FCC TEST REPORT

(PART 22)

REPORT NO.:	RF140717C05
MODEL NO.:	YSAR02-3G
FCC ID:	Y6YYSAR023G
RECEIVED:	Jul. 17, 2014
TESTED:	Aug. 22, 2014
ISSUED:	Sep. 19, 2014

APPLICANT:	YANMAR CO., LTD.
ADDRESS:	Umeda Gate Tower, 1-9, Tsurunocho, Kita-ku, Osaka, Japan

ISSUED BY:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
LAB ADDRESS:	No. 47, 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.

This report should not be used by the client to claim product certification, approval, or endorsement by TAF or any government agencies.

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RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RF140717C05	Original release	Sep. 19, 2014

1 CERTIFICATION

PRODUCT:	Controller Mobile Communicator
MODEL:	YSAR02-3G
BRAND:	YANMAR
APPLICANT:	YANMAR CO., LTD.
TESTED:	Aug. 22, 2014
TEST SAMPLE:	Identical Prototype
STANDARDS:	**FCC PART 22, Subpart H**

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 :** Sep. 19, 2014

Gina Liu / Specialist

APPROVED BY : Sam chen **, DATE :** Sep. 19, 2014

Sam Chen / Senior Project Engineer

2 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 22 & Part 2			
STANDARD SECTION	**TEST TYPE**	**RESULT**	**REMARK**
2.1046 22.913 (a)	Effective Radiated Power	PASS	Meet the requirement of limit.
2.1053 22.917	Radiated Spurious Emissions	PASS	Meet the requirement of limit. Minimum passing margin is -27.29dB at 1672.80MHz.

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. 21, 2013	Dec. 20, 2014
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	Dec. 18, 2013	Dec. 17, 2014
Preamplifier EMCI	EMC 012645	980115	Dec. 26, 2013	Dec. 25, 2014
Preamplifier EMCI	EMC 184045	980116	Jan. 13, 2014	Jan. 12, 2015
Preamplifier EMCI	EMC 330H	980112	Dec. 27, 2013	Dec. 26, 2014
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	309219/4 2950114	Oct. 18, 2013	Oct. 17, 2014
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	250130/4	Oct. 18, 2013	Oct. 17, 2014
RF signal cable Worken	RG-213	NA	Nov. 07, 2013	Nov. 06, 2014
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. 05, 2012	Sep. 04, 2014
Radio Communication Analyzer	MT8820C	6201300640	Aug. 01, 2013	Jul. 31, 2015

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

3 GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

EUT	Controller Mobile Communicator	
MODEL NO.	YSAR02-3G	
POWER SUPPLY	12Vdc	
MODULATION TYPE	**GPRS**	GMSK
	EDGE	GMSK, 8PSK
	WCDMA	BPSK
FREQUENCY RANGE	**GPRS/EDGE**	824.2MHz ~ 848.8MHz
	WCDMA	826.4MHz ~ 846.6MHz
MAX. ERP POWER	**GPRS**	1945.36mW
	EDGE	897.43mW
	WCDMA	363.92mW
ANTENNA TYPE	Cellular and GNSS Combi Antenna	
I/O PORTS	Refer to users' manual	
DATA CABLE	Refer to NOTE as below	
ACCESSORY DEVICES	Refer to NOTE as below	

NOTE:

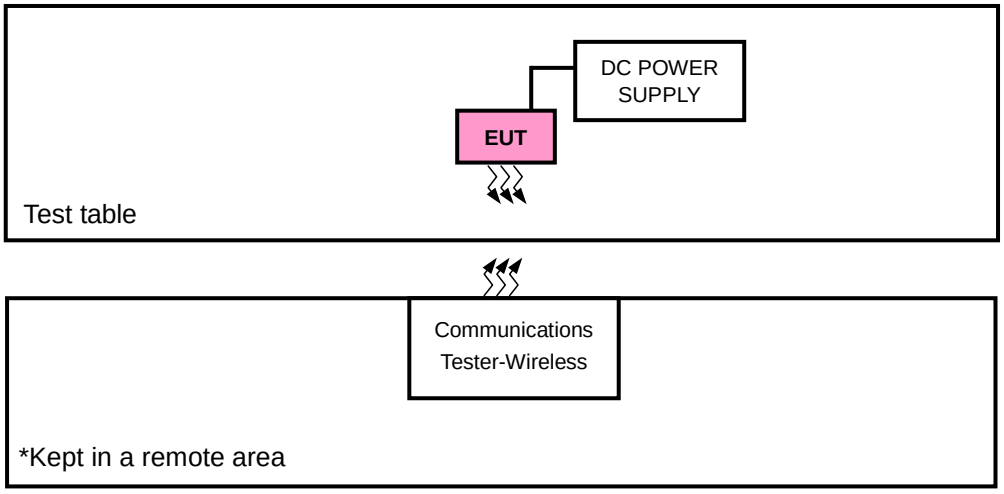
1. The EUT contains following accessory devices.

