

Wireless Monitor Module

Model No.: FW-MM

Date: 02-Mar-2020

Report Prepared By:
Vinay Gujjar

EMC Test Report



Report Number	EMC0418-1
EUT Nomenclature	Wireless Monitor Module
Sample Identification	Model No : FW-MM SL. No : 127 Software Version : 5.88 Hardware Version : Rev 2.1
Number of Samples	1
Date of receipt of Sample	12-Nov-2019
Condition of Sample on receipt	Good
Client name	Honeywell International Inc
Client Address	System Sensor, 3825, Ohio Ave, St. Charles , IL, USA - 60174
Testing Laboratory FCC FRN No.	Honeywell Technology Solutions Lab Pvt Ltd
Address	RMZ ECOWORLD INFRASTRUCTURE PVT Ltd, (Formerly Adarsh Prime Projects Pvt Ltd., SEZ) Survey # 19/2, Devarabisanahalli Village, Varthur Hobli, Bangalore East Taluk, Bangalore - 560103
Test Dates	14-Dec-2019 to 26-Feb-2020
Applicable Standard	FCC Part 15 : 2010, ANSI C63.10:2013
Test Results	PASS

Prepared By: Test Engineer

Name : Vinay Gujjar

Signature:

Date : 03 March 2020

Reviewed By: Prasanna Kumar BT

Authorised Signatory :

Name : Prasanna Kumar BT

Signature:

Date of Issue : 05 March 2020

This Report relates to the above-mentioned test sample only. Without the approval of Lab manager, this report shall not be reproduced except in full.

TEST SUMMARY					
Test Performed	Name	Specification	Test Method	Pass	Fail
FHSS					
☒	20dB Bandwidth	FCC Part 15.247 :2010	DA 00-705	☒	☐
☒	Maximum Peak Output Power	FCC Part 15.247 :2010	DA 00-705	☒	☐
☒	Carrier Frequency Separation	FCC Part 15.247 :2010	DA 00-705	☒	☐
☒	Number of Hopping Frequencies	FCC Part 15.247 :2010	DA 00-705	☒	☐
☒	Band Edge compliance	FCC Part 15.247 :2010	DA 00-705	☒	☐
☒	Time of Occupancy (Dwell Time)	FCC Part 15.247 :2010	DA 00-705	☒	☐
☒	Spurious RF Conducted Emissions	FCC Part 15.247 :2010	DA 00-705	☒	☐
☒	Effective Isotropic Radiated Power	FCC Part 15.247: 2010 and 15.209: 2010	KDB 412172	☒	☐
☒	Spurious Radiated Emissions	FCC Part 15.247: 2010 and 15.209: 2010	DA 00-705 ANSI C63.10 - 2013	☒	☐
DTS					
☒	DTS 6dB Bandwidth	FCC Part 15.247: 2010	KDB 558074	☒	☐
☒	Maximum Peak Output Power	FCC Part 15.247: 2010	KDB 558074	☒	☐
☒	Maximum Power Spectral Density	FCC Part 15.247: 2010	KDB 558074	☒	☐
☒	Band Edge Conducted Emissions	FCC Part 15.247: 2010	KDB 558074	☒	☐
☒	Effective Isotropic Radiated Power	FCC Part 15.247: 2010 and 15.209: 2010	KDB 412172	☒	☐
☒	Spurious Radiated Emissions	FCC Part 15.247: 2010 and 15.209: 2010	KDB 558074 ANSI C63.10 - 2013	☒	☐

MEASUREMENT UNCERTAINTY		
Where relevant, the following measurement uncertainty levels has been estimated for tests performed on the EUT as specified in CISPR 16-4		
The Expanded measurement uncertainty (K=2) is provided below		
#	Name	Value
1	20dB & 6dB Occupied Bandwidth	1.4dB
2	Maximum Peak Output Power Level	1.4dB
3	Power Spectral Density	1.4dB
4	Band Edge Conducted Emission	1.4dB
5	Spurious RF Conducted Emission	1.4dB
6	Radiated Spurious Emission < 1GHz	4.3dB
7	Radiated Spurious Emission > 1GHz	5.5dB

Decision Rule Applied	
☒	Measurement Uncertainty is not accounted while reporting statement of conformity to specification / standard. (shared risk)
☐	Measurement uncertainty is accounted and results reported as per ILAC-G8 guidelines

1 PRODUCT DETAILS

PRODUCT OPERATION AND INTENDED USE

The wireless monitor module is powered by four CR123A batteries. It can be connected to a switch within three feet of its location or wired directly to the pull station. The module has LED indication, controlled by the panel to indicate the status.

RATINGS AND SYSTEM DETAILS

Operating Frequency	902MHz to 928MHz
Number of Channels	DTS :6
	FHSS :55
Channel Bandwidth (20dB)	DTS :1MHz
	FHSS :320KHz
Transmitted Power	DTS :12dBm
	FHSS :17dBm
Modulation Type	FSK
Data Rate	DTS :300Kbps
	FHSS :150Kbps
Antenna Type	Inverted F Patch Antenna
No. of Antenna	3
Antenna Gain	ANT 1 :0.65dBi
	ANT 2 :2.00dBi
	ANT 3 :1.30dBi
Supply Voltage and Current	3.3V, 21.5mA
Dimensions (Diameter x Height)	4.263mm x 4.171mm x 1.465mm
Environmental Conditions	Operating Temperature :0°C to 50°C
	Storage Temperature: -10°C to 60°C
	Humidity :10% to 93% RH

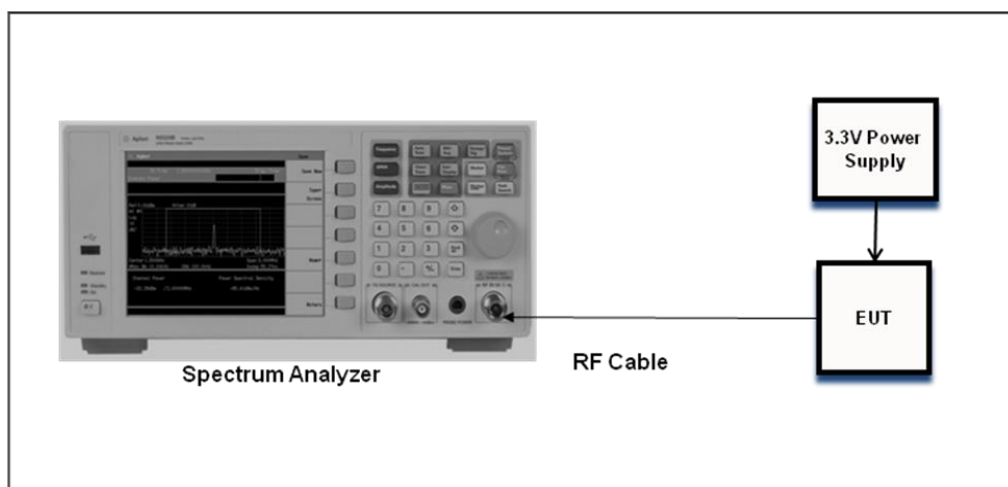
TEST CONFIGURATION	
Config #	Description
Conducted Test	EUT is Powered from Battery. EUT Debug port (UART) is connected to Laptop through USB to UA RT converter cable. EUT is configured to the respective operating mode through Hyper Terminal. Test is performed at Antenna 2 as this is the high gain antenna
Radiated Test	EUT is Powered from Battery. EUT Debug port (UA RT) is connected to Laptop through USB to UA RT converter cable. EUT is configured to the respective operating mode through Hyper Terminal. Test is performed at Antenna 2 as this is the high gain antenna

