FCC RF Test Report

APPLICANT	:	RealWear, Inc.
EQUIPMENT	:	Head Mounted Tablet
BRAND NAME	:	realwear
MODEL NAME	:	T21G
FCC ID	:	2AJOR2101GAA
STANDARD	:	FCC Part 15 Subpart E §15.407
CLASSIFICATION	:	(NII) Unlicensed National Information Infrastructure
TEST DATE(S)	:	Sep. 09, 2021 ~ Sep. 23, 2021

We, Sporton International (Kunshan) Inc., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

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

Jason Jia

Reviewed by: Jason Jia / Supervisor

Alex Wang

Approved by: Alex Wang / Manager

ACCREDITED Cert #5145.02

Sporton International (Kunshan) Inc.
No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300
People's Republic of China

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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR182305D	Rev. 01	Initial issue of report	Oct. 13, 2021

SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	2.1049 & 15.403(i)	26dB & 99% Bandwidth	-	Report only	-
3.2	15.407(a)	Maximum Conducted Output Power	≤ 24 dBm	Pass	-
3.3	15.407(a)	Power Spectral Density	≤ 11 dBm	Pass	-
3.4	15.407(b)	Unwanted Emissions	15.407(b) & 15.209(a)	Pass	Under limit 4.32 dB at 5149.760 MHz
3.5	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 16.81 dB at 0.151 MHz
3.6	15.203 & 15.407(a)	Antenna Requirement	15.203 & 15.407(a)	Pass	-

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

RealWear, Inc.
600 Hatheway Road, Vancouver, WA, 98661

1.2 Manufacturer

RealWear, Inc.
600 Hatheway Road, Vancouver, WA, 98661

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	Head Mounted Tablet
Brand Name	realwear
Model Name	T21G
FCC ID	2AJOR2101GAA
HW Version	A
SW Version	1.0.3-08-T.NAV5XX.G
EUT Stage	Identical Prototype

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

1.4 Product Specification of Equipment Under Test

Standards-related Product Specification	
Tx/Rx Frequency Range	5180 MHz ~ 5240 MHz 5260 MHz ~ 5320 MHz 5500 MHz ~ 5720 MHz
Maximum Output Power to Antenna	**<5180 MHz ~ 5240 MHz>** 802.11a : 14.33 dBm / 0.0271 W 802.11n HT20 : 12.29 dBm / 0.0169 W 802.11n HT40 : 12.48 dBm / 0.0177 W 802.11ac VHT20 : 11.32 dBm / 0.0136 W 802.11ac VHT40 : 11.71 dBm / 0.0148 W 802.11ac VHT80 : 11.26 dBm / 0.0134 W **<5260 MHz ~ 5320 MHz>** 802.11a : 14.12 dBm / 0.0258 W 802.11n HT20 : 12.31 dBm / 0.0170 W 802.11n HT40 : 12.27 dBm / 0.0169 W 802.11ac VHT20 : 11.20 dBm / 0.0132 W 802.11ac VHT40 : 11.58 dBm / 0.0144 W 802.11ac VHT80 : 11.32 dBm / 0.0136 W **<5500 MHz ~ 5720 MHz >** 802.11a : 15.25 dBm / 0.0335 W 802.11n HT20 : 13.29 dBm / 0.0213 W 802.11n HT40 : 12.69 dBm / 0.0186 W

	802.11ac VHT20 : 12.40 dBm / 0.0174 W 802.11ac VHT40 : 10.98 dBm / 0.0125 W 802.11ac VHT80 : 11.56 dBm / 0.0143 W
99% Occupied Bandwidth	802.11a : 17.622 MHz 802.11n HT20 : 18.861 MHz 802.11n HT40 : 36.683 MHz 802.11ac VHT80 : 75.924 MHz
Antenna Type / Gain	**<5150 MHz ~ 5250 MHz>** PIFA Antenna with gain -0.01 dBi **<5250 MHz ~ 5350 MHz>** PIFA Antenna with gain -0.84 dBi **<5470 MHz ~ 5725 MHz>** PIFA Antenna with gain -1.20 dBi
Type of Modulation	802.11a/n : OFDM (BPSK / QPSK / 16QAM / 64QAM) 802.11ac : OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM)

Note: For 802.11n HT20 / ac VHT20 and 802.11n HT40 / ac VHT40 mode, the whole testing have assessed only 802.11n HT20/HT40 by referring to their maximum conducted power.

1.5 Modification of EUT

No modifications are made to the EUT during all test items.

1.6 Testing Location

<FCC>-KS

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.**
	CO01-KS 03CH06-KS TH01-KS	CN1257	314309

1.7 Test Software

Item	Site	Manufacturer	Name	Version
1.	03CH06-KS	AUDIX	E3	6.2009-8-24al
2.	CO01-KS	AUDIX	E3	6.2009-8-24

1.8 Applicable Standards

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

- 47 CFR Part 15 Subpart E
- FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
- ANSI C63.10-2013

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

2 Test Configuration of Equipment Under Test

a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (X plane) were recorded in this report.

b. AC power line Conducted Emission was tested under maximum output power.

2.1 Carrier Frequency and Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
5150-5250 MHz U-NII-1	36	5180	44	5220
	38*	5190	46*	5230
	40	5200	48	5240
	42#	5210		

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
5250-5350 MHz U-NII-2A	52	5260	60	5300
	54*	5270	62*	5310
	56	5280	64	5320
	58#	5290		

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
5470-5725 MHz U-NII-2C	100	5500	112	5560
	102*	5510	116	5580
	104	5520	132	5660
	106#	5530	134*	5670
	108	5540	136	5680
	110*	5550	140	5700

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
TDWR Channel	118*	5590	124	5620
	120	5600	126*	5630
	122#	5610	128	5640

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
Straddle Channel	138#	5690	144	5720
	142*	5710		

Note:

1. The above Frequency and Channel in "*" were 802.11n HT40 and 802.11ac VHT40.
2. The above Frequency and Channel in "#" were 802.11ac VHT80.

2.2 Test Mode

Final test modes are considering the modulation and worse data rates as below table.

Modulation	Data Rate
802.11a	6 Mbps
802.11n HT20	MCS0
802.11n HT40	MCS0
802.11ac VHT80	MCS0

Test Cases	
AC Conducted Emission	Mode 1 : Bluetooth Link + WLAN Link(5G) + Earphone + USB Cable(Charging from Adapter)
Remark: For Radiated Test Cases, The tests were performance with Adapter, Earphone, and USB Cable	

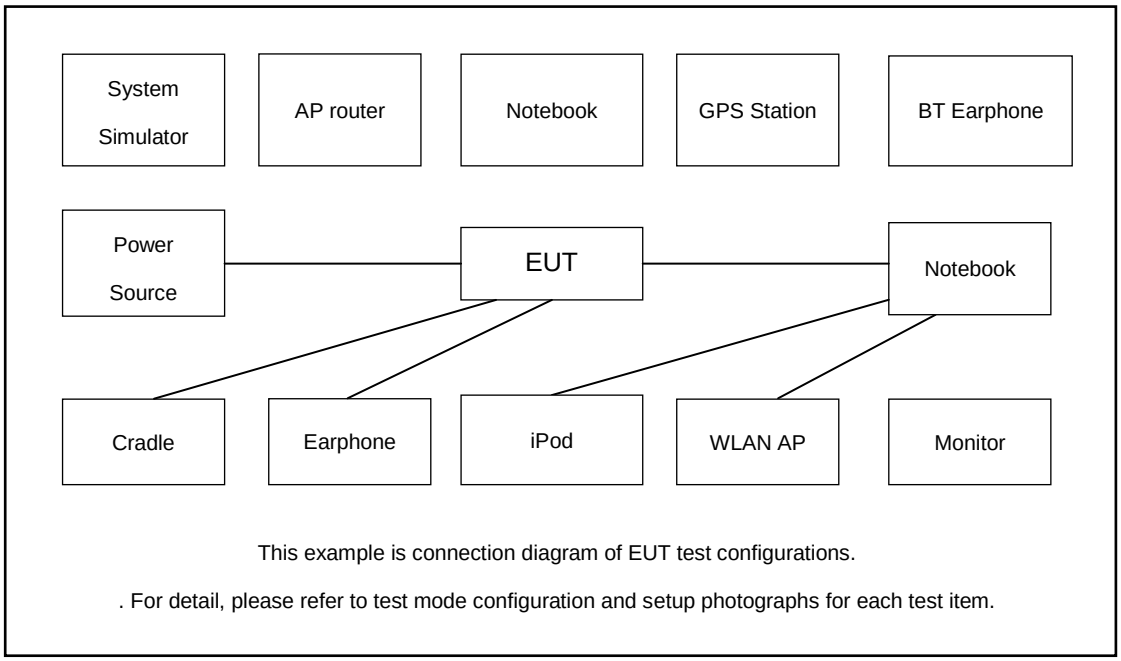
Ch. #		U-NII-1：5150-5250 MHz	U-NII-2A：5250-5350 MHz	U-NII-2C：5470-5725MHz
		802.11a	802.11a	802.11a
L	Low	36	52	100
M	Middle	44	60	116
H	High	48	64	140
Straddle		-	-	144

Ch. #		U-NII-1：5150-5250 MHz	U-NII-2A：5250-5350 MHz	U-NII-2C：5470-5725MHz
		802.11n HT20	802.11n HT20	802.11n HT20
L	Low	36	52	100
M	Middle	44	60	116
H	High	48	64	140
Straddle		-	-	144

Ch. #		U-NII-1：5150-5250 MHz	U-NII-2A：5250-5350 MHz	U-NII-2C：5470-5725MHz
		802.11n HT40	802.11n HT40	802.11n HT40
L	Low	38	54	102
M	Middle	-	-	110
H	High	46	62	134
Straddle		-	-	142

Ch. #		U-NII-1：5150-5250 MHz	U-NII-2A：5250-5350 MHz	U-NII-2C：5470-5725MHz
		802.11ac VHT80	802.11ac VHT80	802.11ac VHT80
L	Low	-	-	106
M	Middle	42	58	-
H	High	-	-	122
Straddle		-	-	138

2.3 Connection Diagram of Test System



This example is connection diagram of EUT test configurations.

. For detail, please refer to test mode configuration and setup photographs for each test item.

2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Bluetooth Earphone	Lenovo	LBH308	N/A	N/A	N/A
2.	Notebook	Lenovo	G480	QDS-BRCM1050I	N/A	shielded cable DC O/P 1.8m , Unshielded AC I/P cable 1.8m
3.	WLAN AP	D-link	DIR-655	KA21R655B1	N/A	Unshielded,1.8m
4.	Earphone	Lenovo	P121	N/A	N/A	N/A
5.	Adapter	realwear	CK18W02U	N/A	N/A	N/A
6.	BT Base Station	R&S	CBT	N/A	N/A	Unshielded,1.8m

2.5 EUT Operation Test Setup

For WLAN RF test items, an engineering test program was provided and enabled to make EUT continuously transmit/receive.

For AC power line conducted emissions, the EUT was set to connect with the WLAN AP under large package sizes transmission.

2.6 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example :

The spectrum analyzer offset is derived from RF cable loss.

Offset = RF cable loss.

Following shows an offset computation example with cable loss 7.2 dB.

Offset(dB) = RF cable loss(dB).

= 7.2 (dB)

3 Test Result

3.1 26dB & 99% Occupied Bandwidth Measurement

3.1.1 Description of 26dB & 99% Occupied Bandwidth

This section is for reporting purpose only.

There is no restriction limits for bandwidth.

For Straddle Channel, According to KDB 789033 D02 General UNII Test Procedures New Rules v02r01, If the power and PSD of the devices are uniform and comply with the lower limits specified for the U-NII-2 bands, a single measurement over the entire emission bandwidth can be performed to show compliance.

3.1.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.1.3 Test Procedures

1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01. Section C) Emission bandwidth
2. Set RBW = approximately 1% of the emission bandwidth.
3. Set the VBW > RBW.
4. Detector = Peak.
5. Trace mode = max hold
6. Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.
7. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set 1MHz and set the Video bandwidth (VBW) ≥ 3 * RBW.
8. Measure and record the results in the test report.

3.1.4 Test Setup

3.1.5 Test Result of 26dB & 99% Occupied Bandwidth

Please refer to Appendix A.

3.2 Maximum Conducted Output Power Measurement

3.2.1 Limit of Maximum Conducted Output Power

<FCC 14-30 CFR 15.407>

For mobile and portable client devices in the 5.15–5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW.

For the 5.25–5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm 10 log B, where B is the 26 dB emission bandwidth in megahertz.

For the 5.47–5.6 GHz and 5.65–5.725 GHz band, the maximum conducted output power shall not exceed 250 mW or 11 + 10 log10 B, dBm, whichever power is less. The maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 log10B, dBm, whichever is less. B is the 99% emission bandwidth in megahertz.

For Straddle Channel, According to KDB 789033 D02 General UNII Test Procedures New Rules v02r01, If the power and PSD of the devices are uniform and comply with the lower limits specified for the U-NII-2 bands, a single measurement over the entire emission bandwidth can be performed to show compliance.

If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Note that U-NII-2 band, devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

3.2.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.2.3 Test Procedures

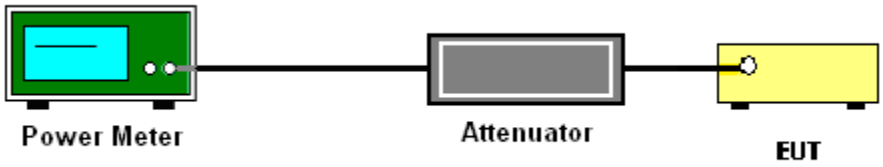
The testing follows Method PM of FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.

Method PM (Measurement using an RF average power meter):

1. Measurement is performed using a wideband RF power meter.
2. The EUT is configured to transmit continuously with a consistent duty cycle at its maximum power control level.
3. Measure the average power of the transmitter, and the average power is corrected with duty factor, 10 log(1/x), where x is the duty cycle.

For Straddle Channel, According to KDB 789033 D02 General UNII Test Procedures New Rules v02r01, If the power and PSD of the devices are uniform and comply with the lower limits specified for the U-NII-2 bands, a single measurement over the entire emission bandwidth can be performed to show compliance.