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

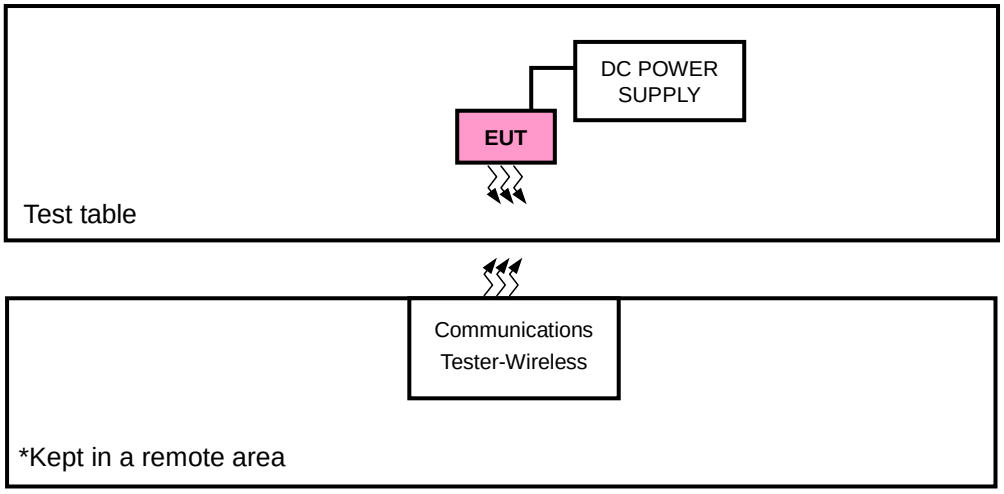
2. The above EUT information was declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or User's Manual.

3.2 CONFIGURATION OF SYSTEM UNDER TEST

FOR RADIATION EMISSION TEST



FOR E.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
	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).
2. Item 1 acted as a communication partner to transfer data.

3.4 TEST ITEM AND TEST CONFIGURATION

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 radiated emission. Following channel(s) was (were) selected for the final test as listed below:

GPRS MODE

EUT CONFIGURE MODE	TEST ITEM	AVAILABLE CHANNEL	TESTED CHANNEL	MODE
-	ERP	128 to 251	128, 189, 251	GPRS, EDGE
-	RADIATED EMISSION	128 to 251	189	GPRS, EDGE

WCDMA MODE

EUT CONFIGURE MODE	TEST ITEM	AVAILABLE CHANNEL	TESTED CHANNEL	MODE
-	ERP	4132 to 4233	4132, 4182, 4233	WCDMA
-	RADIATED EMISSION	4132 to 4233	4182	WCDMA

TEST CONDITION:

TEST ITEM	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
ERP	26deg. C, 58%RH	30Vdc	Howard Kao
RADIATED EMISSION	25deg. C, 65%RH	120Vac, 60Hz	Gavin Wu

3.5 EUT OPERATING CONDITIONS

The EUT makes a call to the communication simulator. The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency

3.6 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 22
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

Mobile / Portable station are limited to 7 watts e.r.p.

