RF TEST REPORT

Report No.: 17021728-FCC-R1
Supersede Report No.: N/A

Applicant	Shenzhen Qi Ying Electronics Co.,Ltd
Product Name	Clip Wireless Car Audio player
Model No.	QY-BK02
Serial No.	N/A
Test Standard	FCC Part 15.247: 2017, ANSI C63.10: 2013
Test Date	December 20 to December 26, 2017
Issue Date	December 29, 2017
Test Result	☑ **Pass** ☐ **Fail**
Equipment complied with the specification	☑
Equipment did not comply with the specification	☐

Amos. Xia	Deon Dai	
Amos Xia **Test Engineer**	**Deon Dai** **Engineer Reviewer**	

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Test result presented in this test report is applicable to the tested sample only

Issued by:
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Accreditations for Conformity Assessment

Country/Region	Scope
USA	EMC, RF/Wireless, SAR, Telecom
Canada	EMC, RF/Wireless, SAR, Telecom
Taiwan	EMC, RF, Telecom, SAR, Safety
Hong Kong	RF/Wireless, SAR, Telecom
Australia	EMC, RF, Telecom, SAR, Safety
Korea	EMI, EMS, RF, SAR, Telecom, Safety
Japan	EMI, RF/Wireless, SAR, Telecom
Singapore	EMC, RF, SAR, Telecom
Europe	EMC, RF, SAR, Telecom, Safety

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1. Report Revision History

Report No.	Report Version	Description	Issue Date
17021728-FCC-R1	NONE	Original	December 29, 2017

2. Customer information

Applicant Name	Shenzhen Qi Ying Electronics Co.,Ltd
Applicant Add	Floor 2,Building D ,Quan Yuan Fa Industrial Zone,Guan Lan Road No.73,Long Hua District,Shenzhen City ,China
Manufacturer	Shenzhen Qi Ying Electronics Co.,Ltd
Manufacturer Add	Floor 2,Building D ,Quan Yuan Fa Industrial Zone,Guan Lan Road No.73,Long Hua District,Shenzhen City ,China

3. Test site information

Lab performing tests	SIEMIC (Nanjing-China) Laboratories
Lab Address	2-1 Longcang Avenue Yuhua Economic and Technology Development Park, Nanjing, China
FCC Test Site No.	694825
IC Test Site No.	4842B-1
Test Software	EZ_EMC

4. Equipment under Test (EUT) Information

Description of EUT:	Clip Wireless Car Audio player
Main Model:	QY-BK02
Serial Model:	N/A
Date EUT received:	December 18, 2017
Test Date(s):	December 20 to December 26, 2017
Antenna Gain:	Bluetooth: 0 dBi
Type of Modulation:	Bluetooth: GFSK, π/4DQPSK, 8DPSK
RF Operating Frequency (ies):	Bluetooth: 2402-2480 MHz
Max. Output Power:	0.195 dBm
Number of Channels:	Bluetooth: 79CH
Port:	DC Port
Input Power:	DC 3.3-4.2V Battery:3.7V 1000mAh
Trade Name :	N/A
FCC ID:	2AOLJQY-BK02

Operating Channel list

Channel	Frequency(MHz)	Channel	Frequency(MHz)	Channel	Frequency(MHz)	Channel	Frequency(MHz)	Channel	Frequency(MHz)
00	2402	17	2419	34	2436	51	2453	68	2470
01	2403	18	2420	35	2437	52	2454	69	2471
02	2404	19	2421	36	2438	53	2455	70	2472
03	2405	20	2422	37	2439	54	2456	71	2473
04	2406	21	2423	38	2440	55	2457	72	2474
05	2407	22	2424	39	2441	56	2458	73	2475
06	2408	23	2425	40	2442	57	2459	74	2476
07	2409	24	2426	41	2443	58	2460	75	2477
08	2410	25	2427	42	2444	59	2461	76	2478
09	2411	26	2428	43	2445	60	2462	77	2479
10	2412	27	2429	44	2446	61	2463	78	2480
11	2413	28	2430	45	2447	62	2464		
12	2414	29	2431	46	2448	63	2465		
13	2415	30	2432	47	2449	64	2466		
14	2416	31	2433	48	2450	65	2467		
15	2417	32	2434	49	2451	66	2468		
16	2418	33	2435	50	2452	67	2469		

5. Test Summary

The product was tested in accordance with the following specifications.
All testing has been performed according to below product classification:

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliance
§15.247(a)(1)	Channel Separation	Compliance
§15.247(a)(1)	20 dB Bandwidth	Compliance
§15.247(b)(1)	Peak Output Power	Compliance
§15.247(a)(1)(iii)	Number of Hopping Channel	Compliance
§15.247(a)(1)(iii)	Time of Occupancy (Dwell Time)	Compliance
§15.247(d)	Band Edge	Compliance
§15.207(a)	AC Line Conducted Emissions	Compliance
§15.205, §15.209, §15.247(d)	Radiated Emissions	Compliance

Measurement Uncertainty

Emissions		
Test Item	**Description**	**Uncertainty**
Band Edge and Radiated Spurious Emissions	Confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2 (for EUTs < 0.5m X 0.5m X 0.5m)	+5.6dB/-4.5dB
-	-	-

6. Measurements, Examination And Derived Results

6.1 Antenna Requirement

Applicable Standard

According to § 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 unique 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 user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules.
§15.203 state that the subject device must meet the following criteria:

a. Antenna must be permanently attached to the unit.
b. Antenna must use a unique type of connector to attach to the EUT.

Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.
And according to FCC 47 CFR section 15.247 (b), if the transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Antenna Connector Construction

The EUT has 1 antennas:
A permanently attached PCB antenna for Bluetooth, the gain is 0 dBi for Bluetooth.

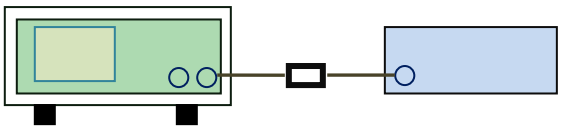
Antenna must be permanently attached to the unit ,it meets up with the ANTENNA REQUIREMENT.

Result: Compliant.

6.2 Channel Separation

Temperature	23°C
Relative Humidity	51%
Atmospheric Pressure	1018mbar
Test date :	December 21, 2017
Tested By :	Amos Xia

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.247(a)(1)	a)	Channel Separation < 20dB BW and 20dB BW < 25KHz ; Channel Separation Limit=25KHz Chanel Separation < 20dB BW and 20dB BW > 25kHz ; Channel Separation Limit=2/3 20dB BW	☒
Test Setup			
Test Procedure	The test follows FCC Public Notice DA 00-705 Measurement Guidelines. Use the following spectrum analyzer settings: - The EUT must have its hopping function enabled - Span = wide enough to capture the peaks of two adjacent channels - Resolution (or IF) Bandwidth (RBW) ≥1% of the span - Video (or Average) Bandwidth (VBW) ≥RBW - Sweep = auto - Detector function = peak - Trace = max hold - Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section. Submit this plot.		
Remark			
Result	☒Pass ☐Fail		

Test Data ☒Yes ☐N/A
Test Plot ☒Yes (See below) ☐N/A

Channel Separation measurement result

Type/ Modulation	CH	CH Freq (MHz)	CH Separation (MHz)	Limit (MHz)	Result
CH Separation GFSK	Low Channel	2402	1.008	0.737	Pass
	Adjacency Channel	2403			
	Mid Channel	2440	1.002	0.734	Pass
	Adjacency Channel	2441			
	High Channel	2480	1.002	0.736	Pass
	Adjacency Channel	2479			
CH Separation π/4 DQPSK	Low Channel	2402	1.002	0.890	Pass
	Adjacency Channel	2403			
	Mid Channel	2440	1.002	0.893	Pass
	Adjacency Channel	2441			
	High Channel	2480	1.008	0.890	Pass
	Adjacency Channel	2479			
CH Separation 8DPSK	Low Channel	2402	1.008	0.909	Pass
	Adjacency Channel	2403			
	Mid Channel	2440	1.005	0.905	Pass
	Adjacency Channel	2441			
	High Channel	2480	1.005	0.906	Pass
	Adjacency Channel	2479			

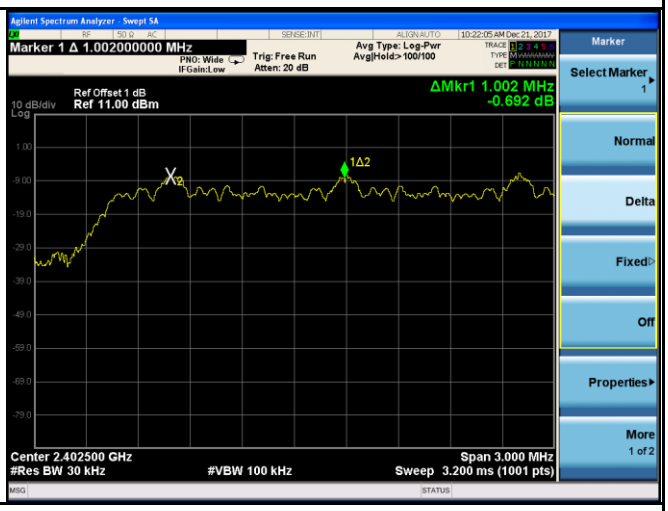
Test Plots

Channel Separation measurement result

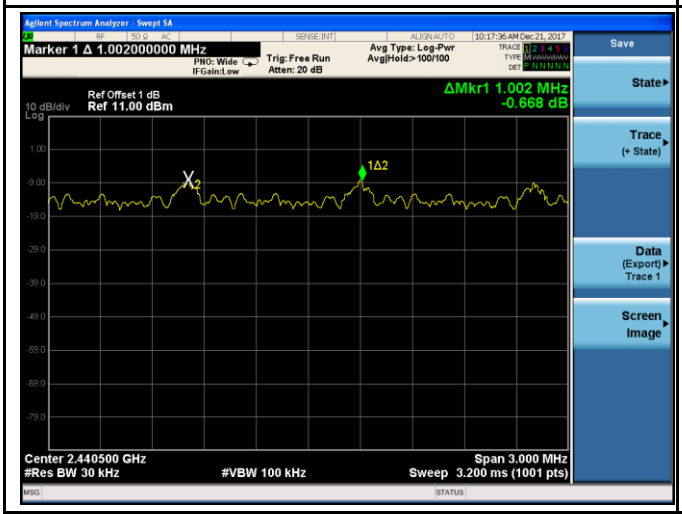
GFSK - Low Channel

GFSK - Middle Channel

GFSK - High Channel

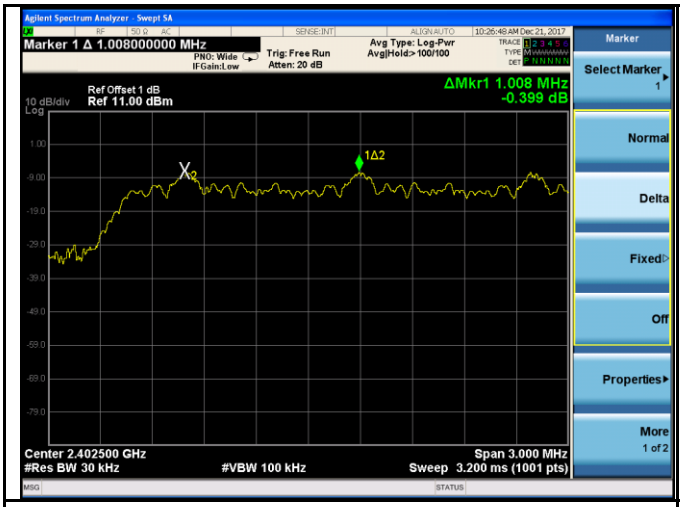


π/4 DQPSK - Low Channel

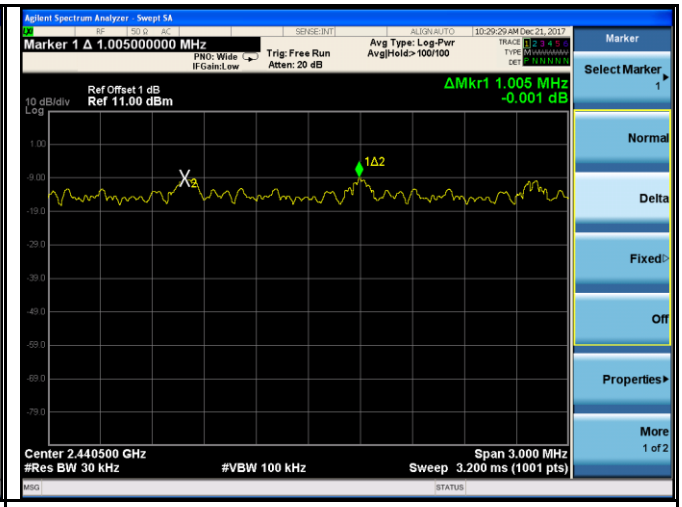


π/4 DQPSK - Middle Channel

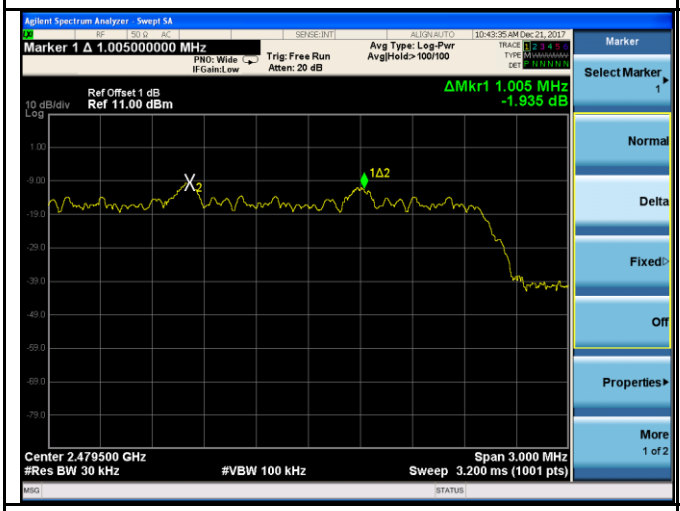
π/4 DQPSK - High Channel



8DPSK - Low Channel



8DPSK - Middle Channel

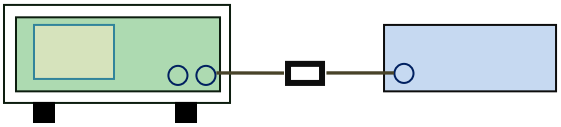


8DPSK - High Channel

6.3 20dB Bandwidth

Temperature	23°C
Relative Humidity	51%
Atmospheric Pressure	1018mbar
Test date :	December 21, 2017
Tested By :	Amos Xia

Requirement(s):

Spec	Item	Requirement	Applicable
§15.247(a) (1)	a)	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.	☒
Test Setup			
Test Procedure	The test follows FCC Public Notice DA 00-705 Measurement Guidelines. Use the following spectrum analyzer settings: - Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel - RBW ≥1% of the 20 dB bandwidth - VBW ≥RBW - Sweep = auto - Detector function = peak - Trace = max hold. - The EUT should be transmitting at its maximum data rate. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 20 dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 20 dB bandwidth of the emission. If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).		
Remark			
Result	☒Pass ☐ Fail		

Test Data ☒Yes ☐ N/A

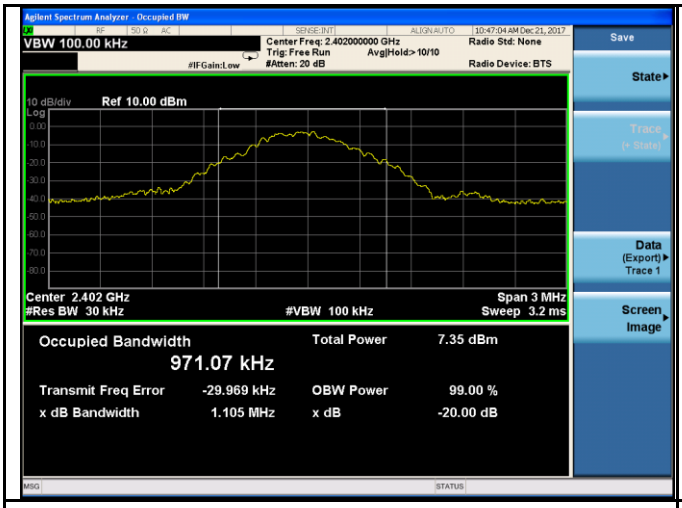
Test Plot ☒Yes (See below) ☐ N/A

Measurement result

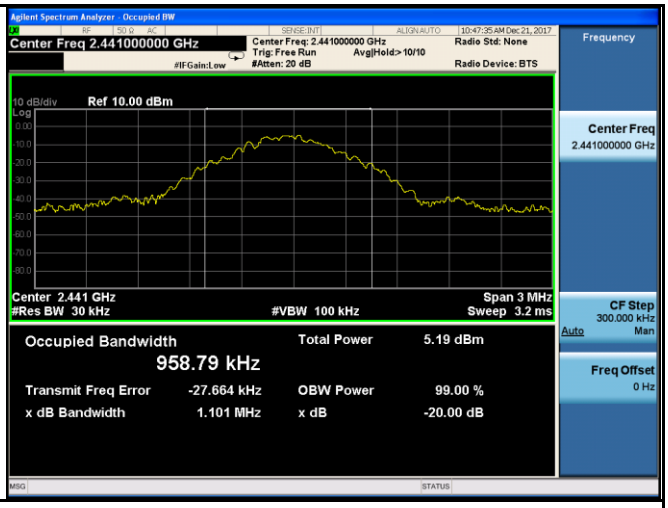
Modulation	CH	CH Freq (MHz)	20dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
GFSK	Low	2402	1.105	0.97107
	Mid	2441	1.101	0.95879
	High	2480	1.104	0.96247
π/4 DQPSK	Low	2402	1.334	1.2602
	Mid	2441	1.339	1.2587
	High	2480	1.348	1.2765
8-DPSK	Low	2402	1.363	1.2565
	Mid	2441	1.358	1.2607
	High	2480	1.359	1.2388

Test Plots

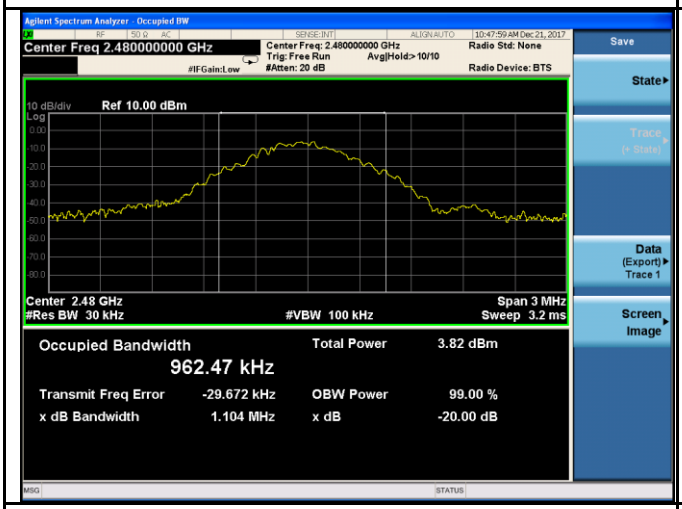
20dB Bandwidth measurement result



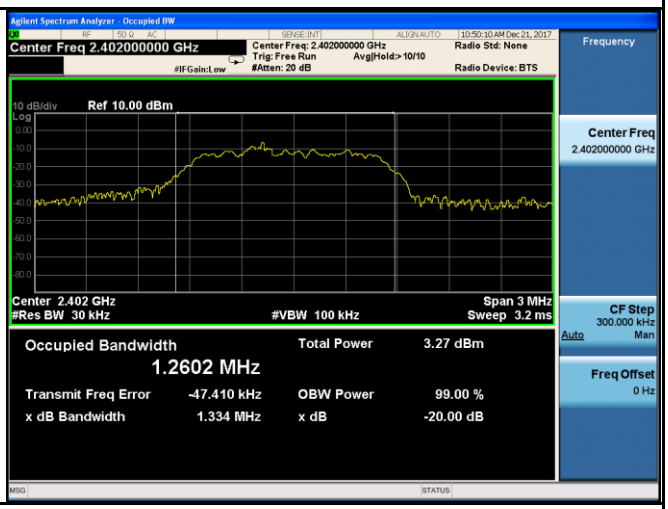
GFSK - Low Channel



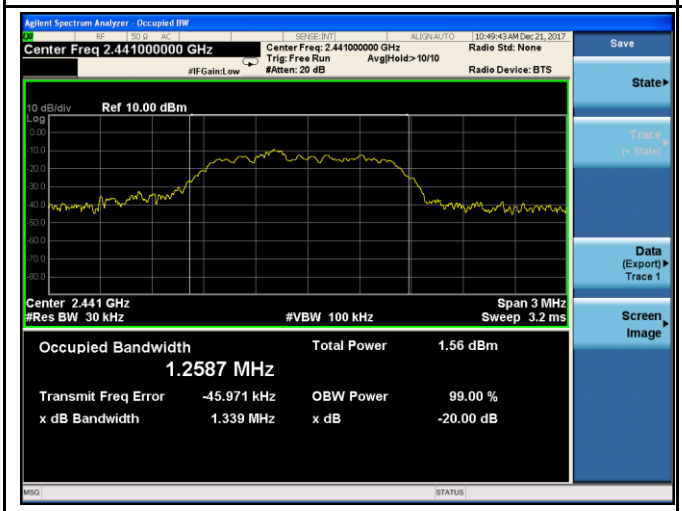
GFSK - Middle Channel



GFSK - High Channel

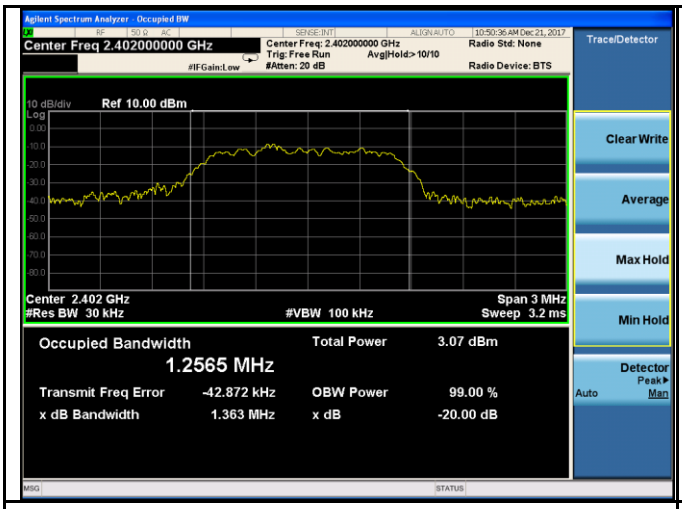


π/4 DQPSK - Low Channel

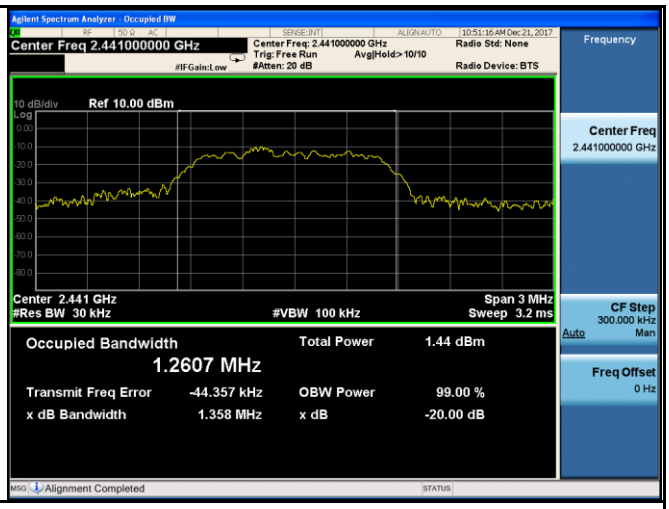


π/4 DQPSK - Middle Channel

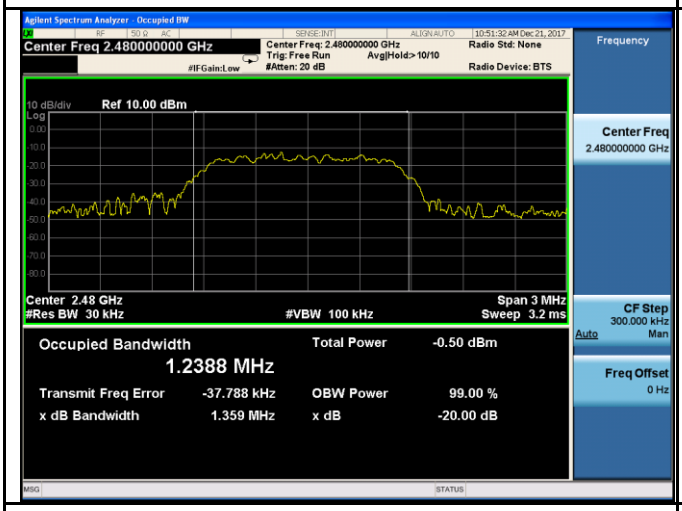
π/4 DQPSK - High Channel



8DPSK - Low Channel



8DPSK - Middle Channel

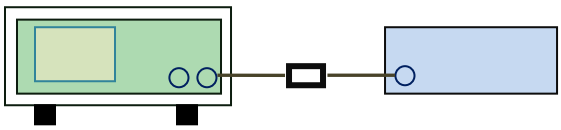


8DPSK - High Channel

6.4 Peak Output Power

Temperature	23°C
Relative Humidity	51%
Atmospheric Pressure	1018mbar
Test date :	December 21, 2017
Tested By :	Amos Xia

Requirement(s):

