
8.5. AVERAGE TIME OF OCCUPANCY

LIMITS

FCC §15.247 (a) (1) (iii)

RSS-247 (5.1) (d)

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.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

The average time of occupancy in the specified 3.16 second period (79 channels * 0.4 s) is equal to $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{pulse width}$.

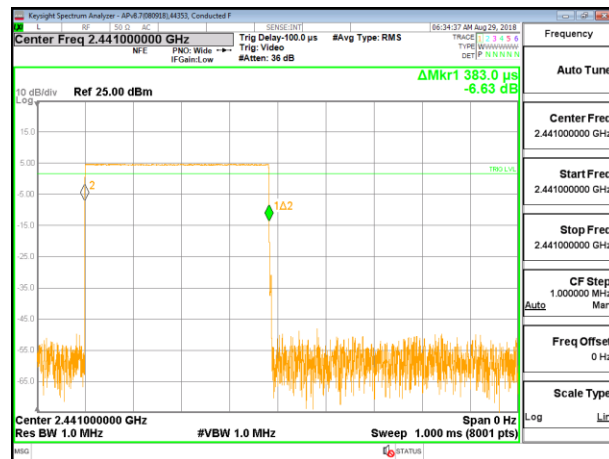
For AFH mode, the average time of occupancy in the specified 8 second period (20 channels * 0.4 seconds) is equal to $10 * (\# \text{ of pulses in } 0.8 \text{ s}) * \text{pulse width}$.

RESULTS

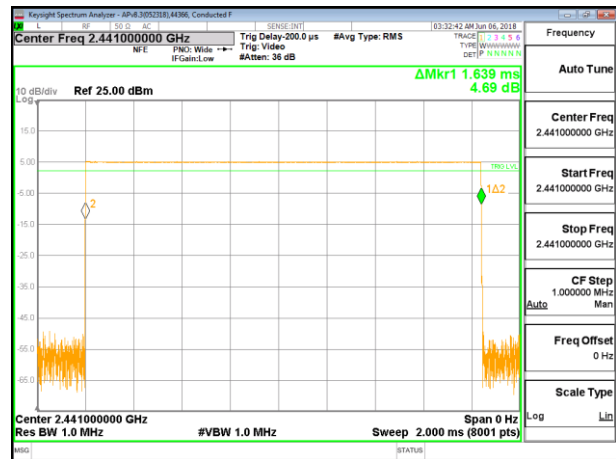
8.5.1. HIGH POWER BASIC DATA RATE GFSK MODULATION

Antenna 2

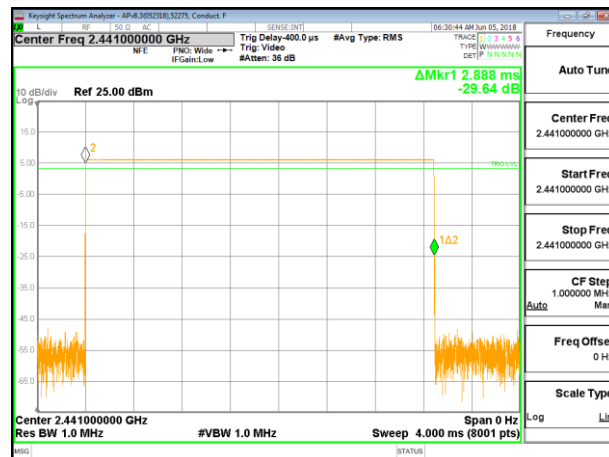
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK Normal Mode					
DH1	0.383	32	0.1226	0.4	-0.2774
DH3	1.639	18	0.2950	0.4	-0.1050
DH5	2.888	9	0.2599	0.4	-0.1401
DH Packet	Pulse Width (sec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK AFH Mode					
DH1	0.383	8	0.03064	0.4	-0.3694
DH3	1.639	4.5	0.07376	0.4	-0.3262
DH5	2.888	2.25	0.06498	0.4	-0.3350



