



FCC Part 15C Test Report

FCC ID: 2AHS6F86

Product Name:	SPEAKER
Trademark:	N/A
Model Name :	F86 A86, F-106D, F-73D, SBX-621500, WAVE215, PSHAKE3500LED,MAHM-15AX2, MAHM-15AX2A
Prepared For :	TIAN RUI HOLDINGS GROUP CO.,LTD
Address :	Feiyang Industrial Zone, Baiyun District, Guangzhou, China
Prepared By :	Shenzhen BCTC Technology Co., Ltd.
Address :	No.101,Yousong Road,Longhua New District, Shenzhen,China
Test Date:	Mar. 16 - Mar. 23, 2016
Date of Report :	Mar. 23, 2016
Report No.:	BCTC-160302682E



VERIFICATION OF COMPLIANCE

Applicant's name : **TIAN RUI HOLDINGS GROUP CO.,LTD**
 Address..... : Feiyang Industrial Zone, Baiyun District, Guangzhou, China
Manufacture's Name : **TIAN RUI HOLDINGS GROUP CO.,LTD**
 Address..... : Feiyang Industrial Zone, Baiyun District, Guangzhou, China

Product description

Product name..... : **SPEAKER**
 Trademark: N/A
 F86
 Model Name: A86, F-106D, F-73D, SBX-621500, WAVE215,
 PSHAKE3500LED,MAHM-15AX2, MAHM-15AX2A
 Test procedure FCC Part15.249
 Standards ANSI C63.10-2013

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
 (Eric Yang)

Technical Manager : Sophie Lee
 (Sophia Lee)

Authorized Signatory : Carson Zhang
 (Carson. Zhang)





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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	Fundamental & Radiated Spurious Emission Measurement	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 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** %.

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	SPEAKER	
Trade Name	N/A	
Model Name	F86	
Serial Model	A86, F-106D, F-73D, SBX-621500, WAVE215, PSHAKE3500LED, MAHM-15AX2, MAHM-15AX2A	
Model Difference	The product's different for model number and outlook color.	
Product Description	Operation Frequency:	2402~2480 MHz
	Modulation Type:	GFSK, PI/4 DPSK, 8DPSK
	Bit Rate of Transmitter	1/2/3M
	Number Of Channel	79CH
	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.	
Power	AC120-240V 50/60Hz	
Connecting I/O Port(s)	Please refer to the User's Manual	
hardware version	--	
Software version	--	
Serial number	--	

Note:

- For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.
-

Channel List					
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
01	2402	11	2413	38	2441
02	2403	12	2414	39	2441
03	2404	13	2415	40	2442
~	~	~	~	~	~
09	2411	19	2421	77	2479
10	2412	20	2422	78	2480

3. Table for Filed Antenna

Ant	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	NOTE
1	N/A	N/A	PCB Antenna	N/A	0	



2.2 DESCRIPTION OF TEST MODES

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base 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.

For Conducted & Radiated Emission		
Final Test Mode	Description	
Mode 1	CH01	GFSK, PI/4 DPSK 8DPSK
Mode 2	CH39	
Mode 3	CH78	
Mode 4	Normal Link	

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 TEXT SOFTWARE SETTING

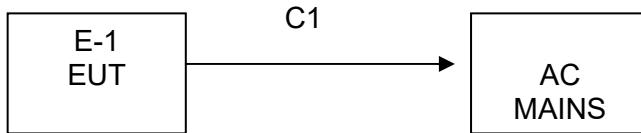
During testing channel & power controlling software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final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

Frequency	2402 MHz	2441 MHz	2480 MHz
Channel	Low	Middle	High



2.4 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

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	SPEAKER	N/A	F86	N/A	EUT

Item	Shielded Type	Ferrite Core	Length	Note
C1	NO Shielded	NO	0.8M	AC Line

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	2015.06.05	2016.06.05	1 year
2	LISN	R&S	NSLK8126	8126466	2015.08.24	2016.08.23	1 year
3	LISN	R&S	NSLK8126	8126487	2015.08.24	2016.08.23	1 year
4	50Ω Coaxial Switch	Anritsu	MP59B	6200264417	2015.06.05	2016.06.05	1 year
5	RF cables	R&S	R204	R20X	2015.06.05	2016.06.05	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	2015.06.05	2016.06.05	1 year
2	Test Receiver	R&S	ESPI	101318	2015.06.05	2016.06.05	1 year
3	Bilog Antenna	R&S	VULB9168	VULB9168-438	2015.06.05	2016.06.05	1 year
4	50Ω Coaxial Switch	Anritsu	MP59B	6200264416	2015.06.05	2016.06.05	1 year
5	Spectrum Analyzer	ADVANTEST	R3132	150900201	2015.06.05	2016.06.05	1 year
6	Horn Antenna	R&S	HF906	10027	2015.06.05	2016.06.05	1 year
7	Horn Ant	Schwarzbeck	BBHA 9170	9170-181	2015.06.05	2016.06.05	1 year
8	Amplifier	R&S	BBV9743	9743-019	2015.12.22	2016.12.21	1 year
9	Loop Antenna	ARA	PLA-1030/B	1029	2015.06.05	2016.06.05	1 year
10	RF cables	R&S	R203	R20X	2015.06.05	2016.06.05	1 year
11	Antenna connector	Florida RFLabs	Lab-Fle	RF 01#	2015.06.05	2016.06.05	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

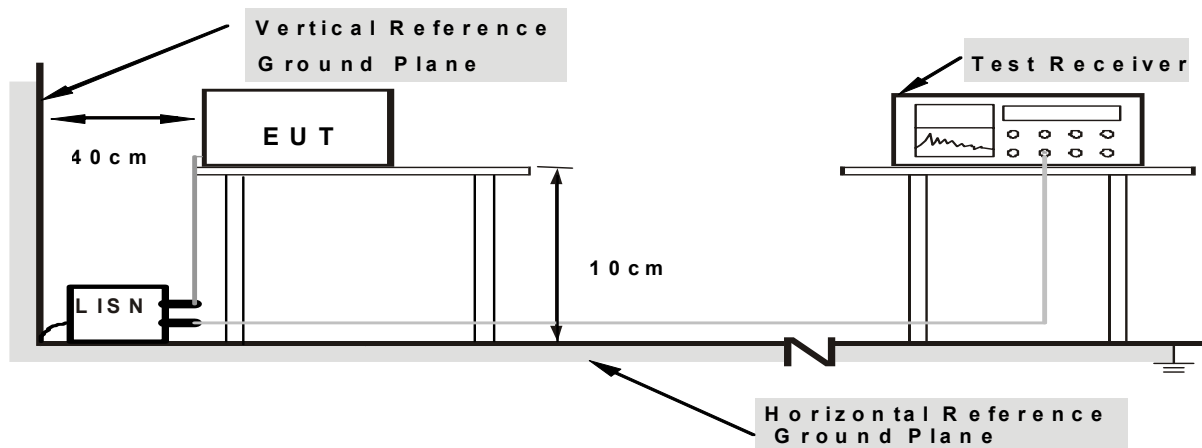
3.1.2 TEST PROCEDURE

- The EUT was placed 0.1 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.

We pretest AC 120V and AC 240V, the worst voltage was AC 120V and the data recording in the report.



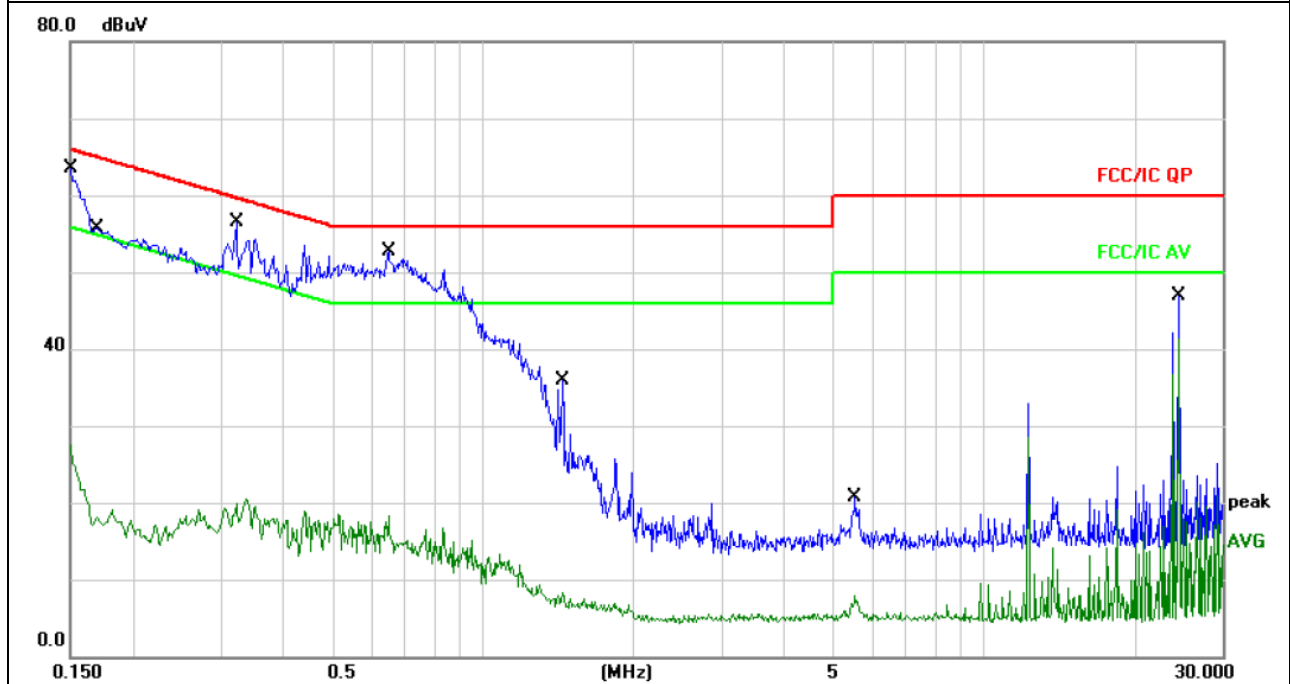
3.1.6 TEST RESULTS

EUT :	SPEAKER	Model Name. :	F86
Temperature :	26°C	Relative Humidity :	54%
Pressure :	1010hPa	Phase :	L
Test Voltage :	AC120V/60Hz	Test Mode :	Mode 4

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1	*	0.1500	53.38	10.05	63.43	65.99	-2.56	QP	
2		0.1500	17.39	10.05	27.44	55.99	-28.55	AVG	
3		0.1712	45.39	10.06	55.45	64.90	-9.45	QP	
4		0.1712	17.38	10.06	27.44	54.90	-27.46	AVG	
5		0.3220	46.42	10.10	56.52	59.65	-3.13	QP	
6		0.3220	10.44	10.10	20.54	49.65	-29.11	AVG	
7		0.6500	41.54	10.13	51.67	56.00	-4.33	QP	
8		0.6500	8.25	10.13	18.38	46.00	-27.62	AVG	
9		1.4420	25.64	10.17	35.81	56.00	-20.19	QP	
10		1.4420	-2.59	10.17	7.58	46.00	-38.42	AVG	
11		5.5500	10.57	10.12	20.69	60.00	-39.31	QP	
12		5.5500	-2.15	10.12	7.97	50.00	-42.03	AVG	

Remark:

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



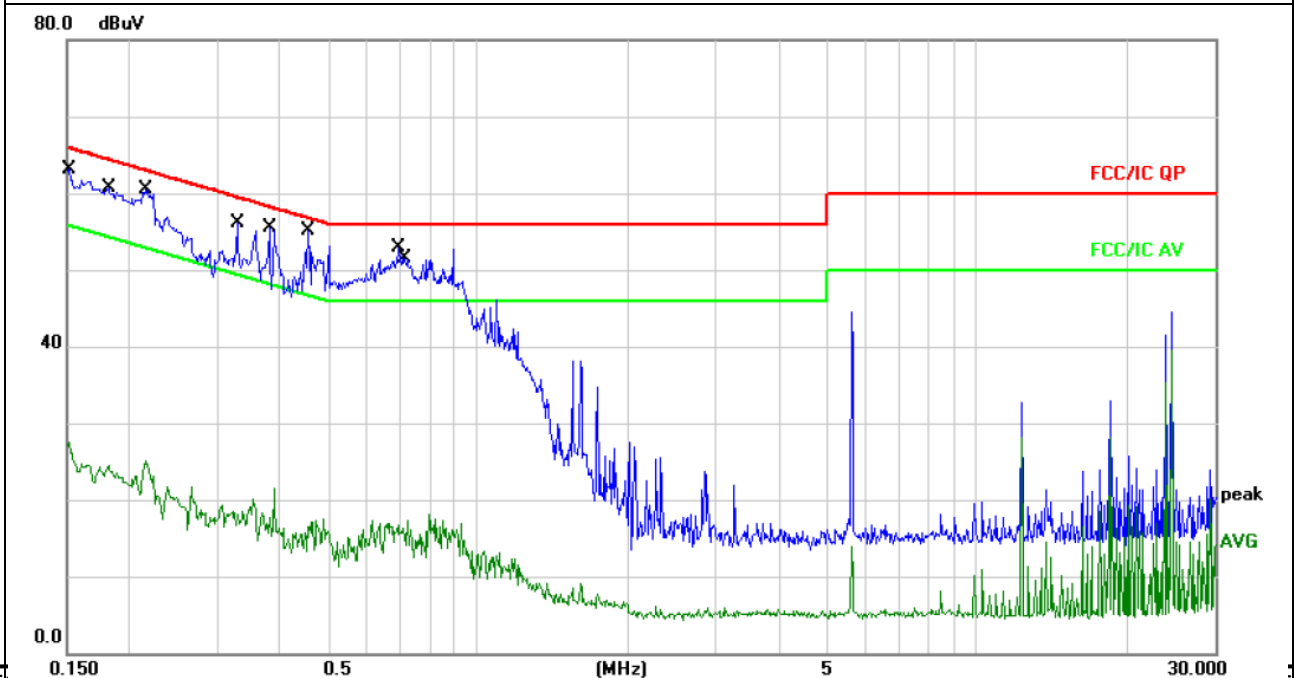


EUT :	SPEAKER	Model Name. :	F86
Temperature :	26°C	Relative Humidity :	54%
Pressure :	1010hPa	Phase :	N
Test Voltage :	AC120V/60Hz	Test Mode :	Mode 4

