

# **TEST REPORT**

## Test report On Behalf of Qixiang Electron Science & Technology Co., Ltd. For Digital DMR and Analog UHF/VHF Two Way Radio Model No.: AT-D878UV, AT-D878UV PLUS, AT-D878UVII, AT-D878UVIII, AT-D9

### FCC ID: T4KD878UV

Prepared for :	Qixiang Electron Science & Technology Co., Ltd. Qixiang Building,Tangxi Industrial Zone,Luojiang District,Quanzhou,Fujian, China
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Date of Test:	Aug. 10, 2018~Sep. 18, 2018
Date of Report:	Oct. 31, 2018
Report Number:	HK1809111046E



# **TEST RESULT CERTIFICATION**

Applicant's name:	Qixiang Electron Science & Technology Co., Ltd.
Address:	Qixiang Building,Tangxi Industrial Zone,Luojiang District,Quanzhou,Fujian, China
Manufacture's Name:	Qixiang Electron Science & Technology Co., Ltd.
Address:	Qixiang Building,Tangxi Industrial Zone,Luojiang District,Quanzhou,Fujian, China
Product description	Digital DMR and Analog UHF/VHF Two Way Radio
Brand Name	AnyTone
Mode Name	AT-D878UV
Serial Name	AT-D878UV PLUS, AT-D878UVII, AT-D878UVIII, AT-D9
Difference Description	Only the model is different, the circuit, appearance and function are exactly the same
Product description	AnyTone
Standards	47 CFR FCC Part 15 Subpart C 15.247

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Date of Test	
Date (s) of performance of tests	Aug. 10, 2018~Sep. 18, 2018
Date of Issue	Oct. 31, 2018
Test Result	Pass

2

2

**Testing Engineer** 

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Revision	Issue Date	Revisions	Revised By
V1.0	Sep. 19, 2018	Initial Issue	Jason Zhou
V1.1	Oct. 09, 2018	Revise Report	Jason Zhou
V1.2	Oct. 31, 2018	Updated comments	Jason Zhou

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# **1.SUMMARY**

# **1.1. TEST STANDARDS**

The tests were performed according to following standards:

FCC Rules Part 15.247: Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

ANSI C63.10:2013 : American National Standard for Testing Unlicensed Wireless Devices

# **1.2. Test Description**

FCC PART 15.247			
FCC Part 15.207	AC Power Conducted Emission	PASS	
FCC Part 15.247(a)(1)(i)	20dB Bandwidth	PASS	
FCC Part 15.247(d)	Spurious RF Conducted Emission	PASS	
FCC Part 15.247(b)	Maximum Peak Output Power	PASS	
FCC Part 15.247(b)	Pseudorandom Frequency Hopping Sequence	PASS	
FCC Part 15.247(a)(1)(iii)	Number of hopping frequency& Time of Occupancy	PASS	
FCC Part 15.247(a)(1)	Frequency Separation	PASS	
FCC Part 15.205/15.209	Radiated Emissions	PASS	
FCC Part 15.247(d)	Band Edge Compliance of RF Emission	PASS	

NOTE: N/A stands for not applicable. The device is only used in the car, so the conducted emission is not applicable.



# 1.3. Test Facility

### 1.3.1 Address of the test laboratory

Shenzhen HUAK Testing Technology Co., Ltd. Add.:1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park,Heping Community, Fuhai Street, Bao'an District, Shenzhen, China

There is one 3m semi-anechoic chamber and two line conducted labs for final test. The Test Sites meet the requirements in documents ANSI C63.4 and CISPR 32/EN 55032 requirements.

### 1.3.2 Laboratory accreditation

The test facility is recognized, certified, or accredited by the following organizations:

### IC Registration No.: 21210

The 3m alternate test site of Shenzhen HUAK Testing Technology Co., Ltd. EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration No.: 21210 on May 24, 2016.

### FCC Registration No.: CN1229

Test Firm Registration Number : 616276

### 1.4. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 "Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements" and is documented in the Shenzhen HUAK Testing Technology Co., Ltd. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for HUAK laboratory is reported:

Test	Measurement Uncertainty	Notes
Transmitter power conducted	±0.57 dB	(1)
Transmitter power Radiated	±2.20 dB	(1)
Conducted spurious emission 9KHz-40 GHz	±2.20 dB	(1)
Occupied Bandwidth	±0.01ppm	(1)
Radiated Emission 30~1000MHz	±4.10dB	(1)
Radiated Emission Above 1GHz	±4.32dB	(1)
Conducted Disturbance0.15~30MHz	±3.20dB	(1)

(1) 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. Environmental conditions

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

Normal Temperature:	25°C
Relative Humidity:	55 %
Air Pressure:	101 kPa

# 2.2. General Description of EUT

Product Name:	Digital DMR and Analog UHF/VHF Two Way Radio
Model/Type reference:	AT-D878UV
Power supply:	DC 7.4V By Battery
Version:	Supported BT4.2
Modulation:	GFSK, π/4DQPSK, 8DPSK
Operation frequency:	2402MHz~2480MHz
Channel number:	79
Channel separation:	1MHz
Antenna type:	PIFA Antenna
Antenna gain:	-0.68dBi
Hardware Version:	D868UV2
Software Version:	V1.0

Note: For more details, refer to the user's manual of the EUT.

# 2.3. Description of Test Modes and Test Frequency

The Applicant provides communication tools software to control the EUT for staying in continuous transmitting and receiving mode for testing.

There are 79 channels provided to the EUT and Channel 00/39/78 was selected for testing.

### **Operation Frequency :**

Channel	Frequency (MHz)
00	2402
01	2403
:	:
38	2440
39	2441
40	2442
:	:
77	2479
78	2480

Note: The line display in grey were the channel selected for testing



NO.	TEST MODE DESCRIPTION
1	Low channel GFSK
2	Middle channel GFSK
3	High channel GFSK
4	Low channel π /4-DQPSK
5	Middle channel π /4-DQPSK
6	High channel π /4-DQPSK
7	Low channel 8DPSK
8	Middle channel 8DPSK
9	High channel 8DPSK
10	Normal Hopping

Note:

1. Only the result of the worst case was recorded in the report, if no other cases.

2. For Radiated Emission, 3axis were chosen for testing for each applicable mode.



# 2.4. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

# 2.5. Modifications

No modifications were implemented to meet testing criteria.

# 2.6. Receiver Input Bandwidth

The input bandwidth of the receiver is 1.3MHZ, In every connection one Bluetooth device is the master and the other one is slave. The master determines the hopping sequence. The slave follows this sequence. Both devices shift between RX and TX time slot according to the clock of the master. Additionally the type of connection(e.g. single of multislot packet) is set up at the beginning of the connection. The master adapts its hopping frequency and its TX/RX timing according to the packet type of the connection. Also the slave of the connection will use these settings.

Repeating of a packet has no influence on the hopping sequence. The hopping sequence generated by the master of the connection will be followed in any case. That means, a repeated packet will not be send on the same frequency, it is send on the next frequency of the hopping sequence.

# 2.7. Example of a Hopping Sequence in Data Mode

Example of a 79 hopping sequence in data mode: 40,21,44,23,42,53,46,55,48,33,52,35,50,65,54,67 56,37,60,39,58,69,62,71,64,25,68,27,66,57,70,59 72,29,76,31,74,61,78,63,01,41,05,43,03,73,07,75 09,45,13,47,11,77,15,00,64,49,66,53,68,02,70,06 01, 51, 03, 55, 05, 04

# 2.8. Equally Average Use of Frequencies and Behaviour

The generation of the hopping sequence in connection mode depends essentially on two input values:

1. LAP/UAP of the master of the connection.

2. Internal master clock

The LAP(lower address part) are the 24 LSB's of the 48 BD\_ADDRESS. The BD\_ADDRESS is an unambiguous number of every Bluetooth unit. The UAP(upper address part) are the 24MSB's of the 48BD\_ADDRESS

The internal clock of a Bluetooth unit is derived from a free running clock which is never adjusted and is never turned off. For ehavior zation with other units only offset are used. It has no relation to the time of the day. Its resolution is at least half the RX/TX slot length of 312.5us. The clock has a cycle of about one day(23h30). In most case it is implemented as 28 bit counter. For the deriving of the hopping sequence the entire. LAP(24 bits),4LSB's(4bits)(Input 1) and the 27MSB's of the clock(Input 2) are used. With this input values different mathematical procedures(permutations, additions, XOR-operations) are performed to generate te Sequence. This will be done at the beginning of every new transmission.

Regarding short transmissions the Bluetooth system has the following ehavior:

The first connection between the two devices is established, a hopping sequence was generated. For Transmitting the wanted data the complete hopping sequence was not used. The connection ended. The second connection will be established. A new hopping sequence is generated. Due to the fact the



Bluetooth clock has a different value, because the period between the two transmission is longer(and it Cannot be shorter) than the minimum resolution of the clock(312.5us). The hopping sequence will always Differ from the first one.

# 2.9. Equipment Used

Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
L.I.S.N. Artificial Mains Network	R&S	ENV216	HKE-002	Dec. 29, 2017	Dec. 28, 2018
Receiver	R&S	ESCI 7	HKE-010	Dec. 29, 2017	Dec. 28, 2018
RF automatic control unit	Tonscend	JS0806-2	HKE-060	Dec. 29, 2017	Dec. 28, 2018
Spectrum analyzer	R&S	FSP40	HKE-025	Dec. 29, 2017	Dec. 28, 2018
Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 29, 2017	Dec. 28, 2018
Preamplifier	Schwarzbeck	BBV 9743	HKE-006	Dec. 29, 2017	Dec. 28, 2018
EMI Test	Rohde & Schwarz	ESCI 7	HKE-010	Dec. 29, 2017	Dec. 28, 2018
Bilog Broadband Antenna	Schwarzbeck	VULB9163	HKE-012	Dec. 29, 2017	Dec. 28, 2018
Loop Antenna	Schwarzbeck	FMZB 1519 B	HKE-014	Dec. 29, 2017	Dec. 28, 2018
Horn Antenna	Schewarzbeck	9120D	HKE-013	Dec. 29, 2017	Dec. 28, 2018
Pre-amplifier	EMCI	EMC051845SE	HKE-015	Dec. 29, 2017	Dec. 28, 2018
Pre-amplifier	Agilent	83051A	HKE-016	Dec. 29, 2017	Dec. 28, 2018
EMI Test Software EZ-EMC	Tonscend	JS1120-B Version	HKE-083	Dec. 29, 2017	Dec. 28, 2018
Power Sensor	Agilent	E9300A	HKE-086	Dec. 29, 2017	Dec. 28, 2018
Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 29, 2017	Dec. 28, 2018
Signal generator	Agilent	N5182A	HKE-029	Dec. 29, 2017	Dec. 28, 2018
Signal Generator	Agilent	83630A	HKE-028	Dec. 29, 2017	Dec. 28, 2018
Shielded room	Shiel Hong	4*3*3	HKE-039	Dec. 29, 2017	Dec. 28, 2018
Horn Ant (18G-40GHz)	Schwarzbeck	BBHA 9170	HKE-094	Mar. 01, 2018	Feb. 28, 2020
Horn Ant (18G-40GHz)	ETS	QWH_SL_18_40 _K_SG	HKE-092	Mar. 01, 2018	Feb. 28, 2020





# 3. Peak Output Power

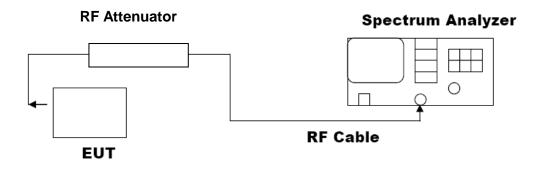
# 3.1. Measurement Procedure

For peak power test:

- 1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
- 2. Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.
- 3. RBW > 20 dB bandwidth of the emission being measured.
- 4. VBW  $\geq$ RBW.
- 5. Sweep: Auto.
- 6. Detector function: Peak.
- 7. Trace: Max hold.

