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	Releas	e Control Record	
Issue No.	Description		Date Issued
RF180928E04-3	Original release.		Jan. 14, 2019



# 1 Certificate of ConformityProduct:Universal hubBrand:LogitechTest Model:N-R0017Sample Status:ENGINEERING SAMPLEApplicant:LOGITECH FAR EAST LTD.Test Date:Oct. 16 to 20, 2018Standards:47 CFR FCC Part 15, Subpart C (Section 15.247)<br/>ANSI C63.10: 2013

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 :	Phoenix Huang / Specialist	, Date:	Jan. 14, 2019	
Approved by :	May Cinen / Manager	_, Date:	Jan. 14, 2019	



## 2 Summary of Test Results

	47 CFR FCC Part 15, Sub	part C (SEC	TION 15.247)
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -4.87dB at 0.56406MHz.
15.205 & 209 & 15.247(d)	Radiated Emissions & Band Edge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -8.5dB at 45.13MHz.
15.247(d)	Antenna Port Emission	PASS	Meet the requirement of limit.
15.247(a)(2)	6dB bandwidth	PASS	Meet the requirement of limit.
15.247(b)	Conducted power	PASS	Meet the requirement of limit.
15.247(e)	Power Spectral Density	PASS	Meet the requirement of limit.
15.203	Antenna Requirement	PASS	No antenna connector is used.

## 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) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	1.84 dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	5.53 dB
	1GHz ~ 6GHz	5.08 dB
Radiated Emissions above 1 GHz	6GHz ~ 18GHz	4.98 dB
	18GHz ~ 40GHz	5.19 dB

#### 2.2 Modification Record

There were no modifications required for compliance.



## 3 General Information

## 3.1 General Description of EUT (BT-LE)

Product	Universal hub
PMN	Harmony Express
Brand	Logitech
Test Model	N-R0017
Status of EUT	ENGINEERING SAMPLE
Power Supply Rating	5Vdc from power adapter
Modulation Type	GFSK
Modulation Technology	DTS
Transfer Rate	Up to 1Mbps
Operating Frequency	2402MHz ~ 2480MHz
Number of Channel	40
Output Power	2.518mW
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	Adapter x1 IR x1
Data Cable Supplied	IR Cable x1 (Unshielded, 2m)

Note:

1. The EUT may have a lot of colors for marketing requirement.

2. Simultaneously transmission condition. (2.4G/5G WLAN can't transmission simultaneously)

Condition	Techr	nology
1	WLAN(2.4GHz)	Bluetooth
2	WLAN(5GHz)	Bluetooth
Note: The emission of	f the simultaneous energtion has been avel	isted and no non compliance was found

Note: The emission of the simultaneous operation has been evaluated and no non-compliance was found.

3. The EUT must be supplied with a power adapter as following table:

Brand	Model No.	Spec.
Blue Iron Holdings Limited	BI12T-050150-BdU	Input: 100-240Vac, 0.5A, 50/60Hz Output: 5Vdc, 1.5A DC output cable: Unshielded, 2m

4. The antennas provided to the EUT, please refer to the following table:

Transmitter Circuit	Antenna Gain with cable loss (dBi)	Frequency range (GHz)	Antenna Type	Antenna Connector
	3.5	2.4~2.4835		
Chain 0	3.8	5.15~5.35	Monopole (PCB)	NA
	4	5.5~5.85		
	2.9	2.4~2.4835		
Chain 1	3	5.15~5.35	Monopole (PCB)	NA
	4.5	5.5~5.85		

Note: Max. gain was selected for the final test.

5. 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 Description of Test Modes

40 channels are provided for BT-LE mode:

Channel	Freq. (MHz)						
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480