OPERATING MODES	
Mode #	Description
DTS	Following DTS channels have been used for Conducted (Continuous Trans mission) and Radiated (Continuous Trans mission) Tests Channel 1: 902.875MHz Channel 4: 915.325MHz Channel 6: 927.125MHz
FHSS	Following FHSS channels have been used for Conducted (Continuous Trans mission) and Radiated (Continuous Trans mission) Tests Channel 1: 903.55MHz Channel 28: 916.00MHz Channel 55: 926.45MHz

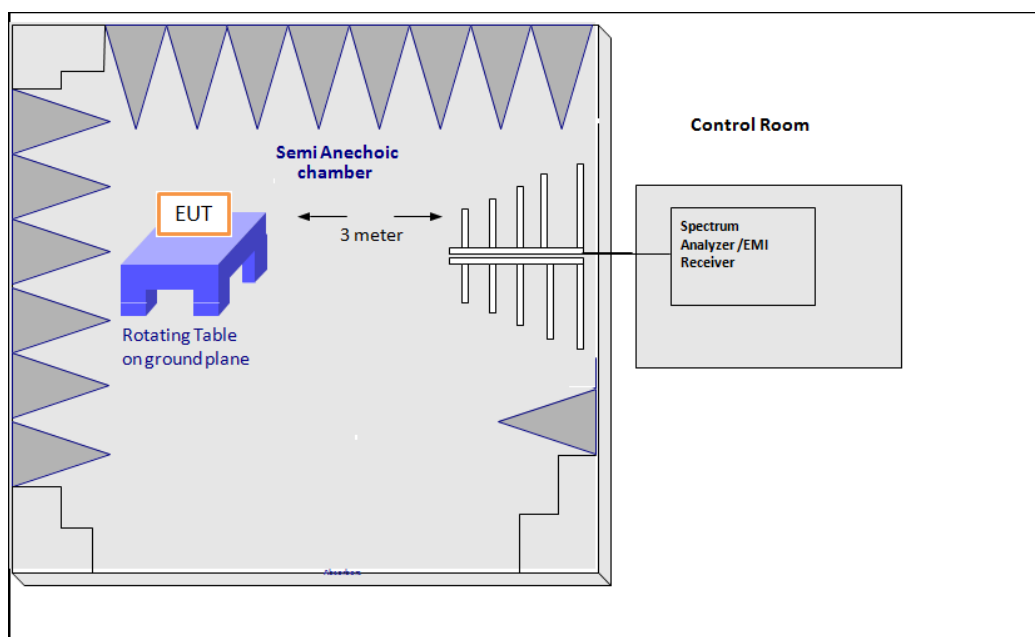
INPUT AND OUTPUT CABLES					
Port #	Name	Port Type	Cable Length	Cable type Shielded/ Unshielded	Comments
	Nil				Nil
*Note : AC = AC Power Port DC = DC Power Port TP = Telecommunication Ports (E.g. Ethernet) DI / DO = Digital Input / Output N / E = Non Electrical AI / AO = Analog Input / Output					

SUPPORT EQUIPMENTS AND ACCESSORIES USED					
#	Item Description	Make	Model	Part No. / Sl. No	Cal Due Date
1	Laptop	DELL	Latitude 5490	5369273282	NA
2	USB to UART Cable	FTDI	TTL-232R-3V3	NA	NA

