



FCC RADIO TEST REPORT

Applicant : Ring LLC
Address : 1523 26th Street, Santa Monica, CA 90404
 : United States
Equipment : Video Doorbell (2nd generation)
Model No. : 5UM5E5
Trade Name : Ring
FCC ID. : 2AEUPBHARG061

I HEREBY CERTIFY THAT :

The sample was received on Feb. 05, 2020 and the testing was completed on Feb. 26, 2020 at CerpPASS Technology Corp. The test result refers exclusively to the test presented test model / sample. Without written approval of CerpPASS Technology Corp., the test report shall not be reproduced except in full.

Approved by:

Mark Liao / Supervisor

Laboratory Accreditation:

CerpPASS Technology Corporation Test Laboratory





Contents

1. Summary of Test Procedure and Test Results.....	5
1.1 Applicable Standards	5
2. Test Configuration of Equipment under Test.....	6
2.1 Feature of Equipment under Test.....	6
2.2 Carrier Frequency of Channels.....	6
2.3 Test Mode and Test Software.....	7
2.4 Description of Test System.....	7
2.5 General Information of Test.....	8
2.6 Measurement Uncertainty	8
3. Test Equipment and Ancillaries Used for Tests	9
4. Antenna Requirements.....	11
4.1 Standard Applicable	11
4.2 Antenna Construction and Directional Gain.....	11
5. Test of AC Power Line Conducted Emission	12
5.1 Test Limit	12
5.2 Test Procedures	12
5.3 Typical Test Setup	13
5.4 Test Result and Data	14
5.5 Test Photographs	18
6. Test of Spurious Emission (Radiated)	19
6.1 Test Limit	19
6.2 Test Procedures	19
6.3 Typical Test Setup	20
6.4 Test Result and Data (9kHz ~ 30MHz).....	21
6.5 Test Result and Data (30MHz ~ 1GHz).....	21
6.6 Test Result and Data (1GHz ~ 25GHz).....	25
6.7 Restricted Bands of Operation	31
6.8 Test Photographs (30MHz ~ 1GHz).....	32
6.9 Test Photographs (1GHz ~ 25GHz).....	33
7. Test of Spurious Emission (Conducted).....	35
7.1 Test Limit	35
7.2 Test Procedure	35
7.3 Test Setup Layout	35
7.4 Test Result and Data	35
8. On Time, Duty Cycle and Measurement methods	38
8.1 Test Limit	38
8.2 Test Procedure	38
8.3 Test Setup Layout	38
8.4 Test Result and Data	38
9. 6dB Bandwidth Measurement Data	40
9.1 Test Limit	40



- 9.2 Test Procedures 40
- 9.3 Test Setup Layout 40
- 9.4 Test Result and Data 40
- 10. Maximum Peak and Average Output Power 42**
 - 10.1 Test Limit 42
 - 10.2 Test Procedures 42
 - 10.3 Test Setup Layout 42
 - 10.4 Test Result and Data 42
- 11. Power Spectral Density 43**
 - 11.1 Test Limit 43
 - 11.2 Test Procedures 43
 - 11.3 Test Setup Layout 43
 - 11.4 Test Result and Data 43
- 12. Radio Frequency Exposure 45**
 - 12.1 Applicable Standards 45
 - 12.2 EUT Specification 45
 - 12.3 Test Results 46
 - 12.4 Calculation 46
 - 12.5 Maximum Permissible Exposure 47



History of this test report

Report No.	Issue Date	Description
TEFQ1911193	Mar. 03, 2020	Original



1. Summary of Test Procedure and Test Results

1.1 Applicable Standards

ANSI C63.10:2013

FCC Rules and Regulations Part 15 Subpart C §15.247

FCC Rule	Description of Test	Result
15.203	Antenna Requirement	PASS
15.207	AC Power Line Conducted Emission	PASS
15.209 15.205	Radiated Spurious Emission	PASS
15.247(d)	Conducted Spurious Emission	PASS
15.247(a)(2)	6dB Bandwidth	PASS
15.247(b)	Maximum Peak Output Power	PASS
15.247(e)	Power Spectral Density	PASS

*The lab has lowered the uncertainty risk of test equipment, environment, and staff technicians according to ISO-IEC17025. Therefore we define test result as compliant when it complies with the standard without further evaluation of test result uncertainty.

*This EUT has been also tested and compiled with the requirement of FCC Part 15, Subpart B, recorded in a separate test report(TEFD1911193).



2. Test Configuration of Equipment under Test

2.1 Feature of Equipment under Test

Frequency Range	BLE: 2400-2483.5MHz 802.11b/g/n: 2400-2483.5MHz
Modulation Type	BLE: GFSK 802.11b: CCK, DQPSK, DBPSK 802.11g/n: BPSK, QPSK, 16QAM, 64QAM
Modulation Technology	DTS, DSSS, OFDM
Data Rate	BLE: GFSK: 1Mbps WLAN: 802.11b: 1, 2, 5.5, 11Mbps 802.11g: 6, 9, 12, 18, 24, 36, 48, 54Mbps 802.11n: MCS0 – MCS7, HT20
Antenna Type	PIFA Antenna
Antenna Gain	ANT1 2.28 dBi ANT2:0.01 dBi
Micro USB Cable	Brand: KimWell Model No: R404001R
Battery	Manufacturer: KAYO Model No:KPL605056-2P-5200mAh-3.8V
	Manufacturer: WTE Model No:S1

*EUT Support WLAN/BLE 1TX Diversity.

Note:

- 1.For more details, please refer to the User's manual of the EUT.
- 2.MIMO operational in 2.4GHz.
3. WLAN and BT can simultaneously transmission.

2.2 Carrier Frequency of Channels

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
*00	2402	14	2430	28	2458
01	2404	15	2432	29	2460
02	2406	16	2434	30	2462
03	2408	17	2436	31	2464
04	2410	18	2438	32	2466
05	2412	*19	2440	33	2468
06	2414	20	2442	34	2470
07	2416	21	2444	35	2472
08	2418	22	2446	36	2474
09	2420	23	2448	37	2476
10	2422	24	2450	38	2478
11	2424	25	2452	*39	2480
12	2426	26	2454	--	--
13	2428	27	2456	--	--

Note: Channels remarked * are selected to perform test.



2.3 Test Mode and Test Software

- a. During testing, the interface cables and equipment positions were varied according to ANSI C63.10.
- b. The complete test system included Notebook and EUT for RF test.
- c. An executive program, " Direct Test Mode Tool ver. 0.9.1" under Windows OS system was executed to transmit and receive data via Bluetooth.
- d. The following test modes were performed for the test:

Conducted Emissions from the AC mains power ports	
Test Mode	Operating Description
1	GFSK (1Mbps) with ANT1, for KAYO Battery
2	GFSK (1Mbps) with ANT1, for WTE Battery
3	GFSK (1Mbps) with ANT2, for KAYO Battery
4	GFSK (1Mbps) with ANT2, for WTE Battery
caused "Test Mode 1,2" generated the worst case, it was reported as the final data.	
Radiation Emissions (30MHz ~ 1GHz)	
Test Mode	Operating Description
1	GFSK (1Mbps) with ANT1, for KAYO Battery
2	GFSK (1Mbps) with ANT1, for WTE Battery
3	GFSK (1Mbps) with ANT2, for KAYO Battery
4	GFSK (1Mbps) with ANT2, for WTE Battery
caused "Test Mode 1,2" generated the worst case, it was reported as the final data.	
Radiation Emissions (1GHz ~ 25GHz)	
Test Mode	Operating Description
1	GFSK (1Mbps) with ANT1, for KAYO Battery
2	GFSK (1Mbps) with ANT2, for KAYO Battery
caused "Test Mode 1" generated the worst case, it was reported as the final data.	

2.4 Description of Test System

RF Conducted				
Equipment	Brand	Model	Length/Type	Power cord/Length/Type
Notebook	ASUS	P2430U	N/A	Adapter / 1.8m / NS
Radiated Emissions				
Equipment	Brand	Model	Length/Type	Power cord/Length/Type
Notebook	ASUS	P2430U	N/A	Adapter / 1.8m / NS
AC Power Line Conducted Emission				
Equipment	Brand	Model	Length/Type	Power cord/Length/Type
Notebook	ASUS	P2430U	N/A	Adapter / 1.8m / NS



2.5 General Information of Test

Test Site	CerpPASS Technology Corporation Test Laboratory Address: No.10, Ln. 2, Lianfu St., Luzhu Dist., Taoyuan City 33848, Taiwan (R.O.C.) Tel:+886-3-3226-888 Fax:+886-3-3226-881	
	FCC	TW1439, TW1079
	IC	4934E-1, 4934E-2
	VCCI	T-2205 for Telecommunication test C-4663 for Conducted emission test R-4218 for Radiated emission test G-10812, G-10813 for radiated disturbance above 1GHz
Frequency Range Investigated:	Conducted: from 150kHz to 30 MHz Radiation: from 30 MHz to 25,000MHz	
Test Distance:	The test distance of radiated emission from antenna to EUT is 3 M.	

