

FCC
RF
TEST REPORT

ISSUED BY
Shenzhen BALUN Technology Co., Ltd.



FOR
Bluetooth Clock Radio

ISSUED TO
Tonika Electronics Technology (Shenzhen) Co., Ltd

No.55 Busha Road, Nanwan Town, Longgang District, Shenzhen,
Guangdong Province, China.



Prepared by: Zhang Yangqiang
Zhang Yangqiang
(Reporting Specialist)

Date: 2014.08.27

Approved by: Wei Yanquan
Wei Yanquan
(Chief Engineer)

Date: 2014.08.27

Report No.: BL-SZ1480058-601

EUT Type: Bluetooth Clock Radio

Model Name: CR41483, TA-265B

Brand Name: Tonika

Test Standard: 47 CFR Part 15 Subpart C

FCC ID: SDN-265B-B021008

Test conclusion: PASS

Test Date: 2014.08.20 – 2014.08.25

Date of Issue: 2014.08.27

NOTE: This test report can be duplicated completely for the legal use with the approval of the applicant; it shall not be reproduced except in full, without the written approval of Shenzhen BALUN Technology Co., Ltd. BALUN Laboratory. Any objections should be raised within thirty days from the date of issue. To validate the report, please visit BALUN website.

Revision History

<u>Version</u>	<u>Issue Date</u>	<u>Revisions</u>
<u>Rev. 01</u>	<u>2014.08.27</u>	<u>Initial Issue</u>

TABLE OF CONTENTS

1	ADMINISTRATIVE DATA (GENERAL INFORMATION)	5
1.1	Identification of the Testing Laboratory	5
1.2	Identification of the Responsible Testing Location	5
1.3	Test Environment Condition	5
1.4	Announce	6
2	PRODUCT INFORMATION	7
2.1	Applicant	7
2.2	Manufacturer	7
2.3	General Description for Equipment under Test (EUT)	7
2.4	Technical Information	7
2.5	Ancillary Equipment	7
3	SUMMARY OF TEST RESULTS	8
3.1	Test Standards	8
3.2	Verdict	8
4	GENERAL TEST CONFIGURATIONS	9
4.1	Test Environments	9
4.2	Test Equipment List	9
4.3	Test Configurations	10
4.4	Description of Test Setup	10
4.4.1	For Antenna Port Test	10
4.4.2	For AC Power Supply Port Test	10
4.4.3	For Radiated Test (Below 30MHz)	11
4.4.4	For Radiated Test (30MHz-1GHz)	11
4.4.5	For Radiated Test (Above 1GHz)	12
4.5	Test Conditions	12

5	TEST ITEMS	13
5.1	Antenna Requirements.....	13
5.1.1	Standard Applicable	13
5.1.2	Antenna Anti-Replacement Construction	13
5.1.3	Antenna Gain	13
5.2	Number of Hopping Frequency	14
5.2.1	Limit.....	14
5.2.2	Test Procedure.....	14
5.3	Peak Output Power	15
5.3.1	Test Limit.....	15
5.3.2	Test Procedure.....	15
5.4	Occupied Bandwidth	16
5.4.1	Limit.....	16
5.4.2	Test Procedure.....	16
5.5	Carrier Frequency Separation	17
5.5.1	Limit.....	17
5.5.2	Test Procedure.....	17
5.6	Time of Occupancy (Dwell time).....	18
5.6.1	Limit.....	18
5.6.2	Test Procedure.....	18
5.7	Conducted Spurious Emission	19
5.7.1	Limit.....	19
5.7.2	Test Procedure.....	19
5.8	Conducted Emission	20
5.8.1	Limit.....	20
5.8.2	Test Procedure.....	20
5.9	Radiated Spurious Emission	21
5.9.1	Limit.....	21
5.9.2	Test Procedure.....	21
5.10	Band Edge.....	22
5.10.1	Limit	22

5.10.2	Test Procedure	22
ANNEX A	TEST RESULT	23
A.1	Number of Hopping Frequency	23
A.2	Peak Output Power	26
A.3	20dB and 99% bandwidth.....	30
A.4	Hopping Frequency Separation.....	34
A.5	Average Time of Occupancy	36
A.6	Conducted Spurious Emissions.....	40
A.7	Conducted Emissions.....	49
A.8	Radiated Emission	51
A.9	Band Edge	86
ANNEX B	TEST SETUP PHOTOS	95
B.1	Conducted Test Photo.....	95
B.2	Conducted Emissions Test Photo.....	95
B.3	Radiated Test Photo.....	96
ANNEX C	EUT PHOTOS	98
C.1	Appearance of the EUT	98
C.2	Inside of the EUT	101

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 6683 3402
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	The laboratory has been listed by Industry Canada to perform electromagnetic emission measurements. The recognition numbers of test site are 11524A-1. The laboratory has been listed by US Federal Communications Commission to perform electromagnetic emission measurements. The recognition numbers of test site are 832625. The laboratory has met the requirements of the IAS Accreditation Criteria for Testing Laboratories (AC89), has demonstrated compliance with ISO/IEC Standard 17025:2005. The accreditation certificate number is TL-588. 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.
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 Test Environment Condition

Ambient Temperature	15 to 35°C
Ambient Relative Humidity	30 to 60%
Ambient Pressure	86 to 106kPa

1.4 Announce

- (1) The test report is invalid if not marked with the signatures of the persons responsible for preparing and approving the test report.
- (2) The test report is invalid if there is any evidence and/or falsification.
- (3) The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein.
- (4) 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.
- (5) 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

Applicant	Tonika Electronics Technology (Shenzhen) Co., Ltd
Address	No.55 Busha Road, Nanwan Town, Longgang District, Shenzhen, Guangdong Province, China.

2.2 Manufacturer

Manufacturer	Tonika Electronics Technology (Shenzhen) Co., Ltd
Address	No.55 Busha Road, Nanwan Town, Longgang District, Shenzhen, Guangdong Province, China.

2.3 General Description for Equipment under Test (EUT)

EUT Type	Bluetooth Clock Radio
Under Tested Model Name	CR41483
Serial Model Name	CR41483, TA-265B
Description of Model Name differentiation	The equipment model CR41483 and TA-265B are Legacy Wireless Bluetooth Headphones, the electrical parameters and internal structure of circuit are same, only the model name is different.
Hardware Version	N/A
Software Version	N/A
Network and Wireless connectivity	BT 2.1+EDR
About the Product	The equipment is BIG JUKEBOX SPEAKER, it contains BT Module operating at 2.4GHz ISM band.

2.4 Technical Information

TX/ RX Operating Range	2400~2483.5MHz band $f_c = 2402 \text{ MHz} + N \times 1 \text{ MHz}$, where - f_c = "Operating Frequency" in MHz, - N = "Channel Number" with the range from 0 to 78.	
Modulation Type	Carrier	Frequency Hopping Spread Spectrum
	Digital	GFSK, $\pi/4$ -DQPSK
Antenna Type	PCB Antenna	
Antenna Gain	0dBi	

2.5 Ancillary Equipment

N/A

3 SUMMARY OF TEST RESULTS

3.1 Test Standards

No.	Identity	Document Title
1	47 CFR Part 15, Subpart C (12-30-13 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 C63.4-2009	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 C63.10-2009	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(c)	ANNEX A.8	Pass
10	Band Edge	15.247(d)	ANNEX A.9	Pass

Note 1: The EUT has a permanently and irreplaceable attached antenna, which complies with the requirement FCC 15.203.

4 GENERAL TEST CONFIGURATIONS

4.1 Test Environments

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

Relative Humidity (%)	30 -60	
Atmospheric Pressure (kPa)	86-106	
Temperature	NT (Normal Temperature)	+20°C to +25°C
	LT (Low Temperature)	-20°C
	HT (High Temperature)	+55°C
Working Voltage of the EUT	NV (Normal Voltage)	AC 120V/60Hz

4.2 Test Equipment List

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Spectrum Analyzer	AGILENT	E4440A	MY45304434	2014.07.07	2015.07.06
Spectrum Analyzer	ROHDE&SCHWARZ	FSL3	103640/003	2014.07.07	2015.07.06
Bluetooth Tester	ROHDE&SCHWARZ	CBT	101005	2014.07.07	2015.07.06
Power Splitter	KMW	DCPD-LDC	1305003215	2014.07.07	2015.07.06
Power Sensor	ROHDE&SCHWARZ	NRP-Z21	103971	2014.07.07	2015.07.06
Attenuator (20dB)	KMW	ZA-S1-201	110617091	--	--
Attenuator (6dB)	KMW	ZA-S1-61	1305003189	--	--
DC Power Supply	ROHDE&SCHWARZ	HMP2020	018141664	2014.07.07	2015.07.06
Temperature Chamber	ANGELANTIONI SCIENCE	NTH64-40A	1310	2014.07.07	2015.07.06
Test Antenna-Loop(9kHz-30MHz)	SCHWARZBECK	FMZB 1519	1519-037	2013.07.03	2015.07.02
Test Antenna-Bi-Log(30MHz-3G Hz)	SCHWARZBECK	VULB 9163	9163-624	2013.07.02	2015.07.01
Test Antenna-Horn(1-18GHz)	SCHWARZBECK	BBHA 9120D	9120D-1148	2013.07.02	2015.07.01
Test Antenna-Horn(15-26.5GHz)	SCHWARZBECK	BBHA 9170	9170-305	2013.07.02	2015.07.01
Anechoic Chamber	RAINFORD	9m*6m*6m	N/A	2013.10.07	2014.10.06

4.3 Test Configurations

Test Configurations (TC) NO.	Description	
	Signal Description	Operating Frequency
Transmitter		
TC01	GFSK modulation, package type DH5, hopping on	--
TC02	GFSK modulation, package type DH5, hopping off	Ch No. 0/ 2402MHz
TC03	GFSK modulation, package type DH5, hopping off	Ch No. 39/ 2441MHz
TC04	GFSK modulation, package type DH5, hopping off	Ch No. 78/ 2480MHz
TC05	$\pi/4$ -DQPSK modulation, package type DH5, hopping on	--
TC06	$\pi/4$ -DQPSK modulation, package type DH5, hopping off	Ch No. 0/ 2402MHz
TC07	$\pi/4$ -DQPSK modulation, package type DH5, hopping off	Ch No. 39/ 2441MHz
TC08	$\pi/4$ -DQPSK modulation, package type DH5, hopping off	Ch No. 78/ 2480MHz

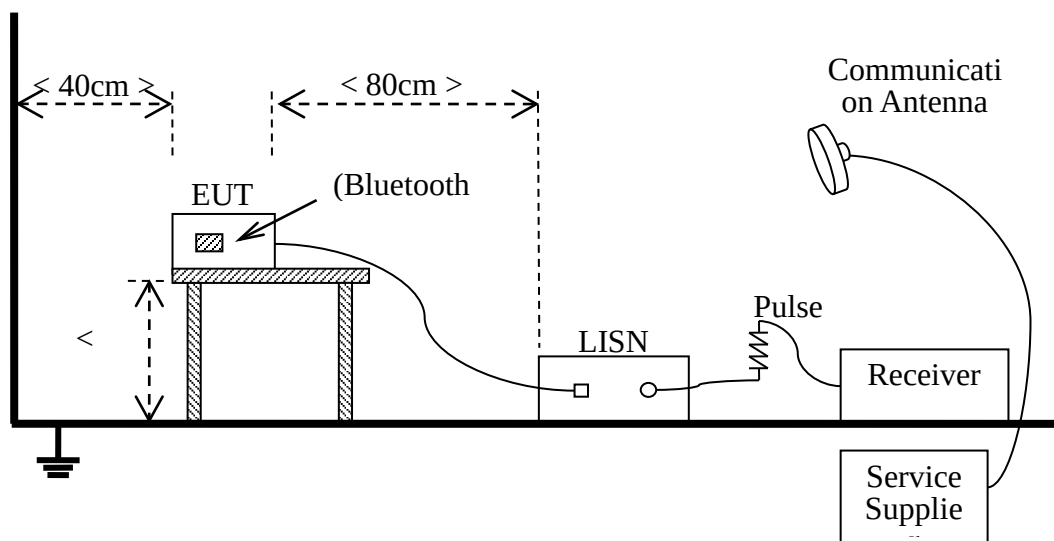
4.4 Description of Test Setup

4.4.1 For Antenna Port Test



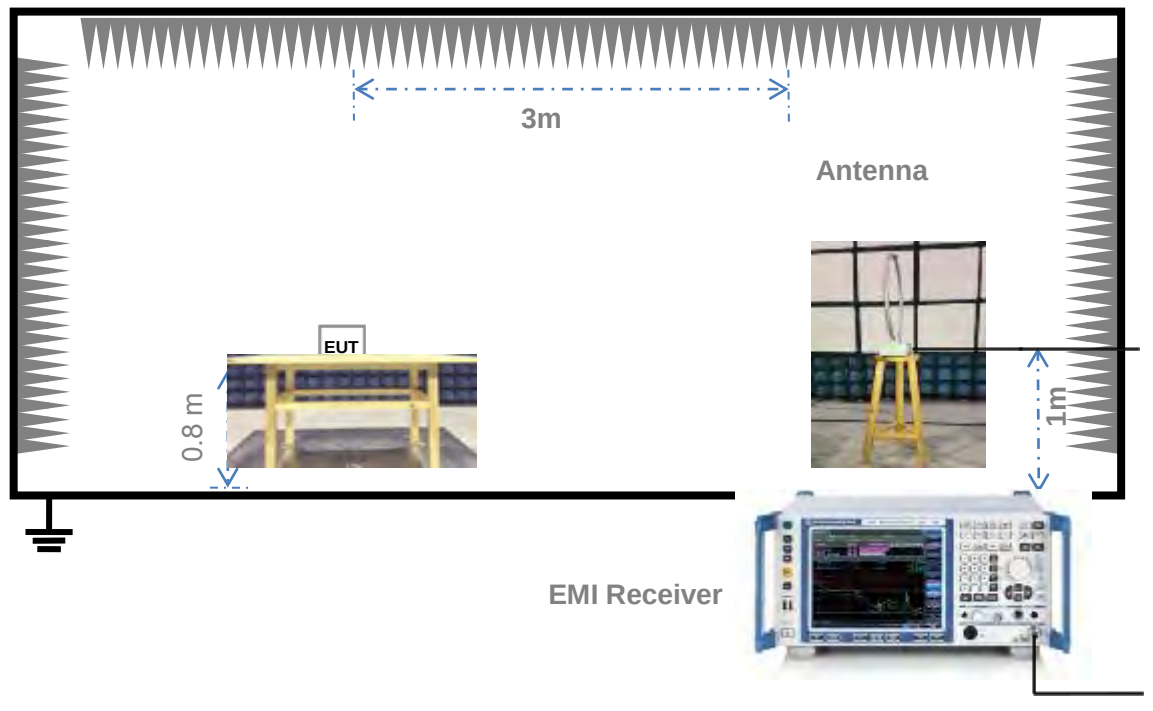
(Diagram 1)

4.4.2 For AC Power Supply Port Test



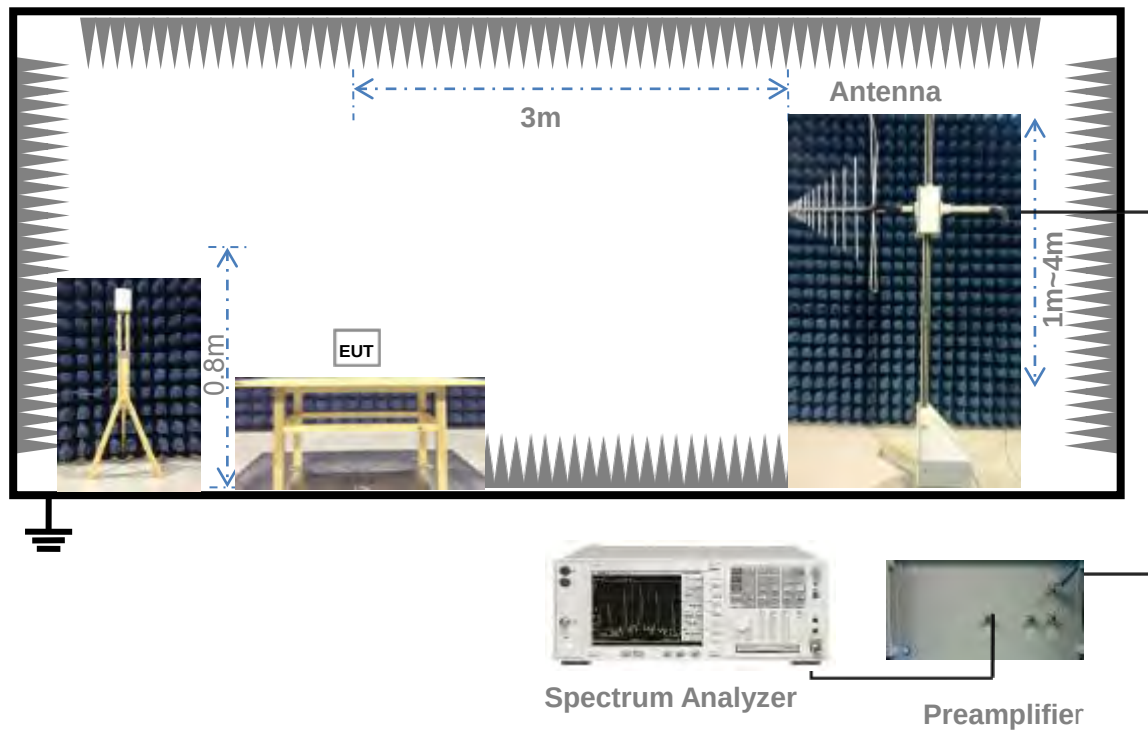
(Diagram 2)

4.4.3 For Radiated Test (Below 30MHz)



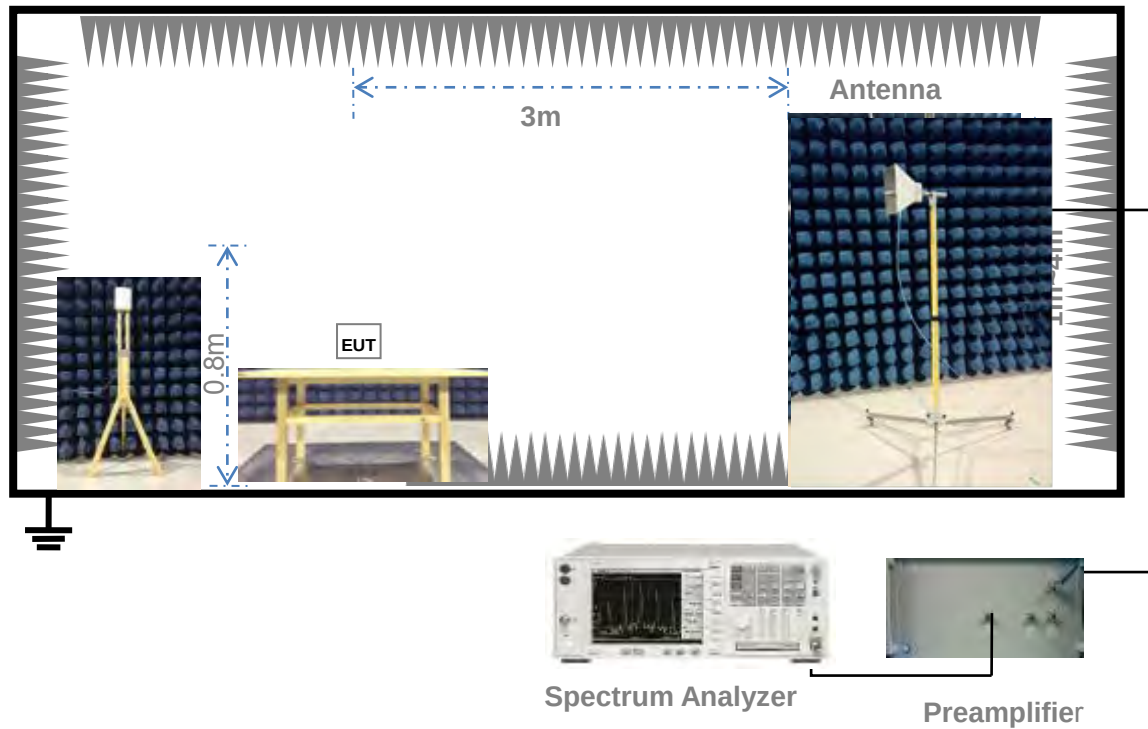
(Diagram 3)

4.4.4 For Radiated Test (30MHz-1GHz)



(Diagram 4)

4.4.5 For Radiated Test (Above 1GHz)



(Diagram 5)

4.5 Test Conditions

Test Case	Test Conditions		
	Test Env.	Test Setup ^{Note 1}	Test Configuration ^{Note 2}
Number of Hopping Frequency	NTNV	Test Setup 1	TC01, TC05
Peak Output Power	NTNV	Test Setup 1	TC02, TC03, TC04, TC06, TC07, TC08,
Occupied Bandwidth	NTNV	Test Setup 1	TC03, TC07
Carrier Frequency Separation	NTNV	Test Setup 1	TC01, TC05
Time of Occupancy (Dwell time)	NTNV	Test Setup 1	TC01, TC05
Conducted Spurious Emission	NTNV	Test Setup 1	TC02, TC03, TC04, TC06, TC07, TC08,
Conducted Emission	NTNV	Test Setup 2	TC02, TC03, TC04, TC06, TC07, TC08,
Radiated Emission	NTNV	Test Setup 3 Test Setup 4 Test Setup 5	TC01, TC02, TC03, TC04, TC05, TC06, TC07, TC08,
Band Edge	NTNV	Test Setup 5	TC01, TC02, TC04, TC05, TC06, TC08
Note:			
1. Please refer to section 4.4 for test setup details.			
2. Please refer to section 4.3 for test setup details.			

5 TEST ITEMS

5.1 Antenna Requirements

5.1.1 Standard Applicable

FCC §15.203 & 15.247(b)

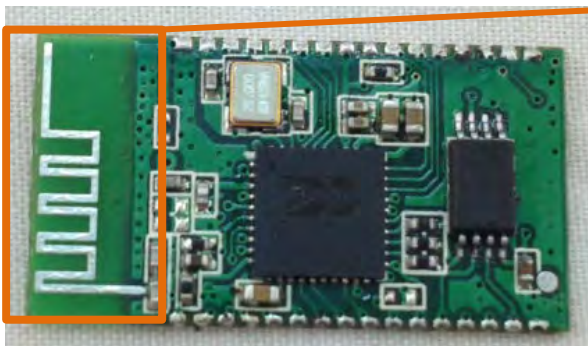
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply 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 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. 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	An embedded-in antenna design is used.

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 2400MHz to 2483.5MHz bands shall use at least 15 hopping frequencies.

5.2.2 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

5.3 Peak Output Power

5.3.1 Test Limit

FCC § 15.247(b)

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

5.3.2 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

5.4 Occupied Bandwidth

5.4.1 Limit

FCC §15.247(a)

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

5.4.2 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

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 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater.

5.5.2 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.

5.6 Time of Occupancy (Dwell time)

5.6.1 Limit

FCC §15.247(a)

Frequency hopping systems in the 2400 - 2483.5MHz 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 Procedure

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

For DH1 package type

$$\begin{aligned}\{\text{Total of Dwell}\} &= \{\text{Pulse Time}\} * (1600 / 2) / \{\text{Number of Hopping Frequency}\} * \{\text{Period}\} \\ \{\text{Period}\} &= 0.4s * \{\text{Number of Hopping Frequency}\}\end{aligned}$$

For DH3 package type

$$\begin{aligned}\{\text{Total of Dwell}\} &= \{\text{Pulse Time}\} * (1600 / 4) / \{\text{Number of Hopping Frequency}\} * \{\text{Period}\} \\ \{\text{Period}\} &= 0.4s * \{\text{Number of Hopping Frequency}\}\end{aligned}$$

For DH5 package type

$$\begin{aligned}\{\text{Total of Dwell}\} &= \{\text{Pulse Time}\} * (1600 / 6) / \{\text{Number of Hopping Frequency}\} * \{\text{Period}\} \\ \{\text{Period}\} &= 0.4s * \{\text{Number of Hopping Frequency}\}\end{aligned}$$

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

5.7 Conducted Spurious Emission

5.7.1 Limit

FCC §15.247(d)

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.

5.7.2 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

5.8 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 150kHz to 30MHz 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 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.

5.9 Radiated Spurious Emission

5.9.1 Limit

FCC §15.209&15.247(c)

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 ($\mu\text{V/m}$)	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. For Above 1000MHz, 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.
2. For above 1000MHz, limit field strength of harmonics: 54dBuV/m@3m (AV) and 74dBuV/m@3m (PK).

5.9.2 Test Procedure

The measurement frequency range is from 30MHz 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

5.10 Band Edge

5.10.1 Limit

FCC §15.209&15.247(d)

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.

5.10.2 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.

$E \text{ [dB}\mu\text{V/m]} = UR + AT + A\text{Factor [dB]}; AT = LCable \text{ loss [dB]} - G\text{preamp [dB]}$

AT: Total correction Factor except Antenna

UR: Receiver Reading

Gpreamp: Preamplifier Gain

AFactor: Antenna Factor at 3m

ANNEX A TEST RESULT

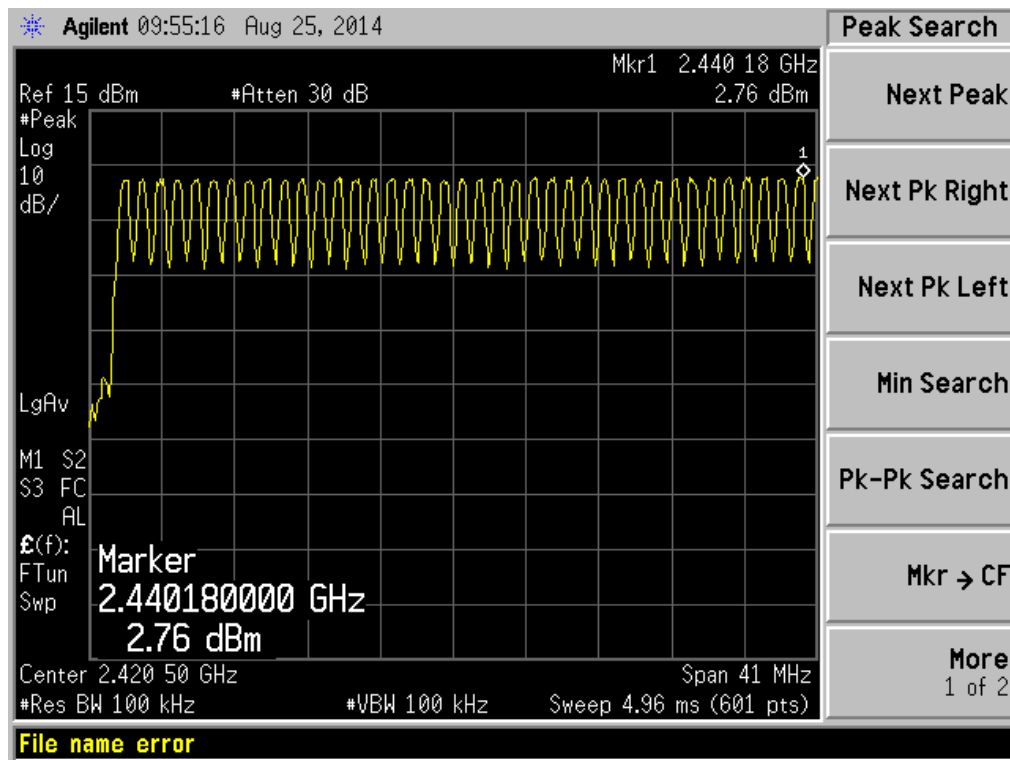
A.1 Number of Hopping Frequency

Test Data

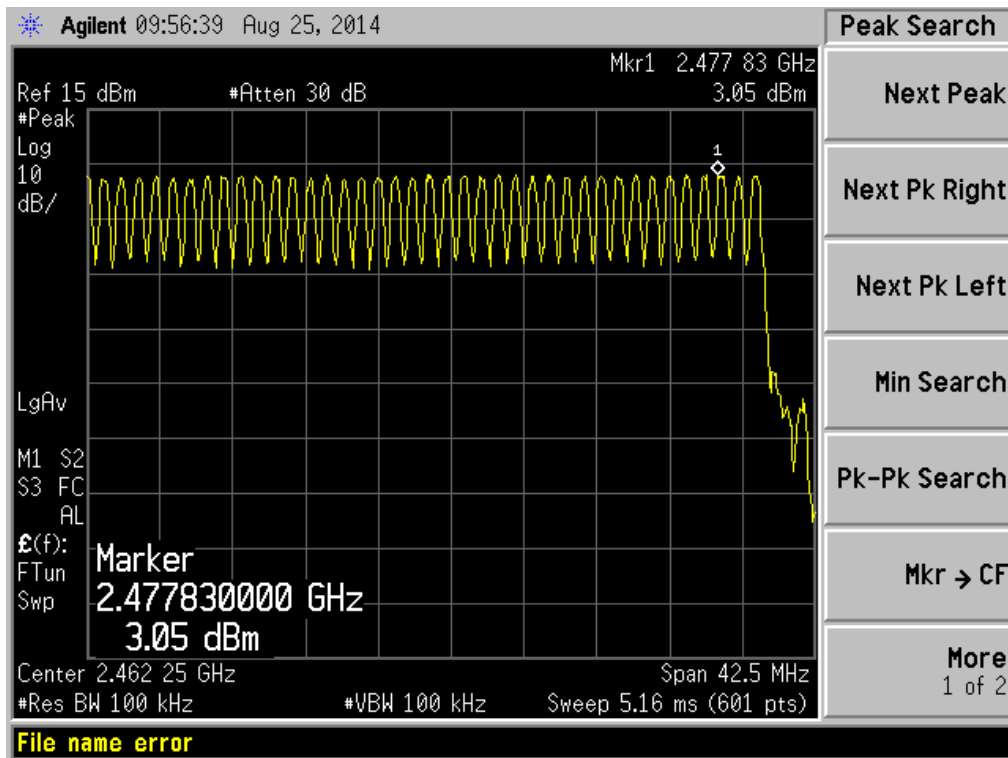
Test Mode	Frequency Block (MHz)	Measured Channel Numbers	Min. Limit	Verdict
GFSK	2400 - 2483.5	79	15	PASS
Π/4-DQPSK	2400 - 2483.5	79	15	PASS

Test plots

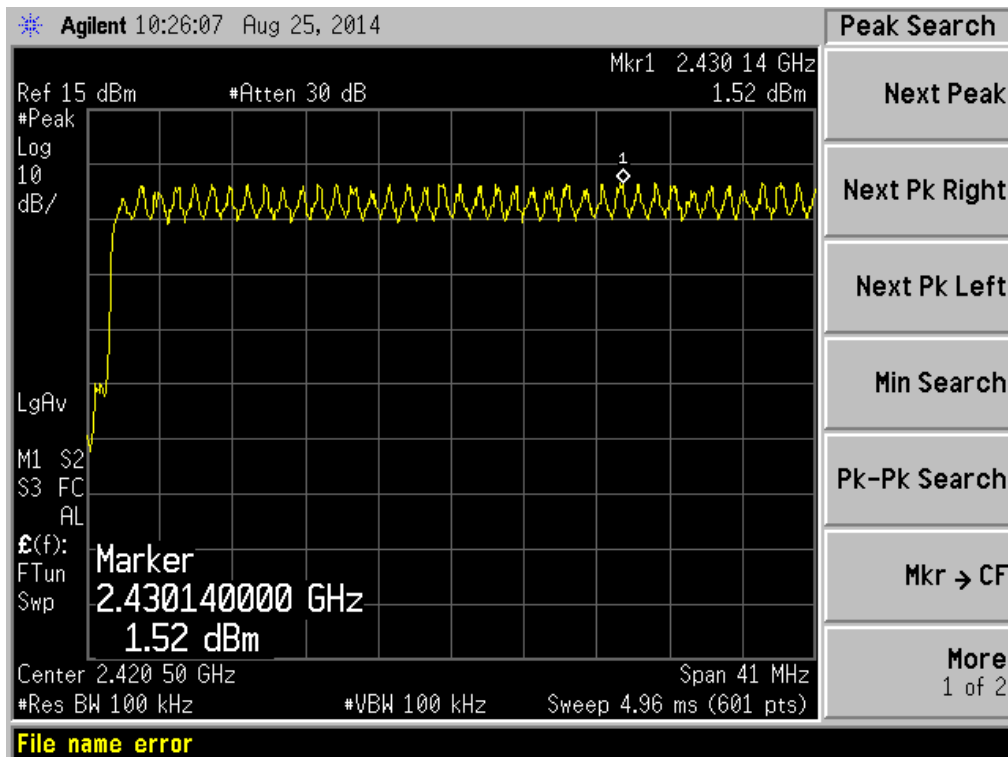
GFSK 2.4GHz~2.4415GHz



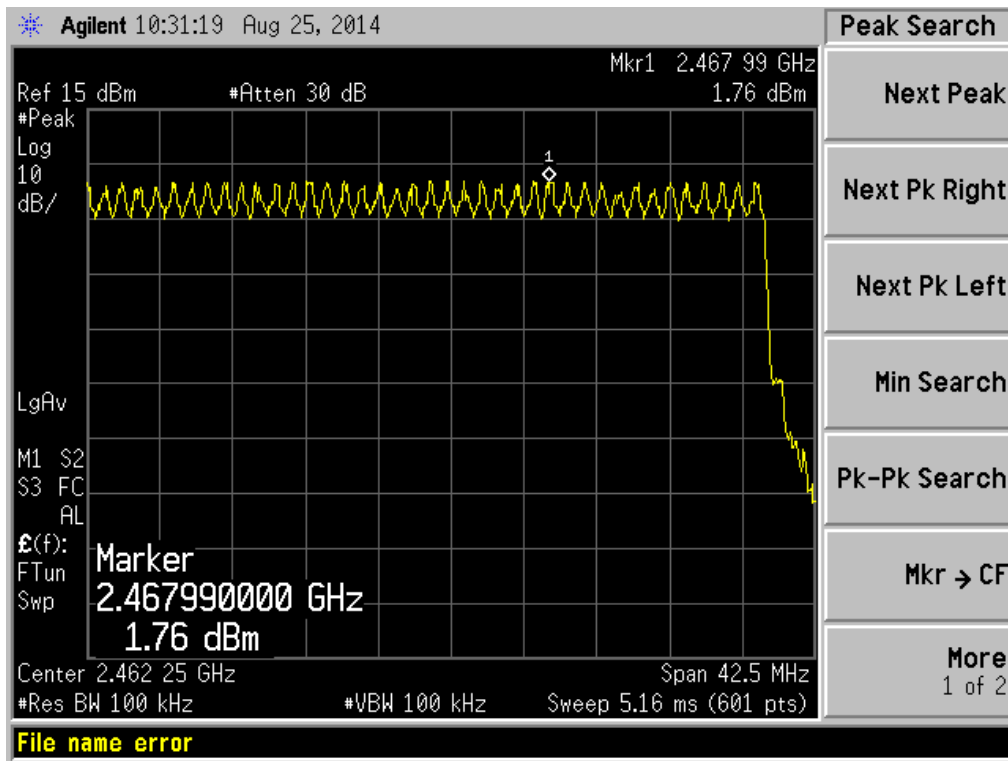
GFSK 2.4415GHz~2.4835GHz



II/4-DQPSK 2.4GHz~2.4415GHz



II/4-DQPSK 2.4415GHz~2.4835GHz



A.2 Peak Output Power

Test Data

GFSK Mode:

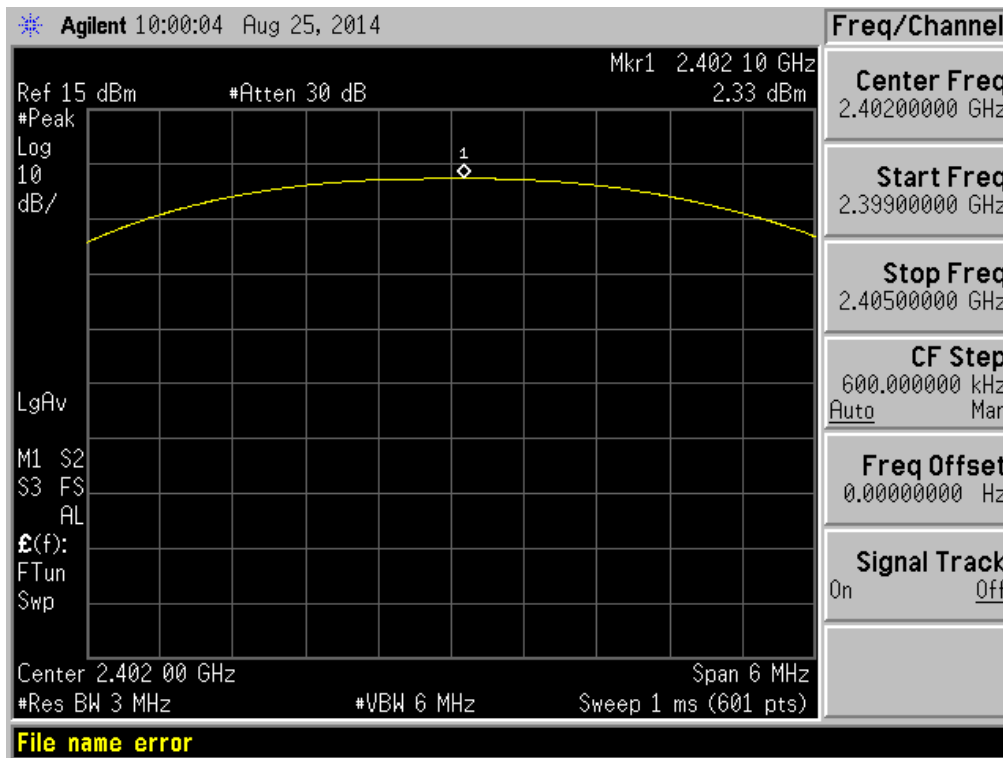
Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	mW	dBm	mW	
0	2402	2.33	1.71	30	1000	PASS
39	2441	2.83	1.92			PASS
78	2480	3.15	2.07			PASS

