

FCC Test Report Page 61 of 110

-42.163 dBm

-42.223 dBm

-42.283 dBm

Test Mode BT EDR (3 Mbps) DH3 Channel 00 Number of Pulses Per 5 sec Spectrum Ref Level 0.00 dBm RBW 100 kHz 20 dB . SWT 5 s . VBW 100 kHz Att SGL ●1Pk Clrw M1[1]-41.15 dBm 246.38 ms -20 dBm-M1 40 aBm 60 dBm -80 dBm-CF 2.402 GHz 691 pts 500.0 ms/ Marker Peak List Stimulus No Stimulus Response No Response 644.927536 ms -42.518 dBm 3.217391 s -42.312 dBm 5 840.579710 ms -42.339 dBm 18 3.413043 s -42.395 dBm 1.036232 s -42.430 dBm 19 3.608696 s -42.403 dBm 6 7 -42.356 dBm -42.428 dBm 3.804348 s 1.239130 s 20 -42.176 dBm 1.434783 s -42.279 dBm 21 4.007246 s 8 9 -42.379 dBm 1.630435 s -42.386 dBm 22 4.202899 s -42.446 dBm -42.412 dBm 10 1.833333 s 23 4.398551 s

24

25

26

4.601449 s

4.797101 s

4.992754 s

Ready

-42.264 dBm

-42.288 dBm

-42.233 dBm

Pulse Width (sec)

11

12

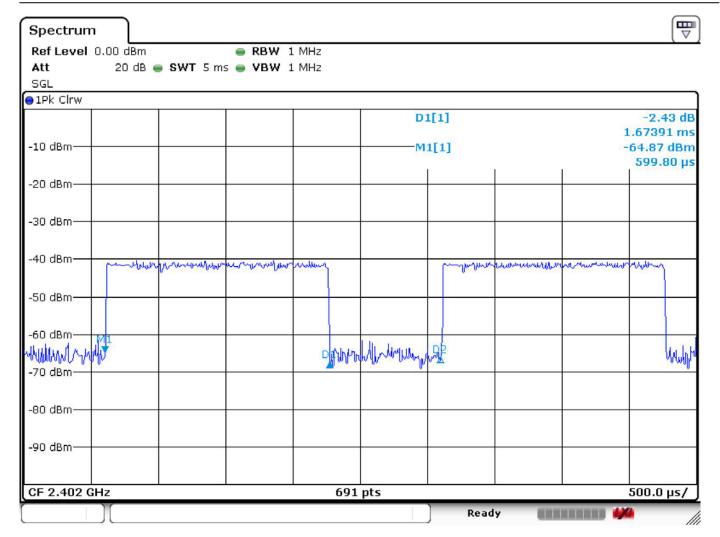
13

2.028986 s

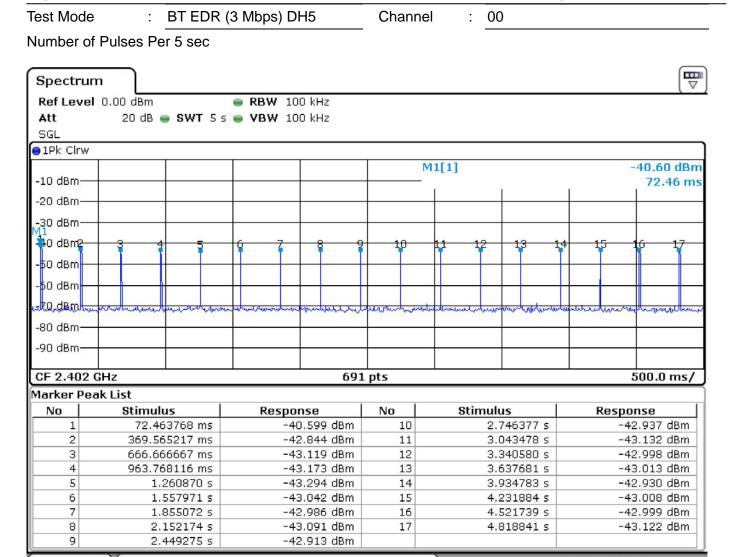
2.224638 s

2.420290 s

FCC Test Report Page 62 of 110



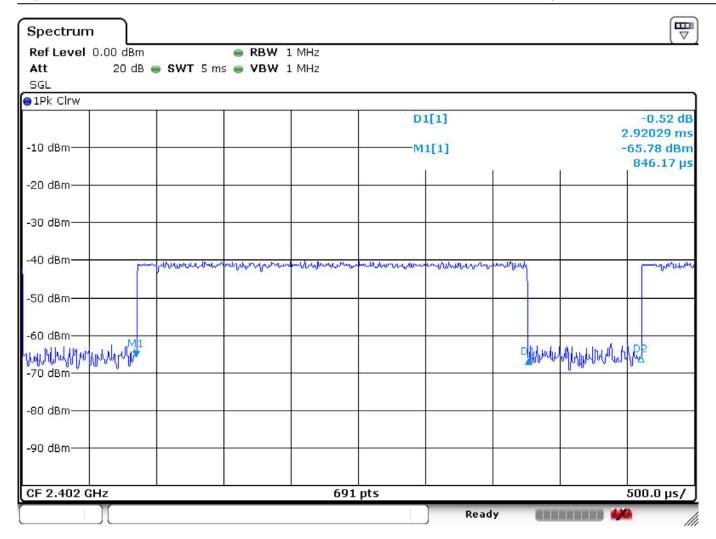
FCC Test Report Page 63 of 110



Ready

Pulse Width (sec)