4.1.2 TEST PROCEDURES

EIRP / ERP MEASUREMENT:

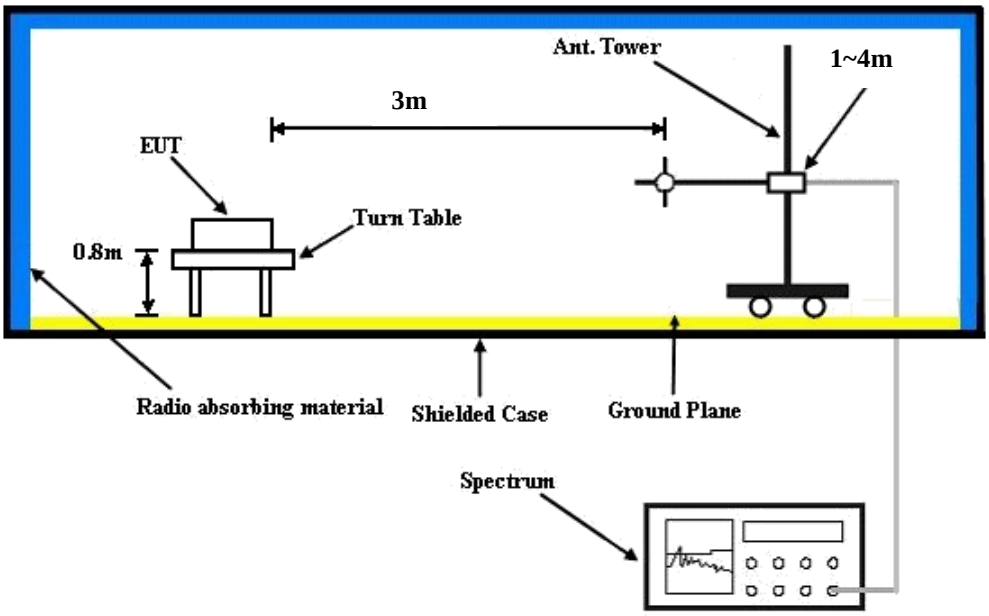
a. All measurements were done at low, middle and high operational frequency range. RBW and VBW is 1MHz for GSM, GPRS & EDGE, 5MHz for WCDMA & CDMA, and 10MHz for LTE mode.
b. Substitution method is used for E.I.R.P measurement. In the semi-anechoic chamber, EUT placed on the 0.8m height of Turn Table, 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 = Output power level of S.G – TX cable loss + Antenna gain of substitution horn. E.R.P power can be calculated form E.I.R.P power by subtracting the gain of dipole, E.R.P power = E.I.R.P power - 2.15dBi.

CONDUCTED POWER MEASUREMENT:

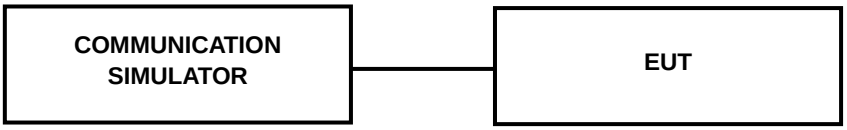
The EUT was set up for the maximum power with GSM, GPRS, EDGE, WCDMA & CDMA & LTE link data modulation and link up with simulator. Set the EUT to transmit under low, middle and high channel and record the power level shown on simulator.

4.1.3 TEST SETUP

EIRP / ERP MEASUREMENT:



CONDUCTED POWER MEASUREMENT:



4.1.4 TEST RESULTS

CONDUCTED OUTPUT POWER (dBm)

Band	GSM850		
Channel	128	189	251
Frequency (MHz)	824.2	836.4	848.8
GPRS 8 (GMSK, 1 slot)	**32.49**	32.47	32.44
GPRS 10 (GMSK, 2 slot)	32.48	32.46	32.43
GPRS 11 (GMSK, 3 slot)	31.67	31.65	31.62
GPRS 12 (GMSK, 4 slot)	30.49	30.47	30.44
EDGE 8 (GMSK, 1 Uplink)	32.47	32.47	32.44
EDGE 10 (GMSK, 2 Uplink)	32.48	32.46	32.43
EDGE 11 (GMSK, 3 Uplink)	31.68	31.66	31.63
EDGE 12 (GMSK, 4 Uplink)	30.48	30.46	30.43
EDGE 8 (8PSK, 1 Uplink)	26.70	26.68	26.65
EDGE 10 (8PSK, 2 Uplink)	26.68	26.66	26.63
EDGE 11 (8PSK, 3 Uplink)	25.87	25.85	25.82
EDGE 12 (8PSK, 4 Uplink)	24.67	24.65	24.62

