FCC Part 15C
Measurement and Test Report

For

Koss Corporation

4129 N. Port Washington Avenue Milwaukee Wisconsin 53212 United States

FCC ID: L76-BT539I

FCC Rule(s):	FCC Part 15.247
Product Description:	Bluetooth Headset
Tested Model:	BT539i
Report No.:	STR16038189I-1
Tested Date:	2016-03-11 to 2016-04-15
Issued Date:	2016-04-15
Tested By:	Tink Zeng / Engineer
Reviewed By:	Silin Chen / EMC Manager
Approved & Authorized By:	Jandy so / PSQ Manager

Prepared By:

Shenzhen SEM.Test Technology Co., Ltd.
1/F, Building A, Hongwei Industrial Park, Liuxian 2nd Road,
Bao'an District, Shenzhen, P.R.C.（518101）
Tel.: +86-755-33663308 Fax.: +86-755-33663309 Website: www.semtest.com.cn

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1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant:	Koss Corporation
Address of applicant:	4129 N. Port Washington Avenue Milwaukee Wisconsin 53212 United States
Manufacturer:	Dongguan Baizhenrong Limited
Address of manufacturer:	3Xin Yuan Street, Ju-zhou NO.2 Industrial Zone, Shijie Town, Dongguan, Guangdong Province, P.R.C

General Description of EUT	
Product Name:	Bluetooth Headset
Trade Name:	KOSS
Model No.:	BT539i
Adding Model(s):	/
Rated Voltage:	Battery DC3.7V ; USB DC5V
Software Version:	V1.0
Hardware Version:	BT-539PCB
Note: The test data is gathered from a production sample provided by the manufacturer.	

Technical Characteristics of EUT	
Bluetooth Version:	Bluetooth V4.0(BR+EDR mode)
Frequency Range:	2402-2480MHz
RF Output Power:	0.5 dBm (Conducted)
Data Rate:	1Mbps, 2Mbps, 3Mbps,
Modulation:	GFSK, Pi/4 QDPSK, 8DPSK
Quantity of Channels:	79
Channel Separation:	1MHz
Type of Antenna:	Integral Antenna
Antenna Gain:	0dBi
Lowest Internal Frequency of EUT:	26MHz

1.2 Test Standards

The following report is prepared on behalf of the Koss Corporation in accordance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 of the Federal Communication Commissions rules.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product, which result in lowering the emission, should be checked to ensure compliance has been maintained.

1.3 Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard for Testing Unlicensed Wireless Devices.

1.4 Test Facility

FCC – Registration No.: 934118

Shenzhen SEM.Test Technology Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files and the Registration is 934118.

Industry Canada (IC) Registration No.: 11464A

The 3m Semi-anechoic chamber of Shenzhen SEM.Test Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 11464A.

CNAS Registration No.: L4062

Shenzhen SEM.Test Technology Co., Ltd. is a testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L4062. All measurement facilities used to collect the measurement data are located at 1/F, Building A, Hongwei Industrial Park, Liuxian 2nd Road, Bao'an District, Shenzhen, P.R.C (518101).

1.5 EUT Setup and Test Mode

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, and to measure its highest possible emissions level, more detailed description as follows:

Test Mode List		
Test Mode	Description	Remark
TM1	Low Channel	2402MHz
TM2	Middle Channel	2441MHz
TM3	High Channel	2480MHz
TM4	Hopping	2402-2480MHz

Modulation Configure			
Modulation	Packet	Packet Type	Packet Size
GFSK	DH1	4	27
	DH3	11	183
	DH5	15	339
Pi/4 QDPSK	2DH1	20	54
	2DH3	26	367
	2DH5	30	679
8DPSK	3DH1	24	83
	3DH3	27	552
	3DH5	31	1021
Normal mode: the Bluetooth has been tested on the modulation of GFSK, (Pi/4)DQPSK and 8DPSK, compliance test and record the worst case.			

Battery: The product use a rechargeable battery , while test , use a fully-charged battery.

Test Software: Use a CSR test fix connect to the product, test fix connect to Notebook with USB port. Open the test software Bluetest3, select the continue Tx mode. Use default power level setting

Test Connect: While during test, it will use a RF cable connect to spectrum. The product need a temporary antenna connector, The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

EUT Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
/	/	/	/

Special Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
USB Cable	1.0	Unshielded	Without Ferrite
AUX Cable	1.0	Unshielded	Without Ferrite

Auxiliary Equipment List and Details			
Description	Manufacturer	Model	Serial Number
Notebook	Lenovo	E10	LR-63C8R
Adapter	Hongben	HB0500	/

1.6 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Cal Date	Due Date
Spectrum Analyzer	Agilent	E4407B	MY41440400	2015-06-17	2016-06-16
Spectrum Analyzer	Rohde & Schwarz	FSP	836079/035	2015-06-17	2016-06-16
EMI Test Receiver	Rohde & Schwarz	ESVB	825471/005	2015-06-17	2016-06-16
Amplifier	Agilent	8447F	3113A06717	2015-06-17	2016-06-16
Amplifier	C&D	PAP-1G18	2002	2015-06-17	2016-06-16
Broadband Antenna	Schwarz beck	VULB9163	9163-333	2015-06-17	2016-06-16
Horn Antenna	ETS	3117	00086197	2015-06-17	2016-06-16
Horn Antenna	ETS	3116B	00088203	2015-06-17	2016-06-16
Loop Antenna	Schwarz beck	FMZB 1516	9773	2015-06-17	2016-06-16
EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2015-06-17	2016-06-16
L.I.S.N	Schwarz beck	NSLK8126	8126-224	2015-06-17	2016-06-16
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100911	2015-06-17	2016-06-16
ipex Connector	SEM	CN-2.4	SEMT-1083	2015-06-17	2016-06-16
RF Cable	SEM.Test	0M2	SEMT-1084	2015-06-17	2016-06-16
Coaxial Cable 30MHz~3GHz	SEM.Test	5M0RFC	SEMT-1042	2015-06-17	2016-06-16
Coaxial Cable 9kHz~30MHz	SEM.Test	5M0RFC	SEMT-1040	2015-06-17	2016-06-16
Coaxial Cable 3GHz~25GHz	Agilent	LL142-07-07-10M(A)	08050035	2015-06-17	2016-06-16

2. SUMMARY OF TEST RESULTS

FCC Rules	Description of Test Item	Result
§ 2.1093	RF Exposure	Compliant
§ 15.203; § 15.247(b)(4)(i)	Antenna Requirement	Compliant
§15.205	Restricted Band of Operation	Compliant
§ 15.207(a)	Conducted Emission	Compliant
§ 15.209(a)	Radiated Spurious Emissions	Compliant
§ 15.247(a)(1)(iii)	Quantity of Hopping Channel	Compliant
§ 15.247(a)(1)	Channel Separation	Compliant
§ 15.247(a)(1)(iii)	Time of Occupancy (Dwell time)	Compliant
§ 15.247(a)	20dB Bandwidth	Compliant
§ 15.247(b)(1)	RF Power Output	Compliant
§ 15.247(d)	Band Edge (Out of Band Emissions)	Compliant
§ 15.247(a)(1)	Frequency Hopping Sequence	Compliant
§ 15.247(g), (h)	Frequency Hopping System	Compliant

N/A: not applicable

3. RF Exposure

3.1 Standard Applicable

According to § 1.1307 and § 2.1093, the portable transmitter must comply the RF exposure requirements.

3.2 Test Result

This product complied with the requirement of the RF exposure, please see the RF Exposure Report.

4. Frequency Hopping System Requirements

4.1 Standard Applicable

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

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

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

5.2 Frequency Hopping System

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

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

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

4.3 EUT Pseudorandom Frequency Hopping Sequence

Pseudorandom Frequency Hopping Sequence Table as below:
Channel: 08, 24, 40, 56, 40, 56, 72, 09, 01, 09, 22, 33, 41, 33, 41, 65, 73, 53, 69, 06, 22, 04, 20, 36, 52, 38, 46, 70, 78, 68, 76, 21, 29, 10, 26, 42, 00, 58, 44, 60, 76, 13, 03, 14, 11, 35, 43, 37, 45, 69, 77, 55, 71, 08, 24, 08, 24, 40, 56, 40, 48, 72, 01, 72, 01, 25, 33, 12, 28, 44, 60, 42, 58, 74, 11, 05, 13, 37, 45, etc.

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

5. Quantity of Hopping Channels and Channel Separation

5.1 Standard Applicable

According to FCC 15.247 a(1), Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

5.2 Test Procedure

The number of hopping frequencies test method as follows.

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
Set span = the frequency band of operation (2400MHz to 2483.5MHz)
RBW = 100kHz, VBW = 100kHz
Sweep = auto
Detector function = peak
Trace = max hold
Allow the trace to stabilize, observed the band of 2400MHz to 2483.5MHz, than count it out the number of channels for comparing with the FCC rules.

The channel spacing test method as follows:

Set span = wide enough to capture the peaks of two adjacent channels
Other setting as above
Allow the trace to stabilize, Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

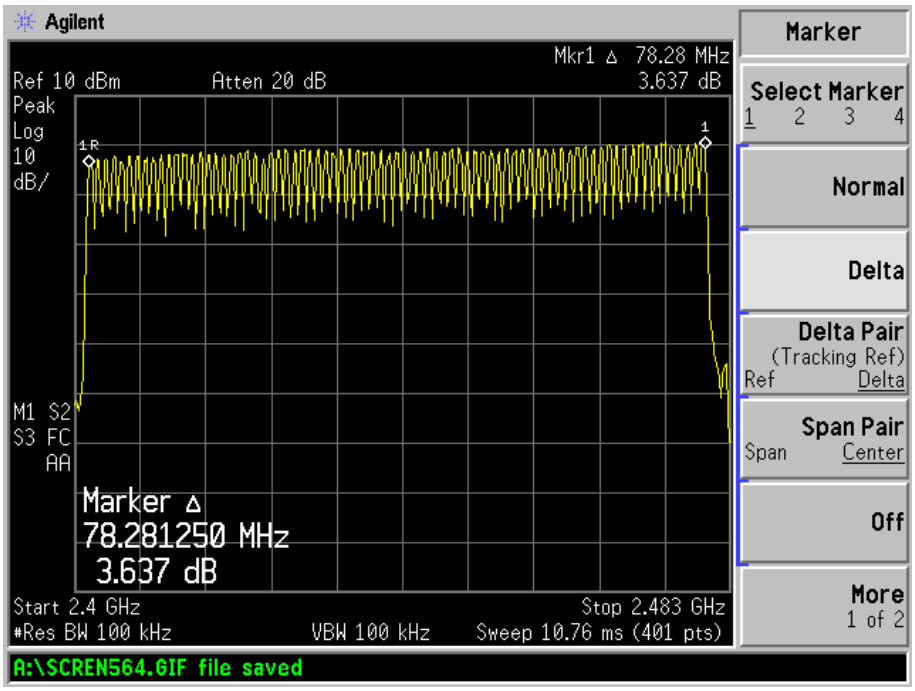
5.3 Environmental Conditions

Temperature:	25 °C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

5.4 Summary of Test Results/Plots

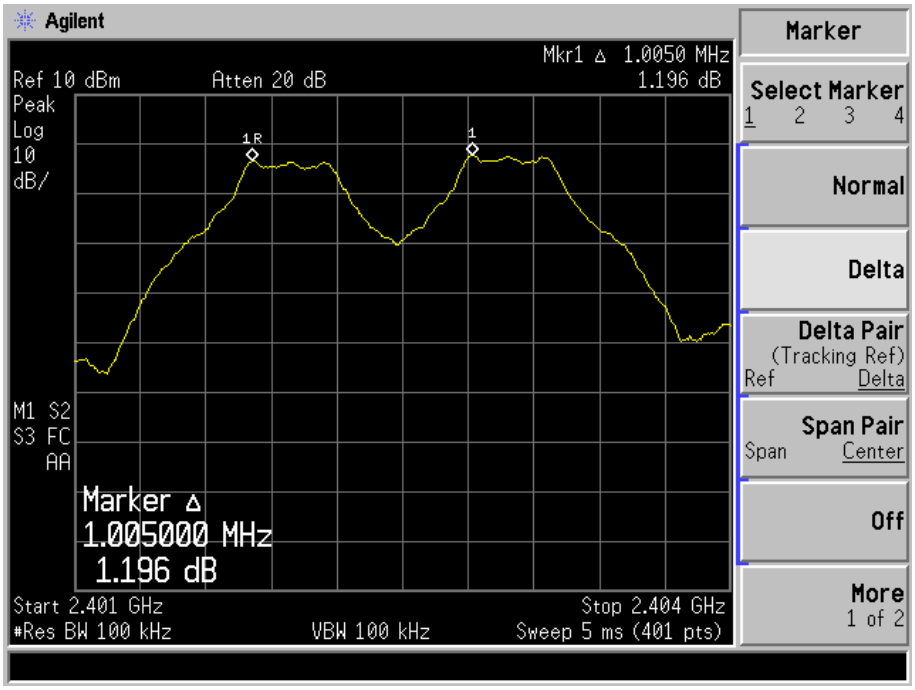
For GFSK

No. of Channel = 79 2402-2480MHz

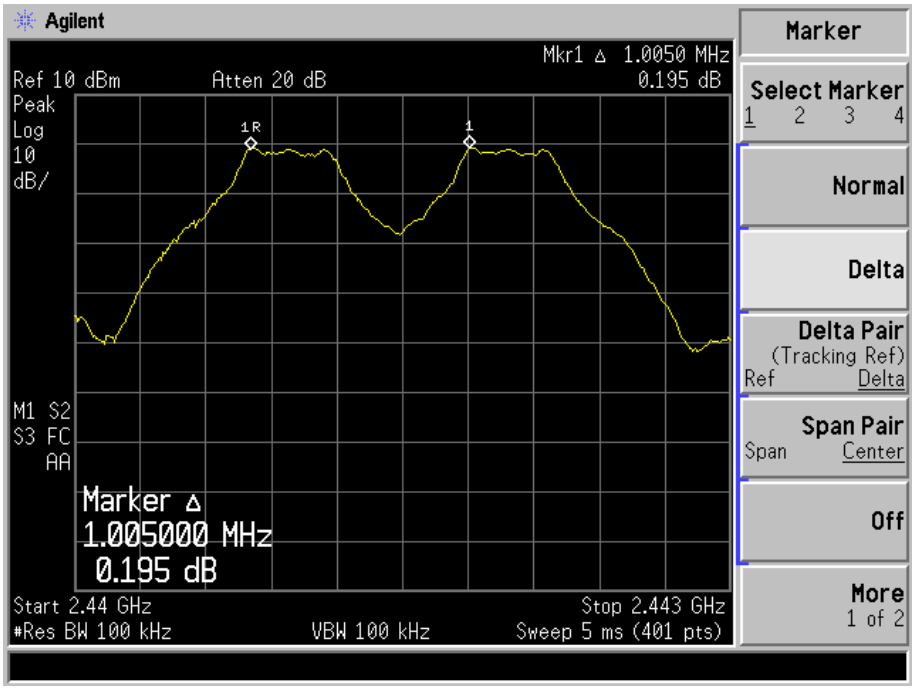


For GFSK

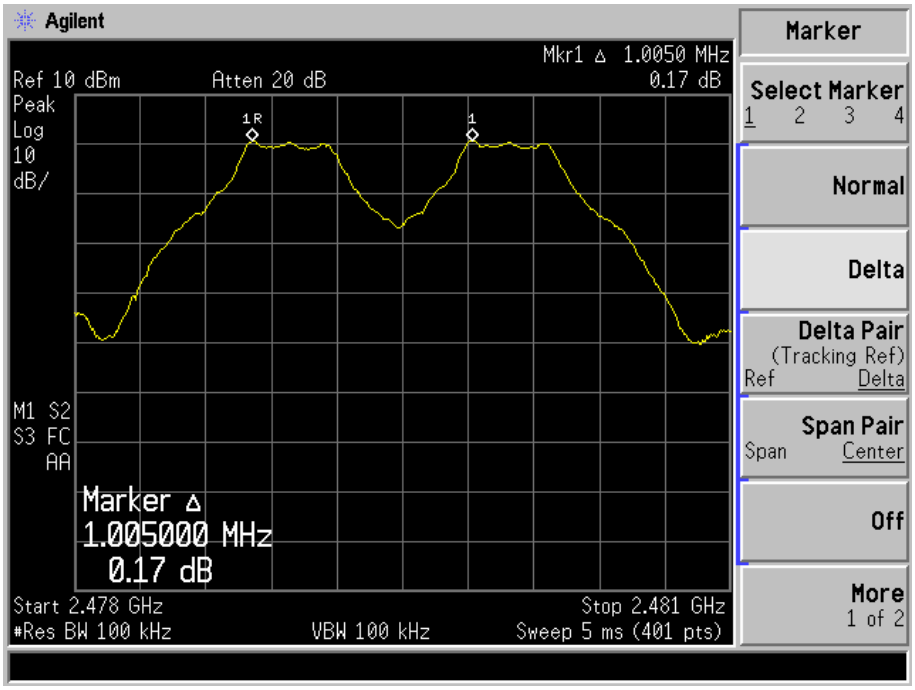
Channel Spacing (Low CH=1MHz)



Channel Spacing (Middle CH=1MHz)

