

FCC Radio Test Report

FCC ID: WA5WH31E

This report concerns (check one): ☒ Original Grant ☐ Class II Change

Project No. : 1605C205
Equipment : Weather Station
Model Name : WH31E
Applicant : Fine Offset Electronics Co., LTD
Address : 2/F., Building no.3, Ping Shan Mingqi Industrial Park,
Xili Town, Nanshan Distri. Shenzhen, Guangdong,
China

Date of Receipt : May 24, 2016
Date of Test : May 24, 2016 ~ Jun. 17, 2016
Issued Date : Jun. 20, 2016
Tested by : BTL Inc.

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Declaration

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Limitation

For the use of the authority's logo is limited unless the Test Standard(s)/Scope(s)/Item(s) mentioned in this test report is (are) included in the conformity assessment authorities acceptance respective.

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REPORT ISSUED HISTORY

Issued No.	Description	Issued Date
BTL-FCCP-1-1605C205	Original Issue.	Jun. 20, 2016

1. CERTIFICATION

Equipment : Weather Station
Brand Name : N/A
Model Name : WH31E
Applicant : Fine Offset Electronics Co., LTD
Date of Test : May 24, 2016 ~ Jun. 17, 2016
Test Sample : Engineering Sample
Standard(s) : FCC Part15, Subpart C (15.249) / ANSI C63.10-2013

The above equipment has been tested and found compliance with the requirement of the relative standards by BTL Inc.

The test data, data evaluation, and equipment configuration contained in our test report (Ref No. BTL-FCCP-1-1605C205) were obtained utilizing the test procedures, test instruments, test sites that has been accredited by the Authority of TAF according to the ISO-17025 quality assessment standard and technical standard(s).

2. SUMMARY OF TEST RESULTS

Test procedures according to the technical standard(s):

FCC Part15, Subpart C (15.249)			
Standard Section	Test Item	Judgment	Remark
FCC			
15.207(a)	Conducted Emission	N/A	NOTE (1) NOTE (2)
15.205	Restricted Band of Operation	PASS	
15.209 15.249(a)	Radiated Emissions	PASS	
15.215(c)	20dB Bandwidth Test	PASS	

NOTE:

(1)"N/A" denotes test is not applicable to this device.

(2) EUT is used new battery.

2.1 TEST FACILITY

The test facilities used to collect the test data in this report is at the location of No.3, Jinshagang 1st Road, Shixia, Dalang Town, Dongguan, Guangdong, China.

BTL's test firm number for FCC: 319330

2.2 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. The BTL measurement uncertainty is less than the CISPR 16-4-2 U_{CISPR} requirement.

The reported uncertainty of measurement $y \pm U$, where expanded uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95%.

A. Radiated Measurement :

Test Site	Method	Measurement Frequency Range	Ant. H / V	U,(dB)
DG-CB03 (3m)	CISPR	9KHz ~ 30MHz	V	3.79
		9KHz ~ 30MHz	H	3.57
		30MHz ~ 200MHz	V	3.82
		30MHz ~ 200MHz	H	3.78
		200MHz ~ 1,000MHz	V	4.10
		200MHz ~ 1,000MHz	H	4.06

Test Site	Method	Measurement Frequency Range	Ant. H / V	U,(dB)
DG-CB03 (3m)	CISPR	1GHz ~ 18GHz	V	3.12
		1GHz ~ 18GHz	H	3.68

Note: Unless specifically mentioned, the uncertainty of measurement has not been taken into account to declare the compliance or non-compliance to the specification.

3. GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

Equipment	Weather Station	
Brand Name	N/A	
Model Name	WH31E	
Model Difference	N/A	
Product Description	Operation Frequency	915 MHz
	Modulation Technology	FSK
	Data rate	17.2 Kbps
	Field Strength	86.22 dBuV/m (Max)
Power Source	Supplied from 2x1.5V AA battery	
Power Rating	DC 3V	

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.
2. Channel List:

Channel	Frequency (MHz)
01	915

3.2 DESCRIPTION OF TEST MODES

To investigate the maximum EMI emission characteristics generated from EUT, the test system was pre-scanning tested based on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Pretest Mode	Description
Mode 1	TX Mode

For Radiated Test	
Final Test Mode	Description
Mode 1	TX Mode

3.3 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED



3.4 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.

Item	Equipment	Mfr/Brand	Model/Type No.	FCC ID	Series No.
-	-	-	-	-	-

Item	Shielded Type	Ferrite Core	Length	Note
-	-	-	-	-

4. EMC EMISSION TEST

4.1 CONDUCTED EMISSION MEASUREMENT

4.1.1 POWER LINE CONDUCTED EMISSION (FREQUENCY RANGE 150KHZ-30MHZ)

Frequency of Emission (MHz)	Conducted Limit (dBμV)	
	Quasi-peak	Average
0.15 -0.5	66 to 56*	56 to 46*
0.50 -5.0	56	46
5.0 -30.0	60	50

Note:

- (1) The limit of " * " decreases with the logarithm of the frequency
- (2) The test result calculated as following:
 Measurement Value = Reading Level + Correct Factor
 Correct Factor = Insertion Loss + Cable Loss + Attenuator Factor(if use)
 Margin Level = Measurement Value - Limit Value

The following table is the setting of the receiver

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

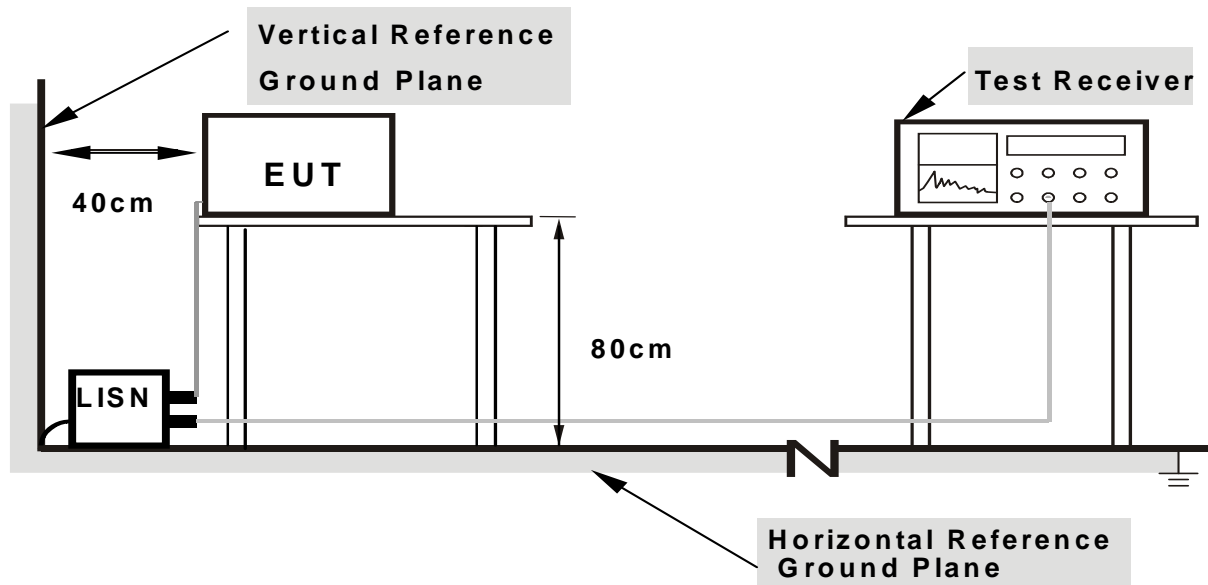
4.1.2 TEST PROCEDURE

- a. The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Interconnecting cables that hang closer than 40 cm to the groundplane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- c. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- d. LISN at least 80 cm from nearest part of EUT chassis.
- e. For the actual test configuration, please refer to the related Item –EUT Test Photos.