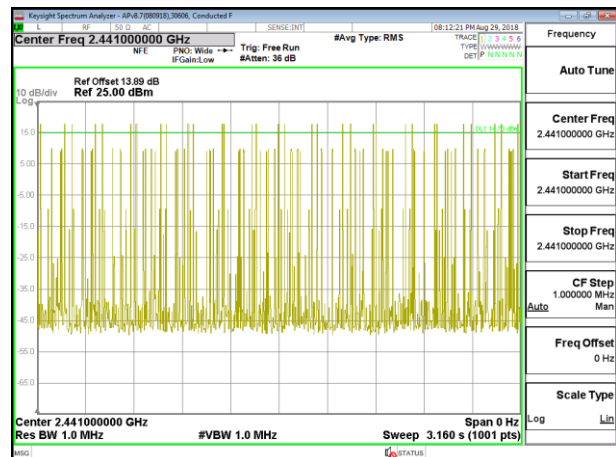
PULSE WIDTH – DH1



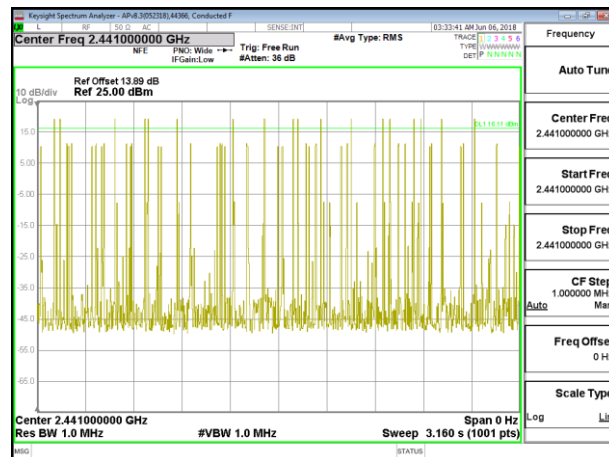
PULSE WIDTH – DH3



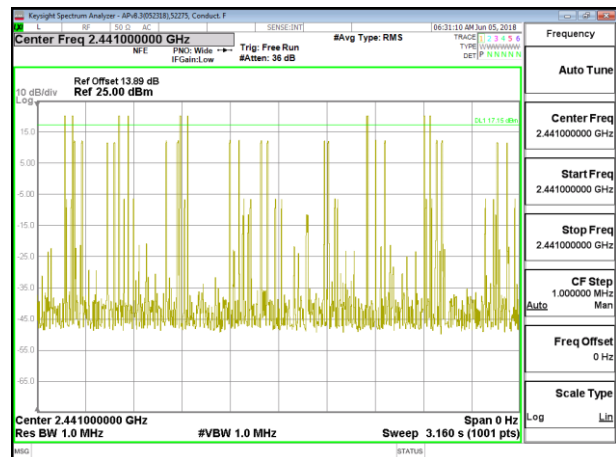
PULSE WIDTH – DH5



**NUMBER OF PULSES IN 3.16 SECOND
OBSERVATION PERIOD – DH1**



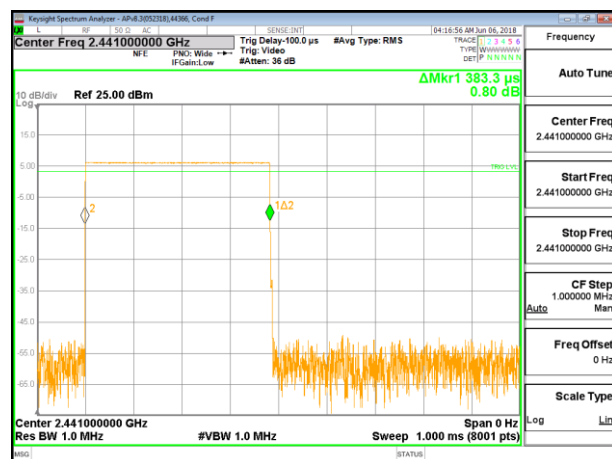
**NUMBER OF PULSES IN 3.16 SECOND
OBSERVATION PERIOD – DH3**



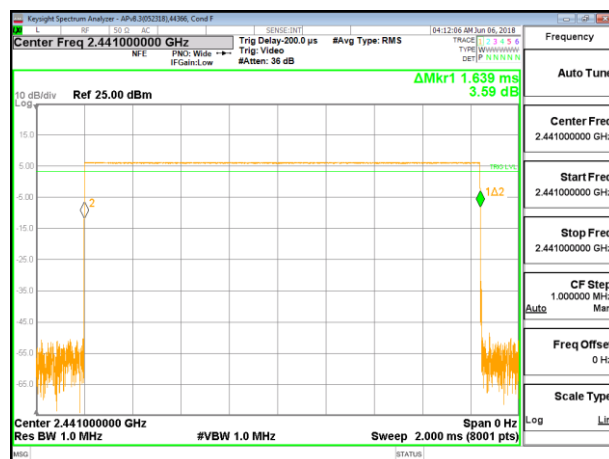
**NUMBER OF PULSES IN 3.16 SECOND
OBSERVATION PERIOD – DH5**

Antenna 5

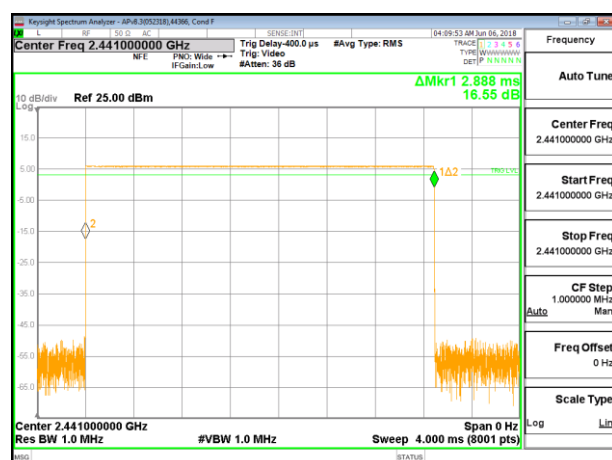
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK Normal Mode					
DH1	0.3833	32	0.1227	0.4	-0.2773
DH3	1.639	15	0.2459	0.4	-0.1542
DH5	2.888	9	0.2599	0.4	-0.1401
DH Packet	Pulse Width (sec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK AFH Mode					
DH1	0.3833	8	0.03066	0.4	-0.3693
DH3	1.639	3.75	0.06146	0.4	-0.3385
DH5	2.888	2.25	0.06498	0.4	-0.3350