Allow trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power, after any corrections for external attenuators and cables.

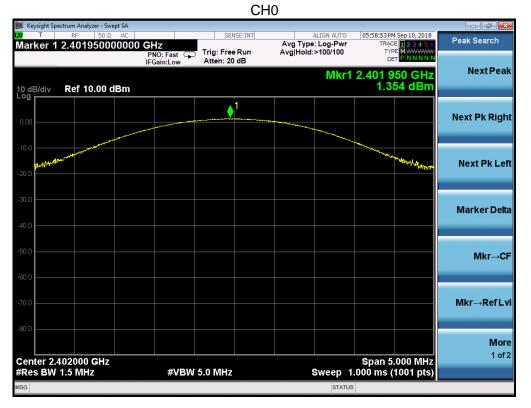
# 3.2. Test Set-Up (Block Diagram of Configuration)





# 3.3. Limits and Measurement Result

PEAK OUTPUT POWER MEASUREMENT RESULT FOR GFSK MOUDULATION						
Frequency (GHz)	Peak Power (dBm)	Applicable Limits (dBm)	Pass or Fail			
2.402	1.354	30	Pass			
2.441	0.554	30	Pass			
2.480	-0.230	30	Pass			





💓 Keysight Spectrum Analyzer - Swept SA



CH39

		1			ectrum Analyzer - Swept SA	Keysight Sp
Peak Search	05:59:03 PM Sep 10, 2018 TRACE 1 2 3 4 5 6	ALIGN AUTO Avg Type: Log-Pwr	SENSE:INT		RF 50 Ω AC 2.441000000000	T arker 1
	TYPE MWWWW DET PNNNN	Avg Hold:>100/100	Trig: Free Run Atten: 20 dB	PNO: Fast IFGain:Low		arner
NextPea	2.441 000 GHz 0.554 dBm	Mkr1				
	0.004 0.011				Ref 10.00 dBm	dB/div
Next Pk Rigi			<b>1</b>			
Next F K Rigi		N N N N N N N N N N N N N N N N N N N				).00
					1. Constraint and the second	0.0
Next Pk Le	and a standard and a standard and a standard				white war and a second second	
NOXT1 N EC	- And Market Market					0.0
Marker Del						0.0
						0.0
Mkr→C						0.0
						0.0
Mkr→RefL						0.0
						0.0
Moi						
1 of	Span 5.000 MHz				441000 GHz	
	.000 ms (1001 pts)		5.0 MHz	#VBW	1.5 MHz	
		STATUS				SG

🊺 Keysight Spectrum A						
<mark>₩</mark> T RF Marker 1 2.48	50 Ω AC 0025000000	GHz	SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr	05:59:14 PM Sep 10, 2018 TRACE 2 3 4 5 6	Peak Search
10 dB/div Ref	10.00 dBm	PNO: Fast IFGain:Low	) Trig: Free Run Atten: 20 dB	Avg Hold:>100/100	2.480 025 GHz -0.230 dBm	NextPeak
0.00			<b>↓</b> 1			Next Pk Right
-10.0	And the second				and the second sec	Next Pk Left
-30.0						Marker Delta
-50.0						Mkr→CF
-70.0						Mkr→RefLvl
-80.0 Center 2.48000 #Res BW 1.5 M		#\/B)//	5.0 MHz	Swoon 1	Span 5.000 MHz .000 ms (1001 pts)	More 1 of 2
#Res DW 1.5 W	1112	#VDV	5.0 10112	Sweep		



PEAK OUTPUT POWER MEASUREMENT RESULT FOR $II$ /4-DQPSK MODULATION						
Frequency (GHz)	Peak Power (dBm) Applicable Limits (dBm) Pass or Fail					
2.402	-1.297	30	Pass			
2.441	-2.178	30	Pass			
2.480	-3.009	30	Pass			

	CH	10	
🚺 Keysight Spectrum Analyzer - Swept SA			
122 T RF 50Ω AC Marker 1 2.401835000000	GHZ PNO: Fast Trig: Free Run IFGain:Low Atten: 20 dB	ALIGN AUTO         05:56:11 PM S           Avg Type: Log-Pwr         TRACE           Avg Hold:>100/100         TYPE           DET         DET	ep 10, 2018 1 2 3 4 5 6 M P NNNNN P NNNNN
10 dB/div Ref 10.00 dBm		Mkr1 2.401 83 -1.29	5 GHz NextPeak 7 dBm
	<b>1</b>		Next Pk Right
-10.0			Next Pk Left
-30.0			Marker Delta
-50.0			Mkr→CF
-70.0			Mkr→RefLvl
-80.0 Center 2.402000 GHz		Span 5.0	More 1 of 2
#Res BW 1.5 MHz	#VBW 5.0 MHz	Sweep 1.000 ms (1	001 pts)

~ '





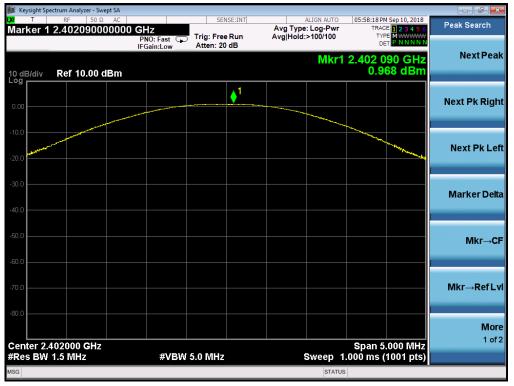
CH39

🚺 Keysight Spect	trum Analyzer - Swept SA					
Marker 1 2	RF 50 Ω AC 2.440780000000	PNO: Fast 😱	SENSE:INT Trig: Free Run Atten: 20 dB	ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>100/100	05:57:52 PM Sep 10, 2018 TRACE 1 2 3 4 5 6 TYPE MWWWW DET P N N N N N	Peak Search
10 dB/div	Ref 10.00 dBm	IFGain:Low	Atten: 20 dB	Mkr1	2.440 780 GHz -2.178 dBm	Next Peak
0.00			<b>1</b>			Next Pk Right
-10.0					and the second s	Next Pk Left
-30.0						Marker Delta
-50.0						Mkr→CF
-70.0						Mkr→RefLvl
Center 2.44		#VBW	5.0 MHz	Sween 1	Span 5.000 MHz .000 ms (1001 pts)	More 1 of 2
MSG				STATUS		

📕 Keysight Spectrum Analyzer - Swept SA 👘							
T RF 50 Ω AC Marker 1 2.479805000000	GHz PNO: Fast Trig:	SENSE:INT	Avg Type: Avg Hold:>	LIGN AUTO Log-Pwr •100/100	TRAC TYP	Sep 10, 2018 E 1 2 3 4 5 6 E M WWWW	Peak Search
10 dB/div Ref 10.00 dBm	IFGain:Low Atter	n: 20 dB	-	Mkr1		05 GHz 09 dBm	Next Peak
0.00		1					Next Pk Righ
20.0					- market		Next Pk Lef
40.0							Marker Delta
50.0 60.0							Mkr→C
70.0							Mkr→RefLv
80.0 Center 2.480000 GHz	4) (DW) 5 6 M				Span 5	000 MHz	<b>Mor</b> 1 of 2
#Res BW 1.5 MHz	#VBW 5.0 M	INZ	5	status	000 ms (	1001 pts)	



PEAK OUTPUT POWER MEASUREMENT RESULT FOR 8-DPSK MODULATION						
Frequency (GHz)	Peak Power (dBm)	Applicable Limits (dBm)	Pass or Fail			
2.402	0.968	30	Pass			
2.441	0.172	30	Pass			
2.480	-0.601	30	Pass			







Keysight Spectrum Analyzer - Swept SA 
 ALIGN AUTO
 05:58:29 PM Sep 10, 2018

 Avg Type: Log-Pwr
 TRACE
 23:45 c

 Avg[Hold:>100/100
 TYPE IMMUNIAN
 DET P.NINNIN
 Marker 1 2.440860000000 GHz PNO: Fast C IFGain:Low Atten: 20 dB Peak Search Mkr1 2.440 860 GHz 0.172 dBm **Next Peak** Ref 10.00 dBm 10 dB/div Log **♦**<sup>1</sup> Next Pk Right Next Pk Left Marker Delta Mkr→CF Mkr→RefLvl More 1 of 2 Center 2.441000 GHz #Res BW 1.5 MHz Span 5.000 MHz Sweep 1.000 ms (1001 pts) #VBW 5.0 MHz STATUS

### CH78

🎉 Keysight S	pectrum Analyzer - Swept SA					
<mark>⊯</mark> Marker 1	RF 50 Ω AC 1 2.479825000000	GHz	SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr	05:58:41 PM Sep 10, 2018 TRACE 1 2 3 4 5 6	Peak Search
10 dB/div	Ref 10.00 dBm	PNO: Fast IFGain:Low	Trig: Free Run Atten: 20 dB	Avg Hold:>100/100	2.479 825 GHz -0.601 dBm	Next Peak
0.00			<b>∮</b> <sup>1</sup>			Next Pk Right
-10.0					and the second s	Next Pk Left
-30.0						Marker Delta
-50.0						Mkr→CF
-70.0						Mkr→RefLv
-80.0 Center 2.	480000 GHz	4\/DW	5 0 MHz		Span 5.000 MHz	More 1 of 2
#Res BM	1.5 MHz	#vBw	5.0 MHz	Sweep 1 status	.000 ms (1001 pts)	

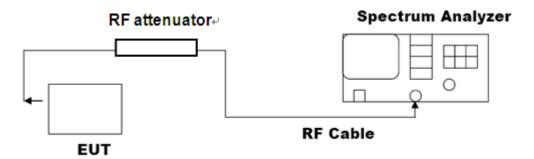


# 4. 20dB Bandwidth

# 4.1. Measurement Procedure

- 1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
- 2, Set the EUT Work on the top, the middle and the bottom operation frequency individually.
- 3. Set Span = approximately 2 to 5 times the 20 dB bandwidth, centered on a hoping channel The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW and video bandwidth (VBW) shall be approximately three times RBW; Sweep = auto; Detector function = peak
- 4. Set SPA Trace 1 Max hold, then View.

