

FCC Test Report

Report No.: RF190924C28-1

FCC ID: 2AQYP-3ABGPSW

Test Model: SNT3-ULTRA-V2-ABGPSW3(RCX)

Series Model: SNT3-ULTRA-V2-ABPSW3(RCX)
SNT3-ULTRA-V2-ABGPS3(RCX)
SNT3-ULTRA-V2-ABPS3(RCX)
SNT3-ULTRA-V2-ABGSW3(RCX)
SNT3-ULTRA-V2-ABSW3(RCX)
SNT3-ULTRA-V2-ABGS3(RCX)
SNT3-ULTRA-V2-ABS3(RCX) (Refer to section 3.1 for more details)

Received Date: Sep. 24, 2019

Test Date: Oct. 19 ~ Oct. 29, 2019

Issued Date: Oct. 30, 2019

Applicant: Sensolus NV

Address: Rijsenbergstraat 148D, 9000 Gent, Belgium

Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
Lin Kou Laboratories

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33383, Taiwan

FCC Registration /
Designation Number: 788550 / TW0003



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Release Control Record

Issue No.	Description	Date Issued
RF190924C28-1	Original Release	Oct. 30, 2019

1 Certificate of Conformity

Product: StickNTrack

Brand: Sensolus

Test Model: SNT3-ULTRA-V2-ABGPSW3(RCX)

Series Model: SNT3-ULTRA-V2-ABPSW3(RCX)
SNT3-ULTRA-V2-ABGPS3(RCX)
SNT3-ULTRA-V2-ABPS3(RCX)
SNT3-ULTRA-V2-ABGSW3(RCX)
SNT3-ULTRA-V2-ABSW3(RCX)
SNT3-ULTRA-V2-ABGS3(RCX)
SNT3-ULTRA-V2-ABS3(RCX) (Refer to section 3.1 for more details)

Sample Status: Mass Production

Applicant: Sensolus NV

Test Date: Oct. 19 ~ Oct. 29, 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 :



Date: Oct. 30, 2019

Gina Liu / Specialist

Approved by :



Date: Oct. 30, 2019

Dylan Chiou / 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	N/A	Without AC power port of the EUT
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)	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 -0.53 dB at 5420.325 MHz
15.247(d)	Band Edge Measurement	Pass	Meet the requirement of limit.
15.247(d)	Antenna Port Emission	Pass	Meet the requirement of limit.
15.203	Antenna Requirement	Pass	No antenna connector is used.

N/A: Not Applicable

Note:

1. If The Frequency Hopping System operating in 902-928 MHz band and 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.
2. 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) (±)
Radiated Emissions up to 1 GHz	9 kHz ~ 30 MHz	3.04 dB
	30 MHz ~ 200 MHz	2.93 dB
	200 MHz ~ 1000 MHz	2.95 dB
Radiated Emissions above 1 GHz	1 GHz ~ 18 GHz	2.26 dB
	18 GHz ~ 40 GHz	1.94 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	StickNTrack
Brand	Sensolus
Test Model	SNT3-ULTRA-V2-ABGPSW3(RCX)
Series Model	SNT3-ULTRA-V2-ABPSW3(RCX) SNT3-ULTRA-V2-ABGPS3(RCX) SNT3-ULTRA-V2-ABPS3(RCX) SNT3-ULTRA-V2-ABGSW3(RCX) SNT3-ULTRA-V2-ABSW3(RCX) SNT3-ULTRA-V2-ABGS3(RCX) SNT3-ULTRA-V2-ABS3(RCX)
Model Difference	Refer to note
Status of EUT	Mass Production
Power Supply Rating	3.6 Vdc (Battery)
Modulation Type	Uplink: DBPSK Downlink: GFSK
Operating Frequency	902.13 ~ 905.2 MHz
Number of Channel	54
Output Power	143.549 mW
Antenna Type	Metal PIFA, SMD mount antenna with -0.87 dBi gain
Antenna Connector	N/A
Accessory Device	N/A
Data Cable Supplied	N/A

Note:

1. The models of EUT are listed as below.

Model	Function list	Disable by SW or HW removed
Main SNT3-ULTRA-V2-ABGPSW3(RCX)	Function: Bluetooth, GPS, Pressure sensor, Sigfox, Wifi	All function
Variant-1 SNT3-ULTRA-V2-ABPSW3(RCX)	Function: Bluetooth, Pressure sensor, Sigfox, Wifi	Disable by HW remove (chip and related components)
Variant-2 SNT3-ULTRA-V2-ABGPS3(RCX)	Function: Bluetooth, GPS, Pressure sensor, Sigfox	Disable by HW remove (chip and related components)
Variant-3 SNT3-ULTRA-V2-ABPS3(RCX)	Function: Bluetooth, Pressure sensor, Sigfox	Disable by HW remove (chip and related components)
Variant-4 SNT3-ULTRA-V2-ABGSW3(RCX)	Function: Bluetooth, GPS, Sigfox, Wifi	Disable by HW remove (chip and related components)
Variant-5 SNT3-ULTRA-V2-ABSW3(RCX)	Function: Bluetooth, Sigfox, Wifi	Disable by HW remove (chip and related components)
Variant-6 SNT3-ULTRA-V2-ABGS3(RCX)	Function: Bluetooth, GPS, Sigfox	Disable by HW remove (chip and related components)
Variant-7 SNT3-ULTRA-V2-ABS3(RCX)	Function: Bluetooth, Sigfox	Disable by HW remove (chip and related components)

* The model: SNT3-ULTRA-V2-ABGPSW3(RCX) was chosen for final test.

Explain the product feature codes:

A = Amplifier on sigfox RF frontend

B = Bluetooth

G = GPS

P = Pressure sensor

S = Sigfox

W = Wifi scanning (passive)

2. The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or User's Manual.

3.2 Description of Test Modes

54 channels are provided to this EUT:

CH	Freq. (MHz)	CH	Freq. (MHz)	CH	Freq. (MHz)	CH	Freq. (MHz)	CH	Freq. (MHz)	CH	Freq. (MHz)
0	902.1375	10	902.5375	20	903.0875	30	903.6375	40	904.0375	50	904.5875
1	902.1625	11	902.5625	21	903.1125	31	903.6625	41	904.0625	51	904.6125
2	902.1875	12	902.7375	22	903.1375	32	903.6875	42	904.2375	52	904.6375
3	902.2125	13	902.7625	23	903.1625	33	903.7125	43	904.2625	53	905.2
4	902.2375	14	902.7875	24	903.3375	34	903.7375	44	904.2875		
5	902.2625	15	902.8125	25	903.3625	35	903.7625	45	904.3125		
6	902.4375	16	902.8375	26	903.3875	36	903.9375	46	904.3375		
7	902.4625	17	902.8625	27	903.4125	37	903.9625	47	904.3625		
8	902.4875	18	903.0375	28	903.4375	38	903.9875	48	904.5375		
9	902.5125	19	903.0625	29	903.4625	39	904.0125	49	904.5625		

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable To			Description
	RE \geq 1G	RE $<$ 1G	APCM	
-	√	√	√	-

Where **RE \geq 1G**: Radiated Emission above 1 GHz **RE $<$ 1G**: Radiated Emission below 1 GHz
APCM: Antenna Port Conducted Measurement

NOTE:

1. The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **Y-plane**
2. "-" means no effect.

Radiated Emission Test (Above 1 GHz):

- ☒ 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
-	0 to 53	0, 26, 53	DBPSK

Radiated Emission Test (Below 1 GHz):

