

## FCC Test Report

**Report No.:** RF181226C13A

**FCC ID:** PZWDWUL07

**Test Model:** DWUL07

**Received Date:** Jan. 24, 2019

**Test Date:** Feb. 01 ~ Feb. 21, 2019

**Issued Date:** Feb. 23, 2019

**Applicant:** DENSO WAVE INCORPORATED

**Address:** 1, Yoshiike, Kusagi, Agui-cho, Chita-gun, Aichi, 470-2297 Japan

**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 Vil., Kwei Shan Dist., Taoyuan City 33383, TAIWAN (R.O.C.)

**FCC Registration /  
Designation Number:** 788550 / TW0003



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### Release Control Record

Issue No.	Description	Date Issued
RF181226C13A	Original release	Feb. 23, 2019

## 1 Certificate of Conformity

**Product:** RFID module

**Brand:** DENSO

**Test Model:** DWUL07

**Sample Status:** Engineering sample

**Applicant:** DENSO WAVE INCORPORATED

**Test Date:** Feb. 01 ~ Feb. 21, 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 RF characteristics under the conditions specified in this report.

**Prepared by :** Pettie Chen, **Date:** Feb. 23, 2019  
Pettie Chen / Senior Specialist

**Approved by :** Bruce Chen, **Date:** Feb. 23, 2019  
Bruce Chen / Project Engineer

## 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 -14.17dB at 0.44390MHz.
15.247(a)(1)(i)	Number of Hopping Frequency Used	Pass	Meet the requirement of limit.
15.247(a)(1)(i)	Dwell Time on Each Channel	Pass	Meet the requirement of limit.
15.247(a)(1)(i)	Spectrum Bandwidth of a Frequency Hopping Sequence Spread Spectrum System	Pass	Meet the requirement of limit.
15.247(b)(2)	Maximum Peak Output Power	Pass	Meet the requirement of limit.
15.205 & 209	Radiated Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -0.6dB at 3611.00, 3659.00MHz.
15.247(d)	Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -47.9dB at 928.00MHz.
15.247(d)	Antenna Port Emission	Pass	Meet the requirement of limit.
15.203	Antenna Requirement	Pass	Antenna connector is i-pex(MHF) not a standard connector.

### Note:

- 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period.
- 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	2.94 dB
Radiated Emissions up to 1 GHz	30MHz ~ 200MHz	3.86 dB
	200MHz ~ 1000MHz	3.87 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	2.29 dB
	18GHz ~ 40GHz	2.29 dB

### 2.2 Modification Record

There were no modifications required for compliance.

### 3 General Information

#### 3.1 General Description of EUT

Product	RFID module
Brand	DENSO
Test Model	DWUL07
Status of EUT	Engineering sample
Power Supply Rating	3.85Vdc (From Battery)
Modulation Type	PR-ASK
Operating Frequency	902.75~927.25MHz
Number of Channel	50
Channel Spacing	500kHz
Output Power	794.328mW
Antenna Type	Patch antenna with 4.7dBi gain
Antenna Connector	i-pex(MHF)
Accessory Device	NA
Cable Supplied	NA

Note:

1. The EUT is authorized for use in specific End-product. Please refer to below table for more details.

Product Name	Brand Name	Model No.
RF Tag Handy Scanner	DENSO	SP1-QUBi

2. The RF Tag Handy Scanner uses following battery.

Battery	
Brand	DENSO
Model	BT-SP1L
Rating	3.85Vdc, 5800mAh, 22.33Wh

3. The client provides the following cradles for tests. (Support unit only)

Cradle for RF Tag Handy Scanner (Support unit)	
Brand	DENSO
Model	CU-SP1A
Output Power	5Vdc, 1.5A

Adapter for cradle (Support unit)	
Brand	FSP GROUP INC.
Model	FSP050-DBAE1
Input Power	100-240Vac, 1.5A, 50/60Hz
Output Power	12Vdc, 4.16A, 50W
Power Line	1.2m non-shielded DC cable with 1 core attached on adapter

### 3.2 Description of Test Modes

50 channels are provided to this EUT:

Channel	Freq. (MHz)	Channel	Freq. (MHz)
0	902.75	25	915.25
1	903.25	26	915.75
2	903.75	27	916.25
3	904.25	28	916.75
4	904.75	29	917.25
5	905.25	30	917.75
6	905.75	31	918.25
7	906.25	32	918.75
8	906.75	33	919.25
9	907.25	34	919.75
10	907.75	35	920.25
11	908.25	36	920.75
12	908.75	37	921.25
13	909.25	38	921.75
14	909.75	39	922.25
15	910.25	40	922.75
16	910.75	41	923.25
17	911.25	42	923.75
18	911.75	43	924.25
19	912.25	44	924.75
20	912.75	45	925.25
21	913.25	46	925.75
22	913.75	47	926.25
23	914.25	48	926.75
24	914.75	49	927.25



### 3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable to				Description
	RE $\geq$ 1G	RE $<$ 1G	PLC	APCM	
A	√	√	-	√	Power from battery
B		√	√	-	Power from cradle

Where RE $\geq$ 1G: Radiated Emission above 1GHz & Bandedge Measurement  
 RE $<$ 1G: Radiated Emission below 1GHz  
 PLC: Power Line Conducted Emission  
 APCM: Antenna Port Conducted Measurement

**NOTE:**

- The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on X-plane (For Test Mode A) and Z-plane (For Test Mode B).
- "-" means no effect.

#### 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.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type	Remark
A	0 to 49	0, 24, 49	PR-ASK	-

#### 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.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type	Remark
A, B	0 to 49	0, 24, 49	PR-ASK	-

#### 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.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type	Remark
B	0 to 49	0, 24, 49	PR-ASK	-

#### 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.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type	Remark
A	0 to 49	0, 24, 49	PR-ASK	-

### Test Condition:

Applicable to	Environmental Conditions	Input Power (System)	Tested by
RE $\geq$ 1G	22 deg. C, 68% RH	3.85Vdc	Willy Cheng
RE<1G	22 deg. C, 67% RH	3.85Vdc 120Vac, 60Hz	Willy Cheng
PLC	23 deg. C, 63% RH	120Vac, 60Hz	Willy Cheng
APCM	25 deg. C, 60% RH	3.85Vdc	Chris Lin, Alan Wu

### 3.3 Description of Support Units

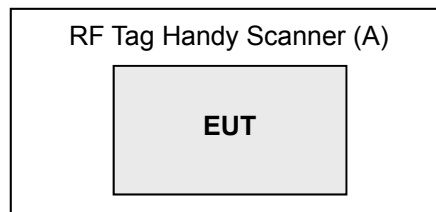
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	RF Tag Handy Scanner	DENSO	SP1-QUBi	NA	NA	Provided by client
B.	Cradle	DENSO	CU-SP1A	NA	NA	Provided by client
C.	Adapter for cradle	FSP GROUP INC.	FSP050-DBAE1	NA	NA	Provided by client

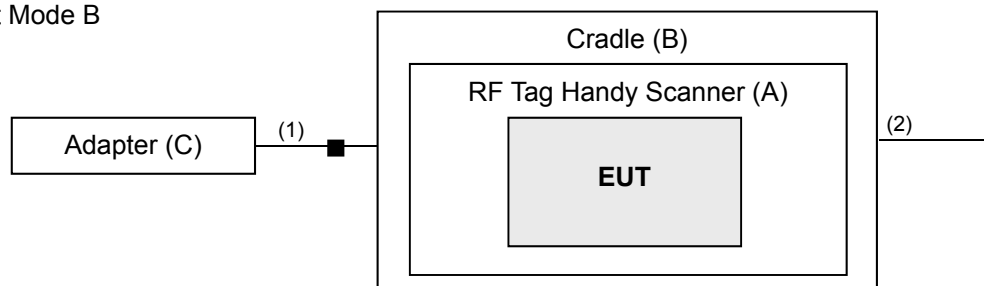
ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	Power cable	1	1.2	N	1	Provided by client
2.	USB cable	2	0.8	Y	0	-

#### 3.3.1 Configuration of System under Test

Test Mode A



Test Mode B



### 3.4 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)**  
 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.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESIB7	100187	May 29, 2018	May 28, 2019
BILOG Antenna SCHWARZBECK	VULB9168	9168-171	Nov. 22, 2018	Nov. 21, 2019
HORN Antenna SCHWARZBECK	9120D	209	Nov. 25, 2018	Nov. 24, 2019
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Nov. 25, 2018	Nov. 24, 2019
Preamplifier Agilent (Below 1GHz)	8447D	2944A10738	Aug. 21, 2018	Aug. 20, 2019
Preamplifier Agilent (Above 1GHz)	8449B	3008A02465	Apr. 03, 2018	Apr. 02, 2019
RF signal cable HUBER+SUHNER	SUCOFLEX 104	Cable-CH3-03 (223653/4)	Aug. 21, 2018	Aug. 20, 2019
RF signal cable HUBER+SUHNER& EMCI	SUCOFLEX 104&EMC104-SM- SM-8000	Cable-CH3-03 (309224+170907)	Aug. 21, 2018	Aug. 20, 2019
Software BV ADT	ADT_Radiated_ V7.6.15.9.5	NA	NA	NA
Antenna Tower inn-co GmbH	MA 4000	013303	NA	NA
Antenna Tower Controller BV ADT	AT100	AT93021702	NA	NA
Turn Table BV ADT	TT100	TT93021702	NA	NA
Turn Table Controller BV ADT	SC100	SC93021702	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA
Turn Table Controller BV ADT	SC100	SC93021702	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA
USB Wideband Power Sensor KEYSIGHT	U2021XA	MY55050005/MY55190 004/MY55190007/MY55 210005	Jul. 17, 2018	Jul. 16, 2019

- 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 3.
3. The horn antenna and preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
4. The FCC Designation Number is TW0003. The number will be varied with the Lab location and scope as attached.
5. The IC Site Registration No. is IC 7450F-3.

