TEST REPORT

Date: 2014-01-22
Report No.: 60.870.13.037.01F

Applicant:	Foreseen Technology Limited Room 1305, New Commerce Centre, Shatin, Hong Kong	
Description of Samples:	Model name:	Portable Bluetooth Speaker
	Brand name:	---
	Model no.:	MSPX-09, BT-09
	FCCID:	2AA9XBT09
Date Samples Received:	2013-12-10	
Date Tested:	2013-12-11 to 2014-01-17	
Investigation Requested:	FCC Part 15 Subpart C, Section 15.247	
Conclusions:	The submitted product COMPLIED with the requirements of Federal Communications Commission [FCC] Rules and Regulations Part 15. The tests were performed in accordance with the standards described above and on Section 2.2 in this Test Report.	
Remarks:	----	

Checked by:

Ray Cheung
Project Engineer
Wireless & Telecom Department

Approved by:-

Jeff Pong
Operation Manager
Wireless & Telecom Department

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6.0 List of Measurement Equipments

Appendix A

Photos of Test Setup

Appendix B

External EUT Photos

Appendix C

Internal EUT Photos

1.0 General Details

1.1 Test Laboratory

Global United Technology Services Co., Ltd.
1st Floor, Block No.2, Laodong Industrial Zone, Xixiang Road Baoan District, Shenzhen, PRC
Registration Number: 600491

Tested by:

John Zhi

1.2 Applicant Details

Applicant

Foreseen Technology Limited
Room 1305, New Commerce Centre, Shatin, Hong Kong.

Manufacturer

Foreseen Technology Limited
Room 1305, New Commerce Centre, Shatin, Hong Kong.

1.3 Equipment Under Test [EUT]

Description of EUT

Product Description:	Portable Bluetooth Speaker
Model No.:	MSPX-09, BT-09
Brand Name:	---
FCCID:	2AA9XBT09
Rating:	5.0 VDC (USB Port) Or 3.7 VDC 1800mAh (Li-ion battery package)
Operated Frequency:	2402 - 2480 MHz
No. of Operated Channel:	79
Accessories and Auxiliary Equipments:	- iPhone

Antenna Type:	Integral
Manufacture of Antenna:	Foreseen
Antenna Gain:	0 dBi
Antenna Model:	N/A

General Operation of EUT

The EUT is the Portable Bluetooth Speaker.

As per Client Declaration, the circuit design, PCB Layout, shielding and interface of MSPX-09 and BT-09 are identical, only the model number are different. So we use MSPX-09 as a representative model to perform all testing.

FHSS Operation Principle:

This module is controlled by Bluetooth microchip to generate Pseudorandom Frequency Hopping Sequence, this module support 79 hopping channels.

1.4 Related Submittal(s) Grants

This is a signal application subjected to Certificate Authorization.

2.0 Technical Details

2.1 Investigations Requested

Perform ElectroMagnetic Interference measurement in accordance with FCC 47CFR [Codes of Federal Regulations] Part 15 and ANSI C63.4: 2003

2.2 Test Standards and Results Summary Tables

Test Condition	Test Requirement	Test Result	
		Pass	N/A
Number of Frequency Hopping	Section 15.247 (a1)	☒	☐
20dB Bandwidth Measurement	Section 15.247 (a1)	☒	☐
Hopping Channel Carrier Frequency Separation	Section 15.247 (a1)	☒	☐
Average Time of Occupancy	Section 15.247 (a1)	☒	☐
Pseudorandom Hopping Algorithm	Section 15.247 (a1)	☒	☐
Band Edge Measurement	Section 15.247	☒	☐
Maximum Output Power	Section 15.247 (b1)	☒	☐
Out of Band Emission	Section 15.247 (d)	☒	☐
Radiated Emission in Restricted Band	Section 15.247 (d)	☒	☐
Conducted Emission on AC Mains	Section 15.207	☒	☐
RF Exposure	Section 15.247 (i)	☒	☐
Antenna Requirement	Section 15.203	☒ See note 1	☐

Note 1 : The EUT uses a permanently attached antenna, which in accordance to Section 15.203, is considered sufficient to comply with the provisions of this section.

Remark: N/A - Not Applicable

3.0 Test Methodology

3.1 Radiated Emission

The sample was placed 0.8m above the ground plane on a standard emission test site *. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.

3.2 Field Strength Calculation

The field strength at 3 m was established by adding the meter reading of the spectrum analyzer to the factors associated with antenna correction factor, cable loss, preamplifiers and filter attenuation.

The equation is expressed as follow:

FS = R + System Factor
System Factor = AF + CF + FA – PA

Where FS = Net Field Strength in dBuV/m at 3 meters.
R = Reading of Spectrum Analyzer / Test Receiver in dBuV.
AF = Antenna Factor in dB.
CF = Cable Attenuation Factor in dB.
FA = Filter Attenuation Factor in dB.
PA = Preamplifier Factor in dB.

FA and PA are only be used for the measuring frequency above 1 GHz.

3.3 Conducted Emissions

The test was performed in accordance with ANSI C63.4: 2003, with the following: initial measurements were performed in peak and average detection modes on the live line of personal computer, any emissions recorded within 30dB of the relevant limit lines were re-measured using quasi-peak and average detection on the live and neutral lines with the worst case recorded in the table of results.

4.0 Test Results

4.1 Number of Hopping Frequency

Test Requirement:	FCC part 15 section 15.247 (a1)(iii)
Test Date:	2014-01-17
Mode of Operation:	BT playing mode.
Detector Function:	Max Hold

Result: PASS

Measured Result :

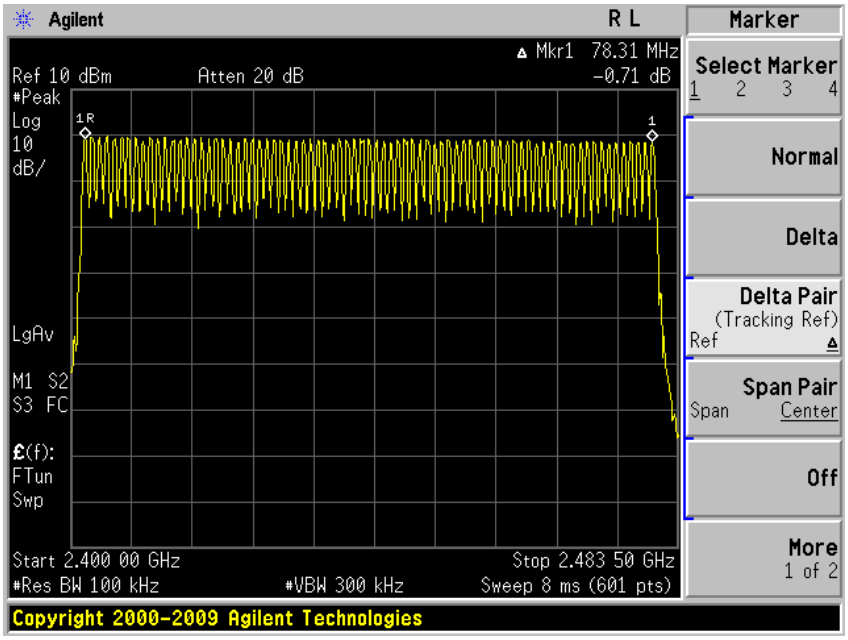
Operating Channel Frequency in sequence:

2402 ; 2403 ; 2404 ; 2405 ; 2406 ; 2407 ; 2408 ; 2409 ; 2410 ; 2411 ; 2412 ; 2413 ; 2414 ; 2415 ;
2416 ; 2417 ; 2418 ; 2419 ; 2420 ; 2421 ; 2422 ; 2423 ; 2424 ; 2425 ; 2426 ; 2427 ; 2428 ; 2429 ;
2430 ; 2431 ; 2432 ; 2433 ; 2434 ; 2435 ; 2436 ; 2437 ; 2438 ; 2439 ; 2440 ; 2441 ; 2442 ; 2443 ;
2444 ; 2445 ; 2446 ; 2447 ; 2448 ; 2449 ; 2450 ; 2451 ; 2452 ; 2453 ; 2454 ; 2455 ; 2456 ; 2457 ;
2458 ; 2459 ; 2460 ; 2461 ; 2462 ; 2463 ; 2464 ; 2465 ; 2466 ; 2467 ; 2468 ; 2469 ; 2470 ; 2471 ;
2472 ; 2473 ; 2474 ; 2475 ; 2476 ; 2477 ; 2478 ; 2479 ; 2480

Limit for Number of Hopping Channel [Section 15.247 (a1)(iii)]

At least 15 non-overlapping channels for 2400-2483.5MHz.

Result data graph shows the number of operation channels:



4.2 20dB Bandwidth Measurement

Test Requirement:	FCC part 15 section 15.247 (a1)
Test Date:	2014-01-17
Mode of Operation:	BT playing mode.
Detector Function:	Max Hold

Test Setup:

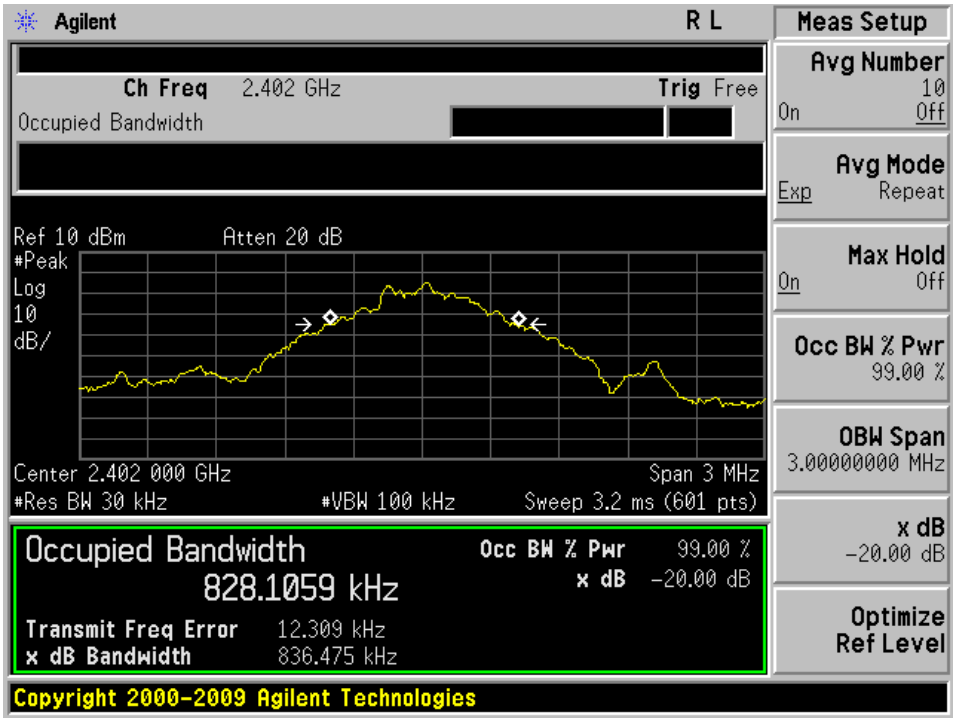
The bandwidth is measured at an amplitude level reduced from the reference level by a specified ratio. The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency. Once the reference level is established, the equipment is conditioned with typical modulating signal to produce the worst-case (i.e. the widest) bandwidth.