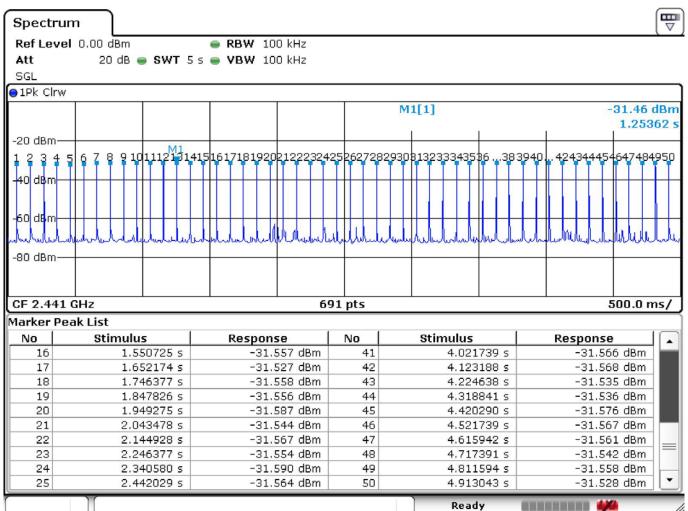
FCC Test Report Page 64 of 110



FCC Test Report Page 65 of 110

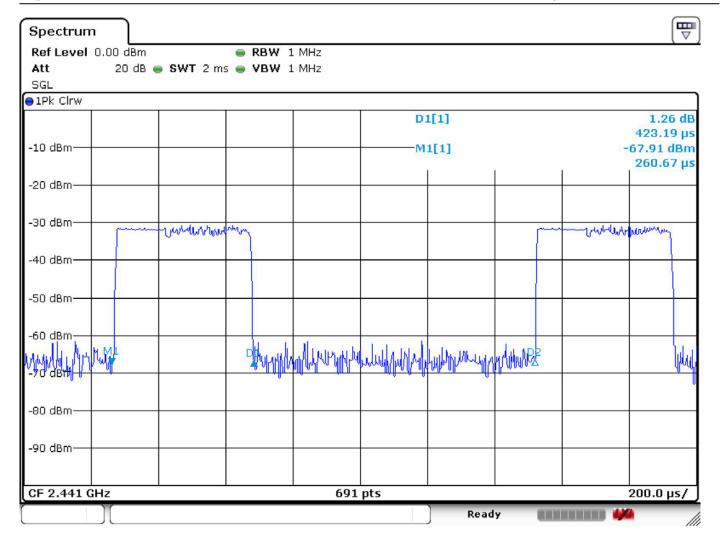
Test Mode : BT EDR (3 Mbps) DH1 Channel : 39

Number of Pulses Per 5 sec

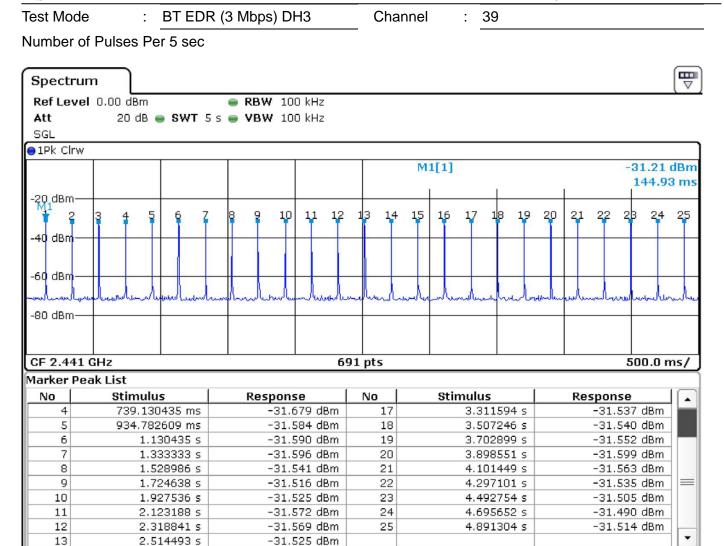


Pulse Width (sec)

FCC Test Report Page 66 of 110



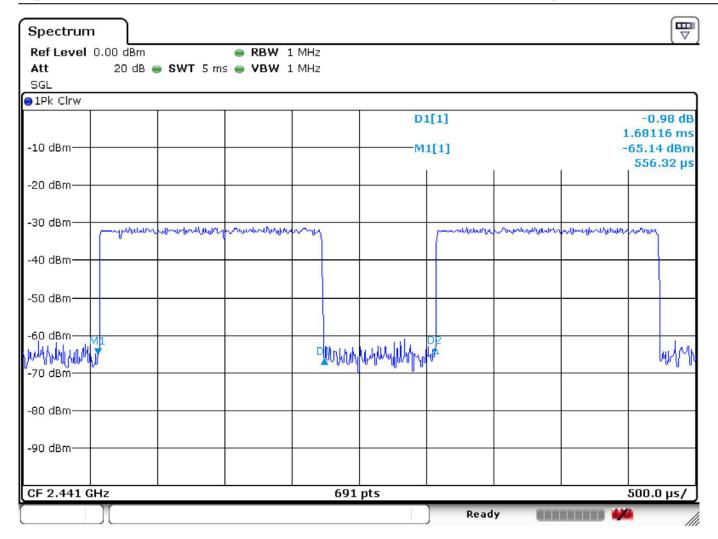
FCC Test Report Page 67 of 110



Ready

Pulse Width (sec)

FCC Test Report Page 68 of 110



FCC Test Report Page 69 of 110

: BT EDR (3 Mbps) DH5

Test Mode

Number of Pulses Per 5 sec Spectrum Ref Level 0.00 dBm RBW 100 kHz Att 20 dB . SWT 5 s . VBW 100 kHz SGL 1Pk Clrw M1[1]-31.79 dBm -10 dBm 3.74638 s -20 dBm-M1 -30**1**dBm· -40 dBm· -50 dBm--60 dBm-≂7Ω/dBm -80 dBm· -90 dBm-CF 2.441 GHz 691 pts 500.0 ms/ Marker Peak List Stimulus Response Stimulus Response 2.855072 s -31.806 dBm 188.405797 ms -32.606 dBm 485.507246 ms -32.040 dBm 3.152174 s -31.826 dBm 11 -31.836 dBm 3 782.608696 ms -31.931 dBm 3.449275 s 12 -31.895 dBm 4 1.079710 s 3.746377 s -31.788 dBm 13 5 -31.879 dBm 1.376812 s -31.862 dBm 14 4.043478 s -31.856 dBm 15 4.340580 s -31.855 dBm 6 1.666667 s 7 1.963768 s -31.849 dBm 16 4.637681 s -31.905 dBm

