

Report No.:	SET2021-01932		
Product Name:	C66 UHF		
FCC ID:	2AC6AC66UHF		
Model No. :	C66		
Applicant:	Shenzhen Chainway Information Technology Co., Ltd.		
Address:	9F Building2,Daqian Industrial Park,District 67, XingDong Community,Xin'an street,Bao'an District,Shenzhen,Guangdong, China		
Dates of Testing:	01/21/2019 — 02/4/2021		
Issued by:	CCIC Southern Testing Co., Ltd.		
Lab Location:	Electronic Testing Building, No. 43 Shahe Road, Xili Street, Nanshan District, Shenzhen, Guangdong, China		
	Tel: 86 755 26627338 Fax: 86 755 26627238		

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## **Test Report**

Product Name:	C66 UHF			
Brand Name:	CHAINWAY			
Trade Name:	CHAINWAY			
Applicant	Shenzhen Chainway Information Technology Co., Ltd.			
Applicant Address:	9F Building2,Daqian Industrial Park,District 67, XingDong Community,Xin'an street,Bao'an District,Shenzhen,Guang dong,China			
Manufacturer:	Shenzhen Chainway Information Technology Co.,Ltd.			
Manufacturer Address:	9F Building2,Daqian Industrial Park,District 67, XingDong Community,Xin'an street,Bao'an District,Shenzhen,Guang dong,China			
Test Standards:	47 CFR Part 15 Subpart C: Radio Frequency Devices ANSI C63.10:2013: American National Standard for Testing Unlicensed Wireless Devices			
Test Result:	PASS			
Tested by: Reviewed by: Approved by:	Vincent 2021.02.05 Vincent, Test Engineer Chris You, Senior Engineer Shuangwan Angy 2021.02.05 Shuangwen Zhang, Manager			



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Change History			
Issue	Date	Reason for change	
1.0	2021.02.05	First edition	



## 1. General Information

## **1.1. EUT Description**

EUT Type	C66 UHF
Hardware Version	C66_MB_B
Software Version	C66_CNCommon_V1.00
Power Supply	DC 5V
Frequency Range	902MHz~928MHz
Operating Range	902.75MHz~927.25MHz
Number of channel	50
Modulation Type	DSB-ASK
Antenna Type	Internal Antenna
Antenna Gain	4dBi



### 1.2. Test Standards and Results

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart C (ISM band radiators) for the EUT FCC ID Certification:

No.	Identity	Document Title	
1	47 CFR Part 15	Radio Erequency Devices	
1	Subpart C 2017	Radio Hequency Devices	
2	ANSI C63.10 2013	American National Standard for Testing Unlicensed Wireless Devices	

Test detailed items/section required by FCC rules and results are as below:

Na	Standard(s) Section	Description	Decult	
INO.	FCC	Description	Kesuit	
1	15.203	Antenna Requirement	PASS	
2	15.247(a)	Number of Hopping Frequency	PASS	
3	15.247(b)	Peak Output Power	PASS	
4	15.247(a)	Bandwidth	PASS	
5	15.247(a)	Carrier Frequency Separation	PASS	
6	15.247(a)	Time of Occupancy (Dwell time)	PASS	
7	15.247(d)	Conducted Spurious Emission	PASS	
8	15.247(d)	Conducted Band Edge PASS		
9	15.207	Conducted Emission	PASS	
10	15.209	Radiated Band Edges and Spurious	DASS	
10	15.247(c)	Emission	FASS	
11	15.247(g)	Frequency hopping spread spectrum	PASS	
11		system requirement		
12	15.247 (h)	FHSS Intelligence	Pass <sup>Note2</sup>	

Note 1: The test of Radiated Emission was performed according to the method of measurements prescribed in ANSI C63.10 2013.

2. The EUT does not coordinate transmission with any other FHSS to avoid simultaneous occupation of hopping frequencies.



## **1.3.** Description of Test Mode

Channel	Frequency(MHz)	Channel	Frequency(MHz)
1	902.75	26	915.25
2	903.25	27	915.75
3	903.75	28	916.25
4	904.25	29	916.75
5	904.75	30	917.25
6	905.25	31	917.75
7	905.75	32	918.25
8	906.25	33	918.75
9	906.75	34	919.25
10	907.25	35	919.75
11	907.75	36	920.25
12	908.25	37	920.75
13	908.75	38	921.25
14	909.25	39	921.75
15	909.75	40	922.25
16	910.25	41	922.75
17	910.75	42	923.25
18	911.25	43	923.75
19	911.75	44	924.25
20	912.25	45	924.75
21	912.75	46	925.25
22	913.25	47	925.75
23	913.75	48	926.25
24	914.25	49	926.75
25	914.75	50	927.25

Test channel: 1channel, 26 channel, 50channel



### **1.4.** Facilities and Accreditations

### 1.4.1. Facilities

### FCC-Registration No.: CN1283

CCIC Southern Testing Co., Ltd EMC Laboratory has been registered and fully described in a re port filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files. Designation Number: CN1283, valid time is until June 30th,2021

### ISED Registration: 11185A-1

#### CAB identifier: CN0064

CCIC Southern Testing Co., Ltd. EMC Laboratory has been registered by Certification and Engi neering Bureau of Industry Canada for the performance of radiated measurements with Registrati on No. 11185A-1 on Aug. 04, 2016, valid time is until June 30th, 2021

#### A2LA Code: 5721.01

CCIC-SET is a third party testing organization accredited by A2LA according to ISO/IEC 17025. The accreditation certificate number is 5721.01.

