

FCC

RF

TEST REPORT

ISSUED BY
Shenzhen BALUN Technology Co., Ltd.



FOR
VR GOGGLES

ISSUED TO
Guangzhou EHang Intelligent Technology Co., Ltd.

Room 402, 4th Floor, 11 Aoti Road, Tianhe District, Guangzhou, China



Tested by:

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Date *Mar. 10, 2016*

Approved by:

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Wei Yanquan
(Chief Engineer)

Date *Mar. 10, 2016*

Report No.: BL-SZ15C0311-602

EUT Type: VR GOGGLES

Model Name: GVR-200B

Brand Name: EHANG

Test Standard: 47 CFR Part 15 Subpart C

FCC ID: 2ADPF-GVR-200B

Test conclusion: Pass

Test Date: Jan. 26, 2016 ~ Jan. 29, 2016

Date of Issue: Mar. 10, 2016

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Revision History

<u>Version</u>	<u>Issue Date</u>	<u>Revisions Content</u>
Rev. 01	Feb. 24, 2016	Initial Issue
Rev. 02	Mar. 1, 2016	The Second Issue
Rev. 03	Mar. 10, 2016	The Third Issue

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1 ADMINISTRATIVE DATA (GENERAL INFORMATION)

1.1 Identification of the Testing Laboratory

Company Name	Shenzhen BALUN Technology Co., Ltd.
Address	Block B, 1st FL, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Phone Number	+86 755 6685 0100
Fax Number	+86 755 6182 4271

1.2 Identification of the Responsible Testing Location

Test Location	Shenzhen BALUN Technology Co., Ltd.
Address	Block B, 1st FL, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Accreditation Certificate	<p>The laboratory has been listed by Industry Canada to perform electromagnetic emission measurements. The recognition numbers of test site are 11524A-1.</p> <p>The laboratory has been listed by US Federal Communications Commission to perform electromagnetic emission measurements. The recognition numbers of test site are 832625.</p> <p>The laboratory is a testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L6791.</p>
Description	All measurement facilities used to collect the measurement data are located at Block B, FL 1, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China 518055

1.3 Laboratory Condition

Ambient Temperature	20 to 25°C
Ambient Relative Humidity	45% - 55%
Ambient Pressure	100 kPa - 102 kPa

1.4 Announce

- (1) The test report reference to the report template version v2.1.
- (2) The test report is invalid if not marked with the signatures of the persons responsible for preparing and approving the test report.
- (3) The test report is invalid if there is any evidence and/or falsification.
- (4) The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein.
- (5) This document may not be altered or revised in any way unless done so by BALUN and all revisions are duly noted in the revisions section.
- (6) Content of the test report, in part or in full, cannot be used for publicity and/or promotional purposes without prior written approval from the laboratory.

2 PRODUCT INFORMATION

2.1 Applicant Information

Applicant	Guangzhou EHang Intelligent Technology Co., Ltd.
Address	Room 402, 4th Floor, 11 Aoti Road, Tianhe District, Guangzhou, China

2.2 Manufacturer Information

Manufacturer	Guangzhou EHang Intelligent Technology Co., Ltd.
Address	Room 402, 4th Floor, 11 Aoti Road, Tianhe District, Guangzhou, China

2.3 Factory Information

Factory	Guangzhou EHang Intelligent Technology Co., Ltd.
Address	Buliding #3, No.72, 2nd Nanxiang Road, Science City, Huangpu Development Zone, Guangzhou, China

2.4 General Description for Equipment under Test (EUT)

EUT Type	VR GOGGLES
Model Name Under Test	GVR-200B
Series Model Name	N/A
Description of Model name differentiation	N/A
Hardware Version	V 1.0
Software Version	V 1.0
Dimensions (Approx.)	N/A
Weight (Approx.)	N/A
Network and Wireless connectivity	Bluetooth, 2.4 G ISM Band(GFSK modulation), 5.8 G(Just receiver)

2.5 Ancillary Equipment

Ancillary Equipment 1	Battery	
	Brand Name	N/A
	Model No.	GEB 702382
	Serial No.	N/A
	Capacitance	1700 mAh
	Rated Voltage	3.7 V
	Limit Charge Voltage	4.25 V
Ancillary Equipment 2	Charger	
	Brand Name	N/A
	Model No.	GAT-200
	Serial No.	N/A
	Rated Input	100-240 V~, 2 A, 50/60 Hz
	Rated Output Port 1	16.8 V=, 3500 mA
Rated Output Port 2	5 V=, 2000 mA	

2.6 Technical Information

The requirement for the following technical information of the EUT was tested in this report:

Modulation Technology		FHSS
Modulation Type		GFSK
Transfer Rate		0.25 Mbps
Frequency Range		The frequency range used is 2405.5 MHz – 2475 MHz; The frequency block is 2400 MHz to 2483.5 MHz.
Number of channel		140 (See note 1)
Tested Channel		Low channel (2405.5 MHz), Middle channel(2437.5 MHz), High channel (2475 MHz)
Antenna Type	Antenna 1 (ANT 1)	PIFA Antenna
	Antenna 2 (ANT 2)	Dipole Antenna
Antenna Gain	Antenna 1 (ANT 1)	2 dBi (All involve the antenna gain test item, has been included in the final results)
	Antenna 2 (ANT 2)	1.4 dBi (All involve the antenna gain test item, has been included in the final results)
Categorization as Correlated or Completely Uncorrelated		Completely Uncorrelated
Antenna System (eg., MIMO, Smart Antenna)		Antenna Work Independently
Adaptive or non-adaptive		non-adaptive
The Max RF Output power	Antenna 1 (ANT 1)	15.02 dBm
	Antenna 2 (ANT 2)	14.99 dBm
About the Product		The equipment is VR GOGGLES, it contains Bluetooth Module operating at 2.4 GHz ISM band. Only the 2.4G ISM Band (GFSK modulation) was tested in this report.

Channel List

Number	Frequency (MHz)	Number	Frequency (MHz)
1	2405.5(Low)	9	2445
2	2409	10	2450
3	2413	11	2453
4	2425	12	2457
5	2429	13	2461
6	2432	14	2465
7	2435	15	2469
8	2437.5(Middle)	16	2475(High)

Note 1: The modulation is GFSK with FHSS, there are total 140 channels (frequency range is 2405.5-2475MHz, channel step is 0.5MHz, totally 140 channels), when this part works, it will choose 16 channels, each channel band width is 1MHz, if one channel is chosen, adjacent two channels cannot be chosen to make sure step of working channels is more than 1MHz. there are two antennas in this part, they are same and work alternatively But in this report, the equipment select the lowest, middle and highest channel from 140 channels, Which are 2405.5 MHz, 2437.5 MHz and 2475 MHz. The more information please refer to the manufacturer's instructions.

Test Case	Test Conditions			
	Modulation Technology	Modulation Type	Date rate	channel
Number of Hopping Frequency	FHSS	GFSK	0.25 Mbps	Hopping
Peak Output Power	FHSS	GFSK	0.25 Mbps	Low/Middle/High
Occupied Bandwidth	FHSS	GFSK	0.25 Mbps	Low/Middle/High
Carrier Frequency Separation	FHSS	GFSK	0.25 Mbps	Hopping
Time of Occupancy (Dwell time)	FHSS	GFSK	0.25 Mbps	Hopping
Conducted Spurious Emission	FHSS	GFSK	0.25 Mbps	Low/Middle/High
Conducted Emission	FHSS	GFSK	0.25 Mbps	Low/Middle/High
Radiated Emission	FHSS	GFSK	0.25 Mbps	Low/Middle/High
Band Edge	FHSS	GFSK	0.25 Mbps	Low/High

Note: The EUT through the button (which is on the EUT) to set parameters.

2.7 Additional Instructions

EUT Software Settings:

Mode	<input checked="" type="checkbox"/> Special software is used. The software provided by client to enable the EUT under transmission condition continuously at specific channel frequencies individually. The software that is built into the EUT, and the specific channel parameter couldn't setup, should be through external button to switch.
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3 SUMMARY OF TEST RESULTS

3.1 Test Standards

No.	Identity	Document Title
1	47 CFR Part 15, Subpart C (10-1-14 Edition)	Miscellaneous Wireless Communications Services
2	FCC PUBLIC NOTICE DA 00-705 (Mar. 30, 2000)	Filling and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems
3	ANSI C63.4-2014	American National Standard for Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
4	ANSI C63.10-2013	American National Standard for Testing Unlicensed Wireless Devices

3.2 Verdict

No.	Description	FCC Part No.	Test Result	Verdict
1	Antenna Requirement	15.203	--	Pass ^{Note 1}
2	Number of Hopping Frequency	15.247(a)	ANNEX A.1	Pass
3	Peak Output Power	15.247(b)	ANNEX A.2	Pass
4	Occupied Bandwidth	15.247(a)	ANNEX A.3	Pass
5	Carrier Frequency Separation	15.247(a)	ANNEX A.4	Pass
6	Time of Occupancy (Dwell time)	15.247(a)	ANNEX A.5	Pass
7	Conducted Spurious Emission	15.247(d)	ANNEX A.6	Pass
8	Conducted Emission	15.207	ANNEX A.7	Pass
9	Radiated Spurious Emission	15.209 15.247(d)	ANNEX A.8	Pass
10	Band Edge	15.209 15.247(d)	ANNEX A.9	Pass

3.3 MEASUREMENT UNCERTAINTY

The following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2.

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Measurement	Value
Peak output power	±1.4 dB
All emissions, radiated	±5.4 dB
Temperature	±1 °C
Humidity	±4%

4 GENERAL TEST CONFIGURATIONS

4.1 Test Environments

During the measurement, the normal environmental conditions were within the listed ranges:

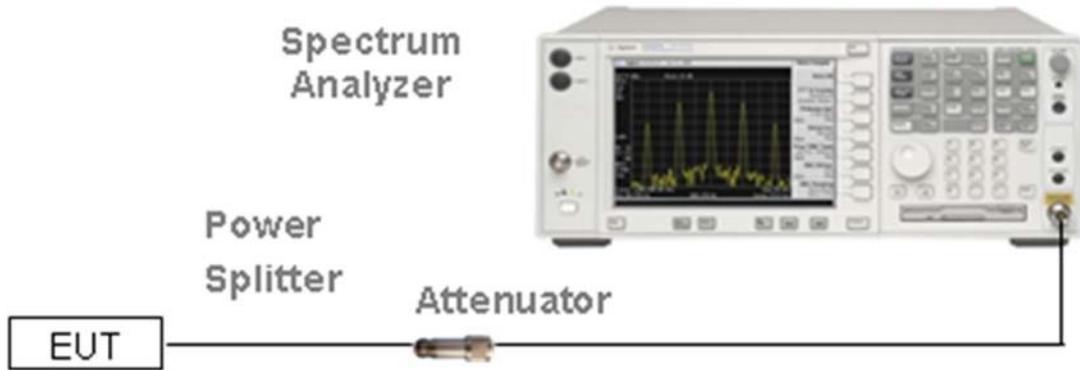
Relative Humidity	45% - 55%	
Atmospheric Pressure	100 kPa - 102 kPa	
Temperature	NT (Normal Temperature)	20°C to +25°C
Working Voltage of the EUT	NV (Normal Voltage)	3.7 V

4.2 Test Equipment List

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Spectrum Analyzer	ROHDE&SCHWARZ	FSV-30	103118	2015.07.16	2016.07.15
Vector Signal Generator	ROHDE&SCHWARZ	SMBV100A	177746	2015.07.16	2016.07.15
Signal Generator	ROHDE&SCHWARZ	SMB100A	260592	2015.07.01	2016.06.30
Switch Unit with OSP-B157	ROHDE&SCHWARZ	OSP120	101270	2015.07.16	2016.07.15
Spectrum Analyzer	AGILENT	E4440A	MY45304434	2015.10.15	2016.10.14
EMI Receiver	ROHDE&SCHWARZ	ESRP	101036	2015.07.14	2016.07.13
LISN	SCHWARZBECK	NSLK 8127	8127-687	2015.07.14	2016.07.13
Bluetooth Tester	ROHDE&SCHWARZ	CBT	101005	2015.07.16	2016.07.15
Power Splitter	KMW	DCPD-LDC	1305003215	2015.07.01	2016.06.30
Power Sensor	ROHDE&SCHWARZ	NRP-Z21	103971	2015.07.21	2016.07.20
Attenuator (20 dB)	KMW	ZA-S1-201	110617091	--	--
Attenuator (6 dB)	KMW	ZA-S1-61	1305003189	--	--
DC Power Supply	ROHDE&SCHWARZ	HMP2020	18141664	2015.07.17	2016.07.16
Temperature Chamber	ANGELANTIONI SCIENCE	NTH64-40A	1310	2015.08.07	2016.08.06
Test Antenna-Loop(9 kHz-30 MHz)	SCHWARZBECK	FMZB 1519	1519-037	2015.07.22	2017.07.21
Test Antenna-Bi-Log(30 MHz-3 GHz)	SCHWARZBECK	VULB 9163	9163-624	2015.07.22	2017.07.21
Test Antenna-Horn(1-18 GHz)	SCHWARZBECK	BBHA 9120D	9120D-1148	2015.07.22	2017.07.21
Test Antenna-Horn(15-26.5 GHz)	SCHWARZBECK	BBHA 9170	9170-305	2015.07.22	2017.07.21
Anechoic Chamber	RAINFORD	9m*6m*6m	N/A	2015.02.28	2016.02.27
Shielded Enclosure	ChangNing	CN-130701	130703	--	--

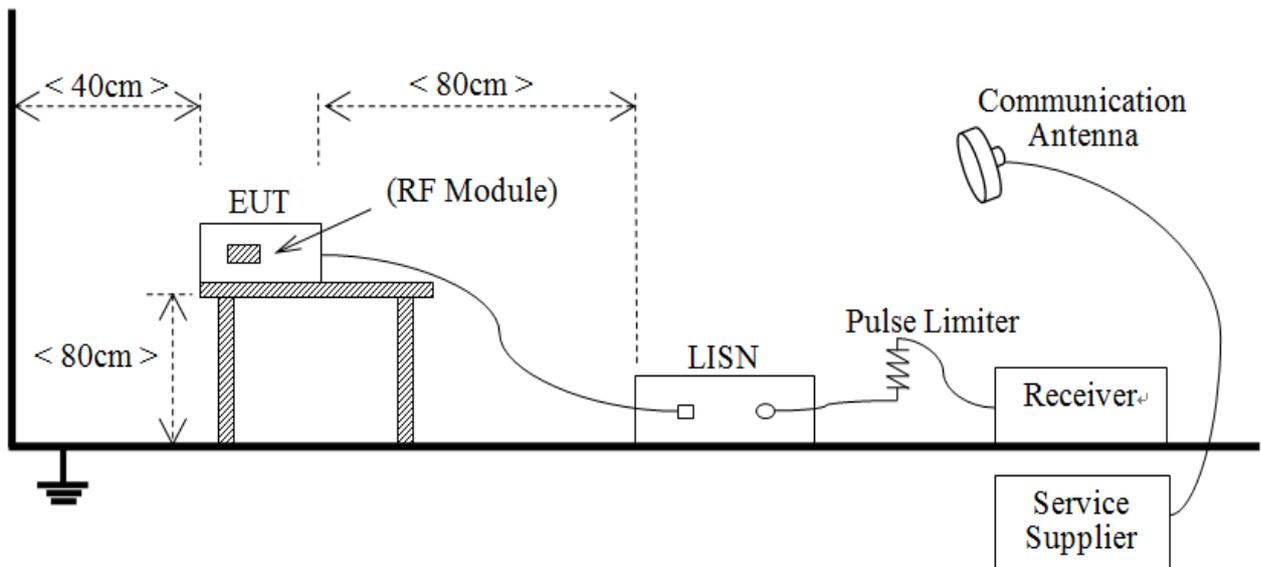
4.3 Description of Test Setup

4.3.1 For Antenna Port Test



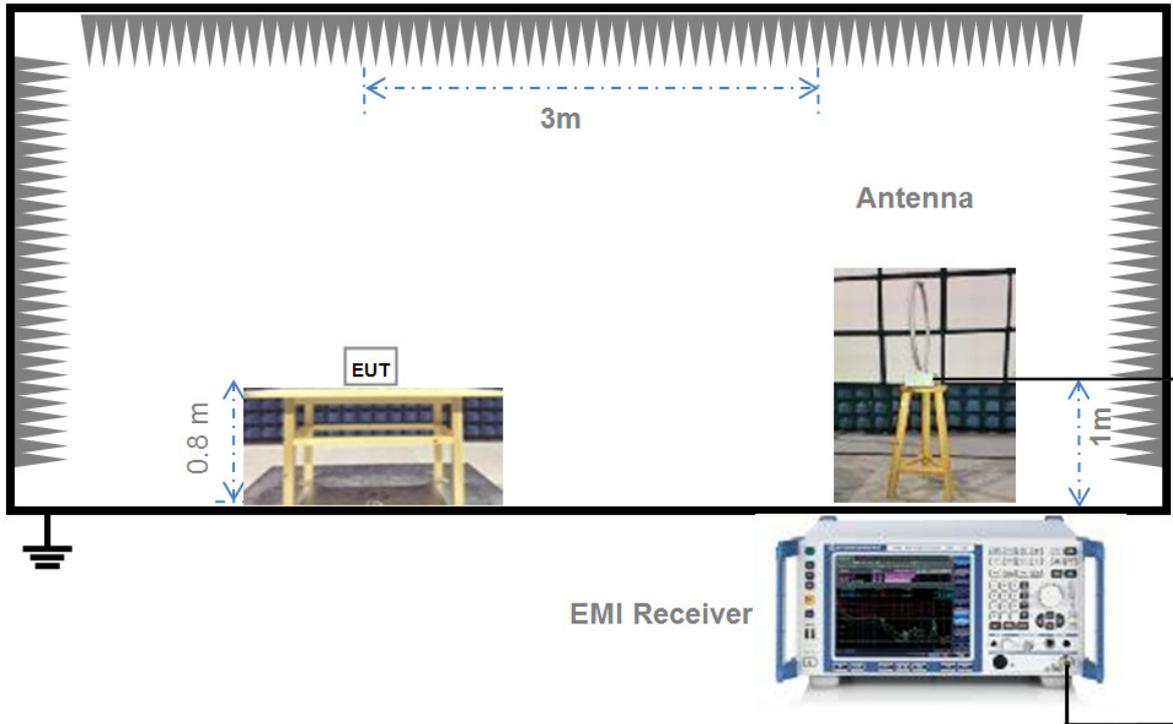
(Diagram 1)

4.3.2 For AC Power Supply Port Test



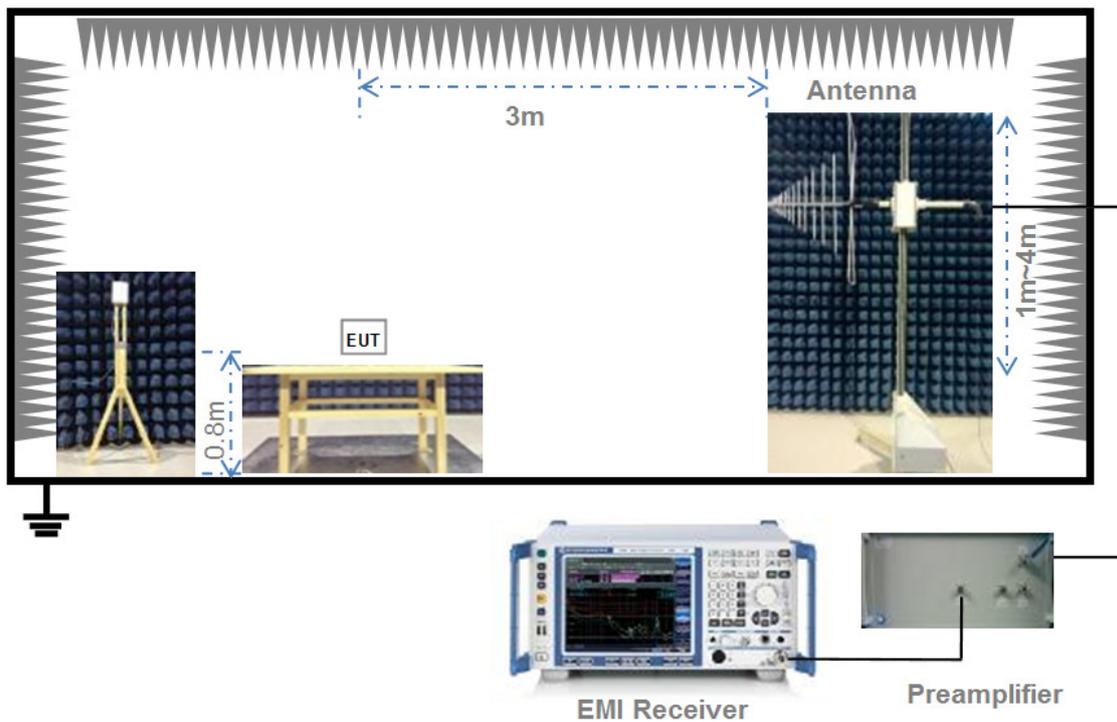
(Diagram 2)

4.3.3 For Radiated Test (Below 30 MHz)



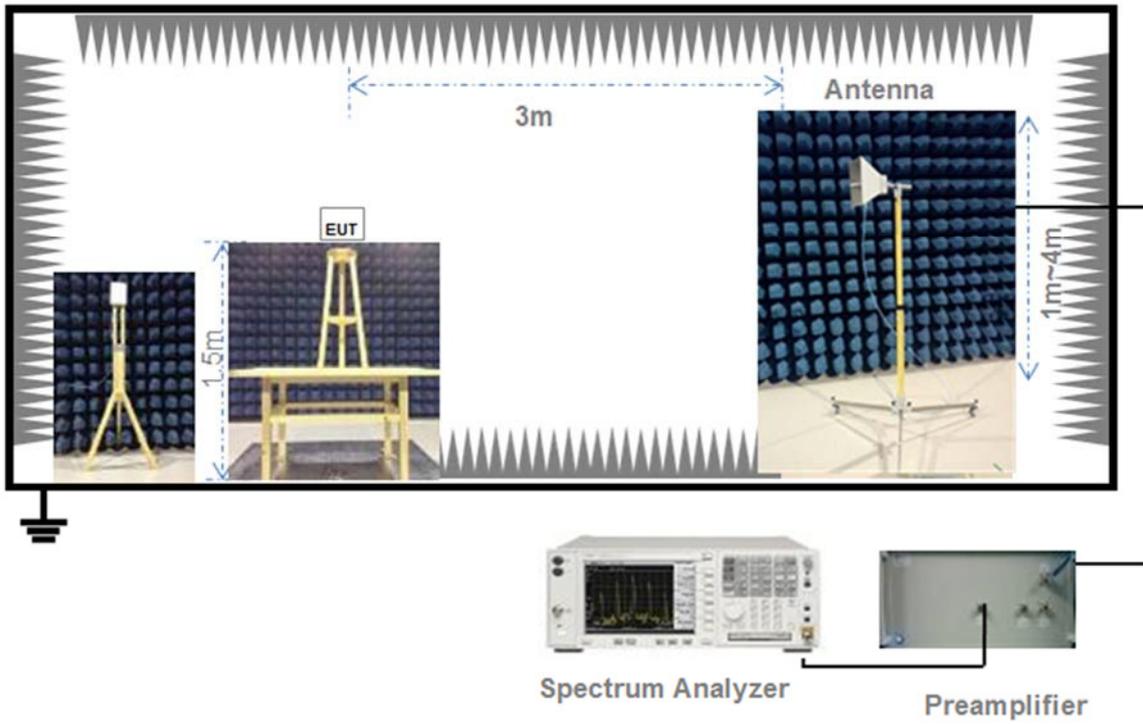
(Diagram 3)

4.3.4 For Radiated Test (30 MHz-1 GHz)



(Diagram 4)

4.3.5 For Radiated Test (Above 1 GHz)



(Diagram 5)

4.4 Measurement Results Explanation Example

4.4.1 For conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

4.4.2 For radiated band edges and spurious emission test:

Per part 15.35(c), the EUT Bluetooth average emission level could be determined by the peak emission level applying duty cycle correction factor, to represent averaging over the whole pulse train.

The average level is derived from the peak level corrected with "Duty cycle correction factor".

Average Emission Level (dBuV/m) = Peak Emission Level (dBuV/m) + Duty cycle correction factor (dB)

Duty cycle correction factor (dB) = $20 * \log(\text{Duty cycle})$.

Duty cycle = on time / 100 milliseconds

On time = dwell time * hopping number in 100 ms

For example: bluetooth with dwell time 2.9 ms and 3 hops in 100 ms, then

Duty cycle correction factor (dB) = $20 * \log((2.9 * 3) / 100) = -21.21 \text{ dB}$

Following shows an average computation example with duty cycle correction factor = -21.21 dB, and the peak emission level is 45.61 dBuV/m.

Example:

Average Emission Level (dBuV/m) = Peak Emission Level (dBuV/m) + duty cycle correction factor (dB)

= $45.61 + (-21.21) = 24.4 \text{ (dBuV/m)}$

5 TEST ITEMS

5.1 Antenna Requirements

5.1.1 Standard Applicable

FCC §15.203 & 15.247(b)

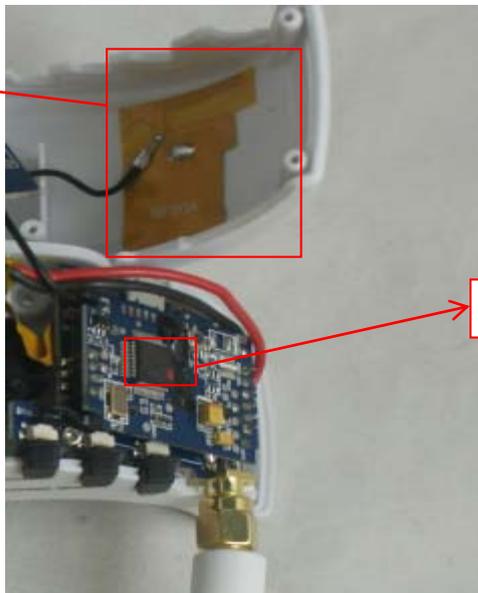
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of § 15.211, § 15.213, § 15.217, § 15.219, or § 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with § 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

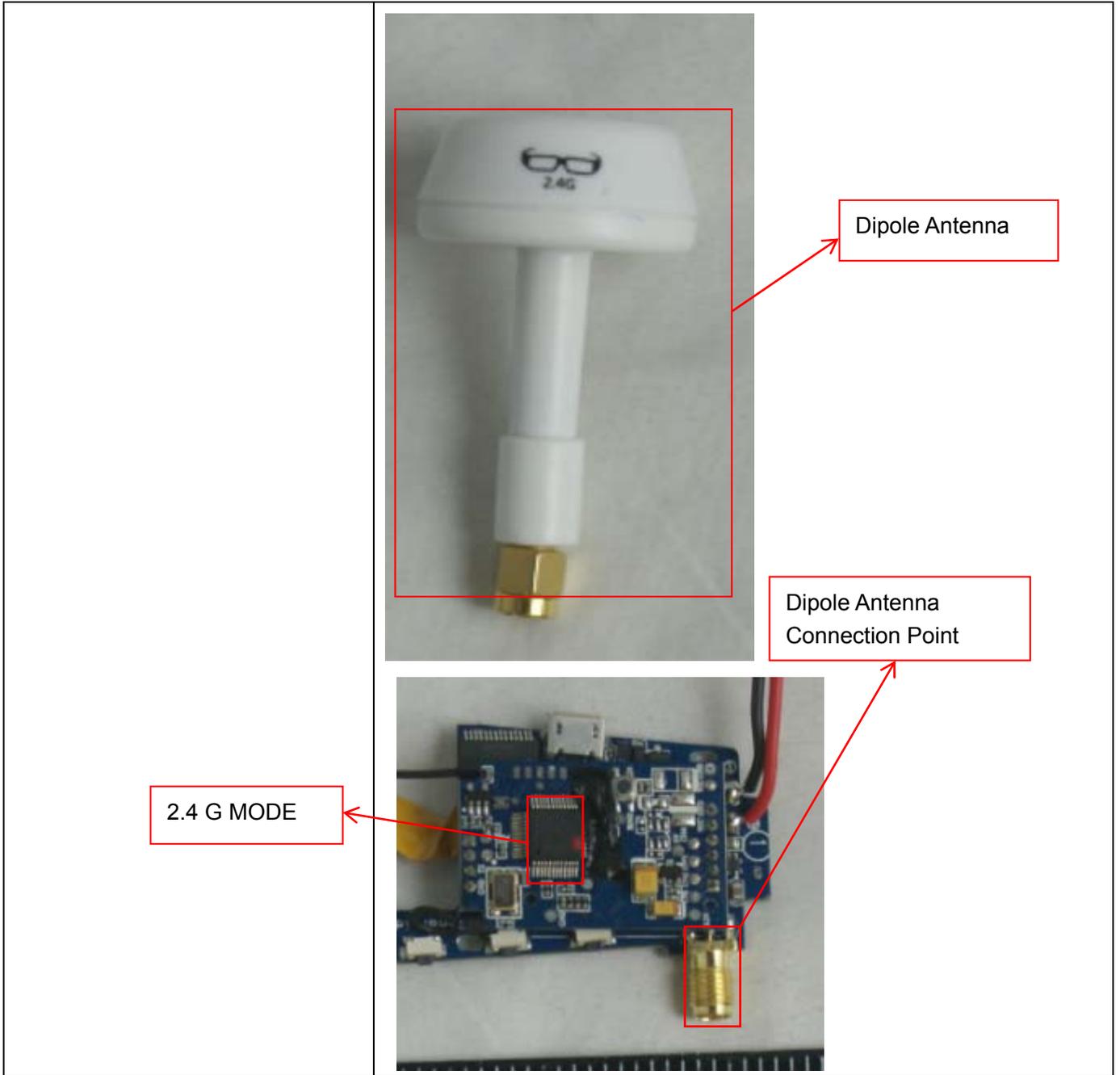
If directional gain of transmitting antennas is greater than 6 dBi, the power shall be reduced by the same level in dB comparing to gain minus 6 dBi. For the fixed point-to-point operation, the power shall be reduced by one dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the FCC rule.

