FCC RF Test Report

Product Type	:	BLE Vibration Alarm
Applicant	:	Electronics Tomorrow Ltd.
Address	:	Unit 903-7, 9/F., Tower 1, Harbour Center, 1 Hok Cheung Street, Hung Hom, Kowloon,HK
Trade Name	:	N/A
Model Number	:	A480
Test Specification	:	FCC 47 CFR PART 15 SUBPART C: Oct., 2013 RSS-210 Issue 8 December 2010 ANSI C63.10:2009 KD558074 D01 DTS Meas Guidance v03r02
Receive Date	:	18 August, 2014
Test Period	:	25 August, 2014 to 02 September, 2014
Issue Date	:	05 September, 2014

Issue by

A Test Lab Techno Corp.

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Taiwan Accreditation Foundation accreditation number: 1330

Revision History

Rev.	Issue Date	Revisions	Revised By
00	05 September, 2014	Initial Issue	

Verification of Compliance

Issued Date: 09/05/2014

Product Type	:	BLE Vibration Alarm
Applicant	:	Electronics Tomorrow Ltd.
Address	:	Unit 903-7, 9/F., Tower 1, Harbour Center, 1 Hok Cheung Street, Hung Hom, Kowloon,HK
Trade Name	:	N/A
Model Number	:	A480
FCC ID	:	PEQA480110813
EUT Rated Voltage	:	DC 4.5V --3×AAA battery
Test Voltage	:	DC 4.5V
Applicable Standard	:	FCC 47 CFR PART 15 SUBPART C: Oct., 2013 RSS-210 Issue 8 December 2010 ANSI C63.10:2009 KD558074 D01 DTS Meas Guidance v03r02
Test Result	:	Complied
Performing Lab.	:	Shenzhen Academy of Metrology and Quality Inspection No.4 Tongfa Road, Xili Town, Nanshan District, Shenzhen, Guangdong, China Tel：0086-755-86928965 / Fax：0086-755-86009898-31396 Web: www.smq.com.cn

The EUT described above is tested by Shenzhen Academy of Metrology and Quality Inspection EMC Laboratory to determine the maximum emissions from the EUT. Shenzhen Academy of Metrology and Quality Inspection EMC Laboratory assumed full responsibility for the accuracy of the test results. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4 (2003) and the energy emitted by the sample EUT tested as described in this report is in compliance with FCC Rules Part 15.207, 15.209 and 15.247.
The test results of this report relate only to the tested sample identified in this report.

Approved By	:		Reviewed By	:	
(Manager)		(Murphy Wang)	(Testing Engineer)		(Fly Lu)

CONTENT

1. General Information

1.1 Applied Standard Applied Rules: FCC 47 CFR PART 15 SUBPART C: Oct., 2013 Test Method: FCC 558074 D01 DTS Meas Guidance FCC KDB 662911 D01MultipleTransmitter Output
1.2 Test Location TestLocation1: Shenzhen Academy of Metrology and quality Inspection Address: No.4 Tongfa Road, Xili Town, Nanshan District, Shenzhen, Guangdong, China
1.3 Test Environment Condition Ambient Temperature: 19.5to 25°C Ambient Relative Humidity: 40 to 55 % Atmospheric Pressure: Not applicable

2. Test Summary

Test Item	FCC Part No.	Requirements	Verdict
DTS (6 dB) Bandwidth	15.247(a)(2)	≥ 500 kHz.	PASS
Maximum Peak Conducted Output Power	15.247(b)(3)	For directional gain:< 30dBm – (G[dBi] –6 [dB]),peak; Otherwise :< 30dBm, peak.	PASS
Maximum Power Spectral Density Level	15.247(e)	For directional gain :< 8dBm/3 kHz – (G[dBi] –6[dB]), peak. Otherwise :< 8dBm/3 kHz, peak.	PASS
Band Edges Compliance	15.247(d)	< -20dBr/100 kHz if total peak power ≤power limit.	PASS
Unwanted Emissions into Non-Restricted Frequency Bands	15.247(d)	< -20dBr/100 kHz if total peak power ≤power limit.	PASS
Unwanted Emissions into Restricted Frequency Bands (Conducted)	15.247(d) 15.209	< -20dBr/100 kHz if total peak power ≤power limit.	PASS
Unwanted Emissions into Restricted Frequency Bands (Radiated)	15.247(d) 15.209	FCC Part 15.209 field strength limit;	PASS
AC Power Line Conducted Emissions	15.207	FCC Part 15.207 conducted limit;	N/A

3. Description of the Equipment under Test (EUT)

3.1 General Description

Product	BLE Vibration Alarm
Trade Name	N/A
Model Number	A480
Applicant	Electronics Tomorrow Ltd. Unit 903-7, 9/F., Tower 1, Harbour Center, 1 Hok Cheung Street, Hung Hom, Kowloon,HK
Manufacturer	Gaojin Electronics (ShenZhen) Co., Ltd. 11 Fang Keng Road, Pinghu Zhen, Longgang, Shenzhen, Guangdong Province, Tha People's Republic of China
FCC ID	PEQA480110813
Frequency Range	2402 ~ 2480 MHz
Modulation Type	GFSK
Type of Antenna	Internal
Antenna Gain (dBi)	5.3 dBi

NOTE: Only Bluetooth test data included in this report.

3.2 EUT Identity

EUT ID information	
BT MAC	E3:C9:0C:D9:20:DA
/	/

NOTE: Unless otherwise noted in the report, the functional boards installed in the units shall be selected from the below list, but not means all the functional boards listed below shall be installed in one unit.

3.3 EUT Configurations

3.3.1 General Configurations

Configuration	Description
Test Antenna Ports	Until otherwise specified, All TX tests are performed at all TX antenna ports of the EUT, and All RX tests are performed at all RX antenna ports of the EUT.
Multiple RF Sources	Other than the tested RF source of the EUT, other RF source(s) are disabled or shutdown during measurements.

Note: The EUT was programmed to be in continuously transmitting mode and the transmit duty cycle is not less than 98%.

3.4 Customized Configurations

#EUT Conf.	Signal Description	Operating Frequency
TM1_ Ch0	GFSK modulation	Ch No. 0 /2402MHz
TM1_ Ch19	GFSK modulation	Ch No. 19/ 2440MHz
TM1_ Ch39	GFSK modulation	Ch No. 39/ 2480MHz

3.5 Test Environments

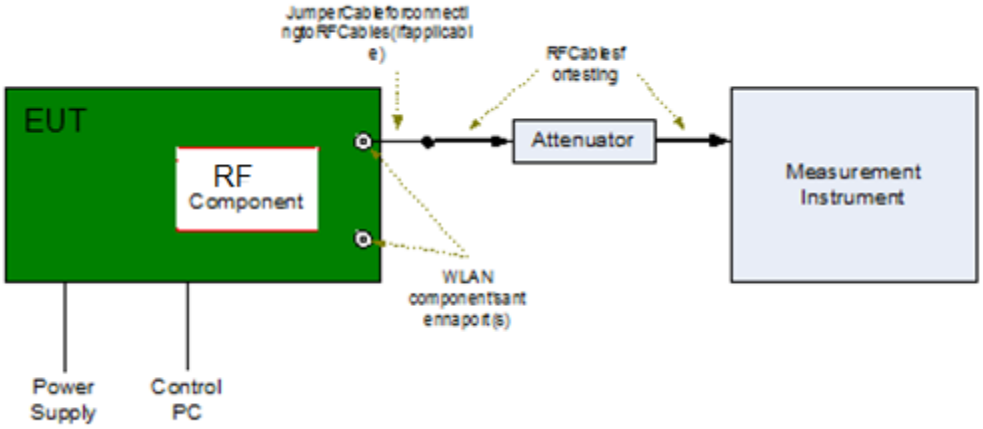
Environment Parameter	Selected Values During Tests		
NTNV	Temperature	Voltage	Relative Humidity
	Ambient	EUT Rated Voltage	Ambient

NOTE: The values used in the test report maybe stringent than the declared.

3.6 Test Setups

3.6.1 Test Setup 1

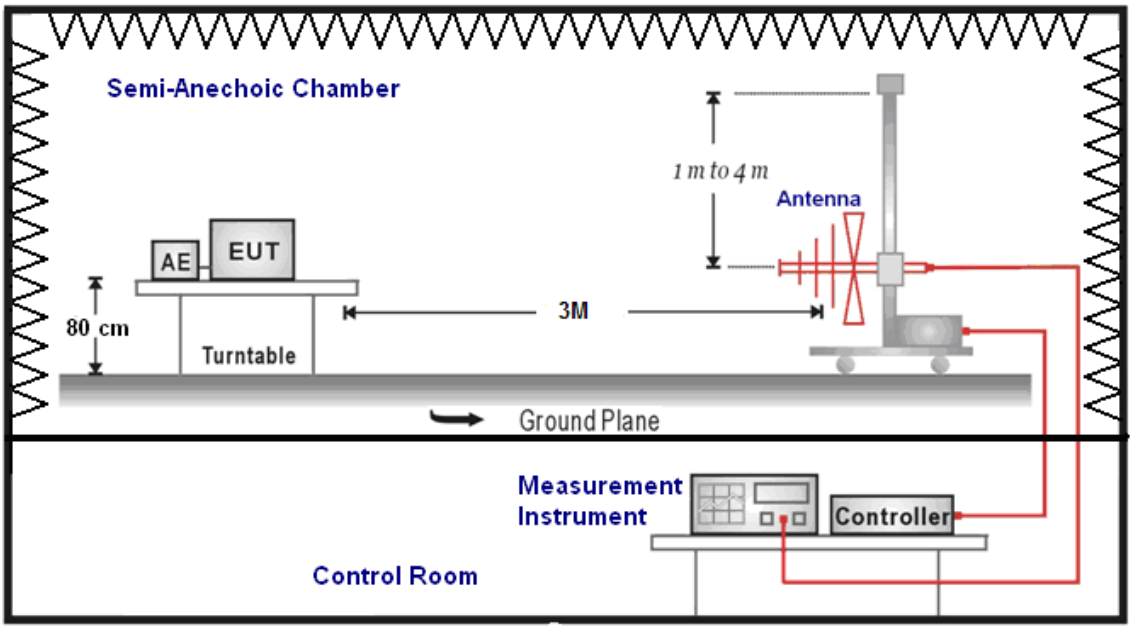
The BLE component's antenna ports(s) of the EUT are connected to the measurement instrument per an appropriate attenuator. The EUT is controlled by PC/software to emit the specified signals for the purpose of measurements.



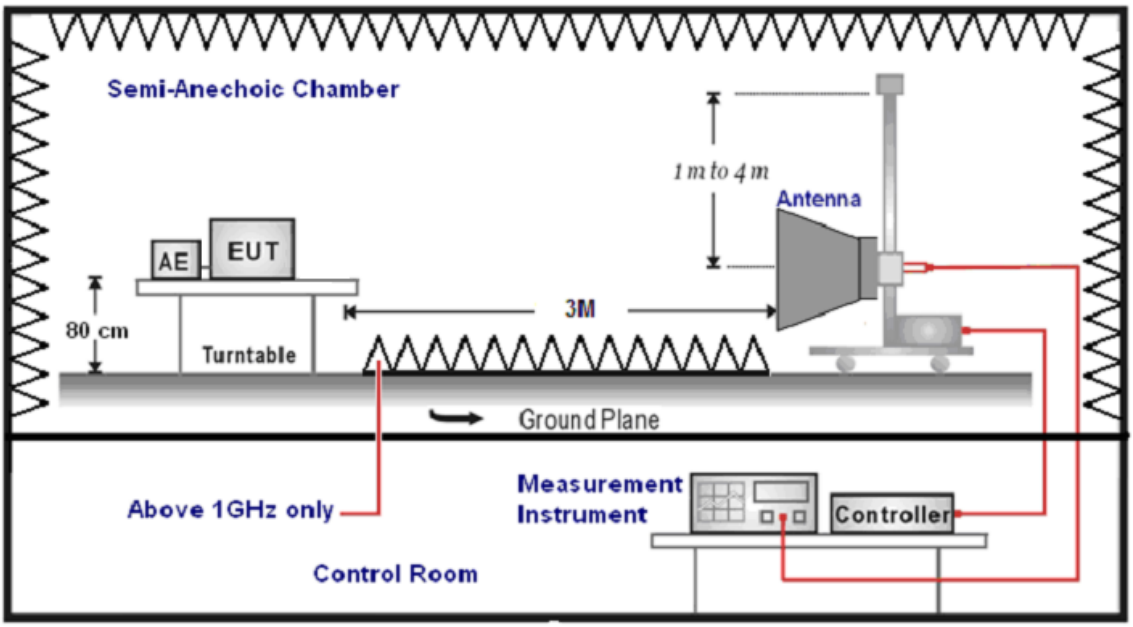
3.6.1 Test Setup 2

The test sites anechoic chamber has met the requirement of NSA tolerance 4dB according to the standards: ANSIC63.4. The test distance is 3m.The setup is according to ANSI C63.4 and CAN/CSA-CEI/IEC CISPR 22.

The maximal emission value is acquired by adjusting the antenna height, polarization and turntable azimuth. Normally, the height range of antenna is 1m to 4m, the azimuth range of turntable is 0° to 360°,and the receive antenna has two polarizations Vertical (V) and Horizontal (H).



(Below1 GHz)

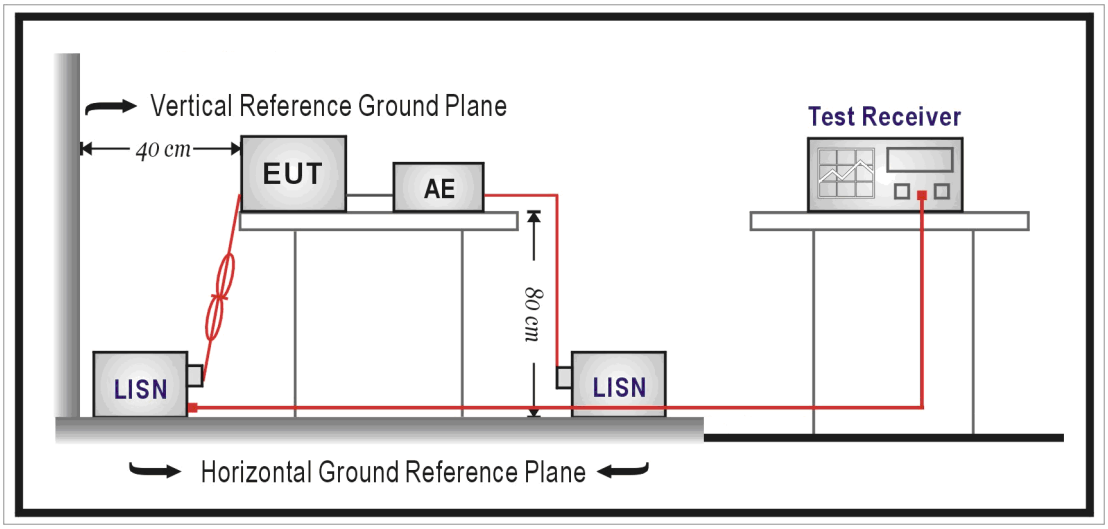


(Above 1GHz)

3.6.2 Test Setup 3

The mains cable of the EUT (maybe per AC/DC Adapter) must be connected to LISN. The LISN shall be placed 0.8 m from the boundary of EUT and bonded to a ground reference plane for LISN mounted on top of the ground reference plane. This distance is between the closest points of the LISN and the EUT. All other units of the EUT and associated equipment shall be least 0.8m from the LISN.

