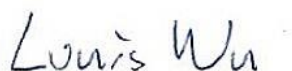


IC Test Report

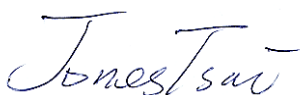
APPLICANT : Texas Instruments Incorporated
EQUIPMENT : 2.4GHz Wi-Fi® Module
BRAND NAME : Texas Instruments
MODEL NAME : CC3220MODASF12MON
CC3220MODASM2MON
CC3220MODSF12MOB
CC3220MODSM2MOB
MARKETING NAME : SimpleLink™ Wi-Fi® CC3220MOD
Wireless Microcontroller Module
IC : 451I-CC3220MOD
STANDARD : ICES-003 Issue 6

The product was received on Mar. 16, 2017 and testing was completed on Apr. 18, 2017. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the test procedures given in ANSI C63.4-2014 and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.



Reviewed by: Louis Wu / Manager



Approved by: Jones Tsai / Manager



SPORTON INTERNATIONAL INC.

No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan District, Tao Yuan City, Taiwan, R.O.C.



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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
CI731625	Rev. 01	Initial issue of report	Jun. 10, 2017



SUMMARY OF TEST RESULT

Report Section	IC Rule	Description	Limit	Result	Remark
3.1	ICES003 Section 6.1	AC Conducted Emission	< ICES003 6.1 limits	PASS	Under limit 12.20 dB at 0.150 MHz
3.2	ICES003 Section 6.2	Radiated Emission	< ICES003 6.2 limits	PASS	Under limit 7.74 dB at 39.720 MHz for peak



1. General Description

1.1.Applicant

Texas Instruments Incorporated
12500 TI BLVD., Dallas Texas, 75243

1.2.Manufacturer

Texas Instruments Incorporated
12500 TI BLVD., Dallas Texas, 75243

1.3.Product Feature of Equipment Under Test

Wi-Fi 2.4GHz 802.11b/g/n

Antenna Information				
	Brand	Antenna Type	Model	2.4GHz gain
1	FoxCon	PCB	T77H533	2.5dBi
2	Ethertronics	Dipole	1000423	-0.6dBi
3	LSR	Rubber Whip / Dipole	001-0012	2dBi
4			080-0013	2dBi
5			080-0014	2dBi
6		PIFA	001-0016	2.5dBi
7			001-0021	2.5dBi
8	Laird	PCB	CAF94504	2dBi
9			CAF9405	2dBi
10	ACX	Multilayer Chip	AT3216-BR2R7HAA	0.5dBi
11			AT312-T2R4PAA	1.5dBi
12	TDK	Multilayer Ceramic Chip Antenna	ANT016008LCD2442MA1	1.6dBi
13			ANT016008LCD2442MA2	2.5dBi
14	Mitsubishi Material	Chip Antenna	AM03DP-ST01	1.6dBi
15		Antenna Unit	UB18CP-100ST01	-1.0dBi
16	Taiyo Yuden	Chip Antenna / Herical Monopole	AF216M245001	1.5dBi
17		Chip Antenna /Monopole Type	AH212M245001	1.3dBi
18			AH316M245001	1.9dBi
19	Antenna Technology	Dipole	AA2402SPU	2.0dBi
20			AA2402RSPU	2.0dBi
21			AA2402A-UFLLP	2.0dBi
22			AA2402AU-UFLLP	2.0dBi
23	Staf	Mono-pole	1019-016	2.14dBi
24			1019-017	2.14dBi
25			1019-018	2.14dBi
26			1019-019	2.14dBi
27	Map Electronics	Rubber Whip	MEIWX-2411SAXX-2400	2.0dBi
28			MEIWX-2411RSXX-2400	2.0dBi
29			MEIWX-282XSAXX-2400	2.0dBi
30			MEIWX-282XRSXX-2400	2.0dBi
31			MEIWF-HP01RS2X-2400	2.0dBi
32	Yageo	Chip	ANT3216A063R2400A	1.69dBi
33	Mag Layers Scientific	Chip	LTA-3216-2G4S3-A1	1dBi
34			LTA-3216-2G4S3-A3	2dBi
35	Advantech	Rubber Whip / Dipole	AN2450-5706RS	2.38dBi

Note: the EUT used a 2.4GHz Chip antenna (Antenna 18 from Taiyo Yuden)

1.4.Modification of EUT

No modifications are made to the EUT during all test items.

1.5.Test Location

Sporton Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code : 1190) and the FCC designation No. TW1190 under the FCC 2.948(e) by Mutual Recognition Agreement (MRA) in FCC Test.

