spectrum Analyzer	R&S	FSP40	100056	9kHz ~ 40GHz	Oct. 27, 2015	Radiation (03CH01-CB)
EMI Receiver	Agilent	N9038A	MY52260123	9kHz ~ 8.4GHz	Jan. 27, 2016	Radiation (03CH01-CB)
RF Cable-low	Woken	Low Cable-1	N/A	30 MHz ~ 1 GHz	Nov. 02, 2015	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-16	N/A	1 GHz ~ 18 GHz	Nov. 02, 2015	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-17	N/A	1 GHz ~ 18 GHz	Nov. 02, 2015	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-40G-1	N/A	18GHz ~ 40 GHz	Nov. 02, 2015	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-40G-2	N/A	18GHz ~ 40 GHz	Nov. 02, 2015	Radiation (03CH01-CB)
Loop Antenna	Teseq	HLA 6120	24155	9kHz - 30 MHz	Mar. 12, 2015*	Radiation (03CH01-CB)

Note: Calibration Interval of instruments listed above is one year.

“*” Calibration Interval of instruments listed above is two years.

N.C.R. means Non-Calibration required.

6. MEASUREMENT UNCERTAINTY

Test Items	Uncertainty	Remark
Conducted Emission (150kHz ~ 30MHz)	3.2 dB	Confidence levels of 95%
Radiated Emission (30MHz ~ 1,000MHz)	3.6 dB	Confidence levels of 95%
Radiated Emission (1GHz ~ 18GHz)	3.7 dB	Confidence levels of 95%
Radiated Emission (18GHz ~ 40GHz)	3.5 dB	Confidence levels of 95%