Spec	Item	Requirement	Applicable
§15.247(b) (2)	a)	FHSS in 2400-2483.5MHz with ≥ 75 channels: ≤1 Watt	☒
	b)	FHSS in 5725-5850MHz: ≤1 Watt	☐
	c)	For all other FHSS in the 2400-2483.5MHz band: ≤0.125 Watt.	☒
	d)	FHSS in 902-928MHz with ≥ 50 channels: ≤1 Watt	☐
	e)	FHSS in 902-928MHz with ≥ 25 & <50 channels: ≤0.25 Watt	☐
	f)	DSSS in 902-928MHz, 2400-2483.5MHz, 5725-5850MHz: ≤1 Watt	☐
Test Setup			
Test Procedure	The test follows FCC Public Notice DA 00-705 Measurement Guidelines. Use the following spectrum analyzer settings: - Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel - RBW > the 20 dB bandwidth of the emission being measured - VBW ≥RBW - Sweep = auto - Detector function = peak - Trace = max hold - Allow the trace to stabilize. - Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power (see the note above regarding external attenuation and cable loss). The limit is specified in one of the subparagraphs of this Section. Submit this plot. A peak responding power meter may be used instead of a spectrum analyzer.		
Remark			
Result	☒Pass ☐ Fail		

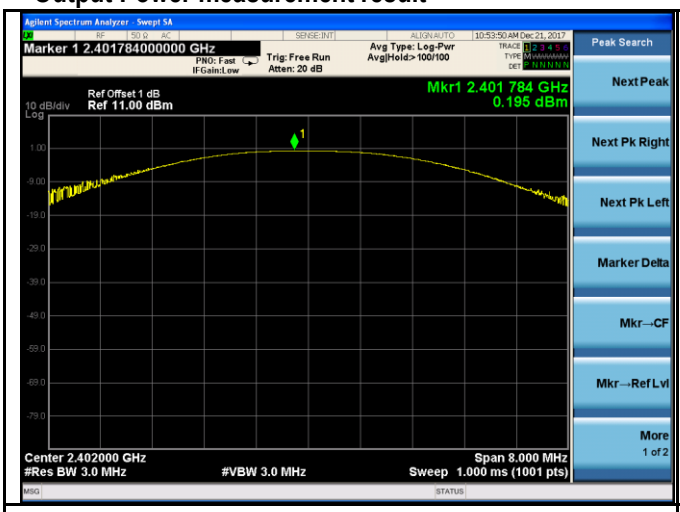
Test Data ☒Yes ☐N/A
Test Plot ☒Yes (See below) ☐N/A

Peak Output Power measurement result

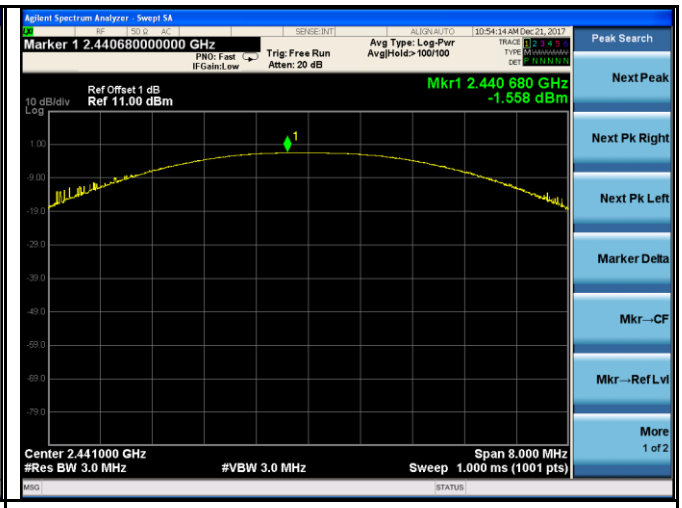
Type	Modulation	CH	Freq (MHz)	Conducted Power (dBm)	Limit (mW)	Result
Output Power	GFSK	Low	2402	0.195	125	Pass
		Mid	2441	-1.558	125	Pass
		High	2480	-3.037	125	Pass
	π/4 DQPSK	Low	2402	0.147	125	Pass
		Mid	2441	-1.591	125	Pass
		High	2480	-3.057	125	Pass
	8-DPSK	Low	2402	0.163	125	Pass
		Mid	2441	-1.567	125	Pass
		High	2480	-3.052	125	Pass

Test Plots

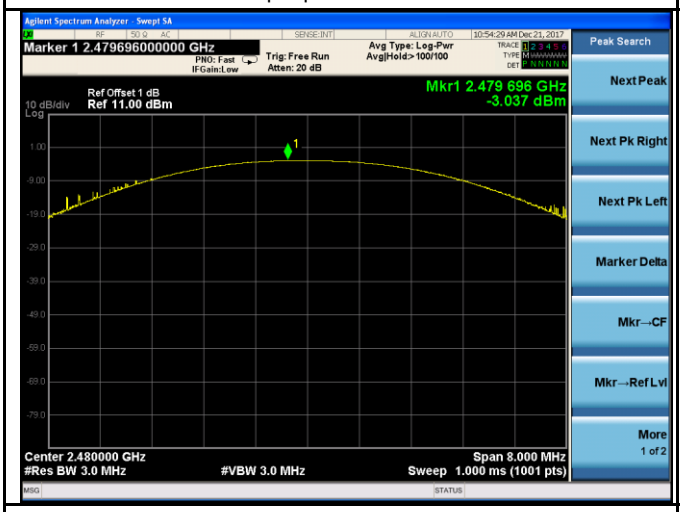
Output Power measurement result



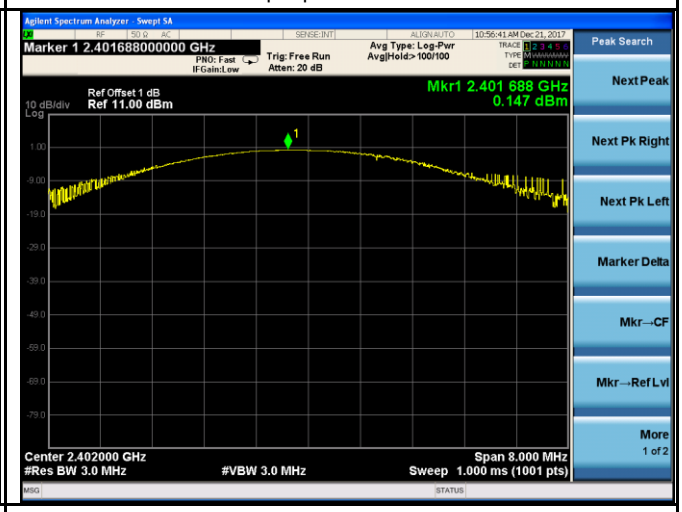
GFSK Output power - Low CH 2402



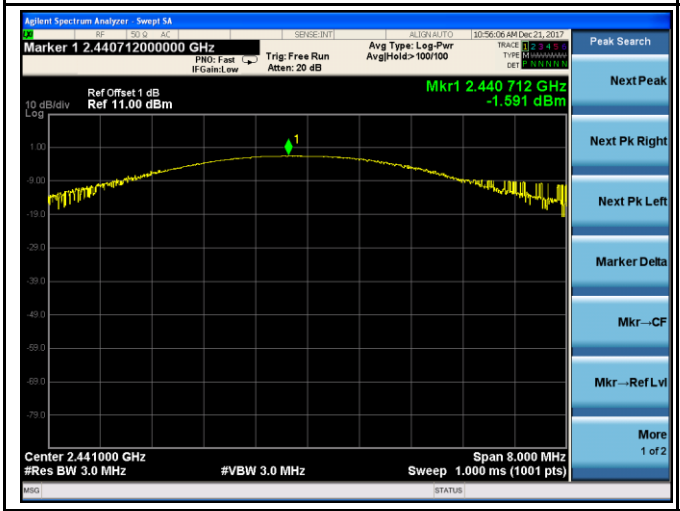
GFSK Output power - Mid CH 2441



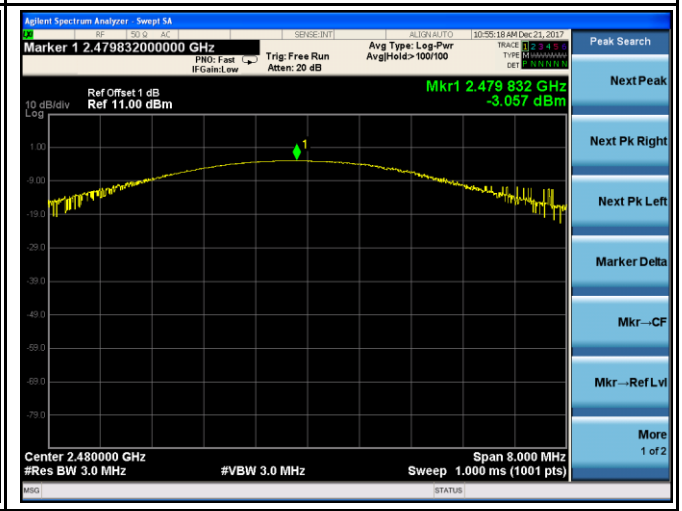
GFSK Output power - High CH 2480



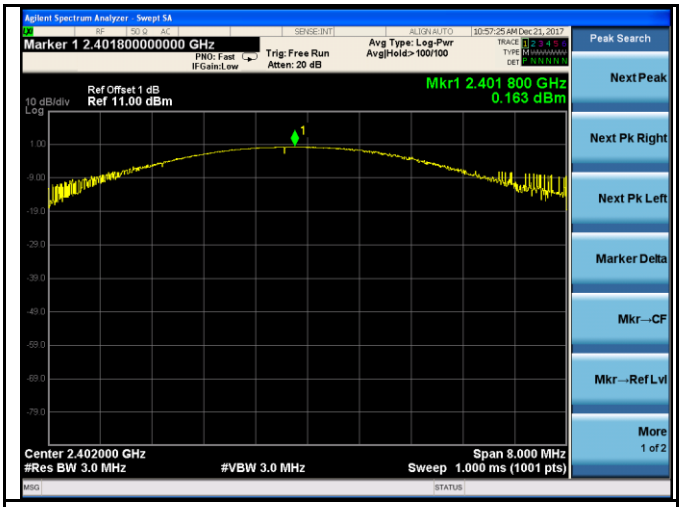
π/4 DQPSK Output power - Low CH 2402



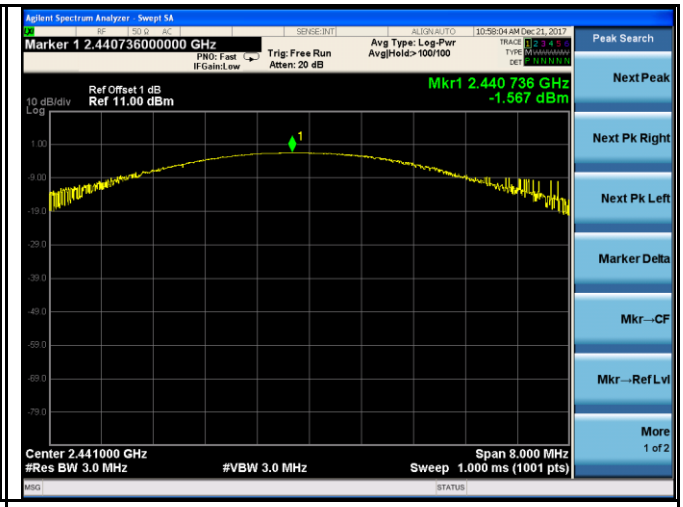
π/4 DQPSK Output power - Mid CH 2441



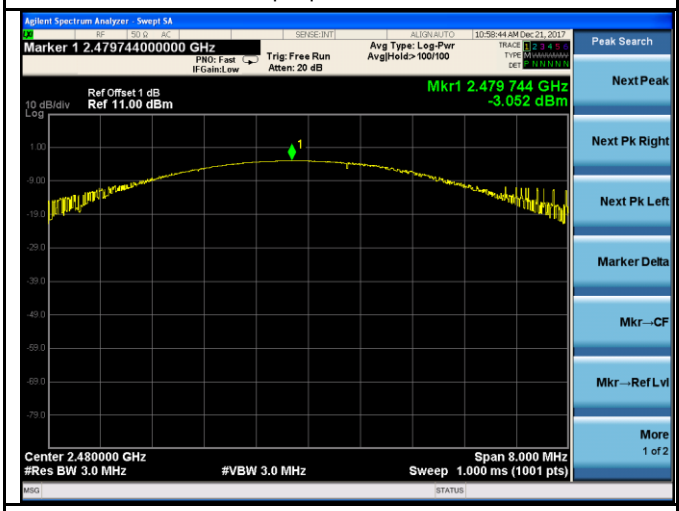
π/4 DQPSK Output power - High CH 2480



8DPSK Output power - Low CH 2402



8DPSK Output power - Mid CH 2441

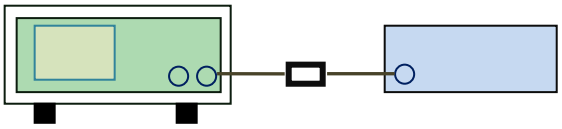


8DPSK Output power - High CH 2480

6.5 Number of Hopping Channel

Temperature	23°C
Relative Humidity	51%
Atmospheric Pressure	1018mbar
Test date :	December 21, 2017
Tested By :	Amos Xia

Requirement(s):

Spec	Item	Requirement	Applicable
§15.247(a)(1)(iii)	a)	FHSS in 2400-2483.5MHz ≥ 15 channels	☒
Test Setup			
Test Procedure	The test follows FCC Public Notice DA 00-705 Measurement Guidelines. Use the following spectrum analyzer settings: The EUT must have its hopping function enabled. - Span = the frequency band of operation - RBW ≥1% of the span - VBW ≥RBW - Sweep = auto - Detector function = peak - Trace = max hold - Allow trace to fully stabilize. - It may prove necessary to break the span up to sections, in order to clearly show all of the hopping frequencies. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).		
Remark			
Result	☒Pass ☐Fail		

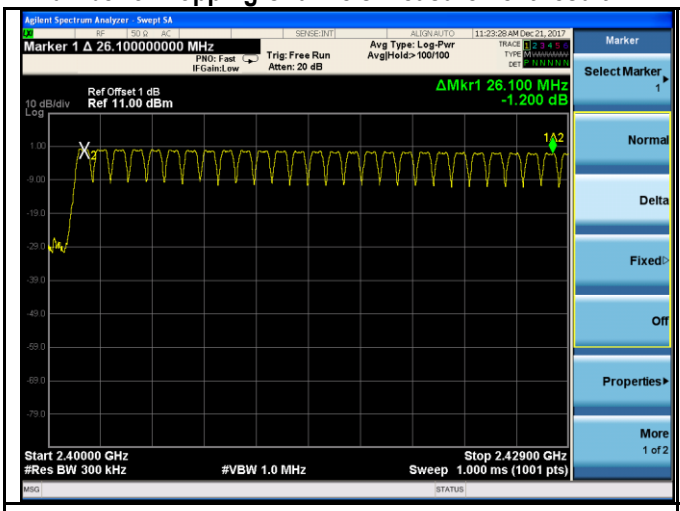
Test Data ☒Yes ☐N/A
Test Plot ☒Yes (See below) ☐N/A

Number of Hopping Channel measurement result

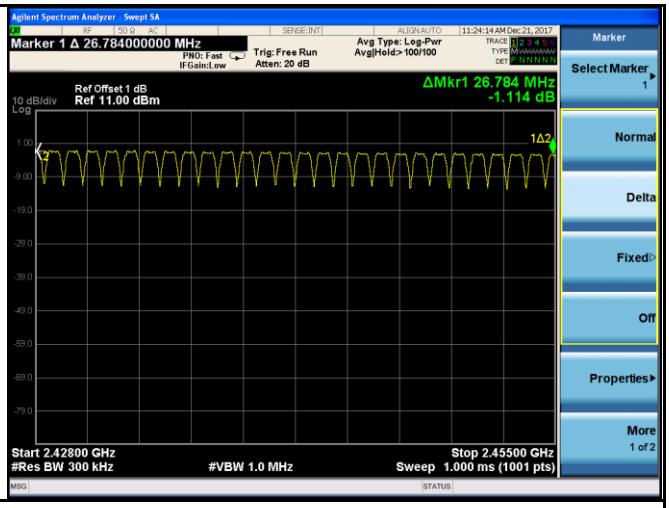
Type	Modulation	Frequency Range	Number of Hopping Channel	Limit
Number of Hopping Channel	GFSK	2400-2483.5	79	15
	π/4 DQPSK	2400-2483.5	79	15
	8-DPSK	2400-2483.5	79	15

Test Plots

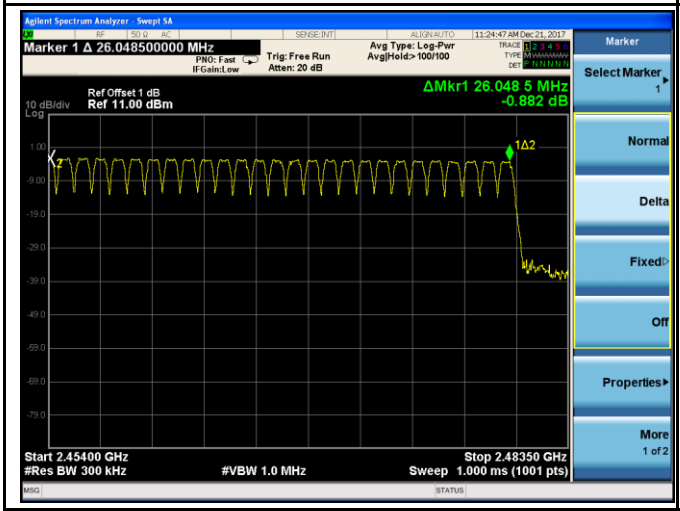
Number of Hopping Channels measurement result



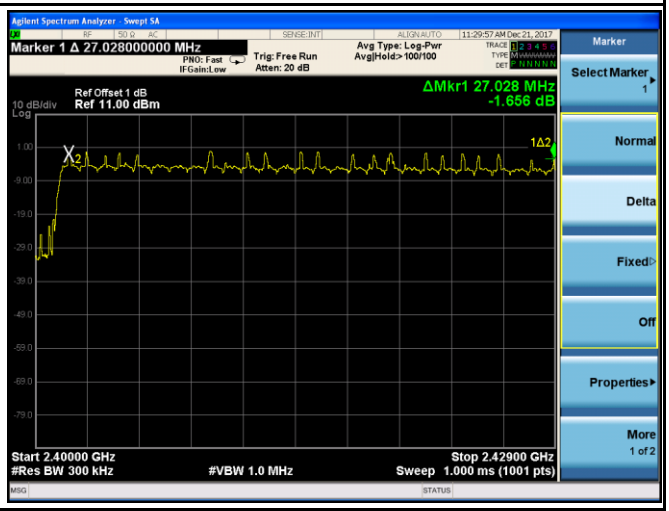
GFSK Number of Hopping Channels - 1



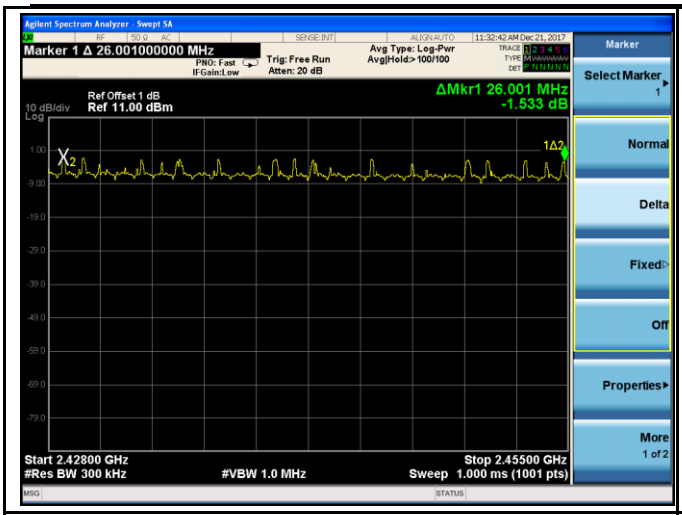
GFSK Number of Hopping Channels -2



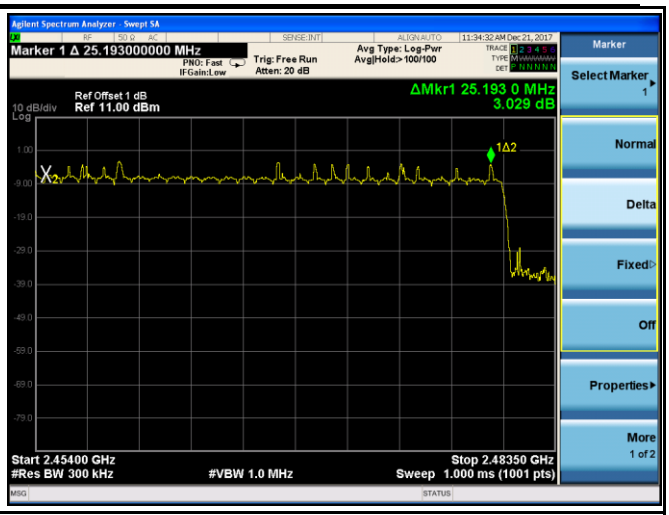
GFSK Number of Hopping Channels – 3



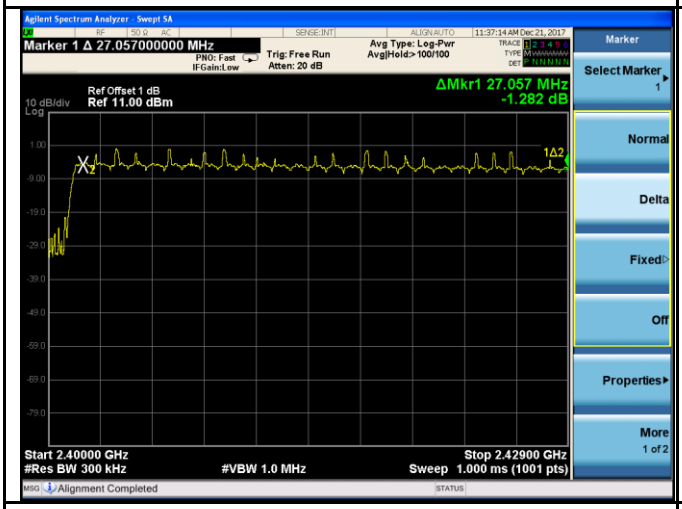
π/4 DQPSK Number of Hopping Channels - 1



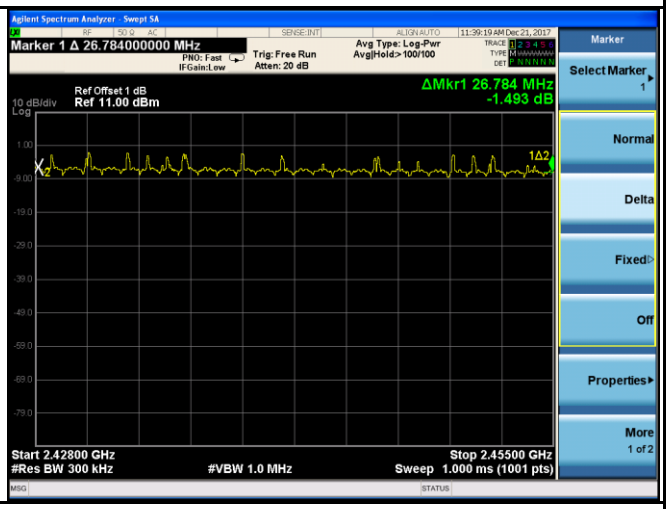
π/4 DQPSK Number of Hopping Channels - 2



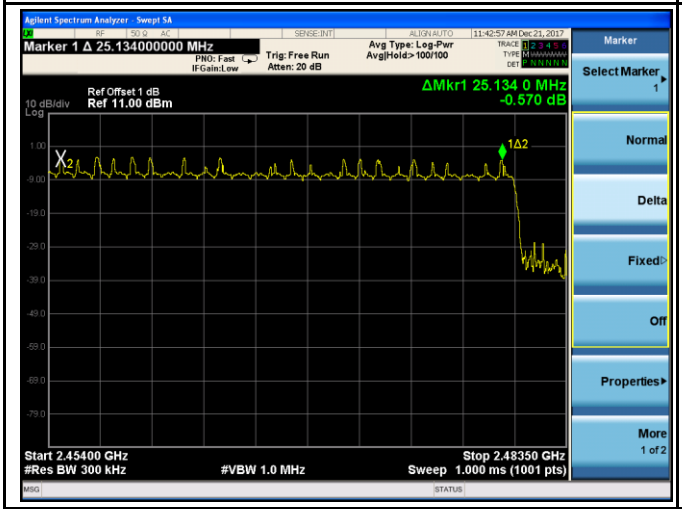
π/4 DQPSK Number of Hopping Channels - 3



8DPSK Number of Hopping Channels - 1



8DPSK Number of Hopping Channels - 2

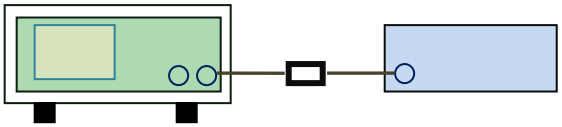


8DPSK Number of Hopping Channels - 3

6.6 Time of Occupancy (Dwell Time)

Temperature	23°C
Relative Humidity	51%
Atmospheric Pressure	1018mbar
Test date :	December 21, 2017
Tested By :	Amos Xia

Requirement(s):

Spec	Item	Requirement	Applicable
§15.247(a)(1)(iii)	a)	Dwell Time < 0.4s	☒
Test Setup			
Test Procedure	The test follows FCC Public Notice DA 00-705 Measurement Guidelines. Use the following spectrum analyzer - Span = zero span, centered on a hopping channel - RBW = 1 MHz - VBW ≥RBW - Sweep = as necessary to capture the entire dwell time per hopping channel - Detector function = peak - Trace = max hold - use the marker-delta function to determine the dwell time		
Remark			
Result	☒Pass ☐ Fail		

Test Data ☒Yes ☐ N/A

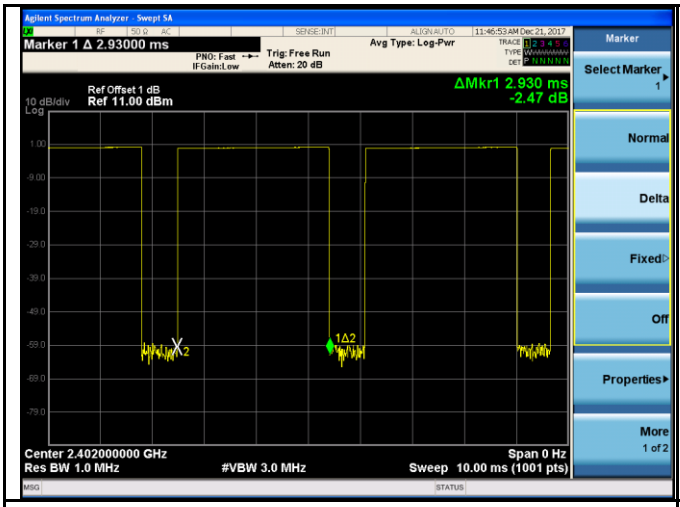
Test Plot ☒Yes (See below) ☐ N/A

Dwell Time measurement result

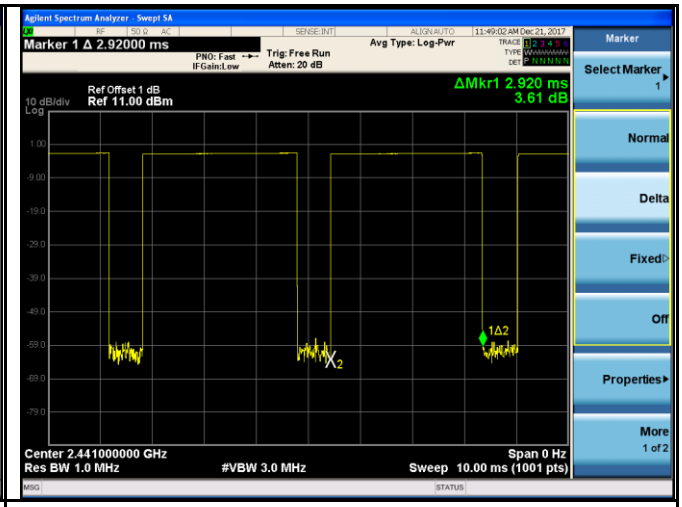
Type	Modulation	CH	Pulse Width (ms)	Dwell Time (ms)	Limit (ms)	Result
Dwell Time	GFSK	Low	2.930	312.53	400	Pass
		Mid	2.920	311.47	400	Pass
		High	2.980	317.87	400	Pass
	π/4 DQPSK	Low	3.000	320.00	400	Pass
		Mid	2.940	313.60	400	Pass
		High	2.980	317.87	400	Pass
	8-DPSK	Low	2.980	317.87	400	Pass
		Mid	2.980	317.87	400	Pass
		High	2.920	311.47	400	Pass
Note: Dwell time=Pulse Time (ms) × (1600 ÷ 6 ÷ 79) ×31.6						

Note：All packet have been tested（DH1、DH2、DH3）,but only worst（DH5）case is the reported.

