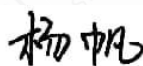


Industrial Internet Innovation Center (Shanghai) Co.,Ltd.**RF TEST REPORT**

PRODUCT	Wireless Display
BRAND	Fellowes
MODEL	LKOUT P
APPLICANT	Fellowes Inc.
FCC ID	IDH-RMTDSPY
ISSUE DATE	February 22, 2024
STANDARD(S)	FCC Part 2, FCC Part 22, FCC Part 24,FCC Part27

Prepared by: *Rui Wu*Reviewed by: *Fan Yang*Approved by: *Min Zhang***CAUTION:**

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CONTENTS

1. SUMMARY OF TEST REPORT	3
1.1 TEST STANDARD (S)	3
1.2 REFERENCE DOCUMENTS.....	3
1.3 SUMMARY OF TEST RESULTS.....	3
1.4 DATA PROVIDED BY APPLICANT.....	5
2. GENERAL INFORMATION OF THE LABORATORY	6
2.1 TESTING LABORATORY	6
2.2 LABORATORY ENVIRONMENTAL REQUIREMENTS.....	6
2.3 PROJECT INFORMATION	6
3. GENERAL INFORMATION OF THE CUSTOMER.....	7
3.1 APPLICANT	7
3.2 MANUFACTURER	7
4. GENERAL INFORMATION OF THE PRODUCT.....	7
4.1 PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT).....	8
4.2 DESCRIPTION FOR AUXILIARY EQUIPMENT (AE)	8
4.3 ADDITIONAL INFORMATION	8
5. TEST CONFIGURATION INFORMATION	9
5.1 LABORATORY ENVIRONMENTAL CONDITIONS.....	9
5.2 TEST EQUIPMENTS UTILIZED.....	9
5.3 MEASUREMENT UNCERTAINTY	10
6. TEST RESULTS	11
6.1 OUTPUT POWER.....	11
6.2 PEAK-TO-AVERAGE POWER RATIO	13
6.3 99% OCCUPIED BANDWIDTH.....	15
6.4 -26dB EMISSION BANDWIDTH.....	18
6.5 BAND EDGE AT ANTENNA TERMINALS	21
6.6 FREQUENCY STABILITY	24
6.7 CONDUCTED SPURIOUS EMISSION.....	27
6.8 EMISSION LIMIT.....	32
ANNEX A: REVISED HISTORY	38
ANNEX B: ACCREDITATION CERTIFICATE.....	39

1. Summary of Test Report

1.1 Test Standard (s)

No.	Test Standard	Title	Version
1	FCC Part 2	FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS	2021-10-01
2	FCC Part 22	PUBLIC MOBILE SERVICES	2022-10-01
3	FCC Part 24	PERSONAL COMMUNICATIONS SERVICES	2022-10-01
4	FCC Part 27	MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES	2022-10-01

Note: FCC Part 2 have not been accredited by A2LA.

1.2 Reference Documents

No.	Test Standard	Title	Version
1	ANSI/TIA-603-E	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards	2016
2	ANSI C63.26	American National Standard of Procedures for Compliance Testing of Licensed Transmitters Used in Licensed Radio	2015
3	KDB 971168 D01	Measurement Guidance for Certification of Licensed Digital Transmitters	v03r01

Note: KDB 971168 D01 have not been accredited by A2LA.

1.3 Summary of Test Results

WCDMA II

Items	Test Name	Clause in FCC rules	Verdict
1	Output Power	2.1046/22.913(a)	Pass
2	Emission Limit	22.917/2.1051	Pass
3	Frequency Stability	22.235/2.1055	Pass
4	Occupied Bandwidth	2.1049	Pass
5	Emission Bandwidth	22.917(b)	Pass
6	Band Edge Compliance	22.917(b)	Pass
7	Conducted Spurious Emission	22.917/2.1057	Pass
8	Peak to Average Power Ratio	22.913(d)	Pass

WCDMA IV

Items	Test Name	Clause in FCC rules	Verdict
1	Output Power	27.50(d)(4)/2.1046	Pass
2	Emission Limit	27.53(h)/ 2.1051	Pass
3	Frequency Stability	27.54/ 2.1055	Pass
4	Occupied Bandwidth	2.1049	Pass
5	Emission Bandwidth	27.53(h)	Pass
6	Band Edge Compliance	27.53(h)	Pass
7	Conducted Spurious Emission	27.53(h)/ 2.1057	Pass
8	Peak to Average Power Ratio	27.50(d)(5)	Pass

WCDMA V

Items	Test Name	Clause in FCC rules	Verdict
1	Output Power	2.1046,24.232(c)	Pass
2	Emission Limit	2.1051,24.238(a)	Pass
3	Frequency Stability	2.1055,24.235	Pass
4	Occupied Bandwidth	2.1049	Pass
5	Emission Bandwidth	24.238(a)	Pass
6	Band Edge Compliance	24.238(a)	Pass
7	Conducted Spurious Emission	2.1057, 24.238(a)	Pass
8	Peak to Average Power Ratio	24.232(d)	Pass

Note:

The LKOUT P, manufactured by Fellowes Inc. is a new product for testing.

Industrial Internet Innovation Center (Shanghai) Co., Ltd. only performed test cases which identified with Pass/Fail/Inc result in section 1.3.

Industrial Internet Innovation Center (Shanghai) Co., Ltd. has verified that the compliance of the tested device specified in section 4 of this test report is successfully evaluated according to the procedure and test methods as defined in type certification requirement listed in section 1 of this test report.

1.4 Data Provided by Applicant

No.	Item(s)	Data
1	WCDMA Band 2	2
2	WCDMA Band 4	2
3	WCDMA Band 5	2

Note: The data of antenna gain is provided by Antenna specification may affect the validity of the test results in this report, and the impact and consequences of this shall be undertaken by the customer.

2. General Information of The Laboratory

2.1 Testing Laboratory

Lab Name	Industrial Internet Innovation Center (Shanghai) Co.,Ltd.
Address	Building 4, No. 766, Jingang Road, Pudong, Shanghai, China
Telephone	021-68866880
FCC Registration No.	708870
FCC Designation No.	CN1364

2.2 Laboratory Environmental Requirements

Temperature	15°C~35°C
Relative Humidity	25%RH~75%RH
Atmospheric Pressure	86kPa~106kPa

2.3 Project Information

Project Manager	Xu Yuting
Test Date	December 05, 2023 to December 28, 2023

3. General Information of The Customer

3.1 Applicant

Company	Fellowes Inc.
Address	1789 Norwood Avenue Itasca, Illinois 60143-1095, USA
Telephone	+16306715102

3.2 Manufacturer

Company	Fellowes Business Machines (Suzhou) Co., Ltd.
Address	No.1 shilin Road,Suzhou NewDistrict,Jiangsu,215151,People's Republic of China
Telephone	N/A

3.3 Factory

Company	Fellowes Office Products(Suzhou) Co., Ltd.
Address	No.1 shilin Road,Suzhou NewDistrict,Jiangsu,215151,People's Republic of China
Telephone	N/A

4. General Information of The Product

4.1 Product Description for Equipment under Test (EUT)

Product	Wireless Display
Model	LKOUT P
Date of Receipt	S01/S02:October 25,2023
EUT ID*	S01/S02
SN/IMEI	/
Supported Radio Technology and Bands	WCDMA Band II/IV/V LTE Band 2/4/5/12/13/14/66/71 802.11b/g/n 802.11a/n/ac BLE 4.2 and Bluetooth V2.1 + EDR
Hardware Version	V2.0
Software Version	11.0.1_#7210_10.1_2168A1-V2.0
FCC ID	IDH-RMTDSPY
NOTE1: EUT ID is the internal identification code of the laboratory. NOTE2: Samples in the test report are provided by the customer. The test results are only applicable to the samples received by the laboratory.	

4.2 Description for Auxiliary Equipment (AE)

AE ID*	Description	Model	SN/Remark
AE1	RF Cable	N/A	N/A
NOTE: AE ID is the internal identification code of the laboratory.			

4.3 Additional Information

Type of modulation	QPSK/16QAM
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5. Test Configuration Information

5.1 Laboratory Environmental Conditions

5.1.1 Permanent Facilities

Relative Humidity	Min. = 45%, Max. = 55 %		
Atmospheric Pressure	101kPa		
Temperature	Normal	Minimum	Maximum
	25°C	-30°C	50°C
Working Voltage of EUT	Normal	Minimum	Maximum
	100-240V	90V	264V

5.2 Test Equipments Utilized

Conduction test system

No.	Name	Model	S/N	SW Version	HW Version	Manufacturer	Cal. Date	Cal. Interval
1	Software	Eagle V3.3	N/A	V3.3	N/A	3IN	N/A	N/A
2	Frequency spectrum analyzer	FSQ	101091	V4.75	V11.00	R&S	2023-07-26	1 Year
3	Wideband Radio Communication Tester	CMW 500	148874	V3.5.136	N/A	R&S	2023-07-27	1 Year
4	Temperature Chamber	B-TF-107C	201804107	N/A	N/A	BoYi	2023-06-28	1 Year
5	Programmable power supply	Keithley 2303	4039070	N/A	N/A	Keithley	2023-06-23	1 Year
6	RF Test Automation Box	RF 2021B	2001	V3.3	N/A	RANATEC	N/A	N/A

Radiated emission test system

NO	Name	Model	S/N	SW Version	HW Version	Manufacturer	Cal. Date	Cal. Interval
1	Universal Radio Communication Tester	CMU200	123126	V5.2.1	B12	R&S	2023-10-16	1 Year
2	Universal Radio Communication Tester	CMW500	104178	V3.7.20	1206.0600.00	R&S	2023-10-16	1 Year

3	EMI Test Receiver	ESU40	100307	V5.1-24-3	01	R&S	2022-12-29	1 Year
							2023-12-19	
4	TRILOG Broadband Antenna	VULB9163	01345	N/A	N/A	Schwarzbeck	2023-03-23	1 Year
5	Double- ridged Waveguide Antenna	ETS-3117	00135890	N/A	N/A	ETS	2022-03-09	2 Years
6	EMI Test Software	EMC32 V10.35.02	N/A	N/A	N/A	R&S	N/A	N/A

Anechoic chamber

Fully anechoic chamber by ETS.