Band	WCDMA V		
Channel	4132	4182	4233
Frequency (MHz)	826.4	836.4	846.6
RMC 12.2K	**22.98**	22.90	22.83
HSDPA Subtest-1	21.73	21.65	21.58
HSDPA Subtest-2	21.72	21.64	21.57
HSDPA Subtest-3	21.72	21.64	21.57
HSDPA Subtest-4	21.73	21.65	21.58
HSUPA Subtest-1	21.81	21.73	21.66
HSUPA Subtest-2	18.44	18.36	18.29
HSUPA Subtest-3	20.87	20.79	20.72
HSUPA Subtest-4	19.92	19.84	19.77
HSUPA Subtest-5	20.89	20.81	20.74

ERP POWER (dBm)

GPRS							
Plane	Channel	Frequency (MHz)	LVL (dBm)	Correction Factor(dB)	ERP(dBm)	ERP(mW)	Polarization (H/V)
X	128	824.2	1.55	32.62	32.02	1592.21	H
	189	836.4	2.52	32.52	32.89	1945.36	H
	251	848.8	2.05	32.65	32.55	1798.87	H
	128	824.2	-3.58	32.76	27.03	504.66	V
	189	836.4	-3.02	32.39	27.22	527.23	V
	251	848.8	-3.66	32.54	26.73	470.98	V

EDGE							
Plane	Channel	Frequency (MHz)	LVL (dBm)	Correction Factor(dB)	ERP(dBm)	ERP(mW)	Polarization (H/V)
X	128	824.2	-1.22	32.62	29.25	841.40	H
	189	836.4	-0.84	32.52	29.53	897.43	H
	251	848.8	-1.44	32.65	29.06	805.38	H
	128	824.2	-7.25	32.76	23.36	216.77	V
	189	836.4	-6.35	32.39	23.89	244.91	V
	251	848.8	-7.33	32.54	23.06	202.30	V

WCDMA							
Plane	Channel	Frequency (MHz)	LVL (dBm)	Correction Factor(dB)	ERP(dBm)	ERP(mW)	Polarization (H/V)
X	4132	826.4	-5.12	32.62	25.35	342.77	H
	4182	836.4	-4.76	32.52	25.61	363.92	H
	4233	846.6	-5.55	32.65	24.95	312.61	H
	4132	826.4	-11.05	32.76	19.56	90.36	V
	4182	836.4	-10.52	32.39	19.72	93.76	V
	4233	846.6	-11.35	32.54	19.04	80.17	V

4.2 RADIATED EMISSION MEASUREMENT

4.2.1 LIMITS OF RADIATED EMISSION MEASUREMENT

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB. The emission limit is equal to -13dBm.

4.2.2 TEST PROCEDURES

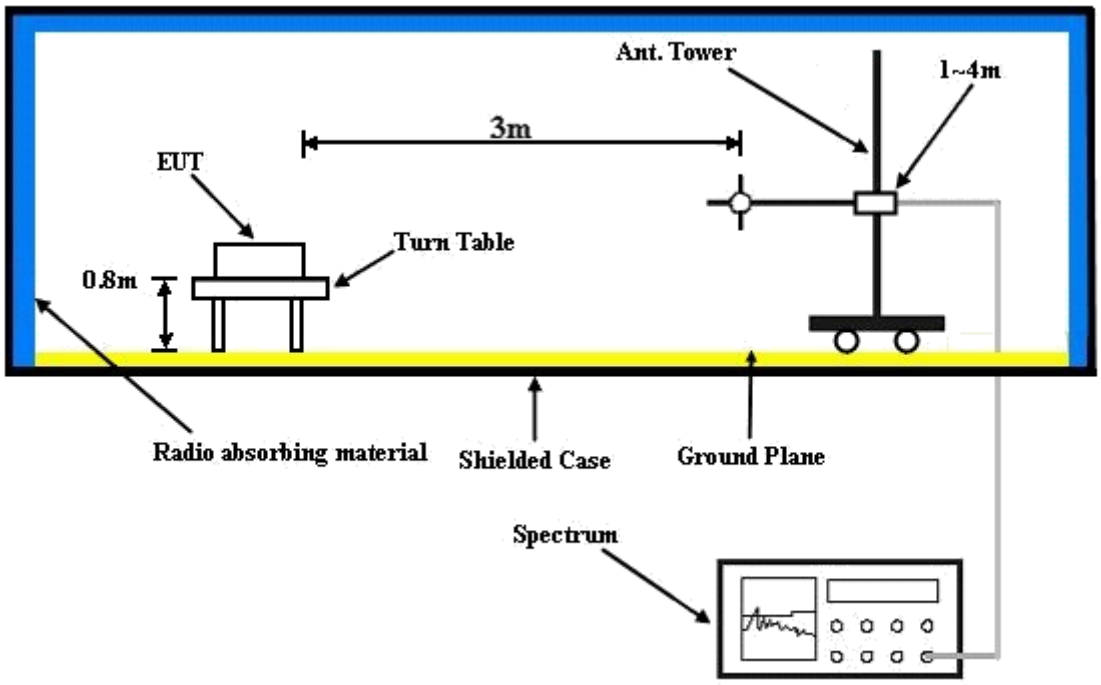
a. Substitution method is used for E.I.R.P measurement. In the semi-anechoic chamber, EUT placed on the 0.8m height of Turn Table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 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. EIRP = Output power level of S.G – TX cable loss + 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, E.R.P power = E.I.R.P power - 2.15dBi.

