

FCC TEST REPORT

(PART 27)

REPORT NO.: RF140717C05D

MODEL NO.: YSAR02-3G

FCC ID: Y6YY SAR023G

RECEIVED: Jan. 14, 2015

TESTED: Jan. 12, 2015 ~ Jan. 13, 2015

ISSUED: Jan. 15, 2015

APPLICANT: YANMAR CO., LTD.

ADDRESS: Umeda Gate Tower, 1-9, Tsurunochō, Kita-ku,
Osaka, Japan

ISSUED BY: Bureau Veritas Consumer Products Services
(H.K.) Ltd., Taoyuan Branch

LAB ADDRESS: No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist.,
New Taipei City, Taiwan, R.O.C.

TEST LOCATION: No. 19, Hwa Ya 2nd Rd, Wen Hwa Tsuen, Kwei
Shan Hsiang, Taoyuan Hsien 333, Taiwan, R.O.C.

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RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RF140717C05D	Original release	Jan. 15, 2015

1 CERTIFICATION

PRODUCT: Controller Mobile Communicator
MODEL NO.: YSAR02-3G
BRAND: YANMAR
APPLICANT: YANMAR CO., LTD.
TESTED: Jan. 12, 2015 ~ Jan. 13, 2015
TEST SAMPLE: Identical Prototype
TEST STANDARDS: **FCC Part 27, Subpart C, L**
FCC Part 2
ANSI C63.4-2003

The above equipment (model: YSAR02-3G) 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 : Gina Liu , **DATE:** Jan. 15, 2015
Gina Liu / Specialist

APPROVED BY : Sam Chen , **DATE:** Jan. 15, 2015
Sam Chen / Senior Project Engineer

2 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

WCDMA			
STANDARD SECTION	TEST TYPE	RESULT	REMARK
2.1046 27.50(d)(4)	Equivalent Isotropically Radiated Power	PASS	Meet the requirement of limit.
2.1053 27.53(h)	Radiated Spurious Emissions	PASS	Meet the requirement of limit. Minimum passing margin is -38.76dB at 3465.20MHz.

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	UNCERTAINTY
Radiated emissions	30MHz ~ 200MHz	2.93 dB
	200MHz ~1000MHz	2.95 dB
	1GHz ~ 18GHz	2.26 dB
	18GHz ~ 40GHz	1.94 dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

2.2 TEST SITE AND INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
Test Receiver ROHDE & SCHWARZ	ESCI	100744	Apr. 15, 2014	Apr. 14, 2015
Spectrum Analyzer ROHDE & SCHWARZ	FSU43	101261	Dec. 10, 2014	Dec. 09, 2015
BILOG Antenna SCHWARZBECK	VULB9168	9168-472	Feb. 27, 2014	Feb. 26, 2015
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-969	Feb. 19, 2014	Feb. 18, 2015
HORN Antenna SCHWARZBECK	BBHA 9170	9170-480	Aug. 27, 2014	Aug. 26, 2015
Preamplifier EMCI	EMC 012645	980115	Dec. 12, 2014	Dec. 11, 2015
Preamplifier EMCI	EMC 184045	980116	Jan. 13, 2014	Jan. 12, 2015
Preamplifier EMCI	EMC 330H	980071	Feb. 27, 2014	Feb. 26, 2015
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	309219/4 2950114	Oct. 18, 2014	Oct. 17, 2015
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	250130/4	Oct. 18, 2014	Oct. 17, 2015
RF signal cable Worken	RG-213	NA	Nov. 07, 2014	Nov. 06, 2015
Software BV ADT	E3 6.120103	NA	NA	NA
Antenna Tower MF	MFA-440H	NA	NA	NA
Turn Table MF	MFT-201SS	NA	NA	NA
Antenna Tower & Turn Table Controller MF	MF-7802	NA	NA	NA
Power Splitter Woken	2-18GHz 2Way SMA Fwd.:30W/Rev.:2W Isolated Power	COM412W5E3	Apr. 17, 2014	Apr. 16, 2015
JFW 20dB attenuation	50HF-020-SMA	NA	NA	NA
Communications Tester-Wireless	E5515C	MY52102544	Sep. 11, 2014	Sep. 10, 2016
Radio Communication Analyzer	MT8820C	6201300640	Aug. 01, 2013	Jul. 31, 2015

- NOTE:**
1. The calibration interval of the above test instruments is 12 / 24 months and the calibrations are traceable to NML/ROC and NIST/USA.
 2. The test was performed in HwaYa Chamber 10.
 3. The horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
 4. The FCC Site Registration No. is 690701.
 5. The IC Site Registration No. is IC 7450F-10.

