

TEST REPORT

Applicant	RHC Holding Corporation.
Address	3581 Larch Lane, Jackson, Missouri 63755 USA

Manufacturer or Supplier	RHC Holding Corporation.
Address	3581 Larch Lane, Jackson, Missouri 63755 USA
Product Name	PROCO WIEMS
Brand Name	PROCO
Model	WTEMS
Additional Model & Model Difference	N/A
Date of tests	Dec. 05, 2019 ~ May 15, 2020

The tests have been carried out according to the requirements of the following standard:

☒ **FCC Part 15, Subpart E, Section 15.407**

CONCLUSION: The submitted sample was found to COMPLY with the test requirement

Tested by Breeze Jiang Project Engineer/ EMC Department	Approved by Glyn He Assistant Manager / EMC Department
	 Date: Jun. 19, 2020

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RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RF191205N008	Original release.	Jun. 19, 2020

1. SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC PART 15, SUBPART E (SECTION 15.407 UNDER NEW RULE)			
STANDARD SECTION	TEST TYPE	RESULT	REMARK
15.407(b)(6)	AC Power Conducted Emissions	PASS	Meet the requirement of limit.
15.407(b)(1/2/3/4/6)	Radiated Emissions & Band Edge Measurement	PASS	Meet the requirement of limit.
15.407(a)(1/2/3)	Max Average Transmit Power	PASS	Meet the requirement of limit.
15.407(a)(1/2/3)	Peak Power Spectral Density	PASS	Meet the requirement of limit.
15.407(g)	Frequency Stability	PASS	Meet the requirement of limit.
15.203	Antenna Requirement	PASS	No antenna connector is used

1.1 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

MEASUREMENT	FREQUENCY	UNCERTAINTY
Radiated emissions	9KHz ~ 30MHz	2.16dB
	30MHz ~ 1GMHz	3.83dB
	1GHz ~ 18GHz	4.66dB
	18GHz ~ 40GHz	4.67dB
Conducted emissions	9kHz~30MHz	2.70dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k = 2$.

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

PRODUCT NAME	PROCO WIEMS
MODEL NO.	WTEMS
FCC ID	2AUQK-WIEMS
POWER SUPPLY	DC 3.7V from Battery or DC 5V from Adapter
MODULATION TYPE	GFSK
OPERATING FREQUENCY	5727~5848MHz
NUMBER OF CHANNEL	Refer to 2.2 section
CONDUCTED OUTPUT POWER	-13.94dBm
ANTENNA TYPE	PCB Antenna, 1.45dBi gain
I/O PORTS	Refer to user's manual
CABLE SUPPLIED	N/A

NOTES:

1. The EUT incorporates a SISO function. the EUT provides 1 completed transmitter and 1 receiver.

MODULATION MODE	TX FUNCTION
GFSK	1TX/1RX

2. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.
3. For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.
4. Please refer to the EUT photo document (Reference No.: 191205N008) for detailed product photo.
5. The EUT was powered by the following adapter:

Adapter	
BRAND:	
MODEL:	QFAW-05-05
INPUT:	AC 100-240V, 50/60Hz 0.3A
OUTPUT:	DC 5V, 1.0A
USB LINE:	Unshielded, Detachable, 0.15m

2.2 DESCRIPTION OF TEST MODES

FOR 5725 ~ 5850MHz

62 channels are provided for GFSK:

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
1	5727	17	5759	33	5791	49	5823
2	5729	18	5761	34	5793	50	5825
3	5731	19	5763	35	5795	51	5827
4	5733	20	5765	36	5797	52	5829
5	5735	21	5767	37	5799	53	5831
6	5737	22	5769	38	5801	54	5833
7	5739	23	5771	39	5803	55	5835
8	5741	24	5773	40	5805	56	5837
9	5743	25	5775	41	5807	57	5839
10	5745	26	5777	42	5809	58	5841
11	5747	27	5780	43	5811	59	5843
12	5749	28	5781	44	5813	60	5845
13	5751	29	5783	45	5815	61	5847
14	5753	30	5785	46	5817	62	5848
15	5755	31	5787	47	5819		
16	5757	32	5789	48	5821		

2.2.1 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE≥1G	RE<1G	PLC	APCM	
-	-	-	-	√	Power by fully Battery
-	√	√	√	-	Power by Adapter

Where **RE≥1G**: Radiated Emission above 1GHz
PLC: Power Line Conducted Emission

RE<1G: Radiated Emission below 1GHz
APCM: Antenna Port Conducted Measurement

NOTE: "-" means no effect.

RADIATED EMISSION TEST (ABOVE 1GHz):

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	FREQ. BAND (MHz)	TESTED CHANNEL	MODULATION TYPE
-	5727-5848	1, 27, 62	GFSK

RADIATED EMISSION TEST (BELOW 1GHz):

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	FREQ. BAND (MHz)	TESTED CHANNEL	MODULATION TYPE
-	5727-5848	1	GFSK

POWER LINE CONDUCTED EMISSION TEST:

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	FREQ. BAND (MHz)	TESTED CHANNEL	MODULATION TYPE
-	5727-5848	1	GFSK

ANTENNA PORT CONDUCTED MEASUREMENT:

- ☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	FREQ. BAND (MHz)	TESTED CHANNEL	MODULATION TYPE
-	5727-5848	1, 27, 62	GFSK

TEST CONDITION:

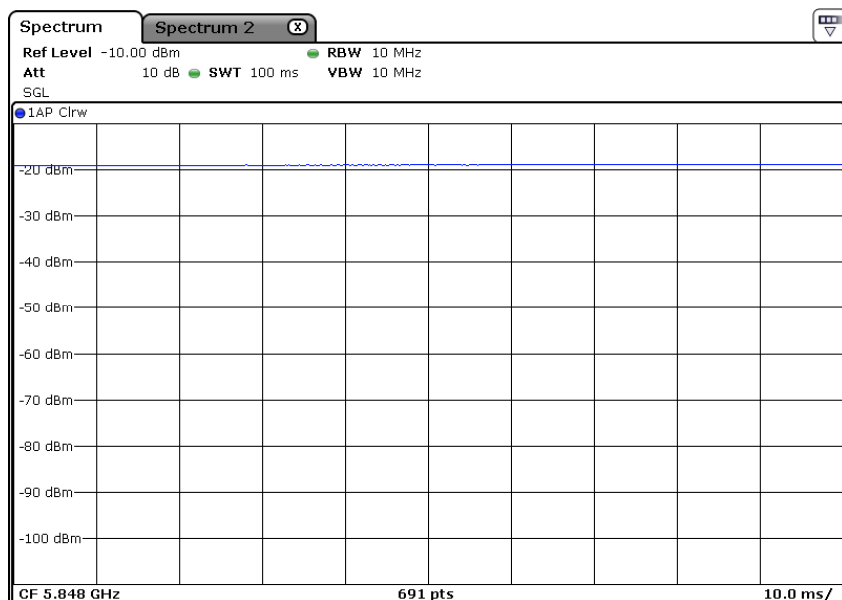
APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE<1G	25deg. C, 51%RH	DC 5V from Adapter	Hu
RE≥1G	25deg. C, 51%RH	DC 5V from Adapter	Hu
PLC	20deg. C, 56%RH	DC 5V from Adapter	Ming Bai
APCM	20deg. C, 55%RH	DC 3.7V from fully Battery	Robert



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2.3 DUTY CYCLE OF TEST SIGNAL

Duty Cycle: 100%



2.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together without any other necessary accessories or support units.

2.5 GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a RF Product. According to the specification of the EUT declared by the manufacturer, it must comply with the requirements of the following standards:

FCC Part 15, Subpart E (15.407)

789033 D02 General UNII Test Procedures New Rules v02r01

ANSI C63.10-2013

All test items have been performed and recorded as per the above standards.

3. TEST TYPES AND RESULTS

3.1 RADIATED EMISSION AND BANDEDGE MEASUREMENT

3.1.1 LIMITS OF RADIATED EMISSION AND BANDEDGE MEASUREMENT

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table:

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

NOTES:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 30dB under any condition of modulation.