# 3.2.1 Test Mode Applicability and Tested Channel Detail

MODE		APPLICABL	ETO			DEGODIDITION
	RE≥1G	RE<1G	PLC	APCM		DESCRIPTION
-	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	-	
nere <b>RE</b> ≥	1G: Radiated I	Emission above 1GHz	RE	<1G: Radiated	Emission below 1G	Hz
PLC	: Power Line C	Conducted Emission	AP	CM: Antenna P	ort Conducted Mea	surement
Radiated E	mission Te	st (Above 1GHz):				
between architect	i available n ture).	nodulations, data r	ates and	antenna por	ts (if EUT with a	ossible combinations intenna diversity
		) was (were) sele				
AVAILABL	E CHANNEL	TESTED CHANNEL	MODUL	ATION TYPE	DATA RATE (Mb	ips)
		0, 19, 39		GFSK	1	
Radiated En ⊠ Pre-Sca between	n has been 1 available m	st (Below 1GHz):				ossible combinations
Radiated En Pre-Sca between architect	mission Te n has been n available m ture). g channel(s	st (Below 1GHz): conducted to dete nodulations, data r ) was (were) selec	ates and	antenna por e final test a	ts (if EUT with a s listed below.	Intenna diversity
Radiated En	mission Te n has been n available m ture). g channel(s .E CHANNEL	st (Below 1GHz): conducted to dete nodulations, data r ) was (were) selec TESTED CHANNEL	ates and cted for th	antenna por e final test a . <b>ATION TYPE</b>	ts (if EUT with a s listed below.	Intenna diversity
Radiated En ∑ Pre-Sca between architect ∑ Followin AVAILABL	mission Te n has been n available m ture). g channel(s	st (Below 1GHz): conducted to dete nodulations, data r ) was (were) selec	ates and cted for th	antenna por e final test a	ts (if EUT with a s listed below.	Intenna diversity
Radiated El         Pre-Sca         between         architect         Followin         AVAILABL         0         Power Line         Pre-Sca         between         architect         architect	mission Te n has been available m ture). g channel(s <b>E CHANNEL</b> to 39 <b>Conducted</b> n has been available m ture).	st (Below 1GHz): conducted to detendulations, data r b) was (were) select TESTED CHANNEL 19 d Emission Test:	ates and ted for th MODUL rmine the ates and	antenna por e final test a .ATION TYPE GFSK GFSK worst-case antenna por	ts (if EUT with a s listed below. DATA RATE (Mb 1 mode from all p ts (if EUT with a	ntenna diversity
Radiated El         Pre-Sca         between         architect         Followin         AVAILABL         0         Power Line         Pre-Sca         between         architect         Year         Power Line         Setween         architect         Followin	mission Te n has been available m ture). g channel(s <b>E CHANNEL</b> to 39 <b>Conducted</b> n has been available m ture).	st (Below 1GHz): conducted to detended nodulations, data r ) was (were) select TESTED CHANNEL 19 d Emission Test: conducted to detended nodulations, data r	ates and ted for th MODUL rmine the ates and ted for th	antenna por e final test a .ATION TYPE GFSK GFSK worst-case antenna por	ts (if EUT with a s listed below. DATA RATE (Mb 1 mode from all p ts (if EUT with a	ntenna diversity <b>ps)</b> ossible combinations intenna diversity



## Antenna Port Conducted Measurement:

- This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)	
0 to 39	0, 19, 39	GFSK	1	

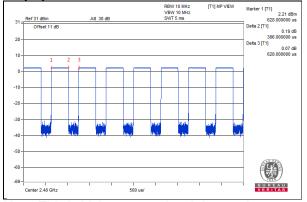
## Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE≥1G	<b>RE≥1G</b> 22deg. C, 65%RH		Frank Chuang
RE<1G	RE<1G 23deg. C, 66%RH		Frank Chuang
PLC	PLC 24deg. C, 76%RH		Andy Ho
APCM	APCM 25deg. C, 60%RH		Jyunchun Lin



# 3.3 Duty Cycle of Test Signal

## Duty cycle = 0.386 ms/0.628 ms = 0.615



Note: This is highest operational duty cycle.

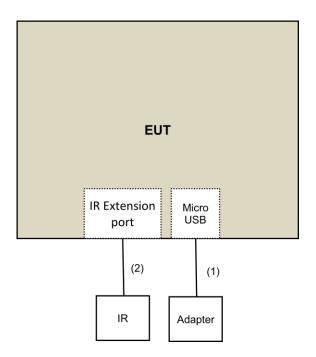


# 3.4 Description of Support Units

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.

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	DC Cable	1	2	No	0	Supplied by client
2.	IR Cable	1	2	No	0	Supplied by client

## 3.4.1 Configuration of System under Test





## 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 Part 15, Subpart C (15.247) KDB 558074 D01 15.247 Meas Guidance v05 ANSI C63.10-2013

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



## 4 Test Types and Results

## 4.1 Radiated Emission and Bandedge Measurement

#### 4.1.1 Limits of Radiated Emission and Bandedge Measurement

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB below the highest level of the desired power:

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

## Note:

- 1. The lower limit shall apply at the transition frequencies.
- 2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
- 3. For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.