5.3 Measurement Uncertainty

Measurement uncertainty for all the testing in this report are within the limit specified in 3IN documents.

The detailed measurement uncertainty is defined in 3IN documents.

Measurement Uncertainty of Radiation test

Frequency Range	Uncertainty(dB)
$30\text{MHz} \leq f \leq 1\text{GHz}$	± 5.10
$1\text{GHz} \leq f \leq 18\text{GHz}$	± 5.66
$18\text{GHz} \leq f \leq 40\text{GHz}$	± 5.22

Measurement Uncertainty of Conduction test

No	Item	Extended uncertainty (k=2)	
1	Frequency Tolerance	23Hz	
2	RF Output Power	0.7dB	
3	conducted spurious	9kHz~3.6GHz	1.5dB
		3.6GHz~8.4GHz	2.8dB
		8.4GHz~12.75GHz	3.4dB
4	EVM	2.1%	
5	Occupied Bandwidth	Bandwidth 1.4MHz	0.03MHz
		Bandwidth 3MHz	0.03MHz
		Bandwidth 5MHz	0.03MHz
		Bandwidth 10MHz	0.05MHz
		Bandwidth 15MHz	0.06MHz
		Bandwidth 20MHz	0.08MHz
6	Emission intermodulation	Adjacent channel	1.4dB
		Alternate channel	1.4dB
7	Range of frequency	0.08MHz	

6. Test Results

6.1 Output Power

Reference

CFR part 2.1046/22.913(a) / 24.232(c)/27.50(d)(4)

6.1.1 Summary

22.913(a) Mobile stations are limited to 7watts.

24.232(c) Mobile and portable stations are limited to 2 watts.

27.50d(4) Fixed, mobile, and portable (hand-held) stations operating in the 1710-1755 MHz band and mobile and portable stations operating in the 1695-1710 MHz and 1755-1780 MHz bands are limited to 1 watt EIRP.

6.1.2 Method of Measurements

Method of measurements please refer to KDB971168 D01 v03 clause 5.

The EUT was set up for the max output power with pseudo random data modulation.

The power was measured with Rhode & Schwarz Spectrum Analyzer FSQ(peak).

These measurements were done at 3 frequencies, 1852.4 MHz, 1880.0MHz and 1907.6MHz for WCDMA Band II; 1732.6 MHz, 1712.4MHz and 1752.6MHz for WCDMA Band IV; 826.4MHz, 836.6MHz and 846.6MHz for WCDMA Band V. (bottom, middle and top of operational frequency range).

During the process of testing, the EUT was controlled Rhode & Schwarz Digital Radio.

Communication tester to ensure max power transmission and proper modulation.

This result contains peak output power and EIRP measurements for the EUT. In all cases, output power is within the specified limits.

6.1.3 Test procedures

The transmitter output port was connected to base station.

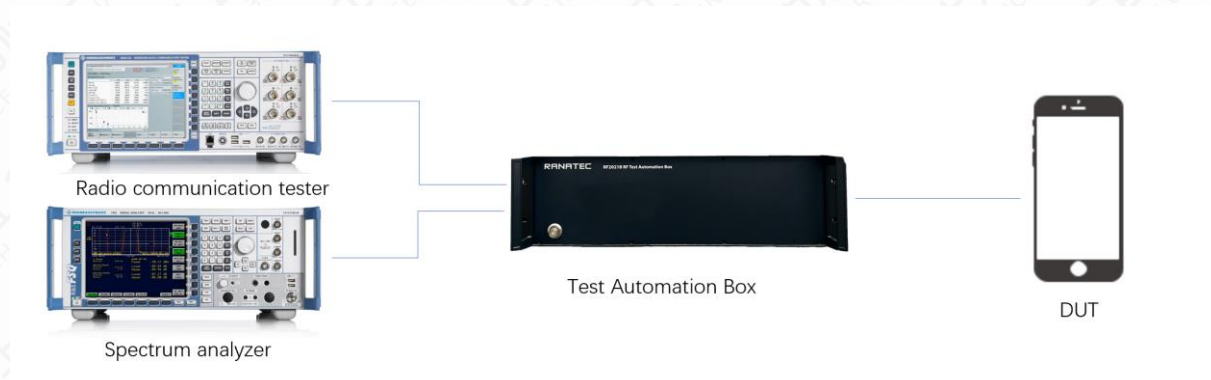
Set the EUT at maximum power through base station.

Select lowest, middle, and highest channels for each band and different modulation.

Measure maximum average power for other modulation signal.

The transmitter output power was connected to calibrated attenuator, the other end of which was connected to signal analyzer. Transmitter output power was read off the power in dBm. The power outputs at the transmitter antenna port was determined by adding the value of attenuator to the signal analyzer reading.

6.1.4 Test Setup



6.1.6 Output Power Measurement results

Mode	Test Mode	Tune up	Channel/Frequency(MHz)		
			9262/1852.4	9400/1880	9538/1907.6
WCDMA II	RMC	23.50	13.52	13.57	13.41
Mode	Test Mode	Tune up	Channel/Frequency(MHz)		
			1312/1712.4	1413/1732.6	1513/1752.6
WCDMA IV	RMC	23.50	12.95	13.95	13.02
Mode	Test Mode	Tune up	Channel/Frequency(MHz)		
			4132/826.4	4183/836.6	4233/846.6
WCDMA V	RMC	24.50	16.98	17.29	17.21

6.1.7 EIRP/ERP

WCDMA Band 2

Frequency (MHz)	Peak EIRP (dBm)
1852.6	15.52
1880.0	15.57
1907.4	15.41

WCDMA Band 4

Frequency(MHz)	Peak EIRP(dBm)
1712.4	14.49
1732.6	15.95
1752.6	15.02

WCDMA Band 5

Frequency(MHz)	Peak EIRP (dBm)	Peak ERP (dBm)
826.4	18.98	16.83
836.6	19.29	17.14
846.6	19.21	17.06

6.2 Peak-to-Average Power Ratio

Reference

CFR Part 22.913(d)/24.232(d)/27.50

6.2.1 Summary

CFR Part 22.913(d)/24.232(d)/27.50: The peak-to-average ratio (PAR) of the transmission must not exceed 13 dB

6.2.2 Method of Measurement

The EUT was connected to the spectrum analyzer and system simulator via a power divider.

Select the spectrum analyzer CCDF function.

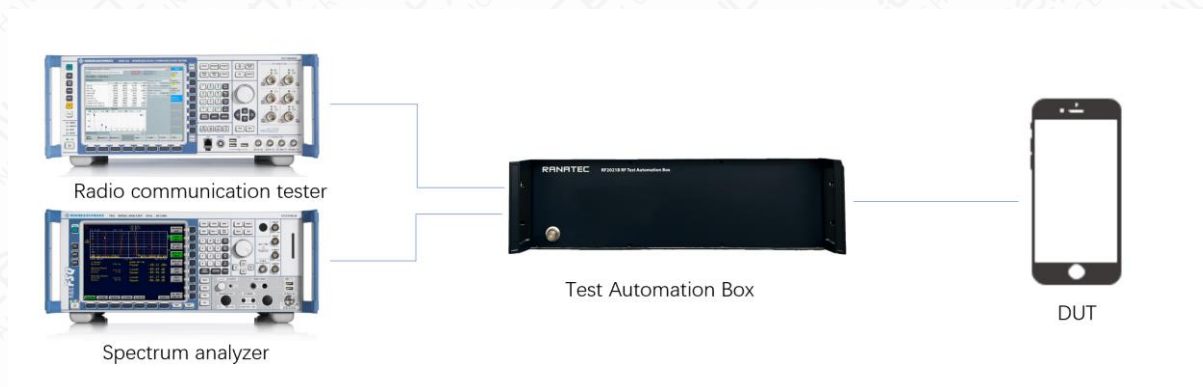
Set RBW $\geq$ signal's occupied bandwidth.

Set the number of counts to a value that stabilizes the measured CCDF curve;

Sweep time $\geq$ 1s.

Record the maximum PAPR level associated with a probability of 0.1%.

6.2.3 Test Setup



6.2.4 Measurement results

Band	Channel/fc	PAPR	Limit
WCDMA II	9263	2.79	13
WCDMA II	9400	2.85	13
WCDMA II	9537	2.79	13
Band	Channel/fc	PAPR	Limit
WCDMA IV	1313	2.85	13
WCDMA IV	1450	2.72	13
WCDMA IV	1512	2.82	13

Band	Channel/fc	PAPR	Limit
WCDMA V	4133	2.95	13
WCDMA V	4175	2.98	13
WCDMA V	4232	2.88	13

6.3 99% Occupied Bandwidth

Reference

CFR Part 2.1049

6.3.1 Summary

Similar to conducted emissions; occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the extreme and mid frequencies of WCDMA BAND II , WCDMA BAND IV and WCDMA BAND V.

6.3.2 Method of Measurement

The EUT output RF connector was connected with a short cable to the signal analyzer.

RBW was set to about 1% of emission BW, VBW $\geq$ 3 times RBW,.

99% bandwidth were measured, the occupied bandwidth is delta frequency between the two points where the display line intersects the signal trace.

