

## FCC Test Report

**Report No.:** RF171102C30-7

**FCC ID:** 2AJOTTA-1045

**Test Model:** TA-1045

**Received Date:** Nov. 02, 2017

**Test Date:** Nov. 16 ~ Dec. 14, 2017

**Issued Date:** Dec. 22, 2017

**Applicant:** HMD Global Oy

**Address:** Karaportti 2, 02610 Espoo, Finland

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

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**Test Location:** No. 19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City 33383, TAIWAN (R.O.C.)

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



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### Release Control Record

Issue No.	Description	Date Issued
RF171102C30-7	Original release	Dec. 22, 2017

## 1 Certificate of Conformity

**Product:** Smart Phone

**Brand:** Nokia

**Test Model:** TA-1045

**Sample Status:** Engineering sample

**Applicant:** HMD Global Oy

**Test Date:** Nov. 16 ~ Dec. 14, 2017

**Standards:** 47 CFR FCC Part 15, Subpart C (Section 15.225)  
47 CFR FCC Part 15, Subpart C (Section 15.215)  
ANSI C63.10:2013

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

**Prepared by :** Alice Ho, **Date:** Dec. 22, 2017  
Alice Ho / Specialist

**Approved by :** Ken Liu, **Date:** Dec. 22, 2017  
Ken Liu / Senior Manager

## 2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.225, 15.215)			
FCC Clause	Test Item	Result	Remarks
15.207	Conducted emission test	Pass	Meet the requirement of limit. Minimum passing margin is -1.39dB at 13.56200MHz
15.225 (a)	The field strength of any emissions within the band 13.553-13.567 MHz	Pass	Meet the requirement of limit. Minimum passing margin is -63.60dB at 13.56MHz.
15.225 (b)	The field strength of any emissions within the bands 13.410-13.553 MHz and 13.567-13.710 MHz	Pass	Meet the requirement of limit.
15.225 (c)	The field strength of any emissions within the bands 13.110-13.410 MHz and 13.710-14.010 MHz	Pass	Meet the requirement of limit.
15.225 (d)	The field strength of any emissions appearing outside of the 13.110-14.010 MHz band	Pass	Meet the requirement of limit. Minimum passing margin is -3.20dB at 39.60MHz & 40.69MHz.
15.225 (e)	The frequency tolerance	Pass	Meet the requirement of limit.
15.215 (c)	20dB Bandwidth	Pass	Meet the requirement of limit.

### 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) ( $\pm$ )
Conducted Emissions at mains ports	150kHz ~ 30MHz	2.94 dB
Radiated Emissions up to 1 GHz	30MHz ~ 200MHz	3.63 dB
	200MHz ~ 1000MHz	3.64 dB

### 2.2 Modification Record

There were no modifications required for compliance.

### 3 General Information

#### 3.1 General Description of EUT

Product	Smart Phone
Test Model	TA-1045
Sample Status	Engineering sample
Power Supply Rating	5Vdc from host equipment 5/9/12Vdc from adapter 3.85Vdc from battery
Modulation Type	ASK
Transfer Rate	848Mbps
Operating Frequency	13.56MHz
Antenna Type	Loop antenna
Accessory Device	Refer to Note
Data Cable Supplied	Refer to Note

Note: The EUT uses following accessory devices.

Item	Brand	Model	Manufacturer	Specification
Adapter 1	Nokia	FC0302	Salcomp	Input: 100-240Vac, 50/60Hz, 0.5A Output: 5Vdc, 2.5A / 9Vdc, 2A / 12Vdc, 1.5A
Adapter 2	Nokia	AD-18WU	Salcomp	Input: 100-240Vac, 50/60Hz, 0.5A Output: 5Vdc, 2.5A / 9Vdc, 2A / 12Vdc, 1.5A
Adapter 3	Nokia	AD-18WU	DVE	Input: 100-240Vac, 50/60Hz, 0.5A Output: 5Vdc, 2.5A / 9Vdc, 2A / 12Vdc, 1.5A
Battery	SCUD	HE345	SCUD	Rating: 3.85Vdc, 3000mAh
Earphone 1	Foxconn	WH-108	Foxconn	1.4m
Earphone 2	Foxconn	WH-108	OBO PRO.2 INC.	1.4m
USB cable 1	FIT	CUDU01B-FA203-DH	Foxconn	1m shielded USB cable without core
USB cable 2	Shenglan	JCT024-F001	Shenglan	1m shielded USB cable without core
USB cable 3	Yinrun	YR680004-A	Yinrun	1m shielded USB cable without core

\*Adapter 1, Adapter 2, Earphone 1 and USB cable 1 were chosen for final test.

#### 3.2 Description of Test Modes

1 channel is provided to this EUT

Channel	Freq. (MHz)
1	13.56

### 3.2.1 Test Mode Applicability and Tested Channel Data

EUT Configure Mode	Applicable to				Description
	RE	PLC	FS	EB	
-	√	√	√	√	-

Where RE: Radiated Emission  
FS: Frequency Stability

PLC: Power Line Conducted Emission  
EB: 20dB Bandwidth measurement

Note:

1. The antenna had been pre-tested on the positioned of each 3 axis. The worst cases were found when positioned on Y-plane.

#### Radiated 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
-	1	1	ASK

#### Power Line Conducted Emission Test:

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

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type
-	1	1	ASK

#### Frequency Stability:

- ☒ 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
-	1	1	ASK

#### 20dB Bandwidth:

- ☒ 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
-	1	1	ASK

#### Test Condition:

Applicable to	Environmental Conditions	Input Power	Tested by
RE	25 deg. C, 70% RH	120Vac, 60Hz	Luis Lee
PLC	25 deg. C, 75% RH	120Vac, 60Hz	Jones Chang
FS	25 deg. C, 70% RH	120Vac, 60Hz	Luis Lee
BW	25 deg. C, 70% RH	120Vac, 60Hz	Luis Lee

### 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 (15.225)**

**FCC Part 15, Subpart C (15.215)**

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 Measurement

#### 4.1.1 Limits of Radiated Emission Measurement

The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in § 15.209.