## 4.1.2 Test Instruments

4.1.2 lest Instruments DESCRIPTION &			CALIBRATED	CALIBRATED
	MODEL NO.	SERIAL NO.		
MANUFACTURER			DATE	UNTIL
Test Receiver	N9038A	MY50010156	July 12, 2018	July 11, 2019
Agilent			-	-
Pre-Amplifier EMCI	EMC001340	980142	Feb. 09, 2018	Feb. 08, 2019
Loop Antenna(*)				
Electro-Metrics	EM-6879	264	Dec. 16, 2016	Dec. 15, 2018
RF Cable	NA	LOOPCAB-001	Jan. 15, 2018	Jan. 14, 2019
RF Cable	NA	LOOPCAB-002	Jan. 15, 2018	Jan. 14, 2019
Pre-Amplifier				
Mini-Circuits	ZFL-1000VH2B	AMP-ZFL-05	May 05, 2018	May 04, 2019
Trilog Broadband Antenna				
SCHWARZBECK	VULB 9168	9168-361	Nov. 29, 2017	Nov. 28, 2018
RF Cable	8D	966-3-1	Mar. 20, 2018	Mar. 19, 2019
RF Cable	8D	966-3-2	Mar. 20, 2018	Mar. 19, 2019
RF Cable	8D	966-3-3	Mar. 20, 2018	Mar. 19, 2019
Fixed attenuator			· · · ·	
Mini-Circuits	UNAT-5+	PAD-3m-3-01	Sep. 27, 2018	Sep. 26, 2019
Horn Antenna			D 40 0047	<b>D</b> 44 0040
SCHWARZBECK	BBHA9120-D	9120D-406	Dec. 12, 2017	Dec. 11, 2018
Pre-Amplifier	FM040000F	000004	1	lan 00 0010
EMCI	EMC12630SE	980384	Jan. 29, 2018	Jan. 28, 2019
RF Cable	EMC104-SM-SM-1200	160922	Jan. 29, 2018	Jan. 28, 2019
RF Cable	EMC104-SM-SM-2000	150317	Jan. 29, 2018	Jan. 28, 2019
RF Cable	EMC104-SM-SM-5000	150322	Jan. 29, 2018	Jan. 28, 2019
Spectrum Analyzer	N9030A	MY54490679	July 23, 2018	July 22, 2019
Keysight	N9030A	W154490079	July 23, 2016	July 22, 2019
Pre-Amplifier	EMC184045SE	980386	Jan. 29, 2018	Jan. 28, 2019
EMCI	EMOTOTOTOE	500500	Jan. 25, 2010	Jan. 20, 2015
Horn_Antenna	BBHA 9170	BBHA9170608	Dec. 14, 2017	Dec. 13, 2018
SCHWARZBECK				
RF Cable	EMC102-KM-KM-1200	160924	Jan. 29, 2018	Jan. 28, 2019
Software	ADT_Radiated_V8.7.08	NA	NA	NA
Antenna Tower & Turn Table	MF-7802	MF780208406	NA	NA
Max-Full				
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA
Spectrum Analyzer	FSV40	100964	June 20, 2018	June 19, 2019
R&S			,,	
Power meter	ML2495A	1014008	May 09, 2018	May 08, 2019
Anritsu		-	, ,	<b>,</b> , – –
Power sensor	MA2411B	0917122	May 09, 2018	May 08, 2019
Anritsu			• •	

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 above test instruments is 24 months and the calibrations are traceable to NML/ROC and NIST/USA.
- 3. The test was performed in 966 Chamber No. 3.
- 4. The CANADA Site Registration No. is 20331-1
- 5. Loop antenna was used for all emissions below 30 MHz.
- 6. Tested Date: Oct. 16 to 20, 2018



## 4.1.3 Test Procedures

## For Radiated emission below 30MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

#### Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

#### For Radiated emission above 30MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. 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.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

#### Note:

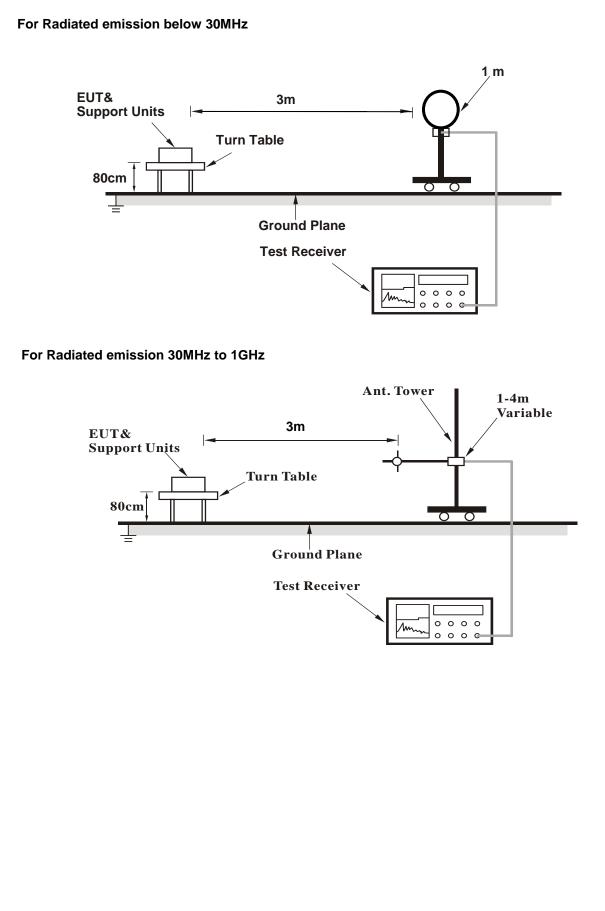
- 1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
- 2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
- 3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Average detection (AV) at frequency above 1GHz.
- 4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

