FCC Test Report

Report No.:	RF180821C03A
FCC ID:	M82-BBWSW2C
Test Model:	BB-WSW2C42100-1
Series Model:	BB-WSW2C00015-1; BB-WSW2C00015-1XXXXXXXXXX ; BBWSW2C000151XXXXXXXXXX ; BB-WSW2C42100-1XXXXXXXXXX ; BBWSW2C421001XXXXXXXXXX (where "X" maybe any alphanumeric character, blank or "-" .)
Received Date:	Dec. 7, 2018
Test Date:	Dec. 19 ~ 20, 2018
Issued Date:	Dec. 28, 2018
Applicant:	ADVANTECH CO., LTD
Address:	No.1, Alley 20, Lane 26, Rueiguang Rd, Neihu District, Taipei, Taiwan 114
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

Testing Laboratory
2021

This report is for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence, provided, however, that such notice shall be in writing and shall specifically address the issue you wish to raise. A failure to raise such issue within the prescribed time shall constitute your unqualified acceptance of the completeness of this report, the tests conducted and the correctness of the report contents. Unless specific mention, the uncertainty of measurement has been explicitly taken into account to declare the compliance or non-compliance to the specification.
This report should not be used by the client to claim product certification, approval, or endorsement by TAF or any government agencies.

Table of Contents

Release Control Record 4

1 Certificate of Conformity 5

2 Summary of Test Results 6

2.1 Measurement Uncertainty 6
2.2 Modification Record 6

3 General Information 7

3.1 General Description of EUT 7
3.2 Description of Test Modes 9
3.2.1 Test Mode Applicability and Tested Channel Detail 10
3.3 Description of Support Units 11
3.3.1 Configuration of System under Test 11
3.4 General Description of Applied Standards 12

4 Test Types and Results 13

4.1 Radiated Emission and Bandedge Measurement 13
4.1.1 Limits of Radiated Emission and Bandedge Measurement 13
4.1.2 Test Instruments 14
4.1.3 Test Procedures 15
4.1.4 Deviation from Test Standard 15
4.1.5 Test Setup 16
4.1.6 EUT Operating Conditions 17
4.1.7 Test Results 18
4.2 Conducted Emission Measurement 30
4.2.1 Limits of Conducted Emission Measurement 30
4.2.2 Test Instruments 30
4.2.3 Test Procedures 31
4.2.4 Deviation from Test Standard 31
4.2.5 Test Setup 31
4.2.6 EUT Operating Condition 31
4.2.7 Test Results 32
4.3 Number of Hopping Frequency Used 36
4.3.1 Limits of Hopping Frequency Used Measurement 36
4.3.2 Test Setup 36
4.3.3 Test Instruments 36
4.3.4 Test Procedure 36
4.3.5 Deviation fromTest Standard 36
4.3.6 Test Results 37
4.4 Dwell Time on Each Channel 38
4.4.1 Limits of Dwell Time on Each Channel Measurement 38
4.4.2 Test Setup 38
4.4.3 Test Instruments 38
4.4.4 Test Procedures 38
4.4.5 Deviation from Test Standard 38
4.4.6 Test Results 39
4.5 Channel Bandwidth 40
4.5.1 Limits of Channel Bandwidth Measurement 40
4.5.2 Test Setup 40
4.5.3 Test Instruments 40
4.5.4 Test Procedure 40
4.5.5 Deviation from Test Standard 40
4.5.6 EUT Operating Condition 40
4.5.7 Test Results 41
4.6 Hopping Channel Separation 42
4.6.1 Limits of Hopping Channel Separation Measurement 42

4.6.2 Test Setup 42
4.6.3 Test Instruments 42
4.6.4 Test Procedure 42
4.6.5 Deviation from Test Standard 42
4.6.6 Test Results 43
4.7 Conducted Output Power Measurement 44
4.7.1 Limits of Conducted Output Power Measurement 44
4.7.2 Test Setup 44
4.7.3 Test Instruments 44
4.7.4 Test Procedure 44
4.7.5 Deviation from Test Standard 44
4.7.6 EUT Operating Condition 44
4.7.7 Test Results 44
4.8 Conducted Out of Band Emission Measurement 45
4.8.1 Limits of Conducted Out Of Band Emission Measurement 45
4.8.2 Test Setup 45
4.8.3 Test Instruments 45
4.8.4 Test Procedure 45
4.8.5 Deviation from Test Standard 45
4.8.6 EUT Operating Condition 45
4.8.7 Test Results 45

5 Pictures of Test Arrangements 47

Appendix – Information of the Testing Laboratories 48

Release Control Record

Issue No.	Description	Date Issued
RF180821C03A	Original release	Dec. 28, 2018

1 Certificate of Conformity

Product:	Industrial LoRaWAN node
Brand:	Advantech
Test Model:	BB-WSW2C42100-1
Series Model:	BB-WSW2C00015-1; BB-WSW2C00015-1XXXXXXXXXX ; BBWSW2C000151XXXXXXXXXX ; BB-WSW2C42100-1XXXXXXXXXX ; BBWSW2C421001XXXXXXXXXX (where "X" maybe any alphanumeric character, blank or "-" .)
Sample Status:	Engineering Sample
Applicant:	ADVANTECH CO., LTD
Test Date:	Dec. 19 ~ 20, 2018
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 : _____ , **Date:** Dec. 28, 2018

Celia Chen / Supervisor

Approved by : _____ , **Date:** Dec. 28, 2018

Rex Lai / Associate Technical Manager

2 Summary of Test Results

(125kHz Bandwidth, 64 channels)

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 -3.48dB at 0.15687MHz.
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)	1. Hopping Channel Separation 2. 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 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -5.5dB at 4511.50MHz.
15.247(d)	Antenna Port Emission	Pass	Meet the requirement of limit.
15.203	Antenna Requirement	Pass	Antenna connector is SMA Male Reverse not a standard connector.

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	2.94 dB
Radiated Emissions up to 1 GHz	30MHz ~ 200MHz	3.59 dB
	200MHz ~1000MHz	3.60 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	Industrial LoRaWAN node
Brand	Advantech
Test Model	BB-WSW2C42100-1
Series Model	BB-WSW2C00015-1; BB-WSW2C00015-1XXXXXXXXXX ; BBWSW2C000151XXXXXXXXXX ; BB-WSW2C42100-1XXXXXXXXXX ; BBWSW2C421001XXXXXXXXXX (where "X" maybe any alphanumeric character, blank or "-" .)
Model Difference	Refer to Note
Sample Status	Engineering Sample
Power Supply Rating	DC 9-36Vdc Battery 7.2Vdc USB 5Vdc
Modulation Type	LoRaWAN
Transfer Rate	980~21900 bit/sec
Operating Frequency	902.3~914.9MHz
Number of Channel	64
Channel Spacing	0.2MHz
Output Power	77.446mW
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	NA
Cable Supplied	1.5m non-shielded power cable without core

Note:

1. The EUT support 125kHz bandwidth only and without hybrid mode.
2. The following models are provided to the EUT.

Brand	Model	Description
Advantech	BB-WSW2C00015-1	LoRaWAN node w/RS485, external antenna (915MHz)
	BB-WSW2C00015-1XXXXXXXXXX	
	BBWSW2C000151XXXXXXXXXX	
	BB-WSW2C42100-1	LoRaWAN node with power monitoring, 4 x AI, 2 x DI, 1 x DO, conduit, external antenna (915 MHz)
	BB-WSW2C42100-1XXXXXXXXXX	
	BBWSW2C421001XXXXXXXXXX	
(where "X" maybe any alphanumeric character, blank or "-" .)		