Test Site	SPORTON INTERNATIONAL INC.		
Test Site Location	No. 52, Hwa Ya 1 st Rd., Hwa Ya Technology Park, Kwei-Shan District, Tao Yuan City, Taiwan, R.O.C. TEL: +886-3-327-3456 FAX: +886-3-328-4978		
Test Site No.	Sporton Site No.		IC Registration No.
	CO05-HY	03CH06-HY	4086B-4

1.6.Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ANSI C63.4-2014
- IC ICES-003 Issue 6
- IC RSS-Gen Issue 4

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. The test results for FCC compliance, indicating that these results are deemed satisfactory evidence of compliance with **Industry Canada Interference-Causing Equipment Standard ICES-003**.

2. Test Configuration of Equipment Under Test

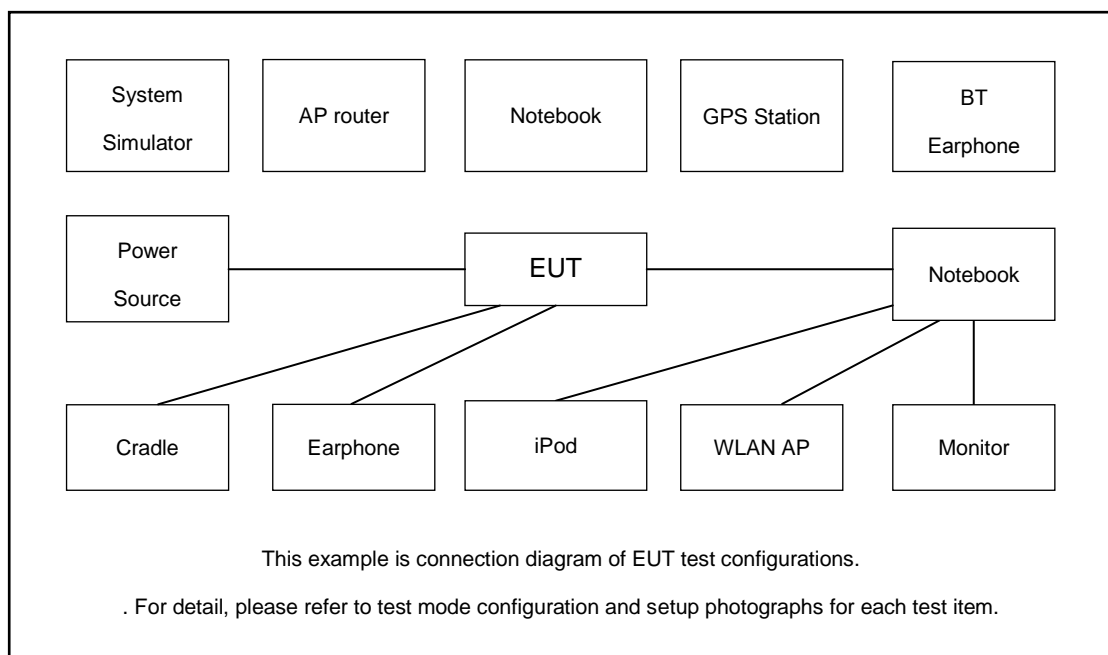
2.1. Test Mode

The EUT has been associated with peripherals pursuant to ANSI C63.4-2014 and configuration operated in a manner tended to maximize its emission characteristics in a typical application.

Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (30MHz to the 5th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower).

Test Items	Function Type
AC Conducted Emission	Mode 1: WLAN Idle
Radiated Emissions	Mode 1: WLAN Idle

2.2. Connection Diagram of Test System



2.3.Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	WLAN AP	ASUS	RT-AC66U	MSQ-RTAC66U	N/A	Unshielded, 1.8 m
2.	Notebook	DELL	Latitude E3340	FCC DoC/ Contains FCC ID: PD97260NGU	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
3.	iPod	Apple	A1199	FCC DoC	Unshielded, 1.2 m	N/A

2.4.EUT Operation Test Setup

The EUT was synchronized to the BCCH, and is in continuous receiving mode by setting system simulator's paging reorganization.

At the same time, the EUT was attached to the WLAN AP.

3. Test Result

3.1. Test of AC Conducted Emission Measurement

3.1.1 Limits of AC Conducted Emission

For equipment that is designed to be connected to the public utility (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 the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

