

TEST REPORT

FCC ID. :	2AG87-RM3625	
Test Report No..... :	TCT210722E013	
Date of issue..... :	Apr. 21, 2022	
Testing laboratory	SHENZHEN TONGCE TESTING LAB	
Testing location/ address:	TCT Testing Industrial Park Fuqiao 5th Industrial Zone, Fuhai Street, Bao'an District Shenzhen, Guangdong, 518103, People's Republic of China	
Applicant's name..... :	Doodle Labs (SG) Pte Ltd	
Address..... :	150 Kampong Ampat, KA Center, Suite 05-03, Singapore 368324, Singapore	
Manufacturer's name ... :	Doodle Labs (SG) Pte Ltd	
Address..... :	150 Kampong Ampat, KA Center, Suite 05-03, Singapore 368324, Singapore	
Standard(s)	FCC CFR Title 47 Part 2 FCC CFR Title 47 Part96 KDB 940660 D01 Part 96 CBRS Eqpt v03	
Product Name..... :	Smart Radio – CBRS	
Trade Mark	N/A	
Model/Type reference..... :	RM-3625	
Rating(s)..... :	Input: DC 5.5~42V	
Date of receipt of test item	Jul. 22, 2021	
Date (s) of performance of test..... :	Jul. 22, 2021 - Apr. 21, 2022	
Tested by (+signature) ... :	Brews XU	
Check by (+signature).... :	Beryl ZHAO	
Approved by (+signature):	Tomsin	

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Appendix A: Photographs of Test Setup

Appendix B: Photographs of EUT

1. General Product Information

1.1. EUT description

Product Name.....:	Smart Radio – CBRS
Model/Type reference.....:	RM-3625
Sample Number.....:	TCT210722E013-0101
Tx Frequency.....:	3555 MHz ~ 3695 MHz
Rx Frequency	3555 MHz ~ 3695 MHz
Bandwidth.....:	3MHz /5MHz /10MHz
EUT Type.....:	Citizens Band End User Devices
Type of Modulation.....:	DSSS, OFDM
Antenna Connector	RP-SMA
Antenna Type.....:	External Antenna
Antenna Gain.....:	3 dBi
Rating(s).....:	Input: DC 5.5 ~ 42V

Note: The antenna gain listed in this report is provided by applicant, and the test laboratory is not responsible for this parameter.

1.2. Model(s) list

No.	Model No.	Tested with
1	RM-3625	☒

1.3. Operation Frequency

Channel List					
Channel:	Frequency (MHz)	Channel:	Frequency (MHz)	Channel:	Frequency (MHz)
1	3555	11	3605	21	3655
2	3560	12	3610	22	3660
3	3565	13	3615	23	3665
4	3570	14	3620	24	3670
5	3575	15	3625	25	3675
6	3580	16	3630	26	3680
7	3585	17	3635	27	3685
8	3590	18	3640	28	3690
9	3595	19	3645	29	3695
10	3600	20	3650		

2. Test Result Summary

Requirement	CFR 47 Section	Result
Conducted Output Power	§2.1046	PASS
Peak-to-Average Ratio	§2.1046; §96.41	PASS
PSD	§96.41	N/A
Equivalent Isotropic Radiated Power	§2.1046; §96.41	PASS
Occupied Bandwidth	§2.1049; §96.41	PASS
Band Edge	§2.1051; §96.41	PASS
Conducted Spurious Emission	§2.1051; §96.41	PASS
Field Strength of Spurious Radiation	§2.1053; §96.41	PASS
Frequency Stability for Temperature & Voltage	§2.1055	PASS

Note:

1. PASS: Test item meets the requirement.
2. Fail: Test item does not meet the requirement.
3. N/A: Test case does not apply to the test object.
4. The test result judgment is decided by the limit of test standard.

3. General Information

3.1. Test environment and mode

Operating Environment:	
Temperature:	25.0 °C
Humidity:	56 % RH
Atmospheric Pressure:	1010 mbar
Test Software:	
Software Information:	Putty tool
Power Level:	30
Test Mode:	Keep the EUT in continuous transmitting by select channel and modulations

Antenna port conducted and radiated test items were performed according to KDB 971168 D01 Power Meas. License Digital Systems v03r01 with maximum output power. Radiated measurements were performed with rotating EUT in different three orthogonal test planes to find the maximum emission. The sample was placed (0.8m below 1GHz, 1.5m above 1GHz) above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarization. The emissions worst-case (Z axis) are shown in Test Results of the following pages.

3.2. Description of Support Units

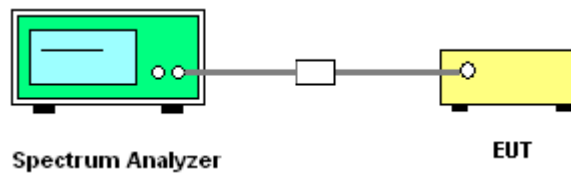
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Equipment	Model No.	Serial No.	FCC ID	Trade Name
Laptop	ThinkPad T430	PO1908049	/	Lenovo
AC Adapter	92P1154	11S92P1154Z1ZDXP7C L957	/	Lenovo

Note:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

3.3. Configuration of Tested System



3.4. Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between RF conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level will be exactly the RF output level. The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

The following shows an offset computation example with RF cable loss 3 dB and a 5dB attenuator.

Example: $\text{Offset (dB)} = \text{RF cable loss (dB)} + \text{attenuator factor (dB)}$
 $= 8(\text{dB})$

4. Facilities and Accreditations

4.1. Facilities

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

- FCC - Registration No.: 645098

SHENZHEN TONGCE TESTING LAB

Designation Number: CN1205

The testing lab has been registered and fully described in a report with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files.

- IC - Registration No.: 10668A-1

SHENZHEN TONGCE TESTING LAB

CAB identifier: CN0031

The testing lab has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing.

4.2. Location

SHENZHEN TONGCE TESTING LAB

Address: TCT Testing Industrial Park Fuqiao 5th Industrial Zone, Fuhai Street, Bao'an District Shenzhen, Guangdong, 518103, People's Republic of China

TEL: +86-755-27673339

4.3. Measurement Uncertainty

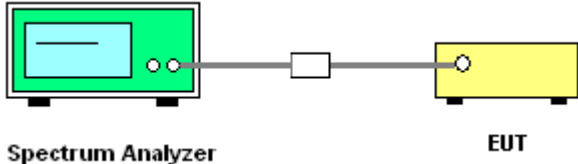
The reported uncertainty of measurement $y \pm U$, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95 %.

No.	Item	MU
1	Conducted Emission	± 3.10 dB
2	RF power, conducted	± 0.12 dB
3	Spurious emissions, conducted	± 0.11 dB
4	All emissions, radiated(<1 GHz)	± 4.56 dB
5	All emissions, radiated(1 GHz - 18 GHz)	± 4.22 dB
6	All emissions, radiated(18 GHz- 40 GHz)	± 4.36 dB
7	Temperature	$\pm 0.1^{\circ}\text{C}$
8	Humidity	$\pm 1.0\%$

5. Test Results and Measurement Data

5.1. Conducted Output Power & EIRP

5.1.1. Test Specification

Test Requirement:	FCC part 96.41(b)(c)								
Test Method:	ANSI C63.26:2015								
Operation mode:	Refer to item 3.1								
Limits:	<table> <tr> <th>Device</th><th>Maximum EIRP (dBm/10 megahertz)</th></tr> <tr> <td>End User Device</td><td>23</td></tr> <tr> <td>Category A CBSD</td><td>30</td></tr> <tr> <td>Category B CBSD¹</td><td>47</td></tr> </table>	Device	Maximum EIRP (dBm/10 megahertz)	End User Device	23	Category A CBSD	30	Category B CBSD ¹	47
Device	Maximum EIRP (dBm/10 megahertz)								
End User Device	23								
Category A CBSD	30								
Category B CBSD ¹	47								
Test Setup:	 Spectrum Analyzer EUT								
Test Procedure:	1. The transmitter output port was connected to the spectrum analyzer. 2. Set to the maximum power setting and enable the EUT transmit continuously. 3. Select lowest, middle, and highest channels for each bandwidth and different modulation. 4. Measure the maximum conducted average power and calculate the EIRP with corresponding cable loss and antenna gain.								
Test Result:	PASS								

5.1.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	N9020A	MY49100619	Jul. 07, 2022
RF cable (9kHz-40GHz)	TCT	RE-05	N/A	Jul. 07, 2022
Antenna Connector	TCT	RFC-02	N/A	Jul. 07, 2022