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

**Note:**

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

#### 4.1.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESCI	100424	Oct. 17, 2017	Oct. 16, 2018
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100040	Aug. 18, 2017	Aug. 17, 2018
BILOG Antenna SCHWARZBECK	VULB9168	9168-155	Dec. 28, 2016	Dec. 27, 2017
HORN Antenna SCHWARZBECK	BBHA 9120D	9120D-1170	Dec. 15, 2016	Dec. 14, 2017
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Dec. 14, 2016	Dec. 13, 2017
			Dec. 01, 2017	Nov. 30, 2018
Loop Antenna	EM-6879	269	Aug. 11, 2017	Aug. 10, 2018
Preamplifier Agilent (Below 1GHz)	8447D	2944A10631	Aug. 08, 2017	Aug. 07, 2018
Preamplifier Agilent (Above 1GHz)	8449B	3008A01960	Aug. 08, 2017	Aug. 07, 2018
RF signal cable HUBER+SUHNER	SUCOFLEX 104	MY 13380+295012/04	Aug. 08, 2017	Aug. 07, 2018
RF signal cable HUBER+SUHNER	SUCOFLEX 104	Cable-CH4-03 (250724)	Aug. 08, 2017	Aug. 07, 2018
Software BV ADT	ADT_Radiated_ V7.6.15.9.4	NA	NA	NA
Antenna Tower inn-co GmbH	MA 4000	010303	NA	NA
Antenna Tower Controller BV ADT	AT100	AT93021703	NA	NA
Turn Table BV ADT	TT100	TT93021703	NA	NA
Turn Table Controller BV ADT	SC100	SC93021703	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 4.
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 IC7450F-4.

#### 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. Both X and Y axes of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

##### Note:

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

##### For Radiated emission above 30MHz

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

##### Note:

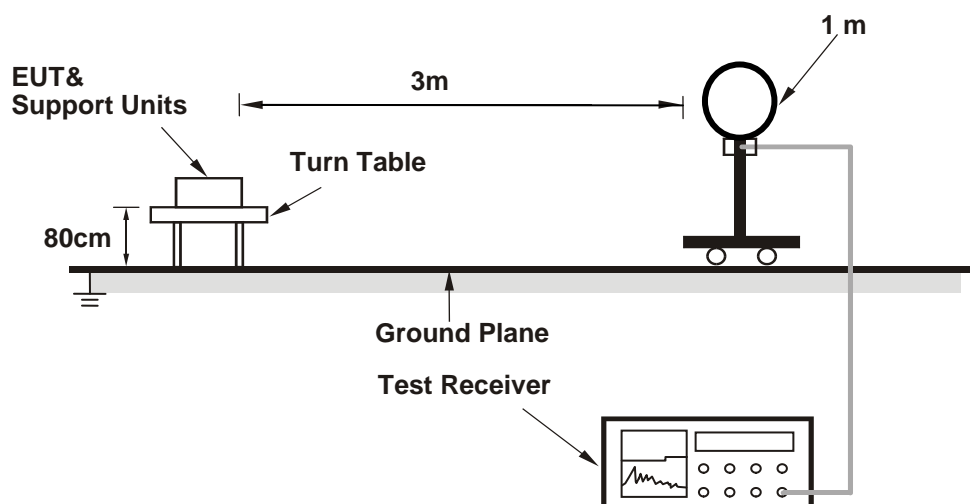
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.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

#### 4.1.4 Deviation from Test Standard

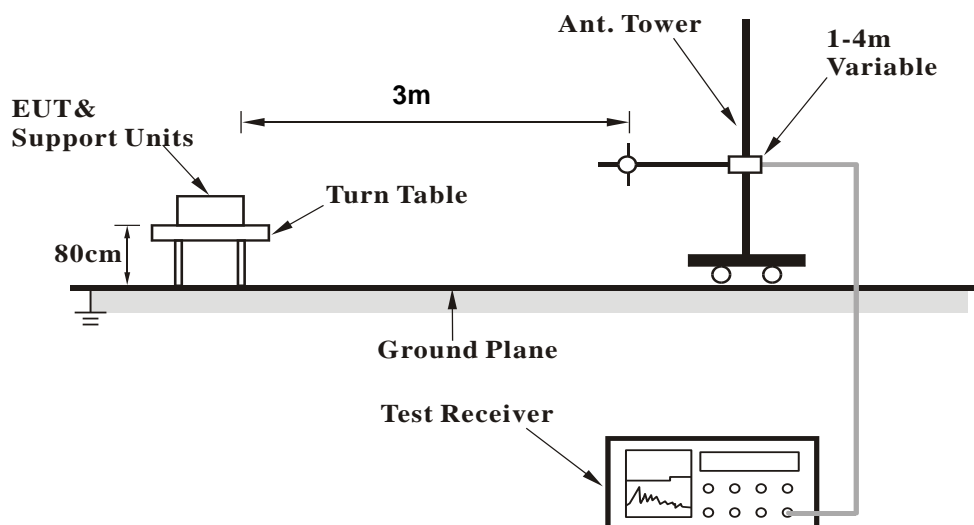
No deviation.

