

FCC Test Report (NFC)

Report No.: RF170907E01-3

FCC ID: MQT-AT15017U

Test Model: xCL_AT-150-17U

Received Date: Sep. 07, 2017

Test Date: Sep. 21 to 27, 2017

Issued Date: Oct. 05, 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
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Release Control Record

Issue No.	Description	Date Issued
RF170907E01-3	Original release.	Oct. 05, 2017

1 Certificate of Conformity

Product: Terminal

Brand: XAC

Test Model: xCL_AT-150-17U

Sample Status: ENGINEERING SAMPLE

Applicant: XAC AUTOMATION CORP.

Test Date: Sep. 21 to 27, 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 :

Mary Ko

Date:

Oct. 05, 2017

Mary Ko / Specialist

Approved by :

May Chen

Date:

Oct. 05, 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 -7.82dB at 2.69141MHz.
15.225 (a)	The field strength of any emissions within the band 13.553-13.567 MHz	PASS	Meet the requirement of limit.
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 -7.5dB at 237.68MHz.
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	1.84 dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	5.30 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	5.16 dB
	6GHz ~ 18GHz	4.91 dB
	18GHz ~ 40GHz	5.30 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT (NFC)

Product	Terminal
Brand	XAC
Test Model	xCL AT-150-17U
Status of EUT	ENGINEERING SAMPLE
Power Supply Rating	DC 3.85V from battery or 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	Li-ion Battery x1 (option)
Data Cable Supplied	NA

Note:

1. There are WLAN, WWAN, Bluetooth and NFC technology used for the EUT.
2. Simultaneously transmission condition.

Condition	Technology		
1	WLAN (2.4GHz)	Bluetooth	NFC
2	WWAN module (FCC ID: QISMU509-65)		NFC

Note: The emission of the simultaneous operation has been evaluated and no non-compliance was found.

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

WWAN Antenna Spec.					
Brand	Model	Ant. Gain (dBi)	Frequency range (MHz)	Antenna Type	Antenna Connector
INPAQ	WA-F-US-02-002	0.24	FDD 2: US(1850 -1910)	PCB	i-pex(MHF)
		-1.78	FDD 5: US(824-849)		
WLAN / Bluetooth Antenna Spec.					
Brand	Model	Ant. Gain (dBi)	Frequency range (MHz)	Antenna Type	Antenna Connector
ACX	AT3216-T2R4PAAT/LF	1.5	2400MHz~2500	chip	none
RFID Antenna Spec.					
Brand	Model	Ant. Gain (dBi)	Frequency range (MHz)	Antenna Type	Antenna Connector
XAC	ASM T103P	13	13.56MHz	Wire	none

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	
MASS POWER	NBS10B050200VEU	Input: AC100-240V, 0.3A, 50~60Hz Output: DC 5V, 2A DC output cable (Shielded, 1.2 m)	
Li-ion Battery (option)			
Brand	Model Name	Specification	Remark
TWS	E200NP	3.85V, 2900mAh, 11.17Wh	Black

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

Test Mode	Description
Mode A	Power from laptop
Mode B	Power from adapter
Mode C	Power from battery

From the above modes, the worst case was found in **Mode A**. Therefore only the test data of the mode was 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 laptop
2	-	√	-	-	Power from adapter

Where **RE:** Radiated Emission
FS: Frequency Stability

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

NOTE: "-" 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 (System)	Tested By
RE	22deg. C, 66%RH	120Vac, 60Hz	JyunChun Lin
PLC	26deg. C, 73%RH	120Vac, 60Hz	Andy Ho
FS	25deg. C, 60%RH	120Vac, 60Hz	Robert Cheng
EB	25deg. C, 60%RH	120Vac, 60Hz	Robert Cheng

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	HP	Pavilion 14-ab023TU	5CD5340WXZ	NA	Provided by Lab
B.	SIM Card	NA	NA	NA	NA	Supplied by client
C.	IC Card	NA	NA	NA	NA	Supplied by client
D.	Magnetic Card	NA	NA	NA	NA	Supplied by client
E.	NFC Card	NA	NA	NA	NA	Supplied by client
F.	SAM Card	NA	NA	NA	NA	Supplied by client
G.	Adapter	MASS	NBS10B050200VEU	NA	NA	Supplied by client

