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FCC Test Report

(PART 90S)

Report No.: RF160104C14-8

FCC ID: GKR-TP00078ASB

Test Model: TP00078A

Received Date: Jan. 04, 2016

Test Date: Jan. 16, 2016

Issued Date: Feb. 18, 2016

Applicant: Compal Electronics Inc

Address: No.581, Ruiguang Rd., Neihu District, Taipei City, Taiwan 11492, R.O.C.

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.	Description	Date Issued
RF160104C14-8	Original Release	Feb. 18, 2016



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1 Certificate of Conformity

Product: Tablet Computer

Brand: Lenovo

Test Model: TP00078A

Sample Status: Production Unit

Applicant: Compal Electronics Inc

Test Date: Jan. 16, 2016

Standards: FCC Part 90, Subpart S

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 EMC characteristics under the conditions specified in this report.

Prepared by : Gina Lin, **Date:** Feb. 18, 2016
Gina Liu / Specialist

Approved by : Stanley Wu, **Date:** Feb. 18, 2016
Stanley Wu / Assistant Manager

2 Summary of Test Results

Applied Standard: FCC Part 90 & Part 2			
FCC Clause	Test Item	Result	Remarks
2.1046 90.635 (b)	Effective Radiated Power	Pass	Meet the requirement of limit.
2.1053 90.691	Radiated Spurious Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -21.84 dB at 2457.00 MHz.

Note: Only test item of Conducted power, ERP, and Radiated Emissions tests were performed for this report.

Other test data please refer to China Telecommunication Techonlgry Labs module report no.: B15W50341-FCC-RF_Rev1 (Brand: Sierra Wireless Inc., Model: EM7455) Issue date: Jul, 10, 2015.

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	Expended Uncertainty (k=2) (±)
Radiated Emissions up to 1 GHz	30 MHz ~ 200 MHz	2.93 dB
	200 MHz ~1000 MHz	2.95 dB
Radiated Emissions above 1 GHz	1 GHz ~ 18 GHz	2.26 dB
	18 GHz ~ 40 GHz	1.94 dB

2.2 Test Site and Instruments

Description & Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date of Calibration
Test Receiver Agilent	N9038A	MY51210203	Jan. 21, 2015	Jan. 21, 2016
Spectrum Analyzer Agilent	N9010A	MY52220314	Sep. 03, 2015	Sep. 02, 2016
Spectrum Analyzer ROHDE & SCHWARZ	FSU43	101261	Dec. 17, 2015	Dec. 16, 2016
BILOG Antenna SCHWARZBECK	VULB9168	9168-472	Feb. 04, 2015	Feb. 04, 2016
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-969	Feb. 09, 2015	Feb. 09, 2016
HORN Antenna SCHWARZBECK	BBHA 9170	9170-480	Feb. 04, 2015	Feb. 04, 2016
Loop Antenna	EM-6879	269	Jul. 31, 2015	Jul. 30, 2016
Preamplifier EMCI	EMC 012645	980115	Dec. 21, 2015	Dec. 20, 2016
Preamplifier EMCI	EMC 184045	980116	Jan. 09, 2015	Jan. 08, 2016
Preamplifier EMCI	EMC 330H	980112	Dec. 27, 2014	Dec. 26, 2015
Power Meter Anritsu	ML2495A	1232002	Sep. 21, 2015	Sep. 20, 2016
Power Sensor Anritsu	MA2411B	1207325	Sep. 21, 2015	Sep. 20, 2016
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	309219/4 2950114	Oct. 12, 2015	Oct. 11, 2016
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	250130/4	Oct. 12, 2015	Oct. 11, 2016
RF Coaxial Cable Worken	8D-FB	Cable-Ch10-01	Oct. 12, 2015	Oct. 11, 2016
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
Radio Communication Analyzer	MT8820C	6201300640	Aug. 10, 2015	Aug. 09, 2017

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 10.
3. The horn antenna and preamplifier (model: EMC 184045) are used only for the measurement of emission frequency above 1 GHz if tested.
4. The FCC Site Registration No. is 690701.
5. The IC Site Registration No. is IC7450F-10.

