FCC Test Report (BT-LE)

Report No.:	RF170513E01E-3
FCC ID:	R68XPICO200
Test Model:	xPico 270
Series Model:	xPico 250, xPico 240
Received Date:	Apr. 15, 2019
Test Date:	June 03, 2019
Issued Date:	June 14, 2019
Applicant:	Lantronix, Inc.
Address:	7535 Irvine Center Drive, Suite 100 Irvine, California 92618
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory
Lab Address:	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan R.O.C.
Test Location :	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan R.O.C.
FCC Registration / Designation Number:	723255 / TW2022

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Release Control Record

Issue No.	Description	Date Issued
RF170513E01E-3	Original release.	June 14, 2019

1 Certificate of Conformity

Product:	xPico® 200 Series Wi-Fi® IoT Gateway module
Brand:	Lantronix
Test Model:	xPico 270
Series Model:	xPico 250, xPico 240
Sample Status:	ENGINEERING SAMPLE
Applicant:	Lantronix, Inc.
Test Date:	June 03, 2019
Standards:	47 CFR FCC Part 15, Subpart C (Section 15.247) 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 : _____ , **Date:** June 14, 2019

Wendy Wu / Specialist

Approved by : _____ , **Date:** June 14, 2019

May Chen / Manager

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (SECTION 15.247)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -6.97dB at 038438MHz.
15.205 & 209 & 15.247(d)	Radiated Emissions & Band Edge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -0.2dB at 2390.00MHz.
15.247(b)	Conducted power	PASS	Meet the requirement of limit.

Note:
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) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	1.8 dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	5.1 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	5.1 dB
	6GHz ~ 18GHz	5.0 dB
	18GHz ~ 40GHz	5.2 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	xPico® 200 Series Wi-Fi® IoT Gateway module
Brand	Lantronix
Test Model	xPico 270
Series Model	xPico 250, xPico 240
Status of EUT	ENGINEERING SAMPLE
Power Supply Rating	3.3Vdc from host equipment
Modulation Type	GFSK
Modulation Technology	DTS
Transfer Rate	Up to 1Mbps
Operating Frequency	2402MHz ~ 2480MHz
Number of Channel	40
Output Power	3.436mW
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	NA
Data Cable Supplied	NA

Note:

1. This report is prepared for FCC Class II permissive change. The difference compared with the Report No.: RF170513E01-3 design is as the following information:
   - ◆ Add new model.

Original				
Product	Brand	Model	Difference	Antenna
xPico® 200 Series Wi-Fi® IoT Gateway module	Lantronix	xPico 250	SKU A: SIP with two UFL connectors Wi-Fi Chip and Bluetooth chip	Dipole Antenna (long) Dipole Anteena (short) PCB Antenna
		xPico 240	SKU B: same as SKU A, no BT function.	Dipole Antenna (long) Dipole Anteena (short) PCB Antenna
			SKU C: same SKU B except the two UFLs are replaced by a single on-module stamped metal antenna. Circuit board is the same. BOM population option for UFL or on-module antenna circuit is the difference.	On-board Antenna
Newly				
Product	Brand	Model	Difference	Antenna
xPico® 200 Series Wi-Fi® IoT Gateway module	Lantronix	xPico 270	SIP with two UFL connectors Wi-Fi Chip and Bluetooth chip uses a TCXO in place of the crystal that runs the Wi-Fi radio and add ac mode	Dipole Antenna (long) Dipole Anteena (short) PCB Antenna

From the above models, model: **xPico 270** was selected as representative model for the test and its data was recorded in this report.

2. According to above conditions, only Conducted power, Conducted Emission and Radiated Emissions need to be performed. And all data were verified to meet the requirements.
3. There are WLAN, BT technology used for the EUT.
4. Simultaneously transmission condition.

Condition	Technology	
1	WLAN (2.4GHz)	Bluetooth
2	WLAN (5GHz)	Bluetooth

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

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

Ant Set.	Brand	Model	Antenna Gain (dBi)	Frequency rang (GHz)	Antenna type	Connector type	*Cable Length	*Cable Loss(dB)	excluding cable loss Antenna Gain(dBi)
1	Taoglas	GW.71.5153	2.8	2.4~2.4835	Dipole	R-SMA	45mm	1	3.8
			3.8	5.15~5.85				1.7	5.5
	Taoglas	GW.71.5153	2.8	2.4~2.4835			45mm	1	3.8
			3.8	5.15~5.85				1.7	5.5
2	NA	WSS002	1	2.4~2.4835	Dipole	R-SMA	45mm	1	2
			0.3	5.15~5.85				1.7	2
	NA	WSS002	1	2.4~2.5			45mm	1	2
			0.3	5.15~5.25				1.7	2
3	ethertronics	1000668	2.5	2.4~2.4835	PCB	i-pex(MHF)	50mm	NA	NA
			5	5.15~5.85					
	ethertronics	1000668	2.5	2.4~2.4835					
			5	5.15~5.85					
4	ProAnt	PRO-OB-536	0.02	2.4~2.4835	Metal	NA	NA	NA	NA
			3.31	5.15~5.85					

Note:
1. Ant Set 4 only for model: xPico 240.
2. From the above antennas, Ant Set 1, 3 were selected as representative antenna for the test.