3 GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

PRODUCT	Controller Mobile Communicator	
MODEL NO.	YSAR02-3G	
POWER SUPPLY	12Vdc	
MODULATION TECHNOLOGY	WCDMA	QPSK, BPSK
FREQUENCY RANGE	WCDMA	1712.4MHz ~1752.5MHz
MAX. EIRP POWER	WCDMA	205.07mW
ANTENNA TYPE	Cellular and GNSS Combi Antenna	
DATA CABLE	Refer to Note as below	
I/O PORTS	Refer to users' manual	
ACCESSORY DEVICES	Refer to Note as below	

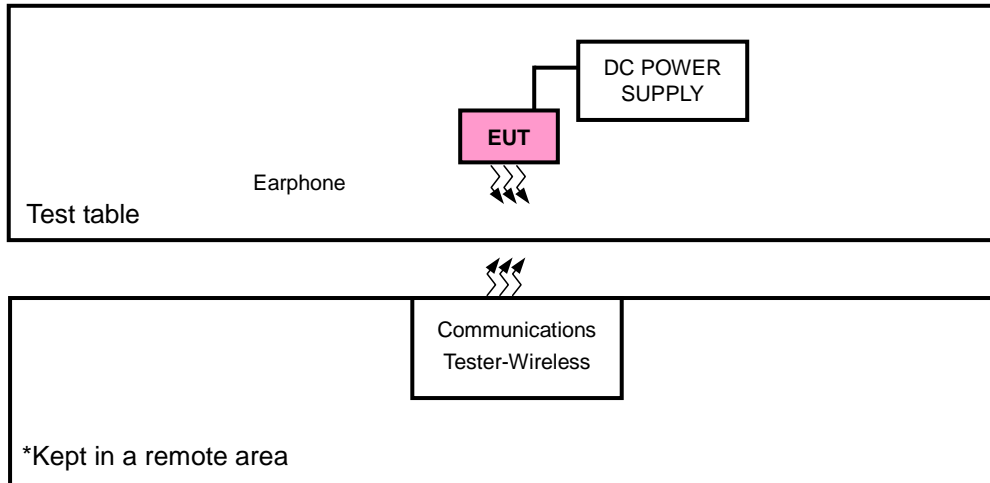
NOTE:

1. The EUT contains following accessory devices.

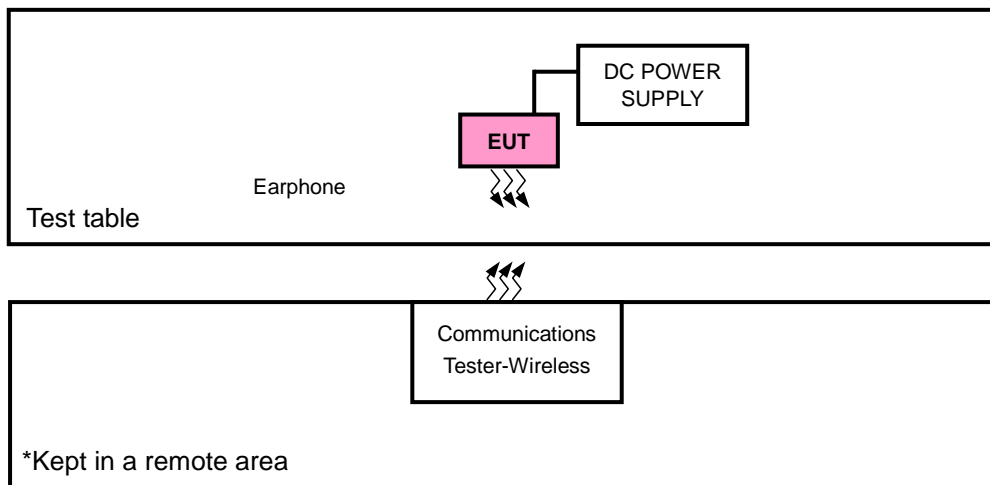
ITEM	BRAND	MODEL	SPECIFICATION
Cellular Module	U-blox	LISA-U200	--