#### 4.1.5 Test Set Up

##### For Radiated emission below 30MHz



##### For Radiated emission 30MHz to 1GHz



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

#### 4.1.6 EUT Operating Conditions

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

#### 4.1.7 Test Results

EUT Test Condition		Measurement Detail	
Channel	Channel 1	Frequency Range	13.553 ~ 13.567MHz
Input Power	120Vac, 60Hz	Detector Function	Quasi-Peak
Environmental Conditions	25 deg. C, 70% RH	Tested By	Luis Lee

Antenna Polarity & Test Distance: Loop Antenna Open At 3m								
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	*13.56	60.40 PK	124.00 QP	-63.60	1.00	124	64.60	-4.20

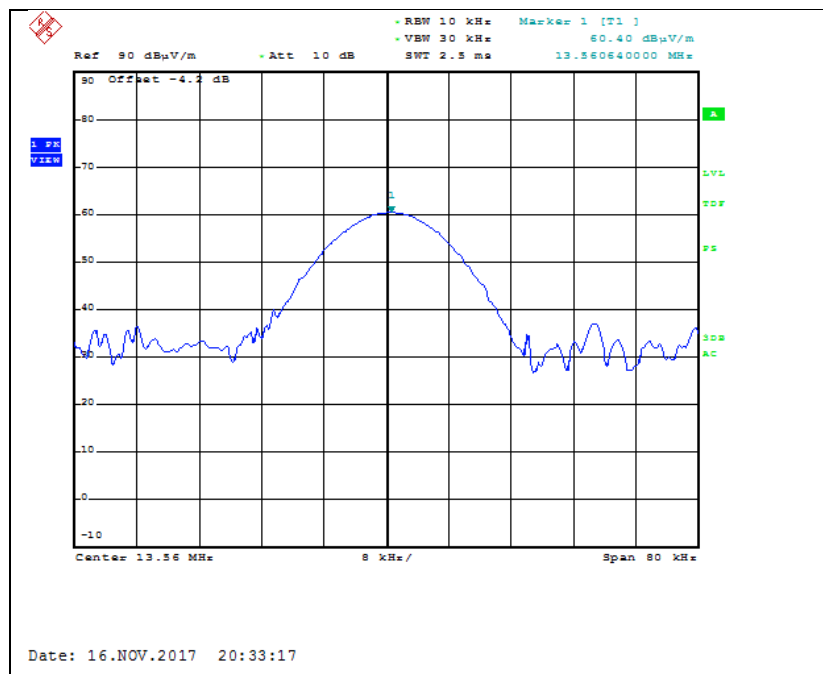
Remarks:

1. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. Above limits have been translated by the formula

The measured field strength was extrapolated to distance 30 meters, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)

Example:

$$\begin{aligned}
 13.56\text{MHz} &= 15848\text{uV/m} & 30\text{m} \\
 &= 84\text{dBuV/m} & 30\text{m} \\
 &= 84+20\log(30/3)^2 & 3\text{m} \\
 &= 124\text{dBuV/m}
 \end{aligned}$$



EUT Test Condition		Measurement Detail	
Channel	Channel 1	Frequency Range	13.553 ~ 13.567MHz
Input Power	120Vac, 60Hz	Detector Function	Quasi-Peak
Environmental Conditions	25 deg. C, 70% RH	Tested By	Luis Lee

Antenna Polarity & Test Distance: Loop Antenna Close At 3m								
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	*13.56	55.38 PK	124.00 QP	-68.62	1.00	19	59.58	-4.20

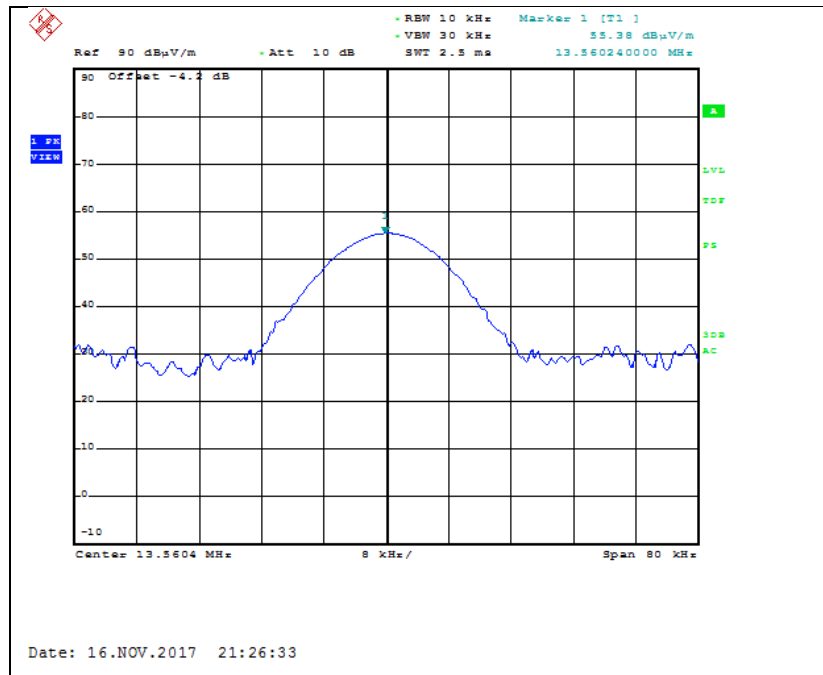
Remarks:

1. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. Above limits have been translated by the formula

The measured field strength was extrapolated to distance 30 meters, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)

Example:

$$\begin{aligned}
 13.56\text{MHz} &= 15848\mu\text{V/m} && 30\text{m} \\
 &= 84\text{dBuV/m} && 30\text{m} \\
 &= 84+20\log(30/3)^2 && 3\text{m} \\
 &= 124\text{dBuV/m}
 \end{aligned}$$



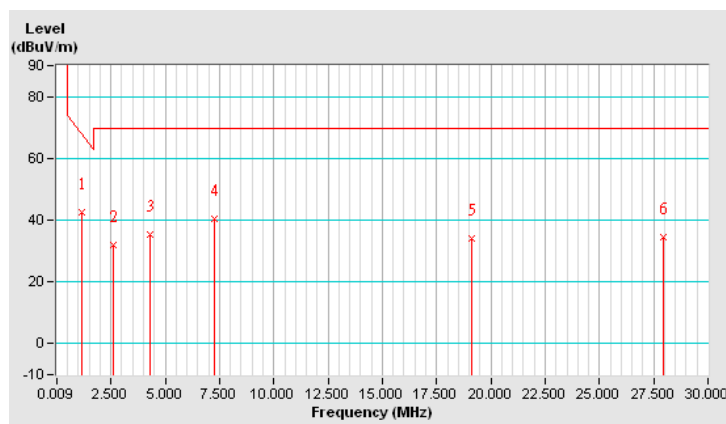
# <Adapter 1>

EUT Test Condition		Measurement Detail	
Channel	Channel 1	Frequency Range	Below 30MHz
Input Power	120Vac, 60Hz	Detector Function	Quasi-Peak
Environmental Conditions	25 deg. C, 70% RH	Tested By	Luis Lee

