FCC Test Report (RFID)

Report No.:	RF140704E05D-2
FCC ID:	MQT-E25CMFI
Test Model:	xCE-25-C
Series Model:	xCE_E25C
Received Date:	Jan. 10, 2017
Test Date:	Jan. 24 to 26, 2017
Issued Date:	Feb. 06, 2017
Applicant:	XAC AUTOMATION CORP.
Address:	4F, No. 30, INDUSTRY E. RD. IX, SCIENCE-BASED INDUSTRIAL PARK,HSINCHU,TAIWAN
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory
Lab Address:	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan R.O.C.
Test Location (1):	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan R.O.C.
Test Location (2):	No. 49, Ln. 206, Wende Rd., Shangshan Tsuen, Chiung Lin Hsiang, Hsin Chu Hsien 307, Taiwan R.O.C.

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Release Control Record

Issue No.	Description	Date Issued
RF140704E05D-2	Original release.	Feb. 06, 2017

1 Certificate of Conformity

Product:	PINPAD
Brand:	XAC
Test Model:	xCE-25-C
Series Model:	xCE_E25C
Sample Status:	ENGINEERING SAMPLE
Applicant:	XAC AUTOMATION CORP.
Test Date:	Jan. 24 to 26, 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 : _____ , **Date:** Feb. 06, 2017

Midoli Peng / Specialist

Approved by : _____ , **Date:** Feb. 06, 2017

May Chen / 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 -7.84dB at 0.62585MHz.
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 -54.7dB 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 -6.0dB at 240.00MHz.
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) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	5.36 dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	5.36 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	3.47 dB
	6GHz ~ 18GHz	3.75 dB
	18GHz ~ 40GHz	3.30 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	PINPAD
Brand	XAC
Test Model	xCE-25-C
Series Model	xCE_E25C
Status of EUT	ENGINEERING SAMPLE
Power Supply Rating	DC 3.7V from Battery DC 5V from USB interface
Modulation Type	ASK
Operating Frequency	13.56MHz
Number of Channel	1
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	NA
Data Cable Supplied	NA

Note:

1. All models are listed as below.

Brand	Model	Difference
XAC	xCE-25-C	For marketing purpose
	xCE_E25C	

From the above models, model: **xCE-25-C** was selected as representative model for the test and its data was recorded in this report.

2. There are Bluetooth and RFID technology used for the EUT.

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

BT Antenna Spec.					
Brand	Model No.	Antenna Type	Antenna Connector	Gain(dBi)	Frequency range (MHz to MHz)
ACX	AT3216-T2R4PAA	Chip	NA	1.5	2400~2500
RFID Antenna Spec.					
Brand	Model No.	Antenna Type	Antenna Connector	Gain(dBi)	Frequency range (MHz)
XAC	39cm wire	Loop	NA	NA	13.56

4. The EUT power needs to be supplied from one power adapter or battery, the information is as below table:

Power adapter (only for test not for sale)		
Brand	Model Name	Specification
AOEM	ADS005F-W050100	AC input: 100-240V, 50-60Hz, 0.2A DC output: 5V, 1.0A DC output cable: Unshielded, 1.5m
Battery		
Brand	Model Name	Specification
Large	523450	1050mAh, 3.7V

5. For radiated emission test, the EUT was pre-tested under the following test modes :

Pre-test Mode	Power
Mode A	Power from battery
Mode B	**Power from USB interface (Adapter)**

The worst radiated emission was found in **Mode B**. Therefore only the test data of the modes were recorded in this report.

6. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

3.2 Description of Test Modes

One channel was provided to this EUT:

Channel	FREQ. (MHz)
1	13.56

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE	PLC	FS	EB	
1	√	√	√	√	Power from USB interface (Adapter)
2	-	-	√	-	Power from USB interface (Host)

Where **RE≥1G:** Radiated Emission above 1GHz **PLC:** Power Line Conducted Emission
FS: Frequency Stability **EB:** 20dB Bandwidth measurement

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

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.

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.