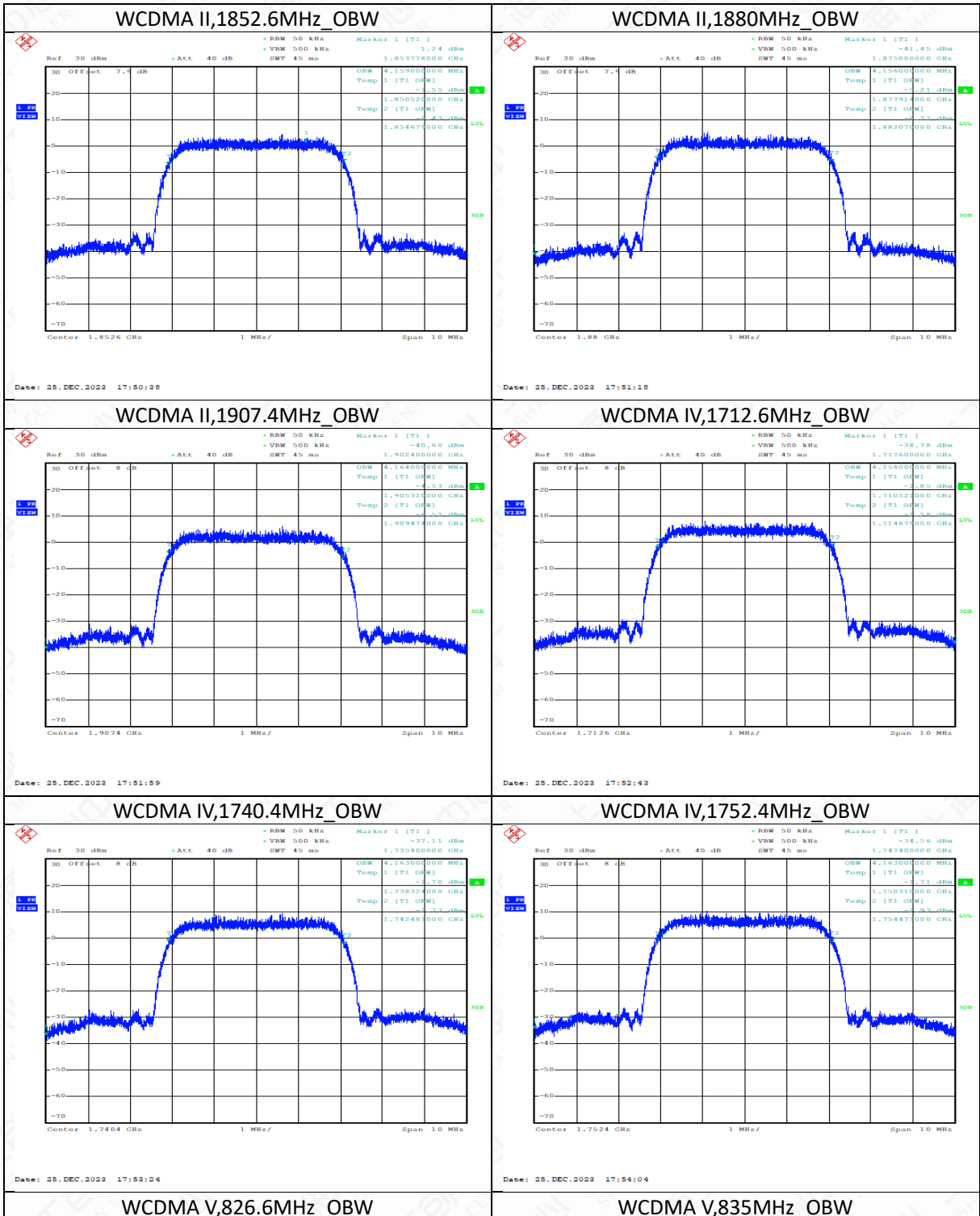
6.3.3 Test Setup

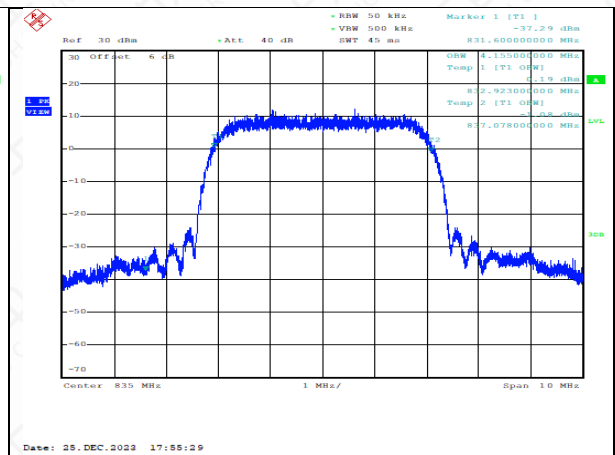
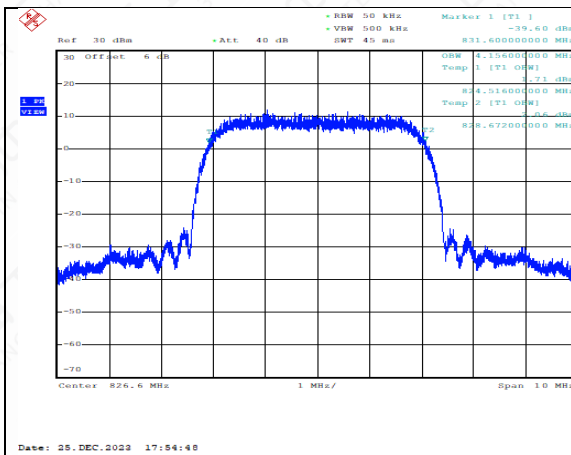


6.3.4 Measurement results

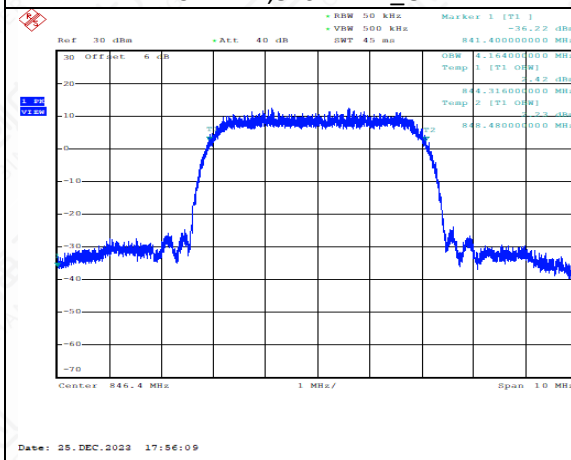
Band	Channel	99%Occupied Width(kHz)
WCDMA II	9263	4159.00 kHz
WCDMA II	9400	4156.00 kHz
WCDMA II	9537	4164.00 kHz
Band	Channel	99%Occupied Width(kHz)
WCDMA IV	1313	4158.00 kHz
WCDMA IV	1450	4163.00 kHz
WCDMA IV	1512	4163.00 kHz
Band	Channel	99%Occupied Width(kHz)
WCDMA V	4133	4156.00 kHz
WCDMA V	4175	4155.00 kHz

WCDMA V	4232	4164.00 kHz
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WCDMA V,846.4MHz_OBW



6.4 -26dB Emission Bandwidth

Reference

CFR Part 2.1049/22.917/24.238(a) /27.53(h)

6.4.1 Summary

Similar to conducted emissions; occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the extreme and mid frequencies of WCDMA BANDII, WCDMA BANDIV, WCDMA BANDV.

6.4.2 Method of Measurement

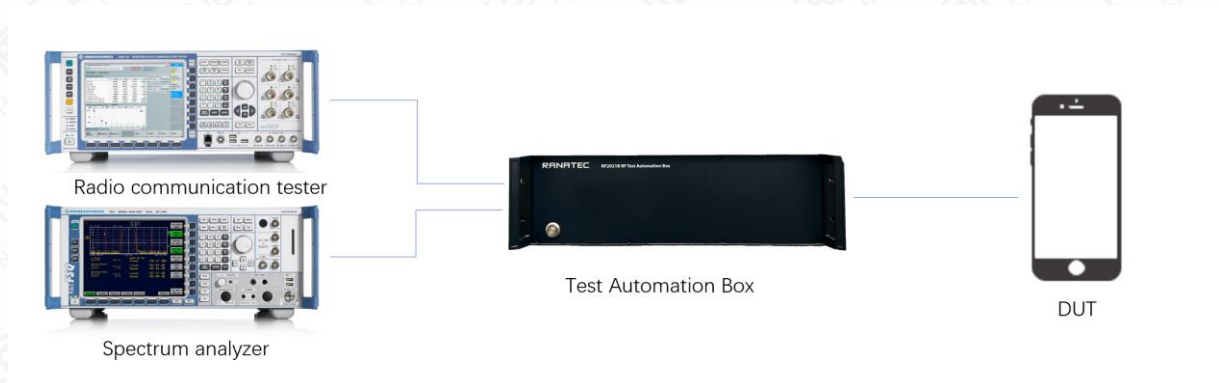
The EUT output RF connector was connected with a short cable to the signal analyzer.

RBW was set to about 1% of emission BW, VBW $\geq$ 3 times RBW,.

26dB bandwidth were measured, the occupied bandwidth is delta frequency between the two points where the display line intersects the signal trace.

For WCDMA: signal analyzer setting as: RBW=50KHz; VBW=200KHz; Span=10MHz.

