RADIO TEST REPORT

The device described below is tested by Dongguan Nore Testing Center Co., Ltd. to determine the maximum emission levels emanating from the device, the severe levels which the device can endure and E.U.T.'s performance criterion. The test results, data evaluation, test procedures, and equipment of configurations shown in this report were made in accordance with the procedures in ANSI C63.10(2013).

Applicant	:	BIG SUN Energy Technology Inc
Address	:	No.458-9, Sinsing Rd., Hukou Township, Hsinchu County, Hsinchu, Taiwan
Manufacturer /Factory	:	BIG SUN Energy Technology Inc
Address	:	No.458-9, Sinsing Rd., Hukou Township, Hsinchu County, Hsinchu, Taiwan
E.U.T.	:	DIWI
Brand Name	:	N/A
Model No.	:	IPVDW01
FCC ID	:	2AQY5-IPVDW01
Measurement Standard	:	FCC PART 15.247
Date of Receiver	:	May 16, 2018
Date of Test	:	May 16, 2018 to July 06, 2018
Date of Report	:	July 06, 2018

This Test Report is Issued Under the Authority of :

Prepared by	Approved & Authorized Signer
Rose Hu / Engineer	Iori Fan / Authorized Signatory

Dongguan NTC Co., Ltd. NTC Nore Testing Center TESTED

This test report is for the customer shown above and their specific product only. This report applies to above tested sample only and shall not be reproduced in part without written approval of Dongguan Nore Testing Center Co., Ltd.

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Address: Building D, Gaosheng Science & Technology Park, Zhouxi Longxi Road, Nancheng District, Dongguan City, Guangdong, China

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Revision History of This Test Report

Report Number	Description	Issued Date
NTC1805215FV00	Initial Issue	2018-07-06

1. GENERAL INFORMATION

1.1 Product Description for Equipment under Test

Product Name	:	DIWI
Main Model Name	:	IPVDW01
Additional Model Name	:	N/A
Model difference	:	N/A
Brand Name	:	N/A
Power Supply	:	DC 8-28V
Adapter	:	N/A
Test voltage	:	DC 12V, DC 24V Only the worst case was recorded in the report.
Hardware version	:	V1.0
Software version	:	V1.0
Serial number	:	N/A
Note	:	N/A

Technical parameters

Frequency Range	:	904-926MHz
Modulation	:	GFSK
Number of Channel	:	23
Channel space	:	1MHz
Antenna Type	:	External antenna
Antenna Gain	:	2.5dBi

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
1	904	13	916
2	905	14	917
3	906	15	918
4	907	16	919
5	908	17	920
6	909	18	921
7	910	19	922
8	911	20	923
9	912	21	924
10	913	22	925
11	914	23	926
12	915		

Note: According to section 15.31(m), regards to the operating frequency range over 10MHz, the Lowest, Middle, and the Highest frequency of channel were selected to perform the test. The selected frequency see below:

Channel	**Frequency MHz**
1	904
12	915
23	926

1.2 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for FCC ID: **2AQY5-IPVDW01** filing to comply with Section 15.247 of the FCC Part 15(2016), Subpart C Rule.

1.3 Test Methodology

The radiated emission measurement was performed according to the procedures in ANSI C63.10 (2013). Radiated emission measurement was performed in semi-anechoic chamber. For radiated emission measurement, preliminary scans were performed in the semi-anechoic chamber only to determine the worst case modes. All radiated tests were performed at an antenna to EUT distance of 3 meters. All other measurements were made in accordance with the procedures in 47 CFR part 2.

1.4 Equipment Modifications

Not available for this EUT intended for grant.

1.5 Support Device

N/A

1.6 Test Facility and Location

Site Description

EMC Lab	:	Listed by CNAS, August 14, 2015 The certificate is valid until August 13, 2018 The Laboratory has been assessed and proved to be in compliance with CNAS/CL01 The Certificate Registration Number is L5795. Listed by A2LA, November 01, 2017 The certificate is valid until December 31, 2019 The Laboratory has been assessed and proved to be in compliance with ISO17025 The Certificate Registration Number is 4429.01 Listed by FCC, November 06, 2017 The Designation Number is CN1214 Test Firm Registration Number: 907417 Listed by Industry Canada, June 08, 2017 The Certificate Registration Number. Is 46405-9743
Name of Firm	:	Dongguan Nore Testing Center Co., Ltd. (Dongguan NTC Co., Ltd.)
Site Location	:	Building D, Gaosheng Science & Technology Park, Zhouxi Longxi Road, Nancheng District, Dongguan City, Guangdong Province, China

1.7 Summary of Test Results

FCC Rules	Description Of Test	Uncertainty	Result
§15.207 (a)	AC Power Conducted Emission	±1.06dB	Not applicable
§15.247(b)(3)	Max. Conducted Output Power	±1.06dB	Compliant
§15.247(a)(2)	6dB Bandwidth	±1.42 x10^{-4}%	Compliant
§15.247(e)	Power Spectral Density	±1.06dB	Compliance
§15.247(d)	Band Edge and Conducted Spurious Emissions	±1.70dB	Compliance
§15.247(d),§15.209, §15.205	Radiated Spurious Emissions and Restricted Bands	±3.70dB	Compliance
§15.203	Antenna Requirement	N/A	Compliance

Note: Due to this EUT is powered by DC power source only, the AC Power Conducted Emission is not applicable.

2. System Test Configuration

2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.2 Special Accessories

Not available for this EUT intended for grant.

2.3 Description of test modes

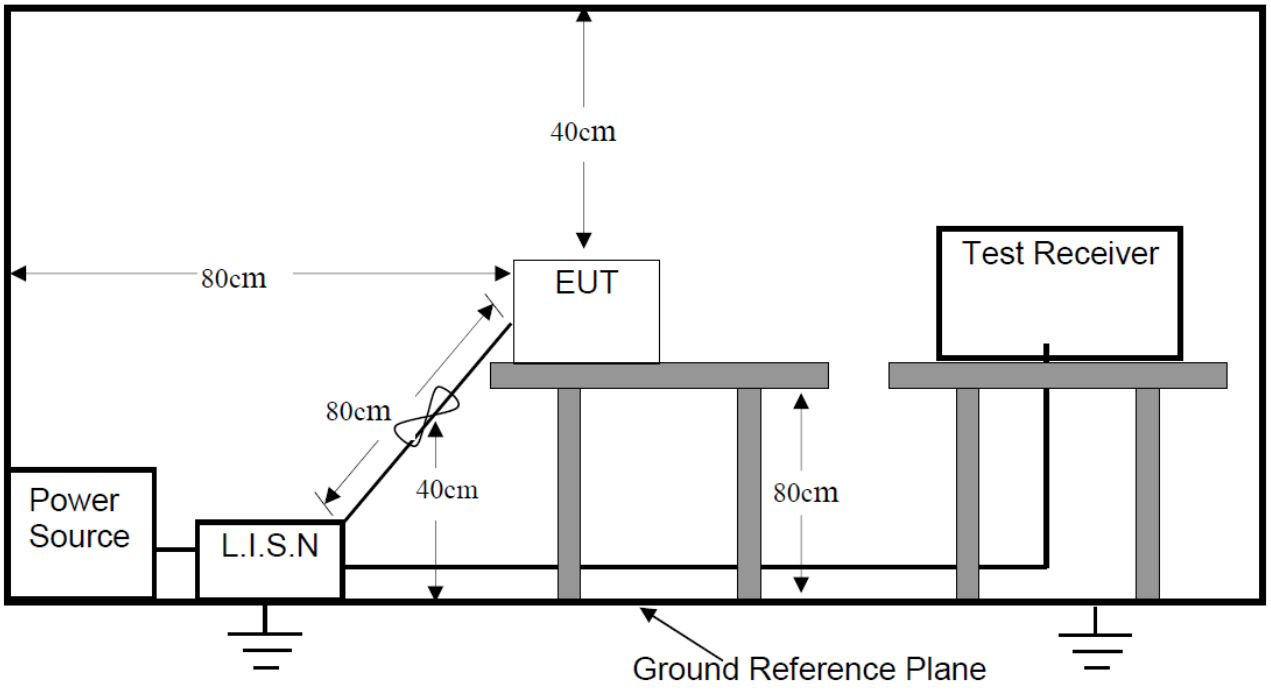
The EUT has been tested under continuous operating condition (The duty cycle >98%). Test program used to control the EUT staying in continuous transmitting mode. The Lowest, Middle and highest channel were chosen for testing, and modulation type GFSK was tested, but only the worst case data is shown in this report.