-31.835 dBm

-31.806 dBm

17

4.934783 s

Ready

-31.862 dBm

Channel

39

Pulse Width (sec)

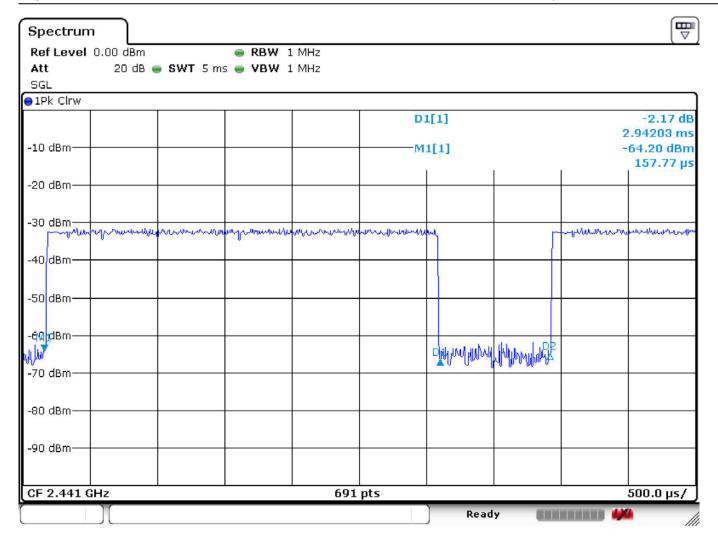
8

9

2.260870 s

2.557971 s

FCC Test Report Page 70 of 110



FCC Test Report Page 71 of 110

-33.557 dBm

BT EDR (3 Mbps) DH1 Channel Test Mode 78 Number of Pulses Per 5 sec Spectrum Ref Level 0.00 dBm RBW 100 kHz 20 dB . SWT 5 s . VBW 100 kHz Att SGL 1Pk Clrw M1[1]-32.75 dBm 202.90 ms -20 dBm 40 dBm 60 dBm -80 dBm-CF 2.48 GHz 691 pts 500.0 ms/ Marker Peak List No Stimulus Response No Stimulus Response 1.586957 s -33,636 dBm 4.159420 s -33.579 dBm 18 1.688406 s -33.648 dBm 44 4.260870 s -33.589 dBm -33.593 dBm -33.595 dBm 45 4.355072 s 19 1.789855 s -33.563 dBm -33.581 dBm 4.456522 s 20 1.884058 s 46 1.985507 s -33.579 dBm 47 4.557971 s -33.536 dBm 21 22 2.079710 s -33.654 dBm 48 4.652174 s -33.527 dBm -33.647 dBm 49 -33.542 dBm 23 2.181159 s 4.753623 s 24 2.282609 s -33.558 dBm 50 4.855072 s -33.592 dBm

51

4.949275 s

Ready

-33.582 dBm

-33.651 dBm

Pulse Width (sec)

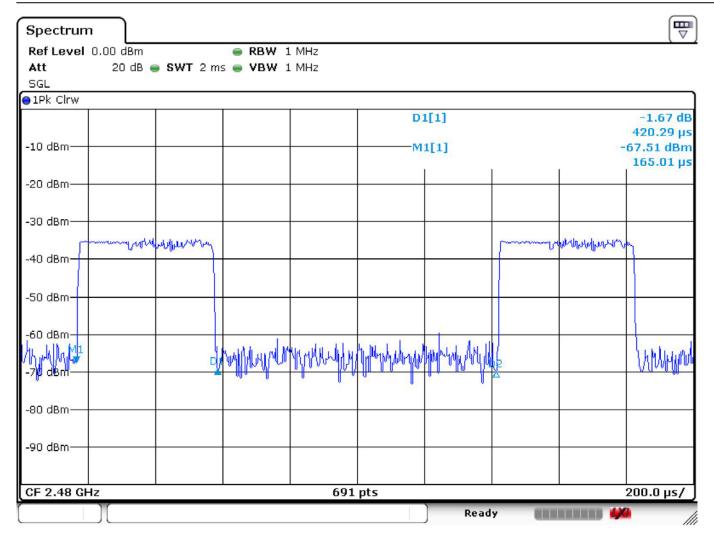
25

26

2.376812 s

2.478261 s

FCC Test Report Page 72 of 110



FCC Test Report Page 73 of 110

-33.602 dBm

-33.540 dBm

-33.661 dBm

Test Mode : BT EDR (3 Mbps) DH3 Channel 78 Number of Pulses Per 5 sec Spectrum Ref Level 0.00 dBm RBW 100 kHz Att 20 dB . SWT 5 s . VBW 100 kHz SGL 1Pk Clrw M1[1]-32.63 dBm 65.22 ms -20 dBm-20 25 40 dBm 60 d**6**m--80 dBm-CF 2.48 GHz 691 pts 500.0 ms/ Marker Peak List Stimulus No Stimulus Response No Response 659.420290 ms -33.697 dBm 3.231884 s -33.741 dBm -33.766 dBm 5 855.072464 ms 18 3.427536 s -33.720 dBm -33.729 dBm -33.717 dBm 1.050725 s 19 3.623188 s 6 7 -33.796 dBm -33.736 dBm 3.826087 s 1.253623 s 20 1.449275 s -33.813 dBm 21 -33.647 dBm 8 4.021739 s 9 -33.595 dBm 1.644928 s -33.764 dBm 22 4.217391 s

23

24

25

4.413043 s

4.615942 s

4.811594 s

Ready

-33.770 dBm

-33.766 dBm

-33.795 dBm

-33.706 dBm

Pulse Width (sec)