Antenna Polarity & Test Distance: Loop Antenna Open At 3m								
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	1.15	42.7 QP	66.4	-23.8	1.00	7	42.6	0.1
2	2.59	32.1 QP	69.5	-37.5	1.00	28	34.1	-2.0
3	4.33	35.3 QP	69.5	-34.3	1.00	104	38.1	-2.8
4	7.27	40.3 QP	69.5	-29.3	1.00	283	43.4	-3.2
5	19.14	34.2 QP	69.5	-35.3	1.00	256	39.5	-5.3
6	27.96	34.6 QP	69.5	-34.9	1.00	126	38.1	-3.5

## Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

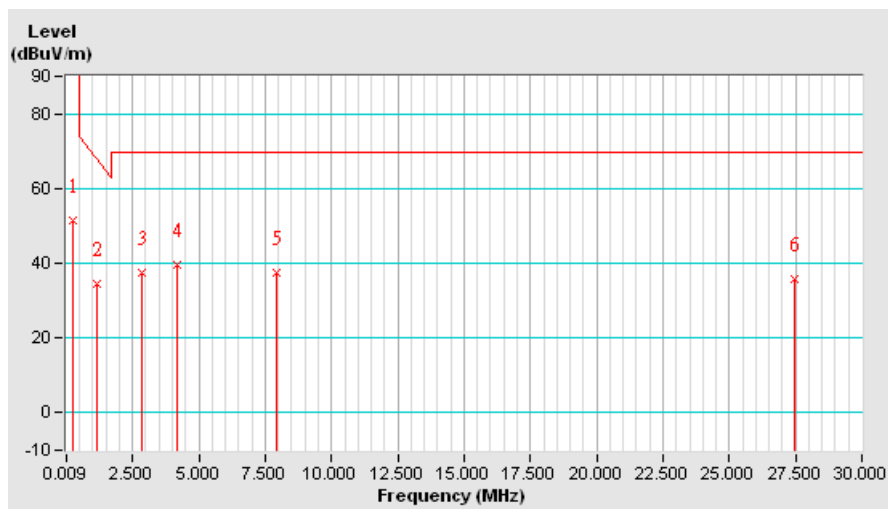


EUT Test Condition		Measurement Detail	
Channel	Channel 1	Frequency Range	Below 30MHz
Input Power	120Vac, 60Hz	Detector Function	Quasi-Peak
Environmental Conditions	25 deg. C, 70% RH	Tested By	Luis Lee

Antenna Polarity & Test Distance: Loop Antenna Close At 3m								
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	0.25	51.4 QP	99.6	-48.2	1.00	297	41.6	9.8
2	1.15	34.4 QP	66.4	-32.1	1.00	65	34.3	0.1
3	2.83	37.4 QP	69.5	-32.2	1.00	185	39.8	-2.4
4	4.21	39.7 QP	69.5	-29.8	1.00	137	42.6	-2.8
5	7.93	37.6 QP	69.5	-31.9	1.00	245	40.9	-3.3
6	27.48	35.7 QP	69.5	-33.8	1.00	121	39.4	-3.7

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



EUT Test Condition		Measurement Detail	
Channel	Channel 1	Frequency Range	Below 1000MHz
Input Power	120Vac, 60Hz	Detector Function	Quasi-Peak
Environmental Conditions	25 deg. C, 70% RH	Tested By	Luis Lee

Antenna Polarity & Test Distance: Horizontal At 3m								
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	93.93	38.8 PK	43.5	-4.7	2.00 H	141	58.0	-19.2
2	204.54	34.1 PK	43.5	-9.4	2.00 H	54	50.3	-16.2
3	326.78	25.8 PK	46.0	-20.2	1.51 H	120	37.2	-11.4
4	561.57	26.5 PK	46.0	-19.5	1.51 H	179	33.8	-7.3
5	720.68	25.5 PK	46.0	-20.5	1.01 H	45	29.2	-3.7
6	936.07	34.7 PK	46.0	-11.3	2.00 H	242	34.5	0.2
Antenna Polarity & Test Distance: Vertical At 3m								
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)
<b>1</b>	<b>39.60</b>	<b>36.8 PK</b>	<b>40.0</b>	<b>-3.2</b>	<b>1.00 V</b>	<b>9</b>	<b>51.9</b>	<b>-15.1</b>
2	86.17	34.1 PK	40.0	-5.9	2.00 V	52	53.6	-19.5
3	204.54	29.7 PK	43.5	-13.8	1.50 V	120	45.9	-16.2
4	429.62	27.2 PK	46.0	-18.8	2.00 V	236	36.8	-9.6
5	536.34	27.6 PK	46.0	-18.4	1.00 V	329	35.4	-7.8
6	936.07	35.8 PK	46.0	-10.2	2.00 V	330	35.6	0.2

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

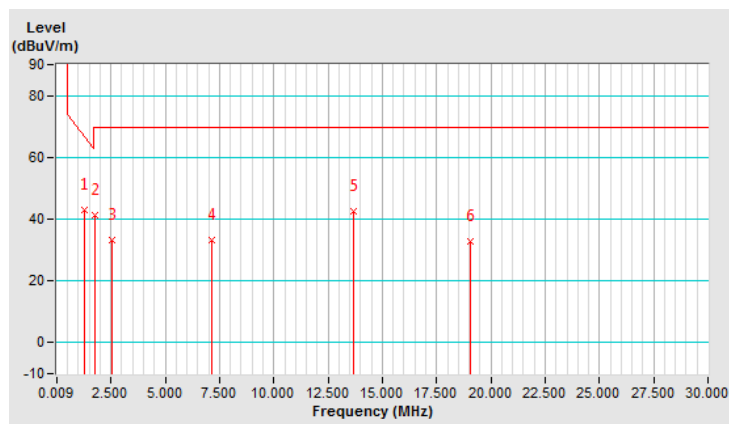
<Adapter 2>

EUT Test Condition		Measurement Detail	
Channel	Channel 1	Frequency Range	Below 30MHz
Input Power	120Vac, 60Hz	Detector Function	Quasi-Peak
Environmental Conditions	25 deg. C, 70% RH	Tested By	Luis Lee