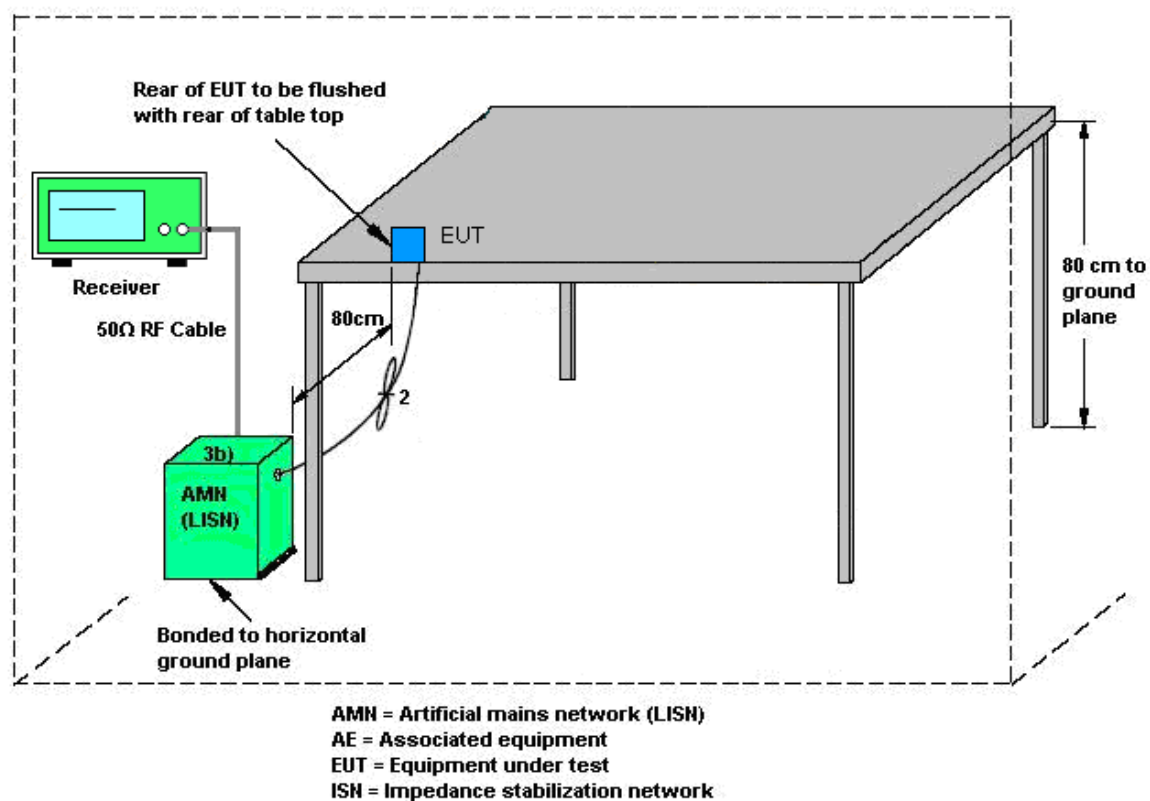
3.1.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.1.3 Test Procedure

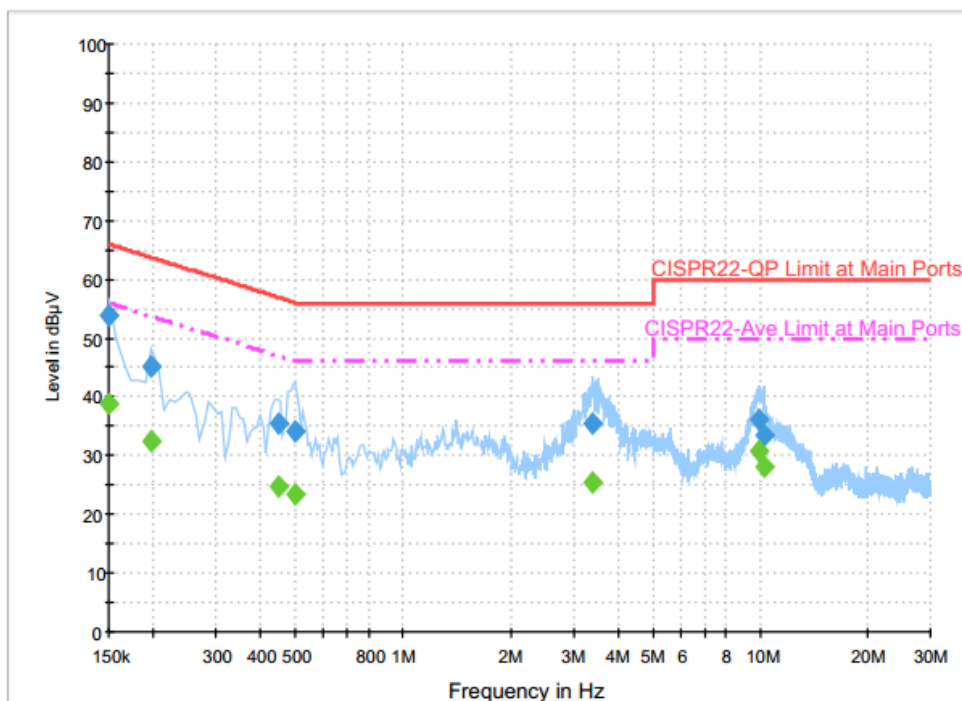
1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