Test Item	Test Site	Finish Date	Environmental Conditions	Tested By
RF Conducted	RFCON01-NK	2020/02/20	22°C / 60%	Vic Yeh
Radiated Emissions	3M02-NK	2020/02/25	25°C / 50%	Vic Yeh
AC Power Line Conducted Emission	CON01-NK	2020/02/26	26°C / 50%	Leon Huang

2.6 Measurement Uncertainty

Measurement Item	Uncertainty
AC Power Line Conduction(150K~30MHz)	±1.60dB
Radiated Spurious Emission(9KHz~30MHz)	±3.405dB
Radiated Spurious Emission(30MHz~1GHz)	±5.326dB
Radiated Spurious Emission(1GHz~25GHz)	±5.918dB
Conducted Spurious Emission	±2.156dB
6dB Bandwidth	±4.401%
20dB Bandwidth	±4.40%
Occupied Bandwidth	±4.41%
Peak Output Power(Conducted Power Meter)	±1.31dB
Dwell Time	±0.11%
Power Spectral Density	±2.146dB
Duty Cycle	±0.17%



3. Test Equipment and Ancillaries Used for Tests

Test Item	Radiated Emissions				
Test Site	Semi Anechoic Room(3M02-NK)				
Instrument	Manufacturer	Model No	Serial No	Calibration Date	Valid Date
Bilog Antenna	Schwarzbeck	VULB9168	275	2019/09/24	2020/09/23
Bilog Antenna	Schwarzbeck	VULB9168	369	2019/03/29	2020/03/28
Active Loop Antenna	EMCO	6507	40855	2019/05/24	2020/05/23
Horn Antenna	EMCO	3115	31589	2019/04/01	2020/03/31
Horn Antenna	EMCO	3116	31974	2019/09/17	2020/09/16
EMI Receiver	ROHDE & SCHWARZ	ESCI	101423	2019/05/14	2020/05/13
Spectrum Analyzer	ROHDE & SCHWARZ	FSP 40	100047	2019/03/28	2020/03/27
Spectrum Analyzer	ROHDE & SCHWARZ	FSV 40-N	102151	2019/08/02	2020/08/01
Preamplifier	EM Electronics corp.	EM330	60660	2019/03/11	2020/03/10
Preamplifier	EMC INSTRUMENTS	EMC051845SE	980333	2019/09/20	2020/09/19
Preamplifier	Agilent	8449B	3008A01954	2019/03/11	2020/03/10
Preamplifier	EMC INSTRUMENTS	EMC184045	980065	2019/11/07	2020/11/06
Bluetooth Tester	ROHDE & SCHWARZ	CBT	101133	2019/04/07	2020/04/06
Cable-3in1(30M-1G)	HARBOUR INDUSTRIES	LL142	CCE1315	2019/04/09	2020/04/08
Cable-3in1(30M-1G)	HARBOUR INDUSTRIES	LL142	CCE1316	2019/09/20	2020/09/19
Cable-0.5m(1G-40G)	HUBER SUHNER	SUCOFLEX 100	805443/4	2019/05/20	2020/05/19
Cable-3m(1G-40G)	HUBER SUHNER	SUCOFLEX 100	805796/4	2019/05/20	2020/05/19
Cable-8m(1G-40G)	HUBER SUHNER	SUCOFLEX 100	805795/4	2019/05/20	2020/05/19
E3	AUDIX	v8.2014-8-6	RK-000529	NA	NA

Test Item	RF Conducted				
Test Site	RFCON01-NK				
Instrument	Manufacturer	Model No	Serial No	Calibration Date	Valid Date
Spectrum Analyzer	ROHDE & SCHWARZ	FSP 40	100047	2019/03/28	2020/03/27
Spectrum Analyzer	ROHDE & SCHWARZ	FSV 40-N	102151	2019/08/02	2020/08/01
Bluetooth Tester	ROHDE & SCHWARZ	CBT	101133	2019/04/07	2020/04/06
Attenuator	KEYSIGHT	8491B	MY39250703	2019/09/12	2020/09/11
TEMP & HUMI CHAMBER	T-MACHINE	TMJ-9712	T-12-040111	2019/08/28	2020/08/27
Power Meter	Anritsu	ML2495A	1224005	2019/04/11	2020/04/10
Power Sensor	Anritsu	MA2411B	1207295	2019/04/09	2020/04/08



Test Item	AC Power Line Conducted Emission				
Test Site	CON01-NK				
Instrument	Manufacturer	Model No	Serial No	Calibration Date	Valid Date
EMI Receiver	ROHDE & SCHWARZ	ESCI	100821	2019/09/16	2020/09/15
Line Impedance Stabilization Network	Schwarzbeck	NSLK 8127	8127-568	2019/03/15	2020/03/14
Pulse Limiter	ROHDE & SCHWARZ	ESH3-Z2	101934	2019/03/12	2020/03/11
Cable-6m(9k~300M)	NA	EMC5D-BM-BM-6	130606	2019/03/14	2020/03/13
E3	AUDIX	v8.2014-8-6	RK-000531	NA	NA



4. Antenna Requirements

4.1 Standard Applicable

For intentional device, according to FCC 47 CFR Section 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.

And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

4.2 Antenna Construction and Directional Gain

Antenna Type	PIFA Antenna
Antenna Gain	ANT1 2.28 dBi ANT2:0.01 dBi



5. Test of AC Power Line Conducted Emission

The power supply is DC source, so this item doesn't require testing.

5.1 Test Limit

Conducted Emissions were measured from 150 kHz to 30 MHz with a bandwidth of 9 KHz, according to the methods defined in ANSI C63.4-2014. The EUT was placed on a nonmetallic stand in a shielded room 0.8 meters above the ground plane. The interface cables and equipment positioning were varied within limits of reasonable applications to determine the position produced maximum conducted emissions.

Frequency (MHz)	Quasi Peak (dB μ V)	Average (dB μ V)
0.15 – 0.5	66-56*	56-46*
0.5 – 5.0	56	46
5.0 – 30.0	60	50

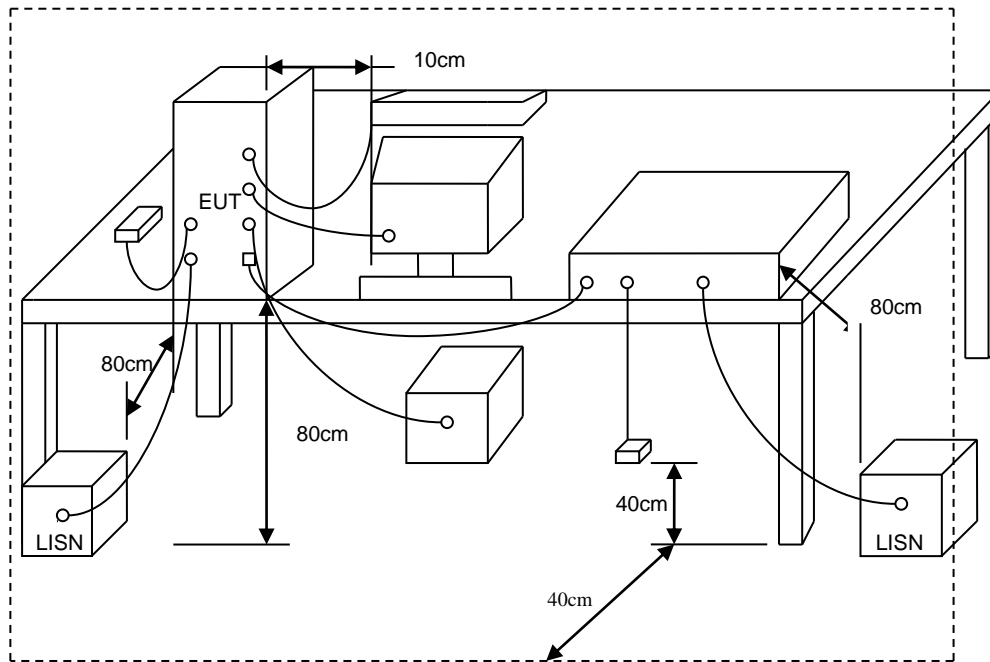
*Decreases with the logarithm of the frequency.

5.2 Test Procedures

- a. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
- b. Connect EUT to the power mains through a line impedance stabilization network (LISN).
- c. All the support units are connecting to the other LISN.
- d. The LISN provides 50 ohm coupling impedance for the measuring instrument.
- e. The FCC states that a 50 ohm, 50 micro-Henry LISN should be used.
- f. Both sides of AC line were checked for maximum conducted interference.
- g. The frequency range from 150 kHz to 30 MHz was searched.
- h. Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.



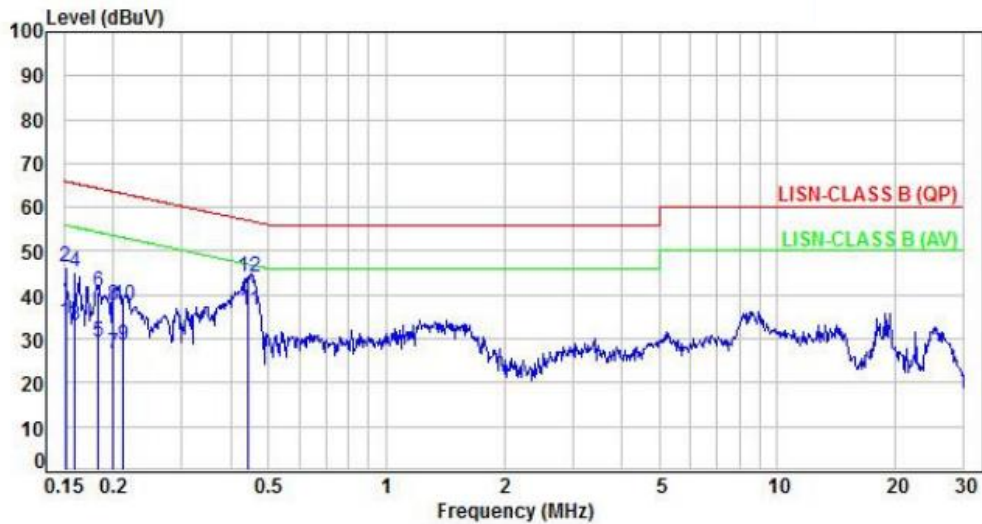
5.3 Typical Test Setup





5.4 Test Result and Data

Power	: DC Power from System (AC 120V)	Pol/Phase	: LINE
Test Mode	: Mode 1		:

