FCC

RF

TEST REPORT

ISSUED BY
Shenzhen BALUN Technology Co., Ltd.

FOR

1100-WATT 15" 2-WAY POWERED LOUDSPEAKER

ISSUED TO
inMusic Brands, Inc.

200 Scenic View Drive, Cumberland, RI 02864, U.S.A

Tested by: Cao Shaodong
Cao Shaodong
(Engineer)
Date Feb. 18, 2016

Approved by: Wei Yanquan
Wei Yanquan
(Chief Engineer)
Date Feb. 18. 2016

Report No.:	BL-SZ15C0278-601
EUT Type:	1100-WATT 15" 2-WAY POWERED LOUDSPEAKER
Model Name:	TS215W
Brand Name:	ALTO PROFESSIONAL
Test Standard:	47 CFR Part 15 Subpart C
FCC ID:	Y4O-TS215W
Test conclusion:	Pass
Test Date:	Jan. 8, 2016 ~ Feb. 18, 2016
Date of Issue:	Feb. 18, 2016

Revision History

Version	Issue Date	Revisions Content
Rev. 01	Feb. 1, 2016	Initial Issue
Rev. 02	Feb. 18, 2016	The Second 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	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 Laboratory Condition

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

1.4 Announce

(1) The test report reference to the report template version v1.0.

(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	inMusic Brands, Inc.
Address	200 Scenic View Drive, Cumberland, RI 02864, U.S.A

2.2 Manufacturer Information

Manufacturer	inMusic Brands, Inc
Address	200 Scenic View Drive, Cumberland, RI 02864, U.S.A

2.3 Factory Information

Factory	inMusic Brands, Inc
Address	200 Scenic View Drive, Cumberland, RI 02864, U.S.A

2.4 General Description for Equipment under Test (EUT)

EUT Type	1100-WATT 15" 2-WAY POWERED LOUDSPEAKER
Model Name Under Test	TS215W
Series Model Name	N/A
Description of Model name differentiation	N/A
Hardware Version	N/A
Software Version	N/A
Dimensions (Approx.)	N/A
Weight (Approx.)	N/A
Network and Wireless connectivity	Bluetooth 3.0

2.5 Ancillary Equipment

Ancillary Equipment 1	Power Line	
	Length (Approx.)	1.85 m

2.6 Technical Information

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

Modulation Technology	FHSS
Modulation Type	Bluetooth(For V3.0): GFSK, ∏/4-DQPSK, 8-DPSK
Transfer Rate	DH5: 1 Mbps 2DH5: 2 Mbps 3DH5: 3 Mbps
Frequency Range	The frequency range used is 2402 MHz – 2480 MHz; The frequency block is 2400 MHz to 2483.5 MHz.
Number of channel	Bluetooth(For V3.0): 79 (at intervals of 1 MHz)
Tested Channel	Bluetooth(For V3.0): 0 (2402 MHz), 39 (2441 MHz), 78 (2480 MHz)
Antenna Type	PIFA Antenna
Antenna Gain	0 dBi (All involve the antenna gain test item, has been included in the final results)
About the Product	Only the Bluetooth 3.0 was tested in this report.

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	KDB Publication 558074 D01v03r03	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247
4	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
5	ANSI C63.10-2013	American National Standard for Testing Unlicensed Wireless Devices

3.2 Verdict

No.	Description	FCC Part No.	IC Part No.	Channel (BT for V3.0)	Channel (BLE)	Test Result	Remark
1	Antenna Requirement	15.203	RSS-247, 5.4 (6)	N/A	N/A	--	Note1
2	Number of Hopping Frequencies	15.247(a)	RSS-247, 5.1 (4)	Hopping Mode	N/A	ANNEX A.1	Note3
3	Peak Output Power	15.247(b)	RSS-247, 5.4 (2)	Low/Middle/High	N/A	ANNEX A.2	
4	Occupied Bandwidth	15.247(a)	RSS-247, 5.1(1); RSS-GEN, 6.6; RSS-247, 5.2 (1)	Low/Middle/High	N/A	ANNEX A.3	
5	Carrier Frequency Separation	15.247(a)	RSS-247, 5.1 (2)	Hopping Mode	N/A	ANNEX A.4	Note3
6	Time of Occupancy (Dwell time)	15.247(a)	RSS-247, 5.1 (4)	Hopping Mode	N/A	ANNEX A.5	Note3
7	Conducted Spurious Emission	15.247(d)	RSS-247, 5.5	Low/Middle/High	N/A	ANNEX A.6	
8	Conducted Emission	15.207	RSS-GEN, 8.8	Low/Middle/High	N/A	ANNEX A.7	
9	Radiated Spurious Emission	15.209 15.247(d)	RSS-247, 5.5	Hopping Mode, Low/Middle/High	N/A	ANNEX A.8	
10	Band Edge	15.209 15.247(d)	RSS-247, 5.5; RSS-GEN, 8.9	Hopping Mode, Low/ High	N/A	ANNEX A.9	
11	Power spectral density (PSD)	15.247(e)	RSS-247, 5.2 (2)	--	N/A	ANNEX A.10	Note2

Note 1: The EUT has a permanently and irreplaceable attached antenna, which complies with the requirement FCC 15.203.
Note 2: This requirement apply to the equipment is using wide band modulations other than FHSS.
Note 3: This requirement apply to the equipment is using FHSS.

4 GENERAL TEST CONFIGURATIONS

4.1 Test Environments

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

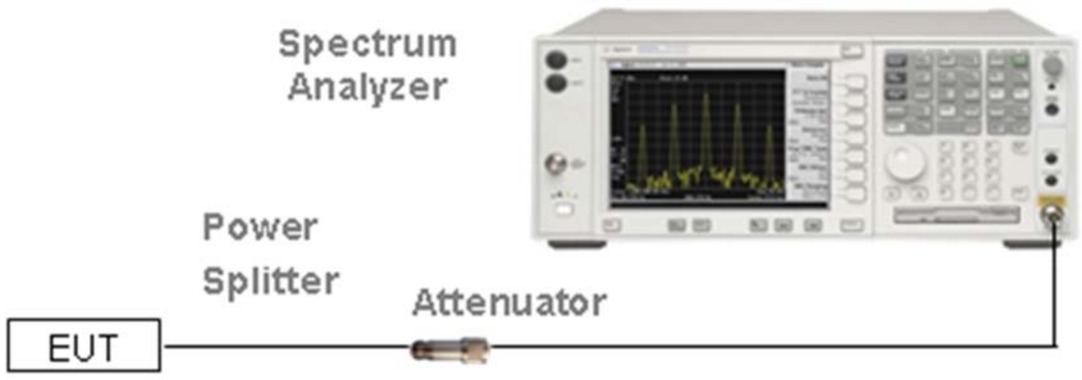
Relative Humidity	45% - 55%	
Atmospheric Pressure	100 kPa - 102 kPa	
Temperature	NT (Normal Temperature)	20℃ to +25℃
Working Voltage of the EUT	NV (Normal Voltage)	110 V

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	--	--

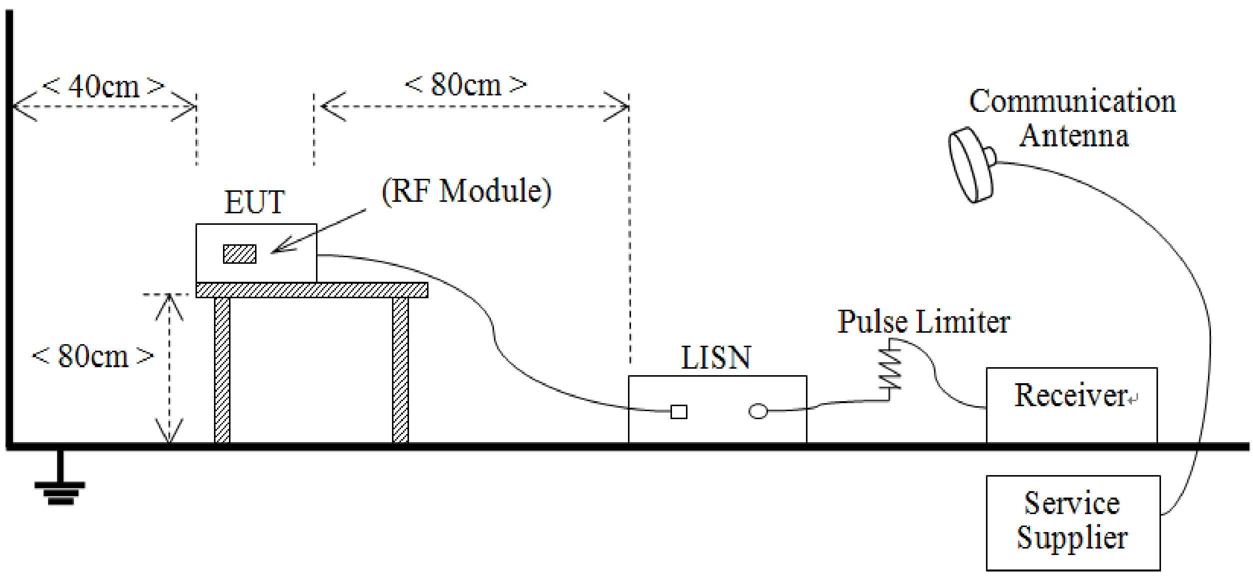
4.3 Description of Test Setup

4.3.1 For Antenna Port Test



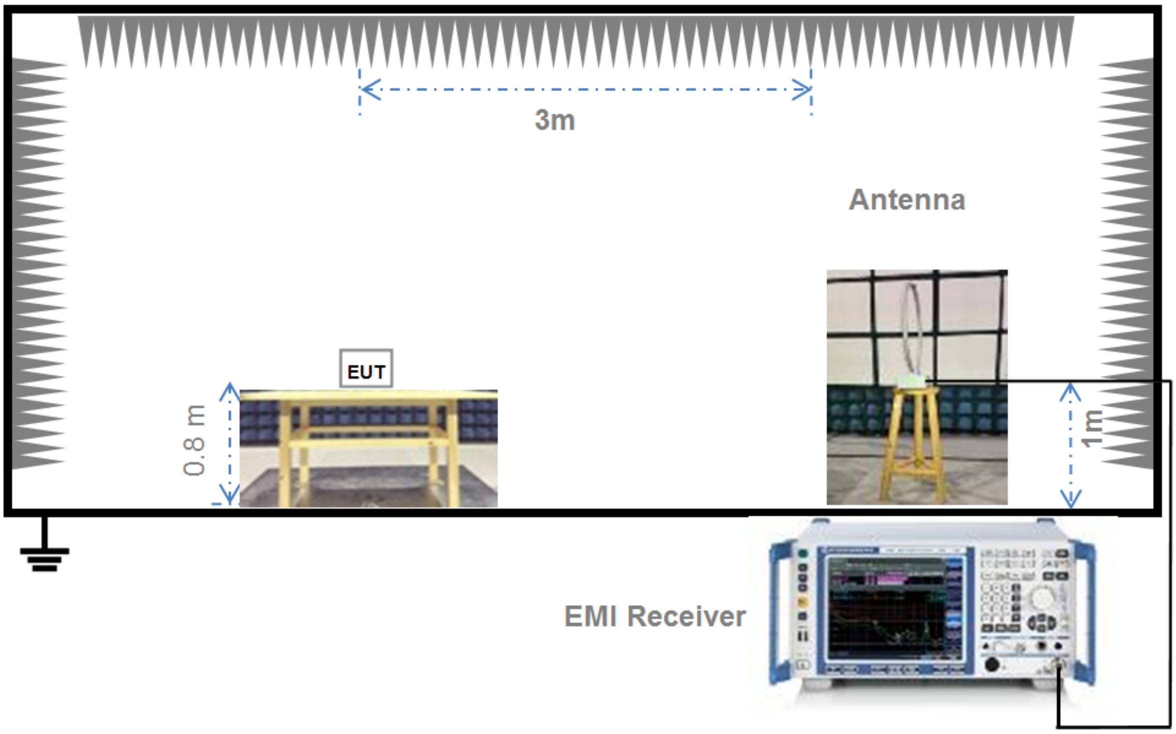
(Diagram 1)

4.3.2 For AC Power Supply Port Test



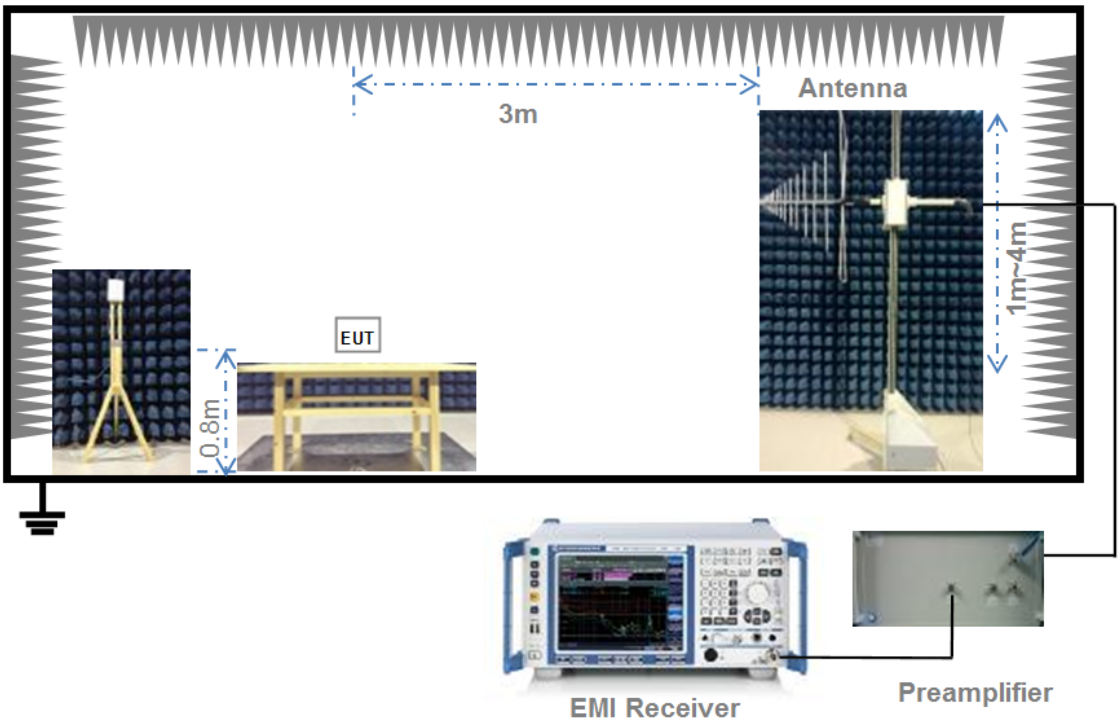
(Diagram 2)

4.3.3 For Radiated Test (Below 30 MHz)



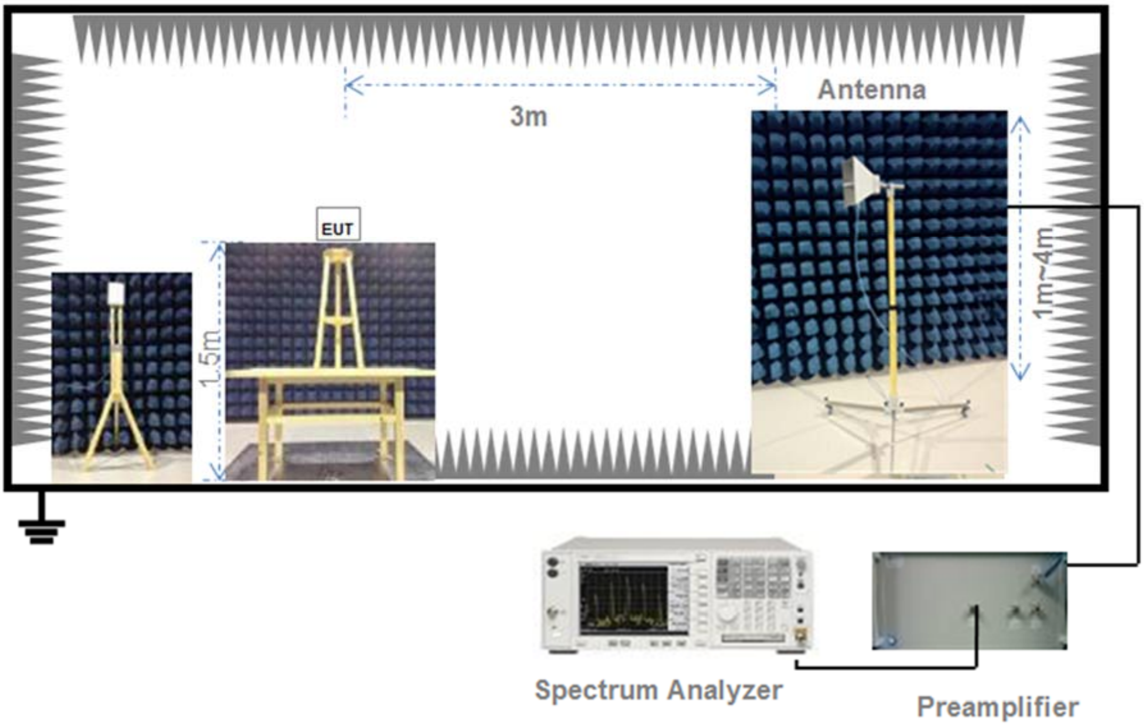
(Diagram 3)

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:

<u>This method apply to the equipment is using FHSS</u>
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 (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 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 (dBuV/m)
<u>This Method apply to the equipment is using wide band modulations other than FHSS.</u>

E = EIRP – 20log D + 104.8

where:

E = electric field strength in dBµV/m,

EIRP = equivalent isotropic radiated power in dBm

D = specified measurement distance in meters.

EIRP= Measure Conducted output power Value (dBm) + Maximum transmit antenna gain (dBi) + the appropriate maximum ground reflection factor (dB)

5 TEST ITEMS

5.1 Antenna Requirements

5.1.1 Standard Applicable

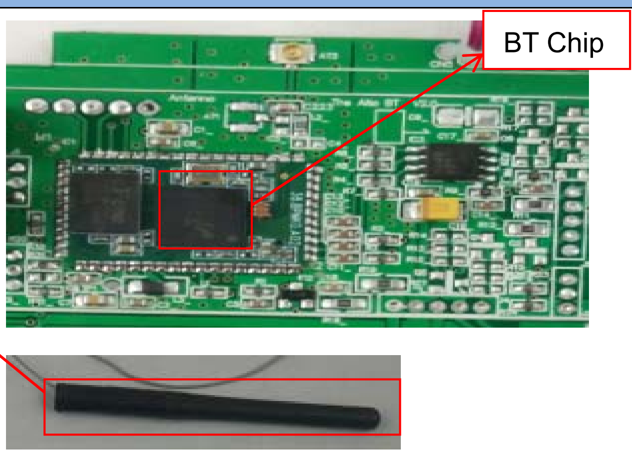
FCC §15.203 & 15.247(b); RSS-247, 5.4 (6)
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator 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

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 Frequencies

5.2.1 Limit

FCC §15.247(a) (1) (iii); RSS-247, 5.1 (4)

This limit apply to the equipment is using FHSS

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

This method apply to the equipment is using FHSS

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

Span = the frequency band of operation

RBW ≥ 1% of the span

VBW ≥ 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); RSS-247, 5.4 (2); RSS-247, 5.4 (4)

This limit apply to the equipment is using FHSS

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.

This limit apply to the equipment is using wide band modulations other than FHSS.

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements.

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

This method apply to the equipment is using FHSS

The 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 ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize.

This Method apply to the equipment is using wide band modulations other than FHSS.

a) Maximum peak conducted output power

This procedure shall be used when the measurement instrument has available a resolution bandwidth that is greater than the DTS bandwidth.

Set the RBW ≥ DTS bandwidth.

Set VBW ≥ 3 x RBW.

Set span ≥ 3 x RBW

Sweep time = auto couple.

Detector = peak.

Trace mode = max hold.

Allow trace to fully stabilize.

Use peak marker function to determine the peak amplitude level.

b) Measurements of duty cycle

The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal.

Set the center frequency of the instrument to the center frequency of the transmission.

Set RBW ≥ OBW if possible; otherwise, set RBW to the largest available value.

Set VBW ≥ RBW. Set detector = peak or average.

The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if T ≤ 16.7 microseconds.)

5.3.4 Test Result

Please refer to ANNEX A.2.

5.4 Occupied Bandwidth

5.4.1 Limit

FCC §15.247(a); RSS-247, 5.1 (1); RSS-GEN, 6.6

This limit apply to the equipment is using FHSS

The 20 dB bandwidth is known as the 99% emission bandwidth, or 20 dB bandwidth (10*log1%=20 dB) taking the total RF output power.

This limit apply to the equipment is using wide band modulations other than FHSS.

Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. In order to make an accurate measurement, set the span greater than RBW. The 6 dB bandwidth must be greater than 500 kHz.

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

This method apply to the equipment is using FHSS

Use the following spectrum analyzer settings:

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

RBW ≥ 1% of the 20 dB bandwidth

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

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

This Method apply to the equipment is using wide band modulations other than FHSS.

Use the following spectrum analyzer settings:

Set RBW = 100 kHz.

Set the video bandwidth (VBW) ≥ 3 RBW.

Detector = Peak.

Trace mode = max hold.

Sweep = auto couple.

Allow the trace to stabilize.

Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

5.4.4 Test Result

Please refer to ANNEX A.3.

5.5 Carrier Frequency Separation

5.5.1 Limit

FCC §15.247(a); RSS-247, 5.1 (2)

This limit apply to the equipment is using FHSS.

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

This method apply to the equipment is using FHSS.

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) ≥ 1% of the span

Video (or Average) Bandwidth (VBW) ≥ 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); RSS-247, 5.1 (4)

This limit apply to the equipment is using FHSS.

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

This method apply to the equipment is using FHSS.

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

For DH1 package type

{Total of Dwell} = {Pulse Time} * (1600 / 2) / {Number of Hopping Frequency} * {Period}

{Period} = 0.4 s * {Number of Hopping Frequency}

For DH3 package type

{Total of Dwell} = {Pulse Time} * (1600 / 4) / {Number of Hopping Frequency} * {Period}

{Period} = 0.4 s * {Number of Hopping Frequency}

For DH5 package type

{Total of Dwell} = {Pulse Time} * (1600 / 6) / {Number of Hopping Frequency} * {Period}

{Period} = 0.4 s * {Number of Hopping Frequency}

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.

5.6.4 Test Result

Please refer to ANNEX A.5

5.7 Conducted Spurious Emission

5.7.1 Limit

FCC §15.247(d); RSS-247, 5.5

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

This Method apply to the equipment is using FHSS.

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 ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold
Allow the trace to stabilize
This Method apply to the equipment is using wide band modulations other than FHSS.

The DTS rules specify that in any 100 kHz bandwidth outside of the authorized frequency band, the power shall be attenuated according to the following conditions:

a) If the maximum peak conducted output power procedure was used to demonstrate compliance as described in 9.1, then the peak output power measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz (i.e., 20 dBc).

b) If maximum conducted (average) output power was used to demonstrate compliance as described in 9.2, then the peak power in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum in-band peak PSD level in 100 kHz (i.e., 30 dBc).

c) In either case, attenuation to levels below the 15.209 general radiated emissions limits is not required.

The following procedures shall be used to demonstrate compliance to these limits. Note that these procedures can be used in either an antenna-port conducted or radiated test set-up. Radiated tests must conform to the test site requirements and utilize maximization procedures defined herein.

Reference level measurement:

Establish a reference level by using the following procedure:

Set instrument center frequency to DTS channel center frequency.

Set the span to ≥ 1.5 times the DTS bandwidth.

Set the RBW = 100 kHz.

Set the VBW ≥ 3 x RBW.

Detector = peak.

Sweep time = auto couple.

Trace mode = max hold.

Allow trace to fully stabilize.

Use the peak marker function to determine the maximum PSD level.

Emission level measurement:

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.

Set the RBW = 100 kHz.

Set the VBW ≥ 3 x RBW.

Detector = peak.

Sweep time = auto couple.

Trace mode = max hold.

Allow trace to fully stabilize.

Use the peak marker function to determine the maximum amplitude level.

Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements specified in 11.1 a) or 11.1 b). Report the three highest emissions relative to the limit.

5.7.4 Test Result

Please refer to ANNEX A.6.

5.8 Conducted Emission

5.8.1 Limit

FCC §15.207; RSS-GEN, 8.8

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 50μH/50Ω line impedance stabilization network (LISN).

Frequency range (MHz)	Conducted Limit (dBμV)	
	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); RSS-GEN, 8.9; RSS-247, 5.5

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 (μV/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 (dBμV/m) = 20*log[Field Strength (μV/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: 54dBuV/m@3m (AV) and 74dBuV/m@3m (PK).

5.9.2 Test Setup

<u>This test setup apply to the equipment is using FHSS.</u>

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.

<u>This test setup apply to the equipment is using wide band modulations other than FHSS.</u>

See section 4.4.1 and 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

<u>This Method apply to the equipment is using FHSS.</u>

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 ≥ 1 GHz, 100 kHz for f < 1 GHz
VBW ≥ 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.
This Method apply to the equipment is using wide band modulations other than FHSS.

Since the emission limits are specified in terms of radiated field strength levels, measurements performed to demonstrate compliance have traditionally relied on a radiated test configuration. Radiated measurements remain the principal method for demonstrating compliance to the specified limits; however antenna-port conducted measurements are also now acceptable to demonstrate compliance (see below for details). When radiated measurements are utilized, test site requirements and procedures for maximizing and measuring radiated emissions that are described in ANSI C63.10 shall be followed.

Antenna-port conducted measurements may also be used as an alternative to radiated measurements for demonstrating compliance in the restricted frequency bands. If conducted measurements are performed, then proper impedance matching must be ensured and an additional radiated test for cabinet/case spurious emissions is required.

General Procedure for conducted measurements in restricted bands:

a) Measure the conducted output power (in dBm) using the detector specified (see guidance regarding measurement procedures for determining quasi-peak, peak, and average conducted output power, respectively).

b) Add the maximum transmit antenna gain (in dBi) to the measured output power level to determine the EIRP level (see guidance on determining the applicable antenna gain)

c) Add the appropriate maximum ground reflection factor to the EIRP level (6 dB for frequencies ≤ 30 MHz, 4.7 dB for frequencies between 30 MHz and 1000 MHz, inclusive and 0 dB for frequencies > 1000 MHz).

d) For devices with multiple antenna-ports, measure the power of each individual chain and sum the EIRP of all chains in linear terms (e.g., Watts, mW).

e) Convert the resultant EIRP level to an equivalent electric field strength using the following relationship:

E = EIRP – 20log D + 104.8

where:

E = electric field strength in dBμV/m,

EIRP = equivalent isotropic radiated power in dBm

D = specified measurement distance in meters.

f) Compare the resultant electric field strength level to the applicable limit.

g) Perform radiated spurious emission test.

Quasi-Peak measurement procedure

The specifications for measurements using the CISPR quasi-peak detector can be found in Publication 16 of the International Special Committee on Radio Frequency Interference (CISPR) of the International Electrotechnical Commission.

As an alternative to CISPR quasi-peak measurement, compliance can be demonstrated to the applicable emission limits using a peak detector.

Peak power measurement procedure:

Peak emission levels are measured by setting the instrument as follows:

a) RBW = as specified in Table 1.

b) VBW ≥ 3 x RBW.

c) Detector = Peak.

d) Sweep time = auto.

e) Trace mode = max hold.

f) Allow sweeps to continue until the trace stabilizes. (Note that the required measurement time may be longer for low duty cycle applications).