5.1.2 Antenna Anti-Replacement Construction

The Antenna Anti-Replacement as following method:

Protected Method	Description
The antenna is An embedded-in	The antenna is welded on the mainboard, can't be replaced by the consumer. The Dipole Antenna is through special thread interface connection mainboard, can't be replaced by the consumer.

Reference Documents	Item
Photo	



5.1.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.

5.2 Number of Hopping Frequency

5.2.1 Limit

FCC §15.247(a) (1) (iii)

Frequency hopping systems operating in the 2400 MHz to 2483.5 MHz bands shall use at least 15 hopping frequencies.

5.2.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.2.3 Test Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

Span = the frequency band of operation

RBW \geq 1% of the span

VBW \geq RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize

5.2.4 Test Result

Please refer to ANNEX A.1.

5.3 Peak Output Power

5.3.1 Test Limit

FCC § 15.247(b)

For frequency hopping systems that operates in the 2400 MHz to 2483.5 MHz band employing at least 75 hopping channels, the maximum peak output power of the intentional radiator shall not exceed 1 Watt.

5.3.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.3.3 Test Procedure

The Bluetooth Module operates at hopping-off test mode. The lowest, middle and highest channels are selected to perform testing to verify the conducted RF output peak power of the Module.

Use the following spectrum analyzer settings:

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

RBW > the 20 dB bandwidth of the emission being measured

VBW \geq RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize.

5.3.4 Test Result

Please refer to ANNEX A.2.

5.4 Occupied Bandwidth

5.4.1 Limit

FCC §15.247(a)

The 20 dB bandwidth is known as the 99% emission bandwidth, or 20 dB bandwidth ($10 \cdot \log 1\% = 20$ dB) taking the total RF output power.

5.4.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.4.3 Test Procedure

Use the following spectrum analyzer settings:

Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel

RBW \geq 1% of the 20 dB bandwidth

VBW \geq RBW

Sweep = auto

Detector function = peak

Trace = max hold

The EUT should be transmitting at its maximum data rate, Allow the trace to stabilize.

5.4.4 Test Result

Please refer to ANNEX A.3.

5.5 Carrier Frequency Separation

5.5.1 Limit

FCC §15.247(a)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

5.5.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.5.3 Test Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

Span = wide enough to capture the peaks of two adjacent channels

Resolution (or IF) Bandwidth (RBW) \geq 1% of the span

Video (or Average) Bandwidth (VBW) \geq RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

5.5.4 Test Result

Please refer to ANNEX A.4.

5.6 Time of Occupancy (Dwell time)

5.6.1 Limit

FCC §15.247(a)

Frequency hopping systems in the 2400 MHz - 2483.5 MHz band shall use at least 15 non-overlapping channels. 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. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

5.6.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.6.3 Test Procedure

The average time of occupancy on any channel within the Period can be calculated with formulas:

$$\{\text{Total of Dwell}\} = \{\text{Pulse Time}\} * (\text{Number of hops in the period specified in the requirements})$$

$$(\text{Number of hops in the period specified in the requirements}) = (\text{number of hops on spectrum analyzer}) \times (\text{period specified in the requirements} / \text{analyzer sweep time})$$

$$\{\text{period specified in the requirements}\} = 0.4 \text{ s} * \{\text{Number of Hopping Frequency}\}$$

The channel is selected to perform testing to record the dwell time of each occupation measured in this channel, which is called Pulse Time here.

5.6.4 Test Result

Please refer to ANNEX A.5

5.7 Conducted Spurious Emission

5.7.1 Limit

FCC §15.247(d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

5.7.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.7.3 Test Procedure

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.

RBW = 100 kHz

VBW \geq RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize

5.7.4 Test Result

Please refer to ANNEX A.6.

5.8 Conducted Emission

5.8.1 Limit

FCC §15.207

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 Ω line impedance stabilization network (LISN).

Frequency range (MHz)	Conducted Limit (dB μ V)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
0.50 - 30	60	50

5.8.2 Test Setup

See section 4.4.2 for test setup description for the AC power supply port. The photo of test setup please refer to ANNEX B.

5.8.3 Test Procedure

The maximum conducted interference is searched using Peak (PK), if the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed. Refer to recorded points and plots below.

5.8.4 Test Result

Please refer to ANNEX A.7.

5.9 Radiated Spurious Emission

5.9.1 Limit

FCC §15.209&15.247(d)

Radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).

According to FCC section 15.209 (a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength ($\mu\text{V}/\text{m}$)	Measurement Distance (m)
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

Note:

1. Field Strength (dB $\mu\text{V}/\text{m}$) = 20*log[Field Strength ($\mu\text{V}/\text{m}$)].
2. In the emission tables above, the tighter limit applies at the band edges.
3. For Above 1000 MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.
4. For above 1000 MHz, limit field strength of harmonics: 54dB $\mu\text{V}/\text{m}$ @3m (AV) and 74dB $\mu\text{V}/\text{m}$ @3m (PK).

5.9.2 Test Setup

See section 4.4.3 to 4.4.5 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.9.3 Test Procedure

The measurement frequency range is from 9 kHz to the 10th harmonic of the fundamental frequency. The Turn Table is actuated to turn from 0° to 360°, and both horizontal and vertical polarizations of the Test Antenna are used to find the maximum radiated power. Mid channels on all channel bandwidth verified. Only the worst RB size/offset presented.

The power of the EUT transmitting frequency should be ignored.

All Spurious Emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

Use the following spectrum analyzer settings:

Span = wide enough to fully capture the emission being measured

RBW = 1 MHz for $f \geq 1$ GHz, 100 kHz for $f < 1$ GHz

VBW \geq RBW

Sweep = auto

Detector function = peak

Trace = max hold

For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported, Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

5.9.4 Test Result

Please refer to ANNEX A.8.

5.10 Band Edge

5.10.1 Limit

FCC §15.209&15.247(d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

5.10.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.10.3 Test Procedure

Span = wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation

RBW \geq 1% of the span

VBW \geq RBW

Sweep = auto

Detector function = peak /AV

Trace = max hold

Allow the trace to stabilize.

$E \text{ [dB}\mu\text{V/m]} = \text{UR} + \text{AT} + \text{AFactor [dB]}; \text{AT} = \text{LCable loss [dB]} - \text{Gpreamp [dB]}$

AT: Total correction Factor except Antenna

UR: Receiver Reading

Gpreamp: Preamplifier Gain

AFactor: Antenna Factor at 3m

5.10.4 Test Result

Please refer to ANNEX A.9.

ANNEX A TEST RESULT

A.1 Number of Hopping Frequency

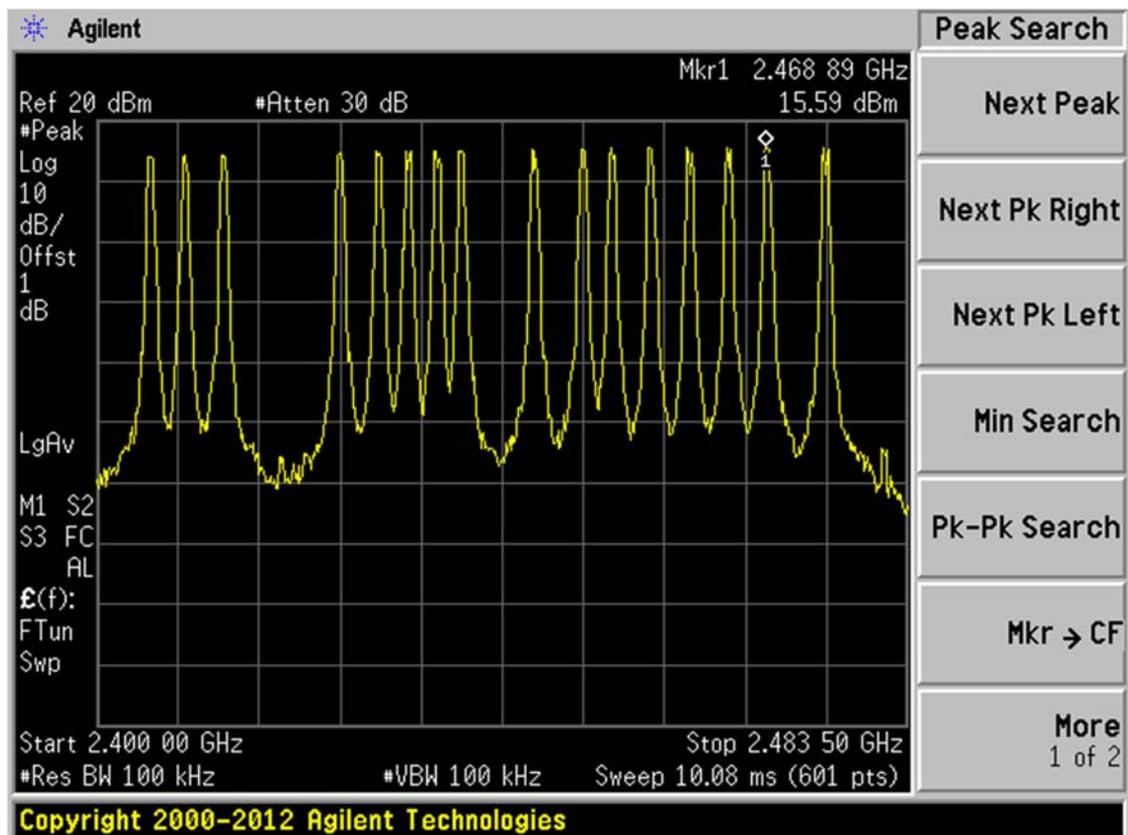
Test Data

ANT 1

Test Mode	Frequency Block (MHz)	Measured Channel Numbers	Min. Limit	Verdict
GFSK	2400 - 2483.5	16	15	Pass

Test plots

GFSK 2.4 GHz ~ 2.4835 GHz

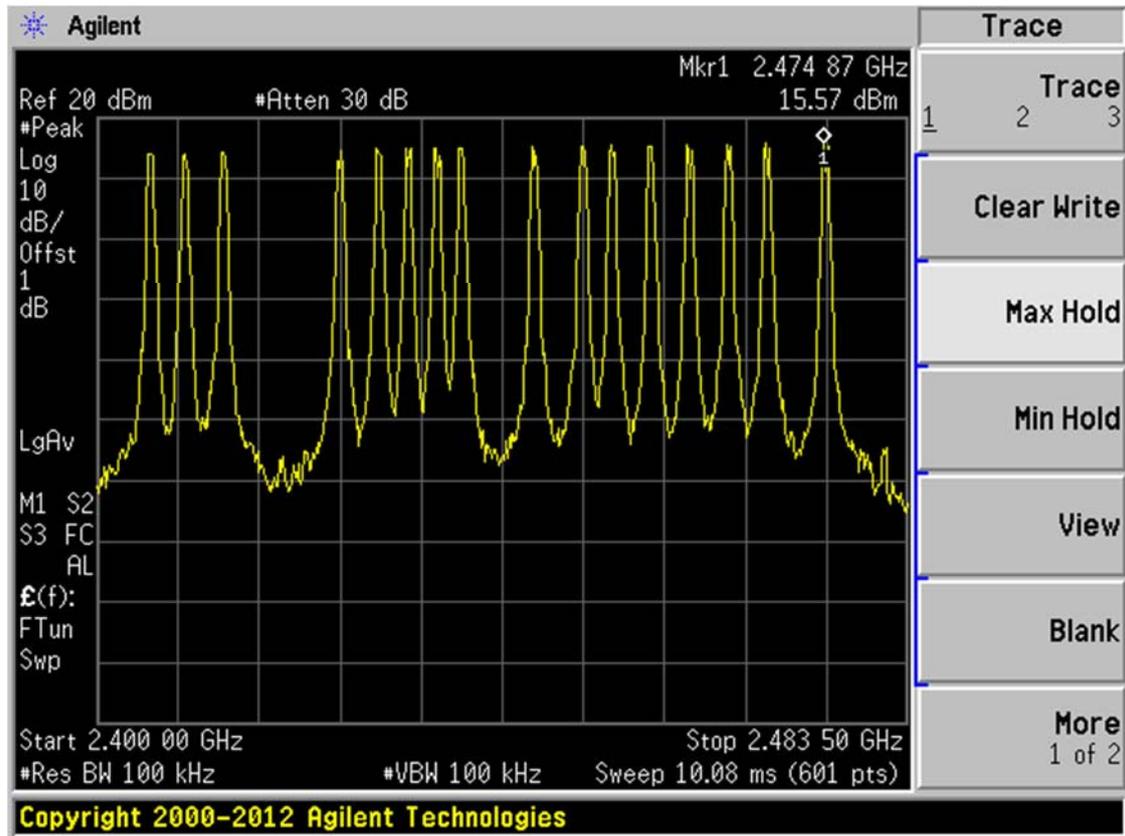


ANT 2

Test Mode	Frequency Block (MHz)	Measured Channel Numbers	Min. Limit	Verdict
GFSK	2400 - 2483.5	16	15	Pass

Test plots

GFSK 2.4 GHz ~ 2.4835 GHz



A.2 Peak Output Power

Test Data

ANT 1

Channel	Measured Output Peak Power		Limit		Verdict
	dBm	mW	dBm	mW	
Low	13.70	23.44	30	1000	Pass
Middle	14.55	28.51			Pass
High	15.02	31.77			Pass

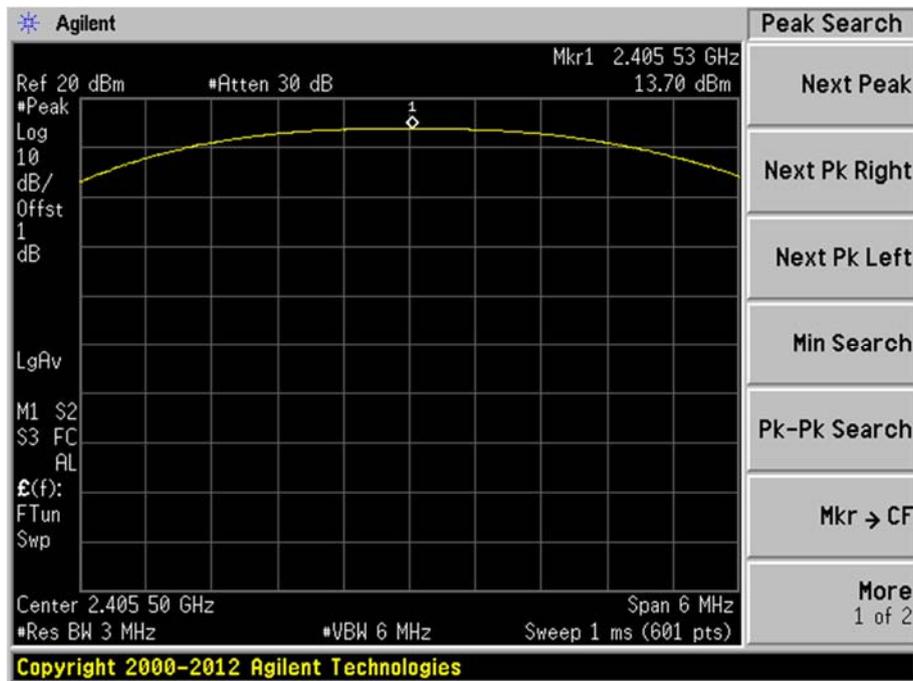
ANT 2

Channel	Measured Output Peak Power		Limit		Verdict
	dBm	mW	dBm	mW	
Low	13.49	22.34	30	1000	Pass
Middle	14.46	27.93			Pass
High	14.99	31.55			Pass

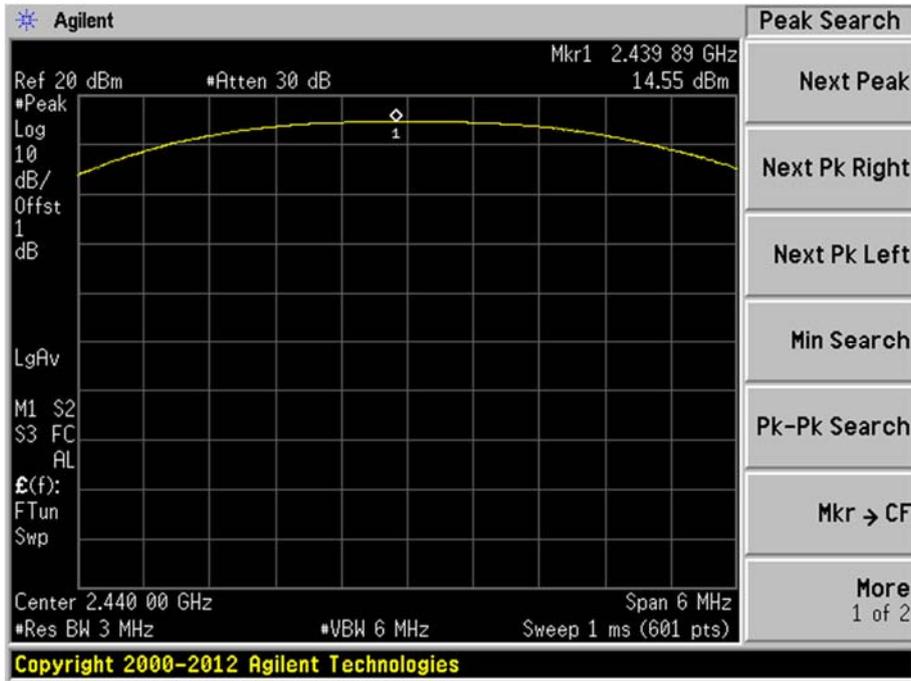
Test plots

ANT 1

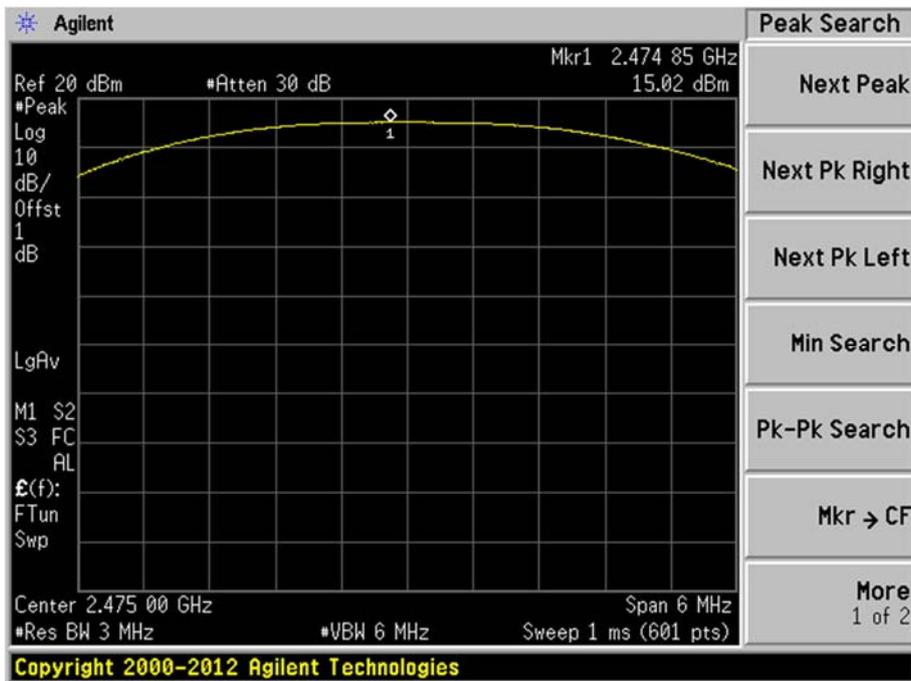
GFSK LOW CHANNEL



GFSK MIDDLE CHANNEL

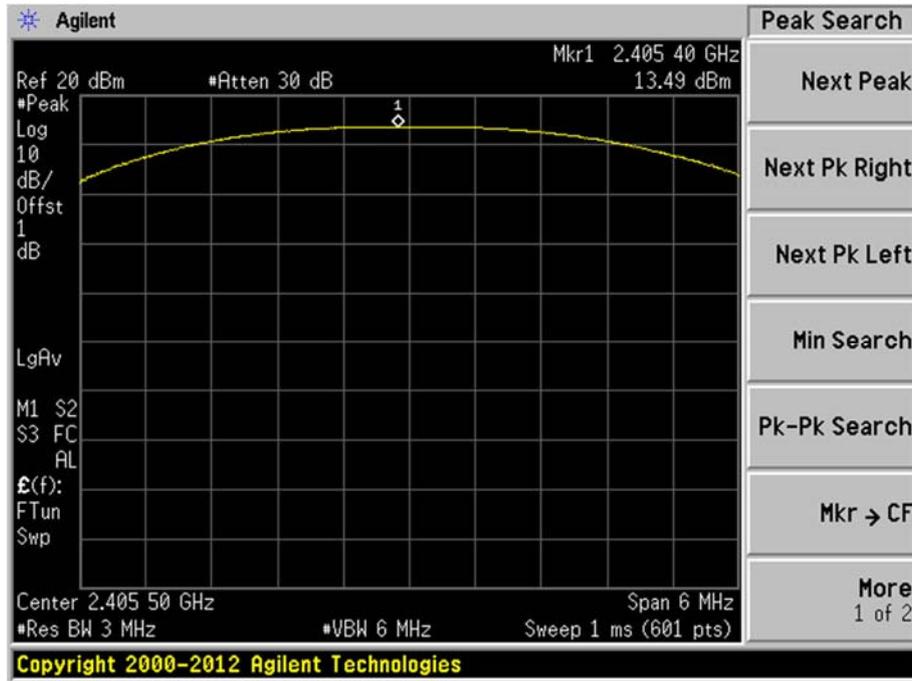


GFSK HIGH CHANNEL

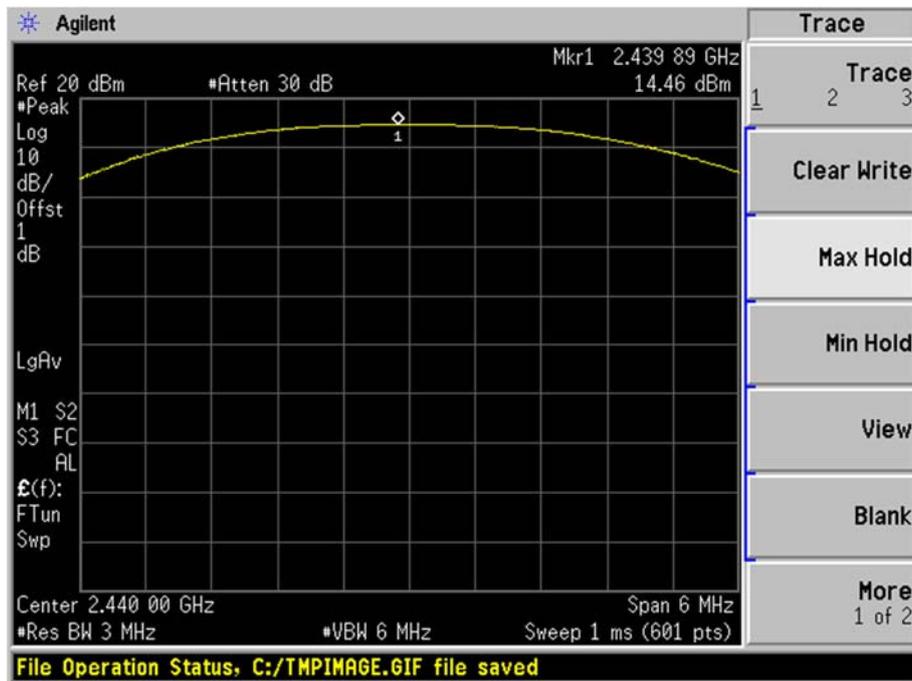


ANT 2

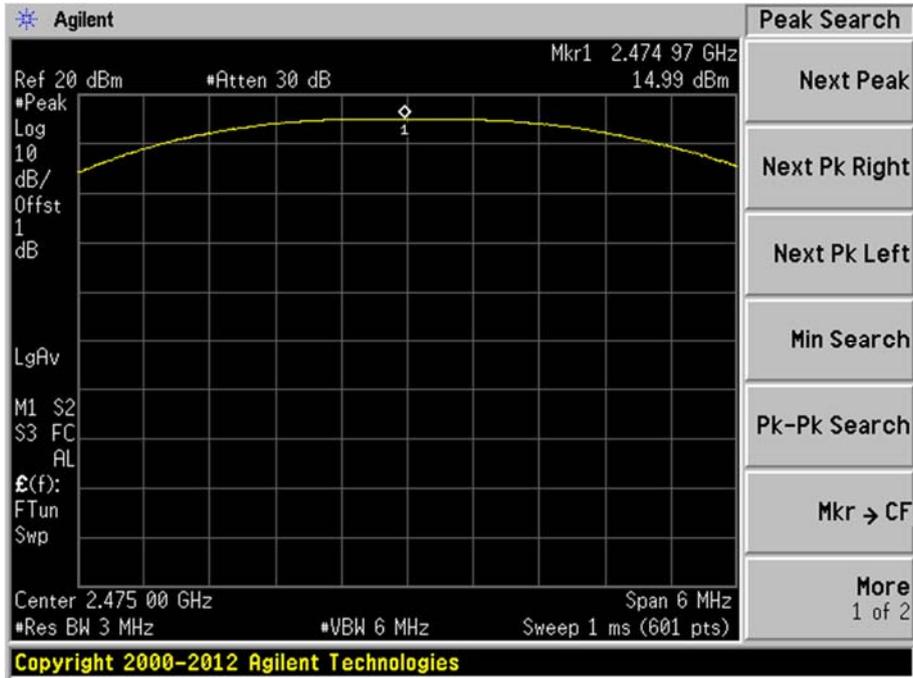
GFSK LOW CHANNEL



GFSK MIDDLE CHANNEL



GFSK HIGH CHANNEL



A.3 20 dB and 99% bandwidth

Test Data

ANT 1

GFSK Mode:

Channel	20 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	1.150	1.0362
Middle	1.153	1.0285
High	1.143	1.0217

ANT 2

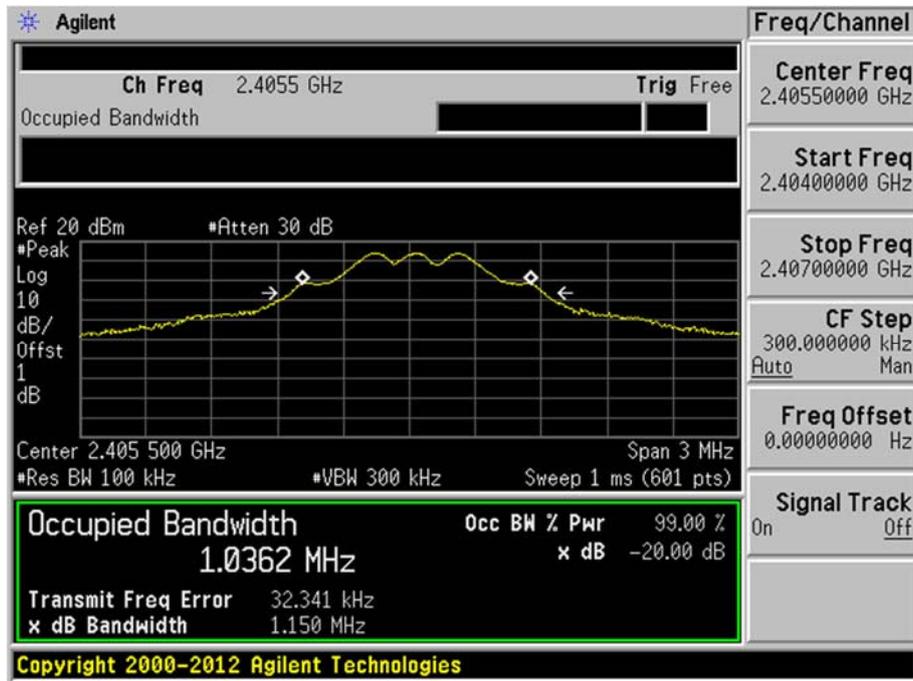
GFSK Mode:

Channel	20 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	1.145	1.0302
Middle	1.156	1.0348
High	1.146	1.0252

Test plots

ANT 1

GFSK LOW CHANNEL



ANT 2

GFSK LOW CHANNEL



GFSK MIDDLE CHANNEL



GFSK HIGH CHANNEL



A.4 Hopping Frequency Separation

Test Data

ANT 1

Mode	Frequency separation (MHz)	Max 20 dB Bandwidth (MHz)	Two-thirds of the 20 dB bandwidth (MHz)	Verdict
GFSK	2.517	1.153	0.769	Pass