5.1.3. Test data

Antenna Gain and cable loss

Type	Cable loss(dBi)	Antenna gain(dBi)
End user	0.63	3

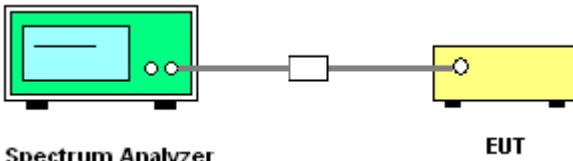
End User Device

Test Mode	Band width [MHz]	Antenna	Channel	Conducted output power [dBm]	E.I.R.P [dBm/10MHz]	Limit [dBm/10MHz]	Verdict
DSSS	3	Ant0	3555	14.90	17.27	<=23	PASS
	3	Ant0	3625	16.42	18.79	<=23	PASS
	3	Ant0	3695	15.40	17.77	<=23	PASS
	3	Ant1	3555	15.78	18.15	<=23	PASS
	3	Ant1	3625	15.72	18.09	<=23	PASS
	3	Ant1	3695	15.30	17.67	<=23	PASS
OFDM	3	Ant0	3555	15.74	18.11	<=23	PASS
	3	Ant0	3625	16.87	19.24	<=23	PASS
	3	Ant0	3695	16.02	18.39	<=23	PASS
	3	Ant1	3555	16.17	18.54	<=23	PASS
	3	Ant1	3625	16.27	18.64	<=23	PASS
	3	Ant1	3695	16.01	18.38	<=23	PASS
DSSS	3	Ant 0+1	3555	18.37	20.74	<=23	PASS
	3	Ant 0+1	3625	19.09	21.46	<=23	PASS
	3	Ant 0+1	3695	18.36	20.73	<=23	PASS
OFDM	3	Ant 0+1	3555	18.97	21.34	<=23	PASS
	3	Ant 0+1	3625	19.59	21.96	<=23	PASS
	3	Ant 0+1	3695	19.03	21.40	<=23	PASS
DSSS	5	Ant0	3555	15.33	17.70	<=23	PASS
	5	Ant0	3625	15.73	18.10	<=23	PASS
	5	Ant0	3695	15.31	17.68	<=23	PASS
	5	Ant1	3555	15.54	17.91	<=23	PASS
	5	Ant1	3625	15.38	17.75	<=23	PASS
	5	Ant1	3695	15.14	17.51	<=23	PASS
OFDM	5	Ant0	3555	15.90	18.27	<=23	PASS
	5	Ant0	3625	16.84	19.21	<=23	PASS
	5	Ant0	3695	15.90	18.27	<=23	PASS
	5	Ant1	3555	16.16	18.53	<=23	PASS
	5	Ant1	3625	16.19	18.56	<=23	PASS
	5	Ant1	3695	15.92	18.29	<=23	PASS
DSSS	5	Ant 0+1	3555	18.45	20.82	<=23	PASS
	5	Ant 0+1	3625	18.57	20.94	<=23	PASS
	5	Ant 0+1	3695	18.24	20.61	<=23	PASS
OFDM	5	Ant 0+1	3555	19.04	21.41	<=23	PASS
	5	Ant 0+1	3625	19.54	21.91	<=23	PASS
	5	Ant 0+1	3695	18.92	21.29	<=23	PASS
DSSS	10	Ant0	3555	14.87	17.24	<=23	PASS

	10	Ant0	3625	15.77	18.14	<=23	PASS
	10	Ant0	3695	14.69	17.06	<=23	PASS
	10	Ant1	3555	15.61	17.98	<=23	PASS
	10	Ant1	3625	15.90	18.27	<=23	PASS
	10	Ant1	3695	15.55	17.92	<=23	PASS
OFDM	10	Ant0	3555	15.47	17.84	<=23	PASS
	10	Ant0	3625	16.51	18.88	<=23	PASS
	10	Ant0	3695	15.80	18.17	<=23	PASS
	10	Ant1	3555	16.11	18.48	<=23	PASS
	10	Ant1	3625	16.09	18.46	<=23	PASS
	10	Ant1	3695	16.07	18.44	<=23	PASS
DSSS	10	Ant 0+1	3555	18.27	20.64	<=23	PASS
	10	Ant 0+1	3625	18.85	21.22	<=23	PASS
	10	Ant 0+1	3695	18.15	20.52	<=23	PASS
OFDM	10	Ant 0+1	3555	18.81	21.18	<=23	PASS
	10	Ant 0+1	3625	19.32	21.69	<=23	PASS
	10	Ant 0+1	3695	18.95	21.32	<=23	PASS

5.2. Peak to Average Ratio

5.2.1. Test Specification

Test Requirement:	FCC part 96.41(g)
Test Method:	ANSI C63.26:2015
Operation mode:	Refer to item 3.1
Limit:	The peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.
Test Setup:	 Spectrum Analyzer EUT
Test Procedure:	1. The testing follows FCC KDB 971168 D01v03r01 Section 5.7.1. 2. The EUT was connected to spectrum analyzer. 3. Set EUT to transmit at maximum output power enable the EUT transmit continuously. 4. Select lowest, middle, and highest channels for each bandwidth and different modulation. 5. Set the CCDF (Complementary Cumulative Distribution Function) option of the spectrum analyzer. Record the maximum PAPR level associated with a probability of 0.1%.
Test Result:	PASS

5.2.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	N9020A	MY49100619	Jul. 07, 2022
RF cable (9kHz-40GHz)	TCT	RE-05	N/A	Jul. 07, 2022
Antenna Connector	TCT	RFC-02	N/A	Jul. 07, 2022

5.2.3. Test Data

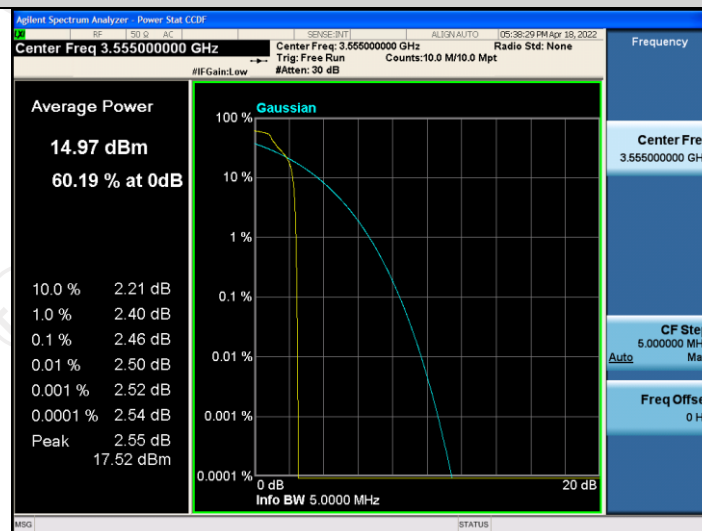
Test Mode	Band width [MHz]	Antenna	Frequency [MHz]	PAR	Limit	Verdict
DSSS	3	Ant0	3555	2.46	<=13	PASS
	3	Ant0	3625	2.51	<=13	PASS
	3	Ant0	3695	2.58	<=13	PASS
	3	Ant1	3555	2.56	<=13	PASS
	3	Ant1	3625	2.62	<=13	PASS
	3	Ant1	3695	2.58	<=13	PASS
OFDM	3	Ant0	3555	7.04	<=13	PASS
	3	Ant0	3625	7.38	<=13	PASS
	3	Ant0	3695	7.95	<=13	PASS
	3	Ant1	3555	7.63	<=13	PASS
	3	Ant1	3625	7.56	<=13	PASS
	3	Ant1	3695	7.91	<=13	PASS
DSSS	5	Ant0	3555	2.51	<=13	PASS
	5	Ant0	3625	2.56	<=13	PASS
	5	Ant0	3695	2.69	<=13	PASS
	5	Ant1	3555	2.63	<=13	PASS
	5	Ant1	3625	2.55	<=13	PASS
	5	Ant1	3695	2.75	<=13	PASS
OFDM	5	Ant0	3555	7.06	<=13	PASS
	5	Ant0	3625	7.51	<=13	PASS
	5	Ant0	3695	7.96	<=13	PASS
	5	Ant1	3555	7.04	<=13	PASS
	5	Ant1	3625	7.59	<=13	PASS
	5	Ant1	3695	7.94	<=13	PASS
DSSS	10	Ant0	3555	2.99	<=13	PASS
	10	Ant0	3625	2.83	<=13	PASS
	10	Ant0	3695	2.90	<=13	PASS
	10	Ant1	3555	2.78	<=13	PASS
	10	Ant1	3625	2.80	<=13	PASS
	10	Ant1	3695	2.93	<=13	PASS
OFDM	10	Ant0	3555	7.68	<=13	PASS

	10	Ant0	3625	7.96	<=13	PASS
	10	Ant0	3695	8.29	<=13	PASS
	10	Ant1	3555	7.59	<=13	PASS
	10	Ant1	3625	8.07	<=13	PASS
	10	Ant1	3695	8.36	<=13	PASS