# 4.2. Test Set-Up (Block Diagram of Configuration)



# 4.3. Limits and Measurement Results

MEASUREMENT RESULT FOR GFSK MOUDULATION						
Annlinghla Limita	Measurement Result					
Applicable Limits	Test Da	Criteria				
	Low Channel	1.024	PASS			
N/A	Middle Channel	1.022	PASS			
	High Channel	1.018	PASS			

### TEST PLOT OF BANDWIDTH FOR LOW CHANNEL

Keysight Spectrum Analyzer - Occupied BW - 6 **X** SENSE:INT ALIGN AUTO Center Freq: 2.402000000 GHz Trig: Free Run Avg|Hold:>10/10 #Atten: 30 dB 06:03:02 PM Sep 10, 2018 Radio Std: None ΔC Attenuation Mech Atten 30 dB Mech Atten 30 dB Radio Device: BTS Ref 20.00 dBm 15 dB/div Log 5.00 Enable Elec Atten <u>Off</u> On Adjust Atten for Min Clip Center 2.402 GHz #Res BW 30 kHz Span 3 MHz Sweep 4.133 ms #VBW 100 kHz **Total Power** 4.71 dBm Occupied Bandwidth 913.16 kHz Mech Atten Step 10 dB <u>2 dB</u> -16.101 kHz **Transmit Freq Error OBW Power** 99.00 % x dB Bandwidth 1.024 MHz x dB -20.00 dB STATUS





### TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL

#### Keysight Spectrum Analyzer - Occupied BW SENSE:INT ALIGN AUTO Center Freq: 2.48000000 GHz Trig: Free Run Avg|Hold:>10/10 #Atten: 30 dB 06:19:23 PM Sep 10, 2018 Radio Std: None Frequency Center Freq 2.480000000 GHz #IFGain:Low Radio Device: BTS Ref 20.00 dBm 5 dB/div **Center Freq** 2.480000000 GHz Center 2.48 GHz #Res BW 30 kHz Span 3 MHz Sweep 4.133 ms CF Step 300.000 kHz #VBW 100 kHz <u>Auto</u> Man **Total Power** 2.98 dBm **Occupied Bandwidth** 908.97 kHz **Freq Offset** 0 Hz Transmit Freq Error -17.583 kHz **OBW** Power 99.00 % x dB Bandwidth 1.018 MHz x dB -20.00 dB STATUS

### TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL

MEASUREMENT RESULT FOR II /4-DQPSK MODULATION						
Angliashia Limita		Measurement Result				
Applicable Limits	Test Data (MHz)		Criteria			
	Low Channel	1.371	PASS			
N/A	Middle Channel	1.373	PASS			
	High Channel	1.369	PASS			

### TEST PLOT OF BANDWIDTH FOR LOW CHANNEL

Keysight Spectrum Analyzer - Occupied B	V				
X         T         RF         50 Ω         AC           Center Freq 2.402000000         C	#IFGain:Low #Atter	SENSE:INT r Freq: 2.402000000 GHz Free Run Avg Hold n: 30 dB	Radio Std		Frequency
Log 5.00 -10.0 -25.0					Center Freq 2.402000000 GHz
-40.0					
-100					
Center 2.402 GHz #Res BW 30 kHz	#	VBW 100 kHz		an 3 MHz 4.133 ms	CF Step 300.000 kHz
Occupied Bandwidt	<sup>th</sup> 2274 MHz	Total Power	5.22 dBm		<u>Auto</u> Man Freq Offset
Transmit Freq Error x dB Bandwidth	-23.195 kHz 1.371 MHz	OBW Power x dB	99.00 % -20.00 dB		0 Hz
MSG			STATUS		







### TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL

#### Keysight Spectrum Analyzer - Occupied BW GHz SENSE:INT ALIGN AUTO Center Freq: 2.48000000 GHz #IFGain:Low #Atten: 30 dB 06:20:10 PM Sep 10, 2018 Radio Std: None Frequency Center Freq 2.480000000 GHz Radio Device: BTS Ref 20.00 dBm 5 dB/div **Center Freq** 2.480000000 GHz Center 2.48 GHz #Res BW 30 kHz Span 3 MHz Sweep 4.133 ms CF Step 300.000 kHz #VBW 100 kHz <u>Auto</u> Man **Total Power** 3.47 dBm **Occupied Bandwidth** 1.2215 MHz **Freq Offset** 0 Hz Transmit Freq Error -22.993 kHz **OBW** Power 99.00 % x dB Bandwidth 1.369 MHz -20.00 dB x dB STATUS

### TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL

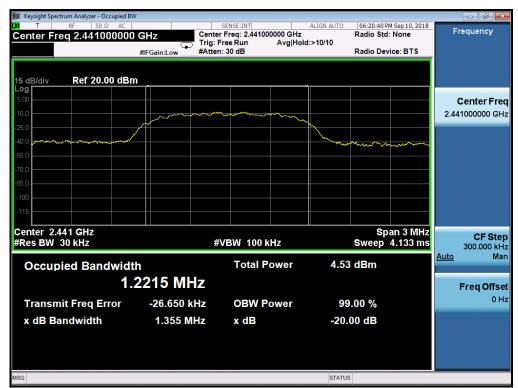
MEASUREMENT RESULT FOR 8-DPSK MODULATION						
Measurement Result						
Applicable Limits	Test Da	Test Data (MHz)				
	Low Channel	1.358	PASS			
N/A	Middle Channel	1.355	PASS			
	High Channel	1.354	PASS			

### TEST PLOT OF BANDWIDTH FOR LOW CHANNEL

Keysight Spectrum Analyzer - Occupied B	N				- d <b>-</b>
04 Τ RF 50Ω AC Center Freq 2.402000000	#IFGain:Low #Atten	SENSE:INT Pr Freq: 2.402000000 GHz Free Run Avg Hol n: 30 dB	ALIGN AUTO 06:20:29 P Radio Std d:>10/10 Radio Dev		Frequency
15 dB/div Ref 20.00 dBr Log 5.00 -10.0 -25.0	n	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~			Center Freq 2.402000000 GHz
-40.0					
-100 -115 Center 2.402 GHz				an 3 MHz	CF Step
#Res BW 30 kHz Occupied Bandwidt	th	∜VBW 100 kHz Total Power	Sweep 5.29 dBm	4.133 ms	300.000 kHz <u>Auto</u> Man
Transmit Freq Error	2211 MHz -27.181 kHz	OBW Power	99.00 %		Freq Offset 0 Hz
x dB Bandwidth	1.358 MHz	x dB	-20.00 dB		
MSG			STATUS		







### TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL

#### Keysight Spectrum Analyzer - Occupied BW GHz SENSE:INT ALIGN AUTO Center Freq: 2.48000000 GHz #IFGain:Low #Atten: 30 dB 06:20:49 PM Sep 10, 2018 Radio Std: None Frequency Center Freq 2.480000000 GHz Radio Device: BTS Ref 20.00 dBm 5 dB/div **Center Freq** 2.480000000 GHz Center 2.48 GHz #Res BW 30 kHz Span 3 MHz Sweep 4.133 ms CF Step 300.000 kHz #VBW 100 kHz <u>Auto</u> Man **Total Power** 3.63 dBm **Occupied Bandwidth** 1.2195 MHz **Freq Offset** 0 Hz Transmit Freq Error -26.754 kHz **OBW** Power 99.00 % x dB Bandwidth 1.354 MHz -20.00 dB x dB STATUS

### TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL



# 5. Conducted Spurious Emission

# 5.1. Measurement Procedure

- 1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
- 2. Set the EUT Work on the top, the Middle and the bottom operation frequency individually.
- Set the Span = wide enough to capture the peak level of the in-band emission and all spurious emissions from the lowest frequency generated in the EUT up through the 10th harmonic. RBW = 100 kHz; VBW= 300 kHz; Sweep = auto; Detector function = peak.
- 4. Set SPA Trace 1 Max hold, then View.

# 5.2. Test Set-Up (Block Diagram of Configuration)

The same as described in section 4.2

# 5.3. Limits and Measurement Result

LIMITS AND MEASUREMENT RESULT					
Ann lingh la Lingita	Measurement Result				
Applicable Limits	Test Data	Criteria			
In any 100 KHz Bandwidth Outside the	At least -20dBc than the limit				
frequency band in which the spread spectrum	Specified on the BOTTOM	PASS			
intentional radiator is operating, the radio	Channel				
frequency power that is produce by the intentional radiator shall be at least 20 dB below that in 100KHz bandwidth within the band that contains the highest level of the desired power. In addition, radiation emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in§15.209(a))	At least -20dBc than the limit Specified on the TOP Channel	PASS			



### 🖡 Keysight Spectrum Analyzer - Swept SA 06:22:40 PM Sep 10, 2018 TRACE 1 2 3 4 5 6 TYPE M Avg Type: Log-Pwr Avg|Hold:>100/100 Peak Search Marker 1 2.402030000000 GHz PN0: Wide IFGain:Low Atten: 20 dB Mkr1 2.402 030 GHz -1.808 dBm **Next Peak** Ref 10.00 dBm 10 dB/div Log 1 Next Pk Right Next Pk Left Marker Delta V.A Mm Mulin Mulana Mkr→CF Mkr→RefLvl More 1 of 2 Center 2.402000 GHz #Res BW 100 kHz Span 5.000 MHz Sweep 1.000 ms (1001 pts) #VBW 300 kHz STATUS 🔰 Keysight Spectrum Analyzer - Swept SA ALIGN AUTO 06:25:45 PM Sep 10, 2018 Display TRACE 1 2 3 4 5 TYPE M Avg Type: Log-Pwr Avg|Hold: 33/100 Display Line -23.41 dBm PNO: Fast Trig: Free Run IFGain:Low Atten: 30 dB Mkr2 4.960 1 GHz -51.288 dBm **Annotation**► 10 dB/div Log Ref 20.00 dBm Title► Graticule <u>On</u> Off Display Line -23.41 dBm -23.41 dB <u> On</u> Off 7 a la sub de la sub de la sub de la sub System Display► Settings Start 30 MHz #Res BW 100 kHz Stop 26.00 GHz Sweep 2.484 s (30000 pts)