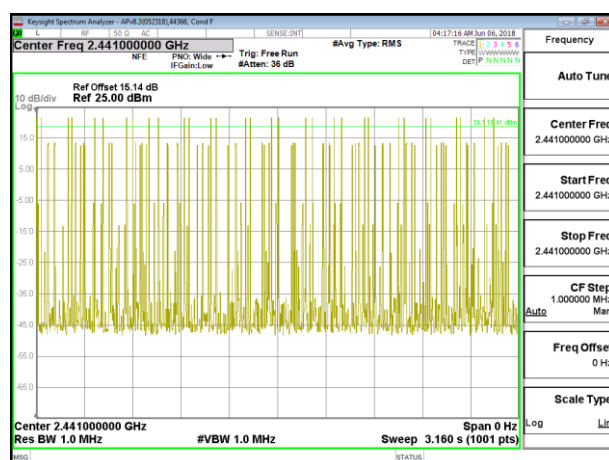
PULSE WIDTH – DH1



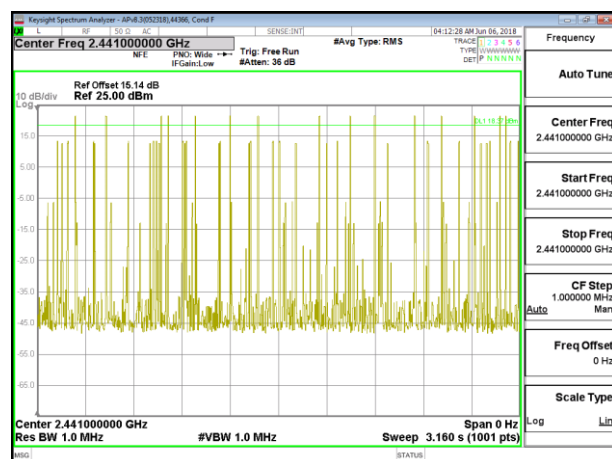
PULSE WIDTH – DH3



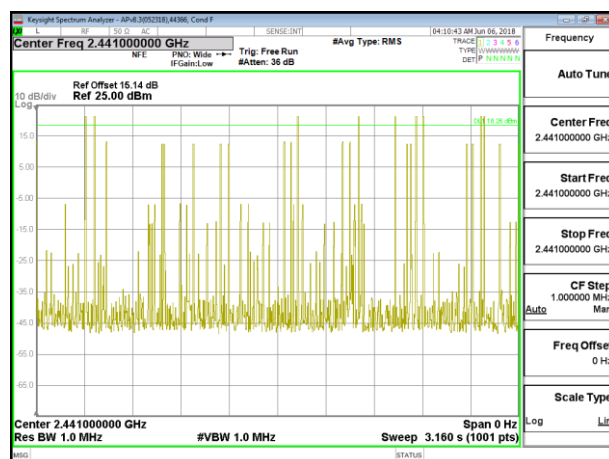
PULSE WIDTH – DH5



**NUMBER OF PULSES IN 3.16 SECOND
OBSERVATION PERIOD – DH1**



**NUMBER OF PULSES IN 3.16 SECOND
OBSERVATION PERIOD – DH3**



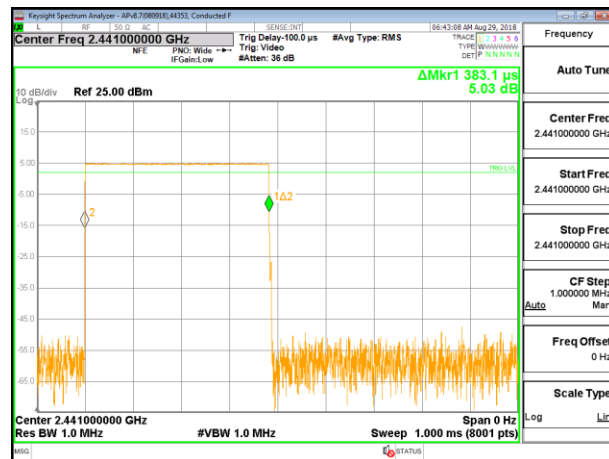
**NUMBER OF PULSES IN 3.16 SECOND
OBSERVATION PERIOD – DH5**

8.5.2. HIGH POWER ENCHANCED DATA RATE 8PSK MODULATION

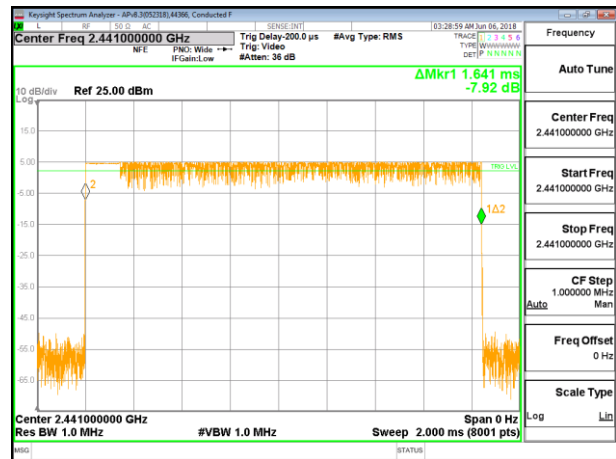
Antenna 2

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
8PSK Normal Mode					
3DH1	0.3831	31	0.1188	0.4	-0.2812
3DH3	1.641	20	0.3282	0.4	-0.0718
3DH5	2.892	10	0.2892	0.4	-0.1108

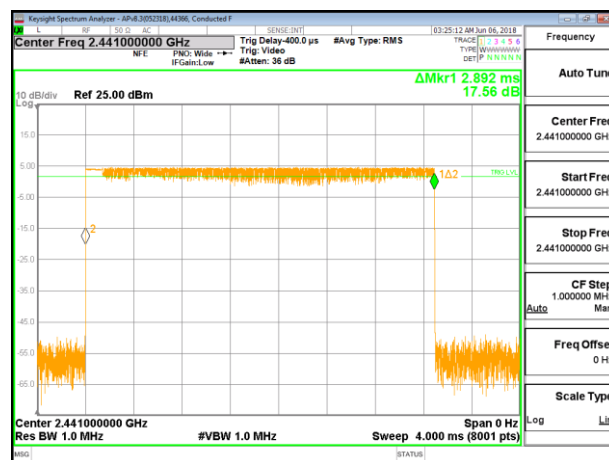
Note: for AFH(8PSK) mode, please refer to the results of AFH(GFSK) mode; the channel selection and hopping rate are the same for both EDR and Basic Rate operation, data for Basic Rate in section 8.5.1 demonstrates compliance with channel occupancy when AFH is employed.



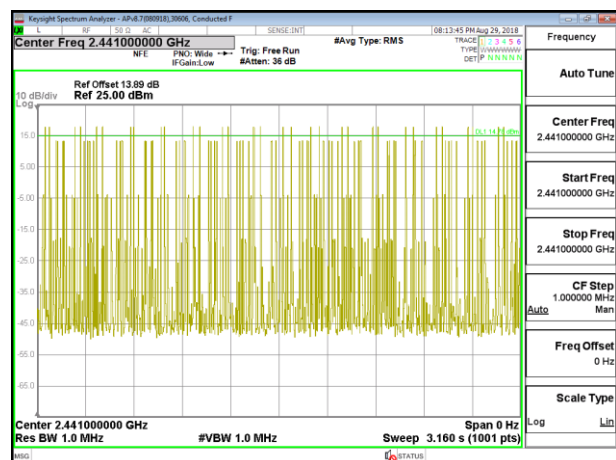
PULSE WIDTH – 3DH1



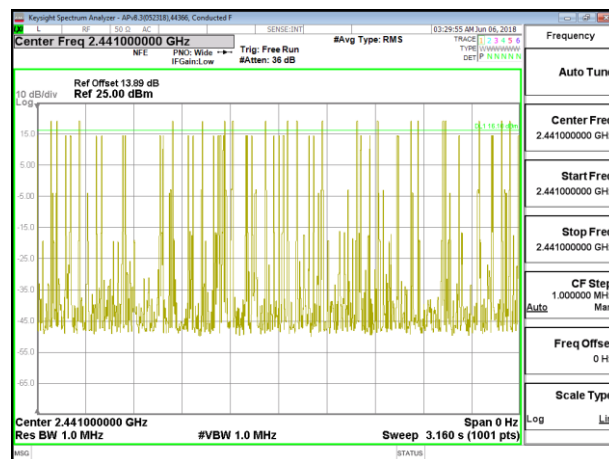
PULSE WIDTH – 3DH3



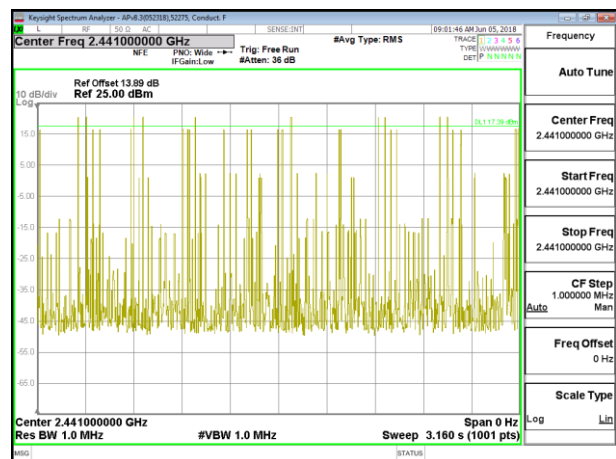
PULSE WIDTH – 3DH5



NUMBER OF PULSES IN 3.16 SECOND
OBSERVATION PERIOD – 3DH1



NUMBER OF PULSES IN 3.16 SECOND
OBSERVATION PERIOD – 3DH3

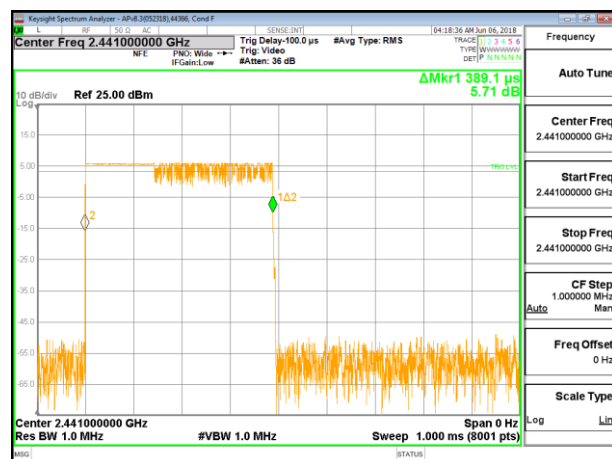


NUMBER OF PULSES IN 3.16 SECOND
OBSERVATION PERIOD – 3DH5

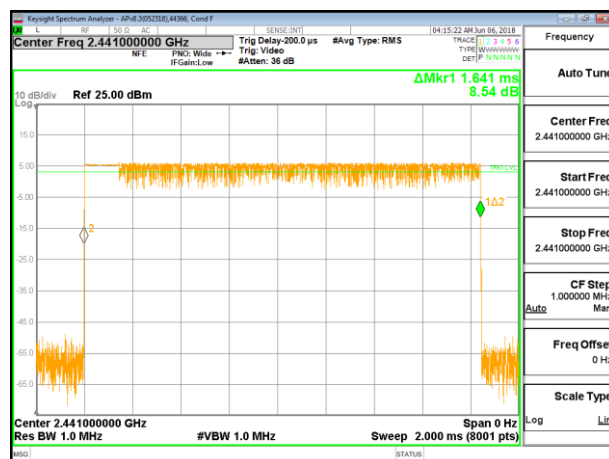
Antenna 5

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
8PSK Normal Mode					
3DH1	0.3891	32	0.1245	0.4	-0.2755
3DH3	1.641	17	0.2790	0.4	-0.1210
3DH5	2.888	10	0.2888	0.4	-0.1112