### **1.4.2.** Test Environment Conditions

During the measurement, the environmental conditions were within the listed ranges:

Temperature (°C):	15 - 35
Relative Humidity (%):	30 -60
Atmospheric Pressure (kPa):	86KPa-106KPa



### 2. 47 CFR Part 15C Requirements

### 2.1. Antenna requirement

### 2.1.1. Applicable Standard

According to FCC 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

And according to FCC 47 CFR Section 15.247(c), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

### 2.1.2. Antenna Information

Antenna Category: Internal Antenna

#### Antenna General Information:

No.	EUT	Ant. Type	Gain(dBi)
1	C66 UHF	Internal Antenna	4

### 2.1.3. Result: comply

The EUT has a permanent antenna. Please refer to the EUT internal photos.



### 2.2. Number of Hopping Frequency

### 2.2.1. Limit of Number of Hopping Frequency

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

### 2.2.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

### 2.2.3. Test Setup



### 2.2.4. Test Procedure

- 1. The testing follows ANSI C63.10-2013 Clause 7.8.3
- 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- 4. Enable the EUT hopping function.
- 5. Use the following spectrum analyzer settings: Span = the frequency band of operation;

Set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is

smaller. VBW  $\geq$  RBW, Trace = max hold Sweep=auto, Detector function=peak.

- 6. The number of hopping frequency used is defined as the number of total channel.
- 7. Record the measurement data derived from spectrum analyzer.



## 2.2.5. Test Results of Number of Hopping Frequency

Frequency (MHz)	Measured Channel Numbers	Min. Limit	Verdict
902 - 928	50	50	PASS

### 2.2.6. Test Results (plots) of Number of Hopping Frequency

	SENS		LIGN AUTO 10:22:43 AM Jan 29, 3	Frequency
PN IFG Ref Offset 10.5 dB	IO: Wide Trig: Free F Gain:Low Atten: 40 c	Run Avg Hold:> dB	100/100 TYPE MWW DET P N N Mkr2 927.27 M	HZ Auto Tune
10 dB/div Ref 40.50 dBm			30.005 dE	Bm
30.5 7 1 20.5 7 1 10.5 7 1 10.5 7 1				Center Freq 915.000000 MHz
0.500				Start Freq 900.000000 MHz
-29.5 -39.5				Stop Freq 930.000000 MHz
Center 915.00 MHz #Res BW 150 kHz	#VBW 510 kHz	St FUNCTION FUNC	Span 30.00 N weep 1.000 ms (1001 p tion width function value	1Hz ots) Auto Auto
1 N 1 f 902.76 2 N 1 f 927.27 3 4 5 6	6 MHz 30.367 dBr 7 MHz 30.005 dBr	m		Freq Offset □ Hz
7				Scale Type
MSG			STATUS	



### 2.3. Peak Output Power

### 2.3.1. Limit of Peak Output Power

Section 15.247 (B)(2) For frequency hopping systems operating in the 902~928MHz

band:1watt for systems employing at least 50 hopping channels.

### 2.3.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

### 2.3.3. Test Setup



### **2.3.4.** Test Procedures

- 1. The testing follows ANSI C63.10-2013 Clause 7.8.5
- 2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- 4. Measure the conducted output power with cable loss and record the results in the test report.
- 5. Measure and record the results in the test report.

### 2.3.5. Test Result of Output Power

Channel	Frequency (MHz)	Measured Output Peak Power (dBm)	Limit (dBm)	Verdict
1	902.75	28.23		PASS
26	915.25	28.72	30	PASS
50	927.25	28.85		PASS



### 2.4. Bandwidth

### 2.4.1. Definition

According to FCC \$15.247(a)(1), the 20dB bandwidth is known as the 99% emission bandwidth, or 20dB bandwidth ( $10*\log 1\% = 20$ dB) taking the total RF output power.

### 2.4.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

### 2.4.3. Test Setup



### 2.4.4. Test Procedure

- 1. The testing follows ANSI C63.10-2013 Clause 6.9.2
- The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- 4. Use the following spectrum analyzer settings for 20dB Bandwidth measurement.

Span = approximately 2 to 5 times the OBW, centered on a hopping channel;

 $RBW \ge 1\%$  to 5% of the OBW; VBW shall be approximately three times RBW; Sweep = auto; Detector function = peak; Trace = max hold.

5. Measure and record the results in the test report.



## 2.4.5. Test Results of 20dB Bandwidth

Channel	Frequency (MHz)	20dB Bandwidth (kHz)
1	902.75	50.58
26	915.25	49.90
50	927.25	49.91

### 2.4.6. Test Results (plots) of Bandwidth



#### 1 channel



### 26 channel



50 channel



### 2.5. Carried Frequency Separation

### 2.5.1. Limit of Carried Frequency Separation

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or 20dB bandwidth of the hopping channel, whichever is greater.

### 2.5.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

### 2.5.3. Test Setup



### 2.5.4. Test Procedure

1. The testing follows ANSI C63.10-2013 Clause 7.8.2.

2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.

3. Set to the maximum power setting and enable the EUT transmit continuously.

- 4. Enable the EUT hopping function.
- 5. Use the following spectrum analyzer settings:

Span = wide enough to capture the peaks of two adjacent channels; RBW: Start with the RBW set to approximately 30% of the channel spacing;

VBW $\geq$ RBW; Sweep = auto; Detector function = peak; Trace = max hold.