2. 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 CONFIGURATION OF SYSTEM UNDER TEST FOR RADIATION EMISSION TEST



FOR E.I.R.P. TEST





3.3 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.

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	Communications Tester-Wireless	Agilent	8960	MY50260642	NA
2	DC Power Supply	Topward	3303D	N/A	N/A

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	NA
2	NA

NOTE:

1. All power cords of the above support units are non shielded (1.8m).

3.4 DESCRIPTION OF TEST MODES

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis and antenna ports. The worst case was found when positioned on X-plane for ERP and X-axis for radiated emission. Following channel(s) was (were) selected for the final test as listed below:

WCDMA

TEST ITEM	AVAILABLE CHANNEL	TESTED CHANNEL	MODE
EIRP	1312 to 1513	1312, 1413, 1513	WCDMA
RADIATED EMISSION	1312 to 1513	1413	WCDMA

TEST CONDITION:

TEST ITEM	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
EIRP	26deg. C, 58%RH	12Vdc	Taylor Liu
RADIATED EMISSION	25deg. C, 65%RH	120Vac, 60Hz	Gavin Wu

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 47 CFR Part 2

FCC 47 CFR Part 27

ANSI C63.4-2003

ANSI/TIA/EIA-603-C 2004

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

4 TEST TYPES AND RESULTS

4.1 OUTPUT POWER MEASUREMENT

4.1.1 LIMITS OF OUTPUT POWER MEASUREMENT

Fixed, mobile, and portable (hand-held) stations operating in the 1710–1755 MHz band are limited to 1 watt EIRP.

4.1.2 TEST PROCEDURES

EIRP MEASUREMENT:

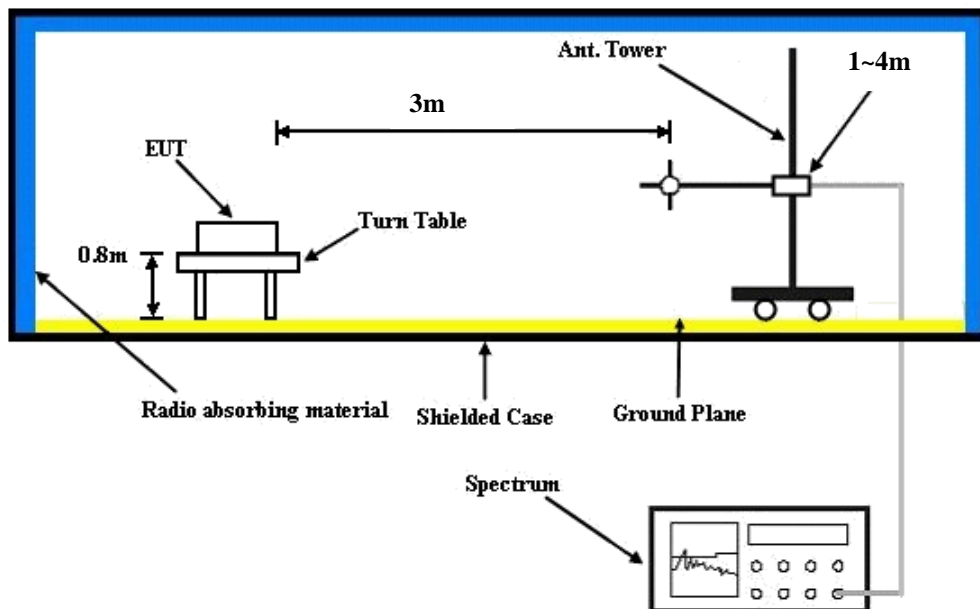
- a. All measurements were done at low, middle and high operational frequency range. RBW and VBW is 1MHz for GSM, GPRS & EDGE, 5MHz for CDMA & WCDMA, and 10MHz for LTE mode.
- b. Substitution method is used for E.I.R.P measurement. In the semi-anechoic chamber, EUT placed on the 0.8m height of Turn Table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1m to 4m to find the maximum polar radiated power. The “Read Value” is the spectrum reading the maximum power value.
- c. The substitution horn antenna is substituted for EUT at the same position and signals generator export the CW signal to the substitution antenna via a tx cable. Rotated the Turn Table and moved receiving antenna to find the maximum radiation power. Adjust output power level of S.G to get a Value of spectrum reading equal to “Read Value” of step b. Record the power level of S.G
- d. $EIRP = \text{Output power level of S.G} - \text{TX cable loss} + \text{Antenna gain of substitution horn}.$