4.1.3 DEVIATION FROM TEST STANDARD

No deviation

4.1.4 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

4.1.5 EUT OPERATING CONDITIONS

The EUT was configured for testing in a typical fashion (as a customer would normally use it).

4.1.6 EUT TEST CONDITIONS

Temperature: N/A Relative Humidity: N/A Test Voltage: N/A

4.1.7 TEST RESULTS

Please refer to the Attachment A.

Remark:

- (1) All readings are QP Mode value unless otherwise stated AVG in column of 'Note'. If the QP Mode Measured value compliance with the QP Limits and lower than AVG Limits, the EUT shall be deemed to meet both QP & AVG Limits and then only QP Mode was measured, but AVG Mode didn't perform in this case, a "*" marked in AVG Mode column of Interference Voltage Measured.
- (2) Measuring frequency range from 150KHz to 30MHz.

4.2 RADIATED EMISSION MEASUREMENT

4.2.1 RADIATED EMISSION LIMITS (FCC 15.209)

Frequencies (MHz)	Field Strength (micorvolts/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
960~1000	500	3

Harmonic emissions limits comply with below 54 dBuV/m at 3m. Other emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or comply with the radiated emissions limits specified in section 15.209(a) limit in the table below has to be followed.

Note:

- (1) The tighter limit applies at the band edges.
- (2) Emission level (dBuV/m)=20log Emission level (uV/m).

LIMITS OF RADIATED EMISSION MEASUREMENT (FCC 15.209)

FREQUENCY (MHz)	(dBuV/m) (at 3m)	
	PEAK	AVERAGE
Above 1000	74	54

Notes:

- (1) The limit for radiated test was performed according to FCC PART 15C.
- (2) The tighter limit applies at the band edges.
- (3) Emission level (dBuV/m)=20log Emission level (uV/m).

LIMITS OF RADIATED EMISSION MEASUREMENT (FCC Part 15.249)

FCC Part15 (15.249) , Subpart C	
Limit	Frequency Range(MHz)
Field strength of fundamental 50000 μ V/m (94 dB μ V/m) @ 3 m	2400-2483.5
Field strength of harmonics 500 μ V/m (54 dB μ V/m) @ 3 m	Above 2483.5

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~90kHz for PK/AVG detector
Start ~ Stop Frequency	90kHz~110kHz for QP detector
Start ~ Stop Frequency	110kHz~490kHz for PK/AVG detector
Start ~ Stop Frequency	490kHz~30MHz for QP detector
Start ~ Stop Frequency	30MHz~1000MHz for QP detector

4.2.2 TESTPROCEDURE

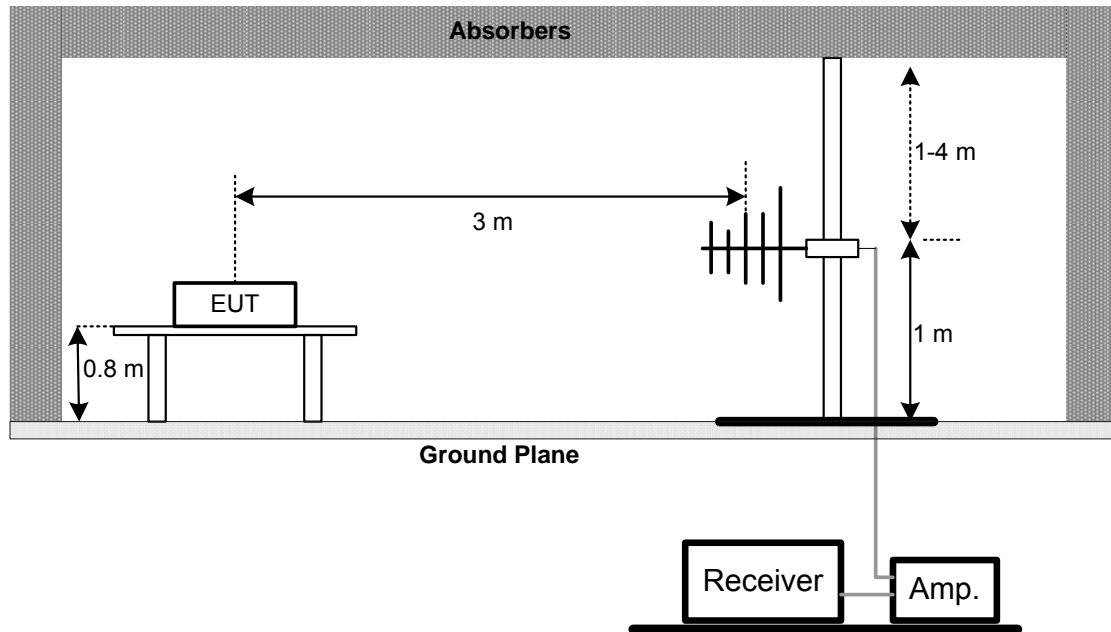
- a. The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(below 1GHz)
- b. The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 1.5 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(above 1GHz)
- c. The height of the equipment or of the substitution antenna shall be 0.8 m or 1.5 m, the height of the test antenna shall vary between 1 m to 4 m. 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 find the maximum reading (used Bore sight function).
- e. The receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1GHz.
- f. The initial step in collecting radiated emission data is a receiver peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- g. All readings are Peak unless otherwise stated QP in column of Note. Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform. (below 1GHz)
- h. All readings are Peak Mode value unless otherwise stated AVG in column of Note. If the Peak Mode Measured value compliance with the Peak Limits and lower than AVG Limits, the EUT shall be deemed to meet both Peak & AVG Limits and then only Peak Mode was measured, but AVG Mode didn't perform. (above 1GHz)
- i. For the actual test configuration, please refer to the related Item –EUT Test Photos.