Antenna Polarity & Test Distance: Loop Antenna Open At 3m								
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	1.27	42.8 QP	65.5	-22.7	1.00	160	43.0	-0.2
2	1.75	41.4 QP	69.5	-28.1	1.00	117	42.1	-0.7
3	2.53	33.4 QP	69.5	-36.1	1.00	49	35.3	-1.9
4	7.15	33.3 QP	69.5	-36.2	1.00	57	36.5	-3.2
5	13.68	42.7 QP	69.5	-26.8	1.00	129	47.0	-4.3
6	19.08	33.0 QP	69.5	-36.5	1.00	243	38.3	-5.3

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

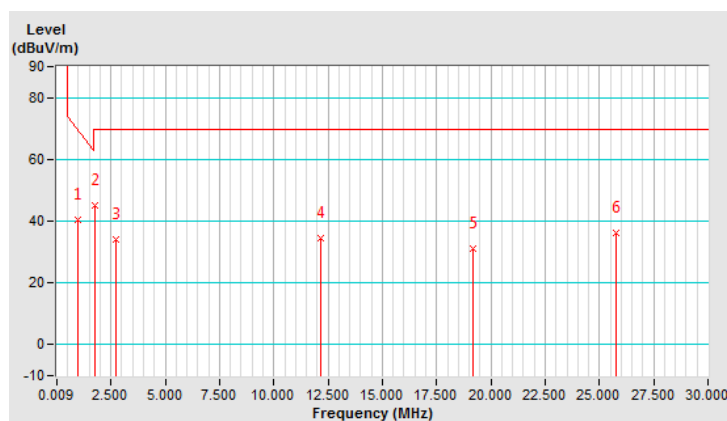


EUT Test Condition		Measurement Detail	
Channel	Channel 1	Frequency Range	Below 30MHz
Input Power	120Vac, 60Hz	Detector Function	Quasi-Peak
Environmental Conditions	25 deg. C, 70% RH	Tested By	Luis Lee

Antenna Polarity & Test Distance: Loop Antenna Close At 3m								
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	0.97	40.4 QP	67.9	-27.5	1.00	280	39.8	0.6
2	1.75	45.1 QP	69.5	-24.4	1.00	9	45.8	-0.7
3	2.71	34.2 QP	69.5	-35.3	1.00	109	36.4	-2.2
4	12.19	34.5 QP	69.5	-35.0	1.00	104	38.4	-3.9
5	19.20	31.0 QP	69.5	-38.5	1.00	104	36.3	-5.3
6	25.74	36.1 QP	69.5	-33.4	1.00	102	40.1	-4.0

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



EUT Test Condition		Measurement Detail	
Channel	Channel 1	Frequency Range	Below 1000MHz
Input Power	120Vac, 60Hz	Detector Function	Quasi-Peak
Environmental Conditions	25 deg. C, 70% RH	Tested By	Luis Lee

Antenna Polarity & Test Distance: Horizontal At 3m								
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	80.35	25.7 PK	40.0	-14.3	1.99 H	134	44.0	-18.3
2	165.73	31.9 PK	43.5	-11.6	1.49 H	316	45.8	-13.9
3	198.71	34.8 PK	43.5	-8.7	1.49 H	316	51.0	-16.2
4	231.70	30.5 PK	46.0	-15.5	1.49 H	285	46.1	-15.6
5	722.62	35.9 PK	46.0	-10.1	1.49 H	7	39.6	-3.7
6	932.19	41.1 PK	46.0	-4.9	1.00 H	141	40.9	0.2
Antenna Polarity & Test Distance: Vertical At 3m								
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)
<b>1</b>	<b>40.69</b>	<b>36.8 QP</b>	<b>40.0</b>	<b>-3.2</b>	<b>1.41 V</b>	<b>89</b>	<b>51.8</b>	<b>-15.0</b>
2	72.59	32.3 PK	40.0	-7.7	1.00 V	292	48.6	-16.3
3	435.44	40.7 PK	46.0	-5.3	1.49 V	7	50.0	-9.3
4	714.86	41.2 PK	46.0	-4.8	1.00 V	230	45.2	-4.0
5	745.91	42.5 PK	46.0	-3.5	1.99 V	352	45.3	-2.8
6	949.65	34.7 PK	46.0	-11.3	1.00 V	160	34.0	0.7

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

## 4.2 Conducted Emission Measurement

### 4.2.1 Limits of Conducted Emission Measurement

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

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

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

### 4.2.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESCI	100613	Nov. 23, 2016	Nov. 22, 2017
			Nov. 23, 2017	Nov. 22, 2018
RF signal cable (with 10dB PAD) Woken	5D-FB	Cable-cond1-01	Dec. 22, 2016	Dec. 21, 2017
LISN ROHDE & SCHWARZ (EUT)	ESH3-Z5	835239/001	Mar. 10, 2017	Mar. 09, 2018
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Aug. 15, 2017	Aug. 14, 2018
Software ADT	BV ADT_Conc_ V7.3.7.3	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

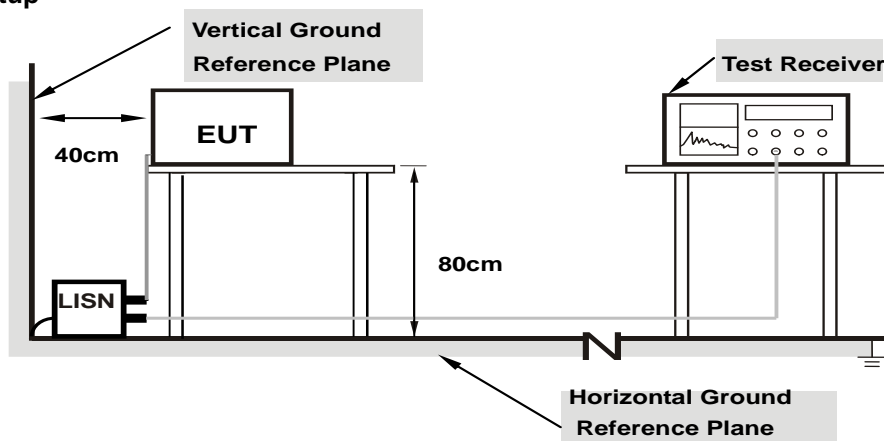
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

**Note:** The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.

#### 4.2.4 Deviation from Test Standard

No deviation.