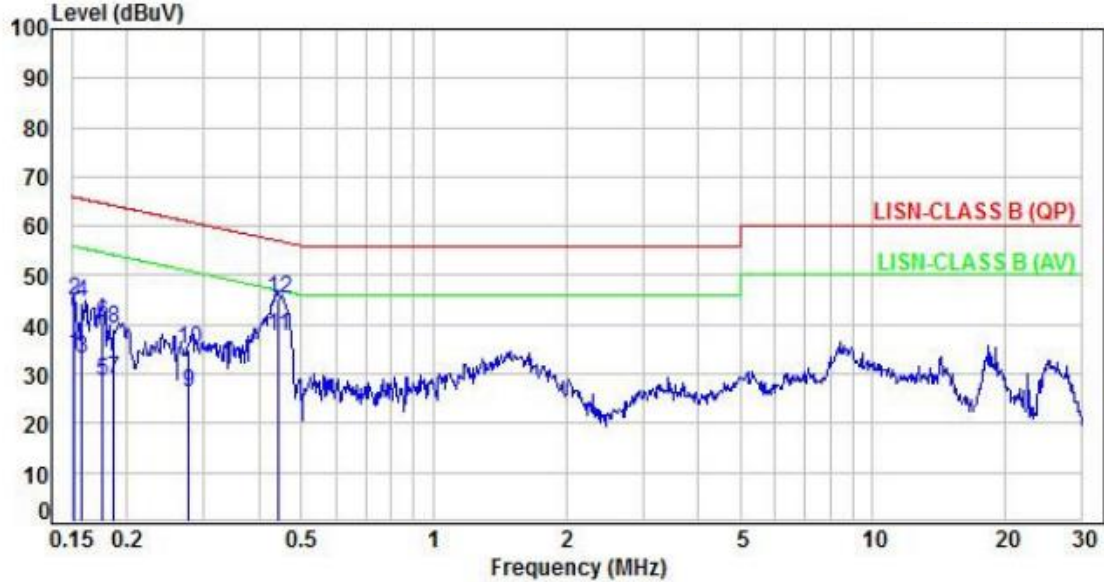


No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F
1	0.15	9.92	23.86	33.78	55.94	-22.16	Average	P
2	0.15	9.92	36.55	46.47	65.94	-19.47	QP	P
3	0.16	9.92	23.07	32.99	55.46	-22.47	Average	P
4	0.16	9.92	35.35	45.27	65.46	-20.19	QP	P
5	0.18	9.92	19.43	29.35	54.34	-24.99	Average	P
6	0.18	9.92	30.78	40.70	64.34	-23.64	QP	P
7	0.20	9.92	16.77	26.69	53.59	-26.90	Average	P
8	0.20	9.92	27.86	37.78	63.59	-25.81	QP	P
9	0.21	9.92	18.53	28.45	53.13	-24.68	Average	P
10	0.21	9.92	27.62	37.54	63.13	-25.59	QP	P
11	0.44	9.94	26.72	36.66	46.98	-10.32	Average	P
12	0.44	9.94	34.35	44.29	56.98	-12.69	QP	P

Note: Level=Reading+Factor
 Margin=Level-Limit
 Factor=(LISN or ISN or Current Probe)Factor + Cable Loss



Power	: DC Power from System (AC 120V)	Pol/Phase	: NEUTRAL
Test Mode	: Mode 1		:

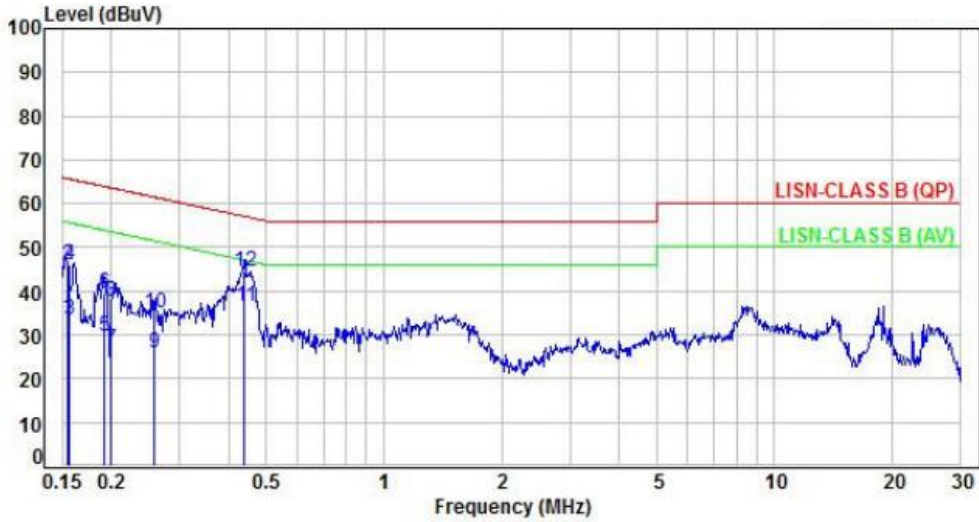


No.	Frequency (MHz)	Factor (dB)	Reading (dBUV)	Level (dBUV)	Limit (dBUV)	Margin (dB)	Detector	P/F
1	0.15	9.95	23.71	33.66	55.87	-22.21	Average	P
2	0.15	9.95	34.92	44.87	65.87	-21.00	QP	P
3	0.16	9.95	23.18	33.13	55.59	-22.46	Average	P
4	0.16	9.95	34.36	44.31	65.59	-21.28	QP	P
5	0.18	9.95	18.52	28.47	54.70	-26.23	Average	P
6	0.18	9.95	30.39	40.34	64.70	-24.36	QP	P
7	0.19	9.95	18.91	28.86	54.18	-25.32	Average	P
8	0.19	9.95	29.17	39.12	64.18	-25.06	QP	P
9	0.28	9.95	16.44	26.39	50.96	-24.57	Average	P
10	0.28	9.95	24.87	34.82	60.96	-26.14	QP	P
11	0.44	9.96	27.64	37.60	47.01	-9.41	Average	P
12	0.44	9.96	35.14	45.10	57.01	-11.91	QP	P

Note: Level=Reading+Factor
 Margin=Level-Limit
 Factor=(LISN or ISN or Current Probe)Factor + Cable Loss



Power	: DC Power from System (AC 120V)	Pol/Phase	: LINE
Test Mode	: Mode 2		:

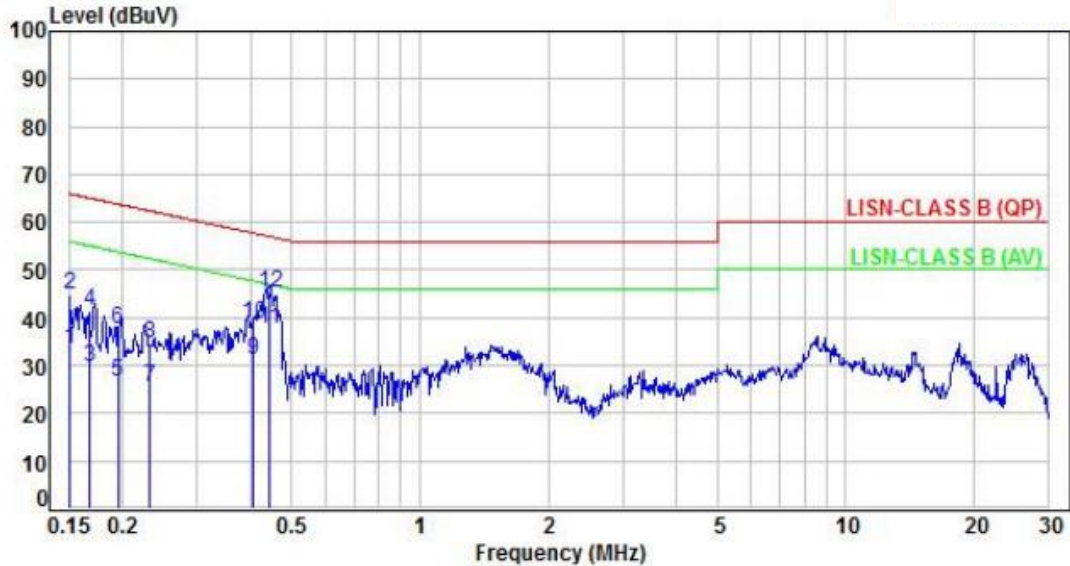


No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F
1	0.16	9.92	23.86	33.78	55.72	-21.94	Average	P
2	0.16	9.92	36.04	45.96	65.72	-19.76	QP	P
3	0.16	9.92	23.51	33.43	55.64	-22.21	Average	P
4	0.16	9.92	35.95	45.87	65.64	-19.77	QP	P
5	0.19	9.92	19.57	29.49	53.98	-24.49	Average	P
6	0.19	9.92	29.62	39.54	63.98	-24.44	QP	P
7	0.20	9.92	16.72	26.64	53.63	-26.99	Average	P
8	0.20	9.92	27.77	37.69	63.63	-25.94	QP	P
9	0.26	9.92	15.81	25.73	51.51	-25.78	Average	P
10	0.26	9.92	24.94	34.86	61.51	-26.65	QP	P
11	0.44	9.94	26.59	36.53	47.08	-10.55	Average	P
12	0.44	9.94	34.39	44.33	57.08	-12.75	QP	P

Note: Level=Reading+Factor
 Margin=Level-Limit
 Factor=(LISN or ISN or Current Probe)Factor + Cable Loss



Power	: DC Power from System (AC 120V)	Pol/Phase	: NEUTRAL
Test Mode	: Mode 2		:



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F
1	0.15	9.95	23.32	33.27	55.99	-22.72	Average	P
2	0.15	9.95	35.09	45.04	65.99	-20.95	QP	P
3	0.17	9.95	19.77	29.72	55.06	-25.34	Average	P
4	0.17	9.95	31.53	41.48	65.06	-23.58	QP	P
5	0.20	9.95	16.72	26.67	53.82	-27.15	Average	P
6	0.20	9.95	27.50	37.45	63.82	-26.37	QP	P
7	0.23	9.95	15.57	25.52	52.37	-26.85	Average	P
8	0.23	9.95	24.52	34.47	62.37	-27.90	QP	P
9	0.40	9.96	21.36	31.32	47.76	-16.44	Average	P
10	0.40	9.96	28.75	38.71	57.76	-19.05	QP	P
11	0.44	9.96	27.69	37.65	47.03	-9.38	Average	P
12	0.44	9.96	35.12	45.08	57.03	-11.95	QP	P

Note: Level=Reading+Factor
 Margin=Level-Limit
 Factor=(LISN or ISN or Current Probe)Factor + Cable Loss



6. Test of Spurious Emission (Radiated)

6.1 Test Limit

In any 100kHz 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. If the transmitter measurement is based on the maximum conducted output power, the attenuation required under this paragraph shall be 30dB instead of 20dB. In addition, radiated emissions which fall in section 15.205(a) the restricted bands must also comply with the radiated emission limit specified in section 15.209(a).