2.4 EUT Exercise

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements.

3. Conducted Emissions Test

3.1 Test SET-UP (Block Diagram of Configuration)



3.2 Test Condition

Test Requirement: FCC Part 15.207

Frequency Range: 150KHz ~ 30MHz

Detector: RBW 9KHz, VBW 30KHz

Operation Mode: TX Mode

3.3 Measurement Results

Not applicable.

4. Max. Conducted Output Power

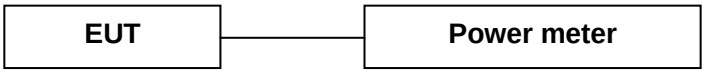
4.1 Measurement Procedure

Maximum Conducted Output power at Antenna Terminals, FCC Rules 15.247(b)(3):

One of the following procedures may be used to determine the maximum peak conducted output power of a DTS EUT.

The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast-responding diode detector.

4.2 Test SET-UP (Block Diagram of Configuration)



4.3 Measurement Results

Please refer to following table.

Temperature :	24 ℃	Humidity :	50 %
Test By:	Sance	Test Date :	June 29, 2018, June 13, 2018
Test Result:	PASS		

Frequency MHz	Data Rate Mbps	Peak Output Power dBm	Limit dBm
Low Channel: 904	1	16.03	30
Middle Channel: 915	1	16.08	30
High Channel: 926	1	15.75	30

5. 6dB Bandwidth

5.1 Measurement Procedure

DTS 6dB Channel Bandwidth, FCC Rule 15.247(a)(2):

The antenna port of the EUT was connected to the input of a spectrum analyzer. Analyzer was set as below:

1. For 6dB bandwidth, Set the RBW = 100KHz.
2. Set the VBW ≥ 3 x RBW
3. Detector = peak.
4. Sweep time = auto couple.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

5.2 Test SET-UP (Block Diagram of Configuration)

EUT —— **Spectrum Analyzer**

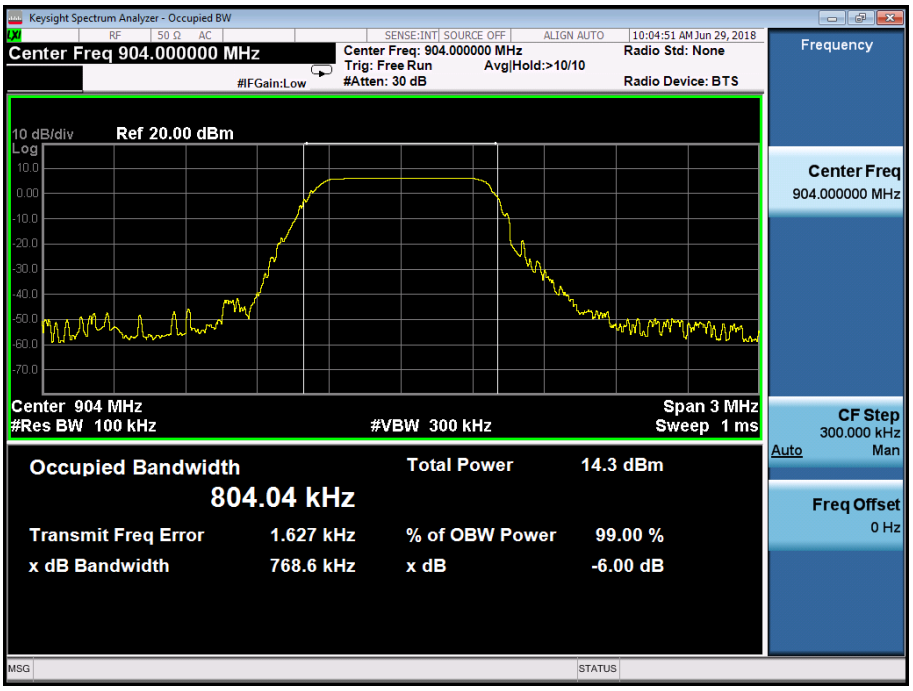
5.3 Measurement Results

Please refer to following table and plots.

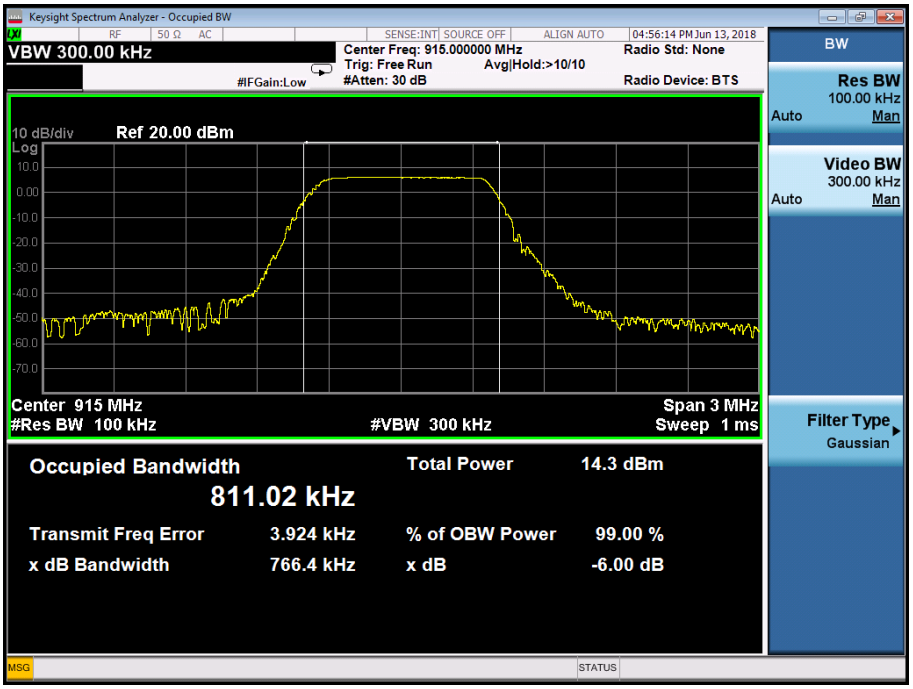
Temperature :	22 ℃	Humidity :	53 %
Test By:	Sance	Test Date :	June 13, 2018 June 29, 2018
Test Result:	PASS		

Frequency MHz	Data Rate Mbps	6dB Bandwidth KHz	Limit
Low Channel: 904	1	768.6	>500KHz
Middle Channel: 915	1	766.4	>500KHz
High Channel: 926	1	760.4	>500KHz

