



FCC RADIO TEST REPORT

Applicant : Shuttle Inc.

Address : No. 30, Lane 76, Rui Guang Rd. Nei-Hu Dist.,
Taipei, Taiwan

Equipment : XPC nano

Model No. : NS03

Trade Name : Shuttle

FCC ID : S8CNS03

I HEREBY CERTIFY THAT :

The sample was received on May. 26, 2022 and the testing was completed on Jun.21 , 2022 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:

Vic Hsiao / Supervisor

Laboratory Accreditation:

CerpPASS Technology Corporation Test Laboratory





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History of this test report

Report No.	Issued Date	Description
22050246-TRFCC03	Jul. 04, 2022	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
15.247(a)(1)	.Pseudorandom Frequency Hopping Sequence	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)(1)	. Channel Carrier Frequencies Separation	PASS
15.247(a)(1)	. 20dB Bandwidth	PASS
15.247(a)(1)	. Dwell Time	PASS
15.247(b)	. Number of Hopping Channels	PASS
15.247(b)	. Output Power	PASS
2.1091	. Radio Frequency Exposure	PASS

* The lab has reduced the uncertainty risk factor from test equipment, environment and staff technicians which according to the standard on contract. Therefore, the test result will only be determined by standard requirement.



2. Test Configuration of Equipment under Test

2.1 Feature of Equipment under Test

Operation Frequency Range	BT / BLE: 2400-2483.5MHz 802.11b/g/n: 2400-2483.5MHz 802.11a/n/ac: 5150-5250MHz, 5250-5350MHz, 5470-5725MHz, 5725-5850MHz
Center Frequency Range	BT / BLE: 2402MHz-2480MHz 802.11b/g/n: 2412MHz-2462MHz 802.11a/n/ac: 5180-5240MHz, 5260-5320MHz, 5500-5700MHz, 5745-5825MHz
Modulation Type	BT: GFSK, $\pi/4$ -DQPSK, 8DPSK BLE: GFSK WLAN: 2.4GHz: 802.11b: CCK, DQPSK, DBPSK 802.11g/n: BPSK, QPSK, 16QAM, 64QAM 5GHz: 802.11n/a: BPSK, QPSK, 16QAM, 64QAM 802.11ac: BPSK, QPSK, 16QAM, 64QAM, 256QAM
Modulation Technology	DSSS, OFDM, FHSS, DTS
Data Rate	BT: GFSK: 1Mbps, $\pi/4$ -DQPSK: 2Mbps, 8DPSK: 3Mbps BLE: GFSK: 1Mbps GFSK: 2 Mbps WLAN: 2.4GHz: 802.11b: 1, 2, 5.5, 11Mbps 802.11g: 6, 9, 12, 18, 24, 36, 48, 54Mbps 802.11n: MCS0 – MCS7, HT20 5GHz: 802.11a: 6, 9, 12, 18, 24, 36, 48, 54Mbps 802.11n: MCS0 – MCS7, HT20/40 802.11ac: MCS0 – MCS9, VHT20/40/80
Antenna Type	PIFA Antenna
Antenna Gain	For BT: 2400-2500MHz: 1.11dBi For WLAN: 2400-2500MHz: 1.11dBi 5150-5250MHz: 3.20dBi 5250-5350MHz: 3.20dBi 5470-5725MHz: 2.47dBi 5725-5850MHz: 2.69dBi
Adapter	Brand: APD Model: WA-36N12R
Battery	Brand: VIC-DAWN ENTERPRISE CO LTD Model: CR2032
Firmware Number	NS03_Series_STD_1.0.7_20220503
Serial Number	NS03000201M14F00008

Note:

1. EUT support TPC Function.
2. EUT support Client Mode without radar detection.
3. For more details, please refer to the User's manual of the EUT.



2.2 Carrier Frequency of Channes

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
*00	2402	20	2422	40	2442	60	2462
01	2403	21	2423	41	2443	61	2463
02	2404	22	2424	42	2444	62	2464
03	2405	23	2425	43	2445	63	2465
04	2406	24	2426	44	2446	64	2466
05	2407	25	2427	45	2447	65	2467
06	2408	26	2428	46	2448	66	2468
07	2409	27	2429	47	2449	67	2469
08	2410	28	2430	48	2450	68	2470
09	2411	29	2431	49	2451	69	2471
10	2412	30	2432	50	2452	70	2472
11	2413	31	2433	51	2453	71	2473
12	2414	32	2434	52	2454	72	2474
13	2415	33	2435	53	2455	73	2475
14	2416	34	2436	54	2456	74	2476
15	2417	35	2437	55	2457	75	2477
16	2418	36	2438	56	2458	76	2478
17	2419	37	2439	57	2459	77	2479
18	2420	38	2440	58	2460	*78	2480
19	2421	*39	2441	59	2461	---	---

Note: Channels remarked * are selected to perform test.



2.3 Test Mode & Test Software

- During testing, the interface cables and equipment positions were varied according to ANSI C63.10
- The complete test system included Notebook and EUT for RF test.
- An executive program, " Ampak RFTTestTool ver.7.0" under Android system was executed to transmit and receive data via Bluetooth.
- The following test modes were performed for the test:

Conducted Emissions from the AC mains power ports	
Test Mode	Operating Description
1	GFSK (1Mbps) , From Adapter (120V/60 Hz)
2	$\pi/4$ -DQPSK (2Mbps) , From Adapter (120V/60 Hz)
3	8DPSK (3Mbps) , From Adapter (120V/60 Hz)
4	GFSK (1Mbps) , From Adapter (240V/60 Hz)
5	$\pi/4$ -DQPSK (2Mbps) , From Adapter (240V/60 Hz)
6	8DPSK (3Mbps) , From Adapter (240V/60 Hz)
caused "Test Mode 1" generated the worst case, it was reported as the final data.	
Radiation Emissions (BELOW1G)	
Test Mode	Operating Description
1	GFSK (1Mbps) , From Adapter (120V/60 Hz)
2	$\pi/4$ -DQPSK (2Mbps) , From Adapter (120V/60 Hz)
3	8DPSK (3Mbps) , From Adapter (120V/60 Hz)
4	GFSK (1Mbps) , From Adapter (240V/60 Hz)
5	$\pi/4$ -DQPSK (2Mbps) , From Adapter (240V/60 Hz)
6	8DPSK (3Mbps) , From Adapter (240V/60 Hz)
caused "Test Mode 4" generated the worst case, it was reported as the final data.	
Radiation Emissions (ABOVE1G)	
Test Mode	Operating Description
1	GFSK (1Mbps) , From Adapter (120V/60 Hz)
2	$\pi/4$ -DQPSK (2Mbps) , From Adapter (120V/60 Hz)
3	8DPSK (3Mbps) , From Adapter (120V/60 Hz)
4	GFSK (1Mbps) , From Adapter (240V/60 Hz)
5	$\pi/4$ -DQPSK (2Mbps) , From Adapter (240V/60 Hz)
6	8DPSK (3Mbps) , From Adapter (240V/60 Hz)
caused "Test Mode 1, 3" generated the worst case, they were reported as the final data.	

Modulation Type	TX CONFIGURATION
GFSK	1TX
$\pi/4$ -DQPSK	1TX
8DPSK	1TX



2.4 Description of Test System

RF Conducted				
Equipment	Brand	Model	Length/Type	Power cord/Length/Type
Notebook	lenovo	S1GL2W	N/A	N/A
USB Cable (A to A)	BENEVO	E210567AWM	1m / NS	N/A
HDMI Cable	YD-TECH	H1	1.8m / S	N/A
Monitor	ViewSonic	VS16024	NA	N/A
Radiated Emissions(ABOVE1G)				
Equipment	Brand	Model	Length/Type	Power cord/Length/Type
Notebook	ASUS	P2430U	N/A	Adapter / 1.8m / NS
USB Cable (A to A)	BENEVO	E210567AWM	1m / NS	N/A
HDMI Cable*2	YD-TECH	H2	1.8m / S	N/A
Monitor	ViewSonic	VS16024	NA	N/A
Transcend Dongle*2	TranScend	USB3.0 16GB	N/A	N/A
RJ45 Cable	TE CONNECTIVITY	CAT5E	1.2m / NS	N/A
Mouse	DELL	MS116t1	2m / NS	N/A
Earphone	Apple	Earpods	1.2m / NS	N/A
Radiated Emissions(BELOW1G)				
Equipment	Brand	Model	Length/Type	Power cord/Length/Type
Notebook	ASUS	P2430U	N/A	Adapter / 1.8m / NS
USB Cable (A to A)	BENEVO	E210567AWM	N/A	N/A
HDMI Cable*2	YD-TECH	H2	1.8m / S	N/A
Monitor	ViewSonic	VS16024	NA	N/A
RJ45 Cable	TE CONNECTIVITY	CAT5E	1.2m / NS	N/A
Transcend Dongle*2	TranScend	USB3.0 16GB	1.8m / NS	N/A
Mouse	DELL	MS116t	1.8m / NS	N/A
Mobile Phone	MI	M1906G7G	N/A	N/A
Earphone	Apple	Earpods	1.2m / NS	N/A



AC Power Line Conducted Emission				
Equipment	Brand	Model	Length/Type	Power cord/Length/Type
Notebook	ASUS	P2430U	N/A	Adapter / 1.8m / NS
USB Cable (A to A)	BENEVO	E210567AWM	1m / NS	N/A
HDMI Cable*2	YD-TECH	H2	1.8m / S	N/A
Monitor	DELL	U2410f	NA	N/A
Transcend Dongle*2	TranScend	USB3.0 16GB	N/A	N/A
RJ45 Cable	TE CONNECTIVITY	CAT5E	1.2m / NS	N/A
Mouse	DELL	MS116t1	2m / NS	N/A
Earphone	Apple	Earpods	1.2m / NS	N/A
Mobile Phone	MI	M1906G7G	N/A	N/A



2.5 General Information of Test

Test Site	Cerpass 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	Test period	Environmental Conditions	Tested By
RF Conducted	RFCON01-NK	2022/06/06	28°C / 40%	Dian Chen
Radiated Emissions	3M02-NK	2022/06/05~2022/6/08	20~25°C / 44~55%	Dian Chen
AC Power Line Conducted Emission	CON01-NK	2022/06/21	25°C / 42%	Dian Chen



2.6 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor ($k=2$))

Measurement Item	Uncertainty
AC Power Line Conduction(150K~30MHz)	$\pm 3.12\text{dB}$
Radiated Spurious Emission(9KHz~30MHz)	$\pm 3.4\text{dB}$
Radiated Spurious Emission(30MHz~1GHz)	$\pm 5.7\text{dB}$
Radiated Spurious Emission(1GHz~25GHz)	$\pm 6.8\text{dB}$
Conducted Spurious Emission	$\pm 1.8\text{dB}$
6dB Bandwidth	$\pm 4.4\%$
20dB Bandwidth	$\pm 4.4\%$
Occupied Bandwidth	$\pm 4.4\%$
Peak Output Power(Conducted Power Meter)	$\pm 1.1\text{dB}$
Dwell Time / Deactivation Time	$\pm 1.2\%$
Power Spectral Density	$\pm 1.8\text{dB}$
Duty Cycle	$\pm 1.2\%$



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	2021/11/05	2022/11/04
Horn Antenna	EMCO	3115	31601	2021/10/14	2022/10/13
Horn Antenna	EMCO	3116	31974	2021/10/04	2022/10/03
Active Loop Antenna	Schwarzbeck	FMZB 1513	414	2022/01/07	2023/01/06
EMI Receiver	ROHDE & SCHWARZ	ESCI	100821	2021/11/16	2022/11/15
Spectrum Analyzer	ROHDE & SCHWARZ	FSV 40-N	102151	2021/08/06	2022/08/05
Preamplifier	Agilent	8449B	3008A01954	2022/03/17	2023/03/16
Preamplifier	EMC INSTRUMENTS	EMC184045	980065	2021/11/16	2022/11/15
Preamplifier	EM Electronics corp.	EM330	60658	2021/10/13	2022/10/12
Cable-6m(9k~300M)	NA	EMC5D-BM-BM-6	130605	2021/09/22	2022/09/21
Cable-3in1(30M-1G)	HARBOUR INDUSTRIES	LL142	CCE1315	2022/03/21	2023/03/20
Cable-0.5m(1G-40G)	HUBER SUHNER	SUCOFLEX 102	MY4569/2	2021/09/03	2022/09/02
Cable-1m(1G-40G)	HUBER SUHNER	SUCOFLEX 102	MY5739/2	2021/09/03	2022/09/02
Cable-6m(1G-40G)	HUBER SUHNER	SUCOFLEX 102	MY5740/2	2021/09/03	2022/09/02
Cable-0.5m(1G-40G)	HUBER SUHNER	SUCOFLEX 104	805443/4	2022/01/11	2023/01/10
Cable-3m(1G-40G)	HUBER SUHNER	SUCOFLEX 104	805796/4	2022/01/11	2023/01/10
Cable-8m(1G-26.5G)	WOKEN	WCBA-WCA203SM	CCE1374	2022/04/25	2023/04/24
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	2022/03/04	2023/03/03
Attenuator	KEYSIGHT	8491B	MY39250703	2022/04/12	2023/04/11
Cable-0.5m(1G-26.5G)	HUBER SUHNER	SUCOFLEX 102	28422/2	2022/04/09	2023/04/08
Power Meter	Anritsu	ML2495A	1224005	2022/04/12	2023/04/11
Power Sensor	Anritsu	MA2411B	1207295	2022/04/12	2023/04/11
Switch Box	Theda	1-4	TW5451159	NA	NA
MXG-B RF Vector Signal Generator	KEYSIGHT	N5182B	MY53051383	2021/06/30	2022/06/29



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	101200	2021/08/30	2022/08/29
Line Impedance Stabilization Network	Schwarzbeck	NSLK 8127	8127-516	2021/10/05	2022/10/04
Pulse Limiter	ROHDE & SCHWARZ	ESH3-Z2	101933	2021/09/15	2022/09/14
Cable-6m(9k~300M)	NA	EMC5D-BM-BM-6	130605	2021/09/22	2022/09/21
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	1.11dBi



5. Frequency Hopping System Requirements

5.1 Frequency Hopping Requirement

According to FCC Part 15.247(a)(1), The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

(g) Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

(h) The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.



5.2 EUT Hopping System

This transmitter device is frequency hopping device, and complies with FCC part 15.247 rule.

This device uses Bluetooth radio which operates in 2400-2483.5 MHz band. Bluetooth uses a radio technology called frequency-hopping spread spectrum, which chops up the data being sent and transmits chunks of it on up to 79 bands (1 MHz each; centred from 2402 to 2480MHz) in the range 2,400-2,483.5 MHz. The transmitter switches hop frequencies 1,600 times per second to assure a high degree of data security. All Bluetooth devices participating in a given piconet are synchronized to the frequency-hopping channel for the piconet. The frequency hopping sequence is determined by the master's device address and the phase of the hopping sequence (the frequency to hop at a specific time) is determined by the master's internal clock. Therefore, all slaves in a piconet must know the master's device address and must synchronize their clocks with the master's clock.

Adaptive Frequency Hopping (AFH) was introduced in the Bluetooth specification to provide an effective way for a Bluetooth radio to counteract normal interference. AFH identifies "bad" channels, where either other wireless devices are interfering with the Bluetooth signal or the Bluetooth signal is interfering with another device. The AFH-enabled Bluetooth device will then communicate with other devices within its piconet to share details of any identified bad channels. The devices will then switch to alternative available "good" channels, away from the areas of interference, thus having no impact on the bandwidth used.

5.3 Pseudorandom Frequency Hopping Sequence

Pseudorandom Frequency Hopping Sequence Table as below:

Channel number:

32	26	2	41	78	35	62	49	64	74
47	26	8	29	63	61	41	63	29	49
34	11	11	6	46	17	59	16	59	13
0	70	64	70	63	70	34	7	70	37

The system receiver have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.



6. Test of AC Power Line Conducted Emission

6.1 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 C63.10-2013. 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

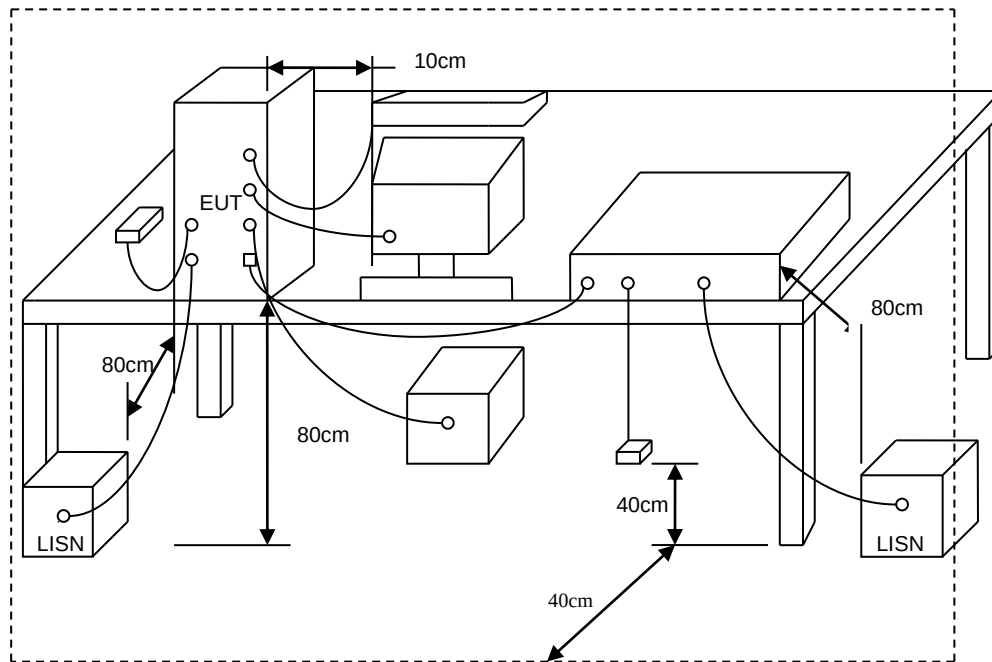
*Decreases with the logarithm of the frequency.