Table 1—RBW as a function of frequency

Frequency	RBW
9-150 kHz	200-300 Hz
0.15-30 MHz	9-10 kHz
30-1000 MHz	100-120 kHz
> 1000 MHz	1 MHz

If the peak-detected amplitude can be shown to comply with the average limit, then it is not necessary to perform a separate average measurement.

Trace averaging across on and off times of the EUT transmissions followed by duty cycle correction:

If continuous transmission of the EUT (i.e., duty cycle ≥ 98 percent) cannot be achieved and the duty cycle is constant (i.e., duty cycle variations are less than ± 2 percent), then the following procedure shall be used:

a) The EUT shall be configured to operate at the maximum achievable duty cycle.

b) Measure the duty cycle, x, of the transmitter output signal as described in section 6.0.

c) RBW = 1 MHz (unless otherwise specified).

d) VBW ≥ 3 x RBW.

e) Detector = RMS, if span/(# of points in sweep) ≤ (RBW/2). Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If this condition cannot be satisfied, then the detector mode shall be set to peak.

f) Averaging type = power (i.e., RMS).

1) As an alternative, the detector and averaging type may be set for linear voltage averaging.

2) Some instruments require linear display mode in order to use linear voltage averaging. Log or dB averaging shall not be used.

g) Sweep time = auto.

h) Perform a trace average of at least 100 traces.

i) A correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 percent duty cycle. The correction factor is computed as follows:

1) If power averaging (RMS) mode was used in step f), then the applicable correction factor is 10 log(1/x), where x is the duty cycle.

2) If linear voltage averaging mode was used in step f), then the applicable correction factor is 20 log(1/x), where x is the duty cycle.

3) If a specific emission is demonstrated to be continuous (≥ 98 percent duty cycle) rather than turning on and off with the transmit cycle, then no duty cycle correction is required for that emission.

NOTE: Reduction of the measured emission amplitude levels to account for operational duty factor is not permitted. Compliance is based on emission levels occurring during transmission - not on an average across on and off times of the transmitter.

Determining the applicable transmit antenna gain:

A conducted power measurement will determine the maximum output power associated with a restricted band emission; however, in order to determine the associated EIRP level, the gain of the transmitting antenna (in dBi) must be added to the measured output power (in dBm).

Since the out-of-band characteristics of the EUT transmit antenna will often be unknown, the use of a conservative antenna gain value is necessary. Thus, when determining the EIRP based on the measured conducted power, the upper bound on antenna gain for a device with a single RF output shall be selected as the maximum in-band gain of the antenna across all operating bands, or 2 dBi, whichever is greater. However, for devices that operate in multiple frequency bands while using the same transmit antenna, the highest gain of the antenna within the operating band nearest in frequency to the restricted band emission being measured may be used in lieu of the overall highest gain when the emission is at a frequency that is within 20 percent of the nearest band edge frequency, but in no case shall a value less than 2 dBi be used.

See KDB 662911 for guidance on calculating the additional array gain term when determining the effective antenna gain for a EUT with multiple outputs occupying the same or overlapping frequency ranges in the same band.

Radiated spurious emission test:

An additional consideration when performing conducted measurements of restricted band emissions is that unwanted emissions radiating from the EUT cabinet, control circuits, power leads, or intermediate circuit elements will likely go undetected in a conducted measurement configuration. To address this concern, a radiated test shall be performed to ensure that emissions emanating from the EUT cabinet (rather than the antenna port) also comply with the applicable limits.

For these cabinet radiated spurious emission measurements the EUT transmit antenna may be replaced with a termination matching the nominal impedance of the antenna. Procedures for performing radiated measurements are specified in ANSI C63.10. All detected emissions shall comply with the applicable limits.

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 ≥ 1 GHz, 100 kHz for f < 1 GHz
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

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); RSS-247, 5.5; RSS-GEN, 8.9

This limit apply to the equipment is using FHSS.

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 (μV/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:

5. Field Strength (dBμV/m) = 20*log[Field Strength (μV/m)].
6. In the emission tables above, the tighter limit applies at the band edges.
7. 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.

For above 1000 MHz, limit field strength of harmonics: 54dBuV/m@3m (AV) and 74dBuV/m@3m (PK).

This limit apply to the equipment is using wide band modulations other than FHSS.

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

This Method apply to the equipment is using FHSS.

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 ≥ 1% of the span

VBW ≥ RBW

Sweep = auto

Detector function = peak /AV

Trace = max hold

Allow the trace to stabilize.

E [dBμV/m] =UR + AT + AFactor [dB]; AT =LCable loss [dB] - Gpreamp [dB]

AT: Total correction Factor except Antenna

UR: Receiver Reading

Gpreamp: Preamplifier Gain

AFactor: Antenna Factor at 3m

<u>This Method apply to the equipment is using wide band modulations other than FHSS.</u>

The following procedures may be used to determine the peak or average field strength or power of an unwanted emission that is within 2 MHz of the authorized band edge. If a peak detector is utilized, use the procedure described in 13.2.1. Use the procedure described in 13.2.2 when using an average detector and the EUT can be configured to transmit continuously (i.e., duty cycle ≥ 98%). Use the procedure described in 13.2.3 when using an average detector and the EUT cannot be configured to transmit continuously but the duty cycle is constant (i.e., duty cycle variations are less than ± 2 percent). Use the procedure described in 13.2.4 when using an average detector for those cases where the EUT cannot be configured to transmit continuously and the duty cycle is not constant (duty cycle variations equal or exceed 2 percent).

When using a peak detector to measure unwanted emissions at or near the band edge (within 2 MHz of the authorized band), the following integration procedure can be used.

Set instrument center frequency to the frequency of the emission to be measured (must be within 2 MHz of the authorized band edge).

Set span to 2 MHz

RBW = 100 kHz.

VBW ≥ 3 x RBW.

Detector = peak.

Sweep time = auto.

Trace mode = max hold.

Allow sweep to continue until the trace stabilizes (required measurement time may increase for low duty cycle applications)

Compute the power by integrating the spectrum over 1 MHz using the analyzer’s band power measurement function with band limits set equal to the emission frequency (femission) ± 0.5 MHz. If the instrument does not have a band power function, then sum the amplitude levels (in power units) at 100 kHz intervals extending across the 1 MHz spectrum defined by femission ± 0.5 MHz.

5.10.4 Test Result

Please refer to ANNEX A.9.

5.11 Power Spectral density (PSD)

5.11.1 Limit

FCC §15.247(e); RSS-247, 5.2 (2)

This limit apply to the equipment is using wide band modulations other than FHSS.

The same method of determining the conducted output power shall be used to determine the power spectral density. If a peak output power is measured, then a peak power spectral density measurement is required. If an average output power is measured, then an average power spectral density measurement should be used.

5.11.2 Test Setup

See section 4.4.1 (Diagram 1) for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.11.3 Test Procedure

This Method apply to the equipment is using wide band modulations other than FHSS.

Set analyzer center frequency to DTS channel center frequency.

Set the span to 1.5 times the DTS bandwidth.

Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.

Set the VBW ≥ 3 RBW.

Detector = peak.

Sweep time = auto couple.

Trace mode = max hold.

Allow trace to fully stabilize.

Use the peak marker function to determine the maximum amplitude level within the RBW.

If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

5.11.4 Test Result

Please refer to ANNEX A.10.

ANNEX A TEST RESULT

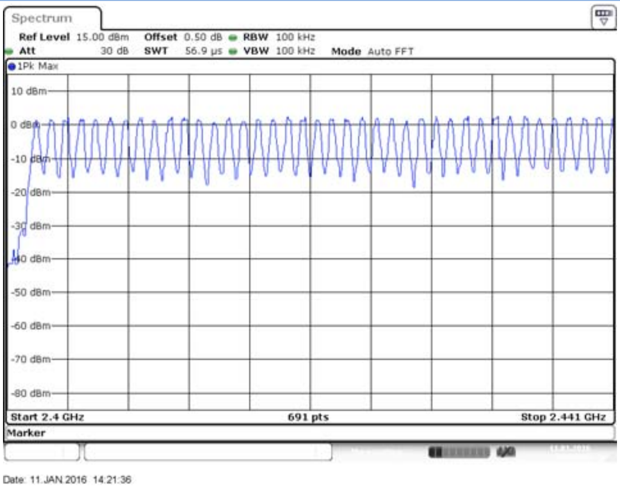
A.1 Number of Hopping Frequency

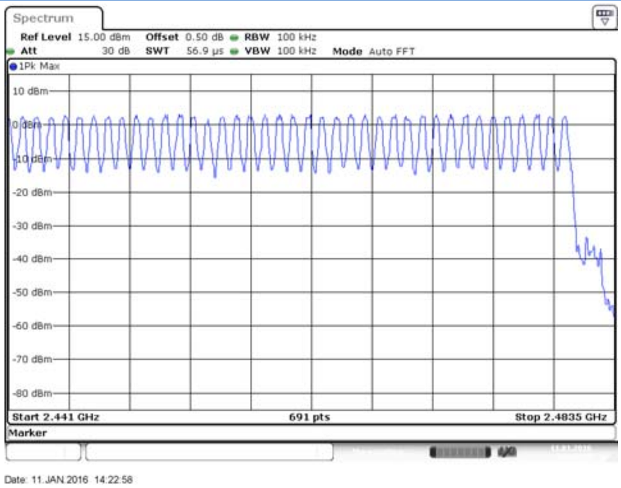
<u>Test Data</u>

Test Mode	Frequency Block (MHz)	Measured Channel Numbers	Min. Limit	Verdict
GFSK	2400 - 2483.5	79	15	Pass
∏/4-DQPSK	2400 - 2483.5	79	15	Pass
8-DPSK	2400 - 2483.5	79	15	Pass

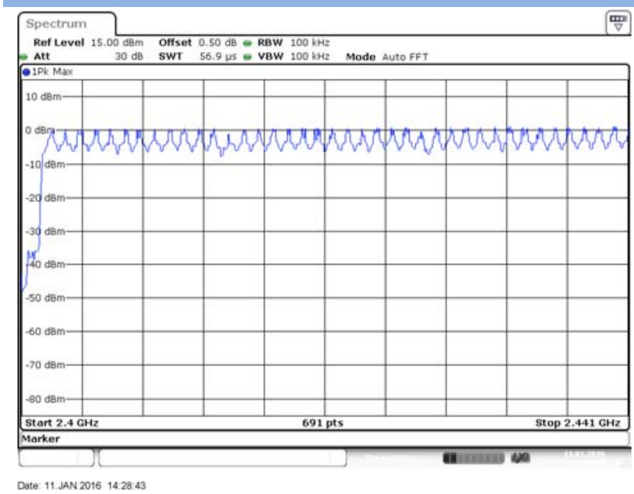
<u>Test plots</u>

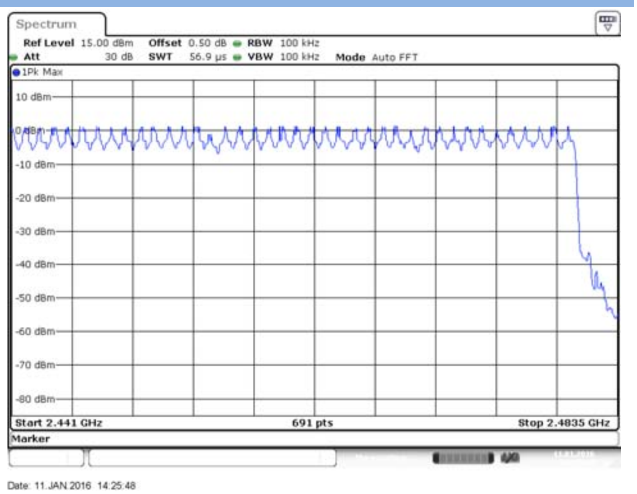
GFSK 2.4 GHz ~ 2.4415 GHz	GFSK 2.4415 GHz ~ 2.4835 GHz

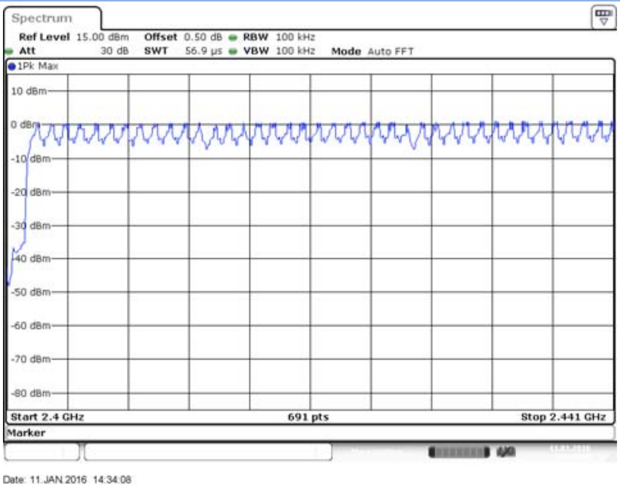
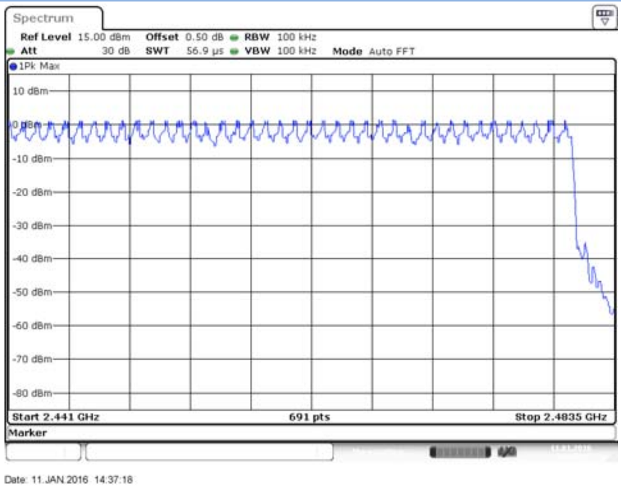




∏/4-DQPSK 2.4 GHz ~ 2.4415 GHz	∏/4-DQPSK GHz ~ 2.4835 GHz





8-DPSK 2.4 GHz ~ 2.4415 GHz	8-DPSK 2.4415 GHz ~ 2.4835 GHz
	

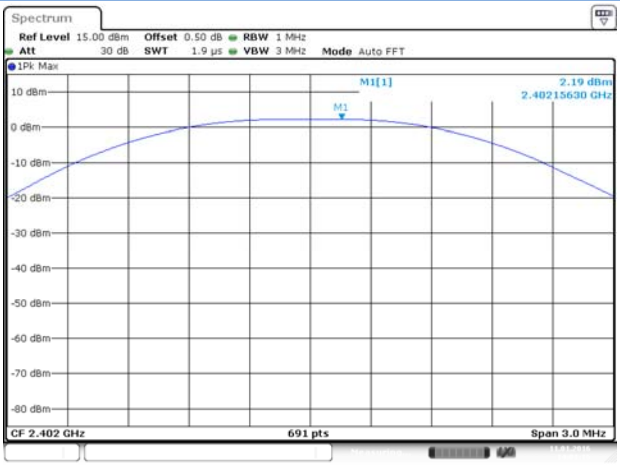
A.2 Peak Output Power

Peak Power Test Data

Channel	Measured Output Peak Power						Limit		Verdict
	GFSK		∏/4-DQPSK		8-DPSK				
	dBm	mW	dBm	mW	dBm	mW	dBm	mW	
Low	2.19	1.66	0.88	1.22	1.08	1.28	30	1000	Pass
Middle	2.77	1.89	1.56	1.43	1.75	1.50			Pass
High	3.07	2.03	1.78	1.51	2.01	1.59			Pass

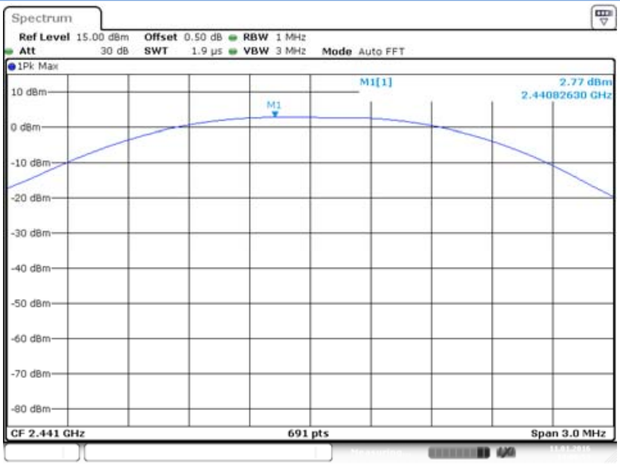
Test plots

GFSK LOW CHANNEL



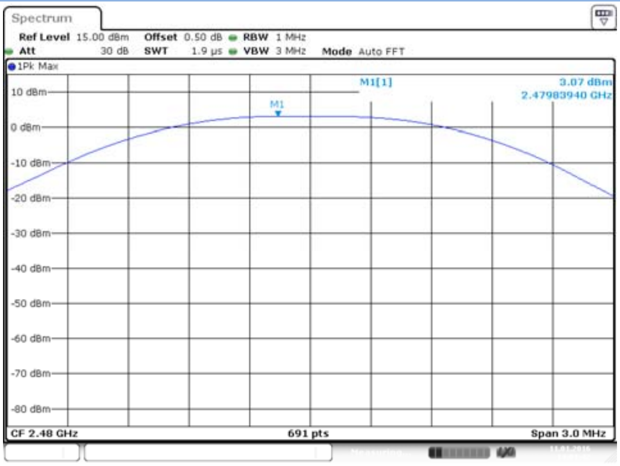
Date: 11.JAN.2016 14:01:16

GFSK MIDDLE CHANNEL



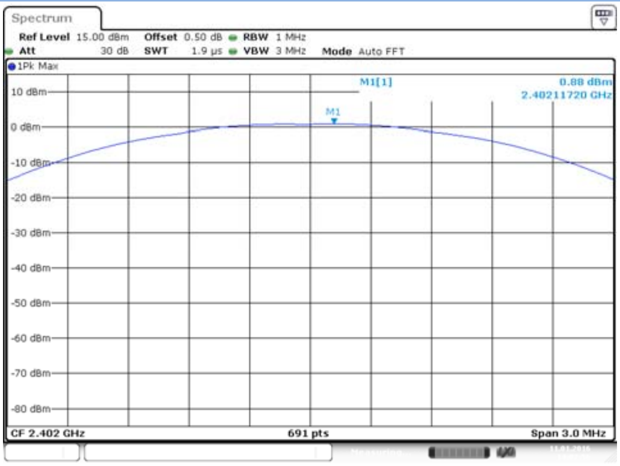
Date: 11.JAN.2016 14:00:54

GFSK HIGH CHANNEL



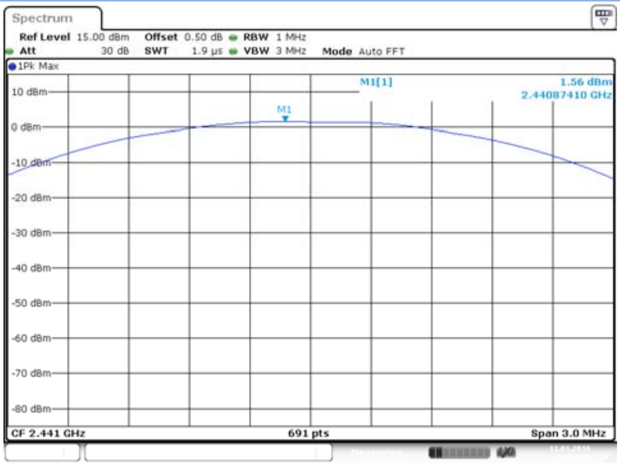
Date: 11.JAN.2016 14:01:42

Π/4-DQPSK LOW CHANNEL



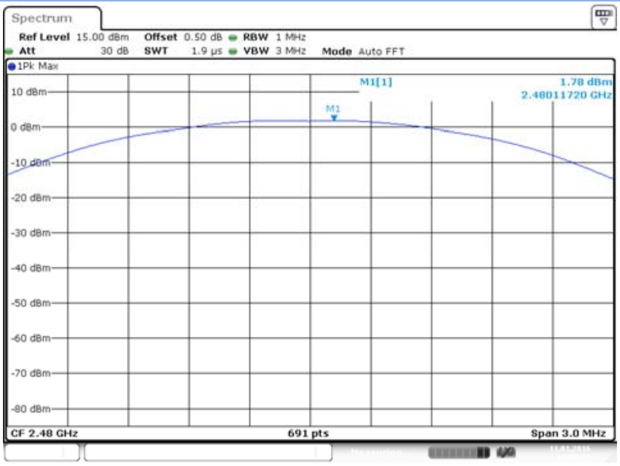
Date: 11.JAN.2016 14:02:56

Π/4-DQPSK MIDDLE CHANNEL



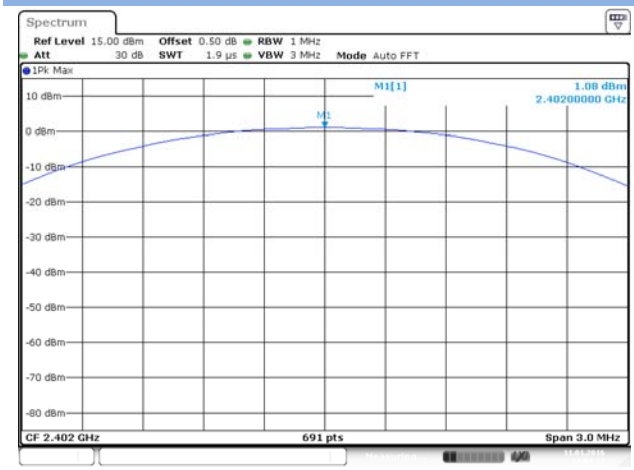
Date: 11.JAN.2016 14:03:28

Π/4-DQPSK HIGH CHANNEL



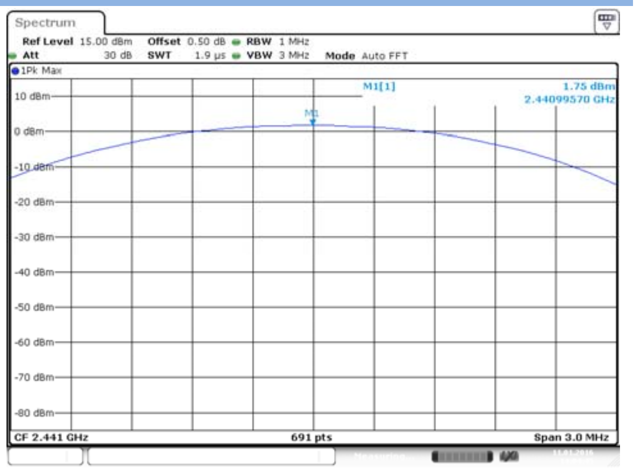
Date: 11.JAN.2016 14:02:28

8-DPSK LOW CHANNEL



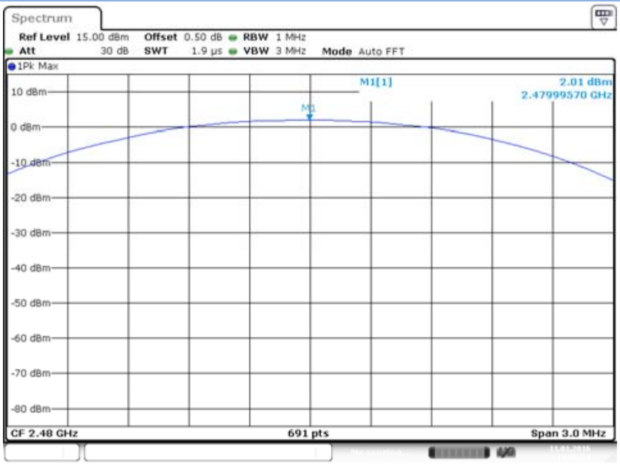
Date: 11.JAN.2016 14:04:17

8-DPSK MIDDLE CHANNEL



Date: 11.JAN.2016 14:04:45

8-DPSK HIGH CHANNEL



Date: 11.JAN.2016 14:05:11

A.3 20 dB and 99% bandwidth

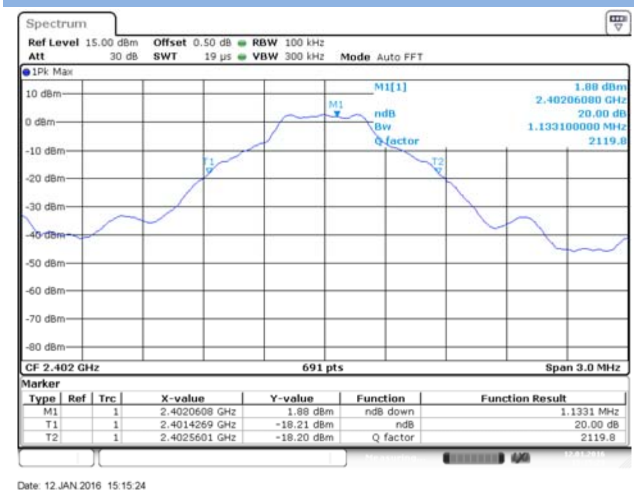
Test Data

GFSK		
Channel	20 dB Bandwidth (MHz)	99% Bandwidth (kHz)
Low	1.1331	959.4790
Middle	1.1027	933.4298
High	1.1158	933.4298
∏/4-DQPSK		
Channel	20 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	1.3806	1.2026
Middle	1.3763	1.2113
High	1.3719	1.2113
8-DPSK		
Channel	20 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	1.3806	1.2113
Middle	1.3849	1.2200
High	1.3849	1.2156

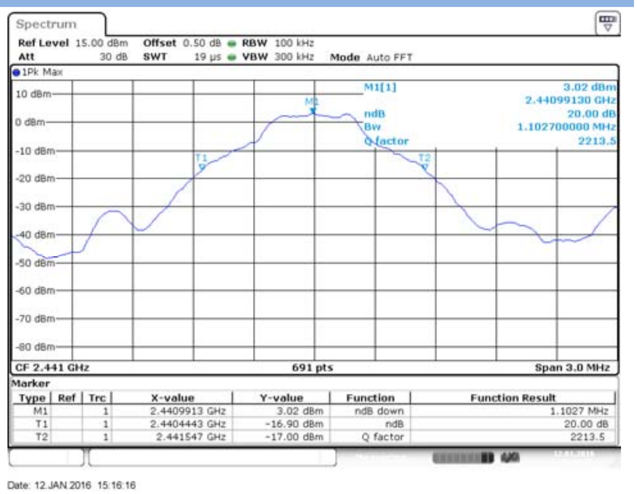
Test plots

20 dB Bandwidth (MHz)