3.1.2 LIMITS OF UNWANTED EMISSION OUT OF THE RESTRICTED BANDS

APPLICABLE TO	LIMIT	
789033 D02 General UNII Test Procedures New Rules v02r01	FIELD STRENGTH AT 3m	
	PK: 74 (dBμV/m)	AV: 54 (dBμV/m)
APPLICABLE TO	EIRP LIMIT	EQUIVALENT FIELD STRENGTH AT 3m
15.407(b)(1)	PK: -27 (dBm/MHz)	PK: 68.2 (dBμV/m)
15.407(b)(2)		
15.407(b)(3)		
15.407(b)(4)	Note	Note

NOTE: For transmitters operating in the 5.725-5.85 GHz band:

Section 15.407(b)(4) specifies the unwanted emissions limit for the U-NII-3 band. A band emissions mask is specified in Section 15.407(b)(4)(i). An alternative to the band emissions mask is specified in Section 15.407(b)(4)(ii). The alternative limits are based on the highest antenna gain specified in the filing. There are also marketing and importation restrictions for the alternative limit.

15.407(b)(4)(i) All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength:

$$E = \frac{1000000\sqrt{30P}}{3} \mu\text{V/m, where } P \text{ is the eirp (Watts).}$$

3.1.3 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESU40	100449	Mar. 18,20	Mar. 17,21
Signal and Spectrum Analyzer	Rohde&Schwarz	FSV7	102331	May 22,19	May 21,20
Active Loop Antenna (9KHz -30MHz)	SCHWARZBECK	FMZB 1519B	1519B-045	May 28,19	May 27,20
Amplifier (9KHz -1GHz)	Burgeon	BPA-530	100210	Mar. 15,20	Mar. 14,21
Bilog Antenna (20MHz -2GHz)	Teseq	CBL 6111D	30643	Jun. 23,19	Jun. 22,20
Horn Antenna (1GHz -18GHz)	ETS -Lindgren	3117	00062558	Jun. 23,19	Jun. 22,20
Horn Antenna (18GHz -40GHz)	SCHWARZBECK	BBHA 9170	BBHA9170147	Jun. 23,19	Jun. 22,20
3m Semi-anechoic Chamber	ETS-LINDGREN	9m*6m*6m	NSEMC003	Apr. 21,20	Apr. 20,21
Test Software	ADT	ADT_Radiate d_V7.6.15.9.2	N/A	N/A	N/A
Broadband Preamplifier (1GHz~18GHz)	SCHWARZBECK	BBV9718	305	Apr. 21,20	Apr. 20,21
Pre-Amplifier (18GHz-40GHz)	EMCI	EMC 184045	980102	Mar. 04,20	Mar. 03,21
Test Software	ADT	ADT_Radiate d_V7.6.15.9.2	N/A	N/A	N/A
BLUETOOTH TESTER	Rohde&Schwarz	CBT32	100811	May 20,19	May 19,20

NOTES:

1. The test was performed in 966 Chamber.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.
3. The horn antenna is used only for the measurement of emission frequency above 1GHz if tested.
4. The FCC Site Registration No. is 749762.



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3.1.4 TEST PROCEDURES

- a. The EUT was placed on the top of a rotating table 1.5 meters(above 1GHz) and 0.8 meters(below 1GHz) above the ground at a 3 meters semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

NOTES:

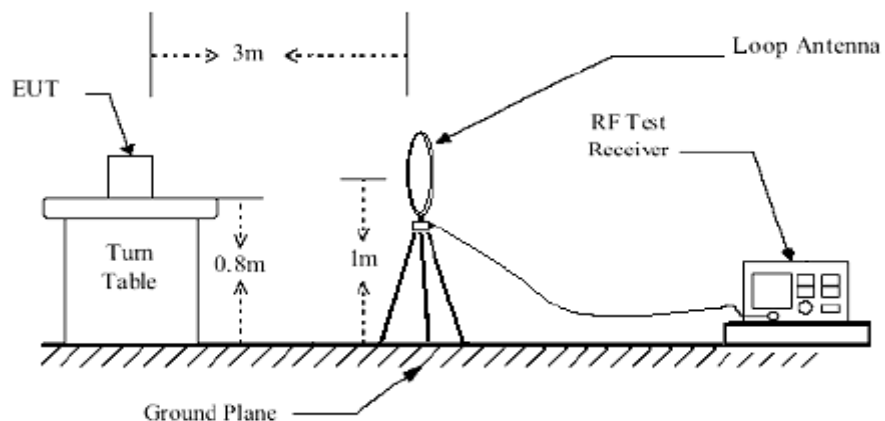
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is $\geq 1/T$ (Duty cycle < 98%) or 10Hz(Duty cycle > 98%) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

3.1.5 DEVIATION FROM TEST STANDARD

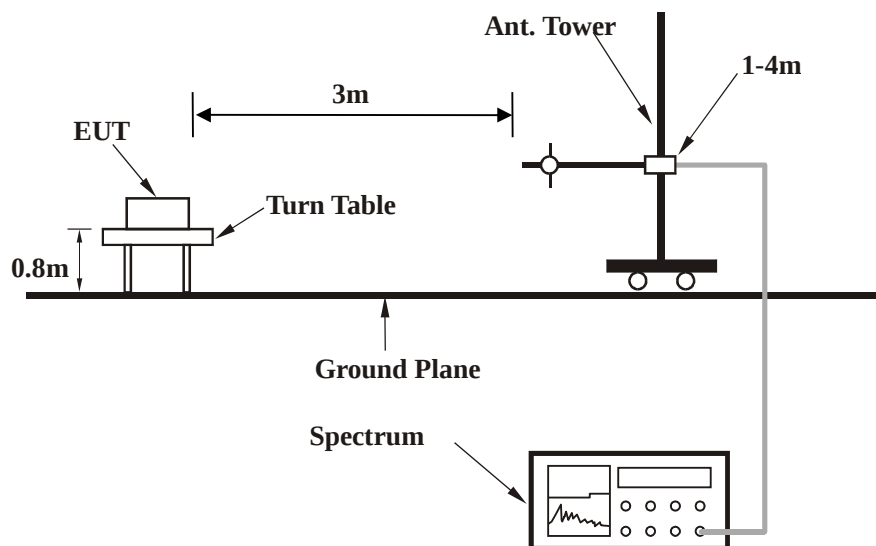
No deviation.

3.1.6 TEST SETUP

Below 30MHz test setup

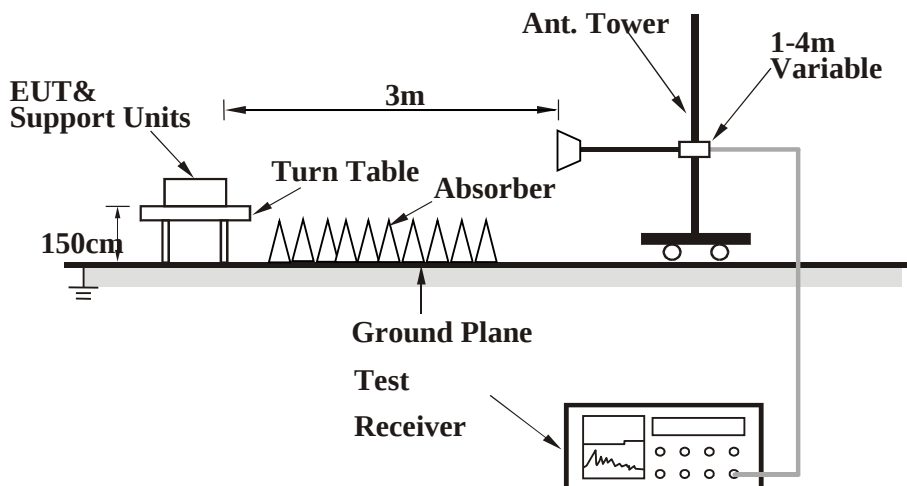


Below 1GHz test setup



Note: For the actual test configuration, please refer to the attached file (Test Setup Photo).

Above 1GHz test setup



Note: For the actual test configuration, please refer to the attached file (Test Setup Photo).