6.2 Test Procedures

- 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.
- Connect EUT to the power mains through a line impedance stabilization network (LISN).
- All the support units are connecting to the other LISN.
- The LISN provides 50 ohm coupling impedance for the measuring instrument.
- The FCC states that a 50 ohm, 50 micro-Henry LISN should be used.
- Both sides of AC line were checked for maximum conducted interference.
- The frequency range from 150 kHz to 30 MHz was searched.
- Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.



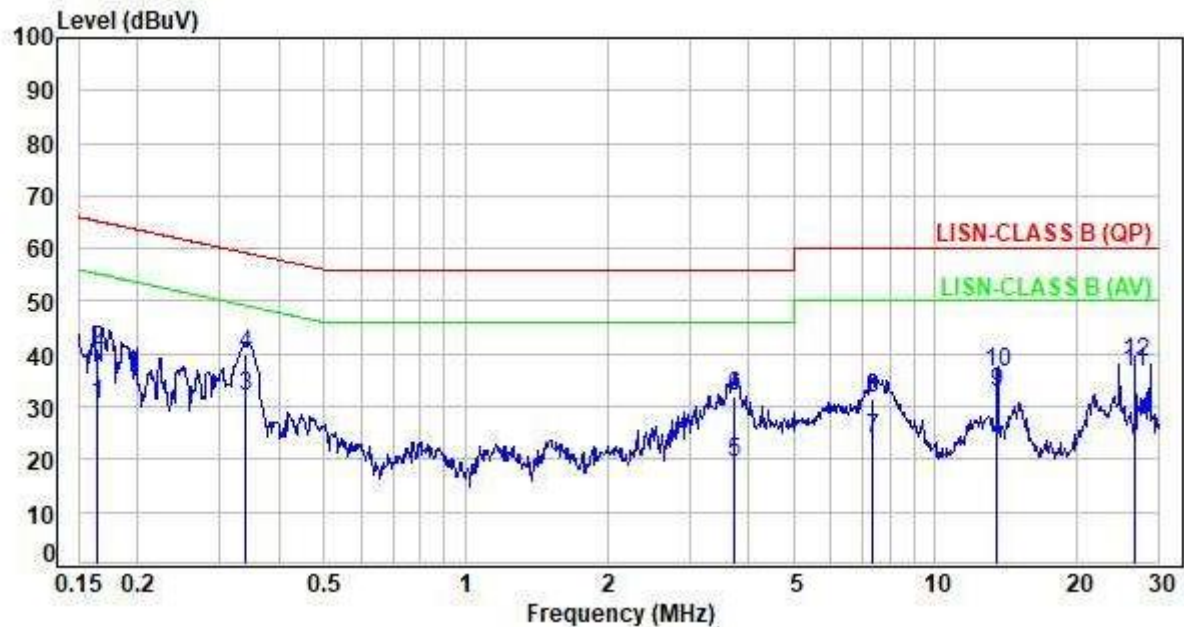
6.3 Typical Test Setup





6.4 Test Result and Data

Power	:	DC 12V From Adapter (AC 120V / 60Hz)	Pol/Phase	:	LINE
Test Mode	:	Mode 1		:	



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F
1	0.16	9.96	20.44	30.40	55.22	-24.82	Average	P
2	0.16	9.96	30.60	40.56	65.22	-24.66	QP	P
3	0.34	9.95	21.84	31.79	49.23	-17.44	Average	P
4	0.34	9.95	30.09	40.04	59.23	-19.19	QP	P
5	3.75	10.20	9.03	19.23	46.00	-26.77	Average	P
6	3.75	10.20	21.90	32.10	56.00	-23.90	QP	P
7	7.34	10.37	13.75	24.12	50.00	-25.88	Average	P
8	7.34	10.37	21.10	31.47	60.00	-28.53	QP	P
9	13.56	10.57	21.97	32.54	50.00	-17.46	Average	P
10	13.56	10.57	26.08	36.65	60.00	-23.35	QP	P
11	26.62	10.90	25.79	36.69	50.00	-13.31	Average	P
12	26.62	10.90	27.43	38.33	60.00	-21.67	QP	P

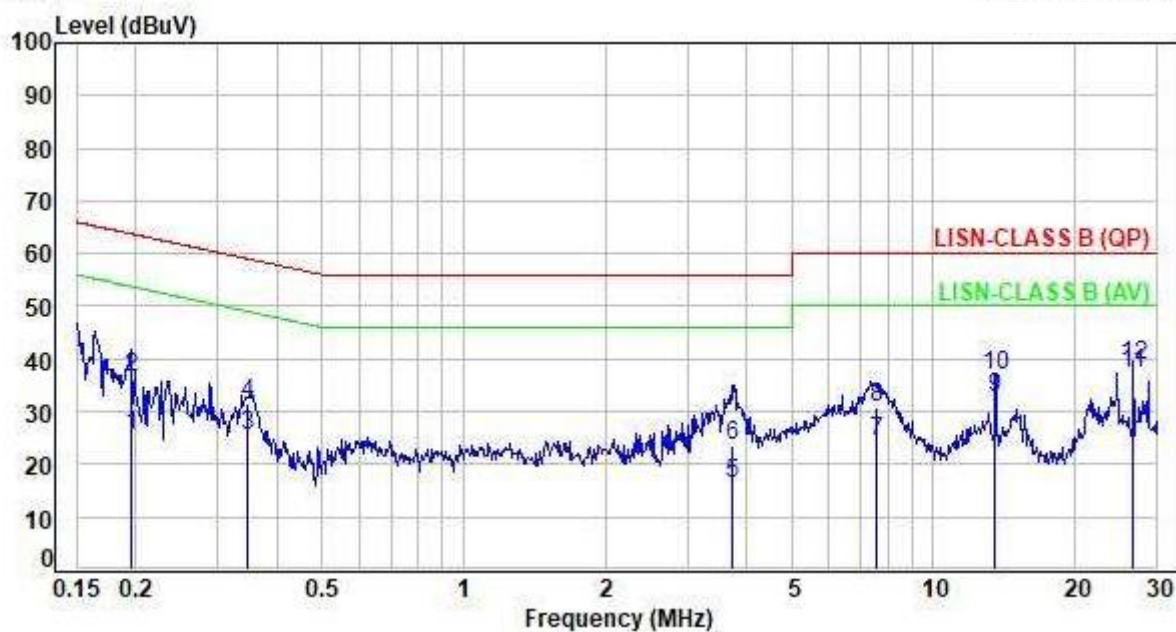
Note: Level=Reading+Factor

Margin=Level-Limit

Factor=(LISN or ISN or Current Probe)Factor + Cable Loss



Power	: DC 12V From Adapter (AC 120V / 60Hz)	Pol/Phase	: NEUTRAL
Test Mode	: Mode 1		:



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F
1	0.20	9.93	15.36	25.29	53.78	-28.49	Average	P
2	0.20	9.93	26.56	36.49	63.78	-27.29	QP	P
3	0.35	9.93	15.55	25.48	49.04	-23.56	Average	P
4	0.35	9.93	21.46	31.39	59.04	-27.65	QP	P
5	3.73	10.12	6.11	16.23	46.00	-29.77	Average	P
6	3.73	10.12	13.58	23.70	56.00	-32.30	QP	P
7	7.54	10.27	14.02	24.29	50.00	-25.71	Average	P
8	7.54	10.27	20.60	30.87	60.00	-29.13	QP	P
9	13.56	10.46	22.28	32.74	50.00	-17.26	Average	P
10	13.56	10.46	26.42	36.88	60.00	-23.12	QP	P
11	26.62	10.81	26.34	37.15	50.00	-12.85	Average	P
12	26.62	10.81	27.98	38.79	60.00	-21.21	QP	P

Note: Level=Reading+Factor

Margin=Level-Limit

Factor=(LISN or ISN or Current Probe)Factor + Cable Loss



7. Test of Radiated Spurious Emission

7.1 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



7.2 Test Procedures

- a. The EUT was placed on a rotatable table top 0.8 meter above ground.
- b. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
- c. The table was rotated 360 degrees to determine the position of the highest radiation.
- d. 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.
- e. 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.
- f. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function and specified bandwidth with Maximum Hold Mode.
- g. 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.
- h. 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.
- i. "Cone of radiation" has been considered to be 3dB bandwidth of the measurement antenna.

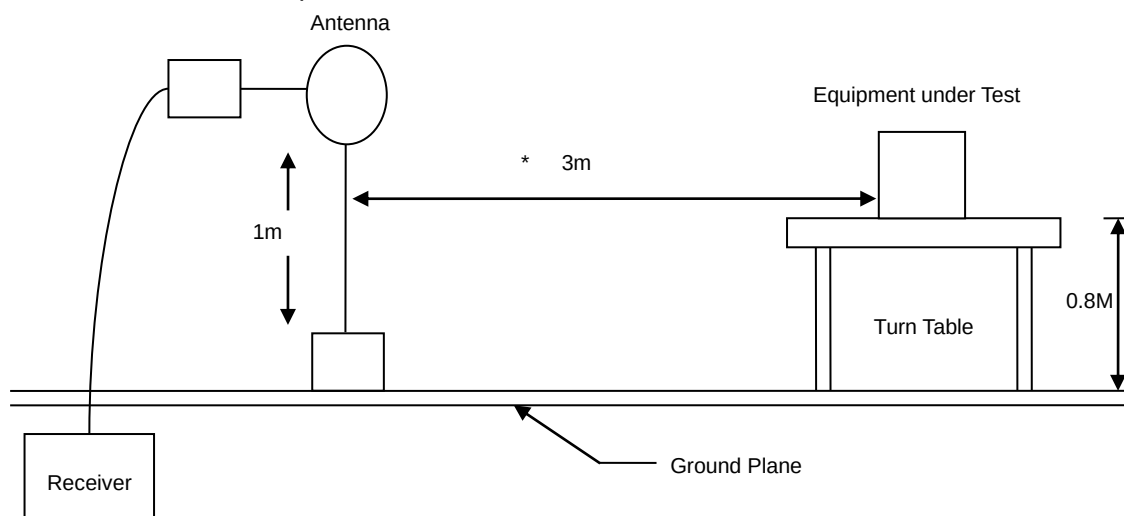
Note:

- 1.The supporting fixture shall permit orientation of the EUT in each of three orthogonal axis positions such that emissions from the EUT are maximized.
- 2.Due to the test software function limit the operation band setting(200dBuV/m).
There's no corresponding limitation in the actual test item.

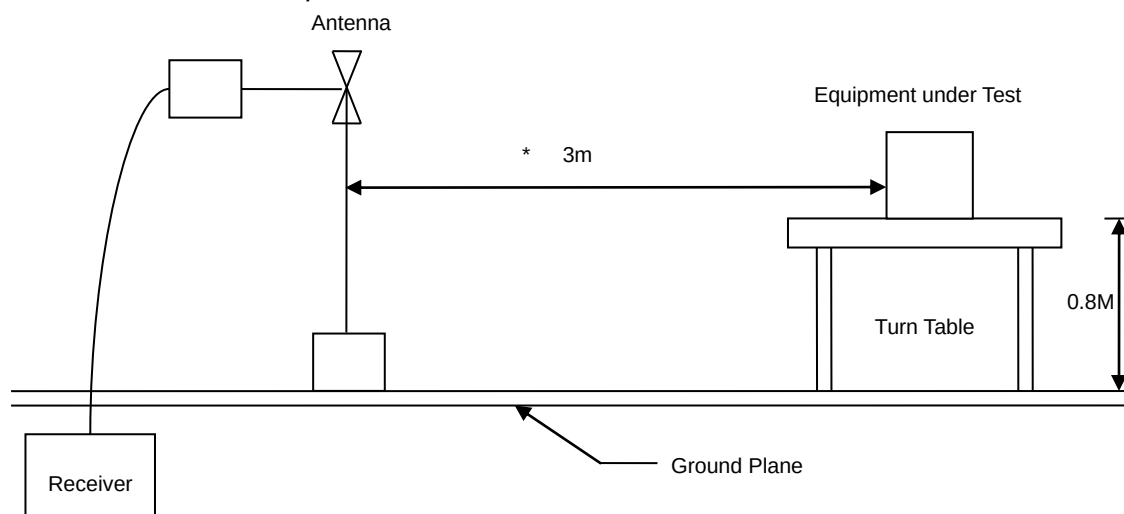


7.3 Typical Test Setup

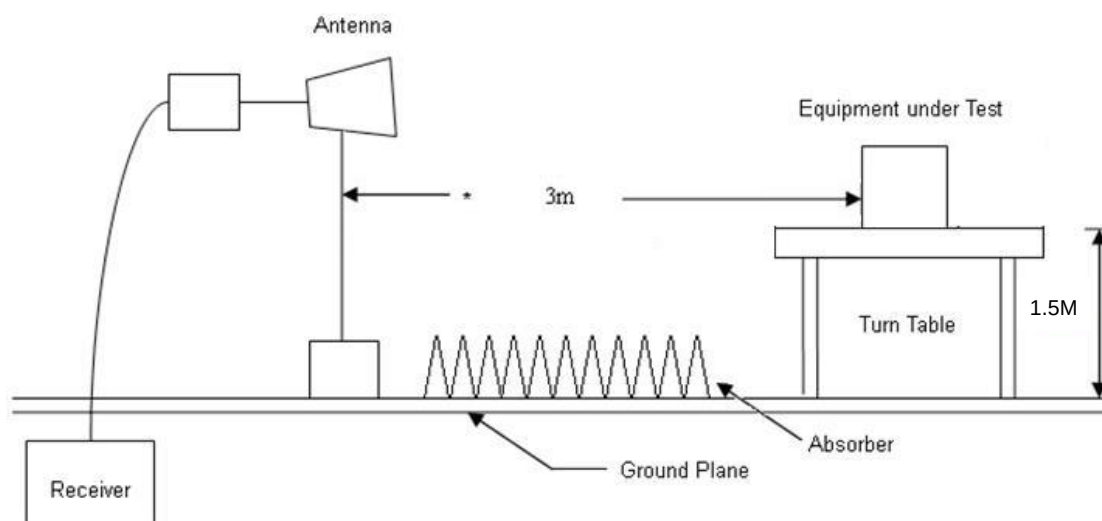
Below 30MHz test setup



30MHz- 1GHz Test Setup



Above 1GHz Test Setup



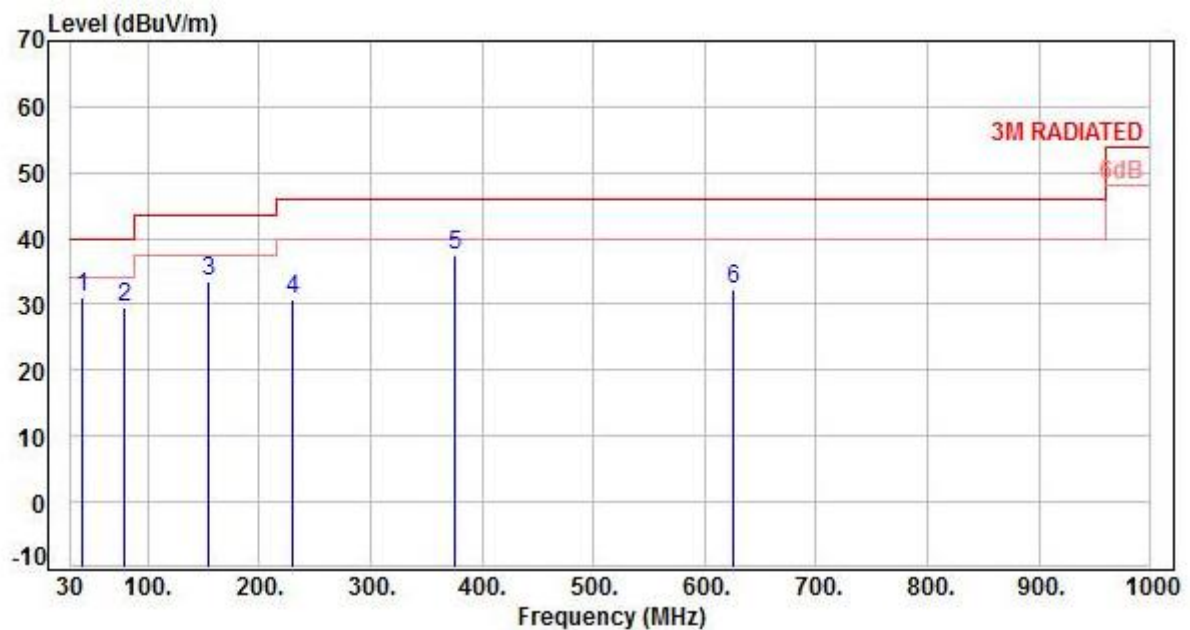


7.4 Test Result and Data (9kHz ~ 30MHz)

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

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

Power	:	DC 12V From Adapter (AC 240V / 60Hz)	Pol/Phase	:	VERTICAL
Test Mode	:	Mode 4		:	