1Mbps:

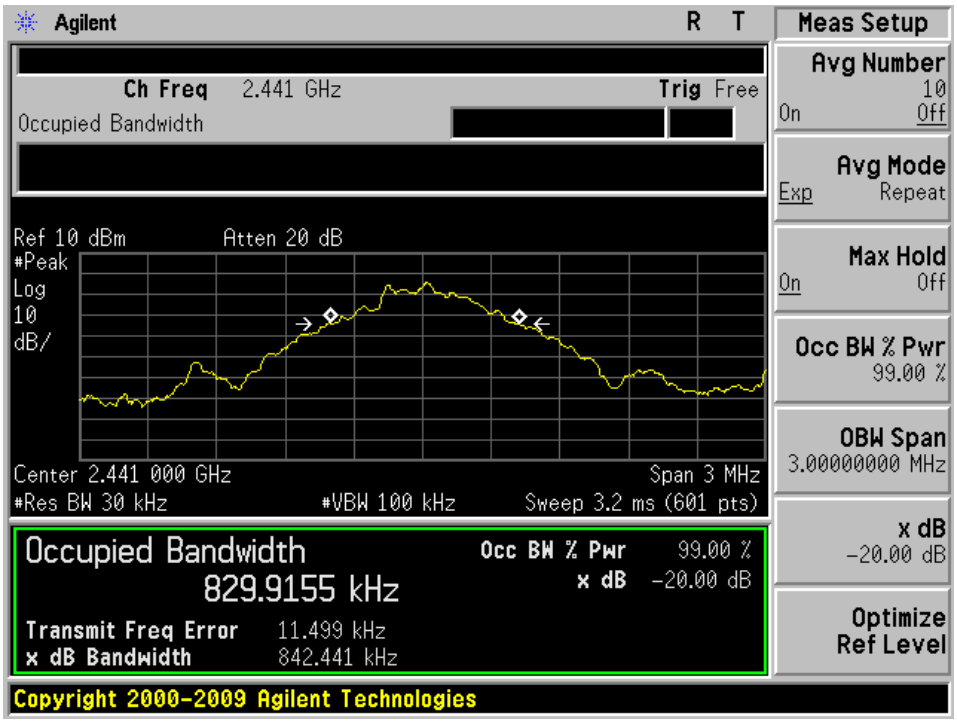
Channel	Measured frequency (MHz)	20dB Bandwidth (MHz)
Lowest	2.402	0.836
Middle	2.441	0.842
Highest	2.480	0.836

This result is used for checking the hopping channel carrier frequencies separation.

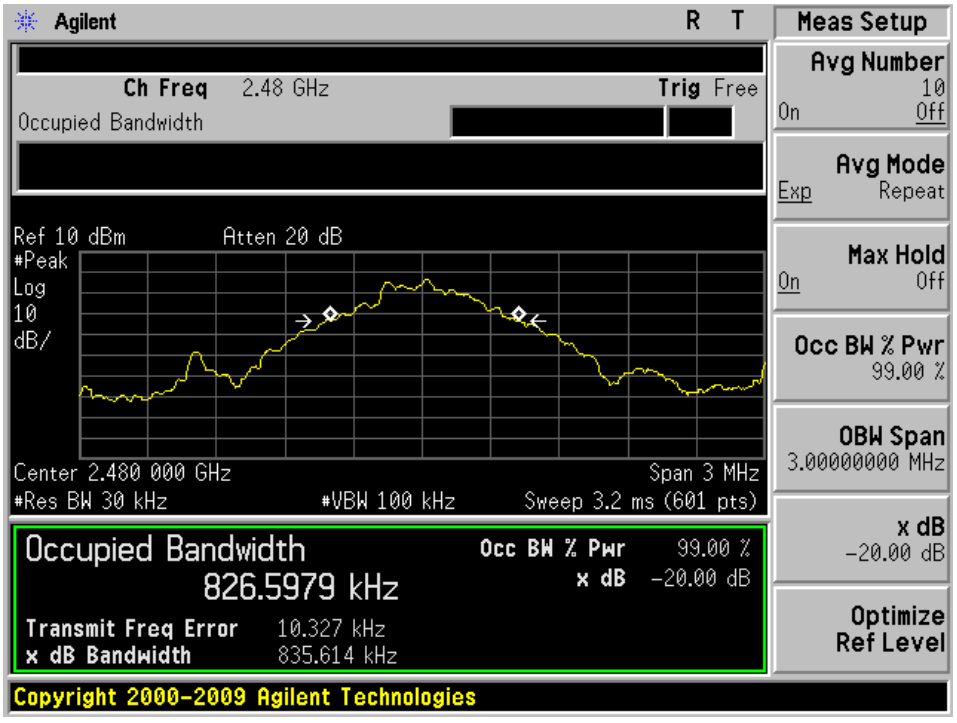
Result data graph shows 20 dB bandwidth, CF = 2.402GHz, BW = 0.836MHz



Result data graph shows 20 dB bandwidth, CF = 2.441GHz, BW = 0.842MHz



Result data graph shows 20 dB bandwidth, CF = 2.480GHz, BW = 0.836MHz

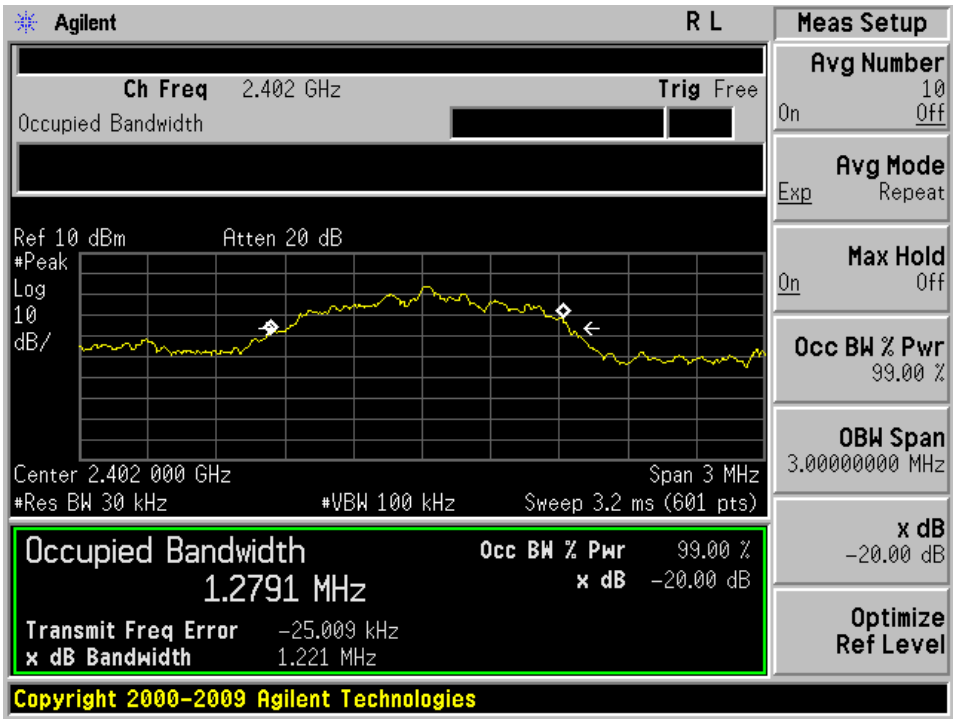


3Mbps:

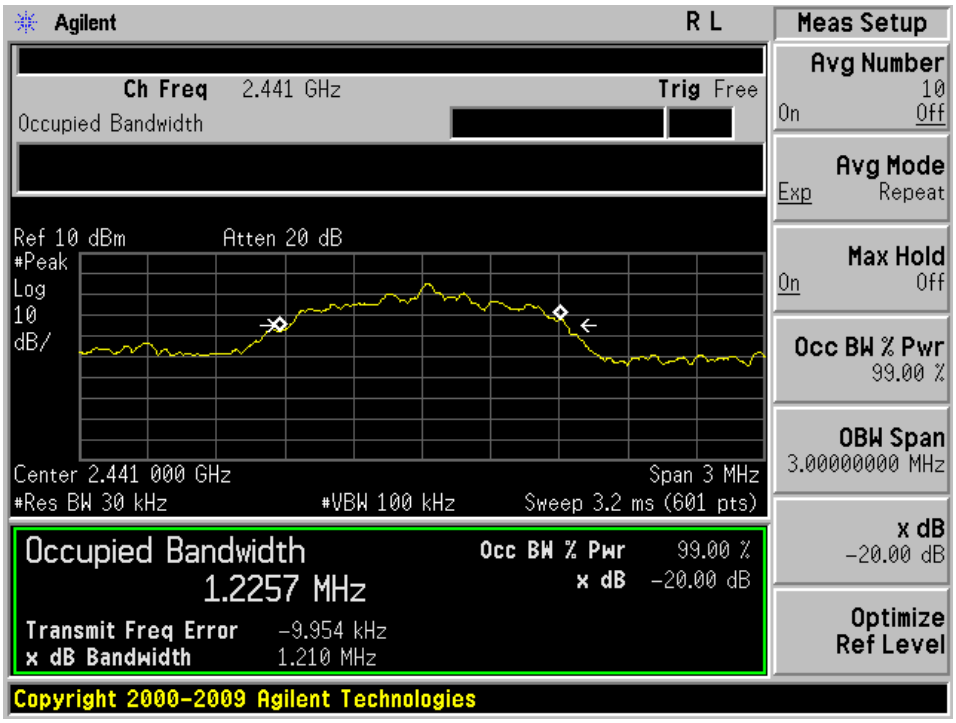
Channel	Measured frequency (MHz)	20dB Bandwidth (MHz)
Lowest	2.402	1.221
Middle	2.441	1.210
Highest	2.480	1.205

This result is used for checking the hopping channel carrier frequencies separation.

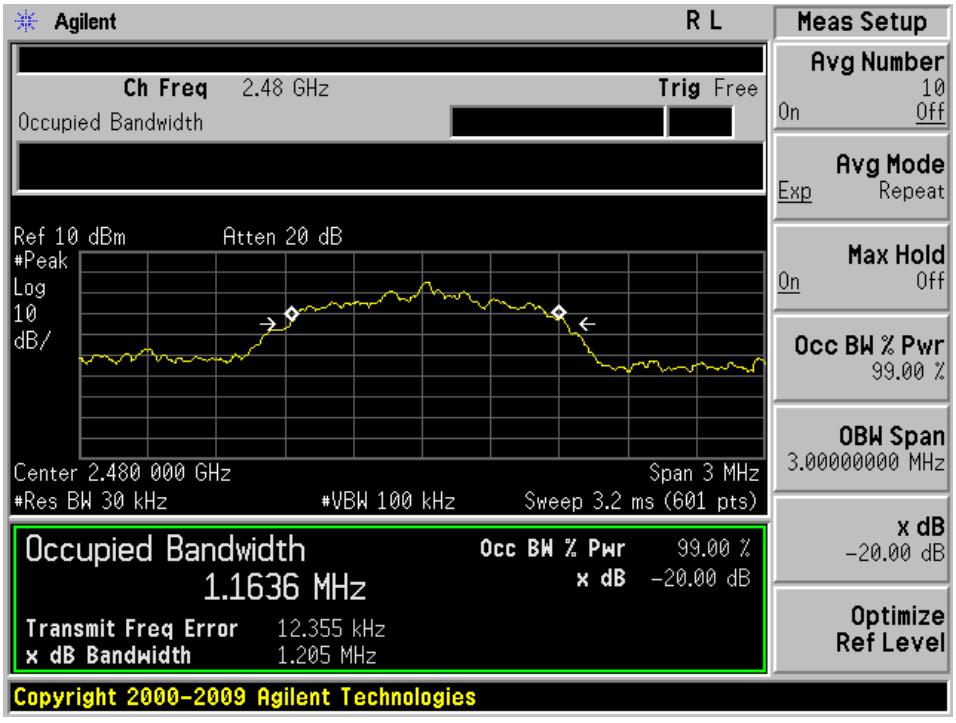
Result data graph shows 20 dB bandwidth, CF = 2.402GHz, BW = 1.221MHz



Result data graph shows 20 dB bandwidth, CF = 2.441GHz, BW = 1.210MHz



Result data graph shows 20 dB bandwidth, CF = 2.480GHz, BW = 1.205MHz



4.3 Hopping Channel Carrier Frequency Separation

Test Requirement:	FCC part 15 section 15.247 (a1)
Test Date:	2014-01-17
Mode of Operation:	BT playing mode.
Detector Function:	Max Hold