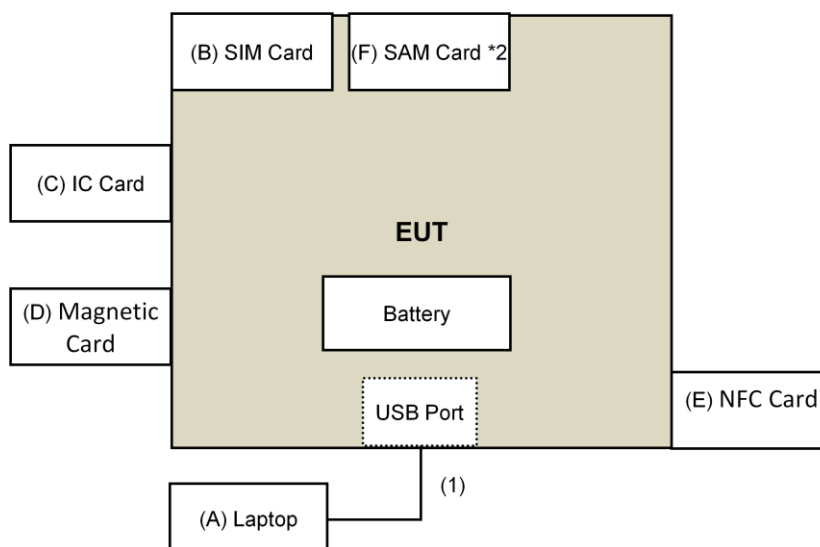
Note:

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

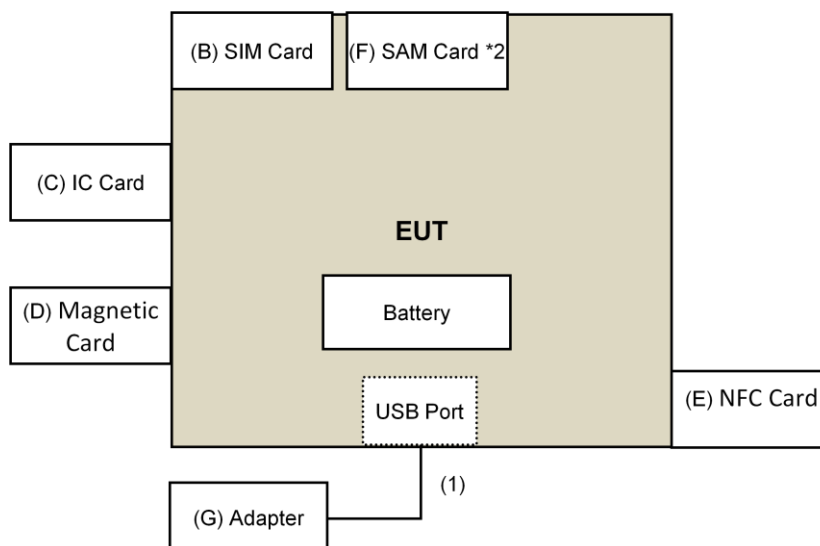
ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	USB Cable	1	1.2	Yes	0	Supplied by client

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.

NOTE: The EUT is also considered as a kind of computer peripheral, because the connection to computer is necessary for typical use. It has been verified to comply with the requirements of FCC Part 15, Subpart B, Class B (DoC). The test report has been issued separately.

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 Keysight	N9038A	MY54450088	July 08, 2017	July 07, 2018
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-1000VH2B	AMP-ZFL-01	Nov. 10, 2016	Nov. 09, 2017
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-406	Dec. 13, 2016	Dec. 12, 2017
RF Cable	8D	966-4-1 966-4-2 966-4-3	Apr. 01, 2017	Mar. 31, 2018
Fixed attenuator Mini-Circuits	UNAT-5+	PAD-3m-4-01	Oct. 05, 2016	Oct. 04, 2017
Software	ADT_Radiated_V8.7.08	NA	NA	NA
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208410	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP02	NA	NA
Spectrum Analyzer R&S	FSV40	100964	July 1, 2017	June 30, 2018
Power meter Anritsu	ML2495A	1014008	May 11, 2017	May 10, 2018
Power sensor Anritsu	MA2411B	0917122	May 11, 2017	May 10, 2018

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. The test was performed in 966 Chamber No. 4.
4. Loop antenna was used for all emissions below 30 MHz.
5. The FCC Designation Number is TW2022. The number will be varied with the Lab location and scope as attached.
6. The CANADA Site Registration No. is 20331-2
7. Tested Date: Sep. 21, 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.