CONDUCTED POWER MEASUREMENT:

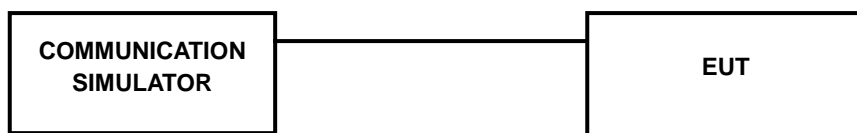
- a. The EUT was set up for the maximum power with LTE link data modulation and link up with simulator.
- b. Set the EUT to transmit under low, middle and high channel and record the power level shown on simulator.

4.1.3 TEST SETUP

EIRP / ERP MEASUREMENT:



CONDUCTED POWER MEASUREMENT:



4.1.4 TEST RESULTS

Average Conducted Output Power (dBm)

Band	WCDMA IV		
Channel	1312	1413	1513
Frequency (MHz)	1712.4	1732.6	1752.6
RMC 12.2K	23.44	23.30	23.34
HSDPA Subtest-1	22.25	22.11	22.15
HSDPA Subtest-2	22.24	22.10	22.14
HSDPA Subtest-3	22.27	22.13	22.17
HSDPA Subtest-4	22.27	22.13	22.17
HSUPA Subtest-1	21.32	21.18	21.22
HSUPA Subtest-2	20.73	20.59	20.63
HSUPA Subtest-3	20.73	20.59	20.63
HSUPA Subtest-4	20.32	20.18	20.22
HSUPA Subtest-5	20.06	19.92	19.96

AVERAGE EIRP (dBm)

WCDMA							
Plane	Channel	Frequency (MHz)	LVL (dBm)	Correction Factor(dB)	EIRP(dBm)	EIRP(mW)	Polarization (H/V)
X	1312	1712.4	-13.36	36.45	23.09	203.70	H
	1413	1732.6	-13.68	36.80	23.12	205.07	
	1513	1752.6	-13.98	36.94	22.96	197.83	
	1312	1712.4	-19.25	37.28	18.03	63.49	V
	1413	1732.6	-19.17	37.63	18.46	70.15	
	1513	1752.5	-19.38	37.64	18.26	66.99	

4.2 RADIATED EMISSION MEASUREMENT

4.2.1 LIMITS OF RADIATED EMISSION MEASUREMENT

The power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least $43 + 10 \log_{10}(P)$ dB. The limit of emission equal to -13dBm

