



RADIO TEST REPORT

Report No.: STS2005237W01

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:	HRD27000
Series Model:	HRD27001
FCC ID:	2AA7KTARVOSHRD27000
IC:	20068-TARVOS27000
Test Standard:	FCC Part 15.247 RSS-247 Issue 2, February 2017

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**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.....: HRD27000
Series Model: HRD27001
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.

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Date of Test.....:

Date of receipt of test item: 26 May 2020

Date (s) of performance of tests : 26 May 2020 ~ 30 June 2020

Date of Issue: 30 June 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	30 June 2020	STS2005237W01	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 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

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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	INTEGRATED READER
Trade Name	TARVOS
Model Name	HRD27000
Series Model	HRD27001
Model Difference	Difference in Antenna Gain and Size. HRD27000 integrated with Cheetah II Antenna (12dbi) and optional external Avior, Cheetah II and Bobcat Antenna. HRD27001 integrated with Bobcat Antenna (8dbi) and optional external Cheetah II and Bobcat Antenna.
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	1.5.2.19881
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	HRD27000	Avior	N/A	15	12	3
2	TARVOS	HRD27000	Cheetah II	N/A	12	12	0
3	TARVOS	HRD27000	Bobcat	N/A	8	12	-4

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



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	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

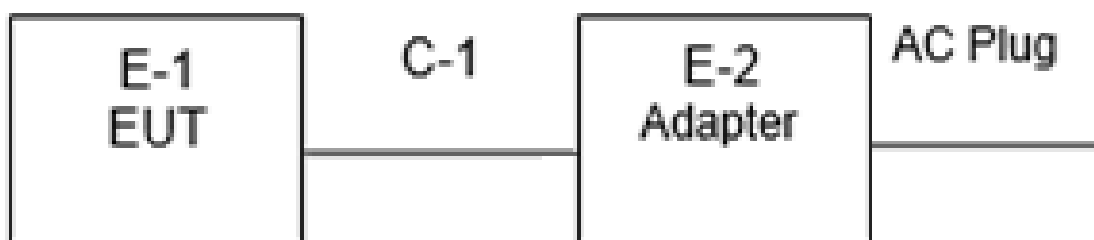
2.3 TABLE OF PARAMETERS OF TEST SOFTWARE SETTING

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.

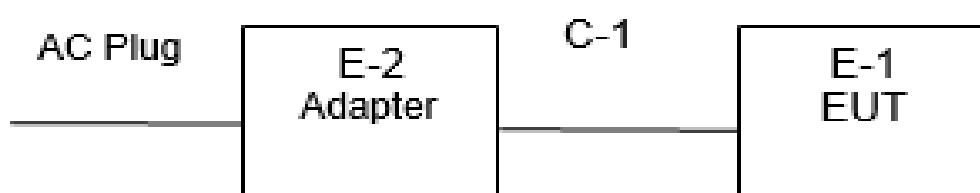


2.4 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

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-2	Adapter	N/A	PSAC30U-240L6	N/A	N/A
C-1	DC Cable	N/A	N/A	100cm	N/A

Support units

Item	Equipment	Mfr/Brand	Model/Type No.	Length	Note
N/A	N/A	N/A	N/A	N/A	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	2019.07.29	2020.07.28
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-40G)	SKET	LNPA_1840-50	SK201810180 1	2019.10.22	2020.10.21
Temperature & Humidity	HH660	Mieo	N/A	2019.10.12	2020.10.11
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	2019.07.29	2020.07.28
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

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.

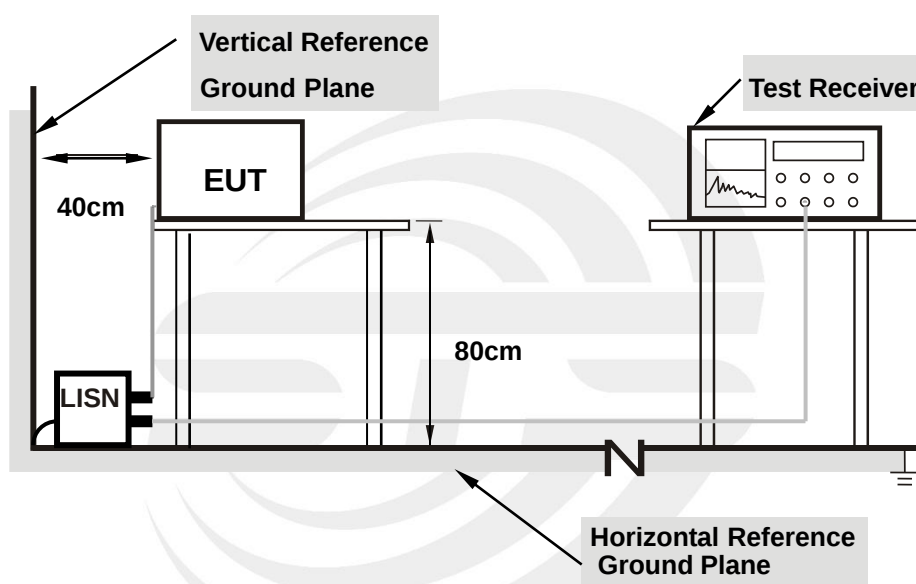
The following table is the setting of the receiver

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

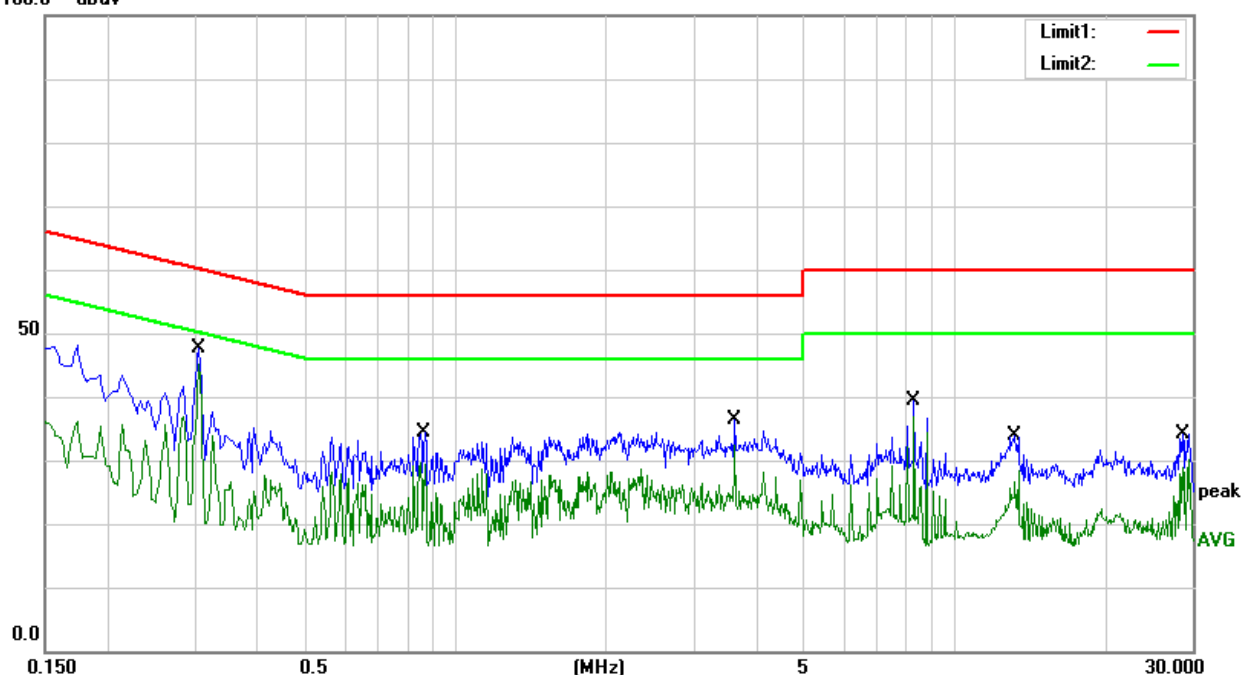
Temperature:	26.8℃	Relative Humidity:	68%RH
Test Voltage:	AC 120V/60Hz	Phase:	L
Test Mode:	Mode 7		

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.3060	26.78	20.75	47.53	60.08	-12.55	QP
2	0.3060	24.35	20.75	45.10	50.08	-4.98	AVG
3	0.8700	14.10	20.21	34.31	56.00	-21.69	QP
4	0.8700	9.19	20.21	29.40	46.00	-16.60	AVG
5	3.6260	16.36	20.07	36.43	56.00	-19.57	QP
6	3.6260	12.24	20.07	32.31	46.00	-13.69	AVG
7	8.2900	19.54	19.88	39.42	60.00	-20.58	QP
8	8.2900	17.11	19.88	36.99	50.00	-13.01	AVG
9	13.2100	13.85	19.97	33.82	60.00	-26.18	QP
10	13.2100	6.55	19.97	26.52	50.00	-23.48	AVG
11	28.7500	13.28	20.91	34.19	60.00	-25.81	QP
12	28.7500	7.87	20.91	28.78	50.00	-21.22	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





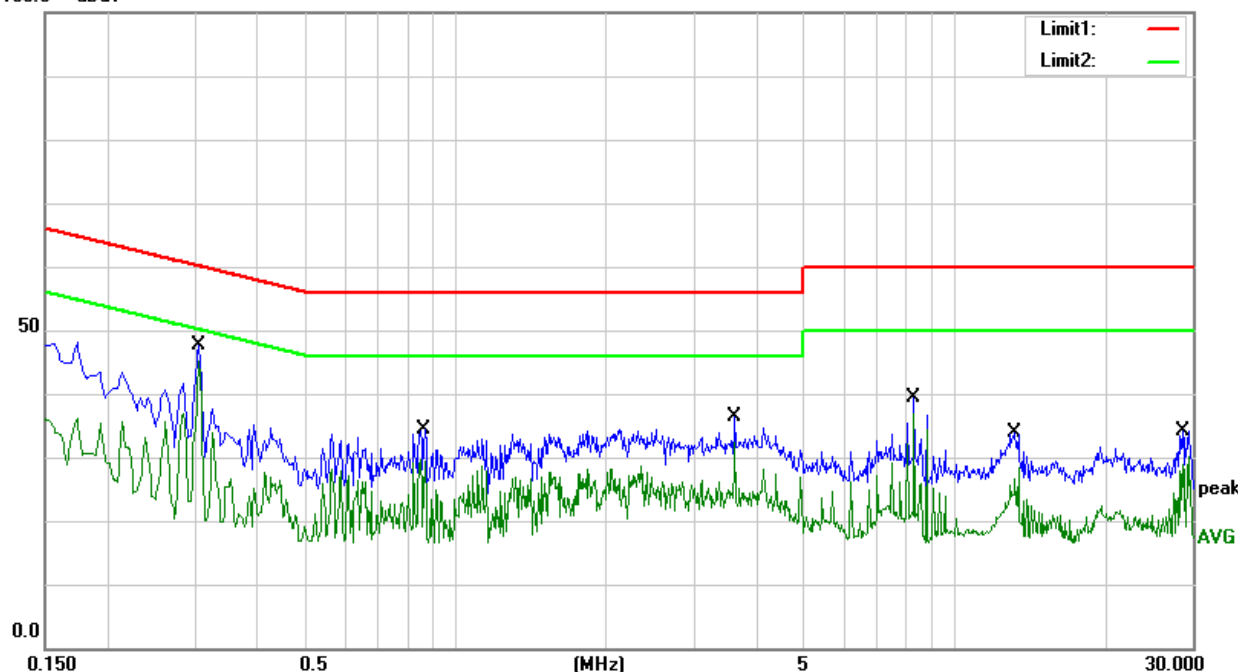
Temperature:	26.8℃	Relative Humidity:	68%RH
Test Voltage:	AC 120V/60Hz	Phase:	N
Test Mode:	Mode 7		

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.3060	26.78	20.75	47.53	60.08	-12.55	QP
2	0.3060	24.35	20.75	45.10	50.08	-4.98	AVG
3	0.8700	14.10	20.21	34.31	56.00	-21.69	QP
4	0.8700	9.19	20.21	29.40	46.00	-16.60	AVG
5	3.6260	16.36	20.07	36.43	56.00	-19.57	QP
6	3.6260	12.24	20.07	32.31	46.00	-13.69	AVG
7	8.2900	19.54	19.88	39.42	60.00	-20.58	QP
8	8.2900	17.11	19.88	36.99	50.00	-13.01	AVG
9	13.2100	13.85	19.97	33.82	60.00	-26.18	QP
10	13.2100	6.55	19.97	26.52	50.00	-23.48	AVG
11	28.7500	13.28	20.91	34.19	60.00	-25.81	QP
12	28.7500	7.87	20.91	28.78	50.00	-21.22	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:

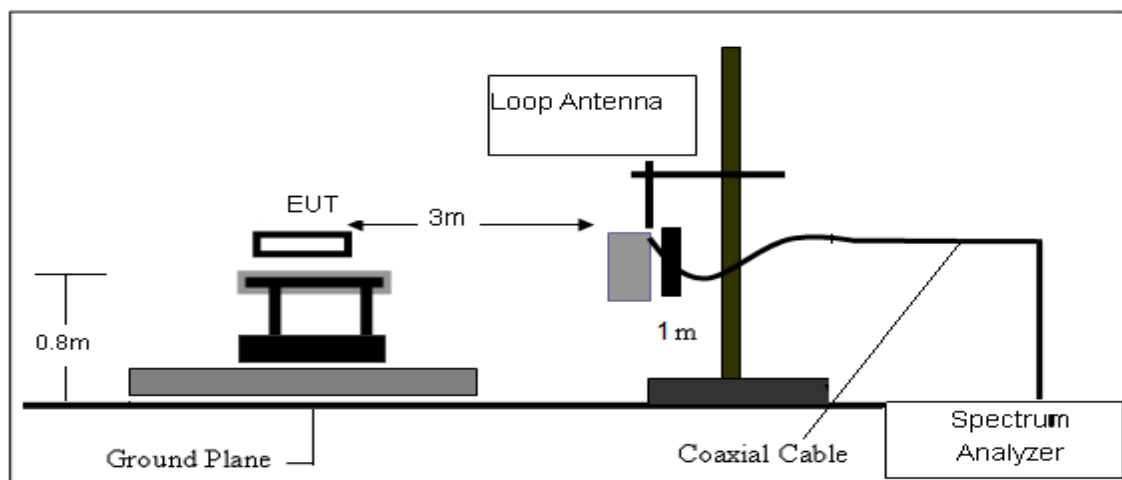
Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported.

3.2.3 DEVIATION FROM TEST STANDARD

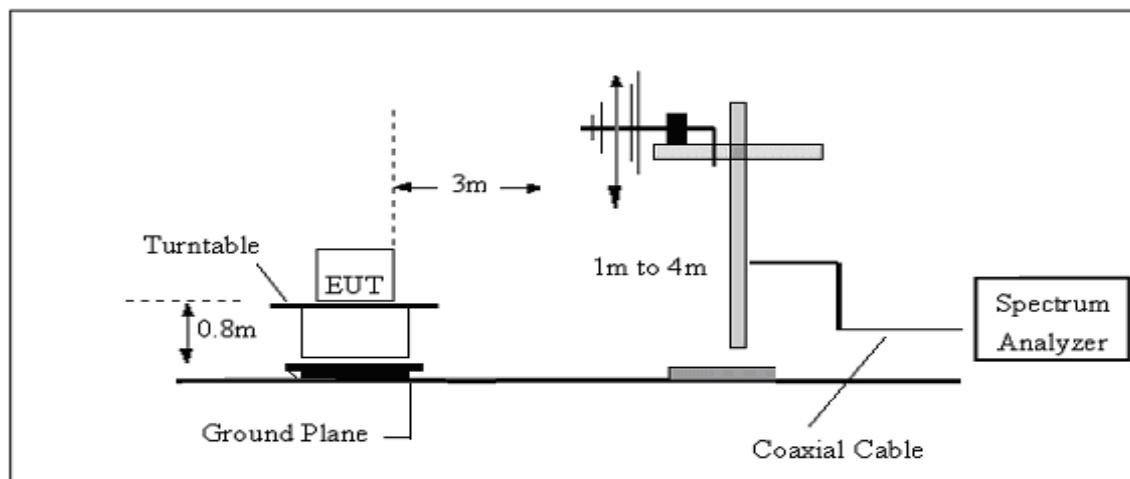
No deviation.

