



FCC RF Test Report

APPLICANT : Motorola Solutions Inc.
EQUIPMENT 1 : 1)EVOLVE SMART HANDHELD W STD BATTERY
 2)EVOLVE SMART HANDHELD W HICAP BATT
EQUIPMENT 2 : EVOLVE-i IS SMART HANDHELD W IS HICAP BATT
BRAND NAME : Motorola Solutions
MODEL NAME 1 : EVOLVE
MODEL NAME 2 : EVOLVE-i
MODEL NUMBER 1 : 1)HK2136A
 2)HK2156A
MODEL NUMBER 2 : HK2137A
FCC ID : AZ489FT7134
STANDARD : FCC Part 15 Subpart E §15.407
CLASSIFICATION : (NII) Unlicensed National Information Infrastructure
TEST DATE(S) : Sep. 19, 2021 ~ Sep. 24, 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



Sporton International (Kunshan) Inc.

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 People's Republic of China**



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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR052616-24A	Rev. 01	Initial issue of report	Dec. 21, 2021
FR052616-24A	Rev. 02	Update the Equipment 1's name	Jun. 07, 2022



SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	2.1049 & 15.403(i)	26dB & 99% Bandwidth	-	Report only	1
3.2	15.407(a)	Maximum Conducted Output Power	≤ 24 dBm	Pass	1
3.3	15.407(a)	Power Spectral Density	≤ 11 dBm	Pass	1
3.4	15.407(b)	Unwanted Emissions	15.407(b) & 15.209(a)	Pass	Under limit 6.66 dB at 5148.320 MHz
3.5	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 14.36 dB at 0.525 MHz
3.6	15.203 & 15.407(a)	Antenna Requirement	15.203 & 15.407(a)	Pass	1

Note 1: The Test was covered under other test reports, FR052616-02D, except 11ac mode

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

Motorola Solutions Inc.
8000 West Sunrise Boulevard, Fort Lauderdale, Florida

1.2 Manufacturer

Motorola Solutions Malaysia Sdn. Bhd.
Plot 2A, Medan Bayan Lepas, Mukim 12, S.W.D. 11900 Bayan Lepas, Penang, Malaysia.

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	1)EVOLVE SMART HANDHELD W STD BATTERY 2)EVOLVE SMART HANDHELD W HICAP BATT
Equipment 2	EVOLVE-i IS SMART HANDHELD W IS HICAP BATT
Brand Name	Motorola Solutions
Model Name 1	EVOLVE
Model Name 2	EVOLVE-i
Model Number 1	1)HK2136A 2)HK2156A
Model Number 2	HK2137A
FCC ID	AZ489FT7134
IMEI Code	Conducted: 352366195005870 Conduction: 354850210041802/354850215041807 Radiation : 354850210041950/354850215041955
HW Version	PVT
SW Version	EVOLVE-userdebug 10 QKQ1.200623.002 D01.01.43 release-keys
EUT Stage	Identical Prototype

Remark:

1. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.
2. This is a variant report. The purpose is to add 802.11ac VHT20/VHT40/VHT80 by software, for sample change note from HW P2.2 to HW PVT Stage, please refer the Product Equality Declaration as Appendix F. Based on the similarity between current and previous project, only the related test cases of 802.11 ac mode were verified from Original test report which can be found on FCC website under original application.
3. According to the Product Equality Declaration as Appendix F about the difference between EVOLVE and EVOLVE-i, the test result is not affected by two samples, we only performed testing about adding 802.11ac mode with EVOLVE sample.



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> 802.11ac VHT20 : 11.85 dBm / 0.0153 W 802.11ac VHT40 : 10.71 dBm / 0.0118 W 802.11ac VHT80 : 10.63 dBm / 0.0116 W <5260 MHz ~ 5320 MHz> 802.11ac VHT20 : 11.90 dBm / 0.0155 W 802.11ac VHT40 : 10.70 dBm / 0.0117 W 802.11ac VHT80 : 10.93 dBm / 0.0124 W <5500 MHz ~ 5700 MHz > 802.11ac VHT20 : 11.71 dBm / 0.0148 W 802.11ac VHT40 : 10.64 dBm / 0.0116 W 802.11ac VHT80 : 11.04 dBm / 0.0127 W
99% Occupied Bandwidth	<5180 MHz ~ 5240 MHz> 802.11ac VHT20 : 18.22 MHz 802.11ac VHT40 : 36.52 MHz 802.11ac VHT80 : 75.76 MHz <5260 MHz ~ 5320 MHz> 802.11ac VHT20 : 18.22 MHz 802.11ac VHT40 : 36.52 MHz 802.11ac VHT80 : 75.92 MHz <5500 MHz ~ 5700 MHz > 802.11ac VHT20 : 18.22 MHz 802.11ac VHT40 : 36.68 MHz 802.11ac VHT80 : 75.92 MHz
Antenna Type / Gain	<5180 MHz ~ 5240 MHz> IFA Antenna with gain 3.0 dBi <5260 MHz ~ 5320 MHz> IFA Antenna with gain 3.0 dBi <5500 MHz ~ 5720 MHz> IFA Antenna with gain 2.0 dBi
Type of Modulation	802.11ac : OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM)

1.5 Modification of EUT

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



1.6 Specification of Accessory

Accessories Information				
MUC Charger base	Brand Name	Motorola	Model Name	PMPN4563A
	Description	CHGR DESKTOP MULTI UNIT EXT PS BASE		
AC Adapter MUC (US)	Brand Name	Motorola	Model Name	PMPN4564A
	Power Rating	I/P: 100 - 240Vac, 1.3A, O/P: 15Vdc, 6A		
AC Adapter 1 (US) Micro-USB rapid-rate plug-in charger	Brand Name	Motorola	P/N	PS000150A11
	Power Rating	I/P: 100 - 240Vac, 0.25A, O/P: 5Vdc, 1.5A		
DC Adapter 2 Vehicular Power Adapter (VPA)	Brand Name	Motorola	P/N	PMPN4169A
	Power Rating	I/P: 10.8 – 33.0Vac, 1.1A, O/P: 5Vdc, 1.5A		
Battery 1	Brand Name	Motorola Solutions	P/N	BT000593A01
	Rated	5800mAh		
Battery 2	Brand Name	Motorola Solutions	P/N	BT000592A01
	Rated	2900mAh		
Battery 3	Brand Name	Motorola Solutions	P/N	BT000594A01
	Rated	5800mAh		
Earpiece	Brand Name	Motorola Solutions	P/N	PMLN8191A
	Signal Line	1.128meter, non-shielded cable, without ferrite core		
Remote Speaker Microphone 1	Brand Name	Motorola Solutions	P/N	PMMN4125B
	Signal Line	0.54 meter(normal), 2.5 meter (stretch) shielded cable, without ferrite core		
BT Wired Speaker Mic (WM500)	Brand Name	Motorola Solutions	P/N	PMMN4127A
Bluetooth Earpiece	Brand Name	Motorola Solutions	P/N	PMLN7851A(EP900)
Belt Clip Holster	Brand Name	Motorola Solutions	Model Name	PMLN6970A
Belt Clip Holster (Short)	Brand Name	Motorola Solutions	Model Name	NTN8266B
Belt Clip Holster (Long)	Brand Name	Motorola Solutions	Model Name	PMLN7965A

Remark: Battery 1 and Battery 2 are for EVOLVE sample, Battery 3 is for EVOLVE-i Sample.



1.7 Testing Location

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

1.8 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

1.9 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 802.11ac 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
802.11ac VHT20	MCS0
802.11ac VHT40	MCS0
802.11ac VHT80	MCS0

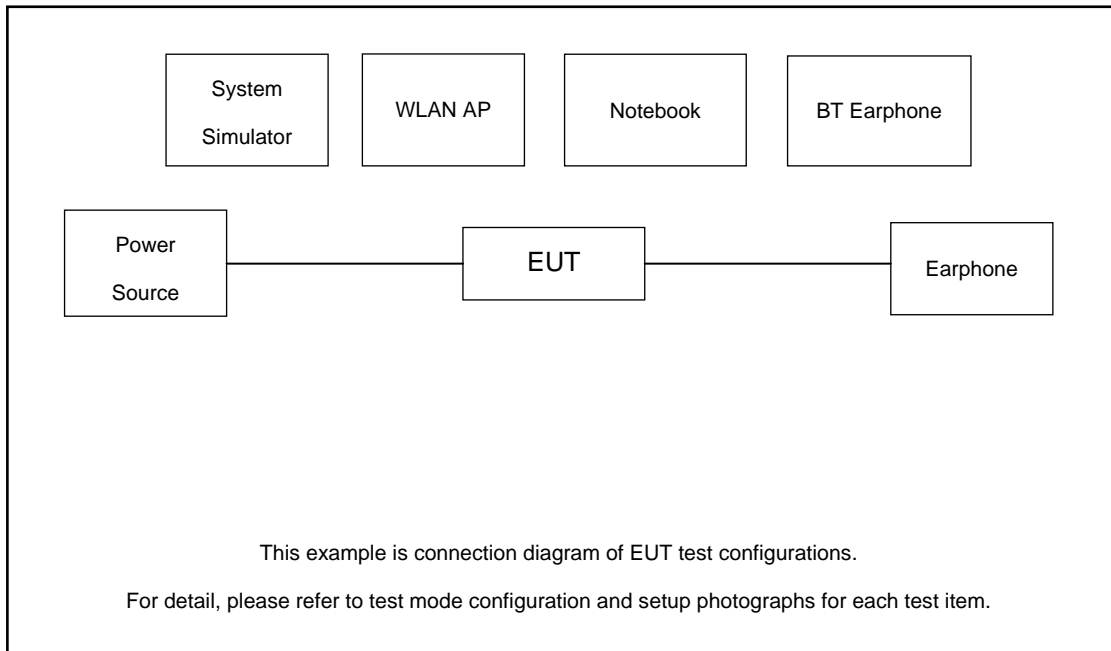
Co-location
WIFI 802.11ac80 CH42 TX + BLE_CH39 TX + LTE B48 16QAM 20M Link

Test Cases	
AC Conducted Emission	Mode 1 : WCDMA Band V Link + WLAN (5G) Link + BT Link(EP900) + Charging From Adapter 1(Earphone Connect to EUT)
Remark: For Radiated Test Cases, The tests were performance with Adapter 1.	

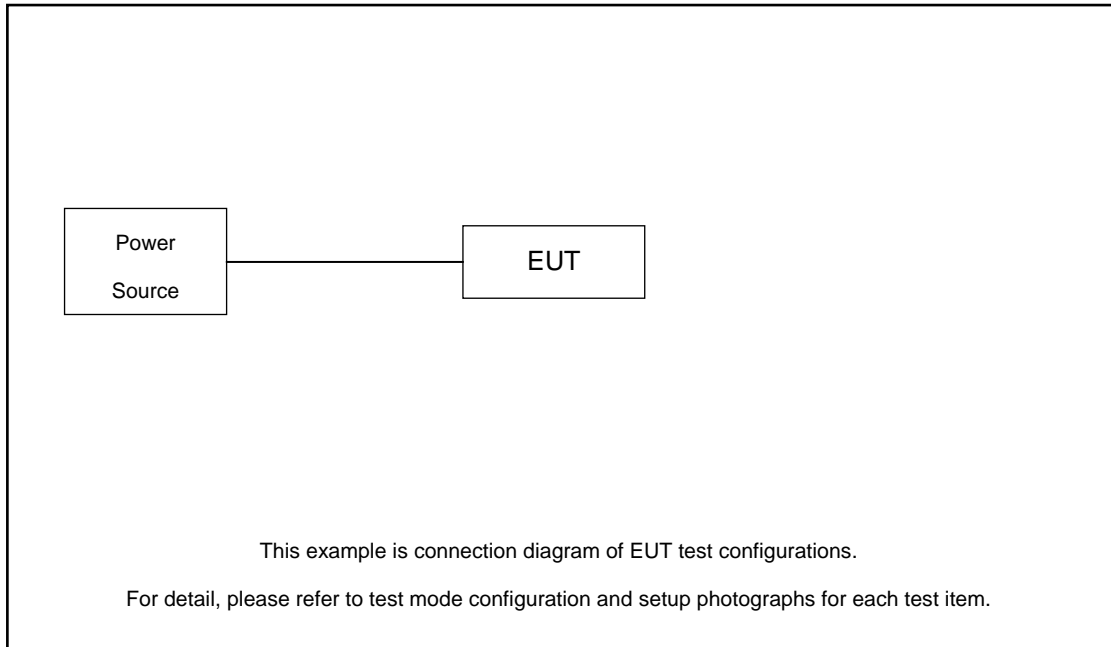
Ch. #		U-NII-1 : 5150-5250 MHz	U-NII-2A : 5250-5350 MHz	U-NII-2C : 5470-5725MHz
		802.11ac VHT80	802.11ac VHT80	802.11ac VHT80
L	Low	-	-	106
M	Middle	42	58	-
H	High	-	-	122
Straddle		-	-	138

2.3 Connection Diagram of Test System

For Conducted Emission:



For Radiated Emission:



2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	System Simulator	Anritus	MT8821C	N/A	N/A	Unshielded,1.8m
2.	WLAN AP	D-link	DIR-655	KA21R655B1	N/A	Unshielded,1.8m
3.	Notebook	Lenovo	G480	QDS-BRCM1050I	N/A	AC I/P: Unshielded, 1.8 m DC O/P: Shielded, 1.8 m
4.	SD Card	Kingston	8GB	N/A	N/A	N/A

2.5 EUT Operation Test Setup

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

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 7.0 dB.

$$\begin{aligned} \text{Offset(dB)} &= \text{RF cable loss(dB)}. \\ &= 7.0 \text{ (dB)} \end{aligned}$$

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.

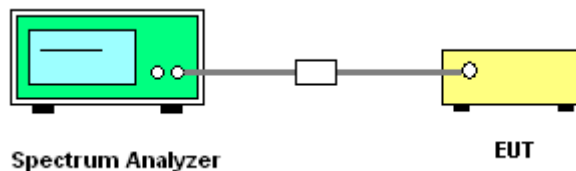
3.1.2 Measuring Instruments

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) $\geq 3 * RBW$.
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 $11 \text{ dBm} + 10 \log B$, where B is the 26 dB 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

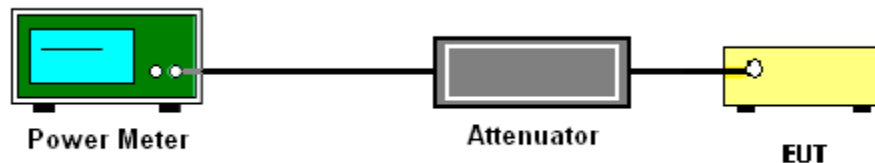
The testing follows Method PM of FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.

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

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
VHT20	MCS0	1	36	5180	0.08	11.54	24.00	3.00	Pass
VHT20	MCS0	1	44	5220	0.08	11.77	24.00	3.00	Pass
VHT20	MCS0	1	48	5240	0.08	11.85	24.00	3.00	Pass
VHT40	MCS0	1	38	5190	0.16	10.71	24.00	3.00	Pass
VHT40	MCS0	1	46	5230	0.16	10.59	24.00	3.00	Pass
VHT80	MCS0	1	42	5210	0.35	10.63	24.00	3.00	Pass

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
VHT20	MCS 0	1	52	5260	0.08	11.90	23.98	3.00	26.99	Pass
VHT20	MCS 0	1	60	5300	0.08	11.71	23.98	3.00	26.99	Pass
VHT20	MCS 0	1	64	5320	0.08	11.60	23.98	3.00	26.99	Pass
VHT40	MCS 0	1	54	5270	0.16	10.70	23.98	3.00	26.99	Pass
VHT40	MCS 0	1	62	5310	0.16	10.61	23.98	3.00	26.99	Pass
VHT80	MCS 0	1	58	5290	0.35	10.93	23.98	3.00	26.99	Pass

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
VHT20	MCS 0	1	100	5500	0.08	11.71	23.98	2.00	26.99	Pass
VHT20	MCS 0	1	116	5580	0.08	11.47	23.98	2.00	26.99	Pass
VHT20	MCS 0	1	140	5700	0.08	11.27	23.98	2.00	26.99	Pass
VHT20	MCS0	1	144	5720	0.08	11.30	23.98	2.00	26.99	Pass
VHT40	MCS 0	1	110	5550	0.16	10.64	23.98	2.00	26.99	Pass
VHT40	MCS 0	1	134	5670	0.16	10.42	23.98	2.00	26.99	Pass
VHT40	MCS0	1	142	5710	0.16	10.35	23.98	2.00	26.99	Pass
VHT80	MCS 0	1	106	5530	0.35	11.04	23.98	2.00	26.99	Pass
VHT80	MCS 0	1	122	5610	0.35	10.93	23.98	2.00	26.99	Pass
VHT80	MCS0	1	138	5690	0.35	10.62	23.98	2.00	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

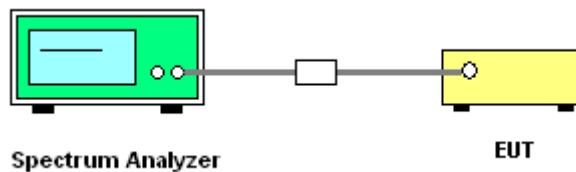
The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
Section F) Maximum power spectral density.

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 \geq 3 MHz.
 - Number of points in sweep \geq 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	68.2

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.

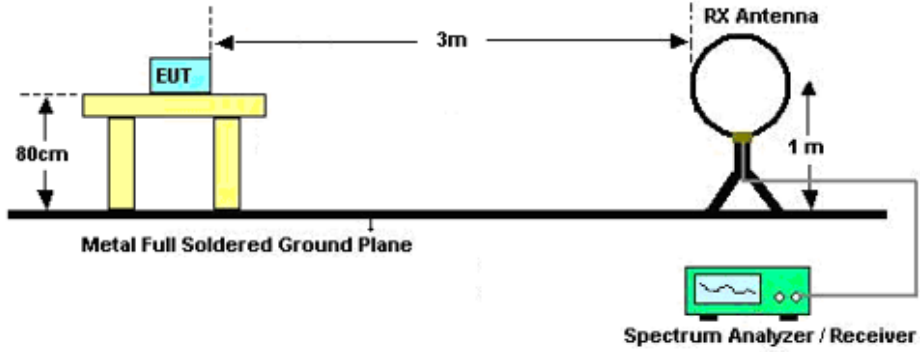


3.4.3 Test Procedures

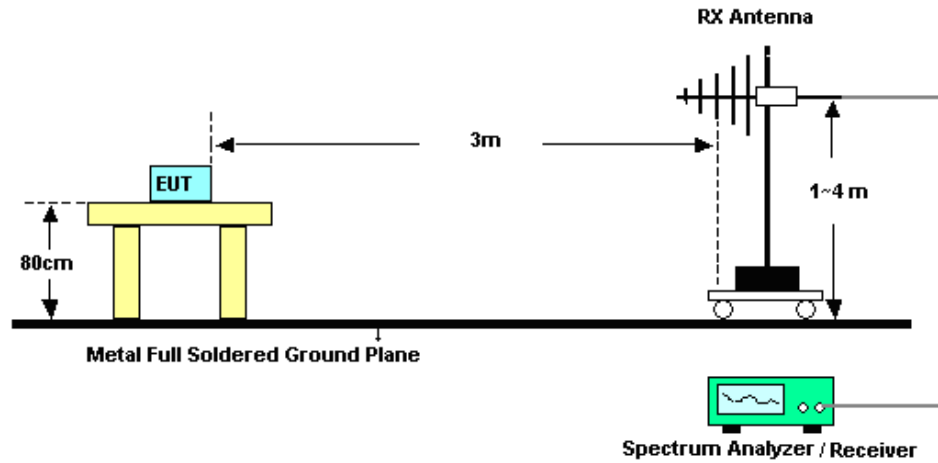
1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01. Section G) Unwanted emissions measurement.
 - (1) Procedure for Unwanted Emissions Measurements Below 1000MHz
 - RBW = 120 kHz
 - VBW = 300 kHz
 - Detector = Peak
 - Trace mode = max hold
 - (2) Procedure for Peak Unwanted Emissions Measurements Above 1000 MHz
 - RBW = 1 MHz
 - VBW \geq 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 \geq 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

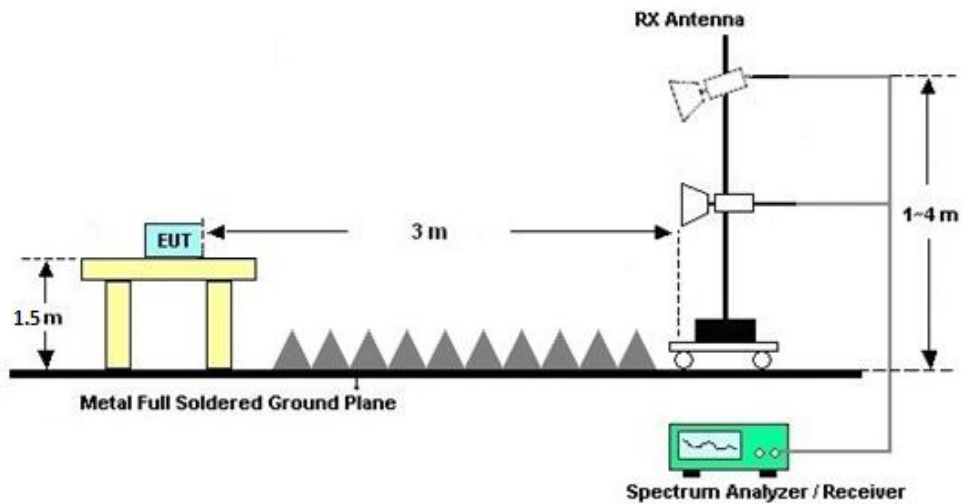
For radiated emissions below 30MHz



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.

