FCC Test Report

(PART 90S)

Report No.:	RFBERD-WTW-P22010914-4
FCC ID:	HD5-CT60L1N
Test Model:	CT60L1N
Received Date:	Feb. 03, 2022
Test Date:	Feb. 24, 2022
Issued Date:	Apr. 29, 2022
Applicant:	Honeywell International Inc.
Address:	9680 Old Bailes Road, Fort Mill, SC 29707 USA
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Lin Kou Laboratories
Lab Address:	No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan
Test Location:	No.19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City 33383, Taiwan
FCC Registration / Designation Number:	788550 / TW0003

Testing Laboratory
2021

Table of Contents

Release Control Record

Issue No.	Description	Date Issued
RFBERD-WTW-P22010914-4	Original Release	Apr. 29, 2022

1 Certificate of Conformity

Product:	Dolphin CT60
Brand:	Honeywell
Test Model:	CT60L1N
Sample Status:	Engineering Sample
Applicant:	Honeywell International Inc.
Test Date:	Feb. 24, 2022
Standards:	FCC Part 90, Subpart S FCC Part 2

The above equipment 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 RF characteristics under the conditions specified in this report.

Prepared by : Vera Huang , **Date:** Apr. 29, 2022

Vera Huang / Specialist

Approved by : Jeremy Lin , **Date:** Apr. 29, 2022

Jeremy Lin / Project Engineer

2 Summary of Test Results

Applied Standard: FCC Part 90 & Part 2 (CDMA)			
FCC Clause	**Test Item**	**Result**	**Remarks**
2.1046 90.635 (b)	Effective Radiated Power	N/A	Refer to Note 1
2.1047	Modulation Characteristics	N/A	Refer to Note 1
2.1055 90.213	Frequency Stability	N/A	Refer to Note 1
2.1049 90.209	Occupied Bandwidth	N/A	Refer to Note 1
2.1051 90.210	Emission Masks	N/A	Refer to Note 1
2.1051 90.691	Conducted Spurious Emissions	N/A	Refer to Note 1
2.1053 90.691	Radiated Spurious Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -33.34 dB at 183.26 MHz.

Applied Standard: FCC Part 90 & Part 2 (LTE 26)			
FCC Clause	**Test Item**	**Result**	**Remarks**
2.1046 90.635 (b)	Effective Radiated Power	N/A	Refer to Note 1
2.1047	Modulation Characteristics	N/A	Refer to Note 1
2.1055 90.213	Frequency Stability	N/A	Refer to Note 1
2.1049 90.209	Occupied Bandwidth	N/A	Refer to Note 1
90.691	Emission Masks	N/A	Refer to Note 1
2.1051 90.691	Conducted Spurious Emissions	N/A	Refer to Note 1
2.1053 90.691	Radiated Spurious Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -36.20 dB at 363.68 MHz.

Note:

1. Only radiated spurious emissions below 1GHz test was performed for this addendum. Refer to BV CPS report no.: RF171122C17-4 for other test data.
2. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

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	Expanded Uncertainty (k=2) (±)
Radiated Emissions up to 1 GHz	9 kHz ~ 30 MHz	3.04 dB
	30 MHz ~ 200 MHz	2.93 dB
	200 MHz ~ 1000 MHz	2.95 dB