#### 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:

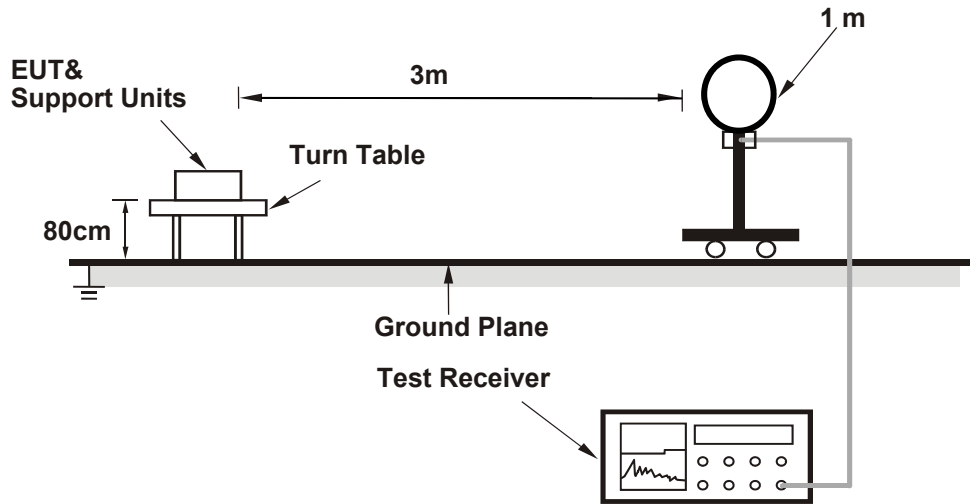
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.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

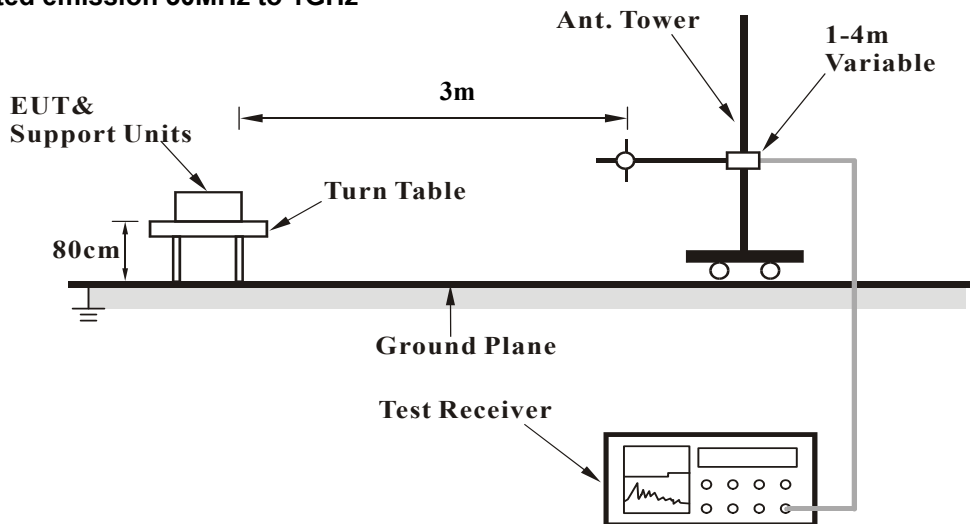
No deviation.

#### 4.1.5 Test Setup

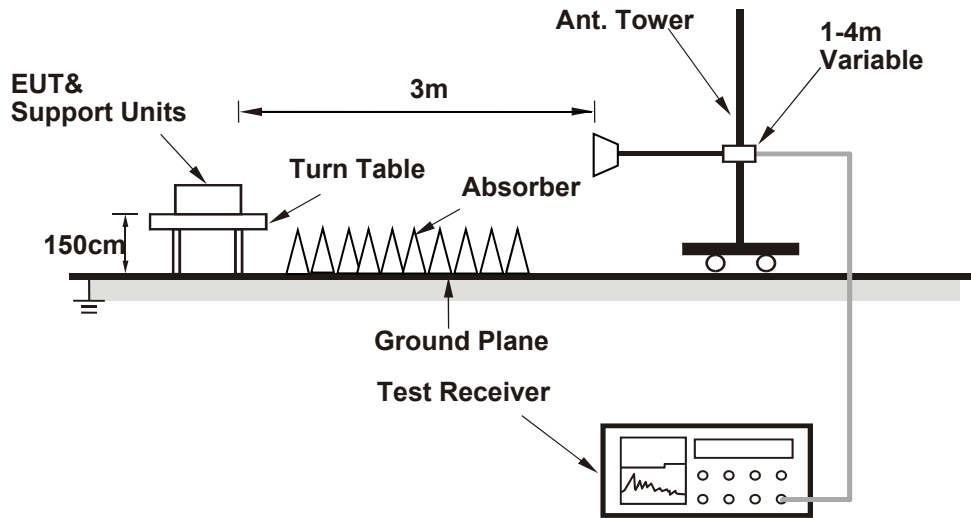
##### For Radiated emission below 30MHz



##### 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**

Set the EUT under transmission condition continuously at specific channel frequency.

#### 4.1.7 Test Results

Above 1GHz Data:

CHANNEL	TX Channel 0	DETECTOR FUNCTION	Quasi-Peak (QP) 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	#902.00	50.4 QP	98.6	-48.2	1.81 H	228	17.8	32.6
2	*902.75	118.6 QP			1.81 H	228	86.0	32.6
3	#1805.50	67.7 PK	98.6	-30.9	1.84 H	334	74.0	-6.3
4	#1805.50	59.1 AV	98.6	-39.5	1.84 H	334	65.4	-6.3
5	2708.25	54.3 PK	74.0	-19.7	1.33 H	197	56.9	-2.6
6	2708.25	48.1 AV	54.0	-5.9	1.33 H	197	50.7	-2.6
7	3611.00	60.5 PK	74.0	-13.5	1.09 H	200	61.0	-0.5
8	<b>3611.00</b>	<b>53.4 AV</b>	<b>54.0</b>	<b>-0.6</b>	<b>1.09 H</b>	<b>200</b>	<b>53.9</b>	<b>-0.5</b>

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	#902.00	54.2 QP	109.8	-55.6	1.11 V	332	21.6	32.6
2	*902.75	129.8 QP			1.11 V	332	97.2	32.6
3	#1805.50	63.3 PK	109.8	-46.5	1.48 V	55	69.6	-6.3
4	#1805.50	53.8 AV	109.8	-56.0	1.48 V	55	60.1	-6.3
5	2708.25	46.2 PK	74.0	-27.8	1.05 V	2	48.8	-2.6
6	2708.25	37.5 AV	54.0	-16.5	1.05 V	2	40.1	-2.6
7	3611.00	54.2 PK	74.0	-19.8	1.30 V	165	54.7	-0.5
8	3611.00	47.9 AV	54.0	-6.1	1.30 V	165	48.4	-0.5

#### 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. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " \* ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.



CHANNEL	TX Channel 24	DETECTOR FUNCTION	Quasi-Peak (QP) 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	*914.75	117.6 QP			2.98 H	54	84.7	32.9
2	#1829.50	60.1 PK	74.0	-13.9	1.58 H	328	66.2	-6.1
3	#1829.50	51.3 AV	54.0	-2.7	1.58 H	328	57.4	-6.1
4	2744.25	52.9 PK	74.0	-21.1	1.23 H	200	55.4	-2.5
5	2744.25	44.8 AV	54.0	-9.2	1.23 H	200	47.3	-2.5
6	3659.00	59.1 PK	74.0	-14.9	1.45 H	193	59.7	-0.6
7	<b>3659.00</b>	<b>53.4 AV</b>	<b>54.0</b>	<b>-0.6</b>	<b>1.45 H</b>	<b>193</b>	<b>54.0</b>	<b>-0.6</b>

**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	*914.75	128.3 QP			1.04 V	327	95.4	32.9
2	#1829.50	55.8 PK	74.0	-18.2	1.52 V	50	61.9	-6.1
3	#1829.50	47.3 AV	54.0	-6.7	1.52 V	50	53.4	-6.1
4	2744.25	45.8 PK	74.0	-28.2	3.28 V	341	48.3	-2.5
5	2744.25	36.9 AV	54.0	-17.1	3.28 V	341	39.4	-2.5
6	3659.00	52.1 PK	74.0	-21.9	1.11 V	356	52.7	-0.6
7	3659.00	45.5 AV	54.0	-8.5	1.11 V	356	46.1	-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. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " \* ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