3.1.4 Test Setup



3.1.5 Test Result of AC Conducted Emission

Test Engineer :	Eric Jeng	Temperature :	23~25°C
		Relative Humidity :	52~56%
Test Voltage :	120Vac / 60Hz	Phase :	Line



Final Result : Quasi-Peak

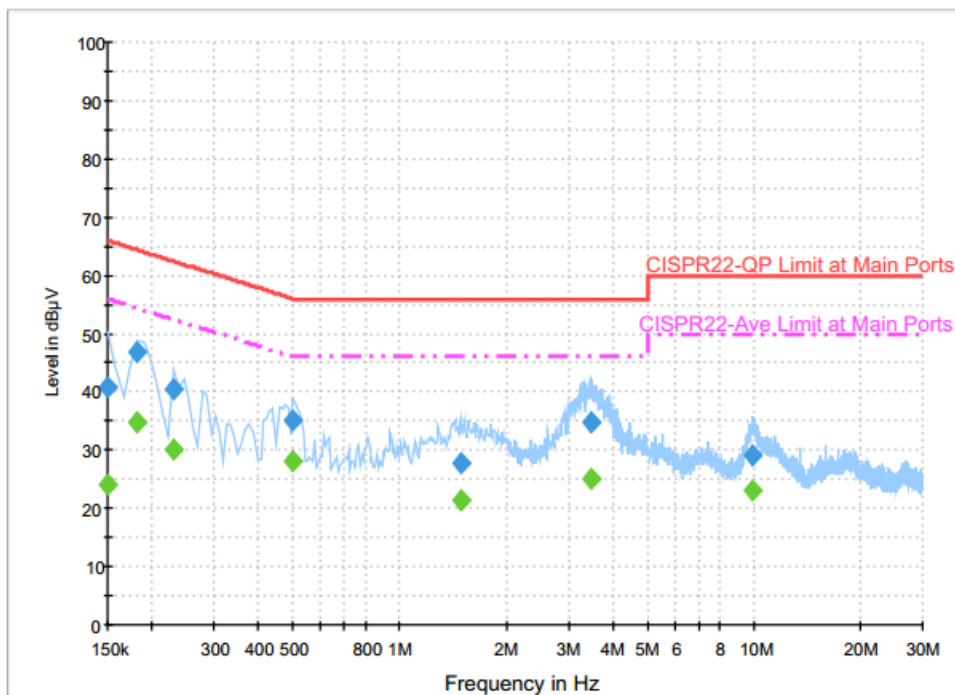
Frequency (MHz)	Quasi-Peak (dBμV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.150000	53.8	Off	L1	19.6	12.2	66.0
0.198000	45.3	Off	L1	19.5	18.4	63.7
0.446000	35.3	Off	L1	19.5	21.6	56.9
0.502000	34.0	Off	L1	19.5	22.0	56.0
3.414000	35.4	Off	L1	19.5	20.6	56.0
9.878000	36.0	Off	L1	19.7	24.0	60.0
10.286000	33.5	Off	L1	19.7	26.5	60.0

Final Result : Average

Frequency (MHz)	Average (dBμV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.150000	38.9	Off	L1	19.6	17.1	56.0
0.198000	32.4	Off	L1	19.5	21.3	53.7
0.446000	24.9	Off	L1	19.5	22.0	46.9
0.502000	23.4	Off	L1	19.5	22.6	46.0
3.414000	25.4	Off	L1	19.5	20.6	46.0
9.878000	30.8	Off	L1	19.7	19.2	50.0
10.286000	28.2	Off	L1	19.7	21.8	50.0



Test Engineer :	Eric Jeng	Temperature :	23~25°C
		Relative Humidity :	52~56%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral

**Final Result : Quasi-Peak**

Frequency (MHz)	Quasi-Peak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	40.9	Off	N	19.5	25.1	66.0
0.182000	46.8	Off	N	19.5	17.6	64.4
0.230000	40.4	Off	N	19.5	22.0	62.4
0.502000	35.3	Off	N	19.5	20.7	56.0
1.486000	27.7	Off	N	19.5	28.3	56.0
3.470000	34.9	Off	N	19.5	21.1	56.0
9.934000	29.1	Off	N	19.7	30.9	60.0

Final Result : Average

Frequency (MHz)	Average (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	23.9	Off	N	19.5	32.1	56.0
0.182000	34.9	Off	N	19.5	19.5	54.4
0.230000	30.0	Off	N	19.5	22.4	52.4
0.502000	28.1	Off	N	19.5	17.9	46.0
1.486000	21.3	Off	N	19.5	24.7	46.0
3.470000	25.2	Off	N	19.5	20.8	46.0
9.934000	23.1	Off	N	19.7	26.9	50.0

3.2. Test of Radiated Emission Measurement

3.2.1. Limit of Radiated Emission

The emissions from an unintentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
30 – 88	100	3
88 – 216	150	3
216 - 960	200	3
Above 960	500	3