6. Measure and record the results in the test report.



Frequency Separation(kHz)(20dB BW) Limits (kHz)Verdict49750.58PASS50349.90PASS50049.91Formation of the temperature50049.9140.9150040.9140.9150040.9140.9150040.9140.9150040.9140.9150040.9140.9150040.9140.9150040.9140.9150040.9140.9150040.9140.9150040.9140.9150040.9140.	2.5.5. Test Results of Carrie	ed Frequency Separati	on
49750.5PASS50349.90PASS50049.91PASS	Frequency Separation(kHz	) (20dB BW) Limits (kHz)	Verdict
50349.90PASS50049.91PASS	497	50.58	PASS
50049.91PASS5.6. Test Results (plots) of Carried Frequency SeparationImage: Separation of Carried Frequency Separation <td< td=""><td>503</td><td>49.90</td><td>PASS</td></td<>	503	49.90	PASS
<section-header></section-header>	500	49.91	PASS
<complex-block></complex-block>	.5.6. Test Results (plots) of	f Carried Frequency S	eparation
<figure></figure>	Conter Fred 0 dBJdl/ R 0 dBJdl/ R 0 d5 dBJdl/ R 0 d5 dBJ 0 d5 dBJ 0 d5 dBJ 0 dBJdl/ R 0	Alagine: Lengt Al.         Stoc Linit         ALION AUTO           903.000.0000 MH2 FileDat.Lengt         Stoc Linit         Avg Type: Leg-Per Avg Type: Leg-Per	0:1-9:15 PMFeb 04,302       Firequency         10:1-9:15 PMFeb 04,302       Firequency         10:10:10:10:10:10:10:10:10:10:10:10:10:1
<figure></figure>		L channel	a[
	Center Freq 0 dBMW R 0.00 D	Velopier - Sing 50         Septem - Sing 50         Septem - Sing 50         Auto Apric           915,5000000 MHz         Fig: Free Run Processor         Avg Type: Log-Avr Avg Type: Log-Av	0:50:33 PWFeb 04,3021 Trade 72 3:53 3:55 27.005 dBm Center Freq 915.50000 MHz
<b>Production Production Production</b> <td>5 30 4 0 11 5 32 5 33 5 4 0 5 5 5 5 5 5 5 5 5 5 5 5 5</td> <td>000 MHz</td> <td>Start Freq 915.00000 MHz Stop Freq 916.00000 MHz CF Step</td>	5 30 4 0 11 5 32 5 33 5 4 0 5 5 5 5 5 5 5 5 5 5 5 5 5	000 MHz	Start Freq 915.00000 MHz Stop Freq 916.00000 MHz CF Step
Michannel         Series for the decision in the series of th		X RTZ	Auto Instruction Just Freq Offset 0 Hz Scale Type Log Lin
Registion       Registion <thregistion< th=""> <thregistion< th=""> <thregistion< th=""></thregistion<></thregistion<></thregistion<>		M channel	
350       35       35       35       35       35       35       35       35       35       35       37       35       37       35       37 <t< td=""><td></td><td>2000/00:0/mgt //         Strot:birl         stlob auto           927.0000000 MHz PrCaint.tow         Strot:birl         stlob auto           927.0000000 MHz PrCaint.tow         Trig: Free Run Avg1Hold:s100100         Avg Type: Log-Pwr Avg1Hold:s100100           rOmeet 10.5 dB r 40.50 dDm         Mit         Mit</td><td>10:5:1:9 Write 04, 3021 That 12:3:3:1:9 Write 04, 3021 That 12:3:3:1:9 Write 04, 3021 That 12:3:3:1:9 Write 04, 3021 That 12:3:1:9 Write 04, 3021 Center Freq 927,000000 MHz Start Freq</td></t<>		2000/00:0/mgt //         Strot:birl         stlob auto           927.0000000 MHz PrCaint.tow         Strot:birl         stlob auto           927.0000000 MHz PrCaint.tow         Trig: Free Run Avg1Hold:s100100         Avg Type: Log-Pwr Avg1Hold:s100100           rOmeet 10.5 dB r 40.50 dDm         Mit         Mit	10:5:1:9 Write 04, 3021 That 12:3:3:1:9 Write 04, 3021 That 12:3:3:1:9 Write 04, 3021 That 12:3:3:1:9 Write 04, 3021 That 12:3:1:9 Write 04, 3021 Center Freq 927,000000 MHz Start Freq
N       I	6.00 	000 MHz 14/2 #VBW 510 kHz Sweep XA 27 MHz T Data and	Span 1.000 MHz Span 1.000 MHz 1.000 ms (100 1 pts) Function visual Annual Annua
		V24 70 1 mitz. 27 0 1 diam 927249 MHz 276 923 diam	S Cale Type
H channel		H channel	



### 2.6. Dwell time

### 2.6.1. Limit of Dwell Time

the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period

### 2.6.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

### 2.6.3. Test Setup



### 2.6.4. Test Procedure

- 1. The testing follows ANSI C63.10-2013 Clause 7.8.4.
- 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.

The path loss was compensated to the results for each measurement.

- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- 4. Enable the EUT hopping function.

5. Use the following spectrum analyzer settings: Span = zero span, centered on a hopping

channel; RBW shall be  $\leq$  channel spacing and where possible RBW should be set >> 1 / T,

where T is the expected dwell time per channel;  $VBW \ge RBW$ ; Sweep = as necessary to capture

the entire dwell time per hopping channel; Detector function = peak; Trace = max hold.