#VBW 300 kHz

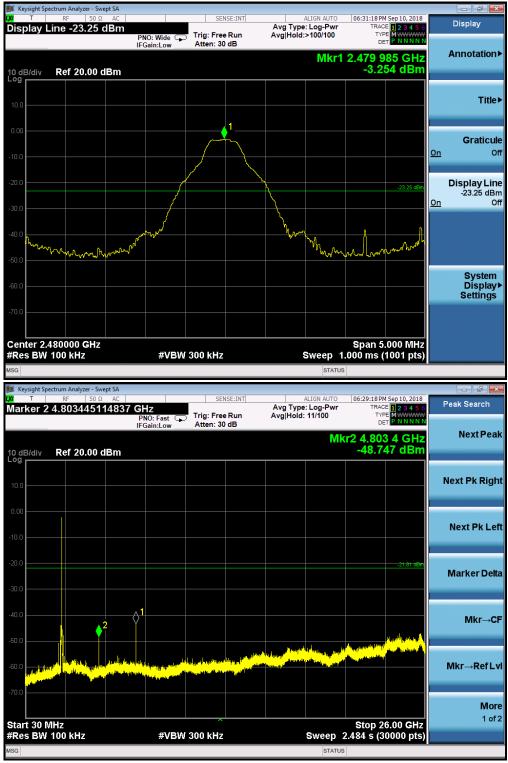
## **TEST RESULT FOR ENTIRE FREQUENCY RANGE** TEST PLOT OF OUT OF BAND EMISSIONS WITH THE WORST CASE OF GFSK MODULATION IN LOW CHANNEL





### TEST PLOT OF OUT OF BAND EMISSIONS OF GFSK MODULATION IN MIDDLE CHANNEL





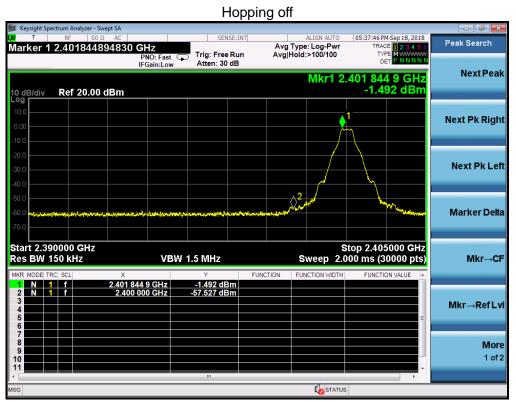
# TEST PLOT OF OUT OF BAND EMISSIONS OF GFSK MODULATION IN HIGH CHANNEL

Note: The peak emissions without marker on the above plots are fundamental wave and need not to compare with the limit. The GFSK modulation is the worst case and only those data recorded in the report.



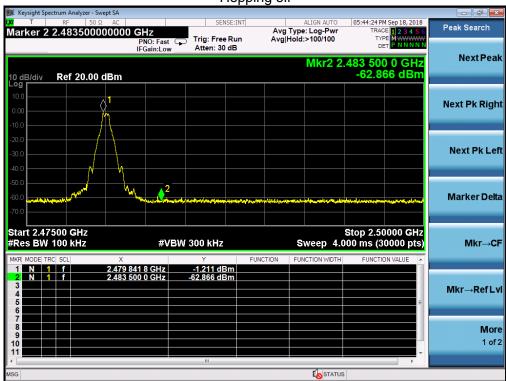
### TEST RESULT FOR BAND EDGE

### GFSK MODULATION IN LOW CHANNEL

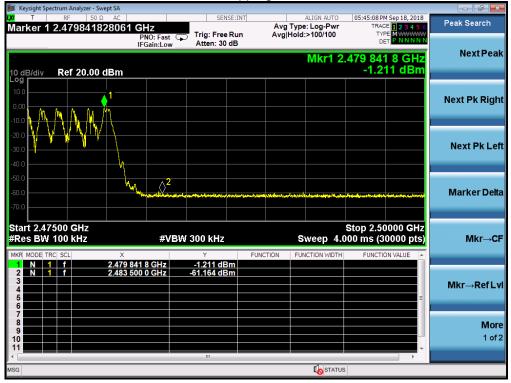


Keysight Spectrum Analyzer - Swept SA			
X T RF 50 Ω AC Marker 1 2.401844394813	GHz	ALIGN AUTO 05:38:58 PM Sep 18, 2018 Avg Type: Log-Pwr TRACE 1 2 3 4 5 6	Peak Search
10 dB/div Ref 20.00 dBm	PNO: Fast Trig: Free Run IFGain:Low Atten: 30 dB	Avg Hold:>100/100 TYPE Mutation Det PINNING Mkr1 2.401 844 4 GHz -1.404 dBm	NextPeak
10.0 0.00 -10.0			Next Pk Right
-20.0			Next Pk Left
-50.0	al ha haan till an		Marker Delta
Start 2.390000 GHz Res BW 150 kHz MKRI MODEI TRCI SCLI X	VBW 1.5 MHz	Stop 2.405000 GHz Sweep 2.000 ms (30000 pts)	Mkr→CF
2 N 1 f 2.400 3 4 5 6 6 6 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	44 4 GHz -1.404 dBm 000 GHz -56.581 dBm	=	Mkr→RefLvl
7 8 9 10 11			More 1 of 2
MSG		STATUS	





### GFSK MODULATION IN HIGH CHANNEL Hopping off



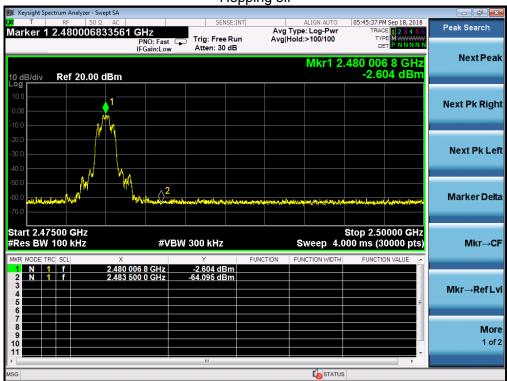




### $\pi$ /4-DQPSK MODULATION IN LOW CHANNEL Hopping off







# $\pi$ /4-DQPSK MODULATION IN HIGH CHANNEL Hopping off

📁 Keysight Spectrum Analyzer - Swept SA			•		
₩ T RF 50Ω AC Marker 1 2.475159171972	CH-	SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr	05:47:18 PM Sep 18, 2018 TRACE 1 2 3 4 5 6	Peak Search
10 dB/div Ref 20.00 dBm	PNO: East	Trig: Free Run Atten: 30 dB	Avg Hold:>100/100	1475 159 2 GHz -2.410 dBm	NextPeak
					Next Pk Right
-20.0					Next Pk Lef
-50.0		مىركەرلىرا تەكىرىكە كېيىر (11 يەكتى) مەر ئەتلىق		an a	Marker Delta
Start 2.47500 GHz #Res BW 100 kHz	#VBW 3		Sweep 4.	Stop 2.50000 GHz 000 ms (30000 pts)	Mkr→CF
1         N         1         f         2.475 1           2         N         1         f         2.483 5           3         -         -         -         -           4         -         -         -         -           5         -         -         -         -           6         -         -         -         -	59 2 GHz -6	2.410 dBm 1.713 dBm			Mkr→RefLv
7 8 9 10 11		111		•	More 1 of 2
MSG			<b>I</b> o statu:	s	

		Норрі	ing off		
Keysight Spectrum Analyzer - TRF 50 Carker 1 2.402163	Ω AC	SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>100/100	05:41:47 PM Sep 18, 2018 TRACE 1 2 3 4 5 6 TYPE MWWWWW DET P N N N N N	Peak Search
0 dB/div Ref 20.00	IFGain:Low 0 dBm	Atten: 30 dB	Mkr1 2.4	402 163 9 GHz -2.452 dBm	NextPea
og 10.0 0.00				1	Next Pk Righ
0.0			- Ann		Next Pk Le
0.0 0.0 <mark>attrake, kompositivest</mark>	engeladamenter et Menseere atenditiens	der abschäftssaksen aus tildet som et, der e skrafter	2/		Marker Del
tart 2.390000 GHz es BW 150 kHz		W 1.5 MHz	Sweep 2.0	op 2.405000 GHz 00 ms (30000 pts)	Mkr→C
KR         MODE         TRC         SCL           1         1         f           2         N         1         f           3         -         -         -           4         -         -         -           5         -         -         -           6         -         -         -	× 2.402 163 9 GHz 2.400 000 GHz	-2.452 dBm -53.743 dBm	FUNCTION FUNCTION WIDTH	FUNCTION VALUE	Mkr→RefL
6 7 8 9 0 1					Mo 1 of
G 🕕 File <screen_008< td=""><td>4.png&gt; saved</td><td>m</td><td><b>I</b> STATUS</td><td>ł</td><td></td></screen_008<>	4.png> saved	m	<b>I</b> STATUS	ł	

### 8-DPSK MODULATION IN LOW CHANNEL Hopping off







### 8-DPSK MODULATION IN HIGH CHANNEL Hopping off

💓 Keysight Spectrum Analyzer - Swept SA						
₩ T RF 50 Ω AC Marker 1 2.480172672422	CH-	SENSE:IN		ALIGN AUTO	05:48:35 PM Sep 18, 201 TRACE 1 2 3 4 5	
10 dB/div Ref 20.00 dBm	PNO: Fast G IFGain:Low	Trig: Free Run Atten: 30 dB		Hold:>100/100	-2.528 dBn	Next Peak
						Next Pk Right
-20 0 -30 0 -40 0						Next Pk Left
-60.0	1000 1000 2000 2000 1000 1000 1000 1000	19 almanting the states for all and	(P) series during the second second	در میروند و از میروند و به میروند و بالی میروند. ار میروند و از میروند و بالی میروند و بالی میروند و بالی میروند میروند و از میروند و بالی م	u dagt som brunds om som de som som til att som som til som	Marker Delta
Start 2.47500 GHz #Res BW 100 kHz	#VB\	N 300 kHz Y	FUNCTION	Sweep 4.0	Stop 2.50000 GH 000 ms (30000 pts FUNCTION VALUE	z )) Mkr→CF
	72 7 GHz 00 0 GHz	-2.528 dBm -62.414 dBm				Mkr→RefLvl
7 8 9 10 11						More 1 of 2
MSG		m		<b>I</b> STATUS	3	





# 6. Radiated Emission

# 6.1. Measurement Procedure

- 1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
- 2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
- 3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
- 4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
- 5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
- 6. For emissions above 1GHz, use 1MHz RBW and 3MHz VBW for peak reading. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
- 7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum values.
- 8.If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
- 9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
- 10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High Low scan is not required in this case.