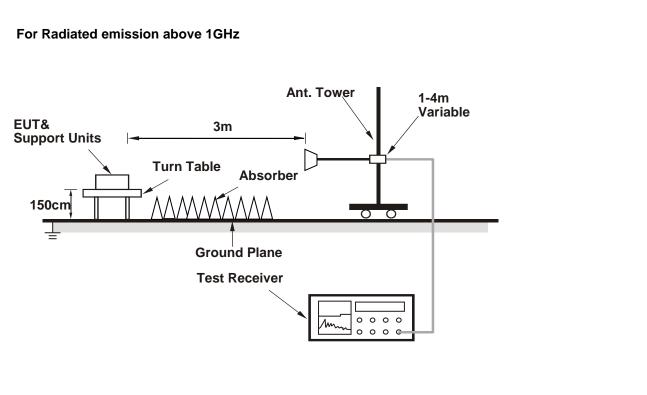
No deviation.



#### 4.1.5 Test Setup







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

## 4.1.6 EUT Operating Conditions

- a. Placed the EUT on the testing table.
- b. Controlling software (Pavarotti\_HUB\_Eng\_Tool\_1.9.exe) has been activated to set the EUT under transmission/receiving condition continuously.



## 4.1.7 Test Results

#### Above 1GHz Data:

CHANNEL	TX Channel 0	DETECTOR	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz	FUNCTION	Average (AV)

	ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)	
1	2390.00	54.2 PK	74.0	-19.8	1.22 H	171	56.9	-2.7	
2	2390.00	42.3 AV	54.0	-11.7	1.22 H	171	45.0	-2.7	
3	*2402.00	98.9 PK			1.22 H	171	101.6	-2.7	
4	*2402.00	95.8 AV			1.22 H	171	98.5	-2.7	
5	4804.00	38.5 PK	74.0	-35.5	1.53 H	213	36.9	1.6	
6	4804.00	27.6 AV	54.0	-26.4	1.53 H	213	26.0	1.6	
		ANTENNA		/ & TEST DI	STANCE: V	ERTICAL A	Т 3 М		
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)	
1	2390.00	53.6 PK	74.0	-20.4	3.81 V	354	56.3	-2.7	
2	2390.00	41.1 AV	54.0	-12.9	3.81 V	354	43.8	-2.7	
3	*2402.00	96.2 PK			3.81 V	354	98.9	-2.7	
4	*2402.00	93.4 AV			3.81 V	354	96.1	-2.7	
5	4804.00	37.9 PK	74.0	-36.1	1.61 V	184	36.3	1.6	
6	4804.00	26.9 AV	54.0	-27.1	1.61 V	184	25.3	1.6	

#### **REMARKS**:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)

2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)

3. The other emission levels were very low against the limit.

4. Margin value = Emission Level - Limit value

5. " \* ": Fundamental frequency.

CHANNEL	TX Channel 19	DETECTOR	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz	FUNCTION	Average (AV)

	ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)	
1	*2440.00	99.1 PK			1.21 H	169	102.1	-3.0	
2	*2440.00	96.2 AV			1.21 H	169	99.2	-3.0	
3	4880.00	38.1 PK	74.0	-35.9	1.50 H	206	36.4	1.7	
4	4880.00	27.4 AV	54.0	-26.6	1.50 H	206	25.7	1.7	
5	7320.00	43.6 PK	74.0	-30.4	1.53 H	215	35.8	7.8	
6	7320.00	32.8 AV	54.0	-21.2	1.53 H	215	25.0	7.8	
		ANTENNA	POLARITY	/ & TEST DI	STANCE: V	ERTICAL A	Т 3 М		
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)	
1	*2440.00	96.7 PK			3.85 V	340	99.7	-3.0	
2	*2440.00	93.6 AV			3.85 V	340	96.6	-3.0	

6	7320.00			
REMARKS:				

4880.00

4880.00

7320.00

3

4

5

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)

-36.5

-27.4

-29.9

-20.8

2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)

1.63 V

1.63 V

1.53 V

1.53 V

198

198

103

103

35.8

24.9

36.3

25.4

1.7

1.7

7.8

7.8

3. The other emission levels were very low against the limit.

74.0

54.0

74.0

54.0

4. Margin value = Emission Level – Limit value

5. " \* ": Fundamental frequency.

