



FCC Test Report

APPLICANT : Bullitt Group
EQUIPMENT : Rugged Smart Phone
BRAND NAME : CAT
MODEL NAME : S31
FCC ID : ZL5S31A
STANDARD : FCC 47 CFR FCC Part 15 Subpart B
CLASSIFICATION : Certification

The product was received on Aug. 06, 2017 and testing was completed on Oct. 06, 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
FC780604-01	Rev. 01	Initial issue of report	Oct. 13, 2017



SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	15.107	AC Conducted Emission	< 15.107 limits	PASS	Under limit 13.00 dB at 0.166 MHz
3.2	15.109	Radiated Emission	< 15.109 limits	PASS	Under limit 2.19 dB at 186.060 MHz for Quasi-Peak



1. General Description

1.1. Applicant

Bullitt Group

One Valpy, Valpy Street, Reading, Berkshire, England RG1 1AR

1.2. Manufacturer

Compal Electronics, INC.

No. 385, Yangguang St. Neihu District, Taipei City 11491, Taiwan, R.O.C

1.3. Product Feature of Equipment Under Test

GSM/WCDMA/LTE, Bluetooth, Wi-Fi 2.4GHz 802.11b/g/n, FM Receiver, and GPS

Product Specification subjective to this standard	
Antenna Type	WWAN: Coupling type (LDS) Antenna WLAN: PIFA Antenna Bluetooth: PIFA Antenna GPS / Glonass / BDS: PIFA Antenna FM: Integral Antenna (Earphone acting as FM antenna deemed as an integral antenna)

<Sample Information>

S31 has 2 different Variant	
Sample 1	Dual SIM
Sample 2	Single SIM
For Dual-SIM or Single-SIM control by SW, The HW difference is SIM holder	

Remark: All test items were performed with Sample 1.

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. TW1093 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.	
	CO05-HY	03CH06-HY

1.6. Applicable Standards

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

- FCC 47 CFR FCC Part 15 Subpart B
- ANSI C63.4-2014

Remark:

All test items were verified and recorded according to the standards and without any deviation during the test.



