FCC Test Report

Report No.:	RF181101E04
FCC ID:	YSI-NMR2
Test Model:	SensOn3x
Received Date:	Nov. 01, 2018
Test Date:	Dec. 12 to 13, 2018
Issued Date:	Dec. 21, 2018
Applicant:	Delta Mobile Systems
Address:	645 Tollgate Road, Suite 300 Elgin IL 60123 United States Of America
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:	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan R.O.C.
FCC Registration / Designation Number:	723255 / TW2022

Testing Laboratory
2022

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Release Control Record

Issue No.	Description	Date Issued
RF181101E04	Original release.	Dec. 21, 2018

1 Certificate of Conformity

Product:	SensOn3x
Brand:	SensOn3x
Test Model:	SensOn3x
Sample Status:	ENGINEERING SAMPLE
Applicant:	Delta Mobile Systems
Test Date:	Dec. 12 to 13, 2018
Standards:	47 CFR FCC Part 95, Subpart M 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:** Dec. 21, 2018

Mary Ko / Specialist

Approved by : , **Date:** Dec. 21, 2018

May Chen / Manager

2 Summary of Test Results

47 CFR FCC Part 95, Subpart M			
FCC Clause	Test Item	Result	Remarks
95.3367 (a)/(b)	Equivalent Isotropically Radiated Power (EIRP)Test	PASS	Meet the requirement of limit.
95.3379(a)	Unwanted Emission Test	PASS	Meet the requirement of limit.
95.3379(b)	Frequency Stability Test	PASS	Meet the requirement of limit.
2.1049	Occupied Bandwidth Measurement	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) (±)
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	5.53 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	5.08 dB
	6GHz ~ 18GHz	4.98 dB
	18GHz ~ 40GHz	5.19 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	SensOn3x
Brand	SensOn3x
Test Model	SensOn3x
Status of EUT	ENGINEERING SAMPLE
Power Supply Rating	12Vdc
Modulation Type	FMCW
Operating Frequency	76.025 ~ 76.975GHz
Emission designator	944MF1N
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	NA
Data Cable Supplied	NA

Note:

1. The antenna provided to the EUT, please refer to the following table:

Antenna Type	Antenna Gain (dBi)	Connector Type	Frequency range (GHz)
Printed Patch Array	10	none	76 ~ 77

2. 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

Frequency range is 76.025~76.975GHz provided for test.

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE≥1G	RE<1G	FS	OB	
-	√	√	√	√	-

Where **RE≥1G:** Radiated Emission above 1GHz & Bandedge Measurement **RE<1G:** Radiated Emission below 1GHz

FS: Frequency Stability **OB:** Occupied Bandwidth measurement

NOTE: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **Z-plane**.

Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE≥1G	22deg. C, 67%RH 23deg. C, 62%RH 25deg. C, 68%RH	DC 12V	Andy Ho Weiwei Lo
RE<1G	23deg. C, 71%RH	DC 12V	Andy Ho
FS	23deg. C, 62%RH	DC 12V	Weiwei Lo
OB	23deg. C, 62%RH	DC 12V	Weiwei Lo

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.

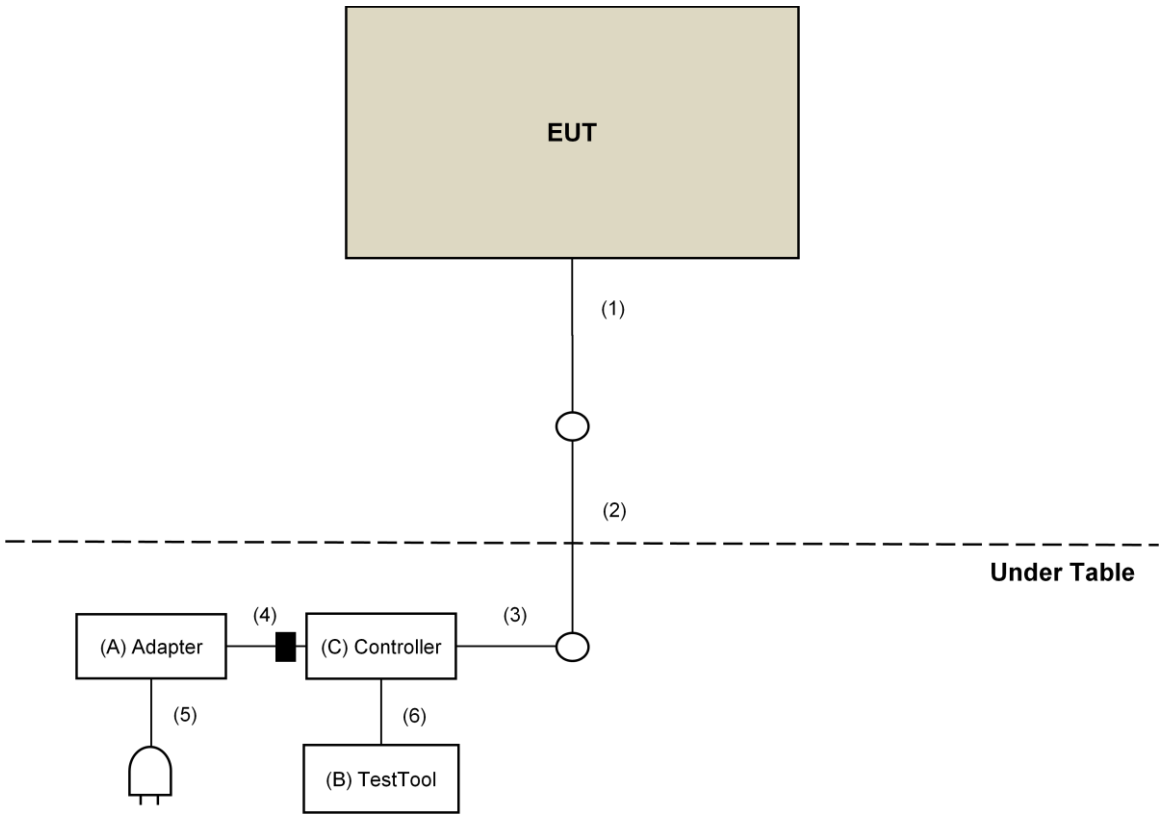
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Adapter	MEAN WELL	GST60A12	EB7A516259	NA	Supplied by client
B.	Test Tool	NA	NA	NA	NA	Supplied by client
C.	Controller	Delta Mobile Systems , Inc.	NA	AC71808220003	NA	Supplied by client

