



RADIO TEST REPORT

Report No.: STS2107149W01

Issued for

Chengdu Just Do It Information and Technology Co., Ltd.

Rm 604&605, Unit 1, Building 2, No. 1, Section 1, Huafu Avenue, Huayang Street, Tianfu New District, Chengdu, China.

Product Name:	Bobcat IoT hotspot
Brand Name:	BOBCAT
Model Name:	Bobcat Miner 300
Series Model:	N/A
FCC ID:	2AZCK-MINER300
Test Standard:	FCC Part 15.247

Any reproduction of this document must be done in full. No single part of this document may be reproduced without permission from STS, all test data presented in this report is only applicable to presented test sample.





TEST RESULT CERTIFICATION

Applicant's Name: Chengdu Just Do It Information and Technology Co., Ltd.
 Address: Rm 604&605, Unit 1, Building 2, No. 1, Section 1, Huafu Avenue, Huayang Street, Tianfu New District, Chengdu, China.
 Manufacturer's Name: SHENZHEN EASYLINKIN TECHNOLOGY CO.,LTD
 Address: 705, Floor 7, Zhongdian Difu Building, Zhenhua Road, Fuqiang Community, Huaqiang North Street, Futian District, Shenzhen, China.

Product Description

Product Name: Bobcat IoT hotspot
 Brand Name: BOBCAT
 Model Name: Bobcat Miner 300
 Series Model: N/A
 Test Standards: FCC Part15.247
 Test Procedure: ANSI C63.10-2013

This device described above has been tested by STS, the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.
 This report shall not be reproduced except in full, without the written approval of STS, this document may be altered or revised by STS, personal only, and shall be noted in the revision of the document.

Date of Test.....:
 Date of receipt of test item.....: 21 July 2021
 Date (s) of performance of tests.: 21 July 2021~ 11 Aug. 2021
 Date of Issue: 11 Aug. 2021
 Test Result: Pass

Testing Engineer : *Chris Chen*

 (Chris Chen)

Technical Manager : *Sean She*

 (Sean she)

Authorized Signatory : *Vita Li*

 (Vita Li)





Table of Contents	Page
1. SUMMARY OF TEST RESULTS	6
1.1 TEST FACTORY	7
1.2 MEASUREMENT UNCERTAINTY	7
2. GENERAL INFORMATION	8
2.1 GENERAL DESCRIPTION OF THE EUT	8
2.2 DESCRIPTION OF THE TEST MODES	10
2.3 TABLE OF PARAMETERS OF TEST SOFTWARE SETTING	10
2.5 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED	11
2.6 DESCRIPTION OF NECESSARY ACCESSORIES AND SUPPORT UNITS	12
2.7 EQUIPMENTS LIST	13
3. EMC EMISSION TEST	15
3.1 CONDUCTED EMISSION MEASUREMENT	15
3.2 RADIATED EMISSION MEASUREMENT	19
4. CONDUCTED SPURIOUS & BAND EDGE EMISSION	31
4.1 LIMIT	31
4.2 TEST PROCEDURE	31
4.3 TEST SETUP	32
4.4 EUT OPERATION CONDITIONS	32
4.5 TEST RESULTS	33
5. NUMBER OF HOPPING CHANNEL	38
5.1 LIMIT	38
5.2 TEST PROCEDURE	38
5.3 TEST SETUP	38
5.4 EUT OPERATION CONDITIONS	38
5.5 TEST RESULTS	39
6. AVERAGE TIME OF OCCUPANCY	40
6.1 LIMIT	40
6.2 TEST PROCEDURE	40
6.3 TEST SETUP	40
6.4 EUT OPERATION CONDITIONS	40
6.5 TEST RESULTS	41
7. HOPPING CHANNEL SEPARATION MEASUREMENT	45
7.1 LIMIT	45



Table of Contents	Page
7.2 TEST PROCEDURE	45
7.3 TEST SETUP	45
7.4 EUT OPERATION CONDITIONS	45
7.5 TEST RESULTS	46
8. BANDWIDTH TEST	48
8.1 LIMIT	48
8.2 TEST PROCEDURE	48
8.3 TEST SETUP	48
8.4 EUT OPERATION CONDITIONS	48
8.5 TEST RESULTS	49
9. OUTPUT POWER TEST	51
9.1 LIMIT	51
9.2 TEST PROCEDURE	51
9.3 TEST SETUP	52
9.4 EUT OPERATION CONDITIONS	52
9.5 TEST RESULTS	53
10. ANTENNA REQUIREMENT	54
10.1 STANDARD REQUIREMENT	54
10.2 EUT ANTENNA	54



Revision History

Rev.	Issue Date	Report NO.	Effect Page	Contents
00	11 Aug. 2021	STS2107149W01	ALL	Initial Issue





1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:
KDB 558074 D01 15.247 Meas Guidance v05r02.

FCC Part 15.247, Subpart C			
Standard Section	Test Item	Judgment	Remark
15.207	Conducted Emission	PASS	--
15.247(a)(1)	Hopping Channel Separation	PASS	--
15.247 (b)(2)	Output Power	PASS	--
15.209	Radiated Spurious Emission	PASS	--
15.247(d)	Conducted Spurious & Band Edge Emission	PASS	--
15.247(a)(1)(i)	Number of Hopping Frequency	PASS	--
15.247(a)(1)(i)	Dwell Time	PASS	--
15.247(a)(1)	20dB Bandwidth 99% Bandwidth	PASS	--
15.205	Restricted bands of operation	PASS	--
Part 15.247(d)/part 15.209(a)	Band Edge Emission	PASS	--
15.203	Antenna Requirement	PASS	--

NOTE:

- (1) 'N/A' denotes test is not applicable in this Test Report.
- (2) All tests are according to ANSI C63.10-2013.



1.1 TEST FACTORY

SHENZHEN STS TEST SERVICES CO., LTD

Add. : A 1/F, Building B, Zhuoke Science Park, No.190 Chongqing Road, HepingShequ, Fuyong Sub-District, Bao'an District, Shenzhen, Guang Dong, China

FCC test Firm Registration Number: 625569

IC test Firm Registration Number: 12108A

A2LA Certificate No.: 4338.01

1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement $y \pm U$, where expanded uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately **95 %**.

No.	Item	Uncertainty
1	RF output power, conducted	$\pm 0.68\text{dB}$
2	Unwanted Emissions, conducted	$\pm 2.988\text{dB}$
3	All emissions, radiated 9K-30MHz	$\pm 2.84\text{dB}$
4	All emissions, radiated 30M-1GHz	$\pm 4.39\text{dB}$
5	All emissions, radiated 1G-6GHz	$\pm 5.10\text{dB}$
6	All emissions, radiated >6G	$\pm 5.48\text{dB}$
7	Conducted Emission (9KHz-150KHz)	$\pm 2.79\text{dB}$
8	Conducted Emission (150KHz-30MHz)	$\pm 2.80\text{dB}$



2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF THE EUT

Product Name	Bobcat IoT hotspot
Trade Name	BOBCAT
Model Name	Bobcat Miner 300
Series Model	N/A
Model Difference	N/A
Channel List	Please refer to the Note 2.
Frequency	902.3 – 915.1MHz(125KHz)
Modulation Type	LongFi
Antenna	Please refer to the Note 3.
Adapter	Input: AC100-240V, 50/60Hz 0.5A Max Output: DC 12V 1.0A 12.0W
Battery	Rated Voltage:3V Capacity: 40mAh
Hardware version number	G280-V1.1
Software version number	2019.11.06.0
Connecting I/O Port(s)	Please refer to the Note 1.

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the User Manual.



2.

Channel List					
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
01	902.3	23	906.7	45	911.1
02	902.5	24	906.9	46	911.3
03	902.7	25	907.1	47	911.5
04	902.9	26	907.3	48	911.7
05	903.1	27	907.5	49	911.9
06	903.3	28	907.7	50	912.1
07	903.5	29	907.9	51	912.3
08	903.7	30	908.1	52	912.5
09	903.9	31	908.3	53	912.7
10	904.1	32	908.5	54	912.9
11	904.3	33	908.7	55	913.1
12	904.5	34	908.9	56	913.3
13	904.7	35	909.1	57	913.5
14	904.9	36	909.3	58	913.7
15	905.1	37	909.5	59	913.9
16	905.3	38	909.7	60	914.1
17	905.5	39	909.9	61	914.3
18	905.7	40	910.1	62	914.5
19	905.9	41	910.3	63	914.7
20	906.1	42	910.5	64	914.9
21	906.3	43	910.7	65	915.1
22	906.5	44	910.9		

3. Table for Filed Antenna

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	NOTE
1	BOBCAT	Bobcat Miner 300	External	N/A	4dBi	Antenna

Note: The antenna information refer the manufacturer provide report, applicable only to the tested sample identified in the report.



2.2 DESCRIPTION OF THE TEST MODES

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Worst Mode	Description	Data Rate/Modulation
Mode 1	TX CH01	1Mbps/LongFi
Mode 2	TX CH32	1Mbps/LongFi
Mode 3	TX CH65	1Mbps/LongFi
Mode 4	Hopping	LongFi

Note:

(1) The measurements are performed at all Bit Rate of Transmitter, the worst data was reported.

(2) We have be tested for all avaiable U.S. voltage and frequencies(For 120V,50/60Hz and 240V, 50/60Hz) for which the device is capable of operation, and the worst case of 120V/60Hz is shown in the report.

(3) The battery is fully-charged during the radited and RF conducted test.

For AC Conducted Emission

Test Case	
AC Conducted Emission	Mode 5: Keeping TX

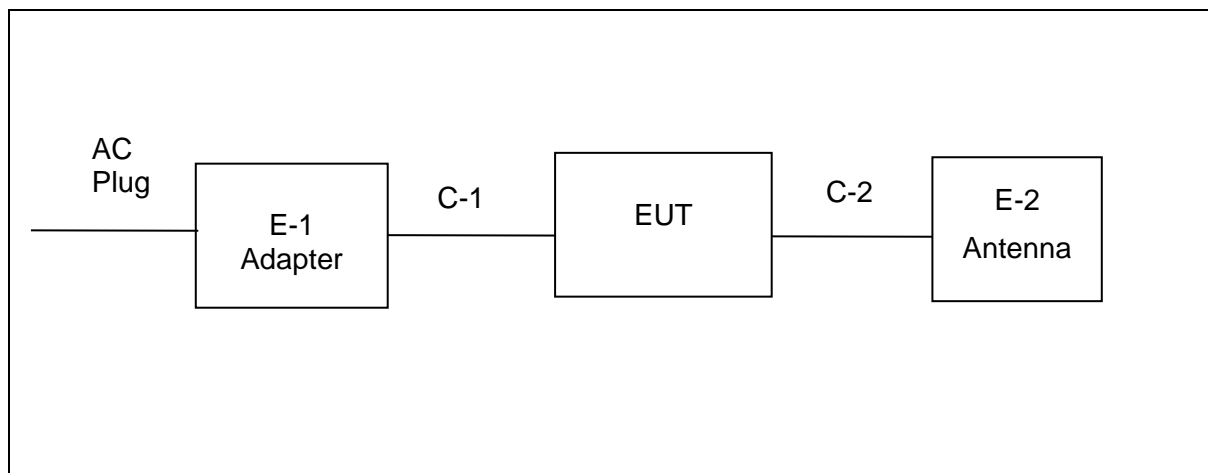
2.3 TABLE OF PARAMETERS OF TEST SOFTWARE SETTING

During testing channel & power controlling software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product power parameters of FHSS.

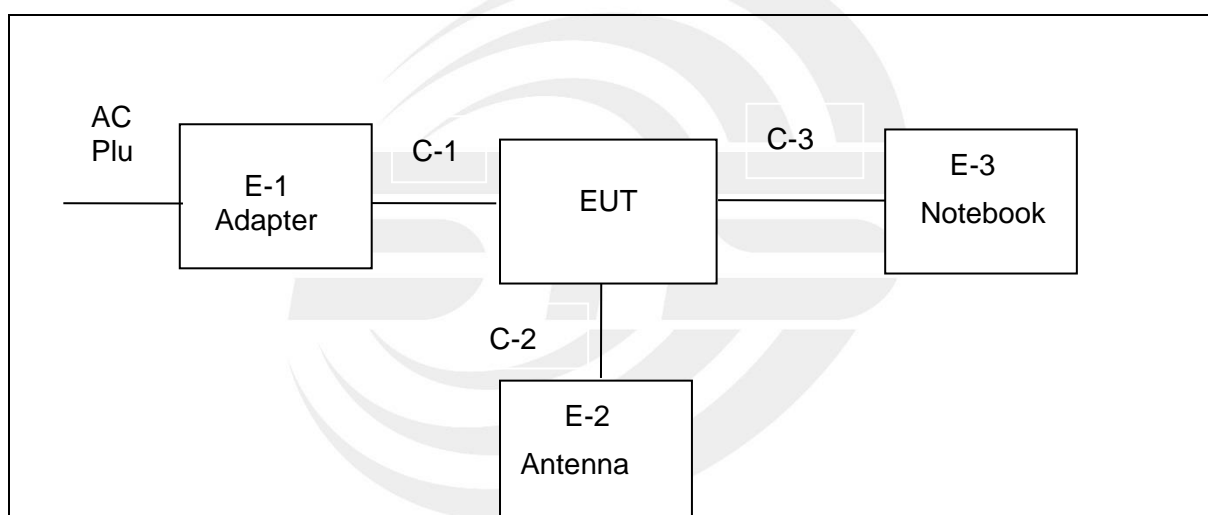
RF Function	Type	Mode Or Modulation type	Ant Gain (dBi)	Power Class	Software For Testing
Other SRD	902M-928M	LongFi	4	Default	SecureCRTPortable

2.5 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

Radiated Spurious Emission Test



Conducted Emission Test





2.6 DESCRIPTION OF NECESSARY ACCESSORIES AND SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Necessary accessories

Item	Equipment	Mfr/Brand	Model/Type No.	Length	Note
E-1	Adapter	N/A	PS120W1000U	N/A	N/A
E-2	Antenna	N/A	N/A	N/A	N/A
C-1	DC Cable	N/A	N/A	155cm	NO
C-2	Signal Cable	N/A	N/A	100CM	NO

Support units

Item	Equipment	Mfr/Brand	Model/Type No.	Length	Note
E-3	Notebook	DELL	500-320cx	N/A	N/A
C-3	USB Cable	N/A	N/A	80cm	NO

Note:

- (1) For detachable type I/O cable should be specified the length in cm in 『Length』 column.
- (2) “YES” is means “with core”; “NO” is means “without core”.