4.2.3 DEVIATION FROM TEST STANDARD

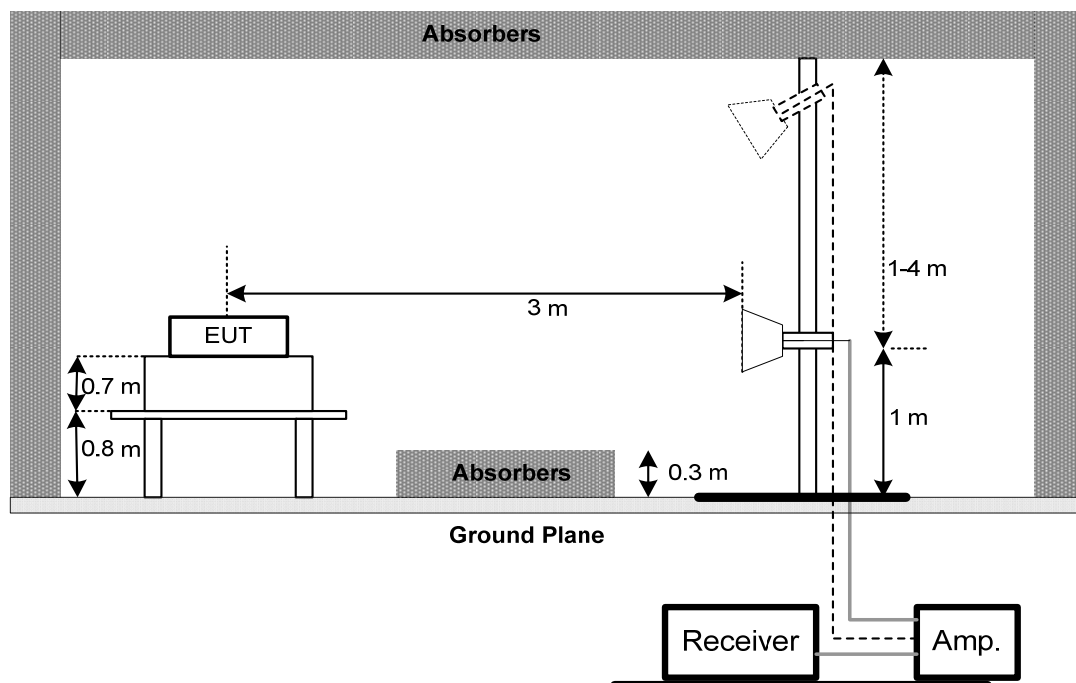
No deviation

4.2.4 TESTSETUP

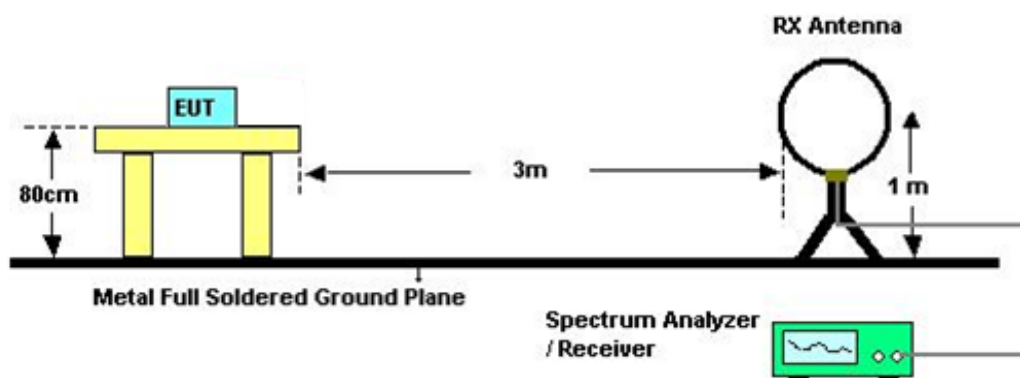
(A) Radiated Emission Test Set-Up Frequency Below 1 GHz



(B) Radiated Emission Test Set-Up Frequency Above 1 GHz



(C) For Radiated Emissions Below 30MHz



4.2.5 EUT OPERATING CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

4.2.6 EUT TEST CONDITIONS

Temperature: 25°C Relative Humidity: 53% Test Voltage: DC 3V

4.2.7 TEST RESULTS (9KHZ 30MHZ)

Please refer to the Attachment B.

Remark:

- (1) The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.
- (2) Distance extrapolation factor = $40 \log (\text{specific distance} / \text{test distance})$ (dB);
- (3) Limit line = specific limits (dBuV) + distance extrapolation factor..

4.2.8 TEST RESULTS (30MHZ to 1000 MHZ)

Please refer to the Attachment C

Remark:

- (1) All readings are Peak unless otherwise stated QP in column of 『Note』 . Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform.
- (2) Measuring frequency range from 30MHz to 1000MHz or the 10th harmonic of highest fundamental frequency. "F" denotes fundamental frequency; "H" denotes spurious frequency. "E" denotes band edge frequency.
- (3) Radiated emissions measured in frequency range from 30 MHz to 1000 MHz were made with an instrument using Peak detector mode or QP detector mode of the emission .

4.2.9 TEST RESULTS (RESTRICTED BAND OF OPERATION)

Please refer to the Attachment D

4.2.10 TEST RESULTS (ABOVE 1000 MHZ)

Please refer to the Attachment E

Remark:

- (1) All readings are Peak unless otherwise stated QP in column of 『Note』 . Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform.
- (2) Radiated emissions measured in frequency range above 1000MHz were made with an instrument using Peak detector mode and AV detector mode of the emission .
- (3) Data of measurement within this frequency range shown “ * ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- (4) A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.
- (5) EUT Orthogonal Axis:
“X” - denotes Laid on Table; “Y” - denotes Vertical Stand; “Z” - denotes Side Stand
- (6) During the measurements above 1 GHz it is taken care of that the EUT is always within the 3 dB cone of radiation BW of the used antenna
- (7) No limit: This is fundamental signal, the judgment is not applicable.
For fundamental signal judgment was referred to Peak output test.

5. BANDWIDTH TEST

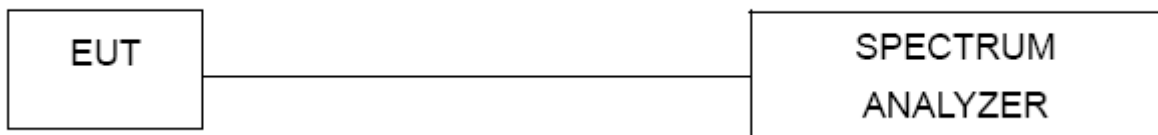
5.1 TEST PROCEDURE

- a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
- b. Spectrum Setting: RBW= 100KHz, VBW=100KHz, Sweep time = Auto.

5.2 DEVIATION FROM STANDARD

No deviation.