2.2 Test Site and Instruments

Description & Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date of Calibration
Test Receiver ROHDE & SCHWARZ	ESCI	100424	Dec. 30, 2021	Dec. 29, 2022
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100040	Sep. 15, 2021	Sep. 14, 2022
BILOG Antenna SCHWARZBECK	VULB9168	9168-155	Nov. 01, 2021	Oct. 31, 2022
HORN Antenna SCHWARZBECK	BBHA 9120D	9120D-1170	Nov. 14, 2021	Nov. 13, 2022
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Oct. 26, 2021	Oct. 25, 2022
Loop Antenna EMCI	EM-6879	269	Sep. 16, 2021	Sep. 15, 2022
Preamplifier Agilent (Below 1GHz)	8447D	2944A10631	Jun. 05, 2021	Jun. 04, 2022
RF Coaxial Cable WOKEN With 5dB PAD	8D-FB	Cable-CH4-01	Jul. 24, 2021	Jul. 23, 2022
RF Coaxial Cable EMCI	EMC102-KM-KM-3000	150929	Jul. 24, 2021	Jul. 23, 2022
RF Coaxial Cable EMCI	EMC102-KM-KM-600	150928	Jul. 24, 2021	Jul. 23, 2022
RF signal cable HUBER+SUHNER	SUCOFLEX 104	MY 13380+295012/04	Jun. 05, 2021	Jun. 04, 2022
RF signal cable HUBER+SUHNER	SUCOFLEX 104	Cable-CH4-03 (250724)	Jun. 05, 2021	Jun. 04, 2022
Software BV ADT	ADT_Radiated_ V7.6.15.9.5	NA	NA	NA
Antenna Tower inn-co GmbH	MA 4000	010303	NA	NA
Turn Table Controller BV ADT	SC100	SC93021703	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA
WIT Standard Temperature And Humidity Chamber	TH-4S-C	W981030	Jun. 01, 2021	May 31, 2022
JFW 20dB attenuation	50HF-020-SMA	NA	NA	NA
True RMS Clamp Meter Fluke	325	31130711WS	Jun. 02, 2021	Jun. 01, 2022

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 test was performed in HwaYa Chamber 4.

3 General Information

3.1 General Description of EUT

Product	Dolphin CT60	
Brand	Honeywell	
Test Model	CT60L1N	
Status of EUT	Engineering Sample	
HW Version	V1.1	
HW P/N	DVT	
SW Version	OS.05.001-HON.03.002	
SW P/N	477D	
Power Supply Rating	3.85 Vdc (Li-ion battery)	
Modulation Type	CDMA	QPSK, OQPSK, HPSK
	LTE	QPSK, 16QAM, 64QAM
Frequency Range	CDMA BC10	817.9 ~ 823.1 MHz
	LTE Band 26 (Channel Bandwidth: 1.4 MHz)	814.7 ~ 823.3 MHz
	LTE Band 26 (Channel Bandwidth: 3 MHz)	815.5 ~ 822.5 MHz
	LTE Band 26 (Channel Bandwidth: 5 MHz)	816.5 ~ 821.5 MHz
	LTE Band 26 (Channel Bandwidth: 10 MHz)	819 MHz
Antenna Type	PIFA Antenna	
Accessory Device	Battery x 1, comfort cover x 1	
Data Cable Supplied	USB snap-on adapter x1 (1.25m, Shielded with two cores)	

Note:

1. This report is issued as a supplementary report to BV CPS report no.: RF171122C17-4. The difference compared with original report is changing NFC Chip, HW/SW, adding WLAN 2.4G_n40, and refer to Note 3 for more details. Therefore, only radiated spurious emissions below 1GHz test was verified and recorded in this report.
2. The EUT contains following accessory devices.

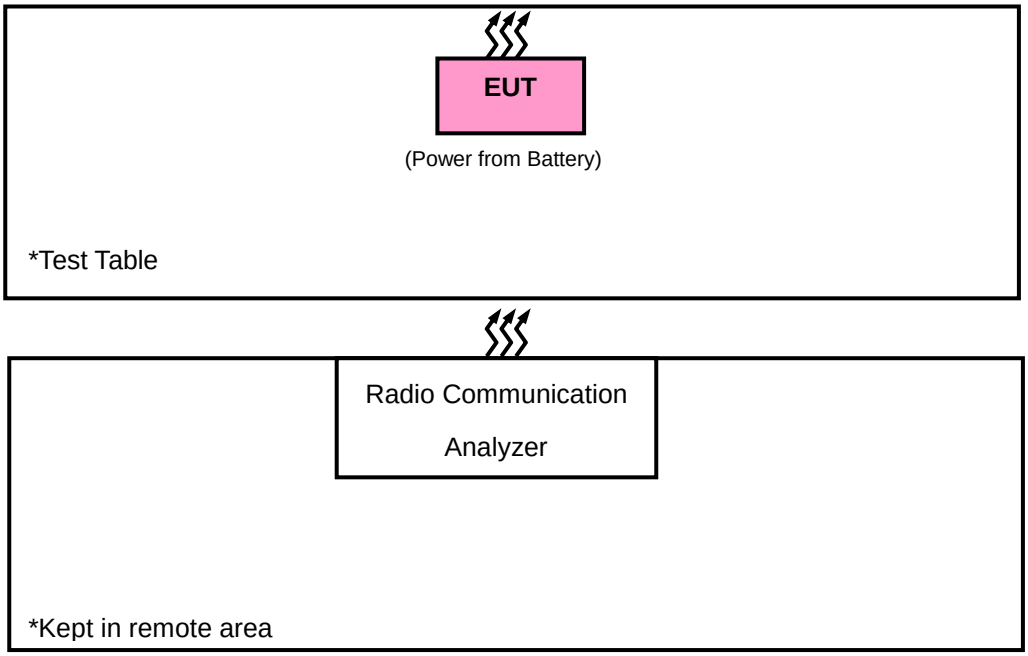
Product	Brand	Model	Description
Battery 1	Inventus	CT50-BTSC	3.6 Vdc, 4040 mAh, 14.6Wh
Battery 2 (For test)	Honeywell	CT50-BTSC	3.85Vdc, 4020mAh, 15.5Wh