2.7 EQUIPMENTS LIST

Radiation Test equipment

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
Test Receiver	R&S	ESCI	101427	2020.10.12	2021.10.11
Signal Analyzer	R&S	FSV 40-N	101823	2020.10.10	2021.10.09
Active loop Antenna	ZHINAN	ZN30900C	16035	2021.04.11	2023.04.10
Bilog Antenna	TESEQ	CBL6111D	34678	2020.10.12	2022.10.11
Horn Antenna	SCHWARZBECK	BBHA 9120D	02014	2019.10.15	2021.10.14
SHF-EHF Horn Antenna (18G-40GHz)	A-INFO	LB-180400-KF	J211020657	2020.10.12	2022.10.11
Pre-Amplifier (0.1M-3GHz)	EM	EM330	060665	2020.10.12	2021.10.11
Pre-Amplifier (1G-18GHz)	SKET	LNPA-01018G-45	SK2018080901	2020.10.12	2021.10.11
Pre-Amplifier (18G-40GHz)	SKET	LNPA-1840-50	SK2018101801	2020.10.10	2021.10.09
Temperature & Humidity	HH660	Mieo	N/A	2020.10.13	2021.10.12
Turn table	EM	SC100_1	60531	N/A	N/A
Antenna mast	EM	SC100	N/A	N/A	N/A
Test SW	FARAD	EZ-EMC(Ver.STSLAB-03A1 RE)			

Conduction Test equipment

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
Test Receiver	R&S	ESCI	101427	2020.10.12	2021.10.11
LISN	R&S	ENV216	101242	2020.10.12	2021.10.11
LISN	EMCO	3810/2NM	23625	2020.10.12	2021.10.11
Temperature & Humidity	HH660	Mieo	N/A	2020.10.13	2021.10.12
Test SW	FARAD	EZ-EMC(Ver.STSLAB-03A1 CE)			



RF Connected Test

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
Power Sensor	Keysight	U2021XA	MY55520005	2020.10.10	2021.10.09
			MY55520006	2020.10.10	2021.10.09
			MY56120038	2020.10.10	2021.10.09
			MY56280002	2020.10.10	2021.10.09
Signal Analyzer	Agilent	N9020A	MY51110105	2021.03.04	2022.03.03
Temperature & Humidity	HH660	Mieo	N/A	2020.10.13	2021.10.12
Test SW	FARAD	EZ-EMC(Ver.STSLAB-03A1 RE)			





3. EMC EMISSION TEST

3.1 CONDUCTED EMISSION MEASUREMENT

3.1.1 POWER LINE CONDUCTED EMISSION LIMITS

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.

FREQUENCY (MHz)	Conducted Emissionlimit (dBuV)	
	Quasi-peak	Average
0.15 -0.5	66 - 56 *	56 - 46 *
0.50 -5.0	56.00	46.00
5.0 -30.0	60.00	50.00

Note:

- (1) The tighter limit applies at the band edges.
- (2) The limit of “ * ” marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

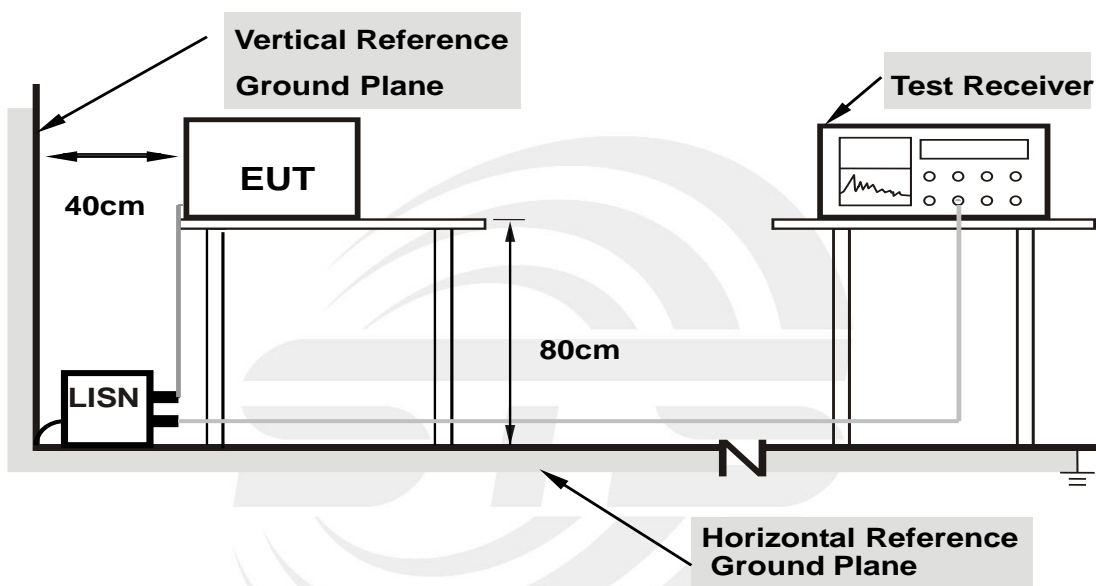
The following table is the setting of the receiver

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

3.1.2 TEST PROCEDURE

- a. The EUT is 0.8 m from the horizontal ground plane and 0.4 m from the vertical ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments are powered from additional LISN(s). The LISN provides 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- c. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- d. LISN is at least 80 cm from the nearest part of EUT chassis.
- e. For the actual test configuration, please refer to the related Item –EUT Test Photos.

3.1.3 TEST SETUP



- Note: 1. Support units were connected to second LISN.**
2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes support units.

3.1.4 EUT OPERATING CONDITIONS

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.



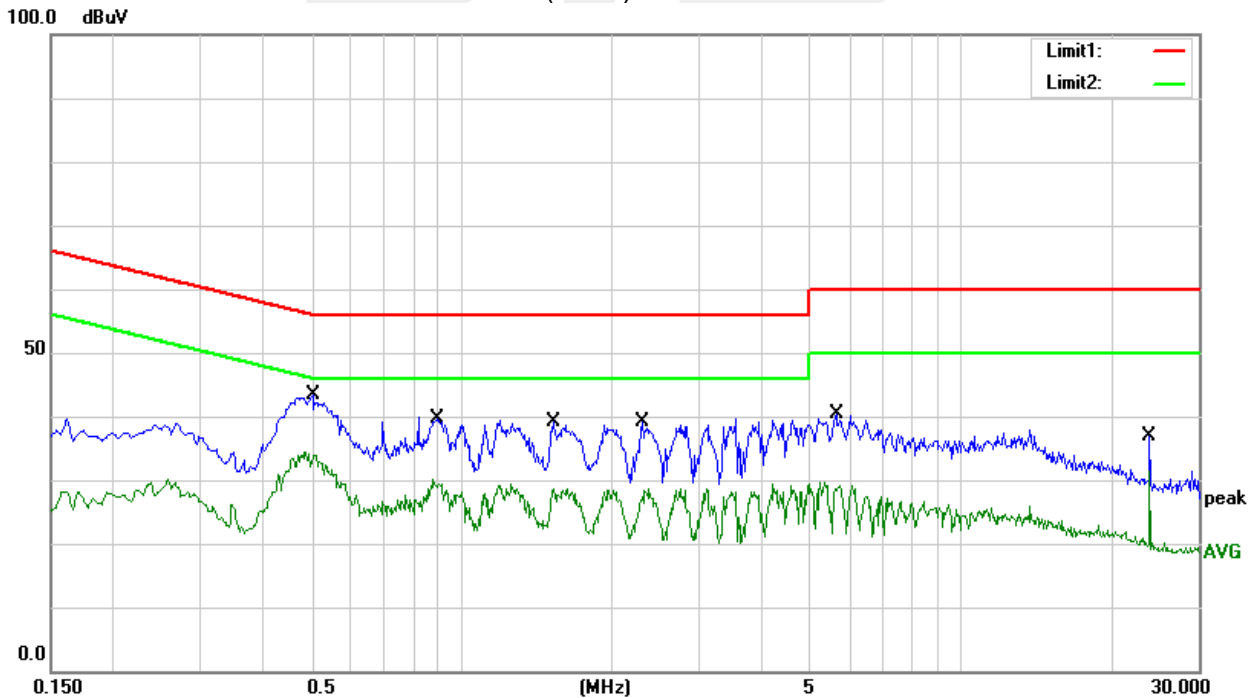
3.1.5 TEST RESULT

Temperature:	26.8(C)	Relative Humidity:	66%RH
Test Voltage:	AC 120V/60Hz	Phase:	L
Test Mode:	Mode 5		

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.5020	22.94	20.43	43.37	56.00	-12.63	QP
2	0.5020	13.38	20.43	33.81	46.00	-12.19	AVG
3	0.8940	19.39	20.20	39.59	56.00	-16.41	QP
4	0.8940	9.81	20.20	30.01	46.00	-15.99	AVG
5	1.5340	18.87	20.16	39.03	56.00	-16.97	QP
6	1.5340	8.54	20.16	28.70	46.00	-17.30	AVG
7	2.3020	19.04	20.13	39.17	56.00	-16.83	QP
8	2.3020	8.53	20.13	28.66	46.00	-17.34	AVG
9	5.6460	20.32	19.96	40.28	60.00	-19.72	QP
10	5.6460	9.19	19.96	29.15	50.00	-20.85	AVG
11	23.9980	16.11	20.68	36.79	60.00	-23.21	QP
12	23.9980	10.58	20.68	31.26	50.00	-18.74	AVG

Remark:

1. All readings are Quasi-Peak and Average values
2. Margin = Result (Result = Reading + Factor) – Limit
3. Factor=LISN factor+Cable loss+Limiter (10dB)



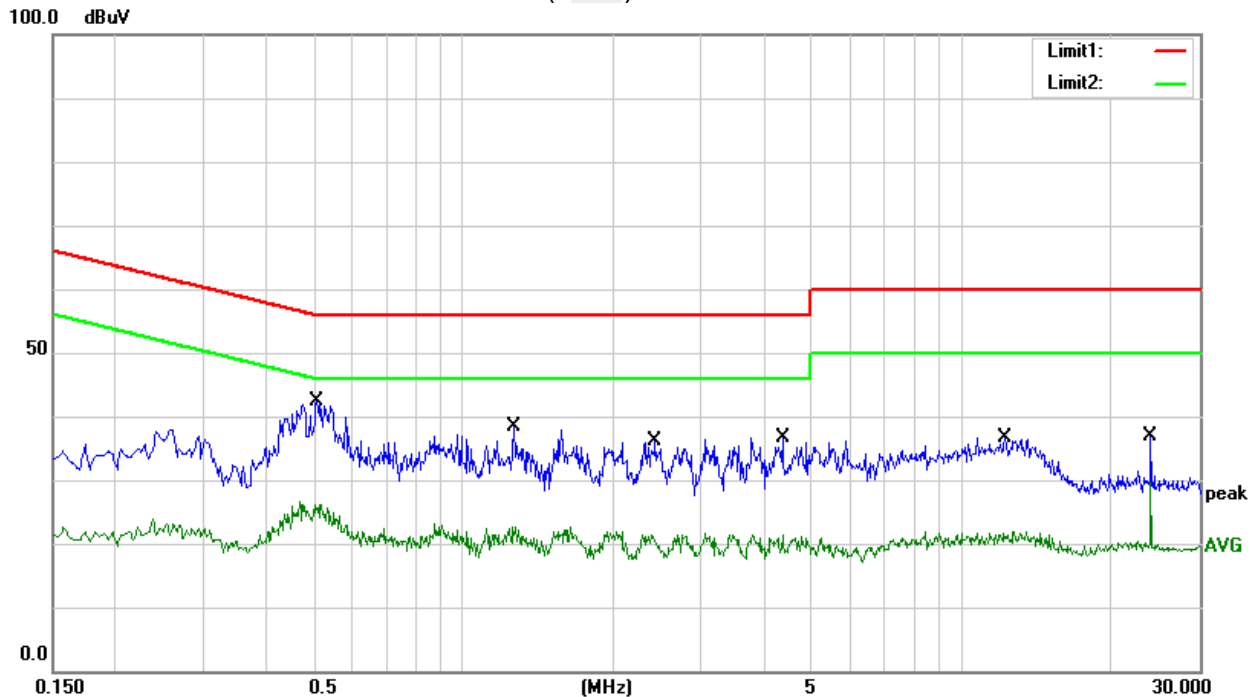


Temperature:	26.8(C)	Relative Humidity:	66%RH
Test Voltage:	AC 120V/60Hz	Phase:	N
Test Mode:	Mode 5		

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.5100	21.90	20.42	42.32	56.00	-13.68	QP
2	0.5100	5.82	20.42	26.24	46.00	-19.76	AVG
3	1.2660	18.23	20.16	38.39	56.00	-17.61	QP
4	1.2660	2.45	20.16	22.61	46.00	-23.39	AVG
5	2.4340	16.03	20.12	36.15	56.00	-19.85	QP
6	2.4340	1.36	20.12	21.48	46.00	-24.52	AVG
7	4.3660	16.53	20.05	36.58	56.00	-19.42	QP
8	4.3660	1.29	20.05	21.34	46.00	-24.66	AVG
9	12.2220	16.61	19.92	36.53	60.00	-23.47	QP
10	12.2220	2.04	19.92	21.96	50.00	-28.04	AVG
11	23.9980	16.16	20.68	36.84	60.00	-23.16	QP
12	23.9980	9.02	20.68	29.70	50.00	-20.30	AVG

Remark:

1. All readings are Quasi-Peak and Average values
2. Margin = Result (Result =Reading + Factor)–Limit
3. Factor=LISN factor+Cable loss+Limiter (10dB)





3.2 RADIATED EMISSION MEASUREMENT

3.2.1 RADIATED EMISSION LIMITS

In any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the Restricted band specified on Part15.205 (a)&209(a) limit in the table and according to ANSI C63.10-2013 below has to be followed.