37.5 PK

26.6 AV

44.1 PK

33.2 AV

CHANNEL	TX Channel 39	DETECTOR	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz	FUNCTION	Average (AV)

	ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)	
1	*2480.00	98.7 PK			1.22 H	156	101.7	-3.0	
2	*2480.00	95.5 AV			1.22 H	156	98.5	-3.0	
3	2483.50	54.1 PK	74.0	-19.9	1.22 H	156	57.1	-3.0	
4	2483.50	42.4 AV	54.0	-11.6	1.22 H	156	45.4	-3.0	
5	4960.00	37.9 PK	74.0	-36.1	1.55 H	216	36.0	1.9	
6	4960.00	27.1 AV	54.0	-26.9	1.55 H	216	25.2	1.9	
7	7440.00	43.7 PK	74.0	-30.3	1.52 H	223	35.8	7.9	
8	7440.00	32.9 AV	54.0	-21.1	1.52 H	223	25.0	7.9	
		ANTENNA	<b>POLARITY</b>	& TEST DI	STANCE: V	ERTICAL A	Т 3 М		
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)	
1	*2480.00	95.9 PK			3.83 V	340	98.9	-3.0	
2	*2480.00	93.1 AV			3.83 V	340	96.1	-3.0	
3	2483.50	53.8 PK	74.0	-20.2	3.83 V	340	56.8	-3.0	
4	2483.50	41.2 AV	54.0	-12.8	3.83 V	340	44.2	-3.0	
5	4960.00	37.3 PK	74.0	-36.7	1.59 V	208	35.4	1.9	
6	4960.00	26.4 AV	54.0	-27.6	1.59 V	208	24.5	1.9	
7	7440.00	43.4 PK	74.0	-30.6	1.50 V	113	35.5	7.9	
8	7440.00	32.7 AV	54.0	-21.3	1.50 V	113	24.8	7.9	

## **REMARKS:**

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)

Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
 The other emission levels were very low against the limit.

4. Margin value = Emission Level – Limit value

5. " \* ": Fundamental frequency.

Report No.: RF180928E04-3



Below 1GHz Data:

CHANNEL	TX Channel 19	DETECTOR	
FREQUENCY RANGE	9kHz ~ 1GHz	FUNCTION	Quasi-Peak (QP)

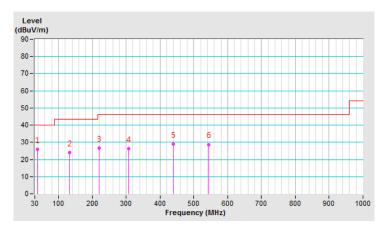
	ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M									
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)		
1	37.78	26.0 QP	40.0	-14.0	1.00 H	38	34.5	-8.5		
2	132.00	24.1 QP	43.5	-19.4	1.50 H	264	32.9	-8.8		
3	220.00	26.5 QP	46.0	-19.5	1.50 H	68	37.3	-10.8		
4	308.00	26.2 QP	46.0	-19.8	1.00 H	233	32.8	-6.6		
5	439.99	28.9 QP	46.0	-17.1	1.00 H	315	32.0	-3.1		
6	544.92	28.8 QP	46.0	-17.2	1.50 H	262	30.2	-1.4		

#### **REMARKS:**

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)

2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)

- 3. Margin value = Emission Level Limit value
- 4. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.



CHANNEL	TX Channel 19	DETECTOR	
FREQUENCY RANGE	9kHz ~ 1GHz	FUNCTION	Quasi-Peak (QP)

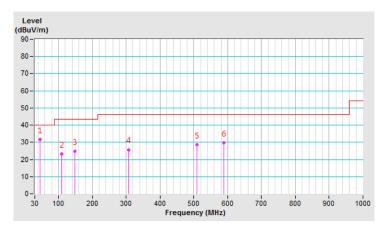
	ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M									
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)		
1	45.13	31.5 QP	40.0	-8.5	1.00 V	186	39.6	-8.1		
2	109.08	23.3 QP	43.5	-20.2	1.00 V	280	34.0	-10.7		
3	148.29	24.8 QP	43.5	-18.7	1.50 V	327	32.4	-7.6		
4	308.00	25.7 QP	46.0	-20.3	1.00 V	0	32.3	-6.6		
5	508.57	28.6 QP	46.0	-17.4	1.00 V	2	30.4	-1.8		
6	588.62	29.7 QP	46.0	-16.3	2.00 V	119	29.7	0.0		

#### **REMARKS:**

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)

2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)

- 3. Margin value = Emission Level Limit value
- 4. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.