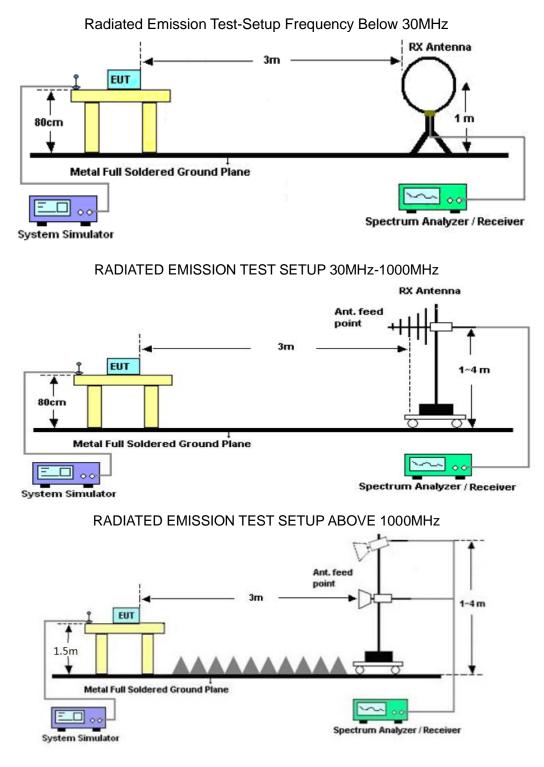
#### The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Start ~Stop Frequency	9KHz~150KHz/RB 200Hz for QP
Start ~Stop Frequency	150KHz~30MHz/RB 9KHz for QP
Start ~Stop Frequency	30MHz~1000MHz/RB 120KHz for QP
Start ~Stop Frequency	1GHz~26.5GHz
Start ~Stop Frequency	1MHz/3MHz for Peak, 1MHz/10Hz for Average

Receiver Parameter	Setting
Start ~Stop Frequency	9KHz~150KHz/RB 200Hz for QP
Start ~Stop Frequency	150KHz~30MHz/RB 9KHz for QP
Start ~Stop Frequency	30MHz~1000MHz/RB 120KHz for QP



### 6.2. Test Setup





### 6.3. Limits and Measurement Result

15.209 Limit in the below table has to be followed

Frequencies (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

Note: All modes were tested For restricted band radiated emission,

the test records reported below are the worst result compared to other modes.

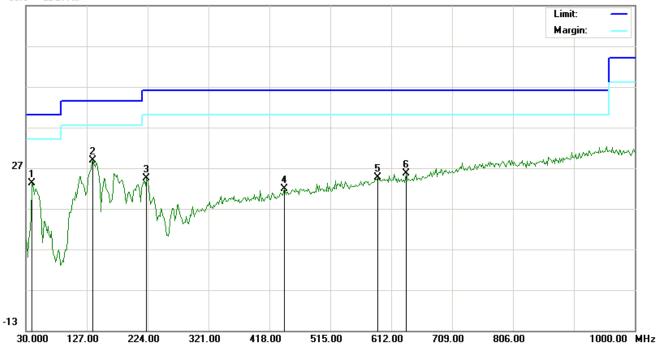


#### **RADIATED EMISSION BELOW 30MHZ**

#### No emission found between lowest internal used/generated frequencies to 30MHz. RADIATED EMISSION BELOW 1GHZ

EUT	Digital DMR and Analog UHF/VHF Two Way Radio	Model Name	AT-D878UV		
Temperature	25°C	Relative Humidity	54.9%		
Pressure	960hPa	Test Voltage	Normal Voltage		
Test Mode	Mode 4	Antenna	Horizontal		

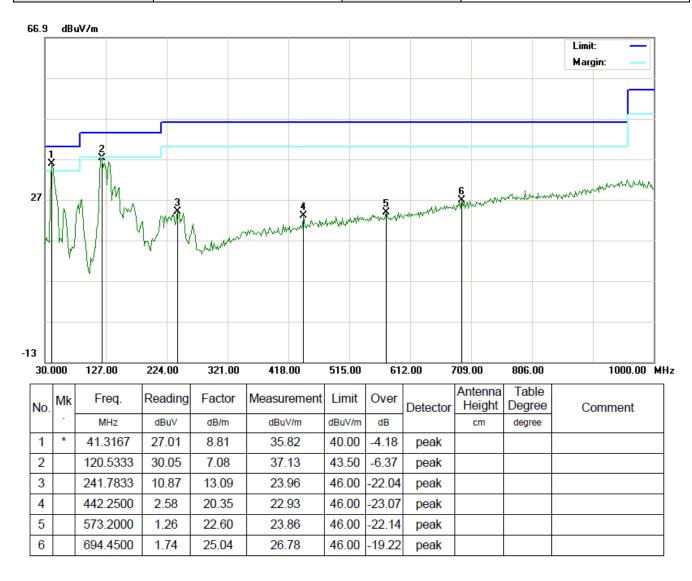
#### 66.9 dBu¥/m



No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
	•	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		39.7000	11.62	11.51	23.13	40.00	-16.87	peak			
2	*	136.7000	15.17	13.66	28.83	43.50	-14.67	peak			
3		222.3833	14.59	9.72	24.31	46.00	-21.69	peak			
4		442.2500	1.52	20.35	21.87	46.00	-24.13	peak			
5		590.9833	1.11	23.50	24.61	46.00	-21.39	peak			
6		636.2500	1.76	23.82	25.58	46.00	-20.42	peak			



EUT	Digital DMR and Analog UHF/VHF Two Way Radio	Model Name	AT-D878UV
Temperature	25°C	Relative Humidity	54.9%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 4	Antenna	Vertical



#### **RESULT: PASS**

Note: 1. Factor=Antenna Factor + Cable loss, Margin=Measurement-Limit.

2. All test modes had been pre-tested. The mode 4 is the worst case and recorded in the report.



EUT	Digital DMR and Analog UHF/VHF Two Way Radio	Model Name	AT-D878UV			
Temperature	25°C	Relative Humidity	54.9%			
Pressure	960hPa	Test Voltage	Normal Voltage			
Test Mode	Mode 1	Antenna	Horizontal			

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type		
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	value Type		
4804.014	44.76	7.12	51.88	74	-22.12	peak		
4804.014	40.48	7.12	47.6	54	-6.4	AVG		
7206.028	43.22	9.84	53.06	74	-20.94	peak		
7206.028	40.46	9.84	50.3	54	-3.7	AVG		
Remark:								
Factor = Ante	enna Factor + Ca	able Loss – P	re-amplifier.					

EUT	Digital DMR and Analog UHF/VHF Two Way Radio	Model Name	AT-D878UV
Temperature	25°C	Relative Humidity	54.9%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Vertical

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type	
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	value Type	
4804.014	45.76	7.12	52.88	74	-21.12	peak	
4804.014	42.14	7.12	49.26	54	-4.74	AVG	
7206.028	44.75	9.84	54.59	74	-19.41	peak	
7206.028	39.43	9.84	49.27	54	-4.73	AVG	
Remark:							
actor = Ante	enna Factor + Ca	able Loss – I	Pre-amplifier.				

### RADIATED EMISSION ABOVE 1GHZ



EUT	Digital DMR and Analog UHF/VHF Two Way Radio	Model Name	AT-D878UV
Temperature	25°C	Relative Humidity	54.9%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 2	Antenna	Horizontal

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type		
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	value Type		
4882.004	43.73	7.12	50.85	74	-23.15	peak		
4882.004	40.23	7.12	47.35	54	-6.65	AVG		
7323.008	42.84	9.84	52.68	74	-21.32	peak		
7323.008	39.16	9.84	49	54	-5	AVG		
Remark:								
Factor = Ante	Factor = Antenna Factor + Cable Loss – Pre-amplifier.							

EUT	Digital DMR and Analog UHF/VHF Two Way Radio	Model Name	AT-D878UV
Temperature	25°C	Relative Humidity	54.9%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 2	Antenna	Vertical

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	value Type
4882.004	43.97	7.12	51.09	74	-22.91	peak
4882.004	37.22	7.12	44.34	54	-9.66	AVG
7323.008	42.71	9.84	52.55	74	-21.45	peak
7323.008	39.59	9.84	49.43	54	-4.57	AVG
emark:						



EUT	Digital DMR and Analog UHF/VHF Two Way Radio	Model Name	AT-D878UV
Temperature	25°C	Relative Humidity	54.9%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Horizontal

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	value Type
4960.031	43.74	7.12	50.86	74	-23.14	peak
4960.031	40.85	7.12	47.97	54	-6.03	AVG
7440.062	42.97	9.84	52.81	74	-21.19	peak
7440.062	38.84	9.84	48.68	54	-5.32	AVG
Remark:						
Factor = Ante	enna Factor + Ca	able Loss – Pi	re-amplifier.			

EUT	Digital DMR and Analog UHF/VHF Two Way Radio	Model Name	AT-D878UV
Temperature	25°C	Relative Humidity	54.9%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Vertical

(dBµV)	(dB)				
	( · )	(dBµV/m)	(dBµV/m)	(dB)	Value Type
44.45	7.12	51.57	74	-22.43	peak
40.27	7.12	47.39	54	-6.61	AVG
43.81	9.84	53.65	74	-20.35	peak
39.05	9.84	48.89	54	-5.11	AVG
	43.81 39.05	43.81     9.84       39.05     9.84	43.81 9.84 53.65	43.81       9.84       53.65       74         39.05       9.84       48.89       54	43.81         9.84         53.65         74         -20.35           39.05         9.84         48.89         54         -5.11

#### **RESULT: PASS**

#### Note:

Other emissions from 1G to 25 GHz are considered as ambient noise. No recording in the test report.

Factor = Antenna Factor + Cable loss - Amplifier gain, Over=Measure-Limit.

The "Factor" value can be calculated automatically by software of measurement system.

All test modes had been tested. The GFSK modulation is the worst case and recorded in the report.



EUT	Digital DMR and Analog UHF/VHF Two Way Radio	Model Name	AT-D878UV
Temperature	25°C	Relative Humidity	54.9%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Horizontal





AV





Mkr→RefLvl

More 1 of 2

EUT	Digital DMR and Analog UHF/VHF Two Way Radio	Model Name	AT-D878UV
Temperature	25°C	Relative Humidity	54.9%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Vertical

ΡK





Mkr→RefLvl

More 1 of 2

EUT	Digital DMR and Analog UHF/VHF Two Way Radio	Model Name	AT-D878UV
Temperature	25°C	Relative Humidity	54.9%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Horizontal

ΡK



2.479 848 GHz 2.483 500 GHz

N 1 f N 1 f 95.210 dBµV 34.743 dBµV



EUT	Digital DMR and Analog UHF/VHF Two Way Radio	Model Name	AT-D878UV
Temperature	25°C	Relative Humidity	54.9%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Vertical



#### **RESULT: PASS**

**Note**: The factor had been edited in the "Input Correction" of the Spectrum Analyzer. So the Amplitude of test plots is equal to Reading level plus the Factor in dB. Use the A dB( $\mu$ V) to represent the Amplitude. Use the F dB( $\mu$ V/m) to represent the Field Strength. So A=F. All test modes had been pre-tested. The GFSK modulation is the worst case and recorded in the report.