Ground connections, where required for safety purposes, shall be connected to the reference ground point of the LISN and, where not otherwise provided or specified by the manufacturer, shall be of same length as the mains cable and run parallel to the mains connection at a separation distance of not more than0.1 m.



3.7 Test Conditions

Test Case	Test Conditions	
	Configuration	Description
DTS (6 dB) Bandwidth	Measurement Method	FCC KDB 558074 §7.1.1Option2.
	Test Environment	NTNV
	Test Setup	Test Setup 1
	EUT Configuration	TM1_ Ch00 TM1_ Ch19 TM1_ Ch39
Maximum Peak Conducted Output Power	Measurement Method	FCC KDB 558074§7.2.1.1
	Test Environment	NTNV
	Test Setup	TestSetup1
	EUT Configuration	TM1_ Ch00 TM1_ Ch19 TM1_ Ch39
Maximum Power Spectral Density Level	Measurement Method	FCC KDB 558074 §7.3.1Option 1 (peak PSD).
	Test Environment	NTNV
	Test Setup	TestSetup1
	EUT Configuration	TM1_ Ch00 TM1_ Ch19 TM1_ Ch39
Unwanted Emissions into Non-Restricted Frequency Bands	Measurement Method	FCC KDB 558074§7.4.1, use Peak PSD.
	Test Environment	NTNV
	Test Setup	TestSetup1
	EUT Configuration	TM1_ Ch00 TM1_ Ch19 TM1_ Ch39
Unwanted Emissions into Restricted Frequency Bands (Conducted)	Measurement Method	FCC KDB 558074§7.4.2, Conducted (antenna-port).
	Test Environment	NTNV
	Test Setup	TestSetup1
	EUT Configuration	TM1_ Ch00 TM1_ Ch19 TM1_ Ch39

Unwanted Emissions into Restricted	Measurement Method	FCC KDB 558074§7.4.2,Radiated(cabinet/case emissions with Impedance matching for antenna-port).
	Test Environment	NTNV
	EUT Configuration	TM1_ Ch00 TM1_ Ch19 TM1_ Ch39

Test Case	Test Conditions	
	Configuration	Description
AC Power Line Conducted Emissions	Measurement Method	AC mains conducted.
	Test Environment	NTNV
	Test Setup	TestSetup3
	EUT Configuration	TM1_ Ch19 (Worst Conf.).

Note: For Radiated Emissions, By preliminary testing and verifying three axis (X, Y and Z) position of EUT transmitted status, it was found that "Z axis" position was the worst, then the final test was executed the worst condition and test data were recorded in this report.

4. Measurement Uncertainty

Test Item	Frequency Range	Uncertainty (dB)
Conducted Emission	9kHz ~ 30MHz	3.50
Radiated Emission	9kHz ~ 30MHz	4.12
	30MHz ~ 1000MHz	4.50
	1000MHz ~ 18000MHz	4.60
	18000MHz ~ 40000MHz	5.12

5. Main Test Instruments

AC Power Conducted Emission					
Equipment Name	Manufacturer	Model	Serial Number	Cal Date	Cal Period
Test Receiver	R&S	ESCS	SB3319	01/20/2014	1 year
LISN	R&S	ESH2-Z5	SB3321	01/20/2014	1 year
LISN	R&S	ESH3-Z5	SB2604	01/20/2014	1 year
Test Software	R&S	ESK1	N/A	N/A	N/A

Radiated Emission					
Equipment Name	Manufacturer	Model	Serial Number	Cal Date	Cal Period
Loop Antenna	Schwarzbeck	FMZB1516	SB3345	01/22/2014	1 year
Horn Antenna	AR	AT4560	SB3450/01	05/16/2014	1 year
Amplifier(18-40GHz)	R&S	---	SB3435/02	05/16/2014	1 year
Amplifier(1-18GHz)	R&S	---	SB3435/01	01/22/2014	1 year
Horn Antenna	R&S	HF907	SB8501/01	05/13/2014	1 year
Bilog Antenna	Schwarzbeck	VULB9163	SB8501/04	01/20/2014	1 year
EMI Test Receiver	R&S	ESU40	SB85001/09	05/16/2014	1 year
EMI Test Receiver	R&S	ESIB26	SB3253	01/22/2014	1 year
Test Software	R&S	ESK1	N/A	N/A	N/A
Test Software	R&S	EMC32	N/A	N/A	N/A

Maximum Peak Output Power / Power Spectral Density / 6dB Bandwidth / Band Edge Compliance of RF Emission / Spurious RF Conducted Emission					
Equipment Name	Manufacturer	Model	Serial Number	Cal Date	Cal Period
MXA Signal Analyzer	Agilent	N9020A	MY53420615	05/12/2014	1 year
Power Sensor	Agilent	U2021XA	MY53180015	05/24/2014	1 year
Power Sensor	Agilent	U2021XA	MY53260040	05/24/2014	1 year
Power Sensor	Agilent	U2021XA	MY53360002	05/24/2014	1 year
Power Sensor	Agilent	U2021XA	MY53360006	05/24/2014	1 year
USB Modular Simultaneous Data Acquisition	Agilent	U2531A	TW53353509	N/A	N/A
USB Modular Simultaneous Data Acquisition	Agilent	U2531A	TW53353511	N/A	N/A

6. Test Conditions and Results

6.1 AC Power Conducted Emission

TEST PROCEDURE

1. The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system; a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10-2009.
2. Support equipment, if needed, was placed as per ANSI C63.10-2009
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10-2009
4. The EUT received DC5V power from the adapter, the adapter received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
5. All support equipments received AC power from a second LISN, if any.
6. The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7. Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.
8. During the above scans, the emissions were maximized by cable manipulation.

AC Power Conducted Emission Limit

For intentional device, according to § 15.207(a) AC Power Conducted Emission Limits is as following：

Frequency (MHz)	Maximum RF Line Voltage (dBμV)			
	CLASS A		CLASS B	
	Q.P.	Ave.	Q.P.	Ave.
0.15 - 0.50	79	66	66-56*	56-46*
0.50 - 5.00	73	60	56	46
5.00 - 30.0	73	60	60	50

* Decreasing linearly with the logarithm of the frequency

TEST RESULTS

Not Applicable.
EUT is only powered by battery.

Test Result Plot

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Test Result Table

	Frequency (MHz)	Correction Factor (dB)	Quasi-Peak			Average		
			Reading (dBμV)	Emission Level (dBμV)	Limits (dBμV)	Reading (dBμV)	Emission Level (dBμV)	Limits (dBμV)
Line	/	/	/	/	/	/	/	/
	/	/	/	/	/	/	/	/
	/	/	/	/	/	/	/	/
	/	/	/	/	/	/	/	/
	/	/	/	/	/	/	/	/
	/	/	/	/	/	/	/	/

Test Result Plot

/

Test Result Table

	Frequency (MHz)	Correction Factor (dB)	Quasi-Peak			Average		
			Reading (dBµV)	Emission Level (dBµV)	Limits (dBµV)	Reading (dBµV)	Emission Level (dBµV)	Limits (dBµV)
Neutral	/	/	/	/	/	/	/	/
	/	/	/	/	/	/	/	/
	/	/	/	/	/	/	/	/
	/	/	/	/	/	/	/	/
	/	/	/	/	/	/	/	/
	/	/	/	/	/	/	/	/

6.2 Radiated Emissions

TEST PROCEDURE

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0℃ to 360℃ to acquire the highest emissions from EUT
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed.
5. The EUT minimum operation frequency was 32.768 KHz and maximum operation frequency was 2480MHz.so radiated emission test frequency band from 9 KHz to 25GHz.

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CL - AG

Where FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude	AG = Amplifier Gain
AF = Antenna Factor	

RADIATION LIMIT

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emission from intentional radiators at a distance of 3 meters shall not exceed the following table. According to § 15.247(d), in any 100kHz bandwidth outside the frequency band in which the EUT is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the100kHz bandwidth within the band that contains the highest level of desired power.

The frequency spectrum above 1 GHz for Transmitter was investigated. All emission not reported are much lower than the prescribed limits. Set the RBW=1MHz, VBW=3MHz for Peak Detector while the RBW=1MHz, VBW=10Hz for Average Detector, Readings are both peak and average values.

Frequency (MHz)	Distance (Meters)	Radiated (dBμV/m)	Radiated (μV/m)
0.009-0.49	300	20log(2400/F(KHz))+80	2400/F(KHz)
0.49-1.705	30	20log(24000/F(KHz))+40	24000/F(KHz)
1.705-30	30	20log(30)+40	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

TEST RESULTS

Remark:

1. The radiated measurement are performed the each channel (low/mid/high), the datum recorded

below (the middle channel) is the worst case for all test channels.

2. ULTRA-BROADBAND ANTENNA for the radiation emission test below 1G.

3. HORN ANTENNA for the radiation emission test above 1G.

4. We tested both battery powered and powered by adapter charging mode at three orientations, recorded worst case at powered by adapter charging mode.

5. "---" means not recorded as emission levels lower than limit.

6. For radiated emission from 18GHz to 26GHz, the limit 54dBuV/m (AV)/74dBuV/m (PK) covert into dBm was -43.26dBm (AV)/-23.26dBm (PK) in 3 meter chamber according to KDB558074 for EIRP level to an equivalent electric field strength using the following relationship

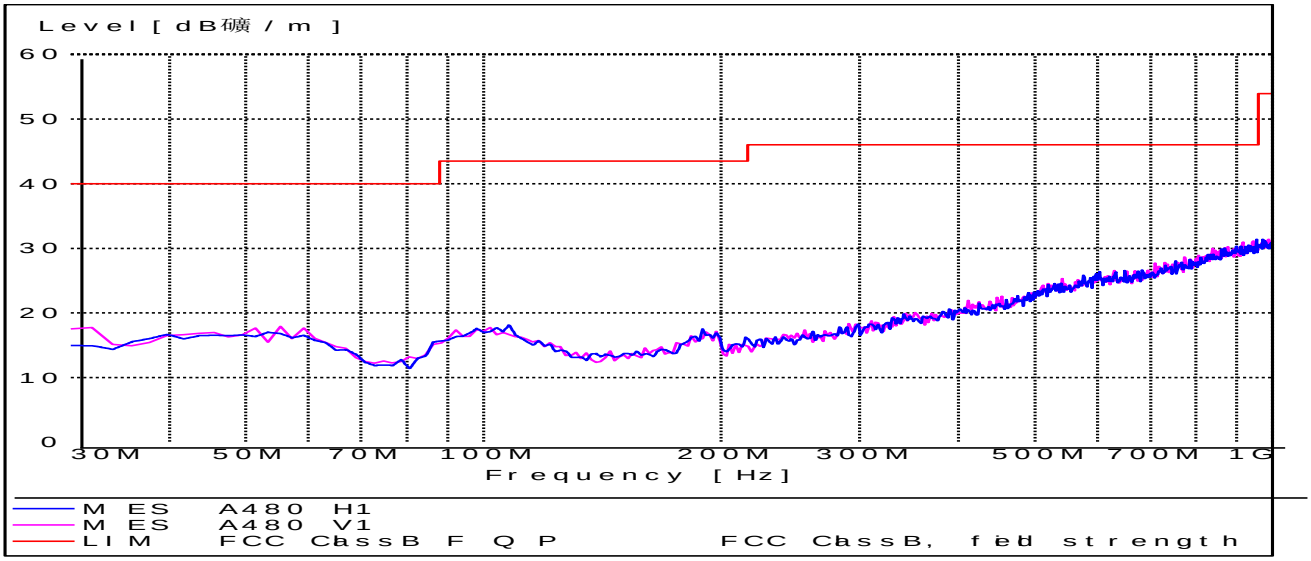
E = EIRP – 20log D + 104.8

For 9 KHz to 30MHz

Frequency (MHz)	Corrected Reading (dBμV/m)@3m	FCC Limit (dBμV/m) @3m	Margin (dB)	Detector	Result
/	/	/	/	QP	PASS
/	/	/	/	QP	PASS

Note: No emissions can be detected from 9KHz to 30MHz.