3. Refer to below table for the change list.

SOM Change list	
RF Module	Underfill Modified
RF Module	LPDDR4x Layout Optimization
RF Module	Wi-Fi Layout Optimization
RF Module	WWAN Path Optimization
RF Module	WWAN Shielding Frame Optimization
RF Module	WWAN PA Power Optimization
RF Module	SOM PAD Mask Optimization
RF Module	Change DC regulator and WLAN amplifier DC power
RF Module	BOM Change for Optimization **
RF Module	B25 Duplexer-AVAGO-ACMD-6225-TR1
RF Module	B40 TRX filter-AVAGO-ACPF-8240-TR1
RF Module	Remove un-used CLK trace WCN_CLK
RF Module	WIFI 11b Power reduction from 18+/-1.5 dB to 17.5+/-1.5 dB **
RF Module	LTE 7 Power reduction from 23.4 + 1 / -2.7 dB to 23 + 1 / -2.7dB **
RF Module	GSM 850 Power reduction for Head with WIFI ON mode from 33.4 + 1 / - 2 dB to 32.8 + 1 / -2 dB **
RF Module	CDMA2K BC0 Power reduction for Head with WIFI ON mode from 24.4 +/- 1 dB to 23.8 + /- 1dB **
RF Module	CDMA2K BC10 Power reduction for Head with WIFI ON mode from 24.4 +/- 1 dB to 23.8 + /- 1dB **
RF Module	Enable WIFI 2.4G N40 by software
Carrier board Change list	
Carrier Board	Scanner change to N6703 imager
Carrier Board	Add 1F/2.7V supercap
Carrier Board	Add MAX38888 DC/DC for supercap charge/ change discharge circuit
Carrier Board	Add low battery protection circuit
Carrier Board	Change speaker and add a connector for it
Carrier Board	Change ADS1014 to ADS1015 to add supercap voltage detection
Carrier Board	AUX antenna tuner circuit change placement location
Carrier Board	Upgrade the SOM to SOM4
Carrier Board	Add a new model battery
Carrier Board	NFC Controller from NQ310 to NQ410
Carrier Board	Add the second source (OV13855 Camera, S0703VE insertion
Carrier Board	Add the second source (ESD, ADC, OPT Sensor, Translator, 6-axis sensor, Pressure sensor, Analog switch)

4. The above Antenna information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible
5. The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or user's manual.

3.2 Configuration of System under Test



3.2.1 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.	Radio Communication Analyzer	Anritsu	MT8820C	6201240431	N/A

Note: Item 1 acted as communication partners to transfer data.

3.3 Test Mode Applicability and Tested Channel Detail

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

Band	Radiated Emission
CDMA	Z-axis
LTE Band 26	Z-axis

CDMA

EUT Configure Mode	Test Item	Available Channel	Tested Channel	Mode
-	Radiated Emission	476 to 684	684	1xRTT

LTE Band 26

EUT Configure Mode	Test Item	Available Channel	Tested Channel	Channel Bandwidth	Modulation	Mode
-	Radiated Emission	26740	26740	10 MHz	QPSK	1 RB / 49 RB Offset

Test Condition:

Test Item	Environmental Conditions	Input Power	Tested By
Radiated Emission	23 deg. C, 66 % RH	3.85 Vdc	Titan Hsu

3.4 General Description of Applied Standards and references

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards and references:

Test Standard:
FCC 47 CFR Part 2
FCC 47 CFR Part 90
ANSI/TIA/EIA-603-E 2016
ANSI 63.26-2015

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

References Test Guidance:
KDB 971168 D01 Power Meas License Digital Systems v03r01
KDB 971168 D02 Misc Rev Approv License Devices v02r01

Note: All test items have been performed as a reference to the above KDB test guidance.