3.2.4 Test Setup



3.2.5 Test Result of Maximum Conducted Output Power

FCC U-NII-1										
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Duty Factor (dB)	Average Conducted Power (dBm)	FCC Conducted Power Limit (dBm)	DG (dBi)		Pass/Fail
11a	6Mbps	1	36	5180	0.08	13.73	24.00	-0.01		Pass
11a	6Mbps	1	40	5200	0.08	13.86	24.00	-0.01		Pass
11a	6Mbps	1	48	5240	0.08	14.33	24.00	-0.01		Pass
HT20	MCS0	1	36	5180	0.08	11.63	24.00	-0.01		Pass
HT20	MCS0	1	40	5200	0.08	11.84	24.00	-0.01		Pass
HT20	MCS0	1	48	5240	0.08	12.29	24.00	-0.01		Pass
HT40	MCS0	1	38	5190	0.16	12.11	24.00	-0.01		Pass
HT40	MCS0	1	46	5230	0.16	12.48	24.00	-0.01		Pass
VHT20	MCS0	1	36	5180	0.08	10.89	24.00	-0.01		Pass
VHT20	MCS0	1	40	5200	0.08	11.02	24.00	-0.01		Pass
VHT20	MCS0	1	48	5240	0.08	11.32	24.00	-0.01		Pass
VHT40	MCS0	1	38	5190	0.16	11.27	24.00	-0.01		Pass
VHT40	MCS0	1	46	5230	0.16	11.71	24.00	-0.01		Pass
VHT80	MCS0	1	42	5210	0.34	11.26	24.00	-0.01		Pass

FCC U-NII-2A										
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Duty Factor (dB)	Average Conducted Power (dBm)	FCC Conducted Power Limit (dBm)	DG (dBi)	EIRP Power Limit (dBm)	Pass/Fail
11a	6M bps	1	52	5260	0.08	14.12	23.98	-0.84	26.99	Pass
11a	6M bps	1	56	5280	0.08	14.06	23.98	-0.84	26.99	Pass
11a	6M bps	1	64	5320	0.08	14.11	23.98	-0.84	26.99	Pass
HT20	MCS 0	1	52	5260	0.08	12.26	23.98	-0.84	26.99	Pass
HT20	MCS 0	1	56	5280	0.08	12.31	23.98	-0.84	26.99	Pass
HT20	MCS 0	1	64	5320	0.08	12.23	23.98	-0.84	26.99	Pass
HT40	MCS 0	1	54	5270	0.16	12.18	23.98	-0.84	26.99	Pass
HT40	MCS 0	1	62	5310	0.16	12.27	23.98	-0.84	26.99	Pass
VHT20	MCS 0	1	52	5260	0.08	11.20	23.98	-0.84	26.99	Pass
VHT20	MCS 0	1	56	5280	0.08	11.13	23.98	-0.84	26.99	Pass
VHT20	MCS 0	1	64	5320	0.08	11.05	23.98	-0.84	26.99	Pass
VHT40	MCS 0	1	54	5270	0.16	11.53	23.98	-0.84	26.99	Pass
VHT40	MCS 0	1	62	5310	0.16	11.58	23.98	-0.84	26.99	Pass
VHT80	MCS 0	1	58	5290	0.34	11.32	23.98	-0.84	26.99	Pass

FCC U-NII-2C										
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Duty Factor (dB)	Average Conducted Power (dBm)	FCC Conducted Power Limit (dBm)	DG (dBi)	EIRP Power Limit (dBm)	Pass/Fail
11a	6M bps	1	100	5500	0.08	14.01	23.98	-1.20	26.99	Pass
11a	6M bps	1	116	5580	0.08	15.25	23.98	-1.20	26.99	Pass
11a	6M bps	1	140	5700	0.08	12.91	23.98	-1.20	26.99	Pass
11a	6Mbps	1	144	5720	0.08	13.13	23.98	-1.20	26.99	Pass
HT20	MCS 0	1	100	5500	0.08	12.15	23.98	-1.20	26.99	Pass
HT20	MCS 0	1	116	5580	0.08	13.29	23.98	-1.20	26.99	Pass
HT20	MCS 0	1	140	5700	0.08	10.94	23.98	-1.20	26.99	Pass
HT20	MCS0	1	144	5720	0.08	11.12	23.98	-1.20	26.99	Pass
HT40	MCS 0	1	102	5510	0.16	12.09	23.98	-1.20	26.99	Pass
HT40	MCS 0	1	110	5550	0.16	12.69	23.98	-1.20	26.99	Pass
HT40	MCS0	1	134	5670	0.16	12.19	23.98	-1.20	26.99	Pass
HT40	MCS 0	1	142	5610	0.16	10.78	23.98	-1.20	26.99	Pass
VHT20	MCS 0	1	100	5500	0.08	11.17	23.98	-1.20	26.99	Pass
VHT20	MCS 0	1	116	5580	0.08	12.40	23.98	-1.20	26.99	Pass
VHT20	MCS 0	1	140	5700	0.08	9.84	23.98	-1.20	26.99	Pass
VHT20	MCS0	1	144	5720	0.08	9.90	23.98	-1.20	26.99	Pass
VHT40	MCS 0	1	102	5510	0.16	10.87	23.98	-1.20	26.99	Pass
VHT40	MCS 0	1	110	5550	0.16	10.98	23.98	-1.20	26.99	Pass
VHT40	MCS0	1	134	5670	0.16	10.46	23.98	-1.20	26.99	Pass
VHT40	MCS 0	1	142	5710	0.16	9.18	23.98	-1.20	26.99	Pass
VHT80	MCS 0	1	106	5530	0.34	11.56	23.98	-1.20	26.99	Pass
VHT80	MCS 0	1	122	5610	0.34	11.03	23.98	-1.20	26.99	Pass
VHT80	MCS0	1	138	5690	0.34	9.62	23.98	-1.20	26.99	Pass

3.3 Power Spectral Density Measurement

3.3.1 Limit of Power Spectral Density

<FCC 14-30 CFR 15.407>

For mobile and portable client devices in the 5.15–5.25 GHz band, the maximum power spectral density shall not exceed 11dBm in any 1 megahertz band.

For the 5.25–5.725 GHz bands, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band.

For Straddle Channel, According to KDB 789033 D02 General UNII Test Procedures New Rules v02r01, If the power and PSD of the devices are uniform and comply with the lower limits specified for the U-NII-2 bands, a single measurement over the entire emission bandwidth can be performed to show compliance.

If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.3.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.3.3 Test Procedures

The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01. Section F) Maximum power spectral density.

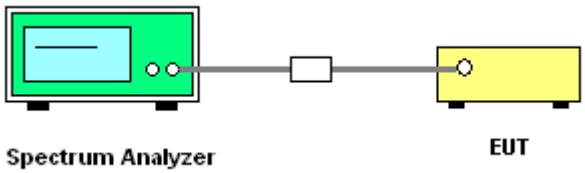
 # Method SA-2 #

(trace averaging across on and off times of the EUT transmissions, followed by duty cycle correction).

- Measure the duty cycle.
- Set span to encompass the entire emission bandwidth (EBW) of the signal.
- Set RBW = 1 MHz.
- Set VBW ≥ 3 MHz.
- Number of points in sweep ≥ 2 Span / RBW.
- Sweep time = auto.
- Detector = RMS
- Trace average at least 100 traces in power averaging mode.
- Add 10 log(1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times. For example, add 10 log(1/0.25) = 6 dB if the duty cycle is 25 percent.

1. The RF output of EUT was connected to the spectrum analyzer by a low loss cable.
2. Each plot has already offset with cable loss, and attenuator loss. Measure the PPSD and record it.

3.3.4 Test Setup



3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.

3.4 Unwanted Emissions Measurement

This section is to measure unwanted emissions through radiated measurement for band edge spurious emissions and out of band emissions measurement.

3.4.1 Limit of Unwanted Emissions

(1) For transmitters operating in the 5150-5250 MHz band: all emissions outside of the 5150-5350 MHz band shall not exceed an EIRP of –27dBm/MHz.

For transmitters operating in the 5250-5350 MHz band: all emissions outside of the 5150-5350 MHz band shall not exceed an EIRP of -27 dBm/MHz. Devices operating in the 5250-5350 MHz band that generate emissions in the 5150-5250 MHz band must meet all applicable technical requirements for operation in the 5150-5250 MHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5150-5250 MHz band.

For transmitters operating in the 5470-5725 MHz band: all emissions outside of the 5470-5725 MHz band shall not exceed an EIRP of -27 dBm/MHz.

(2) Unwanted spurious emissions fallen in restricted bands shall comply with the general field strength limits as below table,

Frequency (MHz)	Field Strength (microvolts/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

EIRP (dBm)	Field Strength at 3m (dBμV/m)
- 27	68.3

Note: The following formula is used to convert the EIRP to field strength.

$$EIRP = E_{Meas} + 20\log(d_{Meas}) - 104.7$$

where

EIRP is the equivalent isotropically radiated power, in dBm

E_{Meas} is the field strength of the emission at the measurement distance, in dBμV/m

d_{Meas} is the measurement distance, in m

3.4.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.4.3 Test Procedures

1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01. Section G) Unwanted emissions measurement.

   (1) Procedure for Unwanted Emissions Measurements Below 1000MHz

   - RBW = 120 kHz
   - VBW = 300 kHz
   - Detector = Peak
   - Trace mode = max hold

   (2) Procedure for Peak Unwanted Emissions Measurements Above 1000 MHz

   - RBW = 1 MHz
   - VBW ≥ 3 MHz
   - Detector = Peak
   - Sweep time = auto
   - Trace mode = max hold

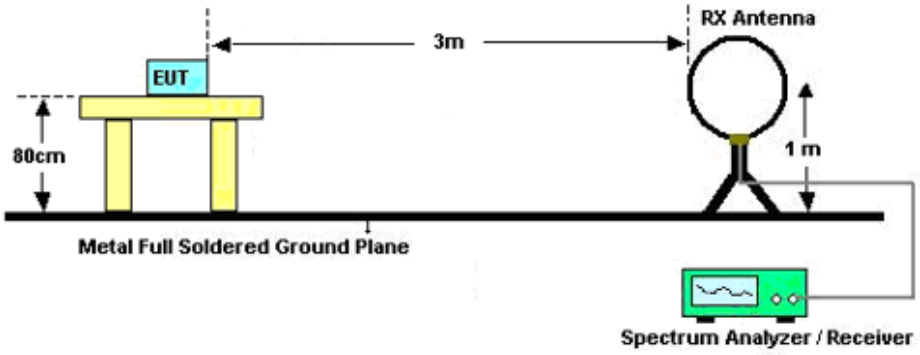
   (3) Procedures for Average Unwanted Emissions Measurements Above 1000MHz

   - RBW = 1 MHz
   - VBW = 10 Hz, when duty cycle is no less than 98 percent.
   - VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

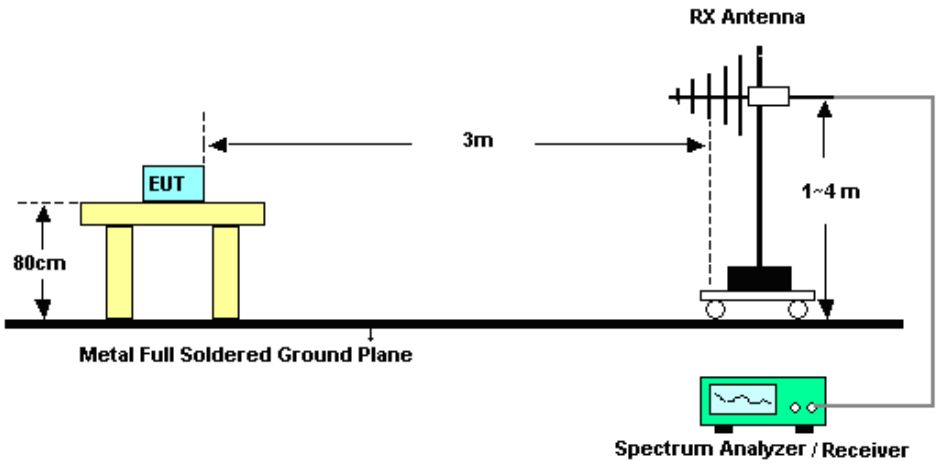
2. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
3. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
4. The antenna is a broadband antenna and its height is adjusted between one meter and four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
5. For each suspected emission, the EUT was arranged to its worst case and then adjust the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.
6. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
7. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than peak limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

3.4.4 Test Setup

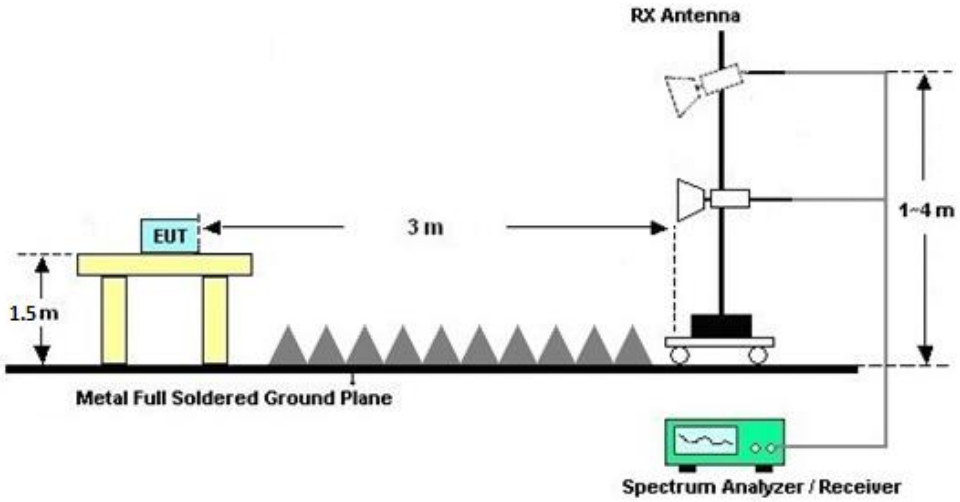
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.4.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

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.

There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

3.4.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C.

3.4.7 Duty Cycle

Please refer to Appendix D.