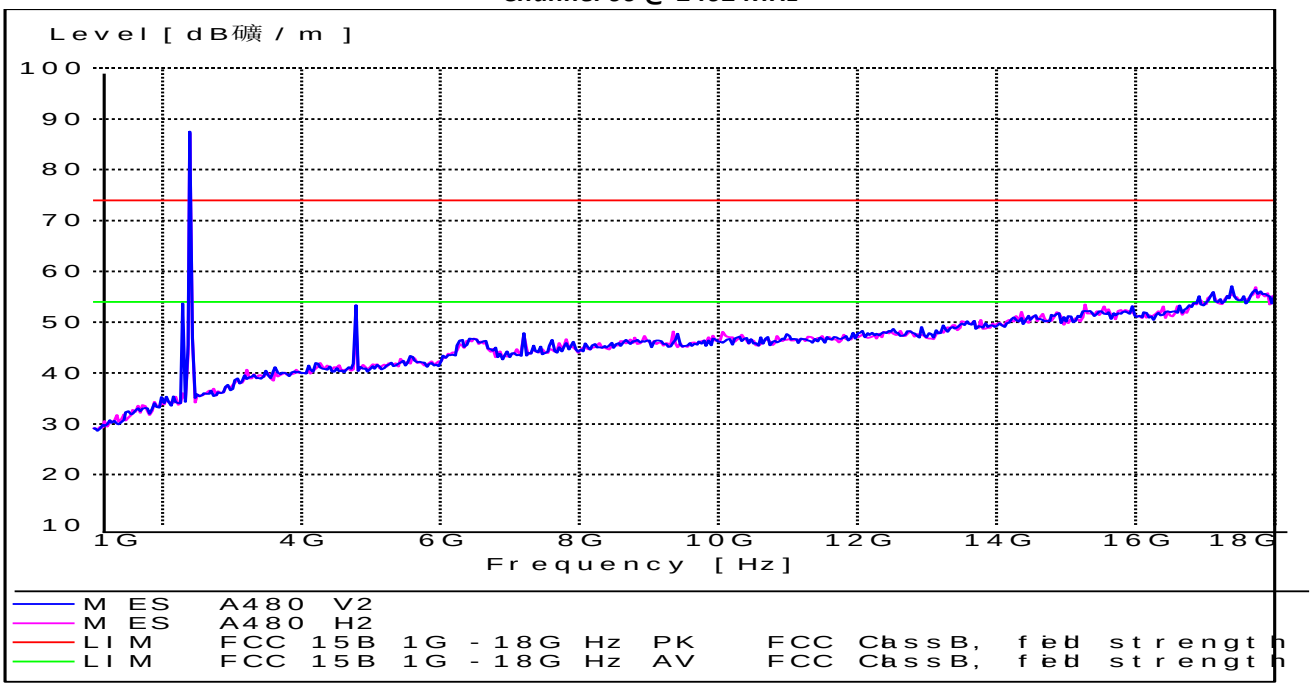
For 30MHz to 1000MHz



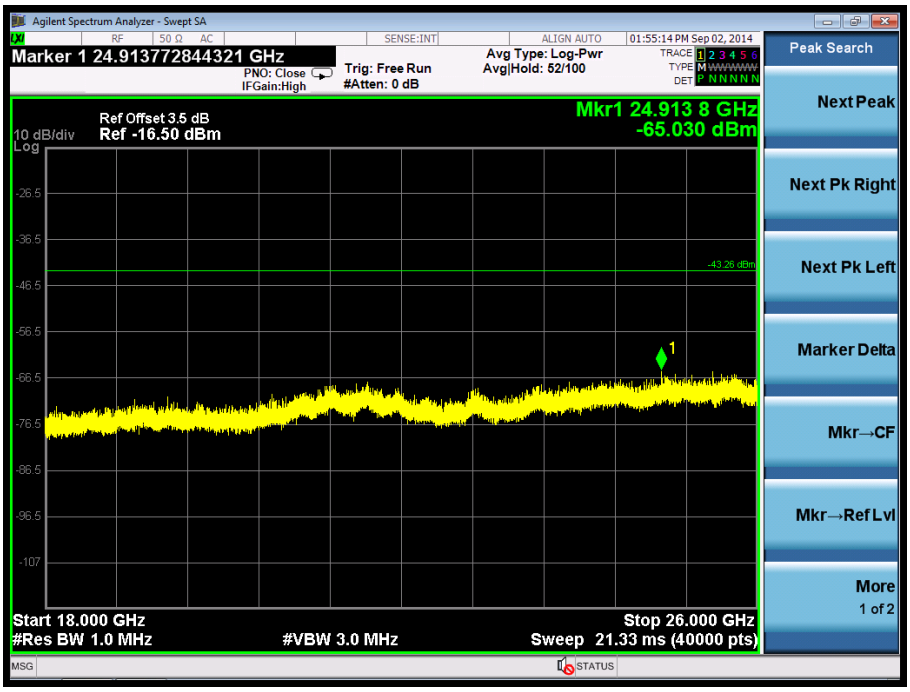
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Ant. Polar. H / V
	---					Peak	H
	---					Peak	V

For 1GHz to 25GHz

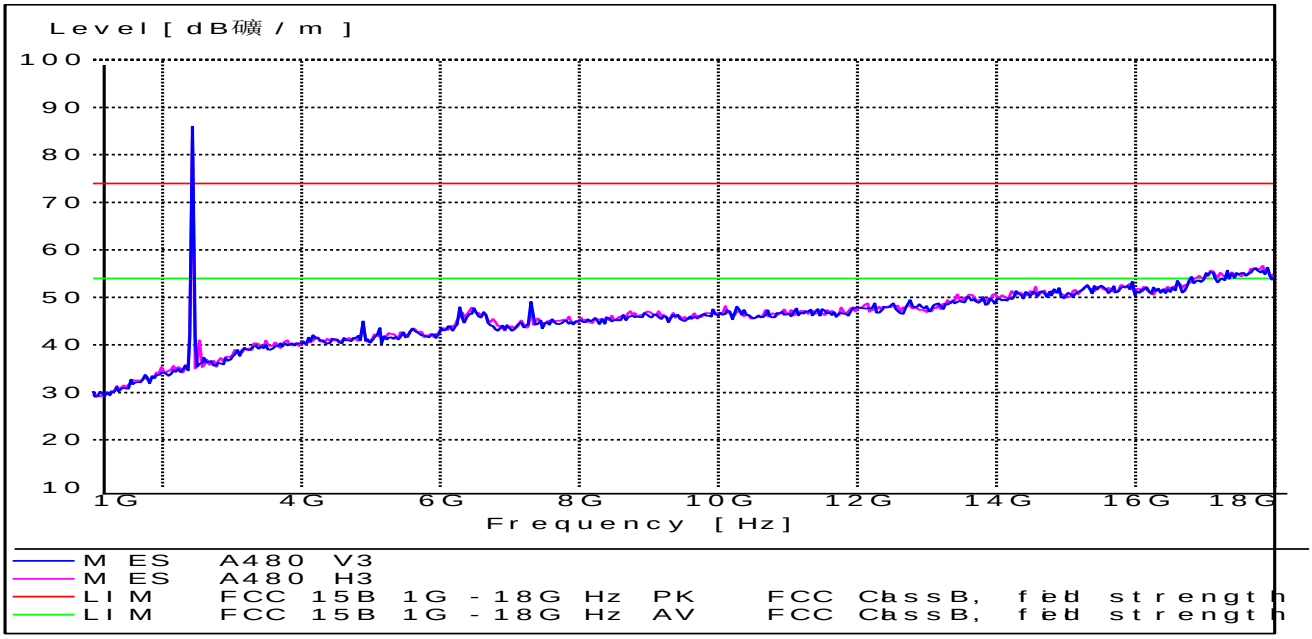
Channel 00 @ 2402 MHz



Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Ant. Polar. H / V
4804	52.1	0.2	52.3	74	21.7	Peak	H
4804	45.0	0.2	45.2	54	8.8	AV	H
17727	44.2	14.2	58.4	74	15.6	Peak	H
17727	30.0	14.2	44.2	54	9.8	AV	H
4804	55.3	0.2	55.5	74	18.5	Peak	V
4804	49.4	0.2	49.6	54	4.4	AV	V
17727	43.4	14.2	57.6	74	16.4	Peak	V
17727	29.9	14.2	44.1	54	9.9	AV	V

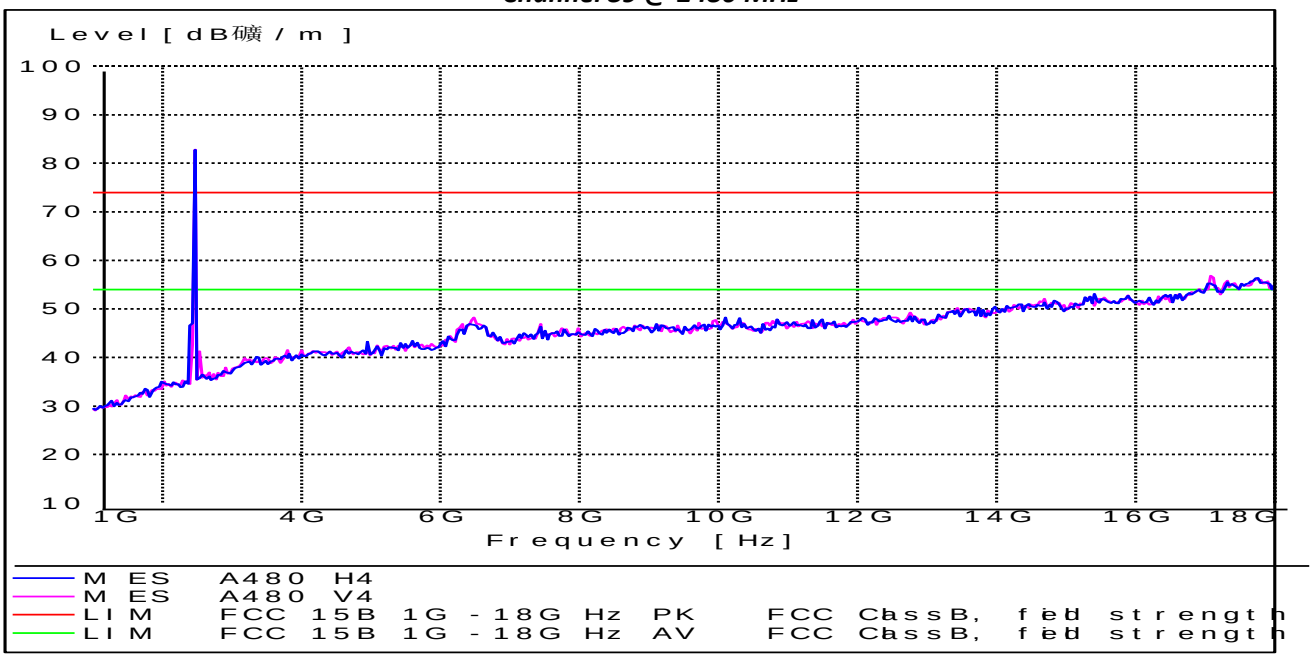


Channel 19 @ 2440 MHz



Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Ant. Polar. H / V
4880	46.5	0.4	46.9	74	27.1	Peak	H
4880	36.8	0.4	37.2	54	16.8	AV	H
4880	48.3	0.4	48.7	74	25.3	Peak	V
4880	38.6	0.4	39.0	54	15.0	AV	V
7320	49.4	2.4	51.8	74	22.2	Peak	V
7320	38.4	2.4	40.8	54	13.2	AV	V

Channel 39 @ 2480 MHz



Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Ant. Polar. H / V
4960	45.7	0.5	46.2	74	27.8	Peak	H
4960	34.8	0.5	35.3	54	18.7	AV	H
4960	46.6	0.5	47.1	74	26.9	Peak	V
4960	36.6	0.5	37.1	54	16.9	AV	V

6.3 Maximum Peak Output Power

TEST PROCEDURE

According to KDB558074 D01 DTS Mea Guidance v03r02 9.1.2 PKPM1 Peak power meter method "The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast-responding diode detector."

LIMIT

The Maximum Peak Output Power Measurement is 30dBm.

TEST RESULTS

A. Test Verdict

Channel	Frequency (MHz)	Measured Output Peak Power (dBm)	Limits (dBm)	Verdict
00	2402	-3.37	30	PASS
19	2440	-2.78	30	PASS
29	2480	-2.69	30	PASS

Note: 1. The test results including the cable lose.

6.4 Power Spectral Density

TEST PROCEDURE

According to KDB 558074 D01 V03 Method PKPSD (peak PSD) this procedure shall be used if maximum peak conducted output power was used to demonstrate compliance, and is optional if the maximum conducted (average) output power was used to demonstrate compliance.
1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS bandwidth.
3. Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
4. Set the VBW ≥ 3 RBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