6. Measure and record the results in the test report.



## 2.6.5. Test Results of Dwell Time

Frequency (MHz)	Length (ms)	Number	Dwell Time (ms)	Limit (ms)	Verdict
902.75	14.8	2	29.6		PASS
915.25	16	2	32	400	PASS
927.25	16	2	32		PASS

<u>Lin</u>

Lin



2.6.6.

#### **Test Results (plots) of Dwell Time** ALIGN AUTO Avg Type: Log-Pwr 02:44:04 PM Feb 04, 202 Frequency Center Freq 902.750000 MHz HZ PNO: Wide ↔→→ IFGain:Low Trig: Free Run Atten: 40 dB Auto Tun ΔMkr<sup>2</sup> 14.80 ms -0.04 dE Ref Offset 10.5 dB Ref 40.50 dBm Center Fred 902.750000 MHz Start Free 902.750000 MH **Stop Freq** 902.750000 MHz Center 902.750000 MHz Res BW 510 kHz Span 0 Hz Sweep 400.0 ms (1001 pts) CF Step 510.000 kHz Man #VBW 510 kHz uto N 1 t Δ1 1 t (Δ) 45.60 ms 14.80 ms (Δ) 26.26 dBm -0.04 dB Freq Offse 0 Hz Scale Type .og STATUS 06:28:02 PM TRACE TYF D ter Freq 902.750000 MHz PR0:Close → IFGainLow Trig: Free Run IFGainLow E N N N N Avg Type: Log-Pwr Freque Auto Tun Ref Offset 10.5 dB Ref 40.50 dBm Center Freq 902.750000 MHz Start Freq 902.750000 MHz Stop Freq 902.750000 MHz CF Step 10.000 kHz Man Auto Freq Offset 0 Hz Scale Type hat A ana h. والرباء are the burn be Span 0 Hz Sweep 20.00 s (1001 pts) Center 902.750000 MHz Res BW 10 kHz Log #VBW 30 kHz

L channel

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Keysight S	pectrum /	Analyzer - Swe	ept SA												_		
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🛄 Keysight Sp	pectrum Analyzer - Swept SA									-	
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10 dB/div	Ref 40.50 dBm										
30.5										91	Center Fred 5.250000 MH2
20.5										91	<b>Start Fred</b> 5.250000 MH:
0.500										91	Stop Fred 5.250000 MH:
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M channel

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🛄 Keysight Spe	ectrum Analyzer - :	Swept SA								- 0 ×
× Center F	RF 50	Ω DC 50000 MI	Hz	SENS	E:INT	ALIGN AUT	02:56:13 P	M Feb 04, 2021	F	requency
10 dB/div	Ref Offset Ref 40.50	10.5 dB ) dBm	PNO: Wide • IFGain:Low	Atten: 40	Run dB		Mkr1 3 26.	68.8 ms 89 dBm		Auto Tune
30.5 20.5								1 241	92	Center Fre 7.250000 MH
0.500 -9.50 -19.5									92	Start Fre 7.250000 MH
-29.5 -39.5 <mark>Milania</mark> -49.5	un that be not an a ship	-to have slipt of	waynadora	dire, estimited in sta	Latilande-Vite/Incel	igadalistra da siste	kapa <sup>la</sup> lkan demoklerisk		92	<b>Stop Fre</b> 7.250000 MH
Center 92 Res BW 5	27.250000 I 510 kHz	MHz	#VB	W 510 kHz	FUNCTION	Sweep	5 400.0 ms ( FUNCTIO	pan 0 Hz 1001 pts)	<u>Auto</u>	CF Stej 510.000 kH Ma
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🔤 Keysight Sp	pectrum Analyzer - Swept SA										×
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Log		1								92	<b>Center Freq</b> 7.250000 MHz
20.5										92	Start Freq 7.250000 MHz
0.500 -9.50										92	Stop Fred 7.250000 MHz
-19.5										<u>Auto</u>	CF Step 10.000 kHz Mar
-39.5											Freq Offse 0 Ha
-49.5 рКлучн	นะไกร่าวสารให้การเห็กรรมการสูงสารารได้สา	human	onlyntus	harpon-ballon	Mer-Have	rehram	Undanstein	www.www.	Marganiand		Scale Type
Center 9 Res BW	27.250000 MHz 10 kHz	#VBW	30 kHz				Sweep	S 20.00 s (	pan 0 Hz 1001 pts)	Log	Lin

H channel



### 2.7. Conducted Spurious Emissions

### 2.7.1. Limit of Spurious Emission

In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

### 2.7.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

### 2.7.3. Test Setup



### 2.7.4. Test Procedure

- 1. The testing follows ANSI C63.10-2013 Clause 7.8.8.
- The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- 4. Set RBW = 100 kHz, VBW = 300 kHz, scan up through 10th harmonic. All harmonics / spurs must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW.
- 5. Measure and record the results in the test report.
- 6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.