- ☒ 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
-	0 to 53	26	DBPSK

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
-	0 to 53	0, 26, 53	DBPSK

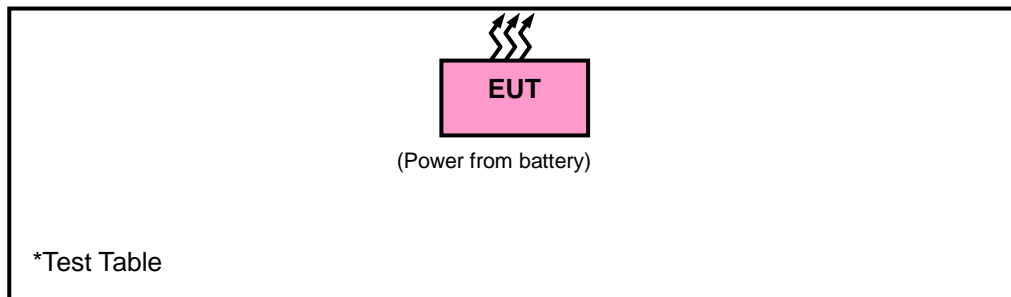
Test Condition:

Applicable To	Environmental Conditions	Input Power	Tested by
RE \geq 1G	25 deg. C, 65 % RH	3.6 Vdc	Tim-Chen
RE $<$ 1G	25 deg. C, 65 % RH	3.6 Vdc	Tim-Chen
APCM	25 deg. C, 65 % RH	3.6 Vdc	Wayne Lin

3.3 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units.

3.3.1 Configuration of System under Test



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)

FCC Public Notice DA 00-705

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 20 dB 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 1000 MHz, 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 20 dB under any condition of modulation.

4.1.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date of Calibration
Test Receiver Agilent	N9038A	MY51210203	Mar. 18, 2019	Mar. 17, 2020
Spectrum Analyzer Agilent	N9010A	MY52220314	Dec. 13, 2018	Dec. 12, 2019
Spectrum Analyzer ROHDE & SCHWARZ	FSU43	101261	Apr. 15, 2019	Apr. 14, 2020
BILOG Antenna SCHWARZBECK	VULB 9168	9168-472	Nov. 23, 2018	Nov. 22, 2019
HORN Antenna SCHWARZBECK	BBHA 9120D	9120D-969	Nov. 25, 2018	Nov. 24, 2019
Broadband Horn Antenna SCHWARZBECK	BBHA 9170	148	Nov. 25, 2018	Nov. 24, 2019
Fixed Attenuator WOKEN	MDCS18N-10	MDCS18N-10-01	Apr. 15, 2019	Apr. 14, 2020
Loop Antenna	HLA 6121	45745	Jul. 01, 2019	Jun. 30, 2020
Preamplifier EMCI	EMC001340	980201	Oct. 14, 2019	Oct. 13, 2020
Preamplifier EMCI	EMC 012645	980115	Oct. 08, 2019	Oct. 07, 2020
Preamplifier EMCI	EMC 184045	980116	Oct. 08, 2019	Oct. 07, 2020
Preamplifier EMCI	EMC 330H	980112	Oct. 08, 2019	Oct. 07, 2020
RF Coaxial Cable HUBER+SUHNNER	EMC104-SM-SM- 8000&3000	140811+170717	Oct. 08, 2019	Oct. 07, 2020
RF Coaxial Cable HUBER+SUHNNER	SUCOFLEX 104	EMC104-SM-SM- 1000(140807)	Oct. 08, 2019	Oct. 07, 2020
RF Coaxial Cable WOKEN	8D-FB	Cable-Ch10-01	Oct. 08, 2019	Oct. 07, 2020
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA
Software BV ADT	E3 6.120103	NA	NA	NA
Antenna Tower MF	MFA-440H	NA	NA	NA
Turn Table MF	MFT-201SS	NA	NA	NA
Antenna Tower & Turn Table Controller MF	MF-7802	NA	NA	NA

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HwaYa Chamber 10.

4.1.3 Test Procedures

For Radiated Emission below 30 MHz

- 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. Both 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 9 kHz at frequency below 30 MHz.

For Radiated Emission above 30 MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30 MHz ~ 1 GHz) / 1.5 meters (for above 1 GHz) 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 detected 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:

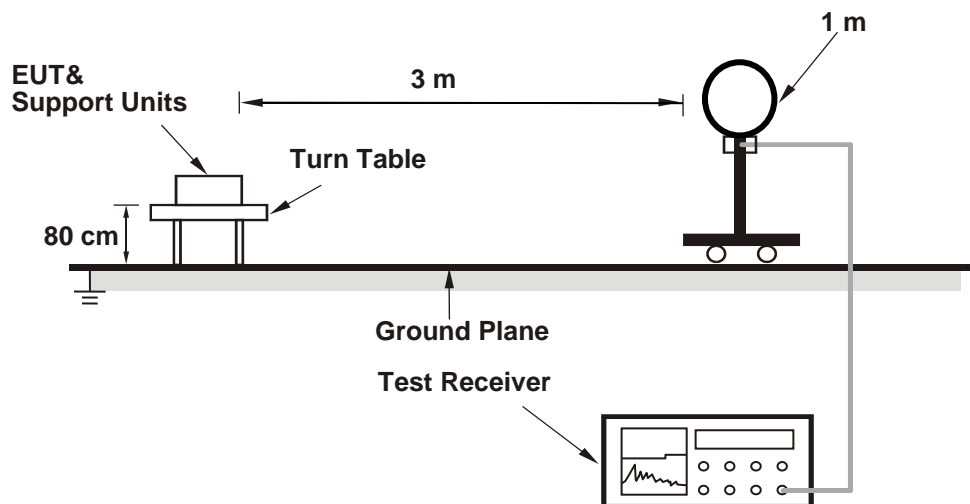
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) at frequency below 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1 GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is $\geq 1/T$ (Duty cycle < 98 %) or 10 Hz (Duty cycle ≥ 98 %) for Average detection (AV) at frequency above 1 GHz. (RBW = 1 MHz, VBW = 1 kHz)
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

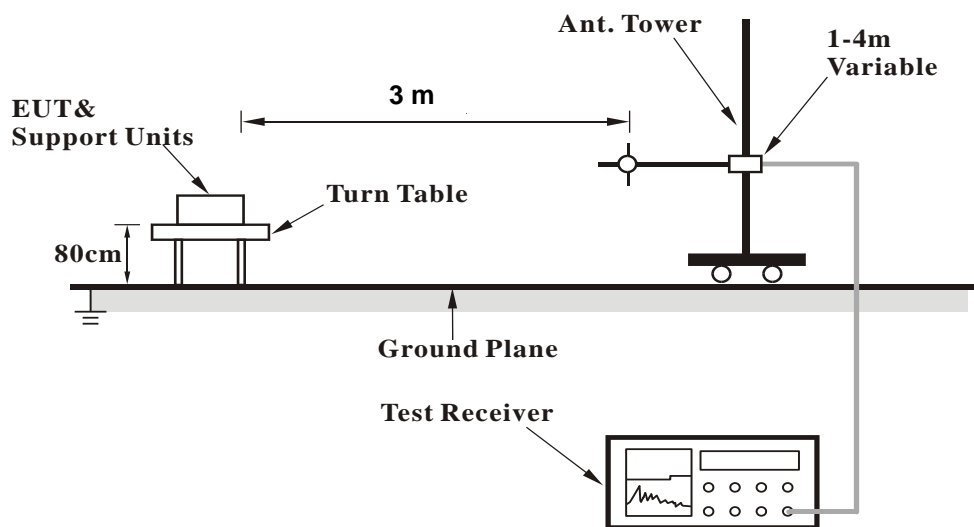
No deviation.