5.3 TEST SETUP



5.4 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

5.5 EUT TEST CONDITIONS

Temperature: 25°C Relative Humidity: 56% Test Voltage: DC 3V

5.6 TEST RESULTS

Please refer to the Attachment F

6. MEASUREMENT INSTRUMENTS LIST AND SETTING

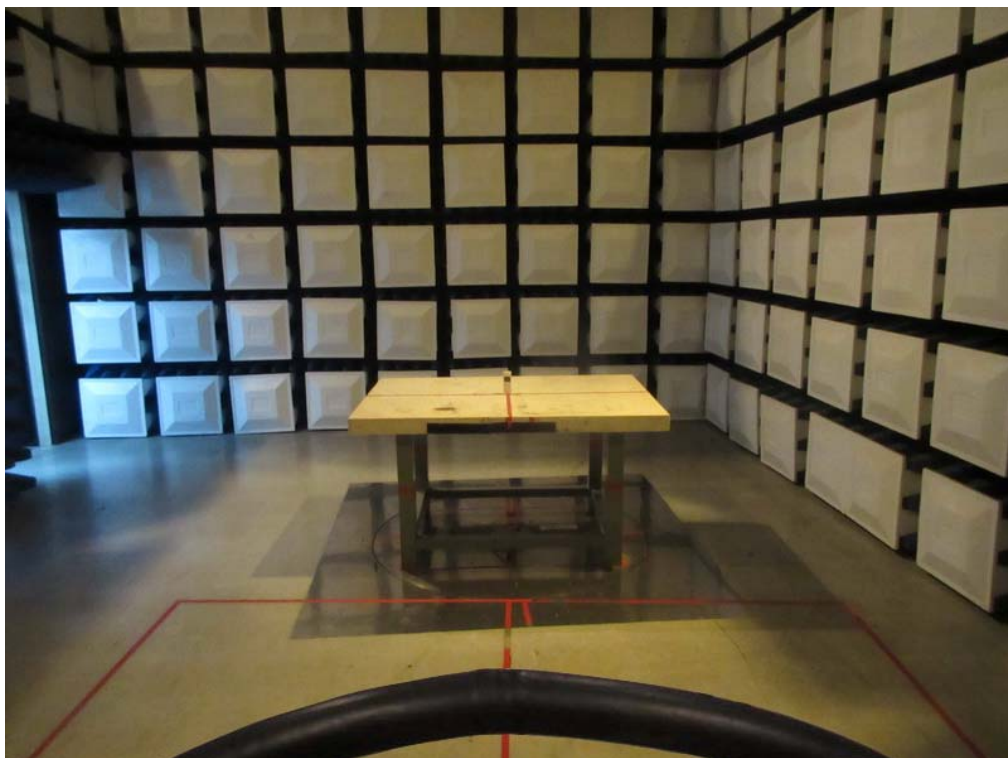
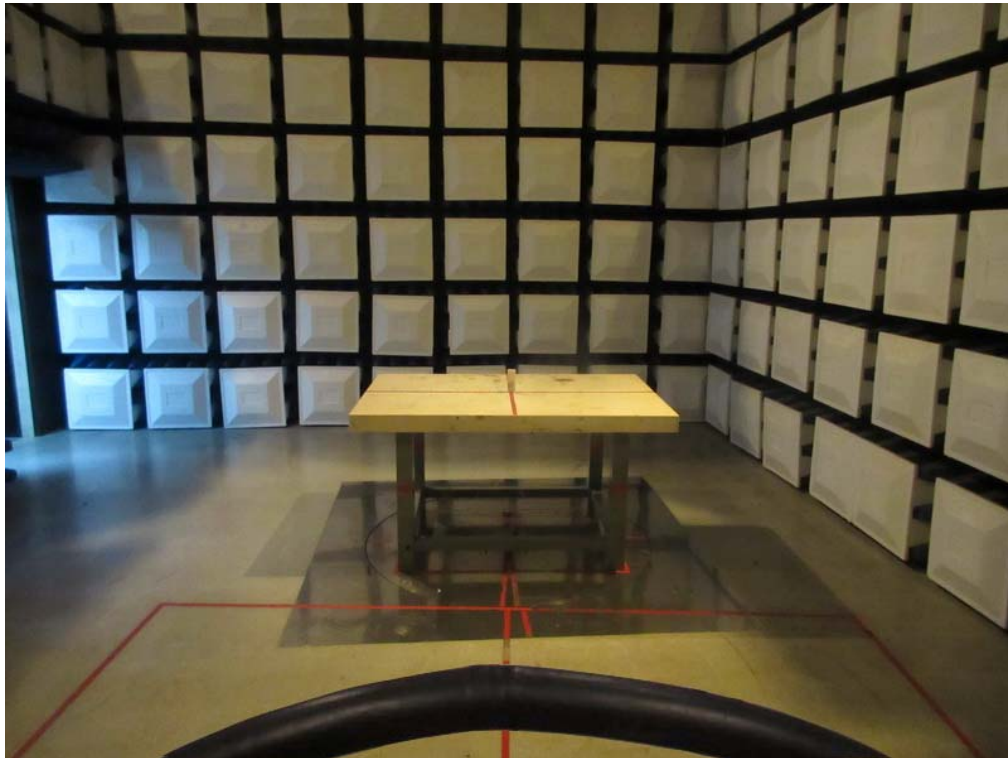
Radiated Emission Measurement					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Antenna	Schwarbeck	VULB9160	9160-3232	Mar. 27, 2017
2	Amplifier	HP	8447D	2944A09673	Nov. 09, 2016
3	Receiver	AGILENT	N9038A	MY52130039	Oct. 11, 2016
4	Test Cable	emci	LMR-400(30MHz-1GHz)	C-01	Jun. 28, 2016
5	Control	CT	SC100	N/A	N/A
6	Position Control	MF	MF-7802	MF780208416	N/A
7	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A
8	Antenna	ETS	3115	00075789	Mar. 27, 2017
9	Amplifier	Agilent	8449B	3008A02274	Nov. 01, 2016
10	Test Cable	emci	EMC104-SM-SM-10000(1GHz-26.5 GHz)	C-68	Jun. 28, 2016
11	Active Loop Antenna	R&S	HFH2-Z2	830749/020	Sep. 07, 2016

Bandwidth					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP 40	100185	Oct. 11, 2016

Remark: "N/A" denotes no model name, serial no. or calibration specified.
All calibration period of equipment list is one year.