3.1.7 EUT OPERATING CONDITION

- Set the EUT under full load condition and placed them on a testing table.
- Set the transmitter part of EUT under transmission condition continuously at specific channel frequency.
- The necessary accessories enable the EUT in full functions.

3.1.8 TEST RESULTS

BELOW 1GHz WORST-CASE DATA

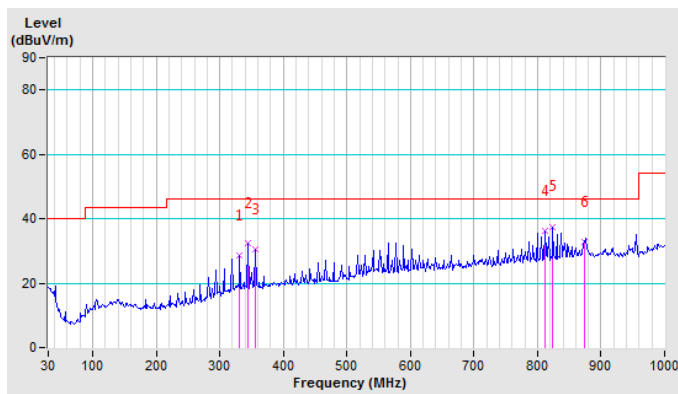
GFSK

CHANNEL	TX Channel 1	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9KHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	331.57	28.57 QP	46.00	-17.43	2.00 H	12	39.67	-11.10
2	344.01	32.44 QP	46.00	-13.56	2.00 H	0	43.07	-10.63
3	356.44	30.43 QP	46.00	-15.57	2.00 H	211	40.74	-10.31
4	811.91	36.10 QP	46.00	-9.90	2.00 H	23	37.34	-1.24
5	824.34	37.53 QP	46.00	-8.47	2.00 H	134	38.68	-1.15
6	874.09	32.63 QP	46.00	-13.37	2.00 H	48	32.83	-0.20

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The emission levels of other frequencies were greater than 20dB margin.
4. 9KHz~30MHz have been test and test data more than 20dB margin.
5. Margin value = Emission level – Limit value.

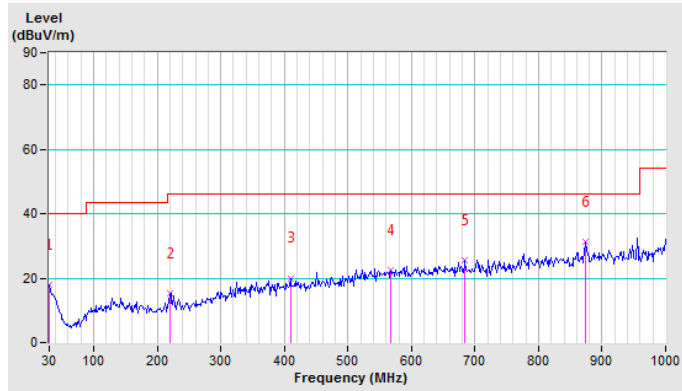


CHANNEL	TX Channel 1	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9KHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	30.00	18.01 QP	40.00	-21.99	1.00 V	117	29.21	-11.20
2	219.65	15.27 QP	46.00	-30.73	1.00 V	242	32.33	-17.06
3	409.29	20.01 QP	46.00	-25.99	1.00 V	183	29.08	-9.07
4	567.85	22.63 QP	46.00	-23.37	1.00 V	159	27.76	-5.13
5	684.44	25.42 QP	46.00	-20.58	1.00 V	194	29.18	-3.76
6	874.09	31.29 QP	46.00	-14.71	1.00 V	302	31.49	-0.20

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The emission levels of other frequencies were greater than 20dB margin.
4. 9KHz~30MHz have been test and test data more than 20dB margin.
5. Margin value = Emission level – Limit value.





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ABOVE 1GHz DATA

GFSK

CHANNEL	TX Channel 1	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

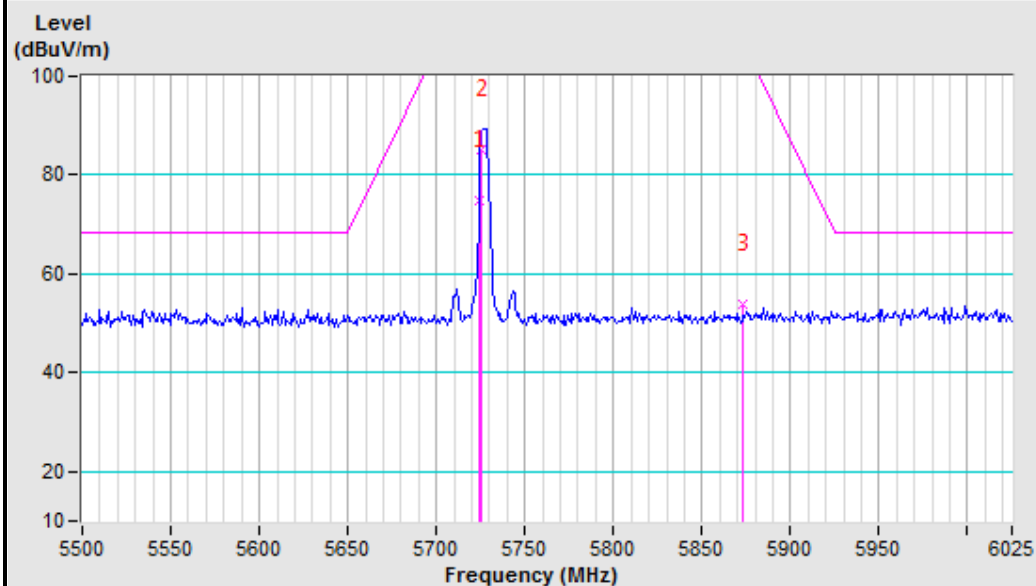
ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	@5724.16	74.72 PK	120.28	-45.56	1.75 H	23	65.16	9.56
2	@5725.00	85.23 PK	122.20	-36.97	1.75 H	23	75.67	9.56
3	*5727.00	90.30 PK			1.00 H	23	80.73	9.57
4	*5727.00	86.49 AV			1.00 H	23	76.92	9.57
5	@5872.72	53.87 PK	105.84	-51.97	1.75 H	23	43.92	9.95
6	#11454.00	59.49 PK	74.00	-14.51	1.00 H	17	39.90	19.59
7	#11454.00	45.50 AV	54.00	-8.50	1.00 H	17	25.91	19.59
8	17181.00	65.10 PK	68.20	-3.10	1.00 H	242	37.81	27.29
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	@5723.32	61.29 PK	118.36	-57.07	2.00 V	100	51.74	9.55
2	@5725.00	82.31 PK	122.20	-39.89	2.00 V	100	72.75	9.56
3	*5727.00	88.78 PK			1.00 V	100	79.21	9.57
4	*5727.00	85.11 AV			1.00 V	100	75.54	9.57
5	@5865.99	51.35 PK	107.72	-56.37	2.00 V	100	41.42	9.93
6	#11454.00	60.24 PK	74.00	-13.76	1.00 V	52	40.65	19.59
7	#11454.00	45.30 AV	54.00	-8.70	1.00 V	52	25.71	19.59
8	17181.00	64.25 PK	68.20	-3.95	1.00 V	111	36.96	27.29

REMARKS:

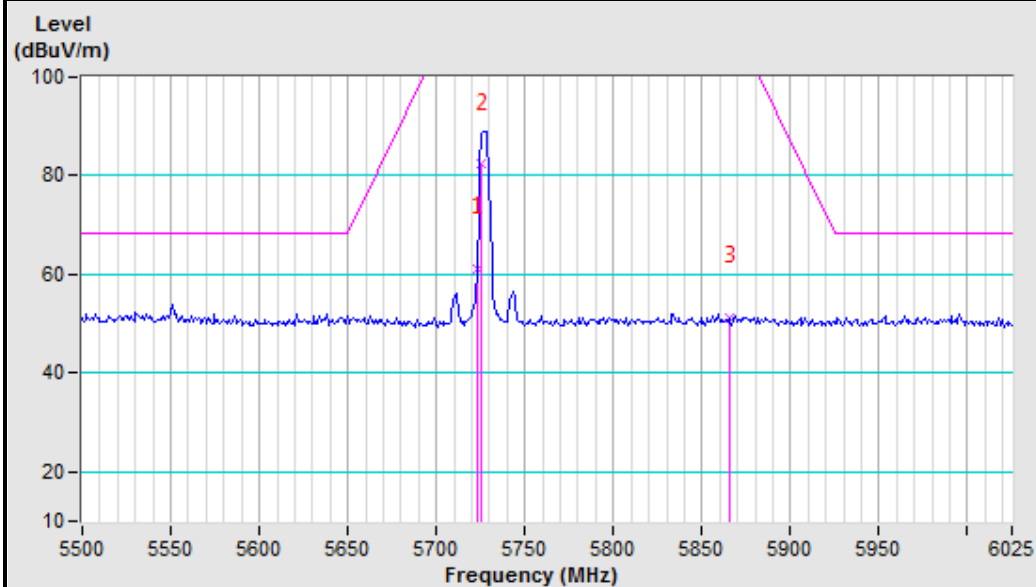
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.
7. " @ ": The radiated frequency is limited by the band edge.