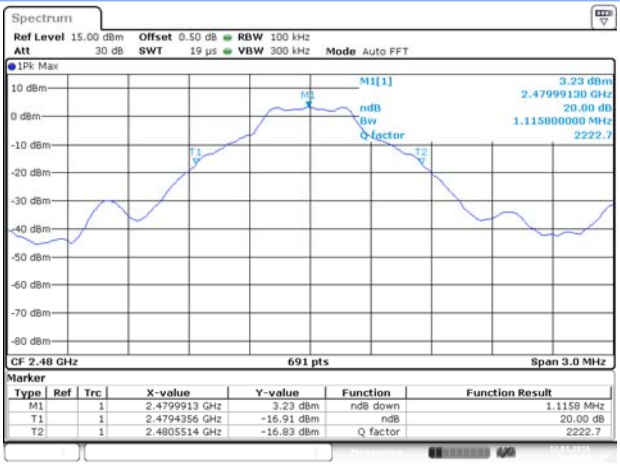
GFSK LOW CHANNEL



GFSK MIDDLE CHANNEL



GFSK HIGH CHANNEL

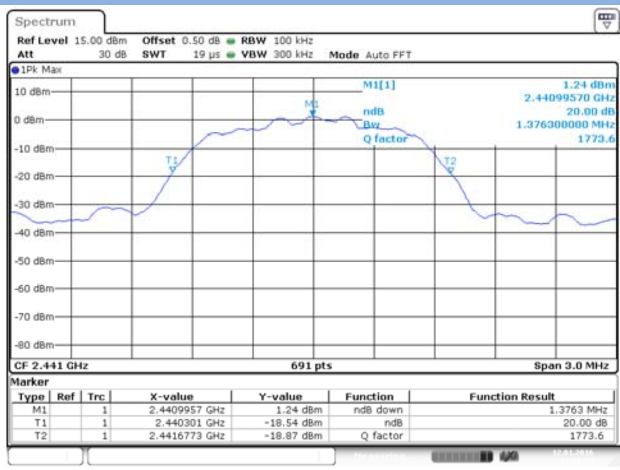


Date: 12.JAN.2016 15:16:50

Π/4-DQPSK LOW CHANNEL

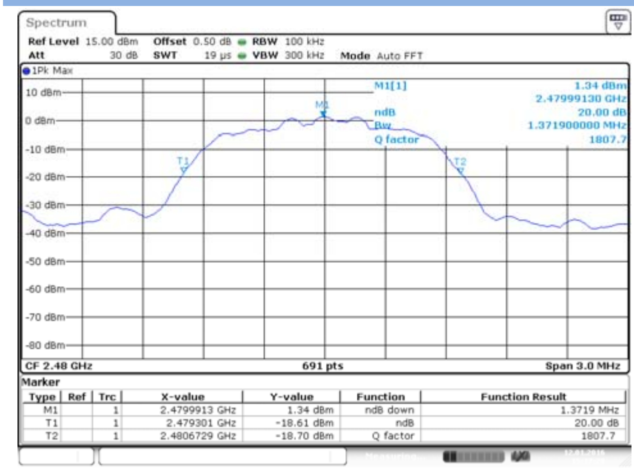
Date: 12.JAN.2016 15:18:03

Π/4-DQPSK MIDDLE CHANNEL



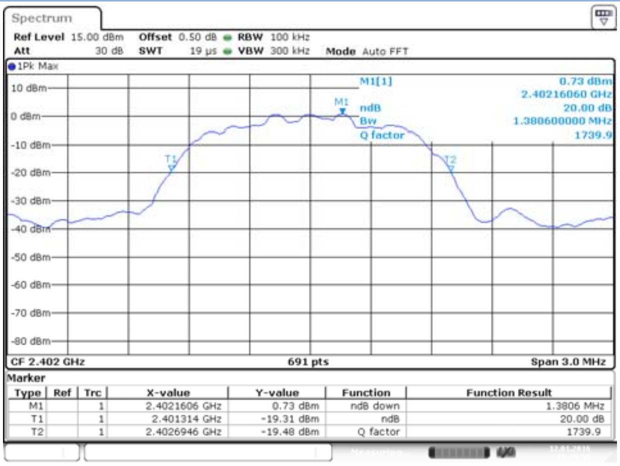
Date: 12.JAN.2016 15:18:56

Π/4-DQPSK HIGH CHANNEL



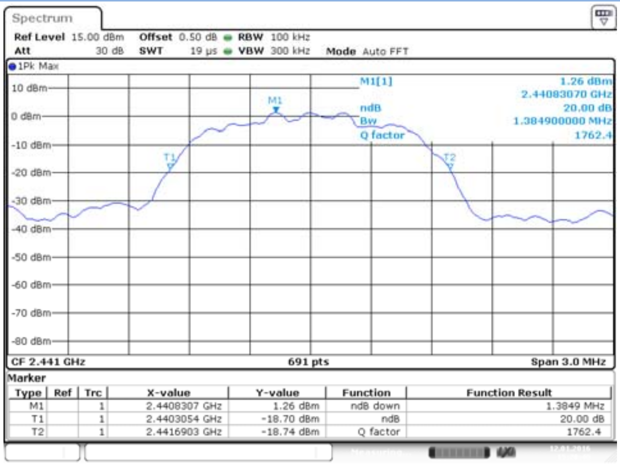
Date: 12.JAN.2016 15:17:28

8-DPSK LOW CHANNEL



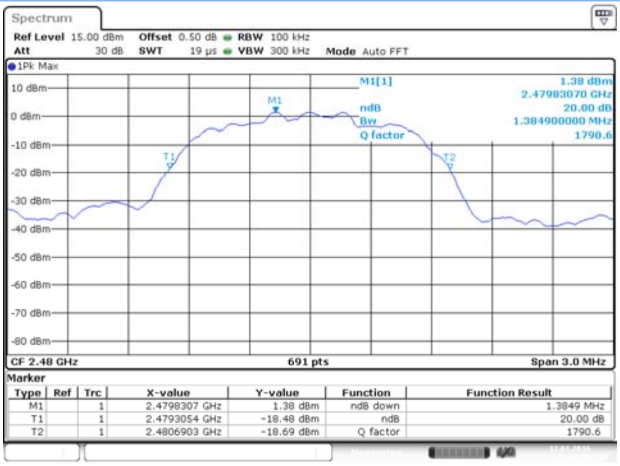
Date: 12.JAN.2016 15:19:59

8-DPSK MIDDLE CHANNEL



Date: 12.JAN.2016 15:20:40

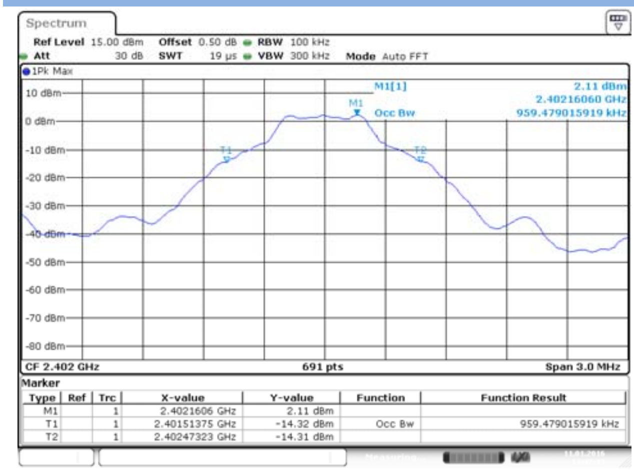
8-DPSK HIGH CHANNEL



Date: 12.JAN.2016 15:21:38

<u>99% Bandwidth (kHz)</u>

GFSK LOW CHANNEL

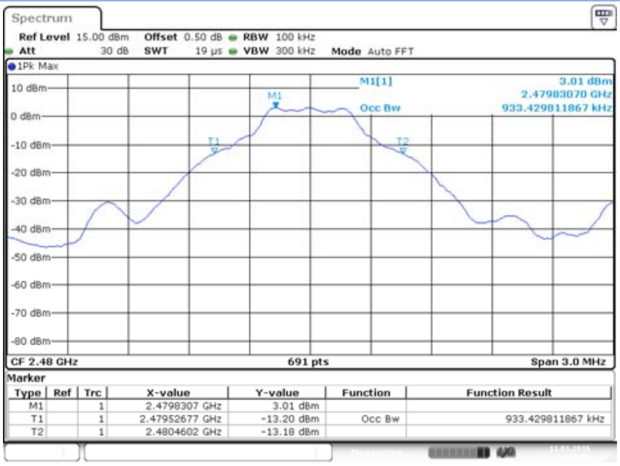


Date: 11.JAN.2016 14:47:33

GFSK MIDDLE CHANNEL

Date: 11.JAN.2016 14:48:55

GFSK HIGH CHANNEL

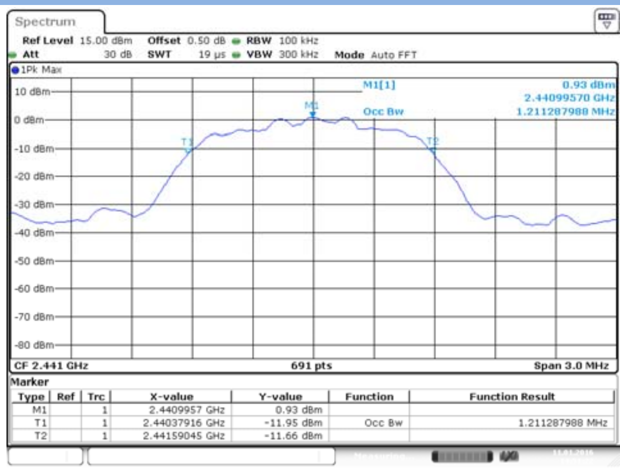


Date: 11.JAN.2016 14:50:00

Π/4-DQPSK LOW CHANNEL

Date: 11.JAN.2016 14:50:47

Π/4-DQPSK MIDDLE CHANNEL



Date: 11.JAN.2016 14:51:22

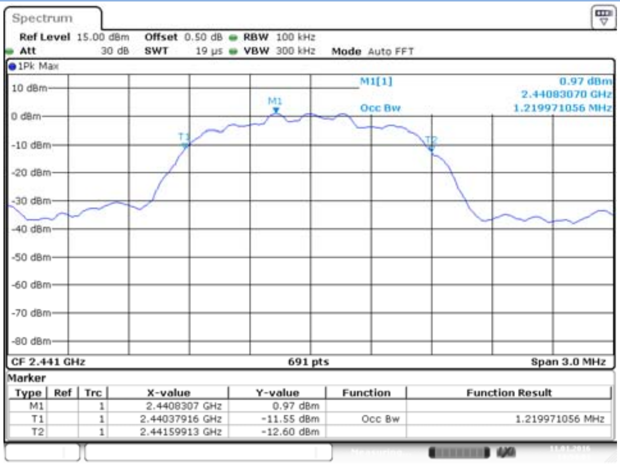
Π/4-DQPSK HIGH CHANNEL

Date: 11.JAN.2016 14:52:19

8-DPSK LOW CHANNEL

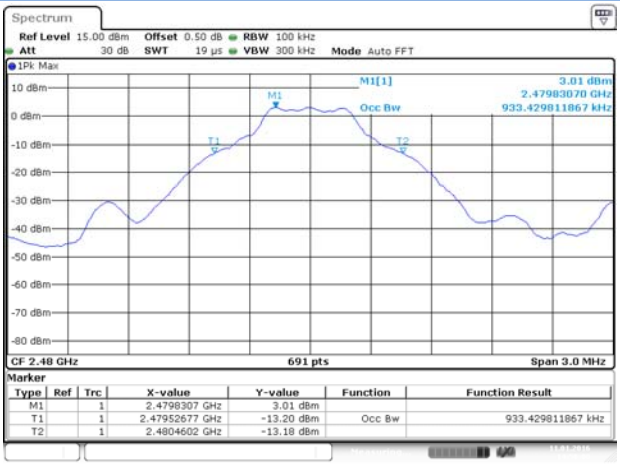
Date: 11.JAN.2016 14:53:31

8-DPSK MIDDLE CHANNEL



Date: 11.JAN.2016 14:54:01

8-DPSK HIGH CHANNEL



Date: 11.JAN.2016 14:50:00

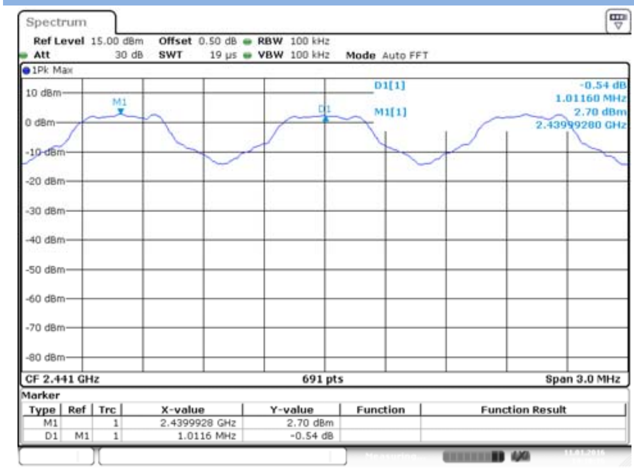
A.4 Hopping Frequency Separation

Test Data

Mode	Frequency separation (MHz)	Max 20 dB Bandwidth (MHz)	Two-thirds of the 20 dB bandwidth (MHz)	Verdict
GFSK	1.0116	1.133	0.755	Pass
∏/4-DQPSK	0.9986	1.381	0.920	Pass
8-DPSK	1.0029	1.385	0.923	Pass

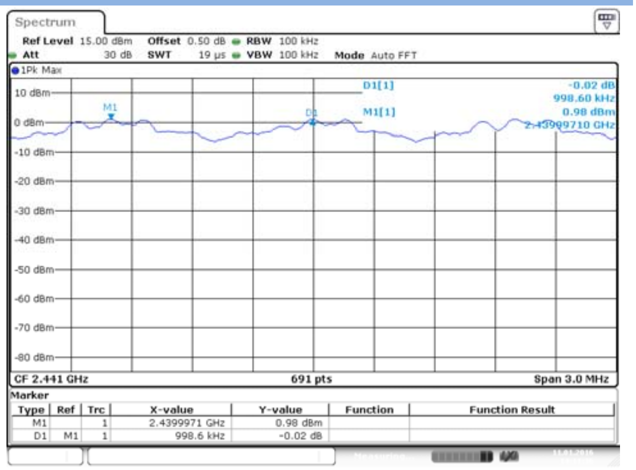
Test Plots

GFSK



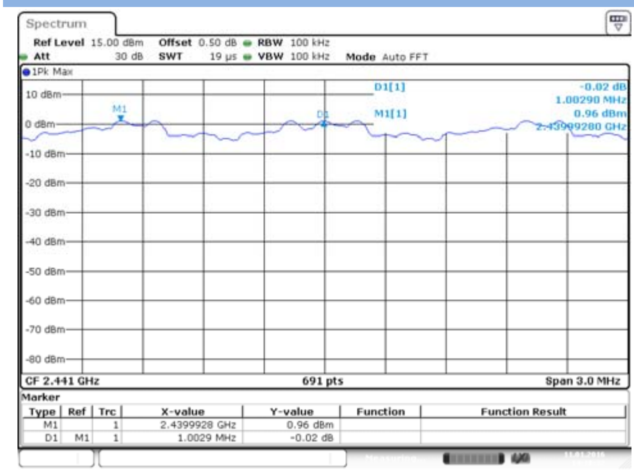
Date: 11.JAN.2016 14:10:16

∏/4-DQPSK



Date: 11.JAN.2016 14:11:37

8-DPSK



Date: 11.JAN.2016 14:18:32

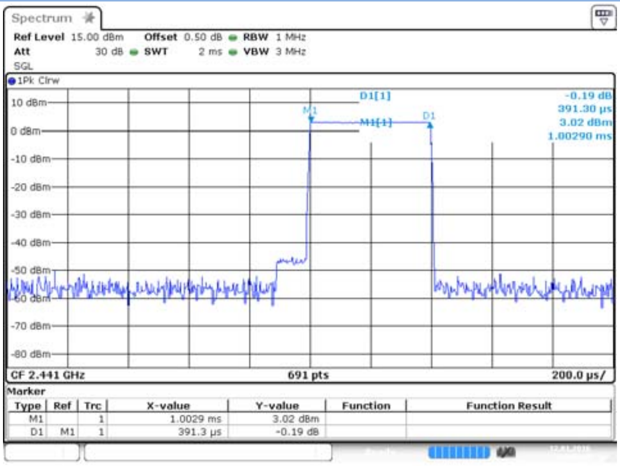
A.5 Average Time of Occupancy

Test Data

GFSK				
DH Packet	Pulse Width (ms)	Total of Dwell (ms)	Limit (sec)	Verdict
DH 1	0.391	125.220	0.4	Pass
DH 3	1.652	264.355	0.4	Pass
DH 5	2.899	309.188	0.4	Pass
∏/4-DQPSK				
DH Packet	Pulse Width (ms)	Total of Dwell (ms)	Limit (sec)	Verdict
DH 1	0.322	102.960	0.4	Pass
DH 3	1.652	264.355	0.4	Pass
DH 5	2.906	309.962	0.4	Pass
8-DPSK				
DH Packet	Pulse Width (ms)	Total of Dwell (ms)	Limit (sec)	Verdict
DH 1	0.409	130.788	0.4	Pass
DH 3	1.652	176.237	0.4	Pass
DH 5	2.906	309.962	0.4	Pass

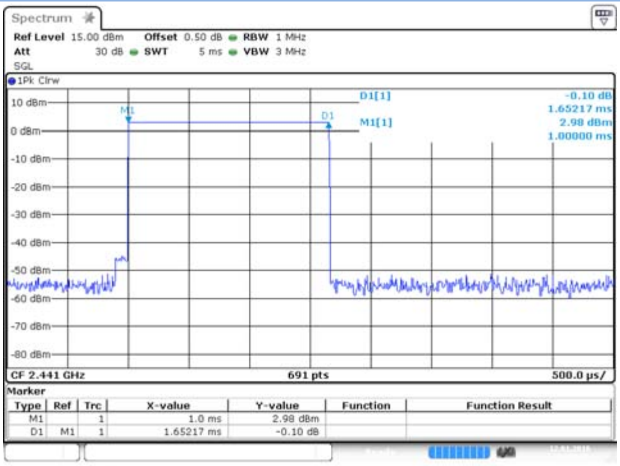
Test Plots

GFSK DH1



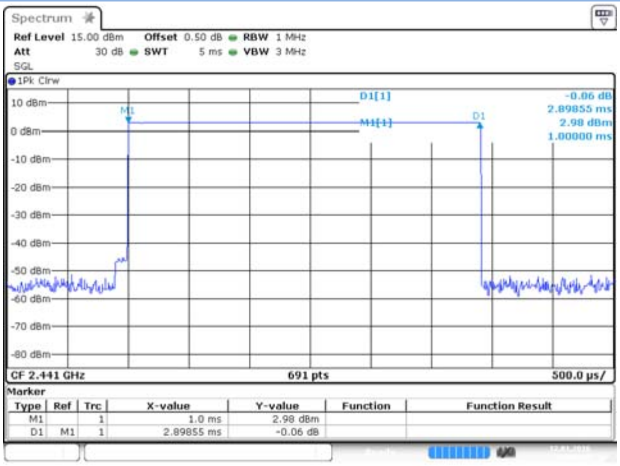
Date: 12.JAN.2016 14:05:44

GFSK DH3



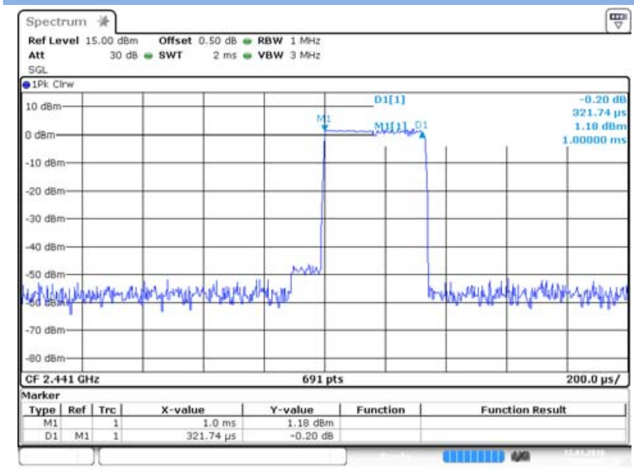
Date: 12.JAN.2016 14:07:06

GFSK DH5



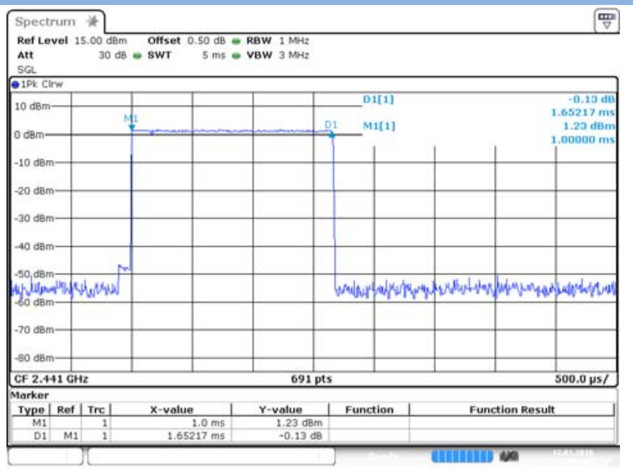
Date: 12.JAN.2016 14:08:31

Π/4-DQPSK DH1



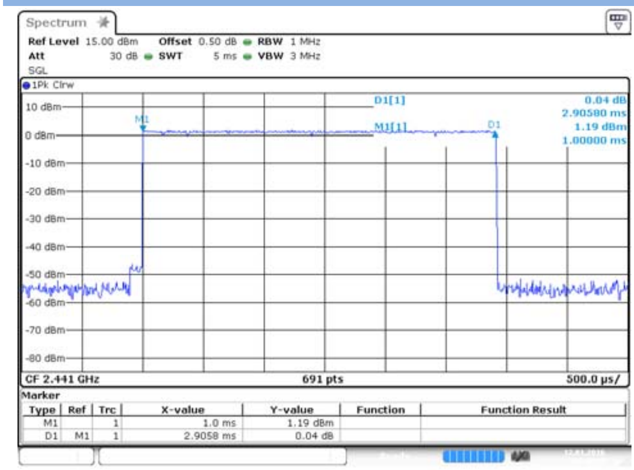
Date: 12.JAN.2016 14:32:12

Π/4-DQPSK DH3



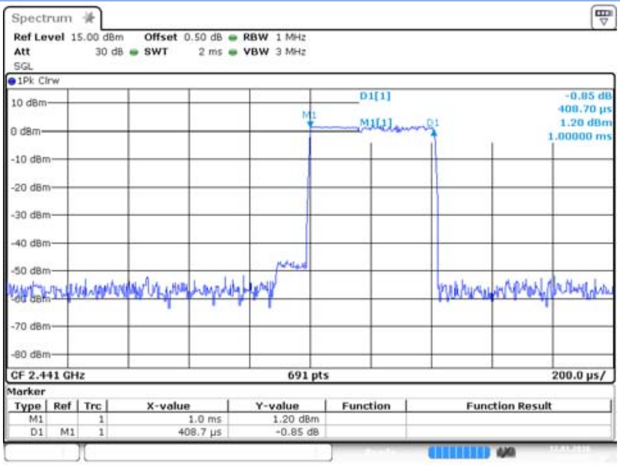
Date: 12.JAN.2016 14:21:43

Π/4-DQPSK DH5



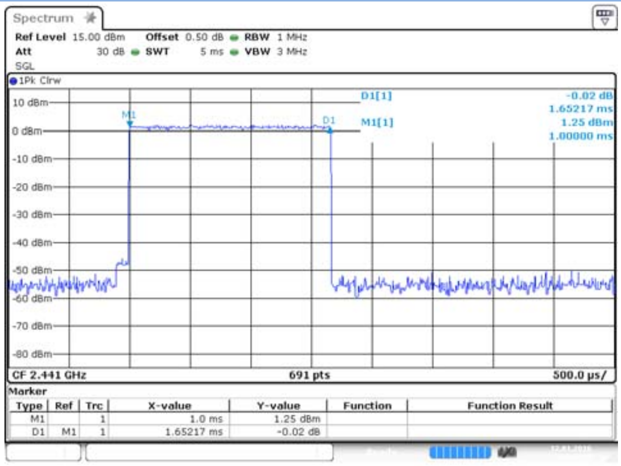
Date: 12.JAN.2016 14:10:12

8-DPSK DH1



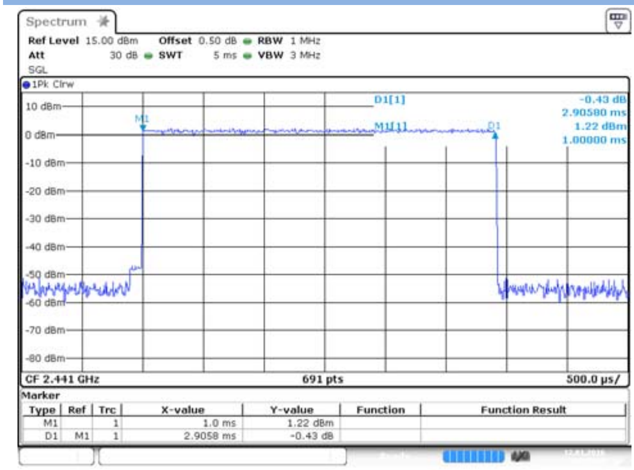
Date: 12.JAN.2016 14:22:42

8-DPSK DH3



Date: 12.JAN.2016 14:23:59

8-DPSK DH5



Date: 12.JAN.2016 14:25:04

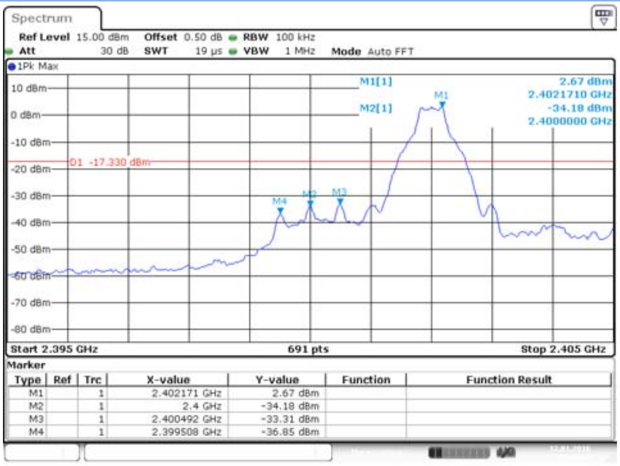
A.6 Conducted Spurious Emissions

Test Data

GFSK				
Channel	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
		Carrier Level	Calculated 20 dBc Limit	
Low	-32.67	2.33	-17.67	Pass
Middle	-40.99	2.75	-17.25	Pass
High	-47.03	3.10	-16.90	Pass
Π/4-DQPSK				
Channel	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
		Carrier Level	Calculated 20 dBc Limit	
Low	-37.84	0.28	-19.72	Pass
Middle	-44.54	1.04	-18.96	Pass
High	-49.72	1.28	-18.72	Pass
8-DPSK				
Channel	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
		Carrier Level	Calculated 20 dBc Limit	
Low	-38.80	0.40	-19.60	Pass
Middle	-48.45	0.93	-19.07	Pass
High	-51.56	1.33	-18.67	Pass