Frequency (MHz)	Field Strength (microvolt/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

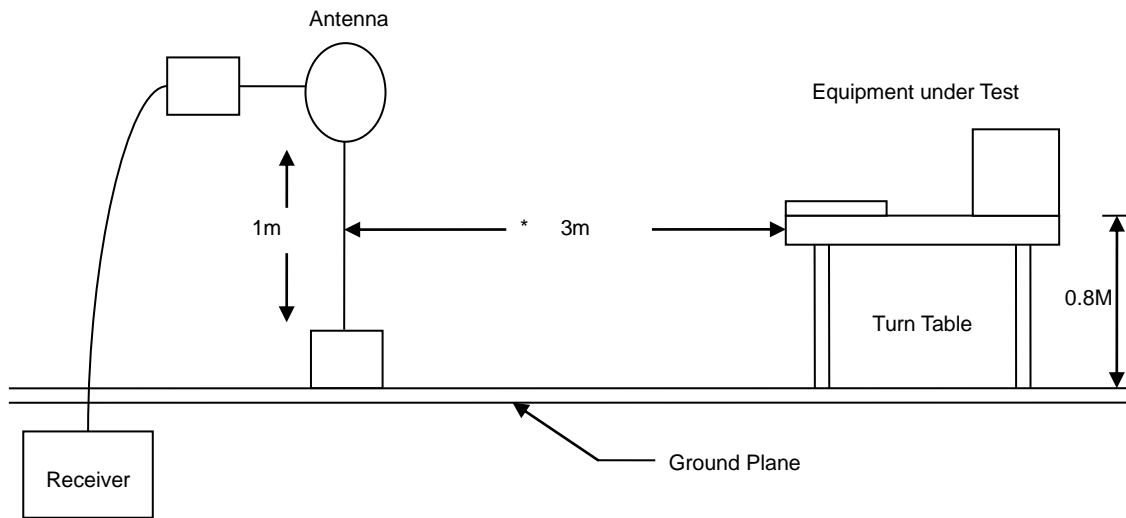
6.2 Test Procedures

- The EUT was placed on a rotatable table top 0.8 meter above ground.
- The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
- The table was rotated 360 degrees to determine the position of the highest radiation.
- The antenna is a broadband antenna and its height is varied between one meter and four meters above ground to find the maximum value of the field strength both horizontal polarization and vertical polarization of the antenna are set to make the measurement.
- For each suspected emission the EUT was arranged to its worst case and then tune the antenna tower (from 1 M to 4 M) and turn table (from 0 degree to 360 degrees) to find the maximum reading.
- Set the test-receiver system to Peak or CISPR quasi-peak Detect Function and specified bandwidth with Maximum Hold Mode.
- If the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method and reported.
- For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
- "Cone of radiation" has been considered to be 3dB bandwidth of the measurement antenna.

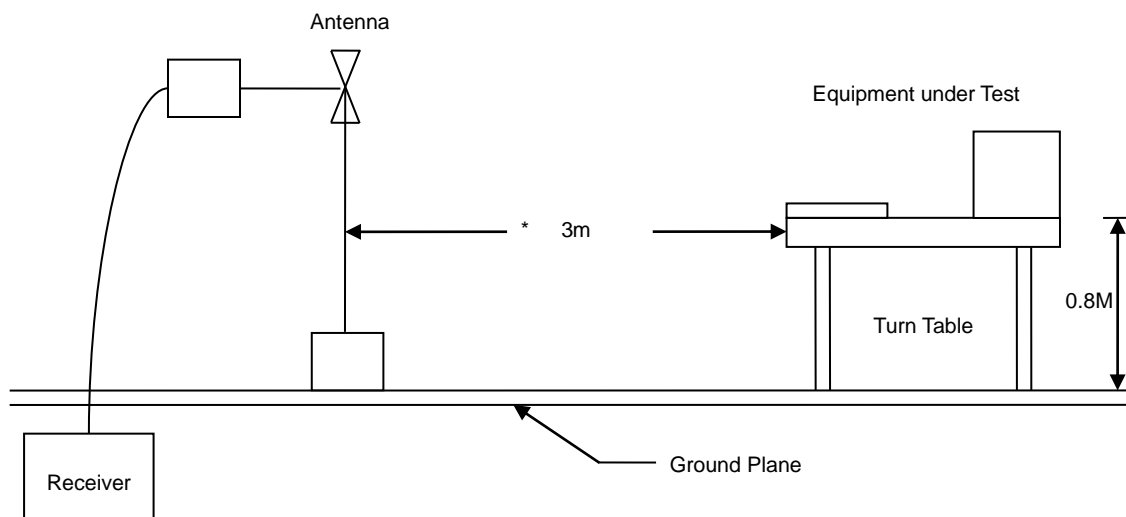


6.3 Typical Test Setup

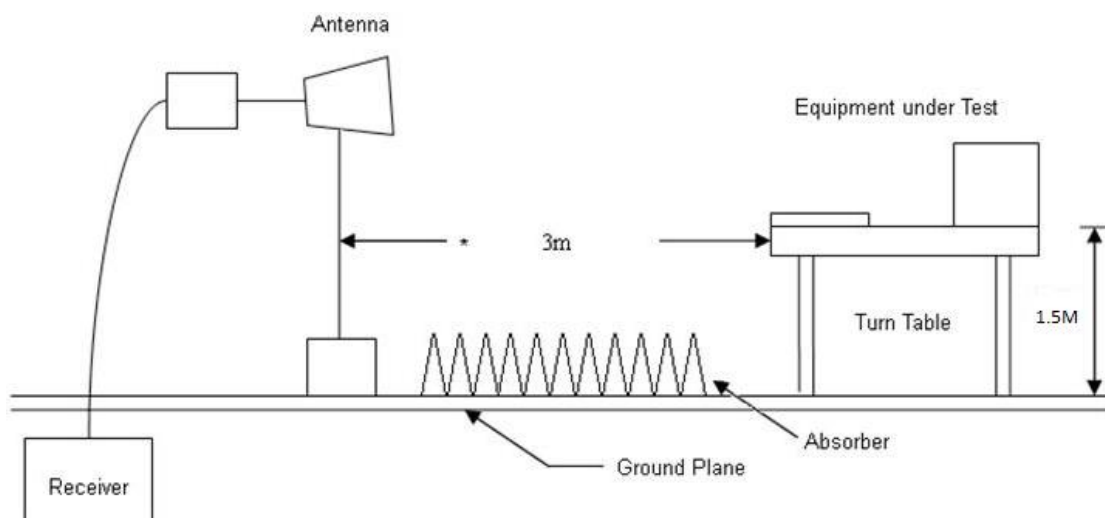
Below 30MHz test setup



30MHz- 1GHz Test Setup



Above 1GHz Test Setup



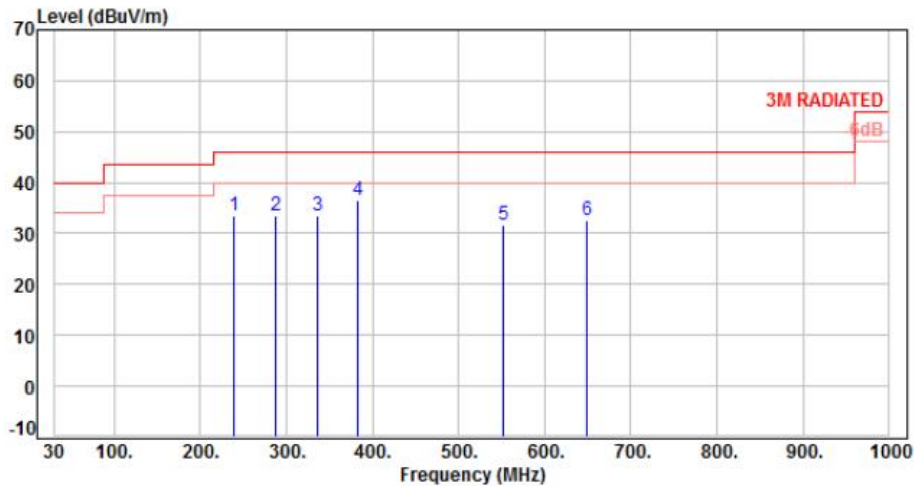


6.4 Test Result and Data (9kHz ~ 30MHz)

The 9kHz - 30MHz spurious emission is under limit 20dB more.