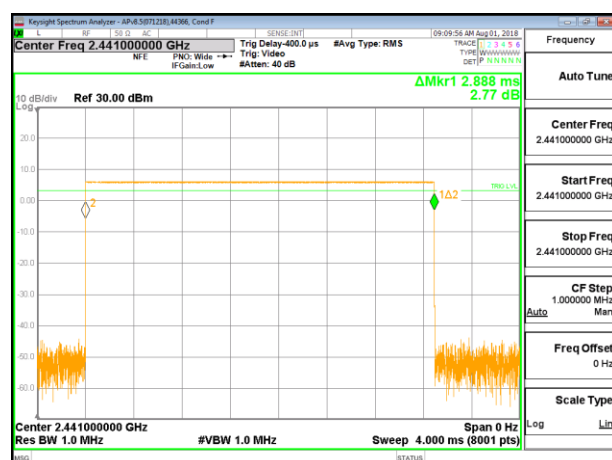
Note: for AFH(8PSK) mode, please refer to the results of AFH(GFSK) mode; the channel selection and hopping rate are the same for both EDR and Basic Rate operation, data for Basic Rate in section 8.5.1 demonstrates compliance with channel occupancy when AFH is employed.



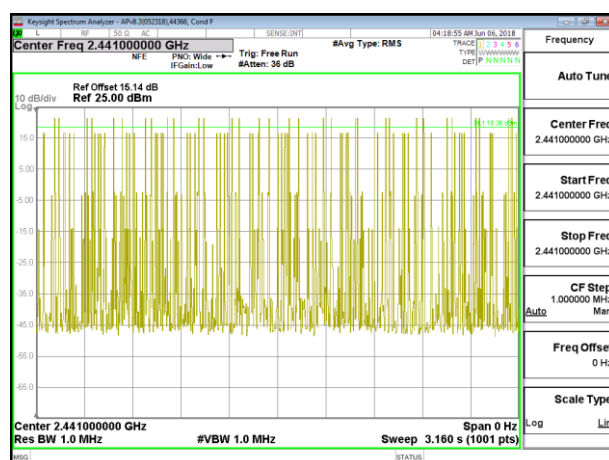
PULSE WIDTH – 3DH1



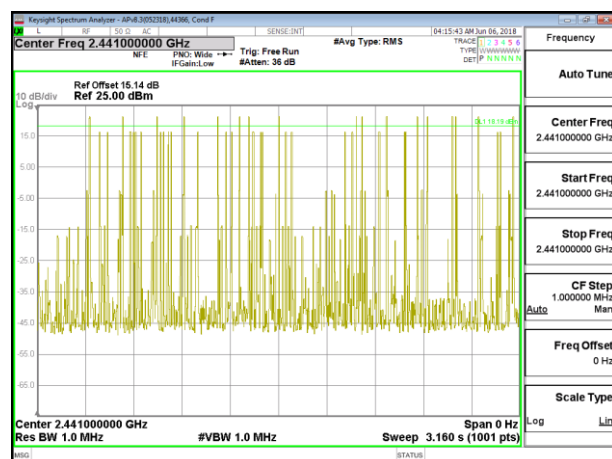
PULSE WIDTH – 3DH3



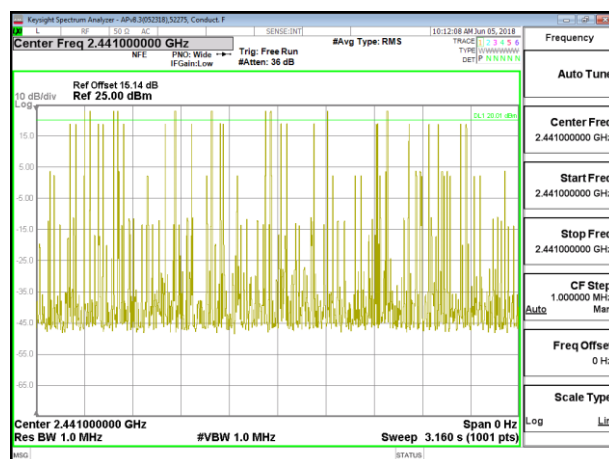
PULSE WIDTH – 3DH5



**NUMBER OF PULSES IN 3.16 SECOND
OBSERVATION PERIOD – 3DH1**



**NUMBER OF PULSES IN 3.16 SECOND
OBSERVATION PERIOD – 3DH3**

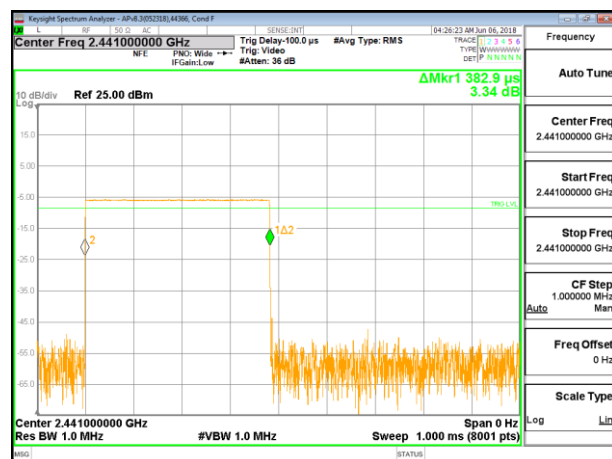


**NUMBER OF PULSES IN 3.16 SECOND
OBSERVATION PERIOD – 3DH5**

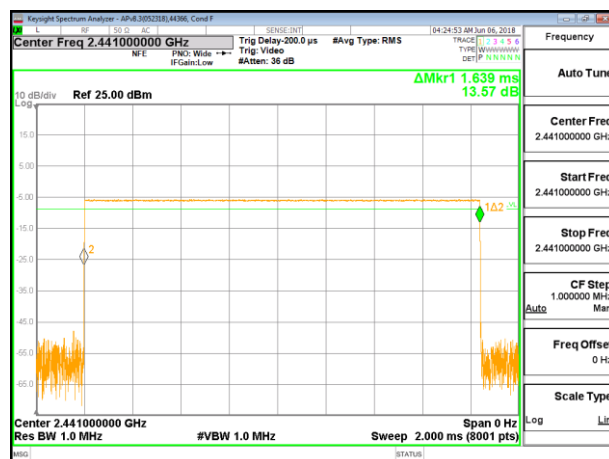
8.5.3. LOW POWER BASIC DATA RATE GFSK MODULATION