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.1499	17.15	10.05	27.20	56.00	-28.80	AVG	
2		0.1516	53.02	10.05	63.07	65.91	-2.84	QP	
3		0.1819	50.58	10.06	60.64	64.39	-3.75	QP	
4		0.1819	14.99	10.06	25.05	54.39	-29.34	AVG	
5		0.2151	50.42	10.07	60.49	63.00	-2.51	QP	
6		0.2162	14.67	10.07	24.74	52.96	-28.22	AVG	
7		0.3300	46.07	10.10	56.17	59.45	-3.28	QP	
8		0.3300	11.39	10.10	21.49	49.45	-27.96	AVG	
9		0.3820	45.33	10.10	55.43	58.23	-2.80	QP	
10		0.3831	7.33	10.10	17.43	48.21	-30.78	AVG	
11	*	0.4580	44.97	10.11	55.08	56.73	-1.65	QP	
12		0.4580	6.47	10.11	16.58	46.73	-30.15	AVG	

Remark:

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





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

- a. 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.
- b. The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
- c. The height of the equipment or of the substitution antenna shall be 0.1 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. 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.
- e. 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.
- f. For the actual test configuration, please refer to the related Item –EUT Test Photos.
- g. 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:

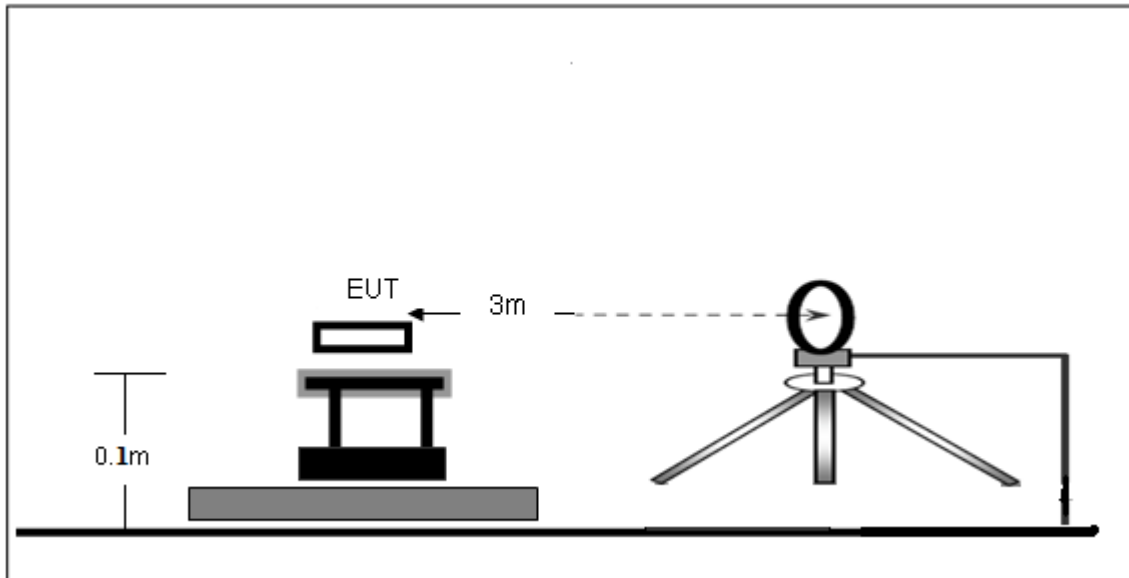
Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported We pretest AC 120V , and AC 240V, the worst voltage was AC 120V and the data recording in the report.

3.2.3 DEVIATION FROM TEST STANDARD

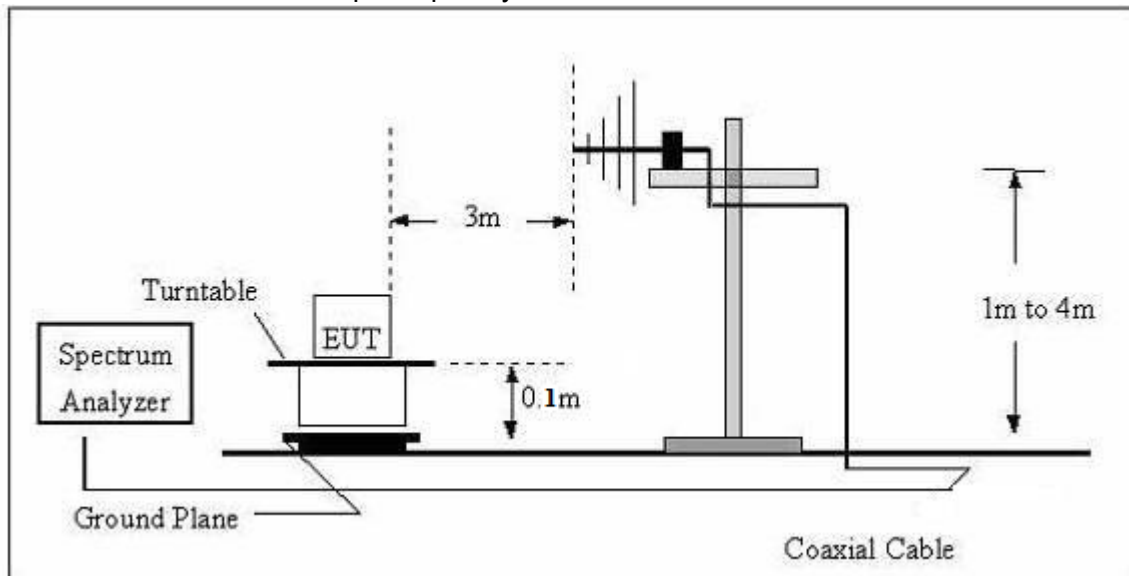
No deviation

3.2.4 TEST SETUP

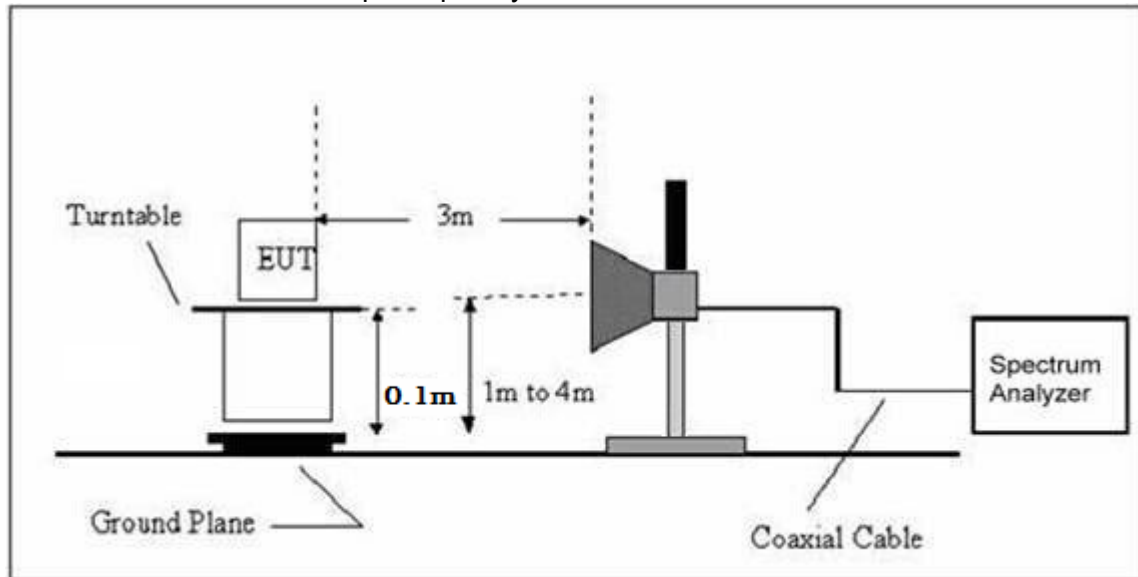
(A) Radiated Emission Test-Up Frequency Below 30MHz



(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)

EUT :	SPEAKER	Model Name :	F86
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010 hPa	Polarization :	---
Test Voltage :	AC 120V/60Hz		
Test Mode :	Normal Link		

Freq. (MHz)	Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)	State 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 = $40 \log (\text{specific distance}/\text{test distance})$ (dB);

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

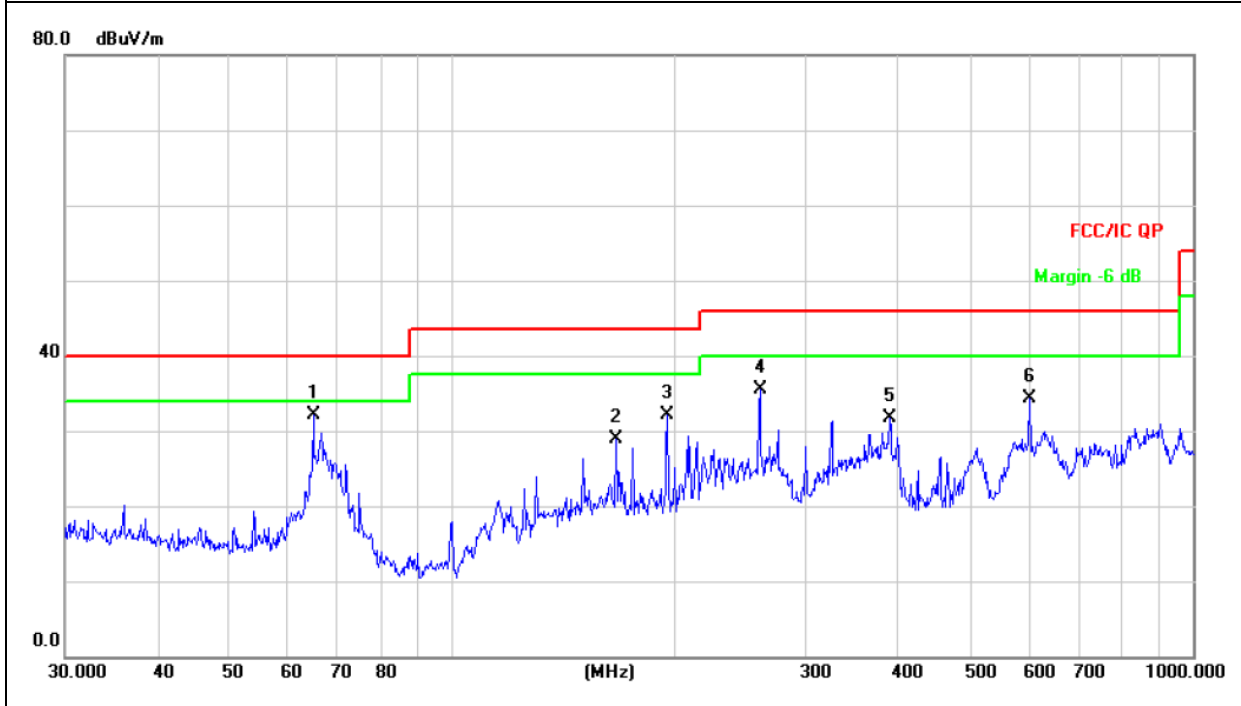


Radiated Spurious Emission (Between 30MHz – 1GHz)

EUT :	SPEAKER	Model Name :	F86
Temperature :	26 °C	Relative Humidity :	54%
Pressure :	1010 hPa	Polarization :	Horizontal
Test Voltage :	AC120V/60Hz		
Test Mode : (Worst)	Mode 4		

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	cm	degree	Comment
1	*	64.8865	44.60	-12.49	32.11	40.00	-7.89	QP		
2		166.6514	42.15	-13.26	28.89	43.50	-14.61	QP		
3		195.1365	48.09	-15.90	32.19	43.50	-11.31	QP		
4		260.1444	49.50	-13.91	35.59	46.00	-10.41	QP		
5		389.3549	42.08	-10.44	31.64	46.00	-14.36	QP		
6		601.4265	39.87	-5.66	34.21	46.00	-11.79	QP		

Remark:
 Factor = Antenna Factor + Cable Loss – Pre-amplifier.
 All interfaces was connected, and BT TX mode was link.

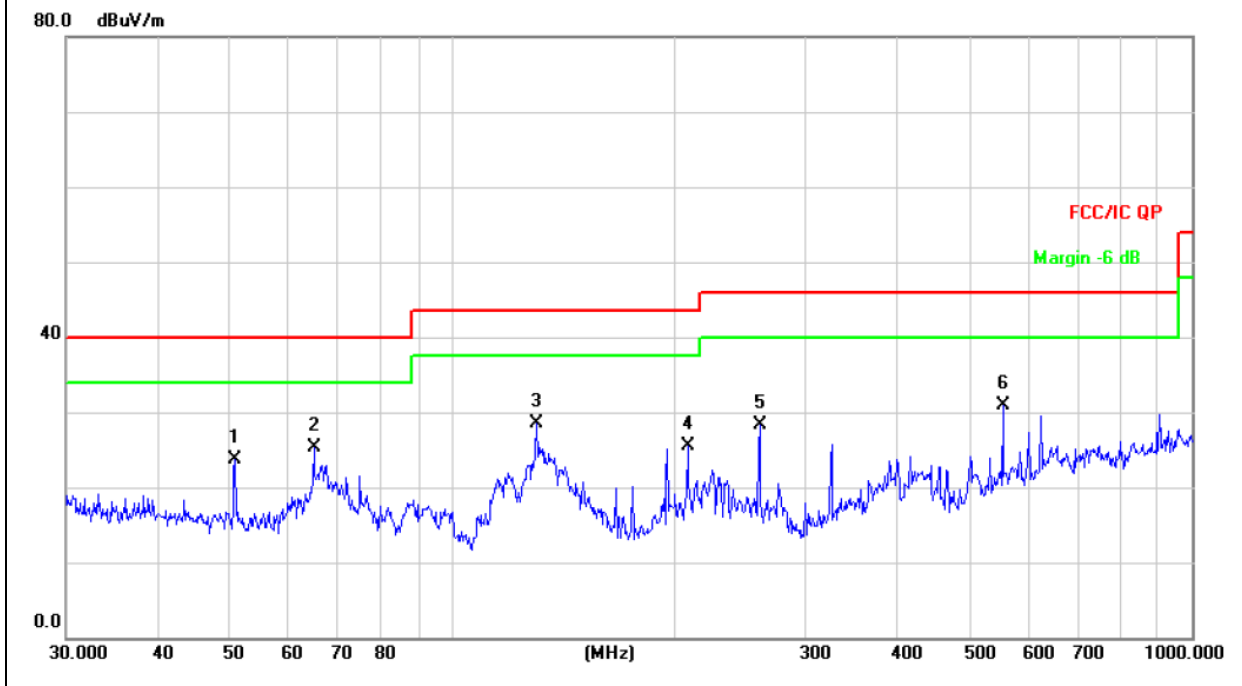




EUT :	SPEAKER	Model Name :	F86
Temperature :	26 °C	Relative Humidity :	54%
Pressure :	1010 hPa	Polarization :	Vertical
Test Voltage :	AC120V/60Hz		
Test Mode : (Worst)	Mode 4		

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	cm	degree	
1		50.7637	34.10	-10.42	23.68	40.00	-16.32	QP		
2	*	64.8865	37.70	-12.49	25.21	40.00	-14.79	QP		
3		129.9226	42.68	-14.11	28.57	43.50	-14.93	QP		
4		207.8501	41.58	-15.98	25.60	43.50	-17.90	QP		
5		260.1444	42.25	-13.91	28.34	46.00	-17.66	QP		
6		554.8254	37.89	-6.96	30.93	46.00	-15.07	QP		

Remark:
 Factor = Antenna Factor + Cable Loss – Pre-amplifier.
 All interfaces was connected, and BT TX mode was link.