CONNECTION DIAGRAM AND SETUP DIAGRAM



Conducted RF Test Setup



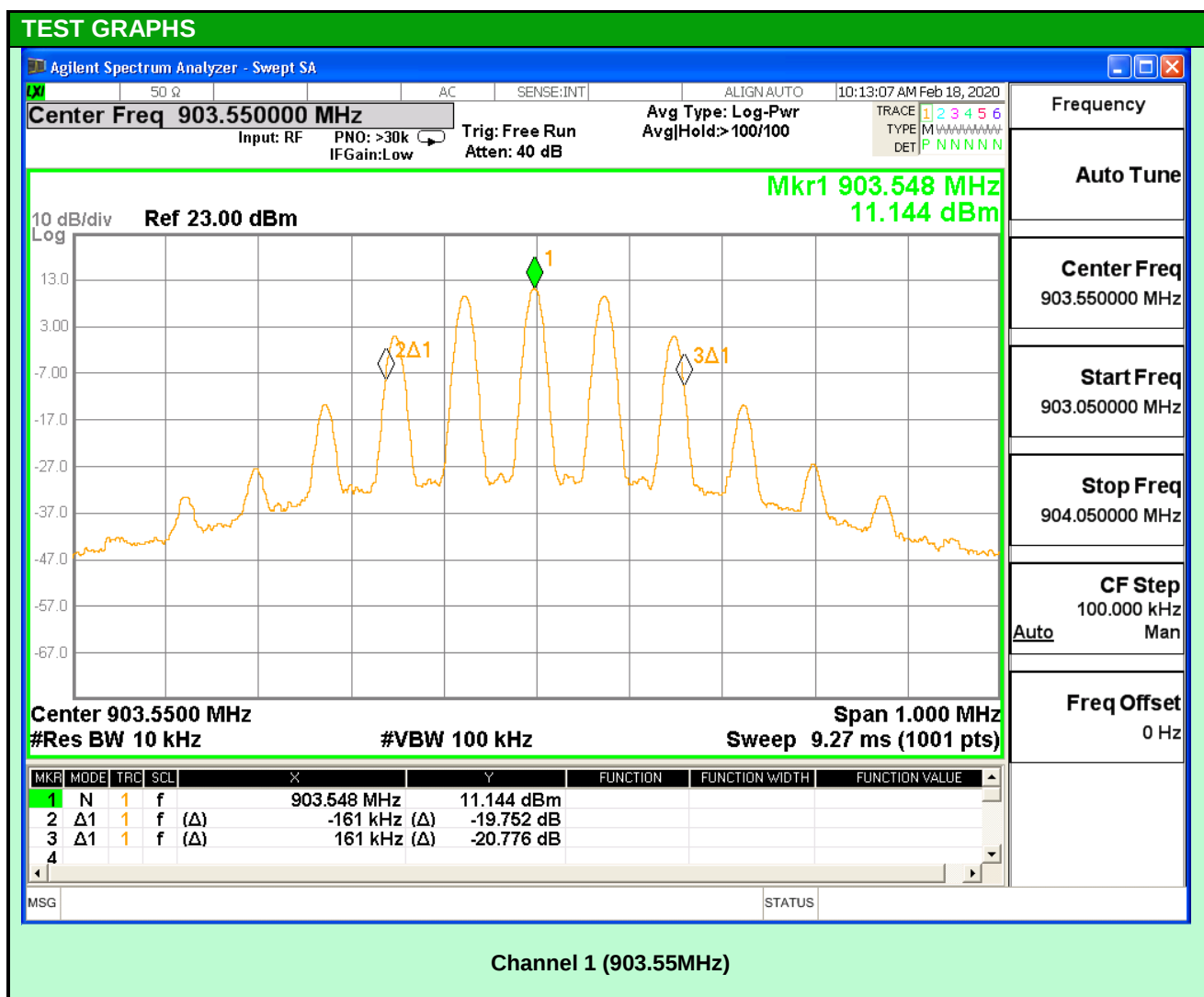
Radiated Emission Test Setup

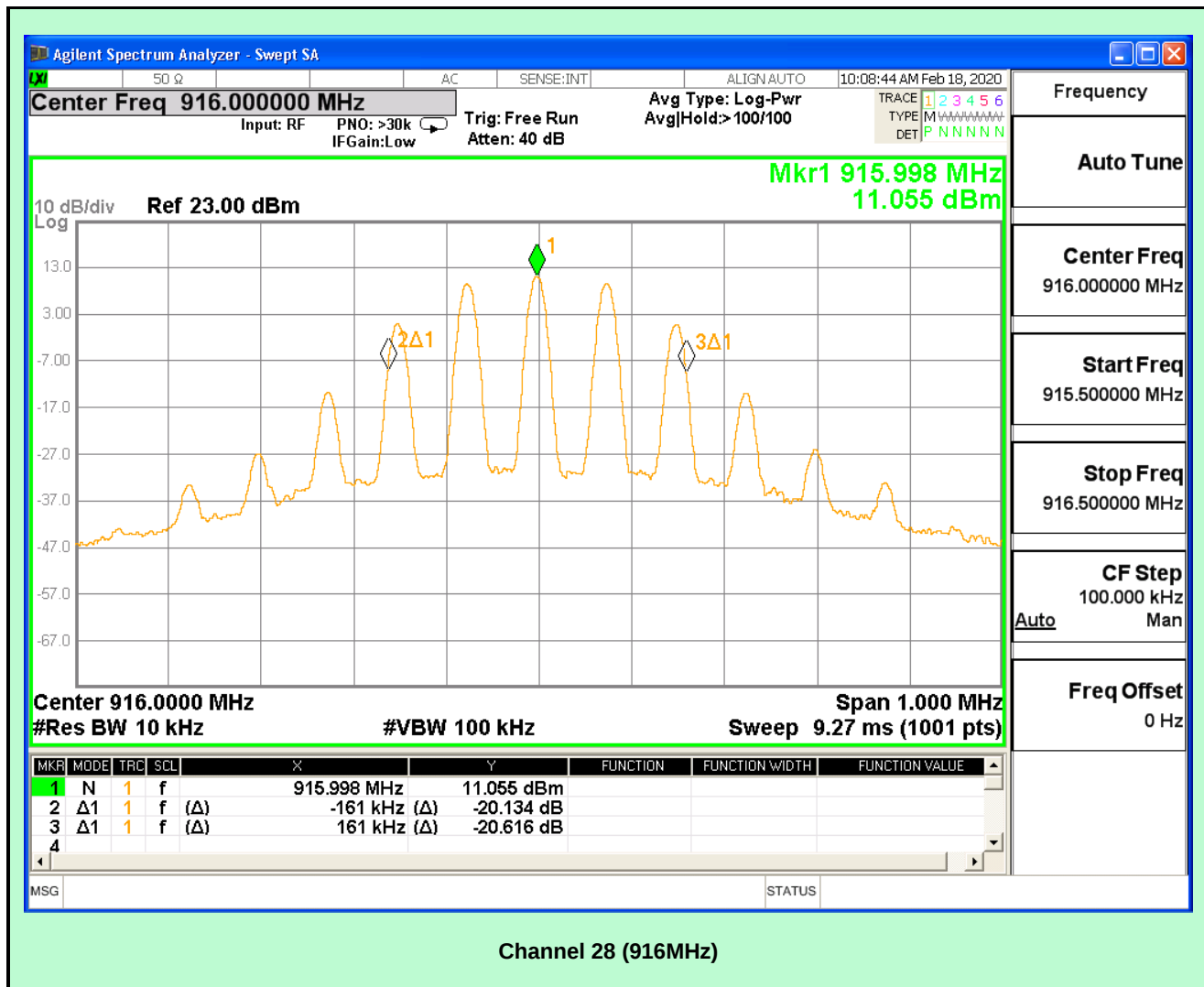
2 FHSS CHANNELS

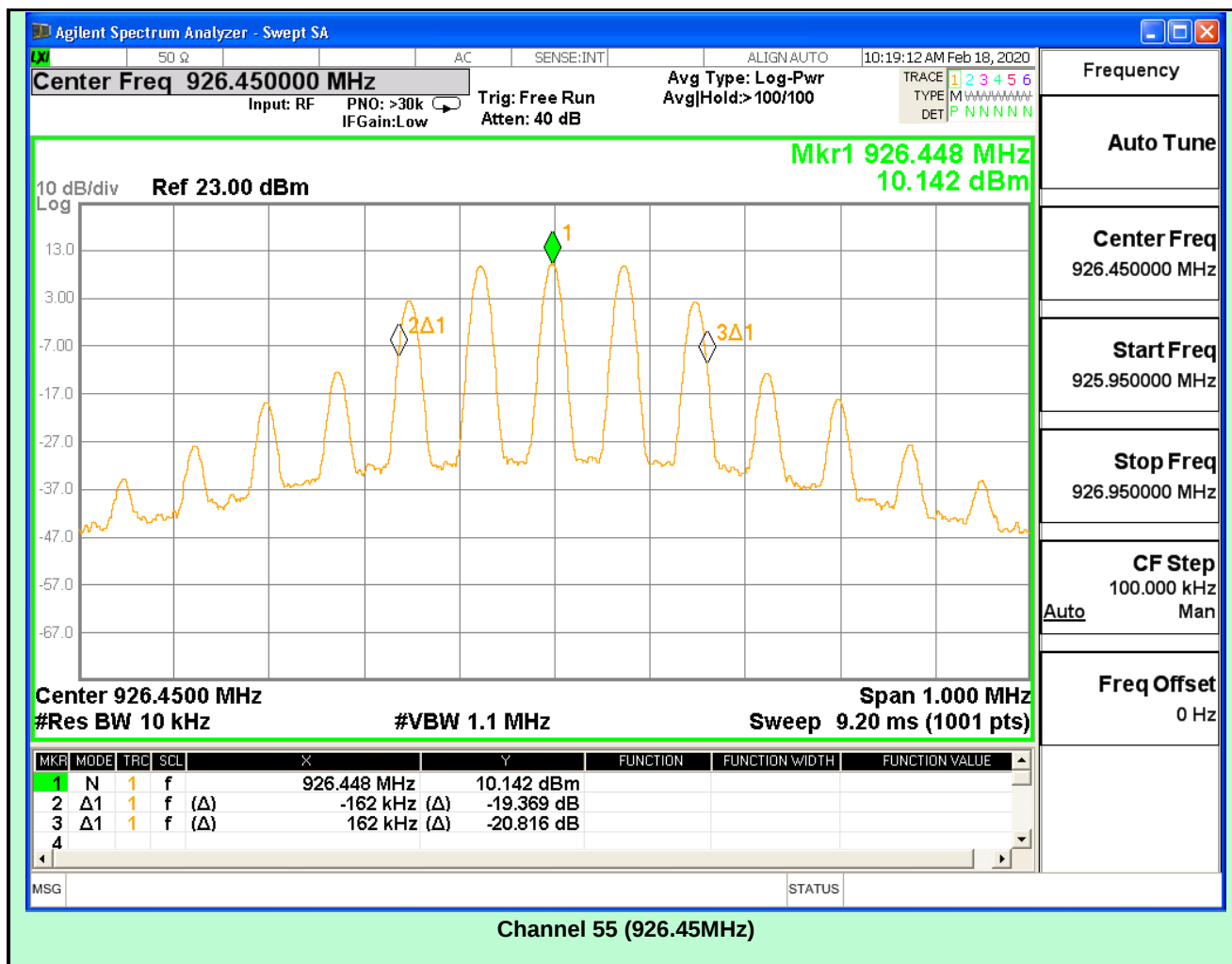
2.1 20dB BANDWIDTH

EUT Nomenclature	Wireless Monitor Module	Test Request No.	EMC0418-1
Model No.	FW-MM	Serial No.	127
Test Start Date	14-Dec-2019	Temperature (°C)	23.6°C
Test End Date	26-Feb-2020	Humidity RH (%)	51.9%RH
Tested By	Vinay Gujjar	Pressure (mbar)	NR
Input Voltage / Freq.	3.3Vdc		
Operating Mode	Refer Page 5 for Operating Mode Table		
Test configuration	Refer Page 5 for Test Configuration Table		
Deviation from Std.	NA		
Applicable standard	FCC Part 15.247:2010		
Test Method	DA 00-705		
Comment	NA		
TEST DETAILS			
Method	Radiated ☐		Conducted ☒
TEST PARAMETERS			
Antenna Height	NA	Turntable Rotation	NA
Equipment Class	NA	Measurement	NA

TEST EQUIPMENT					
Y/N	Equipment	Make	Model	Sl. No.	Cal Due Date
Y	Spectrum Analyzer	Agilent	N9010A	MY48031005	27-Feb-2021
Y	RF Cable	Huber- Suhner	SF104/2X11PC3542/500	NA	NA







TEST RESULT

Channel #	Frequency MHz	Measured Bandwidth KHz	Limit KHz	Result
1	903.55	322	≥250 & ≤500	PASS
28	916	322	≥250 & ≤500	PASS
55	926.45	324	≥250 & ≤500	PASS