3.2.4 TESTSETUP

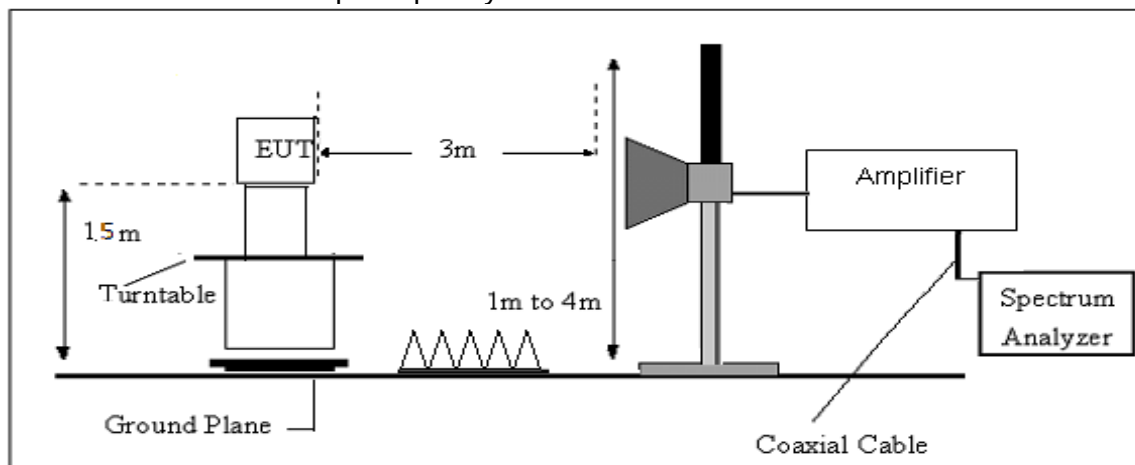
(A) Radiated Emission Test-Up Frequency Below 30MHz



(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.



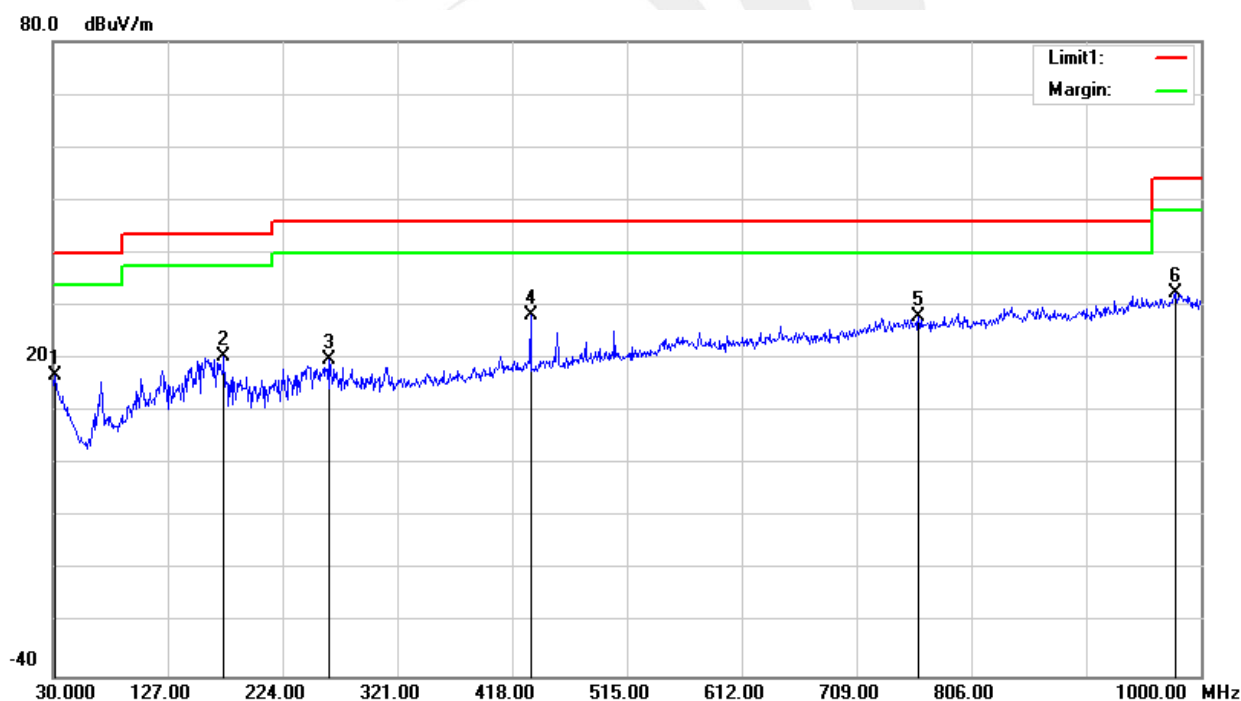
(30MHz-1000MHz)

Temperature:	24°C	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	31.9400	30.74	-13.86	16.88	40.00	-23.12	QP
2	174.5300	40.50	-20.02	20.48	43.50	-23.02	QP
3	263.7700	34.73	-14.75	19.98	46.00	-26.02	QP
4	433.5200	38.52	-10.13	28.39	46.00	-17.61	QP
5	761.3800	30.09	-2.19	27.90	46.00	-18.10	QP
6	978.6600	29.85	2.58	32.43	54.00	-21.57	QP

Remark:

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



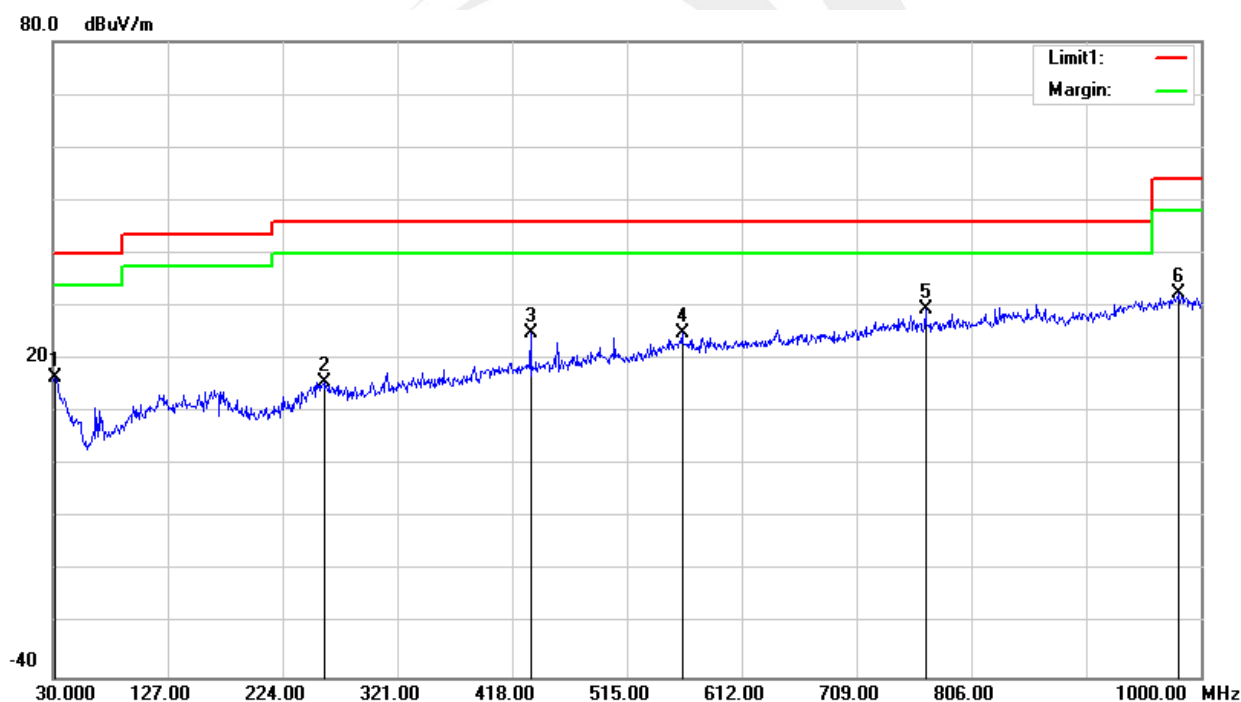


Temperature:	24℃	Relative Humidity:	54%RH
Test Voltage:	DC 24V	Phase:	Vertical
Test Mode:	Mode 1/2/3 (Mode 3 worst mode)		

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	31.9400	30.46	-13.86	16.60	40.00	-23.40	QP
2	258.9200	30.69	-14.90	15.79	46.00	-30.21	QP
3	433.5200	35.10	-10.13	24.97	46.00	-21.03	QP
4	561.5600	30.60	-5.51	25.09	46.00	-20.91	QP
5	767.2000	31.74	-2.29	29.45	46.00	-16.55	QP
6	980.6000	29.90	2.63	32.53	54.00	-21.47	QP

Remark:

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





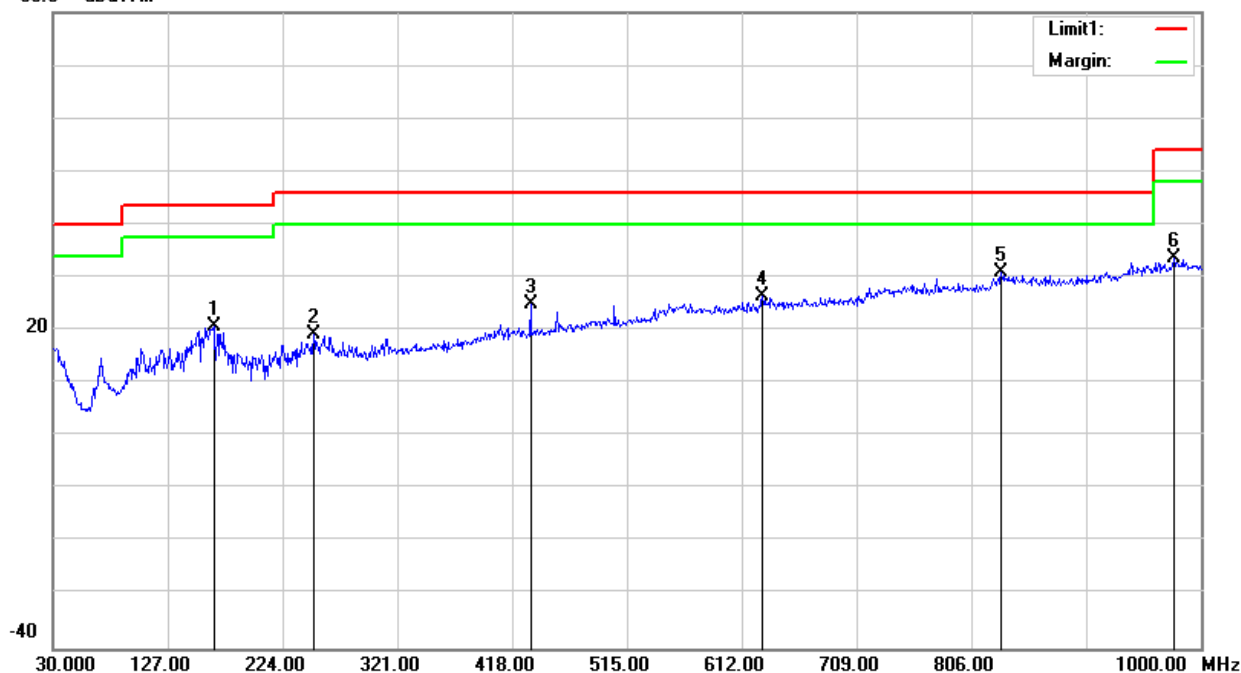
Temperature:	24℃	Relative Humidity:	54%RH
Test Voltage:	DC 24V	Phase:	Horizontal
Test Mode:	Mode 4/5/6 (Mode 6 worst mode)		

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	165.8000	40.11	-19.40	20.71	43.50	-22.79	QP
2	250.1900	35.38	-16.10	19.28	46.00	-26.72	QP
3	433.5200	35.04	-10.13	24.91	46.00	-21.09	QP
4	629.4600	31.43	-5.07	26.36	46.00	-19.64	QP
5	831.2200	31.69	-0.70	30.99	46.00	-15.01	QP
6	977.6900	31.14	2.52	33.66	54.00	-20.34	QP

Remark:

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

80.0 dBuV/m



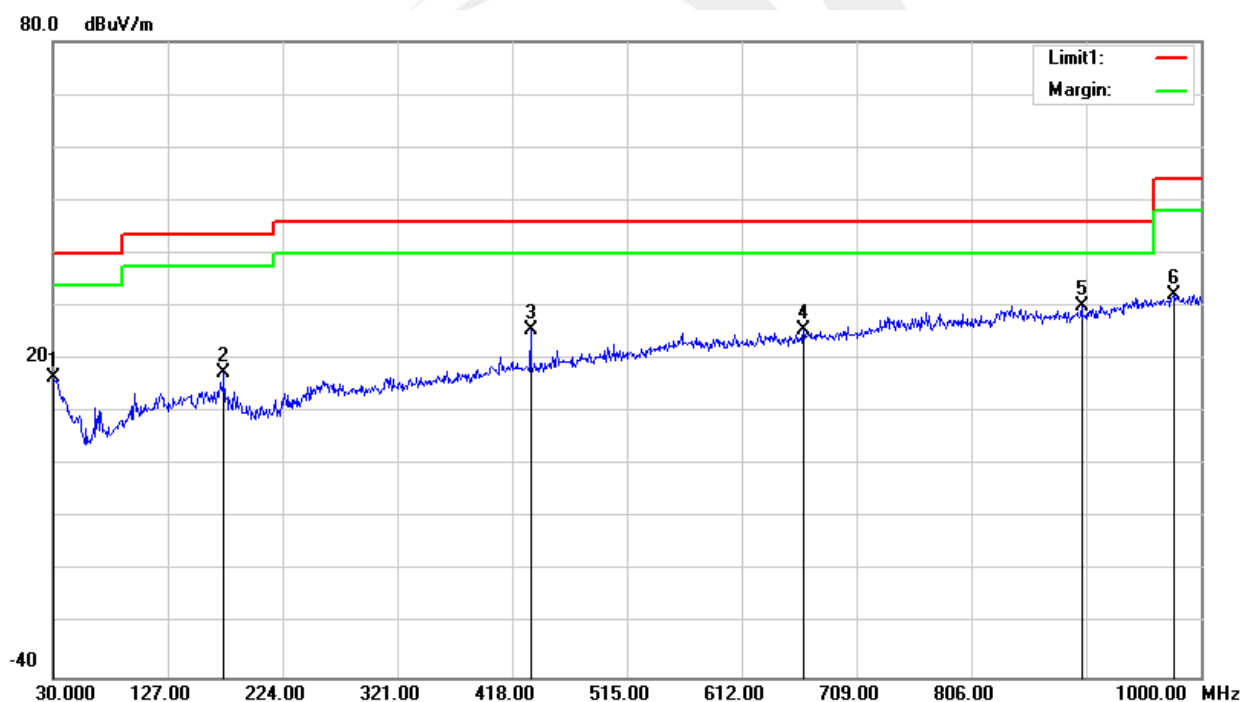


Temperature:	24℃	Relative Humidity:	54%RH
Test Voltage:	DC 24V	Phase:	Vertical
Test Mode:	Mode 4/5/6 (Mode 6 worst mode)		

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	30.0000	29.34	-12.85	16.49	40.00	-23.51	QP
2	174.5300	37.37	-20.02	17.35	43.50	-26.15	QP
3	433.5200	35.71	-10.13	25.58	46.00	-20.42	QP
4	664.3800	30.34	-4.71	25.63	46.00	-20.37	QP
5	899.1200	30.52	-0.47	30.05	46.00	-15.95	QP
6	976.7200	29.60	2.45	32.05	54.00	-21.95	QP

Remark:

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





(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
1805.5	47.15	43.87	0.01	47.16	0.00	43.88	74.00	54.00	-26.84	-10.12	-10.12	Horizontal
2908.5	39.48	28.18	5.66	45.14	0.00	33.84	74.00	54.00	-28.86	-20.16	-20.16	Horizontal
4513.5	55.55	51.43	-8.46	47.09	0.00	42.97	74.00	54.00	-26.91	-11.03	-11.03	Horizontal
5859	51.30	39.98	-3.49	47.81	0.00	36.49	74.00	54.00	-26.19	-17.51	-17.51	Horizontal
8170	51.28	40.35	3.25	54.53	0.00	43.60	74.00	54.00	-19.47	-10.40	-10.40	Horizontal
9796	50.94	40.37	5.01	55.95	0.00	45.38	74.00	54.00	-18.05	-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
1245.5	40.80	29.69	-0.94	39.86	0.00	28.75	74.00	54.00	-34.14	-25.25	-25.25	Vertical
1805.5	50.18	48.08	0.01	50.19	0.00	48.09	74.00	54.00	-23.81	-5.91	-5.91	Vertical
3610.5	53.39	47.25	-11.93	41.46	0.00	35.32	74.00	54.00	-32.54	-18.68	-18.68	Vertical
4513.5	52.81	47.99	-8.46	44.35	0.00	39.53	74.00	54.00	-29.65	-14.47	-14.47	Vertical
8170	51.48	40.49	3.25	54.73	0.00	43.74	74.00	54.00	-19.27	-10.26	-10.26	Vertical
9860	50.82	40.50	5.12	55.94	0.00	45.62	74.00	54.00	-18.06	-8.38	-8.38	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
1831	46.34	40.53	0.45	46.79	0.00	40.98	74.00	54.00	-27.21	-13.02	-13.02	Horizontal
2956	39.44	28.44	5.92	45.36	0.00	34.36	74.00	54.00	-28.64	-19.64	-19.64	Horizontal
4575.75	54.94	48.81	-7.83	47.11	0.00	40.98	74.00	54.00	-26.89	-13.02	-13.02	Horizontal
5563.5	51.53	39.85	-4.43	47.10	0.00	35.42	74.00	54.00	-26.90	-18.58	-18.58	Horizontal
7727	50.36	40.55	2.76	53.12	0.00	43.31	74.00	54.00	-20.88	-10.69	-10.69	Horizontal
9578	51.49	40.44	4.63	56.12	0.00	45.07	74.00	54.00	-17.88	-8.93	-8.93	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
1830.5	44.85	41.96	0.44	45.29	0.00	42.40	74.00	54.00	-28.71	-11.60	-11.60	Vertical
2954.5	39.51	28.77	5.91	45.42	0.00	34.68	74.00	54.00	-28.58	-19.32	-19.32	Vertical
4576.5	54.80	50.39	-7.83	46.97	0.00	42.56	74.00	54.00	-27.03	-11.44	-11.44	Vertical
5472.75	51.84	40.31	-4.97	46.87	0.00	35.34	74.00	54.00	-27.13	-18.66	-18.66	Vertical
8277	52.37	40.66	3.25	55.62	0.00	43.91	74.00	54.00	-18.38	-10.09	-10.09	Vertical
9153	53.77	47.68	3.74	57.51	0.00	51.42	74.00	54.00	-16.49	-2.58	-2.58	Vertical