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.	Signal Cable	1	0.65	No	0	Supplied by client
2.	Signal Cable	1	4	No	0	Supplied by client
3.	Signal Cable	1	0.12	No	0	Supplied by client
4.	DC Cable	1	1.1	No	1	Supplied by client
5.	AC Cable	1	1.5	No	0	Supplied by client
6.	Signal Cable	1	0.2	No	0	Supplied by client

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 95, Subpart M

ANSI 63.10-2013

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

4 Test Types and Results

4.1 Radiated Power and Unwanted Emission Measurement

4.1.1 Limits of Radiated Power and Unwanted Emission Measurement

According to 95.3367 the field strength of emissions from intentional radiators operated under these frequencies bands shall not exceed the following:

Fundamental Frequency (GHz)	Equivalent Isotropically Radiated Power (EIRP)	
	Peak	Average
76 ~ 81	55 dBm/MHz	50 dBm/MHz

According to 95.3379 the power density of any emissions outside the 76-81 GHz band shall consist solely of spurious emissions and shall not exceed the following:
(1) Radiated emissions below 40 GHz shall not exceed the field strength as shown in the following emissions 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 tighter limit applies at the band edges.
2. The limits are based on the frequency of the unwanted emissions and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
3. The emissions limits are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9.0-90.0 kHz, 110.0-490.0 kHz, and above 1000 MHz. Radiated emissions limits in these three bands are based on measurements employing an average detector with a 1 MHz RBW.

(2) The power density of radiated emissions outside the 76-81 GHz band above 40.0 GHz shall not exceed the following, based on measurements employing an average detector with a 1 MHz RBW:

(i) For radiated emissions outside the 76-81 GHz band between 40 GHz and 200 GHz from field disturbance sensors and radar systems operating in the 76-81 GHz band: 600 pW/cm^2 at a distance of 3 meters from the exterior surface of the radiating structure.

(ii) For radiated emissions above 200 GHz from field disturbance sensors and radar systems operating in the 76-81 GHz band: 1000 pW/cm2 at a distance of 3 meters from the exterior surface of the radiating structure.

(3) For field disturbance sensors and radar systems operating in the 76-81 GHz band, the spectrum shall be investigated up to 231.0 GHz.

4.1.2 Test Instruments

Below 40GHz test:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver Agilent	N9038A	MY50010156	July 12, 2018	July 11, 2019
Pre-Amplifier EMCI	EMC001340	980142	Feb. 09, 2018	Feb. 08, 2019
Loop Antenna(*) Electro-Metrics	EM-6879	264	Dec. 16, 2016	Dec. 15, 2018
RF Cable	NA	LOOPCAB-001	Jan. 15, 2018	Jan. 14, 2019
RF Cable	NA	LOOPCAB-002	Jan. 15, 2018	Jan. 14, 2019
Pre-Amplifier Mini-Circuits	ZFL-1000VH2B	AMP-ZFL-05	May 05, 2018	May 04, 2019
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-361	Nov. 22, 2018	Nov. 21, 2019
RF Cable	8D	966-3-1	Mar. 20, 2018	Mar. 19, 2019
RF Cable	8D	966-3-2	Mar. 20, 2018	Mar. 19, 2019
RF Cable	8D	966-3-3	Mar. 20, 2018	Mar. 19, 2019
Fixed attenuator Mini-Circuits	UNAT-5+	PAD-3m-3-01	Sep. 27, 2018	Sep. 26, 2019
Horn_Antenna SCHWARZBECK	BBHA9120-D	9120D-406	Nov. 25, 2018	Nov. 24, 2019
Pre-Amplifier EMCI	EMC12630SE	980384	Jan. 29, 2018	Jan. 28, 2019
RF Cable	EMC104-SM-SM-1200	160922	Jan. 29, 2018	Jan. 28, 2019
RF Cable	EMC104-SM-SM-2000	150317	Jan. 29, 2018	Jan. 28, 2019
RF Cable	EMC104-SM-SM-5000	150322	Jan. 29, 2018	Jan. 28, 2019
Spectrum Analyzer Keysight	N9030A	MY54490679	July 23, 2018	July 22, 2019
Pre-Amplifier EMCI	EMC184045SE	980386	Jan. 29, 2018	Jan. 28, 2019
Horn_Antenna SCHWARZBECK	BBHA 9170	BBHA9170608	Nov. 25, 2018	Nov. 24, 2019
RF Cable	EMC102-KM-KM-1200	160924	Jan. 29, 2018	Jan. 28, 2019
Software	ADT_Radiated_V8.7.08	NA	NA	NA
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208406	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP01	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. The test was performed in 966 Chamber No. 3.
4. The CANADA Site Registration No. is 20331-1
5. Loop antenna was used for all emissions below 30 MHz.
6. Tested Date: Dec. 13, 2018