TEST SETUP PHOTOGRAPH

Refer Annexure -1

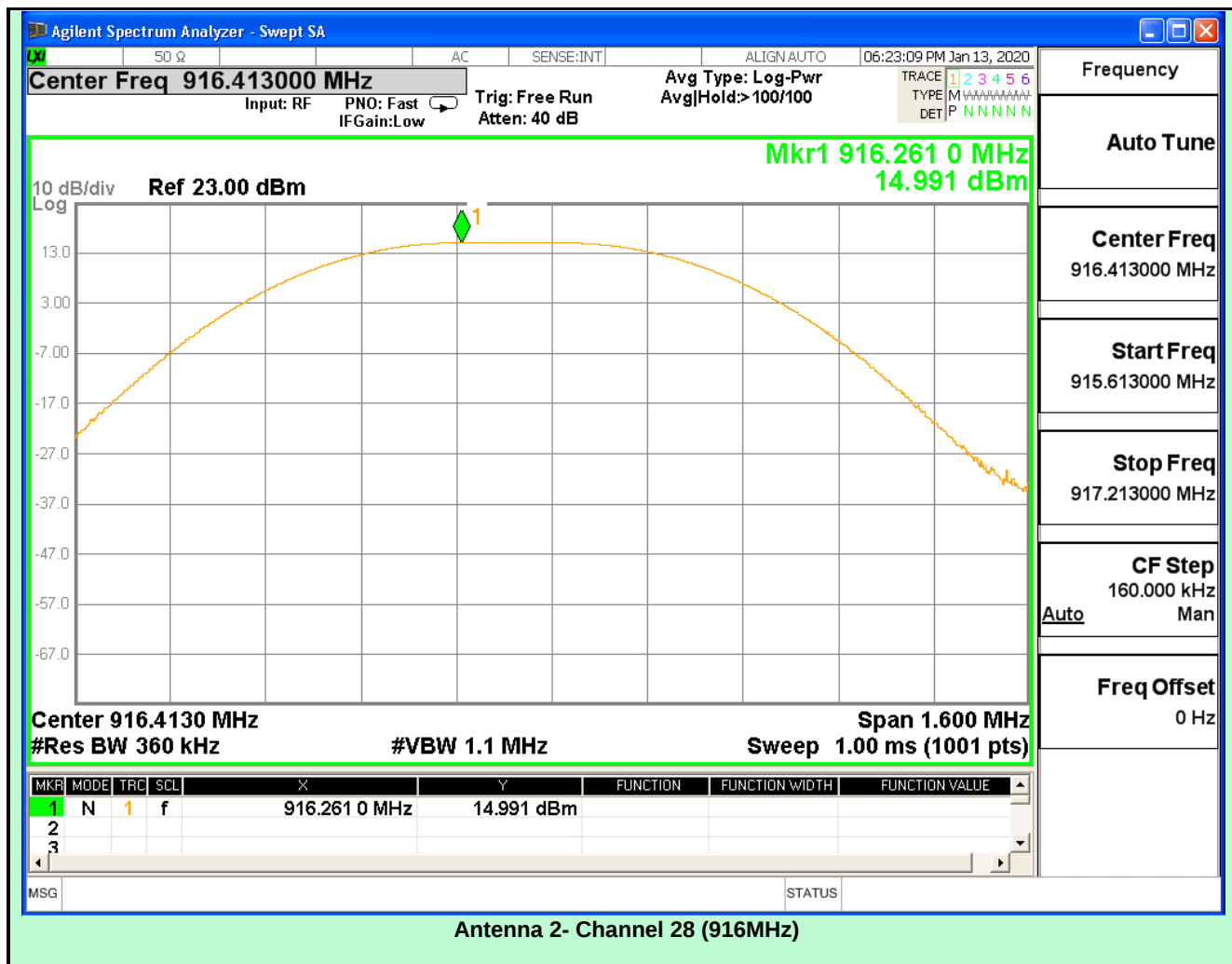
Conducted RF Test setup

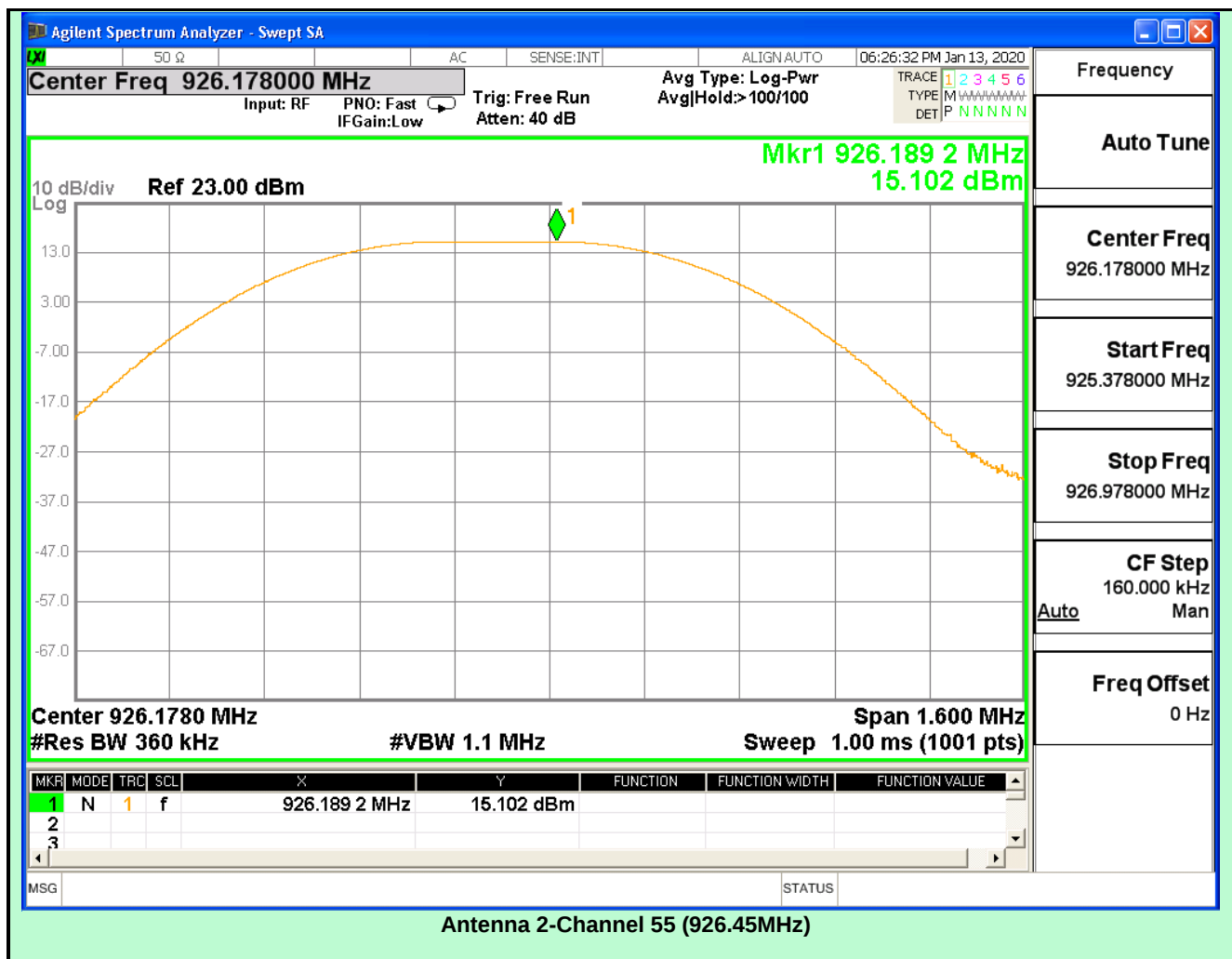
2.2 MAXIMUM PEAK OUTPUT POWER LEVEL

EUT Nomenclature	Wireless Monitor Module	Test Request No.	EMC0418-1
Model No.	FW-MM	Serial No.	127
Test Start Date	14-Dec-2019	Temperature (°C)	22.7°C
Test End Date	26-Feb-2020	Humidity RH (%)	55.3%RH
Tested By	Vinay Gujjar	Pressure (mbar)	NR
Input Voltage /	3.3Vdc		
Operating Mode	Refer Page 5 for Operating Mode Table		
Test configuration	Refer Page 5 for Test Configuration Table		
Deviation from Std.	NA		
Applicable standard	FCC Part 15.247:2010		
Test Method	DA 00-705		
Comment	NA		
TEST DETAILS			
Method	Radiated ☐		Conducted ☒
TEST PARAMETERS			
Antenna Height	NA	Turntable Rotation	NA
Equipment Class	NA	Measurement Distance	NA

TEST EQUIPMENT

Y/N	Equipment	Make	Model	Sl. No.	Cal Due Date
Y	Spectrum Analyzer	Agilent	N9010A	MY48031005	27-Feb-2021
Y	RF Cable	Huber- Suhner	SF104/2X11PC3542/500	NA	NA





TEST RESULT

Channel	Frequency	Measured Power Level	Cable Loss	Transmitter Power Level	Limit	Result
#	MHz	dBm	dB	dBm	dBm	
Antenna 2						
1	903.55	15.039	0.6	15.63	<=23.979	PASS
28	916.00	14.991	0.6	15.59	<=23.979	PASS
55	926.45	15.102	0.6	15.70	<=23.979	PASS

Note: Transmitter Output Power = Measured Level (dBm) + Cable Loss (dB)