LIMIT

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

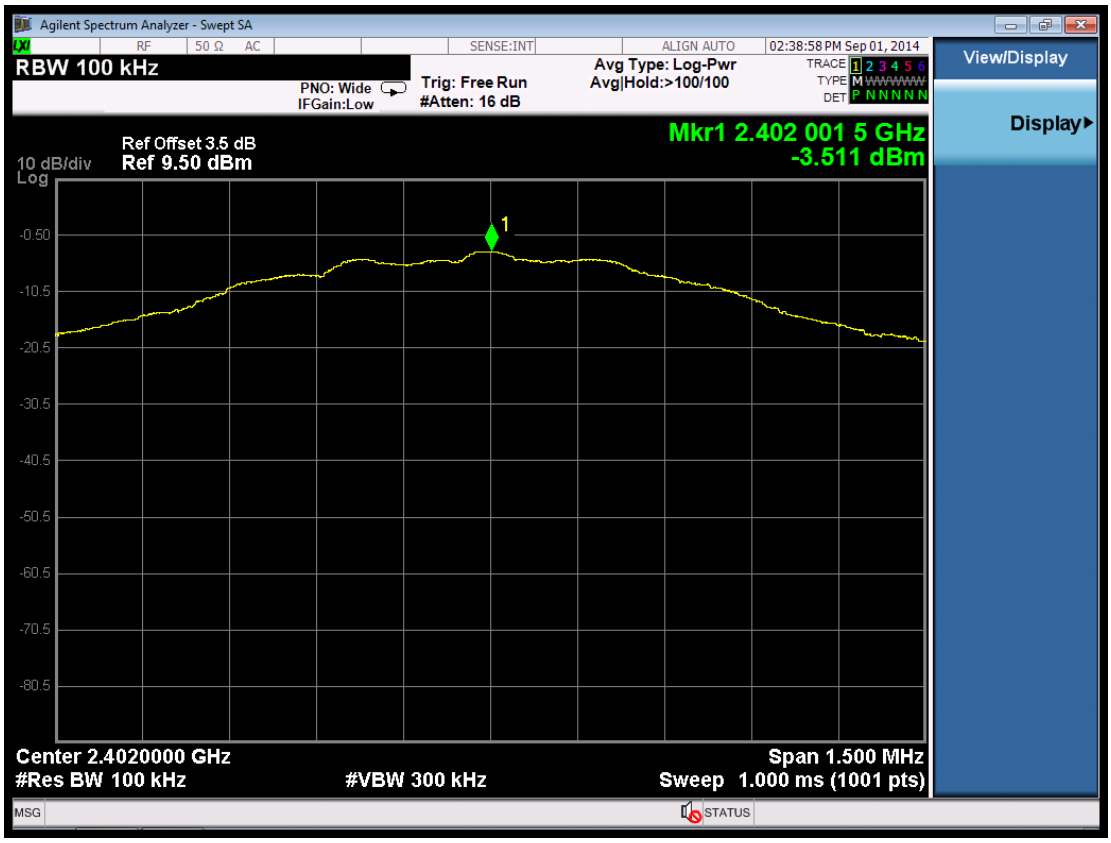
TEST RESULTS

A. Test Verdict

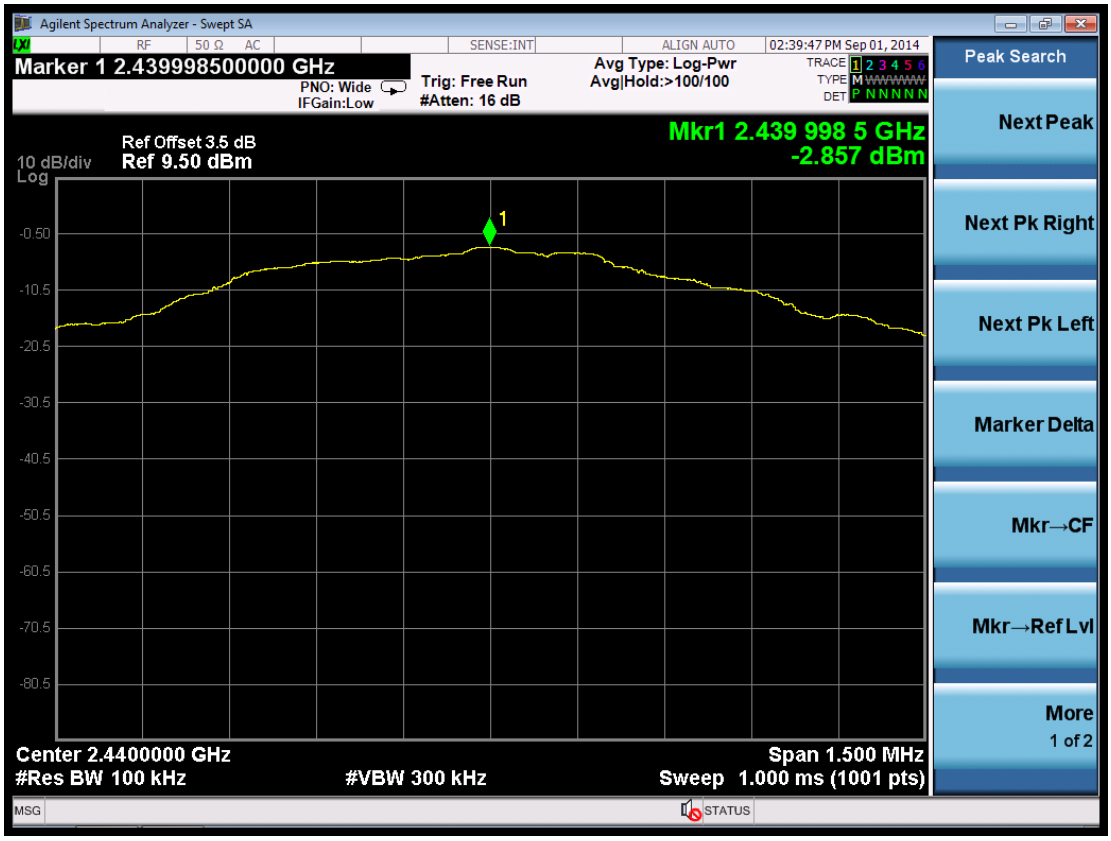
Channel	Frequency (MHz)	Report PSD (dBm/3kHz)	Refer to Plot	Limits (dBm/3KHz)	Verdict
00	2402	-3.511	Plot 6.4.1 A	8	PASS
19	2440	-2.857	Plot 6.4.1 B	8	PASS
39	2480	-2.776	Plot 6.4.1 C	8	PASS

Note 1.The test results including the cable lose.

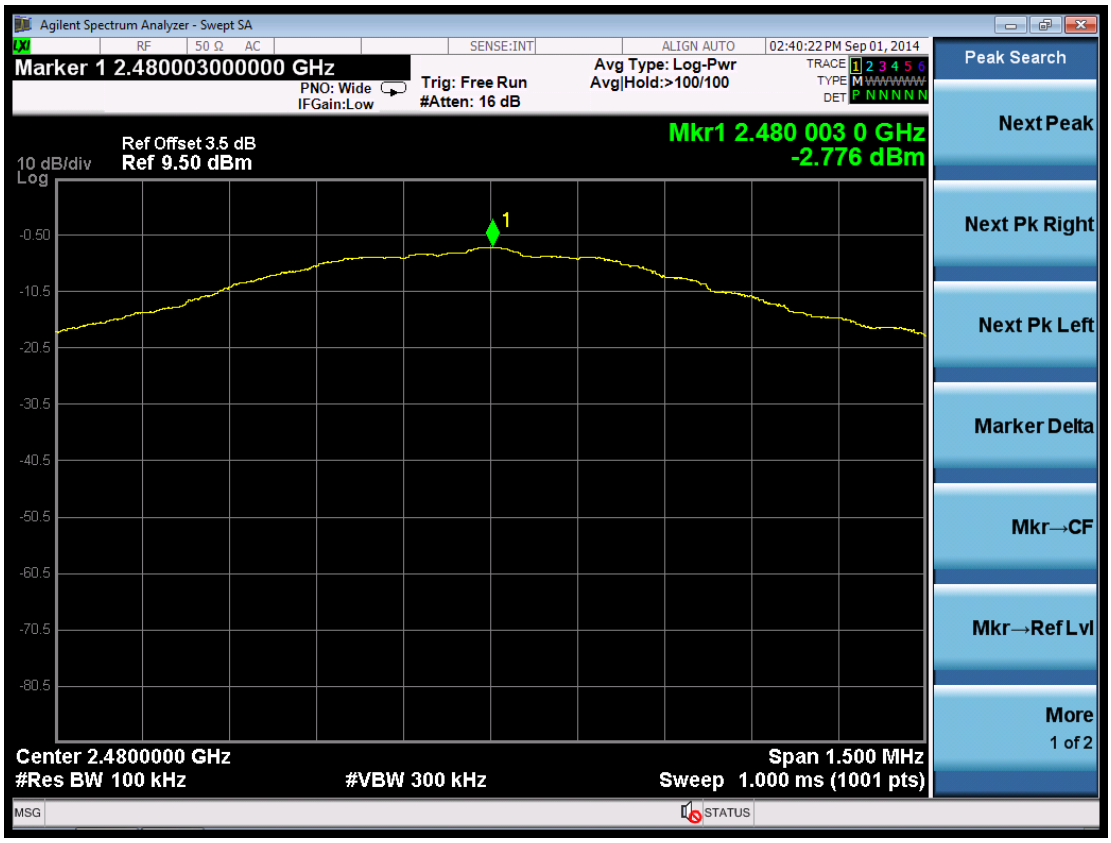
B. Test Plots



(Plot 6.4.1 A: Channel 00: 2402 MHz @ GFSK)



(Plot 6.4.1 B: Channel 19: 2440 MHz @ GFSK)



(Plot 6.4.1 C: Channel 39: 2480 MHz @ GFSK)

6.5 Band Edge Compliance of RF Emission

TEST REQUIREMENT

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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

TEST PROCEDURE

According to KDB 558074 D01 V03 for Antenna-port conducted measurement. 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.

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge, for Radiated emissions restricted band RBW=1MHz, VBW=3MHz for peak detector and RBW=1MHz, VBW=10Hz for average detector.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.
6. Measure the conducted output power (in dBm) using the detector specified by the appropriate regulatory agency (see 12.2.2, 12.2.3, and 12.2.4 for guidance regarding measurement procedures for determining quasi-peak, peak, and average conducted output power, respectively).
7. Add the maximum transmit antenna gain (in dBi) to the measured output power level to determine the EIRP level (see 12.2.5 for guidance on determining the applicable antenna gain)
8. 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).
9. 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).
10. 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.

11. 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.

12. Compare the resultant electric field strength level to the applicable regulatory limit.
13. Perform radiated spurious emission test duress until all measured frequencies were complete.

LIMIT

Below -20dB of the highest emission level in operating band.
Radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a).

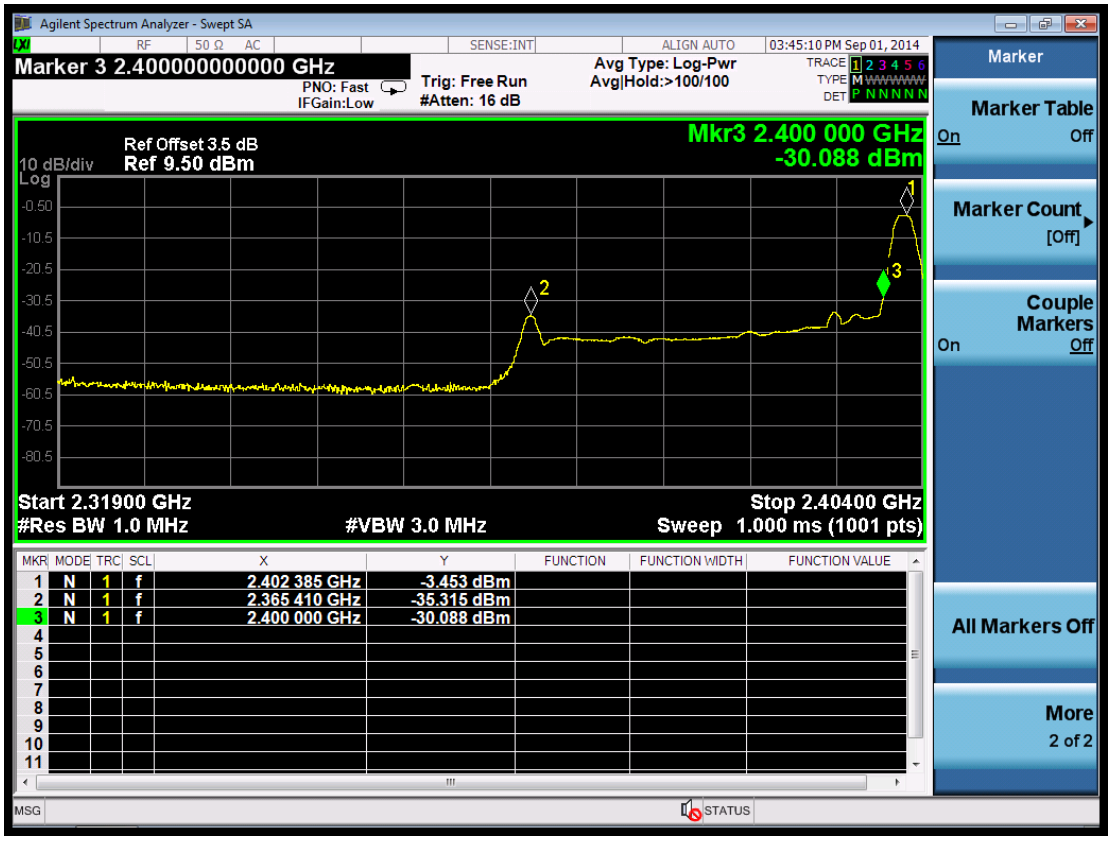
TEST RESULTS

A. Test Verdict

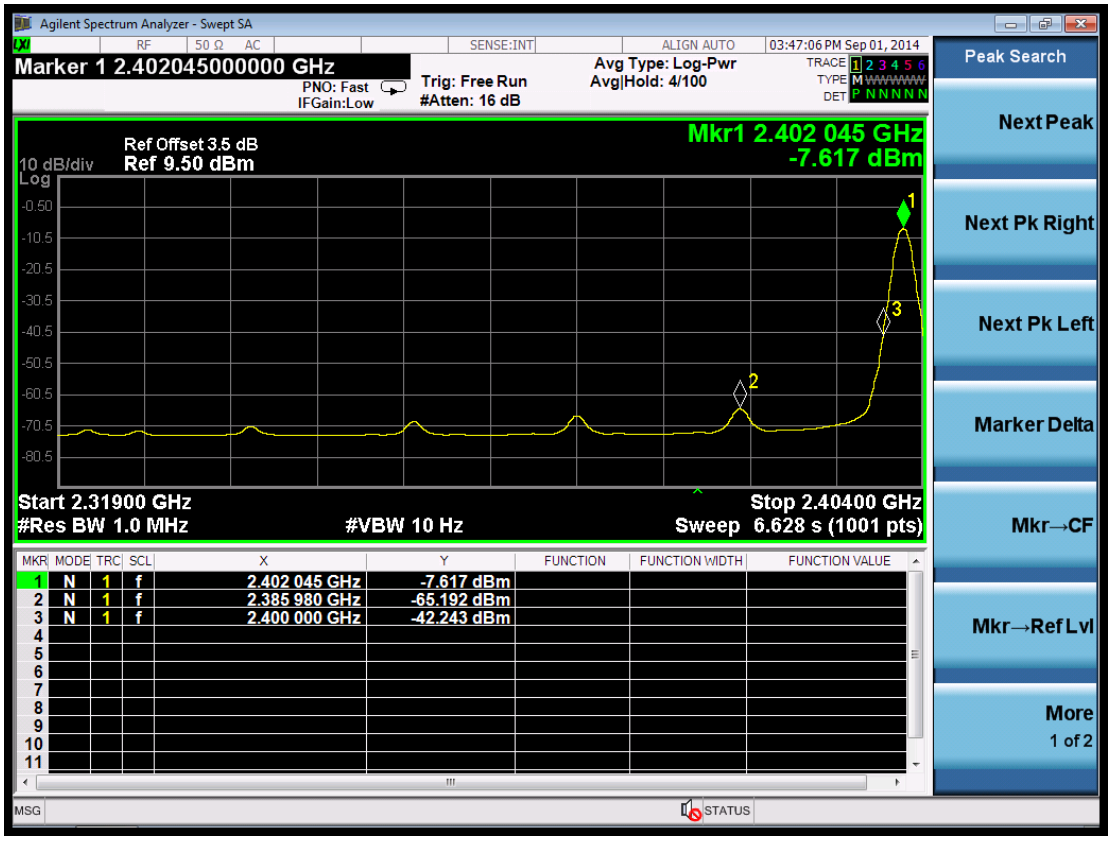
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	Ground Reflection Factor (dB)	Covert Radiated E Level At 3m (dBuV/m)	Detector	Limit (dBuV/m)	Refer to Plot
2365.41	-35.315	5.3	0.00	65.243	Peak	74.00	Plot 6.5.1 A1
2385.98	-65.192	5.3	0.00	35.366	AV	54.00	Plot 6.5.1 A2
2402.38	-3.453	5.3	0.00	97.105	Peak	---	Plot 6.5.1 A1
2402.00	-7.617	5.3	0.00	92.941	AV	---	Plot 6.5.1 A2
2479.65	-2.786	5.3	0.00	97.772	Peak	---	Plot 6.5.1 A3
2480.03	-6.839	5.3	0.00	93.719	AV	---	Plot 6.5.1 A4
2487.40	-32.626	5.3	0.00	67.932	Peak	74.00	Plot 6.5.1 A3
2483.50	-65.615	5.3	0.00	34.943	AV	54.00	Plot 6.5.1 A4

Note: 1. The test results including the cable lose.
2. "---"means that the fundamental frequency not for 15.209 limits requirement.