Available Channel	Tested Channel	Modulation Type
1	1	ASK

FREQUENCY STABILITY:

☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

Available Channel	Tested Channel	Modulation Type
1	1	ASK

20dB BANDWIDTH:

☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

Available Channel	Tested Channel	Modulation Type
1	1	ASK

TEST CONDITION:

Applicable To	Environmental Conditions	Input Power	Tested By
RE	25deg. C, 68%RH	120Vac, 60Hz	Weiwei Lo
PLC	24deg. C, 66%RH	120Vac, 60Hz	Weiwei Lo
FS	25deg. C, 60%RH	120Vac, 60Hz	Chilin Lee
EB	25deg. C, 60%RH	120Vac, 60Hz	Chilin Lee

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	Laptop	DELL	E5430	4YV4VY1	FCC DoC	Provided by Lab
B	Adapter	AOEM	ADS005F-W050100	NA	NA	Supplied by client

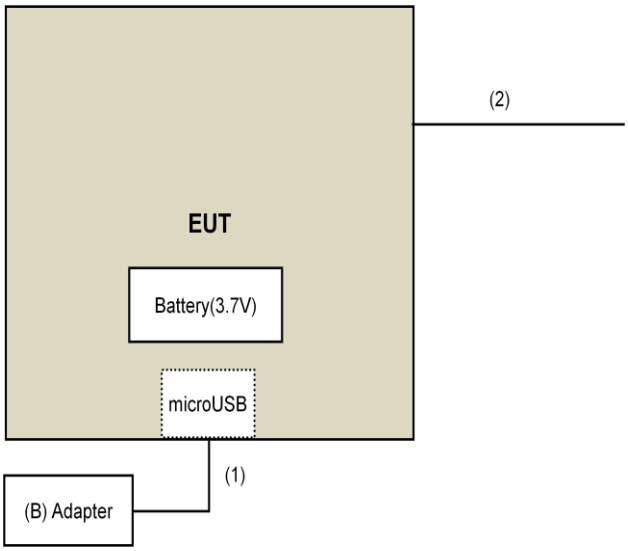
Note:

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

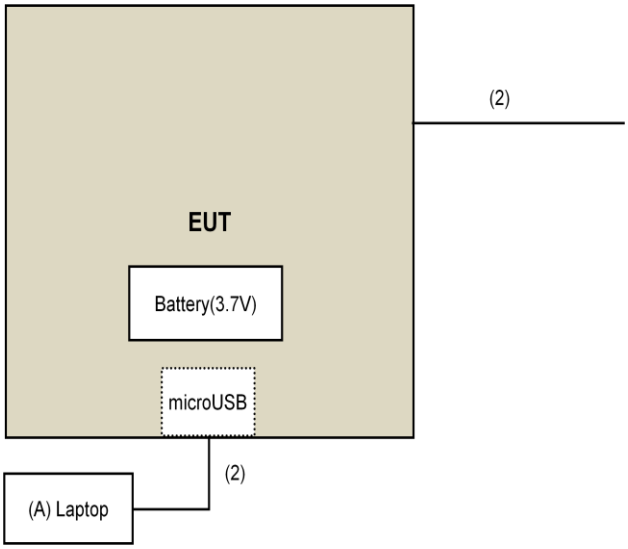
ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1	DC Cable	1	1.5	Yes	0	Supplied by client
2	USB Cable	1	1	Yes	0	Supplied by client
3	Console Cable	1	0.1	No	0	Supplied by client(for RF Setup)

3.3.1 Configuration of System under Test

Mode 1



Mode 2



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

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

(b) 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.

(c) 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.

(d) 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 as below table:

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

NOTE:

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

4.1.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver Agilent	N9038A	MY50010156	Aug. 18, 2016	Aug. 17, 2017
Pre-Amplifier(*) EMCI	EMC001340	980142	Jan. 20, 2016	Jan. 19, 2018
Loop Antenna(*) Electro-Metrics	EM-6879	264	Dec. 16, 2016	Dec. 15, 2018
RF Cable	NA	LOOPCAB-001 LOOPCAB-002	Jan. 17, 2017	Jan. 16, 2018
Pre-Amplifier Mini-Circuits	ZFL-1000VH2 B	AMP-ZFL-05	May 07, 2016	May 06, 2017
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-361	Dec. 29, 2016	Dec. 28, 2017
RF Cable	8D	966-3-1 966-3-2 966-3-3	Apr. 02, 2016	Apr. 01, 2017
Fixed attenuator Mini-Circuits	UNAT-5+	PAD-3m-3-01	Oct. 05, 2016	Oct. 04, 2017
Software	ADT_Radiated _V8.7.08	NA	NA	NA
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208406	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 calibration interval of the above test instruments is 24 months and the calibrations are traceable to NML/ROC and NIST/USA.
3 Loop antenna was used for all emissions below 30 MHz.
4. The test was performed in 966 Chamber No. 3.
5. The FCC Site Registration No. is 147459
6. The CANADA Site Registration No. is 20331-1
7. Tested Date: Jan. 24 to 26, 2017