10

11

12

13

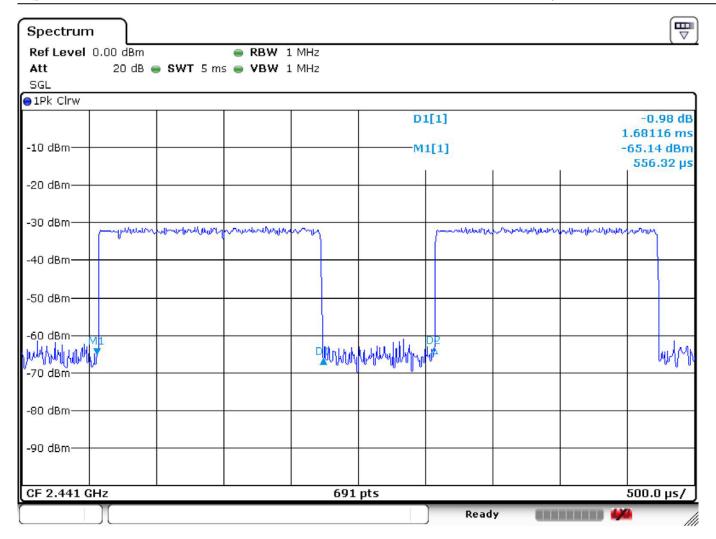
1.847826 s

2.043478 s

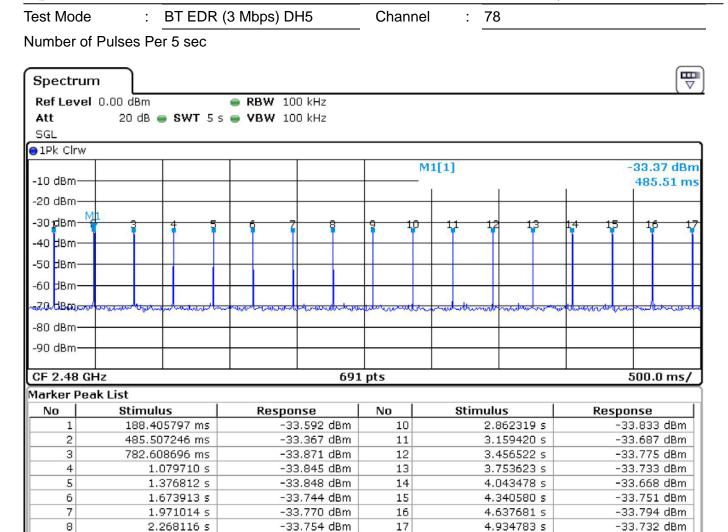
2.239130 s

2.442029 s

FCC Test Report Page 74 of 110



FCC Test Report Page 75 of 110



-33.807 dBm

Ready

Pulse Width (sec)

9

2.565217 s

FCC Test Report Page 76 of 110

FCC Test Report Page 77 of 110

8 Peak Output Power

8.1 Test Instruments

Refer to Sec. 1.2 Test Instruments.

8.2 Test Arrangement and Procedure



1. The transmitter output was connected to a spectrum analyzer (through an attenuator, if it's necessary).

Report No.: HA150773-RA

- 2. The RBW is set to 3MHz and VBW is set to 3MHz. Span set to 5MHz.
- 3. Max Hold...

8.3 Limit (§ 15.247(b))

- 15.247(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:
- 15.247(b)(1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.
- 15.247(b)(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum antenna gain is 3 dBi, therefore, the limit is 30 dBm.

8.4 Test Result

Compliance.

The final test data are shown on the following page(s).

The Test Graphics of the worst case, BT (1 Mbps), have been selected to show on the following page(s).

FCC Test Report Page 78 of 110

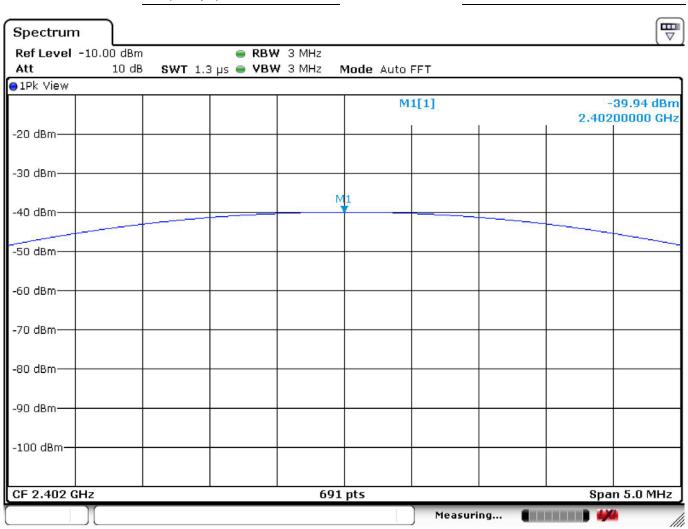
Bluetooth 1 Mbps Limit (dBm) Frequency (MHz) Result (dBm) Channel 00 2402 -39.94 30 39 2441 -30.07 30 78 2480 -32.63 30

Report No.: HA150773-RA

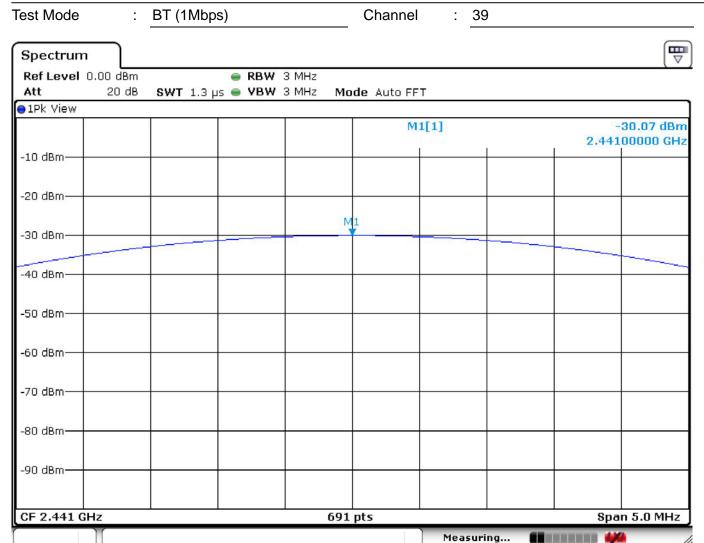
FCC Test Report Page 79 of 110

Temperature : 28.1° C Humidity : 35%Test Date : 07-Sep-2015 Tested by : Eason Hsieh