2. Test Configuration of Equipment Under Test

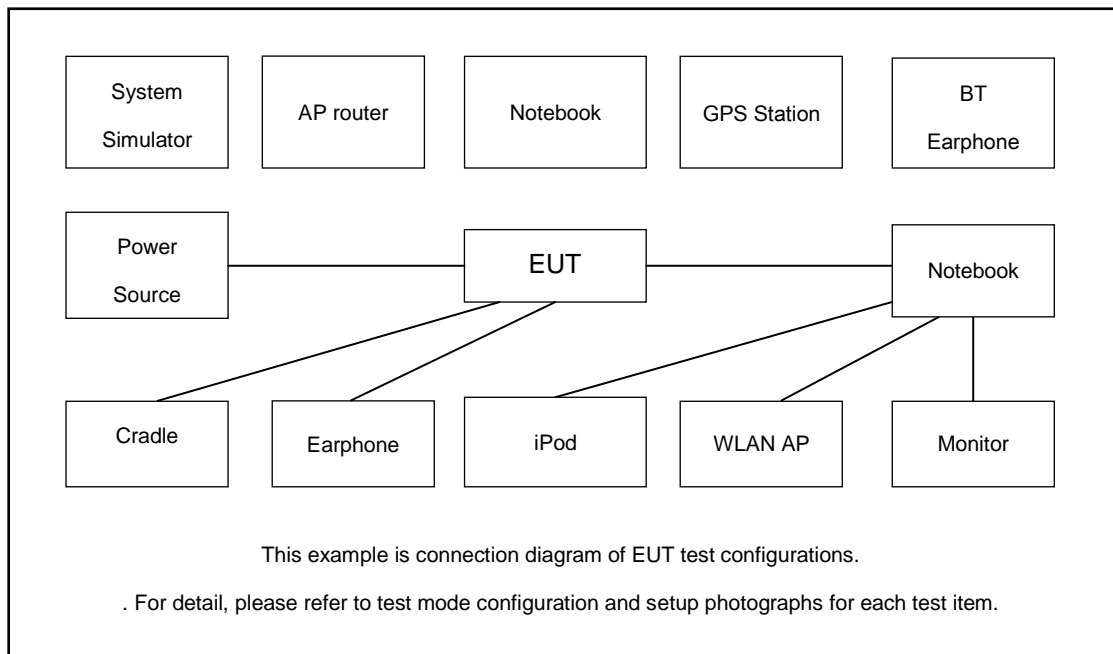
2.1. Test Mode

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: GSM850 Idle + Bluetooth Idle + WLAN Idle + MPEG4 + Earphone + USB Cable (Charging from Adapter) + Battery + SIM1 Mode 2: WCDMA Band II Idle + Bluetooth Idle + WLAN Idle + Camera (Front) + Earphone + USB Cable (Charging from Adapter) + Battery + SIM1 Mode 3: LTE Band 4 Idle + Bluetooth Idle + WLAN Idle + Camera (Rear) + Earphone + USB Cable (Charging from Adapter) + Battery + SIM1 Mode 4: LTE Band 7 Idle + Bluetooth Idle + WLAN Idle + FM Rx (98MHz) + Earphone + USB Cable (Charging from Adapter) + Battery + SIM1 Mode 5: Flight mode + Earphone + USB Cable (Data Link with Notebook) + Battery + SIM1 Mode 6: Flight mode + Earphone + USB Cable (Data Link with Notebook) + Battery + SIM2
Radiated Emissions	Mode 1: GSM850 Idle + Bluetooth Idle + WLAN Idle + MPEG4 + Earphone + USB Cable (Charging from Adapter) + Battery + SIM1 Mode 2: WCDMA Band II Idle + Bluetooth Idle + WLAN Idle + Camera (Front) + Earphone + USB Cable (Charging from Adapter) + Battery + SIM1 Mode 3: LTE Band 12 Idle + Bluetooth Idle + WLAN Idle + Camera (Rear) + Earphone + USB Cable (Charging from Adapter) + Battery + SIM1 Mode 4: LTE Band 7 Idle + Bluetooth Idle + WLAN Idle + FM Rx (98MHz) + Earphone + USB Cable (Charging from Adapter) + Battery + SIM1 Mode 5: Flight mode + Earphone + USB Cable (Data Link with Notebook) + Battery + SIM1 Mode 6: Flight mode + Earphone + USB Cable (Data Link with Notebook) + Battery + SIM2
Remark: <ol style="list-style-type: none"> The worst case of AC is mode 5; only the test data of this mode was reported. The worst case of RE is mode 6; only the test data of this mode was reported. Data Link with Notebook means data application transferred mode between EUT and Notebook. 	

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.	System Simulator	Anritsu	MT8820C	N/A	N/A	Unshielded, 1.8 m
2.	System Simulator	R&S	CMU 200	N/A	N/A	Unshielded, 1.8 m
3.	Bluetooth Earphone	Sony Ericsson	MW600	PY7DDA-2029	N/A	N/A
4.	WLAN AP	ASUS	RT-AC66U	MSQ-RTAC66U	N/A	Unshielded, 1.8m
5.	iPod	Apple	A1285	FCC DoC	Shielded, 1.0 m	N/A
6.	Notebook	DELL	Latitude E6320	FCC DoC/ Contains FCC ID: QDS-BRCM1054	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
7.	SD Card	SanDisk	MicroSD HC	FCC DoC	N/A	N/A



2.4. EUT Operation Test Setup

The EUT was in GSM or WCDMA or LTE idle mode during the testing. 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 Bluetooth earphone or WLAN AP, and the following programs installed in the EUT were programmed during the test.

1. Data application is transferred between Laptop and EUT via USB cable.
2. Execute "Video player" to play MPEG4 files.
3. Turn on camera to capture images.



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.