□/4-DQPSK Mode:

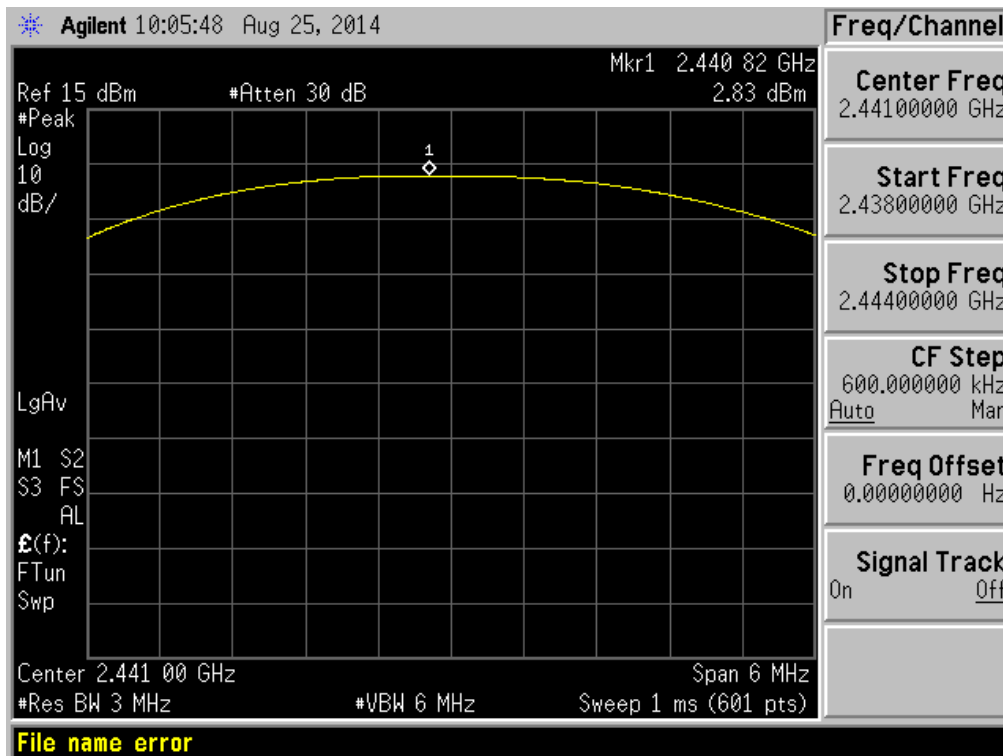
Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	mW	dBm	mW	
0	2402	1.54	1.43	30	1000	PASS
39	2441	2.21	1.66			PASS
78	2480	2.37	1.73			PASS

Test plots

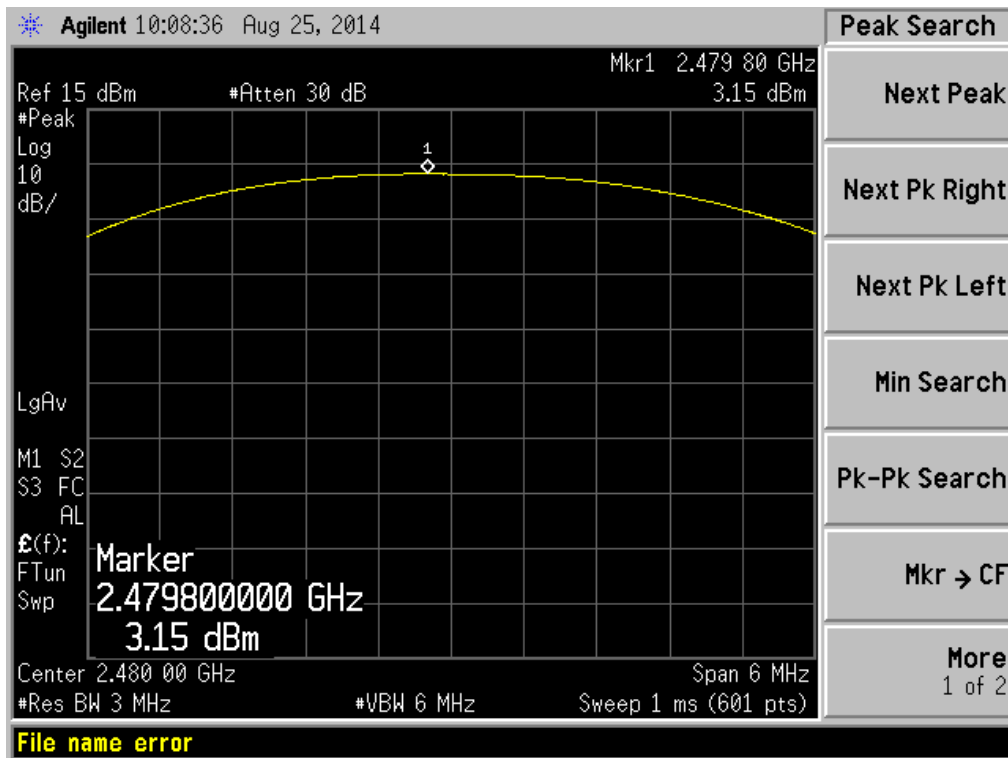
GFSK LOW CHANNEL



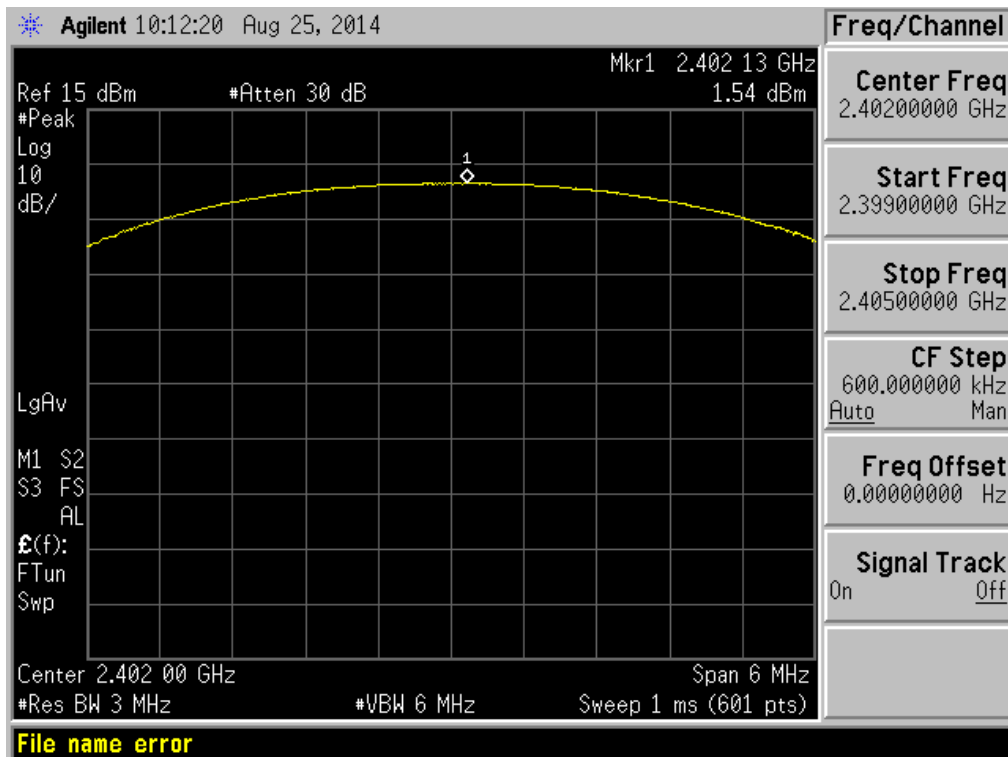
GFSK MID CHANAEL



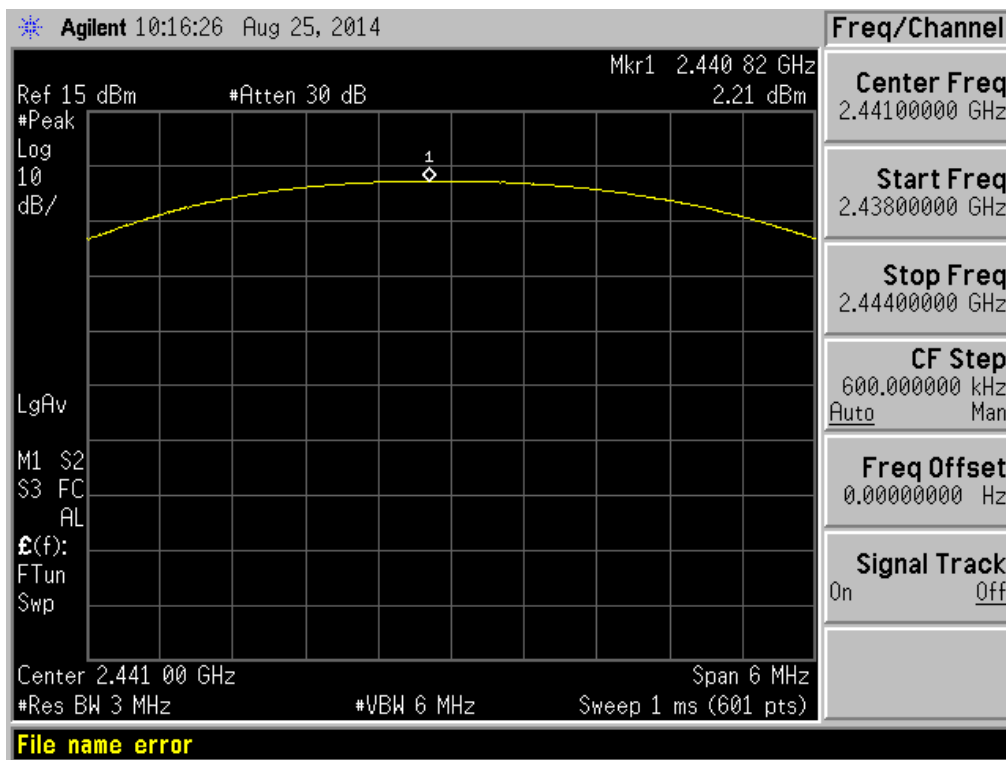
GFSK HIGH CHANNEL



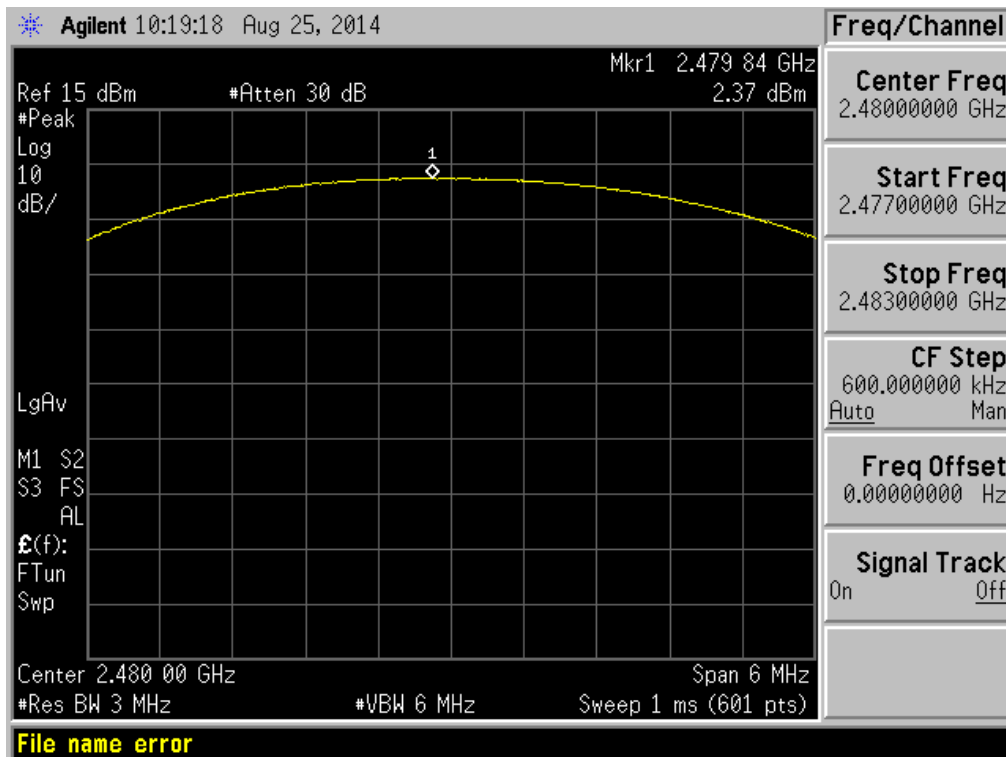
II/4-DQPSK LOW CHANNEL



II/4-DQPSK MID CHANAEL



II/4-DQPSK HIGH CHANNEL



A.3 20dB and 99% bandwidth

Test Data

GFSK Mode:

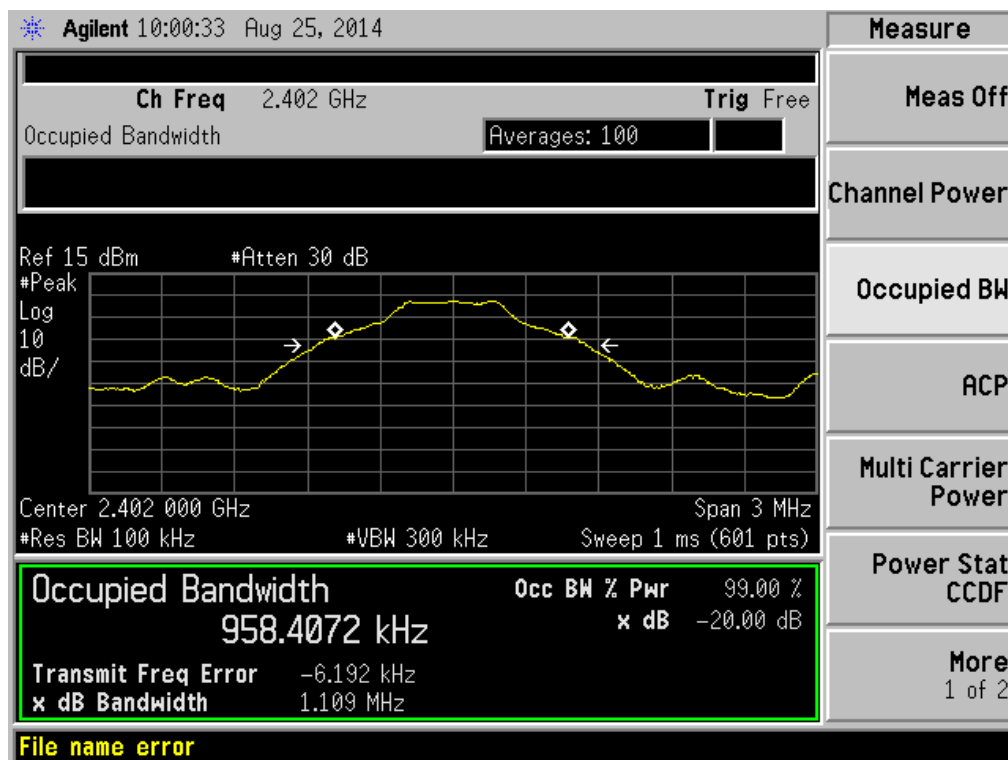
Channel	Frequency (MHz)	20 dB Bandwidth (MHz)	99% Bandwidth (kHz)
Low	2402	1.109	958.4072
Middle	2441	1.116	959.0022
High	2480	1.123	972.5826

π/4-DQPSK Mode:

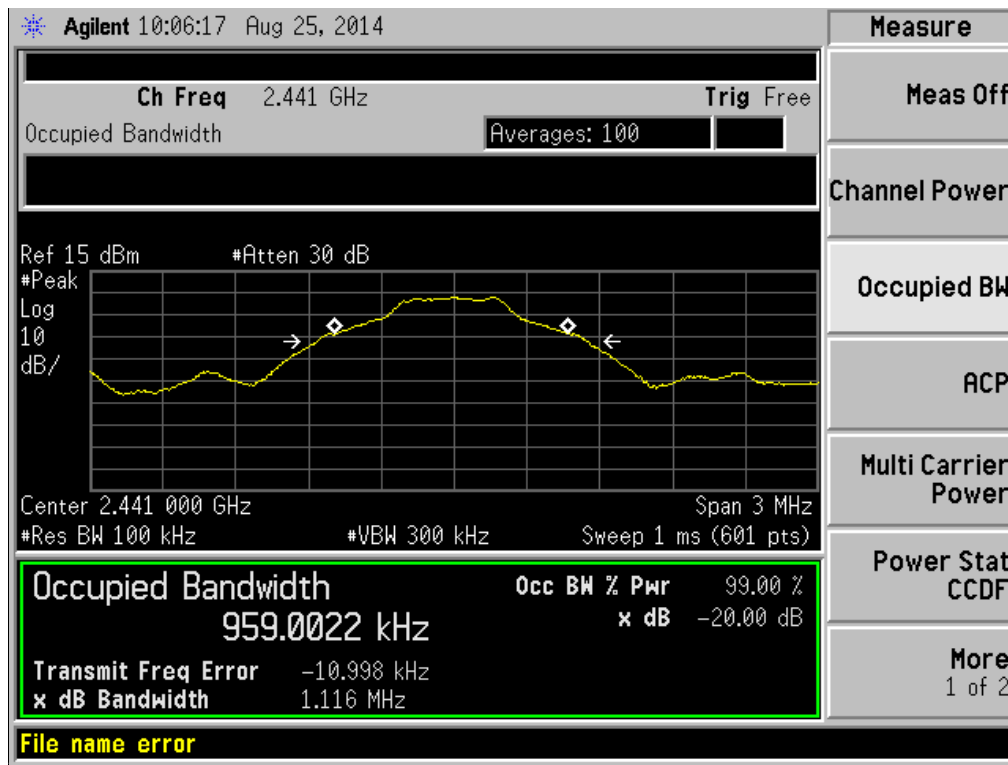
Channel	Frequency (MHz)	20 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	1.380	1.2125
Middle	2441	1.393	1.2388
High	2480	1.386	1.2186

Test plots

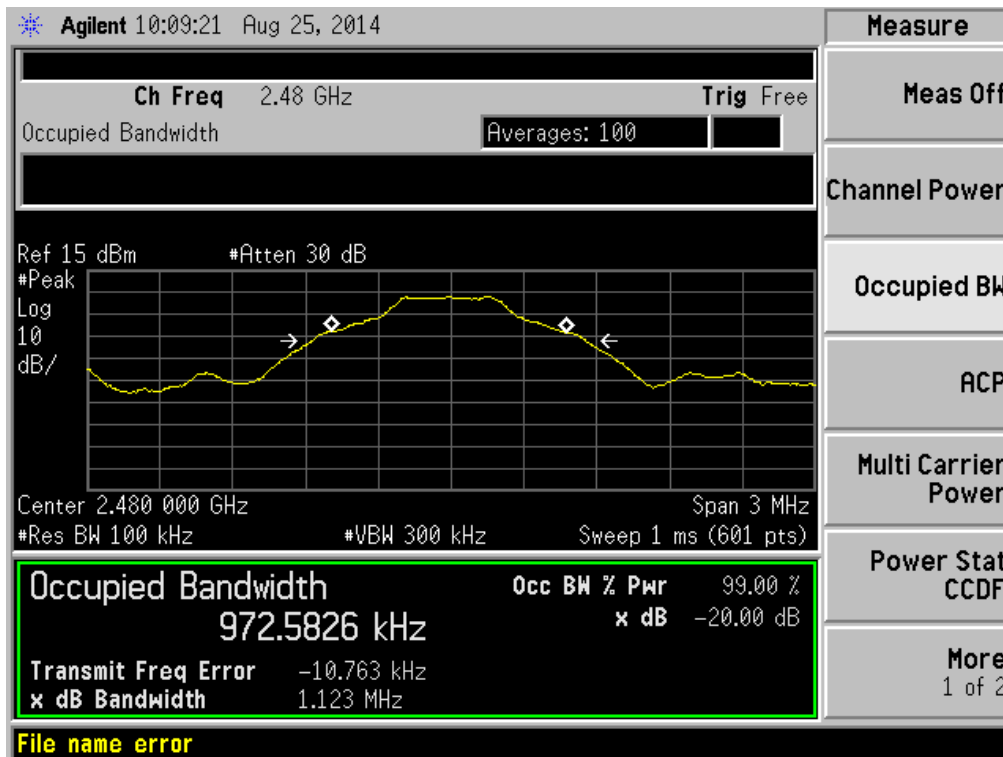
GFSK LOW CHANNEL



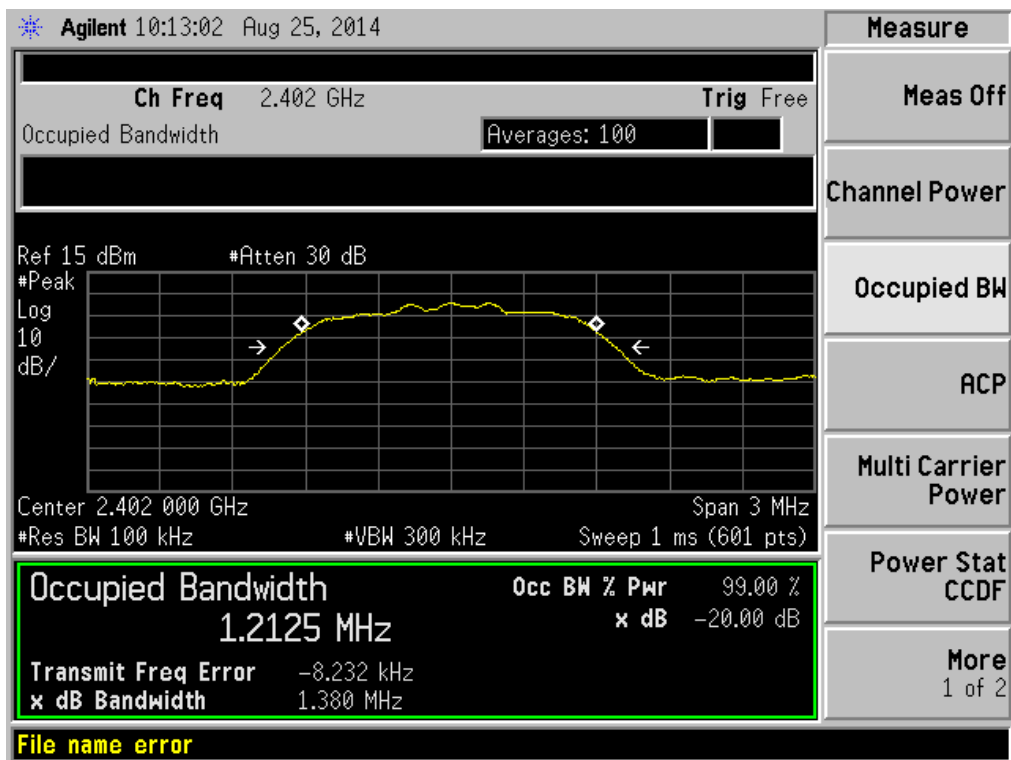
GFSK MID CHANAEL



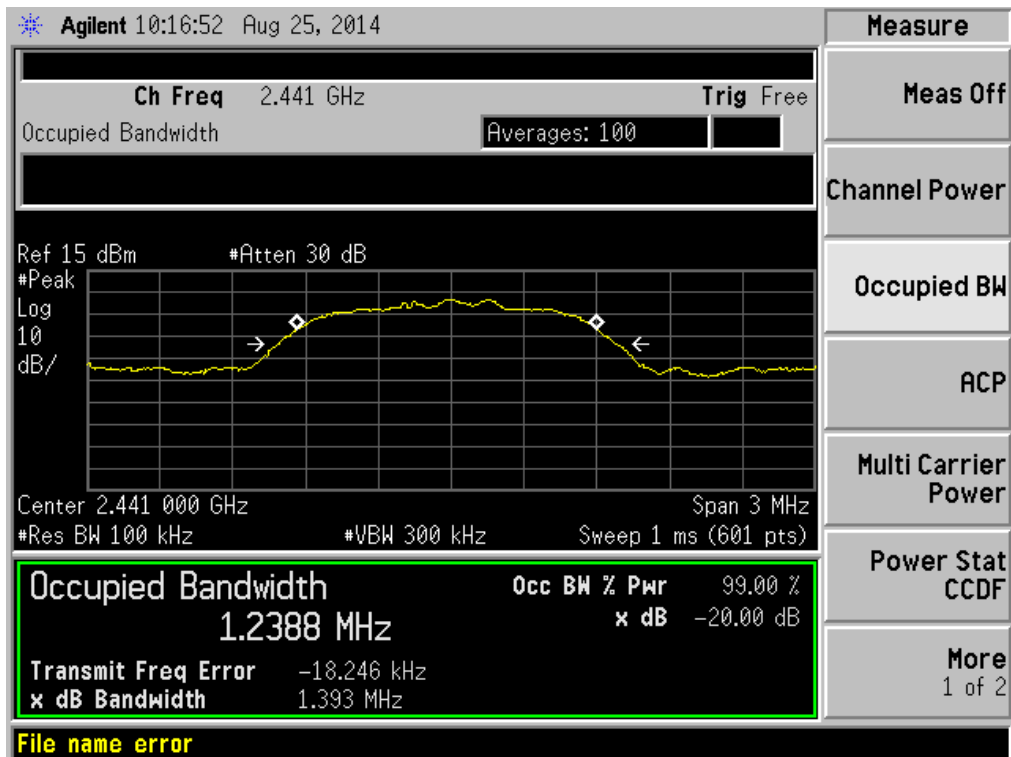
GFSK HIGH CHANNEL



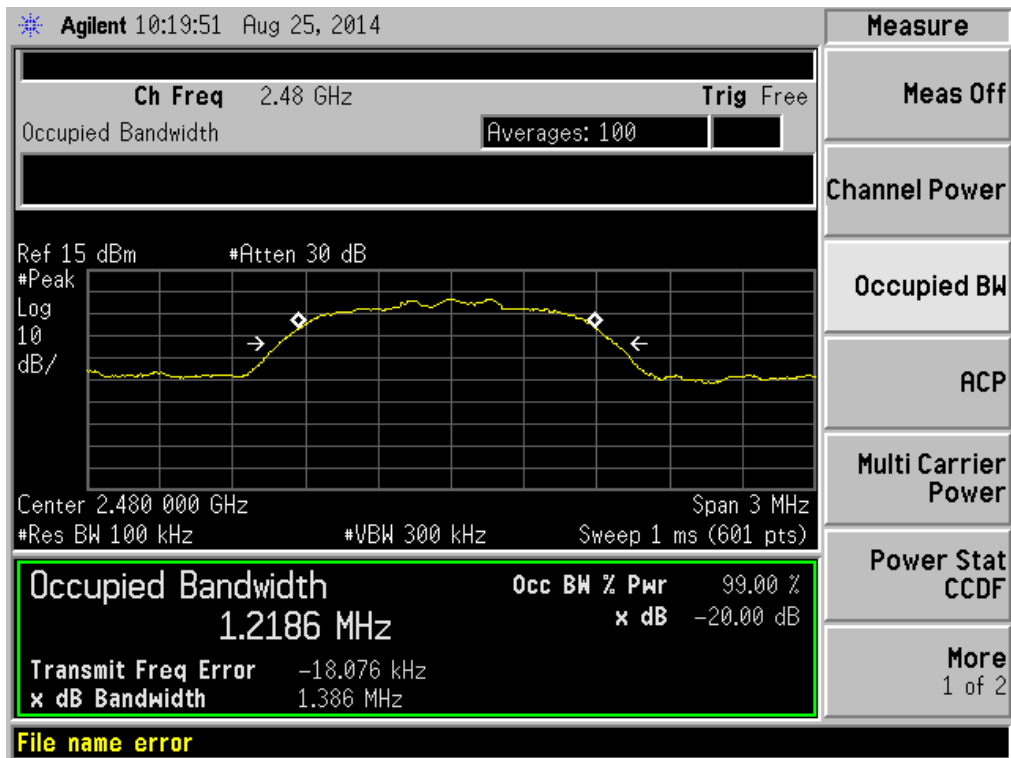
II/4-DQPSK LOW CHANNEL



II/4-DQPSK MID CHANAEL



II/4-DQPSK HIGH CHANNEL



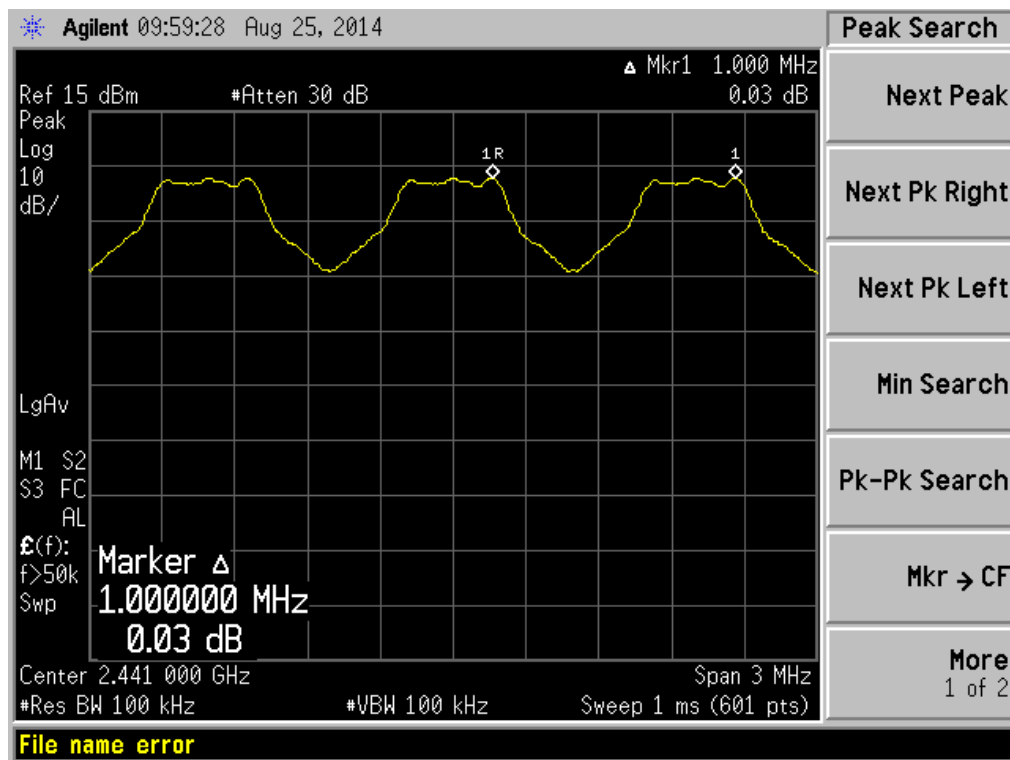
A.4 Hopping Frequency Separation

Test Data

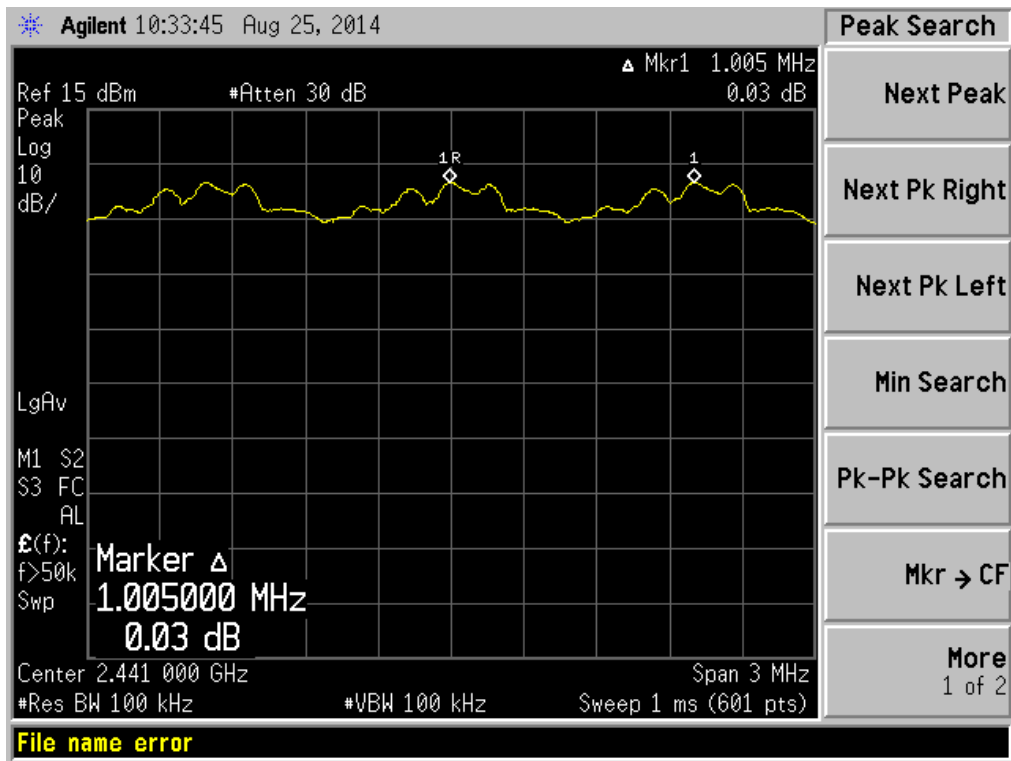
Mode	Frequency separation (MHz)	Max 20 dB Bandwidth (MHz)	Two-thirds of the 20dB bandwidth (MHz)	Verdict
GFSK	1.000	1.123	0.749	PASS
$\Pi/4$ -DQPSK Mode	1.005	1.393	0.929	PASS

Test plots

GFSK



II/4-DQPSK



A.5 Average Time of Occupancy

Test Data

GFSK Mode:

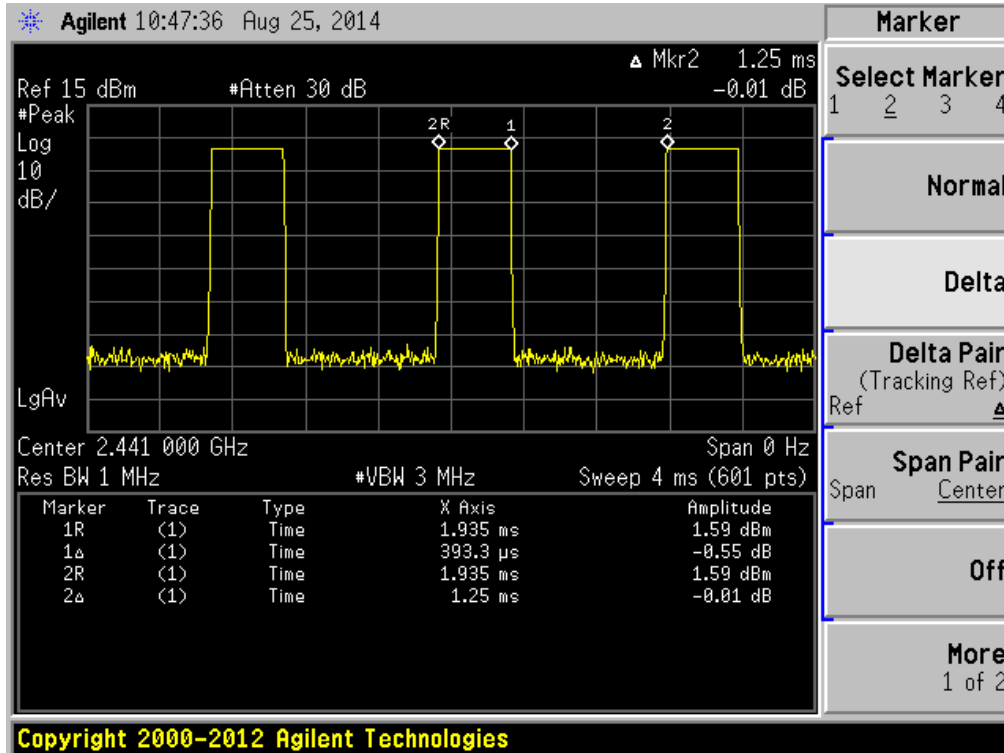
DH Packet	Pulse Width (ms)	Total of Dwell (ms)	Limit (sec)	Verdict
DH 1	0.393	125.860	0.4	PASS
DH 3	1.64	262.408	0.4	PASS
DH 5	2.90	309.343	0.4	PASS

π/4-DQPSK Mode:

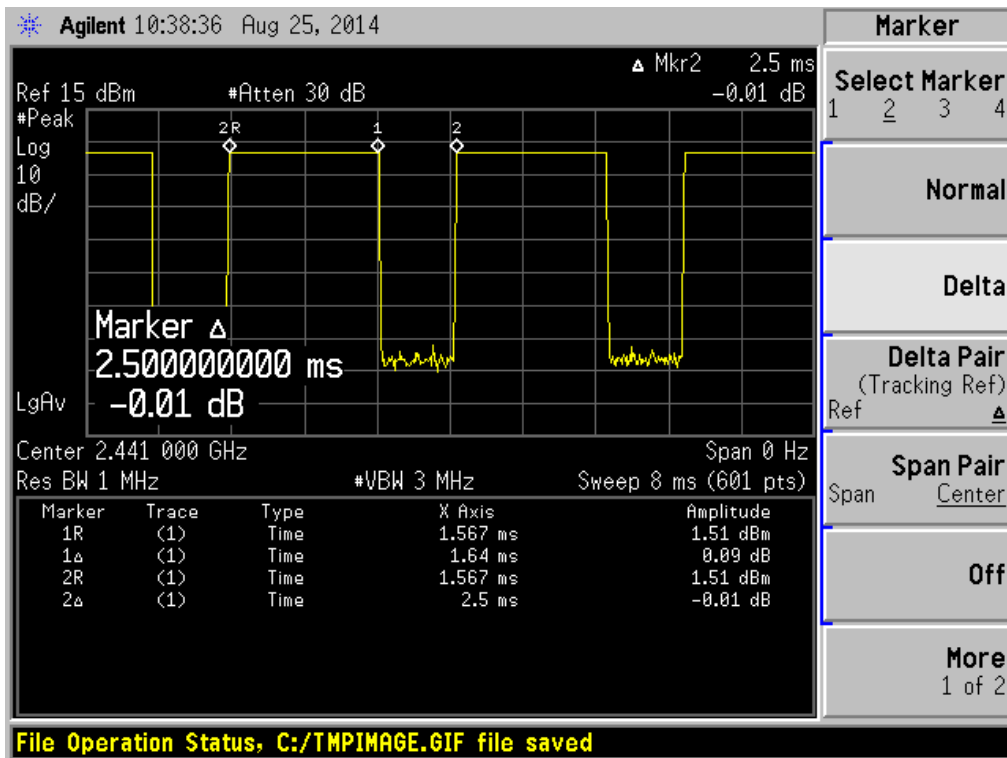
DH Packet	Pulse Width (ms)	Total of Dwell (ms)	Limit (sec)	Verdict
DH 1	0.393	125.860	0.4	PASS
DH 3	1.64	262.408	0.4	PASS
DH 5	2.90	309.343	0.4	PASS

Test Plots

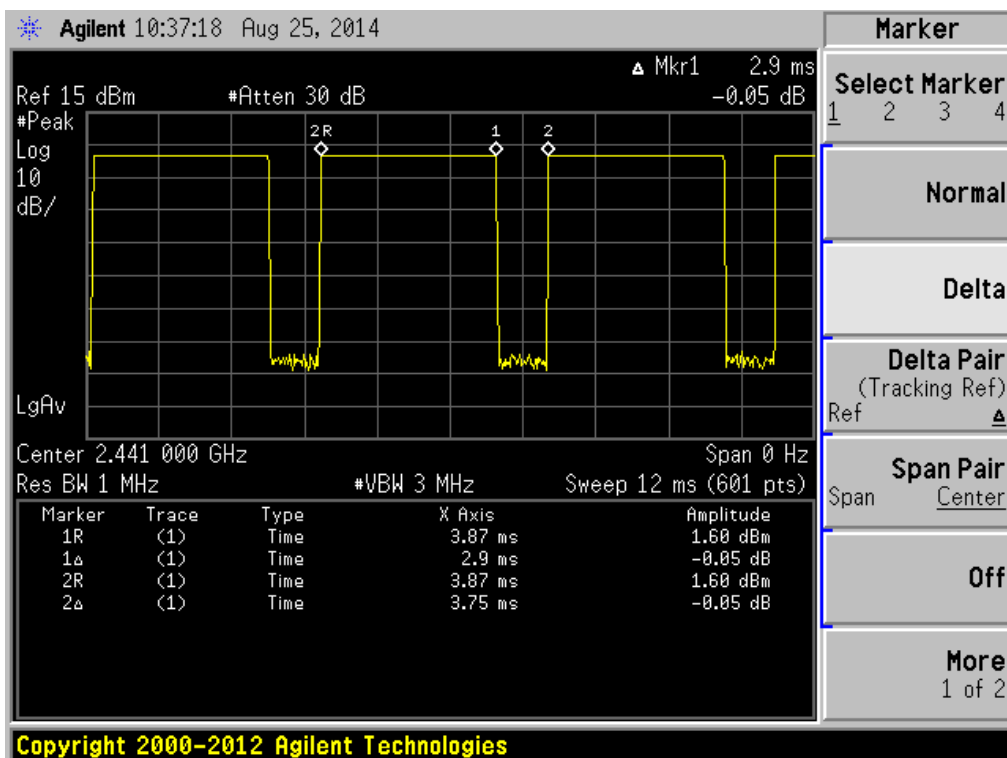
GFSK DH1



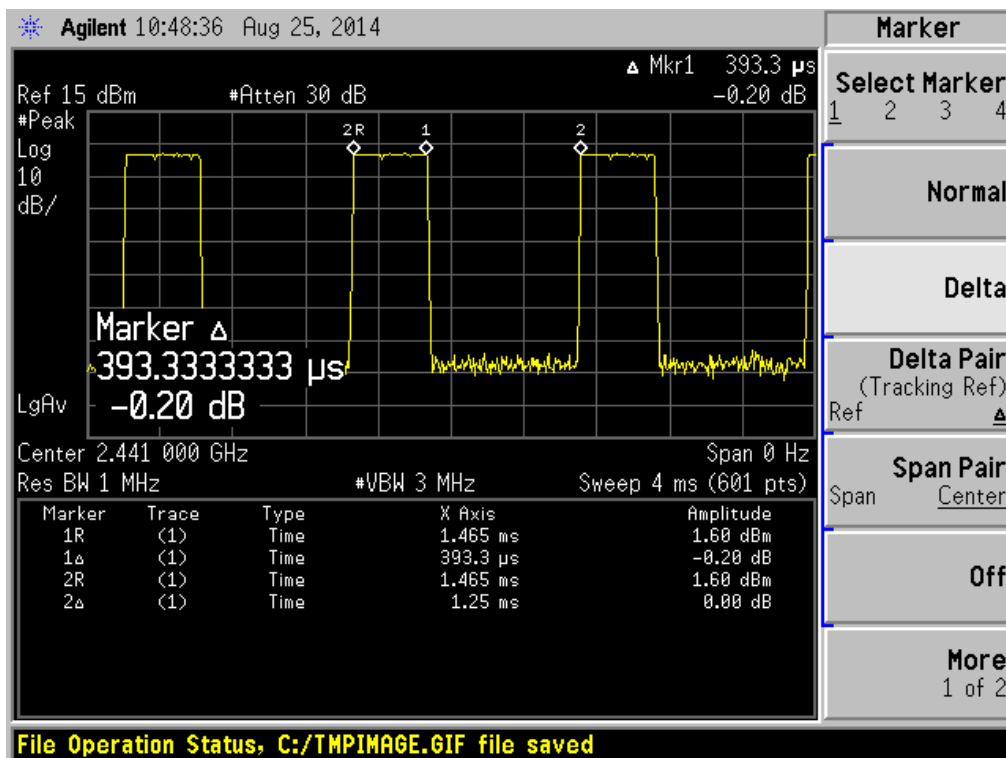
GFSK DH3



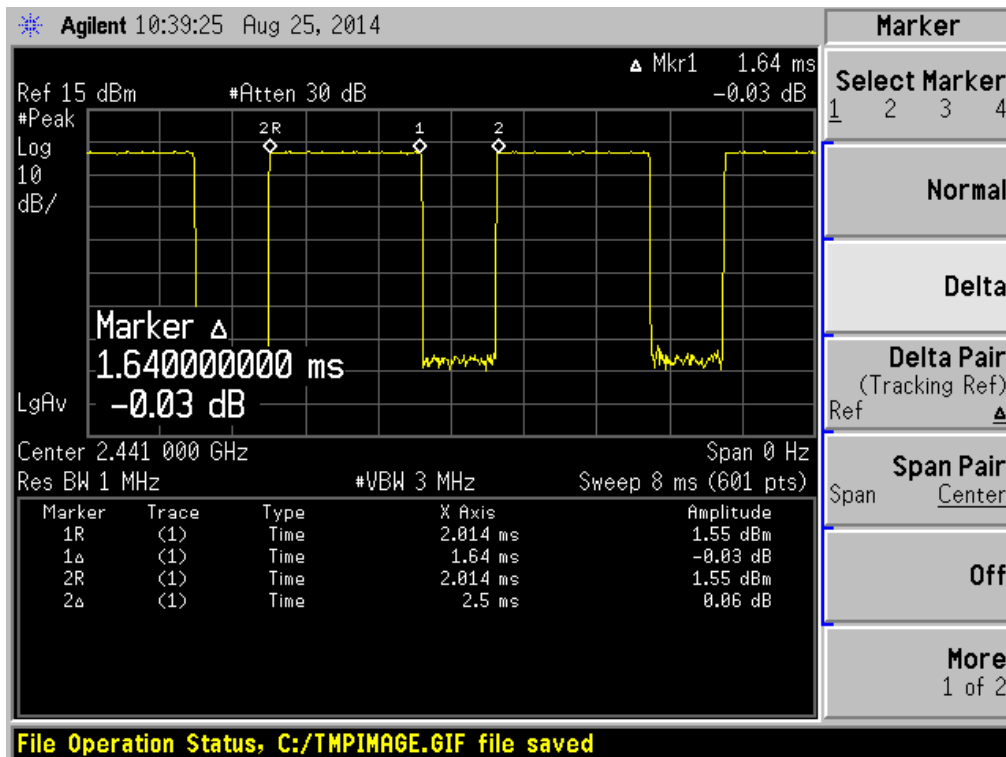
GFSK DH5



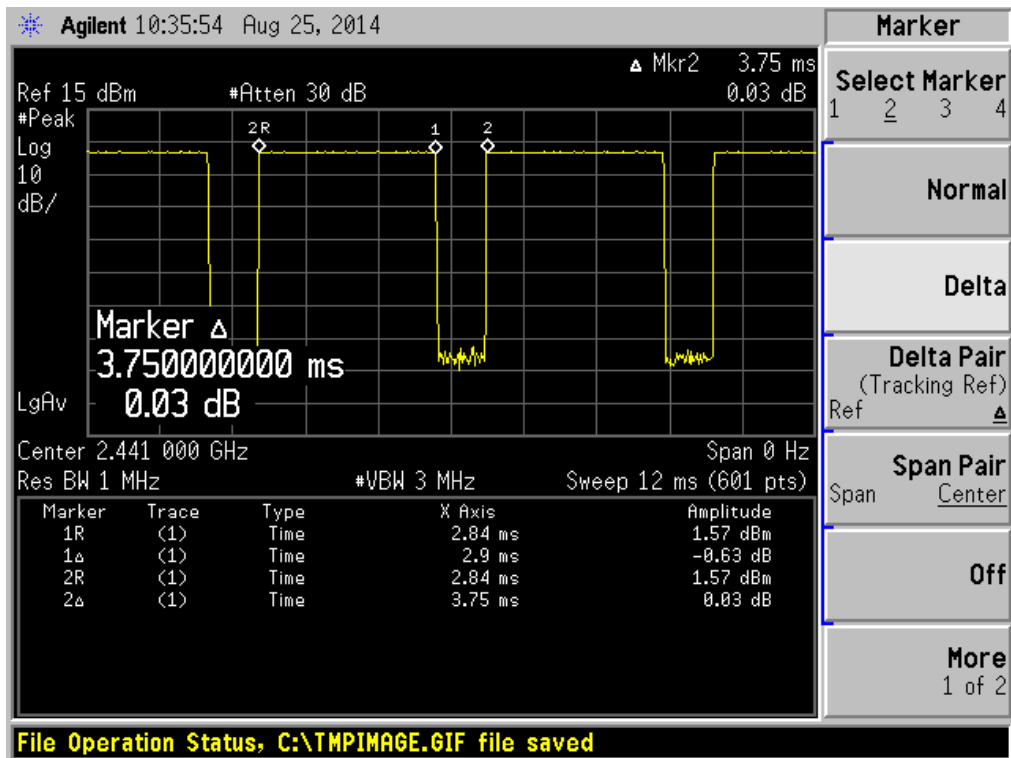
II/4-DQPSK DH1



II/4-DQPSK DH3



II/4-DQPSK DH5



A.6 Conducted Spurious Emissions

Test Data

GFSK Mode:

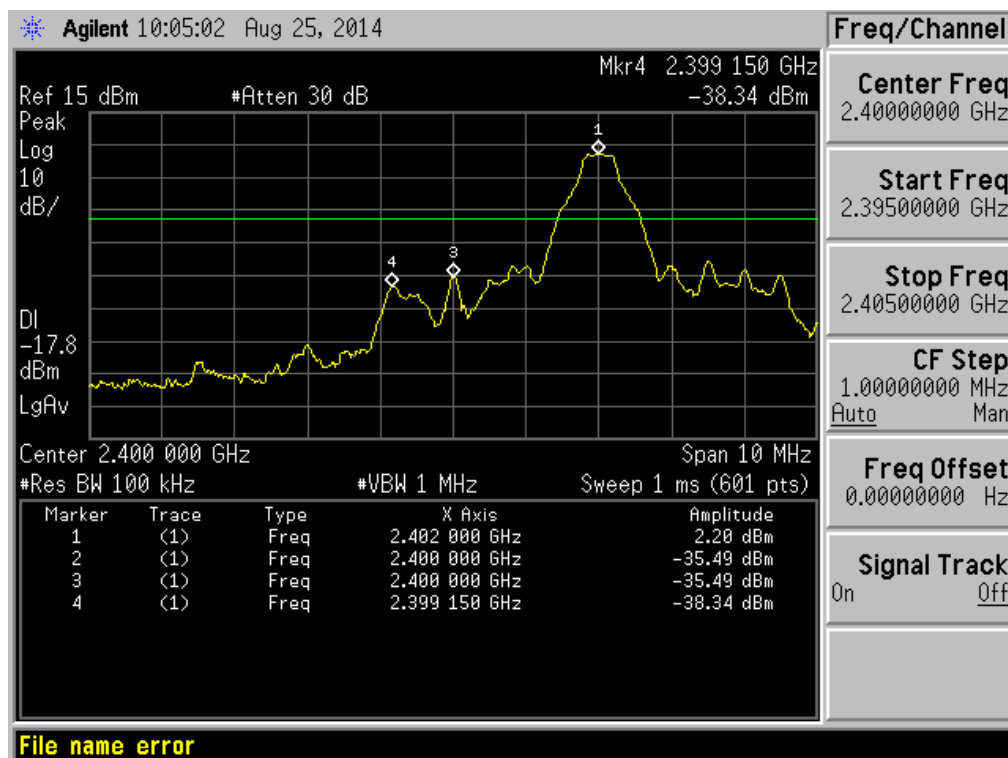
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated 20 dBc Limit	
0	2402	-55.72	2.21	-17.8	PASS
39	2441	-55.77	2.62	-17.4	PASS
78	2480	-54.21	2.29	-17.7	PASS

□/4-DQPSK Mode:

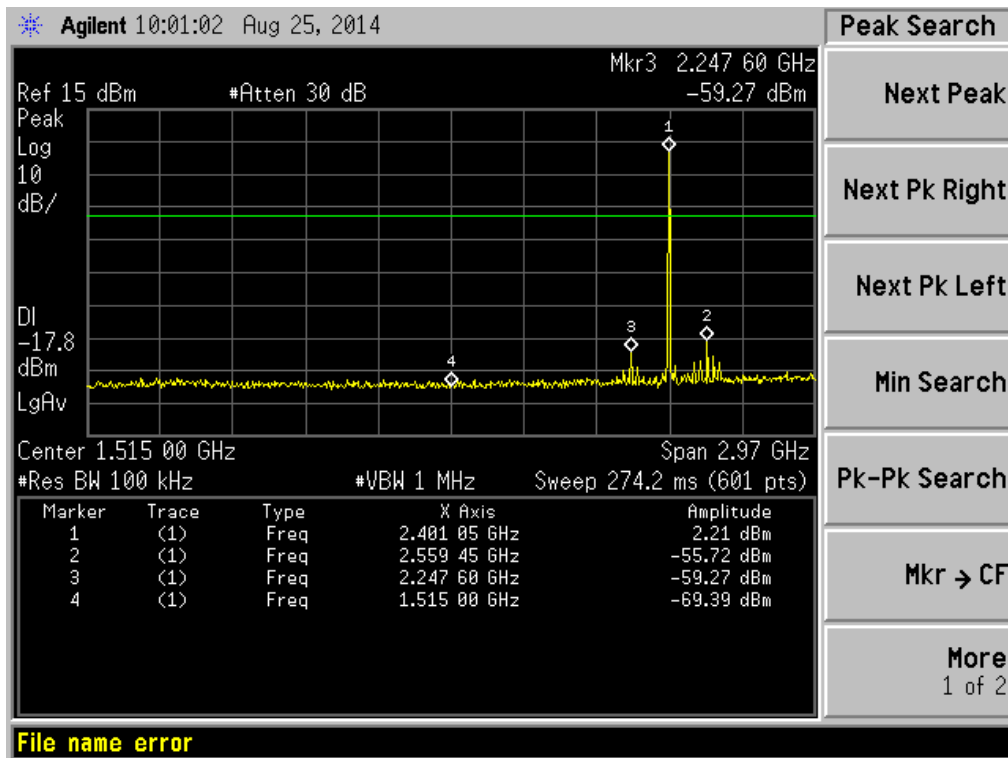
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated 20 dBc Limit	
0	2402	-59.54	0.39	-19.6	PASS
39	2441	-58.52	-0.40	-20.4	PASS
78	2480	-56.11	1.30	-18.7	PASS

Test Plots

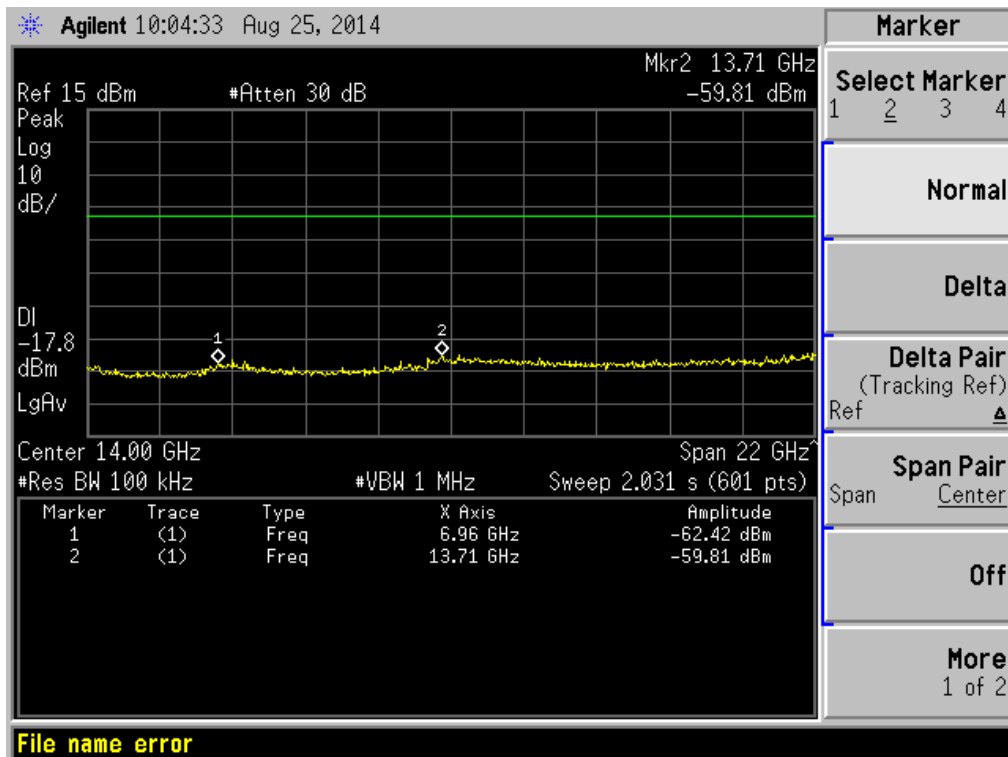
GFSK LOW CHANNEL, BANDEDGE



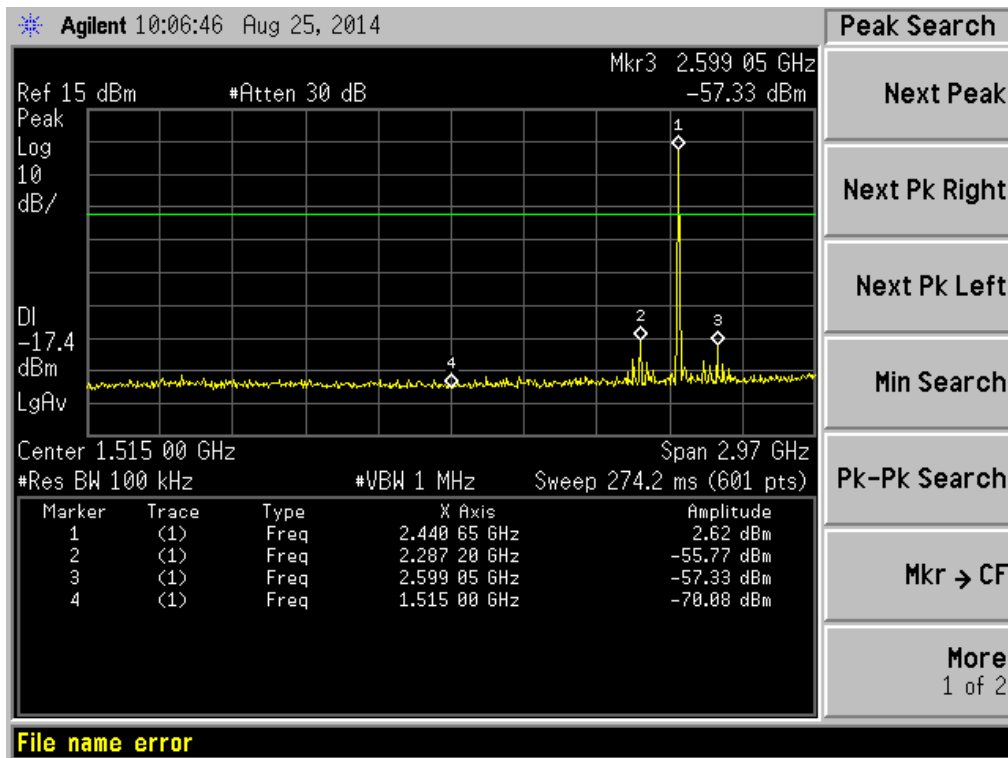
GFSK LOW CHANNEL, SPURIOUS 30MHz~3GHz



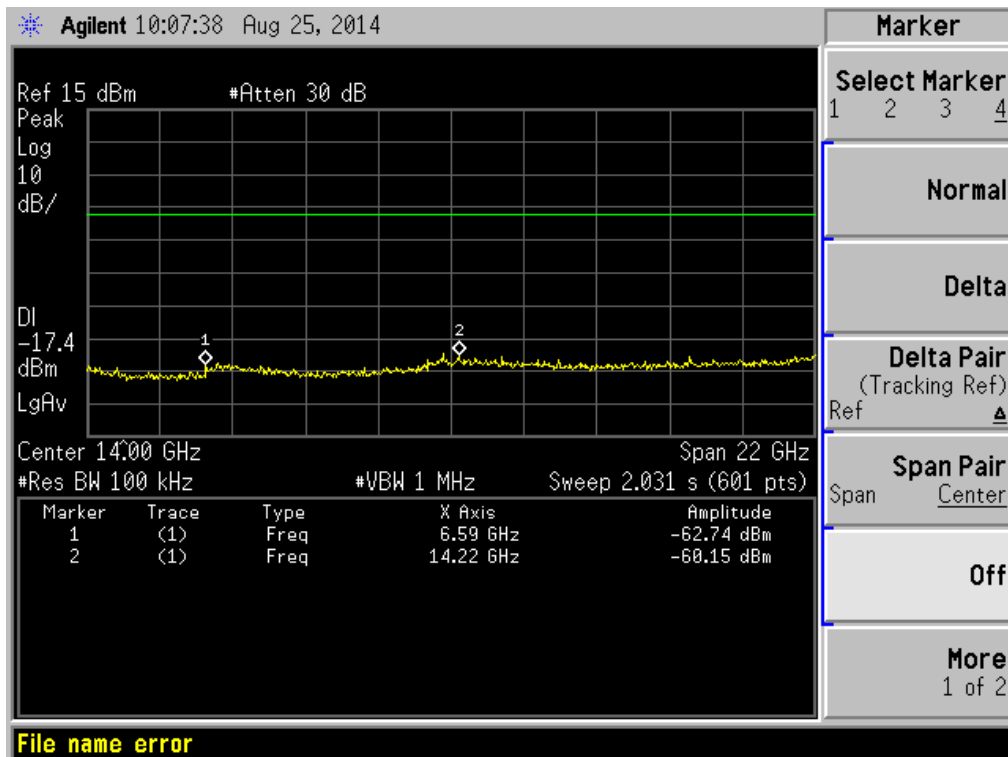
GFSK LOW CHANNEL, SPURIOUS 3GHz~25GHz



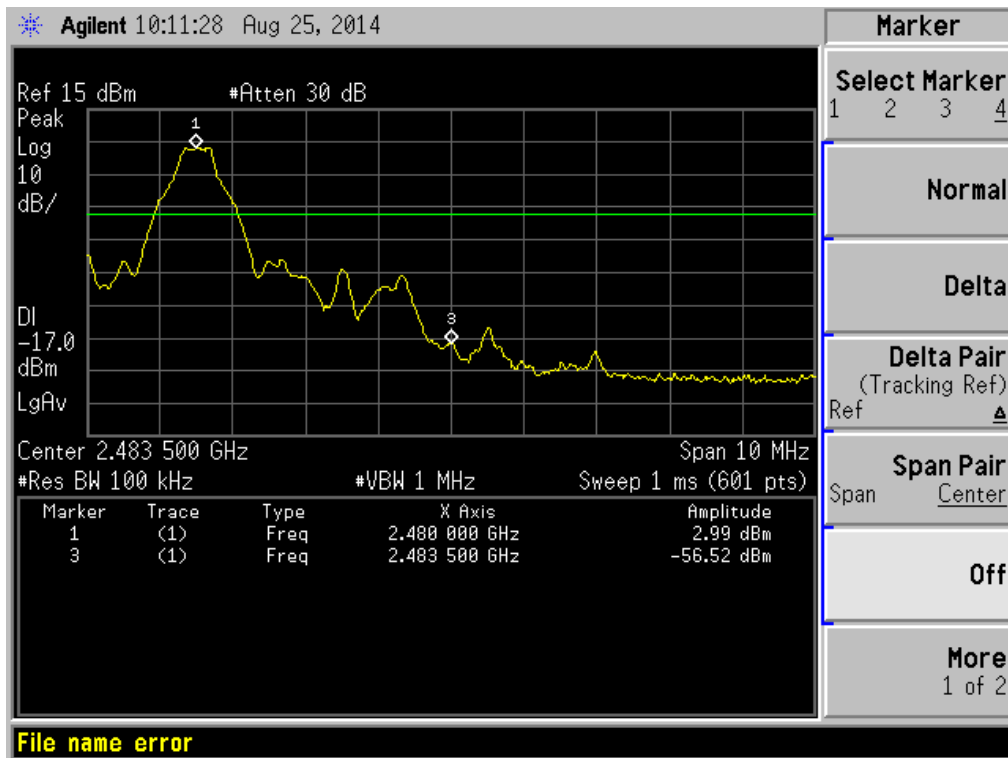
GFSK MID CHANNEL, SPURIOUS 30MHz~3GHz



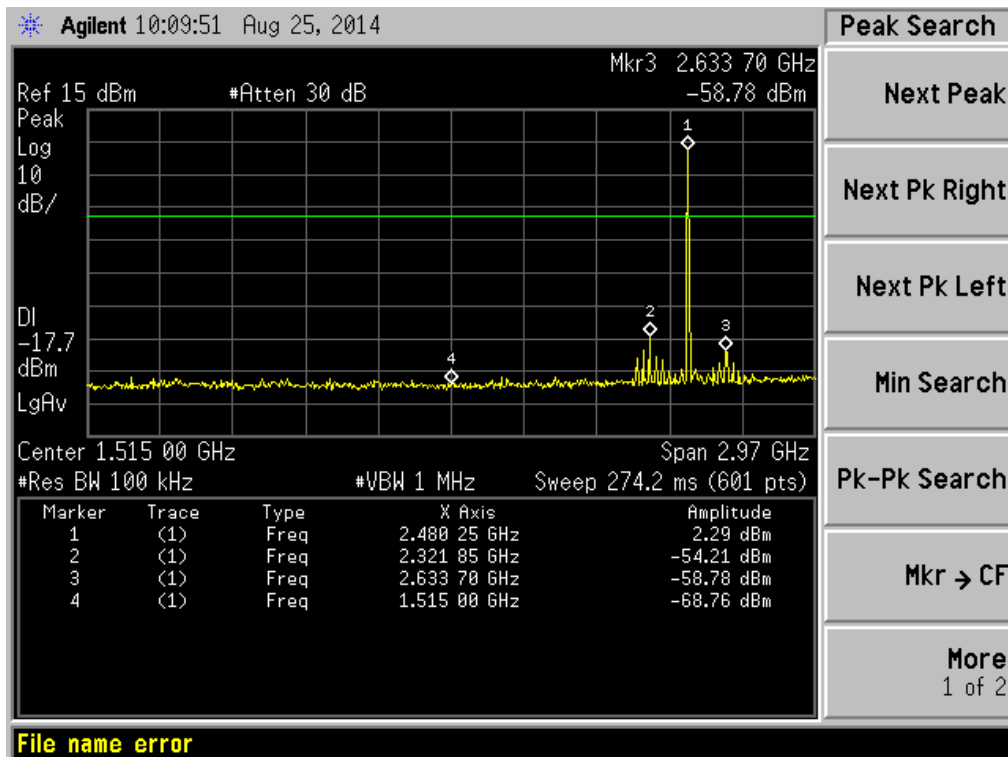
GFSK MID CHANNEL , SPURIOUS 3GHz~25GHz



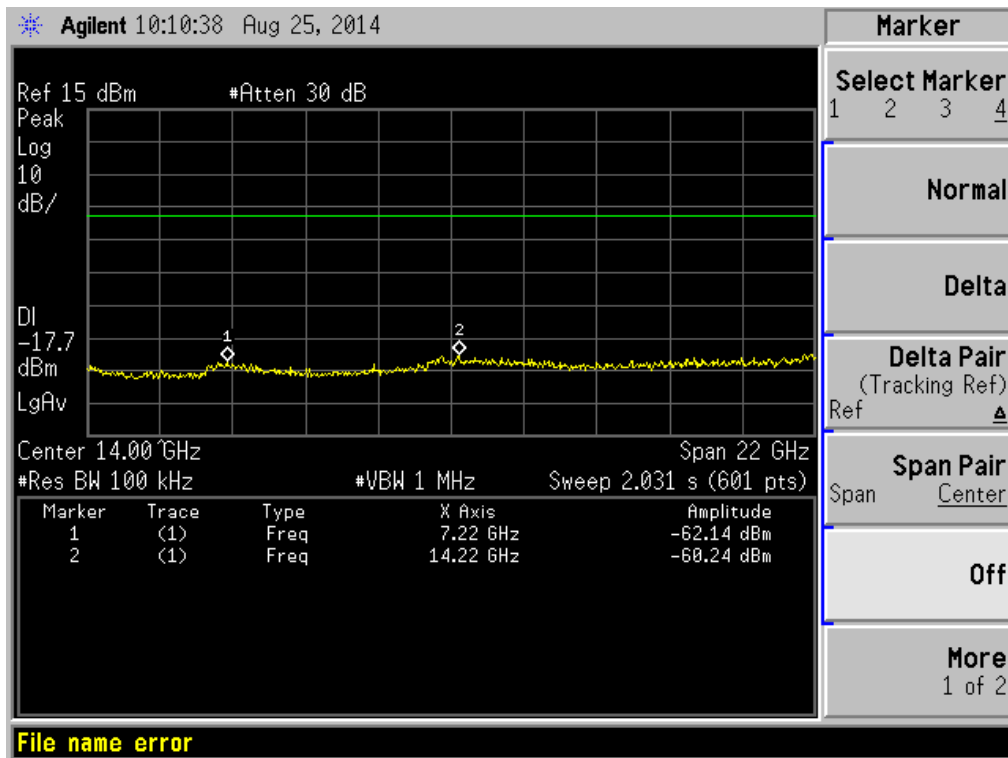
GFSK HIGH CHANNEL, BANDEDGE



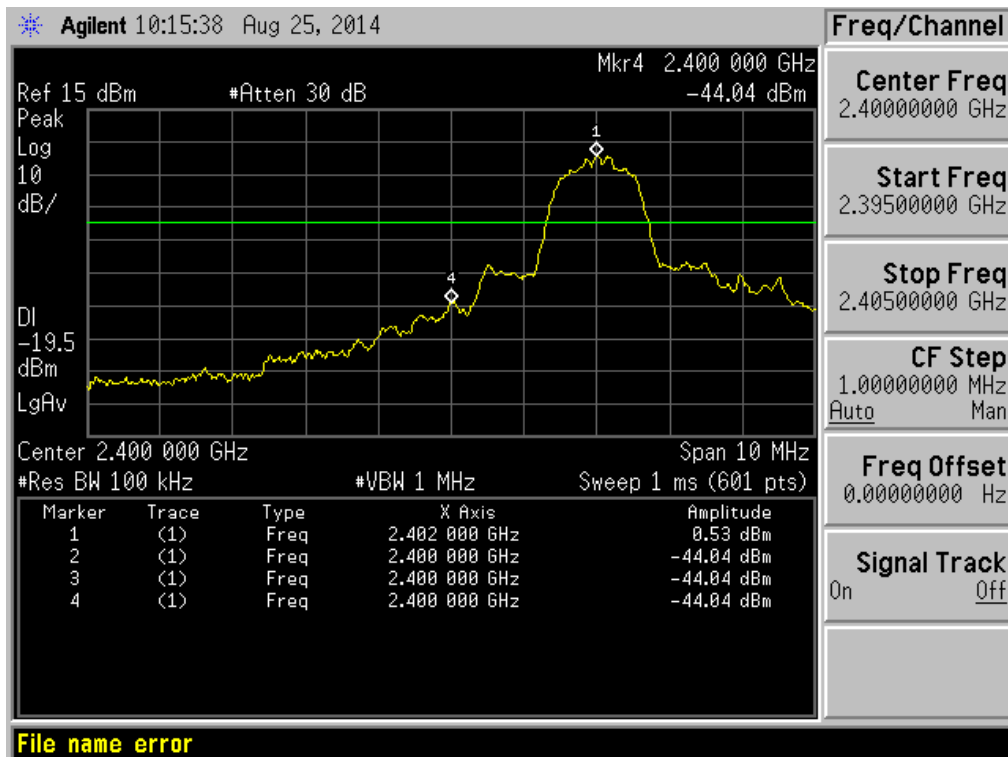
GFSK HIGH CHANNEL, SPURIOUS 30MHz~3GHz



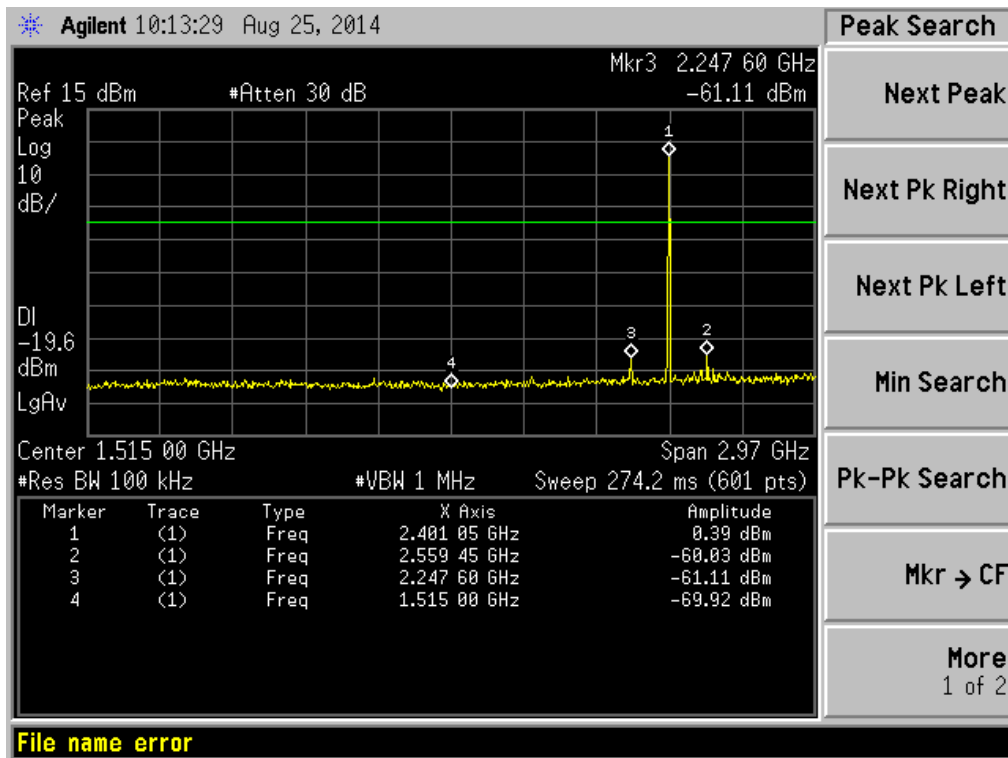
GFSK HIGH CHANNEL, SPURIOUS 3GHz~25GHz



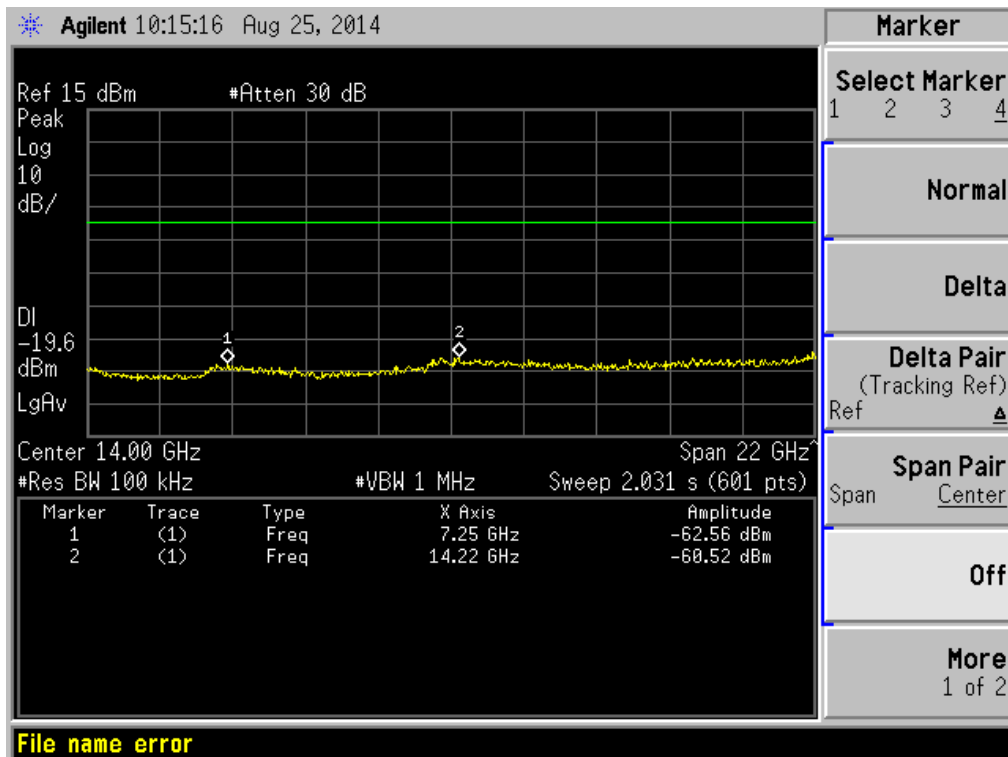
II/4-DQPSK LOW CHANNEL, BANDEDGE



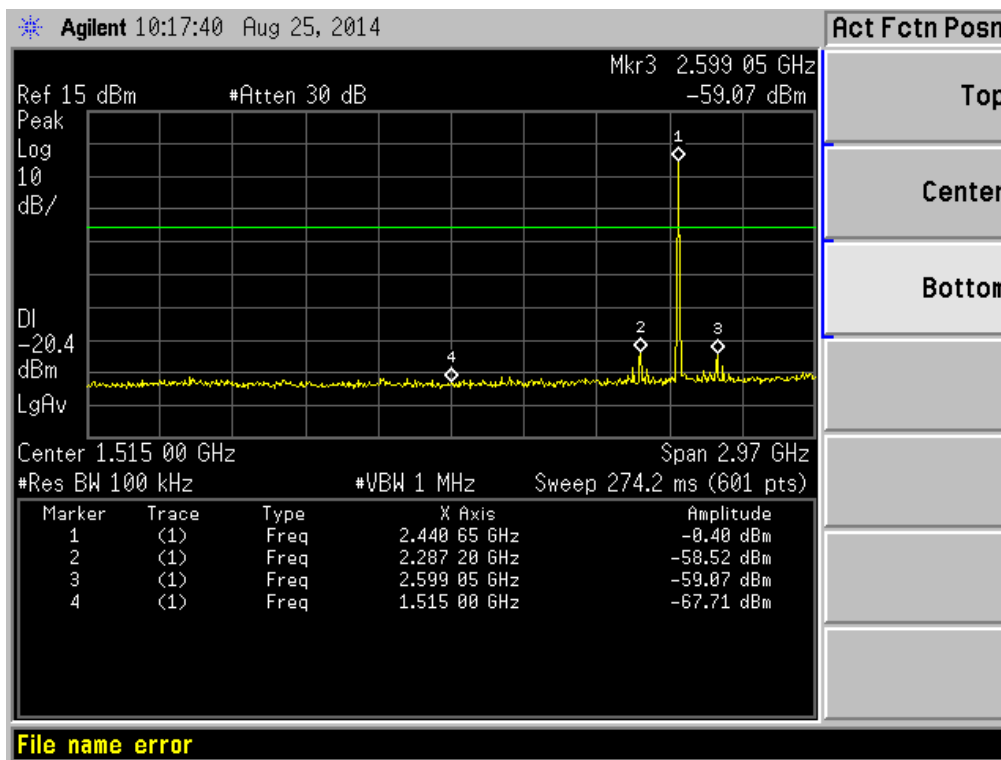
II/4-DQPSK LOW CHANNEL, SPURIOUS 30MHz~3GHz