6. 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 to this EUT:

CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)	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

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE≥1G	RE<1G	PLC	APCM	
1	√	√	√	√	With Antenna Set 1 (Dipole)
2	√	√	-	-	With Antenna Set 3 (PCB)

Where **RE≥1G:** Radiated Emission above 1GHz **RE<1G:** Radiated Emission below 1GHz
PLC: Power Line Conducted Emission **APCM:** Antenna Port Conducted Measurement

NOTE:
1. In original report, the EUT's antenna (PCB) had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **X-plane**.

Radiated Emission Test (Above 1GHz):

☒ 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

Radiated Emission Test (Below 1GHz):

☒ 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	19	GFSK	1

Power Line Conducted Emission Test:

☒ 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	19	GFSK	1

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.

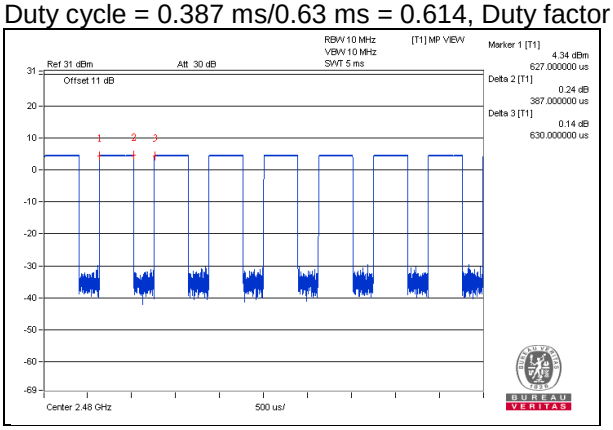
AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
0 to 39	0, 19, 39	GFSK	1

Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER (SYSTEM)	TESTED BY
RE≥1G	25deg. C, 65%RH	120Vac, 60Hz	Robert Cheng
RE<1G	25deg. C, 65%RH	120Vac, 60Hz	Robert Cheng
PLC	24deg. C, 75%RH	120Vac, 60Hz	Andy Ho
APCM	25deg. C, 60%RH	120Vac, 60Hz	Robert Cheng

3.3 Duty Cycle of Test Signal

Duty cycle of test signal is < 98 %, duty factor shall be considered.
Duty cycle = 0.387 ms/0.63 ms = 0.614, Duty factor = 10 * log(1/0.614) = 2.12



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.

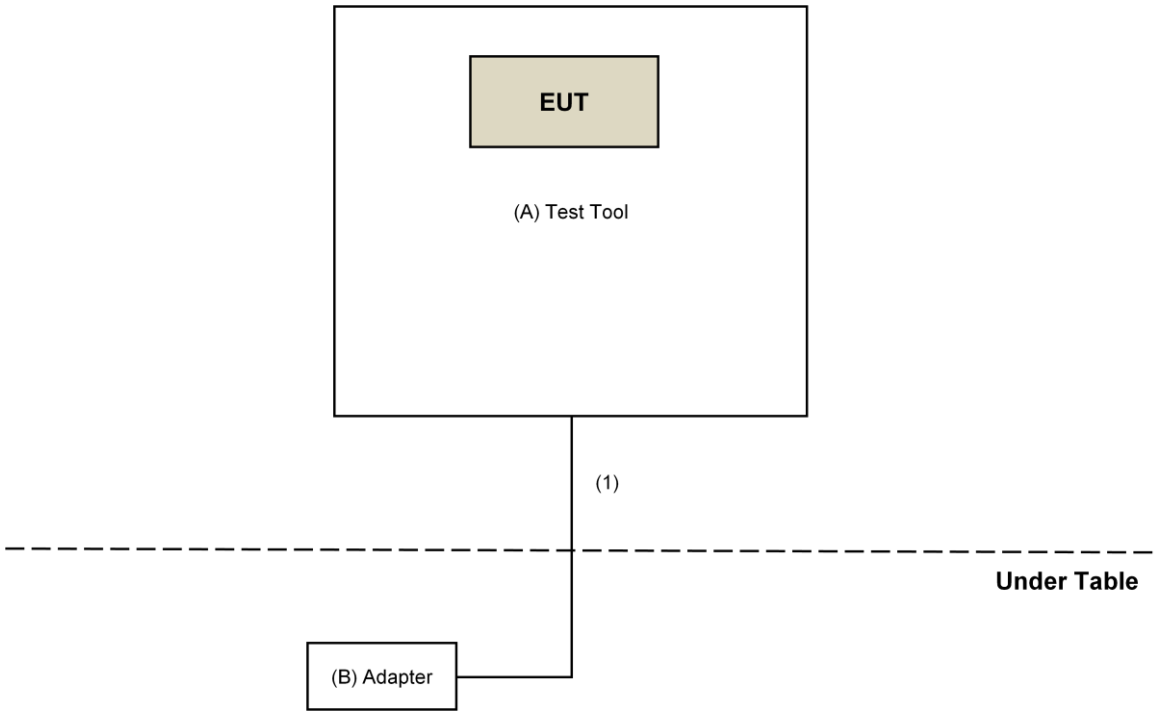
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Test Tool	Lantronix	NA	NA	NA	Supplied by client
B.	Adapter	TOP	W050010GPX1 L1	NA	NA	Supplied by client

