



FCC Part 15C Test Report

FCC ID:2AJSJ-WDMX01A

Product Name:	Wireless DMX512 transmitter&receiver
Trademark:	N/A
Model Name :	TS-WDMX01A TS-WDMX01B, TS-WDMX01C, TS-WDMX01D, TS-WDMX02A, TS-WDMX02B, TS-WDMX02C, TS-WDMX02D, TS-WDMX03A, TS-WDMX03B, TS-WDMX03C, TS-WDMX03D.
Prepared For :	Shenzhen City Tongsheng Electronic Technology Co., Ltd
Address :	Building 2, 3rd Industrial Zone, Bantian Subdistrict, Longgang District, Shenzhen City, Guangdong Province, China
Prepared By :	Shenzhen BCTC Technology Co., Ltd.
Address :	No.101,Yousong Road,Longhua New District, Shenzhen,China
Test Date:	Sep. 05 - Sep. 12, 2016
Date of Report :	Sep. 12, 2016
Report No.:	BCTC-FY160902343E



VERIFICATION OF COMPLIANCE

Applicant's name : Shenzhen City Tongsheng Electronic Technology Co., Ltd
Address : Building 2, 3rd Industrial Zone, Bantian Subdistrict, Longgang District, Shenzhen City, Guangdong Province, China

Manufacture's Name : Shenzhen City Tongsheng Electronic Technology Co., Ltd
Address : Building 2, 3rd Industrial Zone, Bantian Subdistrict, Longgang District, Shenzhen City, Guangdong Province, China

Product description

Product name : Wireless DMX512 transmitter&receiver

Trademark: N/A

Model Name: TS-WDMX01A

Standards: ANSI C63.10:2013
FCC Part15.249:2015

This device described above has been tested by BCTC, and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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Test Result.....: **Pass**

Testing Engineer :

Eric Yang

Reviewer (Supervisor) :

Jade Yang

Approved & Authorized Signer(Manager) :





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1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:

FCC Part15 (15.249) , Subpart C			
Standard Section	Test Item	Judgment	Remark
15.207	Conducted Emission	PASS	
15.249	Radiated Spurious Emission	PASS	
15.249	Bandwidth	PASS	
15.205	Band Edge Emission	PASS	
15.203	Antenna Requirement	PASS	

NOTE:

(1)" N/A" denotes test is not applicable in this Test Report

1.1 TEST FACILITY

Shenzhen BCTC Technology Co., Ltd.

Add.:No.101,Yousong Road,Longhua New District, Shenzhen,China

FCC Registration No.:187086

1.2 MEASUREMENT UNCERTAINTY

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

No.	Item	Uncertainty
1	Conducted Emission Test	$\pm 1.38\text{dB}$
2	RF power,conducted	$\pm 0.16\text{dB}$
3	Spurious emissions,conducted	$\pm 0.21\text{dB}$
4	All emissions,radiated(<1G)	$\pm 4.68\text{dB}$
5	All emissions,radiated(>1G)	$\pm 4.89\text{dB}$
6	Temperature	$\pm 0.5^{\circ}\text{C}$
7	Humidity	$\pm 2\%$



2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

Equipment	Wireless DMX512 transmitter&receiver		
Trade Name	N/A		
Model Name	TS-WDMX01A		
Serial Model	TS-WDMX01B, TS-WDMX01C, TS-WDMX01D, TS-WDMX02A, TS-WDMX02B, TS-WDMX02C, TS-WDMX02D, TS-WDMX03A, TS-WDMX03B, TS-WDMX03C, TS-WDMX03D.		
Model Difference	All the model are the same circuit and RF module,except model names and different for output interface.		
Product Description	Operation Frequency:	2401~2483 MHz	
	Modulation Type:	GFSK	
	Bit Rate of Transmitter	1M	
	Number Of Channel	83 CH	
	Antenna Designation:	Please see Note 3.	
	Based on the application, features, or specification exhibited in User's Manual, the EUT is considered as an ITE/Computing Device. More details of EUT technical specification, please refer to the User's Manual.		
Channel List	Please refer to the Note 2.		
Adapter	DC 5V From adapter		
Connecting I/O Port(s)	Please refer to the User's Manual		
hardware version	--		
Software version	--		
Serial number	--		

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)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
01	2401	30	2430	59	2459
02	2402	31	2431	60	2460
03	2403	32	2432	61	2461
04	2404	33	2433	62	2462
05	2405	34	2434	63	2463
06	2406	35	2435	64	2464
07	2407	36	2436	65	2465
08	2408	37	2437	66	2466



09	2409	38	2438	67	2467
10	2410	39	2439	68	2468
11	2411	40	2440	69	2469
12	2412	41	2441	70	2470
13	2413	42	2442	71	2471
14	2414	43	2443	72	2472
15	2415	44	2444	73	2473
16	2416	45	2445	74	2474
17	2417	46	2446	75	2475
18	2418	47	2447	76	2476
19	2419	48	2448	77	2477
20	2420	49	2449	78	2478
21	2421	50	2450	79	2479
22	2422	51	2451	80	2480
23	2423	52	2452	81	2481
24	2424	53	2453	82	2482
25	2425	54	2454	83	2483
26	2426	55	2455		
27	2427	56	2456		
28	2428	57	2457		
29	2429	58	2458		

3. Table for Filed Antenna

Ant.	Brand	Model Name	Antenna Type	Gain (dBi)	NOTE
1	N/A	N/A	External Antenna	2.5	



2.2 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 possibly have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

For Conducted & Radiated Emission	
Final Test Mode	Description
Mode 1	CH01
Mode 2	CH40
Mode 3	CH83
Mode 4	Link Mode

Note:

- (1) The measurements are performed at the highest, middle, lowest available channels.
- (2) Fully-charged battery is used during the test

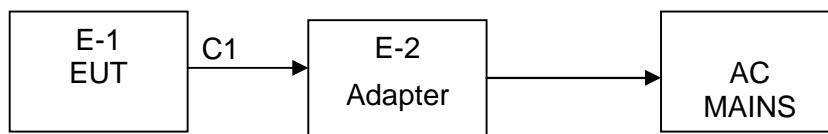
2.3 TABLE OF PARAMETERS OF TEST SOFTWARE SETTING

During testing channel & power controlling software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product power parameters of FHSS

Frequency	2401 MHz	2440 MHz	2483 MHz
Channel	Low	Middle	High

2.4 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

Radiated Spurious Emission/ Conducted Emission Test





2.5 DESCRIPTION OF SUPPORT UNITS(CONDUCTED MODE)

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.	Series No.	Note
E-1	Wireless DMX512 transmitter&receiver	N/A	TS-WDMX01A	N/A	EUT
E-2	Adapter	N/A	XS-0501000	N/A	Input:100-240V~ 50/60Hz 0.3A Output: 5.0V---1000mA

Item	Shielded Type	Ferrite Core	Length	Note
C1	NO	NO	1.2M	DC cable unshielded

Note:

- (1) The support equipment was authorized by Declaration of Confirmation.
- (2) For detachable type I/O cable should be specified the length in cm in 『Length』 column.
- (3) “YES” is means “shielded” “with core”; “NO” is means “unshielded” “without core”.



2.6 EQUIPMENTS LIST FOR ALL TEST ITEMS

Conduction Test equipment

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until	Calibration period
1	Test Receiver	R&S	ESCI	1166.5950K03-101165-ha	2016.06.06	2017.06.05	1 year
2	LISN	R&S	NSLK8126	8126466	2016.08.24	2017.08.23	1 year
3	LISN	R&S	NSLK8126	8126487	2016.08.24	2017.08.23	1 year
4	50Ω Coaxial Switch	Anritsu	MP59B	6200264417	2016.06.07	2017.06.06	1 year
5	RF cables	R&S	R204	R20X	2016.07.06	2017.07.05	1 year