Note:

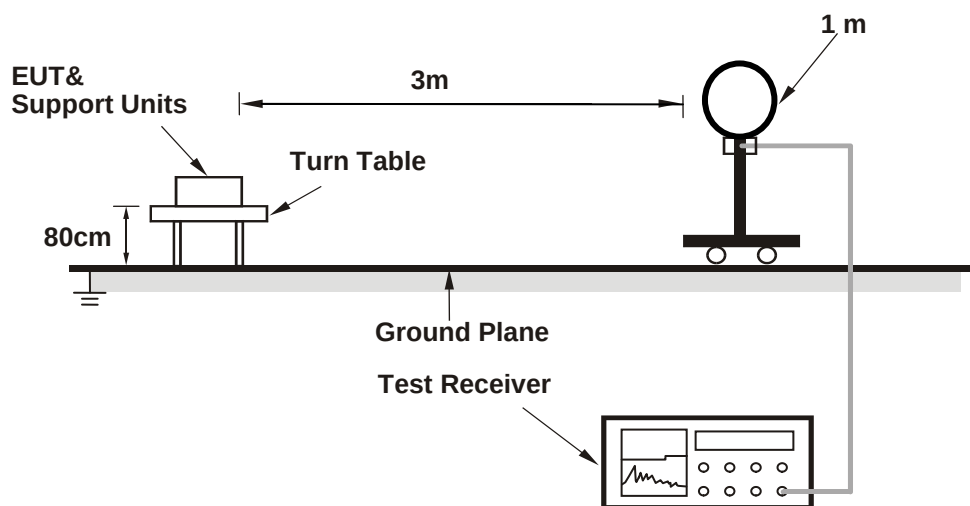
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency above 30MHz.
2. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

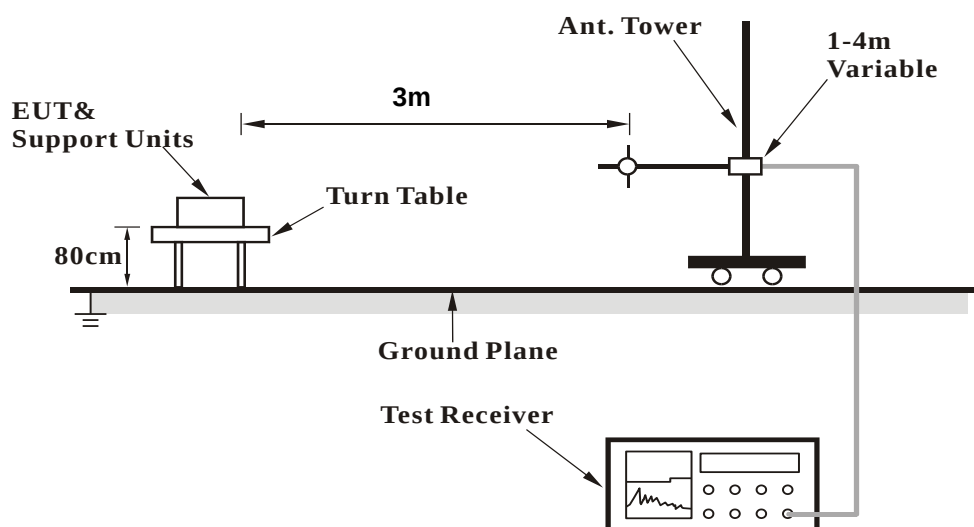
No deviation.

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

- Placed the EUT on the testing table.
- Contorlling software (button function) has been activated to set the EUT on specific status.