3.4.8 Test Result of Radiated Spurious Emissions (30MHz ~ 10th Harmonic or 40GHz, whichever is lower)

Please refer to Appendix C.

3.5 AC Conducted Emission Measurement

3.5.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

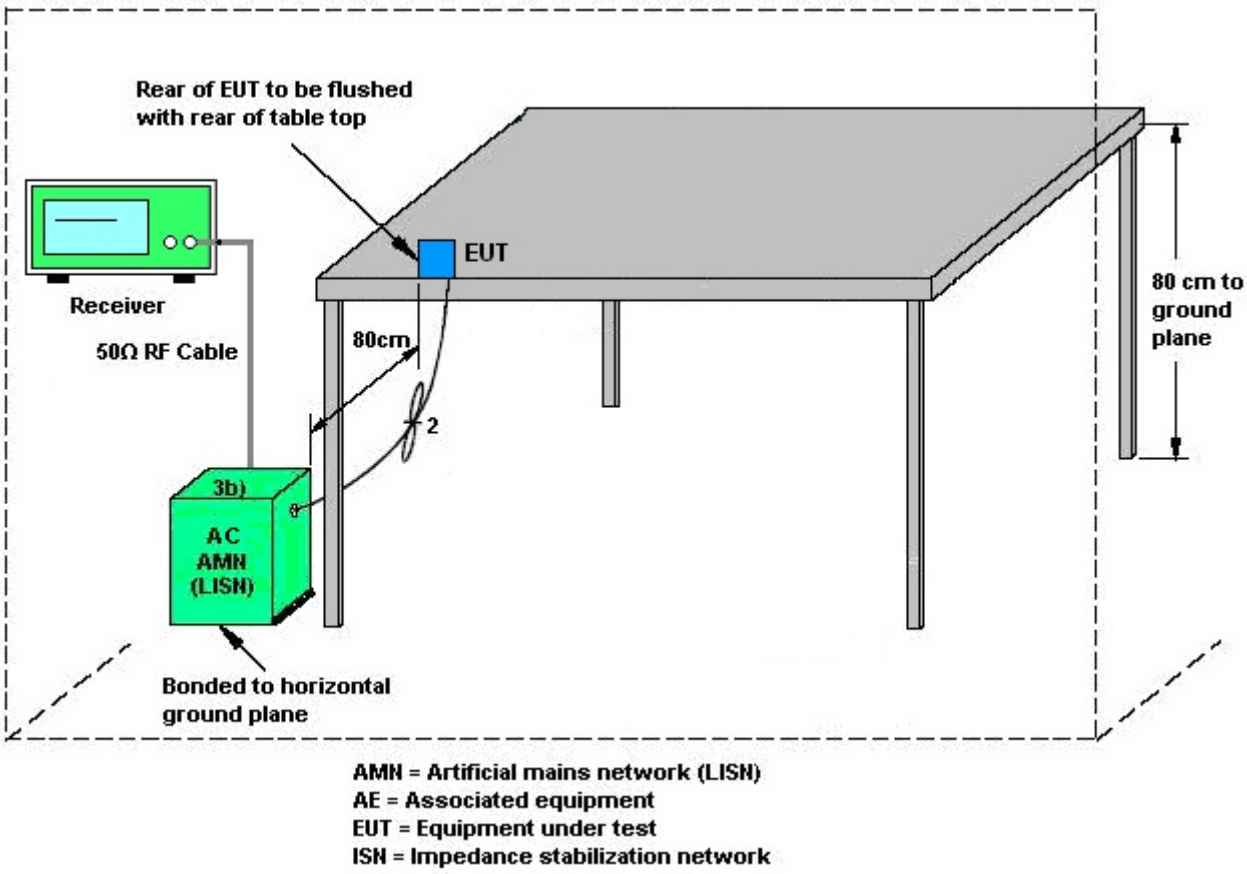
3.5.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.5.3 Test Procedures

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

3.5.4 Test Setup



3.5.5 Test Result of AC Conducted Emission

Please refer to Appendix B.

3.6 Antenna Requirements

3.6.1 Standard Applicable

If transmitting antenna directional gain is greater than 6 dBi, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.6.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.6.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.

4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Spectrum Analyzer	R&S	FSV40	101040	10Hz~40GHz	Nov. 01, 2020	Sep. 09, 2021~ Sep. 19, 2021	Oct. 31, 2021	Conducted (TH01-KS)
Pulse Power Senor	Anritsu	MA2411B	0917070	300MHz~40GHz	Jan. 07, 2021	Sep. 09, 2021~ Sep. 19, 2021	Jan. 06, 2022	Conducted (TH01-KS)
Power Meter	Anritsu	ML2495A	1005002	50MHz Bandwidth	Jan. 07, 2021	Sep. 09, 2021~ Sep. 19, 2021	Jan. 06, 2022	Conducted (TH01-KS)
Temperature &humidity chamber	Hongzhan	LP-150U	H2014011440	-40~+150°C 20%~95%RH	Jul. 12, 2021	Sep. 09, 2021~ Sep. 19, 2021	Jul. 11, 2022	Conducted (TH01-KS)
EMI Test Receiver	Keysight	N9038A	MY56400004	3Hz~8.5GHz;Max 30dBm	Oct. 17, 2020	Sep. 14, 2021	Oct. 16, 2021	Radiation (03CH06-KS)
EXA Spectrum Analyzer	Keysight	N9010A	MY55150208	10Hz-44GHz	Apr. 12, 2021	Sep. 14, 2021	Apr. 11, 2022	Radiation (03CH06-KS)
Loop Antenna	R&S	HFH2-Z2	100321	9kHz~30MHz	Nov. 01, 2020	Sep. 14, 2021	Oct. 31, 2021	Radiation (03CH06-KS)
Bilog Antenna	TeseQ	CBL6111D	49921	30MHz-1GHz	May. 27, 2021	Sep. 14, 2021	May. 26, 2022	Radiation (03CH06-KS)
Double Ridge Horn Antenna	ETS-Lindgren	3117	00218652	1GHz~18GHz	Apr. 25, 2021	Sep. 14, 2021	Apr. 24, 2022	Radiation (03CH06-KS)
SHF-EHF Horn	Com-power	AH-840	101115	18GHz~40GHz	Nov. 10, 2020	Sep. 14, 2021	Nov. 09, 2021	Radiation (03CH06-KS)
Amplifier	SONOMA	310N	187289	9KHz ~1GHZ	Apr. 12, 2021	Sep. 14, 2021	Apr. 11, 2022	Radiation (03CH06-KS)
Amplifier	MITEQ	EM18G40GGA	060728	18~40GHz	Jan. 06, 2021	Sep. 14, 2021	Jan. 05, 2022	Radiation (03CH06-KS)
high gain Amplifier	MITEQ	AMF-7D-00101800-30-10P	2025788	1Ghz-18Ghz	Jan. 06, 2021	Sep. 14, 2021	Jan. 05, 2022	Radiation (03CH06-KS)
Amplifier	Keysight	83017A	MY53270203	500MHz~26.5GHz	Apr. 13, 2021	Sep. 14, 2021	Apr. 12, 2022	Radiation (03CH06-KS)
AC Power Source	Chroma	61601	F104090004	N/A	NCR	Sep. 14, 2021	NCR	Radiation (03CH06-KS)
Turn Table	ChamPro	EM 1000-T	060762-T	0~360 degree	NCR	Sep. 14, 2021	NCR	Radiation (03CH06-KS)
Antenna Mast	ChamPro	EM 1000-A	060762-A	1 m~4 m	NCR	Sep. 14, 2021	NCR	Radiation (03CH06-KS)
EMI Receiver	R&S	ESCI7	100768	9kHz~7GHz;	Apr. 21, 2021	Sep. 23, 2021	Apr. 20, 2022	Conduction (CO01-KS)
AC LISN (for auxiliary equipment)	MessTec	AN3016	060103	9kHz~30MHz	Oct. 17, 2020	Sep. 23, 2021	Oct. 16, 2021	Conduction (CO01-KS)
AC LISN	R&S	ENV216	100334	9kHz~30MHz	Oct. 17, 2020	Sep. 23, 2021	Oct. 16, 2021	Conduction (CO01-KS)
AC Power Source	Chroma	61602	ABP000000811	AC 0V~300V, 45Hz~1000Hz	Oct. 17, 2020	Sep. 23, 2021	Oct. 16, 2021	Conduction (CO01-KS)

NCR: No Calibration Required.

5 Uncertainty of Evaluation

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI 63.10-2013. 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 Conducted Emission Measurement (150kHz ~ 30MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**2.94dB**

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.0dB**

Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.0dB**

Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.0dB**

---------- THE END ----------

Appendix A. Conducted Test Results

Test Engineer :	Yong He	Temperature :	20~26°C
		Relative Humidity :	40~51%

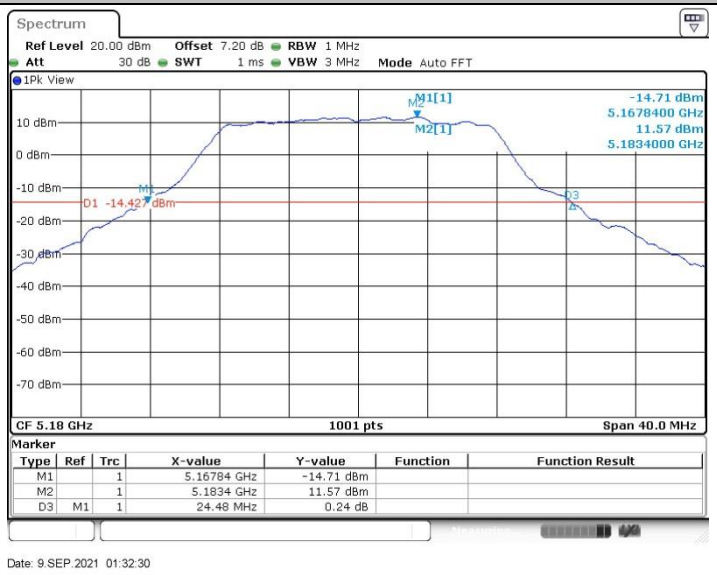
Appendix A1: Emission Bandwidth

Test Result

Test Mode	Antenna	Frequency [MHz]	26db EBW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11A	Ant1	5180	24.480	5167.840	5192.320	---	---
		5200	24.400	5187.920	5212.320	---	---
		5240	24.400	5227.920	5252.320	---	---
		5260	24.120	5248.120	5272.240	---	---
		5280	24.480	5267.880	5292.360	---	---
		5320	24.440	5307.920	5332.360	---	---
		5500	24.400	5487.920	5512.320	---	---
		5580	24.440	5567.960	5592.400	---	---
		5700	24.280	5688.080	5712.360	---	---
		5720	24.760	5707.720	5732.480	---	---
11N20SISO	Ant1	5180	26.400	5166.880	5193.280	---	---
		5200	25.960	5187.320	5213.280	---	---
		5240	25.480	5227.640	5253.120	---	---
		5260	25.360	5247.560	5272.920	---	---
		5280	25.840	5267.360	5293.200	---	---
		5320	25.480	5307.560	5333.040	---	---
		5500	25.760	5487.480	5513.240	---	---
		5580	25.840	5567.480	5593.320	---	---
		5700	25.760	5687.520	5713.280	---	---
		5720	25.960	5707.520	5733.480	---	---
11N40SISO	Ant1	5190	41.920	5169.040	5210.960	---	---
		5230	42.000	5209.040	5251.040	---	---
		5270	42.080	5248.960	5291.040	---	---
		5310	42.240	5288.880	5331.120	---	---
		5510	42.080	5488.960	5531.040	---	---
		5550	42.000	5528.960	5570.960	---	---
		5670	41.920	5649.040	5690.960	---	---
		5710	42.320	5688.800	5731.120	---	---
11AC80SISO	Ant1	5210	84.160	5167.920	5252.080	---	---
		5290	84.480	5247.760	5332.240	---	---
		5530	84.160	5487.920	5572.080	---	---
		5610	84.320	5567.600	5651.920	---	---
		5690	84.800	5647.440	5732.240	---	---

Test Graphs

11A_Ant1_5180



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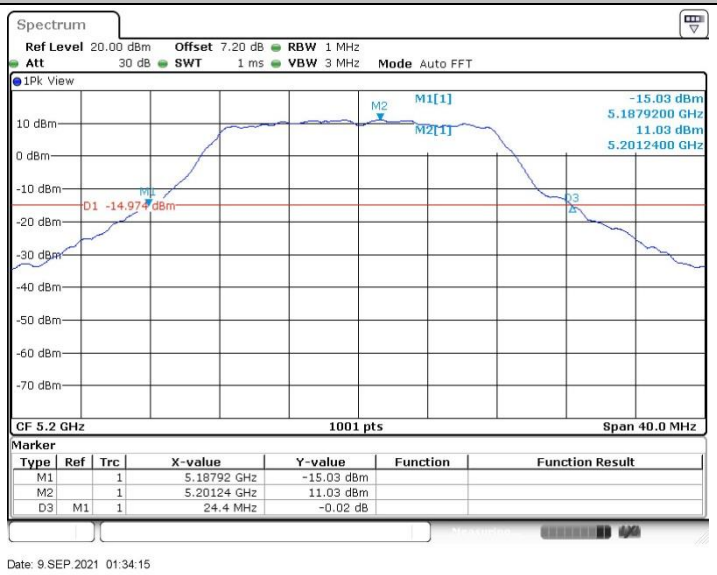

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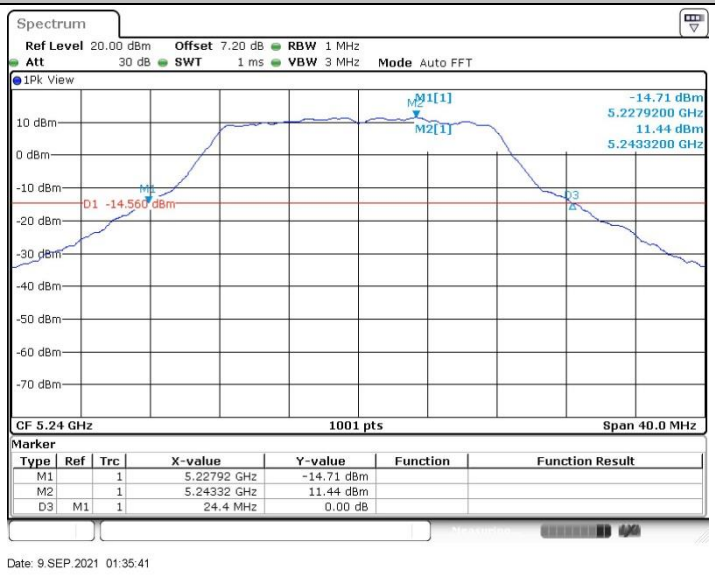