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	41.64	-11.66	42.76	31.10	40.00	-8.90	Peak	400	360	P
2	78.50	-15.54	45.13	29.59	40.00	-10.41	Peak	400	360	P
3	154.16	-11.34	44.97	33.63	43.50	-9.87	Peak	400	360	P
4	229.82	-13.96	44.59	30.63	46.00	-15.37	Peak	400	360	P
5	375.32	-8.25	45.68	37.43	46.00	-8.57	Peak	400	360	P
6	625.58	-2.29	34.56	32.27	46.00	-13.73	Peak	400	360	P

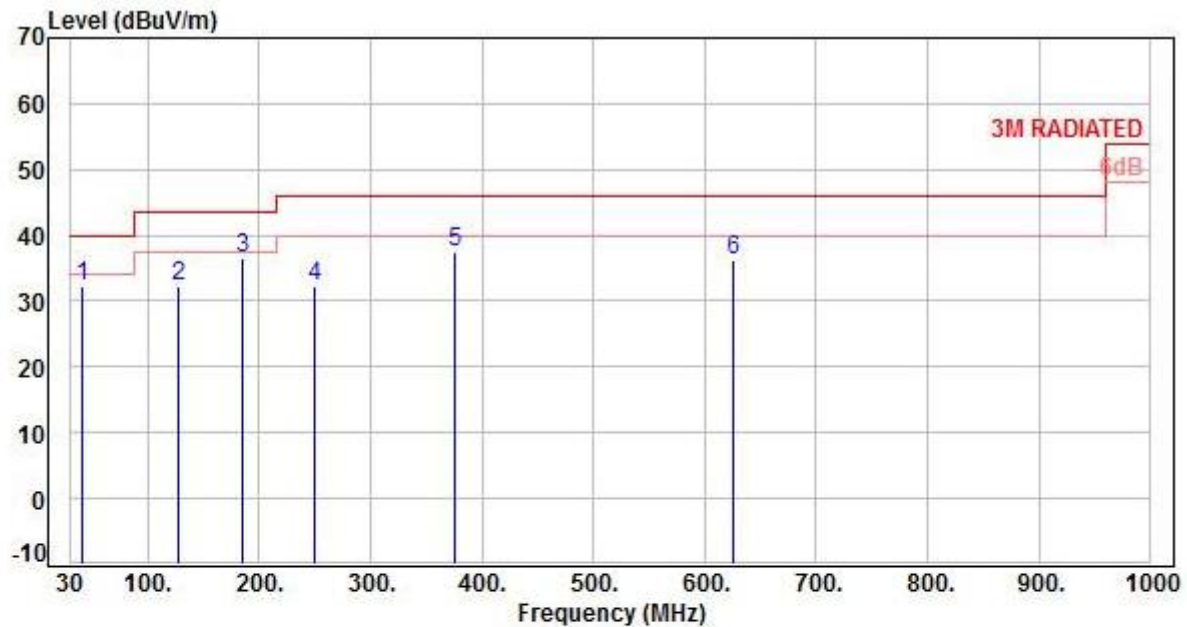
Note: Level=Reading+Factor

Margin=Level-Limit

Factor=Antenna Factor + cable loss - Amplifier Factor



Power	:	DC 12V From Adapter (AC 240V / 60Hz)	Pol/Phase	:	HORIZONTAL
Test Mode	:	Mode 4		:	



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	41.64	-11.66	43.88	32.22	40.00	-7.78	Peak	400	360	P
2	127.00	-13.22	45.63	32.41	43.50	-11.09	Peak	400	360	P
3	185.20	-13.22	49.86	36.64	43.50	-6.86	Peak	400	360	P
4	249.22	-12.08	44.46	32.38	46.00	-13.62	Peak	400	360	P
5	375.32	-8.25	45.69	37.44	46.00	-8.56	Peak	400	360	P
6	625.58	-2.29	38.40	36.11	46.00	-9.89	Peak	400	360	P

Note: Level=Reading+Factor

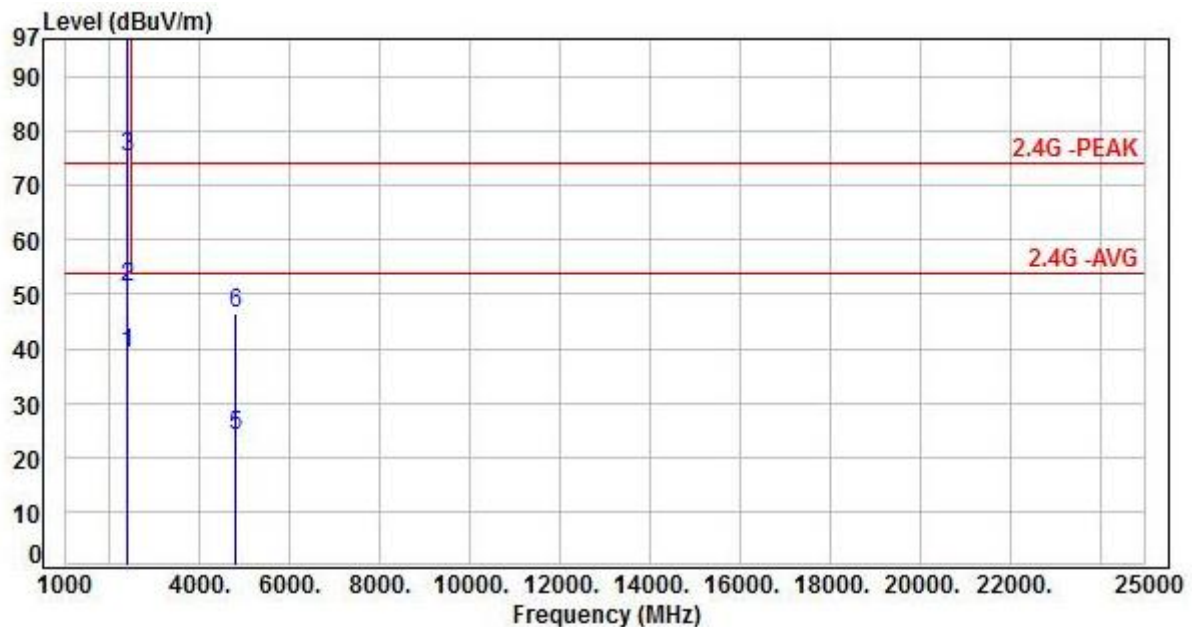
Margin=Level-Limit

Factor=Antenna Factor + cable loss - Amplifier Factor



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

Power	:	DC 12V From Adapter (AC 120V / 60Hz)	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	2390.00	-2.64	41.69	39.05	54.00	-14.95	Average	100	15	P
2	2390.00	-2.64	53.84	51.20	74.00	-22.80	Peak	100	15	P
3	2402.00	-2.61	77.69	75.08	200.00	-124.92	Average	100	15	P
4	2402.00	-2.61	100.19	97.58	200.00	-102.42	Peak	100	15	P
5	4804.00	4.96	18.93	23.89	54.00	-30.11	Average	100	264	P
6	4804.00	4.96	41.43	46.39	74.00	-27.61	Peak	100	264	P

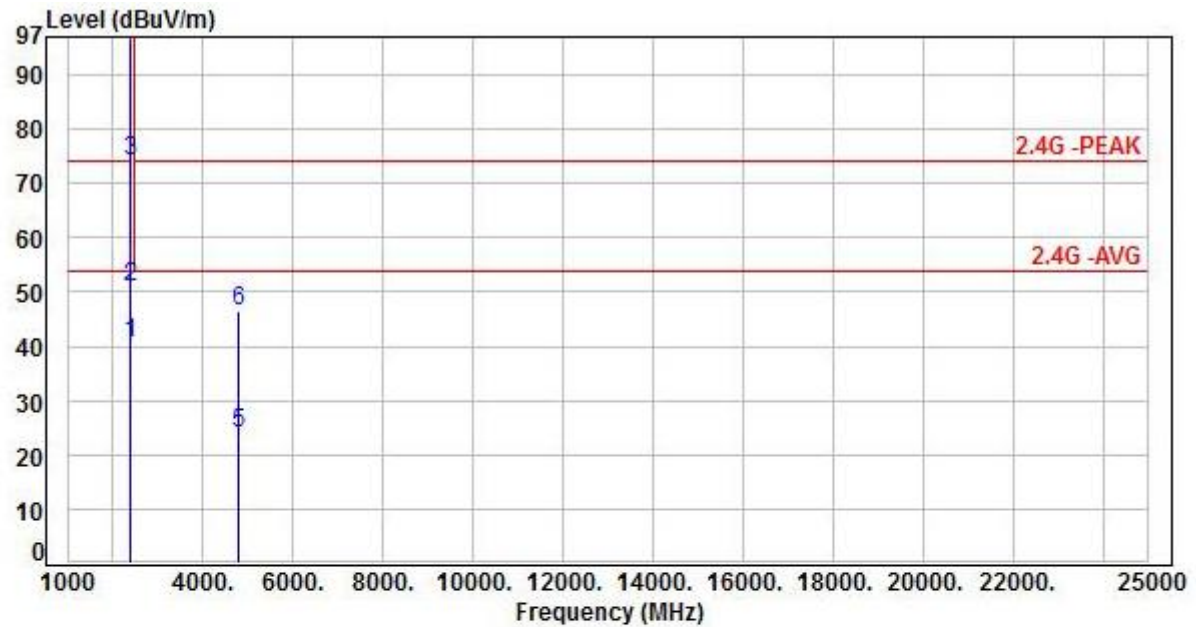
Note: Level=Reading+Factor

Margin=Level-Limit

Factor=Antenna Factor + cable loss - Amplifier Factor



Power	:	DC 12V From Adapter (AC 120V / 60Hz)	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	2390.00	-2.64	43.12	40.48	54.00	-13.52	Average	171	36	P
2	2390.00	-2.64	53.57	50.93	74.00	-23.07	Peak	171	36	P
3	2402.00	-2.61	76.68	74.07	200.00	-125.93	Average	171	36	P
4	2402.00	-2.61	99.18	96.57	200.00	-103.43	Peak	171	36	P
5	4804.00	4.96	18.84	23.80	54.00	-30.20	Average	100	81	P
6	4804.00	4.96	41.34	46.30	74.00	-27.70	Peak	100	81	P

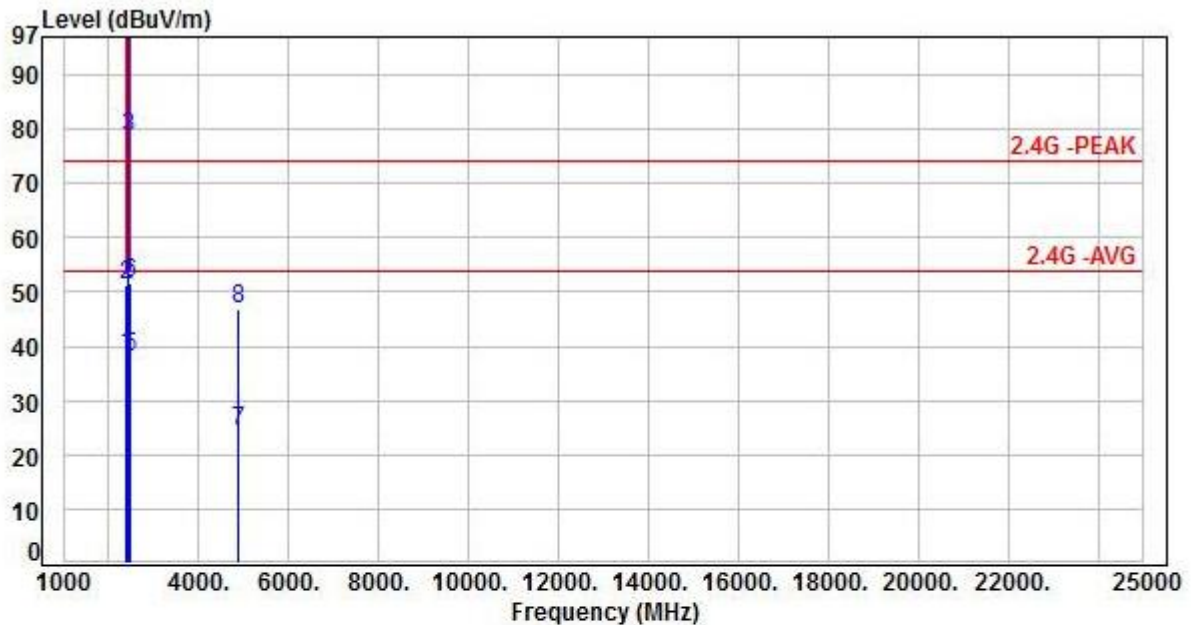
Note: Level=Reading+Factor

Margin=Level-Limit

Factor=Antenna Factor + cable loss - Amplifier Factor



Power	:	DC 12V From Adapter (AC 120V / 60Hz)	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	2390.00	-2.64	40.86	38.22	54.00	-15.78	Average	105	12	P
2	2390.00	-2.64	53.87	51.23	74.00	-22.77	Peak	105	12	P
3	2441.00	-2.56	80.96	78.40	200.00	-121.60	Average	105	12	P
4	2441.00	-2.56	103.46	100.90	200.00	-99.10	Peak	105	12	P
5	2483.50	-2.39	40.40	38.01	54.00	-15.99	Average	105	12	P
6	2483.50	-2.39	54.12	51.73	74.00	-22.27	Peak	105	12	P
7	4882.00	5.21	19.22	24.43	54.00	-29.57	Average	100	266	P
8	4882.00	5.21	41.72	46.93	74.00	-27.07	Peak	100	266	P

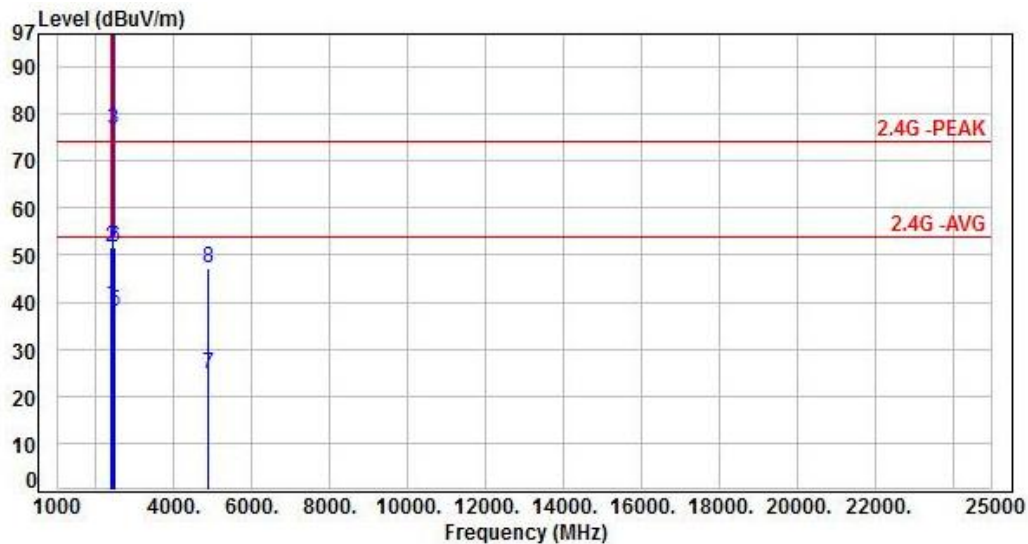
Note: Level=Reading+Factor

Margin=Level-Limit

Factor=Antenna Factor + cable loss - Amplifier Factor



Power	:	DC 12V From Adapter (AC 120V / 60Hz)	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	2390.00	-2.64	42.19	39.55	54.00	-14.45	Average	171	37	P
2	2390.00	-2.64	54.17	51.53	74.00	-22.47	Peak	171	37	P
3	2441.00	-2.56	79.30	76.74	200.00	-123.26	Average	171	37	P
4	2441.00	-2.56	101.80	99.24	200.00	-100.76	Peak	171	37	P
5	2483.50	-2.39	40.44	38.05	54.00	-15.95	Average	171	37	P
6	2483.50	-2.39	54.03	51.64	74.00	-22.36	Peak	171	37	P
7	4882.00	5.21	19.46	24.67	54.00	-29.33	Average	100	83	P
8	4882.00	5.21	41.96	47.17	74.00	-26.83	Peak	100	83	P