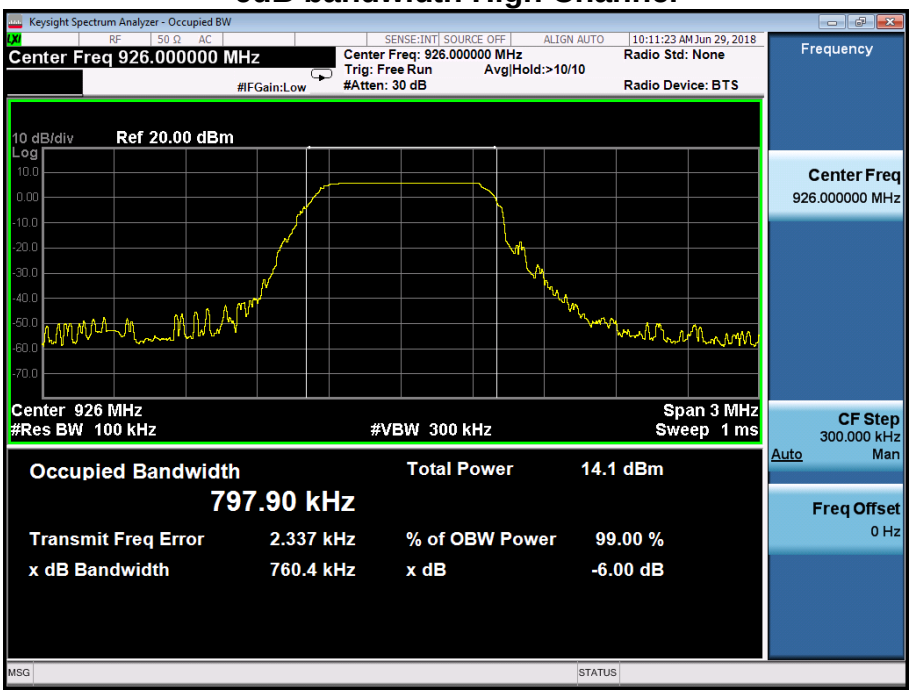
6dB bandwidth Low Channel



6dB bandwidth Middle Channel



6dB bandwidth High Channel



6. Power Spectral Density

6.1 Measurement Procedure

DTS 6dB Channel Bandwidth, FCC Rule 15.247(a)(2):

The antenna port of the EUT was connected to the input of a spectrum analyzer. Analyzer was set as below:

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS bandwidth.
3. Set the RBW to: 3 kHz≤RBW≤100KHz
4. Set the VBW ≥ 3 x RBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

6.2 Test SET-UP (Block Diagram of Configuration)

EUT —— **Spectrum Analyzer**

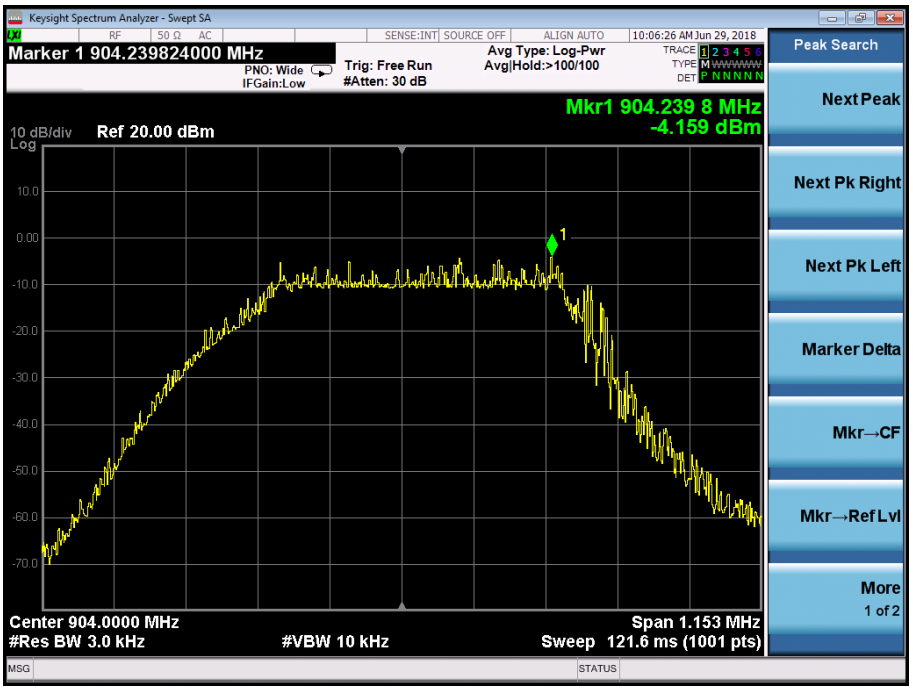
6.3 Measurement Results

Please refer to following table and plots.

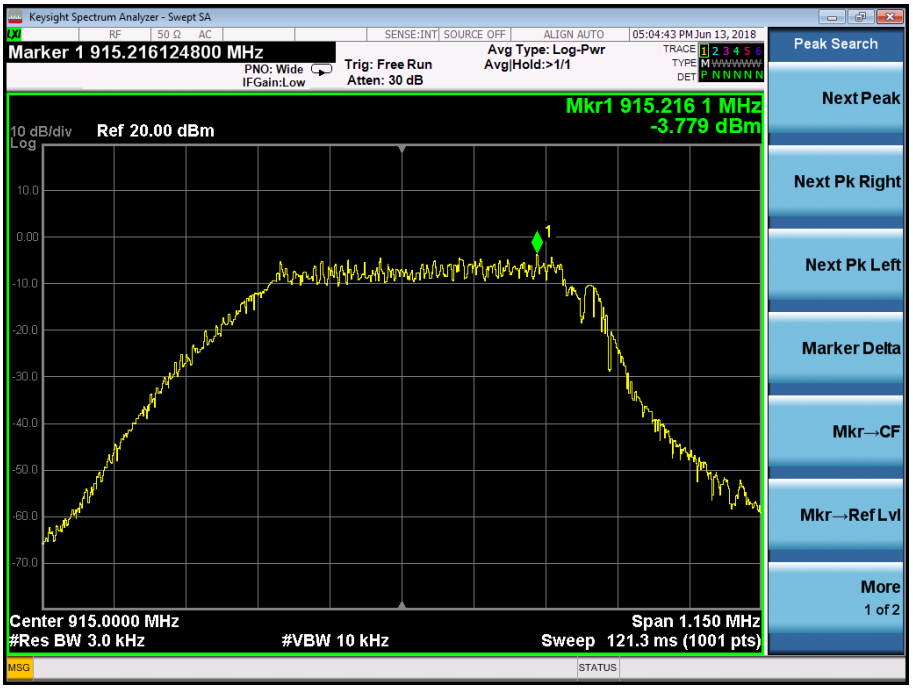
Temperature :	22 ℃	Humidity :	53 %
Test By:	Sance	Test Date :	June 13, 2018 June 29, 2018
Test Result:	PASS		

Frequency MHz	Data Rate Mbps	PSD dBm/3kHz	Limit dBm/3kHz
Low Channel: 904	1	-4.16	8
Middle Channel: 915	1	-3.78	8
High Channel: 926	1	-4.36	8

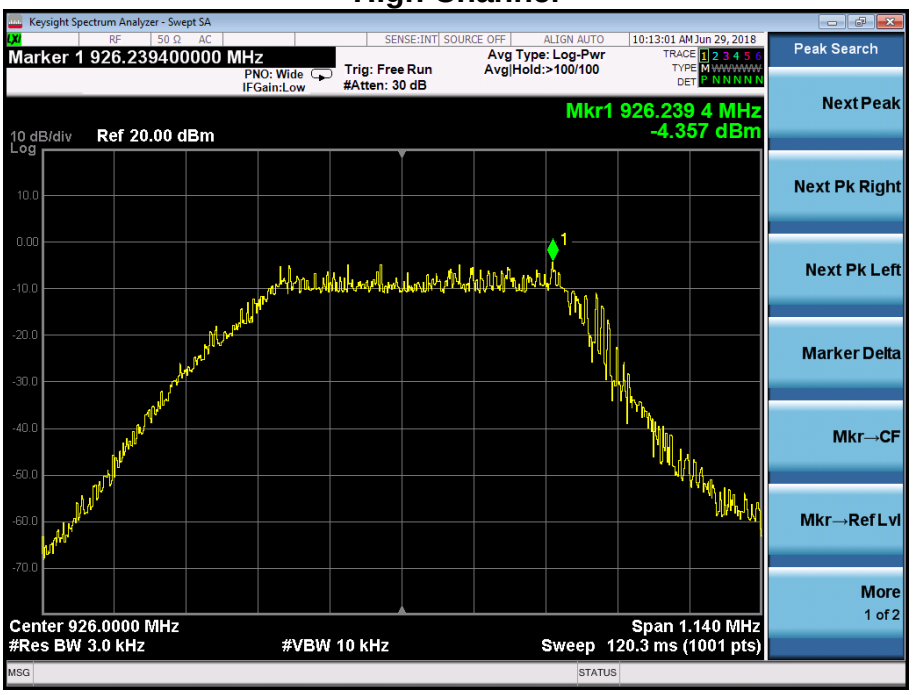
Low Channel



Middle Channel



High Channel



7. Band Edge and Conducted Spurious Emissions

7.1 Requirement and Measurement Procedure

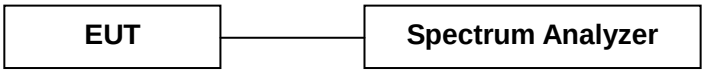
In any 100KHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100KHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.
The antenna port of the EUT was connected to the input of a spectrum analyzer. Analyzer was set as below.