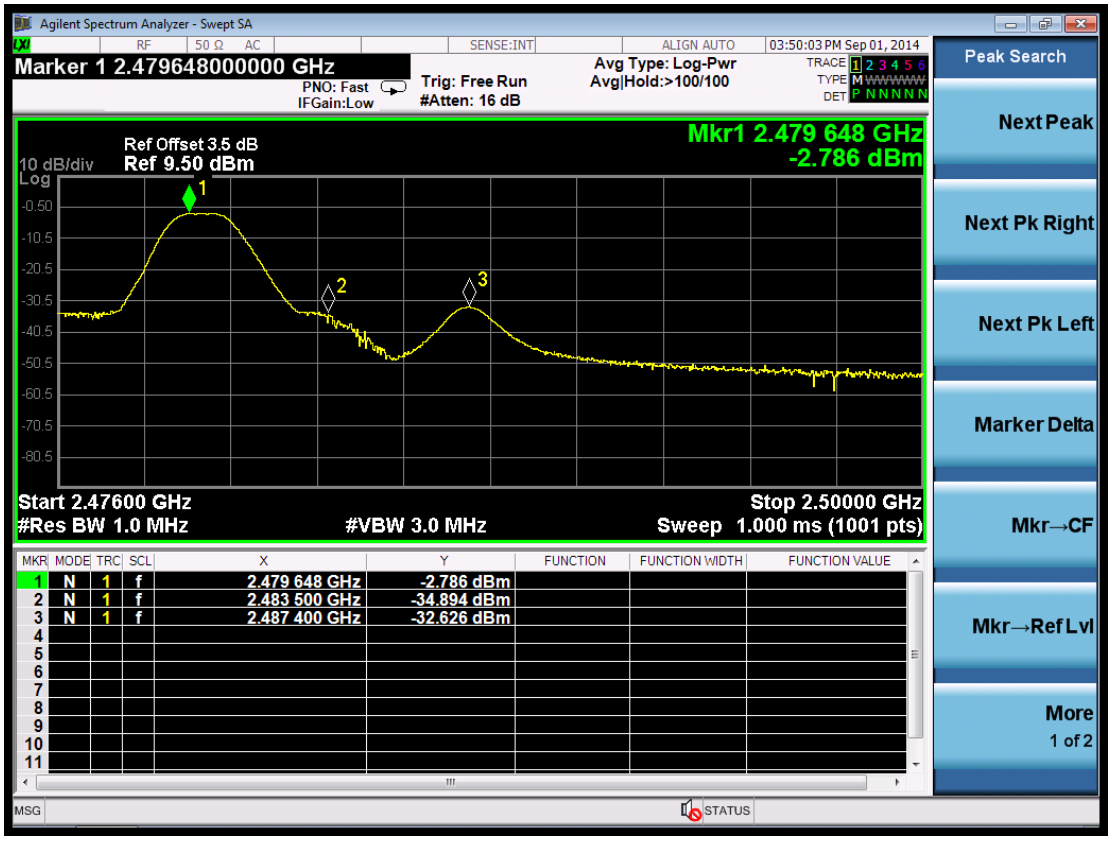
B. Test Plots



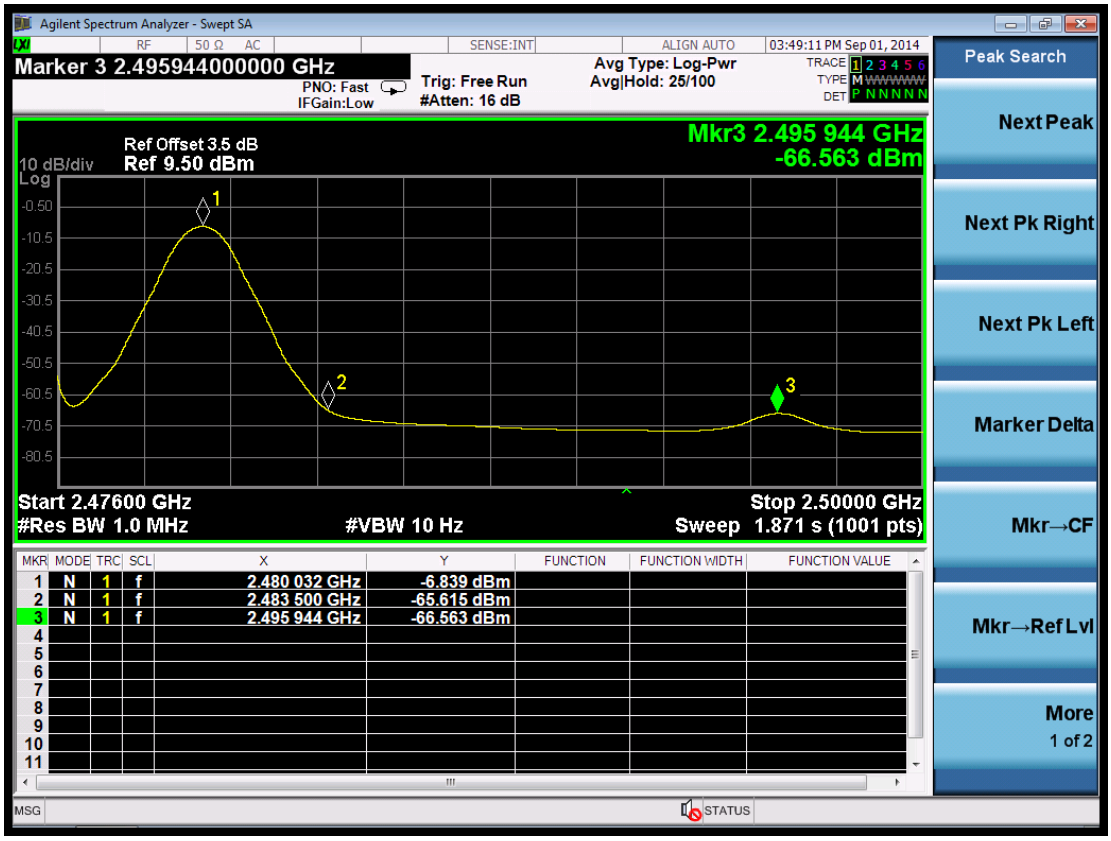
(Plot 6.5.1 A1: Channel 00: 2402MHz @ GFSK)



(Plot 6.5.1 A2: Channel 00: 2402MHz @ GFSK)



(Plot 6.5.1 A3: Channel 39: 2480MHz @ GFSK)



(Plot 6.5.1 A4: Channel 39: 2480MHz @ GFSK)

6.6 Spurious RF Conducted Emission

TEST PROCEDURE

The Spurious RF conducted emissions compliance of RF radiated emission should be measured by following the guidance in ANSI C63.10-2009 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization etc. Set RBW=100 kHz and VBW= 300 KHz to measure the peak field strength, and measure frequency range from 9 KHz to 26.5GHz.

LIMIT

1. Below -20dB of the highest emission level in operating band.
2. Fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209.

TEST RESULTS

Remark: The measurement frequency range is from 9 KHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions and bandege measurement data.

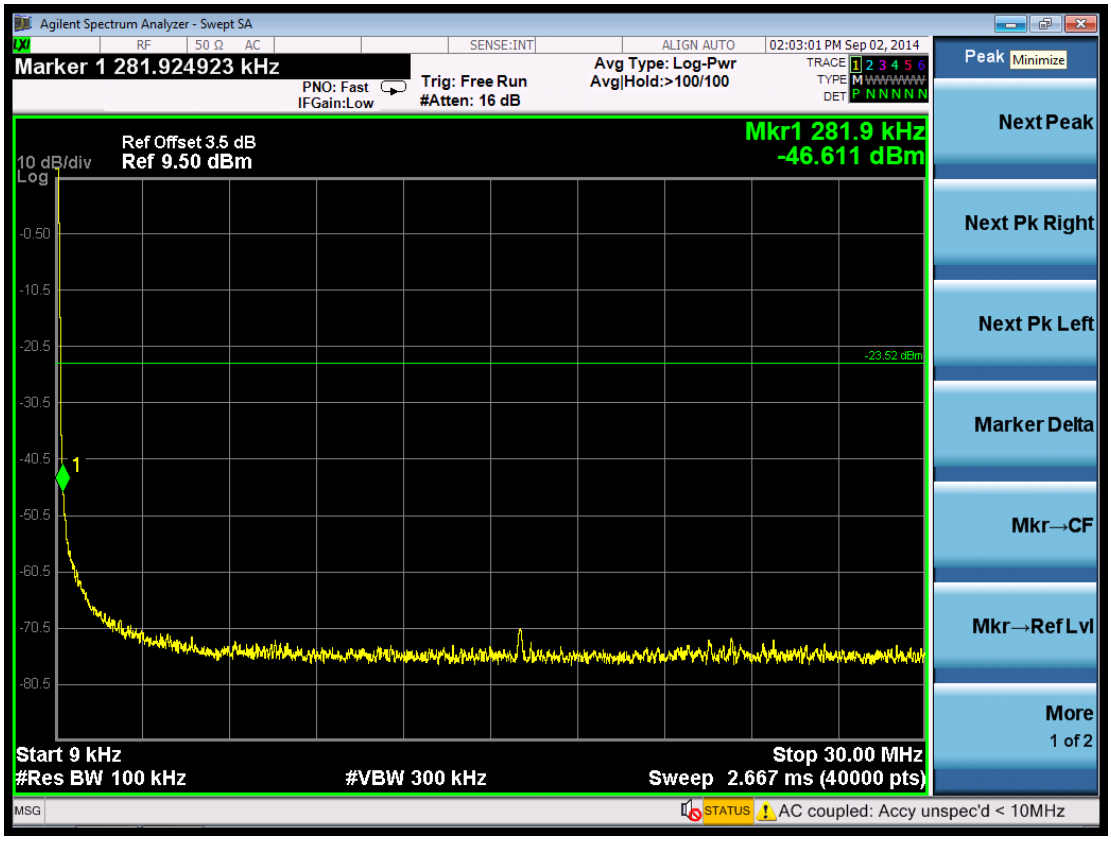
A. Test Verdict

Channel	Frequency (MHz)	Frequency Range	Refer to Plot	Limit (dBc)	Verdict
00	2402	2.402 GHz	Plot 6.6.1 A1	---	PASS
		9KHz-30MHz	Plot 6.6.1 A2	-20	PASS
		30MHz-3GHz	Plot 6.6.1 A3	-20	PASS
		3GHz-10GHz	Plot 6.6.1 A4	-20	PASS
		10GHz-18GHz	Plot 6.6.1 A5	-20	PASS
		18GHz-26GHz	Plot 6.6.1 A6	-20	PASS
19	2440	2.440 GHz	Plot 6.6.1 B1	---	PASS
		9KHz-30MHz	Plot 6.6.1 B2	-20	PASS
		30MHz-3GHz	Plot 6.6.1 B3	-20	PASS
		3GHz-10GHz	Plot 6.6.1 B4	-20	PASS
		10GHz-18GHz	Plot 6.6.1 B5	-20	PASS
		18GHz-26GHz	Plot 6.6.1 B6	-20	PASS
39	2480	2.480 GHz	Plot 6.6.1 C1	---	PASS
		9KHz-30MHz	Plot 6.6.1 C2	-20	PASS
		30MHz-3GHz	Plot 6.6.1 C3	-20	PASS
		3GHz-10GHz	Plot 6.6.1 C4	-20	PASS
		10GHz-18GHz	Plot 6.6.1 C5	-20	PASS
		18GHz-26GHz	Plot 6.6.1 C6	-20	PASS

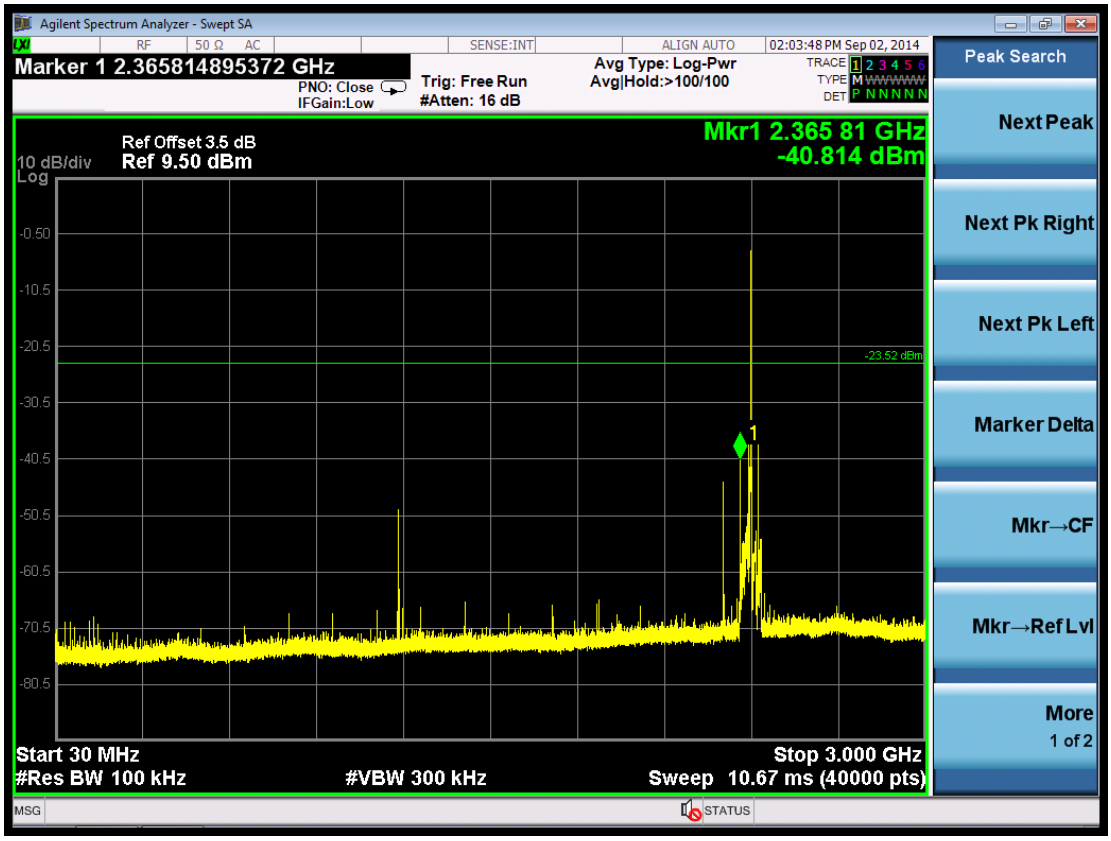
Frequency (MHz)	Delta Peak to Band emission (dBc)	Detector	Limit (dBc)	Refer to Plot	Verdict
2400.00	-33.845	Peak	-20	Plot 6.6.1 D	PASS
2483.50	-30.583	Peak	-20	Plot 6.6.1 E	PASS

Note: 1. The test results including the cable lose.