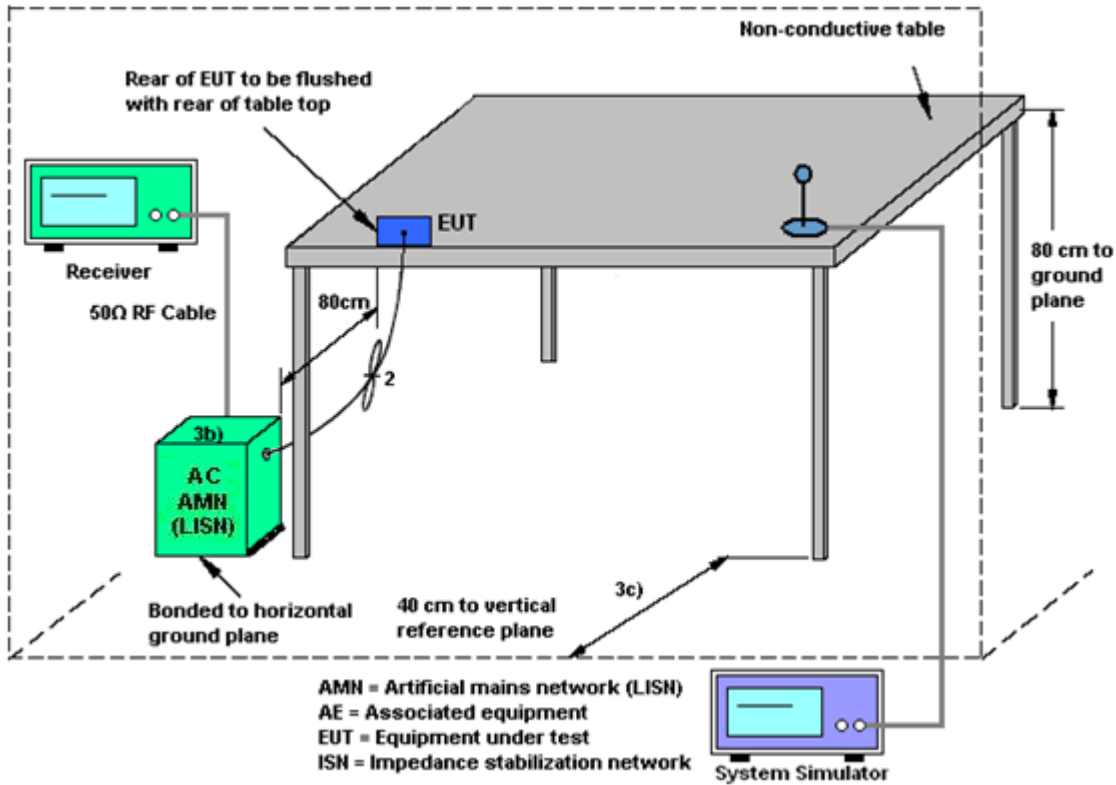
3.5.2 Measuring Instruments

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. 19, 2021~ Sep. 24, 2021	Oct. 31, 2021	Conducted (TH01-KS)
Pulse Power Sensor	Anritsu	MA2411B	0917070	300MHz~40GHz	Jan. 07, 2021	Sep. 19, 2021~ Sep. 24, 2021	Jan. 06, 2022	Conducted (TH01-KS)
Power Meter	Anritsu	ML2495A	1005002	50MHz Bandwidth	Jan. 07, 2021	Sep. 19, 2021~ Sep. 24, 2021	Jan. 06, 2022	Conducted (TH01-KS)
EMI Test Receiver	Keysight	N9038A	MY564000 04	3Hz~8.5GHz;Max 30dBm	Oct. 17, 2020	Sep. 23, 2021	Oct. 16, 2021	Radiation (03CH06-KS)
EXA Spectrum Analyzer	Keysight	N9010A	MY551502 08	10Hz~44GHz	Apr. 12, 2021	Sep. 23, 2021	Apr. 11, 2022	Radiation (03CH06-KS)
Loop Antenna	R&S	HFH2-Z2	100321	9kHz~30MHz	Nov. 01, 2020	Sep. 23, 2021	Oct. 31, 2021	Radiation (03CH06-KS)
Bilog Antenna	TeseQ	CBL6111D	49921	30MHz~1GHz	May 27, 2021	Sep. 23, 2021	May 26, 2022	Radiation (03CH06-KS)
Double Ridge Horn Antenna	ETS-Lindgren	3117	00218652	1GHz~18GHz	Apr. 25, 2021	Sep. 23, 2021	Apr. 24, 2022	Radiation (03CH06-KS)
SHF-EHF Horn	Com-power	AH-840	101115	18GHz~40GHz	Nov. 10, 2020	Sep. 23, 2021	Nov. 09, 2021	Radiation (03CH06-KS)
Amplifier	SONOMA	310N	187289	9KHz ~1GHZ	Apr. 12, 2021	Sep. 23, 2021	Apr. 11, 2022	Radiation (03CH06-KS)
Amplifier	MITEQ	EM18G40GG A	060728	18~40GHz	Jan. 06, 2021	Sep. 23, 2021	Jan. 05, 2022	Radiation (03CH06-KS)
high gain Amplifier	MITEQ	AMF-7D-0010 1800-30-10P	2025788	1Ghz-18Ghz	Jan. 06, 2021	Sep. 23, 2021	Jan. 05, 2022	Radiation (03CH06-KS)
Amplifier	Keysight	83017A	MY532702 03	500MHz~26.5GHz	Apr. 13, 2021	Sep. 23, 2021	Apr. 12, 2022	Radiation (03CH06-KS)
AC Power Source	Chroma	61601	F1040900 04	N/A	NCR	Sep. 23, 2021	NCR	Radiation (03CH06-KS)
Turn Table	ChamPro	EM 1000-T	060762-T	0~360 degree	NCR	Sep. 23, 2021	NCR	Radiation (03CH06-KS)
Antenna Mast	ChamPro	EM 1000-A	060762-A	1 m~4 m	NCR	Sep. 23, 2021	NCR	Radiation (03CH06-KS)
EMI Receiver	R&S	ESCI7	100768	9kHz~7GHz;	Apr. 21, 2021	Sep. 24, 2021	Apr. 20, 2022	Conduction (CO01-KS)
AC LISN (for auxiliary equipment)	MessTec	AN3016	060103	9kHz~30MHz	Oct. 17, 2020	Sep. 24, 2021	Oct. 16, 2021	Conduction (CO01-KS)
AC LISN	R&S	ENV216	100334	9kHz~30MHz	Oct. 17, 2020	Sep. 24, 2021	Oct. 16, 2021	Conduction (CO01-KS)
AC Power Source	Chroma	61602	ABP00000 0811	AC 0V~300V, 45Hz~1000Hz	Oct. 17, 2020	Sep. 24, 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 -----



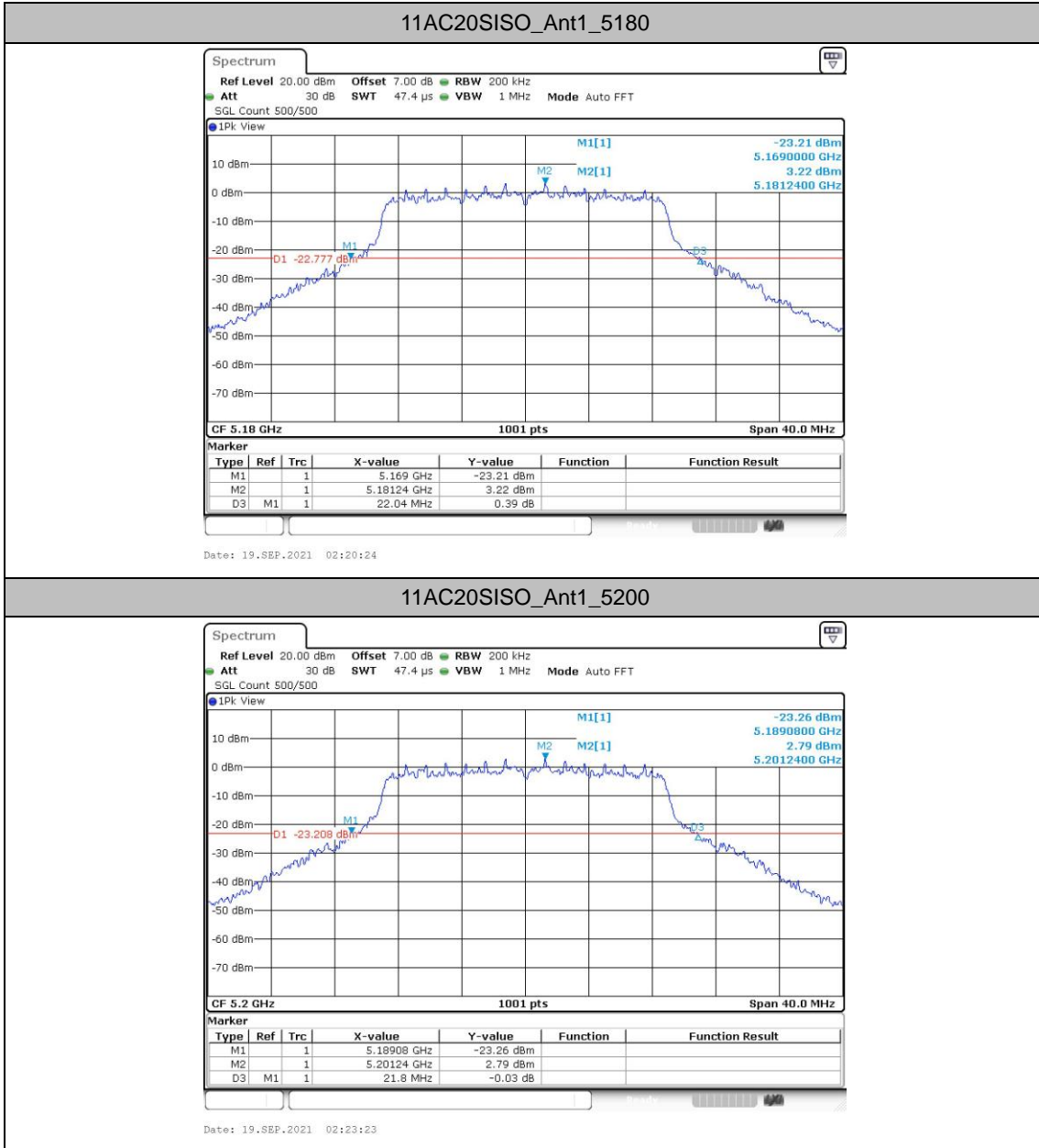
Appendix A. Conducted Test Results

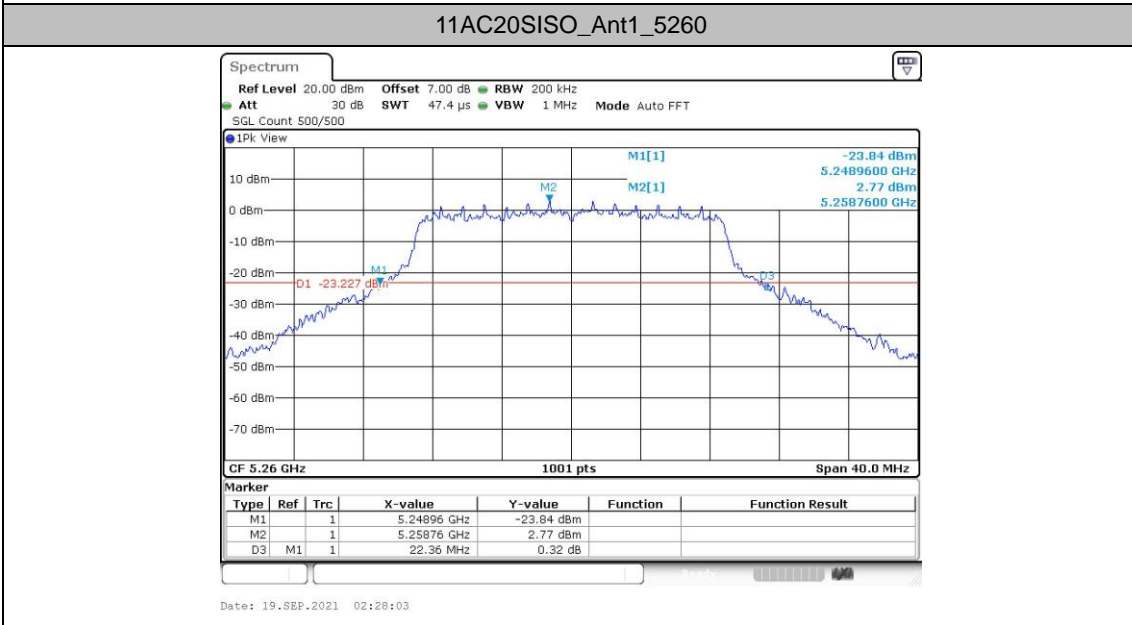
26dB Emission Bandwidth Test Result

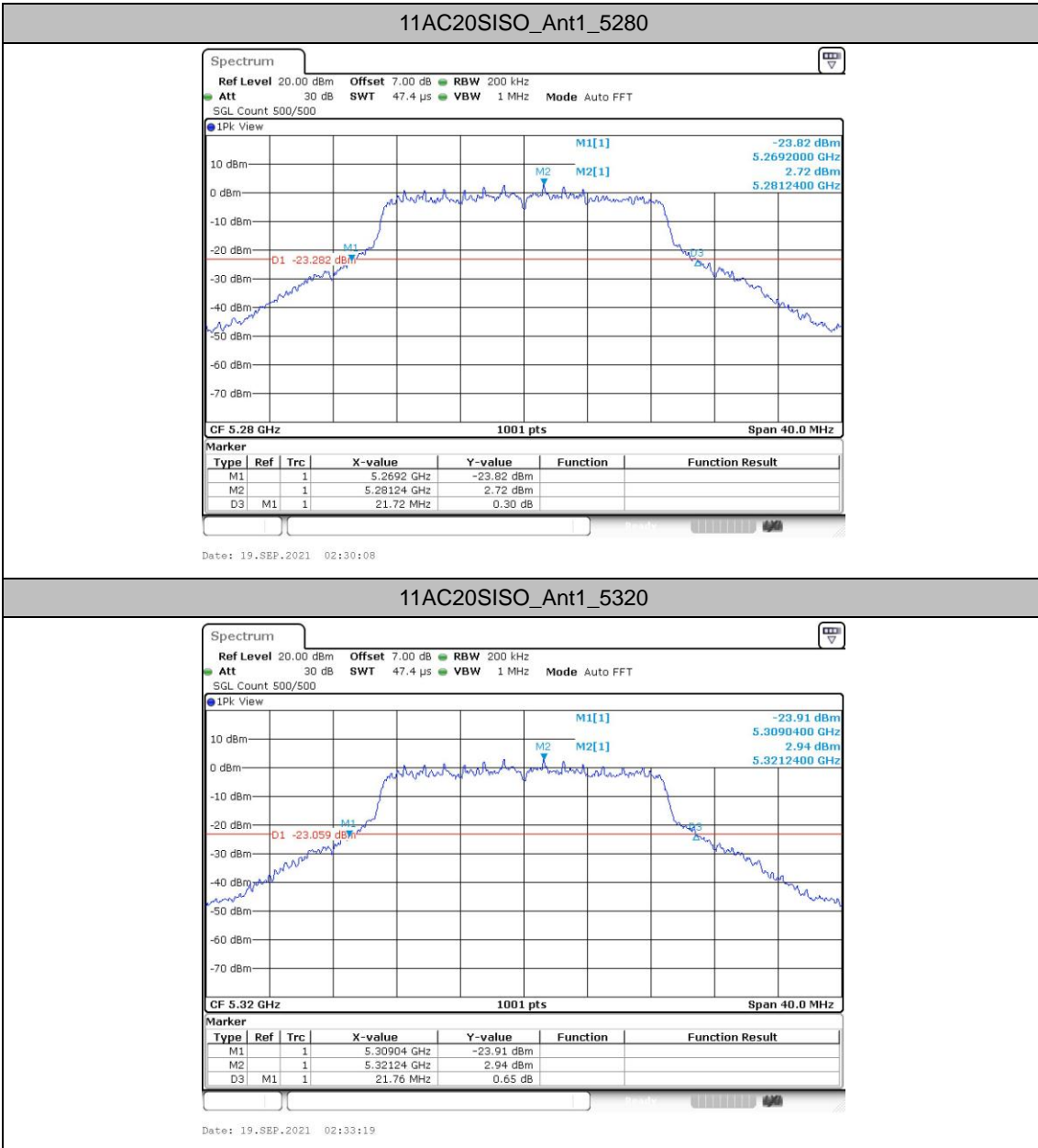
TestMode	Antenna	Frequency [MHz]	26dB EBW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11AC20SISO	Ant1	5180	22.040	5169.000	5191.040	---	---
		5200	21.800	5189.080	5210.880	---	---
		5240	21.760	5229.080	5250.840	---	---
		5260	22.360	5248.960	5271.320	---	---
		5280	21.720	5269.200	5290.920	---	---
		5320	21.760	5309.040	5330.800	---	---
		5500	21.320	5489.320	5510.640	---	---
		5580	22.160	5568.840	5591.000	---	---
		5700	22.560	5688.600	5711.160	---	---
		5720	21.52	5709.24	5721.240	---	---
11AC40SISO	Ant1	5190	42.080	5169.120	5211.200	---	---
		5230	42.000	5209.040	5251.040	---	---
		5270	41.840	5249.120	5290.960	---	---
		5310	41.680	5289.280	5330.960	---	---
		5510	41.600	5489.200	5530.800	---	---
		5550	42.160	5528.800	5570.960	---	---
		5670	41.680	5649.120	5690.800	---	---
		5710	42.000	5688.800	5713.760	---	---
11AC80SISO	Ant1	5210	84.160	5168.240	5252.400	---	---
		5290	84.480	5247.760	5332.240	---	---
		5530	84.000	5488.080	5572.080	---	---
		5610	84.480	5567.760	5652.240	---	---
		5690	82.720	5649.04	5688.08	---	---

