



RADIO TEST REPORT

Report No: STS2009254W01

Issued for

GTSYS LIMITED

R7, UNIT E, 9/F Kwai Shing Industrial Building. Phase 2,
42-46 Tai Lin Pai Road, Kwai Chung, NT, Hong Kong, China

Product Name:	R.I.A. Integrated RFID reader
Brand Name:	GTSYS R.I.A.
Model Name:	IR-U-POEv4/12
Series Model:	N/A
FCC ID:	A2BIRUPOE-12-V4
Test Standard:	FCC Part 15.247

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Shenzhen STS Test Services Co., Ltd.
A 1/F, Building B, Zhuoke Science Park, No.190 Chongqing Road, HepingShequ,
Fuyong Sub-District, Bao'an District, Shenzhen, Guang Dong, China
TEL: +86-755 3688 6288 FAX: +86-755 3688 6277 E-mail:sts@stsapp.com



**TEST RESULT CERTIFICATION**

Applicant's Name: GTSYS LIMITED
Address: R7, UNIT E, 9/F Kwai Shing Industrial Building. Phase 2, 42-46
Tai Lin Pai Road, Kwai Chung, NT, Hong Kong, China
Manufacture's Name: GTSYS LIMITED
Address: R7, UNIT E, 9/F Kwai Shing Industrial Building. Phase 2, 42-46
Tai Lin Pai Road, Kwai Chung, NT, Hong Kong, China

Product Description

Product Name: R.I.A. Integrated RFID reader
Brand Name: GTSYS R.I.A.
Model Name: IR-U-POEv4/12
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.
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Date of Test.....:
Date of receipt of test item.....: 22 Sept. 2020
Date (s) of performance of tests.: 22 Sept. 2020 ~ 29 Sept. 2020
Date of Issue: 29 Sept. 2020
Test Result: Pass

Testing Engineer :

(Chris Chen)

Technical Manager :

(Sean she)

Authorized Signatory :

(Vita Li)





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**Revision History**

Rev.	Issue Date	Report NO.	Effect Page	Contents
00	29 Sept. 2020	STS2009254W01	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)	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 30-1GHz	$\pm 5.6\text{dB}$
4	All emissions, radiated 1G-6GHz	$\pm 5.5\text{dB}$
5	All emissions, radiated >6G	$\pm 5.8\text{dB}$
6	Conducted Emission (9KHz-150KHz)	$\pm 3.37\text{dB}$
7	Conducted Emission (150KHz-30MHz)	$\pm 3.83\text{dB}$



2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF THE EUT

Product Name	R.I.A. Integrated RFID reader
Trade Name	GTSYS R.I.A.
Model Name	IR-U-POEv4/12
Series Model	N/A
Model Difference	N/A
Channel List	Please refer to the Note 2.
Frequency	902-928 MHz
Modulation	ASK
Power Rating	Input: 48VDC 0.52 A
Hardware version number	Revision 4
Software version number	Hw24 V1.3.5
Connecting I/O Port(s)	Please refer to the User's Manual

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)
00	902.75	17	911.25	35	920.25
01	903.25	18	911.75	36	920.75
02	903.75	19	912.25	37	921.25
03	904.25	20	912.75	38	921.75
04	904.75	21	913.25	39	922.25
05	905.25	22	913.75	40	922.75
06	905.75	23	914.25	41	923.25
07	906.25	24	914.75	42	923.75
08	906.75	25	915.25	43	924.25
09	907.25	26	915.75	44	924.75
10	907.75	27	916.25	45	925.25
11	908.25	28	916.75	46	925.75
12	908.75	29	917.25	47	926.25
13	909.25	30	917.75	48	926.75
14	909.75	31	918.25	49	927.25
15	910.25	32	918.75		
16	910.75	33	919.25		

3. Table for Filed Antenna

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	NOTE
1	GTSYS R.I.A.	IR-U-POEv4/12	Flat Panel	N/A	12	Antenna



2.2 DESCRIPTION OF THE TEST MODES

To investigate the maximum EMI emission characteristics generated from EUT, the test system was pre-scanning tested based on the consideration of following EUT operation mode or test configuration mode which possibly 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	Modulation
Mode 1	TX CH00	ASK
Mode 2	TX CH24	ASK
Mode 3	TX CH49	ASK

Note:

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

(2) We have been tested for all available 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 radiated and RF conducted test.

For AC Conducted Emission

Test Case	
AC Conducted Emission	Mode 4 : Keeping EUT TX

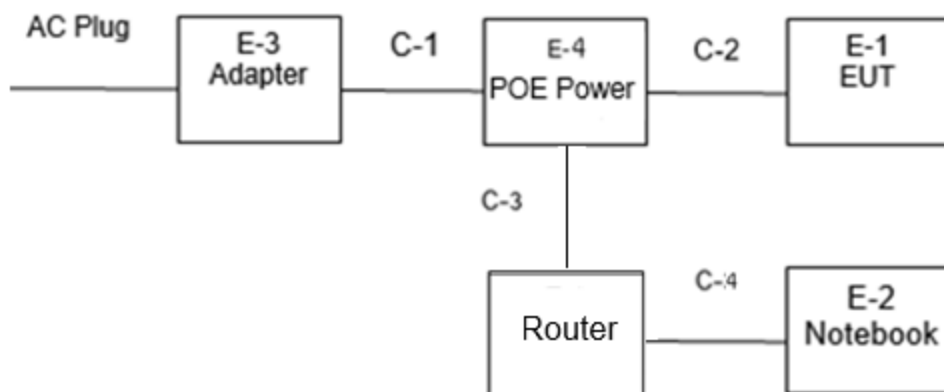
2.3 TEST SOFTWARE AND POWER LEVEL

During testing channel & power controlling software provided by the customer was used to control the operating channel as well as the output power level.

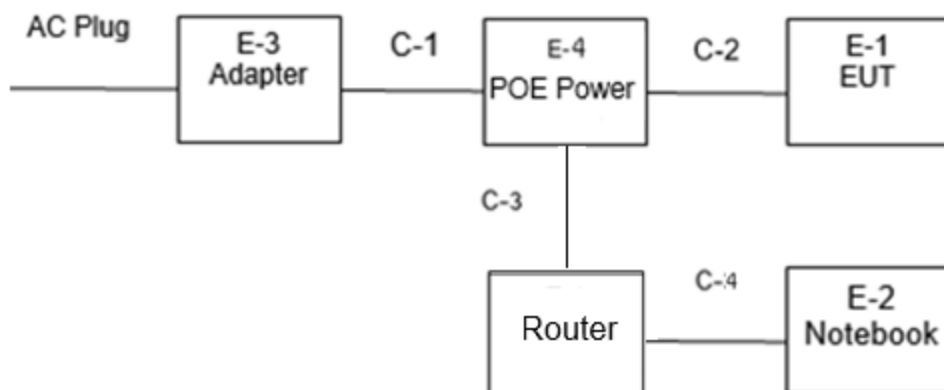
RF Function	Type	Mode Or Modulation type	Ant Gain(dBi)	Power Class	Software For Testing
Other SRD	ASK	902MHz-928MHz	12	Default	APTool Universal

2.4 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

Radiated Spurious Emission Test



Conducted Emission Test





2.5 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
N/A	N/A	N/A	N/A	N/A	N/A

Support units

Item	Equipment	Mfr/Brand	Model/Type No.	Length	Note
E-2	Notebook	LENOVO	ThinkPad E470	N/A	N/A
E-3	Adapter	N/A	2ABF060R	N/A	N/A
E-4	POE	N/A	GS308P	N/A	N/A
C-1	DC Cable	N/A	N/A	100cm	N/A
C-2	USB Cable	N/A	N/A	100cm	N/A
C-3	AC LINE	N/A	N/A	100cm	N/A
C-4	LAN	N/A	N/A	100cm	N/A

Note:

- (1) For detachable type I/O cable should be specified the length in cm in 『Length』 column.



2.6 EQUIPMENTS LIST

Radiation Test equipment

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
Test Receiver	R&S	ESCI	101427	2019.10.09	2020.10.08
Signal Analyzer	Agilent	N9020A	MY51110105	2020.03.05	2021.03.04
Active loop Antenna	ZHINAN	ZN30900C	16035	2018.03.11	2021.03.10
Bilog Antenna	TESEQ	CBL6111D	34678	2017.11.02	2020.11.01
Horn Antenna	SCHWARZBECK	BBHA 9120D	1343	2018.10.19	2021.10.18
SHF-EHF Horn Antenna (18G-40GHz)	A-INFO	LB-180400-KF	J211020657	2018.03.11	2021.03.10
Pre-Amplifier (0.1M-3GHz)	EM	EM330	060665	2019.10.09	2020.10.08
Pre-Amplifier (1G-18GHz)	SKET	LNPA-01018G-45	SK2018080901	2019.10.12	2020.10.11
Pre-Amplifier (18G-40GHz)	SKET	LNPA-1840-50	SK2018101801	2019.10.12	2020.10.11
Temperature & Humidity	HH660	Mieo	N/A	2019.10.17	2020.10.16
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	2019.10.09	2020.10.08
LISN	R&S	ENV216	101242	2019.10.09	2020.10.08
LISN	EMCO	3810/2NM	23625	2019.10.09	2020.10.08
Temperature & Humidity	HH660	Mieo	N/A	2019.10.12	2020.10.11
Test SW	FARAD	EZ-EMC(Ver.STSLAB-03A1 CE)			

RF Connected Test

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
USB RF power sensor	DARE	RPR3006W	15I00041SNO03	2019.10.09	2020.10.08
Signal Analyzer	Agilent	N9020A	MY49100060	2019.10.09	2020.10.08
Temperature & Humidity	HH660	Mieo	N/A	2019.10.12	2020.10.11
Test SW	FARAD	LZ-RF /LzRf-3A3			



3. EMC EMISSION TEST

3.1 CONDUCTED EMISSION MEASUREMENT

3.1.1 POWER LINE CONDUCTED EMISSION LIMITS

Operating frequency band. In case the emission fall within the restricted band specified on Part 207(a) limit in the table below has to be followed.

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.