Above 40GHz test:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer Agilent	E4446A	MY48250254	Nov. 14, 2018	Nov. 13, 2019
*Harmonic Mixer (33~55GHz) OML	M22HWD	110215-1	Oct. 17, 2017	Oct. 16, 2019
*Horn Antenna (33~55GHz) OML	M22RH	110215-1	Oct. 17, 2017	Oct. 16, 2019
*Harmonic Mixer (50~75GHz) OML	M15RH	110215-1	Oct. 17, 2017	Oct. 16, 2019
*Horn Antenna (50~75GHz) OML	M15HWD	110215-1	Oct. 17, 2017	Oct. 16, 2019
*Harmonic Mixer (75~110GHz) OML	M10HWD	110215-1	Oct. 17, 2017	Oct. 16, 2019
*Horn Antenna (75~110GHz) OML	M10RH	110215-1	Oct. 17, 2017	Oct. 16, 2019
*Harmonic Mixer (110~170GHz) OML	M06RH	110215-1	Oct. 17, 2017	Oct. 16, 2019
*Horn Antenna(110~170GHz) OML	M06HWD	110215-1	Oct. 17, 2017	Oct. 16, 2019
*Harmonic Mixer (140~220GHz) OML	M05HWD	110215-1	Oct. 17, 2017	Oct. 16, 2019
*Horn Antenna (140~220GHz) OML	M05RH	110215-1	Oct. 17, 2017	Oct. 16, 2019
*Harmonic Mixer (220~325GHz) OML	M03HWA	M03HWA_140505-1	Oct. 17, 2017	Oct. 16, 2019
*Horn Antenna (220~325GHz) OML	M03RH	M03RH_140508-1	Oct. 17, 2017	Oct. 16, 2019
*Diplexer EMCI	DPL26	DPL26_01	Oct. 17, 2017	Oct. 16, 2019
*Diplexer EMCI	DPL26	DPL26_02	Oct. 17, 2017	Oct. 16, 2019
*Precision 30dB Attenuator Keysight	11708A	MY55260015	Oct. 17, 2017	Oct. 16, 2019
*Zero-Bias Detector (50~75GHz) Vdi	WR15ZBD	WR15R5 1-30	Oct. 17, 2017	Oct. 16, 2019
4CH Infiniivision Oscilloscope Keysight	DSOX6004A	MY55190202	Dec. 13, 2017	Dec. 12, 2018
*WR15CH Conical Horn Keysight	WR15CH	WR15CH-01	Oct. 17, 2017	Oct. 16, 2019
*WR10CH Conical Horn Keysight	WR10CH	WR10CH-01	Oct. 17, 2017	Oct. 16, 2019
*Millimeter-Wave Signal Generator Frequency Extension Module (50~75 GHz) Keysight	E8257DV15	US54250106	Oct. 17, 2017	Oct. 16, 2019
*Millimeter-Wave Signal Generator Frequency Extension Module (75~110 GHz) Keysight	E8257DV10	US53250009	Oct. 17, 2017	Oct. 16, 2019
PSG analog signal generator Keysight	E8257D	MY53401987	June 26, 2018	June 25, 2019
Antenna Tower & Turn Table CT	NA	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 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. 3
4. The CANADA Site Registration No. is IC 7450H-2.
5. Test Date: Dec. 12, 2018

4.1.3 Test Procedures

For Radiated emission: Below 30 MHz

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

NOTE:

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

For Radiated emission: 30 MHz ~ 40GHz

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 is 1MHz and video bandwidth of test receiver/spectrum analyzer is 3MHz for Peak detection (PK) at frequency from 1GHz to 40GHz.
3. The resolution bandwidth is 1MHz and video bandwidth of test receiver/spectrum analyzer is 3MHz for Average detection (AV) at frequency from 1GHz to 40GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

For Radiated emission: Above 40GHz

External mixers are utilized.

a. The EUT was placed on the top of a rotating table 1.8 meters above the ground at a 3 meters chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The distance at which limits are typically specified is 3 meter; however, closer measurement distances may be utilized.

c. Begin handheld measurements with the test antenna (horn) at a distance of 1 meter from the EUT, in a horizontally polarized position. Slowly adjust its position, entirely covering the plane 1 meter from the EUT.

d. Repeat (b) with the horn in a vertically polarized position.

e. If the emission cannot be detected at 1 meter, reduce the RBW in order to increase system sensitivity. Note the value. If the emission still cannot be detected, move the horn closer to the EUT, noting the distance at which a measurement is made.

f. Note the maximum level indicated on the Spectrum Analyzer.

g. Based on the distance at which the measurement was made and the calculated distance to the edge of the far field, determine the appropriate distance attenuation factor. Apply this factor to the calculated field strength in order to determine the equivalent field strength at the distance at which the regulatory limit is specified. Compare to the appropriate limits

h. Repeat (a) - (f) for every emission that must be measured, up through the required frequency range of investigation

NOTE:

1. The resolution bandwidth is 1MHz and video bandwidth of test receiver/spectrum analyzer is 3MHz for Peak and Average detection for fundamental emission.
2. The resolution bandwidth is 1MHz and video bandwidth of test receiver/spectrum analyzer is 3MHz for Average detection at frequency above 40GHz.