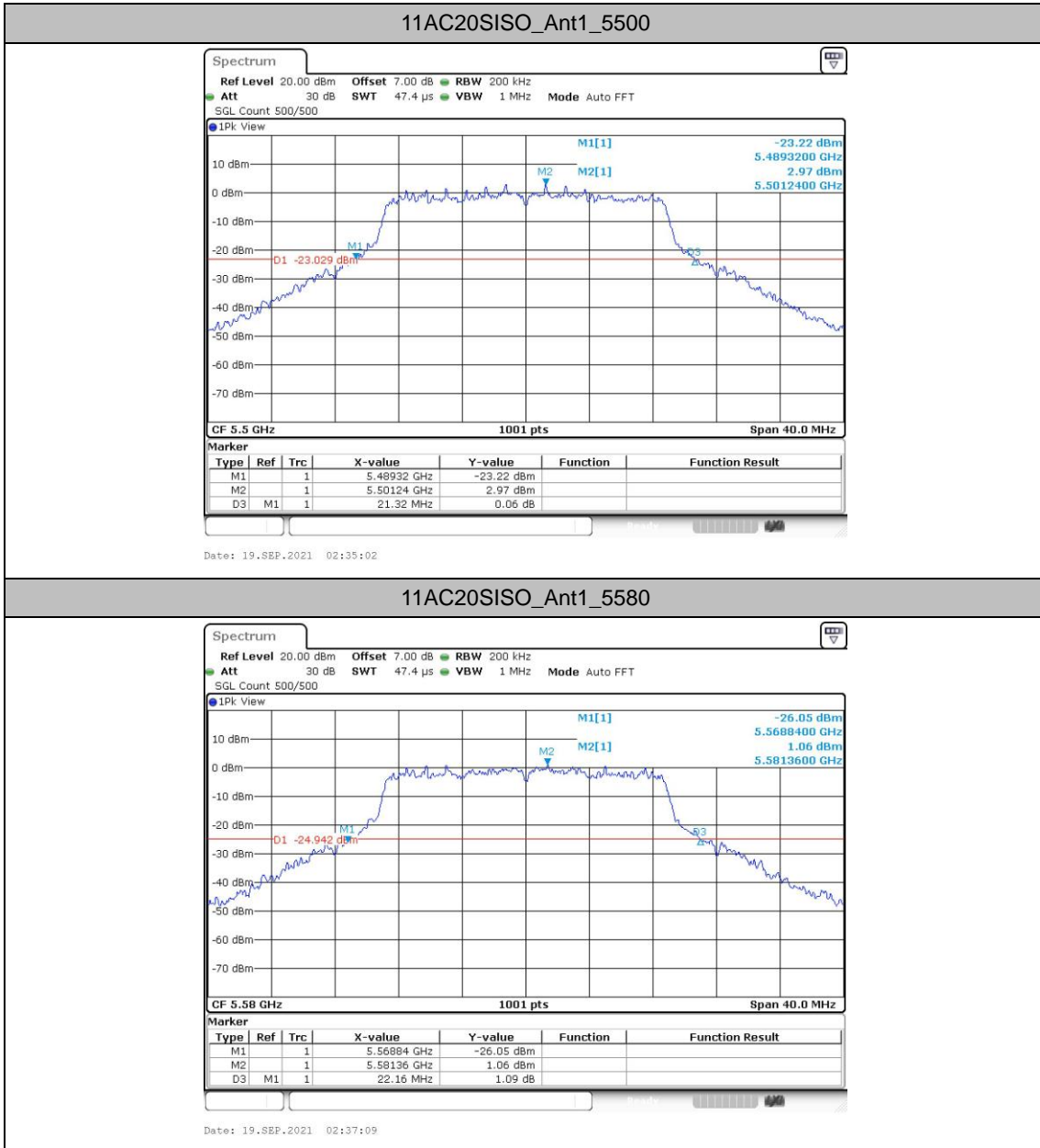


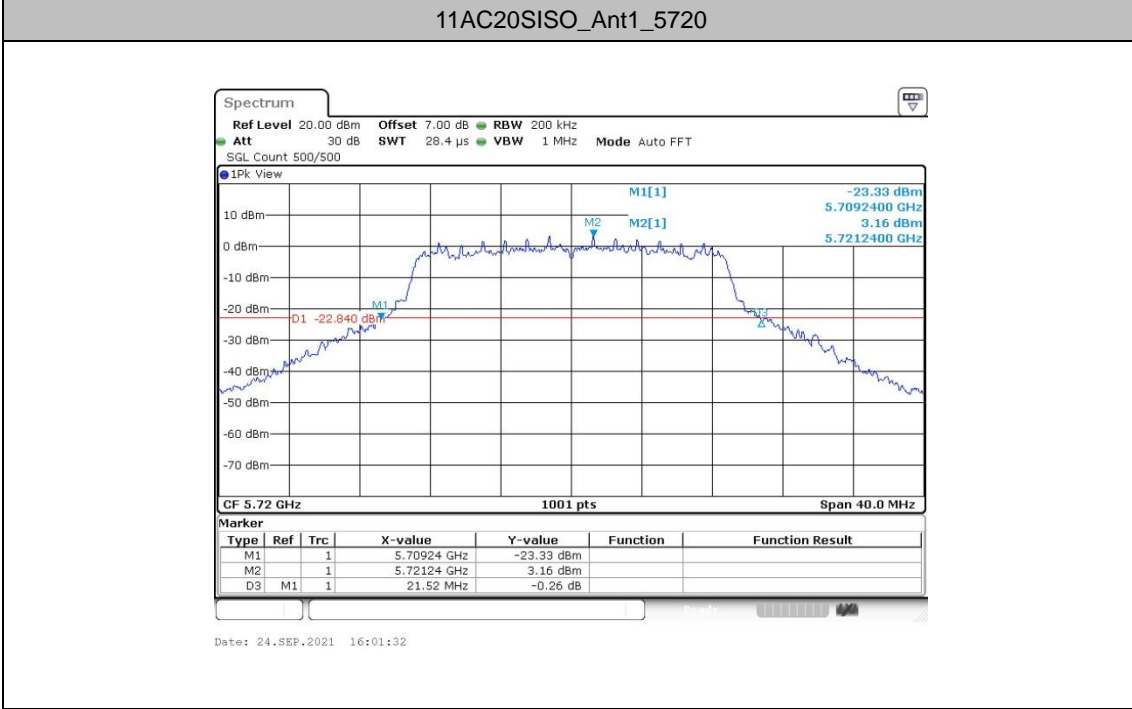
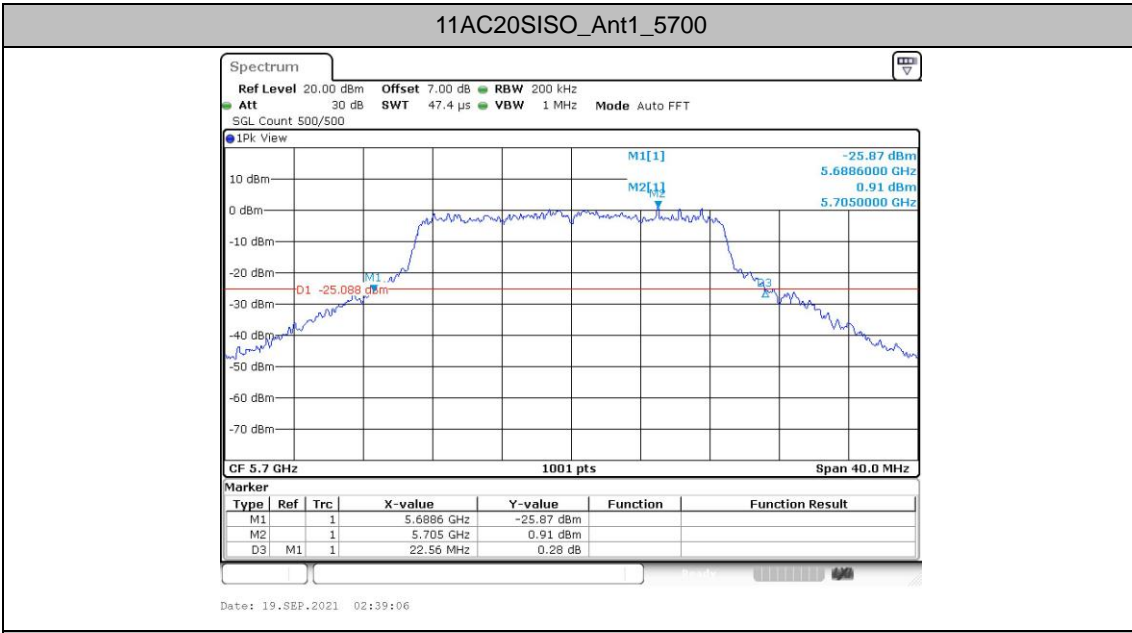
Test Graphs