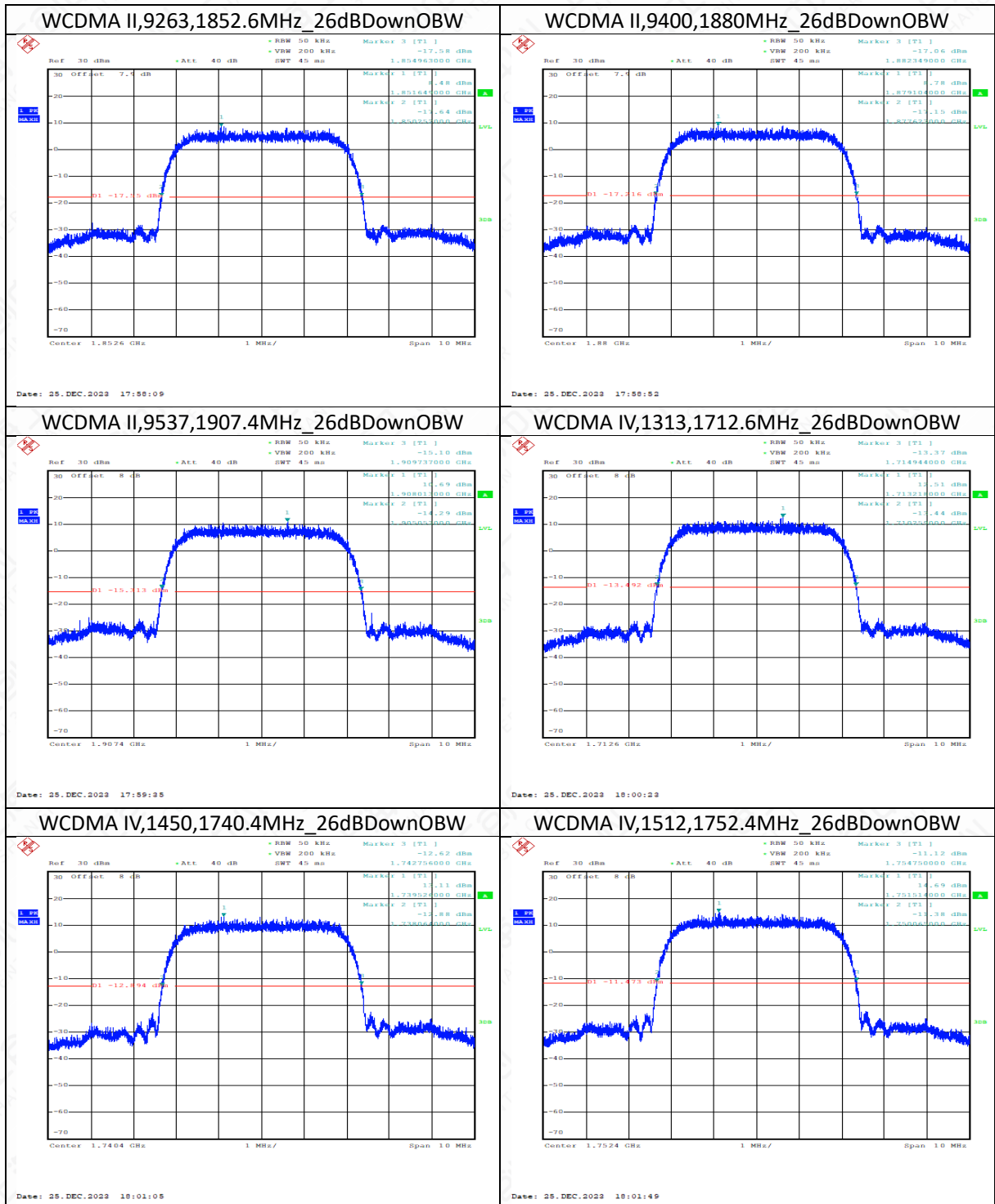
6.4.3 Test Setup

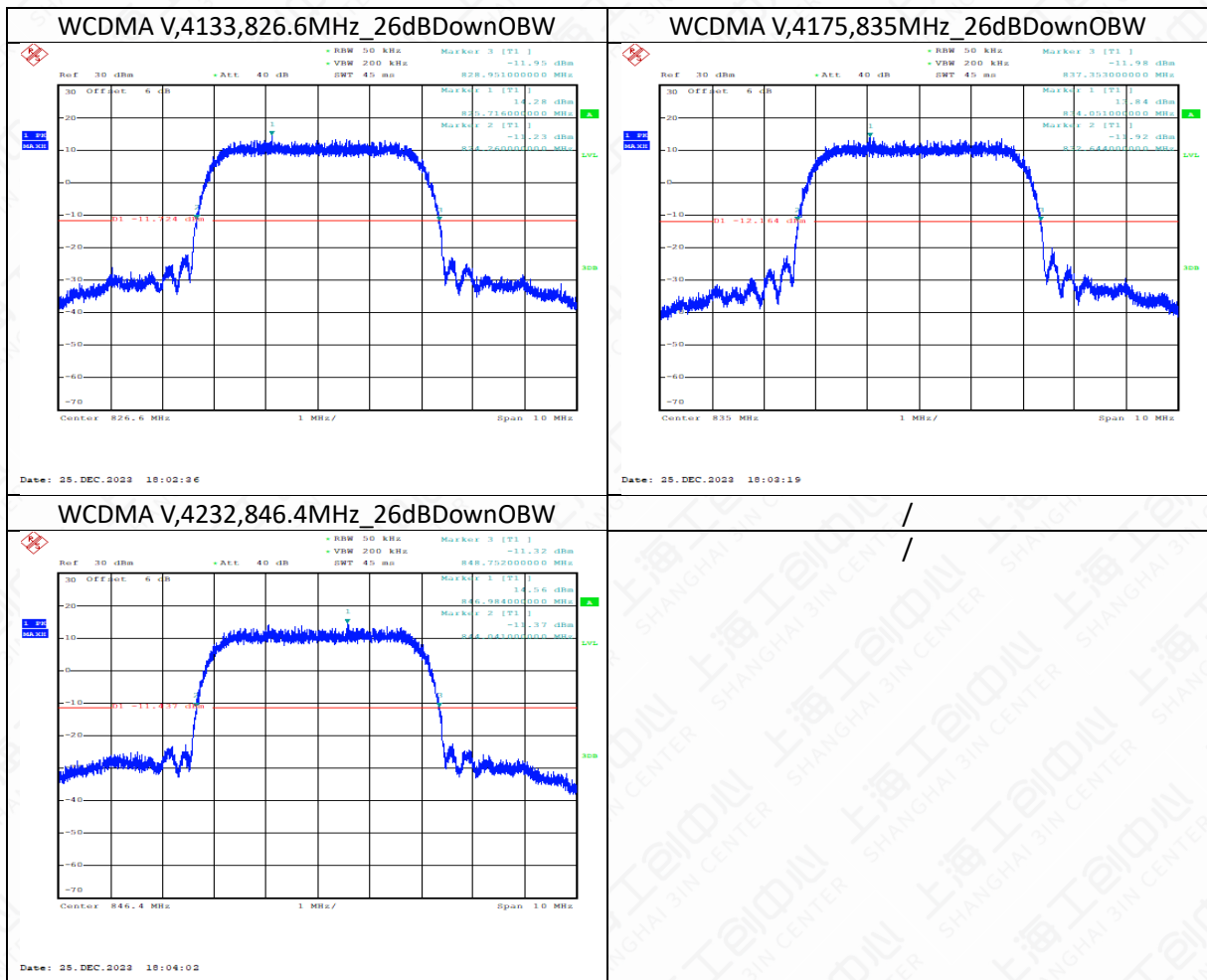


6.4.4 Measurement results

Band	Channel	26dBDown OccupiedWidth(kHz)
WCDMA II	9263	4711.00 kHz
WCDMA II	9400	4726.00 kHz
WCDMA II	9537	4684.00 kHz
Band	Channel	26dBDown OccupiedWidth(kHz)
WCDMA IV	1313	4685.00 kHz
WCDMA IV	1450	4692.00 kHz
WCDMA IV	1512	4685.00 kHz
Band	Channel	26dBDown OccupiedWidth(kHz)

WCDMA V	4133	4691.00 kHz
WCDMA V	4175	4709.00 kHz
WCDMA V	4232	4711.00 kHz





6.5 Band Edge at antenna terminals

Reference

CFR Part 22.917/24.238(a) /27.53(h)

6.5.1 Summary

22.917(a):The rules in this section govern the spectral characteristics of emissions in the Cellular Radiotelephone Service.

(a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

24.238(a): Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

27.53(h):

AWS emission limits —

(1) General protection levels. Except as otherwise specified below, for operations in the 1695–1710 MHz, 1710–1755 MHz, 1755–1780 MHz, 1915–1920 MHz, 1995–2000 MHz, 2000–2020 MHz, 2110–2155 MHz, 2155–2180 MHz, and 2180–2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}(P)$ dB.

(2) Additional protection levels. Notwithstanding the foregoing paragraph (h)(1) of this section:

(i) Operations in the 2180–2200 MHz band are subject to the out-of-band emission requirements set forth in § 27.1134 for the protection of federal government operations operating in the 2200–2290 MHz band.

(ii) For operations in the 2000–2020 MHz band, the power of any emissions below 2000 MHz shall be attenuated below the transmitter power (P) in watts by at least $70 + 10 \log_{10}(P)$ dB.

(iii) For operations in the 1915–1920 MHz band, the power of any emission between 1930–1995 MHz shall be attenuated below the transmitter power (P) in watts by at least $70 + 10 \log_{10}(P)$ dB.

(iv) For operations in the 1995–2000 MHz band, the power of any emission between 2005–2020 MHz shall be attenuated below the transmitter power (P) in watts by at least $70 + 10 \log_{10}(P)$ dB.

6.5.2 Method of Measurement

The RF output of the transceiver was connected to a signal analyzer through appropriate attenuation.

In the 1MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

The RF fundamental frequency should be excluded against the limit line in the operating frequency band

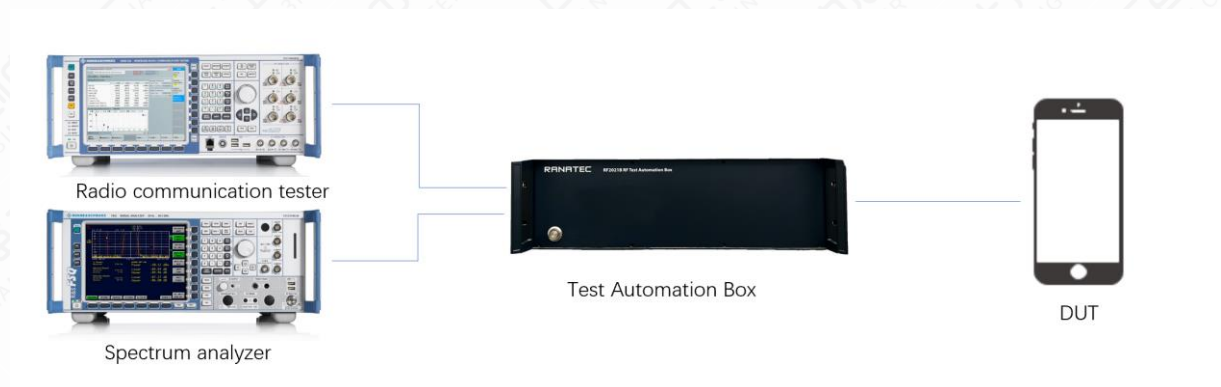
The limit line is derived from $43+10\log(P)$ Db below the transmitter power P(Watts)

