

Graphs

Keysight Spectrum Analyzer - Setup 3a

Center Freq 2.395000000 GHz

Ref Offset 19.5 dB
Ref 19.50 dBm

Mkr4 2.389 370 0 GHz
-59.799 dBm

Start 2.38500 GHz
Res BW 100 kHz

VBW 300 kHz

Sweep 2.133 ms (8001 pts)

Stop 2.40500 GHz

MWR	MODE	TRC	SL	F	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION USAGE
1	N	1	f		2.401 810 0 GHz	3.580 dBm			
2	N	1	f		2.400 000 0 GHz	-19.217 dBm			
3	N	1	f		2.390 000 0 GHz	-42.515 dBm			
4	N	1	f		2.389 370 0 GHz	-59.799 dBm			

Center Freq 2.397500000 GHz

Ref Offset 19.5 dB
Ref 19.50 dBm

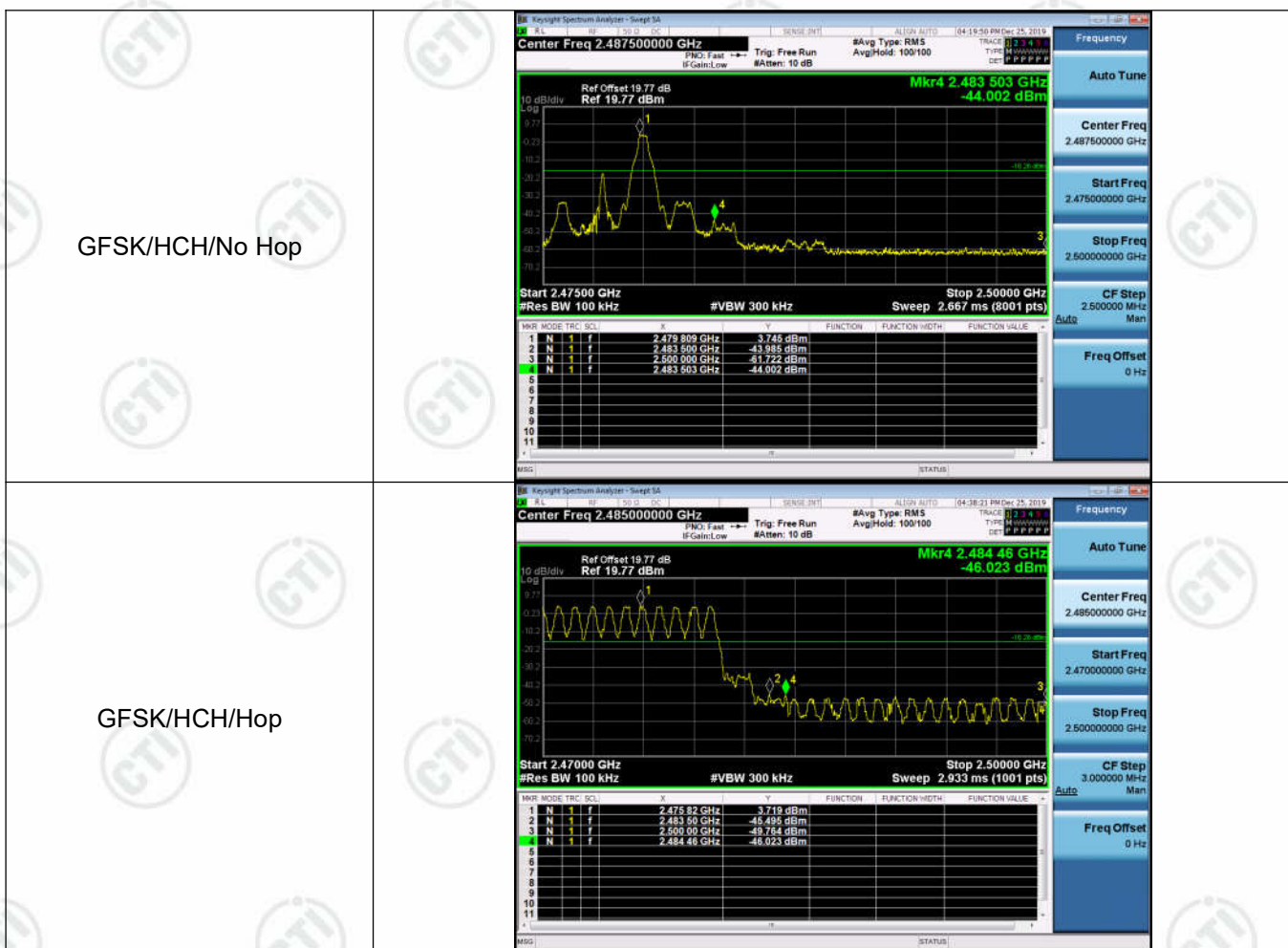
Mkr4 2.386 050 GHz
-50.972 dBm

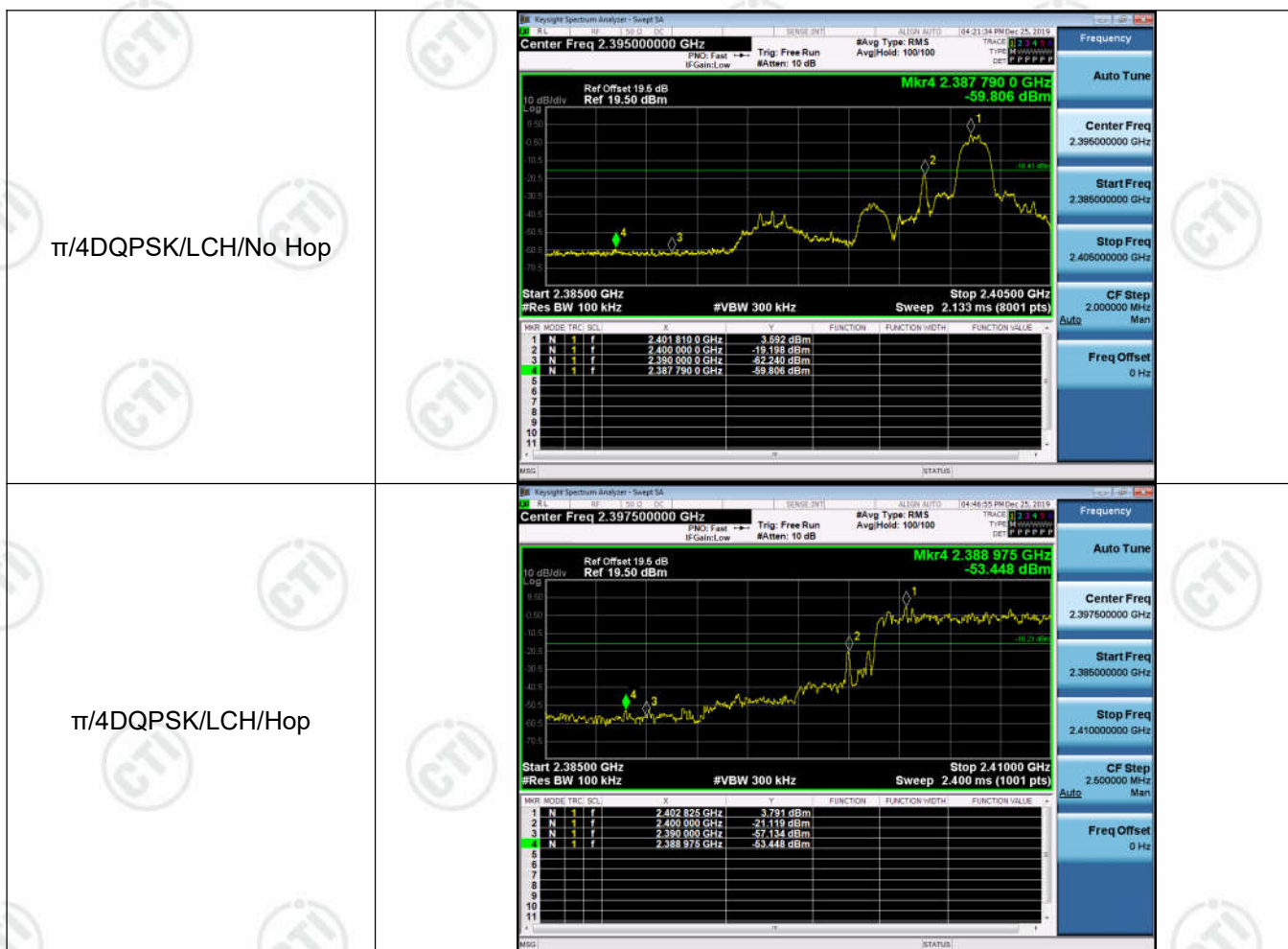
Start 2.38500 GHz
#Res BW 100 kHz

#VBW 300 kHz

Sweep 2.400 ms (1001 pts)

MWR	MODE	TRC	SCU	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.406 800 GHz	3.737 dBm			
2	N	1	f	2.400 000 GHz	-21.903 dBm			
3	N	1	f	2.392 000 GHz	-31.759 dBm			
4	N	1	f	2.386 050 GHz	-50.972 dBm			







Appendix G): RF Conducted Spurious Emissions

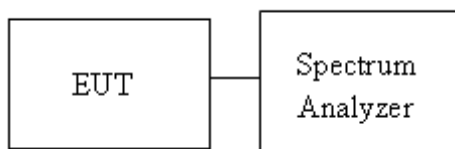
Test Limit
According to §15.247(d),

Limit	-20 dBc
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Test Procedure

1. EUT RF output port connected to the SA by RF cable, and the path loss was compensated to result.
2. SA setting, RBW=100kHz, VBW=300kHz, Detector=Peak, Trace mode = max hold, SWT = Auto.