Radiation test, Band-edge test and 20db bandwidth test equipment

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until	Calibration period
1	Spectrum Analyzer	Agilent	E4407B	MY45108040	2016.07.06	2017.07.05	1 year
2	Test Receiver	R&S	ESPI	101318	2016.06.07	2017.06.06	1 year
3	Bilog Antenna	R&S	VULB9168	VULB9168-438	2016.07.06	2017.07.05	1 year
4	50Ω Coaxial Switch	Anritsu	MP59B	6200264416	2016.06.07	2017.06.06	1 year
5	Spectrum Analyzer	ADVANTEST	R3132	150900201	2016.06.07	2017.06.06	1 year
6	Horn Antenna	R&S	HF906	10027	2016.07.06	2017.07.05	1 year
7	Horn Ant	Schwarzbeck	BBHA 9170	9170-181	2016.07.06	2017.07.05	1 year
8	Amplifier	R&S	BBV9743	9743-019	2016.08.25	2017.08.24	1 year
9	Loop Antenna	ARA	PLA-1030/B	1029	2016.06.08	2017.06.07	1 year
10	RF cables	R&S	R203	R20X	2016.07.06	2017.07.05	1 year
11	Antenna connector	Florida RFLabs	Lab-Fle	RF 01#	2016.07.06	2017.07.05	1 year



3. EMC EMISSION TEST

3.1 CONDUCTED EMISSION MEASUREMENT

3.1.1 POWER LINE CONDUCTED EMISSION Limits (Frequency Range 150KHz-30MHz)

FREQUENCY (MHz)	Class A (dBuV)		Class B (dBuV)		Standard
	Quasi-peak	Average	Quas -peak	Average	
0.15 -0.5	79.00	66.00	66 - 56 *	56 - 46 *	CISPR
0.50 -5.0	73.00	60.00	56.00	46.00	CISPR
5.0 -30.0	73.00	60.00	60.00	50.00	CISPR

0.15 -0.5	79.00	66.00	66 - 56 *	56 - 46 *	FCC
0.50 -5.0	73.00	60.00	56.00	46.00	FCC
5.0 -30.0	73.00	60.00	60.00	50.00	FCC

Note:

- (1) The tighter limit applies at the band edges.
- (2) The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

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

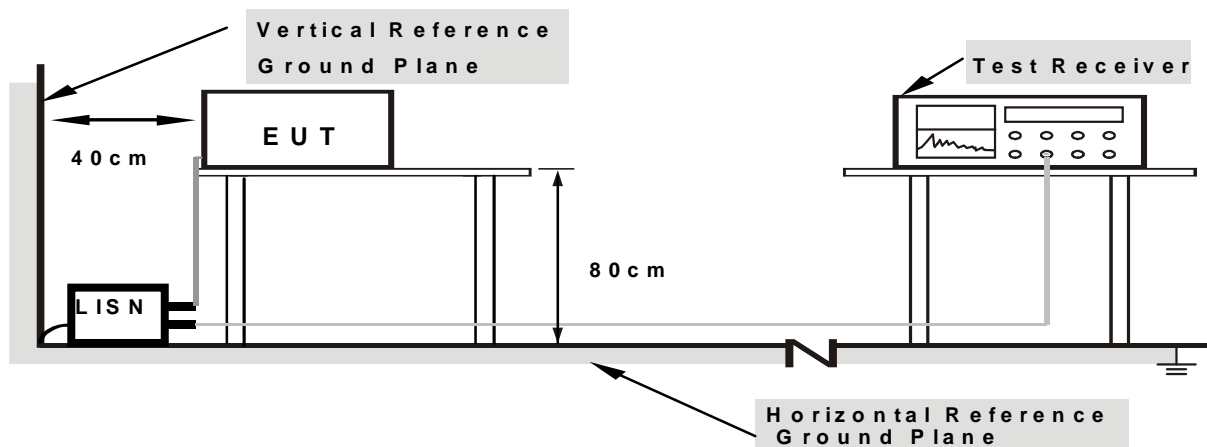
3.1.2 TEST PROCEDURE

- 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.
- Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- 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.
- LISN at least 80 cm from nearest part of EUT chassis.
- For the actual test configuration, please refer to the related Item –EUT Test Photos.

3.1.3 DEVIATION FROM TEST STANDARD

No deviation

3.1.4 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 cm from other units and other metal planes

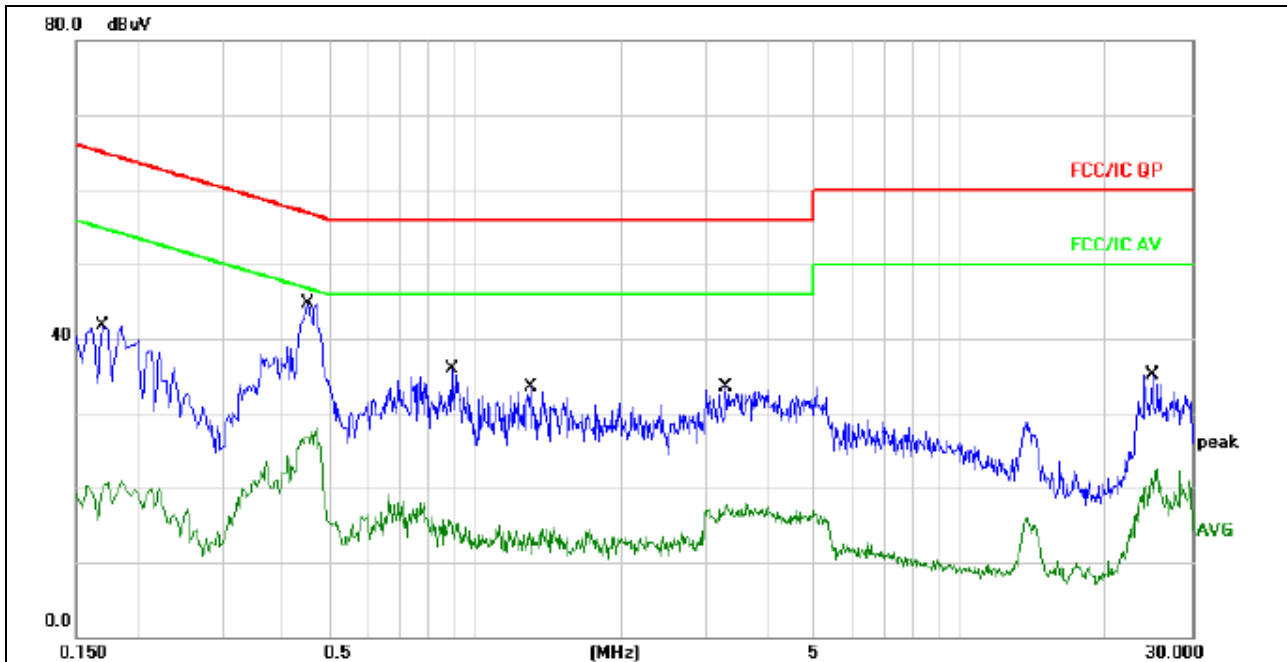
3.1.5 EUT OPERATING CONDITIONS

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.



3.1.6 TEST RESULTS

Temperature :	25°C	Relative Humidity :	54%
Pressure :	1010hPa	Phase :	L
Test Voltage :	AC120V/60Hz	Test Mode :	Mode 4



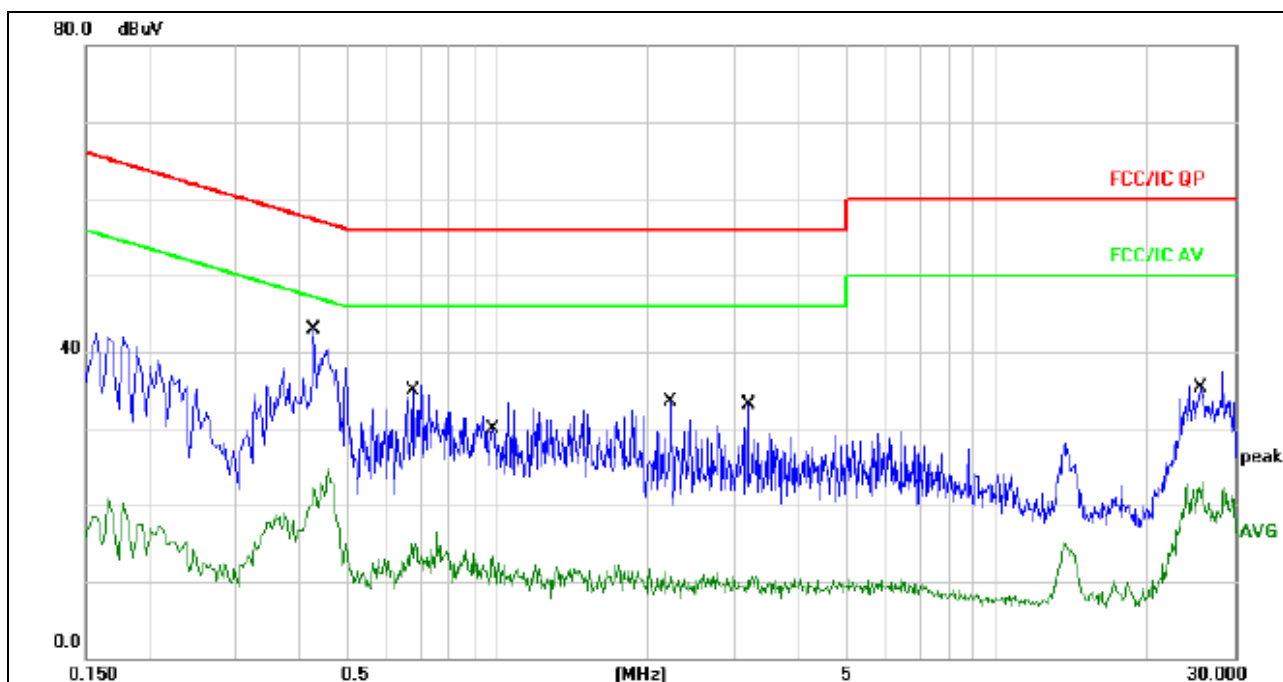
Remark:

1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.

No. Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1	0.1700	41.76	0.00	41.76	64.96	-23.20	QP	
2	0.1700	20.66	0.00	20.66	54.96	-34.30	AVG	
3 *	0.4500	44.73	0.00	44.73	56.87	-12.14	QP	
4	0.4500	28.10	0.00	28.10	46.87	-18.77	AVG	
5	0.8820	35.87	0.00	35.87	56.00	-20.13	QP	
6	0.8820	15.65	0.00	15.65	46.00	-30.35	AVG	
7	1.3020	33.48	0.00	33.48	56.00	-22.52	QP	
8	1.3020	14.63	0.00	14.63	46.00	-31.37	AVG	
9	3.2860	33.42	0.00	33.42	56.00	-22.58	QP	
10	3.2860	17.87	0.00	17.87	46.00	-28.13	AVG	
11	25.0020	35.09	0.00	35.09	60.00	-24.91	QP	
12	25.0020	22.48	0.00	22.48	50.00	-27.52	AVG	



Temperature :	25℃	Relative Humidity :	54%
Pressure :	1010hPa	Phase :	N
Test Voltage :	AC120V/60Hz	Test Mode :	Mode 4



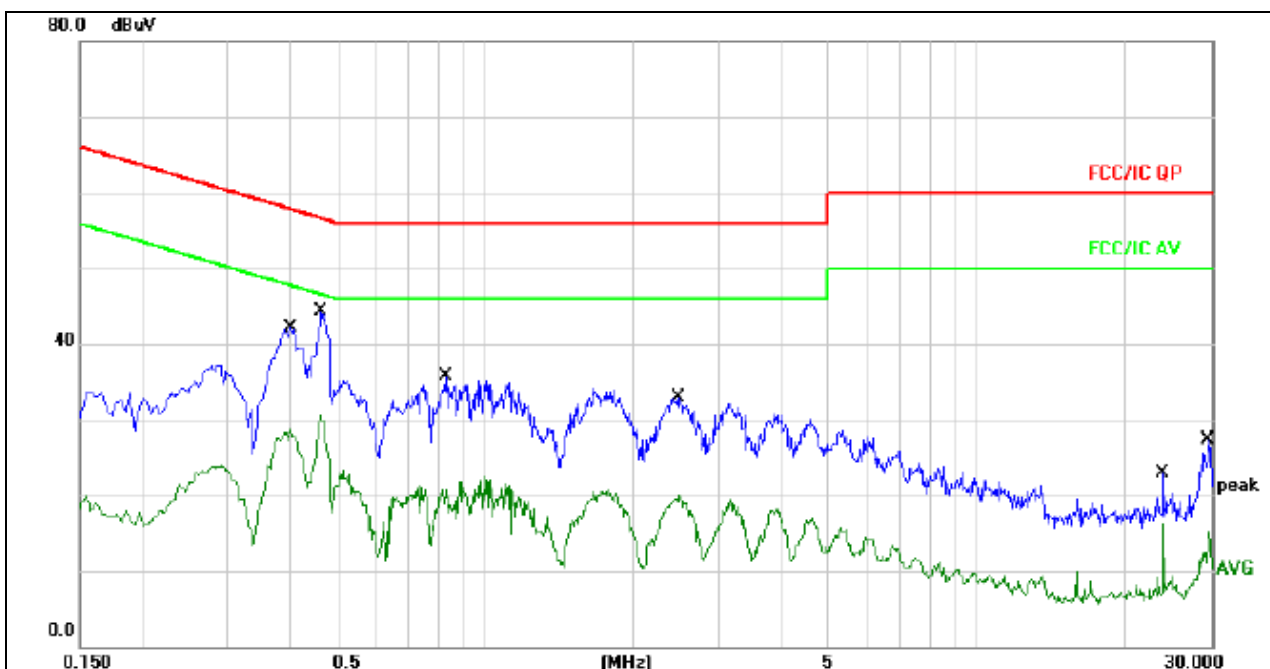
Remark:

1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.

No.	Mk.	Freq. MHz	Reading Level dBμV	Correct Factor dB	Measure- ment dBμV	Limit dBμV	Over dB	Detector	Comment
1	*	0.4300	42.95	0.00	42.95	57.25	-14.30	QP	
2		0.4300	24.64	0.00	24.64	47.25	-22.61	AVG	
3		0.6740	35.63	0.00	35.63	56.00	-20.37	QP	
4		0.6740	14.97	0.00	14.97	46.00	-31.03	AVG	
5		0.9820	33.23	0.00	33.23	56.00	-22.77	QP	
6		0.9820	13.21	0.00	13.21	46.00	-32.79	AVG	
7		2.2260	33.49	0.00	33.49	56.00	-22.51	QP	
8		2.2260	10.66	0.00	10.66	46.00	-35.34	AVG	
9		3.1820	33.12	0.00	33.12	56.00	-22.88	QP	
10		3.1820	10.72	0.00	10.72	46.00	-35.28	AVG	
11		25.8620	37.43	0.00	37.43	60.00	-22.57	QP	
12		25.8620	23.00	0.00	23.00	50.00	-27.00	AVG	



Temperature :	25°C	Relative Humidity :	54%
Pressure :	1010hPa	Phase :	L
Test Voltage :	AC240V/50Hz	Test Mode :	Mode 4



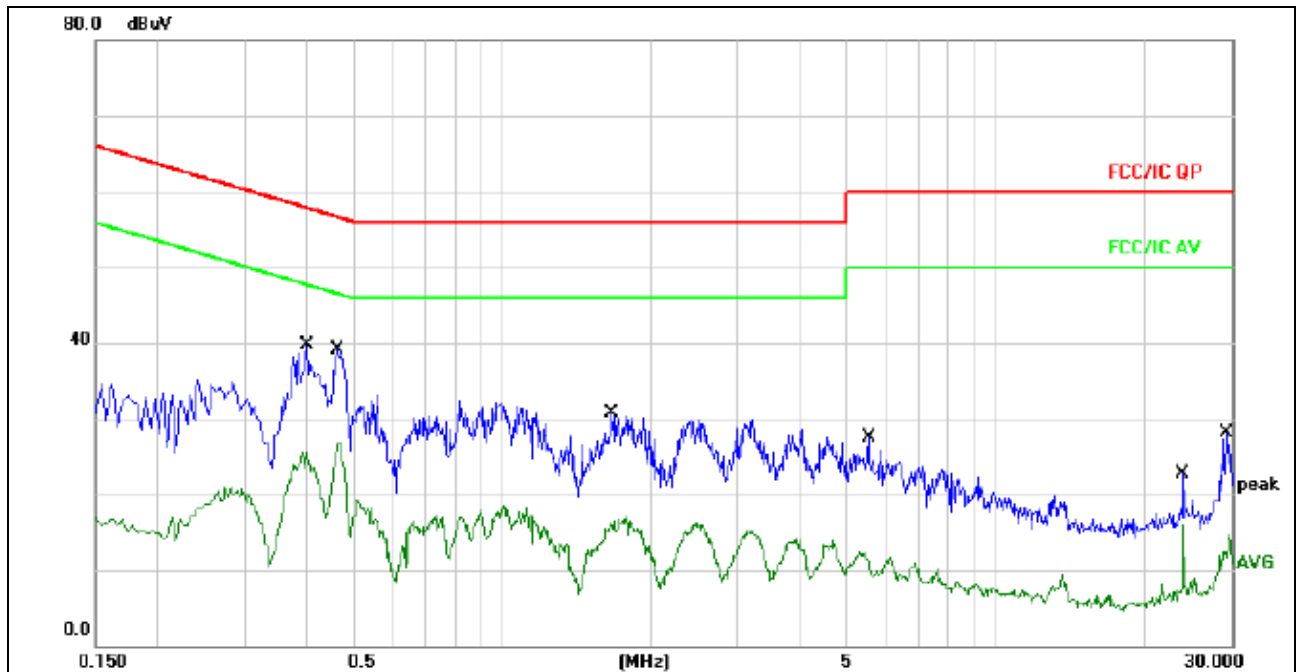
Remark:

1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.