NOTE: The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1MHz/3MHz.

4.2.3 DEVIATION FROM TEST STANDARD

No deviation

4.2.4 TEST SETUP

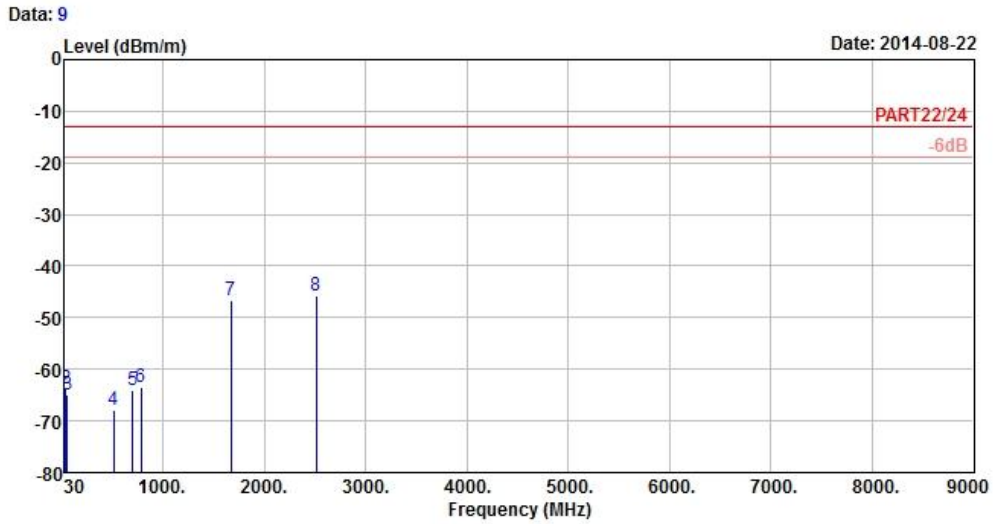


For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.2.5 TEST RESULTS

GPRS:

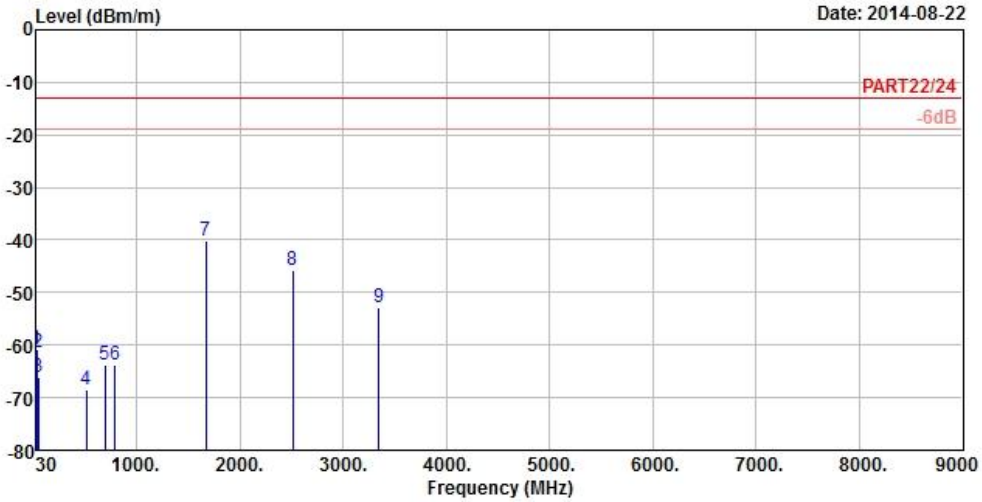
Bureau Veritas Consumer Products Services Ltd.,Taoyuan Branch