A Quasi-peak measurement was then made for that frequency point for below 1GHz test. PK and AV for above 1GHz emission test.

During the radiated emission test, the spectrum analyzer was set with the following configurations:

Frequency Band (MHz)	Level	Resolution Bandwidth	Video Bandwidth
30 to 1000	QP	120 kHz	300 kHz
Above 1000	Peak	1 MHz	3 MHz
	Average	1 MHz	10 Hz

7.2 Test SET-UP (Block Diagram of Configuration)



7.3 Measurement Results

The test plots and table showed all spurious emission and up to the tenth harmonic was measured and they were found to be at least 20dB below the highest level of the desired power in the passband. Please refer to below plots.

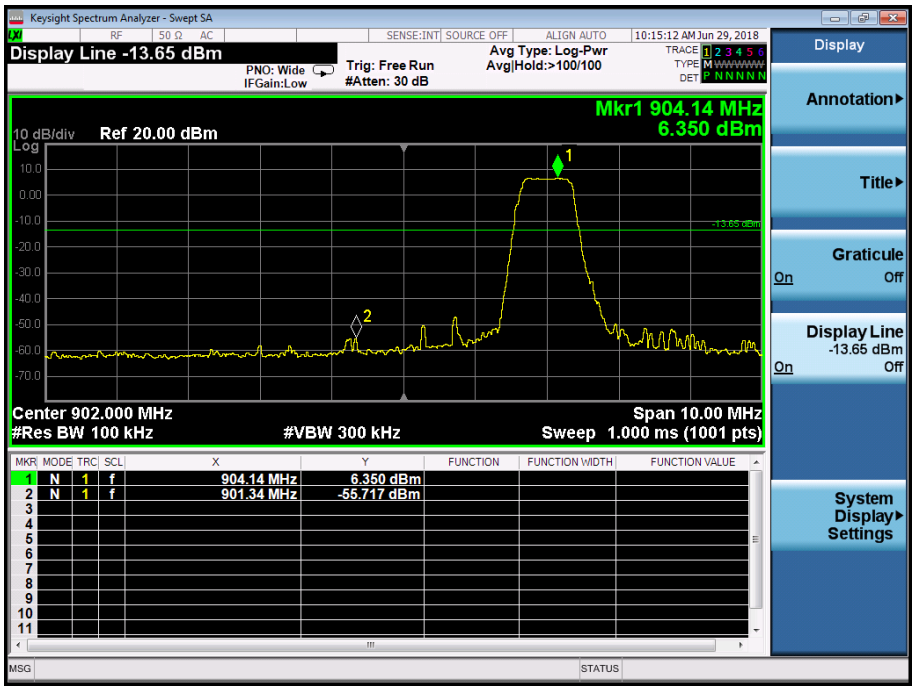
Spurious Emission in restricted band:

Operation Mode:	TX	Test Date :	July 02, 2018
Frequency Range:	Above 1GHz	Temperature :	24 ℃
Test Result:	PASS	Humidity :	47 %
Measured Distance:	3m	Test By:	Sance

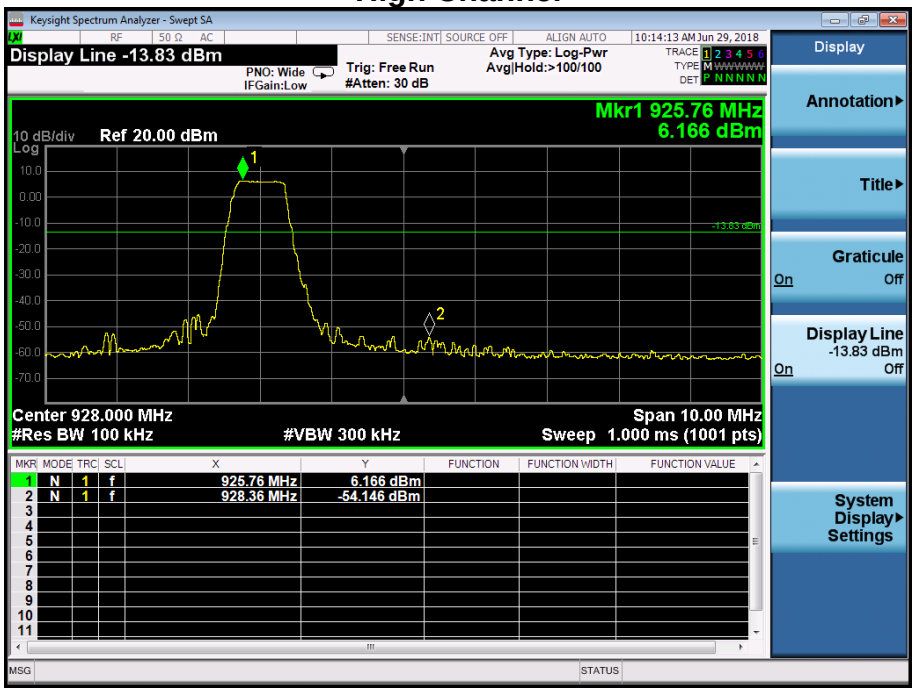
Freq. (MHz)	Ant.Pol. (H/V)	Reading Level(dBuV)	Factor (dB/m)	Emission Level (dBuV)	Limit 3m (dBuV/m)	Margin (dB)
		QP		QP	QP	QP
902.00	H	39.20	-1.19	38.01	46.00	-7.99
902.00	V	24.90	-1.19	23.71	46.00	-22.29
928.00	H	28.25	-0.67	27.58	46.00	-18.42
928.00	V	29.01	-0.67	28.34	46.00	-17.66

Note: (1) All Readings are Peak Value and AV.
(2) Emission Level= Reading Level+Probe Factor +Cable Loss
(3) Measurement uncertainty : ±3.7dB