Far Field Boundary Calculations

The far-field boundary is given as:
R far field = (2 * L^2) /λ
where: L = Largest Antenna Dimension, including the reflector, in meters
λ = wavelength in meters

FREQUENCY RANGE (GHz)	L (m)	Lambda (m)	R (Far Field) (m)
76.025~76.975	0.058	0.00392	1.716

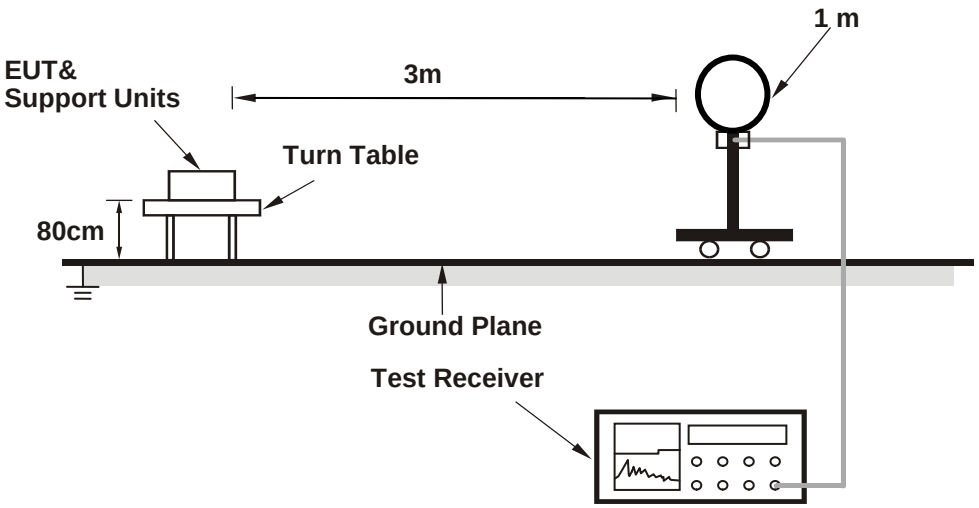
*Measurements made at 1.8 meter distance.

4.1.4 Deviation from Test Standard

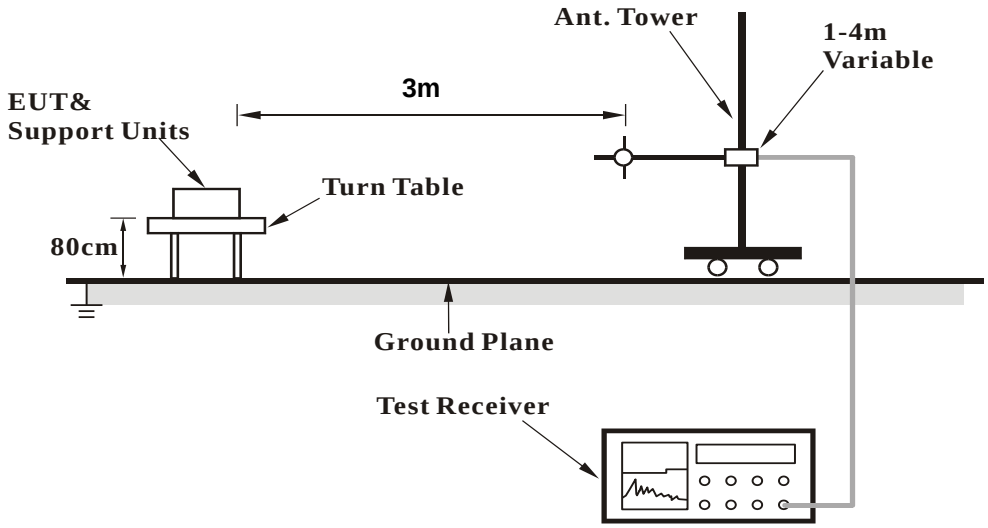
No deviation.