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 2402MHz	2402.00	102.95	PK	H	1.31	104.26	114.00	Pass
	2402.00	88.51	Ave	H	1.31	89.82	94.00	Pass
	4804.00	55.68	PK	H	-1.06	54.62	74.00	Pass
	4804.00	45.70	Ave	H	-1.06	44.64	54.00	Pass
	9653.00	44.29	PK	H	-4.89	39.40	74.00	Pass
	17563.00	43.59	PK	H	-6.61	36.98	74.00	Pass
	2402.00	102.66	PK	V	1.31	103.97	114.00	Pass
	2402.00	89.01	Ave	V	1.31	90.32	94.00	Pass
	4804.00	54.84	PK	V	-1.06	53.78	74.00	Pass
	4804.00	45.50	Ave	V	-1.06	44.44	54.00	Pass
	12010.00	44.61	PK	V	-5.34	39.27	74.00	Pass
	17686.00	43.97	PK	V	-6.87	37.10	74.00	Pass
Middle Channel 2441MHz	2441.00	103.07	PK	H	0.85	103.92	114.00	Pass
	2441.00	88.58	Ave	H	0.85	89.43	94.00	Pass
	4880.00	57.40	PK	H	-0.62	56.78	74.00	Pass
	4880.00	48.47	Ave	H	-0.62	47.85	54.00	Pass
	9652.00	44.52	PK	H	-4.89	39.63	74.00	Pass
	17561.00	43.61	PK	H	-6.61	37.00	74.00	Pass
	2441.00	103.52	PK	V	0.85	104.37	114.00	Pass
	2441.00	87.52	Ave	V	0.85	88.37	94.00	Pass
	4880.00	57.02	PK	V	-0.62	56.40	74.00	Pass
	4880.00	48.18	Ave	V	-0.62	47.56	54.00	Pass
	12011.00	44.59	PK	V	-5.34	39.25	74.00	Pass
	17685.00	43.94	PK	V	-6.87	37.07	74.00	Pass
Upper Channel 2480MHz	2480.00	103.91	PK	H	0.53	104.44	114.00	Pass
	2480.00	88.12	Ave	H	0.53	88.65	94.00	Pass
	4960.00	57.69	PK	H	-0.24	57.45	74.00	Pass
	4960.00	48.77	Ave	H	-0.24	48.53	54.00	Pass
	9656.00	45.02	PK	H	-4.89	40.13	74.00	Pass
	17562.00	43.94	PK	H	-6.61	37.33	74.00	Pass
	2480.00	103.54	PK	V	0.53	104.07	114.00	Pass
	2480.00	88.50	Ave	V	0.53	89.03	94.00	Pass
	4960.00	57.45	PK	V	-0.24	57.21	74.00	Pass
	4960.00	47.46	Ave	V	-0.24	47.22	54.00	Pass
	12012.00	44.68	PK	V	-5.34	39.34	74.00	Pass
	17683.00	43.91	PK	V	-6.87	37.04	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.



PI/4 DPSK

	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 2402MHz	2402.00	101.88	PK	H	1.31	103.19	114.00	Pass
	2402.00	87.84	Ave	H	1.31	89.15	94.00	Pass
	4804.00	57.00	PK	H	-1.06	55.94	74.00	Pass
	4804.00	48.14	Ave	H	-1.06	47.08	54.00	Pass
	9655.00	44.68	PK	H	-4.89	39.79	74.00	Pass
	17561.00	43.91	PK	H	-6.61	37.30	74.00	Pass
	2402.00	100.81	PK	V	1.31	102.12	114.00	Pass
	2402.00	87.13	Ave	V	1.31	88.44	94.00	Pass
	4804.00	58.01	PK	V	-1.06	56.95	74.00	Pass
	4804.00	46.65	Ave	V	-1.06	45.59	54.00	Pass
	12013.00	45.05	PK	V	-5.34	39.71	74.00	Pass
	17682.00	44.87	PK	V	-6.87	38.00	74.00	Pass
Middle Channel 2441MHz	2441.00	101.74	PK	H	0.85	102.59	114.00	Pass
	2441.00	87.38	Ave	H	0.85	88.23	94.00	Pass
	4882.00	53.88	PK	H	-0.62	53.26	74.00	Pass
	4882.00	43.17	Ave	H	-0.62	42.55	54.00	Pass
	9652.00	44.68	PK	H	-4.89	39.79	74.00	Pass
	17561.00	43.69	PK	H	-6.61	37.08	74.00	Pass
	2441.00	101.65	PK	V	0.85	102.50	114.00	Pass
	2441.00	86.77	Ave	V	0.85	87.62	94.00	Pass
	4882.00	54.77	PK	V	-0.62	54.15	74.00	Pass
	4882.00	44.23	Ave	V	-0.62	43.61	54.00	Pass
	12013.00	44.81	PK	V	-5.34	39.47	74.00	Pass
17684.00	43.61	PK	V	-6.87	36.74	74.00	Pass	
Upper Channel 2480MHz	2480.00	101.95	PK	H	0.53	102.48	114.00	Pass
	2480.00	87.45	Ave	H	0.53	87.98	94.00	Pass
	4960.00	52.02	PK	H	-0.24	51.78	74.00	Pass
	4960.00	43.07	Ave	H	-0.24	42.83	54.00	Pass
	9652.00	44.55	PK	H	-4.89	39.66	74.00	Pass
	17566.00	43.36	PK	H	-6.61	36.75	74.00	Pass
	2480.00	101.10	PK	V	0.53	101.63	114.00	Pass
	2480.00	86.74	Ave	V	0.53	87.27	94.00	Pass
	4960.00	54.18	PK	V	-0.24	53.94	74.00	Pass
	4960.00	43.28	Ave	V	-0.24	43.04	54.00	Pass
	12011.00	44.81	PK	V	-5.34	39.47	74.00	Pass
17686.00	43.63	PK	V	-6.87	36.76	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.



8DPSK

	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 2402MHz	2402.00	102.63	PK	H	1.31	103.94	114.00	Pass
	2402.00	88.49	Ave	H	1.31	89.80	94.00	Pass
	4804.00	57.42	PK	H	-1.06	56.36	74.00	Pass
	4804.00	48.48	Ave	H	-1.06	47.42	54.00	Pass
	9654.00	44.94	PK	H	-4.89	40.05	74.00	Pass
	17561.00	43.31	PK	H	-6.61	36.70	74.00	Pass
	2402.00	101.55	PK	V	1.31	102.86	114.00	Pass
	2402.00	87.76	Ave	V	1.31	89.07	94.00	Pass
	4804.00	58.43	PK	V	-1.06	57.37	74.00	Pass
	4804.00	47.00	Ave	V	-1.06	45.94	54.00	Pass
	12015.00	44.36	PK	V	-5.34	39.02	74.00	Pass
	17684.00	43.51	PK	V	-6.87	36.64	74.00	Pass
Middle Channel 2441MHz	2441.00	102.48	PK	H	0.85	103.33	114.00	Pass
	2441.00	88.01	Ave	H	0.85	88.86	94.00	Pass
	4882.00	54.27	PK	H	-0.62	53.65	74.00	Pass
	4882.00	43.48	Ave	H	-0.62	42.86	54.00	Pass
	9651.00	44.21	PK	H	-4.89	39.32	74.00	Pass
	17565.00	43.06	PK	H	-6.61	36.45	74.00	Pass
	2441.00	102.39	PK	V	0.85	103.24	114.00	Pass
	2441.00	87.40	Ave	V	0.85	88.25	94.00	Pass
	4882.00	55.17	PK	V	-0.62	54.55	74.00	Pass
	4882.00	44.55	Ave	V	-0.62	43.93	54.00	Pass
	12012.00	44.52	PK	V	-5.34	39.18	74.00	Pass
	17684.00	43.61	PK	V	-6.87	36.74	74.00	Pass
Upper Channel 2480MHz	2480.00	102.70	PK	H	0.53	103.23	114.00	Pass
	2480.00	88.09	Ave	H	0.53	88.62	94.00	Pass
	4960.00	52.39	PK	H	-0.24	52.15	74.00	Pass
	4960.00	43.38	Ave	H	-0.24	43.14	54.00	Pass
	9653.00	44.91	PK	H	-4.89	40.02	74.00	Pass
	17563.00	43.23	PK	H	-6.61	36.62	74.00	Pass
	2480.00	101.84	PK	V	0.53	102.37	114.00	Pass
	2480.00	87.37	Ave	V	0.53	87.90	94.00	Pass
	4960.00	54.58	PK	V	-0.24	54.34	74.00	Pass
	4960.00	43.59	Ave	V	-0.24	43.35	54.00	Pass
	12010.00	44.96	PK	V	-5.34	39.62	74.00	Pass
	17686.00	43.21	PK	V	-6.87	36.34	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) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.249	Bandwidth	(20dB bandwidth)	2400-2483.5	PASS

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	> Measurement Bandwidth or Channel Separation
RB	30KHz
VB	100KHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

4.1.1 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= 30KHz, VBW≥ RBW, Sweep time = Auto.

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.