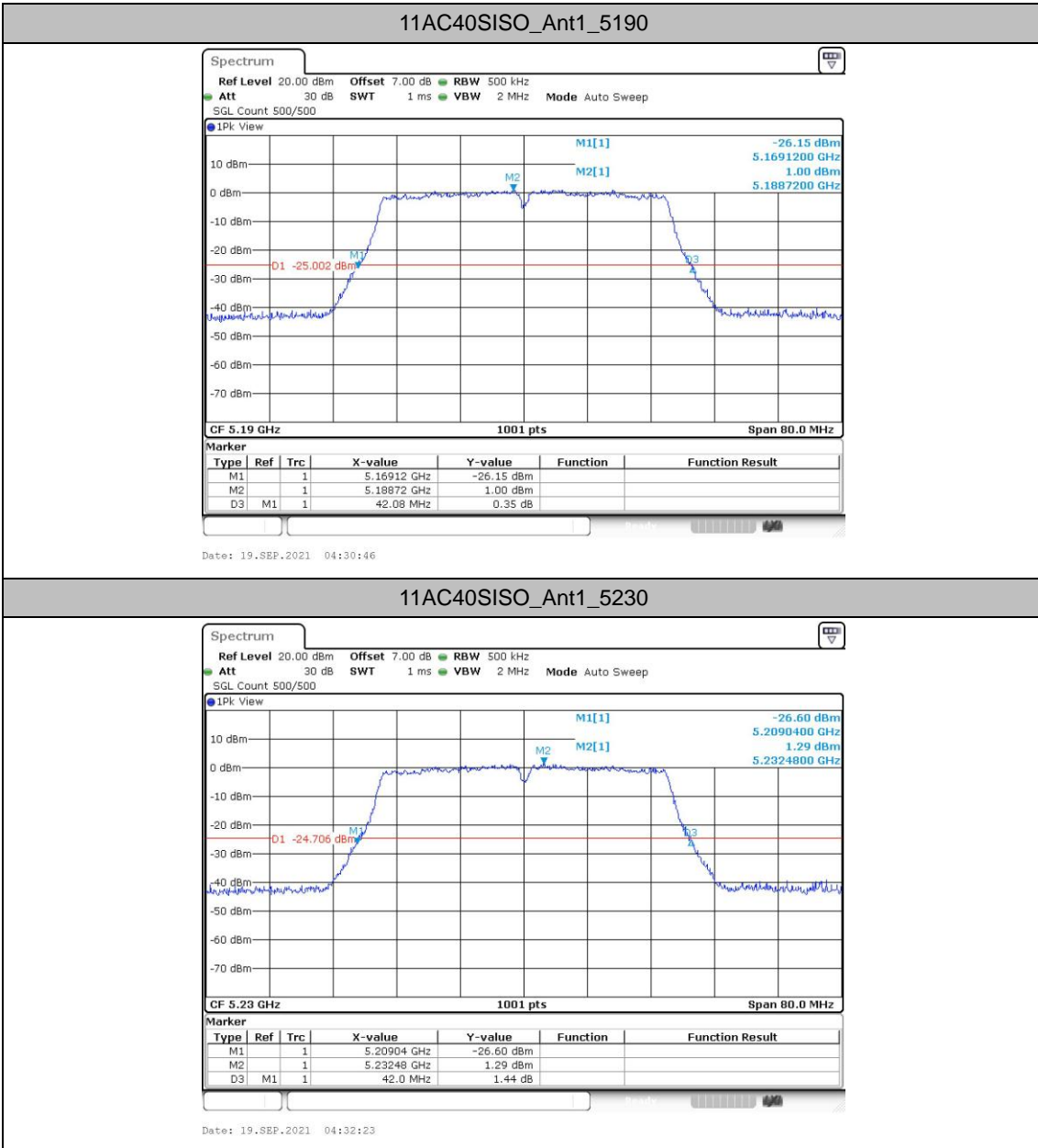


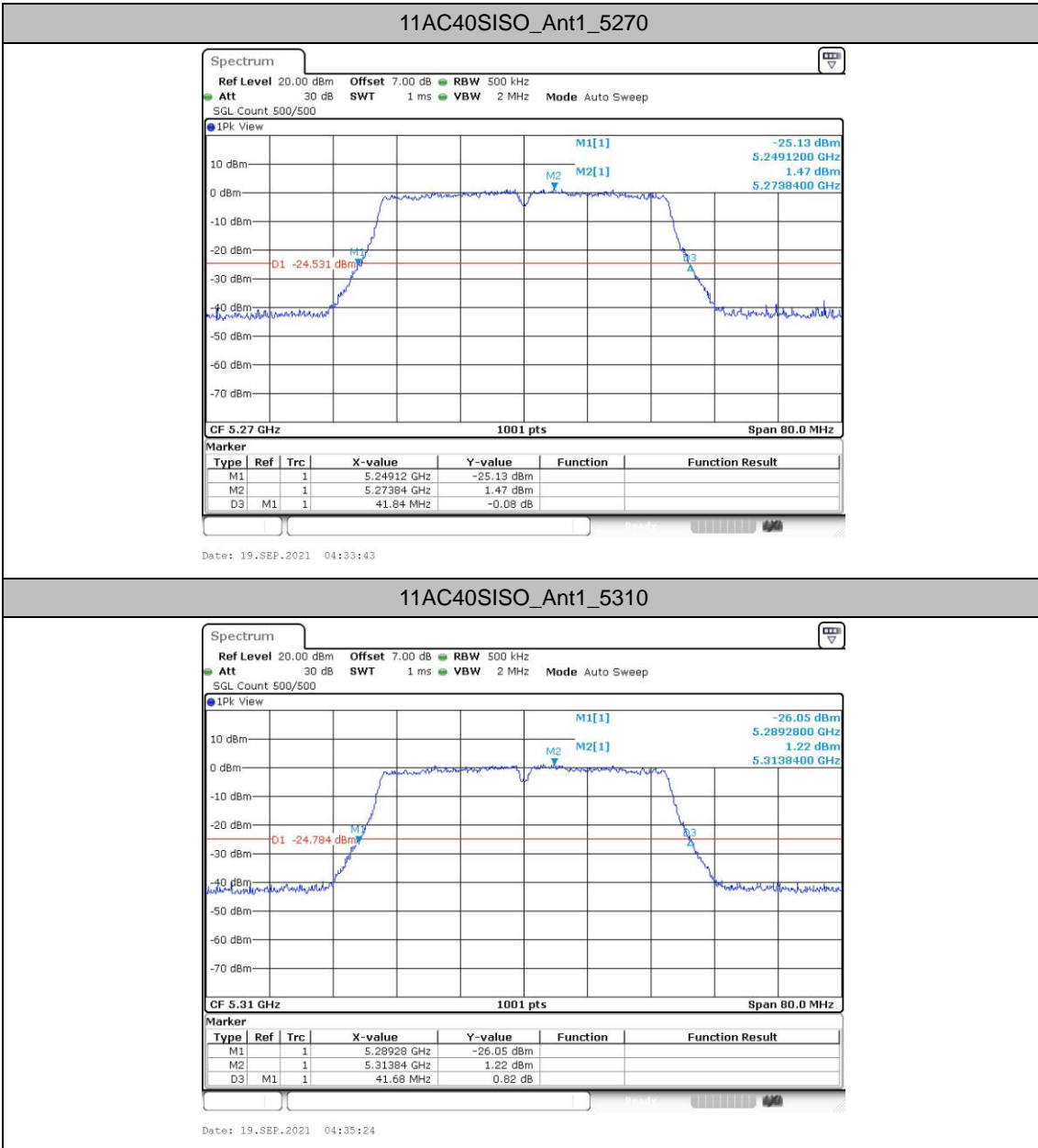


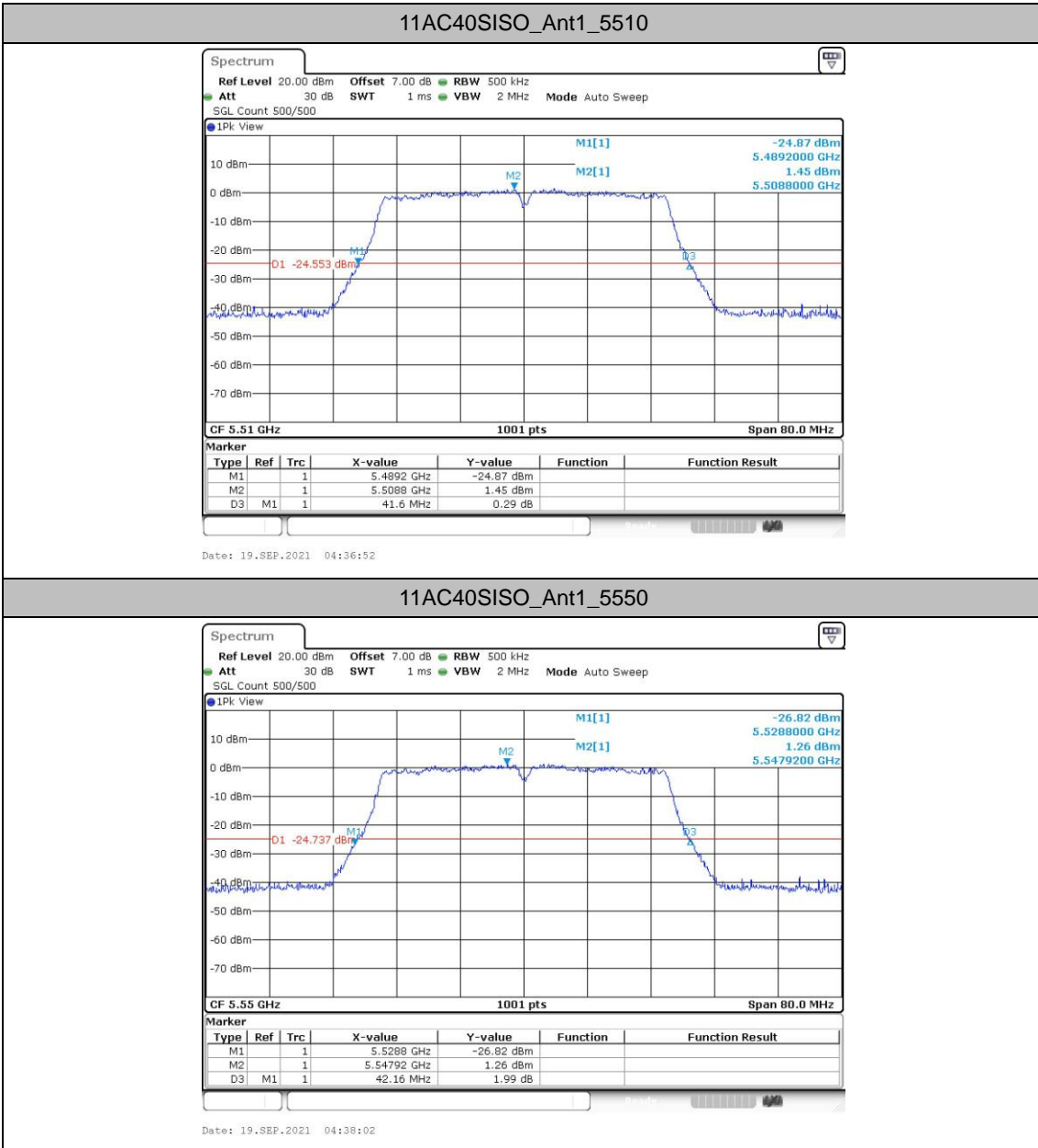


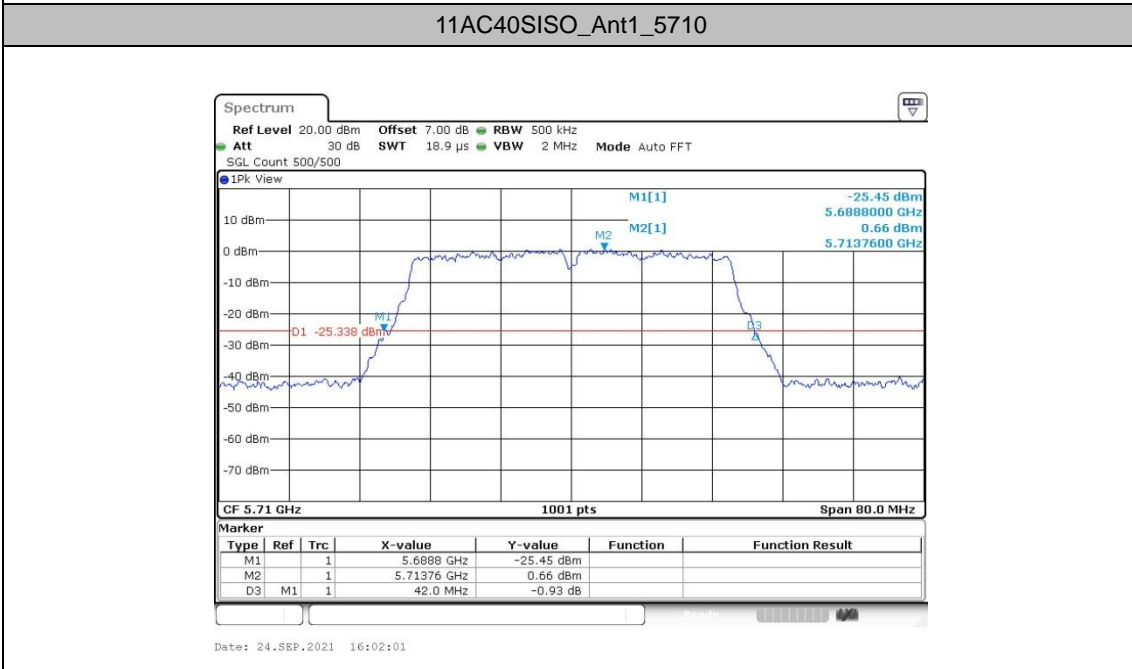
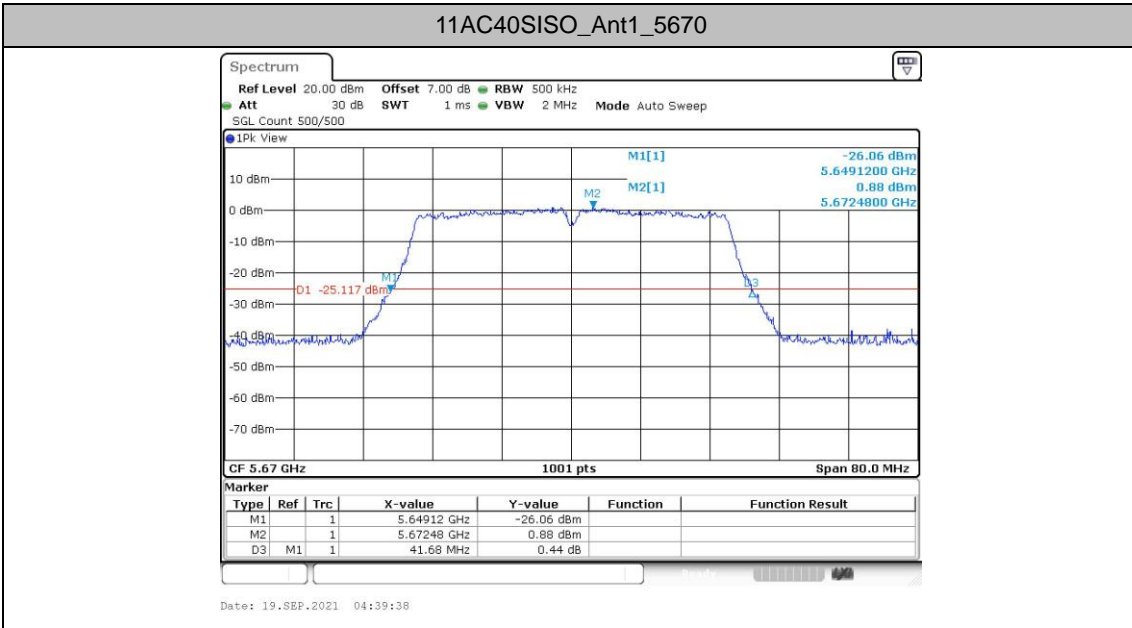


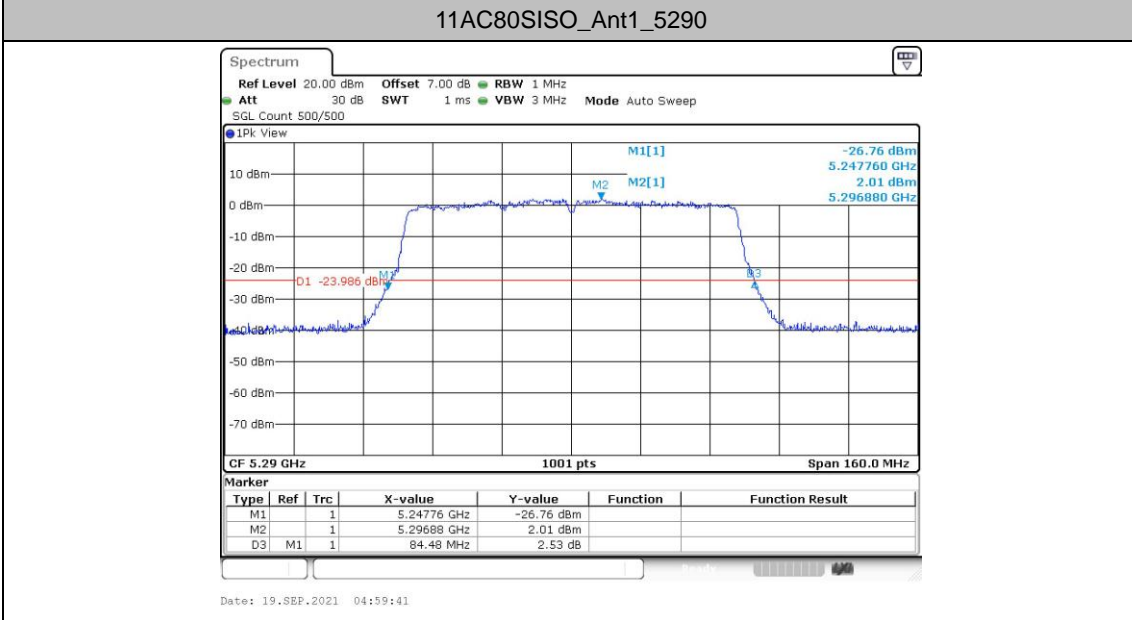
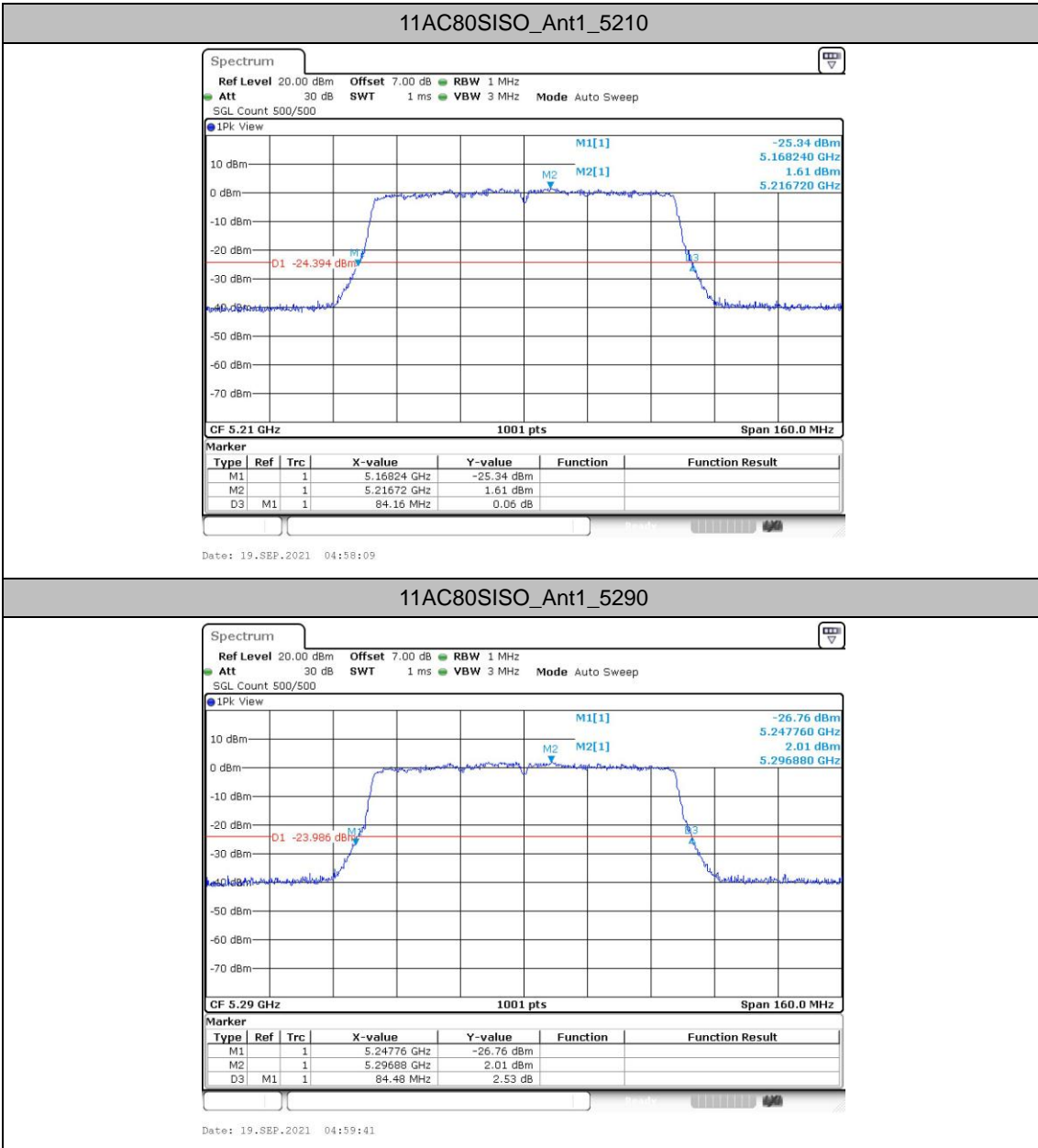