4.1.5 Test Setup

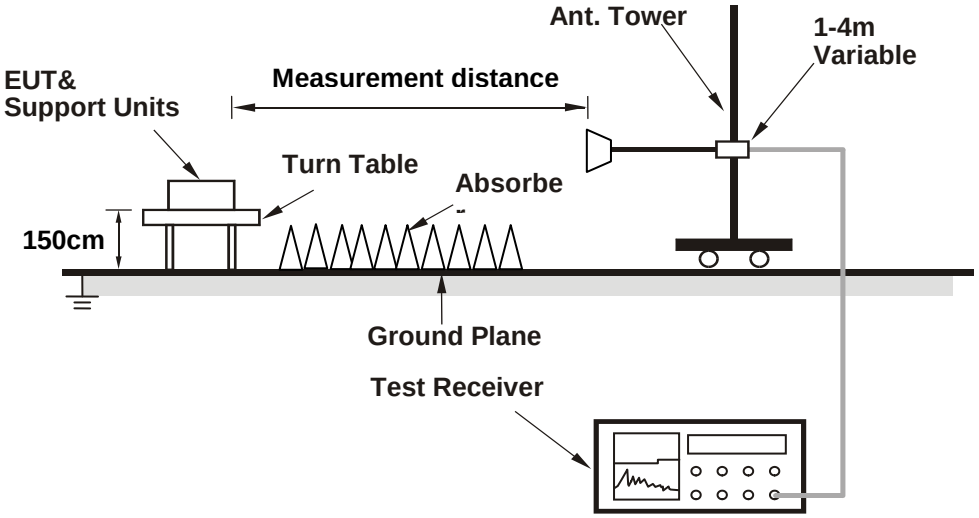
For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



For Radiated emission above 1GHz



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

4.1.6 EUT Operating Conditions

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

4.1.7 Test Results

Above 1GHz Data

FREQUENCY RANGE	1GHz ~ 18GHz	DETECTOR FUNCTION	Peak (PK) Average (AV)

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	1220.11	49.8 PK	74.0	-24.2	1.62 H	300	55.9	-6.1
2	1220.11	42.1 AV	54.0	-11.9	1.62 H	300	48.2	-6.1
3	2482.00	37.7 PK	74.0	-36.3	1.90 H	338	40.7	-3.0
4	2482.00	23.1 AV	54.0	-30.9	1.65 H	228	26.1	-3.0
5	3480.00	37.2 PK	74.0	-36.8	1.65 H	228	38.4	-1.2
6	3480.00	26.3 AV	54.0	-27.7	1.49 H	225	27.5	-1.2
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	1200.40	33.5 PK	74.0	-40.5	1.65 V	250	39.7	-6.2
2	1200.40	29.0 AV	54.0	-25.0	1.65 V	250	35.2	-6.2
3	2861.37	35.4 PK	74.0	-38.6	1.66 V	185	37.4	-2.0
4	2861.37	19.8 AV	54.0	-34.2	1.66 V	185	21.8	-2.0
5	3772.15	37.3 PK	74.0	-36.7	1.65 V	322	37.6	-0.3
6	3772.15	24.7 AV	54.0	-29.3	1.65 V	322	25.0	-0.3

REMARKS:

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

FREQUENCY RANGE	18GHz ~ 40GHz	DETECTOR FUNCTION	Peak (PK) Average (AV)

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	19440.00	33.5 PK	74.0	-40.5	3.51 H	223	54.9	-21.4
2	19440.00	19.3 AV	54.0	-34.7	3.51 H	223	40.7	-21.4
3	23752.00	33.3 PK	74.0	-40.7	1.53 H	116	52.2	-18.9
4	23752.00	19.5 AV	54.0	-34.5	1.53 H	116	38.4	-18.9
5	29780.00	49.8 PK	74.0	-24.2	1.90 H	269	68.3	-18.5
6	29780.00	37.3 AV	54.0	-16.7	1.90 H	269	55.8	-18.5
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	20056.55	43.2 PK	74.0	-30.8	1.50 V	281	64.2	-21.0
2	20056.55	29.8 AV	54.0	-24.2	1.50 V	281	50.8	-21.0
3	21924.25	36.6 PK	74.0	-37.4	1.55 V	278	56.3	-19.7
4	21924.25	24.2 AV	54.0	-29.8	1.55 V	278	43.9	-19.7
5	27801.45	44.2 PK	74.0	-29.8	1.52 V	146	62.4	-18.2
6	27801.45	32.2 AV	54.0	-21.8	1.52 V	146	50.4	-18.2

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	40GHz ~ 100GHz	DETECTOR FUNCTION	Peak (PK) Average (AV)

ANTENNA POLARITY: HORIZONTAL						
NO.	FREQ. RANGE (GHz)	Raw Value (dBm/MHz)	Receiver Antenna Gain (dBi)	EIRP Level (dBm/MHz)	EIRP Limit (dBm/MHz)	PASS/FAIL
1	76.5	-34.7	23.6	16.9 PK	55	PASS
2	76.5	-44.0	23.6	7.7 AV	50	PASS
ANTENNA POLARITY: VERTICAL						
NO.	FREQ. RANGE (GHz)	Raw Value (dBm/MHz)	Receiver Antenna Gain (dBi)	EIRP Level (dBm/MHz)	EIRP Limit (dBm/MHz)	PASS/FAIL
1	76.5	-48.6	23.6	3.0 PK	55	PASS
2	76.5	-59.0	23.6	-7.4 AV	50	PASS

REMARKS:

1.The measured power level is converted to EIRP using the Friis equation:

EIRP = Raw Value - Receiver Antenna Gain + 20*log(4*3.1416*D/λ)

where:

D is the measurement distance

λ is the wavelength

*Measurements made at 1.8 meter distance.