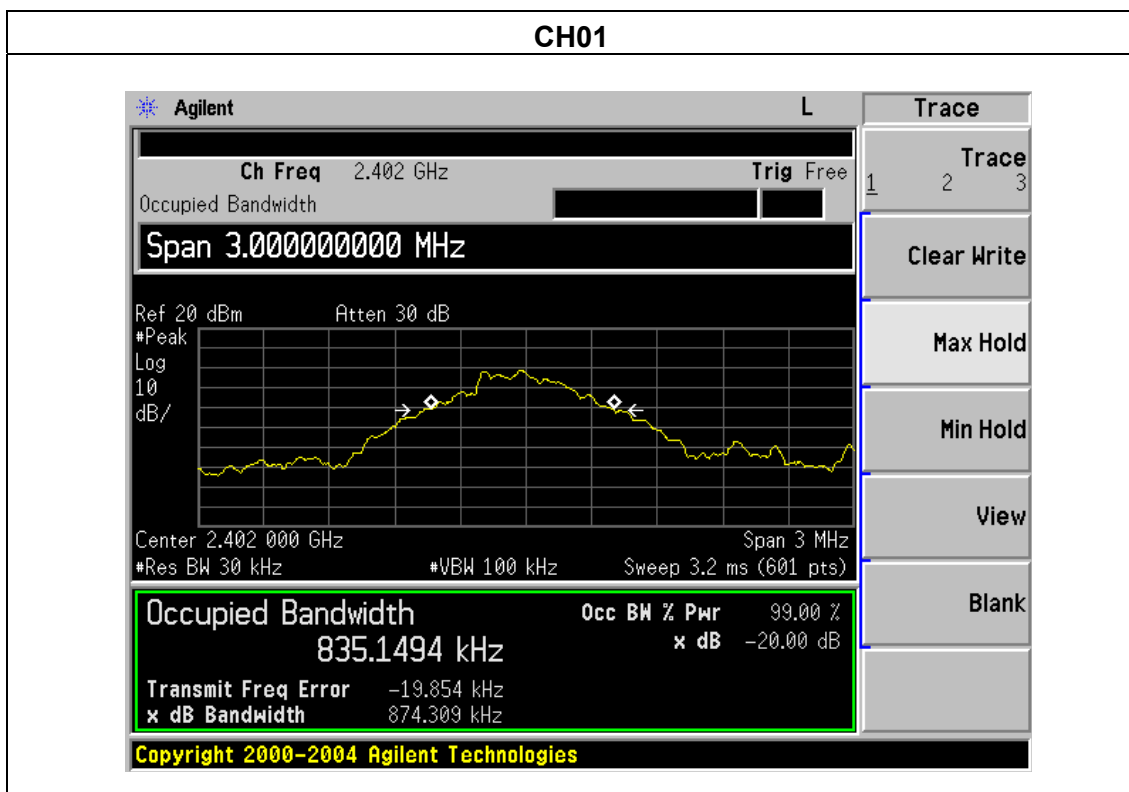


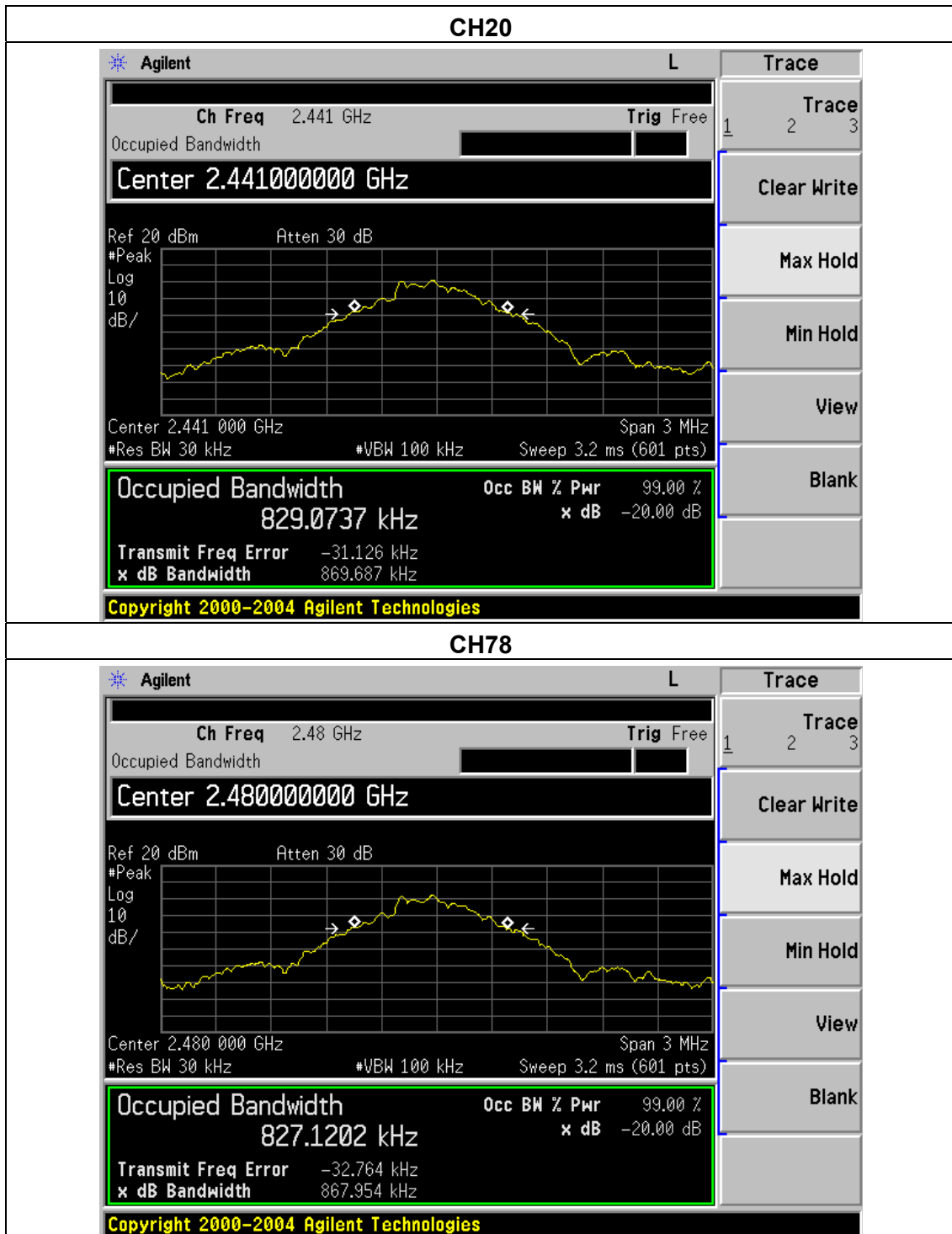
4.1.5 TEST RESULTS

EUT :	SPEAKER	Model Name :	F86
Temperature :	25 °C	Relative Humidity :	60%
Pressure :	1012 hPa	Test Voltage :	AC120V/60Hz
Test Mode :	CH01 / CH20 /CH78		

	Frequency	20dB Bandwidth (MHz)	Result
GFSK	2402 MHz	0.874	PASS
	2441 MHz	0.870	PASS
	2480 MHz	0.868	PASS
PI/4 DPSK	2402 MHz	1.135	PASS
	2441 MHz	1.141	PASS
	2480 MHz	1.138	PASS
8DPSK	2402 MHz	1.210	PASS
	2441 MHz	1.213	PASS
	2480 MHz	1.215	PASS

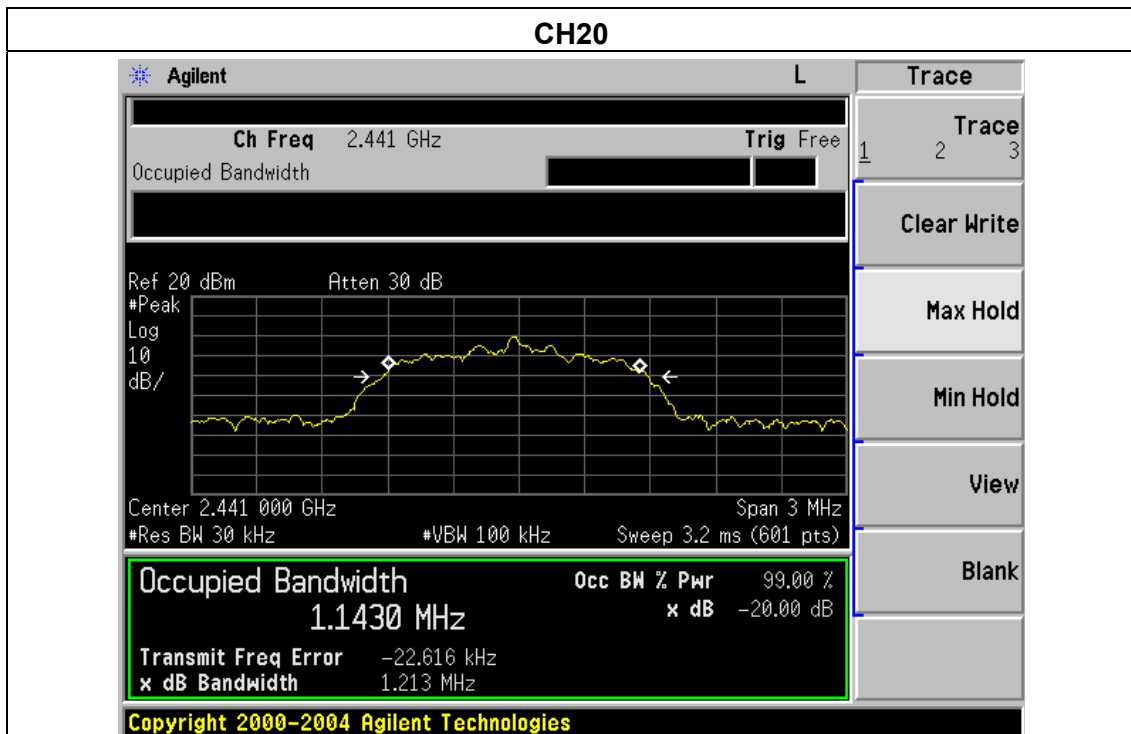
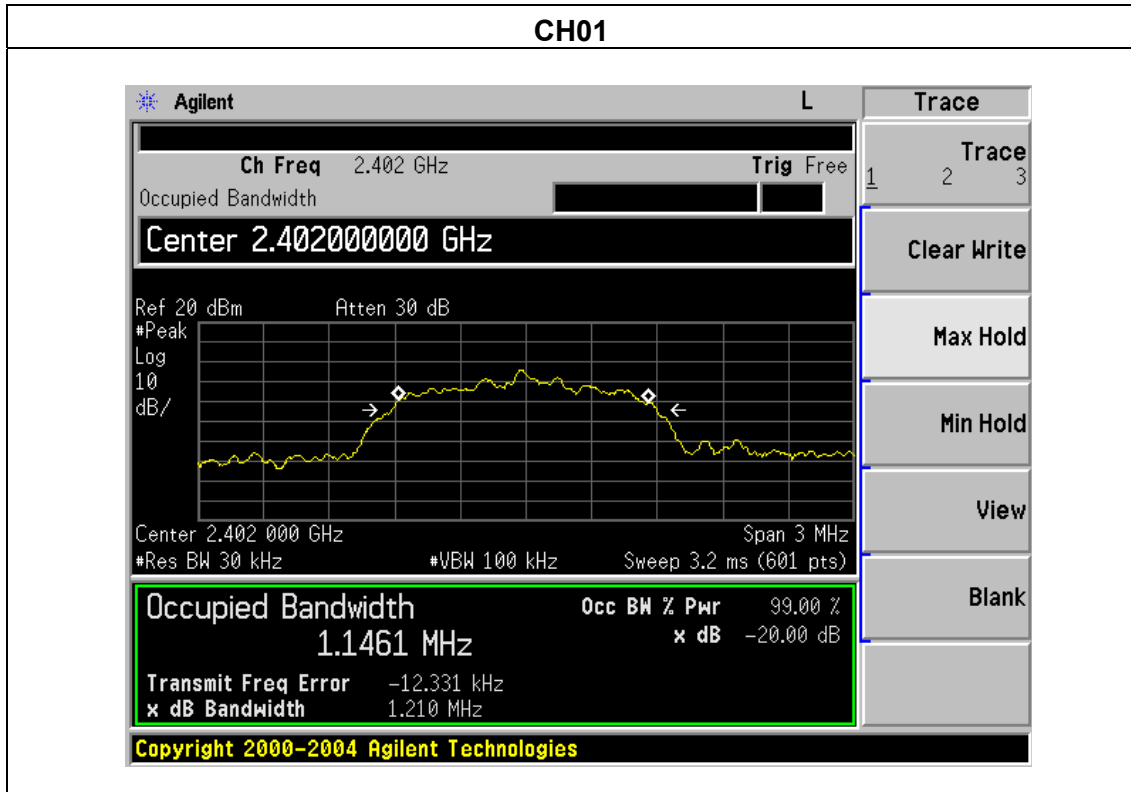
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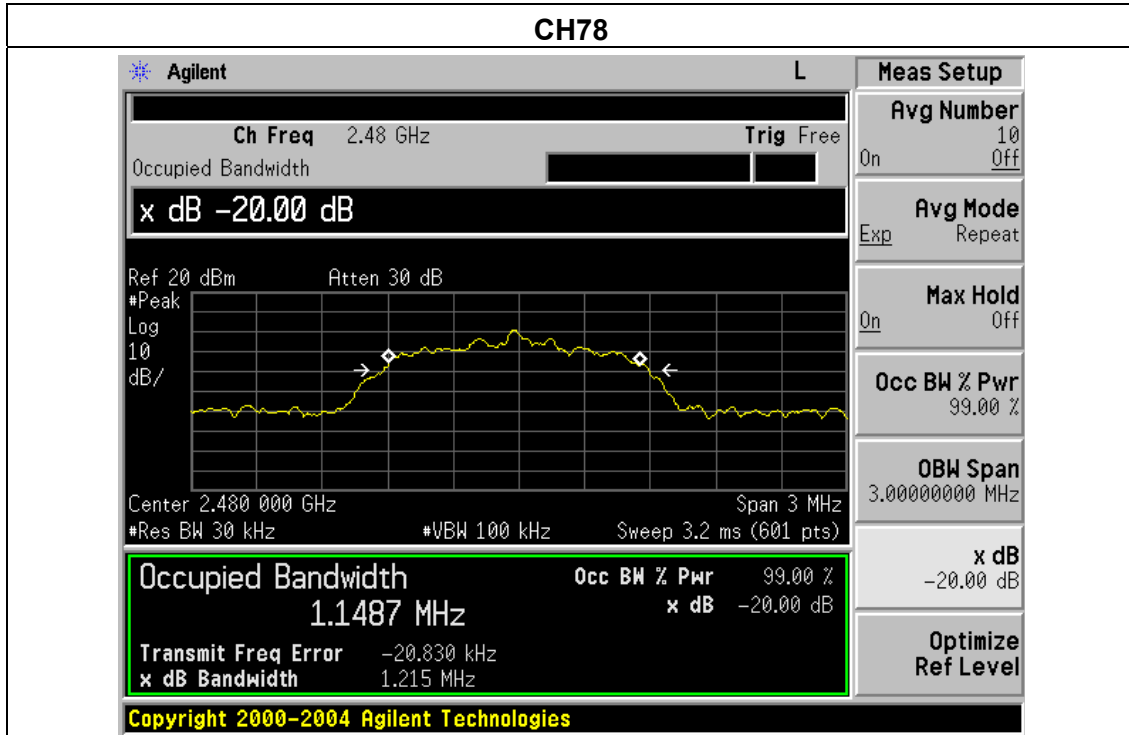






8DPSK







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

The testing follows ANSI C63.10-2013 clause 7.8.6.

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.

The path loss was compensated to the results for each measurement.

Set to the maximum power setting and enable the EUT transmit continuously.

The EUT must have its hopping function enabled.

Use the following spectrum analyzer settings:

Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel

RBW = 100KHz

VBW = 300KHz

Band edge emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100kHz RBW. The attenuation shall be 30 dB instead of 20 dB when RMS conducted output power procedure is used.

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.

Repeat above procedures until all measured frequencies were complete.

The worst mode on horizontal, the data only show worst mode

5.1 DEVIATION FROM STANDARD

No deviation.