#### ALIGN AUTO Avg Type: Log-Pwr Avg|Hold:>100/100 Trig: Free Run Atten: 40 dB Auto T Ref Offset 10.5 dB Ref 40.50 dBm Center Fr 515.000000 M Start Fr rt 0.0300 GHz s BW 100 kHz Stop 1.0000 G eep 3.200 ms (1001 p CFS #VBW 300 kHz 903.00 MHz 612.00 MHz 26.205 dBr -42.198 dBr Freq Off Scale Typ t Freq 1.000000000 GHz ALIGN AUTO Avg Type: Log-Pwr Avg|Hold:>100/100 Trig: Free Ru Auto Tu Ref Offset 10.5 dB Ref 40.50 dBm 79 32 24.246 Center Fr Start Fre Stop F CF S Freq Offs

# L channel

#VBW 3.0 MHz

Scale Typ

Stop 10.000 GHz Sweep 16.00 ms (40001 pts)

Start F	req	RF 50 30.0000	Ω DC 00 MHz	PNO: Fa		SEN	SE:INT	Avg Avgit	ALIGN AUT Type: Log-Pw fold:>100/100	03:36 r	TRACE	2021	F	requency
10 dB/di	iv	Ref Offset Ref 40.50	10.5 dB 0 dBm	IFGain:Lo	ow <sup>™</sup> A	tten: 40	dB			<b>Mkr2 7</b> -4	22.58 M 1.984 dl	Hz 3m		Auto Tune
20.5 10.6												- ater	51	Center Freq 5.000000 MHz
0.500 -9.50 -19.5													3	Start Freq 0.000000 MHz
-29.5 -39.5 -49.5	Le region	and according to the set	64,	4mm and 1	ang magalan sa		ng kasanah pan	<del>.</del>	2 	m (finition m		~~	1.00	Stop Freq 0000000 GHz
Start 0. #Res B	.030 W 1	0 GHz 00 kHz	X	#	VBW 30	0 kHz	FUNCTI	DN FI	Sweep	Stop 3.200 r	0 1.0000 C ns (1001   ICTION VALUE	iHz ots)	9 <u>Auto</u>	CF Step 7.000000 MHz Man
2 N 3			722.5	8 MHz	-41.98	34 dBm								Freq Offset 0 Hz
													Log	Scale Type Lin
K L									STA	TUS		•		

## 2.7.5. Test Results of Conducted Spurious Emissions

000 GHz N 1.0 MH



M channel

Keysight Spi	ectrum Analyzer - Swept SA								0 2
Start Fre	q 30.000000 MI	Hz	SENSE:	A A	ALIGN AUT	0 03:38:58 PM	Feb 04, 2021	Frequer	ncy
10 dB/div	Ref Offset 10.5 dE Ref 40.50 dBm	PNO: Fast IFGain:Low	Atten: 40 dB		ginola:- ivo ivo	Mkr2 830. -40.64	25 MHz 10 dBm	Auto	Tune
20.5							030 LEM	Cente 515.0000	e <b>r Freq</b> 00 MHz
0.500 -9.50 -19.5								Star 30.0000	r <b>t Freq</b> 00 MHz
-29.6 -39.5 -49.6	territud National Campber and	~~~~	haberrow system of a		an a	2		Sto 1.0000000	p Freq 00 GHz
Start 0.03 #Res BW	800 GHz 100 kHz SCL X	#VBW	300 kHz	FUNCTION	Sweep FUNCTION WIDTH	Stop 1.0 3.200 ms (1 FUNCTION	000 GHz 1001 pts) VALUE	Ci 97.0000 <u>Auto</u>	F Step 00 MH2 Man
	f 8.	27.25 MHz 2 30.25 MHz 4	0.640 dBm					Freq	Offsel 0 Hz
7								Scal	е Туре
i <b>H</b>								Log	Lin
MSG					STA	TUS			

_ К	eysight Spe	ctrum Analyzer - Se	wept SA								
N Cta	rt Ero	RF 50 0			SEI	VSE:INT	Avg Type	LOG-Pwr	03:40:26 PM TRAC	Feb 04, 2021	Frequency
Jla	ILFIG	1.000000	JUUU GHZ	NO: Fast 😱	Trig: Free	Run	Avg Hold:	40/100	TYP		
	_		6	Gain:Low	Atten: 40	dB		NAL	1 2 776 0	FO CILLS	Auto Tune
10.1	Diale.	Ref Offset 10	0.5 dB					IVIKI	-25.4	SU GHZ	
Log	Biaiv	Rel 40.50	авт			-					
											Center Freq
30.5	; —										5.50000000 GHz
20.5											Start Freg
10.6											1.000000000 GHz
1000										6.98 dBm	
0.500											Oton From
											10 00000000 GHz
-9.50											10.000000000000
											OF Oton
-19.5				1							900.000000 MHz
				Ma In					والمراجعة المع	an ala	<u>Auto</u> Man
-29.5	a. 114 84	And a state of the other	a provide the start				a staffingen in sta		dia mandri anna di		
- 20 5	a a la balan	and the state of the second	anal and a second			1.00	and a state				Freq Offset
-39.5											0 Hz
-49.5											
											Scale Type
											Log Lin
Sta #De	rt 1.00	0 GHZ 1 0 MHz		#VBM	3.0 MHz		6	ween 1	Stop 10.	000 GHz	
	S BW	nv mnz		#VDW	0.011112		3	neep 1	oloo-ilis (4	ooon pisy	
MbQ								STATU	10		

H channel



### 2.8. Conducted Band Edge

### 2.8.1. Limit of Band Edges

In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

### 2.8.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

### 2.8.3. Test Setup



### 2.8.1. Test Procedure

- 1. The testing follows ANSI C63.10-2013 Clause 7.8.6.
- 2. Set to the maximum power setting and enable the EUT transmit continuously.
- 3. Set RBW = 100kHz (≥1% span=5MHz ), VBW = 300kHz (≥RBW). Band edge emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100kHz RBW. The attenuation shall be 30 dB instead of 20 dB when RMS conducted output power procedure is used.
- 4. Enable hopping function of the EUT and then repeat step 2. and 3.
- 5. Measure and record the results in the test report.