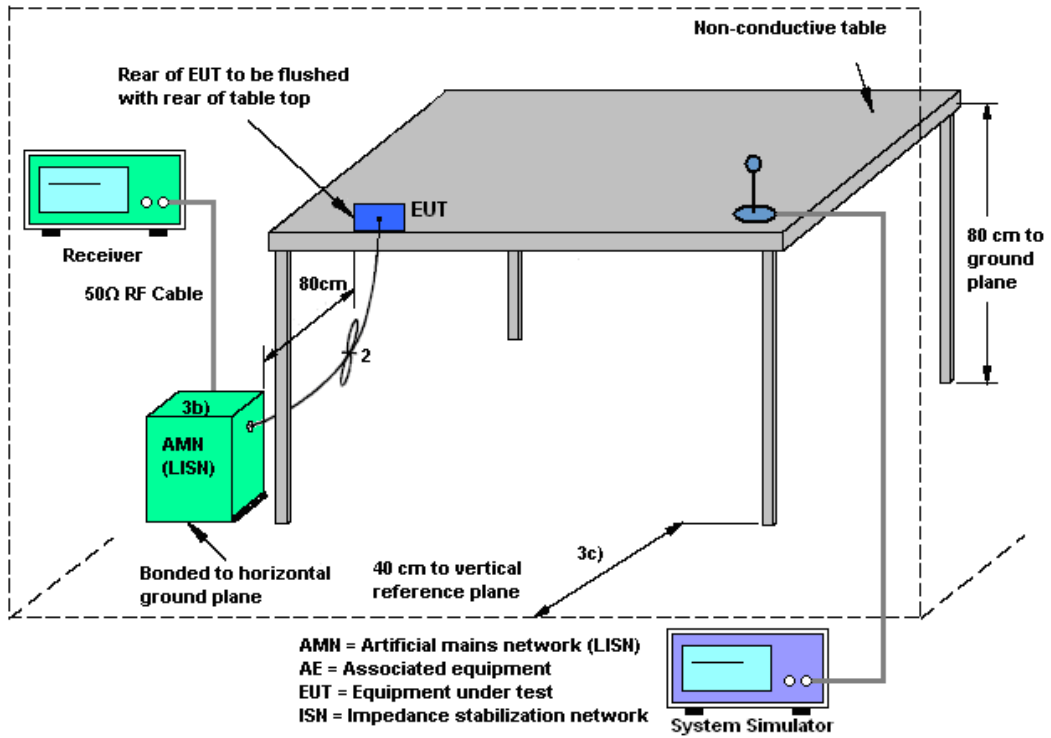
3.1.2 Measuring Instruments

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.

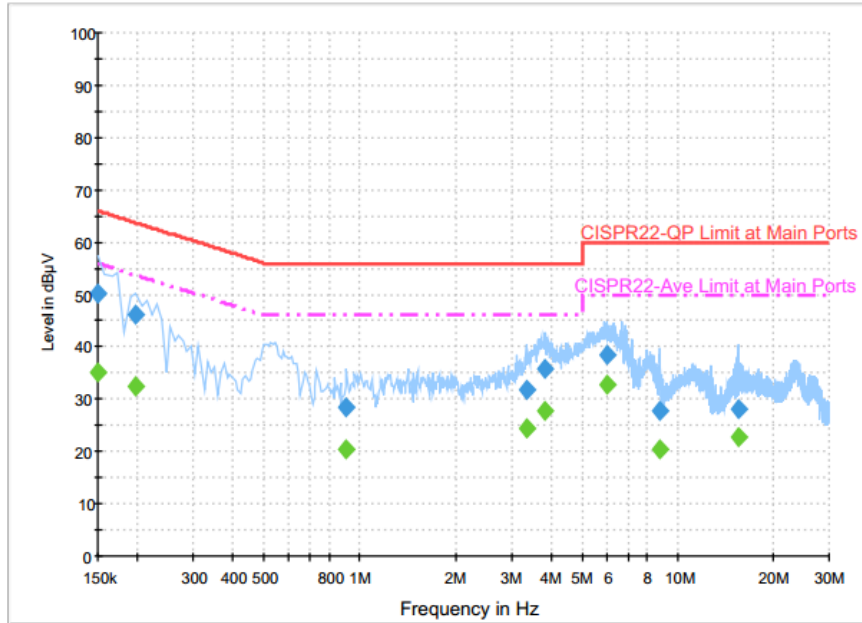
3.1.4 Test Setup





3.1.5 Test Result of AC Conducted Emission

Test Engineer :	Blue Lan	Temperature :	25~26°C
		Relative Humidity :	42~43%
Test Voltage :	120Vac / 60Hz	Phase :	Line