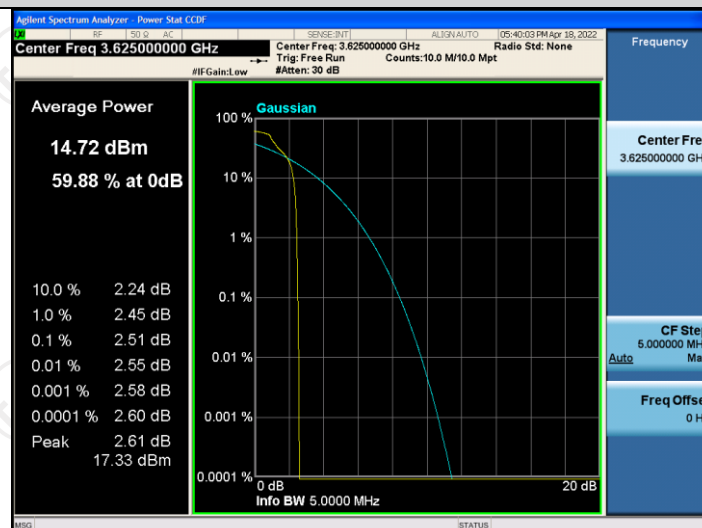
Test plots as follows:

Ant0

3MHz-DSSS-3555



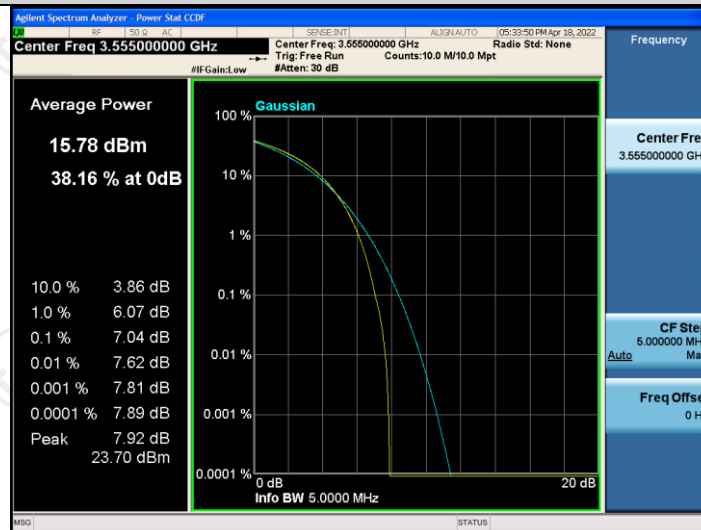
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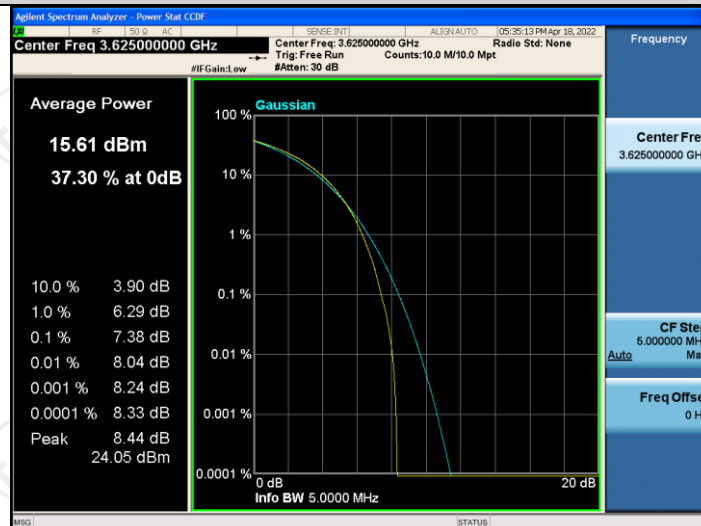
3MHz-DSSS-3695



3MHz-OFDM-3555



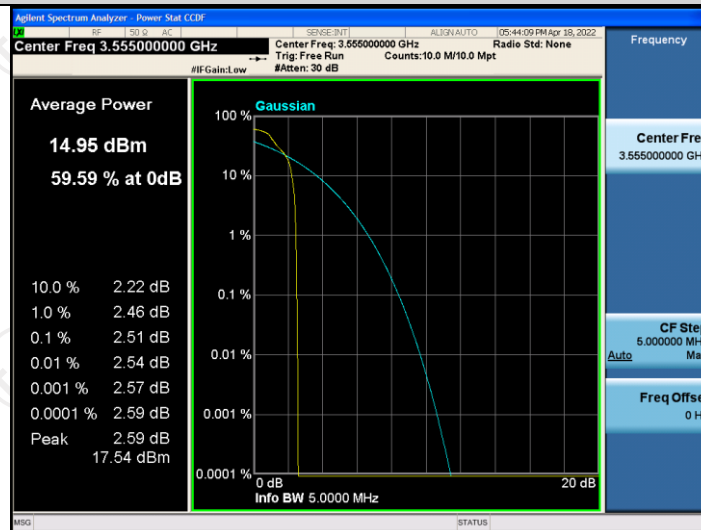
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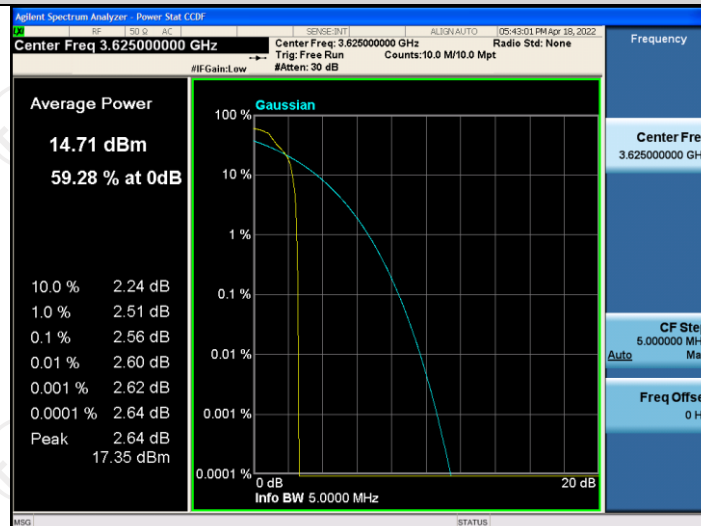
3MHz-OFDM-3695