FREQUENCY RANGE	100GHz ~ 231GHz	DETECTOR FUNCTION	Average (AV)

ANTENNA POLARITY: HORIZONTAL							
NO.	FREQ. (GHz)	Raw Value (dBm/MHz)	Receiver Antenna Gain (dBi)	EIRP Level (dBm/MHz)	Power Density (pW/cm^2)	Power Density Limit (pW/cm^2)	PASS/FAIL
1	153	-90.1	22.7	-31.6	0.613 AV	600	PASS
2	231	-92.3	22.9	-30.3	0.819 AV	1000	PASS
ANTENNA POLARITY: VERTICAL							
NO.	FREQ. (GHz)	Raw Value (dBm/MHz)	Receiver Antenna Gain (dBi)	EIRP Level (dBm/MHz)	Power Density (pW/cm^2)	Power Density Limit (pW/cm^2)	PASS/FAIL
1	153	-91.5	22.7	-32.9	0.453 AV	600	PASS
2	231	-93.7	22.9	-31.8	0.591 AV	1000	PASS

REMARKS:

1.The measured power level is converted to EIRP using the Friis equation:

EIRP = PT * GT = (PR / GR) * (4 * Pi * D/ λ)^ 2

where:

PR is the power of the receive measurement

GR is the gain of the receive measurement antenna

D is the measurement distance

λ is the wavelength

*Measurements made at 1.8 meter distance.

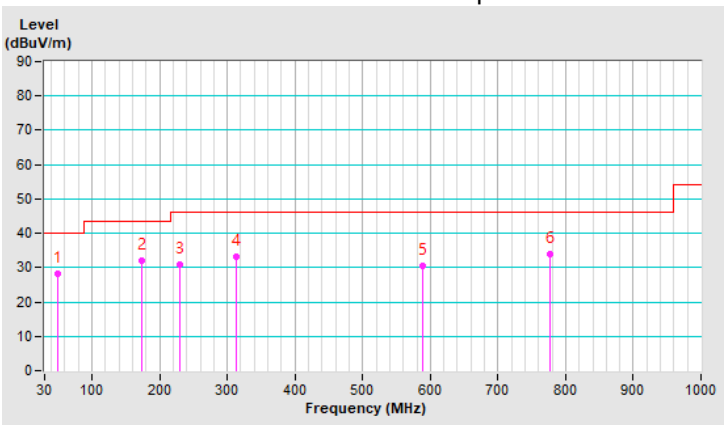
Below 1GHz Data

FREQUENCY RANGE	9kHz ~ 1GHz	DETECTOR FUNCTION	Quasi-Peak (QP)

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	49.35	28.1 QP	40.0	-11.9	3.00 H	132	36.0	-7.9
2	173.13	32.1 QP	43.5	-11.4	2.47 H	306	40.7	-8.6
3	229.58	30.8 QP	46.0	-15.2	1.74 H	249	41.2	-10.4
4	313.79	33.2 QP	46.0	-12.8	1.30 H	241	39.6	-6.4
5	587.83	30.4 QP	46.0	-15.6	4.00 H	213	30.4	0.0
6	776.07	33.9 QP	46.0	-12.1	2.20 H	235	30.3	3.6

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. Margin value = Emission Level – Limit value
4. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.

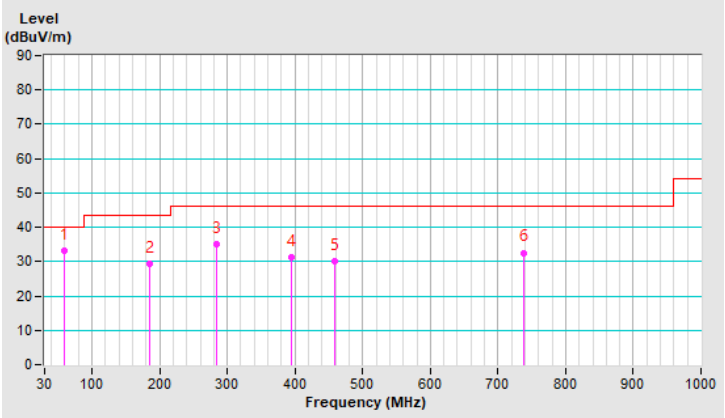


FREQUENCY RANGE	9kHz ~ 1GHz	DETECTOR FUNCTION	Quasi-Peak (QP)

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	58.51	33.3 QP	40.0	-6.7	1.30 V	233	41.6	-8.3
2	185.68	29.2 QP	43.5	-14.3	1.70 V	352	39.1	-9.9
3	283.77	34.9 QP	46.0	-11.1	1.30 V	291	42.4	-7.5
4	394.41	31.4 QP	46.0	-14.6	2.30 V	279	36.0	-4.6
5	457.80	30.0 QP	46.0	-16.0	1.70 V	261	32.8	-2.8
6	737.89	32.6 QP	46.0	-13.4	2.20 V	354	29.8	2.8