#### 4.2.5 Test Setup



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

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

#### 4.2.6 EUT Operating Conditions

Same as 4.1.6.

#### 4.2.7 Test Results

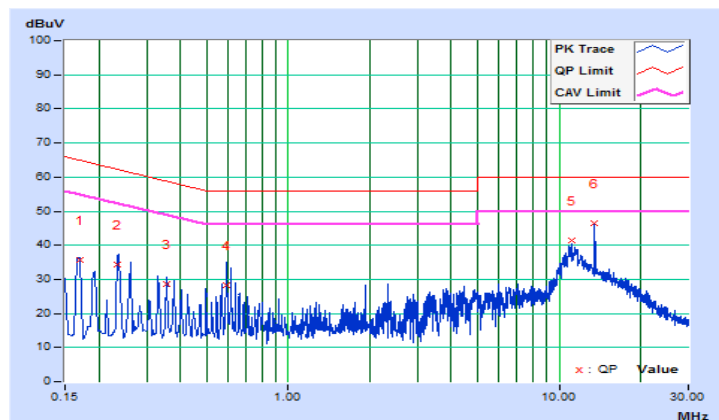
<Adapter 1>

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
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No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16932	10.45	25.29	8.30	35.74	18.75	64.99	54.99	-29.25	-36.24
2	0.23412	10.46	23.86	8.60	34.32	19.06	62.30	52.30	-27.98	-33.24
3	0.35800	10.50	17.97	5.81	28.47	16.31	58.77	48.77	-30.30	-32.46
4	0.59400	10.51	17.61	6.35	28.12	16.86	56.00	46.00	-27.88	-29.14
5	11.06600	10.98	30.53	22.99	41.51	33.97	60.00	50.00	-18.49	-16.03
6	13.55800	11.11	35.43	34.41	46.54	45.52	60.00	50.00	-13.46	-4.48

Remarks:

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

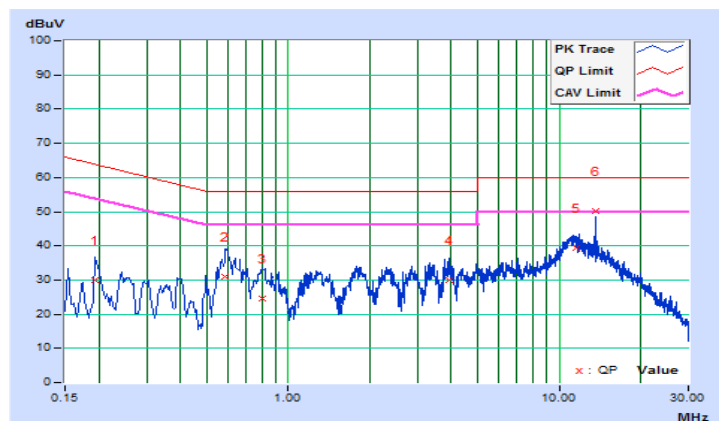


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
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No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.19418	10.22	19.58	6.35	29.80	16.57	63.86	53.86	-34.06	-37.29
2	0.58563	10.24	20.63	13.74	30.87	23.98	56.00	46.00	-25.13	-22.02
3	0.80127	10.25	14.48	6.37	24.73	16.62	56.00	46.00	-31.27	-29.38
4	3.90600	10.40	19.71	15.78	30.11	26.18	56.00	46.00	-25.89	-19.82
5	11.51800	10.73	28.59	21.39	39.32	32.12	60.00	50.00	-20.68	-17.88
6	13.56200	10.81	39.41	37.80	50.22	48.61	60.00	50.00	-9.78	-1.39

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.



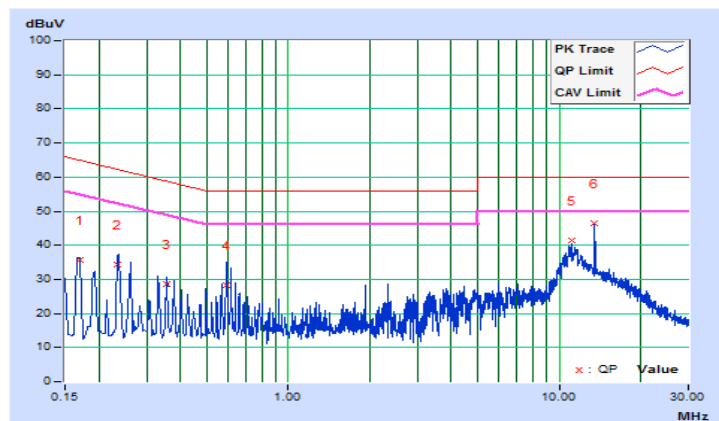
<Adapter 2>

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

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16932	10.45	25.29	8.30	35.74	18.75	64.99	54.99	-29.25	-36.24
2	0.23412	10.46	23.86	8.60	34.32	19.06	62.30	52.30	-27.98	-33.24
3	0.35800	10.50	17.97	5.81	28.47	16.31	58.77	48.77	-30.30	-32.46
4	0.59400	10.51	17.61	6.35	28.12	16.86	56.00	46.00	-27.88	-29.14
5	11.06600	10.98	30.53	22.99	41.51	33.97	60.00	50.00	-18.49	-16.03
6	13.55800	11.11	35.43	34.41	46.54	45.52	60.00	50.00	-13.46	-4.48