4.1.5 Test Set Up

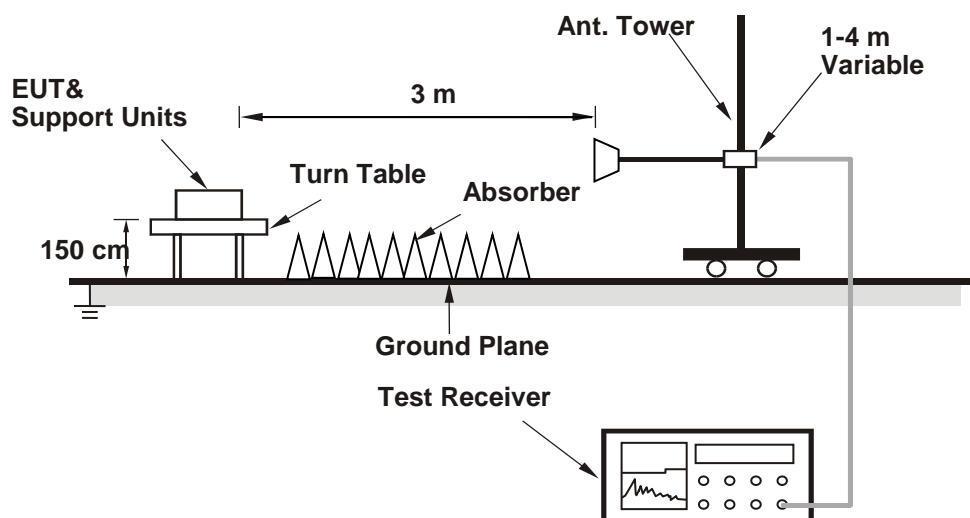
<Radiated Emission below 30 MHz>



<Radiated Emission 30 MHz to 1 GHz>



<Radiated Emission above 1 GHz>



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 1 GHz DATA :

EUT Test Condition		Measurement Detail	
Channel	Channel 0	Frequency Range	1 GHz ~ 10 GHz
Input Power	3.6 Vdc	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Tim-Chen

Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
*1804.274	39.17	62.82	-23.65	78.04	-38.87	200	83	Average
*1804.274	42.43	66.08	-23.65	98.04	-55.61	200	83	Peak
2706.411	49.75	70.1	-20.35	54	-4.25	109	309	Average
2706.411	51.74	72.09	-20.35	74	-22.26	109	309	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
*1804.274	39.02	62.67	-23.65	74.04	-35.02	172	128	Average
*1804.274	42.41	66.06	-23.65	94.04	-51.63	172	128	Peak
2706.411	48.78	69.13	-20.35	54	-5.22	134	70	Average
2706.411	50.94	71.29	-20.35	74	-23.06	134	70	Peak
*6314.959	49.31	60.08	-10.77	74.04	-24.73	193	98	Average
*6314.959	53.1	63.87	-10.77	94.04	-40.94	193	98	Peak

Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin value = Emission level – Limit value
- *: Out of Restricted Band

EUT Test Condition		Measurement Detail	
Channel	Channel 26	Frequency Range	1 GHz ~ 10 GHz
Input Power	3.6 Vdc	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Tim-Chen

Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
*1806.775	42.69	66.34	-23.65	78.12	-35.43	197	237	Average
*1806.775	45.22	68.87	-23.65	98.12	-52.9	197	237	Peak
2710.163	50.07	70.25	-20.18	54	-3.93	111	306	Average
2710.163	51.5	71.68	-20.18	74	-22.5	111	306	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
*1806.775	42.46	66.11	-23.65	73.42	-30.96	117	331	Average
*1806.775	44.87	68.52	-23.65	93.42	-48.55	117	331	Peak
5420.325	53.47	66.53	-13.06	54	-0.53	113	297	Average
5420.325	57.2	70.26	-13.06	74	-16.8	113	297	Peak
*6323.713	51.68	62.45	-10.77	73.42	-21.74	136	306	Average
*6323.713	54.05	64.82	-10.77	93.42	-39.37	136	306	Peak

Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin value = Emission level – Limit value
- *: Out of Restricted Band

EUT Test Condition		Measurement Detail	
Channel	Channel 53	Frequency Range	1 GHz ~ 10 GHz
Input Power	3.6 Vdc	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Tim-Chen

Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
*1809.325	42.97	66.56	-23.59	78.28	-35.31	163	218	Average
*1809.325	46.27	69.86	-23.59	98.28	-52.01	163	218	Peak
2713.988	48.92	69.1	-20.18	54	-5.08	106	316	Average
2713.988	51.51	71.69	-20.18	74	-22.49	106	316	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
*1809.325	43.07	66.66	-23.59	74.47	-31.4	139	83	Average
*1809.325	45.26	68.85	-23.59	94.47	-49.21	139	83	Peak
5427.975	52	65.02	-13.02	54	-2	136	94	Average
5427.975	54.67	67.69	-13.02	74	-19.33	136	94	Peak
*6332.638	51.53	62.26	-10.73	74.47	-22.94	142	101	Average
*6332.638	54.11	64.84	-10.73	94.47	-40.36	142	101	Peak

Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin value = Emission level – Limit value
- *: Out of Restricted Band

9 kHz ~ 30 MHz Data:

The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

30 MHz ~ 1 GHz Worst-Case Dada:

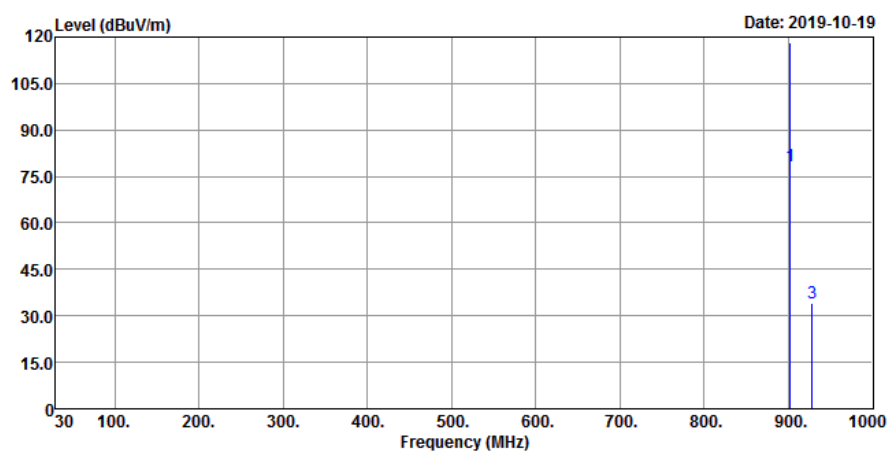
EUT Test Condition		Measurement Detail	
Channel	Channel 0	Frequency Range	30 MHz ~ 1 GHz
Input Power	3.6 Vdc	Detector Function	Peak (PK) Quasi-peak (QP)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Tim-Chen

Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
*902	78.25	82.71	-4.46	98.04	-19.79	144	153	QP
902.138	118.04	122.5	-4.46	-----	-----	144	153	QP
*928	34.1	37.05	-2.95	98.04	-63.94	144	153	QP
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
*902	73.11	77.57	-4.46	94.04	-20.93	160	75	QP
902.138	114.04	118.5	-4.46	-----	-----	160	75	QP
*928	31.25	34.2	-2.95	94.04	-62.79	160	75	QP