Result: PASS

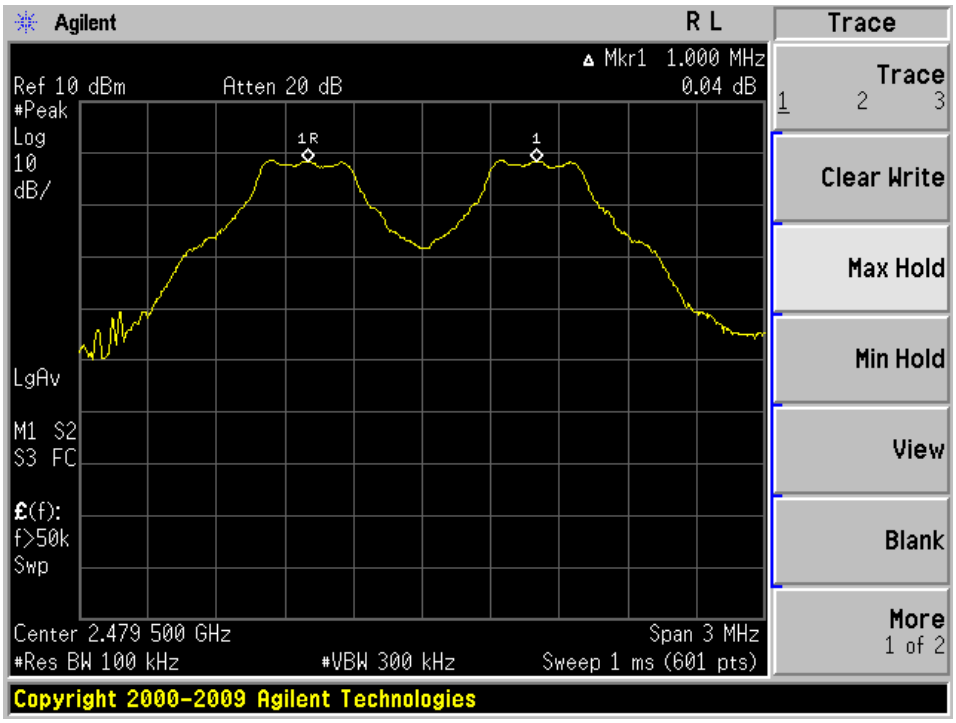
Measured Result :

Refer to the delta marker, the frequency separation between two adjacent channels is 1.00 MHz, therefore, the requirement of channel separated by a two-third of the 20dB bandwidth of the hopping channel is applied.

Limits for Hopping Channel Separation [Section 15.247 (a1)]:

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the 20dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5MHz band may have hopping channel carrier frequencies that are separated by 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater.

Result data graph shows the channel separation



4.4 Average Time of Channel Occupancy

Test Requirement:	FCC part 15 section 15.247 (a1)(iii)
Test Date:	2014-01-17
Mode of Operation:	BT playing mode.
Detector Function:	Zero span

Result : PASS

Measured Result :

Observing period = 79 x 0.4s = 31.6s

Measure the maximum time duration of one single pulse;

DH5 Packet permit maximum :
= 1600 / 79 /6
= 3.37 hop/s in each channel (5 times slots Rx, 1 times slot Tx)
Transmission Times within observing period
= 3.37 x 31.6
= 106.6

DH3 Packet permit maximum :
= 1600 / 79 /4
= 5.06 hop/s in each channel (3 times slots Rx, 1 times slot Tx)
Transmission Times within observing period
= 5.06 x 31.6
= 160

DH1 Packet permit maximum :
= 1600 / 79 /2
= 10.12 hop/s in each channel (1 times slots Rx, 1 times slot Tx)
Transmission Times within observing period
= 10.12 x 31.6
= 320

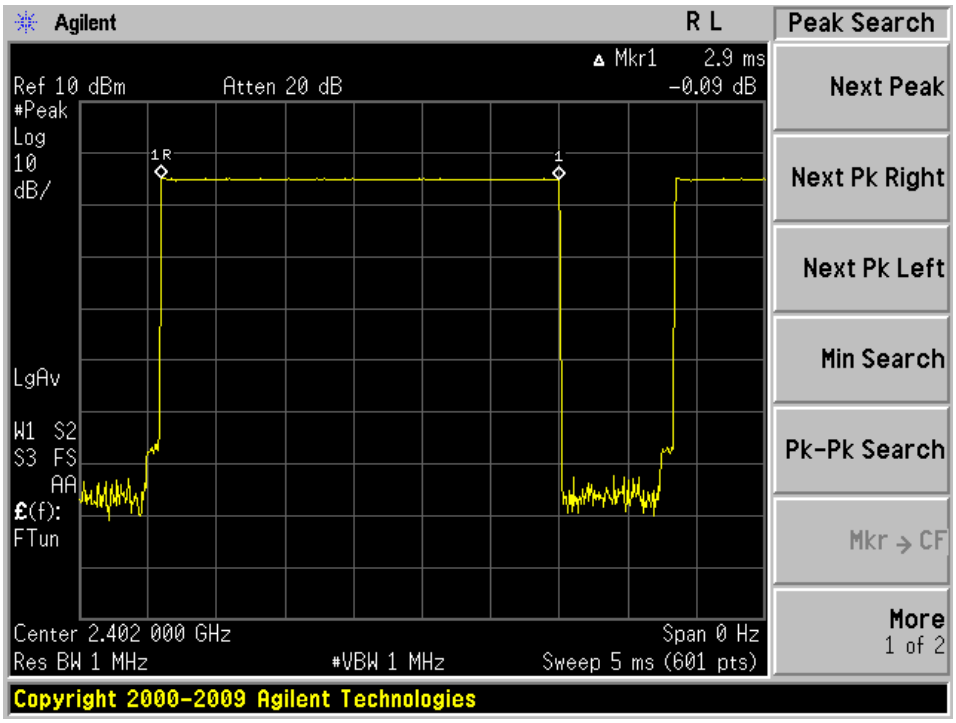
Dell Time = Pulse Duration x Length of Transmission time

Result shown as below table and data graph.

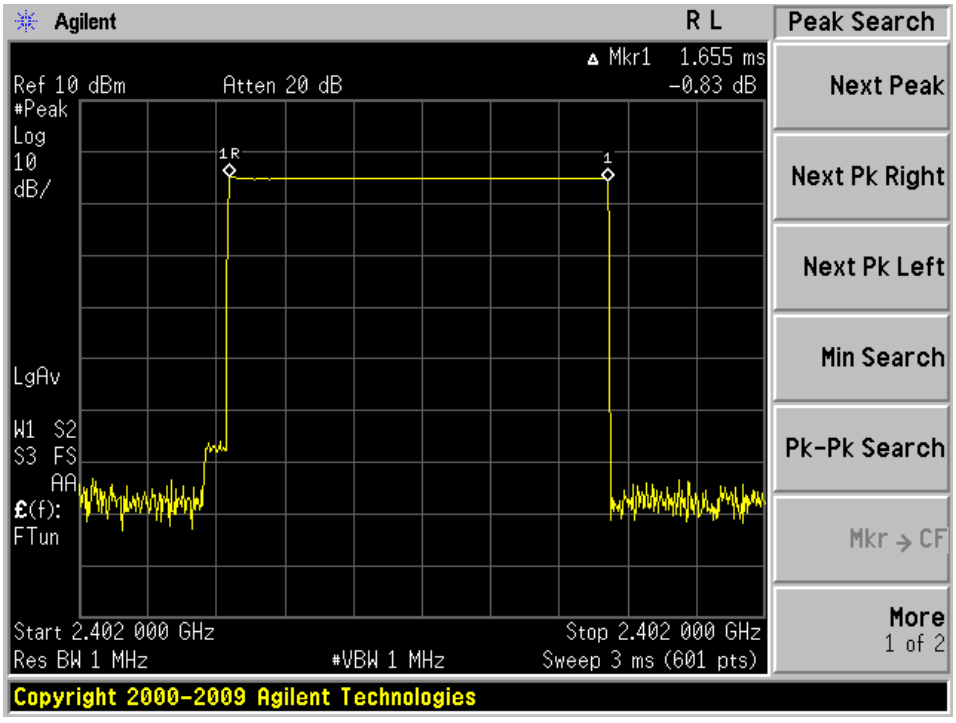
Limits for Average Time of Occupancy [Section 15.247 (a1)(iii)]:

The average time of occupancy on any channel shall not be greater than 0.4 second within a period of 0.4 seconds multiplied by the number of hopping channels employed.

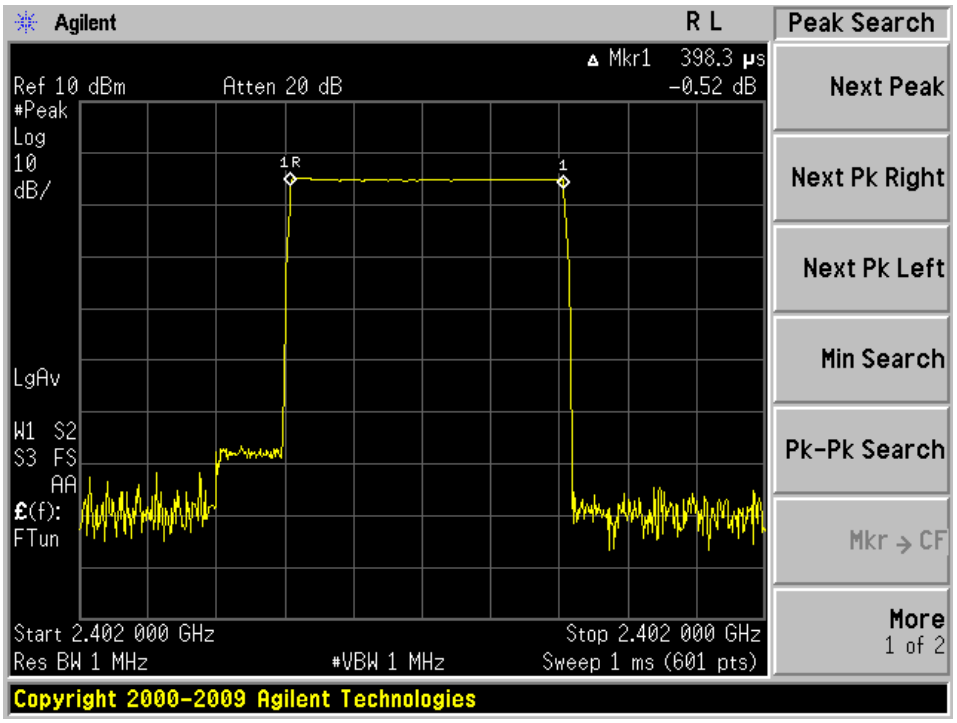
Result data graph shows the pulses duration of DH5 Package at 1MHz



Result data graph shows the pulses duration of DH3 Package at 1 MHz



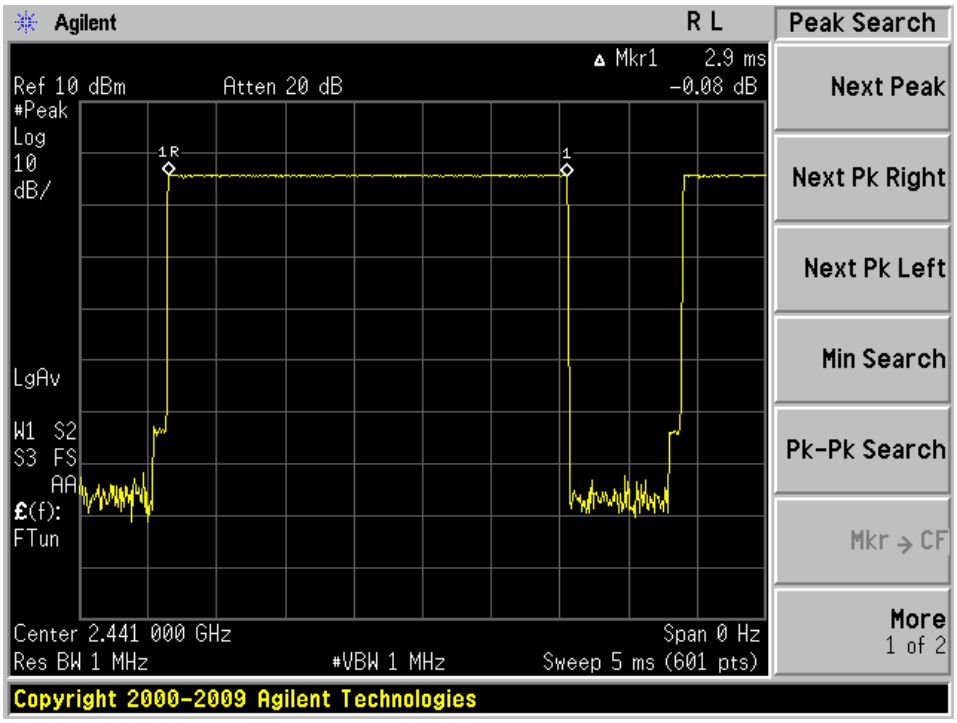
Result data graph shows the pulses duration of DH1 Package at 1 MHz