For the test, model: BB-WSW2C42100-1 was selected as a representative one and therefore only its test data was recorded in this report.

3. The EUT uses following battery*2.

Brand	Tekcell
Model	SB-AA11
Rating	3.6Vdc

4. The following antenna was provided to the EUT.

Antenna Type	Antenna Connector	Brand	Model	Gain
Dipole	SMA Male Reverse	Advantech	AN0891-74S01BRS	2.01dBi

5. For Radiated Emissions, the EUT was pre-tested with the following modes.
- EUT powered from Battery
- EUT powered from 9Vdc source
- EUT powered from 36Vdc source
- EUT powered from 5Vdc USB

The worst emission level was found when the EUT tested under EUT powered from Battery.

6. For Conducted Emission, the EUT was pre-tested with the following modes.
- EUT powered from 9Vdc source
- EUT powered from 36Vdc source
- EUT powered from 5Vdc USB

The worst emission level was found when the EUT tested under EUT powered from 9Vdc source.

3.2 Description of Test Modes

64 channels are provided for EUT (125kHz Bandwidth):

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
0	902.3	16	905.5	32	908.7	48	911.9
1	902.5	17	905.7	33	908.9	49	912.1
2	902.7	18	905.9	34	909.1	50	912.3
3	902.9	19	906.1	35	909.3	51	912.5
4	903.1	20	906.3	36	909.5	52	912.7
5	903.3	21	906.5	37	909.7	53	912.9
6	903.5	22	906.7	38	909.9	54	913.1
7	903.7	23	906.9	39	910.1	55	913.3
8	903.9	24	907.1	40	910.3	56	913.5
9	904.1	25	907.3	41	910.5	57	913.7
10	904.3	26	907.5	42	910.7	58	913.9
11	904.5	27	907.7	43	910.9	59	914.1
12	904.7	28	907.9	44	911.1	60	914.3
13	904.9	29	908.1	45	911.3	61	914.5
14	905.1	30	908.3	46	911.5	62	914.7
15	905.3	31	908.5	47	911.7	63	914.9

3.2.1 Test Mode Applicability and Tested Channel Detail

(125kHz Bandwidth, 64 channels)

EUT Configure Mode	Applicable to				Description
	RE≥1G	RE<1G	PLC	APCM	
A	√	√		√	EUT powered from Battery
B		√	√		EUT powered from 9Vdc source
C			√		EUT powered from 36Vdc source

Where RE≥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 2 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.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type
A	0 to 63	0, 32, 63	LoRaWAN

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
A	0 to 63	0, 32, 63	LoRaWAN
B	0 to 63	0, 32, 63	LoRaWAN

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
B	0 to 63	32	LoRaWAN
C	0 to 63	32	LoRaWAN

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
A	0 to 63	0, 32, 63	LoRaWAN

Test Condition:

Applicable to	EUT Configure Mode	Environmental Conditions	Input Power	Tested by
RE≥1G	A	22 deg. C, 66% RH	7.2Vdc	Han Wu
RE<1G	A	22 deg. C, 66% RH	7.2Vdc	Han Wu
	B	22 deg. C, 66% RH	9Vdc	Han Wu
PLC	B	25 deg. C, 75% RH	9Vdc	Noah Chang
	C	25 deg. C, 75% RH	36Vdc	Noah Chang
APCM	A	25 deg. C, 60% RH	7.2Vdc	Chris Lin

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.

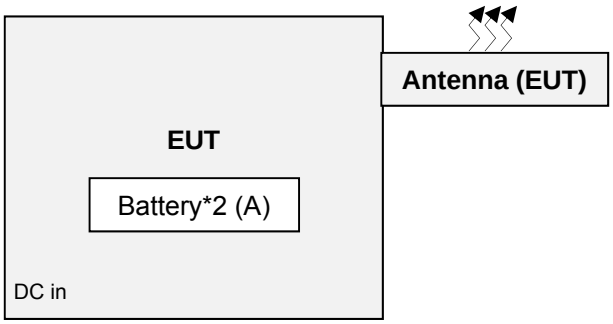
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Battery*2	Tekcell	SB-AA11	NA	NA	Provided by client
B.	DC Power Supply	Keysight	U8002A	MY56330015	NA	-

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

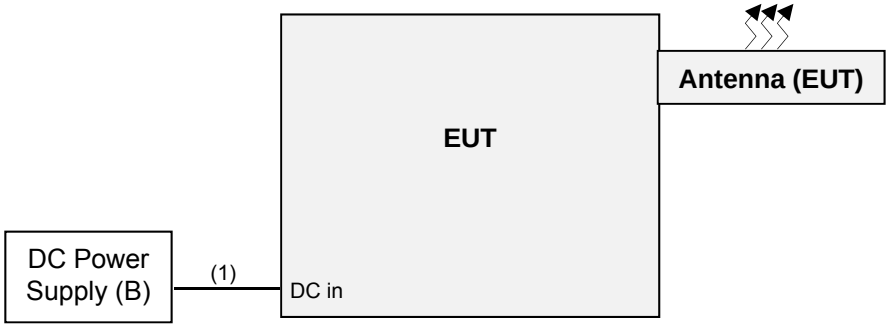
ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	Power cable	1	1.5	N	0	Accessory of EUT

3.3.1 Configuration of System under Test

For Mode A



For Mode B and Mode C



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)
KDB 558074 D01 15.247 Meas Guidance v05
ANSI C63.10:2013

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

4 Test Types and Results

4.1 Radiated Emission and Bandedge Measurement

4.1.1 Limits of Radiated Emission and Bandedge Measurement

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

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

Note:

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

4.1.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver KEYSIGHT	N9038A	MY55420137	Apr. 11, 2018	Apr. 10, 2019
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100269	May 29, 2018	May 28, 2019
BILOG Antenna SCHWARZBECK	VULB9168	9168-160	Nov. 21, 2018	Nov. 20, 2019
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-1169	Nov. 25, 2018	Nov. 24, 2019
Loop Antenna EMCI	EM-6879	269	Sep. 07, 2018	Sep. 06, 2019
Loop Preamplifier EMCI	EMC001340	980201	Jan. 23, 2018	Jan. 22, 2019
Preamplifier Agilent (Below 1GHz)	8447D	2944A10638	Aug. 08, 2018	Aug. 07, 2019
Preamplifier Agilent (Above 1GHz)	8449B	3008A02367	Feb. 22, 2018	Feb. 21, 2019
RF signal cable HUBER+SUHNER&EMCI	SUCOFLEX 104 & EMC104-SM- SM8000	CABLE-CH9-02 (248780+171006)	Jan. 15, 2018	Jan. 14, 2019
RF signal cable HUBER+SUHNER	SUCOFLEX 104	CABLE-CH9-(250795/4)	Aug. 08, 2018	Aug. 07, 2019
RF signal cable Woken	8D-FB	Cable-CH9-01	Jul. 31, 2018	Jul. 30, 2019
Software BV ADT	ADT_Radiated_ V7.6.15.9.5	NA	NA	NA
Antenna Tower EMCO	2070/2080	512.835.4684	NA	NA
Turn Table EMCO	2087-2.03	NA	NA	NA
Antenna Tower &Turn BV ADT	AT100	AT93021705	NA	NA
Turn Table BV ADT	TT100	TT93021705	NA	NA
Turn Table Controller BV ADT	SC100	SC93021705	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 9.
3. The FCC Designation Number is TW0003. The number will be varied with the Lab location and scope as attached.
4. The IC Site Registration No. is 7450F-9.