4.1.7 Test Results

Frequency Range	13.110 ~ 14.010MHz	Detector Function	Quasi-Peak
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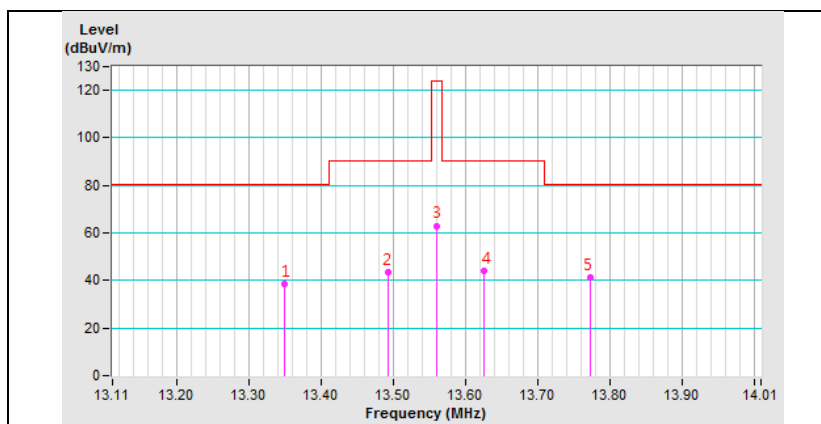
Antenna Polarity & Test Distance: Loop Antenna Open At 3m								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	13.35	38.7 QP	80.5	-41.8	1.00	98	42.0	-3.3
2	13.49	43.6 QP	90.5	-46.9	1.00	92	46.9	-3.3
3	*13.56	63.1 QP	124.0	-60.9	1.00	90	66.4	-3.3
4	13.63	44.3 QP	90.5	-46.2	1.00	102	47.6	-3.3
5	13.77	41.3 QP	80.5	-39.2	1.00	262	44.7	-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:

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



Frequency Range	13.110 ~ 14.010MHz	Detector Function	Quasi-Peak
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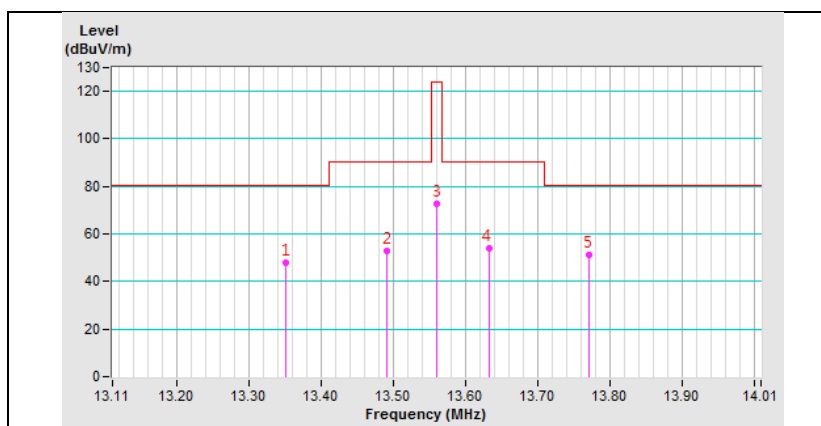
Antenna Polarity & Test Distance: Loop Antenna Close At 3m								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	13.35	47.8 QP	80.5	-32.7	1.00	353	51.1	-3.3
2	13.49	52.9 QP	90.5	-37.6	1.00	360	56.2	-3.3
3	*13.56	72.6 QP	124.0	-51.4	1.00	0	75.9	-3.3
4	13.63	54.0 QP	90.5	-36.5	1.00	0	57.3	-3.3
5	13.77	51.4 QP	80.5	-29.1	1.00	7	54.8	-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:

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



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	0.19	54.9 QP	102.0	-47.1	1.00	94	41.5	13.4
2	5.91	31.5 QP	69.5	-38.0	1.00	0	34.4	-2.9
3	17.69	32.0 QP	69.5	-37.5	1.00	47	36.0	-4.0
4	23.75	43.2 QP	69.5	-26.3	1.00	222	46.7	-3.5
5	26.49	37.1 QP	69.5	-32.4	1.00	340	39.9	-2.8
6	29.97	43.0 QP	69.5	-26.5	1.00	29	45.2	-2.2
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	1.00	43.6 QP	67.6	-24.0	1.00	42	43.0	0.6
2	5.70	36.1 QP	69.5	-33.4	1.00	147	39.0	-2.9
3	17.69	35.4 QP	69.5	-34.1	1.00	353	39.4	-4.0
4	23.11	49.4 QP	69.5	-20.1	1.00	349	53.0	-3.6
5	25.55	43.0 QP	69.5	-26.5	1.00	349	46.0	-3.0
6	29.97	43.2 QP	69.5	-26.3	1.00	324	45.4	-2.2

REMARKS:

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

Frequency Range	30MHz ~ 1000MHz	Detector Function	Quasi-Peak
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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	161.87	31.4 QP	43.5	-12.1	1.50 H	319	39.3	-7.9
2	189.23	34.8 QP	43.5	-8.7	1.50 H	291	45.5	-10.7
3	237.68	38.5 QP	46.0	-7.5	1.50 H	210	48.5	-10.0
4	399.98	33.8 QP	46.0	-12.2	1.00 H	62	39.0	-5.2
5	750.03	33.5 QP	46.0	-12.5	2.00 H	117	31.3	2.2
6	960.01	38.9 QP	54.0	-15.1	1.50 H	122	34.2	4.7
Antenna Polarity & Test Distance: Vertical At 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	242.50	29.6 QP	46.0	-16.4	1.50 V	262	39.4	-9.8
2	350.03	35.4 QP	46.0	-10.6	2.50 V	235	41.9	-6.5
3	450.01	27.7 QP	46.0	-18.3	1.00 V	172	31.3	-3.6
4	550.04	27.2 QP	46.0	-18.8	1.00 V	184	29.2	-2.0
5	796.66	28.5 QP	46.0	-17.5	1.50 V	352	26.1	2.4
6	960.01	36.8 QP	54.0	-17.2	1.50 V	164	32.1	4.7

REMARKS:

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

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 03, 2017	June 02, 2018
50 ohms Terminator	N/A	EMC-02	Sep. 29, 2016	Sep. 28, 2017
RF Cable	5D-FB	COCCAB-001	Sep. 30, 2016	Sep. 29, 2017
10 dB PAD Mini-Circuits	HAT-10+	CONATT-004	June 18, 2017	June 17, 2018
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: Sep. 27, 2017

4.2.3 Test Procedures

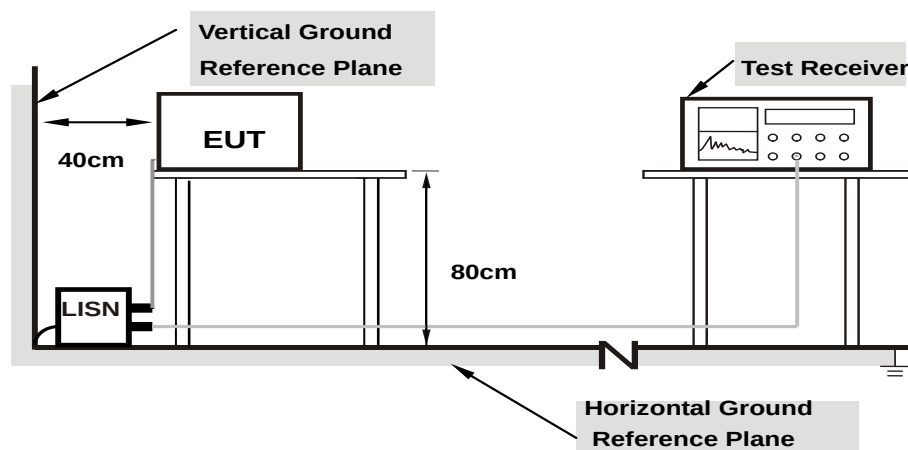
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance 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.

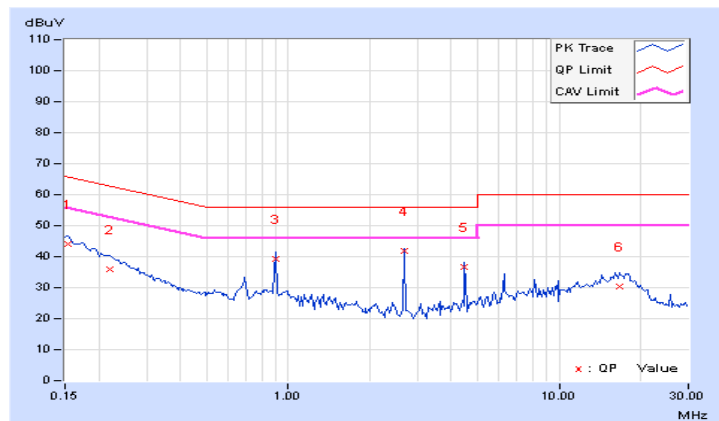
4.2.7 Test Results (Mode 1)

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
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No	Freq.	Corr.	Reading Value		Emission Level		Limit		Margin	
	[MHz]	Factor	[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
		(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15391	10.08	34.16	21.01	44.24	31.09	65.79	55.79	-21.55	-24.70
2	0.22031	10.08	25.87	11.13	35.95	21.21	62.81	52.81	-26.86	-31.60
3	0.89609	10.15	29.21	24.53	39.36	34.68	56.00	46.00	-16.64	-11.32
4	2.69141	10.24	31.74	27.94	41.98	38.18	56.00	46.00	-14.02	-7.82
5	4.48828	10.40	26.35	22.39	36.75	32.79	56.00	46.00	-19.25	-13.21
6	16.72656	11.32	18.88	10.85	30.20	22.17	60.00	50.00	-29.80	-27.83

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.