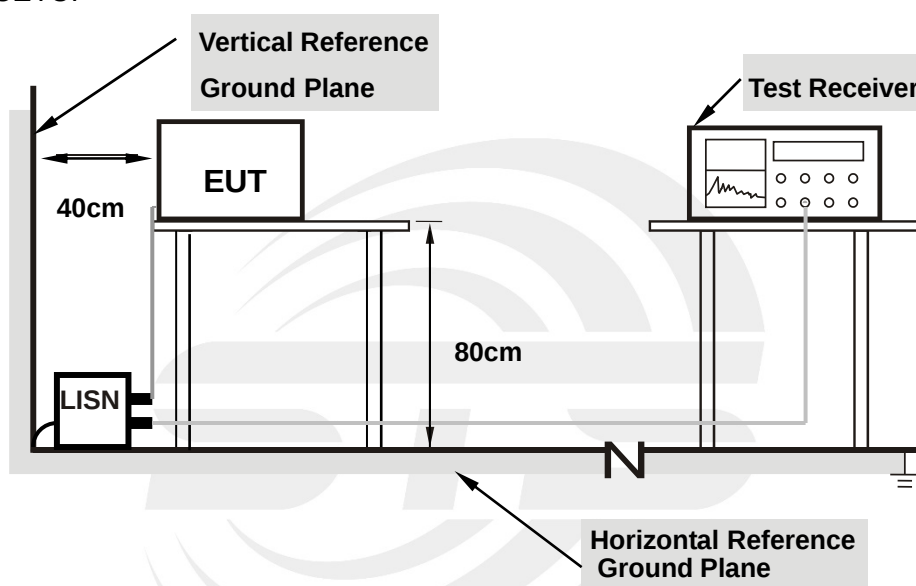
The following table is the setting of the receiver

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

3.1.2 TEST PROCEDURE

- The EUT was 0.8 meters from the horizontal ground plane and 0.4 meters from the vertical ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- 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.
- 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.
- LISN at least 80 cm from nearest part of EUT chassis.
- 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

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

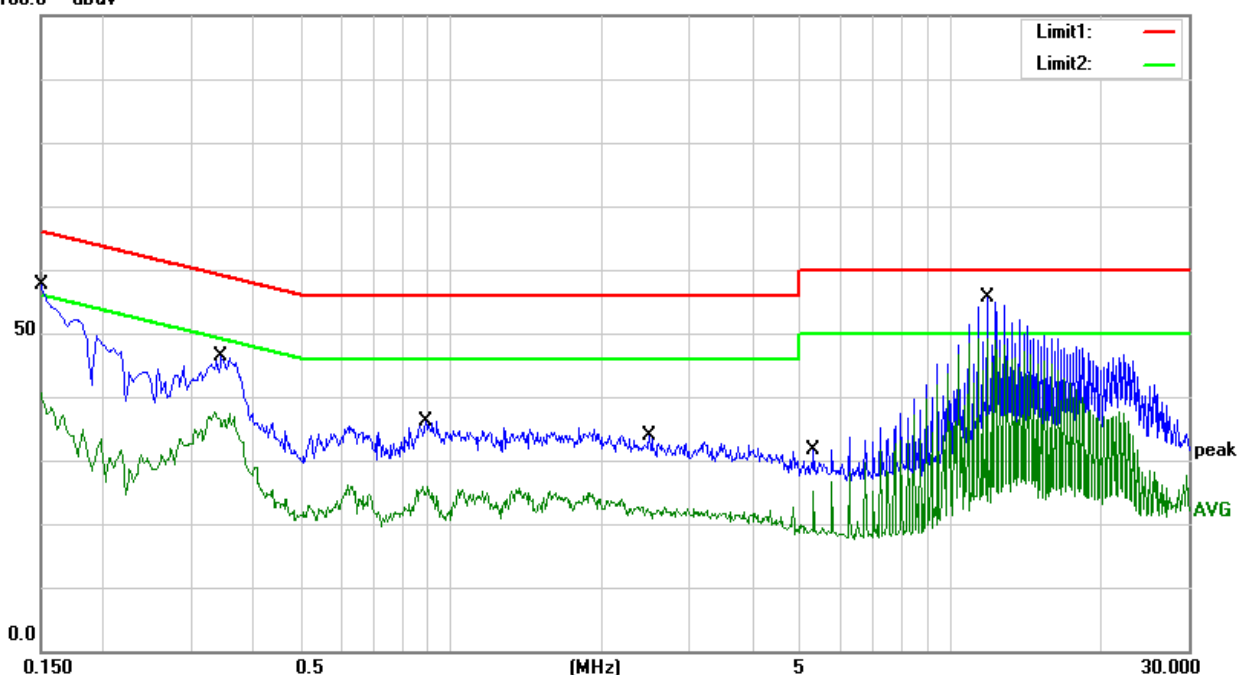
Temperature:	26.8(C)	Relative Humidity:	66%RH
Test Voltage:	AC 120V/60Hz	Phase:	L
Test Mode:	Mode 4		

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1500	37.48	20.19	57.67	66.00	-8.33	QP
2	0.1500	20.44	20.19	40.63	56.00	-15.37	AVG
3	0.3460	25.72	20.65	46.37	59.06	-12.69	QP
4	0.3460	16.88	20.65	37.53	49.06	-11.53	AVG
5	0.8860	15.88	20.21	36.09	56.00	-19.91	QP
6	0.8860	5.78	20.21	25.99	46.00	-20.01	AVG
7	2.4940	13.89	20.11	34.00	56.00	-22.00	QP
8	2.4940	2.07	20.11	22.18	46.00	-23.82	AVG
9	5.3140	11.52	19.99	31.51	60.00	-28.49	QP
10	5.3140	5.08	19.99	25.07	50.00	-24.93	AVG
11	11.8340	35.72	19.90	55.62	60.00	-4.38	QP
12	11.8340	29.42	19.90	49.32	50.00	-0.68	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)

100.0 dBuV





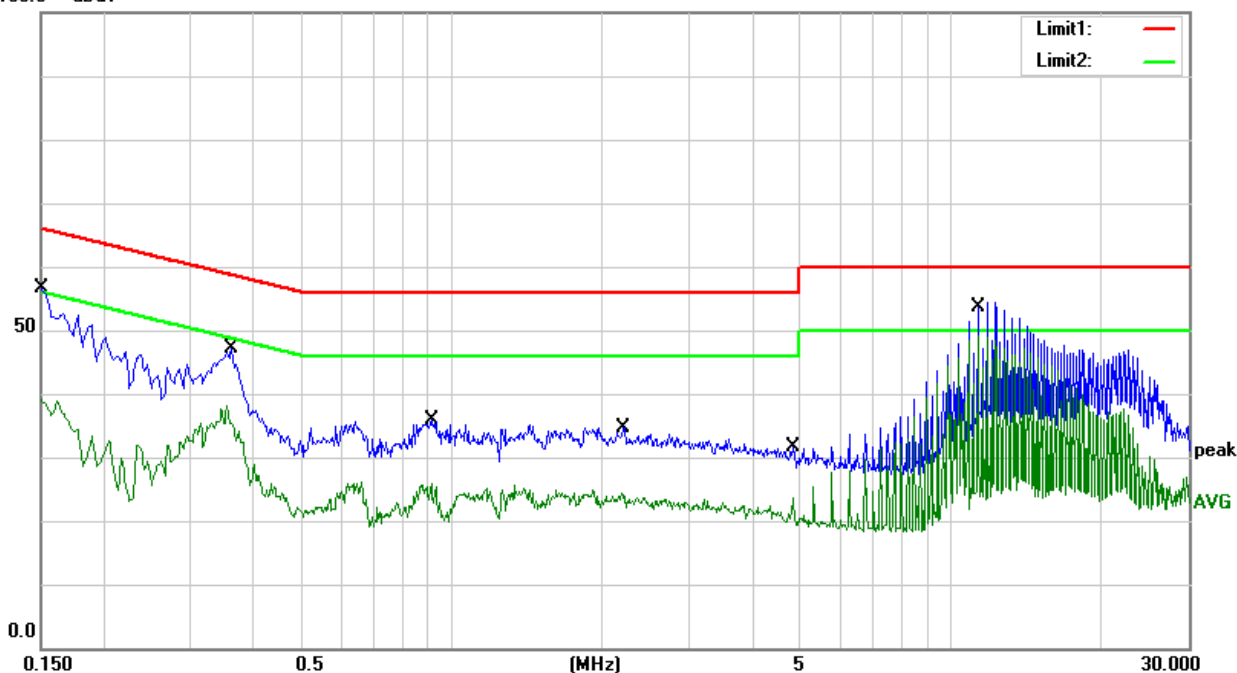
Temperature:	26.8(C)	Relative Humidity:	66%RH
Test Voltage:	AC 120V/60Hz	Phase:	N
Test Mode:	Mode 4		

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1500	36.48	20.19	56.67	66.00	-9.33	QP
2	0.1500	18.96	20.19	39.15	56.00	-16.85	AVG
3	0.3620	26.41	20.61	47.02	58.68	-11.66	QP
4	0.3620	17.53	20.61	38.14	48.68	-10.54	AVG
5	0.9100	15.61	20.19	35.80	56.00	-20.20	QP
6	0.9100	5.58	20.19	25.77	46.00	-20.23	AVG
7	2.2060	14.49	20.14	34.63	56.00	-21.37	QP
8	2.2060	4.12	20.14	24.26	46.00	-21.74	AVG
9	4.8300	11.59	20.03	31.62	56.00	-24.38	QP
10	4.8300	3.61	20.03	23.64	46.00	-22.36	AVG
11	11.3540	33.63	19.89	53.52	60.00	-6.48	QP
12	11.3540	29.28	19.89	49.17	50.00	-0.83	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)

100.0 dBuV





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/ 3 MHz(AVG)

For Band Edge

Spectrum Parameter	Setting
Detector	Peak
Start/Stop Frequency	Lower Band Edge: 890 to 905 MHz Upper Band Edge: 913 to 930 MHz
RB / VB	100 KHz / 300 KHz



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 of 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 meters (above 1GHz is 1.5 m) above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees 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 polarizations 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 then QuasiPeak detector mode re-measured.
- If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
- For the actual test configuration, please refer to the related Item –EUT Test Photos.

Note:

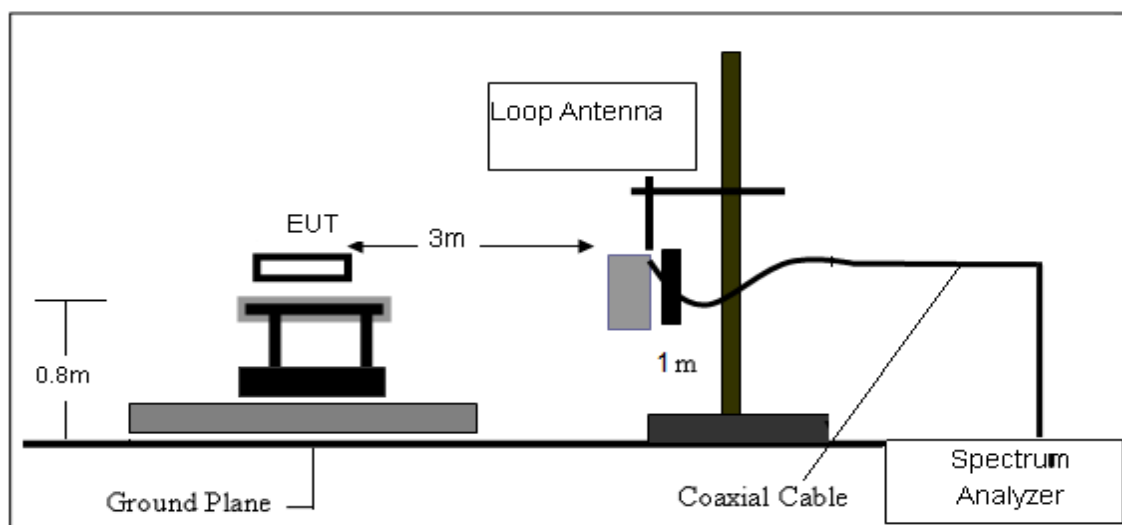
Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported.