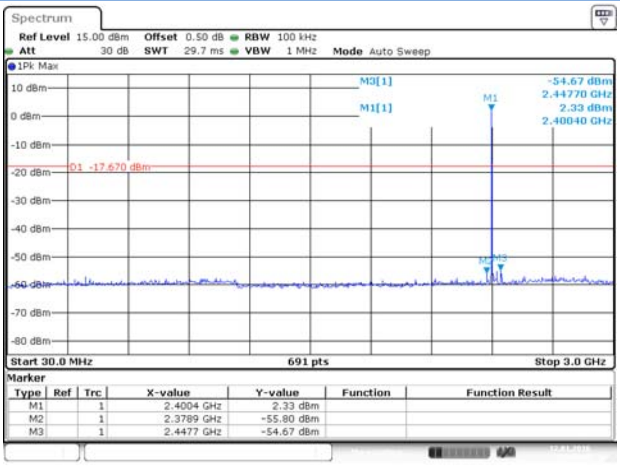
Test Plots

GFSK LOW CHANNEL , BAND EDGE



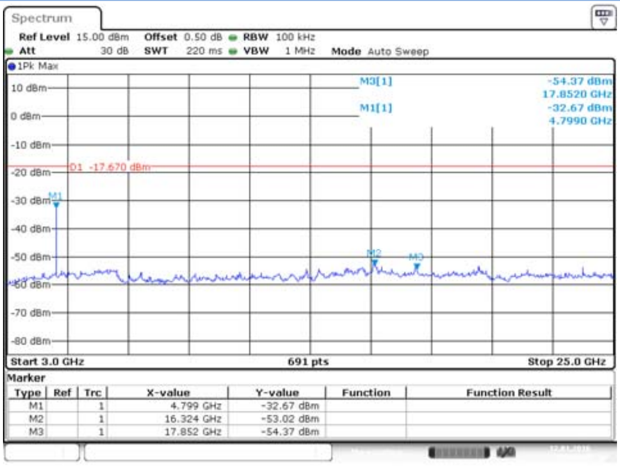
Date: 12.JAN.2016 12:45:13

GFSK LOW CHANNEL , SPURIOUS 30 MHz ~ 3 GHz



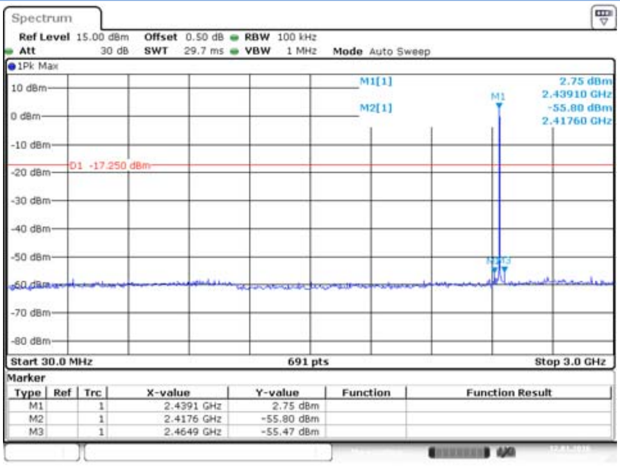
Date: 12.JAN.2016 13:27:43

GFSK LOW CHANNEL , SPURIOUS 3 GHz ~ 25 GHz



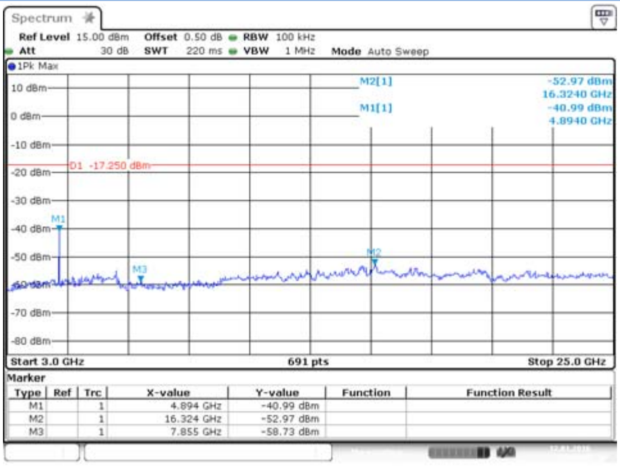
Date: 12.JAN.2016 13:29:18

GFSK MIDDLE CHANNEL , SPURIOUS 30 MHz ~ 3 GHz



Date: 12.JAN.2016 13:31:46

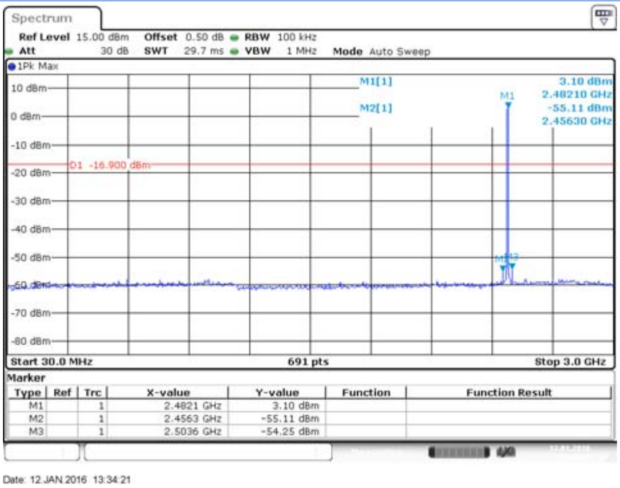
GFSK MIDDLE CHANNEL , SPURIOUS 3 GHz ~ 25 GHz



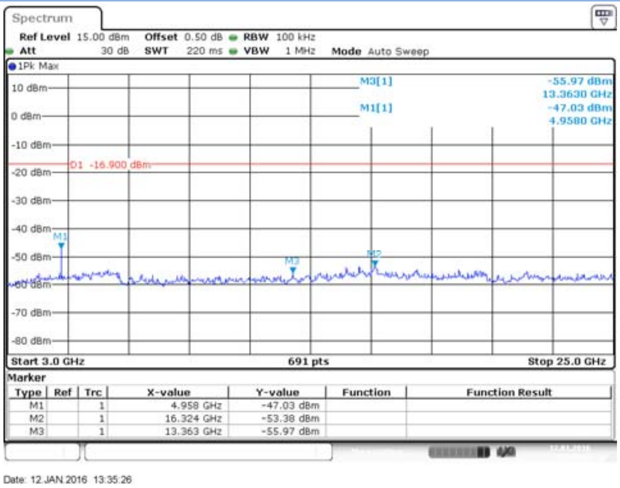
Date: 12.JAN.2016 13:32:49

GFSK High CHANNEL , BAND EDGE

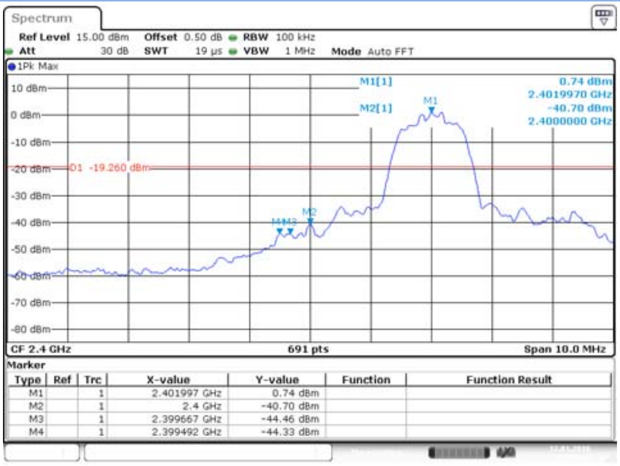
GFSK High CHANNEL , SPURIOUS 30 MHz ~ 3 GHz



GFSK High CHANNEL , SPURIOUS 3 GHz ~ 25 GHz

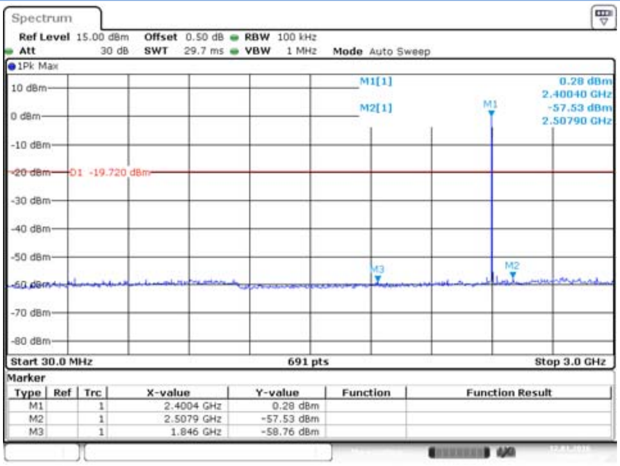


Π/4-DQPSK LOW CHANNEL , BAND EDGE



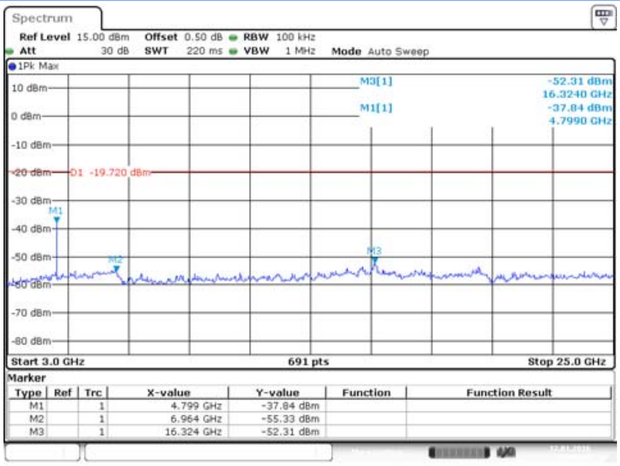
Date: 12.JAN.2016 12:59:25

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



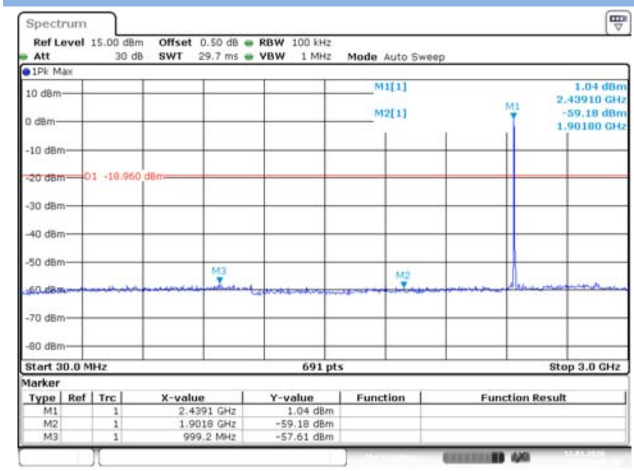
Date: 12.JAN.2016 13:38:29

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



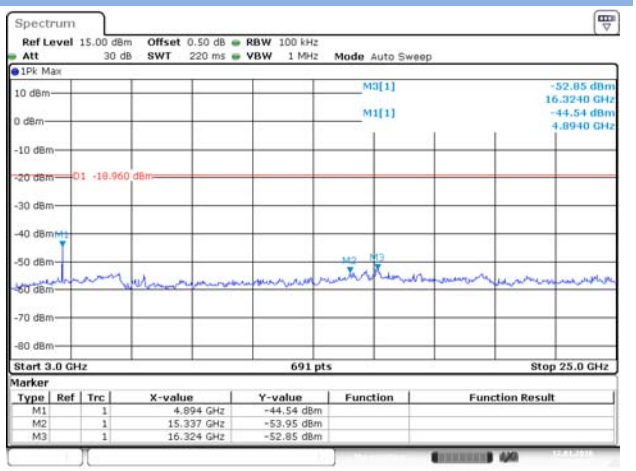
Date: 12.JAN.2016 13:40:00

Π/4-DQPSK MIDDLE CHANNEL , SPURIOUS 30 MHz ~ 3 GHz



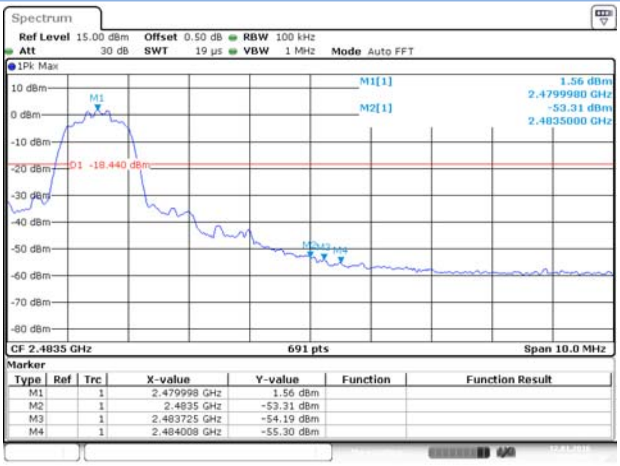
Date: 12.JAN.2016 13:41:31

Π/4-DQPSK MIDDLE CHANNEL , SPURIOUS 3 GHz ~ 25 GHz



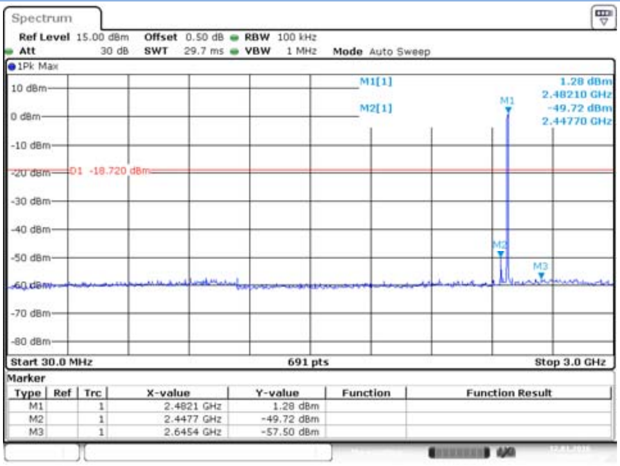
Date: 12.JAN.2016 13:42:28

Π/4-DQPSK High CHANNEL , BAND EDGE



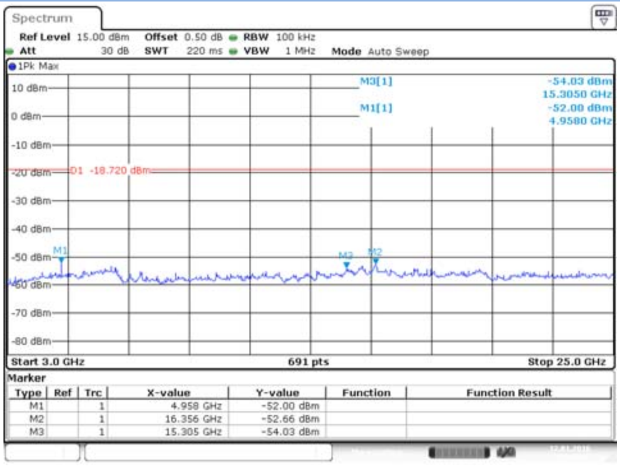
Date: 12.JAN.2016 12:55:05

Π/4-DQPSK High CHANNEL , SPURIOUS 30 MHz ~ 3 GHz



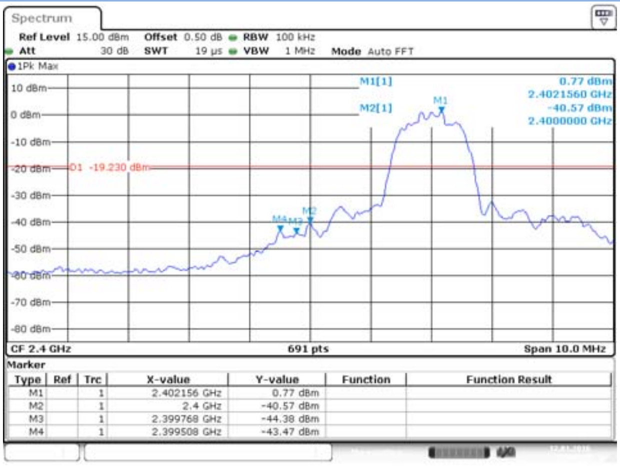
Date: 12.JAN.2016 13:43:50

Π/4-DQPSK High CHANNEL , SPURIOUS 3 GHz ~ 25 GHz



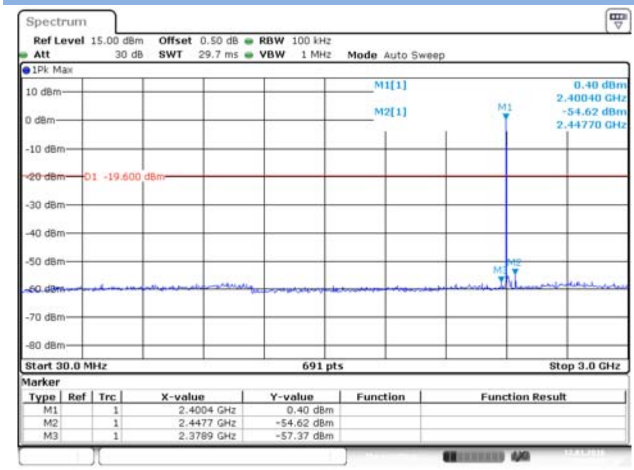
Date: 12.JAN.2016 13:45:07

8-DPSK LOW CHANNEL , BAND EDGE



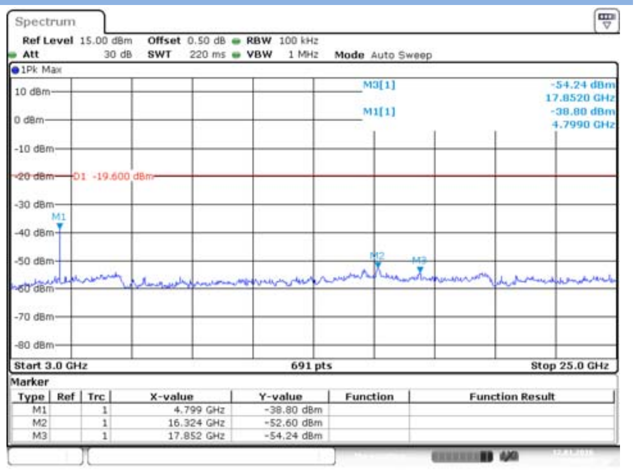
Date: 12.JAN.2016 13:01:18

8-DPSK LOW CHANNEL , SPURIOUS 30 MHz ~ 3 GHz



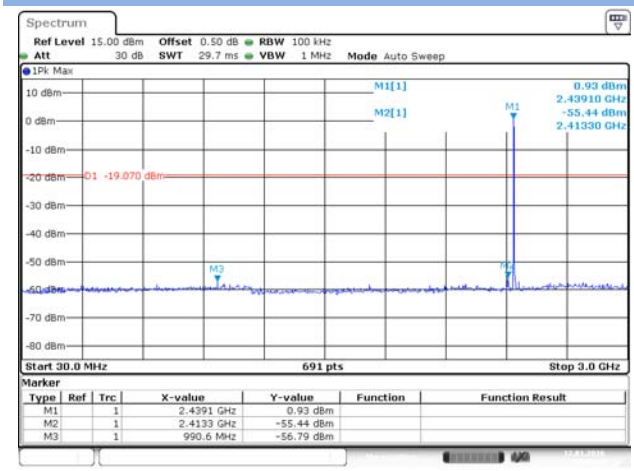
Date: 12.JAN.2016 13:47:09

8-DPSK LOW CHANNEL , SPURIOUS 3 GHz ~ 25 GHz



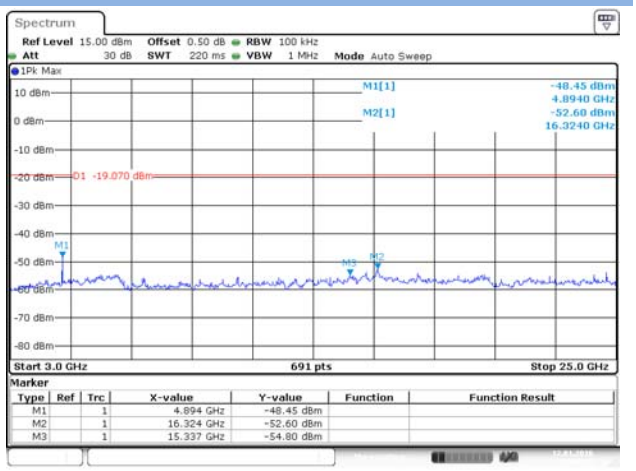
Date: 12.JAN.2016 13:48:05

8-DPSK MIDDLE CHANNEL , SPURIOUS 30 MHz ~ 3 GHz



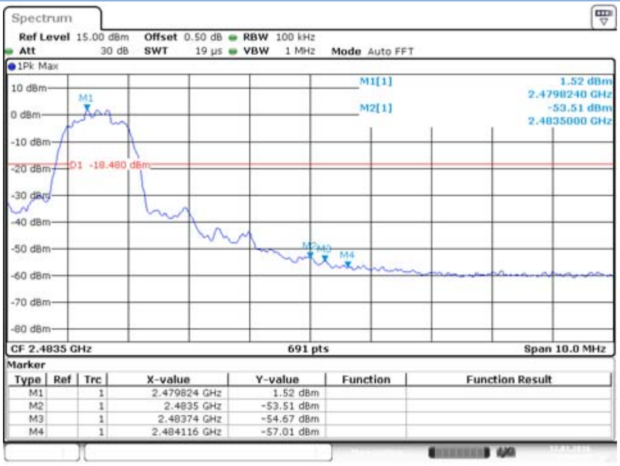
Date: 12.JAN.2016 13:49:20

8-DPSK MIDDLE CHANNEL , SPURIOUS 3 GHz ~ 25 GHz



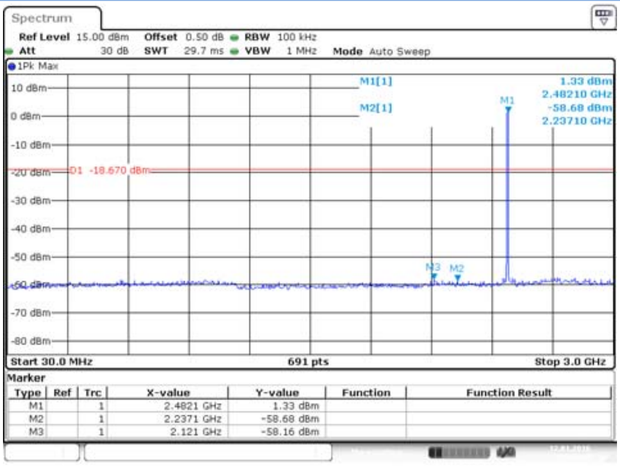
Date: 12.JAN.2016 13:50:15

8-DPSK High CHANNEL , BAND EDGE



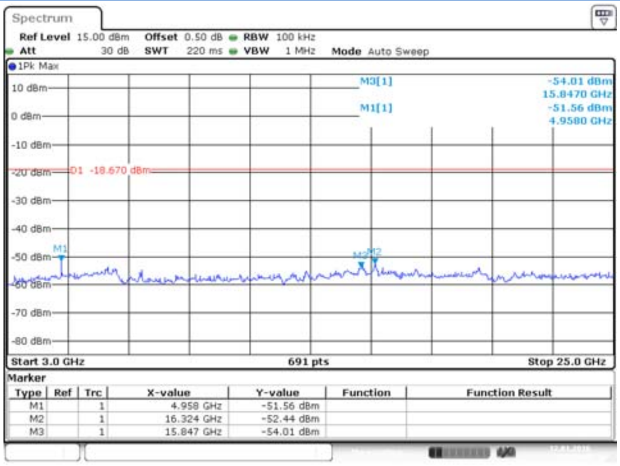
Date: 12.JAN.2016 13:03:11

8-DPSK High CHANNEL , SPURIOUS 30 MHz ~ 3 GHz



Date: 12.JAN.2016 13:52:49

8-DPSK High CHANNEL , SPURIOUS 3 GHz ~ 25 GHz



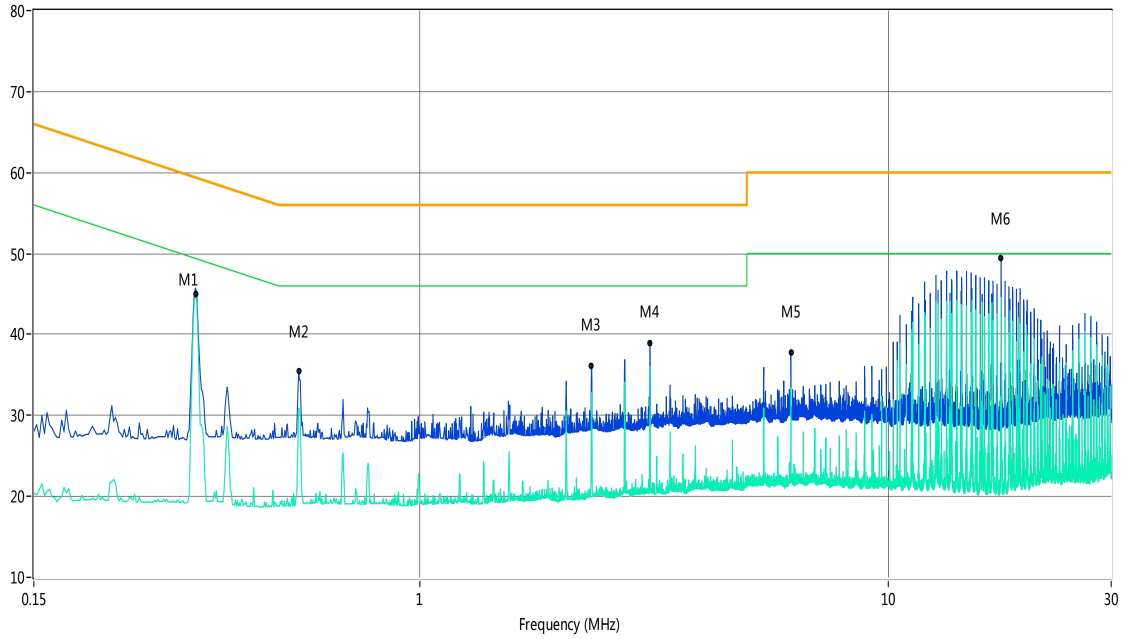
Date: 12.JAN.2016 13:53:44

A.7 Conducted Emissions

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

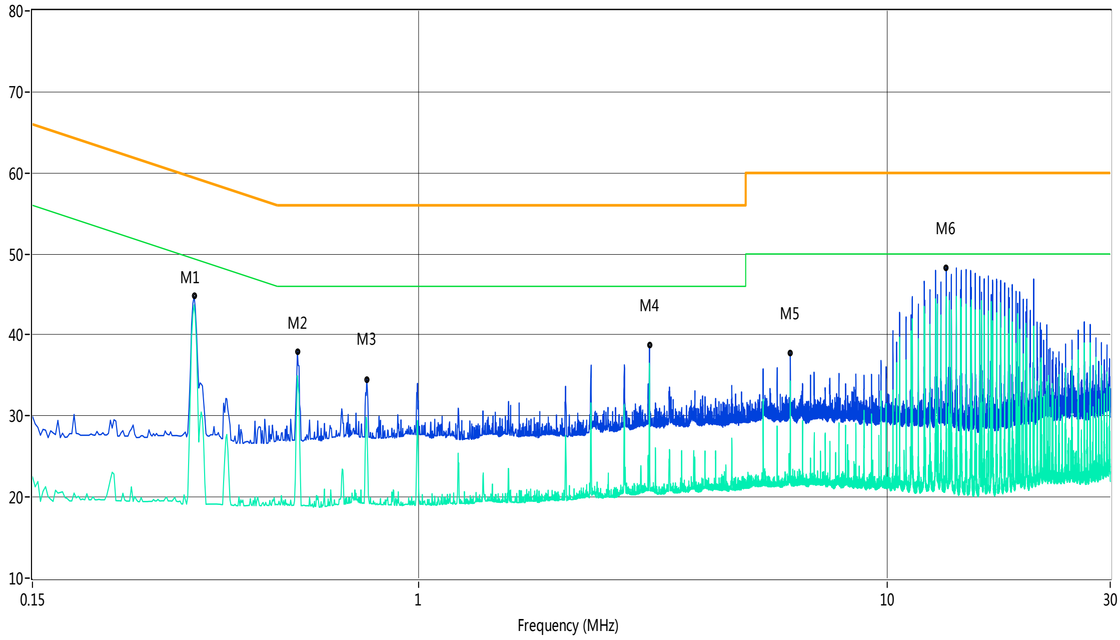
Test Data and Plots

PHASE L



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Margin (dB)	Detector	Line	Verdict
1	0.33	45.7	13.00	60.8	15.10	Peak	L Line	Pass
1**	0.33	45.0	13.00	50.8	5.80	AV	L Line	Pass
2	0.55	35.4	13.00	56.0	20.60	Peak	L Line	Pass
2**	0.55	30.9	13.00	46.0	15.10	AV	L Line	Pass
3	2.33	36.2	13.00	56.0	19.80	Peak	L Line	Pass
3**	2.33	32.9	13.00	46.0	13.10	AV	L Line	Pass
4	3.10	38.9	13.00	56.0	17.10	Peak	L Line	Pass
4**	3.10	35.4	13.00	46.0	10.60	AV	L Line	Pass
5	6.21	37.8	13.00	60.0	22.20	Peak	L Line	Pass
5**	6.21	33.3	13.00	50.0	16.70	AV	L Line	Pass
6	17.46	49.5	13.00	60.0	10.50	Peak	L Line	Pass
6**	17.46	43.5	13.00	50.0	6.50	AV	L Line	Pass