Note:

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

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	DC Cable	1	1.8	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 v05r02
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

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver Agilent	N9038A	MY50010156	July 12, 2018	July 11, 2019
Pre-Amplifier EMCI	EMC001340	980142	Jan. 25, 2019	Jan. 24, 2020
Loop Antenna Electro-Metrics	EM-6879	269	Sep. 07, 2018	Sep. 06, 2019
RF Cable	NA	LOOPCAB-001	Jan. 14, 2019	Jan. 13, 2020
RF Cable	NA	LOOPCAB-002	Jan. 14, 2019	Jan. 13, 2020
Pre-Amplifier Mini-Circuits	ZFL-1000VH2B	AMP-ZFL-05	Apr. 30, 2019	Apr. 29, 2020
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-361	Nov. 22, 2018	Nov. 21, 2019
RF Cable	8D	966-3-1	Mar. 18, 2019	Mar. 17, 2020
RF Cable	8D	966-3-2	Mar. 18, 2019	Mar. 17, 2020
RF Cable	8D	966-3-3	Mar. 18, 2019	Mar. 17, 2020
Fixed attenuator Mini-Circuits	UNAT-5+	PAD-3m-3-01	Sep. 27, 2018	Sep. 26, 2019
Horn_Antenna SCHWARZBECK	BBHA9120-D	9120D-406	Nov. 25, 2018	Nov. 24, 2019
Pre-Amplifier EMCI	EMC12630SE	980384	Jan. 28, 2019	Jan. 27, 2020
RF Cable	EMC104-SM-SM-1200	160922	Jan. 28, 2019	Jan. 27, 2020
RF Cable	EMC104-SM-SM-2000	180601	June 12, 2018	June 11, 2019
RF Cable	EMC104-SM-SM-6000	180602	June 12, 2018	June 11, 2019
Spectrum Analyzer Keysight	N9030A	MY54490679	July 23, 2018	July 22, 2019
Pre-Amplifier EMCI	EMC184045SE	980387	Jan. 28, 2019	Jan. 27, 2020
Horn_Antenna SCHWARZBECK	BBHA 9170	BBHA9170519	Nov. 25, 2018	Nov. 24, 2019
RF Cable	EMC102-KM-KM-1200	160924	Jan. 28, 2019	Jan. 27, 2020
RF Cable	EMC102-KM-KM-1200	160925	Jan. 28, 2019	Jan. 27, 2020
Software	ADT_Radiated_V8.7.08	NA	NA	NA
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208406	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA
Spectrum Analyzer R&S	FSV40	100964	June 20, 2018	June 19, 2019
Power meter Anritsu	ML2495A	1014008	May 13, 2019	May 12, 2020
Power sensor Anritsu	MA2411B	0917122	May 13, 2019	May 12, 2020

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 966 Chamber No. 3.
3. Loop antenna was used for all emissions below 30 MHz.
4. Tested Date: June 03, 2019

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:

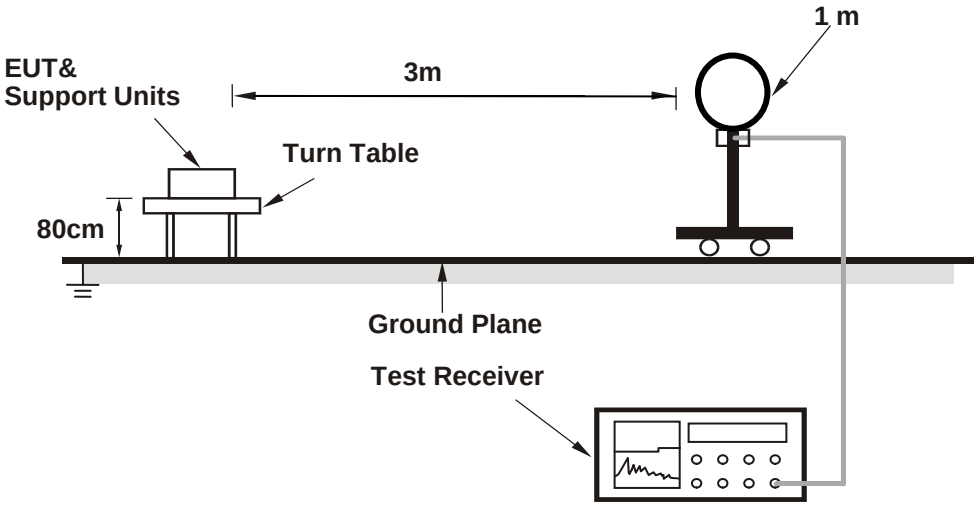
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is ≥ 1/T (Duty cycle < 98%) or 10Hz (Duty cycle ≥ 98%) 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