CHANNEL	TX Channel 49	DETECTOR FUNCTION	Quasi-Peak (QP) 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	*927.25	119.0 QP			2.87 H	58	86.0	33.0
2	#928.00	51.1 QP	99.0	-47.9	2.87 H	58	18.1	33.0
3	#1854.50	58.8 PK	74.0	-15.2	2.38 H	337	64.8	-6.0
4	#1854.50	50.8 AV	54.0	-3.2	2.38 H	337	56.8	-6.0
5	2781.75	53.2 PK	74.0	-20.8	1.37 H	197	55.5	-2.3
6	2781.75	45.0 AV	54.0	-9.0	1.37 H	197	47.3	-2.3
7	3709.00	59.1 PK	74.0	-14.9	1.45 H	192	59.6	-0.5
8	3709.00	51.3 AV	54.0	-2.7	1.45 H	192	51.8	-0.5

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	*927.25	129.3 QP			1.04 V	333	96.3	33.0
2	#928.00	56.5 QP	109.3	-52.8	1.04 V	333	23.5	33.0
3	#1854.50	58.3 PK	74.0	-15.7	1.21 V	49	64.3	-6.0
4	#1854.50	49.8 AV	54.0	-4.2	1.21 V	49	55.8	-6.0
5	2781.75	46.8 PK	74.0	-27.2	3.70 V	5	49.1	-2.3
6	2781.75	37.8 AV	54.0	-16.2	3.70 V	5	40.1	-2.3
7	3709.00	53.6 PK	74.0	-20.4	3.36 V	170	54.1	-0.5
8	3709.00	48.0 AV	54.0	-6.0	3.36 V	170	48.5	-0.5

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. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " \* ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

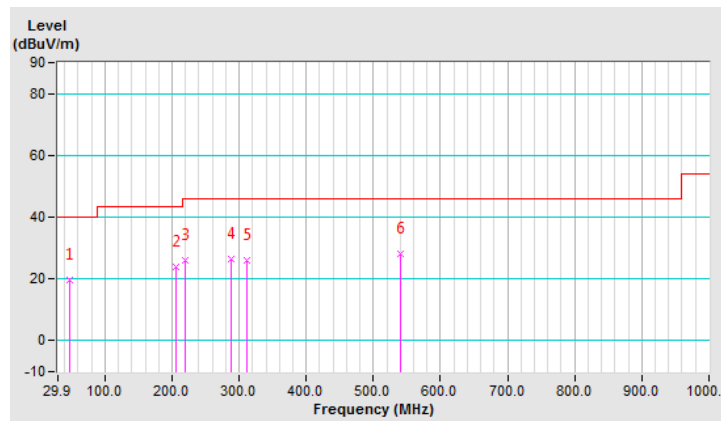
Below 1GHz data:

CHANNEL	TX Channel 0	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz	TEST MODE	A

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	47.40	19.8 QP	40.0	-20.2	1.51 H	298	29.5	-9.7
2	206.83	23.9 QP	43.5	-19.6	1.99 H	150	35.0	-11.1
3	220.44	26.2 QP	46.0	-19.8	1.99 H	121	36.8	-10.6
4	288.49	26.6 QP	46.0	-19.4	1.51 H	332	34.2	-7.6
5	311.82	25.9 QP	46.0	-20.1	1.01 H	265	32.9	-7.0
6	541.25	28.0 QP	46.0	-18.0	1.51 H	45	31.0	-3.0

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. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
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.

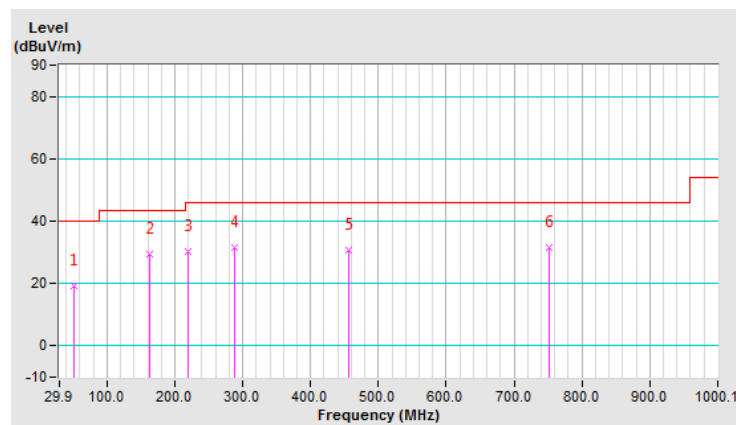


CHANNEL	TX Channel 0	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz	TEST MODE	A

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	51.29	19.3 QP	40.0	-20.7	1.50 V	175	29.0	-9.7
2	162.11	29.6 QP	43.5	-13.9	1.50 V	3	38.6	-9.0
3	220.44	30.3 QP	46.0	-15.7	1.00 V	197	40.9	-10.6
4	288.49	31.5 QP	46.0	-14.5	1.50 V	133	39.1	-7.6
5	455.70	30.8 QP	46.0	-15.2	1.50 V	7	35.2	-4.4
6	751.23	31.5 QP	46.0	-14.5	1.49 V	15	29.7	1.8

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. 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.

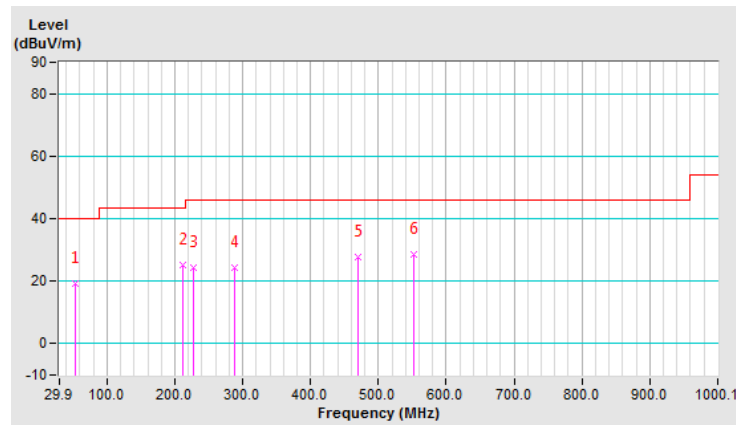


CHANNEL	TX Channel 24	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz	TEST MODE	A

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	53.23	19.1 QP	40.0	-20.9	1.01 H	6	28.9	-9.8
2	212.66	25.3 QP	43.5	-18.2	1.50 H	117	36.2	-10.9
3	228.22	24.5 QP	46.0	-21.5	1.50 H	356	35.0	-10.5
4	288.49	24.4 QP	46.0	-21.6	1.50 H	6	32.0	-7.6
5	469.31	27.9 QP	46.0	-18.1	1.01 H	90	32.1	-4.2
6	552.91	28.4 QP	46.0	-17.6	1.50 H	54	31.1	-2.7

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. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
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.

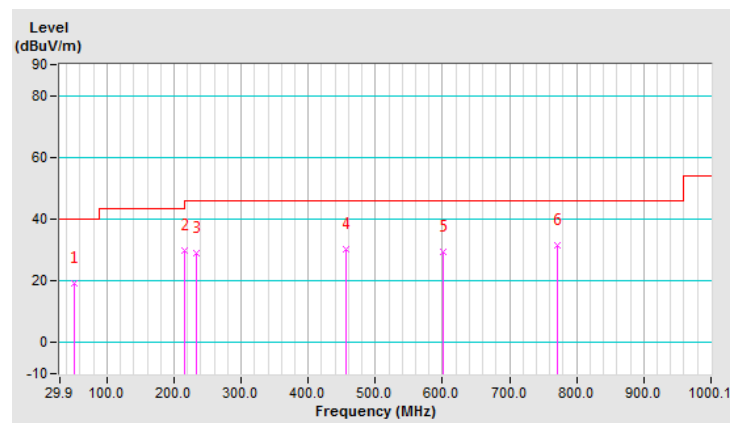


CHANNEL	TX Channel 24	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz	TEST MODE	A

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	51.29	19.2 QP	40.0	-20.8	1.00 V	220	28.9	-9.7
2	216.55	30.0 QP	46.0	-16.0	1.50 V	240	40.9	-10.9
3	234.05	29.1 QP	46.0	-16.9	1.00 V	264	39.2	-10.1
4	455.70	30.3 QP	46.0	-15.7	1.50 V	345	34.7	-4.4
5	601.52	29.5 QP	46.0	-16.5	1.50 V	6	30.7	-1.2
6	770.67	31.4 QP	46.0	-14.6	1.99 V	149	29.4	2.0

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. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
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.