Remarks:

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

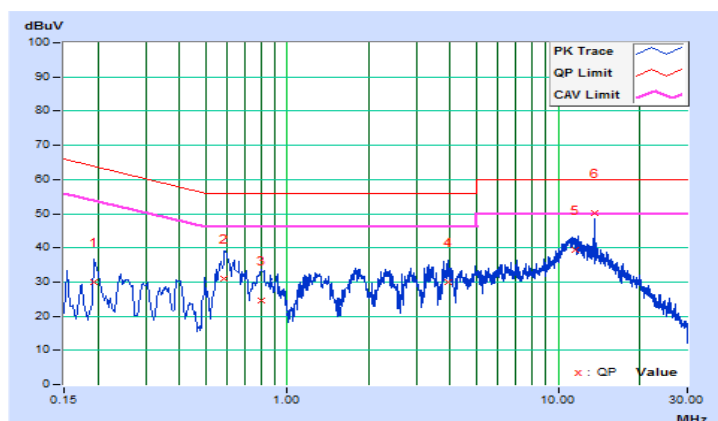


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
-------	-------------	-------------------	--------------------------------

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.19418	10.22	19.58	6.35	29.80	16.57	63.86	53.86	-34.06	-37.29
2	0.58563	10.24	20.63	13.74	30.87	23.98	56.00	46.00	-25.13	-22.02
3	0.80127	10.25	14.48	6.37	24.73	16.62	56.00	46.00	-31.27	-29.38
4	3.90600	10.40	19.71	15.78	30.11	26.18	56.00	46.00	-25.89	-19.82
5	11.51800	10.73	28.59	21.39	39.32	32.12	60.00	50.00	-20.68	-17.88
6	13.56200	10.81	39.41	37.80	50.22	48.61	60.00	50.00	-9.78	-1.39

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.

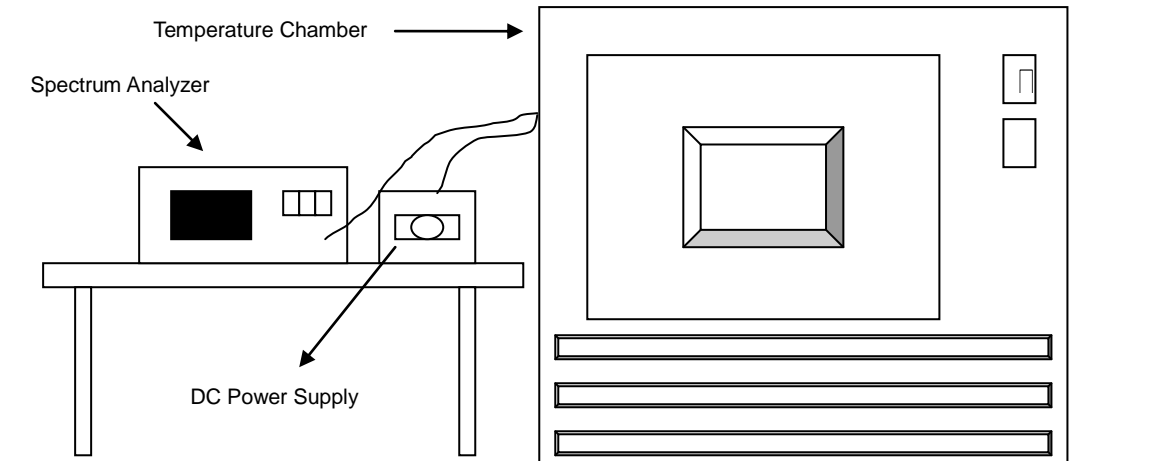


### 4.3 Frequency Stability

#### 4.3.1 Limits of Frequency Stability Measurement

The frequency tolerance of the carrier signal shall be maintained within  $\pm 0.01\%$  of the operating frequency over a temperature variation of  $-20$  degrees to  $50$  degrees C at normal supply voltage, and for a variation in the primary supply voltage from  $85\%$  to  $115\%$  of the rated supply voltage at a temperature of  $20$  degrees C.

#### 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

- The EUT was placed inside the environmental test chamber and powered by nominal AC voltage.
- Turned the EUT on and coupled its output to a spectrum analyzer.
- Turned the EUT off and set the chamber to the highest temperature specified.
- Allowed sufficient time (approximately 30 min) for the temperature of the chamber to stabilize then turned the EUT on and measured the operating frequency after 2, 5, and 10 minutes.
- Repeated step 2 and 3 with the temperature chamber set to the lowest temperature.
- The test chamber was allowed to stabilize at  $+20$  degree C for a minimum of 30 minutes. The supply voltage was then adjusted on the EUT from  $85\%$  to  $115\%$  and the frequency record.

#### 4.3.5 Deviation from Test Standard

No deviation.

#### 4.3.6 EUT Operating Conditions

Same as Item 4.1.6.

#### 4.3.7 Test Result

Frequency Stability Versus Temp.									
TEMP. (°C)	Power Supply (Vdc)	0 Minute		2 Minute		5 Minute		10 Minute	
		Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift
		(MHz)	%	(MHz)	%	(MHz)	%	(MHz)	%
50	12	13.559939	-0.00045	13.559948	-0.00038	13.559955	-0.00033	13.559945	-0.00041
40	12	13.560007	0.00005	13.560026	0.00019	13.560025	0.00018	13.56	0.00000
30	12	13.56005	0.00037	13.560034	0.00025	13.560046	0.00034	13.560058	0.00043
20	12	13.559992	-0.00006	13.56	0.00000	13.560001	0.00001	13.559997	-0.00002
10	12	13.559976	-0.00018	13.559967	-0.00024	13.559959	-0.00030	13.559969	-0.00023
0	12	13.559992	-0.00006	13.559989	-0.00008	13.559997	-0.00002	13.560004	0.00003
-10	12	13.560058	0.00043	13.560059	0.00044	13.560056	0.00041	13.56005	0.00037
-20	12	13.560052	0.00038	13.560049	0.00036	13.560066	0.00049	13.560054	0.00040

