



RADIO TEST REPORT

Report No.: STS2008346W01

Issued for

STAR SYSTEMS INTERNATIONAL LIMITED

UNIT 7B, 8/F VANTA INDUSTRIAL CENTRE, 21-33 TAI LIN
PAI ROAD, KWAI CHUNG, HK

Product Name:	INTEGRATED READER
Brand Name:	TARVOS
Model Name:	HRD27009
Series Model:	N/A
FCC ID:	2AA7KTARVOSHRD27000
IC:	20068-TARVOS27000
Test Standard:	FCC Part 15.247 RSS-247 Issue 2, February 2017

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.

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: STAR SYSTEMS INTERNATIONAL LIMITED
Address: UNIT 7B, 8/F VANTA INDUSTRIAL CENTRE, 21-33 TAI LIN PAI ROAD, KWAI CHUNG, HK
Manufacturer's Name: STAR SYSTEMS INTERNATIONAL LIMITED
Address: UNIT 7B, 8/F VANTA INDUSTRIAL CENTRE, 21-33 TAI LIN PAI ROAD, KWAI CHUNG, HK

Product Description

Product Name: INTEGRATED READER
Brand Name: TARVOS
Model Name: HRD27009
Series Model: N/A
Test Standards: FCC Part15.247
RSS-247 Issue 2, February 2017
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/IC 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.....: 26 May 2020
Date (s) of performance of tests.: 26 May 2020 ~ 30 June 2020
01 Sept. 2020 ~ 28 Sept. 2020
Date of Issue: 28 Sept. 2020
Test Result: Pass

Testing Engineer :

(Chris Chen)

Technical Manager :

(Sean she)

Authorized Signatory :

(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
2.4 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED	11
2.5 DESCRIPTION OF NECESSARY ACCESSORIES AND SUPPORT UNITS	12
2.7 EQUIPMENTS LIST	13
3. EMC EMISSION TEST	14
3.1 CONDUCTED EMISSION MEASUREMENT	14
3.2 RADIATED EMISSION MEASUREMENT	18
4. CONDUCTED SPURIOUS & BAND EDGE EMISSION	39
4.1 LIMIT	39
4.2 TEST PROCEDURE	39
4.3 TEST SETUP	39
4.4 EUT OPERATION CONDITIONS	39
4.5 TEST RESULTS	40
5. NUMBER OF HOPPING CHANNEL	50
5.1 LIMIT	50
5.2 TEST PROCEDURE	50
5.3 TEST SETUP	50
5.4 EUT OPERATION CONDITIONS	50
5.5 TEST RESULTS	51
6. AVERAGE TIME OF OCCUPANCY	53
6.1 LIMIT	53
6.2 TEST PROCEDURE	53
6.3 TEST SETUP	53
6.4 EUT OPERATION CONDITIONS	53
6.5 TEST RESULTS	54
7. HOPPING CHANNEL SEPARATION MEASUREMENT	61
7.1 LIMIT	61



Table of Contents	Page
7.2 TEST PROCEDURE	61
7.3 TEST SETUP	61
7.4 EUT OPERATION CONDITIONS	61
7.5 TEST RESULTS	62
8. BANDWIDTH TEST	66
8.1 LIMIT	66
8.2 TEST PROCEDURE	66
8.3 TEST SETUP	66
8.4 EUT OPERATION CONDITIONS	66
8.5 TEST RESULTS	67
9. OUTPUT POWER TEST	71
9.1 LIMIT	71
9.2 TEST PROCEDURE	71
9.3 TEST SETUP	71
9.4 EUT OPERATION CONDITIONS	71
9.5 TEST RESULTS	72
10. ANTENNA REQUIREMENT	73
10.1 STANDARD REQUIREMENT	73
10.2 EUT ANTENNA	73
11. FREQUENCY STABILITY	74
11.1 LIMITS OF FREQUENCY STABILITY MEASUREMENT	74
11.2 TEST PROCEDURE	74
11.3 TEST RESULT	74
12. RF EXPOSURE COMPLIANCE	76
12.1 LIMIT	76
12.2 RESULT	77

**Revision History**

Rev.	Issue Date	Report No.	Effect Page	Contents
00	30 June 2020	STS2005237W01	ALL	Initial Issue
00	28 Sept. 2020	STS2008346W01	ALL	Updated antenna and Radiated test data.





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 RSS-247 Issue 2, February 2017			
Standard Section	Test Item	Judgement	Remark
15.207 RSS-Gen 8.8	Conducted Emission	PASS	--
15.247(a)(1) RSS-247 5.1(b)	Hopping Channel Separation	PASS	--
15.247(b)(2) RSS-247 5.4(a)	Output Power	PASS	--
15.209 RSS-247 5.5	Radiated Spurious Emission	PASS	--
15.247(d) RSS-247 5.5	Conducted Spurious & Band Edge Emission	PASS	--
15.247(a)(1)(i) RSS-247 5.1(c)	Number of Hopping Frequency	PASS	--
15.247(a)(1)(i) RSS-247 5.1(c)	Dwell Time	PASS	--
15.247(a)(1)(i) RSS-247 5.1(c)	Bandwidth	PASS	--
15.205 RSS-Gen 8.10	Restricted bands of operation	PASS	--
Part 15.247(d)/part 15.209(a) RSS-Gen 8.10	Band Edge Emission	PASS	--
15.203 RSS-Gen 8.3	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 expended 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	INTEGRATED READER
Trade Name	TARVOS
Model Name	HRD27009
Series Model	N/A
Model Difference	N/A
Channel List	Please refer to the Note 2.
RF Information	Frequency: 902~928MHz Modulation: FHSS
Antenna Type	Please refer to the Note 3.
Adapter	Input: AC 100-240V, 800mA, 50/60 Hz Output: DC 24V, 1.25A
Operation mode	Dense reader mode
	Single reader mode
Hardware version number	R5
Software version number	1.5.2.23029
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. Operation Frequency of channel

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	902.75	17	911.25	34	919.75
1	903.25	18	911.75	35	920.25
2	903.75	19	912.25	36	920.75
3	904.25	20	912.75	37	921.25
4	904.75	21	913.25	38	921.75
5	905.25	22	913.75	39	922.25
6	905.75	23	914.25	40	922.75
7	906.25	24	914.75	41	923.25
8	906.75	25	915.25	42	923.75
9	907.25	26	915.75	43	924.25
10	907.75	27	916.25	44	924.75
11	908.25	28	916.75	45	925.25
12	908.75	29	917.25	46	925.75
13	909.25	30	917.75	47	926.25
14	909.75	31	918.25	48	926.75
15	910.25	32	918.75	49	927.25
16	910.75	33	919.25		

3. Table for Filed Antenna

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	Antenna Cable loss (dB)	Antenna combination (dBi)
1	TARVOS	HRD27009	Avior	N/A	15	12	3
2	TARVOS	HRD27009	Cheetah II	N/A	12	12	0
3	TARVOS	HRD27009	Bobcat	N/A	8	12	-4
4	TARVOS	HRD27009	Kuma	N/A	10	12	-2

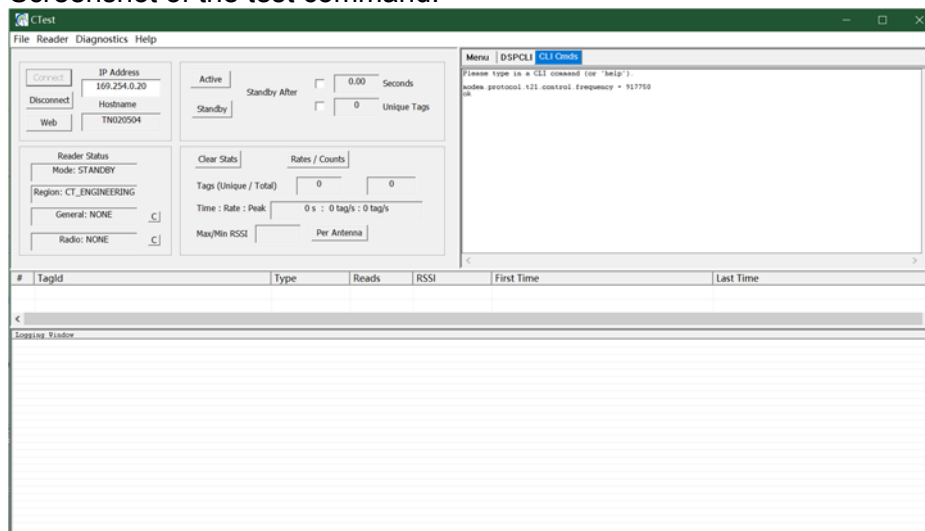
Note: All antennas have been tested for conducted emission and radiated spurious emission, but the report only shows the worst data of the Avior antenna.

4. The EUT has been programmed to continuously transmit during test by the PC via an Ethernet cable. The combination of antenna gain and antenna cable loss is 3dBi.

Power setting by the firmware is:

lowest channel=33dBm,middle channel=33dBm ,highest channel =33dBm

Screenshot of the test command:





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	Operation mode
Mode 1	CH00	Dense reader mode
Mode 2	CH25	Dense reader mode
Mode 3	CH49	Dense reader mode
Mode 4	CH00	Single reader mode
Mode 5	CH25	Single reader mode
Mode 6	CH49	Single reader mode

Note:

- (1) The measurements are performed at all Bit Rate of Transmitter, the worst data was reported.
- (2) We 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 7 : Keeping TX

2.3 TABLE OF PARAMETERS OF TEST SOFTWARE SETTING

During testing, the 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.

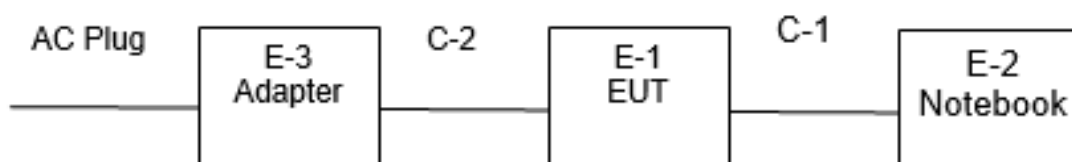


2.4 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

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
E-3	Adapter	N/A	PSAC30U-240L6	N/A	N/A
C-2	DC Cable	N/A	N/A	100cm	N/A

Support units

Item	Equipment	Mfr/Brand	Model/Type No.	Length	Note
E-2	Notebook	DELL	VOSTRO.3800	N/A	N/A
C-1	USB Cable	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.



2.7 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(1201)	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-3G Hz)	EM	EM330	060665	2019.10.09	2020.10.08
Pre-Amplifier (1G-18GHz)	SKET	LNPA-01018G-45	SK201808090 1	2019.10.12	2020.10.11
Pre-Amplifier (18G-40GHz)	SKET	LNPA-1840-50	SK201810180 1	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 Receiver	R&S	ESCI	101427	2019.10.09	2020.10.08
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	2019.10.17	2020.10.16
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	2019.10.17	2020.10.16
Test SW	FARAD	LZ-RF /LzRf-3A3			



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 Emission limit (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.

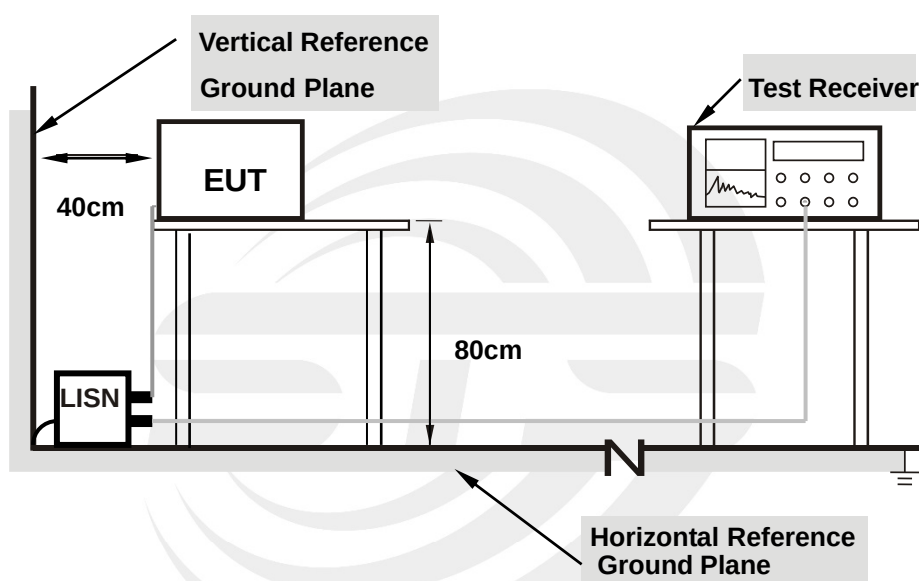
The following table is the setting of the receiver

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 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.
- 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 is at least 80 cm from the 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 support.

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

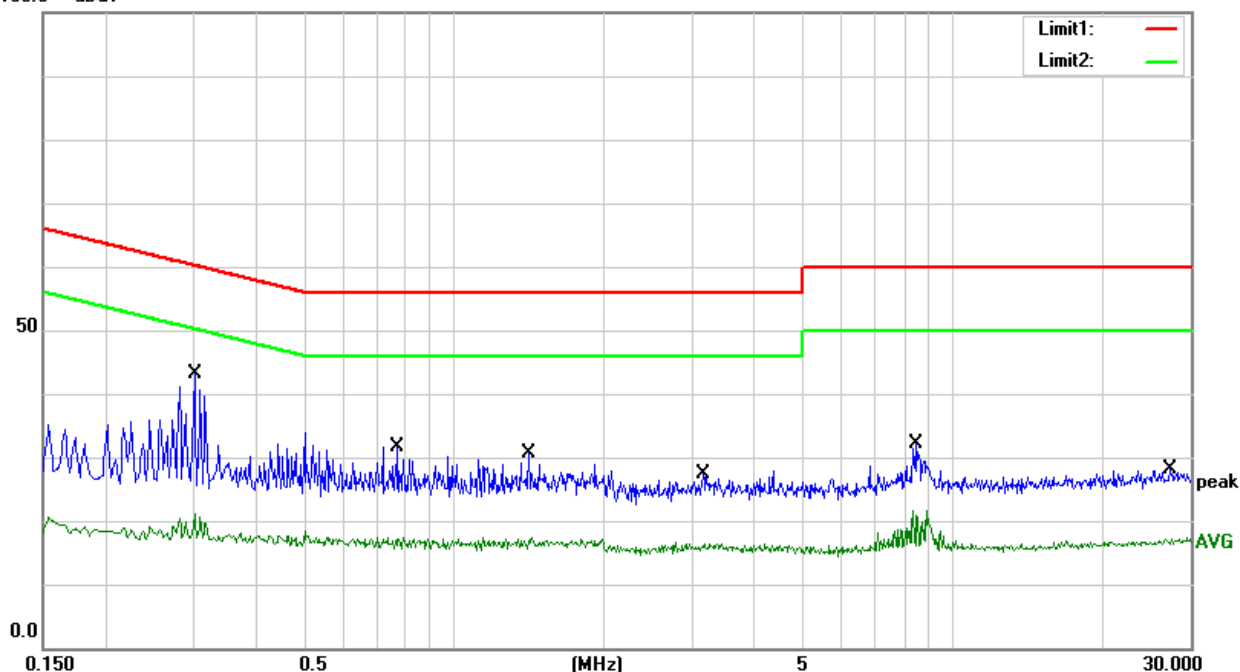
Temperature:	26.8℃	Relative Humidity:	68%RH
Test Voltage:	AC 120V/60Hz	Phase:	L
Test Mode:	Mode 7		

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.3020	22.38	20.72	43.10	60.19	-17.09	QP
2	0.3020	0.30	20.72	21.02	50.19	-29.17	AVG
3	0.7740	11.41	20.24	31.65	56.00	-24.35	QP
4	0.7740	-2.83	20.24	17.41	46.00	-28.59	AVG
5	1.4140	10.58	20.12	30.70	56.00	-25.30	QP
6	1.4140	-2.79	20.12	17.33	46.00	-28.67	AVG
7	3.1660	7.45	19.97	27.42	56.00	-28.58	QP
8	3.1660	-3.58	19.97	16.39	46.00	-29.61	AVG
9	8.4340	12.21	20.02	32.23	60.00	-27.77	QP
10	8.4340	1.49	20.02	21.51	50.00	-28.49	AVG
11	27.3100	7.41	20.64	28.05	60.00	-31.95	QP
12	27.3100	-3.47	20.64	17.17	50.00	-32.83	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





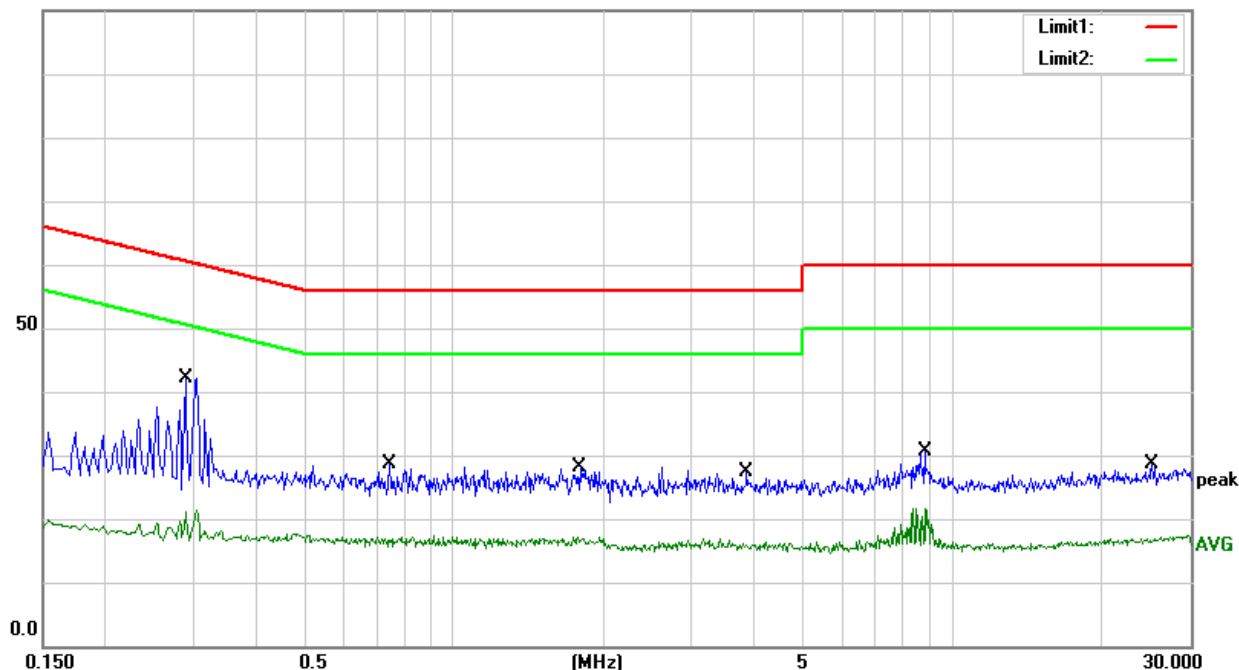
Temperature:	26.8℃	Relative Humidity:	68%RH
Test Voltage:	AC 120V/60Hz	Phase:	N
Test Mode:	Mode 7		

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.2900	21.43	20.67	42.10	60.52	-18.42	QP
2	0.2900	0.43	20.67	21.10	50.52	-29.42	AVG
3	0.7460	8.29	20.24	28.53	56.00	-27.47	QP
4	0.7460	-3.04	20.24	17.20	46.00	-28.80	AVG
5	1.7940	8.12	20.08	28.20	56.00	-27.80	QP
6	1.7940	-3.25	20.08	16.83	46.00	-29.17	AVG
7	3.8700	7.45	19.96	27.41	56.00	-28.59	QP
8	3.8700	-3.87	19.96	16.09	46.00	-29.91	AVG
9	8.8180	10.55	20.05	30.60	60.00	-29.40	QP
10	8.8180	1.49	20.05	21.54	50.00	-28.46	AVG
11	25.0900	8.00	20.55	28.55	60.00	-31.45	QP
12	25.0900	-3.65	20.55	16.90	50.00	-33.10	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 case the emission fall within the Restricted band specified on Part15.205 (a)&209(a), RSS-Gen&RSS-247 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 (microvolts/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)=20 log Emission level (uV/m).