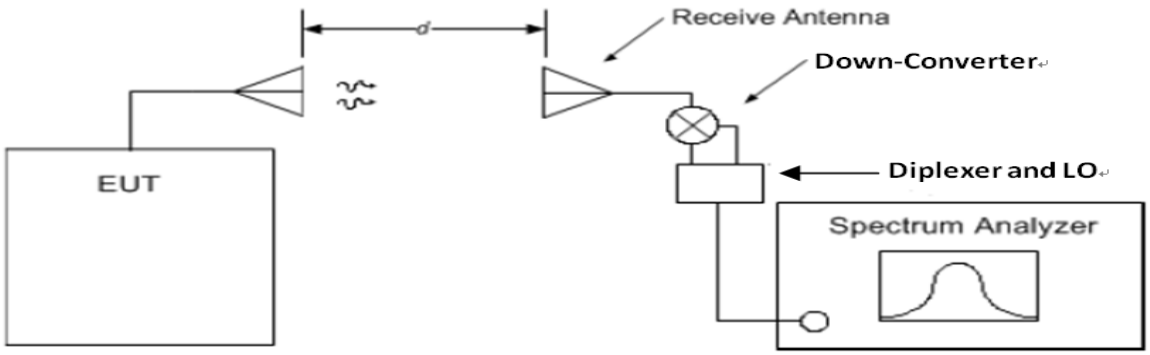
REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.



4.2 Occupied Bandwidth Measurement

4.2.1 Test Setup



4.2.2 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.2.3 Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least 3x the resolution bandwidth and set the detector to sampling. The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5 %of the total mean power of a given emission.

4.2.4 Deviation from Test Standard

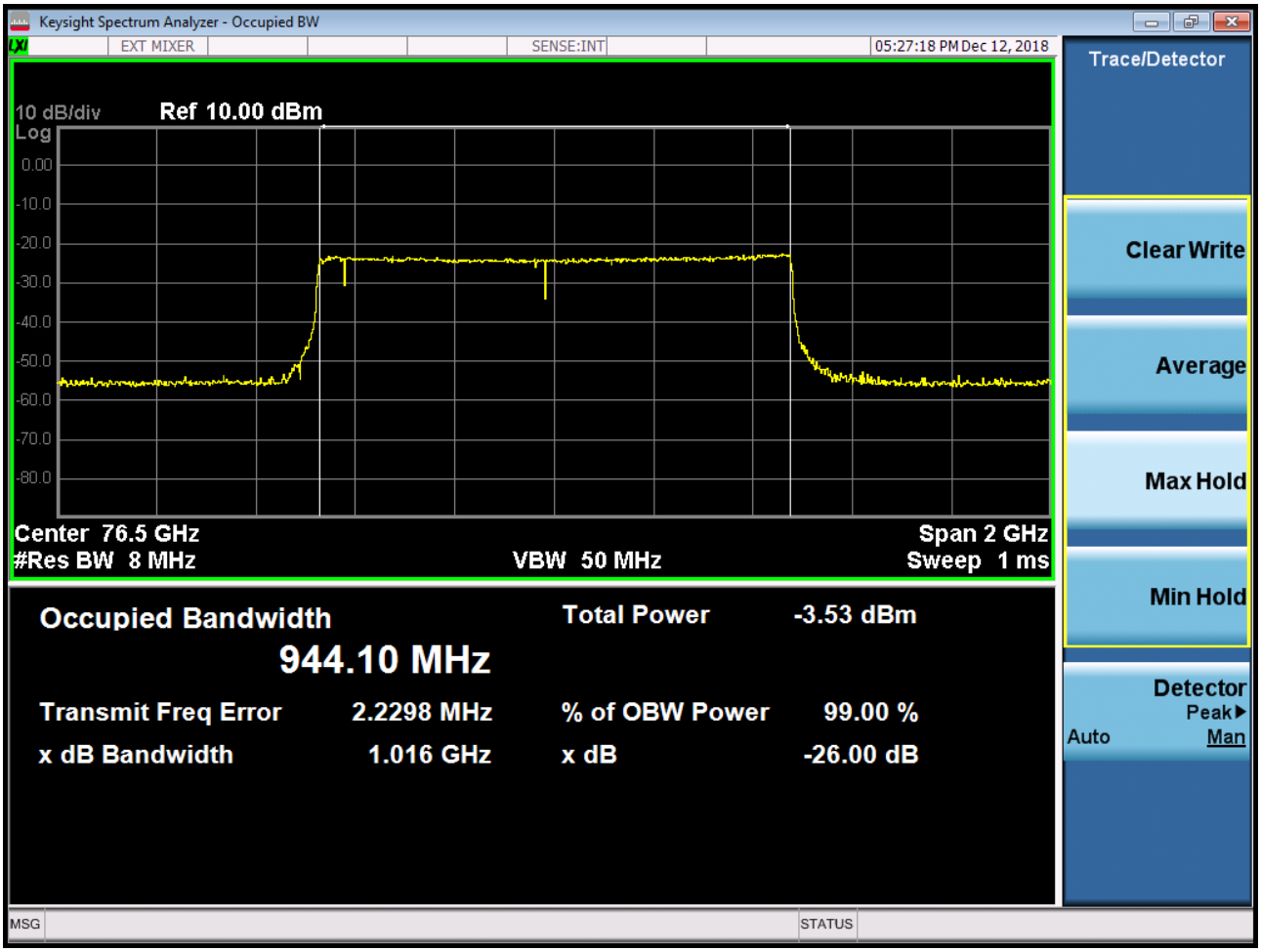
No deviation.

4.2.5 EUT Operating Conditions

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

4.2.6 Test Results

Frequency Range (GHz)	Occupied Bandwidth (MHz)
76.025~76.975	944.10



4.3 Frequency Stability Measurement

4.3.1 Limits of Conducted Emission Measurement

Fundamental emissions must be contained within the frequency bands specified in this section during all conditions of operation.