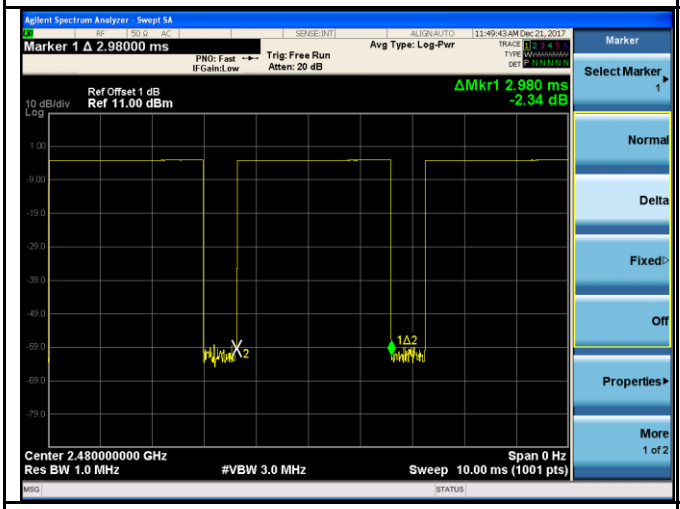
Test Plots
Dwell Time measurement result



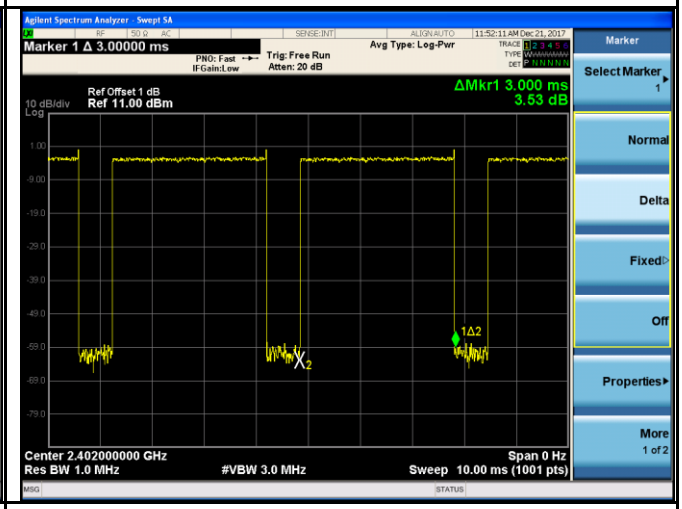
GFSK - Low CH 2402



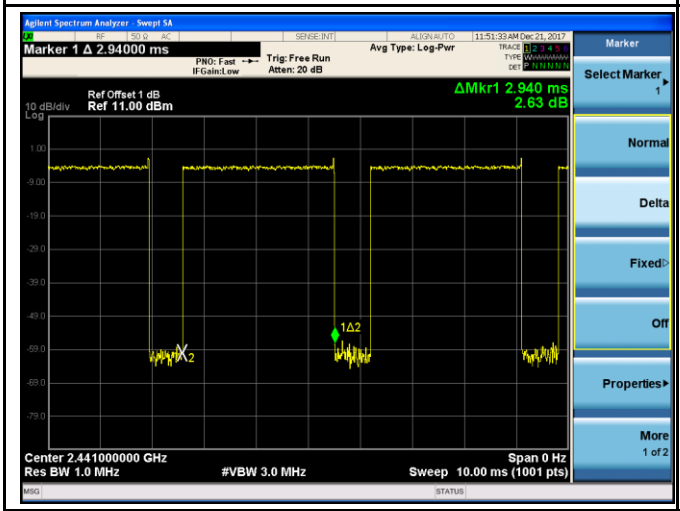
GFSK - Mid CH 2441



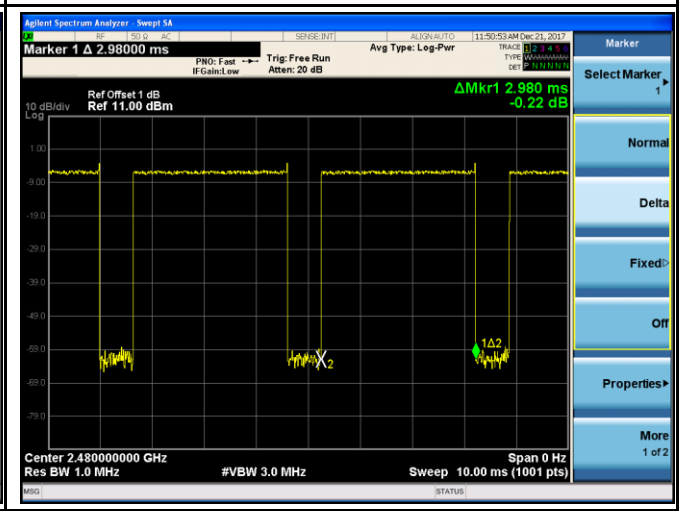
GFSK - High CH 2480



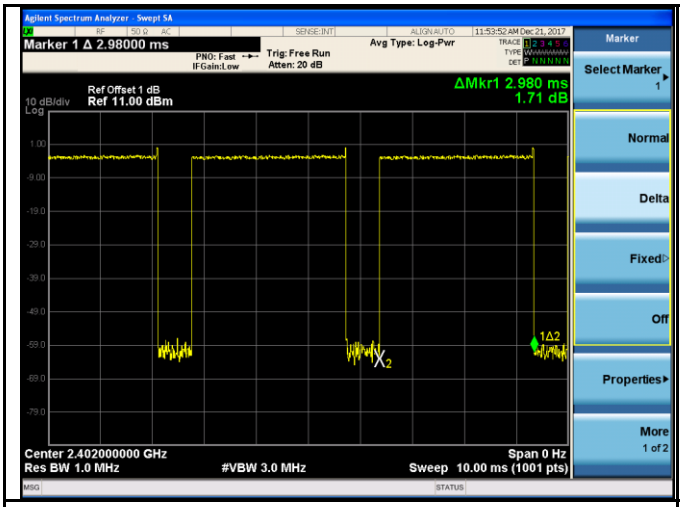
π/4 DQPSK - Low CH 2402



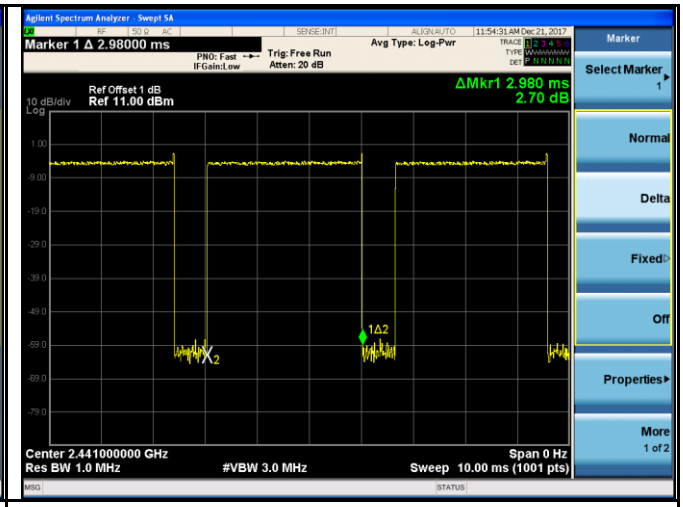
π/4 DQPSK - Mid CH 2441



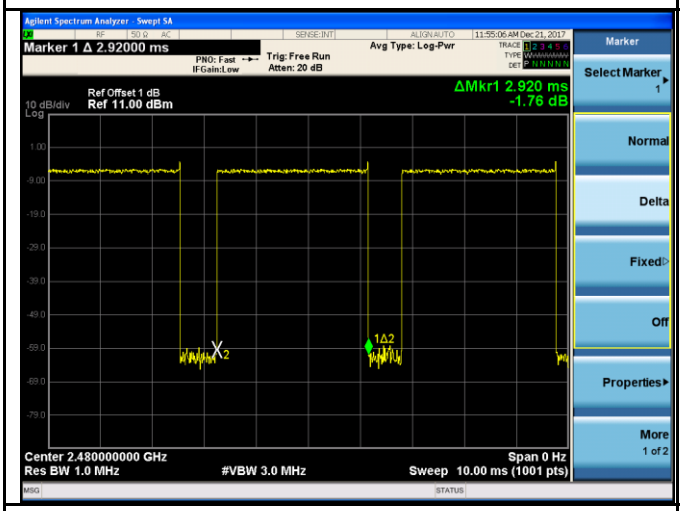
π/4 DQPSK - High CH 2480



8DPSK - Low CH 2402



8DPSK - Mid CH 2441

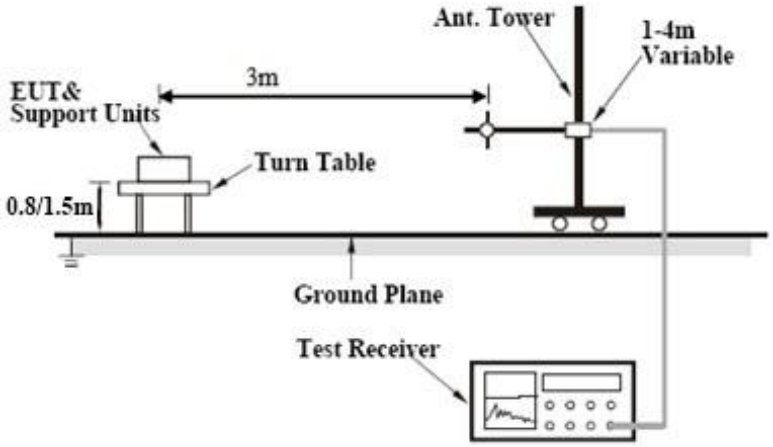


8DPSK - High CH 2480

6.7 Band Edge

Temperature	23°C
Relative Humidity	51%
Atmospheric Pressure	1018mbar
Test date :	December 25 to December 26, 2017
Tested By :	Amos Xia

Requirement(s):

Spec	Item	Requirement	Applicable
§15.247(a)(1)(iii)	a)	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.	☒
Test Setup			
Test Procedure	The test follows FCC Public Notice DA 00-705 Measurement Guidelines. Radiated Method Only - 1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator. - 2. Position the EUT without connection to measurement instrument. Put it on the Rotated table and turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range. - 3. First, set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge, check the emission of EUT, if pass then set Spectrum Analyzer as below: a. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasiy Peak detection at frequency below 1GHz. b. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz with Peak detection for Peak measurement at frequency above 1GHz. c. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz with Peak detection for Average Measurement as below at frequency above 1GHz. - 4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency. - 5. Repeat above procedures until all measured frequencies were complete.		
Remark			

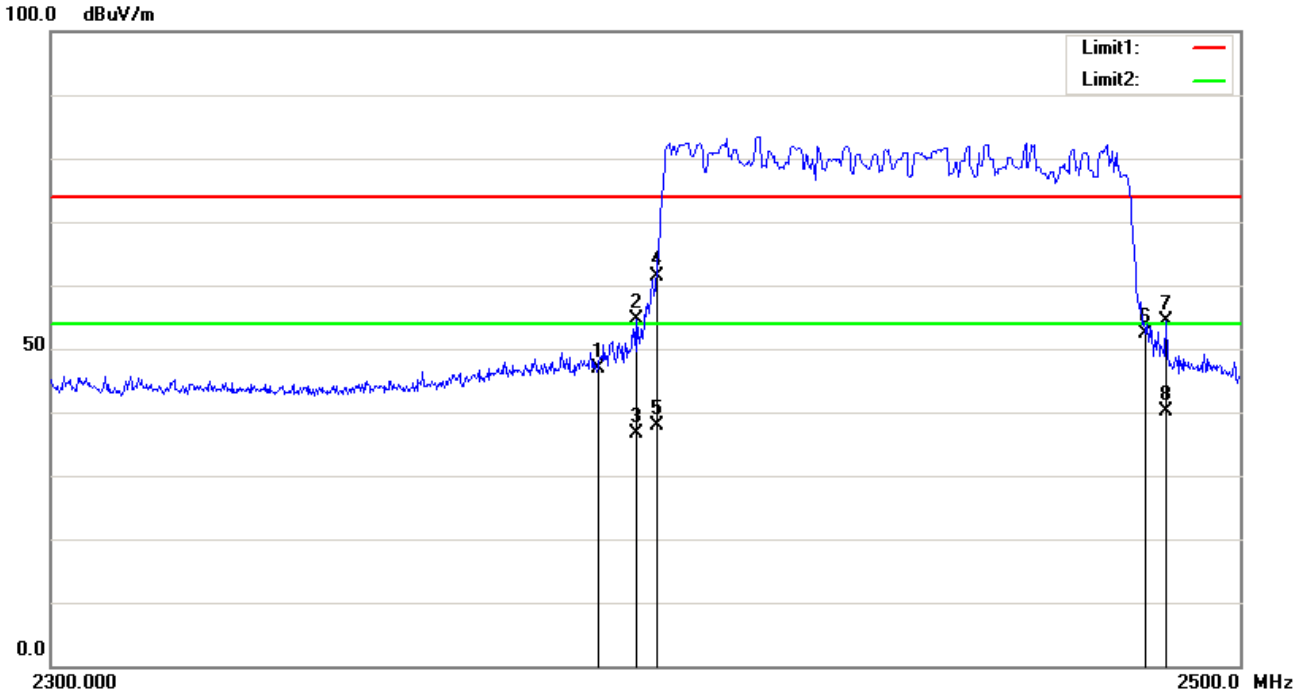
Result	☒Pass ☐Fail

Test Data ☒Yes ☐N/A

Test Plot ☒Yes (See below) ☐N/A

Test Plots
GFSK

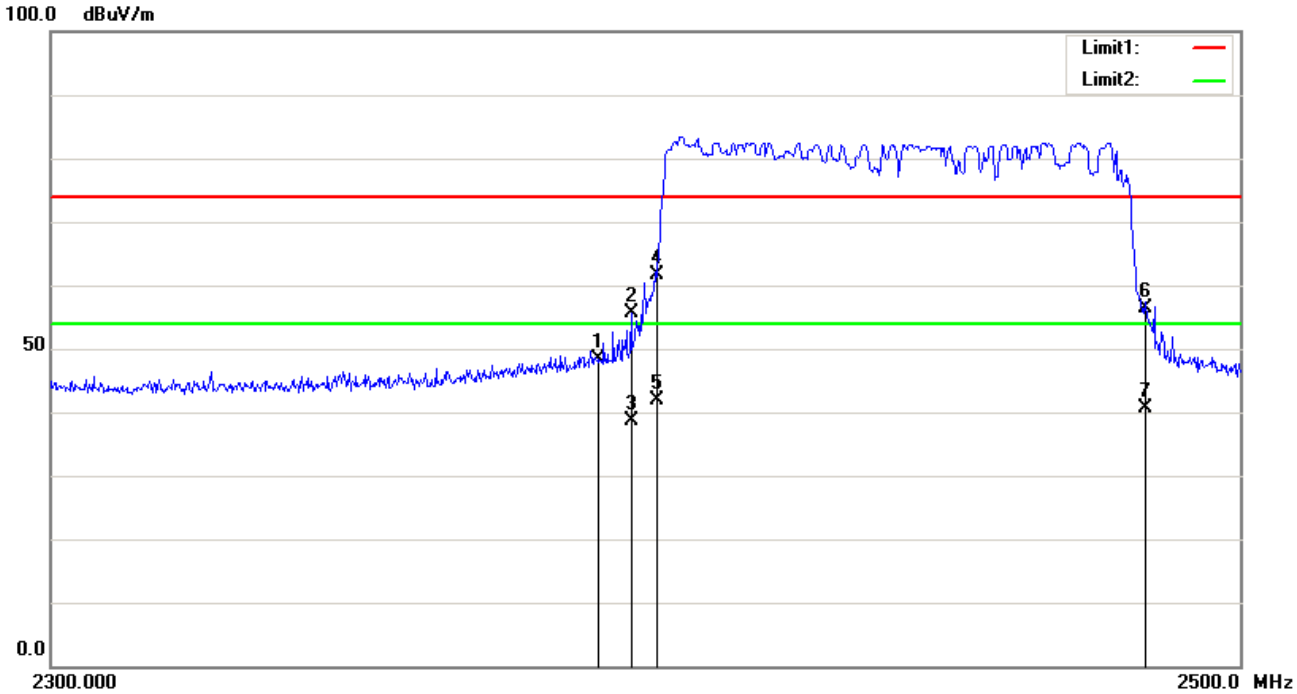
Test Mode:	**Hopping Mode**



Horizontal

No.	Frequency (MHz)	Reading (dBuV/m)	Detector	Ant_F (dB/m)	PA_G (dB)	Cab_L (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)
1	2390.000	63.79	peak	31.53	52.55	4.02	46.79	74.00	-27.21	200	199
2	2396.400	71.57	peak	31.54	52.56	4.01	54.56	74.00	-19.44	200	199
3	2396.400	53.56	AVG	31.54	52.56	4.01	36.55	54.00	-17.45	200	199
4	2400.000	78.32	peak	31.54	52.56	4.01	61.31	74.00	-12.69	200	57
5	2400.000	54.77	AVG	31.54	52.56	4.01	37.76	54.00	-16.24	200	57
6	2483.500	69.45	peak	31.59	52.63	4.06	52.47	74.00	-21.53	200	71
7	2487.200	71.41	peak	31.59	52.63	4.06	54.43	74.00	-19.57	200	43
8	2487.200	57.21	AVG	31.59	52.63	4.06	40.23	54.00	-13.77	200	43

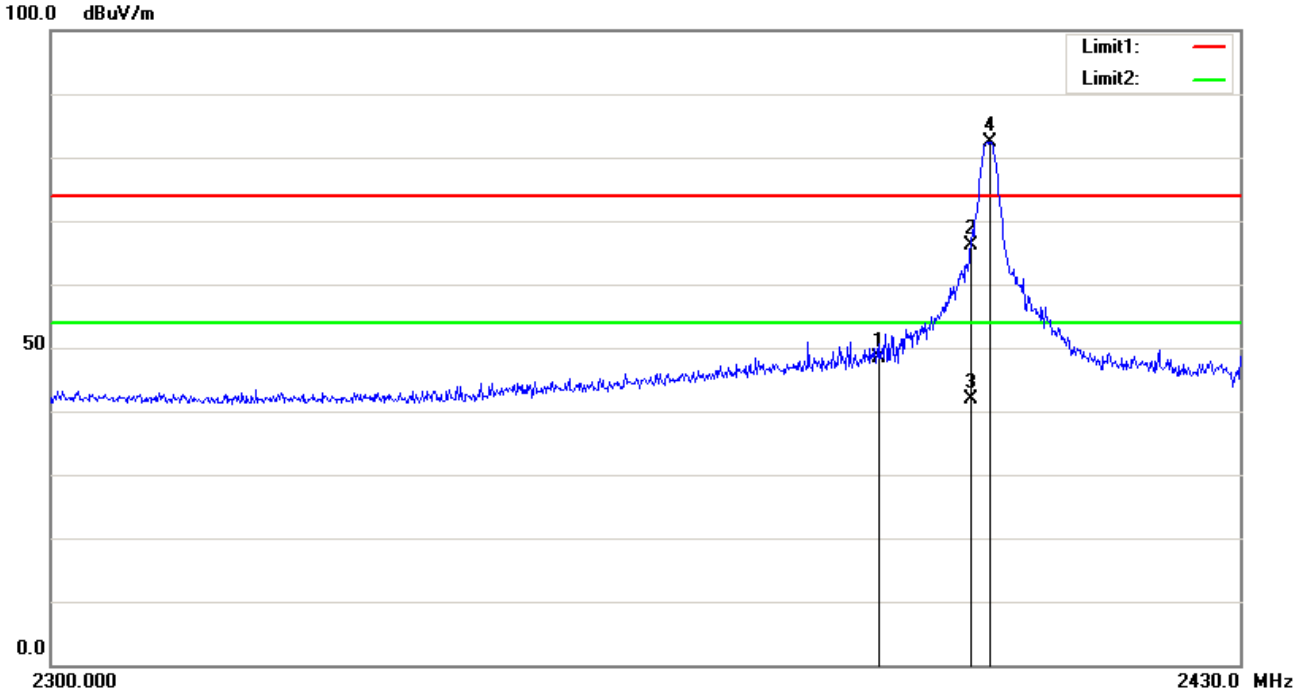
Test Mode:	Hopping Mode



Vertical

No.	Frequency (MHz)	Reading (dBuV/m)	Detector	Ant_F (dB/m)	PA_G (dB)	Cab_L (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)
1	2390.000	65.37	peak	31.53	52.55	4.02	48.37	74.00	-25.63	200	269
2	2395.600	72.61	peak	31.54	52.56	4.01	55.60	74.00	-18.40	200	283
3	2395.600	55.66	AVG	31.54	52.56	4.01	38.65	54.00	-15.35	200	283
4	2400.000	78.65	peak	31.54	52.56	4.01	61.64	74.00	-12.36	200	213
5	2400.000	58.82	AVG	31.54	52.56	4.01	41.81	54.00	-12.19	200	213
6	2483.500	73.47	peak	31.59	52.63	4.06	56.49	74.00	-17.51	200	297
7	2483.500	57.71	AVG	31.59	52.63	4.06	40.73	54.00	-13.27	200	297

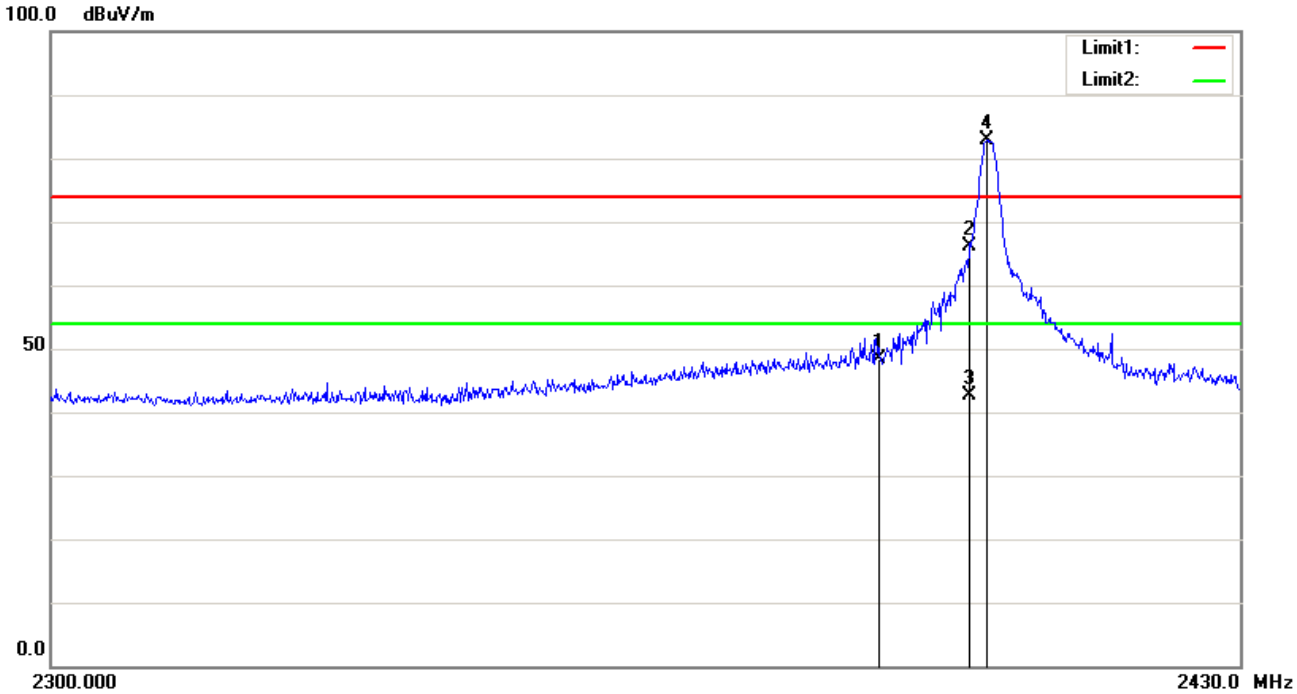
Test Mode:	Low channel TX Mode



Horizontal

No.	Frequency (MHz)	Reading (dBuV/m)	Detector	Ant_F (dB/m)	PA_G (dB)	Cab_L (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)
1	2390.000	65.27	peak	31.53	52.55	4.02	48.27	74.00	-25.73	100	359
2	2400.000	83.06	peak	31.54	52.56	4.01	66.05	74.00	-7.95	200	213
3	2400.000	58.88	AVG	31.54	52.56	4.01	41.87	54.00	-12.13	200	213
4	2402.180	99.42	peak	31.54	52.56	4.01	82.41	74.00	8.41	200	226