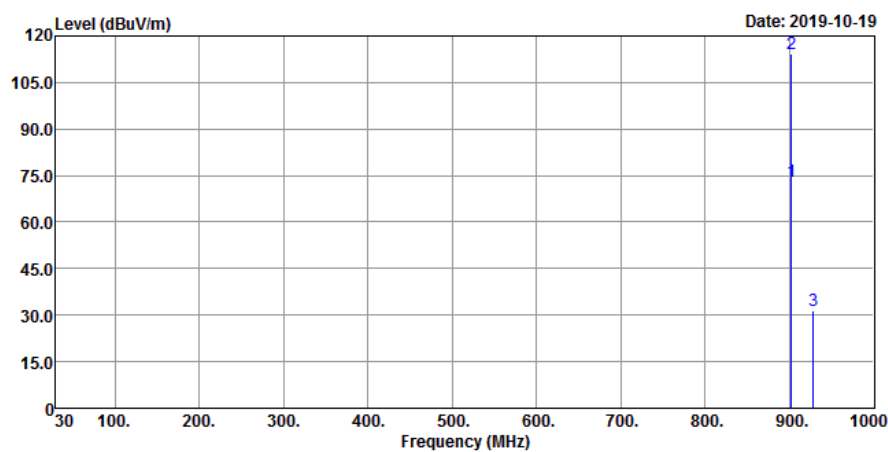
Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin value = Emission level – Limit value
- *: Out of Restricted Band

Horizontal



Vertical



EUT Test Condition		Measurement Detail	
Channel	Channel 26	Frequency Range	30 MHz ~ 1 GHz
Input Power	3.6 Vdc	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Tim-Chen

Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
*902	58.1	62.56	-4.46	98.12	-40.02	151	198	QP
903.388	118.12	122.5	-4.38	-----	-----	151	198	QP
*928	34.24	37.19	-2.95	98.12	-63.88	151	198	QP
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
*902	49.5	53.96	-4.46	93.42	-43.92	163	74	QP
903.388	113.42	117.8	-4.38	-----	-----	163	74	QP
*928	30.97	33.92	-2.95	93.42	-62.45	163	74	QP

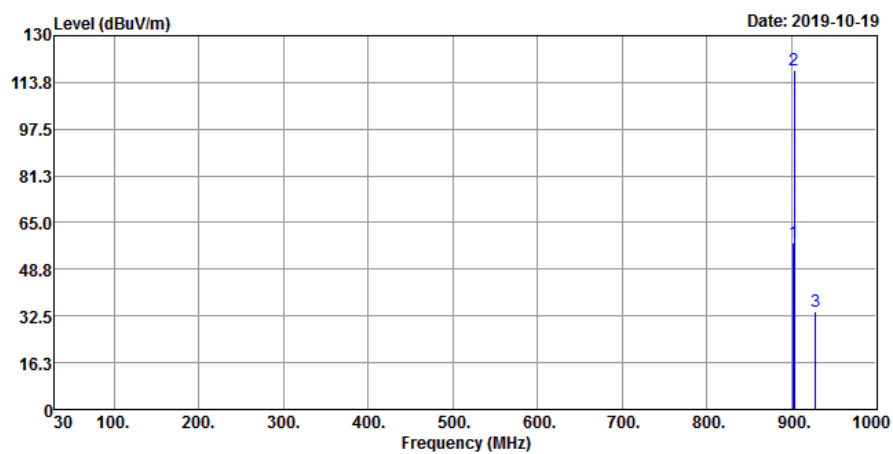
Remarks:

1. Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor

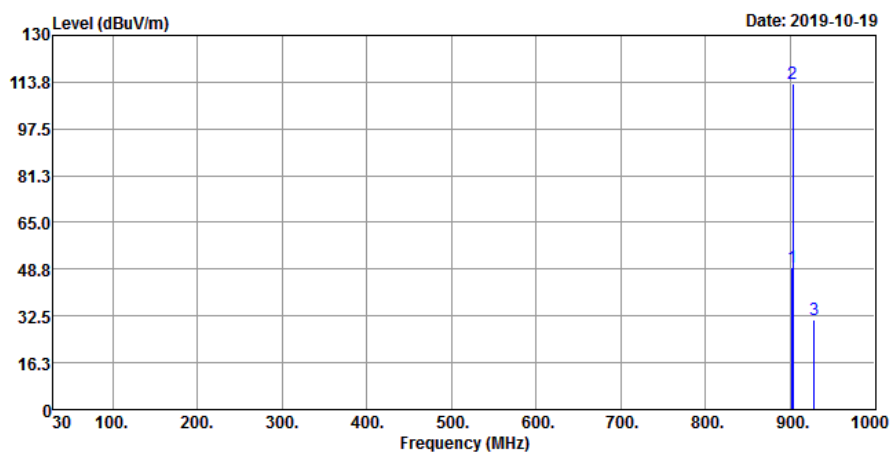
Margin value = Emission level – Limit value

2. *: Out of Restricted Band

Horizontal



Vertical



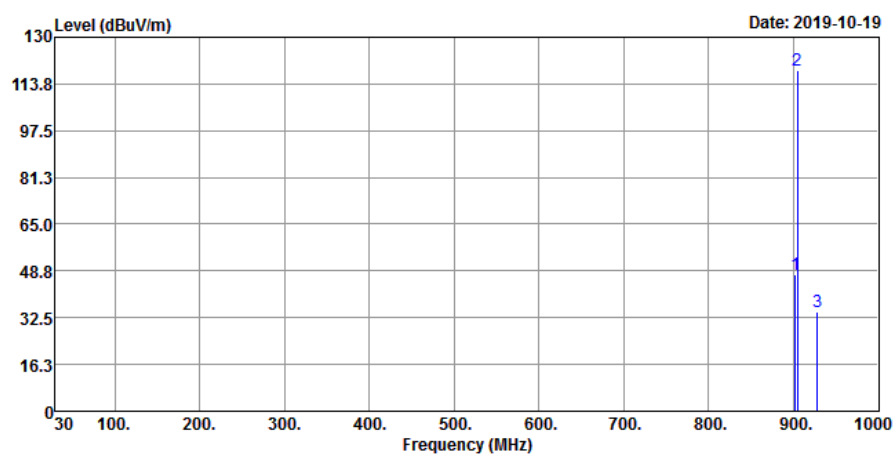
EUT Test Condition		Measurement Detail	
Channel	Channel 53	Frequency Range	30 MHz ~ 1 GHz
Input Power	3.6 Vdc	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Tim-Chen

Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
*902	47.61	52.07	-4.46	98.28	-50.67	146	171	QP
904.663	118.28	122.5	-4.22	-----	-----	146	171	QP
*928	34.44	37.39	-2.95	98.28	-63.84	146	171	QP
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
*902	40.33	44.79	-4.46	94.47	-54.14	161	72	QP
904.663	114.47	118.69	-4.22	-----	-----	161	72	QP
*928	31.34	34.29	-2.95	94.47	-63.13	161	72	QP

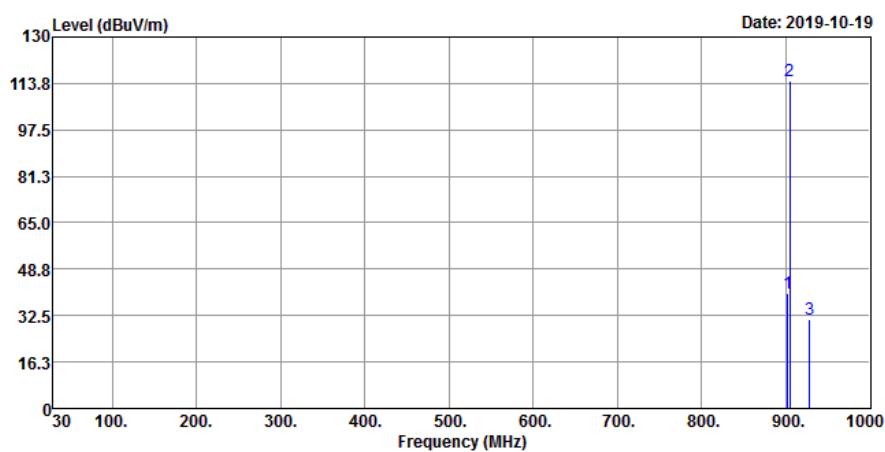
Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin value = Emission level – Limit value
- *: Out of Restricted Band