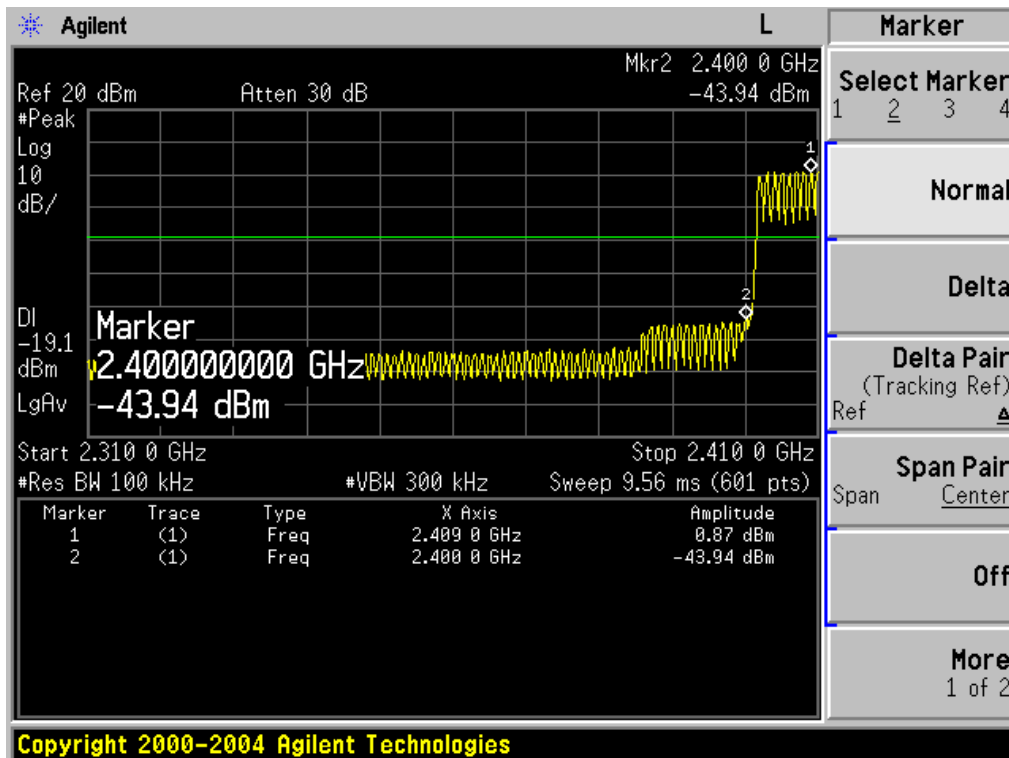
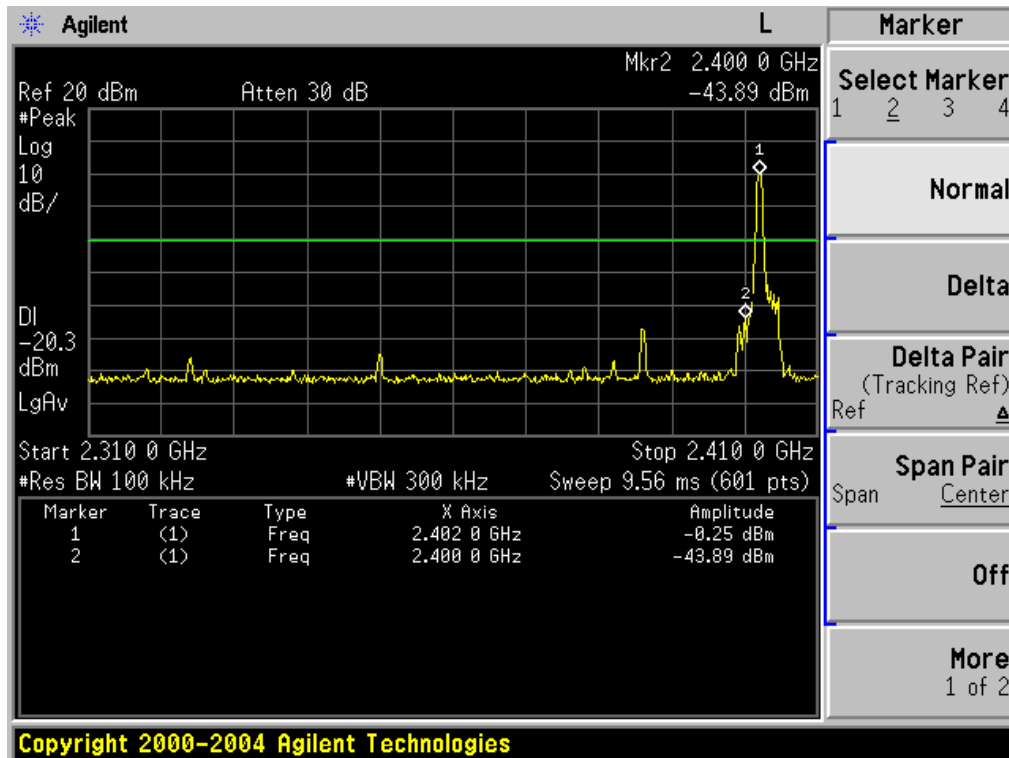
5.2 EUT OPERATION CONDITIONS

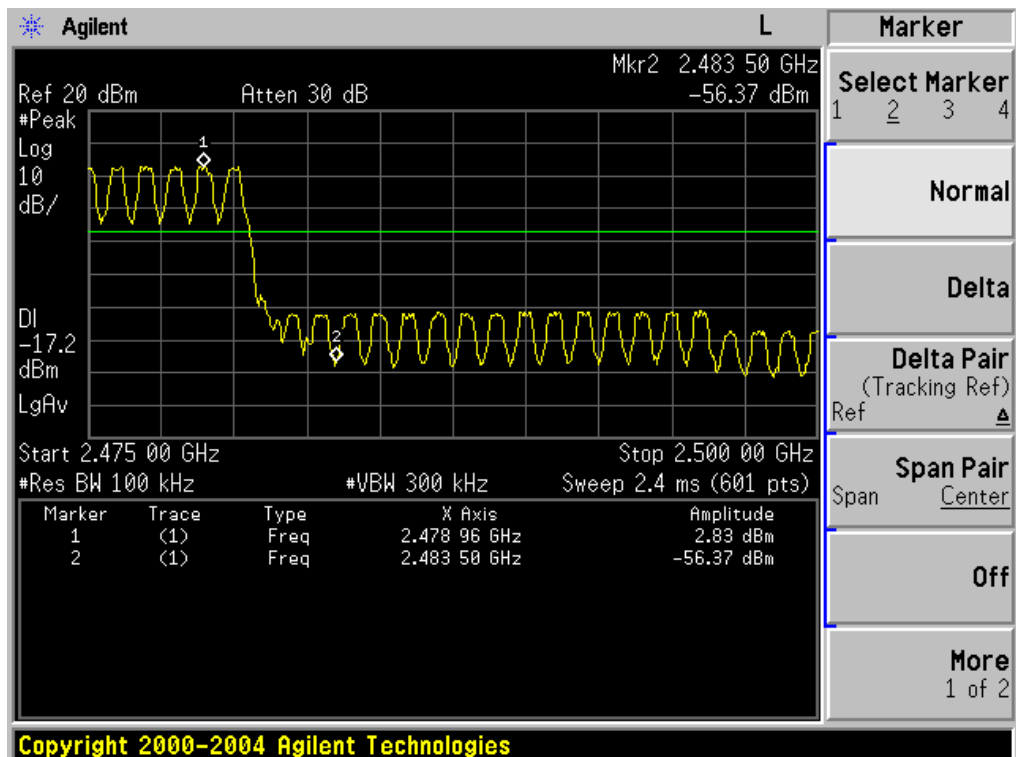
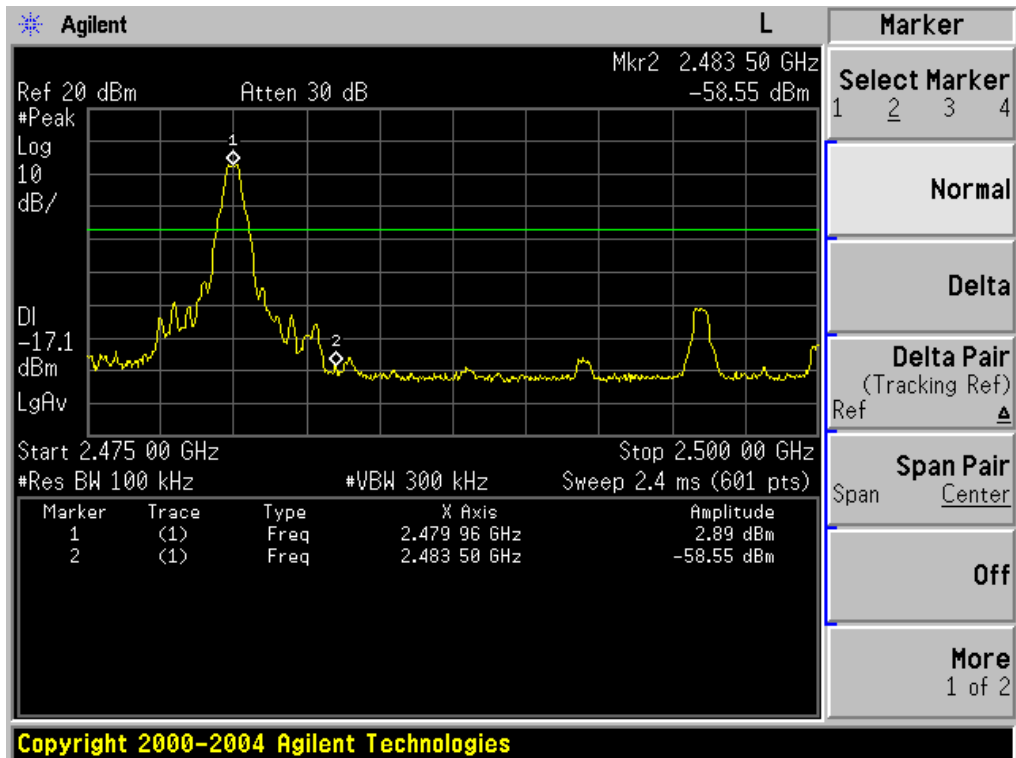
The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

5.3 TEST RESULTS



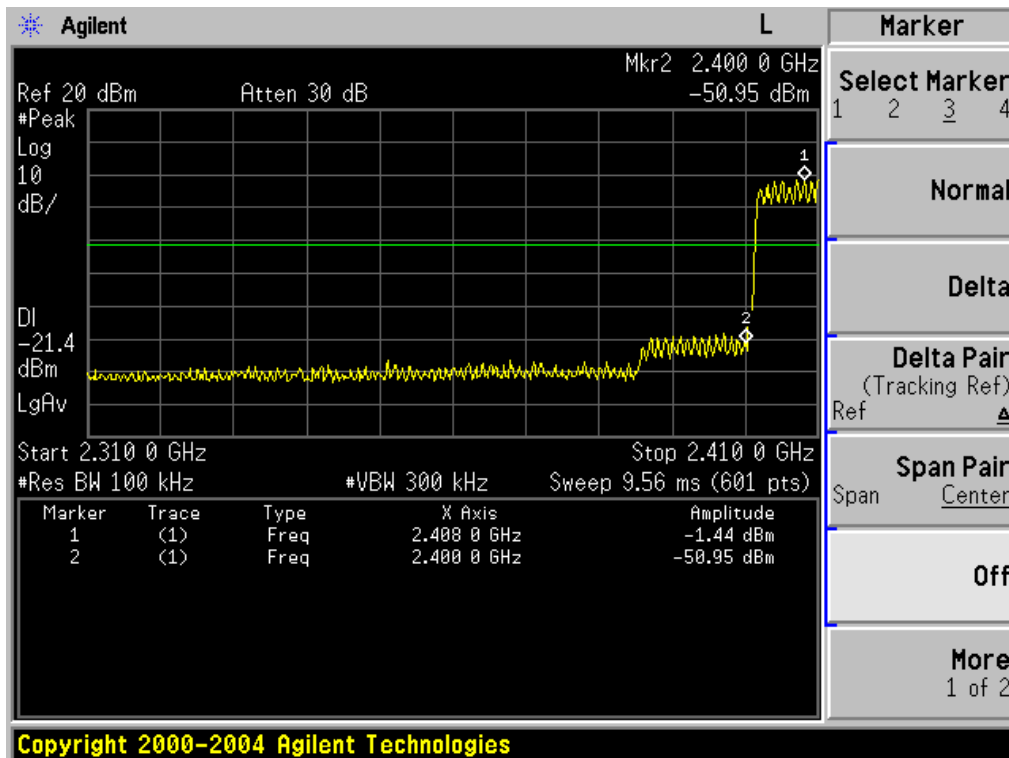
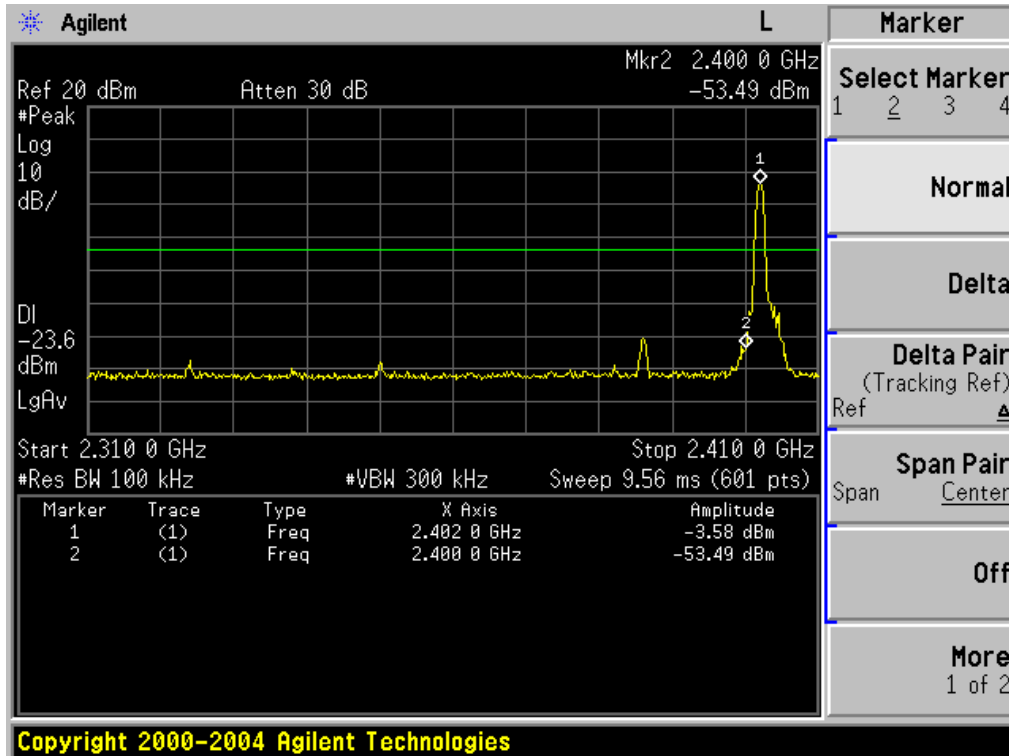
GFSK:

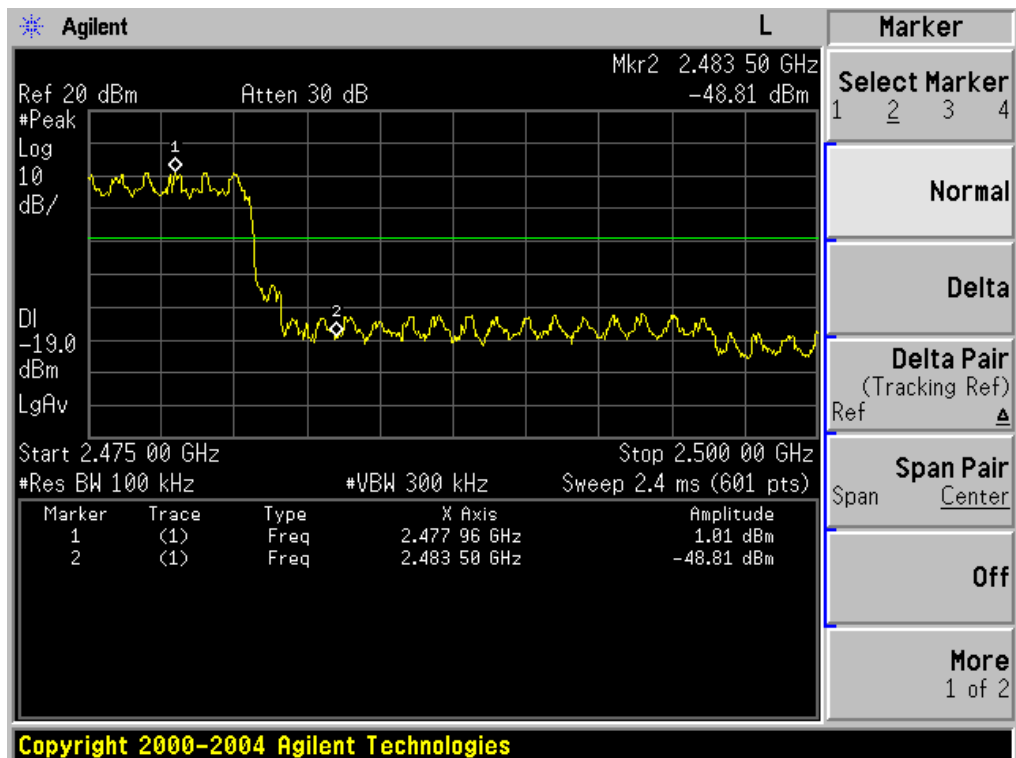
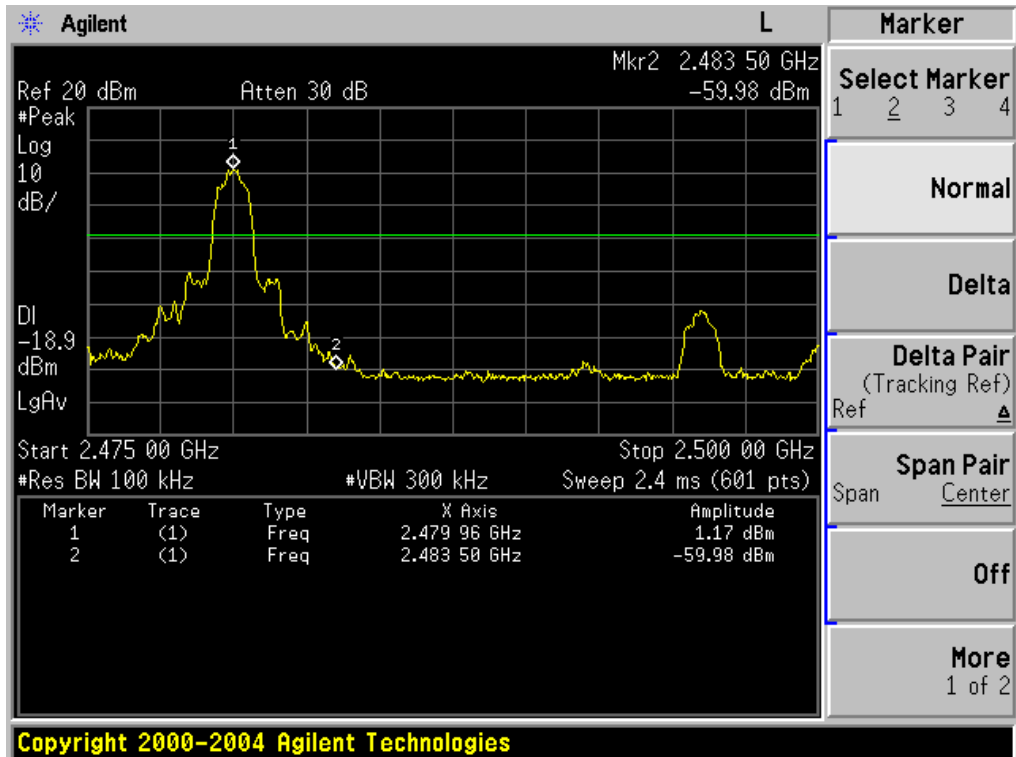






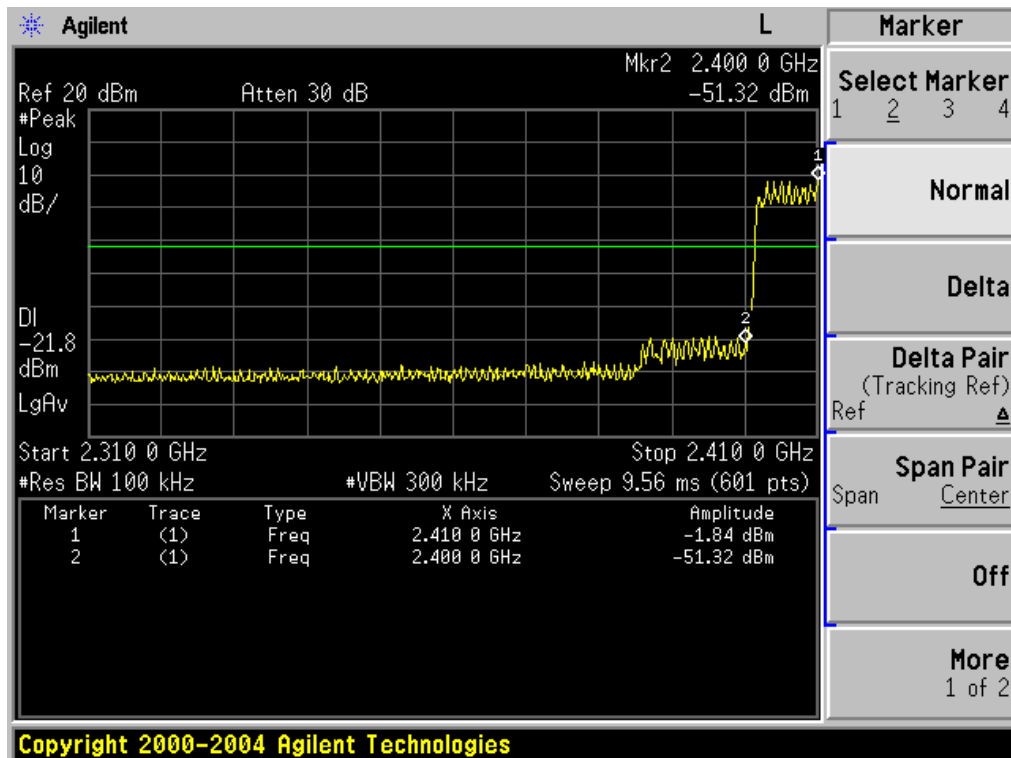
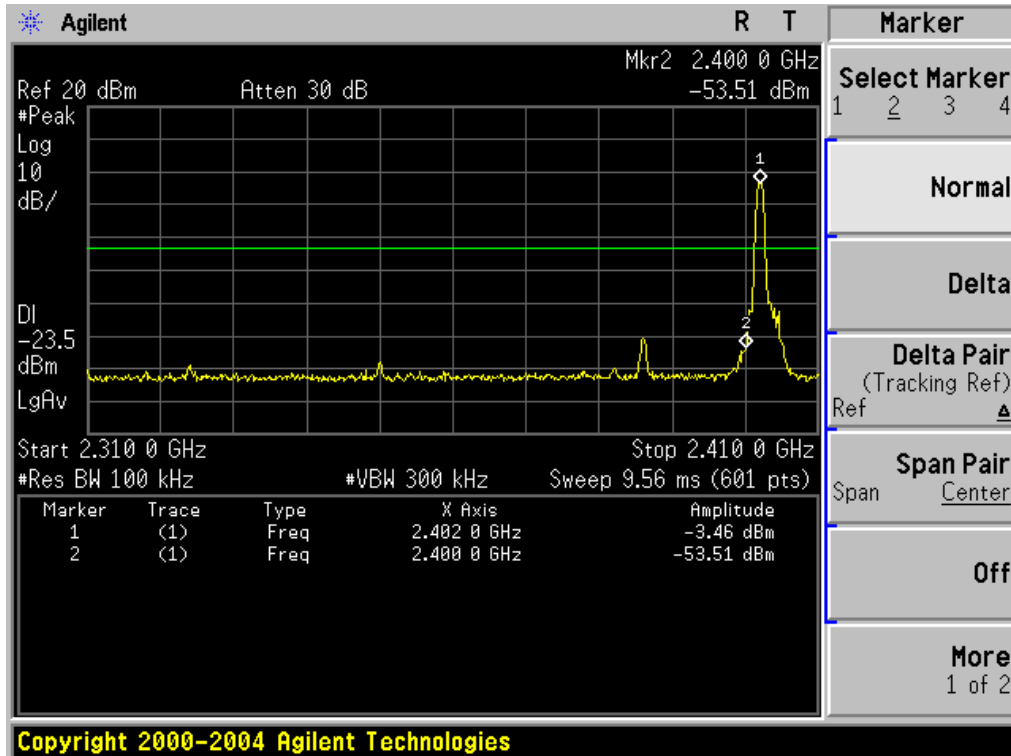
PI/4 DPSK

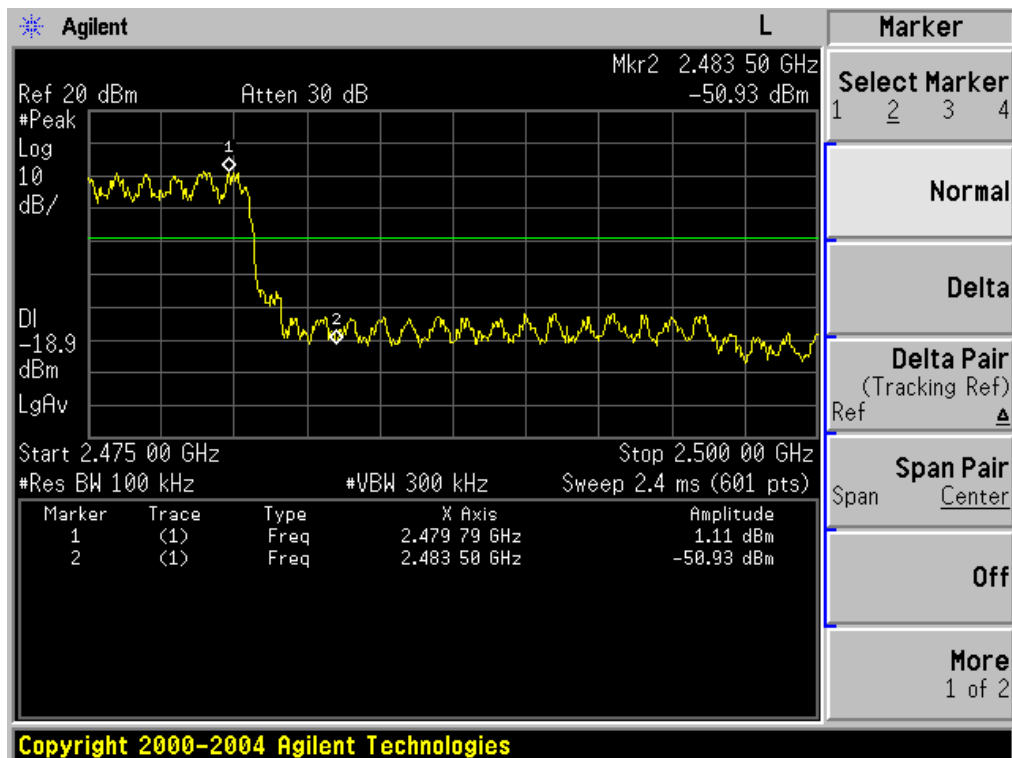
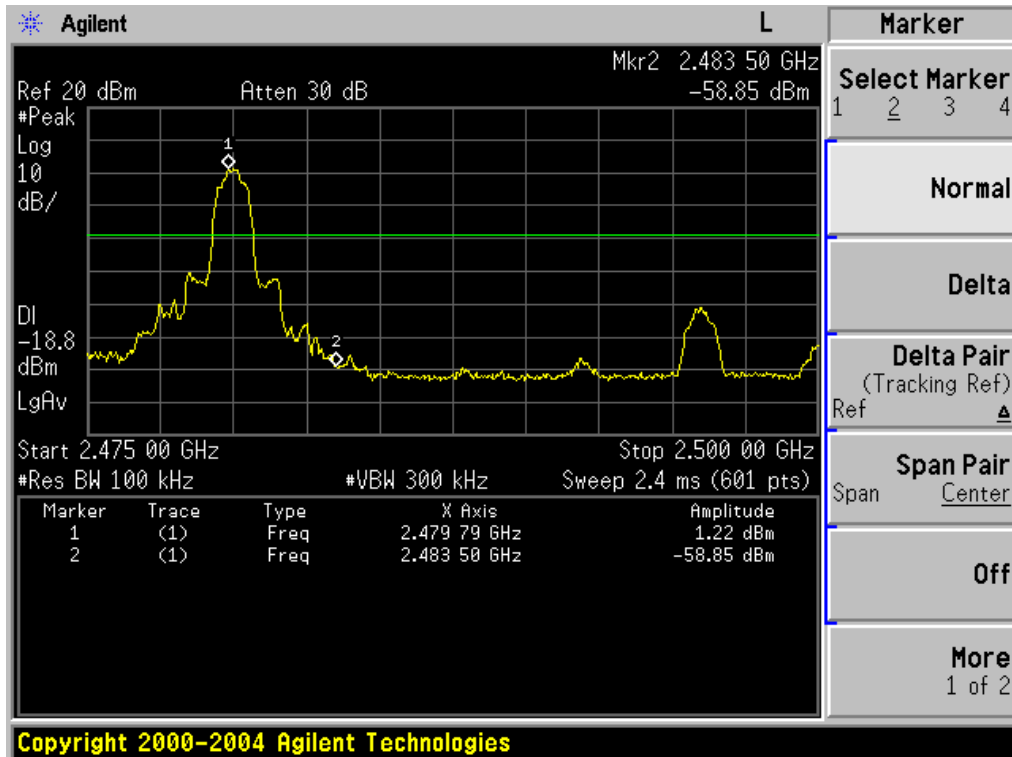






