



FCC RF Test Report

APPLICANT : Franklin Technology Inc.
EQUIPMENT : Mobile Hotspot
MODEL NAME : RG2100
FCC ID : XHG-RG2100
STANDARD : 47 CFR Part 2, 96
CLASSIFICATION : Citizens Band End User Devices (CBE)
EQUIPMENT TYPE : End User Equipment
TEST DATE(S) : Sep. 08, 2022

We, Sporton International Inc. (Kunshan), would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.26-2015 and shown compliance with the applicable technical standards.

This product installed a RF module (Model Name: M2500, FCC ID: XHG-M2500) during the test, only EIRP and RSE test items are tested in this report, all the other test results are leveraged from module RF report.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. (Kunshan), the test report shall not be reproduced except in full.

Jason Jia

Approved by: Jason Jia



Sporton International Inc. (Kunshan)

**No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300
People's Republic of China**



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History of this test report

Report No.	Version	Description	Issued Date
FG262007-01F	01	Initial issue of report	Sep. 09, 2022



Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	§2.1046	Conducted Output Power	Reporting only	-
-	§96.41	Peak-to-Average Ratio	Not Applicable	Not applicable for End User Devices
3.2	§96.41	Maximum E.I.R.P	Pass	-
		Maximum Power Spectral Density	Not Applicable	Not applicable for End User Devices
-	§2.1049 §96.41	Occupied Bandwidth	Reporting only	1
-	§2.1051 §96.41	Conducted Band Edge Measurement Adjacent Channel Leakage Ratio	Pass	1
-	§2.1051 §96.41	Conducted Spurious Emission	Pass	1
-	§2.1055	Frequency Stability for Temperature & Voltage	Pass	1
4.4	§2.1051 §96.41	Radiated Spurious Emission	Pass	Under limit 1.83 dB at 10818.000 MHz

Remark 1:

All test results were leveraged from module RF report which can refer to Report No. FG262007E.

Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.



1 General Description

1.1 Applicant

Franklin Technology Inc.

906 JEI Platz, 186, Gasan digital 1-ro, Gumcheon-Gu, Seoul, South Korea, 08502

1.2 Manufacturer

Franklin Technology Inc.

906 JEI Platz, 186, Gasan digital 1-ro, Gumcheon-Gu, Seoul, South Korea, 08502

1.3 Feature of Equipment Under Test

Product Feature	
Equipment	Mobile Hotspot
Model Name	RG2100
FCC ID	XHG-RG2100
Tx Frequency	5G NR n48: 3550 MHz ~ 3700 MHz
Rx Frequency	5G NR n48: 3550 MHz ~ 3700 MHz
SCS	30kHz
Bandwidth	10MHz / 20MHz / 30MHz / 40MHz
Antenna Type	PIFA Antenna
Antenna Gain	-1.71 dBi
Type of Modulation	CP-OFDM: QPSK / 16QAM / 64QAM / 256QAM DFT-s-OFDM: PI/2 BPSK / QPSK / 16QAM / 64QAM / 256QAM
IMEI Code	Radiation: 358563790000942
HW Version	P1
SW Version	RG2100.TM.1354
EUT Stage	Identical Prototype

Remark:

1. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.
2. 5G NR n48 supports SA mode only.

1.4 Maximum EIRP power and Emission Designator

5G NR n48		PI/2 BPSK / QPSK	16QAM/64QAM/256QAM
BW (MHz)	Frequency Range (MHz)	Maximum EIRP (W)	Maximum EIRP (W)
40	3570.00~3679.98	0.0869	0.0830

Note: All modulations have been tested, and only the worst test results of PSK & QAM are shown in the report.

1.5 Testing Site

Sporton International (Kunshan) Inc. is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02.