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:

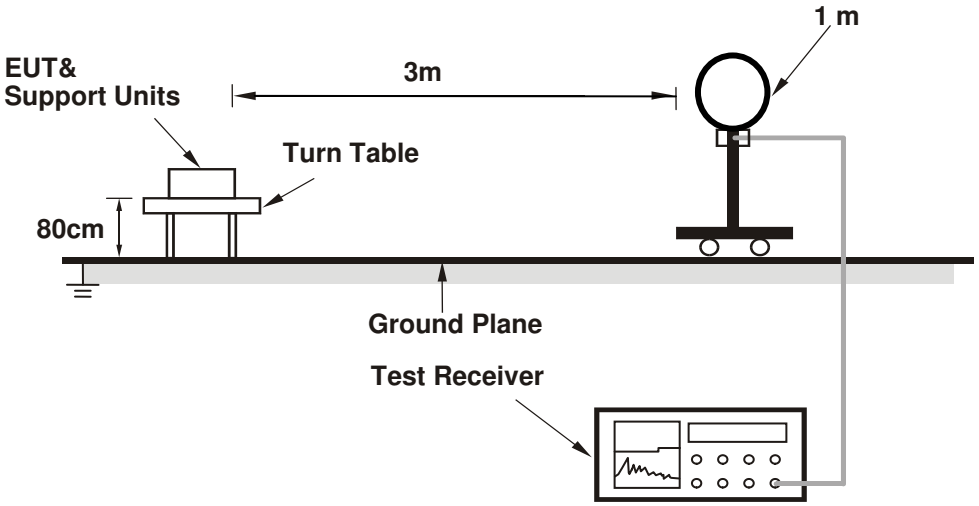
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

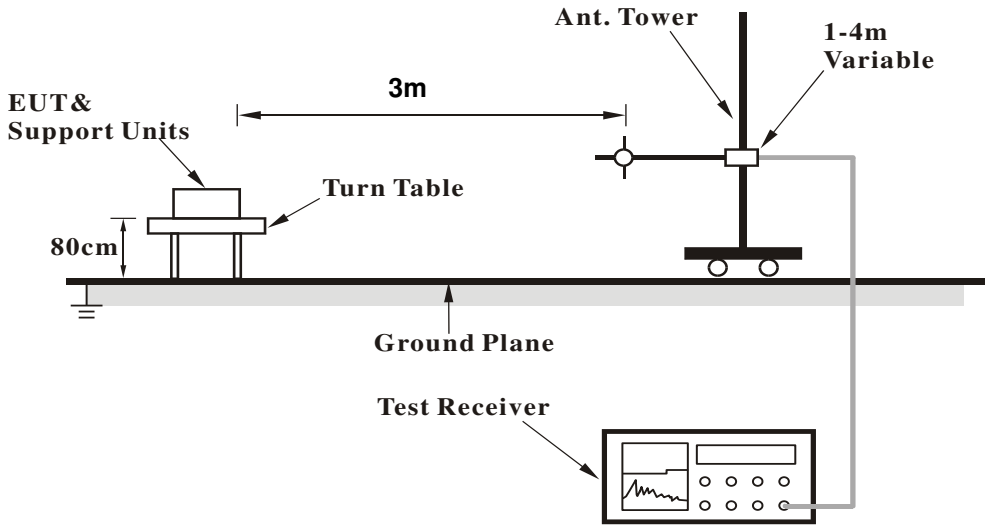
No deviation.

4.1.5 Test Setup

For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



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

4.1.6 EUT Operating Conditions

1 Turn on the power of EUT.

2 The communication partner run test program “PTest.exe” to enable EUT under transmission/receiving condition continuously at specific channel frequency.