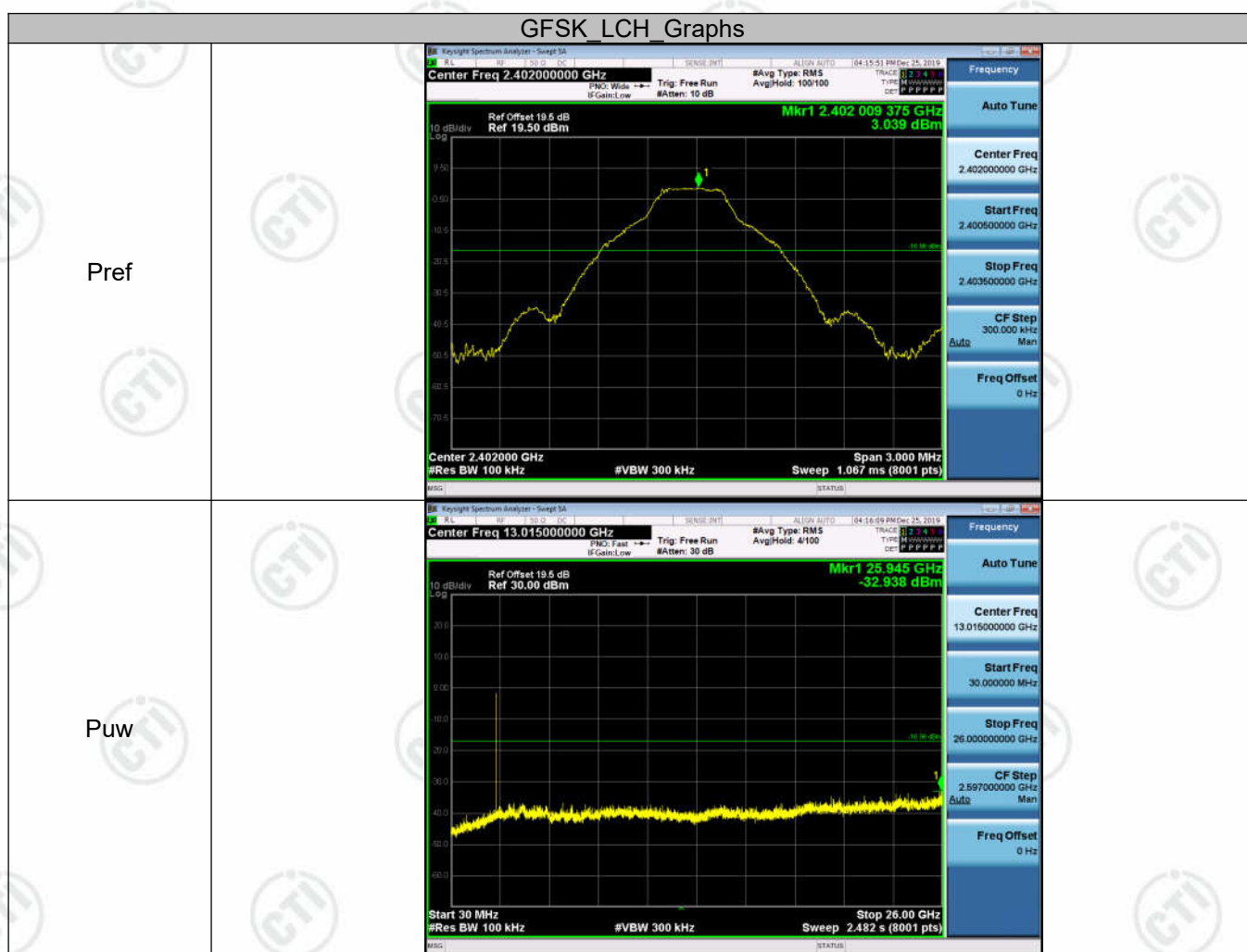
Test Setup

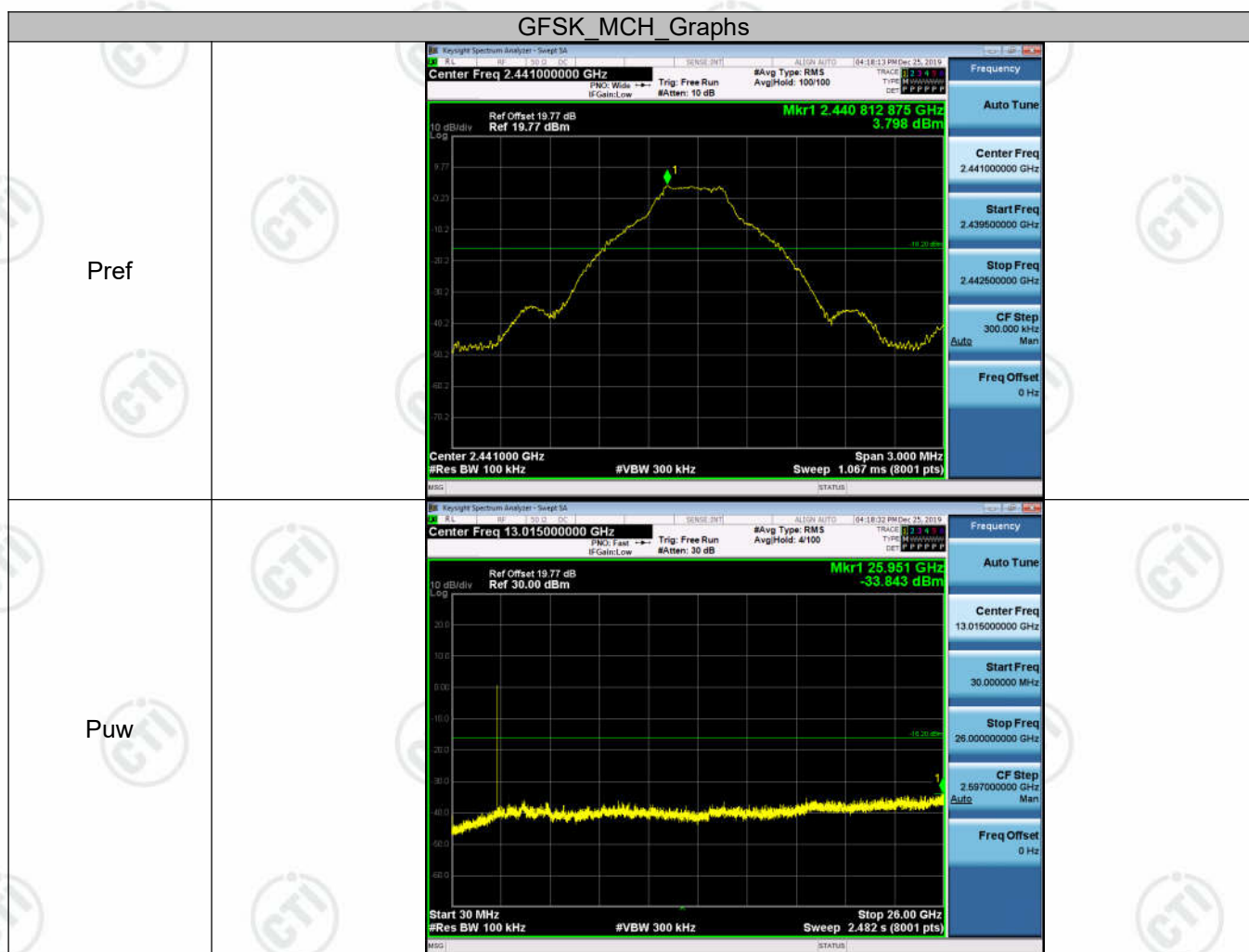


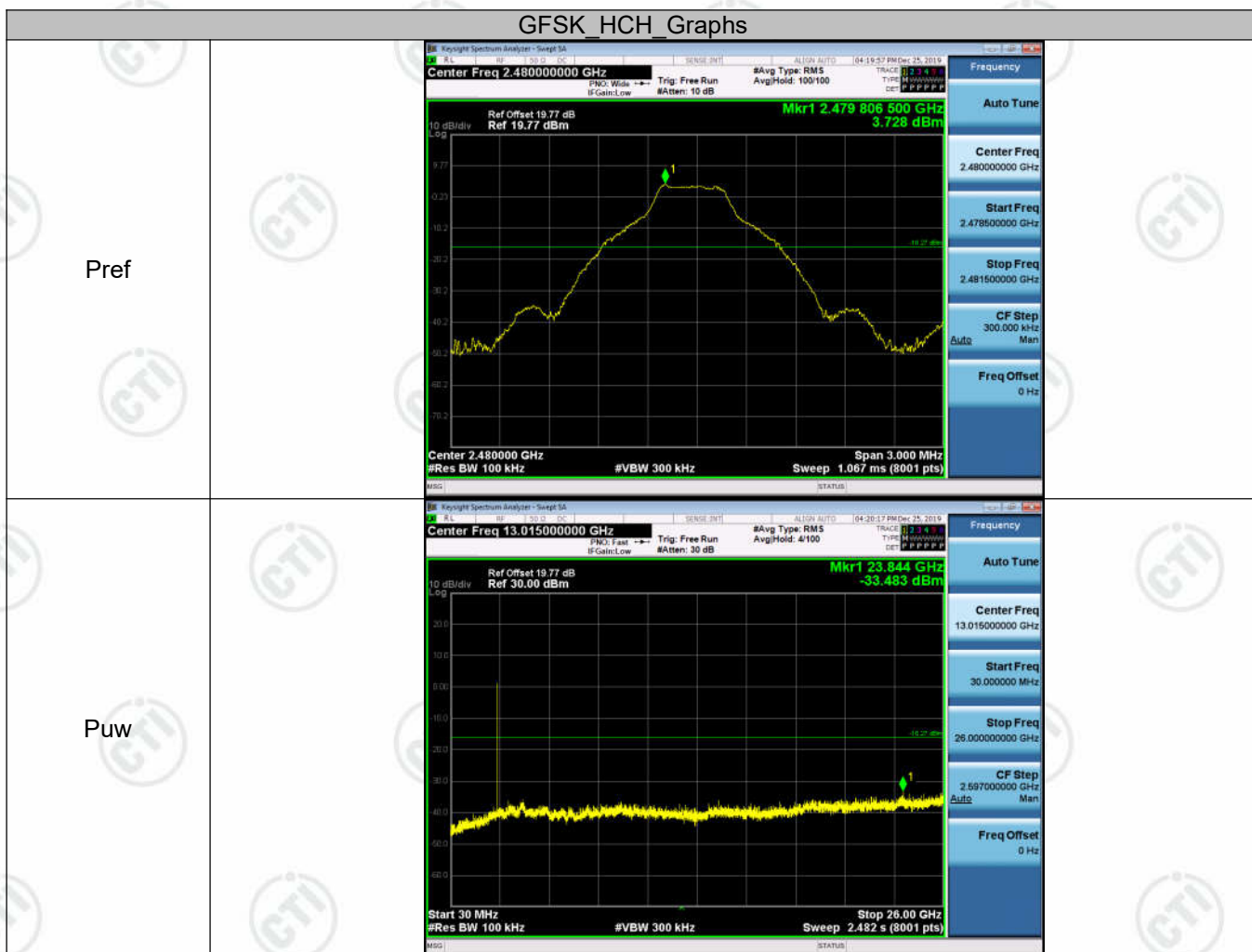
Result Table

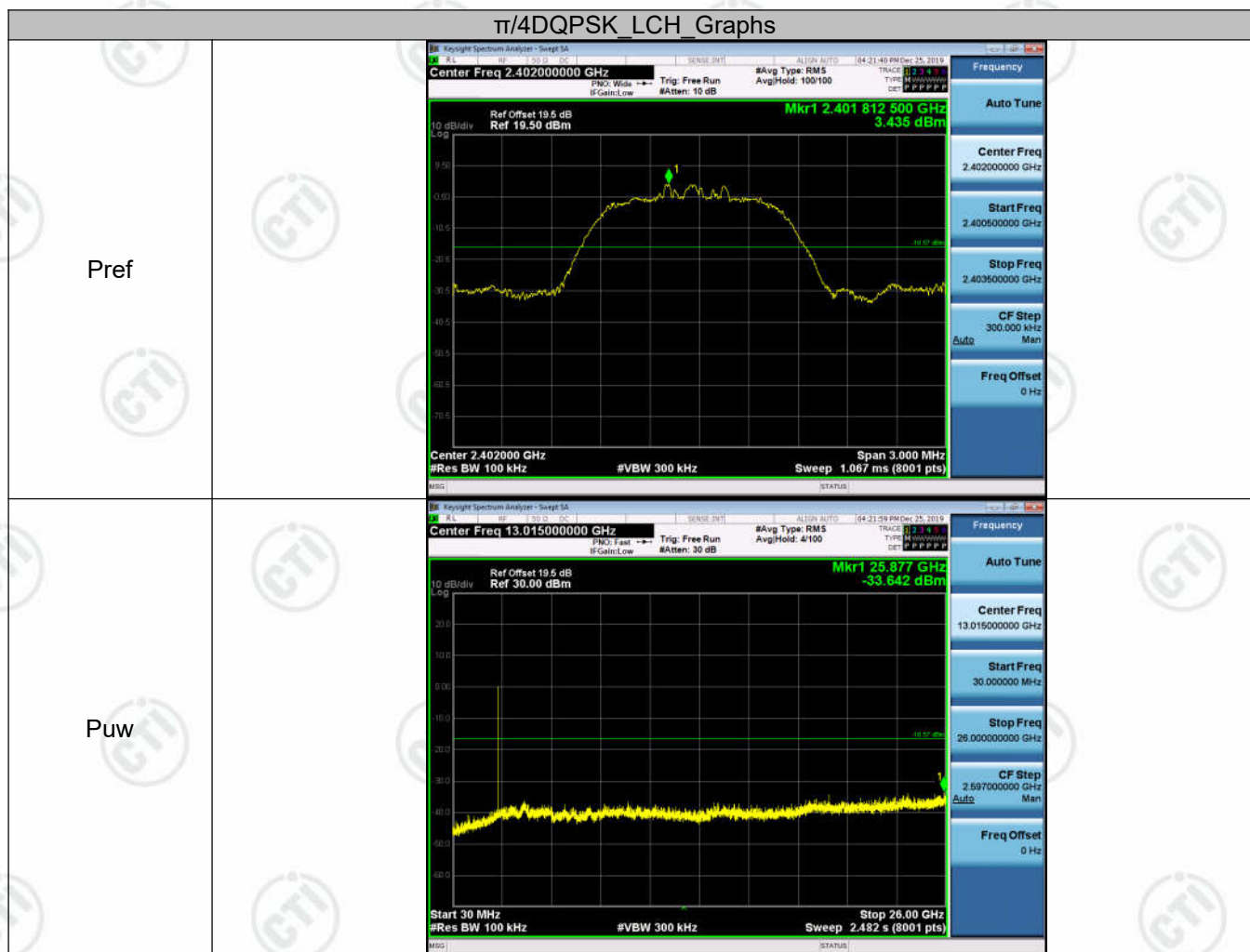
Mode	Channel	Pref [dBm]	Puw[dBm]	Verdict
GFSK	LCH	3.039	<Limit	PASS
GFSK	MCH	3.798	<Limit	PASS
GFSK	HCH	3.728	<Limit	PASS
$\pi/4$ DQPSK	LCH	3.435	<Limit	PASS
$\pi/4$ DQPSK	MCH	3.717	<Limit	PASS
$\pi/4$ DQPSK	HCH	3.696	<Limit	PASS