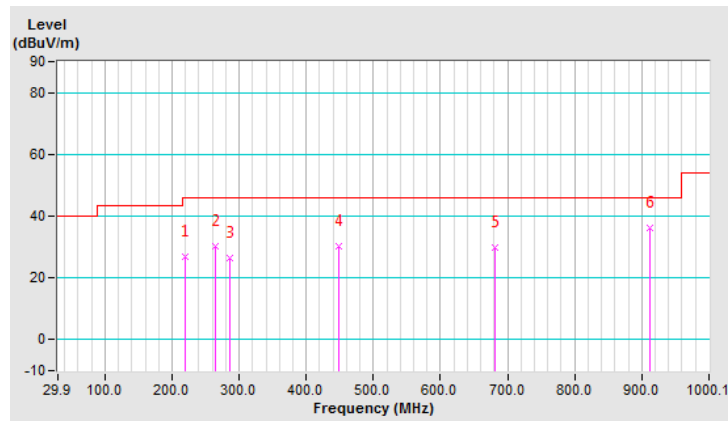


CHANNEL	TX Channel 49	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz	TEST MODE	A

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	220.44	27.0 QP	46.0	-19.0	1.50 H	10	37.6	-10.6
2	265.16	30.2 QP	46.0	-15.8	1.50 H	135	38.7	-8.5
3	286.55	26.4 QP	46.0	-19.6	1.50 H	150	34.0	-7.6
4	447.92	30.2 QP	46.0	-15.8	1.50 H	165	34.6	-4.4
5	681.24	30.0 QP	46.0	-16.0	1.00 H	231	30.1	-0.1
6	912.61	36.3 QP	46.0	-9.7	1.00 H	16	31.7	4.6

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. 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.

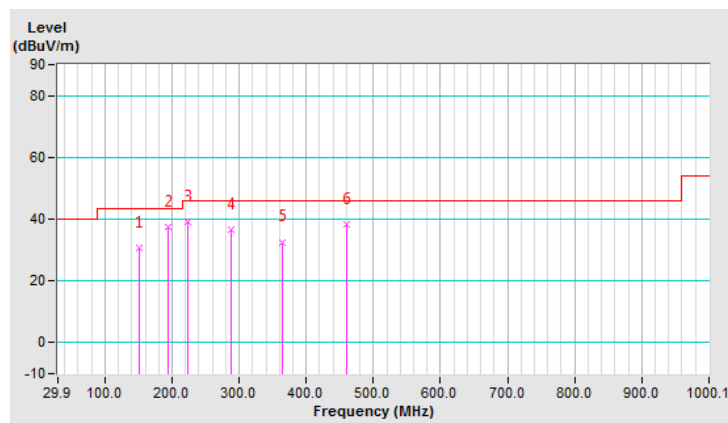


CHANNEL	TX Channel 49	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz	TEST MODE	A

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	150.45	30.6 QP	43.5	-12.9	1.50 V	175	39.7	-9.1
2	195.16	37.4 QP	43.5	-6.1	1.00 V	43	48.7	-11.3
3	224.33	39.2 QP	46.0	-6.8	1.50 V	195	49.8	-10.6
4	288.49	36.7 QP	46.0	-9.3	1.00 V	126	44.3	-7.6
5	364.32	32.6 QP	46.0	-13.4	1.00 V	332	38.9	-6.3
6	459.59	38.2 QP	46.0	-7.8	2.00 V	1	42.5	-4.3

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. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
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.



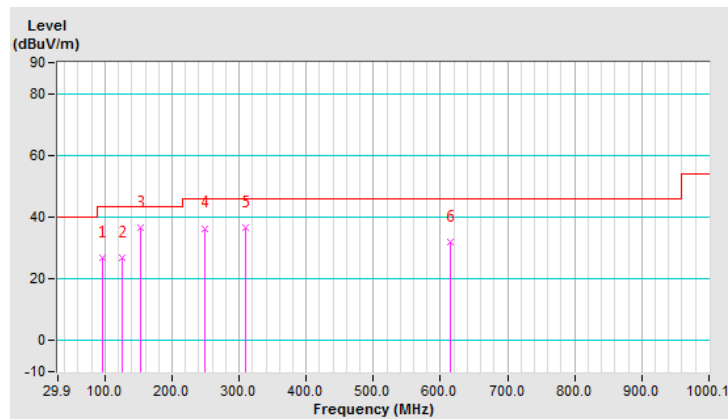


CHANNEL	TX Channel 0	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz	TEST MODE	B

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	96.01	27.0 QP	43.5	-16.5	1.99 H	92	41.0	-14.0
2	125.17	26.8 QP	43.5	-16.7	1.99 H	287	37.8	-11.0
3	152.39	36.8 QP	43.5	-6.7	1.99 H	64	46.0	-9.2
4	249.60	36.4 QP	46.0	-9.6	1.01 H	114	45.5	-9.1
5	309.88	36.6 QP	46.0	-9.4	1.01 H	107	43.7	-7.1
6	615.13	32.1 QP	46.0	-13.9	1.01 H	78	32.9	-0.8

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. 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.

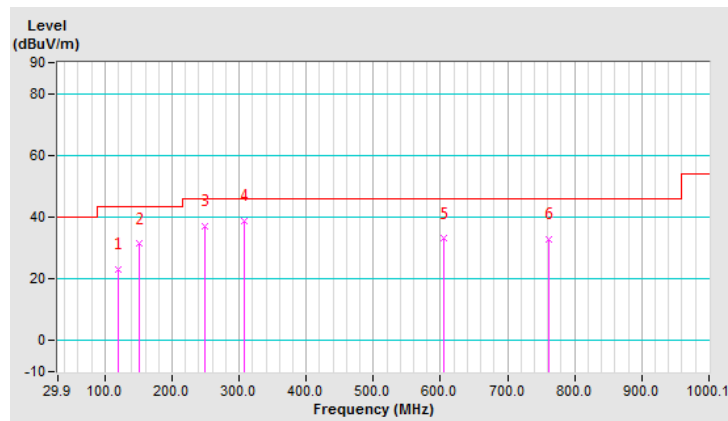


CHANNEL	TX Channel 0	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz	TEST MODE	B

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	119.34	23.0 QP	43.5	-20.5	1.00 V	54	34.6	-11.6
2	150.45	31.3 QP	43.5	-12.2	1.00 V	259	40.4	-9.1
3	249.60	37.0 QP	46.0	-9.0	1.99 V	155	46.1	-9.1
4	307.93	38.6 QP	46.0	-7.4	1.99 V	3	45.7	-7.1
5	605.41	33.0 QP	46.0	-13.0	1.00 V	340	34.1	-1.1
6	760.95	32.8 QP	46.0	-13.2	1.99 V	131	30.8	2.0

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. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
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.

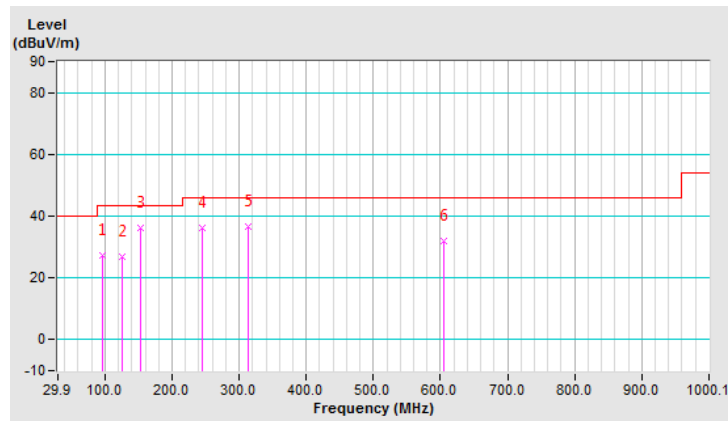


CHANNEL	TX Channel 24	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz	TEST MODE	B

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	96.01	27.3 QP	43.5	-16.2	1.99 H	100	41.3	-14.0
2	125.17	27.0 QP	43.5	-16.5	1.99 H	242	38.0	-11.0
3	152.39	36.2 QP	43.5	-7.3	1.99 H	63	45.4	-9.2
4	245.72	36.1 QP	46.0	-9.9	1.00 H	126	45.4	-9.3
5	313.77	36.4 QP	46.0	-9.6	1.00 H	121	43.5	-7.1
6	605.41	32.1 QP	46.0	-13.9	1.00 H	71	33.2	-1.1

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. 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.

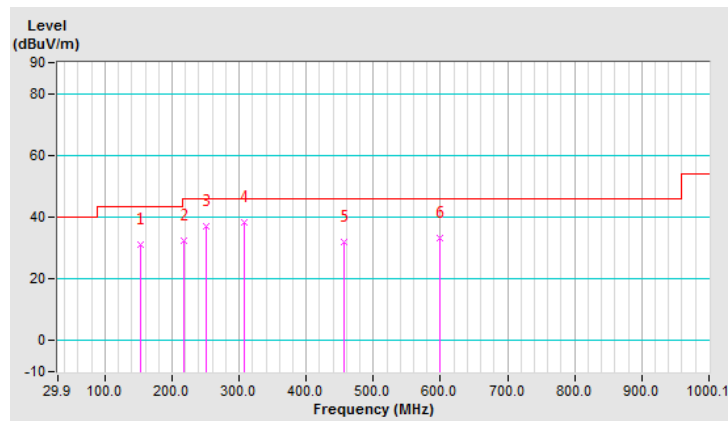


CHANNEL	TX Channel 24	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz	TEST MODE	B

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	152.39	31.1 QP	43.5	-12.4	1.00 V	267	40.3	-9.2
2	218.50	32.5 QP	46.0	-13.5	1.00 V	228	43.2	-10.7
3	251.55	36.9 QP	46.0	-9.1	2.00 V	153	46.0	-9.1
4	307.93	38.5 QP	46.0	-7.5	2.00 V	10	45.6	-7.1
5	455.70	32.0 QP	46.0	-14.0	1.00 V	179	36.4	-4.4
6	599.58	33.2 QP	46.0	-12.8	1.00 V	343	34.4	-1.2

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. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
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.