6.5 Test Result and Data (30MHz ~ 1GHz)

Power	:	DC Power from System (AC 120V)	Pol/Phase	:	VERTICAL
Test Mode	:	Mode 1		:	

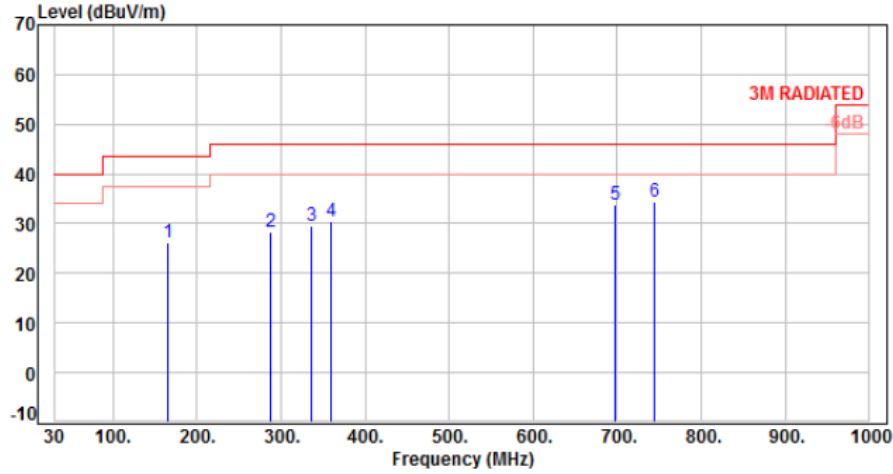


No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	239.77	-10.59	43.95	33.36	46.00	-12.64	Peak	100	0	P
2	288.28	-8.85	42.50	33.65	46.00	-12.35	Peak	100	0	P
3	336.42	-7.35	40.79	33.44	46.00	-12.56	Peak	100	0	P
4	383.23	-6.12	42.72	36.60	46.00	-9.40	Peak	100	0	P
5	551.61	-2.47	34.03	31.56	46.00	-14.44	Peak	100	0	P
6	648.77	-0.63	33.28	32.65	46.00	-13.35	Peak	100	0	P

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=Antenna Factor + cable loss - Amplifier Factor



Power	: DC Power from System (AC 120V)	Pol/Phase	: HORIZONTAL
Test Mode	: Mode 1		:

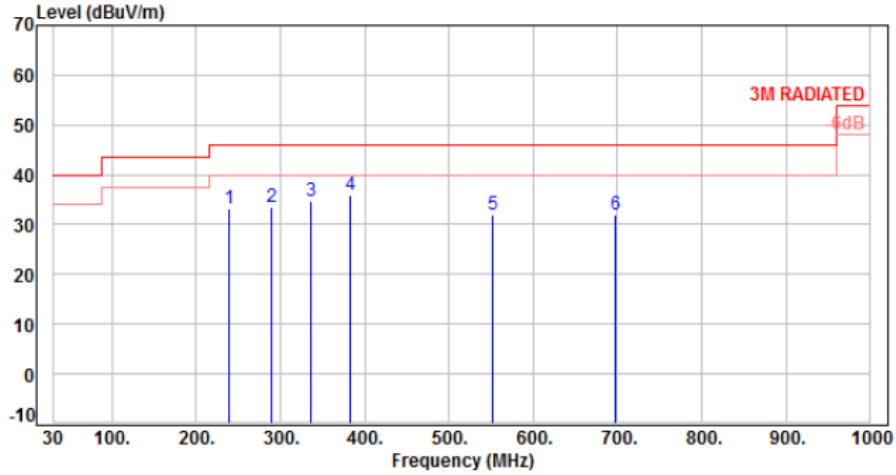


No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	165.75	-9.56	35.78	26.22	43.50	-17.28	Peak	100	0	P
2	288.28	-8.85	37.09	28.24	46.00	-17.76	Peak	100	0	P
3	336.41	-7.35	36.89	29.54	46.00	-16.46	Peak	100	0	P
4	359.63	-6.80	37.16	30.36	46.00	-15.64	Peak	100	0	P
5	697.51	0.09	33.68	33.77	46.00	-12.23	Peak	100	0	P
6	743.83	1.18	33.35	34.53	46.00	-11.47	Peak	100	0	P

Note: Level=Reading+Factor
 Margin=Level-Limit
 Factor=Antenna Factor + cable loss - Amplifier Factor



Power	: DC Power from System (AC 120V)	Pol/Phase	: VERTICAL
Test Mode	: Mode 2		:

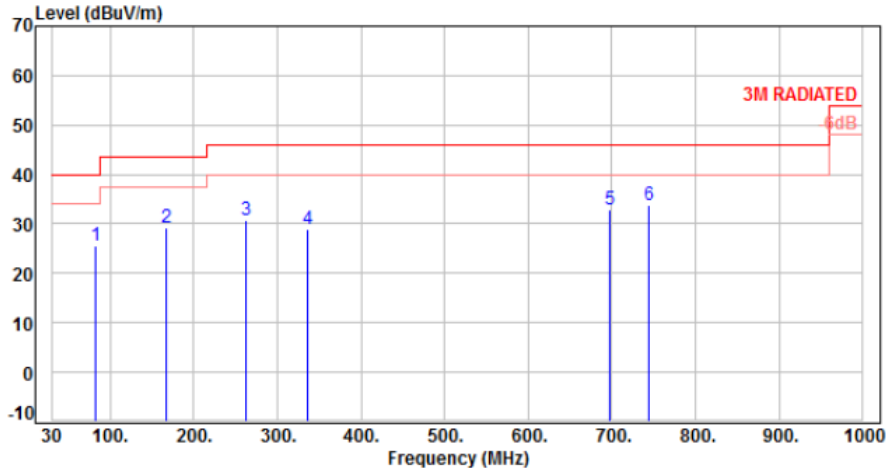


No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	239.26	-10.61	43.83	33.22	46.00	-12.78	Peak	100	248	P
2	288.51	-8.85	42.24	33.39	46.00	-12.61	Peak	100	0	P
3	336.15	-7.36	41.92	34.56	46.00	-11.44	Peak	100	0	P
4	383.08	-6.12	42.16	36.04	46.00	-9.96	Peak	100	0	P
5	551.35	-2.47	34.42	31.95	46.00	-14.05	Peak	100	0	P
6	697.04	0.09	31.80	31.89	46.00	-14.11	Peak	100	0	P

Note: Level=Reading+Factor
 Margin=Level-Limit
 Factor=Antenna Factor + cable loss - Amplifier Factor



Power	: DC Power from System (AC 120V)	Pol/Phase	: HORIZONTAL
Test Mode	: Mode 2		:



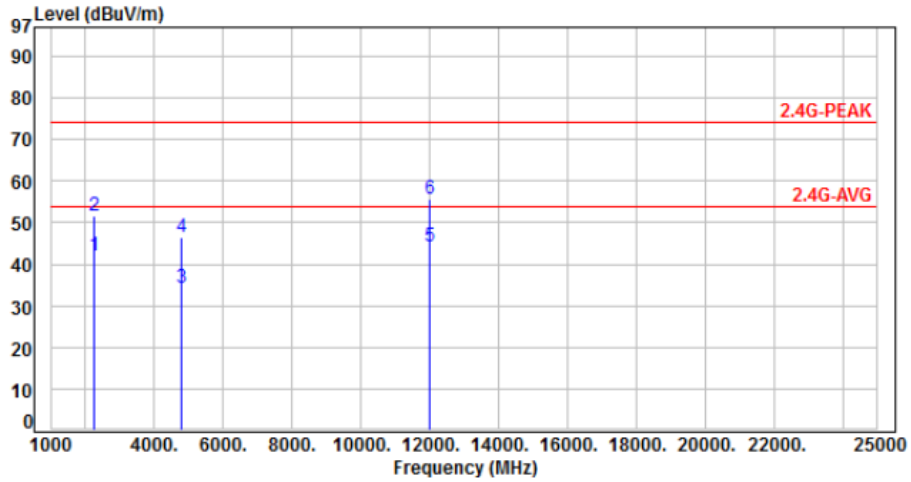
No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	82.38	-14.66	40.37	25.71	40.00	-14.29	Peak	100	0	P
2	167.74	-9.64	38.78	29.14	43.50	-14.36	Peak	100	0	P
3	262.80	-9.85	40.61	30.76	46.00	-15.24	Peak	100	0	P
4	336.52	-7.35	36.14	28.79	46.00	-17.21	Peak	100	0	P
5	697.36	0.09	32.70	32.79	46.00	-13.21	Peak	100	0	P
6	743.92	1.18	32.74	33.92	46.00	-12.08	Peak	100	0	P

Note: Level=Reading+Factor
 Margin=Level-Limit
 Factor=Antenna Factor + cable loss - Amplifier Factor



6.6 Test Result and Data (1GHz ~ 25GHz)

Power	: DC Power from System (AC 120V)	Pol/Phase	: VERTICAL
Test Mode	: Mode 1, CH00		:

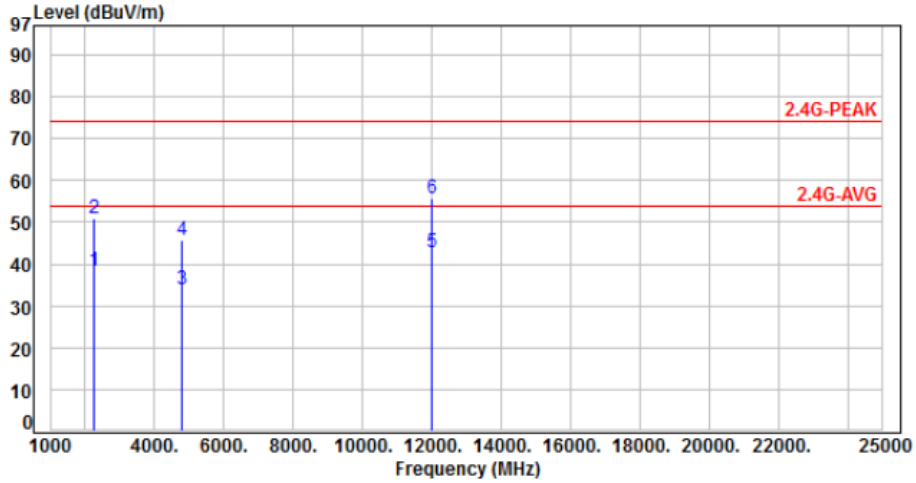


No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	2274.00	-4.06	46.29	42.23	54.00	-11.77	Average	100	305	P
2	2274.00	-4.06	55.74	51.68	74.00	-22.32	Peak	100	305	P
3	4804.00	3.65	30.74	34.39	54.00	-19.61	Average	100	245	P
4	4804.00	3.65	42.71	46.36	74.00	-27.64	Peak	100	245	P
5	12010.00	13.50	30.71	44.21	54.00	-9.79	Average	100	320	P
6	12010.00	13.50	42.12	55.62	74.00	-18.38	Peak	100	320	P