$$=P(W)-[43+10\log(P)](Db)$$

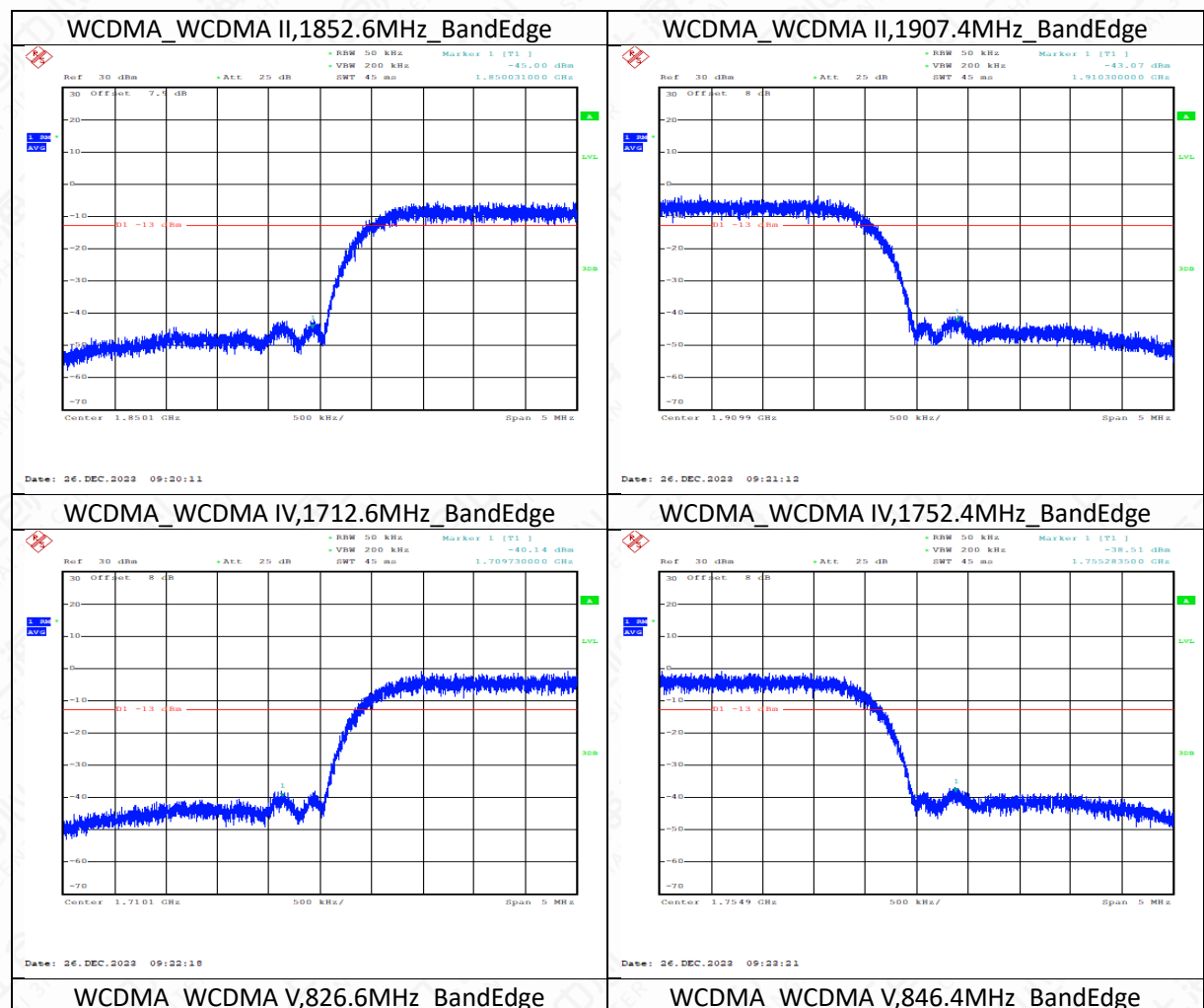
$$=[30+10\log(P)](dBm)-[43+10\log(P)](dB)$$

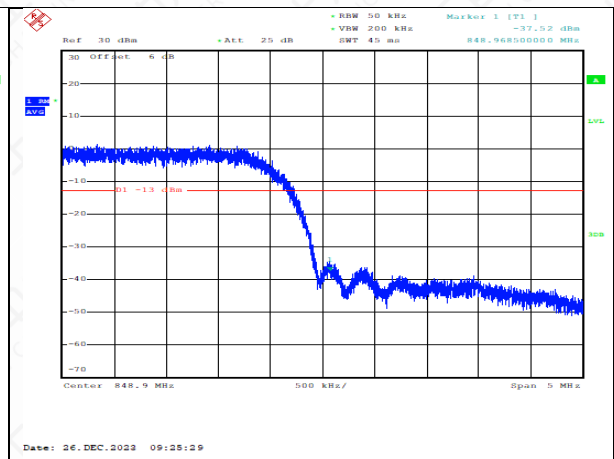
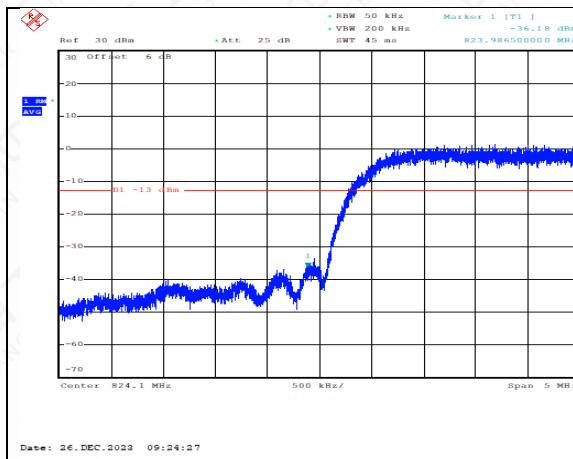
$$=-13dBm$$

6.5.4 Test Setup



6.5.5 Measurement Result:





6.6 Frequency Stability

Reference

CFR Part 2.1055/22.235/24.235/27.54

6.6.1 Summary

According to the JTC standard the frequency stability of the carrier shall be accurate to within 0.1 ppm of the received frequency from the base station. This accuracy is sufficient to meet Sec. 24.235, Frequency Stability. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. As this transceiver is considered "Hand carried, battery powered equipment" Section 2.1055(d) (2) applies. This requires that the lower voltage for frequency stability testing be specified by the manufacturer. This transceiver is specified to operate with an input voltage of between 6.0VDC and 8.8VDC, with a nominal voltage of 7.7VDC. Operation above or below these voltage limits is prohibited by transceiver software in order to prevent improper operation as well as to protect components from overstress. For the purposes of measuring frequency stability these voltage limits are to be used.

6.6.2 Method of Measurement

In order to measure the carrier frequency under the condition of AFC lock, it is necessary to make measurements with the EUT in a "call mode". This is accomplished with the use of R&S CMW500 DIGITAL RADIO COMMUNICATION TESTER.

1. Measure the carrier frequency at room temperature.
2. Subject the EUT to overnight soak at -30°C.
3. With the EUT, powered via nominal voltage, connected to the CMW500 and in a simulated call on mid channel of WCDMA BANDII, WCDMA BANDIV and WCDMA BANDV, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.
4. Repeat the above measurements at 10°C increments from -30°C to +50°C. Allow at least 1 1/2 hours at each temperature, unpowered, before making measurements.
5. Re-measure carrier frequency at room temperature with nominal voltage. Vary supply voltage from minimum voltage to maximum voltage, in 0.1Volt increments re-measuring carrier frequency at each voltage. Pause at nominal voltage for 1 1/2 hours unpowered, to allow any self-heating to stabilize, before continuing.
6. Subject the EUT to overnight soak at +50°C.
7. With the EUT, powered via nominal voltage, connected to the CMU200 and in a simulated call on the centre channel, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.
8. Repeat the above measurements at 10 C increments from +50°C to -30°C. Allow at least 1.5 hours at each temperature, unpowered, before making measurements.
9. At all temperature levels hold the temperature to +/- 0.5°C during the measurement procedure.

6.6.4 Test Setup



6.6.5 Test results

Band	Channel	Temperature	Voltage	Frequency Error(Hz)	Frequency Error(ppm)
WCDMA II	9400	Normal	Low	-2.539	0.001
WCDMA II	9400	Normal	Normal	-0.114	0
WCDMA II	9400	Normal	High	-2.661	0.001
WCDMA II	9400	50	Normal	-5.393	0.003
WCDMA II	9400	40	Normal	-2.818	0.001
WCDMA II	9400	30	Normal	-6.523	0.003
WCDMA II	9400	20	Normal	-1.738	0.001
WCDMA II	9400	10	Normal	-2.439	0.001
WCDMA II	9400	0	Normal	-0.83	0
WCDMA II	9400	-10	Normal	-3.383	0.002
WCDMA II	9400	-20	Normal	-4.549	0.002
WCDMA II	9400	-30	Normal	-1.86	0.001
Band	Channel	Temperature	Voltage	Frequency Error(Hz)	Frequency Error(ppm)
WCDMA IV	1450	Normal	Low	-3.154	0.002
WCDMA IV	1450	Normal	Normal	-7.045	0.004
WCDMA IV	1450	Normal	High	-6.638	0.004
WCDMA IV	1450	50	Normal	-2.003	0.001
WCDMA IV	1450	40	Normal	-8.461	0.005
WCDMA IV	1450	30	Normal	-6.073	0.003

WCDMA IV	1450	20	Normal	-6.373	0.004
WCDMA IV	1450	10	Normal	-8.204	0.005
WCDMA IV	1450	0	Normal	-4.499	0.003
WCDMA IV	1450	-10	Normal	-4.056	0.002
WCDMA IV	1450	-20	Normal	-6.187	0.004
WCDMA IV	1450	-30	Normal	-7.002	0.004
Band	Channel	Temperature	Voltage	Frequency Error(Hz)	Frequency Error(ppm)
WCDMA V	4175	Normal	Low	0.937	0.001
WCDMA V	4175	Normal	Normal	-0.958	0.001
WCDMA V	4175	Normal	High	-0.401	0
WCDMA V	4175	50	Normal	-1.03	0.001
WCDMA V	4175	40	Normal	0.129	0
WCDMA V	4175	30	Normal	0.594	0.001
WCDMA V	4175	20	Normal	-1.659	0.002
WCDMA V	4175	10	Normal	0.679	0.001
WCDMA V	4175	0	Normal	-0.165	0
WCDMA V	4175	-10	Normal	-0.687	0.001
WCDMA V	4175	-20	Normal	-0.086	0
WCDMA V	4175	-30	Normal	-0.587	0.001

6.7 Conducted Spurious Emission

Reference

CFR Part 2.1057 /22.917/24.238(a) /27.53(h)

6.7.1 Summary

22.917(a):The rules in this section govern the spectral characteristics of emissions in the Cellular Radiotelephone Service.