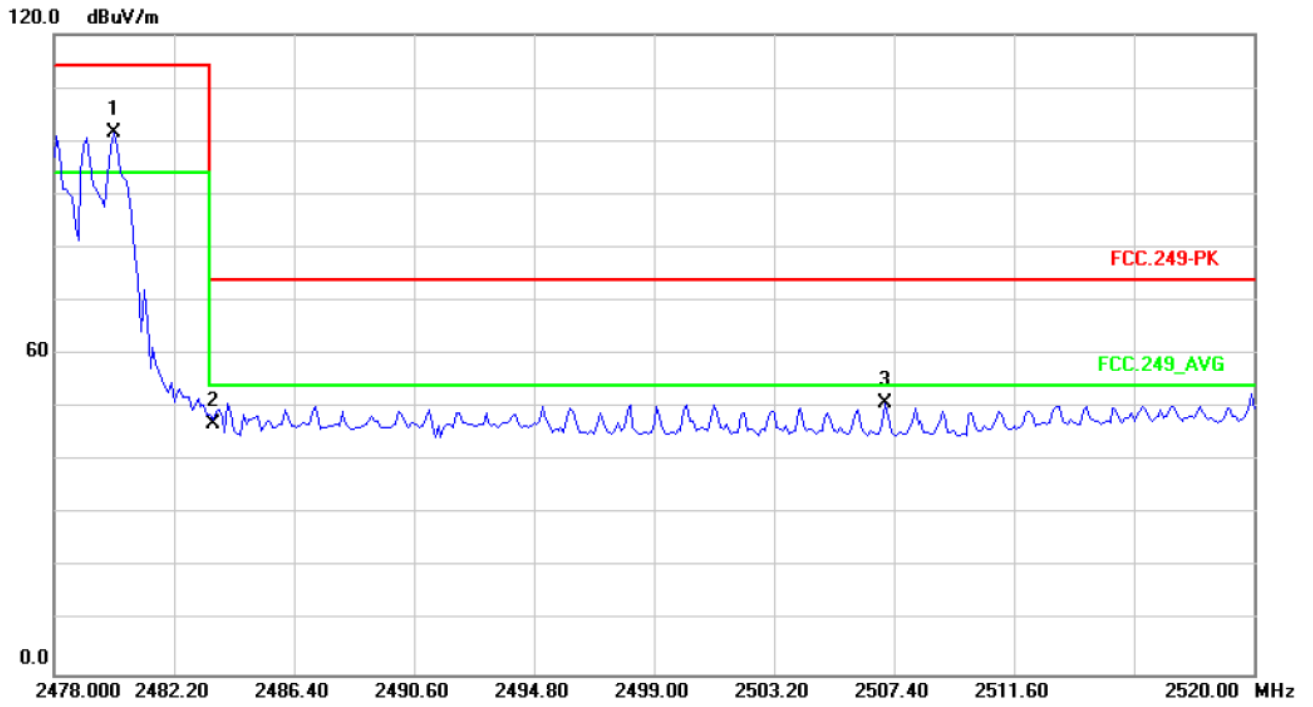
8DPSK



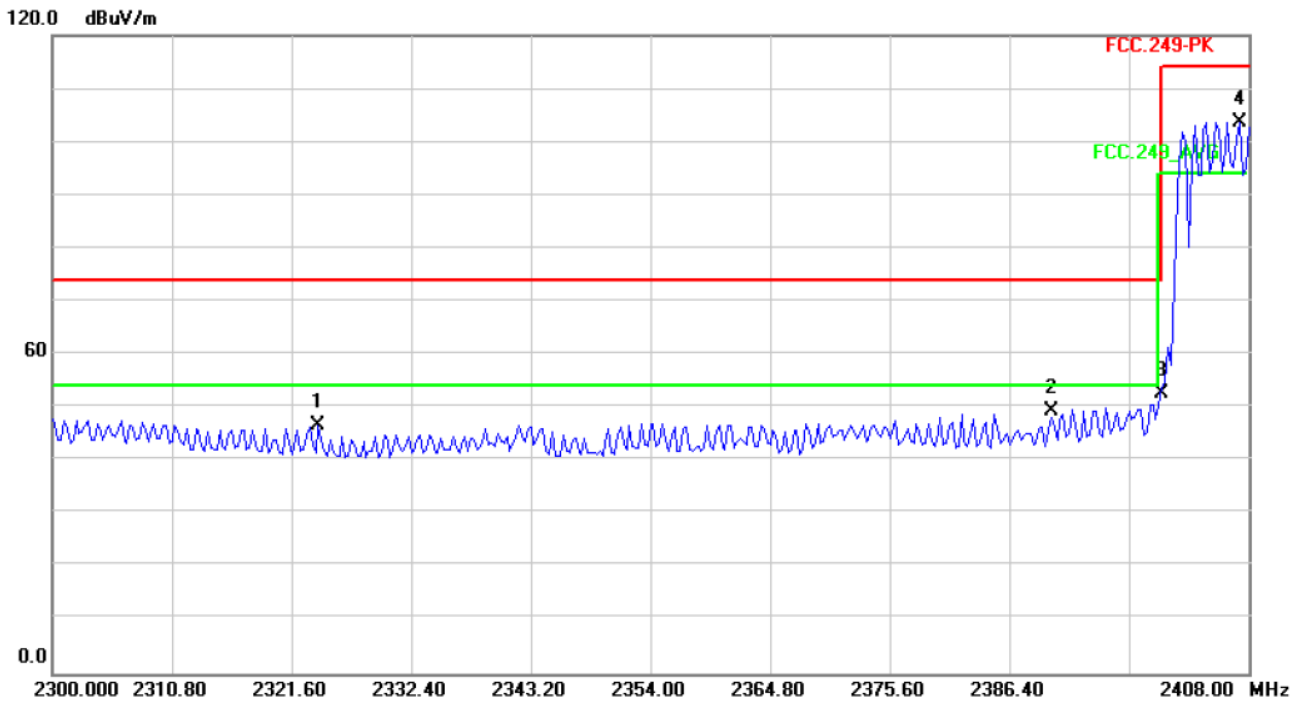




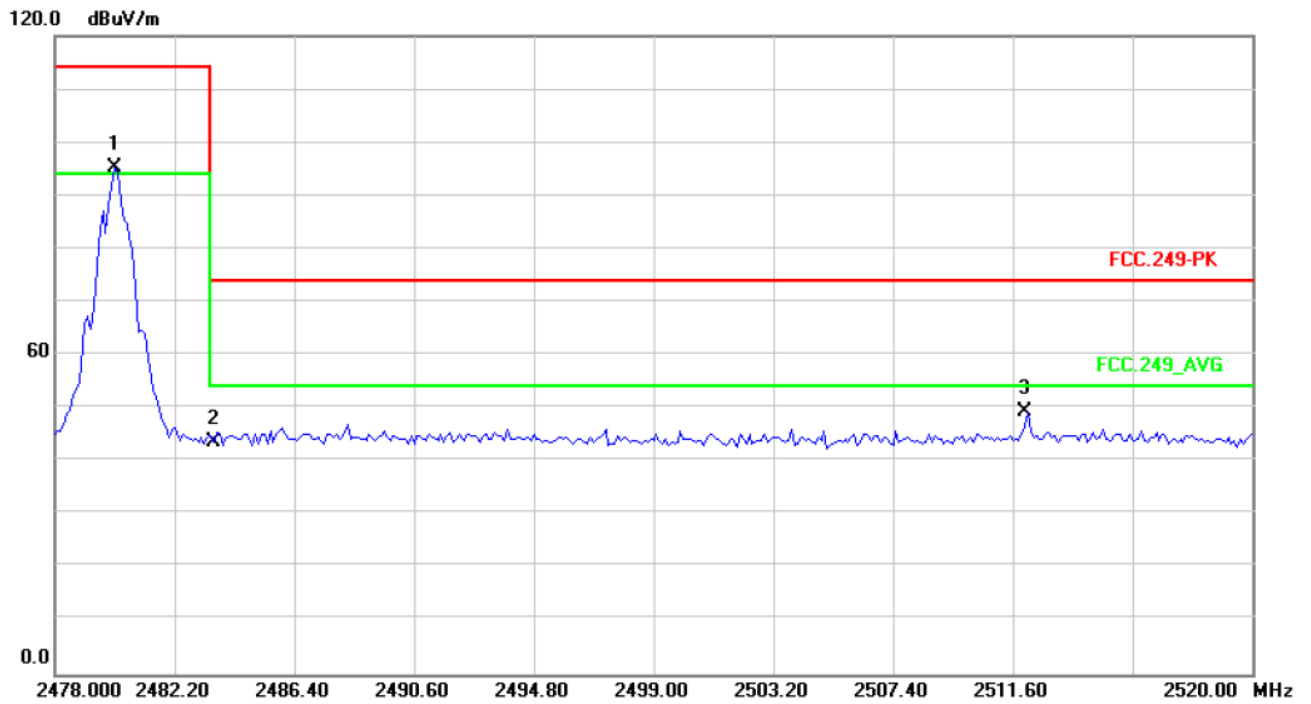
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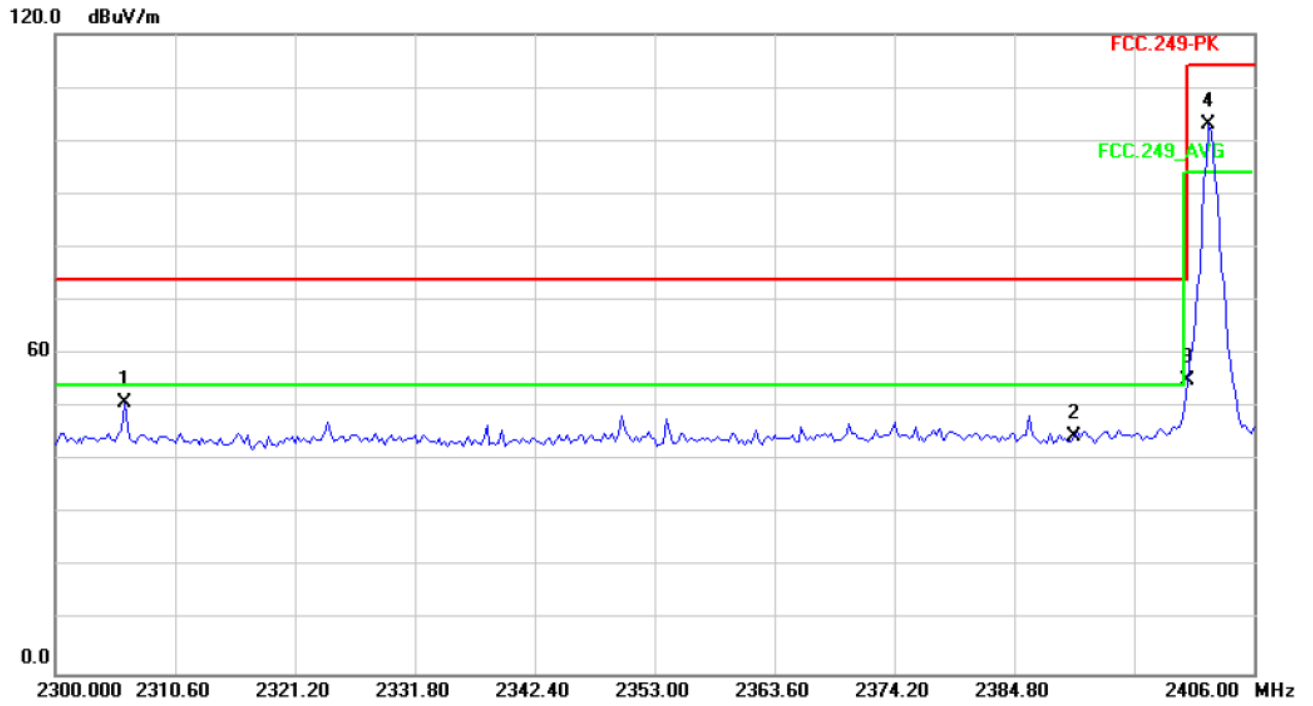
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		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	cm	degree	Comment
1	*	2480.100	87.65	14.02	101.67	114.00	-12.33			peak
2		2483.565	32.94	14.02	46.96	74.00	-27.04			peak
3		2507.085	36.79	14.08	50.87	74.00	-23.13			peak



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	cm	degree	Comment
1		2324.030	32.87	13.69	46.56	74.00	-27.44	peak		
2		2390.180	35.38	13.83	49.21	74.00	-24.79	peak		
3		2400.170	38.82	13.85	52.67	114.00	-61.33	peak		
4	*	2407.190	89.92	13.87	103.79	114.00	-10.21	peak		



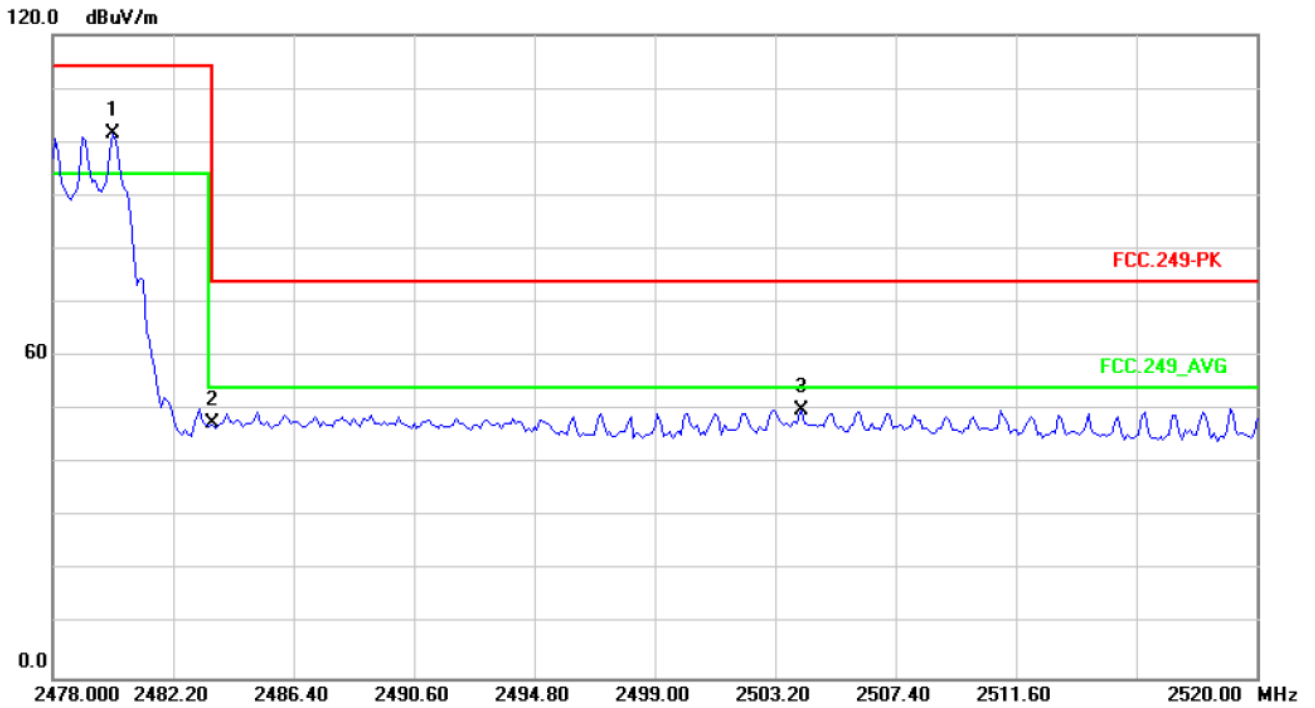
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		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	cm	degree	Comment
1	*	2480.100	81.26	14.02	95.28	114.00	-18.72			peak
2		2483.565	29.66	14.02	43.68	74.00	-30.32			peak
3		2512.031	35.31	14.08	49.39	74.00	-24.61			peak