3.2.3 DEVIATION FROM TEST STANDARD

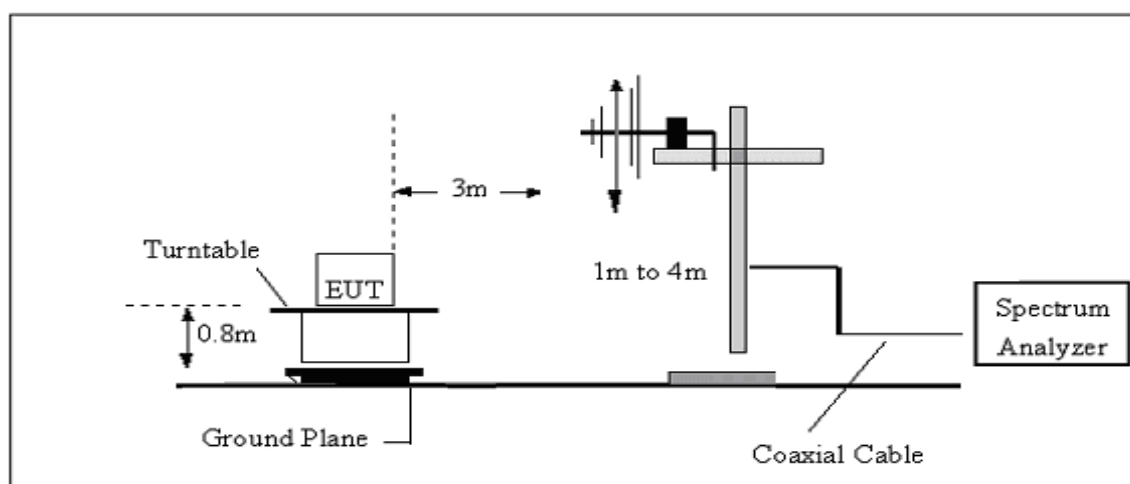
No deviation.

3.2.4 TESTSETUP

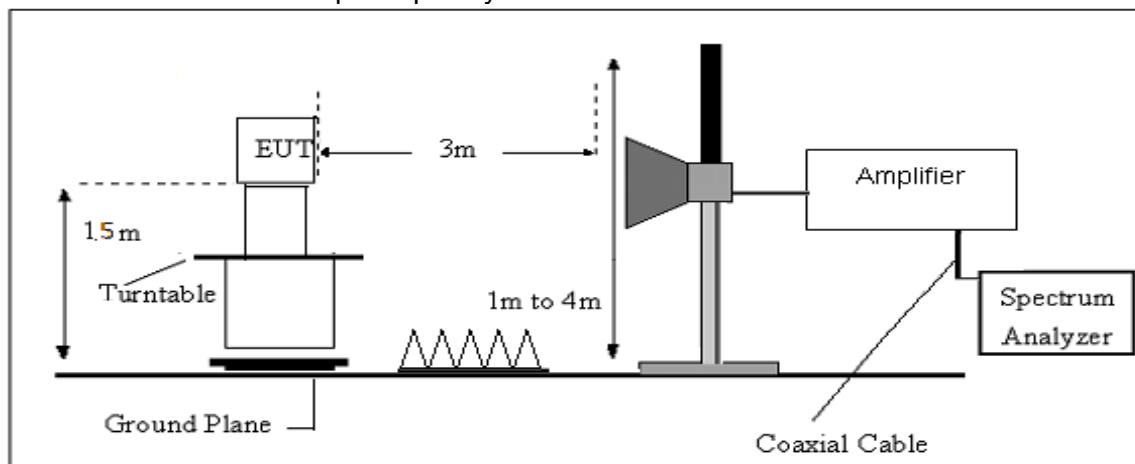
(A) Radiated Emission Test-Up Frequency Below 30MHz



(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	FS	RA	AF	CL	AG	Factor
(MHz)	(dBμV/m)	(dBμV/m)	(dB)	(dB)	(dB)	(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:	25.8(C)	Relative Humidity:	61%RH
Test Voltage:	DC 48V	Test Mode:	TX Mode

Freq.	Reading	Limit	Margin	State	Test Result
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F	
--	--	--	--	--	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 = $40 \log (\text{specific distance/test distance})$ (dB);

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



(30MHz-1000MHz)

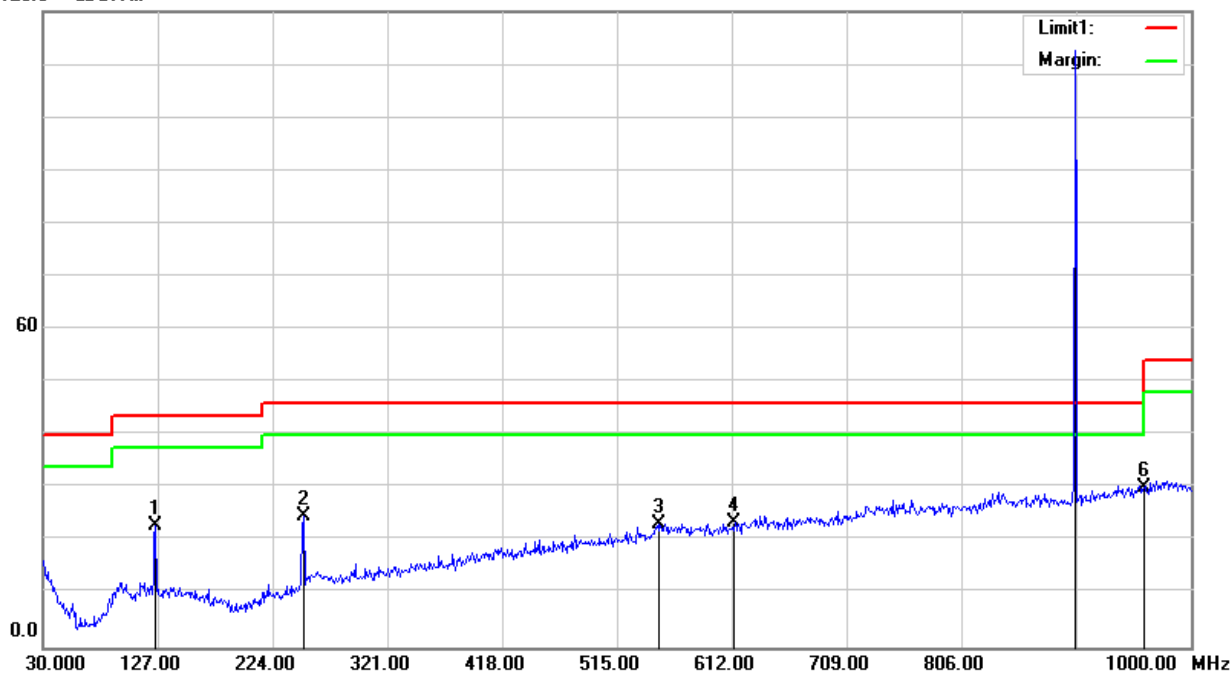
Temperature:	23.2(C)	Relative Humidity:	61%RH
Test Voltage:	DC 48V	Phase:	Horizontal
Test Mode:	Mode 1		

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	125.0600	41.07	-18.22	22.85	43.50	-20.65	QP
2	250.1900	40.76	-16.10	24.66	46.00	-21.34	QP
3	550.8900	28.89	-5.74	23.15	46.00	-22.85	QP
4	614.0000	29.11	-5.50	23.61	46.00	-22.39	QP
5	902.7500	113.04	-0.38	112.66	46.00	66.66	peak
6	960.0000	28.32	1.76	30.08	46.00	-15.92	QP

Remark:

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

120.0 dBuV/m



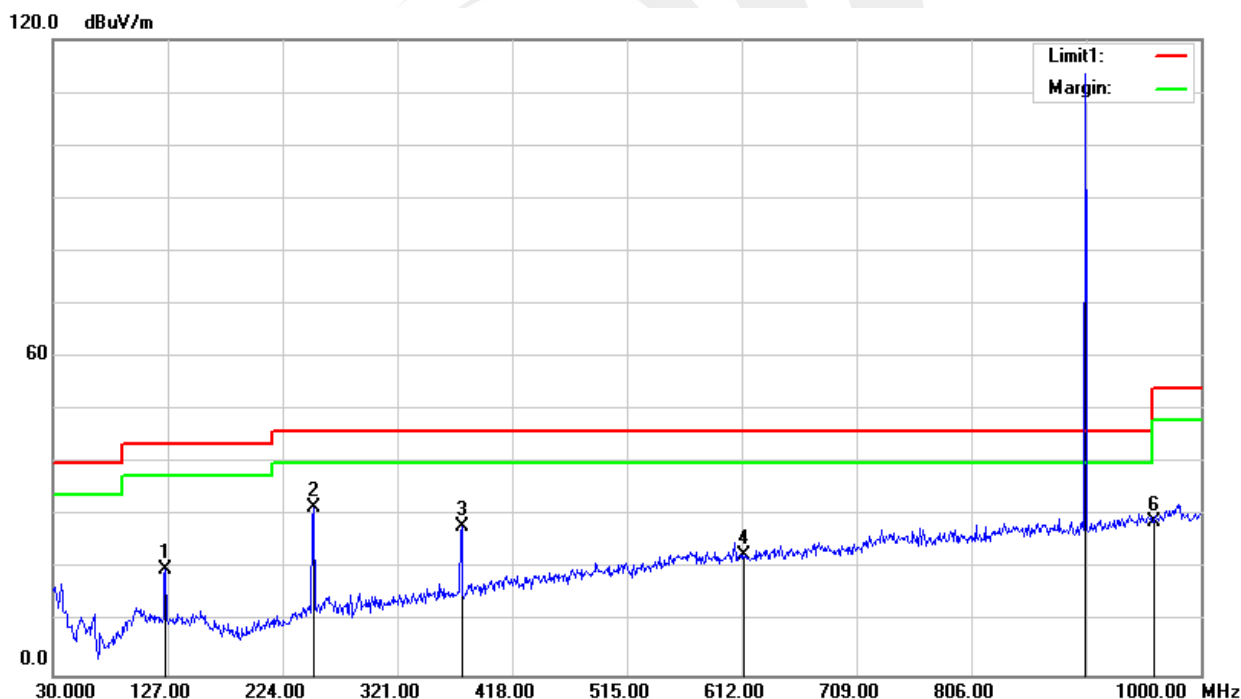


Temperature:	23.2(C)	Relative Humidity:	61%RH
Test Voltage:	DC 48V	Phase:	Vertical
Test Mode:	Mode 1		

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	125.0600	38.19	-18.22	19.97	43.50	-23.53	QP
2	250.1900	47.65	-16.10	31.55	46.00	-14.45	QP
3	375.3200	40.49	-12.37	28.12	46.00	-17.88	QP
4	614.0000	28.25	-5.50	22.75	46.00	-23.25	QP
5	902.7500	114.01	-0.38	113.63	46.00	67.63	peak
6	960.0000	27.15	1.76	28.91	46.00	-17.09	QP

Remark:

1. $\text{Margin} = \text{Result} (\text{Result} = \text{Reading} + \text{Factor}) - \text{Limit}$
2. $\text{Factor} = \text{Antenna factor} + \text{Cable attenuation factor} (\text{cable loss}) - \text{Amplifier gain}$





Temperature:	23.2(C)	Relative Humidity:	61%RH
Test Voltage:	DC 48V	Phase:	Horizontal
Test Mode:	Mode 2		

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	125.0600	42.17	-18.22	23.95	43.50	-19.55	QP
2	250.1900	45.29	-16.10	29.19	46.00	-16.81	QP
3	555.7400	29.60	-5.60	24.00	46.00	-22.00	QP
4	614.0000	27.73	-5.50	22.23	46.00	-23.77	QP
5	914.7500	113.54	-0.10	113.44	46.00	67.44	peak
6	960.0000	28.22	1.76	29.98	46.00	-16.02	QP