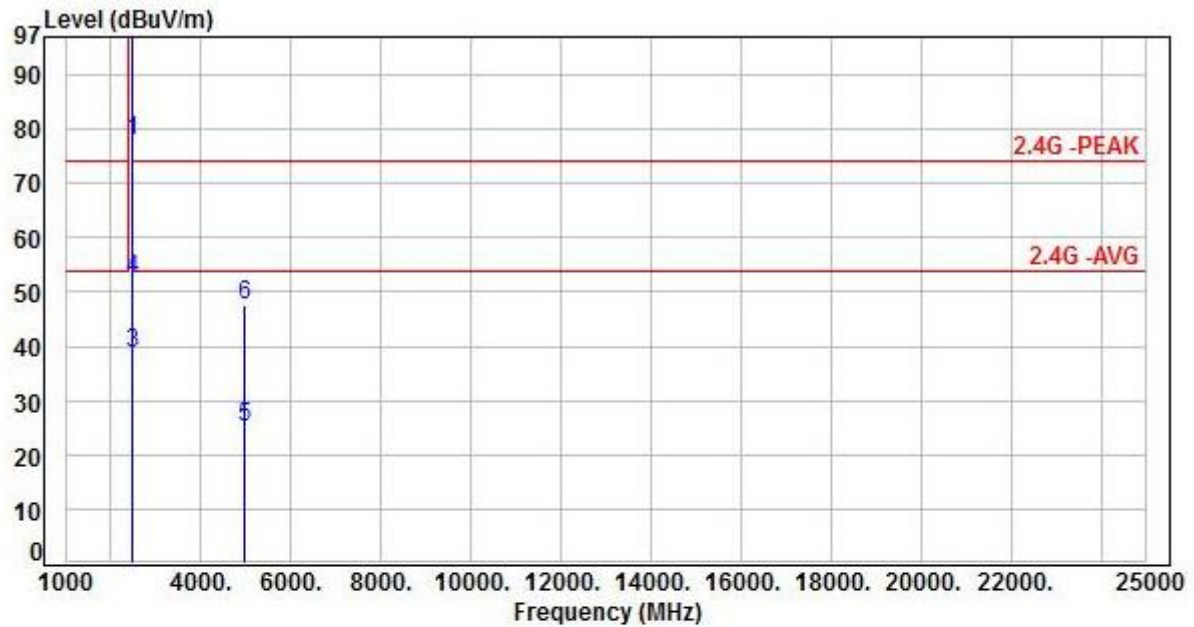
Note: Level=Reading+Factor

Margin=Level-Limit

Factor=Antenna Factor + cable loss - Amplifier Factor



Power	:	DC 12V From Adapter (AC 120V / 60Hz)	Pol/Phase	:	VERTICAL
Test Mode	:	Mode 1, CH78		:	



No.	Frequency (MHz)	Factor (dB)	Reading (dBUV)	Level (dBUV/m)	Limit (dBUV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	2480.00	-2.40	80.30	77.90	200.00	-122.10	Average	100	17	P
2	2480.00	-2.40	102.80	100.40	200.00	-99.60	Peak	100	17	P
3	2483.50	-2.39	41.02	38.63	54.00	-15.37	Average	100	17	P
4	2483.50	-2.39	54.76	52.37	74.00	-21.63	Peak	100	17	P
5	4960.00	5.54	19.48	25.02	54.00	-28.98	Average	100	261	P
6	4960.00	5.54	41.98	47.52	74.00	-26.48	Peak	100	261	P

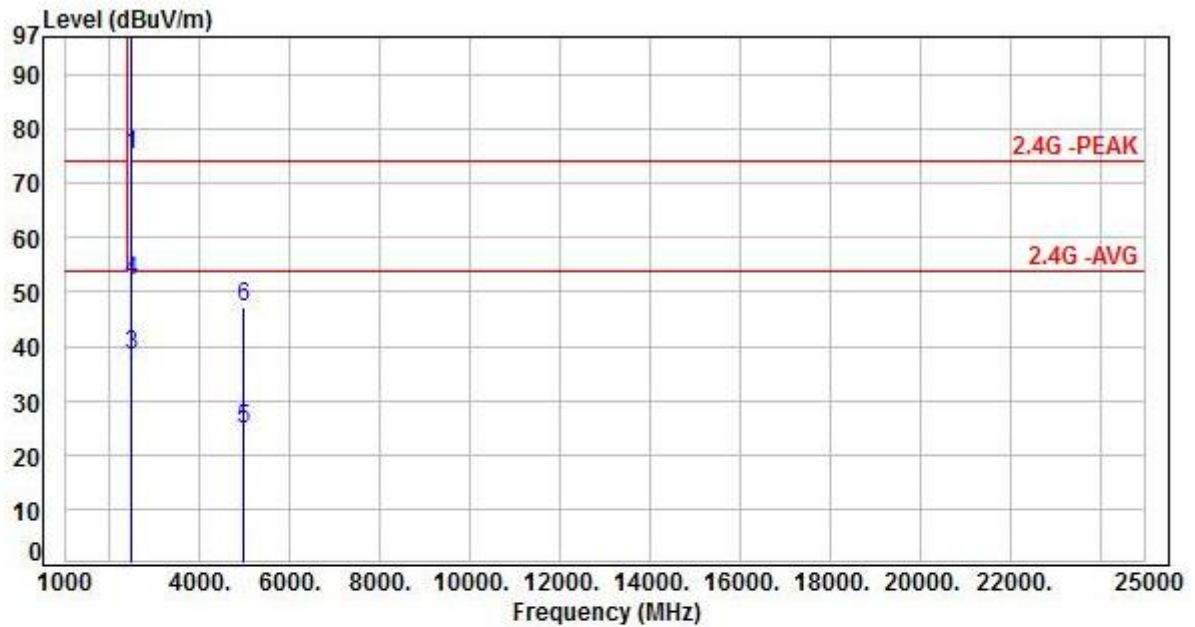
Note: Level=Reading+Factor

Margin=Level-Limit

Factor=Antenna Factor + cable loss - Amplifier Factor



Power	:	DC 12V From Adapter (AC 120V / 60Hz)	Pol/Phase	:	HORIZONTAL
Test Mode	:	Mode 1, CH78		:	



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	2480.00	-2.40	77.64	75.24	200.00	-124.76	Average	142	37	P
2	2480.00	-2.40	100.14	97.74	200.00	-102.26	Peak	142	37	P
3	2483.50	-2.39	40.65	38.26	54.00	-15.74	Average	142	37	P
4	2483.50	-2.39	54.22	51.83	74.00	-22.17	Peak	142	37	P
5	4960.00	5.54	19.10	24.64	54.00	-29.36	Average	100	82	P
6	4960.00	5.54	41.60	47.14	74.00	-26.86	Peak	100	82	P

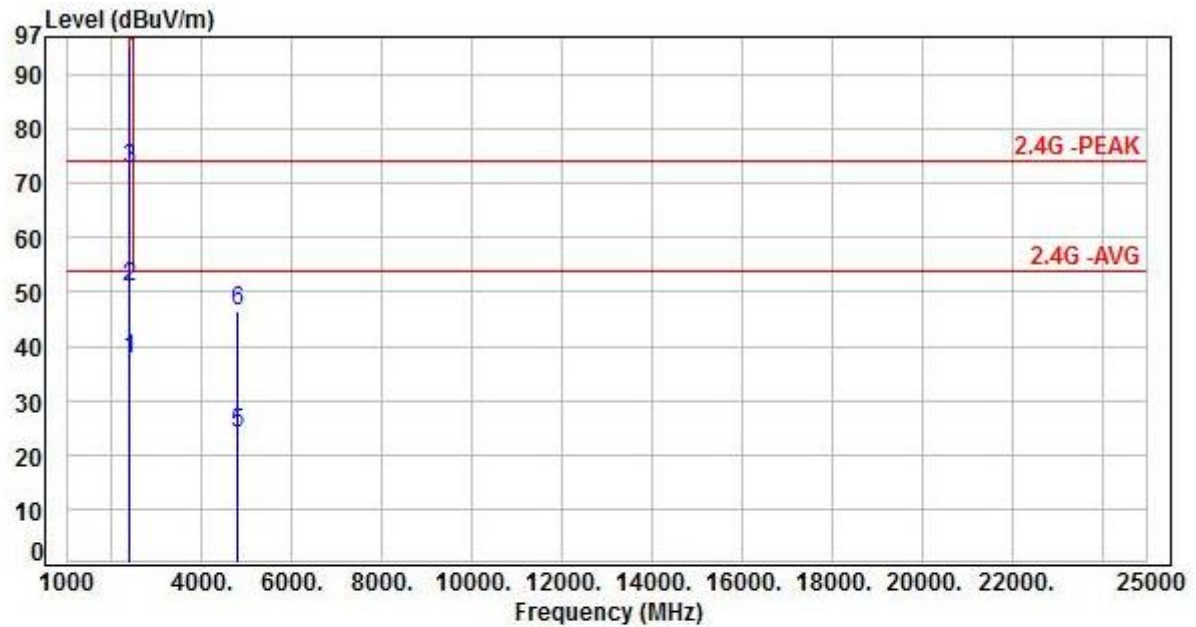
Note: Level=Reading+Factor

Margin=Level-Limit

Factor=Antenna Factor + cable loss - Amplifier Factor



Power	:	DC 12V From Adapter (AC 120V / 60Hz)	Pol/Phase	:	VERTICAL
Test Mode	:	Mode 3, CH00		:	



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	2390.00	-2.64	40.29	37.65	54.00	-16.35	Average	136	12	P
2	2390.00	-2.64	53.45	50.81	74.00	-23.19	Peak	136	12	P
3	2402.00	-2.61	75.25	72.64	200.00	-127.36	Average	136	12	P
4	2402.00	-2.61	97.75	95.14	200.00	-104.86	Peak	136	12	P
5	4804.00	4.96	18.87	23.83	54.00	-30.17	Average	100	265	P
6	4804.00	4.96	41.37	46.33	74.00	-27.67	Peak	100	265	P

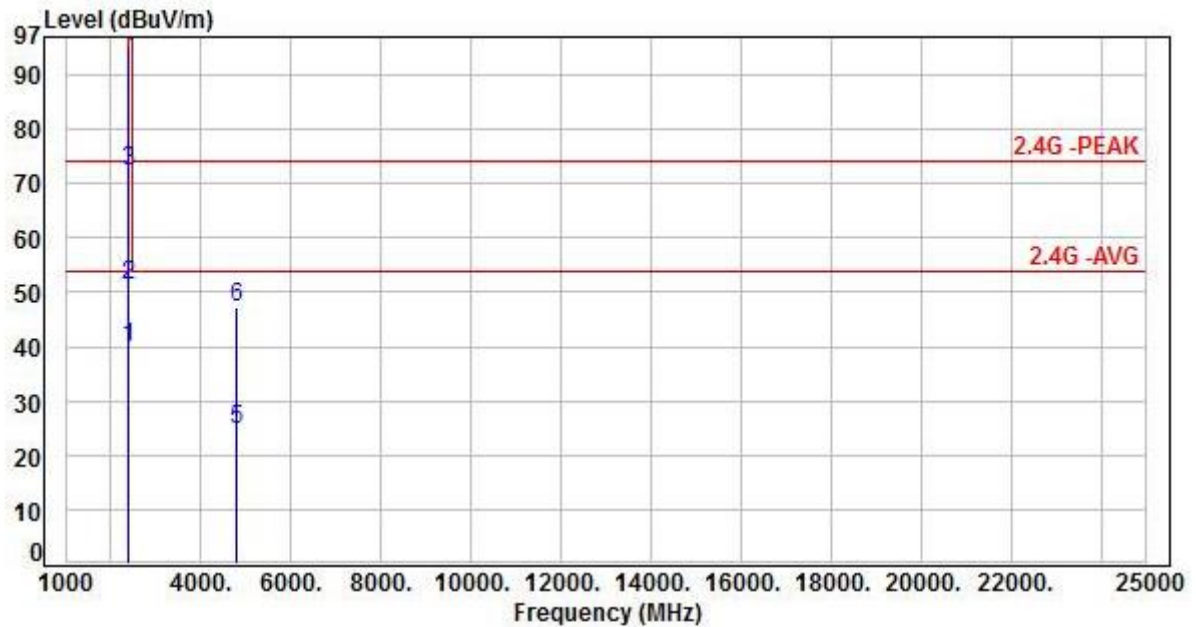
Note: Level=Reading+Factor

Margin=Level-Limit

Factor=Antenna Factor + cable loss - Amplifier Factor



Power	:	DC 12V From Adapter (AC 120V / 60Hz)	Pol/Phase	:	HORIZONTAL
Test Mode	:	Mode 3, CH00		:	



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	2390.00	-2.64	42.33	39.69	54.00	-14.31	Average	169	37	P
2	2390.00	-2.64	53.82	51.18	74.00	-22.82	Peak	169	37	P
3	2402.00	-2.61	75.08	72.47	200.00	-127.53	Average	169	37	P
4	2402.00	-2.61	97.58	94.97	200.00	-105.03	Peak	169	37	P
5	4804.00	4.96	19.66	24.62	54.00	-29.38	Average	100	80	P
6	4804.00	4.96	42.16	47.12	74.00	-26.88	Peak	100	80	P

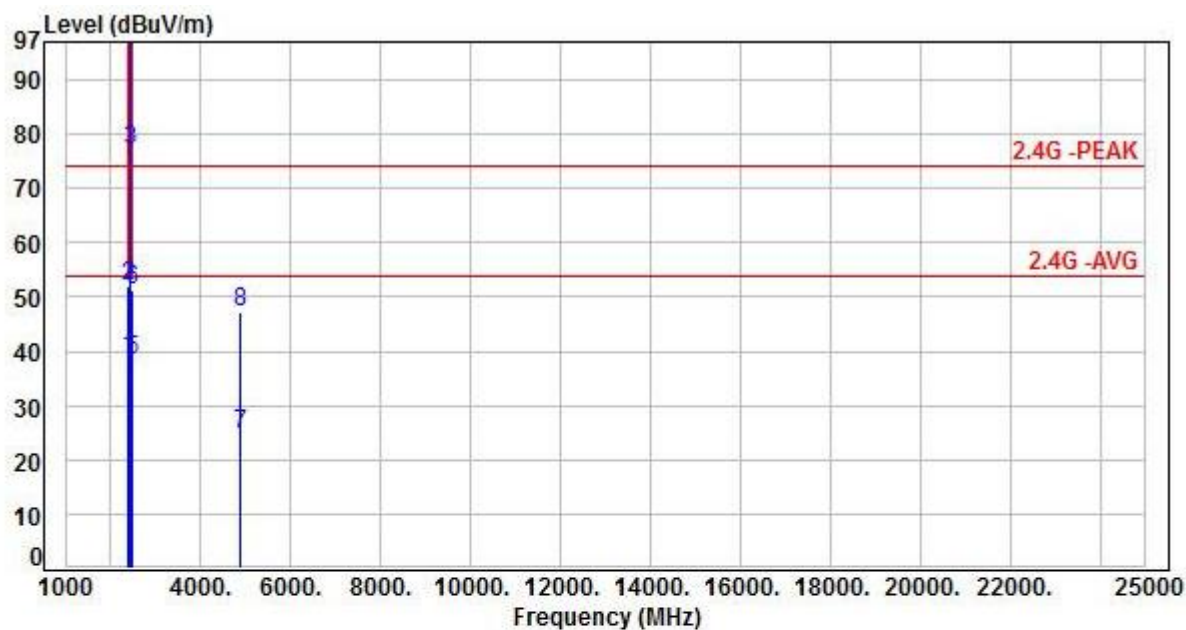
Note: Level=Reading+Factor

Margin=Level-Limit

Factor=Antenna Factor + cable loss - Amplifier Factor



Power	:	DC 12V From Adapter (AC 120V / 60Hz)	Pol/Phase	:	VERTICAL
Test Mode	:	Mode 3, CH39		:	



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	2390.00	-2.64	41.21	38.57	54.00	-15.43	Average	103	13	P
2	2390.00	-2.64	54.51	51.87	74.00	-22.13	Peak	103	13	P
3	2441.00	-2.56	79.57	77.01	200.00	-122.99	Average	103	13	P
4	2441.00	-2.56	102.07	99.51	200.00	-100.49	Peak	103	13	P
5	2483.50	-2.39	40.57	38.18	54.00	-15.82	Average	103	13	P
6	2483.50	-2.39	53.81	51.42	74.00	-22.58	Peak	103	13	P
7	4882.00	5.21	19.59	24.80	54.00	-29.20	Average	100	266	P
8	4882.00	5.21	42.09	47.30	74.00	-26.70	Peak	100	266	P

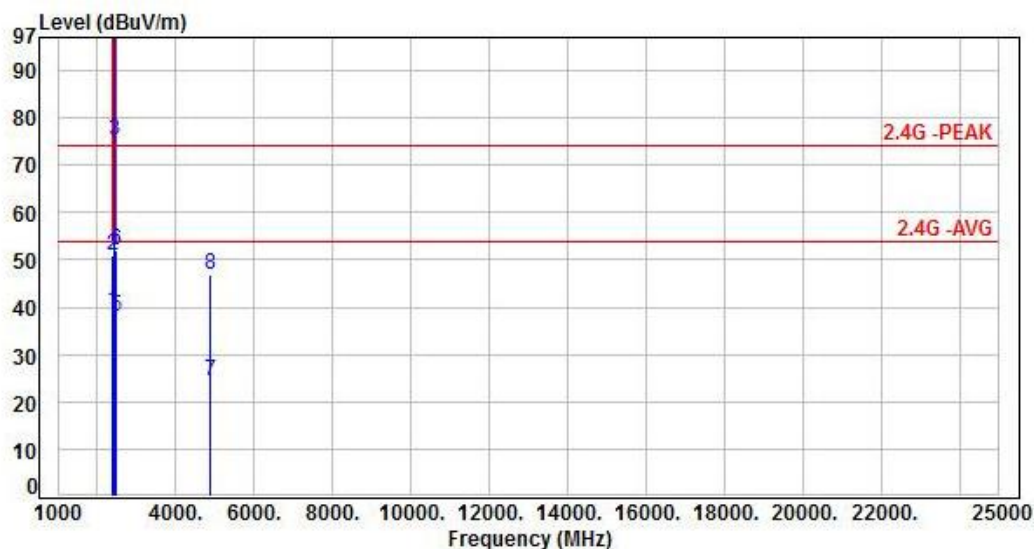
Note: Level=Reading+Factor

Margin=Level-Limit

Factor=Antenna Factor + cable loss - Amplifier Factor



Power	:	DC 12V From Adapter (AC 120V / 60Hz)	Pol/Phase	:	HORIZONTAL
Test Mode	:	Mode 3, CH39		:	