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:

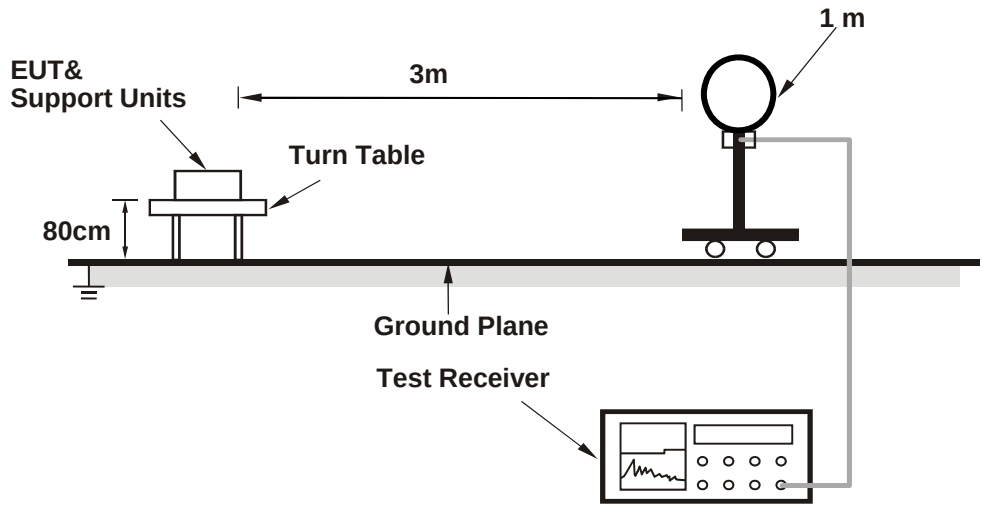
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) or Peak detection (PK) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at 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

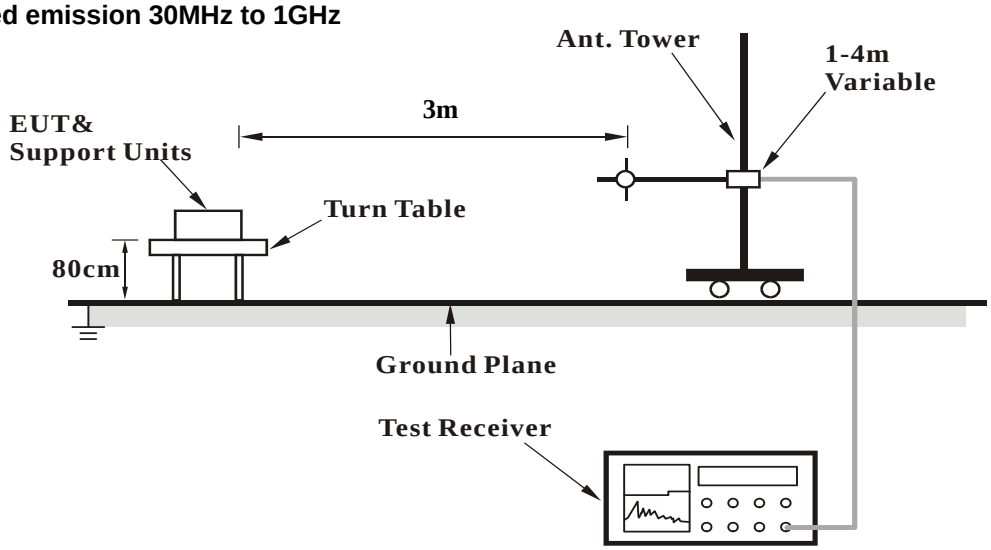
No deviation.

4.1.5 Test Setup

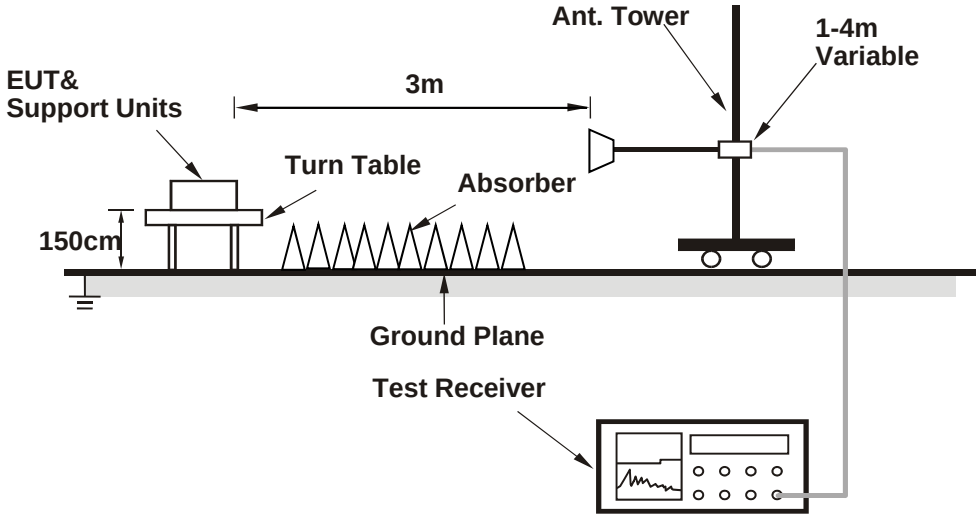
For Radiated emission below 30MHz



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

4.1.7 Test Results

CHANNEL	TX Channel 0	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 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	902.00	55.1 QP	87.5	-32.4	1.00 H	225	23.7	31.4
2	*902.30	107.5 QP			1.00 H	225	76.1	31.4
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	902.00	65.2 QP	97.9	-32.7	1.00 V	214	33.8	31.4
2	*902.30	117.9 QP			1.00 V	214	86.5	31.4

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. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 32	**DETECTOR FUNCTION**	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 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	*908.70	108.2 QP			1.00 H	222	76.5	31.7
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	*908.70	118.7 QP			1.00 V	210	87.0	31.7

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. " * ": Fundamental frequency.

CHANNEL	TX Channel 63	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 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	*914.90	108.9 QP			1.00 H	223	77.1	31.8
2	928.00	41.2 QP	88.9	-47.7	1.00 H	223	9.3	31.9
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	*914.90	119.0 QP			1.00 V	205	87.2	31.8
2	928.00	41.4 QP	99.0	-57.6	1.00 V	205	9.5	31.9

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.

ABOVE 1GHz DATA

CHANNEL	TX Channel 0	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 10GHz		
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	#1804.60	35.4 PK	74.0	-38.6	1.87 H	119	42.8	-7.4
2	#1804.60	24.7 AV	54.0	-29.3	1.87 H	119	32.1	-7.4
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	#1804.60	38.9 PK	74.0	-35.1	2.61 V	167	46.3	-7.4
2	#1804.60	35.0 AV	54.0	-19.0	2.61 V	167	42.4	-7.4
3	4511.50	51.6 PK	74.0	-22.4	2.95 V	98	51.9	-0.3
4	**4511.50**	**48.5 AV**	**54.0**	**-5.5**	**2.95 V**	**98**	**48.8**	**-0.3**

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 radiated frequency is out of the restricted band.