4.2.2 TEST PROCEDURES

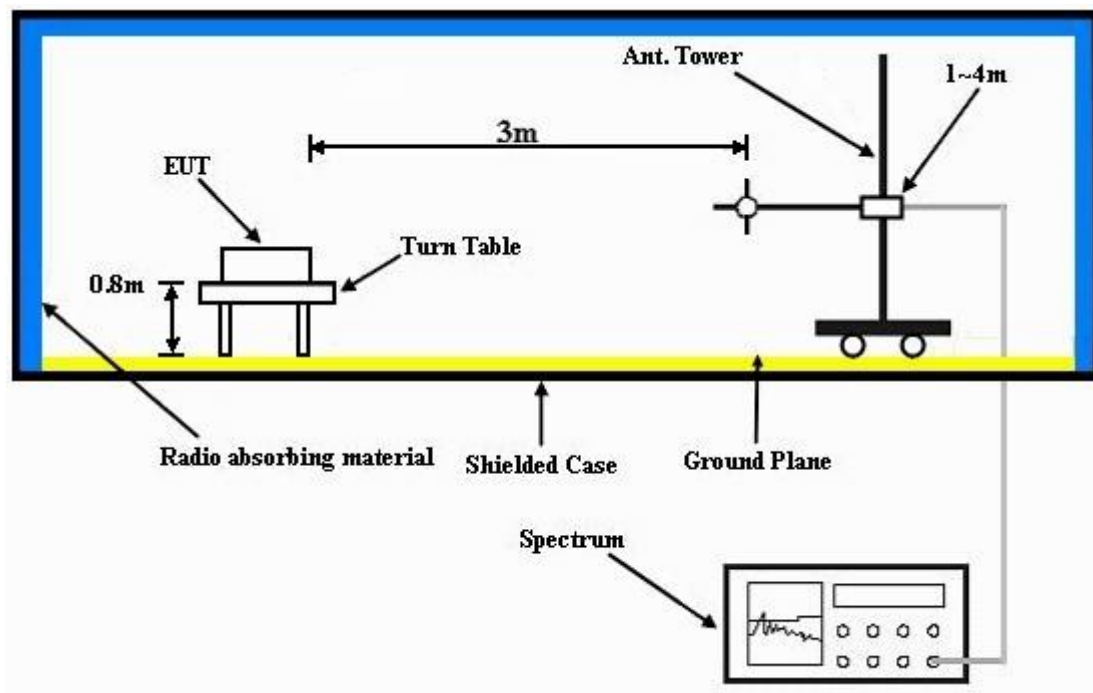
- a. Substitution method is used for E.I.R.P measurement. In the semi-anechoic chamber, EUT placed on the 0.8m height of Turn Table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1m to 4m to find the maximum polar radiated power. The "Read Value" is the spectrum reading the maximum power value.
- b. The substitution horn antenna is substituted for EUT at the same position and signals generator export the CW signal to the substitution antenna via a TX cable. Rotated the Turn Table and moved receiving antenna to find the maximum radiation power. Adjust output power level of S.G to get a Value of spectrum reading equal to "Read Value " of step a. Record the power level of S.G
- c. $\text{EIRP} = \text{Output power level of S.G} - \text{TX cable loss} + \text{Antenna gain of substitution horn}.$
- d. E.R.P power can be calculated form E.I.R.P power by subtracting the gain of dipole, $\text{E.R.P power} = \text{E.I.P.R power} - 2.15\text{dBi}.$

NOTE: The resolution bandwidth of spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz.

4.2.3 DEVIATION FROM TEST STANDARD

No deviation

4.2.4 TEST SETUP



For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.2.5 TEST RESULTS

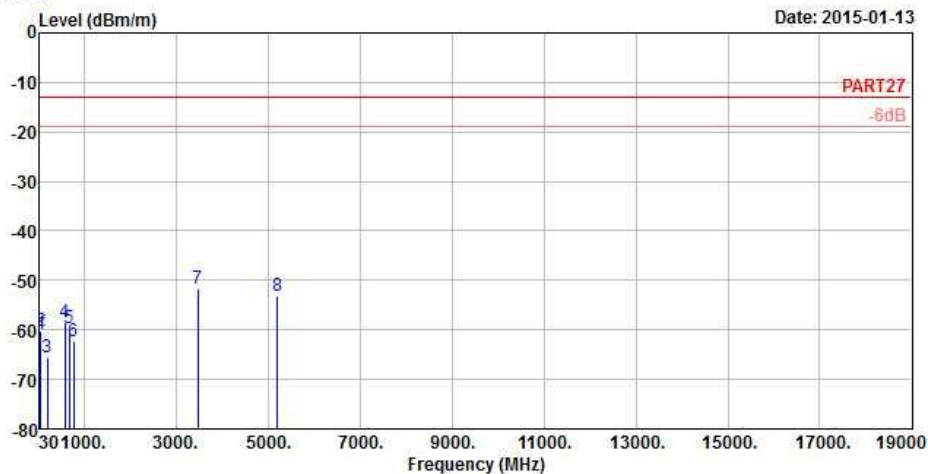
WCDMA



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Data: 13



Site : 966 Chamber 5
Condition: PART27 3m HORIZONTAL
Remark : WCDMA Band 4 Link
Tested by: Gavin Wu
Plane : X