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=Antenna Factor + cable loss - Amplifier Factor



Power	: DC Power from System (AC 120V)	Pol/Phase	: HORIZONTAL
Test Mode	: Mode 1, CH00		:

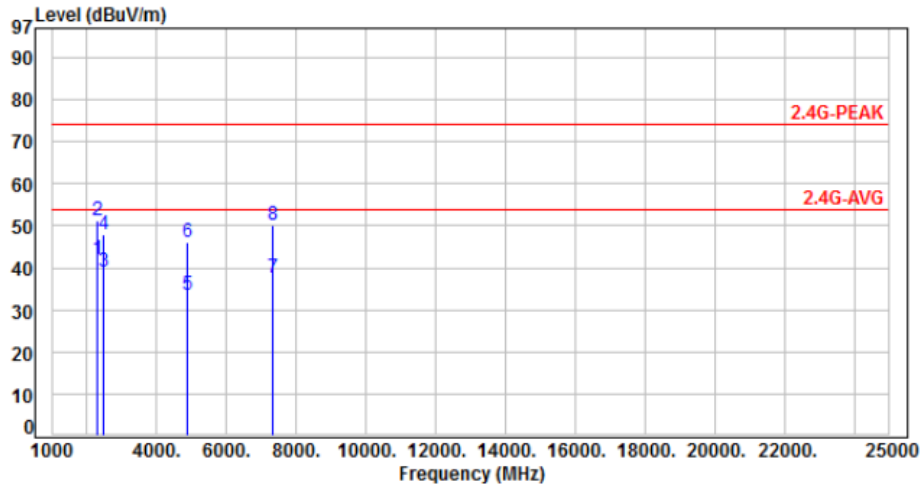


No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	2274.00	-4.06	42.51	38.45	54.00	-15.55	Average	100	136	P
2	2274.00	-4.06	54.99	50.93	74.00	-23.07	Peak	100	136	P
3	4804.00	3.65	30.23	33.88	54.00	-20.12	Average	100	41	P
4	4804.00	3.65	41.96	45.61	74.00	-28.39	Peak	100	41	P
5	12010.00	13.50	29.33	42.83	54.00	-11.17	Average	100	112	P
6	12010.00	13.50	42.06	55.56	74.00	-18.44	Peak	100	112	P

Note: Level=Reading+Factor
 Margin=Level-Limit
 Factor=Antenna Factor + cable loss - Amplifier Factor



Power	: DC Power from System (AC 120V)	Pol/Phase	: VERTICAL
Test Mode	: Mode 1, CH19		:

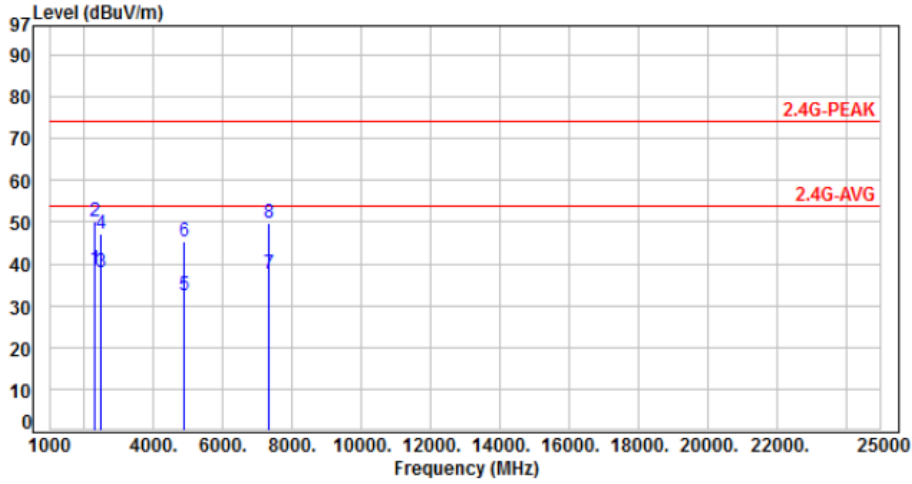


No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	2312.00	-3.86	46.05	42.19	54.00	-11.81	Average	100	340	P
2	2312.00	-3.86	55.03	51.17	74.00	-22.83	Peak	100	340	P
3	2483.50	-3.30	42.44	39.14	54.00	-14.86	Average	100	340	P
4	2483.50	-3.30	51.38	48.08	74.00	-25.92	Peak	100	340	P
5	4880.00	3.97	29.52	33.49	54.00	-20.51	Average	100	249	P
6	4880.00	3.97	41.99	45.96	74.00	-28.04	Peak	100	249	P
7	7320.00	8.83	28.75	37.58	54.00	-16.42	Average	100	114	P
8	7320.00	8.83	41.19	50.02	74.00	-23.98	Peak	100	114	P

Note: Level=Reading+Factor
 Margin=Level-Limit
 Factor=Antenna Factor + cable loss - Amplifier Factor



Power	: DC Power from System (AC 120V)	Pol/Phase	: HORIZONTAL
Test Mode	: Mode 1, CH19		:

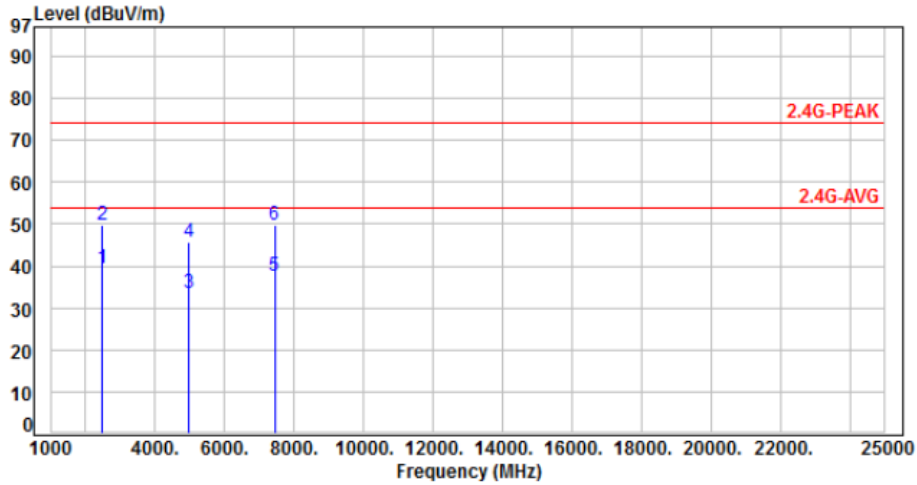


No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	2312.00	-3.86	42.45	38.59	54.00	-15.41	Average	100	102	P
2	2312.00	-3.86	53.90	50.04	74.00	-23.96	Peak	100	102	P
3	2483.50	-3.30	41.40	38.10	54.00	-15.90	Average	100	102	P
4	2483.50	-3.30	50.36	47.06	74.00	-26.94	Peak	100	102	P
5	4880.00	3.97	28.63	32.60	54.00	-21.40	Average	100	117	P
6	4880.00	3.97	41.29	45.26	74.00	-28.74	Peak	100	117	P
7	7320.00	8.83	28.73	37.56	54.00	-16.44	Average	100	222	P
8	7320.00	8.83	40.99	49.82	74.00	-24.18	Peak	100	222	P

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=Antenna Factor + cable loss - Amplifier Factor



Power	: DC Power from System (AC 120V)	Pol/Phase	: VERTICAL
Test Mode	: Mode 1, CH39		:

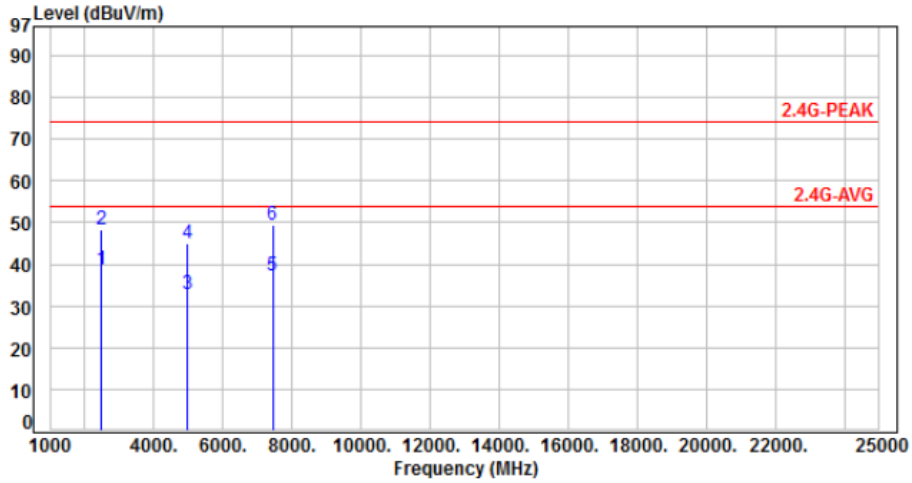


No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	2483.50	-3.30	42.76	39.46	54.00	-14.54	Average	100	358	P
2	2483.50	-3.30	52.96	49.66	74.00	-24.34	Peak	100	358	P
3	4960.00	4.21	29.45	33.66	54.00	-20.34	Average	100	238	P
4	4960.00	4.21	41.64	45.85	74.00	-28.15	Peak	100	238	P
5	7440.00	8.98	28.57	37.55	54.00	-16.45	Average	100	121	P
6	7440.00	8.98	40.75	49.73	74.00	-24.27	Peak	100	121	P