Band Edge
Low Channel

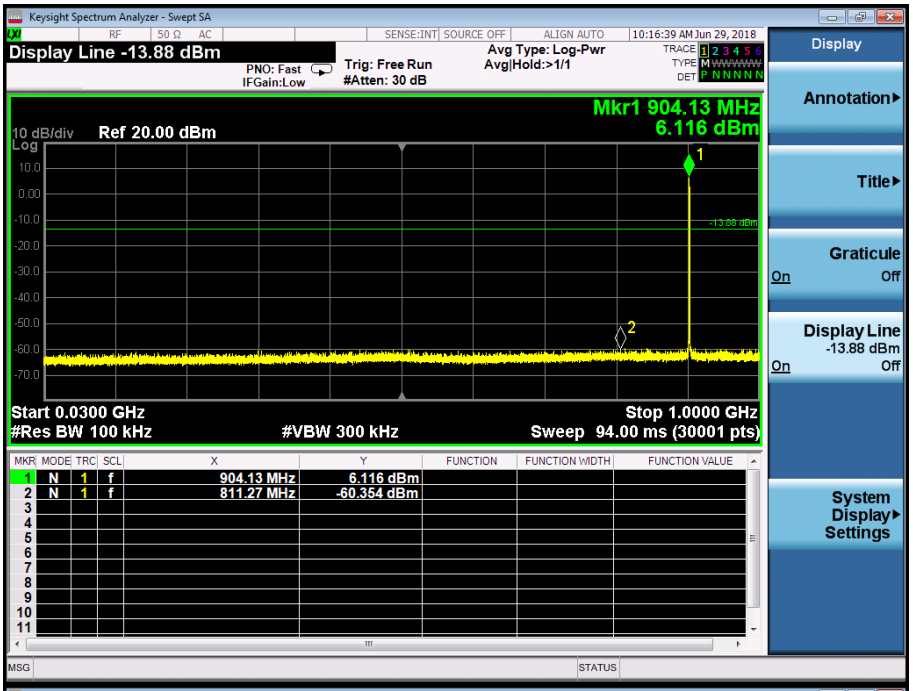


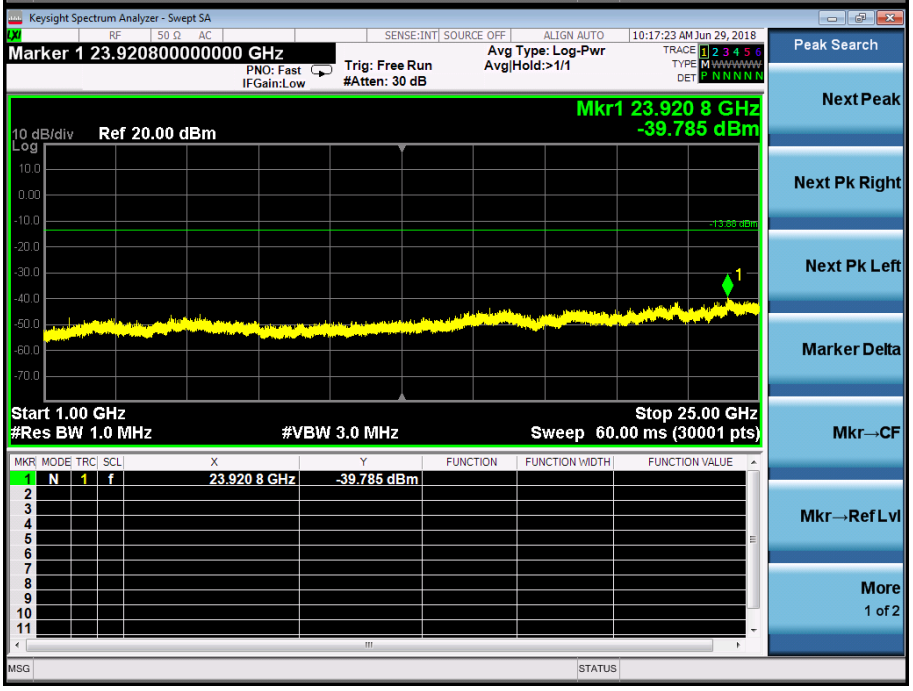
High Channel



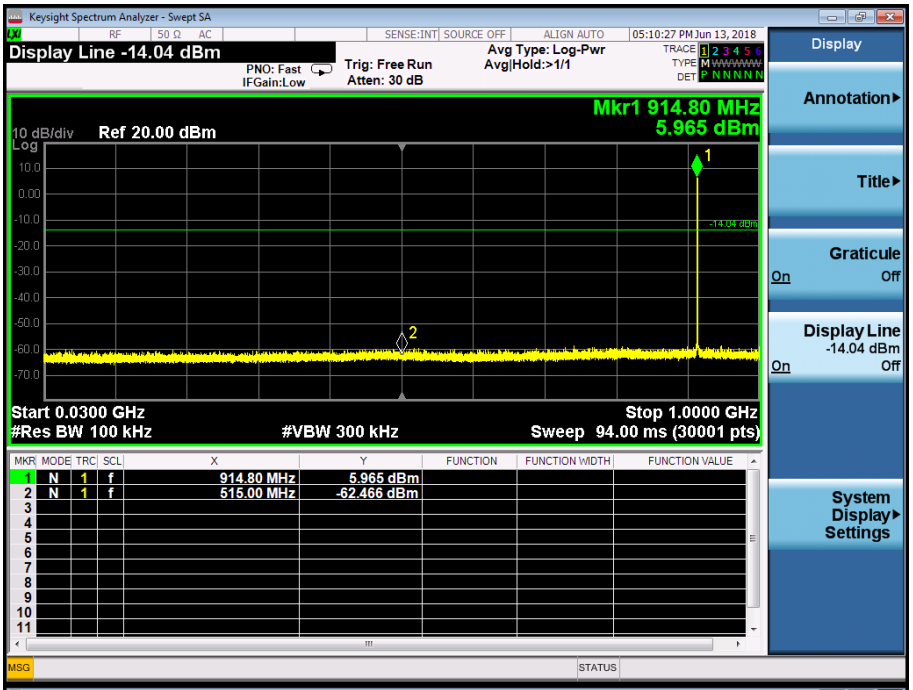
Conducted Spurious Emissions

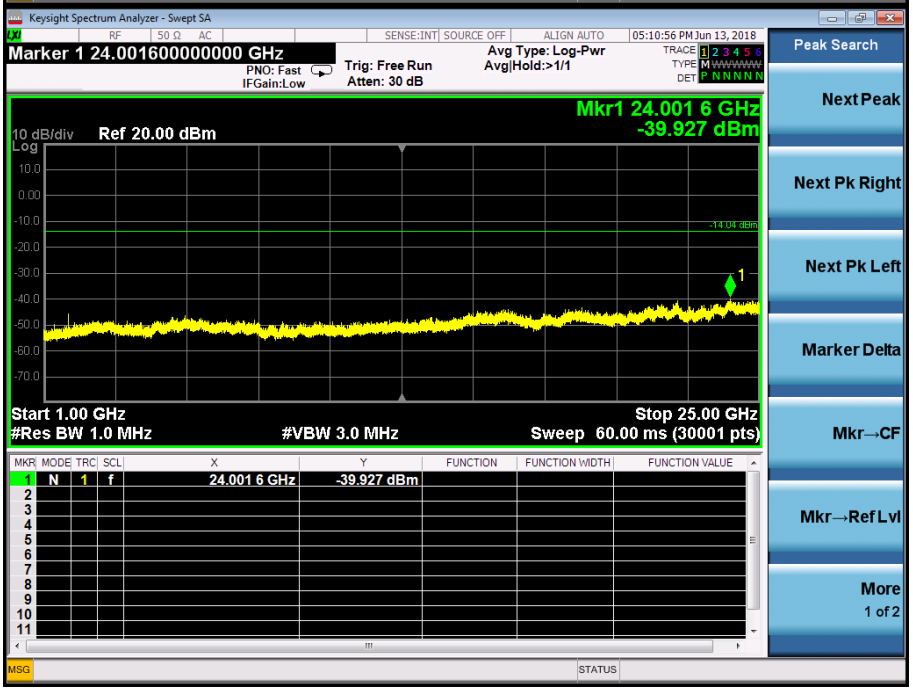
Low Channel



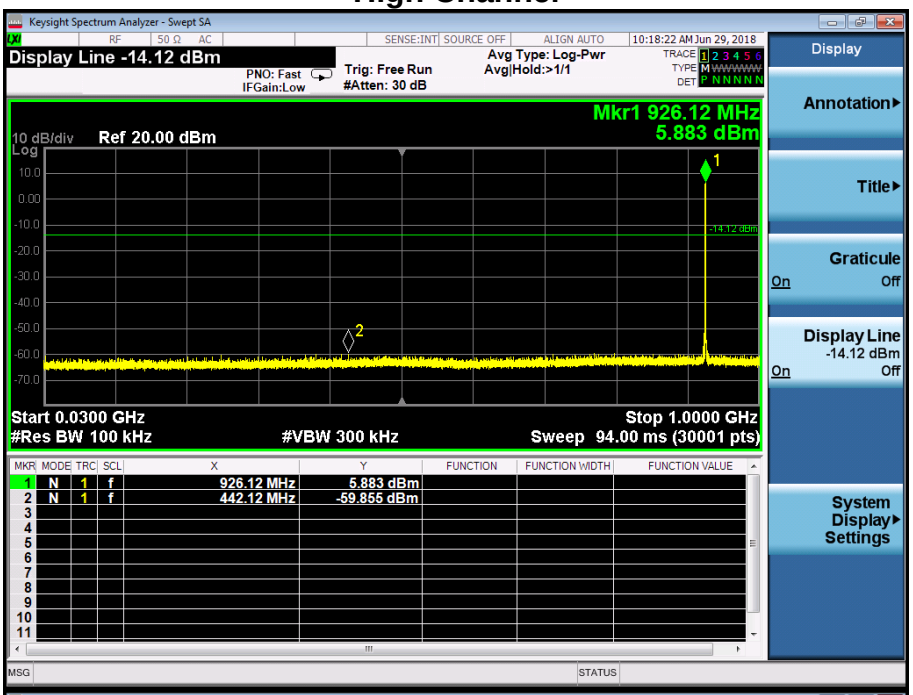


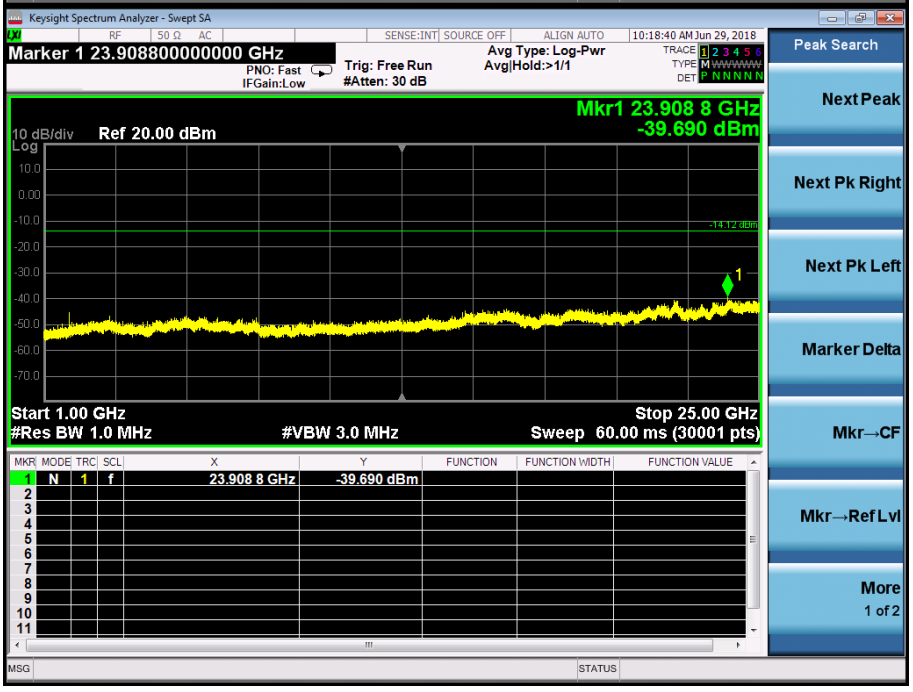
Middle Channel





High Channel



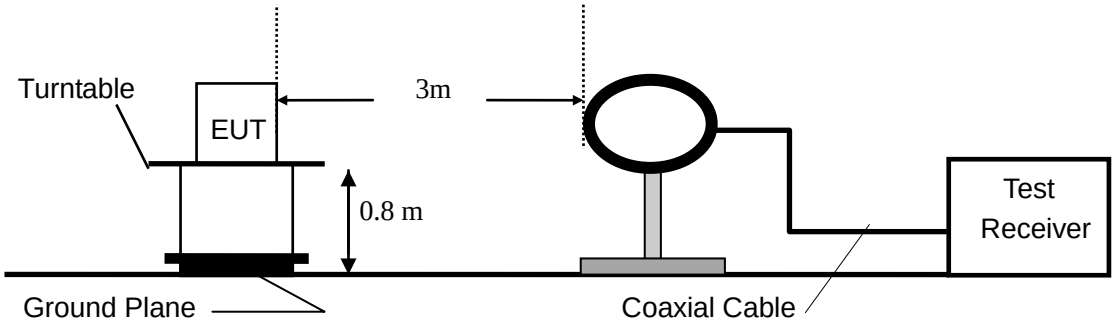


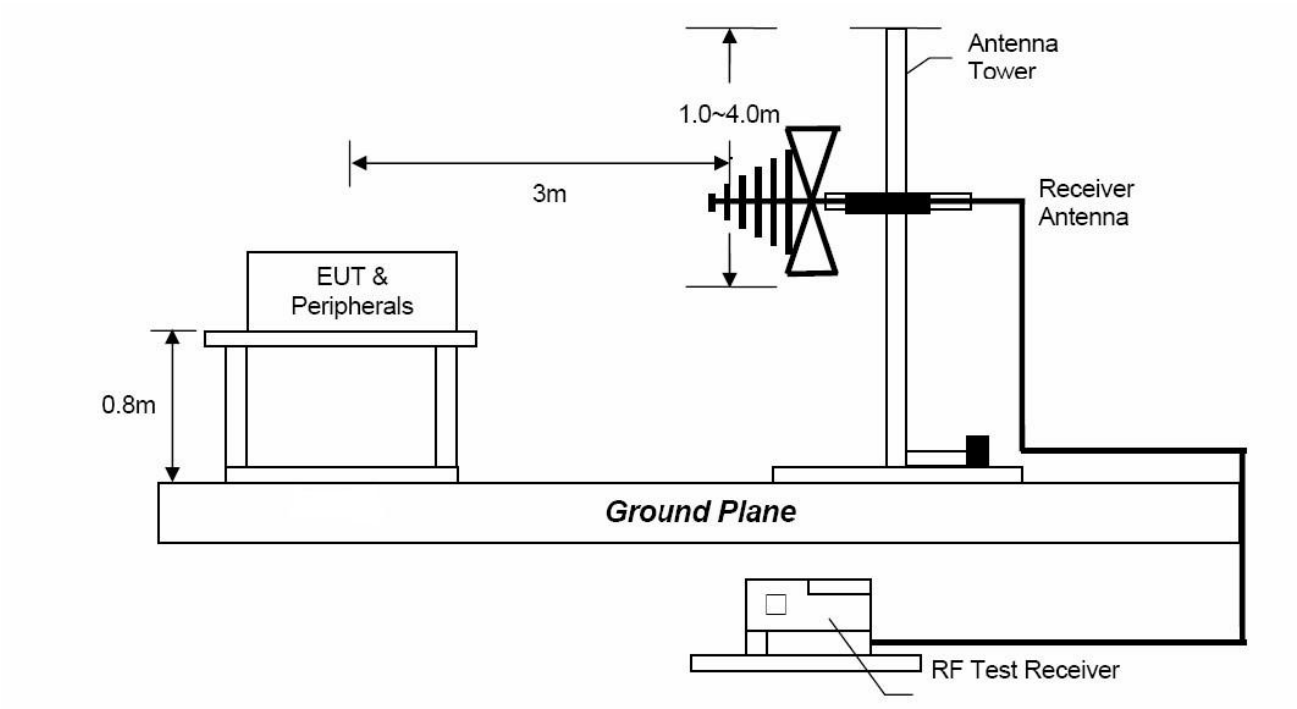
Note: Sweep points=30001pts

8. Radiated Spurious Emissions and Restricted Bands

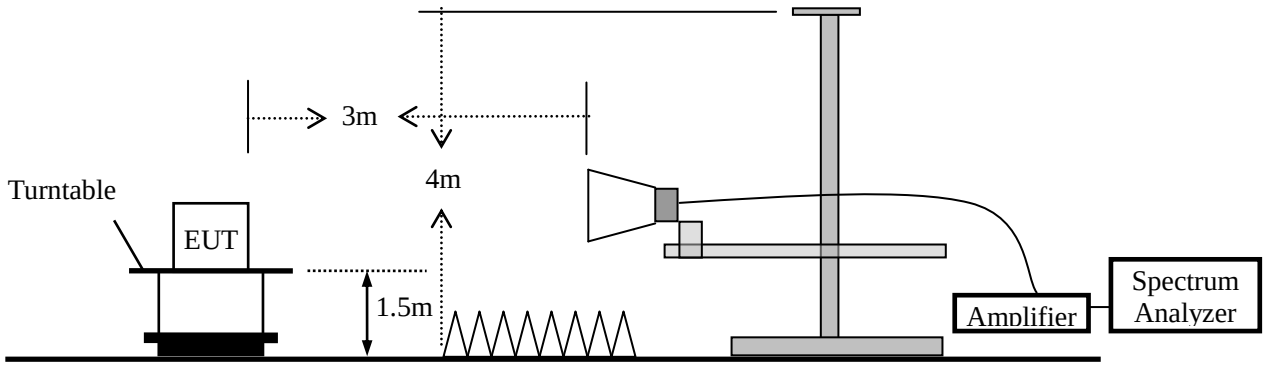
8.1 Test SET-UP (Block Diagram of Configuration)

8.1.1 Radiated Emission Test Set-Up, Frequency Below 30MHz





8.1.2 Radiated Emission Test Set-Up, Frequency above 1GHz



8.2 Measurement Procedure

a. Blow 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi- anechoic chamber room.
b. For the radiated emission test above 1GHz:
   The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter full anechoic chamber room. The table was rotated 360 degrees to determine the position of the highest radiation. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
c. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
d. The height of antenna 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.
e. 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.
f. A Quasi-peak measurement was then made for that frequency point for below 1GHz test. PK and AV for above 1GHz emission test.

During the radiated emission test, the spectrum analyzer was set with the following configurations:

Frequency Band (MHz)	Level	Resolution Bandwidth	Video Bandwidth
30 to 1000	QP	120 kHz	300 kHz
Above 1000	Peak	1 MHz	3 MHz
	Average	1 MHz	10 Hz

8.3 Limit

Frequency range MHz	Distance Meters	Field Strengths Limit (15.209) μV/m
0.009 ~ 0.490	300	2400/F(kHz)
0.490 ~ 1.705	30	24000/F(kHz)
1.705 ~ 30	30	30
30 ~ 88	3	100
88 ~ 216	3	150
216 ~ 960	3	200
Above 960	3	500

Remark: (1) Emission level (dB)μV = 20 log Emission level μV/m
(2) The smaller limit shall apply at the cross point between two frequency bands.
(3) As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.
(4) The frequency range scanned is from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or 40 GHz, whichever is lower.
(5) §15.247(d) specifies that emissions which fall in the restricted bands, as defined in §15.205 comply with radiated emission limits specified in §15.209.

8.4 Measurement Results

Please refer to following plots of the worst case (Middle channel).

Dongguan NTC Co., Ltd.
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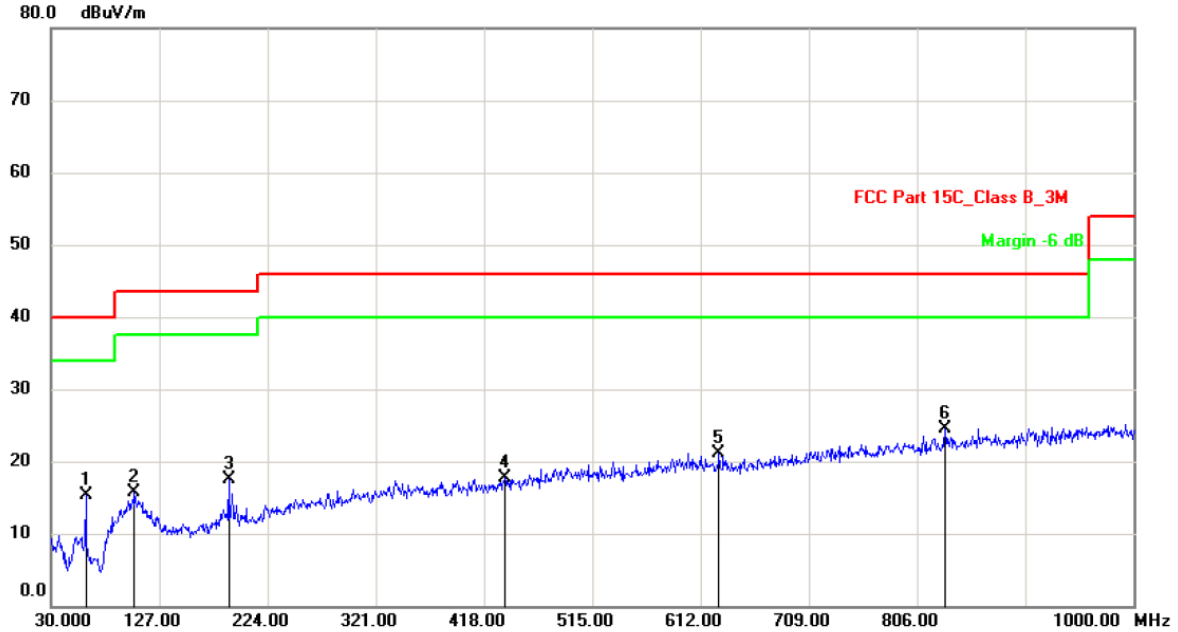
Web: Http://www.ntc-c.com

Radiated Emission Measurement

File :LRP-9700C Data :#18 Date: 2018-7-4 Time: 10:20:13



Site
Limit: FCC Part 15C_Class B_3M
EUT: DIWI
M/N: IPVDW01
Mode: TX
Note:

Polarization: ***Horizontal***
Power: DC12V
Distance: 3m

Temperature: 26
Humidity: 47 %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		61.0400	33.86	-18.61	15.25	40.00	-24.75	QP			
2		104.6900	27.95	-12.16	15.79	43.50	-27.71	QP			
3		189.0800	31.17	-13.63	17.54	43.50	-25.96	QP			
4		436.4300	26.06	-8.28	17.78	46.00	-28.22	QP			
5		628.4900	26.30	-5.10	21.20	46.00	-24.80	QP			
6	*	831.2199	25.96	-1.43	24.53	46.00	-21.47	QP			

Note: Below 30MHz, the emissions are lower than 20dB below the allowable limit.