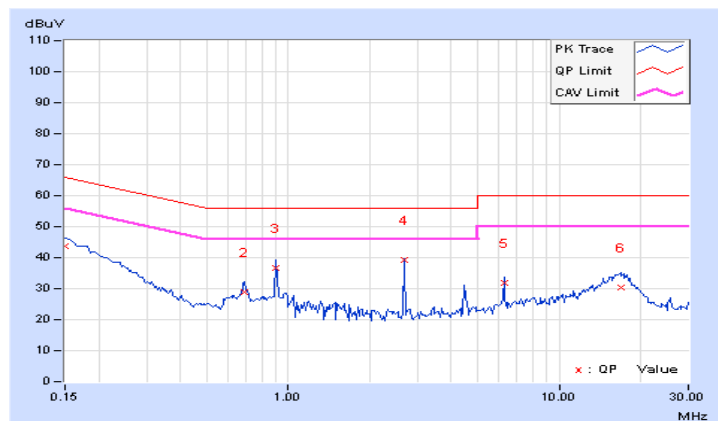


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
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No	Freq. [MHz]	Corr.	Reading Value		Emission Level		Limit		Margin	
		Factor	[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
		(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	10.07	33.77	19.04	43.84	29.11	66.00	56.00	-22.16	-26.89
2	0.68906	10.12	18.63	14.04	28.75	24.16	56.00	46.00	-27.25	-21.84
3	0.89609	10.12	26.47	20.52	36.59	30.64	56.00	46.00	-19.41	-15.36
4	2.69141	10.23	29.12	23.83	39.35	34.06	56.00	46.00	-16.65	-11.94
5	6.27734	10.43	21.56	15.55	31.99	25.98	60.00	50.00	-28.01	-24.02
6	16.83203	11.10	19.28	8.36	30.38	19.46	60.00	50.00	-29.62	-30.54

REMARKS:

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



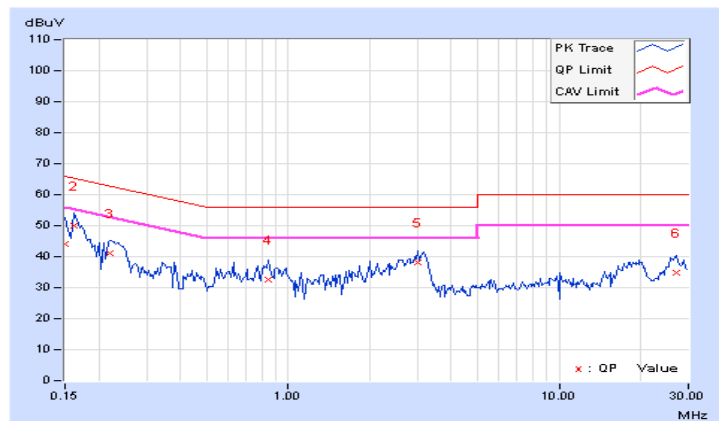
4.2.8 Test Results (Mode 2)

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
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No	Freq. [MHz]	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
		(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	10.07	33.84	21.10	43.91	31.17	66.00	56.00	-22.09	-24.83
2	0.16172	10.07	39.97	21.19	50.04	31.26	65.38	55.38	-15.34	-24.12
3	0.22031	10.07	31.18	13.02	41.25	23.09	62.81	52.81	-21.56	-29.72
4	0.84922	10.13	22.58	13.06	32.71	23.19	56.00	46.00	-23.29	-22.81
5	3.01953	10.22	27.99	21.84	38.21	32.06	56.00	46.00	-17.79	-13.94
6	27.14844	11.35	23.40	16.43	34.75	27.78	60.00	50.00	-25.25	-22.22

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.