PHASE N



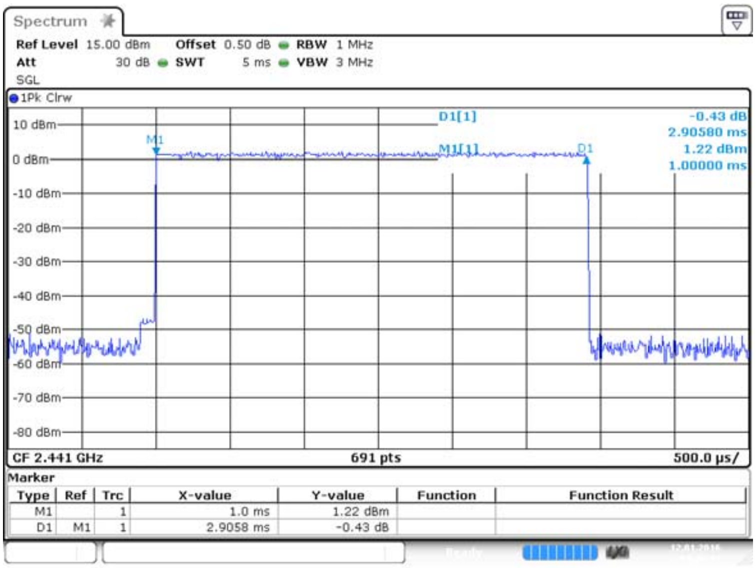
No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Margin (dB)	Detector	Line	Verdict
1	0.33	44.8	13.00	60.8	16.00	Peak	N Line	Pass
1**	0.33	43.7	13.00	50.8	7.10	AV	N Line	Pass
2	0.55	38.0	13.00	56.0	18.00	Peak	N Line	Pass
2**	0.55	35.0	13.00	46.0	11.00	AV	N Line	Pass
3	0.78	34.5	13.00	56.0	21.50	Peak	N Line	Pass
3**	0.78	29.4	13.00	46.0	16.60	AV	N Line	Pass
4	3.11	38.7	13.00	56.0	17.30	Peak	N Line	Pass
4**	3.11	36.5	13.00	46.0	9.50	AV	N Line	Pass
5	6.23	37.8	13.00	60.0	22.20	Peak	N Line	Pass
5**	6.23	34.1	13.00	50.0	15.90	AV	N Line	Pass
6	13.40	48.3	13.00	60.0	11.70	Peak	N Line	Pass
6**	13.40	43.6	13.00	50.0	6.40	AV	N Line	Pass

A.8 Radiated Emission

Test date for Bluetooth 3.0:

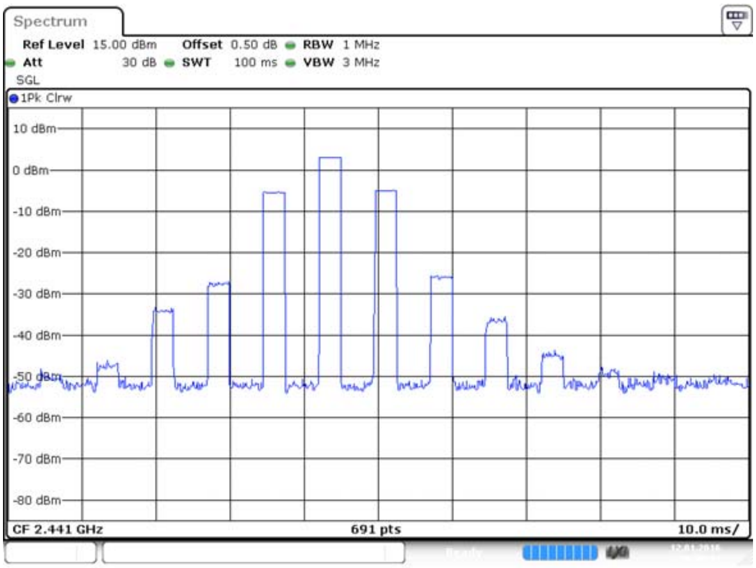
Duty cycle correction factor for average measurement.

DH5 on time/100 ms (One Pulse) Plot on Channel 39



Date: 12.JAN.2016 14:25:04

DH5 on time/100 ms (Count Pulses) Plot on Channel 39



Date: 12.JAN.2016 16:56:04

Note:

1. Duty cycle = on time/100 milliseconds = 3* 2.9058 / 100 =8.72 %
2. Duty cycle correction factor = 20*log (Duty cycle) = -21.1923 dB
3. DH5 has the highest duty cycle and is reported.

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

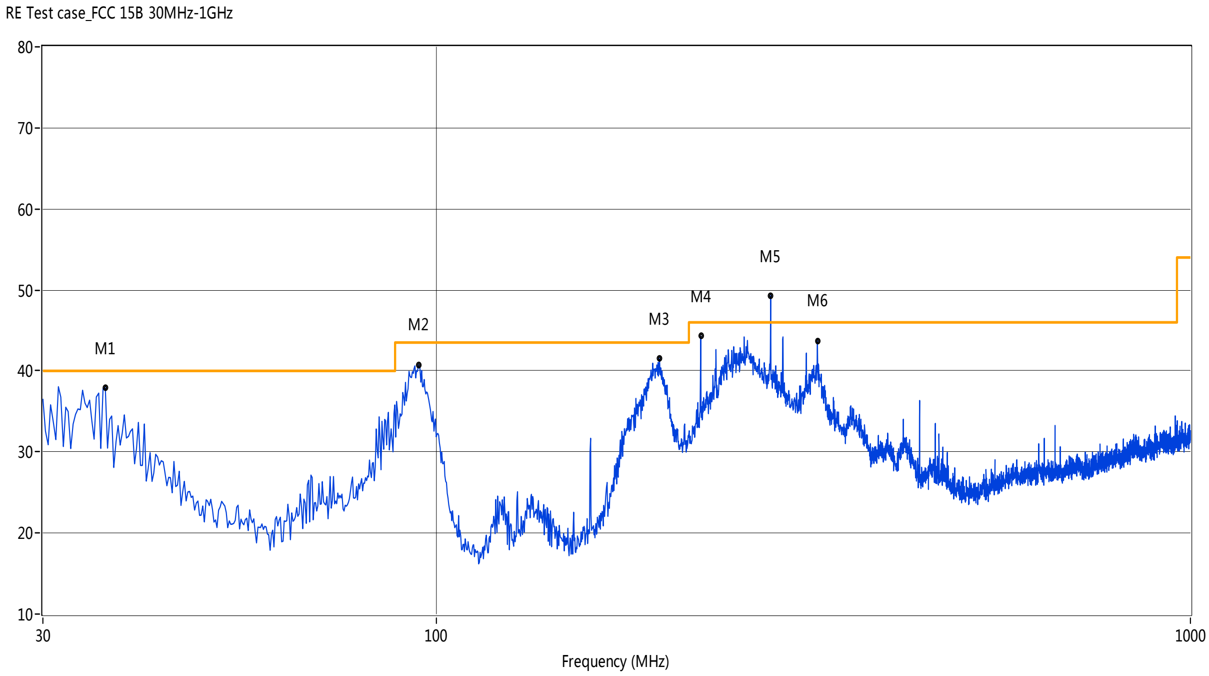
Note 2: For the test data above 1 GHz, according the ANSI C63.4-2014, where limits are specified for both average and peak (or quasi-peak) detector functions, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement.

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

Test Data and Plots

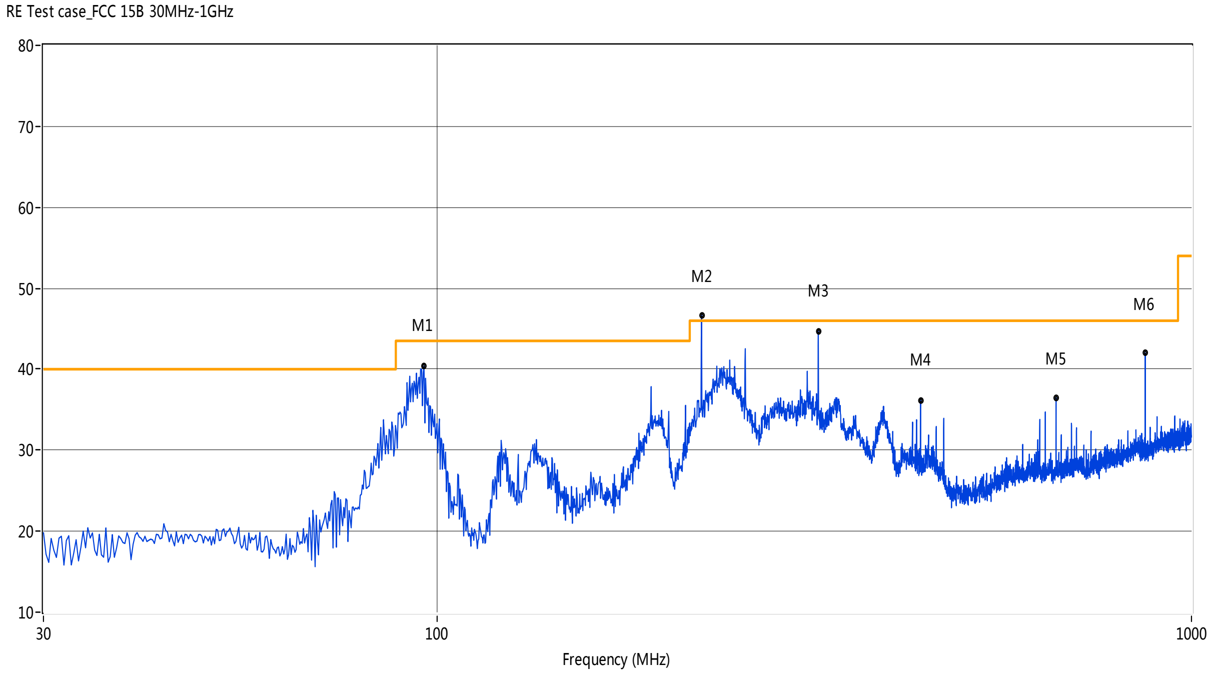
The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20 dB lower than the limit line per 15.31(o) was not reported.

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	36.30	37.92	-20.90	40.0	2.08	Peak	106.90	100	Vertical	Pass
2	94.49	40.75	-21.04	43.5	2.75	Peak	30.70	100	Vertical	Pass
3	197.28	41.53	-20.44	43.5	1.97	Peak	20.80	100	Vertical	Pass
4	223.95	44.28	-19.83	46.0	1.72	Peak	35.90	100	Vertical	Pass
5	277.29	49.28	-18.48	46.0	-3.28	Peak	2.90	143.90	Vertical	N/A
5*	277.29	42.21	-18.48	46.0	3.79	QP	2.90	143.90	Vertical	Pass
7	319.96	43.72	-17.04	46.0	2.28	Peak	-0.70	100	Vertical	Pass

30 MHz to 1 GHz, ANT H

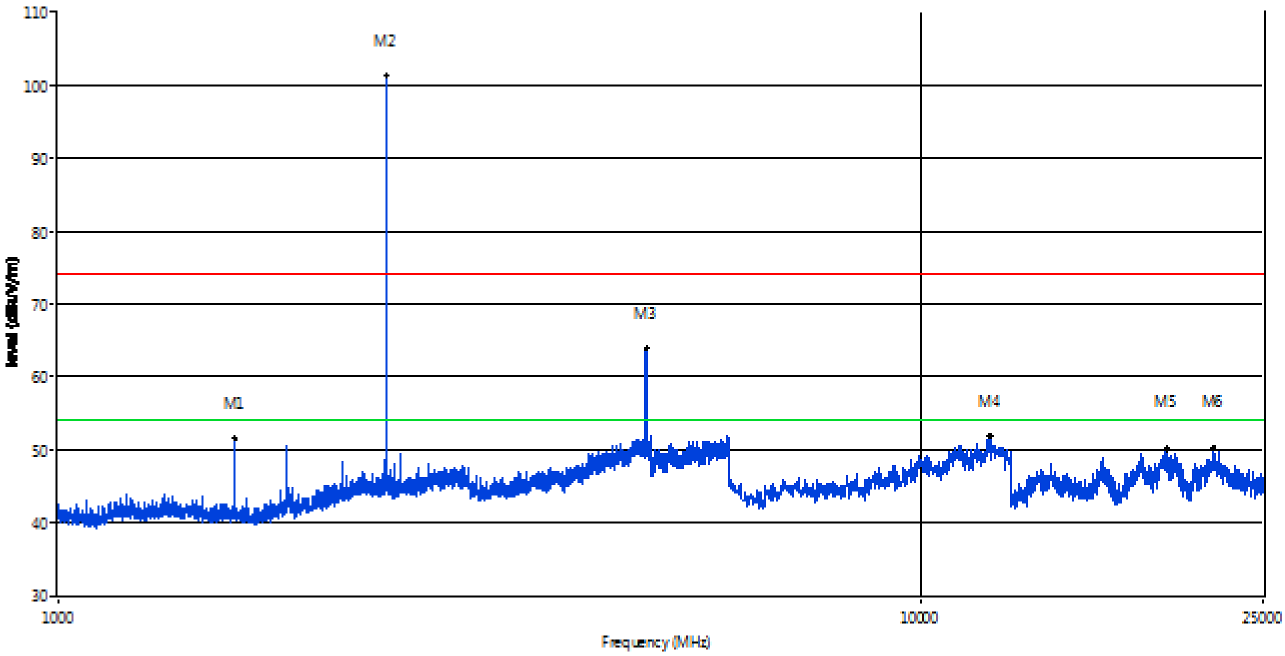


No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	95.94	40.37	-20.82	43.5	3.13	Peak	297.40	100	Horizontal	Pass
2	224.05	46.68	-19.83	46.0	-0.68	Peak	24.80	106.80	Horizontal	N/A
2*	224.05	40.61	-19.83	46.0	5.39	QP	24.80	106.80	Horizontal	Pass
3	319.96	44.70	-17.04	46.0	1.30	Peak	312.60	100	Horizontal	Pass
4	437.30	36.15	-14.58	46.0	9.85	Peak	307.40	100	Horizontal	Pass
5	661.07	36.46	-10.19	46.0	9.54	Peak	106.00	100	Horizontal	Pass
6	868.11	42.01	-6.25	46.0	3.99	Peak	333.00	100	Horizontal	Pass

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

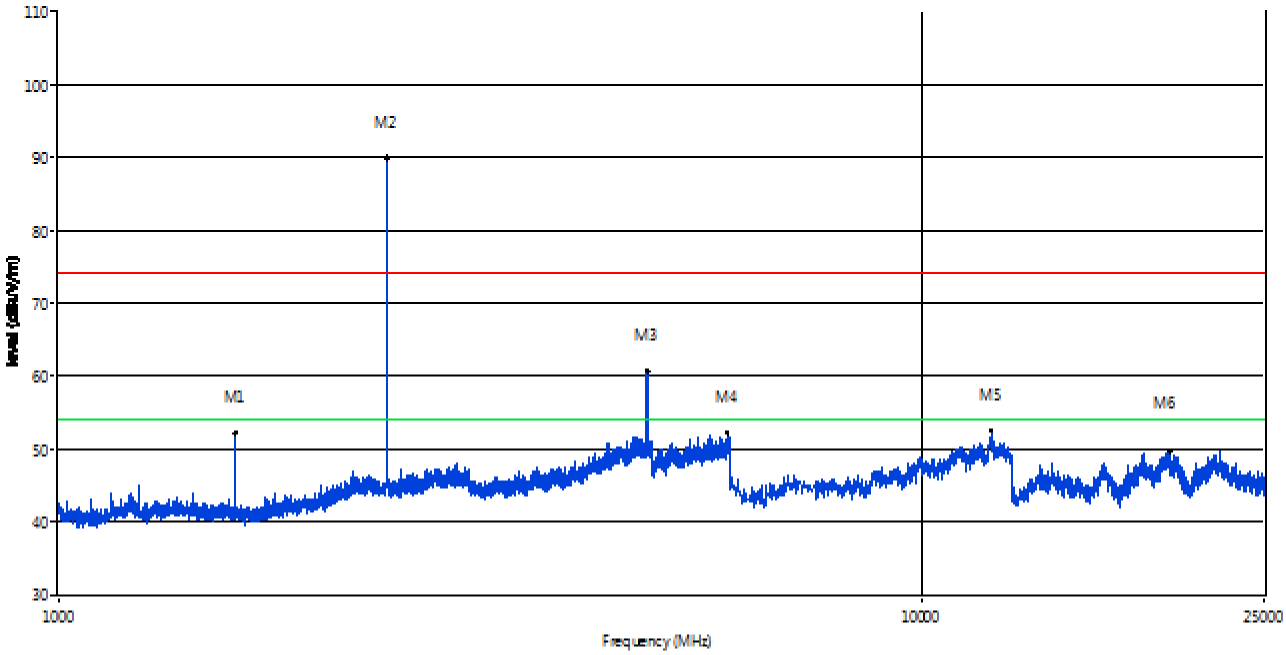
Test Data and Plots (1 GHz ~ 10th Harmonic)

GFSK LOW CHANNEL 1 GHz to 25 GHz, ANT V



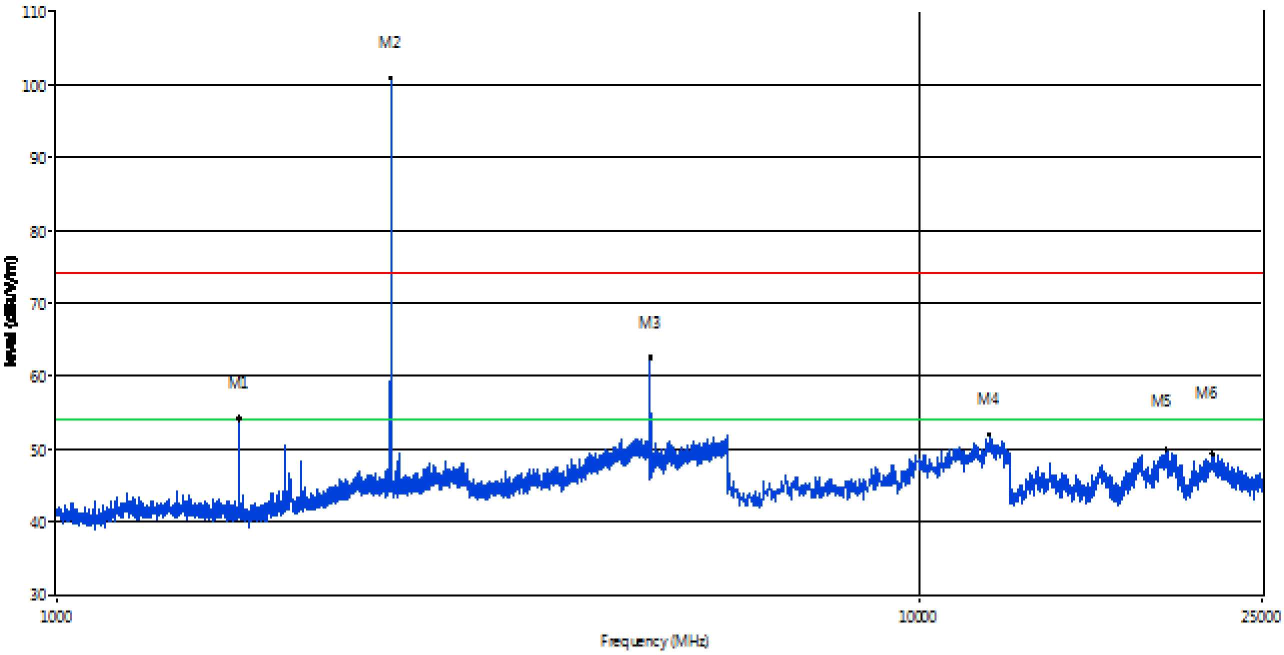
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1601.85	51.45	-4.37	74.0	22.55	Peak	340.30	100	Vertical	Pass
2	2402.15	101.23	-0.34	74.0	-27.23	Peak	35.90	100	Vertical	N/A
3	4804.80	63.95	13.77	74.0	10.05	Peak	33.90	100	Vertical	N/A
3**	4804.80	42.67	13.77	54.0	12.67	AV	33.90	100	Vertical	Pass
4	12053.66	51.89	20.82	74.0	22.11	Peak	269.70	100	Vertical	Pass
5	19309.48	50.04	13.46	74.0	23.96	Peak	57.40	100	Vertical	Pass
6	21885.19	50.24	12.61	74.0	23.76	Peak	325.20	100	Vertical	Pass

GFSK LOW CHANNEL 1 GHz to 25 GHz, ANT H



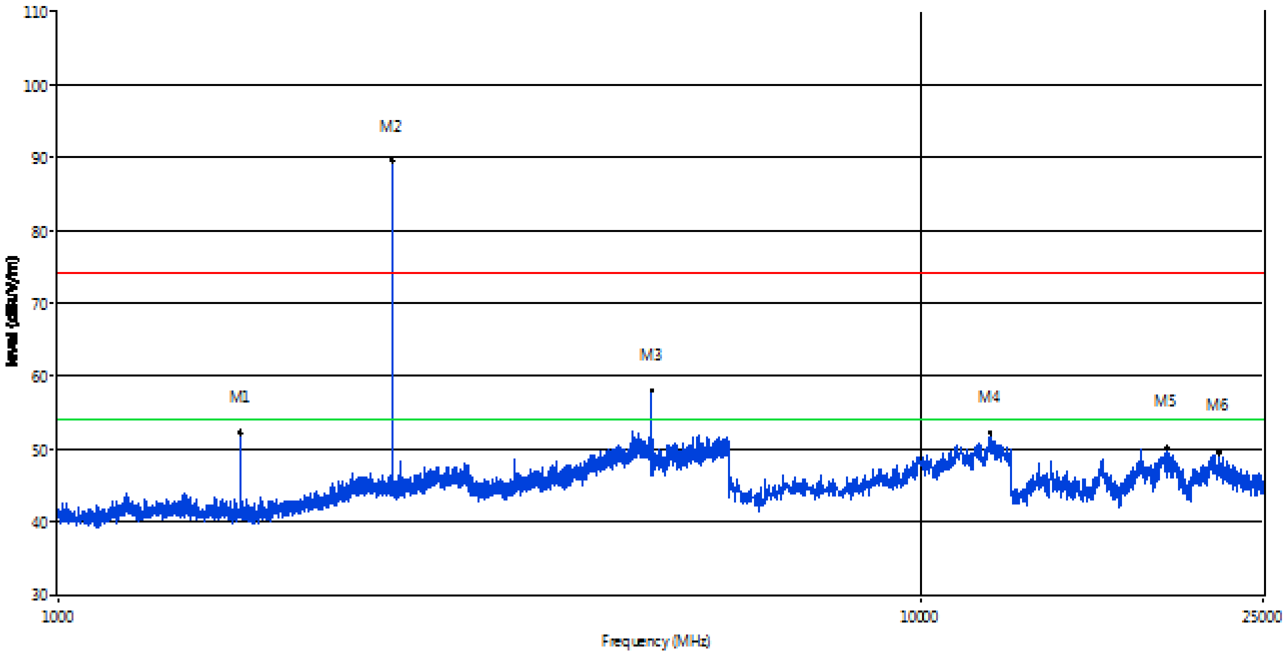
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1601.85	52.24	-4.37	74.0	21.76	Peak	28.80	100	Horizontal	Pass
2	2401.65	89.84	-0.27	74.0	-15.84	Peak	351.60	100	Horizontal	N/A
3	4804.80	60.78	13.77	74.0	13.22	Peak	292.20	100	Horizontal	N/A
3**	4804.80	40.23	13.77	54.0	14.23	AV	292.20	100	Horizontal	Pass
4	5954.26	52.22	15.89	74.0	21.78	Peak	330.00	100	Horizontal	Pass
5	12053.66	52.63	20.82	74.0	21.37	Peak	269.70	100	Horizontal	Pass
6	19449.25	49.67	12.80	74.0	24.33	Peak	46.60	100	Horizontal	Pass

GFSK MIDDLE CHANNEL 1 GHz to 25 GHz, ANT V



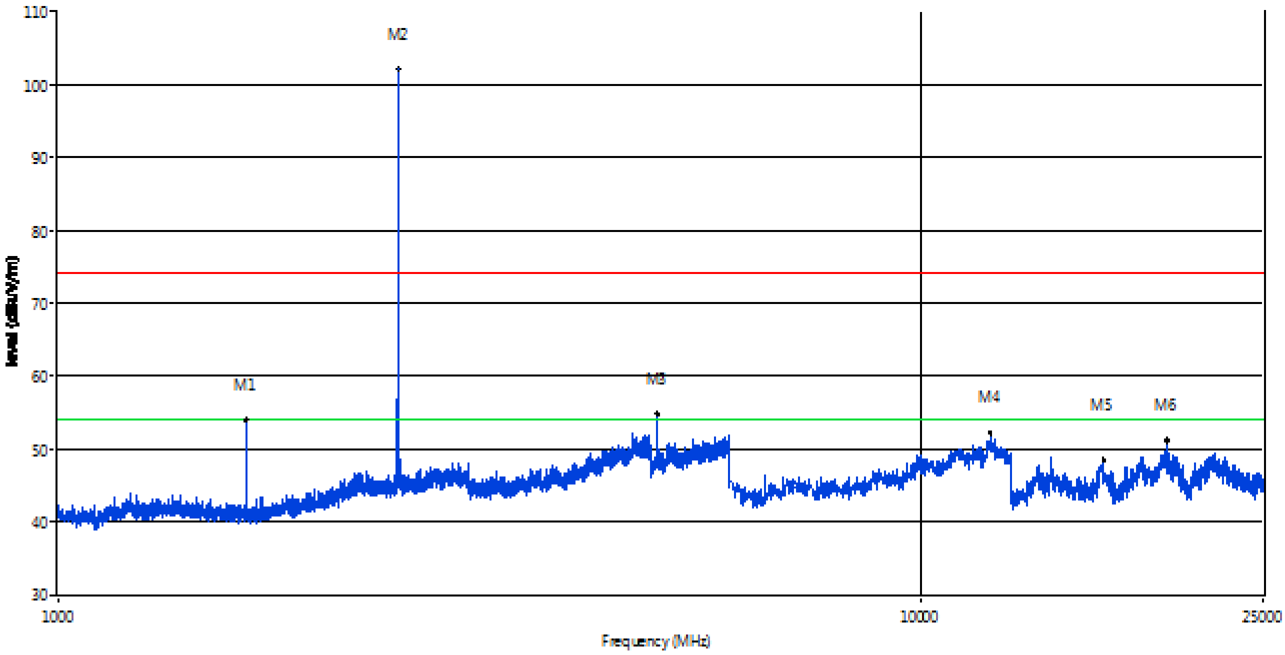
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1626.84	53.89	-4.29	74.0	20.11	Peak	343.30	100	Vertical	Pass
2	2440.64	100.95	-0.41	74.0	-26.95	Peak	35.90	100	Vertical	N/A
3	4882.03	62.58	13.60	74.0	11.42	Peak	32.20	100	Vertical	N/A
3**	4882.03	41.34	13.60	54.0	12.66	AV	32.20	100	Vertical	Pass
4	12053.66	52.11	20.82	74.0	21.89	Peak	269.70	100	Vertical	Pass
5	19359.40	49.83	13.15	74.0	24.17	Peak	111.10	100	Vertical	Pass
6	21885.19	49.38	12.61	74.0	24.62	Peak	325.20	100	Vertical	Pass