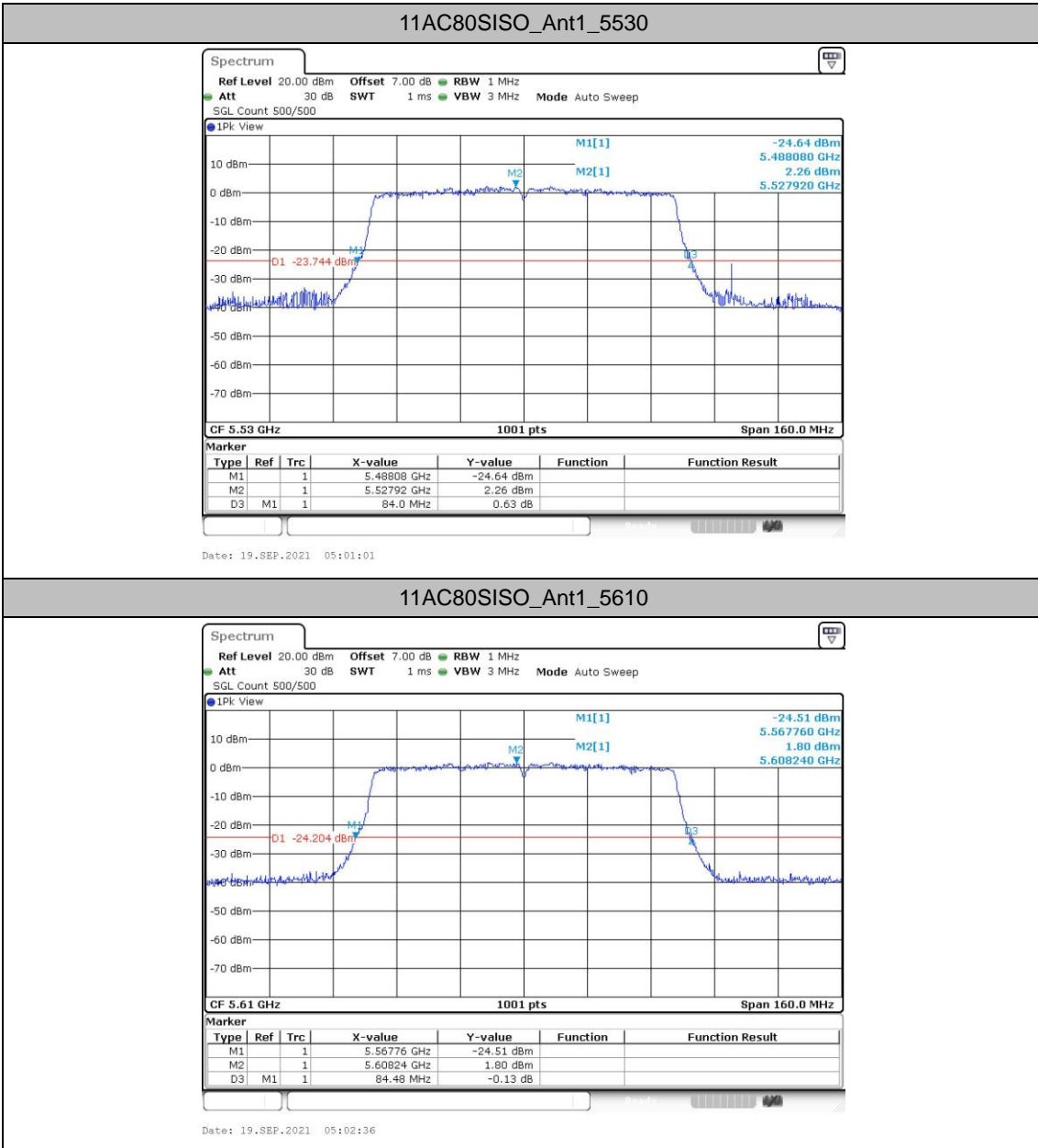


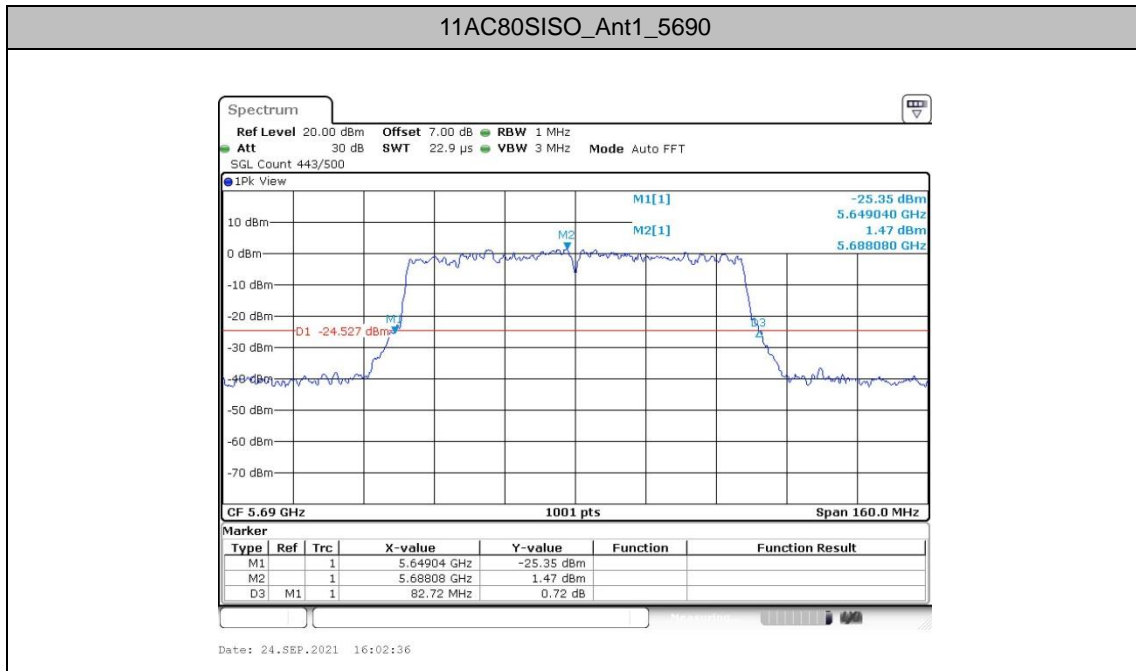












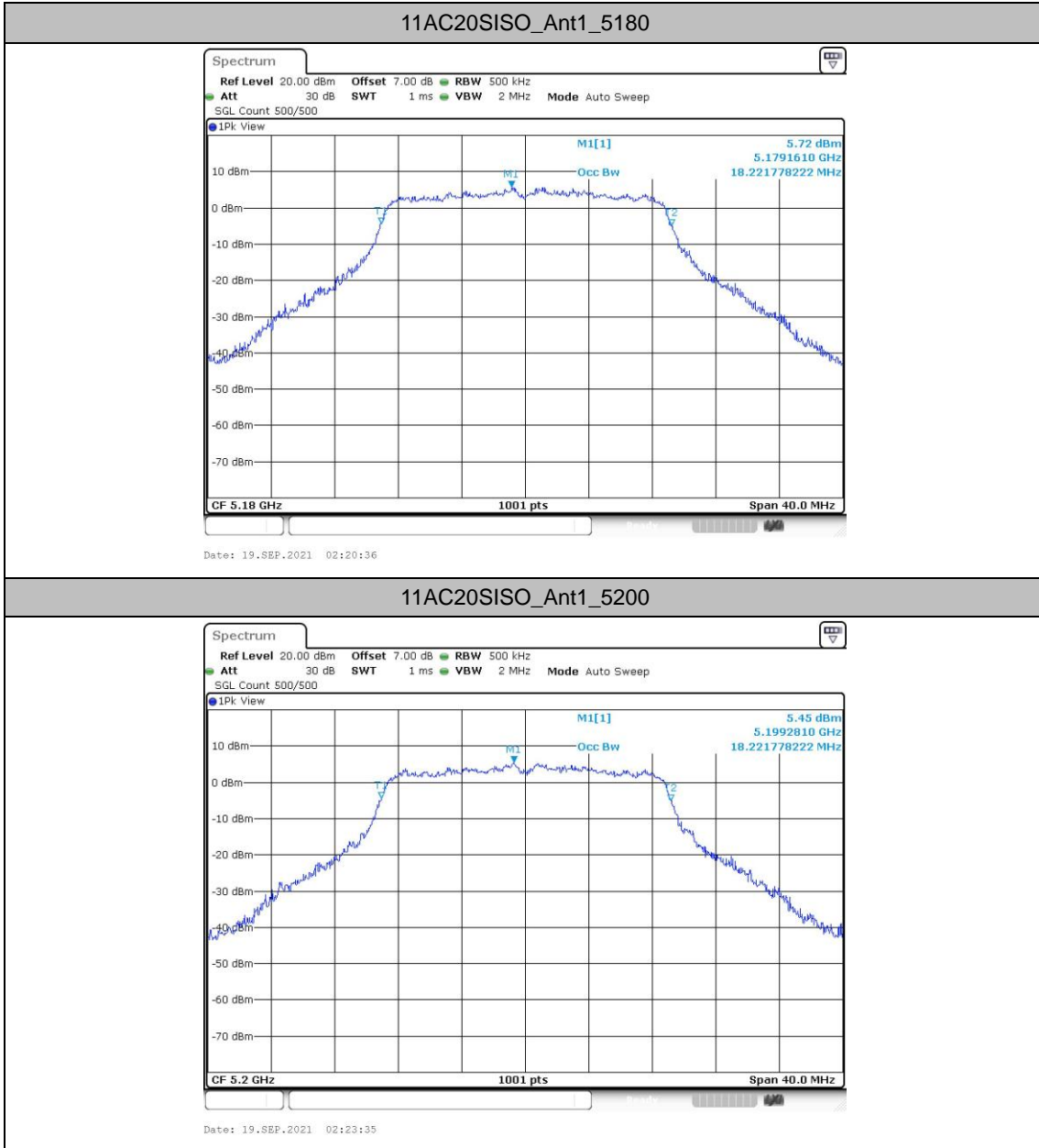


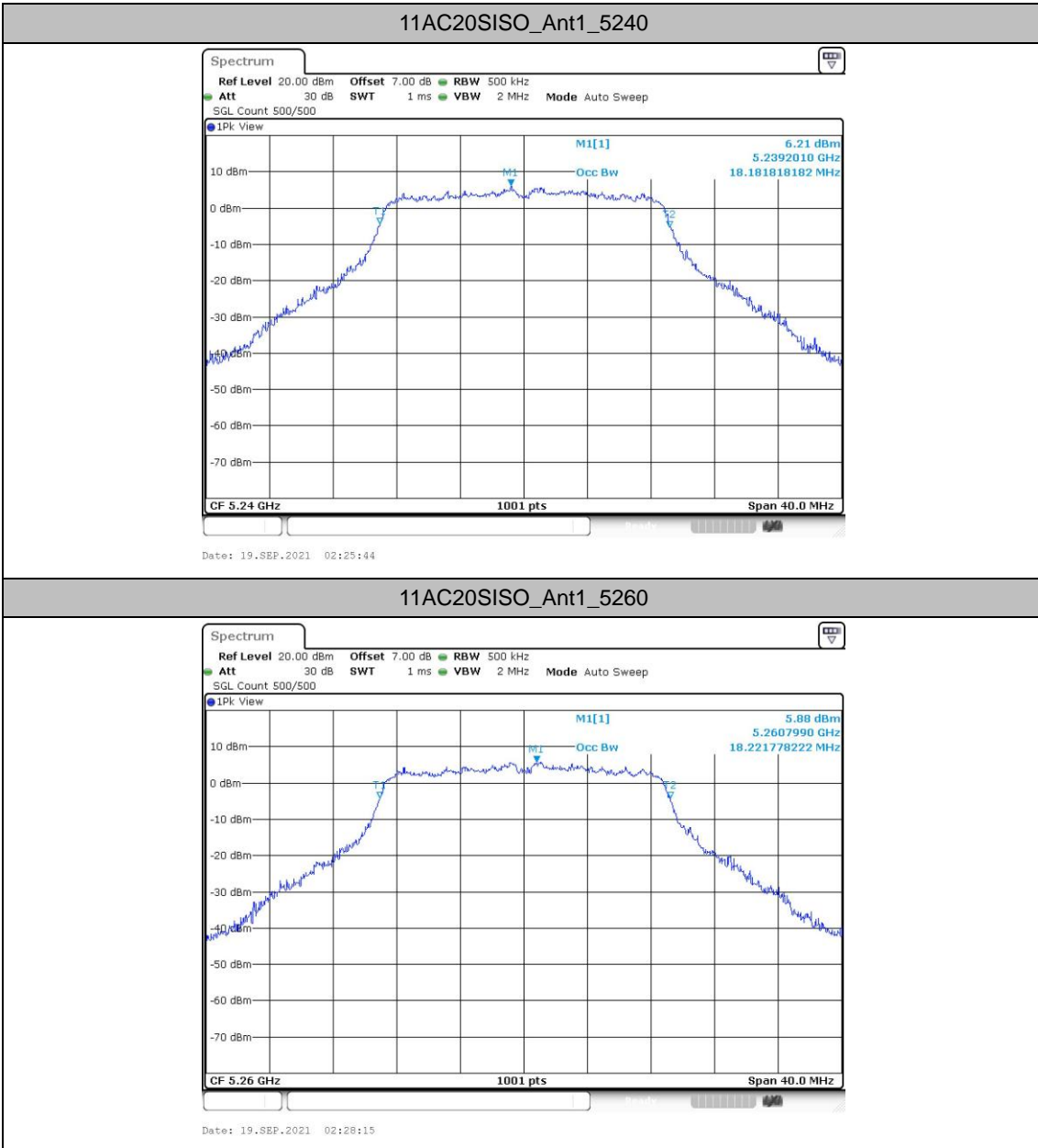
Occupied channel bandwidth Test Result

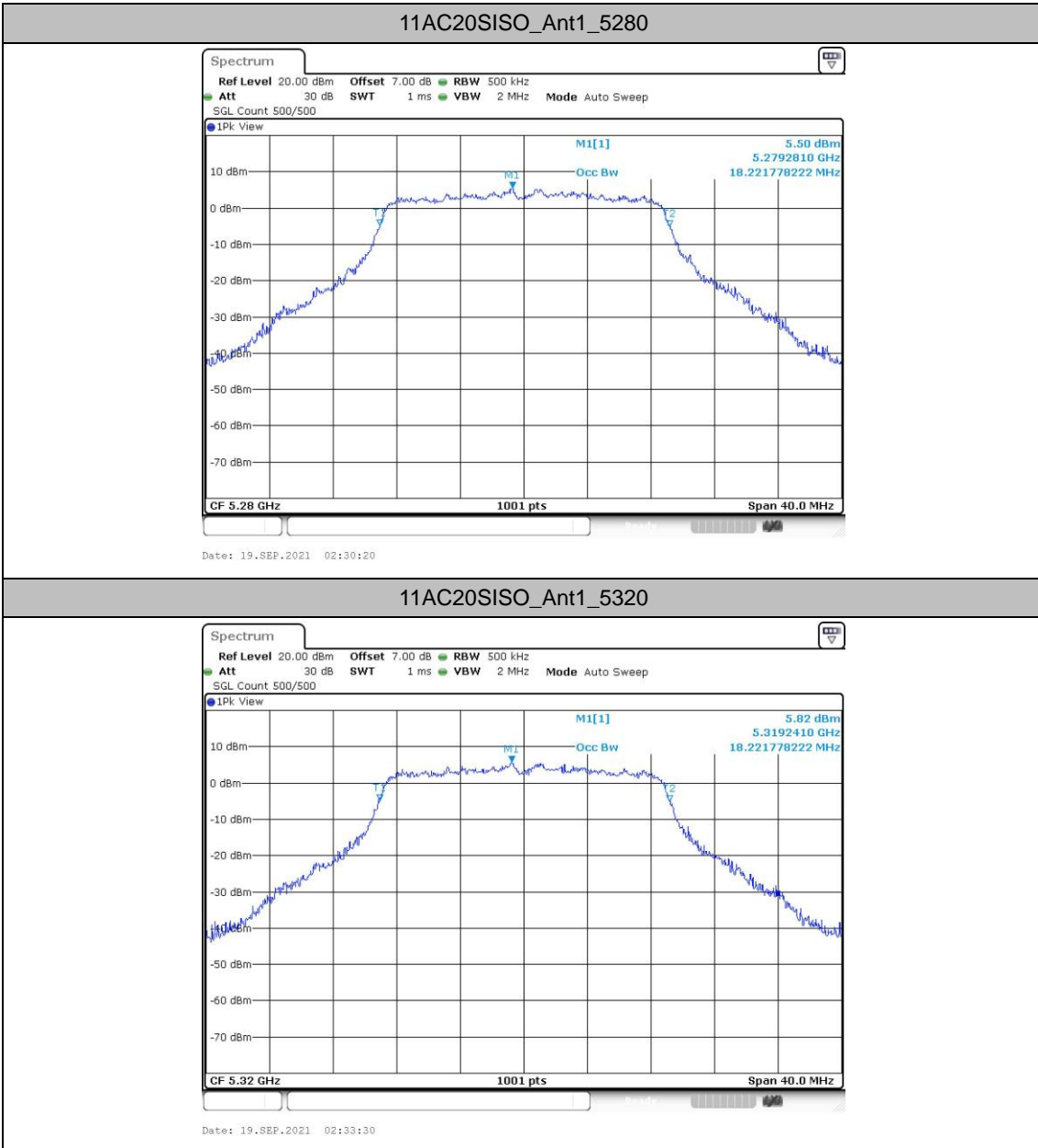
TestMode	Antenna	Frequency [MHz]	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11AC20SISO	Ant1	5180	18.222	5170.969	5189.191	---	---
		5200	18.222	5190.929	5209.151	---	---
		5240	18.182	5230.969	5249.151	---	---
		5260	18.222	5250.969	5269.191	---	---
		5280	18.222	5270.929	5289.151	---	---
		5320	18.222	5310.929	5329.151	---	---
		5500	18.182	5490.969	5509.151	---	---
		5580	18.182	5570.929	5589.111	---	---
		5700	18.222	5690.929	5709.151	---	---
		5720	18.182	5710.929	5729.151		
11AC40SISO	Ant1	5190	36.444	5171.858	5208.302	---	---
		5230	36.523	5211.858	5248.382	---	---
		5270	36.523	5251.858	5288.382	---	---
		5310	36.523	5291.778	5328.302	---	---
		5510	36.523	5491.778	5528.302	---	---
		5550	36.523	5531.778	5568.302	---	---
		5670	36.523	5651.778	5688.302	---	---
		5710	36.683	5691.778	5728.302		
11AC80SISO	Ant1	5210	75.764	5172.438	5248.202	---	---
		5290	75.924	5252.278	5328.202	---	---
		5530	75.764	5492.278	5568.042	---	---
		5610	75.924	5572.118	5648.042	---	---
		5690	75.924	5642.118	5728.042		