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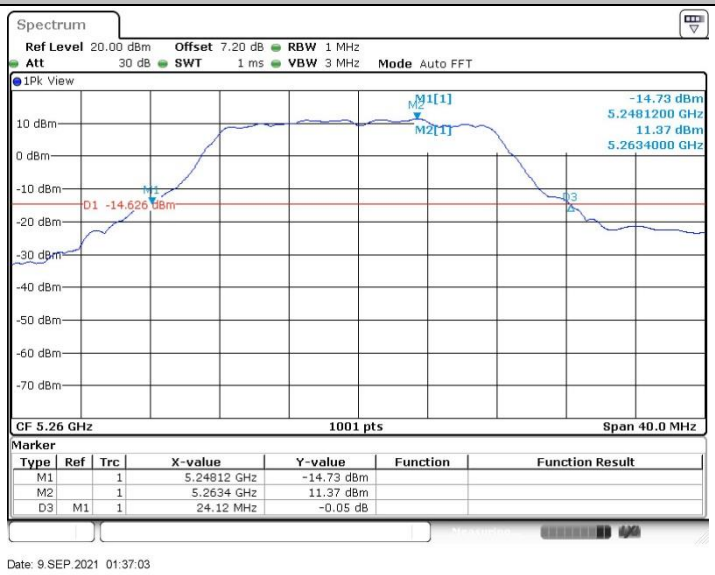

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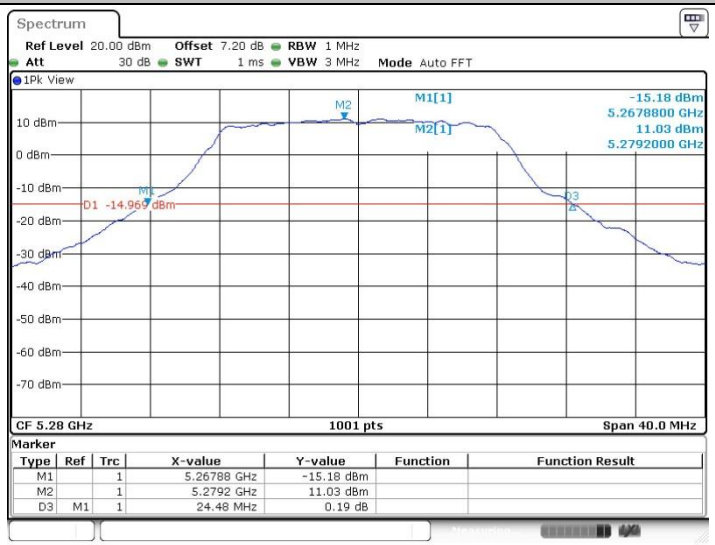

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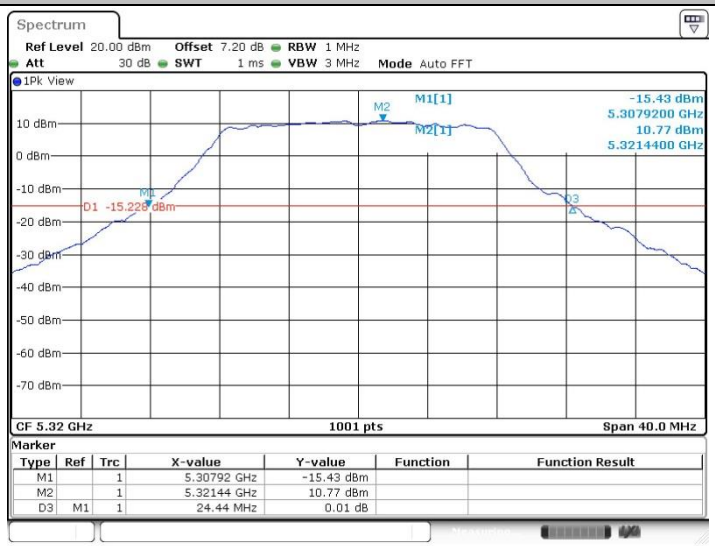

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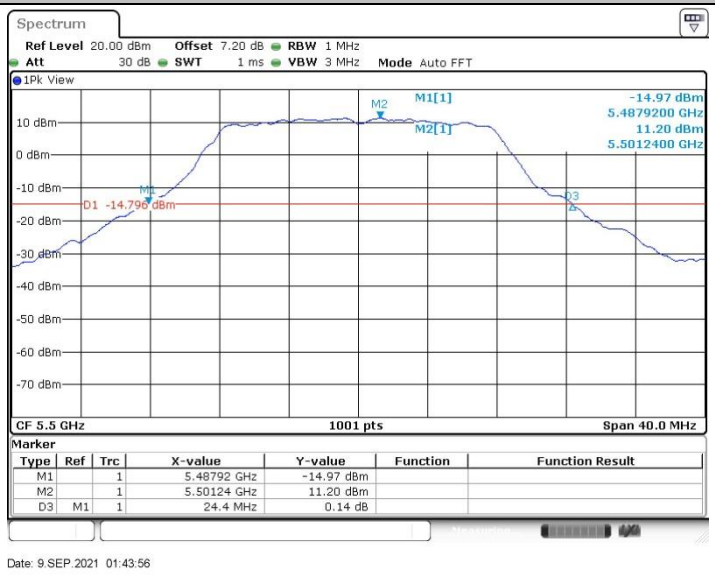

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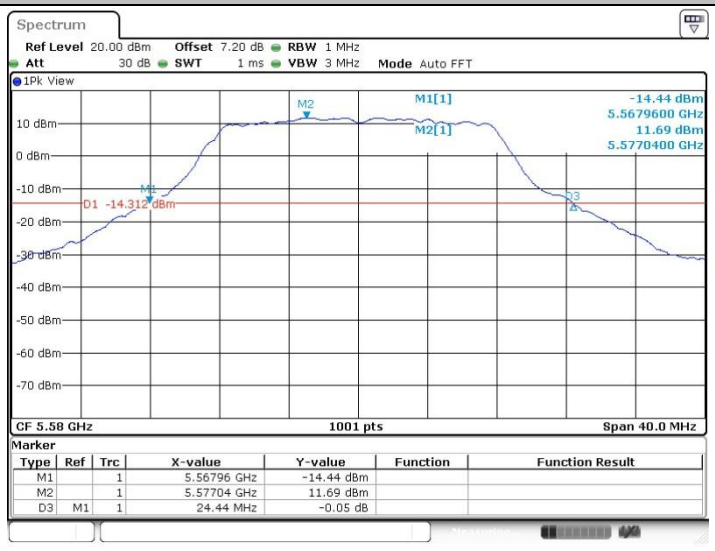

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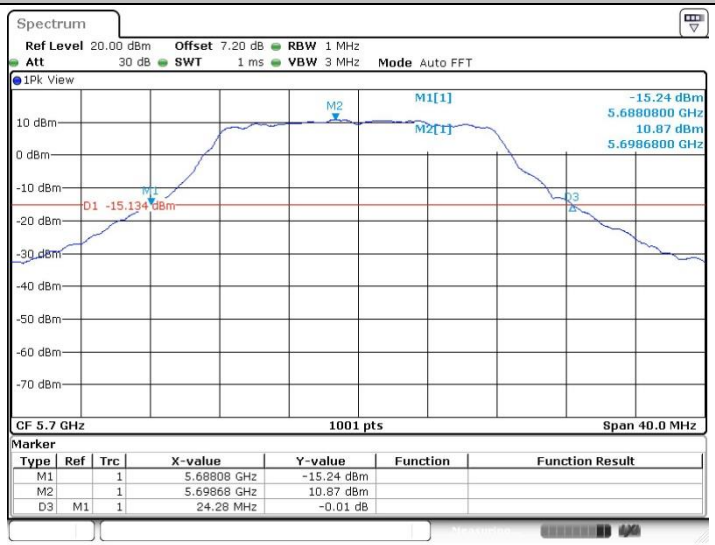

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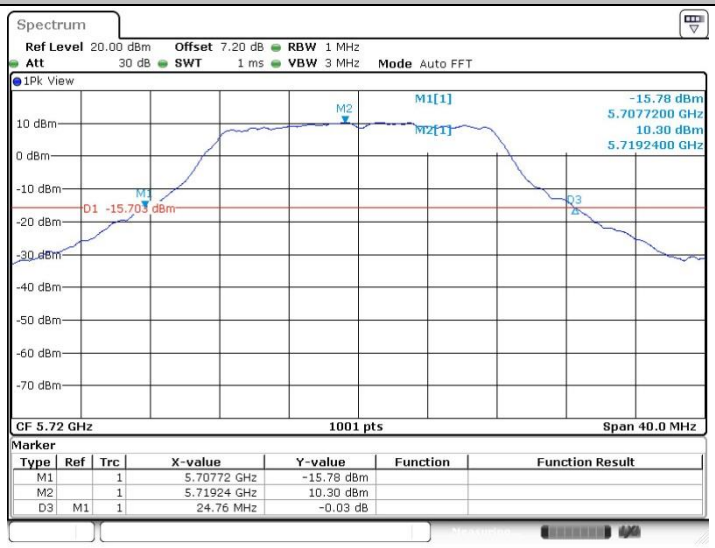

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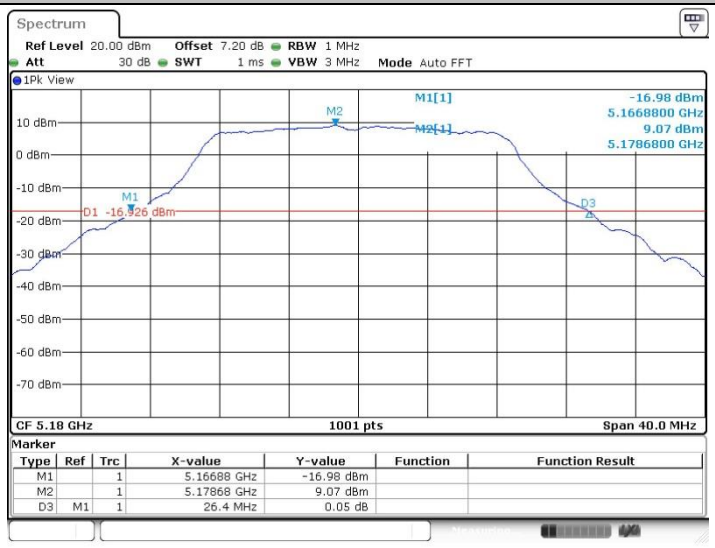

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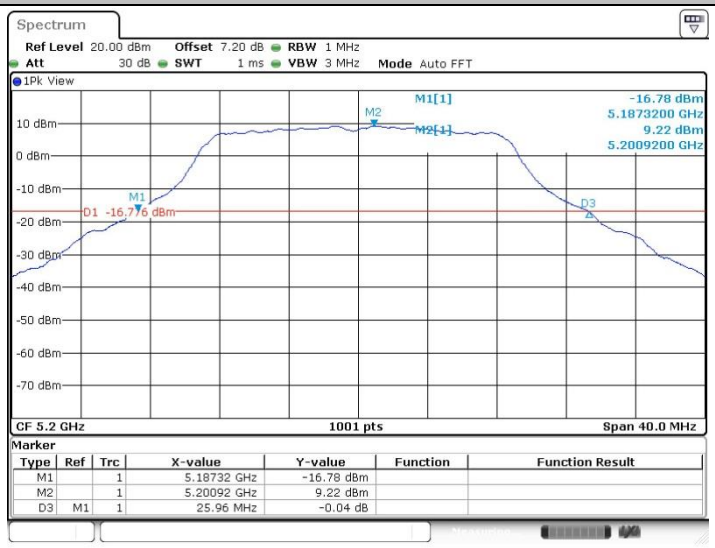

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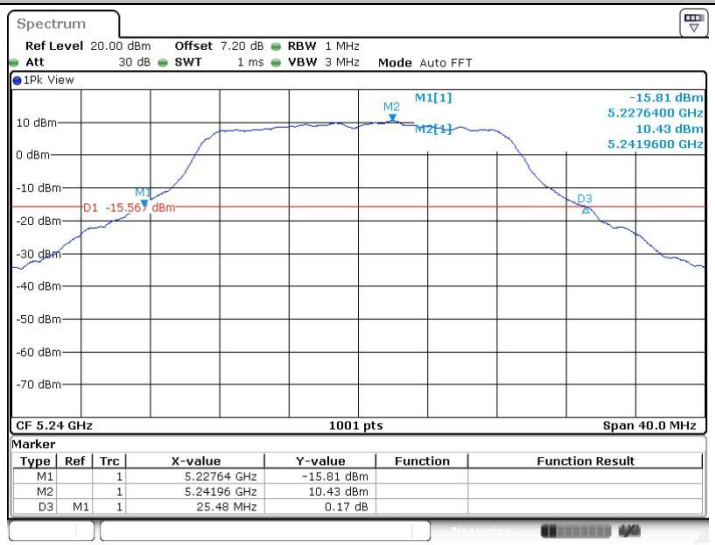

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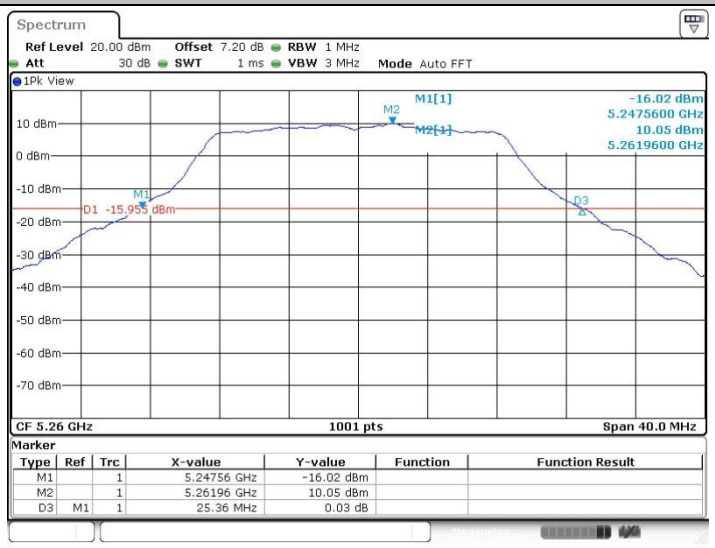