Test Mode : BT (1Mbps) Channel : 00

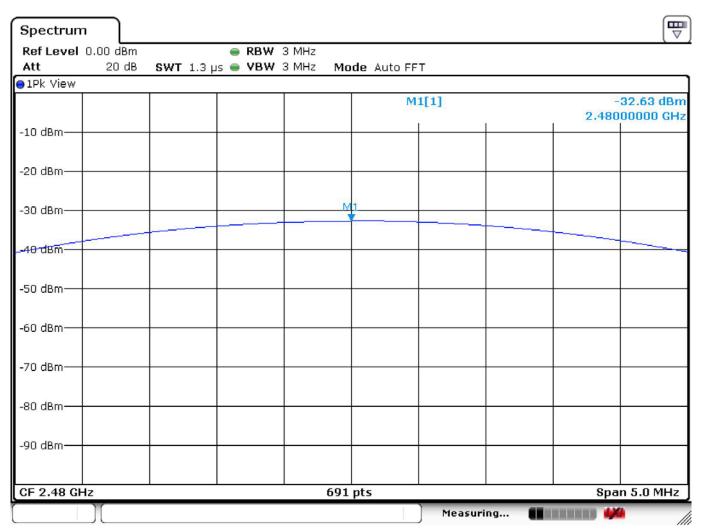


FCC Test Report Page 80 of 110



FCC Test Report Page 81 of 110

Channel: 78 Test Mode : BT (1 Mbps)



FCC Test Report Page 82 of 110

9 100kHz Bandwidth of Band Edges

9.1 Test Instruments

Refer to Sec. 1.2 Test Instruments.

9.2 Test Arrangement and Procedure



1. Remove the antenna from the transmitter and connected it to a spectrum analyzer through a low loss RF cable (connect an attenuator, if it's necessary).

Report No.: HA150773-RA

- 2. The RBW is set to 100 kHz and VBW is set to 100 kHz. Sweep set to Auto. Span set to 100MHz.
- 3. Max Hold, Mark Peak and record max level.
- 4. Keep the same instrument setting, perform the hopping function.
- 5. Max Hold. Mark Peak and record max level.

9.3 Limit (§ 15.247(d))

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)).

9.4 Test Result

Compliance.

The final test data are shown on the following page(s).

Since the fix channel mode is the worst case, test graphics of the hopping mode were not recorded in this report.

FCC Test Report Page 83 of 110

Report No.: HA150773-RA Bluetooth (1Mbps) Channel: <u>00</u> (non-hopping mode) **Measured Result** Result Limit Max Peak Highest Freq. at **Max Peak Power at** Lower **Power** Lower Band edge Lower Band edge (dB) (dB) Channel (MHz) (MHz) (dBm) (dBm) 2401.97 2374.33 -42.82-88.53 45.71 20 Bluetooth EDR (2Mbps) Channel: 00 (non-hopping mode) **Measured Result** Max Peak Highest Freq. at **Max Peak Power at** Result Limit Lower **Power** Lower Band edge Lower Band edge (dB) (dB) Channel (MHz) (dBm) (MHz) (dBm) 2401.97 -44.75 -88.35 2367.24 43.6 20 Bluetooth EDR (3Mbps) Channel: <u>00</u> (non-hopping mode) **Measured Result** Max Peak Highest Freq. at Max Peak Power at Result Limit Lower (dB) (dB) **Power** Lower Band edge Lower Band edge Channel (MHz) (dBm) (MHz) (dBm) 2401.82 -43.10 2373.89 -88.07 44.97 20

Bluetooth (1Mbps) Channel: <u>00</u> (hopping mode)						
Measured Result						
Lower Channel (MHz)	Max Peak Power (dBm)	Highest Freq. at Lower Band edge (MHz)	Max Peak Power at Lower Band edge (dBm)	Result (dB)	Limit (dB)	
2409.93	-34.68	2396.32	-78.79	44.11	20	
Bluetooth EDR (2Mbps) Channel: <u>00</u> (hopping mode)						
Measured Result						
Lower	Max Peak	Highest Freq. at	Max Peak Power at	Result	Limit	
	Power	Lower Band edge	Lower Band edge	(dB)	(dB)	
Channel (MHz)	(dBm)	(MHz)	(dBm)			
0.407.00						
2407.03	-39.91	2396.10	-78.43	38.52	20	
	-39.91 (3Mbps) Channe l			38.52	20	
	(3Mbps) Channel			38.52	20	
Bluetooth EDR	(3Mbps) Channel	: <u>00</u> (hopping mo		38.52	20 Limit	
Bluetooth EDR	(3Mbps) Channel Measure	: <u>00</u> (hopping mo	ode)			
Bluetooth EDR	(3Mbps) Channel Measure Max Peak	: <u>00</u> (hopping mode d Result Highest Freq. at	ode) Max Peak Power at	Result	Limit	

Remark: Result (dB) = Max Peak Power - Max Peak power at lower band edge. When Result > Limit, it's a pass.

FCC Test Report Page 84 of 110

Report No.: HA150773-RA Bluetooth (1Mbps) Channel: <u>78</u> (non-hopping mode) **Measured Result** Result Limit Max Peak Highest Freq. at **Max Peak Power at** Upper **Power** Lower Band edge Lower Band edge (dB) (dB) Channel (MHz) (MHz) (dBm) (dBm) 2480.03 -35.13 -78.28 2508.38 43.15 20 Bluetooth EDR (2Mbps) Channel: 78 (non-hopping mode) **Measured Result** Max Peak Highest Freq. at **Max Peak Power at** Result Limit Upper **Power** Lower Band edge Lower Band edge (dB) (dB) Channel (MHz) (dBm) (MHz) (dBm) 2480.03 -78.03 41.51 -36.52 2532.26 20 Bluetooth EDR (3Mbps) Channel: 78 (non-hopping mode) **Measured Result** Max Peak Highest Freq. at Max Peak Power at Result Limit Upper (dB) (dB) **Power** Lower Band edge Lower Band edge Channel (MHz) (dBm) (MHz) (dBm) 41.01 2480.03 -37.90 2484.82 -78.91 20