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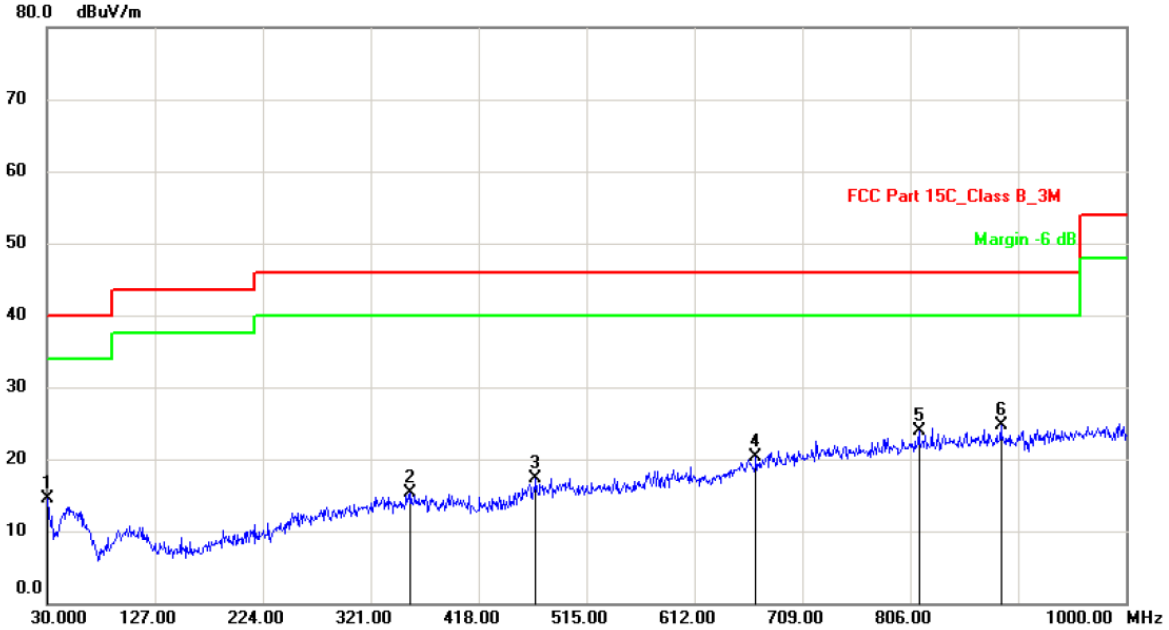
Radiated Emission Measurement

File :LRP-9700C Data :#17 Date: 2018-7-4 Time: 10:12:13



Site
Limit: FCC Part 15C_Class B_3M
EUT: DIWI
M/N: IPVDW01
Mode: TX
Note:

Polarization: *Vertical*
Power: DC12V
Distance: 3m

Temperature: 26
Humidity: 47 %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		30.9700	30.36	-15.83	14.53	40.00	-25.47	QP			
2		356.8900	26.44	-11.12	15.32	46.00	-30.68	QP			
3		469.4100	26.77	-9.48	17.29	46.00	-28.71	QP			
4		667.2900	24.93	-4.69	20.24	46.00	-25.76	QP			
5		813.7600	25.64	-1.71	23.93	46.00	-22.07	QP			
6	*	887.4800	25.85	-1.18	24.67	46.00	-21.33	QP			

Note: Below 30MHz, the emissions are lower than 20dB below the allowable limit.

Frequency Range:	1-10GHz	Test Date :	July 02, 2018
Test Result:	PASS	Temperature :	24 ℃
Measured Distance:	3m	Humidity :	47 %
Test By:	Sance		

Freq. (MHz)	Ant.Pol. (H/V)	Reading Level(dBuV)		Factor (dB/m)	Emission Level (dBuV)		Limit 3m (dBuV/m)		Margin (dB)	
		PK	AV		PK	AV	PK	AV	PK	AV
Operation Mode: TX Mode (Low)										
1808	V	57.88	46.08	-3.38	54.50	42.70	74.00	54.00	-19.50	-11.30
2399	V	49.99	40.08	0.13	50.12	40.21	74.00	54.00	-23.88	-13.79

1808	H	54.45	43.52	-3.38	51.07	40.14	74.00	54.00	-22.93	-13.86
2399	H	48.99	39.23	0.13	49.12	39.36	74.00	54.00	-24.88	-14.64

Operation Mode: TX Mode (Mid)										
1830	V	58.08	50.11	-3.10	54.98	47.01	74.00	54.00	-19.02	-6.99
2745	V	48.49	34.05	1.26	49.75	35.31	74.00	54.00	-24.25	-18.69

1830	H	59.91	51.46	-3.10	56.81	48.36	74.00	54.00	-17.19	-5.64
2745	H	48.66	33.68	1.26	49.92	34.94	74.00	54.00	-24.08	-19.06

Operation Mode: TX Mode (High)										
1852	V	53.32	43.90	-2.82	50.50	41.08	74.00	54.00	-23.50	-12.92
2778	V	47.13	32.16	1.34	48.47	33.50	74.00	54.00	-25.53	-20.50

1852	H	55.49	40.97	-2.82	52.67	38.15	74.00	54.00	-21.33	-15.85
2778	H	47.97	32.75	1.34	49.31	34.09	74.00	54.00	-24.69	-19.91

Other harmonics emissions are lower than 10dB below the allowable limit.

Note:
(1) All Readings are Peak Value and AV.
(2) Emission Level= Reading Level + Factor
(3) Factor= Antenna Gain + Cable Loss – Amplifier Gain
(4) Data of measurement within this frequency range shown " ---" in the table above means the reading of emissions are attenuated more than 10dB below the permissible limits.
(5) Measurement uncertainty : ±3.7dB.
(6) Horn antenna used for the emission over 1000MHz.

9. Antenna Application

9.1 Antenna requirement

According to of FCC part 15C section 15.203 and 15.240:

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.
Systems operating in the 902-928MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum peak output power of the intentional radiator is reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

9.2 Measurement Results

The antenna is External antenna that no antenna other than furnished by the responsible party shall be used with the device, and the best case gain of the antenna is 2.5dBi, So, the antenna is consider meet the requirement.

10. Test Equipment List

Description	Manufacturer	Model Number	Serial Number	Characteristics	Calibration Date	Calibration Due Date
Test Receiver	Rohde & Schwarz	ESCI7	100837	9KHz~7GHz	Mar. 13, 2018	Mar. 12, 2019
Antenna	Schwarzbeck	VULB9162	9162-010	30MHz~7GHz	Mar. 14, 2018	Mar. 13, 2019
Cable	Huber+Suhner	CBL2-NN-1M	22390001	9KHz~7GHz	Mar. 13, 2018	Mar. 12, 2019
Cable	Huber+Suhner	CIL02	N/A	9KHz~7GHz	Mar. 13, 2018	Mar. 12, 2019
RF Cable	Huber+Suhner	SF-104	MY16559/4	9KHz~25GHz	Apr. 25, 2018	Apr. 25, 2019
Power Amplifier	HP	HP 8447D	1145A00203	100KHz~1.3GHz	Mar. 13, 2018	Mar. 12, 2019
Horn Antenna	Schwarzbeck	BBHA9170	9170-242	15GHz~40GHz	Mar. 13, 2018	Mar. 12, 2019
Horn Antenna	Com-Power	AH-118	071078	1GHz~18GHz	Mar. 14, 2018	Mar. 13, 2019
RF Cable	Huber+Suhner	SF-104	N/A	9KHz~40GHz	Apr. 25, 2018	Apr. 25, 2019
Loop antenna	Daze	ZA30900A	0708	9KHz~30MHz	Apr. 25, 2018	Apr. 25, 2019
Spectrum Analyzer	Rohde & Schwarz	FSU26	200409/026	20Hz~26.5GHz	Apr. 25, 2018	Apr. 25, 2019
Spectrum Analyzer	Rohde & Schwarz	FSV40	101003	10Hz~40GHz	Apr. 06, 2018	Apr. 05, 2019
Pre-Amplifier	EMCI	EMC 184045	980102	18GHz~40GHz	Nov. 03, 2017	Nov. 02, 2018
Pre-Amplifier	Agilent	8449B	3008A02964	1GHz~26.5GHz	Apr. 25, 2018	Apr. 25, 2019
L.I.S.N.	Rohde & Schwarz	ENV 216	101317	9KHz~30MHz	Mar. 13, 2018	Mar. 12, 2019
Temporary antenna connector	TESCOM	SS402	N/A	9KHz-25GHz	N/A	N/A
Power Meter	Anritsu	ML2495A	1139001	100k-65GHz	Nov. 03, 2017	Nov. 02, 2018
Power Sensor	Anritsu	MA2411B	100345	300M-40GHz	Nov. 03, 2017	Nov. 02, 2018

Note: The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

---End---