Antenna 2

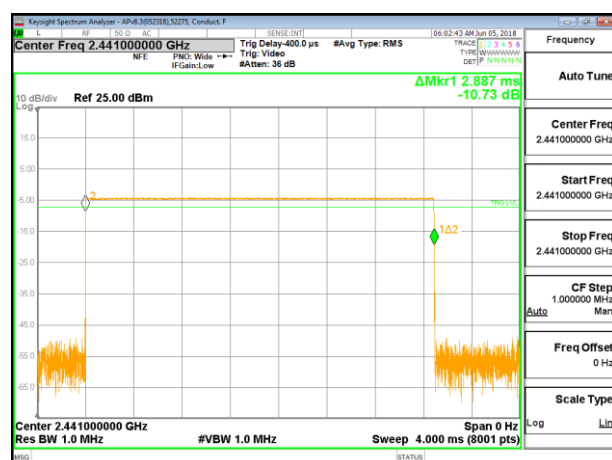
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK Normal Mode					
DH1	0.3829	32	0.1225	0.4	-0.2775
DH3	1.639	18	0.2950	0.4	-0.1050
DH5	2.887	13	0.3753	0.4	-0.0247
DH Packet	Pulse Width (sec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK AFH Mode					
DH1	0.3829	8	0.0306	0.4	-0.3694
DH3	1.639	4.5	0.0738	0.4	-0.3262
DH5	2.887	3.25	0.0938	0.4	-0.3062



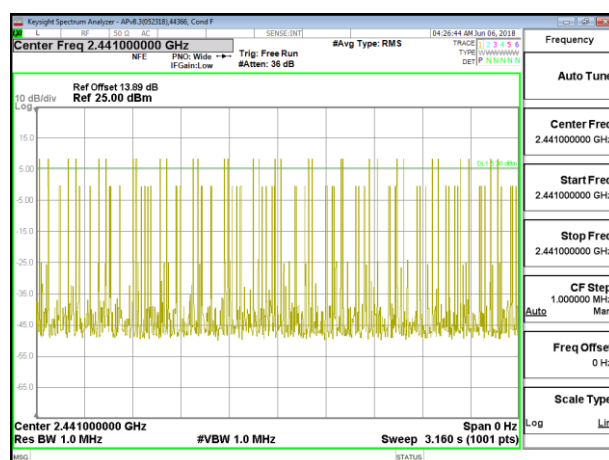
PULSE WIDTH – DH1



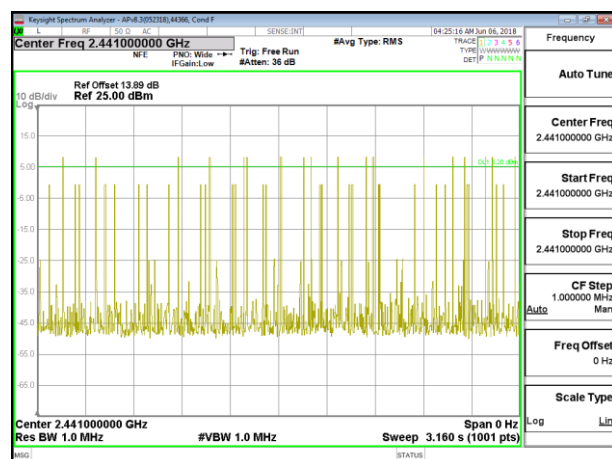
PULSE WIDTH – DH3



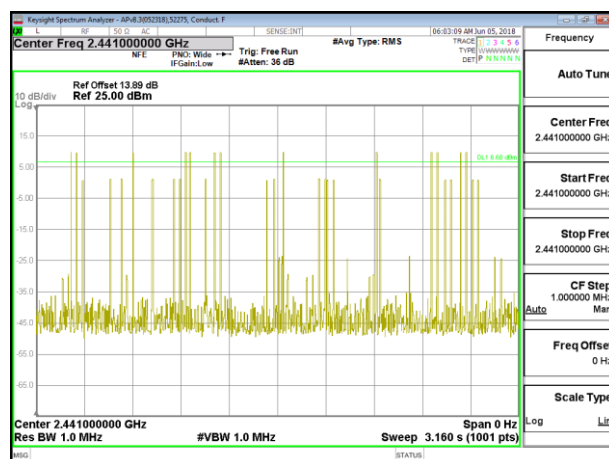
PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND
OBSERVATION PERIOD – DH1



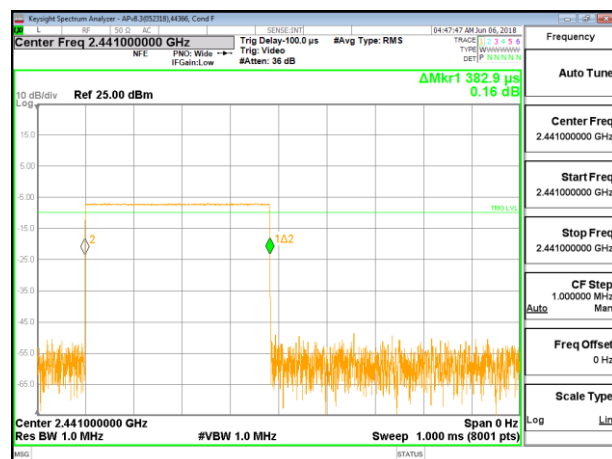
NUMBER OF PULSES IN 3.16 SECOND
OBSERVATION PERIOD – DH3



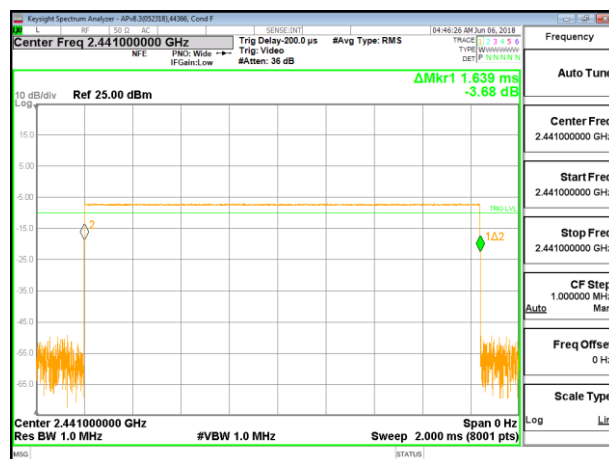
NUMBER OF PULSES IN 3.16 SECOND
OBSERVATION PERIOD – DH5

Antenna 5

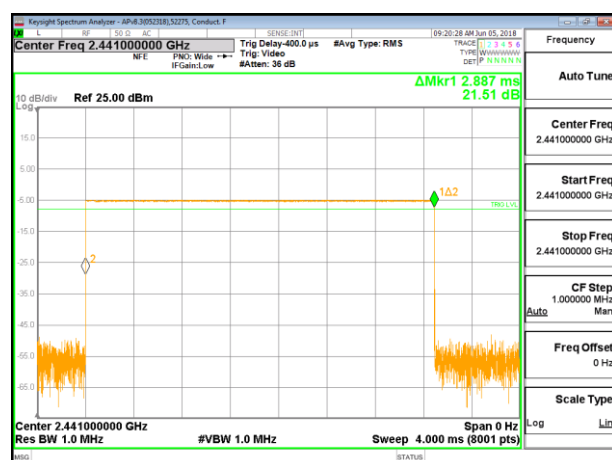
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK Normal Mode					
DH1	0.3829	31	0.1187	0.4	-0.2813
DH3	1.639	15	0.2459	0.4	-0.1542
DH5	2.887	10	0.2887	0.4	-0.1113
DH Packet	Pulse Width (sec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK AFH Mode					
DH1	0.3829	7.75	0.02967	0.4	-0.3703
DH3	1.639	3.75	0.06146	0.4	-0.3385
DH5	2.887	2.5	0.07218	0.4	-0.3278