No.	Mk.	Freq. MHz	Reading Level dBμV	Correct Factor dB	Measure- ment dBμV	Limit dBμV	Over dB	Detector	Comment
1		0.4020	32.40	9.67	42.07	57.81	-15.74	QP	
2		0.4020	19.01	9.67	28.68	47.81	-19.13	AVG	
3	*	0.4660	34.70	9.68	44.38	56.58	-12.20	QP	
4		0.4660	20.78	9.68	30.46	46.58	-16.12	AVG	
5		0.8340	26.10	9.69	35.79	56.00	-20.21	QP	
6		0.8340	12.78	9.69	22.47	46.00	-23.53	AVG	
7		2.4820	23.18	9.72	32.90	56.00	-23.10	QP	
8		2.4820	10.34	9.72	20.06	46.00	-25.94	AVG	
9		23.9980	12.96	9.87	22.83	60.00	-37.17	QP	
10		23.9980	6.42	9.87	16.29	50.00	-33.71	AVG	
11		29.5340	17.34	9.86	27.20	60.00	-32.80	QP	
12		29.5340	5.43	9.86	15.29	50.00	-34.71	AVG	



Temperature :	25°C	Relative Humidity :	54%
Pressure :	1010hPa	Phase :	N
Test Voltage :	AC240V/50Hz	Test Mode :	Mode 4



Remark:

1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.

No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over		
		MHz	Level	Factor	ment			Detector	Comment
			dBuV	dB	dBuV	dBuV	dB		
1		0.4020	29.99	9.67	39.66	57.81	-18.15	QP	
2		0.4020	15.90	9.67	25.57	47.81	-22.24	AVG	
3	*	0.4620	29.51	9.68	39.19	56.66	-17.47	QP	
4		0.4620	17.23	9.68	26.91	46.66	-19.75	AVG	
5		1.6700	20.95	9.70	30.65	56.00	-25.35	QP	
6		1.6700	7.37	9.70	17.07	46.00	-28.93	AVG	
7		5.5060	17.68	9.75	27.43	60.00	-32.57	QP	
8		5.5060	3.54	9.75	13.29	50.00	-36.71	AVG	
9		24.0020	12.76	9.87	22.63	60.00	-37.37	QP	
10		24.0020	6.06	9.87	15.93	50.00	-34.07	AVG	
11		29.2980	18.19	9.86	28.05	60.00	-31.95	QP	
12		29.2980	4.85	9.86	14.71	50.00	-35.29	AVG	



3.2 RADIATED EMISSION MEASUREMENT

3.2.1 RADIATED EMISSION LIMITS (Frequency Range 9kHz-1000MHz)

20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

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
Above 960	500	3

LIMITS OF RADIATED EMISSION MEASUREMENT (Above 1000MHz)

FREQUENCY (MHz)	Class B (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).

FREQUENCY RANGE OF RADIATED MEASUREMENT (For unintentional radiators)

Highest frequency generated or Upper frequency of measurement used in the device or on which the device operates or tunes (MHz)	Range (MHz)
Below 1.705	30
1.705 – 108	1000
108 – 500	2000
500 – 1000	5000
Above 1000	5 th harmonic of the highest frequency or 40 GHz, whichever is lower

Spectrum Parameter	Setting
--------------------	---------



Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (emission in restricted band)	1 MHz / 1 MHz for Peak, 1 MHz / 10Hz for Average

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP

3.2.2 TEST PROCEDURE

- The measuring distance of at 3 m shall be used for measurements at frequency up to 25GHz. For frequencies above 1GHz, any suitable measuring distance may be used.
- The EUT was placed on the top of a rotating table 0.8 and 1.5 meters above the ground at a 3 meter semi-chamber test. The table was rotated 360 degrees to determine the position of the highest radiation.
- The height of the equipment or of the substitution antenna shall be 0.8 m; above 1GHz, the height was 1.5m, 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.
- The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
- For the actual test configuration, please refer to the related Item –EUT Test Photos.

- For the radiated emission test above 1GHz:

Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response.

The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.

Note:

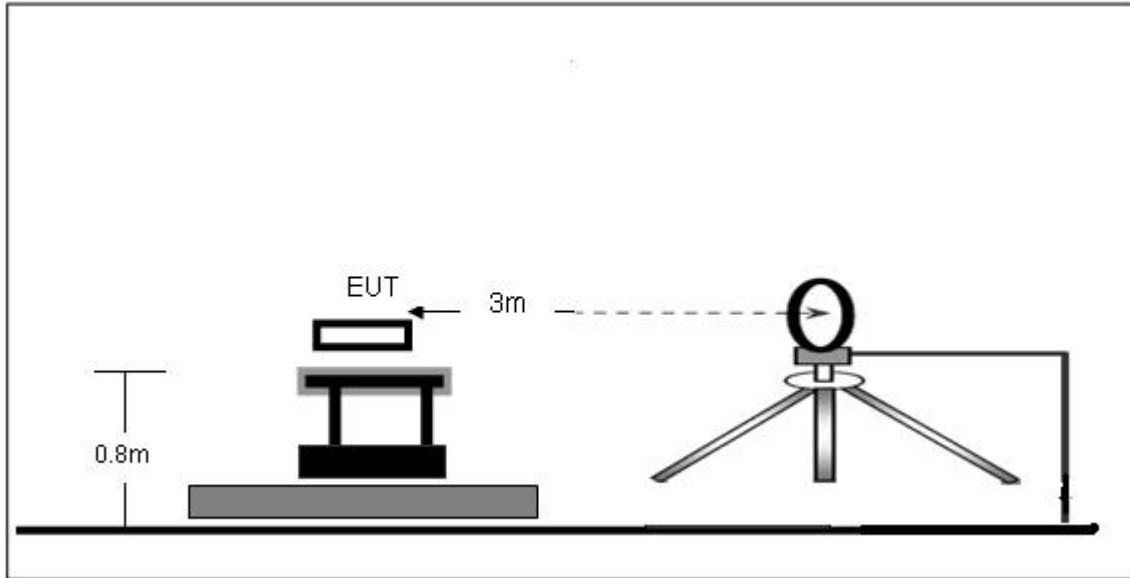
Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported

3.2.3 DEVIATION FROM TEST STANDARD

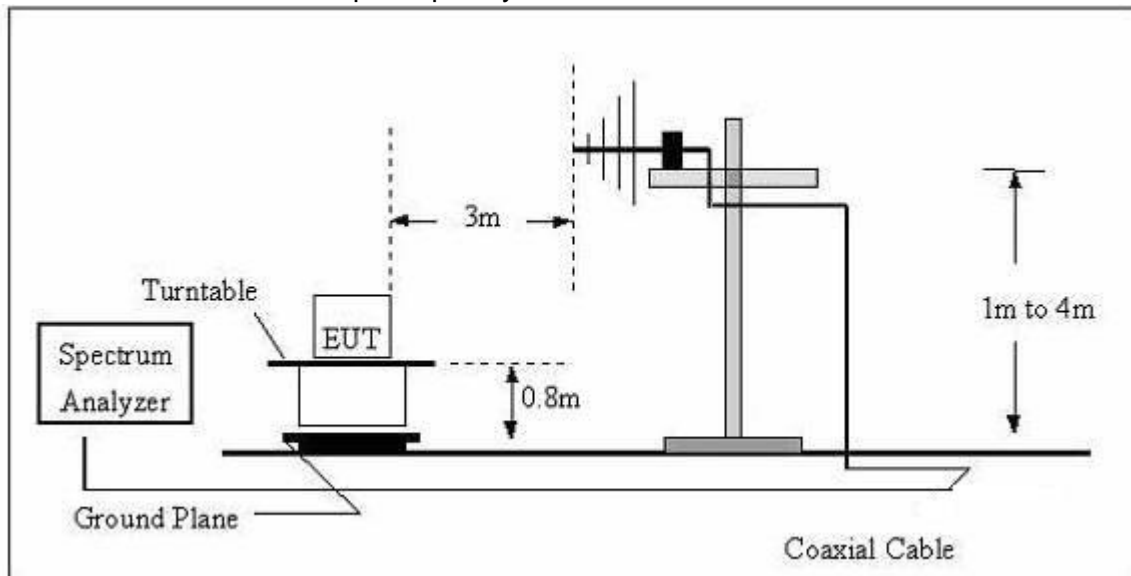
No deviation

3.2.4 TEST SETUP

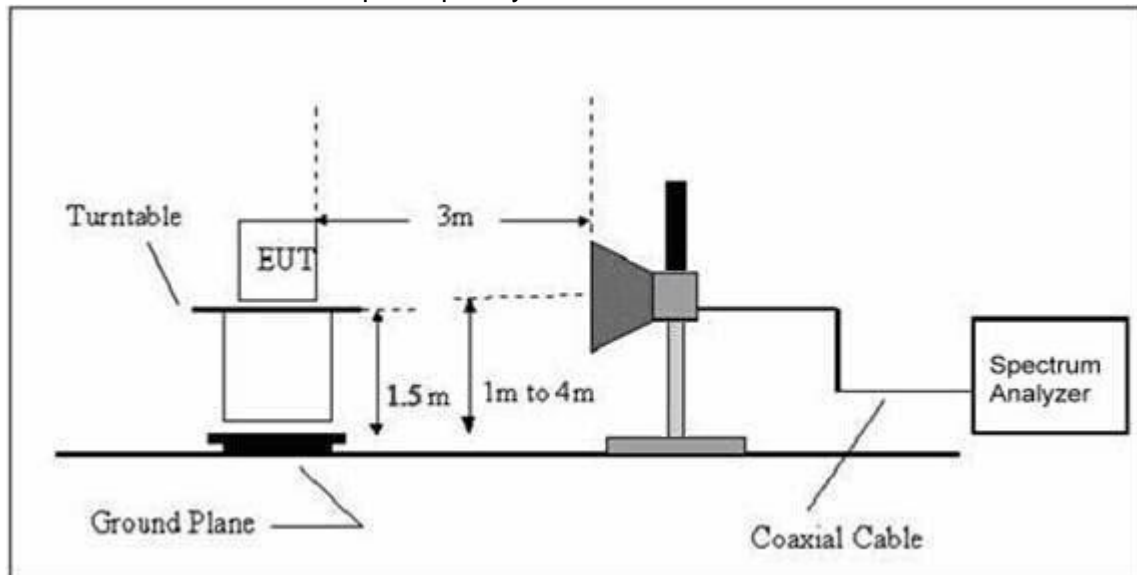
(A) Radiated Emission Test-Up Frequency Below 30MHz



(B) Radiated Emission Test-Up Frequency 30MHz~1GHz



(C) Radiated Emission Test-Up Frequency Above 1GHz



3.2.5 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.



3.2.6 TEST RESULTS

Radiated Spurious Emission (Below 30MHz)

Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010 hPa	Polarization :	---
Test Voltage :	DC 5V From adapter		
Test Mode :	Link Mode		

Freq.	Reading	Limit	Margin	State
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F
--	--	--	--	PASS
--	--	--	--	PASS

NOTE:

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

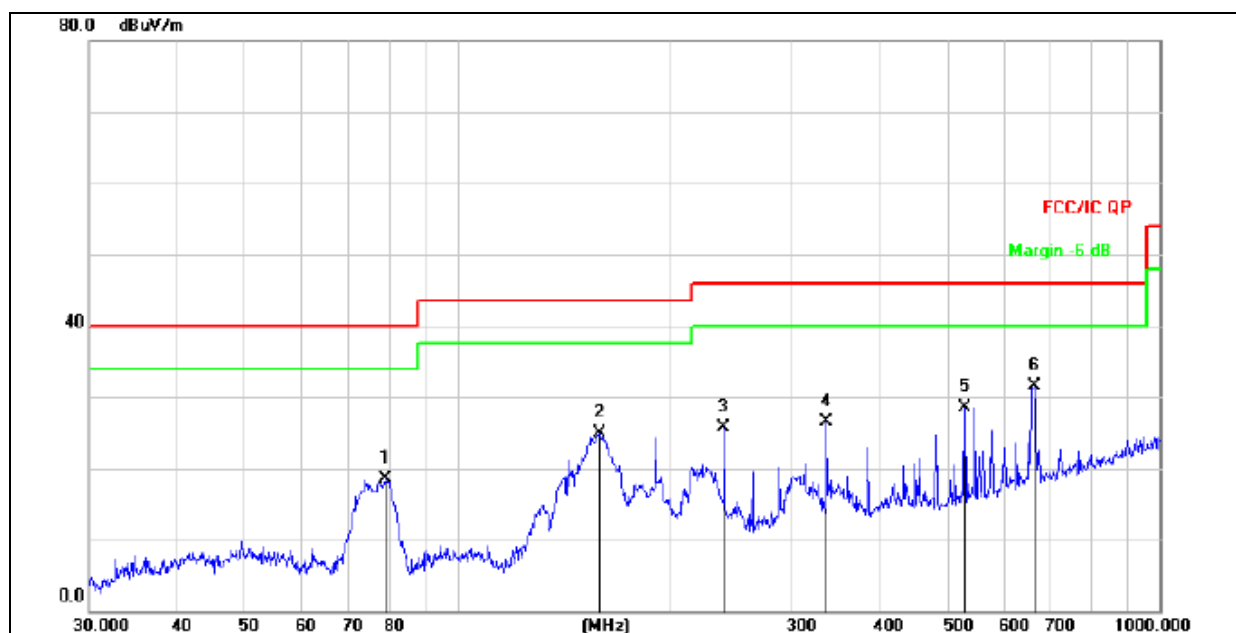
Distance extrapolation factor = $40 \log (\text{specific distance/test distance})$ (dB);

Limit line = specific limits(dBuv) + distance extrapolation factor.



Radiated Spurious Emission (Between 30MHz – 1GHz)

Temperature :	26 °C	Relative Humidity :	54%
Pressure :	1010 hPa	Polarization :	Horizontal
Test Voltage :	DC 5V From adapter		
Test Mode : (Worst)	Link Mode		



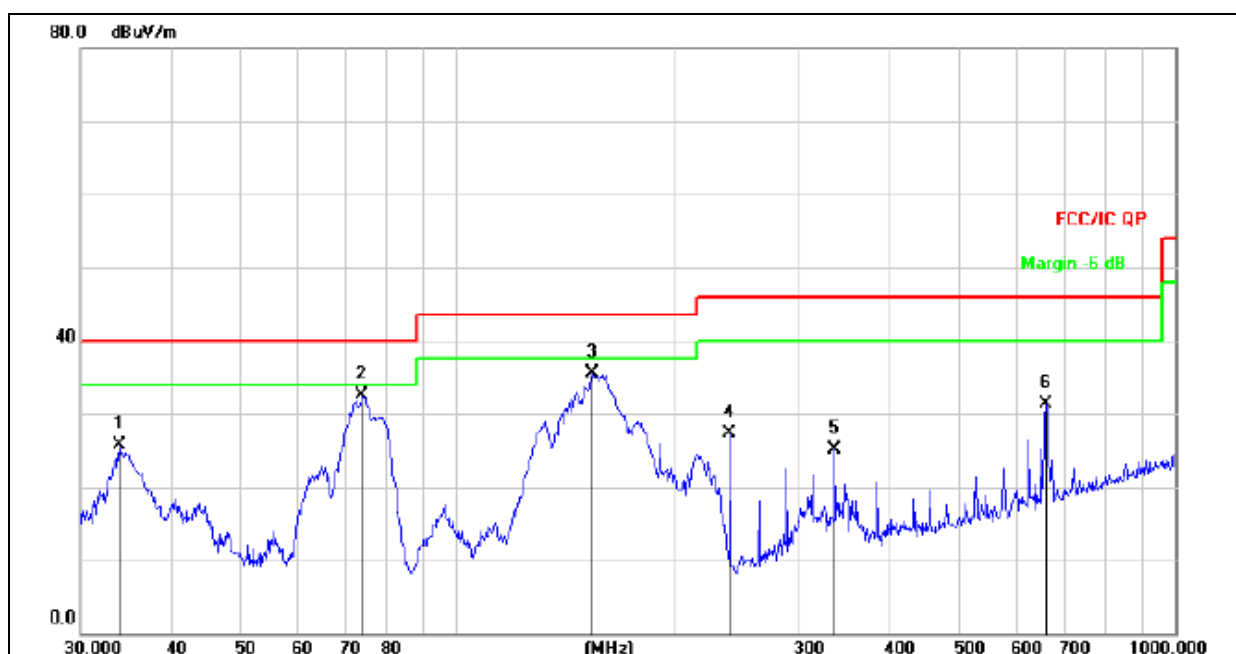
Remark:

Factor = Antenna Factor + Cable Loss – Pre-amplifier.