4.1.7 Test Results

Frequency Range	13.110 ~ 14.010MHz	Detector Function	Quasi-Peak

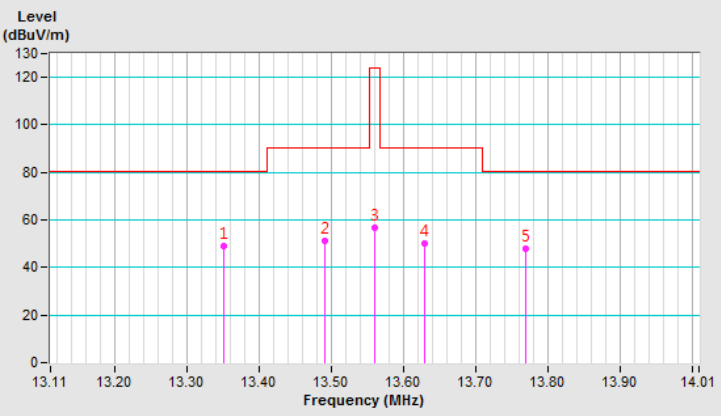
Antenna Polarity & Test Distance: Loop Antenna Open At 3m								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	13.35	49.1 QP	80.5	-31.4	1.00	8	52.4	-3.3
2	13.49	51.3 QP	90.5	-39.2	1.00	360	54.6	-3.3
3	13.56	56.8 QP	124.0	-67.2	1.00	360	60.1	-3.3
4	13.63	50.2 QP	90.5	-40.3	1.00	360	53.5	-3.3
5	13.77	48.1 QP	80.5	-32.4	1.00	360	51.5	-3.4

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. Above limits have been translated by the formula
6. " * ": Fundamental frequency.

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:

13.56MHz = 15848uV/m 30m
= 84dBuV/m 30m
= $84+20\log(30/3)^2$ 3m
= 124dBuV/m



Frequency Range	13.110 ~ 14.010MHz	Detector Function	Quasi-Peak

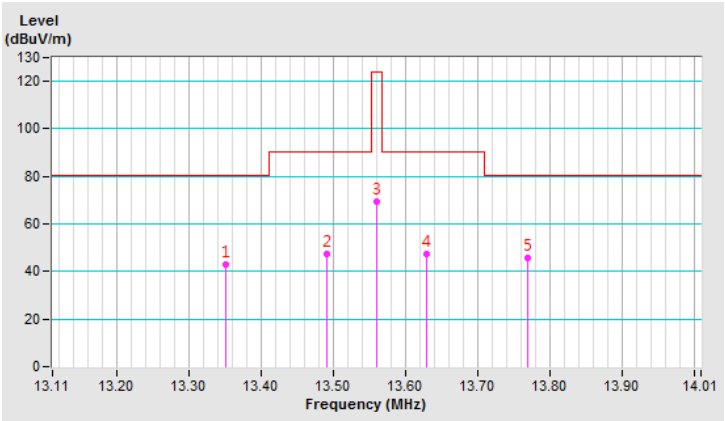
Antenna Polarity & Test Distance: Loop Antenna Close At 3m								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	13.35	43.1 QP	80.5	-37.4	1.00	277	46.4	-3.3
2	13.49	47.2 QP	90.5	-43.3	1.00	265	50.5	-3.3
3	13.56	69.3 QP	124.0	-54.7	1.00	280	72.6	-3.3
4	13.63	47.6 QP	90.5	-42.9	1.00	263	50.9	-3.3
5	13.77	45.8 QP	80.5	-34.7	1.00	289	49.1	-3.3

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. Above limits have been translated by the formula
6. " * ": Fundamental frequency.

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:

13.56MHz = 15848uV/m 30m
= 84dBuV/m 30m
= $84+20\log(30/3)^2$ 3m
= 124dBuV/m



Frequency Range	Below 30MHz	Detector Function	Quasi-Peak

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	1.11	38.2 QP	66.7	-28.5	1.00 H	50	37.8	0.4
2	6.01	30.1 QP	69.5	-39.4	1.00 H	22	33.0	-2.9
3	19.31	35.2 QP	69.5	-34.3	1.00 H	62	39.5	-4.3
4	22.11	46.1 QP	69.5	-23.4	1.00 H	144	50.1	-4.0
5	23.45	49.7 QP	69.5	-19.8	1.00 H	327	53.3	-3.6
6	30.14	39.2 QP	69.5	-30.3	1.00 H	360	39.2	0.0
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	0.63	49.2 QP	71.6	-22.4	1.00 V	268	45.5	3.7
2	4.32	37.1 QP	69.5	-32.4	1.00 V	237	39.9	-2.8
3	8.14	39.1 QP	69.5	-30.4	1.00 V	28	42.0	-2.9
4	22.32	50.1 QP	69.5	-19.4	1.00 V	33	54.0	-3.9
5	23.75	53.1 QP	69.5	-16.4	1.00 V	208	56.6	-3.5
6	28.17	43.6 QP	69.5	-25.9	1.00 V	75	46.2	-2.6

REMARKS:

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

Frequency Range	30MHz ~ 1000MHz	Detector Function	Quasi-Peak

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	112.00	29.3 QP	43.5	-14.2	1.50 H	95	40.2	-10.9
2	160.00	32.9 QP	43.5	-10.6	1.50 H	309	41.1	-8.2
3	208.02	35.8 QP	43.5	-7.7	1.50 H	291	47.4	-11.6
4	240.00	40.0 QP	46.0	-6.0	1.50 H	206	49.6	-9.6
5	288.02	33.2 QP	46.0	-12.8	1.50 H	88	40.9	-7.7
6	336.01	33.5 QP	46.0	-12.5	1.50 H	265	39.8	-6.3
7	368.02	34.3 QP	46.0	-11.7	1.50 H	242	40.1	-5.8
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	144.00	30.4 QP	43.5	-13.1	1.00 V	93	38.7	-8.3
2	160.00	30.0 QP	43.5	-13.5	1.00 V	101	38.2	-8.2
3	208.00	29.3 QP	43.5	-14.2	1.00 V	82	40.9	-11.6
4	239.98	30.5 QP	46.0	-15.5	1.00 V	122	40.2	-9.7
5	384.00	35.9 QP	46.0	-10.1	1.00 V	23	41.3	-5.4
6	729.20	38.8 QP	46.0	-7.2	1.00 V	48	37.4	1.4

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

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.
3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

4.2.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver R&S	ESCS 30	847124/029	Oct. 24, 2016	Oct. 23, 2017
Line-Impedance Stabilization Network (for EUT) R&S	ESH3-Z5	848773/004	Oct. 26, 2016	Oct. 25, 2017
Line-Impedance Stabilization Network (for Peripheral) R&S	ENV216	100072	June 13, 2016	June 12, 2017
RF Cable	5D-FB	COCCAB-001	Sep. 30, 2016	Sep. 29, 2017
10 dB PAD Mini-Circuits	HAT-10+	CONATT-004	June 20, 2016	June 19, 2017
Software BVADT	BVADT_Cond_ V7.3.7.4	NA	NA	NA

Note:
1. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Shielded Room No. 1.
3 Tested Date: Jan. 24 to 26, 2017

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.

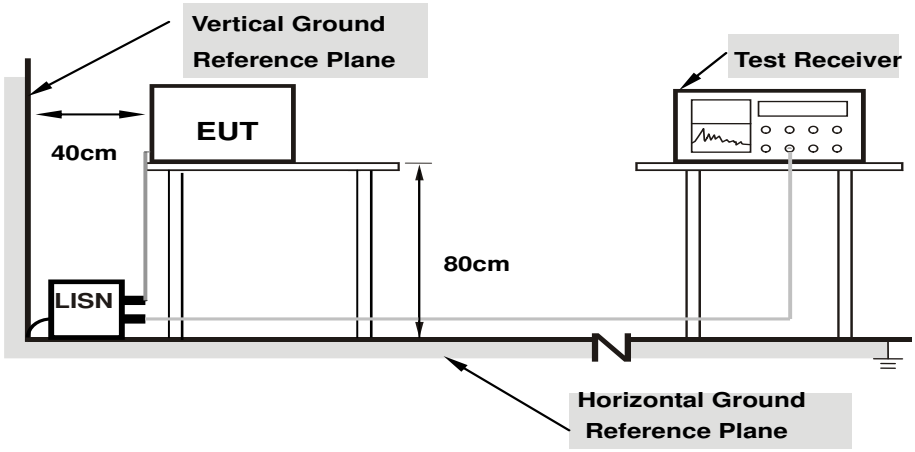
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

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.
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

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

4.2.6 EUT Operating Conditions

Same as 4.1.6.

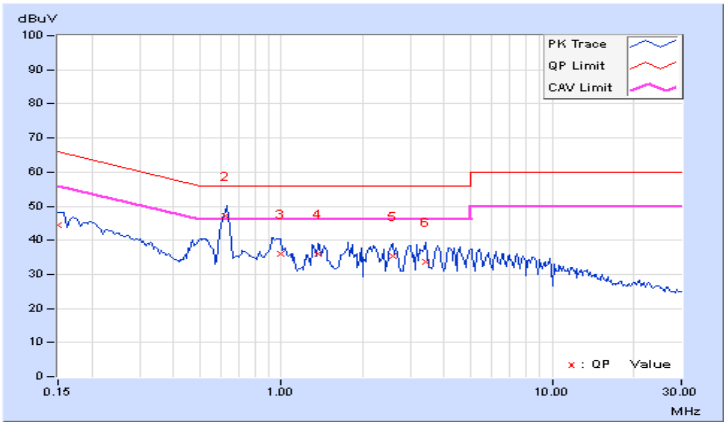
4.2.7 Test Results (Mode 1)