## 4.2 Conducted Emission Measurement

#### 4.2.1 Limits of Conducted Emission Measurement

	Conducted I	Limit (dBuV)
Frequency (MHz)	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

Note: 1. The lower limit shall apply at the transition frequencies.

2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

# 4.2.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver R&S	ESCS 30	847124/029	Nov. 01, 2017	Oct. 31, 2018
Line-Impedance Stabilization Network (for EUT) R&S	ESH3-Z5	848773/004	Nov. 15, 2017	Nov. 14, 2018
Line-Impedance Stabilization Network (for Peripheral) R&S	ENV216	100072	June 04, 2018	June 03, 2019
50 ohms Terminator	N/A	EMC-04	Nov. 01, 2017	Oct. 31, 2018
RF Cable	5D-FB	COCCAB-001	Sep. 28, 2018	Sep. 27, 2019
Fixed attenuator EMCI	STI02-2200-10	003	Mar. 16, 2018	Mar. 15, 2019
Software BVADT	BVADT_Cond_ V7.3.7.4	NA	NA	NA

#### Note:

- 1. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
- 2. The test was performed in Conduction 1.
- 3 Tested Date: Oct. 18, 2018

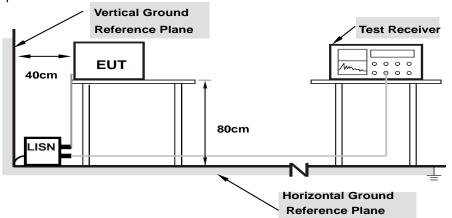


#### 4.2.3 Test Procedures

- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit 20dB) was not recorded.
- **NOTE:** The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.
- 4.2.4 Deviation from Test Standard

No deviation.

4.2.5 Test Setup



Note: 1.Support units were connected to second LISN.

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

#### 4.2.6 EUT Operating Conditions

Same as 4.1.6.



## 4.2.7 Test Results

Phase Line (L)					D	etector Fu	nction	Quasi- Averag	Peak (QP) e (AV)	/
	<b>From</b>	Corr.	Readin	g Value	Emiss	on Level	Lir	nit	Mar	gin
No	Freq.	Factor	[dB	(uV)]	[dB	(uV)]	[dB (	uV)]	(dl	3)
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.56406	10.09	38.67	31.04	48.76	41.13	56.00	46.00	-7.24	-4.87
2	0.93125	10.12	22.88	8.47	33.00	18.59	56.00	46.00	-23.00	-27.41
3	1.74609	10.17	19.64	15.42	29.81	25.59	56.00	46.00	-26.19	-20.41
4	3.26563	10.27	18.56	13.15	28.83	23.42	56.00	46.00	-27.17	-22.58
5	8.73828	10.62	25.05	14.75	35.67	25.37	60.00	50.00	-24.33	-24.63
6	18.28125	11.25	26.16	16.13	37.41	27.38	60.00	50.00	-22.59	-22.62

## **REMARKS:**

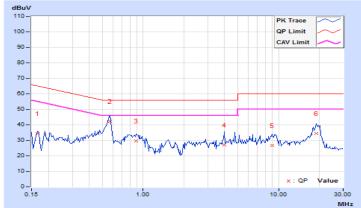
- 1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
- 2. The emission levels of other frequencies were very low against the limit.
- 3. Margin value = Emission level Limit value
- 4. Correction factor = Insertion loss + Cable loss
- 5. Emission Level = Correction Factor + Reading Value.



										1
Phase			eutral (N)		1	Detector Fu	nction	Averag	Peak (QP) e (AV)	/
	Frag	Corr.	Readin	g Value	Emiss	sion Level	Lir	nit	Mar	gin
No	Freq.	Factor	[dB	(uV)]	[dl	B (uV)]	[dB (	[uV)]	(dl	3)
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16562	9.94	24.47	15.01	34.41	24.95	65.18	55.18	-30.77	-30.23
2	0.56797	9.99	32.29	28.57	42.28	38.56	56.00	46.00	-13.72	-7.44
3	0.88438	10.00	19.54	12.93	29.54	22.93	56.00	46.00	-26.46	-23.07
4	3.97656	10.17	16.73	4.29	26.90	14.46	56.00	46.00	-29.10	-31.54
5	8.97656	10.47	16.35	1.82	26.82	12.29	60.00	50.00	-33.18	-37.71
6	18.92578	11.07	23.26	7.73	34.33	18.80	60.00	50.00	-25.67	-31.20

#### **REMARKS**:

- 1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
- 2. The emission levels of other frequencies were very low against the limit.
- 3. Margin value = Emission level Limit value
- 4. Correction factor = Insertion loss + Cable loss
- 5. Emission Level = Correction Factor + Reading Value.