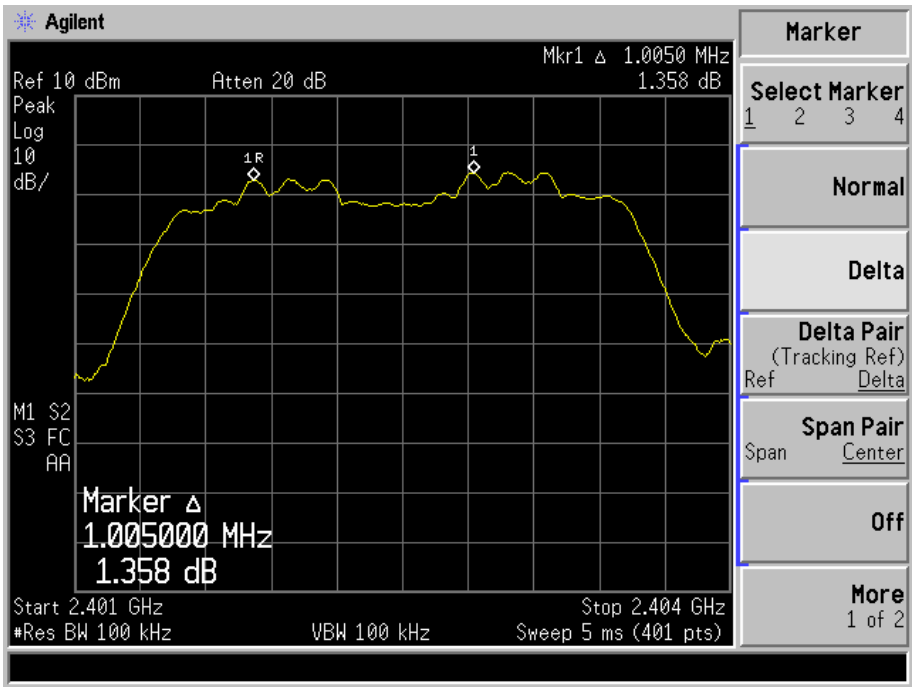


Channel Spacing (High CH=1MHz)

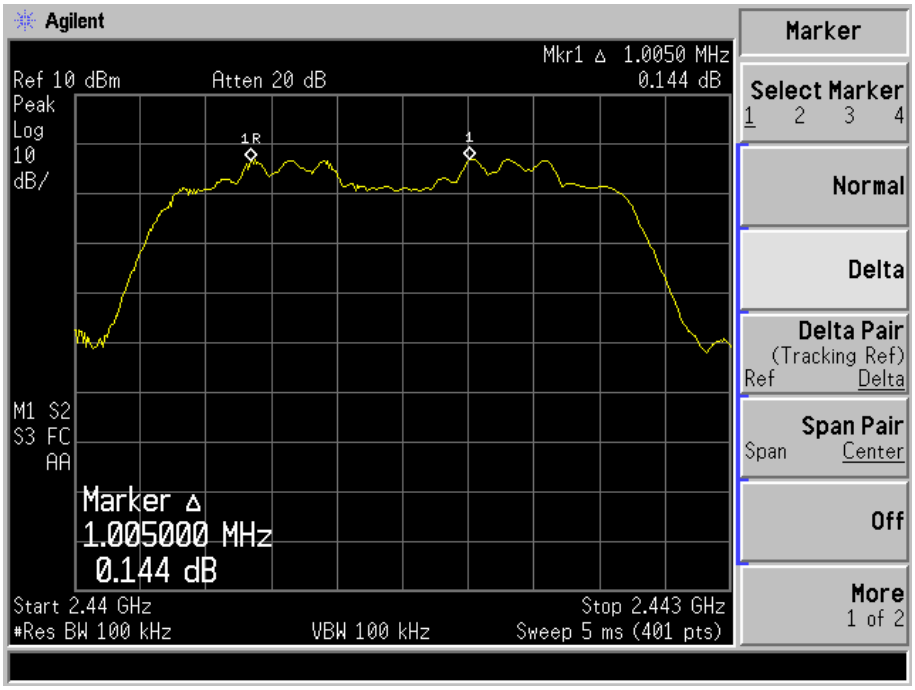


For 8DPSK mode

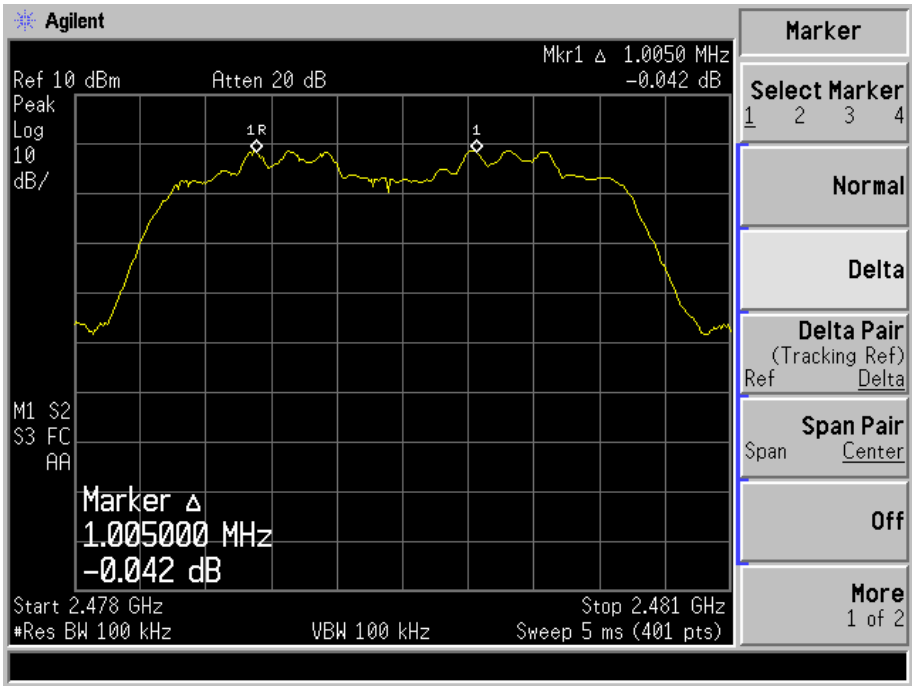
Channel Spacing (Low CH=1MHz)



Channel Spacing (Middle CH=1MHz)



Channel Spacing (High CH=1MHz)



6. Dwell Time of Hopping Channel

6.1 Standard Applicable

According to FCC 15.247, FHSs operating in the band 2400-2483.5 MHz shall use at least 15 hopping 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. Transmissions on particular hopping frequencies may be avoided or suppressed provided that at least 15 hopping channels are used.

6.2 Test Procedure

The dwell time of a hopping channel test method as follows.

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
Set span = zero span, centered on a hopping channel
RBW = 1MHz
VBW ≥ RBW
Sweep = as necessary to capture the entire dwell time per hopping channel
Detector function = peak
Trace = max hold
Use the marker-delta function to determine the dwell time

6.3 Environmental Conditions

Temperature:	20° C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

6.4 Summary of Test Results/Plots

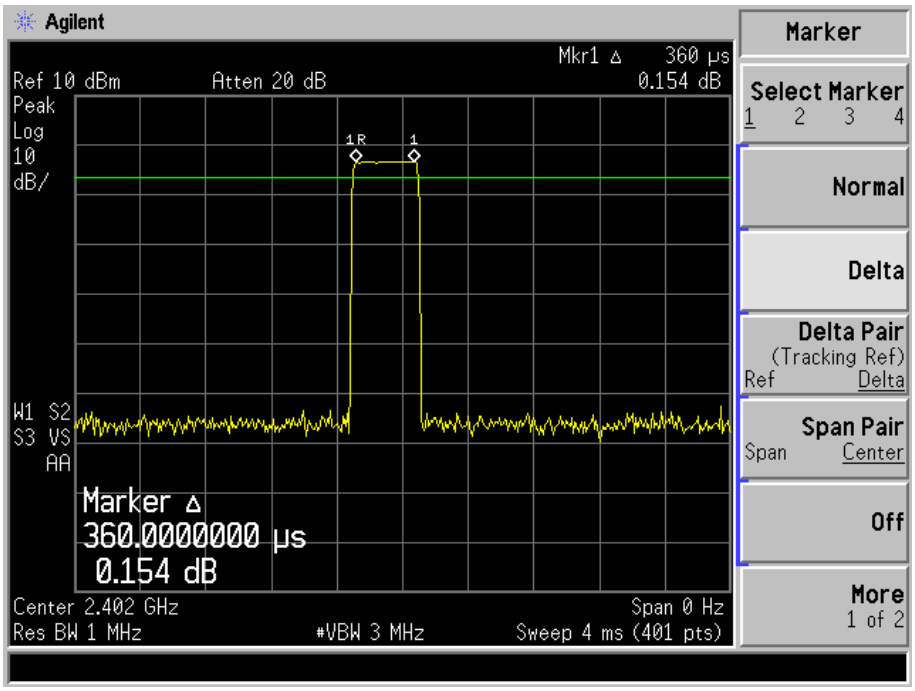
The dwell time within a period in data mode is independent from the packet type (packet length).
Test data is corrected with the worse case, which the packet length is DH1, DH3, DH5.

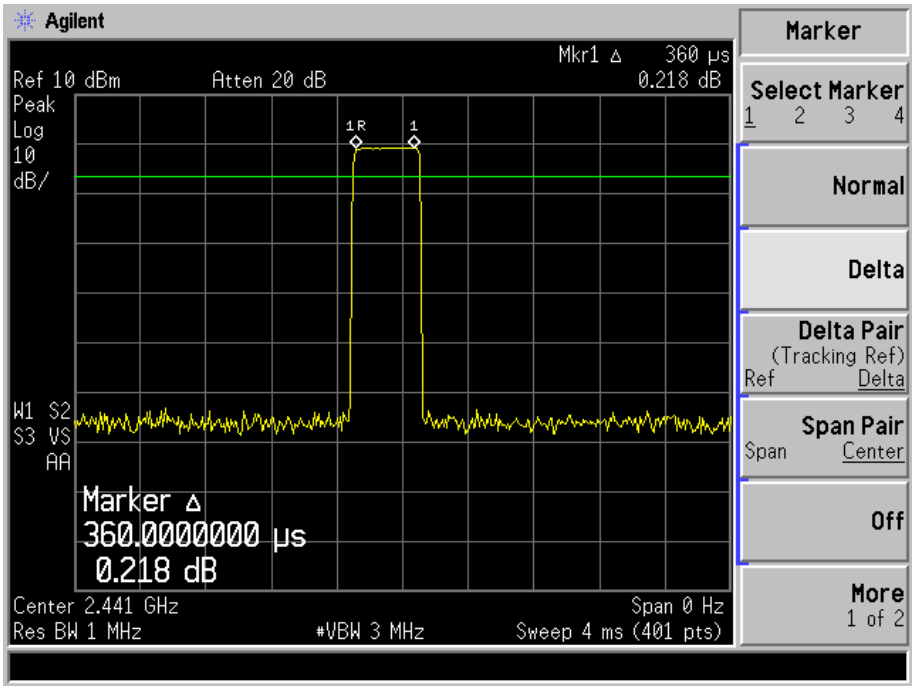
The test period: T = 0.4 Second * 79 Channel = 31.6 s
Dwell time = time slot length * (Hopping rate / Number of hopping channels) * Period

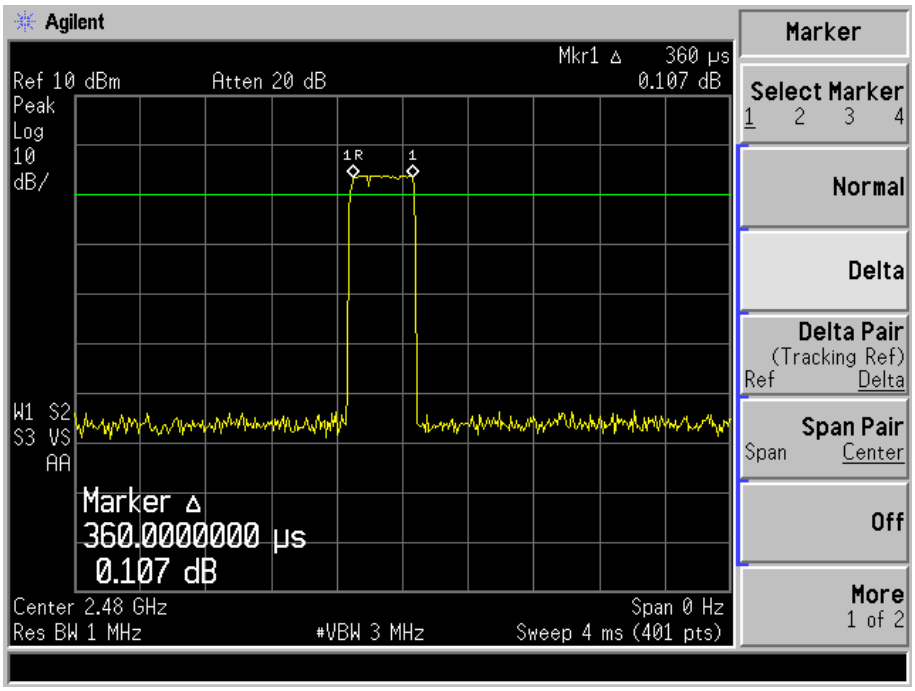
Modulation	Test Channel	Packet	Time Slot Length	Dwell Time	Limit
			ms	ms	ms
GFSK	2402MHz	DH1	0.360	115.200	400
		DH3	1.630	260.800	400
		DH5	2.888	307.200	400
	2441MHz	DH1	0.360	115.200	400
		DH3	1.630	260.800	400
		DH5	2.888	307.200	400
	2480MHz	DH1	0.360	115.200	400
		DH3	1.630	260.800	400
		DH5	2.875	306.133	400
8DPSK	2402MHz	3DH1	0.360	115.200	400
		3DH3	1.630	260.800	400
		3DH5	2.887	307.200	400
	2441MHz	3DH1	0.360	115.200	400
		3DH3	1.630	260.800	400
		3DH5	2.887	307.200	400
	2480MHz	3DH1	0.360	115.200	400
		3DH3	1.630	260.800	400
		3DH5	2.887	307.200	400

Please refer to the test plots as below:

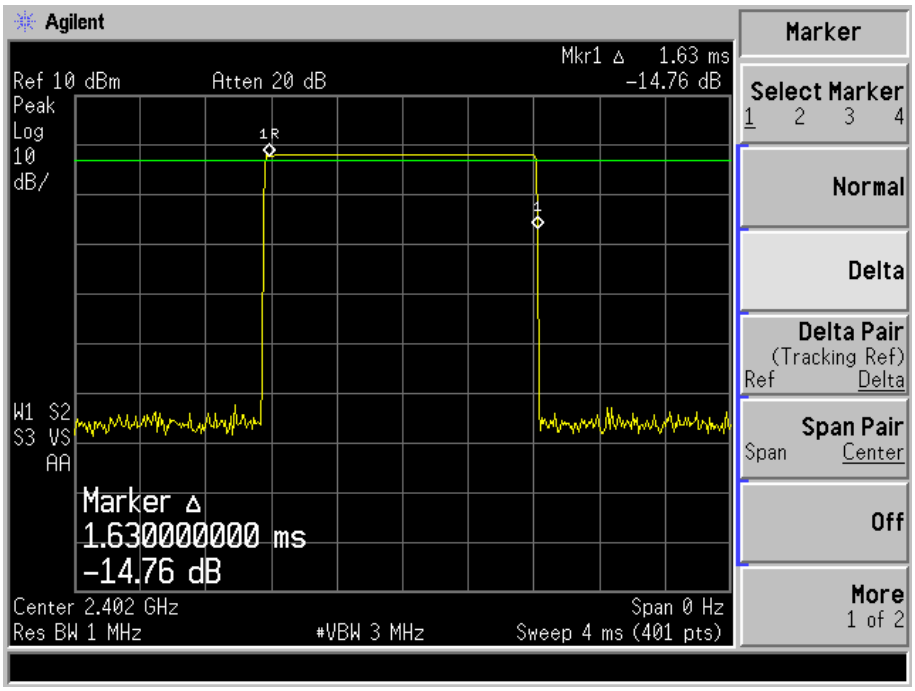
DH1 time slot (Low, Middle, High Channels)