Horizontal



Vertical



EUT Test Condition		Measurement Detail	
Channel	Channel 26	Frequency Range	30 MHz ~ 1 GHz
Input Power	3.6 Vdc	Detector Function	Peak (PK) Quasi-peak (QP)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Tim-Chen

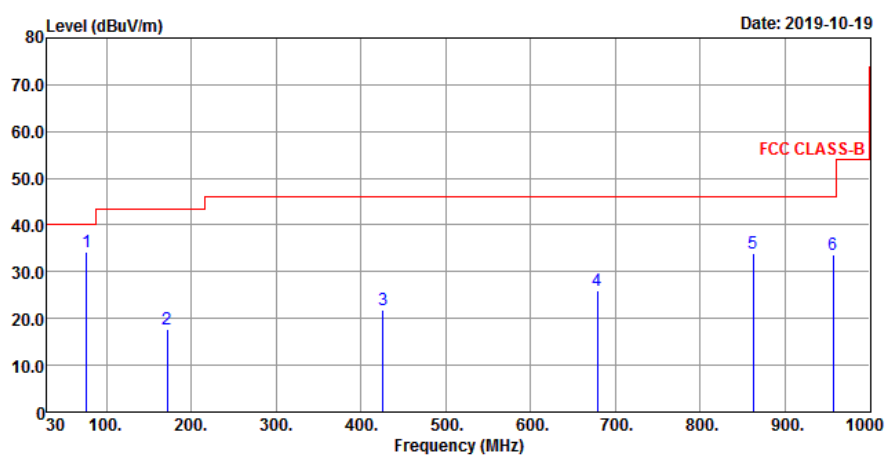
Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
76.56	34.21	55.29	-21.08	40	-5.79	135	241	Peak
171.62	17.61	35.4	-17.79	43.5	-25.89	198	306	Peak
425.76	21.8	34.28	-12.48	46	-24.2	129	67	Peak
678.93	25.91	32.93	-7.02	46	-20.09	108	113	Peak
862.26	33.86	38.05	-4.19	46	-12.14	169	168	Peak
956.35	33.68	36.78	-3.1	46	-12.32	112	100	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
35.82	33.5	50.67	-17.17	40	-6.5	131	299	Peak
134.76	19.13	37.38	-18.25	43.5	-24.37	111	39	Peak
346.22	19.47	34.36	-14.89	46	-26.53	151	147	Peak
605.21	23.17	31.47	-8.3	46	-22.83	103	307	Peak
767.2	26.51	31.1	-4.59	46	-19.49	129	94	Peak
949.56	28.42	31.29	-2.87	46	-17.58	113	189	Peak

Remarks:

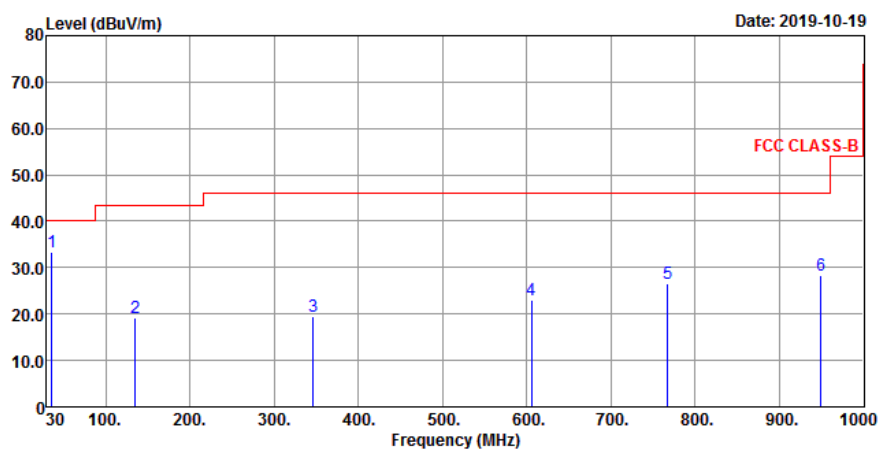
1. Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor

Margin value = Emission level – Limit value

Horizontal



Vertical

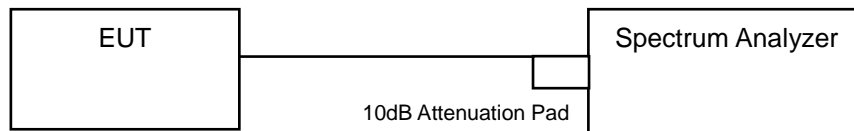


4.2 Number of Hopping Frequency Used

4.2.1 Limits of Hopping Frequency Used Measurement

At least 50 channels frequencies, and should be equally spaced, if the 20 dB bandwidth of the hopping channel is less than 250 kHz.

4.2.2 Test Setup



4.2.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.2.4 Test Procedure

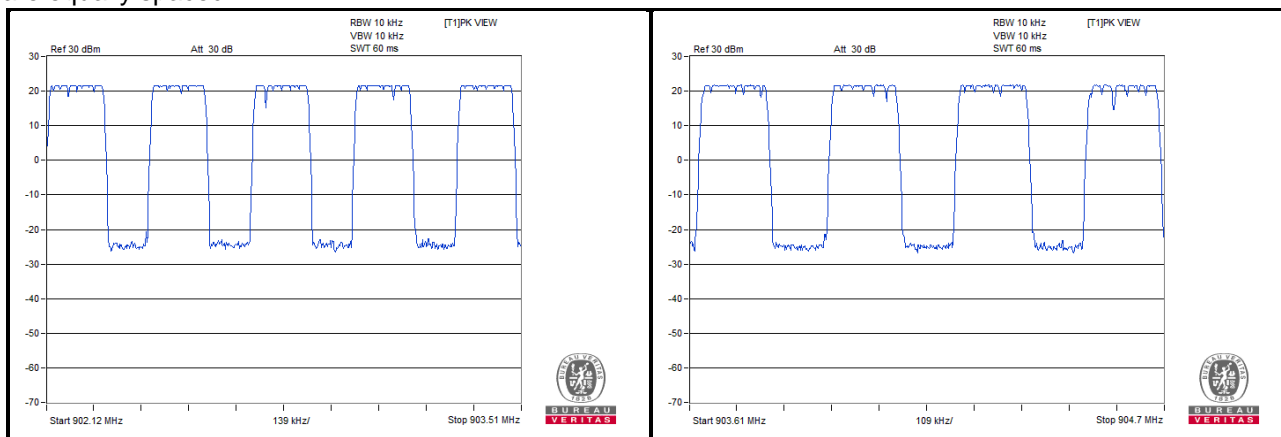
- Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
- Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make 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.

4.2.5 Deviation from Test Standard

No deviation.

4.2.6 Test Results

There are 54 hopping frequencies in the hopping mode. On the plots, it shows that the hopping frequencies are equally spaced.

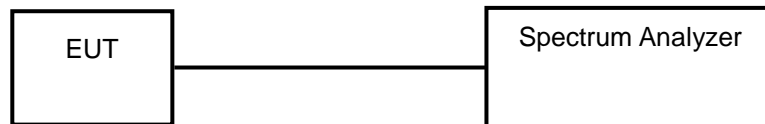


4.3 Dwell Time on Each Channel

4.3.1 Limits of Dwell Time on Each Channel Measurement

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 20 seconds multiplied by the number of hopping channels employed, if the 20 dB bandwidth of the hopping channel is less than 250 kHz.