Band edge Plot

5727MHz Horizontal



5727MHz Vertical



CHANNEL	TX Channel 27	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5780.00	90.66 PK			1.00 H	265	80.95	9.71
2	*5780.00	86.71 AV			1.00 H	265	77.00	9.71
3	#11560.00	65.12 PK	74.00	-8.88	1.00 H	29	45.34	19.78
4	#11560.00	45.08 AV	54.00	-8.92	1.00 H	29	25.30	19.78
5	17340.00	62.90 PK	68.20	-5.30	1.00 H	37	35.44	27.46
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5780.00	90.11 PK			1.00 V	234	80.40	9.71
2	*5780.00	86.44 AV			1.00 V	234	76.73	9.71
3	#11560.00	66.26 PK	74.00	-7.74	1.00 V	63	46.48	19.78
4	#11560.00	45.60 AV	54.00	-8.40	1.00 V	63	25.82	19.78
5	17340.00	63.80 PK	68.20	-4.40	1.00 V	146	36.34	27.46

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

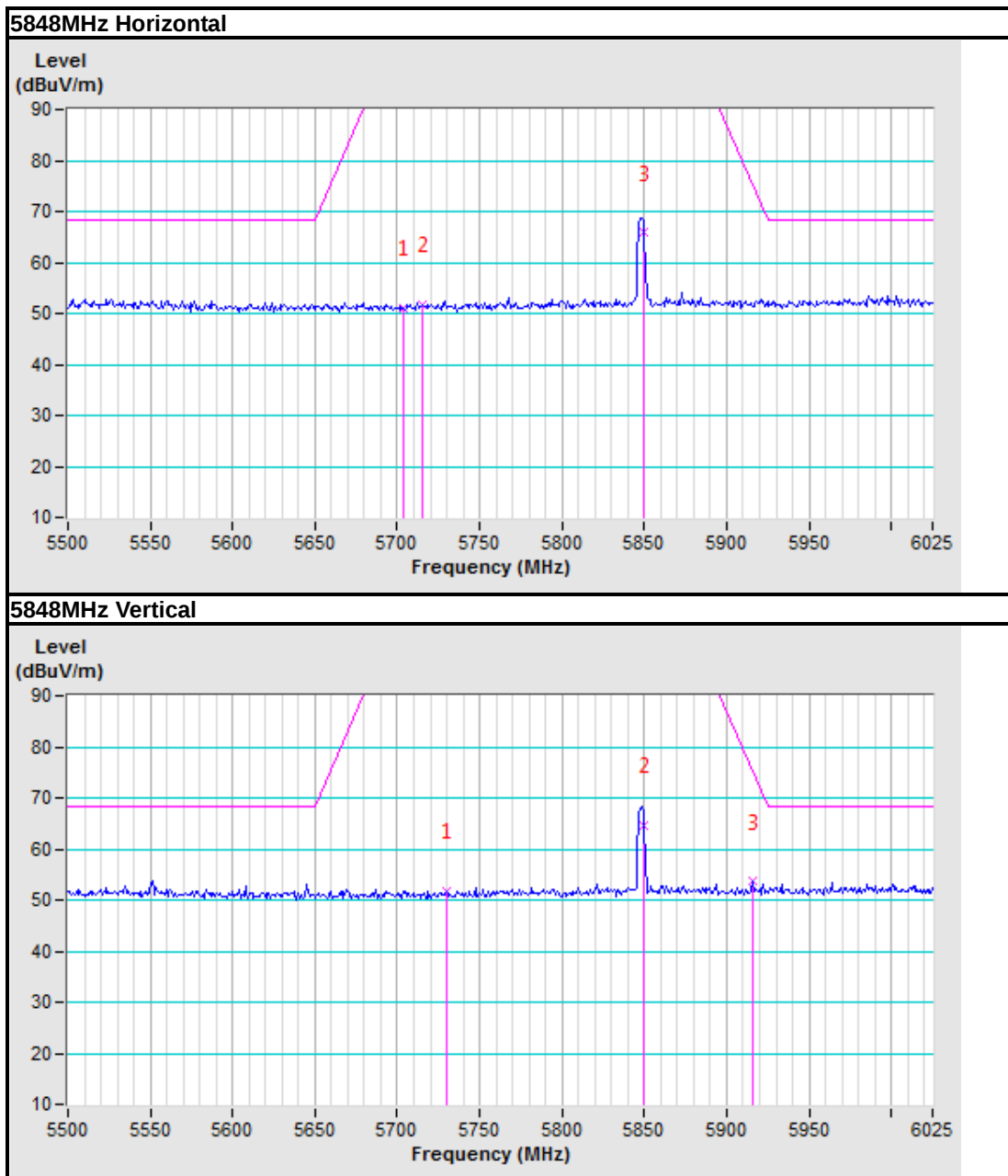
CHANNEL	TX Channel 62	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	@5703.97	50.97 PK	106.31	-55.34	1.37 H	34	41.47	9.50
2	@5715.75	51.76 PK	109.61	-57.85	1.37 H	34	42.22	9.54
3	*5848.00	68.81 PK			1.00 H	34	58.92	9.89
4	*5848.00	65.33 AV			1.00 H	34	55.44	9.89
5	@5850.00	65.83 PK	122.20	-56.37	1.37 H	34	55.95	9.88
6	#11696.00	63.04 PK	74.00	-10.96	1.00 H	48	42.96	20.08
7	#11696.00	44.70 AV	54.00	-9.30	1.00 H	156	24.62	20.08
8	17544.00	61.90 PK	68.20	-6.30	1.00 H	229	34.25	27.65
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	@5729.69	51.66 PK	152.20	-100.54	1.93 V	58	42.08	9.58
2	*5848.00	71.30 PK			1.00 V	58	61.41	9.89
3	*5848.00	68.40 AV			1.00 V	58	58.51	9.89
4	@5850.00	64.66 PK	152.20	-87.54	1.93 V	58	54.78	9.88
5	@5915.62	53.64 PK	75.11	-21.47	1.93 V	63	43.59	10.05
6	#11696.00	64.23 PK	74.00	-9.77	1.00 V	78	44.15	20.08
7	#11696.00	45.20 AV	54.00	-8.80	1.00 V	203	25.12	20.08
8	17544.00	63.40 PK	68.20	-4.80	1.00 V	11	35.75	27.65

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.
7. " @ ": The radiated frequency is limited by the band edge.

Band edge Plot



3.2 CONDUCTED EMISSION MEASUREMENT

3.2.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dB μ V)	
	Quasi-peak	Average
0.15 ~ 0.5	66 to 56	56 to 46
0.5 ~ 5	56	46
5 ~ 30	60	50

- NOTE:**
1. The lower limit shall apply at the transition frequencies.
 2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.
 3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

3.2.2 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESR7	101588	Mar. 18,20	Mar. 17,21
Artificial Mains Network	Rohde&Schwarz	ENV216	101173	Mar. 18,20	Mar. 17,21
Artificial Mains Network	Rohde&Schwarz	ESH3-Z5	100317	Mar. 18,20	Mar. 17,21
Voltage probe	SCHWARZBEC K	TK 9421	TK 9421-176	Sep. 24,19	Sep. 23,20
Test software	ADT	ADT_Conc_ V7.3.7	N/A	N/A	N/A

- NOTE:**
1. The test was performed in shielded room 553.
 2. The calibration interval of the above test instruments is 12 months. And the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.