CHANNEL	TX Channel 32	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 10GHz		
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	1817.00	35.2 PK	74.0	-38.8	1.88 H	124	42.5	-7.3
2	1817.00	24.4 AV	54.0	-29.6	1.88 H	124	31.7	-7.3
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	1817.00	39.3 PK	74.0	-34.7	2.61 V	180	46.6	-7.3
2	1817.00	34.4 AV	54.0	-19.6	2.61 V	180	41.7	-7.3
3	4542.50	50.3 PK	74.0	-23.7	2.99 V	100	50.6	-0.3
4	4542.50	47.1 AV	54.0	-6.9	2.99 V	100	47.4	-0.3

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

CHANNEL	TX Channel 63	**DETECTOR FUNCTION**	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 10GHz		
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	1829.80	36.4 PK	74.0	-37.6	1.85 H	114	43.7	-7.3
2	1829.80	25.2 AV	54.0	-28.8	1.85 H	114	32.5	-7.3
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	1829.80	38.5 PK	74.0	-35.5	2.66 V	173	45.8	-7.3
2	1829.80	33.6 AV	54.0	-20.4	2.66 V	173	40.9	-7.3
3	4574.50	50.7 PK	74.0	-23.3	2.91 V	88	50.8	-0.1
4	4574.50	47.7 AV	54.0	-6.3	2.91 V	88	47.8	-0.1

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

BELOW 1GHz WORST-CASE 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	36.79	26.1 QP	40.0	-13.9	1.00 H	96	36.6	-10.5
2	50.37	23.4 QP	40.0	-16.6	1.00 H	1	33.2	-9.8
3	66.86	13.2 QP	40.0	-26.8	1.00 H	262	24.2	-11.0
4	101.78	20.1 QP	43.5	-23.4	1.00 H	15	33.5	-13.4
5	233.70	16.8 QP	46.0	-29.2	1.00 H	92	27.3	-10.5
6	317.12	16.9 QP	46.0	-29.1	1.00 H	15	24.3	-7.4
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	41.64	30.8 QP	40.0	-9.2	1.00 V	37	40.9	-10.1
2	50.37	27.8 QP	40.0	-12.2	1.00 V	14	37.6	-9.8
3	64.92	24.3 QP	40.0	-15.7	1.00 V	225	35.3	-11.0
4	101.78	23.7 QP	43.5	-19.8	1.00 V	47	37.1	-13.4
5	199.75	16.1 QP	43.5	-27.4	1.00 V	10	27.6	-11.5
6	316.15	17.3 QP	46.0	-28.7	1.00 V	0	24.7	-7.4

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. 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 32	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	34.85	32.6 QP	40.0	-7.4	1.00 H	55	43.4	-10.8
2	50.37	25.4 QP	40.0	-14.6	1.00 H	6	35.2	-9.8
3	64.92	22.2 QP	40.0	-17.8	1.00 H	6	33.2	-11.0
4	101.78	21.1 QP	43.5	-22.4	1.00 H	112	34.5	-13.4
5	171.62	21.0 QP	43.5	-22.5	1.00 H	191	30.6	-9.6
6	233.70	17.5 QP	46.0	-28.5	1.00 H	292	28.0	-10.5
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	33.88	28.2 QP	40.0	-11.8	1.00 V	331	38.9	-10.7
2	50.37	22.0 QP	40.0	-18.0	1.00 V	94	31.8	-9.8
3	64.92	18.1 QP	40.0	-21.9	1.00 V	260	29.1	-11.0
4	101.78	17.7 QP	43.5	-25.8	1.00 V	62	31.1	-13.4
5	233.70	16.7 QP	46.0	-29.3	1.00 V	6	27.2	-10.5
6	478.14	20.5 QP	46.0	-25.5	1.00 V	177	25.5	-5.0

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 63	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	34.85	29.6 QP	40.0	-10.4	1.00 H	73	40.4	-10.8
2	49.40	25.0 QP	40.0	-15.0	1.00 H	72	34.8	-9.8
3	64.92	20.3 QP	40.0	-19.7	1.00 H	17	31.3	-11.0
4	101.78	18.5 QP	43.5	-25.0	1.00 H	60	31.9	-13.4
5	233.70	16.0 QP	46.0	-30.0	1.00 H	205	26.5	-10.5
6	495.60	23.6 QP	46.0	-22.4	1.00 H	195	28.2	-4.6
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	34.85	26.4 QP	40.0	-13.6	1.00 V	271	37.2	-10.8
2	51.34	20.4 QP	40.0	-19.6	1.00 V	176	30.3	-9.9
3	64.92	16.4 QP	40.0	-23.6	1.00 V	6	27.4	-11.0
4	101.78	17.0 QP	43.5	-26.5	1.00 V	321	30.4	-13.4
5	233.70	16.8 QP	46.0	-29.2	1.00 V	282	27.3	-10.5
6	369.50	18.4 QP	46.0	-27.6	1.00 V	152	25.2	-6.8

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: 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	34.85	25.5 QP	40.0	-14.5	1.00 H	355	36.3	-10.8
2	50.37	23.3 QP	40.0	-16.7	1.00 H	309	33.1	-9.8
3	101.78	16.4 QP	43.5	-27.1	1.00 H	13	29.8	-13.4
4	171.62	20.3 QP	43.5	-23.2	1.00 H	67	29.9	-9.6
5	375.32	18.3 QP	46.0	-27.7	1.00 H	8	25.0	-6.7
6	497.54	26.1 QP	46.0	-19.9	1.00 H	354	30.7	-4.6
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	34.85	29.8 QP	40.0	-10.2	1.00 V	229	40.6	-10.8
2	49.40	23.8 QP	40.0	-16.2	1.00 V	1	33.6	-9.8
3	64.92	20.9 QP	40.0	-19.1	1.00 V	108	31.9	-11.0
4	101.78	18.0 QP	43.5	-25.5	1.00 V	286	31.4	-13.4
5	273.47	15.4 QP	46.0	-30.6	1.00 V	285	24.0	-8.6
6	418.00	19.5 QP	46.0	-26.5	1.00 V	199	25.4	-5.9

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 32	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	34.85	31.7 QP	40.0	-8.3	1.00 H	2	42.5	-10.8
2	41.64	24.9 QP	40.0	-15.1	1.00 H	231	35.0	-10.1
3	50.37	24.1 QP	40.0	-15.9	1.00 H	337	33.9	-9.8
4	64.92	20.8 QP	40.0	-19.2	1.00 H	169	31.8	-11.0
5	101.78	20.2 QP	43.5	-23.3	1.00 H	184	33.6	-13.4
6	426.73	29.0 QP	46.0	-17.0	1.00 H	217	34.7	-5.7
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	36.79	23.2 QP	40.0	-16.8	1.00 V	6	33.7	-10.5
2	64.92	18.3 QP	40.0	-21.7	1.00 V	6	29.3	-11.0
3	101.78	16.7 QP	43.5	-26.8	1.00 V	10	30.1	-13.4
4	232.73	14.9 QP	46.0	-31.1	1.00 V	6	25.5	-10.6
5	375.32	19.4 QP	46.0	-26.6	1.00 V	3	26.1	-6.7
6	517.91	25.0 QP	46.0	-21.0	1.00 V	355	29.2	-4.2

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 63	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	34.85	25.9 QP	40.0	-14.1	1.00 H	158	36.7	-10.8
2	50.37	21.3 QP	40.0	-18.7	1.00 H	175	31.1	-9.8
3	64.92	18.2 QP	40.0	-21.8	1.00 H	19	29.2	-11.0
4	101.78	18.5 QP	43.5	-25.0	1.00 H	32	31.9	-13.4
5	272.50	16.1 QP	46.0	-29.9	1.00 H	172	24.8	-8.7
6	374.35	18.7 QP	46.0	-27.3	1.00 H	189	25.4	-6.7
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	34.85	25.5 QP	40.0	-14.5	1.00 V	40	36.3	-10.8
2	48.43	19.8 QP	40.0	-20.2	1.00 V	9	29.6	-9.8
3	64.92	16.1 QP	40.0	-23.9	1.00 V	187	27.1	-11.0
4	101.78	16.4 QP	43.5	-27.1	1.00 V	192	29.8	-13.4
5	233.70	16.5 QP	46.0	-29.5	1.00 V	183	27.0	-10.5
6	368.53	18.3 QP	46.0	-27.7	1.00 V	341	25.1	-6.8

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.