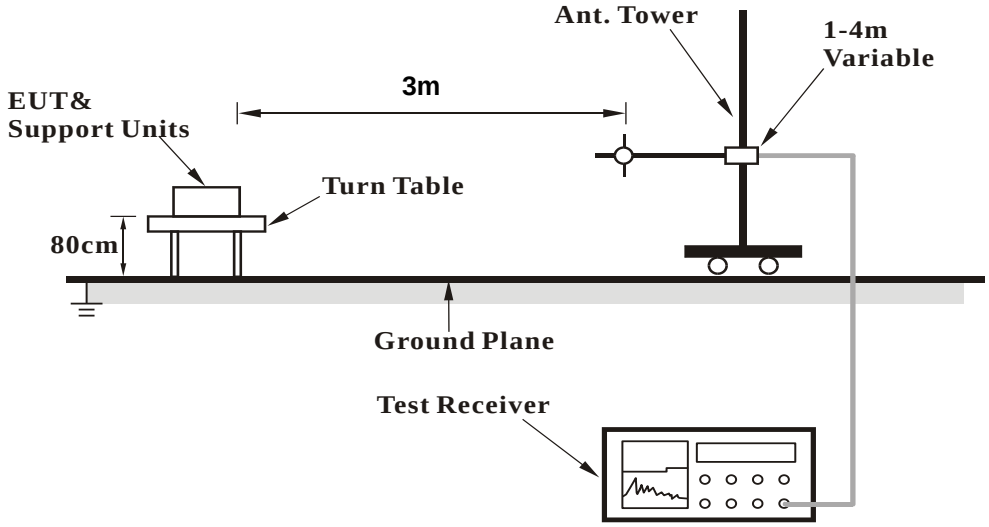
No deviation.

4.1.5 Test Setup

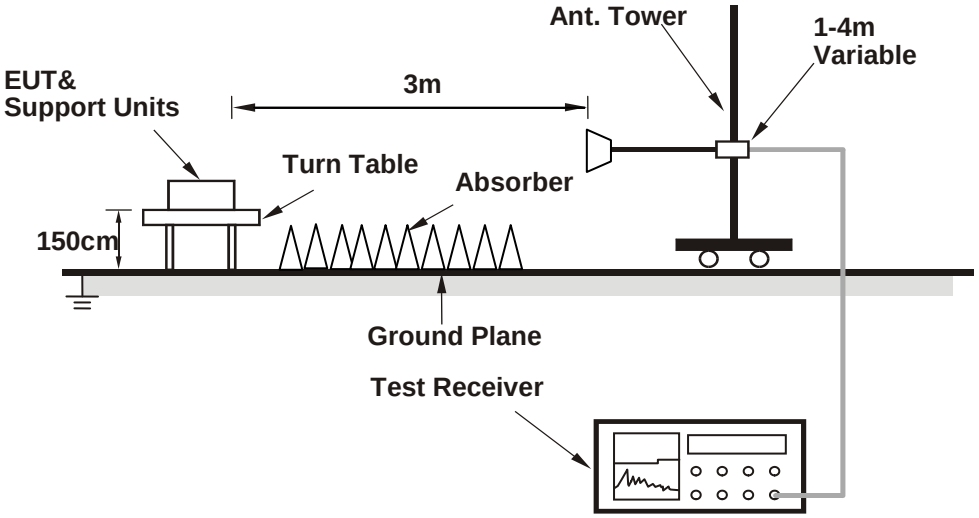
For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



For Radiated emission above 1GHz



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. Contorlling software (Tera team paste xPico 250_BT+WiFi SOP.doc command.) has been activated to set the EUT on specific status.

4.1.7 Test Results (Mode 1)

Above 1GHz Data:

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

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	65.1 PK	74.0	-8.9	1.00 H	337	67.1	-2.0
2	2390.00	51.9 AV	54.0	-2.1	1.00 H	337	53.9	-2.0
3	*2402.00	97.4 PK			1.00 H	337	99.4	-2.0
4	*2402.00	96.7 AV			1.00 H	337	98.7	-2.0
5	4804.00	38.3 PK	74.0	-35.7	1.52 H	191	36.0	2.3
6	4804.00	26.3 AV	54.0	-27.7	1.52 H	191	24.0	2.3
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	2390.00	67.8 PK	74.0	-6.2	1.01 V	266	69.8	-2.0
2	**2390.00**	**53.8 AV**	**54.0**	**-0.2**	**1.01 V**	**266**	**55.8**	**-2.0**
3	*2402.00	102.6 PK			1.01 V	266	104.6	-2.0
4	*2402.00	101.5 AV			1.01 V	266	103.5	-2.0
5	4804.00	38.6 PK	74.0	-35.4	3.61 V	173	36.3	2.3
6	4804.00	27.3 AV	54.0	-26.7	3.61 V	173	25.0	2.3

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 other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