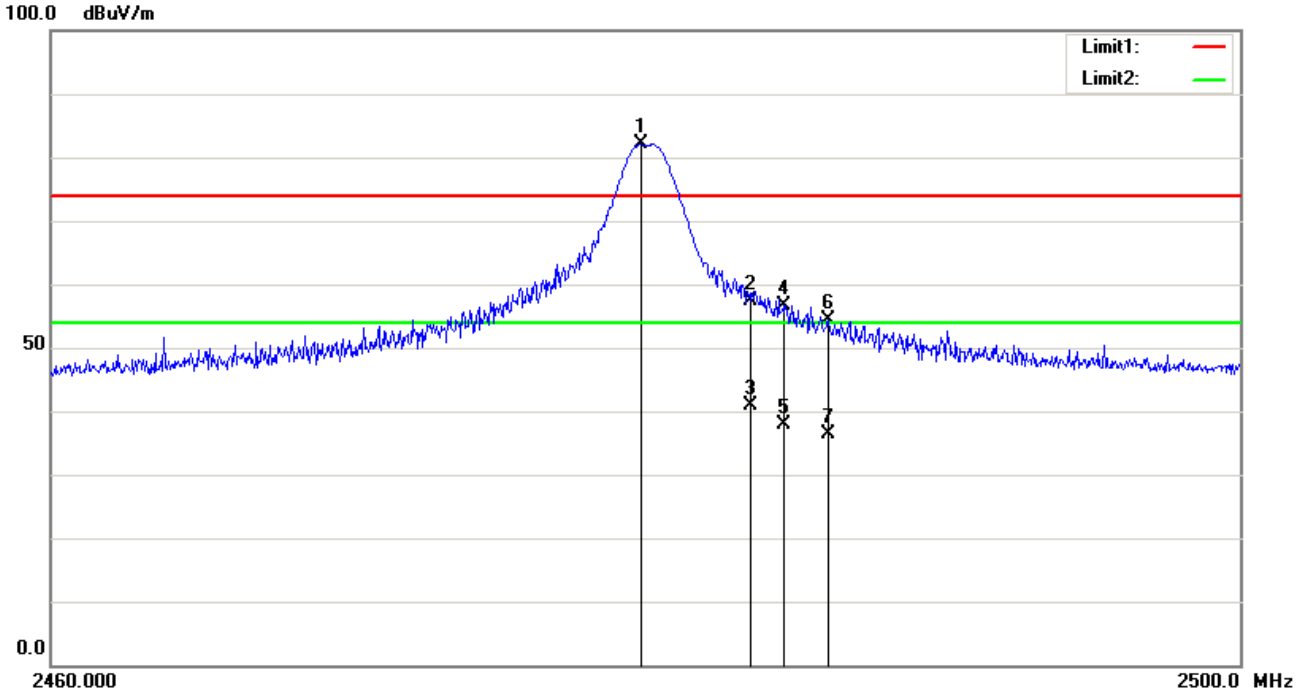
Test Mode:	Low channel TX Mode



Vertical

No.	Frequency (MHz)	Reading (dBuV/m)	Detector	Ant_F (dB/m)	PA_G (dB)	Cab_L (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)
1	2390.000	65.29	peak	31.53	52.55	4.02	48.29	74.00	-25.71	100	188
2	2400.000	83.02	peak	31.54	52.56	4.01	66.01	74.00	-7.99	200	116
3	2400.000	59.67	AVG	31.54	52.56	4.01	42.66	54.00	-11.34	200	116
4	2401.790	99.82	peak	31.54	52.56	4.01	82.81	74.00	8.81	200	116

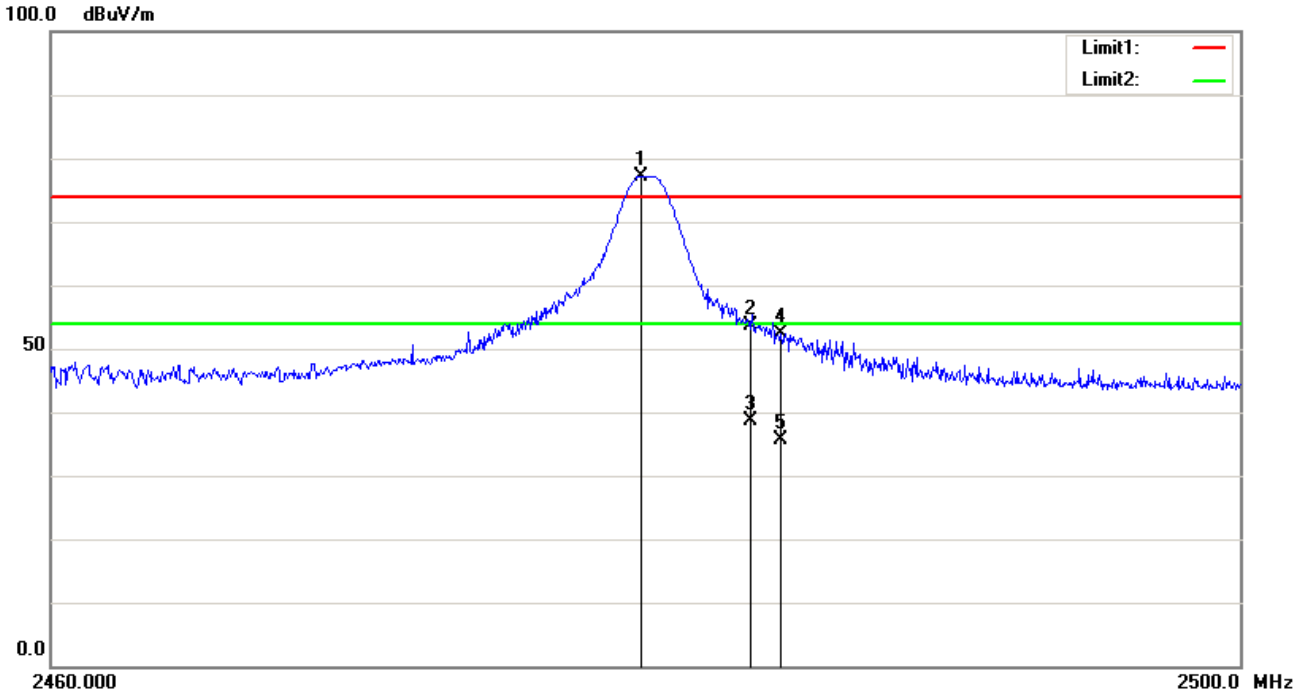
Test Mode:	High channel TX Mode



Horizontal

No.	Frequency (MHz)	Reading (dBuV/m)	Detector	Ant_F (dB/m)	PA_G (dB)	Cab_L (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)
1	2479.760	99.04	peak	31.59	52.62	4.06	82.07	74.00	8.07	200	229
2	2483.500	74.41	peak	31.59	52.63	4.06	57.43	74.00	-16.57	200	243
3	2483.500	57.91	AVG	31.59	52.63	4.06	40.93	54.00	-13.07	200	243
4	2484.600	73.68	peak	31.59	52.63	4.06	56.70	74.00	-17.30	200	229
5	2484.600	54.97	AVG	31.59	52.63	4.06	37.99	54.00	-16.01	200	229
6	2486.120	71.24	peak	31.59	52.63	4.06	54.26	74.00	-19.74	200	243
7	2486.120	53.34	AVG	31.59	52.63	4.06	36.36	54.00	-17.64	200	243

Test Mode:	High channel TX Mode

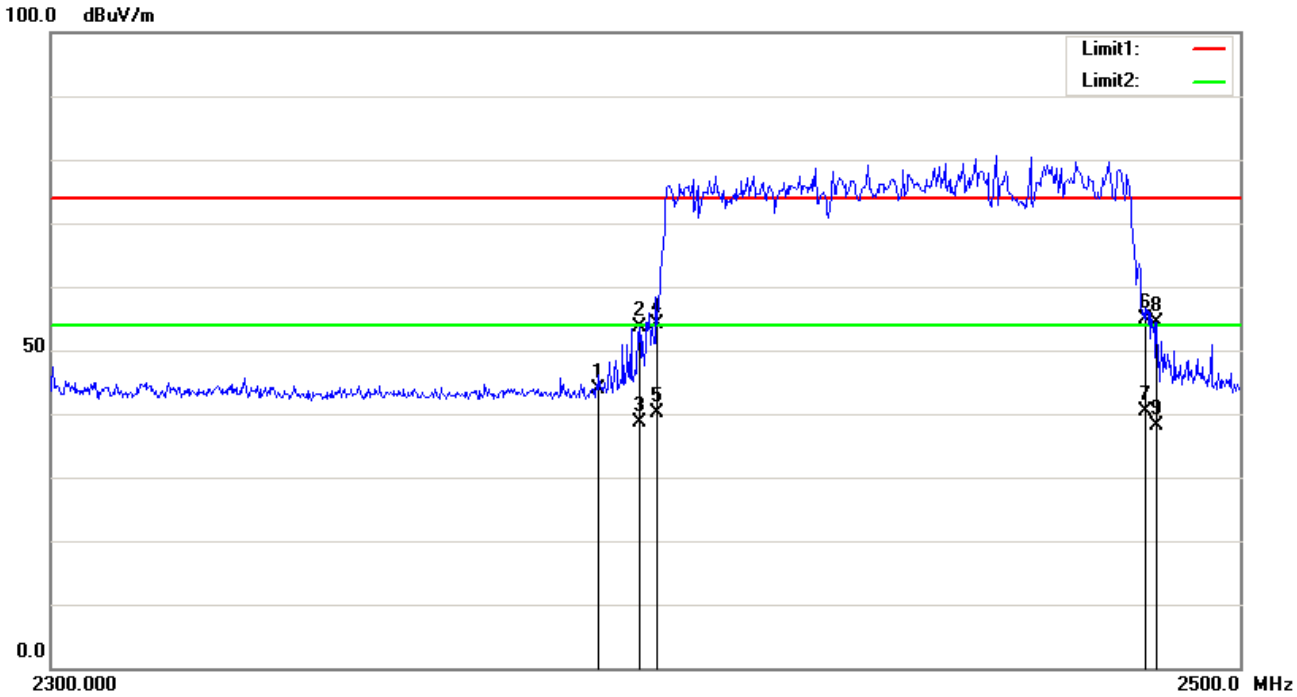


Vertical

No.	Frequency (MHz)	Reading (dBuV/m)	Detector	Ant_F (dB/m)	PA_G (dB)	Cab_L (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)
1	2479.800	94.20	peak	31.59	52.62	4.06	77.23	74.00	3.23	200	19
2	2483.500	70.50	peak	31.59	52.63	4.06	53.52	74.00	-20.48	200	33
3	2483.500	55.61	AVG	31.59	52.63	4.06	38.63	54.00	-15.37	200	33
4	2484.520	69.30	peak	31.59	52.63	4.06	52.32	74.00	-21.68	200	19
5	2484.520	52.64	AVG	31.59	52.63	4.06	35.66	54.00	-18.34	200	19

π/4 DQPSK Mode:

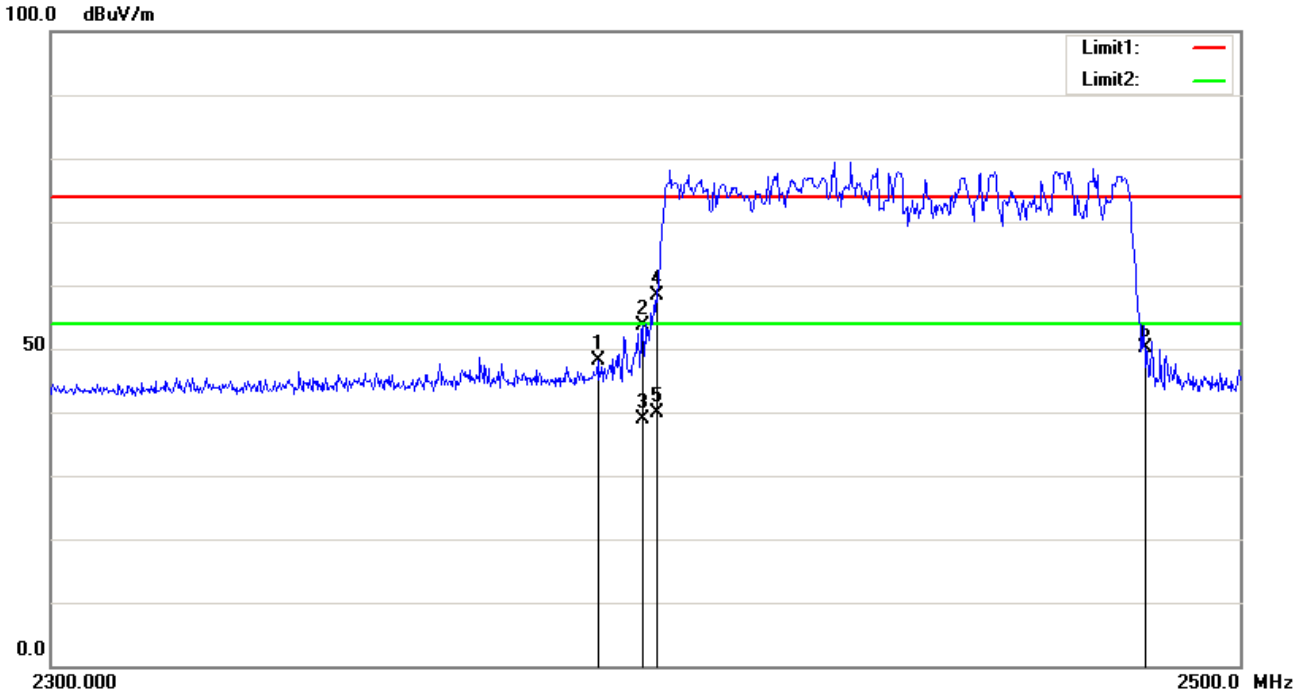
Test Mode:	Hopping Mode



Horizontal

No.	Frequency (MHz)	Reading (dBuV/m)	Detector	Ant_F (dB/m)	PA_G (dB)	Cab_L (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)
1	2390.000	60.98	peak	31.53	52.55	4.02	43.98	74.00	-30.02	100	227
2	2397.000	70.58	peak	31.54	52.56	4.01	53.57	74.00	-20.43	100	157
3	2397.000	55.70	AVG	31.54	52.56	4.01	38.69	54.00	-15.31	100	157
4	2400.000	71.13	peak	31.54	52.56	4.01	54.12	74.00	-19.88	100	340
5	2400.000	57.22	AVG	31.54	52.56	4.01	40.21	54.00	-13.79	100	340
6	2483.500	71.83	peak	31.59	52.63	4.06	54.85	74.00	-19.15	200	48
7	2483.500	57.27	AVG	31.59	52.63	4.06	40.29	54.00	-13.71	100	142
8	2485.600	71.45	peak	31.59	52.63	4.06	54.47	74.00	-19.53	200	19
9	2485.600	55.09	AVG	31.59	52.63	4.06	38.11	54.00	-15.89	200	19

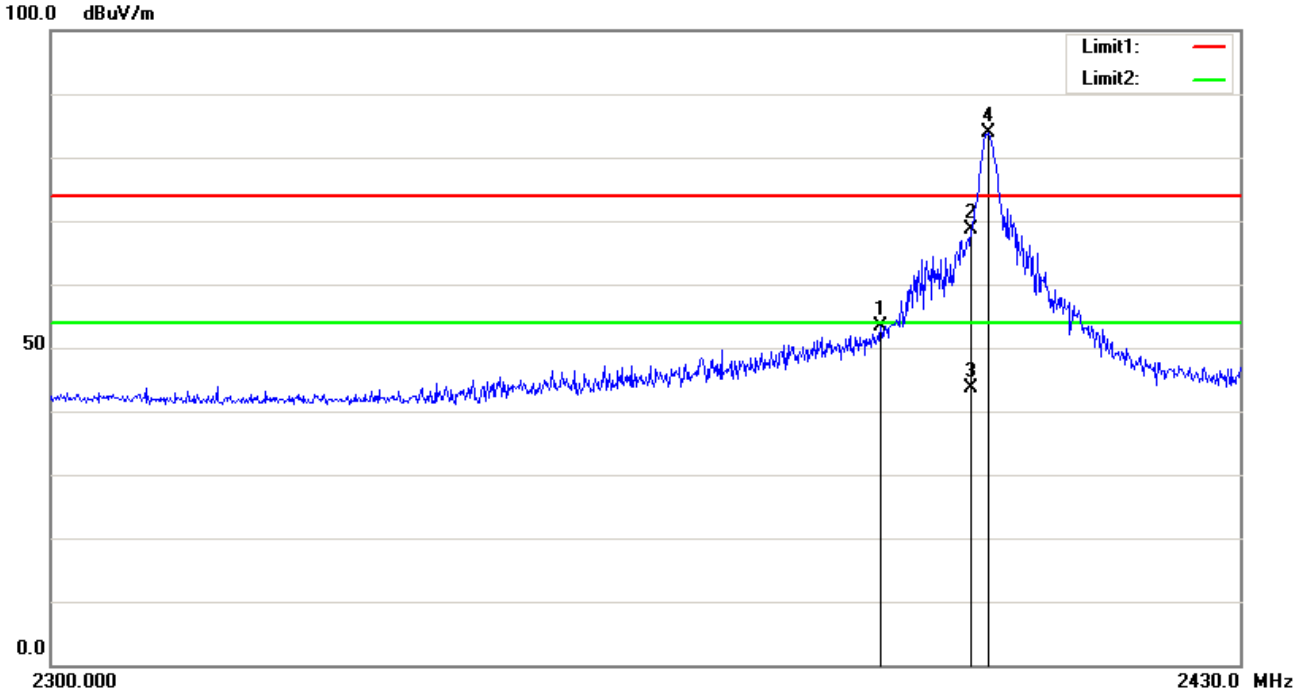
Test Mode:	Hopping Mode



Vertical

No.	Frequency (MHz)	Reading (dBuV/m)	Detector	Ant_F (dB/m)	PA_G (dB)	Cab_L (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)
1	2390.000	65.24	peak	31.53	52.55	4.02	48.24	74.00	-25.76	100	170
2	2397.600	70.57	peak	31.54	52.56	4.01	53.56	74.00	-20.44	200	46
3	2397.600	55.95	AVG	31.54	52.56	4.01	38.94	54.00	-15.06	200	46
4	2400.000	75.49	peak	31.54	52.56	4.01	58.48	74.00	-15.52	200	130
5	2400.000	57.00	AVG	31.54	52.56	4.01	39.99	54.00	-14.01	200	130
6	2483.500	67.04	peak	31.59	52.63	4.06	50.06	74.00	-23.94	200	328

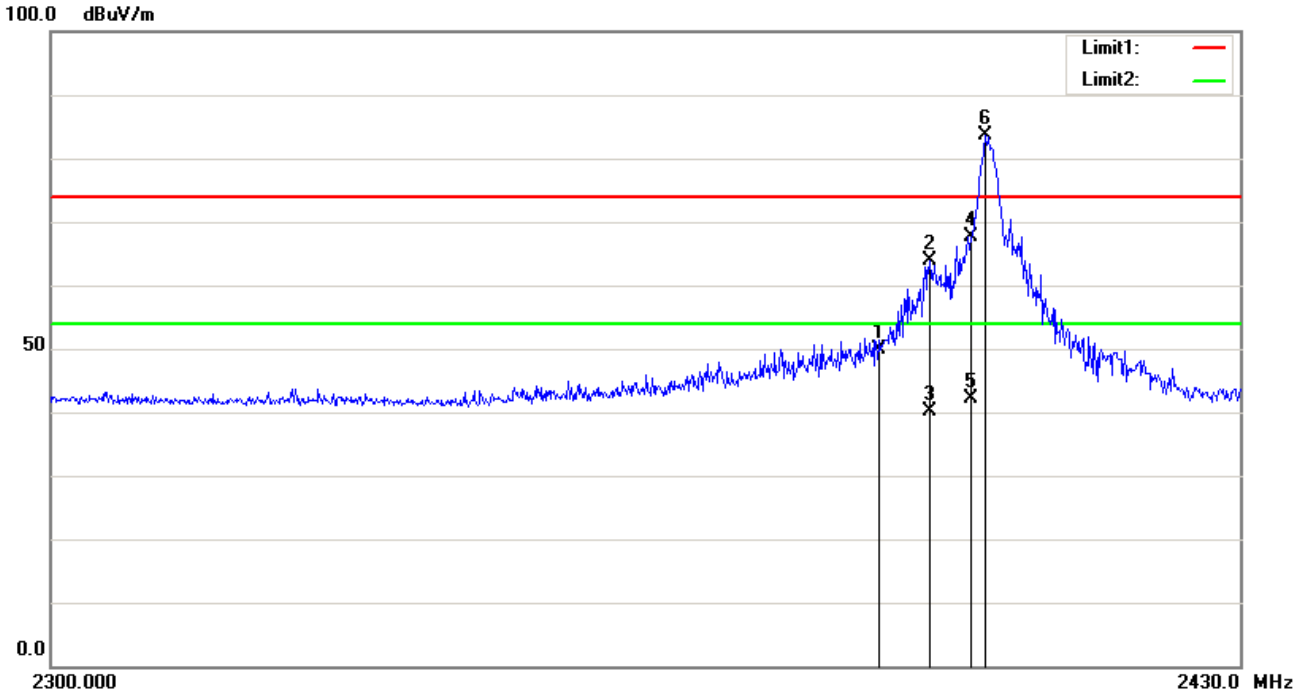
Test Mode:	Low channel TX Mode



Horizontal

No.	Frequency (MHz)	Reading (dBuV/m)	Detector	Ant_F (dB/m)	PA_G (dB)	Cab_L (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)
1	2390.000	70.48	peak	31.53	52.55	4.02	53.48	74.00	-20.52	100	49
2	2400.000	85.74	peak	31.54	52.56	4.01	68.73	74.00	-5.27	100	35
3	2400.000	60.60	AVG	31.54	52.56	4.01	43.59	54.00	-10.41	100	35
4	2401.920	100.93	peak	31.54	52.56	4.01	83.92	74.00	9.92	100	35

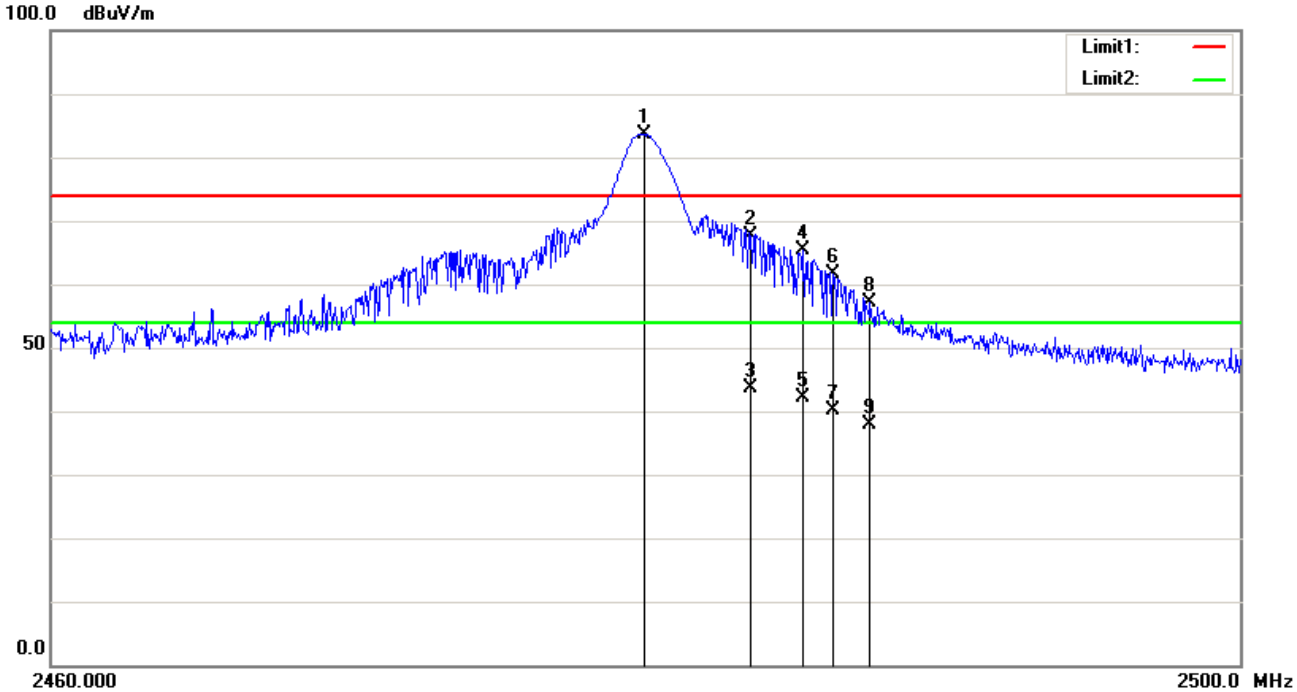
Test Mode:	Low channel TX Mode



Vertical

No.	Frequency (MHz)	Reading (dBuV/m)	Detector	Ant_F (dB/m)	PA_G (dB)	Cab_L (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)
1	2390.000	66.89	peak	31.53	52.55	4.02	49.89	74.00	-24.11	200	33
2	2395.420	80.89	peak	31.54	52.56	4.01	63.88	74.00	-10.12	200	33
3	2395.420	57.19	AVG	31.54	52.56	4.01	40.18	54.00	-13.82	200	33
4	2400.000	84.61	peak	31.54	52.56	4.01	67.60	74.00	-6.40	200	33
5	2400.000	59.12	AVG	31.54	52.56	4.01	42.11	54.00	-11.89	200	33
6	2401.660	100.56	peak	31.54	52.56	4.01	83.55	74.00	9.55	200	47