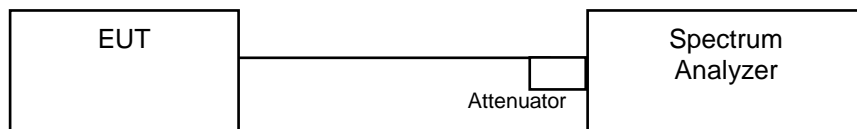
Frequency Stability Versus Voltage									
TEMP. (°C)	Power Supply (Vdc)	0 Minute		2 Minute		5 Minute		10 Minute	
		Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift
		(MHz)	%	(MHz)	%	(MHz)	%	(MHz)	%
20	13.8	13.559993	-0.00005	13.559999	-0.00001	13.559998	-0.00001	13.559999	-0.00001
	12	13.559992	-0.00006	13.56	0.00000	13.560001	0.00001	13.559997	-0.00002
	10.2	13.559995	-0.00004	13.559998	-0.00001	13.559997	-0.00002	13.559994	-0.00004

#### 4.4 20dB Bandwidth

##### 4.4.1 Limits of 20dB Bandwidth Measurement

The 20dB bandwidth shall be specified in operating frequency band.

##### 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

The bandwidth of the fundamental frequency was measured by spectrum analyzer with 1kHz RBW and 3kHz VBW. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

##### 4.4.5 Deviation from Test Standard

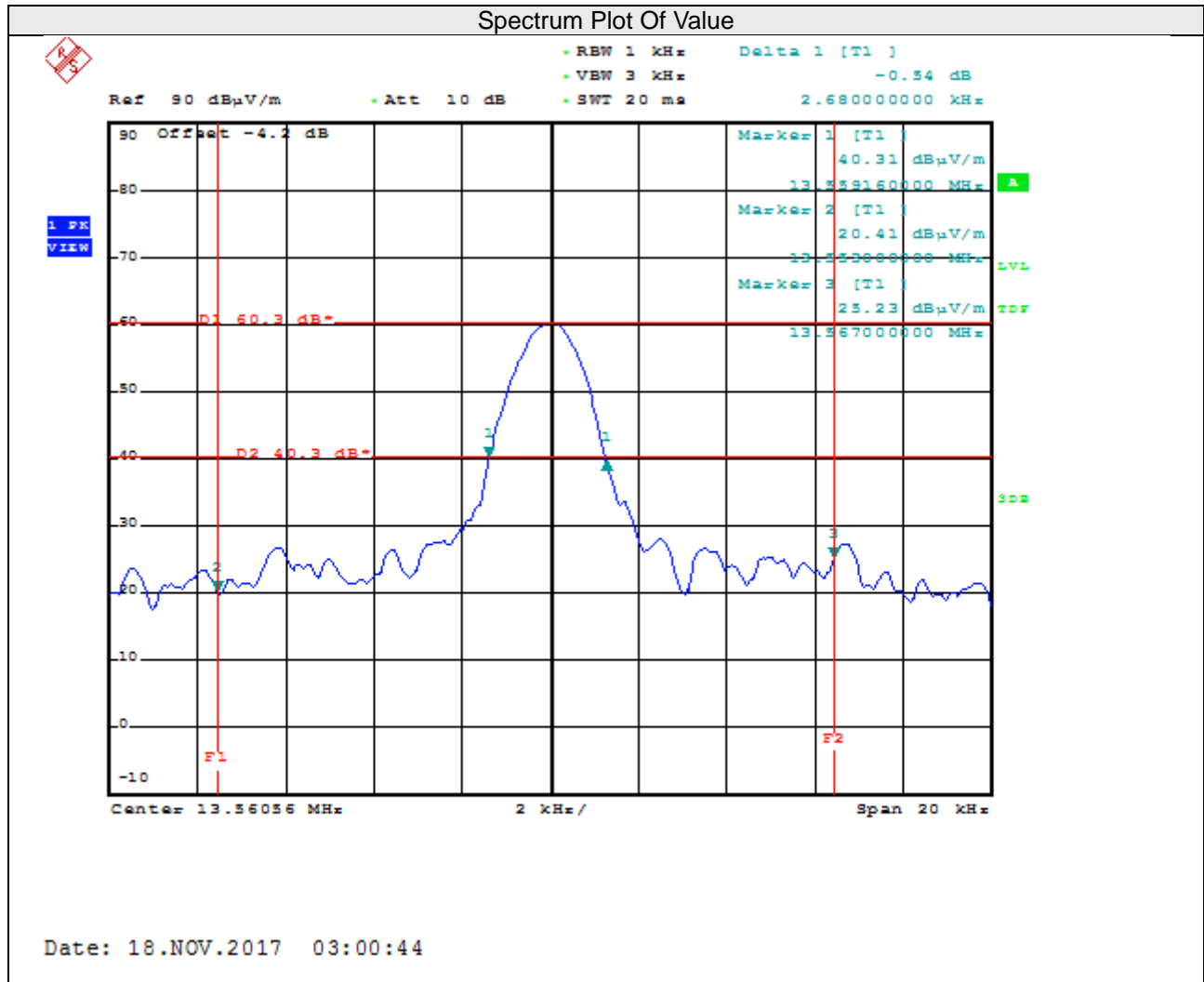
No deviation.

##### 4.4.6 EUT Operating Conditions

Same as Item 4.1.6.

#### 4.4.7 Test Results

20dBc point (Low)	20dBc point (High)	Operating frequency band (MHz)	Pass / Fail
13.55900	13.56700	13.553~13.567	Pass



## 5 Pictures of Test Arrangements

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

## Appendix – Information on the Testing Laboratories

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

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

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Fax: 886-2-26051924

**Hsin Chu EMC/RF/Telecom Lab**

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