LIMITS OF RADIATED EMISSION MEASUREMENT (0.009MHz - 1000MHz)

Frequencies (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

LIMITS OF RADIATED EMISSION MEASUREMENT (1GHz-25 GHz)

FREQUENCY (MHz)	(dBuV/m) (at 3M)	
	PEAK	AVERAGE
Above 1000	74	54

Notes:

- (1) The limit for radiated test was performed according to FCC PART 15C.
- (2) The tighter limit applies at the band edges.
- (3) Emission level (dBuV/m)=20log Emission level (uV/m).

LIMITS OF RESTRICTED FREQUENCY BANDS

FREQUENCY (MHz)	FREQUENCY (MHz)	FREQUENCY (MHz)	FREQUENCY (GHz)
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			



For Radiated Emission

Spectrum Parameter	Setting
Attenuation	Auto
Detector	Peak/QP/AV
Start Frequency	9 KHz/150KHz(Peak/QP/AV)
Stop Frequency	150KHz/30MHz(Peak/QP/AV)
RB / VB (emission in restricted band)	200Hz (From 9kHz to 0.15MHz)/ 9KHz (From 0.15MHz to 30MHz); 200Hz (From 9kHz to 0.15MHz)/ 9KHz (From 0.15MHz to 30MHz)

Spectrum Parameter	Setting
Attenuation	Auto
Detector	Peak/QP
Start Frequency	30 MHz(Peak/QP)
Stop Frequency	1000 MHz (Peak/QP)
RB / VB (emission in restricted band)	120 KHz / 300 KHz

Spectrum Parameter	Setting
Attenuation	Auto
Detector	Peak/AV
Start Frequency	1000 MHz(Peak/AV)
Stop Frequency	10th carrier hamonic(Peak/AV)
RB / VB (emission in restricted band)	1 MHz / 3 MHz(Peak) 1 MHz/1/T MHz(AVG)

For Radited Band edge

Spectrum Parameter	Setting
Detector	Peak/AV
Start/Stop Frequency	Lower Band Edge: 890 to 905 MHz Upper Band Edge: 910 to 940 MHz
RB / VB	1 MHz / 3 MHz(Peak) 1 MHz/1/T MHz(AVG)



Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~90kHz / RB 200Hz for PK & AV
Start ~ Stop Frequency	90kHz~110kHz / RB 200Hz for QP
Start ~ Stop Frequency	110kHz~490kHz / RB 200Hz for PK & AV
Start ~ Stop Frequency	490kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP

3.2.2 TEST PROCEDURE

- The measuring distance at 3 m shall be used for measurements at frequency 0.009MHz up to 1GHz, and above 1GHz.
- The EUT was placed on the top of a rotating table 0.8 m (above 1GHz is 1.5 m) above the ground at a 3 m anechoic chamber test site. The table was rotated 360 degree to determine the position of the highest radiation.
- The height of the equipment shall be 0.8 m (above 1GHz is 1.5 m); the height of the test antenna shall vary between 1 m to 4 m. Horizontal and vertical polarization of the antenna are set to make the measurement.
- The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and QuasiPeak detector mode will be re-measured.
- If the Peak Mode measured value is compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and no additional QP Mode measurement was performed.
- For the actual test configuration, please refer to the related Item –EUT Test Photos.

Note:

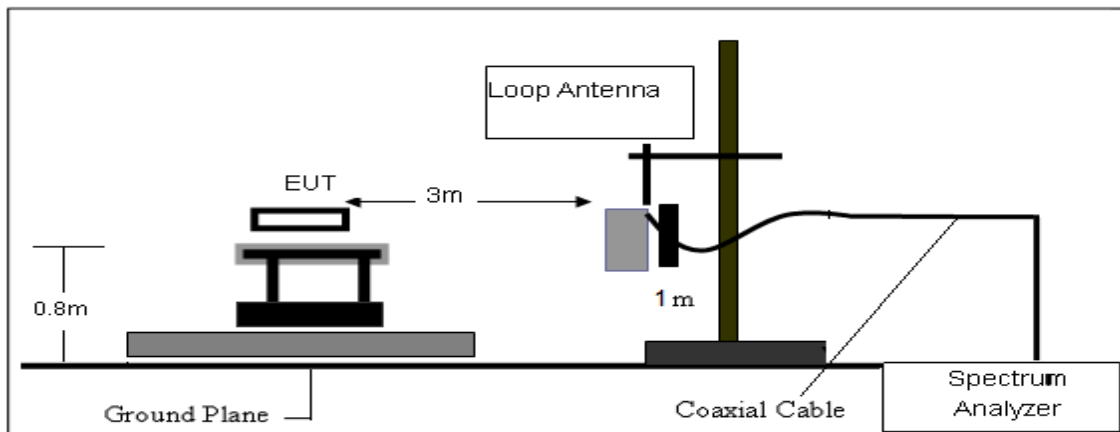
Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported.

3.2.3 DEVIATION FROM TEST STANDARD

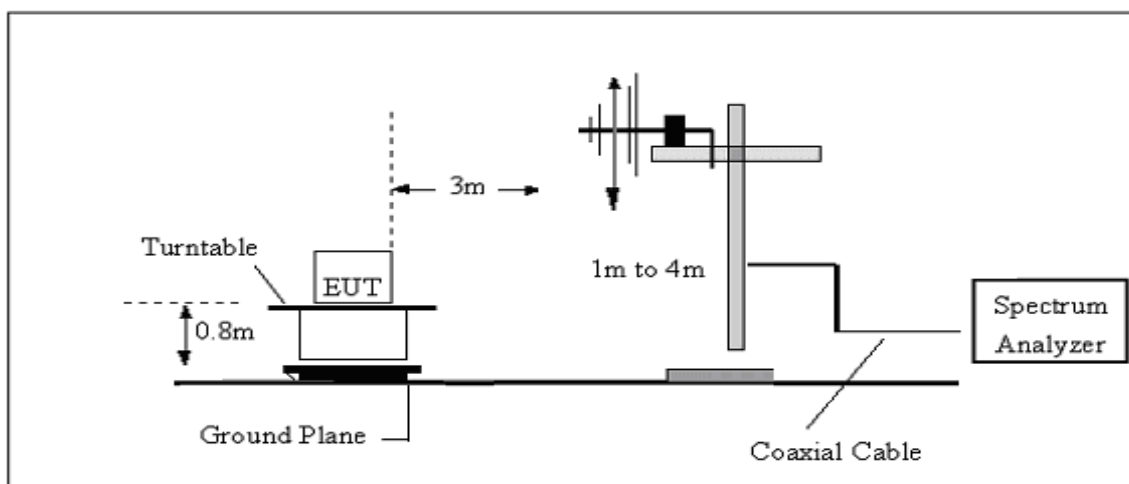
No deviation.

3.2.4 TESTSETUP

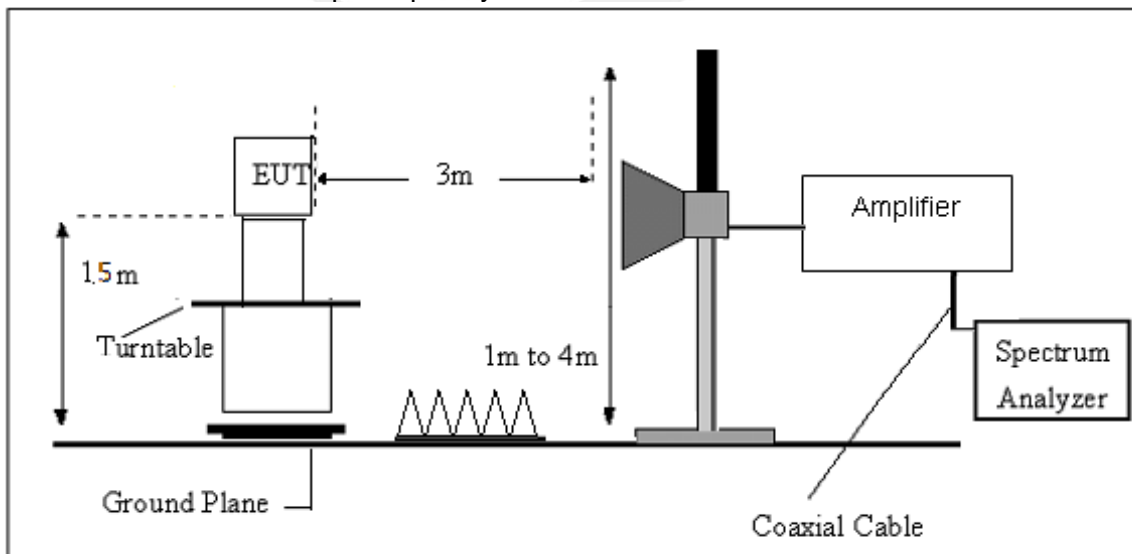
(A) Radiated Emission Test-Up Frequency Below 30MHz



(B) Radiated Emission Test-Up Frequency 30MHz~1GHz



(C) Radiated Emission Test-Up Frequency Above 1GHz



3.2.5 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.



3.2.6 FIELD STRENGTH CALCULATION

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Where

FS = Field Strength

CL = Cable Attenuation Factor (Cable Loss)

RA = Reading Amplitude

AG = Amplifier Gain

AF = Antenna Factor

For example

Frequency (MHz)	FS (dB μ V/m)	RA (dB μ V/m)	AF (dB)	CL (dB)	AG (dB)	Factor (dB)
300	40	58.1	12.2	1.6	31.9	-18.1

$$\text{Factor} = \text{AF} + \text{CL} - \text{AG}$$





3.2.7 TEST RESULTS

(9KHz-30MHz)

Temperature:	23.1(C)	Relative Humidity:	60%RH
Test Voltage:	DC 12V	Test Mode:	TX Mode

Freq. (MHz)	Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)	State P/F	Test Result
--	--	--	--	--	PASS
--	--	--	--	--	PASS

Note:

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor = $40 \log (\text{specific distance}/\text{test distance})$ (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor.



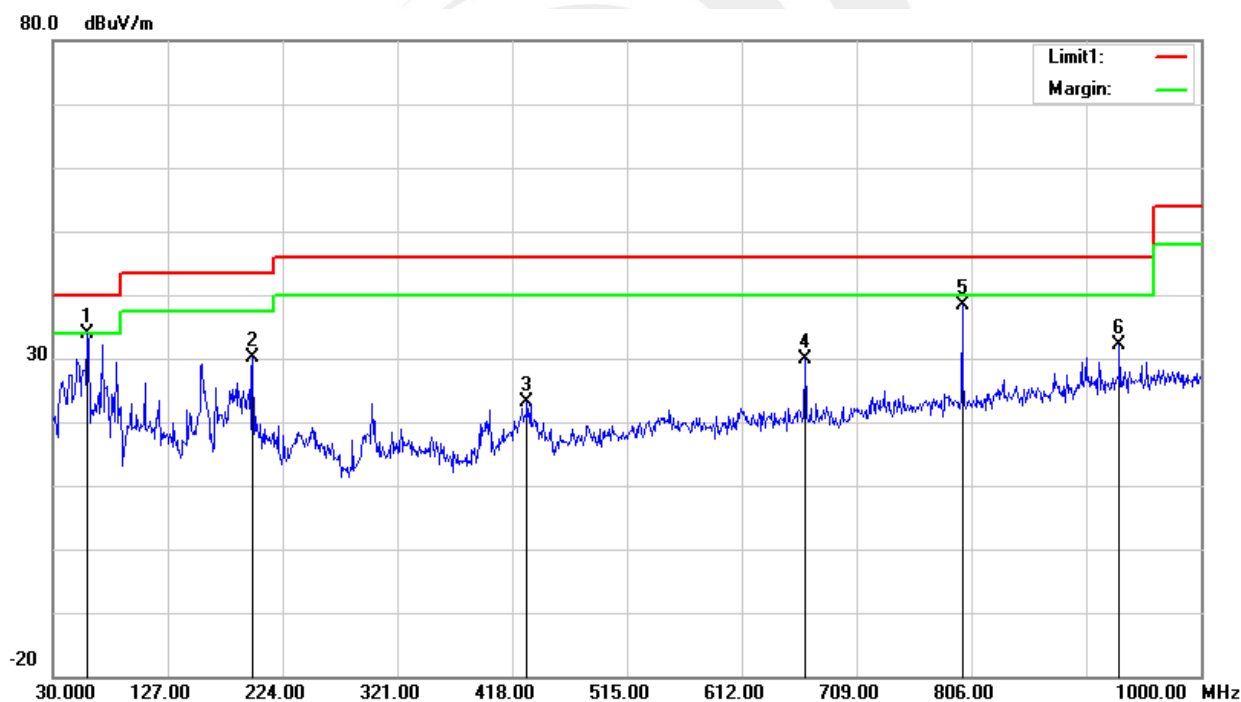
(30MHz-1000MHz)

Temperature:	23.1(C)	Relative Humidity:	60%RH
Test Voltage:	DC 12V	Phase:	Horizontal
Test Mode:	Mode 1/2/3 (Mode 2 worst mode)		

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	59.1000	59.61	-25.73	33.88	40.00	-6.12	QP
2	198.7800	51.36	-21.12	30.24	43.50	-13.26	QP
3	430.6100	33.15	-10.14	23.01	46.00	-22.99	QP
4	665.3500	34.50	-4.69	29.81	46.00	-16.19	QP
5	798.2400	40.47	-2.03	38.44	46.00	-7.56	QP
6	931.1300	31.47	0.64	32.11	46.00	-13.89	QP