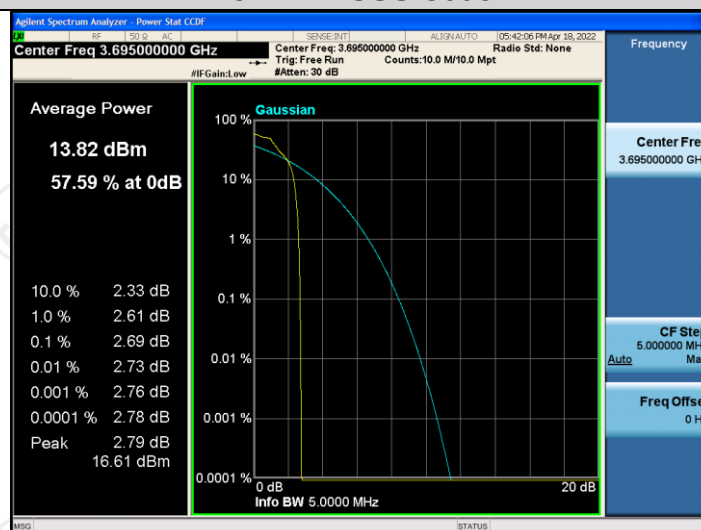
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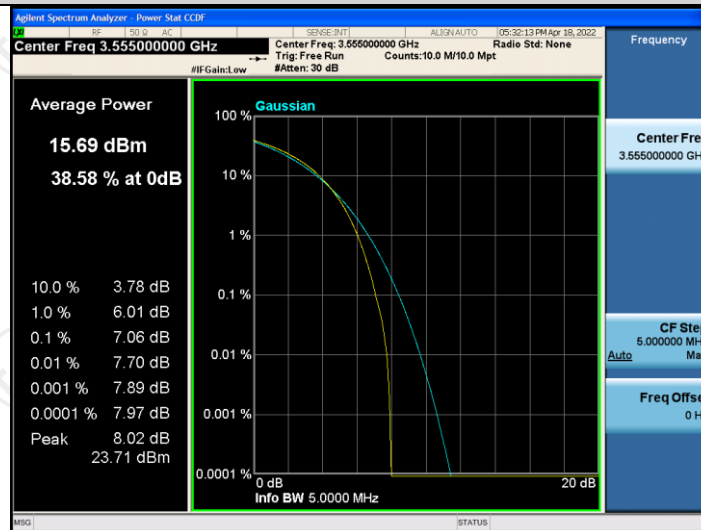
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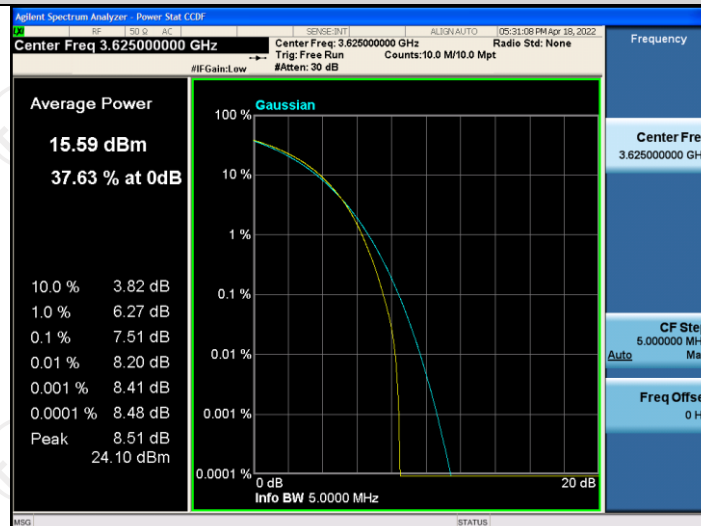
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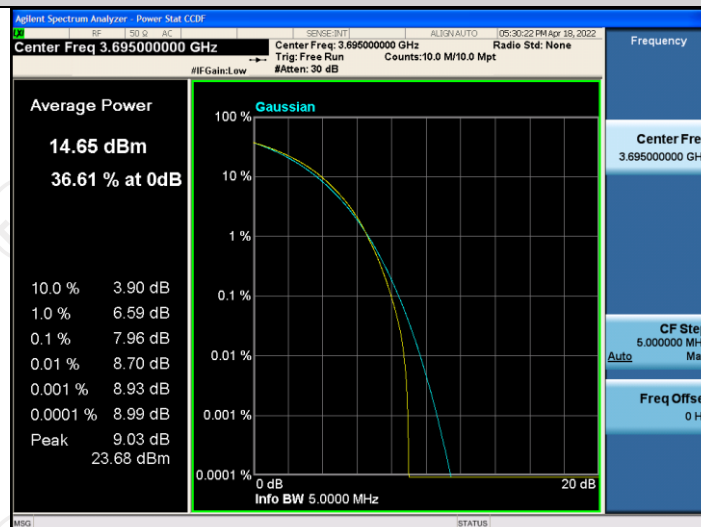
5MHz-OFDM-3555



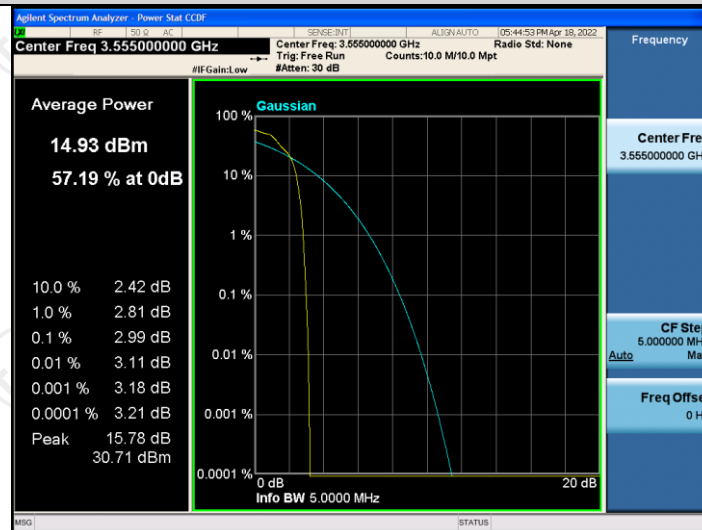
5MHz-OFDM-3625



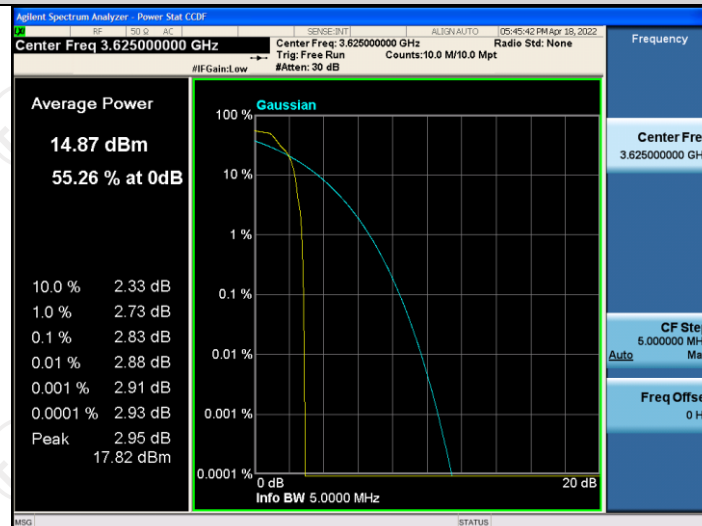
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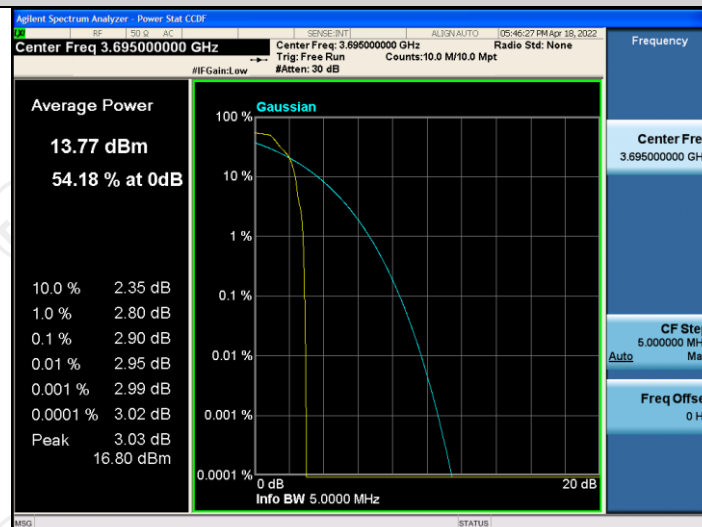
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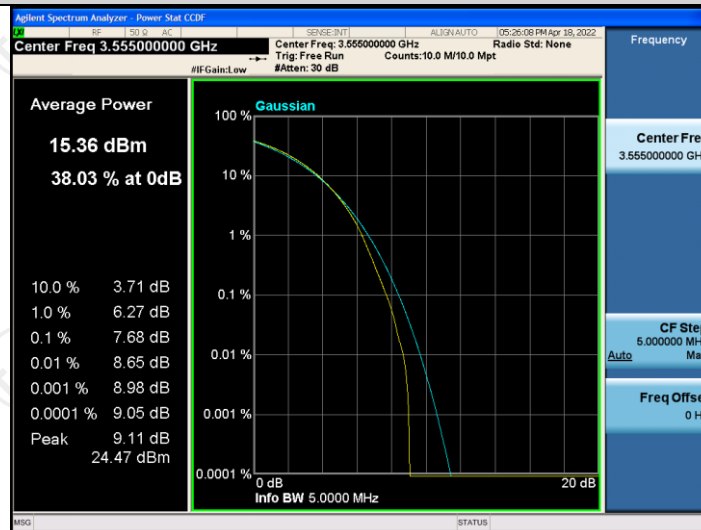
10MHz-DSSS-3625