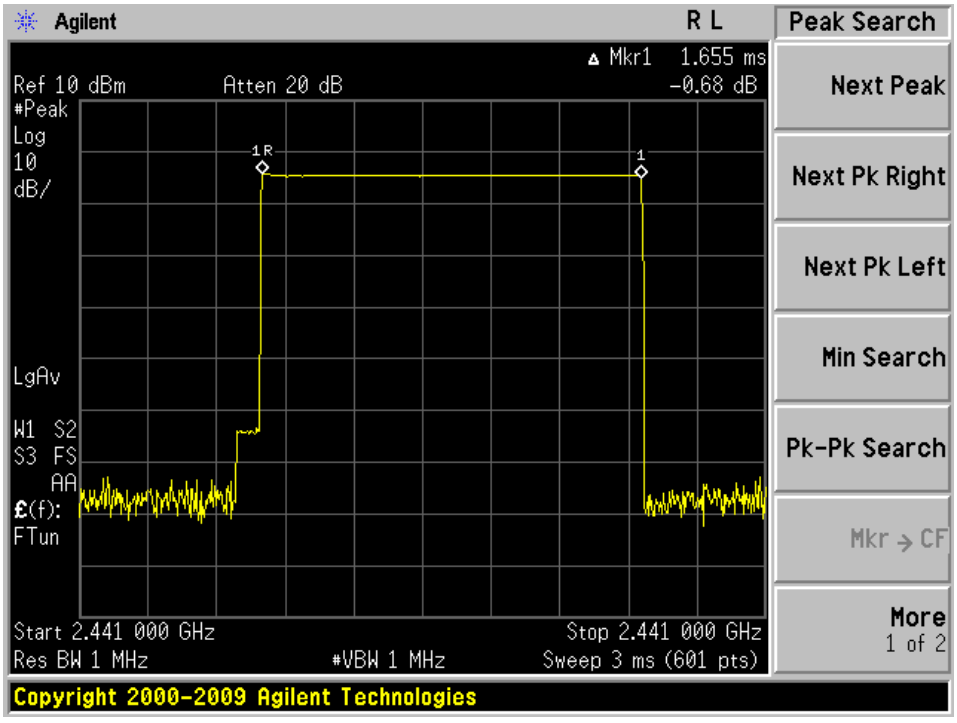
The table shown the result of Lowest Channel at 1Mbps

Data Packet	Frequency (MHz)	Pulse Duration (ms)	Dwell time (ms)	Limit (ms)
DH5	2402	2.900	309.1	400
DH3	2402	1.660	265.6	400
DH1	2402	0.398	127.4	400

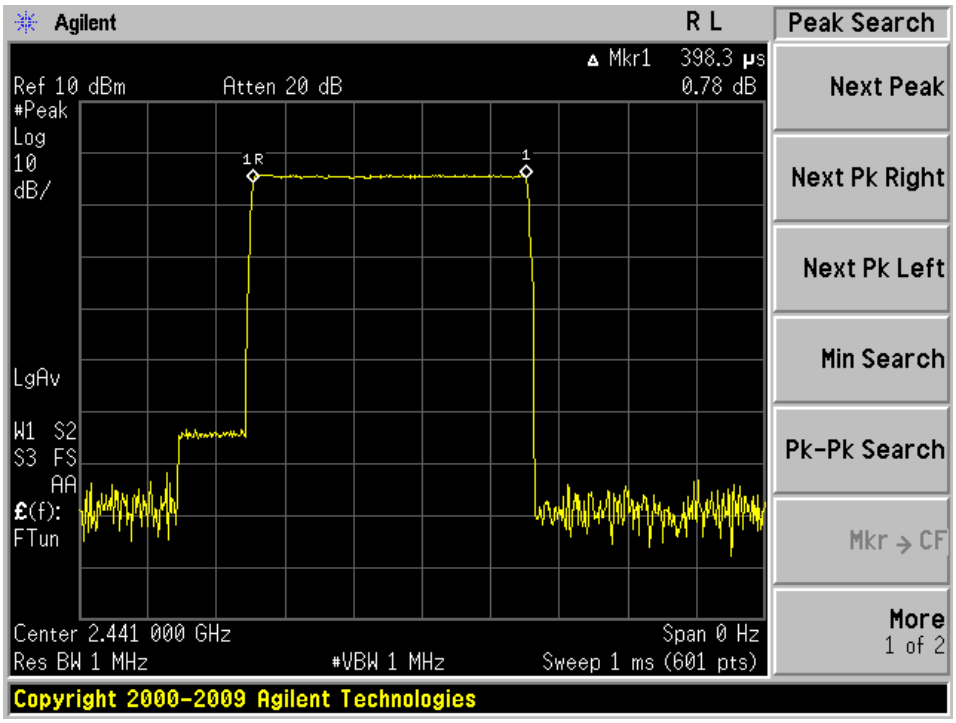
Result data graph shows the pulses duration of DH5 Package at 1MHz



Result data graph shows the pulses duration of DH3 Package at 1MHz



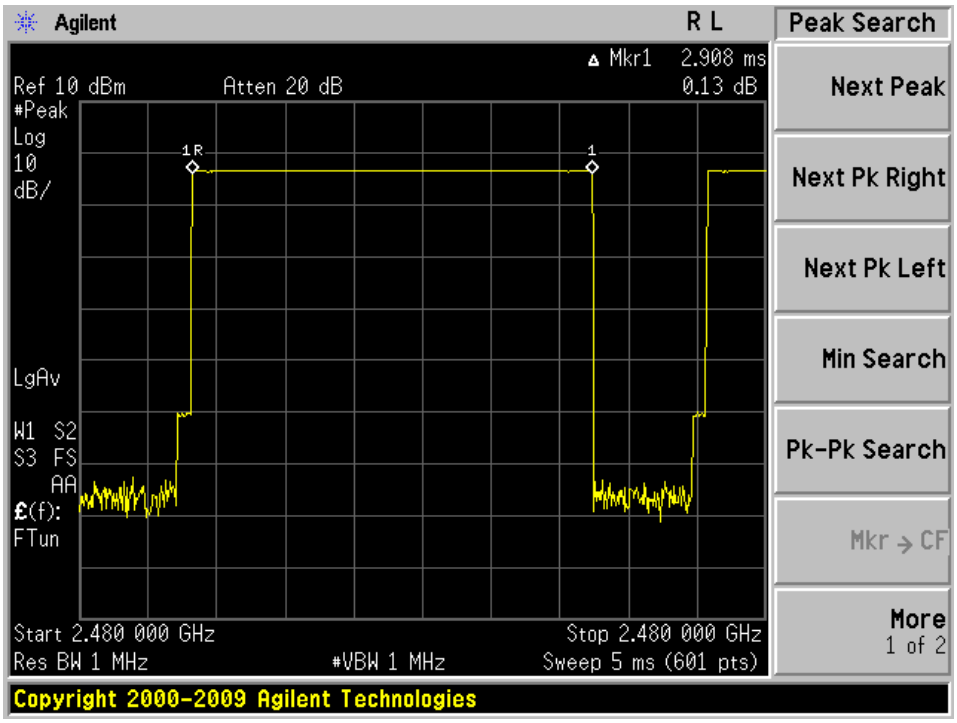
Result data graph shows the pulses duration of DH1 Package at 1MHz



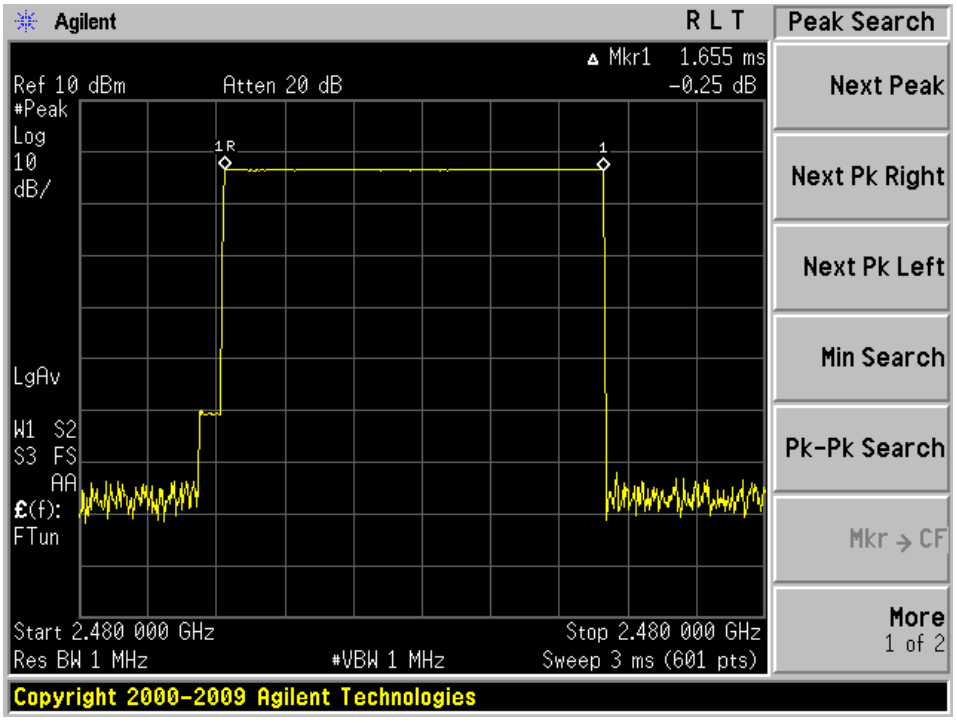
The table shown the result of Middle Channel at 1Mbps

Data Packet	Frequency (MHz)	Pulse Duration (ms)	Dwell time (ms)	Limit (ms)
DH5	2441	2.90	309.1	400
DH3	2441	1.66	265.6	400
DH1	2441	0.40	128.0	400