LIMITS OF RESTRICTED FREQUENCY BANDS

FCC:

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			



IC:

FREQUENCY (MHz)	FREQUENCY (MHz)	FREQUENCY (GHz)
0.090 - 0.110	149.9 - 150.05	9.0 - 9.2
0.495 - 0.505	156.52475 - 156.52525	9.3 - 9.5
2.1735 - 2.1905	156.7 - 156.9	10.6 - 12.7
3.020 - 3.026	162.0125 - 167.17	13.25 - 13.4
4.125 - 4.128	167.72 - 173.2	14.47 - 14.5
4.17725 - 4.17775	240 - 285	15.35 - 16.2
4.20725 - 4.20775	322 - 335.4	17.7 - 21.4
5.677 - 5.683	399.9 - 410	22.01 - 23.12
6.215 - 6.218	608 - 614	23.6 - 24.0
6.26775 - 6.26825	960 - 1427	31.2 - 31.8
6.31175 - 6.31225	1435 - 1626.5	36.43 - 36.5
8.291 - 8.294	1645.5 - 1646.5	Above 38.6
8.362 - 8.366	1660 - 1710	
8.37625 - 8.38675	1718.8 - 1722.2	
8.41425 - 8.41475	2200 - 2300	
12.29 - 12.293	2310 - 2390	
12.51975 - 12.52025	2483.5 - 2500	
12.57675 - 12.57725	2655 - 2900	
13.36 - 13.41	3260 - 3267	
16.42 - 16.423	3332 - 3339	
16.69475 - 16.69525	3345.8 - 3358	
16.80425 - 16.80475	3500 - 4400	
25.5 - 25.67	4500 - 5150	
37.5 - 38.25	5350 - 5460	
73 - 74.6	7250 - 7750	
74.8 - 75.2	8025 - 8500	
108 - 138		



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 Band Edge

Spectrum Parameter	Setting
Detector	Peak/AV
Start/Stop Frequency	Lower Band Edge: 890 to 905 MHz Upper Band Edge: 925 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:

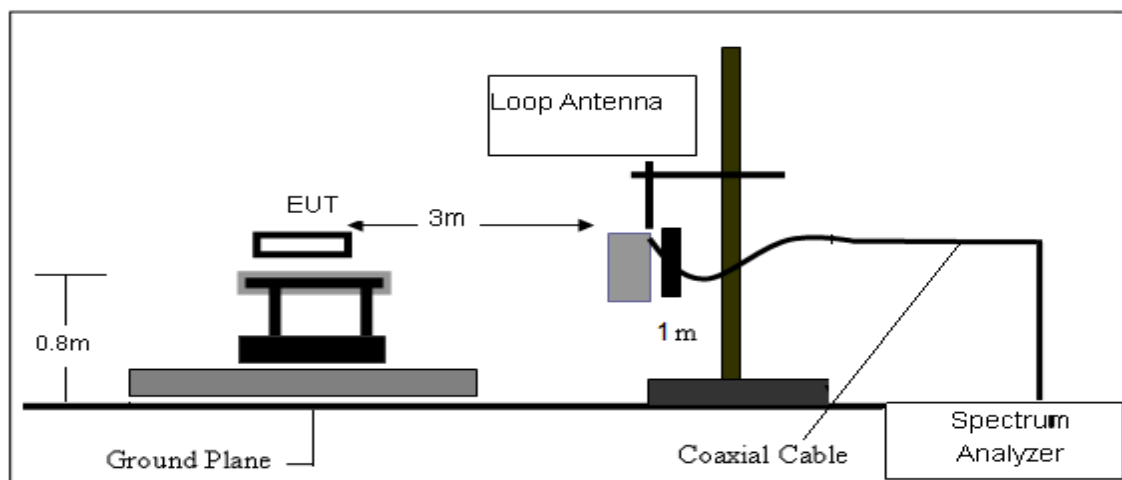
Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported.

3.2.3 DEVIATION FROM TEST STANDARD

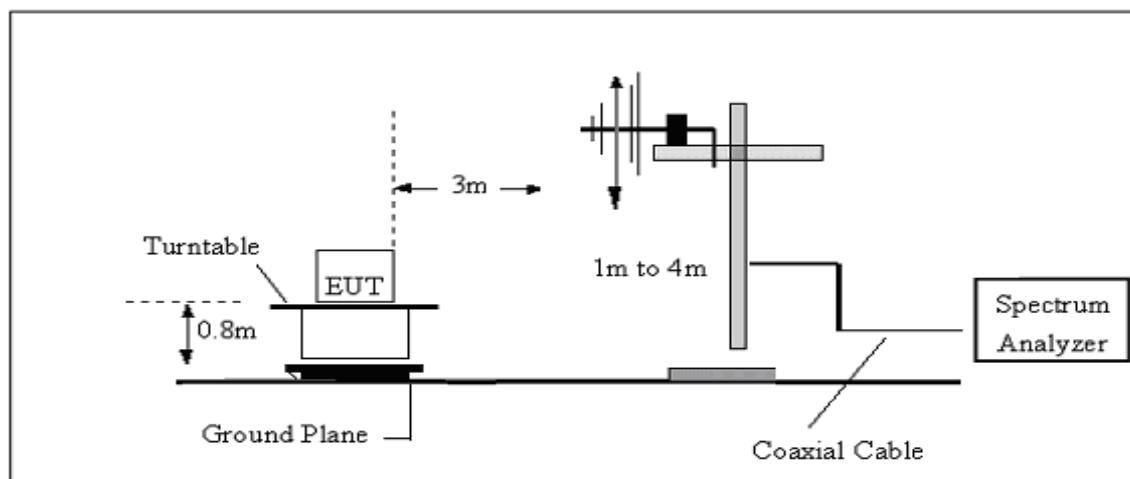
No deviation.

3.2.4 TESTSETUP

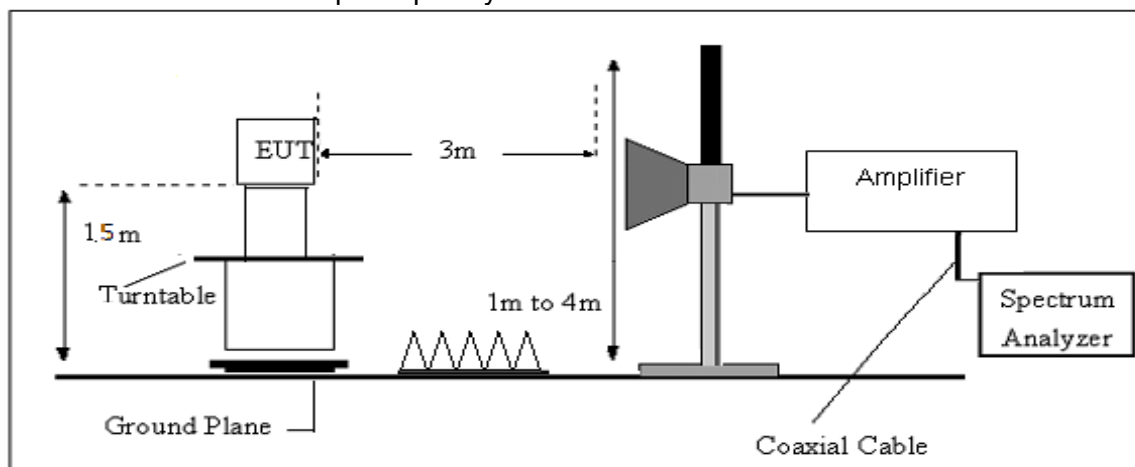
(A) Radiated Emission Test-Up Frequency Below 30MHz



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



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



3.2.5 EUT OPERATING CONDITIONS

Please refer to section 2.4 of this report.



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:	24℃	Relative Humidity:	54%RH
Test Voltage:	DC 24V	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 = $40 \log (\text{specific distance}/\text{test distance})$ (dB);

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



(30MHz-1000MHz)

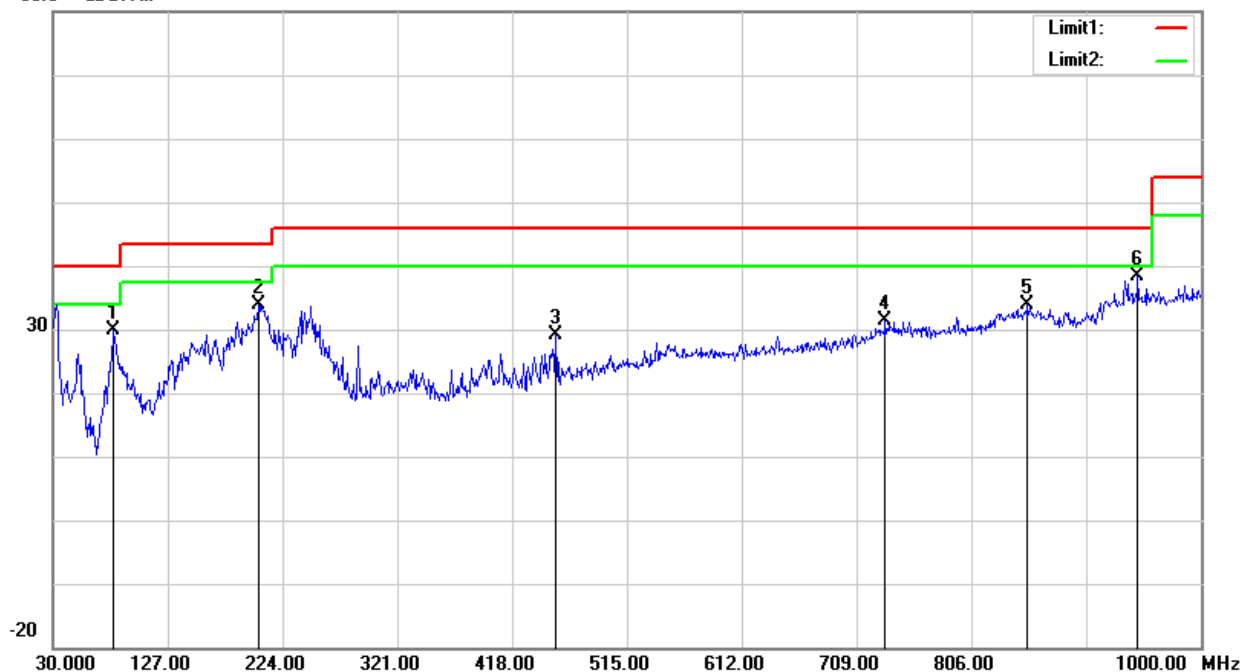
Temperature:	24℃	Relative Humidity:	54%RH
Test Voltage:	DC 24V	Phase:	Horizontal
Test Mode:	Mode 1/2/3 (Mode 3 worst mode)		

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	81.4100	52.60	-22.82	29.78	40.00	-10.22	QP
2	203.6300	54.69	-20.86	33.83	43.50	-9.67	QP
3	454.8600	38.71	-9.57	29.14	46.00	-16.86	QP
4	733.2500	33.76	-2.35	31.41	46.00	-14.59	QP
5	853.5300	34.55	-0.64	33.91	46.00	-12.09	QP
6	946.6500	36.92	1.52	38.44	46.00	-7.56	QP

Remark:

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

80.0 dBuV/m





Temperature:	24℃	Relative Humidity:	54%RH
Test Voltage:	DC 24V	Phase:	Vertical
Test Mode:	Mode 1/2/3 (Mode 3 worst mode)		

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	80.4400	56.68	-22.93	33.75	40.00	-6.25	QP
2	247.2800	46.98	-16.59	30.39	46.00	-15.61	QP
3	570.2900	33.36	-5.61	27.75	46.00	-18.25	QP
4	746.8300	33.30	-2.15	31.15	46.00	-14.85	QP
5	857.4100	33.62	-0.50	33.12	46.00	-12.88	QP
6	938.8900	35.67	1.29	36.96	46.00	-9.04	QP

Remark:

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

80.0 dBuV/m



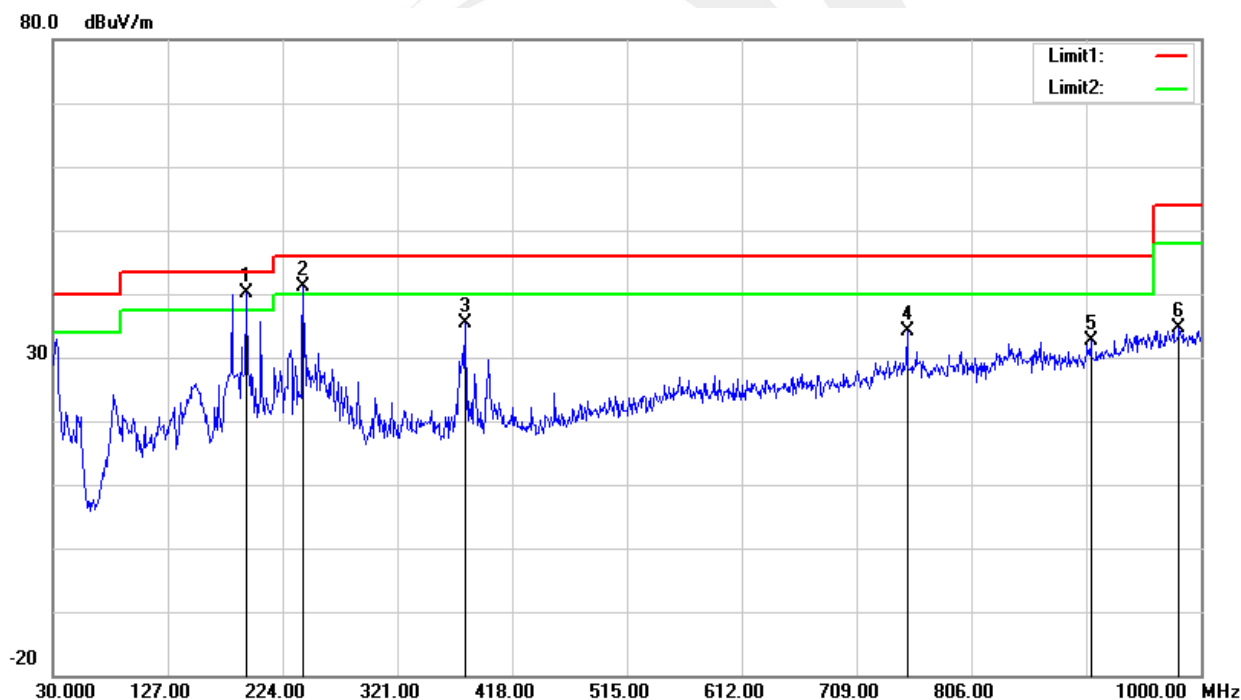


Temperature:	24℃	Relative Humidity:	54%RH
Test Voltage:	DC 24V	Phase:	Horizontal
Test Mode:	Mode 4/5/6 (Mode 6 worst mode)		

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	192.9600	61.25	-21.08	40.17	43.50	-3.33	QP
2	241.4600	58.94	-17.73	41.21	46.00	-4.79	QP
3	378.2300	47.73	-12.31	35.42	46.00	-10.58	QP
4	751.6800	36.27	-2.17	34.10	46.00	-11.90	QP
5	906.8800	32.84	-0.27	32.57	46.00	-13.43	QP
6	981.5700	32.12	2.57	34.69	54.00	-19.31	QP

Remark:

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





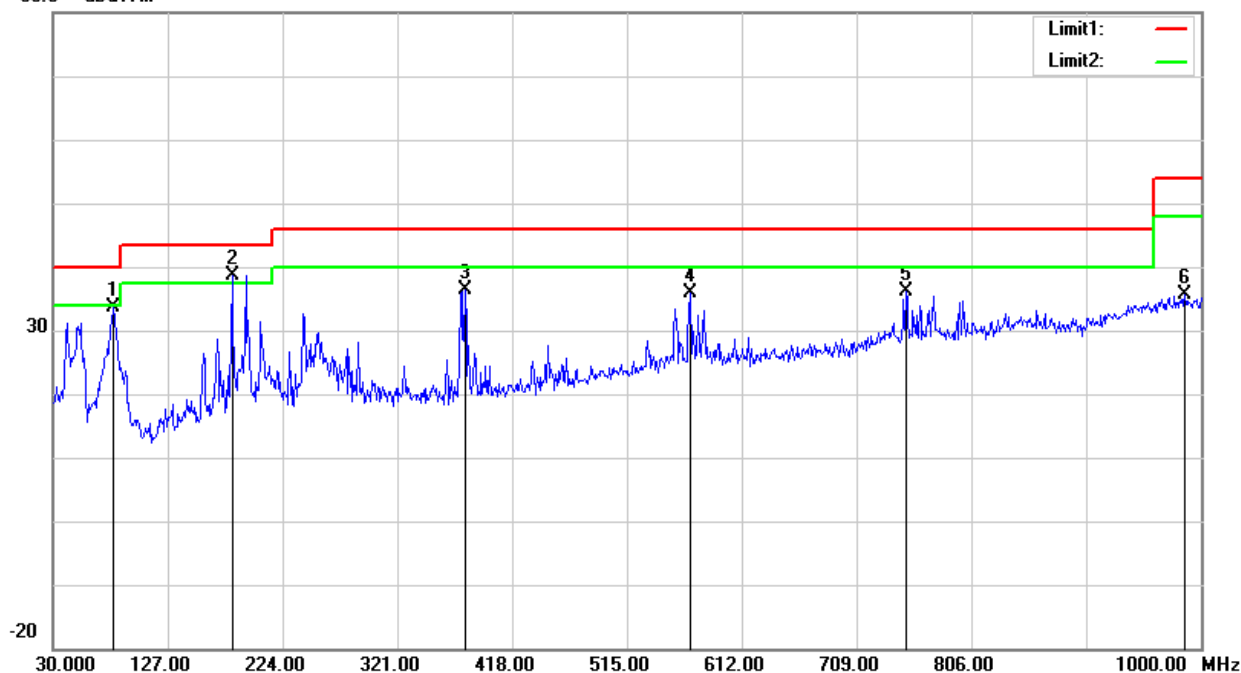
Temperature:	24℃	Relative Humidity:	54%RH
Test Voltage:	DC 24V	Phase:	Vertical
Test Mode:	Mode 4/5/6 (Mode 6 worst mode)		

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	80.4400	56.49	-22.93	33.56	40.00	-6.44	QP
2	181.3200	58.72	-20.11	38.61	43.50	-4.89	QP
3	378.2300	48.64	-12.31	36.33	46.00	-9.67	QP
4	568.3500	41.48	-5.58	35.90	46.00	-10.10	QP
5	750.7100	38.30	-2.16	36.14	46.00	-9.86	QP
6	986.4200	33.37	2.27	35.64	54.00	-18.36	QP

Remark:

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

80.0 dBuV/m





(1GHz~25GHz) Spurious emission Requirements

Dense reader mode
Low channel-Horizontal

Frequency (MHz)	Peak Reading (dBuV/m)	Average Reading (dBuV/m)	Factor (dB)	Peak Level (dBuV/m)	Duty Factor (dB)	Average Level (dBuV/m)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	PK Over Limit (dB)	AV Over Limit (dB)	Min Margin(dB)	ANT
1440.5	41.83	30.38	-0.6	41.23	0.00	29.78	74.00	54.00	-32.77	-24.22	-24.22	Horizontal
1806	47.69	41.51	0.01	47.70	0.00	41.52	74.00	54.00	-26.30	-12.48	-12.48	Horizontal
2966.5	40.98	28.49	5.97	46.95	0.00	34.46	74.00	54.00	-27.05	-19.54	-19.54	Horizontal
11735.5	51.96	43.52	9.36	61.32	0.00	52.88	74.00	54.00	-12.68	-1.12	-1.12	Horizontal
14416.75	50.30	39.94	11.23	61.53	0.00	51.17	74.00	54.00	-12.47	-2.83	-2.83	Horizontal
17142	50.31	39.96	10.24	60.55	0.00	50.20	74.00	54.00	-13.45	-3.80	-3.80	Horizontal

Vertical

Frequency (MHz)	Peak Reading (dBuV/m)	Average Level (dBuV/m)	Factor (dB)	Peak Level (dBuV/m)	Duty Factor (dB)	Average Level (dBuV/m)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	PK Over Limit (dB)	AV Over Limit (dB)	Min Margin(dB)	ANT
1135.5	45.74	29.82	-1.41	44.33	0.00	28.41	74.00	54.00	-29.67	-25.59	-25.59	Vertical
1769	56.12	51.35	0	56.12	0.00	51.35	74.00	54.00	-17.88	-2.65	-2.65	Vertical
2866	39.49	28.50	5.61	45.10	0.00	34.11	74.00	54.00	-28.90	-19.89	-19.89	Vertical
5783	55.74	46.08	-3.9	51.84	0.00	42.18	74.00	54.00	-22.16	-11.82	-11.82	Vertical
11094.75	51.25	41.05	9.71	60.96	0.00	50.76	74.00	54.00	-13.04	-3.24	-3.24	Vertical
14392.001	50.07	38.70	11.38	61.45	0.00	50.08	74.00	54.00	-12.55	-3.92	-3.92	Vertical



Mid channel-Horizontal

Frequency (MHz)	Peak Reading (dBuV/m)	Average Reading (dBuV/m)	Factor (dB)	Peak Level (dBuV/m)	Duty Factor (dB)	Average Level (dBuV/m)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	PK Over Limit (dB)	AV Over Limit (dB)	Min Margin(dB)	ANT
1202.5	41.62	29.40	-1.2	40.42	0.00	28.20	74.00	54.00	-33.58	-25.80	-25.80	Horizontal
1805.5	45.21	42.97	0.01	45.22	0.00	42.98	74.00	54.00	-28.78	-11.02	-11.02	Horizontal
2975.5	39.25	28.43	6	45.25	0.00	34.43	74.00	54.00	-28.75	-19.57	-19.57	Horizontal
10720.75	52.08	40.89	8.33	60.41	0.00	49.22	74.00	54.00	-13.59	-4.78	-4.78	Horizontal
14444.25	50.02	38.83	10.9	60.92	0.00	49.73	74.00	54.00	-13.08	-4.27	-4.27	Horizontal
15203.25	50.25	39.46	11.01	61.26	0.00	50.47	74.00	54.00	-12.74	-3.53	-3.53	Horizontal

Vertical

Frequency (MHz)	Peak Reading (dBuV/m)	Average Level (dBuV/m)	Factor (dB)	Peak Level (dBuV/m)	Duty Factor (dB)	Average Level (dBuV/m)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	PK Over Limit (dB)	AV Over Limit (dB)	Min Margin(dB)	ANT
1106.5	41.82	30.61	-1.47	40.35	0.00	29.14	74.00	54.00	-33.65	-24.86	-24.86	Vertical
1998.5	42.15	31.04	1.48	43.63	0.00	32.52	74.00	54.00	-30.37	-21.48	-21.48	Vertical
2999	39.02	28.44	6.11	45.13	0.00	34.55	74.00	54.00	-28.87	-19.45	-19.45	Vertical
11364.25	51.69	40.59	9.67	61.36	0.00	50.26	74.00	54.00	-12.64	-3.74	-3.74	Vertical
14414	50.08	39.85	11.26	61.34	0.00	51.11	74.00	54.00	-12.66	-2.89	-2.89	Vertical
15813.75	51.28	40.42	9.45	60.73	0.00	49.87	74.00	54.00	-13.27	-4.13	-4.13	Vertical



High channel-Horizontal

Frequency (MHz)	Peak Reading (dBuV/m)	Average Reading (dBuV/m)	Factor (dB)	Peak Level (dBuV/m)	Duty Factor (dB)	Average Level (dBuV/m)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	PK Over Limit (dB)	AV Over Limit (dB)	Min Margin(dB)	ANT
1203.5	41.12	29.11	-1.19	39.93	0.00	27.92	74.00	54.00	-34.07	-26.08	-26.08	Horizontal
2346.5	40.32	28.01	4.4	44.72	0.00	32.41	74.00	54.00	-29.28	-21.59	-21.59	Horizontal
2870	39.19	28.18	5.61	44.80	0.00	33.79	74.00	54.00	-29.20	-20.21	-20.21	Horizontal
8716	51.17	40.56	5.11	56.28	0.00	45.67	74.00	54.00	-17.72	-8.33	-8.33	Horizontal
11009.5	49.91	39.41	10.17	60.08	0.00	49.58	74.00	54.00	-13.92	-4.42	-4.42	Horizontal
17098	50.13	39.07	10.47	60.60	0.00	49.54	74.00	54.00	-13.40	-4.46	-4.46	Horizontal

Vertical

Frequency (MHz)	Peak Reading (dBuV/m)	Average Level (dBuV/m)	Factor (dB)	Peak Level (dBuV/m)	Duty Factor (dB)	Average Level (dBuV/m)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	PK Over Limit (dB)	AV Over Limit (dB)	Min Margin(dB)	ANT
1205.5	40.04	28.88	-1.18	38.86	0.00	27.70	74.00	54.00	-35.14	-26.30	-26.30	Vertical
2119.5	39.80	28.89	4.12	43.92	0.00	33.01	74.00	54.00	-30.08	-20.99	-20.99	Vertical
2965	39.13	28.30	5.96	45.09	0.00	34.26	74.00	54.00	-28.91	-19.74	-19.74	Vertical
10157	52.09	41.58	7.14	59.23	0.00	48.72	74.00	54.00	-14.77	-5.28	-5.28	Vertical
11394.5	51.01	40.36	9.73	60.74	0.00	50.09	74.00	54.00	-13.26	-3.91	-3.91	Vertical
14416.75	49.68	39.54	11.23	60.91	0.00	50.77	74.00	54.00	-13.09	-3.23	-3.23	Vertical

Single reader mode
Low channel-Horizontal

Frequency (MHz)	Peak Reading (dBuV/m)	Average Reading (dBuV/m)	Factor (dB)	Peak Level (dBuV/m)	Duty Factor (dB)	Average Level (dBuV/m)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	PK Over Limit (dB)	AV Over Limit (dB)	Min Margin(dB)	ANT
1206	41.35	45.05	-1.17	40.18	28.04	43.88	74.00	54.00	-33.82	-10.12	-10.12	Horizontal
2191	39.63	29.64	4.2	43.83	32.47	33.84	74.00	54.00	-30.17	-20.16	-20.16	Horizontal
2955.5	38.68	37.05	5.92	44.60	34.38	42.97	74.00	54.00	-29.40	-11.03	-11.03	Horizontal
10091	51.11	29.49	7	58.11	48.19	36.49	74.00	54.00	-15.89	-17.51	-15.89	Horizontal
11103	50.82	33.92	9.68	60.50	49.83	43.60	74.00	54.00	-13.50	-10.40	-10.40	Horizontal
14408.5	49.46	34.06	11.32	60.78	50.29	45.38	74.00	54.00	-13.22	-8.62	-8.62	Horizontal

Vertical

Frequency (MHz)	Peak Reading (dBuV/m)	Average Level (dBuV/m)	Factor (dB)	Peak Level (dBuV/m)	Duty Factor (dB)	Average Level (dBuV/m)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	PK Over Limit (dB)	AV Over Limit (dB)	Min Margin(dB)	ANT
1329.5	40.40	30.21	-0.85	39.55	0.00	29.36	74.00	54.00	-34.45	-24.64	-24.64	Vertical
2128	39.72	28.34	4.26	43.98	0.00	32.60	74.00	54.00	-30.02	-21.40	-21.40	Vertical
2883.5	39.52	28.12	5.61	45.13	0.00	33.73	74.00	54.00	-28.87	-20.27	-20.27	Vertical
8776.5	51.12	40.75	4.92	56.04	0.00	45.67	74.00	54.00	-17.96	-8.33	-8.33	Vertical
11056.25	50.38	40.19	9.92	60.30	0.00	50.11	74.00	54.00	-13.70	-3.89	-3.89	Vertical
17026.5	50.97	39.31	9.95	60.92	0.00	49.26	74.00	54.00	-13.08	-4.74	-4.74	Vertical



Mid channel-Horizontal

Frequency (MHz)	Peak Reading (dBuV/m)	Average Reading (dBuV/m)	Factor (dB)	Peak Level (dBuV/m)	Duty Factor (dB)	Average Level (dBuV/m)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	PK Over Limit (dB)	AV Over Limit (dB)	Min Margin(dB)	ANT
1200.5	40.41	28.95	-1.21	39.20	0.00	27.74	74.00	54.00	-34.80	-26.26	-26.26	Horizontal
2157	39.44	28.31	4.56	44.00	0.00	32.87	74.00	54.00	-30.00	-21.13	-21.13	Horizontal
2871.5	39.55	27.79	5.61	45.16	0.00	33.40	74.00	54.00	-28.84	-20.60	-20.60	Horizontal
8262.25	51.10	40.73	4.22	55.32	0.00	44.95	74.00	54.00	-18.68	-9.05	-9.05	Horizontal
11391.75	51.14	40.01	9.73	60.87	0.00	49.74	74.00	54.00	-13.13	-4.26	-4.26	Horizontal
15140	50.14	39.13	10.6	60.74	0.00	49.73	74.00	54.00	-13.26	-4.27	-4.27	Horizontal

Vertical

Frequency (MHz)	Peak Reading (dBuV/m)	Average Level (dBuV/m)	Factor (dB)	Peak Level (dBuV/m)	Duty Factor (dB)	Average Level (dBuV/m)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	PK Over Limit (dB)	AV Over Limit (dB)	Min Margin(dB)	ANT
1198.5	41.11	30.53	-1.22	39.89	0.00	29.31	74.00	54.00	-34.11	-24.69	-24.69	Vertical
2123	39.72	29.03	4.18	43.90	0.00	33.21	74.00	54.00	-30.10	-20.79	-20.79	Vertical
2889.5	39.38	28.08	5.61	44.99	0.00	33.69	74.00	54.00	-29.01	-20.31	-20.31	Vertical
8749	51.19	40.76	5.01	56.20	0.00	45.77	74.00	54.00	-17.80	-8.23	-8.23	Vertical
10976.5	50.60	39.99	10.04	60.64	0.00	50.03	74.00	54.00	-13.36	-3.97	-3.97	Vertical
14878.75	51.36	39.66	9.93	61.29	0.00	49.59	74.00	54.00	-12.71	-4.41	-4.41	Vertical



High channel-Horizontal

Frequency (MHz)	Peak Reading (dBuV/m)	Average Reading (dBuV/m)	Factor (dB)	Peak Level (dBuV/m)	Duty Factor (dB)	Average Level (dBuV/m)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	PK Over Limit (dB)	AV Over Limit (dB)	Min Margin (dB)	ANT
1203.5	40.18	29.19	-1.19	38.99	0.00	28.00	74.00	54.00	-35.01	-26.00	-26.00	Horizontal
1805.5	44.30	41.88	0.01	44.31	0.00	41.89	74.00	54.00	-29.69	-12.11	-12.11	Horizontal
2930.5	38.75	28.01	5.78	44.53	0.00	33.79	74.00	54.00	-29.47	-20.21	-20.21	Horizontal
10162.5	52.18	40.78	7.14	59.32	0.00	47.92	74.00	54.00	-14.68	-6.08	-6.08	Horizontal
11394.5	51.17	40.16	9.73	60.90	0.00	49.89	74.00	54.00	-13.10	-4.11	-4.11	Horizontal
15203.25	49.62	39.12	11.01	60.63	0.00	50.13	74.00	54.00	-13.37	-3.87	-3.87	Horizontal

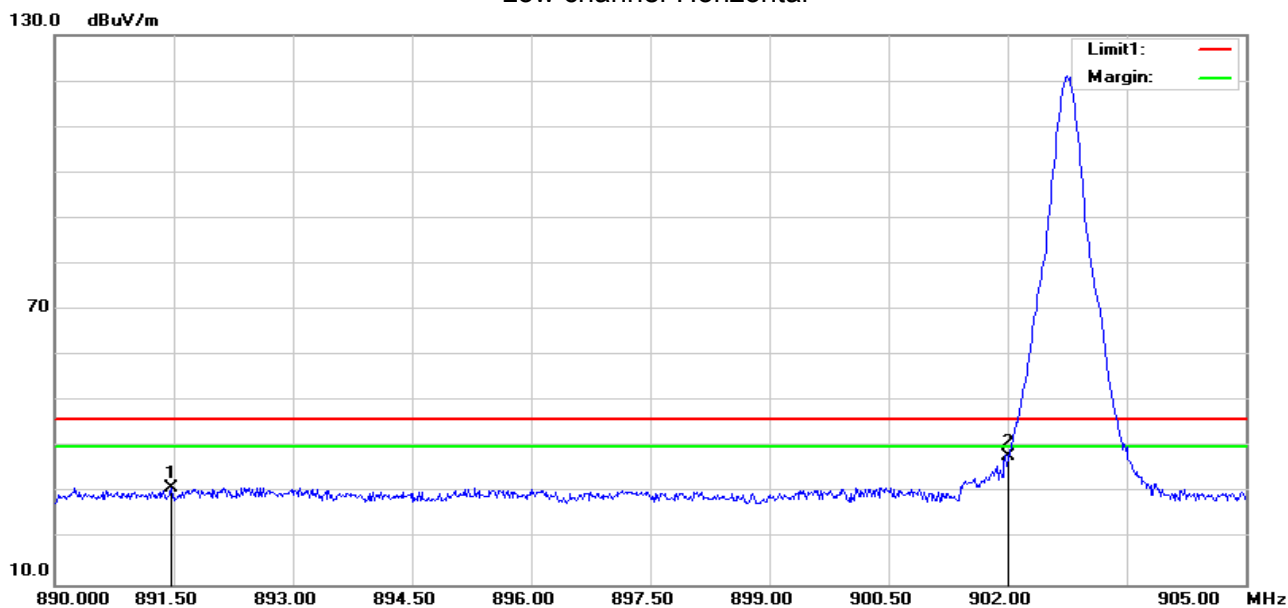
Vertical

Frequency (MHz)	Peak Reading (dBuV/m)	Average Level (dBuV/m)	Factor (dB)	Peak Level (dBuV/m)	Duty Factor (dB)	Average Level (dBuV/m)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	PK Over Limit (dB)	AV Over Limit (dB)	Min Margin (dB)	ANT
1206	40.68	28.28	-1.17	39.51	0.00	27.11	74.00	54.00	-34.49	-26.89	-26.89	Vertical
1805.5	45.87	43.59	0.01	45.88	0.00	43.60	74.00	54.00	-28.12	-10.40	-10.40	Vertical
2923.5	39.03	28.50	5.74	44.77	0.00	34.24	74.00	54.00	-29.23	-19.76	-19.76	Vertical
8746.25	50.84	40.94	5.02	55.86	0.00	45.96	74.00	54.00	-18.14	-8.04	-8.04	Vertical
10993	50.20	39.64	10.17	60.37	0.00	49.81	74.00	54.00	-13.63	-4.19	-4.19	Vertical
14419.5	49.91	39.67	11.19	61.10	0.00	50.86	74.00	54.00	-12.90	-3.14	-3.14	Vertical

Note: 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.