# 7. Number of Hopping Frequency

### 7.1. Measurement Procedure

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

1. Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.

2. RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.

3. VBW  $\geq$  RBW. Sweep: Auto. Detector function: Peak. Trace: Max hold.

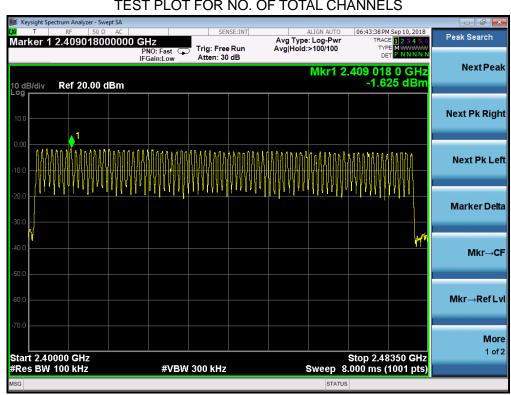
4. Allow the trace to stabilize.

### 7.2. Test Setup (Block Diagram of Configuration)

Same as described in section 4.2

### 7.3. Limits and Measurement Result

TOTAL NO. OF	LIMIT (NO. OF CH)	MEASUREMENT (NO. OF CH)	RESULT			
HOPPING CHANNEL	>=15	79	PASS			
1	TEST DI OT EOD NO, OE TOTAL CHANNELS					



Note: The 4-DPSK modulation is the worst case and recorded in the report.



# 8. Time Of Occupancy (Dwell Time)

### 8.1. Measurement Procedure

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

1. Span: Zero span, centered on a hopping channel.

2. RBW shall be  $\leq$  channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel.

3. Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.

4. Detector function: Peak. Trace: Max hold.

5. Use the marker-delta function to determine the transmit time per hop.

6. Repeat the measurement using a longer sweep time to determine the number of hops over the period specified in the requirements. The sweep time shall be equal to, or less than, the period specified in the requirements. Determine the number of hops over the sweep time and calculate the total number of hops in the period specified in the requirements, using the following equation:

(Number of hops in the period specified in the requirements) = (number of hops on spectrum analyzer)  $\times$  (period specified in the requirements / analyzer sweep time)

7. The average time of occupancy is calculated from the transmit time per hop multiplied by the number of hops in the period specified in the requirements.

## 8.2. Test Setup (Block Diagram of Configuration)

Same as described in section 4.2

### 8.3. Limits and Measurement Result

Channel	Time of Pulse for DH5 (ms)	Number of hops in the period specified in the requirements	Sweep Time (ms)	Limit (ms)
Low	2.917	27*4	315.036	400
Middle	2.883	27*4	311.364	400
High	2.900	27*4	313.200	400

Note: The 8-DPSK modulation is the worst case and recorded in the report.



TEST PLOT OF		
Image: Weysight Spectrum Analyzer - Swept SA           T         RF         50 Ω         AC         SENSE:INT		
Marker 1 Δ 2.91667 ms	ALIGN AUTO 06:45:22 PM Sep 10, 2018 Avg Type: Log-Pwr TRACE 23 4 5 6	Marker
PNO: Fast ↔ Trig: Free Run IFGain:Low Atten: 20 dB	TYPE WWWWW DET N N N N N	
in GuineOw	ΔMkr1 2.917 ms	Select Marker
10 dB/div Ref 10.00 dBm	-1.93 dB	1
10 dB/div Ref 10.00 dBm		
	_1∆2	Normal
0.00 <mark>dana dahar berkerakan katan dahar berkerakan be</mark>		Norma
م الدير البارية بالتي الدير البارية بالت	البين التأبين بينينا المراجع	
		Delta
-30.0		
		Fixed⊳
-40.0		
-50.0		Off
-60.0		
-70.0		Properties
		Properties►
-80.0		
		More
		1 of 2
Center 2.402000000 GHz Res BW 1.0 MHz #VBW 3.0 MHz	Span 0 Hz Sweep  8.333 ms (1001 pts)	
	STATUS	
	514105	
Keysight Spectrum Analyzer - Swept SA	ALTON AUTO 06:47:15 DM Sep 10, 2019	
RF 50Ω AC SENSE:INT Ref Level 20.00 dBm	ALIGN AUTO 06:47:15 PM Sep 10, 2018 Avg Type: Log-Pwr TRACE 2 3 4 5 6	Amplitude
X         T         RF         50 Ω         AC         SENSE:INT           Ref Level 20.00 dBm         PNO: Fast         →         Trig: Free Run		Amplitude
	Avg Type: Log-Pwr TRACE 1 2 3 4 5 6	Amplitude <b>Ref Level</b>
Ref Level 20.00 dBm PNO: Fast →→ Trig: Free Run IFGain:Low 10 dB/div Ref 20.00 dBm	Avg Type: Log-Pwr TRACE 1 2 3 4 5 6	Amplitude
Ref Level 20.00 dBm PNO: Fast →→ IFGain:Low Ref Level 20.00 dBm	Avg Type: Log-Pwr TRACE 1 2 3 4 5 6	Amplitude <b>Ref Level</b> 20.00 dBm
Image: Weight of the second seco	Avg Type: Log-Pwr TRACE 1 2 3 4 5 6	Amplitude Ref Level 20.00 dBm Attenuation
Ref Level 20.00 dBm     PNO: Fast →→ Trig: Free Run Atten: 30 dB       10 dB/div     Ref 20.00 dBm	Avg Type: Log-Pwr TRACE 1 2 3 4 5 6	Amplitude <b>Ref Level</b> 20.00 dBm
Image: Weight of the second seco	Avg Type: Log-Pwr TRACE 1 2 3 4 5 6	Amplitude Ref Level 20.00 dBm Attenuation
Image: Weight of the second seco	Avg Type: Log-Pwr TRACE 1 2 3 4 5 6	Amplitude Ref Level 20.00 dBm Attenuation
Image: Weight of the second distribution of the second d	Avg Type: Log-Pwr TRACE 1 2 3 4 5 6	Amplitude Ref Level 20.00 dBm Attenuation [30 dB]
Image: Non-Section 2000 dBm         SENSE:INT         SENSE:INT           Ref Level 20.00 dBm         PNO: Fast →→         Trig: Free Run Atten: 30 dB           10 dB/div         Ref 20.00 dBm         Free Run Atten: 30 dB           10 dB/div         Ref 20.00 dBm         Free Run Atten: 30 dB           0 00         Free Run Atten: 30 dB         Free Run Atten: 30 dB	Avg Type: Log-Pwr TRACE 1 2 3 4 5 6	Amplitude Ref Level 20.00 dBm Attenuation [30 dB] Scale/Div
Image: Non-Section 2000 dBm         SENSE:INT         SENSE:INT           Ref Level 20.00 dBm         PNO: Fast →→         Trig: Free Run Atten: 30 dB           10 dB/div         Ref 20.00 dBm         Free Run Atten: 30 dB           10 dB/div         Ref 20.00 dBm         Free Run Atten: 30 dB           0 00         Free Run Atten: 30 dB         Free Run Atten: 30 dB	Avg Type: Log-Pwr TRACE 1 2 3 4 5 6	Amplitude Ref Level 20.00 dBm Attenuation [30 dB] Scale/Div 10 dB
Image: Non-Section 2000 dBm         PNO: Fast →→         Trig: Free Run Atten: 30 dB           10 dB/div         Ref 20.00 dBm         Free Run Atten: 30 dB           10 dB/div         Ref 20.00 dBm         Free Run Atten: 30 dB           10.0	Avg Type: Log-Pwr	Amplitude Ref Level 20.00 dBm Attenuation [30 dB] Scale/Div 10 dB Scale Type
Image: Non-Section 2000 dBm         PNO: Fast →→         Trig: Free Run Atten: 30 dB           10 dB/div         Ref 20.00 dBm         Free Run Atten: 30 dB           10 dB/div         Ref 20.00 dBm         Free Run Atten: 30 dB           10.0	Avg Type: Log-Pwr	Amplitude Ref Level 20.00 dBm Attenuation [30 dB] Scale/Div 10 dB Scale Type
Image: Non-Section 2000 dBm         PNO: Fast →→         Trig: Free Run Atten: 30 dB           10 dB/div         Ref 20.00 dBm         Free Run Atten: 30 dB           10 dB/div         Ref 20.00 dBm         Free Run Atten: 30 dB           10.0	Avg Type: Log-Pwr	Amplitude Ref Level 20.00 dBm Attenuation [30 dB] Scale/Div 10 dB Scale Type
IX         T         RF         50 Ω         AC         SENSE:INT           Ref Level 20.00 dBm         PNO: Fast         →→         Trig: Free Run           10 dE/div         Ref 20.00 dBm         -→         Atten: 30 dB           10 dE/div         Ref 20.00 dBm         -→         -→           -0 00         -→         -→         -→         -→           10 dE/div         Ref 20.00 dBm         -→         -→         -→           -0 00         -→         -→         -→         -→         -→           10.0         -→         -→         -→         -→         -→         -→           -10.0         -→         -→         -→         -→         -→         -→         -→	Avg Type: Log-Pwr	Amplitude Ref Level 20.00 dBm (30 dB) Scale/Div 10 dB Scale Type
Image: Non-Section 2000 dBm         SENSE:INT         SENSE:INT           Ref Level 20.00 dBm         PN0: Fast → Figain:Low         Trig: Free Run Atten: 30 dB           10 dB/div         Ref 20.00 dBm         Image: Non-Section 2000 dBm           0.00         Image: Non-Section 2000 dBm         Image: Non-Section 2000 dBm           10.0         Image: Non-Section 2000 dBm         Image: Non-Section 2000 dBm           10.0         Image: Non-Section 2000 dBm         Image: Non-Section 2000 dBm           10.0         Image: Non-Section 2000 dBm         Image: Non-Section 2000 dBm           10.0         Image: Non-Section 2000 dBm         Image: Non-Section 2000 dBm           10.0         Image: Non-Section 2000 dBm         Image: Non-Section 2000 dBm           10.0         Image: Non-Section 2000 dBm         Image: Non-Section 2000 dBm           10.0         Image: Non-Section 2000 dBm         Image: Non-Section 2000 dBm           10.0         Image: Non-Section 2000 dBm         Image: Non-Section 2000 dBm           10.0         Image: Non-Section 2000 dBm         Image: Non-Section 2000 dBm           10.0         Image: Non-Section 2000 dBm         Image: Non-Section 2000 dBm           10.0         Image: Non-Section 2000 dBm         Image: Non-Section 2000 dBm           10.0         Image: Non-Section 2000 dBm         I	Avg Type: Log-Pwr	Amplitude Ref Level 20.00 dBm (30 dB) Scale/Div 10 dB Scale Type Log Lin
Image: Non-Section 2000 dBm         PNO: Fast →→         Trig: Free Run Atten: 30 dB           10 dB/div         Ref 20.00 dBm         Free Run Atten: 30 dB           10 dB/div         Ref 20.00 dBm         Free Run Atten: 30 dB           10.0	Avg Type: Log-Pwr	Amplitude Ref Level 20.00 dBm Attenuation [30 dB] Scale/Div 10 dB Scale Type Log Lin
Image: Note of the second	Avg Type: Log-Pwr	Amplitude Ref Level 20.00 dBm (30 dB) Scale/Div 10 dB Scale Type Log Lin
Image: Non-Section 2000 dBm         SENSE:INT         SENSE:INT           Ref Level 20.00 dBm         PN0: Fast → Figain:Low         Trig: Free Run Atten: 30 dB           10 dB/div         Ref 20.00 dBm         Image: Non-Section 2000 dBm           0.00         Image: Non-Section 2000 dBm         Image: Non-Section 2000 dBm           10.0         Image: Non-Section 2000 dBm         Image: Non-Section 2000 dBm           10.0         Image: Non-Section 2000 dBm         Image: Non-Section 2000 dBm           10.0         Image: Non-Section 2000 dBm         Image: Non-Section 2000 dBm           10.0         Image: Non-Section 2000 dBm         Image: Non-Section 2000 dBm           10.0         Image: Non-Section 2000 dBm         Image: Non-Section 2000 dBm           10.0         Image: Non-Section 2000 dBm         Image: Non-Section 2000 dBm           10.0         Image: Non-Section 2000 dBm         Image: Non-Section 2000 dBm           10.0         Image: Non-Section 2000 dBm         Image: Non-Section 2000 dBm           10.0         Image: Non-Section 2000 dBm         Image: Non-Section 2000 dBm           10.0         Image: Non-Section 2000 dBm         Image: Non-Section 2000 dBm           10.0         Image: Non-Section 2000 dBm         Image: Non-Section 2000 dBm           10.0         Image: Non-Section 2000 dBm         I	Avg Type: Log-Pwr	Amplitude Ref Level 20.00 dBm Attenuation [30 dB] Scale/Div 10 dB Scale Type Log Lin
Image: Note of the second	Avg Type: Log-Pwr	Amplitude Ref Level 20.00 dBm Attenuation [30 dB] Scale/Div 10 dB Scale Type Log Lin
Image: Note of the second	Avg Type: Log-Pwr	Amplitude Ref Level 20.00 dBm Attenuation [30 dB] Scale/Div 10 dB Scale Type Log Lin Presel Center
Image: Note of the second	Avg Type: Log-Pwr	Amplitude Ref Level 20.00 dBm Attenuation [30 dB] Scale/Div 10 dB Scale Type Log Lin Presel Center Presel Adjust 0 H:
Image: Note of the second	Avg Type: Log-Pwr TRACE 12.3.4.5 G TYPE WWWWWW DET N N N N N DET N N N N N N N N N N N N N N N N N N N	Amplitude Ref Level 20.00 dBm (30 dB) Scale/Div 10 dB Scale Type Log Lin Presel Center Presel Adjust 0H:
Diff         RF         50 Ω         AC         SENSE:INT           Ref Level 20.00 dBm         PN0: Fast          Trig: Free Run Atten: 30 dB           10 dB/div         Ref 20.00 dBm           Atten: 30 dB           10 dB/div         Ref 20.00 dBm              10.0               10.0               10.0	Avg Type: Log-Pwr	Amplitude Ref Level 20.00 dBm Attenuation [30 dB] Scale/Div 10 dB Scale Type Log Lin Presel Center Presel Adjust 0 Hz