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	2390.00	-2.64	41.66	39.02	54.00	-14.98	Average	171	38	P
2	2390.00	-2.64	53.57	50.93	74.00	-23.07	Peak	171	38	P
3	2441.00	-2.56	77.86	75.30	200.00	-124.70	Average	171	38	P
4	2441.00	-2.56	100.36	97.80	200.00	-102.20	Peak	171	38	P
5	2483.50	-2.39	40.45	38.06	54.00	-15.94	Average	171	38	P
6	2483.50	-2.39	54.34	51.95	74.00	-22.05	Peak	171	38	P
7	4882.00	5.21	19.13	24.34	54.00	-29.66	Average	100	83	P
8	4882.00	5.21	41.63	46.84	74.00	-27.16	Peak	100	83	P

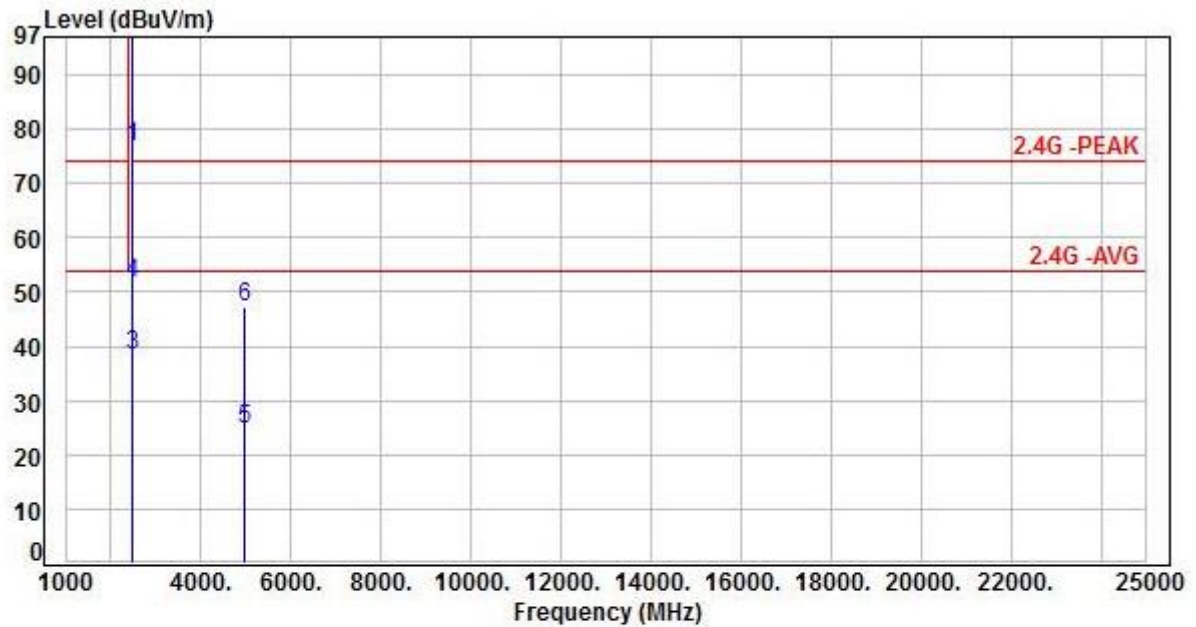
Note: Level=Reading+Factor

Margin=Level-Limit

Factor=Antenna Factor + cable loss - Amplifier Factor



Power	:	DC 12V From Adapter (AC 120V / 60Hz)	Pol/Phase	:	VERTICAL
Test Mode	:	Mode 3, CH78		:	



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	2480.00	-2.40	79.07	76.67	200.00	-123.33	Average	100	18	P
2	2480.00	-2.40	101.57	99.17	200.00	-100.83	Peak	100	18	P
3	2483.50	-2.39	40.92	38.53	54.00	-15.47	Average	100	18	P
4	2483.50	-2.39	53.96	51.57	74.00	-22.43	Peak	100	18	P
5	4960.00	5.54	19.26	24.80	54.00	-29.20	Average	100	266	P
6	4960.00	5.54	41.76	47.30	74.00	-26.70	Peak	100	266	P

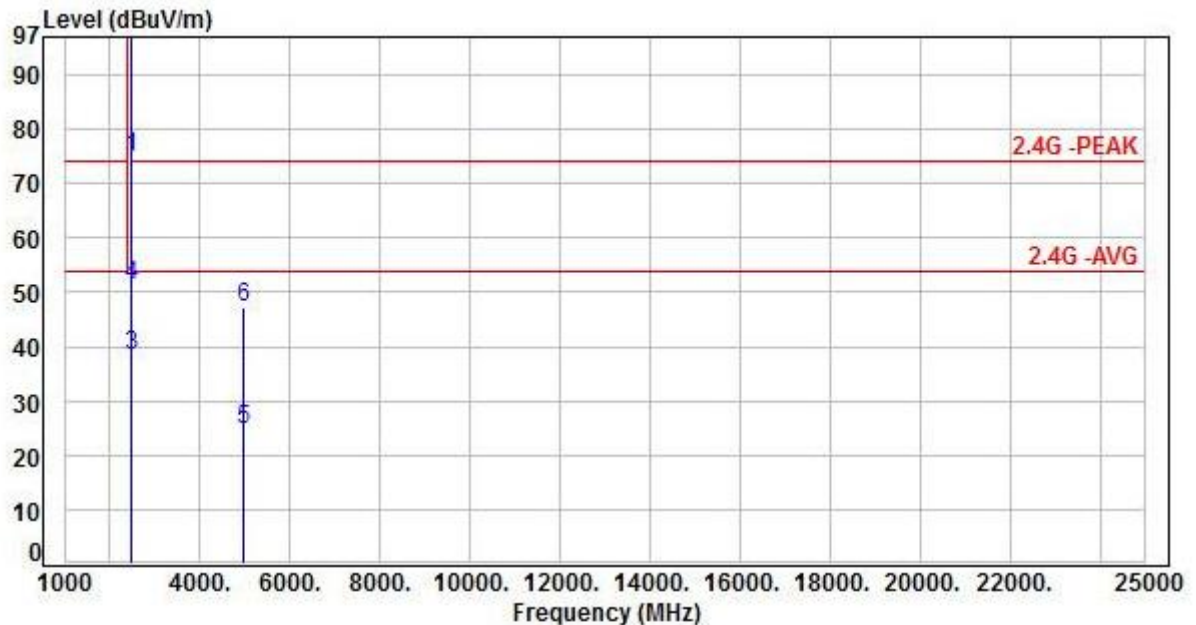
Note: Level=Reading+Factor

Margin=Level-Limit

Factor=Antenna Factor + cable loss - Amplifier Factor



Power	:	DC 12V From Adapter (AC 120V / 60Hz)	Pol/Phase	:	HORIZONTAL
Test Mode	:	Mode 3, CH78		:	



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	2480.00	-2.40	77.33	74.93	200.00	-125.07	Average	112	38	P
2	2480.00	-2.40	99.83	97.43	200.00	-102.57	Peak	112	38	P
3	2483.50	-2.39	40.84	38.45	54.00	-15.55	Average	112	38	P
4	2483.50	-2.39	53.76	51.37	74.00	-22.63	Peak	112	38	P
5	4960.00	5.54	19.19	24.73	54.00	-29.27	Average	100	84	P
6	4960.00	5.54	41.69	47.23	74.00	-26.77	Peak	100	84	P

Note: Level=Reading+Factor

Margin=Level-Limit

Factor=Antenna Factor + cable loss - Amplifier Factor



7.7 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



8. Test of Conducted Spurious Emission

8.1 Test Limit

According to the methods defined in ANSI C63.10-2013 Section 7.8.8

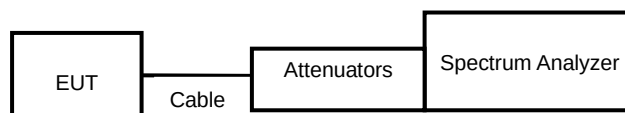
Below -30dB of the highest emission level of operating band (in 100kHz Resolution Bandwidth).

8.2 Test Procedure

According to the methods defined in ANSI C63.10-2013

- The transmitter output was connected to the spectrum analyzer via a low loss cable.
- 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.
- The band edges was measured and recorded.

8.3 Test Setup Layout

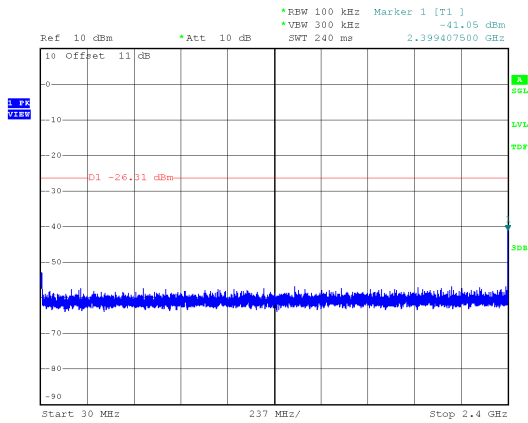


8.4 Test Result and Data

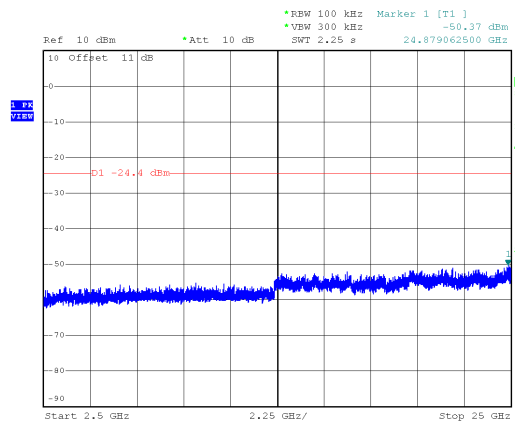
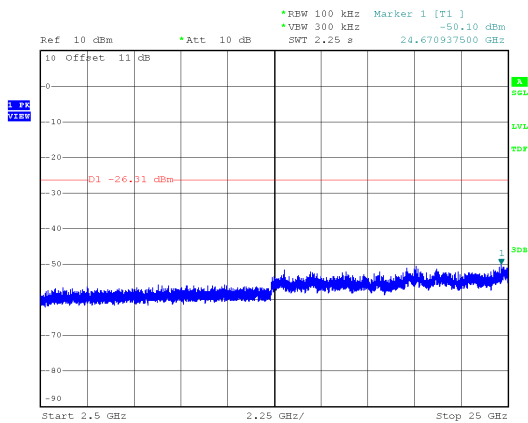
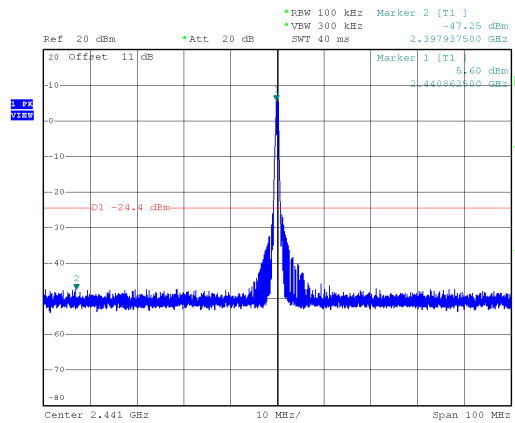
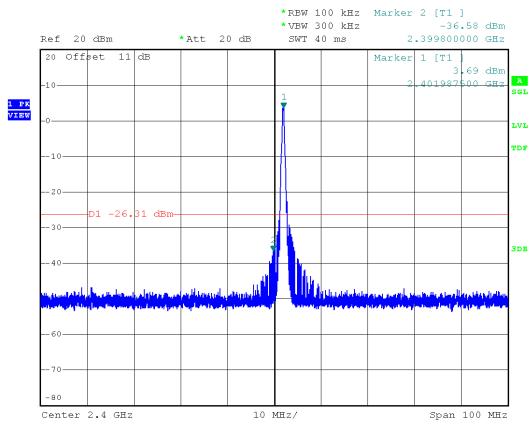
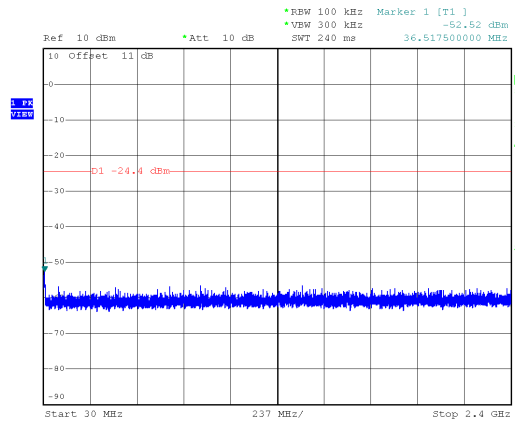
Note: Test plots refer to the following pages.



Modulation Type: GFSK (1Mbps)
Channel: 00

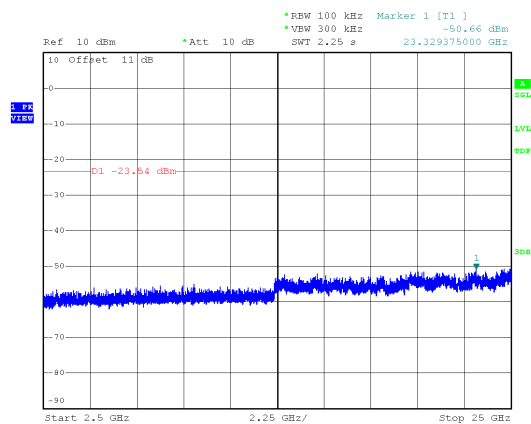
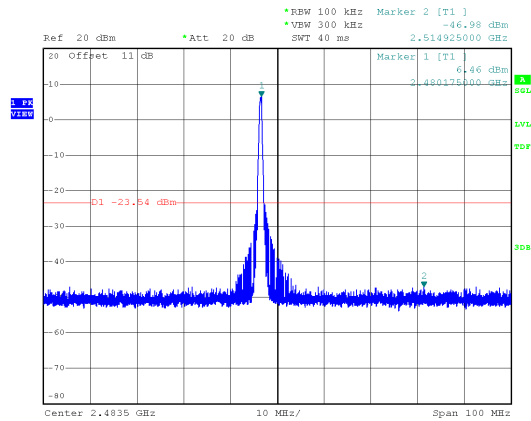
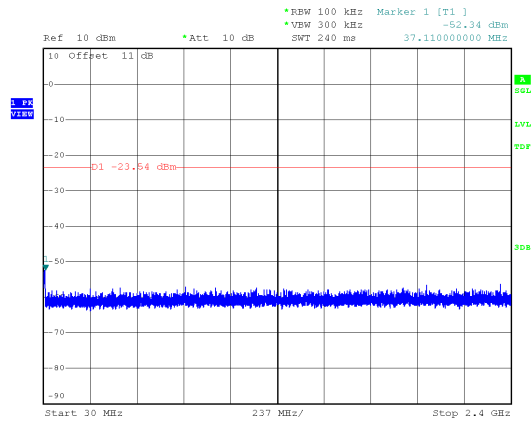


Modulation Type: GFSK (1Mbps)
Channel: 39

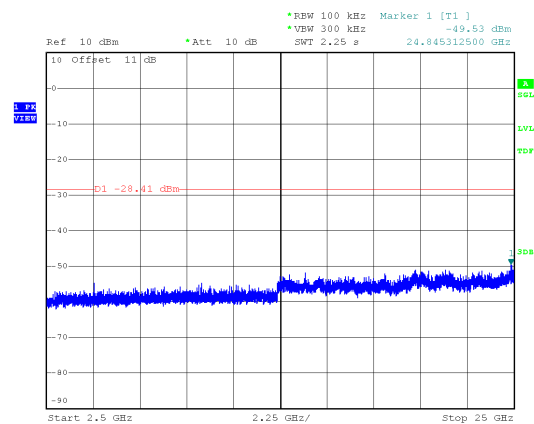
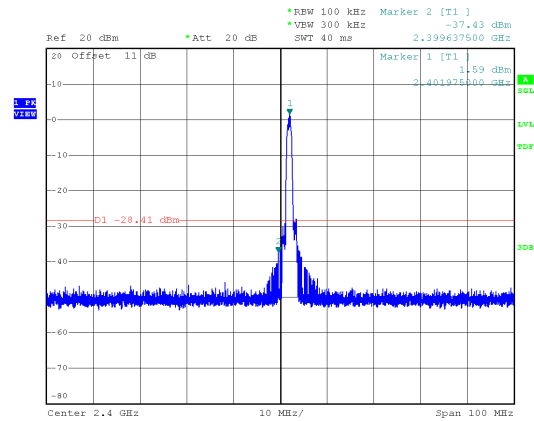
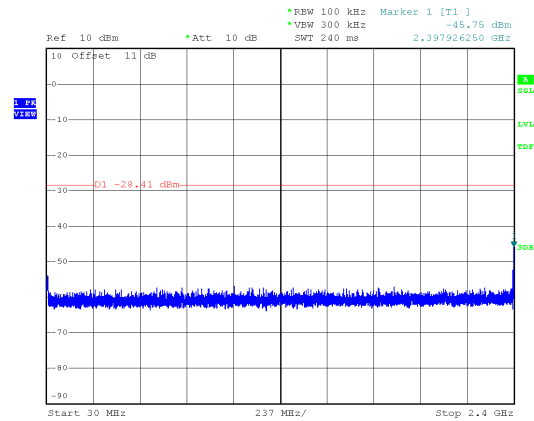