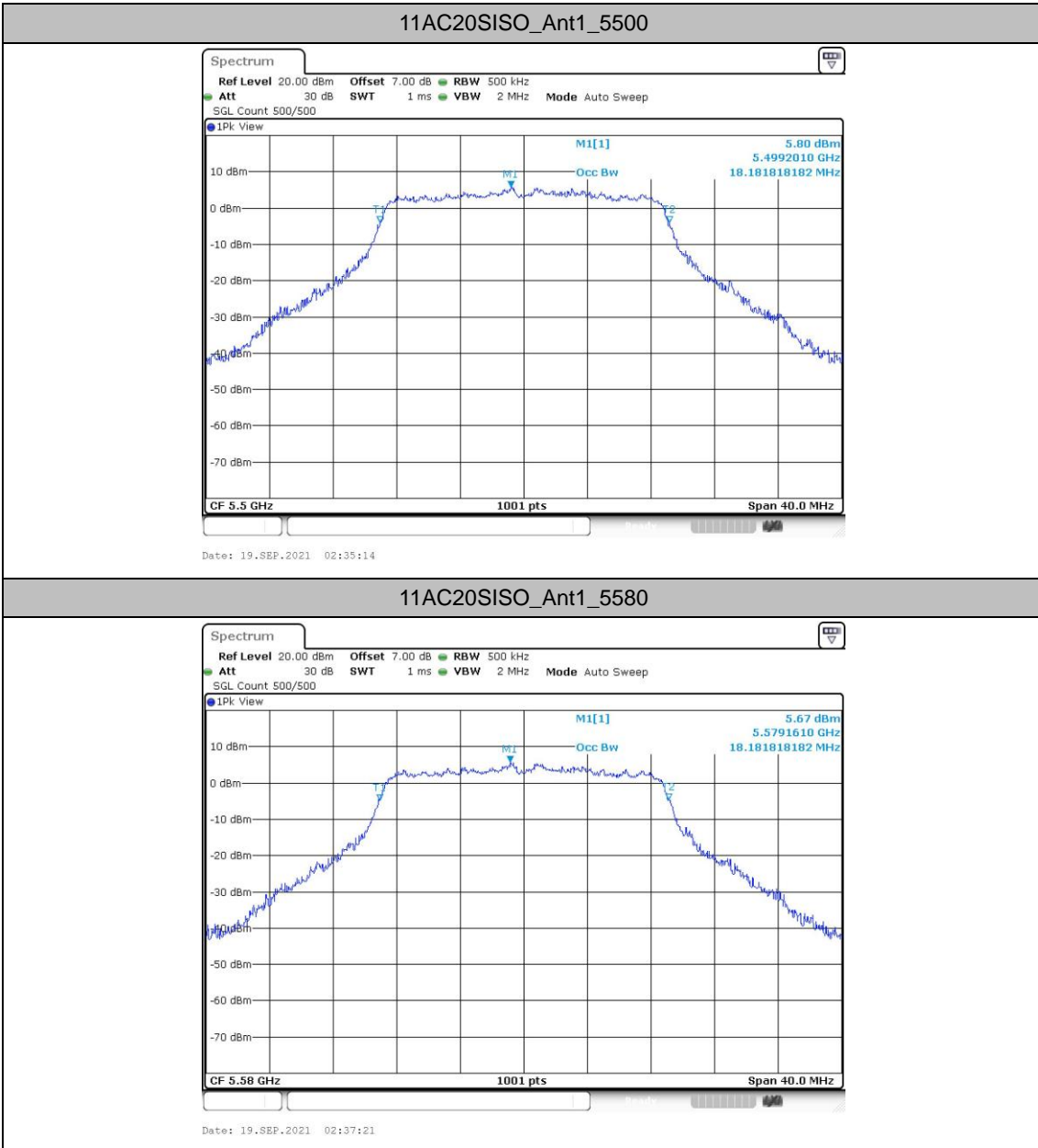


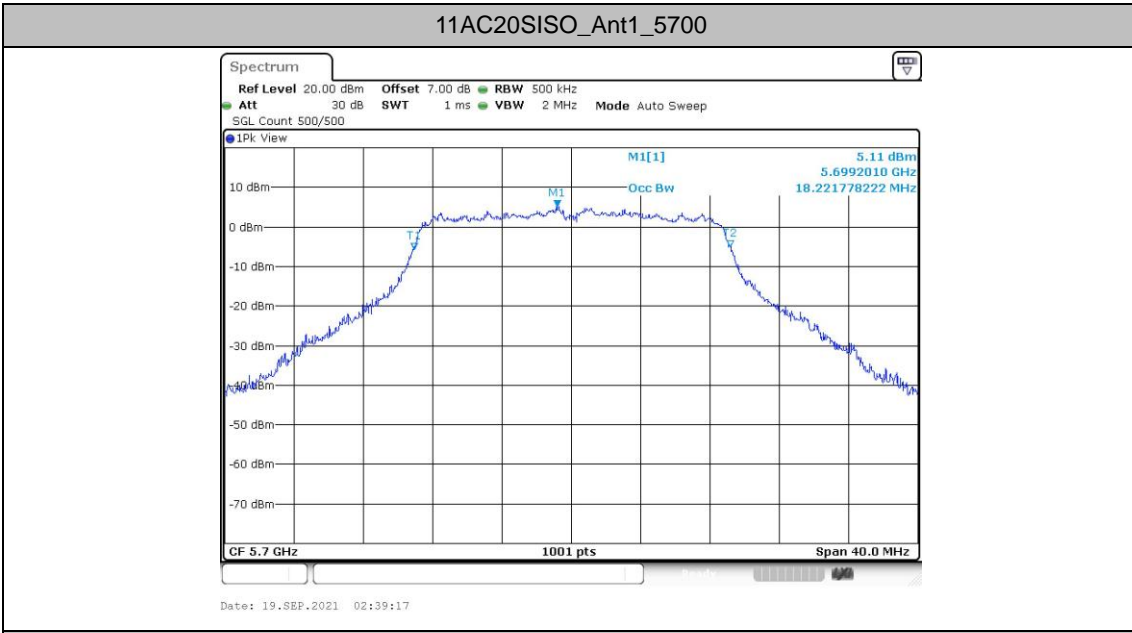
Test Graphs

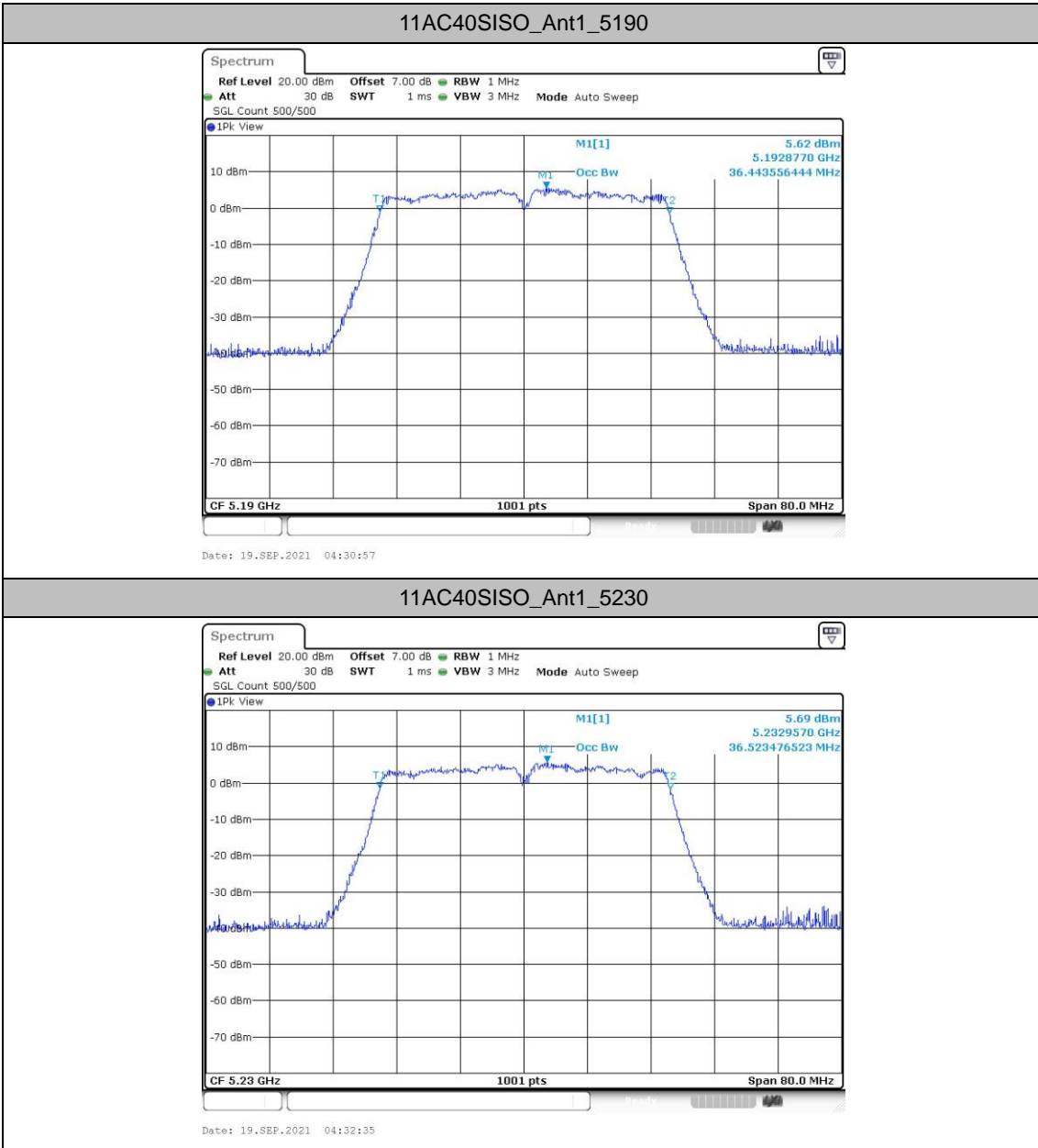


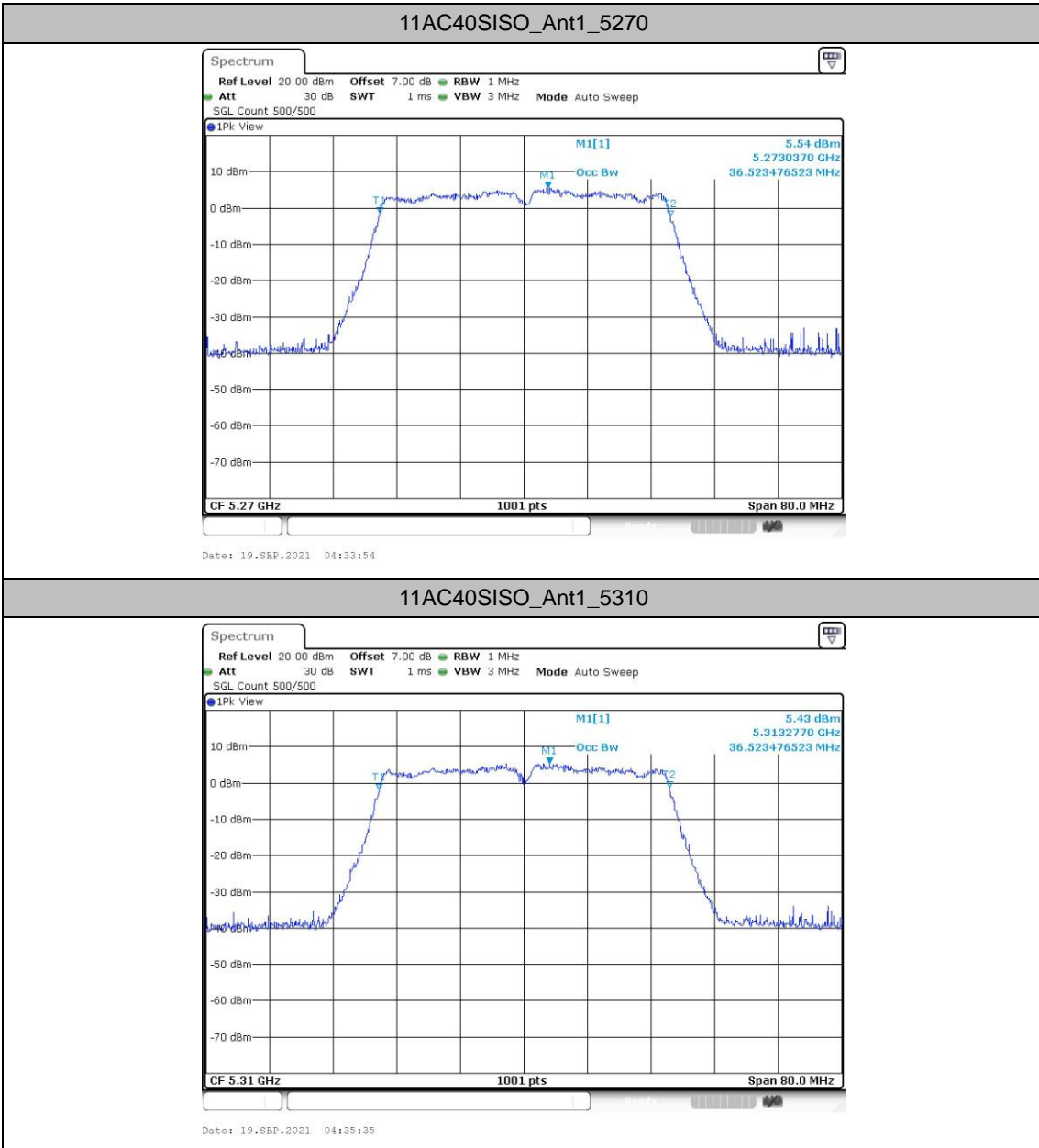


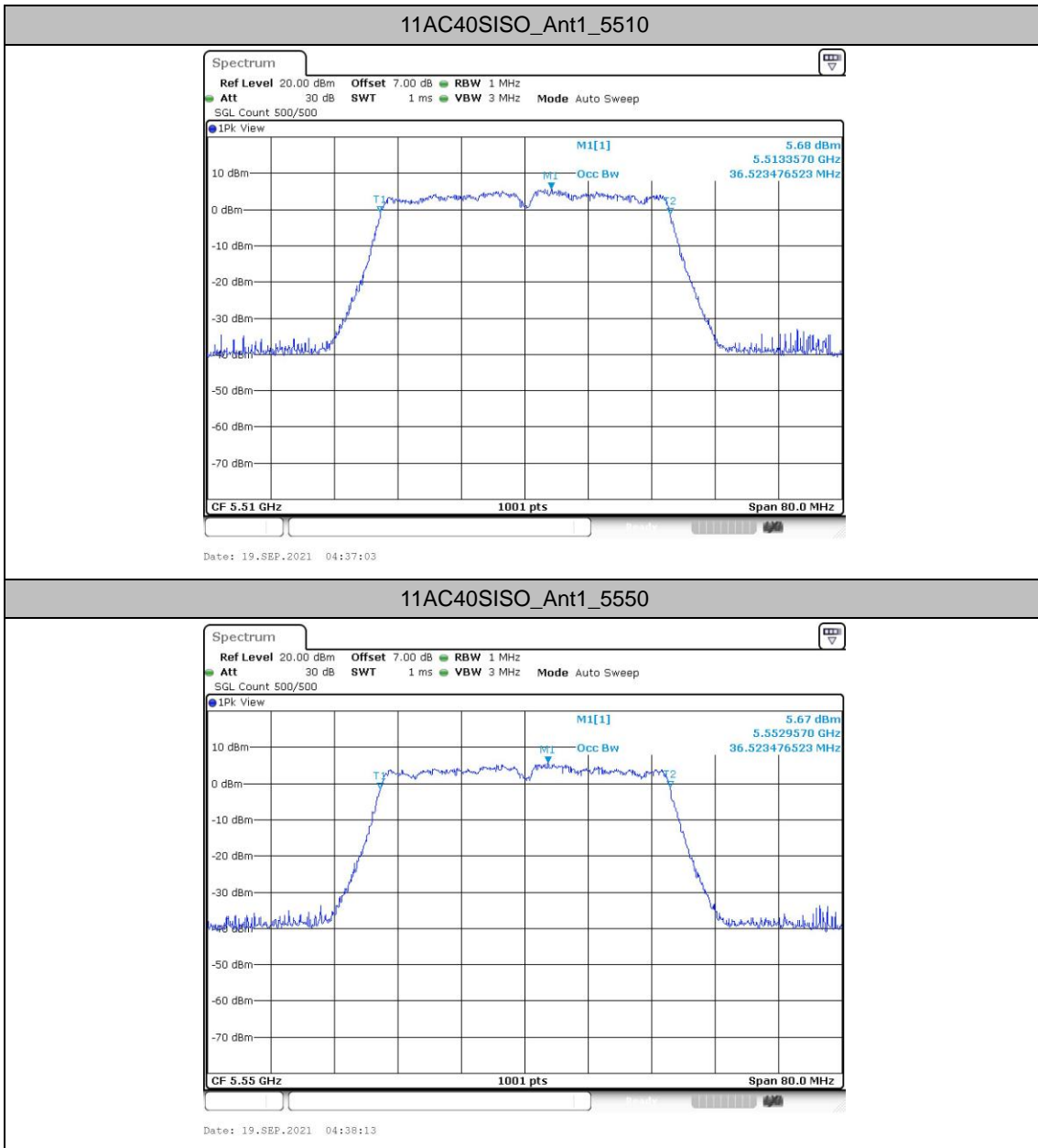


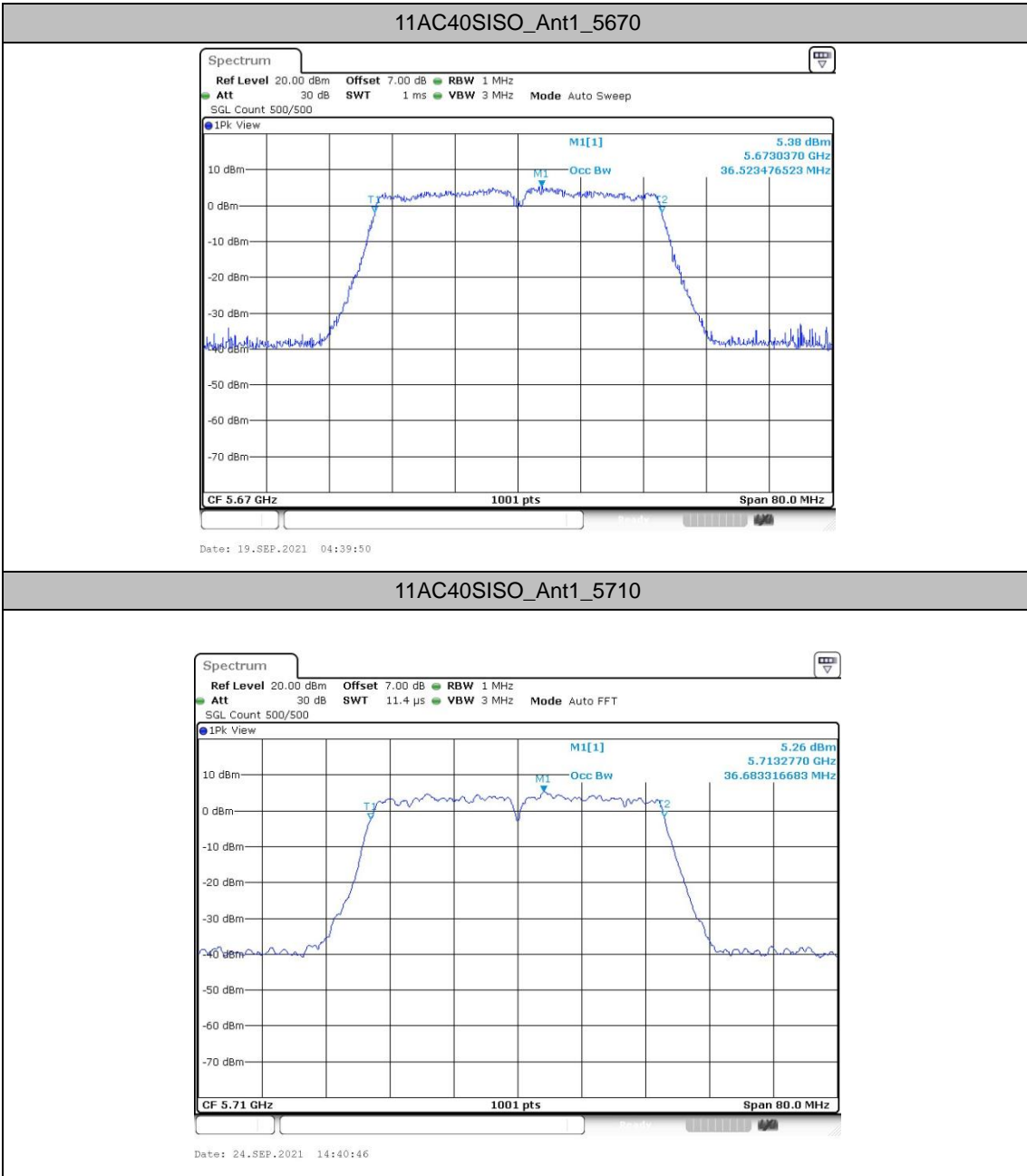


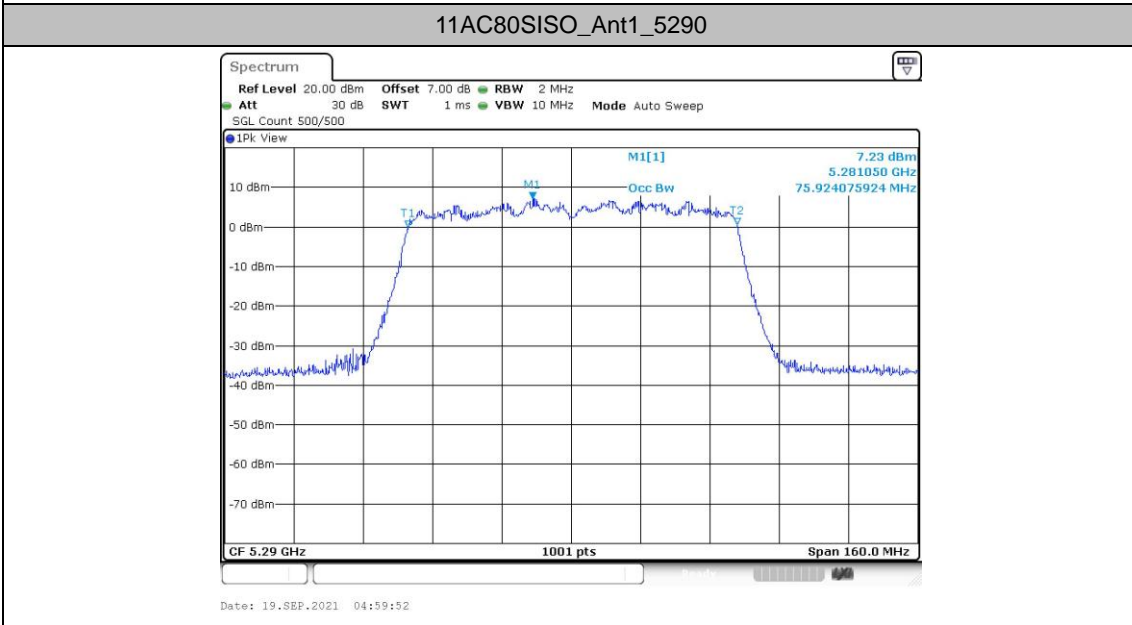
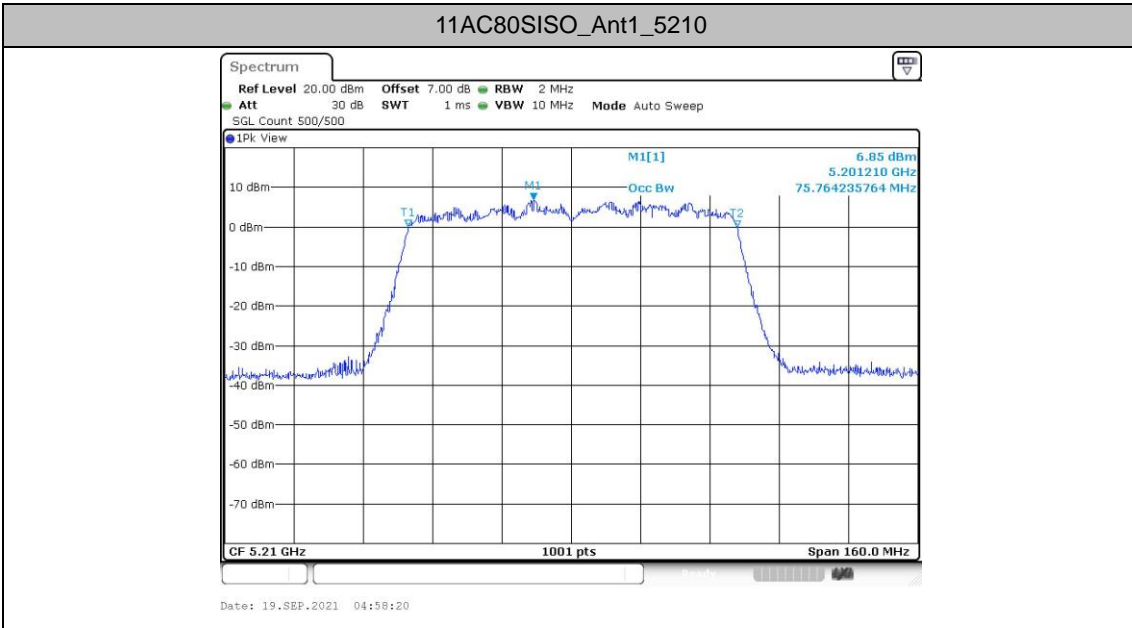