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB/m	Over dB	Detector
1		79.2426	39.15	-20.66	18.49	40.00	-21.51	QP
2		159.2251	43.95	-19.06	24.89	43.50	-18.61	QP
3		239.9874	39.78	-14.12	25.66	46.00	-20.34	QP
4		336.0352	37.35	-10.94	26.41	46.00	-19.59	QP
5		528.2458	35.09	-6.52	28.57	46.00	-17.43	QP
6	*	663.4729	35.09	-3.57	31.52	46.00	-14.48	QP



Temperature :	26 °C	Relative Humidity :	54%
Pressure :	1010 hPa	Polarization :	Vertical
Test Voltage :	DC 5V From adapter		
Test Mode : (Worst)	Link Mode		



Remark:

Factor = Antenna Factor + Cable Loss – Pre-amplifier.

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1		33.9174	43.43	-17.71	25.72	40.00	-14.28	QP
2	*	73.8756	52.65	-20.21	32.44	40.00	-7.56	QP
3		154.2786	54.80	-19.39	35.41	43.50	-8.09	QP
4		239.9874	41.39	-14.12	27.27	46.00	-18.73	QP
5		336.0352	36.07	-10.94	25.13	46.00	-20.87	QP
6		661.1505	34.83	-3.61	31.22	46.00	-14.78	QP


Radiated Spurious Emission (1GHz to 10th harmonics)

GFSK

	Freq.	Receiver Reading	Detector	Polar	Corrected Factor	Emission Level	Limit	Result
	(MHz)	(dBμV)	(PK/QP/Ave)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	
Lower Channel 2401MHz	2401.00	90.55	PK	H	13.85	104.4	114.00	Pass
	2401.00	73.72	Ave	H	13.85	87.57	94.00	Pass
	4802.00	50.38	PK	H	19.33	69.71	74.00	Pass
	4802.00	29.55	Ave	H	19.33	48.88	54.00	Pass
	12355.00	27.35	PK	H	17.81	45.16	74.00	Pass
	17850.00	20.56	PK	H	25.39	45.95	74.00	Pass
	2401.00	91.52	PK	V	13.85	105.37	114.00	Pass
	2401.00	72.87	Ave	V	13.85	86.72	94.00	Pass
	4802.00	47.48	PK	V	19.33	66.81	74.00	Pass
	4802.00	27.35	Ave	V	19.33	46.68	54.00	Pass
	12355.00	26.28	PK	V	17.81	44.09	74.00	Pass
	17850.00	20.44	PK	V	25.39	45.83	74.00	Pass
Middle Channel 2440MHz	2440.00	90.76	PK	H	13.94	104.70	114.00	Pass
	2440.00	70.94	Ave	H	13.94	84.88	94.00	Pass
	4880.00	46.82	PK	H	19.43	66.25	74.00	Pass
	4880.00	28.54	Ave	H	19.43	47.97	54.00	Pass
	12355.00	25.68	PK	H	17.81	43.49	74.00	Pass
	17850.00	18.67	PK	H	25.39	44.06	74.00	Pass
	2440.00	89.28	PK	V	13.94	103.22	114.00	Pass
	2440.00	71.49	Ave	V	13.94	85.43	94.00	Pass
	4880.00	47.26	PK	V	19.43	66.69	74.00	Pass
	4880.00	29.82	Ave	V	19.43	49.25	54.00	Pass
	12355.00	25.77	PK	V	17.81	43.58	74.00	Pass
	17850.00	18.58	PK	V	25.39	43.97	74.00	Pass
Upper Channel 2483MHz	2483.00	90.33	PK	H	14.02	104.35	114.00	Pass
	2483.00	71.65	Ave	H	14.02	85.67	94.00	Pass
	4966.00	45.46	PK	H	19.51	64.97	74.00	Pass



	4966.00	27.65	Ave	H	19.51	47.16	54.00	Pass
	12355.00	25.73	PK	H	17.81	43.54	74.00	Pass
	17850.00	19.56	PK	H	25.39	44.95	74.00	Pass
	2483.00	91.62	PK	V	14.02	105.64	114.00	Pass
	2483.00	72.54	Ave	V	14.02	86.56	94.00	Pass
	4966.00	44.77	PK	V	19.51	64.28	74.00	Pass
	4966.00	27.92	Ave	V	19.51	47.43	54.00	Pass
	12355.00	26.58	PK	V	17.81	44.39	74.00	Pass
	17850.00	19.44	PK	V	25.39	44.83	74.00	Pass

Remark:

Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Emission Level = Meter Reading + Factor

Margin = Emission Level - Limit

Other harmonics emissions are lower than 20dB below the allowable limit.



4. BANDWIDTH TEST

4.1 APPLIED PROCEDURES / LIMIT

FCC Part15 (15.249) ,	
Section	Test Item
15.249	Bandwidth

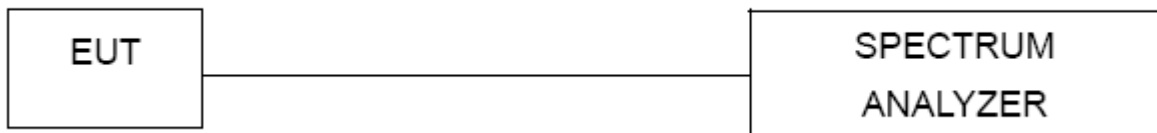
4.1.1 TEST PROCEDURE

1. Set RBW = 30 kHz.
2. Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

4.1.2 DEVIATION FROM STANDARD

No deviation.

4.1.3 TEST SETUP



4.1.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

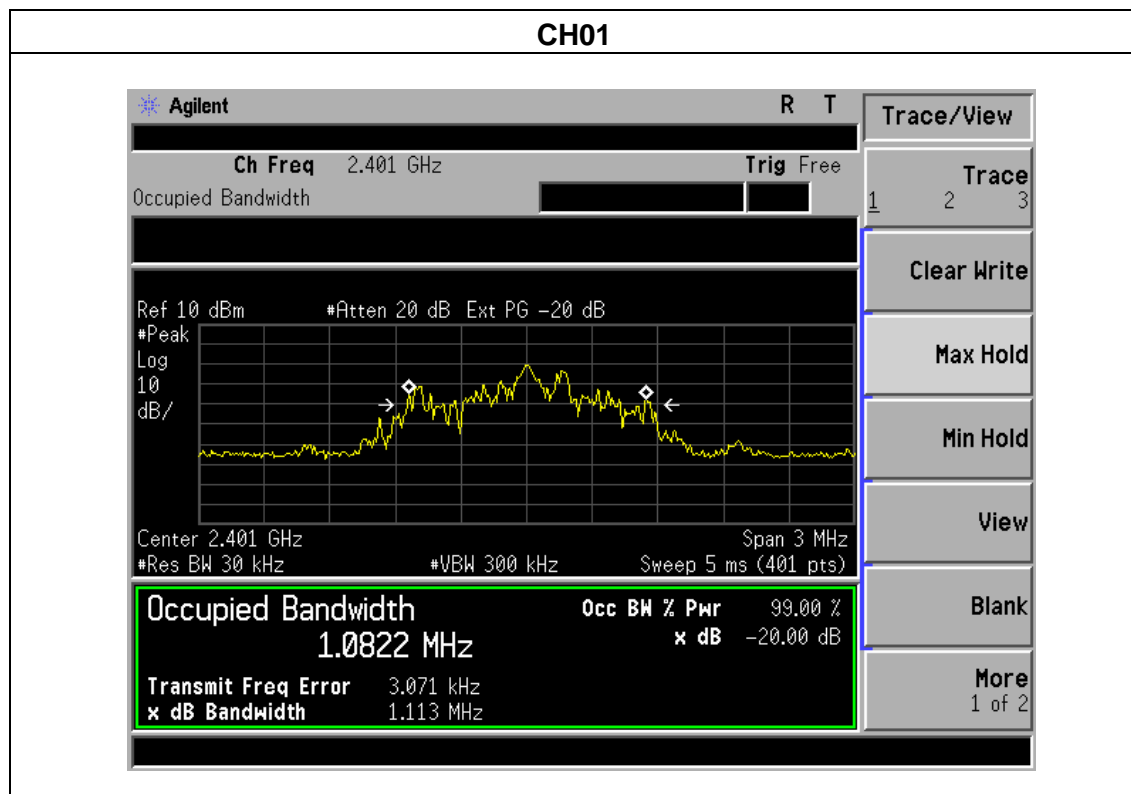


4.1.5 TEST RESULTS

Temperature :	25 °C	Relative Humidity :	54%
Pressure :	1012 hPa	Test Voltage :	DC 5V From adapter
Test Mode :	CH01 / CH40 /CH83		