3.2.2. Measuring Instruments

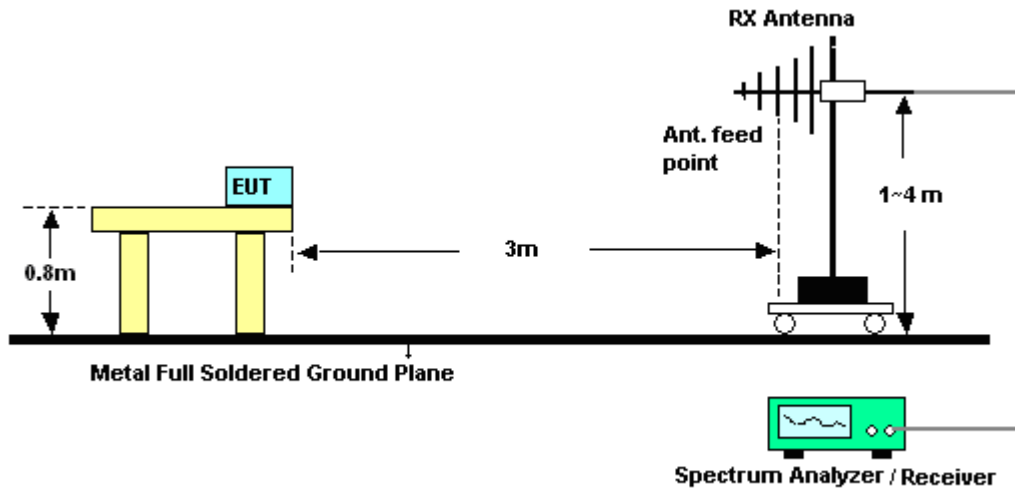
The measuring equipment is listed in the section 4 of this test report.

3.2.3. Test Procedures

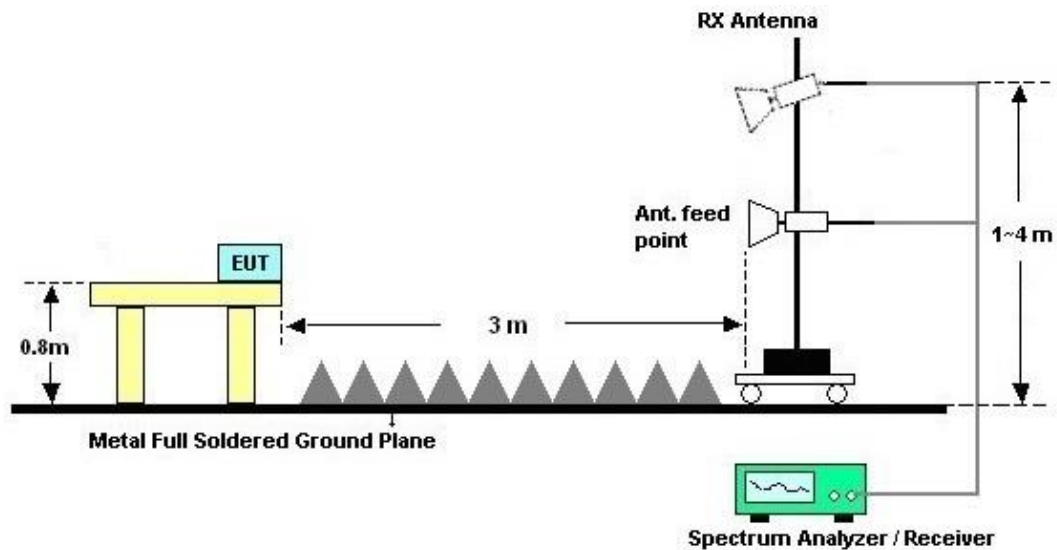
1. The EUT was placed on a turntable with 0.8 meter above ground.
2. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
3. The table was rotated 360 degrees to determine the position of the highest radiation.
4. The antenna is a Bi-Log antenna and its height is adjusted between one to four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
5. For each suspected emission, the EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.
6. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode (RBW=120kHz/VBW=300kHz for frequency below 1GHz; RBW=1MHz VBW=3MHz (Peak), RBW=1MHz/VBW=10Hz (Average) for frequency above 1GHz).
7. If the emission level of the EUT in peak mode was 3 dB lower than the limit specified, peak values of EUT will be reported. Otherwise, the emission will be repeated by using the quasi-peak method and reported.
8. Emission level (dBμV/m) = 20 log Emission level (μV/m)
9. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level