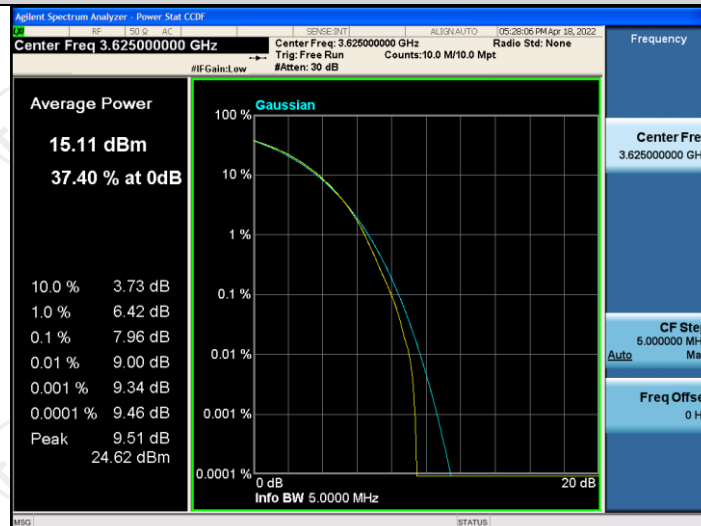
10MHz-DSSS-3695



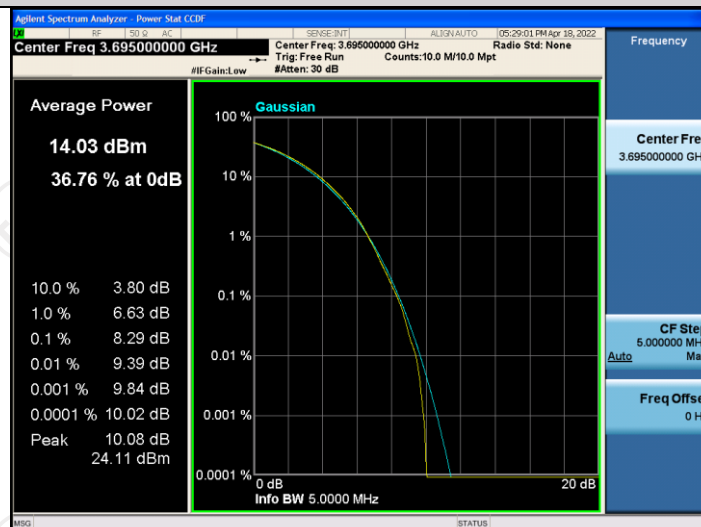
10MHz-OFDM-3555



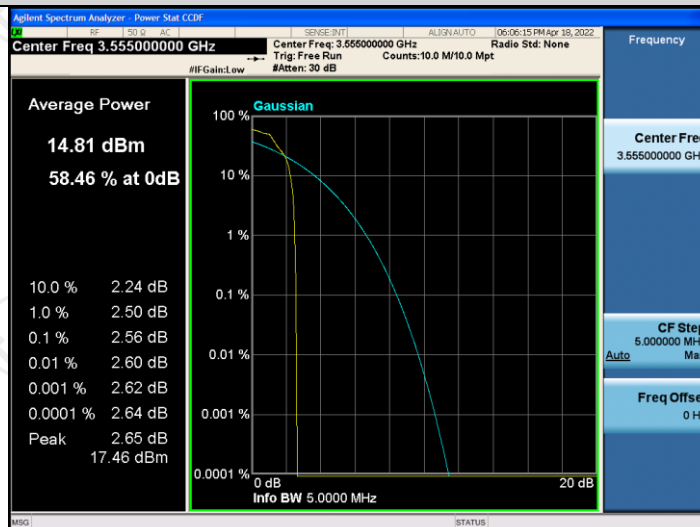
10MHz-OFDM-3625



10MHz-OFDM-3695



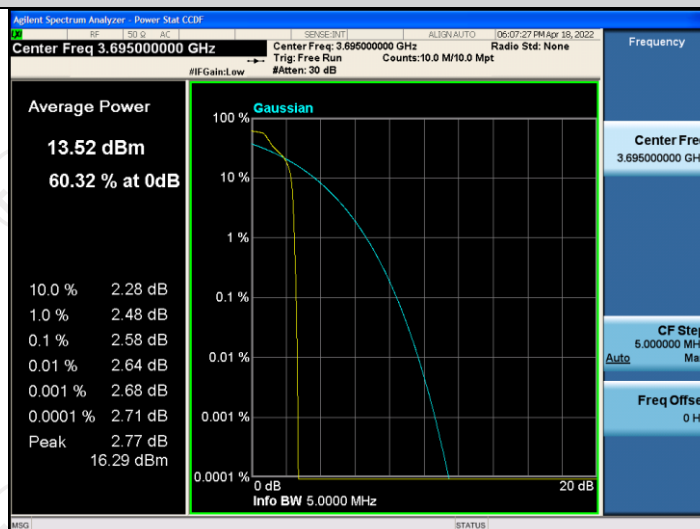
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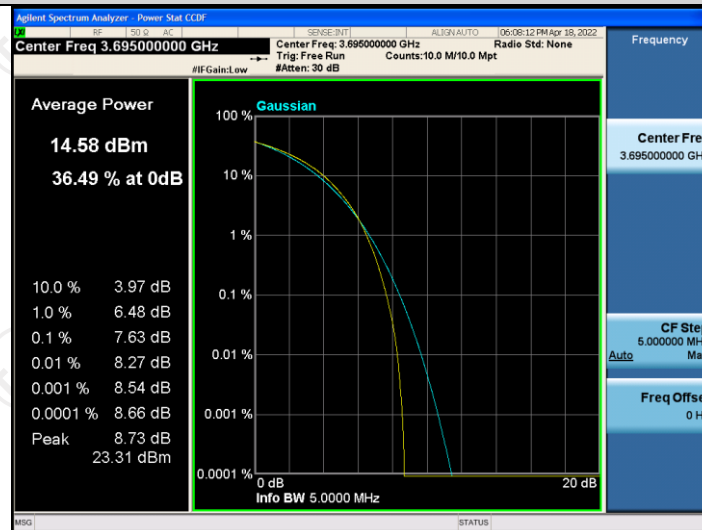
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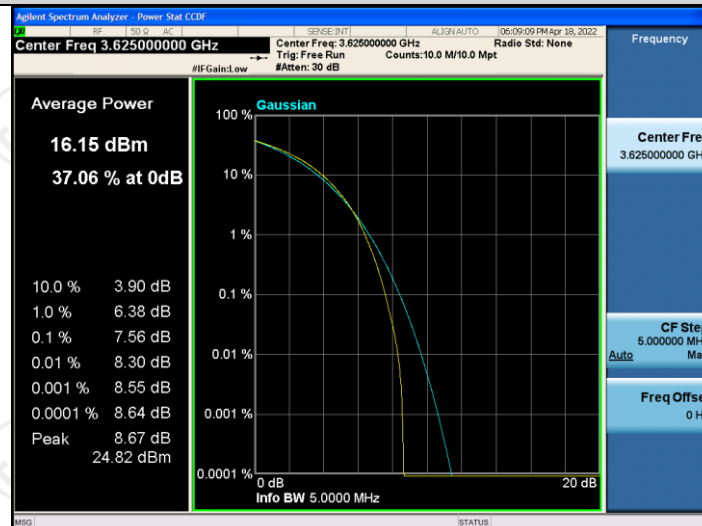
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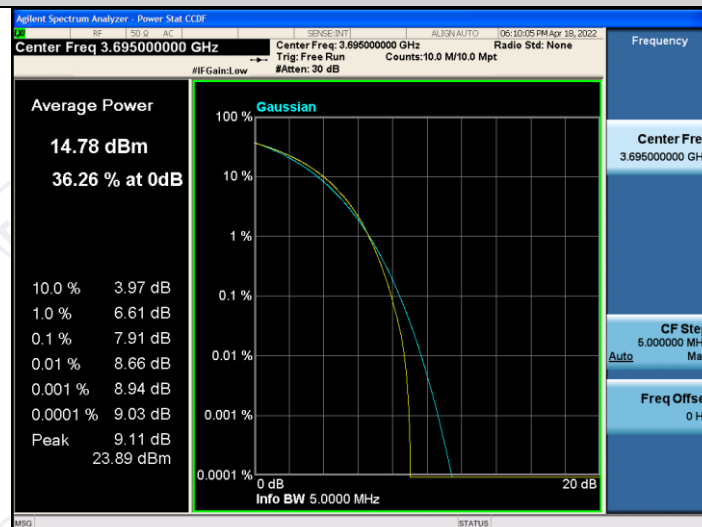
3MHz-OFDM-3555