3 General Information

3.1 General Description of EUT

Product	Tablet Computer	
Brand	Lenovo	
Test Model	TP00078A	
Status of EUT	Production Unit	
Power Supply Rating	20Vdc (Adapter) 15.2Vdc (Li-ion battery)	
Modulation Type	LTE	QPSK, OQPSK, HPSK
Frequency Range	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
Max. ERP Power	LTE Band 26 (Channel Bandwidth: 1.4 MHz)	0.09 W
	LTE Band 26 (Channel Bandwidth: 3 MHz)	0.09 W
	LTE Band 26 (Channel Bandwidth: 5 MHz)	0.09 W
	LTE Band 26 (Channel Bandwidth: 10 MHz)	0.09 W
Antenna Type	PIFA Antenna	
Accessory Device	Refer to Note as below	
Data Cable Supplied	Refer to Note as below	

Note:

1. The EUT contains following accessory devices.

Product	Brand	Model	Description
Adapter 1	Lenovo	ADLX45NCC2A	I/P: 100-240Vac, 50~60Hz, 1.3A O/P: 20Vdc, 2.25A
Adapter 2	Lenovo	ADLX45NDC2A	I/P: 100-240Vac, 50~60Hz, 1.3A O/P: 20Vdc, 2.25A
Battery	Lenovo	SB10F46465	15.2Vdc, 2.895Ah
WLAN Module	Broadcom	BCM94356Z	--
WWAN Module	Sierra	EM7455	--

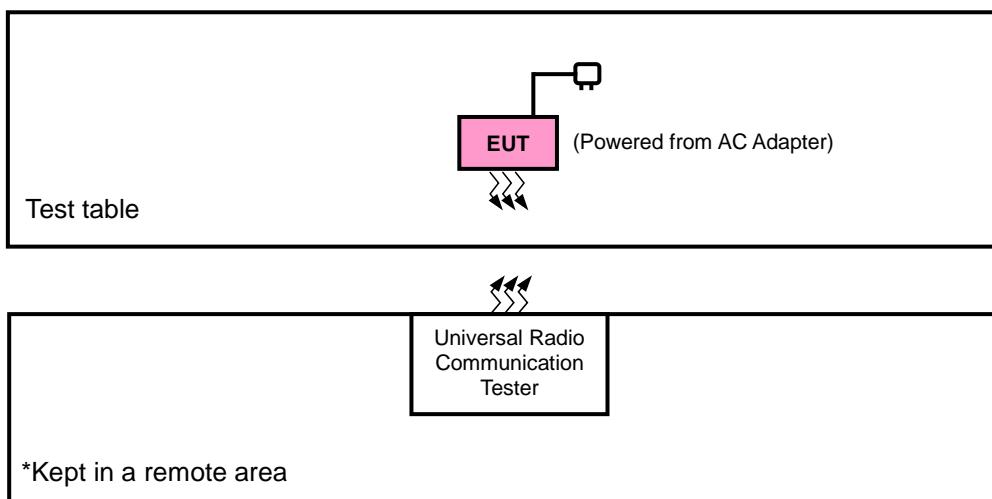
2. The antenna information is listed as below.

Antenna Type	Brand Name	Parts Number	Antenna Gain
			LTE 26
PIFA	Ethertronics Inc.	WWAN Main Antenna: 5001997 WWAN Aux. Antenna: 5002014 (RX only)	-0.89

3. 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

<Radiated Emission 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	6201300640	N/A

No.	Signal Cable Description Of The Above Support Units
1.	N/A

Note:

1. All power cords of the above support units are non-shielded (1.8m).
2. 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
LTE Band 26	Z-axis

LTE Band 26

EUT Configure Mode	Test Item	Available Channel	Tested Channel	Channel Bandwidth	Modulation	Mode
-	ERP	26697 to 26783	26697, 26740, 26783	1.4 MHz	QPSK, 16QAM	1 RB / 2 RB Offset
		26705 to 26775	26705, 26740, 26775	3 MHz	QPSK, 16QAM	1 RB / 7 RB Offset
		26715 to 26765	26715, 26740, 26765	5 MHz	QPSK, 16QAM	1 RB / 12 RB Offset
		26740	26740	10 MHz	QPSK, 16QAM	1 RB / 49 RB Offset
-	Radiated Emission	26697 to 26783	26740	1.4 MHz	QPSK	1 RB / 2 RB Offset
		26705 to 26775	26740	3 MHz	QPSK	1 RB / 7 RB Offset
		26715 to 26765	26740	5 MHz	QPSK	1 RB / 12 RB Offset
		26740	26740	10 MHz	QPSK	1 RB / 49 RB Offset

Note: This device was tested under all bandwidths, RB configurations and modulations. The worst case was found in QPSK modulation.