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

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	97.5 PK			1.03 H	352	99.6	-2.1
2	*2440.00	96.3 AV			1.03 H	352	98.4	-2.1
3	4880.00	37.9 PK	74.0	-36.1	1.42 H	194	35.6	2.3
4	4880.00	26.6 AV	54.0	-27.4	1.42 H	194	24.3	2.3
5	7320.00	44.2 PK	74.0	-29.8	1.47 H	262	36.0	8.2
6	7320.00	34.9 AV	54.0	-19.1	1.47 H	262	26.7	8.2
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	*2440.00	103.3 PK			1.05 V	291	105.4	-2.1
2	*2440.00	101.6 AV			1.05 V	291	103.7	-2.1
3	4880.00	37.6 PK	74.0	-36.4	3.62 V	206	35.3	2.3
4	4880.00	26.3 AV	54.0	-27.7	3.62 V	206	24.0	2.3
5	7320.00	50.3 PK	74.0	-23.7	3.50 V	183	42.1	8.2
6	7320.00	41.6 AV	54.0	-12.4	3.50 V	183	33.4	8.2

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 other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

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

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	97.2 PK			1.07 H	347	99.4	-2.2
2	*2480.00	96.2 AV			1.07 H	347	98.4	-2.2
3	2483.50	46.9 PK	74.0	-27.1	1.07 H	347	49.1	-2.2
4	2483.50	35.1 AV	54.0	-18.9	1.07 H	347	37.3	-2.2
5	4960.00	37.6 PK	74.0	-36.4	1.48 H	186	35.1	2.5
6	4960.00	26.6 AV	54.0	-27.4	1.48 H	186	24.1	2.5
7	7440.00	44.7 PK	74.0	-29.3	1.50 H	257	36.3	8.4
8	7440.00	35.4 AV	54.0	-18.6	1.50 H	257	27.0	8.4
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	*2480.00	102.6 PK			1.09 V	296	104.8	-2.2
2	*2480.00	101.9 AV			1.09 V	296	104.1	-2.2
3	2483.50	47.8 PK	74.0	-26.2	1.09 V	296	50.0	-2.2
4	2483.50	36.9 AV	54.0	-17.1	1.09 V	296	39.1	-2.2
5	4960.00	37.7 PK	74.0	-36.3	3.80 V	168	35.2	2.5
6	4960.00	26.3 AV	54.0	-27.7	3.80 V	168	23.8	2.5
7	7440.00	50.0 PK	74.0	-24.0	3.58 V	200	41.6	8.4
8	7440.00	40.8 AV	54.0	-13.2	3.58 V	200	32.4	8.4

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 other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

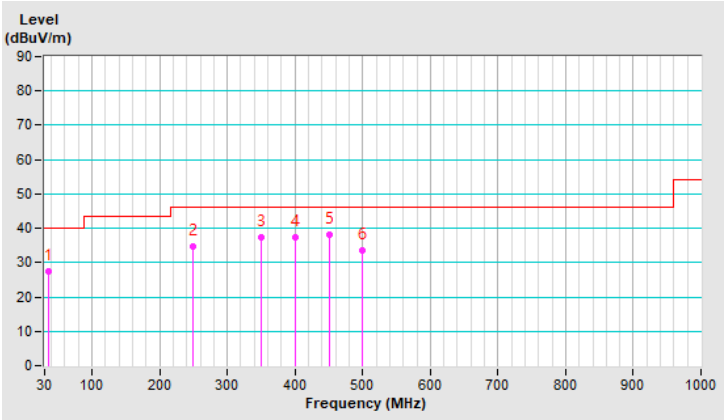
Below 1GHz Data:

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

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	35.78	27.4 QP	40.0	-12.6	1.54 H	209	41.9	-14.5
2	249.81	34.6 QP	46.0	-11.4	1.43 H	267	48.0	-13.4
3	350.44	37.3 QP	46.0	-8.7	1.67 H	257	47.6	-10.3
4	400.44	37.5 QP	46.0	-8.5	1.75 H	295	46.8	-9.3
5	450.45	38.1 QP	46.0	-7.9	1.41 H	84	46.2	-8.1
6	499.58	33.4 QP	46.0	-12.6	1.44 H	296	39.9	-6.5

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 other emission levels were very low against the limit of frequency range 30MHz~1000MHz.
5. 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.