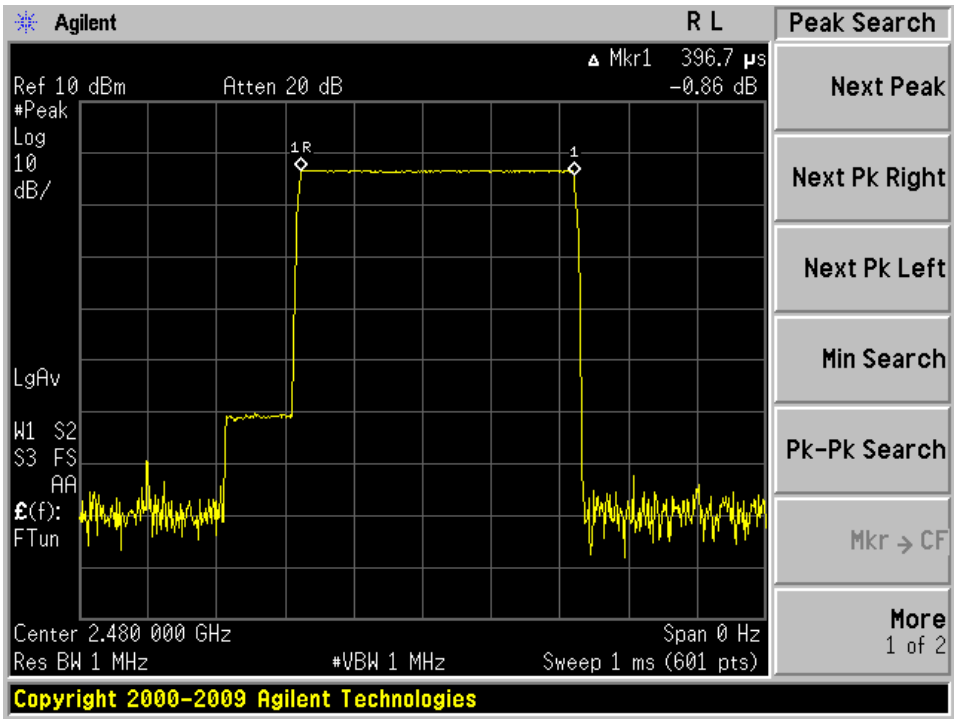
Result data graph shows the pulses duration of DH5 Package at 1MHz



Result data graph shows the pulses duration of DH3 Package at 1MHz



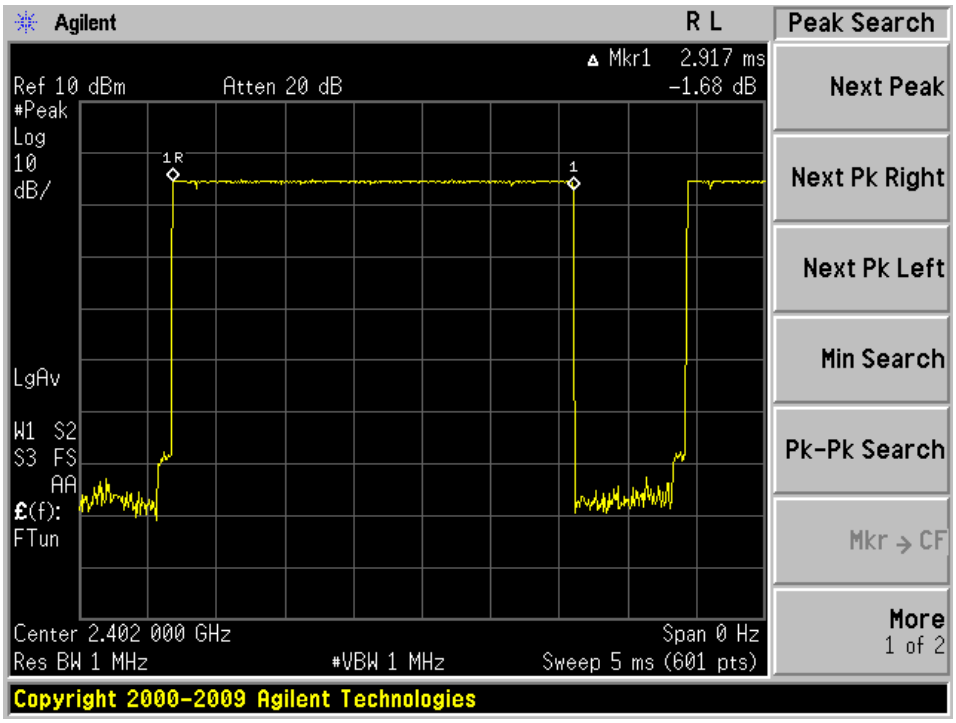
Result data graph shows the pulses duration of DH1 Package at 1MHz



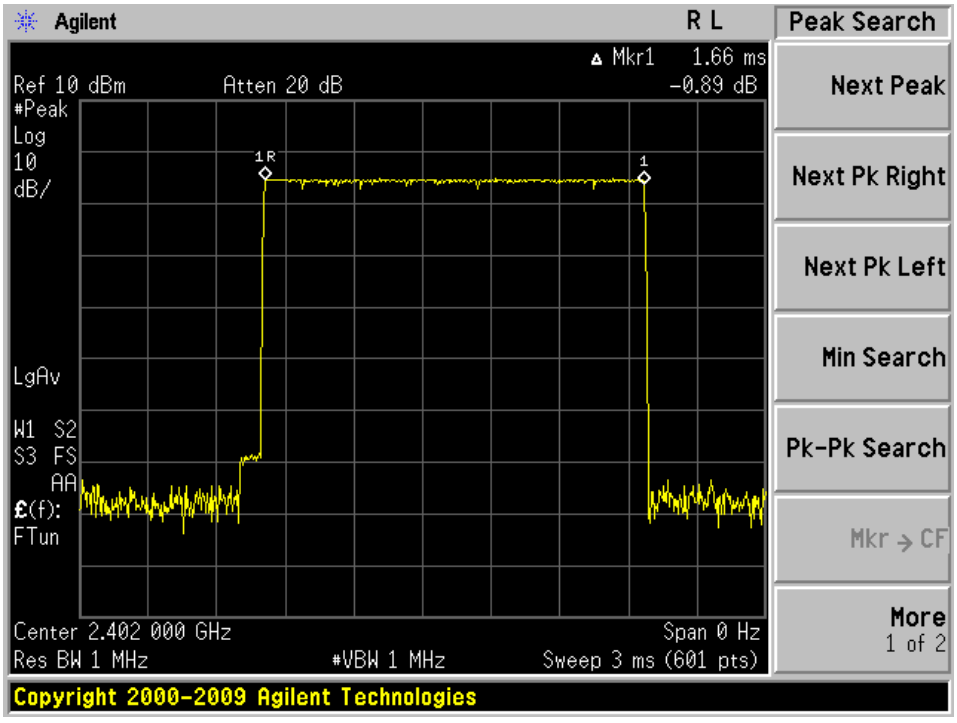
The table shown the result of Highest Channel at 1Mbps

Data Packet	Frequency (MHz)	Pulse Duration (ms)	Dwell time (ms)	Limit (ms)
DH5	2480	2.908	310.0	400
DH3	2480	1.655	264.8	400
DH1	2480	0397	127.0	400

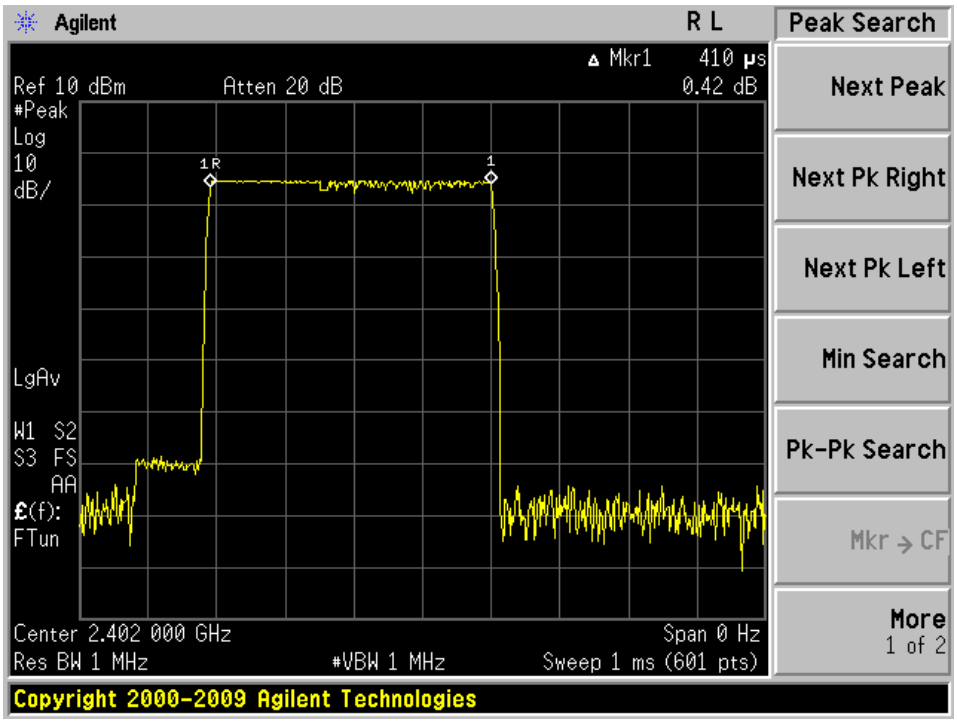
Result data graph shows the pulse duration of DH5 Package at 3MHz



Result data graph shows the pulses duration of DH3 Package at 3MHz



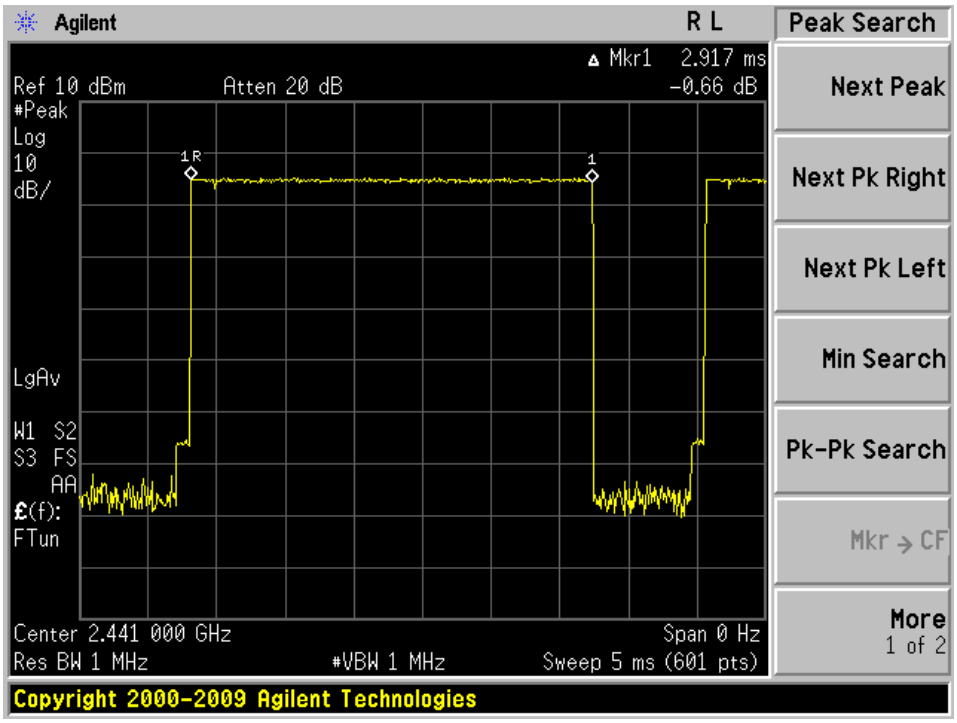
Result data graph shows the pulses duration of DH1 Package at 3MHz