Modulation Type: GFSK (1Mbps)
Channel: 78

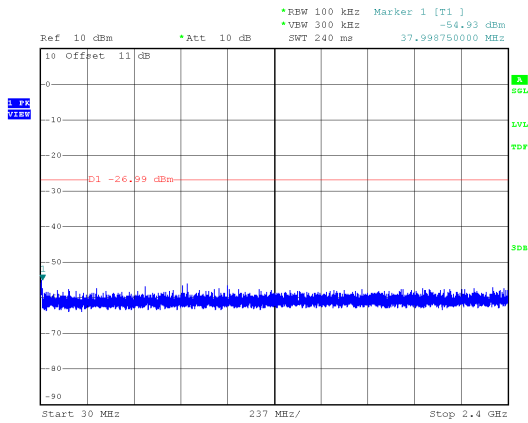


Modulation Type: $\pi/4$ -DQPSK (2Mbps)
Channel: 00

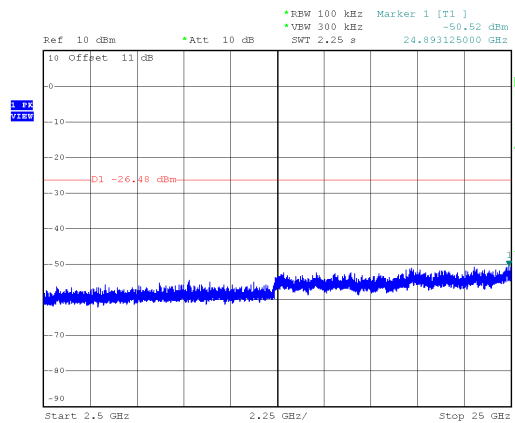
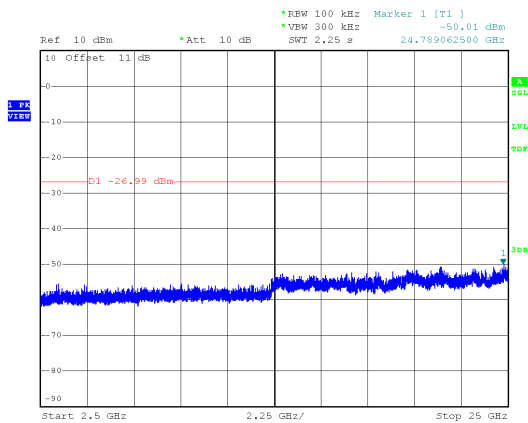
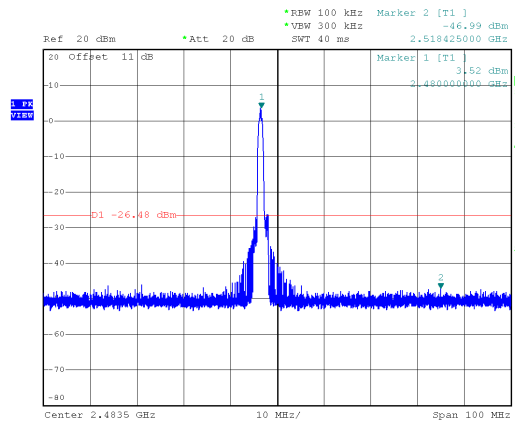
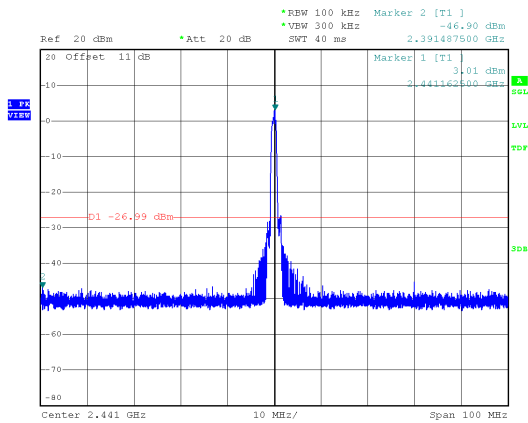
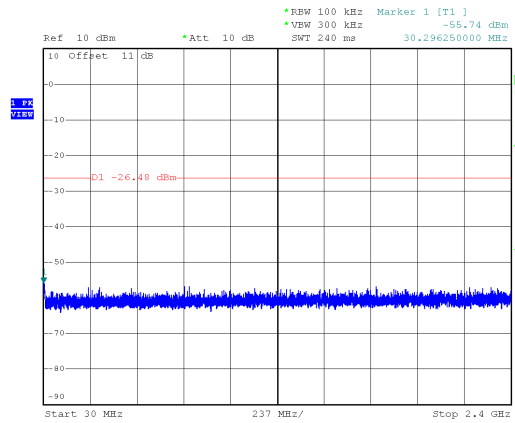




Modulation Type: $\pi/4$ -DQPSK (2Mbps)
Channel: 39

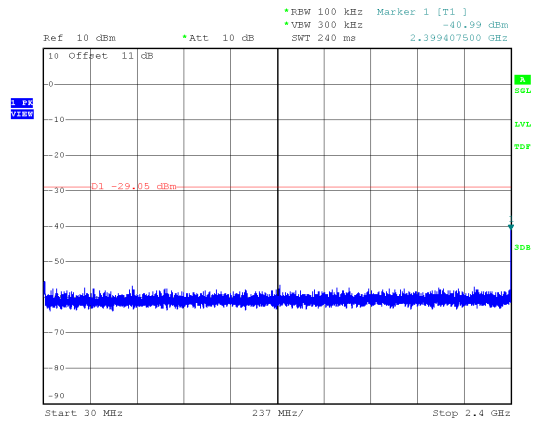


Modulation Type: $\pi/4$ -DQPSK (2Mbps)
Channel: 78

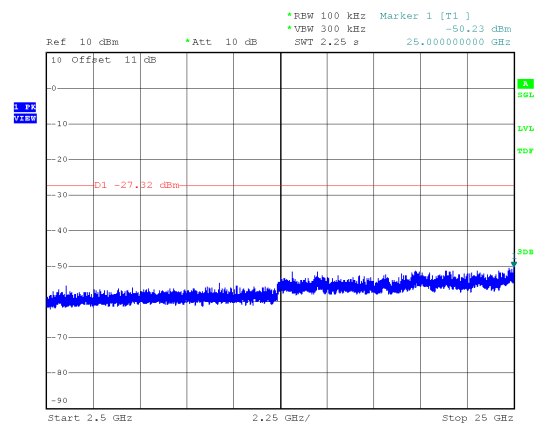
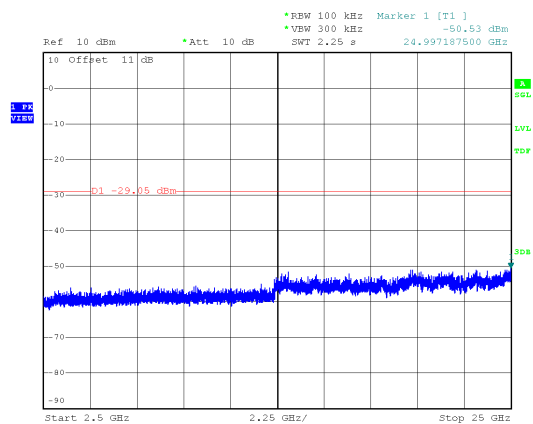
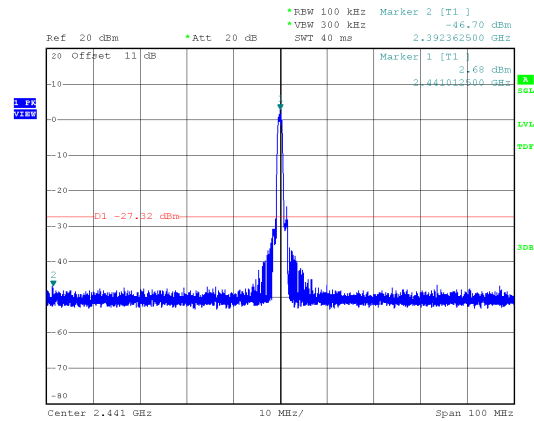
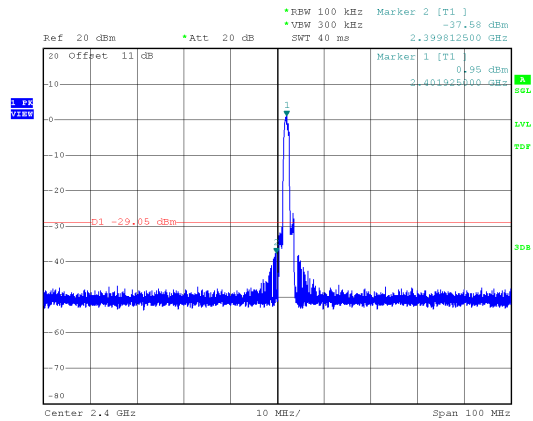
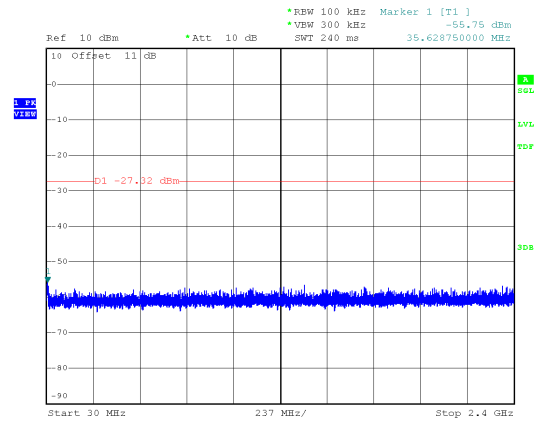




Modulation Type: 8DPSK (3Mbps)
Channel: 00

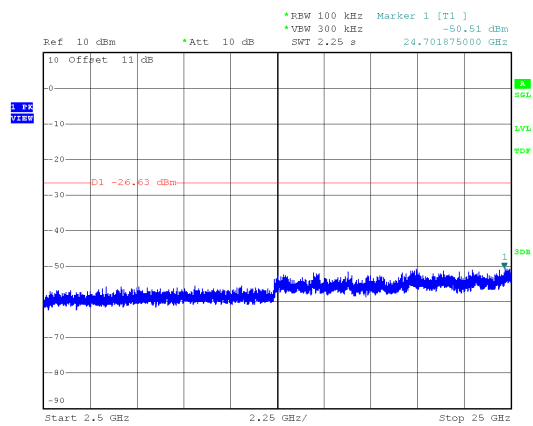
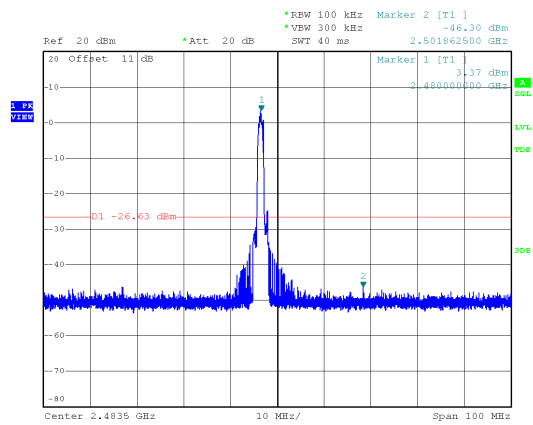
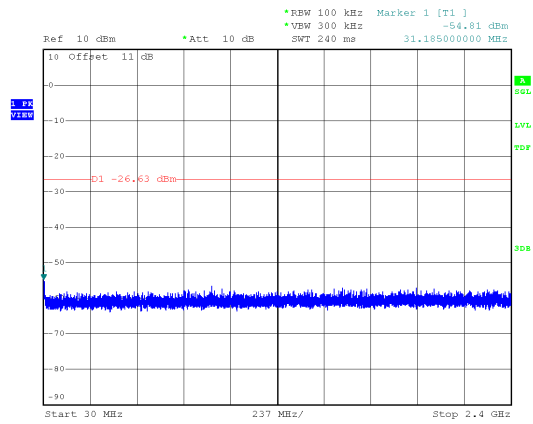


Modulation Type: 8DPSK (3Mbps)
Channel: 39



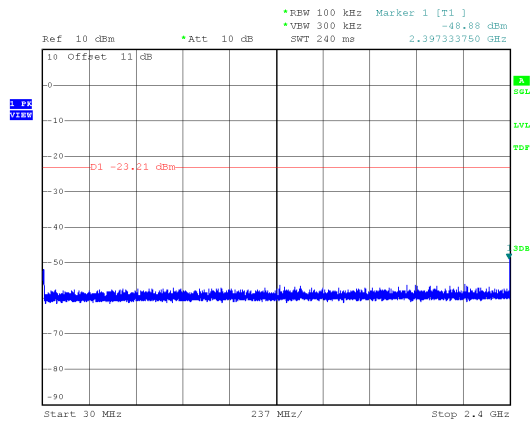


Modulation Type: 8DPSK (3Mbps)
Channel: 78

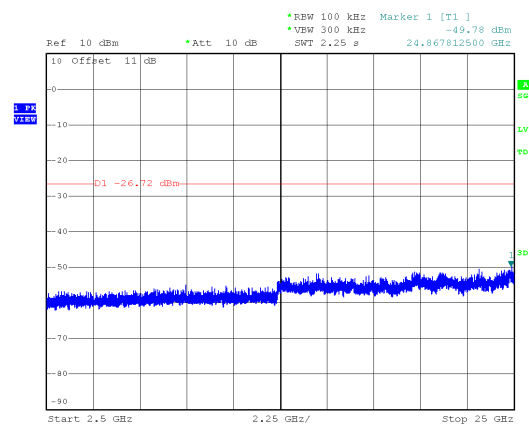
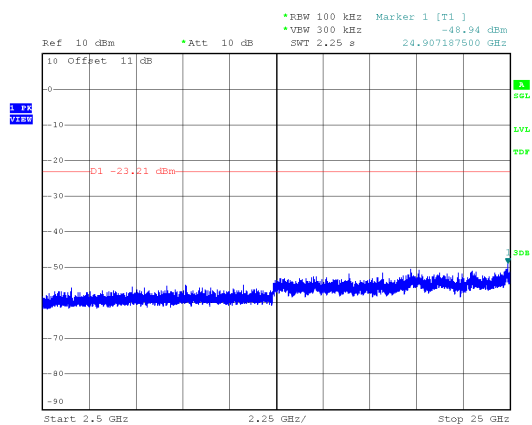
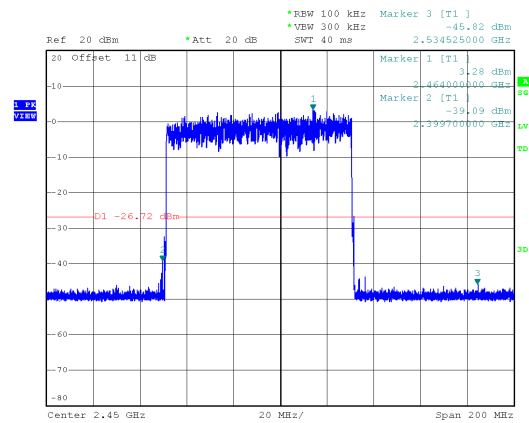
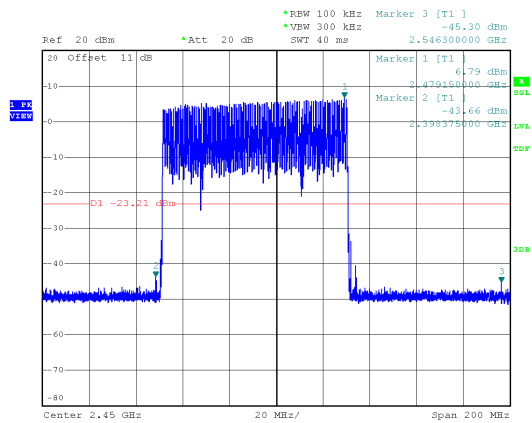
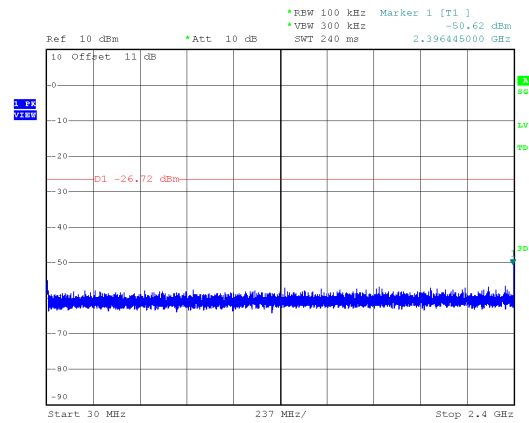




Hopping Mode:
Modulation Type: GFSK

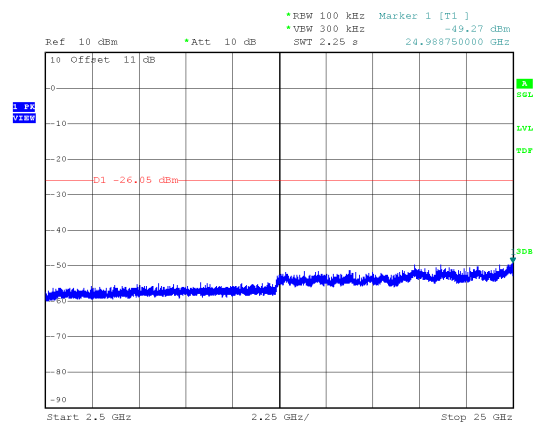
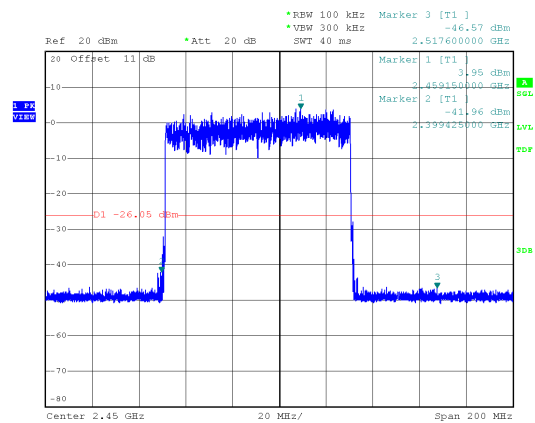
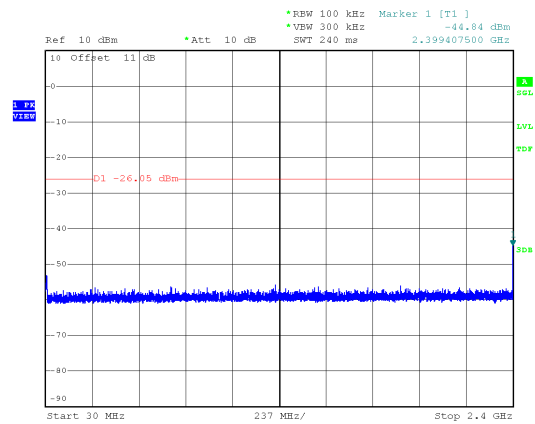


Modulation Type: $\pi/4$ -DQPSK





Modulation Type: 8DPSK





9. 20dB Bandwidth Measurement Data

9.1 Test Limit

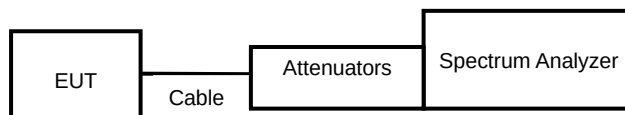
For reference data.