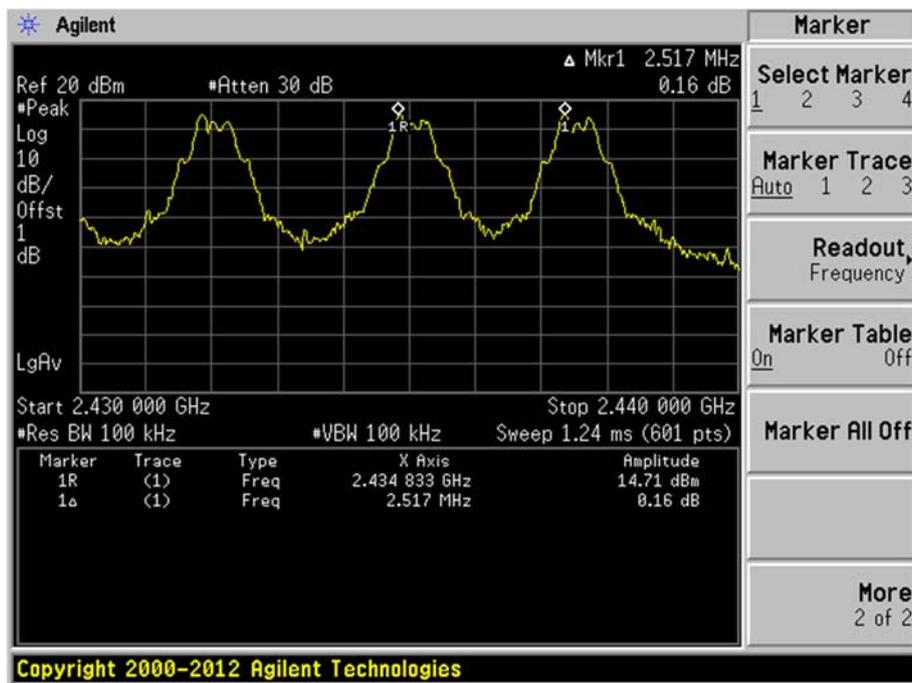
ANT 2

Mode	Frequency separation (MHz)	Max 20 dB Bandwidth (MHz)	Two-thirds of the 20 dB bandwidth (MHz)	Verdict
GFSK	2.500	1.156	0.769	Pass

Test Plots

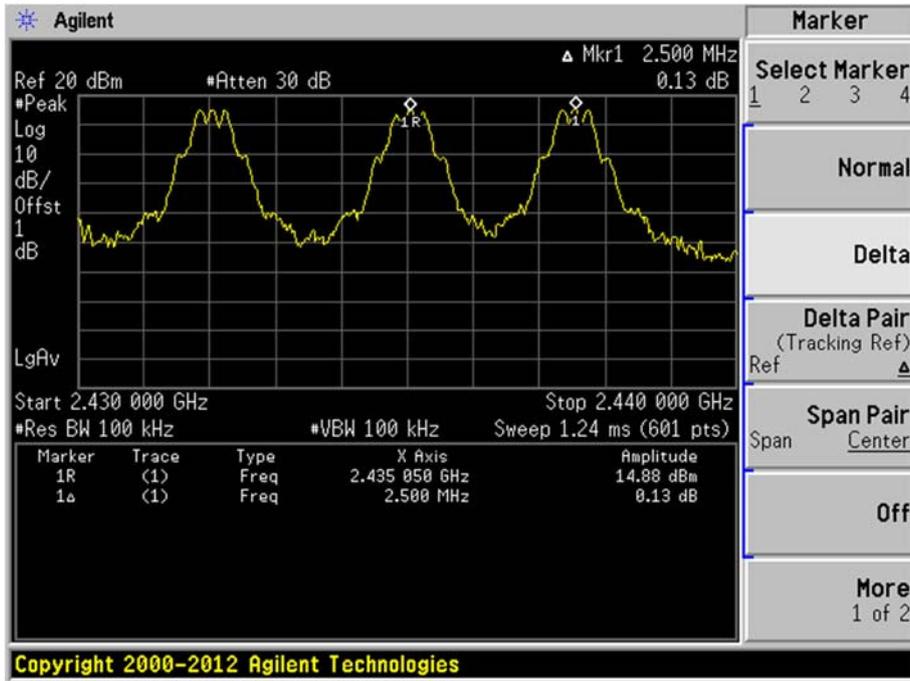
ANT 1

GFSK



ANT 2

GFSK



A.5 Average Time of Occupancy

Test Data

ANT 1

GFSK Mode:

DH Packet	Pulse Width (ms)	Total of Dwell (ms)	Limit (sec)	Verdict
N/A	1.297	332.032	0.4	Pass

ANT 2

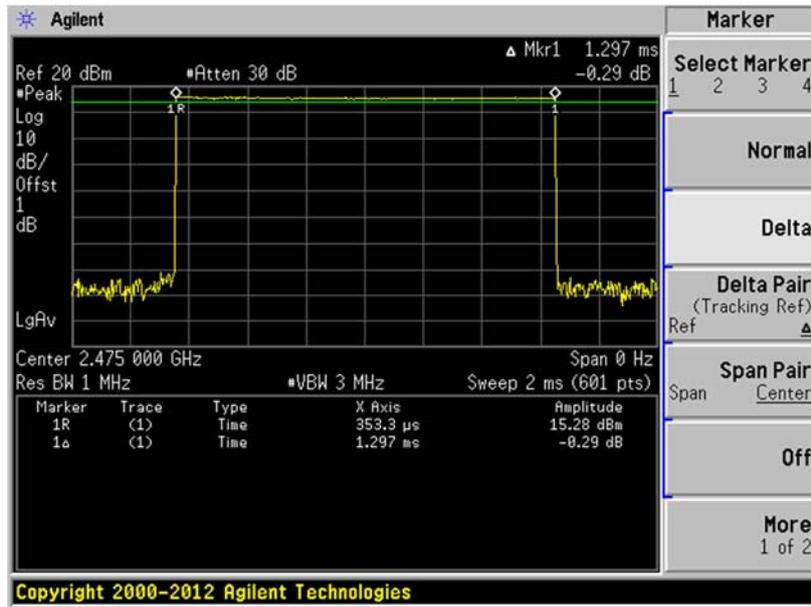
GFSK Mode:

DH Packet	Pulse Width (ms)	Total of Dwell (ms)	Limit (sec)	Verdict
N/A	1.293	331.008	0.4	Pass

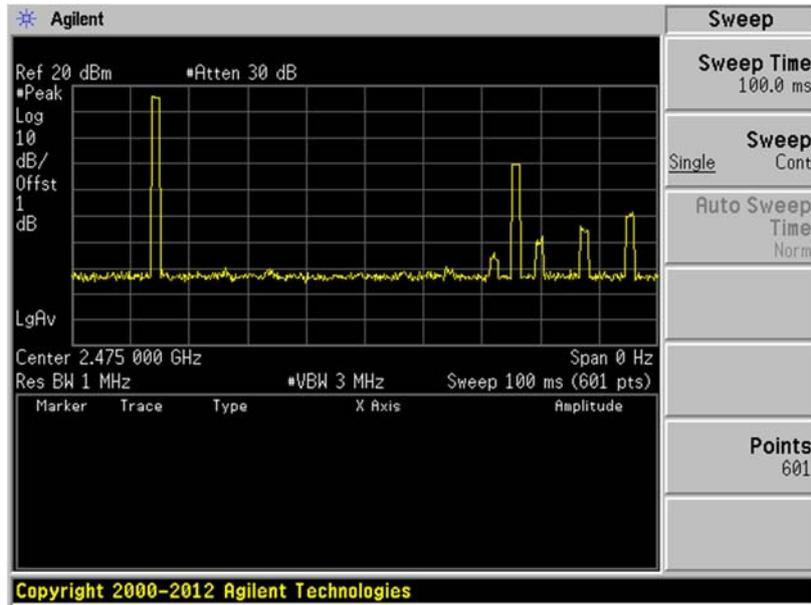
Test Plots

ANT 1

GFSK 1



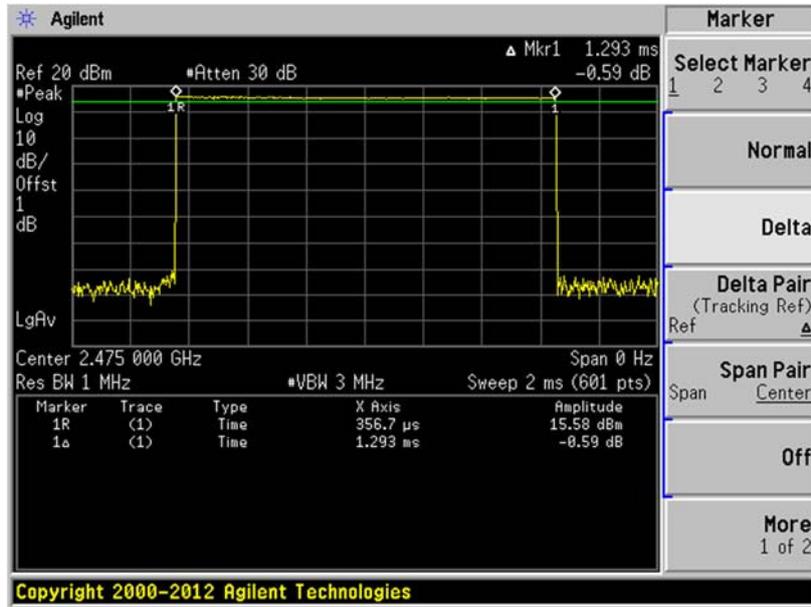
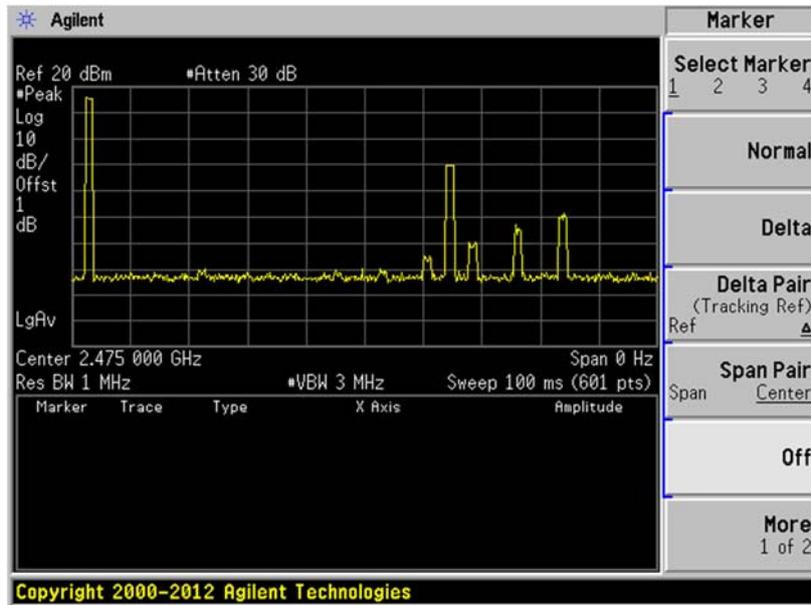
GFSK 2



Period specified in the requirements = $0.4 \text{ s} * \text{Number of Hopping Frequency} = 0.4 * 16 = 6.4 \text{ s}$;

Number of hops in the period specified in the requirements = $(\text{number of hops on spectrum analyzer}) * (\text{period specified in the requirements} / \text{analyzer sweep time}) = 4 * (6.4 / 0.1) = 256$;

Total of Dwell = $\{\text{Pulse Time}\} * (\text{Number of hops in the period specified in the requirements})$
 $= 1.297 \text{ ms} * 256$
 $= 332.032 \text{ ms}$.

ANT 2
GFSK 1

GFSK 2


Period specified in the requirements = $0.4 \text{ s} * \text{Number of Hopping Frequency} = 0.4 * 16 = 6.4\text{s}$;

Number of hops in the period specified in the requirements = (number of hops on spectrum analyzer) \times (period specified in the requirements / analyzer sweep time) = $4 * (6.4 / 0.1) = 256$;

Total of Dwell = {Pulse Time} * (Number of hops in the period specified in the requirements)
 = $1.293 \text{ ms} * 256$
 = 331.008 ms .

A.6 Conducted Spurious Emissions

Test Data

ANT 1

GFSK Mode:

Channel	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
		Carrier Level	Calculated 20 dBc Limit	
Low	-37.96	13.61	-6.39	Pass
Middle	-53.22	14.52	-5.48	Pass
High	-34.50	15.08	-4.92	Pass

ANT 2

GFSK Mode:

Channel	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
		Carrier Level	Calculated 20 dBc Limit	
Low	-37.73	13.60	-6.40	Pass
Middle	-54.22	14.44	-5.56	Pass
High	-35.00	14.95	-5.05	Pass

Hopping

ANT 1

Mode	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
		Carrier Level	Calculated 20 dBc Limit	
Hopping	-34.25	14.18	-5.8	Pass

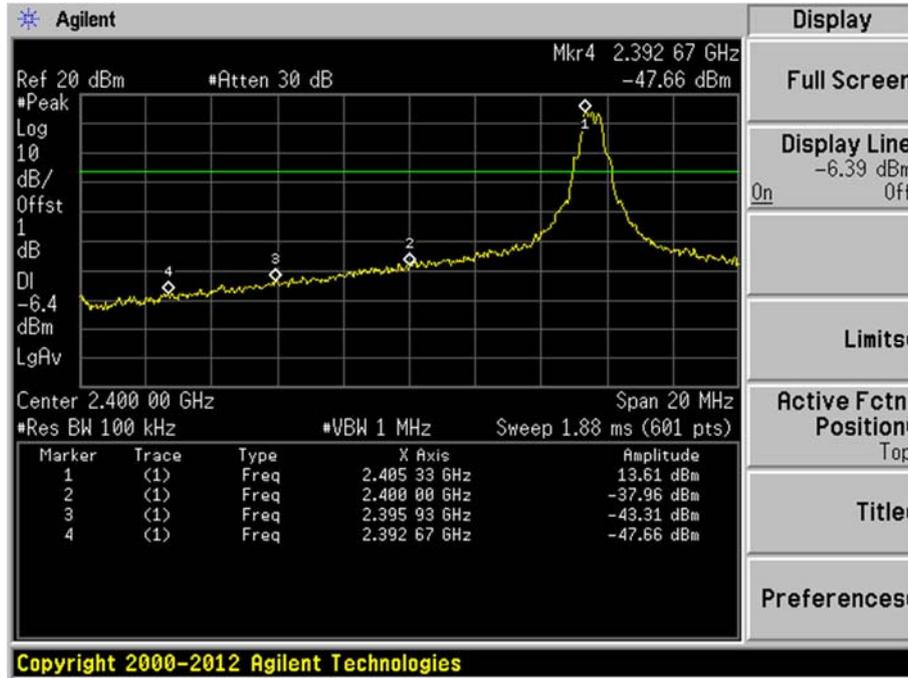
ANT 2

Mode	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
		Carrier Level	Calculated 20 dBc Limit	
Hopping	-34.21	15.43	-4.6	Pass

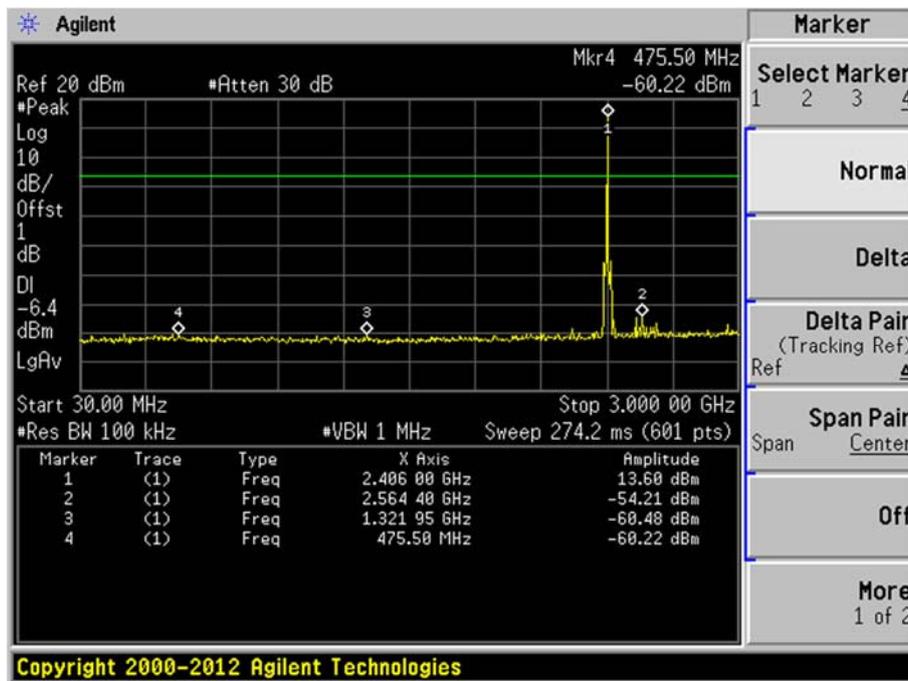
Test Plots

ANT 1

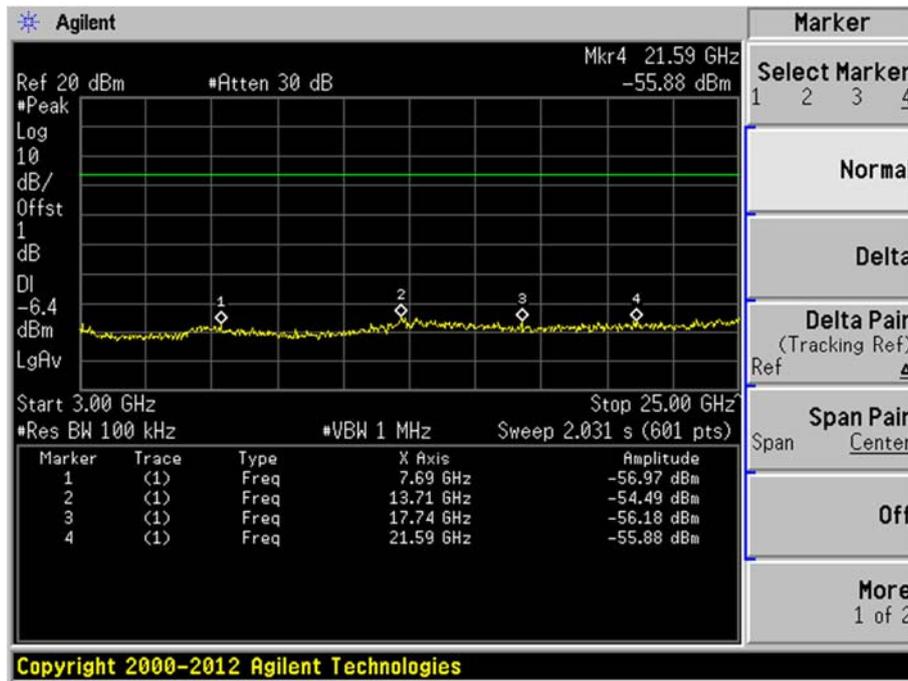
GFSK LOW CHANNEL , BAND EDGE



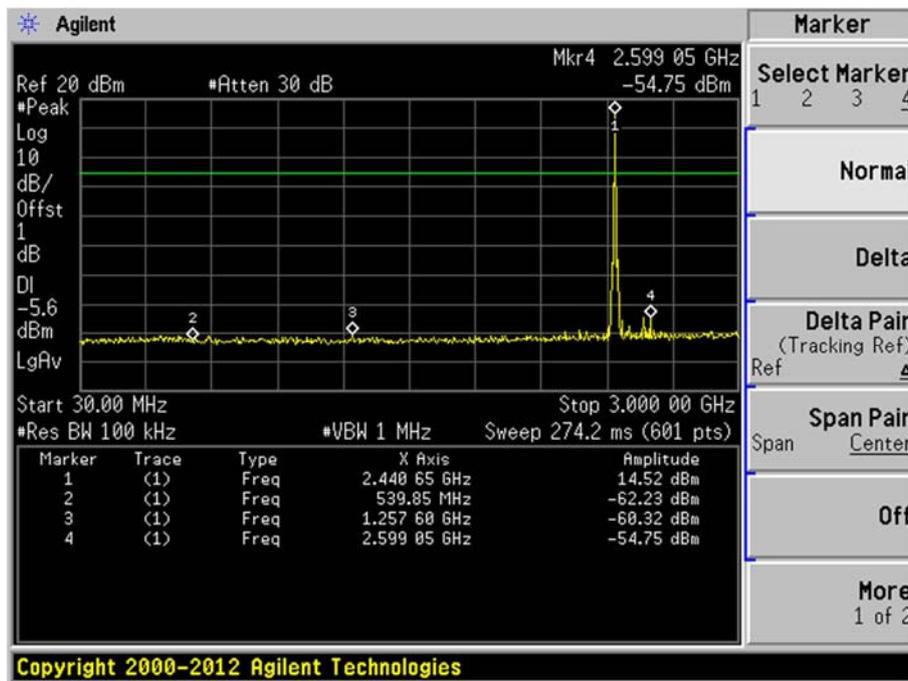
GFSK LOW CHANNEL , SPURIOUS 30 MHz ~ 3 GHz



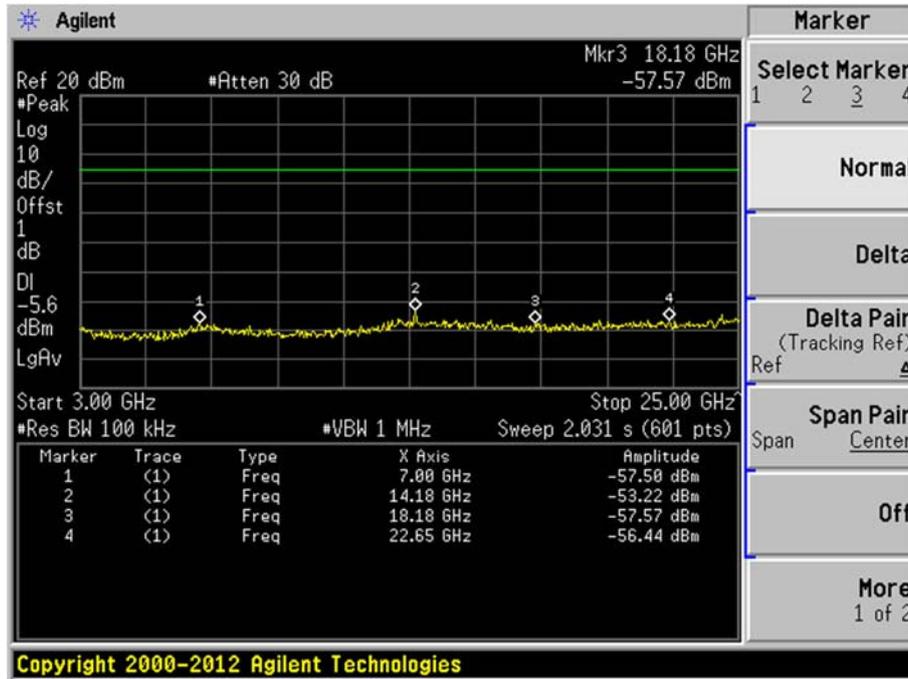
GFSK LOW CHANNEL , SPURIOUS 3 GHz ~ 25 GHz



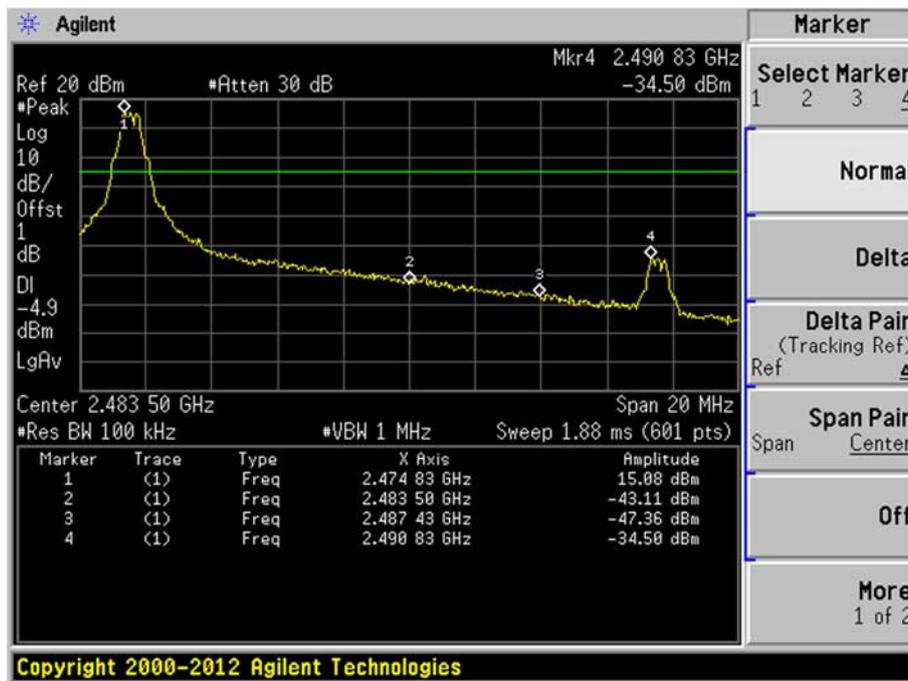
GFSK MIDDLE CHANNEL , SPURIOUS 30 MHz ~ 3 GHz



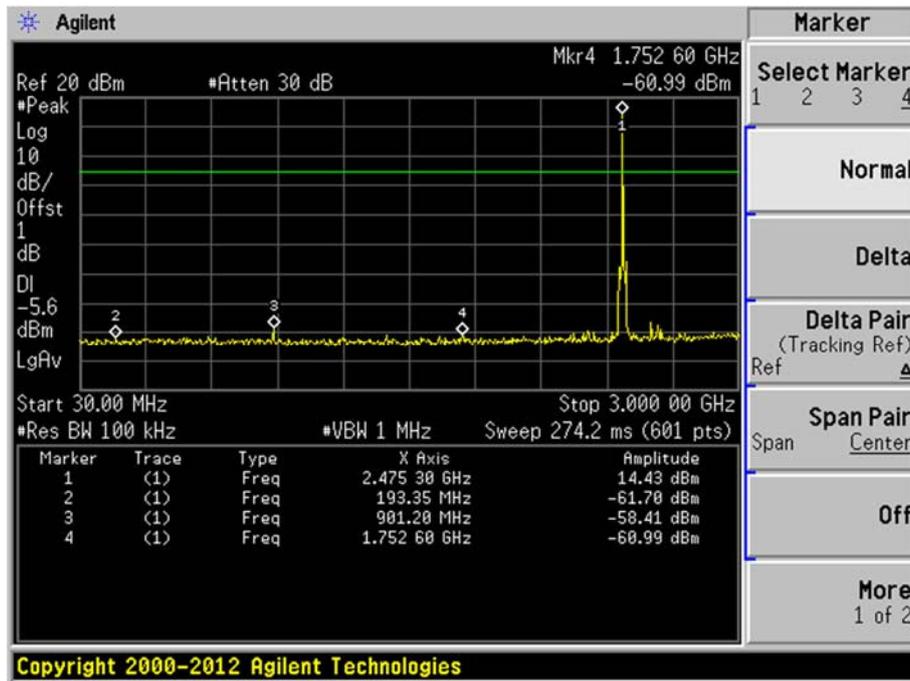
GFSK MIDDLE CHANNEL , SPURIOUS 3 GHz ~ 25 GHz