Bluetooth (1Mbps) Channel: 78 (hopping mode)						
Measured Result						
Upper Channel (MHz)	Max Peak Power	Highest Freq. at Lower Band edge	Max Peak Power at Lower Band edge	Result (dB)	Limit (dB)	
Chamie (Willz)	(dBm)	(MHz)	(dBm)			
2473.02	-31.85	2583.18	-76.81	44.96	20	
Bluetooth EDR (2Mbps) Channel: 78 (hopping mode)						
Measured Result						
Upper Channel (MHz)	Max Peak	Highest Freq. at	Max Peak Power at	Result	Limit	
	Power	Lower Band edge	Lower Band edge	(dB)	(dB)	
	(dBm)	(MHz)	(dBm)			
2472.07		'				
2472.07	-34.96	2492.76	-77.51	42.55	20	
		2492.76 : <u>78</u> (hopping mo		42.55	20	
	(3Mbps) Channel			42.55	20	
Bluetooth EDR	(3Mbps) Channel	: <u>78</u> (hopping mo		42.55	20 Limit	
Bluetooth EDR	(3Mbps) Channel Measure	: <u>78</u> (hopping mo	ode)	.=.55		
Bluetooth EDR	(3Mbps) Channel Measure Max Peak	: 78 (hopping mo	ode) Max Peak Power at	Result	Limit	

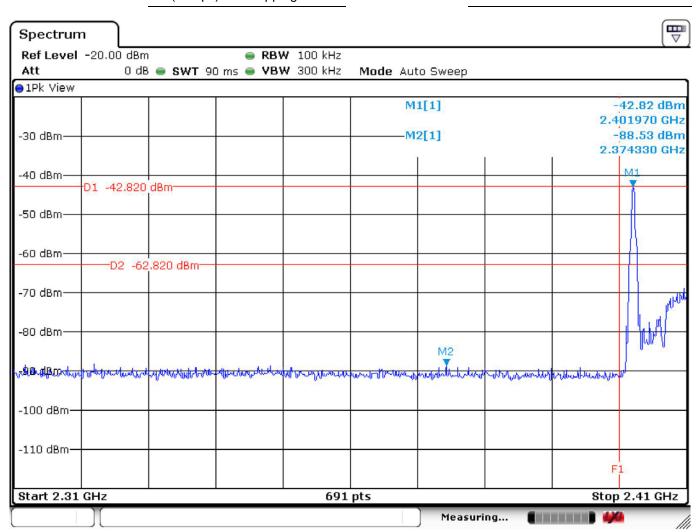
Remark: Result (dB) = Max Peak Power - Max Peak power at lower band edge. When Result > Limit, it's a pass.

FCC Test Report Page 85 of 110

Temperature : 28.1° C Humidity : 35%

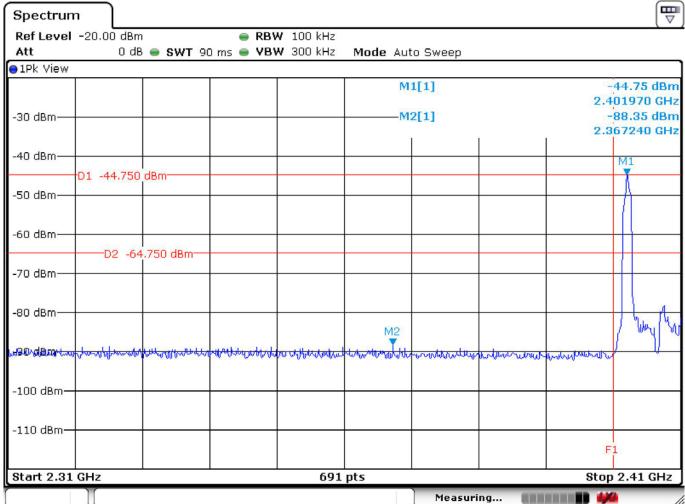
Test Date : 07-Sep-2015 Tested by : Eason Hsieh

Test Mode : BT (1Mbps) non-hopping mode Channel : 2402



FCC Test Report Page 86 of 110

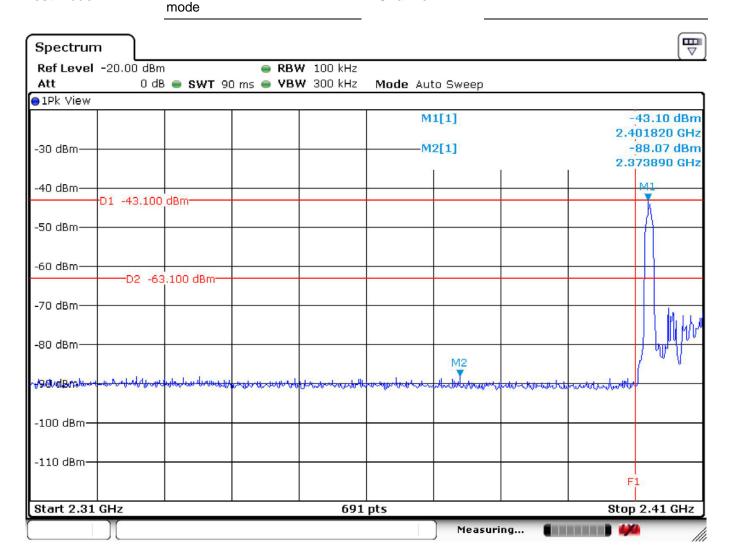
Test Mode : BT EDR (2Mbps) non-hopping channel : Mode Channel : Mode Channel : Mode Channel : Mode Mode Auto Sweep