Test Firm	Sporton International (Kunshan) Inc.		
Test Site Location	No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China TEL : +86-512-57900158 FAX : +86-512-57900958		
Test Site No.	Sporton Site No.	FCC Designation No.	FCC Test Firm Registration No.
	03CH04-KS	CN1257	314309

1.6 Test Software

Item	Site	Manufacturer	Name	Version
1.	03CH04-KS	AUDIX	E3	6.2009-8-24a

1.7 Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ ANSI C63.26-2015
- ♦ ANSI / TIA-603-E
- ♦ 47 CFR Part 2, 96
- ♦ FCC KDB 971168 D01 Power Meas. License Digital Systems v03r01
- ♦ FCC KDB 940660 D01 Part 96 CBRS v03
- ♦ FCC KDB 412172 D01 Determining ERP and EIRP v01r01

Remark: All test items were verified and recorded according to the standards and without any deviation during the test.



2 Test Configuration of Equipment Under Test

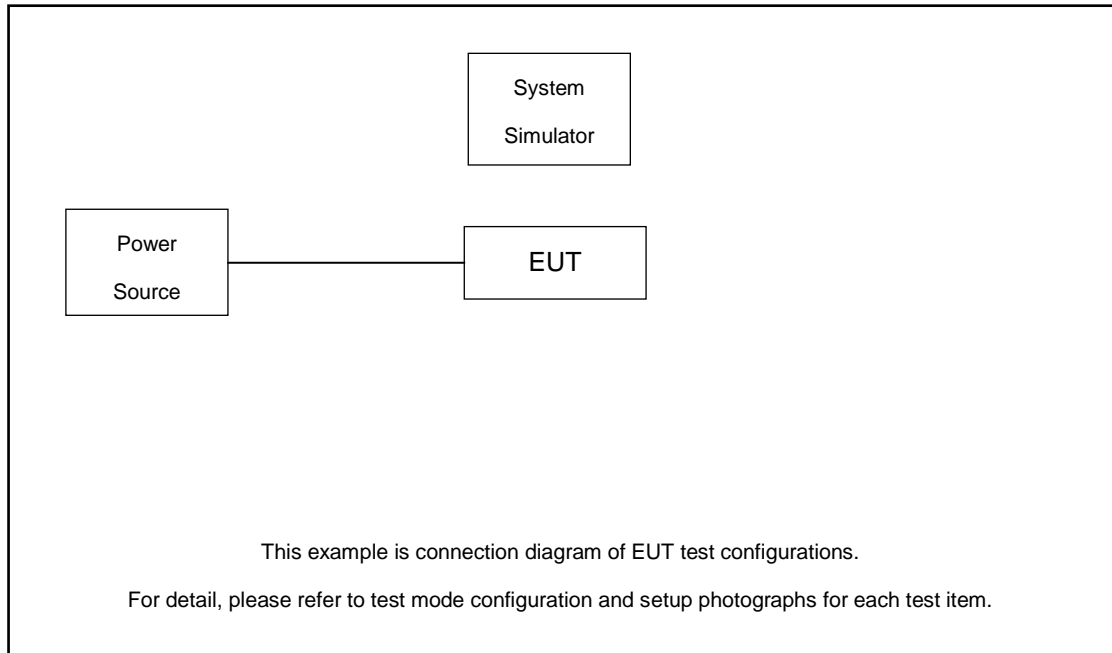
2.1 Test Mode

Antenna port conducted and radiated test items listed below are performed according to KDB 971168 D01 Power Meas. License Digital Systems v03r01 with maximum output power.

For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (Z plane) were recorded in this report.

Test Items	Band	Bandwidth (MHz)						Modulation					RB #		Test Channel			
		5	10	15	20	30	40	PI/2 BPSK	QPSK	16QAM	64QAM	256 QAM	1	Full	L	M	H	
Max. Output Power	n48	-	v	-	v	v	v	v	v	v	v	v	v	v	v	v	v	v
E.R.P / E.I.R.P	n48	-	v	-	v	-	v	v	v	v	v	v	v	v	v	v	v	v
Radiated Spurious Emission	n48	Worst Case															v	
Remark	<ol style="list-style-type: none"> The mark "v " means that this configuration is chosen for testing The mark "- " means that this bandwidth is not supported. The device is investigated from 30MHz to 10 times of fundamental signal for radiated spurious emission test under different RB size/offset and modulations in exploratory test. Subsequently, only the worst case emissions are reported. All test items are based on engineering evaluation. Normal Voltage = 3.8V ; Low Voltage =3.6V; High Voltage =4.2V 																	