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	ESCS30	100291	Sep. 03, 2018	Sep. 02, 2019
RF signal cable Woken	5D-FB	Cable-cond1-01	Sep. 05, 2018	Sep. 04, 2019
LISN ROHDE & SCHWARZ (EUT)	ENV216	101826	Feb. 26, 2018	Feb. 25, 2019
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Aug. 19, 2018	Aug. 18, 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 1.
3. The VCCI Site Registration No. is C-2040.

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.

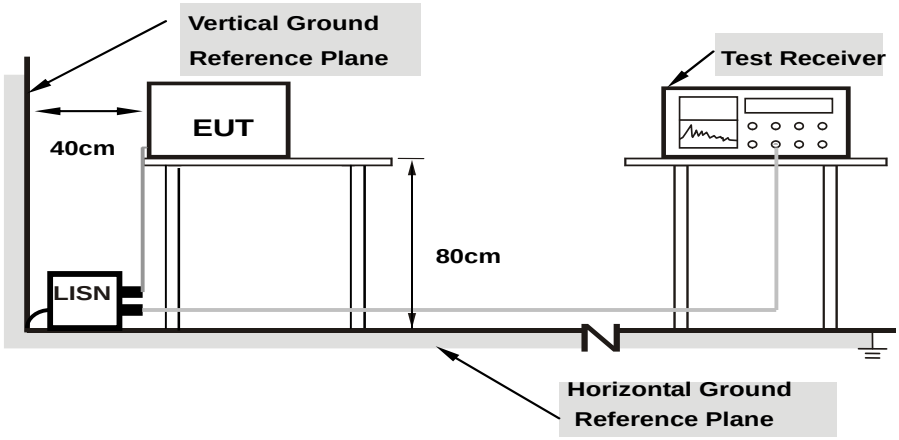
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

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 Condition

Same as 4.1.6.

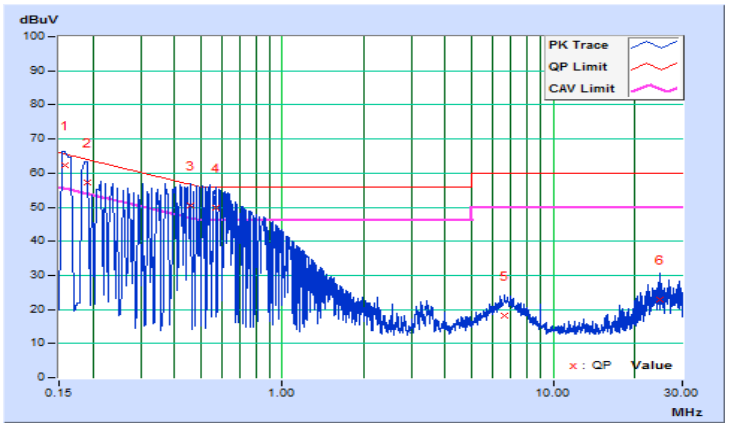
4.2.7 Test Results

Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Test Mode	Mode B		

Phase Of Power : Positive (+)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	**0.15687**	**9.67**	**52.48**	**22.29**	**62.15**	**31.96**	**65.63**	**55.63**	**-3.48**	**-23.67**
2	0.19000	9.67	47.52	17.57	57.19	27.24	64.04	54.04	-6.85	-26.80
3	0.45800	9.66	40.81	11.44	50.47	21.10	56.73	46.73	-6.26	-25.63
4	0.56591	9.66	40.29	10.96	49.95	20.62	56.00	46.00	-6.05	-25.38
5	6.61000	9.78	8.32	2.45	18.10	12.23	60.00	50.00	-41.90	-37.77
6	24.67800	9.91	12.86	0.70	22.77	10.61	60.00	50.00	-37.23	-39.39

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

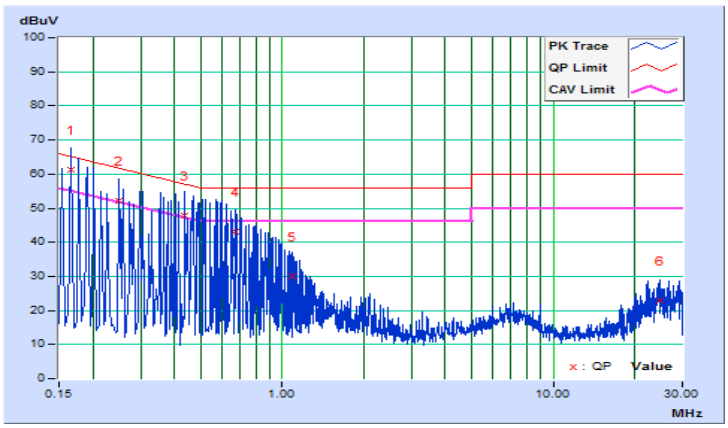


Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Test Mode	Mode B		

Phase Of Power : Negative (-)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16600	9.68	51.58	21.12	61.26	30.80	65.16	55.16	-3.90	-24.36
2	0.25000	9.67	42.50	12.98	52.17	22.65	61.76	51.76	-9.59	-29.11
3	0.43800	9.67	38.17	9.39	47.84	19.06	57.10	47.10	-9.26	-28.04
4	0.67400	9.66	33.51	6.00	43.17	15.66	56.00	46.00	-12.83	-30.34
5	1.08198	9.65	20.19	1.02	29.84	10.67	56.00	46.00	-26.16	-35.33
6	24.66600	10.03	12.97	0.80	23.00	10.83	60.00	50.00	-37.00	-39.17

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

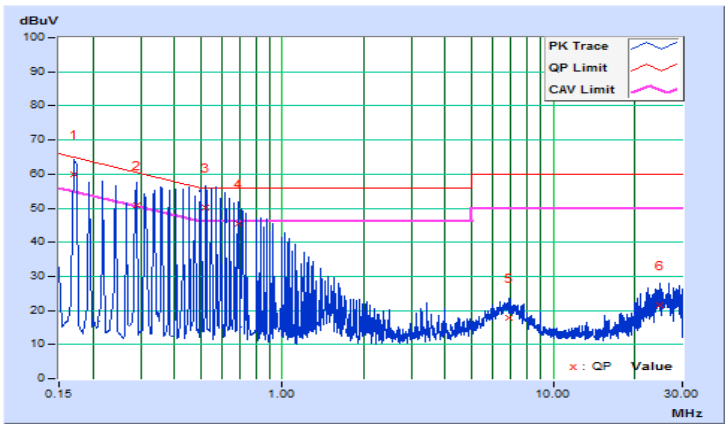


Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Test Mode	Mode C		

Phase Of Power : Positive (+)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.17022	9.67	50.37	20.35	60.04	30.02	64.95	54.95	-4.91	-24.93
2	0.29000	9.67	41.15	11.95	50.82	21.62	60.52	50.52	-9.70	-28.90
3	0.52200	9.66	40.58	11.21	50.24	20.87	56.00	46.00	-5.76	-25.13
4	0.68600	9.66	35.78	7.69	45.44	17.35	56.00	46.00	-10.56	-28.65
5	6.87400	9.79	8.05	2.50	17.84	12.29	60.00	50.00	-42.16	-37.71
6	24.64200	9.91	11.60	1.55	21.51	11.46	60.00	50.00	-38.49	-38.54