High channel-Horizontal

Frequency (MHz)	Peak Reading (dBuV/m)	Average Readingl (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
1854.5	51.22	48.67	0.79	52.01	0.00	49.46	74.00	54.00	-21.99	-4.54	-4.54	Horizontal
2868.5	40.02	28.31	5.61	45.63	0.00	33.92	74.00	54.00	-28.37	-20.08	-20.08	Horizontal
4636.5	53.80	48.83	-7.53	46.27	0.00	41.30	74.00	54.00	-27.73	-12.70	-12.70	Horizontal
4914.75	52.49	45.40	-6.39	46.10	0.00	39.01	74.00	54.00	-27.90	-14.99	-14.99	Horizontal
8280	51.64	41.08	3.24	54.88	0.00	44.32	74.00	54.00	-19.12	-9.68	-9.68	Horizontal
9831	50.63	40.57	5.09	55.72	0.00	45.66	74.00	54.00	-18.28	-8.34	-8.34	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
1854.5	50.21	46.68	0.79	51.00	0.00	47.47	74.00	54.00	-23.00	-6.53	-6.53	Vertical
2781.5	41.76	35.79	5.15	46.91	0.00	40.94	74.00	54.00	-27.09	-13.06	-13.06	Vertical
3708.75	52.40	46.43	-11.27	41.13	0.00	35.16	74.00	54.00	-32.87	-18.84	-18.84	Vertical
4636.5	53.44	49.02	-7.53	45.91	0.00	41.49	74.00	54.00	-28.09	-12.51	-12.51	Vertical
7001	52.04	41.45	0.54	52.58	0.00	41.99	74.00	54.00	-21.42	-12.01	-12.01	Vertical
8707	50.86	40.26	4.33	55.19	0.00	44.59	74.00	54.00	-18.81	-9.41	-9.41	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
1805.5	47.77	45.41	0.01	47.78	0.00	45.42	74.00	54.00	-26.22	-8.58	-8.58	Horizontal
2917	39.88	28.37	5.71	45.59	0.00	34.08	74.00	54.00	-28.41	-19.92	-19.92	Horizontal
4514.25	55.56	50.80	-8.46	47.10	0.00	42.34	74.00	54.00	-26.90	-11.66	-11.66	Horizontal
6329	50.66	39.74	-1.42	49.24	0.00	38.32	74.00	54.00	-24.76	-15.68	-15.68	Horizontal
8198	51.11	41.06	3.33	54.44	0.00	44.39	74.00	54.00	-19.56	-9.61	-9.61	Horizontal
9347	51.55	40.50	4.29	55.84	0.00	44.79	74.00	54.00	-18.16	-9.21	-9.21	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
1805.5	47.65	45.22	0.01	47.66	0.00	45.23	74.00	54.00	-26.34	-8.77	-8.77	Vertical
2810	39.66	28.23	5.34	45.00	0.00	33.57	74.00	54.00	-29.00	-20.43	-20.43	Vertical
4514.25	55.91	50.30	-8.46	47.45	0.00	41.84	74.00	54.00	-26.55	-12.16	-12.16	Vertical
5900.25	51.07	39.85	-3.23	47.84	0.00	36.62	74.00	54.00	-26.16	-17.38	-17.38	Vertical
7354	51.89	40.13	1.96	53.85	0.00	42.09	74.00	54.00	-20.15	-11.91	-11.91	Vertical
9927	51.04	40.77	4.88	55.92	0.00	45.65	74.00	54.00	-18.08	-8.35	-8.35	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
1830.5	46.01	42.45	0.44	46.45	0.00	42.89	74.00	54.00	-27.55	-11.11	-11.11	Horizontal
2746	40.42	35.56	4.9	45.32	0.00	40.46	74.00	54.00	-28.68	-13.54	-13.54	Horizontal
4576.5	54.41	49.89	-7.83	46.58	0.00	42.06	74.00	54.00	-27.42	-11.94	-11.94	Horizontal
7715	50.44	39.68	2.86	53.30	0.00	42.54	74.00	54.00	-20.70	-11.46	-11.46	Horizontal
8748	52.37	40.31	3.94	56.31	0.00	44.25	74.00	54.00	-17.69	-9.75	-9.75	Horizontal
9573	51.35	40.39	4.59	55.94	0.00	44.98	74.00	54.00	-18.06	-9.02	-9.02	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
1830.5	44.68	42.29	0.44	45.12	0.00	42.73	74.00	54.00	-28.88	-11.27	-11.27	Vertical
2953	39.71	28.53	5.91	45.62	0.00	34.44	74.00	54.00	-28.38	-19.56	-19.56	Vertical
4576.5	54.27	50.12	-7.83	46.44	0.00	42.29	74.00	54.00	-27.56	-11.71	-11.71	Vertical
6525	50.10	41.39	-0.41	49.69	0.00	40.98	74.00	54.00	-24.31	-13.02	-13.02	Vertical
8095	51.85	39.63	3.07	54.92	0.00	42.70	74.00	54.00	-19.08	-11.30	-11.30	Vertical
9849	52.12	40.19	5.11	57.23	0.00	45.30	74.00	54.00	-16.77	-8.70	-8.70	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
1854.5	47.54	44.56	0.79	48.33	0.00	45.35	74.00	54.00	-25.67	-8.65	-8.65	Horizontal
2782	40.05	36.21	5.15	45.20	0.00	41.36	74.00	54.00	-28.80	-12.64	-12.64	Horizontal
4636.5	53.73	48.84	-7.53	46.20	0.00	41.31	74.00	54.00	-27.80	-12.69	-12.69	Horizontal
5640.75	51.53	40.57	-4.06	47.47	0.00	36.51	74.00	54.00	-26.53	-17.49	-17.49	Horizontal
8171	52.59	40.61	3.26	55.85	0.00	43.87	74.00	54.00	-18.15	-10.13	-10.13	Horizontal
9917	51.19	40.44	4.98	56.17	0.00	45.42	74.00	54.00	-17.83	-8.58	-8.58	Horizontal

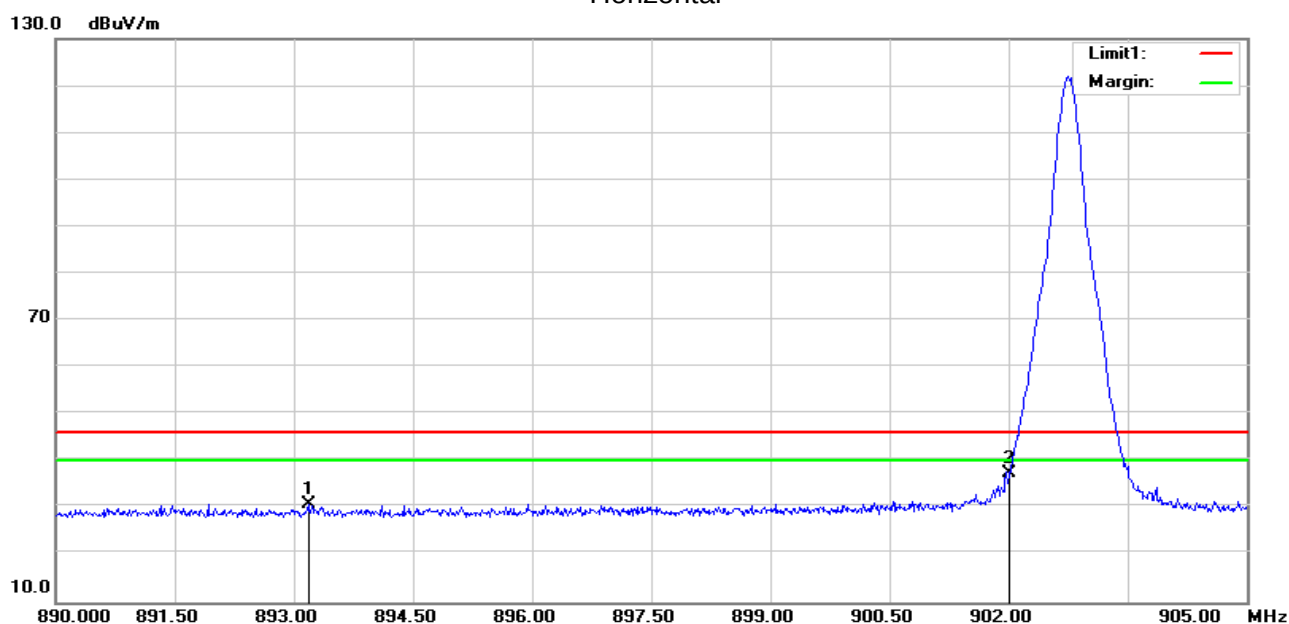
Vertical

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
1854.5	50.81	47.91	0.79	51.60	0.00	48.70	74.00	54.00	-22.40	-5.30	-5.30	Vertical
2782	42.41	39.54	5.15	47.56	0.00	44.69	74.00	54.00	-26.44	-9.31	-9.31	Vertical
4636.5	54.70	49.21	-7.53	47.17	0.00	41.68	74.00	54.00	-26.83	-12.32	-12.32	Vertical
5903.25	51.47	39.88	-3.22	48.25	0.00	36.66	74.00	54.00	-25.75	-17.34	-17.34	Vertical
8716	51.16	40.23	4.25	55.41	0.00	44.48	74.00	54.00	-18.59	-9.52	-9.52	Vertical
9871	50.70	40.25	5.13	55.83	0.00	45.38	74.00	54.00	-18.17	-8.62	-8.62	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.

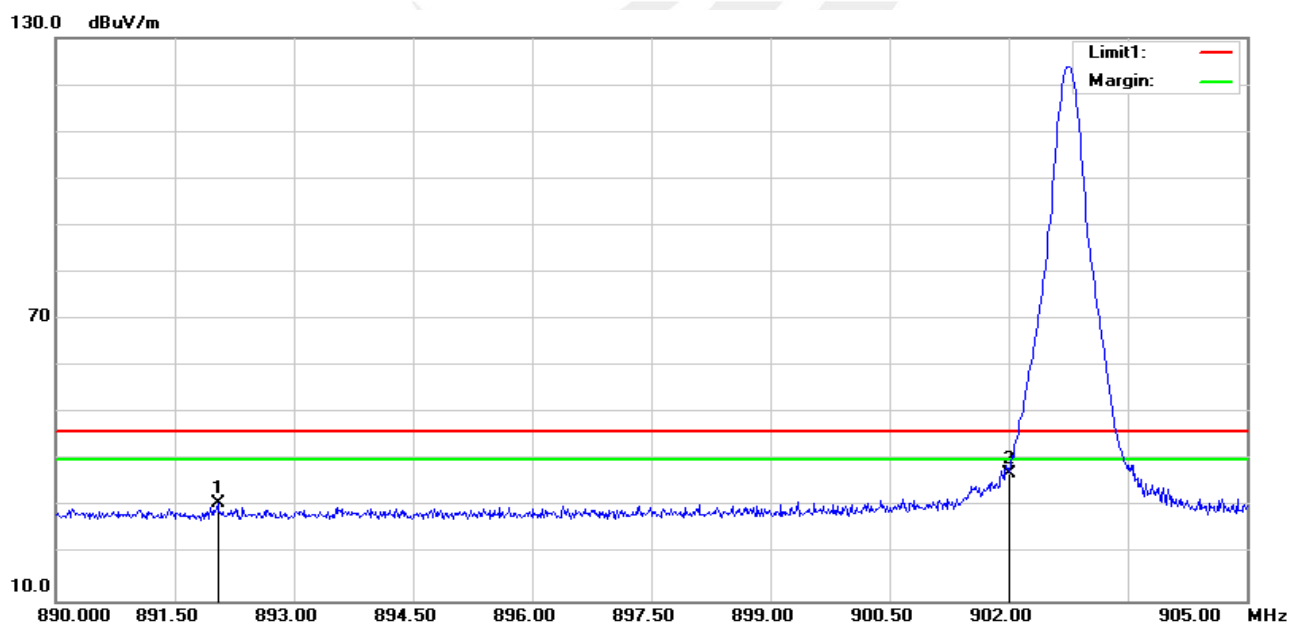


Band Edge Requirements

Dense reader mode-Low
Horizontal

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	893.1800	31.54	-0.61	30.93	46.00	-15.07	peak
2	902.0000	37.90	-0.40	37.50	46.00	-8.50	peak

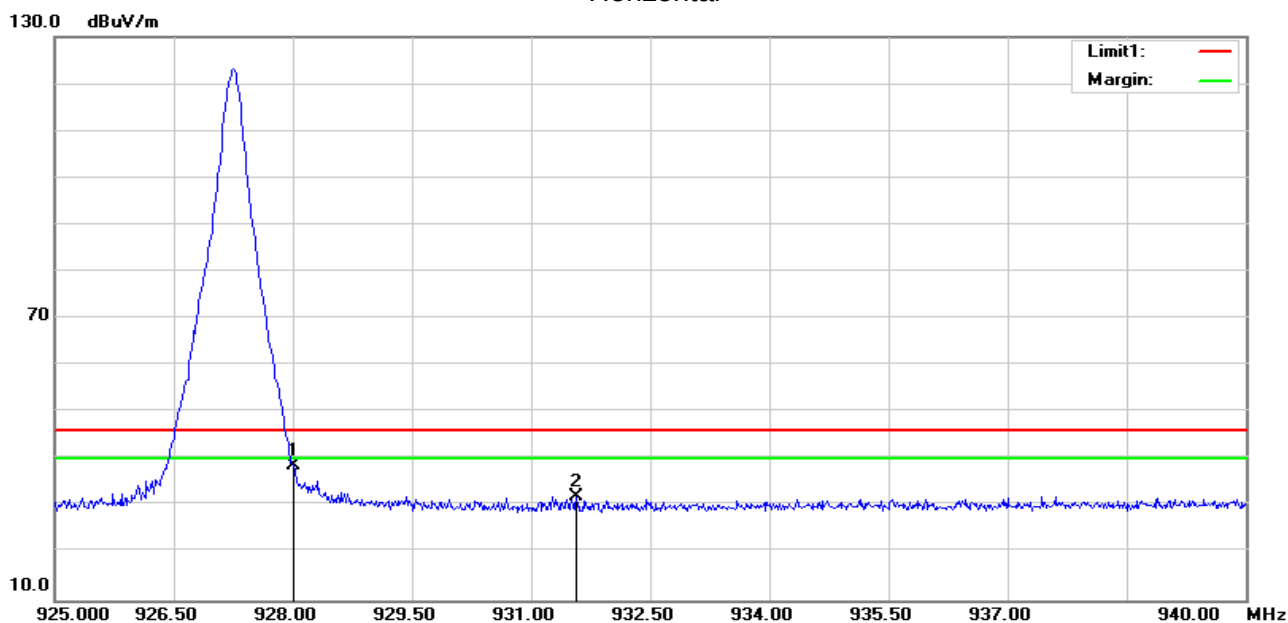
Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	892.0400	31.41	-0.64	30.77	46.00	-15.23	peak
2	902.0000	37.44	-0.40	37.04	46.00	-8.96	peak

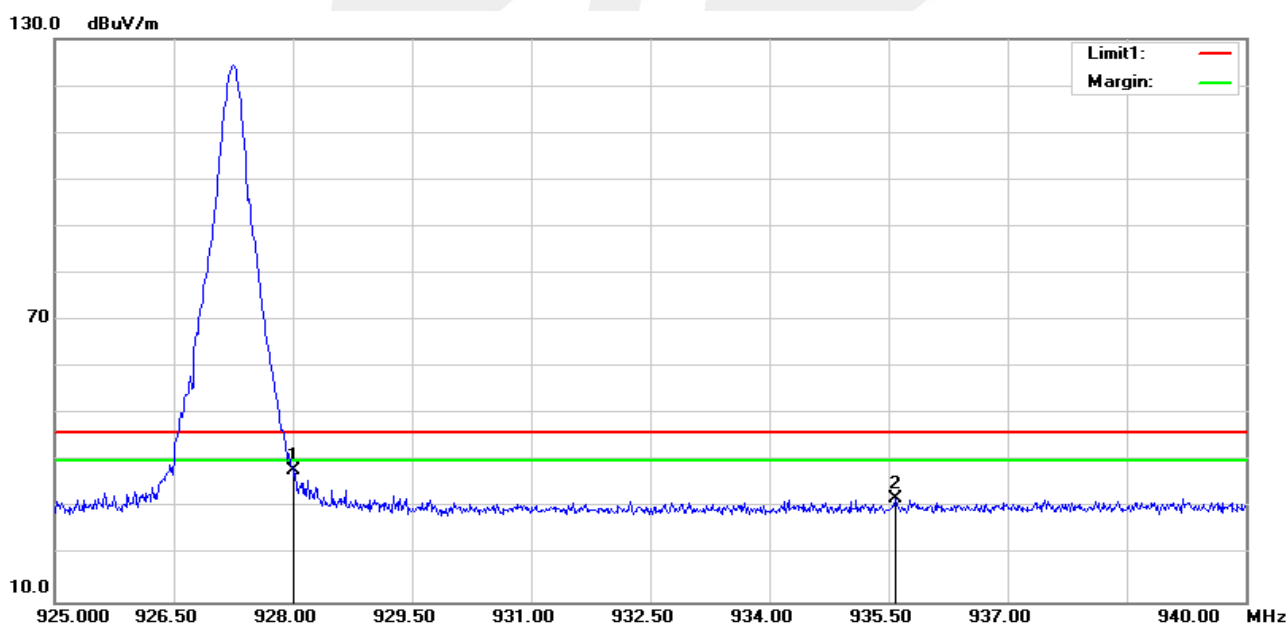


Dense reader mode-High Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	928.0000	38.26	0.43	38.69	46.00	-7.31	peak
2	931.5700	31.47	0.68	32.15	46.00	-13.85	peak