2.2 Connection Diagram of Test System



2.3 Support Unit used in test configuration

Item	Equipment	Trade Name	Model No.	FCC ID	Data Cable	Power Cord
1.	Base Station	Anritsu	MT8820/8821	N/A	N/A	Unshielded, 1.8 m
2.	Base Station	Anritsu	MT8000A	N/A	N/A	Unshielded, 1.8 m

2.4 Frequency List of Low/Middle/High Channels

5G NR n48 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
40	Channel	638000	641666	645332
	Frequency	3570	3624.99	3679.98
30	Channel	637668	641666	645666
	Frequency	3565.02	3624.99	3684.99
20	Channel	637334	641666	646000
	Frequency	3560.01	3624.99	3690
10	Channel	637000	641666	646332
	Frequency	3555	3624.99	3694.98

3 Conducted Test Items

3.1 Conducted Output Power

3.1.1 Description of the Conducted Output Power Measurement

A system simulator was used to establish communication with the EUT. Its parameters were set to force the EUT transmitting at maximum output power. The measured power in the radio frequency on the transmitter output terminals shall be reported.

3.1.2 Test Procedures

1. The transmitter output port was connected to the system simulator.
2. Set EUT at maximum power through the system simulator.
3. Select lowest, middle, and highest channels for each band and different modulation.
4. Measure and record the power level from the system simulator.

3.2 EIRP

3.2.1 Description of the EIRP Measurement

EIRP and PSD limits for CBRS equipment as below table:

Device		Maximum EIRP (dBm/10 MHz)	Maximum PSD (dBm/MHz)
Applied	End User Device	23	n/a
<input type="checkbox"/>	Category A CBSD	30	20
<input type="checkbox"/>	Category B CBSD	47	37

Remark: The worst case EIRP shown in this section is found with LTE operating only using 1RB. As such, the EIRP/10MHz and full channel EIRP values will be identical since 1RB is fully contained within all available channel bandwidths for Band n48



3.2.2 Test Procedures for EIRP

1. Establishing a communications link with the call box (Base station) to measure the Maximum conducted power, the parameters were set to force the EUT transmitting at maximum output power level. Use the average power measurement function to measure total channel power of each channel bandwidth (per ANSI C63.26-2015 Section 5.2.1)
2. Determining ERP and/or EIRP from conducted RF output power measurements (Per ANSI C63.26-2015 Section 5.2.5.5)
$$\text{EIRP} = P_T + G_T - L_C, \text{ ERP} = \text{EIRP} - 2.15, \text{ where}$$

P_T = transmitter output power in dBm
 G_T = gain of the transmitting antenna in dBi
 L_C = signal attenuation in the connecting cable between the transmitter and antenna in dB

3.2.3 Test Result

Please refer to Appendix A.