Remark:

3. Margin = Result (Result = Reading + Factor) - Limit

4. Factor = Antenna factor + Cable attenuation factor (cable loss) - Amplifier gain





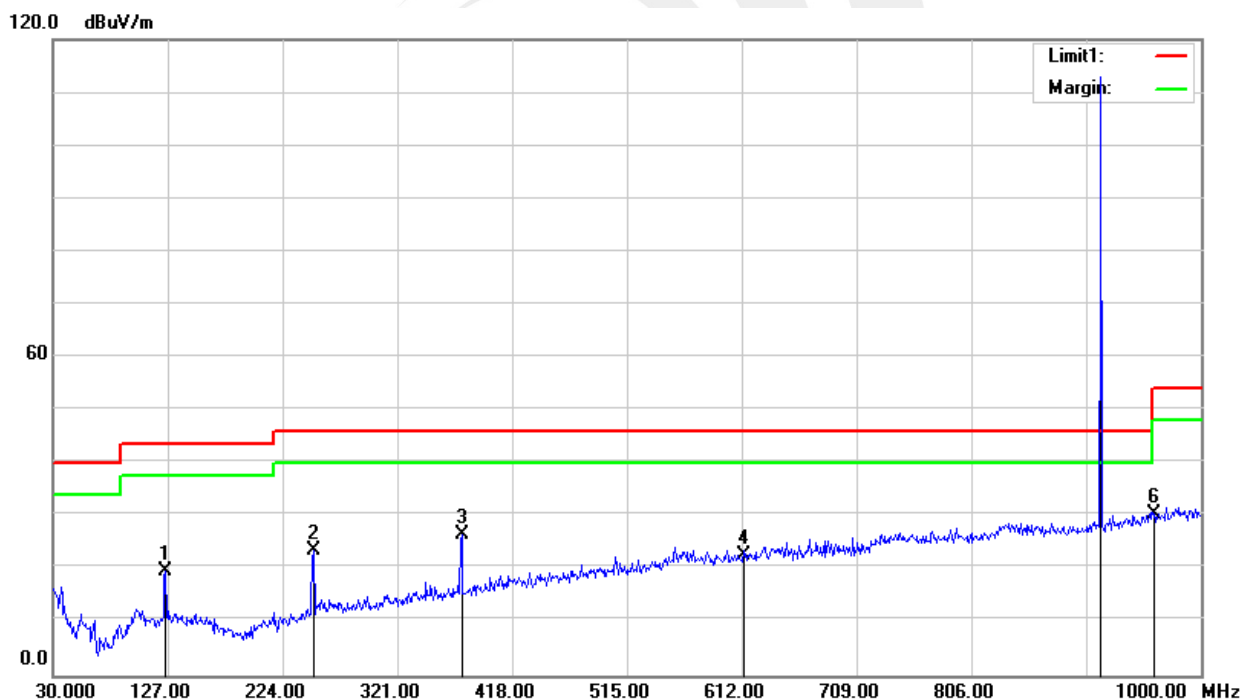
Temperature:	23.2(C)	Relative Humidity:	61%RH
Test Voltage:	DC 48V	Phase:	Vertical
Test Mode:	Mode 2		

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	125.0600	37.74	-18.22	19.52	43.50	-23.98	QP
2	250.1900	39.73	-16.10	23.63	46.00	-22.37	QP
3	375.3200	39.06	-12.37	26.69	46.00	-19.31	QP
4	614.0000	28.13	-5.50	22.63	46.00	-23.37	QP
5	914.7500	113.13	-0.10	113.03	46.00	67.03	peak
6	960.0000	28.72	1.76	30.48	46.00	-15.52	QP

Remark:

3. Margin = Result (Result =Reading + Factor)-Limit

4. Factor= Antenna factor+Cable attenuation factor(cable loss)-Amplifier gain





Temperature:	23.2(C)	Relative Humidity:	61%RH
Test Voltage:	DC 48V	Phase:	Horizontal
Test Mode:	Mode 3		

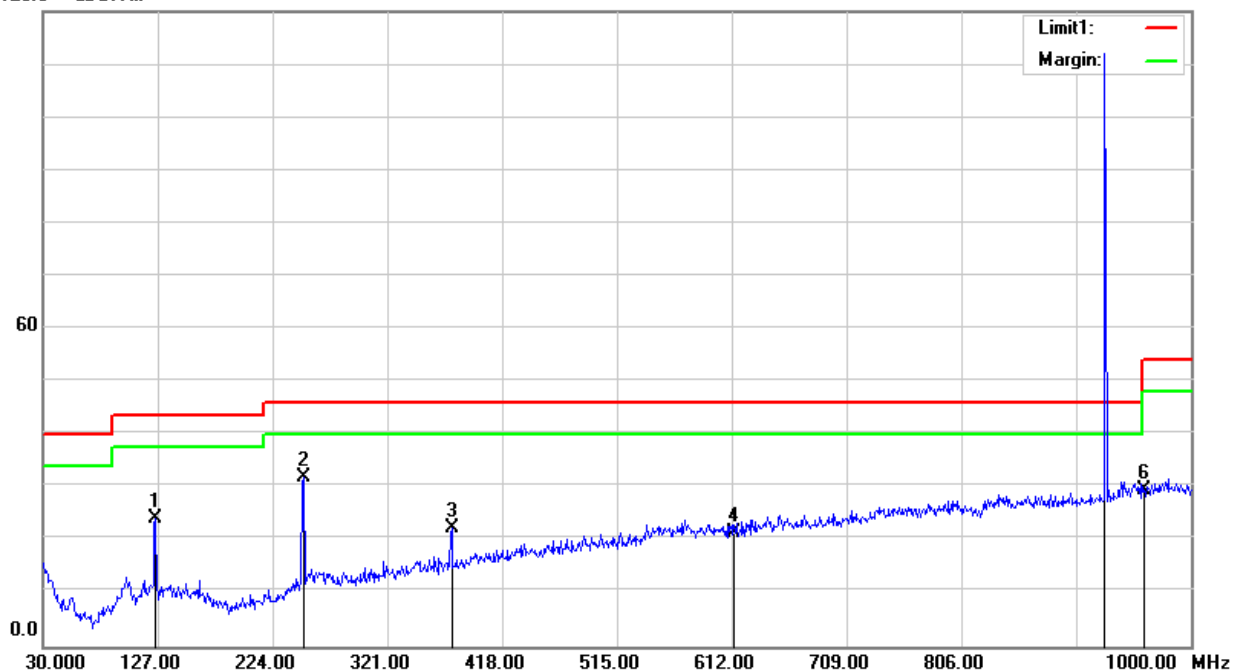
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	125.0600	42.34	-18.22	24.12	43.50	-19.38	QP
2	250.1900	48.16	-16.10	32.06	46.00	-13.94	QP
3	375.3200	34.58	-12.37	22.21	46.00	-23.79	QP
4	614.0000	27.01	-5.50	21.51	46.00	-24.49	QP
5	927.2500	111.51	0.39	111.90	46.00	65.90	peak
6	960.0000	27.87	1.76	29.63	46.00	-16.37	QP

Remark:

5. Margin = Result (Result = Reading + Factor) - Limit

6. Factor= Antenna factor+Cable attenuation factor(cable loss)-Amplifier gain

120.0 dBuV/m





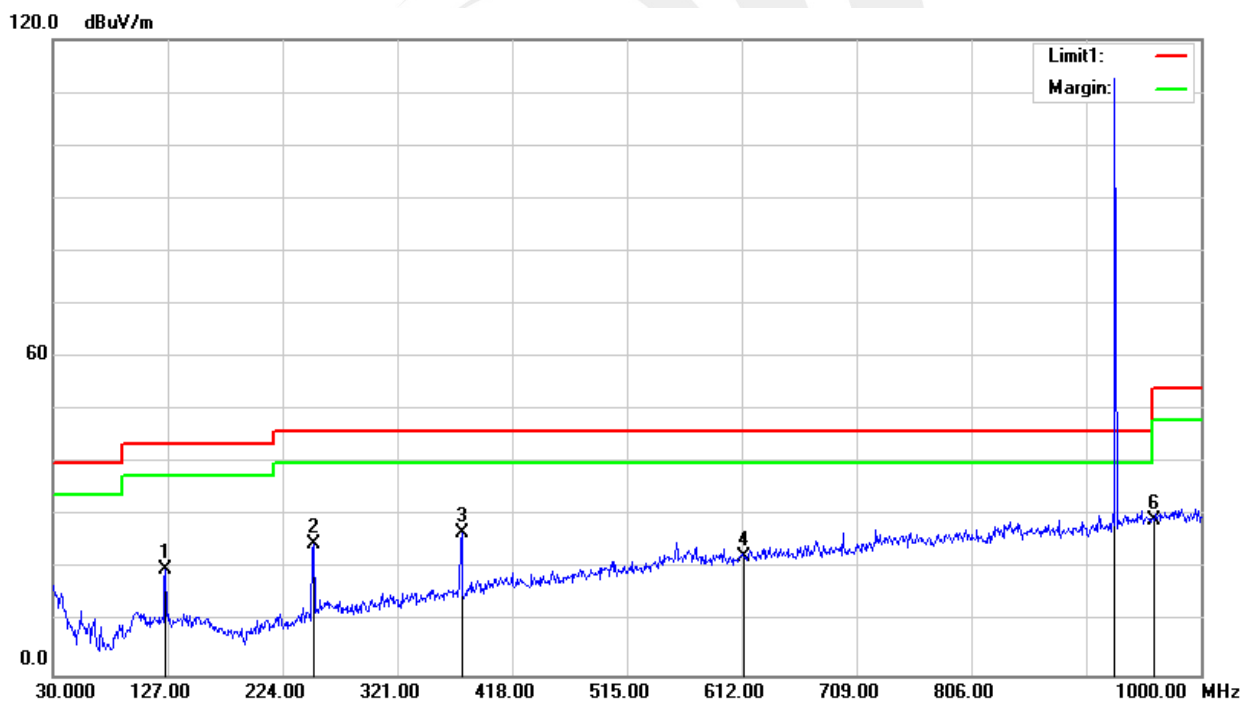
Temperature:	23.2(C)	Relative Humidity:	61%RH
Test Voltage:	DC 48V	Phase:	Vertical
Test Mode:	Mode 3		

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	125.0600	38.09	-18.22	19.87	43.50	-23.63	QP
2	250.1900	40.80	-16.10	24.70	46.00	-21.30	QP
3	375.3200	39.28	-12.37	26.91	46.00	-19.09	QP
4	614.0000	27.74	-5.50	22.24	46.00	-23.76	QP
5	927.2500	112.35	0.39	112.74	46.00	66.74	peak
6	960.0000	27.49	1.76	29.25	46.00	-16.75	QP

Remark:

5. Margin = Result (Result =Reading + Factor)-Limit

6. Factor= Antenna factor+Cable attenuation factor(cable loss)-Amplifier gain





(1GHz~25GHz) Spurious emission Requirements

Frequency	Meter Reading	Amplifier	Loss	Antenna Factor	Orrected Factor	Emission Level	Limits	Margin	Detector	Comment
(MHz)	(dBμV)	(dB)	(dB)	(dB/m)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	Type	
Low Channel (902.75 MHz)										
1227.03	62.10	44.70	6.70	28.20	-9.80	52.30	74.00	-21.70	PK	Vertical
1227.03	50.17	44.70	6.70	28.20	-9.80	40.37	54.00	-13.63	AV	Vertical
1226.95	61.53	44.70	6.70	28.20	-9.80	51.73	74.00	-22.27	PK	Horizontal
1226.95	50.75	44.70	6.70	28.20	-9.80	40.95	54.00	-13.05	AV	Horizontal
1805.64	59.59	44.20	9.04	31.60	-3.56	56.03	74.00	-17.97	PK	Vertical
1805.64	50.19	44.20	9.04	31.60	-3.56	46.63	54.00	-7.37	AV	Vertical
1805.66	59.54	44.20	9.04	31.60	-3.56	55.98	74.00	-18.02	PK	Horizontal
1805.66	49.28	44.20	9.04	31.60	-3.56	45.72	54.00	-8.28	AV	Horizontal
2014.41	48.37	44.20	9.86	32.00	-2.34	46.03	74.00	-27.97	PK	Vertical
2014.41	40.27	44.20	9.86	32.00	-2.34	37.93	54.00	-16.07	AV	Vertical
2014.32	47.15	44.20	9.86	32.00	-2.34	44.81	74.00	-29.19	PK	Horizontal
2014.32	39.00	44.20	9.86	32.00	-2.34	36.66	54.00	-17.34	AV	Horizontal
2708.19	54.64	43.50	11.40	35.50	3.40	58.04	74.00	-15.96	PK	Vertical
2708.19	43.85	43.50	11.40	35.50	3.40	47.25	54.00	-6.75	AV	Vertical
2708.22	54.20	43.50	11.40	35.50	3.40	57.60	74.00	-16.40	PK	Horizontal
2708.22	43.79	43.50	11.40	35.50	3.40	47.19	54.00	-6.81	AV	Horizontal
Middle Channel (914.75 MHz)										
1223.47	62.09	44.70	6.70	28.20	-9.80	52.29	74.00	-21.71	PK	Vertical
1223.47	50.41	44.70	6.70	28.20	-9.80	40.61	54.00	-13.39	AV	Vertical
1223.39	61.75	44.70	6.70	28.20	-9.80	51.95	74.00	-22.05	PK	Horizontal
1223.39	51.07	44.70	6.70	28.20	-9.80	41.27	54.00	-12.73	AV	Horizontal
1829.66	58.73	44.20	9.04	31.60	-3.56	55.17	74.00	-18.83	PK	Vertical
1829.66	49.68	44.20	9.04	31.60	-3.56	46.12	54.00	-7.88	AV	Vertical
1829.67	58.88	44.20	9.04	31.60	-3.56	55.32	74.00	-18.68	PK	Horizontal
1829.67	50.02	44.20	9.04	31.60	-3.56	46.46	54.00	-7.54	AV	Horizontal
2008.50	49.09	44.20	9.86	32.00	-2.34	46.75	74.00	-27.25	PK	Vertical
2008.50	39.82	44.20	9.86	32.00	-2.34	37.48	54.00	-16.52	AV	Vertical
2008.53	47.75	44.20	9.86	32.00	-2.34	45.41	74.00	-28.59	PK	Horizontal
2008.53	38.79	44.20	9.86	32.00	-2.34	36.45	54.00	-17.55	AV	Horizontal
2744.61	54.48	43.50	11.40	35.50	3.40	57.88	74.00	-16.12	PK	Vertical
2744.61	44.27	43.50	11.40	35.50	3.40	47.67	54.00	-6.33	AV	Vertical
2744.59	54.30	43.50	11.40	35.50	3.40	57.70	74.00	-16.30	PK	Horizontal
2744.59	43.73	43.50	11.40	35.50	3.40	47.13	54.00	-6.87	AV	Horizontal



High Channel (927.25 MHz)										
1220.71	62.29	44.70	6.70	28.20	-9.80	52.49	74.00	-21.51	PK	Vertical
1220.71	51.73	44.70	6.70	28.20	-9.80	41.93	54.00	-12.07	AV	Vertical
1220.63	62.25	44.70	6.70	28.20	-9.80	52.45	74.00	-21.55	PK	Horizontal
1220.63	50.04	44.70	6.70	28.20	-9.80	40.24	54.00	-13.76	AV	Horizontal
1854.67	59.08	44.20	9.04	31.60	-3.56	55.52	74.00	-18.48	PK	Vertical
1854.67	49.97	44.20	9.04	31.60	-3.56	46.41	54.00	-7.59	AV	Vertical
1854.67	58.68	44.20	9.04	31.60	-3.56	55.12	74.00	-18.88	PK	Horizontal
1854.67	49.87	44.20	9.04	31.60	-3.56	46.31	54.00	-7.69	AV	Horizontal
2003.99	48.68	44.20	9.86	32.00	-2.34	46.34	74.00	-27.66	PK	Vertical
2003.99	39.90	44.20	9.86	32.00	-2.34	37.56	54.00	-16.44	AV	Vertical
2003.93	47.39	44.20	9.86	32.00	-2.34	45.05	74.00	-28.95	PK	Horizontal
2003.93	39.01	44.20	9.86	32.00	-2.34	36.67	54.00	-17.33	AV	Horizontal
2781.72	54.71	43.50	11.40	35.50	3.40	58.11	74.00	-15.89	PK	Vertical
2781.72	44.48	43.50	11.40	35.50	3.40	47.88	54.00	-6.12	AV	Vertical
2781.73	54.63	43.50	11.40	35.50	3.40	58.03	74.00	-15.97	PK	Horizontal
2781.73	43.62	43.50	11.40	35.50	3.40	47.02	54.00	-6.98	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.

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 Hode

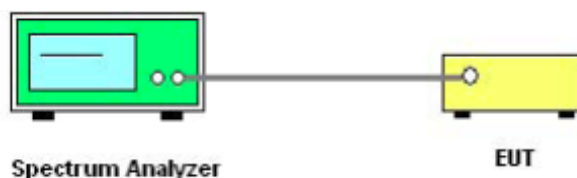
For Band edge

Spectrum Parameter	Setting
Detector	Peak
Start/Stop Frequency	Lower Band Edge: 850– 905 MHz Upper Band Edge: 926 – 950 MHz
RB / VB (emission in restricted band)	100 KHz/300 KHz
Trace-Mode:	Max Hode

For Hopping Band edge

Spectrum Parameter	Setting
Detector	Peak
Start/Stop Frequency	Lower Band Edge: 890– 903 MHz Upper Band Edge: 927 – 935 MHz
RB / VB (emission in restricted band)	100 KHz/300 KHz
Trace-Mode:	Max Hode

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

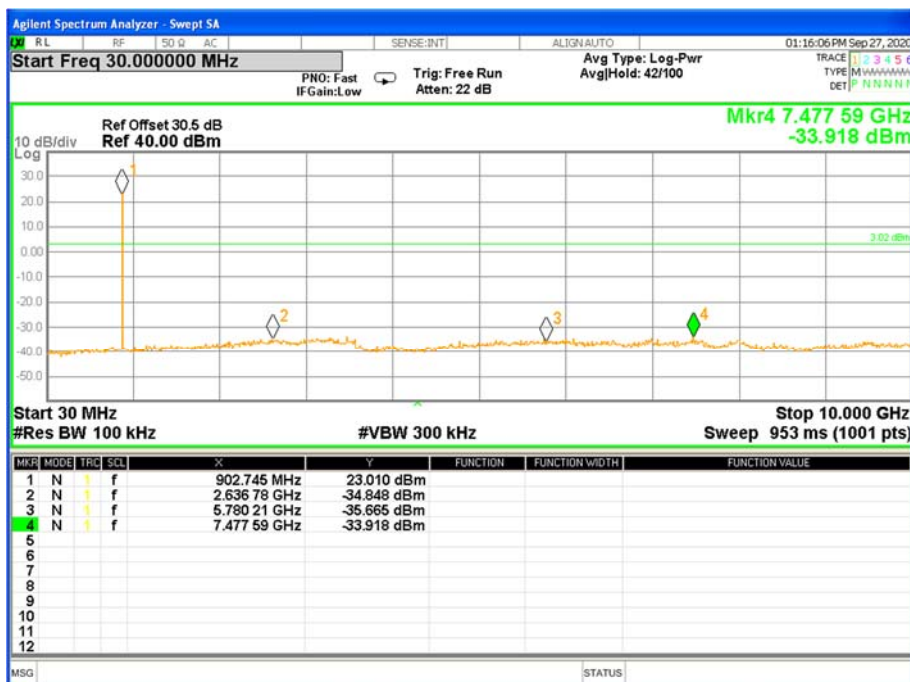
The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.



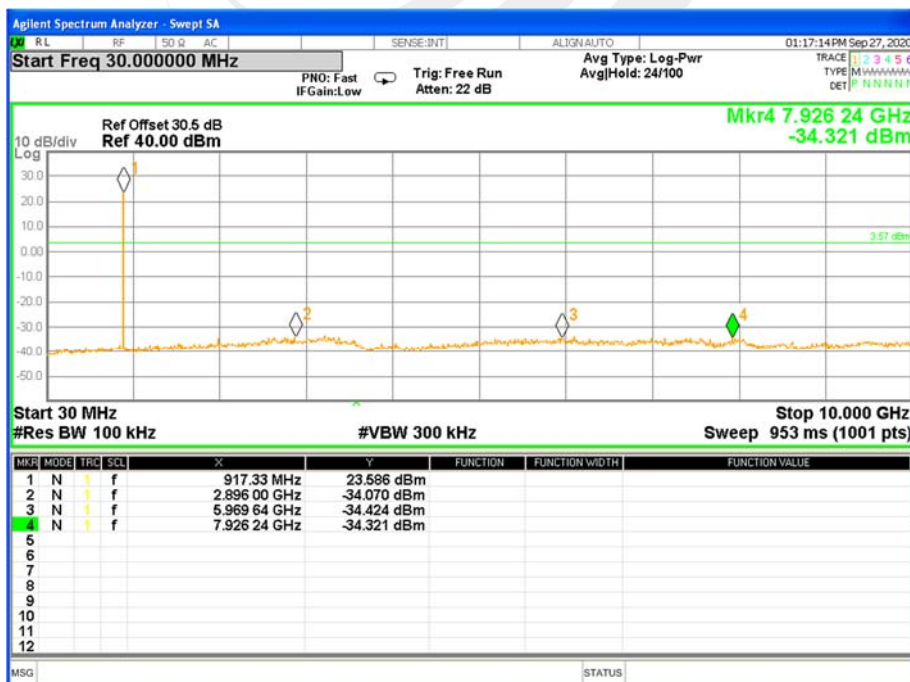
4.5 TEST RESULTS

Temperature:	25°C	Relative Humidity:	50%
Test Mode:	ASK-00/24/49 CH	Test Voltage:	DC 48V