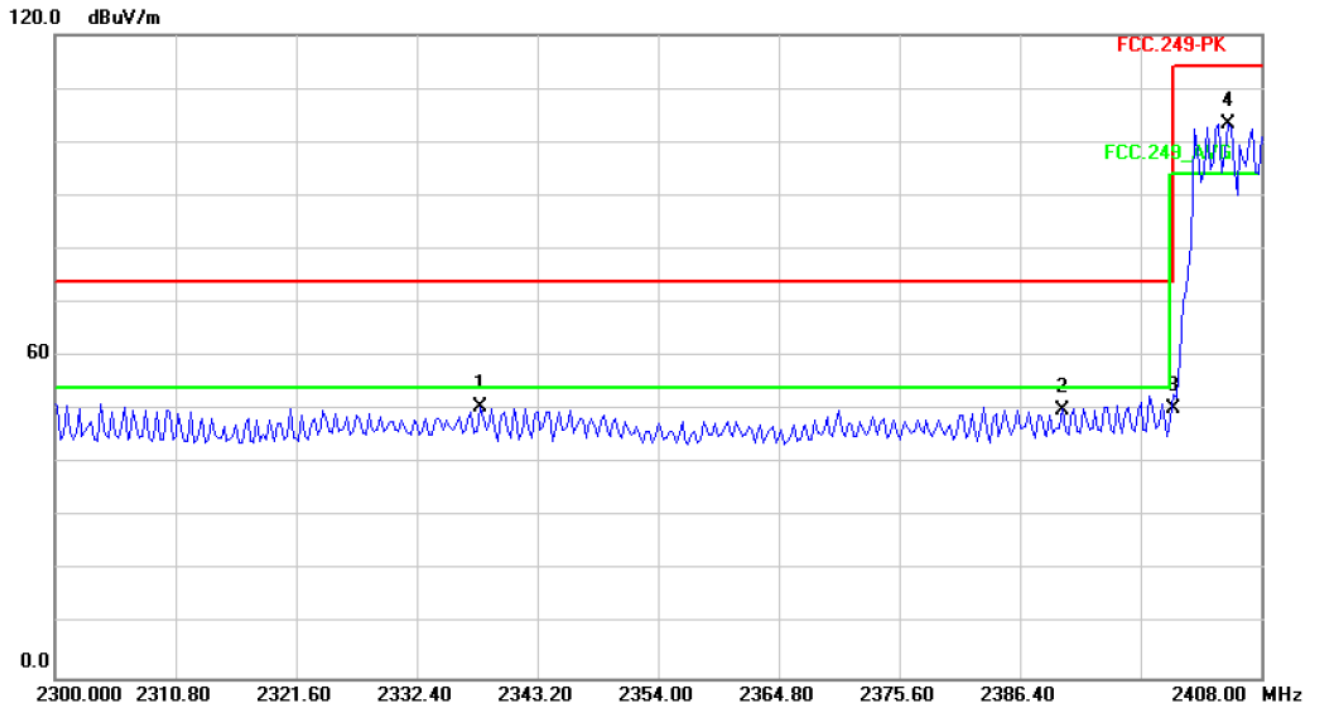
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		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	cm	degree	Comment
1		2306.095	37.05	13.66	50.71	74.00	-23.29			peak
2		2390.100	30.77	13.83	44.60	74.00	-29.40			peak
3		2400.170	41.17	13.85	55.02	114.00	-58.98			peak
4	*	2402.025	89.11	13.85	102.96	114.00	-11.04			peak



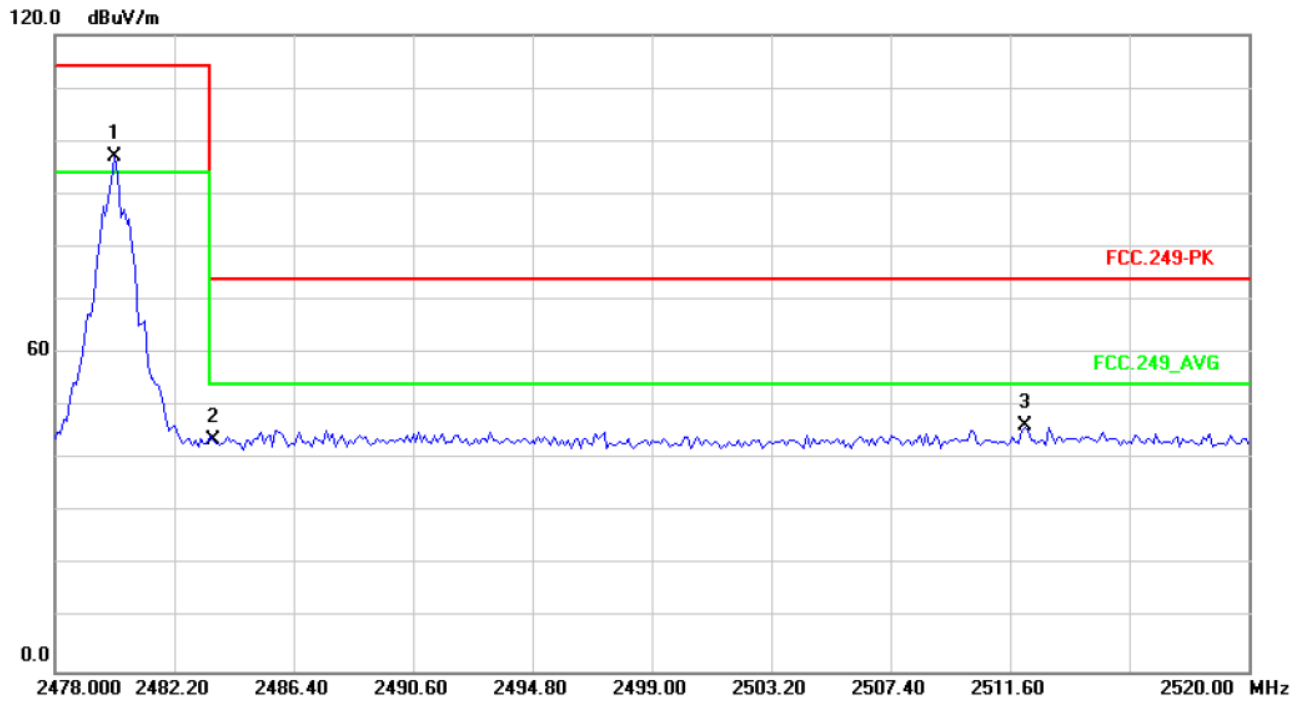
8DPSK



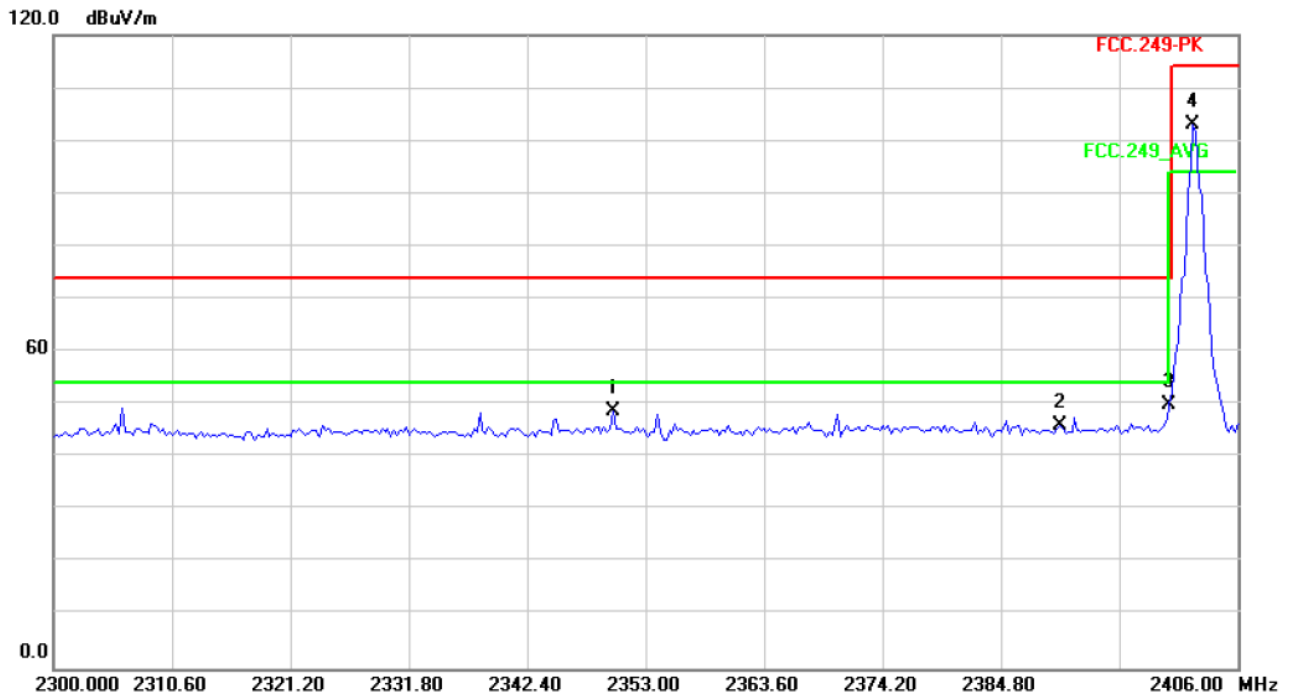
No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	cm	degree	Comment
1	*	2480.100	81.26	14.02	95.28	114.00	-18.72			peak
2		2483.565	29.66	14.02	43.68	74.00	-30.32			peak
3		2512.031	35.31	14.08	49.39	74.00	-24.61			peak



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB/m	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Antenna Height cm	Table Degree	Comment
1		2338.070	36.75	13.71	50.46	74.00	-23.54	peak			
2		2390.180	36.06	13.83	49.89	74.00	-24.11	peak			
3		2400.170	36.36	13.85	50.21	114.00	-63.79	peak			
4	*	2405.030	89.38	13.87	103.25	114.00	-10.75	peak			



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB/m	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Antenna Height cm	Table Degree degree	Comment
1	*	2480.100	82.90	14.02	96.92	114.00	-17.08	peak			
2		2483.565	29.72	14.02	43.74	74.00	-30.26	peak			
3		2512.125	32.12	14.08	46.20	74.00	-27.80	peak			



No. Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB/m	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Antenna Height cm	Table Degree	Comment
1	2350.085	34.87	13.75	48.62	74.00	-25.38	peak			
2	2390.100	32.18	13.83	46.01	74.00	-27.99	peak			
3	2399.905	36.15	13.85	50.00	74.00	-24.00	peak			
4 *	2402.025	89.24	13.85	103.09	114.00	-10.91	peak			



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

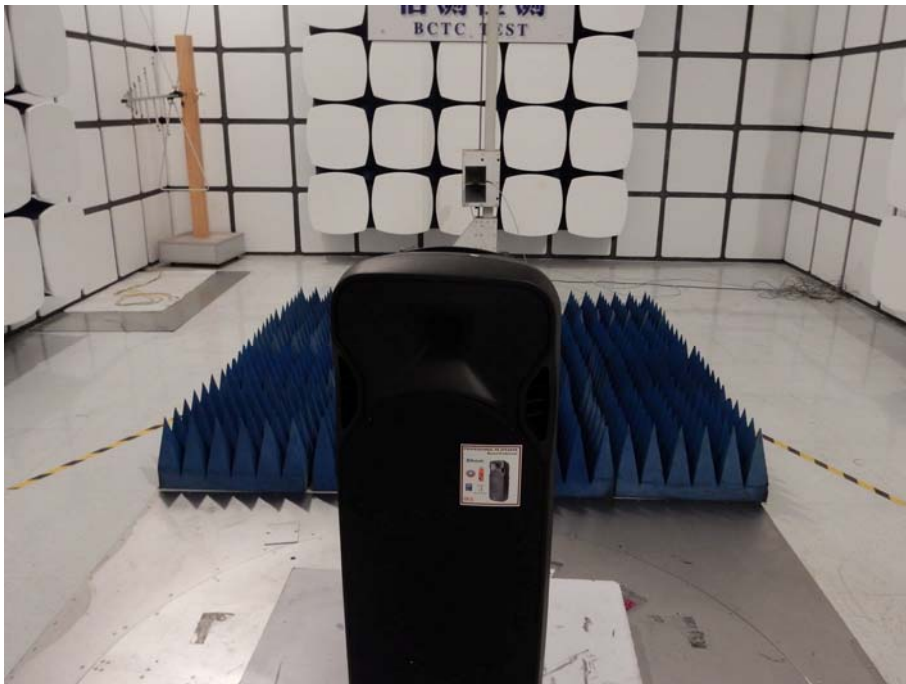
The EUT antenna is PCB antenna. It complies with the standard requirement.

7. EUT TEST PHOTO

Conducted Measurement Photos



Radiated Measurement Photos



8. PHOTOS OF THE EUT