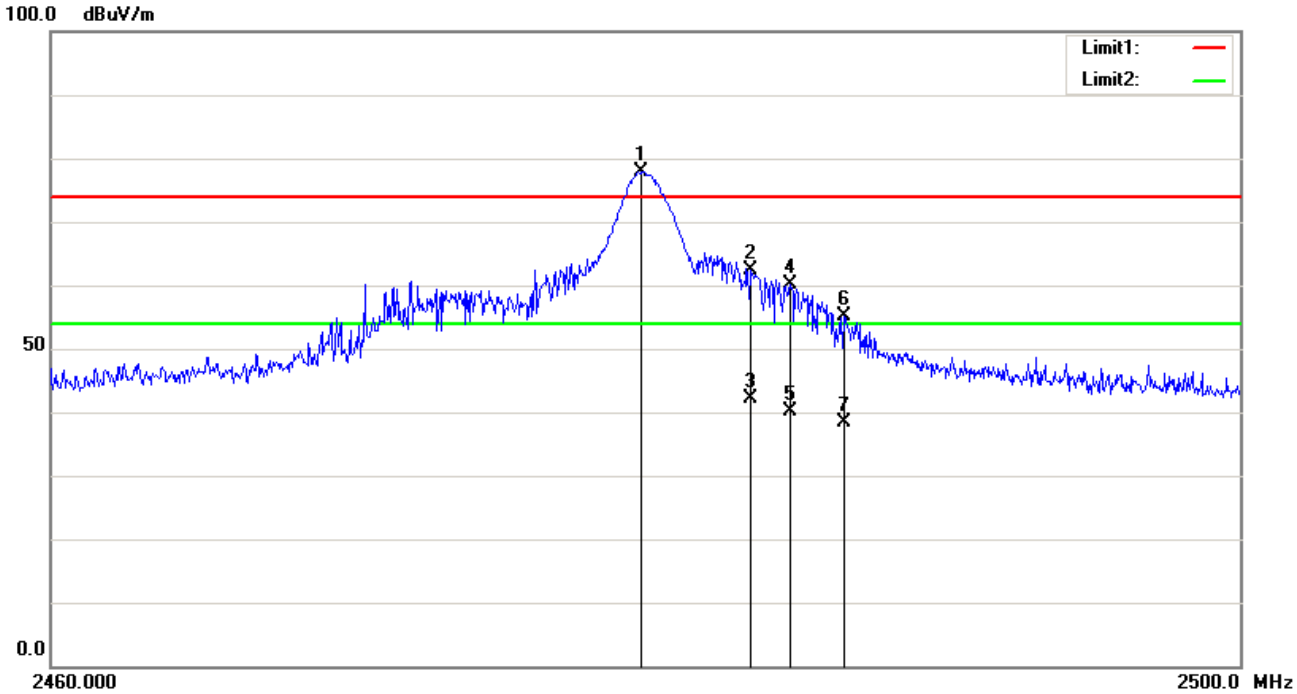
Test Mode:	High channel TX Mode



Horizontal

No.	Frequency (MHz)	Reading (dBuV/m)	Detector	Ant_F (dB/m)	PA_G (dB)	Cab_L (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)
1	2479.880	100.63	peak	31.59	52.62	4.06	83.66	74.00	9.66	200	359
2	2483.500	84.70	peak	31.59	52.63	4.06	67.72	74.00	-6.28	200	0
3	2483.500	60.67	AVG	31.59	52.63	4.06	43.69	54.00	-10.31	200	0
4	2485.280	82.36	peak	31.59	52.63	4.06	65.38	74.00	-8.62	200	351
5	2485.280	59.09	AVG	31.59	52.63	4.06	42.11	54.00	-11.89	200	351
6	2486.280	78.73	peak	31.59	52.63	4.06	61.75	74.00	-12.25	178	0
7	2486.280	57.17	AVG	31.59	52.63	4.06	40.19	54.00	-13.81	178	0
8	2487.520	74.08	peak	31.59	52.63	4.06	57.10	74.00	-16.90	200	0
9	2487.520	54.96	AVG	31.59	52.63	4.06	37.98	54.00	-16.02	200	0

Test Mode:	High channel TX Mode

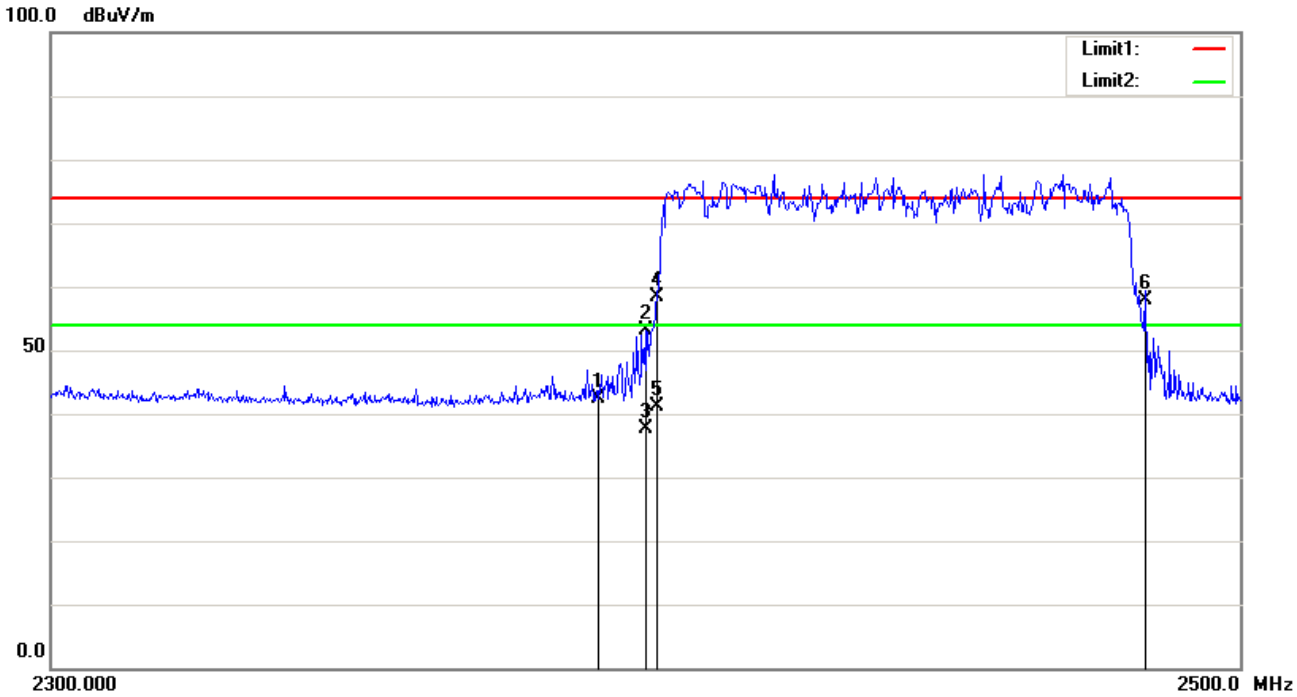


Vertical

No.	Frequency (MHz)	Reading (dBuV/m)	Detector	Ant_F (dB/m)	PA_G (dB)	Cab_L (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)
1	2479.800	94.86	peak	31.59	52.62	4.06	77.89	74.00	3.89	200	4
2	2483.500	79.29	peak	31.59	52.63	4.06	62.31	74.00	-11.69	100	62
3	2483.500	59.09	AVG	31.59	52.63	4.06	42.11	54.00	-11.89	100	62
4	2484.840	77.09	peak	31.59	52.63	4.06	60.11	74.00	-13.89	200	351
5	2484.840	57.17	AVG	31.59	52.63	4.06	40.19	54.00	-13.81	200	351
6	2486.640	72.12	peak	31.59	52.63	4.06	55.14	74.00	-18.86	200	0
7	2486.640	55.47	AVG	31.59	52.63	4.06	38.49	54.00	-15.51	200	0

8-DPSK Mode:

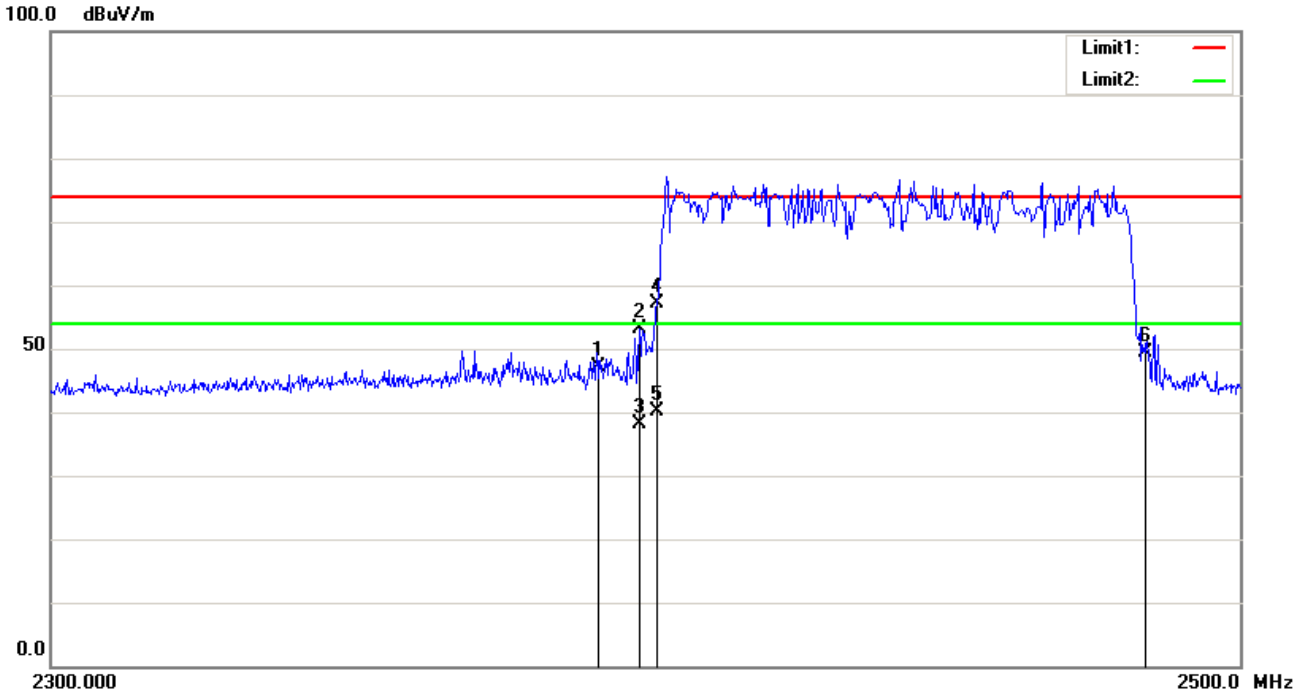
Test Mode:	Hopping Mode



Horizontal

No.	Frequency (MHz)	Reading (dBuV/m)	Detector	Ant_F (dB/m)	PA_G (dB)	Cab_L (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)
1	2390.000	59.40	peak	31.53	52.55	4.02	42.40	74.00	-31.60	200	359
2	2398.000	70.15	peak	31.54	52.56	4.01	53.14	74.00	-20.86	200	33
3	2398.000	54.59	AVG	31.54	52.56	4.01	37.58	54.00	-16.42	200	33
4	2400.000	75.27	peak	31.54	52.56	4.01	58.26	74.00	-15.74	100	201
5	2400.000	58.09	AVG	31.54	52.56	4.01	41.08	54.00	-12.92	100	201
6	2483.500	74.75	peak	31.59	52.63	4.06	57.77	74.00	-16.23	140	0

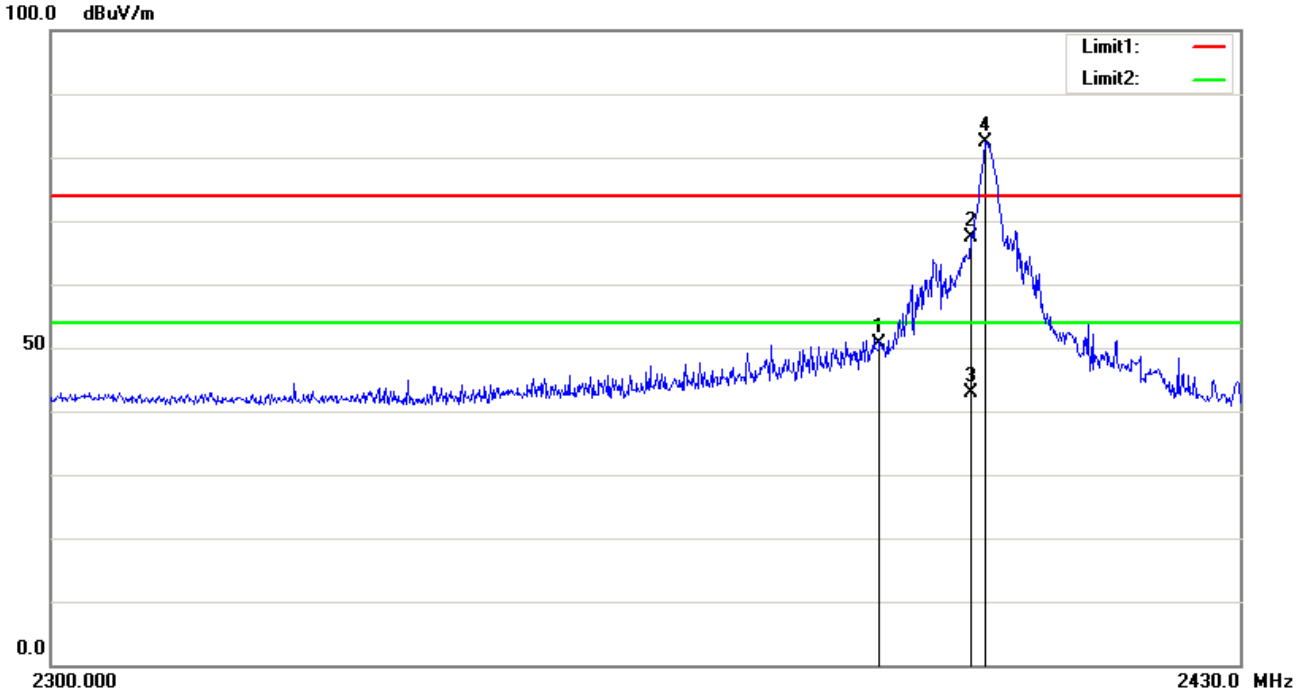
Test Mode:	Hopping Mode



Vertical

No.	Frequency (MHz)	Reading (dBuV/m)	Detector	Ant_F (dB/m)	PA_G (dB)	Cab_L (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)
1	2390.000	64.07	peak	31.53	52.55	4.02	47.07	74.00	-26.93	100	184
2	2397.000	70.21	peak	31.54	52.56	4.01	53.20	74.00	-20.80	200	315
3	2397.000	55.12	AVG	31.54	52.56	4.01	38.11	54.00	-15.89	200	315
4	2400.000	74.10	peak	31.54	52.56	4.01	57.09	74.00	-16.91	200	258
5	2400.000	57.20	AVG	31.54	52.56	4.01	40.19	54.00	-13.81	200	258
6	2483.500	66.35	peak	31.59	52.63	4.06	49.37	74.00	-24.63	200	103

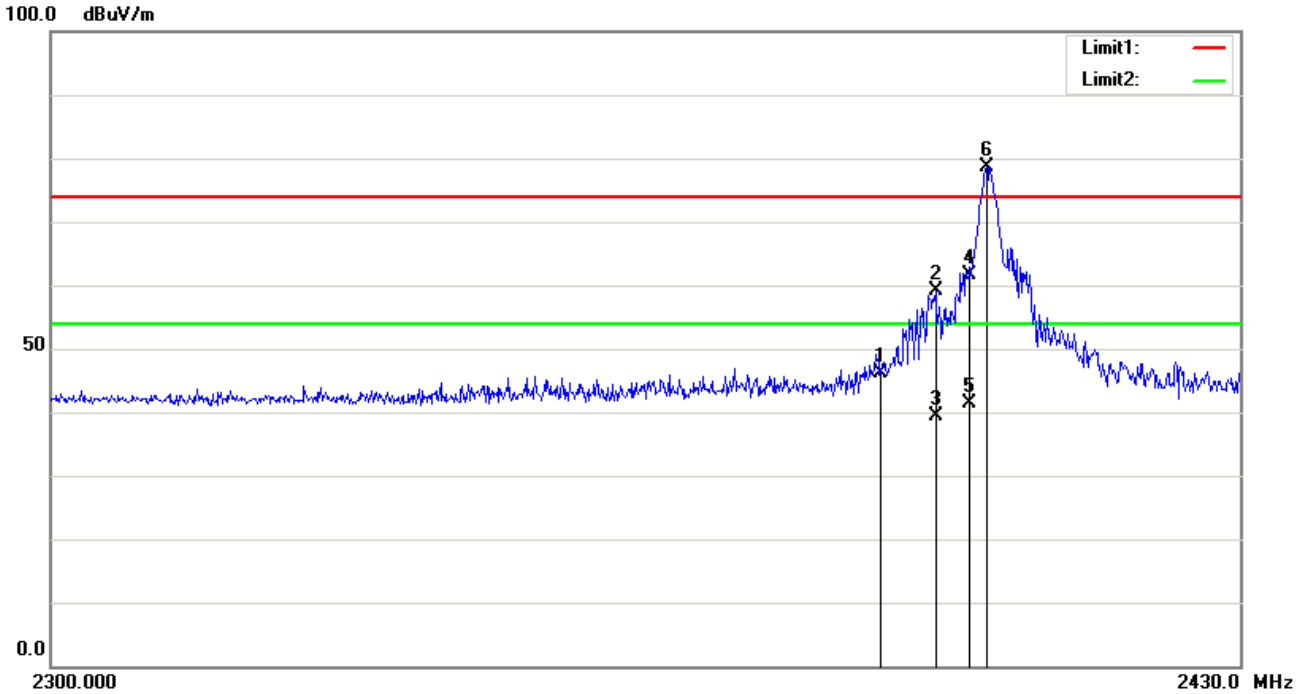
Test Mode:	Low channel TX Mode



Horizontal

No.	Frequency (MHz)	Reading (dBuV/m)	Detector	Ant_F (dB/m)	PA_G (dB)	Cab_L (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)
1	2390.000	67.67	peak	31.53	52.55	4.02	50.67	74.00	-23.33	200	324
2	2400.000	84.31	peak	31.54	52.56	4.01	67.30	74.00	-6.70	200	337
3	2400.000	59.99	AVG	31.54	52.56	4.01	42.98	54.00	-11.02	200	0
4	2401.660	99.36	peak	31.54	52.56	4.01	82.35	74.00	8.35	200	337

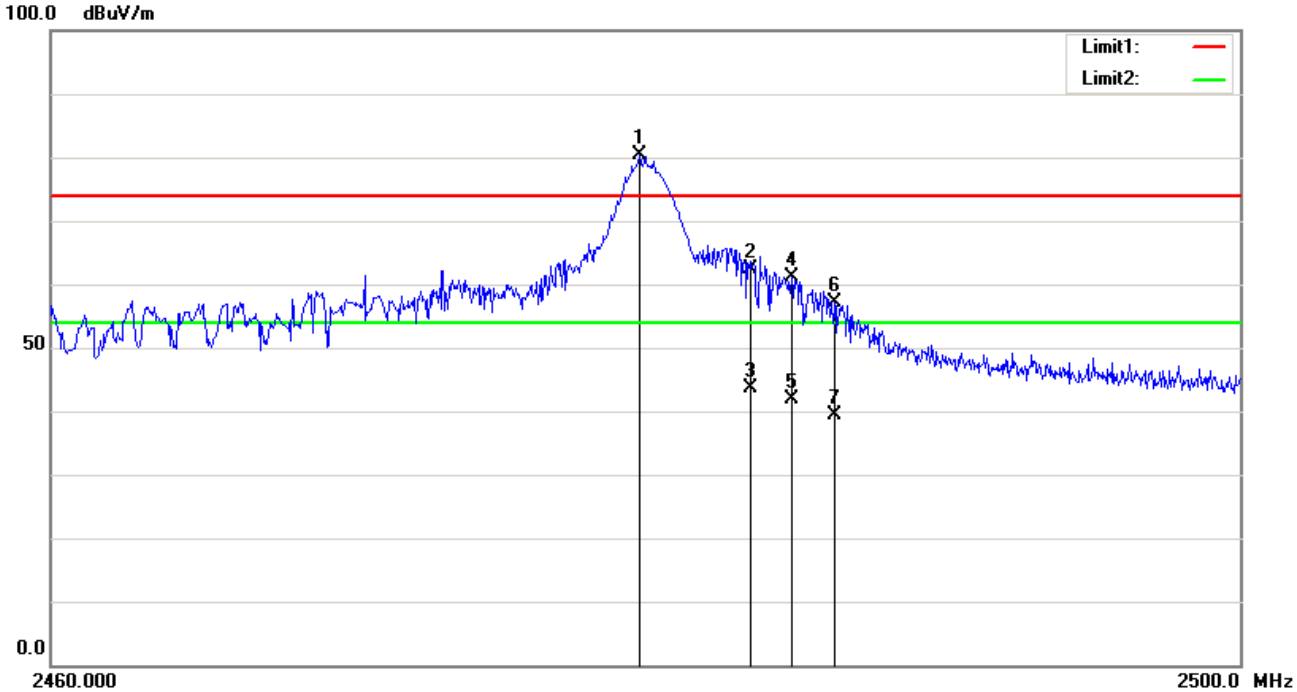
Test Mode:	Low channel TX Mode



Vertical

No.	Frequency (MHz)	Reading (dBuV/m)	Detector	Ant_F (dB/m)	PA_G (dB)	Cab_L (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)
1	2390.000	63.22	peak	31.53	52.55	4.02	46.22	74.00	-27.78	200	227
2	2396.070	76.10	peak	31.54	52.56	4.01	59.09	74.00	-14.91	200	255
3	2396.070	56.50	AVG	31.54	52.56	4.01	39.49	54.00	-14.51	200	255
4	2400.000	78.69	peak	31.54	52.56	4.01	61.68	74.00	-12.32	200	255
5	2400.000	58.30	AVG	31.54	52.56	4.01	41.29	54.00	-12.71	200	241
6	2401.790	95.68	peak	31.54	52.56	4.01	78.67	74.00	4.67	200	255

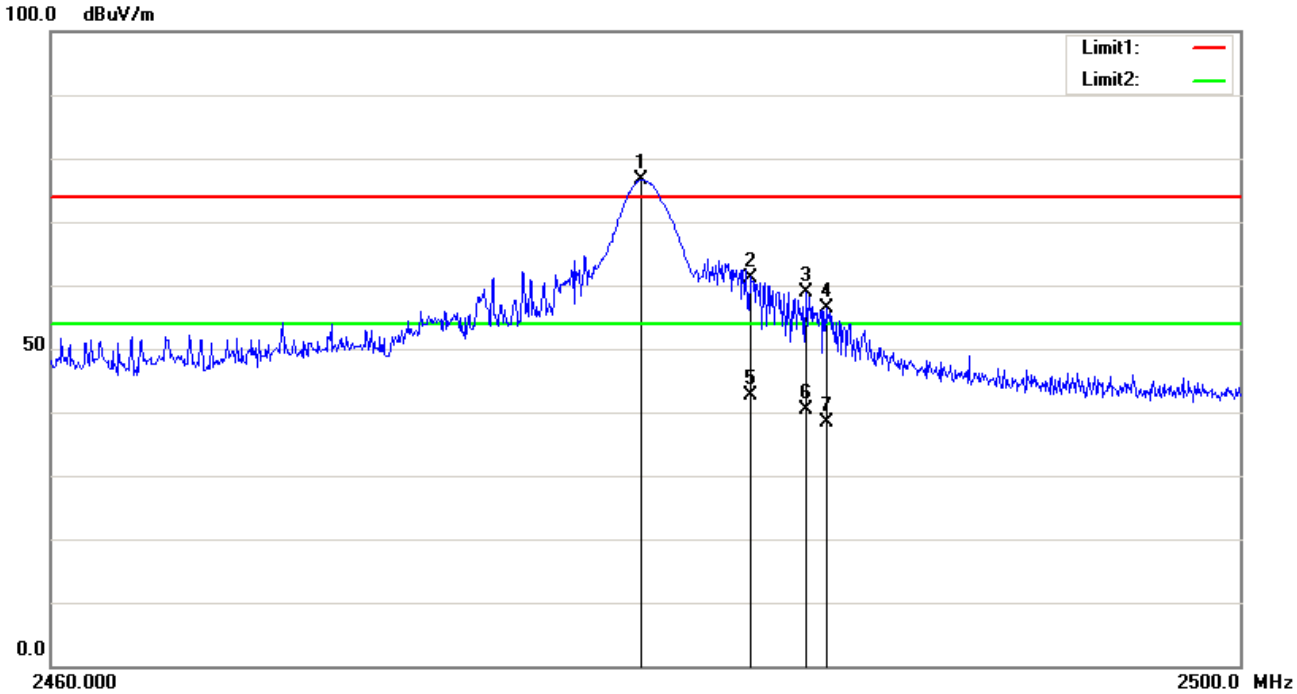
Test Mode:	High channel TX Mode



Horizontal

No.	Frequency (MHz)	Reading (dBuV/m)	Detector	Ant_F (dB/m)	PA_G (dB)	Cab_L (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)
1	2479.720	97.39	peak	31.59	52.62	4.06	80.42	74.00	6.42	139	0
2	2483.500	79.25	peak	31.59	52.63	4.06	62.27	74.00	-11.73	200	359
3	2483.500	60.64	AVG	31.59	52.63	4.06	43.66	54.00	-10.34	200	338
4	2484.880	78.05	peak	31.59	52.63	4.06	61.07	74.00	-12.93	200	338
5	2484.880	58.75	AVG	31.59	52.63	4.06	41.77	54.00	-12.23	200	338
6	2486.320	74.09	peak	31.59	52.63	4.06	57.11	74.00	-16.89	200	338
7	2486.320	56.43	AVG	31.59	52.63	4.06	39.45	54.00	-14.55	200	338

Test Mode:	High channel TX Mode



Vertical

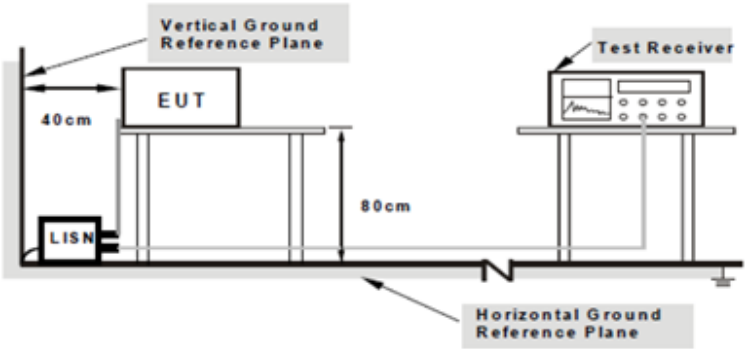
No.	Frequency (MHz)	Reading (dBuV/m)	Detector	Ant_F (dB/m)	PA_G (dB)	Cab_L (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)
1	2479.800	93.57	peak	31.59	52.62	4.06	76.60	74.00	2.60	200	360
2	2483.500	78.19	peak	31.59	52.63	4.06	61.21	74.00	-12.79	200	360
3	2485.360	75.75	peak	31.59	52.63	4.06	58.77	74.00	-15.23	200	351
4	2486.040	73.27	peak	31.59	52.63	4.06	56.29	74.00	-17.71	200	360
5	2483.500	59.53	AVG	31.59	52.63	4.06	42.55	54.00	-11.45	200	351
6	2485.360	57.46	AVG	31.59	52.63	4.06	40.48	54.00	-13.52	200	351
7	2486.040	55.42	AVG	31.59	52.63	4.06	38.44	54.00	-15.56	200	360

6.8 AC Power Line Conducted Emissions

Temperature	23°C
Relative Humidity	51%
Atmospheric Pressure	1018mbar
Test date :	December 21,2017
Tested By :	Amos Xia

Requirement(s):

<table>
<tr><th>Spec</th><th>Item</th><th>Requirement</th><th>Applicable</th></tr>
<tr><td>47CFR§15.207</td><td>a)</td><td>For Low-power radio-frequency devices that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 [mu]H/50 ohms line impedance stabilization network (LISN). The lower limit applies at the boundary between the frequencies ranges.