### 2.8.2. Test Results of Conducted Band Edge



L channel

🔤 Key	sight Sp	ectrum	Analyzer - Sv	wept SA									
Cent	ter F	R req	50 s 900.87	2 DC 5000 M	Hz	SEN	ISE:INT	Avg Type	ALIGN AUTO	02:14:20 P	M Feb 04, 2021 DE <b>1 2 3 4 5 6</b>	F	requency
10 dE	3/div	Re	of Offset 1 ef 40.50	0.5 dB dBm	PNO: Wide IFGain:Low	Atten: 40	}Run ∤dB	Avginoia:	:>100/100	(r1 903.2 26.3	50 MHz 73 dBm		Auto Tune
Log 30.5 20.5 10.5											ELST dem	90	Center Freq 0.875000 MHz
0.500 -9.50 -19.5									<u>3_2</u>		$\bigvee$	89	Start Freq 8.375000 MHz
-29.5 -39.5 -49.5	an Malandon		manhan	an san san san san san san san san san s	Arnsmulm	mannanananan	alaan an	n her mand	winika	A A A A A A A A A A A A A A A A A A A		90	Stop Freq 3.375000 MHz
Cent #Res	ter 90 s BW	00.87 100 SCL	75 MHz I kHz	X 002.24	#V	/BW 300 kHz	FUNCTIC	DN FUNCTI	Sweep 1	Span 5 2.533 ms ( FUNCTION	.000 MHz 1001 pts) VALUE	Auto	CF Step 500.000 kHz Man
2 N 3 N 4 5 3		f		903.23 902.14 901.99	0 MH2 0 MH2 5 MH2	-32.140 dBm -32.357 dBm							Freq Offset 0 Hz
7 3 9 0												Log	Scale Type
1											•		
MSG									STATU	US			

L channel Hopping Mode

#### Report No.: SET2021-01932



### H channel



H channel Hopping Mode

![](_page_27_Picture_0.jpeg)

### **2.9.** Conducted Emission

### 2.9.1. Limit of Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, 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.

Eraquanay ranga (MHz)	Conducted Limit (dB µV)					
Frequency range (MHZ)	Quai-peak	Average				
0.15 - 0.50	66 to 56	56 to 46				
0.50 - 5	56	46				
0.50 - 30	60	50				

### 2.9.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

### 2.9.3. Test Setup

![](_page_27_Figure_9.jpeg)

![](_page_28_Picture_1.jpeg)

### 2.9.4. Test Procedures

- 1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
- 2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
- 3. All the support units are connecting to the other LISN.
- 4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
- 5. The FCC states that a 50 ohm, 50 micrometry LISN should be used.
- 6. Both sides of AC line were checked for maximum conducted interference.
- 7. The frequency range from 150 kHz to 30 MHz was searched.
- 8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

![](_page_29_Figure_1.jpeg)

(Plot A: L Phase)

Frequency	QuasiPeak	CAverage	Cabel Loss	Corr.	Margin -	Limit -	Margin -	Limit - AV
(MHz)	(dB µ V)	(dB µ V)	(dB)	(dB)	QPK	QPK	AV	(dB µ V)
0.546000	43.32	36.13	0.1	10.1	12.68	56.0	9.87	46.0
1.162500	43.00	34.46	0.1	10.1	13.00	56.0	11.54	46.0
2.256000	43.31	31.04	0.6	10.6	12.69	56.0	14.96	46.0
3.759000	41.77	27.92	0.6	10.6	14.23	56.0	18.08	46.0
4.780500	43.61	28.15	0.6	10.6	12.39	56.0	17.85	46.0
7.233000	45.36	27.63	0.7	10.7	14.64	60.0	22.37	50.0

![](_page_30_Figure_1.jpeg)

#### (Plot B: N Phase)

Frequency	QuasiPeak	CAverage	Cabel Loss	Corr.	Margin -	Limit -	Margin -	Limit - AV
(MHz)	(dB µ V)	(dB µ V)	(dB)	(dB)	QPK	QPK	AV	(dB µ V)
0.613500	38.73	32.37	0.1	10.1	17.27	56.0	13.63	46.0
1.086000	39.92	32.44	0.1	10.1	16.08	56.0	13.56	46.0
1.221000	39.91	31.32	0.6	10.6	16.09	56.0	14.68	46.0
2.233500	40.26	29.26	0.6	10.6	15.74	56.0	16.74	46.0
3.462000	39.56	29.59	0.6	10.6	16.44	56.0	16.41	46.0
4.555500	39.63	27.34	0.7	10.7	16.37	56.0	18.66	46.0

#### Test Result: PASS

Note: Correction factor=Cabel loss+ attenuation factor attenuation factor=10dB

![](_page_31_Picture_1.jpeg)

### 2.10. Radiated Band Edges and Spurious Emission

### 2.10.1. Limit of Radiated Band Edges and Spurious Emission

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. In addition, radiated emissions which fall in the restricted bands must also comply with the FCC section 15.209 limits as below.