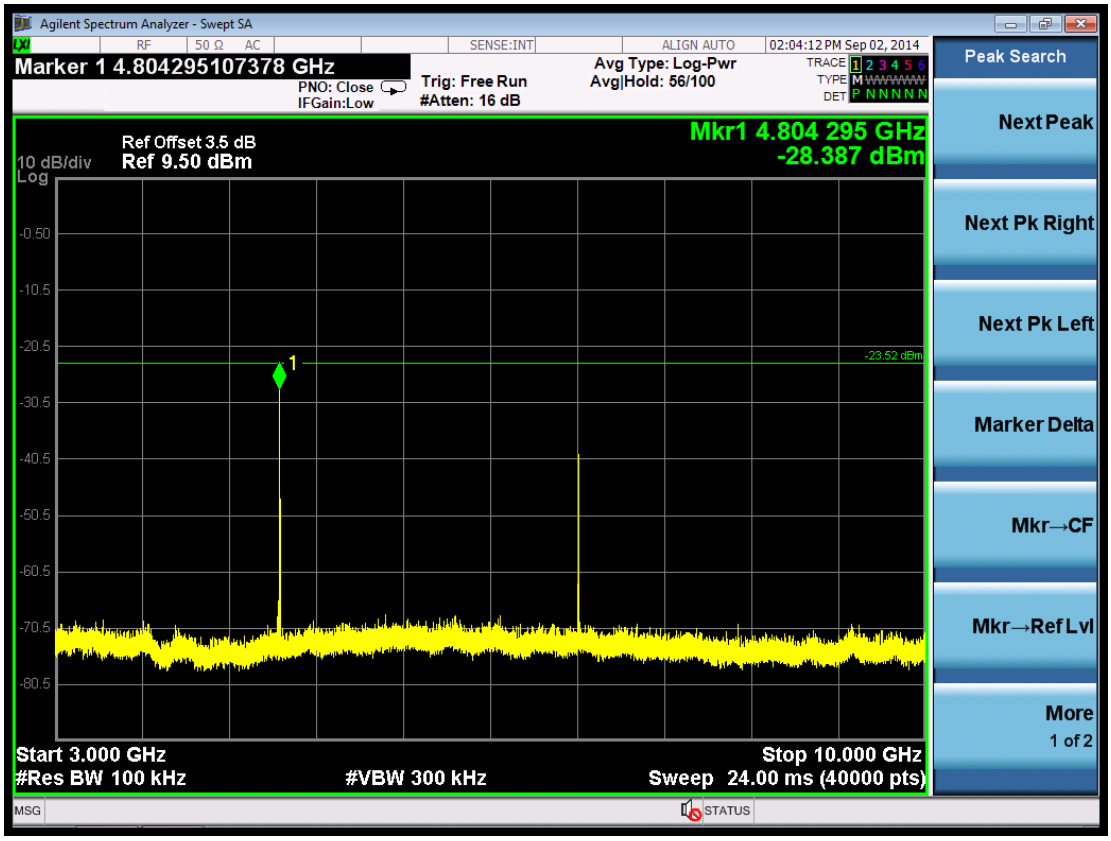
(Plot 6.6.1 A1: Channel 00: 2402MHz @ GFSK)



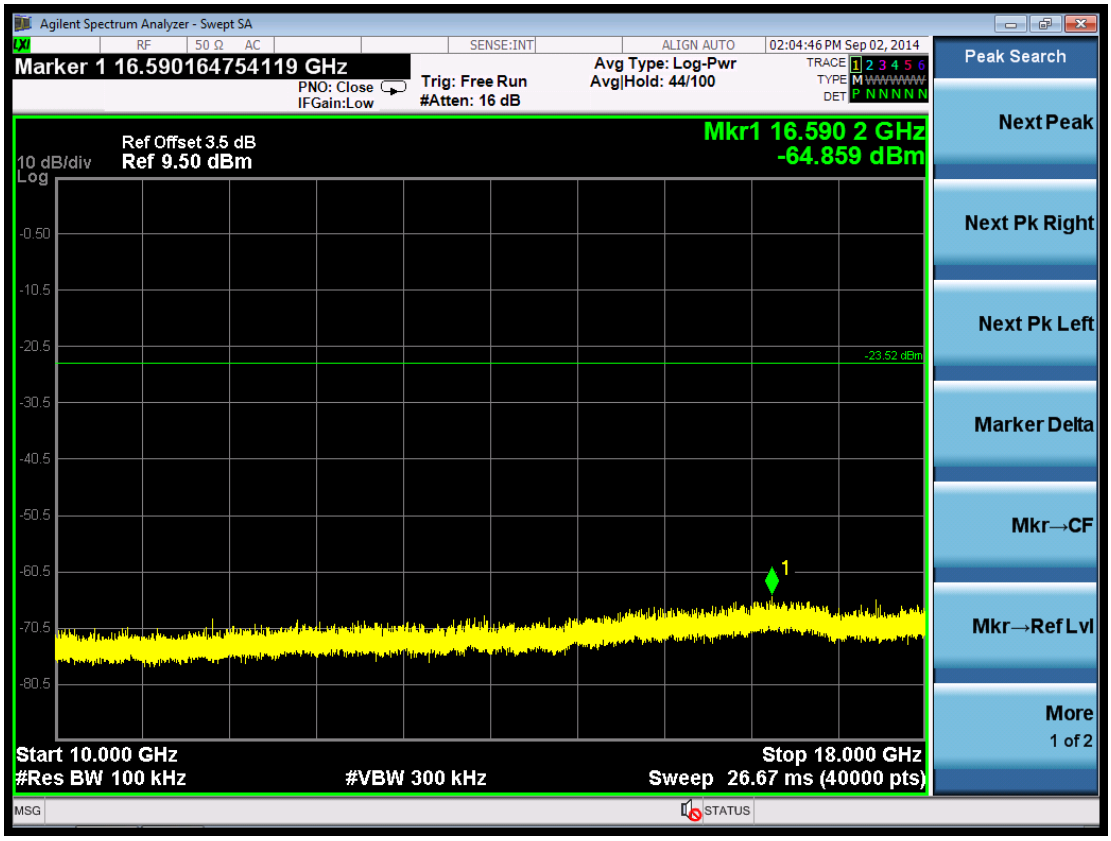
(Plot 6.6.1 A2: Channel 00: 2402MHz @ GFSK)



(Plot 6.6.1 A3: Channel 00: 2402MHz @ GFSK)



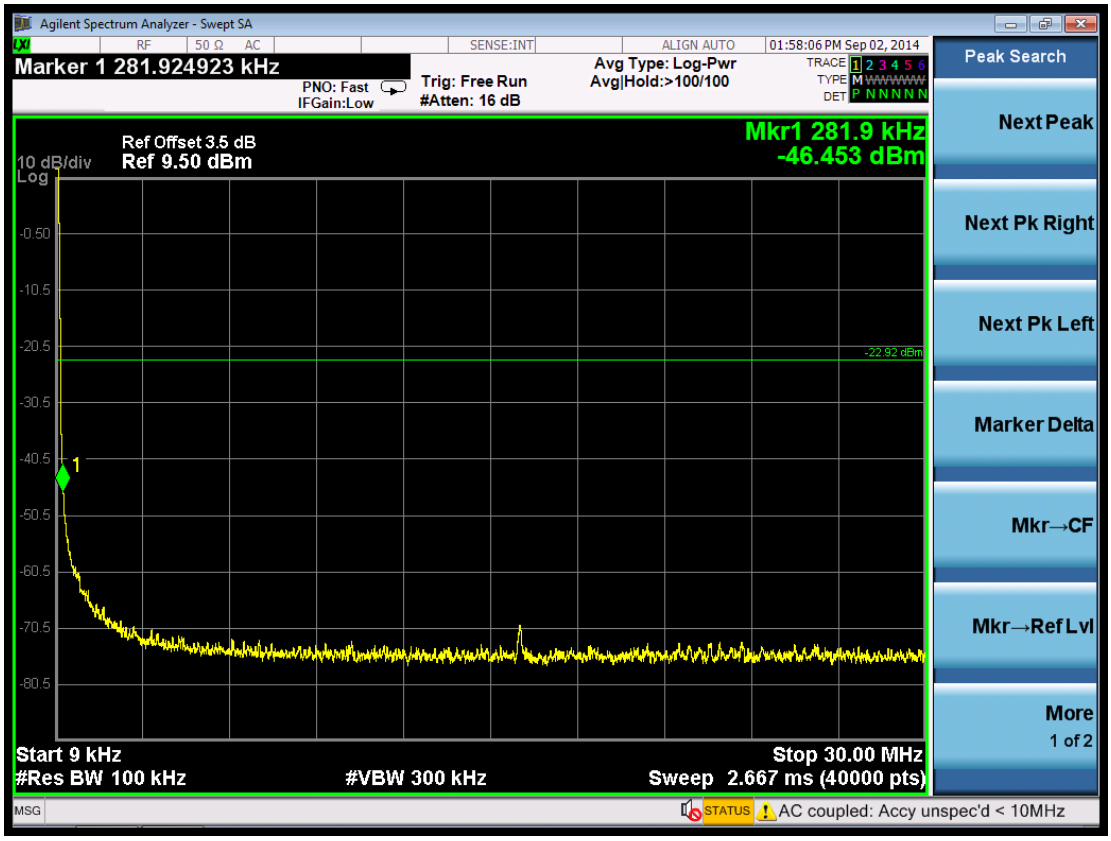
(Plot 6.6.1 A4: Channel 00: 2402MHz @ GFSK)



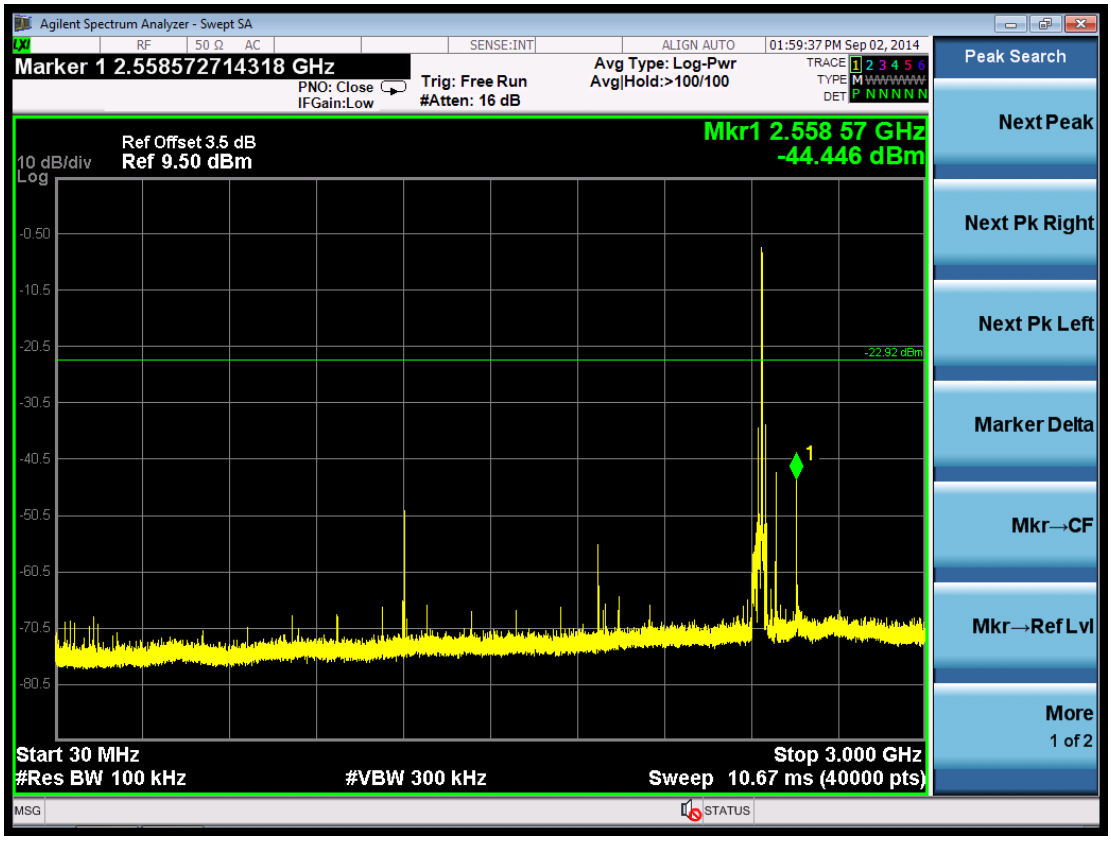
(Plot 6.6.1 A5: Channel 00: 2402MHz @ GFSK)

(Plot 6.6.1 A6: Channel 00: 2402MHz @ GFSK)