Final Result : Quasi-Peak

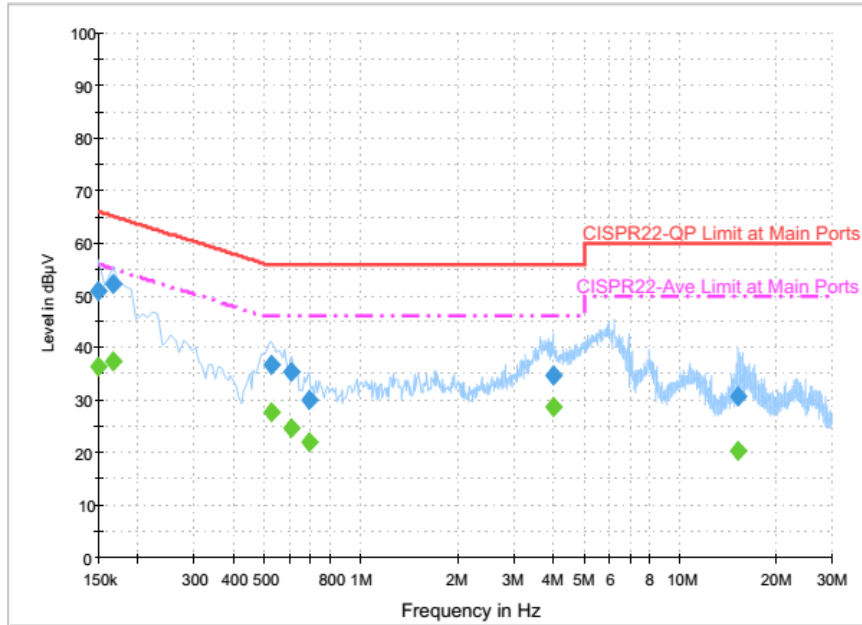
Frequency (MHz)	Quasi-Peak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	50.1	Off	L1	19.6	15.9	66.0
0.198000	46.1	Off	L1	19.6	17.6	63.7
0.910000	28.3	Off	L1	19.6	27.7	56.0
3.342000	31.6	Off	L1	19.6	24.4	56.0
3.814000	35.7	Off	L1	19.7	20.3	56.0
6.038000	38.6	Off	L1	19.8	21.4	60.0
8.806000	27.9	Off	L1	20.0	32.1	60.0
15.646000	28.1	Off	L1	20.4	31.9	60.0

Final Result : Average

Frequency (MHz)	Average (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	35.1	Off	L1	19.6	20.9	56.0
0.198000	32.6	Off	L1	19.6	21.1	53.7
0.910000	20.3	Off	L1	19.6	25.7	46.0
3.342000	24.6	Off	L1	19.6	21.4	46.0
3.814000	27.7	Off	L1	19.7	18.3	46.0
6.038000	32.7	Off	L1	19.8	17.3	50.0
8.806000	20.4	Off	L1	20.0	29.6	50.0
15.646000	22.9	Off	L1	20.4	27.1	50.0



Test Engineer :	Blue Lan	Temperature :	25~26°C
		Relative Humidity :	42~43%
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	50.7	Off	N	19.5	15.3	66.0
0.166000	52.2	Off	N	19.5	13.0	65.2
0.526000	36.8	Off	N	19.5	19.2	56.0
0.606000	35.4	Off	N	19.5	20.6	56.0
0.686000	30.3	Off	N	19.5	25.7	56.0
3.990000	34.9	Off	N	19.7	21.1	56.0
15.182000	30.8	Off	N	20.4	29.2	60.0

Final Result : Average

Frequency (MHz)	Average (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	36.5	Off	N	19.5	19.5	56.0
0.166000	37.5	Off	N	19.5	17.7	55.2
0.526000	27.7	Off	N	19.5	18.3	46.0
0.606000	24.7	Off	N	19.5	21.3	46.0
0.686000	22.1	Off	N	19.5	23.9	46.0
3.990000	28.6	Off	N	19.7	17.4	46.0
15.182000	20.4	Off	N	20.4	29.6	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