3.2.3 TEST PROCEDURES

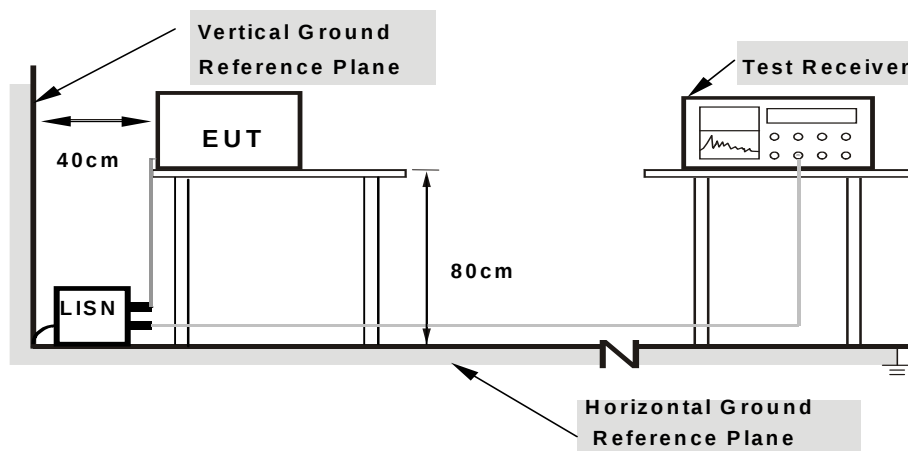
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) were not recorded.

NOTE: All modes of operation were investigated and the worst-case emissions are reported.

3.2.4 DEVIATION FROM TEST STANDARD

No deviation.

3.2.5 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 from other units and other metal planes

For the actual test configuration, please refer to the attached file (Test Setup Photo).

3.2.6 EUT OPERATING CONDITIONS

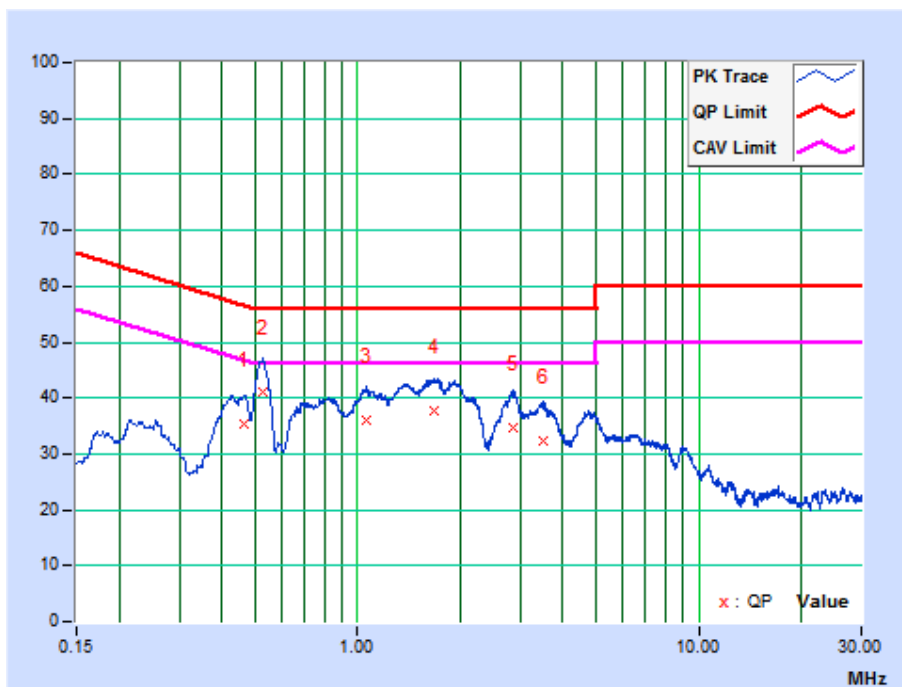
Same as 3.1.6

3.2.7 TEST RESULTS

CONDUCTED WORST-CASE DATA:

PHASE		Line			6dB BANDWIDTH				9kHz	
No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.46271	10.22	25.14	15.69	35.36	25.91	56.64	46.64	-21.28	-20.73
2	0.52941	10.22	30.80	20.92	41.02	31.14	56.00	46.00	-14.98	-14.86
3	1.06125	10.24	25.65	14.66	35.89	24.90	56.00	46.00	-20.11	-21.10
4	1.66650	10.23	27.48	16.25	37.71	26.48	56.00	46.00	-18.29	-19.52
5	2.86575	10.22	24.51	14.11	34.73	24.33	56.00	46.00	-21.27	-21.67
6	3.48675	10.22	22.24	12.01	32.46	22.23	56.00	46.00	-23.54	-23.77

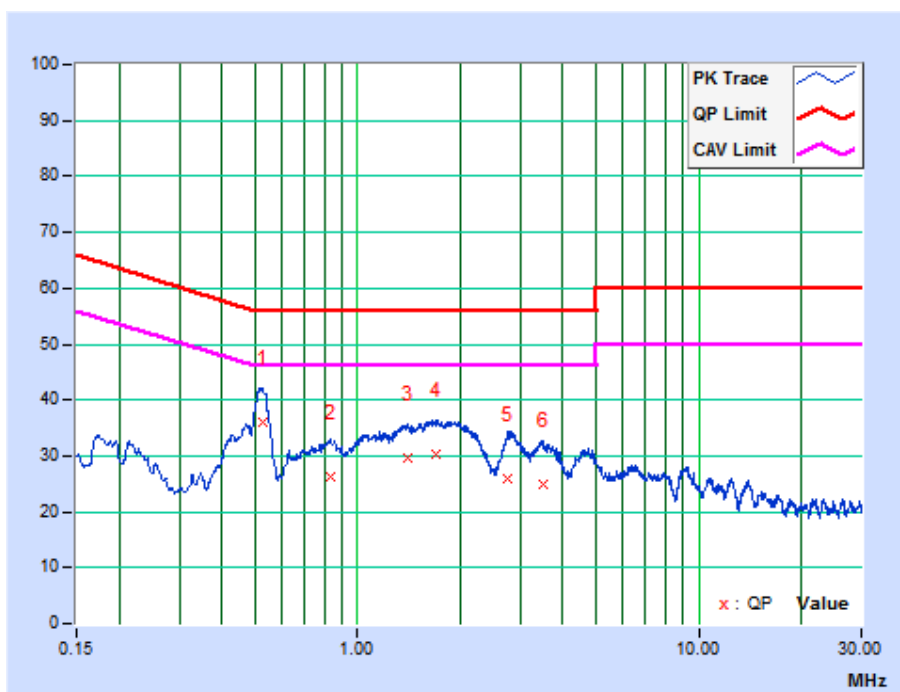
- REMARKS:**
1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
 2. The emission levels of other frequencies were very low against the limit.
 3. Margin value = Emission level - Limit value
 4. Correction factor = Insertion loss + Cable loss
 5. Emission Level = Correction Factor + Reading Value.



PHASE	Neutral	6dB BANDWIDTH	9kHz
-------	---------	---------------	------

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.52575	10.02	26.06	13.44	36.08	23.46	56.00	46.00	-19.92	-22.54
2	0.83175	10.03	16.36	8.53	26.39	18.56	56.00	46.00	-29.61	-27.44
3	1.39650	10.02	19.60	12.19	29.62	22.21	56.00	46.00	-26.38	-23.79
4	1.68900	10.01	20.39	12.95	30.40	22.96	56.00	46.00	-25.60	-23.04
5	2.75325	10.03	15.88	6.56	25.91	16.59	56.00	46.00	-30.09	-29.41
6	3.51600	10.03	14.84	6.03	24.87	16.06	56.00	46.00	-31.13	-29.94

- REMARKS:** 1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.