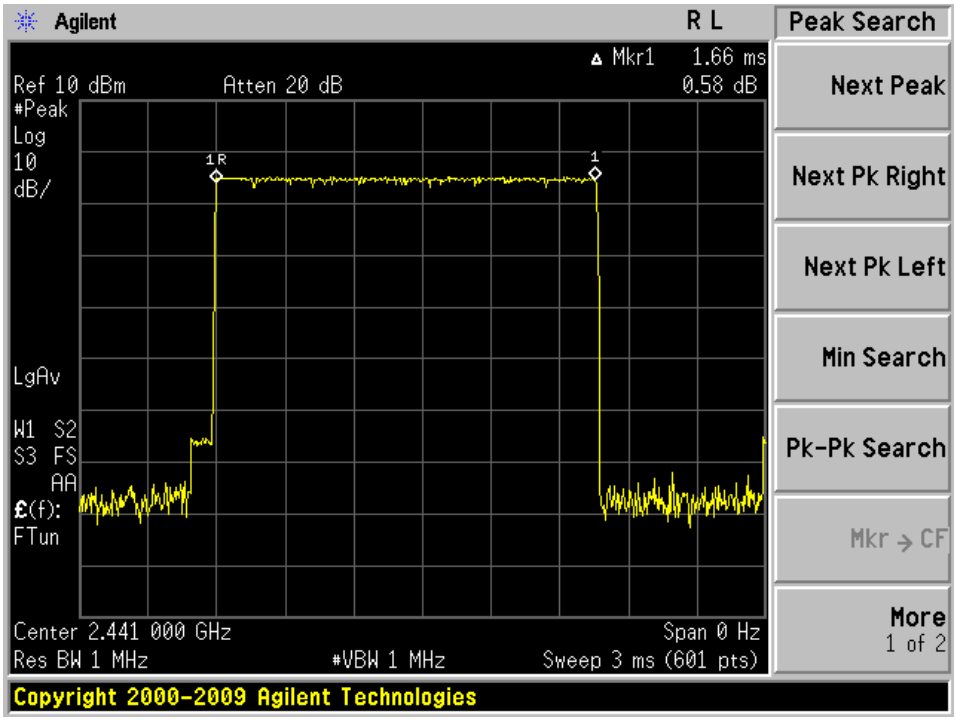
The table shown the result of Lowest Channel at 3Mbps

Data Packet	Frequency (MHz)	Pulse Duration (ms)	Dwell time (ms)	Limit (ms)
DH5	2402	2.917	311.0	400
DH3	2402	1.660	265.6	400
DH1	2402	0.410	131.2	400

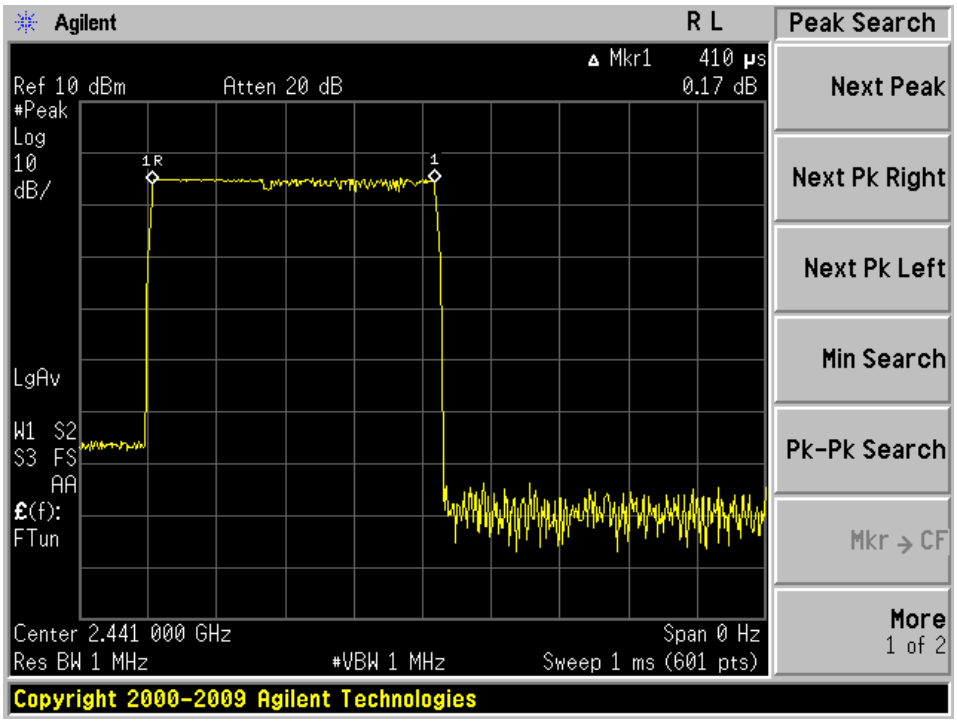
Result data graph shows the pulses duration of DH5 Package at 3MHz



Result data graph shows the pulses duration of DH3 Package at 3MHz



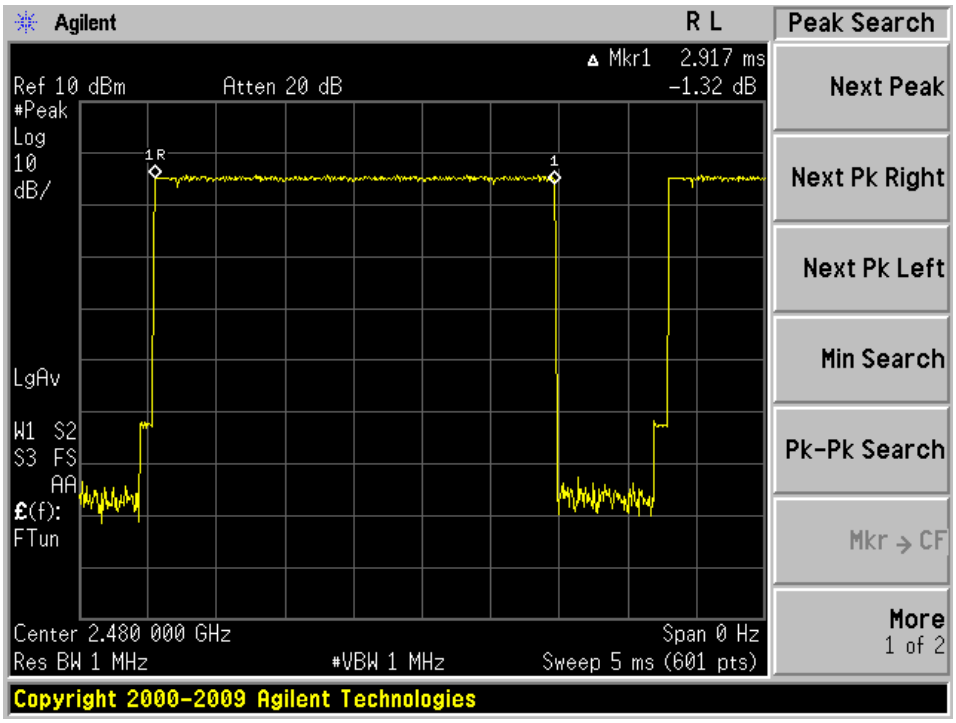
Result data graph shows the pulses duration of DH1 Package at 3MHz



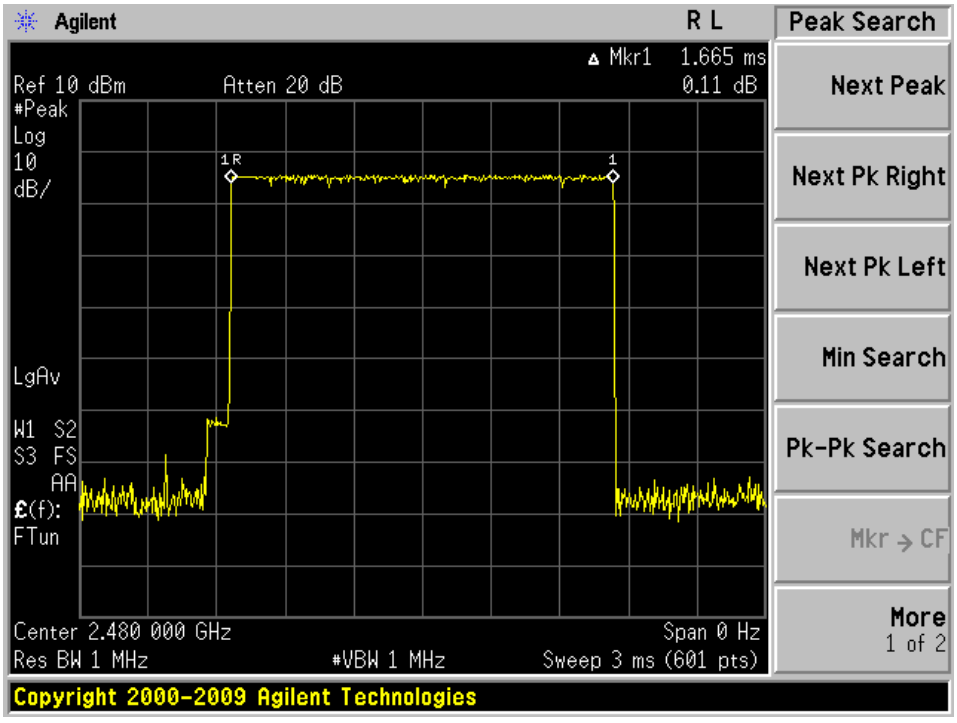
The table shown the result of Middle Channel at 3Mbps

Data Packet	Frequency (MHz)	Pulse Duration (ms)	Dwell time (ms)	Limit (ms)
DH5	2441	2.917	311.0	400
DH3	2441	1.660	265.6	400
DH1	2441	0.410	137.6	400

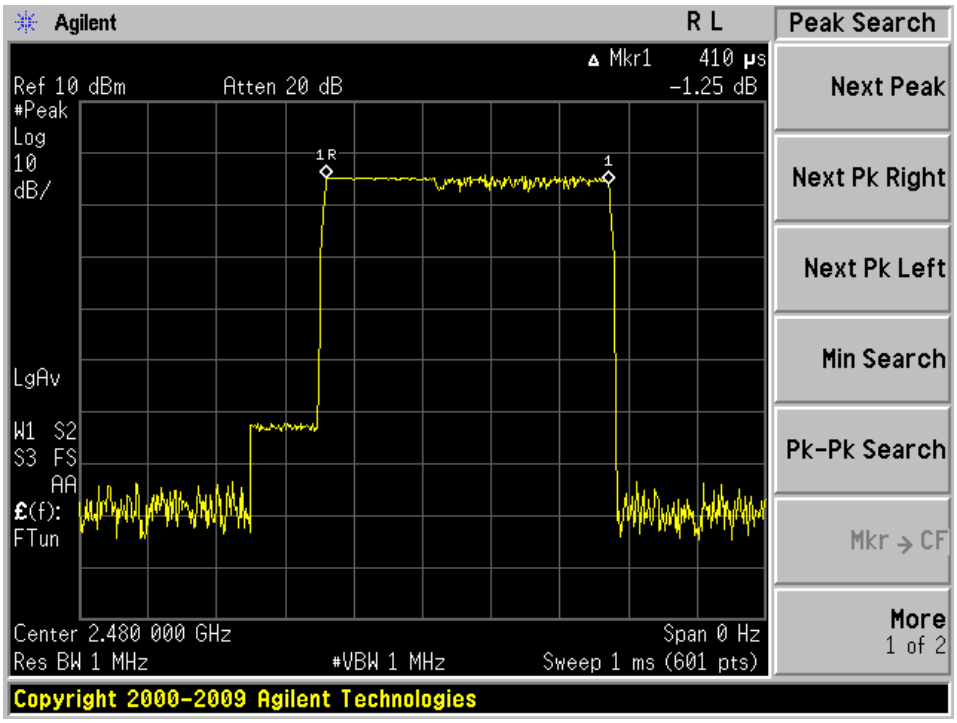
Result data graph shows the pulses duration of DH5 Package at 3MHz



Result data graph shows the pulses duration of DH3 Package at 3MHz



Result data graph shows the pulses duration of DH1 Package at 3MHz



The table shown the result of Highest Channel at 3Mbps

Data Packet	Frequency (MHz)	Pulse Duration (ms)	Dwell time (ms)	Limit (ms)
DH5	2480	2.917	311.0	400
DH3	2480	1.665	266.4	400
DH1	2480	0.410	131.2	400

4.5 Band Edge Measurement

Test Requirement:	FCC part 15 section 15.247
Test Date:	2014-01-17
Mode of Operation:	BT playing mode.
Detector Function:	Max Hold

Result: PASS

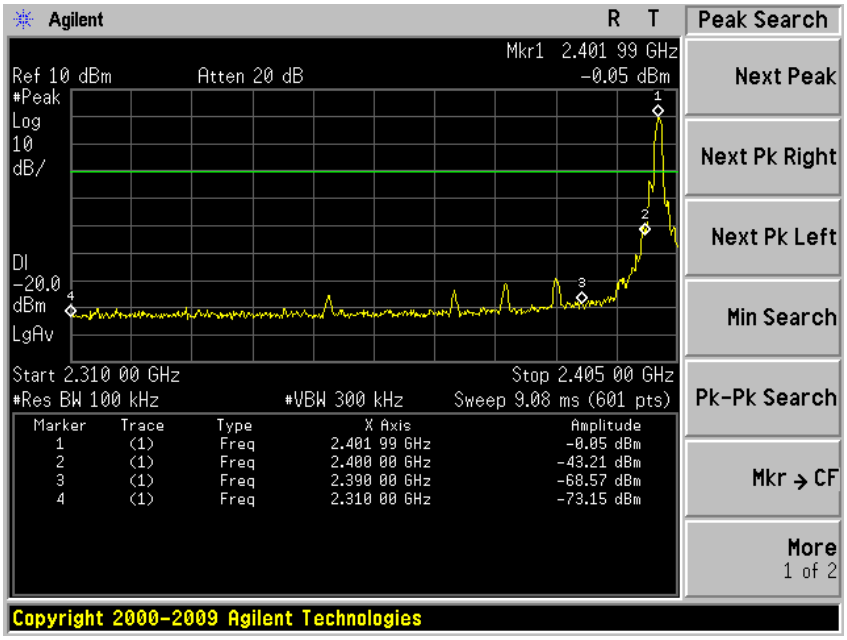
Measured Result :

Refer to the data graph, it shows the frequency of lower band edge and upper band edge separately.