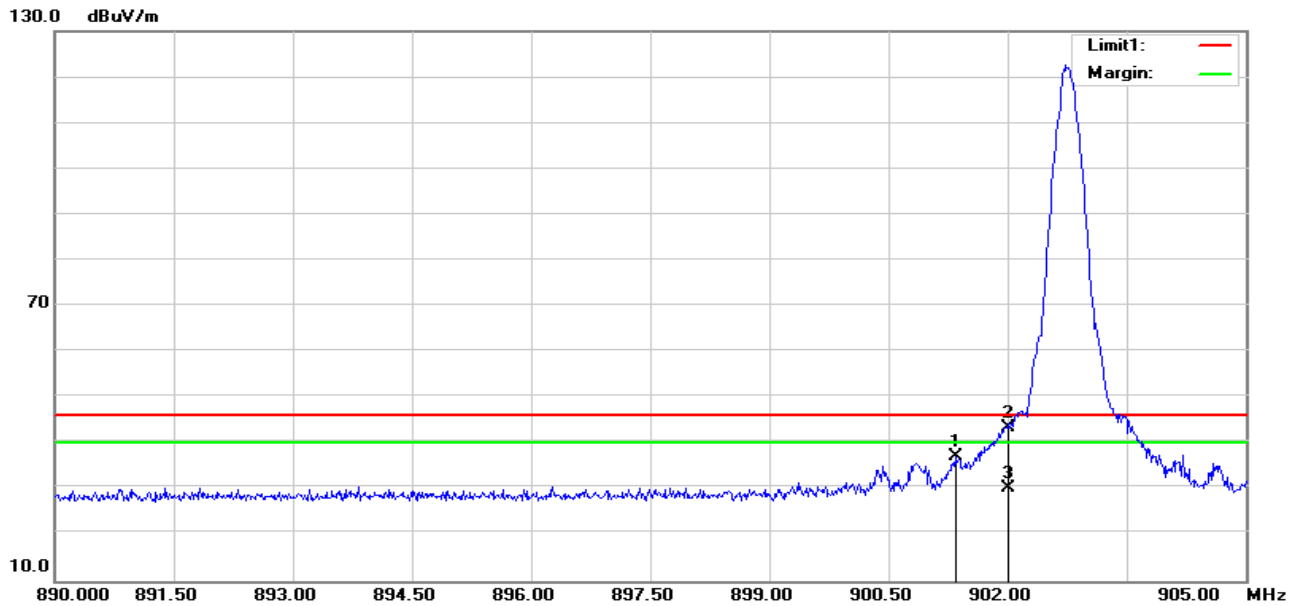
Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	928.0000	37.58	0.43	38.01	46.00	-7.99	peak
2	935.5900	30.93	1.01	31.94	46.00	-14.06	peak

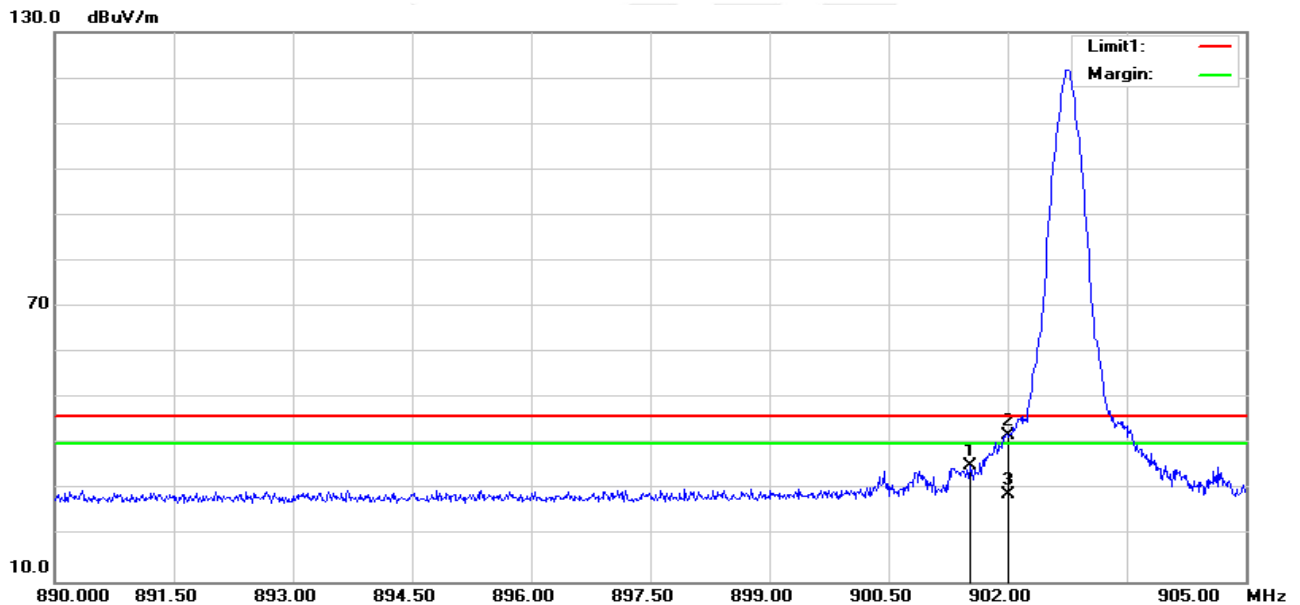


Single reader mode-Low Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	901.3400	37.57	-0.41	37.16	46.00	-8.84	peak
2	902.0000	43.82	-0.40	43.42	46.00	-2.58	peak
3	902.0000	30.54	-0.40	30.14	46.00	-15.86	AVG

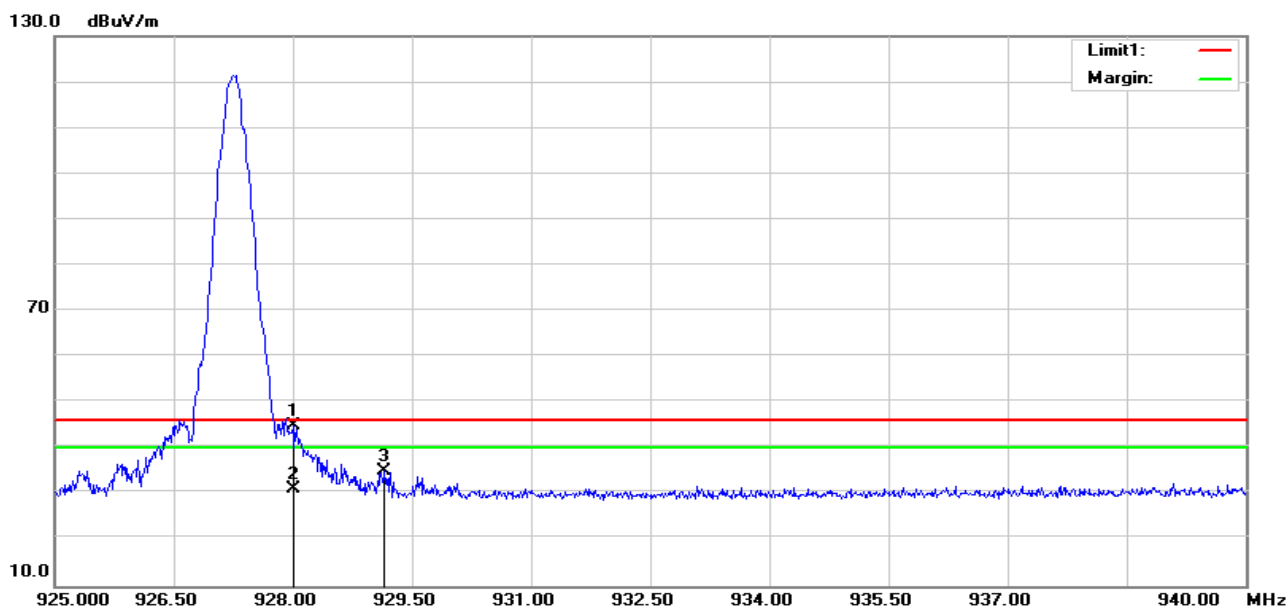
Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	901.5350	35.66	-0.41	35.25	46.00	-10.75	peak
2	902.0000	42.38	-0.40	41.98	46.00	-4.02	peak
3	902.0000	29.36	-0.40	28.96	46.00	-17.04	AVG

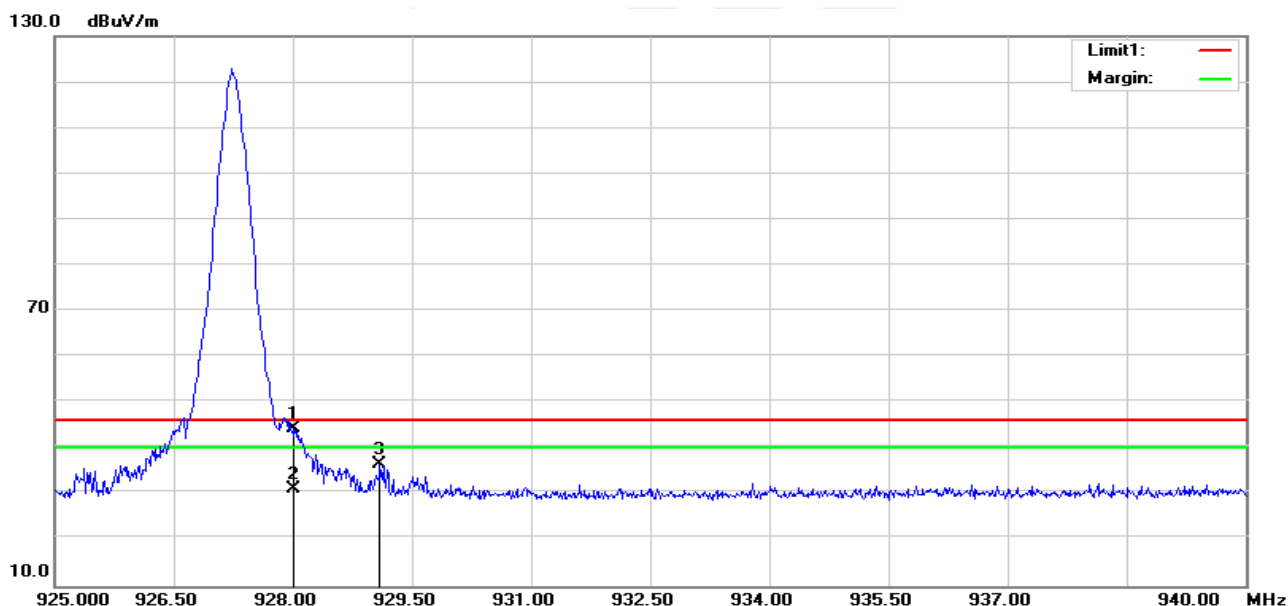


Single reader mode-High Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	928.0000	44.45	0.43	44.88	46.00	-1.12	peak
2	928.0000	30.85	0.43	31.28	46.00	-14.72	AVG
3	929.1550	34.60	0.50	35.10	46.00	-10.90	peak

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	928.0000	43.87	0.43	44.30	46.00	-1.70	peak
2	928.0000	30.62	0.43	31.05	46.00	-14.95	AVG
3	929.0950	36.16	0.50	36.66	46.00	-9.34	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

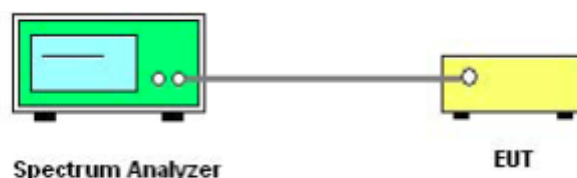
For Band edge

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

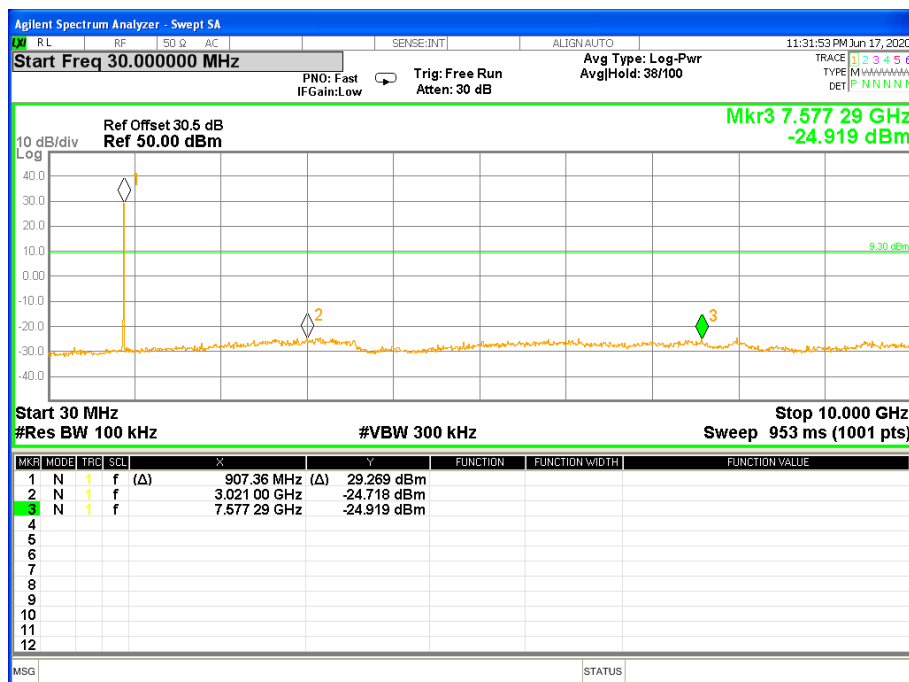
Please refer to section 2.4 of this report.