Site : 966 Chamber 5
Condition: PART22/24 3m HORIZONTAL
Remark : GPRS 850 Link
Tested by: Gavin Wu

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm/m	dBm	dBm/m	dB	dB/m	
1	33.51	-69.80	-67.96	-13.00	-56.80	-1.84	Peak
2	40.80	-63.62	-62.16	-13.00	-50.62	-1.46	Peak
3	52.14	-64.93	-60.03	-13.00	-51.93	-4.90	Peak
4	511.40	-67.77	-64.97	-13.00	-54.77	-2.80	Peak
5	703.90	-64.18	-65.66	-13.00	-51.18	1.48	Peak
6	783.00	-63.44	-65.45	-13.00	-50.44	2.01	Peak
7	1672.80	-46.57	-32.73	-13.00	-33.57	-13.84	Peak
8 pp	2509.20	-45.64	-35.65	-13.00	-32.64	-9.99	Peak

Data: 10

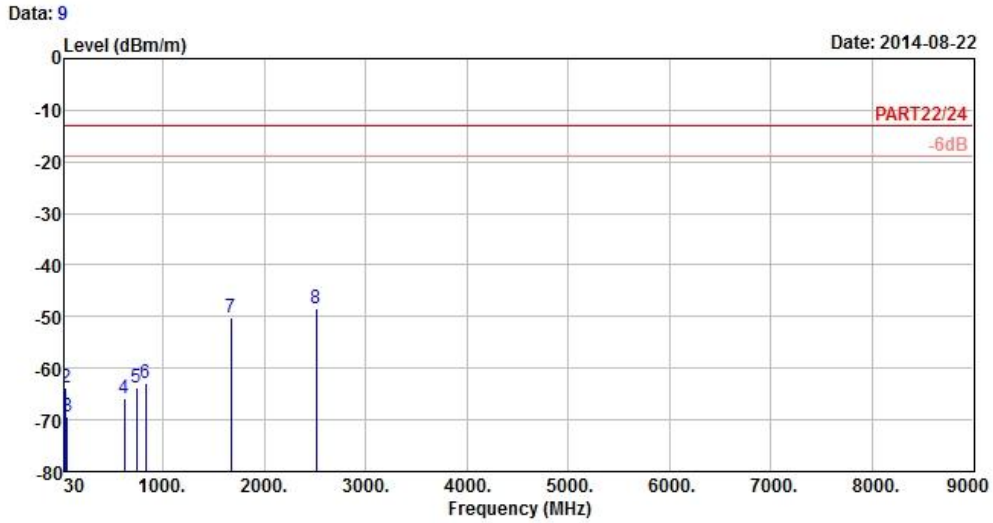


Site : 966 Chamber 5
Condition: PART22/24 3m VERTICAL
Remark : GPRS 850 Link
Tested by: Gavin Wu

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm/m	dBm	dBm/m	dB	dB/m	
1	31.89	-60.95	-60.56	-13.00	-47.95	-0.39	Peak
2	41.07	-61.45	-59.99	-13.00	-48.45	-1.46	Peak
3	47.28	-66.10	-63.21	-13.00	-53.10	-2.89	Peak
4	516.30	-68.55	-65.89	-13.00	-55.55	-2.66	Peak
5	694.80	-63.84	-65.19	-13.00	-50.84	1.35	Peak
6	788.60	-63.79	-65.84	-13.00	-50.79	2.05	Peak
7 pp	1672.80	-40.29	-26.45	-13.00	-27.29	-13.84	Peak
8	2509.20	-45.63	-35.64	-13.00	-32.63	-9.99	Peak
9	3345.60	-52.79	-43.43	-13.00	-39.79	-9.36	Peak

EDGE:

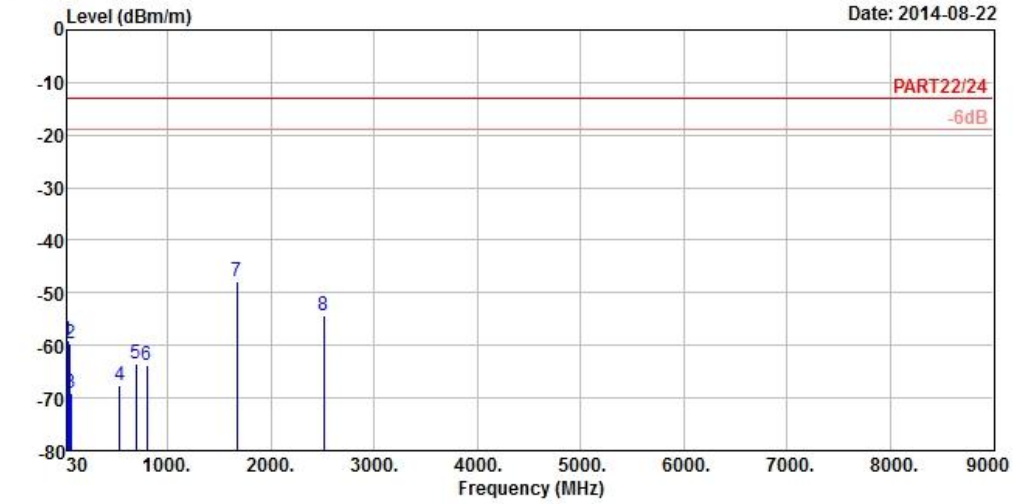
Bureau Veritas Consumer Products Services Ltd.,Taoyuan Branch



Site : 966 Chamber 5
Condition: PART22/24 3m HORIZONTAL
Remark : EDGE 850 Link
Tested by: Gavin Wu

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm/m	dBm	dBm/m	dB	dB/m	
1	32.43	-68.42	-67.31	-13.00	-55.42	-1.11	Peak
2	40.80	-63.62	-62.16	-13.00	-50.62	-1.46	Peak
3	52.95	-69.37	-64.32	-13.00	-56.37	-5.05	Peak
4	615.70	-65.86	-65.79	-13.00	-52.86	-0.07	Peak
5	738.90	-63.63	-65.34	-13.00	-50.63	1.71	Peak
6	826.40	-62.79	-65.07	-13.00	-49.79	2.28	Peak
7	1672.80	-50.14	-36.30	-13.00	-37.14	-13.84	Peak
8 pp	2509.20	-48.49	-38.50	-13.00	-35.49	-9.99	Peak

Data: 10

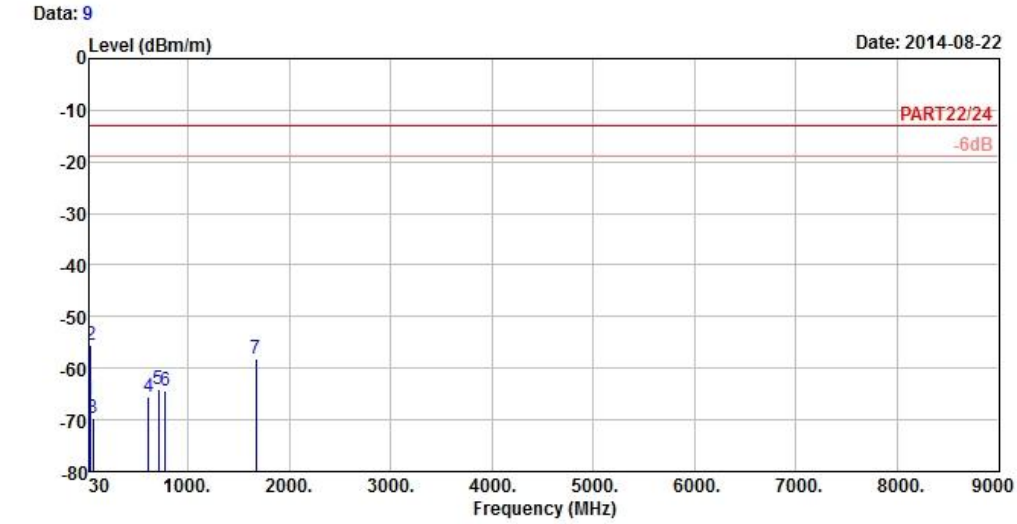


Site : 966 Chamber 5
Condition: PART22/24 3m VERTICAL
Remark : EDGE 850 Link
Tested by: Gavin Wu