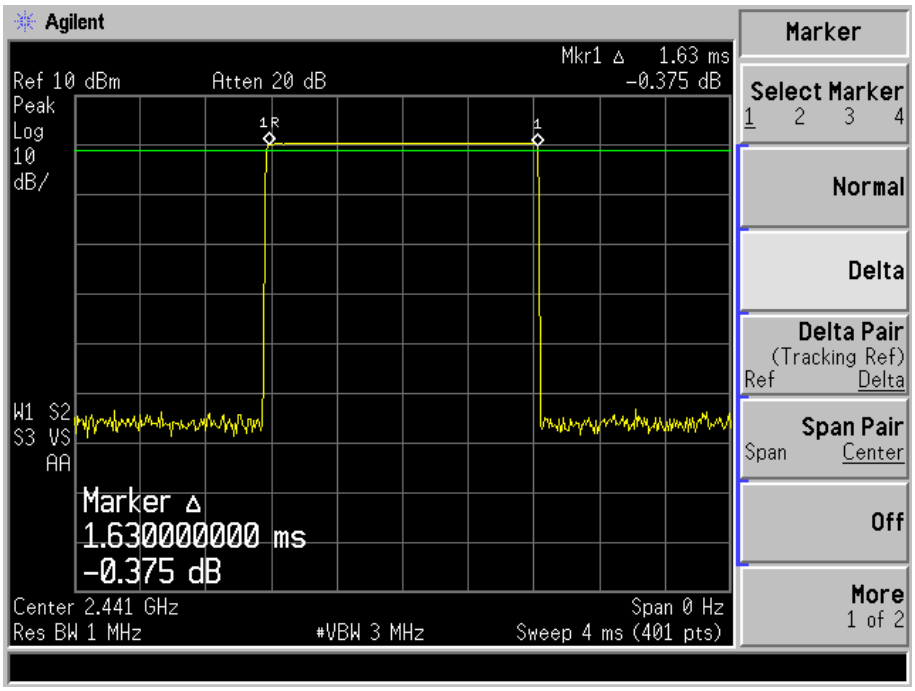


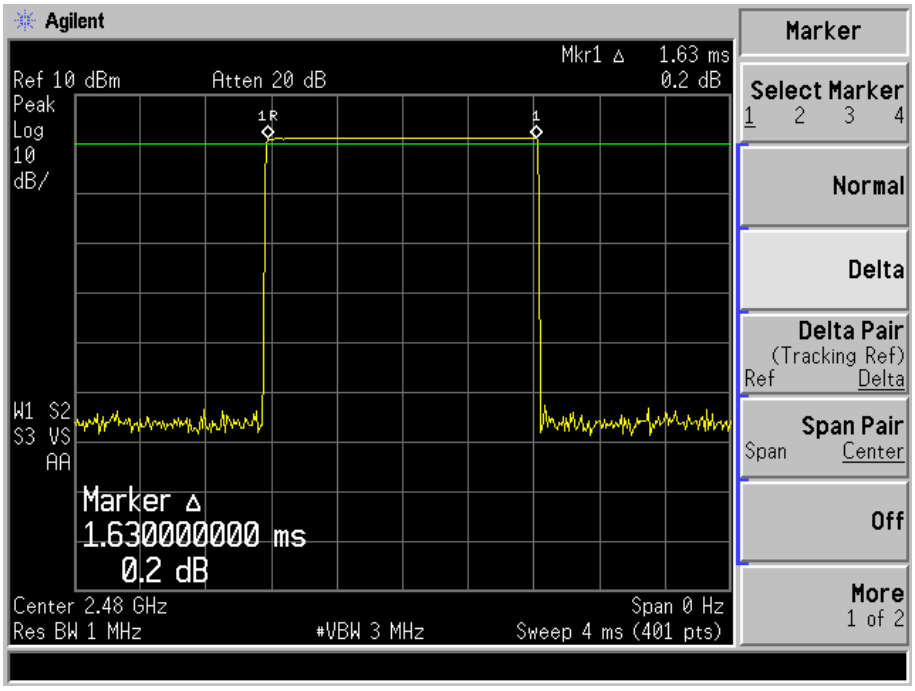




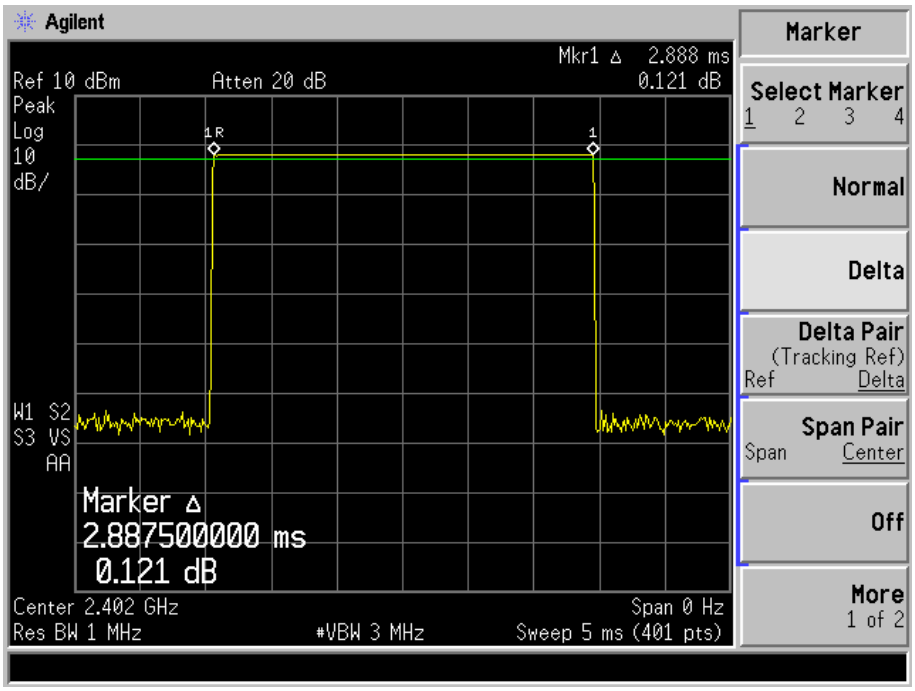
DH3 time slot (Low, Middle, High Channels)

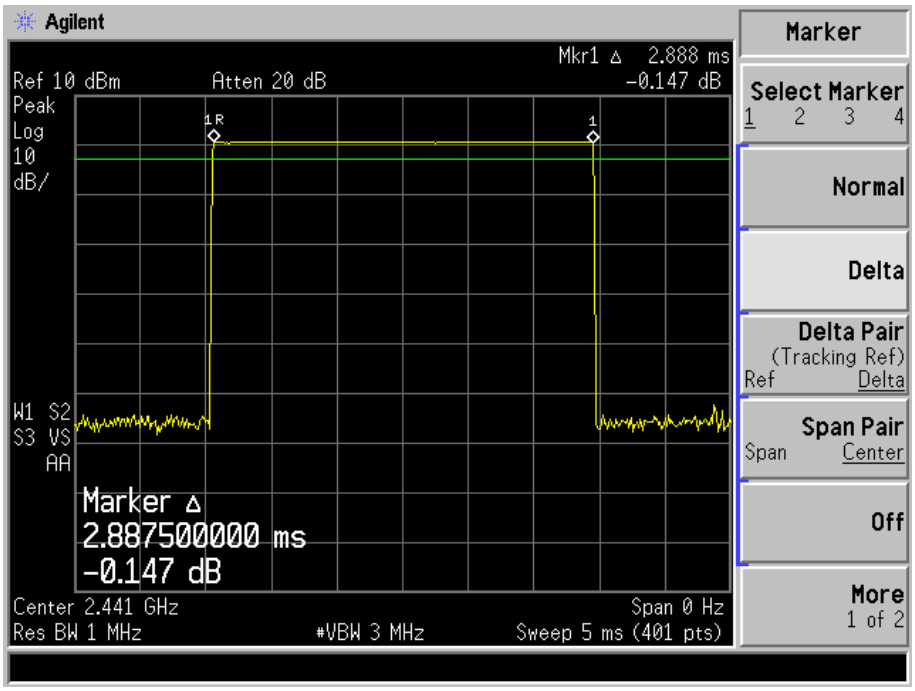


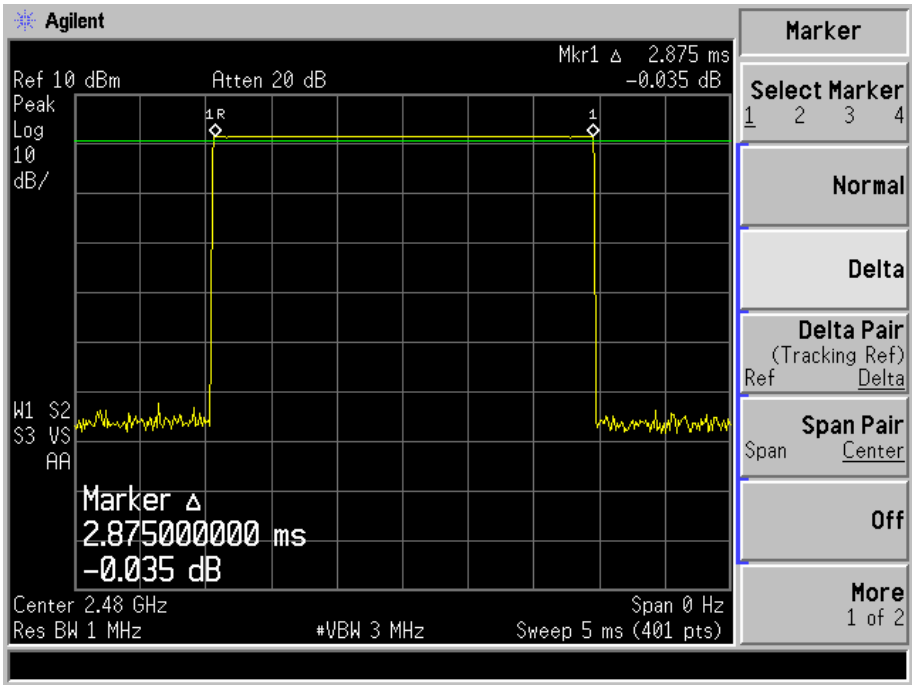

Agilent
Mkr1 Δ 1.63 ms
Ref 10 dBm
Atten 20 dB
−0.375 dB
Peak
Log
10
dB/
1R
1
W1 S2
S3 VS
AA
Marker Δ
1.630000000 ms
−0.375 dB
Center 2.441 GHz
Span 0 Hz
Res BW 1 MHz
#VBW 3 MHz
Sweep 4 ms (401 pts)
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2


Agilent
Mkr1 Δ 1.63 ms
Ref 10 dBm
Atten 20 dB
0.2 dB
Peak
Log
10
dB/
1R
1
W1 S2
S3 VS
AA
Marker Δ
1.630000000 ms
0.2 dB
Center 2.48 GHz
Span 0 Hz
Res BW 1 MHz
#VBW 3 MHz
Sweep 4 ms (401 pts)
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2

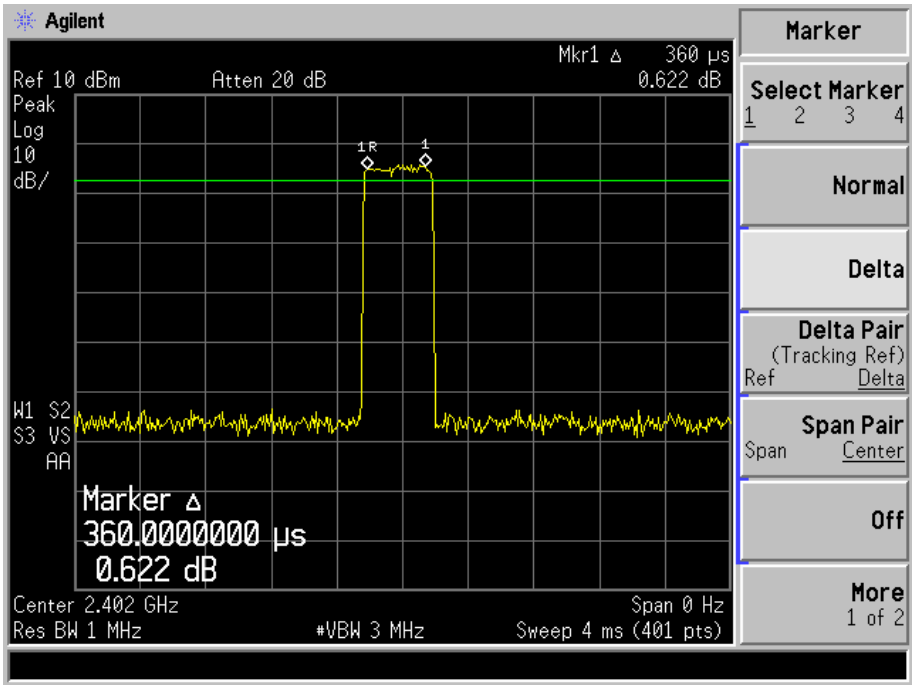
DH5 time slot (Low, Middle, High Channels)

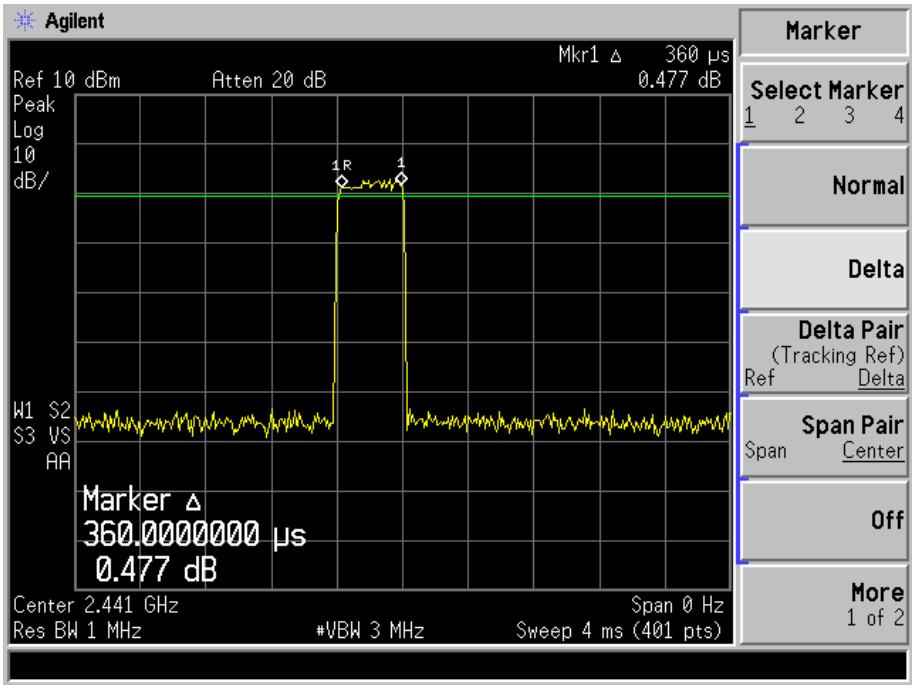


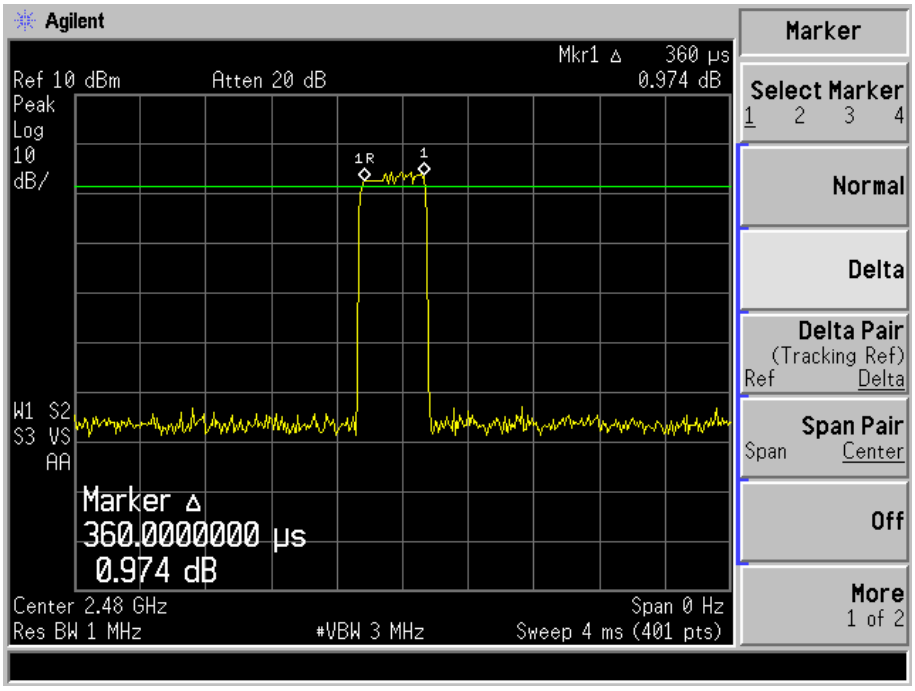




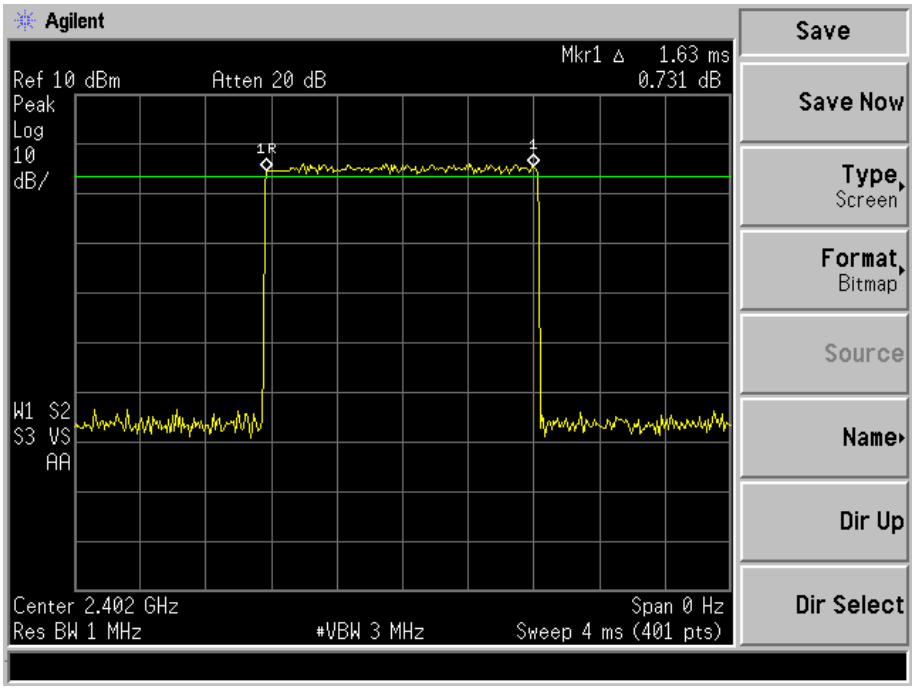
3DH1 time slot (Low, Middle, High Channels)