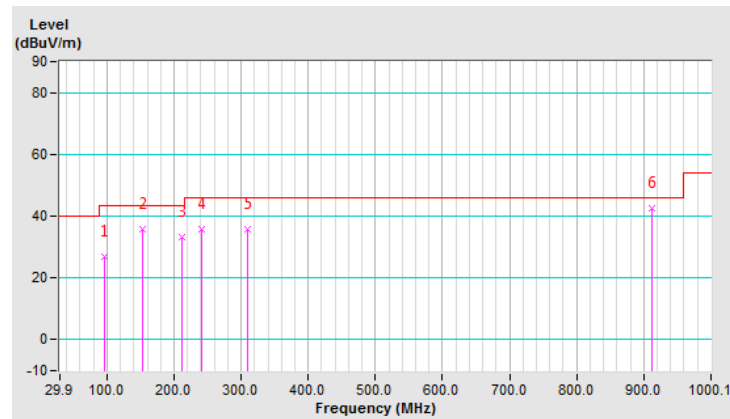


CHANNEL	TX Channel 49	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz	TEST MODE	B

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	96.01	26.8 QP	43.5	-16.7	2.00 H	98	40.8	-14.0
2	152.39	35.7 QP	43.5	-7.8	2.00 H	217	44.9	-9.2
3	212.66	33.3 QP	43.5	-10.2	1.01 H	117	44.2	-10.9
4	241.83	35.6 QP	46.0	-10.4	1.01 H	121	45.1	-9.5
5	309.88	35.9 QP	46.0	-10.1	1.01 H	119	43.0	-7.1
6	912.61	42.6 QP	46.0	-3.4	2.00 H	156	38.0	4.6

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. 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.

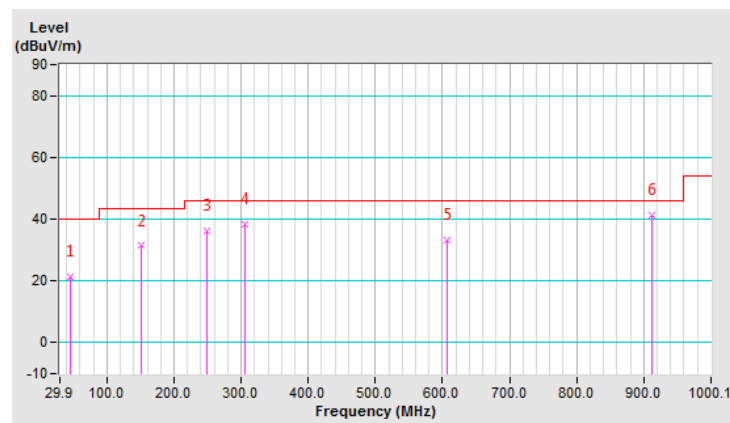


CHANNEL	TX Channel 49	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz	TEST MODE	B

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	45.45	21.5 QP	40.0	-18.5	1.00 V	260	31.3	-9.8
2	150.45	31.3 QP	43.5	-12.2	1.00 V	262	40.4	-9.1
3	249.60	36.1 QP	46.0	-9.9	1.99 V	148	45.2	-9.1
4	305.99	38.3 QP	46.0	-7.7	1.99 V	1	45.5	-7.2
5	607.35	33.4 QP	46.0	-12.6	1.00 V	336	34.4	-1.0
6	912.61	41.1 QP	46.0	-4.9	1.00 V	280	36.5	4.6

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. 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.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESCI	100613	Dec. 10, 2018	Dec. 09, 2019
RF signal cable Woken	5D-FB	Cable-cond2-01	Sep. 05, 2018	Sep. 04, 2019
LISN ROHDE & SCHWARZ (EUT)	NNBL 8226-2	8226-142	Jul. 23, 2018	Jul. 22, 2019
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100312	Aug. 13, 2018	Aug. 12, 2019
Software ADT	BV ADT_Cond_ V7.3.7.4	NA	NA	NA

- 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 Shielded Room 2.  
 3. The VCCI Site Registration No. is C-2047.

#### 4.2.3 Test Procedures

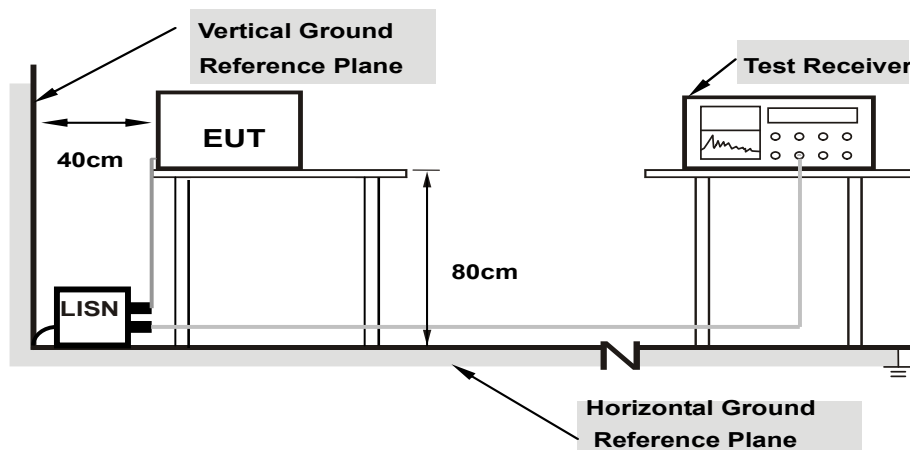
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- 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:**
- Support units were connected to second LISN.
  - Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

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

#### 4.2.6 EUT Operating Condition

Same as item 4.1.6.



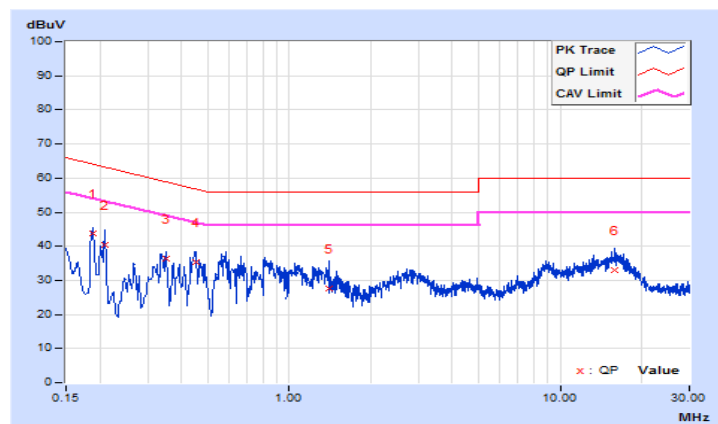
#### 4.2.7 Test Results

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
Channel	TX Channel 0		

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
			1	0.18903	10.06	33.63	17.97	43.69	28.03	64.08
2	0.20865	10.06	30.49	14.79	40.55	24.85	63.26	53.26	-22.71	-28.41
3	0.34941	10.06	26.21	13.73	36.27	23.79	58.98	48.98	-22.71	-25.19
4	0.45498	10.06	25.42	15.22	35.48	25.28	56.78	46.78	-21.30	-21.50
5	1.39729	10.07	17.65	10.70	27.72	20.77	56.00	46.00	-28.28	-25.23
6	15.96986	10.44	22.64	14.95	33.08	25.39	60.00	50.00	-26.92	-24.61

#### 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.

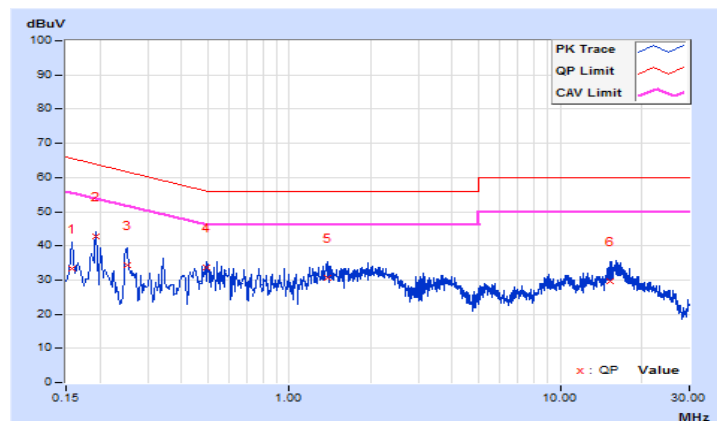


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
Channel	TX Channel 0		

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
			1	0.15782	10.06	23.33	12.53	33.39	22.59	65.58
2	0.19301	10.07	32.62	16.72	42.69	26.79	63.91	53.91	-21.22	-27.12
3	0.25125	10.07	24.30	12.90	34.37	22.97	61.72	51.72	-27.35	-28.75
4	0.49799	10.07	23.54	13.41	33.61	23.48	56.03	46.03	-22.42	-22.55
5	1.37774	10.08	20.50	13.90	30.58	23.98	56.00	46.00	-25.42	-22.02
6	15.32471	10.53	18.96	12.00	29.49	22.53	60.00	50.00	-30.51	-27.47