4.3.2 Test Setup



4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.3.4 Test Procedures

- 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.

4.3.5 Deviation from Test Standard

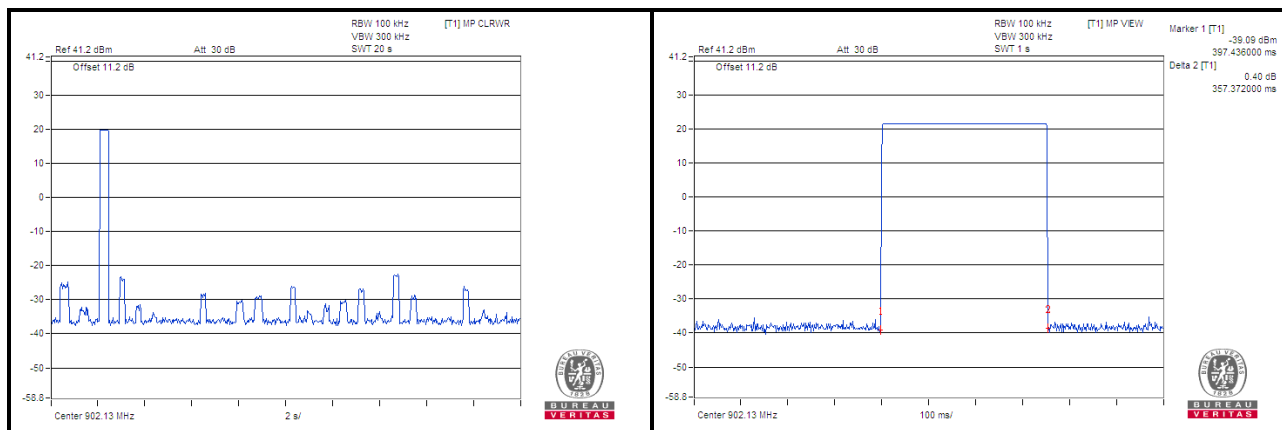
No deviation.

4.3.6 Test Results

Average Hopping Channel	Package Transfer Time (msec)	Result (msec)	Limit (sec)
54	357.37	385.96	0.4

NOTE:

- Test plots of the transmitting time slot are shown as below.
- Calculator Result = $54 * 0.4 \text{ s} * (1 \text{ time} / 20 \text{ s}) * 357.37 = 385.96$

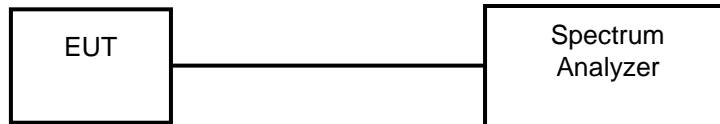


4.4 Channel Bandwidth

4.4.1 Limits of Channel Bandwidth Measurement

The 20 dB bandwidth of the hopping channel shall be less than 500 kHz.

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 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 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
- Repeat above procedures until all frequencies measured were complete.

4.4.5 Deviation from Test Standard

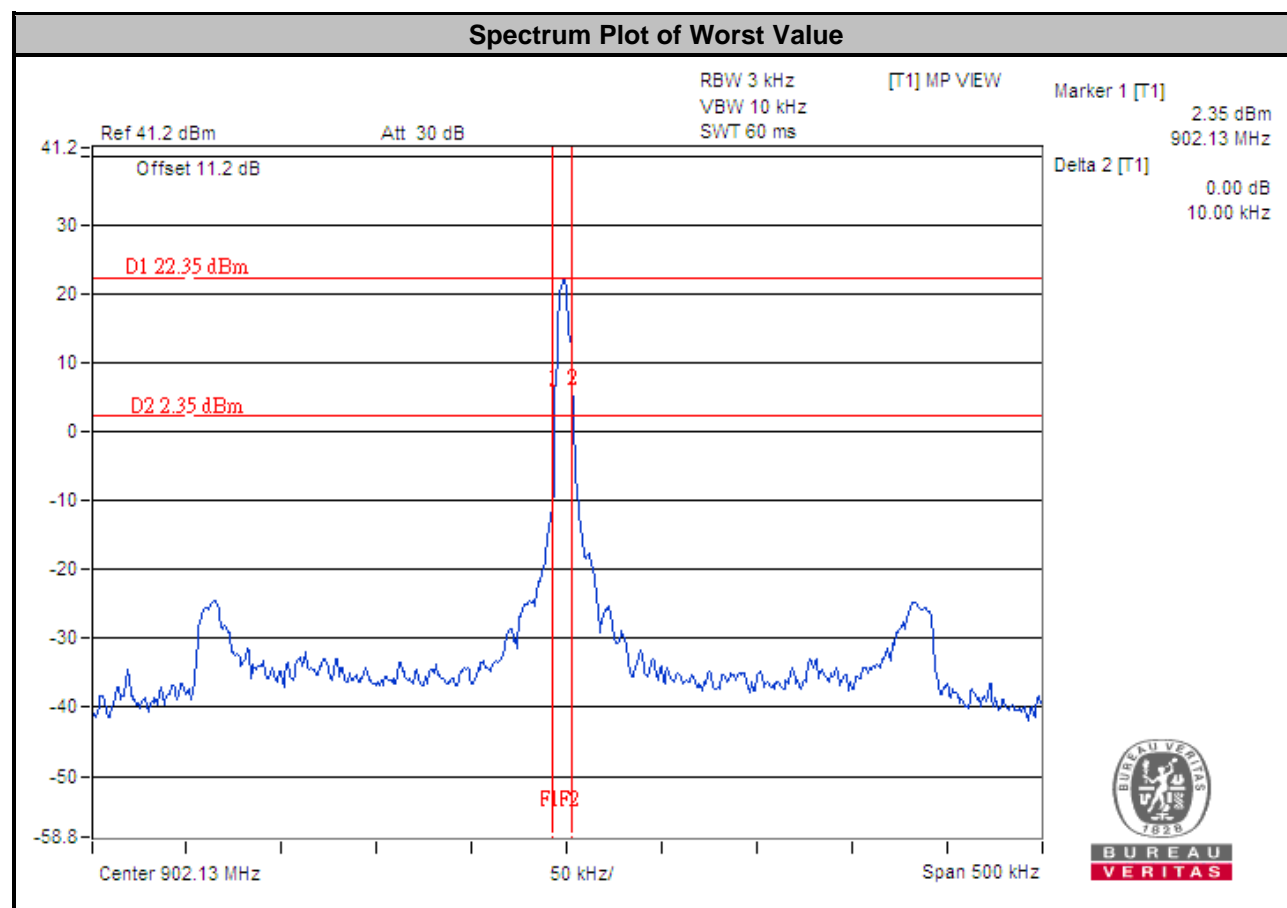
No deviation.

4.4.6 EUT Operating Condition

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

4.4.7 Test Results

Channel	Frequency (MHz)	20 dB Bandwidth (MHz)	Limit (kHz)
0	902.1375	0.01	500
26	903.3875	0.01	500
53	904.6625	0.01	500

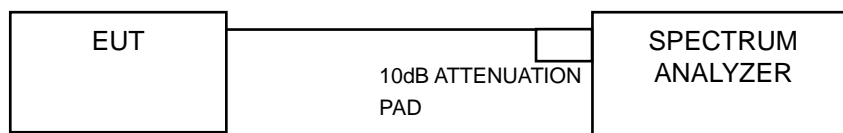


4.5 Hopping Channel Separation

4.5.1 Limits of Hopping Channel Separation Measurement

At least 25 kHz or 20 dB hopping channel bandwidth (whichever is greater).