00 CH

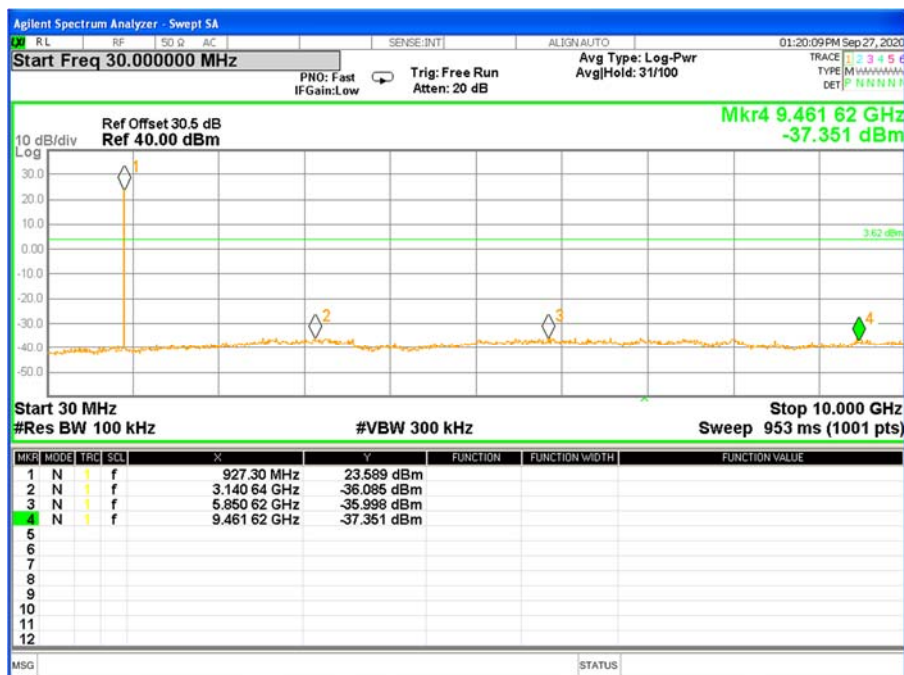


24 CH





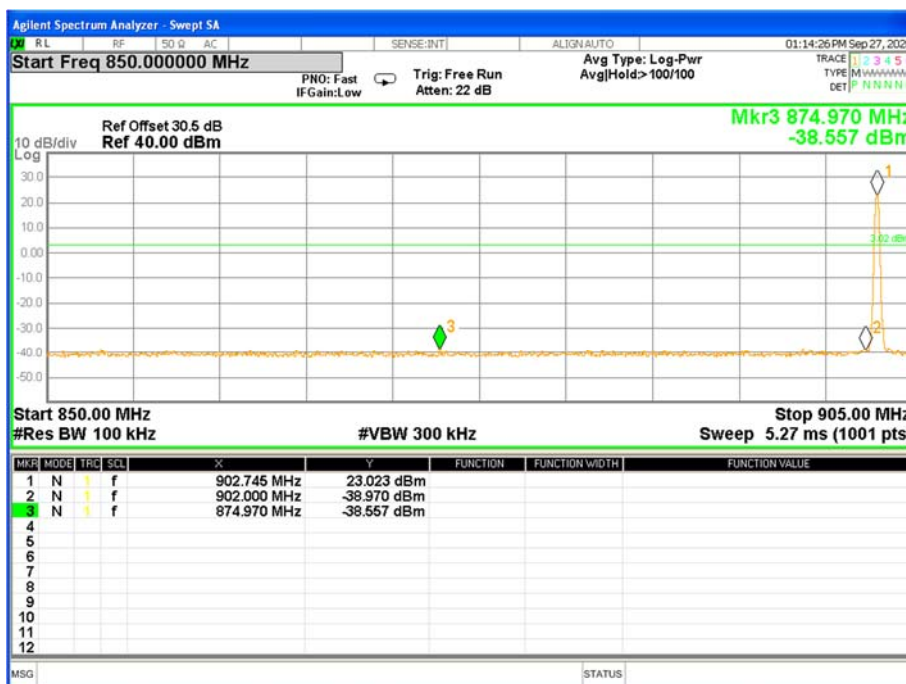
49 CH



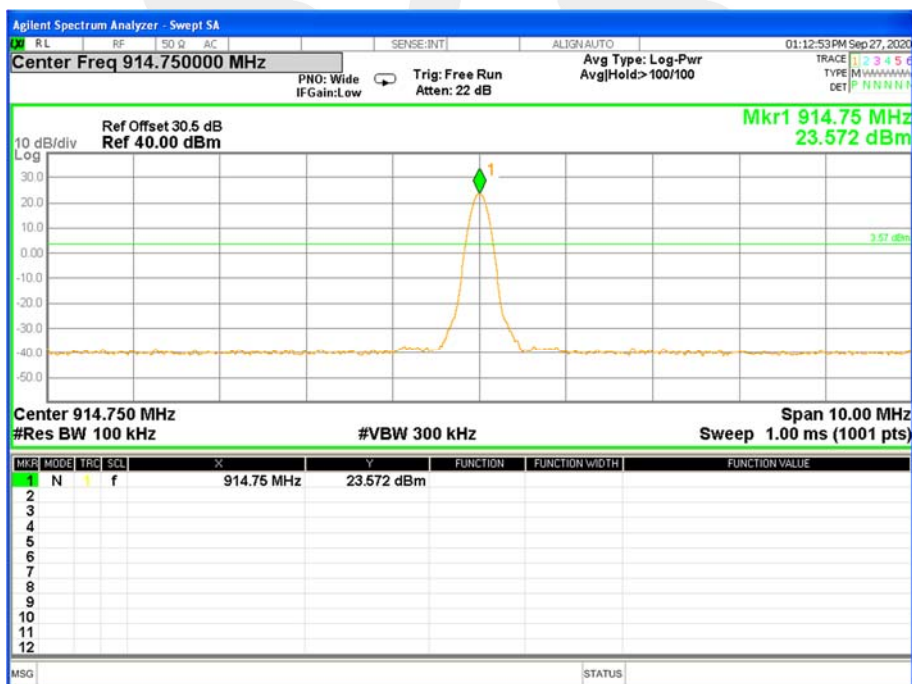


For Band edge(it's also the reference level for conducted spurious emission)

00 CH

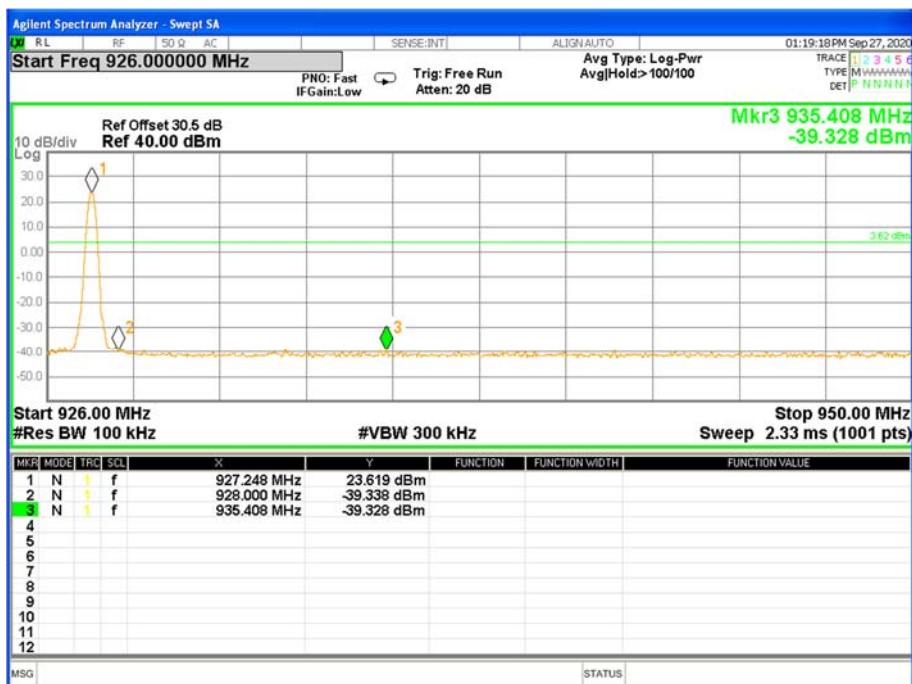


24 CH





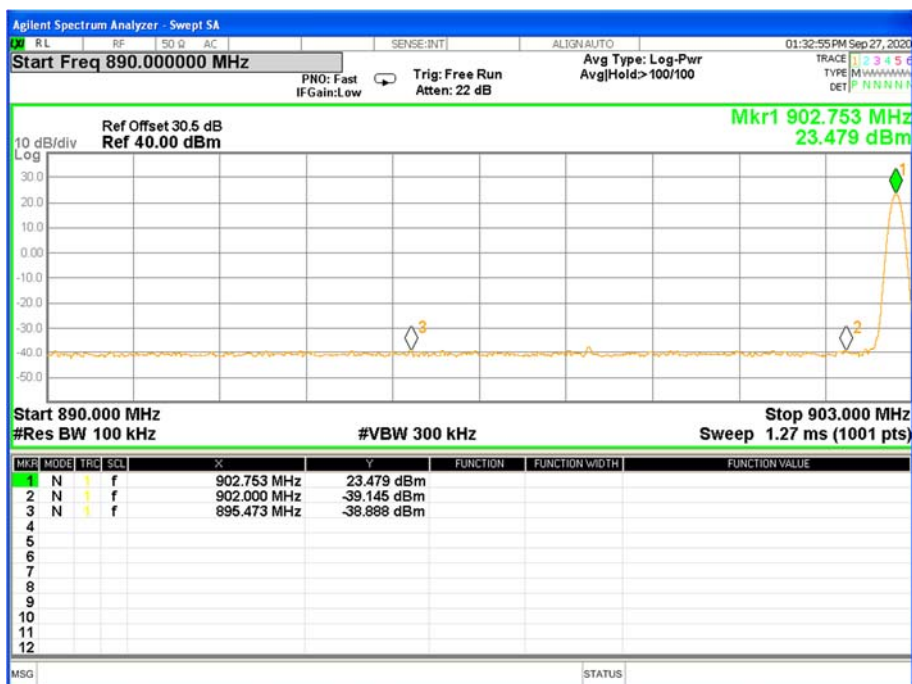
49 CH





For Hopping Band edge

00 CH



49 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.

EUT 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50.

Spectrum Parameters	Setting
Attenuation	Auto
Span Frequency	> Operating FrequencyRange
RB	91KHz
VB	270KHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

5.2 TEST PROCEDURE

- The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- Spectrum Setting: RBW= 91KHz, VBW=270KHz, 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.