**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.

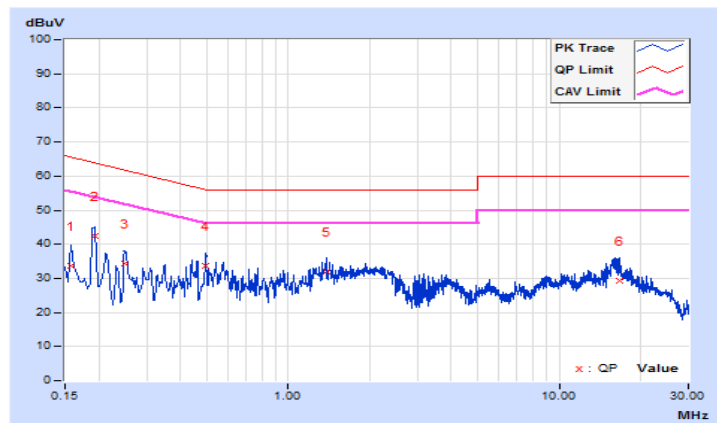


Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
Channel	TX Channel 24		

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
			1	0.15782	10.05	23.69	12.95	33.74	23.00	65.58
2	0.19255	10.06	32.27	16.76	42.33	26.82	63.93	53.93	-21.60	-27.11
3	0.24796	10.06	24.33	12.30	34.39	22.36	61.83	51.83	-27.44	-29.47
4	0.49799	10.06	23.46	13.31	33.52	23.37	56.03	46.03	-22.51	-22.66
5	1.37774	10.07	21.81	15.17	31.88	25.24	56.00	46.00	-24.12	-20.76
6	16.74404	10.45	18.94	11.35	29.39	21.80	60.00	50.00	-30.61	-28.20

**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.

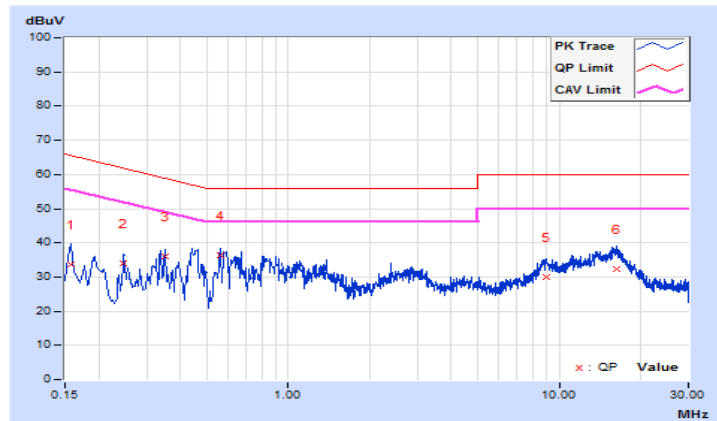


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
Channel	TX Channel 24		

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
			1	0.15760	10.06	23.66	13.68	33.72	23.74	65.59
2	0.24775	10.07	23.98	12.35	34.05	22.42	61.83	51.83	-27.78	-29.41
3	0.34941	10.07	25.89	13.37	35.96	23.44	58.98	48.98	-23.02	-25.54
4	0.56055	10.07	26.33	13.68	36.40	23.75	56.00	46.00	-19.60	-22.25
5	8.95923	10.33	19.68	12.87	30.01	23.20	60.00	50.00	-29.99	-26.80
6	16.28266	10.56	21.82	14.49	32.38	25.05	60.00	50.00	-27.62	-24.95

**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.

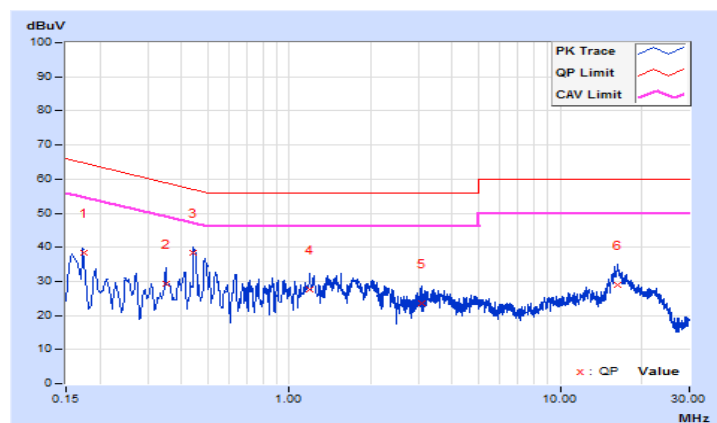


Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
Channel	TX Channel 49		

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
			1	0.17374	10.05	28.22	14.01	38.27	24.06	64.78
2	0.34941	10.06	19.12	10.48	29.18	20.54	58.98	48.98	-29.80	-28.44
<b>3</b>	<b>0.44390</b>	<b>10.06</b>	<b>28.40</b>	<b>22.76</b>	<b>38.46</b>	<b>32.82</b>	<b>56.99</b>	<b>46.99</b>	<b>-18.53</b>	<b>-14.17</b>
4	1.19006	10.07	17.68	10.22	27.75	20.29	56.00	46.00	-28.25	-25.71
5	3.07468	10.12	13.47	6.03	23.59	16.15	56.00	46.00	-32.41	-29.85
6	16.26311	10.44	18.66	11.97	29.10	22.41	60.00	50.00	-30.90	-27.59

**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.

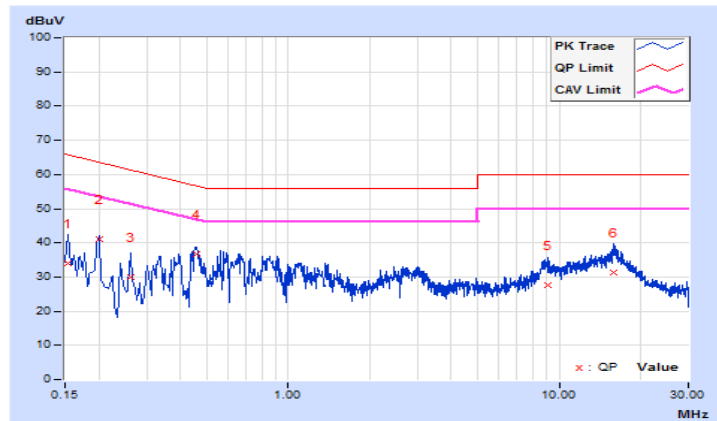


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
Channel	TX Channel 49		

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
			1	0.15391	10.06	24.10	13.71	34.16	23.77	65.79
2	0.20084	10.07	31.08	18.18	41.15	28.25	63.58	53.58	-22.43	-25.33
3	0.26339	10.07	20.00	12.07	30.07	22.14	61.32	51.32	-31.25	-29.18
4	0.45695	10.07	26.58	18.29	36.65	28.36	56.75	46.75	-20.10	-18.39
5	9.13127	10.33	17.15	11.41	27.48	21.74	60.00	50.00	-32.52	-28.26
6	15.84474	10.55	20.65	14.56	31.20	25.11	60.00	50.00	-28.80	-24.89

**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.

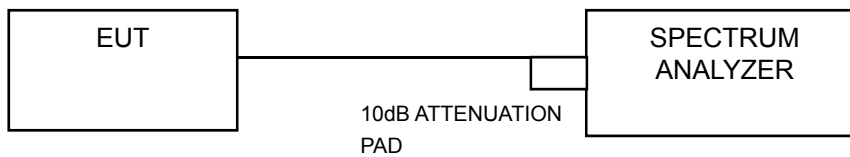


### 4.3 Number of Hopping Frequency Used

#### 4.3.1 Limits of Hopping Frequency Used Measurement

At least 50 channels frequencies, and should be equally spaced.

#### 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

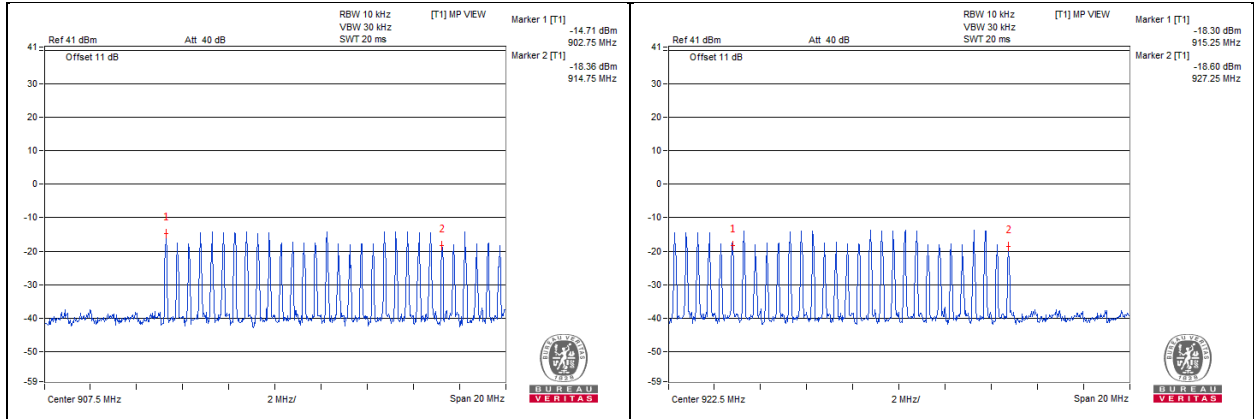
- Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
- Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
- Set the SA on MaxHold Mode, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been recorded.
- Set the SA on View mode and then plot the result on SA screen.
- Repeat above procedures until all frequencies measured were complete.