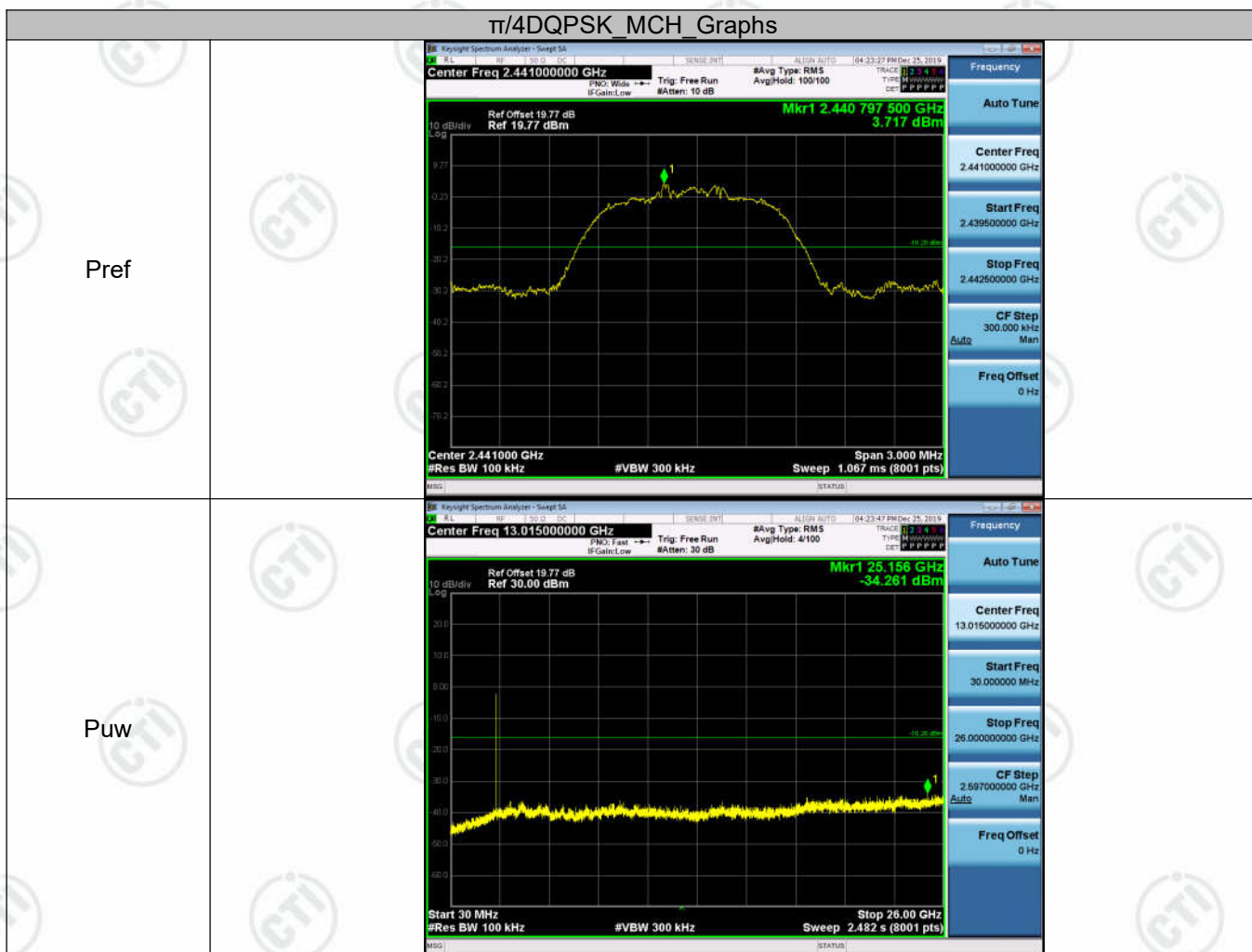
Test Graph

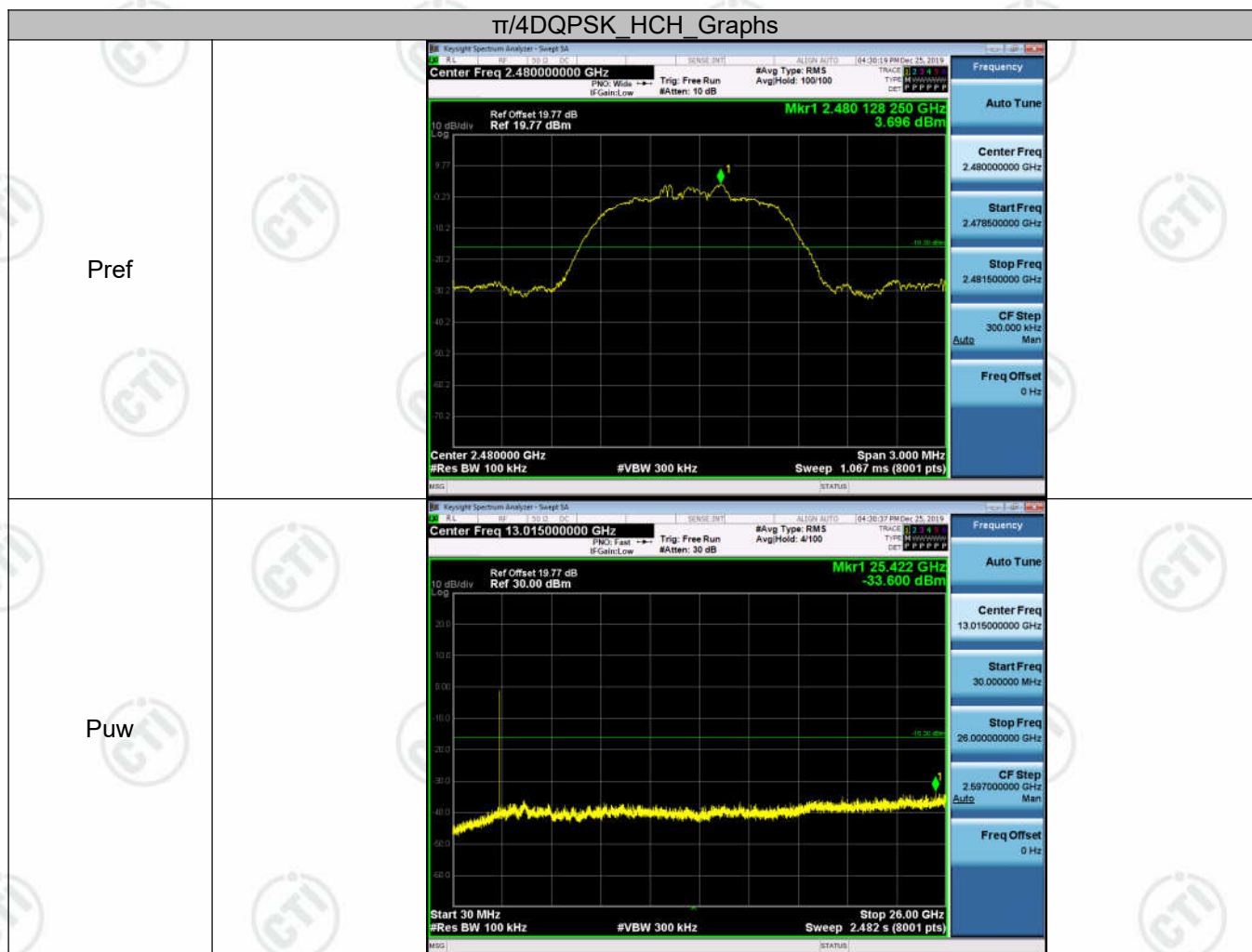




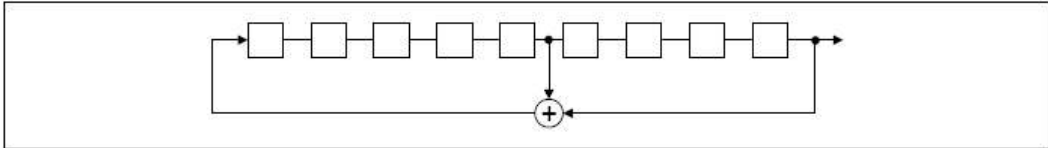









Appendix H) Pseudorandom Frequency Hopping Sequence

Test Requirement:	47 CFR Part 15C Section 15.247 (a)(1) requirement:
<p>Frequency hopping systems 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.</p> <p>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. The system shall hop to channel frequencies that are selected at the system hopping rate from a Pseudorandom 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.</p>	
EUT Pseudorandom Frequency Hopping Sequence	
<p>The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONES; i.e. the shift register is initialized with nine ones.</p> <ul style="list-style-type: none"> • Number of shift register stages: 9 • Length of pseudo-random sequence: $2^9 - 1 = 511$ bits • Longest sequence of zeros: 8 (non-inverted signal) 	
 <p style="text-align: center;"><i>Linear Feedback Shift Register for Generation of the PRBS sequence</i></p>	
<p>An example of Pseudorandom Frequency Hopping Sequence as follow:</p>	
	
<p>Each frequency used equally on the average by each transmitter.</p> <p>The system receivers have input bandwidths that match the hopping channel bandwidths of their Corresponding transmitters and shift frequencies in synchronization with the transmitted signals.</p>	
<p>The device does not have the ability to be coordinated with other FHSS systems in an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitters.</p>	

Appendix I) Antenna Requirement

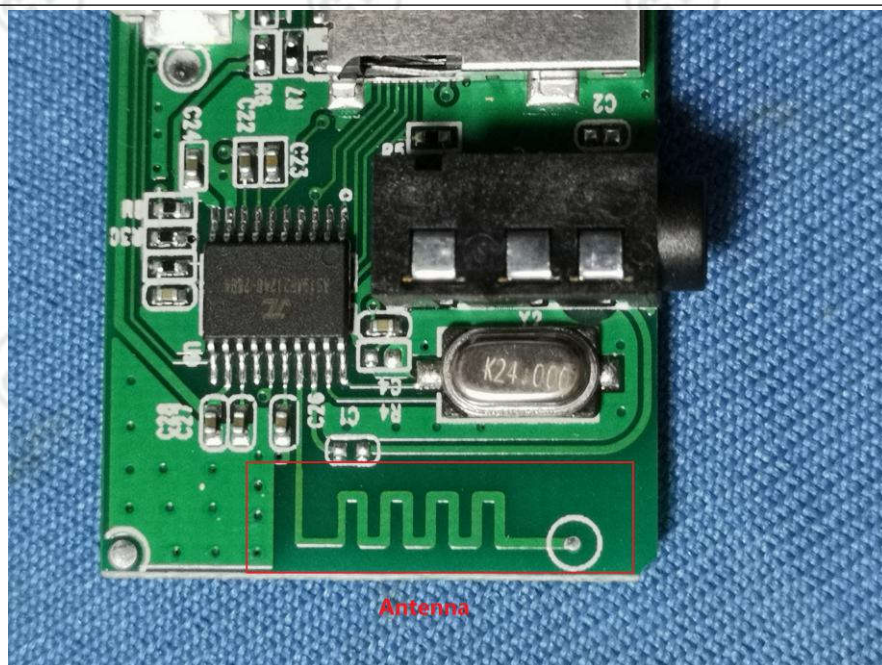
15.203 requirement:

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 unique coupling to the intentional radiator, 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.

15.247(b) (4) requirement:

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.

EUT Antenna:



The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is -0.5dBi.