(a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

24.238(a): Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

27.53(h):

AWS emission limits —

(1) General protection levels. Except as otherwise specified below, for operations in the 1695–1710 MHz, 1710–1755 MHz, 1755–1780 MHz, 1915–1920 MHz, 1995–2000 MHz, 2000–2020 MHz, 2110–2155 MHz, 2155–2180 MHz, and 2180–2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}(P)$ dB.

(2) Additional protection levels. Notwithstanding the foregoing paragraph (h)(1) of this section:

(i) Operations in the 2180–2200 MHz band are subject to the out-of-band emission requirements set forth in § 27.1134 for the protection of federal government operations operating in the 2200–2290 MHz band.

(ii) For operations in the 2000–2020 MHz band, the power of any emissions below 2000 MHz shall be attenuated below the transmitter power (P) in watts by at least $70 + 10 \log_{10}(P)$ dB.

(iii) For operations in the 1915–1920 MHz band, the power of any emission between 1930–1995 MHz shall be attenuated below the transmitter power (P) in watts by at least $70 + 10 \log_{10}(P)$ dB.

(iv) For operations in the 1995–2000 MHz band, the power of any emission between 2005–2020 MHz shall be attenuated below the transmitter power (P) in watts by at least $70 + 10 \log_{10}(P)$ dB.

6.7.2 Method of Measurement

The following steps outline the procedure used to measure the conducted emissions from the EUT.

1. Determine frequency range for measurements: From CFR 2.1057 the spectrum should be investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency. For the equipment of WCDMA Band II and WCDMA BANDIV, these equate to a frequency range of 30 MHz to 19.1 GHz, data taken from 30 MHz to 20 GHz. For WCDMA Band V, data taken from 30 MHz to 10GHz.

2. The sweep time is set automatically by instrument itself. That should be the optimal sweep time for the span and the RBW. If the sweep time is too short, that is sweep is too fast, the sweep result is not accurate; If the sweep time is too long, that is sweep is too low, some frequency components may be lost. The instrument will give a optimal sweep time according the selected span and RBW.

3. The procedure to get the conducted spurious emission is as follows:

The trace mode is set to MaxHold to get the highest signal at each frequency;

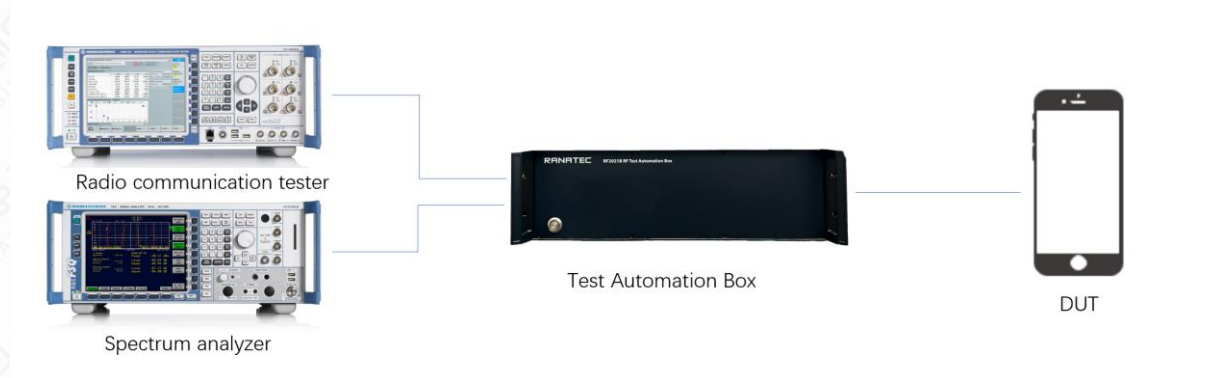
Wait 25 seconds;

Get the result.

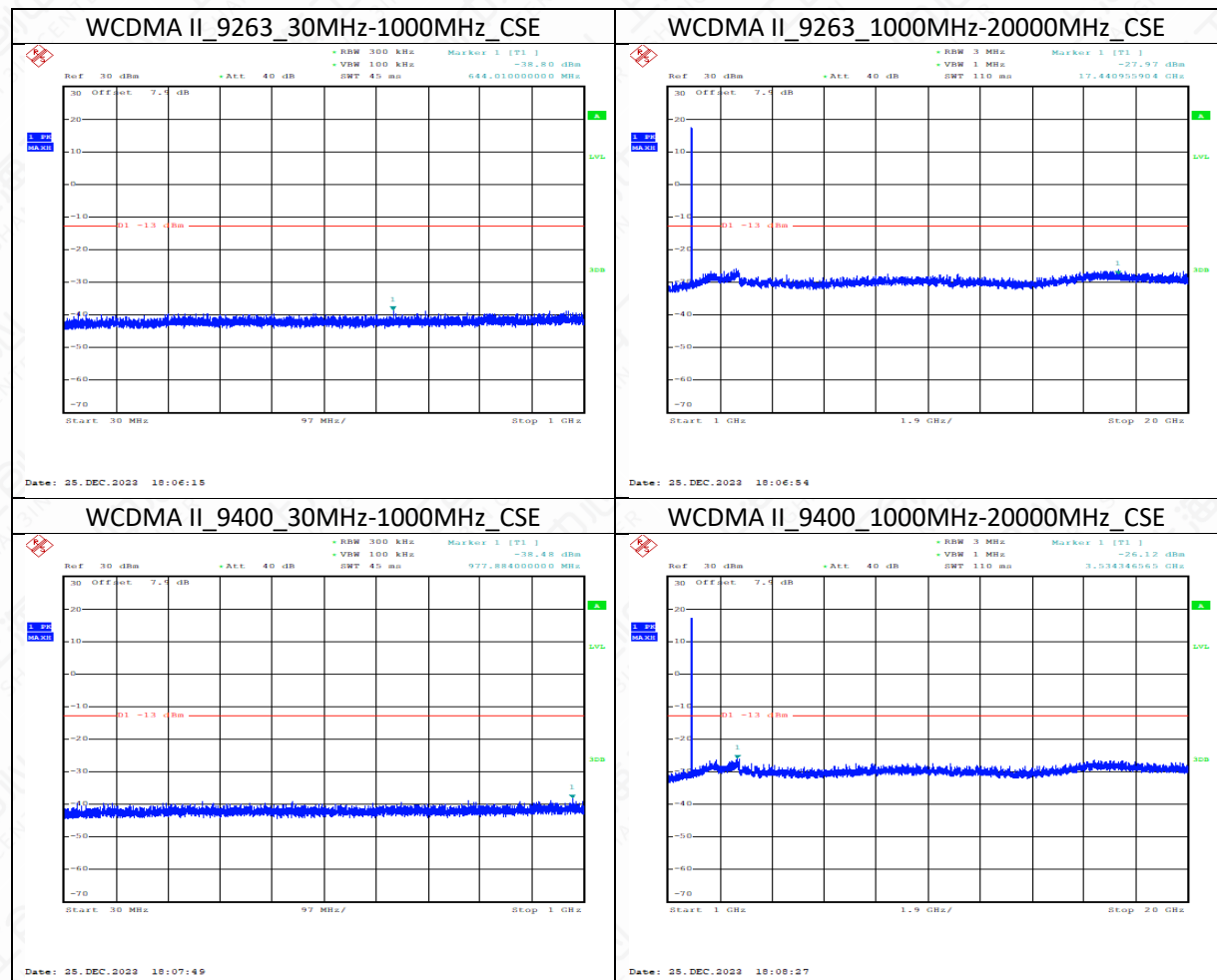
4. Determine EUT transmit frequencies: below outlines the band edge frequencies pertinent to