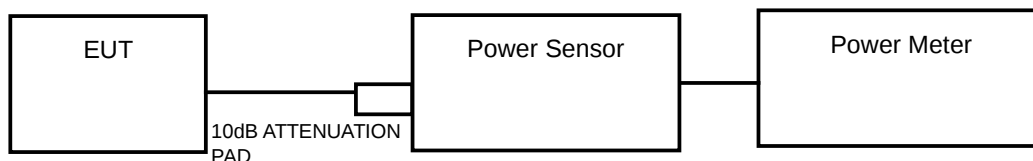
3.3 TRANSMIT POWER MEASUREMENT

3.3.1 LIMITS OF TRANSMIT POWER MEASUREMENT

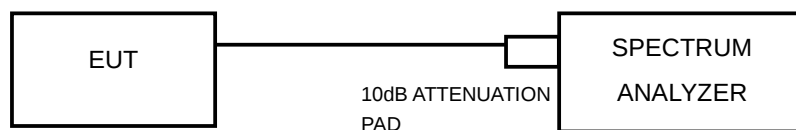
Operation Band	EUT Category		LIMIT
U-NII-1		Outdoor Access Point	1 Watt (30 dBm) (Max. e.i.r.p $\leq$ 125mW(21 dBm) at any elevation angle above 30 degrees as measured from the horizon)
		Fixed point-to-point Access Point	1 Watt (30 dBm)
		Indoor Access Point	1 Watt (30 dBm)
	√	Mobile and Portable client device	250mW (24 dBm)
U-NII-2A	√		250mW(24dBm) or 11 dBm+10LogB*
U-NII-2C	-		250mW(24dBm) or 11 dBm+10LogB*
U-NII-3	-		1 Watt (30 dBm)

NOTE: 1. Where B is the 26dB emission bandwidth in MHz.

3.3.2 TEST SETUP



FOR 6/26dB BANDWIDTH



3.3.3 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Power Sensor	Keysight	U2021XA	MY55060016	May 22,19	May 21,20
Power Sensor	Keysight	U2021XA	MY55060018	May 22,19	May 21,20
Power Meter	Anritsu	ML2495A	1139001	Mar. 18,20	Mar. 17,21
Power Sensor	Anritsu	MA2411B	1531155	Mar. 18,20	Mar. 17,21
Digital Multimeter	FLUKE	15B	A1220010DG	Oct. 17, 19	Oct.16, 20
Humid & Temp Programmable Tester	Haida	HD-225T	110807201	Oct.31,19	Oct. 30,20
Oscilloscope	Agilent	DSO9254A	MY51260160	Sep. 18,19	Sep. 17,20
Signal and Spectrum Analyzer	Rohde&Schwarz	FSV40	101094	Mar. 18,20	Mar. 17,21
Signal Generator	Agilent	N5183A	MY50140980	Sep. 19,19	Sep. 18,20
MXG-B RF Vector Signal Generator	Keysight	N5182B	MY56200288	Sep. 12,19	Sep. 11,20
Attenuator	MINI	BW-S10W2+	S130129FGE2	N/A	N/A
DC Source	Keysight	E3642A	MY56146098	N/A	N/A

NOTE:

1. The test was performed in RF Oven room.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.

3.3.4 TEST PROCEDURE

FOR AVERAGE POWER MEASUREMENT

Method PM is used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of TX on burst. Duty factor is not added to measured value.

FOR 26dB BANDWIDTH

- 1) Set RBW = approximately 1% of the emission bandwidth.
- 2) Set the VBW > RBW.
- 3) Detector = RMS.
- 4) Trace mode = max hold.
- 5) Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.



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FOR 6dB BANDWIDTH

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

3.3.5 DEVIATION FROM TEST STANDARD

No deviation.

3.3.6 EUT OPERATING CONDITIONS

The software provided by client to enable the EUT under transmission condition continuously at specific channel frequencies individually.



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3.3.7 TEST RESULTS

OUTPUT POWER:

GFSK

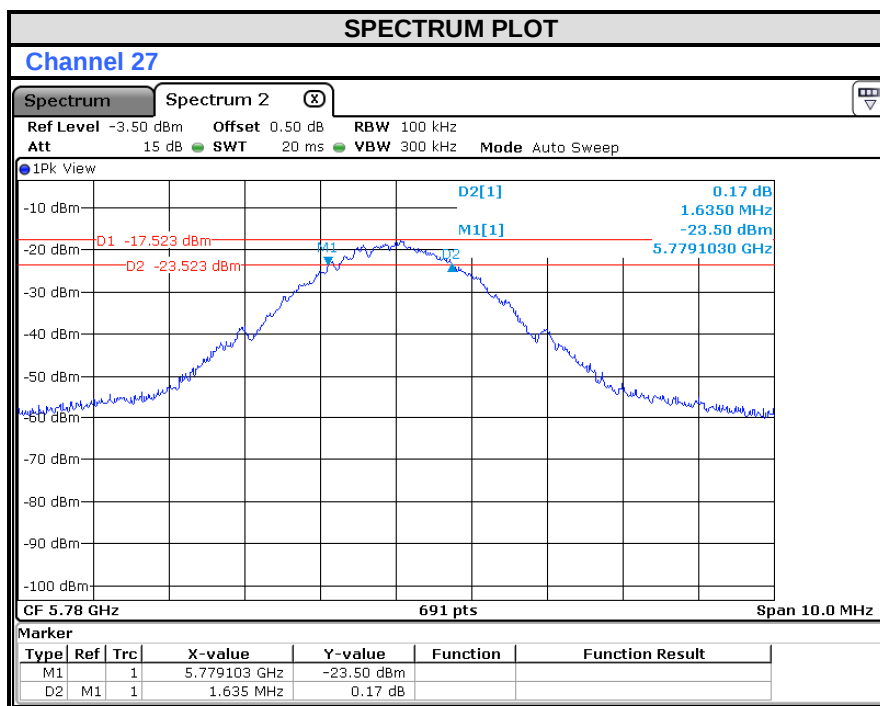
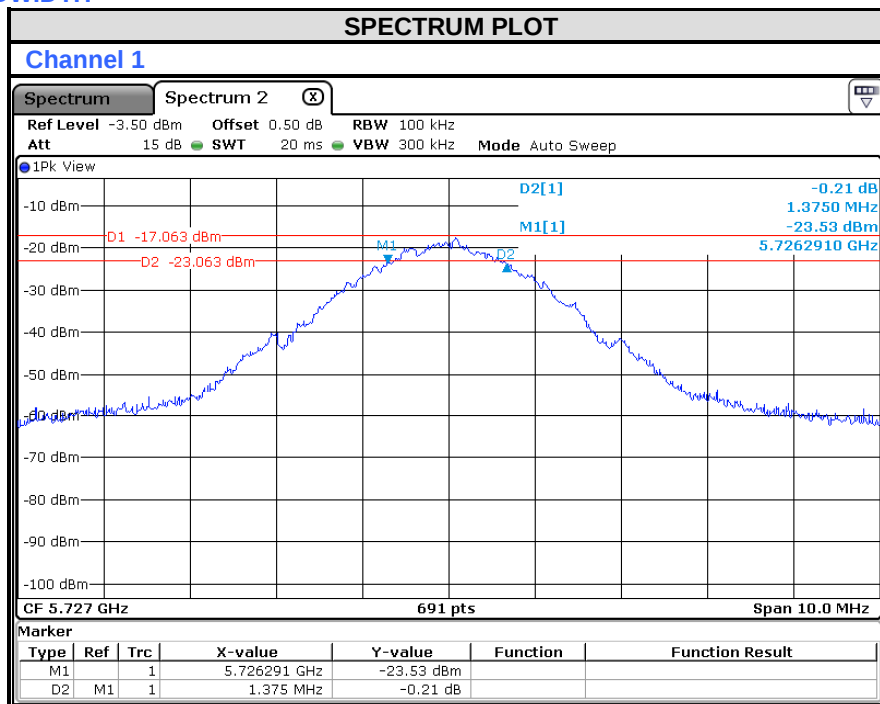
Channel Number	FREQ. (MHz)	AVG. CONDUCTED POWER (dBm)	LIMIT (dBm)	PASS /FAIL
1	5727	-14.38	30.00	PASS
27	5780	-13.94	30.00	PASS
62	5848	-15.29	30.00	PASS