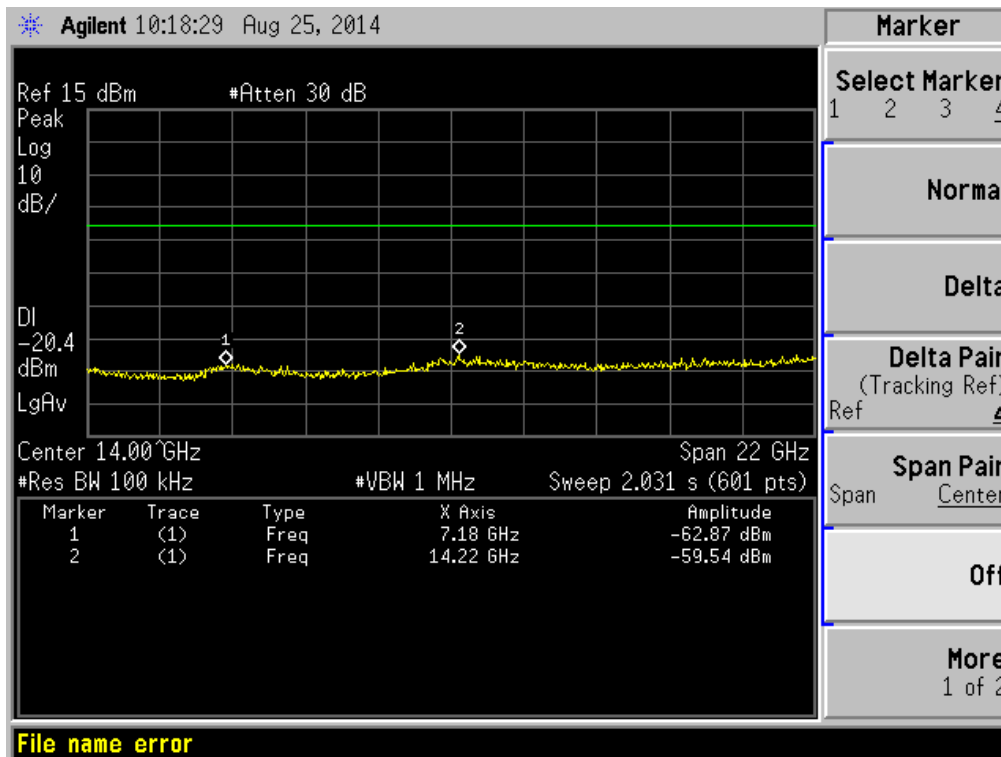
II/4-DQPSK LOW CHANNEL, SPURIOUS 3GHz~25GHz



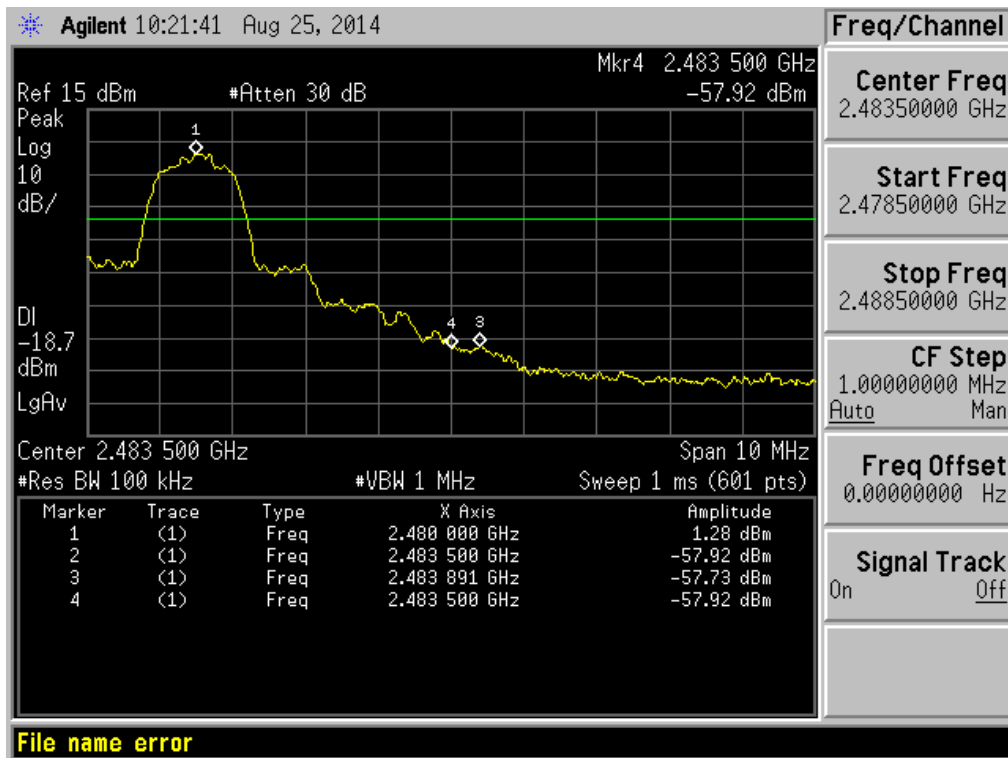
II/4-DQPSK MID CHANNEL, SPURIOUS 30MHz~3GHz



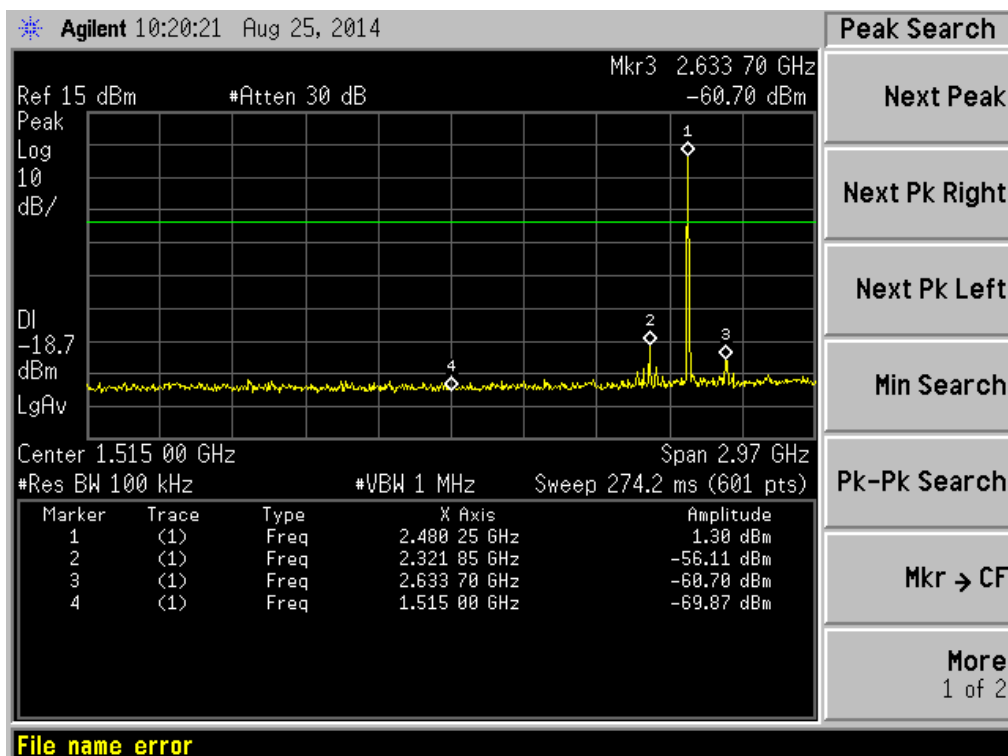
II/4-DQPSK MID CHANNEL , SPURIOUS 3GHz~25GHz



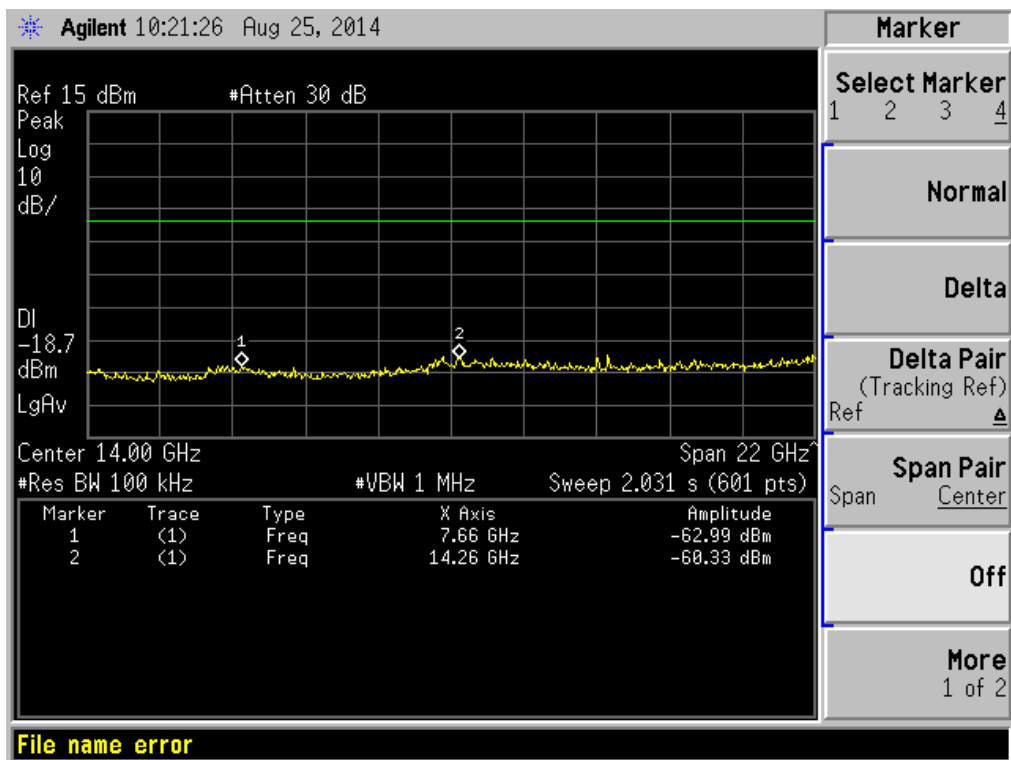
II/4-DQPSK HIGH CHANNEL , BANDEDGE



II/4-DQPSK HIGH CHANNEL, SPURIOUS 30MHz~3GHz



II/4-DQPSK HIGH CHANNEL, SPURIOUS 3GHz~25GHz



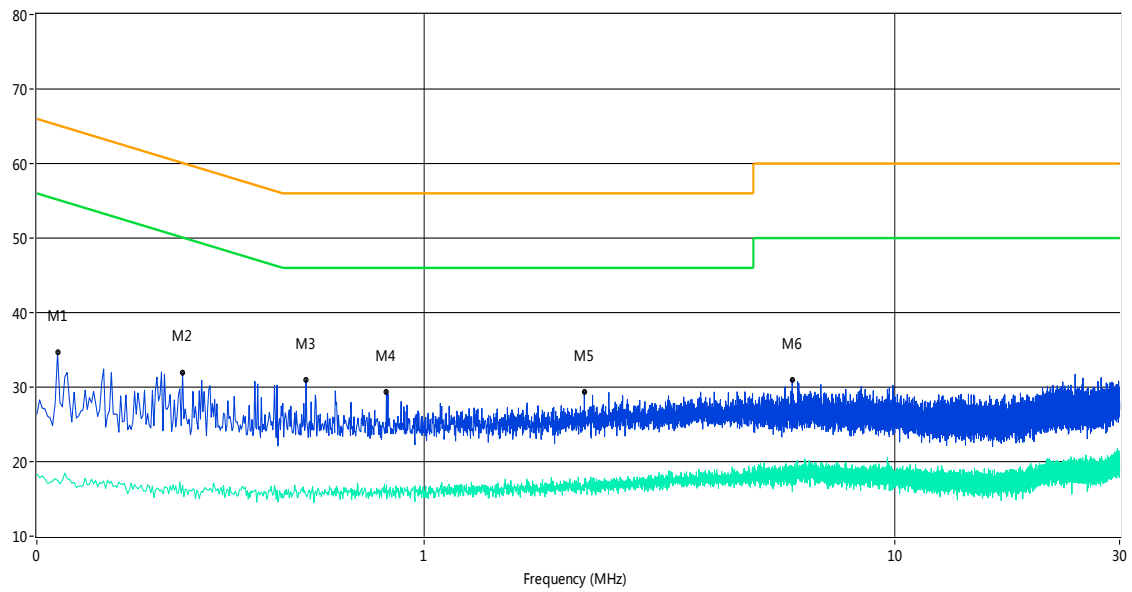
A.7 Conducted Emissions

Test Data

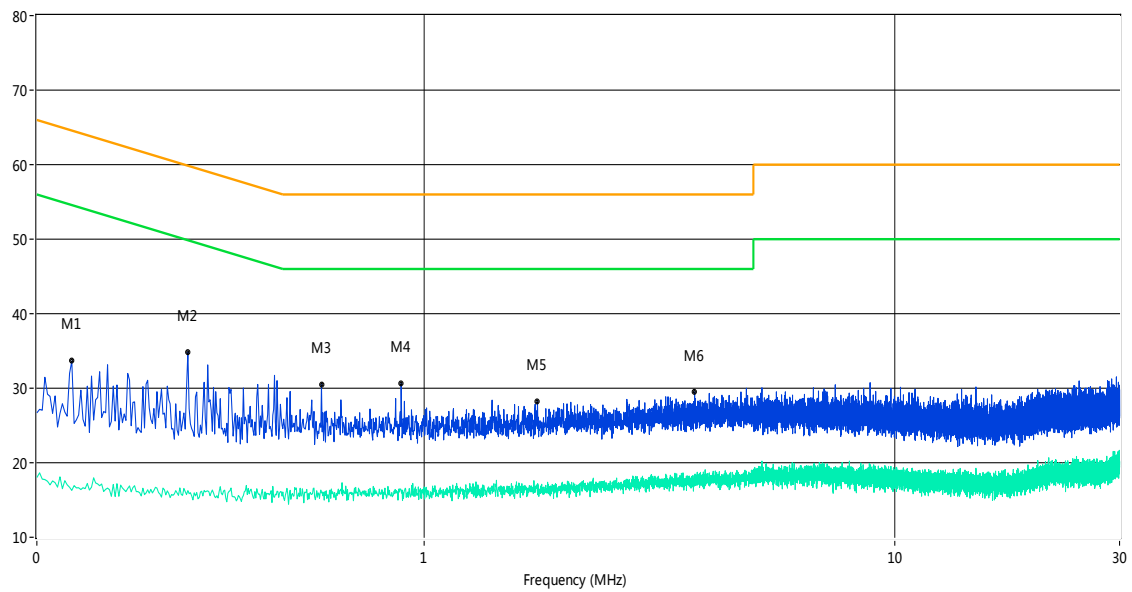
Frequency (MHz)	Peak (dBm)	Q-peak (dBuV)	Average (dBuV)	Factor (dB)	QP Limit (dBuV)	AV Limit (dBuV)	Margin (dB)	Line	Verdict
0.17	34.6	--	17.5	10.00	65.5	55.5	38.00	L Line	PASS
0.31	31.9	--	16.8	10.00	61.5	51.5	34.70	L Line	PASS
0.56	31.0	--	15.6	10.00	56.0	46.0	30.40	L Line	PASS
0.83	29.4	--	16.9	10.00	56.0	46.0	29.10	L Line	PASS
2.19	29.4	--	16.5	10.00	56.0	46.0	29.50	L Line	PASS
6.05	30.9	--	19.3	10.00	60.0	50.0	30.70	L Line	PASS
Frequency (MHz)	Peak (dBm)	Q-peak (dBuV)	Average (dBuV)	Factor (dB)	QP Limit (dBuV)	AV Limit (dBuV)	Margin (dB)	Line	Verdict
0.18	33.6	--	16.3	10.00	65.2	55.2	38.90	N Line	PASS
0.31	34.9	--	16.3	10.00	61.3	51.3	35.00	N Line	PASS
0.60	30.5	--	16.0	10.00	56.0	46.0	30.00	N Line	PASS
0.89	30.6	--	16.2	10.00	56.0	46.0	29.80	N Line	PASS
1.74	28.2	--	16.0	10.00	56.0	46.0	30.00	N Line	PASS
3.75	29.5	--	17.5	10.00	56.0	46.0	28.50	N Line	PASS

Test Plots

PHASE L



PHASE N

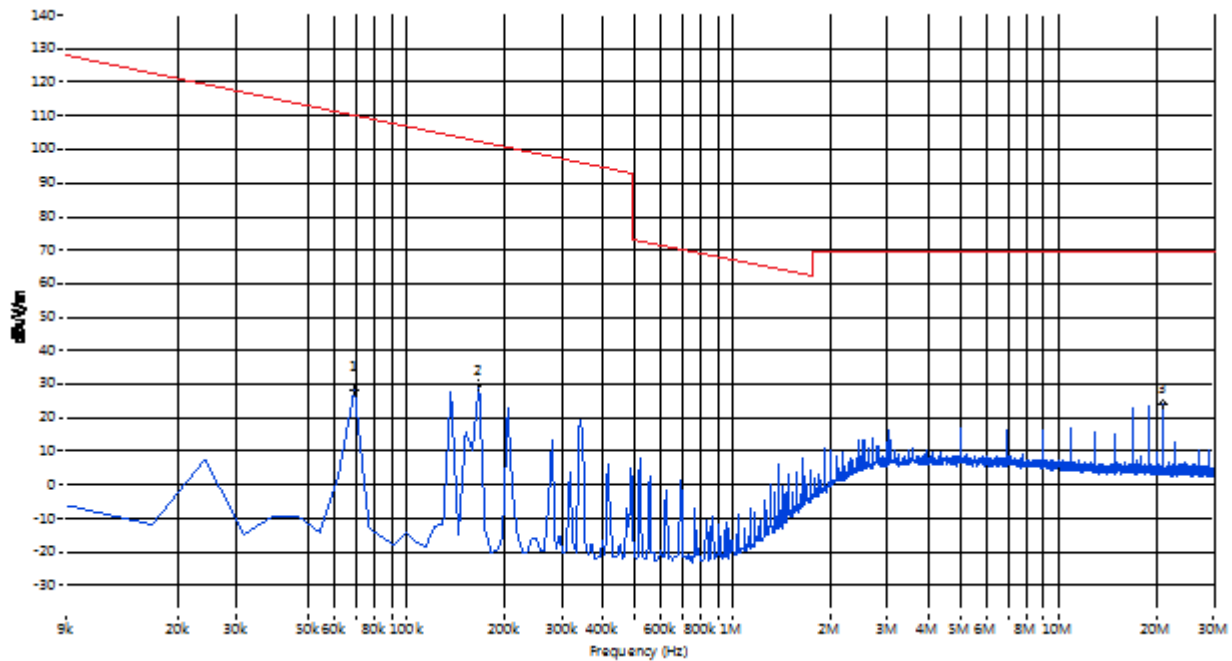


A.8 Radiated Emission

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

The worst data of 9 kHz to 1GHz

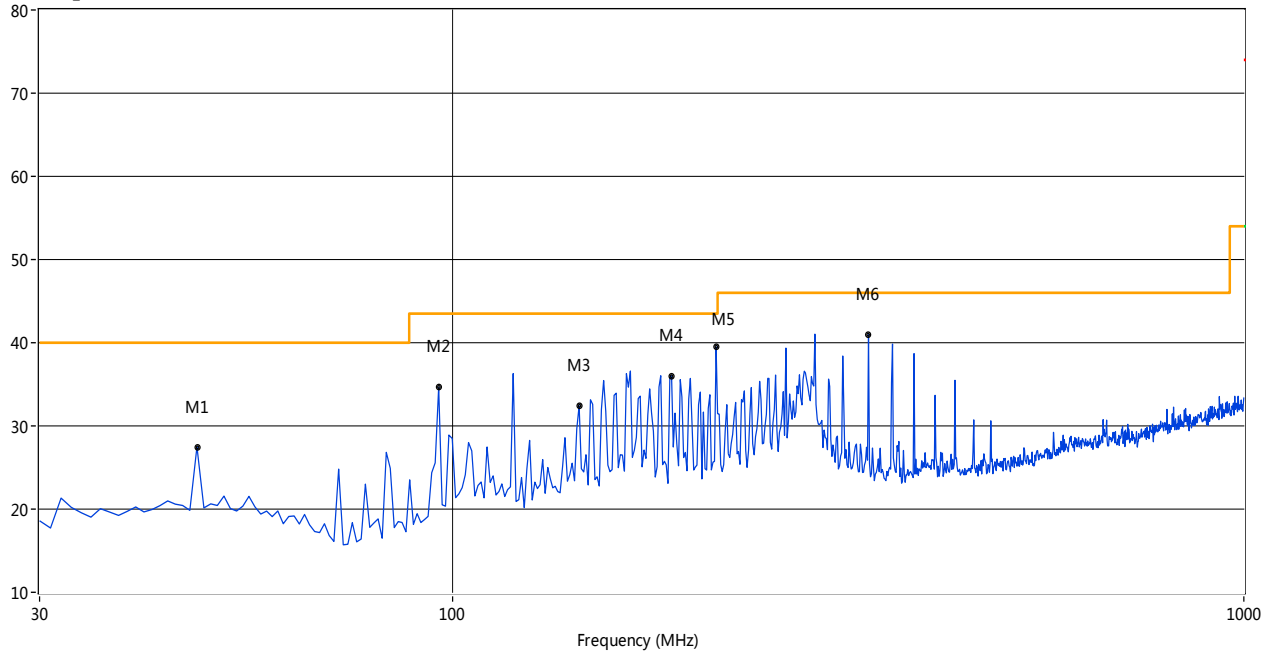
Below 30MHz



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Degree	Verdical
0.069	29.33	--	--	--	110.8	--	25.0	PASS
0.166	29.56	--	--	--	103.2	--	356.0	PASS
20.997	24.82	--	--	--	69.5	--	168.0	PASS

30MHz to 1GHz, ANT V

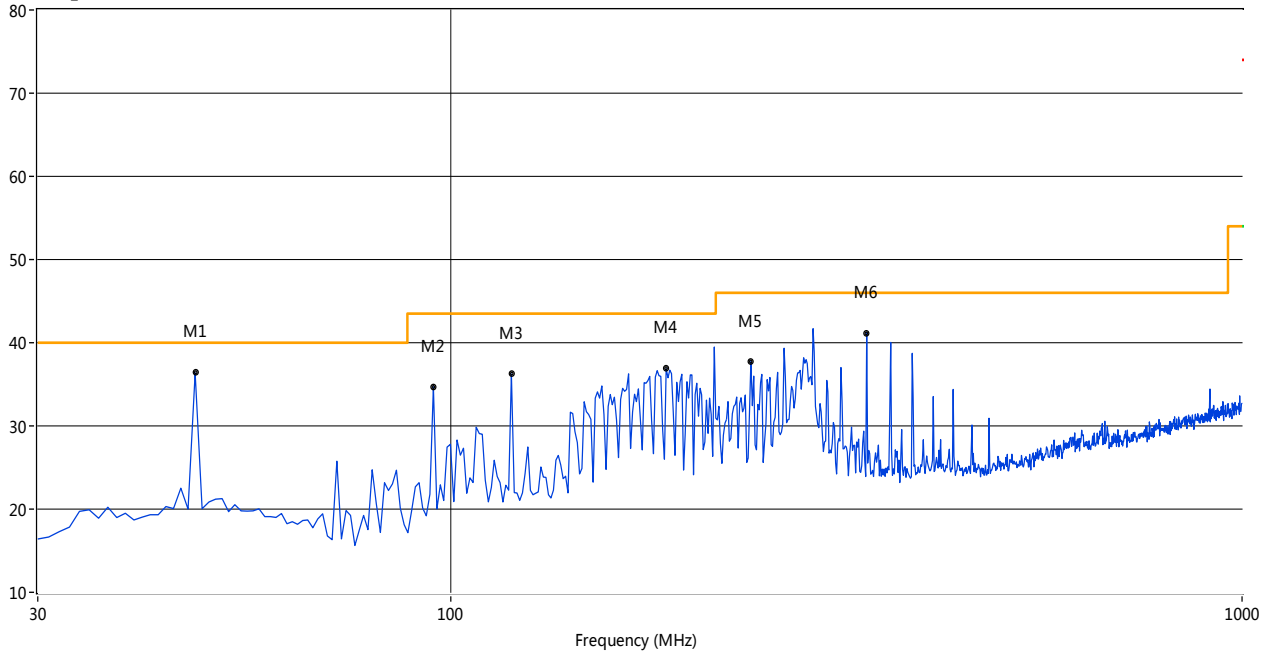
RE Test case_FCC 15C 30MHz-1GHz



Frequency (MHz)	Peak (dBuV/m)	Q-peak (dBuV/m)	Average (dBuV/m)	Factor (dB)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Table (o)	Height (cm)	ANT	Verdict
47.44	27.49			-18.02	--	40.0	--	12.51	166.50	200	Vertical	PASS
95.89	34.63			-20.33	--	43.5	--	8.87	105.40	200	Vertical	PASS
144.35	32.42			-23.11	--	43.5	--	11.08	360.00	200	Vertical	PASS
188.92	36.01			-20.76	--	43.5	--	7.49	118.90	100	Vertical	PASS
215.08	39.49			-19.76	--	43.5	--	4.01	108.90	100	Vertical	PASS
335.24	40.99			-16.13	--	46.0	--	5.01	311.60	100	Vertical	PASS

30MHz to 1GHz, ANT H

RE Test case_FCC 15C 30MHz-1GHz



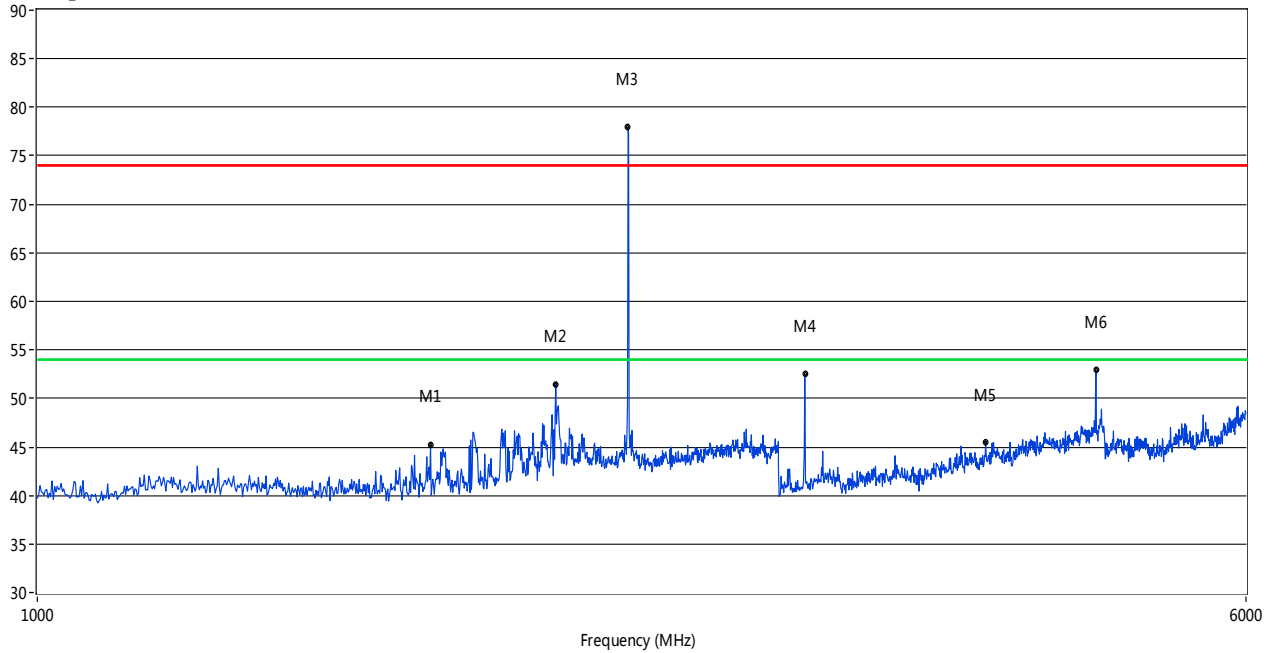
Frequency (MHz)	Peak (dBuV/m)	Q-peak (dBuV/m)	Average (dBuV/m)	Factor (dB)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Table (o)	Height (cm)	ANT	Verdict
47.44	36.38			-18.02	--	40.0	--	3.62	159.10	100	Horizontal	PASS
94.93	34.70			-20.46	--	43.5	--	8.80	109.00	100	Horizontal	PASS
119.15	36.24			-21.20	--	43.5	--	7.26	244.90	100	Horizontal	PASS
186.98	36.87			-20.95	--	43.5	--	6.63	109.00	100	Horizontal	PASS
239.31	37.73			-18.73	--	46.0	--	8.27	93.40	100	Horizontal	PASS
335.24	41.20			-16.13	--	46.0	--	4.80	312.00	100	Horizontal	PASS

Note: The marked spikes near 2400MHz with circle should be ignored because they are Fundamental signal.