Class A Limit
<table>
<tr><th rowspan="2">Frequency ranges (MHz)</th><th colspan="2">Limit (dBμV)</th></tr>
<tr><th>QP</th><th>Average</th></tr>
<tr><td>0.15 ~ 0.5</td><td>79</td><td>66</td></tr>
<tr><td>0.5 ~ 30</td><td>73</td><td>60</td></tr>
</table>
Class B Limit
<table>
<tr><th rowspan="2">Frequency ranges (MHz)</th><th colspan="2">Limit (dBμV)</th></tr>
<tr><th>QP</th><th>Average</th></tr>
<tr><td>0.15 ~ 0.5</td><td>66 – 56</td><td>56 – 46</td></tr>
<tr><td>0.5 ~ 5</td><td>56</td><td>46</td></tr>
<tr><td>5 ~ 30</td><td>60</td><td>50</td></tr>
</table></td><td>☒</td></tr>
<tr><td>Test Setup</td><td colspan="3"> 

Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80cm from EUT and at least 80cm from other units and other metal planes support units.</td></tr>
<tr><td>Procedure</td><td colspan="3">1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table.
2. The power supply for the EUT was fed through a 50 [mu]H/50 EUT LISN, connected to filtered mains.
3. The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable.
4. All other supporting equipment were powered separately from another main supply.
5. The EUT was switched on and allowed to warm up to its normal operating condition.
6. A scan was made on the NEUTRAL line (for AC mains) or Earth line (for DC power) over the required frequency range using an EMI test receiver.
7. High peaks, relative to the limit line, The EMI test receiver was then tuned to the selected frequencies and the necessary measurements made with a receiver bandwidth setting of 10 kHz.
8. Step 7 was then repeated for the LIVE line (for AC mains) or DC line (for DC power).</td></tr>
<tr><td>Remark</td><td colspan="3">We test 3 modulations, only show GFSK test data in the report.</td></tr>
</table>

Result	☒Pass ☐Fail

Test Data ☒Yes ☐N/A

Test Plot ☒Yes (See below) ☐N/A

Data sample

No.	Frequency (MHz)	Reading (dBμV)	Detector	Lisn/Isn (dB}	Ps_Lmt (dB)	Cab_L (dB)	Result (dBμV)	Limit (dBμV)	Margin (dB)

Frequency (MHz) = Emission frequency in MHz

Reading (dBμV) = Receiver Reading Value

Detector=Quasi Peak Detector or Average Detector

Lisn/ISN= Insertion loss of LISN

Ps_Lmt= Insertion loss of transient limiter (The transient limiter included 10dB attenuation)

Cab_L= cable loss

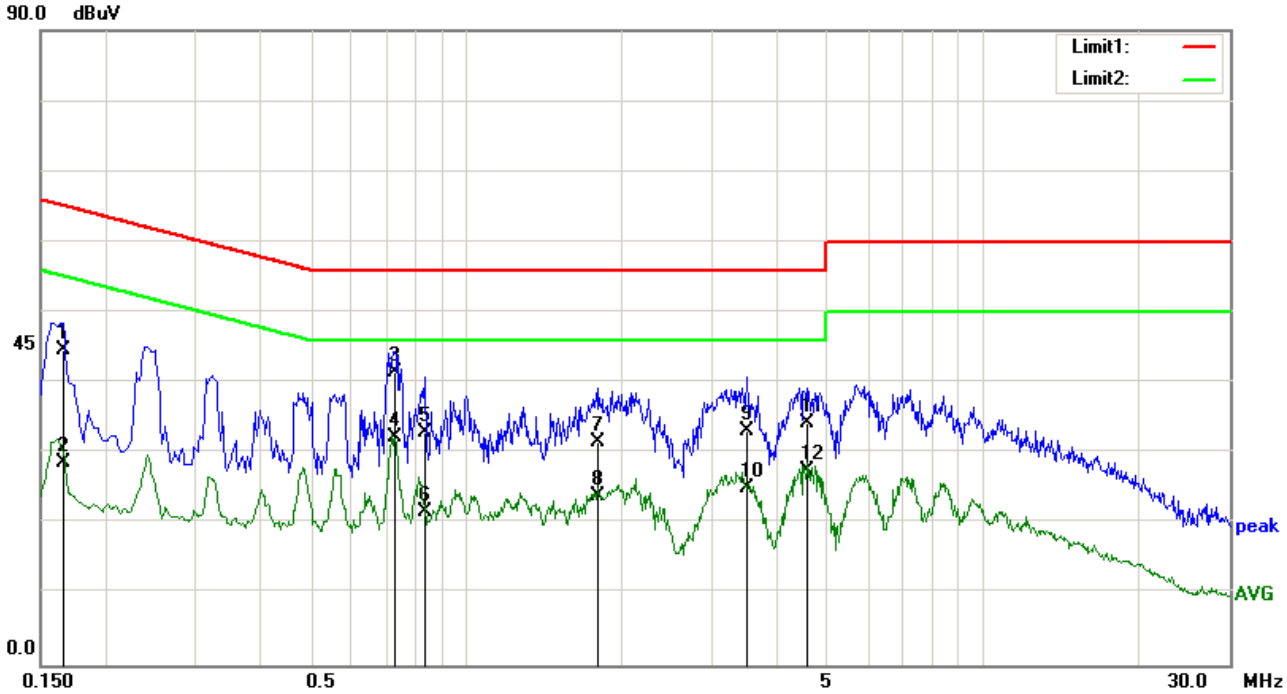
Result (dBμV) = Reading Value + Corrected Value

Limit (dBμV) = Limit stated in standard

Calculation Formula:

Margin (dB) = Result (dBμV) – limit (dBμV)

Test Mode :	Normal Working Mode

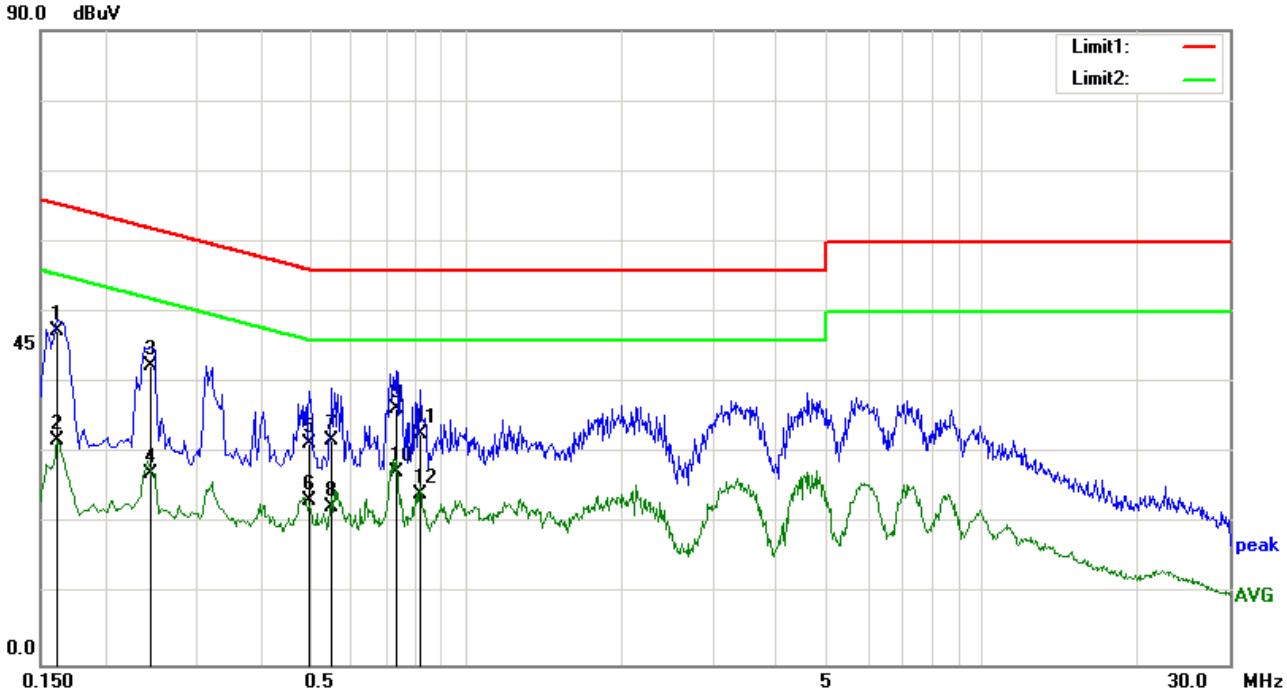


Test Data

Phase Line Plot at 120Vac, 60Hz

No.	Frequency (MHz)	Reading (dBuV)	Detector	Lisn/Isn (dB}	Ps_Lmt (dB)	Cab_L (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)
1	0.1660	34.34	QP	0.10	-10.00	0.33	44.77	65.16	-20.39
2	0.1660	18.19	AVG	0.10	-10.00	0.33	28.62	55.16	-26.54
3	0.7300	31.21	QP	0.13	-10.00	0.20	41.54	56.00	-14.46
4	0.7300	21.90	AVG	0.13	-10.00	0.20	32.23	46.00	-13.77
5	0.8340	22.68	QP	0.13	-10.00	0.20	33.01	56.00	-22.99
6	0.8340	11.45	AVG	0.13	-10.00	0.20	21.78	46.00	-24.22
7	1.8020	21.25	QP	0.16	-10.00	0.20	31.61	56.00	-24.39
8	1.8020	13.64	AVG	0.16	-10.00	0.20	24.00	46.00	-22.00
9	3.5020	22.68	QP	0.22	-10.00	0.25	33.15	56.00	-22.85
10	3.5020	14.58	AVG	0.22	-10.00	0.25	25.05	46.00	-20.95
11	4.5940	23.74	QP	0.26	-10.00	0.28	34.28	56.00	-21.72
12	4.5940	16.99	AVG	0.26	-10.00	0.28	27.53	46.00	-18.47

Test Mode :	Normal Working Mode

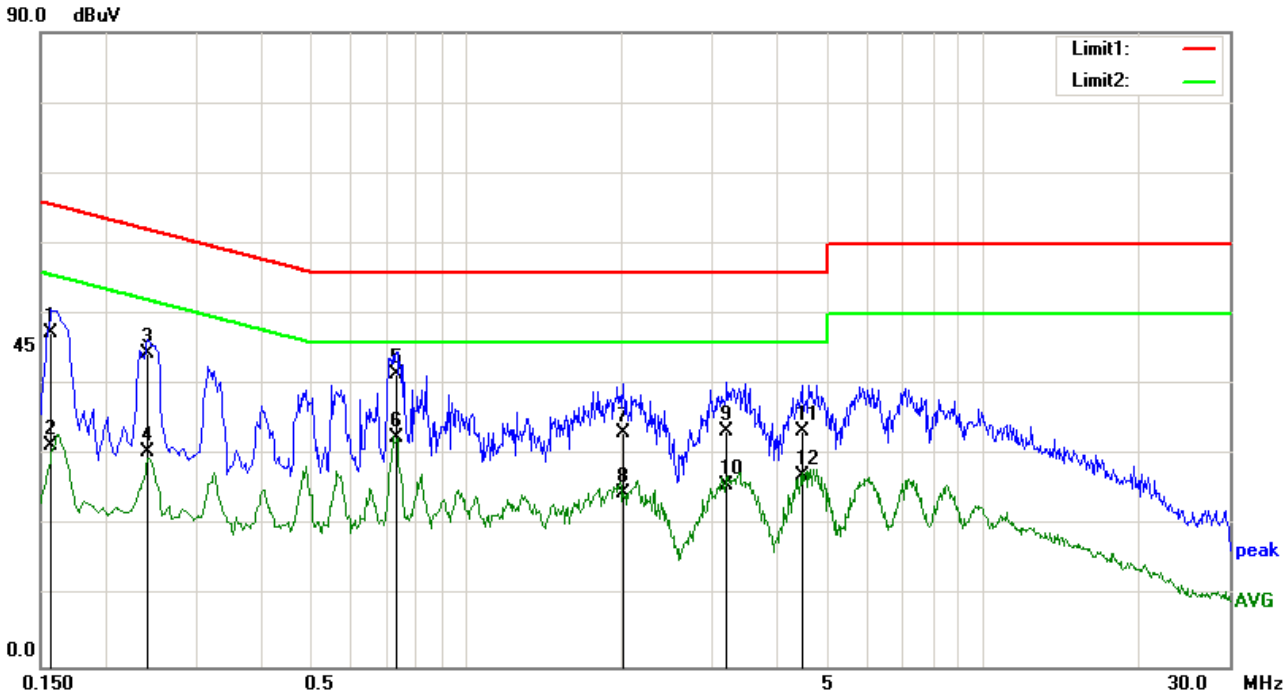


Test Data

Phase Neutral Plot at 120Vac, 60Hz

No.	Frequency (MHz)	Reading (dBuV)	Detector	Lisn/Isn (dB}	Ps_Lmt (dB)	Cab_L (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)
1	0.1620	36.85	QP	0.11	-10.00	0.34	47.30	65.36	-18.06
2	0.1620	21.50	AVG	0.11	-10.00	0.34	31.95	55.36	-23.41
3	0.2460	32.15	QP	0.10	-10.00	0.21	42.46	61.89	-19.43
4	0.2460	16.90	AVG	0.10	-10.00	0.21	27.21	51.89	-24.68
5	0.4980	21.05	QP	0.11	-10.00	0.21	31.37	56.03	-24.66
6	0.4980	13.00	AVG	0.11	-10.00	0.21	23.32	46.03	-22.71
7	0.5500	21.59	QP	0.11	-10.00	0.21	31.91	56.00	-24.09
8	0.5500	12.07	AVG	0.11	-10.00	0.21	22.39	46.00	-23.61
9	0.7340	26.05	QP	0.12	-10.00	0.20	36.37	56.00	-19.63
10	0.7340	16.93	AVG	0.12	-10.00	0.20	27.25	46.00	-18.75
11	0.8140	22.31	QP	0.12	-10.00	0.20	32.63	56.00	-23.37
12	0.8140	13.88	AVG	0.12	-10.00	0.20	24.20	46.00	-21.80

Test Mode :	Normal Working Mode

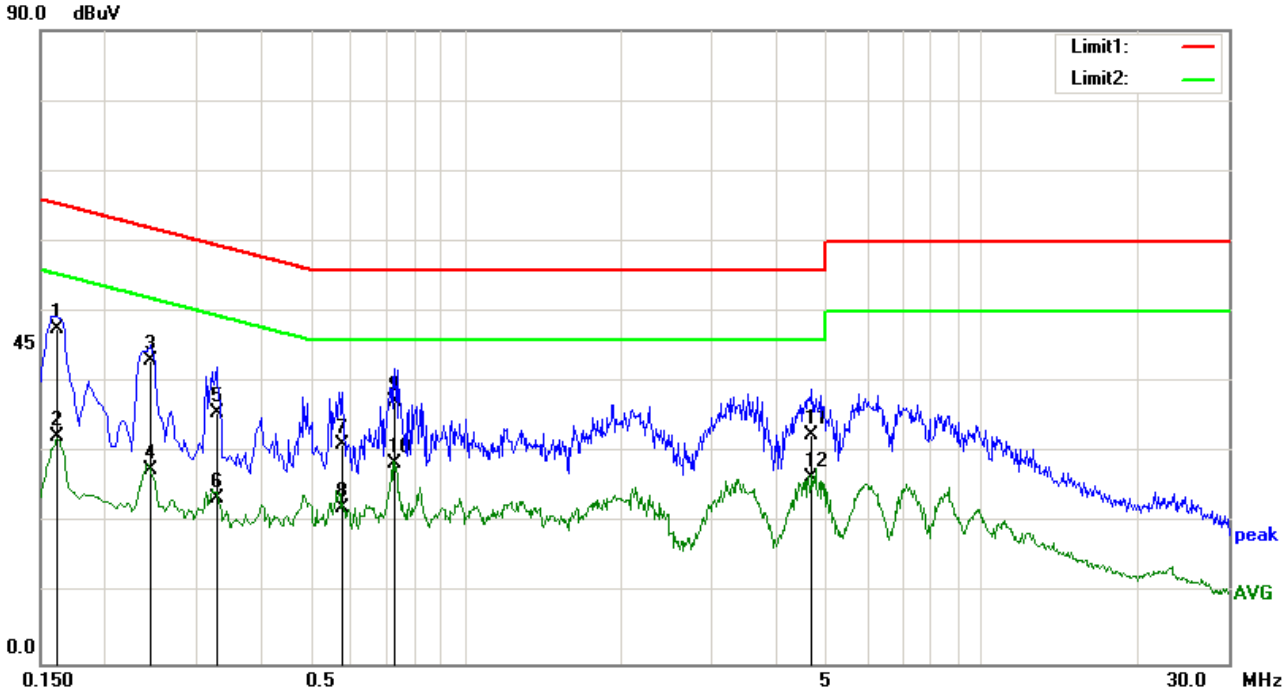


Test Data

Phase Line Plot at 230Vac, 50Hz

No.	Frequency (MHz)	Reading (dBuV)	Detector	Lisn/Isn (dB}	Ps_Lmt (dB)	Cab_L (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)
1	0.1580	36.92	QP	0.10	-10.00	0.35	47.37	65.57	-18.20
2	0.1580	20.93	AVG	0.10	-10.00	0.35	31.38	55.57	-24.19
3	0.2420	34.15	QP	0.10	-10.00	0.21	44.46	62.03	-17.57
4	0.2420	20.16	AVG	0.10	-10.00	0.21	30.47	52.03	-21.56
5	0.7340	31.22	QP	0.13	-10.00	0.20	41.55	56.00	-14.45
6	0.7340	22.11	AVG	0.13	-10.00	0.20	32.44	46.00	-13.56
7	2.0140	22.79	QP	0.16	-10.00	0.18	33.13	56.00	-22.87
8	2.0140	14.36	AVG	0.16	-10.00	0.18	24.70	46.00	-21.30
9	3.1940	23.07	QP	0.20	-10.00	0.24	33.51	56.00	-22.49
10	3.1940	15.25	AVG	0.20	-10.00	0.24	25.69	46.00	-20.31
11	4.4580	22.97	QP	0.25	-10.00	0.28	33.50	56.00	-22.50
12	4.4580	16.49	AVG	0.25	-10.00	0.28	27.02	46.00	-18.98

Test Mode :	Normal Working Mode



Test Data

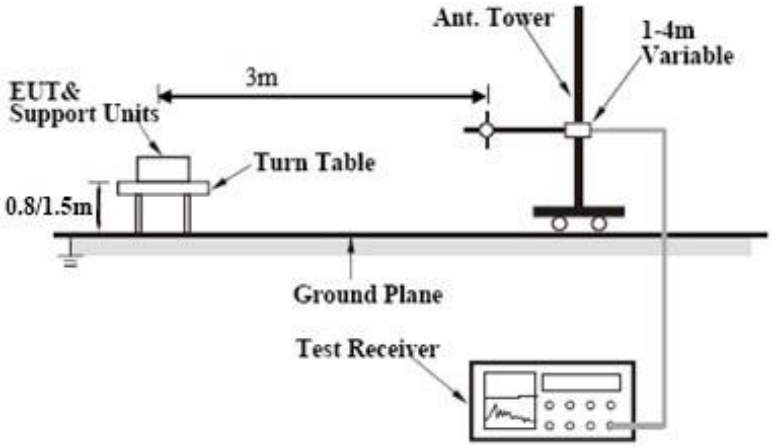
Phase Neutral Plot at 230Vac, 50Hz

No.	Frequency (MHz)	Reading (dBuV)	Detector	Lisn/Isn (dB}	Ps_Lmt (dB)	Cab_L (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)
1	0.1620	37.23	QP	0.11	-10.00	0.34	47.68	65.36	-17.68
2	0.1620	21.77	AVG	0.11	-10.00	0.34	32.22	55.36	-23.14
3	0.2460	32.77	QP	0.10	-10.00	0.21	43.08	61.89	-18.81
4	0.2460	17.32	AVG	0.10	-10.00	0.21	27.63	51.89	-24.26
5	0.3300	25.44	QP	0.10	-10.00	0.20	35.74	59.45	-23.71
6	0.3300	13.21	AVG	0.10	-10.00	0.20	23.51	49.45	-25.94
7	0.5780	20.74	QP	0.11	-10.00	0.21	31.06	56.00	-24.94
8	0.5780	11.78	AVG	0.11	-10.00	0.21	22.10	46.00	-23.90
9	0.7300	26.84	QP	0.12	-10.00	0.20	37.16	56.00	-18.84
10	0.7300	18.04	AVG	0.12	-10.00	0.20	28.36	46.00	-17.64
11	4.6860	21.92	QP	0.27	-10.00	0.28	32.47	56.00	-23.53
12	4.6860	15.96	AVG	0.27	-10.00	0.28	26.51	46.00	-19.49

6.9 Radiated Emissions

Temperature	23°C
Relative Humidity	51%
Atmospheric Pressure	1018mbar
Test date :	December 20 to December 21, 2017
Tested By :	Amos Xia

Requirement(s):

Spec	Item	Requirement	Applicable
47CFR§15.205, §15.209, §15.247(d)	a)	Except higher limit as specified elsewhere in other section, the emissions from the low-power radio-frequency devices shall not exceed the field strength levels specified in the following table and the level of any unwanted emissions shall not exceed the level of the fundamental emission. The tighter limit applies at the band edges **Class A Limit** Frequency range (MHz) / Field Strength (μV/m) 30 – 88 / 90 88 – 216 / 150 216 – 960 / 210 Above 960 / 300 **Class B Limit** Frequency range (MHz) / Field Strength (μV/m) 30 – 88 / 100 88 – 216 / 150 216 – 960 / 200 Above 960 / 500	☑
Test Setup			
Procedure	1. The EUT was switched on and allowed to warm up to its normal operating condition. 2. The test was carried out at the selected frequency points obtained from the EUT characterization. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner: a. Vertical or horizontal polarization (whichever gave the higher emission level over a full rotation of the EUT) was chosen. b. The EUT was then rotated to the direction that gave the maximum emission. c. Finally, the antenna height was adjusted to the height that gave the maximum emission. 3. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasiy Peak detection at frequency below 1GHz. 4. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz with Peak detection for Peak measurement at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz		