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm/m	dBm	dBm/m	dB	dB/m	
1	43.50	-60.70	-59.44	-13.00	-47.70	-1.26	Peak
2	55.92	-60.14	-54.64	-13.00	-47.14	-5.50	Peak
3	192.54	-65.56	-58.41	-13.00	-52.56	-7.15	Peak
4	576.50	-58.48	-57.46	-13.00	-45.48	-1.02	Peak
5	666.10	-59.62	-60.46	-13.00	-46.62	0.84	Peak
6	769.70	-62.25	-64.18	-13.00	-49.25	1.93	Peak
7 pp	3465.20	-51.76	-42.74	-13.00	-38.76	-9.02	Peak
8	5197.80	-53.18	-50.12	-13.00	-40.18	-3.06	Peak



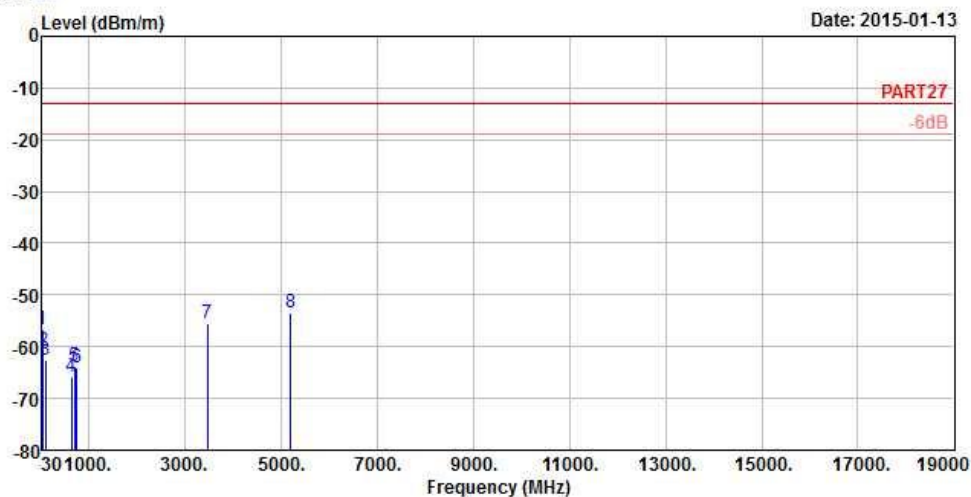
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Data: 14



Site : 966 Chamber 5
Condition: PART27 3m VERTICAL
Remark : WCDMA Band 4 Link
Tested by: Gavin Wu
Plane : X

	Freq	Level	Read	Limit	Over		
	MHz	dBm/m	Level	Line	Limit	Factor	Remark
			dBm	dBm/m	dB	dB/m	
1	31.35	-56.82	-57.16	-13.00	-43.82	0.34	Peak
2	55.65	-60.84	-55.49	-13.00	-47.84	-5.35	Peak
3	98.31	-62.55	-52.11	-13.00	-49.55	-10.44	Peak
4	638.80	-65.76	-66.11	-13.00	-52.76	0.35	Peak
5	702.50	-63.64	-65.10	-13.00	-50.64	1.46	Peak
6	757.80	-64.17	-66.01	-13.00	-51.17	1.84	Peak
7	3465.20	-55.56	-46.54	-13.00	-42.56	-9.02	Peak
8 pp	5197.80	-53.31	-50.25	-13.00	-40.31	-3.06	Peak

5 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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The address and road map of all our labs can be found in our web site also.



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6 APPENDIX A – MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB

No modifications were made to the EUT by the lab during the test.

---END---