Test Condition:

Test Item	Environmental Conditions	Input Power	Tested By
ERP	25 deg. C, 65 % RH	15.2 Vdc	Anson Lin
Radiated Emission	25 deg. C, 65 % RH	120 Vac, 60 Hz	Anson Lin



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3.4 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

3.5 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

KDB 412172 D0 Determining ERP and EIRP v01

KDB 996369 D01 Module Certification Guide v02

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

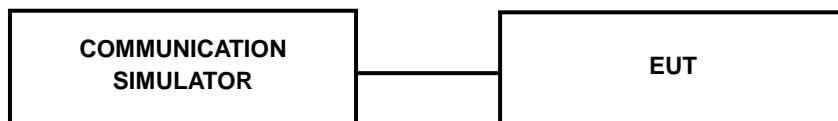
Mobile / Portable station are limited to 100 watts e.r.p.

4.1.2 Test Procedures

A base station simulator was used to establish communication with the EUT. Its parameters were set to transmit the maximum power on the EUT. The measured power in the radio frequency on the transmitter output terminals shall be reported.

Conducted Power Measurement:

- The EUT was set up for the maximum power with 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.



EIRP / ERP Measurement:

According to KDB 412172 D01 Power Approach,

$$\text{EIRP} = P_T + G_T - L_C, \text{ ERP} = \text{EIRP} - 2.15, \text{ where}$$

P_T = transmitter output power in dBm

G_T = gain of the transmitting antenna in dBi

L_C = signal attenuation in the connecting cable between the transmitter and antenna in dB

4.1.3 Test Results

Conducted Output Power (dBm)

Band / BW	RB Size	RB Offset	QPSK			3GPP MPR (dB)	16QAM			3GPP MPR (dB)
			Low Ch 26697	Mid Ch 26740	High Ch 26783		Low Ch 26697	Mid Ch 26740	High Ch 26783	
			814.7 MHz	819.0 MHz	823.3 MHz		814.7 MHz	819.0 MHz	823.3 MHz	
26 / 1.4M	1	0	22.28	22.71	22.68	0	21.31	21.76	21.73	1
	1	2	21.93	22.51	22.40	0	21.00	21.55	21.43	1
	1	5	22.13	22.56	22.53	0	21.15	21.61	21.57	1
	3	0	21.17	21.35	21.33	0	20.08	20.35	20.33	1
	3	1	21.01	21.23	21.16	0	20.01	20.21	20.13	1
	3	3	21.06	21.29	21.25	0	20.05	20.28	20.23	1
	6	0	20.99	21.43	21.35	1	19.98	20.43	20.35	2

Band / BW	RB Size	RB Offset	QPSK			3GPP MPR (dB)	16QAM			3GPP MPR (dB)
			Low Ch 26705	Mid CH 26740	High CH 26775		Low Ch 26705	Mid CH 26740	High CH 26775	
			815.5 MHz	819.0 MHz	822.5 MHz		815.5 MHz	819.0 MHz	822.5 MHz	
26 / 3M	1	0	22.37	22.76	22.73	0	21.36	21.81	21.78	1
	1	7	22.04	22.58	22.51	0	21.00	21.62	21.55	1
	1	14	22.19	22.61	22.58	0	21.27	21.66	21.62	1
	8	0	20.96	21.53	21.42	1	19.96	20.54	20.43	2
	8	3	20.89	21.39	21.31	1	19.83	20.39	20.30	2
	8	7	20.92	21.43	21.40	1	19.87	20.44	20.40	2
	15	0	21.09	21.55	21.53	1	20.06	20.57	20.55	2