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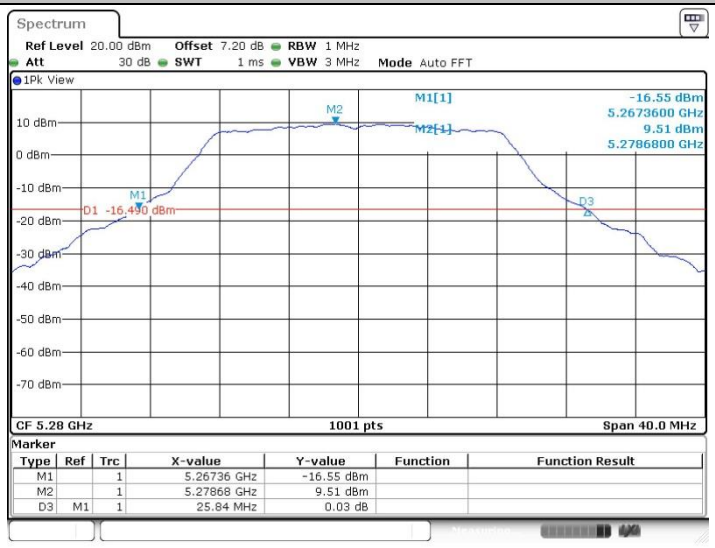

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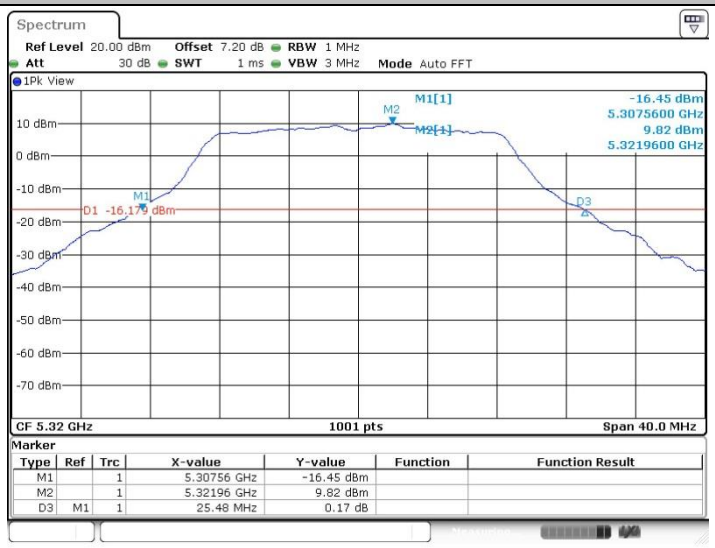

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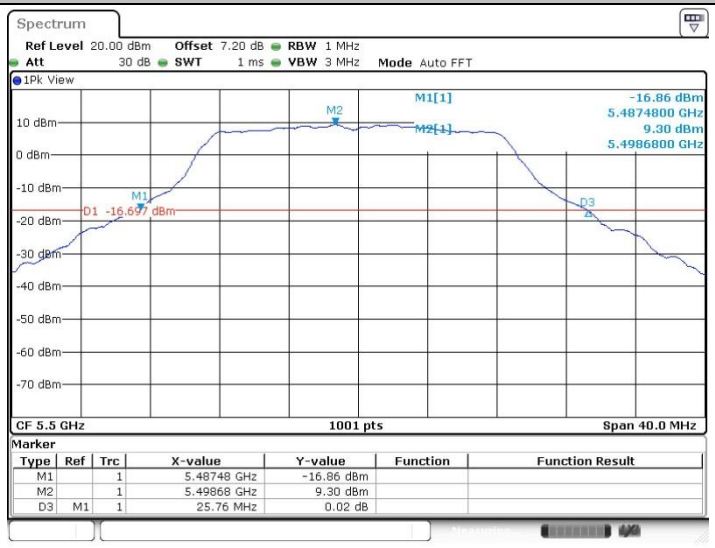

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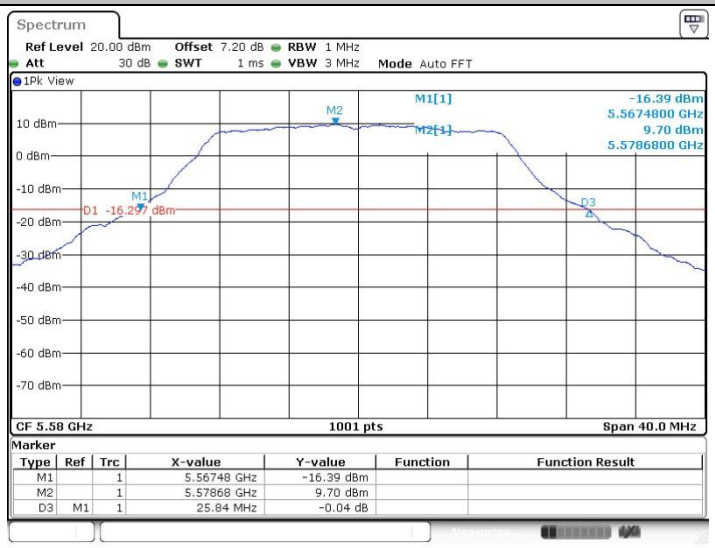

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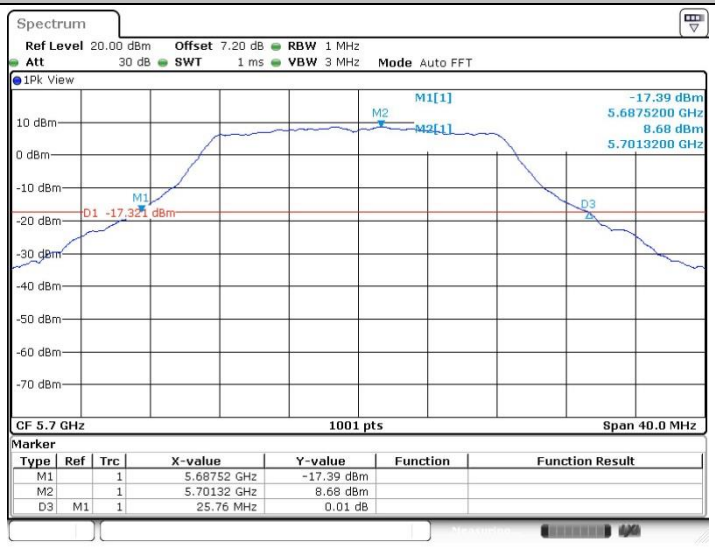

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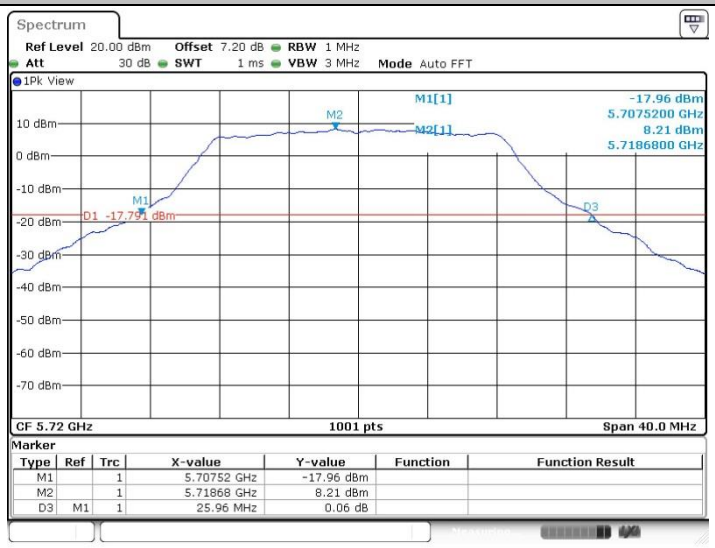

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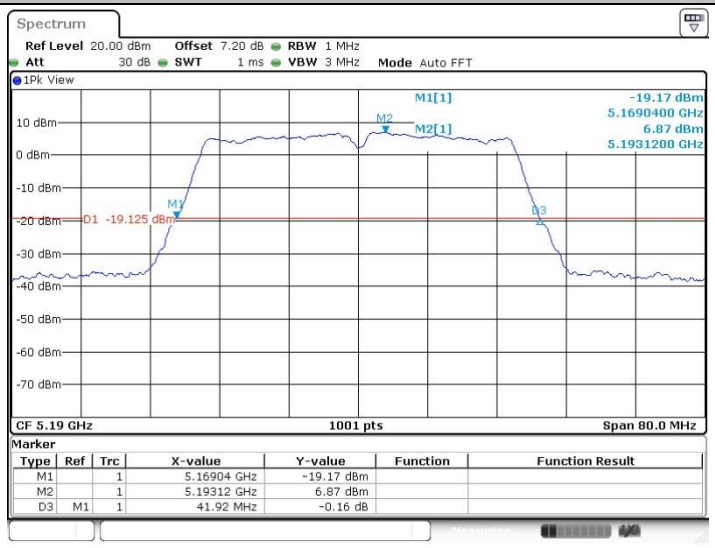

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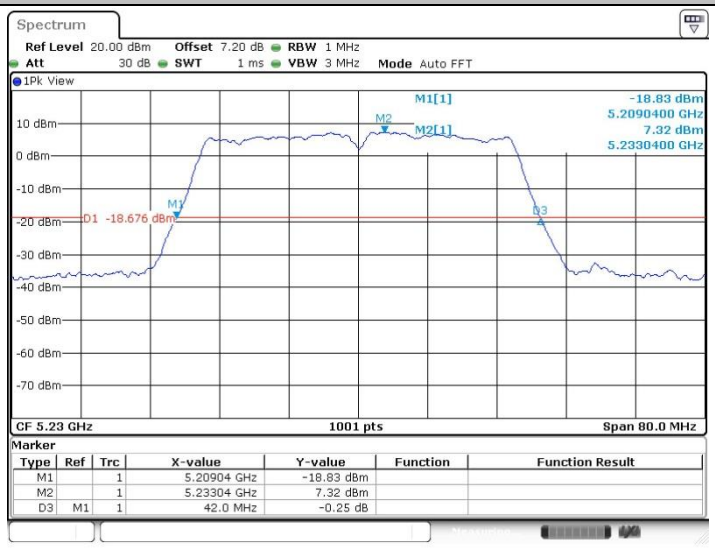

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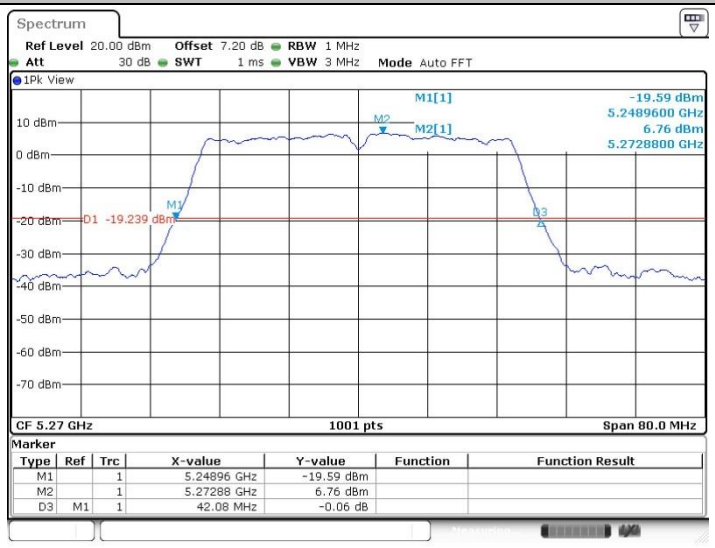

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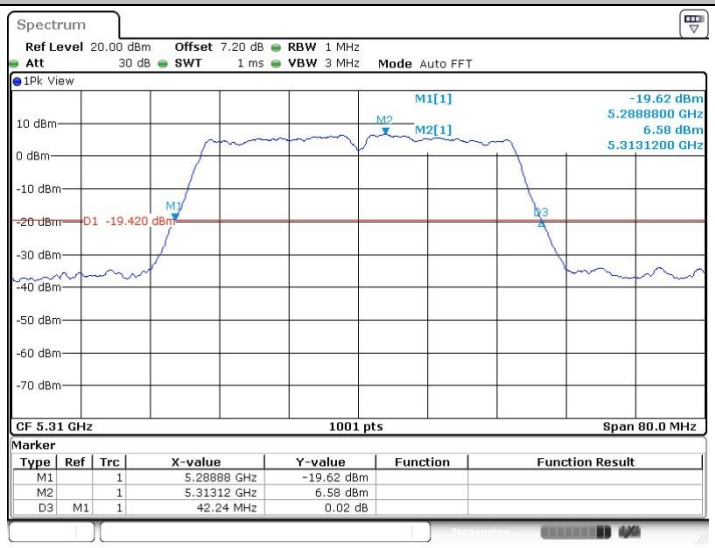

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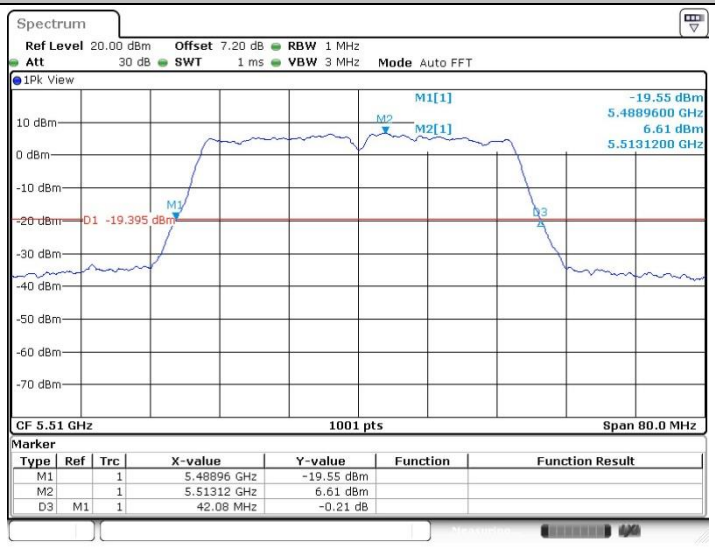