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

Phase Of Power : Line (L)										
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	0.15000	10.19	34.11	21.38	44.30	31.57	66.00	56.00	-21.70	-24.43
2	**0.62585**	**10.24**	**36.88**	**27.92**	**47.12**	**38.16**	**56.00**	**46.00**	**-8.88**	**-7.84**
3	0.98984	10.26	25.76	17.55	36.02	27.81	56.00	46.00	-19.98	-18.19
4	1.36719	10.25	25.71	18.01	35.96	28.26	56.00	46.00	-20.04	-17.74
5	2.57031	10.24	25.01	16.33	35.25	26.57	56.00	46.00	-20.75	-19.43
6	3.39453	10.24	23.42	13.66	33.66	23.90	56.00	46.00	-22.34	-22.10

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

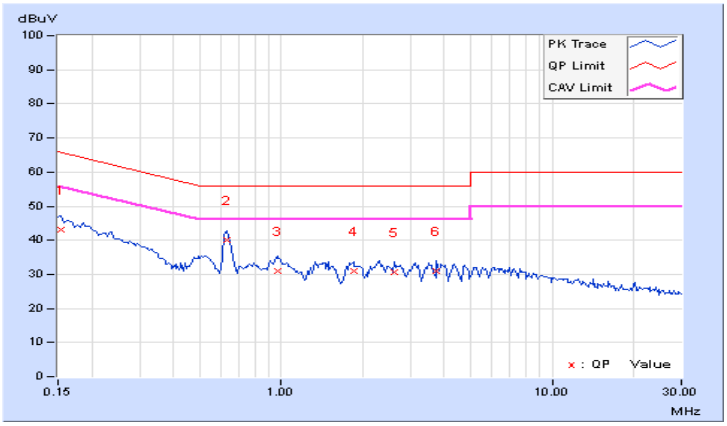


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)

Phase Of Power : Neutral (N)										
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	0.15391	10.18	32.92	20.43	43.10	30.61	65.79	55.79	-22.69	-25.18
2	0.62650	10.22	29.85	22.92	40.07	33.14	56.00	46.00	-15.93	-12.86
3	0.97000	10.23	20.63	10.55	30.86	20.78	56.00	46.00	-25.14	-25.22
4	1.84776	10.27	20.75	10.91	31.02	21.18	56.00	46.00	-24.98	-24.82
5	2.60156	10.24	20.45	10.74	30.69	20.98	56.00	46.00	-25.31	-25.02
6	3.75394	10.17	20.83	10.85	31.00	21.02	56.00	46.00	-25.00	-24.98

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



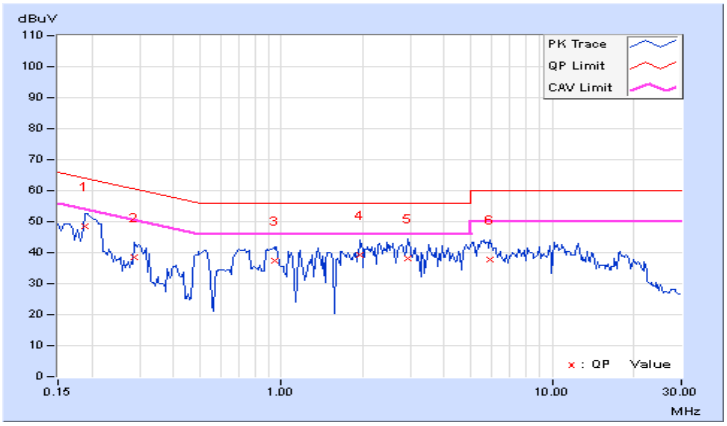
4.2.8 Test Results (Mode 2)

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

Phase Of Power : Line (L)										
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	0.18906	10.19	38.16	20.95	48.35	31.14	64.08	54.08	-15.73	-22.94
2	0.28672	10.20	28.43	15.62	38.63	25.82	60.62	50.62	-21.99	-24.80
3	0.94297	10.26	27.20	11.26	37.46	21.52	56.00	46.00	-18.54	-24.48
4	1.96094	10.24	29.02	14.45	39.26	24.69	56.00	46.00	-16.74	-21.31
5	2.94922	10.24	28.01	14.69	38.25	24.93	56.00	46.00	-17.75	-21.07
6	5.89844	10.34	27.27	15.62	37.61	25.96	60.00	50.00	-22.39	-24.04