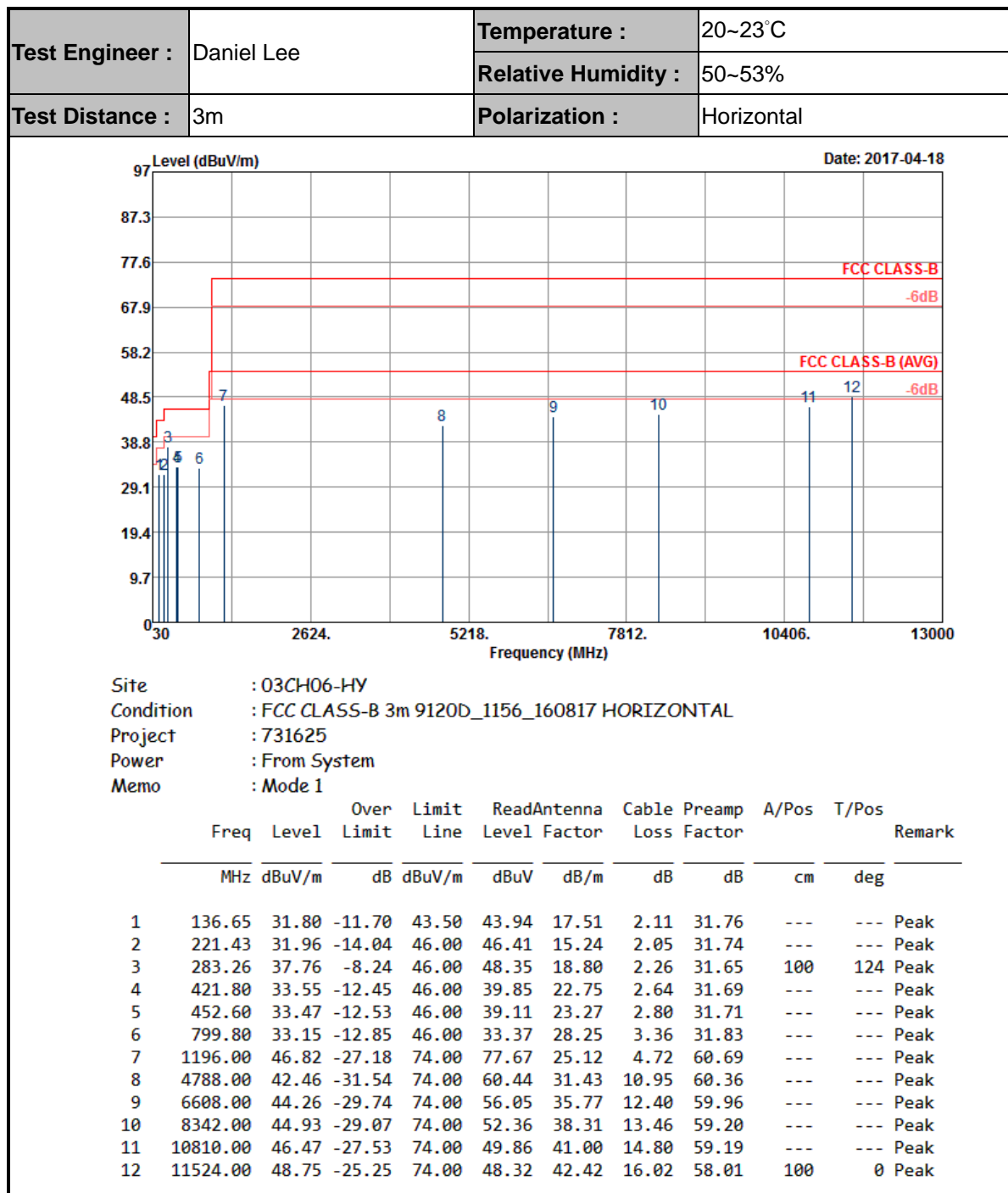
3.2.4. Test Setup of Radiated Emission

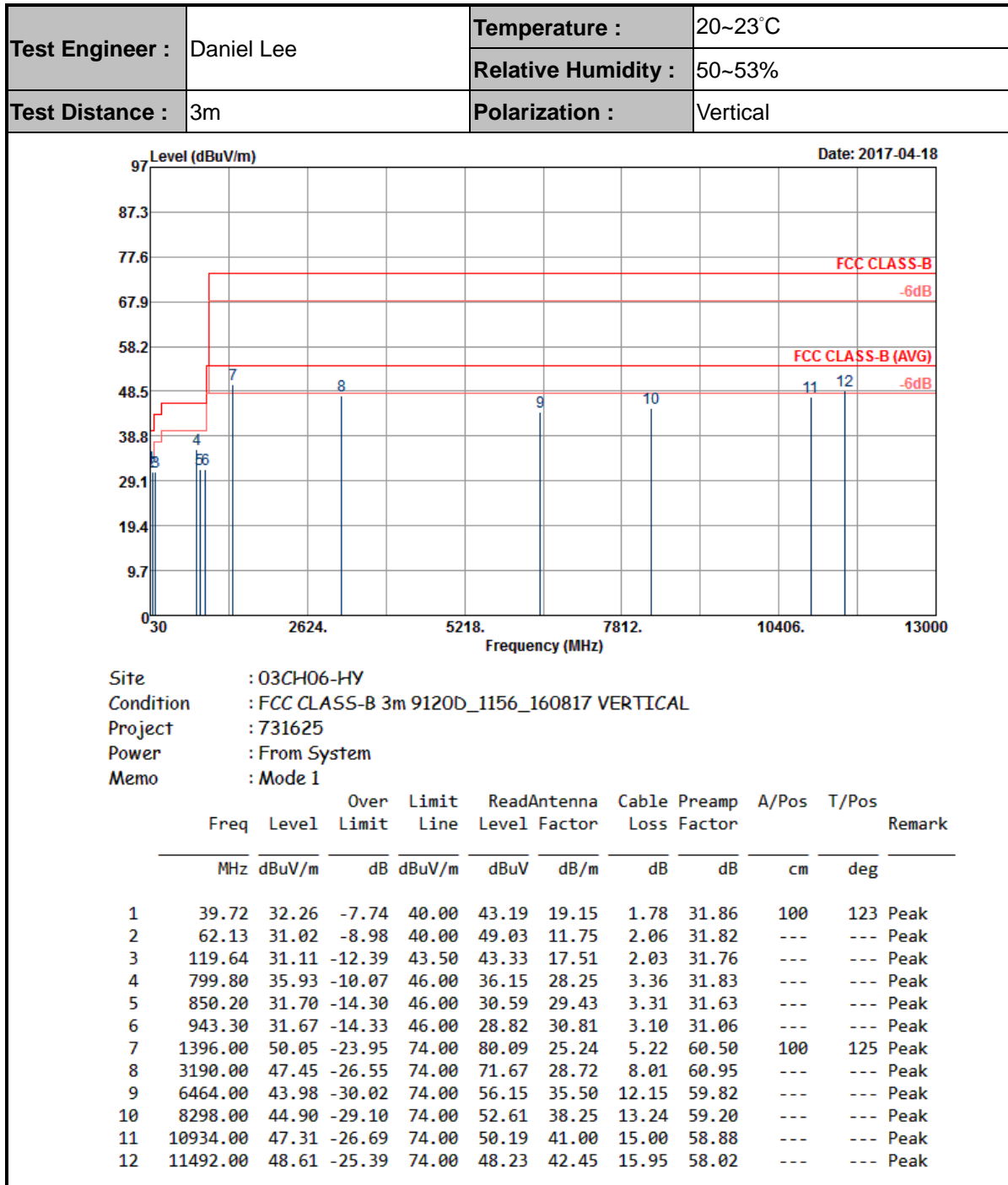
For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.2.5. Test Result of Radiated Emission






4. List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
AC Power Source	ChainTek	APC-1000W	N/A	N/A	N/A	Apr. 18, 2017	N/A	Conduction (CO05-HY)
EMI Test Receiver	Rohde & Schwarz	ESCI 7	100724	9kHz~7GHz	Aug. 30, 2016	Apr. 18, 2017	Aug. 29, 2017	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100080	9kHz~30MHz	Nov. 29, 2016	Apr. 18, 2017	Nov. 28, 2017	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100081	9kHz~30MHz	Dec. 06, 2016	Apr. 18, 2017	Dec. 05, 2017	Conduction (CO05-HY)