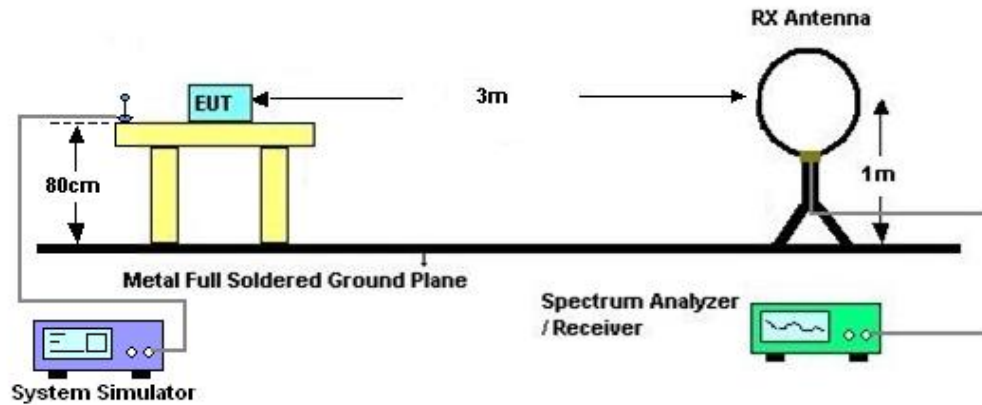
4 Radiated Test Items

4.1 Measuring Instruments

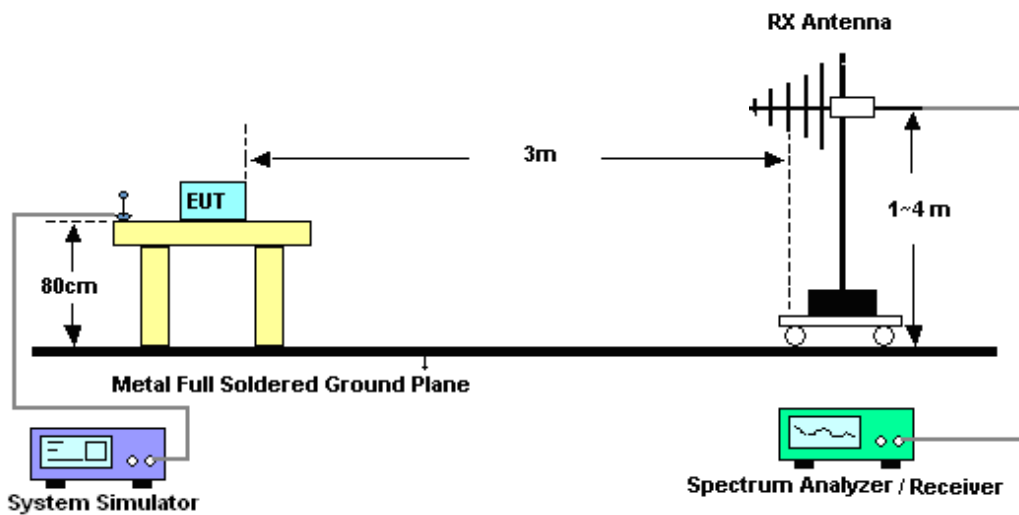
See list of measuring instruments of this test report.

4.2 Test Setup

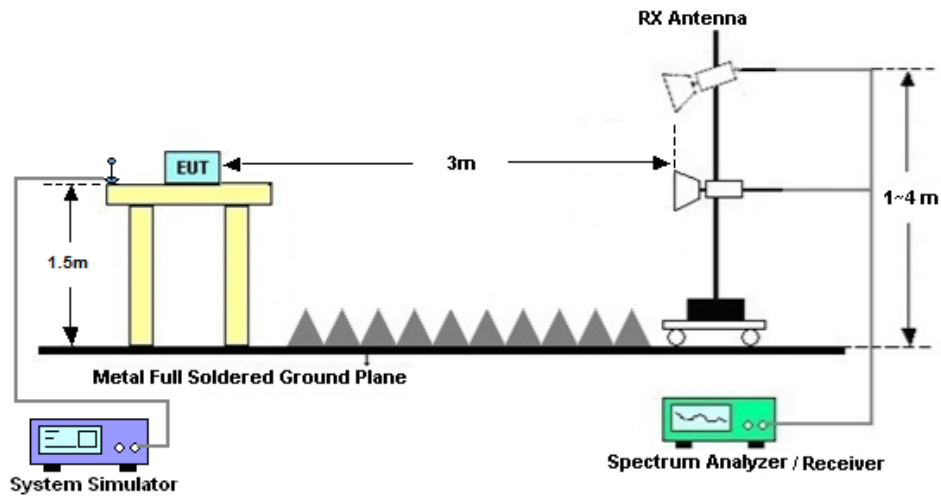
4.2.1 For radiated test below 30MHz



4.2.2 For radiated test from 30MHz to 1GHz



4.2.3 For radiated test above 1GHz



4.3 Test Result of Radiated Test

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported.