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

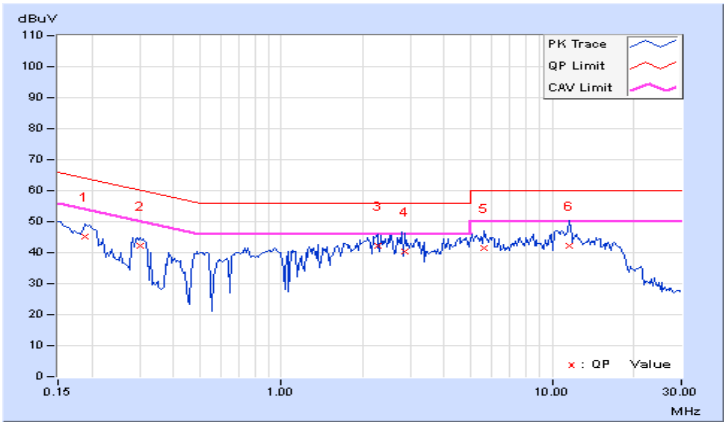


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)

Phase Of Power : Neutral (N)										
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	0.18906	10.16	35.17	20.83	45.33	30.99	64.08	54.08	-18.75	-23.09
2	0.30234	10.19	31.89	22.06	42.08	32.25	60.18	50.18	-18.10	-17.93
3	2.26563	10.26	31.99	18.23	42.25	28.49	56.00	46.00	-13.75	-17.51
4	2.85156	10.23	30.08	16.73	40.31	26.96	56.00	46.00	-15.69	-19.04
5	5.58594	10.25	31.17	19.52	41.42	29.77	60.00	50.00	-18.58	-20.23
6	11.55469	10.61	31.48	22.99	42.09	33.60	60.00	50.00	-17.91	-16.40

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

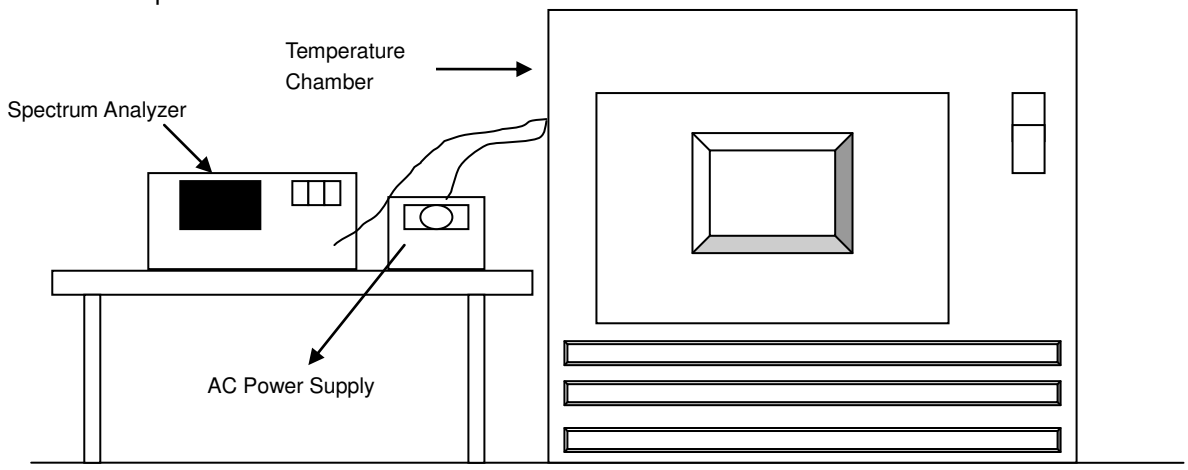


4.3 Frequency Stability

4.3.1 Limits of Frequency Stability Measurement

The frequency tolerance of the carrier signal shall be maintained within +/- 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

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
SPECTRUM ANALYZER R&S	FSV40	100964	June 28, 2016	June 27, 2017
Temperature & Humidity Chamber GIANTFORCE	GTH-150-40-SP-AR	MAA0812-008	Jan. 11, 2017	Jan. 10, 2018
Digital Multimeter FLUKE	87III	73680266	Nov. 10, 2016	Nov. 09, 2017

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. Tested date : Jan 26, 2017

4.3.4 Test Procedure

a. The EUT was placed inside the environmental test chamber and powered by nominal AC voltage.

b. Turned the EUT on and coupled its output to a spectrum analyzer.

c. Turned the EUT off and set the chamber to the highest temperature specified.

d. 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.

e. Repeated step 2 and 3 with the temperature chamber set to the lowest temperature.

f. 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 fromTest Standard

No deviation.