Appendix J) AC Power Line Conducted Emission

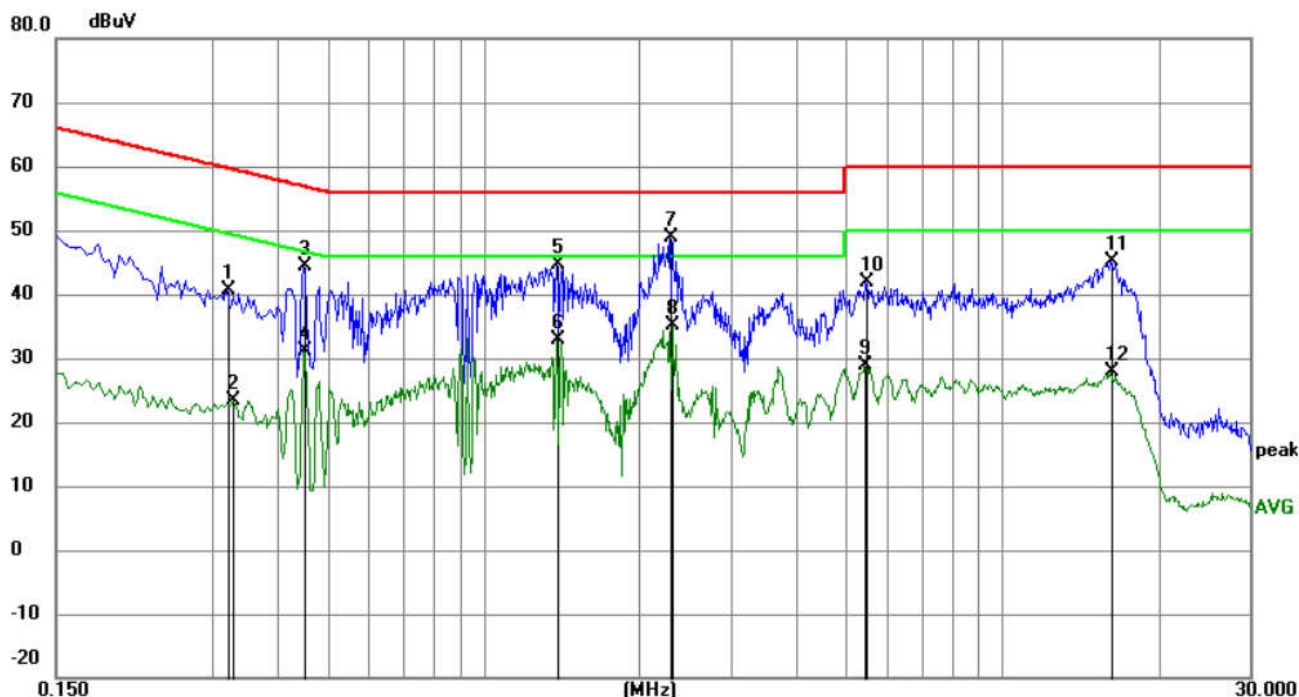
Test Procedure:	<p>Test frequency range :150KHz-30MHz</p> <ol style="list-style-type: none"> 1) The mains terminal disturbance voltage test was conducted in a shielded room. 2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a $50\Omega/50\mu\text{H} + 5\Omega$ linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded. 3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane, 4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2. 5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement. 		
Limit:	Frequency range (MHz)	Limit (dBuV)	
		Quasi-peak	Average
	0.15-0.5	66 to 56*	56 to 46*
	0.5-5	56	46
	5-30	60	50
<p>* The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.</p> <p>NOTE : The lower limit is applicable at the transition frequency</p>			

Measurement Data

An initial pre-scan was performed on the live and neutral lines with peak detector.

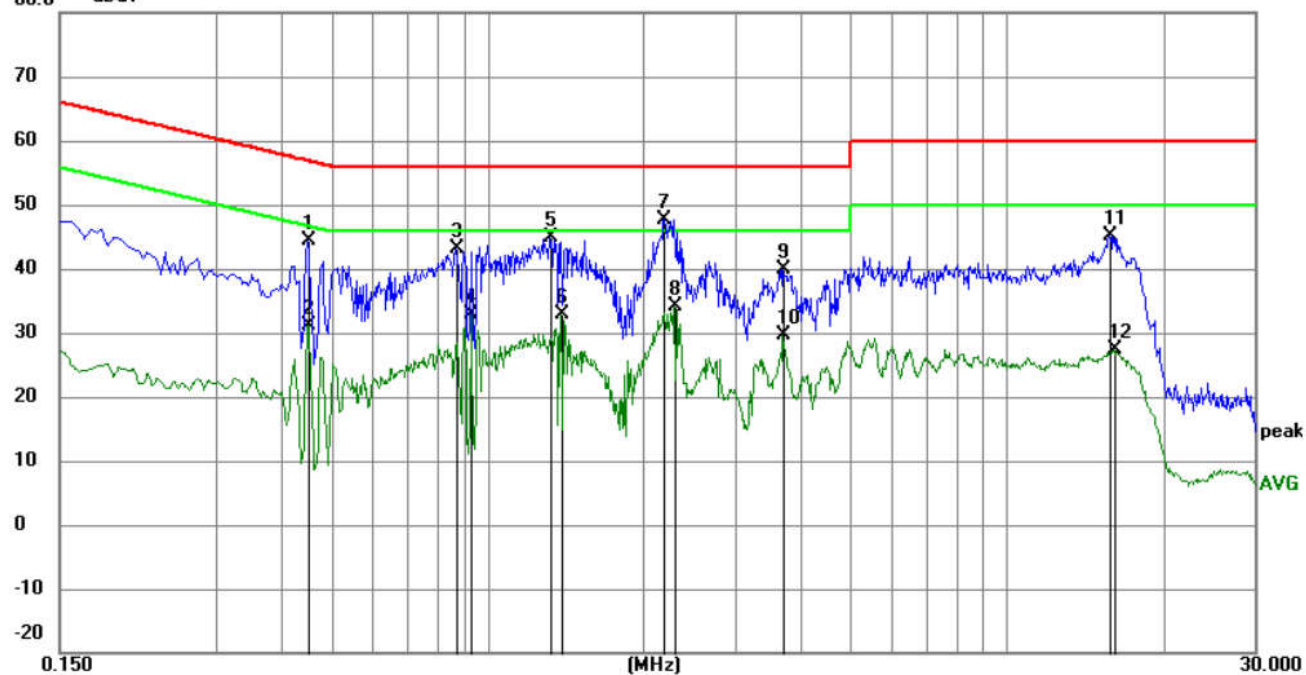
Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.

Live line:



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.3209	30.46	10.08	40.54	59.68	-19.14	QP	
2		0.3300	13.26	10.07	23.33	49.45	-26.12	AVG	
3		0.4515	34.46	10.00	44.46	56.85	-12.39	QP	
4		0.4515	21.02	10.00	31.02	46.85	-15.83	AVG	
5		1.3875	34.81	9.88	44.69	56.00	-11.31	QP	
6		1.3875	22.96	9.88	32.84	46.00	-13.16	AVG	
7	*	2.2920	39.00	9.83	48.83	56.00	-7.17	QP	
8		2.3190	25.25	9.83	35.08	46.00	-10.92	AVG	
9		5.4465	19.01	9.83	28.84	50.00	-21.16	AVG	
10		5.4645	32.15	9.83	41.98	60.00	-18.02	QP	
11		16.2105	35.17	9.97	45.14	60.00	-14.86	QP	
12		16.2105	17.93	9.97	27.90	50.00	-22.10	AVG	

Neutral line:
80.0 dBuV



No. Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Margin dB	Detector	Comment
1	0.4515	34.26	10.00	44.26	56.85	-12.59	QP	
2	0.4515	21.11	10.00	31.11	46.85	-15.74	AVG	
3	0.8700	33.18	9.92	43.10	56.00	-12.90	QP	
4	0.9330	23.04	9.92	32.96	46.00	-13.04	AVG	
5	1.3200	34.94	9.88	44.82	56.00	-11.18	QP	
6	1.3829	23.04	9.88	32.92	46.00	-13.08	AVG	
7 *	2.1885	37.89	9.83	47.72	56.00	-8.28	QP	
8	2.2875	24.34	9.83	34.17	46.00	-11.83	AVG	
9	3.7005	30.03	9.83	39.86	56.00	-16.14	QP	
10	3.7005	19.77	9.83	29.60	46.00	-16.40	AVG	
11	15.7920	35.20	9.97	45.17	60.00	-14.83	QP	
12	16.0889	17.38	9.97	27.35	50.00	-22.65	AVG	

Notes:

1. The following Quasi-Peak and Average measurements were performed on the EUT:
2. Final Test Level =Receiver Reading + LISN Factor + Cable Loss.

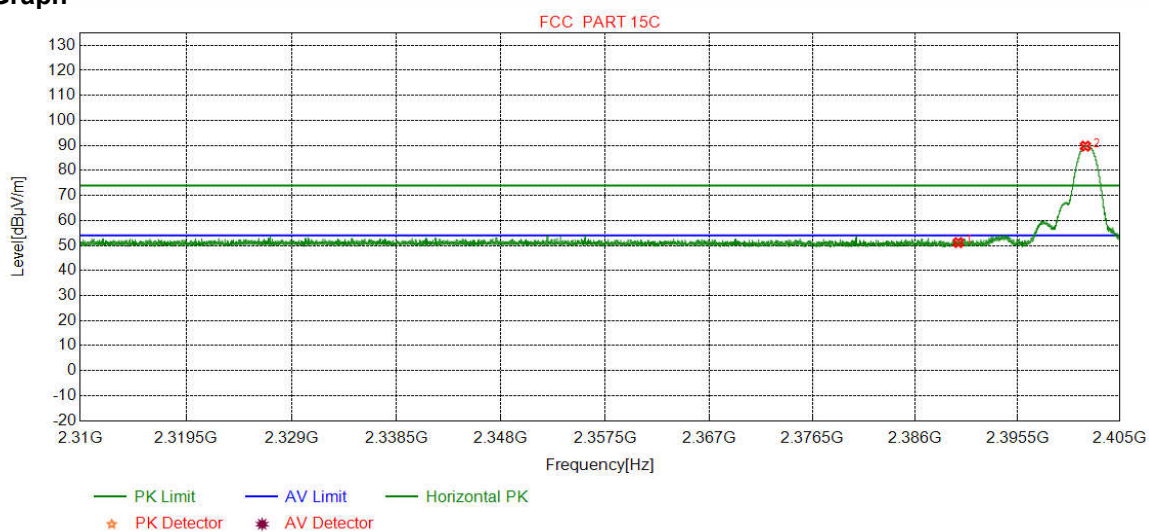
Appendix K) Restricted bands around fundamental frequency (Radiated)

Receiver Setup:	Frequency	Detector	RBW	VBW	Remark
	30MHz-1GHz	Quasi-peak	120 kHz	300kHz	Quasi-peak
	Above 1GHz	Peak	1MHz	3MHz	Peak
		Peak	1MHz	10Hz	Average
Test Procedure:	<p>Below 1GHz test procedure as below:</p> <ol style="list-style-type: none"> The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. Place a marker at the end of the restricted band closest to the transmit frequency to show compliance. Also measure any emissions in the restricted bands. Save the spectrum analyzer plot. Repeat for each power and modulation for lowest and highest channel <p>Above 1GHz test procedure as below:</p> <ol style="list-style-type: none"> Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber and change form table 0.8 metre to 1.5 metre(Above 18GHz the distance is 1 meter and table is 1.5 metre). b. Test the EUT in the lowest channel , the Highest channel The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is worse case. Repeat above procedures until all frequencies measured was complete. 				
Limit:	Frequency	Limit (dBuV/m @3m)		Remark	
	30MHz-88MHz	40.0		Quasi-peak Value	
	88MHz-216MHz	43.5		Quasi-peak Value	
	216MHz-960MHz	46.0		Quasi-peak Value	
	960MHz-1GHz	54.0		Quasi-peak Value	
	Above 1GHz	54.0		Average Value	
		74.0		Peak Value	

Test plot as follows:

Mode:	GFSK Transmitting	Channel:	2402
Remark:	PK		

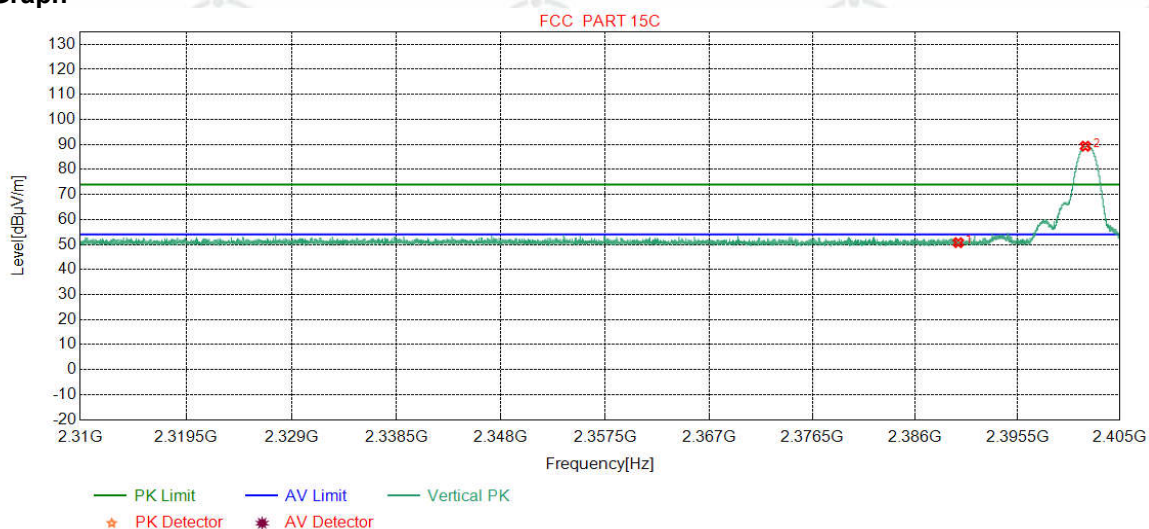
Test Graph



NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity
1	2390.0000	32.25	13.37	-43.12	48.66	51.16	74.00	22.84	Pass	Horizontal
2	2401.8015	32.26	13.31	-43.12	87.25	89.70	74.00	-15.70	Pass	Horizontal

Mode:	GFSK Transmitting	Channel:	2402
Remark:	PK		

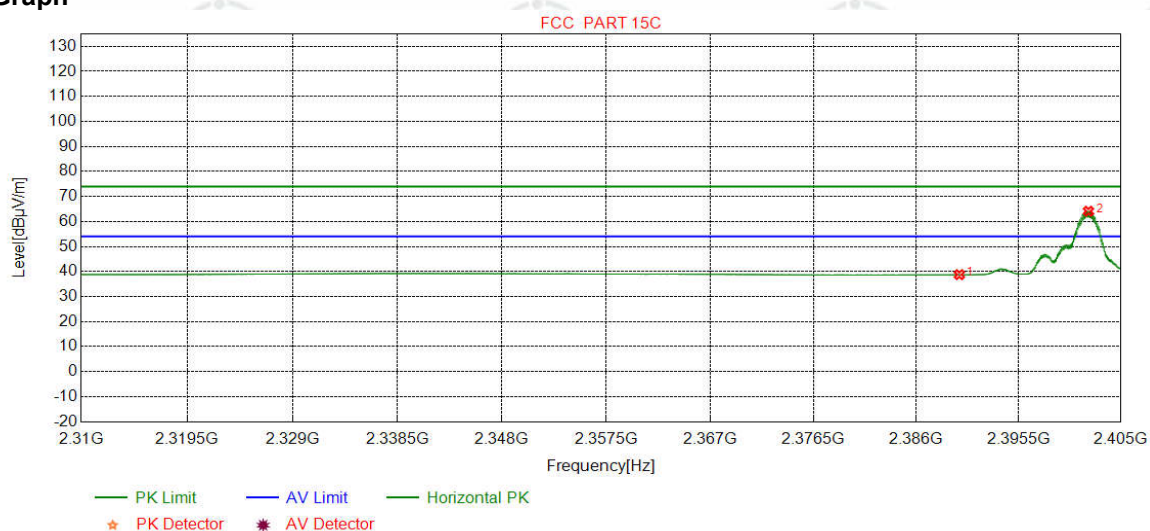
Test Graph



NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity
1	2390.0000	32.25	13.37	-43.12	48.24	50.74	74.00	23.26	Pass	Vertical
2	2401.8015	32.26	13.31	-43.12	86.82	89.27	74.00	-15.27	Pass	Vertical

Mode:	GFSK Transmitting	Channel:	2402
Remark:	AV		

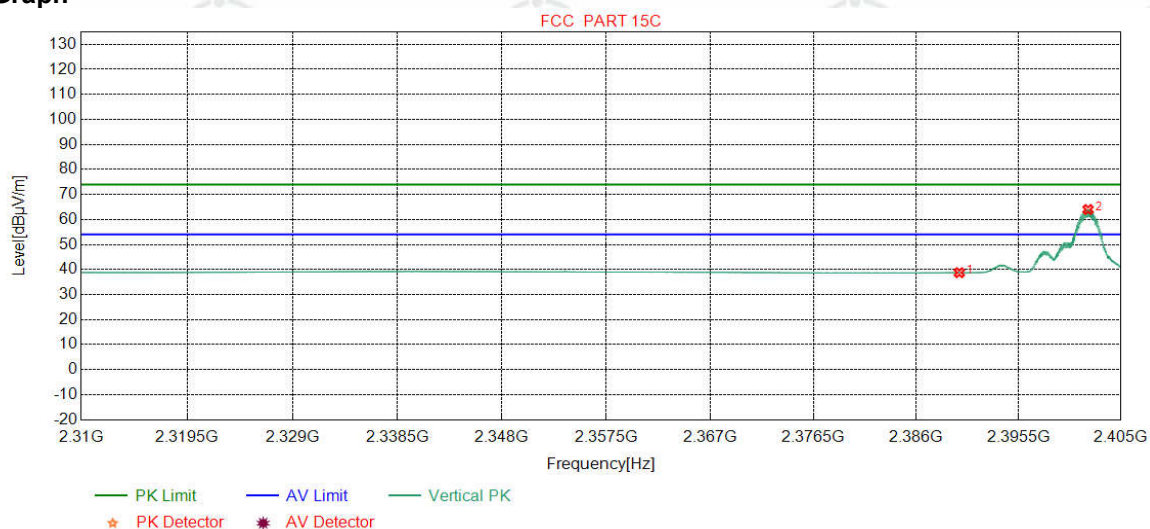
Test Graph



NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity
1	2390.0000	32.25	13.37	-43.12	36.25	38.75	54.00	15.25	Pass	Horizontal
2	2401.9915	32.26	13.31	-43.12	61.65	64.10	54.00	-10.10	Pass	Horizontal

Mode:	GFSK Transmitting	Channel:	2402
Remark:	AV		

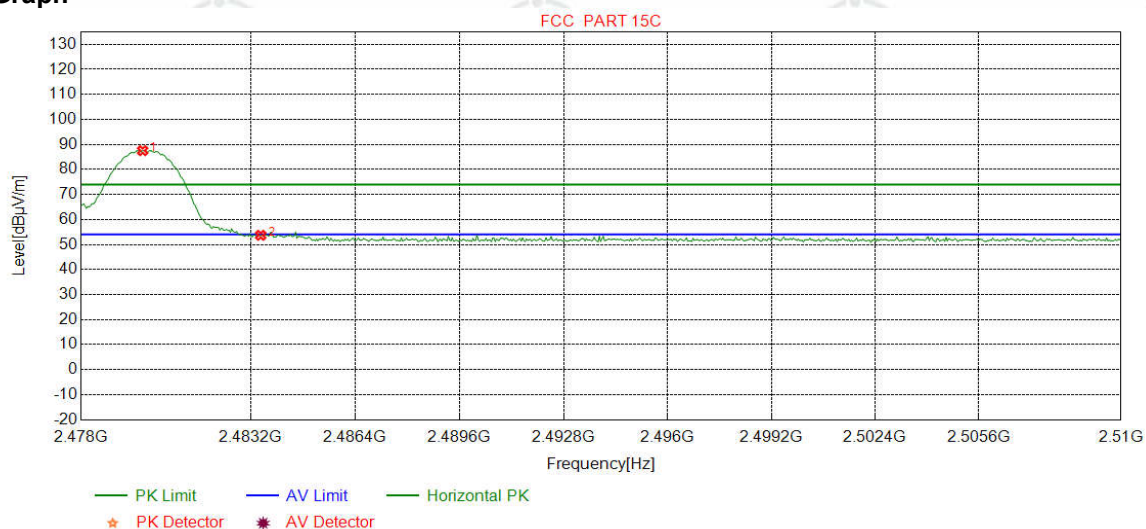
Test Graph



NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity
1	2390.0000	32.25	13.37	-43.12	36.24	38.74	54.00	15.26	Pass	Vertical
2	2401.9535	32.26	13.31	-43.12	61.54	63.99	54.00	-9.99	Pass	Vertical

Mode:	GFSK Transmitting	Channel:	2480
Remark:	PK		

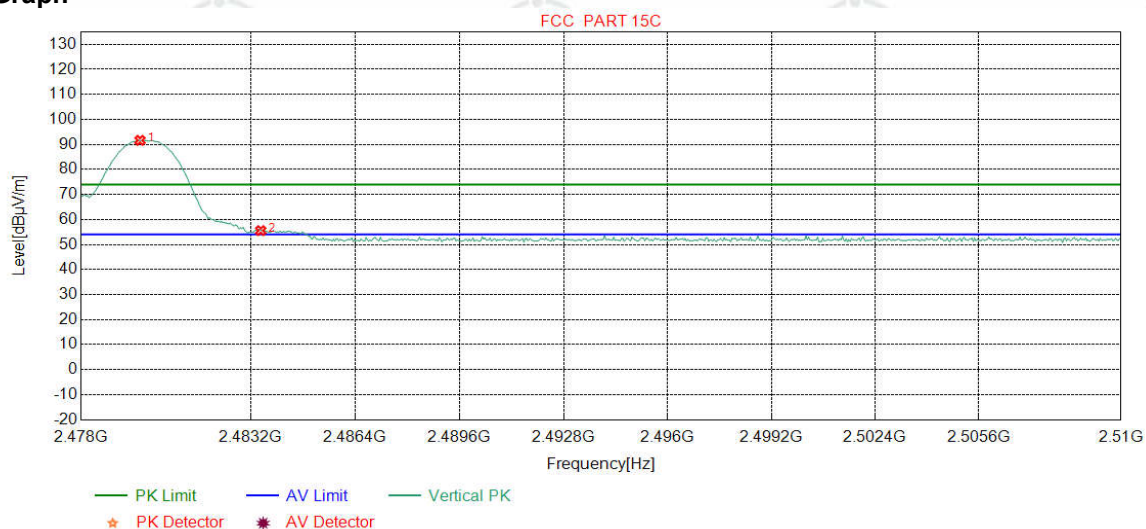
Test Graph



NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity
1	2479.8824	32.37	13.39	-43.10	84.84	87.50	74.00	-13.50	Pass	Horizontal
2	2483.5000	32.38	13.38	-43.11	51.03	53.68	74.00	20.32	Pass	Horizontal

Mode:	GFSK Transmitting	Channel:	2480
Remark:	PK		

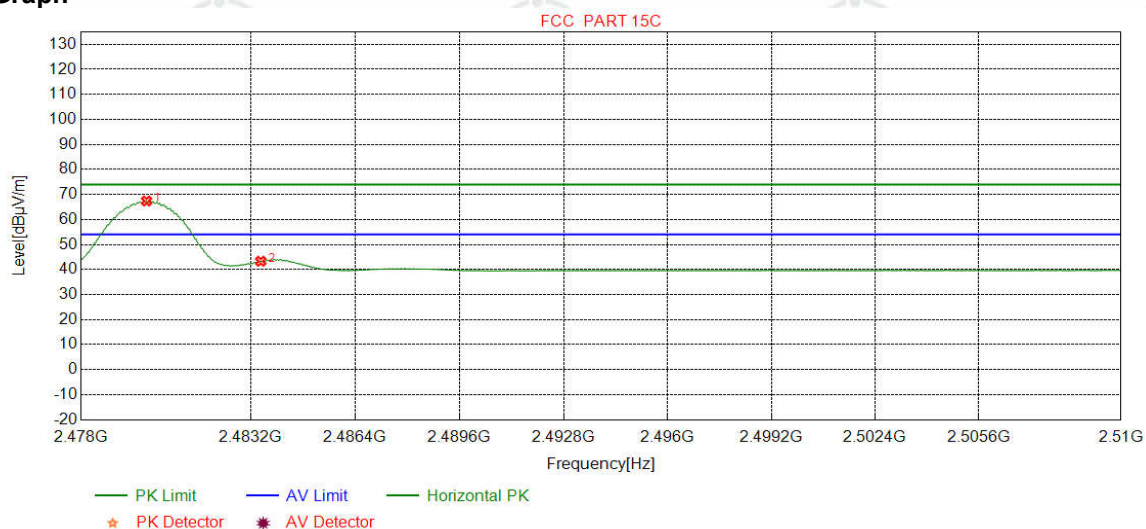
Test Graph



NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity
1	2479.8023	32.37	13.39	-43.10	88.96	91.62	74.00	-17.62	Pass	Vertical
2	2483.5000	32.38	13.38	-43.11	52.91	55.56	74.00	18.44	Pass	Vertical