6dB BANDWIDTH

GFSK

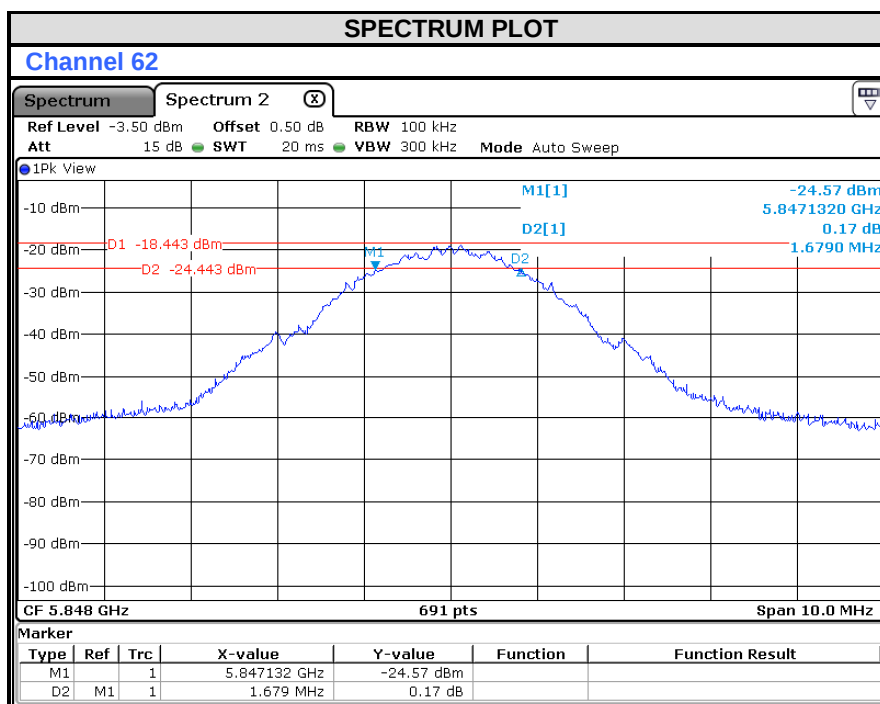
Channel Number	Freq. (MHz)	6dB DOWN BANDWIDTH (MHz)	PASS /FAIL
1	5727	1.38	PASS
27	5780	1.64	PASS
62	5848	1.68	PASS

6dB BANDWIDTH





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Bureau Veritas Shenzhen Co., Ltd.
Dongguan Branch

No. 96, Guantai Road (Houjie Section), Houjie
Town, Dongguan City, Guangdong Province.
523942. People's Republic of China.

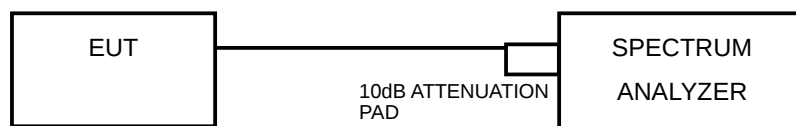
Tel: +86 769 8998 2098
Fax: +86 769 8593 1080
Email: customerservice.dg@cn.bureauveritas.com

3.4 PEAK POWER SPECTRAL DENSITY MEASUREMENT

3.4.1 LIMITS OF PEAK POWER SPECTRAL DENSITY MEASUREMENT

Operation Band	EUT Category		LIMIT
U-NII-1		Outdoor Access Point	17dBm/ MHz
		Fixed point-to-point Access Point	
		Indoor Access Point	
		Mobile and Portable client device	11dBm/ MHz
U-NII-2A			11dBm/ MHz
U-NII-2C	-		11dBm/ MHz
U-NII-3	√		30dBm/ 500kHz

3.4.2 TEST SETUP



3.4.3 TEST INSTRUMENTS

Refer to section 3.2.3 to get information of above instrument.

3.4.4 TEST PROCEDURES

For U-NII-1, U-NII-2A, U-NII-2C band:

Using method SA-2

- 1) Set span to encompass the entire emission bandwidth (EBW) of the signal.
- 2) Set RBW = 1MHz, Set VBW = 3 MHz, Detector = RMS
- 3) Set Channel power measure = 1MHz
- 4) Sweep time = auto, trigger set to "free run".
- 5) Trace average at least 100 traces in power averaging mode.
- 6) Record the max value and add 10 log (1/duty cycle)



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For U-NII-3 band:

Using method SA-2

- 1) Set span to encompass the entire emission bandwidth (EBW) of the signal.
- 2) Set RBW = 300 kHz, Set VBW = 1 MHz, Detector = RMS
- 3) Set Channel power measure = 1MHz
- 4) Sweep time = auto, trigger set to "free run".
- 5) Trace average at least 100 traces in power averaging mode.
- 6) Record the max value and add 10 log (1/duty cycle)

3.4.5 DEVIATION FROM TEST STANDARD

No deviation.