Remark:

- Margin = Result (Result =Reading + Factor)-Limit
- Factor= Antenna factor+Cable attenuation factor(cable loss)-Amplifier gain



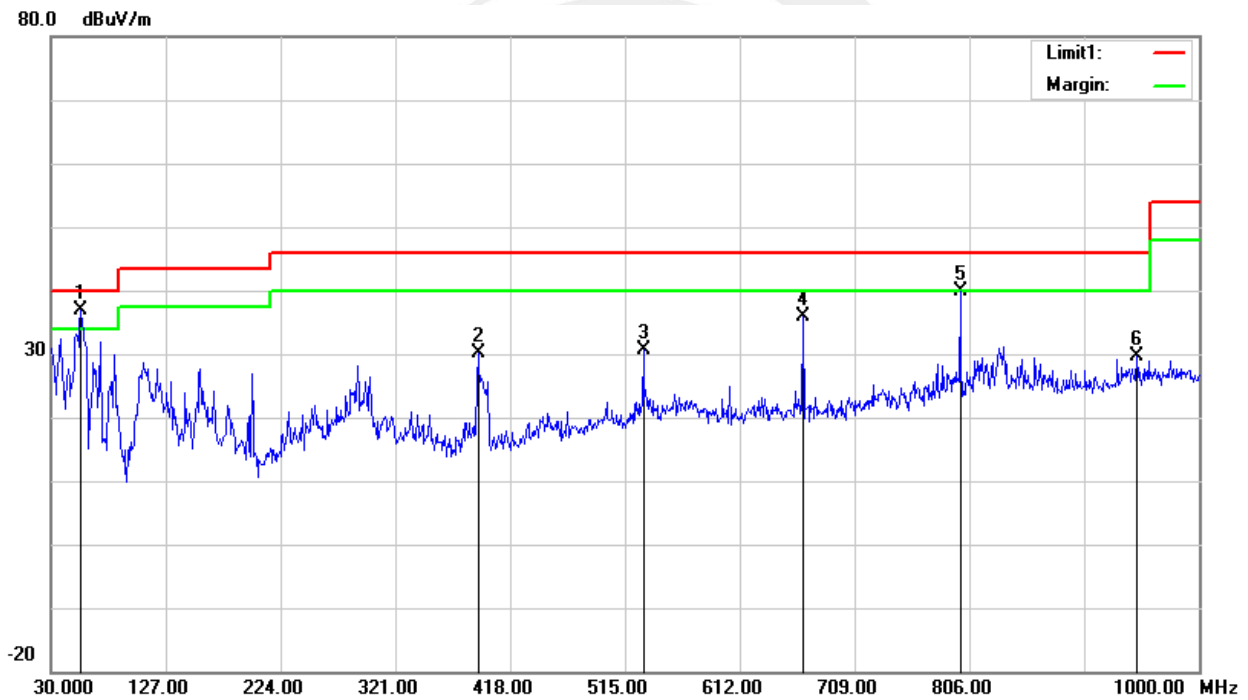


Temperature:	23.1(C)	Relative Humidity:	60%RH
Test Voltage:	DC 12V	Phase:	Vertical
Test Mode:	Mode 1/2/3 (Mode 2 worst mode)		

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	55.2200	62.01	-25.04	36.97	40.00	-3.03	QP
2	390.8400	41.75	-11.54	30.21	46.00	-15.79	QP
3	530.5200	38.00	-7.43	30.57	46.00	-15.43	QP
4	665.3500	40.61	-4.69	35.92	46.00	-10.08	QP
5	798.2400	41.83	-2.03	39.80	46.00	-6.20	QP
6	947.6200	28.04	1.55	29.59	46.00	-16.41	QP

Remark:

- Margin = Result (Result =Reading + Factor) –Limit
- Factor= Antenna factor+Cable attenuation factor(cable loss)-Amplifier gain





(1GHz~25GHz) Spurious emission Requirements

Frequency (MHz)	Meter Reading (dBμV)	Amplifier (dB)	Loss (dB)	Antenna Factor (dB/m)	Corrected Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type	Comment
Low Channel (LongFi/902.3 MHz)										
1226.42	60.88	44.70	6.70	28.20	-9.80	51.08	74.00	-22.92	PK	Vertical
1226.42	50.38	44.70	6.70	28.20	-9.80	40.58	54.00	-13.42	AV	Vertical
1226.35	61.86	44.70	6.70	28.20	-9.80	52.06	74.00	-21.94	PK	Horizontal
1226.35	50.34	44.70	6.70	28.20	-9.80	40.54	54.00	-13.46	AV	Horizontal
1804.73	58.88	44.20	9.04	31.60	-3.56	55.32	74.00	-18.68	PK	Vertical
1804.73	49.80	44.20	9.04	31.60	-3.56	46.24	54.00	-7.76	AV	Vertical
1804.77	58.25	44.20	9.04	31.60	-3.56	54.69	74.00	-19.31	PK	Horizontal
1804.77	49.26	44.20	9.04	31.60	-3.56	45.70	54.00	-8.30	AV	Horizontal
2013.38	48.97	44.20	9.86	32.00	-2.34	46.63	74.00	-27.37	PK	Vertical
2013.38	39.63	44.20	9.86	32.00	-2.34	37.29	54.00	-16.71	AV	Vertical
2013.39	48.44	44.20	9.86	32.00	-2.34	46.10	74.00	-27.90	PK	Horizontal
2013.39	39.47	44.20	9.86	32.00	-2.34	37.13	54.00	-16.87	AV	Horizontal
2706.79	53.72	43.50	11.40	35.50	3.40	57.12	74.00	-16.88	PK	Vertical
2706.79	44.92	43.50	11.40	35.50	3.40	48.32	54.00	-5.68	AV	Vertical
2706.79	53.96	43.50	11.40	35.50	3.40	57.36	74.00	-16.64	PK	Horizontal
2706.79	44.14	43.50	11.40	35.50	3.40	47.54	54.00	-6.46	AV	Horizontal
Middle Channel (LongFi/908.5 MHz)										
1215.07	62.17	44.70	6.70	28.20	-9.80	52.37	74.00	-21.63	PK	Vertical
1215.07	50.85	44.70	6.70	28.20	-9.80	41.05	54.00	-12.95	AV	Vertical
1215.10	61.69	44.70	6.70	28.20	-9.80	51.89	74.00	-22.11	PK	Horizontal
1215.10	50.89	44.70	6.70	28.20	-9.80	41.09	54.00	-12.91	AV	Horizontal
1817.21	58.87	44.20	9.04	31.60	-3.56	55.31	74.00	-18.69	PK	Vertical
1817.21	49.76	44.20	9.04	31.60	-3.56	46.20	54.00	-7.80	AV	Vertical
1817.12	59.11	44.20	9.04	31.60	-3.56	55.55	74.00	-18.45	PK	Horizontal
1817.12	49.71	44.20	9.04	31.60	-3.56	46.15	54.00	-7.85	AV	Horizontal
1994.77	48.86	44.20	9.86	32.00	-2.34	46.52	74.00	-27.48	PK	Vertical
1994.77	39.32	44.20	9.86	32.00	-2.34	36.98	54.00	-17.02	AV	Vertical
1994.76	48.18	44.20	9.86	32.00	-2.34	45.84	74.00	-28.16	PK	Horizontal
1994.76	38.31	44.20	9.86	32.00	-2.34	35.97	54.00	-18.03	AV	Horizontal
2725.76	54.10	43.50	11.40	35.50	3.40	57.50	74.00	-16.50	PK	Vertical
2725.76	43.62	43.50	11.40	35.50	3.40	47.02	54.00	-6.98	AV	Vertical
2725.85	54.86	43.50	11.40	35.50	3.40	58.26	74.00	-15.74	PK	Horizontal
2725.85	43.58	43.50	11.40	35.50	3.40	46.98	54.00	-7.02	AV	Horizontal



High Channel (LongFi/915.1 MHz)										
1204.71	62.01	44.70	6.70	28.20	-9.80	52.21	74.00	-21.79	PK	Vertical
1204.71	51.70	44.70	6.70	28.20	-9.80	41.90	54.00	-12.10	AV	Vertical
1204.67	61.10	44.70	6.70	28.20	-9.80	51.30	74.00	-22.70	PK	Horizontal
1204.67	49.91	44.70	6.70	28.20	-9.80	40.11	54.00	-13.89	AV	Horizontal
1830.31	59.15	44.20	9.04	31.60	-3.56	55.59	74.00	-18.41	PK	Vertical
1830.31	49.42	44.20	9.04	31.60	-3.56	45.86	54.00	-8.14	AV	Vertical
1830.40	58.69	44.20	9.04	31.60	-3.56	55.13	74.00	-18.87	PK	Horizontal
1830.40	49.37	44.20	9.04	31.60	-3.56	45.81	54.00	-8.19	AV	Horizontal
1977.68	49.17	44.20	9.86	32.00	-2.34	46.83	74.00	-27.17	PK	Vertical
1977.68	39.93	44.20	9.86	32.00	-2.34	37.59	54.00	-16.41	AV	Vertical
1977.67	48.38	44.20	9.86	32.00	-2.34	46.04	74.00	-27.96	PK	Horizontal
1977.67	39.23	44.20	9.86	32.00	-2.34	36.89	54.00	-17.11	AV	Horizontal
2745.28	54.91	43.50	11.40	35.50	3.40	58.31	74.00	-15.69	PK	Vertical
2745.28	44.80	43.50	11.40	35.50	3.40	48.20	54.00	-5.80	AV	Vertical
2745.22	53.50	43.50	11.40	35.50	3.40	56.90	74.00	-17.10	PK	Horizontal
2745.22	44.23	43.50	11.40	35.50	3.40	47.63	54.00	-6.37	AV	Horizontal

Note:

1) Factor = Antenna Factor + Cable Loss – Pre-amplifier.

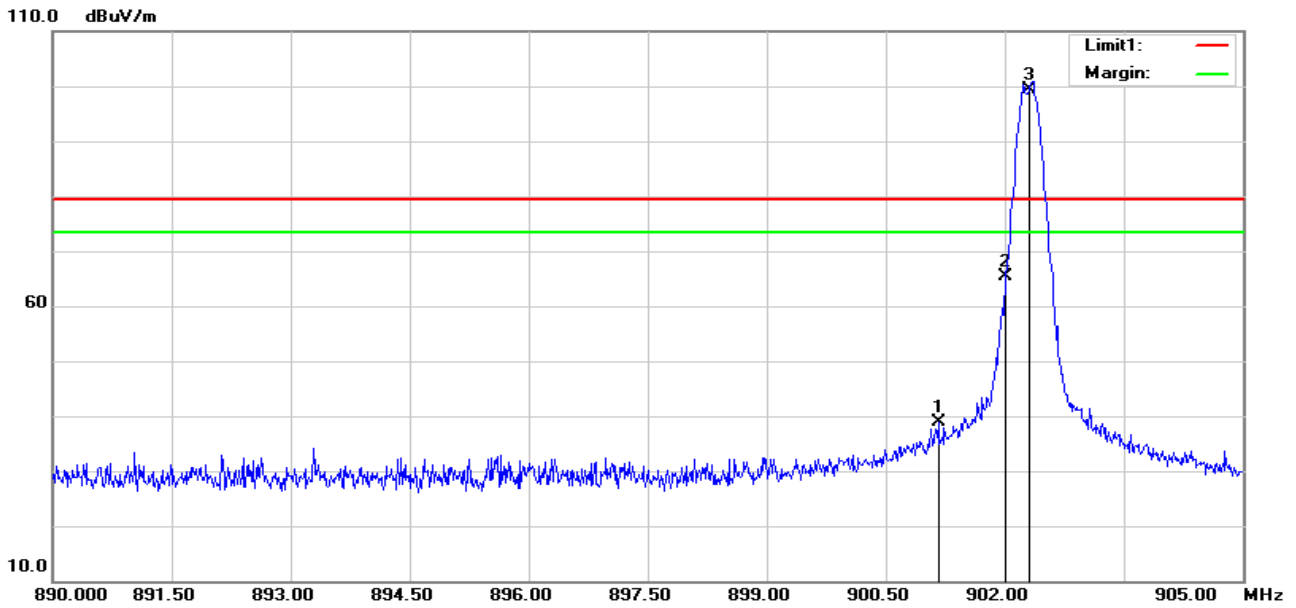
Emission Level = Reading + Factor

2) The frequency emission of peak points that did not show above the forms are at least 20dB below the limit, the frequency emission is mainly from the environment noise.