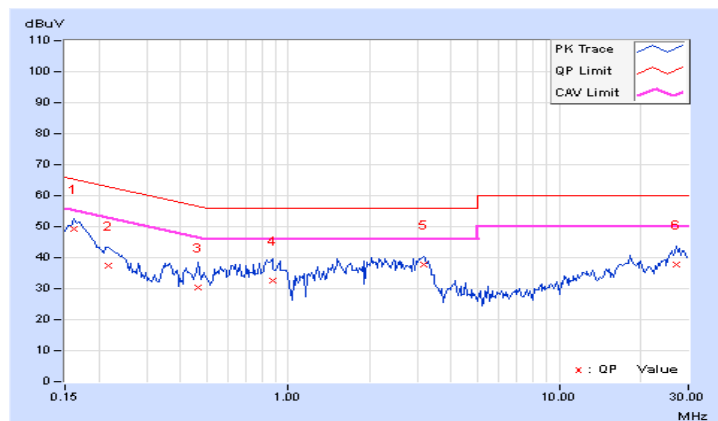


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
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No	Freq. [MHz]	Corr.	Reading Value		Emission Level		Limit		Margin	
		Factor	[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
		(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16172	10.05	39.05	19.10	49.10	29.15	65.38	55.38	-16.28	-26.23
2	0.21641	10.04	27.43	13.80	37.47	23.84	62.96	52.96	-25.49	-29.12
3	0.46250	10.10	20.31	8.98	30.41	19.08	56.65	46.65	-26.24	-27.57
4	0.87266	10.11	22.30	11.32	32.41	21.43	56.00	46.00	-23.59	-24.57
5	3.15625	10.20	27.41	21.49	37.61	31.69	56.00	46.00	-18.39	-14.31
6	27.12109	10.97	26.80	18.59	37.77	29.56	60.00	50.00	-22.23	-20.44

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.

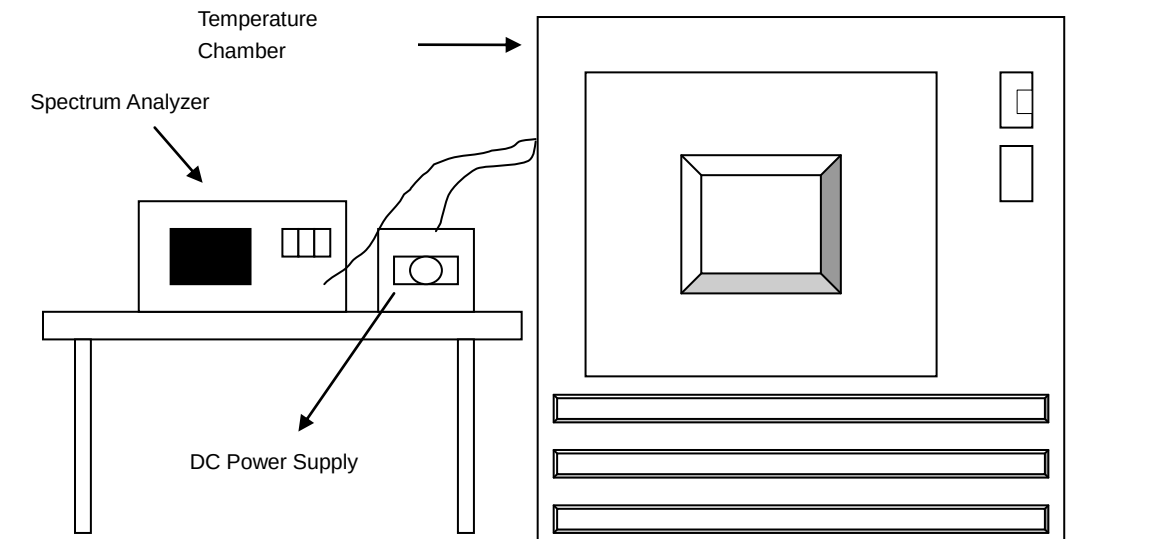


4.3 Frequency Stability

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 DC 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 Minutes		5 Minutes		10 Minutes	
		Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift
		(MHz)	%	(MHz)	%	(MHz)	%	(MHz)	%
50	3.85	13.55999	-0.00007	13.55999	-0.00007	13.55998	-0.00015	13.56	0.00000
40	3.85	13.56003	0.00022	13.56003	0.00022	13.56003	0.00022	13.56003	0.00022
30	3.85	13.55995	-0.00037	13.55995	-0.00037	13.55996	-0.00029	13.55994	-0.00044
20	3.85	13.55998	-0.00015	13.55998	-0.00015	13.55999	-0.00007	13.55998	-0.00015
10	3.85	13.56006	0.00044	13.56006	0.00044	13.56006	0.00044	13.56007	0.00052
0	3.85	13.55996	-0.00029	13.55997	-0.00022	13.55997	-0.00022	13.55996	-0.00029
-10	3.85	13.55993	-0.00052	13.55993	-0.00052	13.55993	-0.00052	13.55994	-0.00044
-20	3.85	13.55996	-0.00029	13.55996	-0.00029	13.55996	-0.00029	13.55996	-0.00029