3.4.6 EUT OPERATING CONDITIONS

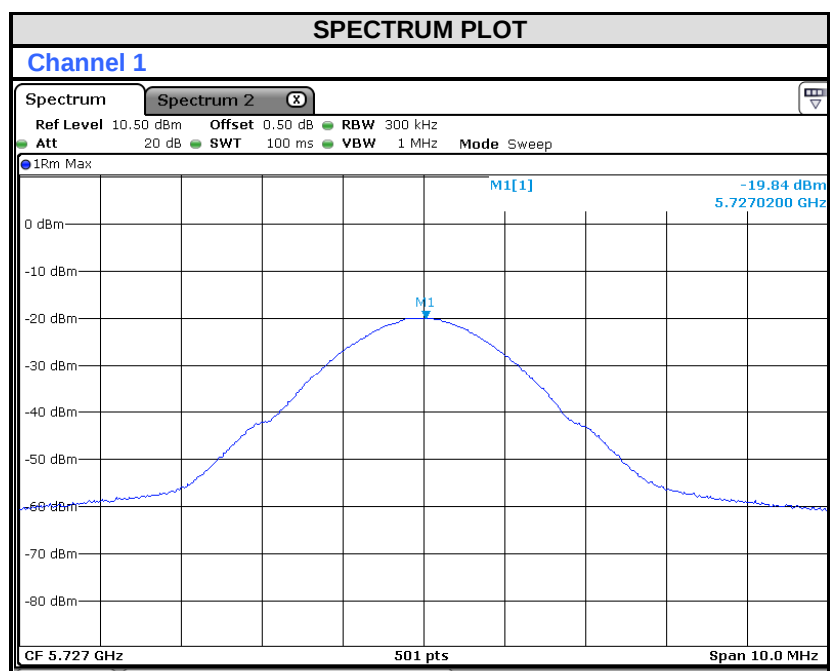
Same as 3.3.6

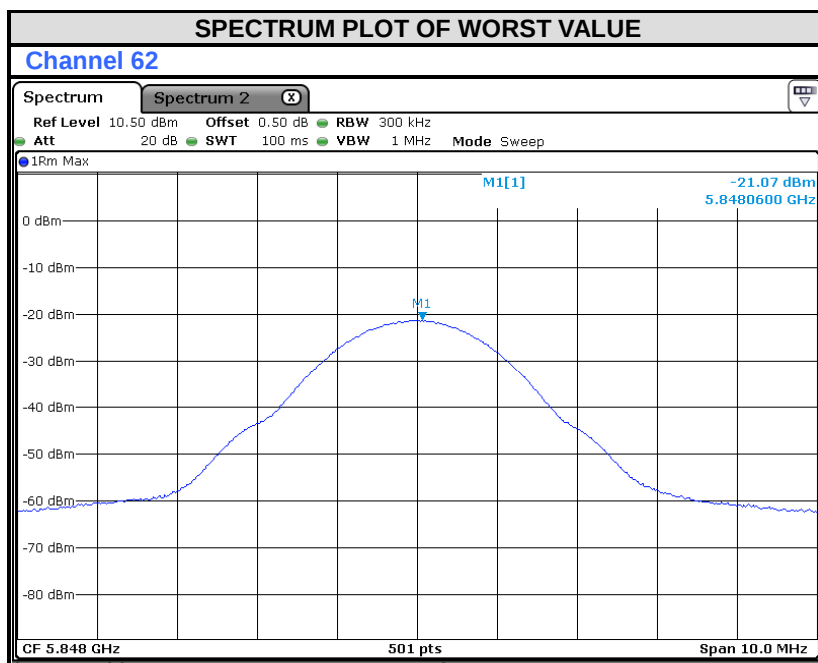
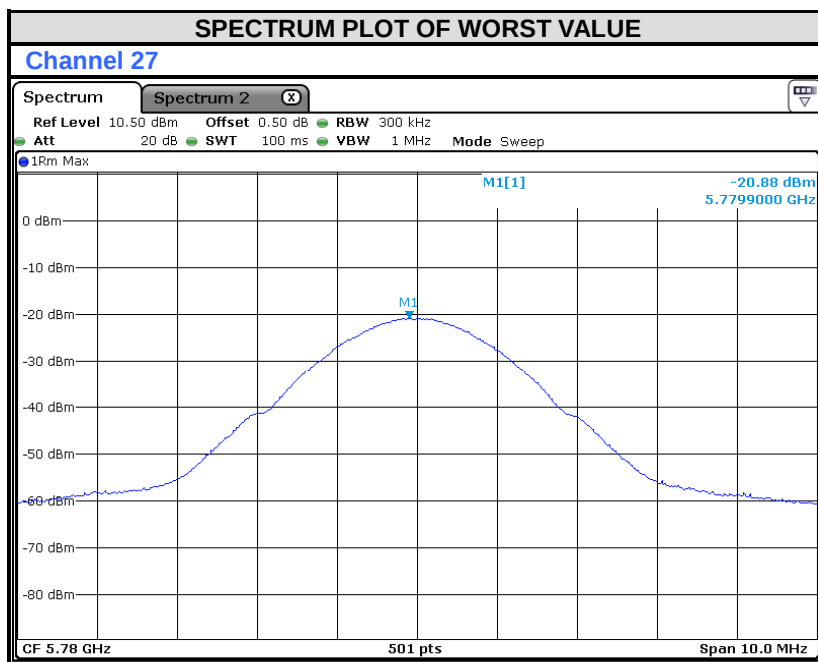
3.4.7 TEST RESULTS

GFSK

Channel Number	Frequency (MHz)	RF Power Level in 300kHz BW (dBm)	RF Power Level in 500kHz BW (dBm)	MAX. Limit (dBm/500k)	PASS / FAIL
1	5727	-19.84	-17.62	30.00	PASS
27	5780	-20.88	-18.66	30.00	PASS
62	5848	-21.07	-18.85	30.00	PASS

PSD Test Plot



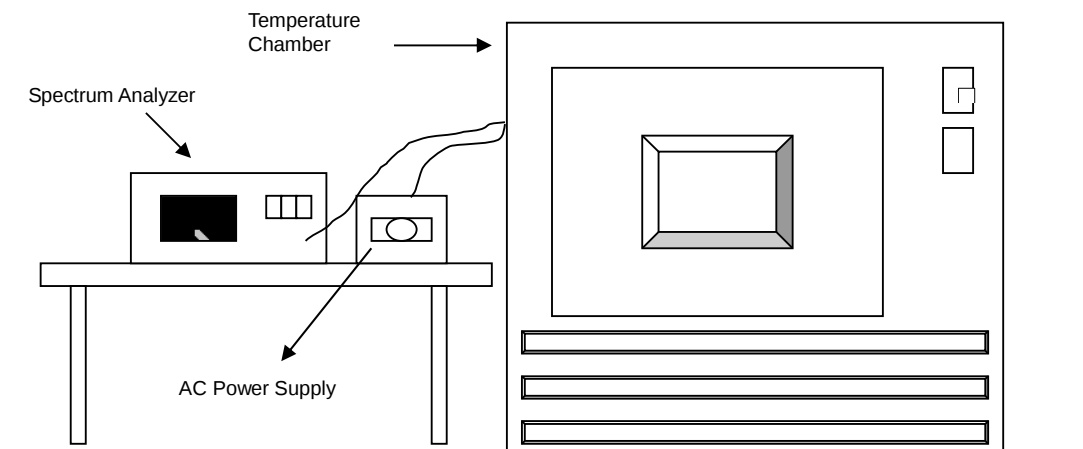


3.5 FREQUENCY STABILITY

3.5.1 LIMITS OF FREQUENCY STABILITY MEASUREMENT

The frequency of the carrier signal shall be maintained within band of operation.

3.5.2 TEST SETUP



3.5.3 TEST INSTRUMENTS

Refer to section 3.2.3 to get information of above instrument.



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3.5.4 TEST PROCEDURE

- a. The EUT was placed inside the environmental test chamber and powered by nominal AC voltage.
- b. Turn the EUT on and couple its output to a spectrum analyzer.
- c. Turn the EUT off and set the chamber to the highest temperature specified.
- d. 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.
- e. Repeat step 2 and 3 with the temperature chamber set to the lowest temperature.
- f. The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record.

3.5.5 DEVIATION FROM TEST STANDARD

No deviation.

3.5.6 EUT OPERATING CONDITION

Set the EUT transmit at un-modulation mode to test frequency stability.

3.5.7 TEST RESULTS

FREQUENCY STABILITY VERSUS TEMP.									
OPERATING FREQUENCY: 5727MHz									
TEMP. (°C)	POWER SUPPLY (Vac)	0 MINUTE		2 MINUTE		5 MINUTE		10 MINUTE	
		Measured Frequency (MHz)	Frequency Drift	Measured Frequency (MHz)	Frequency Drift	Measured Frequency (MHz)	Frequency Drift	Measured Frequency (MHz)	Frequency Drift
50	120	5727.013	0.00023	5727.014	0.00024	5727.0102	0.00018	5727.0109	0.00019
40	120	5727.0064	0.00011	5727.0041	0.00007	5727.0068	0.00012	5727.0048	0.00008
30	120	5727.0105	0.00018	5727.0099	0.00017	5727.0074	0.00013	5727.0058	0.00010
20	120	5726.9827	-0.00030	5726.9851	-0.00026	5726.9862	-0.00024	5726.9833	-0.00029
10	120	5726.9953	-0.00008	5726.9983	-0.00003	5726.9973	-0.00005	5726.9972	-0.00005
0	120	5726.9783	-0.00038	5726.9801	-0.00035	5726.9787	-0.00037	5726.9763	-0.00041
-10	120	5727.0245	0.00043	5727.0228	0.00040	5727.0203	0.00035	5727.0228	0.00040
-20	120	5726.9945	-0.00010	5726.9934	-0.00012	5726.9973	-0.00005	5726.9975	-0.00004
-30	120	5726.988	-0.00021	5726.9866	-0.00023	5726.987	-0.00023	5726.9835	-0.00029

FREQUENCY STABILITY VERSUS TEMP.									
OPERATING FREQUENCY: 5727MHz									
TEMP. (°C)	POWER SUPPLY (Vac)	0 MINUTE		2 MINUTE		5 MINUTE		10 MINUTE	
		Measured Frequency (MHz)	Frequency Drift	Measured Frequency (MHz)	Frequency Drift	Measured Frequency (MHz)	Frequency Drift	Measured Frequency (MHz)	Frequency Drift
20	138	5726.9816	-0.00032	5726.9856	-0.00025	5726.9866	-0.00023	5726.9836	-0.00029
	120	5726.9827	-0.00030	5726.9851	-0.00026	5726.9862	-0.00024	5726.9833	-0.00029
	102	5726.9828	-0.00030	5726.9858	-0.00025	5726.9865	-0.00024	5726.9839	-0.00028



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4. PHOTOGRAPHS OF THE TEST CONFIGURATION

Please refer to the attached file (Test Setup Photo).



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5. APPENDIX A – MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB

No modifications were made to the EUT by the lab during the test.

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