## 4.3 6dB Bandwidth Measurement

4.3.1 Limits of 6dB Bandwidth Measurement

The minimum of 6dB Bandwidth Measurement is 0.5 MHz.

## 4.3.2 Test Setup



#### 4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

#### 4.3.4 Test Procedure

- a. Set resolution bandwidth (RBW) = 100kHz
- b. Set the video bandwidth (VBW)  $\ge$  3 x RBW, Detector = Peak.
- c. Trace mode = max hold.
- d. Sweep = auto couple.
- e. Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission
- 4.3.5 Deviation from Test Standard

No deviation.

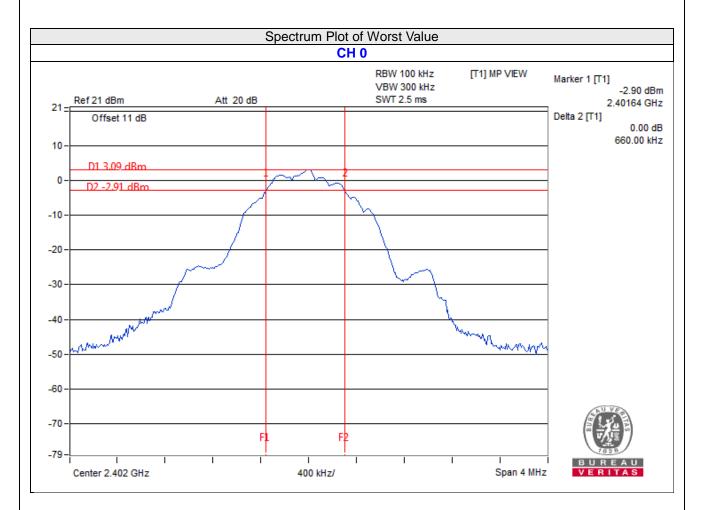
#### 4.3.6 EUT Operating Conditions

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.



## 4.3.7 Test Result

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
0	2402	0.66	0.5	Pass
19	2440	0.66	0.5	Pass
39	2480	0.66	0.5	Pass





## 4.4 Conducted Output Power Measurement

#### 4.4.1 Limits of Conducted Output Power Measurement

For systems using digital modulation in the 2400–2483.5 MHz bands: 1 Watt (30dBm)

#### 4.4.2 Test Setup



#### 4.4.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

#### 4.4.4 Test Procedures

A peak power sensor was used on the output port of the EUT. A power meter was used to read the response of the peak power sensor. Record the power level.

Average power sensor was used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of TX on burst. Duty factor is not added to measured value.

#### 4.4.5 Deviation from Test Standard

No deviation.

4.4.6 EUT Operating Conditions

Same as Item 4.3.6.



## 4.4.7 Test Results

## FOR PEAK POWER

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass/Fail
0	2402	2.438	3.87	30	Pass
19	2440	2.518	4.01	30	Pass
39	2480	2.104	3.23	30	Pass

## FOR AVERAGE POWER

Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)
0	2402	2.109	3.24
19	2440	2.178	3.38
39	2480	1.687	2.27



## 4.5 **Power Spectral Density Measurement**

4.5.1 Limits of Power Spectral Density Measurement

The Maximum of Power Spectral Density Measurement is 8dBm in any 3kHz.

## 4.5.2 Test Setup



#### 4.5.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

#### 4.5.4 Test Procedure

- a. Set analyzer center frequency to DTS channel center frequency.
- b. Set the span to 1.5 times the DTS bandwidth.
- c. Set the RBW to:  $3 \text{ kHz} \le \text{RBW} \le 100 \text{ kHz}$ .
- d. Set the VBW  $\geq$  3 × RBW.
- e. Detector = peak.
- f. Sweep time = auto couple.
- g. Trace mode = max hold.
- h. Allow trace to fully stabilize.
- i. Use the peak marker function to determine the maximum amplitude level within the RBW.

4.5.5 Deviation from Test Standard

No deviation.