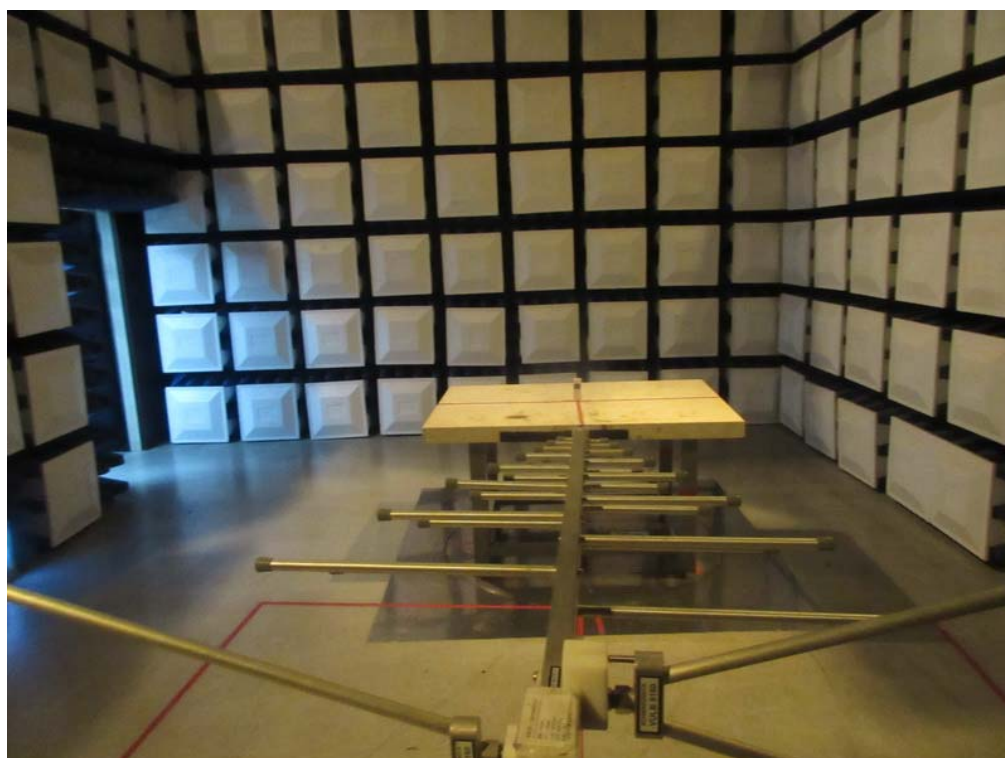
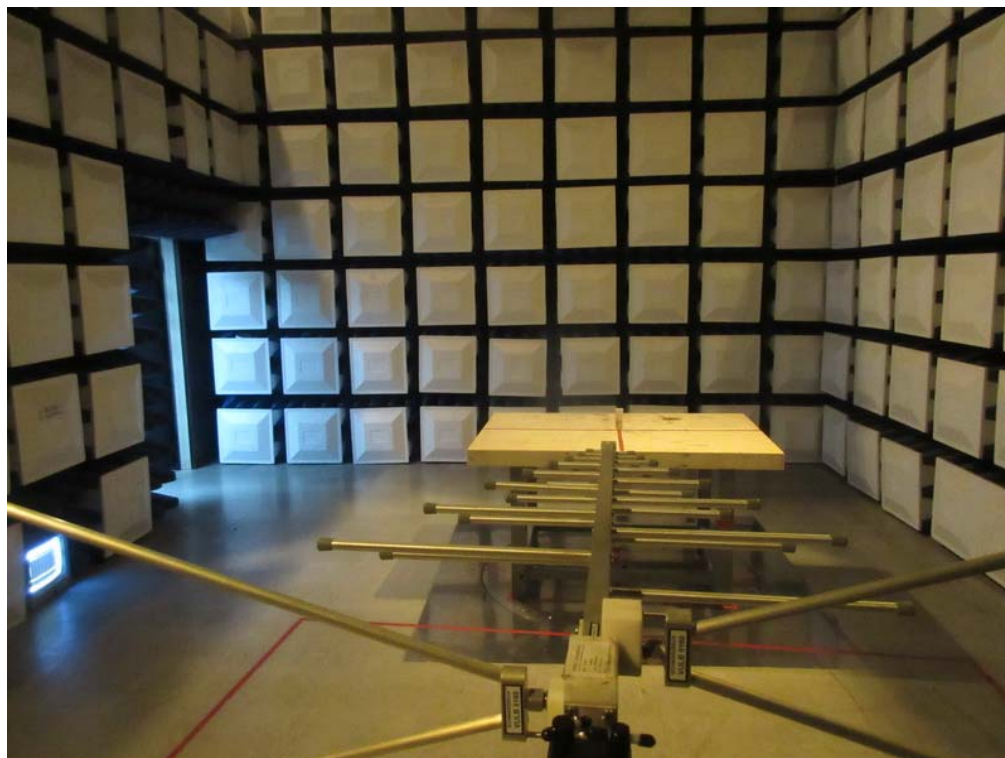
7. EUT TEST PHOTO

**Radiated Measurement Photos
9KHz to 30MHz**



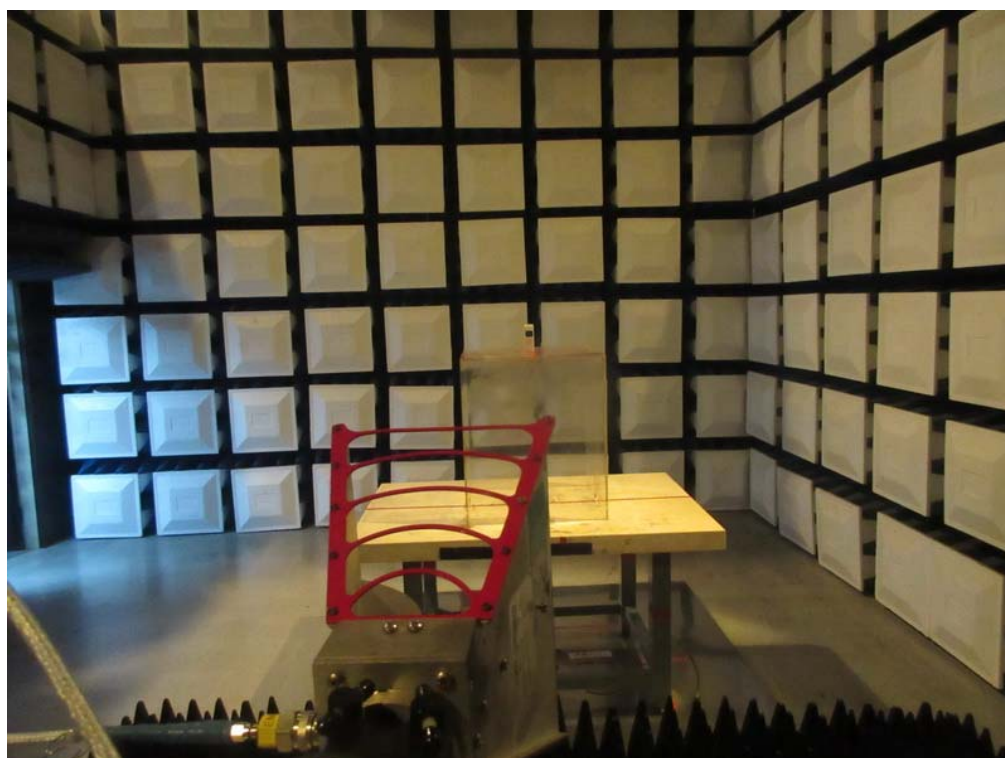
Radiated Measurement Photos

30MHz to 1000MHz



Radiated Measurement Photos

Above 1000MHz



ATTACHMENT A - CONDUCTED EMISSION

Test Mode: N/A

Note: "N/A" denotes test is not applicable to this device.
EUT is used new battery.