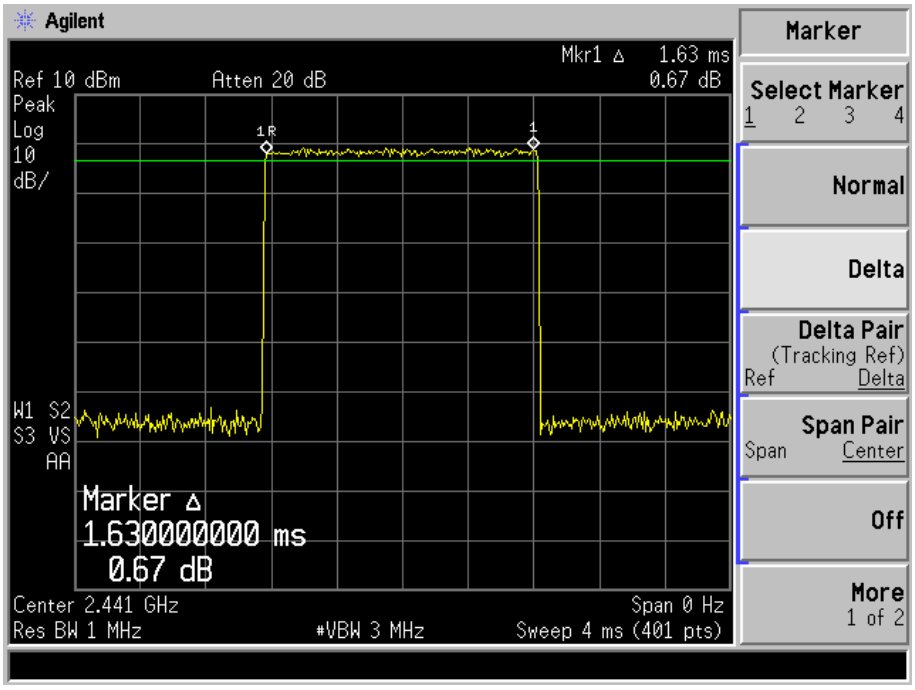


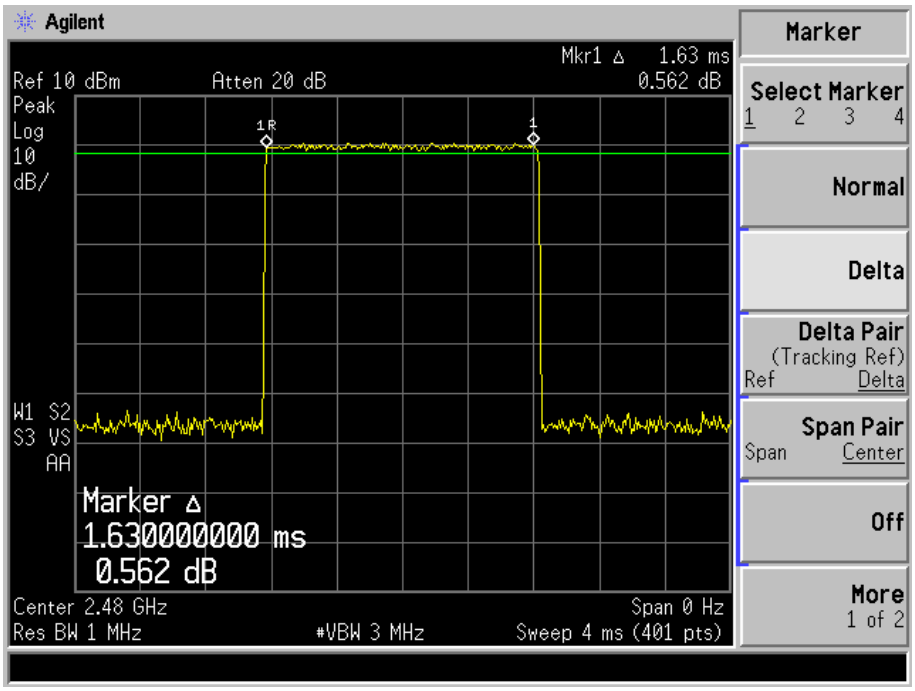

Agilent
Mkr1 Δ 360 µs
Ref 10 dBm
Atten 20 dB
0.477 dB
Peak
Log
10
dB/
1R
1
W1 S2
S3 VS
AA
Marker Δ
360.0000000 µs
0.477 dB
Center 2.441 GHz
Span 0 Hz
Res BW 1 MHz
#VBW 3 MHz
Sweep 4 ms (401 pts)
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2


Agilent
Mkr1 Δ 360 µs
Ref 10 dBm
Atten 20 dB
0.974 dB
Peak
Log
10
dB/
1R
1
W1 S2
S3 VS
AA
Marker Δ
360.0000000 µs
0.974 dB
Center 2.48 GHz
Span 0 Hz
Res BW 1 MHz
#VBW 3 MHz
Sweep 4 ms (401 pts)
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2

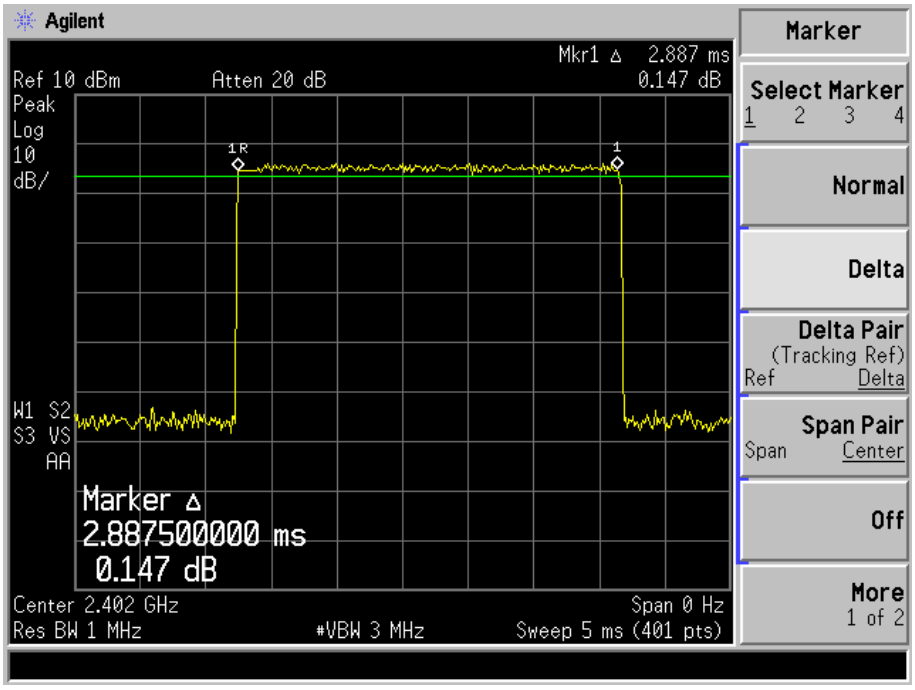
3DH3 time slot (Low, Middle, High Channels)

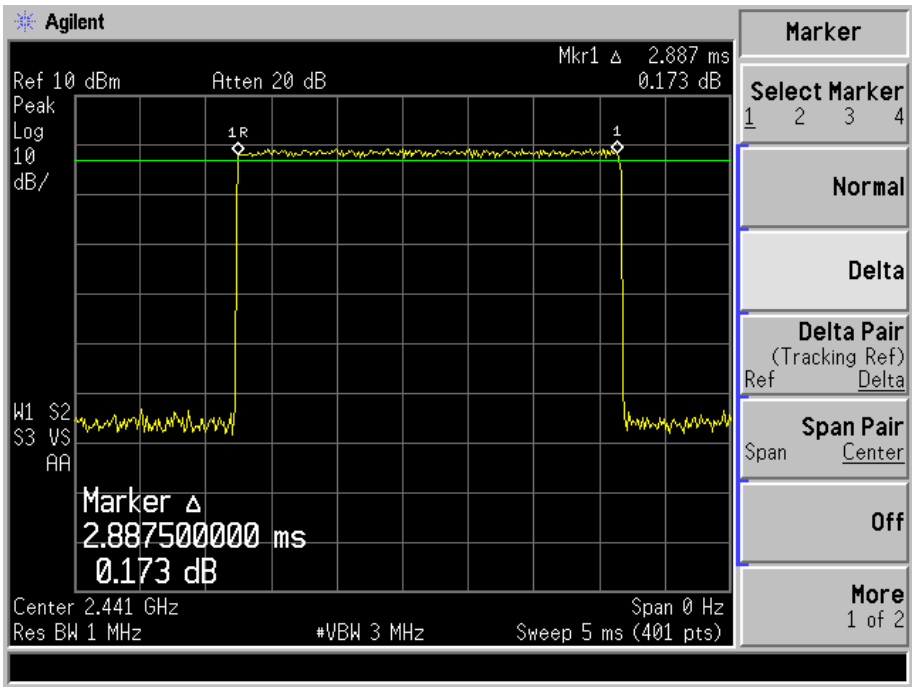


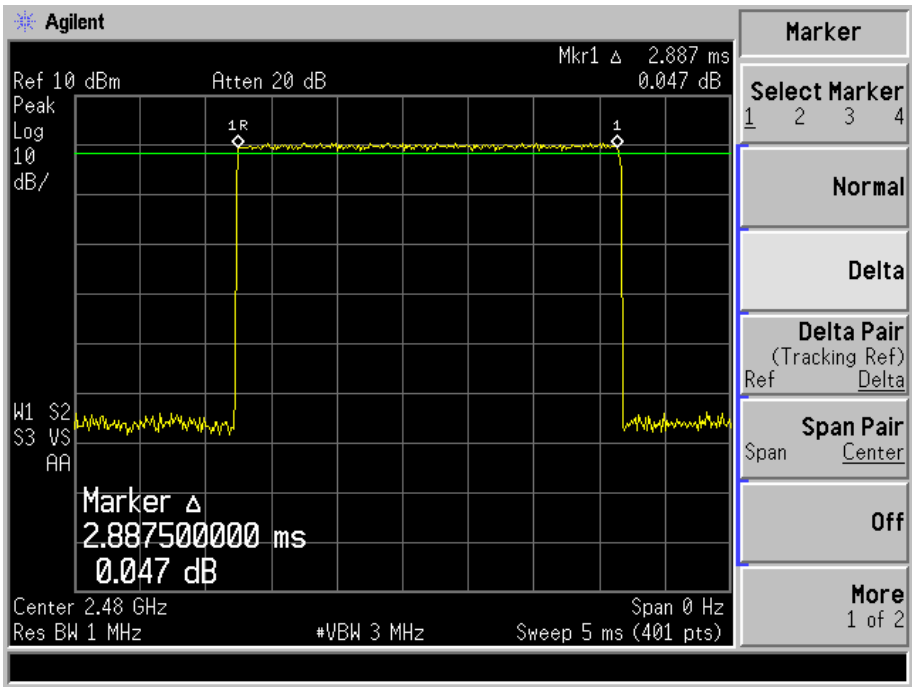




3DH5 time slot (Low, Middle, High Channels)




Agilent
Mkr1 Δ 2.887 ms
Ref 10 dBm
Atten 20 dB
0.173 dB
Peak
Log
10
dB/
1R
1
W1 S2
S3 VS
AA
Marker Δ
2.887500000 ms
0.173 dB
Center 2.441 GHz
Span 0 Hz
Res BW 1 MHz
#VBW 3 MHz
Sweep 5 ms (401 pts)
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2


Agilent
Mkr1 Δ 2.887 ms
Ref 10 dBm
Atten 20 dB
0.047 dB
Peak
Log
10
dB/
1R
1
W1 S2
S3 VS
AA
Marker Δ
2.887500000 ms
0.047 dB
Center 2.48 GHz
Span 0 Hz
Res BW 1 MHz
#VBW 3 MHz
Sweep 5 ms (401 pts)
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2

7. 20dB Bandwidth

7.1 Standard Applicable

According to FCC 15.247, FHSs shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the -20 dB bandwidth of the hopping channel, whichever is greater.

7.2 Test Procedure

The 20dB bandwidth test method as follows.

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
RBW ≥1% 20dB Bandwidth, VBW ≥RBW
Sweep = auto
Detector function = peak
Trace = max hold
All the trace to stabilize, use the marker-to-peak function to set the marker to the peak of the emission, use the marker-delta function to measure and record the 20dB down bandwidth and 99% bandwidth of the emission.

7.3 Environmental Conditions

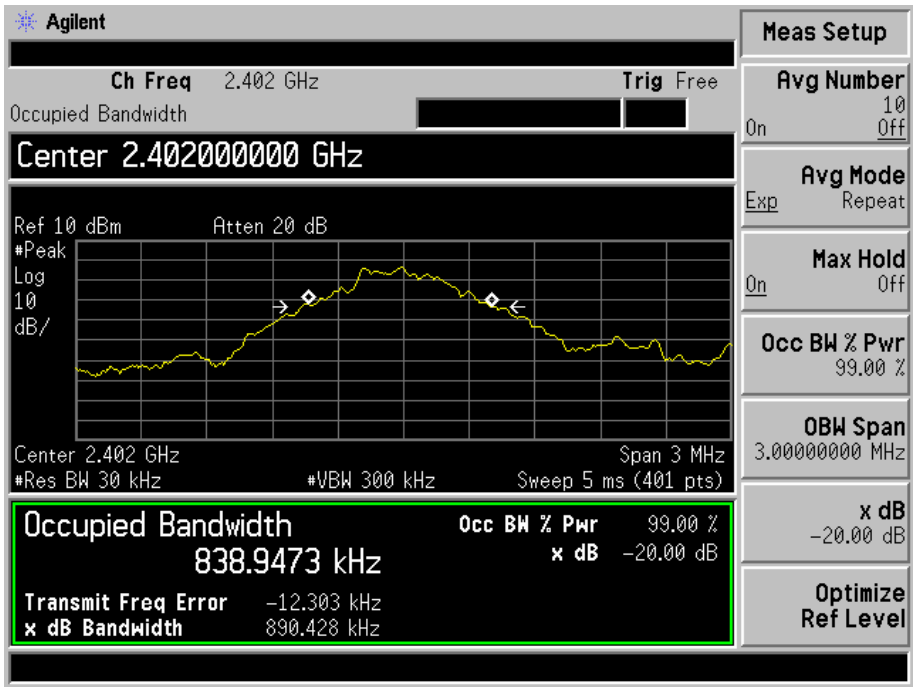
Temperature:	24° C
Relative Humidity:	53%
ATM Pressure:	1018 mbar

7.4 Summary of Test Results/Plots

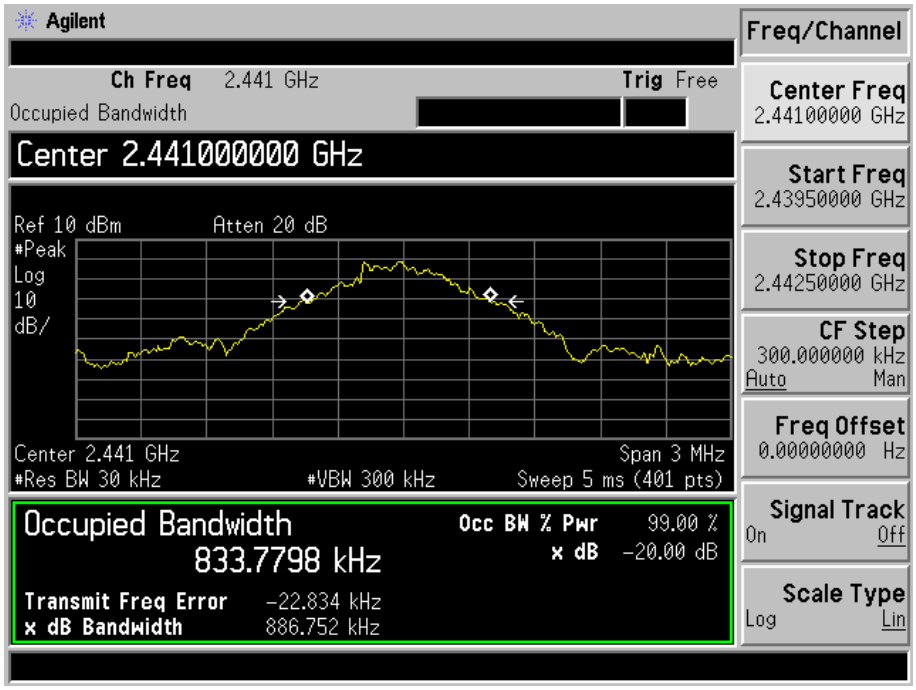
Test Mode	Test Channel MHz	20 dB Bandwidth kHz	99% Bandwidth kHz	Limit kHz
GFSK	2402	890.4	838.9	---
	2441	886.8	833.8	---
	2480	890.1	832.9	---
8DPSK	2402	1219.0	1148.0	---
	2441	1228.0	1143.5	---
	2480	1228.0	1153.4	---

For GFSK

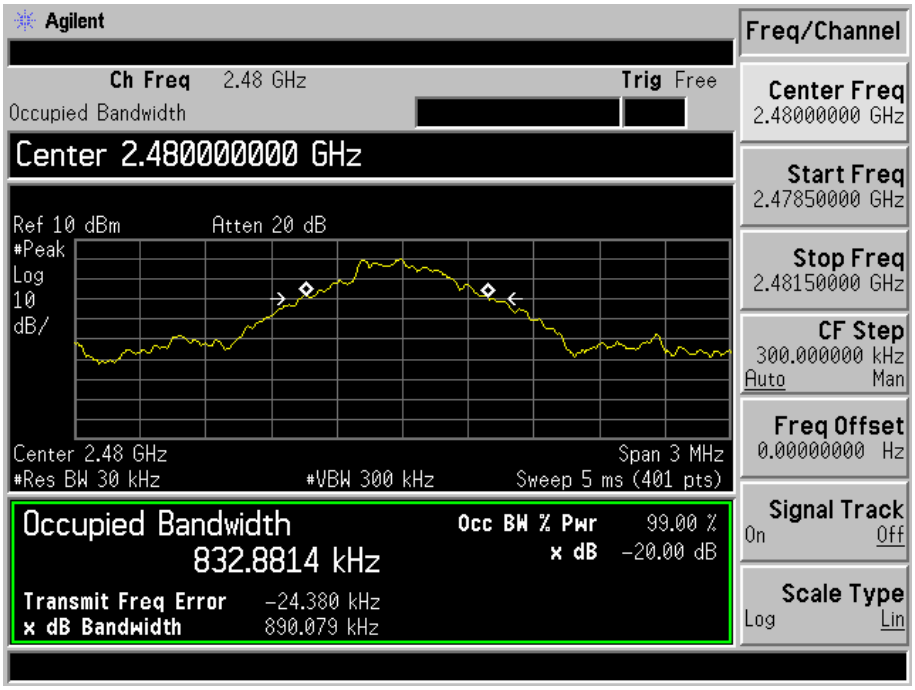
Low Channel:



Middle Channel:

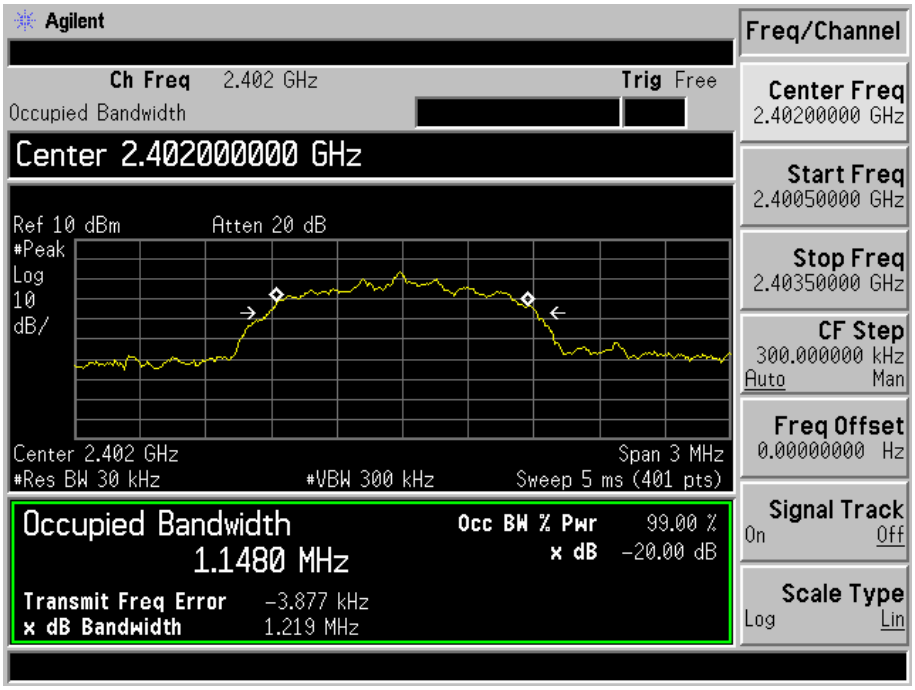


High Channel:

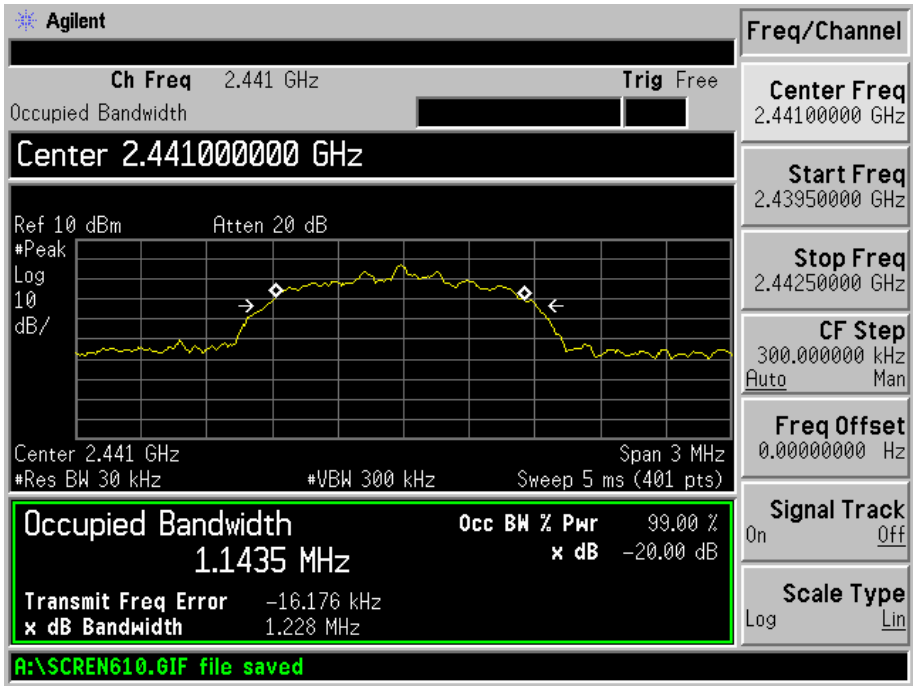


For 8DPSK

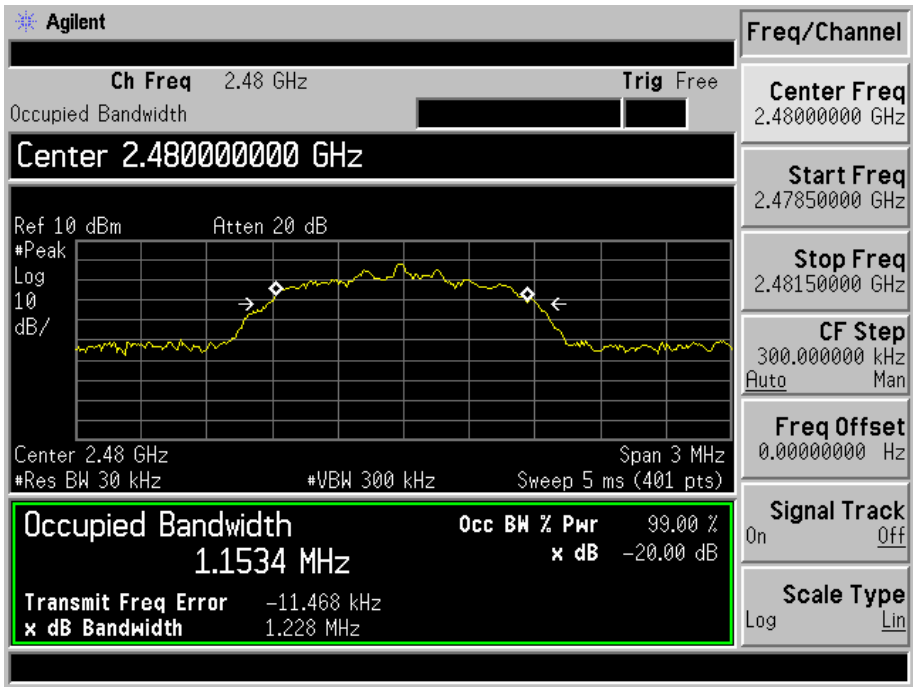
Low Channel:



Middle Channel:



High Channel:



8. RF Output Power

8.1 Standard Applicable

According to FCC 15.247, For FHSs operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W and the e.i.r.p. shall not exceed 4 W if the hopset uses 75 or more hopping channels; the maximum peak conducted output power shall not exceed 0.125 W and the e.i.r.p. shall not exceed 0.5 W if the hopset uses less than 75 hopping channels (see Section 5.4(5) for exceptions).

8.2 Test Procedure

The peak output power test method as follows.

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
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

All the trace to stabilize, use the marker-to-peak function to set the marker to the peak of the emission, the indicated level is the peak output power (the external attenuation and cable loss shall be considered).

8.3 Environmental Conditions

Temperature:	24 °C
Relative Humidity:	55%
ATM Pressure:	1011 mbar

8.4 Summary of Test Results/Plots

For GFSK

Channel	Frequency MHz	Measured Value dBm	Output Power mW	Limit mW
Low Channel	2402	-2.49	0.56	125
Middle Channel	2441	-0.40	0.91	125
High Channel	2480	0.50	1.12	125

For Pi/4 QDPSK

Channel	Frequency MHz	Measured Value dBm	Output Power mW	Limit mW
Low Channel	2402	-5.47	0.28	125
Middle Channel	2441	-2.22	0.60	125
High Channel	2480	-1.03	0.79	125

For 8DPSK

Channel	Frequency MHz	Measured Value dBm	Output Power mW	Limit mW
Low Channel	2402	-4.91	0.32	125
Middle Channel	2441	-1.96	0.64	125
High Channel	2480	-0.77	0.84	125

Note: the antenna gain of 0dBi less than 6dBi maximum permission antenna gain value based on 1 watt peak output power limit.

9. Field Strength of Spurious Emissions

9.1 Measurement Uncertainty

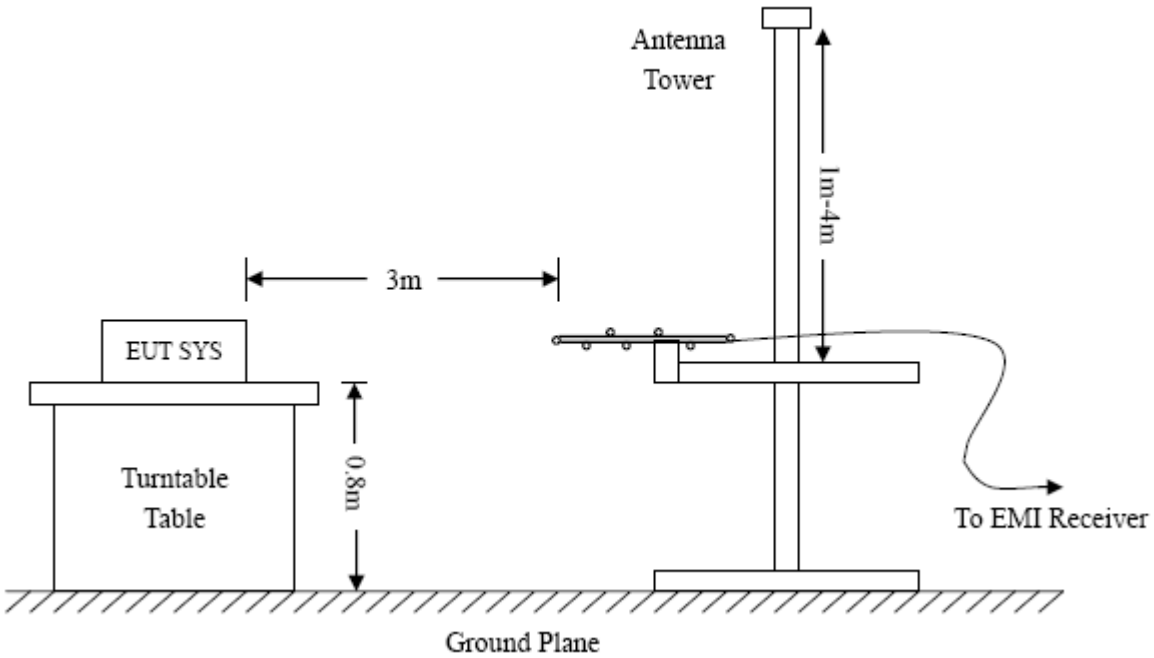
Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement is ±5.10 dB.

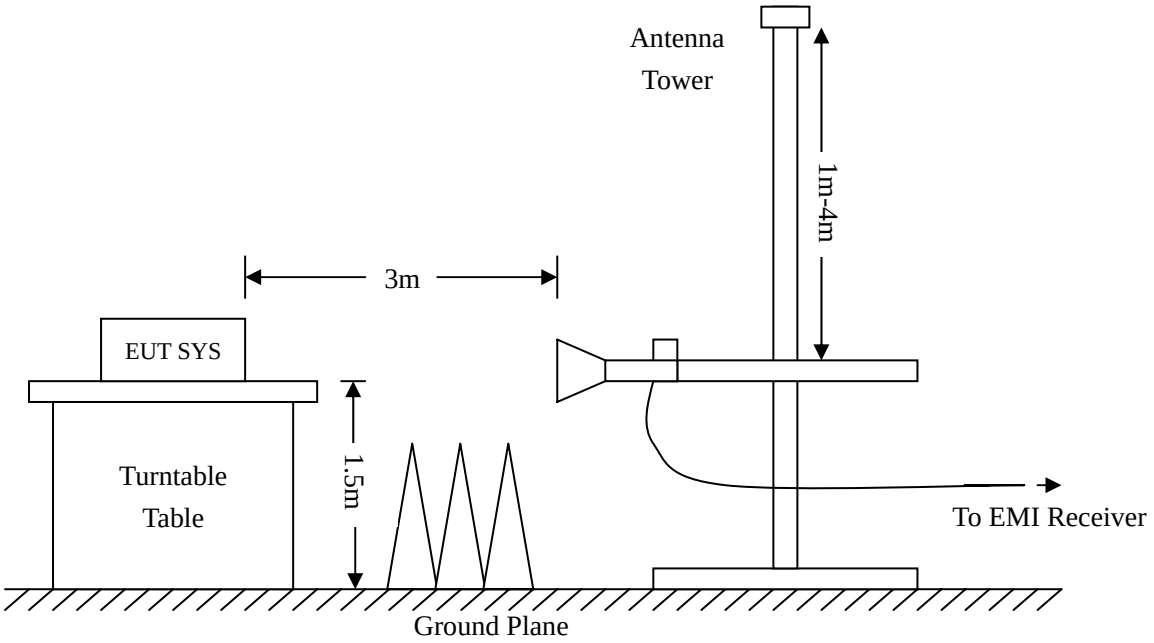
9.2 Standard Applicable

According to FCC 15.247. In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in FCC 15C is not required.

9.3 Test Procedure

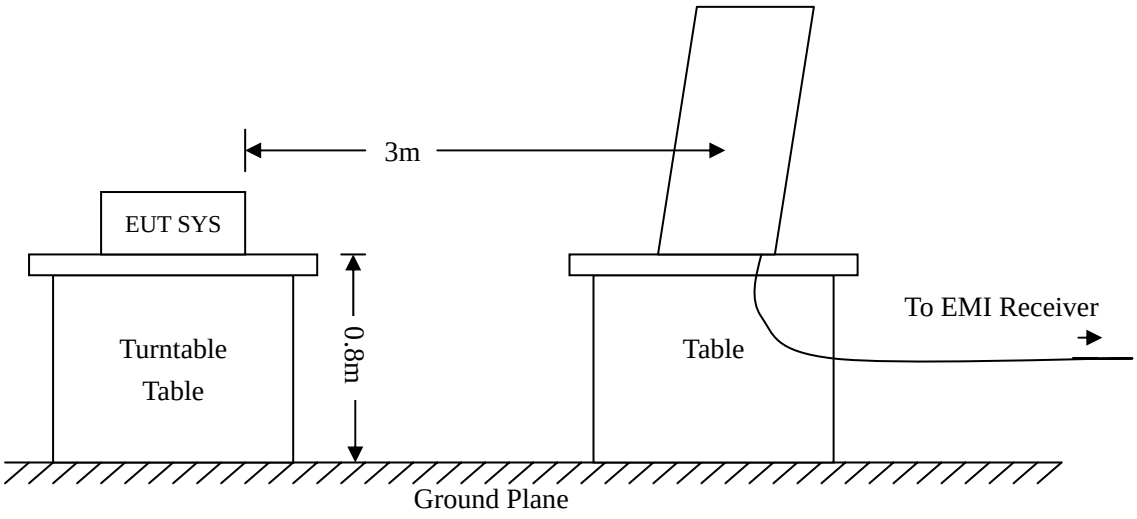
The setup of EUT is according with per ANSI C63.10: 2013 measurement procedure. The specification used was with the FCC 15C Limit.
The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.
The spacing between the peripherals was 10 cm.





For the radiated emission test above 1GHz:

Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.