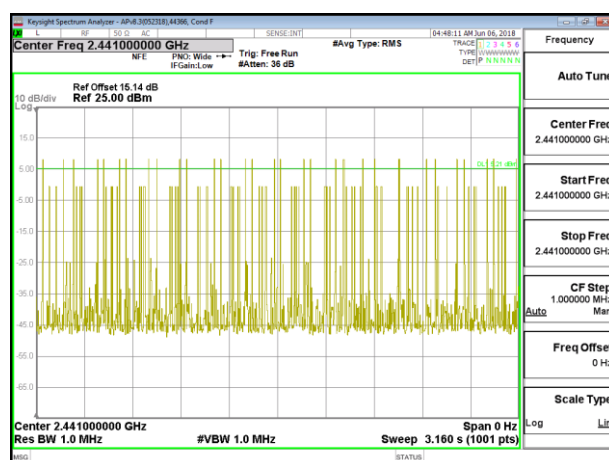
PULSE WIDTH – DH1



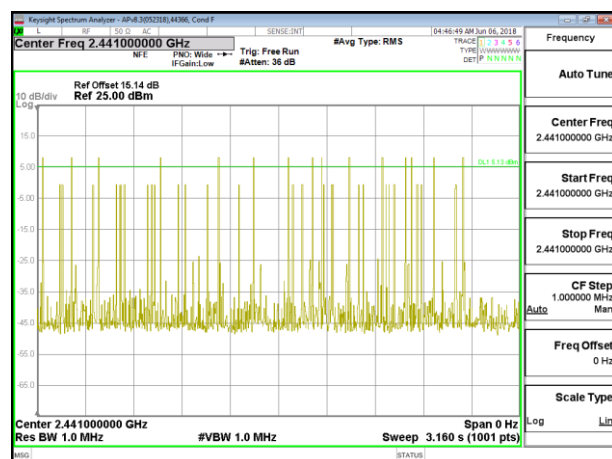
PULSE WIDTH – DH3



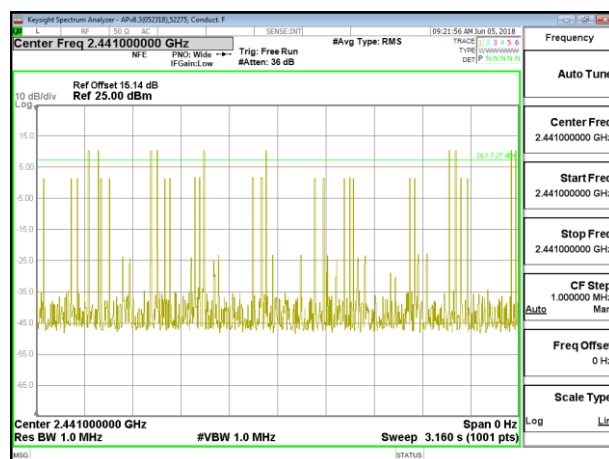
PULSE WIDTH – DH5



**NUMBER OF PULSES IN 3.16 SECOND
OBSERVATION PERIOD – DH1**



**NUMBER OF PULSES IN 3.16 SECOND
OBSERVATION PERIOD – DH3**



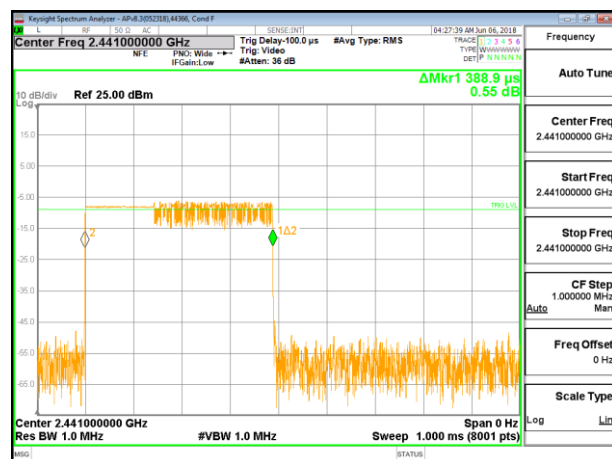
**NUMBER OF PULSES IN 3.16 SECOND
OBSERVATION PERIOD – DH5**

8.5.4. LOW POWER ENHANCED DATA RATE 8PSK MODULATION

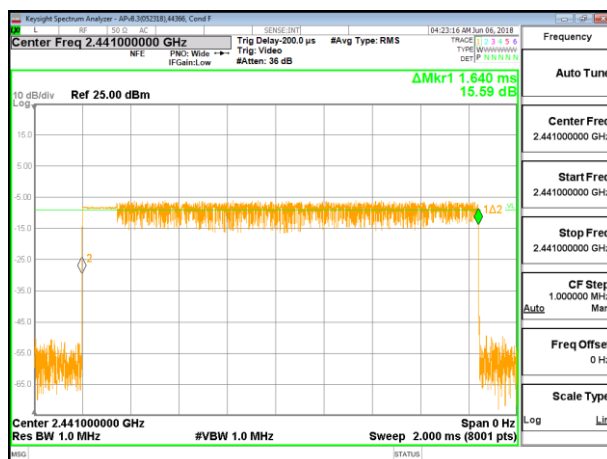
Antenna 2

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
8PSK Normal Mode					
3DH1	0.3889	32	0.1244	0.4	-0.2756
3DH3	1.64	16	0.2624	0.4	-0.1376
3DH5	2.891	9	0.26019	0.4	-0.1398

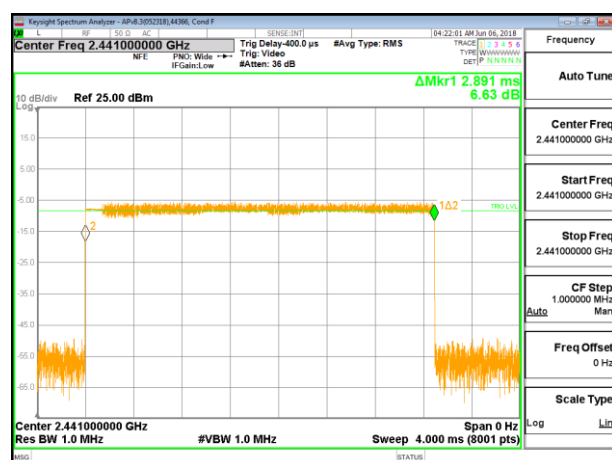
Note: for AFH(8PSK) mode, please refer to the results of AFH(GFSK) mode; the channel selection and hopping rate are the same for both EDR and Basic Rate operation, data for Basic Rate in section 8.5.3 demonstrates compliance with channel occupancy when AFH is employed.