GFSK MIDDLE CHANNEL 1 GHz to 25 GHz, ANT H



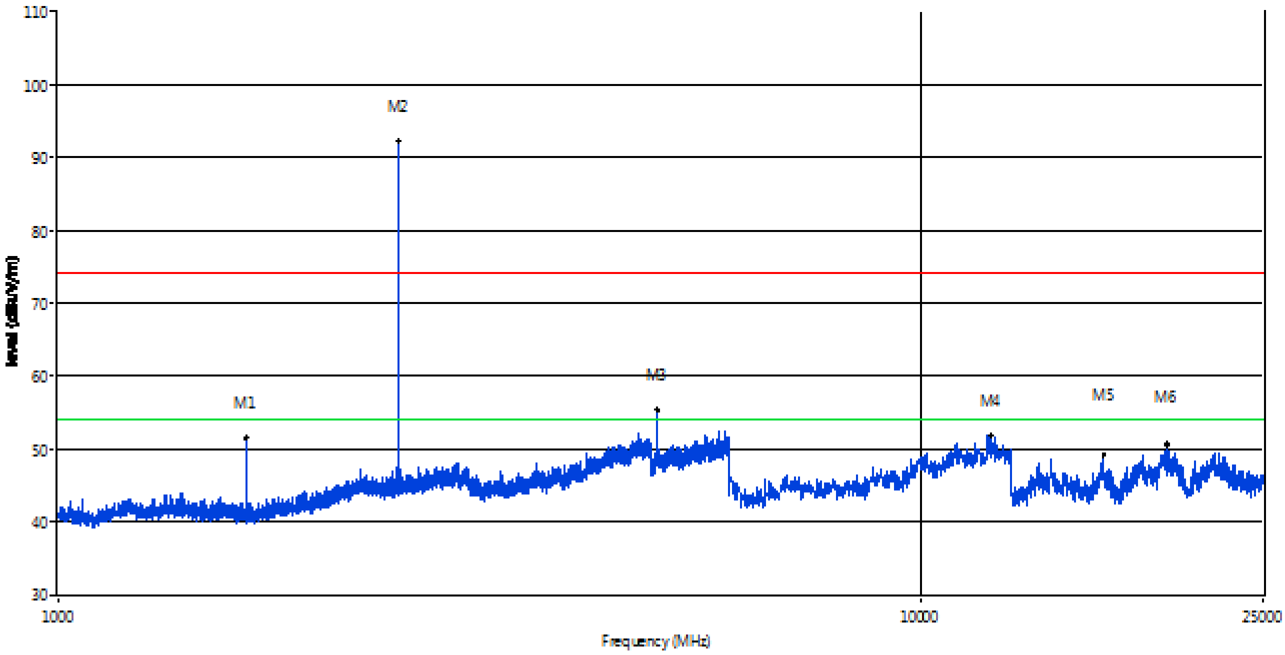
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1626.84	52.22	-4.29	74.0	21.78	Peak	356.50	100	Horizontal	Pass
2	2441.14	89.51	-0.38	74.0	-15.51	Peak	348.30	100	Horizontal	N/A
3	4882.03	58.08	13.60	74.0	15.92	Peak	226.70	100	Horizontal	N/A
3**	4882.03	41.03	13.60	54.0	12.97	AV	226.70	100	Horizontal	Pass
4	12053.66	52.29	20.82	74.0	21.71	Peak	269.70	100	Horizontal	Pass
5	19309.48	50.32	13.46	74.0	23.68	Peak	57.40	100	Horizontal	Pass
6	22194.68	49.53	12.12	74.0	24.47	Peak	0.50	100	Horizontal	Pass

GFSK HIGH CHANNEL 1 GHz to 25 GHz, ANT V



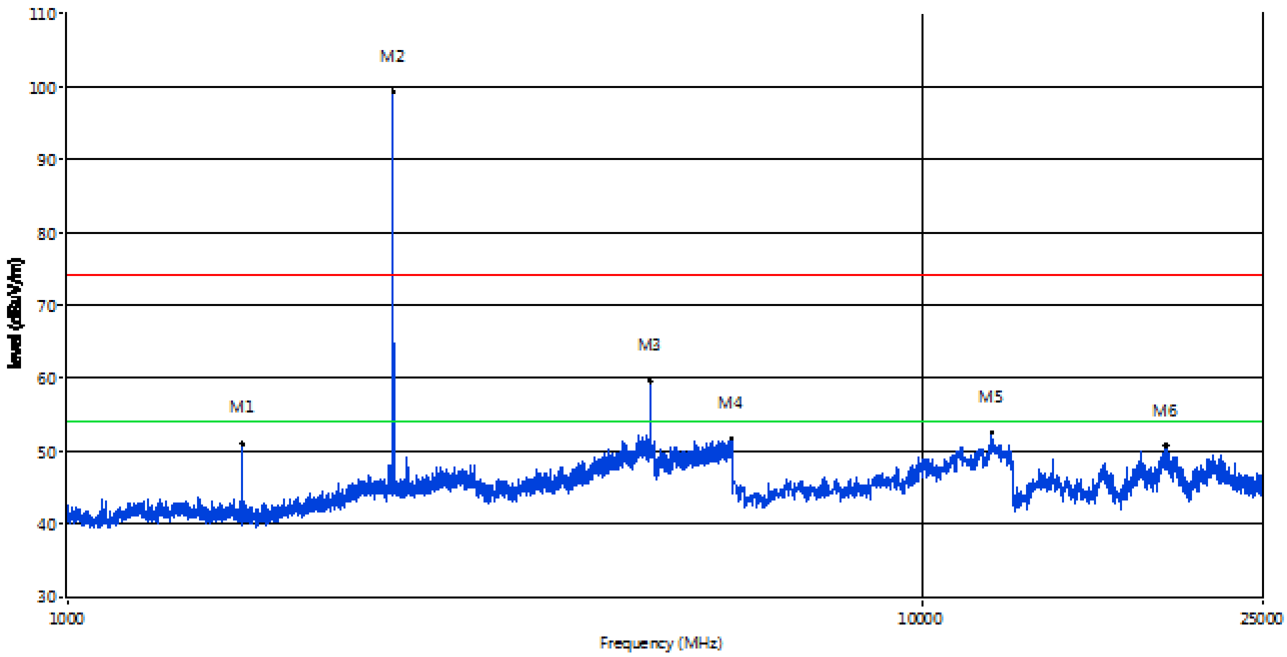
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1652.84	53.97	-4.05	74.0	20.03	Peak	334.70	100	Vertical	Pass
2	2480.13	102.21	-0.60	74.0	-28.21	Peak	35.90	100	Vertical	N/A
3	4960.01	54.80	14.22	74.0	19.20	Peak	274.10	100	Vertical	N/A
3**	4960.01	34.79	14.22	54.0	19.21	AV	274.10	100	Vertical	Pass
4	12053.66	52.19	20.82	74.0	21.81	Peak	269.70	100	Vertical	Pass
5	16327.37	48.41	11.70	74.0	25.59	Peak	157.30	100	Vertical	Pass
6	19309.48	51.18	13.46	74.0	22.82	Peak	57.40	100	Vertical	Pass

GFSK HIGH CHANNEL 1 GHz to 25 GHz, ANT H



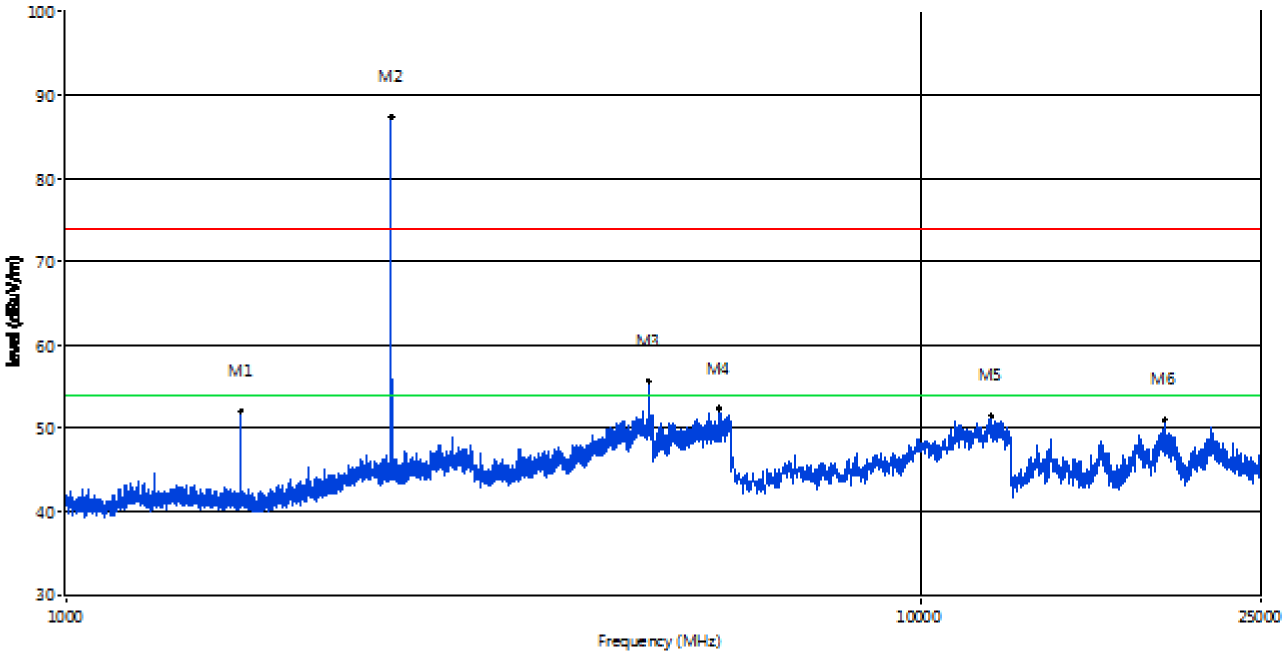
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1652.84	51.56	-4.05	74.0	22.44	Peak	271.10	100	Horizontal	Pass
2	2480.13	92.19	-0.60	74.0	-18.19	Peak	353.10	100	Horizontal	N/A
3	4960.01	55.39	14.22	74.0	18.61	Peak	208.40	100	Horizontal	N/A
3**	4960.01	34.57	14.22	54.0	19.43	AV	208.40	100	Horizontal	Pass
4	12098.59	51.80	20.77	74.0	22.20	Peak	307.00	100	Horizontal	Pass
5	16327.37	49.17	11.70	74.0	24.83	Peak	157.30	100	Horizontal	Pass
6	19309.48	50.62	13.46	74.0	23.38	Peak	57.40	100	Horizontal	Pass

∏/4-DQPSK LOW CHANNEL 1 GHz to 25 GHz, ANT V



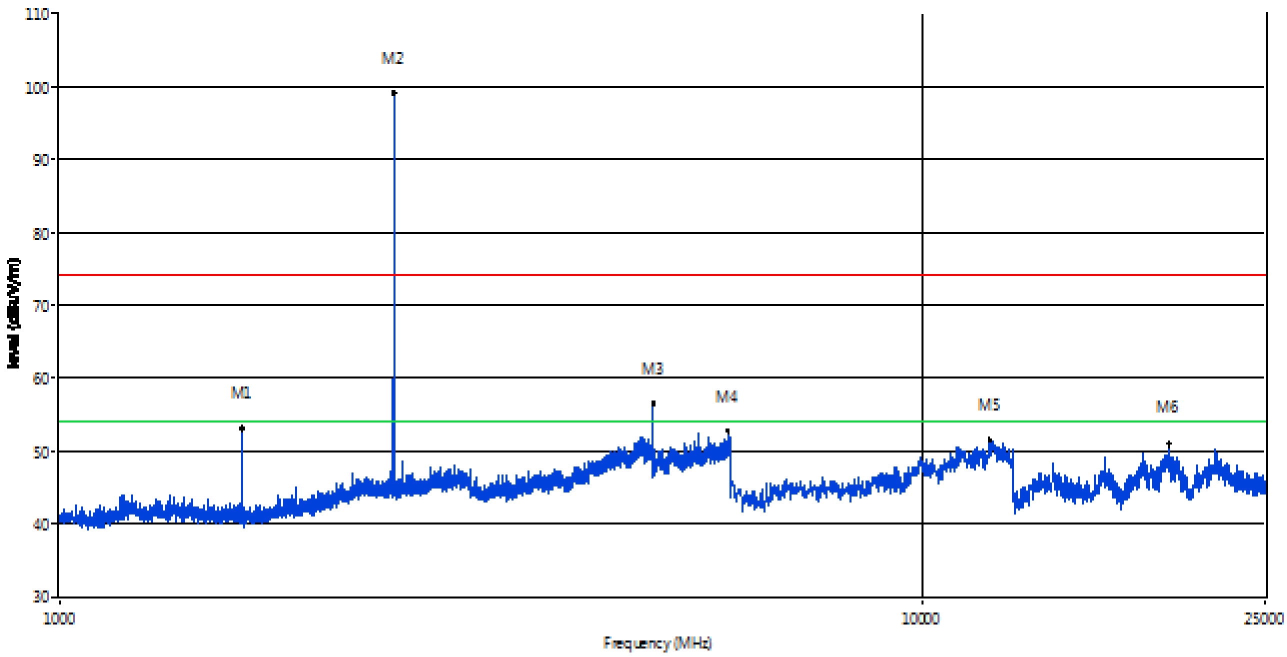
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1601.85	51.06	-4.37	74.0	22.94	Peak	348.20	100	Vertical	Pass
2	2401.65	99.32	-0.27	74.0	-25.32	Peak	35.80	100	Vertical	N/A
3	4804.05	59.70	13.74	74.0	14.30	Peak	31.30	100	Vertical	N/A
3**	4804.05	38.56	13.74	54.0	15.44	Peak	31.30	100	Vertical	Pass
4	5981.26	51.69	15.81	74.0	22.31	Peak	134.40	100	Vertical	Pass
5	12053.66	52.66	20.82	74.0	21.34	Peak	269.70	100	Vertical	Pass
6	19309.48	50.85	13.46	74.0	23.15	Peak	57.40	100	Vertical	Pass

∏/4-DQPSK LOW CHANNEL 1 GHz to 25 GHz, ANT H



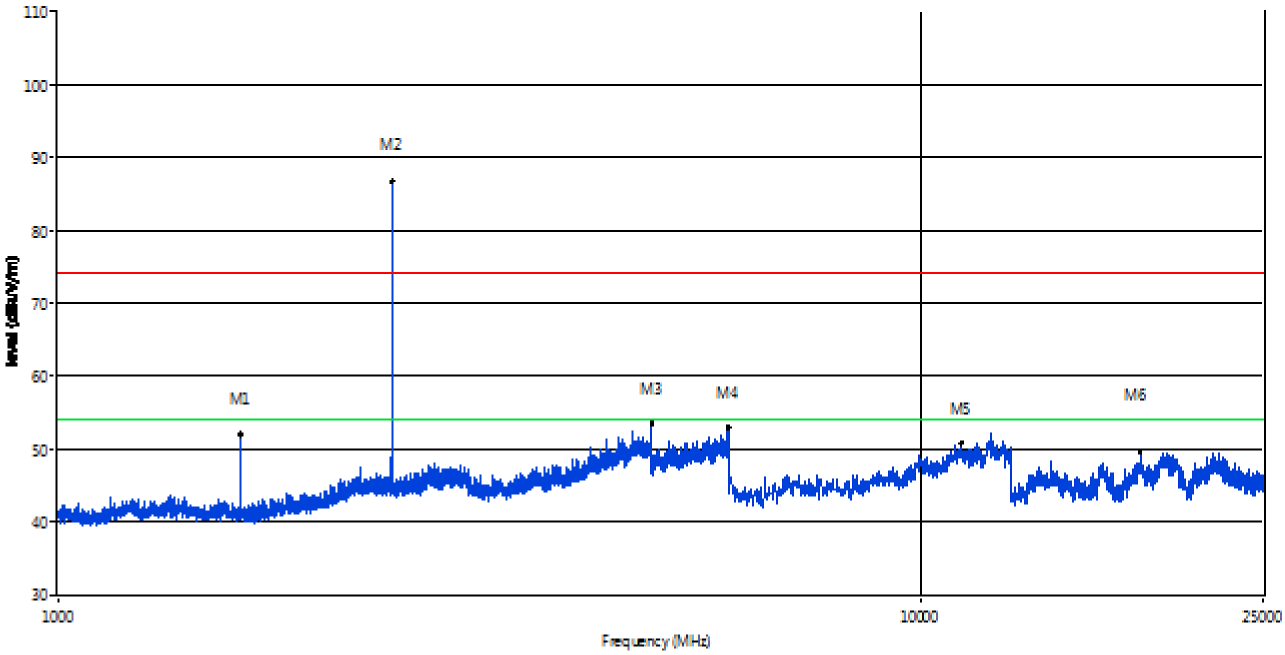
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1602.35	52.08	-4.32	74.0	21.92	Peak	17.10	100	Horizontal	PASS
2	2402.15	87.44	-0.34	74.0	-13.44	Peak	348.90	100	Horizontal	N/A
3	4804.05	55.65	13.74	74.0	18.35	Peak	58.30	100	Horizontal	N/A
3**	4804.05	44.32	13.74	54.0	9.68	AV	58.30	100	Horizontal	PASS
4	5803.55	52.36	15.41	74.0	21.64	Peak	184.60	100	Horizontal	PASS
5	12098.59	51.39	20.77	74.0	22.61	Peak	307.00	100	Horizontal	PASS

∏/4-DQPSK MIDDLE CHANNEL 1 GHz to 25 GHz, ANT V



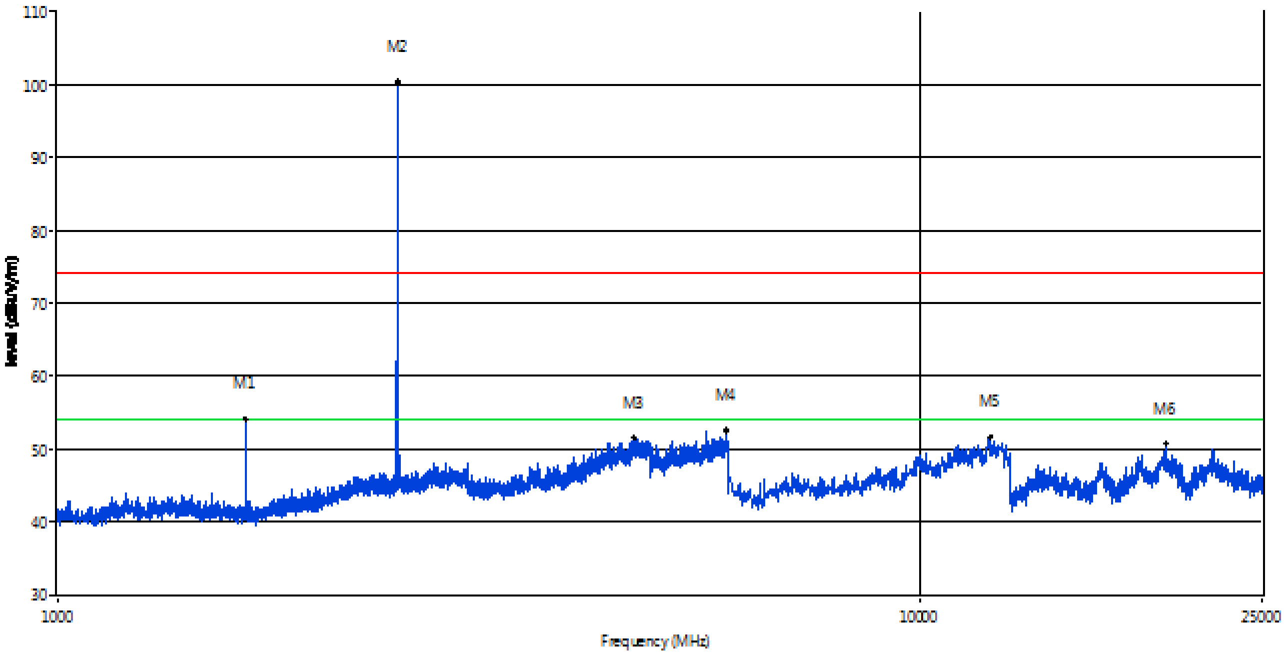
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1626.84	53.14	-4.29	74.0	20.86	Peak	335.60	100	Vertical	PASS
2	2440.64	99.09	-0.41	74.0	-25.09	Peak	36.00	100	Vertical	N/A
3	4881.28	56.51	13.62	74.0	17.49	Peak	36.90	100	Vertical	N/A
3**	4881.28	35.73	13.62	54.0	18.27	AV	36.90	100	Vertical	PASS
4	5952.76	52.80	15.90	74.0	21.20	Peak	209.30	100	Vertical	PASS
5	11986.27	51.43	20.81	74.0	22.57	Peak	70.90	100	Vertical	PASS
6	19309.48	51.06	13.46	74.0	22.94	Peak	57.40	100	Vertical	PASS

∏/4-DQPSK MIDDLE CHANNEL 1 GHz to 25 GHz, ANT H



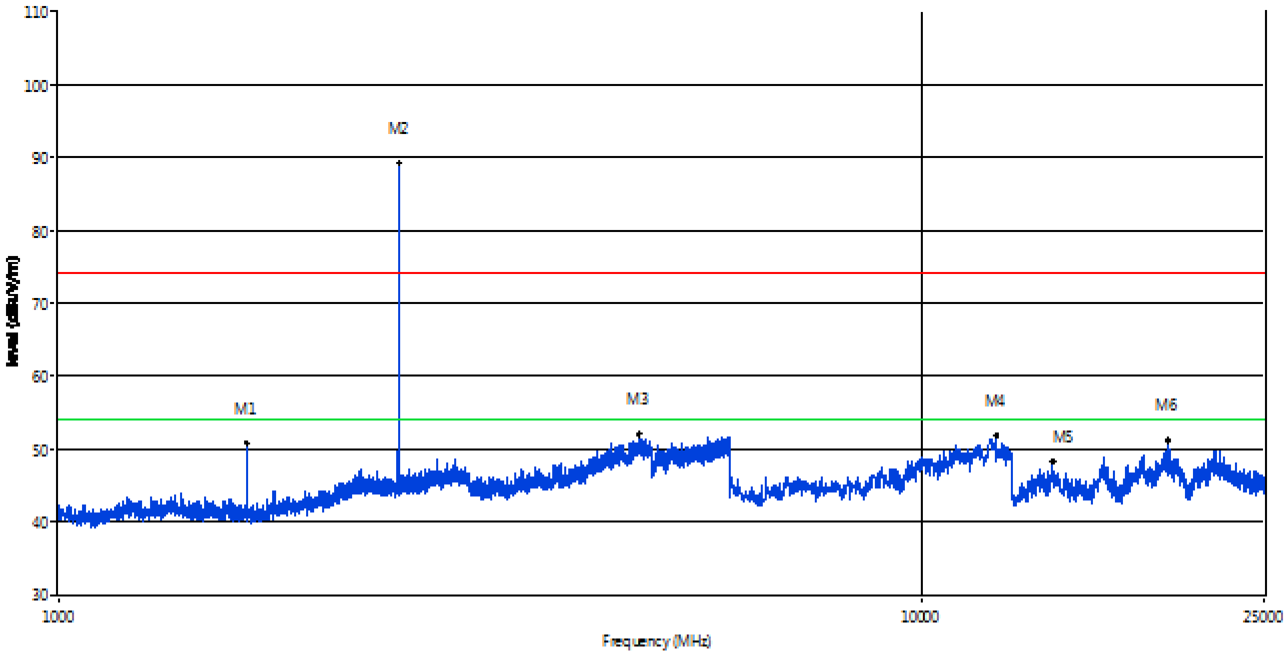
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1626.84	51.96	-4.29	74.0	22.04	Peak	360.00	100	Horizontal	PASS
2	2441.14	86.80	-0.38	74.0	-12.80	Peak	347.80	100	Horizontal	N/A
3	4882.03	53.52	13.60	74.0	20.48	Peak	82.90	100	Horizontal	PASS
4	5990.25	52.99	15.78	74.0	21.01	Peak	208.90	100	Horizontal	PASS
5	11166.39	50.79	20.21	74.0	23.21	Peak	76.10	100	Horizontal	PASS
6	18022.46	49.48	13.26	74.0	24.52	Peak	168.00	100	Horizontal	PASS

∏/4-DQPSK HIGH CHANNEL 1 GHz to 25 GHz, ANT V



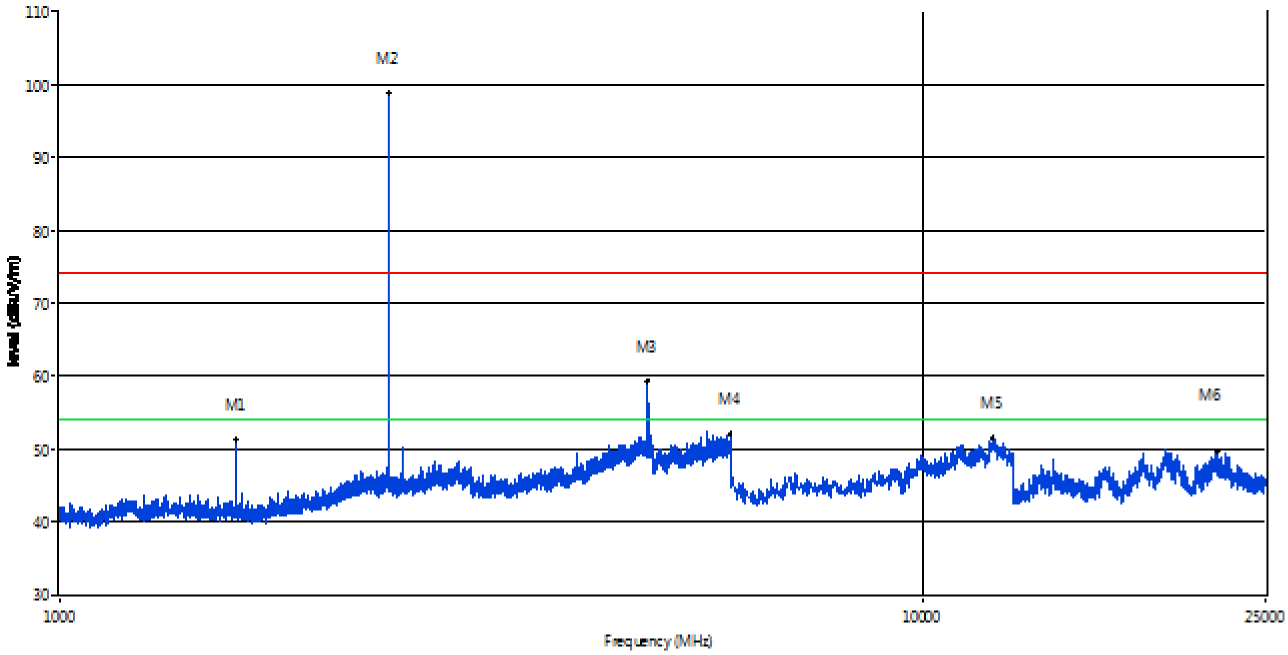
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1652.34	53.21	-4.10	74.0	20.79	Peak	334.90	100	Vertical	PASS
2	2480.13	100.44	-0.60	74.0	-26.44	Peak	35.90	100	Vertical	N/A
3	4676.58	51.60	13.11	74.0	22.40	Peak	157.60	100	Vertical	PASS
4	5961.01	52.62	15.71	74.0	21.38	Peak	274.00	100	Vertical	PASS
5	12098.59	51.66	20.77	74.0	22.34	Peak	307.00	100	Vertical	PASS
6	19309.48	50.79	13.46	74.0	23.21	Peak	57.40	100	Vertical	PASS