4 Test Types and Results

4.1 Radiated Emission Measurement

4.1.1 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 (P) dB. The limit of emission is equal to -13 dBm.

4.1.2 Test Procedure

a. In the semi-anechoic chamber, EUT placed on the 0.8m(below or equal 1GHz) and/or 1.5m(above 1GHz) 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 height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
c. Perform a field strength measurement and record the worse read value, is the field strength value via a spectrum reading obtained corrected for antenna factor, cable loss and pre-amplifier factor and then mathematically convert the measured field strength level to EIRP/ERP level.
d. Following C63.26 section 5.5 and 5.2.7
   EIRP (dBm) = E (dBμV/m) + 20log(D) - 104.8; where D is the measurement distance (in the far field region) in m.
   ERP (dBm) = E (dBμV/m) + 20log(D) - 104.8 - 2.15; where D is the measurement distance (in the far field region) in m.

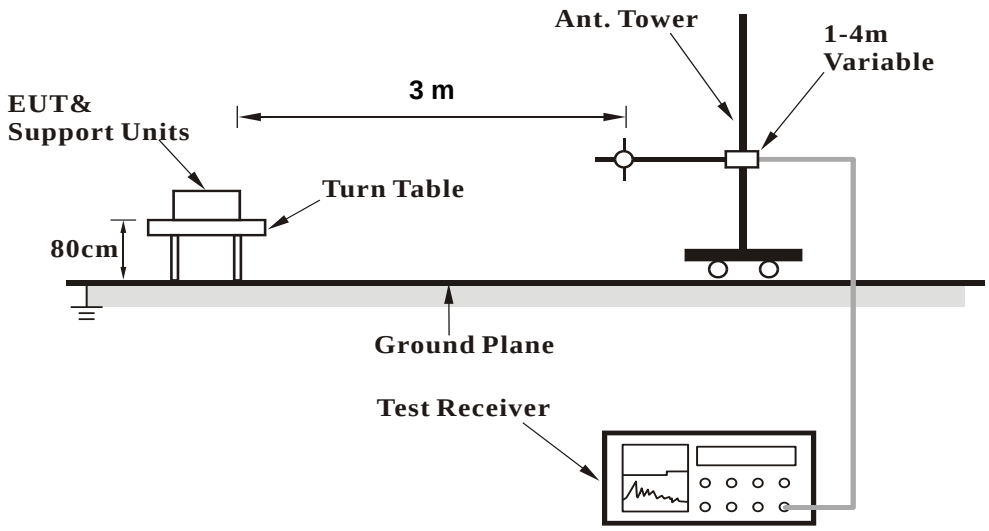
Note: The resolution bandwidth of spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz.

4.1.3 Deviation from Test Standard

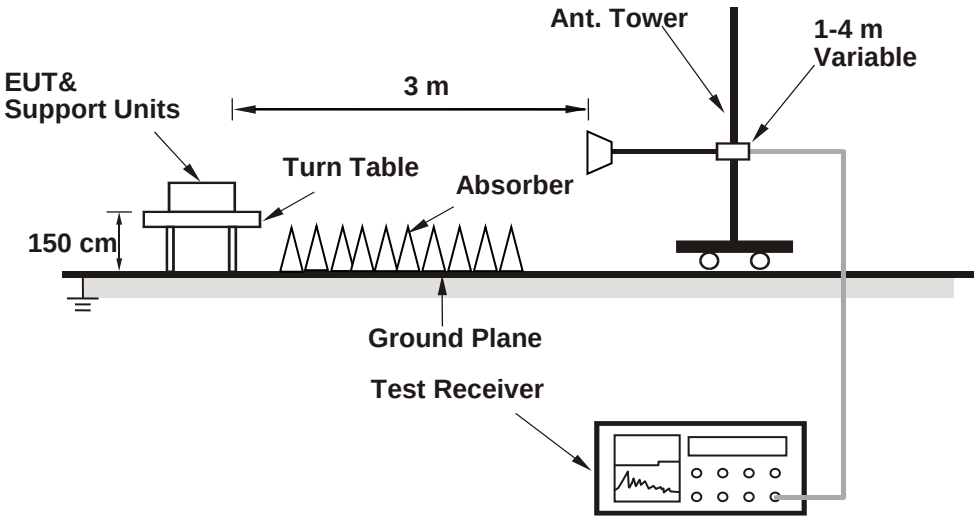
No deviation.