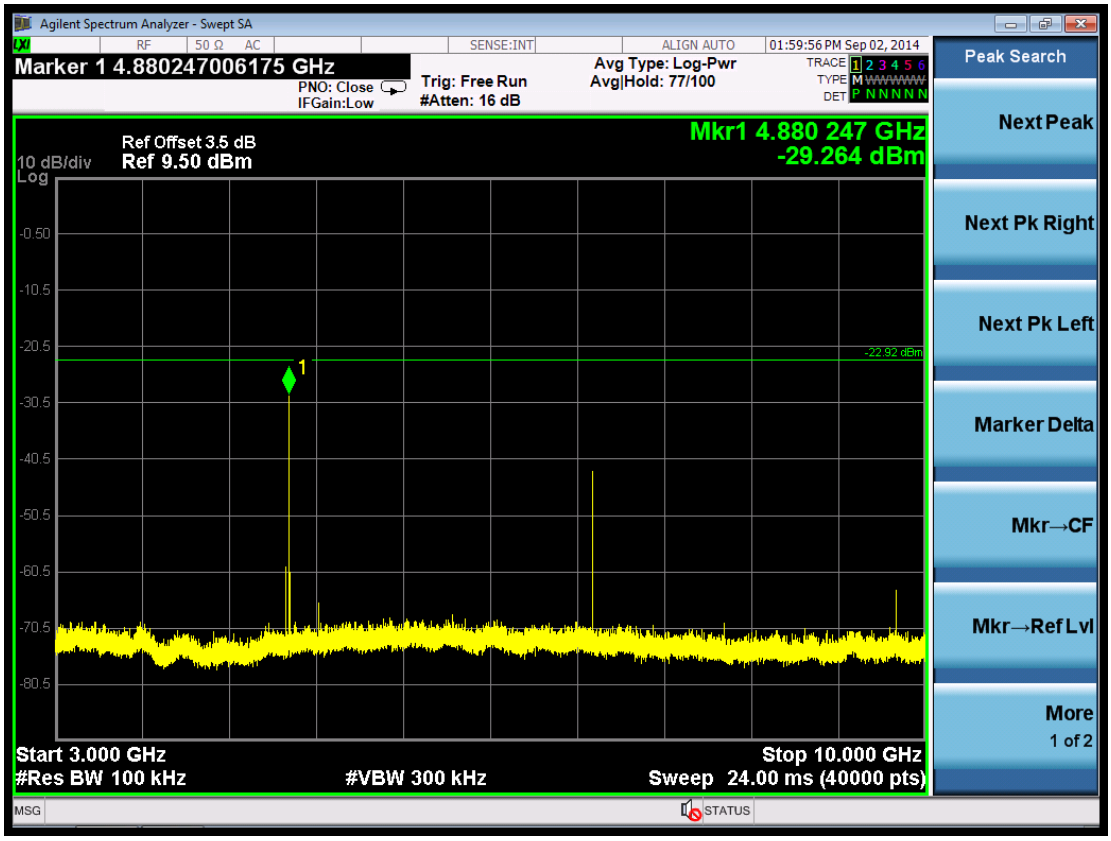
(Plot 6.6.1 B1: Channel 19: 2440MHz @ GFSK)



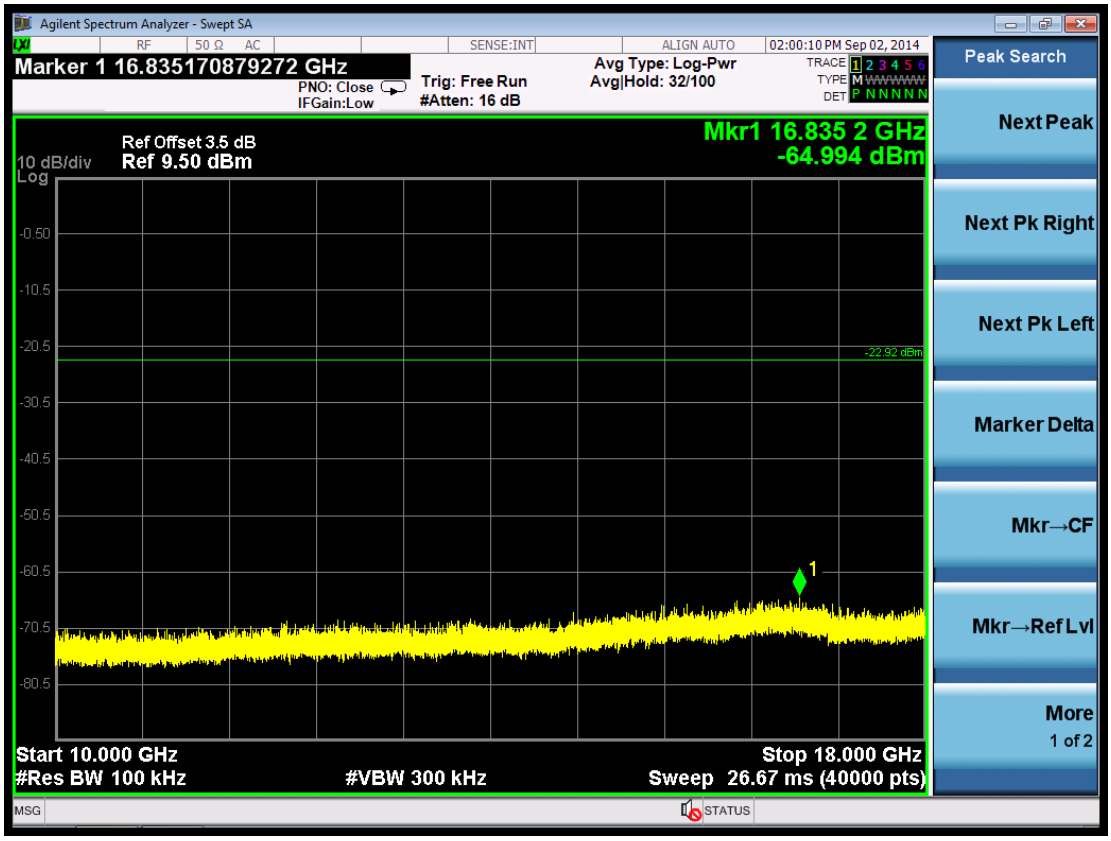
(Plot 6.6.1 B2: Channel 19: 2440MHz @ GFSK)



(Plot 6.6.1 B3: Channel 19: 2440MHz @ GFSK)



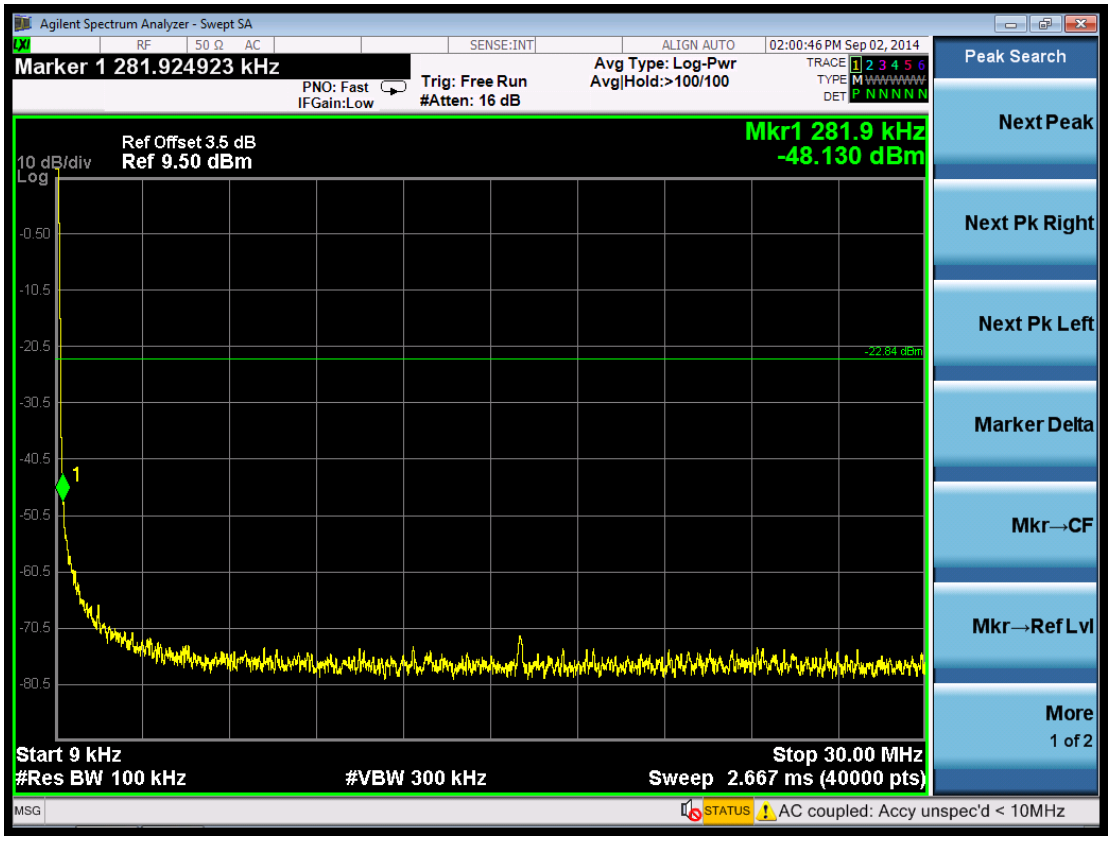
(Plot 6.6.1 B4: Channel 19: 2440MHz @ GFSK)



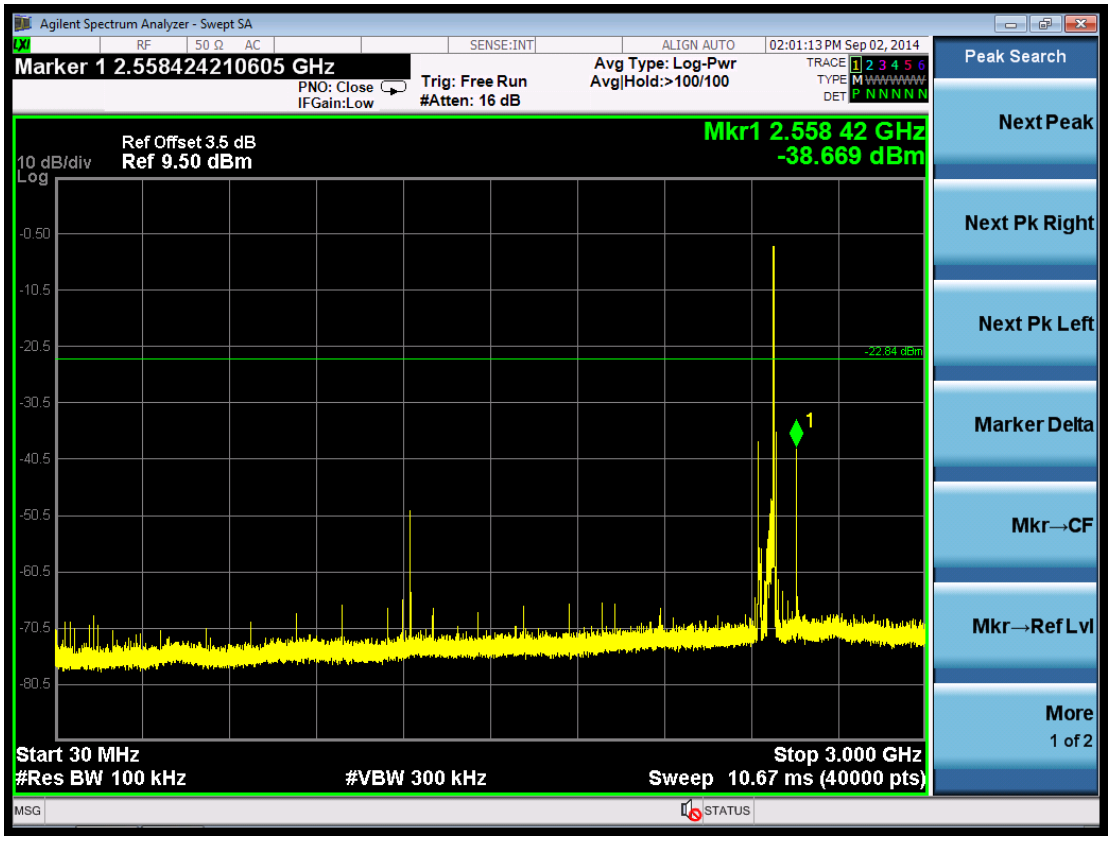
(Plot 6.6.1 B5: Channel 19: 2440MHz @ GFSK)

(Plot 6.6.1 B6: Channel 19: 2440MHz @ GFSK)

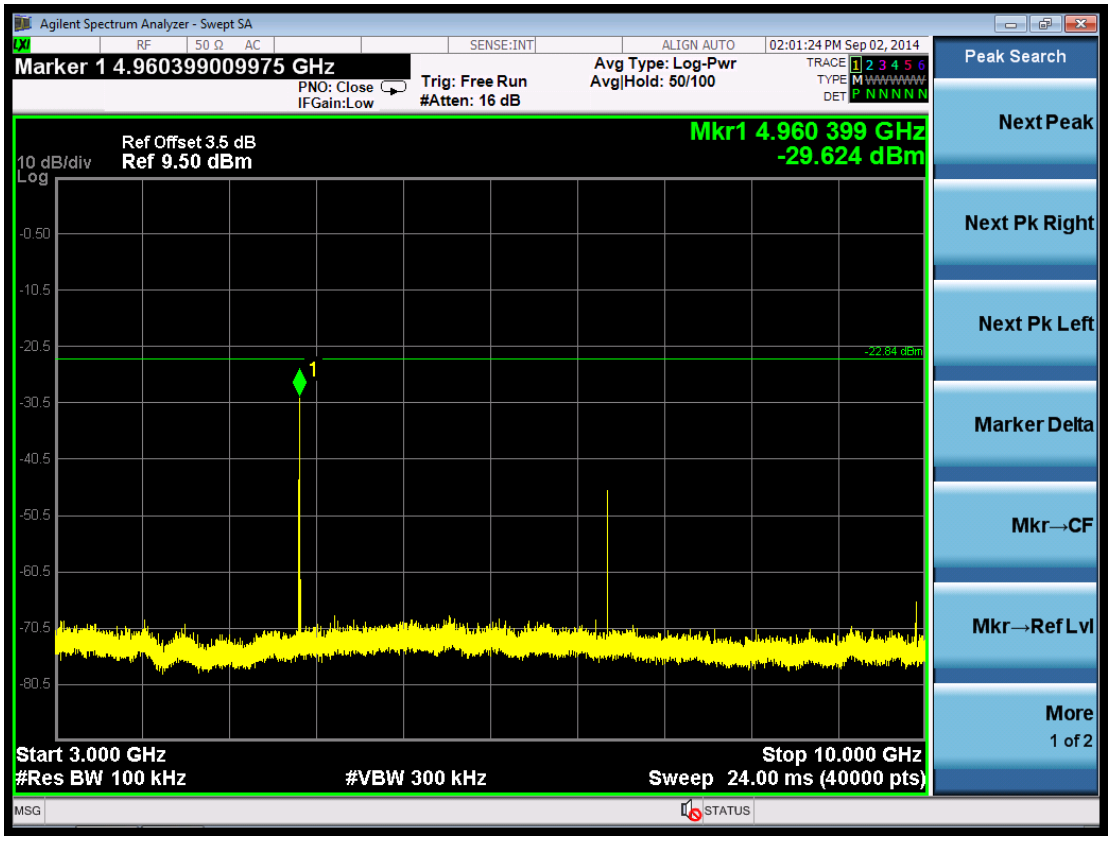
(Plot 6.6.1 C1: Channel 39: 2480MHz @ GFSK)