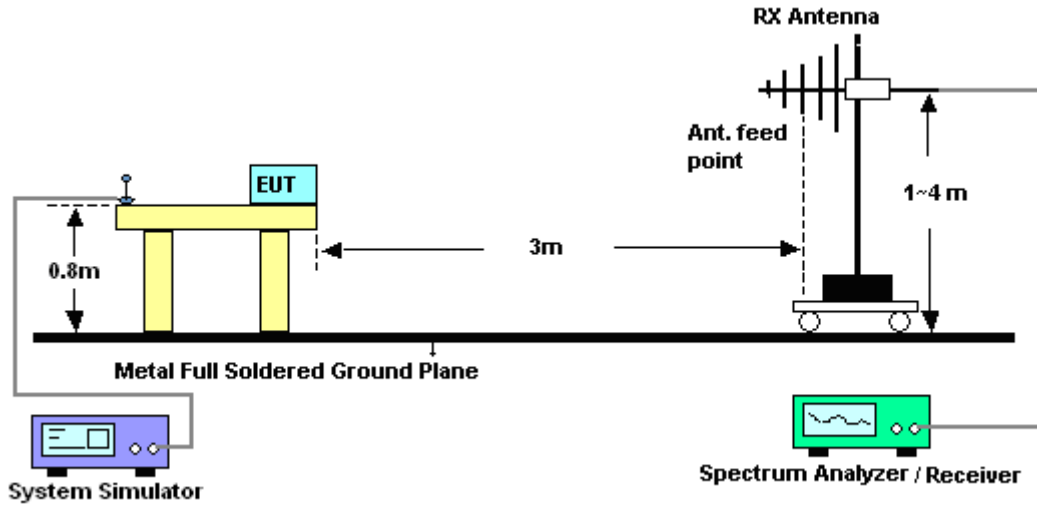
The measuring equipment is listed in the section 4 of this test report.

3.2.3. Test Procedures

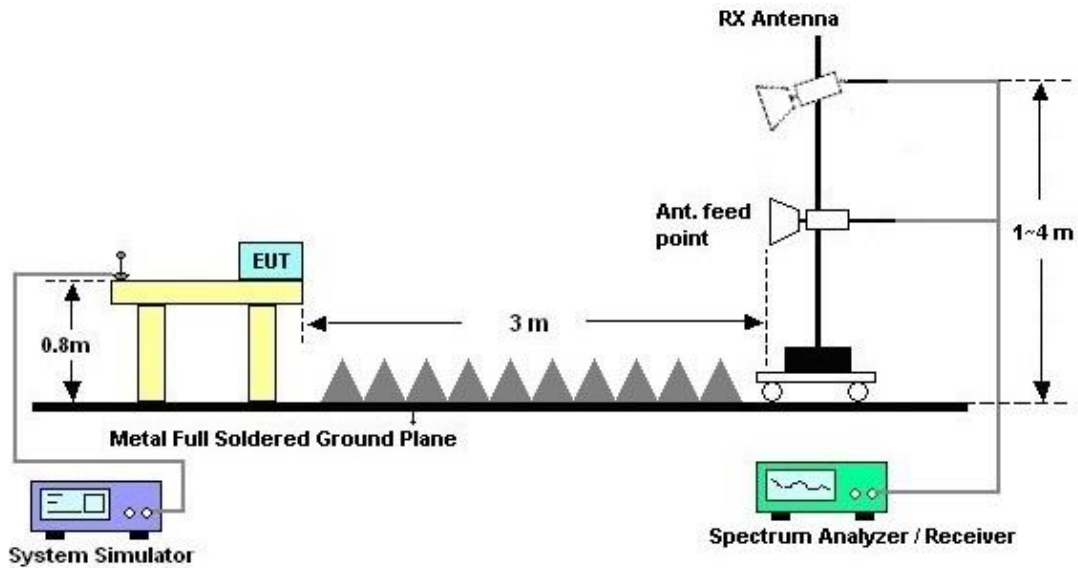
1. The EUT was placed on a turntable with 0.8 meter above ground.
2. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
3. The table was rotated 360 degrees to determine the position of the highest radiation.
4. The antenna 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