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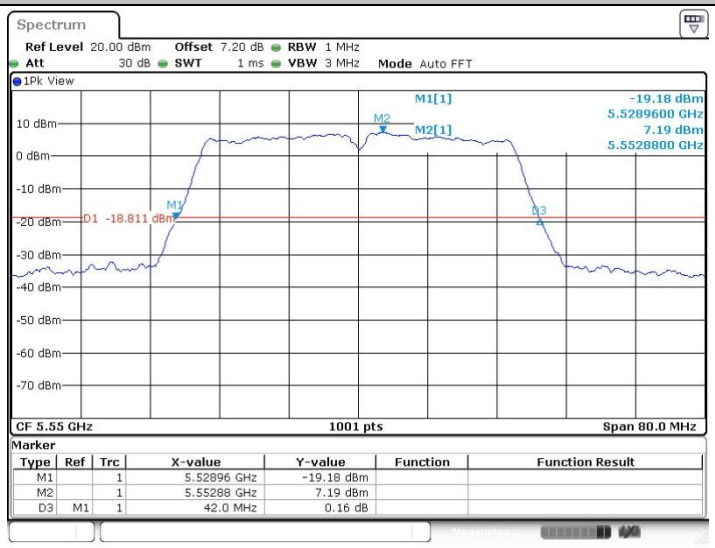

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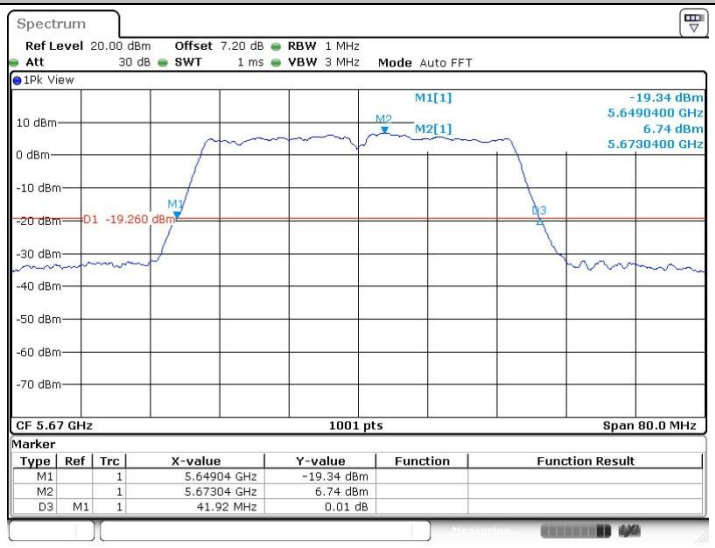

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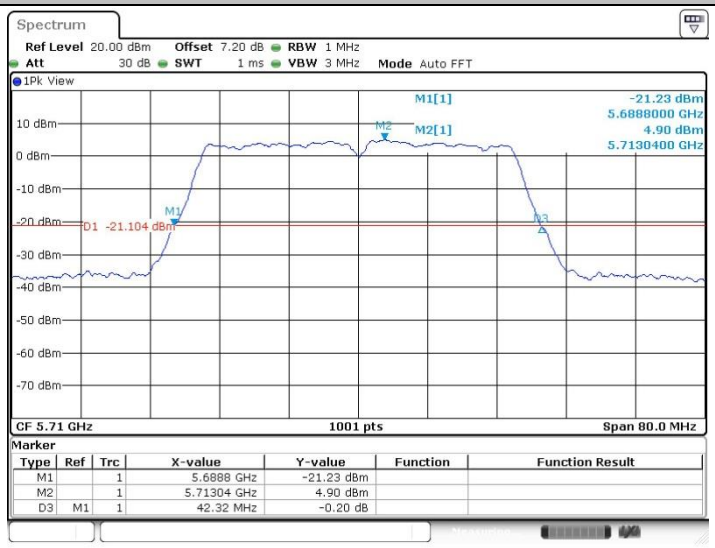

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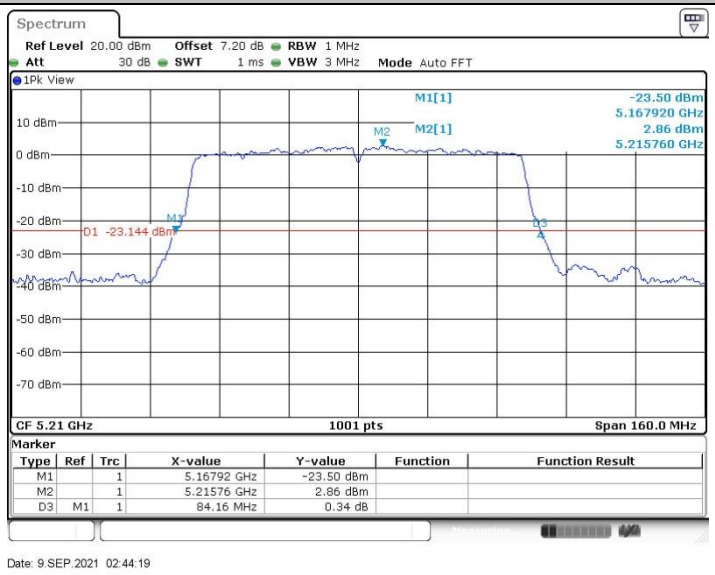

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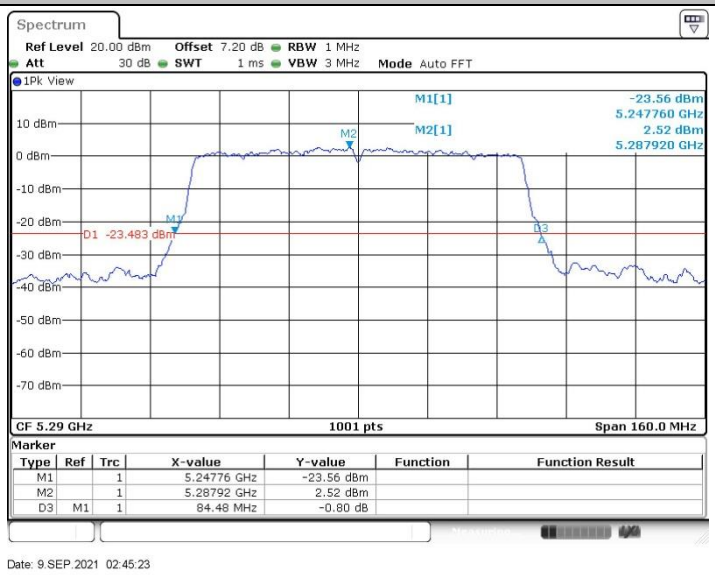

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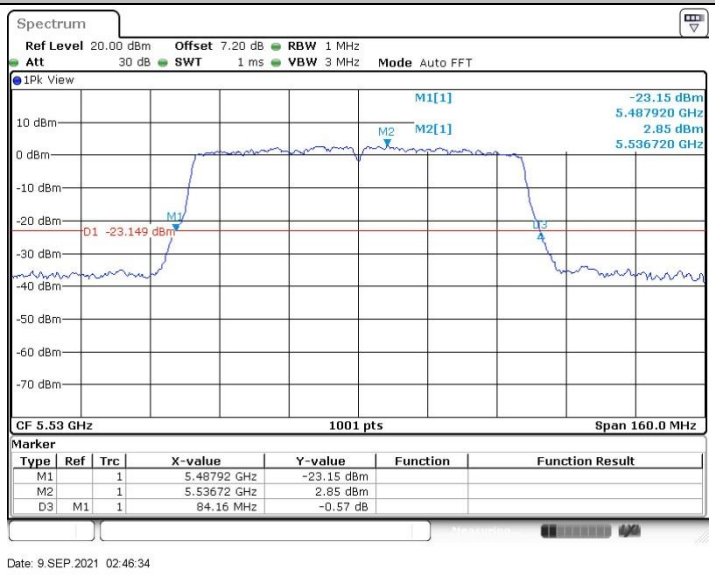

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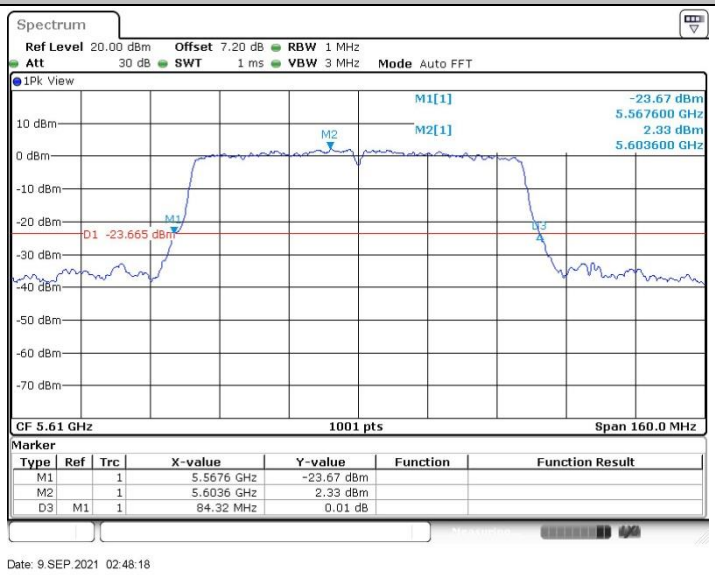

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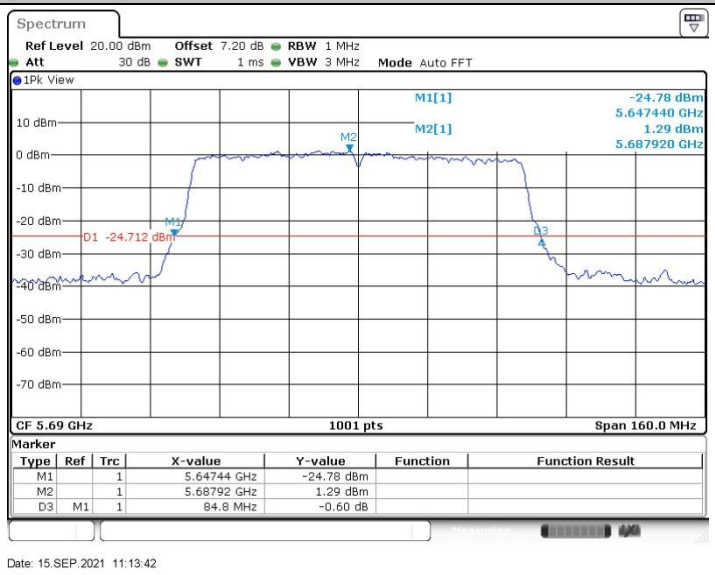


Appendix A2: Occupied channel bandwidth

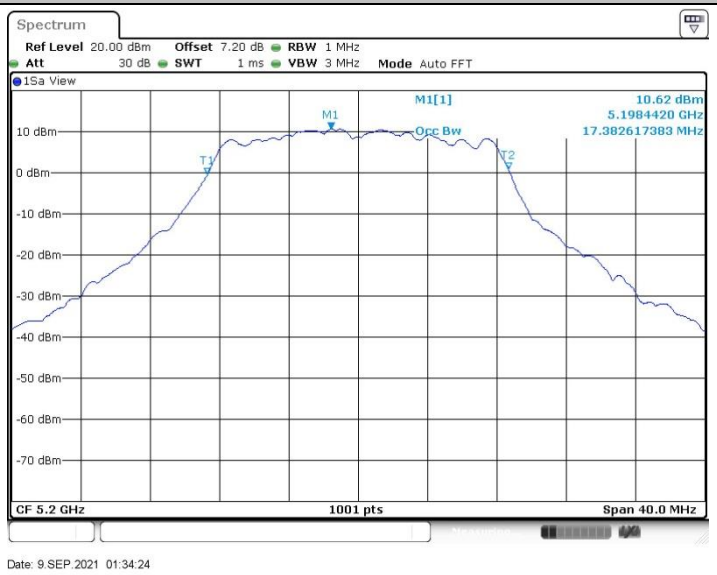
Test Result

Test Mode	Antenna	Frequency [MHz]	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11A	Ant1	5180	17.463	5171.169	5188.631	---	---
		5200	17.383	5191.289	5208.671	---	---
		5240	17.263	5231.528	5248.791	---	---
		5260	17.542	5251.169	5268.711	---	---
		5280	17.383	5271.249	5288.631	---	---
		5320	17.383	5311.249	5328.631	---	---
		5500	17.343	5491.249	5508.591	---	---
		5580	17.263	5571.369	5588.631	---	---
		5700	17.463	5691.209	5708.671	---	---
		5720	17.622	5711.169	5728.791	---	---
11N20SISO	Ant1	5180	18.861	5170.649	5189.510	---	---
		5200	18.661	5190.609	5209.271	---	---
		5240	18.701	5230.689	5249.391	---	---
		5260	18.541	5250.729	5269.271	---	---
		5280	18.661	5270.689	5289.351	---	---
		5320	18.501	5310.729	5329.231	---	---
		5500	18.541	5490.689	5509.231	---	---
		5580	18.781	5570.569	5589.351	---	---
		5700	18.382	5690.769	5709.151	---	---
		5720	18.501	5710.809	5729.311	---	---
11N40SISO	Ant1	5190	36.603	5171.698	5208.302	---	---
		5230	36.364	5211.778	5248.142	---	---
		5270	36.683	5251.778	5288.462	---	---
		5310	36.523	5291.778	5328.302	---	---
		5510	36.444	5491.778	5528.222	---	---
		5550	36.603	5531.778	5568.382	---	---
		5670	36.603	5651.778	5688.382	---	---
		5710	36.444	5691.778	5728.222	---	---
11AC80SISO	Ant1	5210	75.764	5172.118	5247.882	---	---
		5290	75.764	5252.118	5327.882	---	---
		5530	75.604	5492.118	5567.722	---	---
		5610	75.604	5572.118	5647.722	---	---
		5690	75.924	5651.958	5727.882	---	---