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm/m	dBm	dBm/m	dB	dB/m	
1	30.00	-59.02	-60.09	-13.00	-46.02	1.07	Peak
2	57.81	-59.50	-53.70	-13.00	-46.50	-5.80	Peak
3	62.13	-69.12	-62.37	-13.00	-56.12	-6.75	Peak
4	539.40	-67.46	-65.43	-13.00	-54.46	-2.03	Peak
5	696.90	-63.52	-64.92	-13.00	-50.52	1.40	Peak
6	799.80	-63.64	-65.77	-13.00	-50.64	2.13	Peak
7 pp	1672.80	-47.76	-33.92	-13.00	-34.76	-13.84	Peak
8	2509.20	-54.22	-44.23	-13.00	-41.22	-9.99	Peak

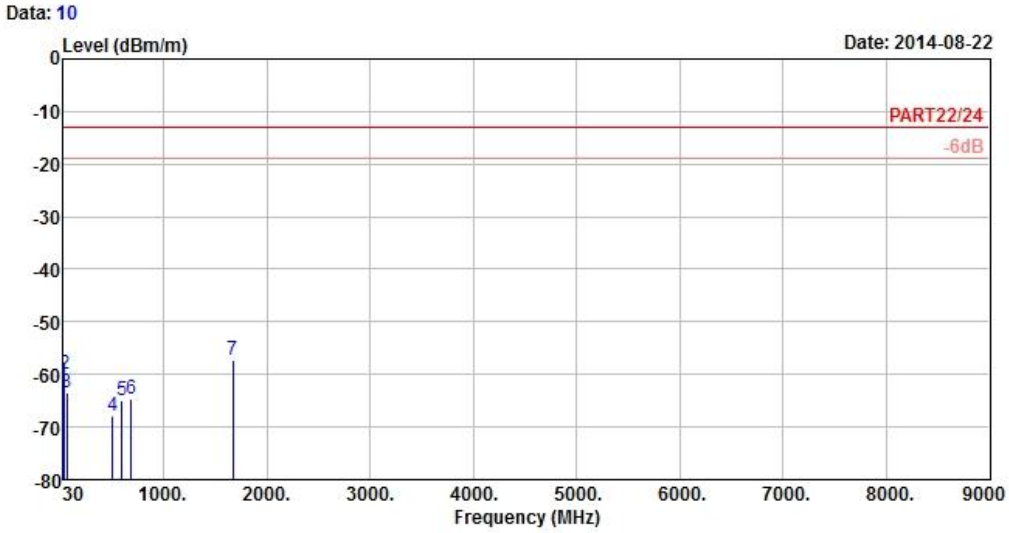
WCDMA:

Bureau Veritas Consumer Products Services Ltd.,Taoyuan Branch



Site : 966 Chamber 5
Condition: PART22/24 3m HORIZONTAL
Remark : WCDMA Band V Link
Tested by: Gavin Wu

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm/m	dBm	dBm/m	dB	dB/m	
1	31.08	-66.20	-66.54	-13.00	-53.20	0.34	Peak
2 pp	42.15	-55.51	-54.18	-13.00	-42.51	-1.33	Peak
3	63.48	-69.70	-62.30	-13.00	-56.70	-7.40	Peak
4	608.70	-65.39	-65.20	-13.00	-52.39	-0.19	Peak
5	707.40	-64.07	-65.57	-13.00	-51.07	1.50	Peak
6	779.50	-64.26	-66.25	-13.00	-51.26	1.99	Peak
7	1672.80	-58.14	-44.30	-13.00	-45.14	-13.84	Peak



Site : 966 Chamber 5
Condition: PART22/24 3m VERTICAL
Remark : WCDMA Band V Link
Tested by: Gavin Wu

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm/m	dBm	dBm/m	dB	dB/m	
1	30.54	-61.36	-61.70	-13.00	-48.36	0.34	Peak
2	41.34	-59.91	-58.52	-13.00	-46.91	-1.39	Peak
3	58.89	-63.53	-57.58	-13.00	-50.53	-5.95	Peak
4	505.80	-68.00	-65.07	-13.00	-55.00	-2.93	Peak
5	594.00	-65.07	-64.53	-13.00	-52.07	-0.54	Peak
6	689.20	-64.53	-65.79	-13.00	-51.53	1.26	Peak
7 pp	1672.80	-57.23	-43.39	-13.00	-44.23	-13.84	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.

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

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

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