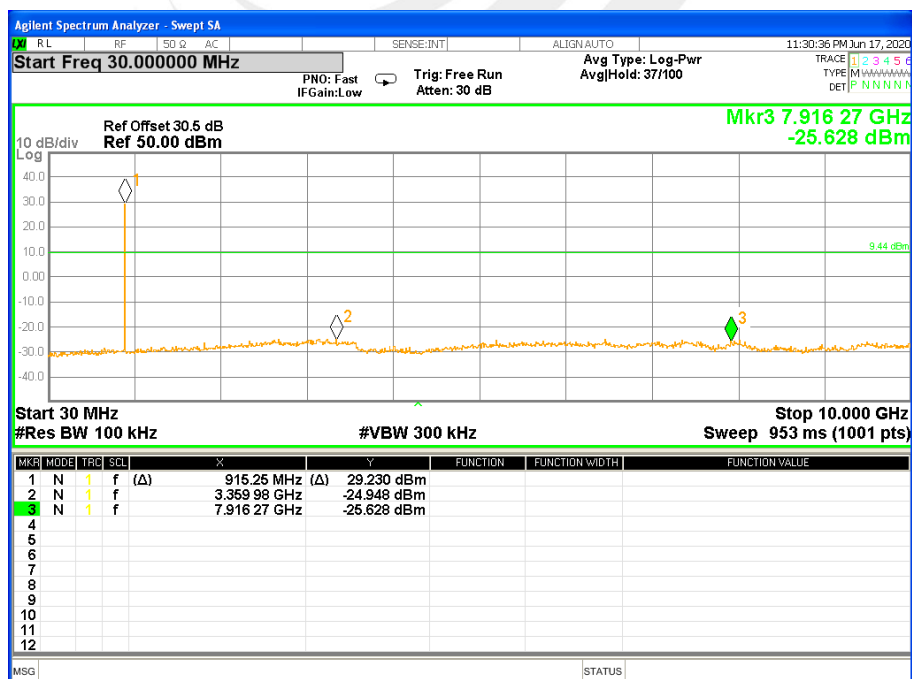
4.5 TEST RESULTS

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

CH 00

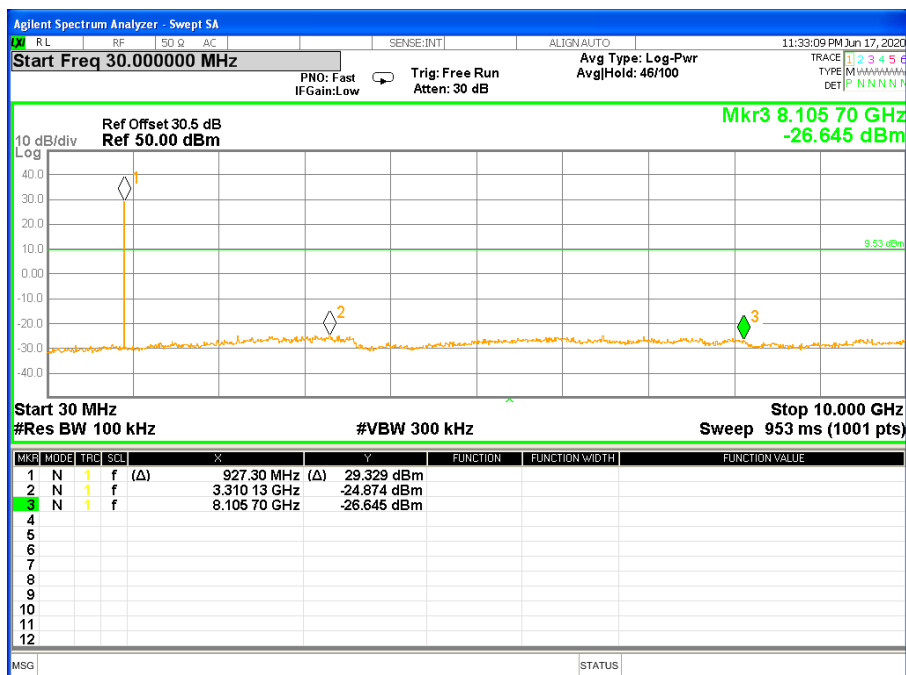


CH 25





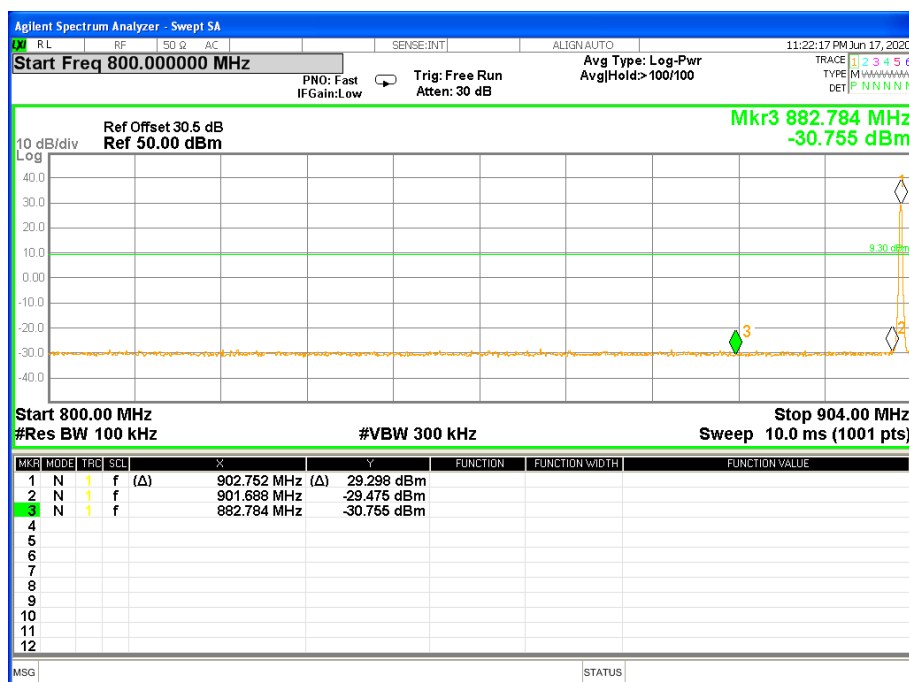
CH 49



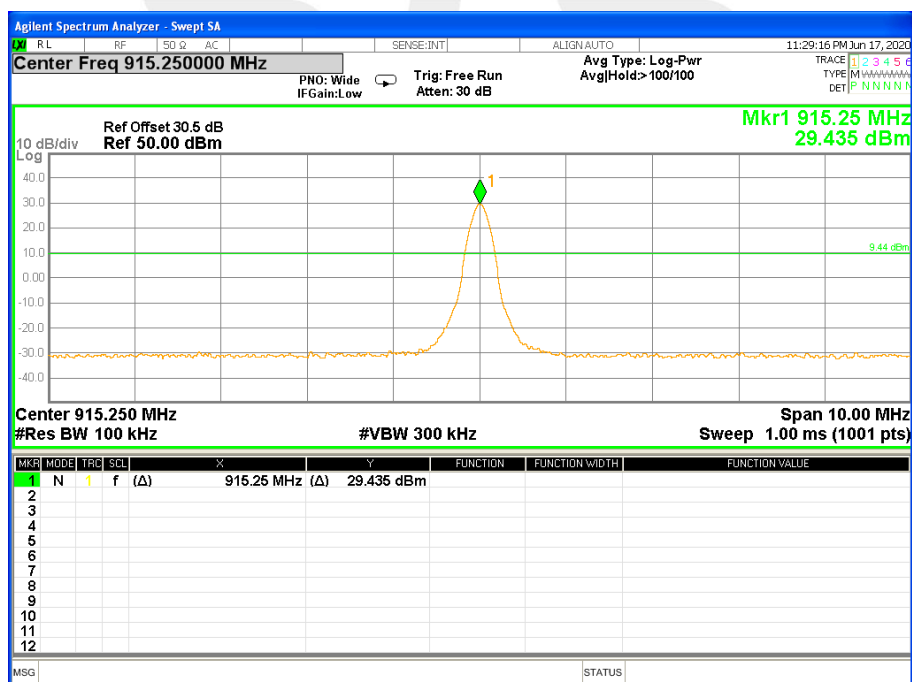


For Band edge(it's also the reference level for conducted spurious emission)

CH 00

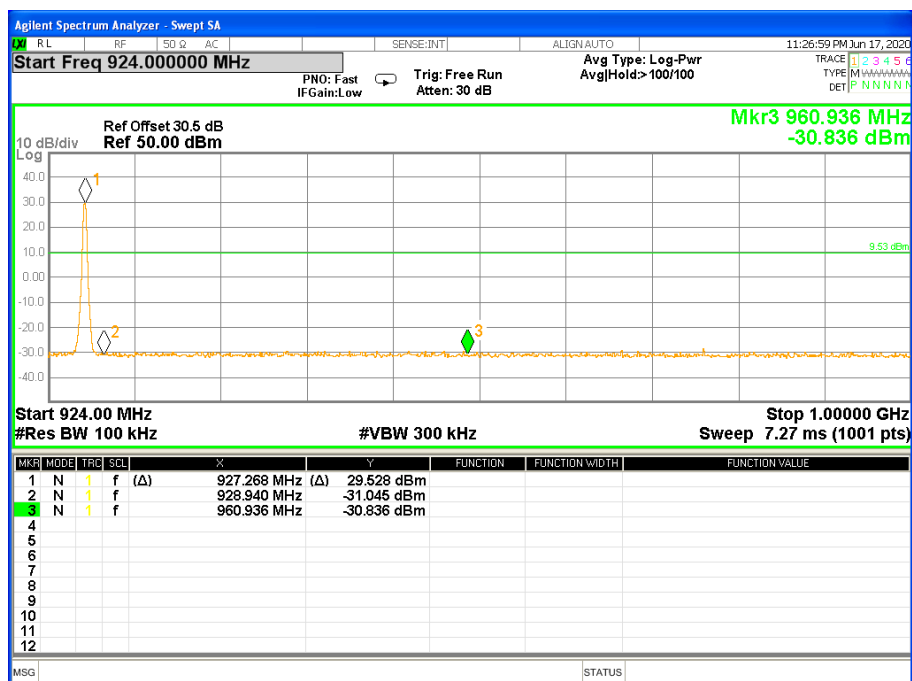


CH 25





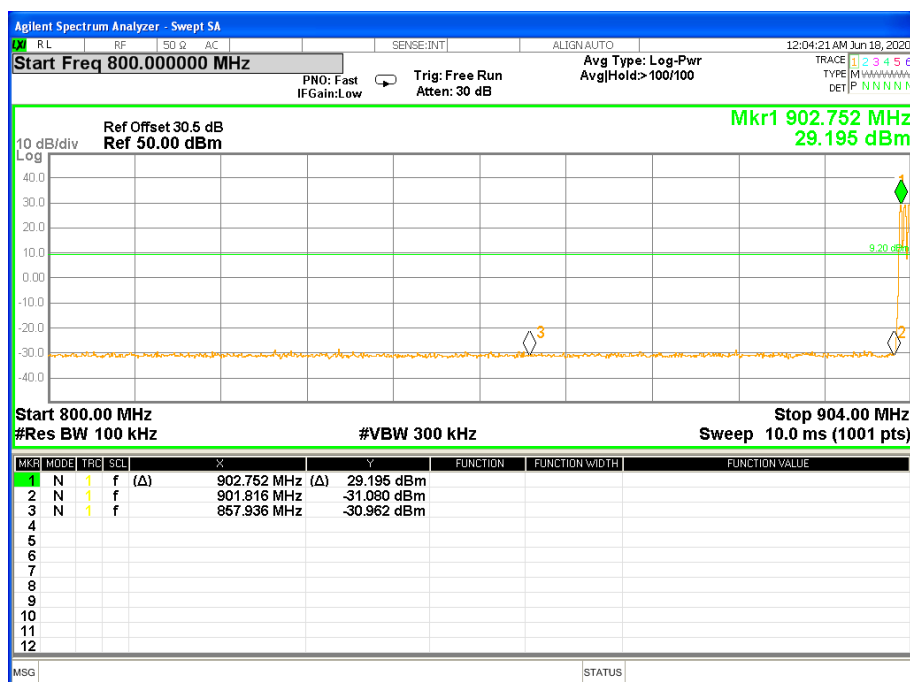
CH 49



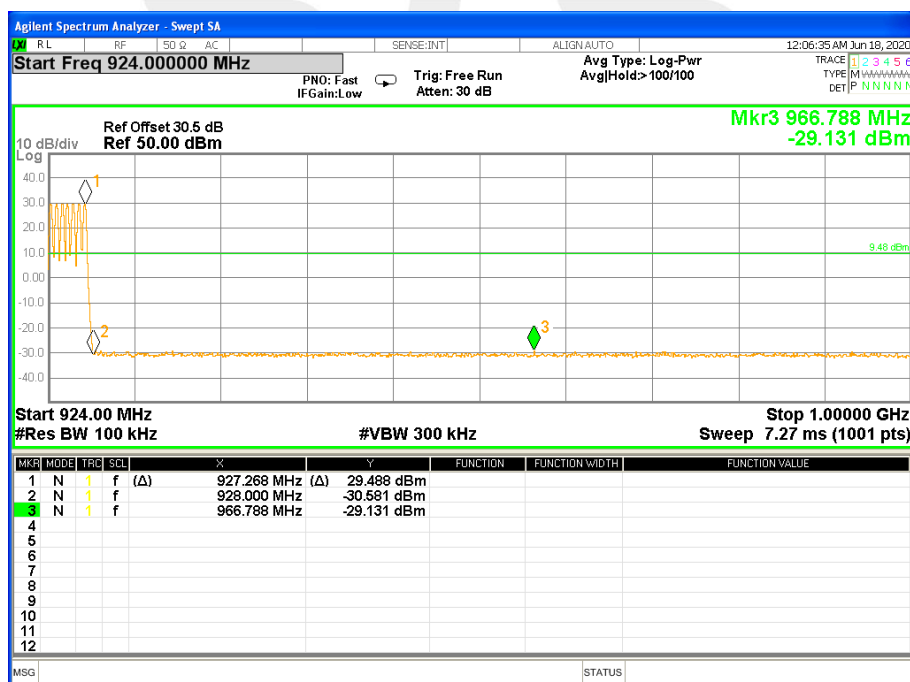


For Hopping Band edge

CH 00



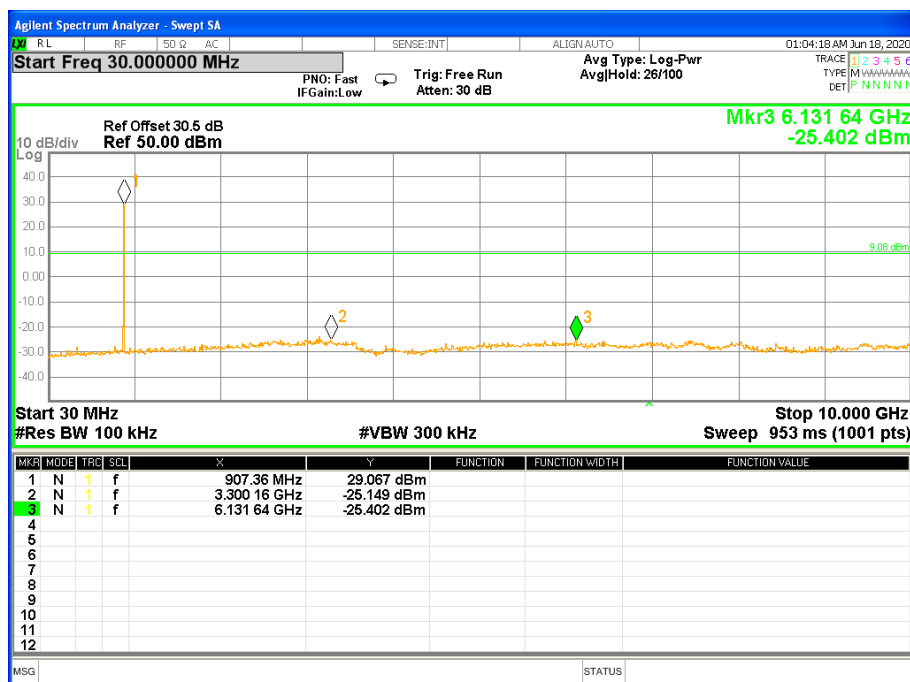
CH 49



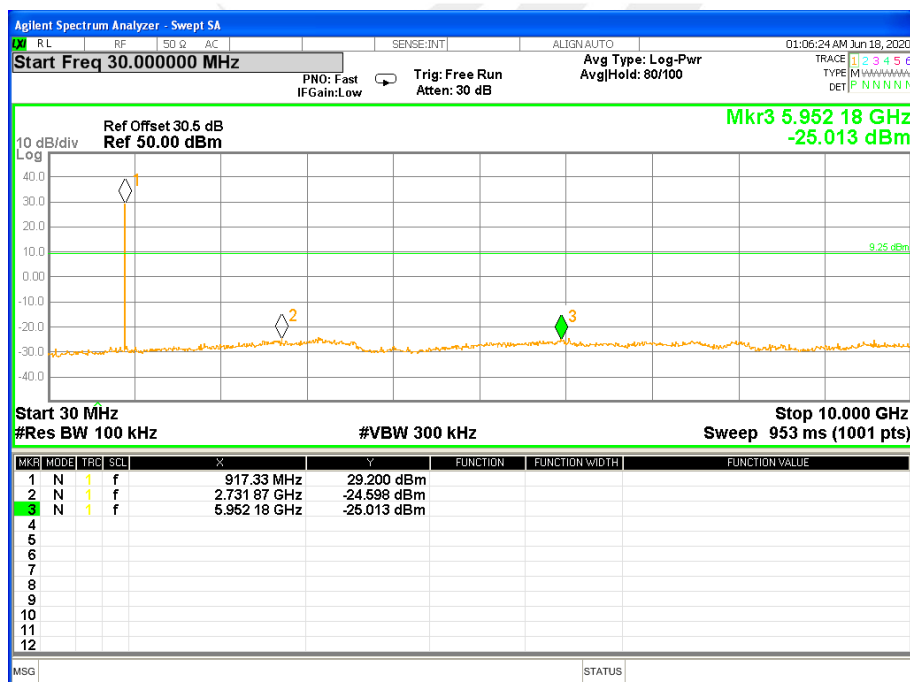


Temperature:	25°C	Relative Humidity:	50%
Test Mode:	Single reader mode / CH00, CH25, CH49	Test Voltage:	DC 24V