	5. with Peak detection for Average Measurement as below at frequency above 1GHz. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.
Remark	We test 3 modulations, only show GFSK test data in the report.
Result	☑ Pass ☐ Fail

Test Data ☑ Yes ☐ N/A

Test Plot ☑ Yes (See below) ☐ N/A

Data sample

No.	Frequency	Reading	Detector	Ant_F	PA_G	Cab_L	Result	Limit	Margin	Height	Degree
	(MHz)	(dBμV/m)		(dB/m)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(cm)	(°)

Frequency (MHz) = Emission frequency in MHz

Reading (dBμV/m) = Receiver Reading Value

Detector= Peak Detector or Quasi Peak Detector

Ant_F=Antenna Factor

PA_G=Pre-Amplifier Gain

Cab_L=Cable Loss

Result (dBμV/m) = Read ing Value + Corrected Value

Limit (dBμV/m) = Limit stated in standard

Height (cm) = Height of Receiver antenna

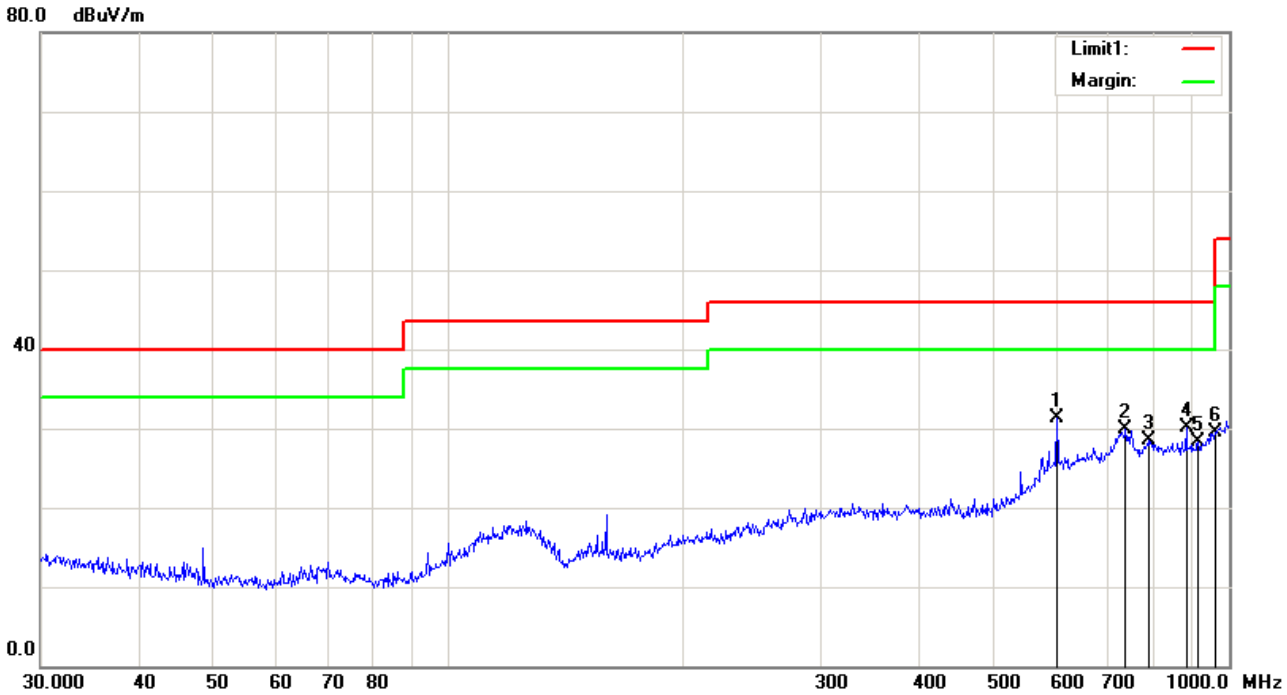
Degree = Turn table degree

Calculation Formula:

Margin (dB) = Result (dBμV/m) – limit (dBμV/m)

Test Mode :	Normal Working Mode – Low Channel

Below 1GHz



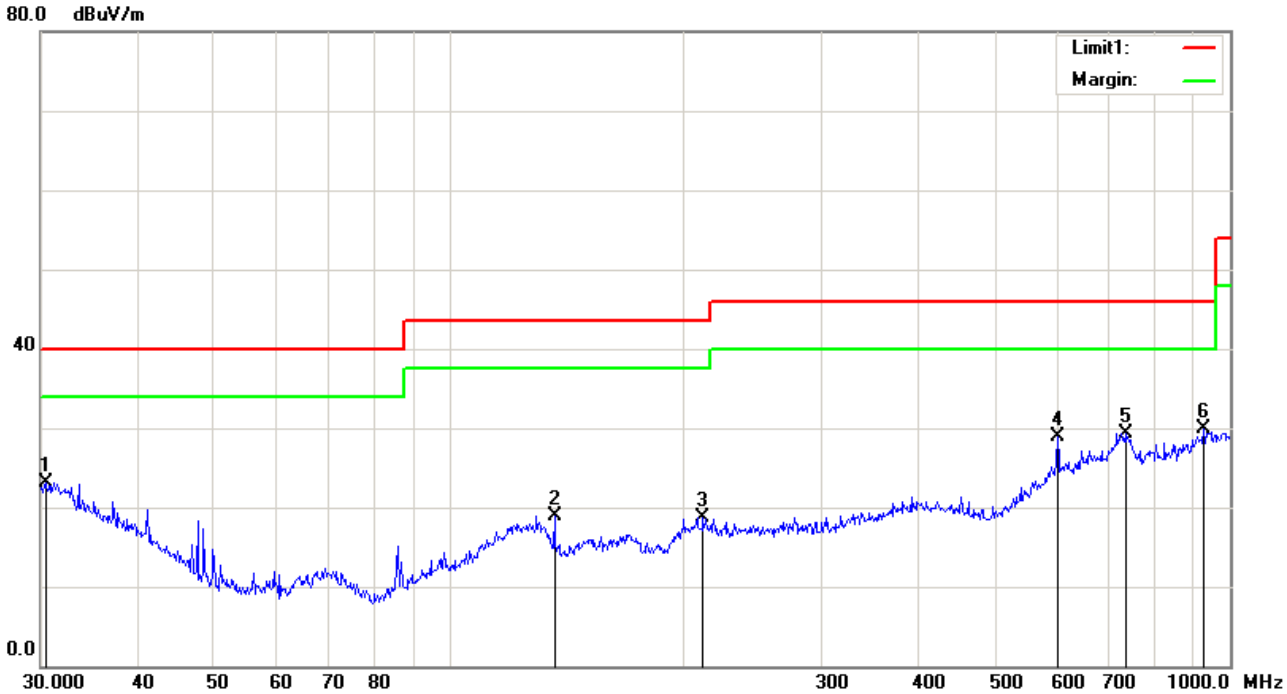
Test Data

Horizontal Polarity Plot @3m

No.	Frequency (MHz)	Reading (dBuV/m)	Detector	Ant_F (dB/m)	PA_G (dB)	Cab_L (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)
1	601.4265	54.70	peak	21.28	48.58	3.94	31.34	46.00	-14.66	200	205
2	737.0714	48.13	peak	22.62	45.21	4.36	29.90	46.00	-16.10	300	170
3	787.8513	47.32	peak	22.93	46.22	4.51	28.54	46.00	-17.46	200	323
4	881.4067	48.49	peak	22.76	45.95	4.80	30.10	46.00	-15.90	300	133
5	912.8620	47.11	peak	23.01	46.63	4.89	28.38	46.00	-17.62	200	360
6	958.7943	46.61	peak	24.11	46.23	4.98	29.47	46.00	-16.53	280	360

Test Mode :	Normal Working Mode – Low Channel

Below 1GHz



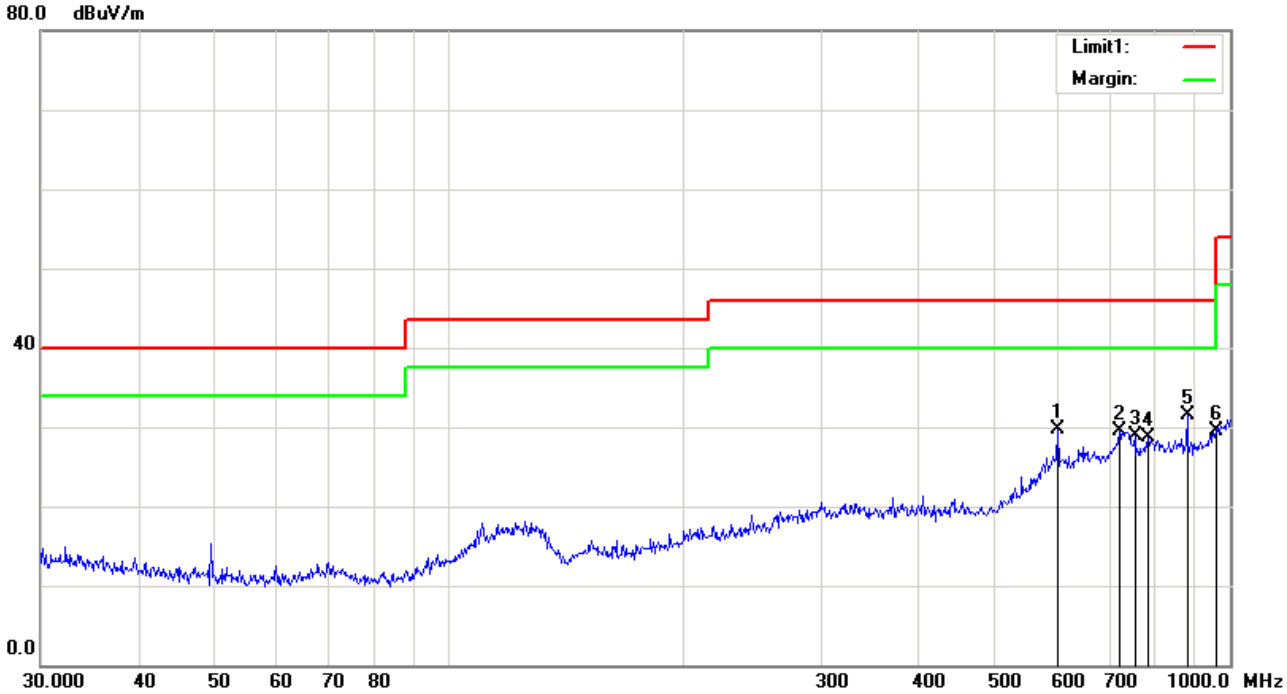
Test Data

Vertical Polarity Plot @3m

No.	Frequency (MHz)	Reading (dBuV/m)	Detector	Ant_F (dB/m)	PA_G (dB)	Cab_L (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)
1	30.4238	46.59	peak	21.35	45.68	0.88	23.14	40.00	-16.86	100	90
2	136.4598	50.94	peak	13.82	47.73	1.95	18.98	43.50	-24.52	100	158
3	211.5265	49.18	peak	14.86	47.62	2.32	18.74	43.50	-24.76	100	240
4	601.4265	53.29	peak	20.29	48.58	3.94	28.94	46.00	-17.06	100	131
5	734.4913	48.09	peak	22.23	45.29	4.35	29.38	46.00	-16.62	100	0
6	925.7563	47.67	peak	23.66	46.40	4.91	29.84	46.00	-16.16	100	40

Test Mode :	Normal Working Mode – Mid Channel

Below 1GHz



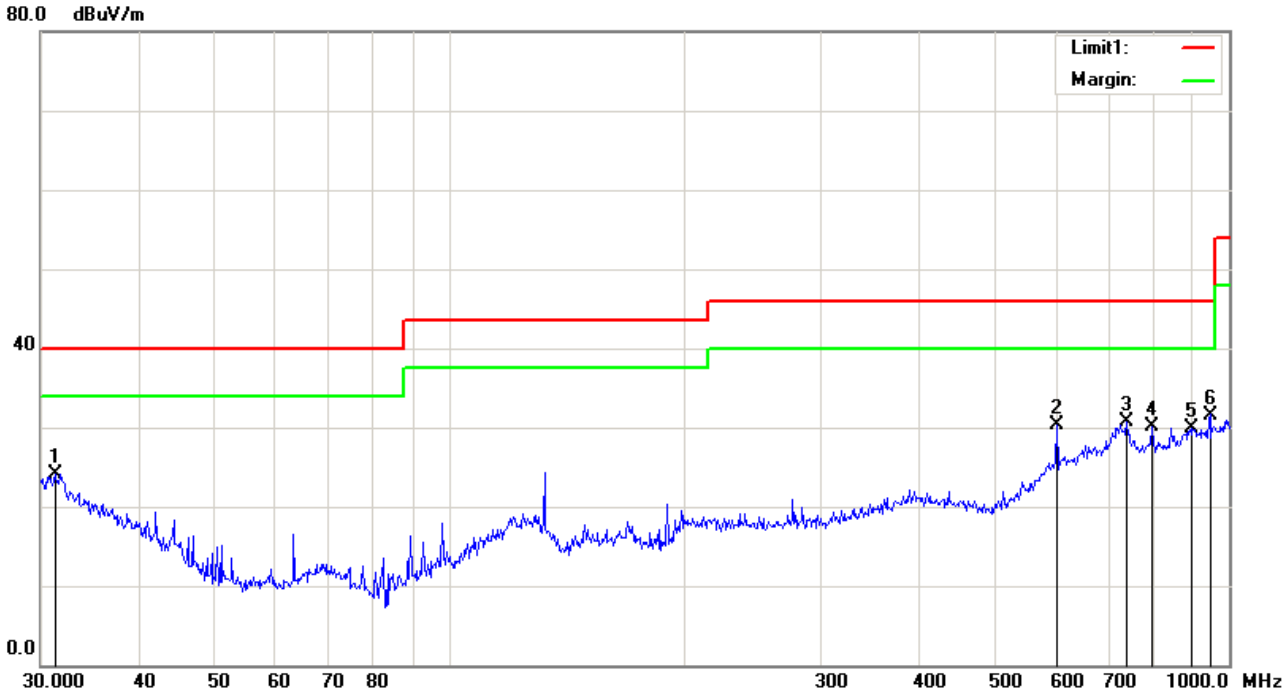
Test Data

Horizontal Polarity Plot @3m

No.	Frequency (MHz)	Reading (dBuV/m)	Detector	Ant_F (dB/m)	PA_G (dB)	Cab_L (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)
1	601.4265	53.06	peak	21.28	48.58	3.94	29.70	46.00	-16.30	200	232
2	721.7259	48.35	peak	22.53	45.71	4.31	29.48	46.00	-16.52	200	115
3	755.3873	46.74	peak	22.73	44.98	4.41	28.90	46.00	-17.10	300	319
4	785.0935	47.42	peak	22.91	46.19	4.50	28.64	46.00	-17.36	200	331
5	881.4067	49.82	peak	22.76	45.95	4.80	31.43	46.00	-14.57	300	141
6	958.7943	46.74	peak	24.11	46.23	4.98	29.60	46.00	-16.40	300	303

Test Mode :	Normal Working Mode – Mid Channel

Below 1GHz



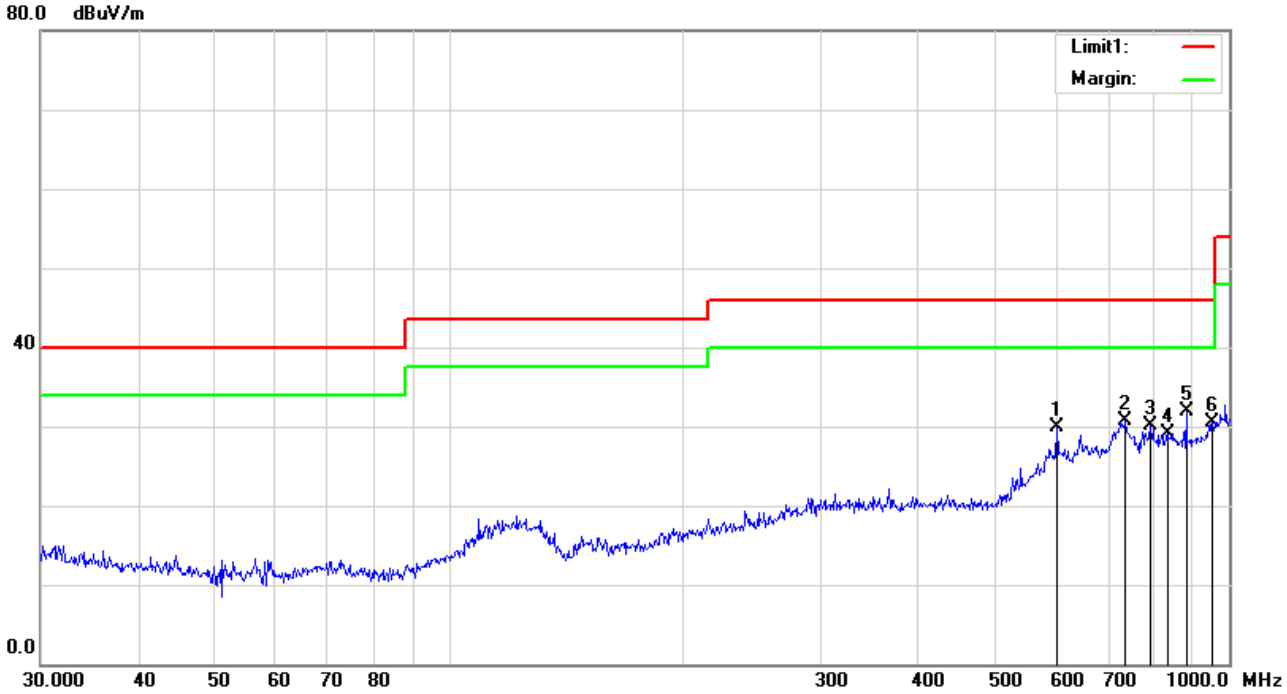
Test Data

Vertical Polarity Plot @3m

No.	Frequency (MHz)	Reading (dBuV/m)	Detector	Ant_F (dB/m)	PA_G (dB)	Cab_L (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)
1	31.2893	48.13	peak	20.85	45.67	0.89	24.20	40.00	-15.80	200	213
2	601.4265	54.61	peak	20.29	48.58	3.94	30.26	46.00	-15.74	100	132
3	739.6605	49.23	peak	22.18	45.12	4.37	30.66	46.00	-15.34	100	216
4	796.1830	50.26	peak	21.59	46.33	4.53	30.05	46.00	-15.95	100	113
5	896.9965	47.97	peak	23.61	46.53	4.85	29.90	46.00	-16.10	200	118
6	945.4399	48.95	peak	23.65	45.95	4.95	31.60	46.00	-14.40	100	328

Test Mode :	Normal Working Mode – High Channel

Below 1GHz



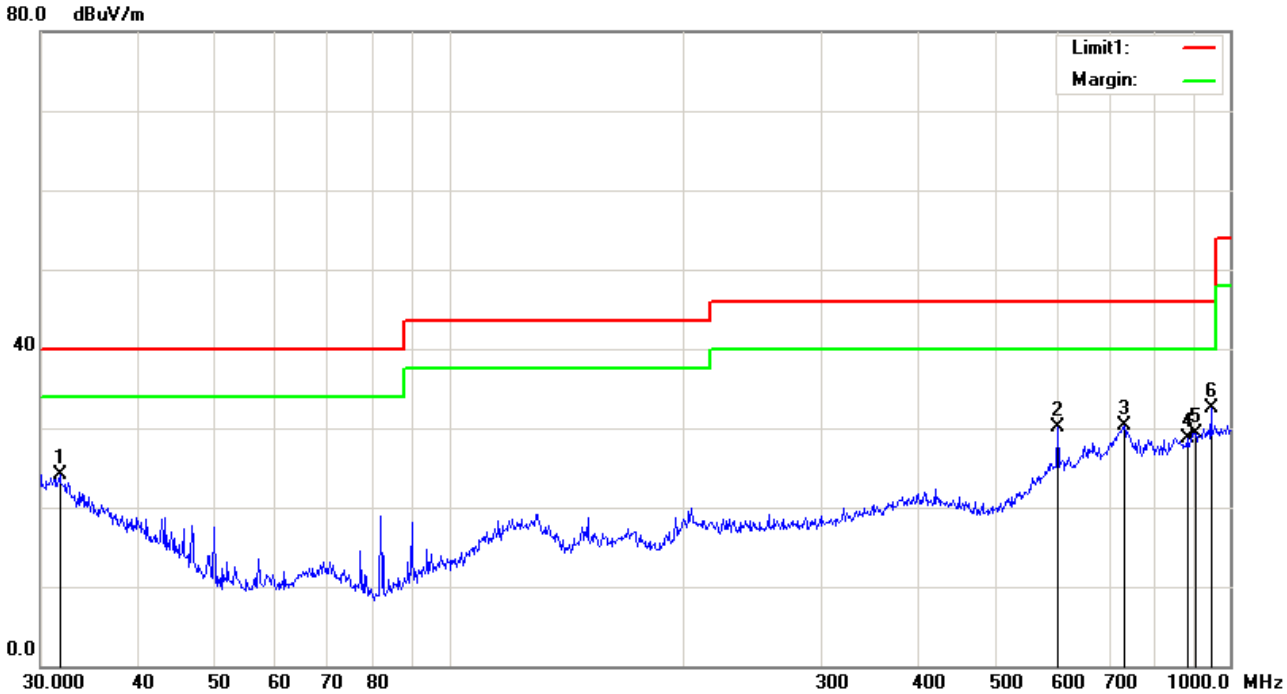
Test Data

Horizontal Polarity Plot @3m

No.	Frequency (MHz)	Reading (dBuV/m)	Detector	Ant_F (dB/m)	PA_G (dB)	Cab_L (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)
1	601.4265	53.31	peak	21.28	48.58	3.94	29.95	46.00	-16.05	200	40
2	737.0714	48.91	peak	22.62	45.21	4.36	30.68	46.00	-15.32	200	253
3	793.3960	48.96	peak	22.96	46.29	4.53	30.16	46.00	-15.84	200	285
4	833.3171	47.55	peak	22.90	45.99	4.65	29.11	46.00	-16.89	100	13
5	881.4067	50.25	peak	22.76	45.95	4.80	31.86	46.00	-14.14	100	94
6	952.0937	47.60	peak	23.95	46.09	4.96	30.42	46.00	-15.58	200	195

Test Mode :	Normal Working Mode – High Channel

Below 1GHz



Test Data

Vertical Polarity Plot @3m

No.	Frequency (MHz)	Reading (dBuV/m)	Detector	Ant_F (dB/m)	PA_G (dB)	Cab_L (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)
1	31.7313	48.34	peak	20.59	45.67	0.90	24.16	40.00	-15.84	100	346
2	601.4265	54.48	peak	20.29	48.58	3.94	30.13	46.00	-15.87	100	122
3	731.9203	49.12	peak	22.26	45.38	4.34	30.34	46.00	-15.66	200	20
4	881.4067	46.67	peak	23.28	45.95	4.80	28.80	46.00	-17.20	200	177
5	903.3094	47.49	peak	23.67	46.64	4.87	29.39	46.00	-16.61	100	123
6	945.4399	49.85	peak	23.65	45.95	4.95	32.50	46.00	-13.50	100	15

Test Mode :	Normal Working Mode – Low Channel

Above 1GHz

Vertical

No.	Frequency	Reading	Detector	Ant_F	PA_G	Cab_L	Result	Limit	Margin	Height	Degree
	(MHz)	(dBuV/m)		(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(°)
1	1867.000	52.49	AVG	30.53	51.61	3.99	35.40	54.00	-18.60	100	232
2	3329.000	62.61	peak	31.58	52.86	4.87	46.20	74.00	-27.80	200	175
3	4808.000	63.29	peak	33.18	53.35	6.10	49.22	74.00	-24.78	100	205
4	8072.000	56.70	peak	36.24	54.60	7.93	46.27	74.00	-27.73	134	360
5	10962.000	56.55	peak	38.42	53.21	9.49	51.25	74.00	-22.75	200	242
6	13580.000	51.23	AVG	41.68	52.02	9.34	50.23	54.00	-3.77	100	20

Horizontal

No.	Frequency	Reading	Detector	Ant_F	PA_G	Cab_L	Result	Limit	Margin	Height	Degree
	(MHz)	(dBuV/m)		(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(°)
1	1850.000	52.17	AVG	30.43	51.53	4.00	35.07	54.00	-18.93	116	360
2	3329.000	63.60	peak	31.58	52.86	4.87	47.19	74.00	-26.81	100	23
3	4808.000	63.76	peak	33.18	53.35	6.10	49.69	74.00	-24.31	100	156
4	9806.000	56.16	peak	38.23	53.96	9.09	49.52	74.00	-24.48	200	13
5	11608.000	56.22	peak	38.58	53.33	10.06	51.53	74.00	-22.47	100	143
6	13733.000	53.58	AVG	41.83	52.07	9.23	52.57	54.00	-1.43	100	292

Test Mode :	Normal Working Mode – Mid Channel

Above 1GHz

Vertical

No.	Frequency	Reading	Detector	Ant_F	PA_G	Cab_L	Result	Limit	Margin	Height	Degree
	(MHz)	(dBuV/m)		(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(°)
1	1867.000	56.49	AVG	30.53	51.61	3.99	39.40	54.00	-14.60	100	193
2	3329.000	61.24	peak	31.58	52.86	4.87	44.83	74.00	-29.17	100	1
3	4876.000	61.17	peak	33.33	53.66	6.00	46.84	74.00	-27.16	100	120
4	8072.000	56.43	peak	36.24	54.60	7.93	46.00	74.00	-28.00	100	288
5	10979.000	56.18	peak	38.41	53.22	9.49	50.86	74.00	-23.14	100	216
6	13699.000	52.88	AVG	41.80	52.06	9.26	51.88	54.00	-2.12	200	145