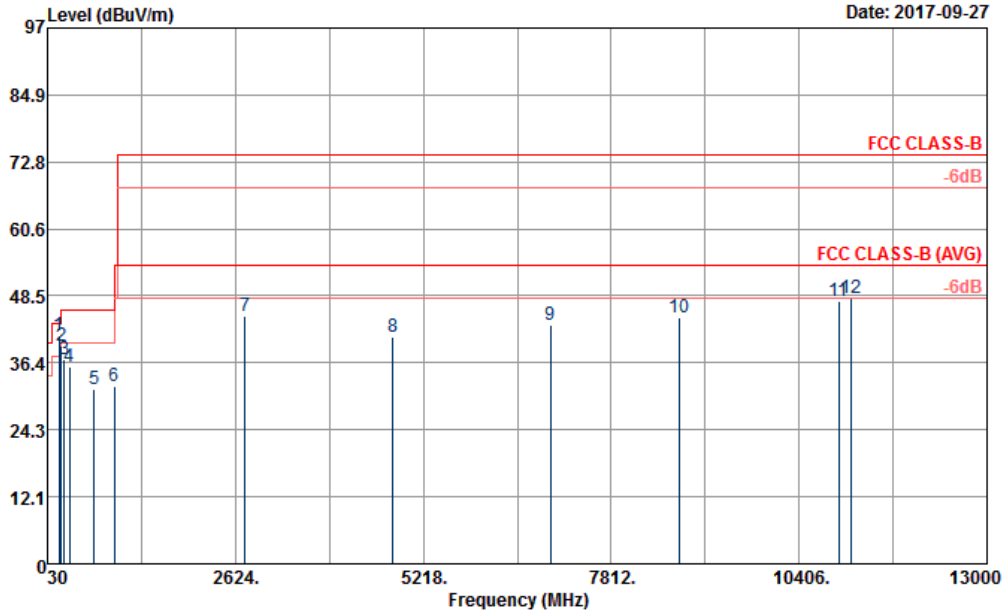
For radiated emissions above 1GHz





3.2.5. Test Result of Radiated Emission

Test Engineer :	Kai-Chun Chu and Donny Tamg	Temperature :	26~27°C
		Relative Humidity :	51~53%
Test Distance :	3m	Polarization :	Horizontal

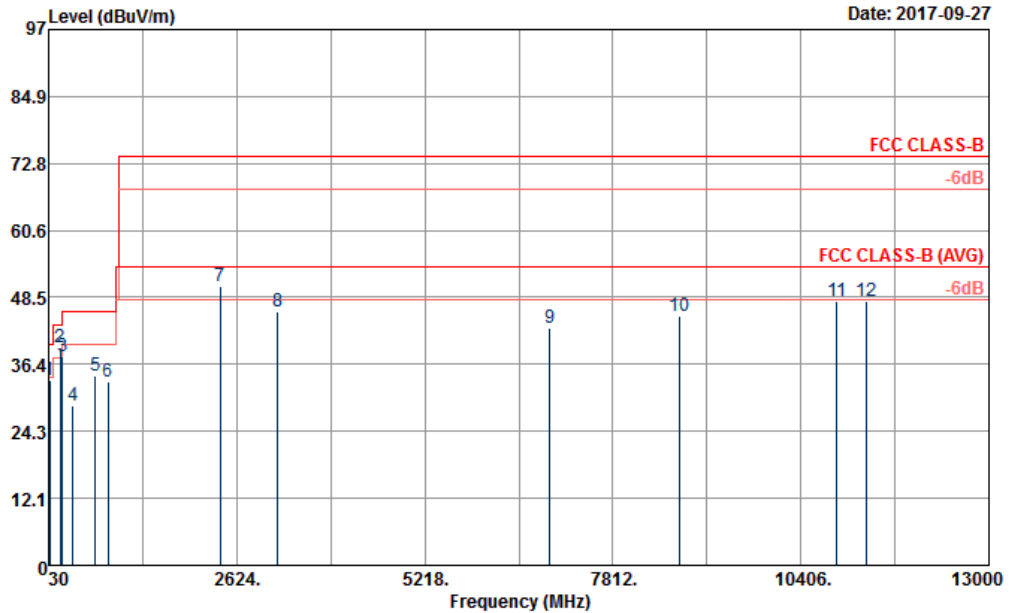


Site : 03CH06-HY
 Condition : FCC CLASS-B 3m 9120D_1156_170915 HORIZONTAL
 Project : 780604-01
 Power : From System
 Memo : Mode 6

	Freq	Level	Over Limit	Limit Line	ReadAntenna Level	Cable Factor	Preamp Loss	A/Pos	T/Pos	Remark	
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	cm	deg	
1	186.06	41.31	-2.19	43.50	56.40	14.72	1.97	31.78	200	21 QP	
2	216.30	39.58	-6.42	46.00	54.23	15.09	2.03	31.77	---	---	Peak
3	266.52	36.92	-9.08	46.00	46.92	19.52	2.23	31.75	---	---	Peak
4	336.40	35.60	-10.40	46.00	45.19	19.92	2.25	31.76	---	---	Peak
5	678.00	31.69	-14.31	46.00	33.85	26.56	3.38	32.10	---	---	Peak
6	953.80	32.10	-13.90	46.00	29.13	30.98	3.06	31.07	---	---	Peak
7	2758.00	44.87	-29.13	74.00	70.62	28.01	7.40	61.16	---	---	Peak
8	4800.00	41.05	-32.95	74.00	58.72	31.10	10.81	59.58	---	---	Peak
9	6972.00	43.19	-30.81	74.00	54.26	35.41	12.73	59.21	---	---	Peak
10	8758.00	44.52	-29.48	74.00	51.10	36.76	14.77	58.11	---	---	Peak
11	10956.00	47.47	-26.53	74.00	48.27	40.09	16.21	57.10	---	---	Peak
12	11118.00	48.04	-25.96	74.00	48.60	39.94	16.38	56.88	100	118	Peak