Mode:	GFSK Transmitting	Channel:	2480
Remark:	AV		

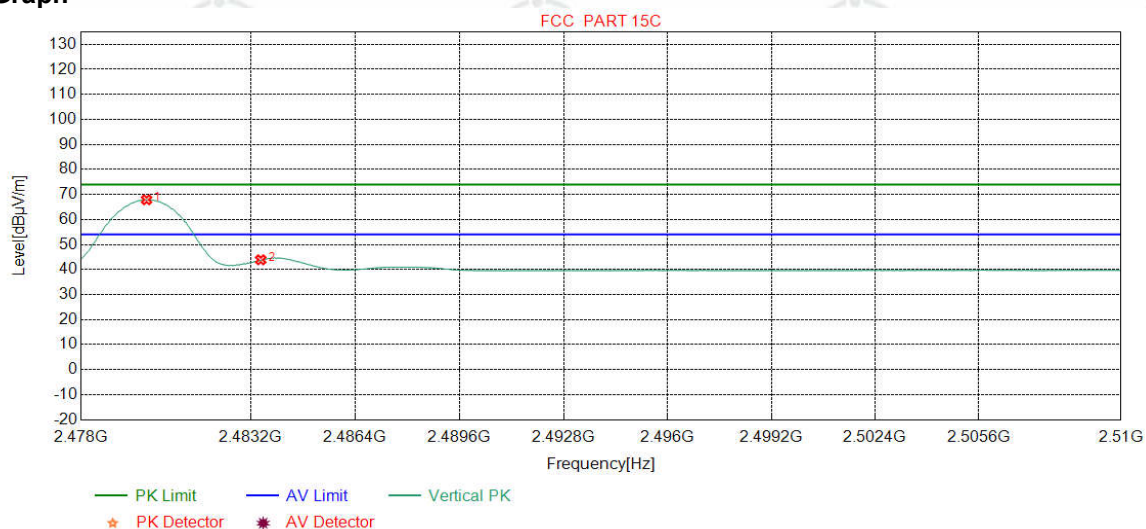
Test Graph



NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity
1	2480.0025	32.37	13.39	-42.39	64.02	67.39	54.00	-13.39	Pass	Horizontal
2	2483.5000	32.38	13.38	-42.40	39.94	43.30	54.00	10.70	Pass	Horizontal

Mode:	GFSK Transmitting	Channel:	2480
Remark:	AV		

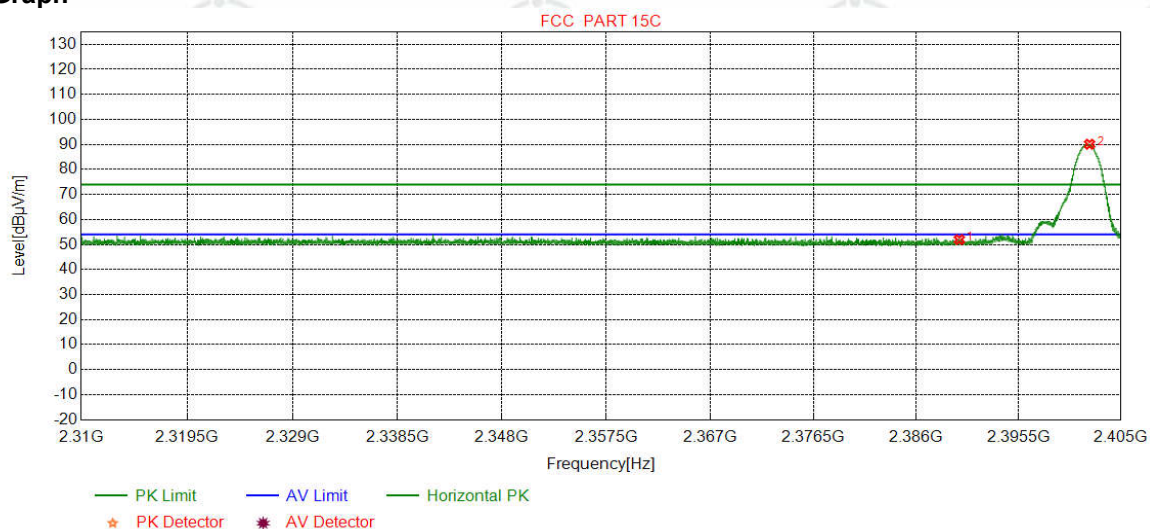
Test Graph



NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity
1	2480.0025	32.37	13.39	-42.39	64.52	67.89	54.00	-13.89	Pass	Vertical
2	2483.5000	32.38	13.38	-42.40	40.52	43.88	54.00	10.12	Pass	Vertical

Mode:	$\pi/4$ DQPSK Transmitting	Channel:	2402
Remark:	PK		

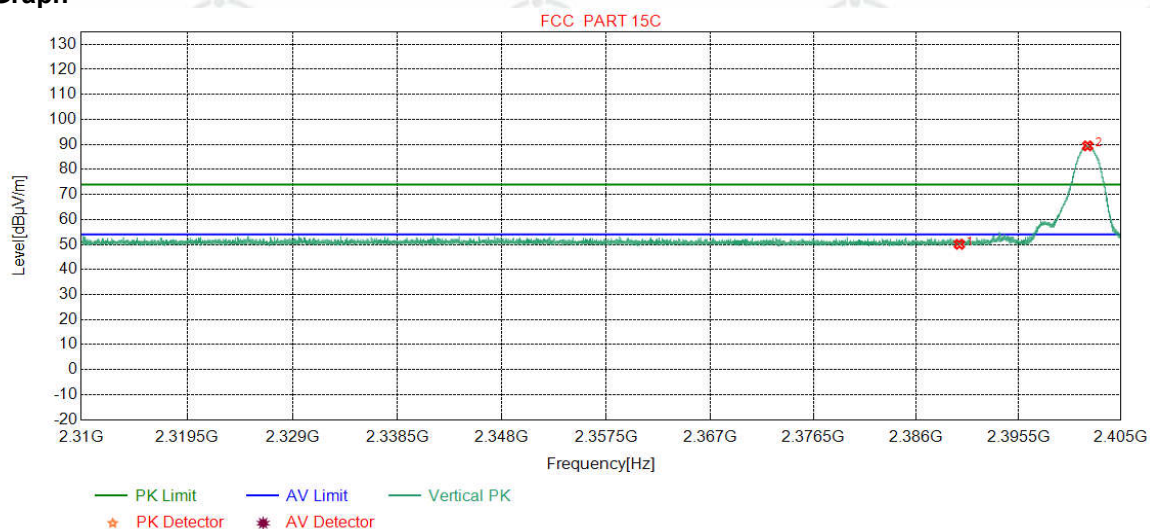
Test Graph



NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity
1	2390.0000	32.25	13.37	-43.12	49.46	51.96	74.00	22.04	Pass	Horizontal
2	2402.0928	32.26	13.31	-43.12	87.63	90.08	74.00	-16.08	Pass	Horizontal

Mode:	$\pi/4$ DQPSK Transmitting	Channel:	2402
Remark:	PK		

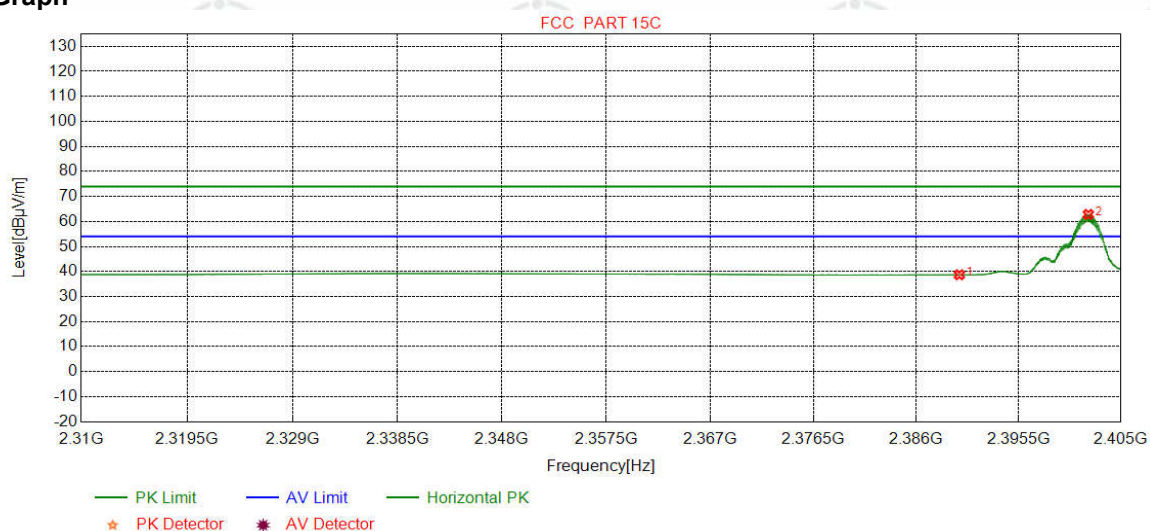
Test Graph



NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity
1	2390.0000	32.25	13.37	-43.12	47.58	50.08	74.00	23.92	Pass	Vertical
2	2401.9155	32.26	13.31	-43.12	86.97	89.42	74.00	-15.42	Pass	Vertical

Mode:	$\pi/4$ DQPSK Transmitting	Channel:	2402
Remark:	AV		

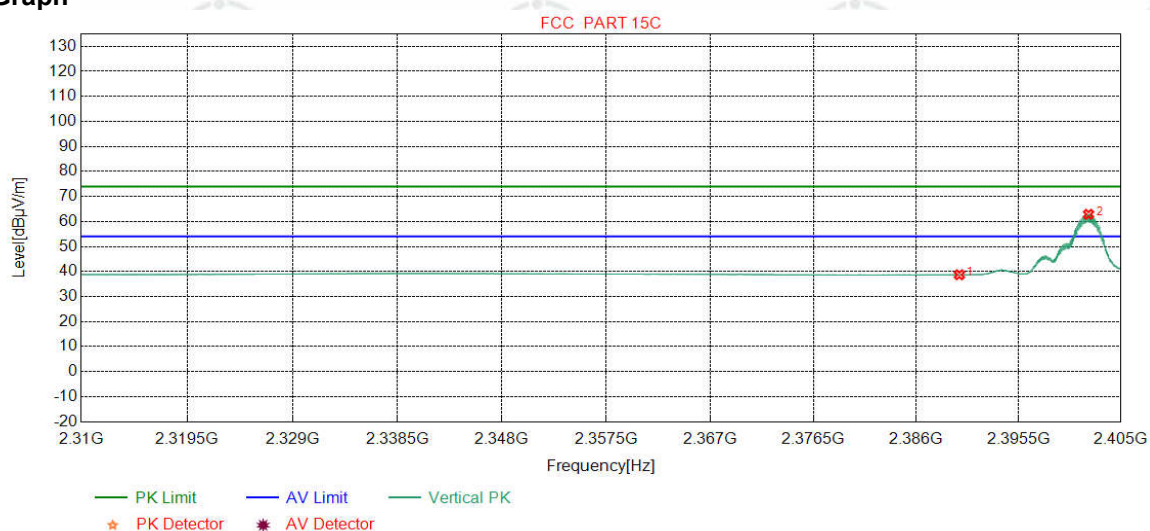
Test Graph



NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity
1	2390.0000	32.25	13.37	-43.12	36.20	38.70	54.00	15.30	Pass	Horizontal
2	2401.9788	32.26	13.31	-43.12	60.38	62.83	54.00	-8.83	Pass	Horizontal