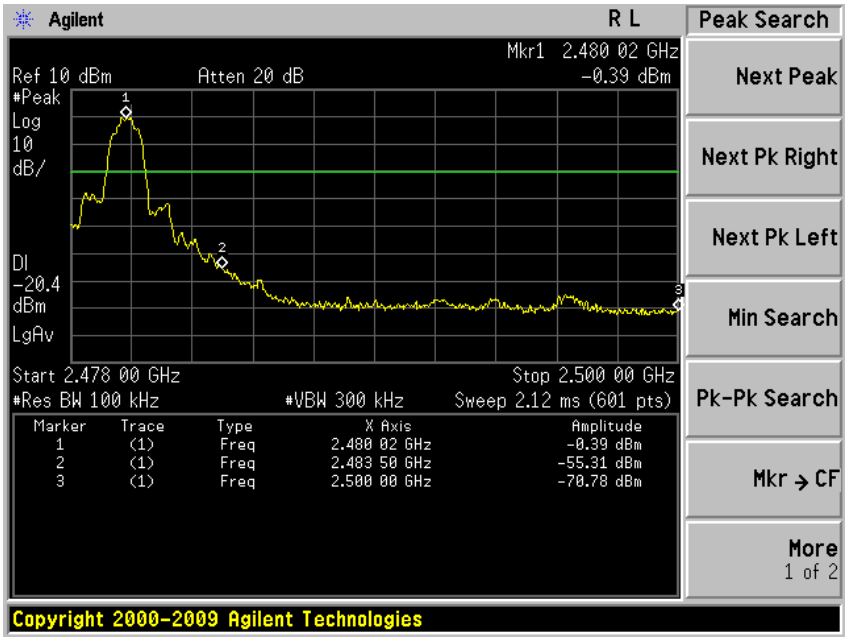
Limits of Band Edge for Carrier Frequencies Operated within the Bands [Section 15.247]:

The carrier frequencies should operate within 2400-2483.5MHz.

Result data graph shows the frequency of lower channel.



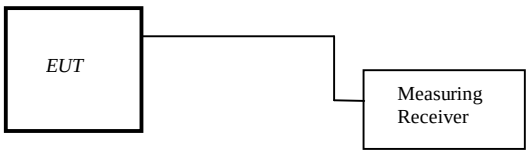
Result data graph shows the frequency of upper channel.



4.6 Maximum Output Power

Test Requirement:	FCC part 15 section 15.247 (b1)
Test Method:	ANSI C63.4:2003
Test Date:	2014-01-17
Mode of Operation:	BT playing mode.
Detector Function:	Peak
Measurement BW:	RBW 1MHz ; VBW 3MHz

Test Setup:



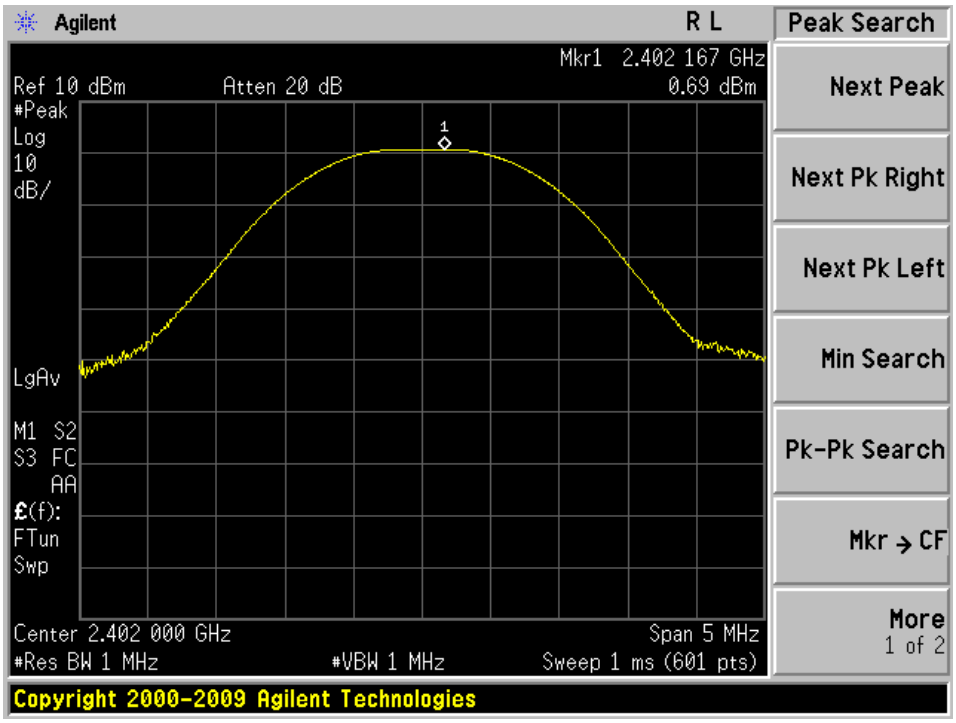
Result : PASS

Frequency (MHz)	Peak Output Power		Limit	
	(dBm)	(W)	(dBm)	(W)
Lowest Channel : 2402	0.69	0.0012	30	1.0
Middle Channel : 2441	0.54	0.0011	30	1.0
Highest Channel : 2480	0.58	0.0011	30	1.0

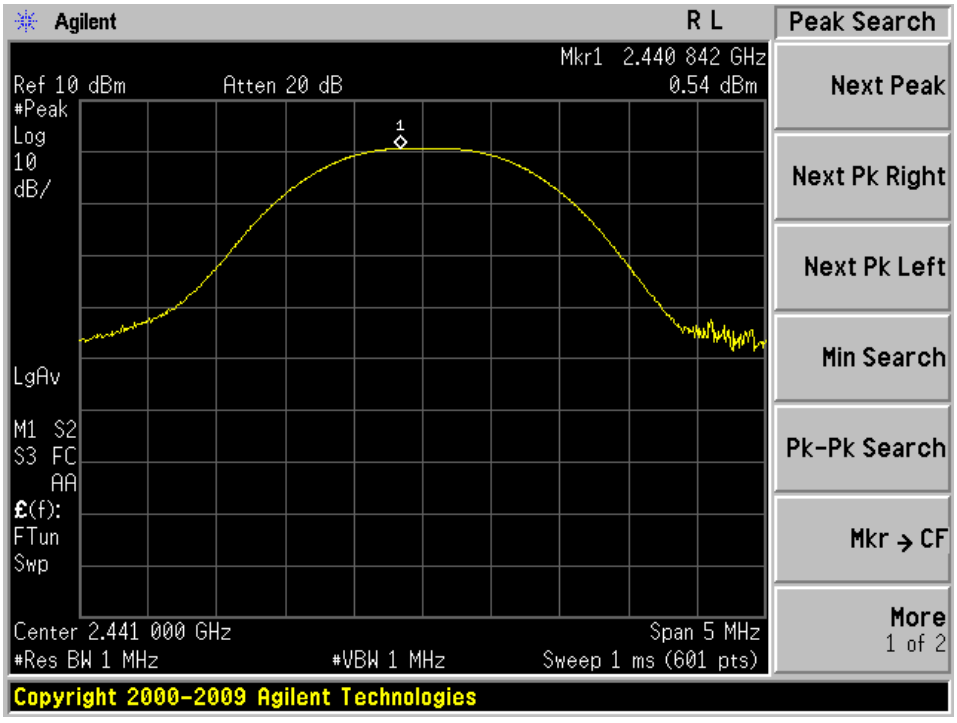
Limits for Maximum Output Power [Section 15.247 (a1)(iii)]:

For frequency hopping systems employing at least 75 hopping channels: 1 Watt
For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 Watts

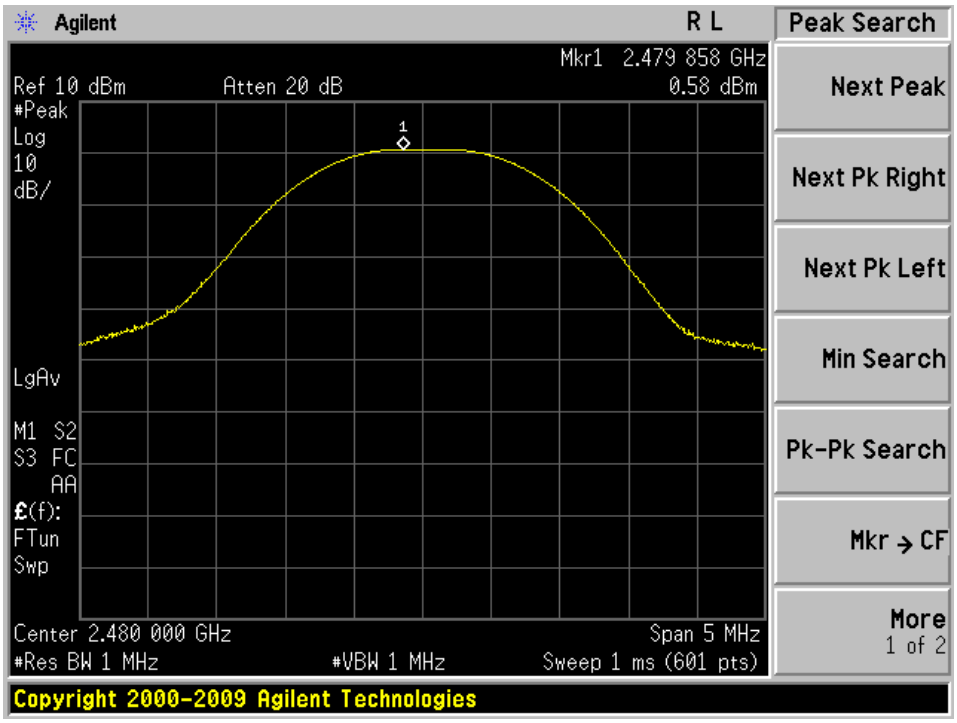
Result data graph shows the frequency of lowest channel



Result data graph shows the frequency of middle channel.