Frequency (MHz)	Field Strength (µV/m)	Measurement Distance (m)
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

#### 2.10.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

### 2.10.3. Test Setup

1) For radiated emissions from 9kHz to 30MHz

![](_page_31_Figure_10.jpeg)

![](_page_32_Picture_0.jpeg)

2) For radiated emissions from 30MHz to1GHz

![](_page_32_Figure_3.jpeg)

3) For radiated emissions above 1GHz

![](_page_32_Figure_5.jpeg)

![](_page_33_Picture_1.jpeg)

### 2.10.4. Test Procedure

- 1. The EUT was placed on a turntable with 0.8m below 1GHz 1.5m above 1GHz above the ground.
- 2. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
- 3. For each suspected emission, the EUT was arranged to its worst case and then tune the

Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.

- 4. Set to the maximum power setting and enable the EUT transmit continuously.
- 5. Use the following spectrum analyzer settings:
- (1) Span shall wide enough to fully capture the emission being measured;
- (2) Set RBW=100 kHz for f < 1 GHz, RBW=1MHz for f>1GHz ; VBW $\geq$ RBW; Sweep = auto; Detector function = peak; Trace = max hold for peak
- (3) For average measurement: use duty cycle correction factor method per 15.35(c).

Duty cycle = On time/100 milliseconds

On time =  $N_1 * L_1 + N_2 * L_2 + ... + N_{n-1} * LN_{n-1} + Nn * Ln$ 

Where  $N_1$  is number of type 1 pulses, L1 is length of type 1 pulses, etc.

Average Emission Level = Peak Emission Level + 20\*log(Duty cycle)

- 6. Corrected Reading: Antenna Factor + Cable Loss + Read Level Preamp Factor = Level
- 7. Device under transmit mode and filter the fundamental .

![](_page_34_Picture_0.jpeg)

### 2.10.5. Test Results of Radiated Band Edge and Spurious Emission

### For 9 KHz to 30MHz

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

### For 30MHz to 1000MHz

![](_page_34_Figure_6.jpeg)

#### Plot A: 30MHz to 1GHz, Antenna Horizontal

Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Corr. Factor (dB/m)	Antenna height (cm)	Limit (dBµV/m)	Margin	Antenna	Verdict
191.0200	27.98	120.000	10.3	100.0	43.5	15.52	Horizontal	Pass
251.1600	31.13	120.000	11.6	100.0	46.0	14.87	Horizontal	Pass
264.7400	37.01	120.000	11.9	100.0	46.0	8.99	Horizontal	Pass
299.6600	41.22	120.000	13.1	100.0	46.0	4.78	Horizontal	Pass
311.3000	41.43	120.000	13.1	100.0	46.0	4.57	Horizontal	Pass
396.6600	33.22	120.000	17.5	100.0	46.0	12.78	Horizontal	Pass

![](_page_35_Figure_1.jpeg)

#### Plot B: 30MHz to 1GHz, Antenna Vertical

Frequency (MHz)	QuasiPeak (dB µ V/m)	Bandwidth (kHz)	Corr. Factor (dBµV/m)	Antenna height (cm)	Limit (dB µ V/m)	Margin	Antenna	Verdict
264.740000	28.66	120.000	11.9	100.0	46.0	17.34	Vertical	Pass
359.800000	32.83	120.000	15.8	100.0	46.0	13.17	Vertical	Pass
371.440000	36.16	120.000	15.8	100.0	46.0	9.84	Vertical	Pass
419.940000	39.88	120.000	17.5	100.0	46.0	6.12	Vertical	Pass
431.580000	42.49	120.000	18.5	100.0	46.0	3.51	Vertical	Pass
870.020000	39.59	120.000	23.9	100.0	46.0	6.41	Vertical	Pass

#### (30MHz to 1GHz, Antenna Vertical)

### Above 1GHz Data:

Susp	ected Lis	st							
NO	Freq. [MHz]	Level [dBµV/m ]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Height [cm]	Angle [°]	Polarity
1	902.00	39.99	26.54	54.00	14.01	AV	150	78	Horizontal
2	902.00	47.66	26.54	74.00	26.34	PK	150	102	Horizontal
3	1805.9	34.63	-11.15	74.00	39.37	PK	100	30	Horizontal
4	1809.3	27.28	-11.11	54.00	26.72	AV	100	20	Horizontal
5	2710.5	31.16	-6.30	54.00	22.84	AV	100	20	Horizontal
6	2710.5	38.78	-6.30	74.00	35.22	PK	100	20	Horizontal
7	3611.7	42.99	-1.82	74.00	31.01	PK	100	30	Horizontal
8	3611.7	35.21	-1.82	54.00	18.79	AV	100	20	Horizontal

Susp	Suspected List											
NO	Freq. [MHz]	Level [dBµV/m ]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Height [cm]	Angle [°]	Polarity			
1	902.00	40.00	26.54	54.00	14.00	AV	150	49	Vertical			
2	902.00	48.31	26.54	74.00	25.69	PK	150	156	Vertical			
3	1805.9	27.17	-11.15	54.00	26.83	AV	100	120	Vertical			
4	1809.3	36.09	-11.11	74.00	37.91	PK	100	130	Vertical			
5	2710.5	40.60	-6.30	74.00	33.40	PK	100	100	Vertical			
6	2710.5	32.88	-6.30	54.00	21.12	AV	100	120	Vertical			
7	3611.7	35.68	-1.82	54.00	18.32	AV	100	70	Vertical			
8	3611.7	43.70	-1.82	74.00	30.30	PK	100	150	Vertical			