#### TEST PLOT OF LOW CHANNEL



	TEST PLOT OF N			
$\mathbf{W}$ Keysight Spectrum Analyzer - Swept SA $\mathbf{W}$ T RF 50 Ω AC Marker 1 Δ 2.88333 ms	SENSE:INT	ALIGN AUTO 06: Avg Type: Log-Pwr	45:45 PM Sep 10, 2018 TRACE 1 2 3 4 5 6	Marker
	PNO: Fast +++ Trig: Free Run FGain:Low Atten: 20 dB	AMk	TYPE DET NNNNNN r1 2.883 ms	Select Marker
10 dB/div Ref 10.00 dBm			-0.02 dB	
			n allerer	Normal
-10.0	i al antificial il nitili	an la air is inn d' na - la air	I	
-20.0				Delta
-30.0				Fixed⊳
-40.0				
-50.0				Off
-60.0	ուլիկուս		line line and line	
-70.0				Properties►
			ىلىل يە <mark>لىلى</mark>	More
Center 2.441000000 GHz Res BW 1.0 MHz	#VBW 3.0 MHz	Sweep 8.333	Span 0 Hz ms (1001 pts)	1 of 2
1100				
MSG		STATUS		
J Keysight Spectrum Analyzer - Swept SA X T RF 50 Ω AC	SENSE:INT	ALIGN AUTO 06:	47:27 PM Sep 10, 2018	Frequency
M Keysight Spectrum Analyzer - Swept SA M T RF 50 Ω AC Center Freq 2.441000000 G			47:27 PM Sep 10, 2018 TRACE 1 2 3 4 5 6 TYPE WWWWWW DET N N N N N	Frequency
Keysight Spectrum Analyzer - Swept SA     RF 50 Ω AC     Center Freq 2.441000000 G     I     10 dB/div Ref 20.00 dBm	Hz PNO: Fast +++ Trig: Free Run	ALIGN AUTO 06:	TRACE 1 2 3 4 5 6	
Image: Keysight Spectrum Analyzer - Swept SA           Image: Keysight Spectre - Swept SA           Image:	Hz PNO: Fast +++ Trig: Free Run	ALIGN AUTO 06:	TRACE 1 2 3 4 5 6	Frequency Auto Tune Center Freq
Image: Keysight Spectrum Analyzer - Swept SA           Image: Market Spectrum Analyzer - Swept SA           Image: Market Spectrum Analyzer - Swept SA           Image: Center Freq 2.441000000 G           Image: Center Freq 2.4410000000 G           Image: Center Freq 2.441000000 G           Image: Center Freq 2.4410000000 G           Image: Center Freq 2.4410000000 G <tr< td=""><td>Hz PNO: Fast +++ Trig: Free Run</td><td>ALIGN AUTO 06:</td><td>TRACE 1 2 3 4 5 6</td><td>Frequency Auto Tune</td></tr<>	Hz PNO: Fast +++ Trig: Free Run	ALIGN AUTO 06:	TRACE 1 2 3 4 5 6	Frequency Auto Tune
Image: Keysight Spectrum Analyzer - Swept SA           Image: Keysight Spectre - Swept SA           Image:	Hz PNO: Fast +++ Trig: Free Run	ALIGN AUTO 06:	TRACE 1 2 3 4 5 6	Frequency Auto Tune Center Freq
Keysight Spectrum Analyzer - Swept SA           χer         50 Ω         AC           Center Freq 2.441000000 G         C           10 dB/div         Ref 20.00 dBm           000         000         000	Hz PNO: Fast +++ Trig: Free Run	ALIGN AUTO 06:	TRACE 1 2 3 4 5 6	Frequency Auto Tune Center Freq 2.441000000 GHz Start Freq 2.441000000 GHz
Keysight Spectrum Analyzer - Swept SA     X     T RF 50 Ω AC     Center Freq 2.441000000 G     I	Hz PNO: Fast Trig: Free Run FGain:Low Atten: 30 dB	ALIGN AUTO 06: Avg Type: Log-Pwr		Frequency Auto Tune Center Freq 2.441000000 GHz Start Freq 2.441000000 GHz
Keysight Spectrum Analyzer - Swept SA           Center Freq 2.441000000 G           Conter Freq 2.441000000 G           10 dB/div         Ref 20.00 dBm           000         1000           10.0         1000           10.0         1000           10.0         1000           10.0         1000           10.0         1000           10.0         1000           10.0         1000           10.0         1000           10.0         1000           10.0         1000           10.0         1000         1000           10.0         1000         1000           1000         1000         1000           1000         1000         1000           1000         1000         1000         1000           1000         1000         1000         1000         1000           1000         1000         1000         1000         1000         1000           1000         1000         1000         1000         1000         1000         1000         1000	Hz PNO: Fast Trig: Free Run FGain:Low Atten: 30 dB	ALIGN AUTO 06: Avg Type: Log-Pwr		Frequency Auto Tune Center Freq 2.441000000 GHz Start Freq 2.441000000 GHz Stop Freq 2.441000000 GHz
Image: Reysight Spectrum Analyzer - Swept SA           Image: Reysight Spectrum Analyzer - Swept SA           Center Freq 2.441000000 G           Image: Reysight Spectrum Analyzer - Swept SA           Image: Reysight	Hz PNO: Fast Trig: Free Run FGain:Low Atten: 30 dB	ALIGN AUTO 06: Avg Type: Log-Pwr		Frequency Auto Tune Center Freq 2.441000000 GHz Start Freq 2.441000000 GHz Stop Freq 2.441000000 GHz
Image: Keysight Spectrum Analyzer - Swept SA           CM         T         RF         50 Ω         AC         Image: Constraint of the system of	Hz PNO: Fast Trig: Free Run FGain:Low Atten: 30 dB	ALIGN AUTO 06: Avg Type: Log-Pwr		Frequency Auto Tune Center Freq 2.441000000 GHz Start Freq 2.441000000 GHz Stop Freq 2.441000000 GHz
Image: Secture Analyzer - Swept SA	Hz PNO: Fast Trig: Free Run FGain:Low Atten: 30 dB	ALIGN AUTO 06: Avg Type: Log-Pwr		Frequency Auto Tune Center Freq 2.441000000 GHz Start Freq 2.441000000 GHz 2.441000000 GHz 2.441000000 GHz 1.000000 MHz Auto Man Freq Offset
Keysight Spectrum Analyzer - Swept SA     X     X	Hz PNO: Fast Trig: Free Run FGain:Low Atten: 30 dB	ALIGN AUTO		Frequency Auto Tune Center Freq 2.441000000 GHz Start Freq 2.441000000 GHz 2.441000000 GHz 2.441000000 GHz 1.000000 MHz Auto Man Freq Offset