4.3.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
True RMS Clamp Meter FLUKE	325	31130711WS	May 22, 2018	May 21, 2019
Temperature & Humidity Chamber Giant Force	GTH-150-40-SP-AR	MAA0812-008	Jan. 10, 2018	Jan. 09, 2019
DC Power Supply Topward	6603D	795558	NA	NA
Spectrum Analyzer R&S	FSV40	100964	June 20, 2018	June 19, 2019
*Millimeter-Wave Signal Generator Frequency Extension Module (75~110 GHz) Keysight	E8257DV10	US53250009	Oct. 17, 2017	Oct. 16, 2019
*Waveguide Harmonic Mixer Keysight	M1971E	MY55270157	Oct. 17, 2017	Oct. 16, 2019

NOTE: 1. The test was performed in Oven room 2.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
3. *The calibration interval of the above test instruments is 24 months and the calibrations are traceable to NML/ROC and NIST/USA.
4. Tested Date: Dec. 12, 2018

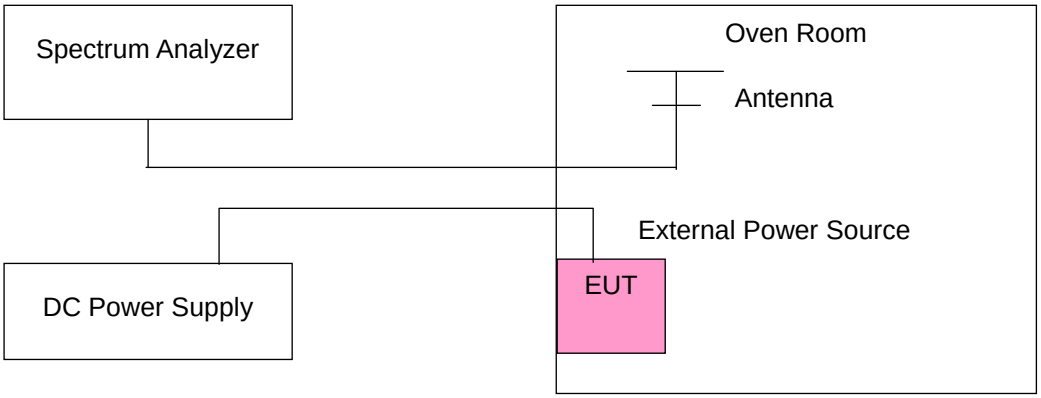
4.3.3 Test Procedure

a. Device is placed at the oven room. The oven room could control the temperatures and humidity. Power warm up is at least 15 min and power applied should perform before recording frequency error.

b. EUT is connected the external power supply to control the DC input power. The test voltage range is from minimum to maximum working voltage. Each step shall be record the frequency error rate.

c. The temperature range step is 10 degrees in this test items. All temperature levels shall be hold the ±0.5 ℃ during the measurement testing. The each temperature step shall be at least 0.5 hours, consider the EUT could be test under the stability condition.

4.3.4 Test Setup



4.3.5 Test Results

Frequency Stability Versus Temp.									
Operating Frequency: 76500 MHz									
TEMP. (℃)	Power Supply (Vdc)	0 Minute		2 Minutes		5 Minutes		10 Minutes	
		Measured Frequency (MHz)	Pass/Fail	Measured Frequency (MHz)	Pass/Fail	Measured Frequency (MHz)	Pass/Fail	Measured Frequency (MHz)	Pass/Fail
50	12	76500.2025	PASS	76500.1858	PASS	76500.1335	PASS	76500.1912	PASS
40	12	76499.9182	PASS	76499.9307	PASS	76499.9587	PASS	76499.9028	PASS
30	12	76500.0379	PASS	76500.0407	PASS	76500.0008	PASS	76500.0002	PASS
20	12	76500.022	PASS	76500.0261	PASS	76500.0529	PASS	76500.0417	PASS
10	12	76500.3558	PASS	76500.3268	PASS	76500.3536	PASS	76500.354	PASS
0	12	76499.9601	PASS	76499.9581	PASS	76499.9835	PASS	76499.9973	PASS
-10	12	76500.1813	PASS	76500.1829	PASS	76500.1784	PASS	76500.1291	PASS
-20	12	76500.3443	PASS	76500.3136	PASS	76500.3429	PASS	76500.3234	PASS

Frequency Stability Versus Voltage									
Operating Frequency: 76500 MHz									
TEMP. (℃)	Power Supply (Vdc)	0 Minute		2 Minutes		5 Minutes		10 Minutes	
		Measured Frequency (MHz)	Pass/Fail	Measured Frequency (MHz)	Pass/Fail	Measured Frequency (MHz)	Pass/Fail	Measured Frequency (MHz)	Pass/Fail
20	13.8	76500.0349	PASS	76500.0139	PASS	76500.0453	PASS	76500.0505	PASS
	12	76500.022	PASS	76500.0261	PASS	76500.0529	PASS	76500.0417	PASS
	10.2	76500.0232	PASS	76500.0291	PASS	76500.0622	PASS	76500.0373	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:

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

Hsin Chu EMC/RF/Telecom Lab
Tel: 886-3-6668565
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Hwa Ya EMC/RF/Safety Lab
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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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