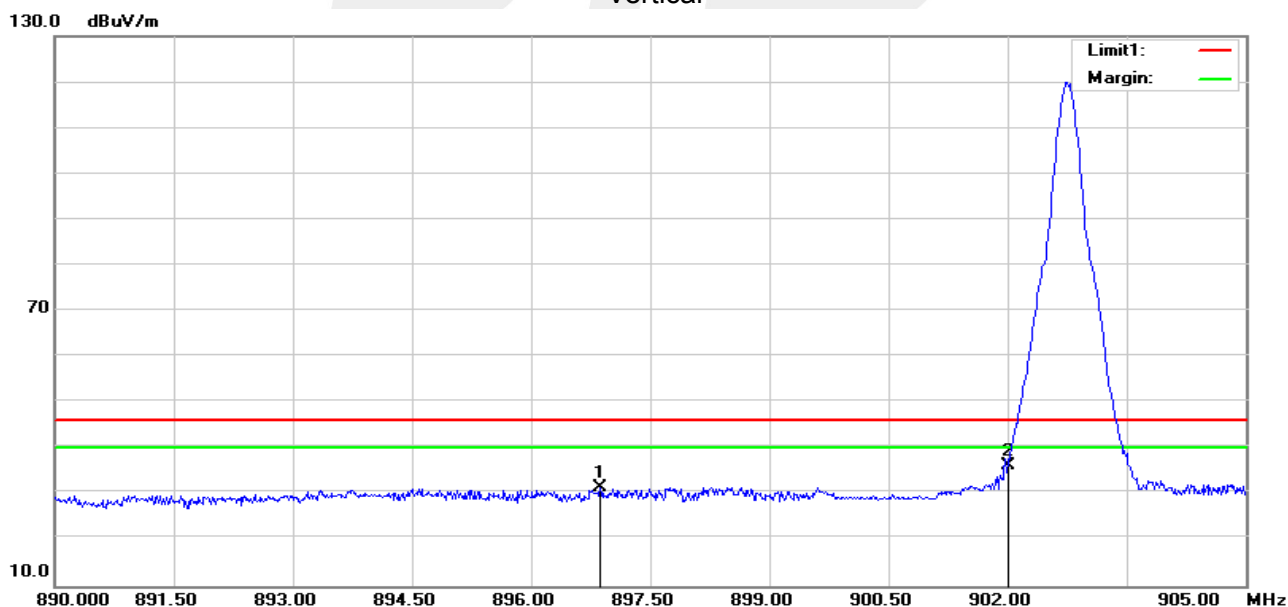


(Radiation Band edge)

Dense reader mode
Low channel-Horizontal

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	891.4700	31.74	-0.65	31.09	46.00	-14.91	peak
2	902.0000	38.40	-0.40	38.00	46.00	-8.00	peak

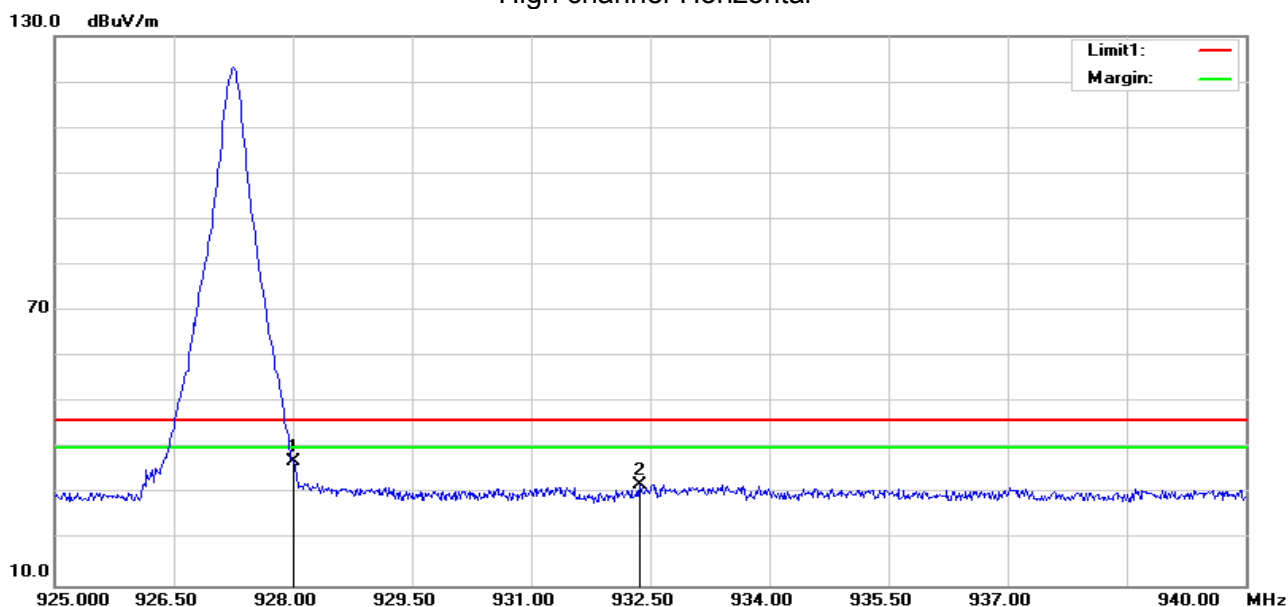
Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	896.8700	31.98	-0.53	31.45	46.00	-14.55	peak
2	902.0000	36.55	-0.40	36.15	46.00	-9.85	peak

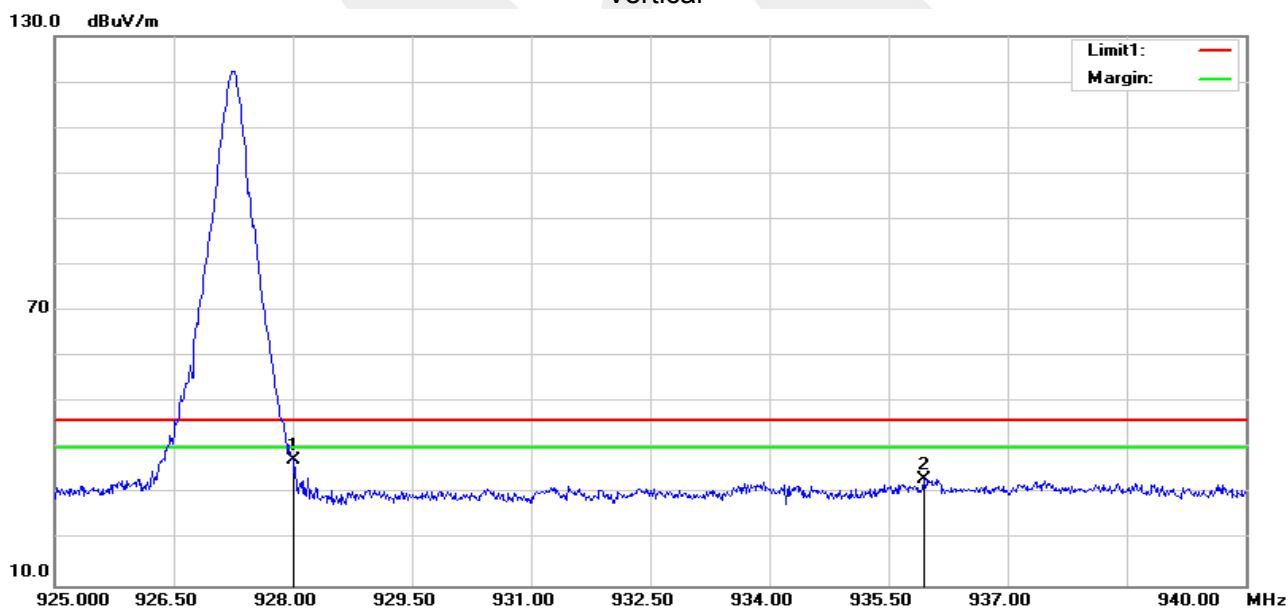


High channel-Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	928.0000	36.76	0.43	37.19	46.00	-8.81	peak
2	932.3650	31.41	0.74	32.15	46.00	-13.85	peak

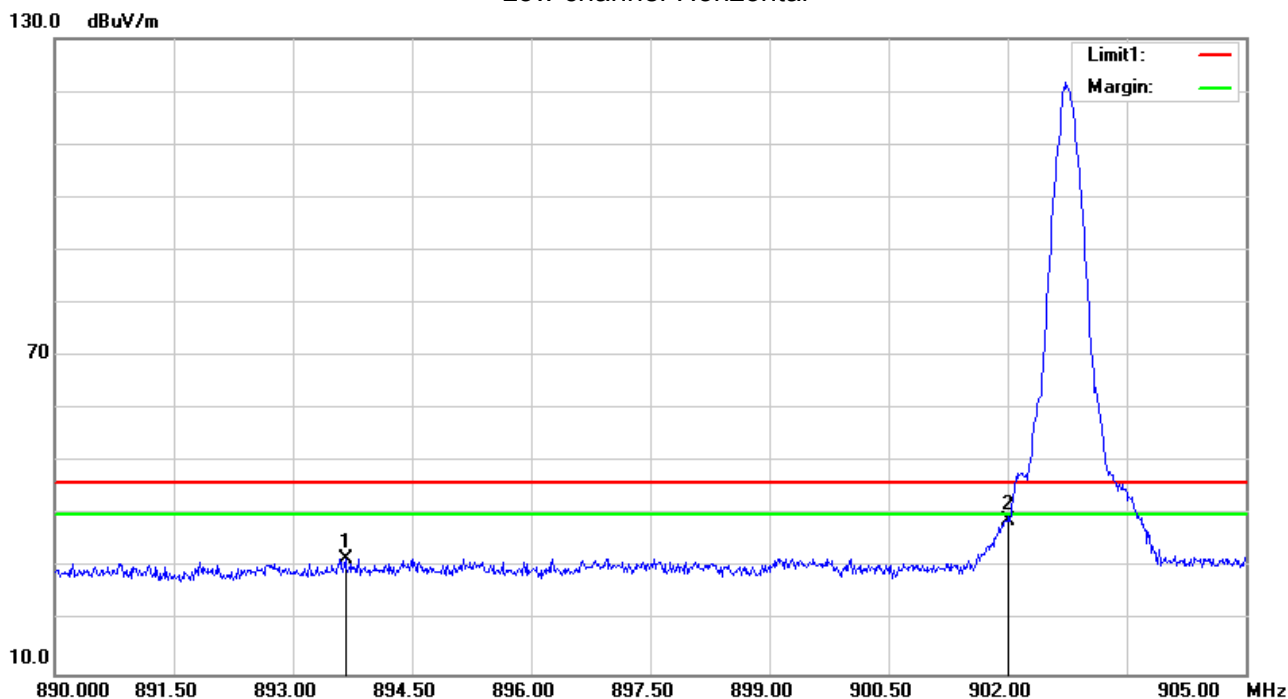
Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	928.0000	36.99	0.43	37.42	46.00	-8.58	peak
2	935.9500	32.14	1.04	33.18	46.00	-12.82	peak

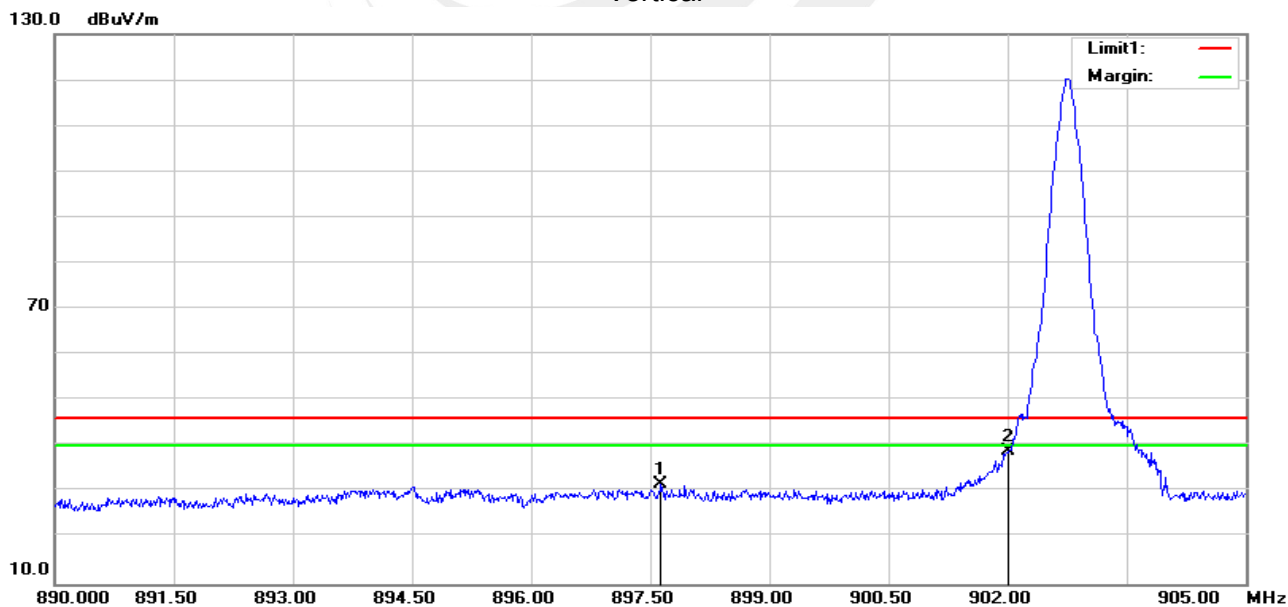


Single reader mode
Low channel-Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	893.6600	32.49	-0.60	31.89	46.00	-14.11	peak
2	902.0000	39.32	-0.40	38.92	46.00	-7.08	peak

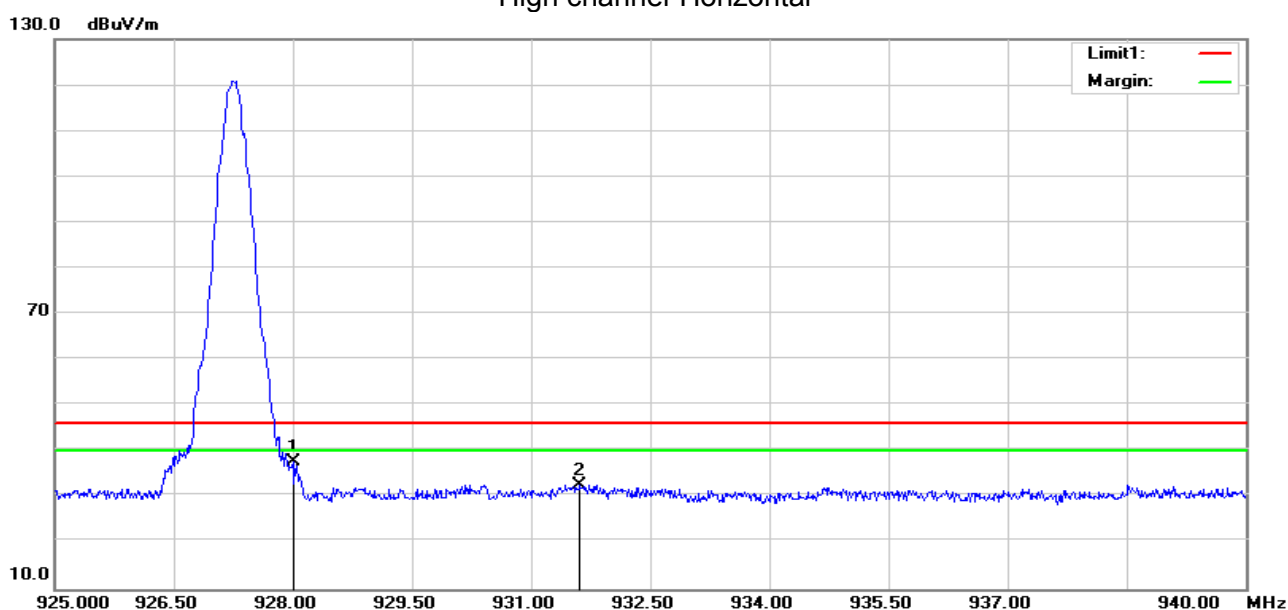
Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	897.6350	32.33	-0.51	31.82	46.00	-14.18	peak
2	902.0000	39.38	-0.40	38.98	46.00	-7.02	peak

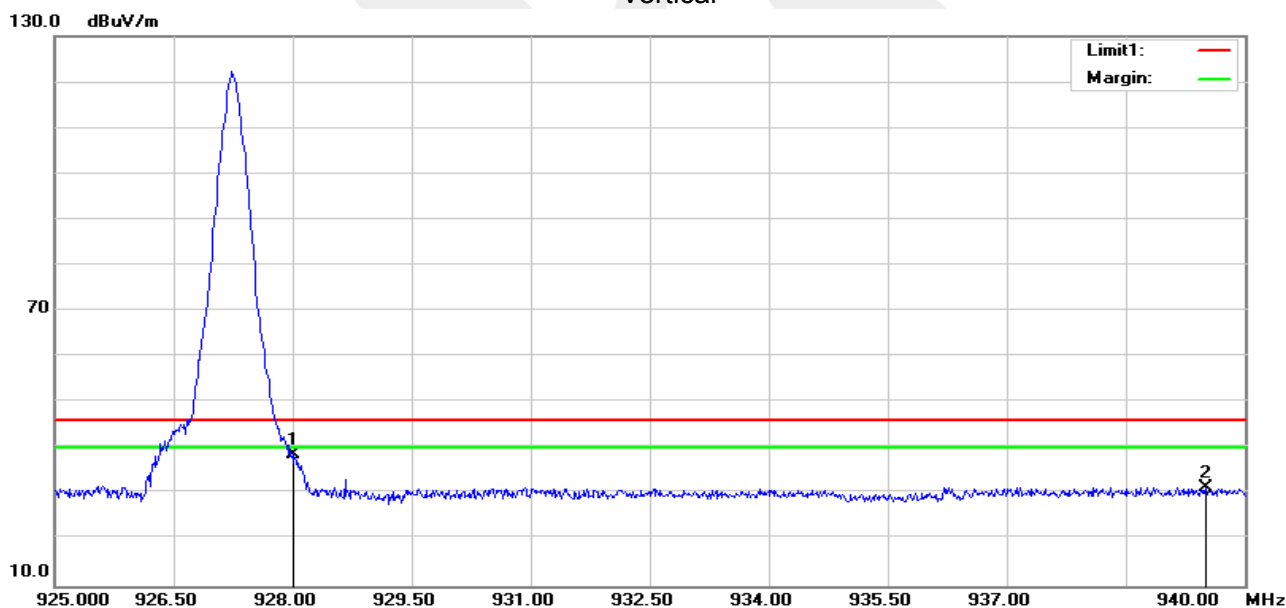


High channel-Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	928.0000	37.45	0.43	37.88	46.00	-8.12	peak
2	931.6150	32.01	0.68	32.69	46.00	-13.31	peak

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	928.0000	38.37	0.43	38.80	46.00	-7.20	peak
2	939.5050	30.21	1.34	31.55	46.00	-14.45	peak

4. CONDUCTED SPURIOUS & BAND EDGE EMISSION

4.1 LIMIT

According to FCC section 15.247(d)&RSS-247 5.5, 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

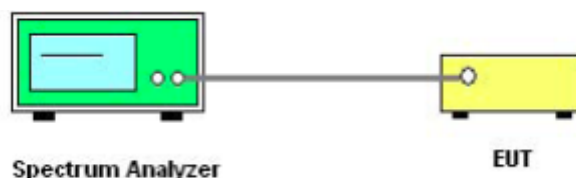
For Band edge

Spectrum Parameter	Setting
Detector	Peak
Start/Stop Frequency	Lower Band Edge: 800 - 904 MHz Upper Band Edge: 924 - 1000 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: 800 - 904 MHz Upper Band Edge: 924 - 1000 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. Tune the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. In order to make an accurate measurement, the span is set to be greater than RBW.