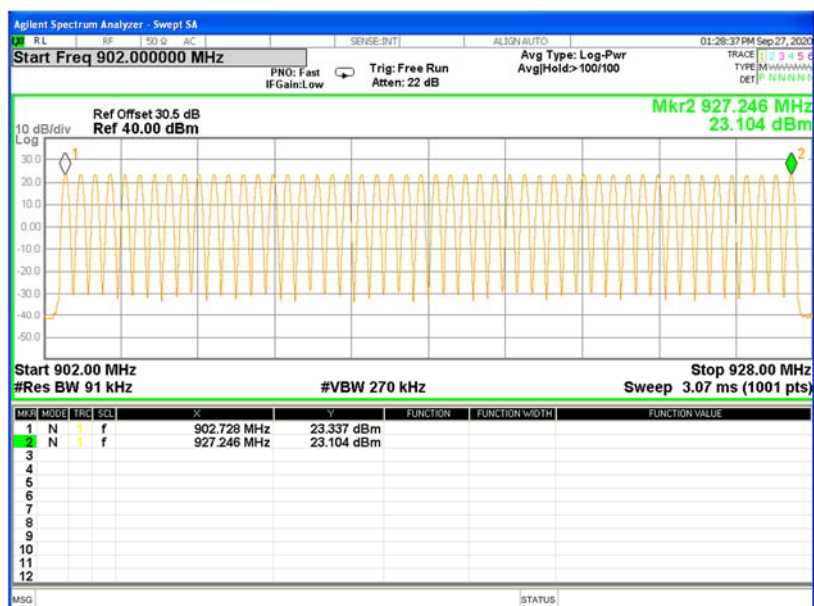


5.5 TEST RESULTS

Temperature:	25°C	Relative Humidity:	60%
Test Mode:	Hopping Mode -ASK Mode	Test Voltage:	DC 48V

Number of Hopping Channel: 50

Hopping channel





6. AVERAGE TIME OF OCCUPANCY

6.1 LIMIT

FCC Part 15.247, Subpart C				
Section	Test Item	Limit	FrequencyRange (MHz)	Result
15.247 (a)(1)(i)	Average Time of Occupancy	< 0.4sec	902-928	PASS

6.2 TEST PROCEDURE

- The transmitter output (antenna port) was connected to the spectrum analyzer.
- Set RBW =180KHz/VBW =510KHz.
- Use a video trigger with the trigger level set to enable triggering only on full pulses.
- Sweep Time is 20 second.
- Set the center frequency on any frequency would be measure and set the frequency span to zero span.
- Measure the maximum time duration of one single pulse.

6.3 TEST SETUP



6.4 EUT OPERATION CONDITIONS

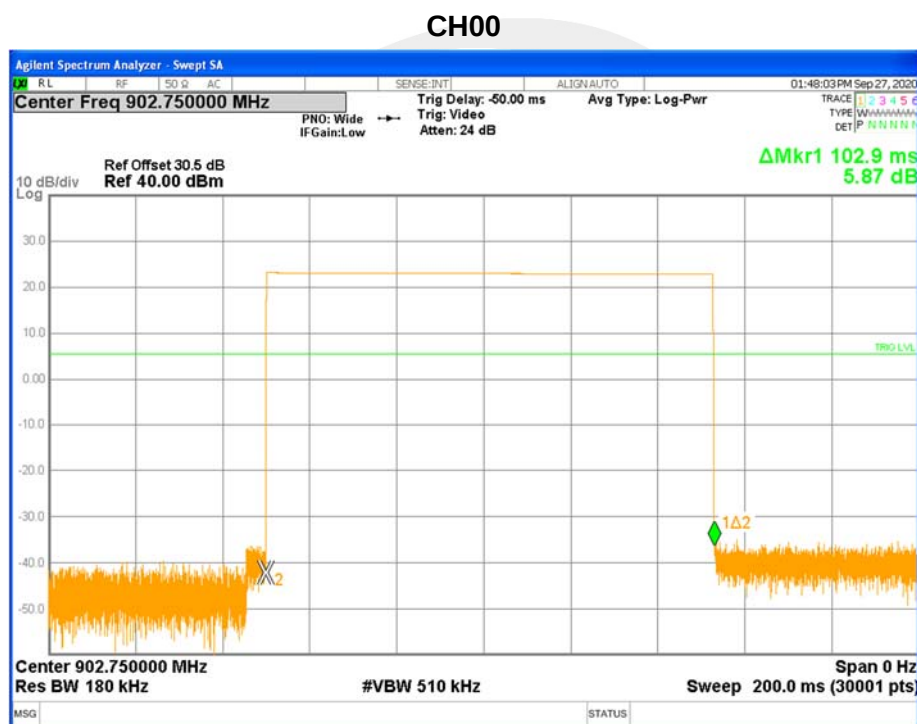
The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

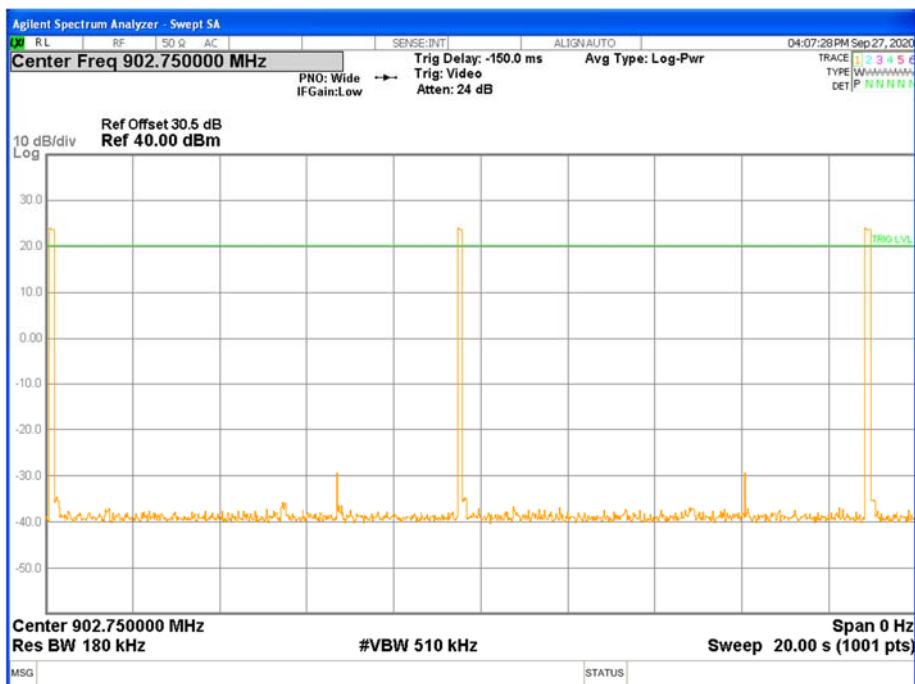


6.5 TEST RESULTS

Temperature:	25°C	Relative Humidity:	50%
Test Mode:	ASK	Test Voltage:	DC 48V

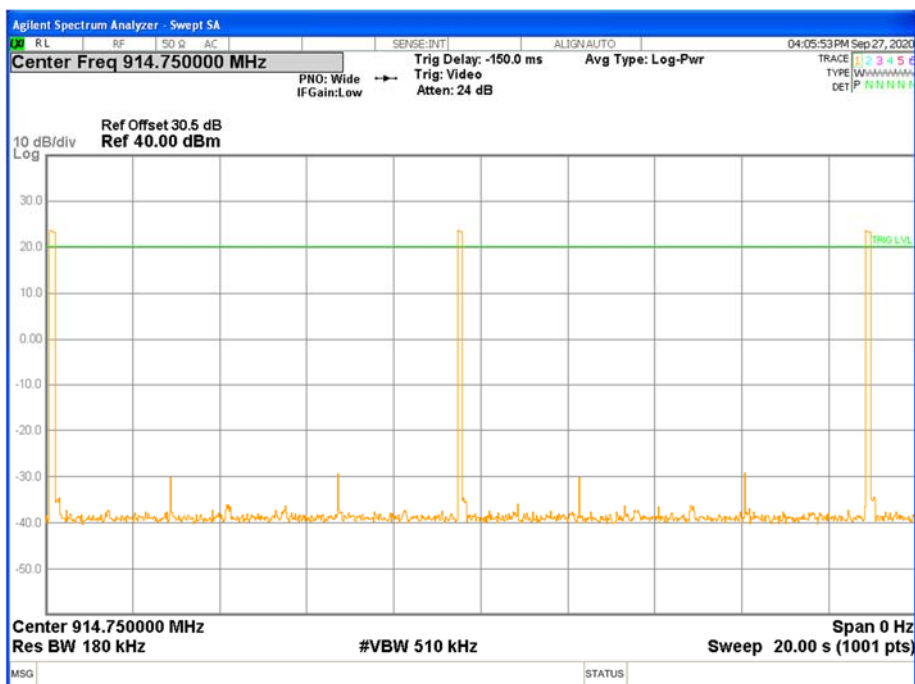
Modulation	Channel	Frequency (MHz)	pulse time(ms)	Number of pulses	Dwell Time(s)	Limits(s)
ASK	Low	902.75	102.900	3	0.309	0.4
	Middle	914.75	102.900	3	0.309	0.4
	High	927.25	103.000	3	0.309	0.4



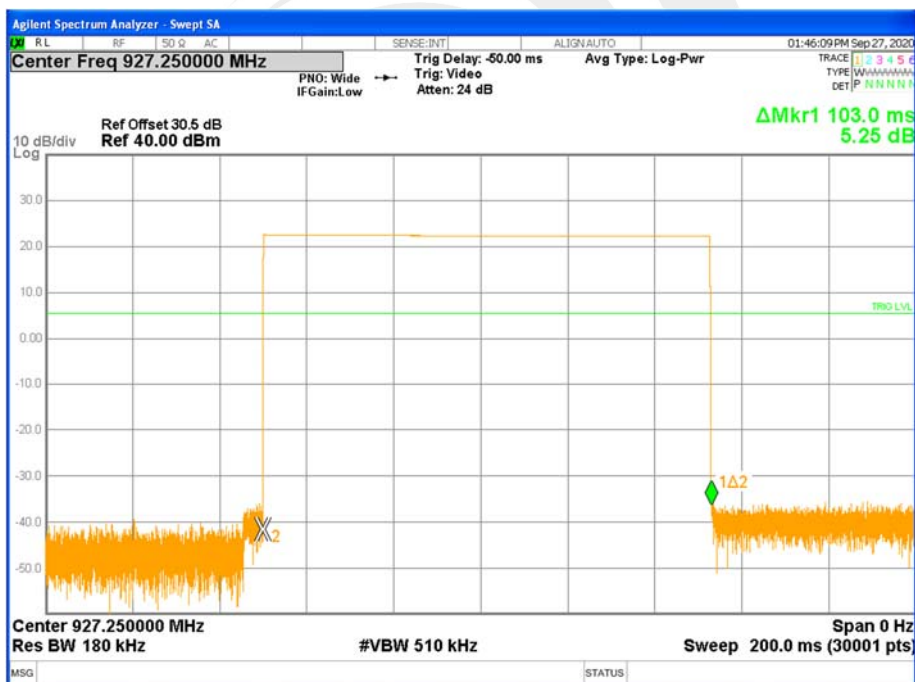


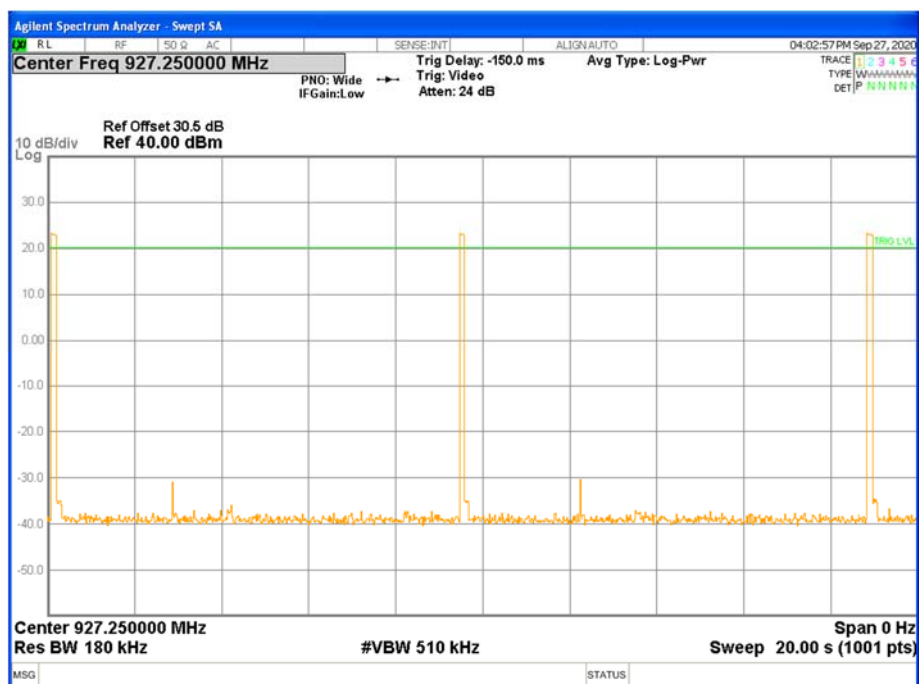
CH24





CH49





7. HOPPING CHANNEL SEPARATION MEASUREMENT

7.1 LIMIT

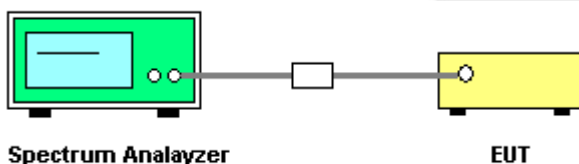
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