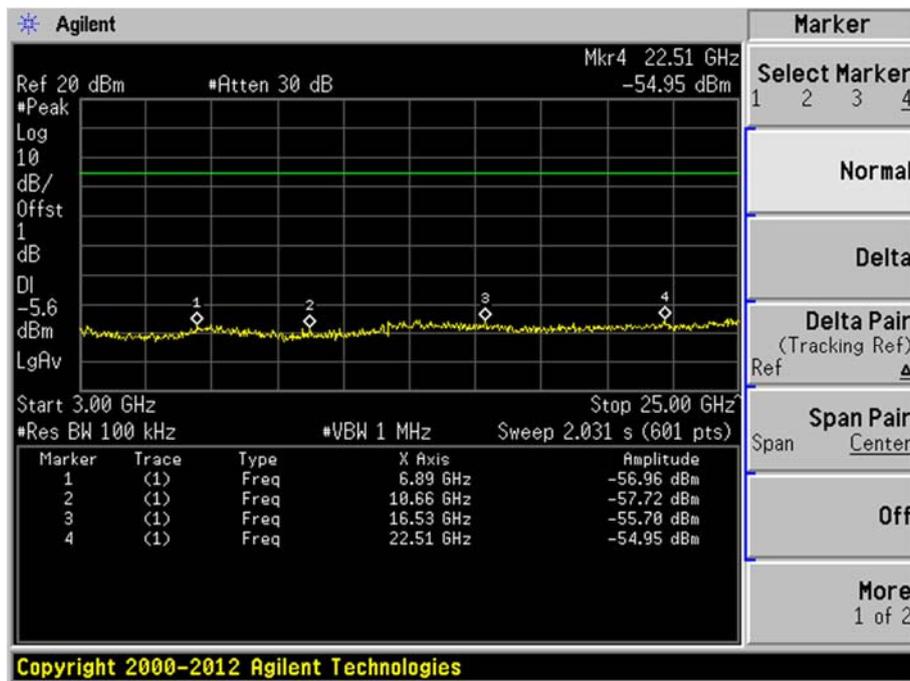
GFSK HIGH CHANNEL , BAND EDGE



GFSK HIGH CHANNEL , SPURIOUS 30 MHz ~ 3 GHz

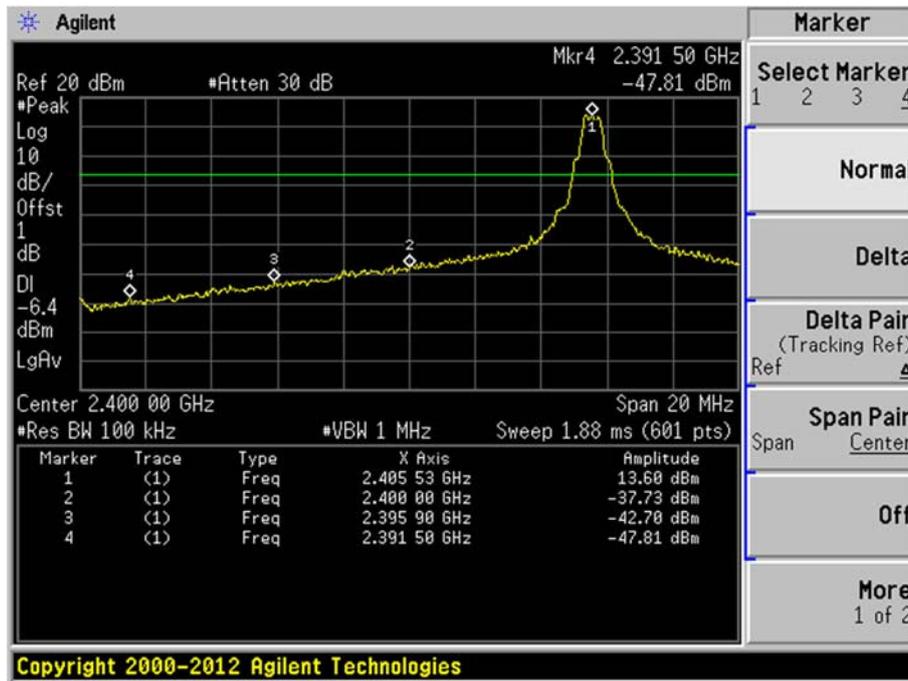


GFSK HIGH CHANNEL , SPURIOUS 3 GHz ~ 25 GHz

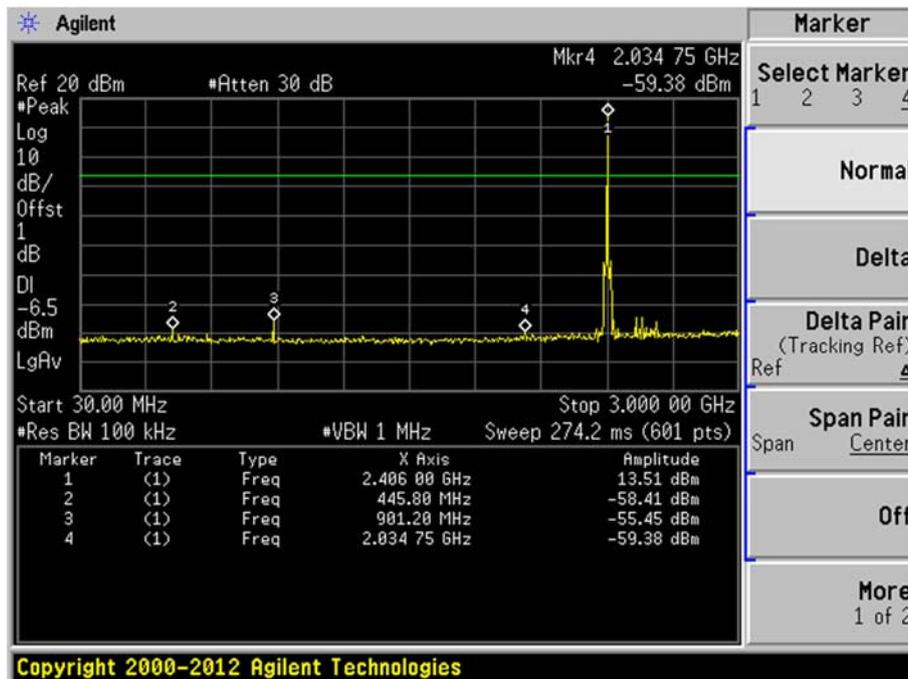


ANT 2

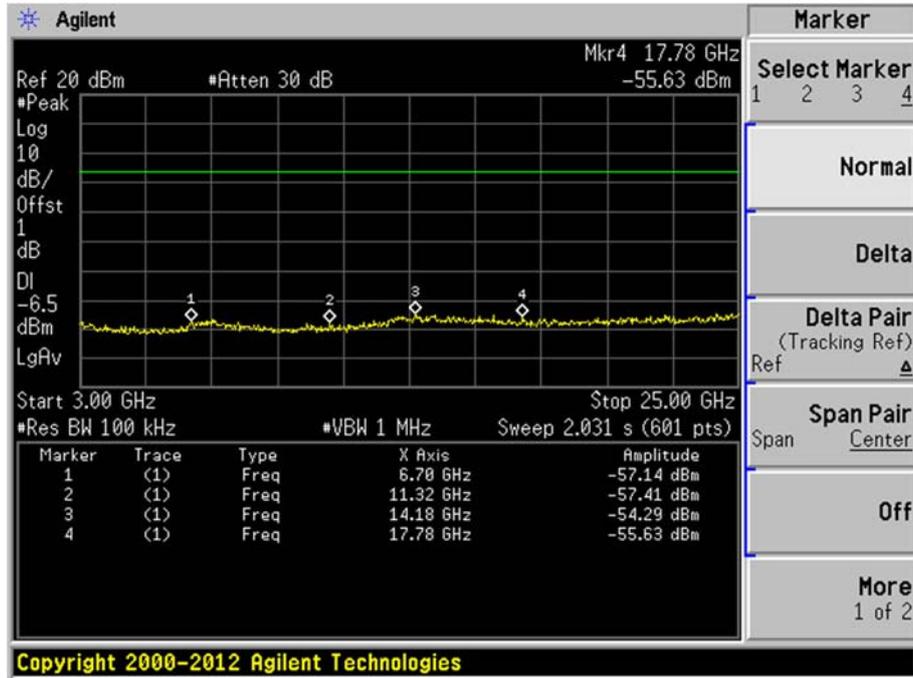
GFSK LOW CHANNEL , BAND EDGE



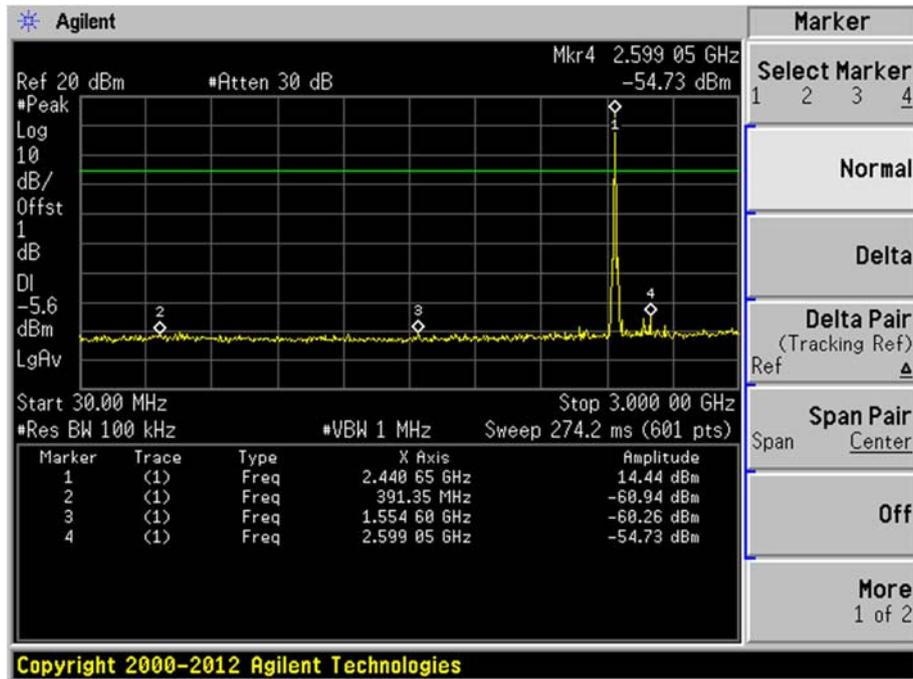
GFSK LOW CHANNEL , SPURIOUS 30 MHz ~ 3 GHz



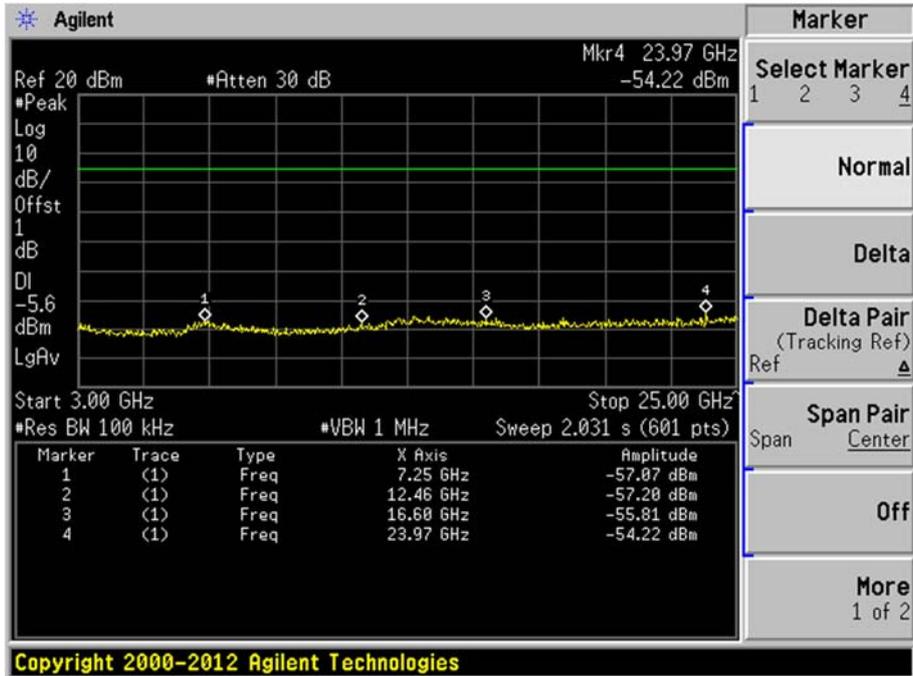
GFSK LOW CHANNEL , SPURIOUS 3 GHz ~ 25 GHz



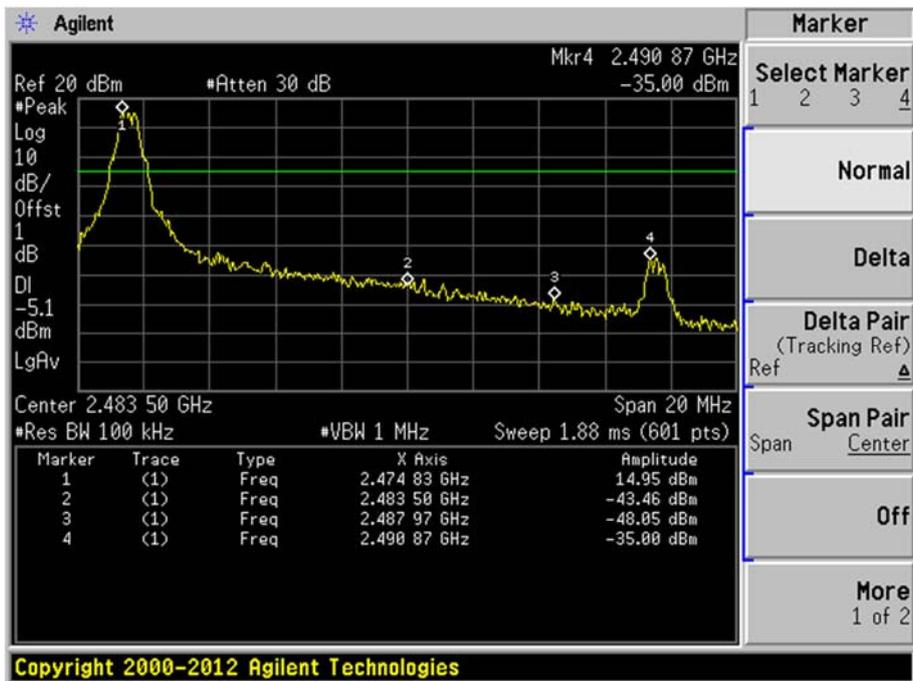
GFSK MIDDLE CHANNEL , SPURIOUS 30 MHz ~ 3 GHz



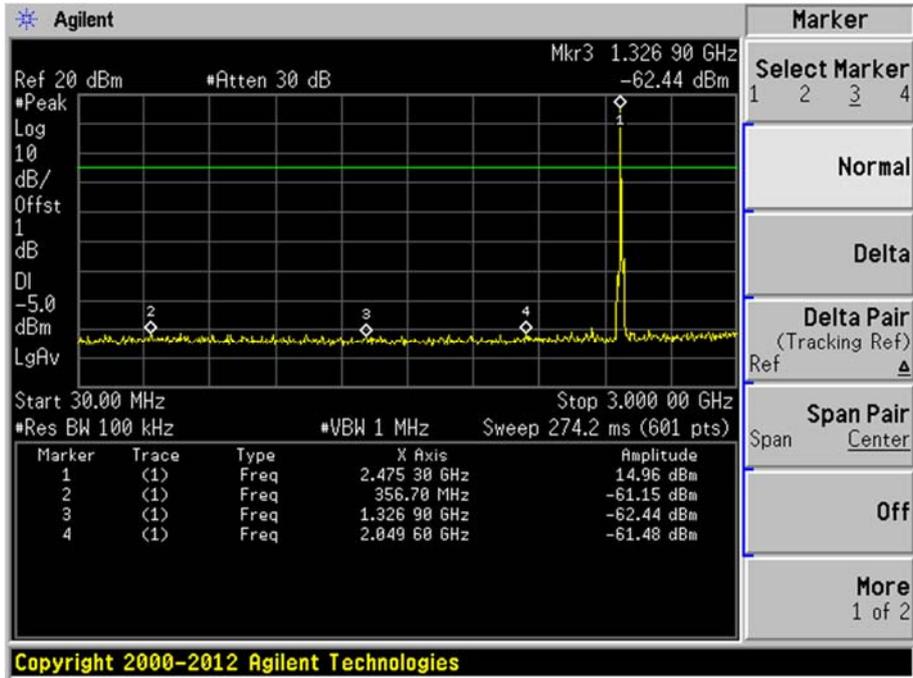
GFSK MIDDLE CHANNEL , SPURIOUS 3 GHz ~ 25 GHz