#### TEST PLOT OF MIDDLE CHANNEL



💓 Keysight Spectrum Analyzer - Swept SA						
ματίας Γ΄ ΝΕ 50 Ω ΑΟ Marker 1 Δ 2.90000 ms	PNO:Fast ↔	SENSE:IN	Avg Type:		C1 PM Sep 10, 2018 TRACE 1 2 3 4 5 6 TYPE WWWWWW DET NNNNNN	Peak Search
IF	FGain:Low	Atten: 20 dB		ΔMkr	1 2.900 ms	Next Peak
10 dB/div Ref 10.00 dBm					-0.09 dB	
	to start to the fighter by		X			Next Pk Right
						Next Pk Left
-30.0						Marker Delta
-60.0						Mkr→CF
-70.0					,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Mkr→RefLvl
Center 2.480000000 GHz	<i>#</i> )( <b>D</b> )( <b>1</b> )			0.000	Span 0 Hz	More 1 of 2
Res BW 1.0 MHz	#VDVV	3.0 MHz	3	weep 8.333 n	ns (1001 pts)	
MSG				STATUS		
💓 Keysight Spectrum Analyzer - Swept SA						
Center Freq 2.480000000 G		SENSE:IN	T AI Avg Type:		:40 PM Sep 10, 2018 TRACE 1 2 3 4 5 6	Frequency
F	PNO: Fast +++	Trig: Free Run		209111		
	FGain:Low	Atten: 30 dB				Auto Tune
10 dB/div Ref 20.00 dBm						
10.0						
Log						2.480000000 GHz Start Freq
Log 10.0 0.00						2.48000000 GHz Start Freq 2.48000000 GHz Stop Freq
Log 10.0 0.00 -10.0						2.48000000 GHz Start Freq 2.48000000 GHz 2.48000000 GHz 2.48000000 GHz CF Step 1.00000 MHz
Log 10.0 0.00 -10.0 -20.0 -20.0 -30.0 -40.0 -50.0 -60.0						2.48000000 GHz Start Freq 2.48000000 GHz Stop Freq 2.48000000 GHz CF Step 1.000000 MHz <u>Auto</u> Man Freq Offset
Log 10.0 .000 .10.0 .20.0 .20.0 .30.0 .40.0 .50.0 .60.0 .70.0						2.48000000 GHz Start Freq 2.48000000 GHz Stop Freq 2.48000000 GHz CF Step 1.000000 MHz <u>Auto</u> Man Freq Offset
Log 10.0 0.00 -10.0 -20.0 -20.0 -30.0 -40.0 -50.0 -60.0	#vBW	3.0 MHz			Span 0 Hz s (10000 pts)	1.000000 MHz <u>Auto</u> Man

### TEST PLOT OF HIGH CHANNEL





## 9. Frequency Separation

### 9.1. Measurement Procedure

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

1. Span: Wide enough to capture the peaks of two adjacent channels.

2. RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.

3. Video (or average) bandwidth (VBW)  $\geq$  RBW.

4. Sweep: Auto. e) Detector function: Peak. f) Trace: Max hold. g) Allow the trace to stabilize.

Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

## 9.2. Test Setup (Block Diagram of Configuration)

Same as described in section 4.2

### 9.3. Limits and Measurement Result

CHANNEL	CHANNEL SEPARATION	LIMIT	RESULT
	KHz	KHz	Data
CH01-CH02	990	>=25 KHz or 2/3 20 dB BW	Pass

TEST PLOT FOR FREQUENCY SEPARATION r - Swept SA 39 PM Sep 10, 2018 Marker Avg Type: Log-Pwr Avg|Hold:>100/100 Trig: Free Run Atten: 30 dB PNO: Wide IFGain:Low Select Marker ΔMkr1 990 kHz 0.204 dE 10 dB/div Ref 20.00 dBm Normal ▲1∆2 Delta X2 **Fixed** Am way why Off Properties▶ More 1 of 2 Stop 2.405000 GHz Sweep 5.333 ms (1001 pts) Start 2.400000 GHz #VBW 100 kHz #Res BW 30 kHz

Note: The 8-DPSK modulation is the worst case and recorded in the report.



# **10. FCC LINE CONDUCTED EMISSION TEST**

### **10.1.** LIMITS OF LINE CONDUCTED EMISSION TEST

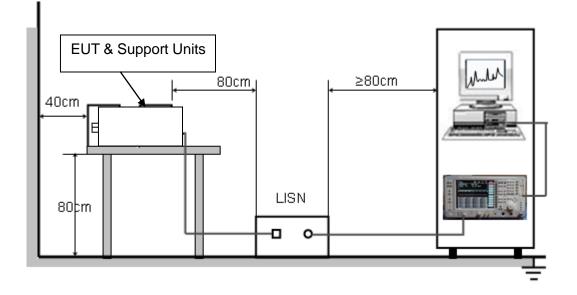
Eroguopou	Maximum RF Line Voltage			
Frequency	Q.P.( dBuV) Average( dBuV)			
150kHz~500kHz	66-56	56-46		
500kHz~5MHz	56	46		
5MHz~30MHz	60	50		

Note:

1. The lower limit shall apply at the transition frequency.

2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

### **10.2.** BLOCK DIAGRAM OF LINE CONDUCTED EMISSION TEST





### **10.3.** PRELIMINARY PROCEDURE OF LINE CONDUCTED EMISSION TEST

- The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. When the EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10 (see Test Facility for the dimensions of the ground plane used). When the EUT is a floor-standing equipment, it is placed on the ground plane which has a 3-12 mm non-conductive covering to insulate the EUT from the ground plane.
- 2. Support equipment, if needed, was placed as per ANSI C63.10.
- 3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10.
- 4. All support equipments received AC120V/60Hz power from a LISN, if any.
- 5. The EUT received DC charging voltage by adapter which received 120V/60Hzpower by a LISN.
- 6. The test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
- 7. Analyzer / Receiver scanned from 150 kHz to 30MHz for emissions in each of the test modes.
- 8. During the above scans, the emissions were maximized by cable manipulation.
- 9. The test mode(s) were scanned during the preliminary test.

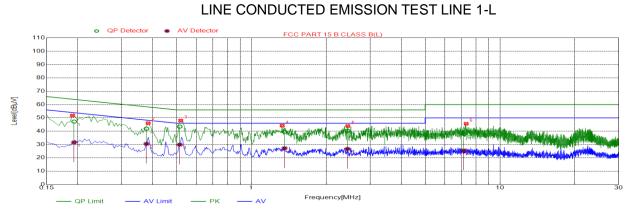
Then, the EUT configuration and cable configuration of the above highest emission level were recorded for reference of final testing.

#### **10.4.** FINAL PROCEDURE OF LINE CONDUCTED EMISSION TEST

- 1. EUT and support equipment was set up on the test bench as per step 2 of the preliminary test.
- 2. A scan was taken on both power lines, Line 1 and Line 2, recording at least the six highest emissions. Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit. If EUT emission level was less –2dB to the A.V. limit in Peak mode, then the emission signal was re-checked using Q.P and Average detector.
- 3. The test data of the worst case condition(s) was reported on the Summary Data page.



### **10.5.** TEST RESULT OF LINE CONDUCTED EMISSION TEST



## Suspected List

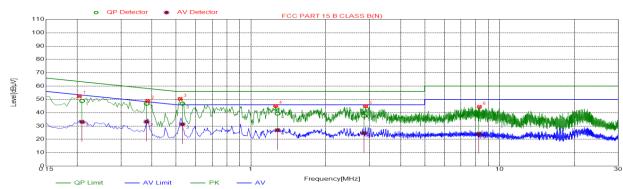
NO.	Freq. [MHz]	Level [dBµV]	Factor [dB]	Limit [dBµV]	Margin [dB]	Detector
1	0.1905	51.85	10.04	64.02	12.17	PK
2	0.3840	46.05	10.04	58.19	12.14	PK
3	0.5190	47.99	10.04	56.00	8.01	PK
4	1.3290	44.16	10.10	56.00	11.84	PK
5	2.4405	43.94	10.18	56.00	12.06	PK
6	7.3095	45.59	10.18	60.00	14.41	PK

## Final Data List

NO.	Freq.	Factor	QP Value	QP Limit	QP Margin	AV Value	AV Limit	AV Margin
140.	[MHz]	[dB]	[dBµV]	[dBµV]	[dB]	[dBµV]	[dBµV]	[dB]
1	0.1934	10.04	47.23	63.89	16.66	31.62	53.89	22.27
2	0.3779	10.05	41.91	58.32	16.41	30.50	48.32	17.82
3	0.5140	10.04	43.44	56.00	12.56	29.91	46.00	16.09
4	1.3577	10.10	39.55	56.00	16.45	27.19	46.00	18.81
5	2.4350	10.18	40.31	56.00	15.69	26.71	46.00	19.29
6	7.1477	10.19	37.90	60.00	22.10	25.53	50.00	24.47



LINE CONDUCTED EMISSION TEST LINE 2-N



## Suspected List

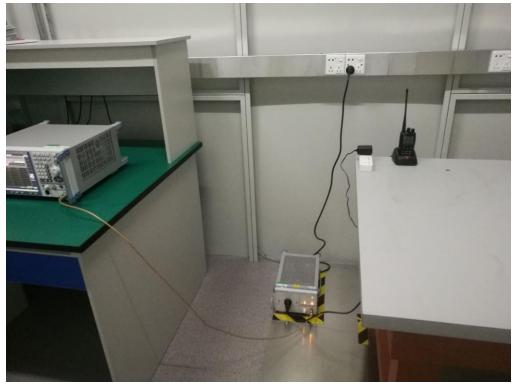
NO.	Freq.	Level	Factor	Limit	Margin	Detector
NO.	[MHz]	[dBµV]	[dB]	[dBµV]	[dB]	Detector
1	0.2040	52.44	10.04	63.45	11.01	PK
2	0.3840	48.77	10.04	58.19	9.42	PK
3	0.5190	50.41	10.04	56.00	5.59	PK
4	1.2570	45.11	10.09	56.00	10.89	PK
5	2.8905	44.86	10.21	56.00	11.14	PK
6	8.2950	44.42	10.13	60.00	15.58	PK

### Final Data List

NO. Freq.	Factor	QP Value	QP Limit	QP Margin	AV Value	AV Limit	AV Margin	
	[MHz]	[dB]	[dBµV]	[dBµV]	[dB]	[dBµV]	[dBµV]	[dB]
1	0.2091	10.04	48.86	63.24	14.38	33.11	53.24	20.13
2	0.3801	10.05	46.76	58.28	11.52	33.24	48.28	15.04
3	0.5296	10.04	46.80	56.00	9.20	31.37	46.00	14.63
4	1.2778	10.09	39.32	56.00	16.68	26.88	46.00	19.12
5	2.8474	10.21	37.62	56.00	18.38	24.68	46.00	21.32
6	8.2680	10.14	39.21	60.00	20.79	24.16	50.00	25.84

# **11. Test Setup Photos of the EUT**

CONDUCTED EMISSION TEST SETUP



### RADIATED EMISSION TEST SETUP







----END OF REPORT----