4.1.4 Test Setup

<Radiated Emission below or equal 1 GHz>



<Radiated Emission above 1 GHz>



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

4.1.5 Test Results

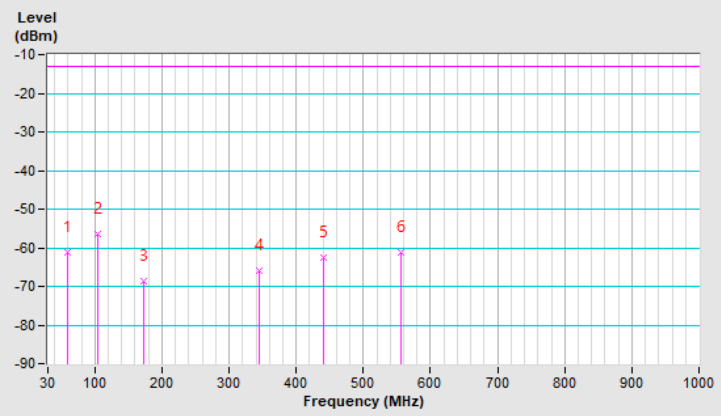
CDMA:

RF Mode	TX CDMA BC 10	Channel	CH 684：823.1 MHz
Frequency Range	30MHz ~ 1GHz		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	ERP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	59.10	-61.30	-13.00	-48.30	1.50 H	198	45.07	-106.37
2	103.72	-56.54	-13.00	-43.54	1.00 H	198	53.63	-110.17
3	173.56	-68.66	-13.00	-55.66	1.00 H	25	38.24	-106.90
4	344.28	-66.10	-13.00	-53.10	1.50 H	250	38.22	-104.32
5	441.28	-62.52	-13.00	-49.52	1.00 H	273	39.84	-102.36
6	555.74	-61.16	-13.00	-48.16	1.00 H	198	39.55	-100.71

Remarks:

1. ERP(dBm) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + 20log(D) – 104.8 – 2.15
3. Margin value = ERP – Limit value
4. The other ERP levels were very low against the limit.

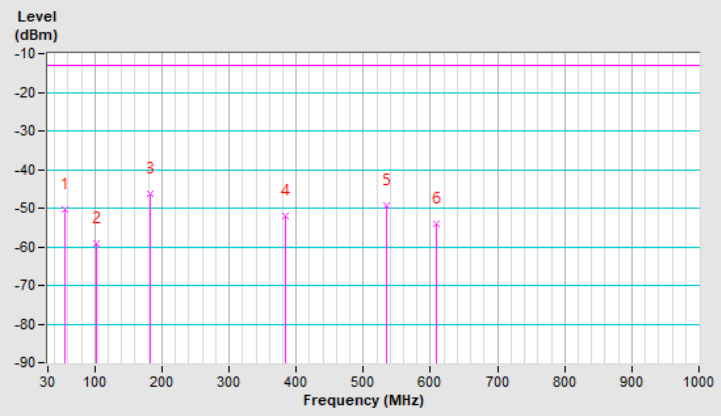


RF Mode	TX CDMA BC 10	Channel	CH 684：823.1 MHz
Frequency Range	30MHz ~ 1GHz		

Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	ERP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	55.22	-50.50	-13.00	-37.50	1.00 V	268	55.70	-106.20
2	101.78	-59.25	-13.00	-46.25	1.49 V	308	51.25	-110.50
3	**183.26**	**-46.34**	**-13.00**	**-33.34**	**1.49 V**	**268**	**61.71**	**-108.05**
4	383.08	-52.20	-13.00	-39.20	2.00 V	288	51.40	-103.60
5	534.40	-49.47	-13.00	-36.47	1.49 V	279	51.45	-100.92
6	608.12	-53.96	-13.00	-40.96	1.49 V	45	45.13	-99.09

Remarks:

1. ERP(dBm) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + 20log(D) – 104.8 – 2.15
3. Margin value = ERP – Limit value
4. The other ERP levels were very low against the limit.