9.2 Test Procedures

According to the methods defined in ANSI C63.10-2013 Section 6.9

- The transmitter output was connected to the spectrum analyzer.
- Set RBW of spectrum analyzer to 1% to 5% of the 20dB Bandwidth and VBW to approximately three times RBW.
- The 20 dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20 dB.

9.3 Test Setup Layout

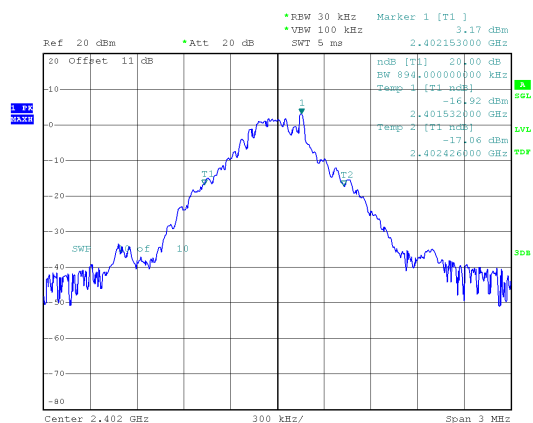


**9.4 Test Result and Data**

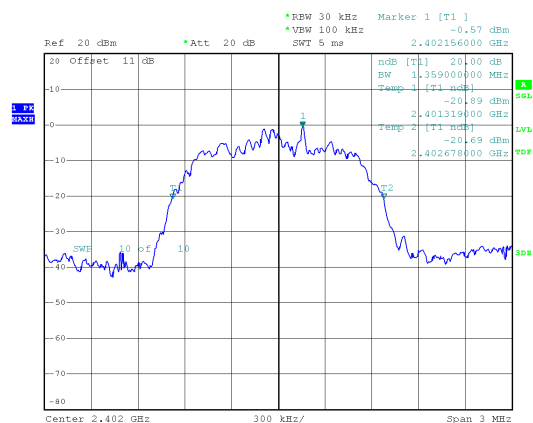
Modulation Type	Channel	Frequency (MHz)	20dB Bandwidth (MHz)	2/3 20dB Bandwidth (MHz)
GFSK	0	2402	0.894	0.596
	39	2441	0.891	0.594
	78	2480	0.891	0.594
$\pi/4$ -DQPSK	0	2402	1.359	0.906
	39	2441	1.356	0.904
	78	2480	1.359	0.906
8DPSK	0	2402	1.311	0.874
	39	2441	1.314	0.876
	78	2480	1.311	0.874



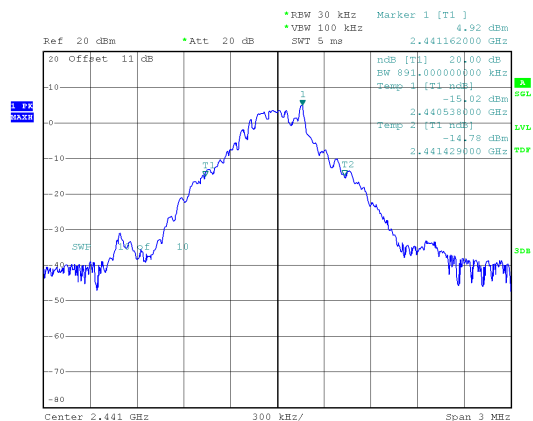
Modulation Type: GFSK (1Mbps)
Channel: 00



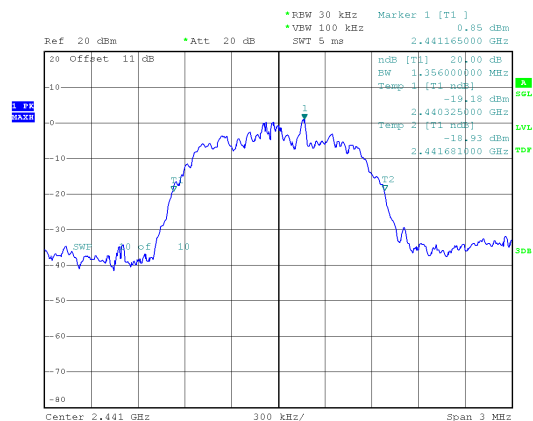
Modulation Type: $\pi/4$ -DQPSK (2Mbps)
Channel: 00



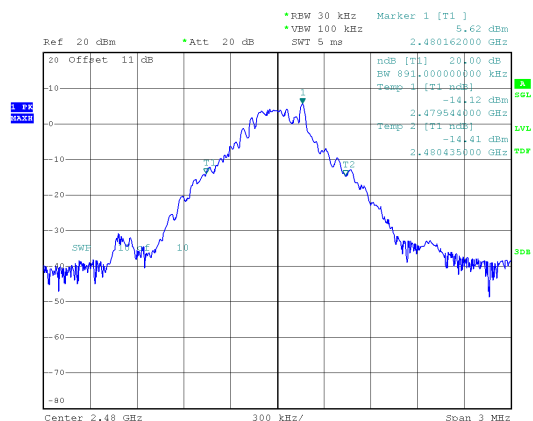
CH39



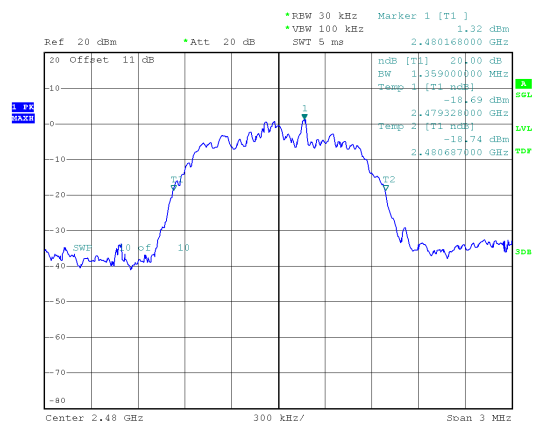
CH39



CH78

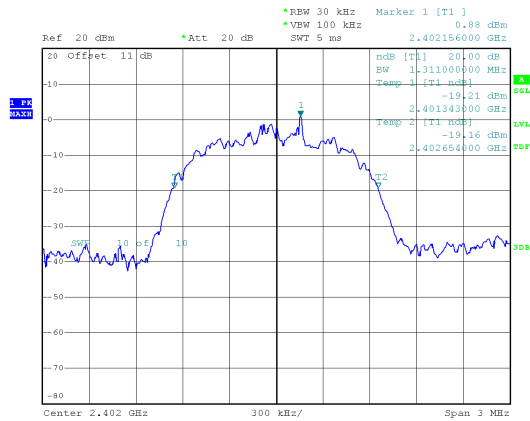


CH78

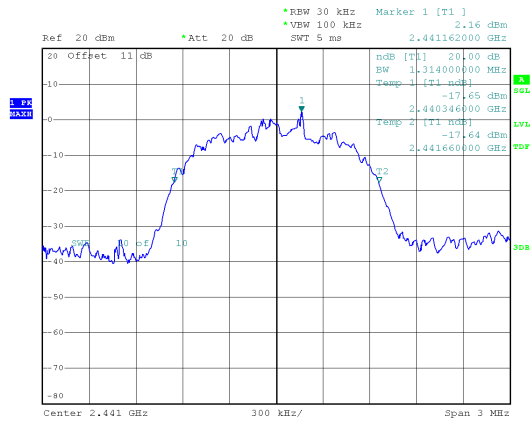




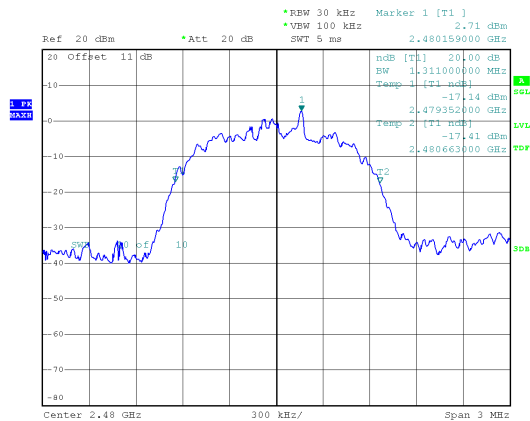
Modulation Type: 8DPSK (3Mbps)
Channel: 00



CH39



CH78





10. Carrier Frequency Separation

10.1 Test Limit

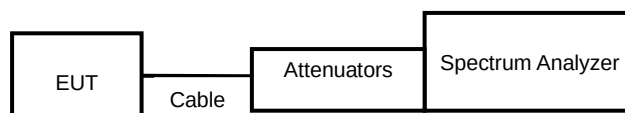
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

10.2 Test Procedures

According to the methods defined in ANSI C63.10-2013 Section 7.8.2

- The transmitter output was connected to the spectrum analyzer.
- Set RBW of spectrum analyzer to 300 KHz and VBW to 1000 KHz.
- By using the MaxHold function record the separation of two adjacent channels.
- Measure the frequency difference of these two adjacent channels.

10.3 Test Setup Layout

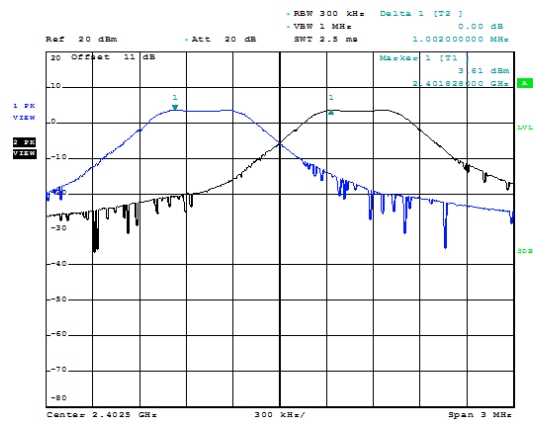


**10.4 Test Result and Data**

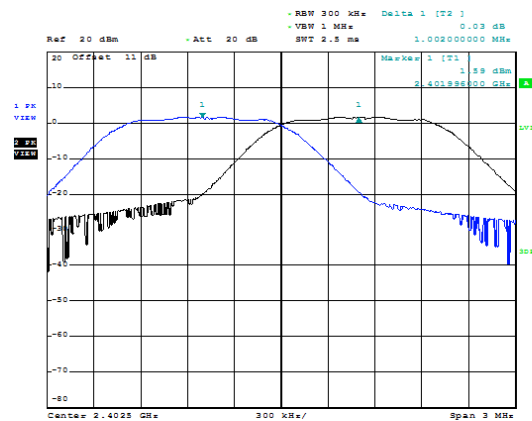
Modulation Type	Channel	Frequency (MHz)	Channel Separation (MHz)	Limit (MHz)
GFSK	0	2402	1.002	0.596
	39	2441	1.002	0.594
	78	2480	1.002	0.594
$\pi/4$ -DQPSK	0	2402	1.002	0.906
	39	2441	1.002	0.904
	78	2480	1.002	0.906
8DPSK	0	2402	1.002	0.874
	39	2441	1.002	0.876
	78	2480	1.002	0.874



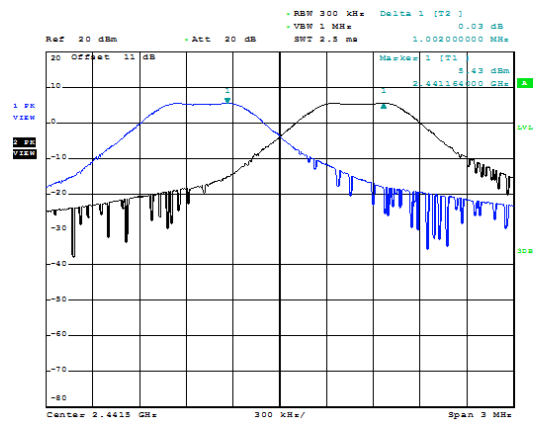
Modulation Type: GFSK (1Mbps)
Channel: 00



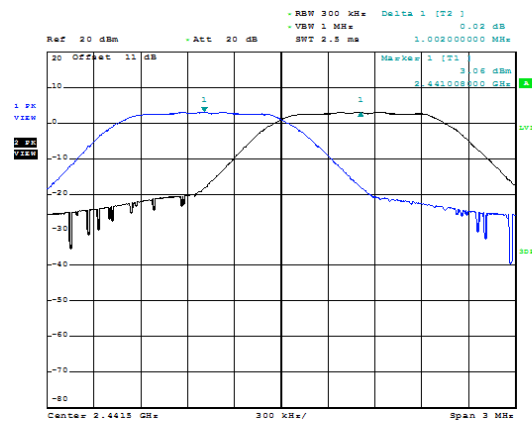
Modulation Type: $\pi/4$ -DQPSK (2Mbps)
Channel: 00



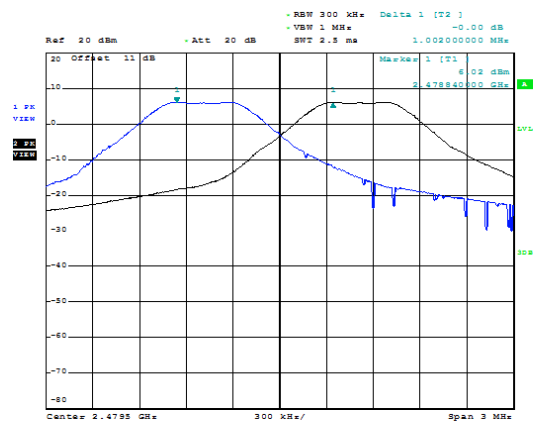
CH39



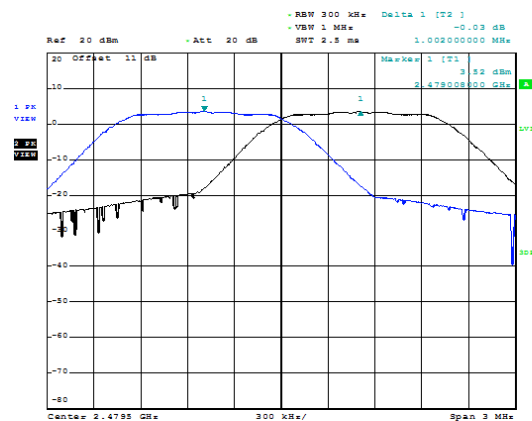
CH39



CH78

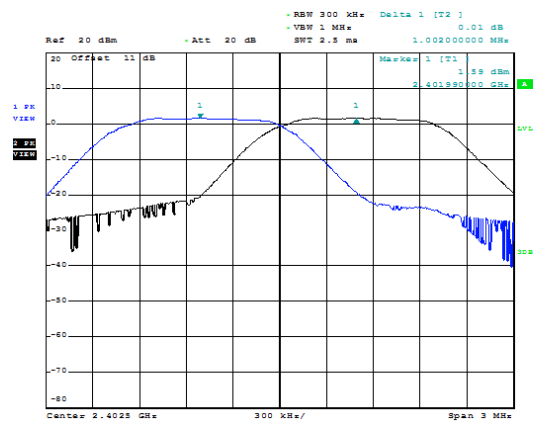


CH78

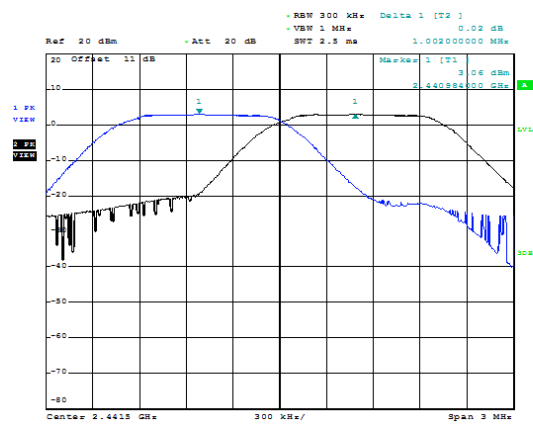




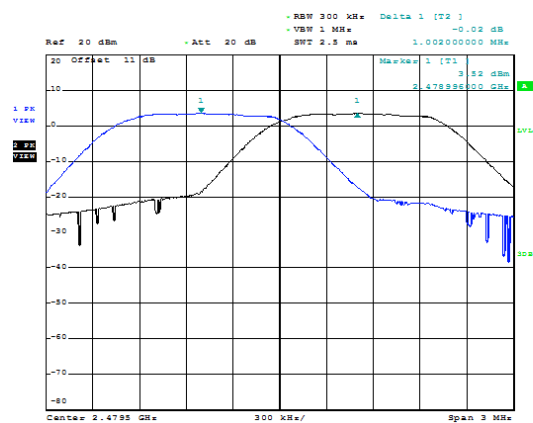
Modulation Type: 8DPSK (3Mbps)
Channel: 00



CH39



CH78





11. Dwell Time on each channel

11.1 Test Limit

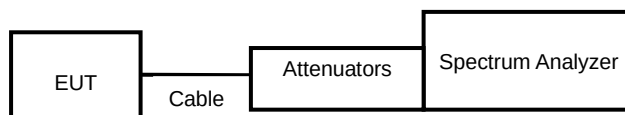
The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

11.2 Test Procedures

According to the methods defined in ANSI C63.10-2013 Section 7.8.4

1. The transmitter output was connected to the spectrum analyzer.
2. Adjust the center frequency to measure frequency, then set zero span mode.
3. Set RBW of spectrum analyzer to 300KHz and VBW to 1MHz.
4. Measure the time duration of one transmission on the measured frequency.