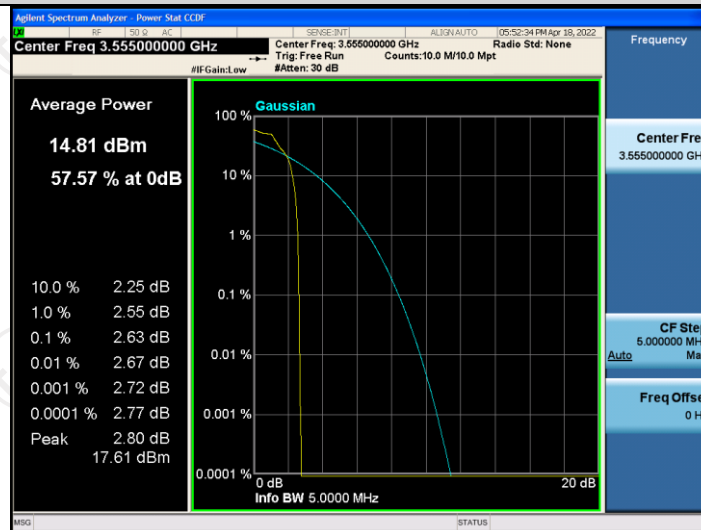
3MHz-OFDM-3625



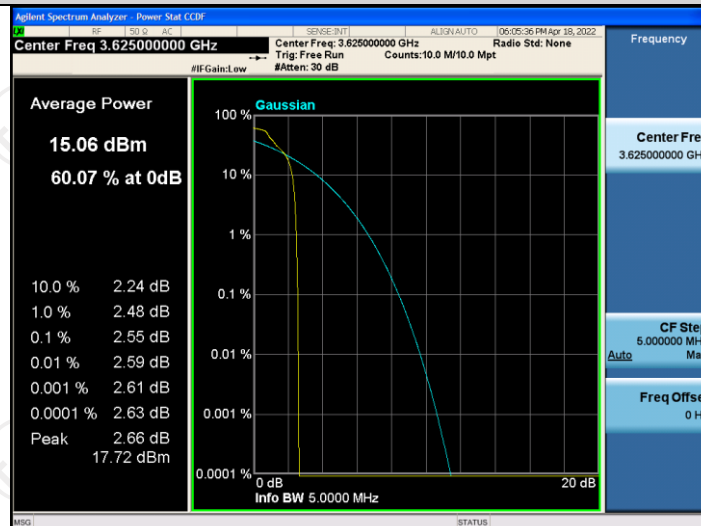
3MHz-OFDM-3695



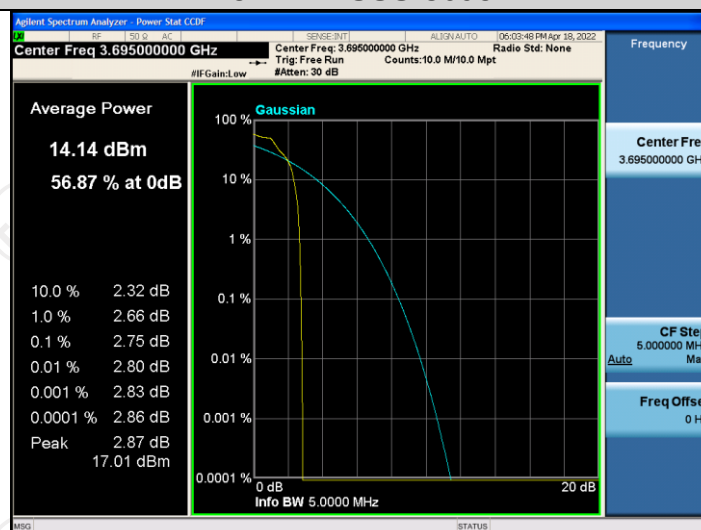
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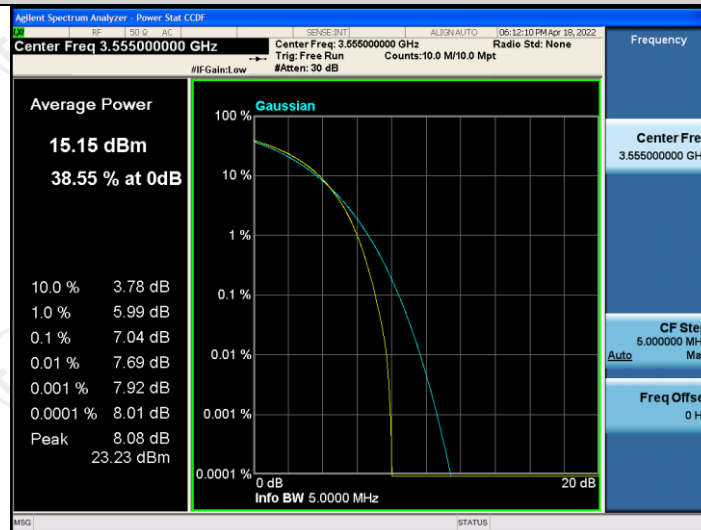
5MHz-DSSS-3625



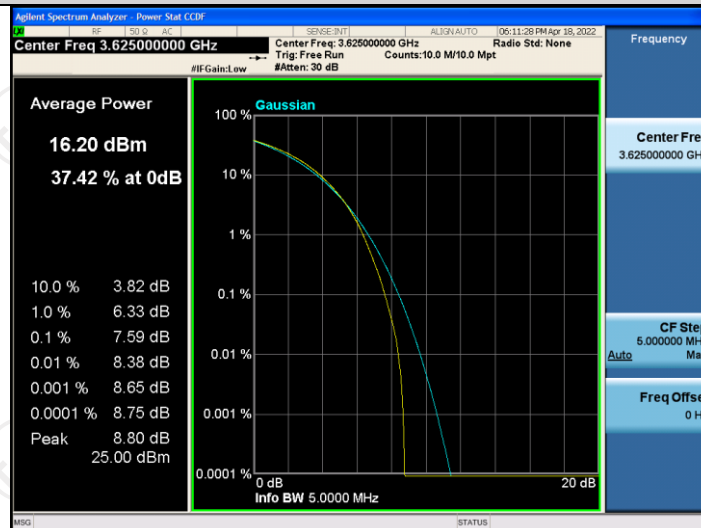
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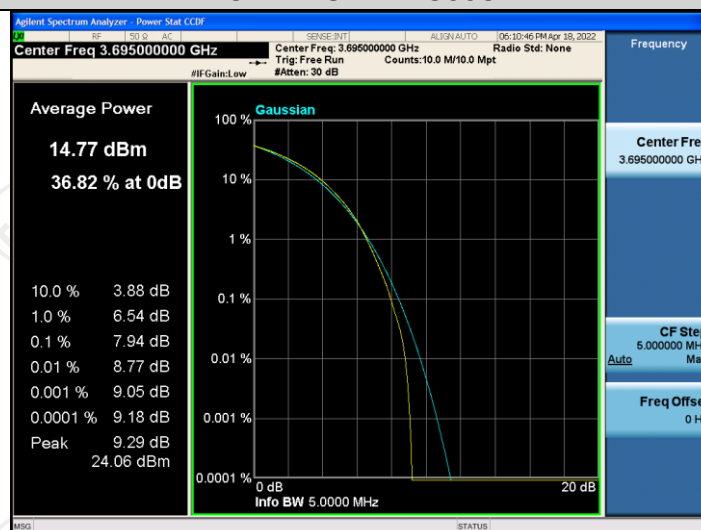
5MHz-OFDM-3555