Test Data and Plots(1GHz ~ 10th Harmonic)

GFSK LOW CHANNEL 1GHz to 6GHz, ANT V

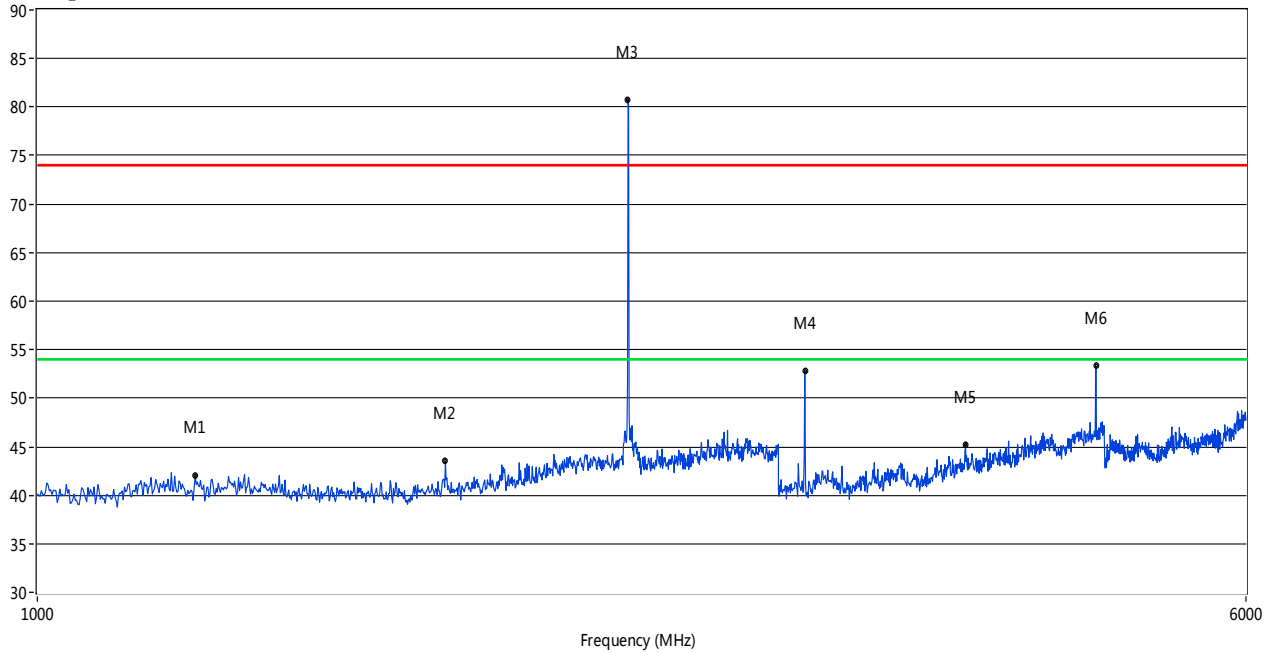
RE Test case_FCC 15C 1GHz-6GHz



Frequency (MHz)	Peak (dBuV/m)	Q-peak (dBuV/m)	Average (dBuV/m)	Factor (dB)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Table (o)	Height (cm)	ANT	Verdict
1791.21	45.20			-3.92	74.0	--	54.0	8.80	131.70	100	Vertical	PASS
2156.84	51.48			-1.36	74.0	--	54.0	2.52	131.70	100	Vertical	PASS
2400.60	77.97			-0.67	74.0	--	54.0	-23.97	5.90	100	Vertical	N/A
3119.88	52.52			7.97	74.0	--	54.0	1.48	37.10	100	Vertical	PASS
4078.92	45.50			10.21	74.0	--	54.0	8.50	61.90	100	Vertical	PASS
4804.20	52.90			12.35	74.0	--	54.0	1.10	359.00	100	Vertical	PASS

GFSK LOW CHANNEL 1GHz to 6GHz, ANT H

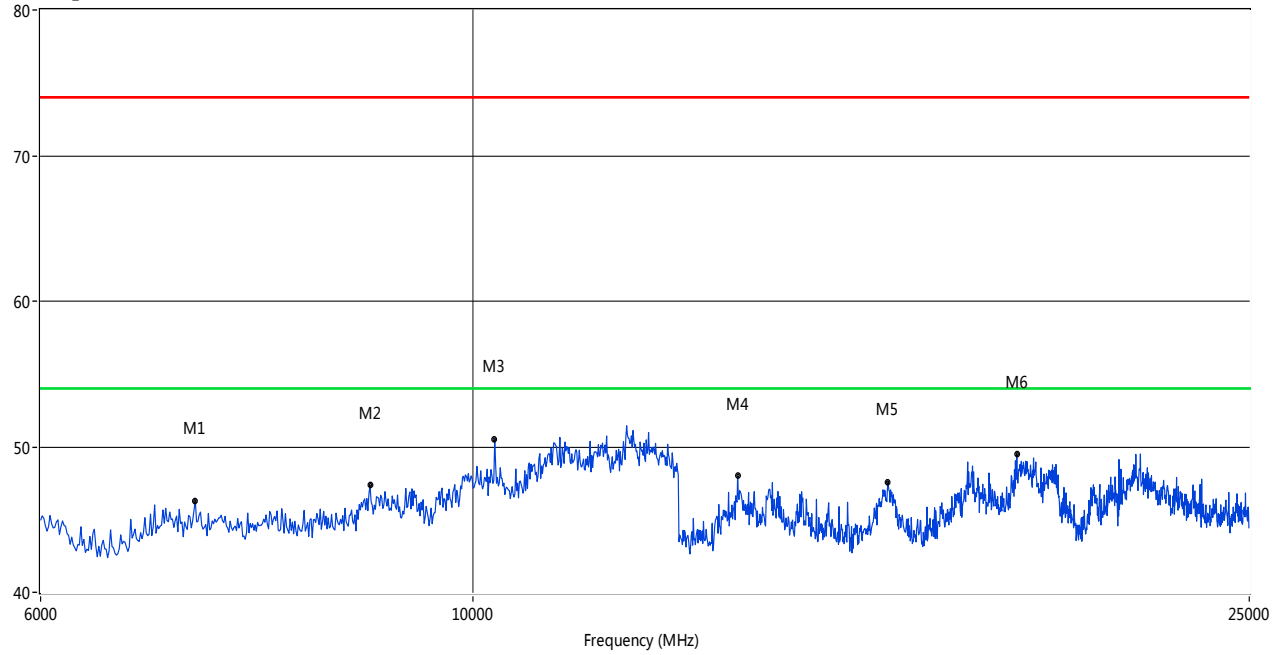
RE Test case_FCC 15C 1GHz-6GHz



Frequency (MHz)	Peak (dBuV/m)	Q-peak (dBuV/m)	Average (dBuV/m)	Factor (dB)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Table (o)	Height (cm)	ANT	Verdict
1263.74	42.04			-4.04	74.0	--	54.0	11.96	290.70	100	Horizontal	PASS
1831.17	43.48			-3.67	74.0	--	54.0	10.52	263.00	100	Horizontal	PASS
2400.60	80.79			-0.67	74.0	--	54.0	-26.79	173.40	100	Horizontal	N/A
3119.88	52.84			7.97	74.0	--	54.0	1.16	98.10	100	Horizontal	PASS
3959.04	45.22			9.82	74.0	--	54.0	8.78	250.10	100	Horizontal	PASS
4804.20	53.31			12.35	74.0	--	54.0	0.69	53.80	100	Horizontal	PASS

GFSK LOW CHANNEL 6GHz to 25GHz, ANT V

RE Test case_FCC 15C 6GHz-25GHz



Frequency (MHz)	Peak (dBuV/m)	Q-peak (dBuV/m)	Average (dBuV/m)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	ANT	Verdict
7201.75	46.30			74.0	--	54.0	7.70	Vertical	PASS
8852.75	47.36			74.0	--	54.0	6.64	Vertical	PASS
10256.66	50.52			74.0	--	54.0	3.48	Vertical	PASS
13665.14	47.99			74.0	--	54.0	6.01	Vertical	PASS
16316.97	47.60			74.0	--	54.0	6.40	Vertical	PASS
19000.00	49.51			74.0	--	54.0	4.49	Vertical	PASS

GFSK LOW CHANNEL 6GHz to 25GHz, ANT H

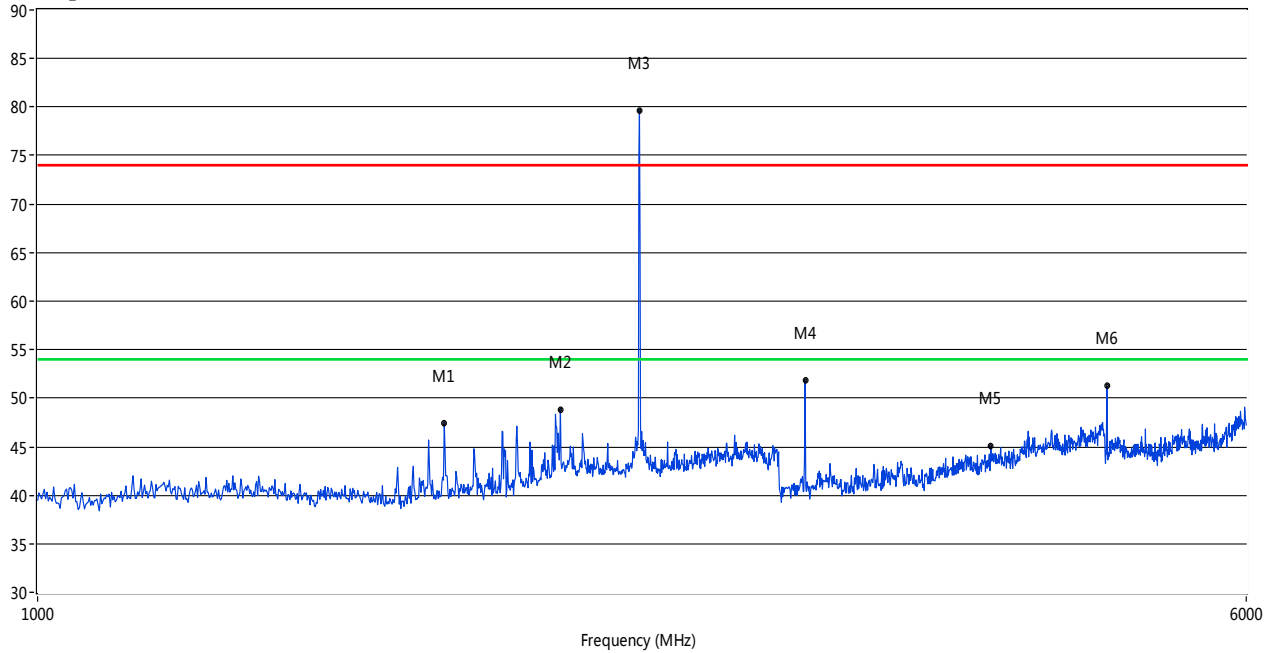
RE Test case_FCC 15C 6GHz-25GHz



Frequency (MHz)	Peak (dBuV/m)	Q-peak (dBuV/m)	Average (dBuV/m)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	ANT	Verdict
7212.98	46.45			74.0	--	54.0	7.55	Horizontal	PASS
9234.61	48.45			74.0	--	54.0	5.55	Horizontal	PASS
11301.16	51.30			74.0	--	54.0	2.70	Horizontal	PASS
13696.34	48.57			74.0	--	54.0	5.43	Horizontal	PASS
16171.38	47.68			74.0	--	54.0	6.32	Horizontal	PASS
19778.70	49.61			74.0	--	54.0	4.39	Horizontal	PASS

GFSK MID CHANNEL 1GHz to 6GHz, ANT V

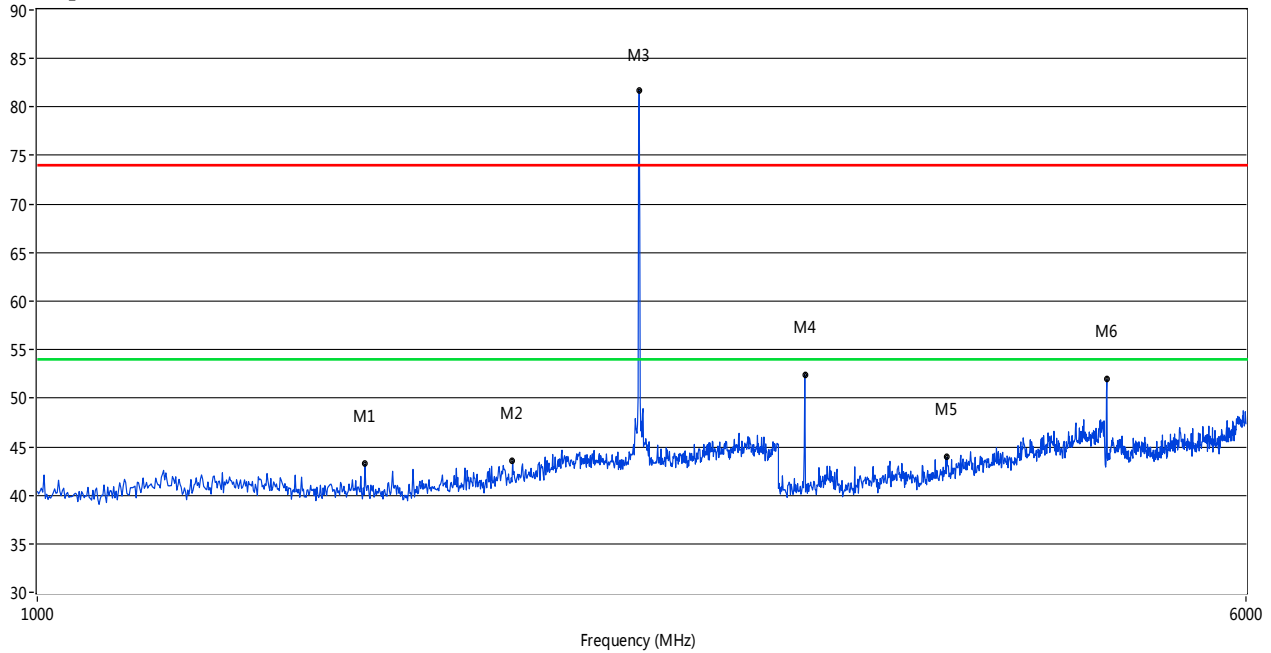
RE Test case_FCC 15C 1GHz-6GHz



Frequency (MHz)	Peak (dBuV/m)	Q-peak (dBuV/m)	Average (dBuV/m)	Factor (dB)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Table (o)	Height (cm)	ANT	Verdict
1827.17	47.45			-3.60	74.0	--	54.0	6.55	132.80	100	Vertical	PASS
2170.83	48.83			-0.96	74.0	--	54.0	5.17	139.50	100	Vertical	PASS
2440.56	79.62			-0.54	74.0	--	54.0	-25.62	4.30	100	Vertical	N/A
3119.88	51.85			7.97	74.0	--	54.0	2.15	28.90	100	Vertical	PASS
4108.89	45.03			9.93	74.0	--	54.0	8.97	0.90	100	Vertical	PASS
4882.12	51.26			12.34	74.0	--	54.0	2.74	325.30	100	Vertical	PASS

GFSK MID CHANNEL 1GHz to 6GHz, ANT H

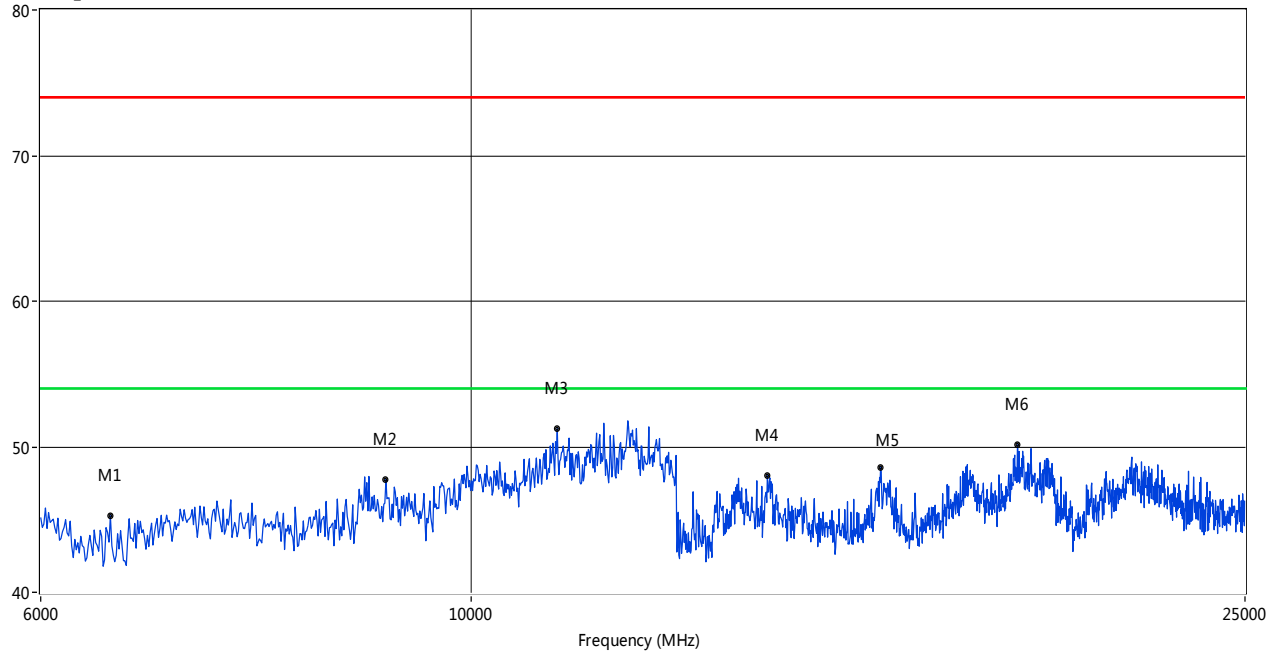
RE Test case_FCC 15C 1GHz-6GHz



Frequency (MHz)	Peak (dBuV/m)	Q-peak (dBuV/m)	Average (dBuV/m)	Factor (dB)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Table (o)	Height (cm)	ANT	Verdict
1625.37	43.21			-4.37	74.0	--	54.0	10.79	56.90	100	Horizontal	PASS
2022.98	43.52			-2.38	74.0	--	54.0	10.48	0.30	100	Horizontal	PASS
2440.56	81.76			-0.54	74.0	--	54.0	-27.76	222.30	100	Horizontal	N/A
3119.88	52.43			7.97	74.0	--	54.0	1.57	98.20	100	Horizontal	PASS
3851.15	43.93			10.01	74.0	--	54.0	10.07	83.90	100	Horizontal	PASS
4882.12	51.91			12.34	74.0	--	54.0	2.09	54.40	100	Horizontal	PASS

GFSK MID CHANNEL 6GHz to 25GHz, ANT V

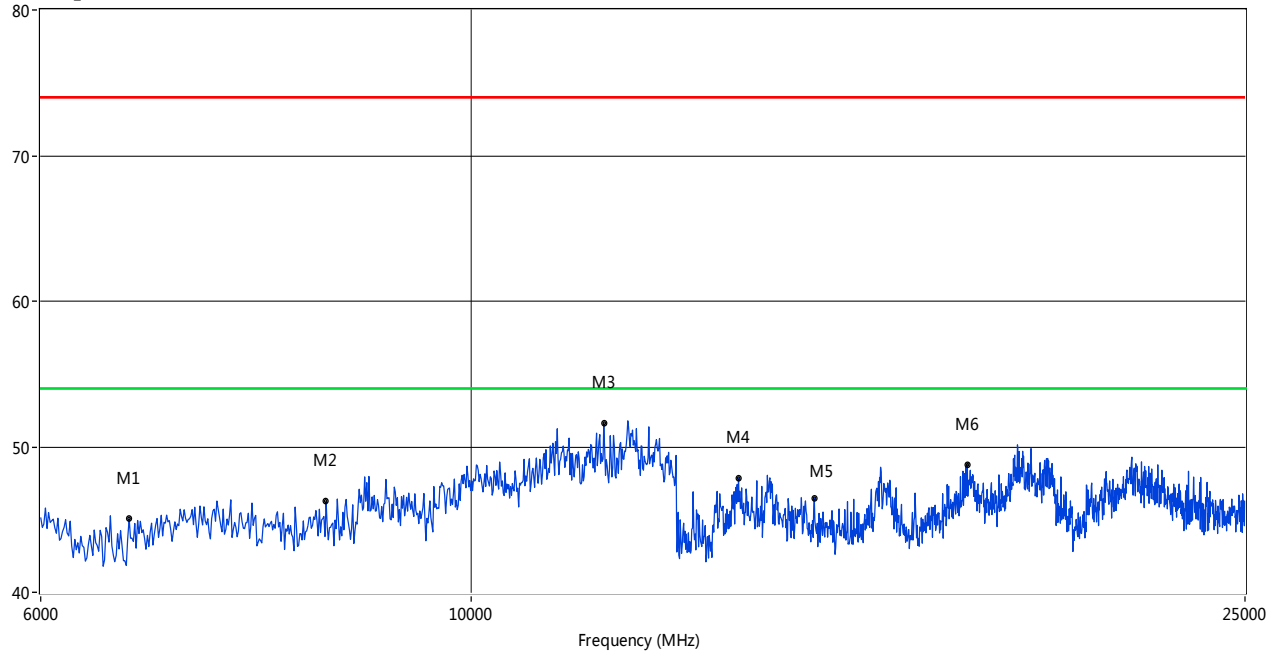
RE Test case_FCC 15C 6GHz-25GHz



Frequency (MHz)	Peak (dBuV/m)	Q-peak (dBuV/m)	Average (dBuV/m)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	ANT	Verdict
6516.64	45.25			74.0	--	54.0	8.75	Vertical	PASS
9032.45	47.75			74.0	--	54.0	6.25	Vertical	PASS
11065.31	51.24			74.0	--	54.0	2.76	Vertical	PASS
14195.51	48.03			74.0	--	54.0	5.97	Vertical	PASS
16233.78	48.59			74.0	--	54.0	5.41	Vertical	PASS
19089.85	50.13			74.0	--	54.0	3.87	Vertical	PASS

GFSK MID CHANNEL 6GHz to 25GHz, ANT H

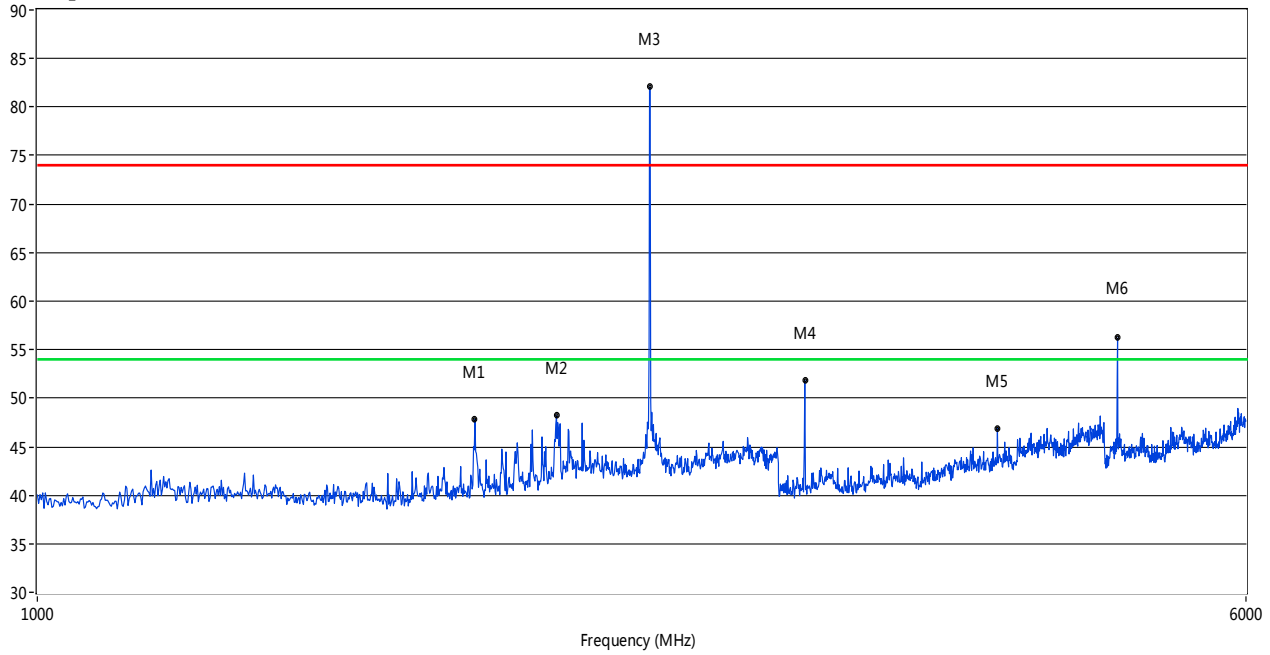
RE Test case_FCC 15C 6GHz-25GHz



Frequency (MHz)	Peak (dBuV/m)	Q-peak (dBuV/m)	Average (dBuV/m)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	ANT	Verdict
6662.65	45.05			74.0	--	54.0	8.95	Horizontal	PASS
8414.73	46.24			74.0	--	54.0	7.76	Horizontal	PASS
11694.26	51.61			74.0	--	54.0	2.39	Horizontal	PASS
13717.14	47.84			74.0	--	54.0	6.16	Horizontal	PASS
15006.66	46.43			74.0	--	54.0	7.57	Horizontal	PASS
17991.26	48.76			74.0	--	54.0	5.24	Horizontal	PASS

GFSK HIGH CHANNEL 1GHz to 6GHz, ANT V

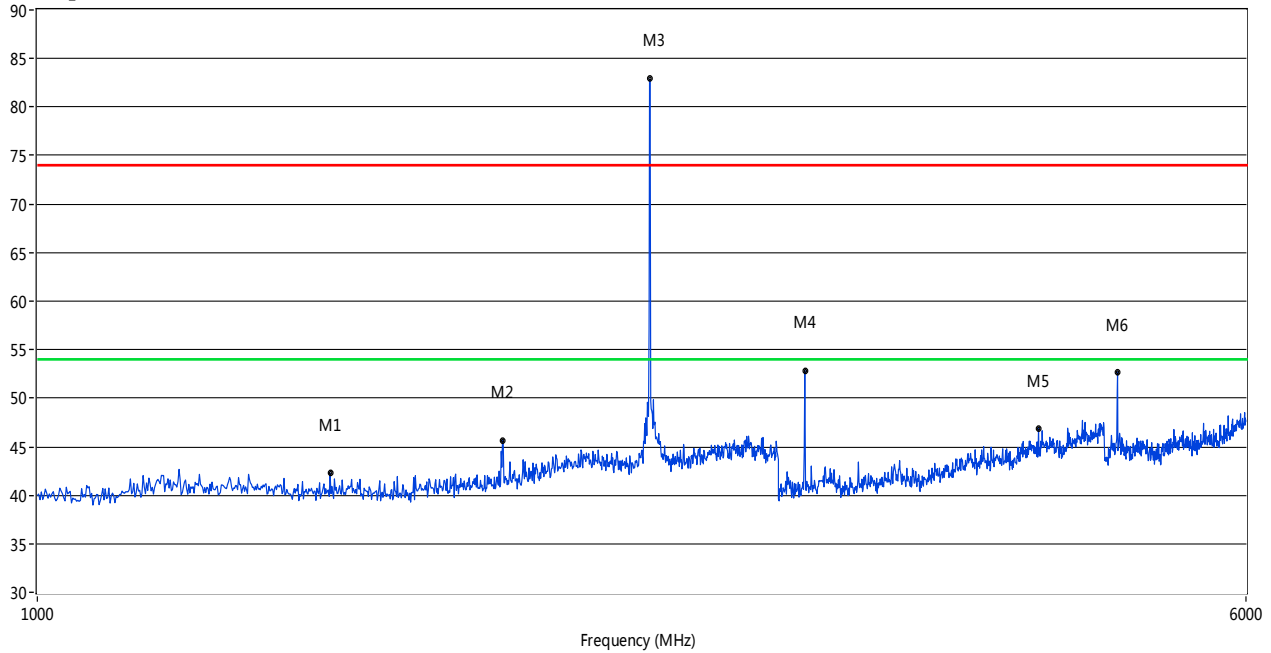
RE Test case_FCC 15C 1GHz-6GHz



Frequency (MHz)	Peak (dBuV/m)	Q-peak (dBuV/m)	Average (dBuV/m)	Factor (dB)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Table (o)	Height (cm)	ANT	Verdict
1913.09	47.85			-2.96	74.0	--	54.0	6.15	124.00	100	Vertical	PASS
2158.84	48.19			-1.34	74.0	--	54.0	5.81	130.70	100	Vertical	PASS
2478.52	82.06			-0.62	74.0	--	54.0	-28.06	3.70	100	Vertical	N/A
3119.88	51.86			7.97	74.0	--	54.0	2.14	38.40	100	Vertical	PASS
4150.85	46.88			10.21	74.0	--	54.0	7.12	209.20	100	Vertical	PASS
4960.04	56.20	--	50.79	12.64	74.0	--	54.0	3.21	327.10	200.00	Vertical	PASS

GFSK HIGH CHANNEL 1GHz to 6GHz, ANT H

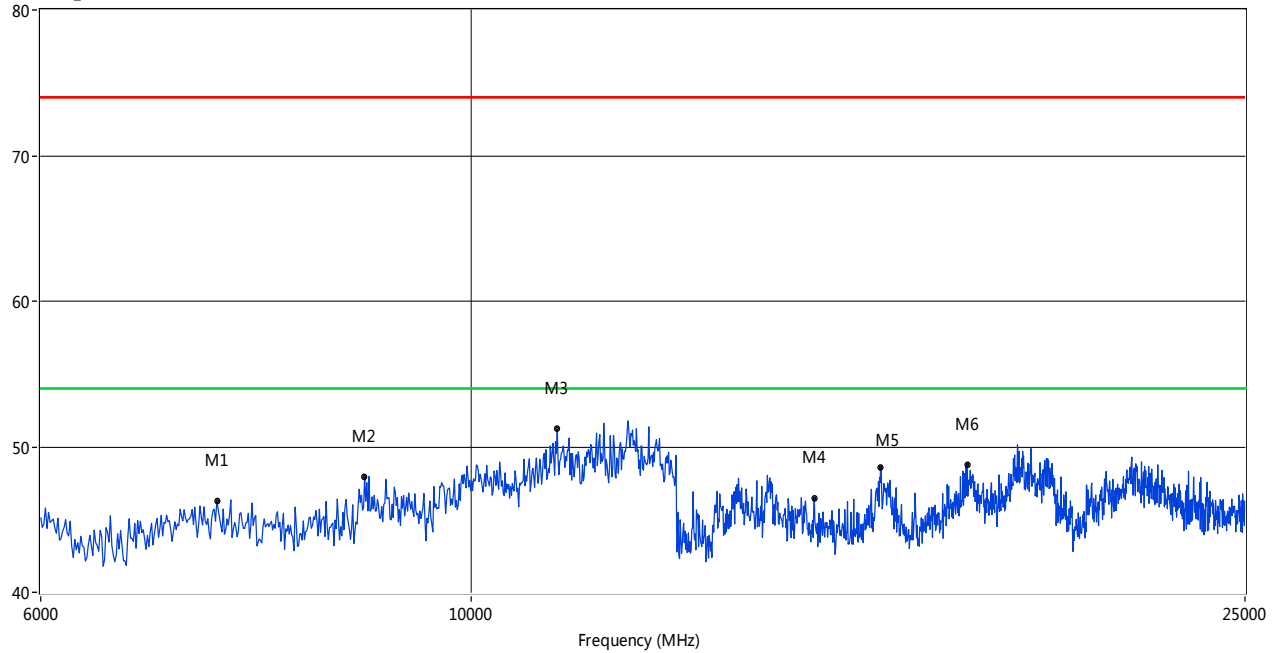
RE Test case_FCC 15C 1GHz-6GHz



Frequency (MHz)	Peak (dBuV/m)	Q-peak (dBuV/m)	Average (dBuV/m)	Factor (dB)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Table (o)	Height (cm)	ANT	Verdict
1543.46	42.28			-4.31	74.0	--	54.0	11.72	3.90	100	Horizontal	PASS
1993.01	45.67			-2.85	74.0	--	54.0	8.33	75.80	100	Horizontal	PASS
2478.52	82.88			-0.62	74.0	--	54.0	-28.88	207.70	100	Horizontal	N/A
3119.88	52.87			7.97	74.0	--	54.0	1.13	93.40	100	Horizontal	PASS
4411.59	46.91			10.64	74.0	--	54.0	7.09	0.60	100	Horizontal	PASS
4960.04	52.68			12.64	74.0	--	54.0	1.32	54.00	100	Horizontal	PASS

GFSK HIGH CHANNEL 6GHz to 25GHz, ANT V

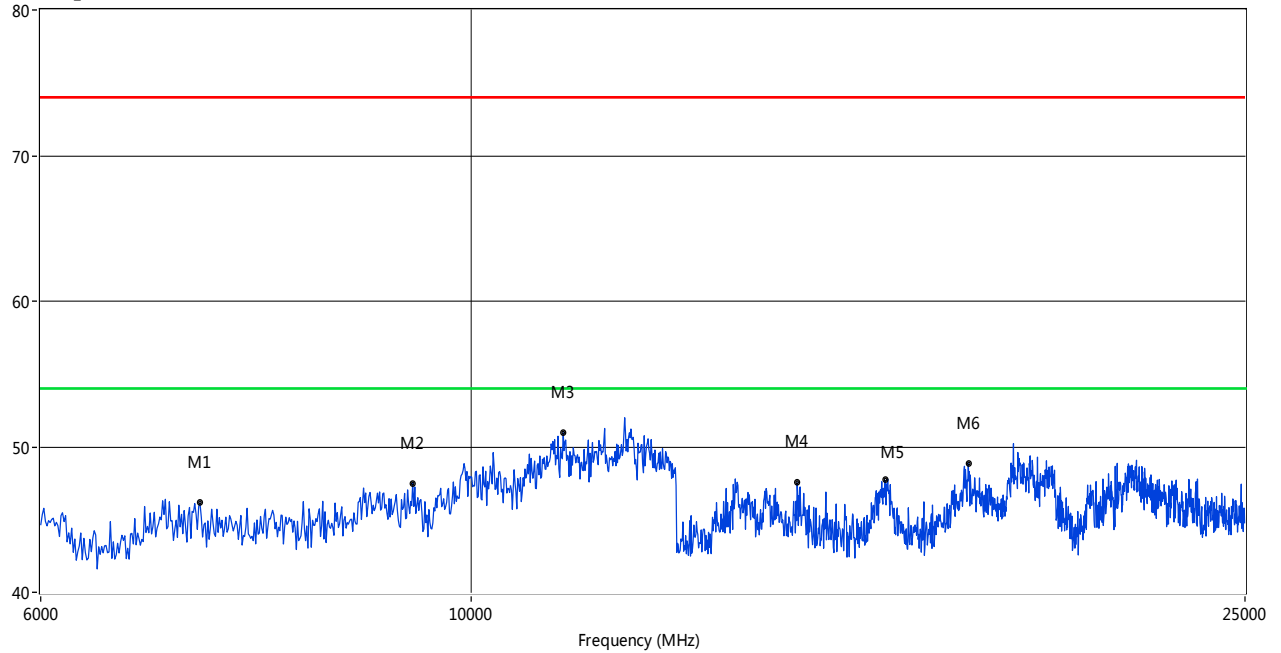
RE Test case_FCC 15C 6GHz-25GHz



Frequency (MHz)	Peak (dBuV/m)	Q-peak (dBuV/m)	Average (dBuV/m)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	ANT	Verdict
7392.68	46.27			74.0	--	54.0	7.73	Vertical	PASS
8807.82	47.92			74.0	--	54.0	6.08	Vertical	PASS
11065.31	51.24			74.0	--	54.0	2.76	Vertical	PASS
15006.66	46.43			74.0	--	54.0	7.57	Vertical	PASS
16233.78	48.59			74.0	--	54.0	5.41	Vertical	PASS
17991.26	48.76			74.0	--	54.0	5.24	Vertical	PASS

GFSK HIGH CHANNEL 6GHz to 25GHz, ANT H

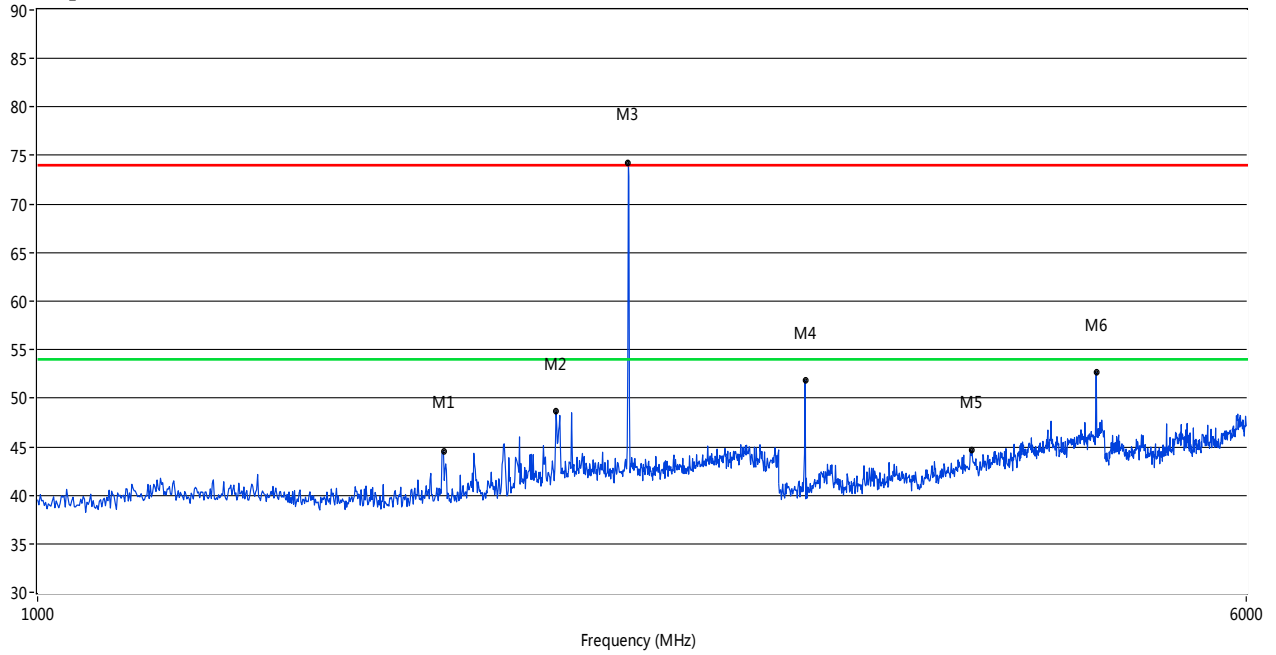
RE Test case_FCC 15C 6GHz-25GHz



Frequency (MHz)	Peak (dBuV/m)	Q-peak (dBuV/m)	Average (dBuV/m)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	ANT	Verdict
7246.67	46.15			74.0	--	54.0	7.85	Horizontal	PASS
9324.46	47.47			74.0	--	54.0	6.53	Horizontal	PASS
11143.93	50.96			74.0	--	54.0	3.04	Horizontal	PASS
14705.08	47.52			74.0	--	54.0	6.48	Horizontal	PASS
16316.97	47.72			74.0	--	54.0	6.28	Horizontal	PASS
18012.06	48.83			74.0	--	54.0	5.17	Horizontal	PASS