∏/4-DQPSK HIGH CHANNEL 1 GHz to 25 GHz, ANT H



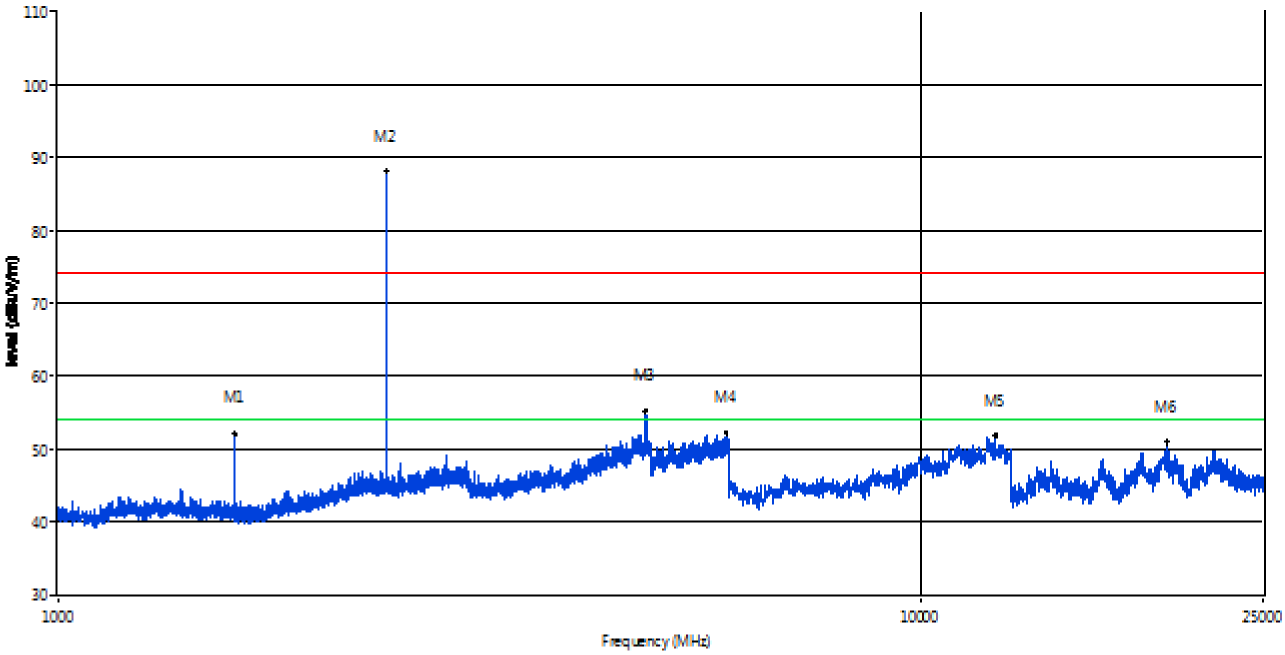
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1652.34	50.87	-4.10	74.0	23.13	Peak	270.40	100	Horizontal	PASS
2	2479.63	89.11	-0.63	74.0	-15.11	Peak	352.50	100	Horizontal	N/A
3	4713.32	52.04	13.47	74.0	21.96	Peak	185.00	100	Horizontal	PASS
4	12233.36	51.83	20.65	74.0	22.17	Peak	0.30	100	Horizontal	PASS
5	14205.91	48.31	9.61	74.0	25.69	Peak	18.00	100	Horizontal	PASS
6	19309.48	51.22	13.46	74.0	22.78	Peak	57.40	100	Horizontal	PASS

8-DPSK LOW CHANNEL 1 GHz to 25 GHz, ANT V



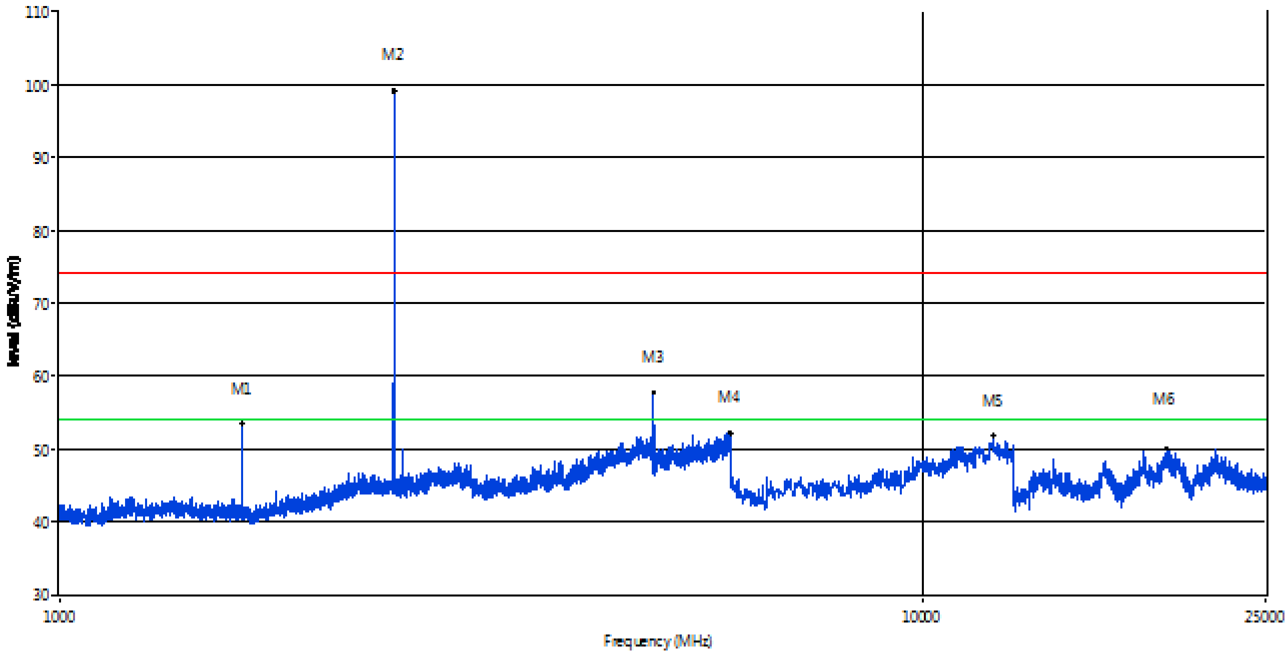
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1601.85	51.25	-4.37	74.0	22.75	Peak	337.60	100	Vertical	PASS
2	2402.15	98.85	-0.34	74.0	-24.85	Peak	32.40	100	Vertical	N/A
3	4804.05	59.39	13.74	74.0	14.61	Peak	34.60	100	Vertical	N/A
3**	4804.05	38.83	13.74	54.0	15.17	AV	34.60	100	Vertical	PASS
4	5994.75	51.96	15.72	74.0	22.04	Peak	350.70	100	Vertical	PASS
5	12053.66	51.52	20.82	74.0	22.48	Peak	269.70	100	Vertical	PASS
6	21995.01	49.68	12.40	74.0	24.32	Peak	1.90	100	Vertical	PASS

8-DPSK LOW CHANNEL 1 GHz to 25 GHz, ANT H



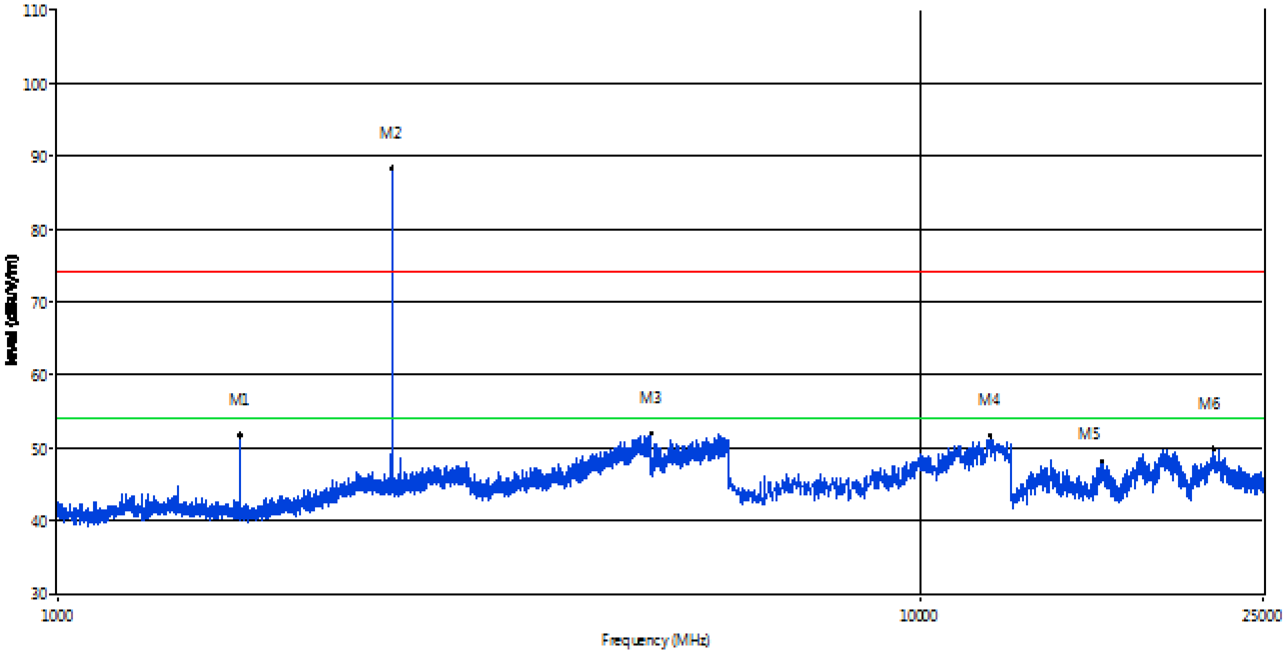
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1601.85	52.13	-4.37	74.0	21.87	Peak	26.20	100	Horizontal	PASS
2	2401.65	88.06	-0.27	74.0	-14.06	Peak	342.70	100	Horizontal	N/A
3	4804.05	55.31	13.74	74.0	18.69	Peak	62.70	100	Horizontal	N/A
3**	4804.05	34.61	13.74	54.0	19.39	AV	62.70	100	Horizontal	PASS
4	5951.26	52.13	15.91	74.0	21.87	Peak	208.00	100	Horizontal	PASS
5	12233.36	51.80	20.65	74.0	22.20	Peak	0.30	100	Horizontal	PASS
6	19309.48	50.98	13.46	74.0	23.02	Peak	57.40	100	Horizontal	PASS

8-DPSK MIDDLE CHANNEL 1 GHz to 25 GHz, ANT V



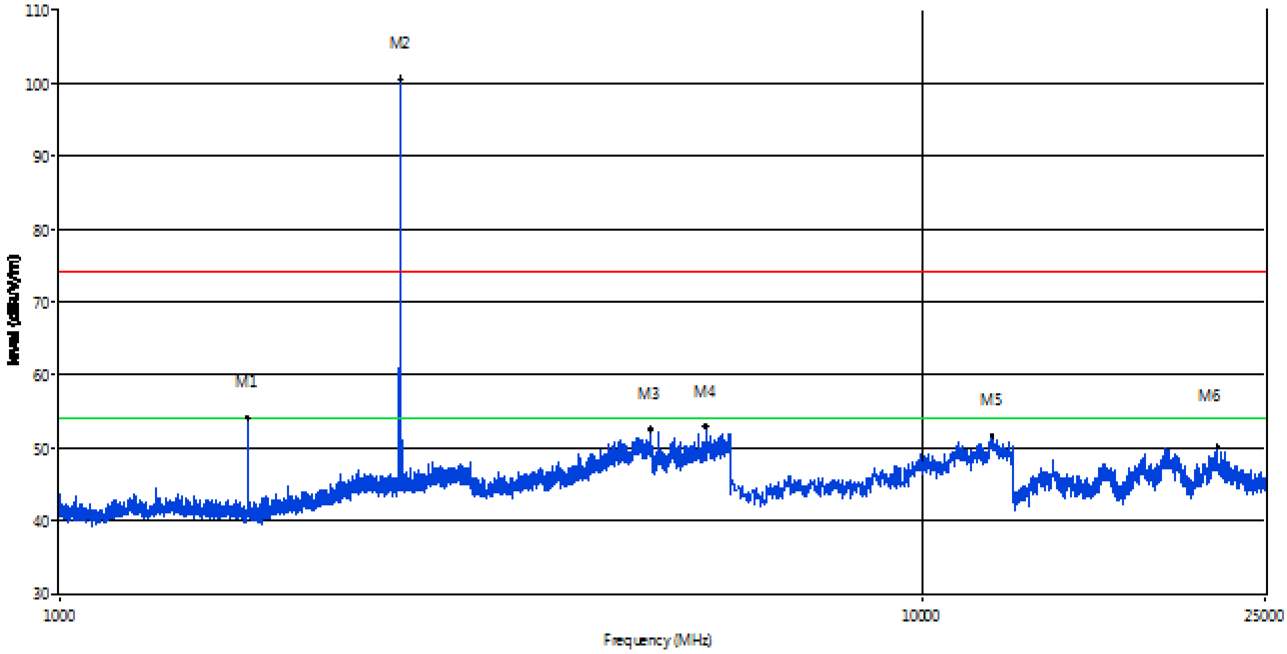
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1626.84	53.40	-4.29	74.0	20.60	Peak	330.40	100	Vertical	PASS
2	2441.14	99.22	-0.38	74.0	-25.22	Peak	31.60	100	Vertical	N/A
3	4882.03	57.68	13.60	74.0	16.32	Peak	304.00	100	Vertical	N/A
3**	4882.03	36.45	13.60	54.0	17.55	AV	304.00	100	Vertical	PASS
4	5986.50	52.22	15.72	74.0	21.78	Peak	262.40	100	Vertical	PASS
5	12098.59	51.90	20.77	74.0	22.10	Peak	307.00	100	Vertical	PASS

8-DPSK MIDDLE CHANNEL 1 GHz to 25 GHz, ANT H



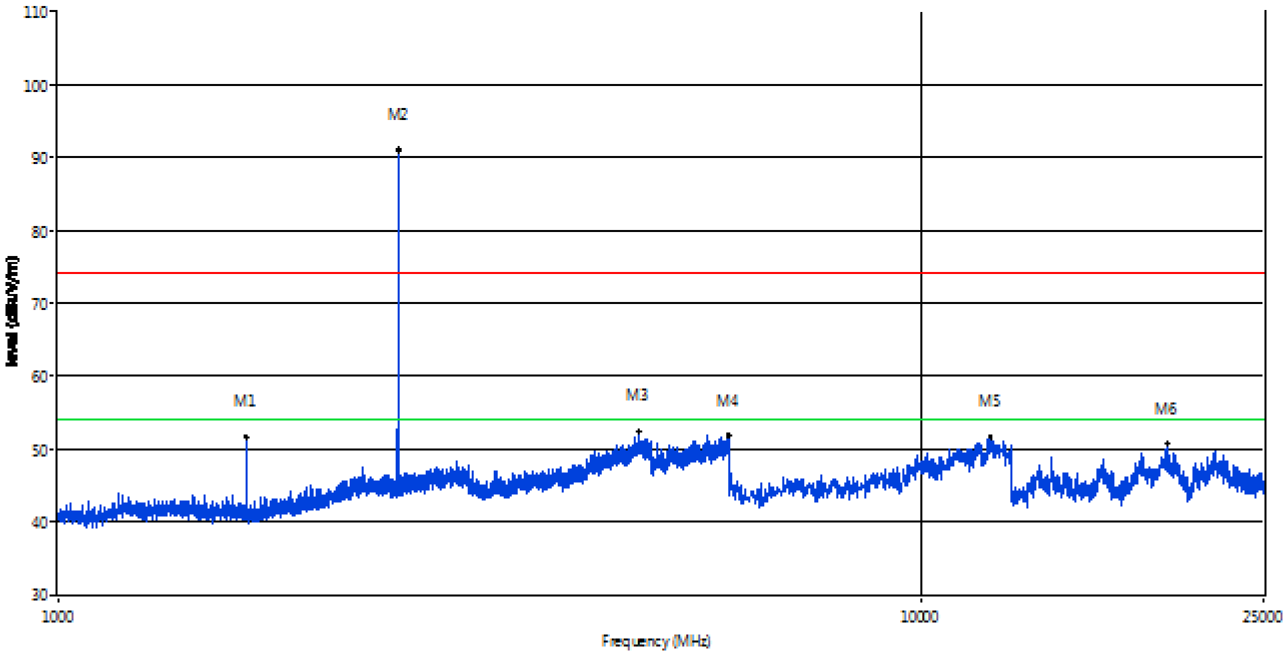
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1626.84	51.67	-4.29	74.0	22.33	Peak	360.00	100	Horizontal	PASS
2	2441.14	88.27	-0.38	74.0	-14.27	Peak	343.20	100	Horizontal	N/A
3	4881.28	51.98	13.62	74.0	22.02	Peak	234.30	100	Horizontal	PASS
4	12053.66	51.65	20.82	74.0	22.35	Peak	269.70	100	Horizontal	PASS
5	16244.18	48.06	11.47	74.0	25.94	Peak	269.10	100	Horizontal	PASS
6	21885.19	49.90	12.61	74.0	24.10	Peak	325.20	100	Horizontal	PASS

8-DPSK HIGH CHANNEL 1 GHz to 25 GHz, ANT V



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1652.84	53.78	-4.05	74.0	20.22	Peak	330.80	100	Vertical	PASS
2	2480.13	100.61	-0.60	74.0	-26.61	Peak	32.40	100	Vertical	N/A
3	4834.04	52.54	13.68	74.0	21.46	Peak	356.80	100	Vertical	PASS
4	5618.35	52.91	15.40	74.0	21.09	Peak	347.60	100	Vertical	PASS
5	12053.66	51.64	20.82	74.0	22.36	Peak	269.70	100	Vertical	PASS
6	21995.01	50.06	12.40	74.0	23.94	Peak	1.90	100	Vertical	PASS
1	1652.84	53.78	-4.05	74.0	20.22	Peak	330.80	100	Vertical	PASS

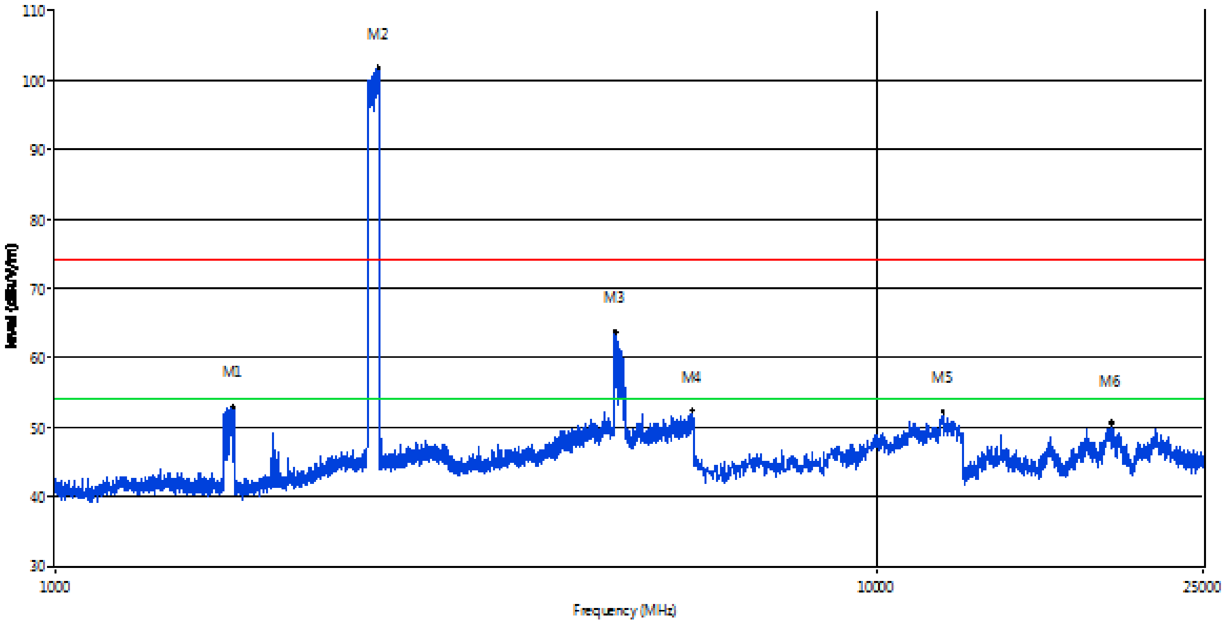
8-DPSK HIGH CHANNEL 1 GHz to 25 GHz, ANT H



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1652.84	51.61	-4.05	74.0	22.39	Peak	286.00	100	Horizontal	PASS
2	2480.13	90.94	-0.60	74.0	-16.94	Peak	343.00	100	Horizontal	N/A
3	4711.07	52.33	13.38	74.0	21.67	Peak	183.80	100	Horizontal	PASS
4	5987.25	51.89	15.77	74.0	22.11	Peak	342.20	100	Horizontal	PASS
5	12053.66	51.66	20.82	74.0	22.34	Peak	269.70	100	Horizontal	PASS
6	19309.48	50.84	13.46	74.0	23.16	Peak	57.40	100	Horizontal	PASS

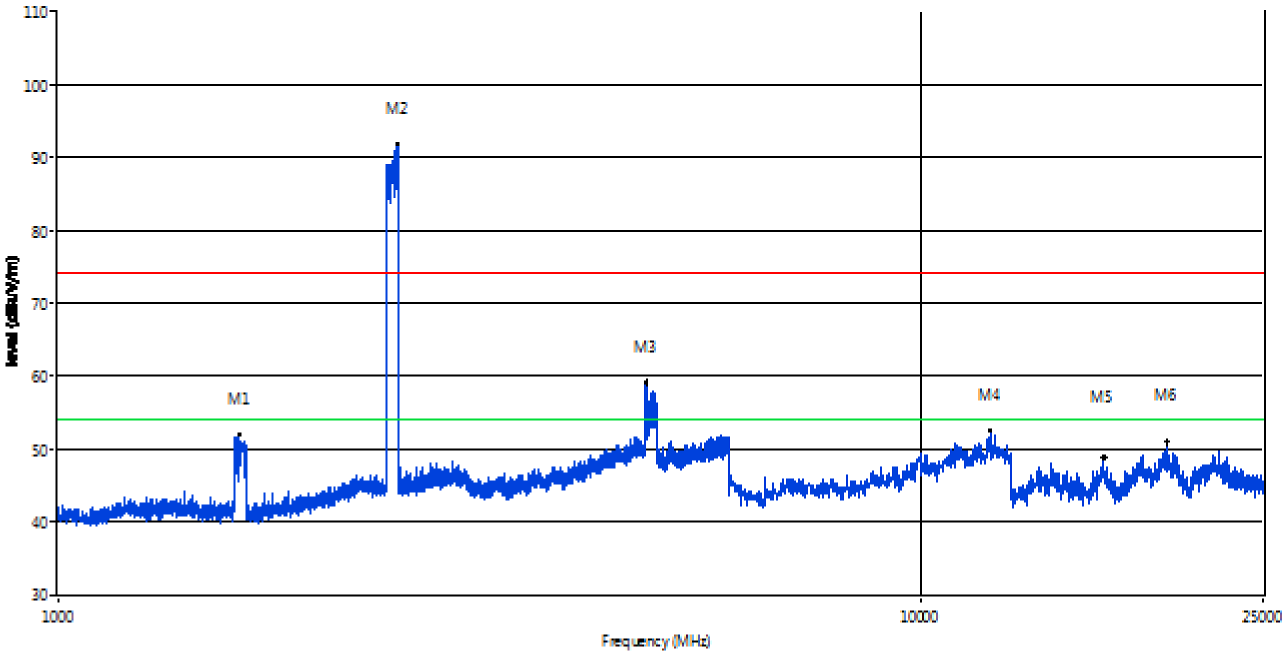
Hopping Mode:

GFSK MODE 1 GHz to 25 GHz, ANT V



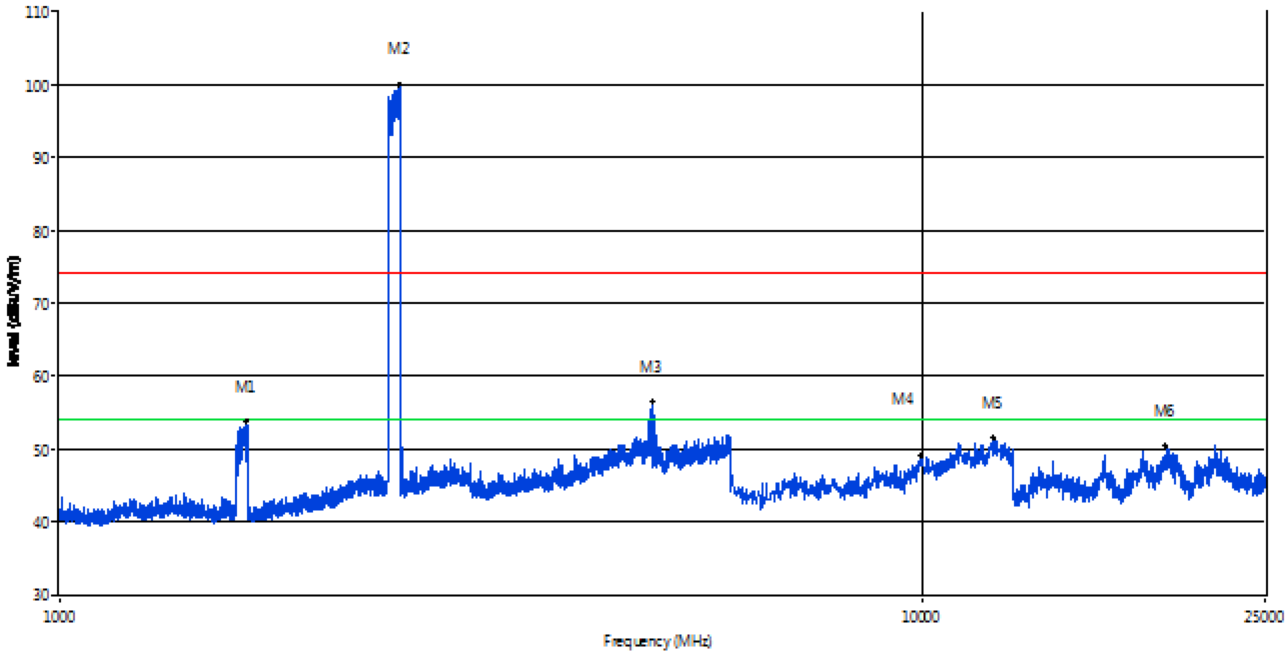
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1649.34	52.98	-4.08	74.0	21.02	Peak	333.00	100	Vertical	PASS
2	2476.13	101.76	-0.55	74.0	-27.76	Peak	35.00	100	Vertical	N/A
3	4813.80	63.71	13.96	74.0	10.29	Peak	34.30	100	Vertical	N/A
3**	4813.80	43.61	13.96	54.0	10.39	AV	34.30	100	Vertical	PASS
4	5971.51	52.37	15.64	74.0	21.63	Peak	144.80	100	Vertical	PASS
5	12053.66	52.28	20.82	74.0	21.72	Peak	269.70	100	Vertical	PASS
6	19309.48	50.59	13.46	74.0	23.41	Peak	57.40	100	Vertical	PASS