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=Antenna Factor + cable loss - Amplifier Factor



Power	: DC Power from System (AC 120V)	Pol/Phase	: HORIZONTAL
Test Mode	: Mode 1, CH39		:



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	2483.50	-3.30	42.05	38.75	54.00	-15.25	Average	100	123	P
2	2483.50	-3.30	51.48	48.18	74.00	-25.82	Peak	100	123	P
3	4960.00	4.21	28.59	32.80	54.00	-21.20	Average	100	136	P
4	4960.00	4.21	40.81	45.02	74.00	-28.98	Peak	100	136	P
5	7440.00	8.98	28.20	37.18	54.00	-16.82	Average	100	240	P
6	7440.00	8.98	40.45	49.43	74.00	-24.57	Peak	100	240	P

Note: Level=Reading+Factor
 Margin=Level-Limit
 Factor=Antenna Factor + cable loss - Amplifier Factor



6.7 Restricted Bands of Operation

Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.09000 – 0.11000	16.42000 – 16.42300	399.9 – 410.0	4.500 – 5.250
0.49500 – 0.505**	16.69475 – 16.69525	608.0 – 614.0	5.350 – 5.460
2.17350 – 2.19050	16.80425 – 16.80475	960.0 – 1240.0	7.250 – 7.750
4.12500 – 4.12800	25.50000 – 25.67000	1300.0 – 1427.0	8.025 – 8.500
4.17725 – 4.17775	37.50000 – 38.25000	1435.0 – 1626.5	9.000 – 9.200
4.20725 – 4.20775	73.00000 – 74.60000	1645.5 – 1646.5	9.300 – 9.500
6.21500 – 6.21800	74.80000 – 75.20000	1660.0 – 1710.0	10.600 – 12.700
6.26775 – 6.26825	108.00000 – 121.94000	1718.8 – 1722.2	13.250 – 13.400
6.31175 – 6.31225	123.00000 – 138.00000	2200.0 – 2300.0	14.470 – 14.500
8.29100 – 8.29400	149.90000 – 150.05000	2310.0 – 2390.0	15.350 – 16.200
8.36200 – 8.36600	156.52475 – 156.52525	2483.5 – 2500.0	17.700 – 21.400
8.37625 – 8.38675	156.70000 – 156.90000	2655.0 – 2900.0	22.010 – 23.120
8.41425 – 8.41475	162.01250 – 167.17000	3260.0 – 3267.0	23.600 – 24.000
12.29000 – 12.29300	167.72000 – 173.20000	3332.0 – 3339.0	31.200 – 31.800
12.51975 – 12.52025	240.00000 – 285.00000	3345.8 – 3358.0	36.430 – 36.500
12.57675 – 12.57725	322.00000 – 335.40000	3600.0 – 4400.0	Above 38.6
13.36000 – 13.41000			

** : Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz



7. Test of Spurious Emission (Conducted)

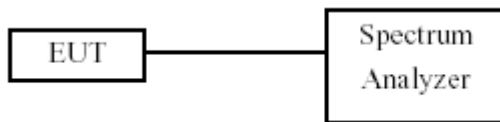
7.1 Test Limit

Below -20dB of the highest emission level of operating band (In 100 kHz Resolution Bandwidth)

7.2 Test Procedure

- a. The transmitter output was connected to the spectrum analyzer via a low loss cable.
- b. Set RBW of spectrum analyzer to 100 KHz and VBW of spectrum analyzer to 300 KHz with convenient frequency span including 100 KHz bandwidth from band edge.
- c. Peak conducted output power measured within any 100 kHz outside the authorized frequency band shall be attenuated by at least 20dB relative to the maximum measured in-band peak PSD level.
- d. The band edges was measured and recorded.

7.3 Test Setup Layout

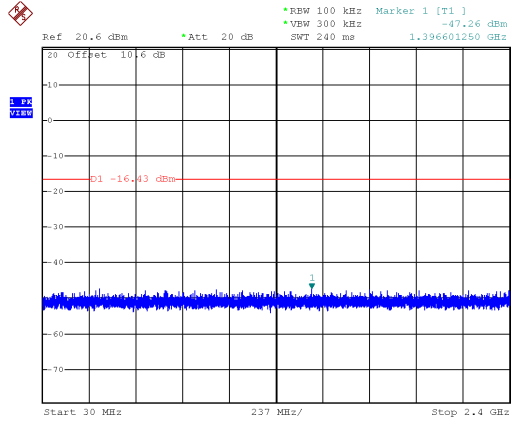


7.4 Test Result and Data

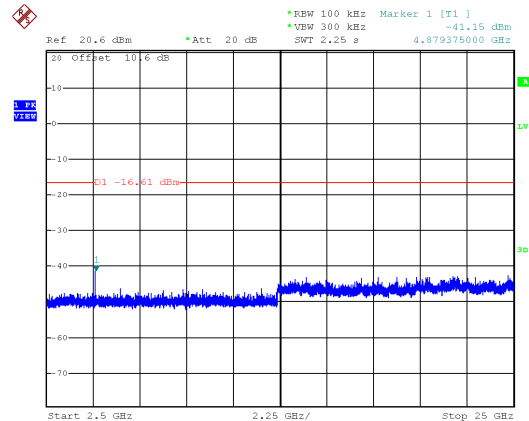
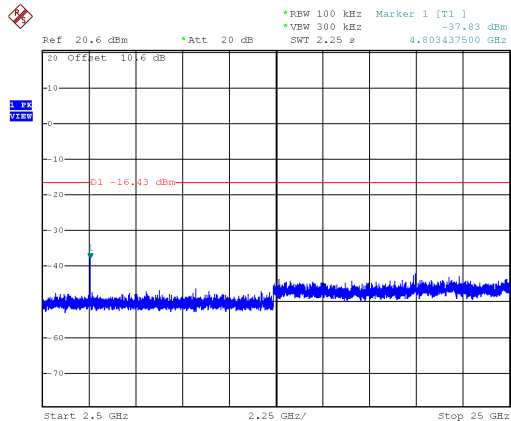
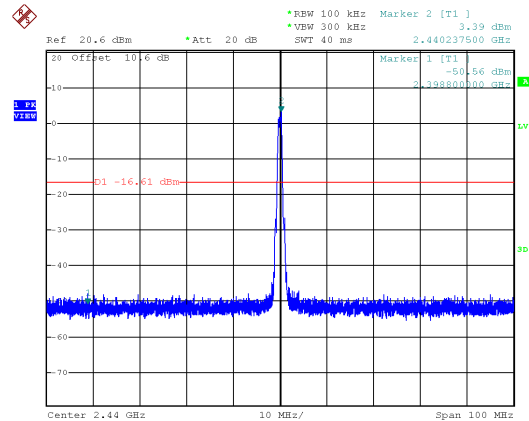
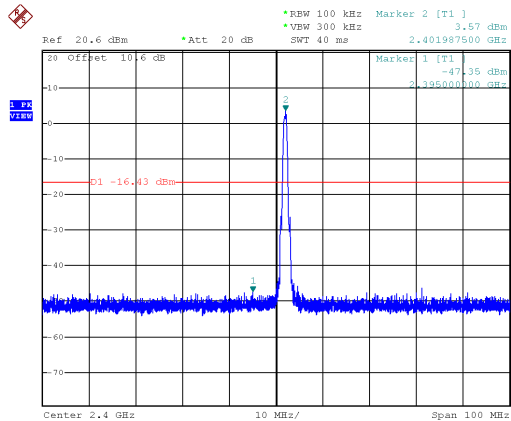
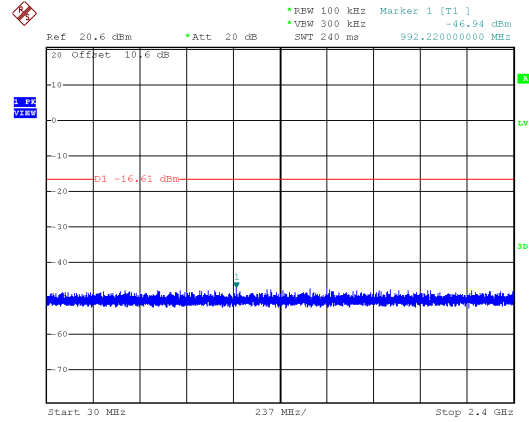
Note: Test plots refer to the following pages.