Π/4-DQPSK LOW CHANNEL 1GHz to 6GHz, ANT V

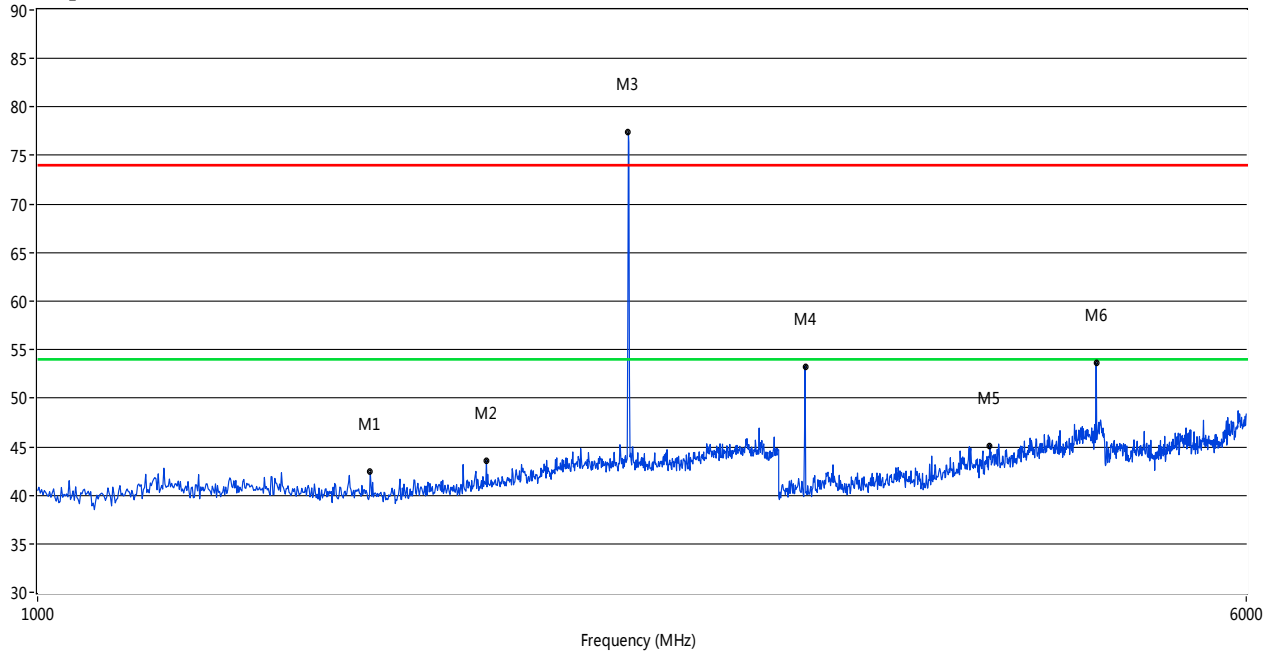
RE Test case_FCC 15C 1GHz-6GHz



Frequency (MHz)	Peak (dBuV/m)	Q-peak (dBuV/m)	Average (dBuV/m)	Factor (dB)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	AV limit (dBuV/m)	Margin (dB)	Table (o)	Height (cm)	ANT	Verdict
1825.17	44.57			-3.58	74.0	--	54.0	9.43	131.30	100	Vertical	PASS
2156.84	48.62			-1.36	74.0	--	54.0	5.38	151.60	100	Vertical	PASS
2400.60	74.29			-0.67	74.0	--	54.0	-20.29	7.60	100	Vertical	N/A
3119.88	51.83			7.97	74.0	--	54.0	2.17	34.20	100	Vertical	PASS
3995.00	44.61			10.09	74.0	--	54.0	9.39	-0.00	100	Vertical	PASS
4804.20	52.63			12.35	74.0	--	54.0	1.37	359.00	100	Vertical	PASS

II/4-DQPSK LOW CHANNEL 1GHz to 6GHz, ANT H

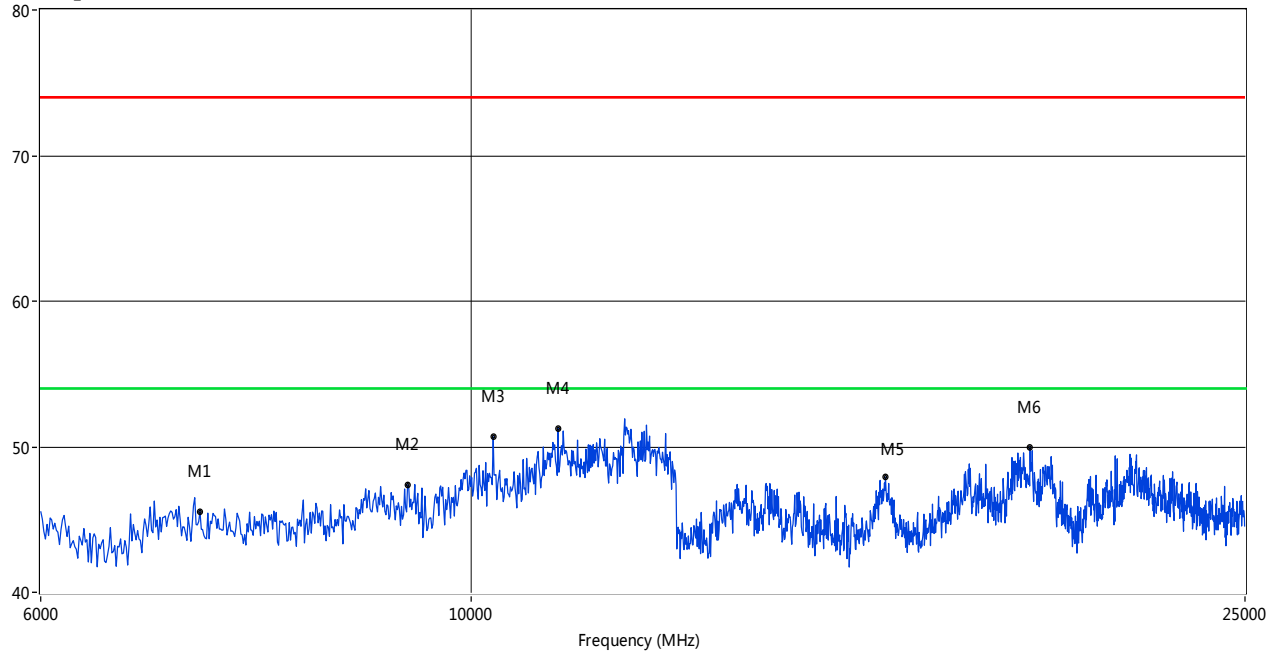
RE Test case_FCC 15C 1GHz-6GHz



Frequency (MHz)	Peak (dBuV/m)	Q-peak (dBuV/m)	Average (dBuV/m)	Factor (dB)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Table (o)	Height (cm)	ANT	Verdict
1637.36	42.40			-4.32	74.0	--	54.0	11.60	69.00	100	Horizontal	PASS
1945.05	43.55			-3.14	74.0	--	54.0	10.45	186.80	100	Horizontal	PASS
2400.60	77.39			-0.67	74.0	--	54.0	-23.39	193.50	100	Horizontal	N/A
3119.88	53.27			7.97	74.0	--	54.0	0.73	102.90	100	Horizontal	PASS
4102.90	45.09			9.94	74.0	--	54.0	8.91	82.90	100	Horizontal	PASS
4804.20	53.64			12.35	74.0	--	54.0	0.36	53.40	100	Horizontal	PASS

II/4-DQPSK LOW CHANNEL 6GHz to 25GHz, ANT V

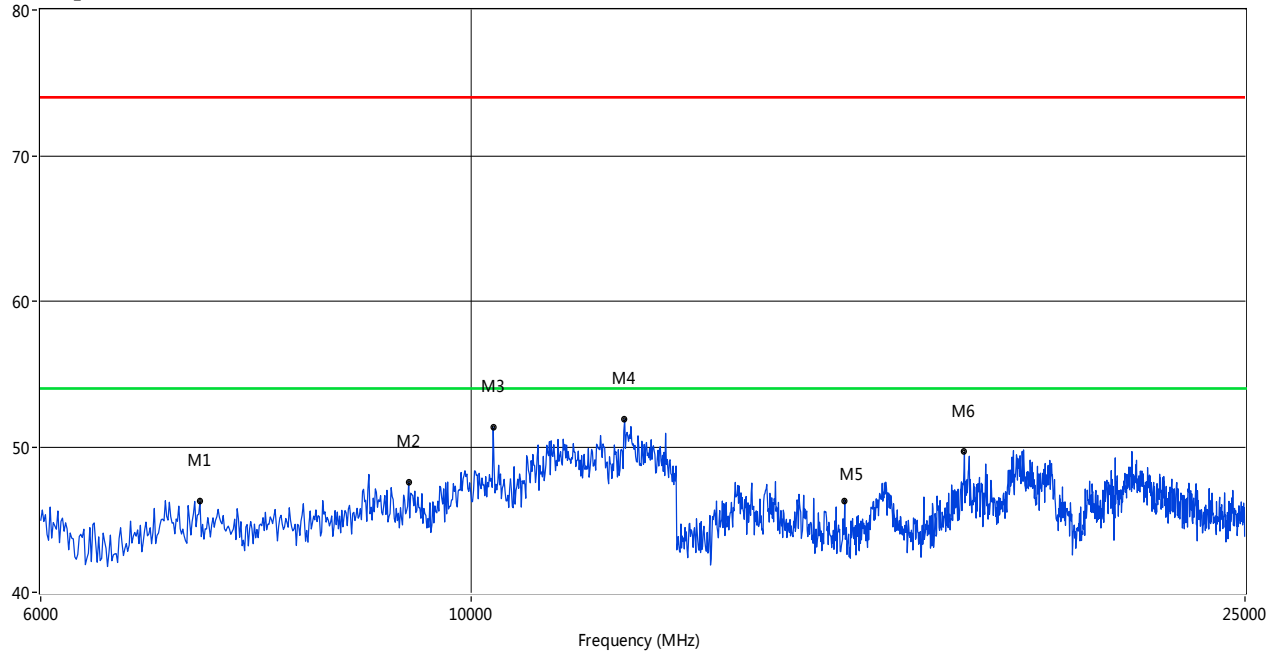
RE Test case_FCC 15C 6GHz-25GHz



Frequency (MHz)	Peak (dBuV/m)	Q-peak (dBuV/m)	Average (dBuV/m)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	ANT	Verdict
7246.67	46.15			74.0	--	54.0	7.85	Vertical	PASS
9268.30	47.38			74.0	--	54.0	6.62	Vertical	PASS
10256.66	50.68			74.0	--	54.0	3.32	Vertical	PASS
11076.54	51.27			74.0	--	54.0	2.73	Vertical	PASS
16327.37	47.92			74.0	--	54.0	6.08	Vertical	PASS
19379.37	49.93			74.0	--	54.0	4.07	Vertical	PASS

Π/4-DQPSK LOW CHANNEL 6GHz to 25GHz, ANT H

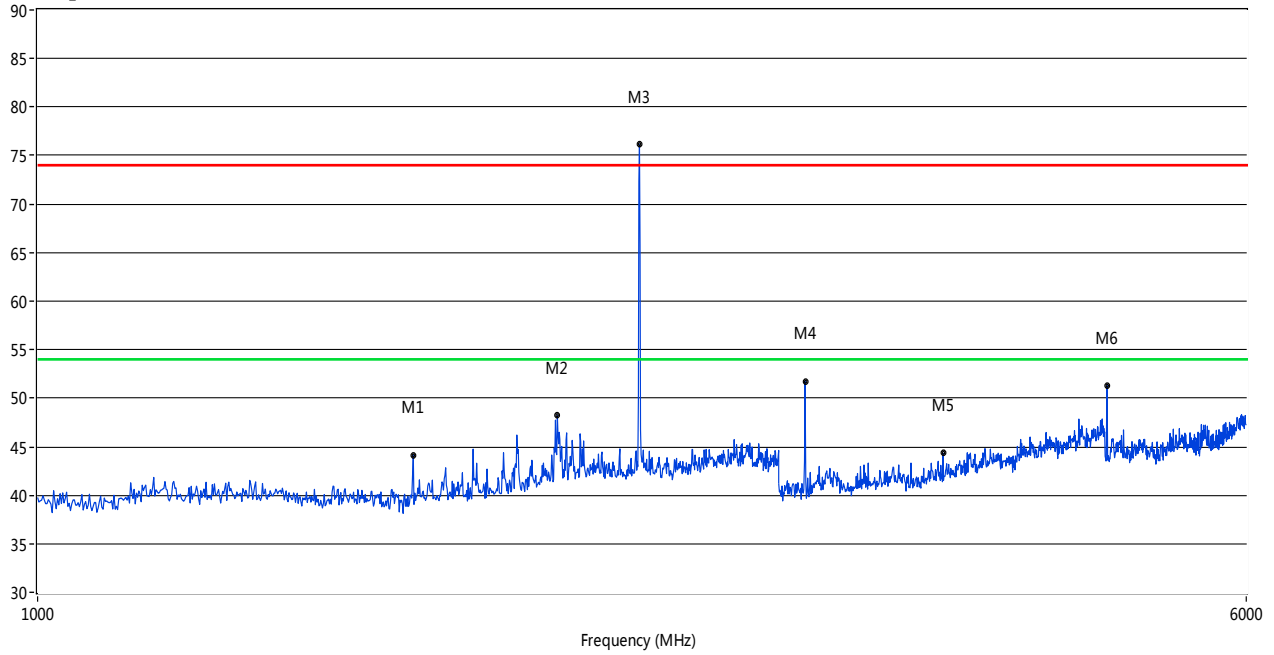
RE Test case_FCC 15C 6GHz-25GHz



Frequency (MHz)	Peak (dBuV/m)	Q-peak (dBuV/m)	Average (dBuV/m)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	ANT	Verdict
7246.67	46.15			74.0	--	54.0	7.85	Horizontal	PASS
9279.53	47.57			74.0	--	54.0	6.43	Horizontal	PASS
10256.66	50.68			74.0	--	54.0	3.32	Horizontal	PASS
11986.27	51.86			74.0	--	54.0	2.14	Horizontal	PASS
15557.82	46.30			74.0	--	54.0	7.70	Horizontal	PASS
17928.87	49.63			74.0	--	54.0	4.37	Horizontal	PASS

Π/4-DQPSK MID CHANNEL 1GHz to 6GHz, ANT V

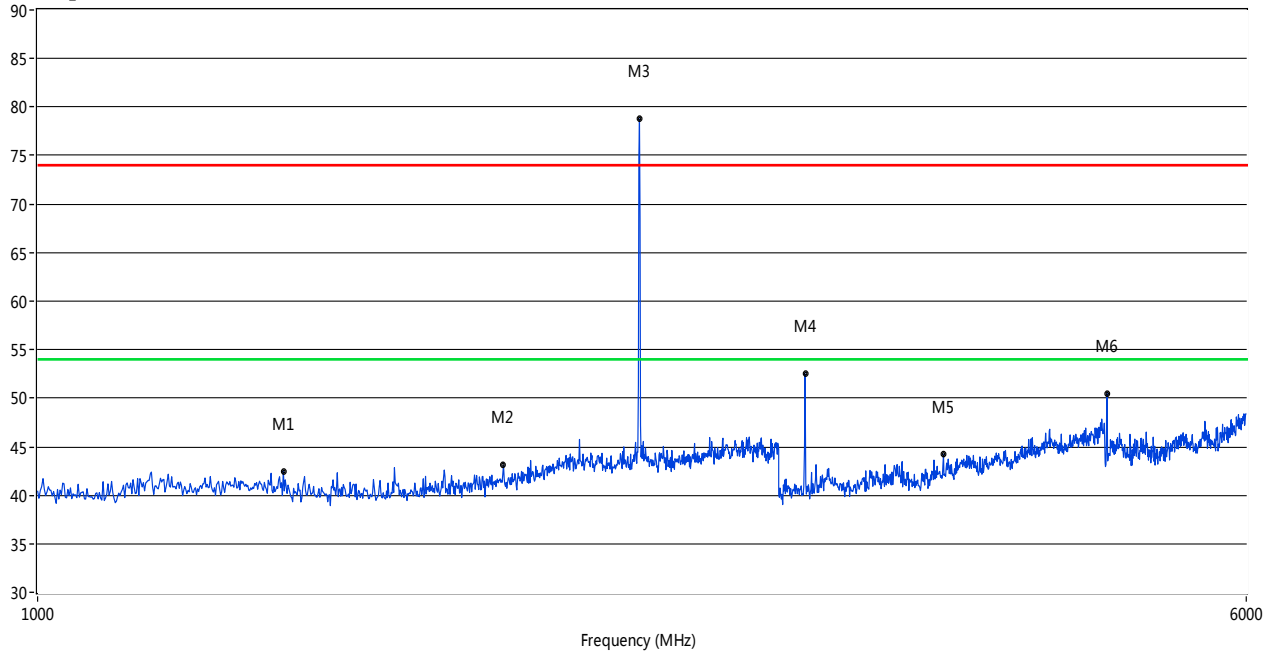
RE Test case_FCC 15C 1GHz-6GHz



Frequency (MHz)	Peak (dBuV/m)	Q-peak (dBuV/m)	Average (dBuV/m)	Factor (dB)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Table (o)	Height (cm)	ANT	Verdict
1745.25	44.15			-4.01	74.0	--	54.	9.85	138.00	100	Vertical	PASS
2160.84	48.22			-1.32	74.0	--	54.0	5.78	152.00	100	Vertical	PASS
2440.56	76.14			-0.54	74.0	--	54.0	-22.14	317.80	100	Vertical	N/A
3119.88	51.76			7.97	74.0	--	54.0	2.24	35.40	100	Vertical	PASS
3827.17	44.36			9.71	74.0	--	54.0	9.64	286.60	100	Vertical	PASS
4882.12	51.30			12.34	74.0	--	54.0	2.70	320.70	100	Vertical	PASS

Π/4-DQPSK MID CHANNEL 1GHz to 6GHz, ANT H

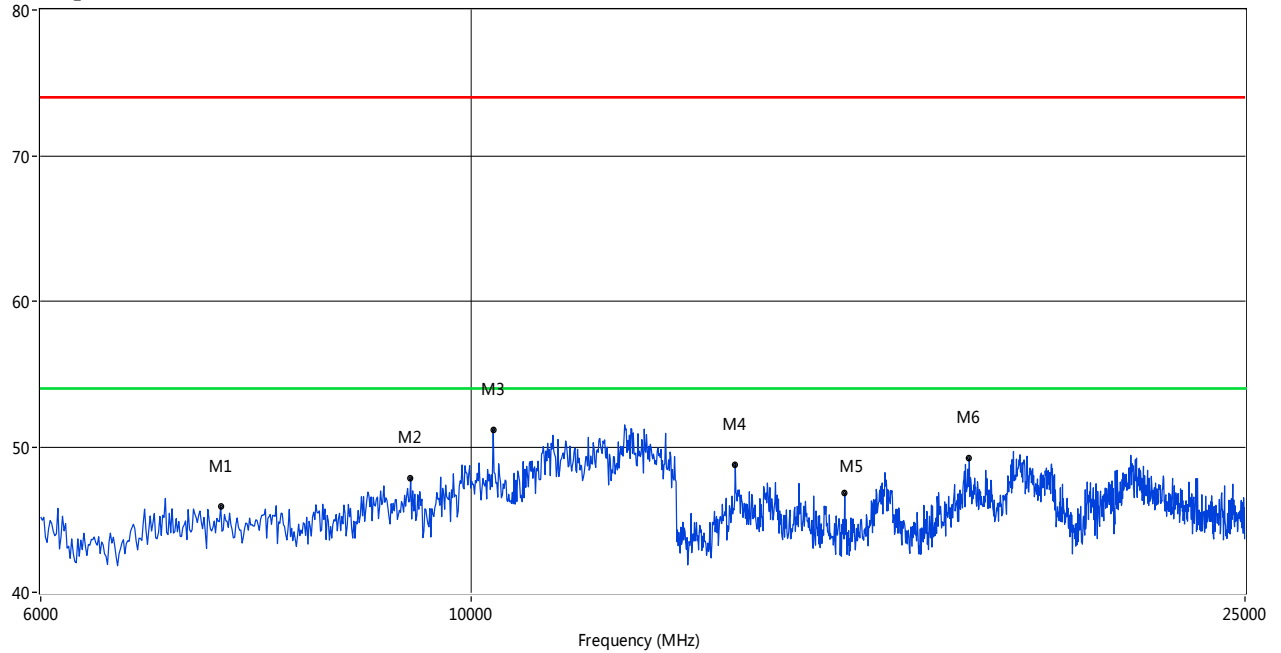
RE Test case_FCC 15C 1GHz-6GHz



Frequency (MHz)	Peak (dBuV/m)	Q-peak (dBuV/m)	Average (dBuV/m)	Factor (dB)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Table (o)	Height (cm)	ANT	Verdict
1439.56	42.49			-4.17	74.0	--	54.0	11.51	0.80	100	Horizontal	PASS
1995.00	43.10			-2.89	74.0	--	54.0	10.90	110.20	100	Horizontal	PASS
2440.56	78.77			-0.54	74.0	--	54.0	-24.77	193.20	100	Horizontal	N/A
3119.88	52.51			7.97	74.0	--	54.0	1.49	99.00	100	Horizontal	PASS
3830.17	44.19			9.77	74.0	--	54.0	9.81	0.10	100	Horizontal	PASS
4882.12	50.48			12.34	74.0	--	54.0	3.52	49.20	100	Horizontal	PASS

II/4-DQPSK MID CHANNEL 6GHz to 25GHz, ANT V

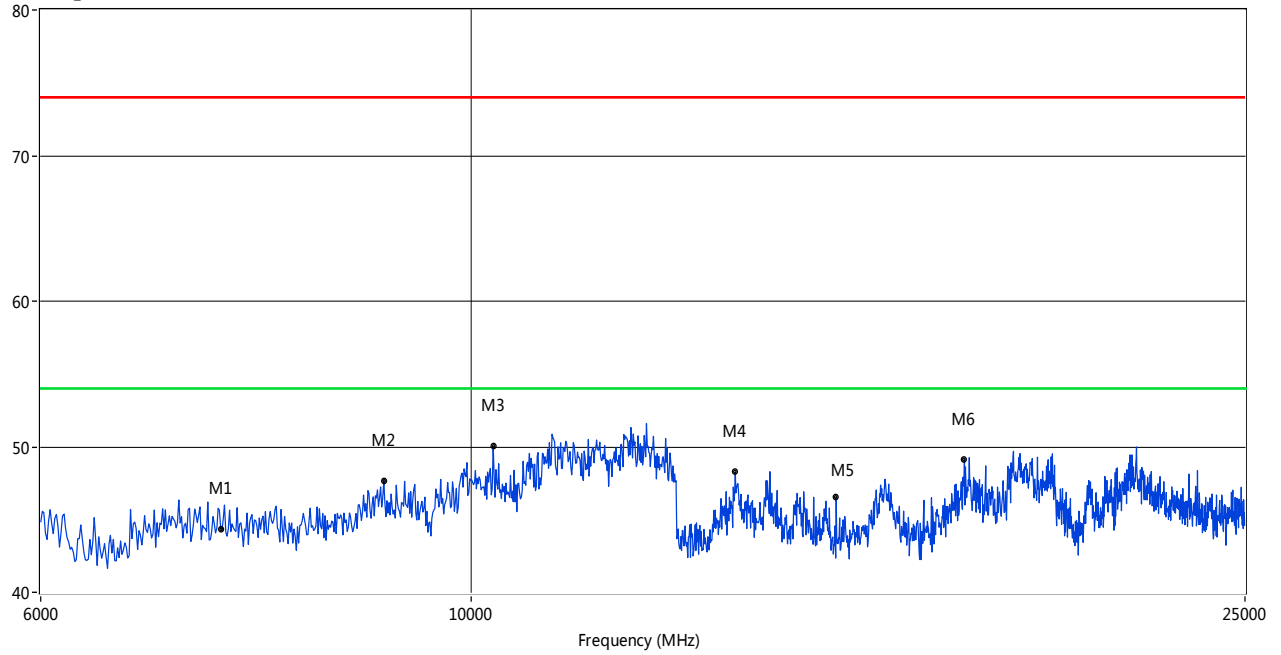
RE Test case_FCC 15C 6GHz-25GHz



Frequency (MHz)	Peak (dBuV/m)	Q-peak (dBuV/m)	Average (dBuV/m)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	ANT	Verdict
7426.37	45.89			74.0	--	54.0	8.11	Vertical	PASS
9302.00	47.83			74.0	--	54.0	6.17	Vertical	PASS
10256.66	50.68			74.0	--	54.0	3.32	Vertical	PASS
13665.14	48.79			74.0	--	54.0	5.21	Vertical	PASS
15557.82	46.30			74.0	--	54.0	7.70	Vertical	PASS
18032.86	49.21			74.0	--	54.0	4.79	Vertical	PASS

Π/4-DQPSK MID CHANNEL 6GHz to 25GHz, ANT H

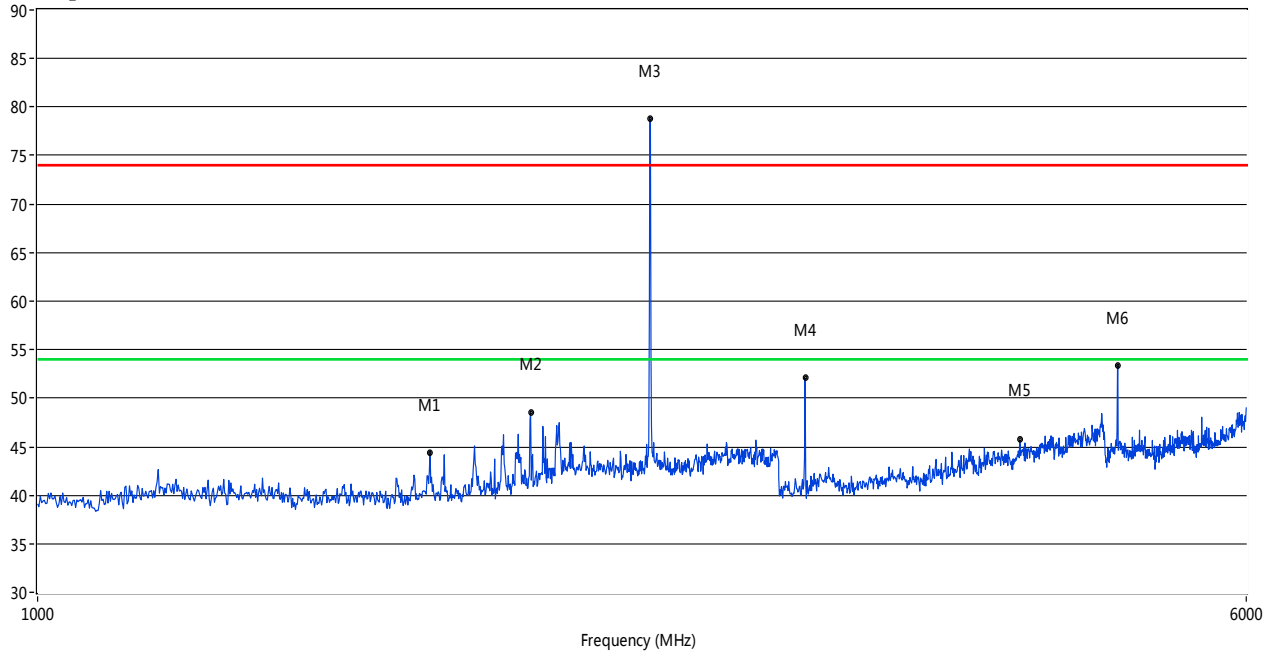
RE Test case_FCC 15C 6GHz-25GHz



Frequency (MHz)	Peak (dBuV/m)	Q-peak (dBuV/m)	Average (dBuV/m)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	ANT	Verdict
7426.37	45.89			74.0	--	54.0	8.11	Horizontal	PASS
9009.98	47.68			74.0	--	54.0	6.32	Horizontal	PASS
10256.66	50.68			74.0	--	54.0	3.32	Horizontal	PASS
13665.14	48.79			74.0	--	54.0	5.21	Horizontal	PASS
15401.83	46.54			74.0	--	54.0	7.46	Horizontal	PASS
17928.87	49.16			74.0	--	54.0	4.84	Horizontal	PASS

Π/4-DQPSK HIGH CHANNEL 1GHz to 6GHz, ANT V

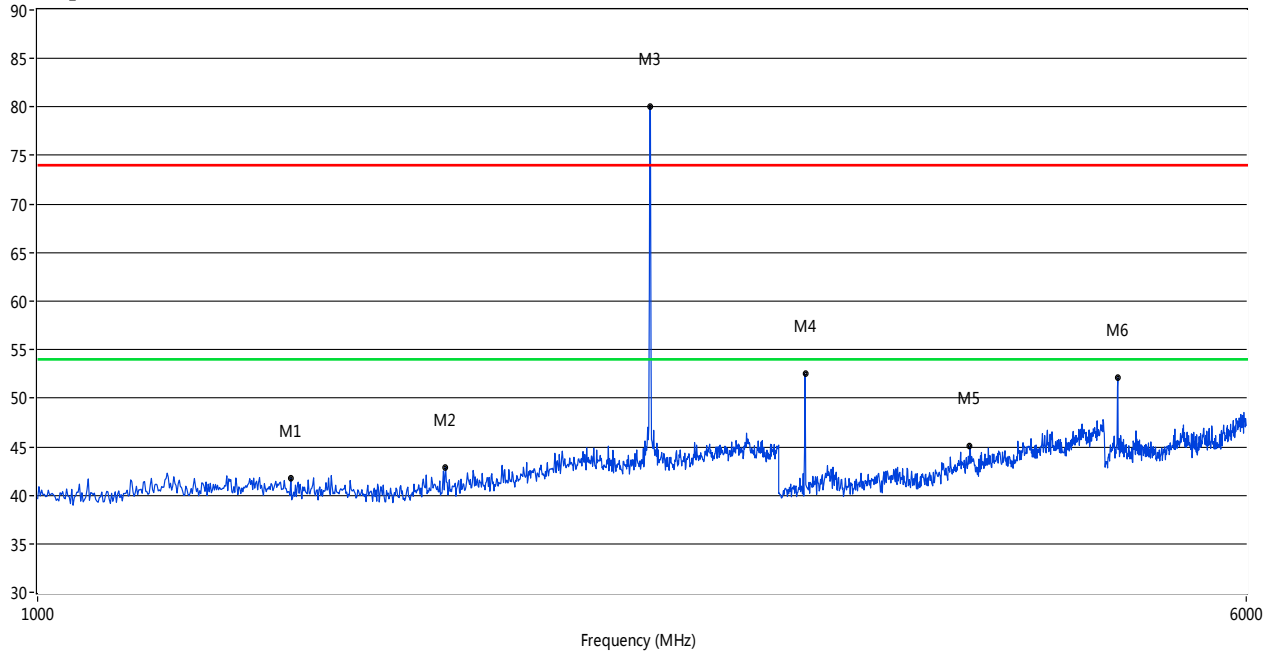
RE Test case_FCC 15C 1GHz-6GHz



Frequency (MHz)	Peak (dBuV/m)	Q-peak (dBuV/m)	Average (dBuV/m)	Factor (dB)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Table (o)	Height (cm)	ANT	Verdict
1789.21	44.42			-3.94	74.0	--	54.0	9.58	137.60	100	Vertical	PASS
2076.92	48.57			-2.13	74.0	--	54.0	5.43	137.60	100	Vertical	PASS
2478.52	78.81			-0.62	74.0	--	54.0	-24.81	7.40	100	Vertical	N/A
3119.88	52.09			7.97	74.0	--	54.0	1.91	38.20	100	Vertical	PASS
4288.71	45.70			10.69	74.0	--	54.0	8.30	325.20	100	Vertical	PASS
4960.04	53.39			12.64	74.0	--	54.0	0.61	320.40	100	Vertical	PASS

Π/4-DQPSK HIGH CHANNEL 1GHz to 6GHz, ANT H

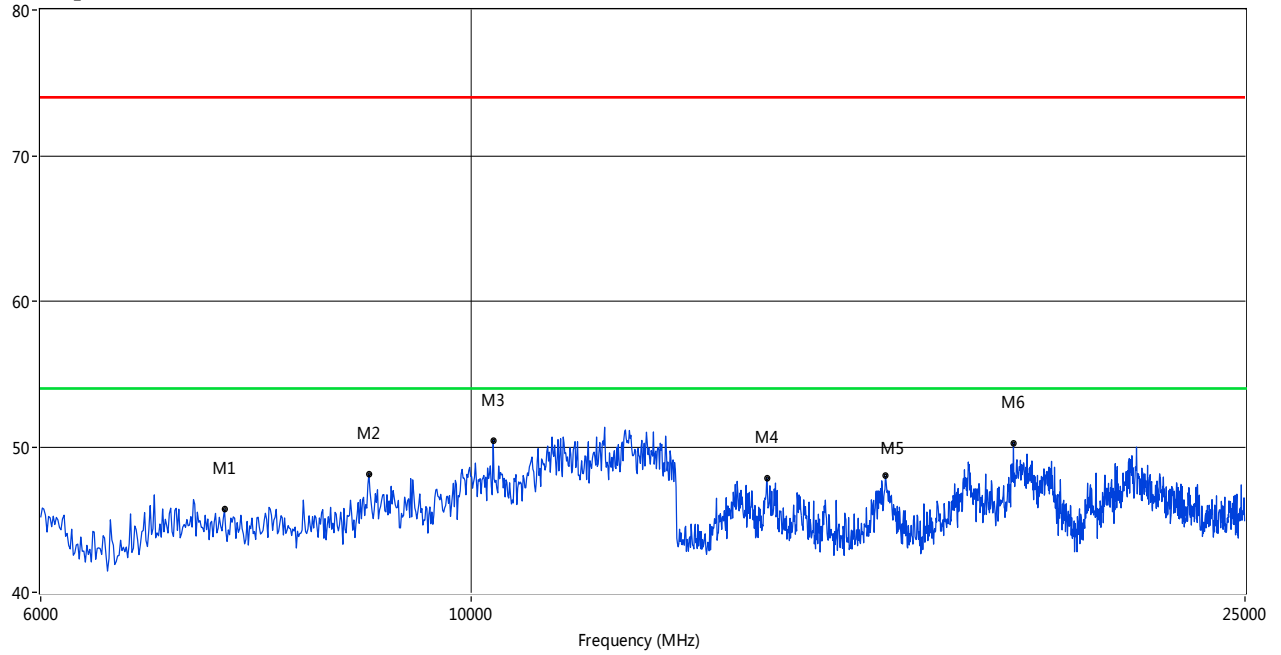
RE Test case_FCC 15C 1GHz-6GHz



Frequency (MHz)	Peak (dBuV/m)	Q-peak (dBuV/m)	Average (dBuV/m)	Factor (dB)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Table (o)	Height (cm)	ANT	Verdict
1455.54	41.80			-4.43	74.0	--	54.0	12.20	355.80	100	Horizontal	PASS
1831.17	42.84			-3.67	74.0	--	54.0	11.16	103.90	100	Horizontal	PASS
2478.52	79.99			-0.62	74.0	--	54.0	-25.99	208.40	100	Horizontal	N/A
3119.88	52.49			7.97	74.0	--	54.0	1.51	98.80	100	Horizontal	PASS
3983.02	45.03			10.17	74.0	--	54.0	8.97	178.10	100	Horizontal	PASS
4960.04	52.10			12.64	74.0	--	54.0	1.90	54.20	100	Horizontal	PASS

$\Pi/4$ -DQPSK HIGH CHANNEL 6GHz to 25GHz, ANT V

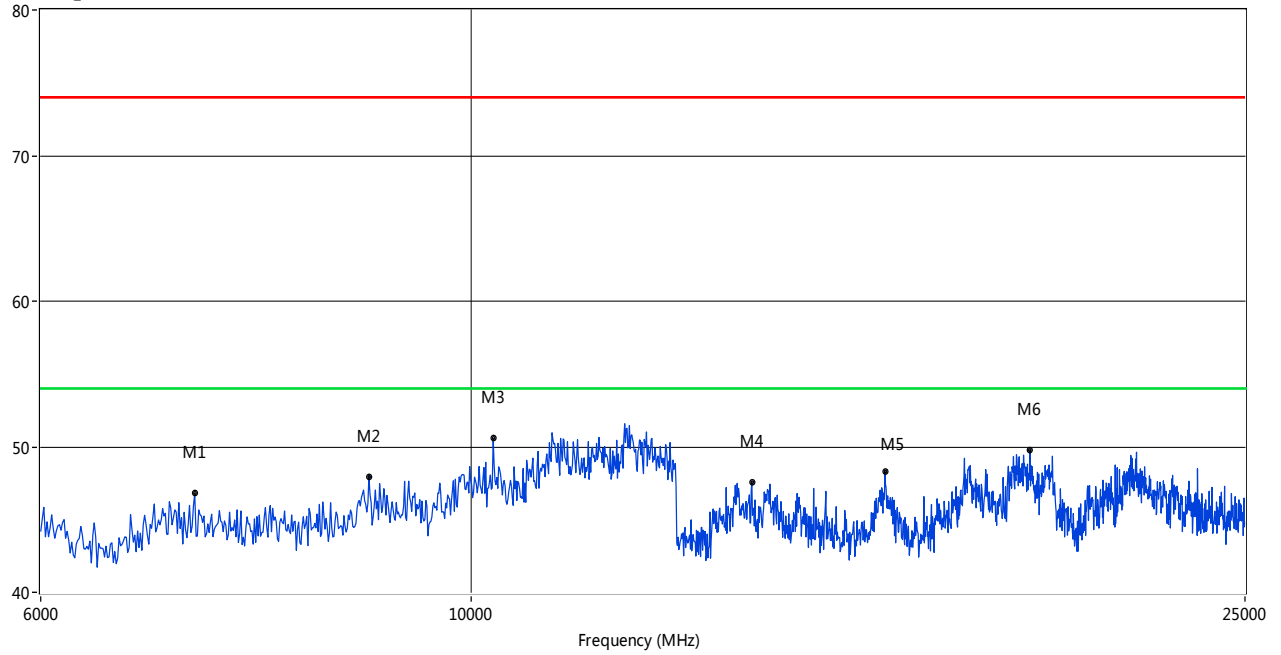
RE Test case_FCC 15C 6GHz-25GHz



Frequency (MHz)	Peak (dBuV/m)	Q-peak (dBuV/m)	Average (dBuV/m)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	ANT	Verdict
7460.07	45.67			74.0	--	54.0	8.33	Vertical	PASS
8852.75	48.13			74.0	--	54.0	5.87	Vertical	PASS
10256.66	50.68			74.0	--	54.0	3.32	Vertical	PASS
14185.11	47.87			74.0	--	54.0	6.13	Vertical	PASS
16327.37	48.00			74.0	--	54.0	6.00	Vertical	PASS
19000.00	50.25			74.0	--	54.0	3.75	Vertical	PASS