TEST SETUP PHOTOGRAPH

Refer Annexure -1

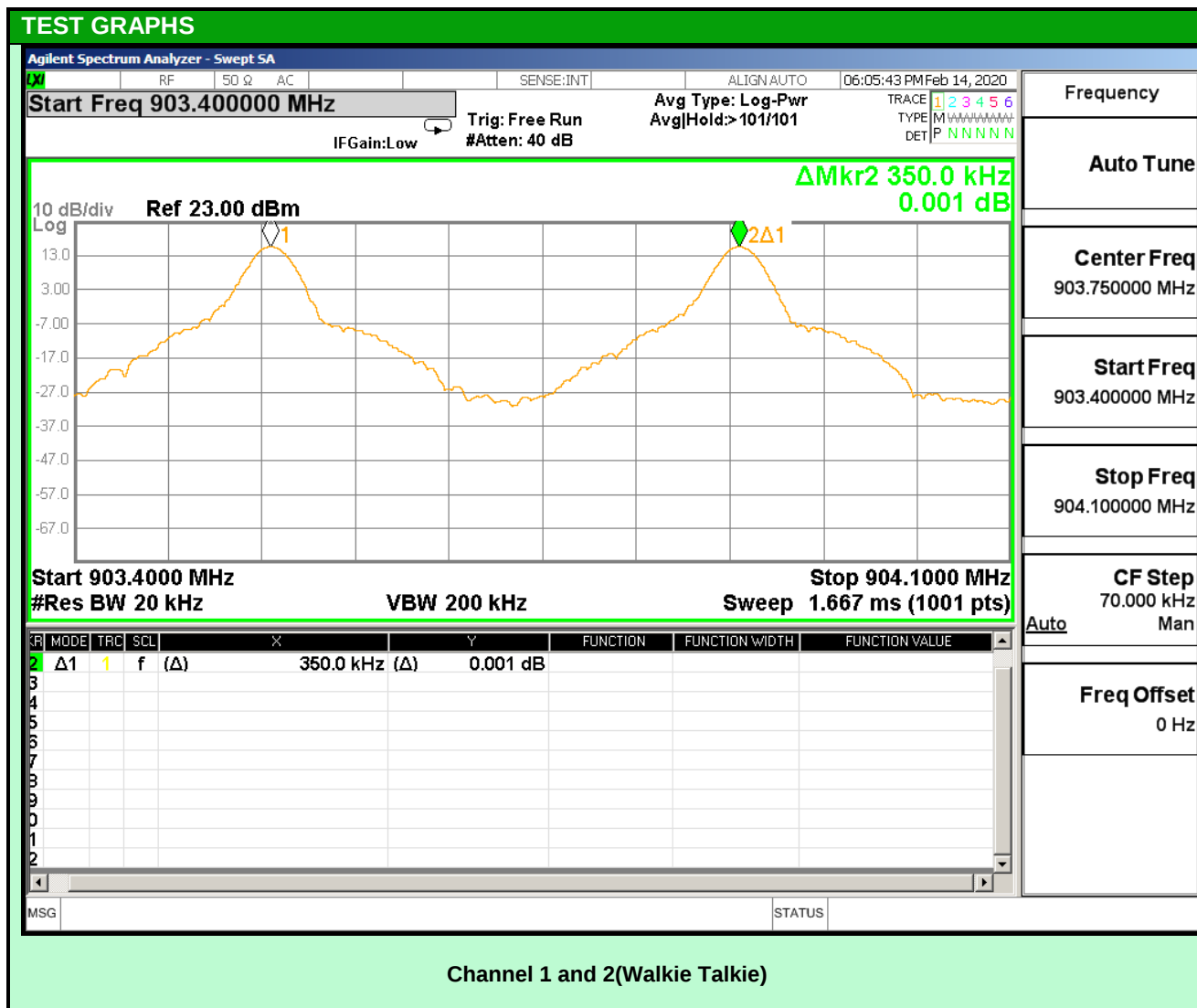
Conducted RF Test setup

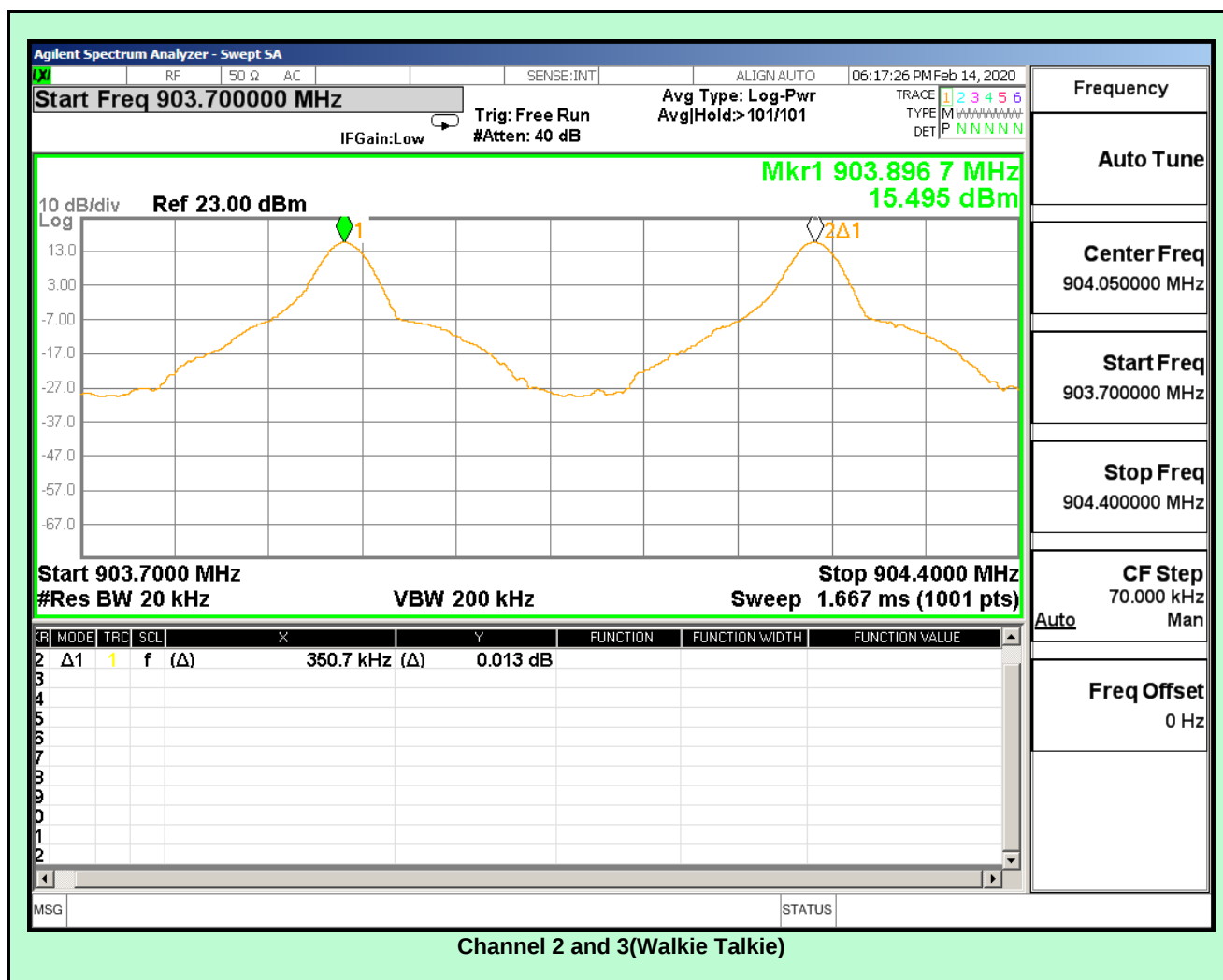
2.3 CARRIER FREQUENCY SEPERATION

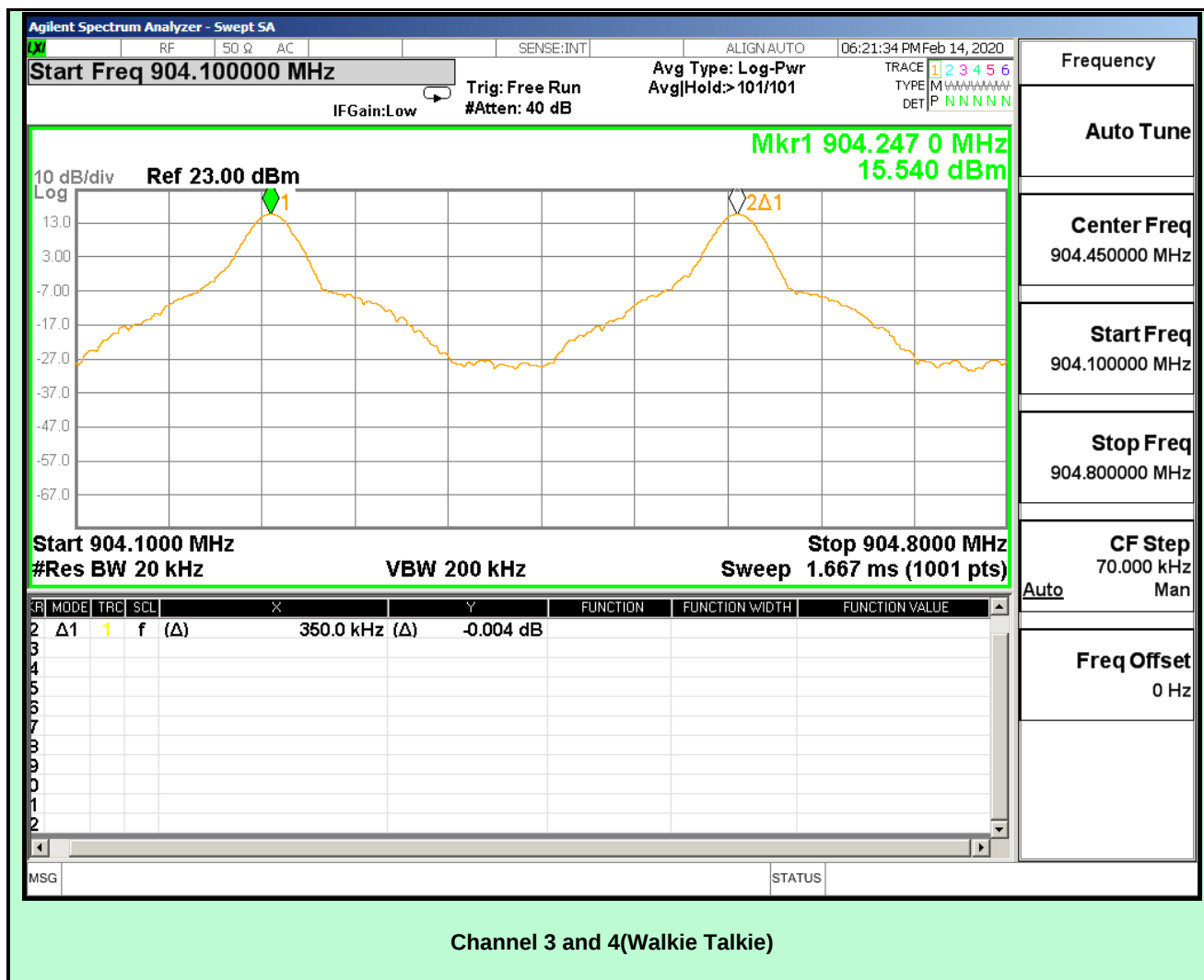
EUT Nomenclature	Wireless Monitor Module	Test Request No.	EMC0418-1
Model No.	FW-MM	Serial No.	127
Test Start Date	14-Dec-2019	Temperature (°C)	23.6°C ± 1°C
Test End Date	26-Feb-2020	Humidity RH (%)	51.9% ± 2% RH
Tested By	Vinay Gujjar	Pressure (mbar)	NR
Input Voltage /	3.3Vdc		
Operating Mode	Refer Page 5 for Operating Mode Table		
Test configuration	Refer Page 5 for Test Configuration Table		
Deviation from Std.	NA		
Applicable standard	FCC Part 15.247:2010		
Test Method	DA 00-705		
Comment	NA		
TEST DETAILS			
Method	Radiated ☐	Conducted ☒	
TEST PARAMETERS			
Antenna Height	NA	Turntable Rotation	NA
Equipment Class	NA	Measurement Distance	NA