9.4 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and the Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corr. Ampl. = Indicated Reading + Ant. Factor + Cable Loss – Ampl. Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -6dBμV means the emission is 6dBμV below the maximum limit for Class B. The equation for margin calculation is as follows:

Margin = Corr. Ampl. –FCC Limit

9.5 Environmental Conditions

Temperature:	25 °C
Relative Humidity:	52%
ATM Pressure:	1012 mbar

9.6 Summary of Test Results/Plots

According to the data below, the FCC 15.247 Issue 1 standards, and had the worst margin of:

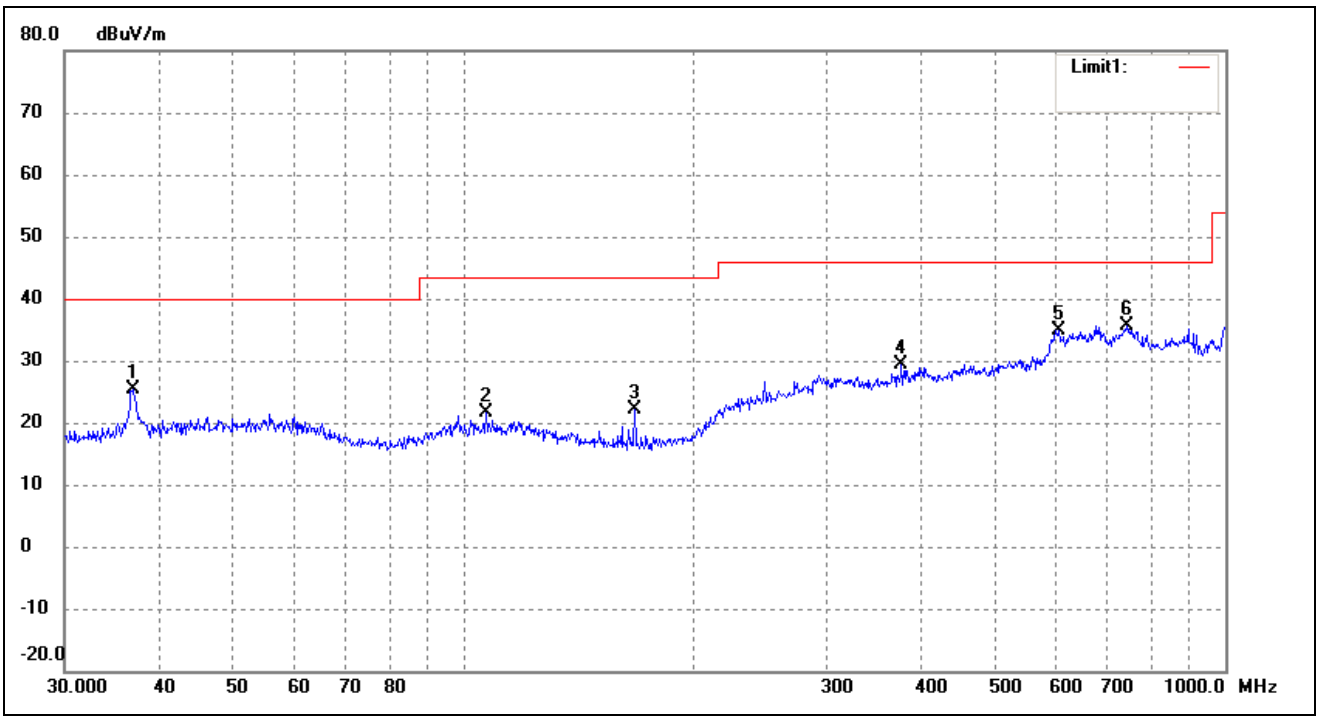
Note: this EUT was tested in 3 orthogonal positions and the worst case position data was reported.

Test is carry on all modes and the datas of worst case (GFSK mode DH1) are list below

Plot of Radiated Emissions Test Data (30MHz to 1GHz)

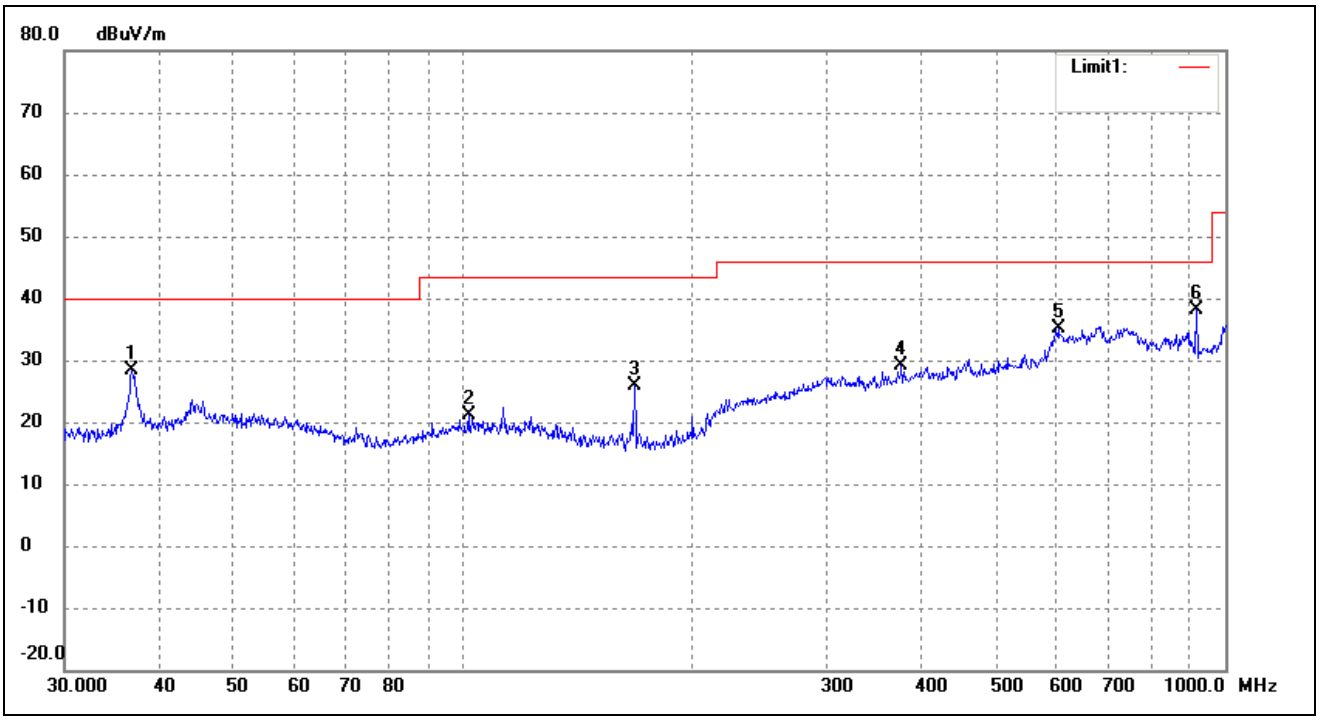
EUT: *Bluetooth Headset*
Tested Model: *BT539i*
Operating Condition: *Transmitting Low Channel (2402MHz)*
Comment: *DC 3.7V*

Test Specification: *Horizontal*



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	Factor(dB)	(dBuV/m)	(dBuV/m)	(dB)	(•)	(cm)	
1	36.8953	8.90	16.52	25.42	40.00	-14.58	360	100	peak
2	107.1337	4.63	16.89	21.52	43.50	-21.98	360	100	peak
3	167.8243	7.58	14.47	22.05	43.50	-21.45	360	100	peak
4	375.9385	5.33	24.00	29.33	46.00	-16.67	360	100	peak
5	603.5392	3.95	30.86	34.81	46.00	-11.19	360	100	peak
6	742.2587	4.38	31.25	35.63	46.00	-10.37	360	100	peak

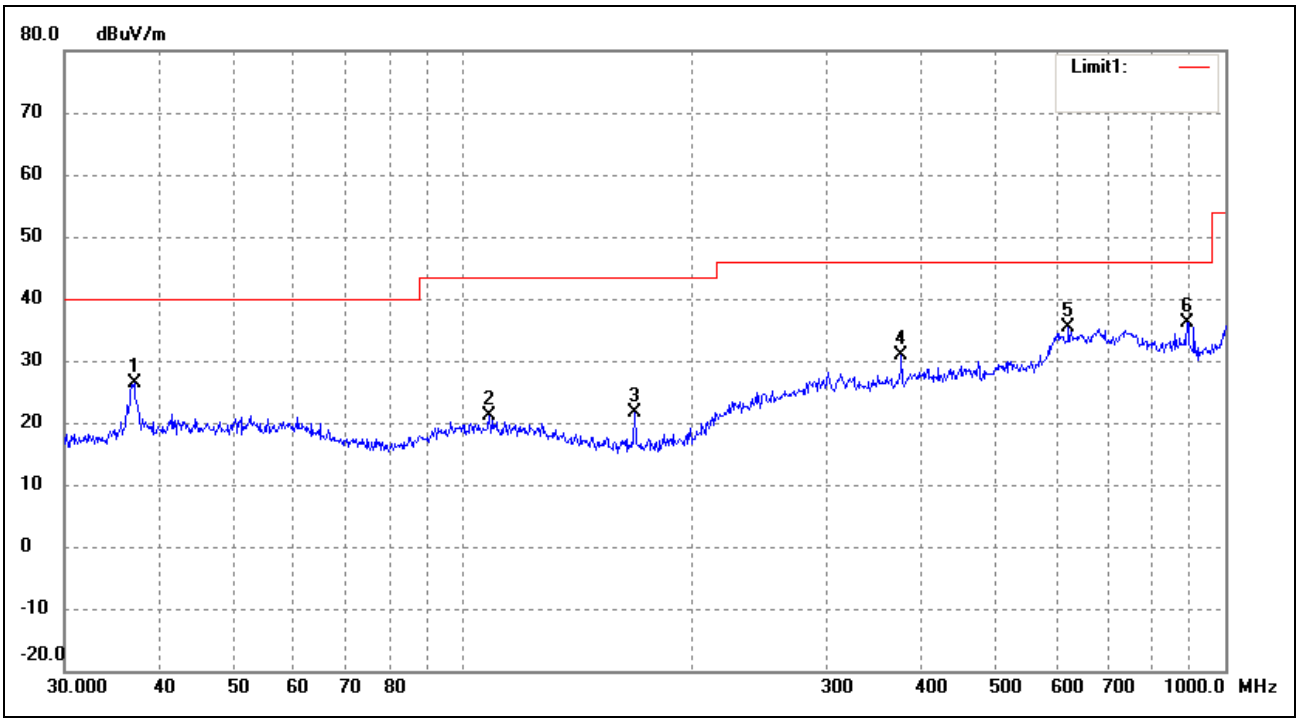
Test Specification: *Vertical*



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	Factor(dB)	(dBuV/m)	(dBuV/m)	(dB)	(•)	(cm)	
1	36.7662	11.90	16.50	28.40	40.00	-11.60	360	100	peak
2	101.6443	4.22	16.91	21.13	43.50	-22.37	360	100	peak
3	167.8243	11.29	14.47	25.76	43.50	-17.74	360	100	peak
4	375.9385	5.10	24.00	29.10	46.00	-16.90	360	100	peak
5	603.5392	4.28	30.86	35.14	46.00	-10.86	360	100	peak
6	916.0687	10.67	27.56	38.23	46.00	-7.77	360	100	peak

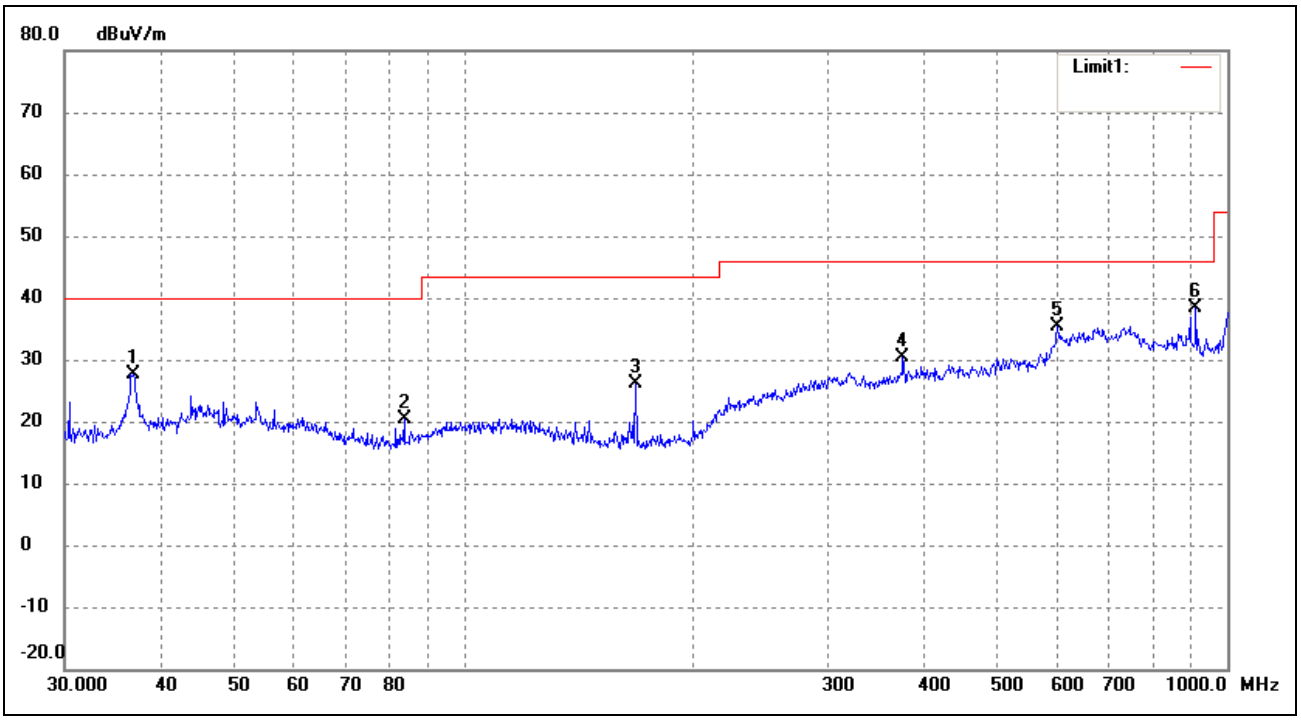
Operating Condition: *Transmitting Middle Channel (2441MHz)*
Comment: *DC 3.7V*

Test Specification: *Horizontal*



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB	(dBuV/m)	(dBuV/m)	(dB)	(•)	(cm)	
1	37.0249	9.80	16.54	26.34	40.00	-13.66	360	100	peak
2	108.2667	4.21	16.89	21.10	43.50	-22.40	360	100	peak
3	167.8243	7.22	14.47	21.69	43.50	-21.81	360	100	peak
4	375.9385	6.87	24.00	30.87	46.00	-15.13	360	100	peak
5	622.8900	5.66	29.82	35.48	46.00	-10.52	360	100	peak
6	890.7278	7.05	29.10	36.15	46.00	-9.85	360	100	peak

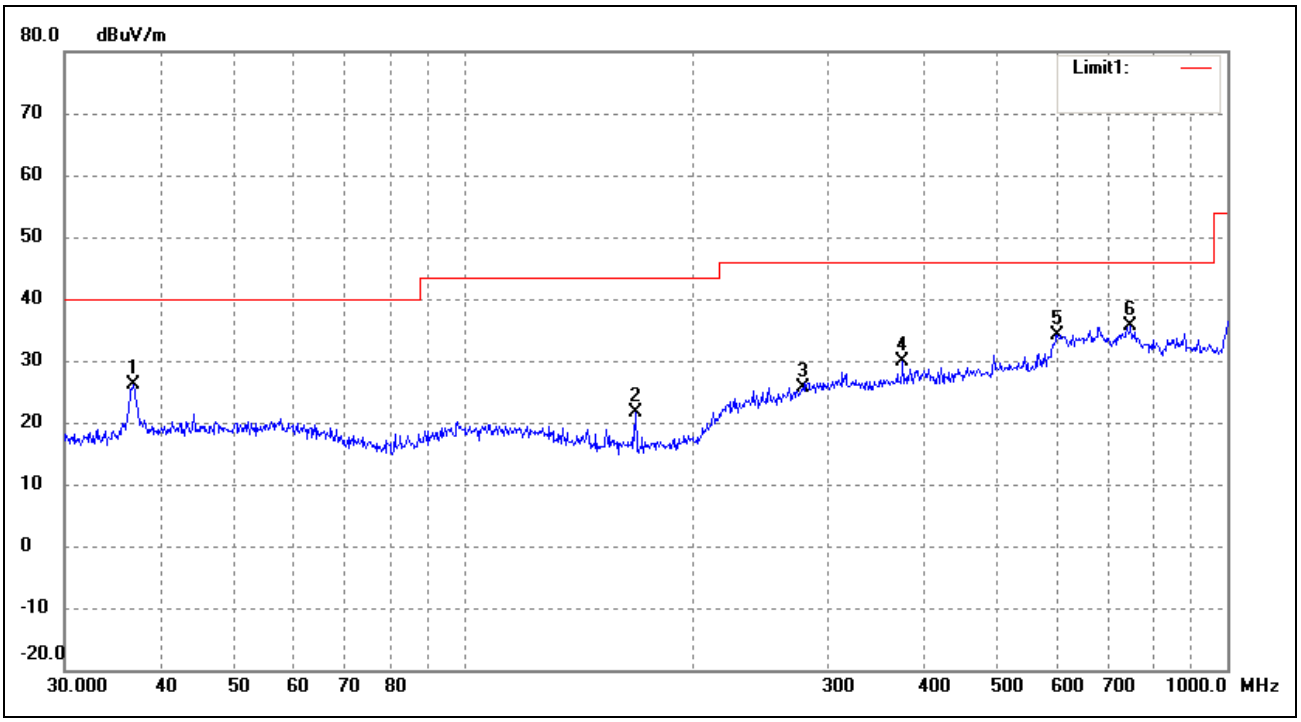
Test Specification: *Vertical*



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB	(dBuV/m)	(dBuV/m)	(dB)	(•)	(cm)	
1	36.8953	11.09	16.52	27.61	40.00	-12.39	360	100	peak
2	83.5222	6.06	14.37	20.43	40.00	-19.57	360	100	peak
3	167.8243	11.62	14.47	26.09	43.50	-17.41	360	100	peak
4	375.9385	6.26	24.00	30.26	46.00	-15.74	360	100	peak
5	599.3213	4.27	30.99	35.26	46.00	-10.74	360	100	peak
6	909.6667	10.47	27.99	38.46	46.00	-7.54	360	100	peak