Bilog Antenna	Schaffner	CBL6111C&N-6-06	2725&AT-N0601	30MHz~1GHz	Oct. 15, 2016	Apr. 18, 2017	Oct. 14, 2017	Radiation (03CH06-HY)
EMI Test Receiver	Rohde & Schwarz	ESU26	100472	20Hz~26.5GHz	Dec. 29, 2016	Apr. 18, 2017	Dec. 28, 2017	Radiation (03CH06-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1156	1GHz~18GHz	Aug. 05, 2016	Apr. 18, 2017	Aug. 04, 2017	Radiation (03CH06-HY)
Preamplifier	MITEQ	AMF-7D-0010 1800-30-10P	1850117	1GHz ~ 18GHz	Jun. 22, 2016	Apr. 18, 2017	Jun. 21, 2017	Radiation (03CH06-HY)
Antenna Mast	MF	MF-7802	MF780208212	1m~4m	N/A	Apr. 18, 2017	N/A	Radiation (03CH06-HY)
Turn Table	INN-CO	DS2000	420/650/00	0-360 degree	N/A	Apr. 18, 2017	N/A	Radiation (03CH06-HY)
Amplifier	SONOMA	310N	187231	9kHz~1GHz	Jan. 09, 2017	Apr. 18, 2017	Jan. 08, 2018	Radiation (03CH06-HY)