Spectrum Parameter	Setting
Attenuation	Auto
Span	1MHz
RB	150KHz
VB	470 kHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

7.2 TEST PROCEDURE

- The transmitter output (antenna port) was connected to the spectrum analyser in peak hold mode.
- Spectrum Setting: RBW= 150KHz, VBW= 470KHz, 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:	CH00 / CH24 / CH49	Test Voltage:	DC 48V

Frequency	Mark1 Frequency (MHz)	Mark2 Frequency (MHz)	Ch. Separation (MHz)	Limit (MHz)	Result
902.75MHz	902.750	903.250	0.500	0.0912	Complies
914.75 MHz	914.750	915.250	0.500	0.0915	Complies
927.25 MHz	926.750	927.250	0.500	0.0912	Complies

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

CH00





CH24



CH49





8. BANDWIDTH TEST

8.1 LIMIT

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

Spectrum Parameter	Setting
Attenuation	Auto
Span	200KHz
RB	3 kHz
VB	10 kHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

8.2 TEST PROCEDURE

- The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- 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.

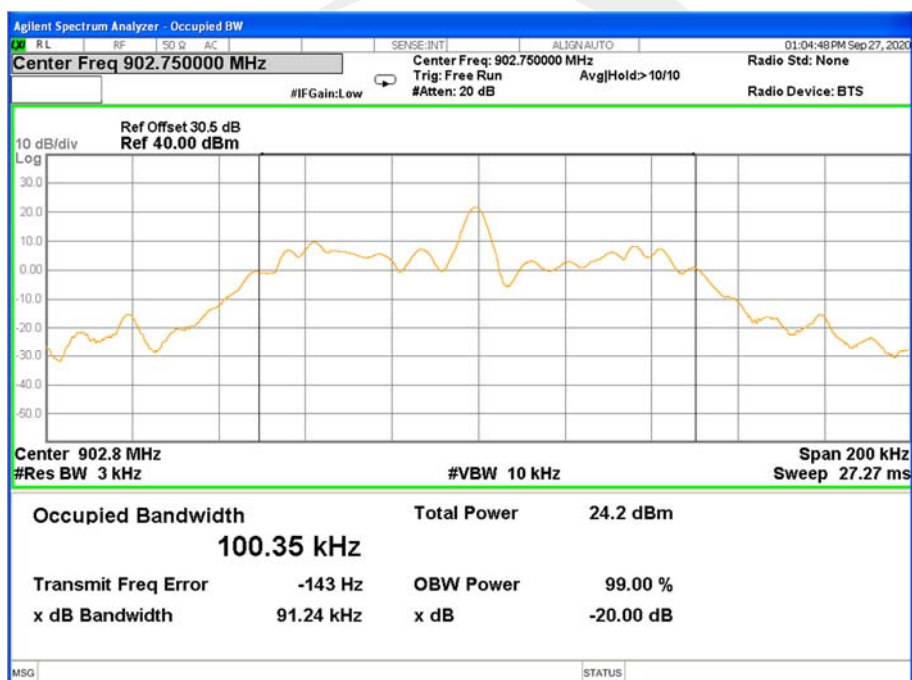


8.5 TEST RESULTS

Temperature:	25°C	Relative Humidity:	50%
Test Mode:	CH00 / CH24 / CH49	Test Voltage:	DC 48V

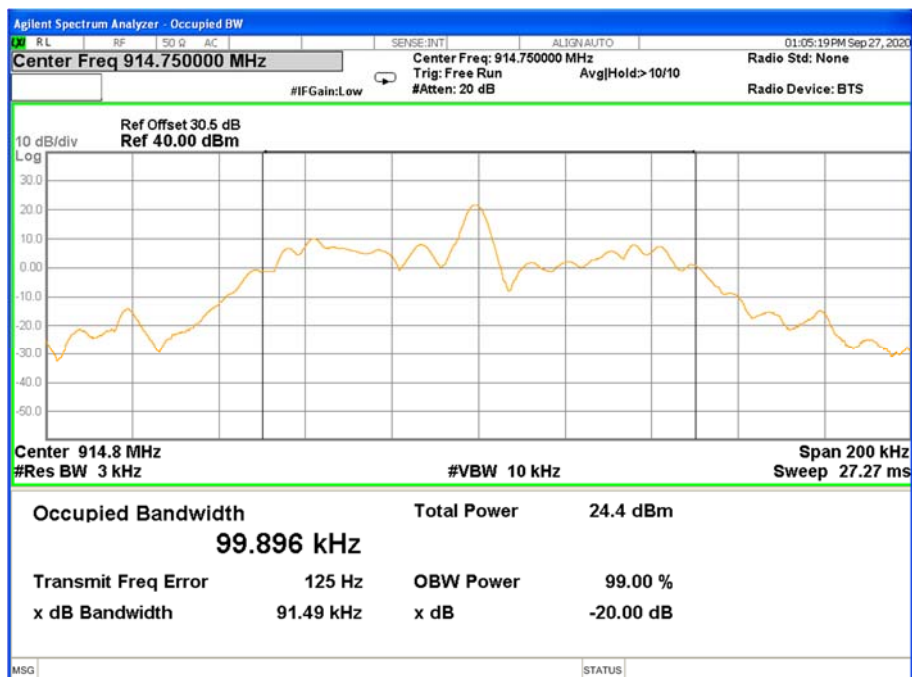
Frequency	20dB Bandwidth (MHz)	Result
902.75 MHz	0.0912	PASS
914.75 MHz	0.0915	PASS
927.25 MHz	0.0912	PASS

CH00

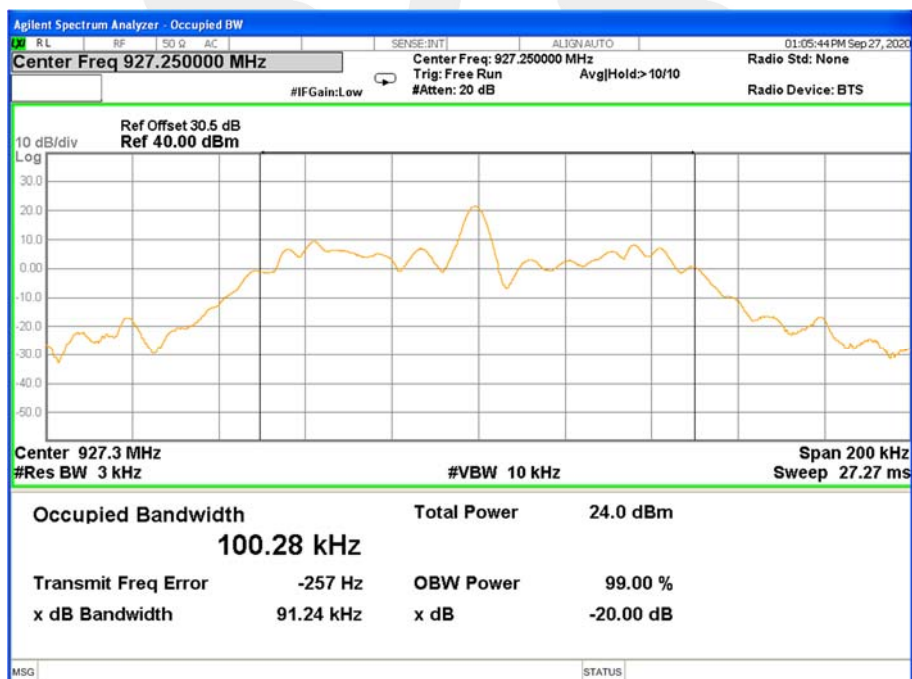




CH24



CH49





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: AV.

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.

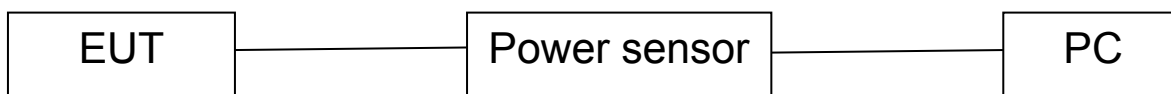
e) A plot of the test results and setup description shall be included in the test report.

NOTE—A av 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.

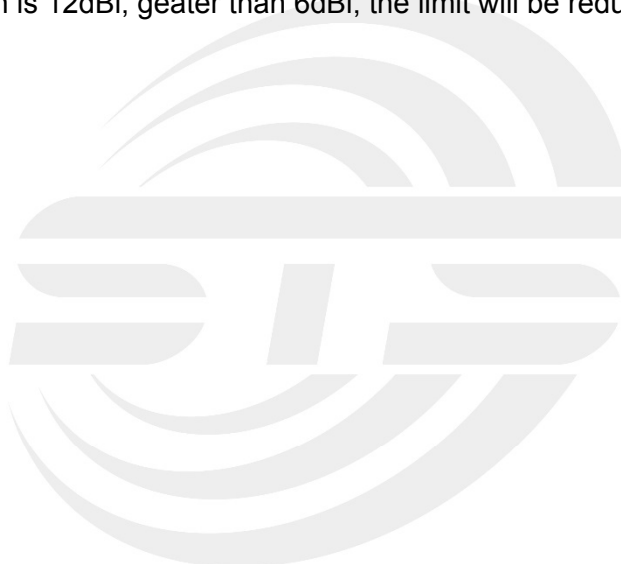


9.5 TEST RESULTS

Temperature:	25°C	Relative Humidity:	60%
Test Voltage:	DC 48V		

Channel Number	Frequency (MHz)	Peak Power	Average Power	Limit
		(dBm)	(dBm)	(dBm)
0	902.75	23.89	20.88	24.00
24	914.75	23.71	20.69	24.00
49	927.25	23.63	20.57	24.00

Note: The antenna gain is 12dBi, geater than 6dBi, the limit will be reduced by 6dBi.





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 Flat Panel Antenna. It comply with the standard requirement.





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※※※※※