#### 4.3.5 Deviation from Test Standard

No deviation.

### 4.3.6 Test Results

There are 50 hopping frequencies in the hopping mode. On the plots, it shows that the hopping frequencies are equally spaced.



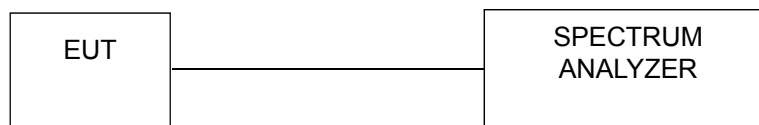


#### 4.4 Dwell Time on Each Channel

##### 4.4.1 Limits of Dwell Time on Each Channel Measurement

The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period.

##### 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

- Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
- Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
- Adjust the center frequency of SA on any frequency be measured and set SA to zero span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
- Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.
- Repeat above procedures until all different time-slot modes have been completed.

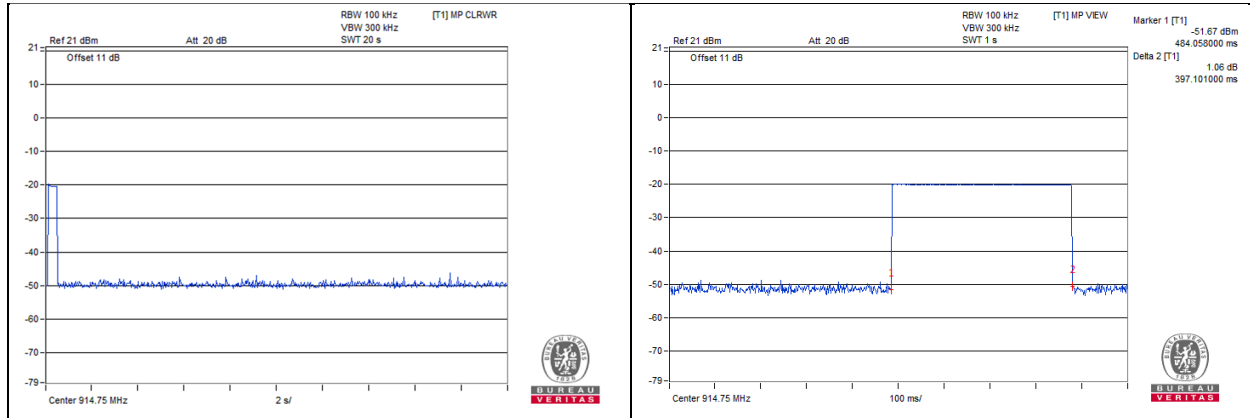
##### 4.4.5 Deviation from Test Standard

No deviation.

#### 4.4.6 Test Results

Number of transmission in a period (50Hopping*0.4)	Length of transmission time (msec)	Result (msec)	Limit (msec)
1 (times / 20 sec) * 1 = 1 times	397.1	397.1	400

Note: Test plots of the transmitting time slot are shown as below.

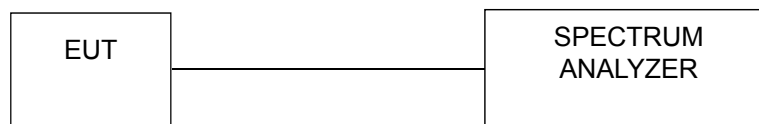


## 4.5 Channel Bandwidth

### 4.5.1 Limits of Channel Bandwidth Measurement

The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

### 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

- Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
- Measure the frequency difference of two frequencies that were attenuated 20dB from the reference level. Record the frequency difference as the emission bandwidth.
- Repeat above procedures until all frequencies measured were complete.

### 4.5.5 Deviation from Test Standard

No deviation.

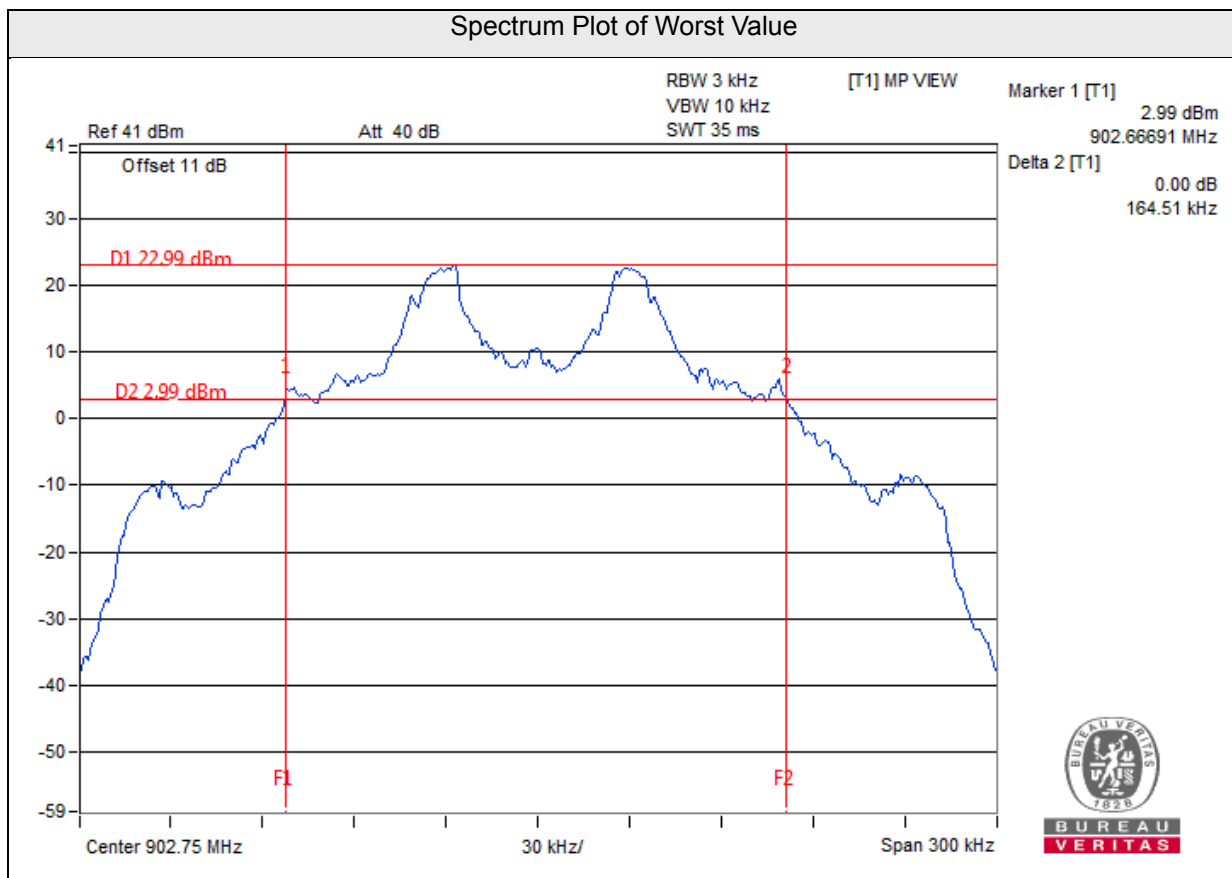
### 4.5.6 EUT Operating Condition

The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

#### 4.5.7 Test Results

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Limit (MHz)
0	902.75	0.164	0.5
24	914.75	0.164	0.5
49	927.25	0.163	0.5

Note: 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period.