	Frequency	20dB Bandwidth (MHz)	Result
GFSK	2401 MHz	1.113	PASS
	2440 MHz	1.099	PASS
	2483 MHz	1.087	PASS

GFSK

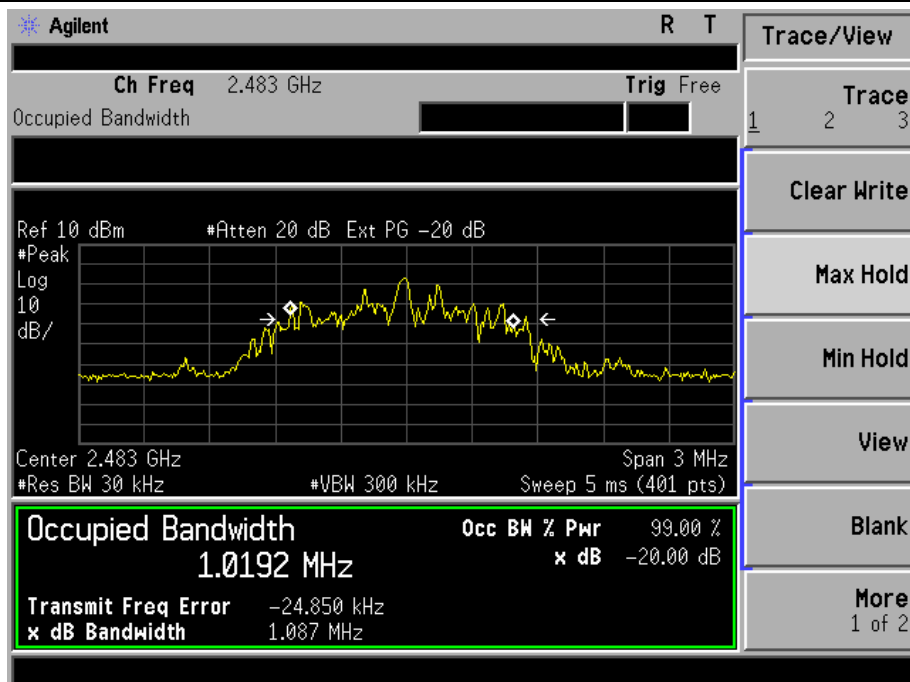




CH40



CH83





5. 100 KHZ BANDWIDTH OF FREQUENCY BAND EDGE APPLICABLE STANDARD

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

TEST PROCEDURE

- a) Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- b) Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
- c) Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
- d) Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
- e) Repeat above procedures until all measured frequencies were complete.

Note:

Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported



5.1 DEVIATION FROM STANDARD

No deviation.

5.2 TEST SETUP

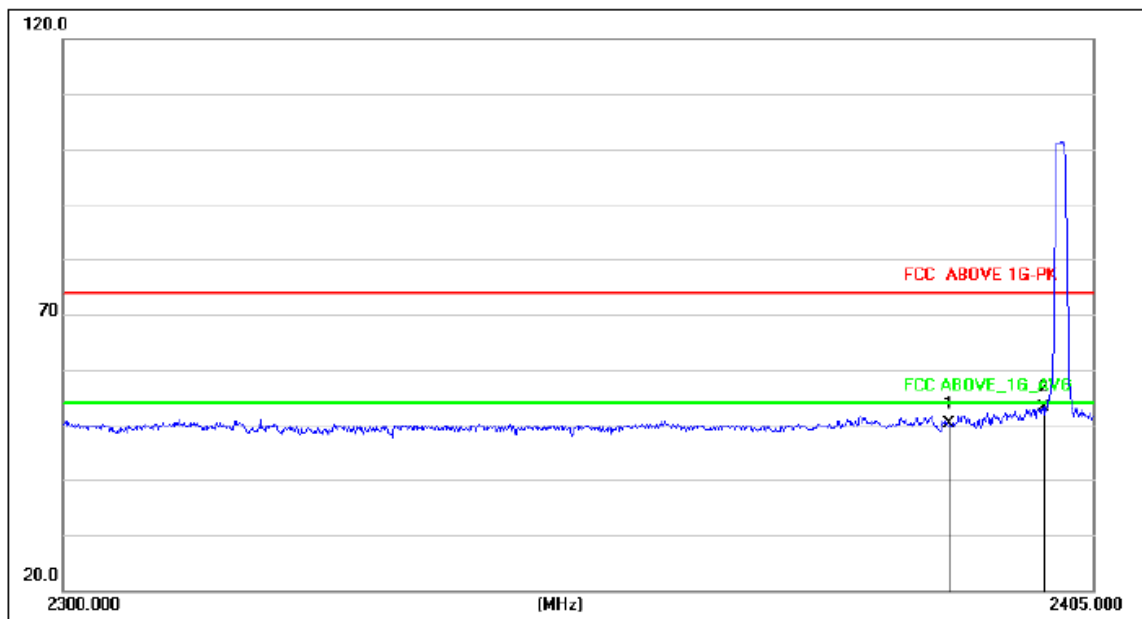
5.3 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

5.4 TEST RESULTS

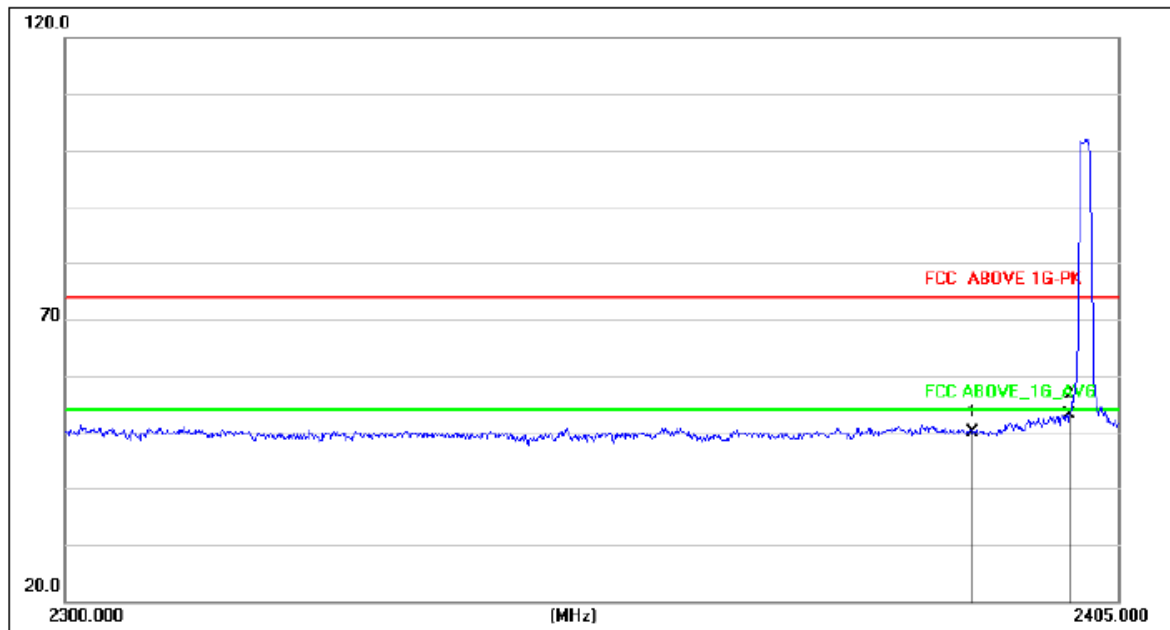
Temperature :	25 °C	Relative Humidity :	54%
Pressure :	1012 hPa	Test Voltage :	DC 5V From adapter
Test Mode :	CH01/CH83	Polarization :	Horizontal