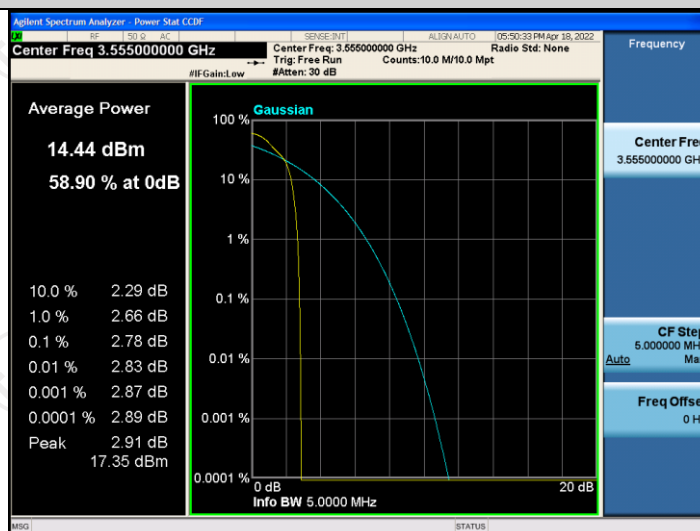
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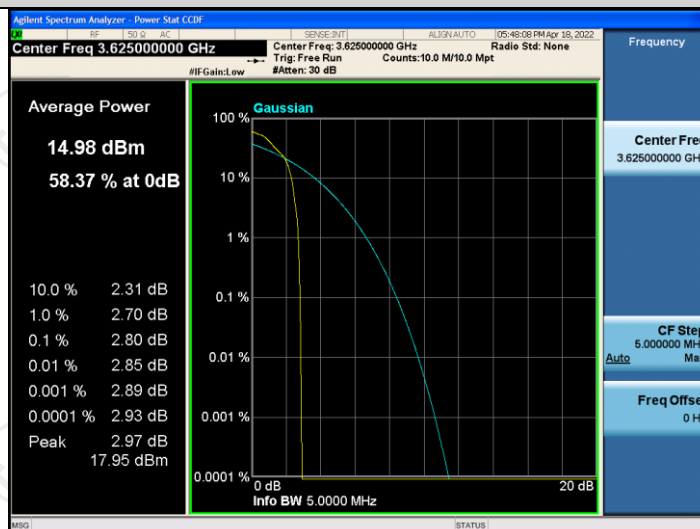
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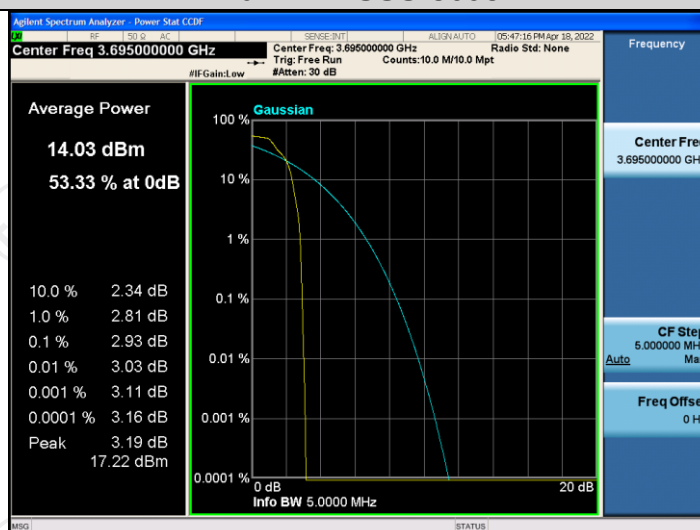
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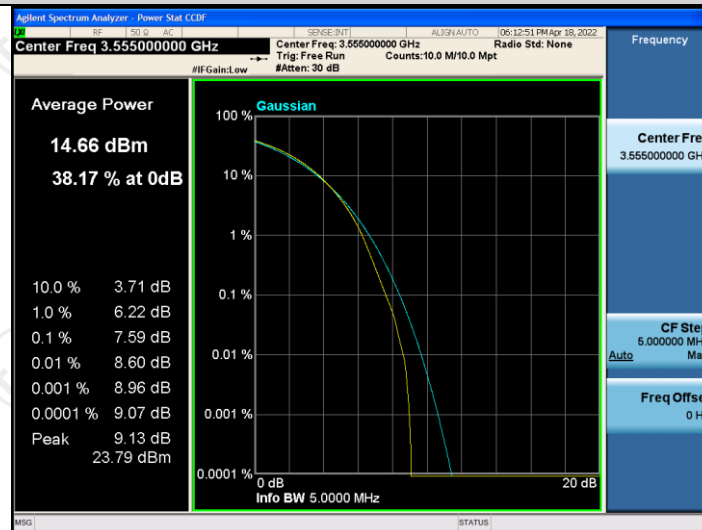
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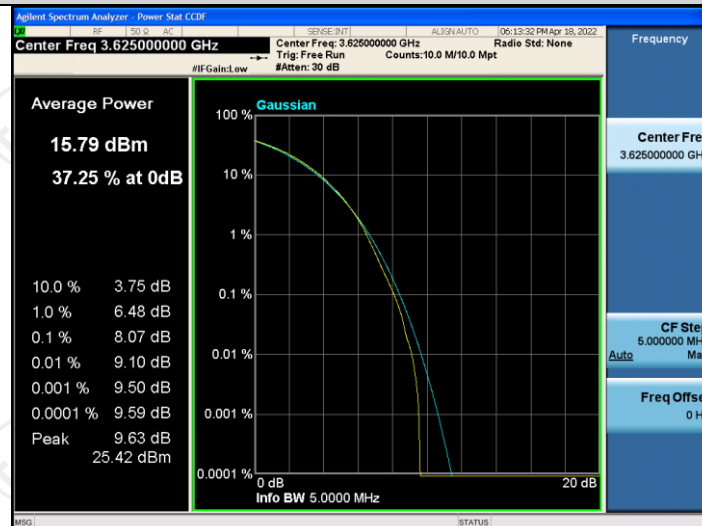
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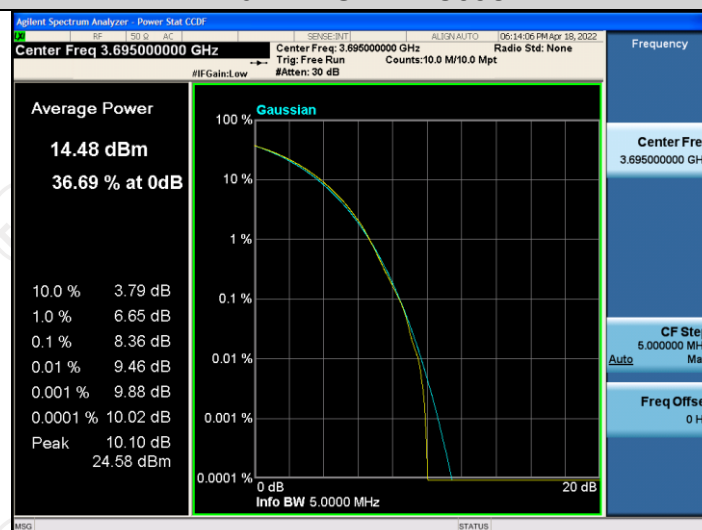
10MHz-OFDM-3555



10MHz-OFDM-3625



10MHz-OFDM-3695



5.3. 99% Occupied Bandwidth and 26dB Bandwidth Measurement

5.3.1. Test Specification

Test Requirement:	FCC part 2.1049
Test Method:	FCC KDB 971168 D01v03r01
Operation mode:	Refer to item 3.1
Limit:	N/A
Test Setup:	 Spectrum Analyzer EUT
Test Procedure:	1. The testing follows FCC KDB 971168 D01v03r01 Section 4.2. 2. The EUT was connected to the spectrum analyzer. 3. The RF output of the EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement. 4. The 99% occupied bandwidth were measured, set RBW= 1% of span, VBW= 3*RBW, sample detector, trace maximum hold. 5. The 26dB bandwidth were measured, set RBW= 1% of EBW, VBW= 3*RBW, peak detector, trace maximum hold.
Test Result:	PASS

5.3.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	N9020A	MY49100619	Jul. 07, 2022
RF cable (9kHz-40GHz)	TCT	RE-05	N/A	Jul. 07, 2022
Antenna Connector	TCT	RFC-02	N/A	Jul. 07, 2022

5.3.3. Test data

Antenna	Bandwidth	Modulation	Channel	Occupied Bandwidth (MHz)	26dB Bandwidth (MHz)	Verdict
Ant0	3MHz	DSSS	3555	1.958	2.392	PASS
Ant0	3MHz	DSSS	3625	1.961	2.388	PASS
Ant0	3MHz	DSSS	3695	1.945	2.358	PASS
Ant0	3MHz	OFDM	3555	2.555	4.675	PASS
Ant0	3MHz	OFDM	3625	2.557	4.659	PASS
Ant0	3MHz	OFDM	3695	2.566	4.904	PASS
Ant0	5MHz	DSSS	3555	3.416	4.176	PASS
Ant0	5MHz	DSSS	3625	3.421	4.176	PASS
Ant0	5MHz	DSSS	3695	3.352	4.100	PASS
Ant0	5MHz	OFDM	3555	4.466	8.072	PASS
Ant0	5MHz	OFDM	3625	4.451	8.057	PASS
Ant0	5MHz	OFDM	3695	4.462	8.064	PASS
Ant0	10MHz	DSSS	3555	5.502	6.725	PASS
Ant0	10MHz	DSSS	3625	5.617	6.758	PASS
Ant0	10MHz	DSSS	3695	5.424	6.670	PASS
Ant0	10MHz	OFDM	3555	7.284	13.17	PASS
Ant0	10MHz	OFDM	3625	7.281	13.18	PASS
Ant0	10MHz	OFDM	3695	7.292	14.11	PASS
Ant1	3MHz	DSSS	3555	1.961	2.394	PASS
Ant1	3MHz	DSSS	3625	1.965	2.397	PASS
Ant1	3MHz	DSSS	3695	1.922	2.341	PASS
Ant1	3MHz	OFDM	3555	2.634	5.014	PASS
Ant1	3MHz	OFDM	3625	2.640	5.220	PASS
Ant1	3MHz	OFDM	3695	2.713	5.615	PASS
Ant1	5MHz	DSSS	3555	3.448	4.225	PASS
Ant1	5MHz	DSSS	3625	3.387	4.200	PASS
Ant1	5MHz	DSSS	3695	3.356	4.103	PASS
Ant1	5MHz	OFDM	3555	4.612	8.758	PASS
Ant1	5MHz	OFDM	3625	4.605	8.690	PASS
Ant1	5MHz	OFDM	3695	4.658	8.705	PASS
Ant1	10MHz	DSSS	3555	5.573	6.753	PASS
Ant1	10MHz	DSSS	3625	5.577	6.746	PASS
Ant1	10MHz	DSSS	3695	5.528	9.588	PASS
Ant1	10MHz	OFDM	3555	7.461	13.72	PASS
Ant1	10MHz	OFDM	3625	7.437	13.36	PASS
Ant1	10MHz	OFDM	3695	7.661	14.77	PASS