ATTACHMENT B -RADIATED EMISSION (9KHZ to 30MHZ)

Test Mode:	TX Mode
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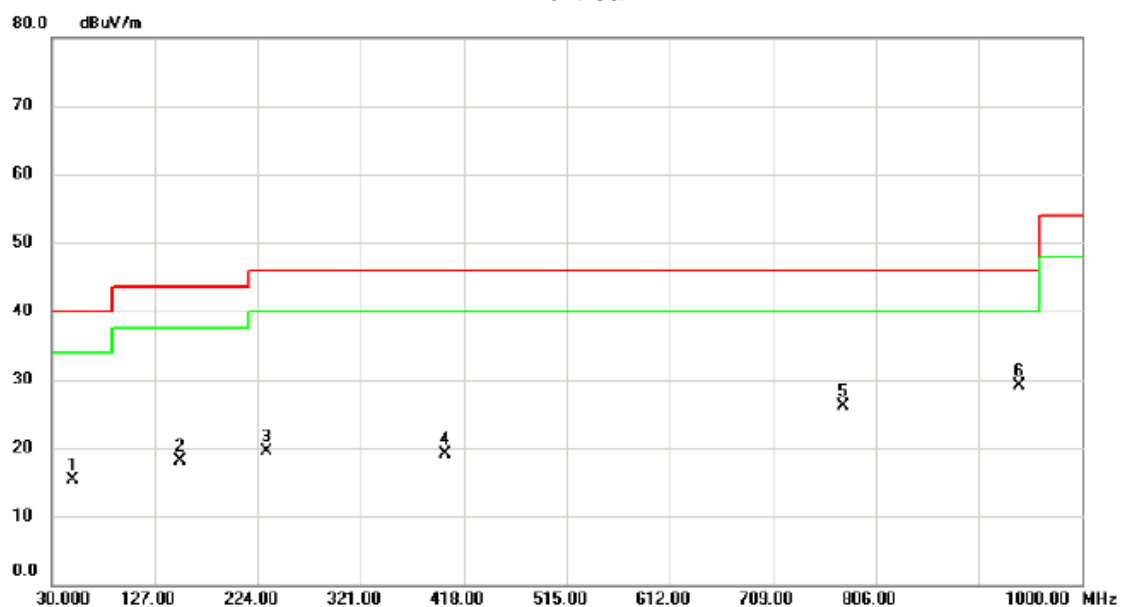
Frequency (MHz)	Ant 0°/90°	Read level dBuV/m	Factor (dB)	Measured(FS) (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Note
0.0156	0°	13.16	24.58	37.74	123.74	-86.00	AVG
0.0156	0°	14.46	24.58	39.04	143.74	-104.70	PEAK
0.0267	0°	6.89	23.88	30.77	119.07	-88.31	AVG
0.0267	0°	8.57	23.88	32.45	139.07	-106.63	PEAK
0.0561	0°	4.07	22.28	26.35	112.62	-86.28	AVG
0.0561	0°	6.02	22.28	28.30	132.62	-104.33	PEAK
0.0745	0°	2.04	21.91	23.95	110.16	-86.21	AVG
0.0745	0°	3.25	21.91	25.16	130.16	-105.00	PEAK
0.9852	0°	20.65	19.66	40.31	67.73	-27.42	QP
2.6413	0°	24.98	19.12	44.10	69.54	-25.44	QP

Frequency (MHz)	Ant 0°/90°	Read level dBuV/m	Factor (dB)	Measured(FS) (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Note
0.0136	90°	13.12	24.30	37.42	124.93	-87.51	AVG
0.0136	90°	14.45	24.30	38.75	144.93	-106.18	PEAK
0.0362	90°	7.16	23.27	30.43	116.43	-86.00	AVG
0.0362	90°	8.14	23.27	31.41	136.43	-105.02	PEAK
0.0529	90°	5.39	22.34	27.73	113.14	-85.40	AVG
0.0529	90°	6.05	22.34	28.39	133.14	-104.74	PEAK
0.0945	90°	1.98	21.51	23.49	108.10	-84.61	AVG
0.0945	90°	3.52	21.51	25.03	128.10	-103.07	PEAK
1.2583	90°	23.85	19.57	43.42	65.61	-22.18	QP
3.8566	90°	26.97	18.99	45.96	69.54	-23.58	QP

ATTACHMENT C -RADIATED EMISSION (30MHZ TO 1000MHZ)

Test Mode:	TX Mode
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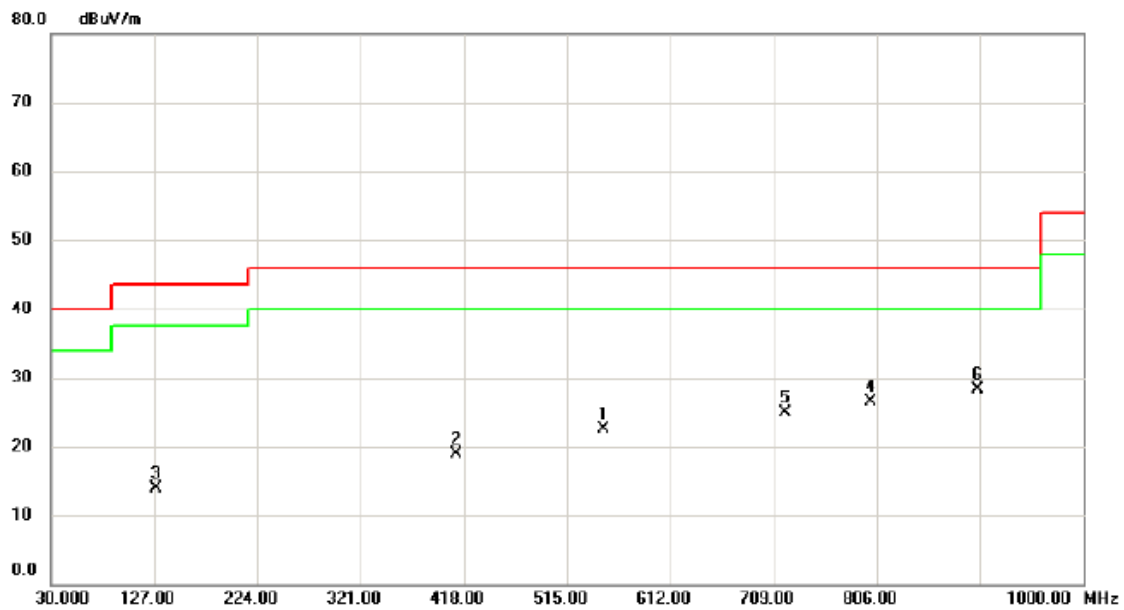
Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin	Detector	Comment
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB		
1		50.3700	28.72	-13.46	15.26	40.00	-24.74	peak	
2		151.2500	31.01	-12.87	18.14	43.50	-25.36	peak	
3		231.7600	33.11	-13.62	19.49	46.00	-26.51	peak	
4		400.5400	27.34	-8.27	19.07	46.00	-26.93	peak	
5		774.9600	27.99	-1.84	26.15	46.00	-19.85	peak	
6	*	940.8300	27.74	1.34	29.08	46.00	-16.92	peak	