4.3.6 EUT Operating Conditions

Same as Item 4.1.6.

4.3.7 Test Result

FREQUEMCY STABILITY VERSUS TEMP.									
TEMP. (℃)	POWER SUPPLY (Vac)	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	120	13.56002	0.00015	13.56002	0.00015	13.56001	0.00007	13.56	0.00000
40	120	13.55997	-0.00022	13.55997	-0.00022	13.55997	-0.00022	13.55996	-0.00029
30	120	13.56002	0.00015	13.56002	0.00015	13.56001	0.00007	13.56001	0.00007
20	120	13.56007	0.00052	13.56007	0.00052	13.56007	0.00052	13.56006	0.00044
10	120	13.56001	0.00007	13.56003	0.00022	13.56002	0.00015	13.56002	0.00015
0	120	13.55998	-0.00015	13.55997	-0.00022	13.55999	-0.00007	13.55999	-0.00007
-10	120	13.56008	0.00059	13.56008	0.00059	13.56008	0.00059	13.56008	0.00059
-20	120	13.55993	-0.00052	13.55994	-0.00044	13.55993	-0.00052	13.55995	-0.00037
-30	120	13.56003	0.00022	13.56002	0.00015	13.56001	0.00007	13.56001	0.00007

FREQUEMCY STABILITY VERSUS VOLTAGE									
TEMP. (℃)	POWER SUPPLY (Vac)	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	138	13.56007	0.00052	13.56007	0.00052	13.56007	0.00052	13.56006	0.00044
	120	13.56007	0.00052	13.56007	0.00052	13.56007	0.00052	13.56006	0.00044
	102	13.56007	0.00052	13.56007	0.00052	13.56007	0.00052	13.56006	0.00044

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

Same as Item 4.1.5.

4.4.3 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
SPECTRUM ANALYZER R&S	FSV40	100964	June 28, 2016	June 27, 2017

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. Tested date : Jan 26, 2017

4.4.4 Test Procedures

The bandwidth of the fundamental frequency was measured by spectrum analyzer with 10kHz RBW and 30kHz 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.

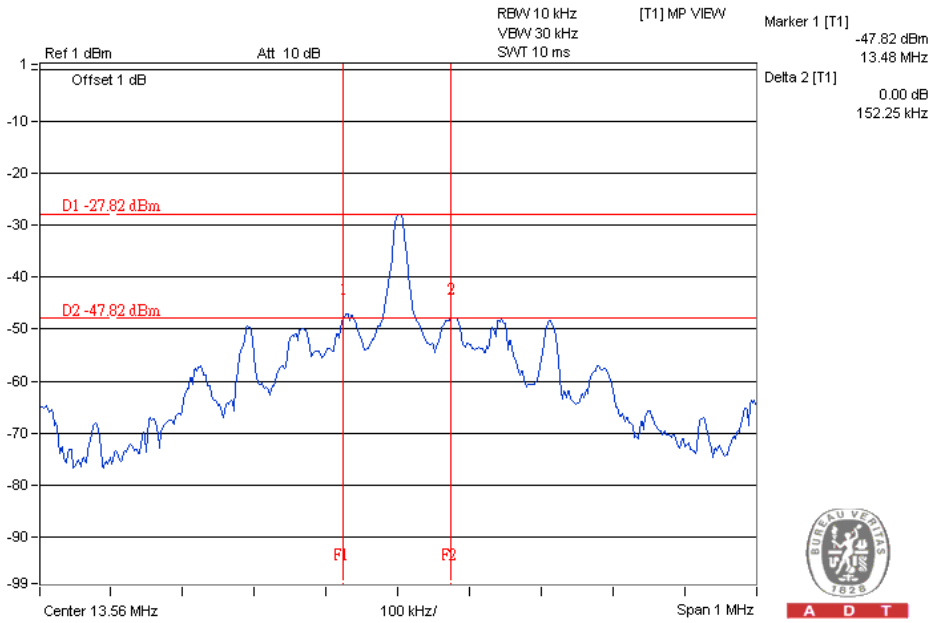
4.4.6 EUT Operating Conditions

Same as Item 4.1.6.

4.4.7 Test Results

20dBc point (Low)	20dBc point (High)	Operating frequency band (MHz)	Pass/Fail
13.48 MHz	13.692 MHz	13.11 – 14.01	Pass

Spectrum Plot Of Value



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 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
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Hsin Chu EMC/RF/Telecom Lab
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Hwa Ya EMC/RF/Safety Lab
Tel: 886-3-3183232
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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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