Band / BW	RB Size	RB Offset	QPSK			3GPP MPR (dB)	16QAM			3GPP MPR (dB)
			Low Ch 26715	Mid Ch 26740	High Ch 26765		Low Ch 26715	Mid Ch 26740	High Ch 26765	
			816.5 MHz	819.0 MHz	821.5 MHz		816.5 MHz	819.0 MHz	821.5 MHz	
26 / 5M	1	0	22.39	22.81	22.78	0	21.46	21.86	21.83	1
	1	12	22.16	22.65	22.60	0	21.17	21.69	21.63	1
	1	24	22.26	22.68	22.66	0	21.29	21.73	21.70	1
	12	0	21.15	21.59	21.52	1	20.04	20.60	20.53	2
	12	6	21.04	21.47	21.45	1	19.98	20.47	20.44	2
	12	13	21.07	21.55	21.51	1	20.04	20.56	20.51	2
	25	0	21.20	21.64	21.59	1	20.21	20.66	20.61	2



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Band / BW	RB Size	RB Offset	QPSK	3GPP MPR (dB)	16QAM	3GPP MPR (dB)
			Mid Ch 26740		Mid Ch 26740	
			819.0 MHz		819.0 MHz	
26 / 10M	1	0	22.49	0	21.50	1
	1	24	22.23	0	21.25	1
	1	49	22.42	0	21.39	1
	25	0	21.26	1	20.26	2
	25	12	21.19	1	20.14	2
	25	25	21.25	1	20.17	2
	50	0	21.36	1	20.31	2

ERP Power (dBm)

Band / BW	Mode	QPSK			16QAM		
	Channel	Low CH 26697	Mid CH 26740	High CH 26783	Low CH 26697	Mid CH 26740	High CH 26783
	Frequency	814.7 MHz	819 MHz	823.3 MHz	814.7 MHz	819 MHz	823.3 MHz
26 / 1.4M	Conducted power(dBm)	22.28	22.71	22.68	21.31	21.76	21.73
	Conducted power (Watts)	0.17	0.19	0.19	0.14	0.15	0.15
	ERP (dBm)	19.24	19.67	19.64	18.27	18.72	18.69
	ERP (Watts)	0.08	0.09	0.09	0.07	0.07	0.07

Band / BW	Mode	QPSK			16QAM		
	Channel	Low CH 26705	Mid CH 26740	High CH 26775	Low CH 26705	Mid CH 26740	High CH 26775
	Frequency	815.5 MHz	819 MHz	822.5 MHz	815.5 MHz	819 MHz	822.5 MHz
26 / 3M	Conducted power(dBm)	22.37	22.76	22.73	21.36	21.81	21.78
	Conducted power (Watts)	0.17	0.19	0.19	0.14	0.15	0.15
	ERP (dBm)	19.33	19.72	19.69	18.32	18.77	18.74
	ERP (Watts)	0.09	0.09	0.09	0.07	0.08	0.07

Band / BW	Mode	QPSK			16QAM		
	Channel	Low CH 26715	Mid CH 26740	High CH 26765	Low CH 26715	Mid CH 26740	High CH 26765
	Frequency	816.5 MHz	819 MHz	821.5 MHz	816.5 MHz	819 MHz	821.5 MHz
26 / 5M	Conducted power(dBm)	22.39	22.81	22.78	21.46	21.86	21.83
	Conducted power (Watts)	0.17	0.19	0.19	0.14	0.15	0.15
	ERP (dBm)	19.35	19.77	19.74	18.42	18.82	18.79
	ERP (Watts)	0.09	0.09	0.09	0.07	0.08	0.08



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Band / BW	Mode	QPSK	16QAM
	Channel	Mid CH	Mid CH
		26740	26740
26 / 10M	Frequency	819	819
		MHz	MHz
	Conducted power(dBm)	22.49	21.5
	Conducted power (Watts)	0.18	0.14
	ERP (dBm)	19.45	18.46
	ERP (Watts)	0.09	0.07

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 is equal to -13 dBm.