Mode:	$\pi/4$ DQPSK Transmitting	Channel:	2402
Remark:	AV		

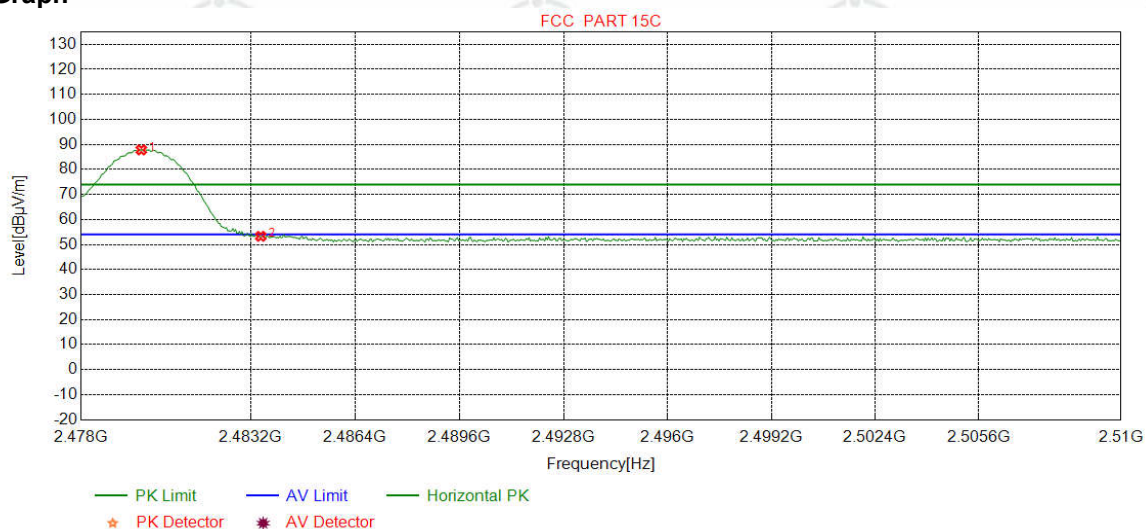
Test Graph



NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity
1	2390.0000	32.25	13.37	-43.12	36.20	38.70	54.00	15.30	Pass	Vertical
2	2401.9978	32.26	13.31	-43.12	60.43	62.88	54.00	-8.88	Pass	Vertical

Mode:	$\pi/4$ DQPSK Transmitting	Channel:	2480
Remark:	PK		

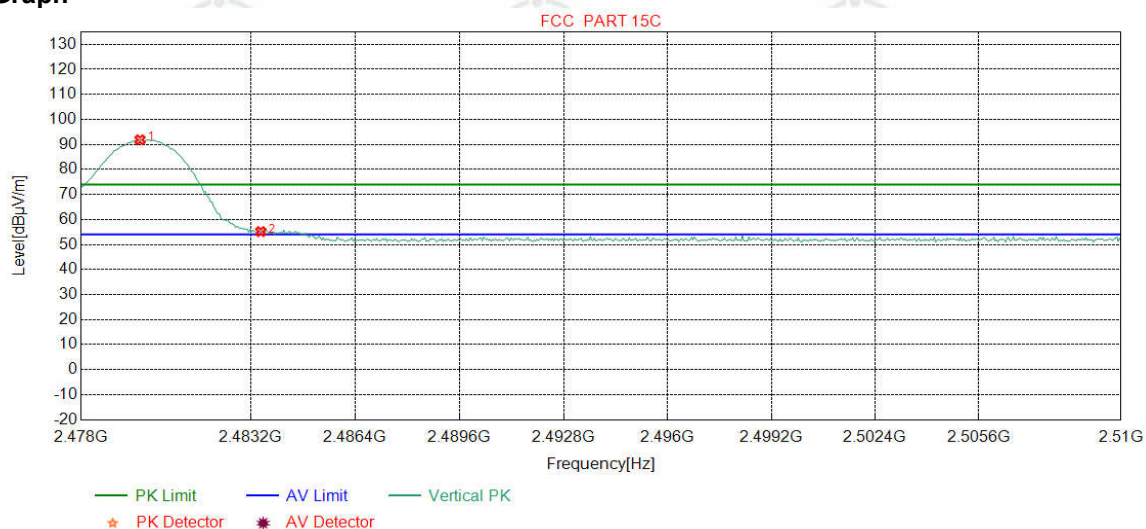
Test Graph



NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity
1	2479.8423	32.37	13.39	-43.10	85.15	87.81	74.00	-13.81	Pass	Horizontal
2	2483.5000	32.38	13.38	-43.11	50.63	53.28	74.00	20.72	Pass	Horizontal

Mode:	$\pi/4$ DQPSK Transmitting	Channel:	2480
Remark:	PK		

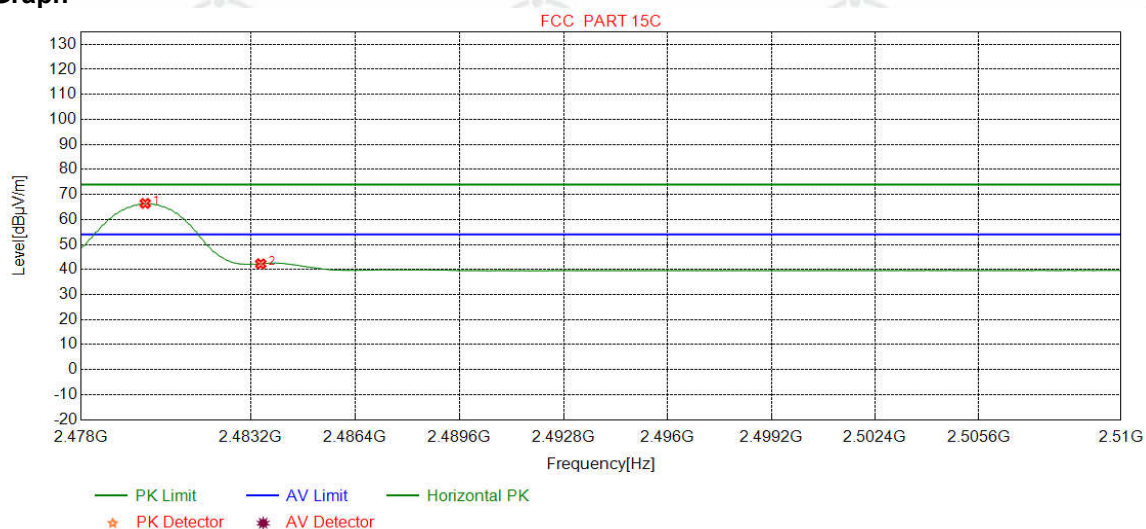
Test Graph



NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity
1	2479.8023	32.37	13.39	-43.10	89.19	91.85	74.00	-17.85	Pass	Vertical
2	2483.5000	32.38	13.38	-43.11	52.51	55.16	74.00	18.84	Pass	Vertical

Mode:	$\pi/4$ DQPSK Transmitting	Channel:	2480
Remark:	AV		

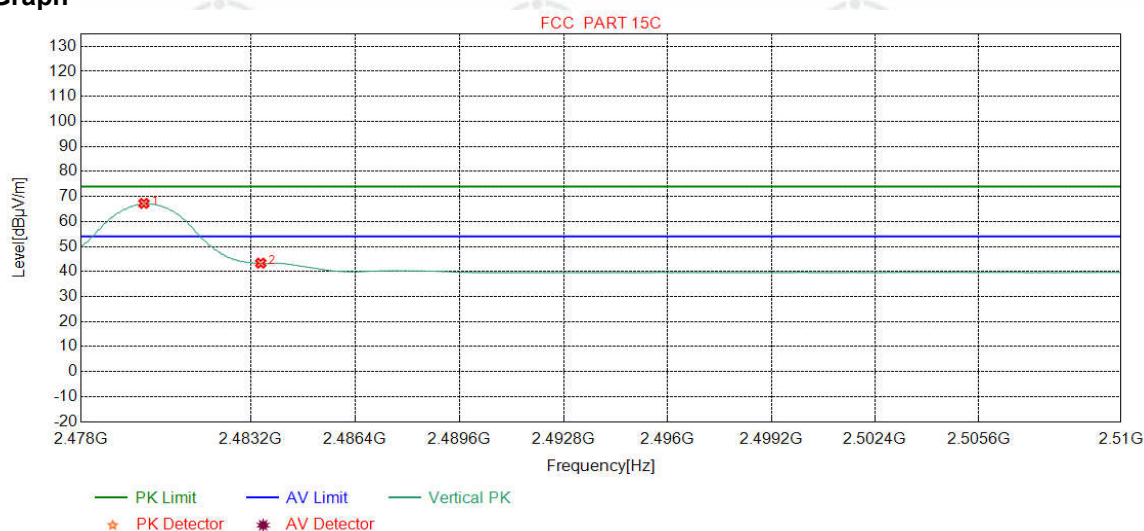
Test Graph



NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity
1	2479.9625	32.37	13.39	-42.39	63.05	66.42	54.00	-12.42	Pass	Horizontal
2	2483.5000	32.38	13.38	-42.40	38.92	42.28	54.00	11.72	Pass	Horizontal

Mode:	$\pi/4$ DQPSK Transmitting	Channel:	2480
Remark:	AV		

Test Graph



NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity
1	2479.9224	32.37	13.39	-42.39	63.85	67.22	54.00	-13.22	Pass	Vertical
2	2483.5000	32.38	13.38	-42.40	39.98	43.34	54.00	10.66	Pass	Vertical

Note:

1) Through Pre-scan Non-hopping transmitting mode and charge+transmitter mode with all kind of modulation and all kind of data type, find the DH5 of data type is the worse case of GFSK modulation type in charge + transmitter mode.

2) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Final Test Level = Receiver Reading - Correct Factor

Correct Factor = Preamplifier Factor - Antenna Factor - Cable Factor

Appendix L) Radiated Spurious Emissions

Receiver Setup:	Frequency	Detector	RBW	VBW	Remark
	0.009MHz-0.090MHz	Peak	10kHz	30kHz	Peak
	0.009MHz-0.090MHz	Average	10kHz	30kHz	Average
	0.090MHz-0.110MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
	0.110MHz-0.490MHz	Peak	10kHz	30kHz	Peak
	0.110MHz-0.490MHz	Average	10kHz	30kHz	Average
	0.490MHz -30MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
	30MHz-1GHz	Quasi-peak	120 kHz	300kHz	Quasi-peak
	Above 1GHz	Peak	1MHz	3MHz	Peak
		Peak	1MHz	10Hz	Average
Test Procedure:					
Below 1GHz test procedure as below:					
<p>a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.</p> <p>b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.</p> <p>c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.</p> <p>d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.</p> <p>e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.</p> <p>f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.</p>					
Above 1GHz test procedure as below:					
<p>g. Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber and change form table 0.8 metre to 1.5 metre(Above 18GHz the distance is 1 meter and table is 1.5 metre).</p> <p>h. Test the EUT in the lowest channel ,the middle channel ,the Highest channel</p> <p>i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is worse case.</p> <p>j. Repeat above procedures until all frequencies measured was complete.</p>					
Limit:	Frequency	Field strength (microvolt/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
	0.009MHz-0.490MHz	2400/F(kHz)	-	-	300
	0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
	1.705MHz-30MHz	30	-	-	30
	30MHz-88MHz	100	40.0	Quasi-peak	3
	88MHz-216MHz	150	43.5	Quasi-peak	3
	216MHz-960MHz	200	46.0	Quasi-peak	3
	960MHz-1GHz	500	54.0	Quasi-peak	3
	Above 1GHz	500	54.0	Average	3
<p>Note: 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.</p>					

Radiated Spurious Emissions test Data:

Mode:		GFSK Transmitting					Channel:		2441		
NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity	Remark
1	156.0156	7.76	1.46	-31.99	61.40	38.63	43.50	4.87	Pass	H	PK
2	240.0260	11.94	1.84	-31.90	51.19	33.07	46.00	12.93	Pass	H	PK
3	444.0374	16.10	2.49	-31.88	45.89	32.60	46.00	13.40	Pass	H	PK
4	600.0290	19.00	2.96	-31.50	49.42	39.88	46.00	6.12	Pass	H	PK
5	840.1280	21.38	3.50	-31.89	42.18	35.17	46.00	10.83	Pass	H	PK
6	974.9715	22.55	3.75	-30.95	43.07	38.42	54.00	15.58	Pass	H	PK
7	107.9958	10.92	1.23	-32.04	49.79	29.90	43.50	13.60	Pass	V	PK
8	132.0542	7.60	1.34	-32.01	55.89	32.82	43.50	10.68	Pass	V	PK
9	156.0156	7.76	1.46	-31.99	59.06	36.29	43.50	7.21	Pass	V	PK
10	216.0646	11.32	1.75	-31.95	54.41	35.53	46.00	10.47	Pass	V	PK
11	600.0290	19.00	2.96	-31.50	46.34	36.80	46.00	9.20	Pass	V	PK
12	974.9715	22.55	3.75	-30.95	41.92	37.27	54.00	16.73	Pass	V	PK