Horizontal

No.	Frequency	Reading	Detector	Ant_F	PA_G	Cab_L	Result	Limit	Margin	Height	Degree
	(MHz)	(dBuV/m)		(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(°)
1	1867.000	58.69	AVG	30.53	51.61	3.99	41.60	54.00	-12.40	100	122
2	3329.000	62.45	peak	31.58	52.86	4.87	46.04	74.00	-27.96	100	29
3	4876.000	63.16	peak	33.33	53.66	6.00	48.83	74.00	-25.17	200	115
4	8157.000	56.20	peak	35.82	54.43	8.02	45.61	74.00	-28.39	200	245
5	11523.000	55.76	peak	38.60	53.18	10.09	51.27	74.00	-22.73	100	235
6	15518.000	52.17	AVG	39.46	50.08	10.18	51.73	54.00	-2.27	100	53

Test Mode :	Normal Working Mode – High Channel

Above 1GHz

Vertical

No.	Frequency	Reading	Detector	Ant_F	PA_G	Cab_L	Result	Limit	Margin	Height	Degree
	(MHz)	(dBuV/m)		(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(°)
1	1867.000	59.61	AVG	30.53	51.61	3.99	42.52	54.00	-11.48	200	262
2	3329.000	60.99	peak	31.58	52.86	4.87	44.58	74.00	-29.42	200	179
3	4961.000	63.28	peak	33.51	54.04	5.88	48.63	74.00	-25.37	100	94
4	8174.000	55.61	peak	35.73	54.39	8.04	44.99	74.00	-29.01	140	360
5	10775.000	55.28	peak	38.49	53.14	9.43	50.06	74.00	-23.94	200	196
6	13682.000	52.11	AVG	41.78	52.05	9.27	51.11	54.00	-2.89	100	90

Horizontal

No.	Frequency	Reading	Detector	Ant_F	PA_G	Cab_L	Result	Limit	Margin	Height	Degree
	(MHz)	(dBuV/m)		(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(°)
1	1867.000	59.66	AVG	30.53	51.61	3.99	42.57	54.00	-11.43	177	360
2	3329.000	62.18	peak	31.58	52.86	4.87	45.77	74.00	-28.23	100	25
3	4961.000	64.18	peak	33.51	54.04	5.88	49.53	74.00	-24.47	200	130
4	8106.000	55.99	peak	36.07	54.53	7.96	45.49	74.00	-28.51	100	52
5	10316.000	55.11	peak	38.64	53.42	9.31	49.64	74.00	-24.36	200	0
6	13869.000	50.34	AVG	41.97	52.10	9.13	49.34	54.00	-4.66	100	138

Annex A. TEST INSTRUMENT

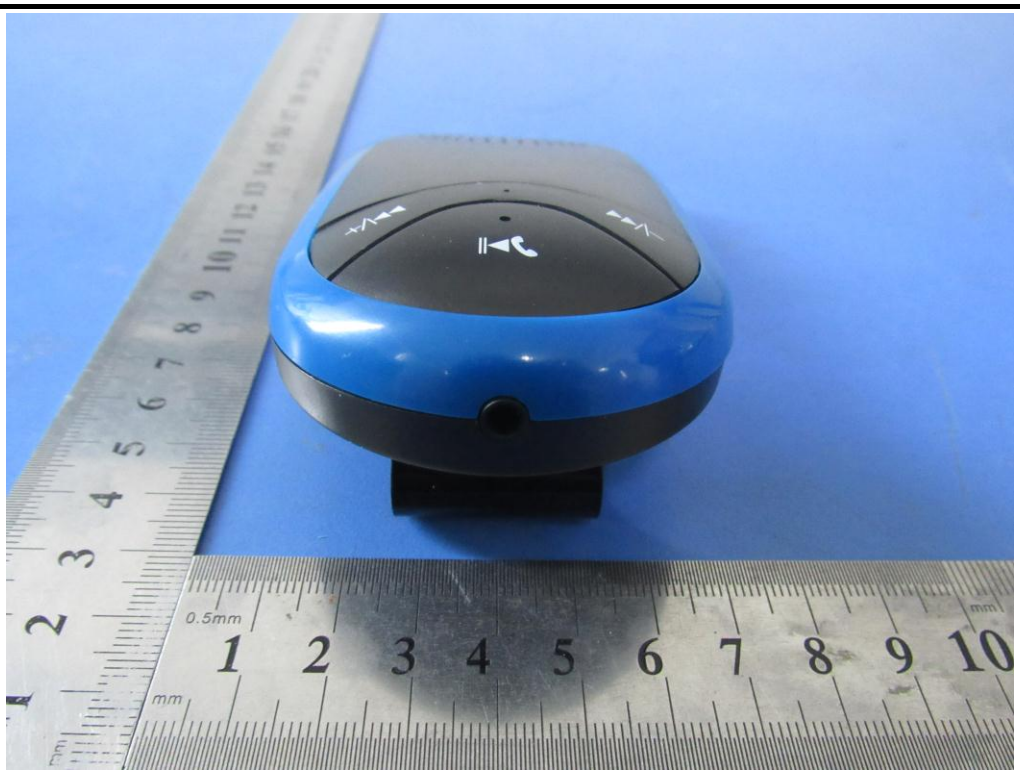
Instrument	Model	Serial #	Cal Date	Cal Due	In use
AC Line Conducted Emissions					
R&S EMI Test Receiver	ESPI3	101216	05/03/2017	05/02/2018	☒
V-LISN	ESH3-Z5	838979/005	03/30/2017	03/29/2018	☒
INFOMW Antenna (1 ~18GHz)	JXTXLB-10180	J2031081120092	10/08/2017	10/07/2018	☒
SIEMIC EZ_EMC Conducted Emissions	Ver.ICP-03A1	N/A	N/A	N/A	☒
RF conducted test					
R&S EMI Receiver	ESPI3	101216	05/03/2017	05/02/2018	☒
Power Splitter	1#	1#	02/02/2017	02/01/2018	☒
Spectrum Analyzer	N9010A	MY47191130	03/30/2017	03/29/2018	☒
Temperature/Humidity Chamber	1007H	N/A	01/07/2017	01/06/2018	☒
Radiated Emissions					
Spectrum Analyzer	N9010A	MY47191130	05/03/2017	05/02/2018	☒
R&S EMI Receiver	ESPI3	101216	05/03/2017	05/02/2018	☒
Antenna (30MHz~6GHz)	JB6	A121411	10/31/2017	10/30/2018	☒
EMCO Horn Antenna (1 ~18GHz)	3115	N/A	11/15/2017	11/14/2018	☒
INFOMW Antenna (1 ~18GHz)	JXTXLB-10180	J2031081120092	10/09/2017	10/08/2018	☒
Horn Antenna (18~40GHz)	AH-840	101013	04/30/2017	04/29/2018	N/A
Microwave Pre-Amp (18~40GHz)	PA-840	181250	05/28/2017	05/27/2018	N/A
Hp Pre-Amplifier	8447F	1937A01160	10/31/2017	10/30/2018	☒
Agilent Pre-Amplifier	8447B	N/A	10/31/2017	10/30/2018	☒
MITEQ Pre-Amplifier (0.1 ~ 18GHz)	AMF-7D-00101800-	1451709	10/27/2017	10/26/2018	☒
SIEMIC Labview Radiated Emissions software	V1.0	N/A	N/A	N/A	☒

Annex B. EUT And Test Setup Photographs

Annex B.i. Photograph: EUT External Photo

EUT - Top View

EUT - Bottom View



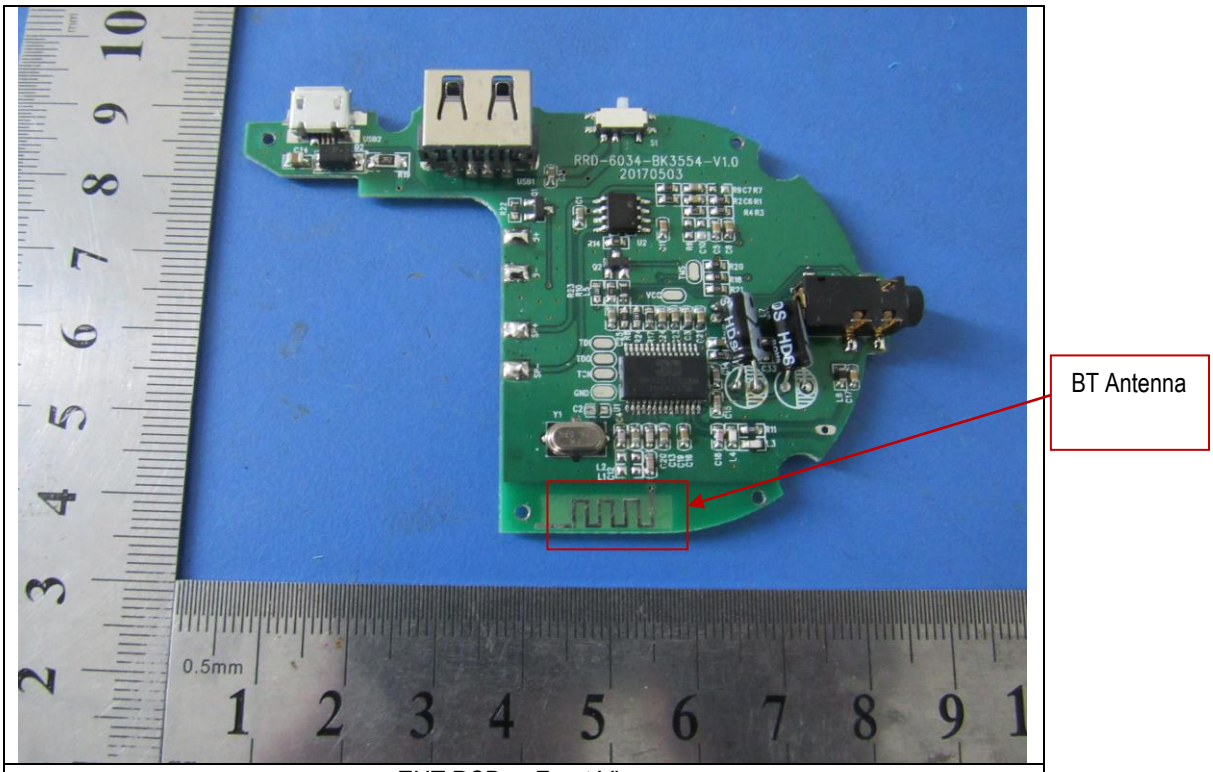
EUT - Front View

EUT - Rear View

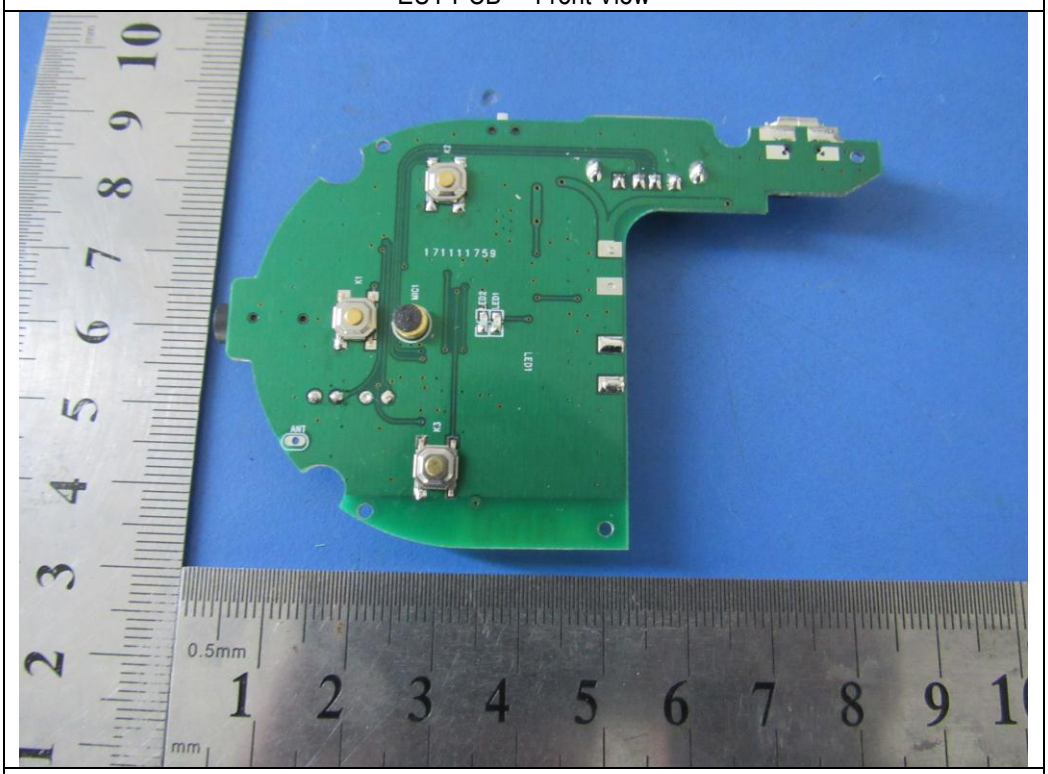
EUT - Left View

EUT - Right View

Annex B.ii. Photograph: EUT Internal Photo



EUT PCB – Front View



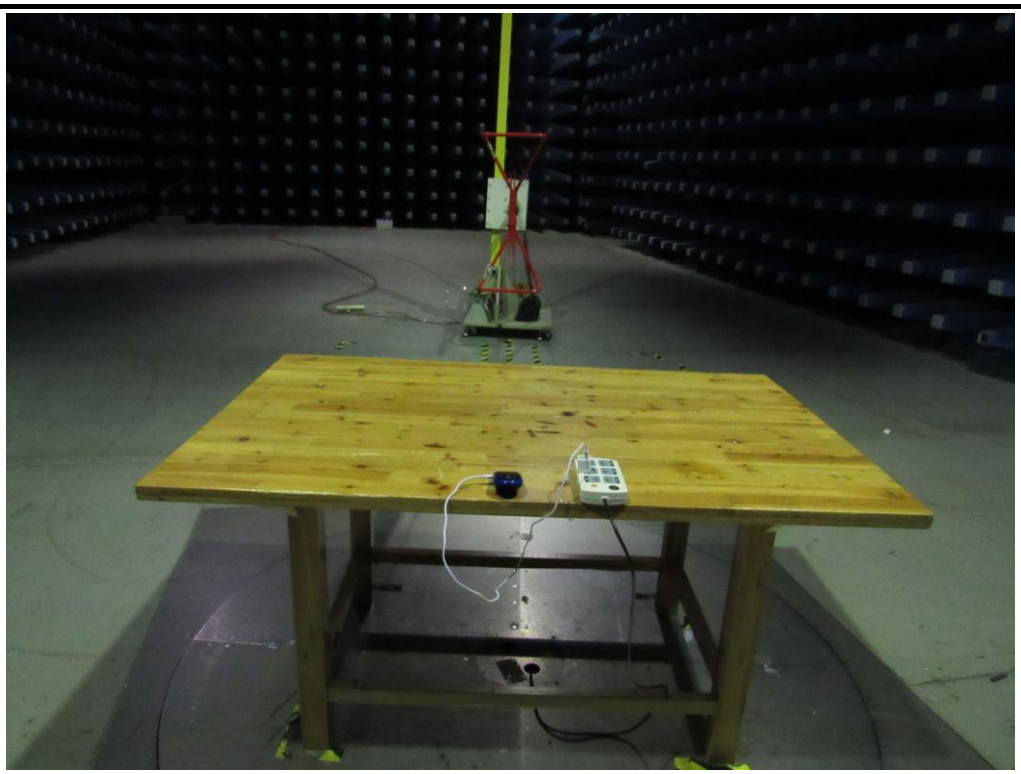
EUT PCB – Rear View

EUT Battery – Front View

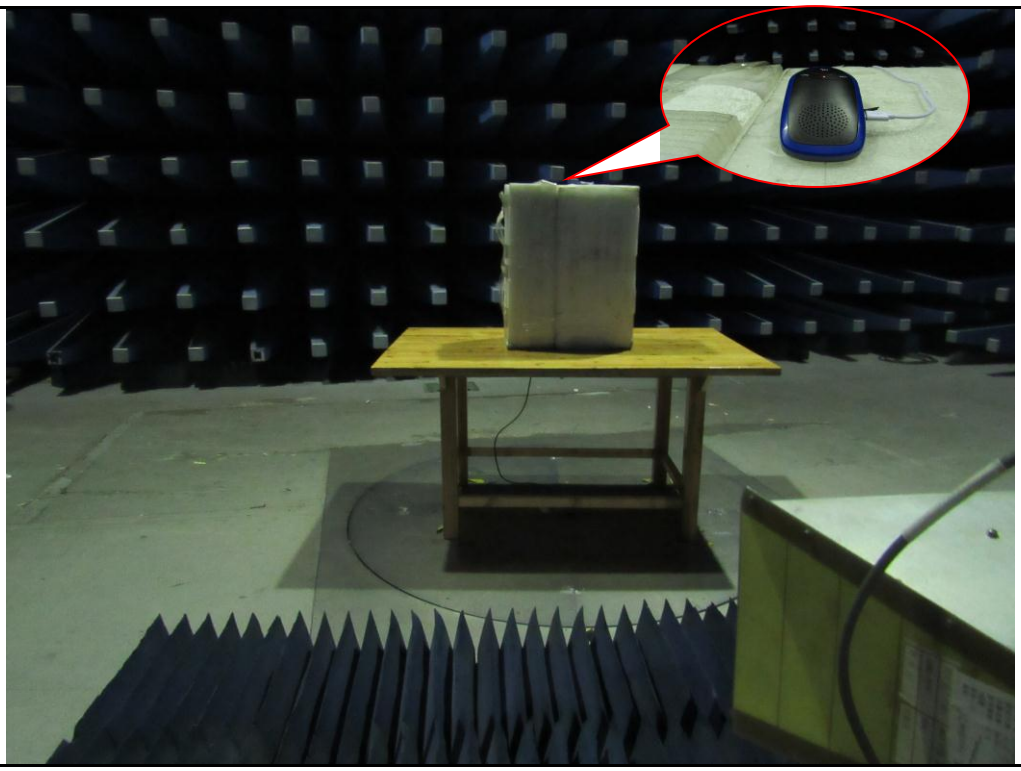
Annex B.iii. Photograph: Test Setup Photo

Conducted Emissions Test Setup Front View

Conducted Emissions Test Setup Side View



Radiated Spurious Emissions Test Setup Below 1GHz

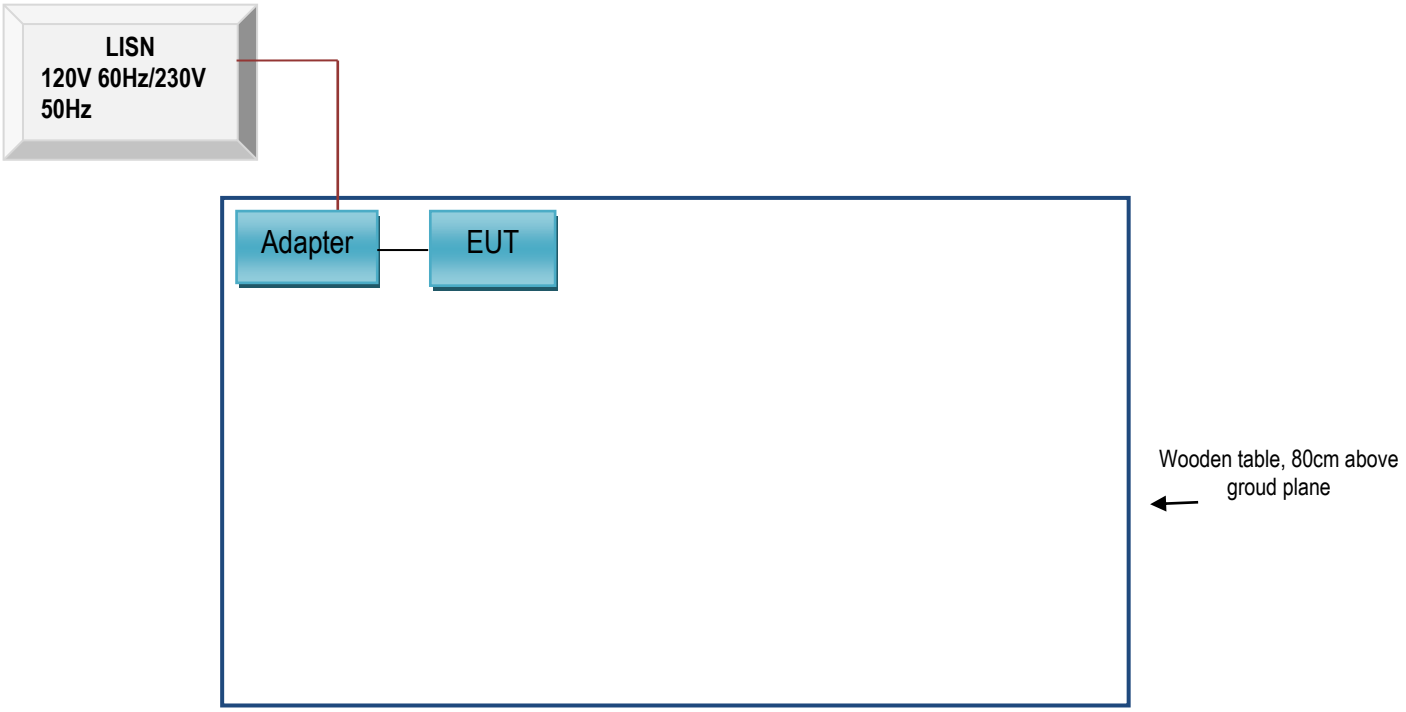


Radiated Spurious Emissions Test Setup Above 1GHz

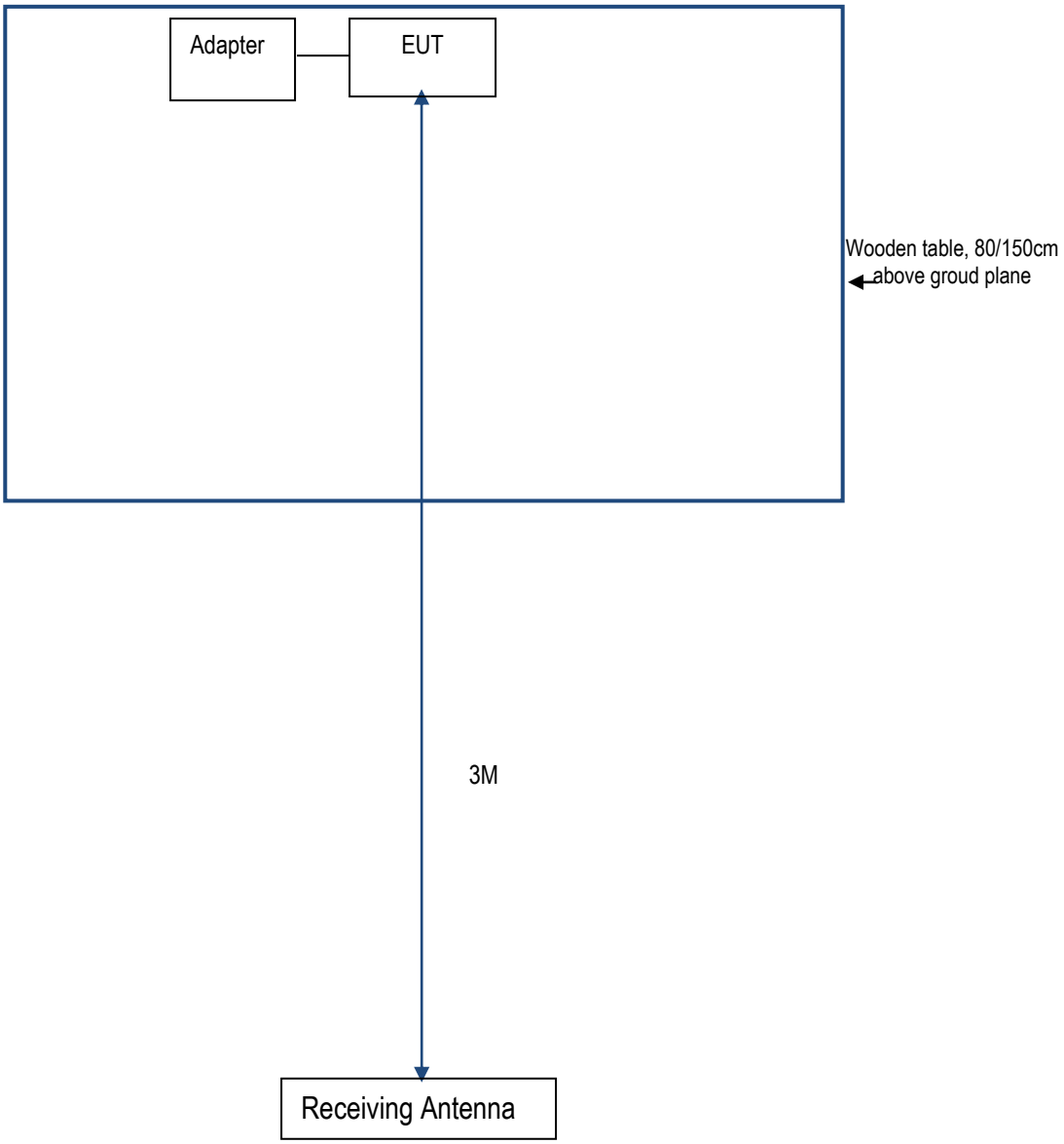
Annex C. TEST SETUP AND SUPPORTING EQUIPMENT

Annex C.ii. TEST SET UP BLOCK

Block Configuration Diagram for AC Line Conducted Emissions



Block Configuration Diagram for Radiated Emissions



Annex C. il. SUPPORTING EQUIPMENT DESCRIPTION

The following is a description of supporting equipment and details of cables used with the EUT.

Manufacturer	Equipment Description	Model	Calibration Date	Calibration Due Date
Saierkang	Adapter	A1443	N/A	N/A

Annex D. User Manual / Block Diagram / Schematics / Partlist

Please see attachment

Annex E. DECLARATION OF SIMILARITY

N/A