2401MHz Horizontal



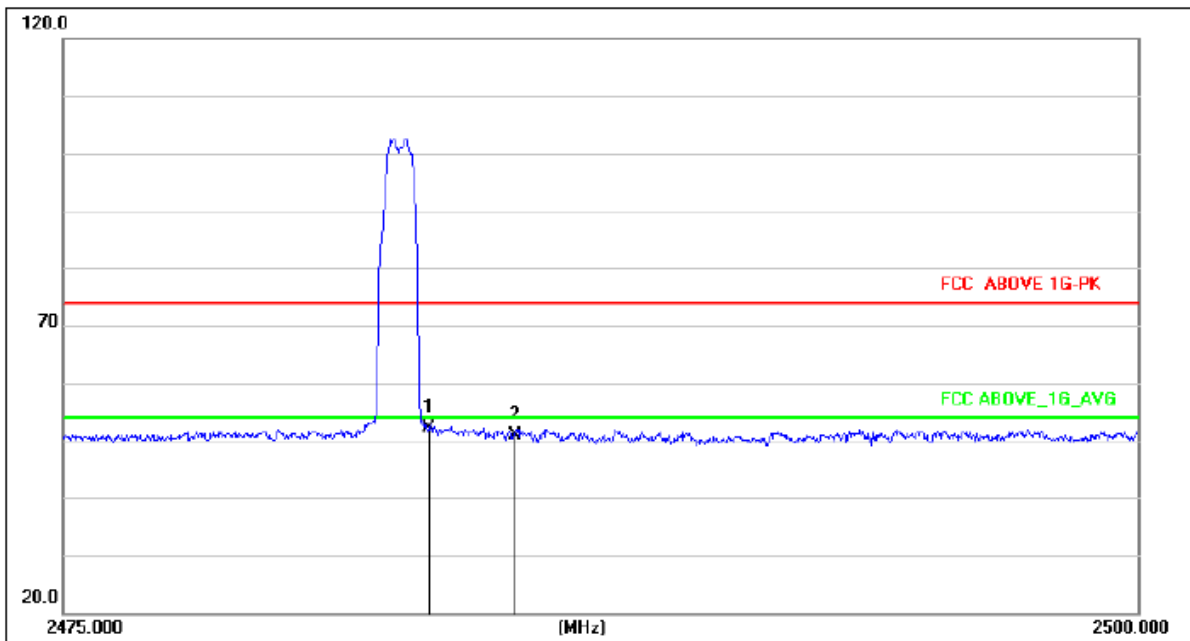
No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2390.195	54.85	-4.71	50.14	74.00	-23.86	peak
2	2400.000	57.96	-4.77	53.19	74.00	-20.81	peak

2401MHz Vertical



No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2390.300	54.54	-4.72	49.82	74.00	-24.18	peak
2	2400.000	57.67	-4.77	52.9	74.00	-21.1	peak

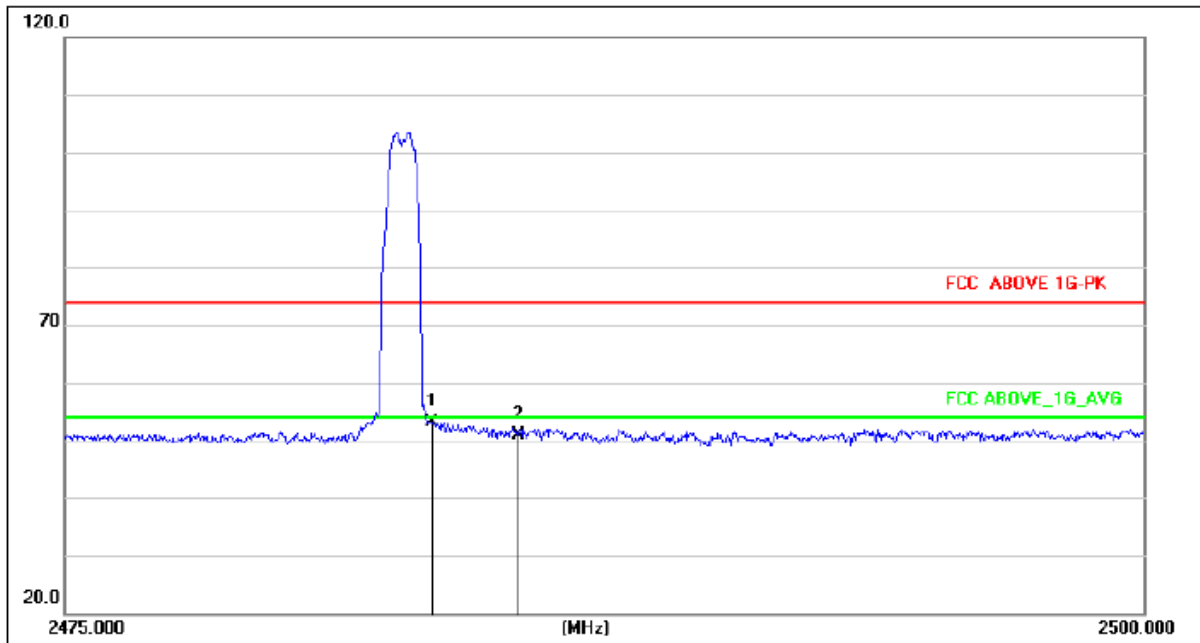
2483MHz Horizontal



No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	57.11	-5.08	52.03	74.00	-21.97	peak
2	2485.500	55.99	-5.08	50.91	74.00	-23.09	peak



2483MHz Vertical



No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	58.11	-5.08	53.03	74.00	-20.97	peak
2	2485.500	55.99	-5.08	50.91	74.00	-23.09	peak

If the PK measured levels comply with average limit, then the average level were deemed to comply with average limit.



6. ANTENNA REQUIREMENT

6.1 STANDARD REQUIREMENT

15.203 requirement: For intentional device, according to 15.203: an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

6.2 EUT ANTENNA

The EUT antenna is Integrated (External) antenna. It complies with the standard requirement.



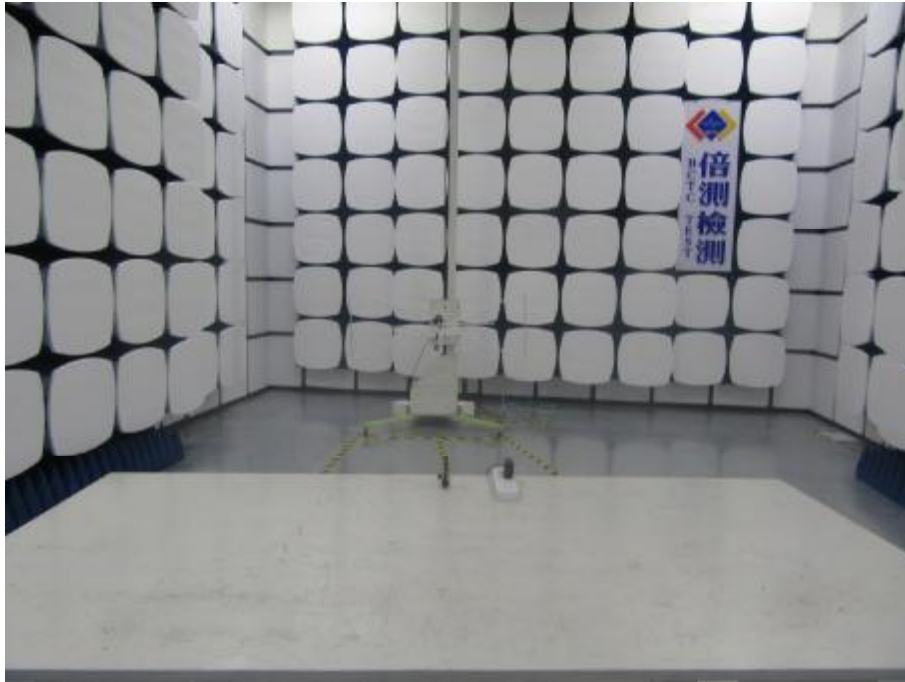
7. EUT TEST PHOTO

Conducted Measurement Photos





Radiated Measurement Photos



8. PHOTOS OF THE EUT



***** END OF REPORT *****