Frequency Stability Versus Voltage									
TEMP. (°C)	Power Supply (Vdc)	0 Minute		2 Minutes		5 Minutes		10 Minutes	
		Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift
		(MHz)	%	(MHz)	%	(MHz)	%	(MHz)	%
20	4.4275	13.55998	-0.00015	13.55994	-0.00044	13.55994	-0.00044	13.55995	-0.00037
	3.85	13.55994	-0.00044	13.55995	-0.00037	13.55999	-0.00007	13.55993	-0.00052
	3.2725	13.55992	-0.00059	13.55996	-0.00029	13.55995	-0.00037	13.55996	-0.00029

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

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 10HzRBW and 30Hz 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

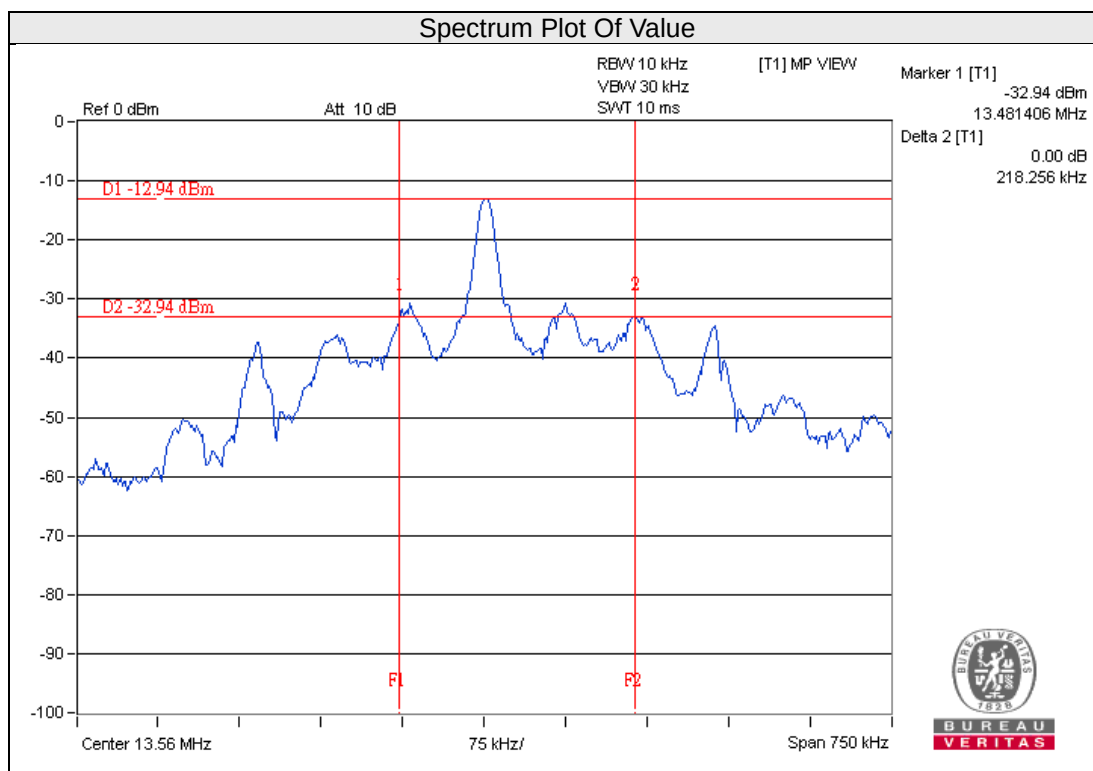
No deviation.

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
13.481406	13.699406	13.11 – 14.01	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 according to ISO/IEC 17025.

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

Linko EMC/RF Lab

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Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab

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Tel: 886-3-3183232

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Email: service.adt@tw.bureauveritas.com

Web Site: www.bureauveritas-adt.com

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

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