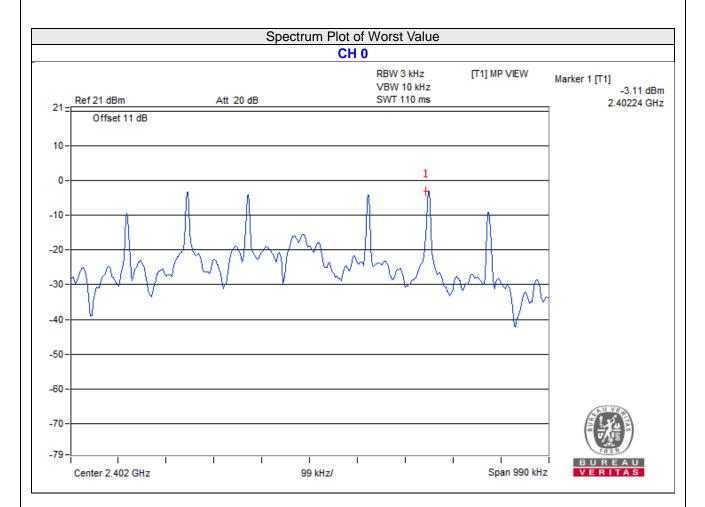
4.5.6 EUT Operating Condition

Same as Item 4.3.6.



## 4.5.7 Test Results

Channel	Freq. (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Pass /Fail
0	2402	-3.11	8	Pass
19	2440	-3.39	8	Pass
39	2480	-4.61	8	Pass



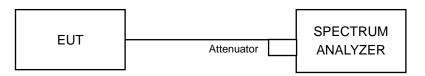


## 4.6 Conducted Out of Band Emission Measurement

4.6.1 Limits of Conducted Out of Band Emission Measurement

Below 20dB of the highest emission level of operating band (in 100kHz Resolution Bandwidth).

#### 4.6.2 Test Setup



#### 4.6.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

#### 4.6.4 Test Procedure

## MEASUREMENT PROCEDURE REF

- 1. Set the RBW = 100 kHz.
- 2. Set the VBW  $\geq$  300 kHz.
- 3. Detector = peak.
- 4. Sweep time = auto couple.
- 5. Trace mode = max hold.
- 6. Allow trace to fully stabilize.
- 7. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

## MEASUREMENT PROCEDURE OOBE

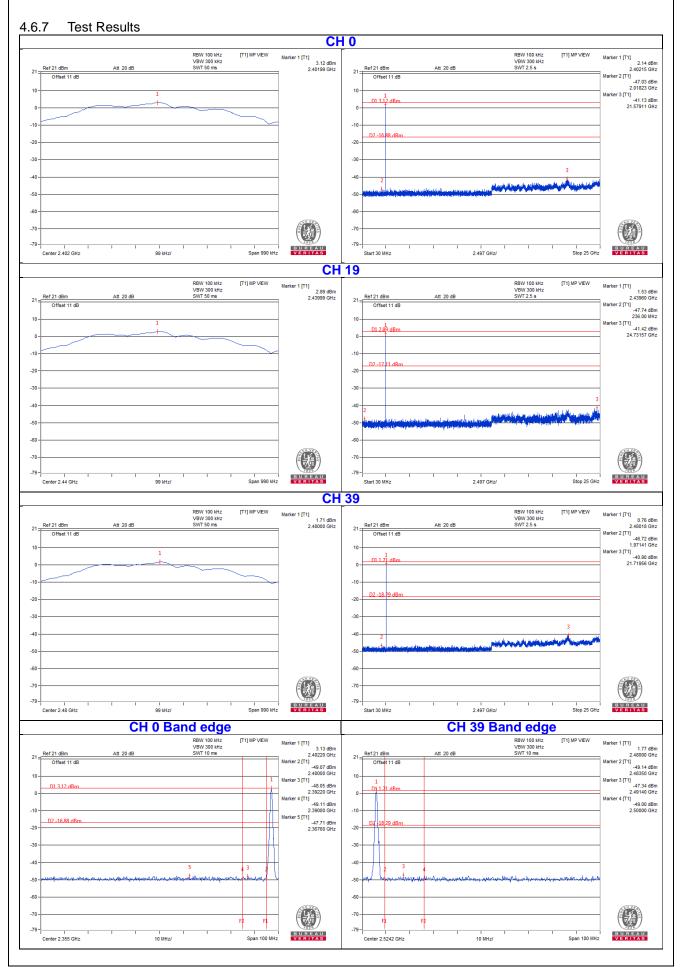
- 1. Set RBW = 100 kHz.
- 2. Set VBW ≥ 300 kHz.
- 3. Detector = peak.
- 4. Sweep = auto couple.
- 5. Trace Mode = max hold.
- 6. Allow trace to fully stabilize.
- 7. Use the peak marker function to determine the maximum amplitude level.
- 4.6.5 Deviation from Test Standard

No deviation.

4.6.6 EUT Operating Condition

Same as Item 4.3.6.







# 5 Pictures of Test Arrangements

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



## 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 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:

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 Lab Tel: 886-3-3183232 Fax: 886-3-3270892

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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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