Please refer to Appendix B.



4.4 Radiated Spurious Emission

4.4.1 Description of Radiated Spurious Emission Measurement

The radiated spurious emission was measured by substitution method according to ANSI / TIA-603-E. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitter power (P) by a factor of at least -40dBm / MHz. The spectrum is scanned from 30 MHz up to a frequency including its 10th harmonic.

4.4.2 Test Procedures

1. The EUT was placed on a turntable with 0.8 meter height for frequency below 1GHz and 1.5 meter height for frequency above 1GHz respectively above ground.
2. The EUT was set 3 meters from the receiving antenna mounted on the antenna tower.
3. The table was rotated 360 degrees to determine the position of the highest spurious emission.
4. The height of the receiving antenna is varied between 1m to 4m to search the maximum spurious emission for both horizontal and vertical polarizations.
5. During the measurement, the system simulator parameters were set to force the EUT transmitting at maximum output power.
6. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, taking the record of maximum spurious emission.
7. A horn antenna was substituted in place of the EUT and was driven by a signal generator. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission.
$$\text{EIRP (dBm)} = \text{S.G. Power} - \text{Tx Cable Loss} + \text{Tx Antenna Gain}$$
$$\text{ERP (dBm)} = \text{EIRP} - 2.15$$
8. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
The limit line is -40dBm/MHz



5 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
EXA Spectrum Analyzer	Keysight	N9010B	MY57541079	10Hz-44G,MAX 30dB	Oct. 14, 2021	Sep. 08, 2022	Oct. 13, 2022	Radiation (03CH04-KS)
Loop Antenna	R&S	HFH2-Z2	100321	9kHz~30MHz	Oct. 30, 2021	Sep. 08, 2022	Oct. 29, 2022	Radiation (03CH04-KS)
Bilog Antenna	TeseQ	CBL6111D	49922	30MHz~1GHz	May 30, 2022	Sep. 08, 2022	May 29, 2023	Radiation (03CH04-KS)
Horn Antenna	Schwarzbeck	BBHA9120D	1284	1GHz~18GHz	Oct. 18, 2021	Sep. 08, 2022	Oct. 17, 2022	Radiation (03CH04-KS)
SHF-EHF Horn	Com-power	AH-840	101070	18GHz~40GHz	Jan. 05, 2022	Sep. 08, 2022	Jan. 04, 2023	Radiation (03CH04-KS)
Amplifier	SONOMA	310N	187289	9KHz-1GHz	Jan. 05, 2022	Sep. 08, 2022	Jan. 04, 2023	Radiation (03CH04-KS)
Amplifier	MITEQ	EM18G40GG A	060728	18~40GHz	Jan. 05, 2022	Sep. 08, 2022	Jan. 04, 2023	Radiation (03CH04-KS)
high gain Amplifier	EM	EM01G18GA	060839	1Ghz-18Ghz	Oct. 14, 2021	Sep. 08, 2022	Oct. 13, 2022	Radiation (03CH04-KS)
Amplifier	Keysight	83017A	MY57280106	500MHz~26.5G Hz	Oct. 13, 2021	Sep. 08, 2022	Oct. 12, 2022	Radiation (03CH04-KS)
AC Power Source	Chroma	61601	F104090004	N/A	NCR	Sep. 08, 2022	NCR	Radiation (03CH04-KS)
Turn Table	ChamPro	EM 1000-T	060762-T	0~360 degree	NCR	Sep. 08, 2022	NCR	Radiation (03CH04-KS)
Antenna Mast	ChamPro	EM 1000-A	060762-A	1 m~4 m	NCR	Sep. 08, 2022	NCR	Radiation (03CH04-KS)