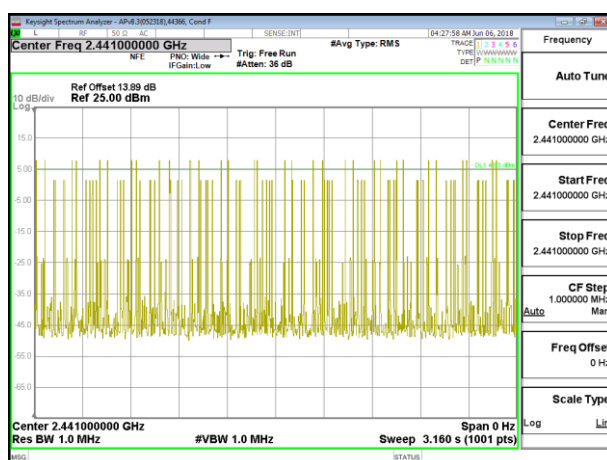
PULSE WIDTH – 3DH1



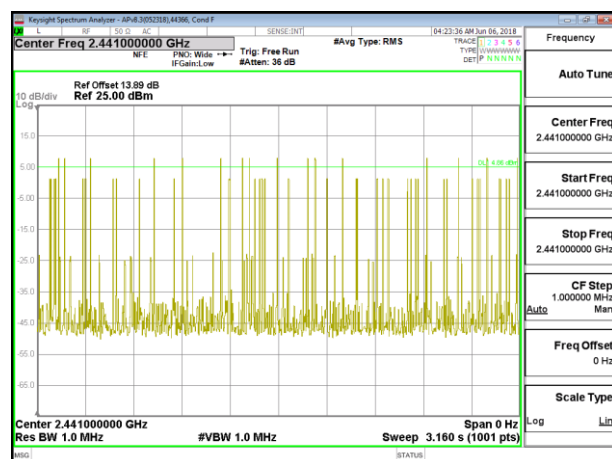
PULSE WIDTH – 3DH3



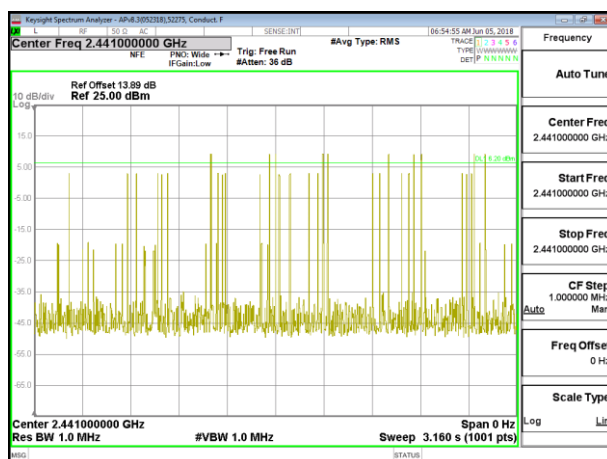
PULSE WIDTH – 3DH5



**NUMBER OF PULSES IN 3.16 SECOND
OBSERVATION PERIOD – 3DH1**



**NUMBER OF PULSES IN 3.16 SECOND
OBSERVATION PERIOD – 3DH3**

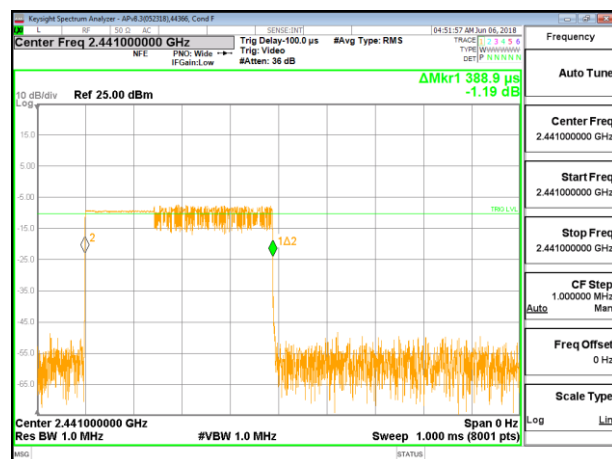


**NUMBER OF PULSES IN 3.16 SECOND
OBSERVATION PERIOD – 3DH5**

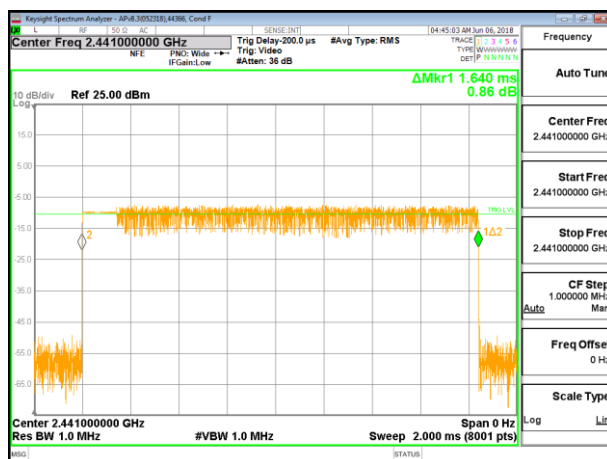
Antenna 5

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
8PSK Normal Mode					
DH1	0.3889	32	0.1244	0.4	-0.2756
DH3	1.640	18	0.2952	0.4	-0.1048
DH5	2.891	11	0.31801	0.4	-0.0820

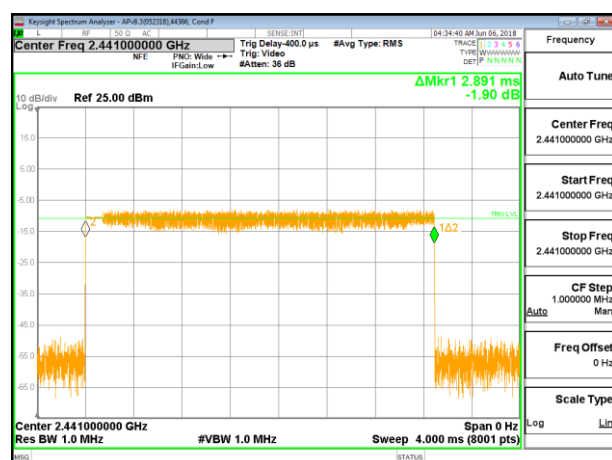
Note: for AFH(8PSK) mode, please refer to the results of AFH(GFSK) mode; the channel selection and hopping rate are the same for both EDR and Basic Rate operation, data for Basic Rate in section 8.5.3 demonstrates compliance with channel occupancy when AFH is employed.