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

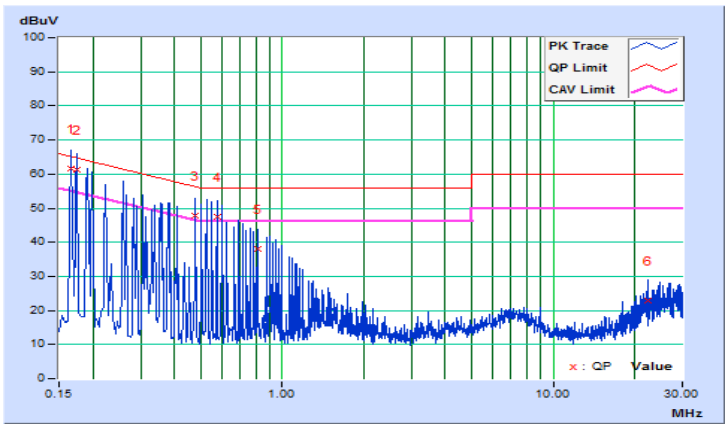


Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Test Mode	Mode C		

Phase Of Power : Negative (-)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16600	9.68	51.86	21.48	61.54	31.16	65.16	55.16	-3.62	-24.00
2	0.17400	9.68	51.51	21.21	61.19	30.89	64.77	54.77	-3.58	-23.88
3	0.47800	9.67	38.22	9.39	47.89	19.06	56.37	46.37	-8.48	-27.31
4	0.57400	9.66	37.96	9.03	47.62	18.69	56.00	46.00	-8.38	-27.31
5	0.81000	9.66	28.52	3.41	38.18	13.07	56.00	46.00	-17.82	-32.93
6	22.44600	10.02	12.85	0.03	22.87	10.05	60.00	50.00	-37.13	-39.95

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

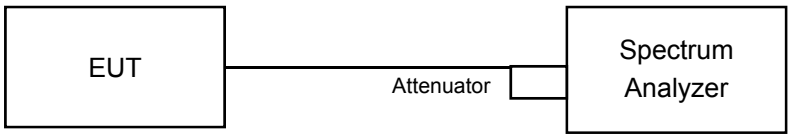


4.3 Number of Hopping Frequency Used

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

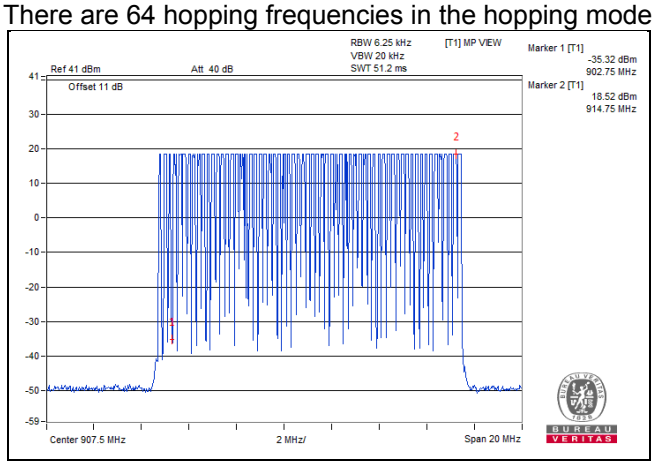
a. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
b. Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
c. 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.
d. Set the SA on View mode and then plot the result on SA screen.
e. Repeat above procedures until all frequencies measured were complete.

4.3.5 Deviation fromTest Standard

No deviation.

4.3.6 Test Results

There are 64 hopping frequencies in the hopping mode.

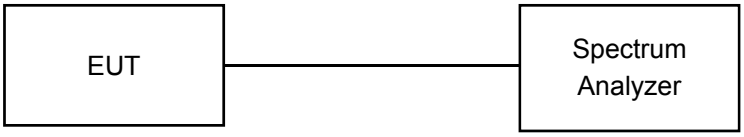


4.4 Dwell Time on Each Channel

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

a. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
b. 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.
c. 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.
d. Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.
e. Repeat above procedures until all different time-slot modes have been completed.

4.4.5 Deviation from Test Standard

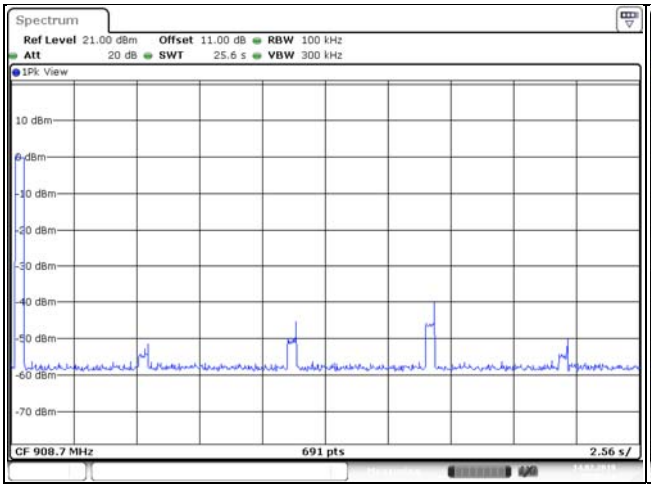
No deviation.

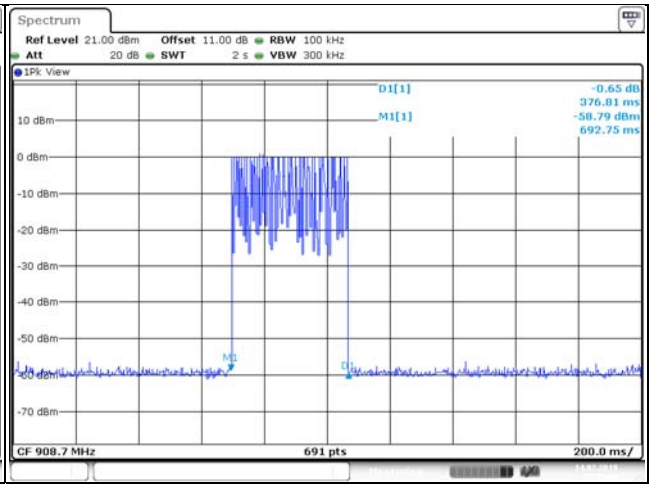
4.4.6 Test Results

Mode A

Number of transmission in 20 sec	Length of transmission time (msec)	Result (msec)	Limit (msec)
1 time	376	376	400

Note: Test plots of the transmitting time slot are shown on following.



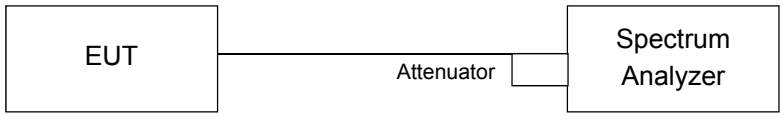


4.5 Channel Bandwidth

4.5.1 Limits of Channel Bandwidth Measurement

For frequency hopping systems operating in the 902–928 MHz band: if the 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.

4.5.2 Test Setup



4.5.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.5.4 Test Procedure

a. 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. Set a reference level on the measuring instrument equal to the highest peak value.
c. Measure the frequency difference of two frequencies that were attenuated 20dB from the reference level. Record the frequency difference as the emission bandwidth.
d. Repeat above procedures until all frequencies measured were complete.

4.5.5 Deviation from Test Standard

No deviation.