NCR: No Calibration Required



6 Uncertainty of Evaluation

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI 63.26-2015. All the measurement uncertainty value were shown with a coverage K=2 to indicate 95% level of confidence. The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	3.3dB
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Uncertainty of Radiated Emission Measurement (1 GHz ~ 18 GHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	2.8dB
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Uncertainty of Radiated Emission Measurement (18 GHz ~ 40 GHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	2.8dB
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----- THE END -----



Appendix A. Test Results of Conducted Test

Test Engineer :	Simle Wang	Temperature :	22~23°C
		Relative Humidity :	40~42%

Conducted Output Power(Average power)and EIRP

Channel				638000	641666	645332	EIRP	EIRP	EIRP
Frequency (MHz)				3570	3624.99	3679.98			
40	PI/2 BPSK	1	1	20.75	21.10	20.82	0.0802	0.0869	0.0815
40	PI/2 BPSK	1	53	20.69	21.03	20.71	0.0791	0.0855	0.0794
40	PI/2 BPSK	1	104	20.63	20.98	20.77	0.0780	0.0845	0.0805
40	PI/2 BPSK	50	0	20.63	21.00	20.79	0.0780	0.0849	0.0809
40	PI/2 BPSK	50	28	20.59	21.03	20.68	0.0773	0.0855	0.0789
40	PI/2 BPSK	50	56	20.70	20.99	20.76	0.0793	0.0847	0.0804
40	PI/2 BPSK	100	0	20.53	20.92	20.63	0.0762	0.0834	0.0780
40	QPSK	1	1	20.62	21.04	20.75	0.0778	0.0857	0.0802
40	QPSK	1	53	20.56	20.90	20.70	0.0767	0.0830	0.0793
40	QPSK	1	104	20.74	21.00	20.76	0.0800	0.0849	0.0804
40	QPSK	50	0	20.55	20.91	20.72	0.0766	0.0832	0.0796
40	QPSK	50	28	20.62	20.98	20.66	0.0778	0.0845	0.0785
40	QPSK	50	56	20.52	20.90	20.66	0.0760	0.0830	0.0785
40	QPSK	100	0	20.65	20.92	20.77	0.0783	0.0834	0.0805
40	16QAM	1	1	20.59	20.90	20.70	0.0773	0.0830	0.0793
40	64QAM	1	1	20.42	20.59	20.52	0.0743	0.0773	0.0760
40	256QAM	1	1	18.12	18.50	18.23	0.0438	0.0478	0.0449
Channel				637668	641666	645666	EIRP	EIRP	EIRP
Frequency (MHz)				3565.02	3624.99	3684.99			
30	PI/2 BPSK	1	1	20.68	21.08	20.73	0.0789	0.0865	0.0798
Channel				637334	641666	646000	EIRP	EIRP	EIRP
Frequency (MHz)				3560.01	3624.99	3690			
20	PI/2 BPSK	1	1	20.74	21.07	20.81	0.0800	0.0863	0.0813
Channel				637000	641666	646332	EIRP	EIRP	EIRP
Frequency (MHz)				3555	3624.99	3694.98			
10	PI/2 BPSK	1	1	20.75	21.02	20.82	0.0802	0.0853	0.0815



Appendix B. Test Results of Radiated Test

Radiated Spurious Emission

Test Engineer :	Levi zhuo	Temperature :	23~25°C
		Relative Humidity :	41~42%

n48 SA / NR 40MHz / QPSK								
Channel	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Over Limit (dB)	S.G. Power (dBm)	TX Cable loss (dB)	TX Antenna Gain (dBi)	Polarization (H/V)
Middle	7212	-43.60	-40	-3.60	-55.06	2.84	14.30	H
	10818	-41.83	-40	-1.83	-51.77	3.49	13.43	H
	14424	-46.15	-40	-6.15	-56.39	3.85	14.09	H
	7212	-42.18	-40	-2.18	-53.64	2.84	14.30	V
	10818	-42.59	-40	-2.59	-52.53	3.49	13.43	V
	14424	-42.85	-40	-2.85	-53.09	3.85	14.09	V

Remark: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.