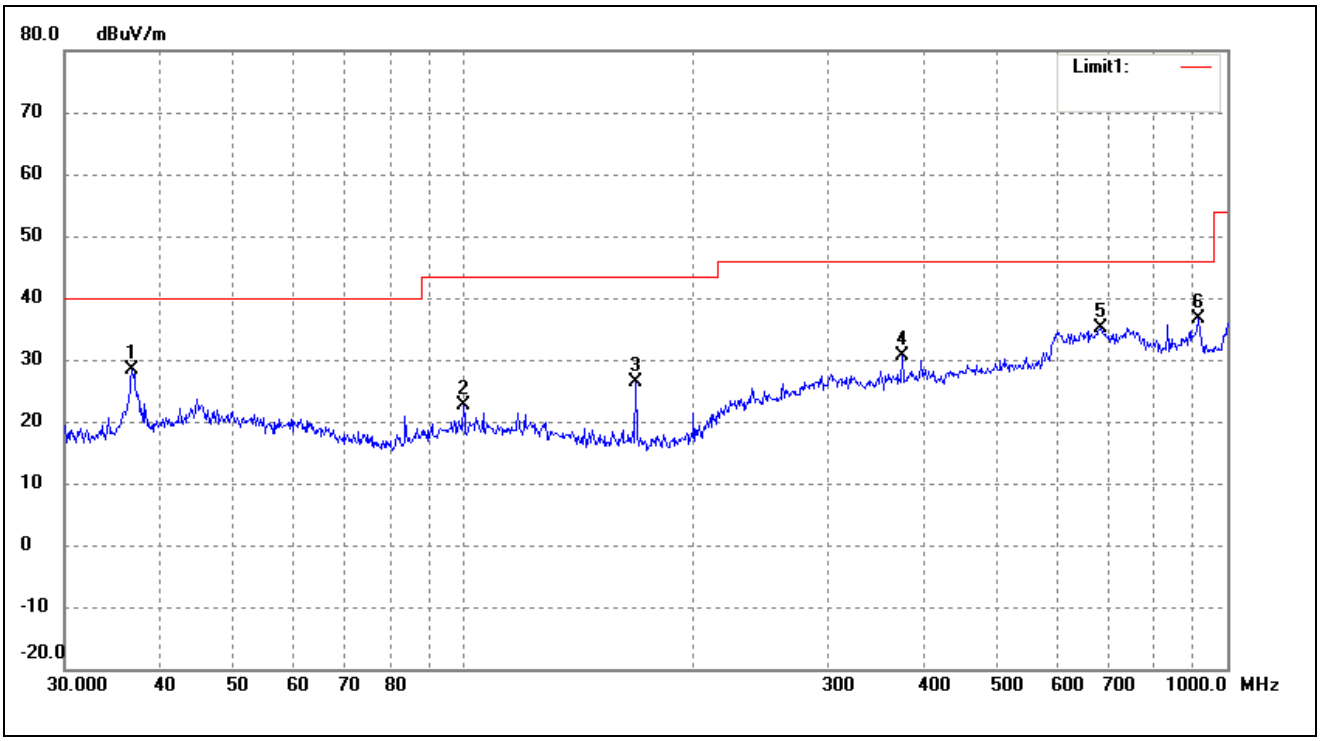
Operating Condition: *Transmitting High Channel (2480MHz)*
Comment: *DC 3.7V*

Test Specification: *Horizontal*



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB	(dBuV/m)	(dBuV/m)	(dB)	(•)	(cm)	
1	36.8953	9.66	16.52	26.18	40.00	-13.82	360	100	peak
2	167.8243	7.21	14.47	21.68	43.50	-21.82	360	100	peak
3	278.0669	2.64	23.07	25.71	46.00	-20.29	360	100	peak
4	375.9385	5.82	24.00	29.82	46.00	-16.18	360	100	peak
5	599.3213	3.25	30.99	34.24	46.00	-11.76	360	100	peak
6	747.4826	4.51	31.00	35.51	46.00	-10.49	360	100	peak

Test Specification: *Vertical*



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB	(dBuV/m)	(dBuV/m)	(dB)	(•)	(cm)	
1	36.7662	11.87	16.50	28.37	40.00	-11.63	360	100	peak
2	99.8777	5.75	16.91	22.66	43.50	-20.84	360	100	peak
3	167.8243	11.83	14.47	26.30	43.50	-17.20	360	100	peak
4	375.9385	6.72	24.00	30.72	46.00	-15.28	360	100	peak
5	682.3485	4.30	30.88	35.18	46.00	-10.82	360	100	peak
6	916.0687	8.95	27.56	36.51	46.00	-9.49	360	100	peak

Test is carry on all modes and the datas of worst case (GFSK mode DH1) are list below

Spurious Emissions Above 1GHz

Frequency	Reading	Correct	Result	Limit	Margin	Polar	Detector
(MHz)	(dBuV/m)	dB	(dBuV/m)	(dBuV/m)	(dB)	H/V	
Low Channel-2402MHz							
4804	55.36	-3.59	51.77	74	-22.23	H	PK
4804	42.51	-3.59	38.92	54	-15.08	H	AV
7206	51.39	-0.52	50.87	74	-23.13	H	PK
7206	39.53	-0.52	39.01	54	-14.99	H	AV
4804	57.46	-3.59	53.87	74	-20.13	V	PK
4804	44.52	-3.59	40.93	54	-13.07	V	AV
7206	53.12	-0.52	52.6	74	-21.4	V	PK
7206	45.61	-0.52	45.09	54	-8.91	V	AV
Middle Channel-2441MHz							
4882	56.74	-3.49	53.25	74	-20.75	H	PK
4882	45.6	-3.49	42.11	54	-11.89	H	AV
7323	51.87	-0.47	51.4	74	-22.6	H	PK
7323	42.69	-0.47	42.22	54	-11.78	H	AV
4882	52.38	-3.49	48.89	74	-25.11	V	PK
4882	42.29	-3.49	38.8	54	-15.2	V	AV
7323	52.38	-0.47	51.91	74	-22.09	V	PK
7323	40.64	-0.47	40.17	54	-13.83	V	AV
High Channel-2480MHz							
4960	57.23	-3.41	53.82	74	-20.18	H	PK
4960	44.99	-3.41	41.58	54	-12.42	H	AV
7440	49.68	-0.42	49.26	74	-24.74	H	PK
7440	41.09	-0.42	40.67	54	-13.33	H	AV
4960	55.16	-3.41	51.75	74	-22.25	V	PK
4960	43.5	-3.41	40.09	54	-13.91	V	AV
7440	53.67	-0.42	53.25	74	-20.75	V	PK
7440	42.86	-0.42	42.44	54	-11.56	V	AV

Note: Testing is carried out with frequency rang 9kHz to the tenth harmonics, which above 5th Harmonics are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
The measurements greater than 20dB below the limit from 9kHz to 30MHz..

10. Out of Band Emissions

10.1 Standard Applicable

According to FCC 15.247, In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in FCC is not required.

10.2 Test Procedure

The band-edge radiated test method as follows.

Set span = wide enough to capture the peak level of the emission operating on the channel closest to the bandedge, as well as any modulation products which fall outside of the authorized band of operation (2310MHz to 2410MHz for low bandedge, 2470MHz to 2500MHz for the high bandedge)
RBW = 1MHz, VBW = 1MHz for peak value measured
RBW = 1MHz, VBW = 10Hz for average value measured
Sweep = auto; Detector function = peak; Trace = max hold

All the trace to stabilize, set the marker on the emission at the bandedge, or on the highest modulation porduct outside of the band, if this level is greater than that at the bandedge. Enable the marker-delta function, then use the marker-to-peak function to move the marker to the peak of the in-band emission. Those emission must comply with the 15.209 limit for fall in the restricted bands listed in section 15.205. Note that the method of measurement KDB publication number: 913591 may be used for the radiated bandedge measurements.

The band-edge conducted test method as follows:

Set span = wide enough to capture the peak level of the emission operating on the channel closest to the bandedge, as well as any modulation products which fall outside of the authorized band of operation (2380MHz to 2410MHz for low bandedge, 2470MHz to 2500MHz for the high bandedge)
RBW = 100kHz, VBW = 300kHz
Sweep = auto; Detector function = peak; Trace = max hold

All the trace to stabilize, set the marker on the emission at the bandedge, or on the highest modulation porduct outside of the band, if this level is greater than that at the bandedge. Enable the marker-delta function, then use the marker-to-peak function to move the marker to the peak of the in-band emission. Those emission must comply with the limit specified in this section (at least 20dB attenuation).

10.3 Environmental Conditions

Temperature:	23°C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

10.4 Summary of Test Results/Plots

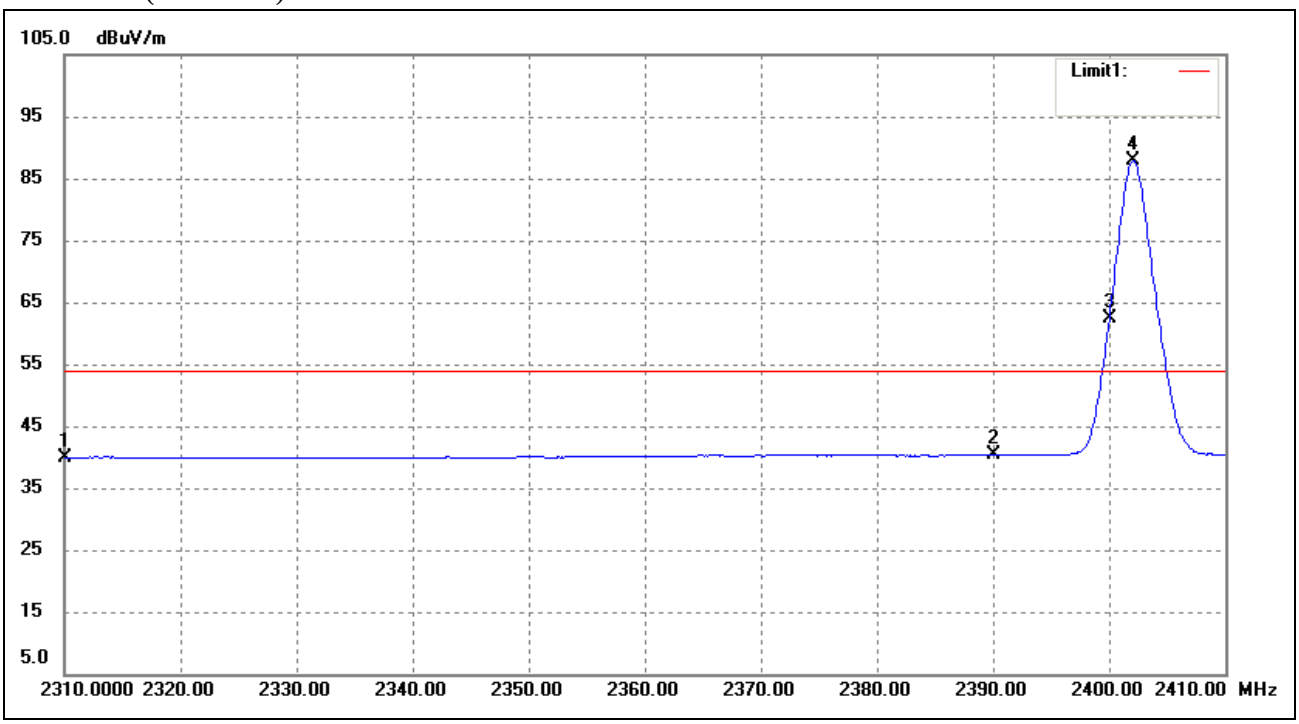
Test mode	Frequency	Limit	Result
	MHz	dBuV / dBc	
Lowest	2310.00	<54 dBuV	Pass
	2390.00	<54 dBuV	Pass
	2400.00	>20 dBc	Pass
Highest	2483.50	<54 dBuV	Pass
	2500.00	<54 dBuV	Pass

Test is carry on all modes and the datas of worst case (GFSK mode DH1) are list below

The edge emissions are below the FCC 15 Limits. Please refer to the test plots below.

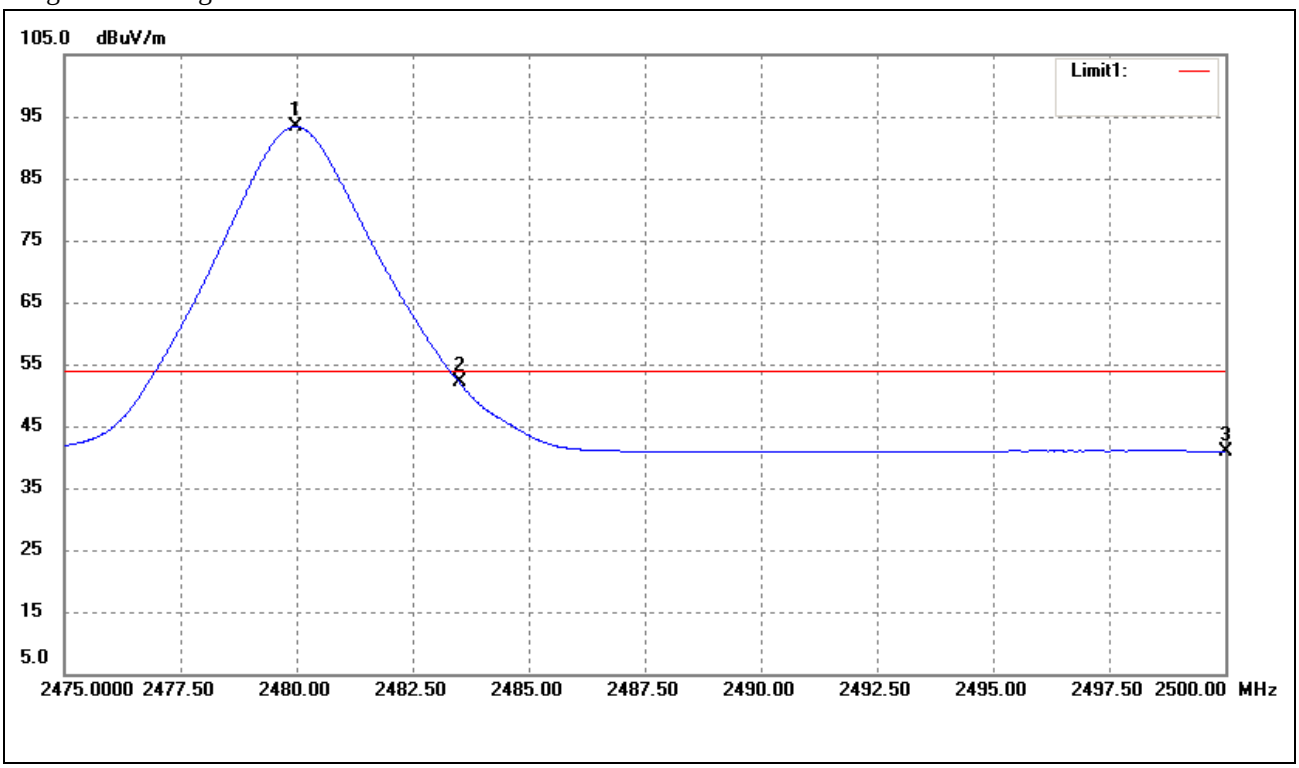
Please refer to the test plots as below.

Bandedge (Radiated)
Lowest Bandedge
Horizontal (Worst case)



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	Factor(dB)	(dBuV/m)	(dBuV/m)	(dB)	
1	2310.000	23.61	16.34	39.95	54.00	-14.05	Average Detector
	2310.000	35.84	16.34	52.18	74.00	-21.82	Peak Detector
2	2390.000	23.23	17.03	40.26	54.00	-13.74	Average Detector
	2390.000	36.60	17.03	53.63	74.00	-20.37	Peak Detector
3	2400.000	45.34	17.11	62.45	Delta = 25.48 dBc		Average Detector
4	2402.000	70.81	17.12	87.93			Average Detector

Highest Bandedge

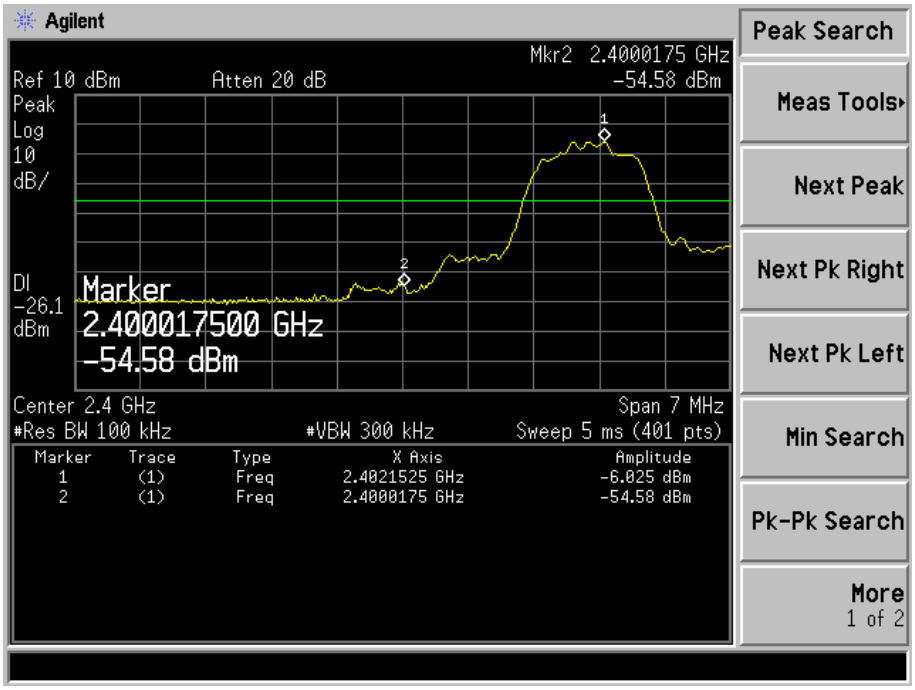


No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	Factor(dB)	(dBuV/m)	(dBuV/m)	(dB)	
1	2479.975	75.72	17.71	93.43	/	/	Average Detector
	2480.100	76.92	17.71	94.63	/	/	Peak Detector
2	2483.500	Delta = 41.35 dBc		52.08	54.00	-1.92	Average Detector
	2483.500			59.48	74.00	-14.52	Peak Detector
3	2500.000	23.11	17.85	40.96	54.00	-13.04	Average Detector
	2500.000	36.82	17.86	54.68	74.00	-19.32	Peak Detector