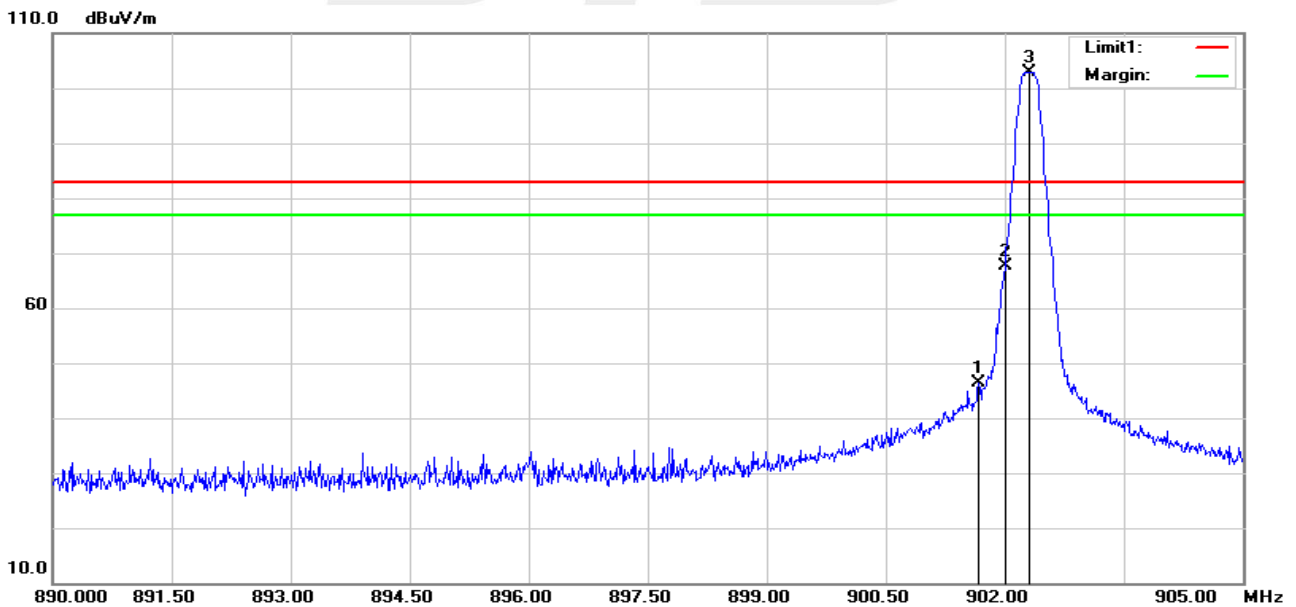
Radited Band edge Requirements

Low
Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	901.1600	39.37	-0.41	38.96	79.36	-40.40	peak
2	902.0000	65.83	-0.40	65.43	79.36	-13.93	peak
3	902.3000	99.75	-0.39	99.36	/	/	peak

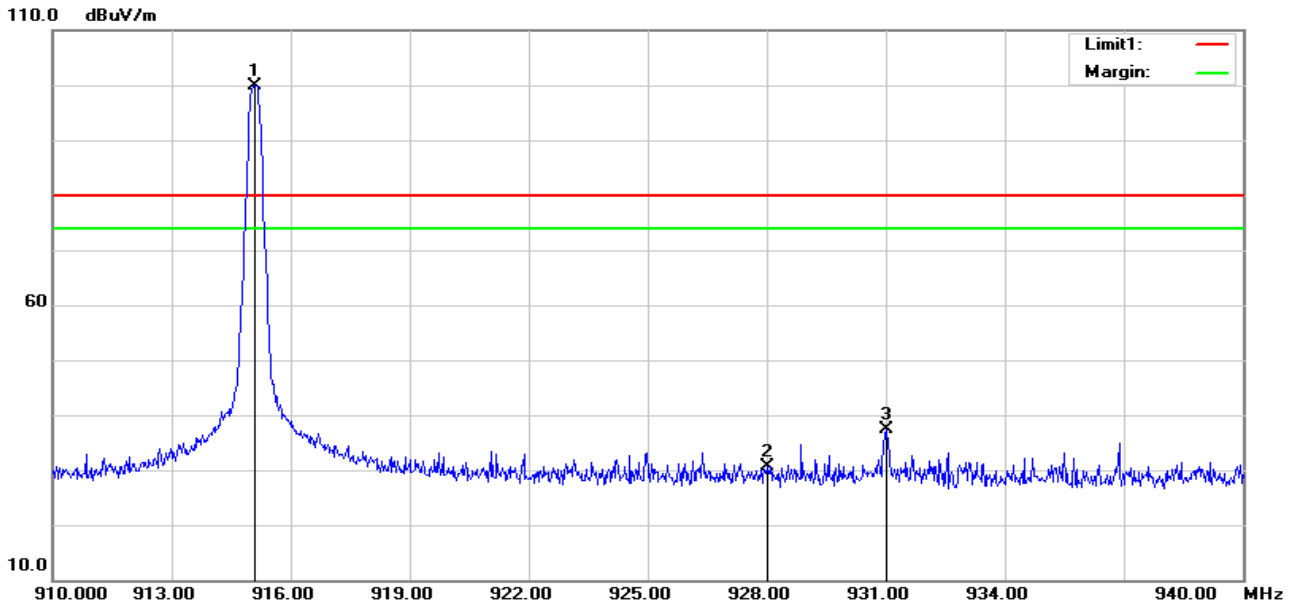
Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	901.6700	46.83	-0.40	46.43	82.89	-36.46	peak
2	902.0000	68.07	-0.40	67.67	82.89	-15.22	peak
3	902.3000	103.28	-0.39	102.89	/	/	peak

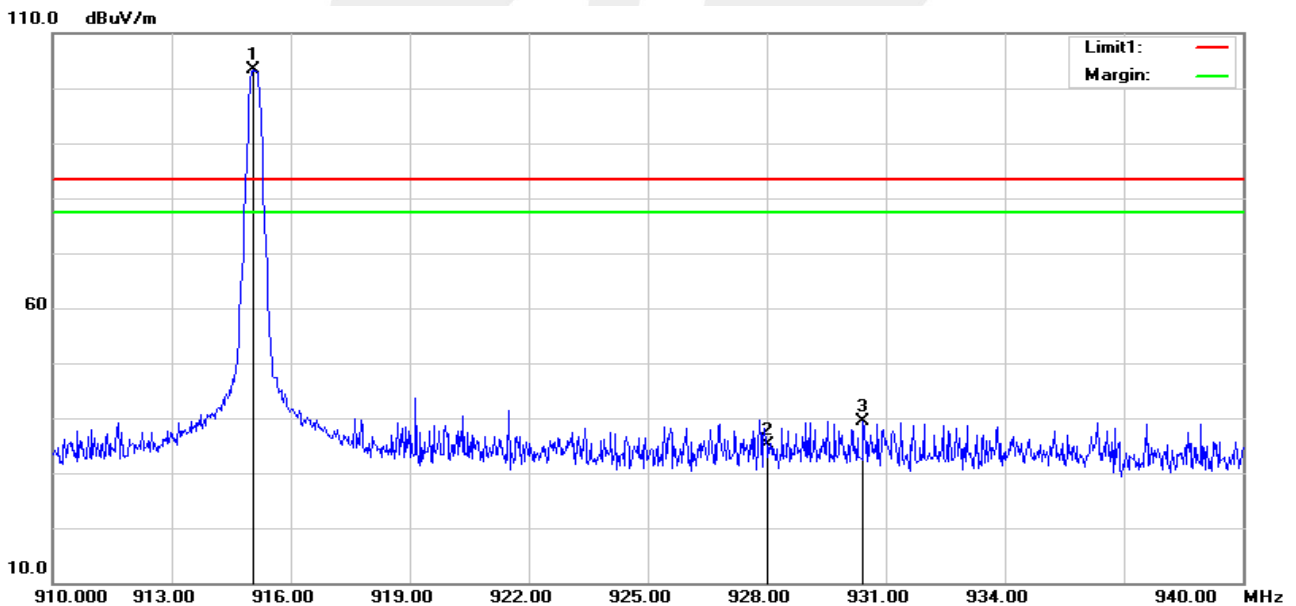


High
Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	915.1000	100.08	-0.10	99.98	/	/	peak
2	928.0000	30.32	0.43	30.75	79.98	-49.23	peak
3	931.0000	36.84	0.63	37.47	79.98	-42.51	peak

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	915.1000	103.38	-0.10	103.28	/	/	peak
2	928.0000	34.65	0.43	35.08	83.28	-48.20	peak
3	930.4300	38.78	0.58	39.36	83.28	-43.92	peak

Note: LongFi of the nohopping and hopping mode all have been test, the worst case is LongFi of the nohopping mode, this report only show the worst case.



4. CONDUCTED SPURIOUS & BAND EDGE EMISSION

4.1 LIMIT

According to FCC section 15.247(d), in any 100kHz 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 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.

4.2 TEST PROCEDURE

Spectrum Parameter	Setting
Detector	Peak
Start/Stop Frequency	30 MHz to 10th carrier harmonic
RB / VB (emission in restricted band)	100 KHz/300 KHz
Trace-Mode:	Max hold

For Band edge

Spectrum Parameter	Setting
Detector	Peak
Start/Stop Frequency	Lower Band Edge: 880 – 910 MHz Upper Band Edge: 910 – 940 MHz
RB / VB (emission in restricted band)	100 KHz/300 KHz
Trace-Mode:	Max hold

For Hopping Band edge

Spectrum Parameter	Setting
Detector	Peak
Start/Stop Frequency	Lower Band Edge: 900– 915 MHz Upper Band Edge: 925 – 950 MHz
RB / VB (emission in restricted band)	100 KHz/300 KHz
Trace-Mode:	Max hold

4.3 TEST SETUP



The EUT is connected to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. In order to make an accurate measurement, set the span greater than RBW.

4.4 EUT OPERATION CONDITIONS

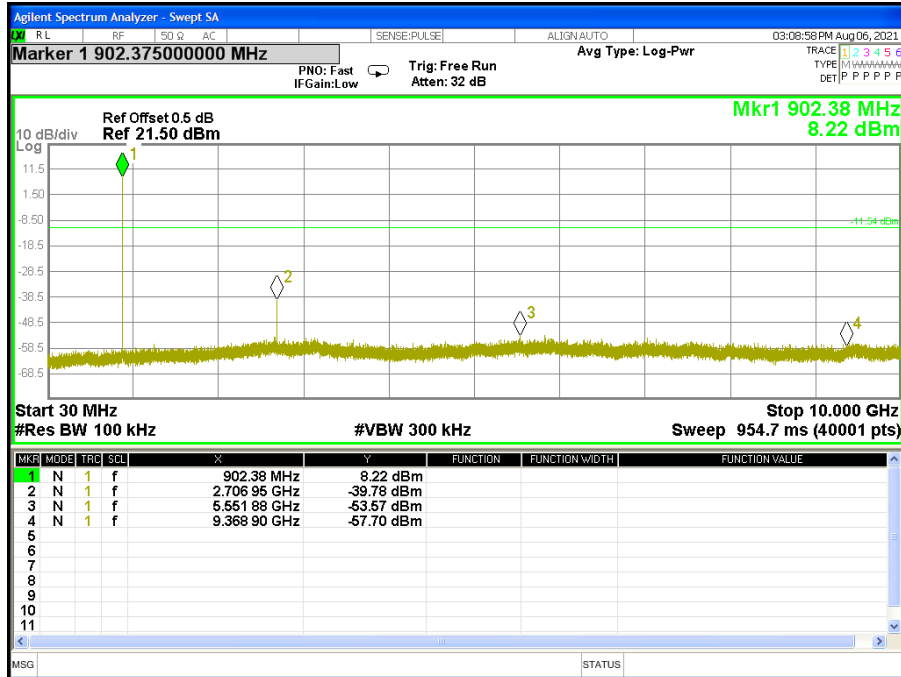
The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.



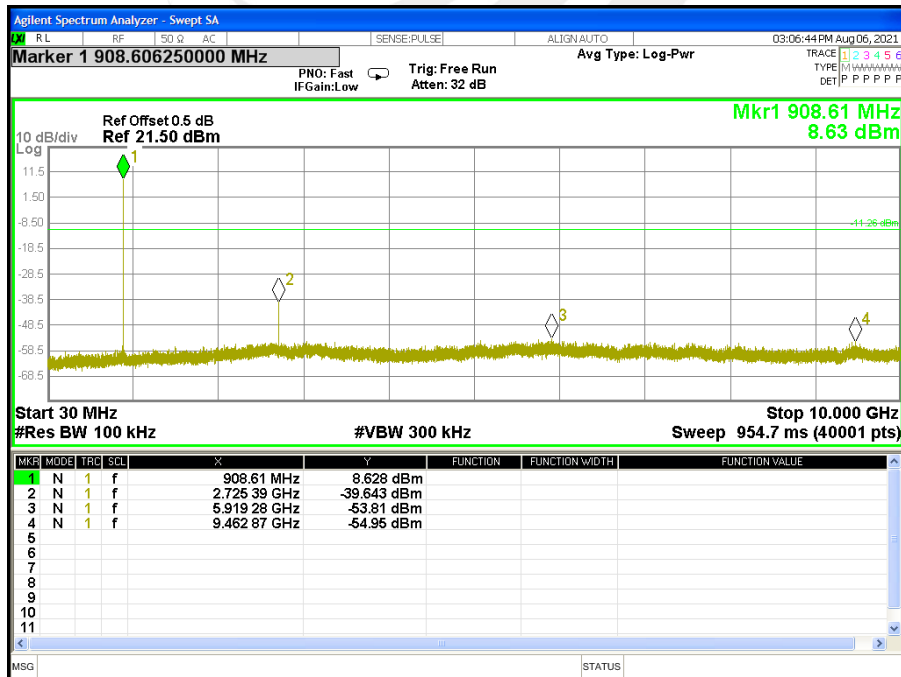
4.5 TEST RESULTS

Temperature:	25°C	Relative Humidity:	50%
Test Mode:	LongFi(1Mbps)-01/35/65 CH	Test Voltage:	DC 12V