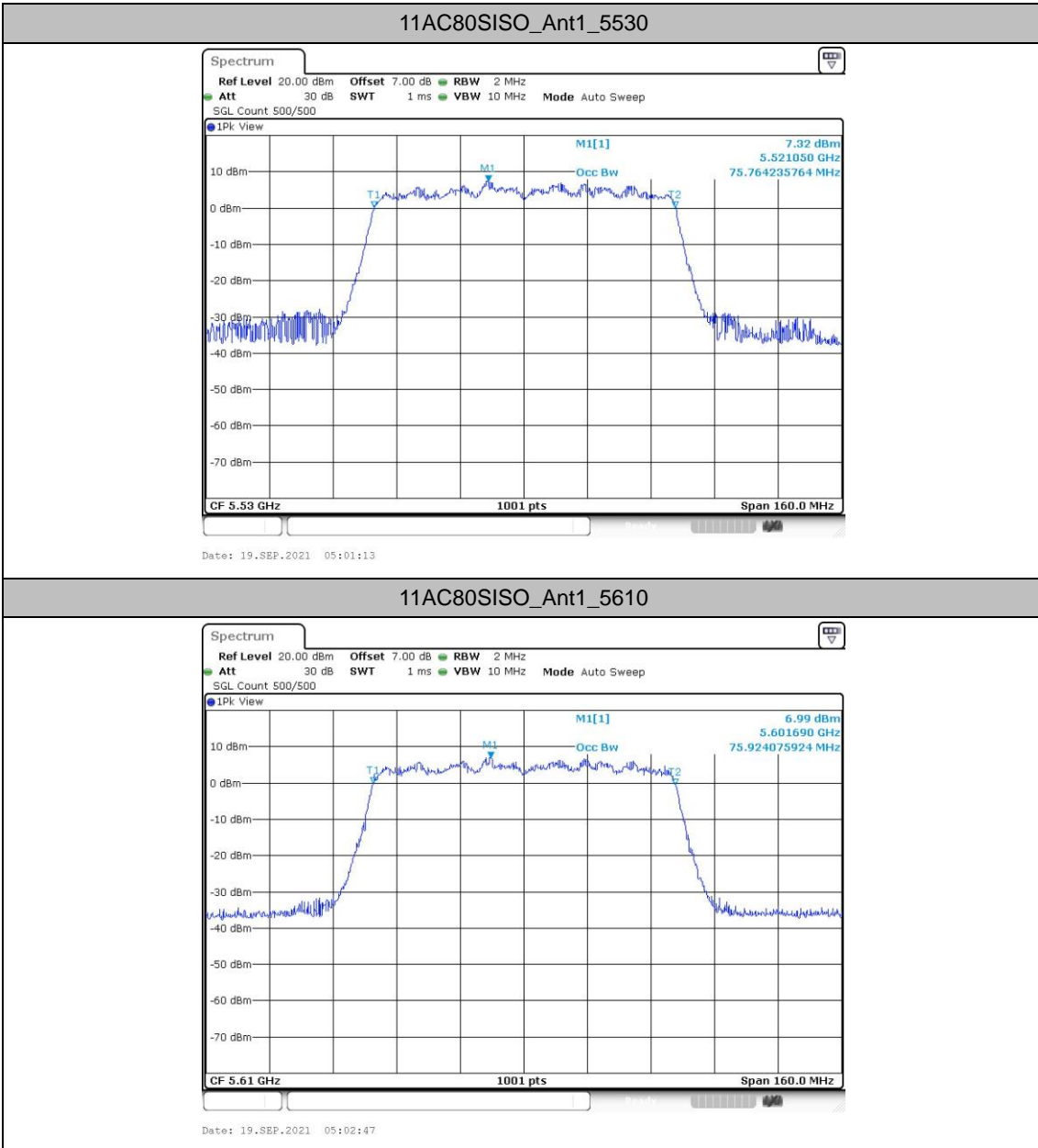


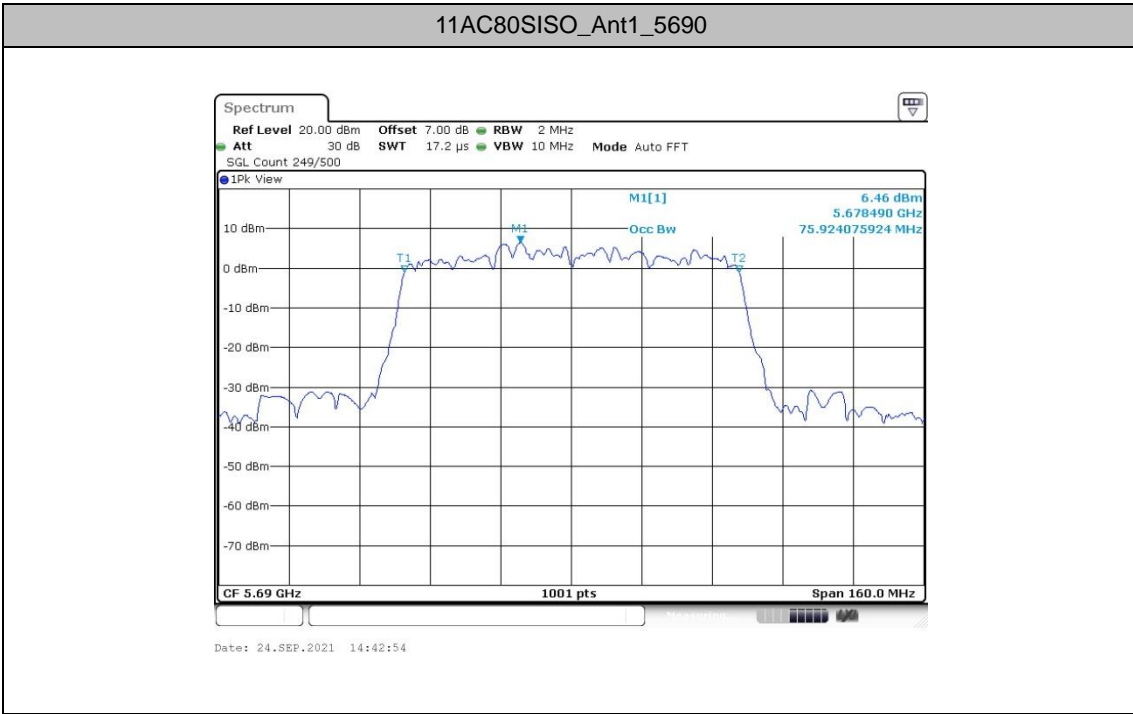












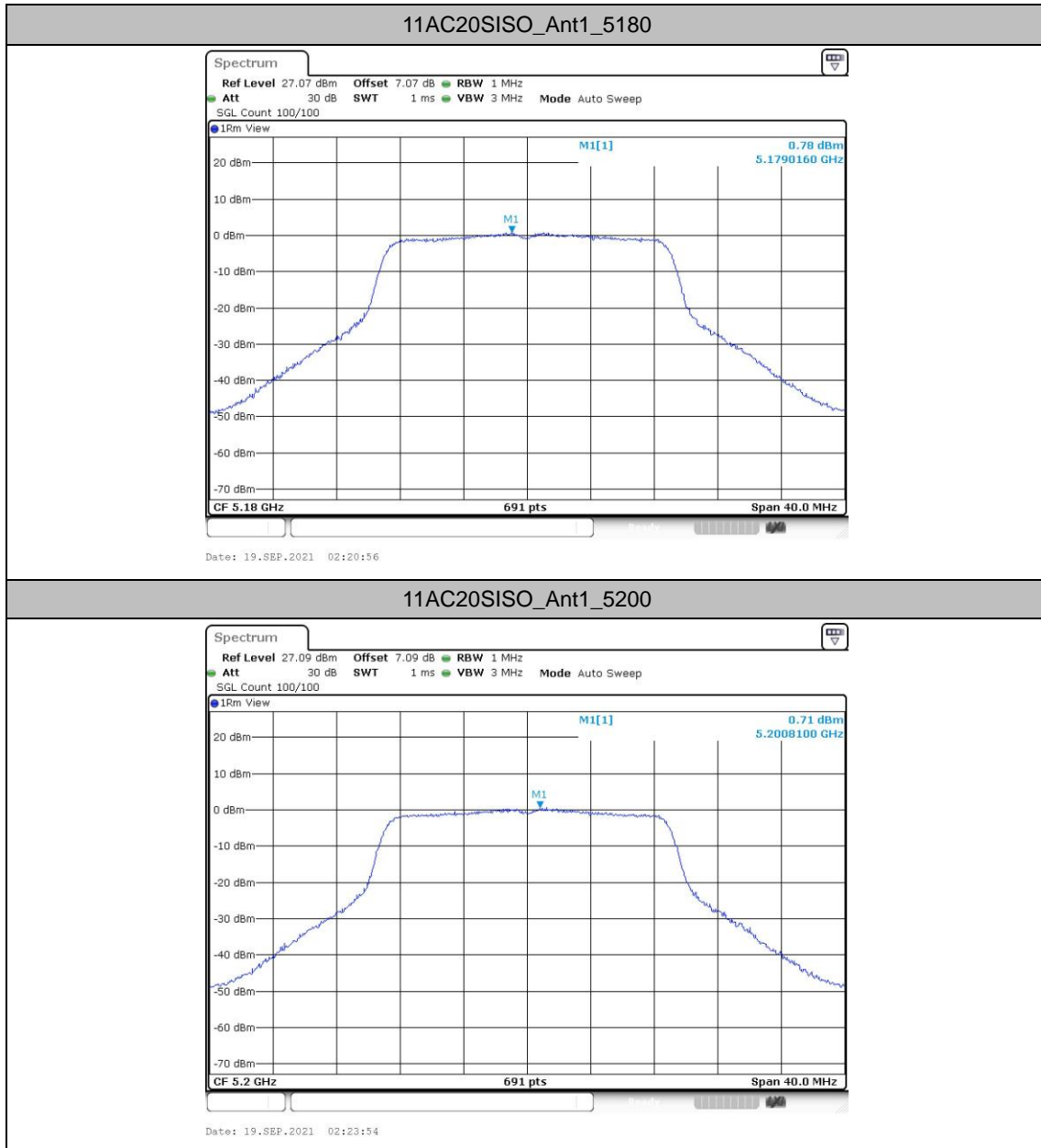


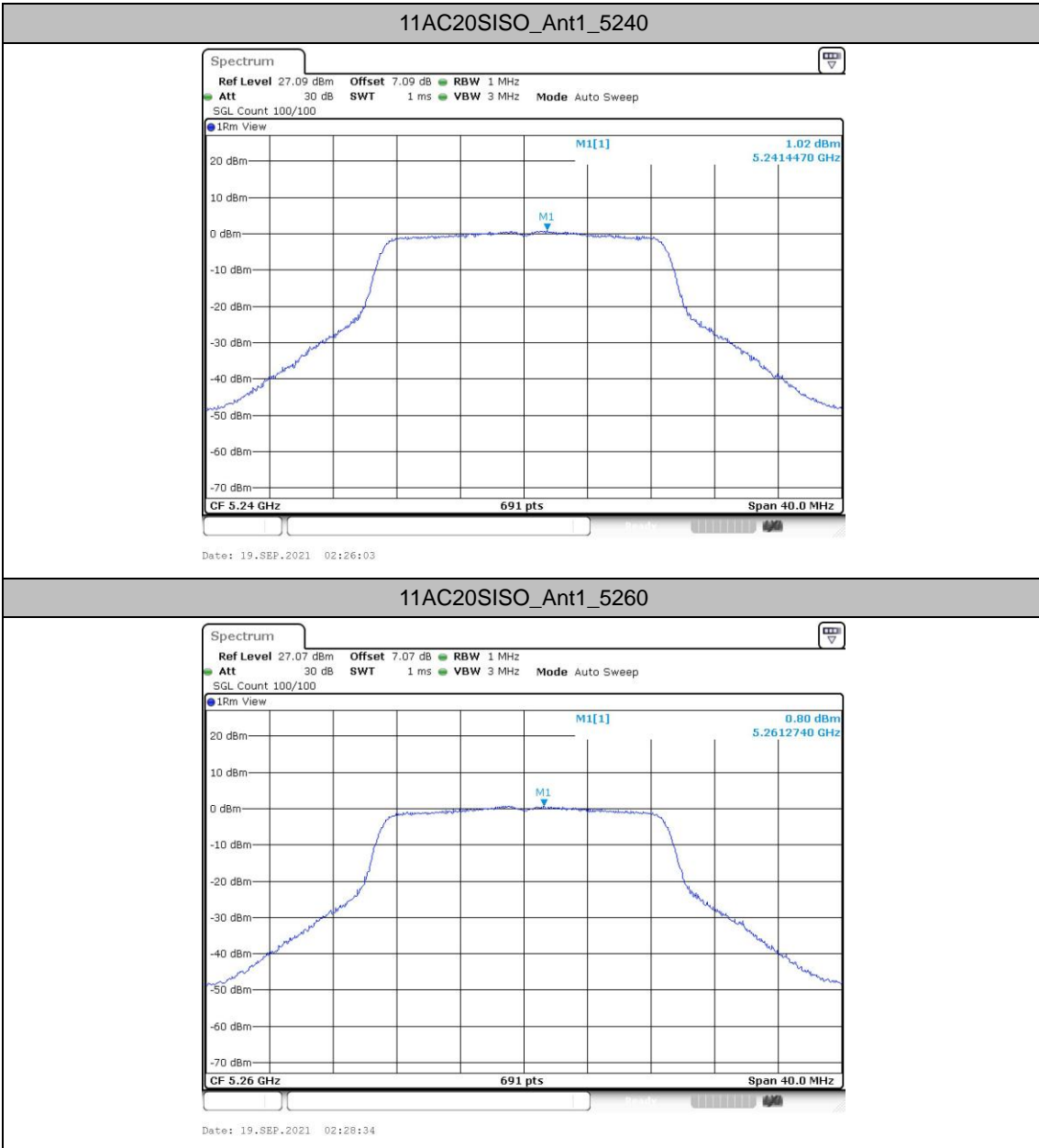
Maximum power spectral density Test Result

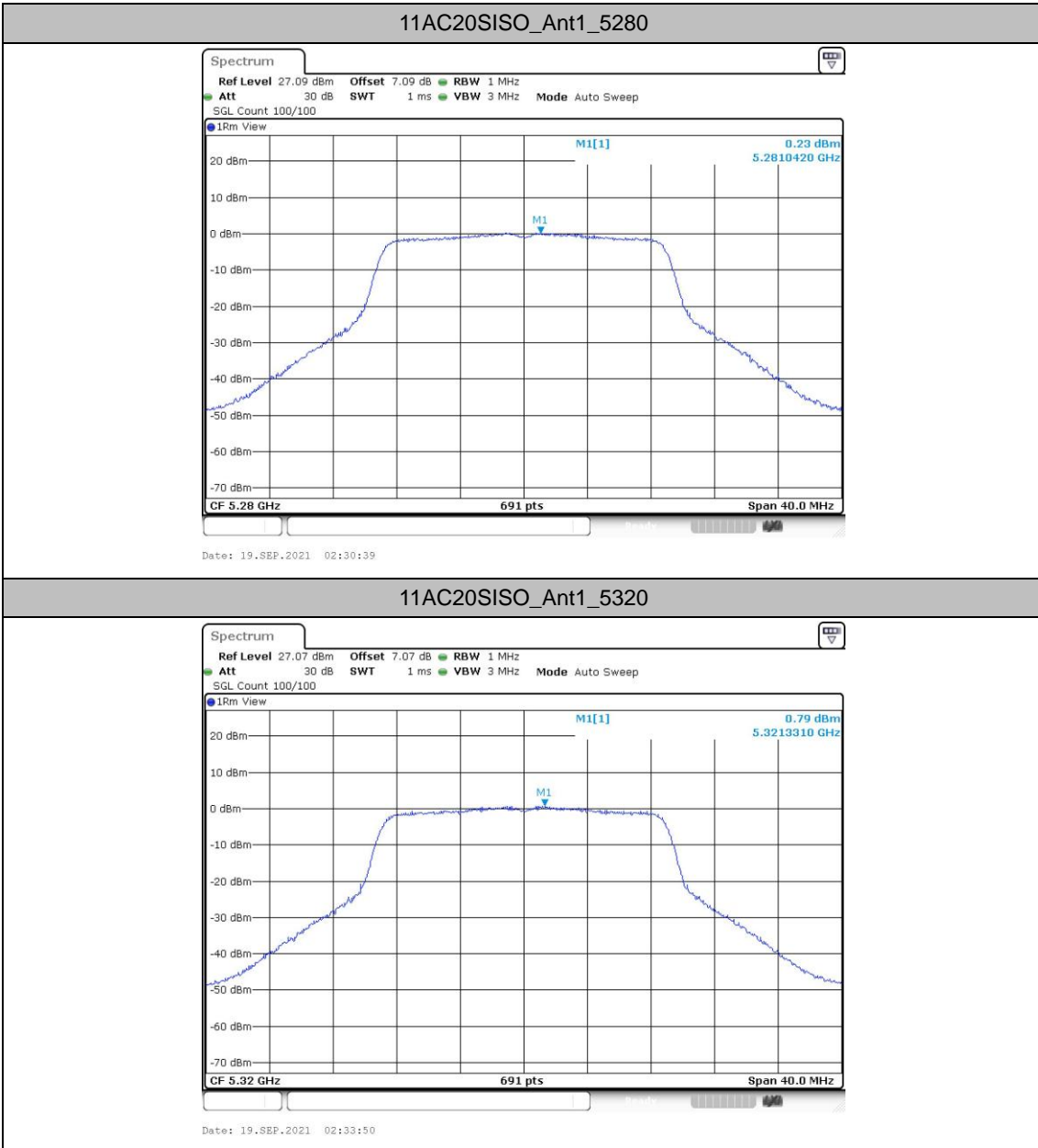
TestMode	Antenna	Frequency [MHz]	Result [dBm/MHz]	Limit[dBm/MHz]	Verdict
11AC20SISO	Ant1	5180	0.78	≤11	PASS
		5200	0.71	≤11	PASS
		5240	1.02	≤11	PASS
		5260	0.8	≤11	PASS
		5280	0.23	≤11	PASS
		5320	0.79	≤11	PASS
		5500	0.73	≤11	PASS
		5580	0.54	≤11	PASS
		5700	0.19	≤11	PASS
		5720-2C	0.55	≤11	PASS
		5720-3	-3.85	≤11	PASS
11AC40SISO	Ant1	5190	-3.14	≤11	PASS
		5230	-3.15	≤11	PASS
		5270	-3.29	≤11	PASS
		5310	-3.27	≤11	PASS
		5510	-3	≤11	PASS
		5550	-3.17	≤11	PASS
		5670	-3.24	≤11	PASS
		5710-2C	-3.52	≤11	PASS
		5710-3	-6.68	≤11	PASS
11AC80SISO	Ant1	5210	-6.8	≤11	PASS
		5290	-6.47	≤11	PASS
		5530	-6.2	≤11	PASS
		5610	-6.41	≤11	PASS
		5690-2C	-6.48	≤11	PASS
		5690-3	-10.29	≤11	PASS