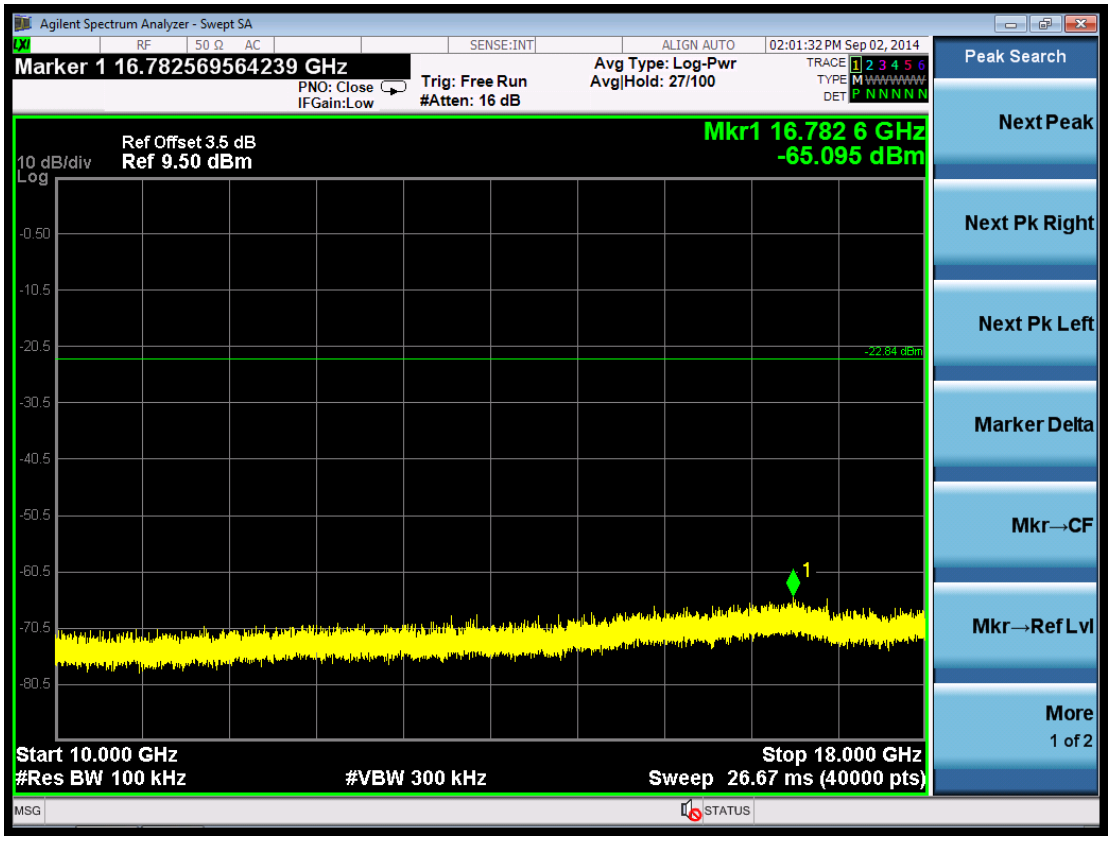
(Plot 6.6.1 C2: Channel 39: 2480MHz @ GFSK)



(Plot 6.6.1 C3: Channel 39: 2480MHz @ GFSK)

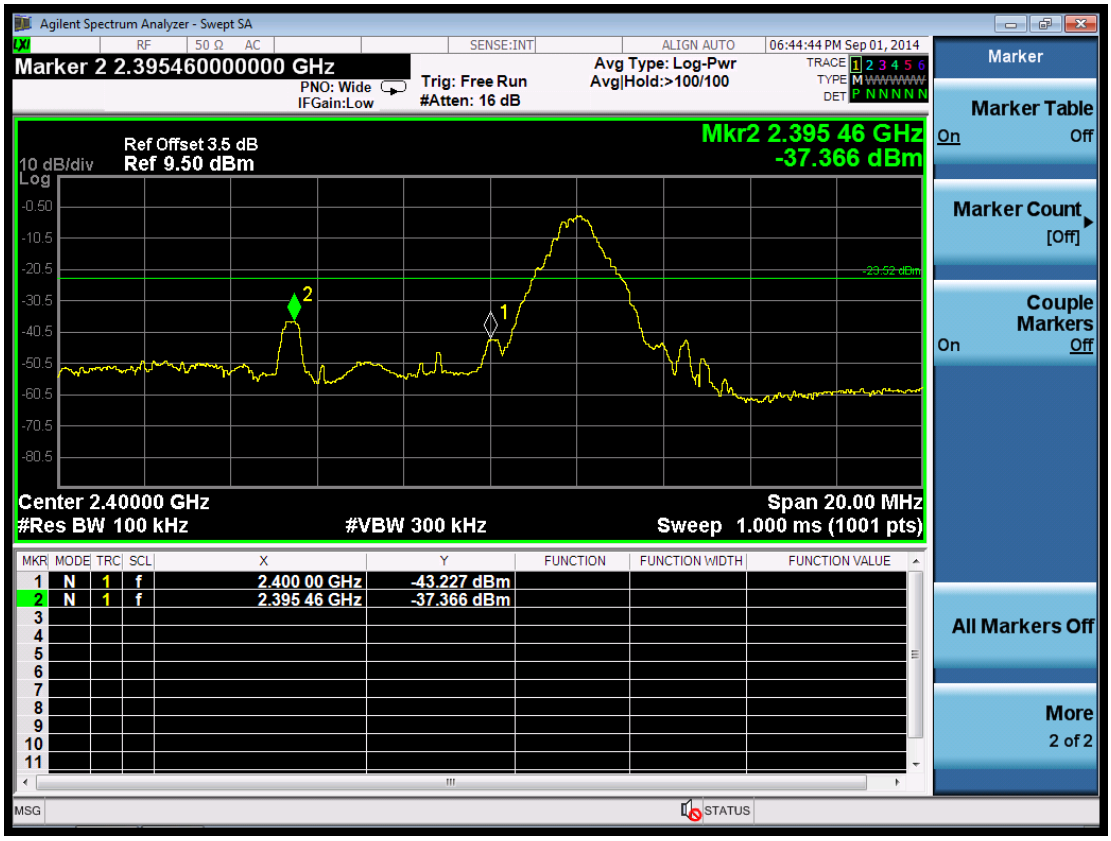


(Plot 6.6.1 C4: Channel 39: 2480MHz @ GFSK)

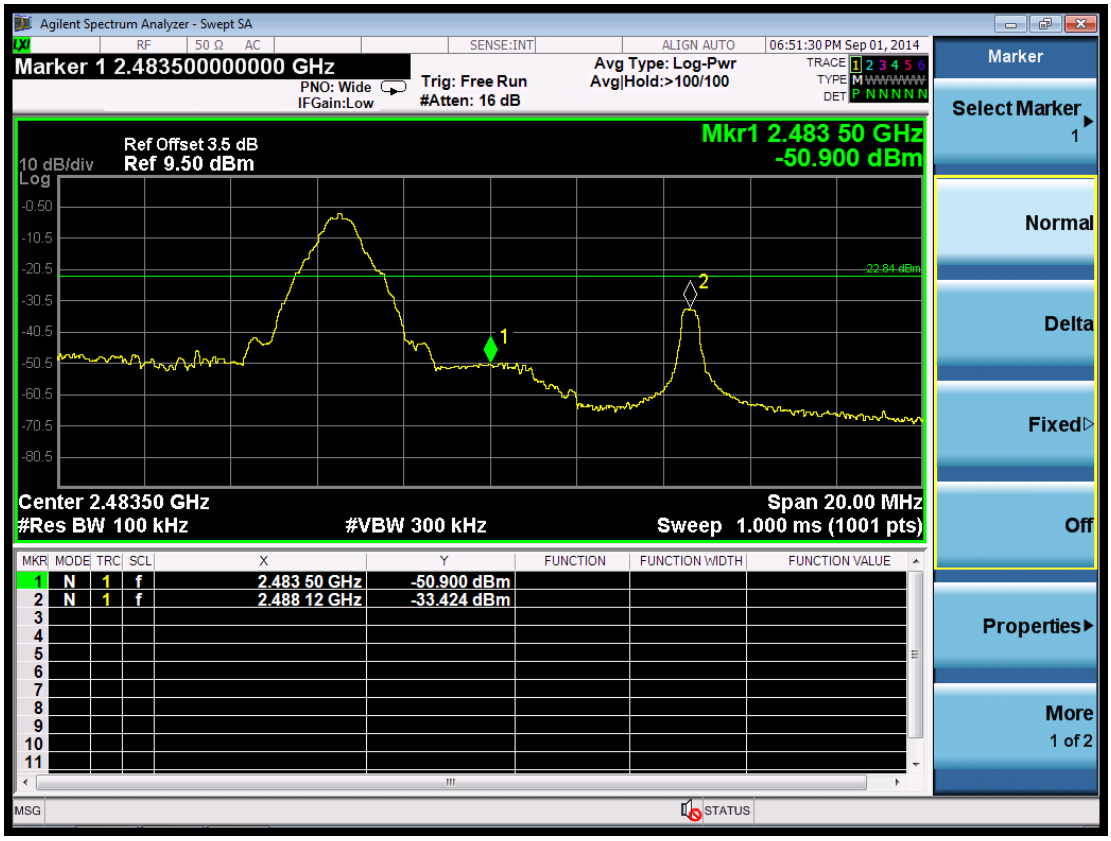


(Plot 6.6.1 C5: Channel 39: 2480MHz @ GFSK)

(Plot 6.6.1 C6: Channel 39: 2480MHz @ GFSK)



(Plot 6.6.1 D: Channel 00: 2402MHz @ GFSK)



(Plot 6.6.1 E: Channel 39: 2480MHz @ GFSK)

6.7 6dB Bandwidth

TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with100 KHz RBW and 300KHz VBW.
The 6dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6dB.
According to KDB558074 D01 V03 for one of the following procedures may be used to determine the modulated DTS device signal bandwidth.
1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) ≥ 3 RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. 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.

LIMIT

For digital modulation systems, the minimum 6 dB bandwidth shall be at least 500 kHz.

TEST RESULTS

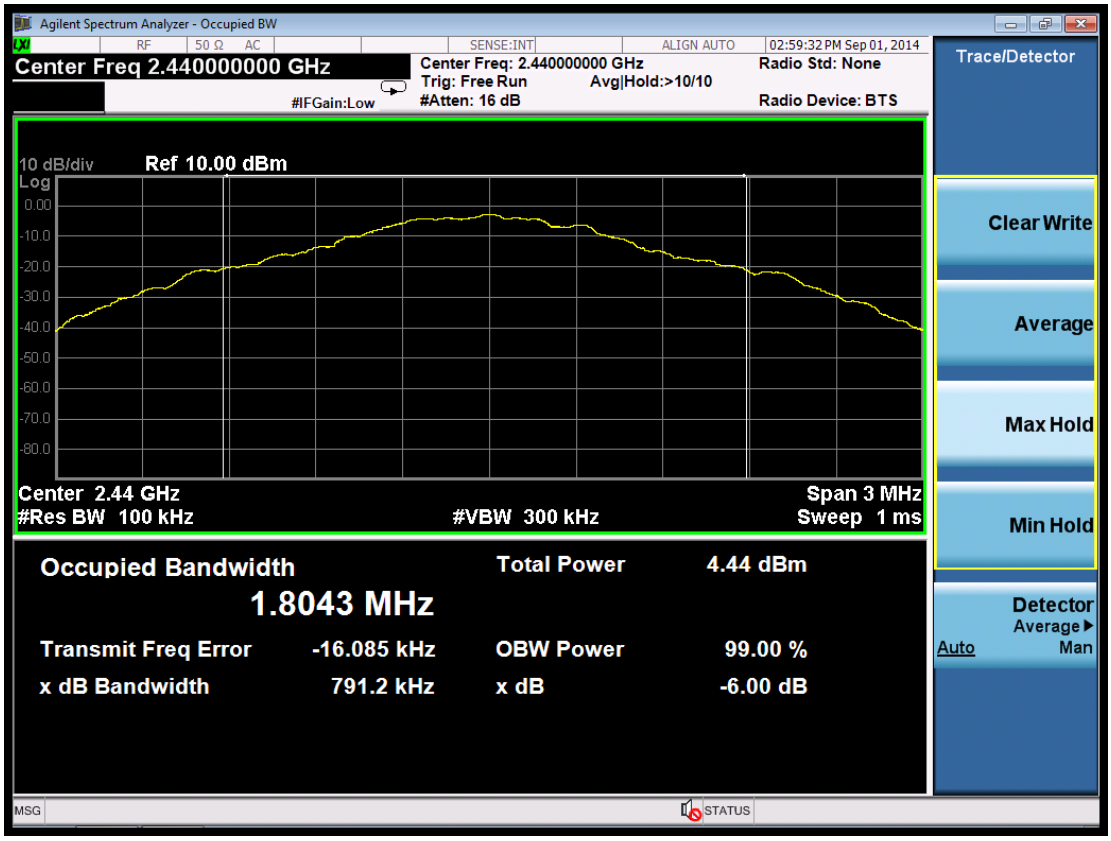
A. Test Verdict

Channel	Frequency (MHz)	6 dB Bandwidth (KHz)	Refer to Plot	Limits (kHz)	Verdict
00	2402	769.0	Plot 6.7.1 A	≥500	PASS
19	2440	791.2	Plot 6.7.1 B	≥500	PASS
39	2480	793.4	Plot 6.7.1 C	≥500	PASS

Note: 1.The test results including the cable lose.

B. Test Plots

(Plot 6.7.1 A: Channel 00: 2402MHz @ GFSK)



(Plot 6.7.1 B: Channel 19: 2440MHz @ GFSK)

(Plot 6.7.1 C: Channel 39: 2480MHz @ GFSK)

6.8 Antenna Requirement

Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

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

Refer to statement below for compliance

The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

Antenna Connected Construction

The Bluetooth antenna is an internal PCB antenna and the maximum antenna gain of BT used was 5.3 dBi.

END