## CH26 915.25MHz

Susp	Suspected List										
NO	Freq. [MHz]	Level [dBµV/m ]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Height [cm]	Angle [°]	Polarity		
1	1833.1	36.02	-10.83	74.00	37.98	PK	100	10	Horizontal		
2	1833.1	28.01	-10.83	54.00	25.99	AV	100	10	Horizontal		
3	2747.9	32.08	-6.12	54.00	21.92	AV	100	20	Horizontal		
4	2751.3	38.41	-6.11	74.00	35.59	PK	100	20	Horizontal		
5	3662.7	42.63	-1.51	74.00	31.37	PK	100	40	Horizontal		
6	3662.7	35.73	-1.51	54.00	18.27	AV	100	30	Horizontal		
Susp	ected Lis	st									
NO	Freq. [MHz]	Level [dBµV/m ]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Height [cm]	Angle [°]	Polarity		
1	1833.1	34.26	-10.83	74.00	39.74	PK	100	20	Vertical		
2	1833.1	28.09	-10.83	54.00	25.91	AV	100	10	Vertical		
3	2747.9	31.21	-6.12	54.00	22.79	AV	100	20	Vertical		
4	2751.3	39.23	-6.11	74.00	34.77	PK	100	20	Vertical		
5	3662.7	43.82	-1.51	74.00	30.18	PK	100	30	Vertical		
6	3662.7	36.13	-1.51	54.00	17.87	AV	100	30	Vertical		

### CH50 927.25MHz

Susp	Suspected List											
NO	Freq. [MHz]	Level [dBµV/m ]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Height [cm]	Angle [°]	Polarity			
1	928.00	47.98	26.88	74.00	26.02	PK	150	357	Horizontal			
2	928.00	40.15	26.88	54.00	13.85	AV	150	357	Horizontal			
3	1856.9	33.59	-10.55	74.00	40.41	PK	100	20	Horizontal			
4	1860.3	27.47	-10.51	54.00	26.53	AV	100	40	Horizontal			
5	2781.9	31.82	-5.96	54.00	22.18	AV	100	30	Horizontal			
6	2785.3	38.93	-5.95	74.00	35.07	PK	100	40	Horizontal			
7	3710.3	43.16	-1.26	74.00	30.84	PK	100	30	Horizontal			
8	3713.7	35.46	-1.25	54.00	18.54	AV	100	30	Horizontal			
Susp	ected Lis	st										
NO	Freq. [MHz]	Level [dBµV/m ]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Height [cm]	Angle [°]	Polarity			
1	928.00	48.04	26.88	74.00	25.96	PK	150	225	Vertical			
2	928.00	40.43	26.88	54.00	13.57	AV	150	337	Vertical			
3	1856.9	34.28	-10.55	74.00	39.72	PK	100	30	Vertical			
4	1860.3	27.26	-10.51	54.00	26.74	AV	100	20	Vertical			
5	2781.9	30.93	-5.96	54.00	23.07	AV	100	20	Vertical			
6	2785.3	38.01	-5.95	74.00	35.99	PK	100	30	Vertical			
7	3710.3	44.50	-1.26	74.00	29.50	PK	100	20	Vertical			
8	3713.7	36.69	-1.25	54.00	17.31	AV	100	10	Vertical			

### **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) - Pre-Amplifier Factor(dB)

- 3. The other emission levels were very low against the limit.
- 4. Margin value = Emission Level Limit value

![](_page_39_Picture_1.jpeg)

## 3. List of measuring equipment

Item	Test Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	EMI TEST RECEIVER	R&S	ESU8	A0805559	2020.04.03	2021.04.02
2	Power Meter	R&S	NRP-Z31	102872	2020.05.18	2021.05.17
3	TURNTABLE	ETS	2088	2149	N/A	N/A
4	ANTENNA MAST	ETS	2075	2346	N/A	N/A
5	EMI TEST Software	R&S	ESK1	N/A	N/A	N/A
6	Horn antenna (18GHz~26.5GHz)	AR	AT4003A	325306	2020.09.16	2022.09.15
7	Amplifier 30M~1GHz	MILMEGA	80RF1000-10004	A140101634	2020.03.24	2021.03.23
8	Amplifier 1G~18GHz	MILMEGA	AS0104R-800/40 0	A160302517	2020.03.24	2021.03.23
9	High pass filter	Compliance Direction systems	BSU-6	34202	2020.11.10	2021.11.09
10	Horn Antenna	R&S	HF906	A0304225	2019.04.17	2022.04.16
11	Horn Antenna	R&S	ESIB7	A0501375	2020.06.24	2021.06.23
12	ULTRA-BROADBA ND ANTENNA	SCHWARZBECK	VULB9160	A0805560	2019.05.24	2022.05.23
13	Passive Loop Antenna	R&S	HFH2-Z2	100047	2019.04.26	2022.04.25
14	Temperature chamber	XSM	DNF810C	A0501375	2020.05.26	2021.05.25
15	Spectrum Analyzer	KEYSIGHT	N9030A	A160702554	2020.05.18	2021.05.17
16	Power Supply	R&S	ESIB26	A0304218	2020.04.29	2021.04.28
17	LISN	ROHDE&SCHWA RZ	ESH2-Z5	A0304221	2020.04.03	2021.04.02

### \*\* END OF REPORT \*\*