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

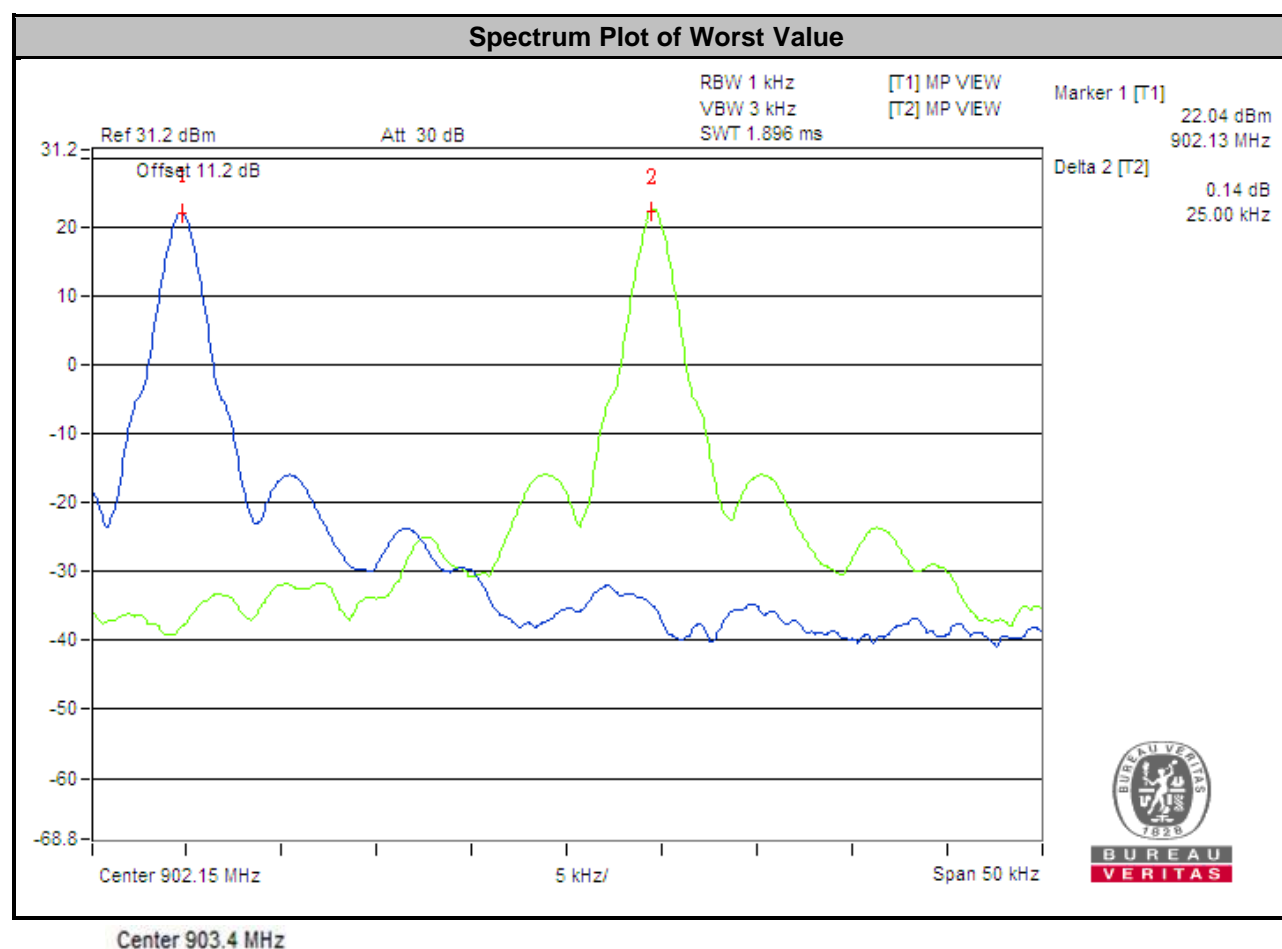
- Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range.
- By using the MaxHold function record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

4.5.5 Deviation from Test Standard

No deviation.

4.5.6 Test Results

Channel	Freq. (MHz)	Adjacent Channel Separation (MHz)	20 dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
0	902.1375	0.025	0.01	0.025	Pass
26	903.3875	0.025	0.01	0.025	Pass
53	904.6625	0.025	0.01	0.025	Pass

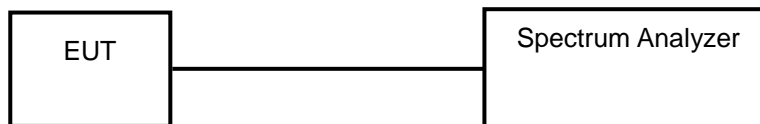


4.6 Maximum Output Power

4.6.1 Limits of Maximum Output Power Measurement

The Maximum Output Power Measurement is 30 dBm for systems employing at least 50 hopping channels.

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

- 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.
- The center frequency of the spectrum analyzer is set to the fundamental frequency and using 3 MHz RBW and 10 MHz VBW.
- Measure the captured power within the band and recording the plot.
- Repeat above procedures until all frequencies required were complete.

4.6.5 Deviation from Test Standard

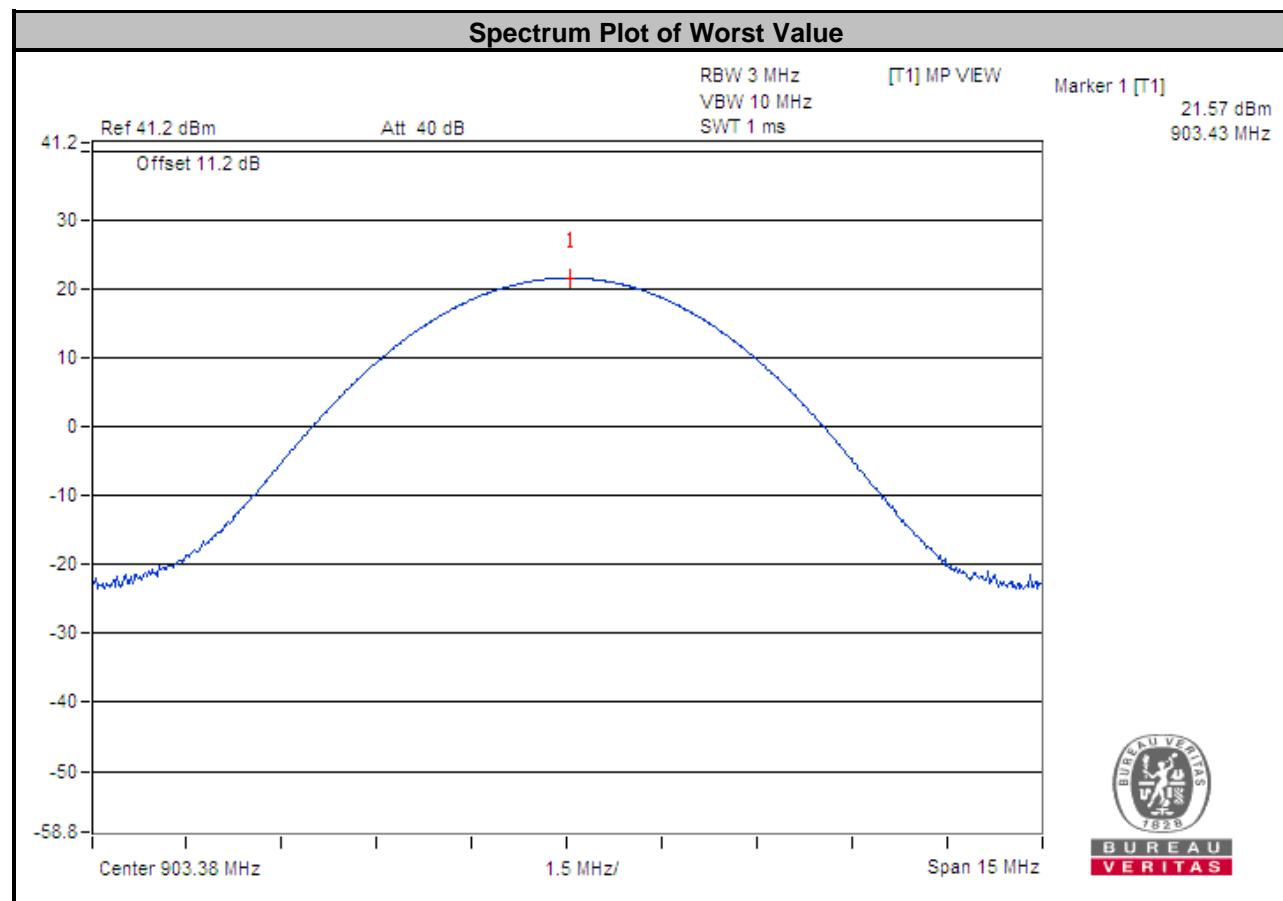
No deviation.