4.4 EUT OPERATION CONDITIONS

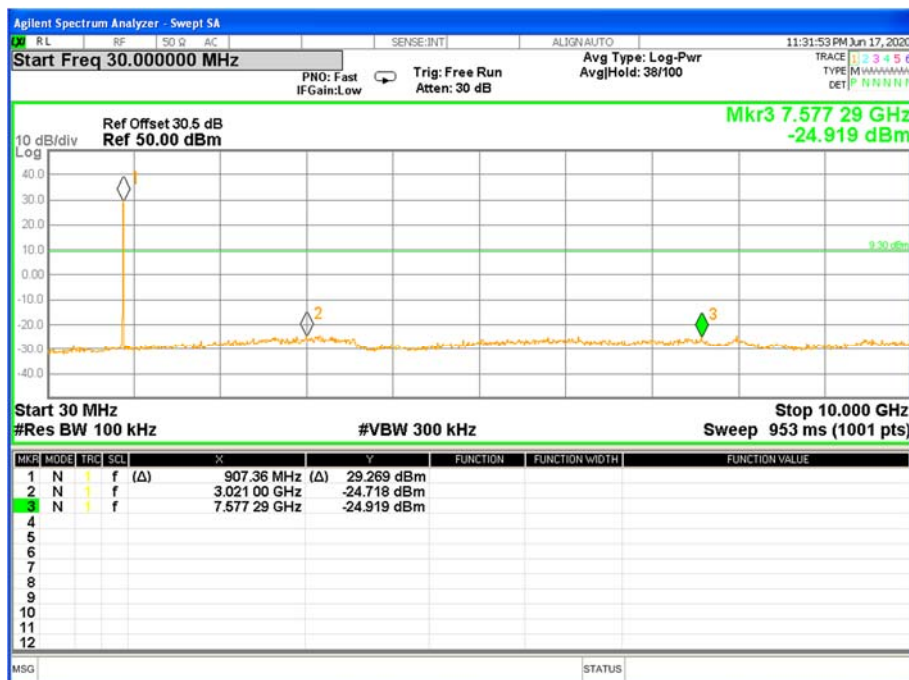
Please refer to section 2.4 of this report.



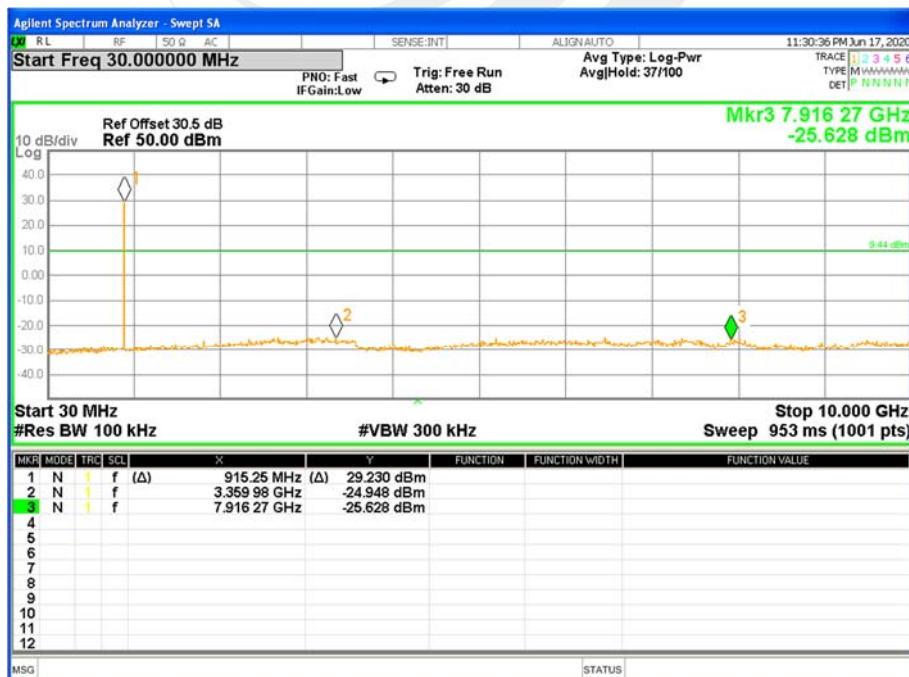
4.5 TEST RESULTS

Temperature:	25°C	Relative Humidity:	50%
Test Mode:	Dense reader mode / CH00, CH25, CH49	Test Voltage:	DC 24V

CH 00

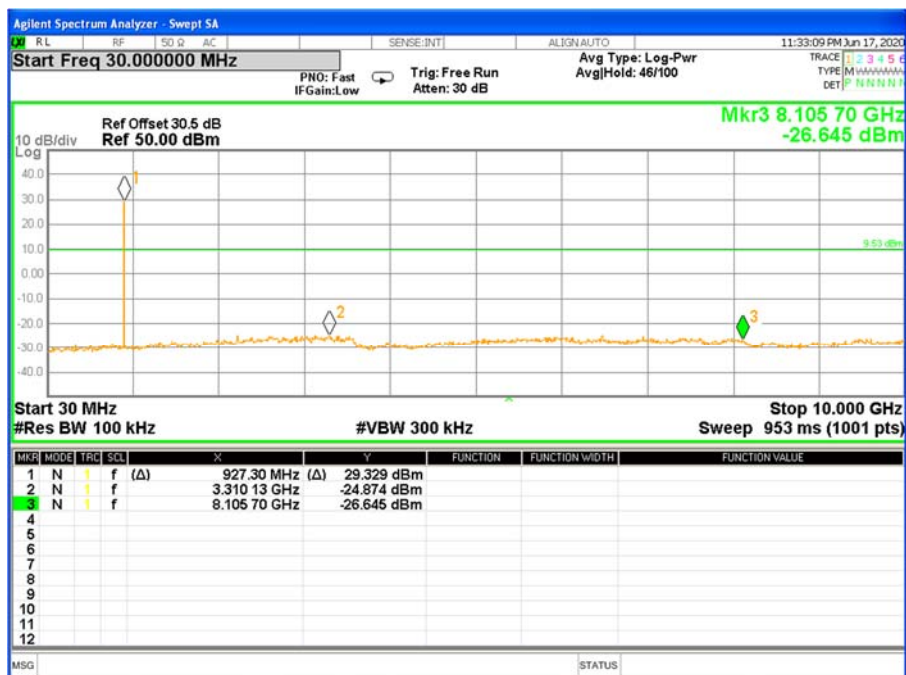


CH 25





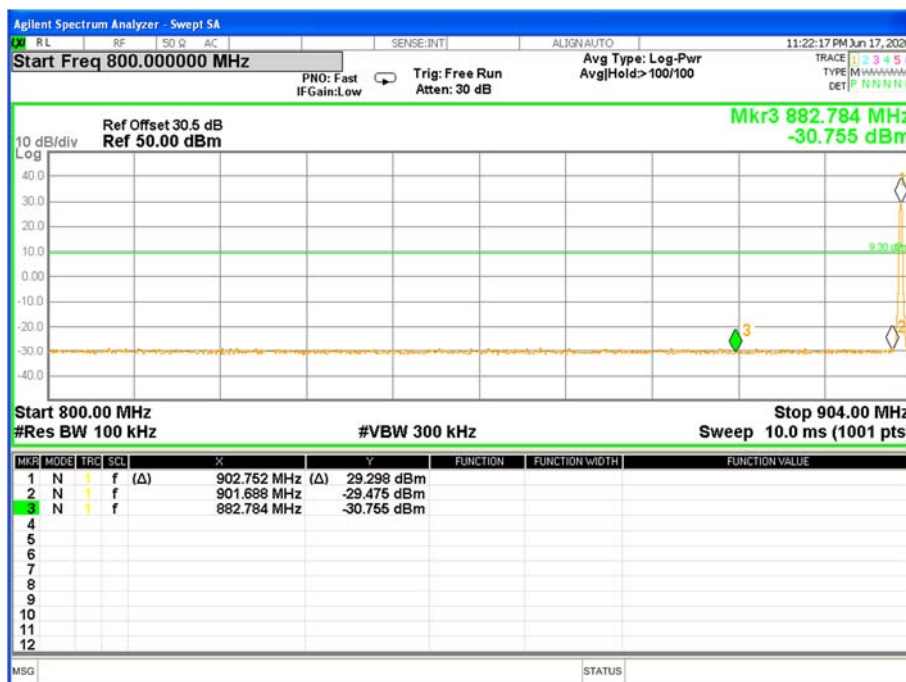
CH 49



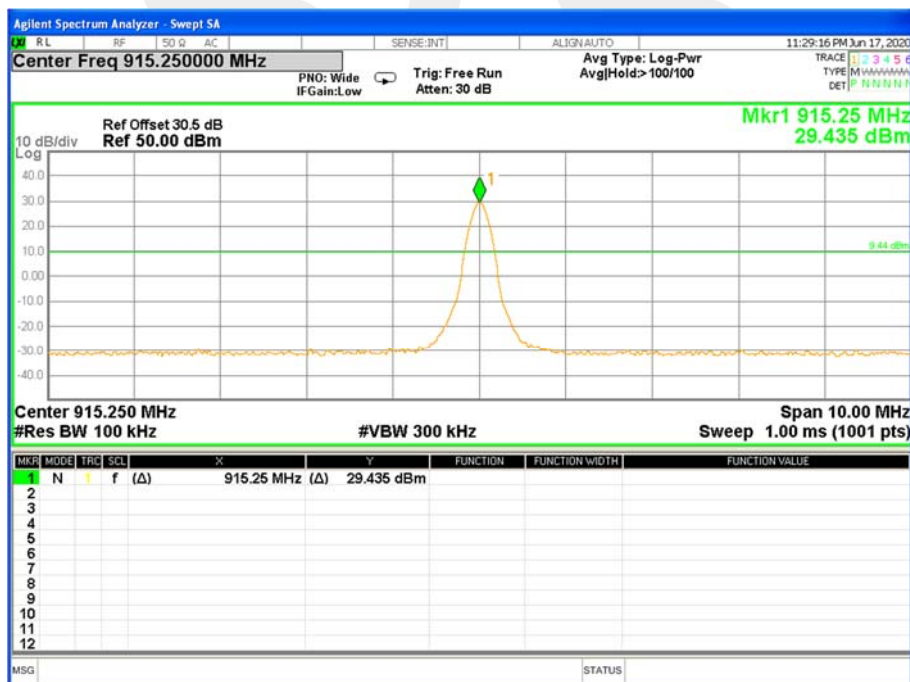


For Band edge(it's also the reference level for conducted spurious emission)