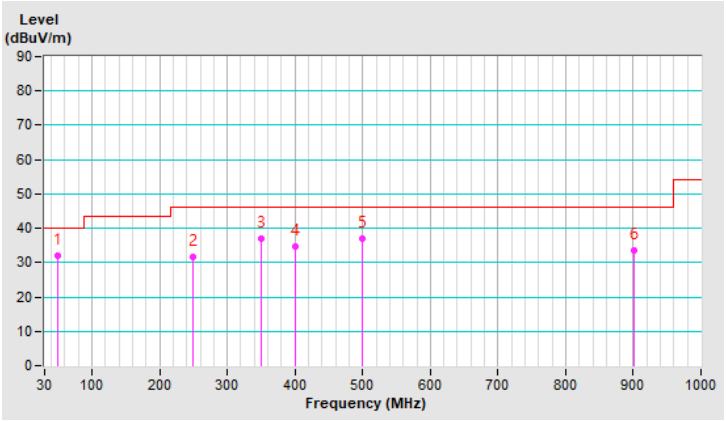


CHANNEL	TX Channel 19	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

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	49.70	32.0 QP	40.0	-8.0	1.59 V	180	45.6	-13.6
2	250.09	31.5 QP	46.0	-14.5	1.44 V	208	44.9	-13.4
3	349.74	37.1 QP	46.0	-8.9	1.35 V	209	47.6	-10.5
4	400.28	34.8 QP	46.0	-11.2	1.11 V	128	44.1	-9.3
5	500.02	36.9 QP	46.0	-9.1	1.42 V	209	43.4	-6.5
6	901.45	33.7 QP	46.0	-12.3	1.51 V	176	33.1	0.6

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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30MHz~1000MHz.
5. 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.



4.1.8 Test Results (Mode 2)

Above 1GHz Data:

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

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	67.2 PK	74.0	-6.8	1.06 H	318	69.2	-2.0
2	2390.00	53.6 AV	54.0	-0.4	1.06 H	318	55.6	-2.0
3	*2402.00	103.7 PK			1.06 H	318	105.7	-2.0
4	*2402.00	102.6 AV			1.06 H	318	104.6	-2.0
5	4804.00	38.9 PK	74.0	-35.1	1.50 H	208	36.6	2.3
6	4804.00	27.0 AV	54.0	-27.0	1.50 H	208	24.7	2.3
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	2390.00	64.6 PK	74.0	-9.4	1.03 V	286	66.6	-2.0
2	2390.00	51.4 AV	54.0	-2.6	1.03 V	286	53.4	-2.0
3	*2402.00	96.4 PK			1.03 V	286	98.4	-2.0
4	*2402.00	95.4 AV			1.03 V	286	97.4	-2.0
5	4804.00	37.1 PK	74.0	-36.9	3.71 V	190	34.8	2.3
6	4804.00	26.1 AV	54.0	-27.9	3.71 V	190	23.8	2.3

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 other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

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

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	104.4 PK			1.07 H	331	106.5	-2.1
2	*2440.00	103.5 AV			1.07 H	331	105.6	-2.1
3	4880.00	38.6 PK	74.0	-35.4	1.56 H	193	36.3	2.3
4	4880.00	27.0 AV	54.0	-27.0	1.56 H	193	24.7	2.3
5	7320.00	44.7 PK	74.0	-29.3	1.47 H	252	36.5	8.2
6	7320.00	35.4 AV	54.0	-18.6	1.47 H	252	27.2	8.2
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	*2440.00	96.8 PK			1.00 V	299	98.9	-2.1
2	*2440.00	96.1 AV			1.00 V	299	98.2	-2.1
3	4880.00	37.5 PK	74.0	-36.5	3.67 V	201	35.2	2.3
4	4880.00	26.1 AV	54.0	-27.9	3.67 V	201	23.8	2.3
5	7320.00	50.4 PK	74.0	-23.6	3.52 V	179	42.2	8.2
6	7320.00	41.2 AV	54.0	-12.8	3.52 V	179	33.0	8.2

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 other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

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

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	104.3 PK			1.03 H	360	106.5	-2.2
2	*2480.00	103.3 AV			1.03 H	360	105.5	-2.2
3	2483.50	48.5 PK	74.0	-25.5	1.03 H	360	50.7	-2.2
4	2483.50	37.5 AV	54.0	-16.5	1.03 H	360	39.7	-2.2
5	4960.00	38.0 PK	74.0	-36.0	1.52 H	205	35.5	2.5
6	4960.00	26.4 AV	54.0	-27.6	1.52 H	205	23.9	2.5
7	7440.00	44.8 PK	74.0	-29.2	1.42 H	251	36.4	8.4
8	7440.00	35.4 AV	54.0	-18.6	1.42 H	251	27.0	8.4
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	*2480.00	98.2 PK			1.02 V	304	100.4	-2.2
2	*2480.00	97.1 AV			1.02 V	304	99.3	-2.2
3	2483.50	46.5 PK	74.0	-27.5	1.02 V	304	48.7	-2.2
4	2483.50	34.9 AV	54.0	-19.1	1.02 V	304	37.1	-2.2
5	4960.00	37.3 PK	74.0	-36.7	3.74 V	200	34.8	2.5
6	4960.00	25.9 AV	54.0	-28.1	3.74 V	200	23.4	2.5
7	7440.00	50.1 PK	74.0	-23.9	3.51 V	194	41.7	8.4
8	7440.00	40.8 AV	54.0	-13.2	3.51 V	194	32.4	8.4

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 other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