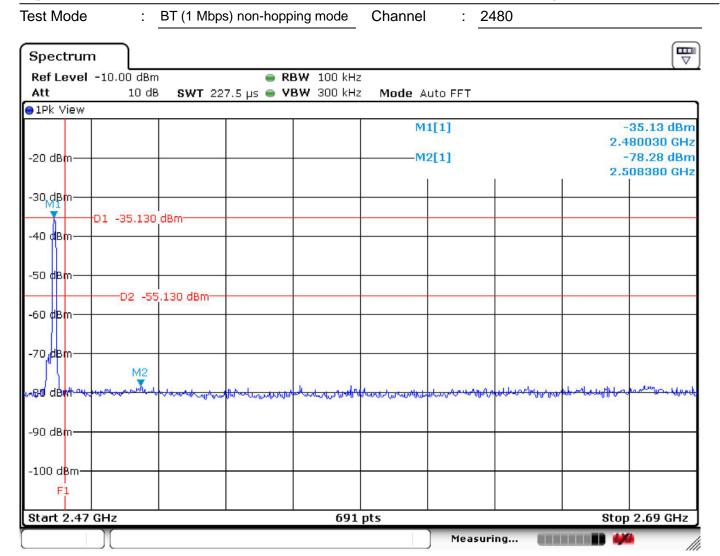
FCC Test Report Page 87 of 110

(Bard

Test Mode : EDR (3Mbps) non-hopping 2402 : Channel :



FCC Test Report Page 88 of 110



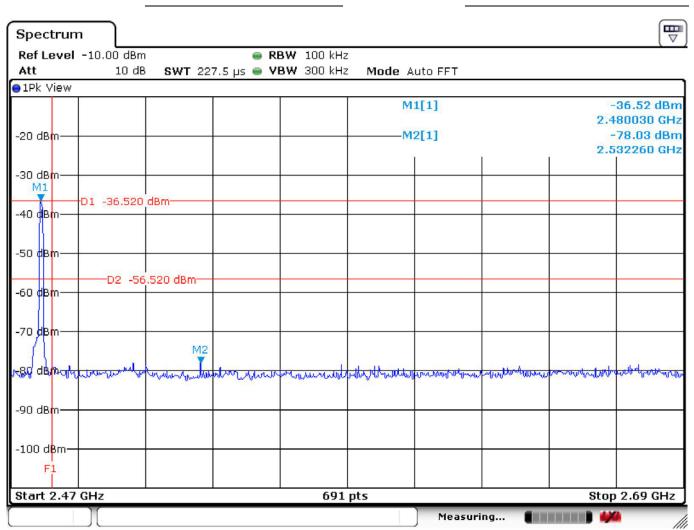
FCC Test Report Page 89 of 110

Test Mode

BT EDR (2 Mbps) non-hopping 2480

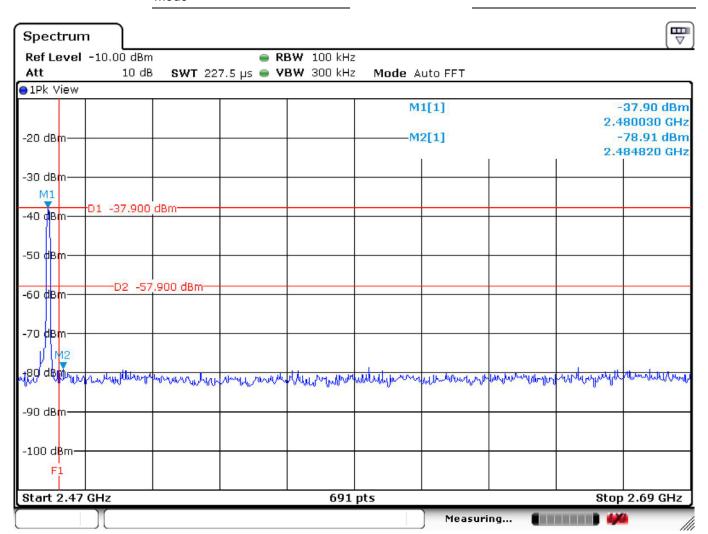
mode

Channel :



FCC Test Report Page 90 of 110

Test Mode BT EDR (3 Mbps) non-hopping 2480 : Channel :



FCC Test Report Page 91 of 110

10 Spurious RF Conducted Emissions

10.1 Test Instruments

Refer to Sec. 1.2 Test Instruments.

10.2 Test Arrangement and Procedure



1. Remove the antenna from the transmitter and connected it to a spectrum analyzer through a low loss RF cable (connect an attenuator, if it's necessary).

Report No.: HA150773-RA

2. Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic.

- 3. Typically, several plots are required to cover this entire span.
- 4. RBW = 100 kHz; VBW ≥ RBW; Sweep = auto
- 5. Detector function = peak; Trace = max hold; Allow the trace to stabilize.
- 6. Set the marker on the peak of any spurious emission recorded.
- 7. The level displayed must comply with the limit specified in this Section.
- 8. Submit these plots.

10.3 Limit (§ 15.247(d))

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)).

10.4 Test Result

Compliance.

The final test data are shown on the following page(s).

Since the fix channel mode is the worst case, data of the hopping mode were not recorded in this report.

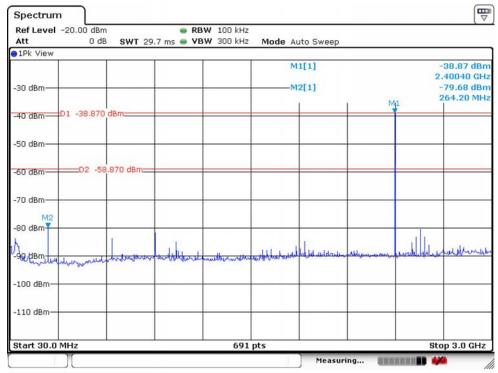
FCC Test Report Page 92 of 110

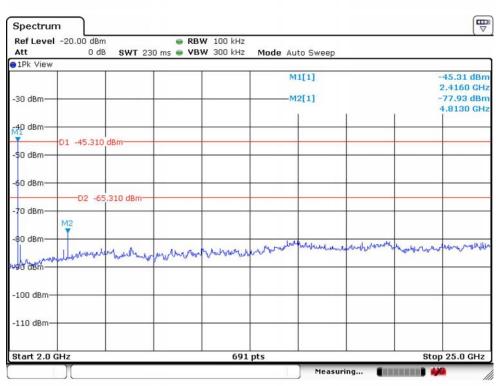


Bluetooth (1Mbps) Channel: <u>00</u>						
Measured Result						
	Max Peak	Highest Freq. at	Max Peak Power at	Result	Limit	
(GHz)	Power	spurious emissions	spurious emissions	(dB)	(dB)	
	(dBm)	(GHz)	(dBm)			
2.40040	-38.87	0.2642	-79.68	40.81	20	
2.4160	-45.31	4.813	-77.93	32.62	20	

Remark: Result (dB) = Max Peak Power – Max Peak power at spurious emissions.