01 CH

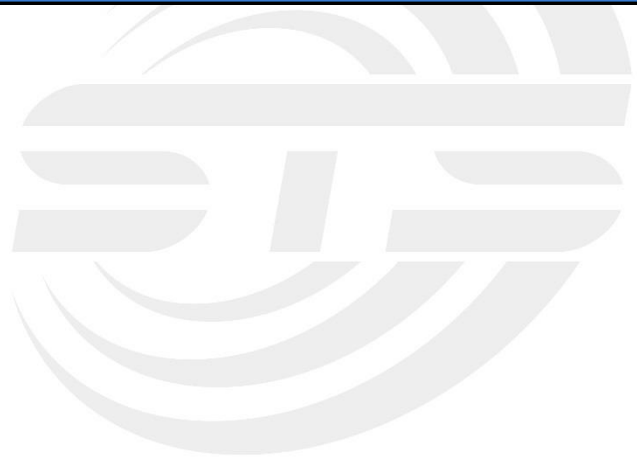
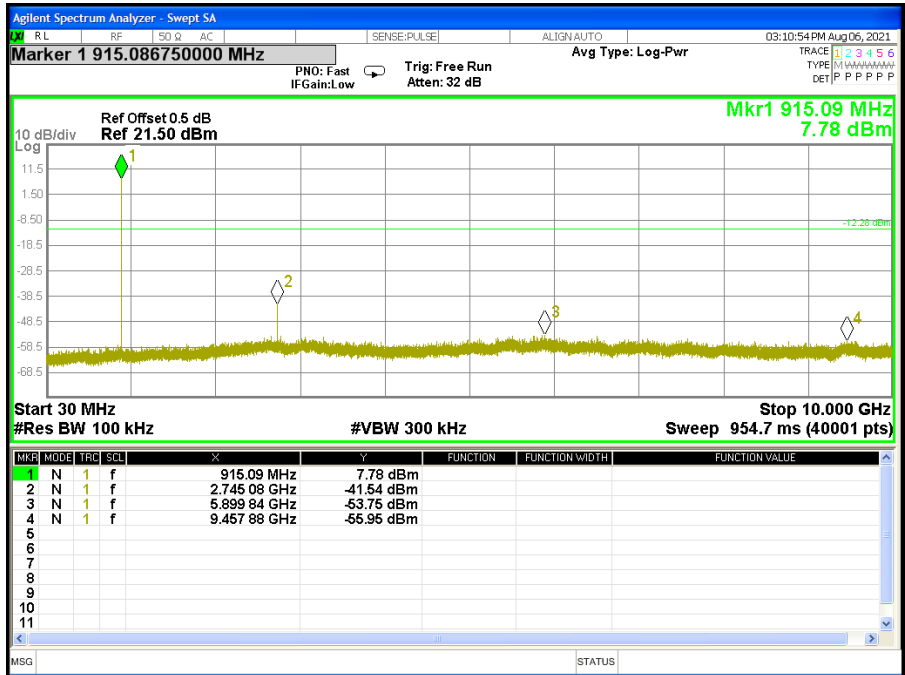


32 CH





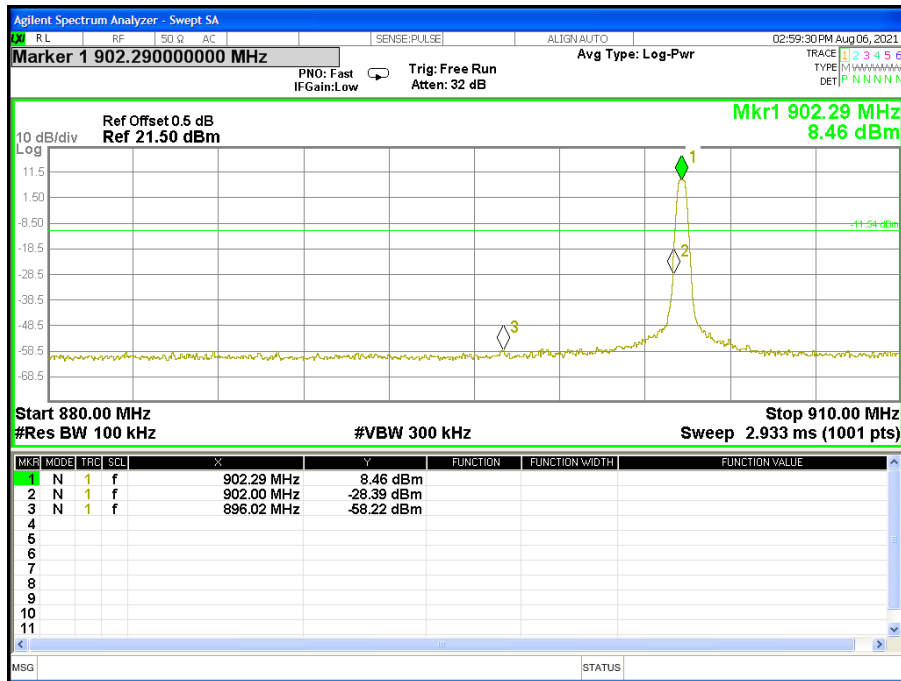
65 CH



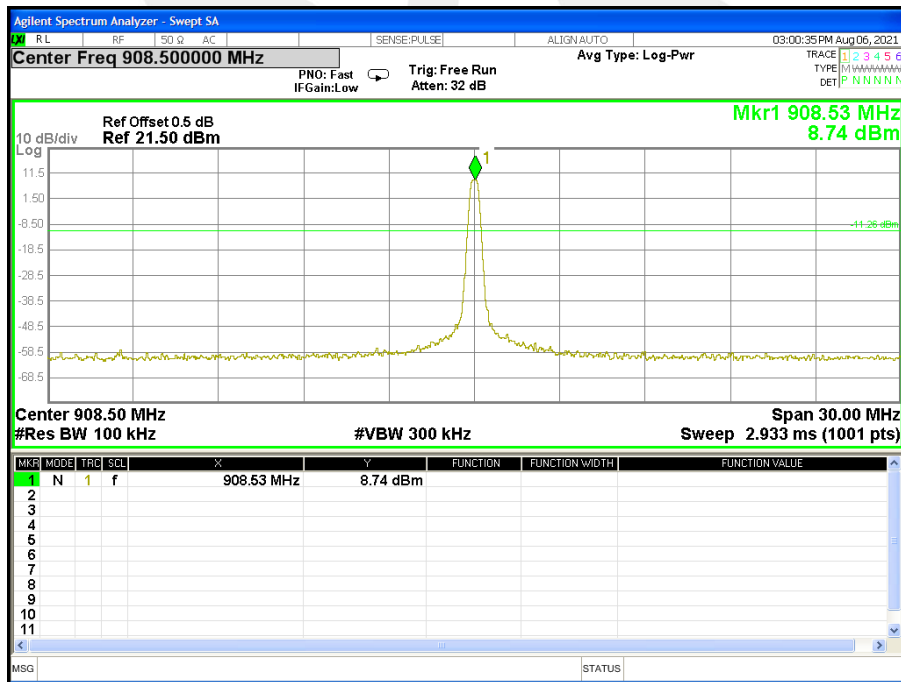


For Band edge(it's also the reference level for conducted spurious emission)

01 CH

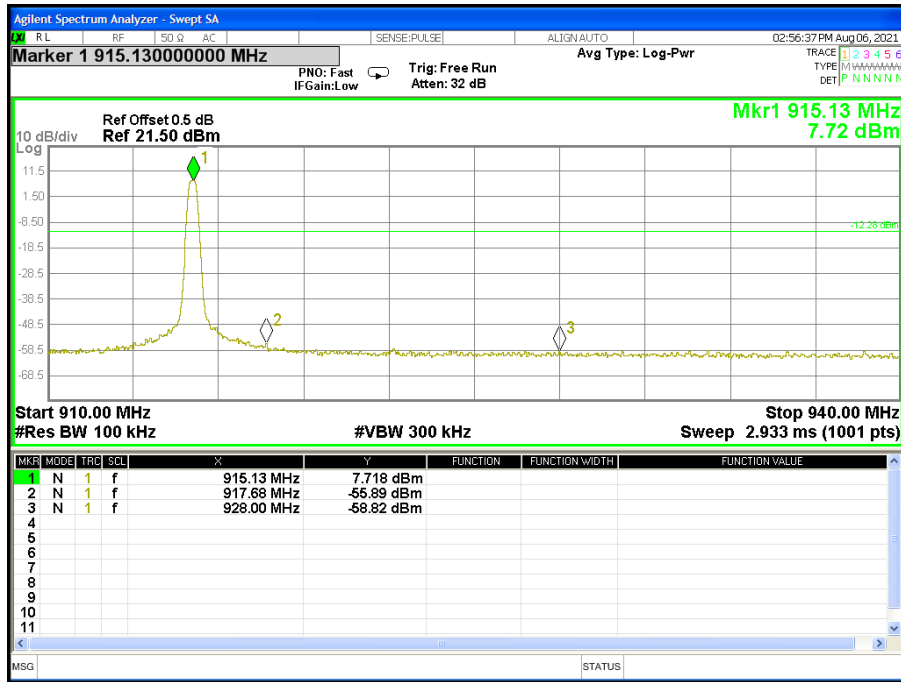


32 CH





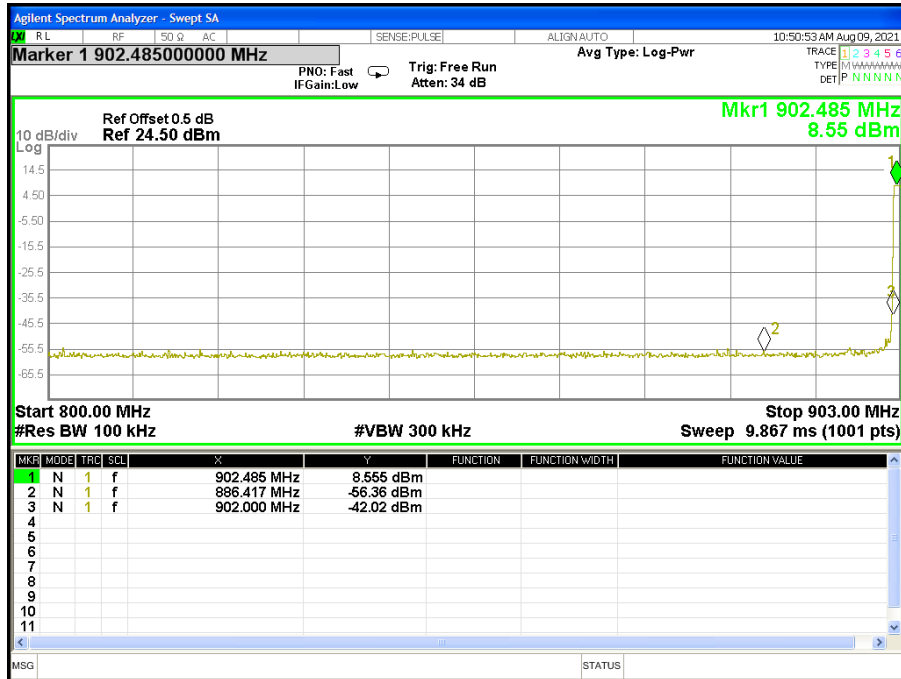
65 CH



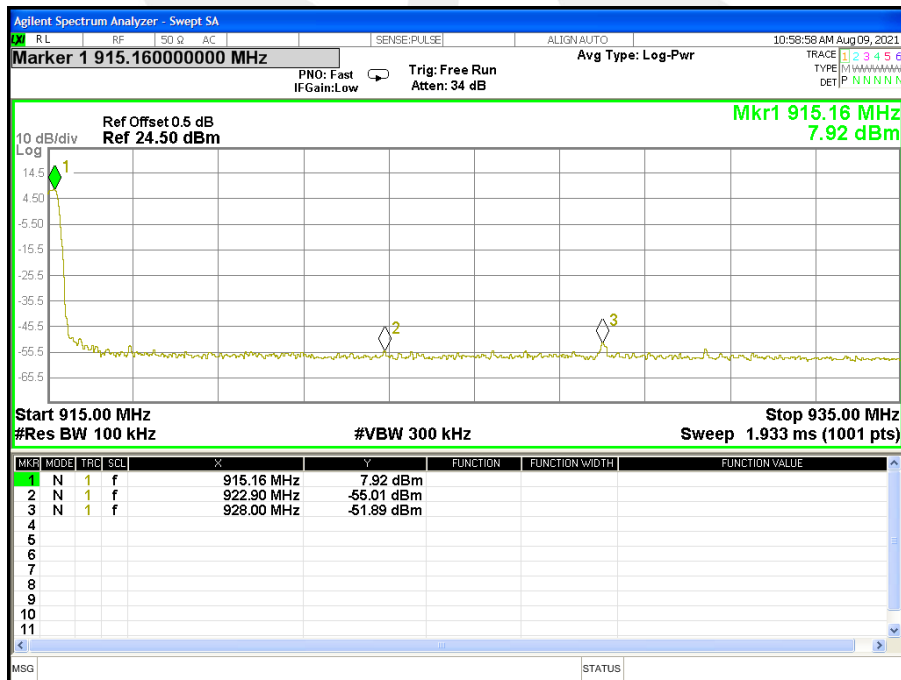


For Hopping Band edge

01 CH



65 CH



5. NUMBER OF HOPPING CHANNEL

5.1 LIMIT

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

Spectrum Parameters	Setting
Attenuation	Auto
Span Frequency	> Operating Frequency Range
RB	30KHz
VB	100KHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

5.2 TEST PROCEDURE

- a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- b. Spectrum Setting: RBW= 30KHz, VBW=100KHz, Sweep time = Auto.

5.3 TEST SETUP



5.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.



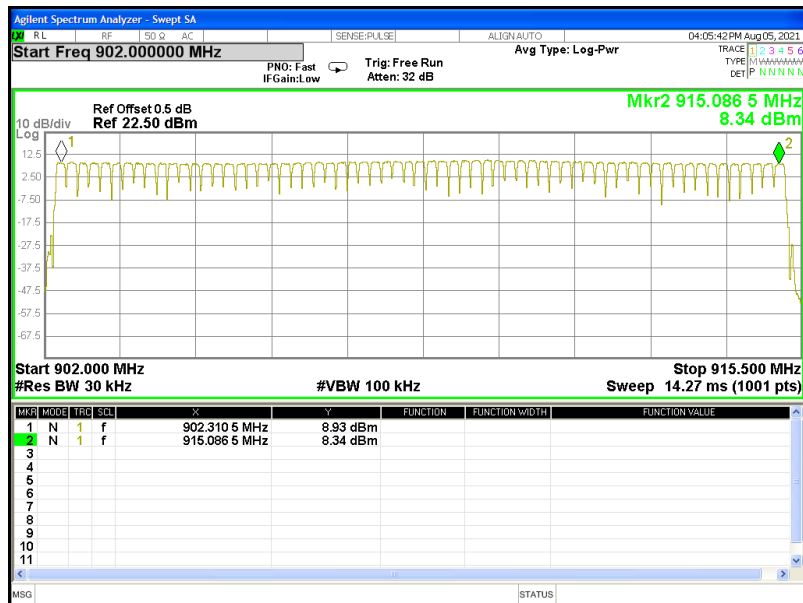
5.5 TEST RESULTS

Temperature:	25°C	Relative Humidity:	60%
Test Mode:	Hopping Mode -LongFi Mode	Test Voltage:	DC 12V

Number of Hopping Channel

65

Hopping channel



6. AVERAGE TIME OF OCCUPANCY

6.1 LIMIT

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

6.2 TEST PROCEDURE

- a. The transmitter output (antenna port) was connected to the spectrum analyzer.
- b. Set RBW =68KHz/VBW =200KHz.
- c. Use a video trigger with the trigger level set to enable triggering only on full pulses.
- d. Sweep Time is 0.4* channel number.
- e. Set the center frequency on any frequency would be measure and set the frequency span to zero span.
- f. Measure the maximum time duration of one single pulse.