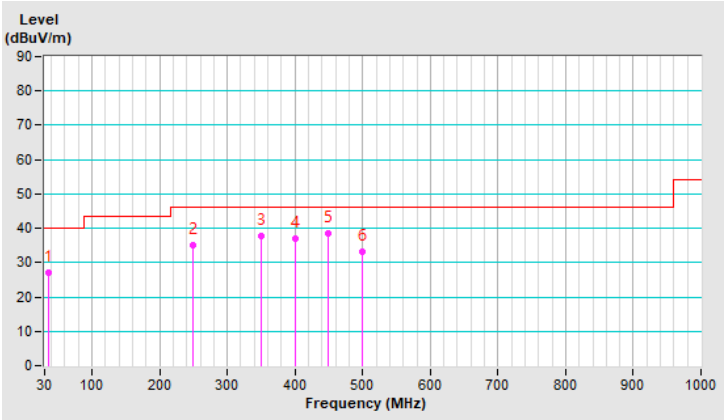
Below 1GHz Data:

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

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	36.02	27.2 QP	40.0	-12.8	1.55 H	219	41.6	-14.4
2	249.84	34.9 QP	46.0	-11.1	1.43 H	279	48.3	-13.4
3	350.16	37.6 QP	46.0	-8.4	1.65 H	251	48.0	-10.4
4	400.17	37.1 QP	46.0	-8.9	1.71 H	294	46.4	-9.3
5	449.94	38.4 QP	46.0	-7.6	1.47 H	72	46.5	-8.1
6	499.85	33.3 QP	46.0	-12.7	1.48 H	311	39.8	-6.5

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 other emission levels were very low against the limit of frequency range 30MHz~1000MHz.
5. 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.

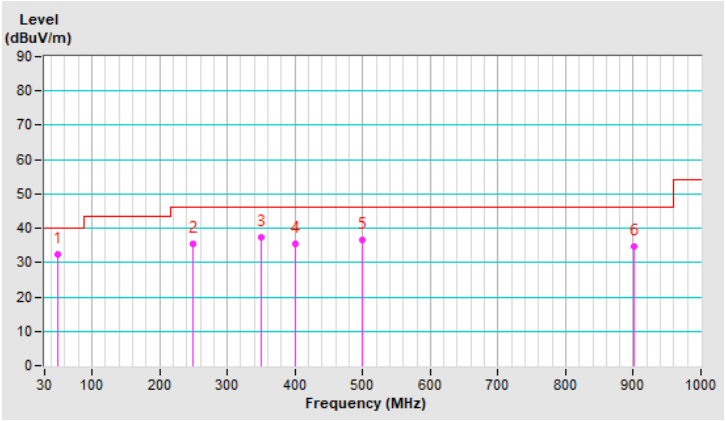


CHANNEL	TX Channel 19	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

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	50.23	32.5 QP	40.0	-7.5	1.56 V	170	46.0	-13.5
2	249.98	35.4 QP	46.0	-10.6	1.46 V	210	48.8	-13.4
3	350.50	37.2 QP	46.0	-8.8	1.33 V	228	47.5	-10.3
4	399.98	35.6 QP	46.0	-10.4	1.07 V	139	44.9	-9.3
5	499.75	36.6 QP	46.0	-9.4	1.35 V	201	43.1	-6.5
6	901.63	34.7 QP	46.0	-11.3	1.49 V	180	34.0	0.7

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 other emission levels were very low against the limit of frequency range 30MHz~1000MHz.
5. 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

Frequency (MHz)	Conducted Limit (dBuV)	
	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	Oct. 24, 2018	Oct. 23, 2019
Line-Impedance Stabilization Network (for EUT) R&S	ESH3-Z5	848773/004	Oct. 22, 2018	Oct. 21, 2019
Line-Impedance Stabilization Network (for Peripheral) R&S	ESH3-Z5	835239/001	Mar. 17, 2019	Mar. 16, 2020
50 ohms Terminator	N/A	3	Oct. 22, 2018	Oct. 21, 2019
RF Cable	5D-FB	COCCAB-001	Sep. 28, 2018	Sep. 27, 2019
Fixed attenuator EMCI	STI02-2200-10	003	Mar. 14, 2019	Mar. 13, 2020
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: June 03, 2019

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.

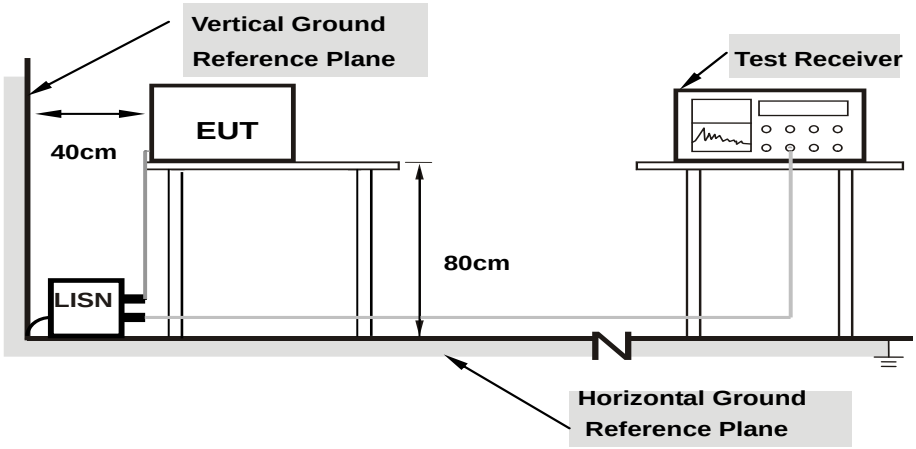
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

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.