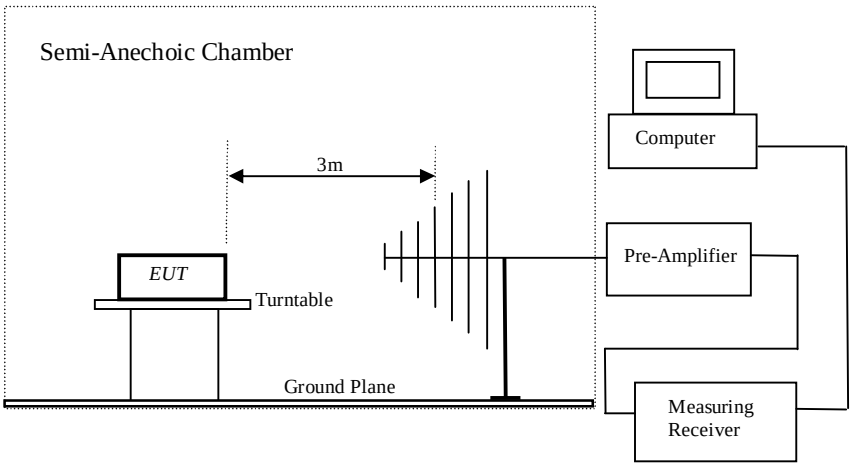
Result data graph shows the frequency of highest channel



4.7 Out of Band Emissions and Emissions in Restricted Bands

Test Requirement:	FCC part 15 section 15.247 (d)
Test Method:	ANSI C63.4:2003
Test Date:	2014-01-17
Mode of Operation:	BT playing mode
Detector Function:	Peak
Measurement BW:	RBW 100KHz ; VBW 300KHz

Test Setup:



Result : PASS

Out of Frequency Band Emissions:

For out of band emissions that are close to or exceed 20dB attenuation requirement, and emission falls into restricted band, radiated emission was performed in order to show compliance with the general radiated emission requirement.

Result Summary:

Refer to the data graph for the emission data graph, result shows that the significant emissions detected are with more than 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power.

Limits for Out of Frequency Band Emission [Section 15.247 (d)]:

In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power. Attenuation below the general limits specified in Section 15.209(a) is not required.

Limit for Radiated Emission Falling in Restricted Bands [Section 15.209]:

Frequency (MHz)	Field Strength [μV/m]	Field Strength [dBμV/m]
30-88	100	40.0
88-216	150	43.5
216-960	200	46.0
Above 960	500	54.0

Radiated emissions, which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209.

The emission limits shown in the above table are based on measurement employing a CISPR quasi-peak detector and above 1000MHz are based on measurements employing an average detector.

Result : PASS

All Emission and Emissions Fall into Restricted Band were recorded as below:

Radiated Emissions							
	Emissions Frequency MHz	E-Field Polarity	Reading dBuV/m	System Factor dB	Field strength at 3m dBuV/m	Limit dBuV/m	Delta to Limit dBuV/m
	Lowest Channel						
PK	4804.00	H	41.34	8.29	49.63	74.00	-24.37
AV		H	23.84	8.29	32.13	54.00	-21.87
	Middle Channel						
PK	4882.00	H	44.82	8.40	53.22	74.00	-20.78
AV		H	27.25	8.40	35.65	54.00	-18.35
	Highest Channel						
PK	4960.00	H	40.28	8.50	48.78	74.00	-25.22
PK		H	22.82	8.50	31.32	54.00	-22.68
	Spurious Emissions						
QP	34.16	V	42.49	-17.15	25.34	40.00	-14.66
QP	35.38	V	46.10	-17.06	29.04	40.00	-10.96
QP	36.51	V	43.97	-16.71	27.26	40.00	-12.74
QP	37.68	V	43.61	-16.41	27.20	40.00	-12.80
QP	152.13	V	41.15	-13.44	27.71	43.50	-15.79
QP	155.91	V	49.12	-19.89	29.23	43.50	-14.27
QP	36.51	H	47.44	-16.71	30.73	40.00	-9.27
QP	82.07	H	46.58	-19.42	27.16	40.00	-12.84
QP	147.92	H	49.23	-20.17	29.06	43.50	-14.44
QP	180.02	H	47.92	-18.66	29.26	43.50	-14.24
QP	239.99	H	45.77	-16.00	29.77	46.00	-16.23
QP	968.93	H	35.87	-2.56	33.31	54.00	-20.69

- Refer to the data graph shows the worst case channel's emission data graph from 30MHz-1GHz.
- Only background noise was measured from 1GHz-26GHz except related to the operation frequency.

Result Summary:

1) Communication mode: All other emissions are more than 20dB below FCC part 15.209 limit.

2) No further spurious emissions found between 30 MHz and lowest internal used/generated frequency and from 30MHz to 1GHz.

-

Remarks:

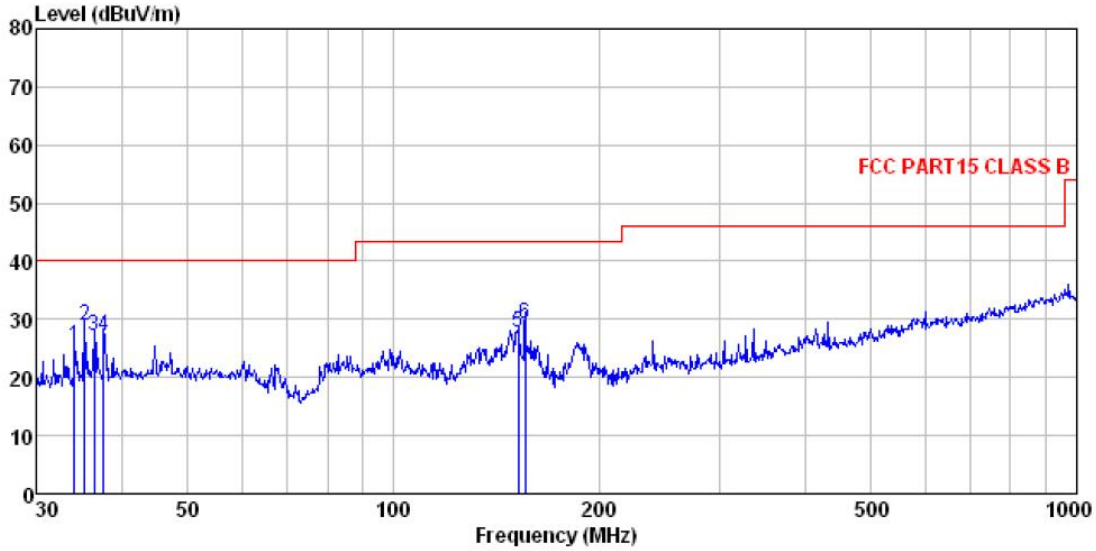
1. " * " Radiated emissions which fall in the restricted bands as defined in Section 15.205(a).

2. Emission level with more than 20dB below the FCC required limit is not mentioned in table.

3. Delta to Limit = Field strength (dBµV/m) – Limit (dBµV/m).

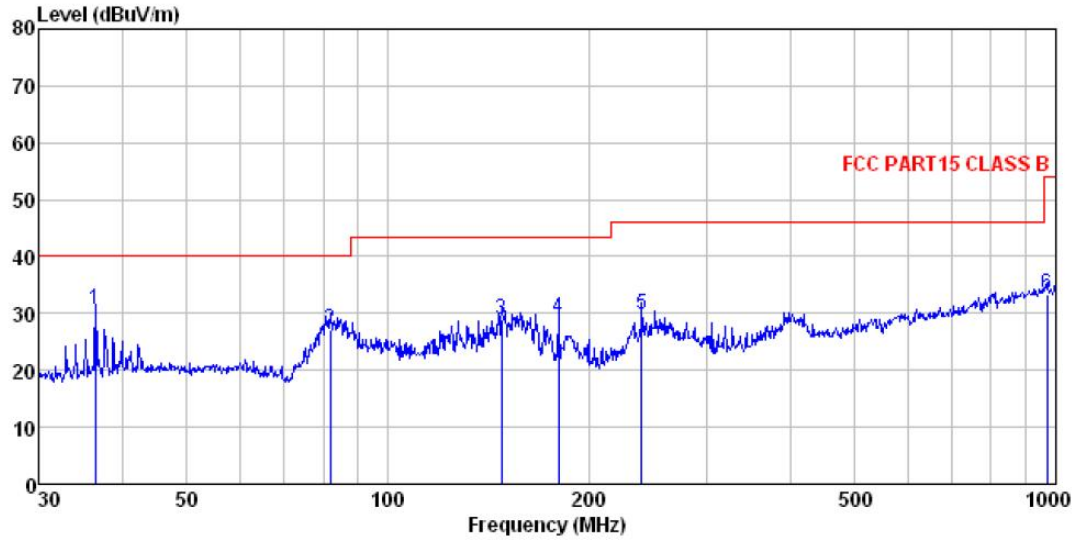
4. Calculated measurement uncertainty: 9kHz -30MHz: 1.8dB.
30MHz -1GHz: 5.2dB.
1GHz -18GHz: 5.1dB.

Radiated emission data graph (Vertical polarization, 30MHz-1GHz)



Remark: Only background noise was measured from 1GHz-26GHz except related to the operation frequency.

Radiated emission data graph (Horizontal polarization, 30MHz-1GHz)

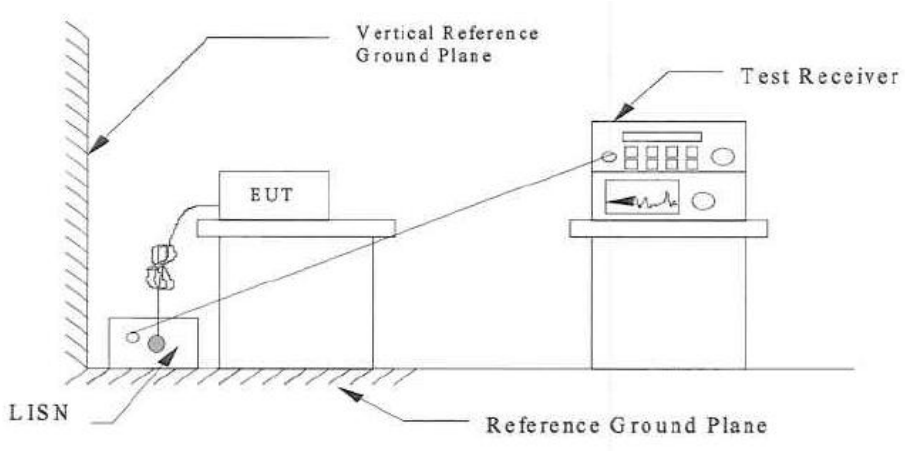


Remark: Only background noise was measured from 1GHz-26GHz except related to the operation frequency.

4.8 Conducted Emissions on AC Main (0.15MHz to 30MHz)

Test Requirement:	FCC part 15 Section 15.207 Class B
Test Method:	ANSI C63.4:2003
Test Date:	---
Mode of Operation:	---
Detector Function:	CISPR Quasi Peak
Measurement BW:	5 kHz
Worst Case Channel:	1

Test Setup:



Results: N/A

This test is not applicable for the battery operated product.

Limits for Conducted Emission [Section 15.207]:

Frequency Range [MHz]	Quasi-Peak Limit [dBμV]	Average Limit [dBμV]
0.15-0.5	66 to 56*	56 to 46*
0.5-5.0	56	46
5.0-30.0	60	50

* Decreases with the logarithm of the frequency.

Remarks:
Calculated measurement uncertainty: ±2.8dB

5.0 List of Measurement Equipment

Radiated Emission and Bandwidth Emissions

Description	Manufacturer	Model no.	Serial no.	CAL due
3m Semi-Anechoic Chamber	ZhongYu Electron	9.0(L)*6.0(W)* 6.0(H)	GTS250	29 Mar 2014
ESU EMI Test Receiver	R&S	ESU26	GTS203	06 Jul 2014
BiConiLog Antenna	SCHWARZBECK	VULB9163	GTS214	09 Mar 2014
Double-ridged waveguide horn	SCHWARZBECK	9120D	GTS208	09 Mar 2014
RF Amplifier	HP	8347A	GTS204	06 Jul 2014
Preamplifier	HP	8349B	GTS206	06 Jul 2014

N/A Not Applicable or Not Available