$\pi/4$ -DQPSK HIGH CHANNEL 6GHz to 25GHz, ANT H

RE Test case_FCC 15C 6GHz-25GHz

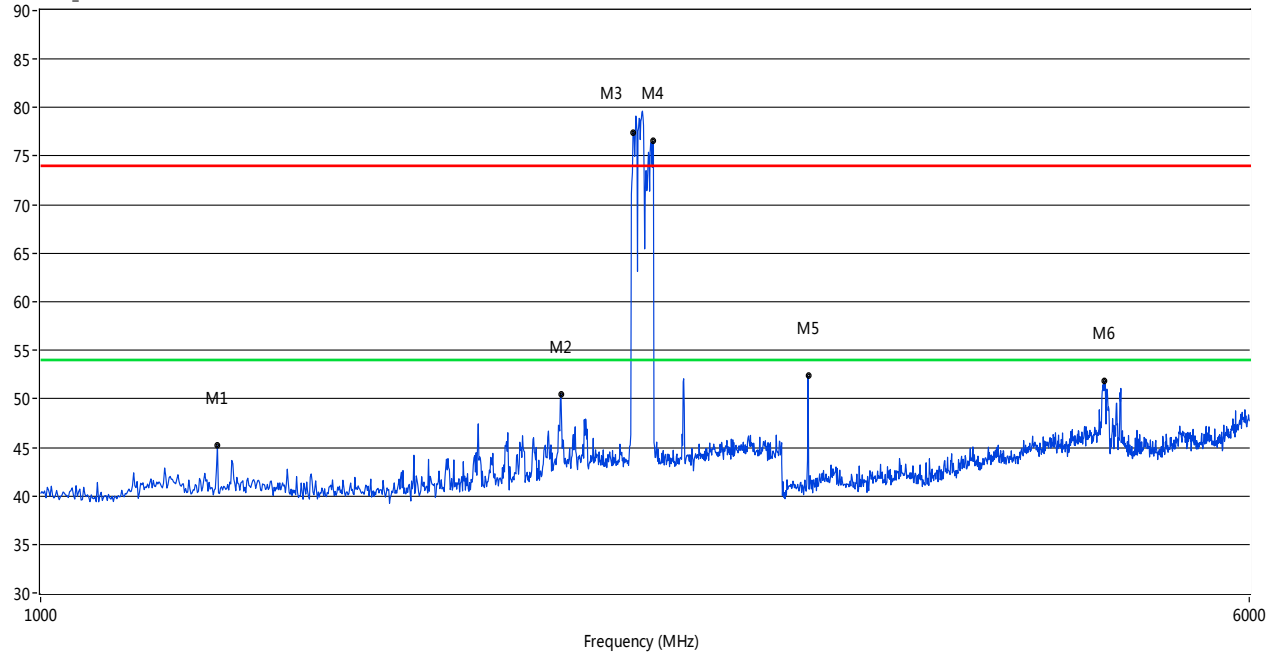


Frequency (MHz)	Peak (dBuV/m)	Q-peak (dBuV/m)	Average (dBuV/m)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	ANT	Verdict
7201.75	46.79			74.0	--	54.0	7.21	Horizontal	PASS
8852.75	48.13			74.0	--	54.0	5.87	Horizontal	PASS
10256.66	50.68			74.0	--	54.0	3.32	Horizontal	PASS
13935.52	47.60			74.0	--	54.0	6.40	Horizontal	PASS
16316.97	48.32			74.0	--	54.0	5.68	Horizontal	PASS
19379.37	49.80			74.0	--	54.0	4.20	Horizontal	PASS

Hopping Mode:

GFSK MODE 1GHz to 6GHz, ANT V

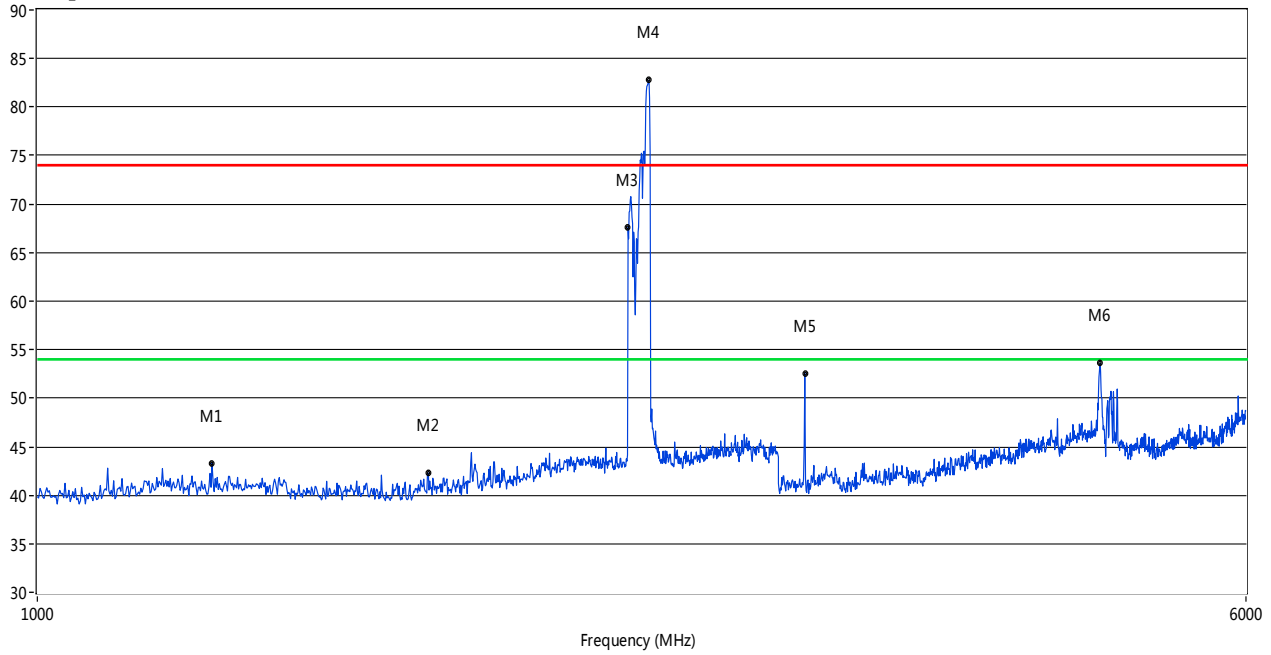
RE Test case_FCC 15C 1GHz-6GHz



Frequency (MHz)	Peak (dBuV/m)	Q-peak (dBuV/m)	Average (dBuV/m)	Factor (dB)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Table (o)	Height (cm)	ANT	Verdict
1299.70	45.15			-4.09	74.0	--	54.0	8.85	149.10	100	Vertical	PASS
2162.84	50.48			-1.32	74.0	--	54.0	3.52	146.20	100	Vertical	PASS
2406.59	77.44			-0.78	74.0	--	54.0	-23.44	54.50	100	Vertical	N/A
2478.52	76.54			-0.62	74.0	--	54.0	-22.54	91.70	100	Vertical	N/A
3119.88	52.35			7.97	74.0	--	54.0	1.65	37.20	100	Vertical	PASS
4840.16	51.82			13.03	74.0	--	54.0	2.18	348.80	100	Vertical	PASS

GFSK MODE 1GHz to 6GHz, ANT H

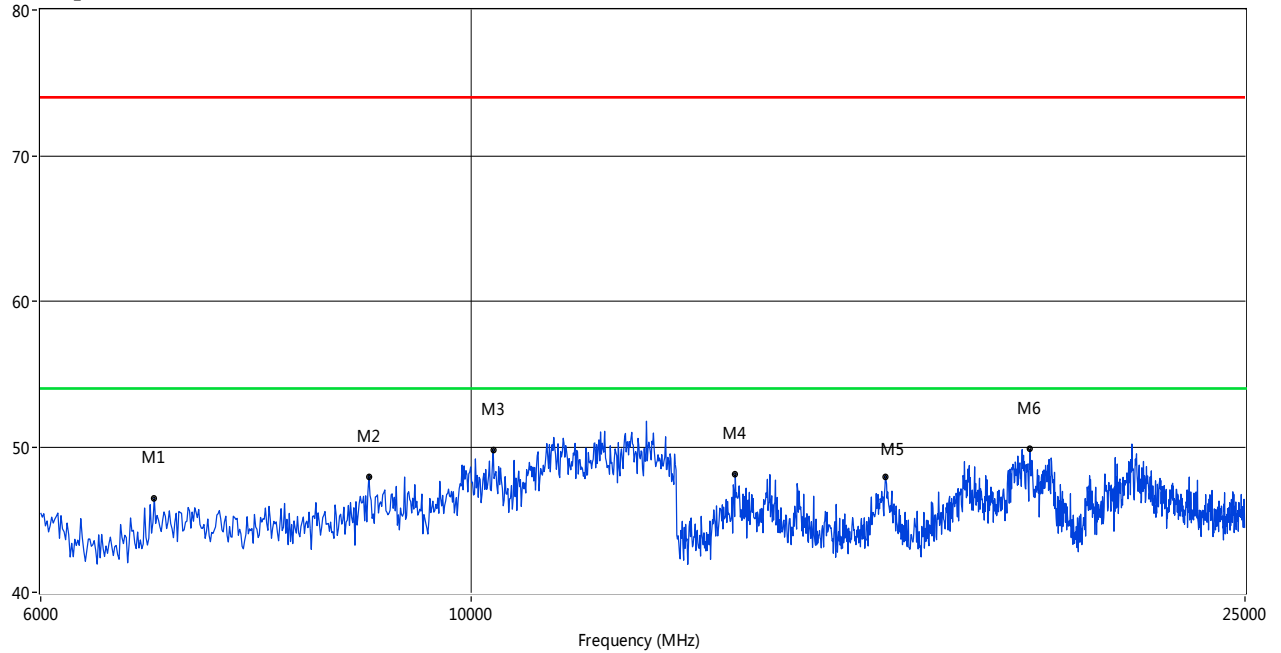
RE Test case_FCC 15C 1GHz-6GHz



Frequency (MHz)	Peak (dBuV/m)	Q-peak (dBuV/m)	Average (dBuV/m)	Factor (dB)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Table (o)	Height (cm)	ANT	Verdict
1295.70	43.32			-4.17	74.0	--	54.0	10.68	132.40	100	Horizontal	PASS
1785.21	42.29			-3.97	74.0	--	54.0	11.71	95.90	100	Horizontal	PASS
2400.60	67.61			-0.67	74.0	--	54.0	-13.61	254.00	100	Horizontal	N/A
2474.53	82.74			-0.51	74.0	--	54.0	-28.74	233.90	100	Horizontal	N/A
3119.88	51.36			7.97	74.0	--	54.0	2.64	109.50	100	Horizontal	PASS
4834.17	53.59			12.94	74.0	--	54.0	0.41	47.80	100	Horizontal	PASS

GFSK MODE 6GHz to 25GHz, ANT V

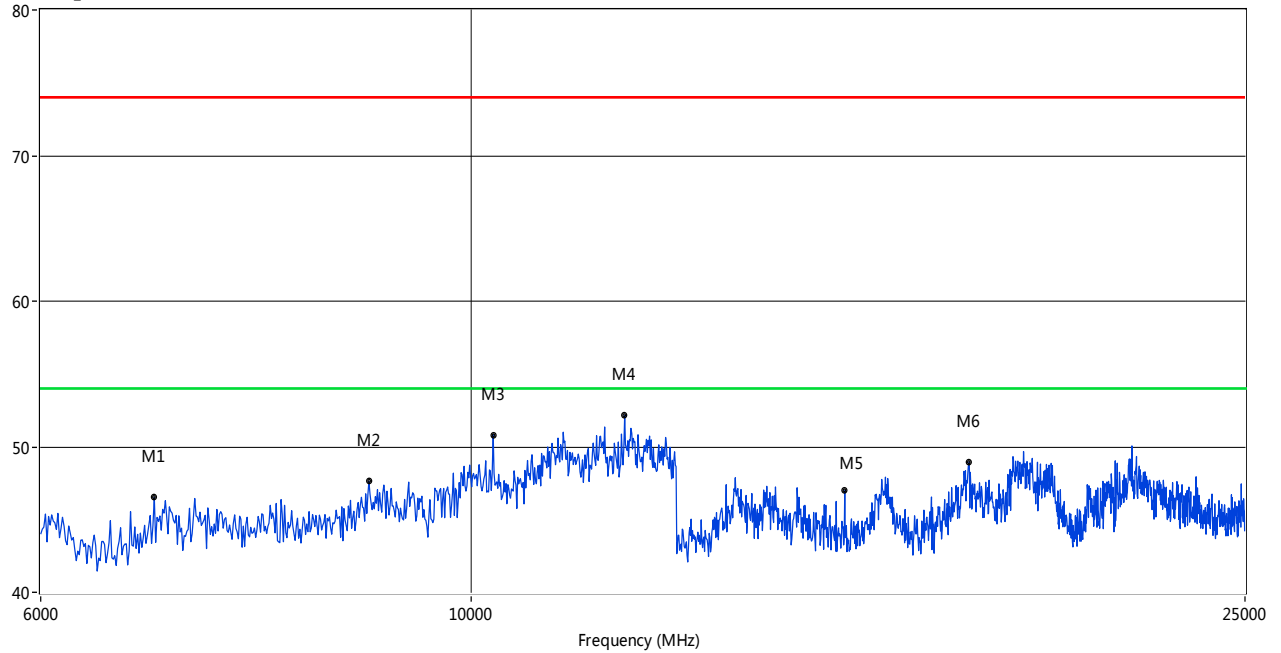
RE Test case_FCC 15C 6GHz-25GHz



Frequency (MHz)	Peak (dBuV/m)	Q-peak (dBuV/m)	Average (dBuV/m)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	ANT	Verdict
6864.81	46.47			74.0	--	54.0	7.53	Vertical	PASS
8852.75	48.13			74.0	--	54.0	5.87	Vertical	PASS
10256.66	50.68			74.0	--	54.0	3.32	Vertical	PASS
13665.14	48.15			74.0	--	54.0	5.85	Vertical	PASS
16327.37	47.96			74.0	--	54.0	6.04	Vertical	PASS
19379.37	49.80			74.0	--	54.0	4.20	Vertical	PASS

GFSK MODE 6GHz to 25GHz, ANT H

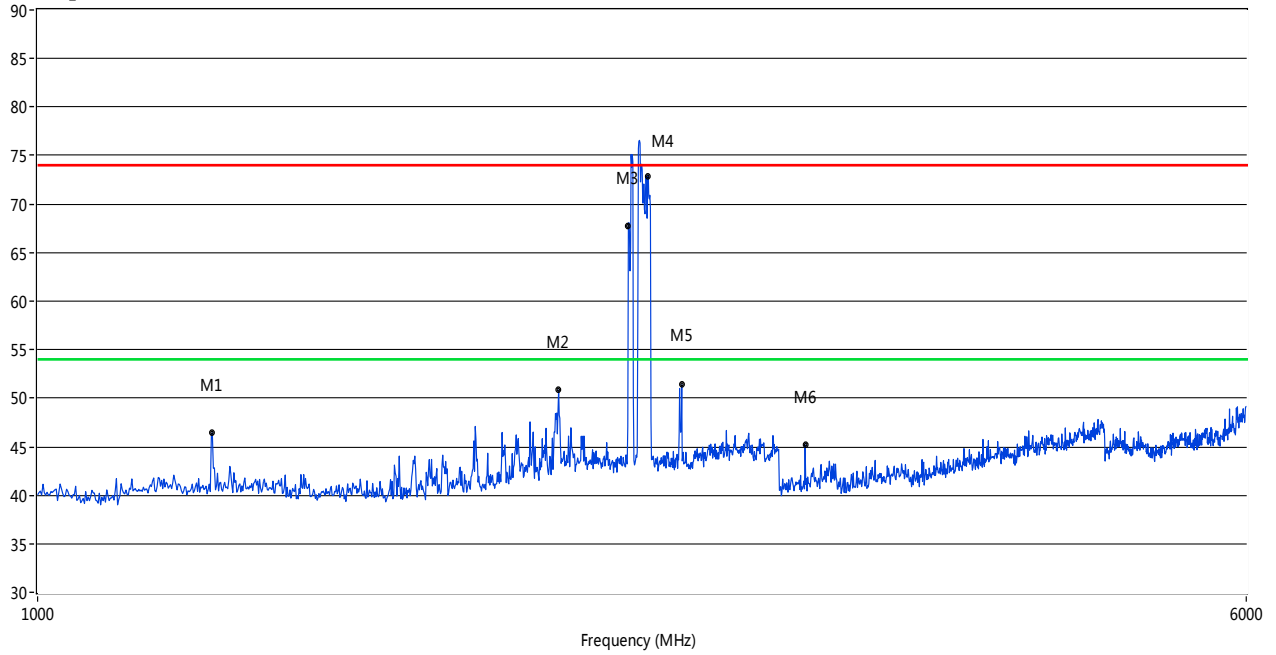
RE Test case_FCC 15C 6GHz-25GHz



Frequency (MHz)	Peak (dBuV/m)	Q-peak (dBuV/m)	Average (dBuV/m)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	ANT	Verdict
6864.81	46.47			74.0	--	54.0	7.53	Horizontal	PASS
8852.75	48.13			74.0	--	54.0	5.87	Horizontal	PASS
10256.66	50.68			74.0	--	54.0	3.32	Horizontal	PASS
11986.27	52.16			74.0	--	54.0	1.84	Horizontal	PASS
15557.82	46.98			74.0	--	54.0	7.02	Horizontal	PASS
18032.86	48.96			74.0	--	54.0	5.04	Horizontal	PASS

$\pi/4$ -DQPSK MODE 1GHz to 6GHz, ANT V

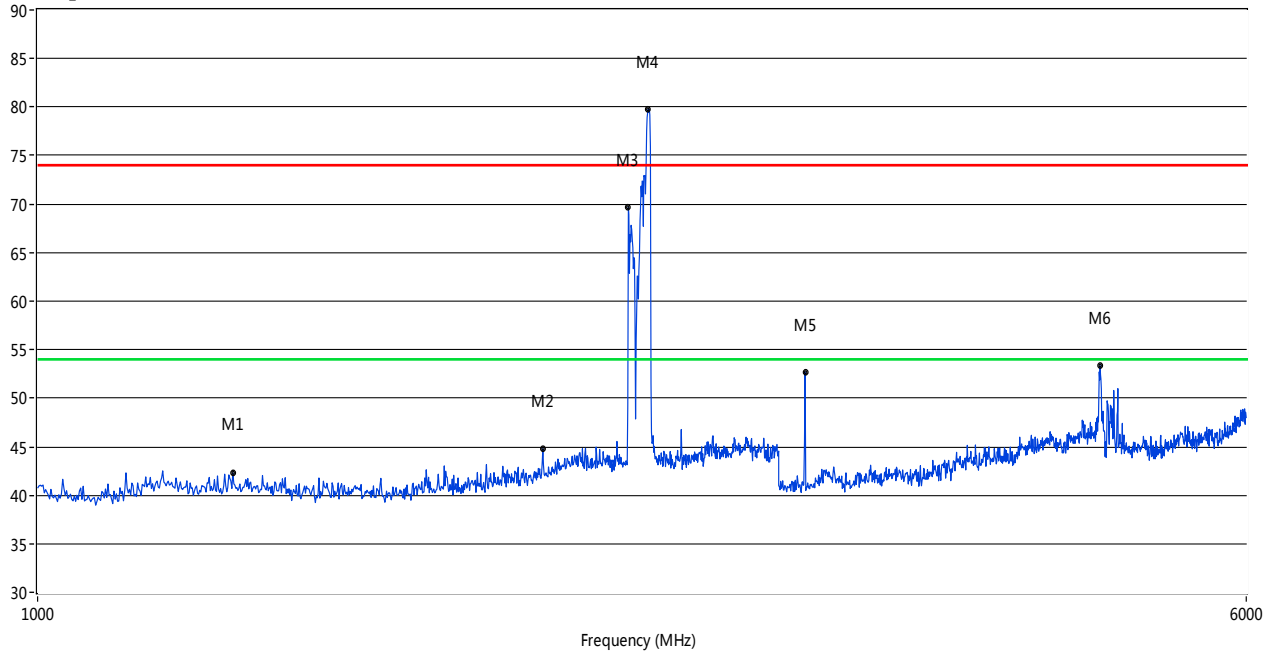
RE Test case_FCC 15C 1GHz-6GHz



Frequency (MHz)	Peak (dBuV/m)	Q-peak (dBuV/m)	Average (dBuV/m)	Factor (dB)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Table (o)	Height (cm)	ANT	Verdict
1295.70	46.44			-4.17	74.0	--	54.0	7.56	75.70	100	Vertical	PASS
2164.84	50.83			-1.25	74.0	--	54.0	3.17	142.20	100	Vertical	PASS
2400.60	67.70			-0.67	74.0	--	54.0	-13.70	219.40	100	Vertical	N/A
2470.53	72.90			-0.41	74.0	--	54.0	-18.90	173.50	100	Vertical	N/A
2598.40	51.37			0.28	74.0	--	54.0	2.63	107.70	100	Vertical	PASS
3119.88	45.19			7.97	74.0	--	54.0	8.81	290.60	100	Vertical	PASS

Π/4-DQPSK MODE 1GHz to 6GHz, ANT H

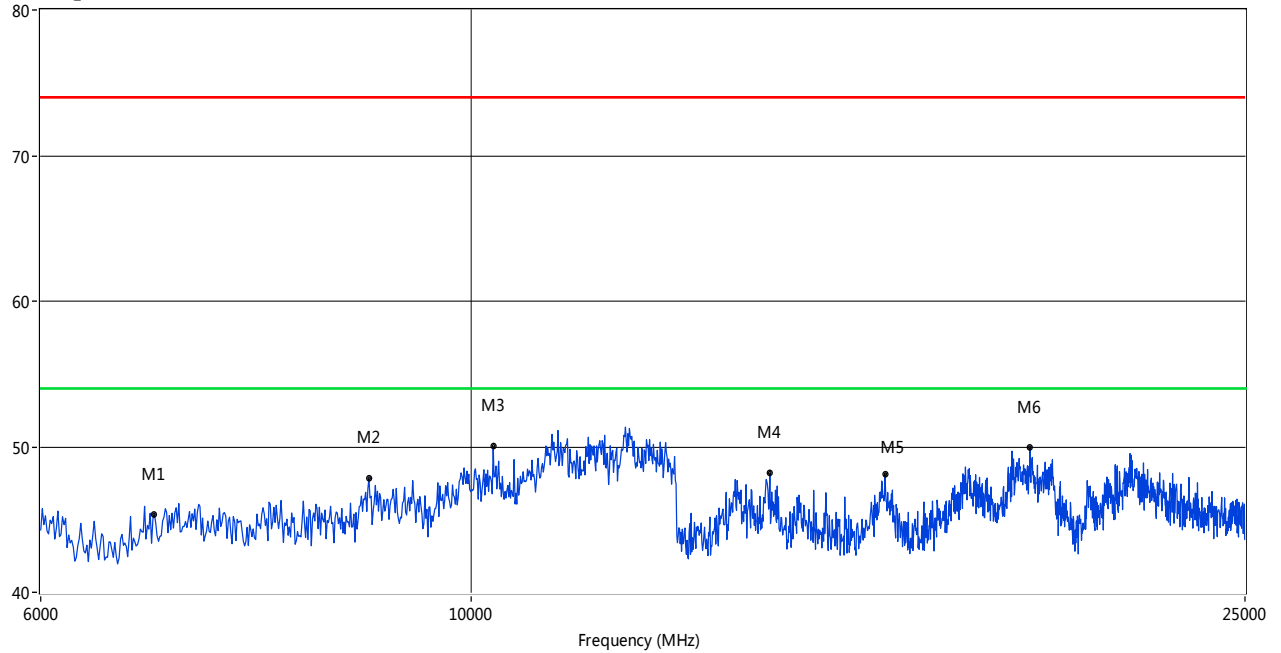
RE Test case_FCC 15C 1GHz-6GHz



Frequency (MHz)	Peak (dBuV/m)	Q-peak (dBuV/m)	Average (dBuV/m)	Factor (dB)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Table (o)	Height (cm)	ANT	Verdict
1335.66	42.32			-4.19	74.0	--	54.0	11.68	332.20	100	Horizontal	PASS
2114.89	44.79			-1.69	74.0	--	54.0	9.21	130.90	100	Horizontal	PASS
2400.60	69.69			-0.67	74.0	--	54.0	-15.69	248.60	100	Horizontal	N/A
2472.53	79.81			-0.47	74.0	--	54.0	-25.81	217.00	100	Horizontal	N/A
3119.88	52.70			7.97	74.0	--	54.0	1.30	99.30	100	Horizontal	PASS
4831.17	53.35			12.87	74.0	--	54.0	0.65	48.30	100	Horizontal	PASS

Π/4-DQPSK MODE 6GHz to 25GHz, ANT V

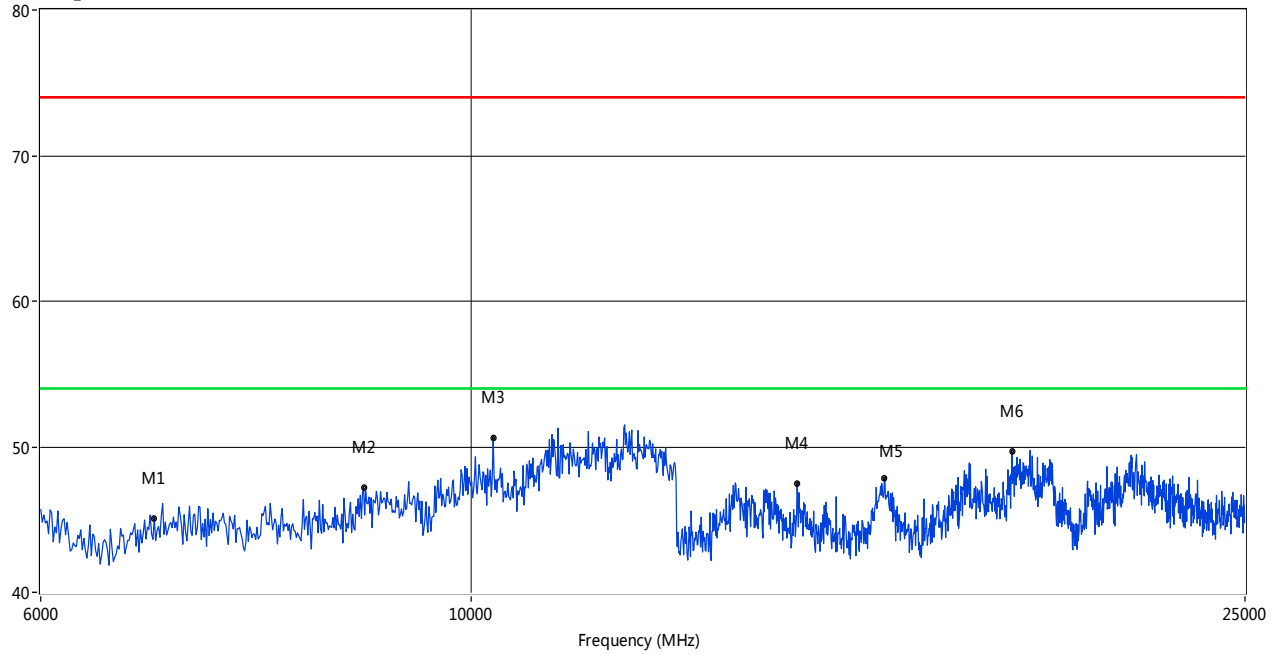
RE Test case_FCC 15C 6GHz-25GHz



Frequency (MHz)	Peak (dBuV/m)	Q-peak (dBuV/m)	Average (dBuV/m)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	ANT	Verdict
6864.81	46.47			74.0	--	54.0	7.53	Vertical	PASS
8852.75	48.13			74.0	--	54.0	5.87	Vertical	PASS
10256.66	50.68			74.0	--	54.0	3.32	Vertical	PASS
14237.10	48.20			74.0	--	54.0	5.80	Vertical	PASS
16316.97	48.16			74.0	--	54.0	5.84	Vertical	PASS
19379.37	49.95			74.0	--	54.0	4.05	Vertical	PASS

Π/4-DQPSK MODE 6GHz to 25GHz, ANT H

RE Test case_FCC 15C 6GHz-25GHz



Frequency (MHz)	Peak (dBuV/m)	Q-peak (dBuV/m)	Average (dBuV/m)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	ANT	Verdict
6864.81	46.47			74.0	--	54.0	7.53	Horizontal	PASS
8796.59	47.20			74.0	--	54.0	6.80	Horizontal	PASS
10256.66	50.68			74.0	--	54.0	3.32	Horizontal	PASS
14705.08	47.47			74.0	--	54.0	6.53	Horizontal	PASS
16306.57	47.81			74.0	--	54.0	6.19	Horizontal	PASS
18968.80	49.65			74.0	--	54.0	4.35	Horizontal	PASS

A.9 Band Edge

Test Data

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

The test data all are tested in the vertical and horizontal antenna which the trace is max hold. So these plots are show the worst case.

Test Plots

GFSK LOW CHANNEL , PEAK

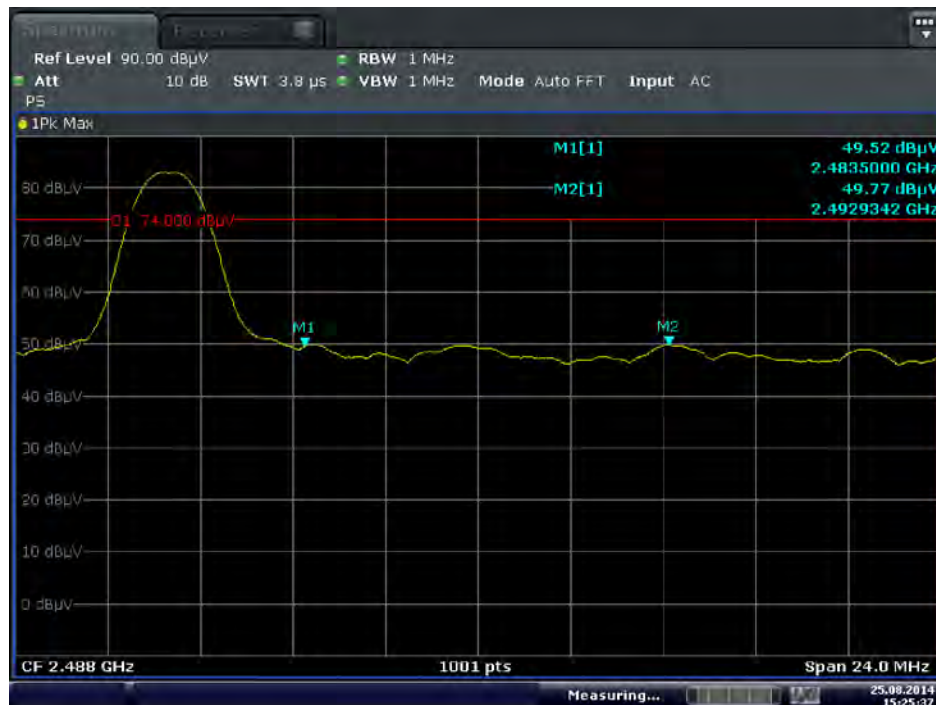


GFSK LOW CHANNEL , AVERAGE



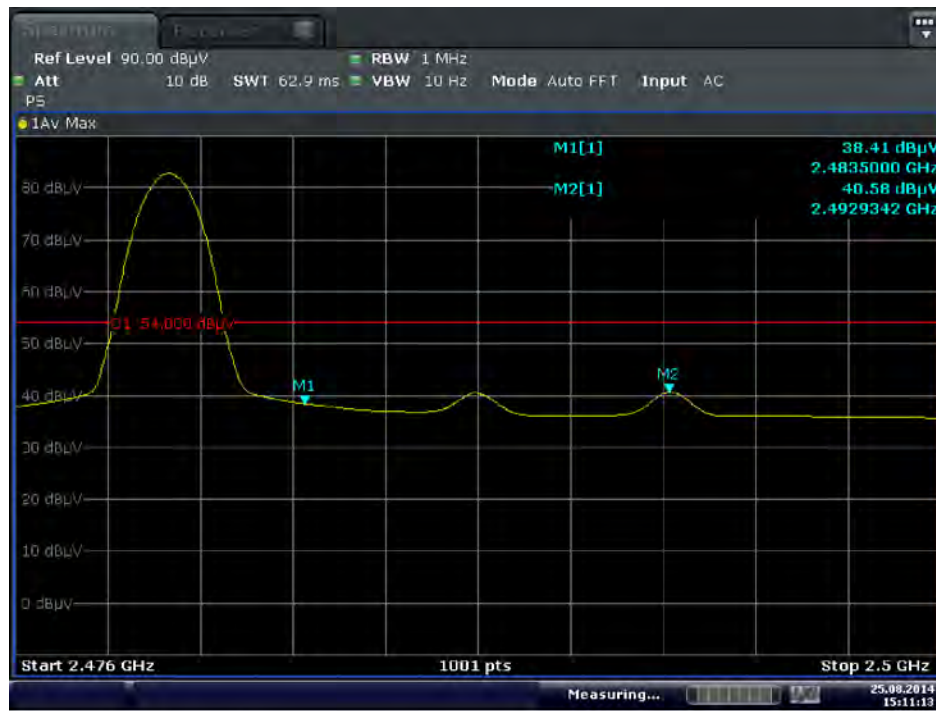
Date: 25.AUG.2014 15:04:48

GFSK HIGH CHANNEL , PEAK



Date: 25.AUG.2014 15:25:37

GFSK HIGH CHANNEL, AVERAGE



π /4DQPSK LOW CHANNEL , PEAK



π /4DQPSK LOW CHANNEL, AVERAGE



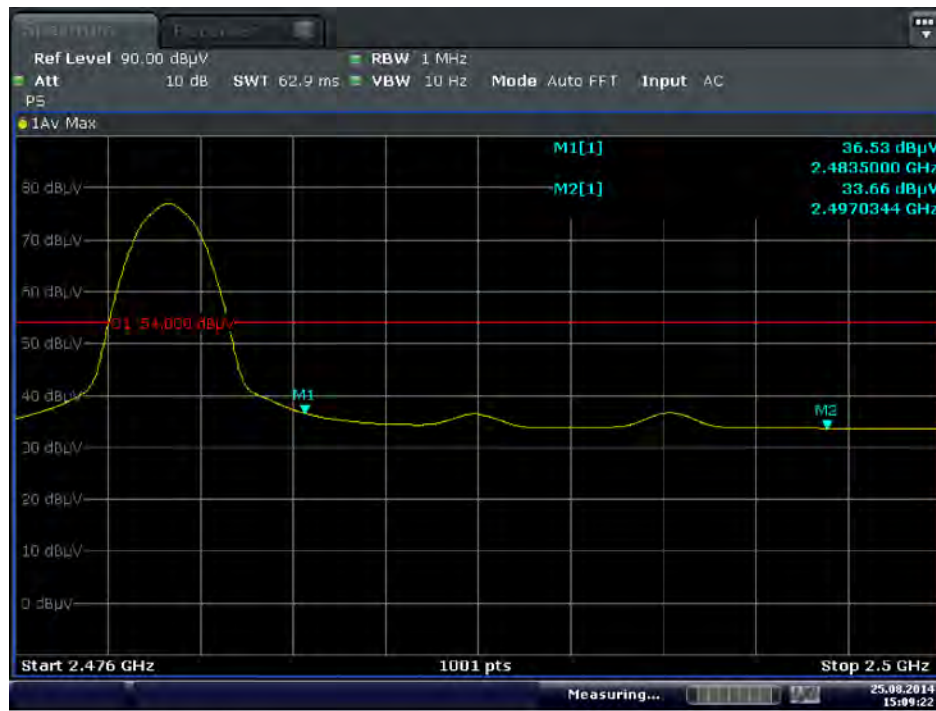
Date: 25.AUG.2014 15:06:43

π /4DQPSK HIGH CHANNEL, PEAK



Date: 25.AUG.2014 15:23:59

π /4DQPSK HIGH CHANNEL, AVERAGE



Date: 25.AUG.2014 15:09:22

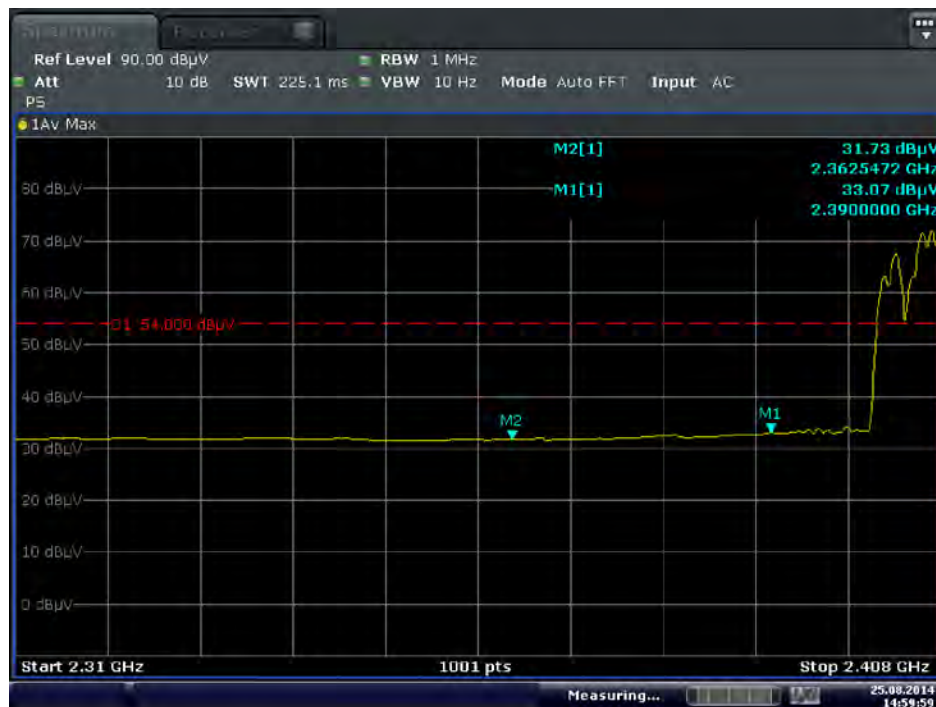
Hopping Mode:

GFSK LOW FREQUENCY BAND, PEAK



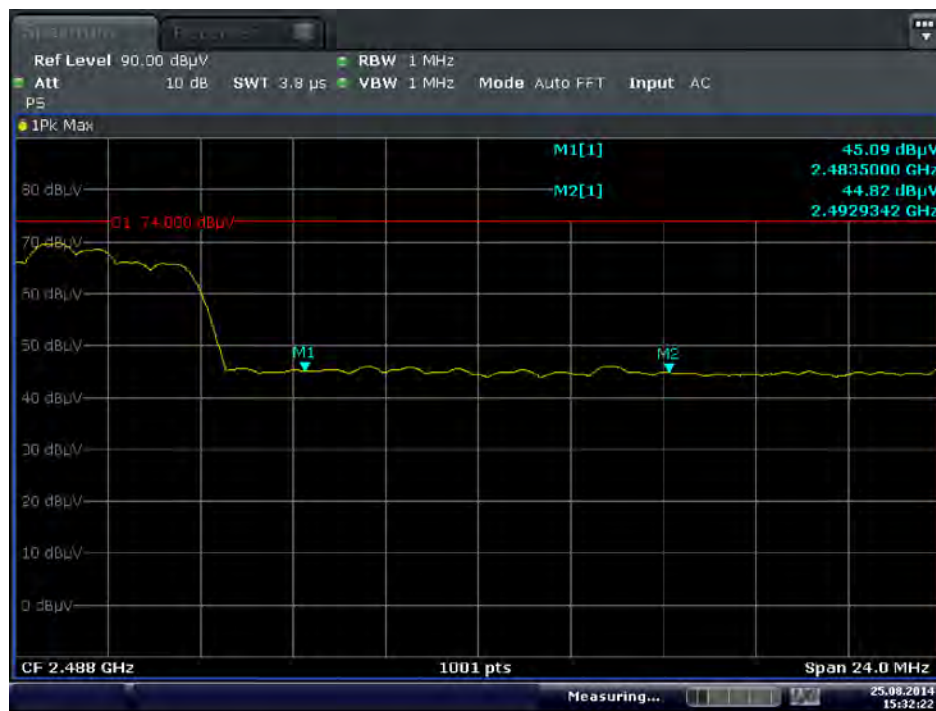
Date: 25.AUG.2014 14:51:47

GFSK LOW FREQUENCY BAND, AVERAGE



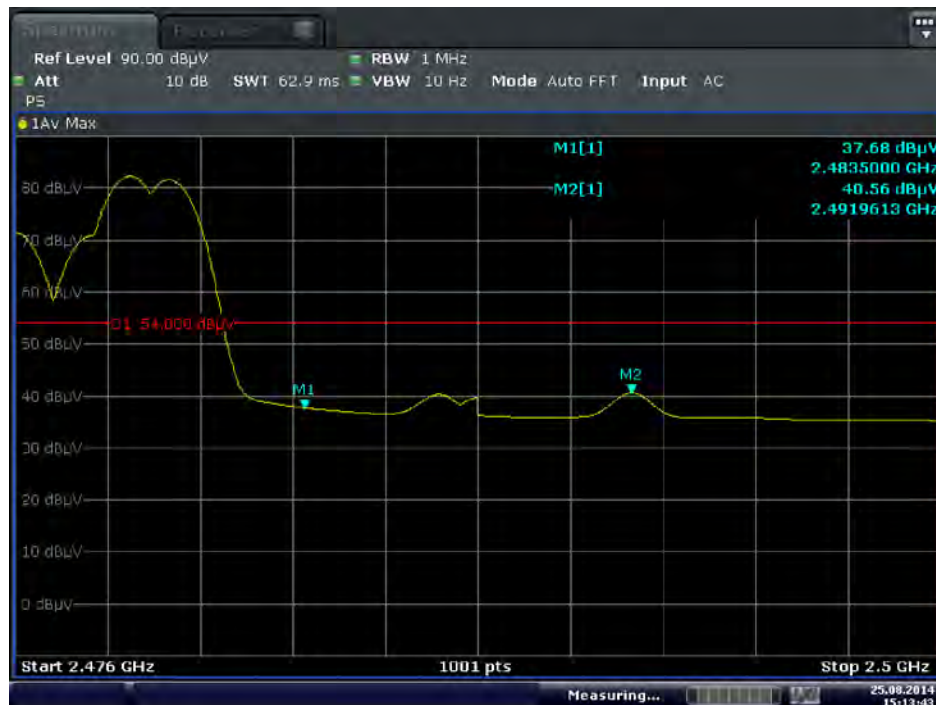
Date: 25.AUG.2014 15:00:00

GFSK HIGH FREQUENCY BAND, PEAK



Date: 25.AUG.2014 15:32:23

GFSK HIGH FREQUENCY BAND, AVERAGE

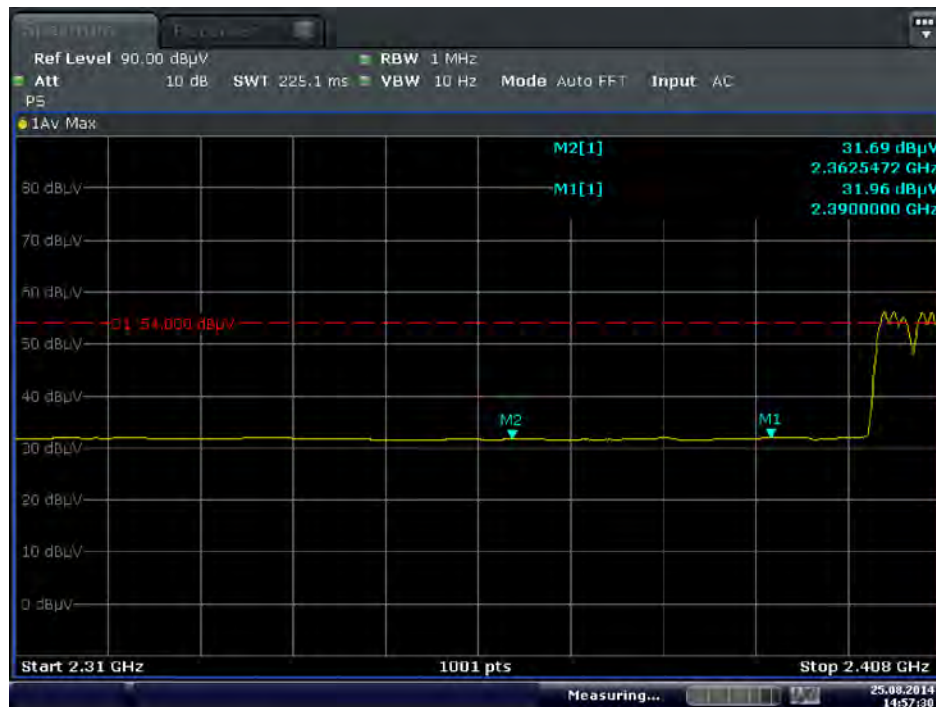


Date: 25.AUG.2014 15:13:43

π /4DQPSK LOW FREQUENCY BAND, PEAK



π /4DQPSK LOW FREQUENCY BAND, AVERAGE

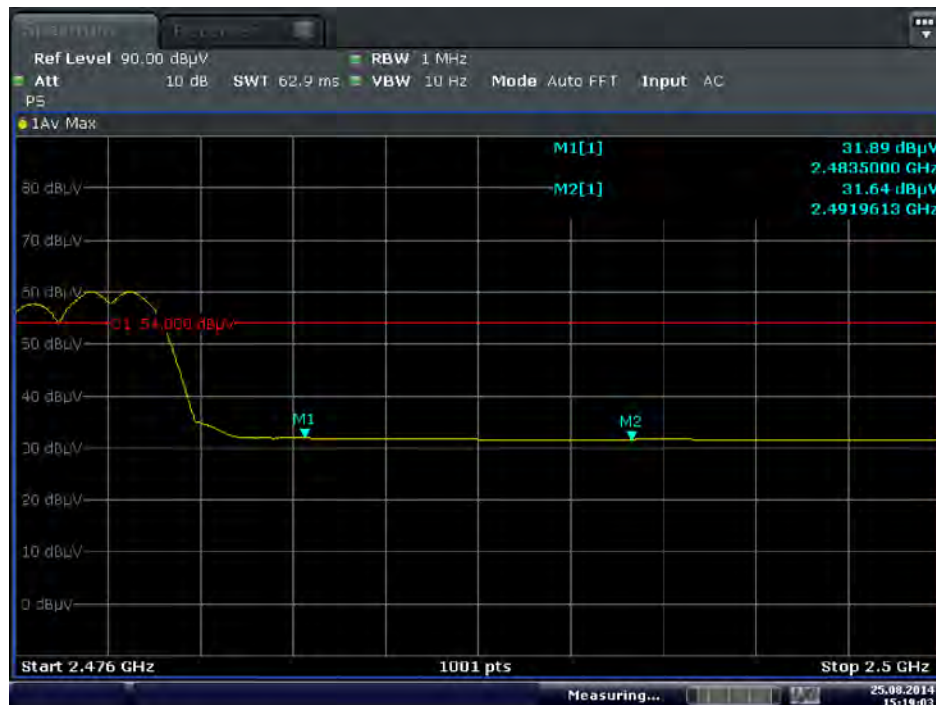


π /4DQPSK HIGH FREQUENCY BAND, PEAK



Date: 25.AUG.2014 15:35:19

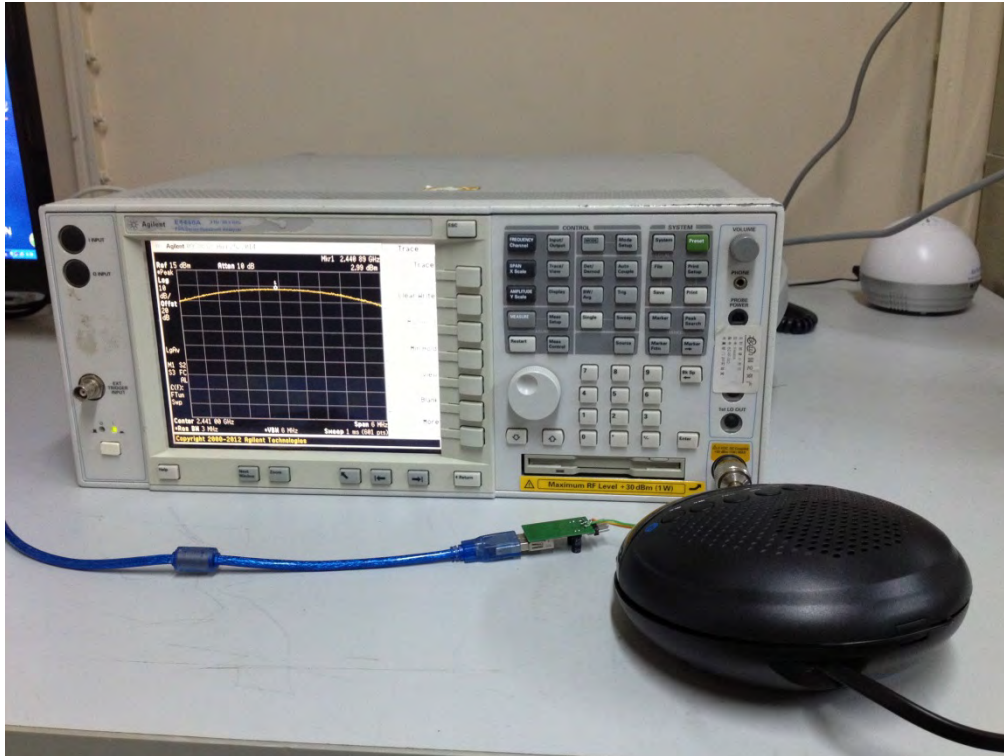
π /4DQPSK HIGH FREQUENCY BAND, AVERAGE



Date: 25.AUG.2014 15:19:04

ANNEX B TEST SETUP PHOTOS

B.1 Conducted Test Photo



B.2 Conducted Emissions Test Photo



B.3 Radiated Test Photo



Below 30MHz



30MHz to 1GHz



Above 1GHz

ANNEX C EUT PHOTOS

C.1 Appearance of the EUT



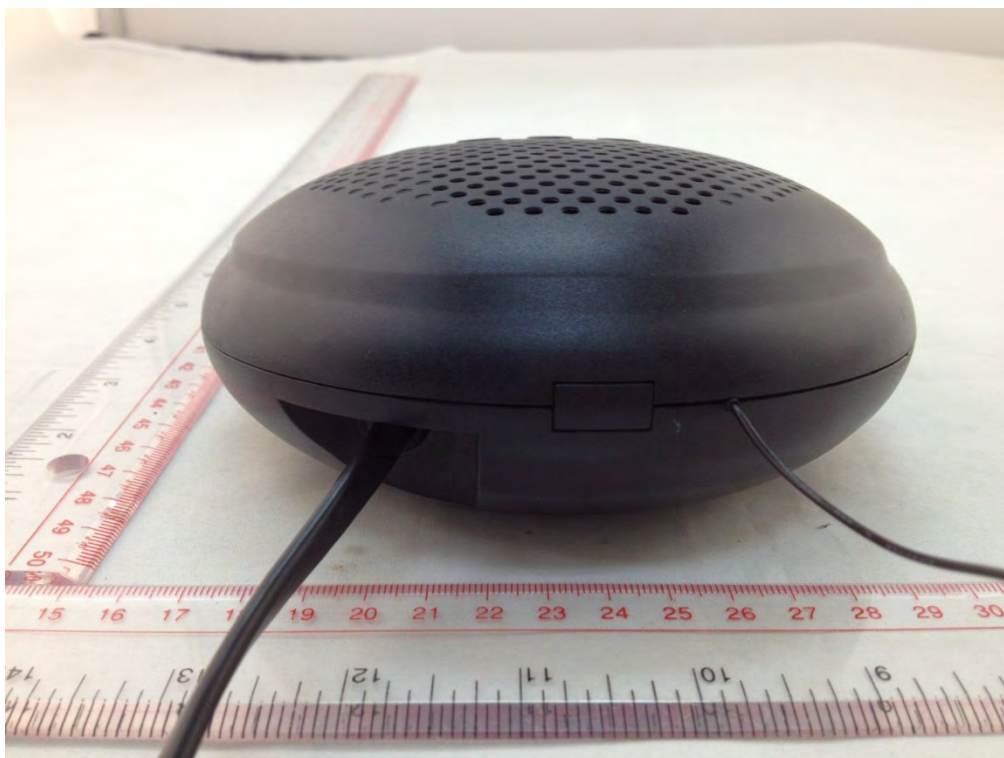
THE FRONT OF EUT



THE BACK OF EUT



THE DOWN OF EUT



THE UP OF EUT

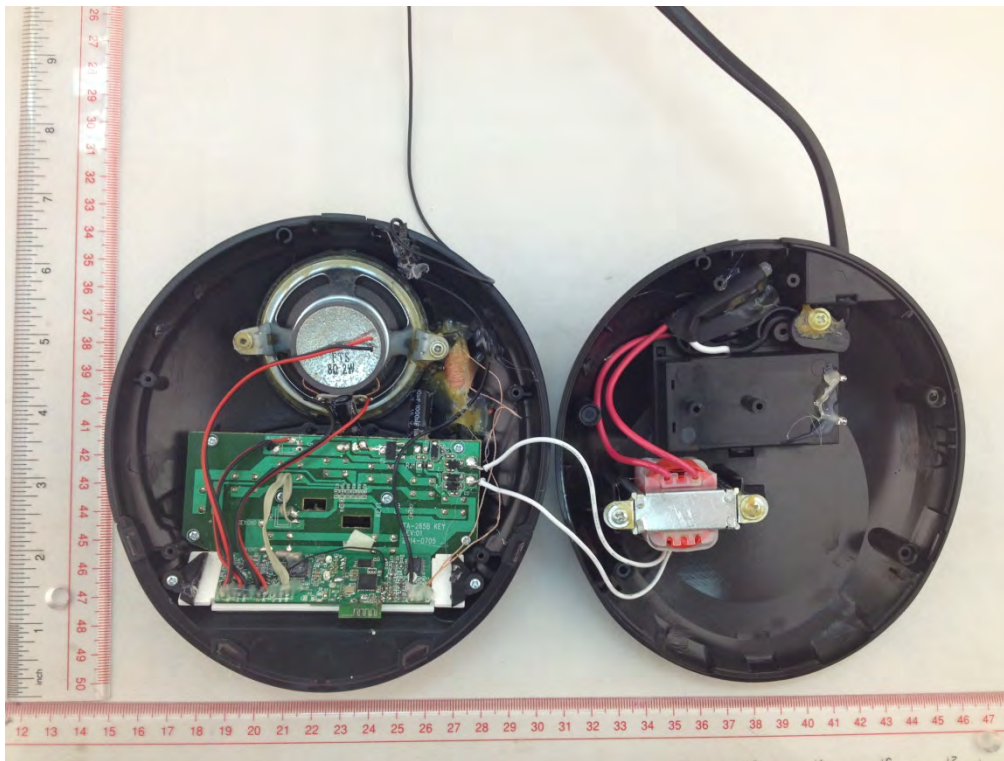


THE LEFT OF EUT

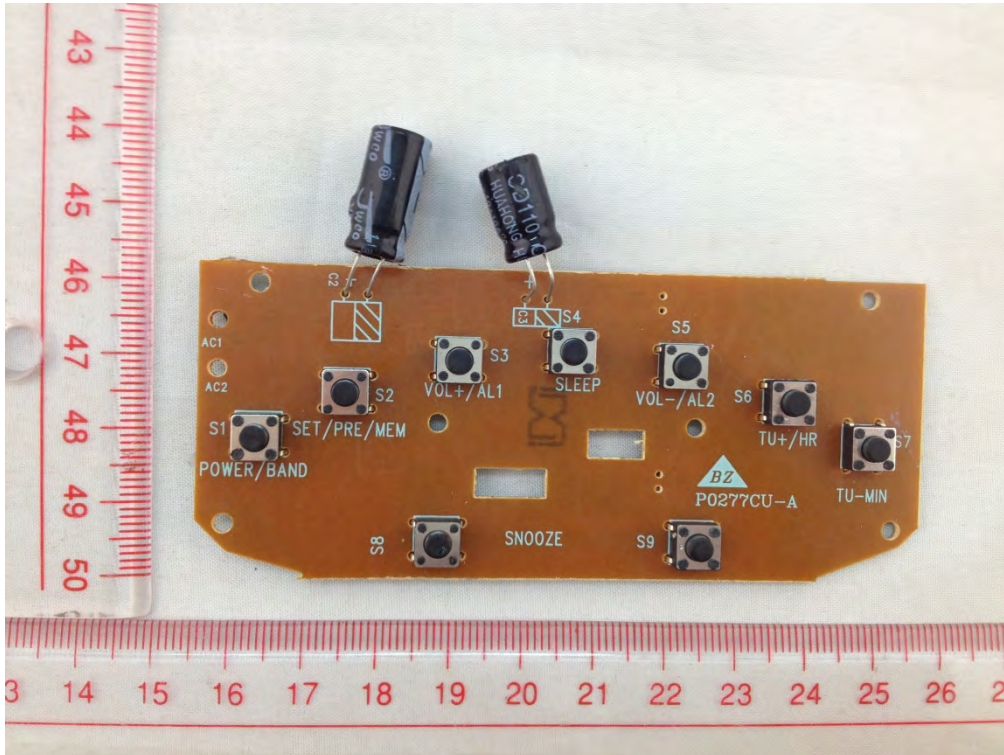


THE RIGHT OF EUT

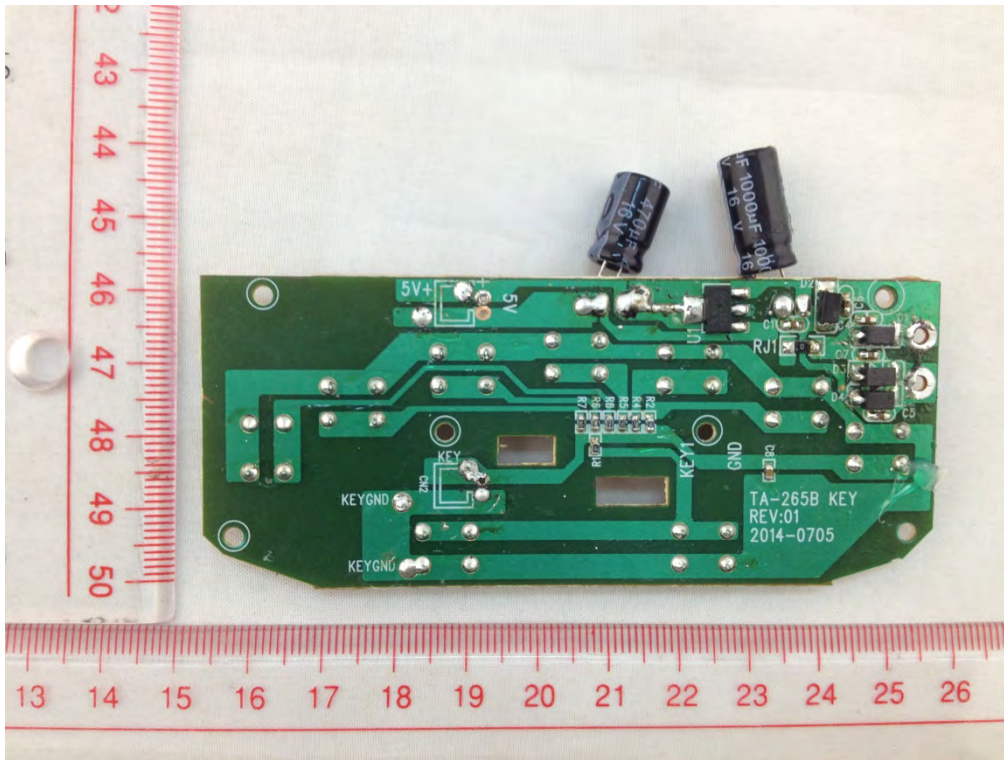
C.2 Inside of the EUT



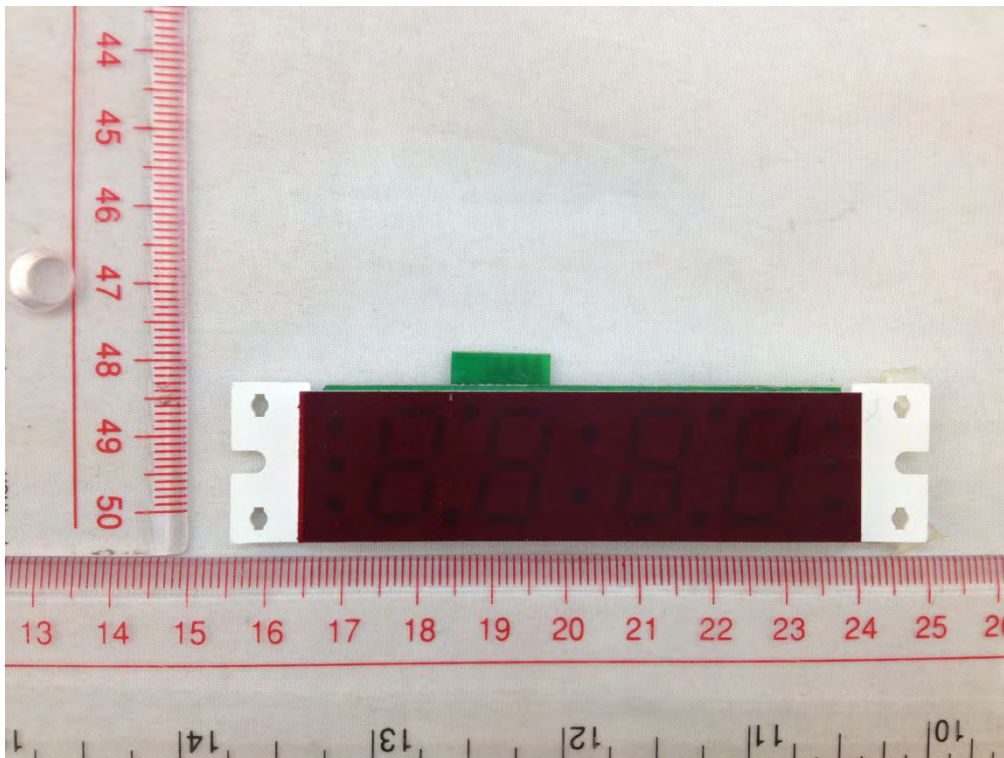
EUT UNCOVER VIEW



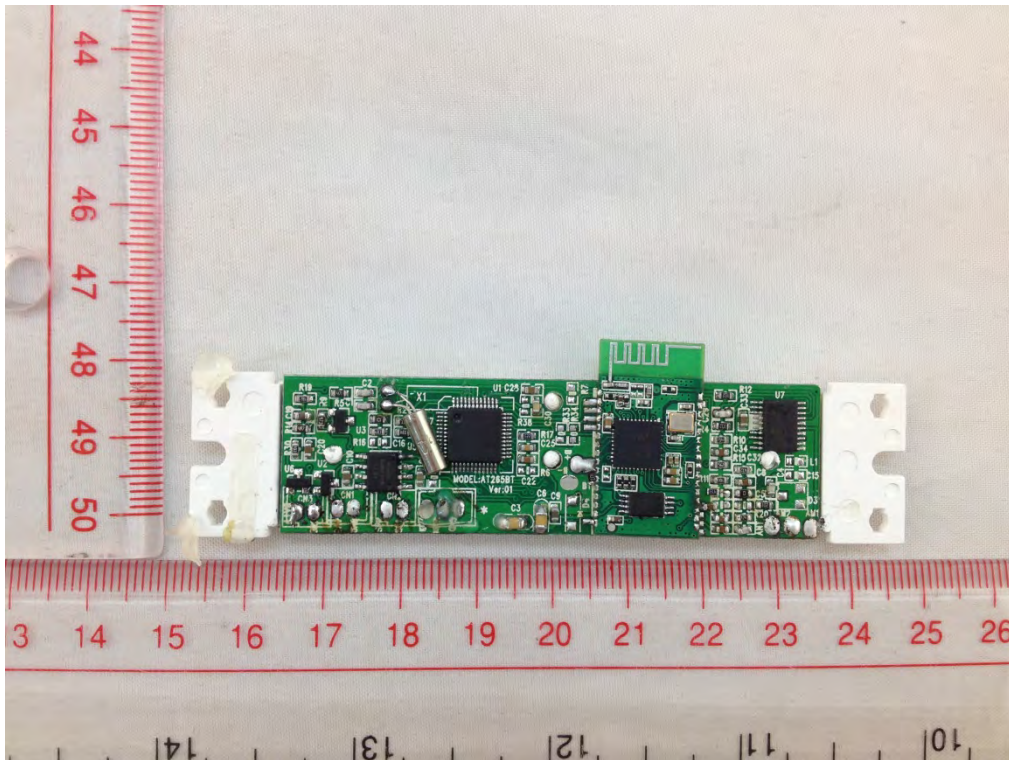
MAIN BOARD BACK VIEW 1



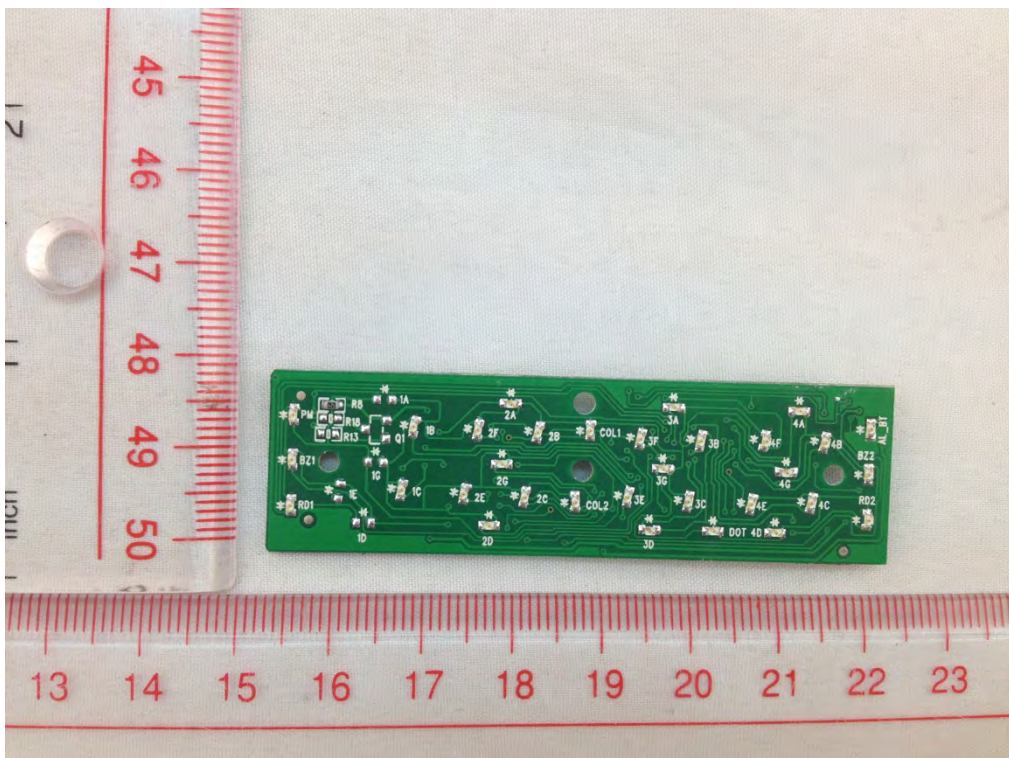
MAIN BOARD BACK VIEW 2



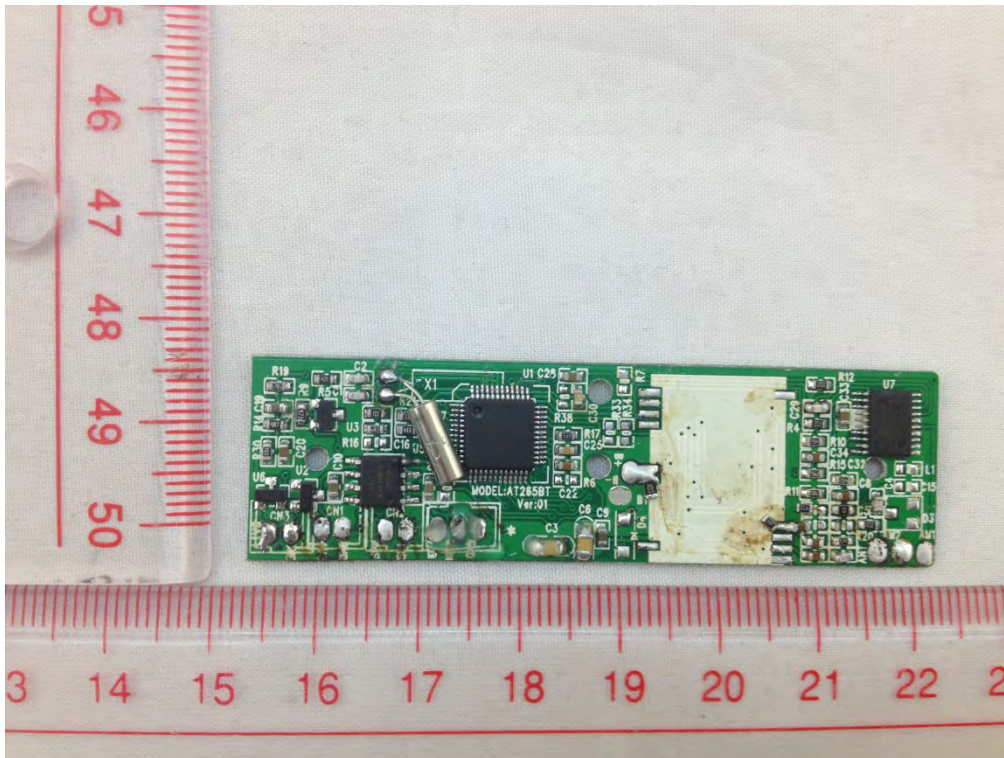
MAIN BOARD BACK VIEW 3



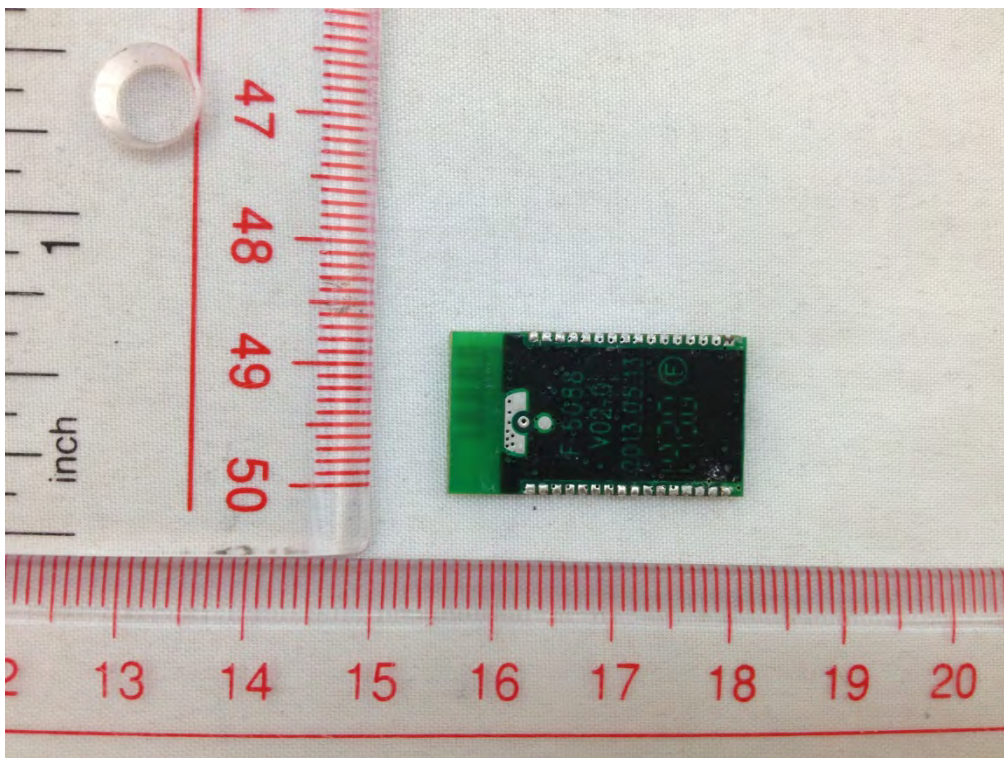
MAIN BOARD BACK VIEW 4



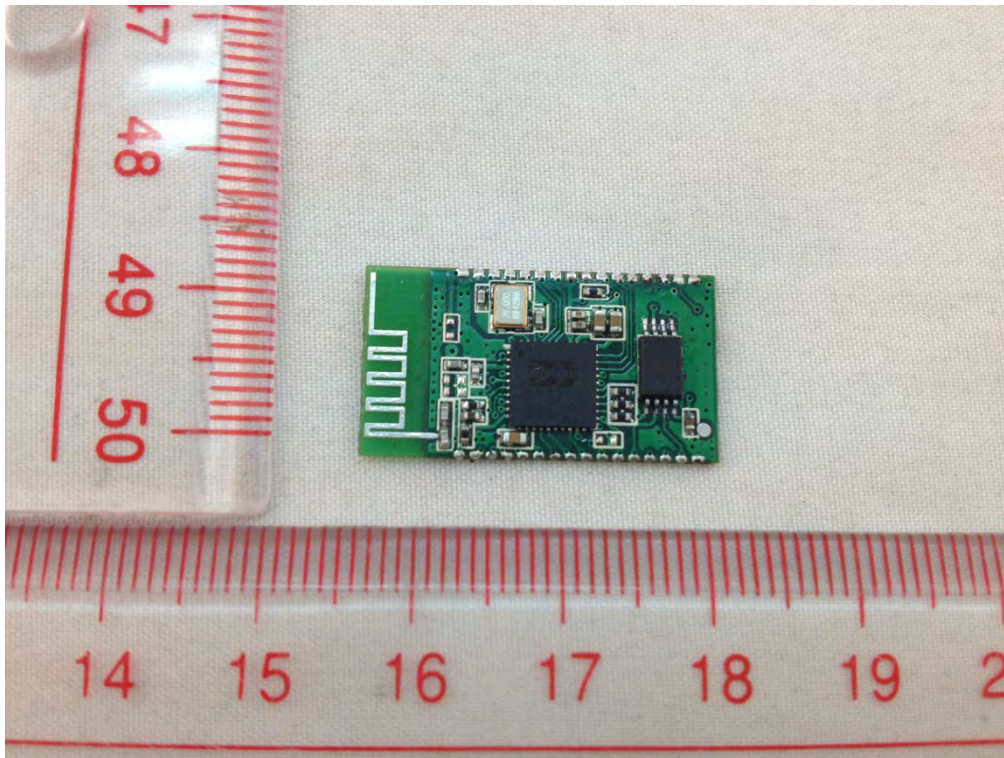
MAIN BOARD BACK VIEW 4



MAIN BOARD BACK VIEW 5



RF MODULE



RF MODULE

--END OF REPORT--