CH 00

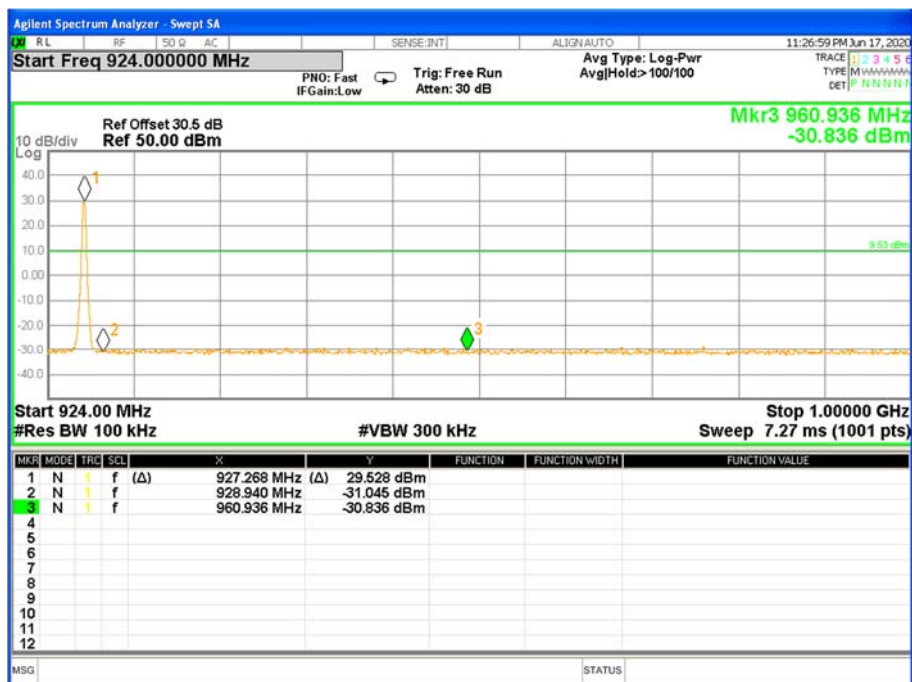


CH 25





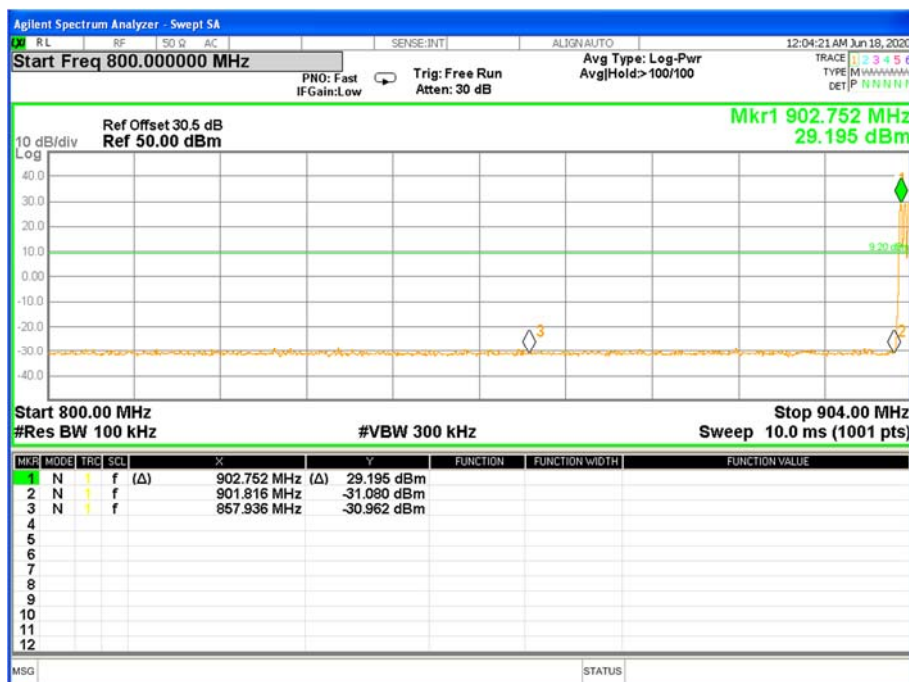
CH 49



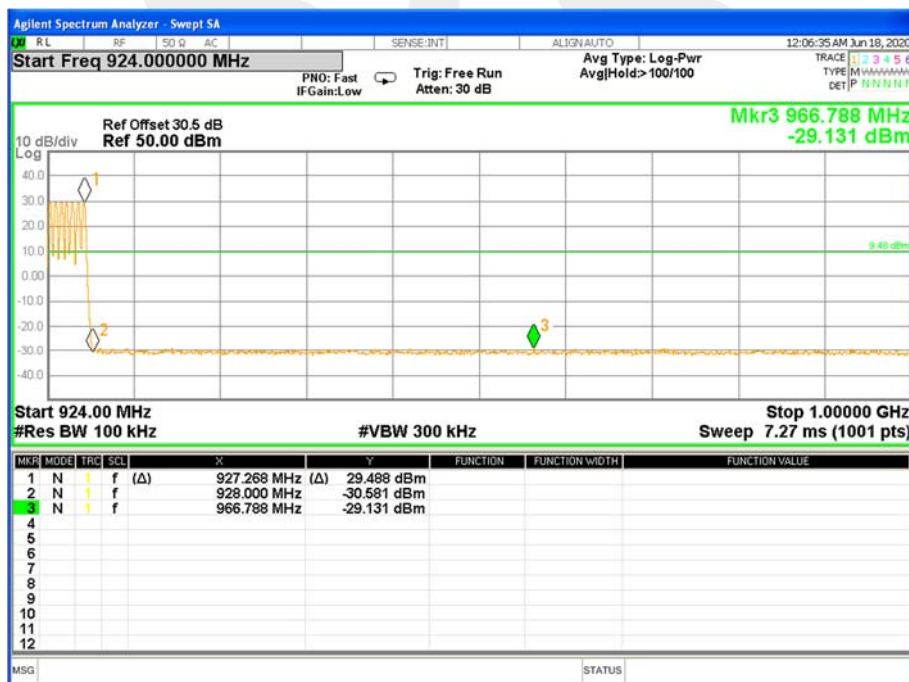


For Hopping Band edge

CH 00



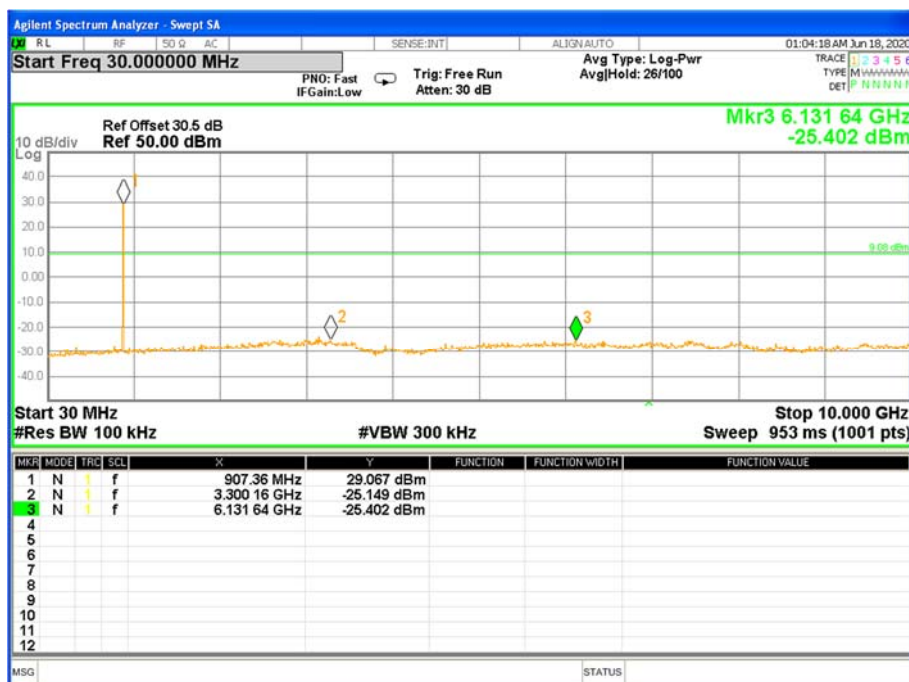
CH 49



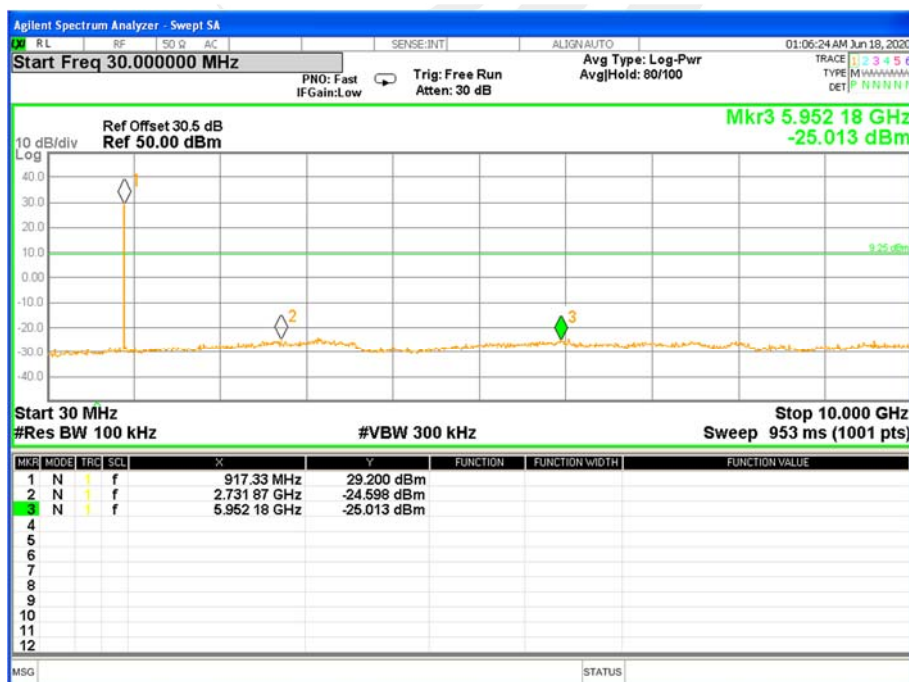


Temperature:	25°C	Relative Humidity:	50%
Test Mode:	Single reader mode / CH00, CH25, CH49	Test Voltage:	DC 24V

CH 00

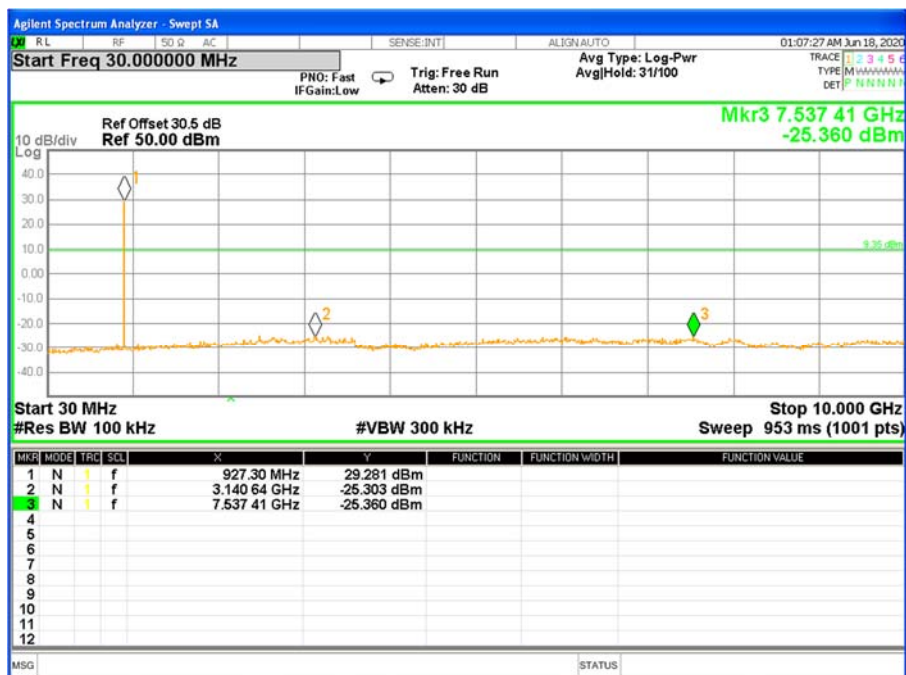


CH 25





CH 49



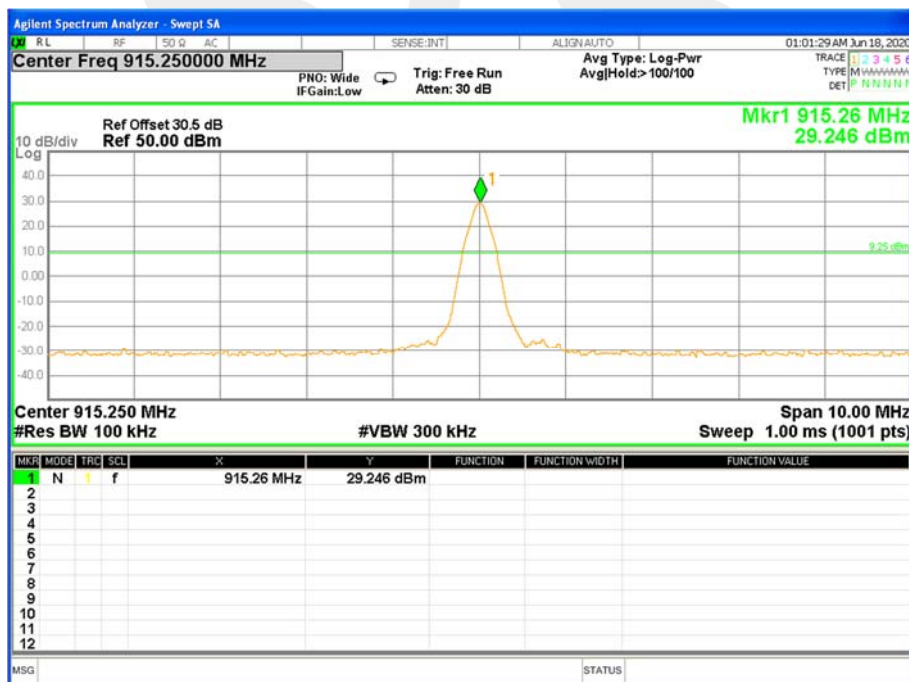


For Band edge(it's also the reference level for conducted spurious emission)

CH 00

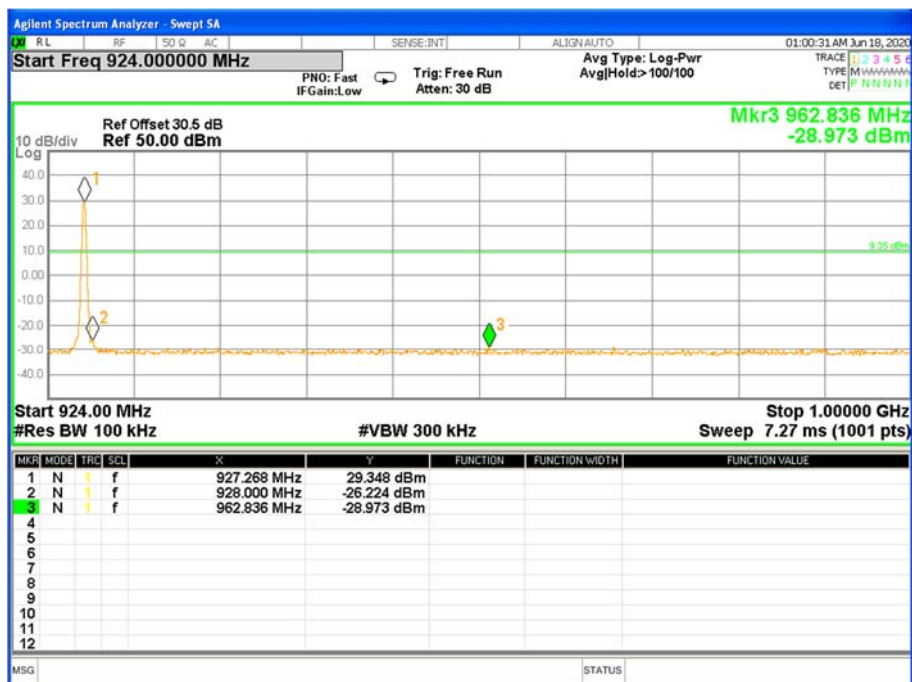


CH 25





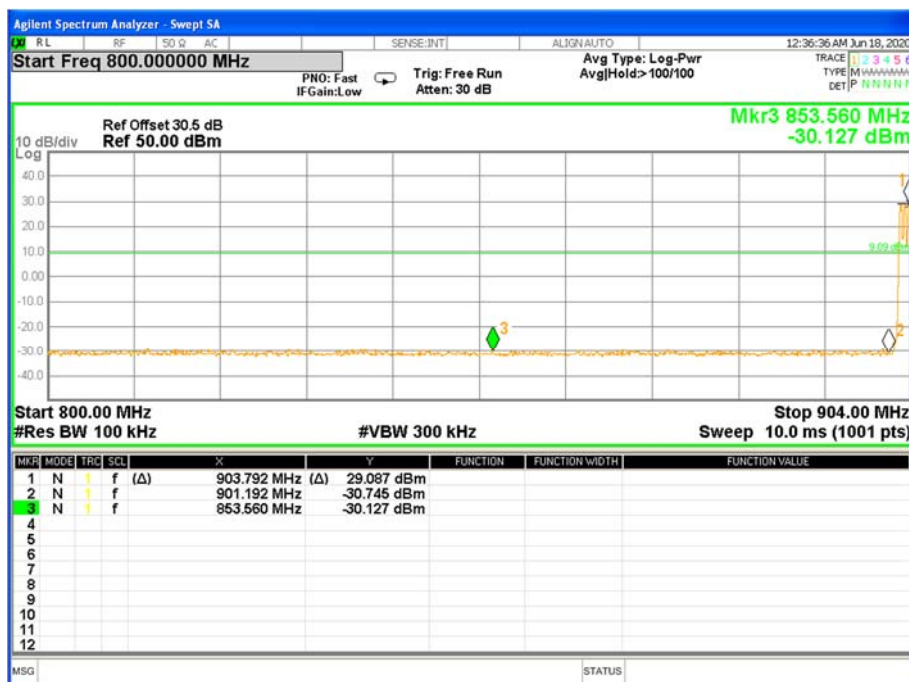
CH 49



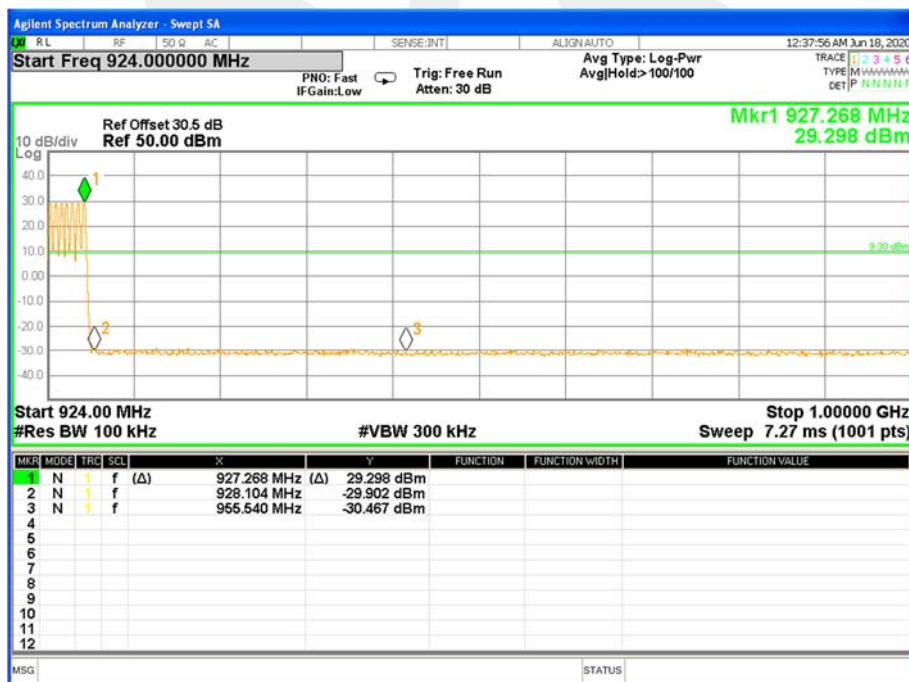


For Hopping Band edge

CH 00



CH 49





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 Frequency Range
RB	100KHz
VB	300KHz
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 shown in the block diagram below.
- Spectrum Setting: RBW= 100KHz, VBW=300KHz, Sweep time = Auto.

5.3 TEST SETUP



5.4 EUT OPERATION CONDITIONS

Please refer to section 2.4 of this report.

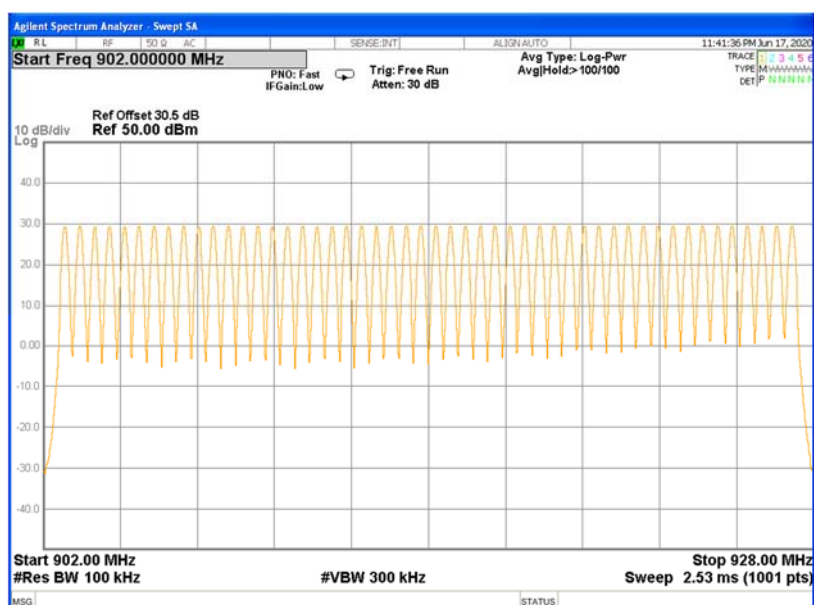
5.5 TEST RESULTS

Temperature:	25°C	Relative Humidity:	60%
Test Mode:	Hopping Mode (Dense reader mode)	Test Voltage:	DC 24V

Number of Hopping Channel

50

Hopping channel





Temperature:	25°C	Relative Humidity:	60%
Test Mode:	Hopping Mode (Single reader mode)	Test Voltage:	DC 24V

Number of Hopping Channel

50

Hopping channel



6. AVERAGE TIME OF OCCUPANCY

6.1 LIMIT

FCC Part 15.247, Subpart C RSS-247				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247 (a)(1)(i) RSS-247 5.1(c)	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 = 100KHz/VBW = 300KHz.
- 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 measured 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

Please refer to section 2.4 of this report.