GFSK MODE 1 GHz to 25 GHz, ANT H



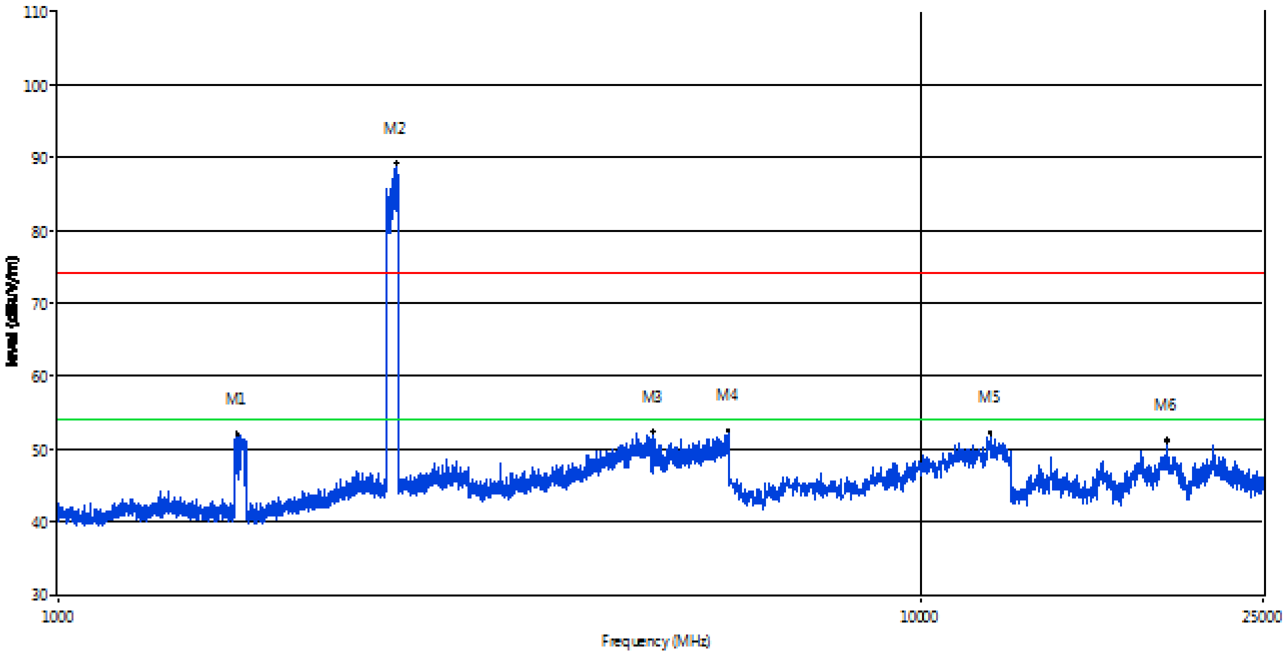
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1620.85	52.06	-4.21	74.0	21.94	Peak	359.60	100	Horizontal	PASS
2	2479.13	91.79	-0.58	74.0	-17.79	Peak	352.40	100	Horizontal	N/A
3	4807.80	59.22	13.83	74.0	14.78	Peak	344.10	100	Horizontal	N/A
3**	4807.80	38.43	13.83	54.0	15.57	AV	344.10	100	Horizontal	PASS
4	12053.66	52.52	20.82	74.0	21.48	Peak	269.70	100	Horizontal	PASS
5	16327.37	48.90	11.70	74.0	25.10	Peak	157.30	100	Horizontal	PASS
6	19309.48	50.96	13.46	74.0	23.04	Peak	57.40	100	Horizontal	PASS

∏/4-DQPSK MODE 1 GHz to 25 GHz, ANT V



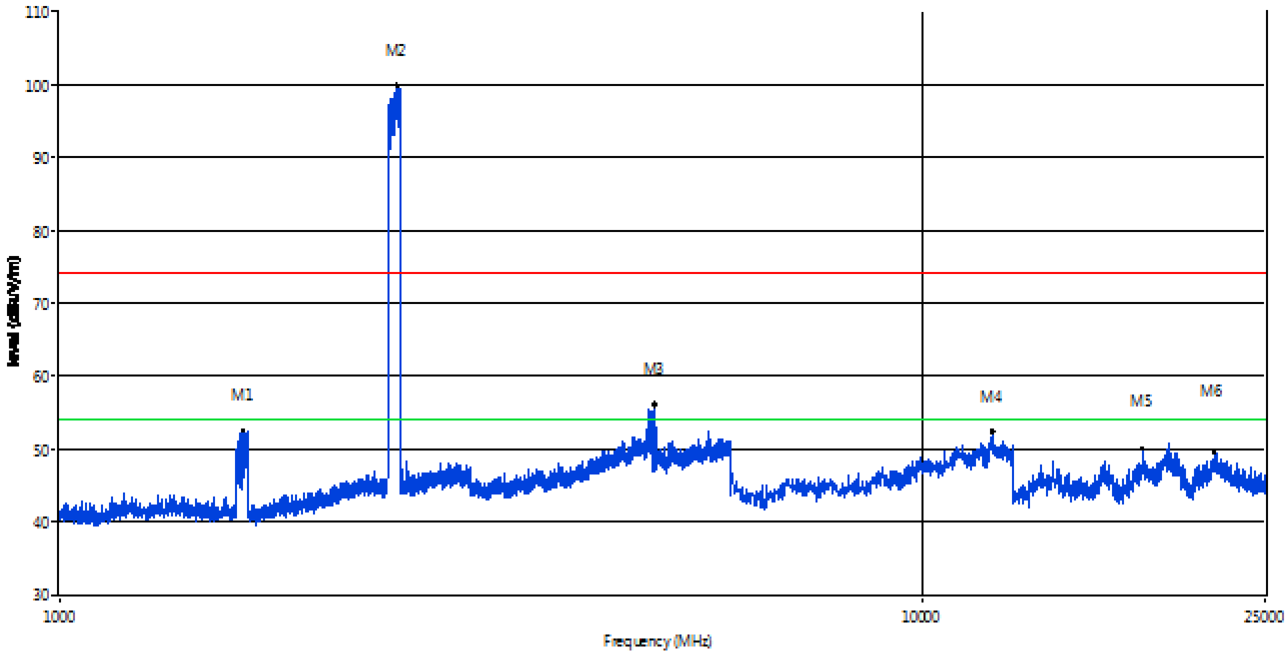
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1648.34	53.75	-4.04	74.0	20.25	Peak	334.80	100	Vertical	PASS
2	2478.63	99.96	-0.61	74.0	-25.96	Peak	334.80	100	Vertical	N/A
3	4869.28	56.40	13.61	74.0	17.60	Peak	35.80	100	Vertical	N/A
3**	4869.28	35.23	13.61	54.0	19.77	AV	35.80	100	Vertical	PASS
4	9987.10	49.11	19.33	74.0	24.89	Peak	1.40	100	Vertical	PASS
5	12098.59	51.55	20.77	74.0	22.45	Peak	307.00	100	Vertical	PASS
6	19189.68	50.46	14.08	74.0	23.54	Peak	360.20	100	Vertical	PASS

∏/4-DQPSK MODE 1 GHz to 25 GHz, ANT H



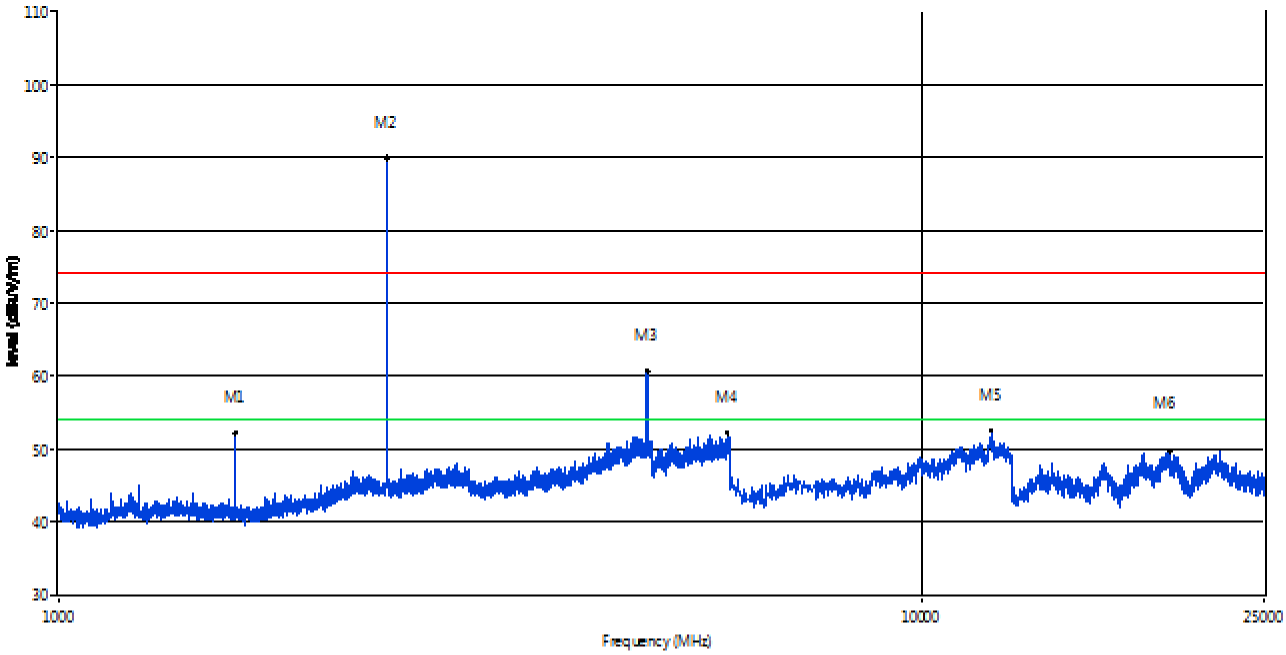
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1614.85	52.07	-4.31	74.0	21.93	Peak	0.40	100	Horizontal	PASS
2	2470.13	89.15	-0.51	74.0	-15.15	Peak	355.70	100	Horizontal	N/A
3	4897.78	52.45	13.62	74.0	21.55	Peak	209.20	100	Horizontal	PASS
4	5985.75	52.54	15.76	74.0	21.46	Peak	101.80	100	Horizontal	PASS
5	12053.66	52.27	20.82	74.0	21.73	Peak	269.70	100	Horizontal	PASS
6	19309.48	51.19	13.46	74.0	22.81	Peak	57.40	100	Horizontal	PASS

8-DPSK MODE 1 GHz to 25 GHz, ANT V



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1633.34	52.51	-4.30	74.0	21.49	Peak	337.10	100	Vertical	PASS
2	2462.13	99.93	-0.56	74.0	-25.93	Peak	31.00	100	Vertical	N/A
3	4891.78	56.09	13.61	74.0	17.91	Peak	35.10	100	Vertical	N/A
3**	4891.78	35.21	13.61	54.0	19.79	AV	35.10	100	Vertical	PASS
4	12053.66	52.42	20.82	74.0	21.58	Peak	269.70	100	Vertical	PASS
5	18022.46	50.04	13.26	74.0	23.96	Peak	168.00	100	Vertical	PASS
6	21835.28	49.62	12.70	74.0	24.38	Peak	1.90	100	Vertical	PASS

8-DPSK MODE 1 GHz to 25 GHz, ANT H



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1601.85	52.24	-4.37	74.0	21.76	Peak	28.80	100	Horizontal	PASS
2	2401.65	89.84	-0.27	74.0	-15.84	Peak	351.60	100	Horizontal	N/A
3	4804.80	60.78	13.77	74.0	13.22	Peak	292.20	100	Horizontal	N/A
3**	4804.80	40.23	13.77	54.0	14.23	AV	292.20	100	Horizontal	PASS
4	5954.26	52.22	15.89	74.0	21.78	Peak	330.00	100	Horizontal	PASS
5	12053.66	52.63	20.82	74.0	21.37	Peak	269.70	100	Horizontal	PASS
6	19449.25	49.67	12.80	74.0	24.33	Peak	46.60	100	Horizontal	PASS

A.9 Band Edge

Test data for Bluetooth 3.0:

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.

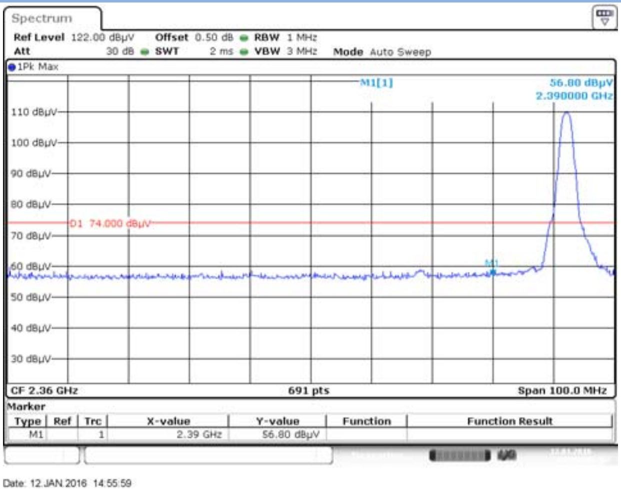
Note 3: The average levels were calculated from the peak level corrected with duty cycle correction factor (-21.1923 dB) derived from 20log (dwell time/100 ms).

For example: Average level = 56.80 dBuV/m – 21.1923 (dB) = 35.6077 dBuV/m.

Test Mode	Test Channel	Frequency (MHz)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Remark	Verdict
GFSK	Low	2390	56.80	74	17.20	PEAK	Pass
		2390	35.61	54	18.39	AVERAGE	Pass
GFSK	HIGH	2483.5	67.92	74	6.08	PEAK	Pass
		2483.5	46.73	54	7.27	AVERAGE	Pass
∏/4DQPSK	Low	2390	57.76	74	16.24	PEAK	Pass
		2390	36.57	54	17.43	AVERAGE	Pass
∏/4DQPSK	HIGH	2483.5	65.08	74	8.92	PEAK	Pass
		2483.5	43.89	54	10.11	AVERAGE	Pass
8-DPSK	Low	2390	56.86	74	17.14	PEAK	Pass
		2390	35.67	54	18.33	AVERAGE	Pass
8-DPSK	HIGH	2483.5	64.49	74	9.51	PEAK	Pass
		2483.5	43.30	54	10.70	AVERAGE	Pass
GFSK(Hopping)	Low	2390	57.66	74	16.34	PEAK	Pass
		2390	36.47	54	17.53	AVERAGE	Pass
GFSK(Hopping	HIGH	2483.5	66.80	74	7.20	PEAK	Pass
		2483.5	45.61	54	8.39	AVERAGE	Pass
∏/4DQPSK (Hopping)	Low	2390	57.58	74	16.42	PEAK	Pass
		2390	36.39	54	17.61	AVERAGE	Pass
∏/4DQPSK (Hopping)	HIGH	2483.5	64.09	74	9.91	PEAK	Pass
		2483.5	42.90	54	11.10	AVERAGE	Pass
8-DPSK (Hopping)	Low	2390	55.74	74	18.26	PEAK	Pass
		2390	34.55	54	19.45	AVERAGE	Pass
8-DPSK (Hopping)	HIGH	2483.5	62.53	74	11.47	PEAK	Pass
		2483.5	41.34	54	12.66	AVERAGE	Pass

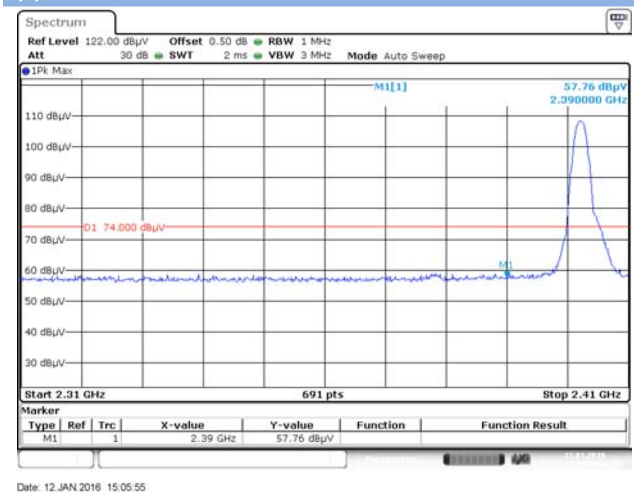
Test Plots

GFSK LOW CHANNEL , PEAK

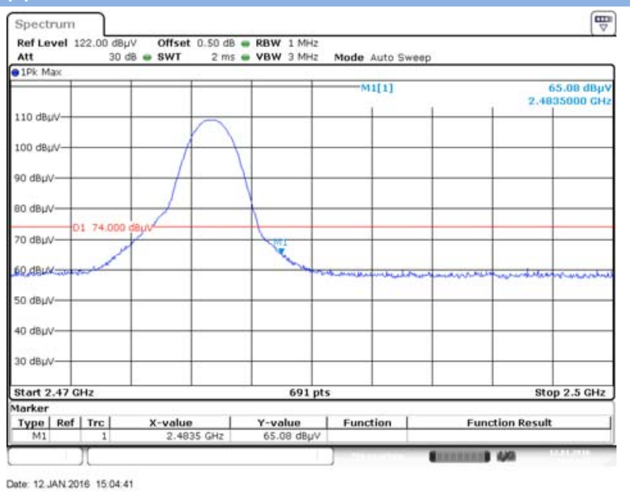


GFSK HIGH CHANNEL , PEAK

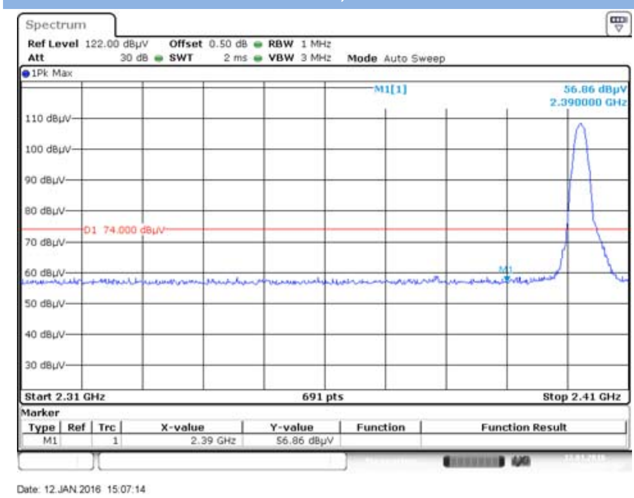
∏/4-DQPSK LOW CHANNEL , PEAK



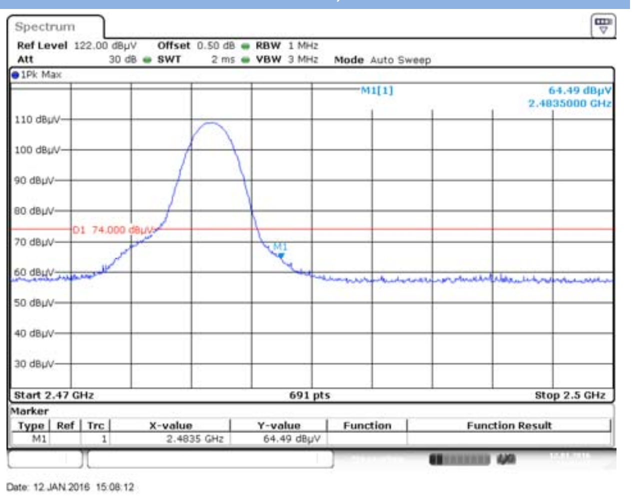
∏/4-DQPSK HIGH CHANNEL , PEAK



8-DPSK LOW CHANNEL , PEAK

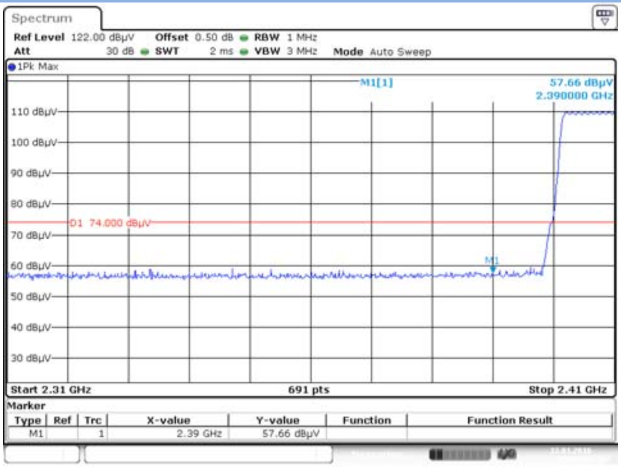


8-DPSK HIGH CHANNEL , PEAK



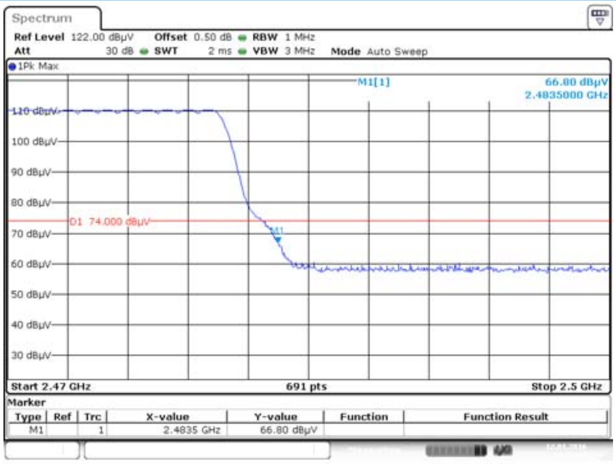
Hopping Mode:

GFSK LOW FREQUENCY BAND, PEAK



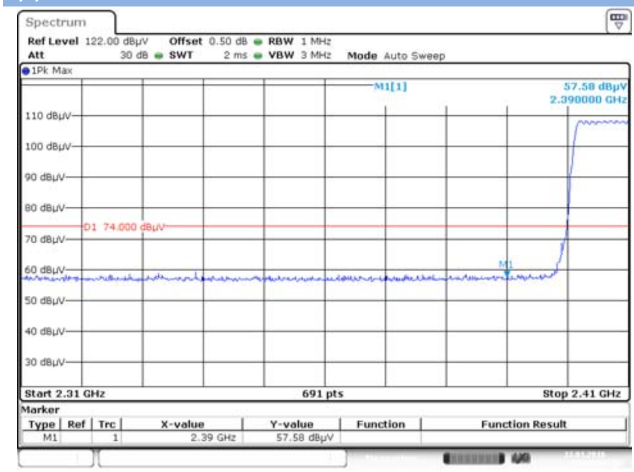
Date: 12.JAN.2016 15:00:44

GFSK HIGH FREQUENCY BAND, PEAK



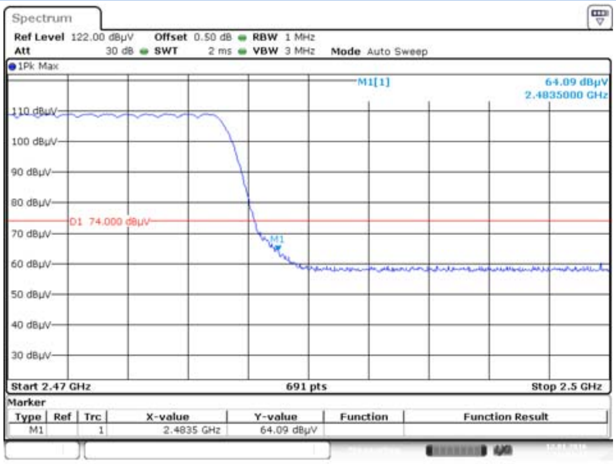
Date: 12.JAN.2016 14:59:40

∏/4-DQPSK LOW FREQUENCY BAND, PEAK



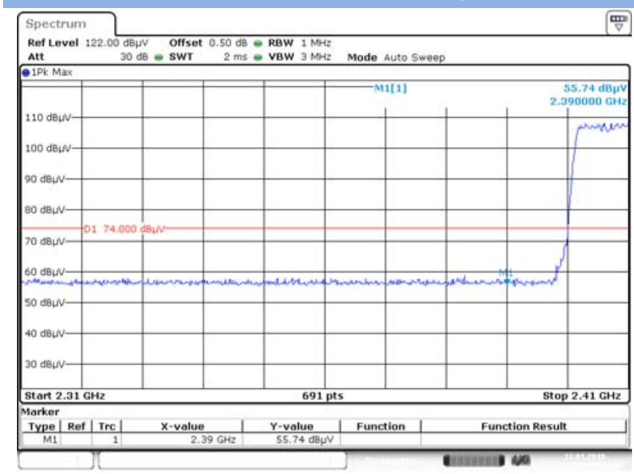
Date: 12.JAN.2016 15:01:55

∏/4-DQPSK HIGH FREQUENCY BAND, PEAK



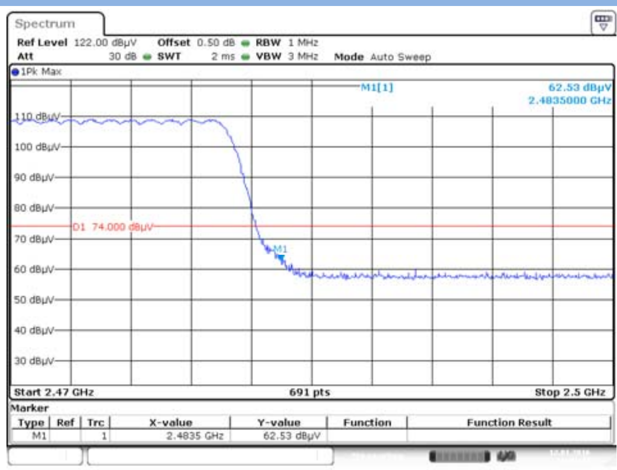
Date: 12.JAN.2016 15:03:44

8-DPSK LOW FREQUENCY BAND, PEAK



Date: 12.JAN.2016 15:09:45

8-DPSK HIGH FREQUENCY BAND, PEAK



Date: 12.JAN.2016 15:08:42

A.10 Power Spectral Density (PSD)

Not Applicable.

ANNEX B TEST SETUP PHOTOS

Please refer the document “BL-SZ15C0278-AR 2.PDF”.

ANNEX C EUT EXTERNAL PHOTOS

Please refer the document “BL- SZ15C0278-AW 2.PDF”.

ANNEX D EUT INTERNAL PHOTOS

Please refer the document “BL- SZ15C0278-AI 2.PDF”.

--END OF REPORT--