4.2.2 Test Procedure

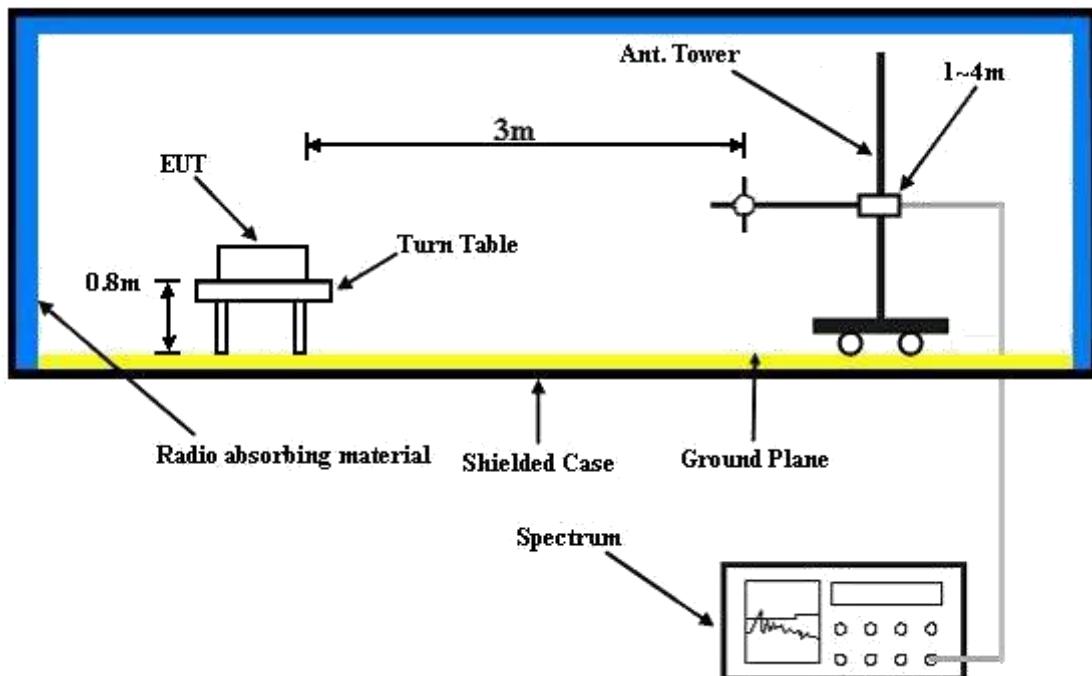
- a. Substitution method is used for E.I.R.P measurement. In the semi-anechoic chamber, EUT placed on the 0.8 m height of Turn Table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1 m to 4 m 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.P.R power - 2.15 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