Test Engineer :	Kai-Chun Chu and Donny Tamg	Temperature :	26~27°C
		Relative Humidity :	51~53%
Test Distance :	3m	Polarization :	Vertical



Site : 03CH06-HY
 Condition : FCC CLASS-B 3m 9120D_1156_170915 VERTICAL
 Project : 780604-01
 Power : From System
 Memo : Mode 6

	Freq	Level	Over Limit	Limit Line	ReadAntenna Level	Cable Factor	Preamp Loss	A/Pos	T/Pos	Remark	
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	cm	deg	
1	45.93	33.55	-6.45	40.00	47.59	16.02	1.78	31.84	---	---	Peak
2	187.95	39.49	-4.01	43.50	54.60	14.70	1.96	31.77	200	27	Peak
3	218.19	37.77	-8.23	46.00	52.37	15.12	2.04	31.76	---	---	Peak
4	360.90	29.01	-16.99	46.00	38.00	20.49	2.30	31.78	---	---	Peak
5	676.60	34.21	-11.79	46.00	36.39	26.55	3.37	32.10	---	---	Peak
6	846.00	33.21	-12.79	46.00	32.24	29.44	3.31	31.78	---	---	Peak
7	2392.00	50.40	-23.60	74.00	77.58	26.96	6.86	61.00	100	160	Peak
8	3194.00	45.98	-28.02	74.00	70.60	28.68	8.04	61.34	---	---	Peak
9	6946.00	43.03	-30.97	74.00	54.19	35.36	12.70	59.22	---	---	Peak
10	8738.00	45.21	-28.79	74.00	51.78	36.75	14.77	58.09	---	---	Peak
11	10900.00	47.75	-26.25	74.00	48.83	40.00	16.16	57.24	---	---	Peak
12	11310.00	47.88	-26.12	74.00	48.37	39.65	16.55	56.69	---	---	Peak



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	Oct. 06, 2017	N/A	Conduction (CO05-HY)
EMI Test Receiver	Rohde & Schwarz	ESCI 7	100724	9kHz~7GHz	Sep. 20, 2017	Oct. 06, 2017	Sep. 19, 2018	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100080	9kHz~30MHz	Nov. 29, 2016	Oct. 06, 2017	Nov. 28, 2017	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100081	9kHz~30MHz	Dec. 06, 2016	Oct. 06, 2017	Dec. 05, 2017	Conduction (CO05-HY)
Bilog Antenna	Schaffner	CBL6111C&N-6-06	2725&AT-N0601	30MHz~1GHz	Oct. 15, 2016	Sep. 26, 2017~ Sep. 27, 2017	Oct. 14, 2017	Radiation (03CH06-HY)
EMI Test Receiver	Rohde & Schwarz	ESU26	100472	20Hz~26.5GHz	Dec. 29, 2016	Sep. 26, 2017~ Sep. 27, 2017	Dec. 28, 2017	Radiation (03CH06-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1156	1GHz~18GHz	Aug. 08, 2017	Sep. 26, 2017~ Sep. 27, 2017	Aug. 07, 2018	Radiation (03CH06-HY)
Preamplifier	SONOMA	310N	186713	9kHz~1GHz	Apr. 25, 2017	Sep. 26, 2017~ Sep. 27, 2017	Apr. 24, 2018	Radiation (03CH06-HY)
Preamplifier	MITEQ	AMF-7D-0010 1800-30-10P	1850117	1GHz ~ 18GHz	May. 22, 2017	Sep. 26, 2017~ Sep. 27, 2017	May 21, 2018	Radiation (03CH06-HY)
Antenna Mast	MF	MF-7802	MF78020821 2	1m~4m	N/A	Sep. 26, 2017~ Sep. 27, 2017	N/A	Radiation (03CH06-HY)
Turn Table	INN-CO	DS2000	420/650/00	0-360 degree	N/A	Sep. 26, 2017~ Sep. 27, 2017	N/A	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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