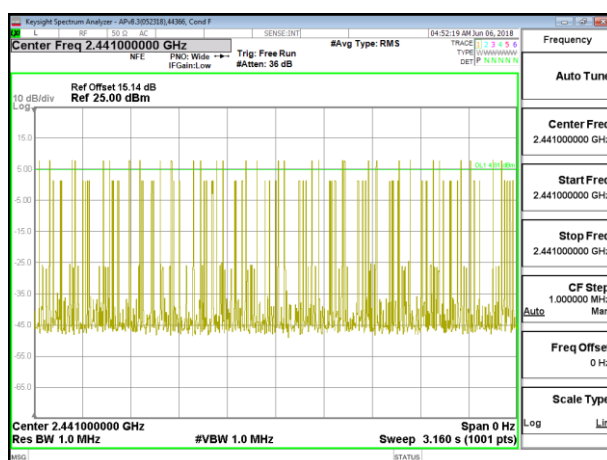
PULSE WIDTH – 3DH1



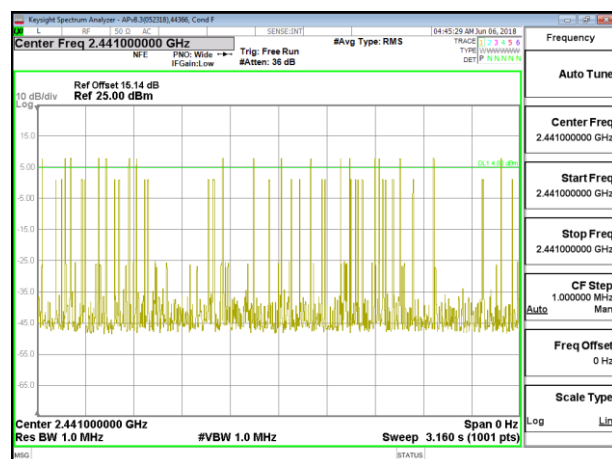
PULSE WIDTH – 3DH3



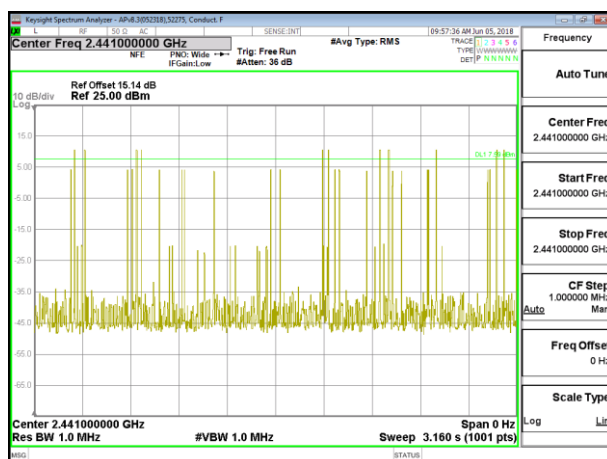
PULSE WIDTH – 3DH5



NUMBER OF PULSES IN 3.16 SECOND
OBSERVATION PERIOD – 3DH1



NUMBER OF PULSES IN 3.16 SECOND
OBSERVATION PERIOD – 3DH3



NUMBER OF PULSES IN 3.16 SECOND
OBSERVATION PERIOD – 3DH5

8.6. OUTPUT POWER

LIMITS

§15.247 (b) (1)

RSS-247 (5.4) (b)

The maximum antenna gain is less than 6 dBi, therefore the limit is 30 dBm. Alternatively, 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.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.5 dB (including 10 dB pad and 0.5 dB cable) was entered as an offset in the power meter to allow for a gated peak reading of power.

RESULTS

8.6.1. HIGH POWER BASIC DATA RATE GFSK MODULATION

Antenna 2

Tested By:	44366
Date:	7/27/2018

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	20.31	30	-9.69
Middle	2441	20.39	30	-9.61
High	2480	20.28	30	-9.72

Antenna 5

Tested By:	44366
Date:	7/27/2018

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	20.29	30	-9.71
Middle	2441	20.37	30	-9.63
High	2480	20.26	30	-9.74

8.6.2. HIGH POWER ENCHANCED DATA RATE 8PSK MODULATION

Antenna 2

Tested By:	44366
Date:	7/27/2018

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	19.70	21	-1.3
Middle	2441	19.75	21	-1.25
High	2480	19.63	21	-1.37

Antenna 5

Tested By:	44366
Date:	7/27/2018

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	19.68	21	-1.32
Middle	2441	19.73	21	-1.27
High	2480	19.65	21	-1.35

8.6.3. HIGH POWER ENCHANCED DATA RATE DQPSK MODULATION

Antenna 2

Tested By:	44366
Date:	7/27/2018

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	19.64	21	-1.36
Middle	2441	19.70	21	-1.3
High	2480	19.59	21	-1.41

Antenna 5

Tested By:	44366
Date:	7/27/2018

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	19.61	21	-1.39
Middle	2441	19.67	21	-1.33
High	2480	19.56	21	-1.44

8.6.4. LOW POWER BASIC DATA RATE GFSK MODULATION

Antenna 2

Tested By:	44366
Date:	7/27/2018

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	11.26	30	-18.74
Middle	2441	11.45	30	-18.55
High	2480	11.21	30	-18.79

Antenna 5

Tested By:	44366
Date:	7/27/2018

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	11.22	30	-18.78
Middle	2441	11.35	30	-18.65
High	2480	11.14	30	-18.86

8.6.5. LOW POWER ENHANCED DATA RATE 8PSK MODULATION

Antenna 2

Tested By:	44366
Date:	7/27/2018

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	10.15	21	-10.85
Middle	2441	10.21	21	-10.79
High	2480	10.12	21	-10.88

Antenna 5

Tested By:	44366
Date:	7/27/2018

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	10.14	21	-10.86
Middle	2441	10.18	21	-10.82
High	2480	10.10	21	-10.9

8.6.6. LOW POWER ENCHANCED DATA RATE DQPSK MODULATION

Antenna 2

Tested By:	44366
Date:	7/27/2018

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	10.12	21	-10.88
Middle	2441	10.15	21	-10.85
High	2480	10.09	21	-10.91

Antenna 5

Tested By:	44366
Date:	7/27/2018

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	10.12	21	-10.88
Middle	2441	10.14	21	-10.86
High	2480	10.08	21	-10.92

8.7. AVERAGE POWER

LIMITS

None; for reporting purposes only

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.5 dB (including 10 dB pad and 0.5 dB cable) was entered as an offset in the power meter to allow for a gated average reading of power.

RESULTS

8.7.1. HIGH POWER BASIC DATA RATE GFSK MODULATION

Antenna 2

Tested By:	44366
Date	7/27/2018

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	19.89
Middle	2441	19.94
High	2480	19.87

Antenna 5

Tested By:	44366
Date	7/27/2018

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	19.88
Middle	2441	19.92
High	2480	19.79

8.7.2. HIGH POWER ENCHANCED DATA RATE 8PSK MODULATION

Antenna 2

Tested By:	44366
Date	7/27/2018

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	16.92
Middle	2441	16.95
High	2480	16.88

Antenna 5

Tested By:	44366
Date	7/27/2018

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	16.87
Middle	2441	16.93
High	2480	16.84

8.7.3. HIGH POWER ENCHANCED DATA RATE DQPSK MODULATION

Antenna 2

Tested By:	44366
Date	7/27/2018

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	16.84
Middle	2441	16.92
High	2480	16.80

Antenna 5

Tested By:	44366
Date	7/27/2018

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	16.82
Middle	2441	16.90
High	2480	16.77

8.7.4. LOW POWER BASIC DATA RATE GFSK MODULATION

Antenna 2

Tested By:	44366
Date	7/27/2018

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	10.90
Middle	2441	10.96
High	2480	10.85

Antenna 5

Tested By:	44366
Date	7/27/2018

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	10.89
Middle	2441	10.94
High	2480	10.83

8.7.5. LOW POWER ENCHANCED DATA RATE 8PSK MODULATION

Antenna 2

Tested By:	44366
Date	7/27/2018

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	7.43
Middle	2441	7.48
High	2480	7.40

Antenna 5

Tested By:	44366
Date	7/27/2018

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	7.41
Middle	2441	7.45
High	2480	7.35

8.7.6. LOW POWER ENCHANCED DATA RATE DQPSK MODULATION

Antenna2

Tested By:	4366
Date	7/27/2018

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	7.37
Middle	2441	7.40
High	2480	7.32

Antenna 5

Tested By:	44366
Date	7/27/2018

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	7.35
Middle	2441	7.38
High	2480	7.31