4.5.6 EUT Operating Condition

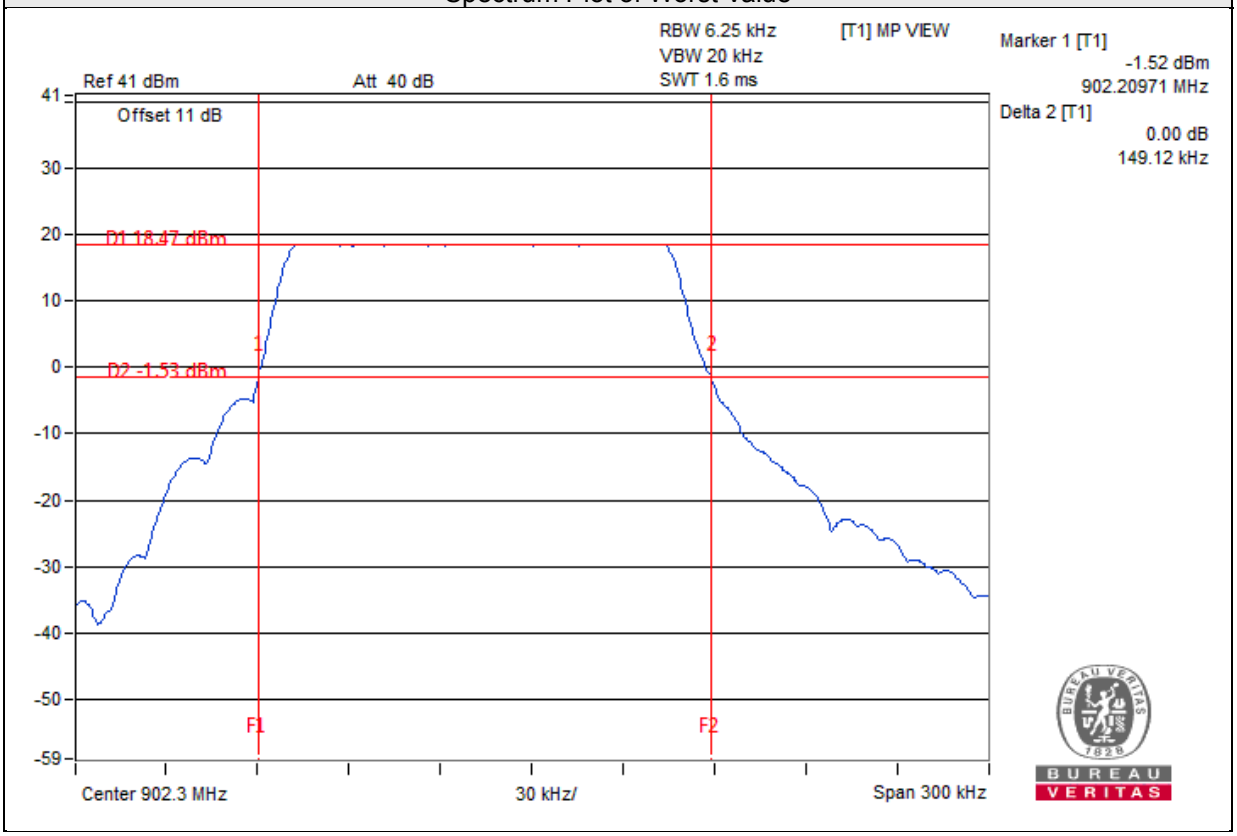
The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

4.5.7 Test Results

Mode A

Channel	Frequency (MHz)	20dB Bandwidth (MHz)
0	902.3	0.149
32	908.7	0.148
63	914.9	0.148

Spectrum Plot of Worst Value

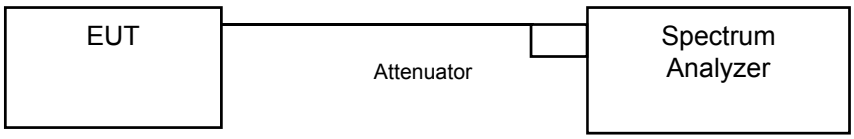


4.6 Hopping Channel Separation

4.6.1 Limits of Hopping Channel Separation Measurement

At least 25kHz or 20dB hopping channel bandwidth (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

Measurement Procedure REF

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.

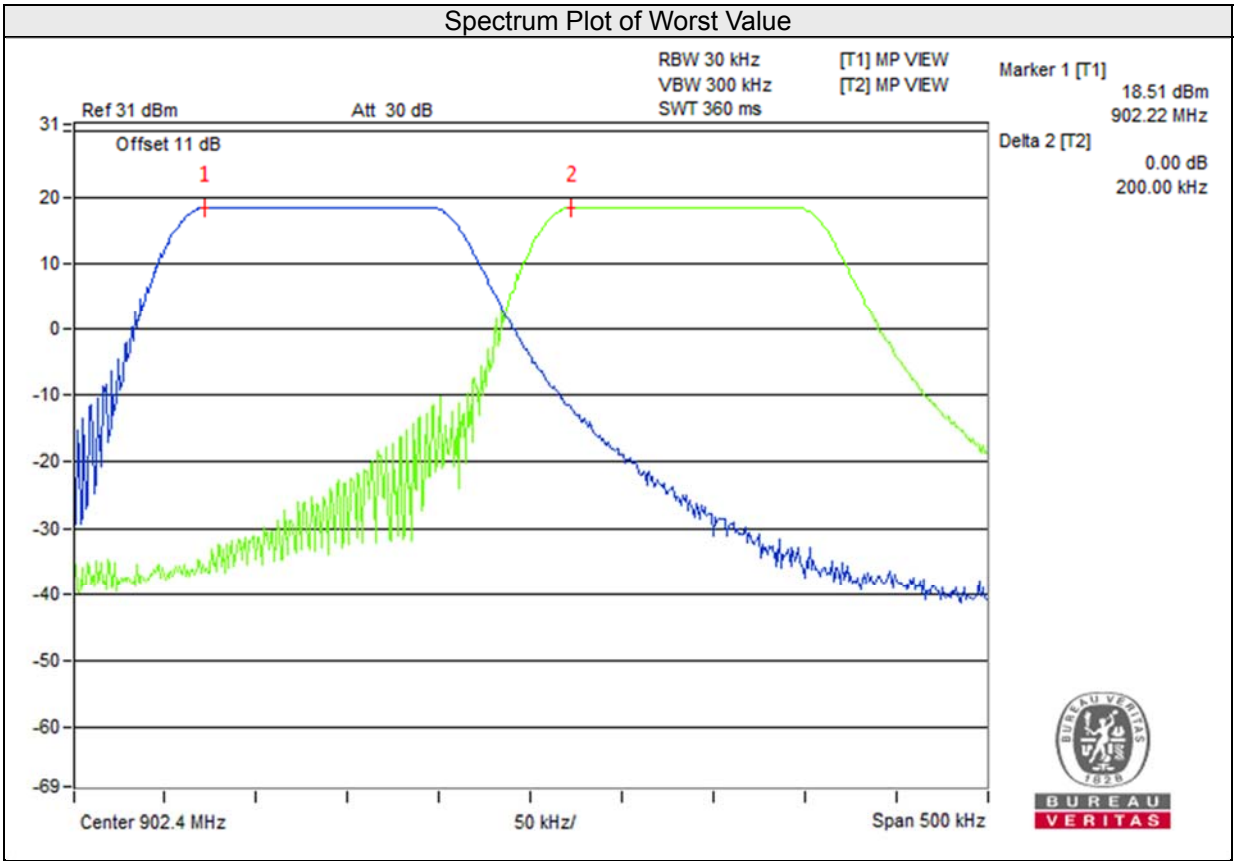
4.6.6 Test Results

Mode A

Channel	Frequency (MHz)	Adjacent Channel Separation (MHz)	Minimum Limit (MHz)	Pass / Fail
0	902.3	0.20	0.15	Pass
32	908.7	0.20	0.15	Pass
63	914.9	0.20	0.15	Pass

NOTE: The minimum limit is 20dB bandwidth.