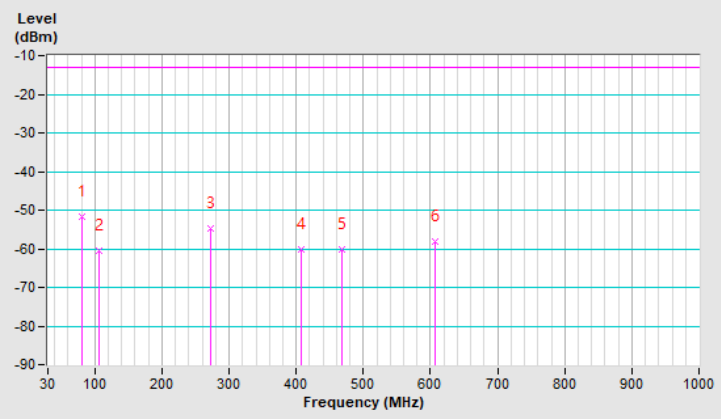
LTE Band 26

RF Mode	TX LTE Band 26-10MHz	Channel	CH 26740：819 MHz
Frequency Range	30MHz ~ 1GHz		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	ERP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	80.44	-51.60	-13.00	-38.60	1.00 H	157	59.08	-110.68
2	105.66	-60.60	-13.00	-47.60	1.50 H	216	49.36	-109.96
3	272.50	-54.59	-13.00	-41.59	1.50 H	279	51.09	-105.68
4	408.30	-60.28	-13.00	-47.28	1.50 H	15	42.98	-103.26
5	468.44	-60.00	-13.00	-47.00	1.00 H	343	41.97	-101.97
6	606.18	-58.14	-13.00	-45.14	1.50 H	6	41.06	-99.20

Remarks:

1. ERP(dBm) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + 20log(D) – 104.8 – 2.15
3. Margin value = ERP – Limit value
4. The other ERP levels were very low against the limit.

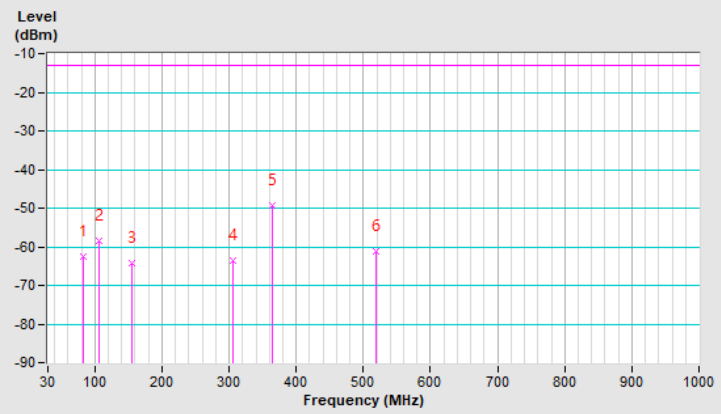


RF Mode	TX LTE Band 26-10MHz	Channel	CH 26740：819 MHz
Frequency Range	30MHz ~ 1GHz		

Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	ERP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	82.38	-62.39	-13.00	-49.39	1.50 V	133	48.70	-111.09
2	105.66	-58.63	-13.00	-45.63	1.50 V	7	51.33	-109.96
3	156.10	-64.10	-13.00	-51.10	2.00 V	199	42.01	-106.11
4	305.48	-63.67	-13.00	-50.67	1.50 V	351	41.13	-104.80
5	**363.68**	**-49.20**	**-13.00**	**-36.20**	**1.00 V**	**192**	**54.70**	**-103.90**
6	518.88	-61.34	-13.00	-48.34	1.50 V	145	39.76	-101.10

Remarks:

1. ERP(dBm) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + 20log(D) – 104.8 – 2.15
3. Margin value = ERP – Limit value
4. The other ERP levels were very low against the limit.



5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

Appendix – Information of 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 FCC recognized accredited test firms and accredited according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

Lin Kou EMC/RF Lab
Tel: 886-2-26052180
Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab
Tel: 886-3-6668565
Fax: 886-3-6668323

Hwa Ya EMC/RF/Safety Lab
Tel: 886-3-3183232
Fax: 886-3-3270892

Email: service.adt@tw.bureauveritas.com
Web Site: www.bureauveritas-adt.com

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

--- END ---