11.3 Test Setup Layout





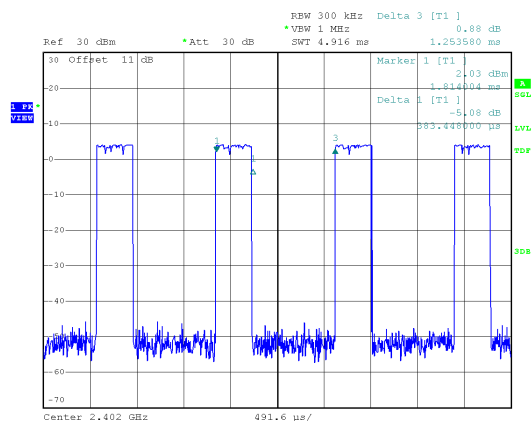
11.4 Test Result and Data

Modulation Type	Frequency (MHz)	Length of transmission time (ms)	Number of transmission in a 31.6 (79 Hopping*0.4)	Dwell Time (ms)	Limit (ms)
GFSK-DH1	2402	0.383	320.00	122.70	400
GFSK-DH3	2402	1.642	160.00	262.66	400
GFSK-DH5	2402	2.896	106.67	308.91	400
$\pi/4$ -DQPSK-DH1	2402	0.393	320.00	125.83	400
$\pi/4$ -DQPSK-DH3	2402	1.651	160.00	264.19	400
$\pi/4$ -DQPSK-DH5	2402	2.893	106.67	308.57	400
8DPSK-DH1	2402	0.388	320.00	124.28	400
8DPSK-DH3	2402	1.651	160.00	264.19	400
8DPSK-DH5	2402	2.893	106.67	308.57	400

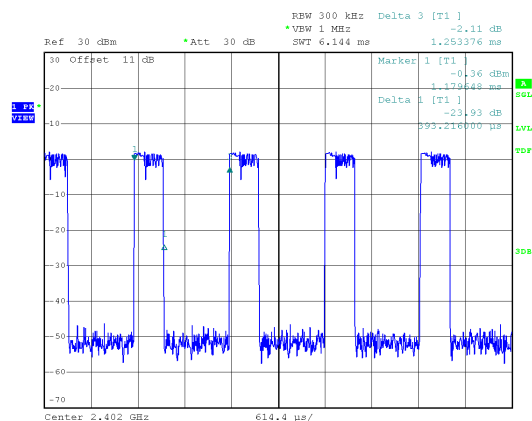
Modulation Type	Frequency (MHz)	Length of transmission time (ms)	Number of transmission in a 8 (20 Hopping*0.4)	Dwell Time (ms)	Limit (ms)
AFH-DH1	2402-2421	0.382	160.00	61.09	400
AFH-DH3	2402-2421	1.638	80.00	131.07	400
AFH-DH5	2402-2421	2.890	53.33	154.10	400



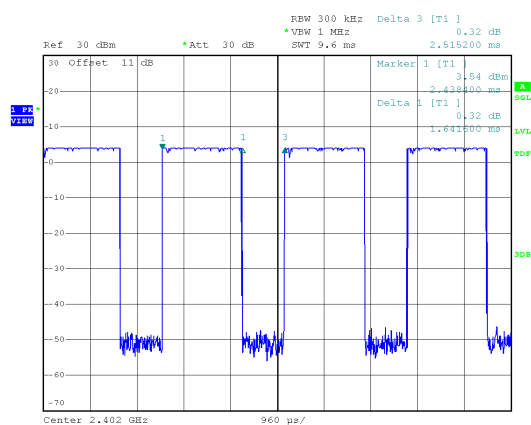
Modulation Type: GFSK-DH1
Channel: 00



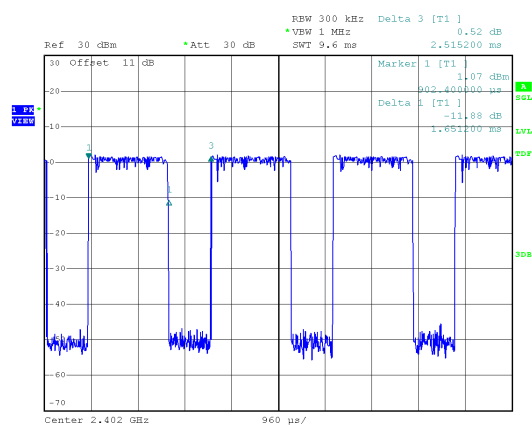
Modulation Type: $\pi/4$ -DQPSK-DH1
Channel: 00



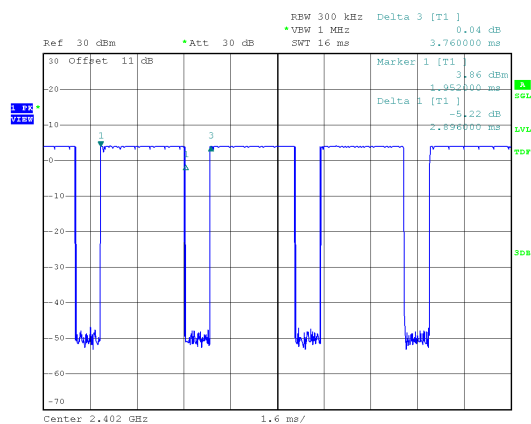
Modulation Type: GFSK-DH3
Channel: 00



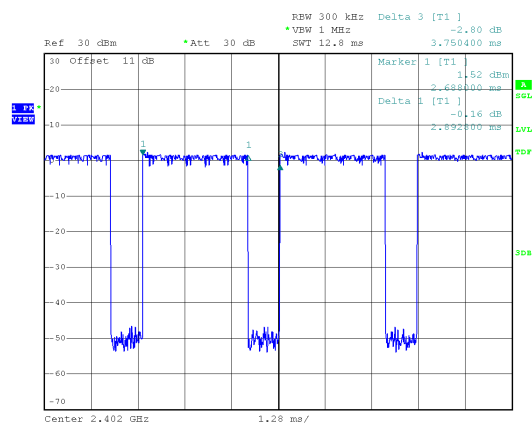
Modulation Type: $\pi/4$ -DQPSK-DH3
Channel: 00



Modulation Type: GFSK-DH5
Channel: 00

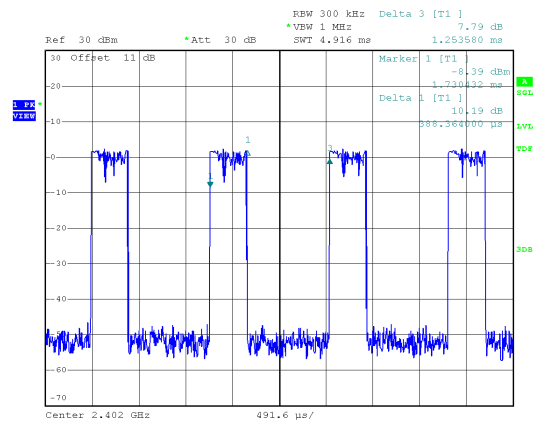


Modulation Type: $\pi/4$ -DQPSK-DH5
Channel: 00

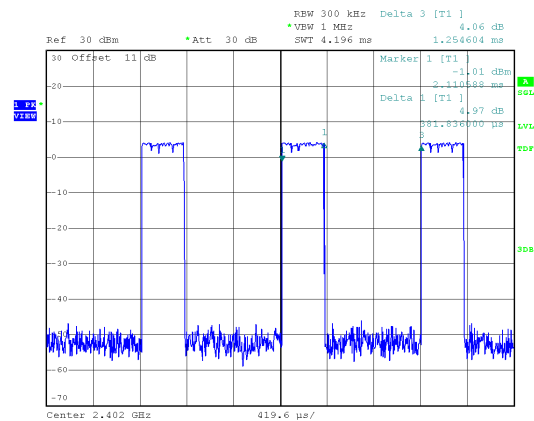




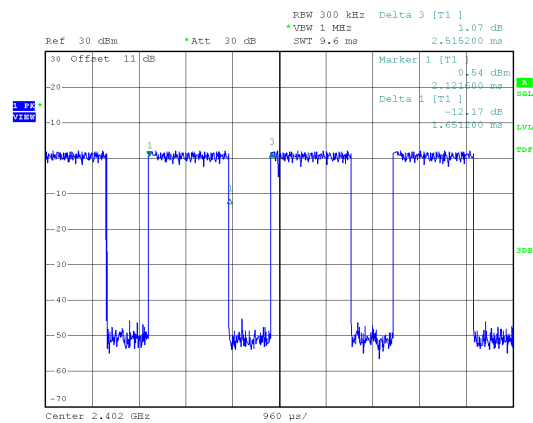
Modulation Type: 8DPSK-DH1
Channel: 00



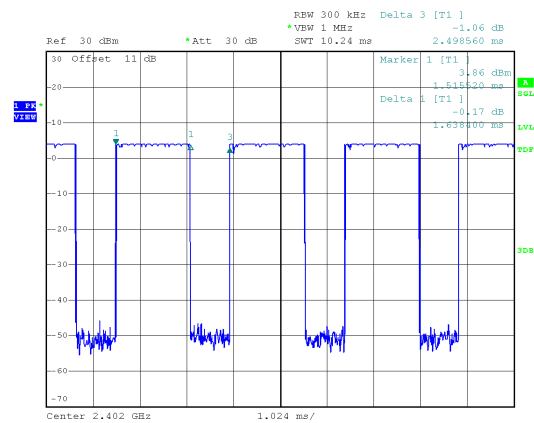
Modulation Type: AFH (DH1)



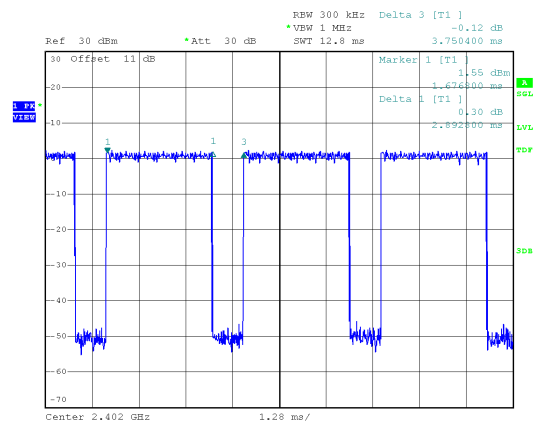
Modulation Type: 8DPSK-DH3
Channel: 00



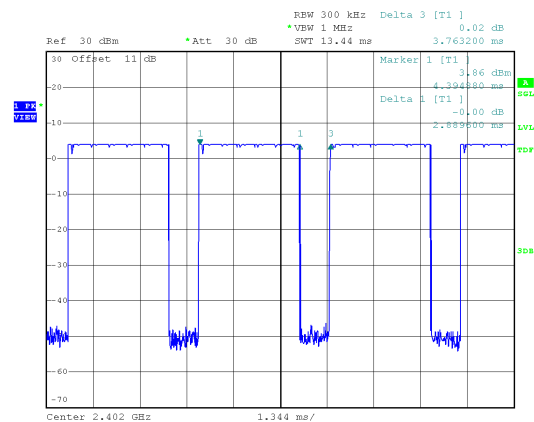
Modulation Type: AFH (DH3)



Modulation Type: 8DPSK-DH5
Channel: 00



Modulation Type: AFH (DH5)





12. Number of Hopping Channels

12.1 Test Limit

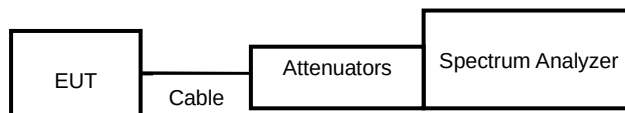
Frequency hopping systems in the 2400 ~ 2483.5 MHz band shall use at least 15 channels.

12.2 Test Procedures

According to the methods defined in ANSI C63.10-2013 Section 7.8.3

- The transmitter output was connected to the spectrum analyzer.
2. Set RBW of spectrum analyzer to 100 KHz and VBW to 300 KHz.
3. Set the MaxHold function, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been record.

12.3 Test Setup Layout

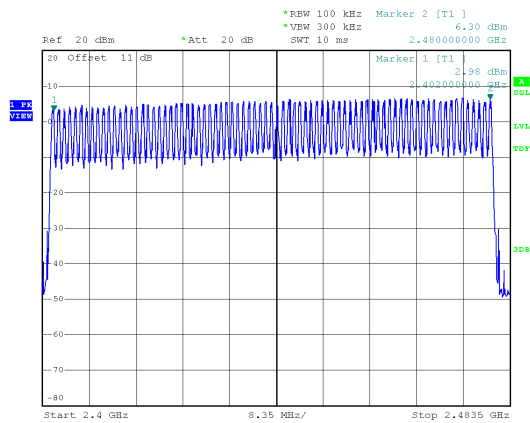


12.4 Test Result and Data

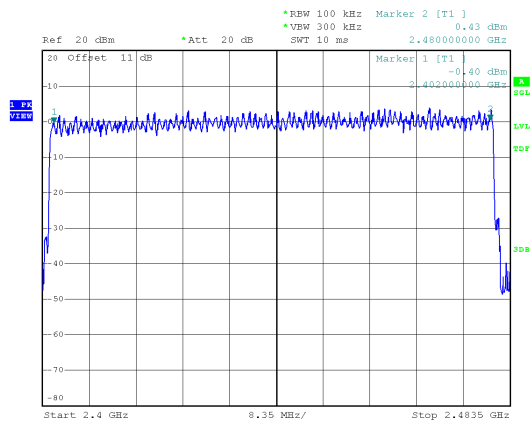
Modulation Type	Hopping Channels
GFSK	79
$\pi/4$ -DQPSK	79
8DPSK	79



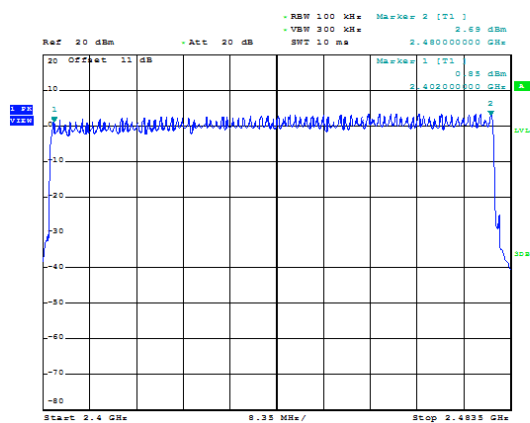
Modulation Type: GFSK (1Mbps)



Modulation Type: $\pi/4$ -DQPSK (2Mbps)



Modulation Type: 8DPSK (3Mbps)





13. Maximum Average Output Power

13.1 Test Limit

The Maximum Average Output Power Measurement is 30dBm.

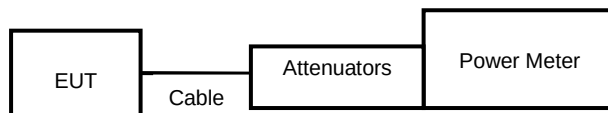
13.2 Test Procedures

According to the methods defined in ANSI C63.10-2013 Section 7.8.5

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.

13.3 Test Setup Layout





13.4 Test Result and Data

Modulation Type	Setting	Channel	Frequency (MHz)	AV Output Power (dBm)	AV Output Power (mW)
GFSK	0	0	2402	4.47	2.799
	0	39	2441	6.23	4.198
	0	78	2480	6.74	4.721
$\pi/4$ -DQPSK	0	0	2402	2.23	1.671
	0	39	2441	3.75	2.371
	0	78	2480	4.02	2.523
8DPSK	0	0	2402	2.24	1.675
	0	39	2441	3.77	2.382
	0	78	2480	4.03	2.529

AFH Mode

Modulation Type	Setting	Channel	Frequency (MHz)	AV Output Power (dBm)	AV Output Power (mW)
GFSK	0	0-19	2402-2421	5.35	3.428
$\pi/4$ -DQPSK	0	0-19	2402-2421	2.99	1.991
8DPSK	0	0-19	2402-2421	3.01	1.998