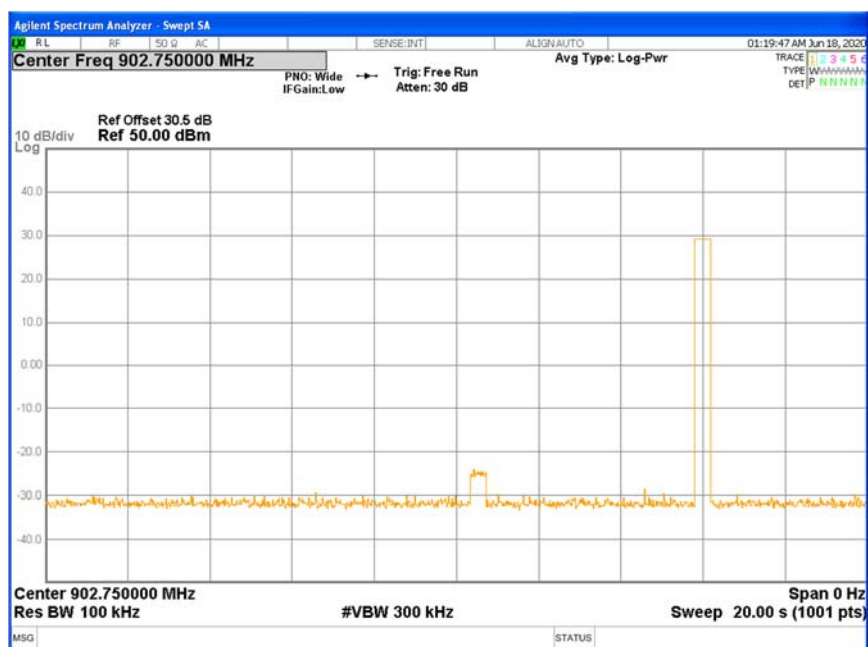


6.5 TEST RESULTS

Temperature:	25°C	Relative Humidity:	50%
Test Mode:	Dense reader mode / CH00, CH25, CH49	Test Voltage:	DC 24V

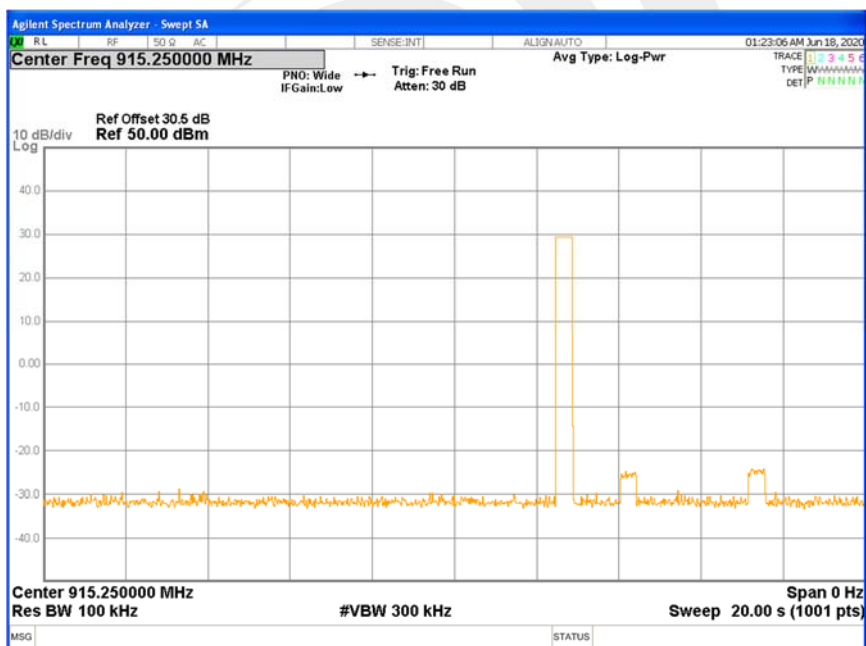
Frequency	Dwell Time(s)	Limits(s)	result
902.75 MHz	0.383	0.4	Pass
915.25 MHz	0.384	0.4	Pass
927.25 MHz	0.383	0.4	Pass

CH 00





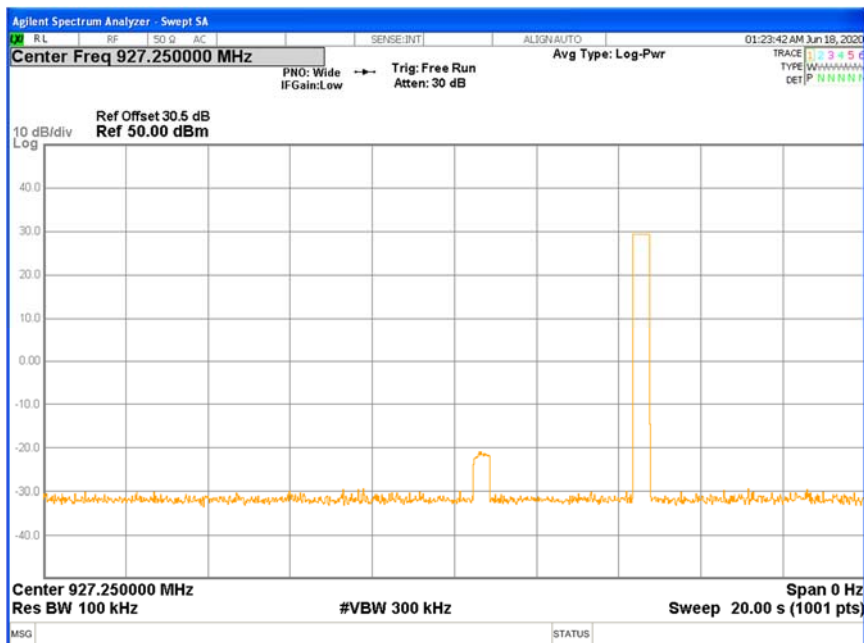
CH 25







CH 49

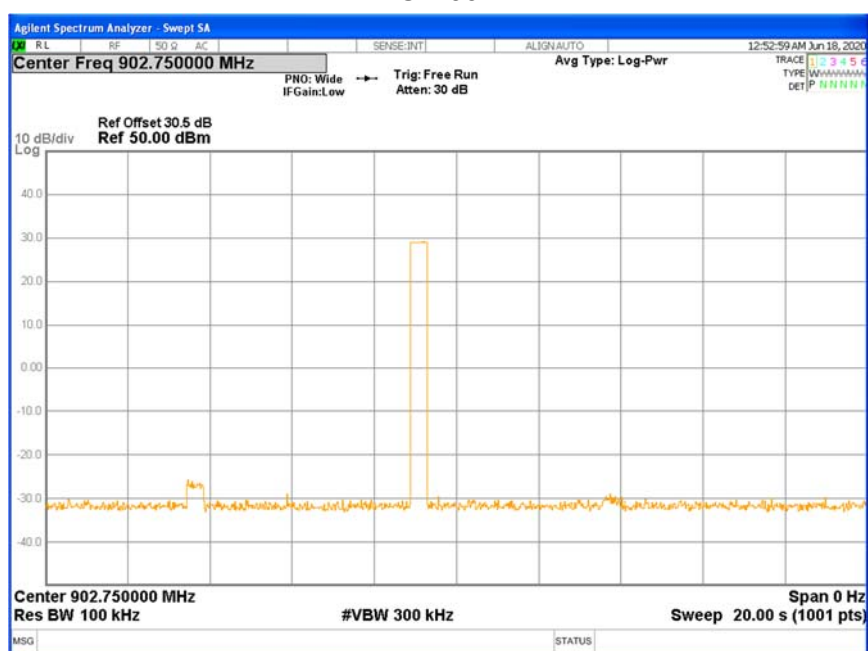




Temperature:	25°C	Relative Humidity:	50%
Test Mode:	Single reader mode / CH00, CH25, CH49	Test Voltage:	DC 24V

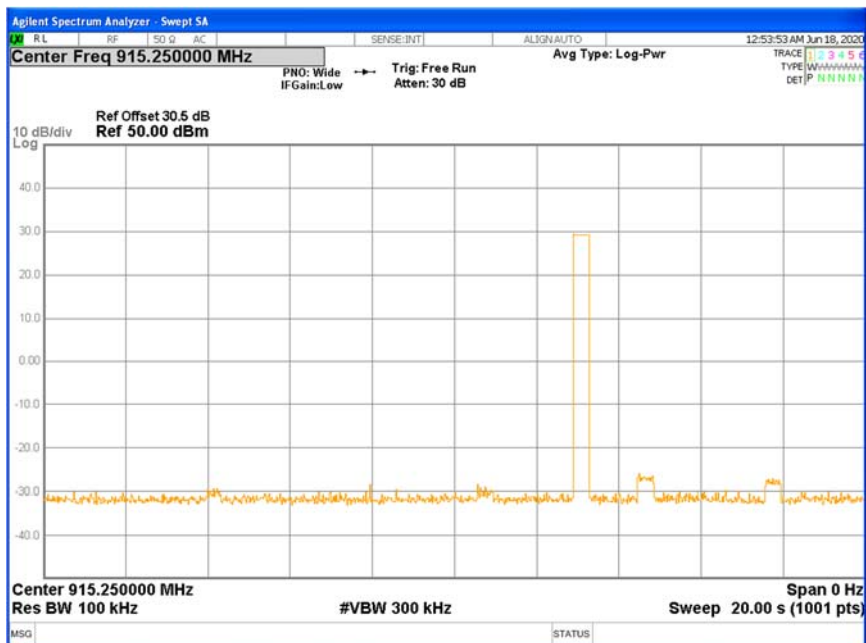
Frequency	Dwell Time(s)	Limits(s)	result
902.75 MHz	0.383	0.4	Pass
915.25 MHz	0.383	0.4	Pass
927.25 MHz	0.383	0.4	Pass

CH 00



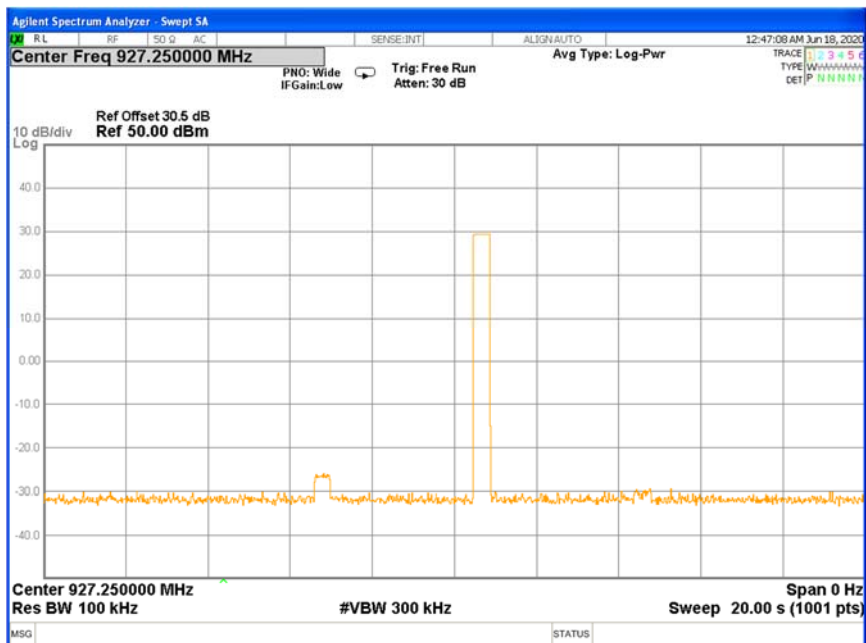


CH 25





CH 49



7. HOPPING CHANNEL SEPARATION MEASUREMENT

7.1 LIMIT

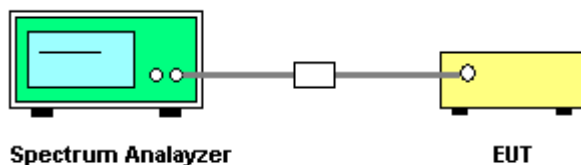
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operating 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	30KHz
VB	100KHz
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= 30KHz, VBW= 100KHz, Sweep time = Auto.

7.3 TEST SETUP



7.4 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuous transmitting mode.



7.5 TEST RESULTS

Temperature:	25°C	Relative Humidity:	50%
Test Mode:	Dense reader mode / CH00, CH25, CH49	Test Voltage:	DC 24V

Frequency	Mark1 Frequency (MHz)	Mark2 Frequency (MHz)	Ch. Separation (MHz)	Limit (MHz)	Result
902.75 MHz	902.750	903.251	0.501	0.09536	Comply
915.25 MHz	915.250	915.750	0.500	0.09500	Comply
927.25 MHz	926.752	927.248	0.496	0.09448	Comply

Ch. Separation Limits: > 20dB bandwidth

CH 00

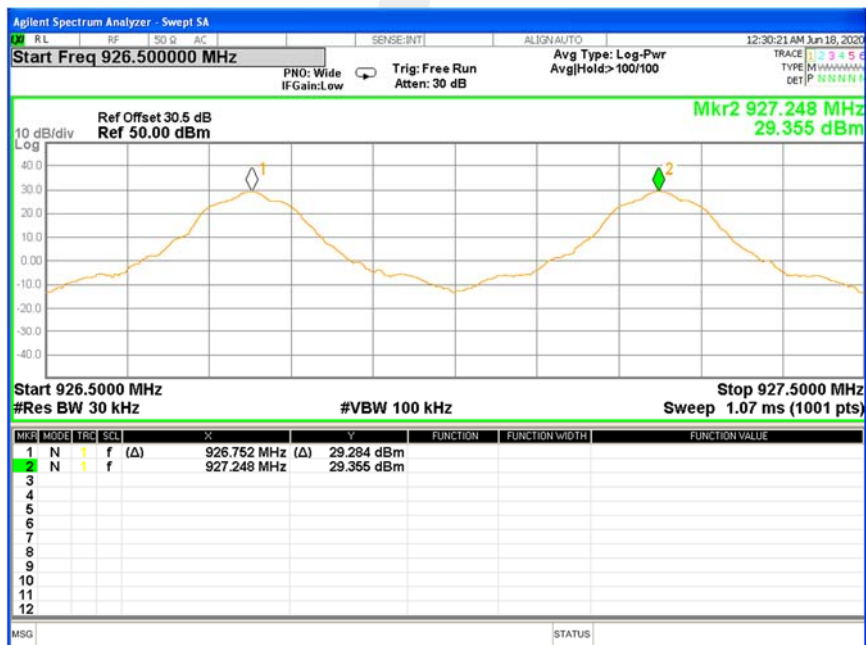




CH 25



CH 49



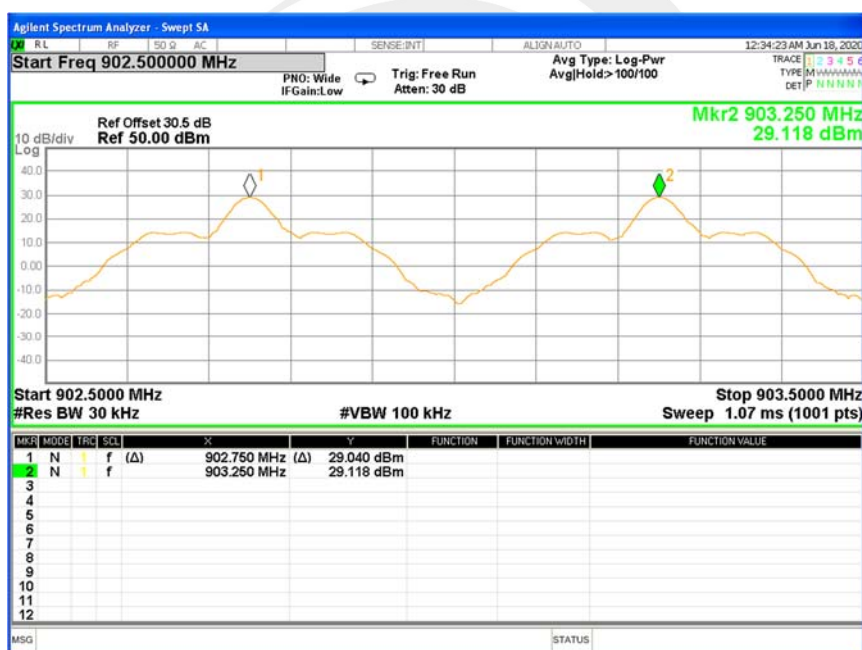


Temperature:	25°C	Relative Humidity:	50%
Test Mode:	Single reader mode / CH00, CH25, CH49	Test Voltage:	DC 24V

Frequency	Mark1 Frequency (MHz)	Mark2 Frequency (MHz)	Ch. Separation (MHz)	Limit (KHz)	Result
902.75 MHz	902.750	903.250	0.500	25	Complies
915.25 MHz	915.250	915.751	0.501	25	Complies
927.25 MHz	926.750	927.250	0.500	25	Complies

Ch. Separation Limits: > 25KHz

CH 00

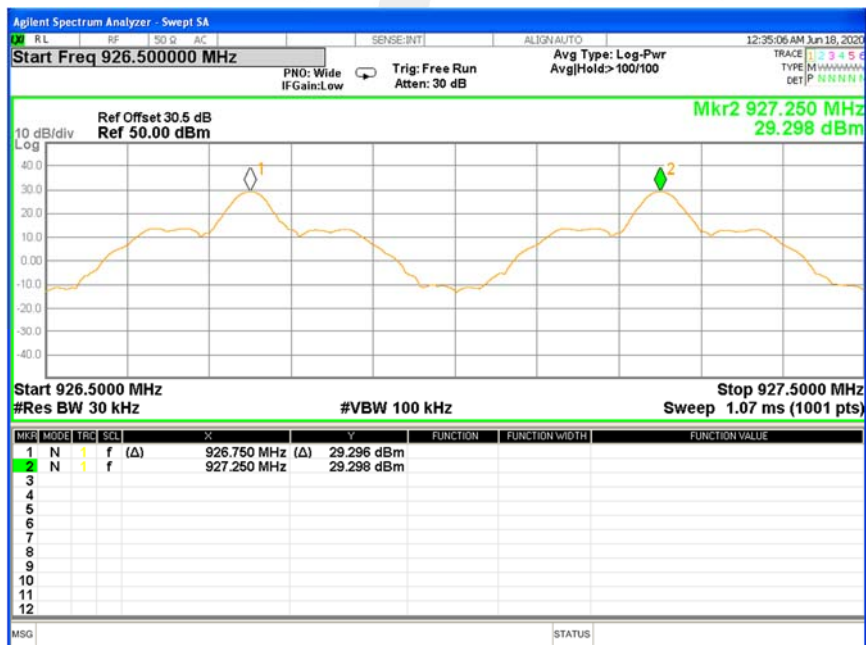




CH 25



CH 49





8. BANDWIDTH TEST

8.1 LIMIT

FCC Part15 15.247,Subpart C RSS-247				
Section	Test Item	Limit	FrequencyRange (MHz)	Result
15.247 (a)(1)(i) RSS-247 5.1(c)	20dB Bandwidth	500KHz	902-928	PASS

Spectrum Parameter	Setting
Attenuation	Auto
Span	500 KHz
RB	1 KHz
VB	3 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 shown in the block diagram below.
- Spectrum Setting: RBW= 1KHz, VBW=3KHz, Sweep time = Auto.

8.3 TEST SETUP



8.4 EUT OPERATION CONDITIONS

Please refer to section 2.4 of this report.