When Result > Limit, it's a pass.





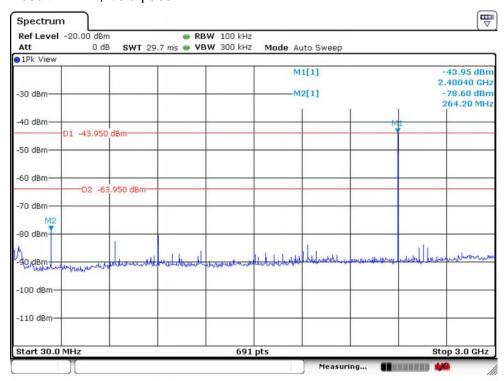
FCC Test Report Page 93 of 110

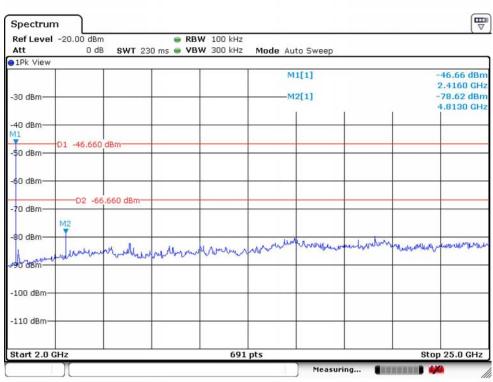


Bluetooth (1Mbps) Channel: 39						
Measured Result						
	Max Peak	Highest Freq. at	Max Peak Power at	Result	Limit	
(GHz)	Power	spurious emissions	spurious emissions	(dB)	(dB)	
	(dBm)	(GHz)	(dBm)			
2.40040	-43.95	0.2642	-78.60	34.65	20	
2.4160	-46.66	4.8130	-78.62	31.96	20	

Remark: Result (dB) = Max Peak Power – Max Peak power at spurious emissions.

When Result > Limit, it's a pass.



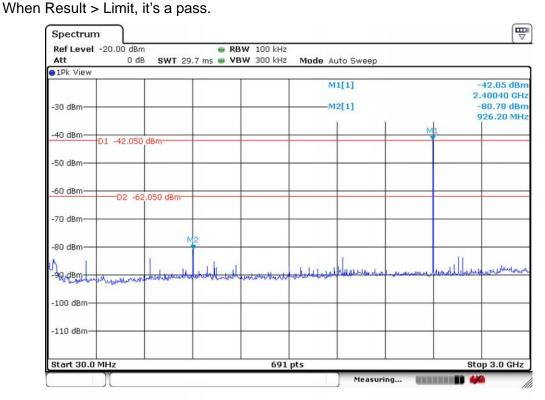


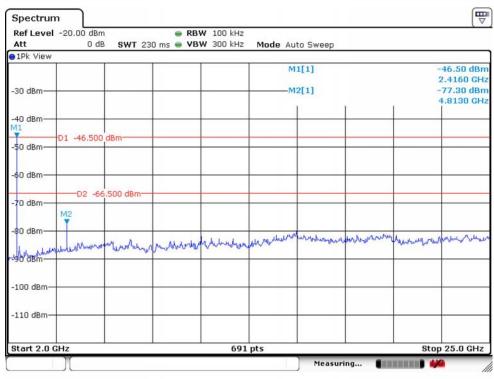
FCC Test Report Page 94 of 110



Bluetooth (1Mbps) Channel: 78					
Measured Result					
	Max Peak	Highest Freq. at	Max Peak Power at	Result	Limit
(GHz)	Power	spurious emissions	spurious emissions	(dB)	(dB)
	(dBm)	(GHz)	(dBm)		
2.40040	-42.05	0.9262	-80.78	38.73	20
2.4160	-46.50	4.8130	-77.30	30.8	20

Remark: Result (dB) = Max Peak Power – Max Peak power at spurious emissions.





FCC Test Report Page 95 of 110

11 Antenna requirement

11.1 Limit (§ 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. The use of a permanently attached antenna or of an antenna that uses a uniue coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of § 15.211, § 15.213, § 15.217, § 15.219, or § 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with § 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

Report No.: HA150773-RA

11.2 Test Result

Compliance.

The EUT applies a Chip Ceramic antenna.

FCC Test Report Page 96 of 110

12 Information about the FHSS characteristics

12.1 Pseudorandom Frequency Hopping Sequence

The channel is represented by a pseudo-random hopping sequence hopping through the 79 RF channels.

Report No.: HA150773-RA

The hopping sequence is unique for the piconet and is determined by the Bluetooth device address of the master; the phase in the hopping sequence is determined by the Bluetooth clock of the master.

The channel is divided into time slots where each slot corresponds to an RF hop frequency. Consecutive hops correspond to different RF hop frequencies. The nominal hop rate is 1600 hops/s.

12.2 Example of a 79 hopping sequence in data mode:

02, 05, 31, 24, 20, 10,43, 36, 30, 23, 40, 06, 21, 50, 44, 09, 71, 78, 01, 13, 73, 07, 70, 72, 35, 62, 42, 11, 41, 08, 16, 29, 60, 15, 34, 61, 58, 04, 67, 12, 22, 53, 57, 18, 27, 76, 39, 32, 17, 77, 52, 33, 56, 46, 37, 47, 64, 49, 45, 38, 69, 14, 51, 26, 79, 19, 28, 65, 75, 54, 48, 03, 25, 66, 05, 16, 68, 74, 59, 63, 55

12.3 Equal Hopping Frequency Use

Due to each the GFSK of modulation of hopping frequency will be transmitted in accordance to the frequency tables described above, there is no any frequency will be able to hop more times than other. Therefore each frequency will be used equally.

-----End Of Test Report-----

FCC Test Report Page 97 of 110