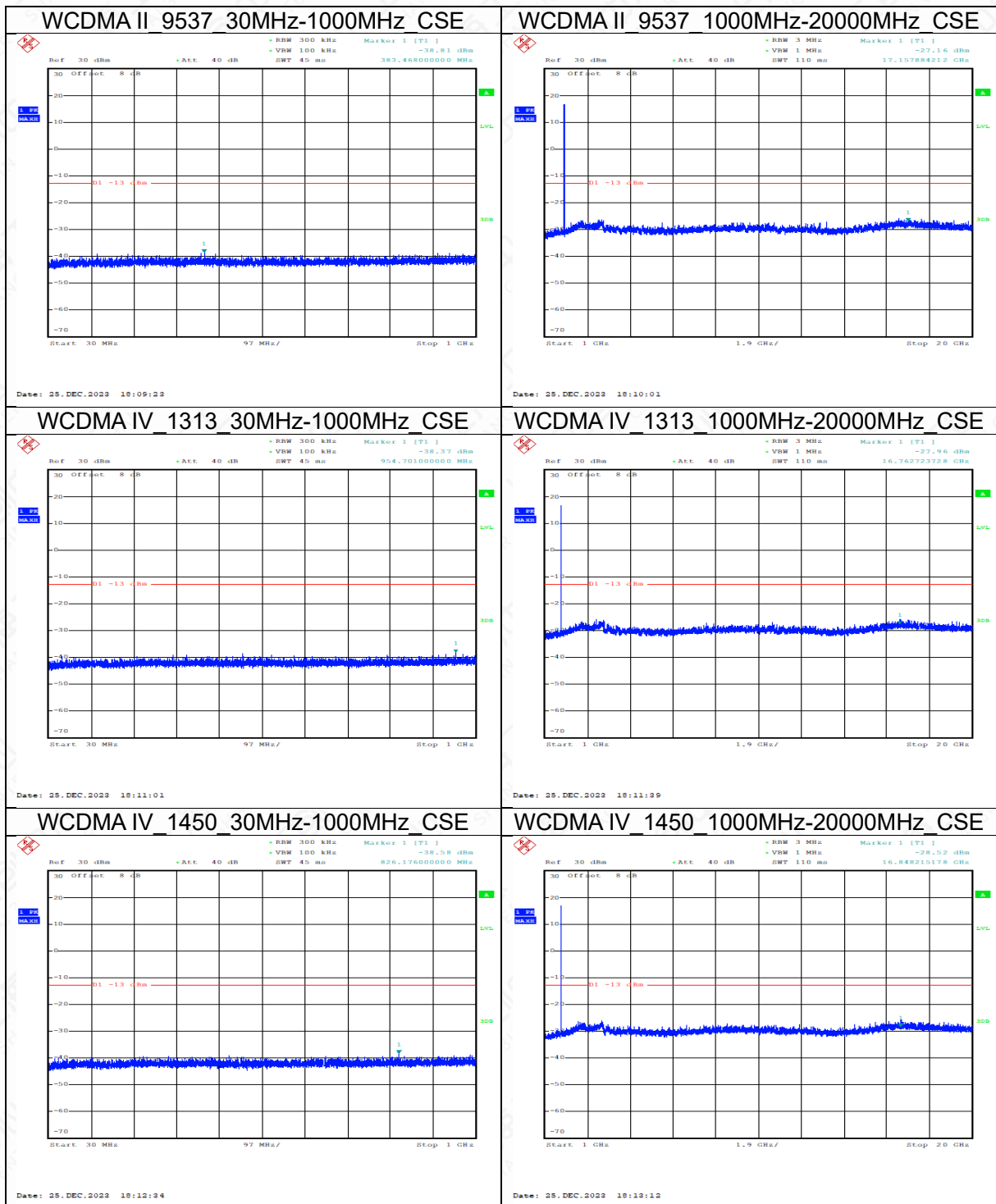
conducted emissions testing.

6.7.3 Test Setup

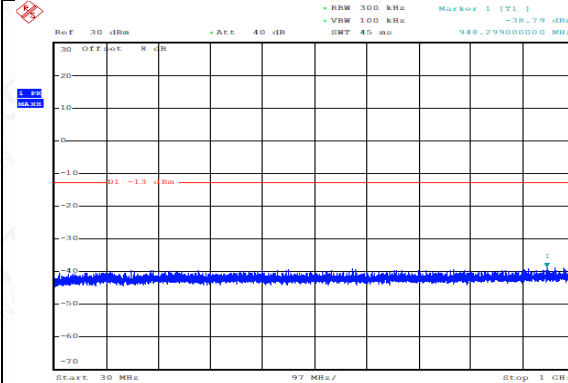


6.7.4 Measurement Limit



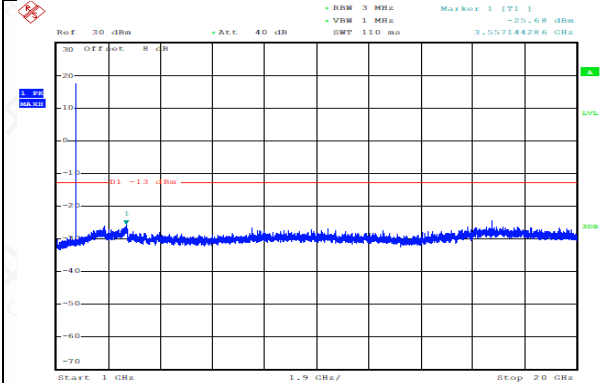


WCDMA IV 1512 30MHz-1000MHz CSE



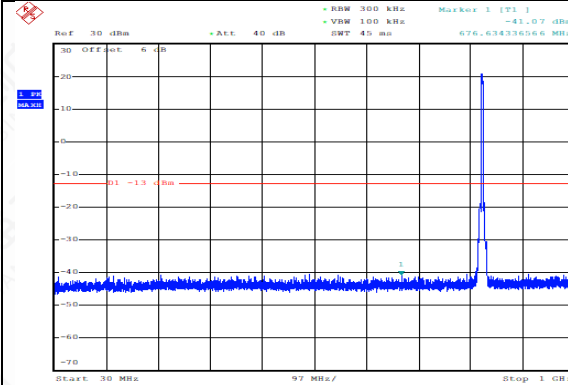
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WCDMA IV 1512 1000MHz-20000MHz CSE



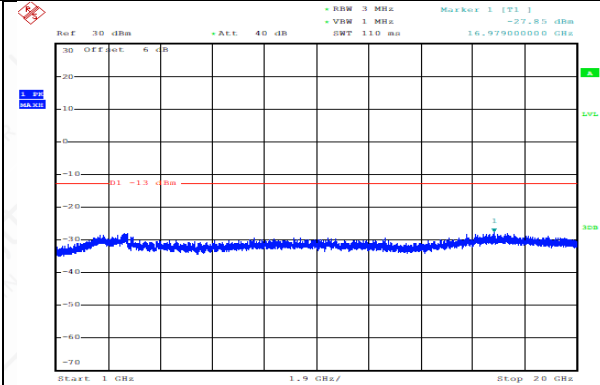
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WCDMA V 4133 30MHz-1000MHz CSE



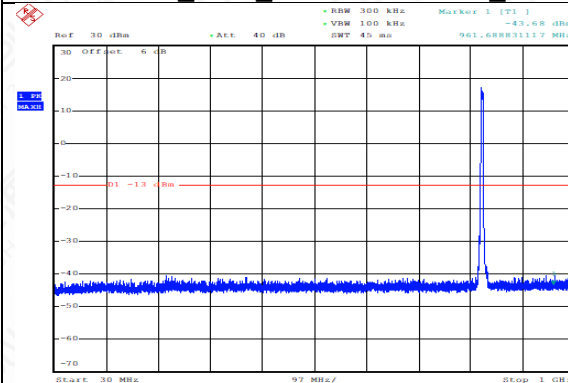
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WCDMA V 4133 1000MHz-20000MHz CSE



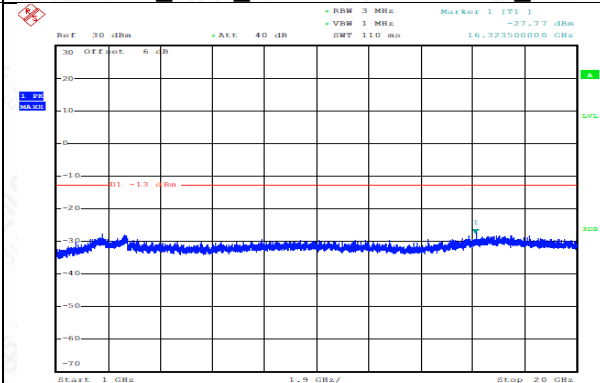
Date: 11.DEC.2022 13:56:31

WCDMA V 4175 30MHz-1000MHz CSE

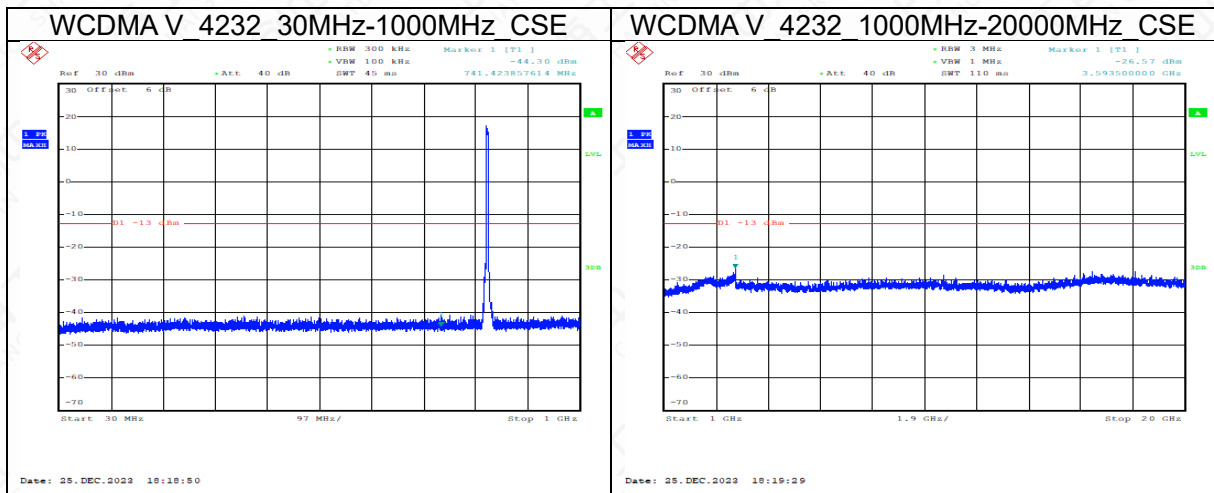


Date: 25.DEC.2022 10:17:16

WCDMA V 4175 1000MHz-20000MHz CSE



Date: 25.DEC.2022 10:17:55



6.8 Emission Limit

Reference

CFR Part 2.1057 /22.917/24.238(a) /27.53(h)

6.8.1 Summary

After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least $43 + 10 \log_{10} p$ (watts) dB.

Limit -13 dBm

22.917(a): The rules in this section govern the spectral characteristics of emissions in the Cellular Radiotelephone Service.

(a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

24.238(a): Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

27.53(h):

AWS emission limits —

(1) General protection levels. Except as otherwise specified below, for operations in the 1695–1710 MHz, 1710–1755 MHz, 1755–1780 MHz, 1915–1920 MHz, 1995–2000 MHz, 2000–2020 MHz, 2110–2155 MHz, 2155–2180 MHz, and 2180–2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}(P)$ dB.