Mode:		GFSK Transmitting						Channel:		2402	
NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity	Remark
1	1599.2599	29.06	3.07	-42.91	58.56	47.78	74.00	26.22	Pass	H	PK
2	2123.1123	31.87	3.61	-43.17	59.76	52.07	74.00	21.93	Pass	H	PK
3	4804.0000	34.50	4.55	-42.80	58.81	55.06	74.00	18.94	Pass	H	PK
4	7206.0000	36.31	5.81	-42.16	56.22	56.18	74.00	17.82	Pass	H	PK
5	9608.0000	37.64	6.63	-42.10	46.75	48.92	74.00	25.08	Pass	H	PK
6	12010.0000	39.31	7.60	-41.90	46.26	51.27	74.00	22.73	Pass	H	PK
7	4803.9503	34.50	4.55	-42.80	45.87	42.12	54.00	11.88	Pass	H	AV
8	7205.9404	36.31	5.82	-42.16	42.58	42.55	54.00	11.45	Pass	H	AV
9	1661.4661	29.47	3.15	-42.75	51.75	41.62	74.00	32.38	Pass	V	PK
10	2127.1127	31.88	3.62	-43.18	60.73	53.05	74.00	20.95	Pass	V	PK
11	4804.0000	34.50	4.55	-42.80	61.73	57.98	74.00	16.02	Pass	V	PK
12	7206.0000	36.31	5.81	-42.16	56.93	56.89	74.00	17.11	Pass	V	PK
13	9608.0000	37.64	6.63	-42.10	47.17	49.34	74.00	24.66	Pass	V	PK
14	12010.0000	39.31	7.60	-41.90	47.37	52.38	74.00	21.62	Pass	V	PK
15	4804.0003	34.50	4.55	-42.80	47.63	43.88	54.00	10.12	Pass	V	AV
16	7205.8804	36.31	5.82	-42.16	44.45	44.42	54.00	9.58	Pass	V	AV

Mode:		GFSK Transmitting						Channel:		2441	
NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity	Remark
1	1330.8331	28.23	2.79	-42.75	53.86	42.13	74.00	31.87	Pass	H	PK
2	2123.1123	31.87	3.61	-43.17	61.64	53.95	74.00	20.05	Pass	H	PK
3	4882.1255	34.50	4.81	-42.80	58.71	55.22	74.00	18.78	Pass	H	PK
4	7323.2882	36.42	5.85	-42.13	54.01	54.15	74.00	19.85	Pass	H	PK
5	9764.0000	37.71	6.71	-42.10	47.33	49.65	74.00	24.35	Pass	H	PK
6	12205.0000	39.42	7.67	-41.89	45.73	50.93	74.00	23.07	Pass	H	PK
7	4881.9655	34.50	4.81	-42.80	46.52	43.03	54.00	10.97	Pass	H	AV
8	7322.9282	36.42	5.85	-42.14	43.70	43.83	54.00	10.17	Pass	H	AV
9	1597.6598	29.04	3.07	-42.90	54.84	44.05	74.00	29.95	Pass	V	PK
10	2663.7664	32.66	4.10	-43.10	60.21	53.87	74.00	20.13	Pass	V	PK
11	4881.1254	34.50	4.80	-42.80	62.20	58.70	74.00	15.30	Pass	V	PK
12	7323.0000	36.42	5.85	-42.13	56.97	57.11	74.00	16.89	Pass	V	PK
13	9764.0000	37.71	6.71	-42.10	49.41	51.73	74.00	22.27	Pass	V	PK
14	12205.0000	39.42	7.67	-41.89	45.95	51.15	74.00	22.85	Pass	V	PK
15	4881.9254	34.50	4.81	-42.80	47.70	44.21	54.00	9.79	Pass	V	AV
16	7322.9382	36.42	5.85	-42.14	44.32	44.45	54.00	9.55	Pass	V	AV

Mode:		GFSK Transmitting					Channel:		2480		
NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity	Remark
1	1598.0598	29.05	3.07	-42.91	57.57	46.78	74.00	27.22	Pass	H	PK
2	2127.3127	31.88	3.62	-43.18	60.46	52.78	74.00	21.22	Pass	H	PK
3	4960.0000	34.50	4.82	-42.80	57.97	54.49	74.00	19.51	Pass	H	PK
4	7440.0000	36.54	5.85	-42.11	56.71	56.99	74.00	17.01	Pass	H	PK
5	9920.0000	37.77	6.79	-42.10	46.68	49.14	74.00	24.86	Pass	H	PK
6	12400.0000	39.54	7.86	-41.90	47.13	52.63	74.00	21.37	Pass	H	PK
7	4959.9906	34.50	4.82	-42.80	47.11	43.63	54.00	10.37	Pass	H	AV
8	7439.9160	36.54	5.85	-42.11	43.89	44.17	54.00	9.83	Pass	H	AV
9	1594.4594	29.02	3.07	-42.91	55.57	44.75	74.00	29.25	Pass	V	PK
10	2164.7165	31.93	3.65	-43.17	53.32	45.73	74.00	28.27	Pass	V	PK
11	4960.1307	34.50	4.82	-42.80	61.03	57.55	74.00	16.45	Pass	V	PK
12	7440.0000	36.54	5.85	-42.11	57.17	57.45	74.00	16.55	Pass	V	PK
13	9920.0000	37.77	6.79	-42.10	47.21	49.67	74.00	24.33	Pass	V	PK
14	12400.0000	39.54	7.86	-41.90	46.68	52.18	74.00	21.82	Pass	V	PK
15	4959.9507	34.50	4.82	-42.80	47.12	43.64	54.00	10.36	Pass	V	AV
16	7439.9360	36.54	5.85	-42.11	44.93	45.21	54.00	8.79	Pass	V	AV

Mode:		$\pi/4$ DQPSK Transmitting					Channel:		2402		
NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dB μ V]	Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Result	Polarity	Remark
1	1327.8328	28.23	2.79	-42.76	53.30	41.56	74.00	32.44	Pass	H	PK
2	2125.9126	31.88	3.62	-43.18	57.46	49.78	74.00	24.22	Pass	H	PK
3	4804.1203	34.50	4.55	-42.80	58.56	54.81	74.00	19.19	Pass	H	PK
4	7206.2804	36.31	5.81	-42.16	55.36	55.32	74.00	18.68	Pass	H	PK
5	9608.0000	37.64	6.63	-42.10	47.22	49.39	74.00	24.61	Pass	H	PK
6	12010.0000	39.31	7.60	-41.90	46.54	51.55	74.00	22.45	Pass	H	PK
7	4803.9203	34.50	4.55	-42.80	43.95	40.20	54.00	13.80	Pass	H	AV
8	7205.9304	36.31	5.82	-42.16	41.30	41.27	54.00	12.73	Pass	H	AV
9	1593.4593	29.02	3.06	-42.91	54.91	44.08	74.00	29.92	Pass	V	PK
10	2125.3125	31.88	3.62	-43.18	55.38	47.70	74.00	26.30	Pass	V	PK
11	4804.0000	34.50	4.55	-42.80	60.66	56.91	74.00	17.09	Pass	V	PK
12	7205.2804	36.31	5.82	-42.17	58.84	58.80	74.00	15.20	Pass	V	PK
13	9608.0000	37.64	6.63	-42.10	47.52	49.69	74.00	24.31	Pass	V	PK
14	12010.0000	39.31	7.60	-41.90	46.99	52.00	74.00	22.00	Pass	V	PK
15	4803.9402	34.50	4.55	-42.80	45.56	41.81	54.00	12.19	Pass	V	AV
16	7205.9204	36.31	5.82	-42.16	42.78	42.75	54.00	11.25	Pass	V	AV

Mode:		$\pi/4$ DQPSK Transmitting					Channel:		2441		
NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dB μ V]	Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Result	Polarity	Remark
1	1663.4663	29.48	3.16	-42.75	54.23	44.12	74.00	29.88	Pass	H	PK
2	2127.1127	31.88	3.62	-43.18	57.07	49.39	74.00	24.61	Pass	H	PK
3	4881.1254	34.50	4.80	-42.80	59.44	55.94	74.00	18.06	Pass	H	PK
4	7322.2882	36.42	5.85	-42.13	57.80	57.94	74.00	16.06	Pass	H	PK
5	9764.0000	37.71	6.71	-42.10	47.90	50.22	74.00	23.78	Pass	H	PK
6	12205.0000	39.42	7.67	-41.89	46.26	51.46	74.00	22.54	Pass	H	PK
7	4881.9254	34.50	4.81	-42.80	44.61	41.12	54.00	12.88	Pass	H	AV
8	7322.9482	36.42	5.85	-42.14	41.68	41.81	54.00	12.19	Pass	H	AV
9	1598.8599	29.05	3.07	-42.90	54.15	43.37	74.00	30.63	Pass	V	PK
10	2126.3126	31.88	3.62	-43.18	57.35	49.67	74.00	24.33	Pass	V	PK
11	4882.1255	34.50	4.81	-42.80	62.37	58.88	74.00	15.12	Pass	V	PK
12	7322.2882	36.42	5.85	-42.13	58.84	58.98	74.00	15.02	Pass	V	PK
13	9755.4504	37.70	6.75	-42.09	50.78	53.14	74.00	20.86	Pass	V	PK
14	12205.0000	39.42	7.67	-41.89	45.72	50.92	74.00	23.08	Pass	V	PK
15	4881.9255	34.50	4.81	-42.80	45.75	42.26	54.00	11.74	Pass	V	AV
16	7322.8682	36.42	5.85	-42.14	42.58	42.71	54.00	11.29	Pass	V	AV

Mode:		$\pi/4$ DQPSK Transmitting					Channel:		2480		
NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dB μ V]	Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Result	Polarity	Remark
1	1597.0597	29.04	3.07	-42.91	56.97	46.17	74.00	27.83	Pass	H	PK
2	2133.3133	31.89	3.63	-43.18	57.95	50.29	74.00	23.71	Pass	H	PK
3	4960.1307	34.50	4.82	-42.80	60.99	57.51	74.00	16.49	Pass	H	PK
4	7440.2960	36.54	5.85	-42.11	57.63	57.91	74.00	16.09	Pass	H	PK
5	9920.0000	37.77	6.79	-42.10	45.71	48.17	74.00	25.83	Pass	H	PK
6	12400.0000	39.54	7.86	-41.90	46.72	52.22	74.00	21.78	Pass	H	PK
7	4959.9207	34.50	4.82	-42.80	45.29	41.81	54.00	12.19	Pass	H	AV
8	7439.8860	36.54	5.85	-42.11	42.12	42.40	54.00	11.60	Pass	H	AV
9	1592.4592	29.01	3.06	-42.91	54.71	43.87	74.00	30.13	Pass	V	PK
10	2125.5126	31.88	3.62	-43.18	55.89	48.21	74.00	25.79	Pass	V	PK
11	4960.1307	34.50	4.82	-42.80	59.74	56.26	74.00	17.74	Pass	V	PK
12	7439.2960	36.54	5.85	-42.11	59.84	60.12	74.00	13.88	Pass	V	PK
13	9920.0000	37.77	6.79	-42.10	46.48	48.94	74.00	25.06	Pass	V	PK
14	12400.0000	39.54	7.86	-41.90	45.93	51.43	74.00	22.57	Pass	V	PK
15	4959.9407	34.50	4.82	-42.80	45.35	41.87	54.00	12.13	Pass	V	AV
16	7439.8960	36.54	5.85	-42.11	43.02	43.30	54.00	10.70	Pass	V	AV

Note:

1) Through Pre-scan Non-hopping transmitting mode and charge+transmitter mode with all kind of modulation and all kind of data type, find the DH5 of data type is the worse case of GFSK modulation type in charge + transmitter mode.

2) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Final Test Level = Receiver Reading - Correct Factor

Correct Factor = Preamplifier Factor - Antenna Factor - Cable Factor

3) Scan from 9kHz to 25GHz, the disturbance above 13GHz and below 30MHz was very low, and the above harmonics were the highest point could be found when testing, so only the above harmonics had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.