CH 00

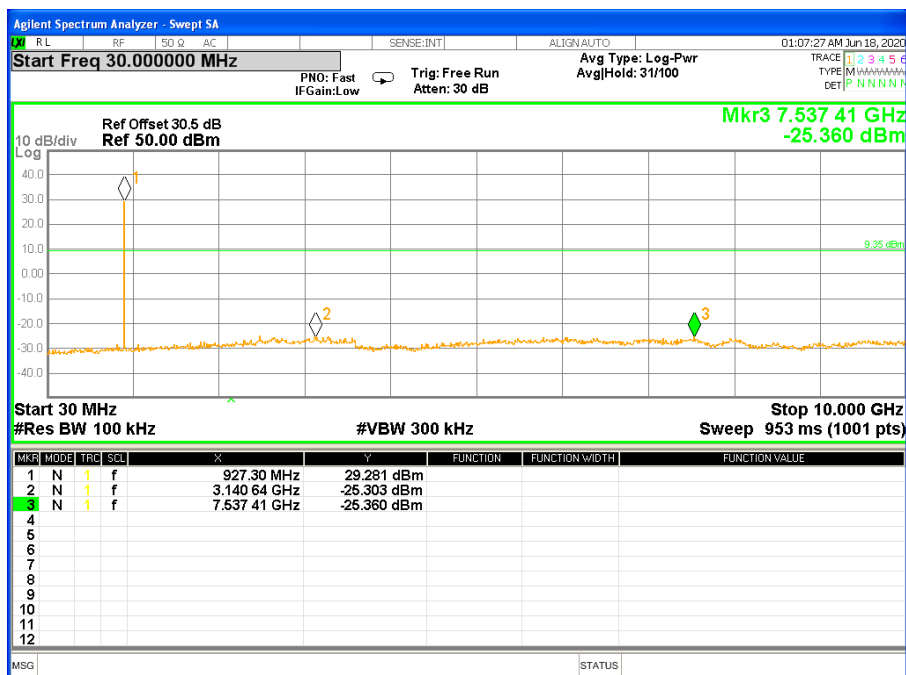


CH 25





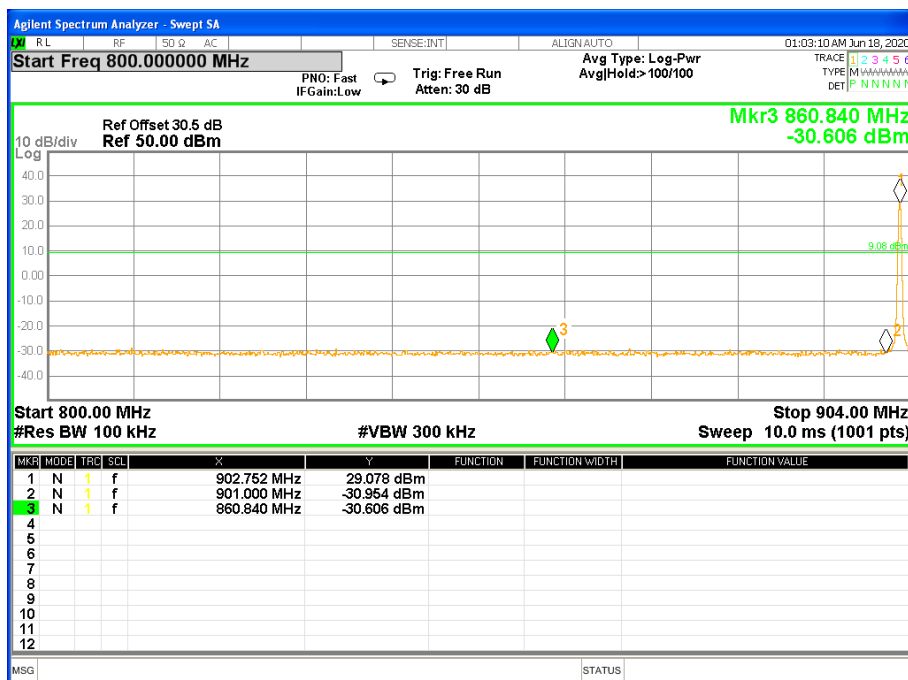
CH 49



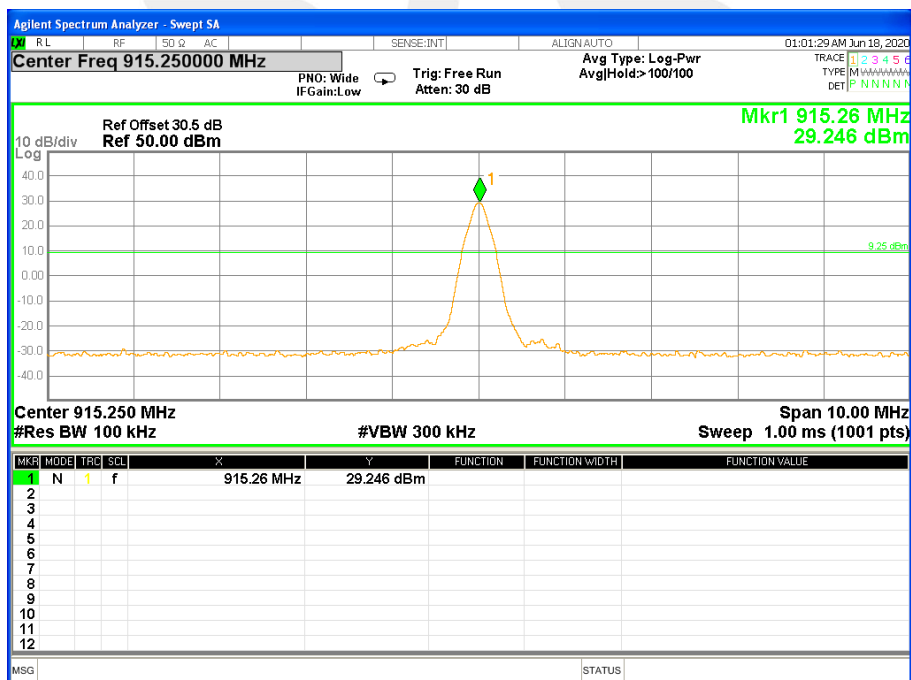


For Band edge(it's also the reference level for conducted spurious emission)

CH 00

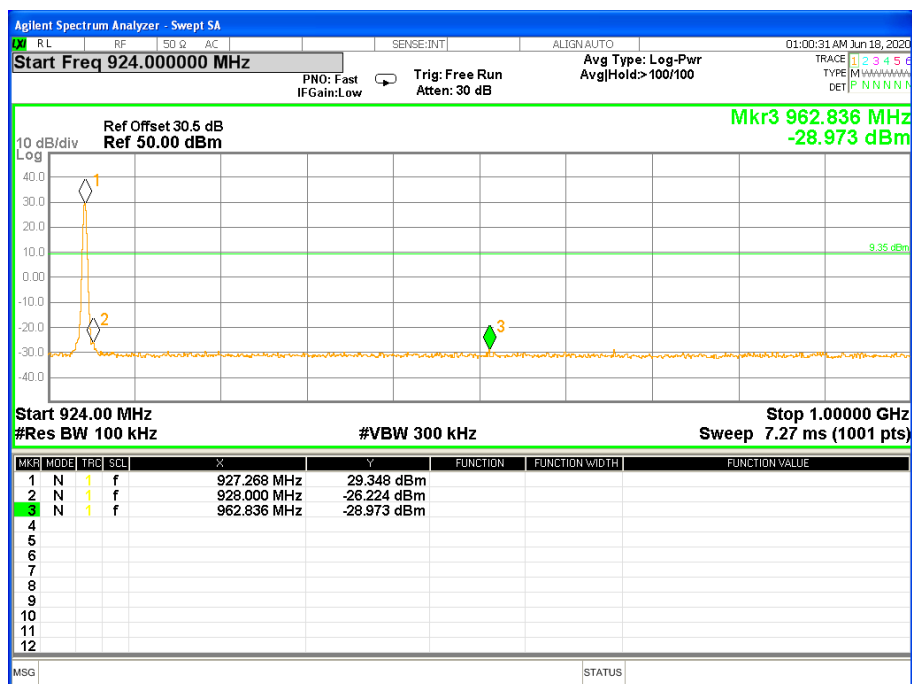


CH 25





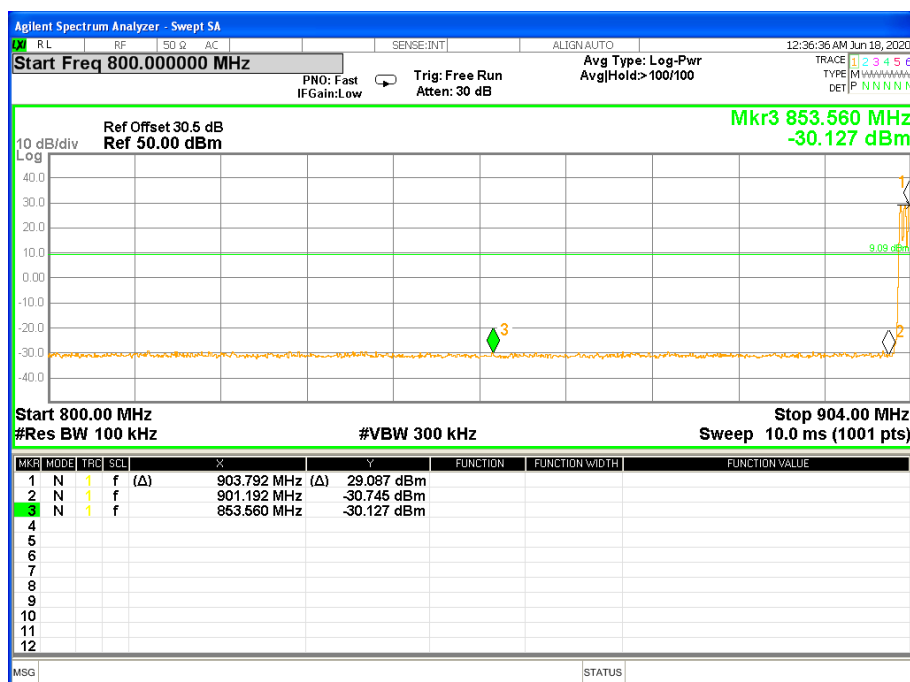
CH 49



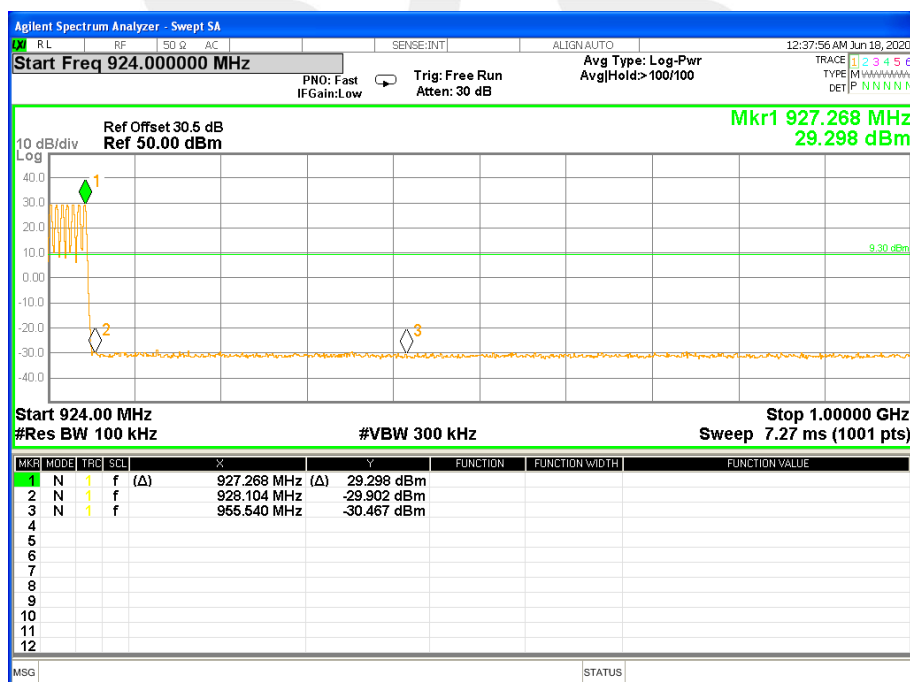


For Hopping Band edge

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.

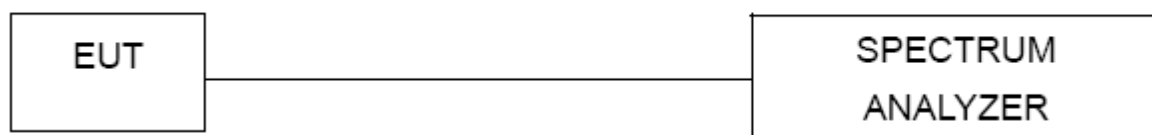
EUT 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50.

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.



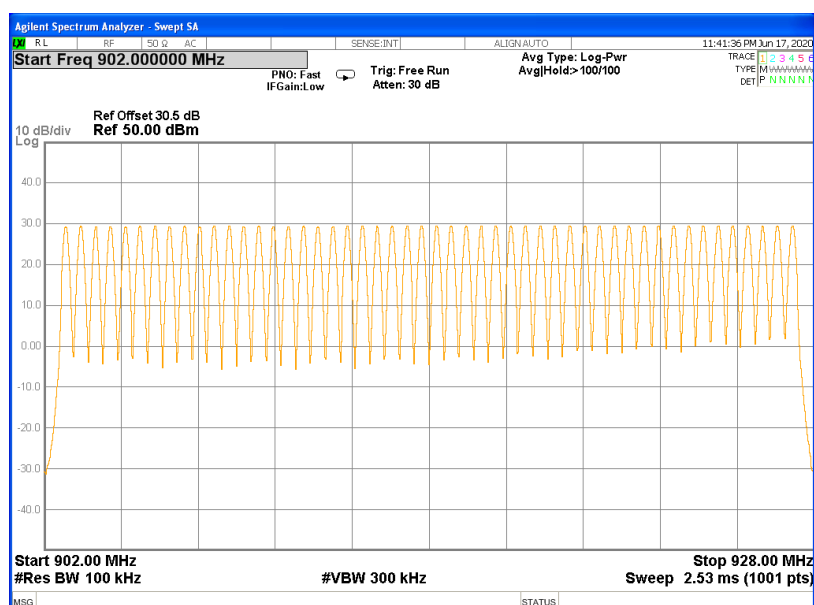
5.5 TEST RESULTS

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

Number of Hopping Channel

50

Hopping channel



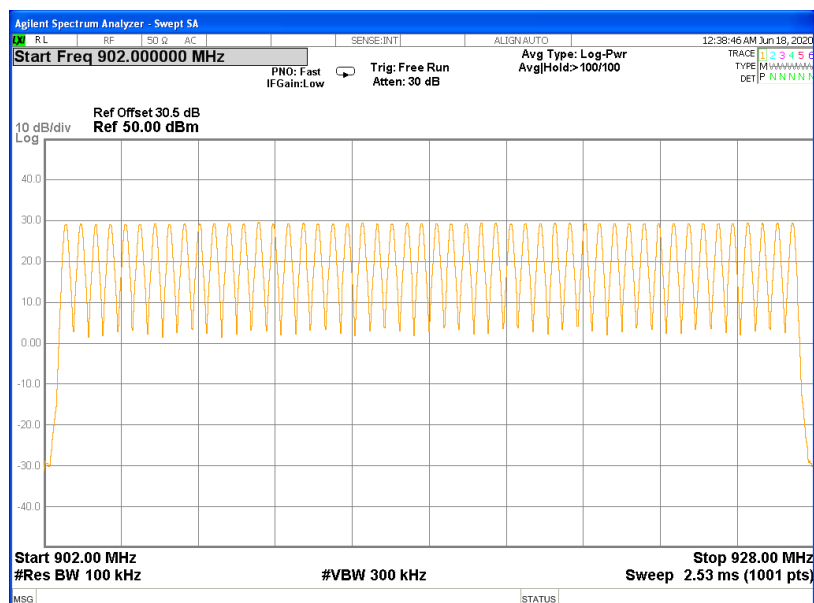


Temperature:	25°C	Relative Humidity:	60%
Test Mode:	Hopping Mode (Single reader mode)	Test Voltage:	DC 24V

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

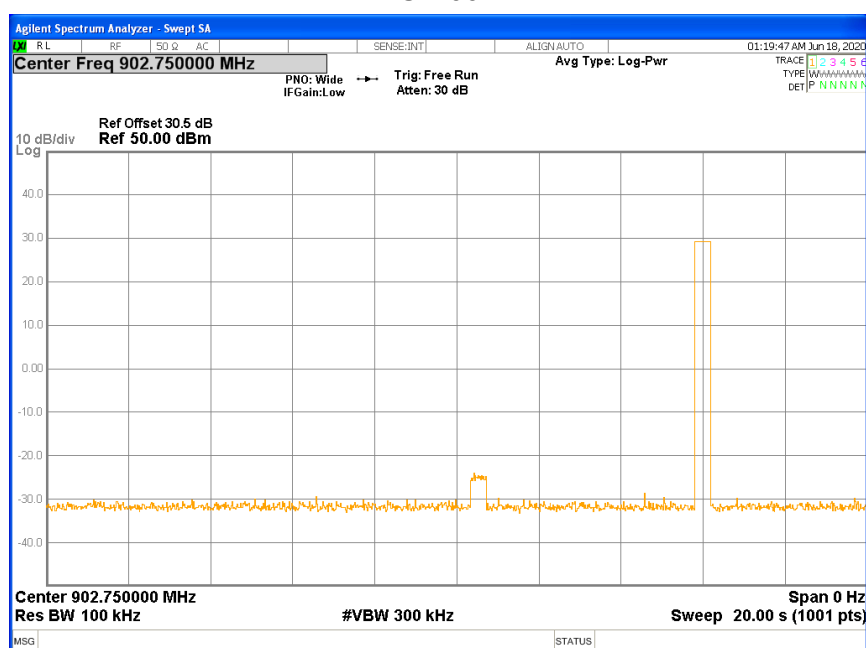
Please refer to section 2.4 of this report.