(2) Additional protection levels. Notwithstanding the foregoing paragraph (h)(1) of this section:

(i) Operations in the 2180–2200 MHz band are subject to the out-of-band emission requirements set forth in § 27.1134 for the protection of federal government operations operating in the 2200–2290 MHz band.

(ii) For operations in the 2000–2020 MHz band, the power of any emissions below 2000 MHz shall be attenuated below the transmitter power (P) in watts by at least $70 + 10 \log_{10}(P)$ dB.

(iii) For operations in the 1915–1920 MHz band, the power of any emission between 1930–1995 MHz shall be attenuated below the transmitter power (P) in watts by at least $70 + 10 \log_{10}(P)$ dB.

(iv) For operations in the 1995–2000 MHz band, the power of any emission between 2005–2020 MHz shall be attenuated below the transmitter power (P) in watts by at least $70 + 10 \log_{10}(P)$ dB.

6.8.2 Method of Measurement

The measurements procedures in TIA-603E-2016 are used.

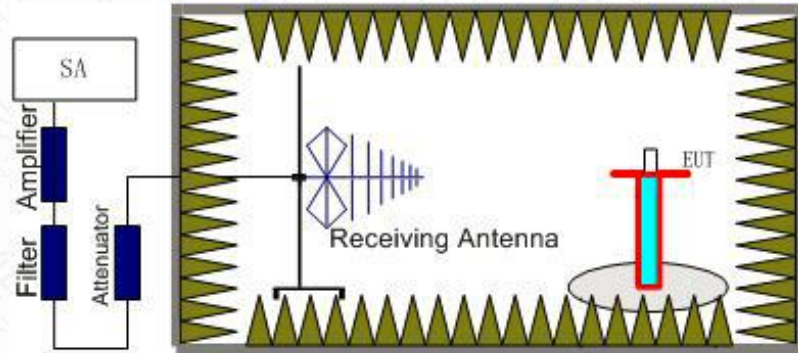
The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment. The resolution bandwidth is set as outlined in Part 24.238 and Part 24.917.

The spectrum is scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of WCDMA Band V.

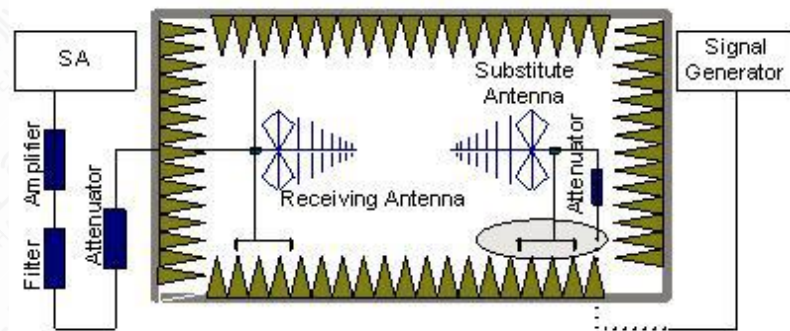
The procedure of radiated spurious emissions is as follows

1. EUT was placed on a 1.5 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The height of receiving antenna is 1.5m. The test setup refers to figure below. Detected emissions were maximized at each frequency by rotating the EUT through 360° and

adjusting the receiving antenna polarization. The radiated emission measurements of all non-harmonic and harmonics of the transmit frequency through the 10th harmonic were measured with peak detector.



2. The EUT is then put into continuously transmitting mode at its maximum power level during the test. And the maximum value of the receiver should be recorded as (P_r).
3. The EUT shall be replaced by a substitution antenna. The test setup refers to figure below.



In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power (P_{Mea}) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded (P_r). The power of signal source (P_{Mea}) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.

4. The Path loss (P_{pl}) between the Signal Source with the Substitution Antenna and the Substitution Antenna Gain (G_a) should be recorded after test.

A amplifier should be connected in for the test.

The Path loss (P_{pl}) is the summation of the cable loss .

The measurement results are obtained as described below:

$$\text{Power(EIRP)} = P_{Mea} - P_{pl} + G_a$$

5. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power.

6. ERP can be calculated from EIRP by subtracting the gain of the dipole, $ERP = EIRP - 2.15\text{dBi}$

6.8.3 Measurement Results

Radiated emissions measurements were made only at the upper, middle, and lower carrier

frequencies of the WCDMA Band V (826.4MHz, 836.6MHz and 846.6MHz) . It was decided that measurements at these three carrier frequencies would be sufficient to demonstrate compliance with emissions limits because it was seen that all the significant spurs occur well outside the band and no radiation was seen from a carrier in one block of the WCDMA Band V into any of the other blocks. The equipment must still, however, meet emissions requirements with the carrier at all frequencies over which it is capable of operating and it is the manufacturer's responsibility to verify this.

Frequency	Channel	Frequency Range	Result
WCDMA Band II	Low	30MHz~20GHz	Pass
	Middle	30MHz~20GHz	Pass
	High	30MHz~20GHz	Pass
WCDMA Band IV	Low	30MHz~20GHz	Pass
	Middle	30MHz~20GHz	Pass
	High	30MHz~20GHz	Pass
WCDMA Band V	Low	30MHz~20GHz	Pass
	Middle	30MHz~20GHz	Pass
	High	30MHz~20GHz	Pass

RSE-W2-L-S02

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Margin(dBm)	Polarization
3706.4	-57.07	6.6	7.9	-55.77	-13	42.77	H
5114.8	-59.34	7.9	9.6	-57.64	-13	44.64	H
6730.8	-59.99	9.2	10.9	-58.29	-13	45.29	V
8845.6	-59.62	10.4	12.7	-57.32	-13	44.32	H
11619.5	-52.8	12.2	12.3	-52.7	-13	39.70	V
15995.6	-48.29	15.0	12.3	-50.99	-13	37.99	H

RSE-W2-M-S02

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Margin(dBm)	Polarization
4123.2	-59.87	7.0	8.6	-58.27	-13	45.27	H
5644.4	-56.23	8.3	10.2	-54.33	-13	41.33	H
7484.8	-59.42	9.7	11.6	-57.52	-13	44.52	H
9973.2	-56.14	11.2	12.5	-54.84	-13	41.84	H
13696.0	-53.86	13.9	12.3	-55.46	-13	42.46	V

16976.2	-45.58	16.0	12.3	-49.28	-13	36.28	H
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RSE-W2-H-S02

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Margin(dBm)	Polarization
3814.0	-57.69	6.7	7.9	-56.49	-13	43.49	V
5726.0	-53.65	8.5	10.2	-51.95	-13	38.95	H
8039.2	-59.63	9.9	12.2	-57.33	-13	44.33	H
11638.0	-52.15	12.2	12.3	-52.05	-13	39.05	V
14173.8	-53.1	13.7	12.3	-54.5	-13	41.50	V
16791.4	-44.9	15.8	12.3	-48.4	-13	35.40	H

RSE-W4-L-S02

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Margin(dBm)	Polarization
3426.4	-60.23	6.4	7.8	-58.83	-13	45.83	V
6850.8	-58.36	9.2	10.9	-56.66	-13	43.66	V
9012.8	-59.63	10.4	12.6	-57.43	-13	44.43	H
11845.2	-55.59	12.5	12.3	-55.79	-13	42.79	H
14459.4	-54.8	14.2	12.3	-56.7	-13	43.70	V
16796.7	-48.12	15.8	12.3	-51.62	-13	38.62	H

RSE-W4-M-S02

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Margin(dBm)	Polarization
3466.8	-59.46	6.4	7.8	-58.06	-13	45.06	V
6933.2	-58.28	9.3	11.1	-56.48	-13	43.48	V
9694.4	-58.43	10.9	12.7	-56.63	-13	43.63	V
12117.2	-54.94	12.6	12.3	-55.24	-13	42.24	V
14308.2	-55.63	13.6	12.3	-56.93	-13	43.93	V
16303.2	-49.68	14.7	12.3	-52.08	-13	39.08	H

RSE-W4-H-S02

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Margin(dBm)	Polarization
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3506.4	-61.54	6.4	7.8	-60.14	-13	47.14	V
5261.2	-58.83	8.0	9.4	-57.43	-13	44.43	H
7005.2	-58.31	9.3	11.1	-56.51	-13	43.51	V
9685.6	-58.62	10.9	12.7	-56.82	-13	43.82	V
12340.2	-54.19	12.7	12.3	-54.59	-13	41.59	H
14824.8	-54.55	14.3	12.3	-56.55	-13	43.55	V

RSE-W5-L-S02

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Margin(dBm)	Polarization
1250.0	-59.17	3.8	3.0	-59.97	-13	46.97	V
1737.9	-60.95	4.5	4.7	-60.75	-13	47.75	H
2718.1	-54.7	5.6	6.1	-54.2	-13	41.20	H
4160.8	-62.45	7.0	8.9	-60.55	-13	47.55	H
5605.2	-60.93	8.3	9.8	-59.43	-13	46.43	H
7438.6	-61.24	9.7	11.6	-59.34	-13	46.34	H

RSE-W5-M-S02

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Margin(dBm)	Polarization
1250.0	-59.48	3.8	3.0	-60.28	-13	47.28	V
1818.6	-61.25	4.5	4.7	-61.05	-13	48.05	H
2527.3	-54.47	5.4	5.6	-54.27	-13	41.27	H
4242.4	-61.75	7.1	8.9	-59.95	-13	46.95	H
5810.0	-60.74	8.4	10.2	-58.94	-13	45.94	V
7720.0	-60.98	9.8	11.8	-58.98	-13	45.98	V

RSE-W5-H-S02

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Margin(dBm)	Polarization
1250.0	-59.2	3.8	3.0	-60	-13	47.00	V
1691.1	-60.35	4.5	4.7	-60.15	-13	47.15	V
2672.7	-55.77	5.5	6.1	-55.17	-13	42.17	V

4020.0	-62.03	6.9	8.6	-60.33	-13	47.33	H
5220.0	-60.31	8.0	9.4	-58.91	-13	45.91	H
7194.4	-59.39	9.5	11.4	-57.49	-13	44.49	H

Annex A: Revised History

Version	Revised Content
V00	Initial

Annex B: Accreditation Certificate



END OF REPORT