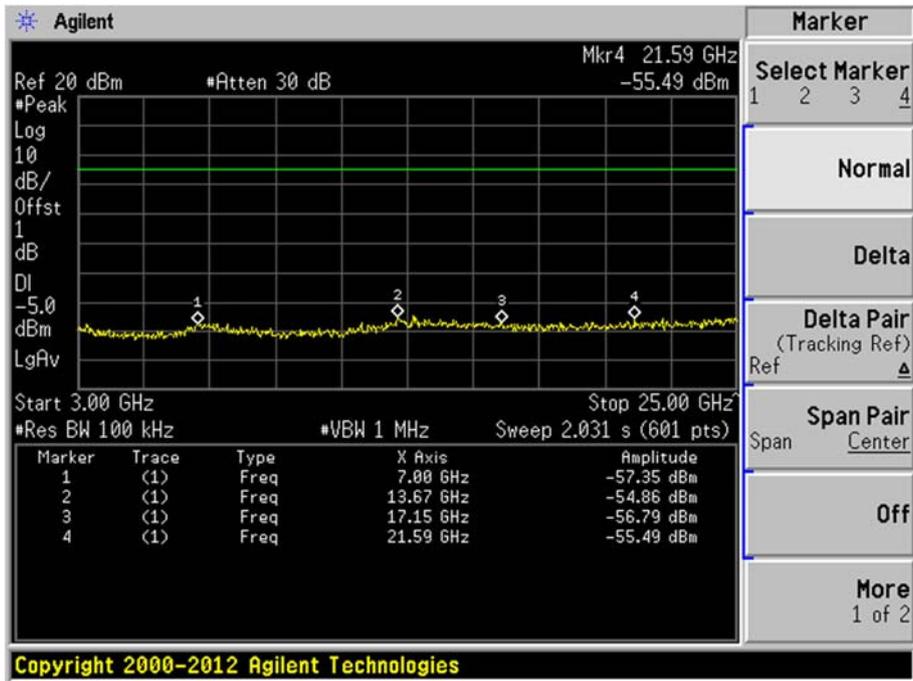
GFSK HIGH CHANNEL , BAND EDGE



GFSK HIGH CHANNEL , SPURIOUS 30 MHz ~ 3 GHz

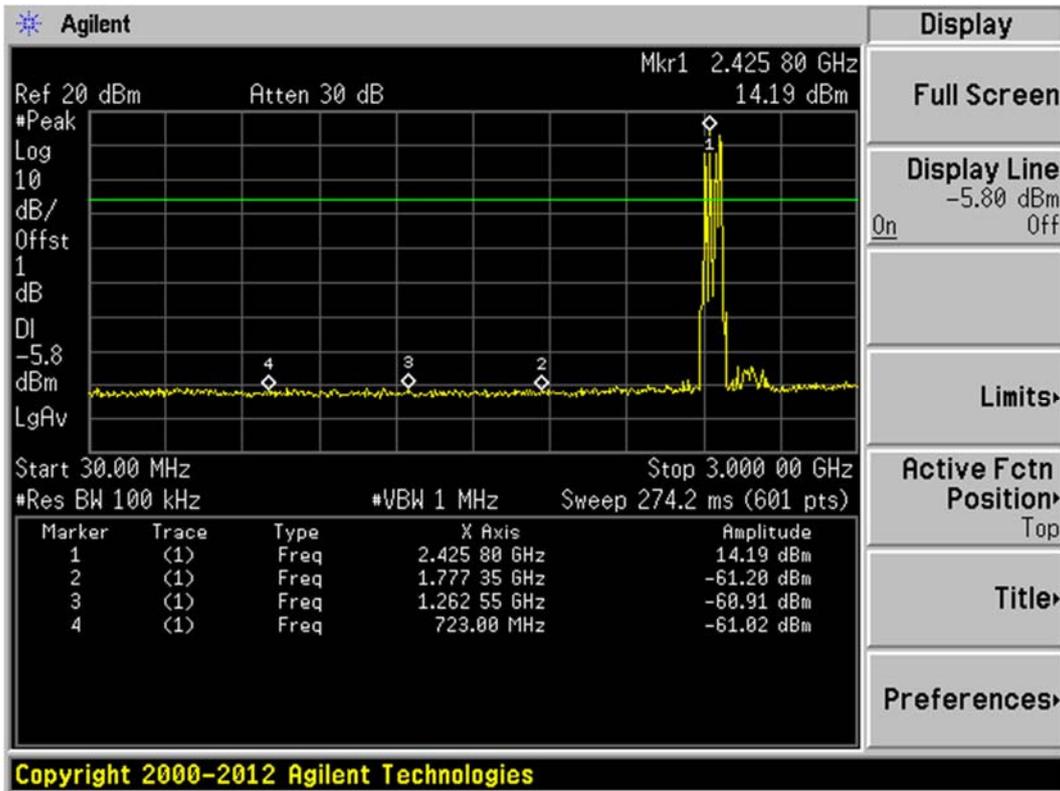


GFSK HIGH CHANNEL , SPURIOUS 3 GHz ~ 25 GHz

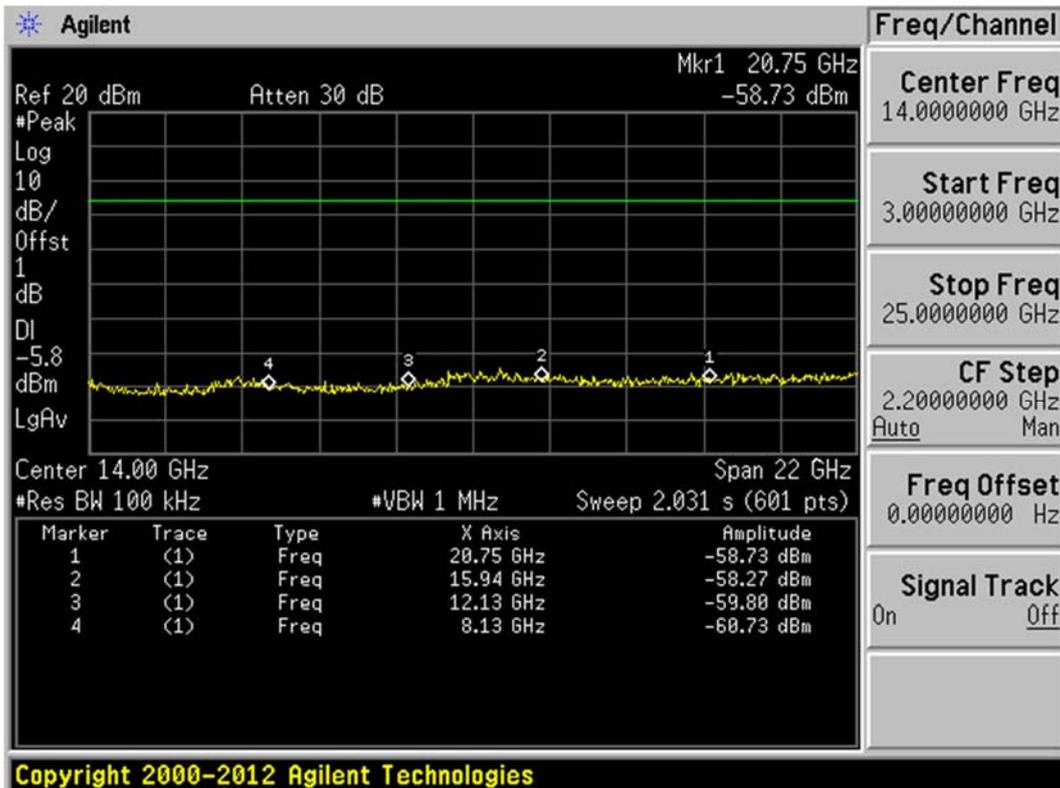


Hopping
 ANT 1

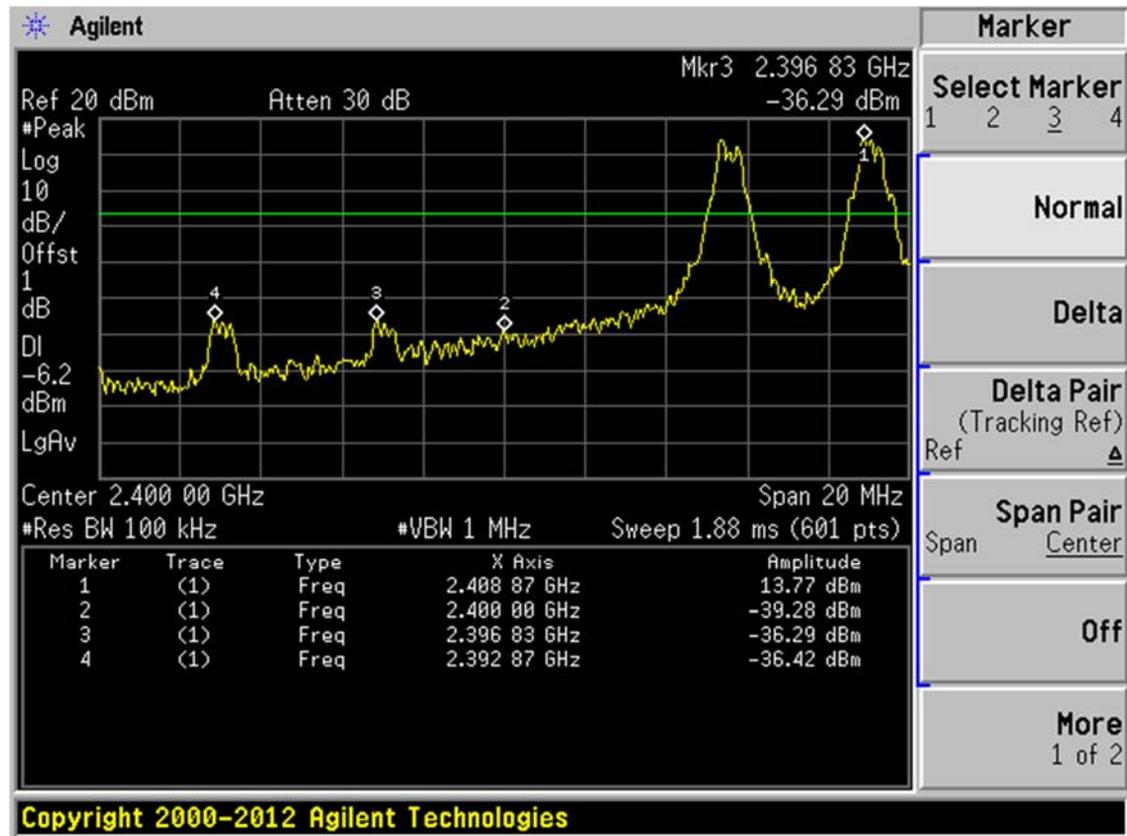
Hopping, SPURIOUS 30 MHz ~ 3 GHz



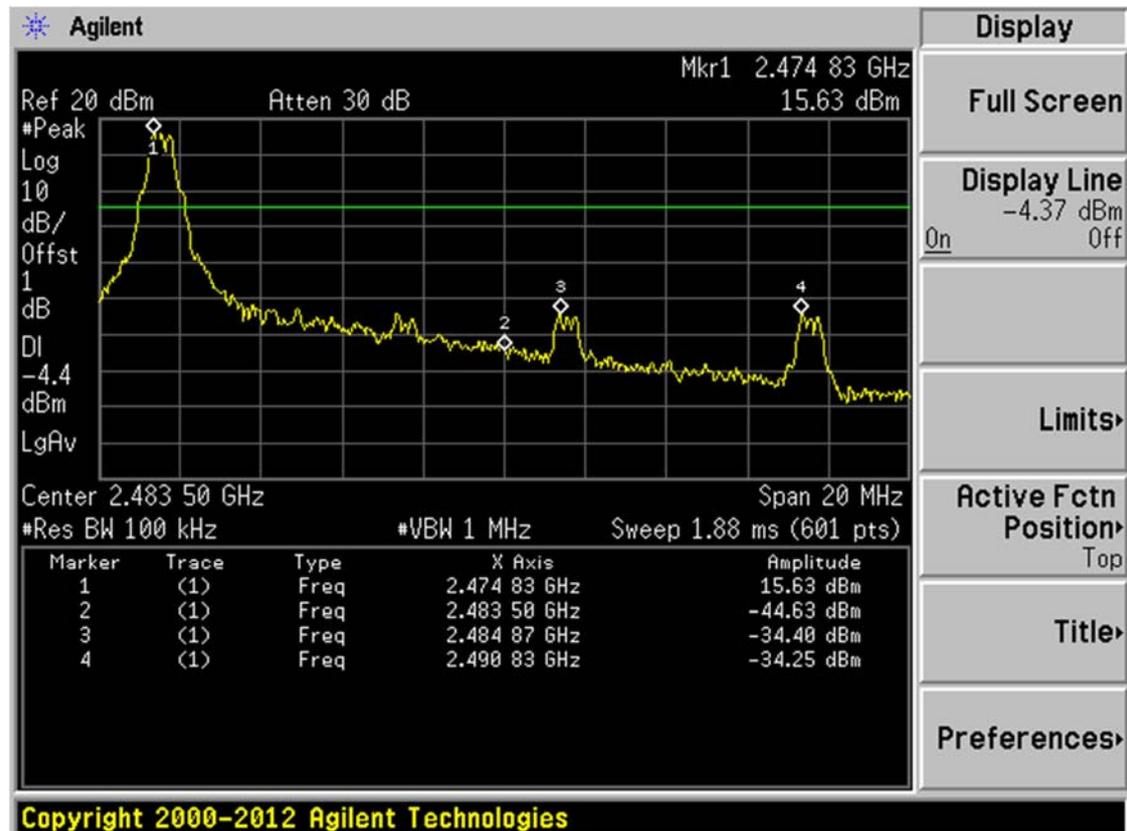
Hopping, SPURIOUS 3 GHz ~ 25 GHz



Hopping, BAND EDGE , Low

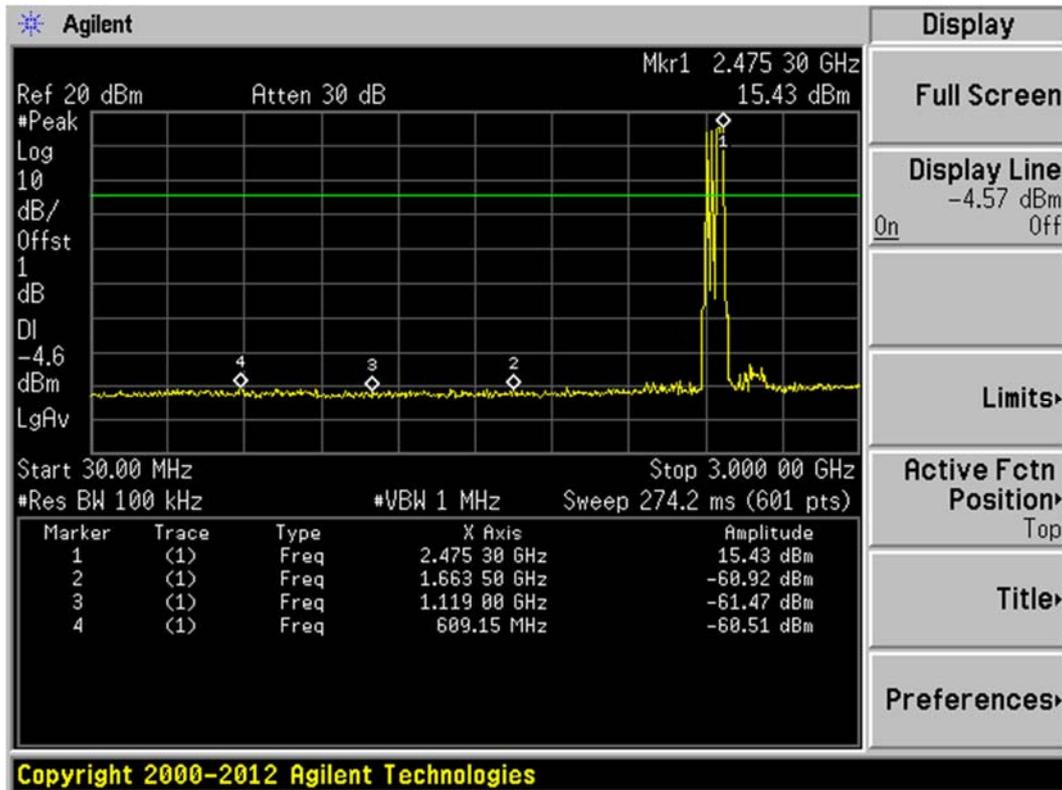


Hopping, BAND EDGE , High

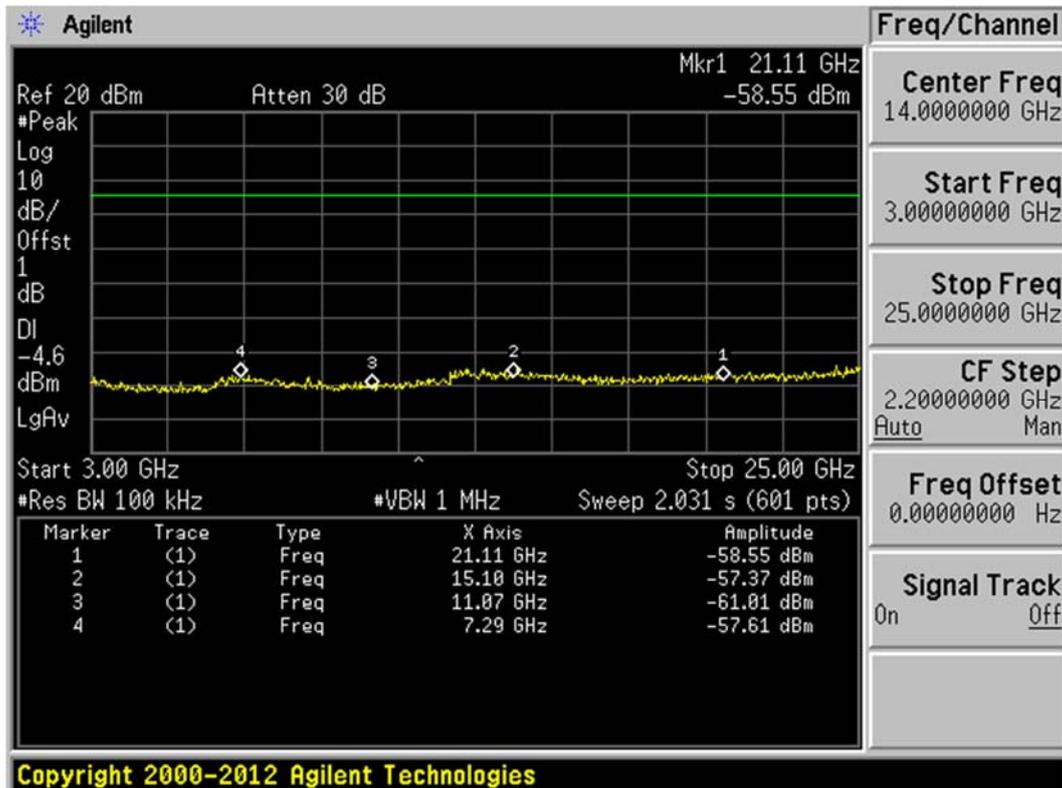


ANT 2

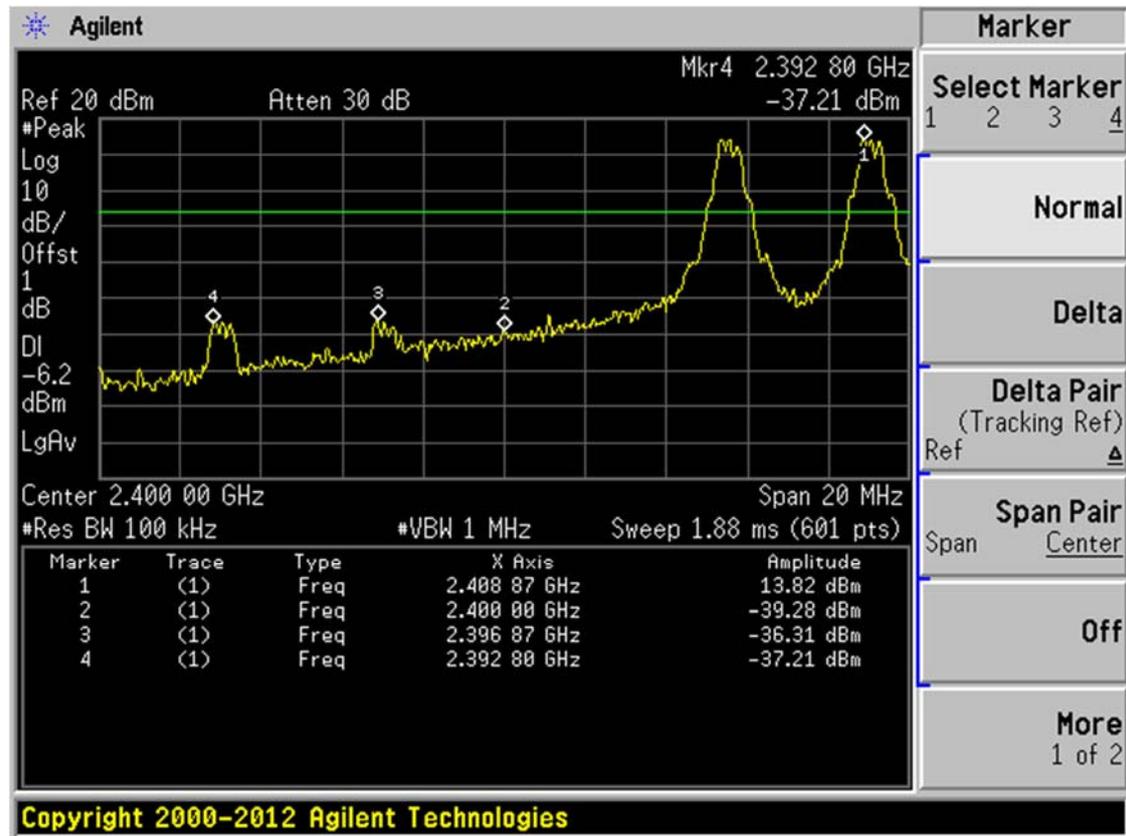
Hopping, SPURIOUS 30 MHz ~ 3 GHz



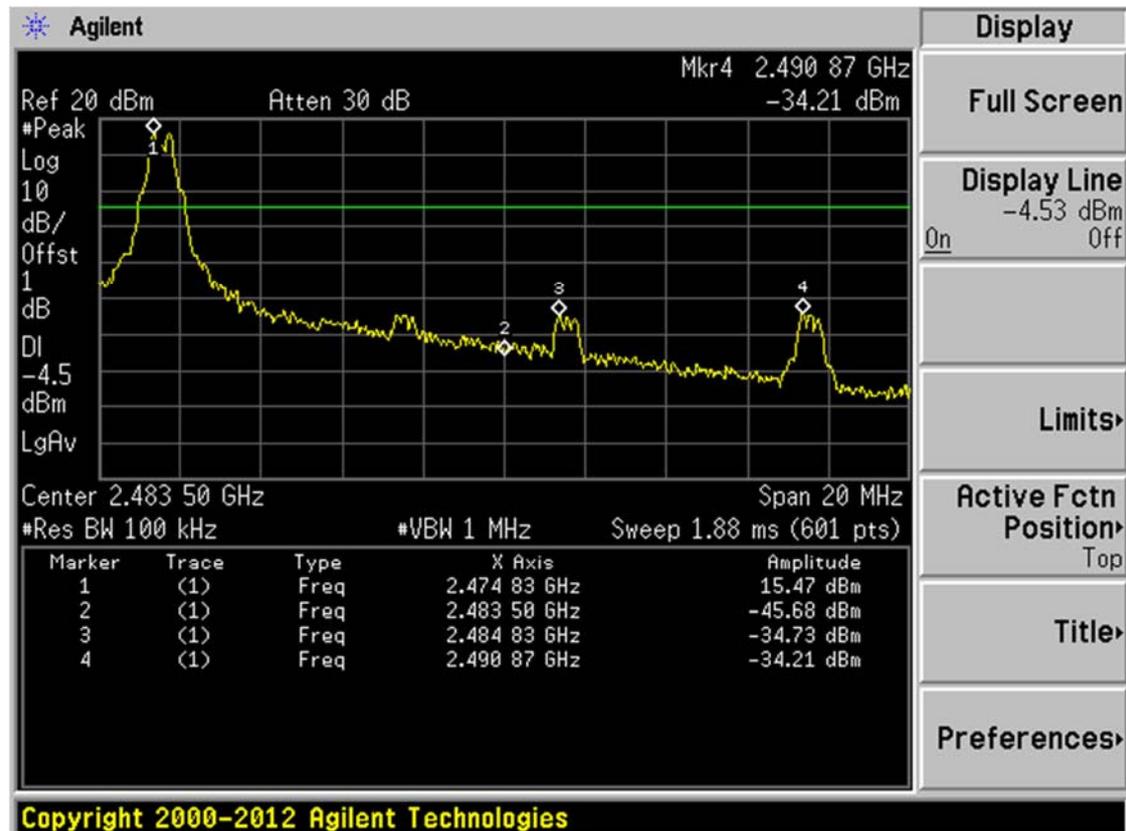
Hopping, SPURIOUS 3 GHz ~ 25 GHz



Hopping, BAND EDGE , Low



Hopping, BAND EDGE , High



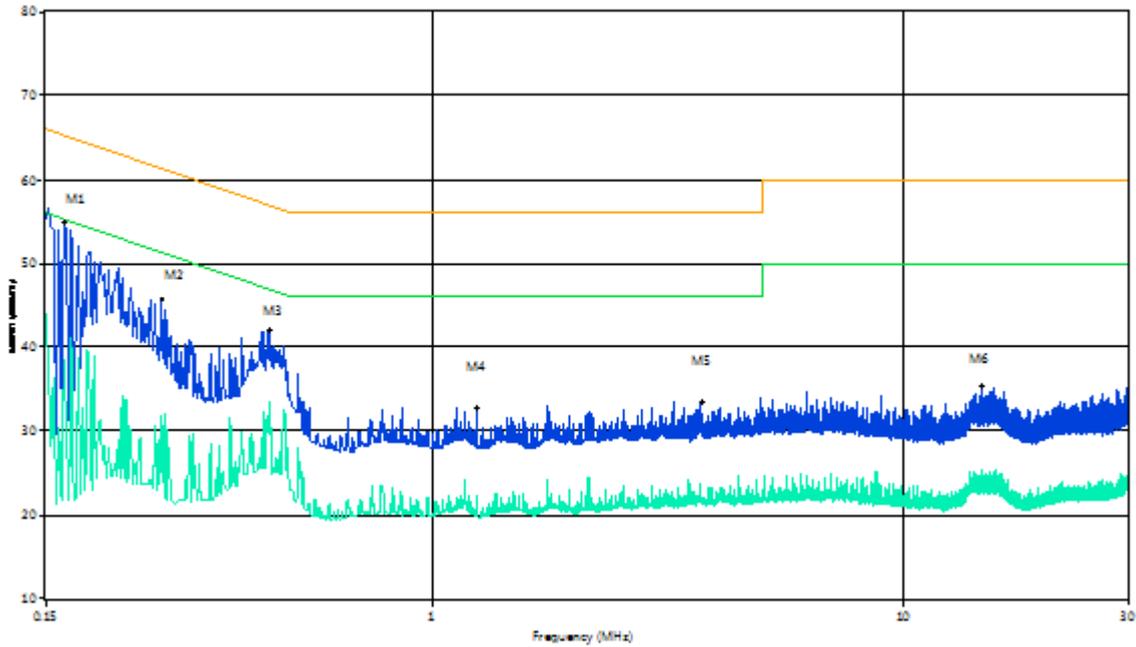
A.7 Conducted Emissions

Note: All configurations have been tested, only the worst configuration (GFSK High Channel) shown here.

Test Data and Plots

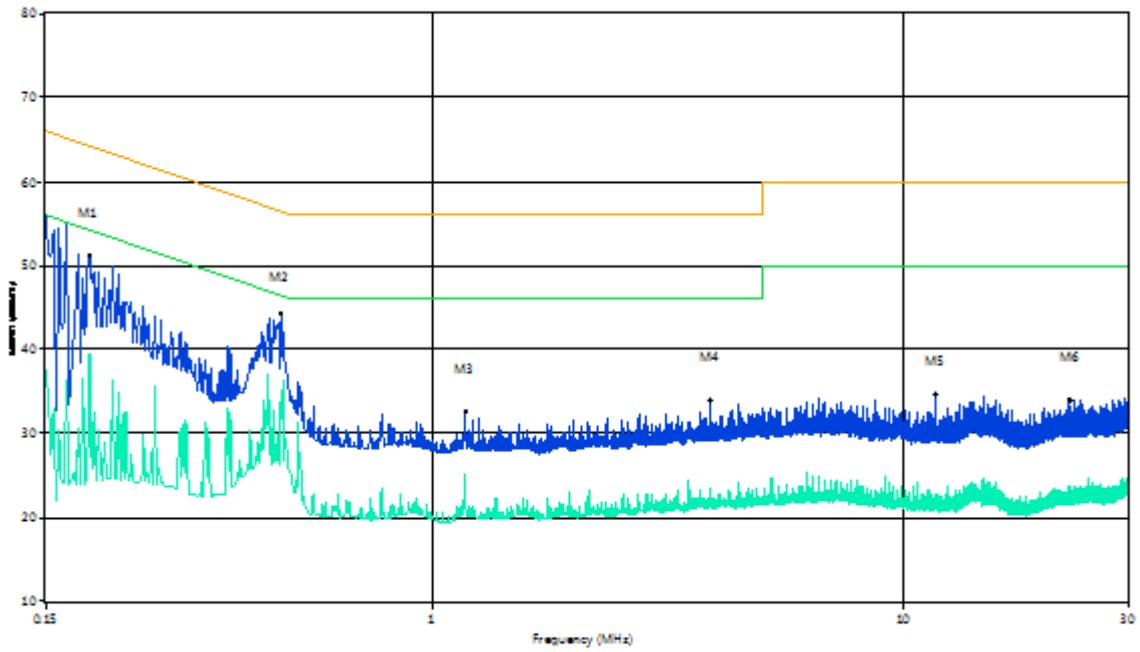
ANT 1

PHASE L

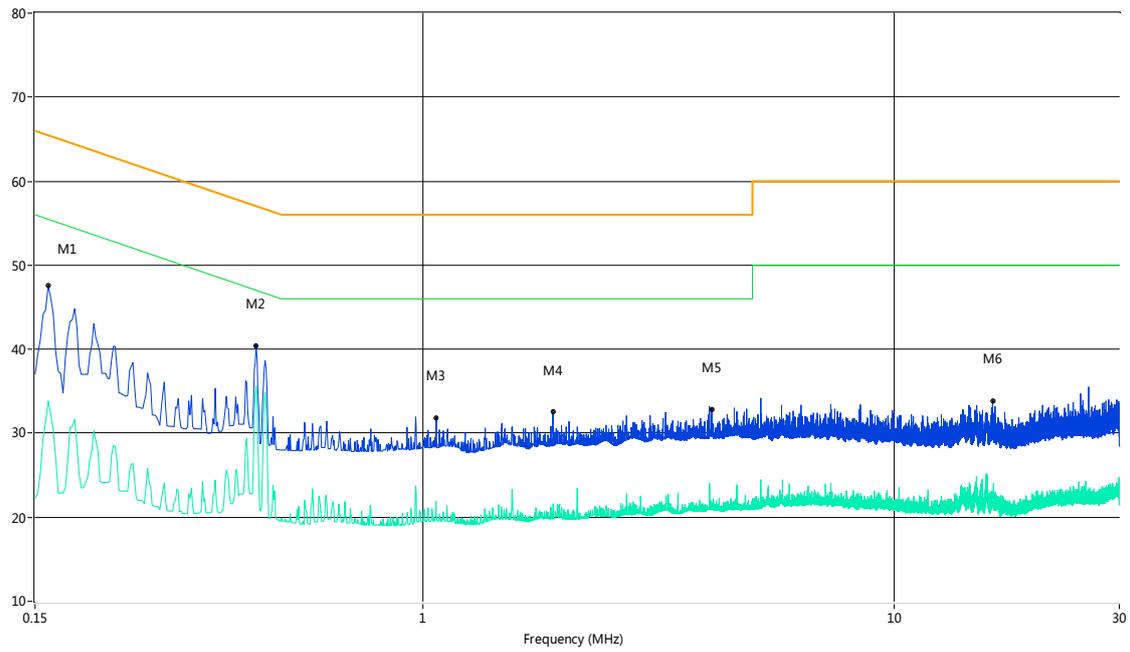


No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Margin (dB)	Detector	Line	Verdict
1	0.16	54.9	13.00	65.6	10.70	Peak	L Line	Pass
1**	0.16	38.6	13.00	55.6	17.00	AV	L Line	Pass
2	0.26	45.7	13.00	62.7	17.00	Peak	L Line	Pass
2**	0.26	31.7	13.00	52.7	21.00	AV	L Line	Pass
3	0.45	42.0	13.00	57.4	15.40	Peak	L Line	Pass
3**	0.45	33.4	13.00	47.4	14.00	AV	L Line	Pass
4	1.23	32.7	13.00	56.0	23.30	Peak	L Line	Pass
4**	1.23	19.5	13.00	46.0	26.50	AV	L Line	Pass
5	3.71	33.5	13.00	56.0	22.50	Peak	L Line	Pass
5**	3.71	22.4	13.00	46.0	23.60	AV	L Line	Pass
6	14.59	35.3	13.00	60.0	24.70	Peak	L Line	Pass
6**	14.59	22.6	13.00	50.0	27.40	AV	L Line	Pass

PHASE N

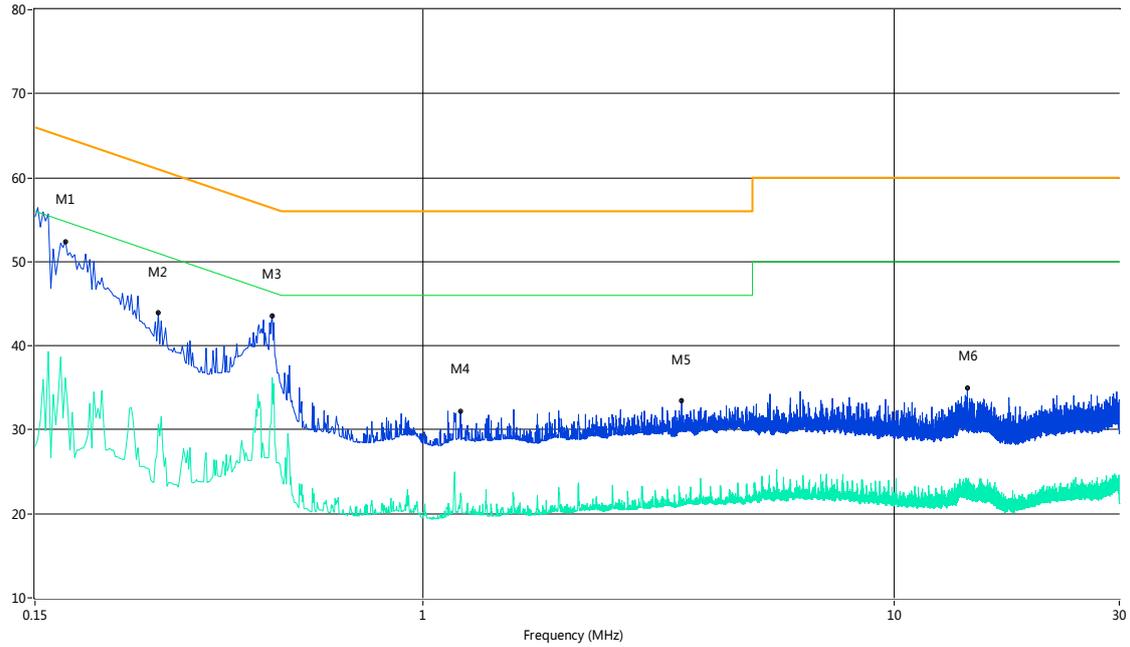


No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Margin (dB)	Detector	Line	Verdict
1	0.19	51.1	13.00	65.0	13.90	Peak	N Line	Pass
1**	0.19	39.5	13.00	55.0	15.50	AV	N Line	Pass
2	0.47	44.3	13.00	56.7	12.40	Peak	N Line	Pass
2**	0.47	35.1	13.00	46.7	11.60	AV	N Line	Pass
3	1.17	32.7	13.00	56.0	23.30	Peak	N Line	Pass
3**	1.17	23.2	13.00	46.0	22.80	AV	N Line	Pass
4	3.89	34.0	13.00	56.0	22.00	Peak	N Line	Pass
4**	3.89	23.7	13.00	46.0	22.30	AV	N Line	Pass
5	11.63	34.5	13.00	60.0	25.50	Peak	N Line	Pass
5**	11.63	22.7	13.00	50.0	27.30	AV	N Line	Pass
6	22.46	34.0	13.00	60.0	26.00	Peak	N Line	Pass
6**	22.46	22.7	13.00	50.0	27.30	AV	N Line	Pass

ANT 2
PHASE L


No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Margin (dB)	Detector	Line	Verdict
1	0.16	47.5	13.00	65.7	18.20	Peak	L Line	Pass
1**	0.16	33.8	13.00	55.7	21.90	AV	L Line	Pass
2	0.44	40.4	13.00	57.7	17.30	Peak	L Line	Pass
2**	0.44	35.6	13.00	47.7	12.10	AV	L Line	Pass
3	1.07	31.9	13.00	56.0	24.10	Peak	L Line	Pass
3**	1.07	20.3	13.00	46.0	25.70	AV	L Line	Pass
4	1.88	32.5	13.00	56.0	23.50	Peak	L Line	Pass
4**	1.88	21.0	13.00	46.0	25.00	AV	L Line	Pass
5	4.10	32.9	13.00	56.0	23.10	Peak	L Line	Pass
5**	4.10	21.6	13.00	46.0	24.40	AV	L Line	Pass
6	16.17	33.8	13.00	60.0	26.20	Peak	L Line	Pass
6**	16.17	22.8	13.00	50.0	27.20	AV	L Line	Pass

PHASE N



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Margin (dB)	Detector	Line	Verdict
1	0.17	52.4	13.00	65.3	12.90	Peak	N Line	Pass
1**	0.17	36.2	13.00	55.3	19.10	AV	N Line	Pass
2	0.27	43.9	13.00	62.5	18.60	Peak	N Line	Pass
2**	0.27	30.7	13.00	52.5	21.80	AV	N Line	Pass
3	0.48	43.6	13.00	56.6	13.00	Peak	N Line	Pass
3**	0.48	36.2	13.00	46.6	10.40	AV	N Line	Pass
4	1.20	32.2	13.00	56.0	23.80	Peak	N Line	Pass
4**	1.20	22.5	13.00	46.0	23.50	AV	N Line	Pass
5	3.54	33.5	13.00	56.0	22.50	Peak	N Line	Pass
5**	3.54	21.2	13.00	46.0	24.80	AV	N Line	Pass
6	14.28	34.9	13.00	60.0	25.10	Peak	N Line	Pass
6**	14.28	23.9	13.00	50.0	26.10	AV	N Line	Pass

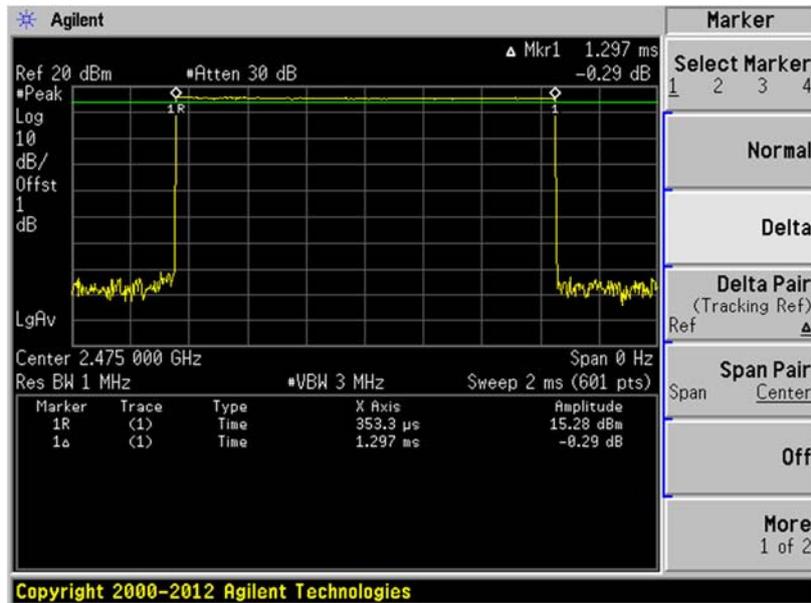
A.8 Radiated Emission

Duty cycle correction factor for average measurement.

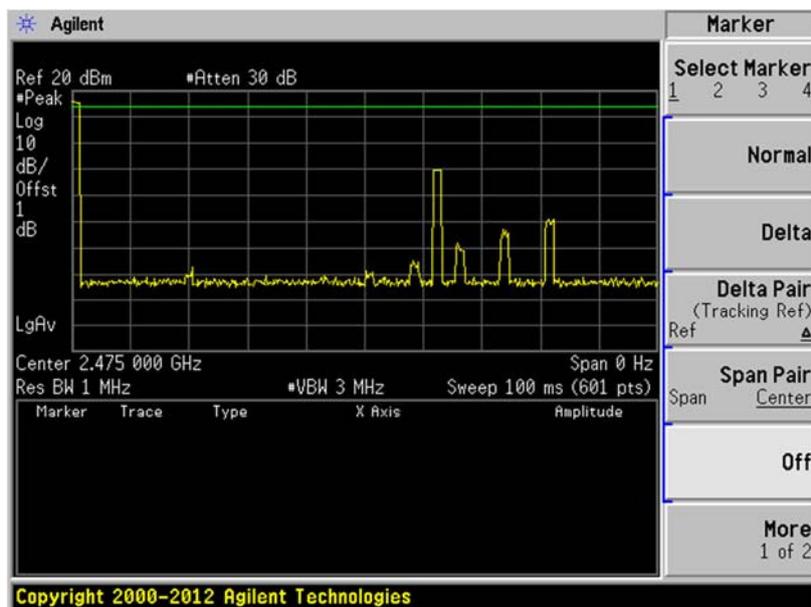
Test Plots

ANT 1

GFSK on time/100 ms (One Pulse) Plot on Channel 78



GFSK on time/100 ms (Count Pulses) Plot on Channel 78

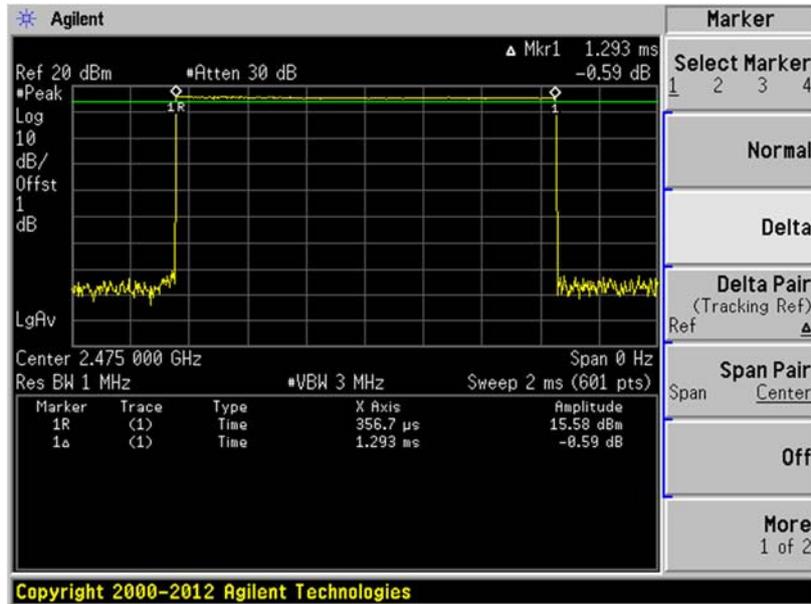


Note:

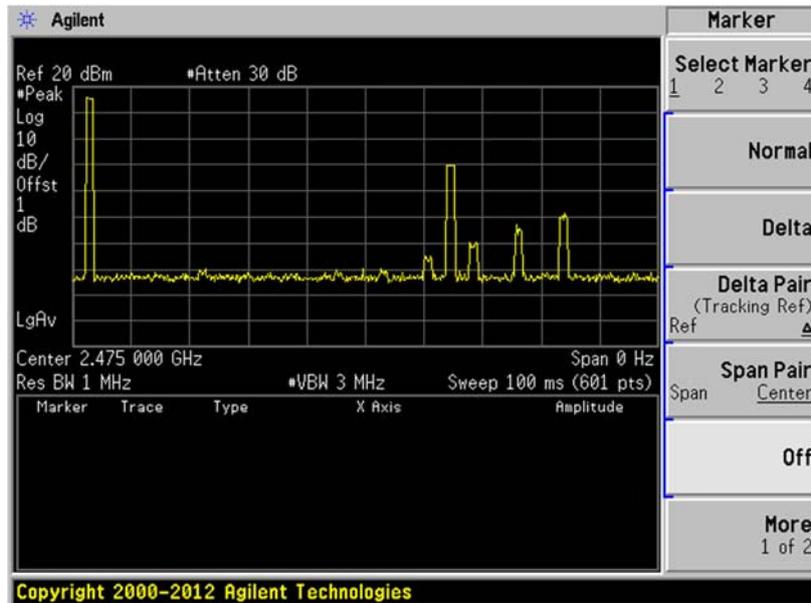
1. Duty cycle = on time/100 milliseconds = $2 * 1.297 / 100 = 2.59 \%$
2. Duty cycle correction factor = $20 * \log(\text{Duty cycle}) = -31.72 \text{ dB}$
3. GFSK has the highest duty cycle and is reported.