6.5 TEST RESULTS

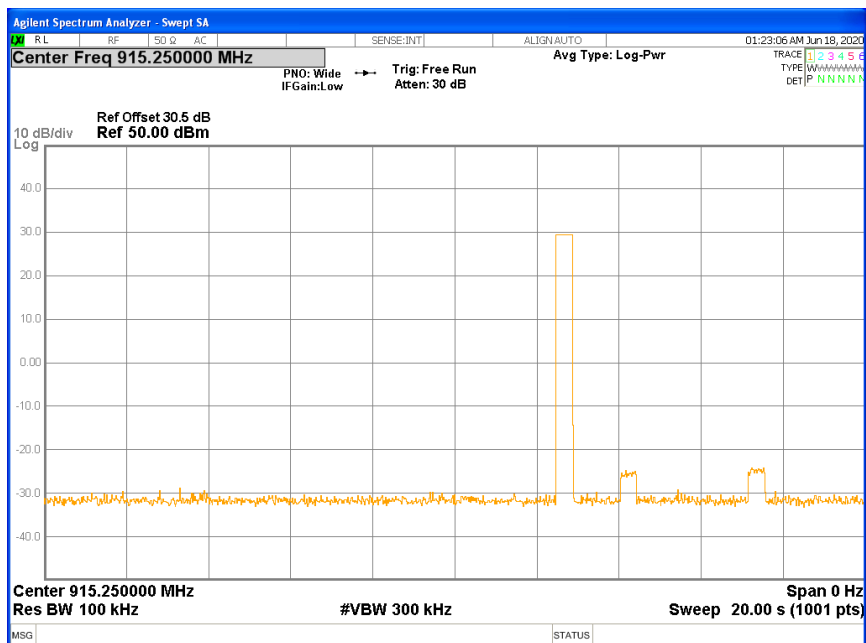
Temperature:	25°C	Relative Humidity:	50%
Test Mode:	Dense reader mode / CH00, CH25, CH49	Test Voltage:	DC 24V
Frequency	Dwell Time(s)	Limits(s)	result
902.75 MHz	0.383	0.4	Pass
915.25 MHz	0.384	0.4	Pass
927.25 MHz	0.383	0.4	Pass

CH 00



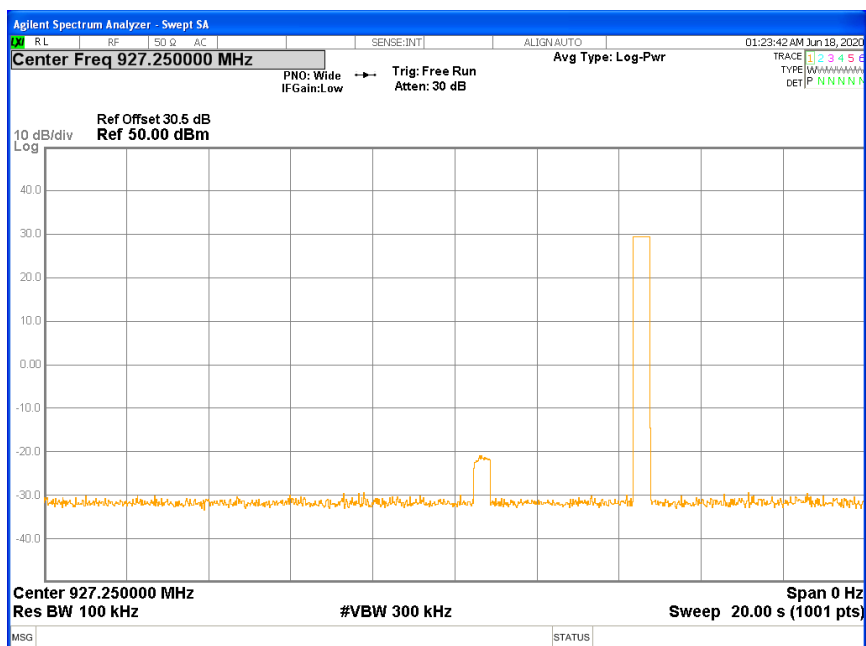


CH 25





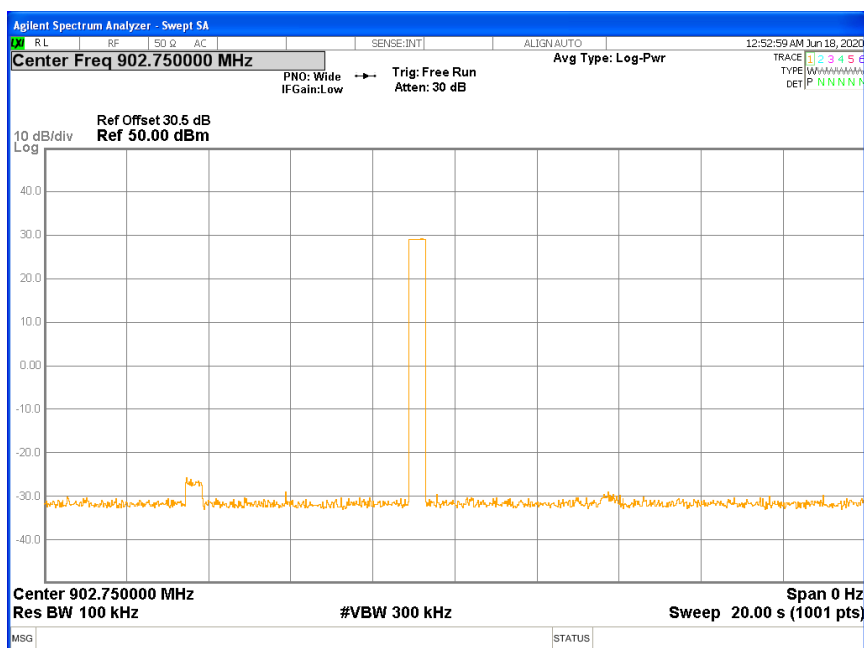
CH 49





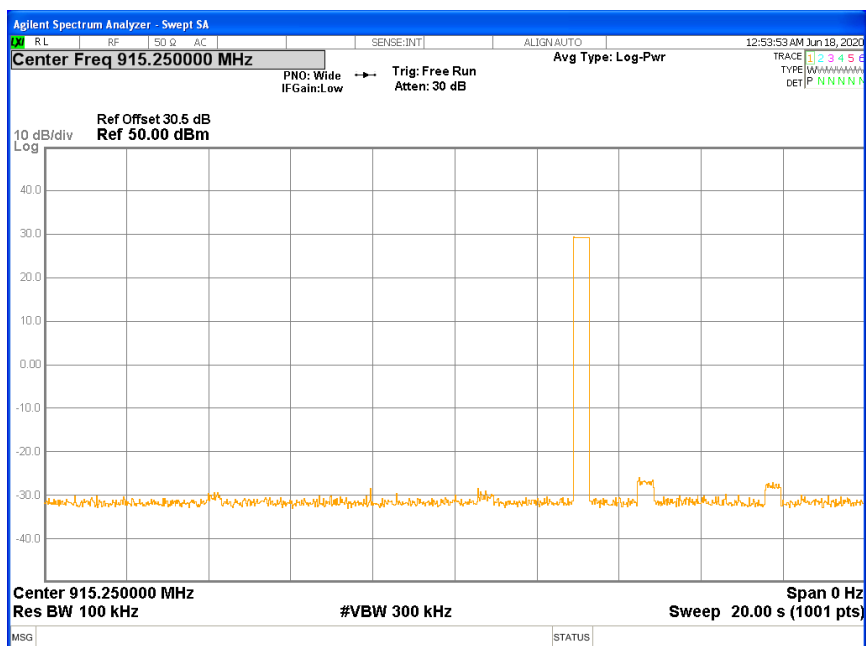
Temperature:	25°C	Relative Humidity:	50%
Test Mode:	Single reader mode / CH00, CH25, CH49	Test Voltage:	DC 24V
Frequency	Dwell Time(s)	Limits(s)	result
902.75 MHz	0.383	0.4	Pass
915.25 MHz	0.383	0.4	Pass
927.25 MHz	0.383	0.4	Pass

CH 00



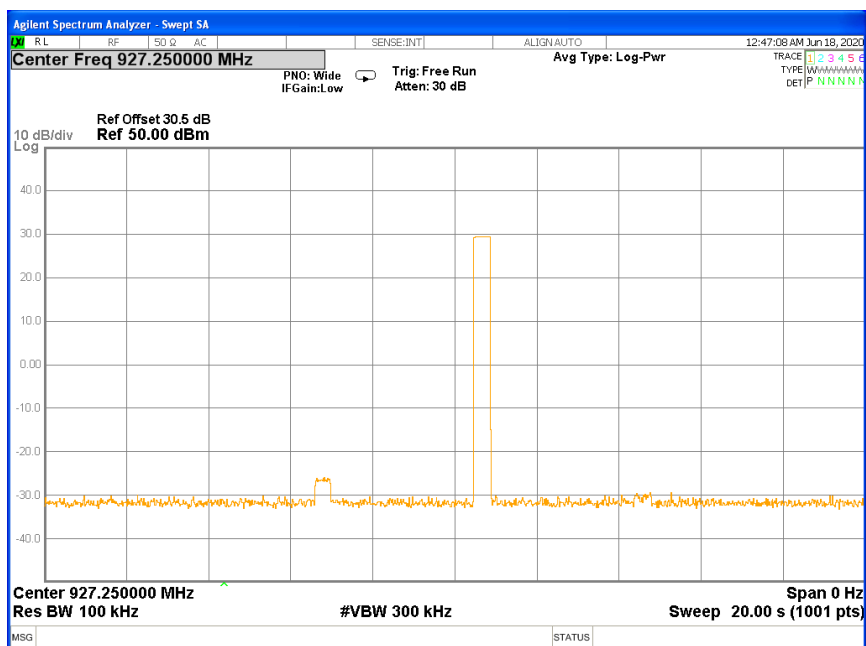


CH 25





CH 49



7. HOPPING CHANNEL SEPARATION MEASUREMENT

7.1 LIMIT

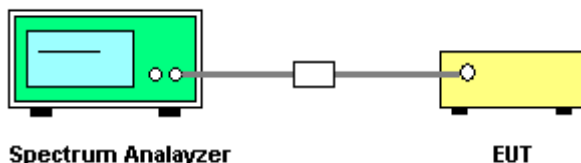
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that 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.



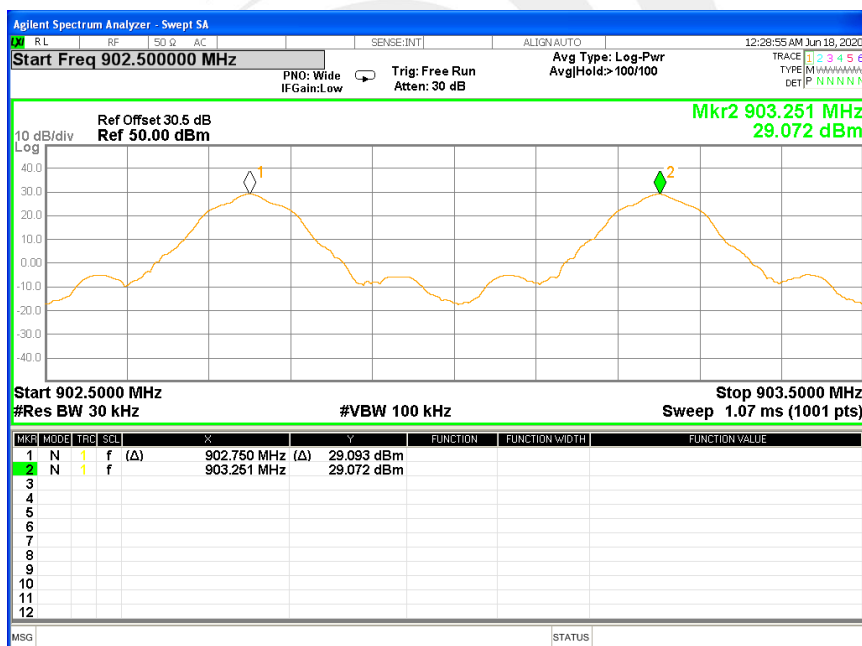
7.5 TEST RESULTS

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

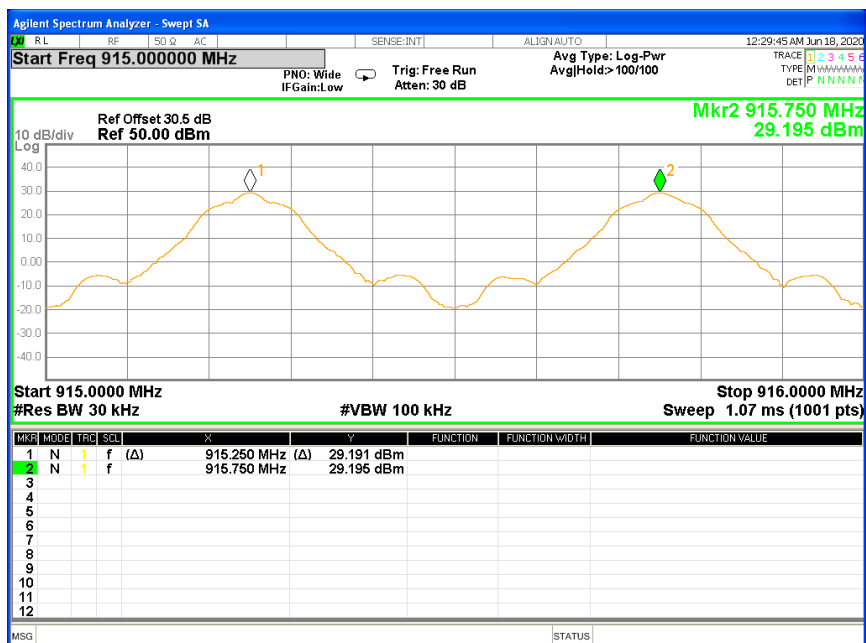
Frequency	Mark1 Frequency (MHz)	Mark2 Frequency (MHz)	Ch. Separation (MHz)	Limit (MHz)	Result
902.75 MHz	902.750	903.251	0.501	0.09536	Complies
915.25 MHz	915.250	915.750	0.500	0.09500	Complies
927.25 MHz	926.752	927.248	0.496	0.09448	Complies

Ch. Separation Limits: > 20dB bandwidth

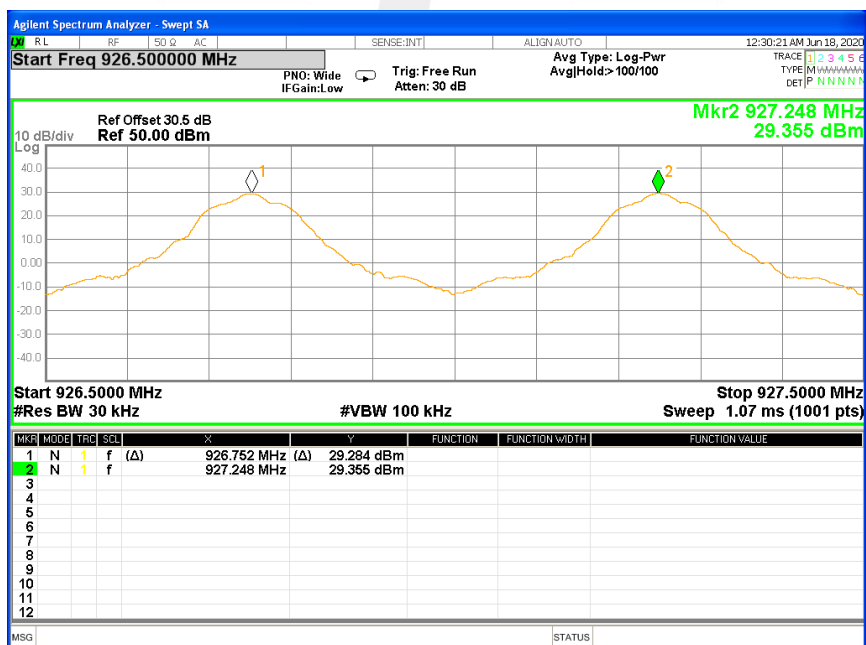
CH 00



CH 25



CH 49



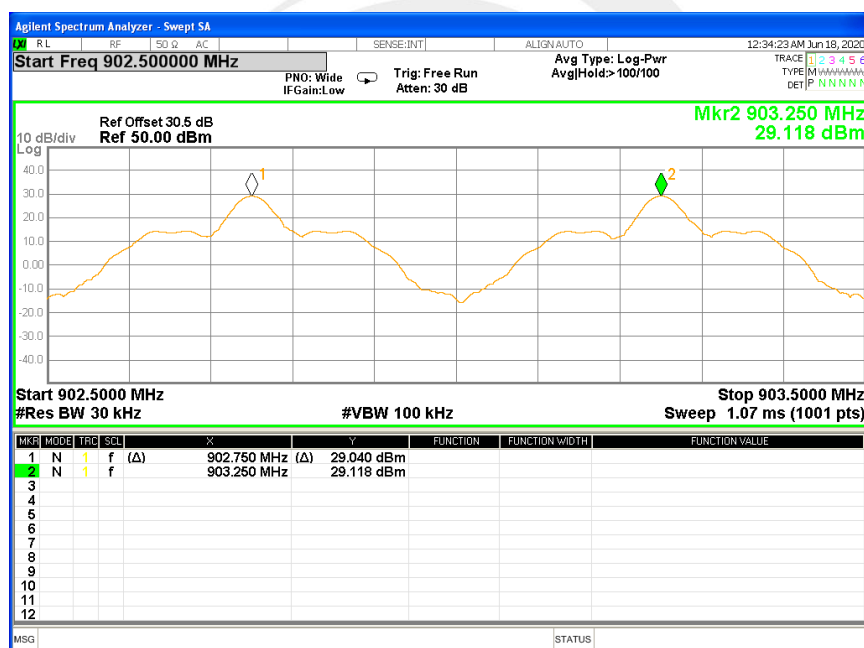


Temperature:	25°C	Relative Humidity:	50%
Test Mode:	Single reader mode / CH00, CH25, CH49	Test Voltage:	DC 24V