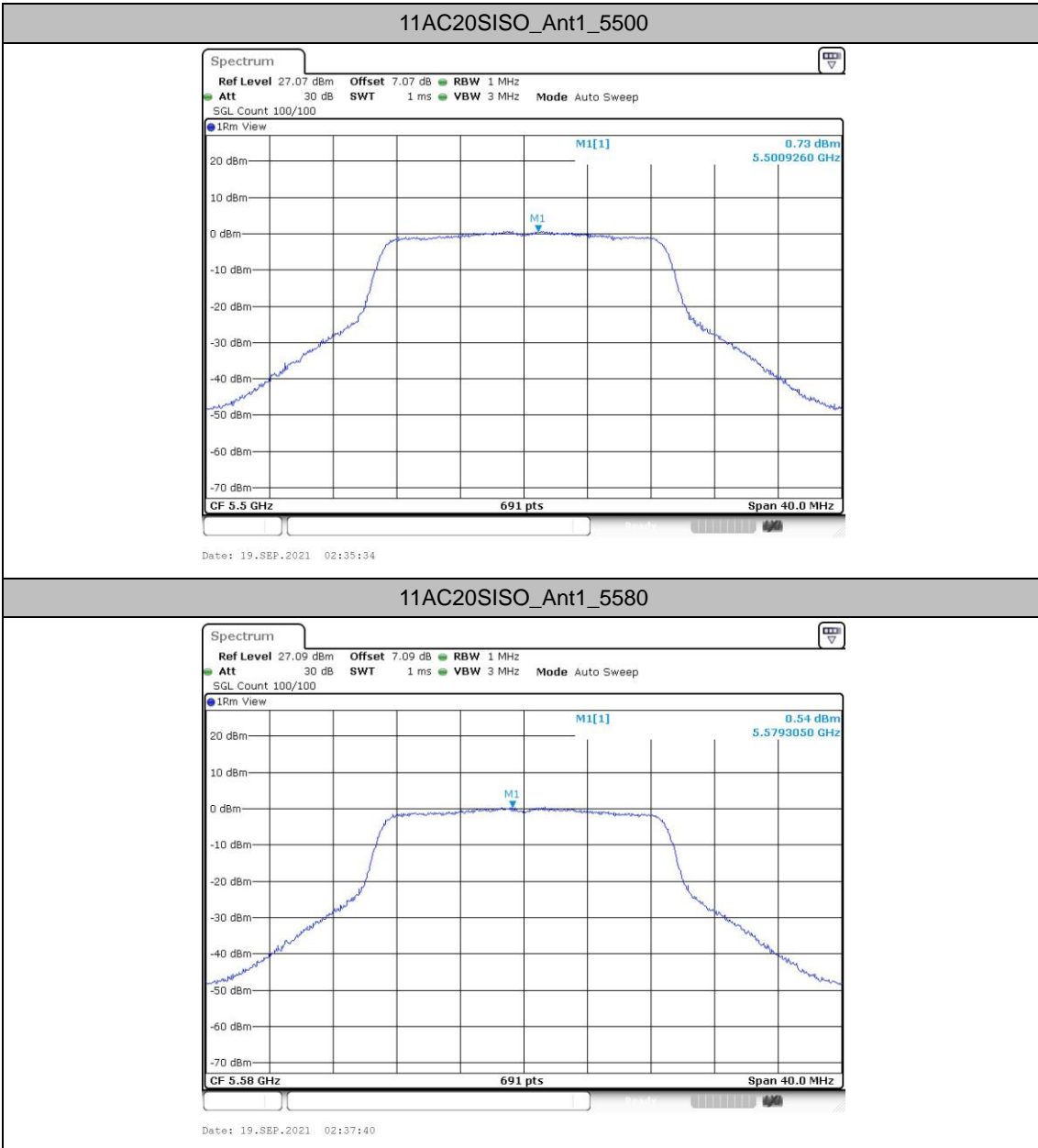


Test Graphs



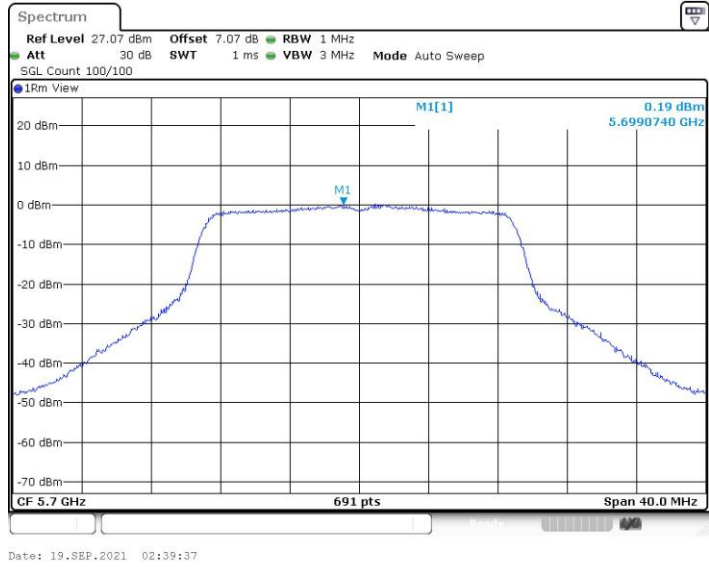




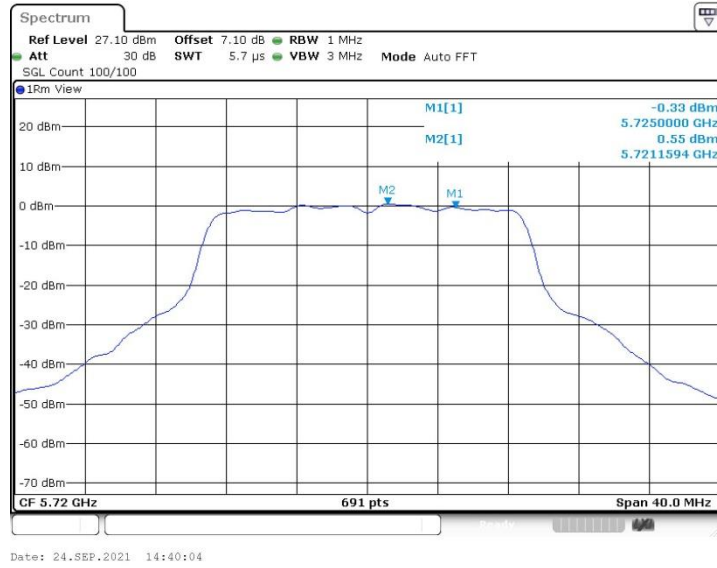


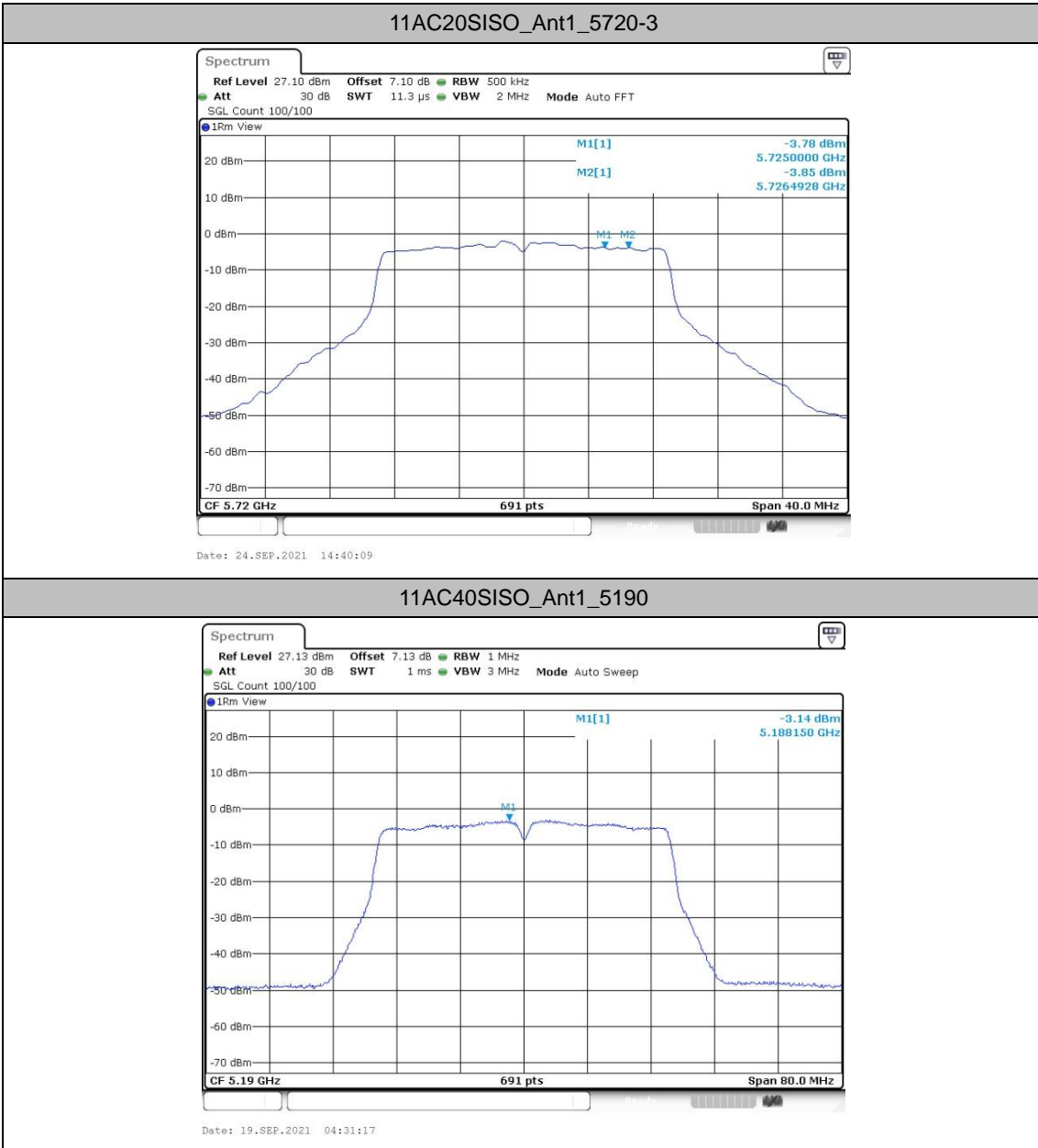


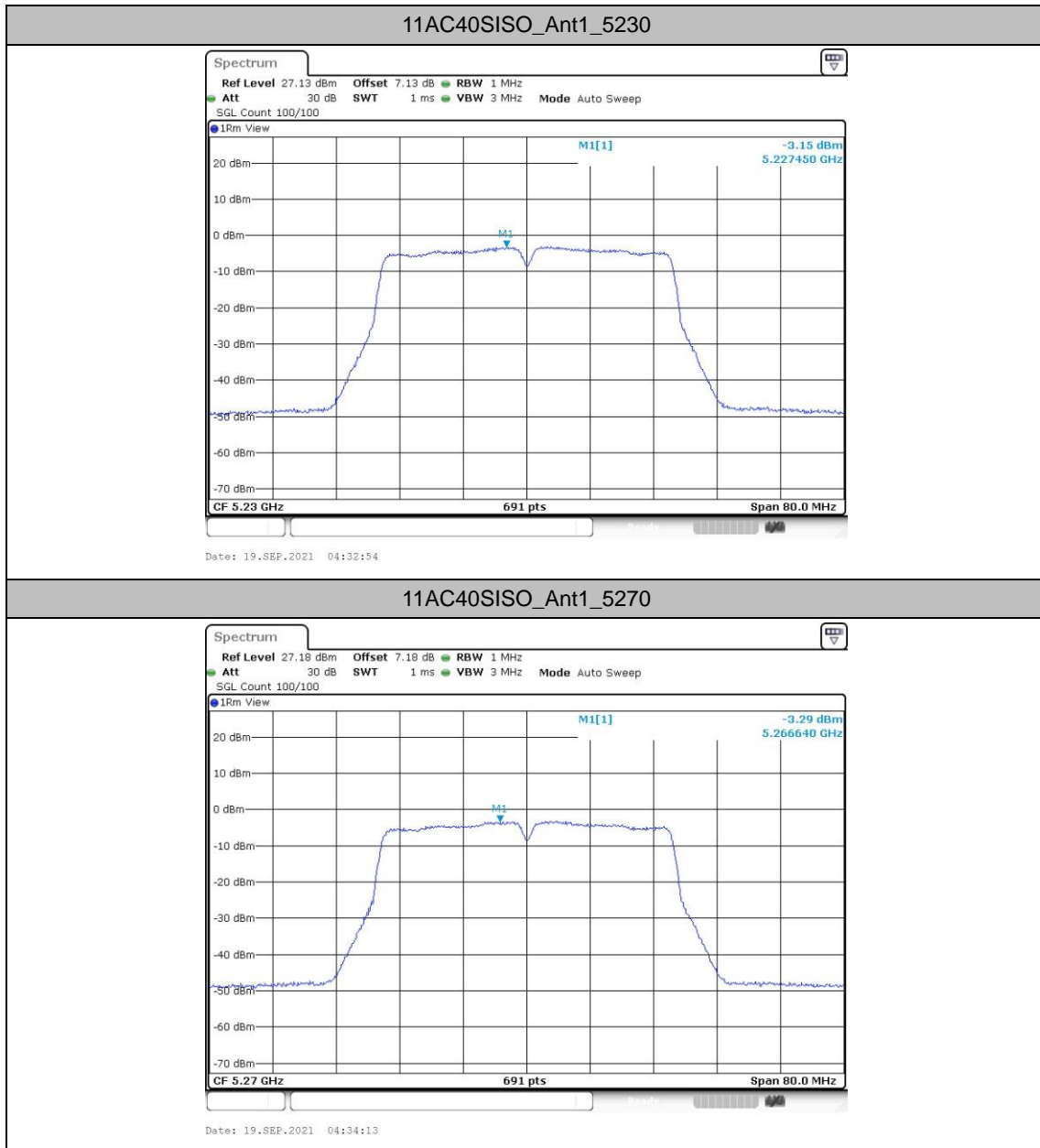
11AC20SISO_Ant1_5700

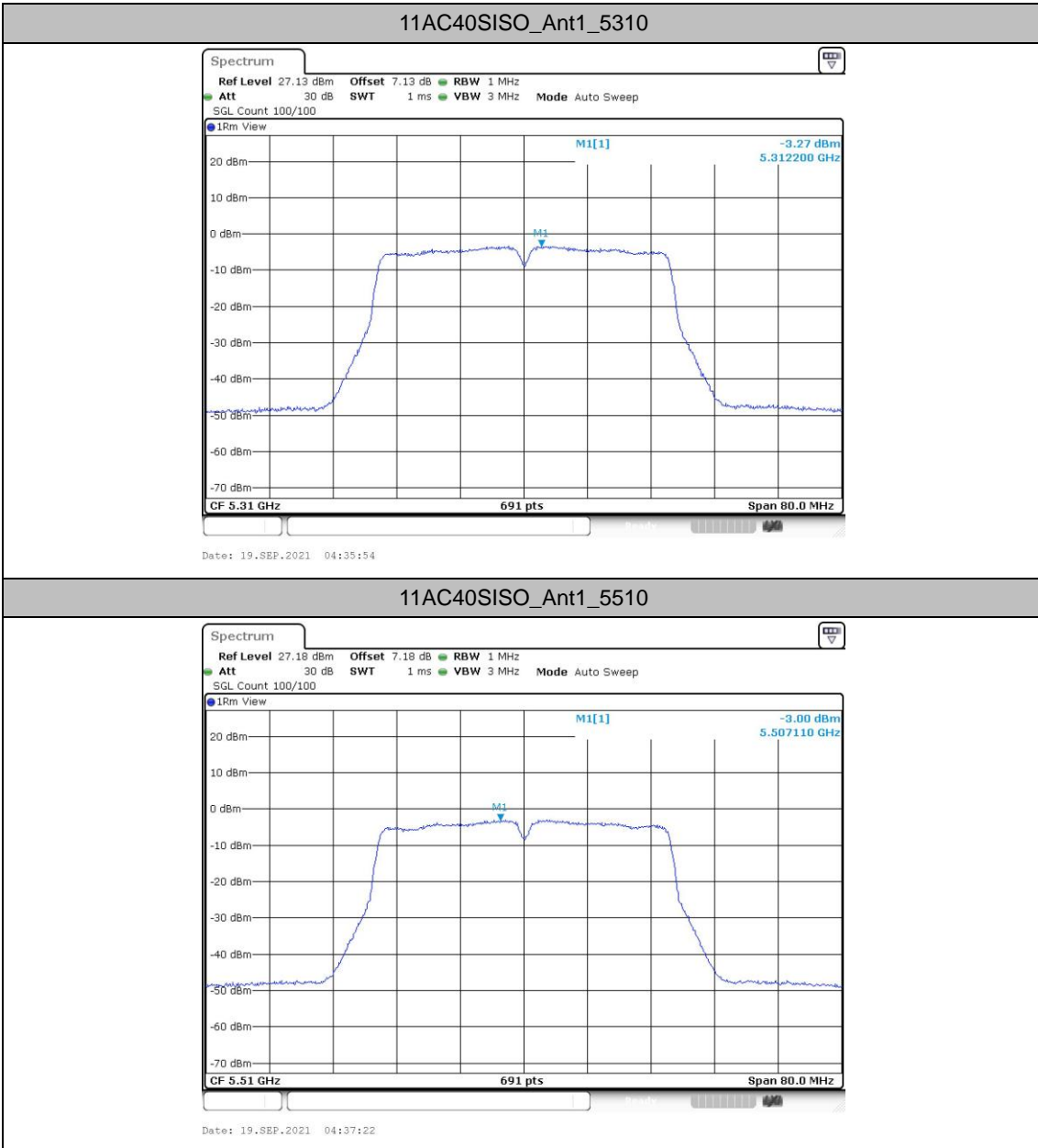


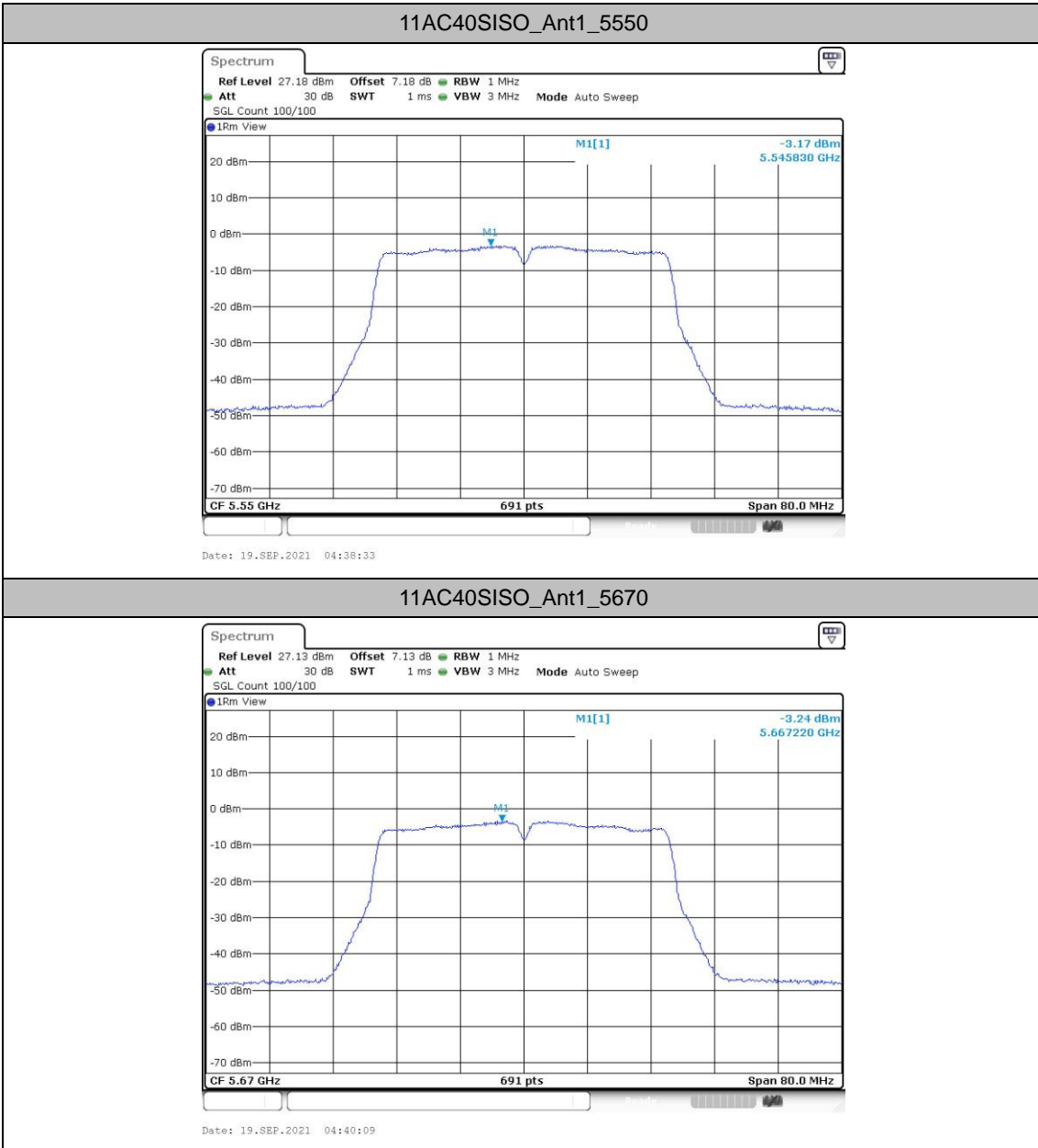
11AC20SISO_Ant1_5720-2C





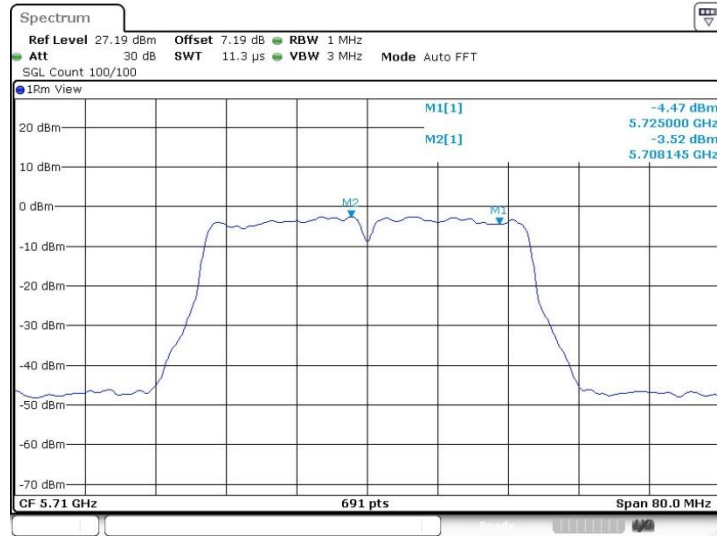






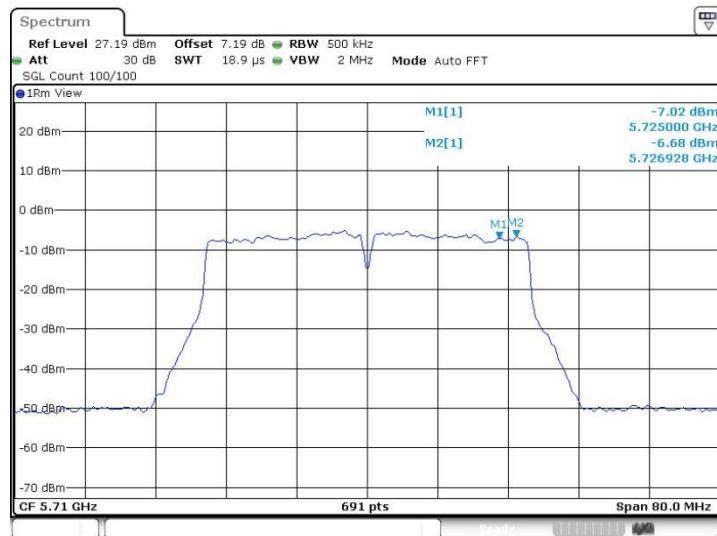


11AC40SISO_Ant1_5710-2C



Date: 24.SEP.2021 14:41:05

11AC40SISO_Ant1_5710-3



Date: 24.SEP.2021 14:41:09