Modulation Type: GFSK
CH00

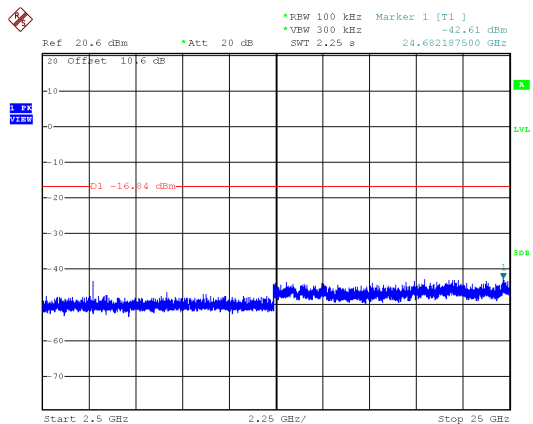
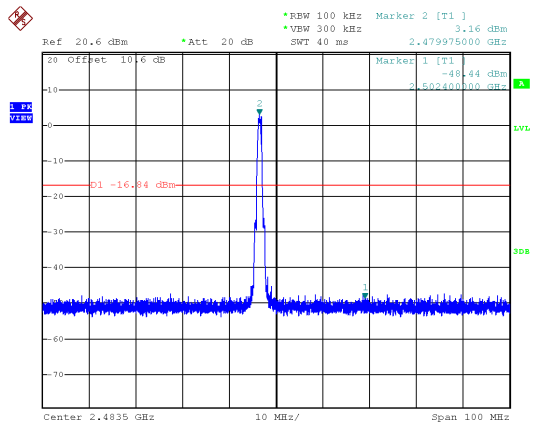
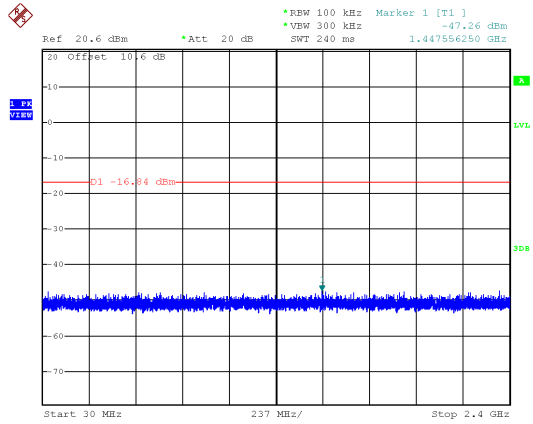


Modulation Type: GFSK
CH19





Modulation Type: GFSK
CH39





8. On Time, Duty Cycle and Measurement methods

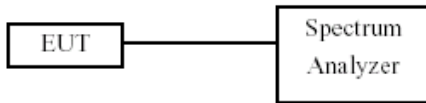
8.1 Test Limit

None; for reporting purposes only.

8.2 Test Procedure

Zero-Span Spectrum Analyzer Method.

8.3 Test Setup Layout

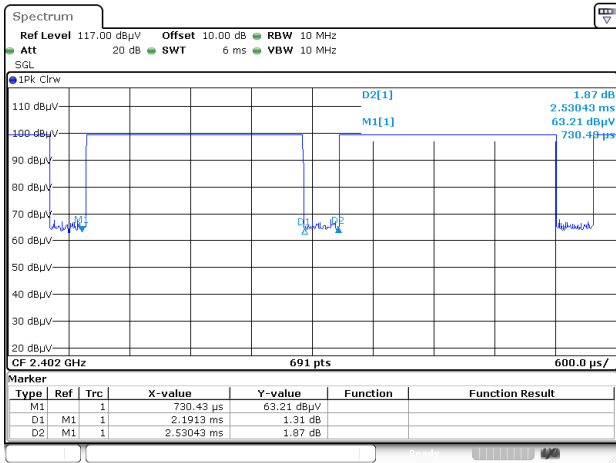


8.4 Test Result and Data

Modulation Type	On Time (ms)	Period Time (ms)	Duty Cycle (%)
GFSK	2.19	2.53	86.60%



Modulation Type: GFSK (1Mbps)





9. 6dB Bandwidth Measurement Data

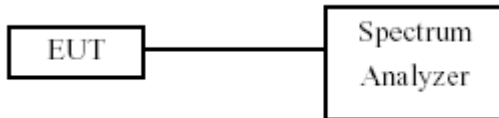
9.1 Test Limit

The minimum of 6dB Bandwidth Measurement is 0.5 MHz.

9.2 Test Procedures

- a. The transmitter output was connected to the spectrum analyzer.
- b. Set RBW of spectrum analyzer to 100 KHz and VBW to 300 KHz.
- c. The 6 dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6 dB.
- d. The 6dB Bandwidth was measured and recorded.

9.3 Test Setup Layout

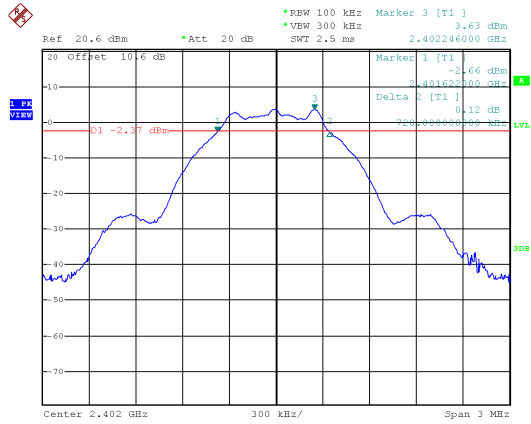


9.4 Test Result and Data

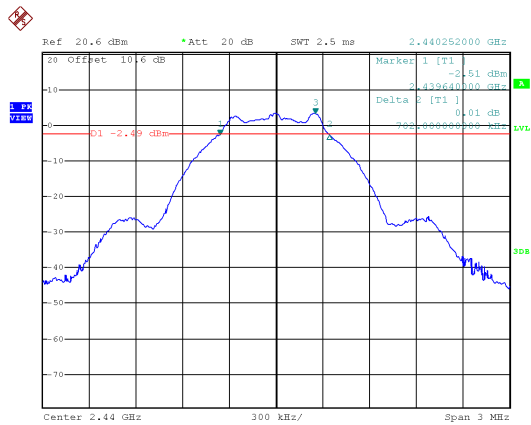
Modulation Type	Channel	Frequency (MHz)	6dB Bandwidth (KHz)	Limit (KHz)
GFSK(1Mbps)	0	2402	720.00	500
	19	2440	702.00	500
	39	2480	690.00	500



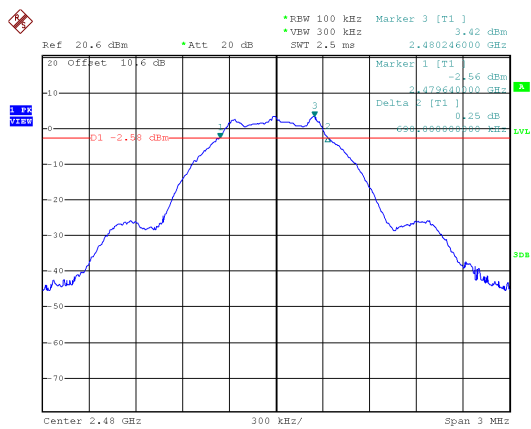
Modulation Type: GFSK
CH00



CH19



CH39





10. Maximum Peak and Average Output Power

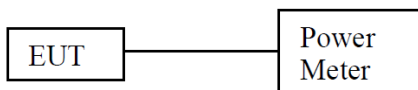
10.1 Test Limit

The Maximum Peak Output Power Measurement is 30dBm.

10.2 Test Procedures

The antenna port (RF output) of the EUT was connected to the input (RF input) of a power meter. Power was read directly from the meter and cable loss connection was added to the reading to obtain power at the EUT antenna terminal. The EUT Output Power was set to maximum to produce the worse case test result.

10.3 Test Setup Layout



10.4 Test Result and Data

Modulation Type	Channel	Frequency (MHz)	Power Output (dBm)		Power Output (mW)	
			Peak	Average	Peak	Average
GFSK	0	2402	3.51	3.45	2.244	2.213
	19	2440	3.43	3.38	2.203	2.178
	39	2480	3.33	3.27	2.153	2.123

*Average Power is for reference only



11. Power Spectral Density

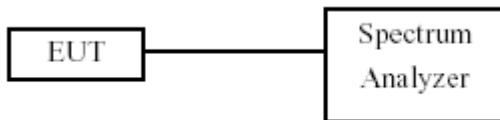
11.1 Test Limit

The Maximum of Power Spectral Density Measurement is 8dBm.

11.2 Test Procedures

- a. The transmitter output was connected to spectrum analyzer.
- b. The spectrum analyzer's resolution bandwidth were set at 3KHz RBW and 30KHz VBW as that of the fundamental frequency. Set the sweep time=auto couple.
- c. The power spectral density was measured and recorded.

11.3 Test Setup Layout

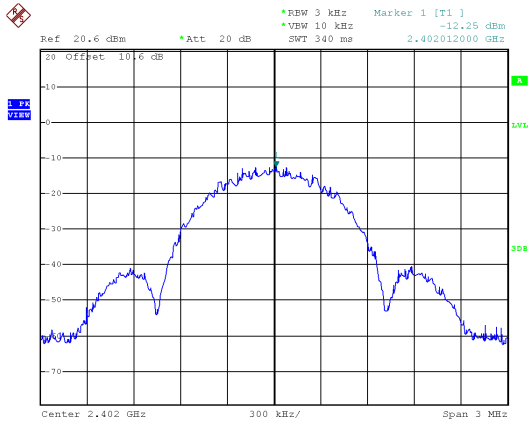


11.4 Test Result and Data

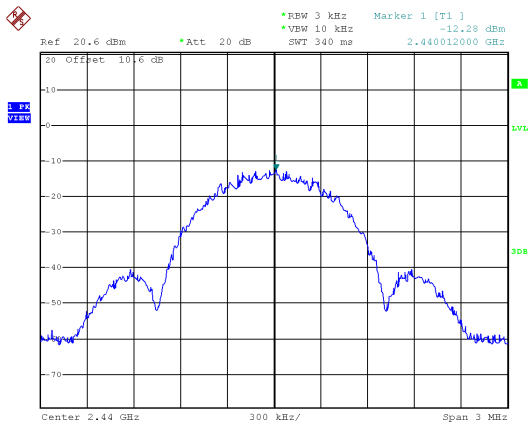
Modulation Type	Channel	Frequency (MHz)	Maximum Power Density of 3KHz Bandwidth(dBm)	Limit
GFSK(1Mbps)	0	2402	-12.25	8.00
	19	2440	-12.28	8.00
	39	2480	-12.62	8.00



Modulation Type: GFSK
CH00



CH19



CH39