ANT 2

GFSK on time/100 ms (One Pulse) Plot on Channel 78



GFSK on time/100 ms (Count Pulses) Plot on Channel 78


Note:

1. Duty cycle = on time/100 milliseconds = $2 * 1.297 / 100 = 2.59 \%$
2. Duty cycle correction factor = $20 * \log(\text{Duty cycle}) = -31.72 \text{ dB}$
3. GFSK has the highest duty cycle and is reported.

Note 1: The symbol of "--" in the table which means not application.

Note 2: For the test data above 1 GHz, according the ANSI C63.4-2014, where limits are specified for both average and peak (or quasi-peak) detector functions, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement.

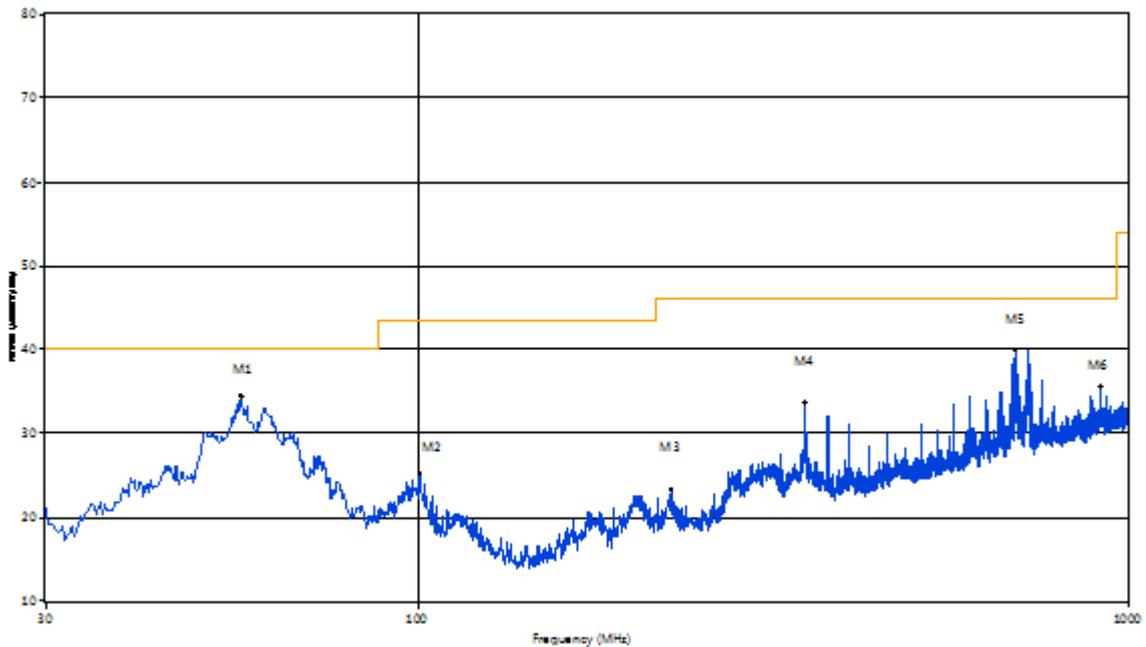
Note 3: All configurations have been tested, only the worst configuration (GFSK High Channel) shown here.

Test Data and Plots

ANT 1

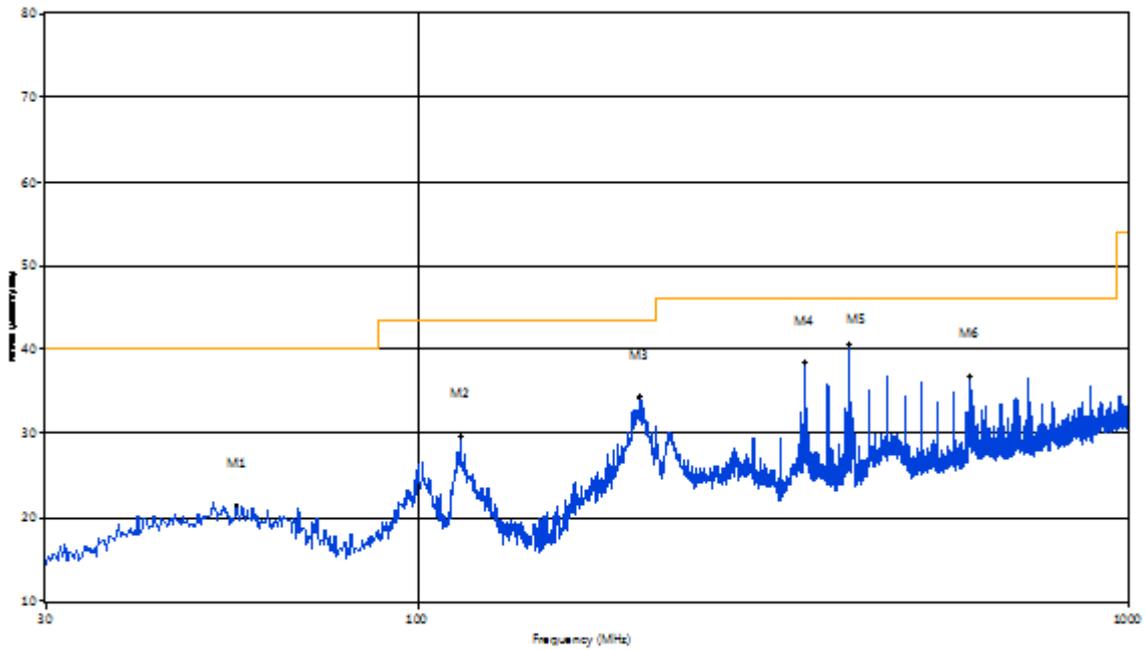
The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20 dB lower than the limit line per 15.31(o) was not reported.

30 MHz to 1 GHz, ANT V



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	56.43	34.44	-19.32	40.0	5.56	Peak	360.00	100	Vertical	Pass
2	100.79	25.28	-20.17	43.5	18.22	Peak	283.90	100	Vertical	Pass
3	227.35	23.41	-19.74	46.0	22.59	Peak	54.30	100	Vertical	Pass
4	350.99	33.70	-16.22	46.0	12.30	Peak	263.30	100	Vertical	Pass
5	692.83	40.03	-9.26	46.0	5.97	Peak	300.80	100	Vertical	Pass
6	913.45	35.58	-5.28	46.0	10.42	Peak	33.50	100	Vertical	Pass

30 MHz to 1 GHz, ANT H

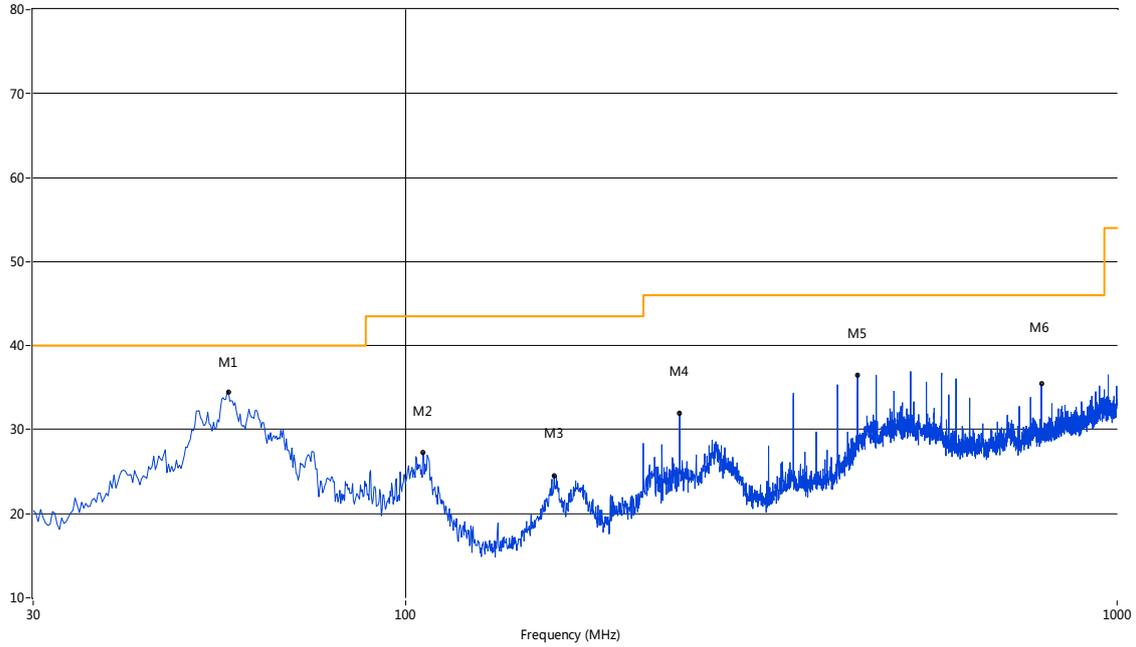


No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	55.70	21.51	-19.19	40.0	18.49	Peak	322.00	100	Horizontal	Pass
2	115.10	29.69	-21.06	43.5	13.81	Peak	40.90	100	Horizontal	Pass
3	205.53	34.37	-20.13	43.5	9.13	Peak	53.50	100	Horizontal	Pass
4	350.99	38.48	-16.22	46.0	7.52	Peak	280.20	100	Horizontal	Pass
5	404.81	40.65	-14.99	46.0	5.35	Peak	301.10	100	Horizontal	Pass
6	598.04	36.90	-10.88	46.0	9.10	Peak	7.70	100	Horizontal	Pass

ANT 2

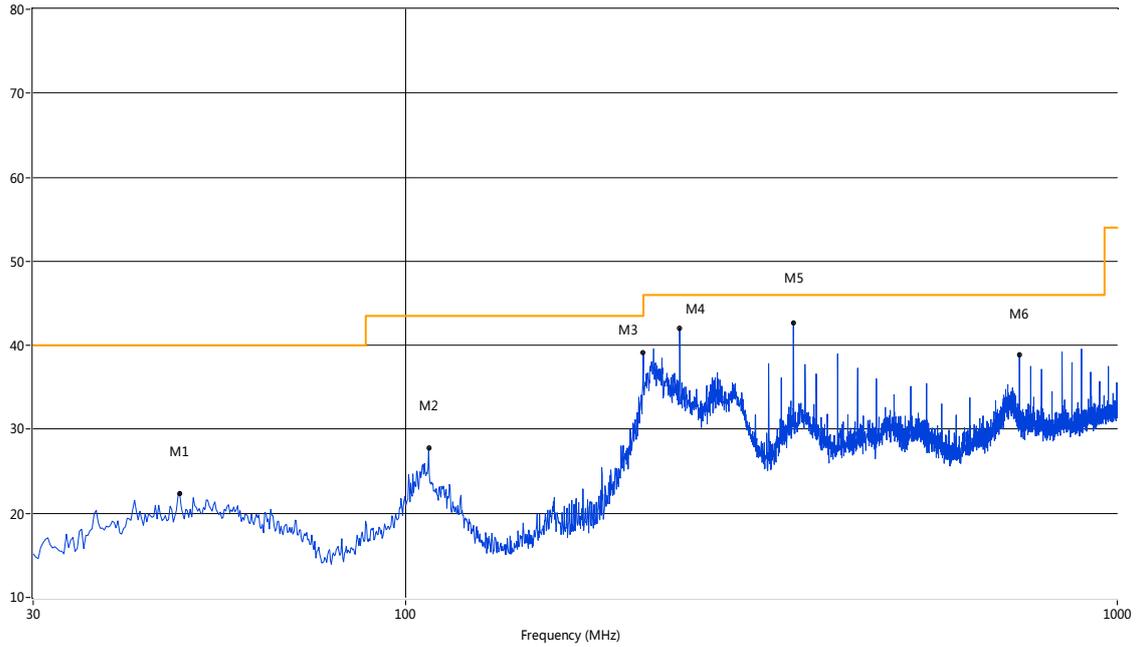
The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20 dB lower than the limit line per 15.31(o) was not reported.

30 MHz to 1 GHz, ANT V



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	56.43	34.46	-19.32	40.0	5.54	Peak	292.50	100	Vertical	Pass
2	105.88	27.24	-20.22	43.5	16.26	Peak	111.80	100	Vertical	Pass
3	161.89	24.55	-23.11	43.5	18.95	Peak	254.50	100	Vertical	Pass
4	242.86	31.95	-19.03	46.0	14.05	Peak	342.70	100	Vertical	Pass
5	431.96	36.50	-14.65	46.0	9.50	Peak	74.80	100	Vertical	Pass
6	783.02	35.44	-7.78	46.0	10.56	Peak	354.50	100	Vertical	Pass

30 MHz to 1 GHz, ANT H



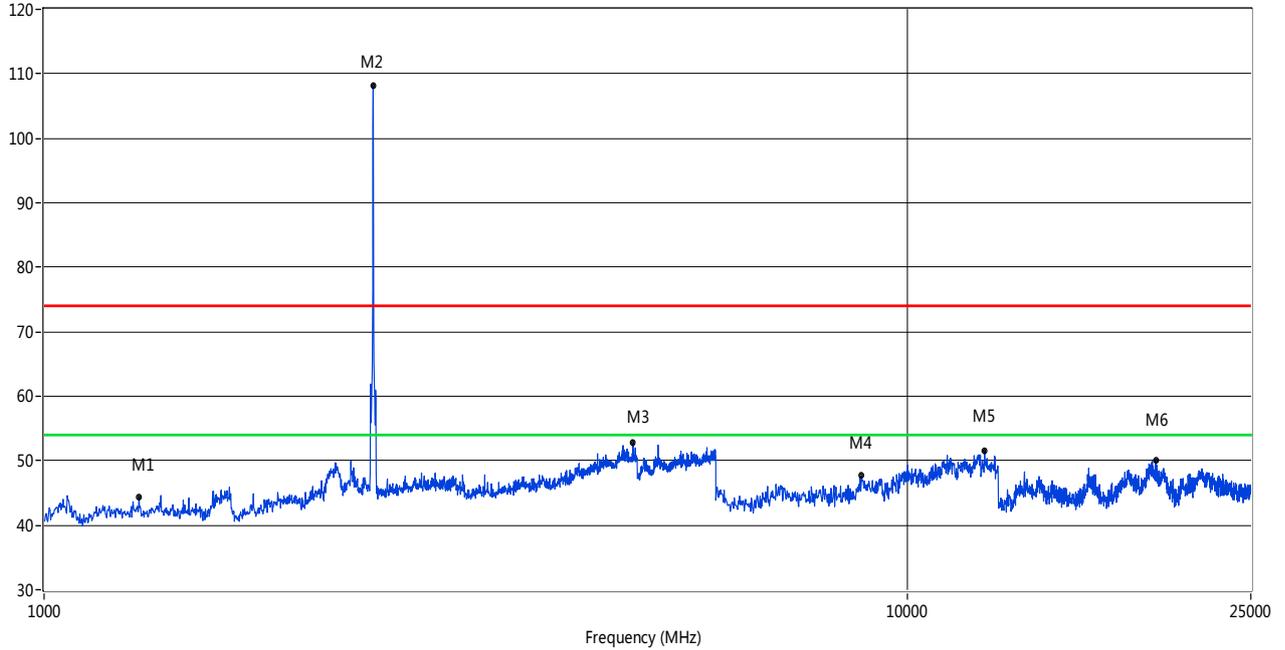
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	55.70	21.51	-19.19	40.0	18.49	Peak	322.00	100	Horizontal	Pass
2	115.10	29.69	-21.06	43.5	13.81	Peak	40.90	100	Horizontal	Pass
3	205.53	34.37	-20.13	43.5	9.13	Peak	53.50	100	Horizontal	Pass
4	350.99	38.48	-16.22	46.0	7.52	Peak	280.20	100	Horizontal	Pass
5	404.81	40.65	-14.99	46.0	5.35	Peak	301.10	100	Horizontal	Pass
6	598.04	36.90	-10.88	46.0	9.10	Peak	7.70	100	Horizontal	Pass

Note: The marked spikes near 2400 MHz with circle should be ignored because they are Fundamental signal.
Test Data and Plots (1 GHz ~ 10th Harmonic)

ANT 1

GFSK LOW CHANNEL 1 GHz to 25 GHz, ANT V

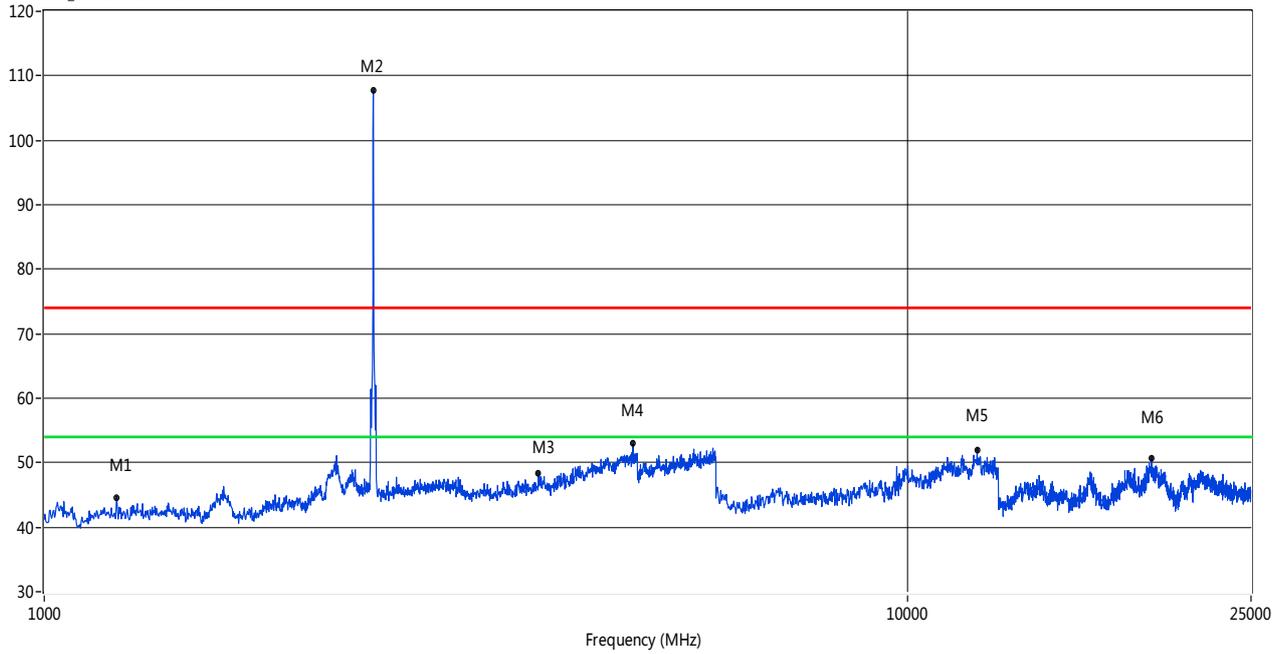
RE Test case_FCC 15C 1GHz-25GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1287.71	44.36	-4.83	74.0	29.64	Peak	224.00	100	Vertical	Pass
2	2406.59	108.19	-0.26	74.0	-34.19	Peak	141.00	100	Vertical	N/A
3	4810.19	52.84	13.87	74.0	21.16	Peak	210.00	100	Vertical	Pass
4	8852.75	47.69	16.61	74.0	26.31	Peak	133.00	100	Vertical	Pass
5	12289.52	51.61	20.65	74.0	22.39	Peak	253.00	100	Vertical	Pass
6	19389.35	50.13	12.97	74.0	23.87	Peak	348.00	100	Vertical	Pass

GFSK LOW CHANNEL 1 GHz to 25 GHz, ANT H

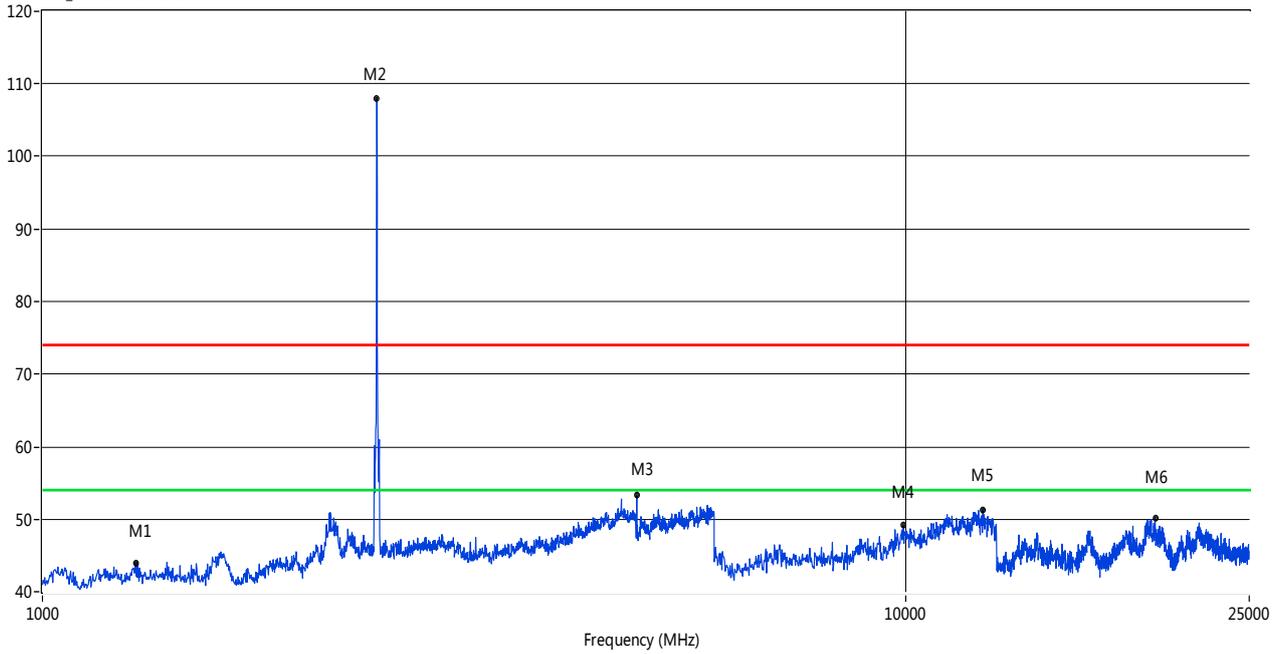
RE Test case_FCC 15C 1GHz-25GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1213.79	44.60	-5.12	74.0	29.40	Peak	355.00	100	Horizontal	Pass
2	2406.59	107.77	-0.26	74.0	-33.77	Peak	177.00	100	Horizontal	N/A
3	3737.26	48.42	10.57	74.0	25.58	Peak	316.00	100	Horizontal	Pass
4	4810.19	52.98	13.87	74.0	21.02	Peak	269.00	100	Horizontal	Pass
5	12042.43	52.06	20.83	74.0	21.94	Peak	212.00	100	Horizontal	Pass
6	19179.70	50.80	14.04	74.0	23.20	Peak	231.00	100	Horizontal	Pass

GFSK MIDDLE CHANNEL 1 GHz to 25 GHz, ANT V

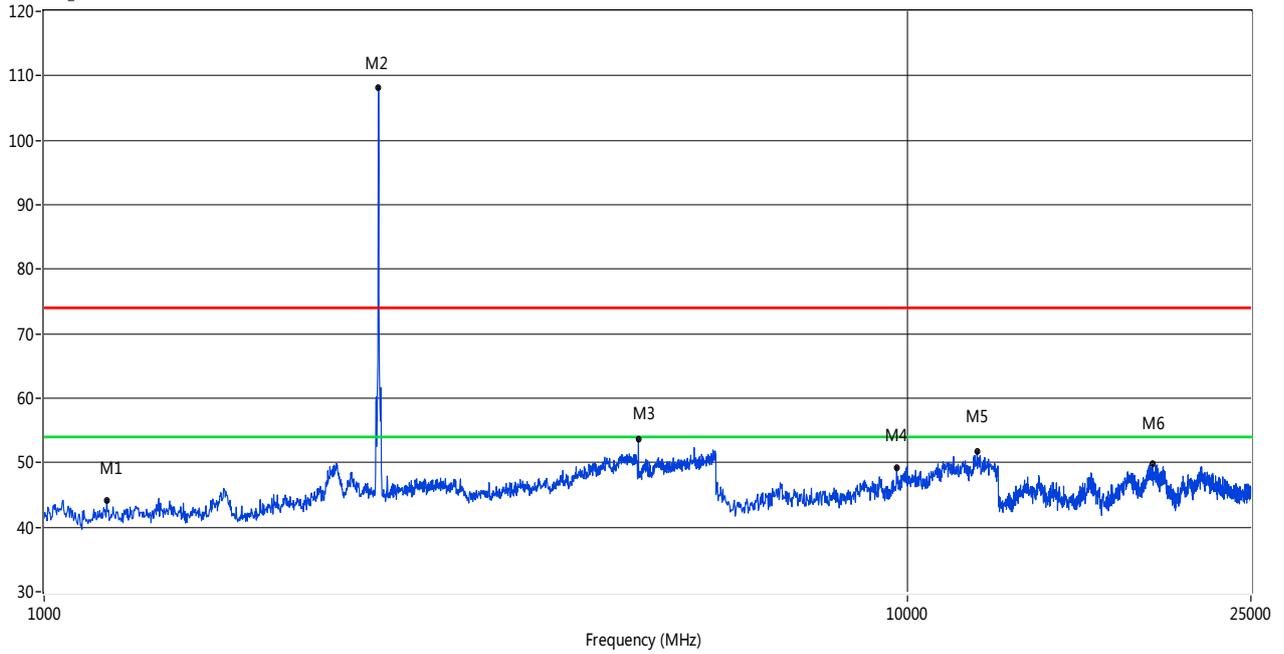
RE Test case_FCC 15C 1GHz-25GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1281.72	44.02	-4.85	74.0	29.98	Peak	18.00	100	Vertical	Pass
2	2438.56	108.06	-0.49	74.0	-34.06	Peak	352.00	100	Vertical	N/A
3	4879.12	53.25	13.64	74.0	20.75	Peak	93.00	100	Vertical	Pass
4	9942.18	49.15	19.17	74.0	24.85	Peak	245.00	100	Vertical	Pass
5	12289.52	51.33	20.65	74.0	22.67	Peak	100.00	100	Vertical	Pass
6	19449.25	50.20	12.80	74.0	23.80	Peak	22.00	100	Vertical	Pass

GFSK MIDDLE CHANNEL 1 GHz to 25 GHz, ANT H

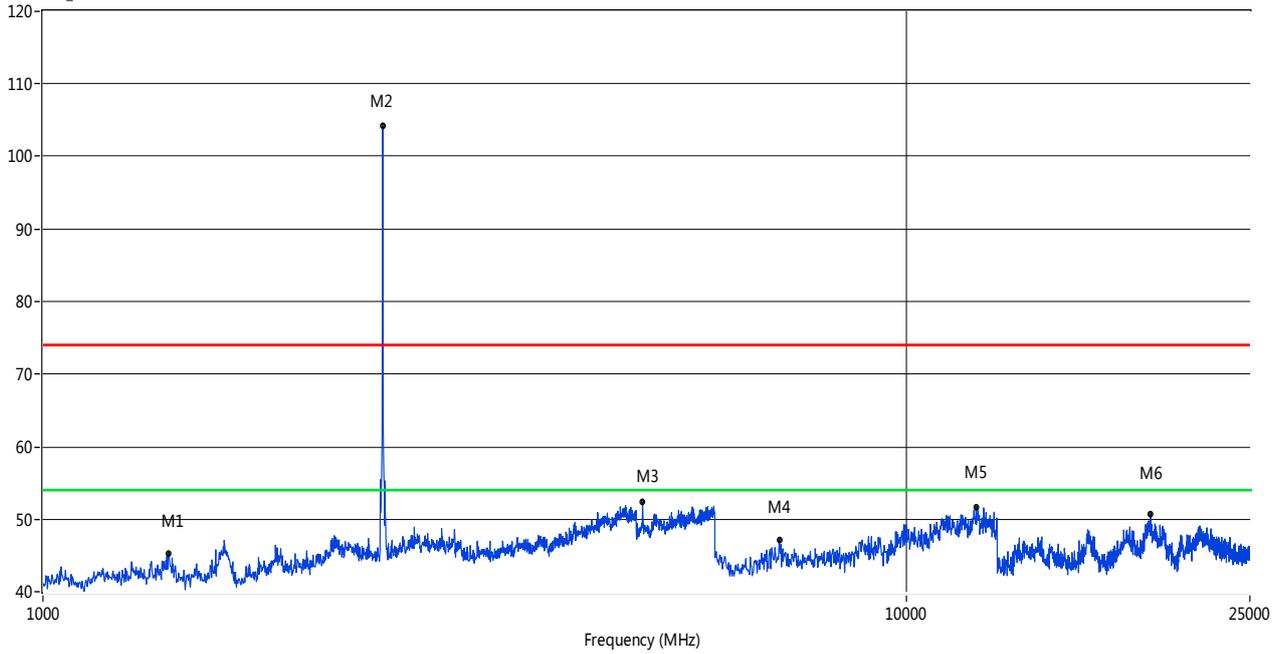
RE Test case_FCC 15C 1GHz-25GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1181.82	44.24	-5.51	74.0	29.76	Peak	45.00	100	Horizontal	Pass
2	2438.56	108.25	-0.49	74.0	-34.25	Peak	328.00	100	Horizontal	N/A
3	4879.12	53.60	13.64	74.0	20.40	Peak	180.00	100	Horizontal	Pass
4	9717.55	49.33	17.74	74.0	24.67	Peak	319.00	100	Horizontal	Pass
5	12042.43	51.74	20.83	74.0	22.26	Peak	146.00	100	Horizontal	Pass
6	19249.58	49.77	13.82	74.0	24.23	Peak	217.00	100	Horizontal	Pass