LTE Band 26

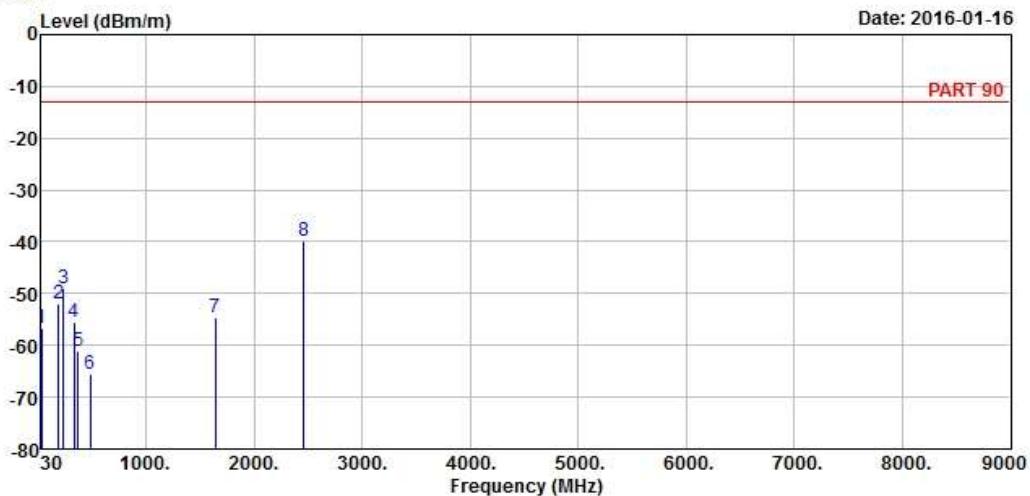
Channel Bandwidth: 10 MHz / QPSK



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Data: 5



Site : 966 Chamber 5

Condition: PART 90 3m HORIZONTAL

Remak : LTE Band 26 QPSK_10M(1,0) Link

Tested by: Anson Lin

Plane : NB

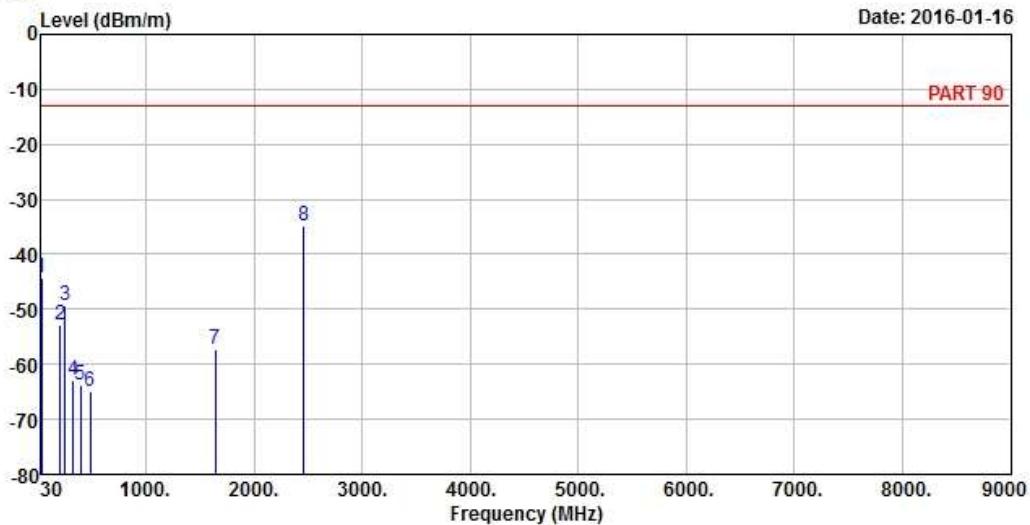
Freq	Level	Read	Limit	Over	Factor	Remark	
		MHz	dBm/m	dBm	Line	dB	dB/m
1	30.00	-56.61	-56.99	-13.00	-43.61	0.38	Peak
2	191.02	-51.83	-44.65	-13.00	-38.83	-7.18	Peak
3	234.67	-49.15	-42.53	-13.00	-36.15	-6.62	Peak
4	331.67	-55.55	-49.03	-13.00	-42.55	-6.52	Peak
5	373.38	-61.23	-55.13	-13.00	-48.23	-6.10	Peak
6	481.05	-65.57	-60.60	-13.00	-52.57	-4.97	Peak
7	1638.00	-54.59	-39.80	-13.00	-41.59	-14.79	Peak
8 pp	2457.00	-39.90	-29.46	-13.00	-26.90	-10.44	Peak



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Data: 6



Site : 966 Chamber 5

Condition: PART 90 3m VERTICAL

Remak : LTE Band 26 QPSK_10M(1,0) Link

Tested by: Anson Lin

Plane : NB

Freq	Level	Read	Limit	Over	Factor	Remark
		Level	Line	Limit		
MHz	dBm/m	dBm	dBm/m	dB	dB/m	
1	30.00	-44.39	-44.77	-13.00	-31.39	0.38 Peak
2	204.60	-52.85	-45.02	-13.00	-39.85	-7.83 Peak
3	247.28	-49.25	-43.14	-13.00	-36.25	-6.11 Peak
4	327.79	-62.85	-56.27	-13.00	-49.85	-6.58 Peak
5	394.72	-63.65	-57.67	-13.00	-50.65	-5.98 Peak
6	482.02	-64.94	-59.99	-13.00	-51.94	-4.95 Peak
7	1638.00	-57.26	-42.47	-13.00	-44.26	-14.79 Peak
8 pp	2457.00	-34.84	-24.40	-13.00	-21.84	-10.44 Peak



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5 Pictures of Test Arrangements

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



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Appendix – 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:

Linko 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

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 ---