6.3 TEST SETUP



6.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.



6.5 TEST RESULTS

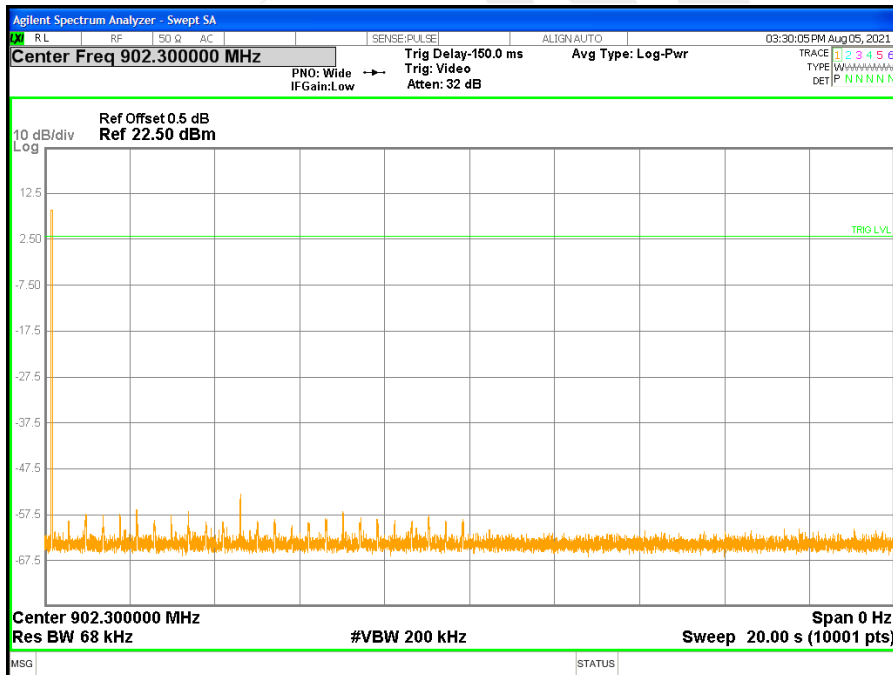
Temperature:	25°C	Relative Humidity:	50%
Test Mode:	LongFi	Test Voltage:	DC 12V

Modulation	Channel	pulse time(ms)	Burst Number	Dwell Time(s)	Limits(s)
LongFi	low	34.140	1	0.034	0.4
	middle	34.160	1	0.034	0.4
	high	34.170	1	0.034	0.4



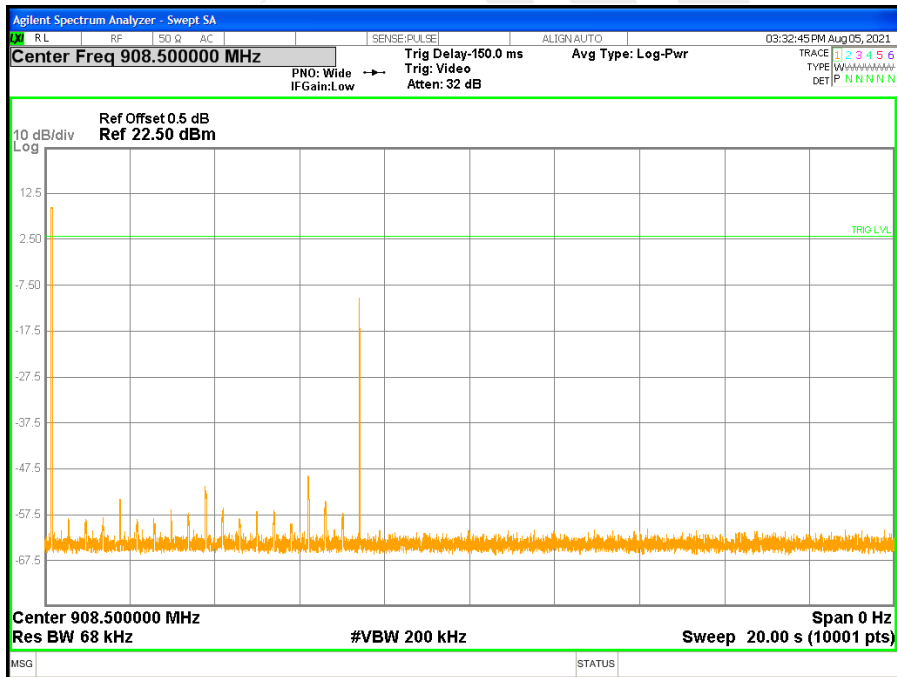
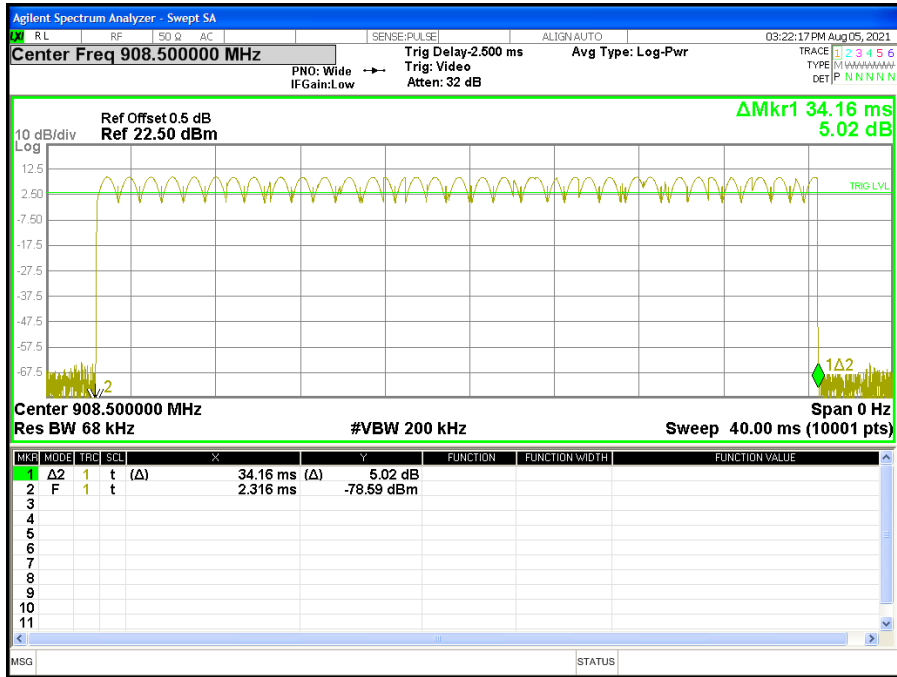


CH01



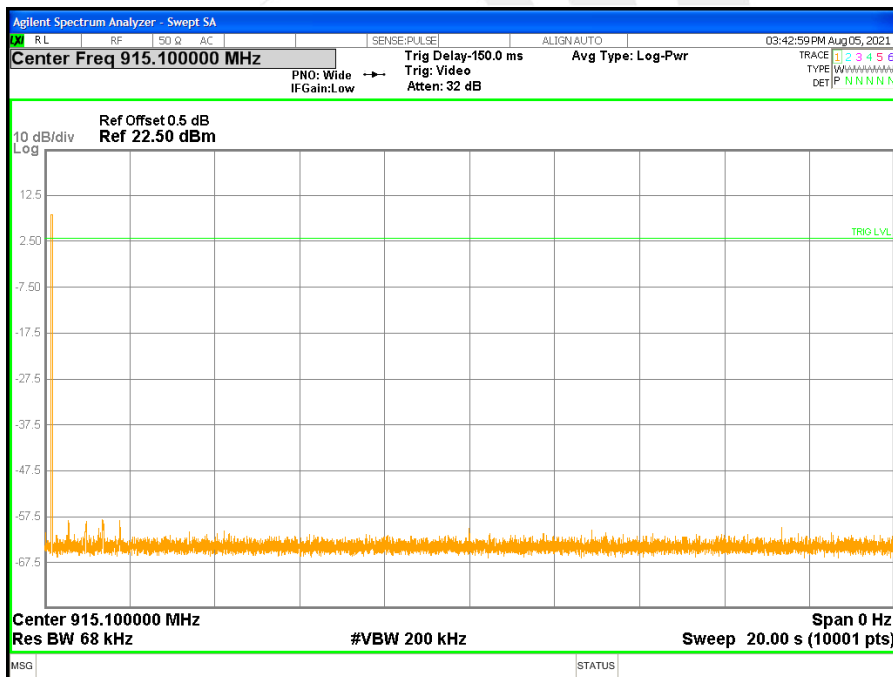


CH32





CH65



7. HOPPING CHANNEL SEPARATION MEASUREMENT

7.1 LIMIT

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.

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	500KHz
RB	30 KHz
VB	100 KHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

7.2 TEST PROCEDURE

- a. The transmitter output (antenna port) was connected to the spectrum analyser in peak hold mode.
- b. Spectrum Setting: RBW= 30KHz, VBW= 100KHz, Sweep time = Auto.

7.3 TEST SETUP



7.4 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.



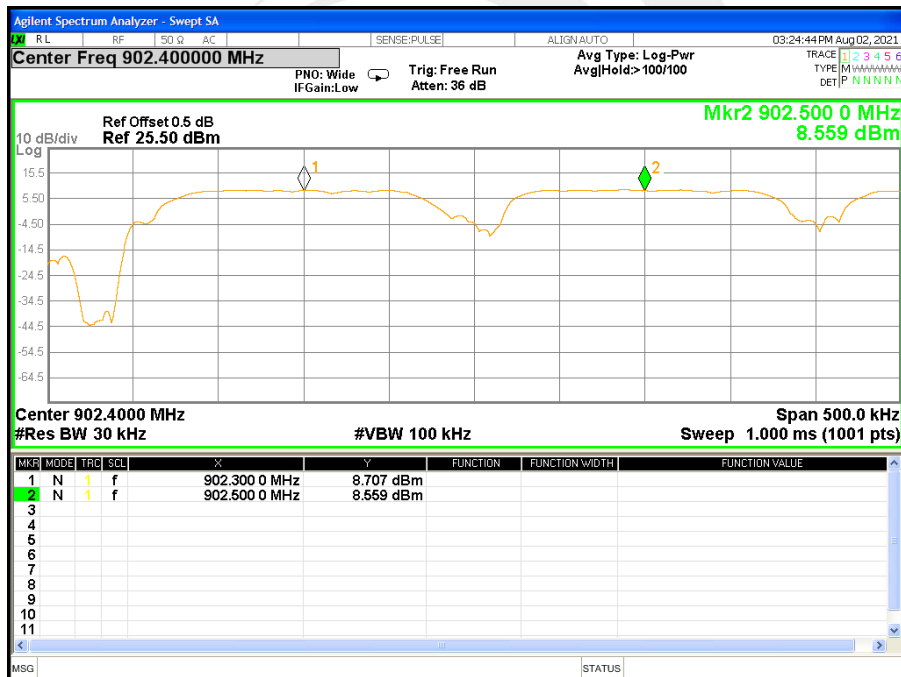
7.5 TEST RESULTS

Temperature:	25°C	Relative Humidity:	50%
Test Mode:	CH01 / CH35 / CH65 (LongFi Mode)	Test Voltage:	DC 12V

Frequency	Mark1 Frequency (MHz)	Mark2 Frequency (MHz)	Ch. Separation (MHz)	Limit (MHz)	Result
902.3 MHz	902.300	902.500	0.200	0.152	Complies
908.5 MHz	908.500	908.700	0.200	0.152	Complies
915.1 MHz	914.900	915.100	0.200	0.152	Complies

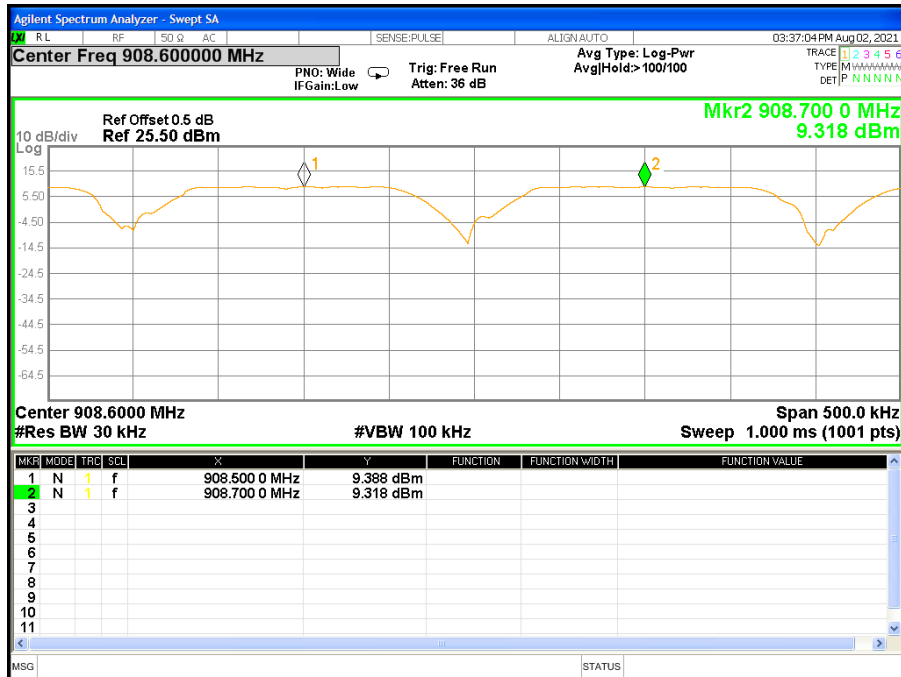
For LongFi: Ch. Separation Limits: > 20dB bandwidth