5. Uncertainty of Evaluation

Uncertainty of Conducted Emission Measurement (150 kHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	2.7
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Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	3.9
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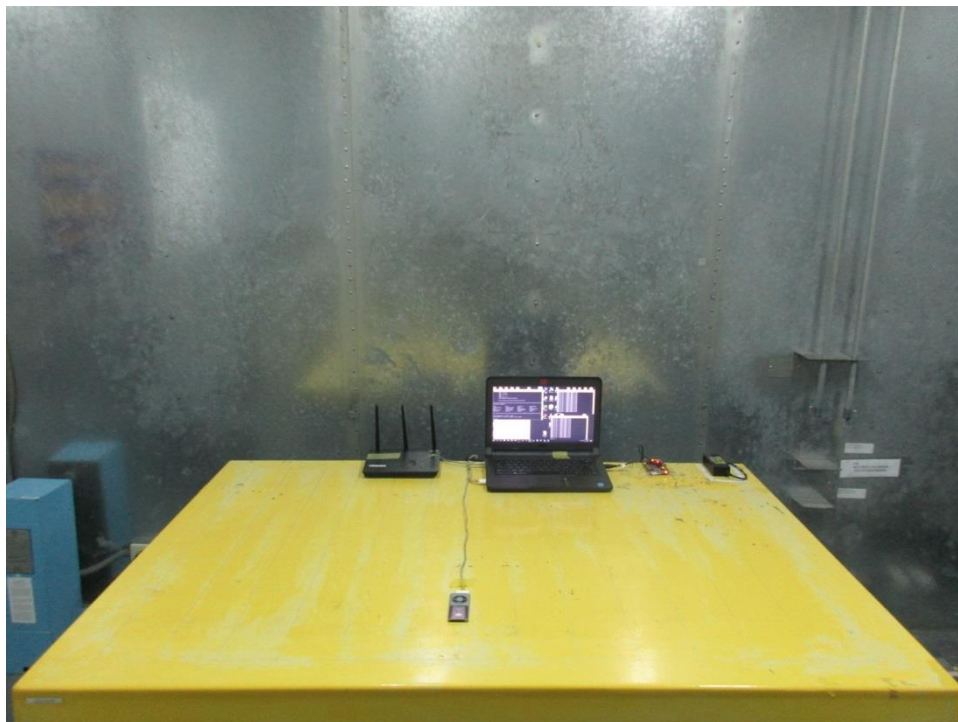
Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

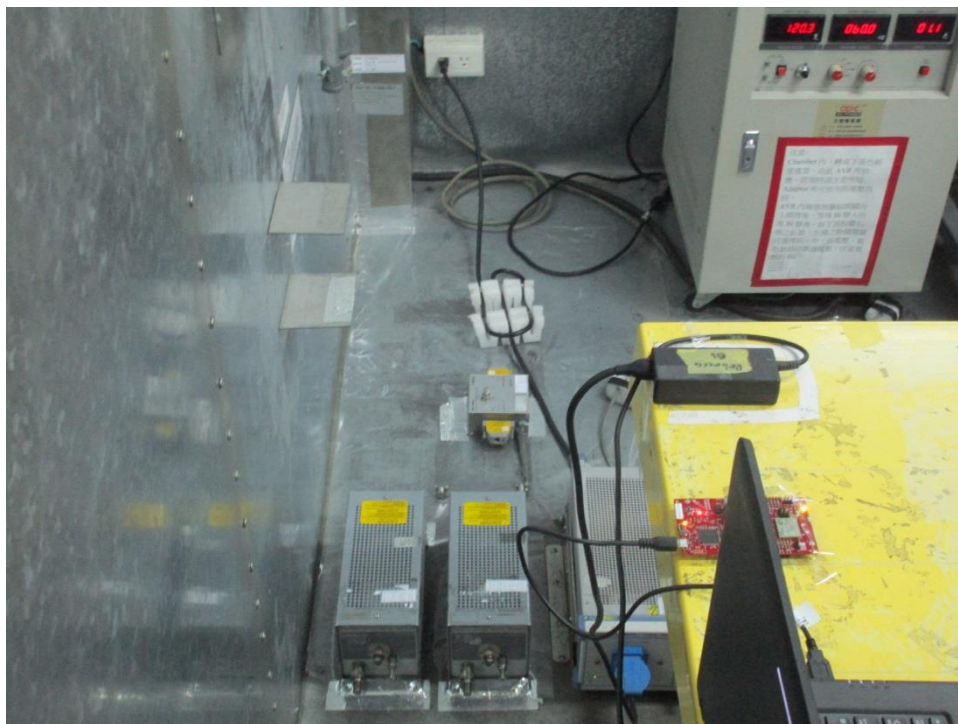
Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	4.7
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Appendix A. Setup Photographs

<Conducted Emission>

Remote View





Rear View



<Radiated Emission>

LF



HF