Test Mode: TX Mode

Horizontal

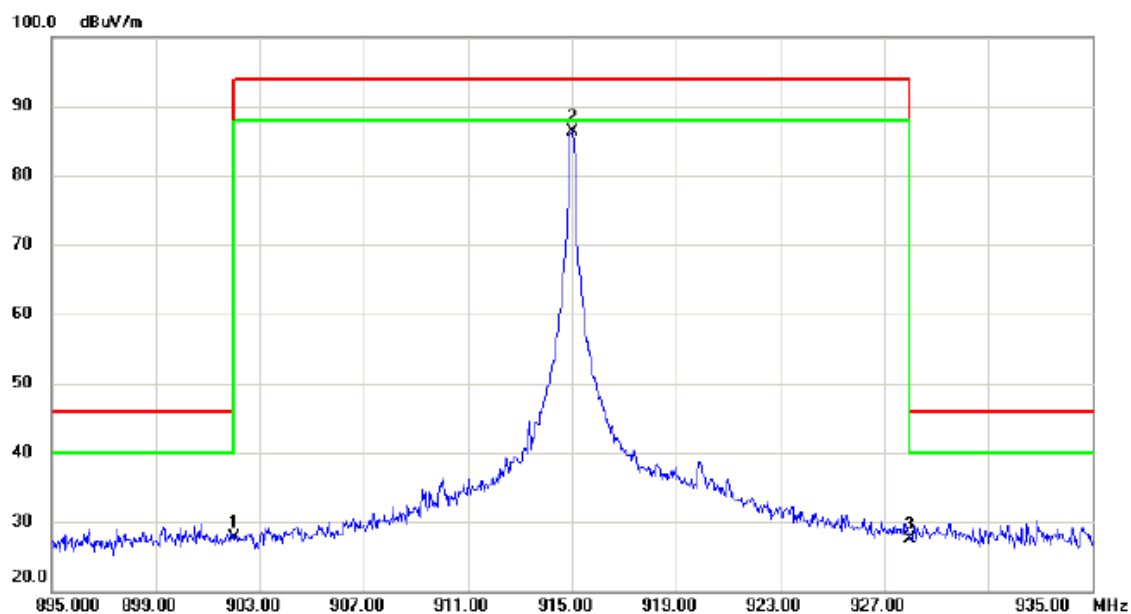


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1		549.9200	27.76	-5.28	22.48	46.00	-23.52	peak	
2		410.2400	27.28	-8.33	18.95	46.00	-27.05	peak	
3		128.9400	26.46	-12.48	13.98	43.50	-29.52	peak	
4		800.1800	27.32	-0.75	26.57	46.00	-19.43	peak	
5		719.6700	27.90	-2.98	24.92	46.00	-21.08	peak	
6	*	901.0600	26.73	1.54	28.27	46.00	-17.73	peak	

ATTACHMENT D - RESTRICTED BAND OF OPERATION

Test Mode : TX Mode

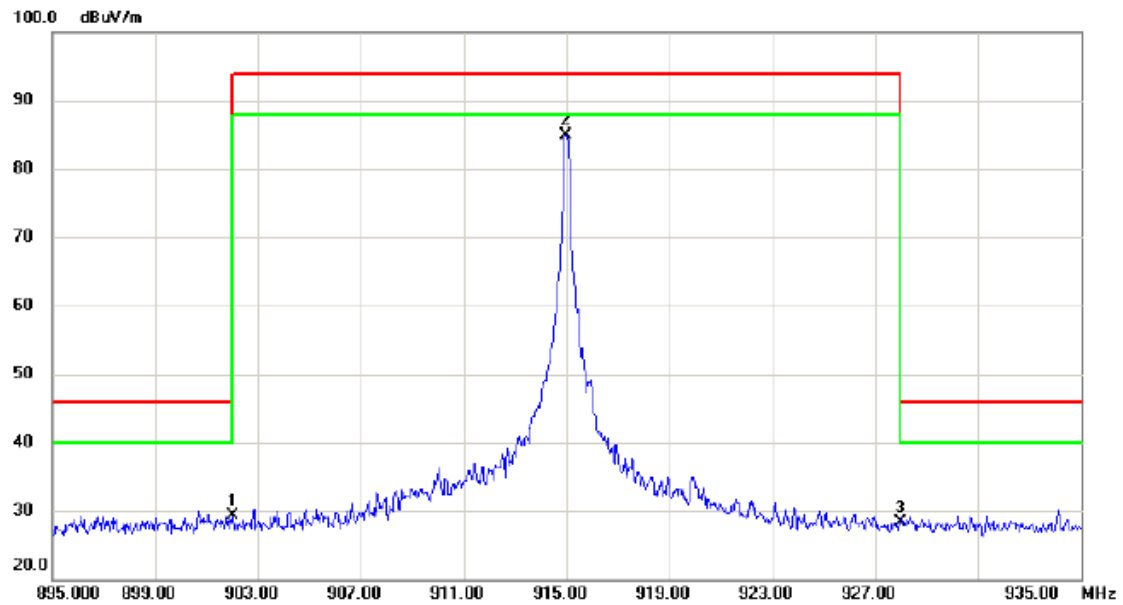
Vertical



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1		902.0000	25.04	2.64	27.68	46.00	-18.32	peak	
2	*	915.0000	83.64	2.58	86.22	94.00	-7.78	peak	
3		928.0000	24.98	2.52	27.50	46.00	-18.50	peak	

Test Mode : TX Mode

Horizontal

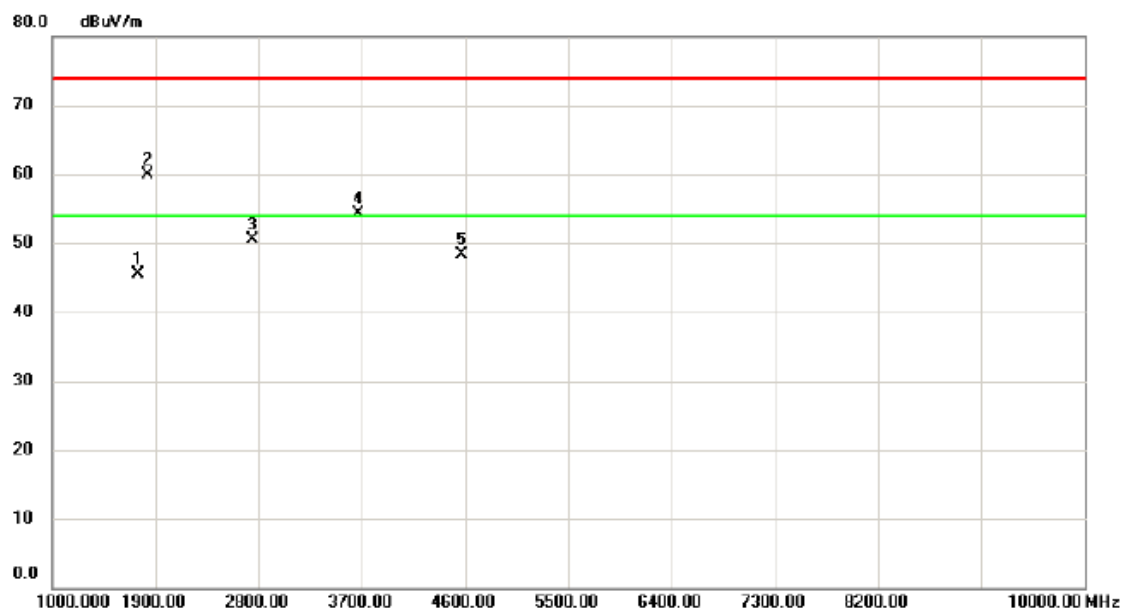


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1		902.0000	26.63	2.64	29.27	46.00	-16.73	peak	
2	*	914.9600	82.35	2.58	84.93	94.00	-9.07	peak	
3		928.0000	25.75	2.52	28.27	46.00	-17.73	peak	