Test Graphs

11A_Ant1_5180

11A_Ant1_5200



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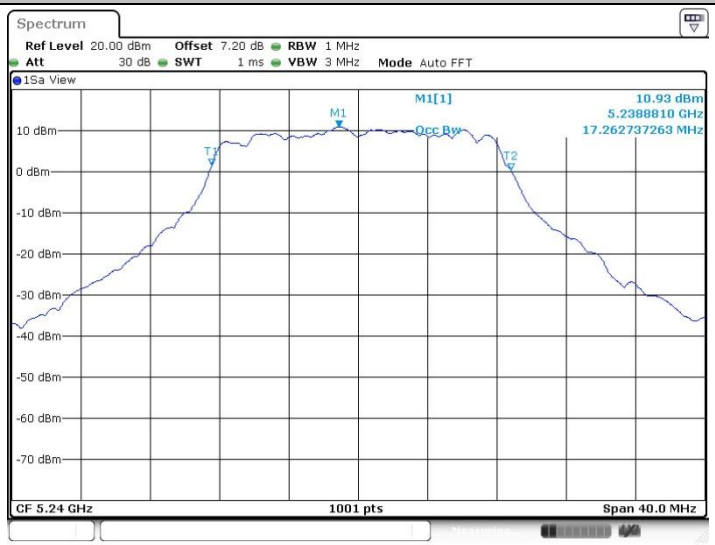
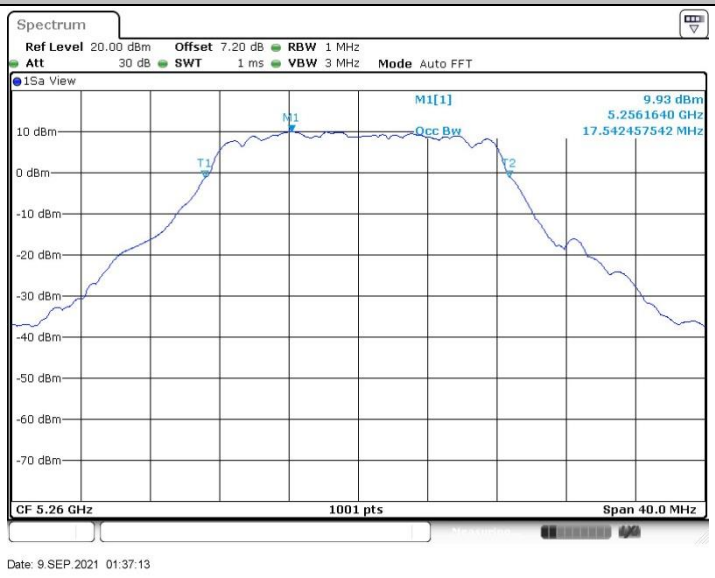
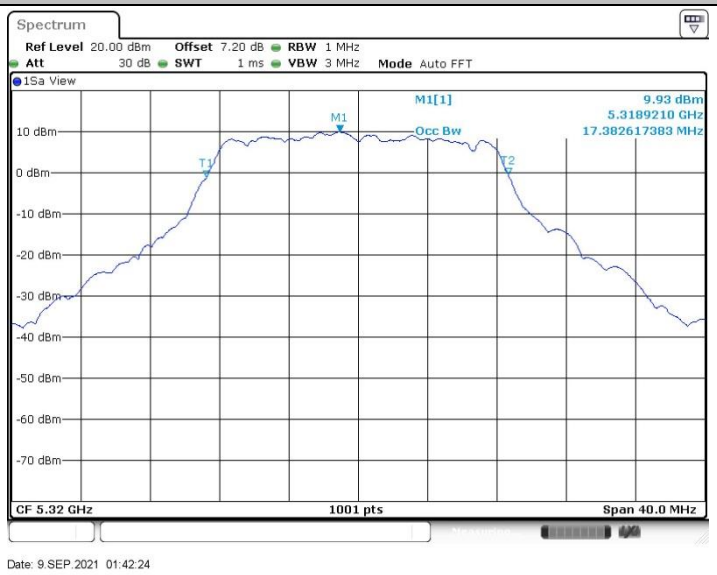


11A_Ant1_5260


11A_Ant1_5280


11A_Ant1_5320


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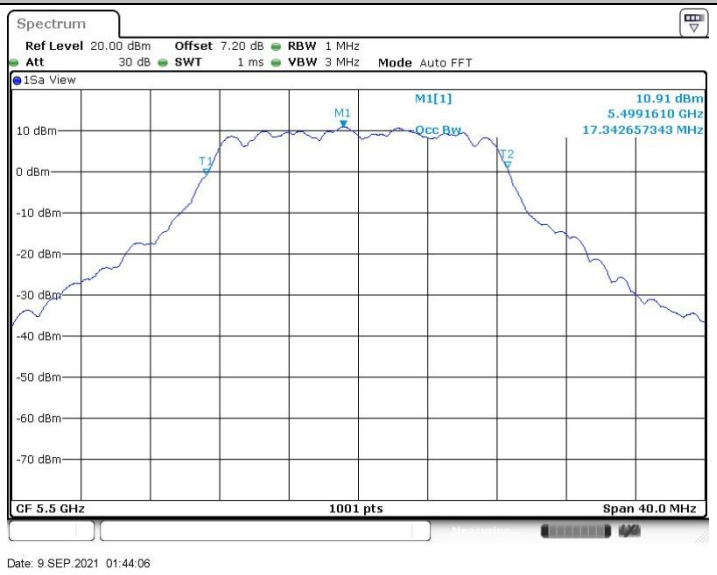

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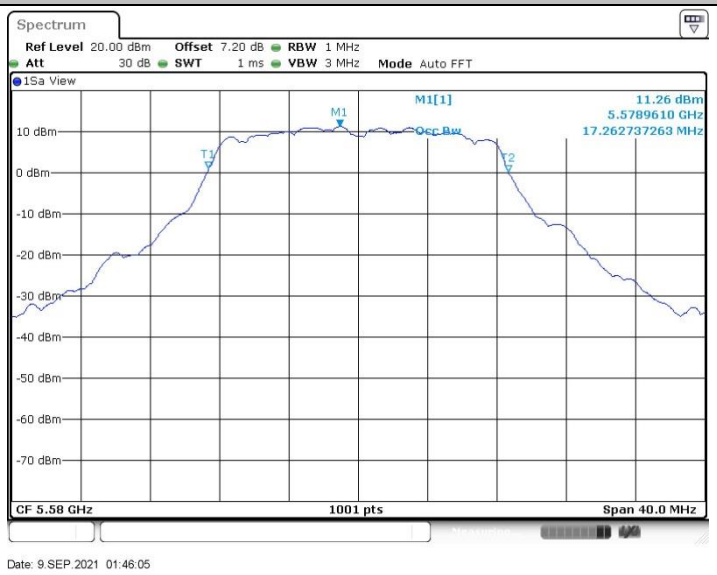

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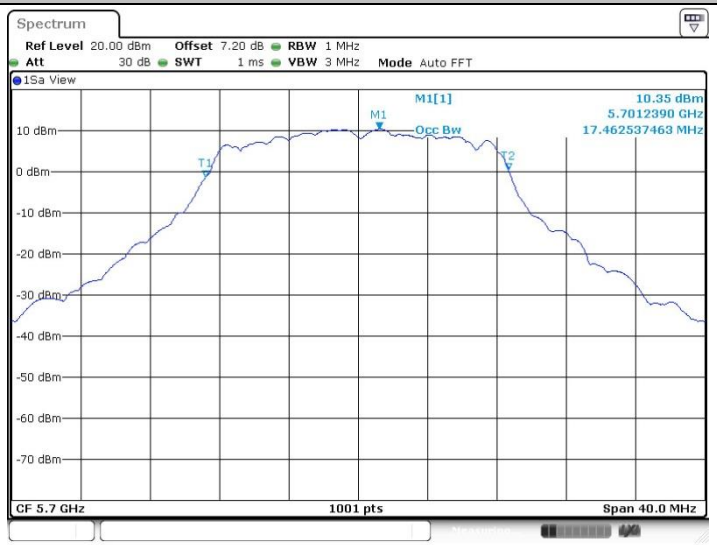

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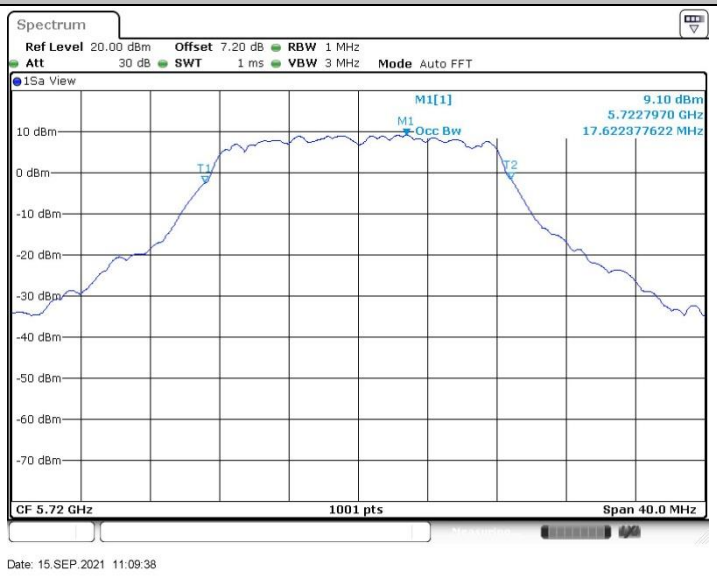
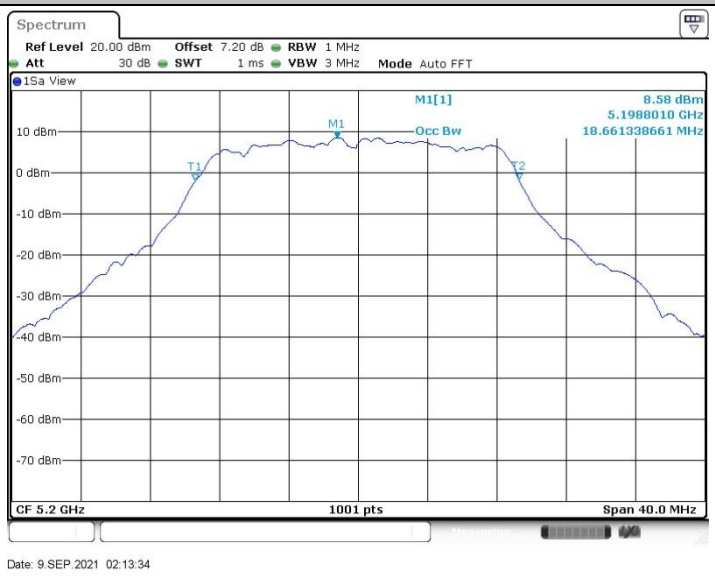


11N20SISO_Ant1_5180


11N20SISO_Ant1_5200


11N20SISO_Ant1_5240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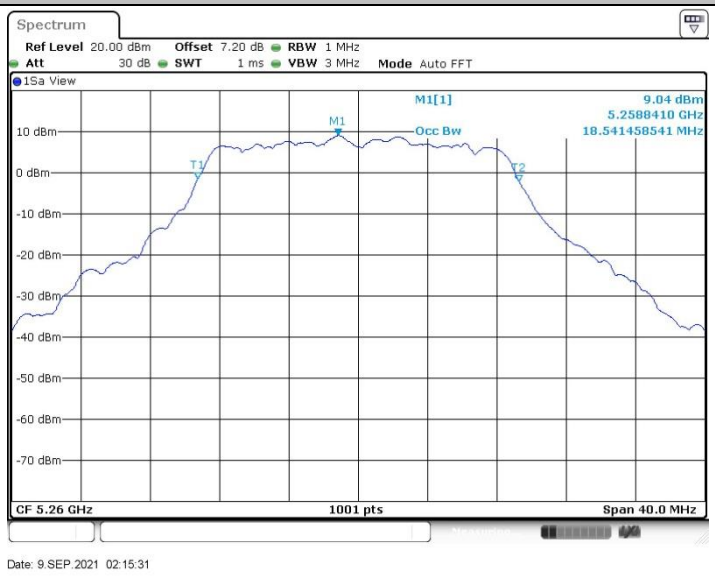

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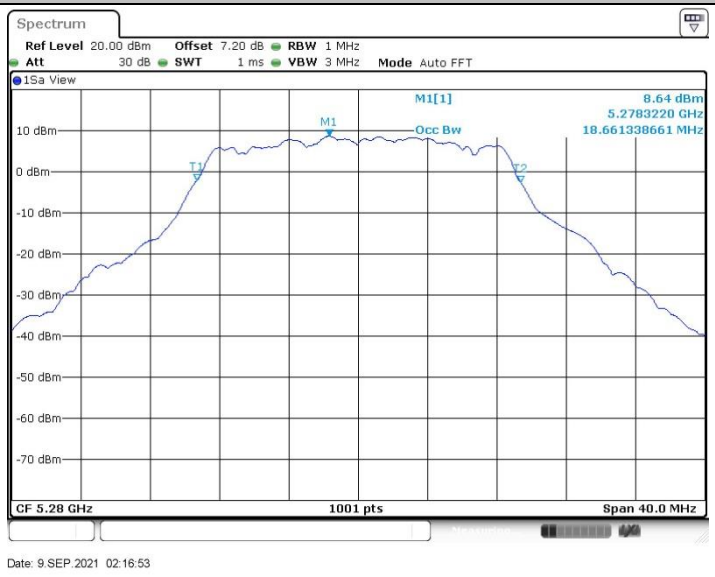