Spectrum Plot of Worst Value

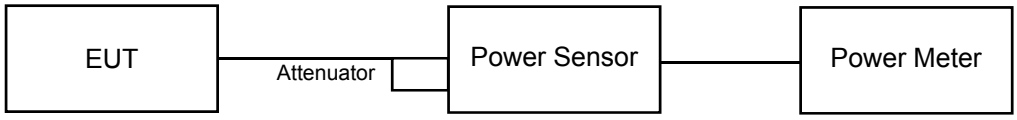


4.7 Conducted Output Power Measurement

4.7.1 Limits of Conducted Output Power Measurement

For systems using digital modulation in the 902-928 MHz bands: 1 Watt (30dBm)

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 peak 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

Mode A

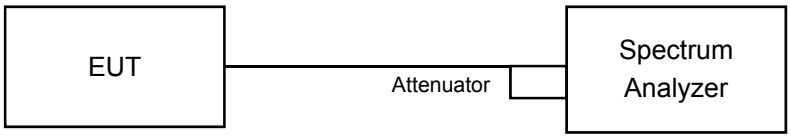
Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Power Limit (dBm)	Pass / Fail
0	902.3	77.268	18.88	30	Pass
32	908.7	**77.446**	18.89	30	Pass
63	914.9	77.268	18.88	30	Pass

4.8 Conducted Out of Band Emission Measurement

4.8.1 Limits of Conducted Out Of Band Emission Measurement

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

4.8.2 Test Setup



4.8.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.8.4 Test Procedure

Measurement Procedure REF

a. Set the RBW = 100 kHz.
b. Set the VBW ≥ 300 kHz.
c. Detector = peak.
d. Sweep time = auto couple.
e. Trace mode = max hold.
f. Allow trace to fully stabilize.
g. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

Measurement Procedure OOBE

a. Set RBW = 100 kHz.
b. Set VBW ≥ 300 kHz.
c. Detector = peak.
d. Sweep = auto couple.
e. Trace Mode = max hold.
f. Allow trace to fully stabilize.
g. Use the peak marker function to determine the maximum amplitude level.

4.8.5 Deviation from Test Standard

No deviation.

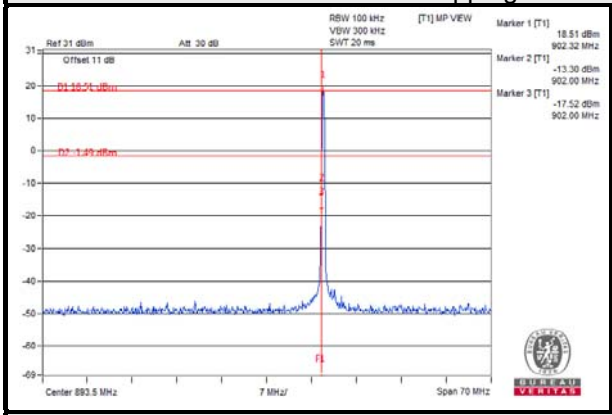
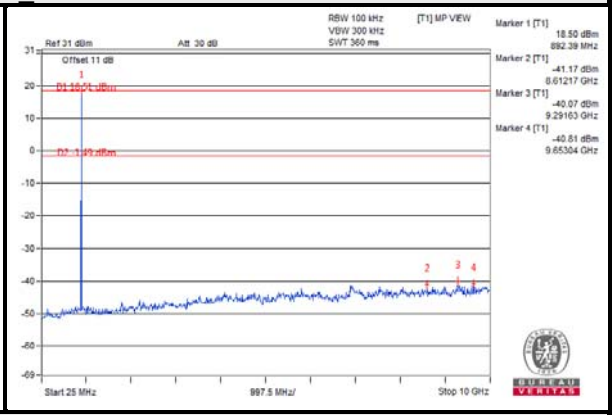
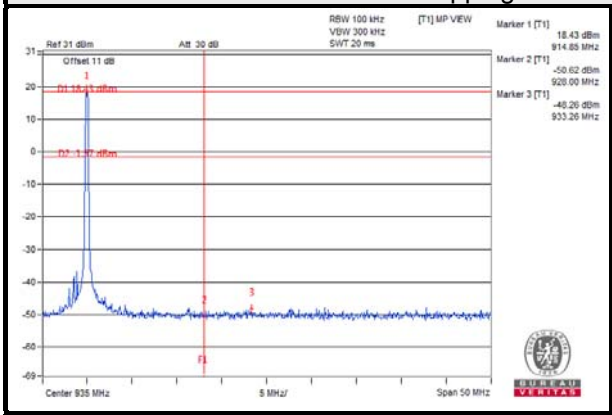
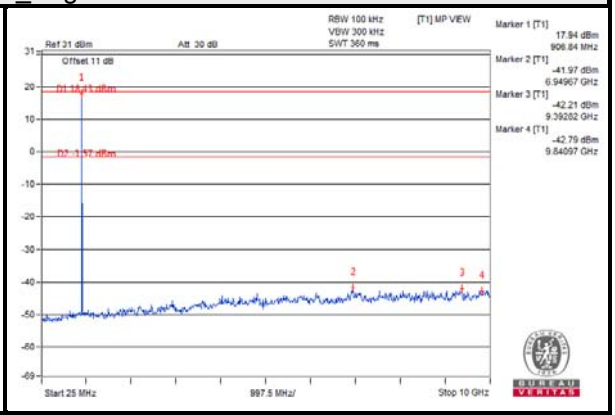
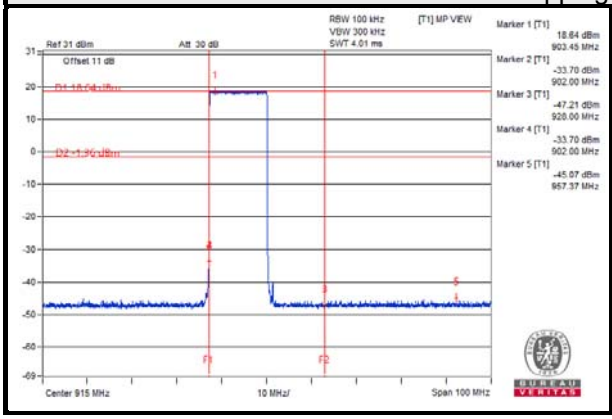
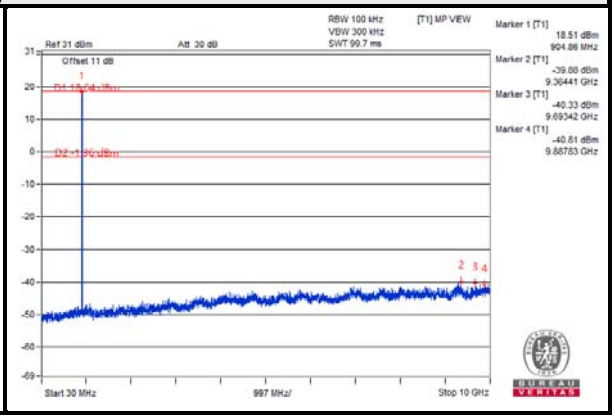
4.8.6 EUT Operating Condition

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

4.8.7 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.

Mode A

Hopping disabled_ Low Channel	
	
Hopping disabled_ High Channel	
	
Hopping enabled	
	

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:

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

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

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

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

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

--- END ---