ATTACHMENT E -RADIATED EMISSION (ABOVE 1000MHZ)

Test Mode : TX Mode

Vertical



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1		1747.000	50.52	-4.98	45.54	74.00	-28.46	peak	
2	*	1828.000	64.36	-4.36	60.00	74.00	-14.00	peak	
3		2746.000	50.45	-0.03	50.42	74.00	-23.58	peak	
4		3664.000	52.71	1.68	54.39	74.00	-19.61	peak	
5		4573.000	44.68	3.72	48.40	74.00	-25.60	peak	

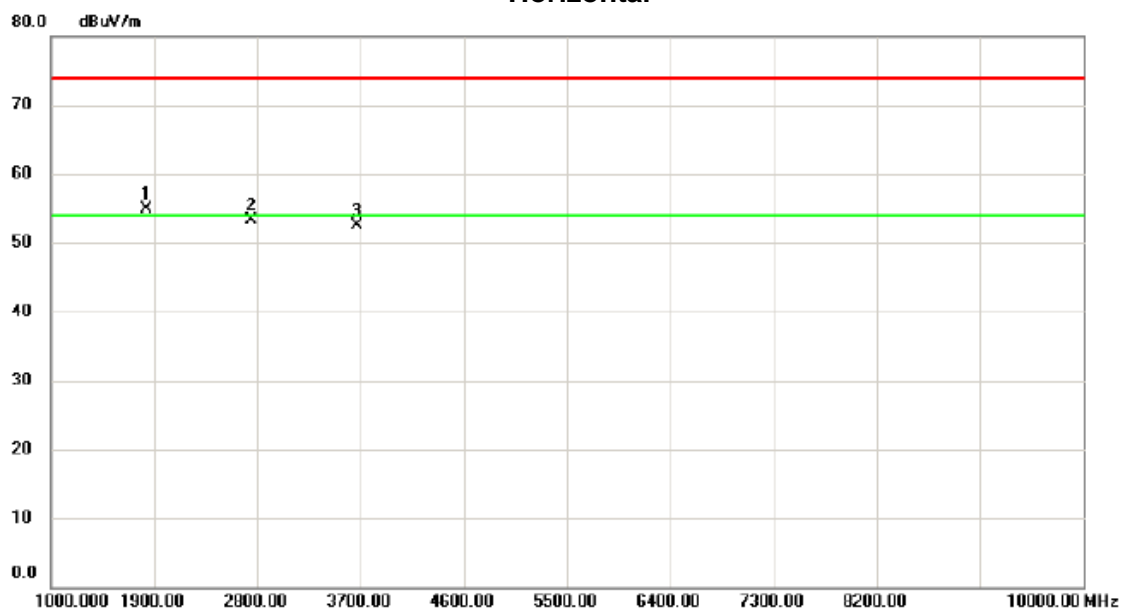
Remark:

- (1) Peak value is much lower than the limit, so AV value isn't shown on this test item.
- (2) The average value of fundamental frequency is:
Average Reading = Peak value + 20log(Duty cycle) , AV=Peak-10.81.

Frequency (MHz)	Peak value (dBuV/m)	AV value (dBuV/m)	AV Limit (dBuV/m)	Result
1828.000	60.00	49.19	54.00	PASS
3664.000	54.39	43.58	54.00	PASS

Test Mode : TX Mode

Horizontal



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1	*	1828.000	59.17	-4.36	54.81	74.00	-19.19	peak	
2		2746.000	53.28	-0.03	53.25	74.00	-20.75	peak	
3		3664.000	50.76	1.68	52.44	74.00	-21.56	peak	

Remark:

- (1) Peak value is much lower than the limit, so AV value isn't shown on this test item.
- (2) The average value of fundamental frequency is:
Average Reading = Peak value + 20log(Duty cycle) , AV=Peak-10.81.

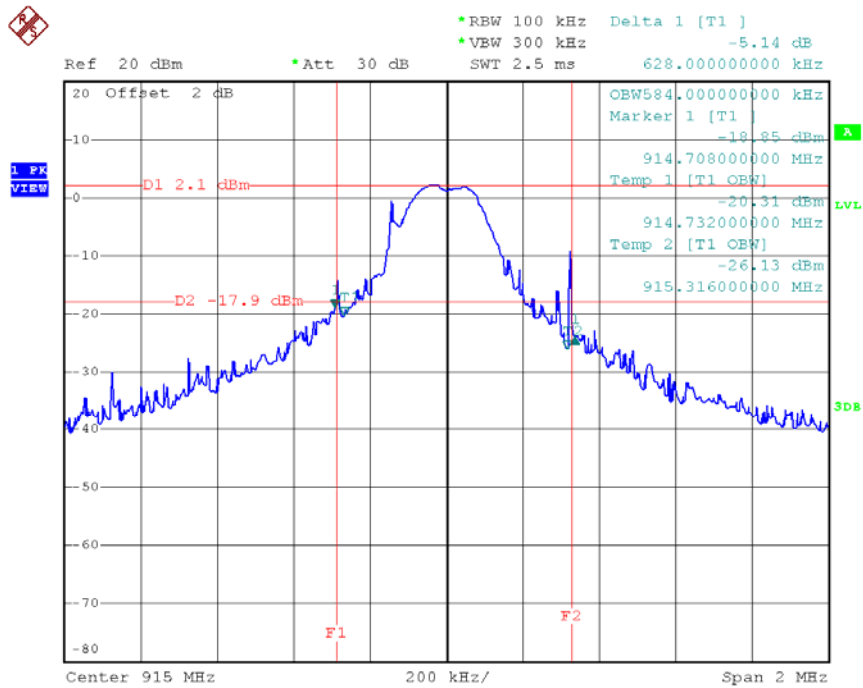
Frequency (MHz)	Peak value (dBuV/m)	AV value (dBuV/m)	AV Limit (dBuV/m)	Result
1828.000	54.81	44.00	54.00	PASS

ATTACHMENT F - BANDWIDTH

Test Mode:	TX Mode
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Frequency (MHz)	20dB Bandwidth (kHz)	99% Occupied BW (kHz)
915	628	584

TX Mode



Date: 16.JUN.2016 21:22:49