4.6.6 EUT Operating Condition

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

4.6.7 Test Results

Channel	Frequency (MHz)	Output Power (mW)	Output Power (dBm)	Power Limit (dBm)	Pass / Fail
0	902.1375	142.561	21.54	30	PASS
26	903.3875	143.549	21.57	30	PASS
53	904.6625	143.219	21.56	30	PASS



4.7 Conducted Out of Band Emission Measurement

4.7.1 Limits of Conducted Out of Band Emission Measurement

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

4.7.2 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.7.3 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.

4.7.4 Deviation from Test Standard

No deviation.

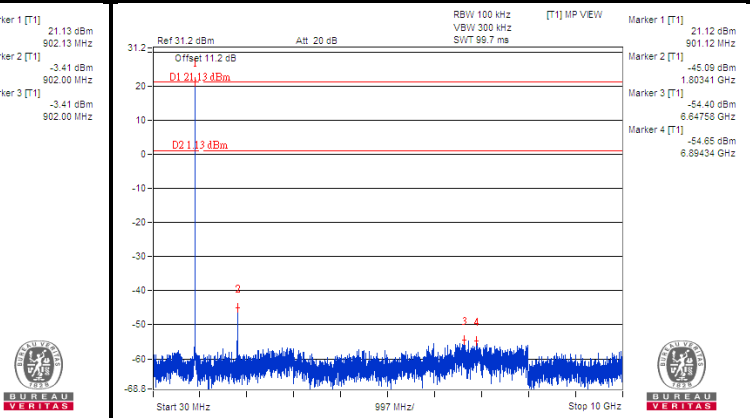
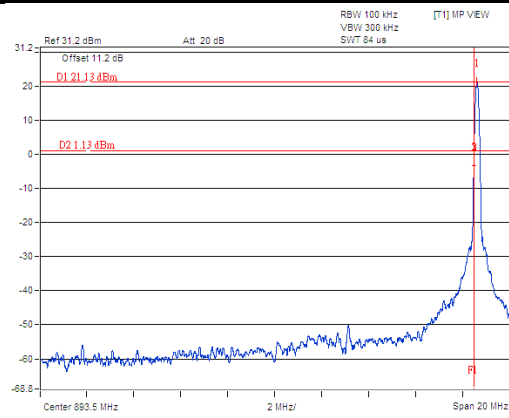
4.7.5 EUT Operating Condition

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

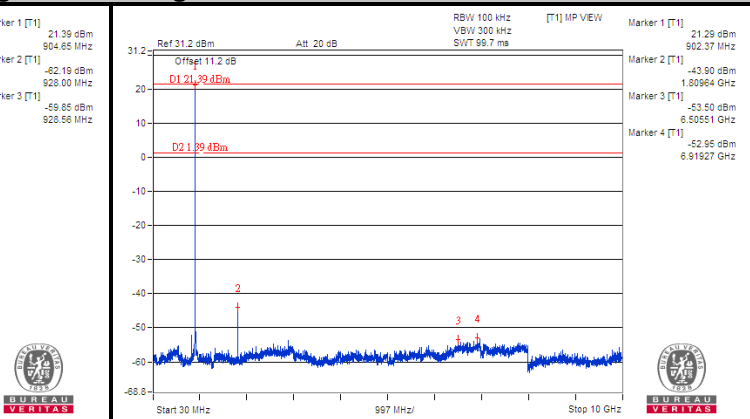
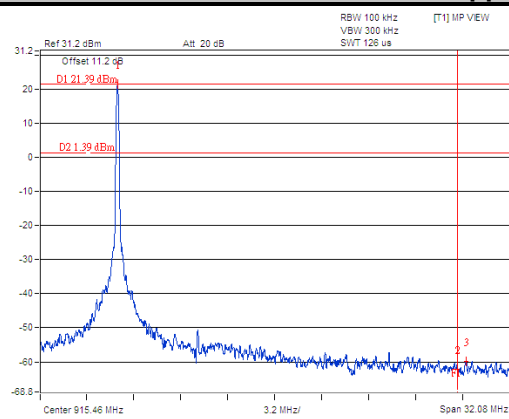
4.7.6 Test Results

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

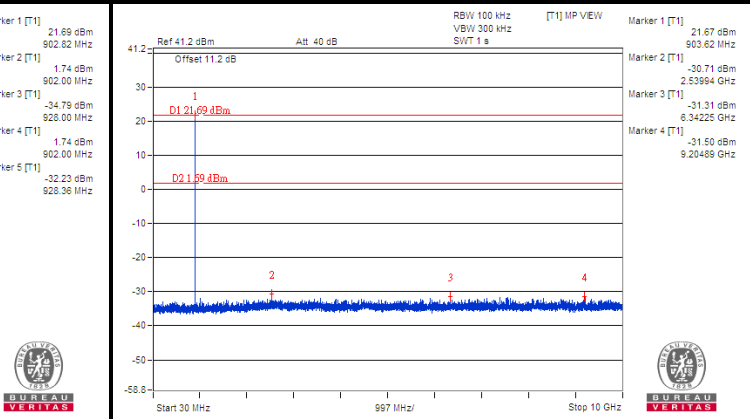
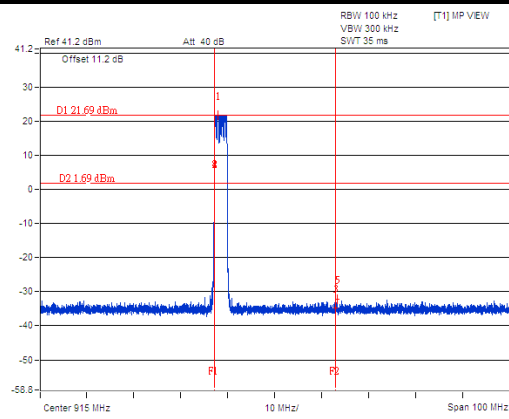
Hopping Disabled_Low Channel



Hopping Disabled_High Channel



Hopping Enabled Channel



5 Pictures of Test Arrangements

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

Appendix – Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited according to ISO/IEC 17025.

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

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Web Site: www.bureauveritas-adt.com

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

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