GFSK HIGH CHANNEL 1 GHz to 25 GHz, ANT V

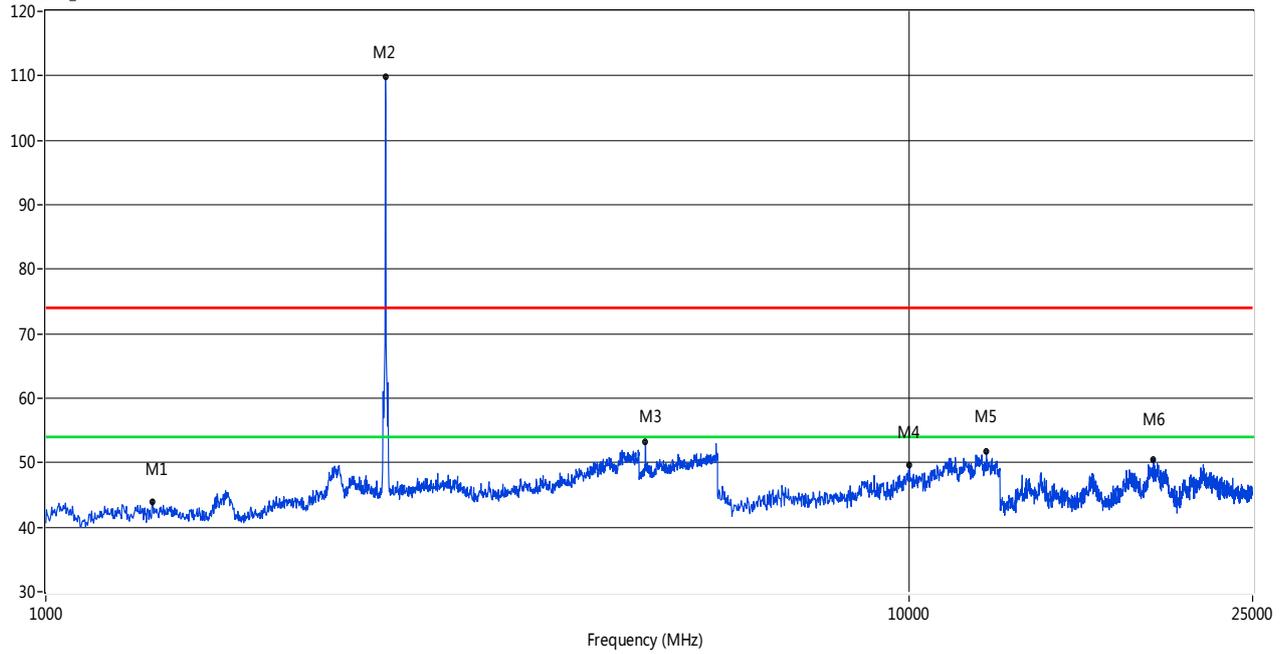
RE Test case_FCC 15C 1GHz-25GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1397.60	45.30	-4.57	74.0	28.70	Peak	86.00	100	Vertical	Pass
2	2474.53	104.16	-0.50	74.0	-30.16	Peak	302.00	100	Vertical	N/A
3	4948.05	52.34	14.03	74.0	21.66	Peak	152.00	100	Vertical	Pass
4	7123.13	47.21	14.28	74.0	26.79	Peak	36.00	100	Vertical	Pass
5	12042.43	51.64	20.83	74.0	22.36	Peak	183.00	100	Vertical	Pass
6	19179.70	50.64	14.04	74.0	23.36	Peak	97.00	100	Vertical	Pass

GFSK HIGH CHANNEL 1 GHz to 25 GHz, ANT H

RE Test case_FCC 15C 1GHz-25GHz

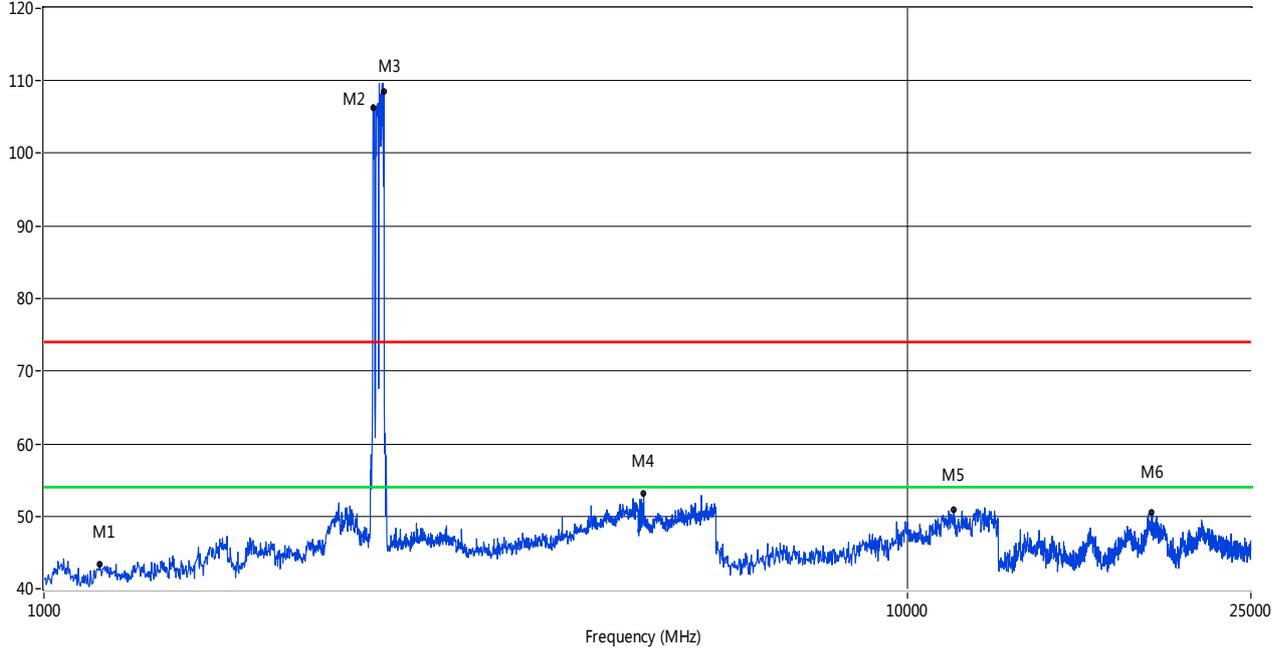


No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1327.67	43.91	-4.82	74.0	30.09	Peak	164.00	100	Horizontal	Pass
2	2474.53	109.83	-0.50	74.0	-35.83	Peak	49.00	100	Horizontal	N/A
3	4948.05	53.19	14.03	74.0	20.81	Peak	348.00	100	Horizontal	Pass
4	10009.57	49.55	19.33	74.0	24.45	Peak	31.00	100	Horizontal	Pass
5	12289.52	51.33	20.65	74.0	22.67	Peak	100.00	100	Horizontal	Pass
6	19179.70	50.48	14.04	74.0	23.52	Peak	157.00	100	Horizontal	Pass

Hopping Mode:

GFSK MODE 1 GHz to 25 GHz, ANT V

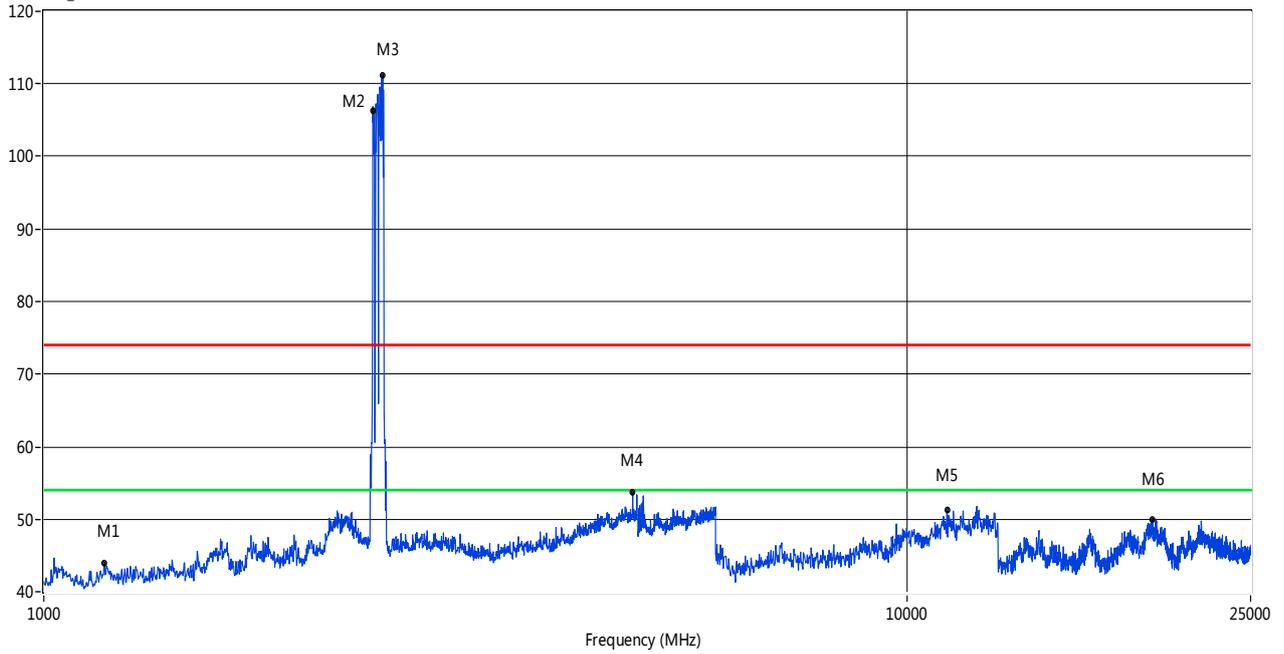
RE Test case_FCC 15C 1GHz-25GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1159.84	43.37	-5.82	74.0	30.63	Peak	171.00	100	Vertical	Pass
2	2408.59	106.30	-0.10	74.0	-32.30	Peak	233.00	100	Vertical	N/A
3	2474.53	108.63	-0.50	74.0	-34.63	Peak	284.00	100	Vertical	N/A
3*	2474.53	76.91	-0.50	54.0	-22.91	AV	284.00	100	Vertical	Pass
4	4948.05	53.11	14.03	74.0	20.89	Peak	222.00	100	Vertical	Pass
5	11312.40	50.83	20.18	74.0	23.17	Peak	322.00	100	Vertical	Pass
6	19179.70	50.49	14.04	74.0	23.51	Peak	139.00	100	Vertical	Pass

GFSK MODE 1 GHz to 25 GHz, ANT H

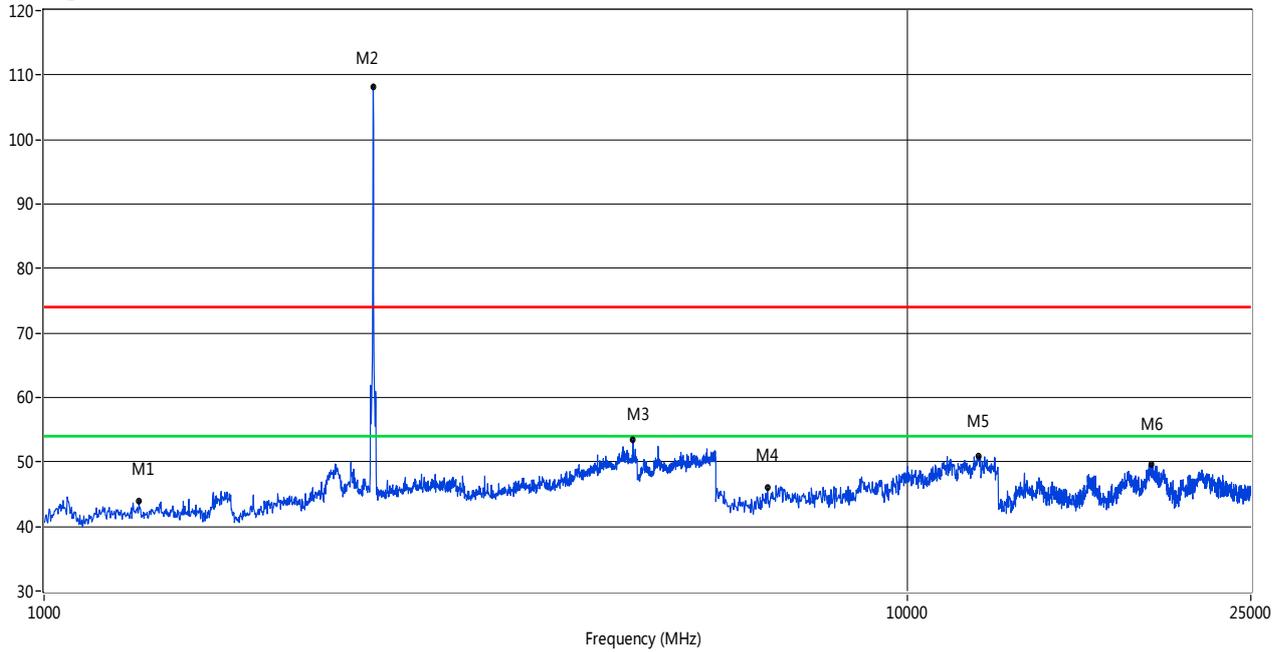
RE Test case_FCC 15C 1GHz-25GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1175.82	43.92	-5.50	74.0	30.08	Peak	290.00	100	Horizontal	Pass
2	2408.59	106.30	-0.10	74.0	-32.30	Peak	233.00	100	Horizontal	N/A
3	2464.53	111.08	-0.56	74.0	-37.08	Peak	356.00	100	Horizontal	N/A
3*	2464.53	79.36	-0.56	54.0	-25.36	AV	356.00	100	Horizontal	Pass
4	4810.19	53.70	13.87	74.0	20.30	Peak	163.00	100	Horizontal	Pass
5	11121.46	51.18	20.22	74.0	22.82	Peak	191.00	100	Horizontal	Pass
6	19249.58	49.96	13.82	74.0	24.04	Peak	90.00	100	Horizontal	Pass

ANT 2
GFSK LOW CHANNEL 1 GHz to 25 GHz, ANT V

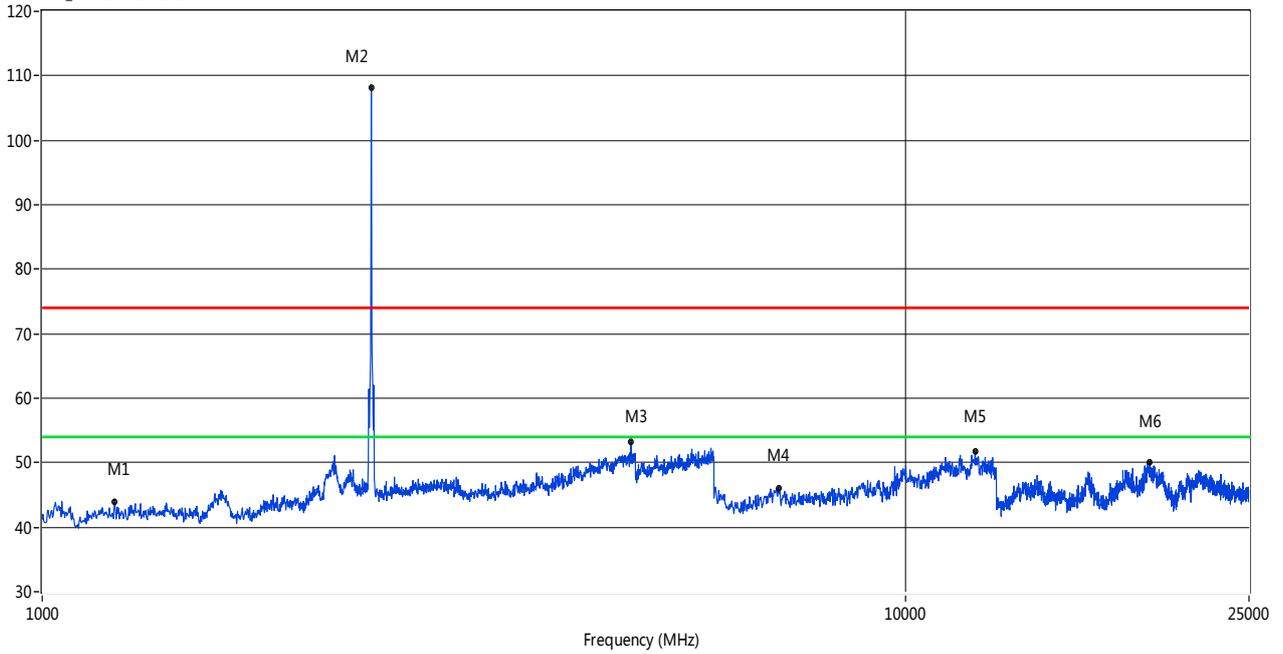
RE Test case_FCC 15C 1GHz-25GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1287.71	43.96	-4.83	74.0	30.04	Peak	85.00	100	Vertical	Pass
2	2406.59	108.19	-0.26	74.0	-34.19	Peak	55.00	100	Vertical	N/A
3	4810.19	53.44	13.87	74.0	20.56	Peak	57.00	100	Vertical	Pass
4	6887.27	46.01	14.14	74.0	27.99	Peak	150.00	100	Vertical	Pass
5	12076.12	50.88	20.80	74.0	23.12	Peak	129.00	100	Vertical	Pass
6	19179.70	49.72	14.04	74.0	24.28	Peak	14.00	100	Vertical	Pass

GFSK LOW CHANNEL 1 GHz to 25 GHz, ANT H

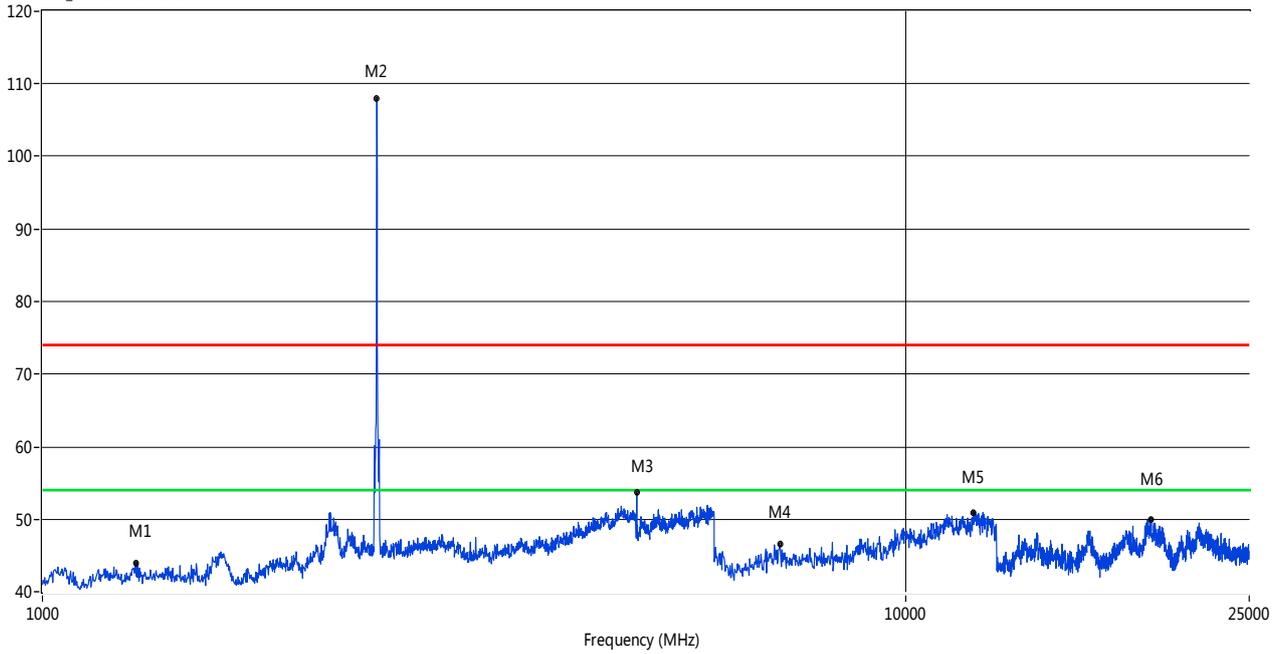
RE Test case_FCC 15C 1GHz-25GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1211.79	43.93	-5.15	74.0	30.07	Peak	273.00	100	Horizontal	Pass
2	2404.59	108.22	-0.32	74.0	-34.22	Peak	43.00	100	Horizontal	N/A
3	4810.19	53.18	13.87	74.0	20.82	Peak	325.00	100	Horizontal	Pass
4	7123.13	46.09	14.28	74.0	27.91	Peak	328.00	100	Horizontal	Pass
5	12042.43	51.66	20.83	74.0	22.34	Peak	243.00	100	Horizontal	Pass
6	19179.70	50.00	14.04	74.0	24.00	Peak	63.00	100	Horizontal	Pass

GFSK MIDDLE CHANNEL 1 GHz to 25 GHz, ANT V

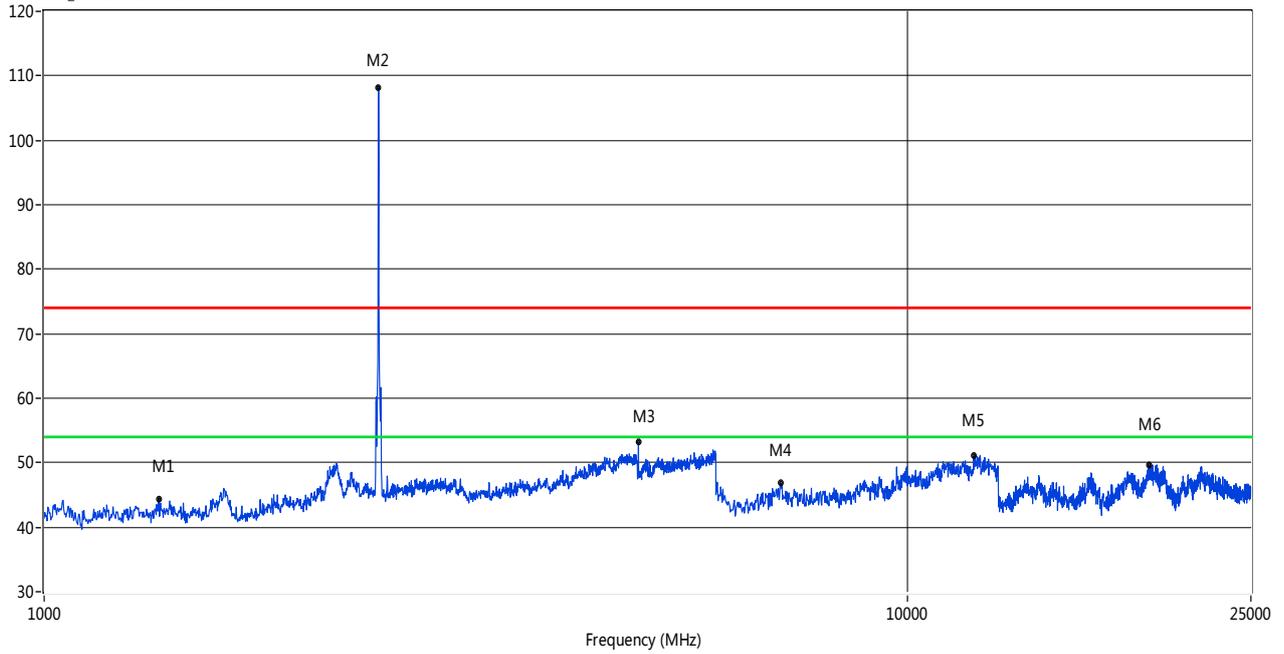
RE Test case_FCC 15C 1GHz-25GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1281.72	44.02	-4.85	74.0	29.98	Peak	191.00	100	Vertical	Pass
2	2438.56	108.06	-0.49	74.0	-34.06	Peak	289.00	100	Vertical	N/A
3	4879.12	53.65	13.64	74.0	20.35	Peak	359.00	100	Vertical	Pass
4	7145.59	46.48	14.33	74.0	27.52	Peak	112.00	100	Vertical	Pass
5	11975.04	50.90	20.76	74.0	23.10	Peak	297.00	100	Vertical	Pass
6	19249.58	49.95	13.82	74.0	24.05	Peak	307.00	100	Vertical	Pass

GFSK MIDDLE CHANNEL 1 GHz to 25 GHz, ANT H

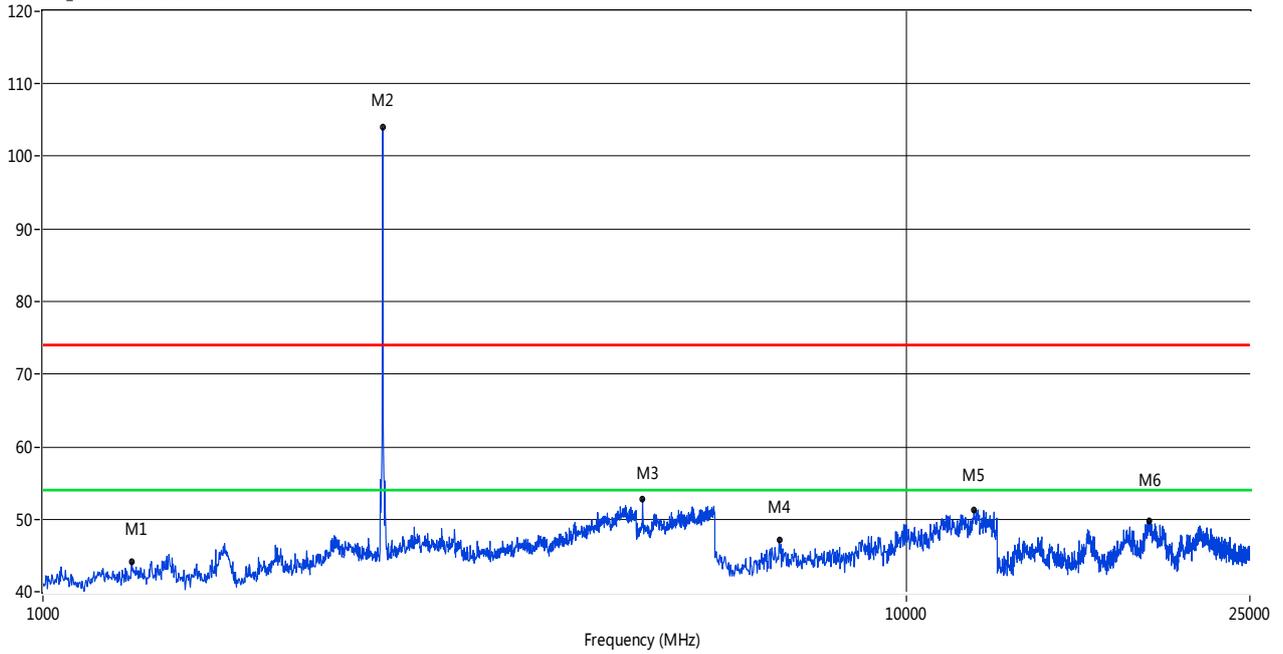
RE Test case_FCC 15C 1GHz-25GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1357.64	44.45	-4.44	74.0	29.55	Peak	229.00	100	Horizontal	Pass
2	2438.56	108.25	-0.49	74.0	-34.25	Peak	237.00	100	Horizontal	N/A
3	4879.12	53.20	13.64	74.0	20.80	Peak	119.00	100	Horizontal	Pass
4	7123.13	46.89	14.28	74.0	27.11	Peak	209.00	100	Horizontal	Pass
5	11952.58	51.10	20.65	74.0	22.90	Peak	147.00	100	Horizontal	Pass
6	19079.87	49.66	13.68	74.0	24.34	Peak	332.00	100	Horizontal	Pass