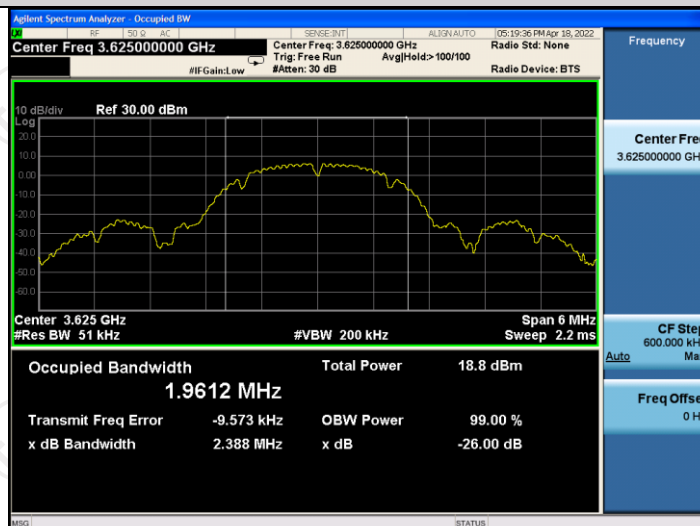
Test plots as follows:

Ant0

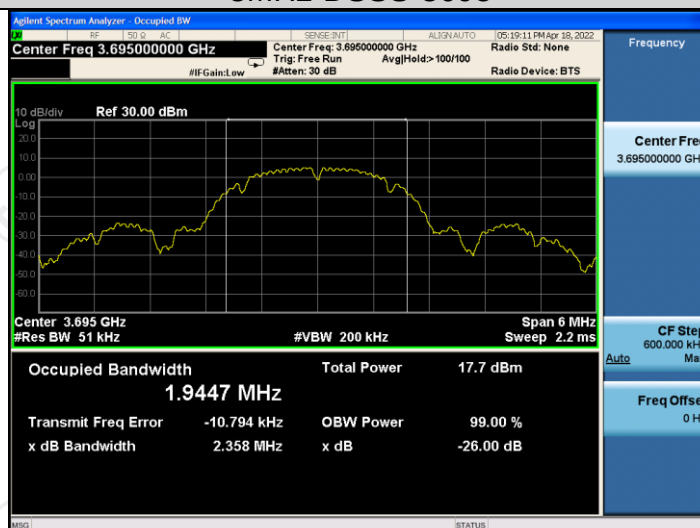
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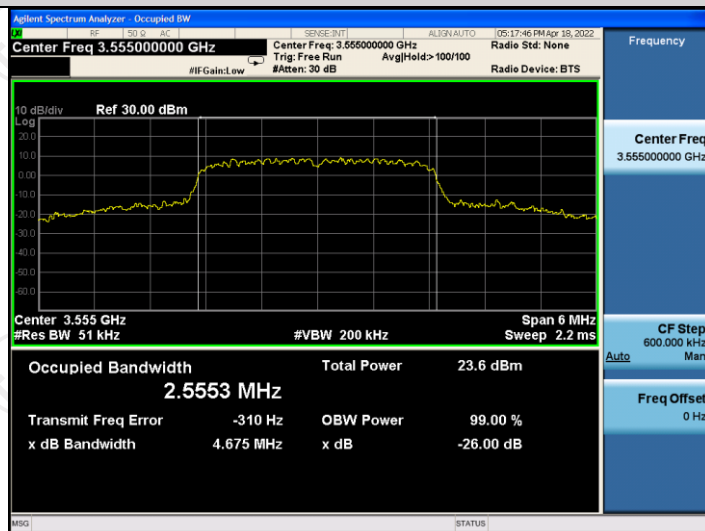
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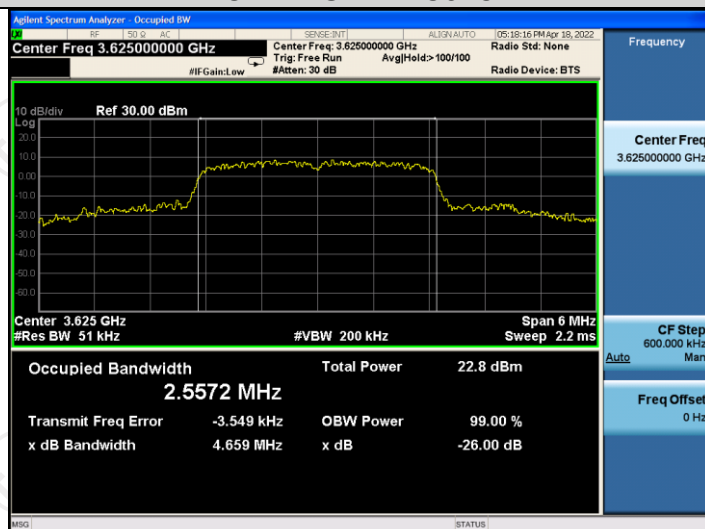
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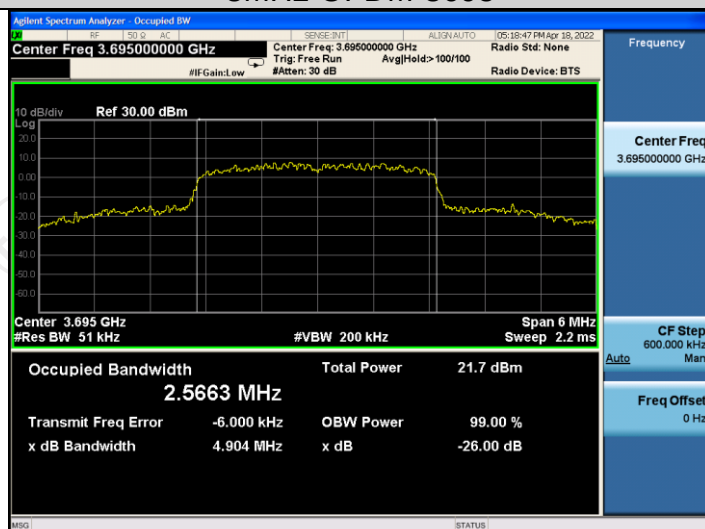
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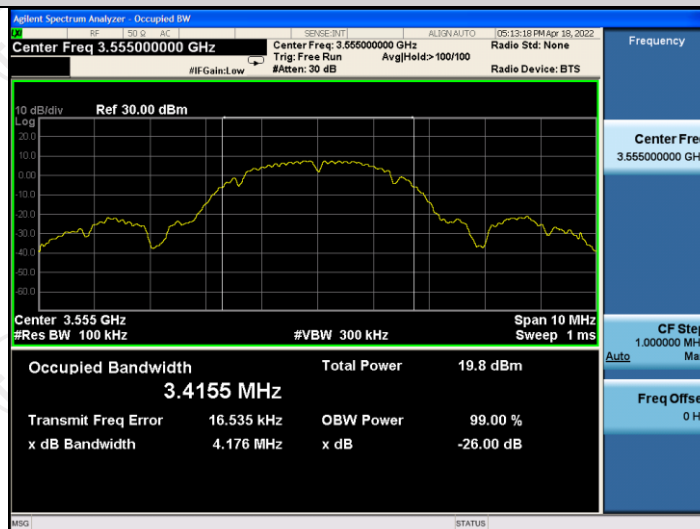
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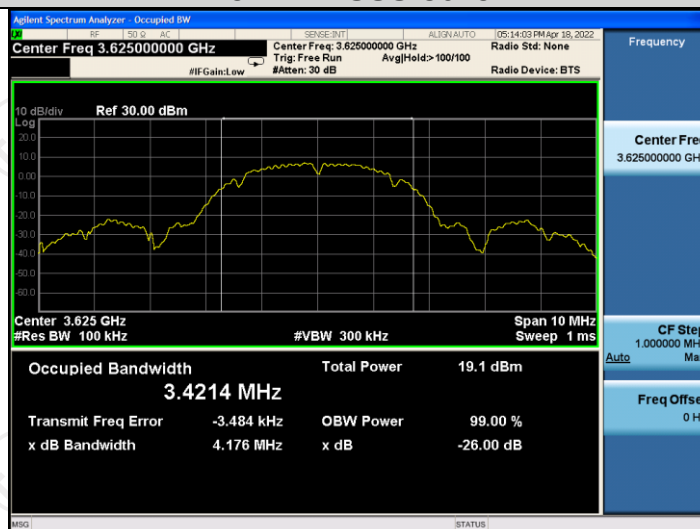
3MHz-OFDM-3695



5MHz-DSSS-3555



5MHz-DSSS-3625



5MHz-DSSS-3695