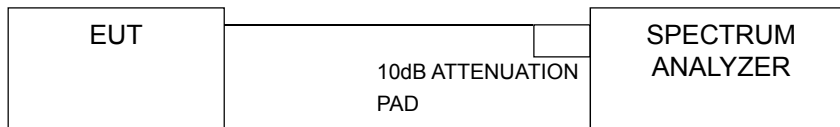


## 4.6 Hopping Channel Separation

### 4.6.1 Limits of Hopping Channel Separation Measurement

At least of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

### 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

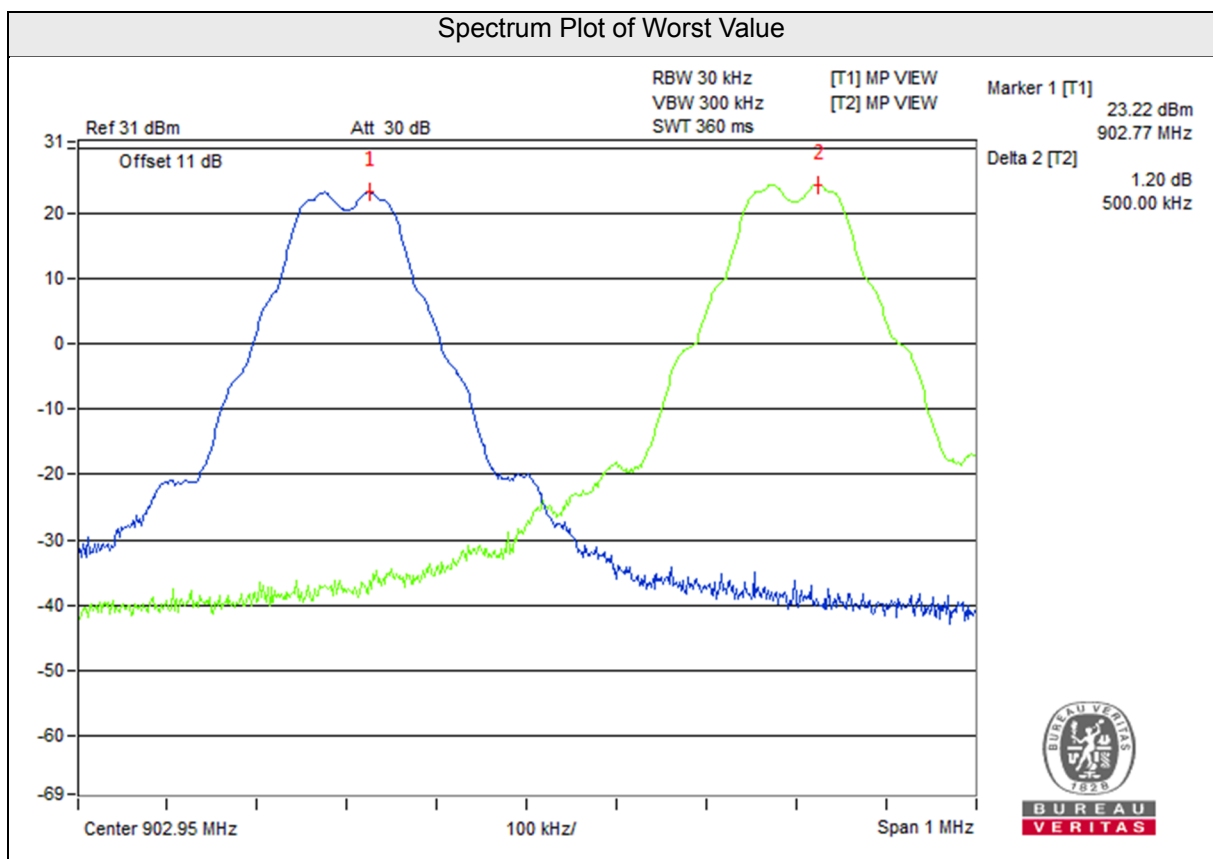
- a. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- b. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range.
- c. By using the MaxHold function record the separation of two adjacent channels.
- d. Measure the frequency difference of these two adjacent channels by SA MARK function. And then plot the result on SA screen.
- e. Repeat above procedures until all frequencies measured were complete.

### 4.6.5 Deviation from Test Standard

No deviation.

#### 4.6.6 Test Results

Channel	Frequency (MHz)	Adjacent Channel Separation (MHz)	Minimum Limit (MHz)	Pass / Fail
0	902.75	0.50	0.16	PASS
24	914.75	0.50	0.16	PASS
49	927.25	0.49	0.16	PASS

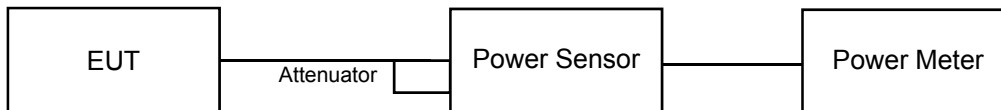


## 4.7 Maximum Output Power

### 4.7.1 Limits of Maximum Output Power Measurement

For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels.

### 4.7.2 Test Setup



### 4.7.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

### 4.7.4 Test Procedure

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

### 4.7.5 Deviation from Test Standard

No deviation.

### 4.7.6 EUT Operating Condition

The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

### 4.7.7 Test Results

Channel	Frequency (MHz)	Output Power (mW)	Output Power (dBm)	Power Limit (dBm)	Pass / Fail
0	902.75	<b>794.328</b>	29.00	30	PASS
24	914.75	516.416	27.13	30	PASS
49	927.25	676.083	28.30	30	PASS

## **4.8 Conducted Out of Band Emission Measurement**

### **4.8.1 Limits Of Conducted Out of Band Emission Measurement**

Below  $-20\text{dB}$  of the highest emission level of operating band (in 100kHz RBW).

### **4.8.2 Test Instruments**

Refer to section 4.1.2 to get information of above instrument.

### **4.8.3 Test Procedure**

The transmitter output was connected to the spectrum analyzer via a low lose cable. Set both RBW and VBW of spectrum analyzer to 100 kHz and 300 kHz with suitable frequency span including 100 MHz bandwidth from band edge. The band edges was measured and recorded.

### **4.8.4 Deviation from Test Standard**

No deviation.

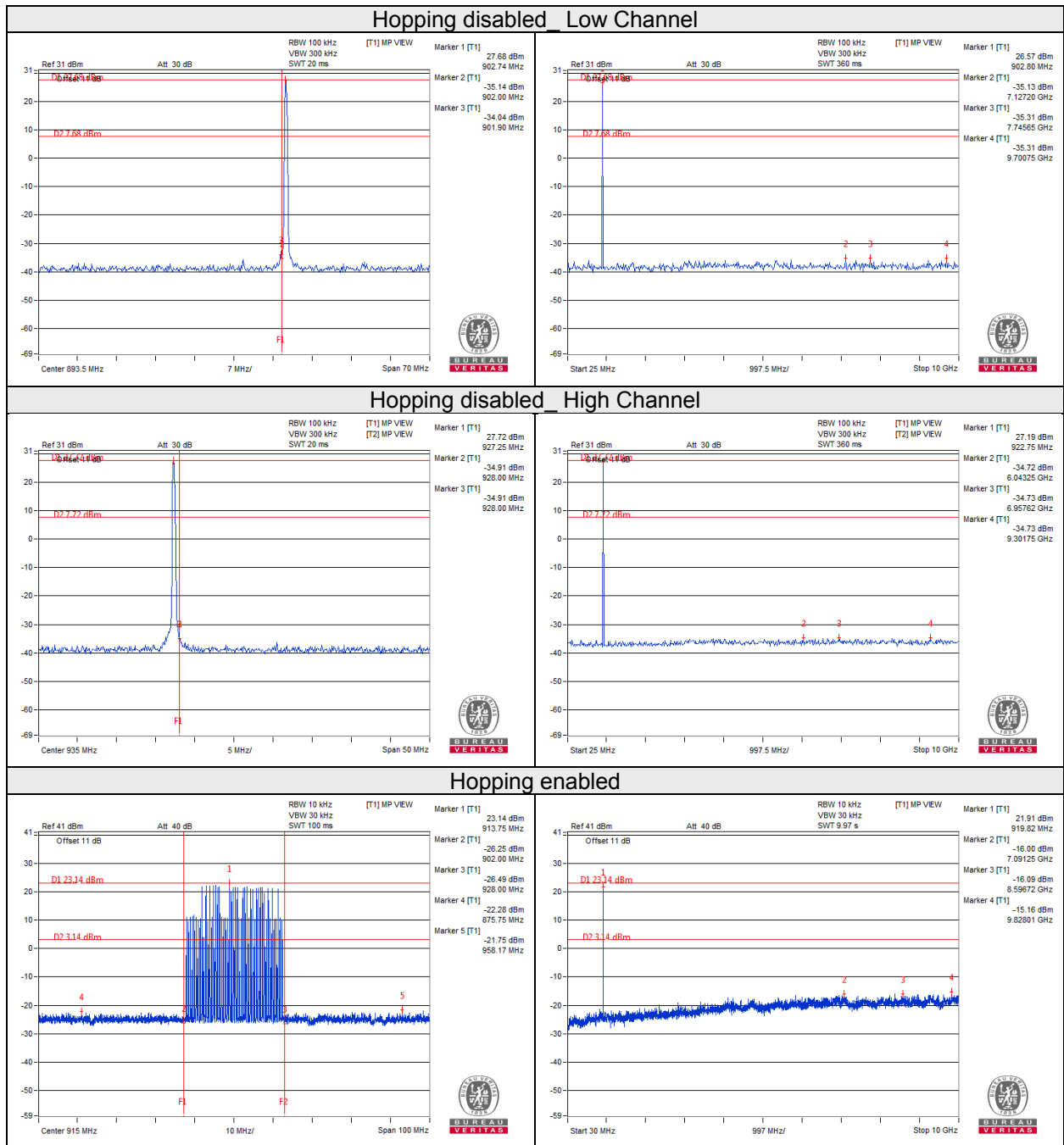
### **4.8.5 EUT Operating Condition**

The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

### **4.8.6 Test Results**

The spectrum plots are attached on the following images. D1 line indicates the highest level, D2 line indicates the 20dB offset below D1. It shows compliance with the requirement.





Note: Emissions in non-restricted frequency bands by radiated measurement comply with test requirement.

## 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 and approved according to ISO/IEC 17025.

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

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**Web Site:** [www.bureauveritas-adt.com](http://www.bureauveritas-adt.com)

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