GFSK HIGH CHANNEL 1 GHz to 25 GHz, ANT V

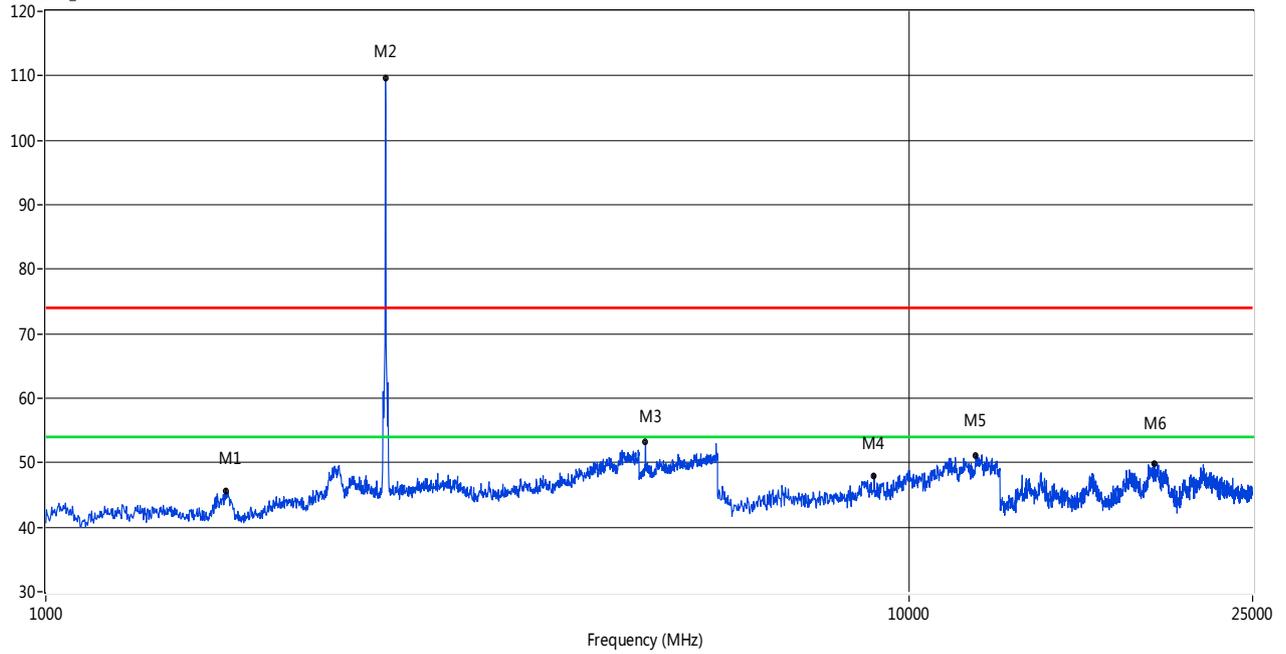
RE Test case_FCC 15C 1GHz-25GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1267.73	44.09	-5.01	74.0	29.91	Peak	212.00	100	Vertical	Pass
2	2474.53	103.96	-0.50	74.0	-29.96	Peak	155.00	100	Vertical	N/A
3	4948.05	52.74	14.03	74.0	21.26	Peak	312.00	100	Vertical	Pass
4	7123.13	47.21	14.28	74.0	26.79	Peak	236.00	100	Vertical	Pass
5	11975.04	51.22	20.76	74.0	22.78	Peak	54.00	100	Vertical	Pass
6	19089.85	49.77	13.71	74.0	24.23	Peak	85.00	100	Vertical	Pass

GFSK HIGH CHANNEL 1 GHz to 25 GHz, ANT H

RE Test case_FCC 15C 1GHz-25GHz

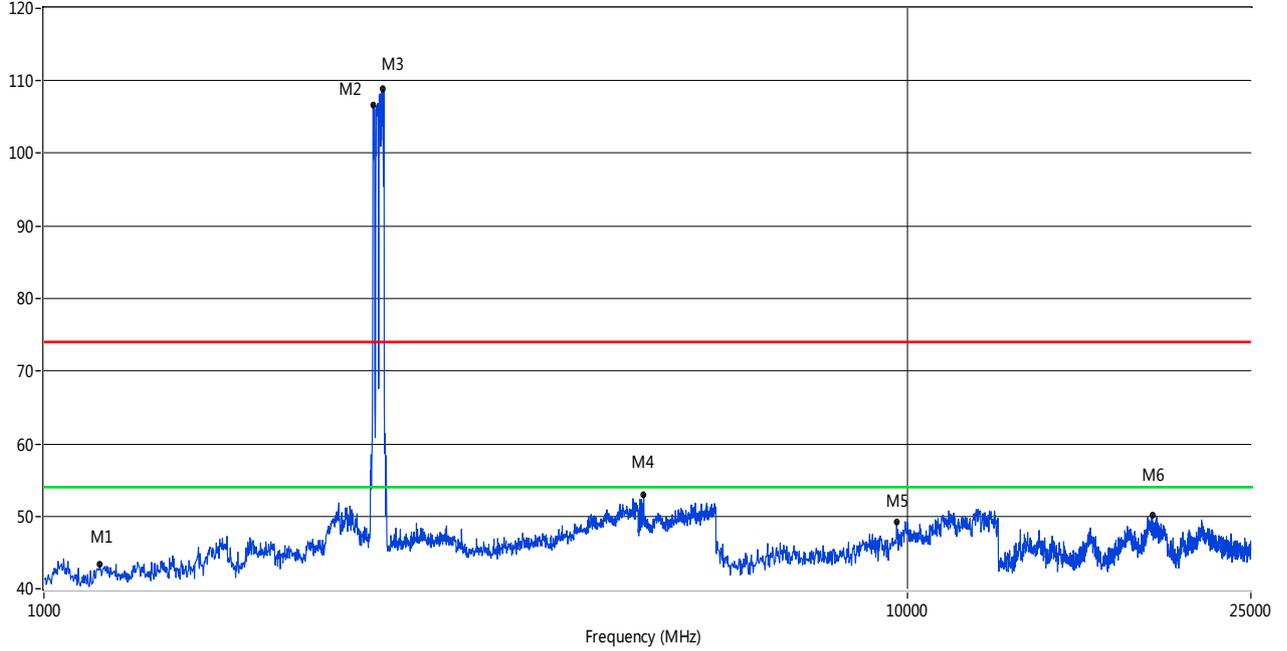


No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1615.38	45.67	-4.30	74.0	28.33	Peak	51.00	100	Horizontal	Pass
2	2474.53	109.63	-0.50	74.0	-35.63	Peak	358.00	100	Horizontal	N/A
3	4951.05	53.18	14.10	74.0	20.82	Peak	292.00	100	Horizontal	Pass
4	9111.07	48.01	17.02	74.0	25.99	Peak	96.00	100	Horizontal	Pass
5	11952.58	51.19	20.65	74.0	22.81	Peak	273.00	100	Horizontal	Pass
6	19219.63	49.85	14.00	74.0	24.15	Peak	295.00	100	Horizontal	Pass

Hopping Mode:

GFSK MODE 1 GHz to 25 GHz, ANT V

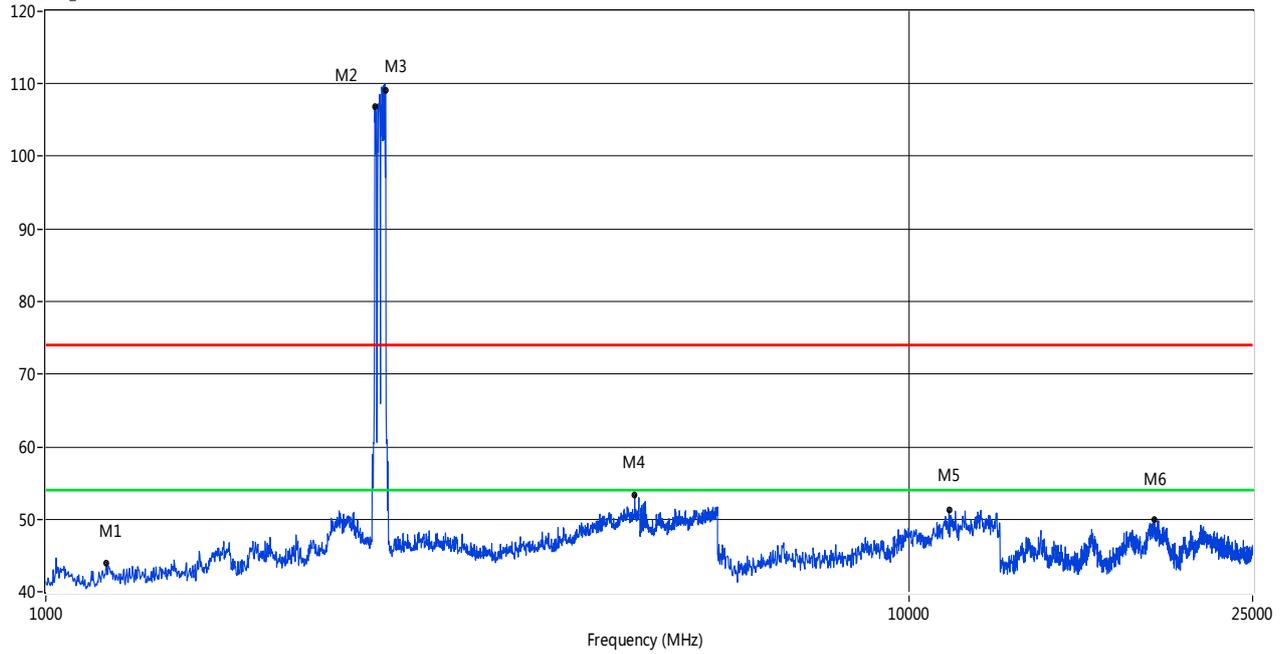
RE Test case_FCC 15C 1GHz-25GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1159.84	43.37	-5.82	74.0	30.63	Peak	62.00	100	Vertical	Pass
2	2404.59	106.85	-0.32	74.0	-32.85	Peak	336.00	100	Vertical	N/A
3	2468.53	108.89	-0.49	74.0	-34.89	Peak	113.00	100	Vertical	N/A
4	4951.05	52.99	14.10	74.0	21.01	Peak	102.00	100	Vertical	Pass
5	9717.55	49.23	17.74	74.0	24.77	Peak	282.00	100	Vertical	Pass
6	19219.63	50.11	14.00	74.0	23.89	Peak	4.00	100	Vertical	Pass

GFSK MODE 1 GHz to 25 GHz, ANT H

RE Test case_FCC 15C 1GHz-25GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1175.82	43.92	-5.50	74.0	30.08	Peak	287.00	100	Horizontal	Pass
2	2404.59	106.85	-0.32	74.0	-32.85	Peak	336.00	100	Horizontal	N/A
3	2474.53	109.11	-0.50	74.0	-35.11	Peak	273.00	100	Horizontal	N/A
4	4810.19	53.30	13.87	74.0	20.70	Peak	109.00	100	Horizontal	Pass
5	11121.46	51.18	20.22	74.0	22.82	Peak	280.00	100	Horizontal	Pass
6	19249.58	49.96	13.82	74.0	24.04	Peak	335.00	100	Horizontal	Pass

A.9 Band Edge

Test Data

Note 1: The lowest and highest channels are tested to verify the band edge emissions. Please refer to the following the plots for emissions values.

Note 2: The test data all are tested in the vertical and horizontal antenna which the trace is max hold. So these plots have shown the worst case.

Note 3: The average levels were calculated from the peak level corrected with duty cycle correction factor (-31.72 dB) derived from $20\log(\text{dwell time}/100 \text{ ms})$.

For example: Average level = 71.40 dBuV/m – 31.72 (dB) = 39.68 dBuV/m.

Test Plots

ANT 1

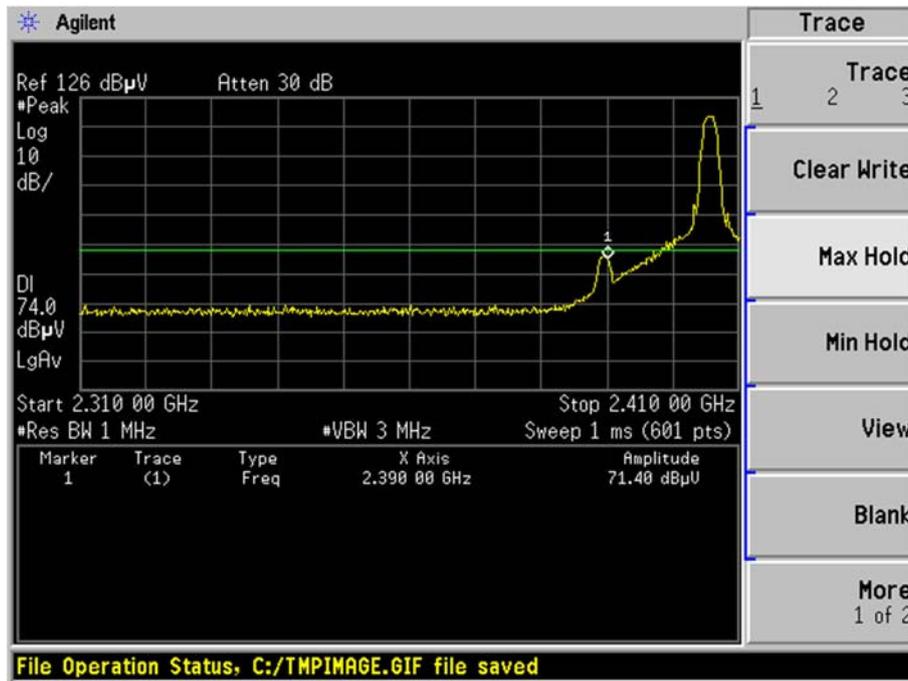
Test Mode	Test Channel	Frequency (MHz)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Remark	Verdict
GFSK	Low	2390	71.40	74	2.60	PEAK	Pass
		2390	39.68	54	14.32	AVERAGE	Pass
GFSK	HIGH	2490.65	71.01	74	2.99	PEAK	Pass
		2490.65	39.29	54	14.71	AVERAGE	Pass
GFSK(Hopping)	Low	2390	70.47	74	3.53	PEAK	Pass
		2390	38.75	54	15.25	AVERAGE	Pass
GFSK(Hopping)	HIGH	2485.1	68.26	74	5.74	PEAK	Pass
		2485.1	36.54	54	17.46	AVERAGE	Pass

ANT 2

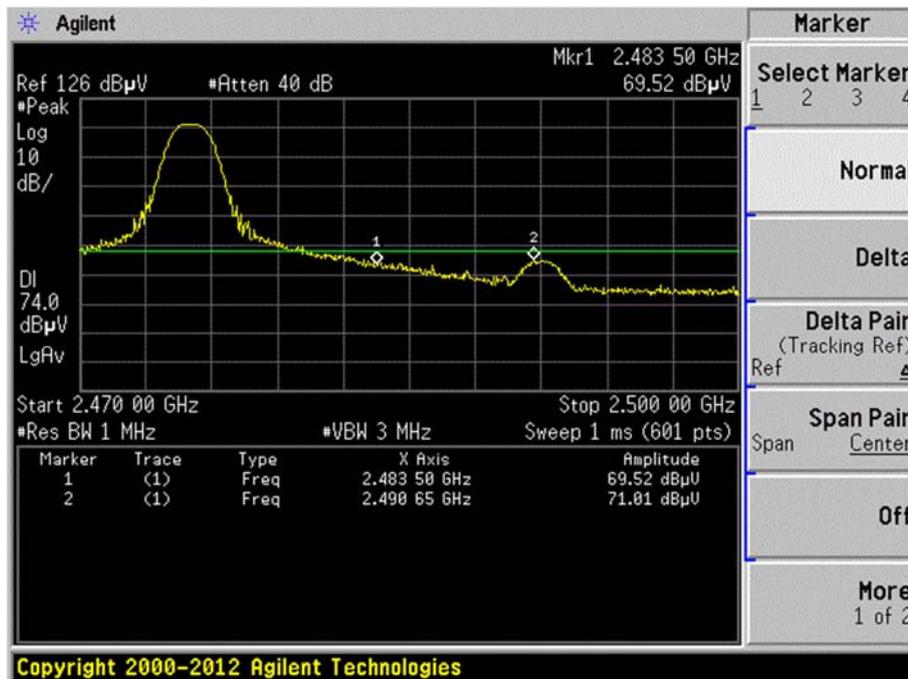
Test Mode	Test Channel	Frequency (MHz)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Remark	Verdict
GFSK	Low	2390	70.76	74	3.24	PEAK	Pass
		2390	39.04	54	14.96	AVERAGE	Pass
GFSK	HIGH	2490.8	70.53	74	3.47	PEAK	Pass
		2490.8	38.81	54	15.19	AVERAGE	Pass
GFSK(Hopping)	Low	2390	70.61	74	3.39	PEAK	Pass
		2390	38.89	54	15.11	AVERAGE	Pass
GFSK(Hopping)	HIGH	2485.1	69.83	74	4.17	PEAK	Pass
		2485.1	38.11	54	15.89	AVERAGE	Pass

ANT1

GFSK LOW CHANNEL , PEAK

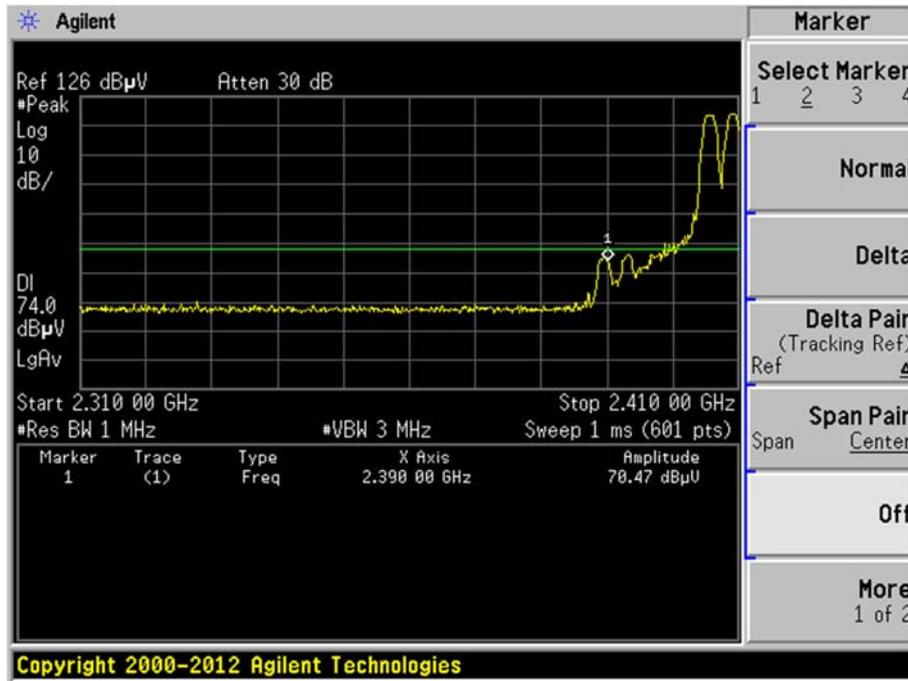


GFSK HIGH CHANNEL , PEAK

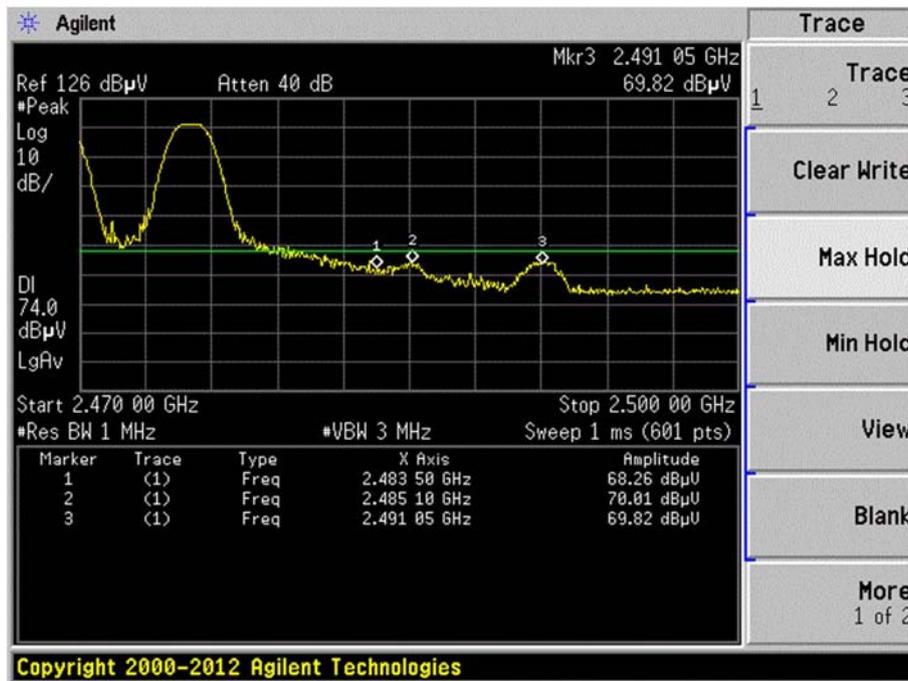


Hopping Mode:

GFSK LOW FREQUENCY BAND, PEAK

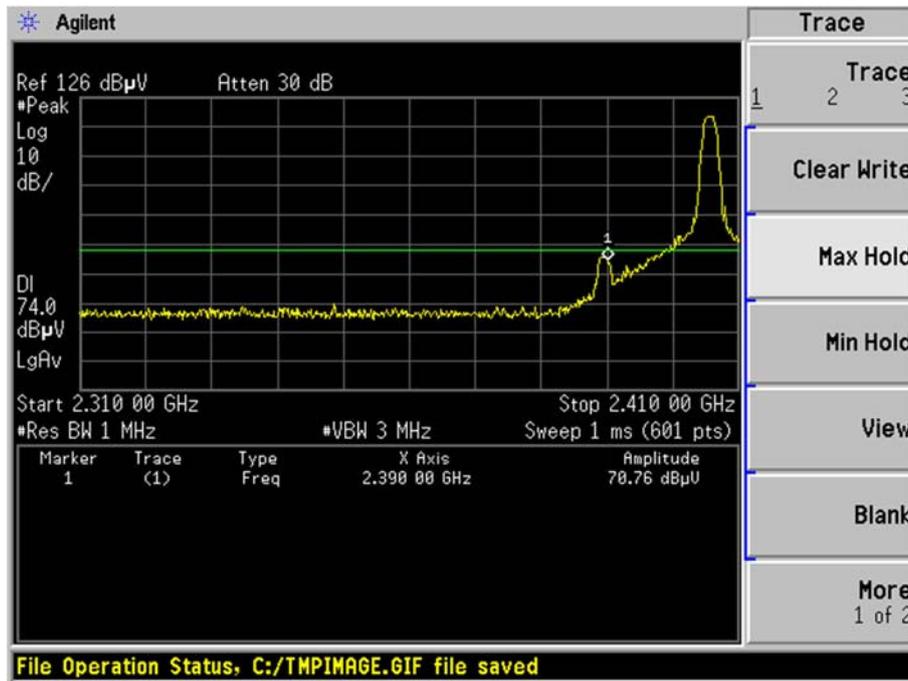


GFSK HIGH FREQUENCY BAND, PEAK

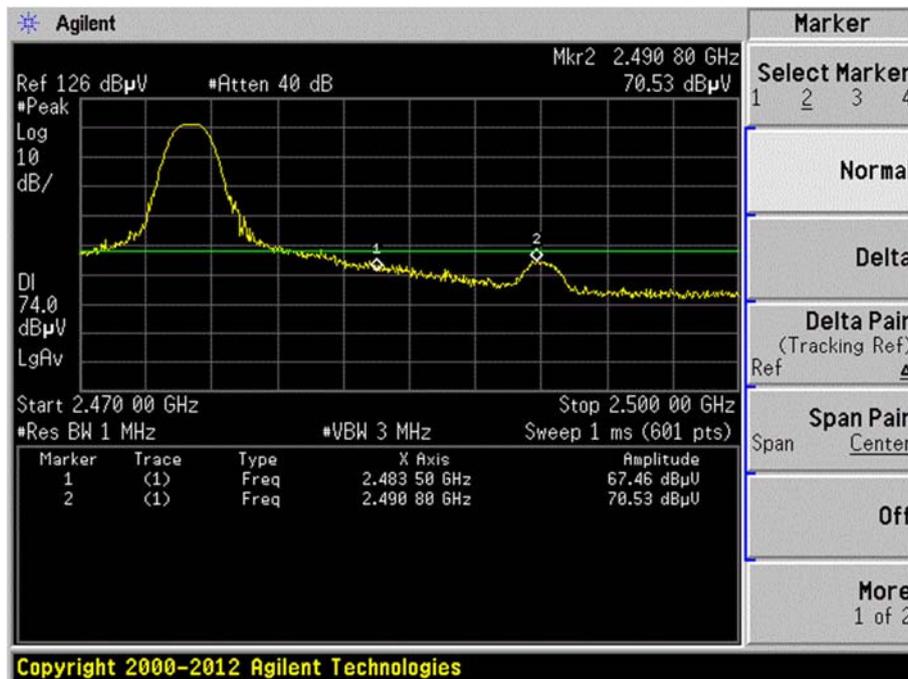


ANT 2

GFSK LOW CHANNEL , PEAK

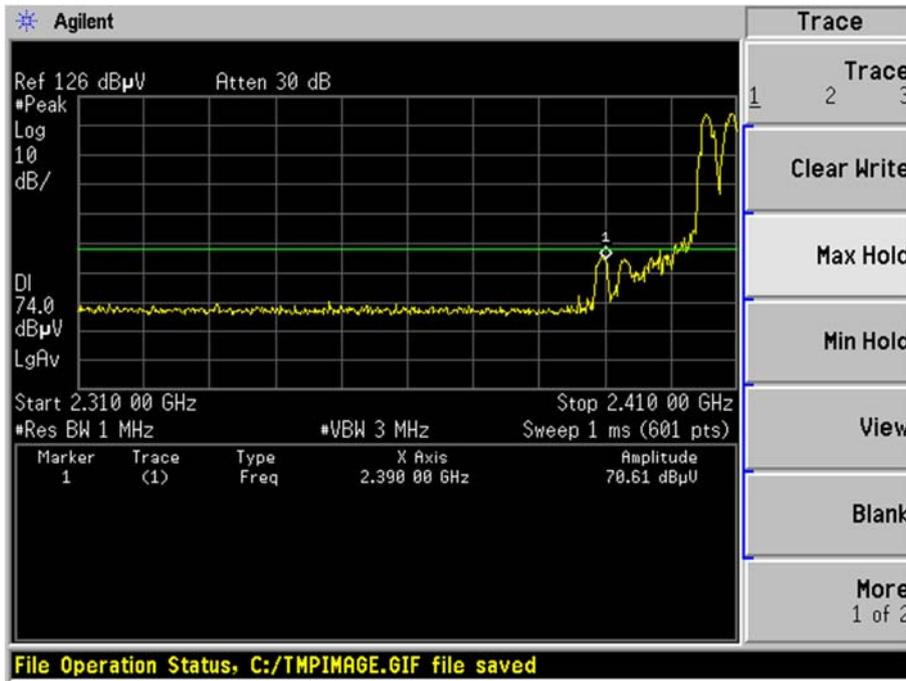


GFSK HIGH CHANNEL , PEAK

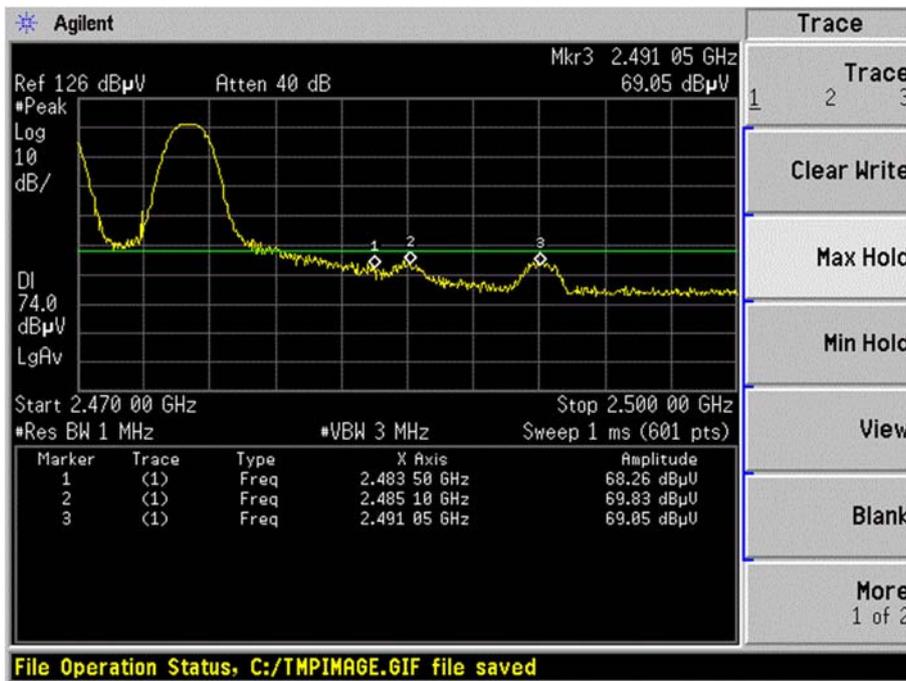


Hopping Mode:

GFSK LOW FREQUENCY BAND, PEAK



GFSK HIGH FREQUENCY BAND, PEAK



ANNEX B TEST SETUP PHOTOS

Please refer the document "BL-SZ15C0311-AR.PDF".

ANNEX C EUT EXTERNAL PHOTOS

Please refer the document "BL-SZ15C0311-AW.PDF".

ANNEX D EUT INTERNAL PHOTOS

Please refer the document "BL-SZ15C0311-AI.PDF".

--END OF REPORT--