CH01

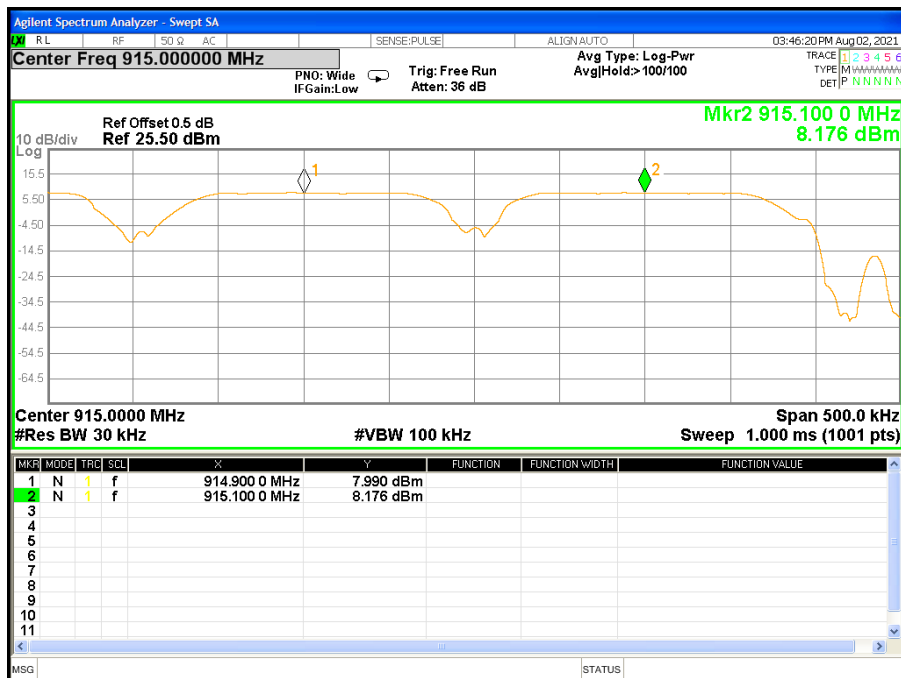




CH32



CH65



8. BANDWIDTH TEST

8.1 LIMIT

FCC Part15 15.247,Subpart C				
Section	Test Item	Limit	FrequencyRange (MHz)	Result
15.247(a)(1)(i)	(20dB bandwidth)	<250kHz	902-928	PASS

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	300 KHz
RB	3 kHz
VB	10 kHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

8.2 TEST PROCEDURE

- a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- b. Spectrum Setting: RBW= 3KHz, VBW=10KHz, Sweep time = Auto.

8.3 TEST SETUP



8.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

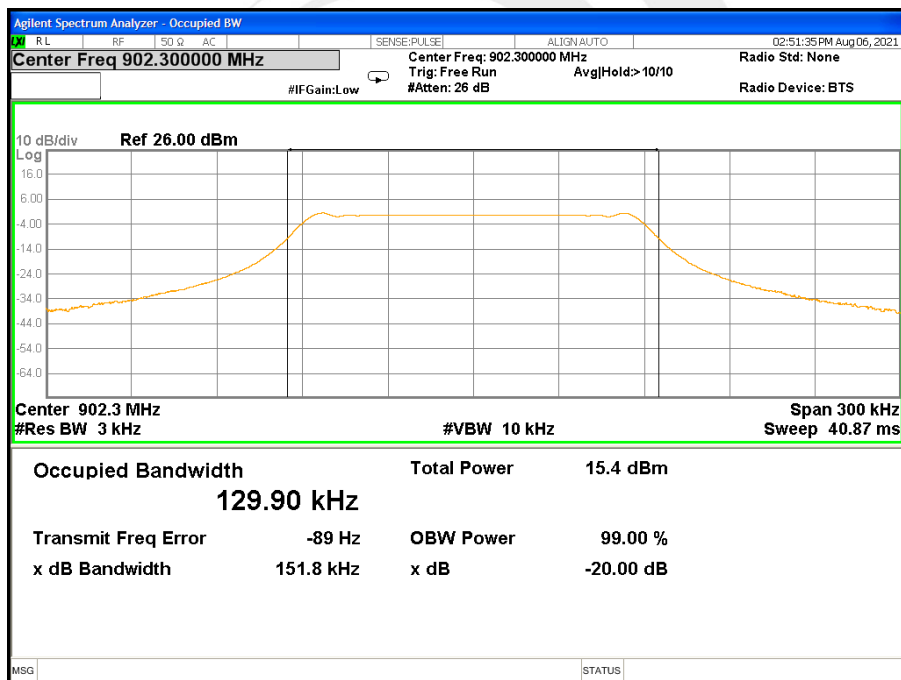


8.5 TEST RESULTS

Temperature:	25°C	Relative Humidity:	50%
Test Mode:	LongFi CH01/ CH35 / CH65	Test Voltage:	DC 12V

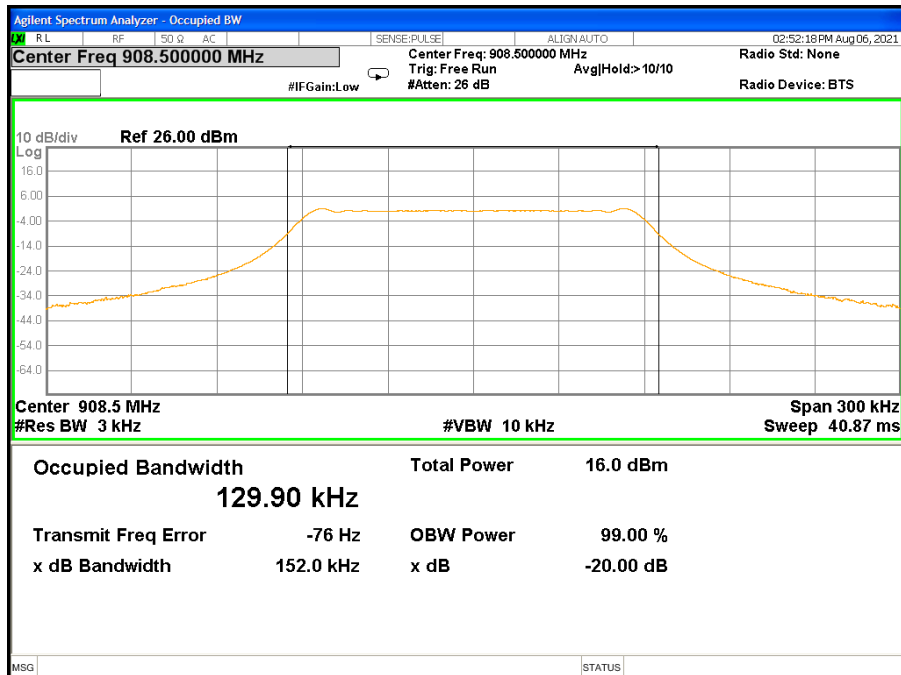
Frequency	20dB Bandwidth (MHz)	Result
902.3 MHz	0.1518	PASS
908.5 MHz	0.1520	PASS
915.1 MHz	0.1519	PASS

CH01

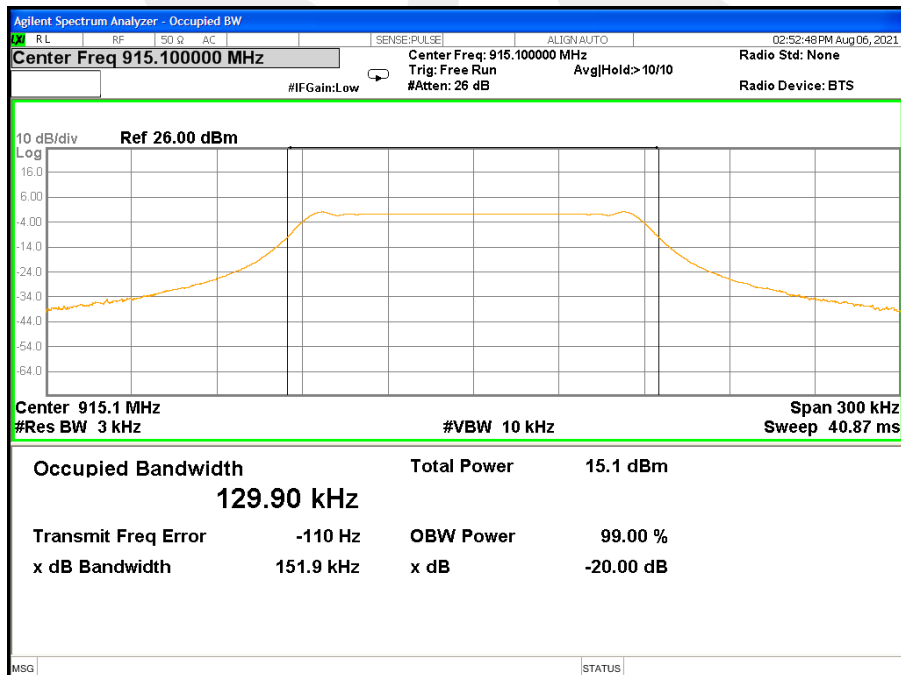




CH32



CH65





9. OUTPUT POWER TEST

9.1 LIMIT

FCC Part 15.247, Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247 (b)(2)	Output Power	1 W	902-928	PASS

9.2 TEST PROCEDURE

This is an RF-conducted test to evaluate maximum peak output power. Use a direct connection between the antenna port of the unlicensed wireless device and the spectrum analyzer, through suitable attenuation. The hopping shall be disabled for this test:

a) Use the following spectrum analyzer settings:

1) Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.

2) RBW > 20 dB bandwidth of the emission being measured.

3) VBW \geq RBW.

4) Sweep: Auto.

5) Detector function: Peak.

6) Trace: Max hold.

b) Allow trace to stabilize.

c) Use the marker-to-peak function to set the marker to the peak of the emission.

d) The indicated level is the peak output power, after any corrections for external attenuators and cables.

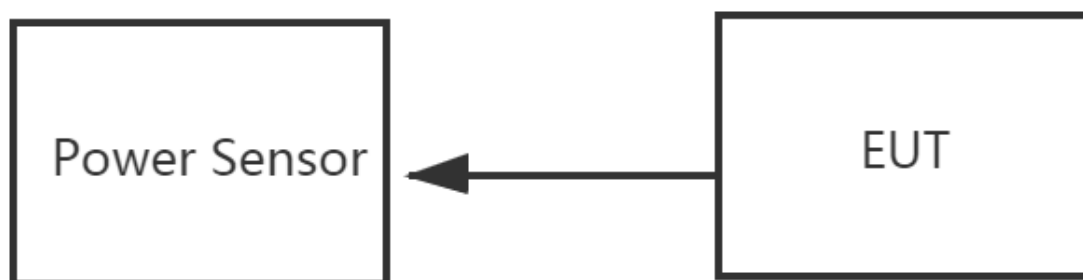
e) A plot of the test results and setup description shall be included in the test report.

NOTE—A peak responding power meter may be used, where the power meter and sensor system video bandwidth is greater than the occupied bandwidth of the unlicensed wireless device, rather than a spectrum analyzer.

PKPM1 Peak power meter method:

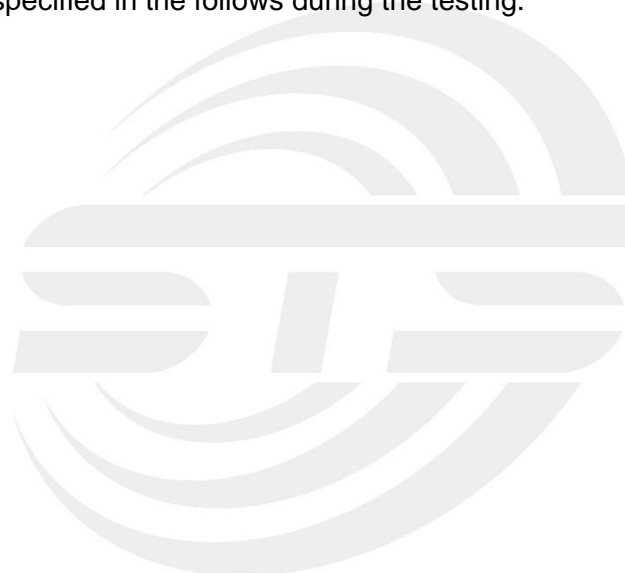
The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DSS bandwidth and shall use a fast-responding diode detector.

9.3 TEST SETUP



9.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.





9.5 TEST RESULTS

Temperature:	25°C	Relative Humidity:	60%
Test Voltage:	DC 12V		

Mode	Channel Number	Frequency (MHz)	Peak Power	Average Power	Limit
			(dBm)	(dBm)	(dBm)
LongFi	1	902.3	8.99	8.77	30.00
	32	908.5	9.34	9.15	30.00
	65	915.1	8.56	8.31	30.00



10. ANTENNA REQUIREMENT

10.1 STANDARD REQUIREMENT

15.203 requirement: For intentional device, 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.

10.2 EUT ANTENNA

The EUT antenna is External Antenna. It comply with the standard requirement. The antenna is a non-standard SMA interface antenna, refer to below photo.

Antenna Photo





APPENDIX-PHOTOS OF TEST SETUP

Note: See test photos in setup photo document for the actual connections between Product and support equipment.

※※※※※END OF THE REPORT※※※※※