Frequency	Mark1 Frequency (MHz)	Mark2 Frequency (MHz)	Ch. Separation (MHz)	Limit (MHz)	Result
902.75 MHz	902.750	903.250	0.500	0.00480	Complies
915.25 MHz	915.250	915.751	0.501	0.00473	Complies
927.25 MHz	926.750	927.250	0.500	0.00464	Complies

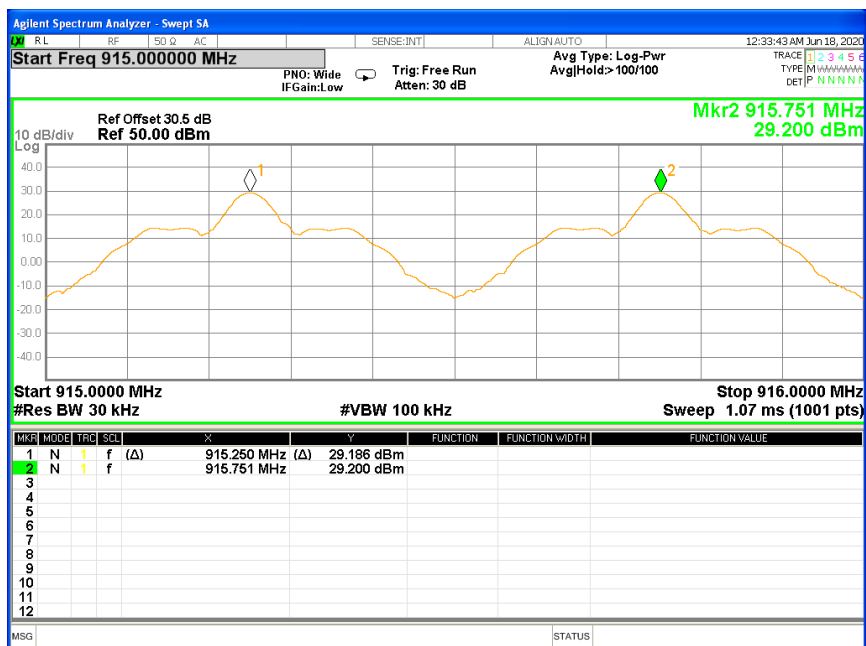
Ch. Separation Limits: > 20dB bandwidth

CH 00

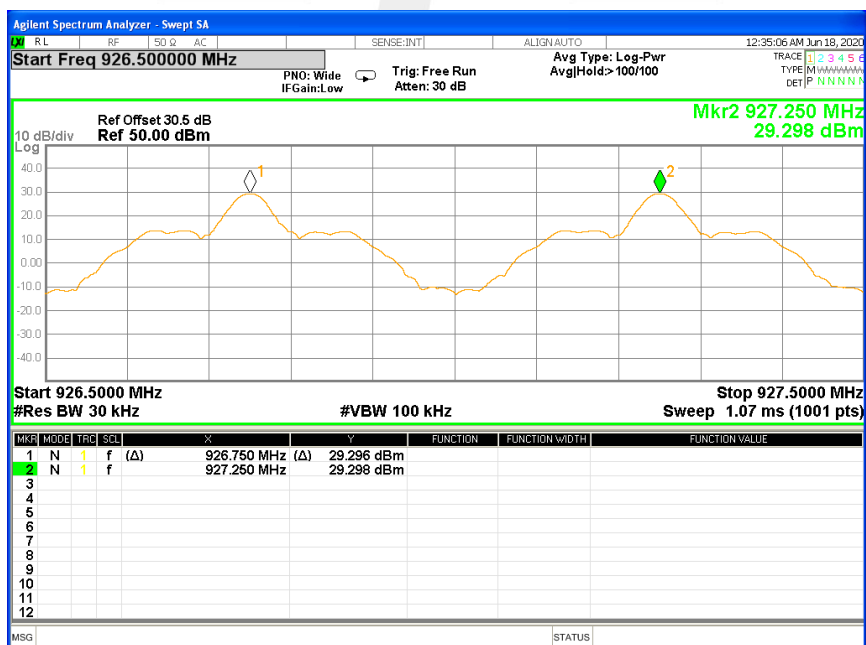




CH 25



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.

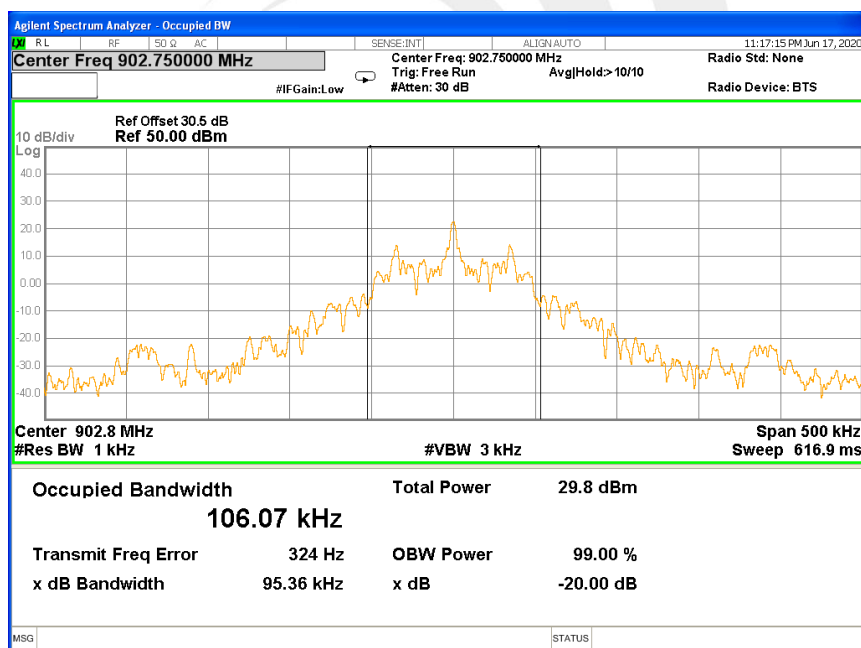


8.5 TEST RESULTS

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

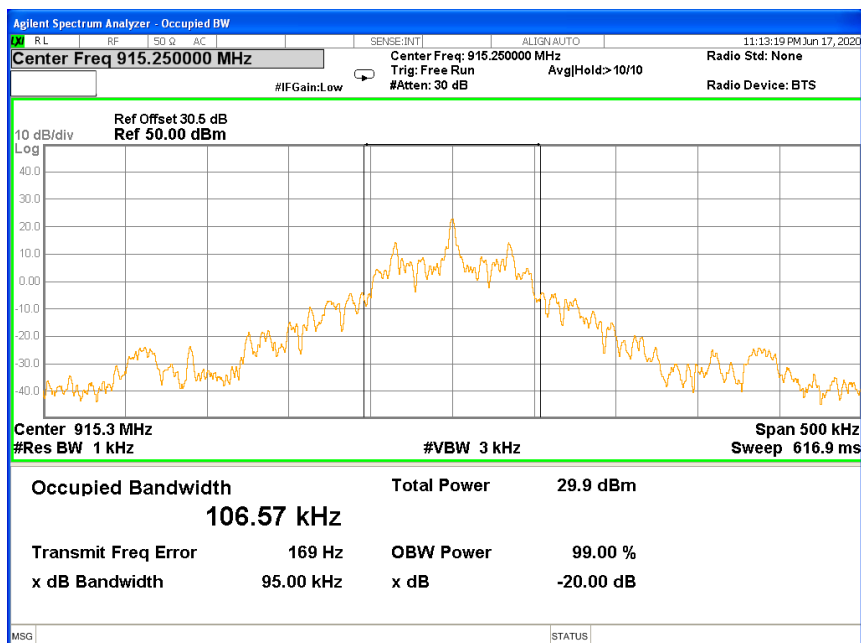
Frequency	20dB Bandwidth(kHz)	99% Bandwidth(kHz)	Limit (KHz)	Result
902.75 MHz	95.36	106.07	500	PASS
915.25 MHz	95.00	106.57	500	PASS
927.25 MHz	94.48	121.44	500	PASS

CH 00

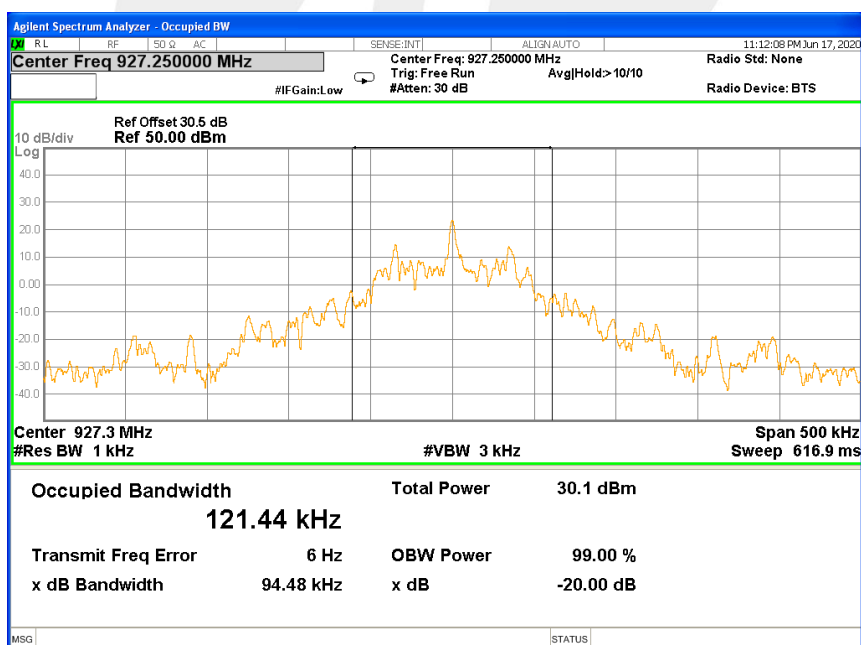




CH 25



CH 49

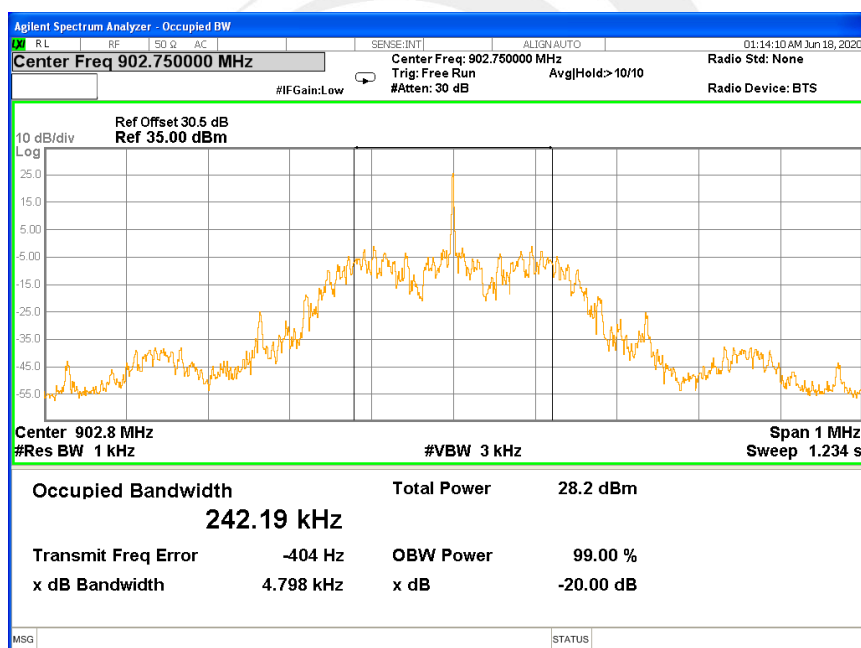




Temperature:	25°C	Relative Humidity:	50%
Test Mode:	Single reader mode / CH00, CH25, CH49	Test Voltage:	DC 24V

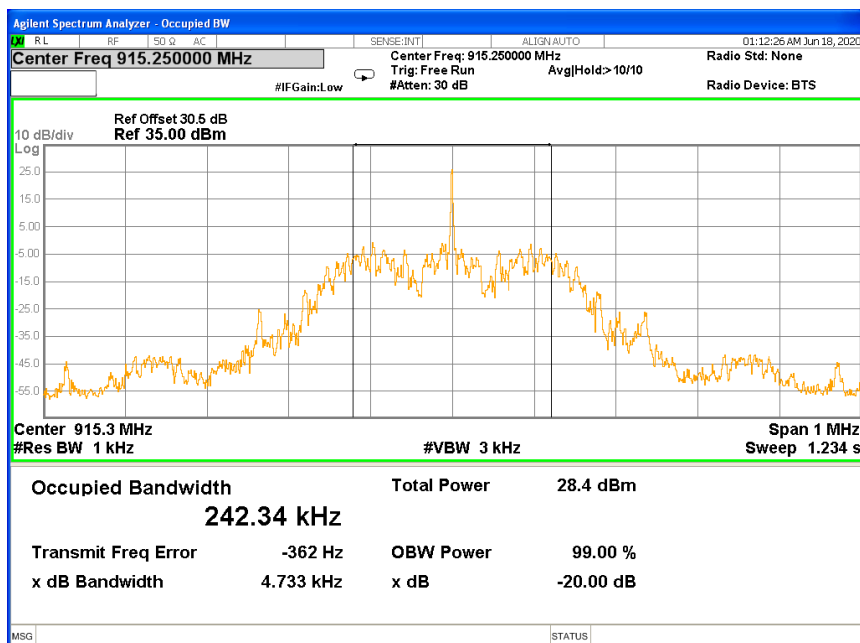
Frequency	20dB Bandwidth(kHz)	99% Bandwidth(kHz)	Limit (KHz)	Result
902.75 MHz	4.798	242.19	500	PASS
915.25 MHz	4.733	242.34	500	PASS
927.25 MHz	4.644	234.73	500	PASS

CH 00

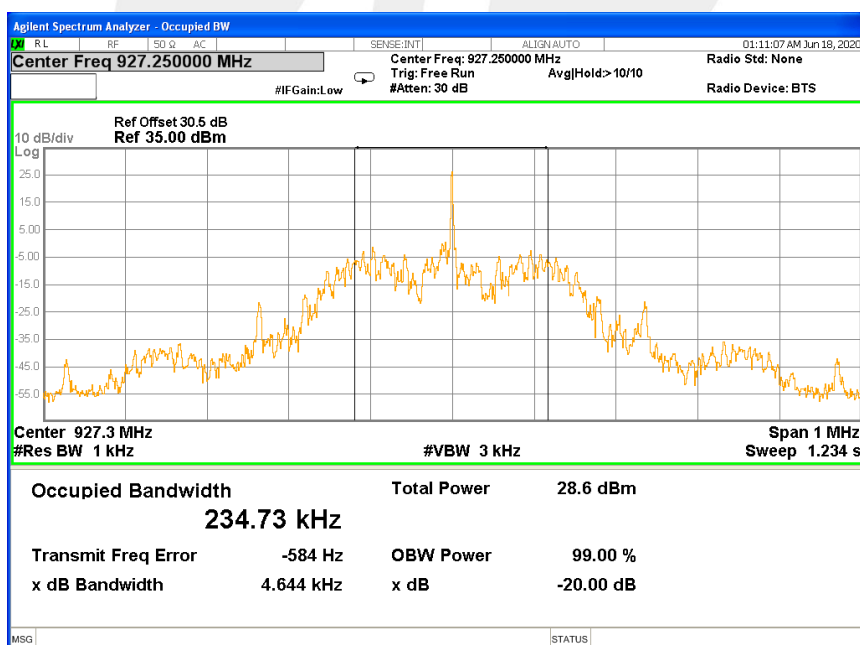




CH 25



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.

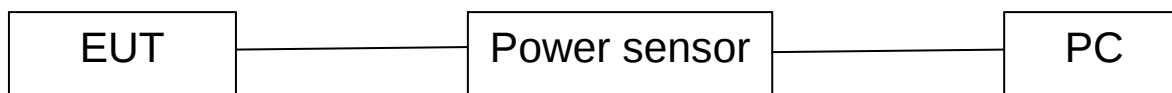
e) A plot of the test results and setup description shall be included in the test report.

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 no 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 EIRP (dBm)	MAX EIRP (mW)	Power Density (mW/cm ²)	Limit (mW/cm ²)	Result
FHSS	32.48	1770	0.0282	0.6182	Pass

IC:

Protocol	MAX EIRP (dBm)	MAX EIRP (mW)	Power Density (mW/cm ²)	Limit (mW/cm ²)	Result
FHSS	32.48	1770	0.0282	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※※※※※