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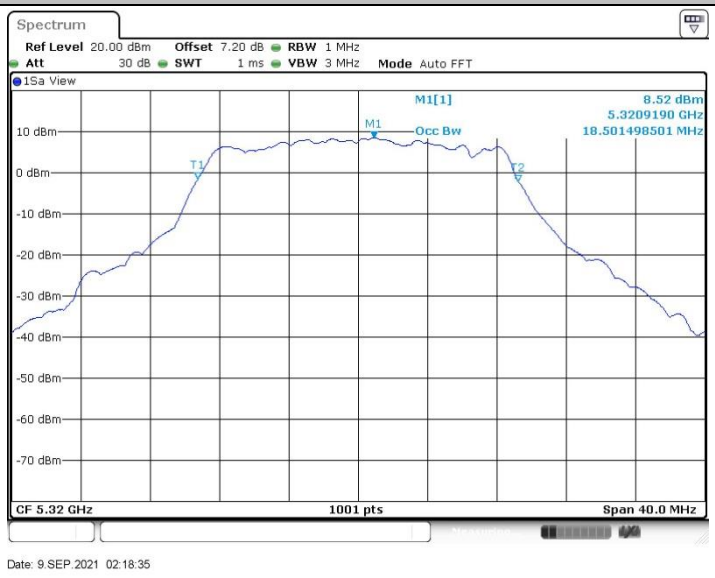

11N20SISO_Ant1_5500


11N20SISO_Ant1_5580


11N20SISO_Ant1_5700


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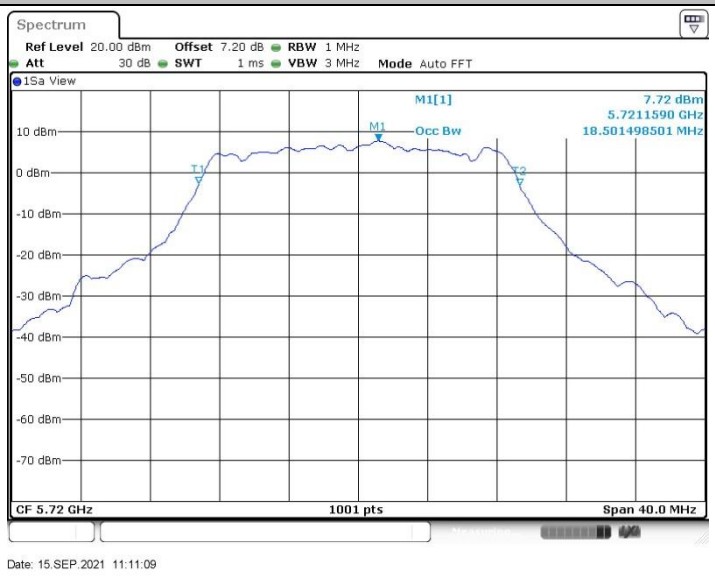

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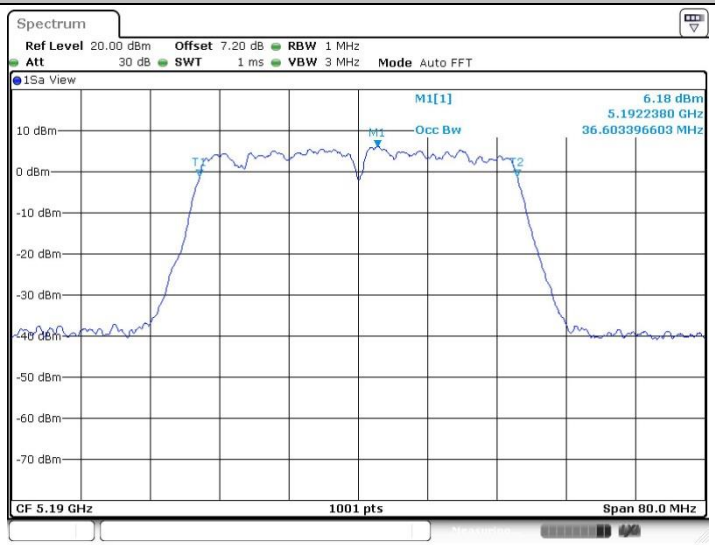

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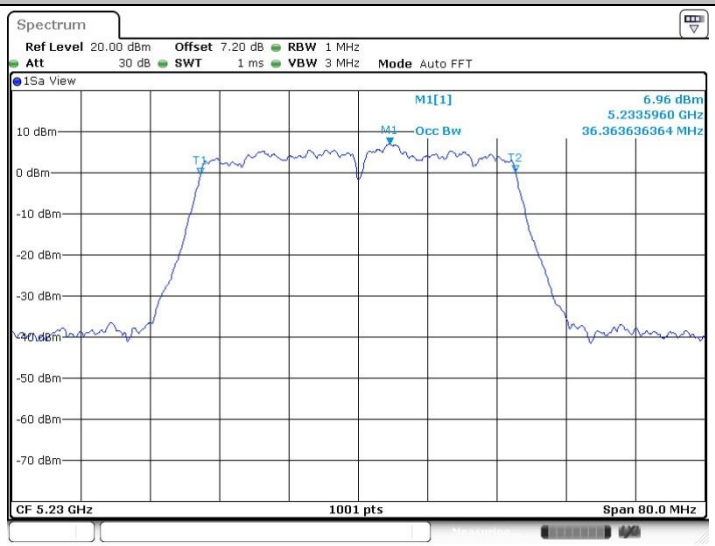

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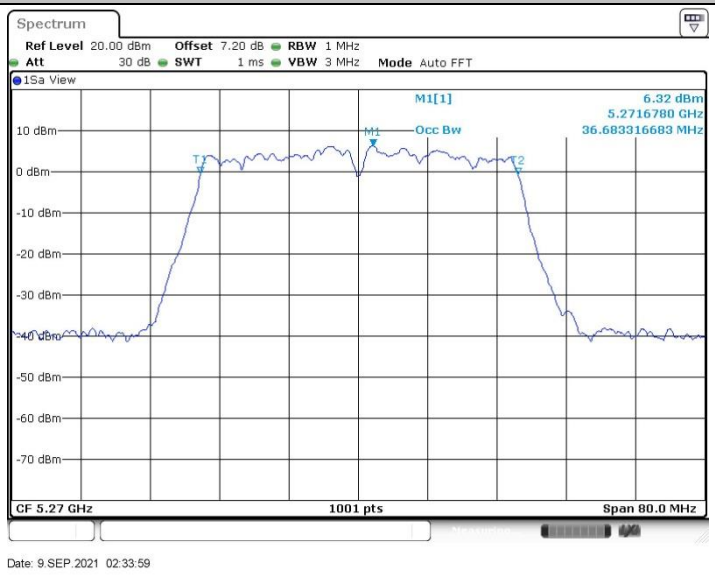

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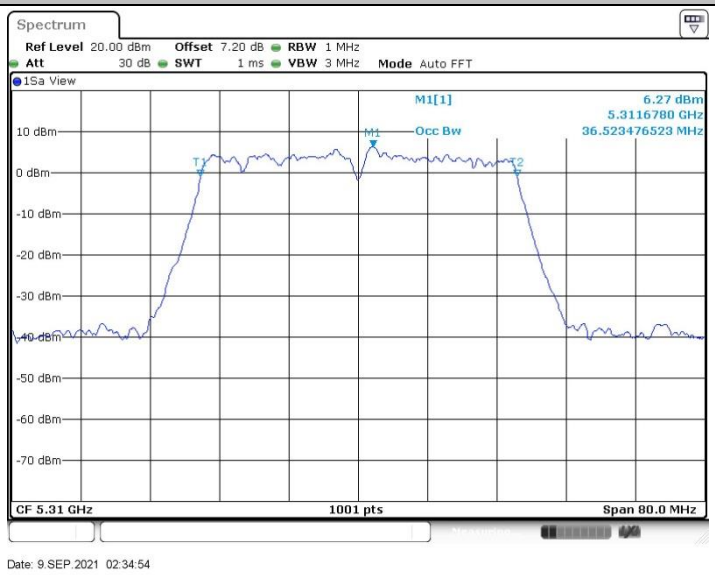

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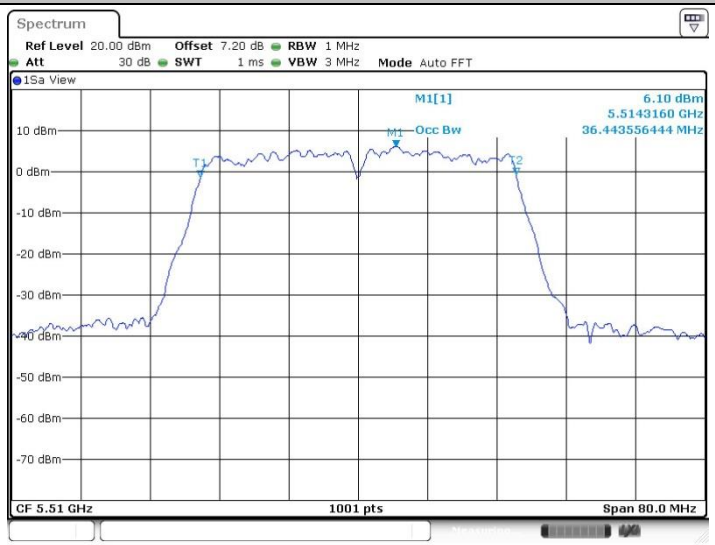

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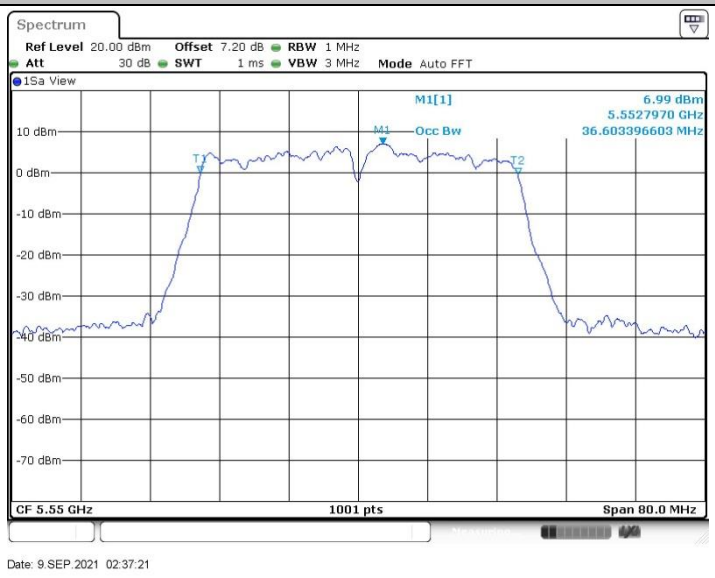

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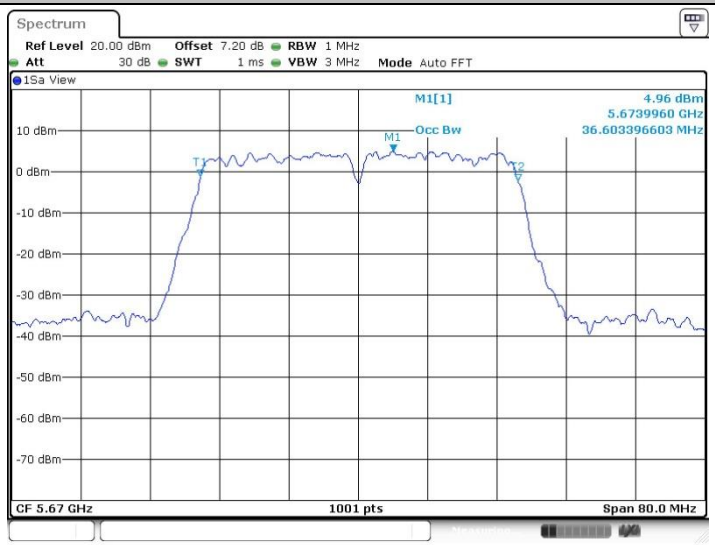
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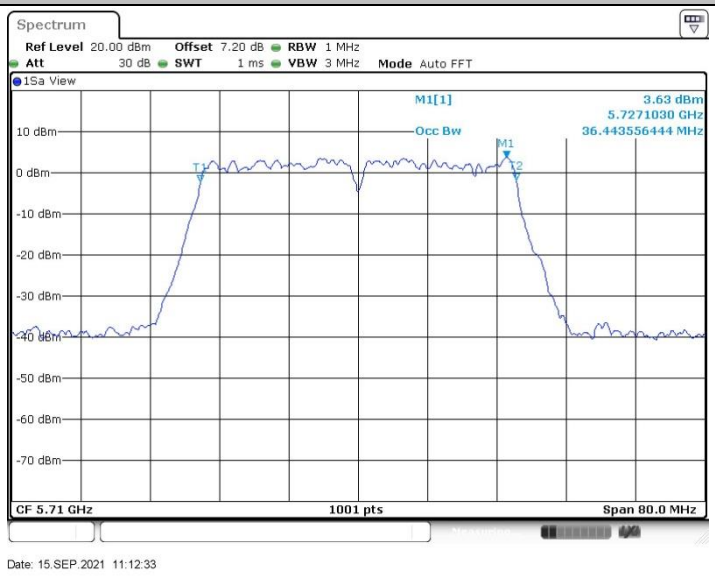

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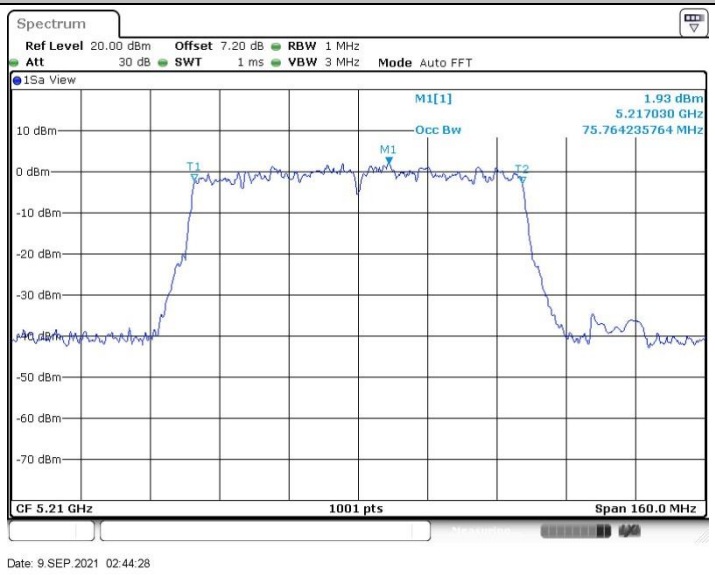

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