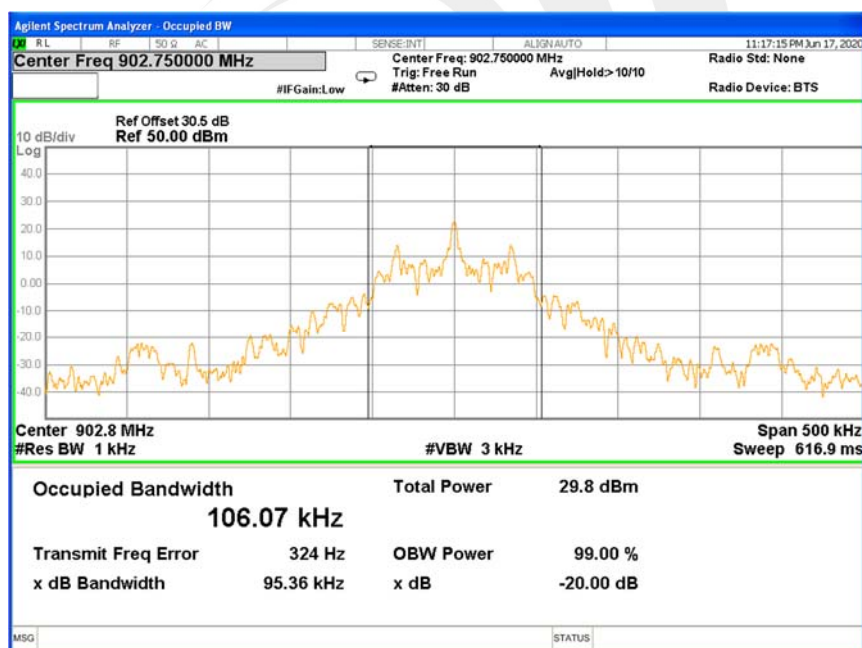


8.5 TEST RESULTS

Temperature:	25°C	Relative Humidity:	50%
Test Mode:	Dense reader mode / CH00, CH25, CH49	Test Voltage:	DC 24V

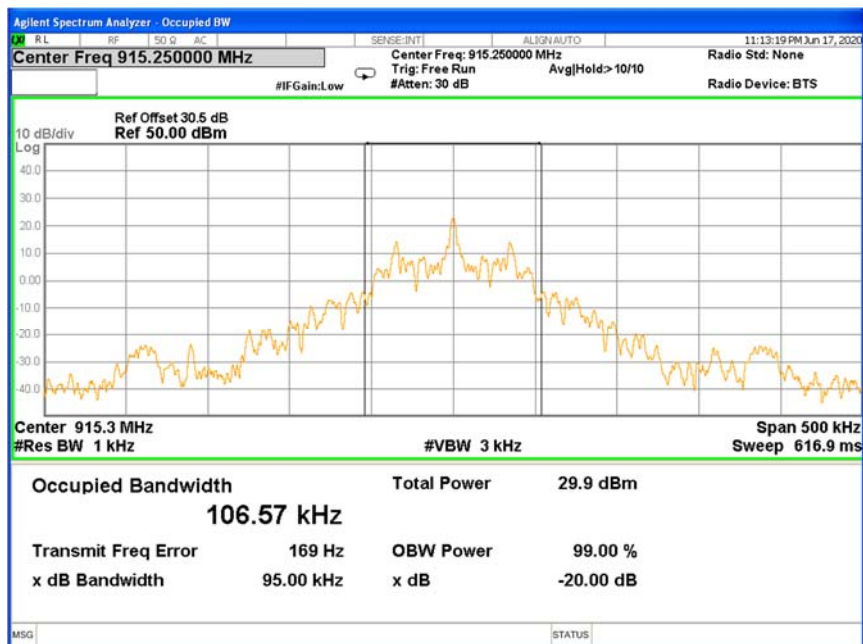
Frequency	20dB Bandwidth(kHz)	99% Bandwidth(kHz)	Limit (KHz)	Result
902.75 MHz	95.36	106.07	500	PASS
915.25 MHz	95.00	106.57	500	PASS
927.25 MHz	94.48	121.44	500	PASS

CH 00

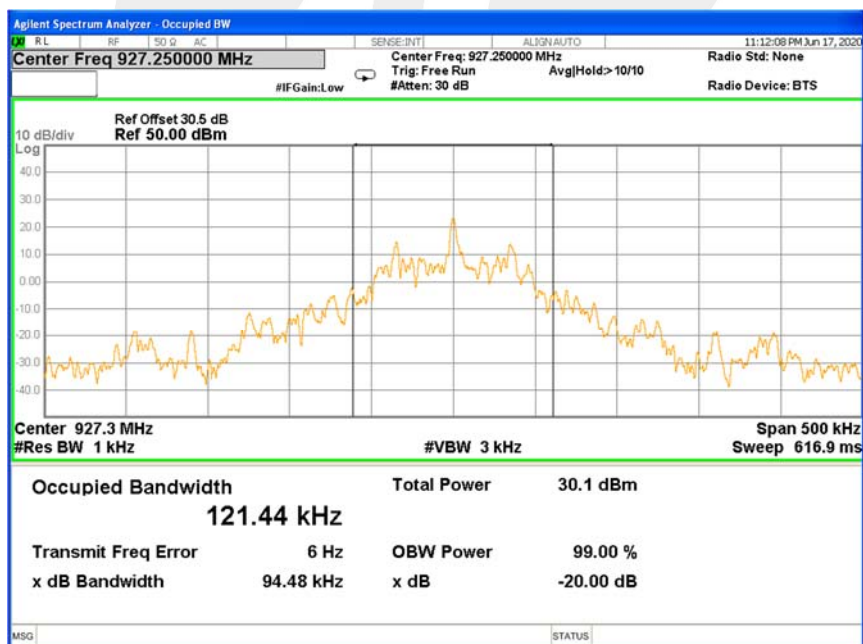




CH 25



CH 49

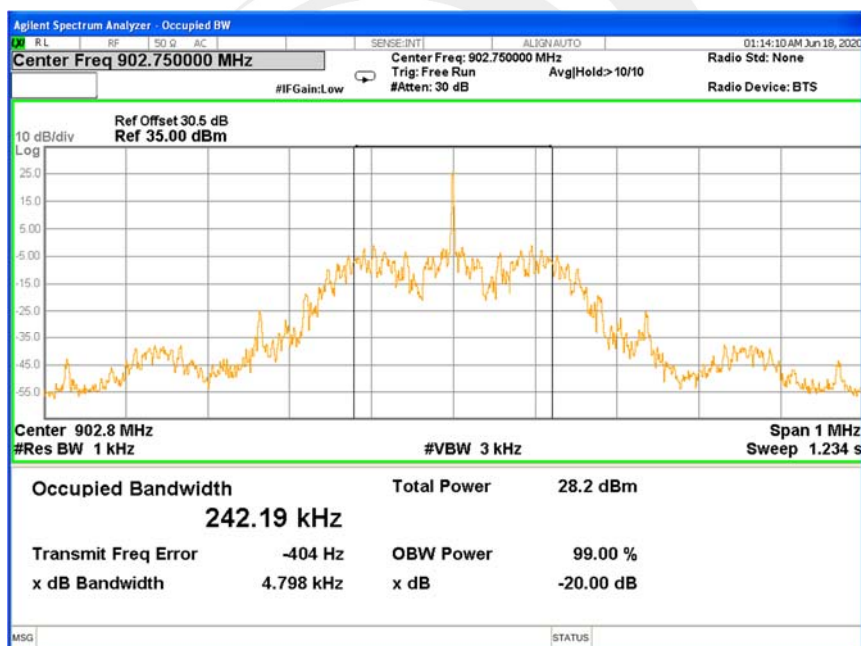




Temperature:	25°C	Relative Humidity:	50%
Test Mode:	Single reader mode / CH00, CH25, CH49	Test Voltage:	DC 24V

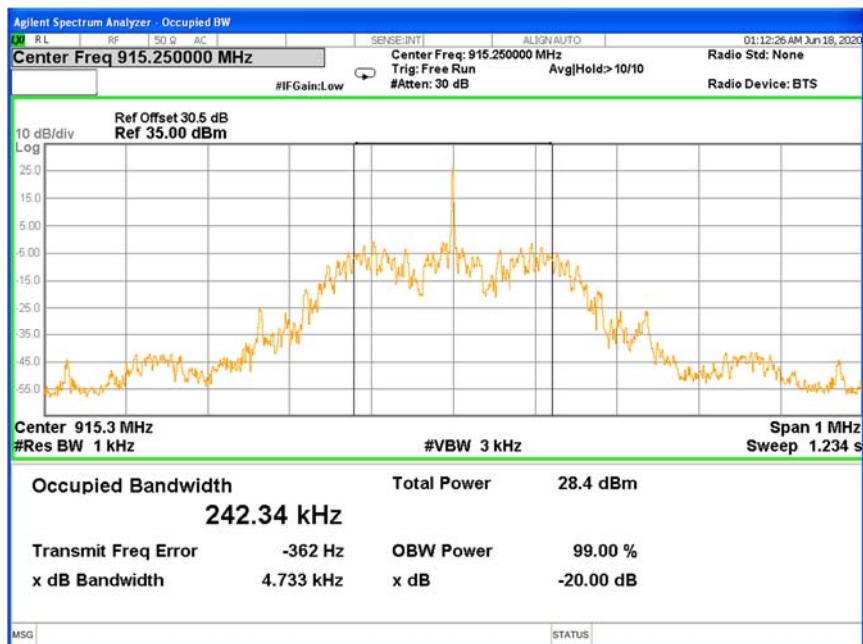
Frequency	20dB Bandwidth(kHz)	99% Bandwidth(kHz)	Limit (KHz)	Result
902.75 MHz	4.798	242.19	500	PASS
915.25 MHz	4.733	242.34	500	PASS
927.25 MHz	4.644	234.73	500	PASS

CH 00

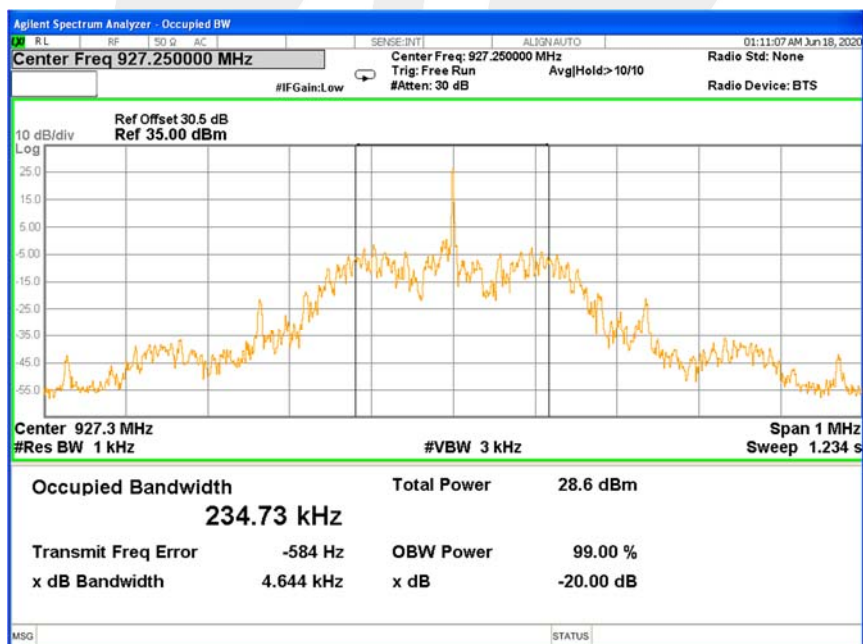




CH 25



CH 49





9. OUTPUT POWER TEST

9.1 LIMIT

FCC Part 15.247, Subpart C RSS-247				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247 (b)(2) RSS-247 5.4(a)	Output Power	1 W	902-928	PASS
RSS-247 5.4(a)	EIRP	4W		

9.2 TEST PROCEDURE

This is a RF-conducted test to evaluate the 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 ≥ 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

Please refer to section 2.4 of this report.



9.5 TEST RESULTS

Temperature:	25℃	Relative Humidity:	60%
Test Voltage:	DC 24V		

Dense reader mode			
Test Channel	Frequency	Conducted Output Power	LIMIT
	(MHz)	Peak (dBm)	dBm
CH 00	902.75	29.244	30
CH 25	915.25	29.384	30
CH 49	927.25	29.482	30

Single reader mode			
Test Channel	Frequency	Conducted Output Power	LIMIT
	(MHz)	Peak (dBm)	dBm
CH 00	902.75	29.101	30
CH 25	915.25	29.252	30
CH 49	927.25	29.355	30

EIRP Power							
Mode	Channel Number	Frequency (MHz)	Peak Power	Cable Loss	Antenna Gain	EIRP Power	Limit
			(dBm)	(dB)	(dBi)	(dBm)	(dBm)
Dense reader mode	0	902.75	29.24	12.00	15.00	32.24	36.02
	25	915.25	29.38	12.00	15.00	32.38	36.02
	49	927.25	29.48	12.00	15.00	32.48	36.02

Mode	Channel Number	Frequency (MHz)	Peak Power	Cable Loss	Antenna Gain	EIRP Power	Limit
			(dBm)	(dB)	(dBi)	(dBm)	(dBm)
Single reader mode	0	902.75	29.10	12.00	15.00	32.10	36.02
	25	915.25	29.25	12.00	15.00	32.25	36.02
	49	927.25	29.36	12.00	15.00	32.36	36.02



10. ANTENNA REQUIREMENT

10.1 STANDARD REQUIREMENT

FCC Part 15.203&RSS-Gen requirement: For intentional device, according to FCC Part 15.203&RSS-Gen: 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.

Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

10.2 EUT ANTENNA

The EUT antenna should be installed by professional installer only so that the limits in this part **do not exceed**.





11. FREQUENCY STABILITY

11.1 LIMITS OF FREQUENCY STABILITY MEASUREMENT

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.02\%$ of the operating frequency over a temperature variation of $-30\text{ }^{\circ}\text{C}$ to $50\text{ }^{\circ}\text{C}$ at normal supply voltage, and for a variation in primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of $20\text{ }^{\circ}\text{C}$.

11.2 TEST PROCEDURE

1. The EUT was placed inside the environmental test chamber and powered by nominal DC voltage.
2. Turn the EUT on and couple its output to spectrum analyzer.
3. Turn the EUT off and set the chamber to the highest temperature specified.
4. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT on and measure the operating frequency after 2, 5, and 10 minutes.
5. Repeat step 2 and 3 with the temperature chamber set to the lowest temperature.
6. The test chamber was allowed to stabilize at $+20\text{ }^{\circ}\text{C}$ for a minimum of 30 minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and record the frequency.

11.3 TEST RESULT

Dense reader mode

Channel 25 (915.25MHz)

Voltage vs. Frequency Stability

Voltage(V)	Measurement Frequency(MHz)
27.6	915.2501
24	915.2495
20.4	915.2499
Max.Deviation(MHz)	0.0001
Max.Deviation(ppm)	0.11

Rated working voltage: DC 24V

Temperature vs. Frequency Stability

Temperature($^{\circ}\text{C}$)	Measurement Frequency(MHz)
-30	915.2503
-20	915.2494
-10	915.2502
0	915.2503
10	915.2501
20	915.2500
30	915.2501
40	915.2502
50	915.2499
Max.Deviation(MHz)	0.0003
Max.Deviation(ppm)	0.33



Single reader mode

Channel 25 (915.25MHz)

Voltage vs. Frequency Stability

Voltage(V)	Measurement Frequency(MHz)
27.6	915.2503
24	915.2499
20.4	915.2494
Max.Deviation(MHz)	0.0003
Max.Deviation(ppm)	0.33

Rated working voltage: DC 24V

Temperature vs. Frequency Stability

Temperature(°C)	Measurement Frequency(MHz)
-30	915.2504
-20	915.2498
-10	915.2501
0	915.2503
10	915.2502
20	915.2500
30	915.2502
40	915.2503
50	915.2495
Max.Deviation(MHz)	0.0004
Max.Deviation(ppm)	0.44



12. RF EXPOSURE COMPLIANCE

12.1 LIMIT

The limit for Maximum Permissible Exposure (MPE) specified in FCC 1.1310 is followed. According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environmental impact of the human exposure to radio-frequency (RF) radiation as specified in 1.1307 (b).

Limits for Maximum Permissible Exposure (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)
Limits for Occupational / controlled Exposures			
300 - 1500	--	--	F/300
1500 - 100000	--	--	5.0
Limits for General population / Uncontrolled Exposure			
300 - 1500	--	--	F/1500
1500 - 100000	--	--	1.0

For the purpose of this standard, Industry Canada has adopted the SAR and RF field strength limits established in Health Canada's RF exposure guideline

Table 4: RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Reference Period (minutes)
0.003-10 ²¹	83	90	-	Instantaneous*
0.1-10	-	0.73/ <i>f</i>	-	6**
1.1-10	87/ <i>f</i> ^{0.5}	-	-	6**
10-20	27.46	0.0728	-2	6
20-48	58.07/ <i>f</i> ^{0.25}	0.1540/ <i>f</i> ^{0.25}	8.944/ <i>f</i> ^{0.5}	6
48-300	22.06	0.05852	1.291	6
300-6000	3.142 <i>f</i> ^{0.3417}	0.008335 <i>f</i> ^{0.3417}	0.02619 <i>f</i> ^{0.6834}	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/ <i>f</i> ^{1.2}
150000-300000	0.158 <i>f</i> ^{0.5}	4.21 x 10 ⁻⁴ <i>f</i> ^{0.5}	6.67 x 10 ⁻⁵ <i>f</i>	616000/ <i>f</i> ^{1.2}

Note: *f* is frequency in MHz.

* Based on nerve stimulation (NS).

** Based on specific absorption rate (SAR).



12.2 RESULT

Friss Transmission Formula: $P_d = (P_{out} * G) / (4 * \pi * r^2)$

Where

P_d = power density in mW/cm²

P_{out} = antenna power in mW

G = gain of antenna in linear scale

π = 3.1416

R = Distance between observation point and the center of radiator in cm, $R=100$ cm

ANT Gain (G)

Combination gain: 3dBi (gain of antenna in linear scale=2.00)

FCC:

Protocol	MAX Power (dBm)	MAX Power (mW)	Power Density (mW/cm ²)	Limit (mW/cm ²)	Result
FHSS	29.482	887.565	0.0141	0.6182	Pass

IC:

Protocol	MAX Power (dBm)	MAX Power (mW)	Power Density (mW/cm ²)	Limit (mW/cm ²)	Result
FHSS	29.482	887.565	0.0141	0.2792	Pass



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※※※※※