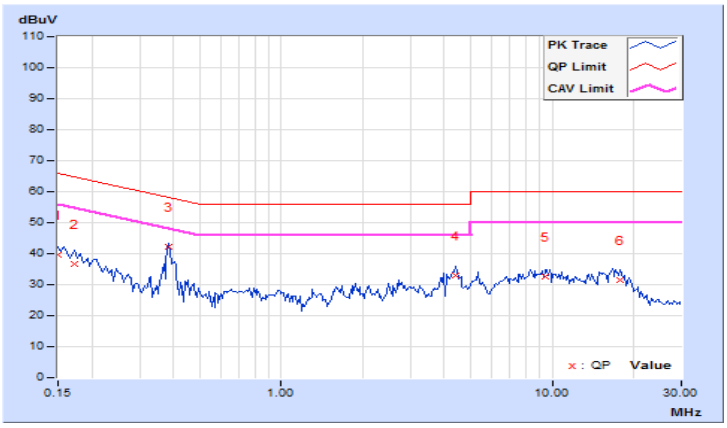
4.2.7 Test Results

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	10.03	29.59	14.20	39.62	24.23	66.00	56.00	-26.38	-31.77
2	0.17344	10.04	26.72	14.02	36.76	24.06	64.79	54.79	-28.03	-30.73
3	**0.38438**	**10.08**	**32.05**	**31.13**	**42.13**	**41.21**	**58.18**	**48.18**	**-16.05**	**-6.97**
4	4.41797	10.35	22.55	13.13	32.90	23.48	56.00	46.00	-23.10	-22.52
5	9.46875	10.67	21.90	11.96	32.57	22.63	60.00	50.00	-27.43	-27.37
6	17.85547	11.22	20.20	10.91	31.42	22.13	60.00	50.00	-28.58	-27.87

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.

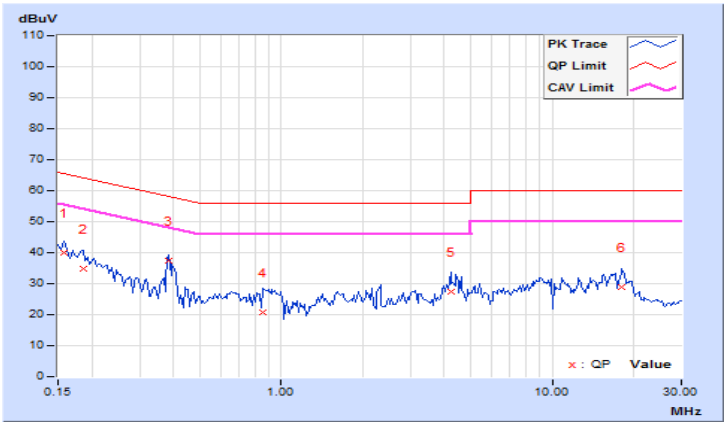


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15781	9.94	30.24	15.32	40.18	25.26	65.58	55.58	-25.40	-30.32
2	0.18516	9.95	24.79	10.93	34.74	20.88	64.25	54.25	-29.51	-33.37
3	0.38438	9.98	27.56	19.39	37.54	29.37	58.18	48.18	-20.64	-18.81
4	0.85313	10.00	10.85	1.13	20.85	11.13	56.00	46.00	-35.15	-34.87
5	4.21484	10.18	17.19	7.90	27.37	18.08	56.00	46.00	-28.63	-27.92
6	18.14844	11.03	17.84	7.11	28.87	18.14	60.00	50.00	-31.13	-31.86

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.

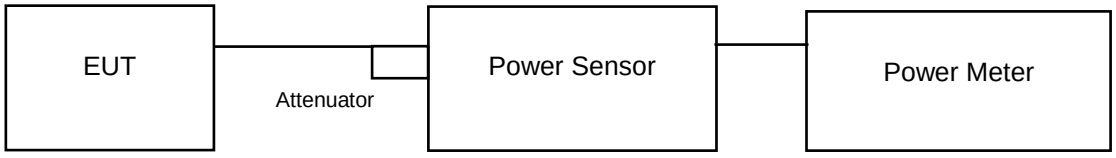


4.3 Conducted Output Power Measurement

4.3.1 Limits OF Conducted Output Power Measurement

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

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 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..

4.3.5 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 Results

FOR PEAK POWER

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass/Fail
0	2402	3.112	4.93	30	Pass
19	2440	3.436	5.36	30	Pass
39	2480	3.281	5.16	30	Pass

FOR AVERAGE POWER

Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)
0	2402	2.786	4.45
19	2440	3.155	4.99
39	2480	3.119	4.94

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.

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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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