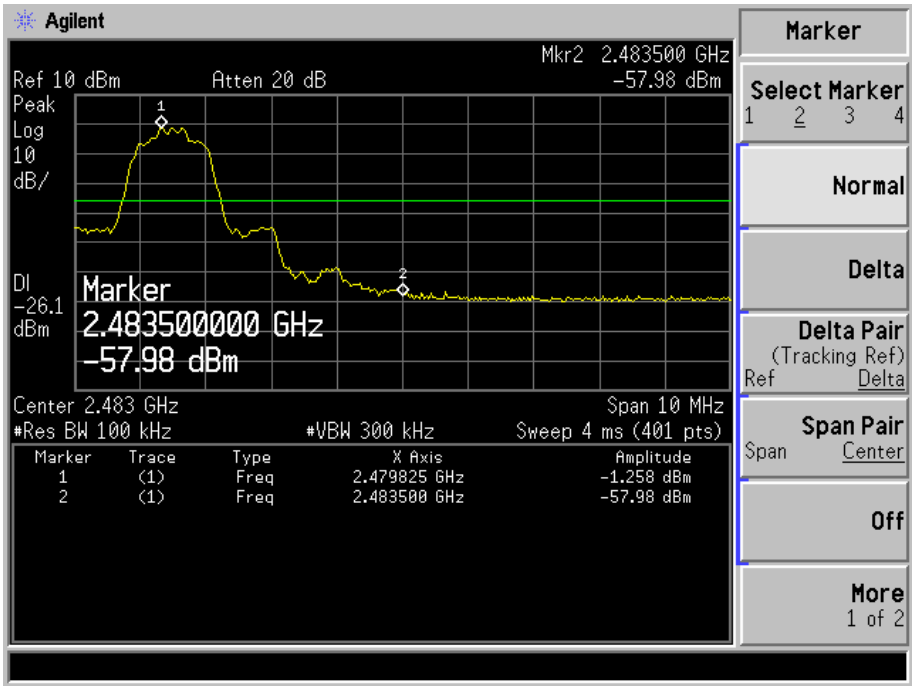
Test is carry on all modes and the datas of worst case (GFSK mode DH1) are list below

Bandedge (Conducted)

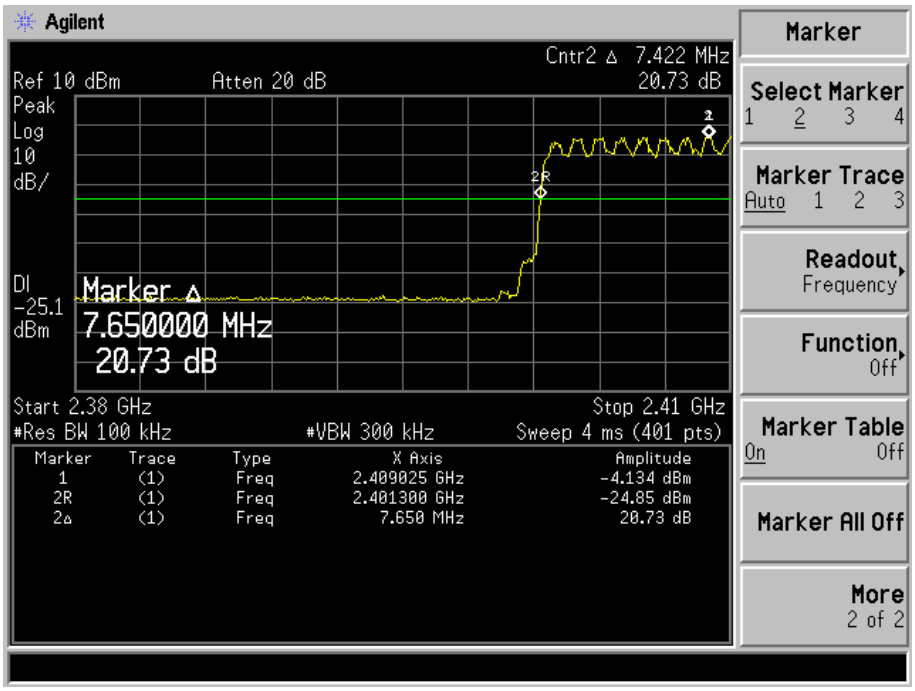
Lowest



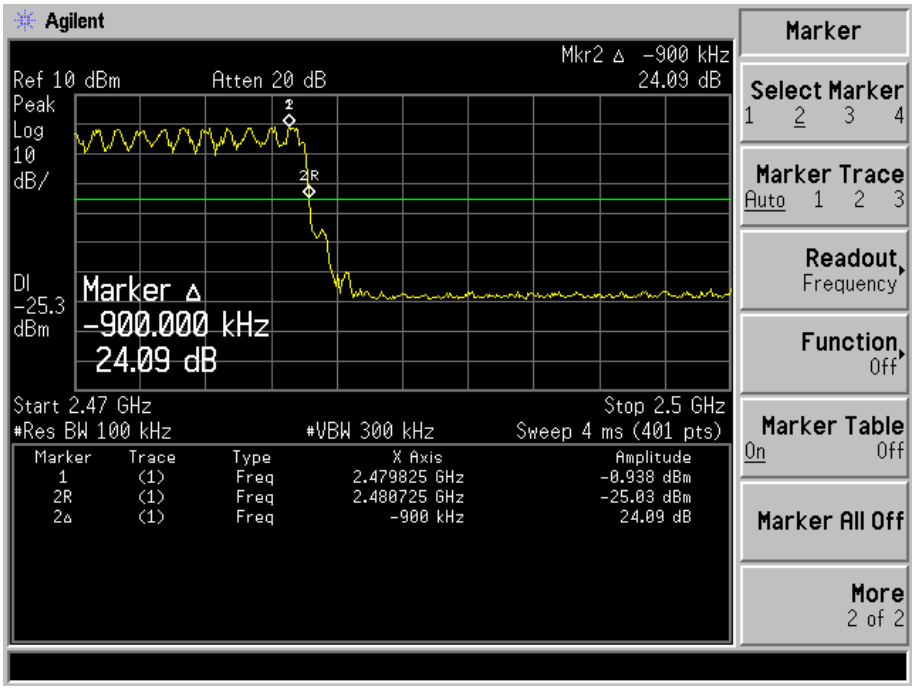
Highest



Hopping Bandedge (Conducted)
Lowest Bandedge



Highest Bandedge



11. Conducted Emissions

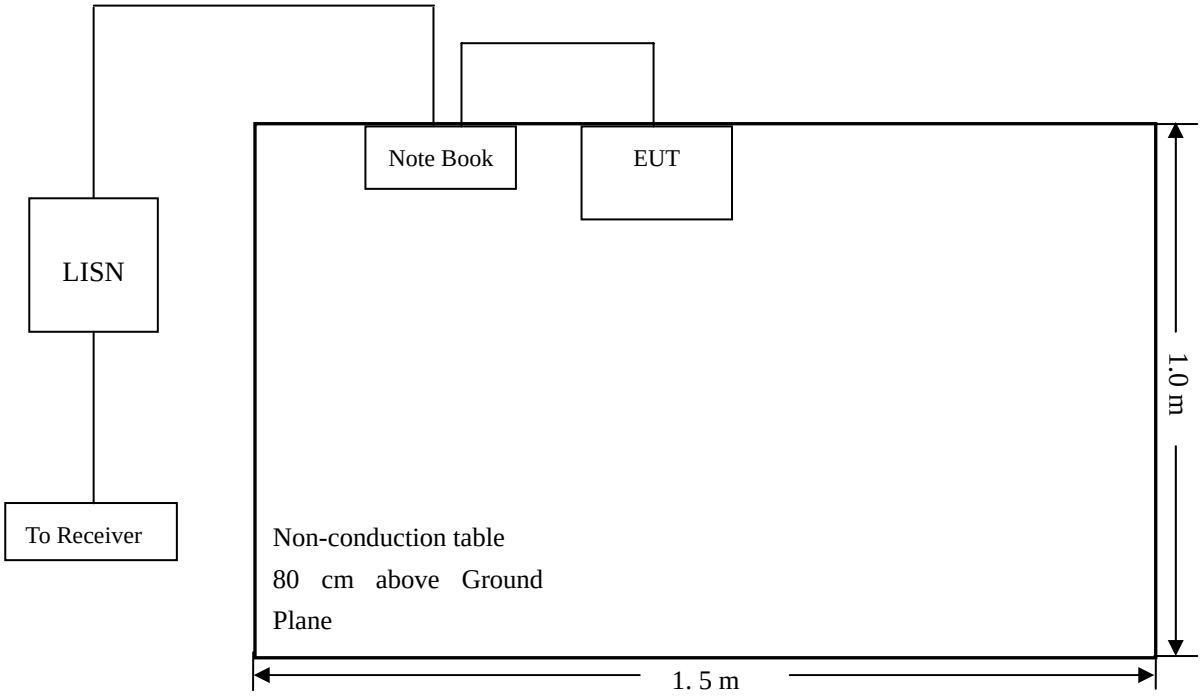
11.1 Measurement Uncertainty

Base on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement is ± 2.88 dB.

11.2 Test Procedure

The setup of EUT is according with per ANSI C63.10: 2013 measurement procedure. The specification used was with the FCC 15 Limit.
The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.
The spacing between the peripherals was 10 cm.

11.3 Basic Test Setup Block Diagram



11.4 Environmental Conditions

Temperature:	25 °C
Relative Humidity:	52%
ATM Pressure:	1012 mbar

11.5 Test Receiver Setup

During the conducted emission test, the test receiver was set with the following configurations:

Start Frequency ..... 150 kHz
Stop Frequency..... 30 MHz
Sweep Speed ..... Auto
IF Bandwidth..... 10 kHz
Quasi-Peak Adapter Bandwidth ..... 9 kHz
Quasi-Peak Adapter Mode ..... Normal

11.6 Summary of Test Results/Plots

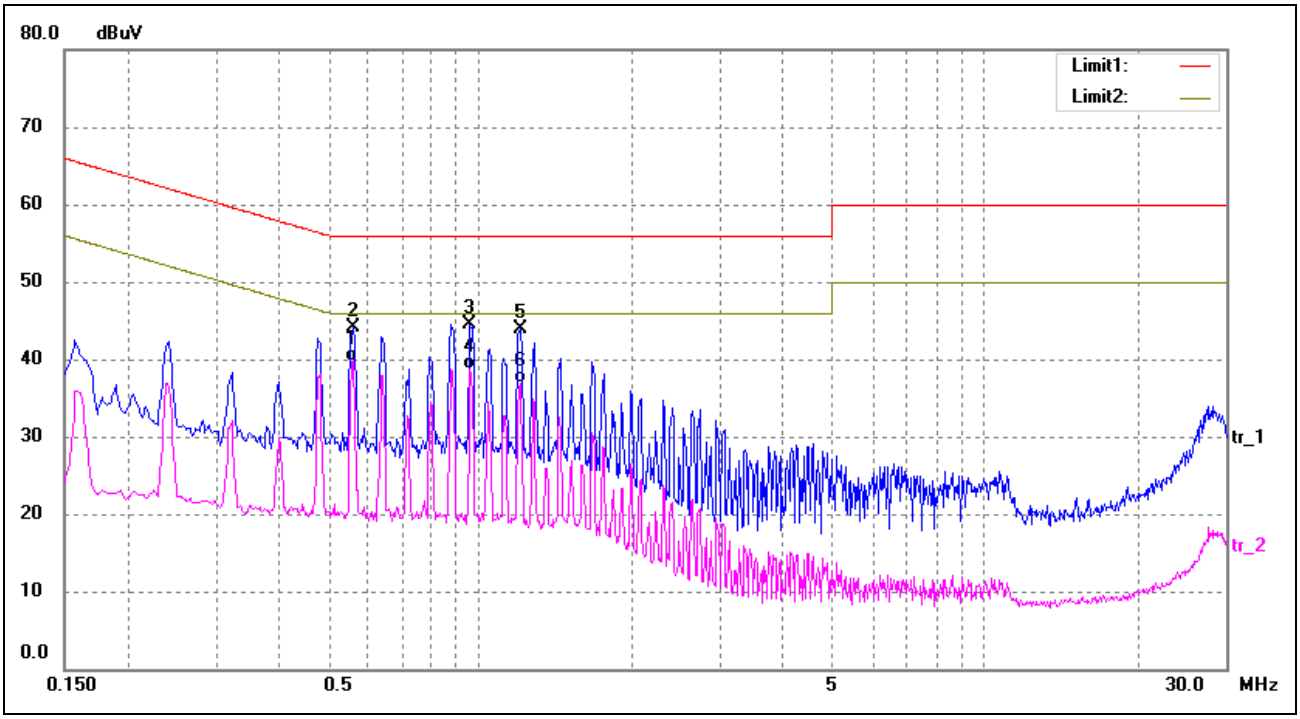
According to the data in section 11.7, the EUT complied with the FCC 15 Conducted margin for this device, with the *worst* margin reading of:

-6.23 dB at 0.5580 MHz in the **Neutral** mode**, average** detector, **0.15-30MHz**

11.7 Conducted Emissions Test Data

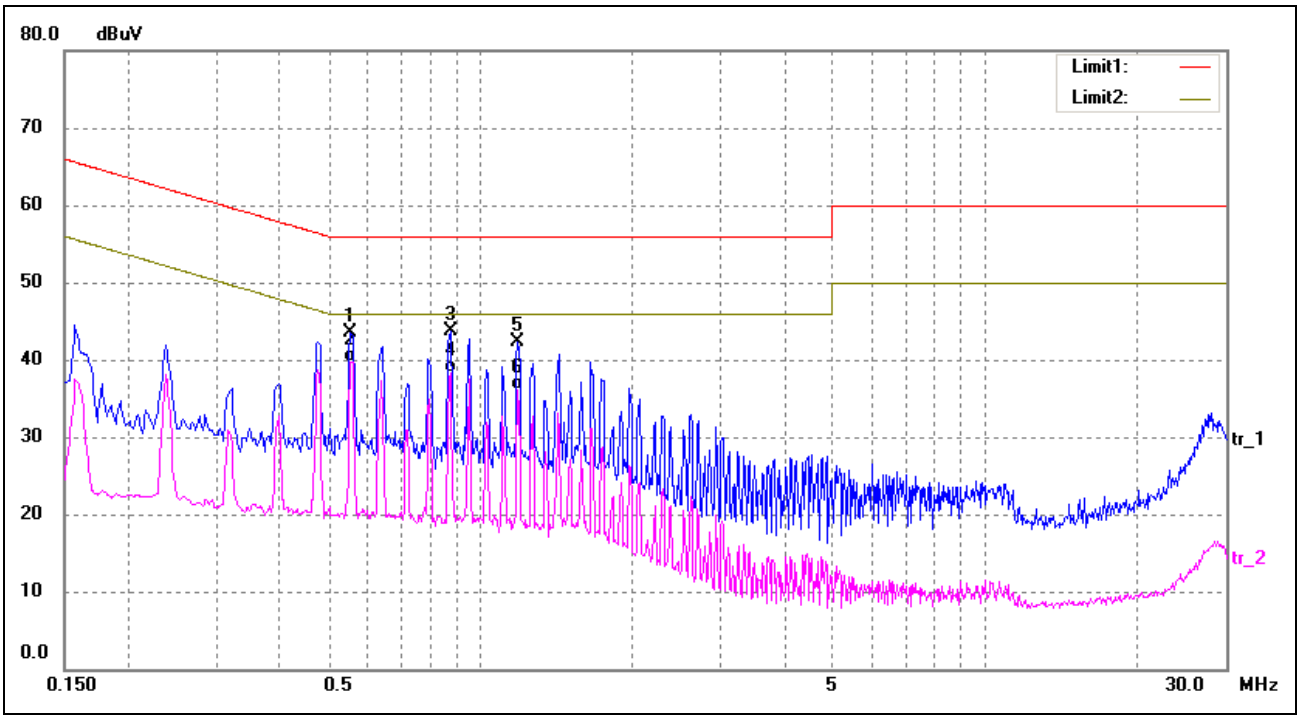
Plot of Conducted Emissions Test Data

EUT: *Bluetooth Headset*
Tested Model: *BT539i*
Operating Condition: *BT Link*
Comment: *AC 120V/60Hz;Notebook USB 5V*
Test with adapter and notebook, Connect to notebook is worse case
Test Specification: *Neutral*



No.	Frequency	Reading	Correct	Result	Limit	Margin	Detector
	(MHz)	(dBuV)	(dB/m)	(dBuV)	(dBuV)	(dB)	
1*	0.5580	30.20	9.57	39.77	46.00	-6.23	AVG
2	0.5620	34.45	9.57	44.02	56.00	-11.98	peak
3	0.9580	34.79	9.67	44.46	56.00	-11.54	peak
4	0.9580	28.99	9.67	38.66	46.00	-7.34	AVG
5	1.1980	34.19	9.71	43.90	56.00	-12.10	peak
6	1.1980	27.13	9.71	36.84	46.00	-9.16	AVG

Test Specification: *Line*



No.	Frequency	Reading	Correct	Result	Limit	Margin	Detector
	(MHz)	(dBuV)	(dB/m)	(dBuV)	(dBuV)	(dB)	
1	0.5540	33.90	9.57	43.47	56.00	-12.53	peak
2*	0.5580	30.17	9.57	39.74	46.00	-6.26	AVG
3	0.8740	34.00	9.65	43.65	56.00	-12.35	peak
4	0.8740	28.74	9.65	38.39	46.00	-7.61	AVG
5	1.1900	32.52	9.71	42.23	56.00	-13.77	peak
6	1.1900	26.39	9.71	36.10	46.00	-9.90	AVG

******* END OF REPORT *******