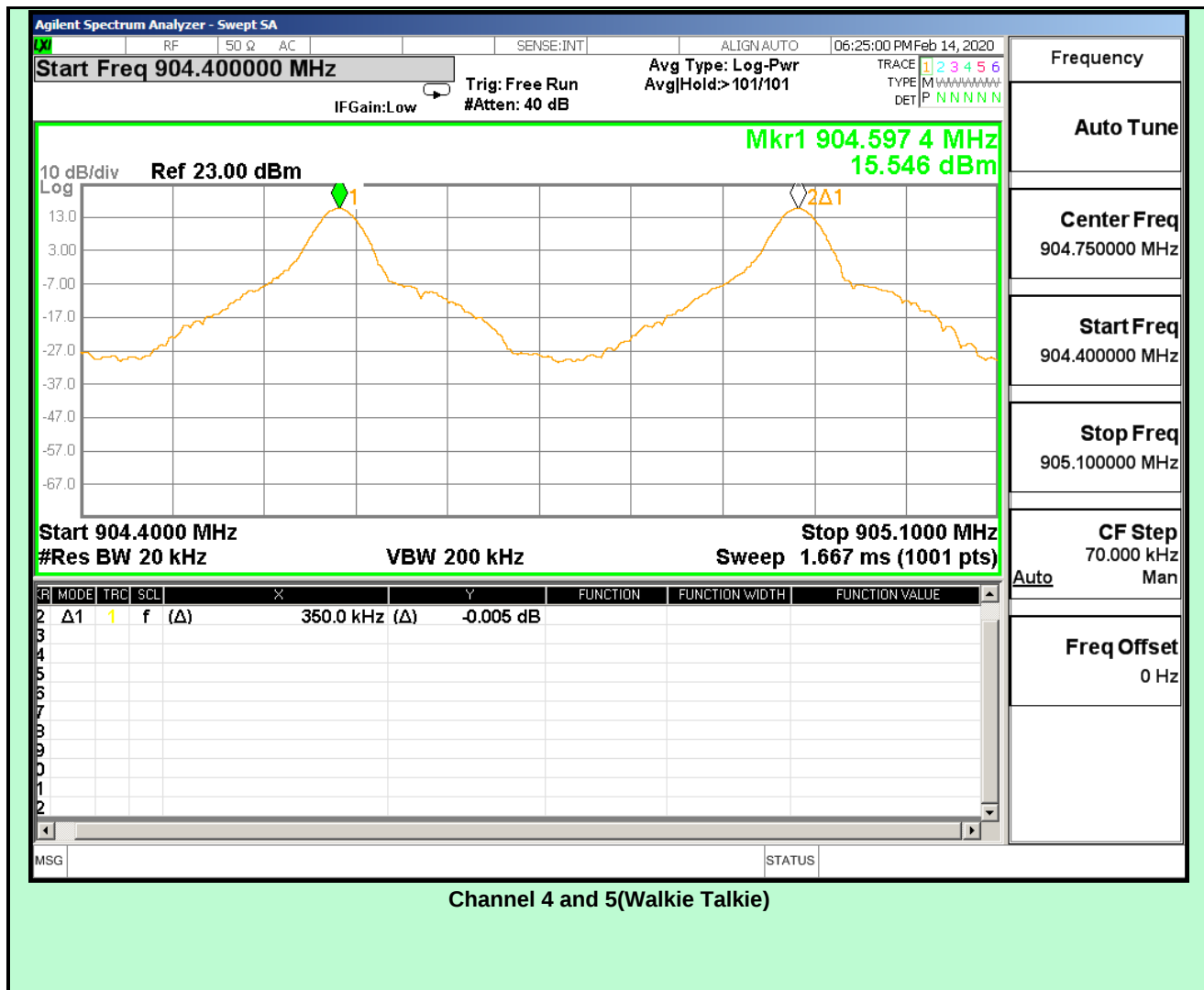
TEST EQUIPMENT

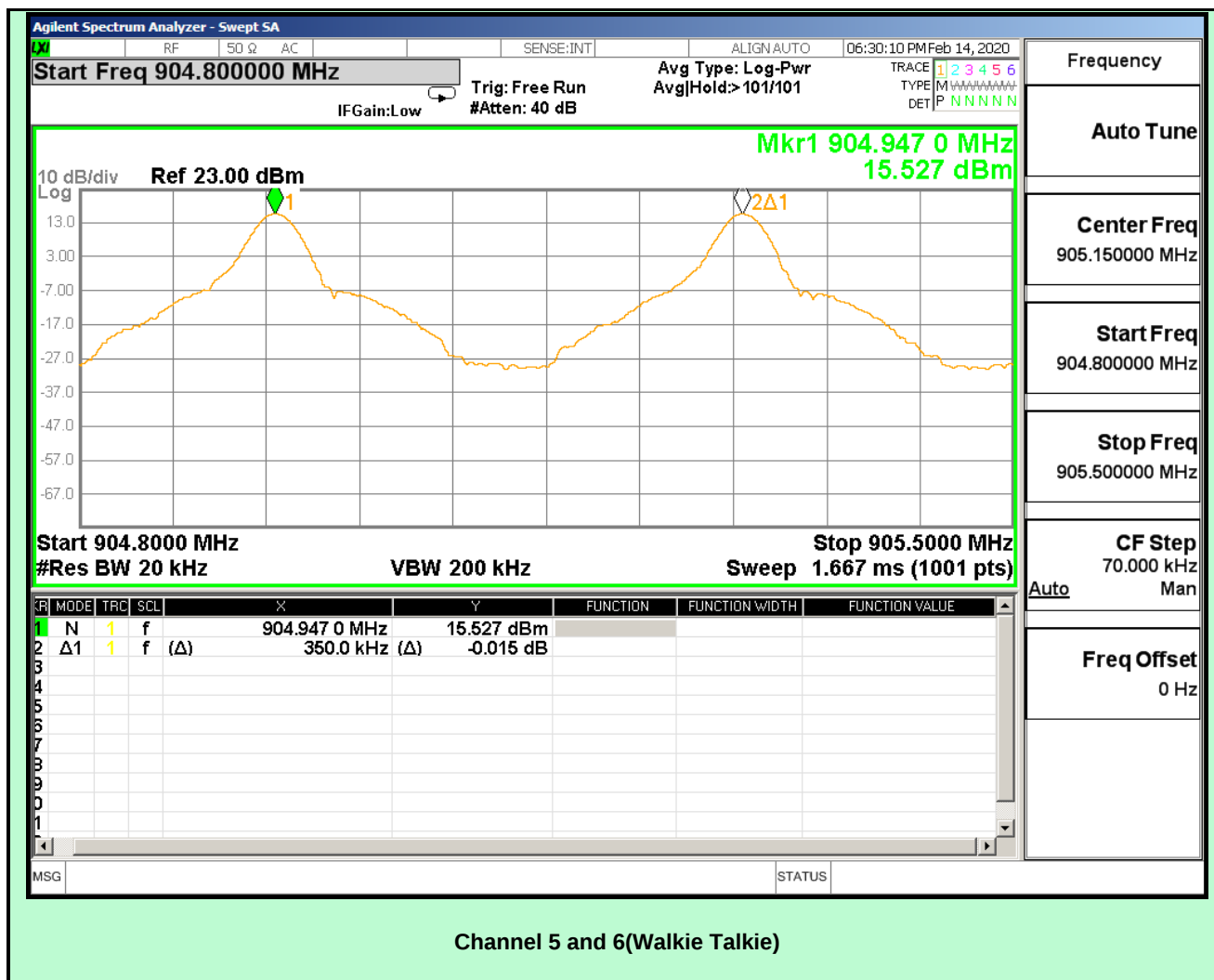
Y/N	Equipment	Make	Model	Sl. No.	Cal Due Date
Y	Spectrum Analyzer	Agilent	N9010A	MY48031005	27-Feb-2021
Y	RF Cable	Huber- Suhner	SF104/2X11PC3542/500	NA	NA

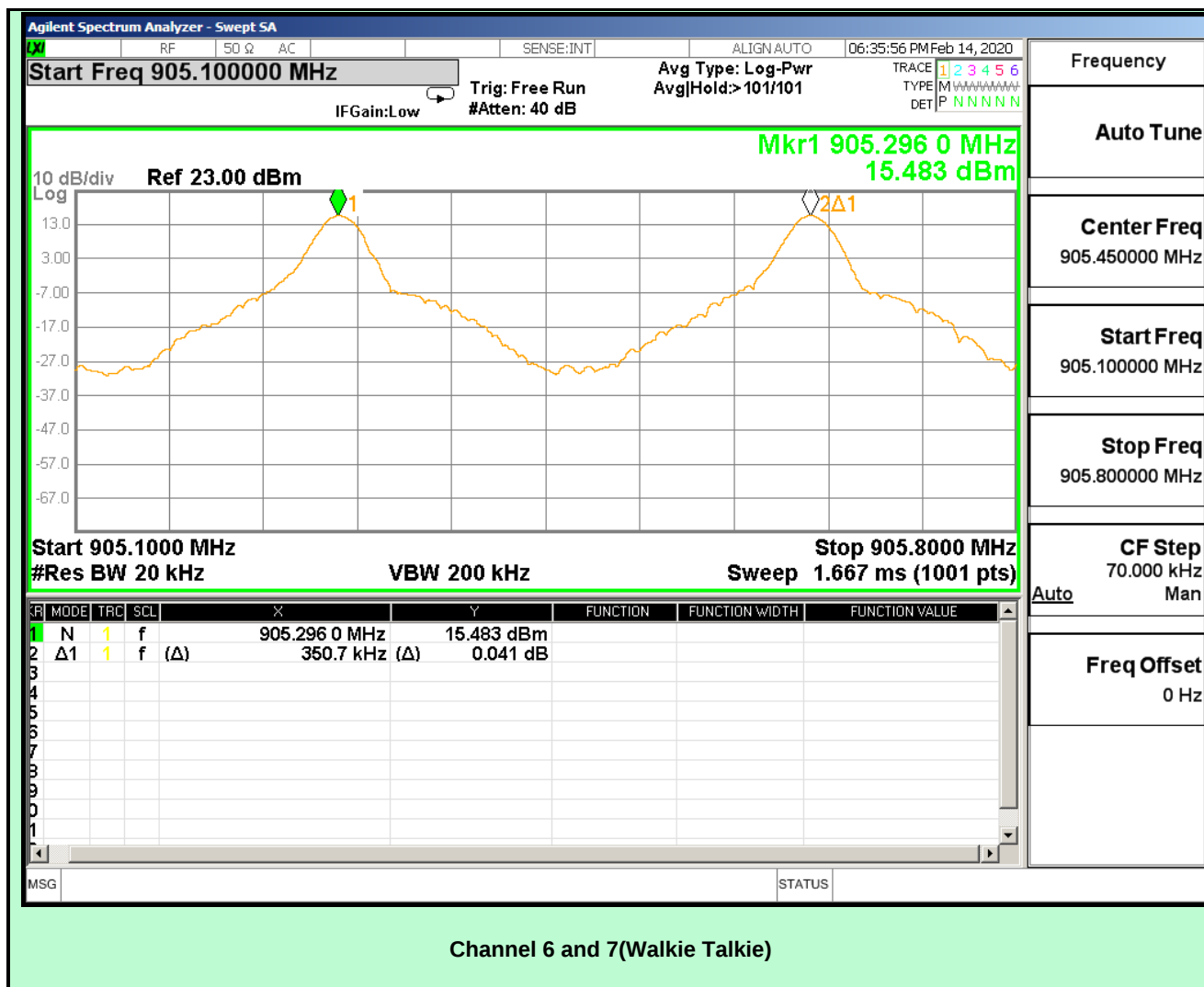


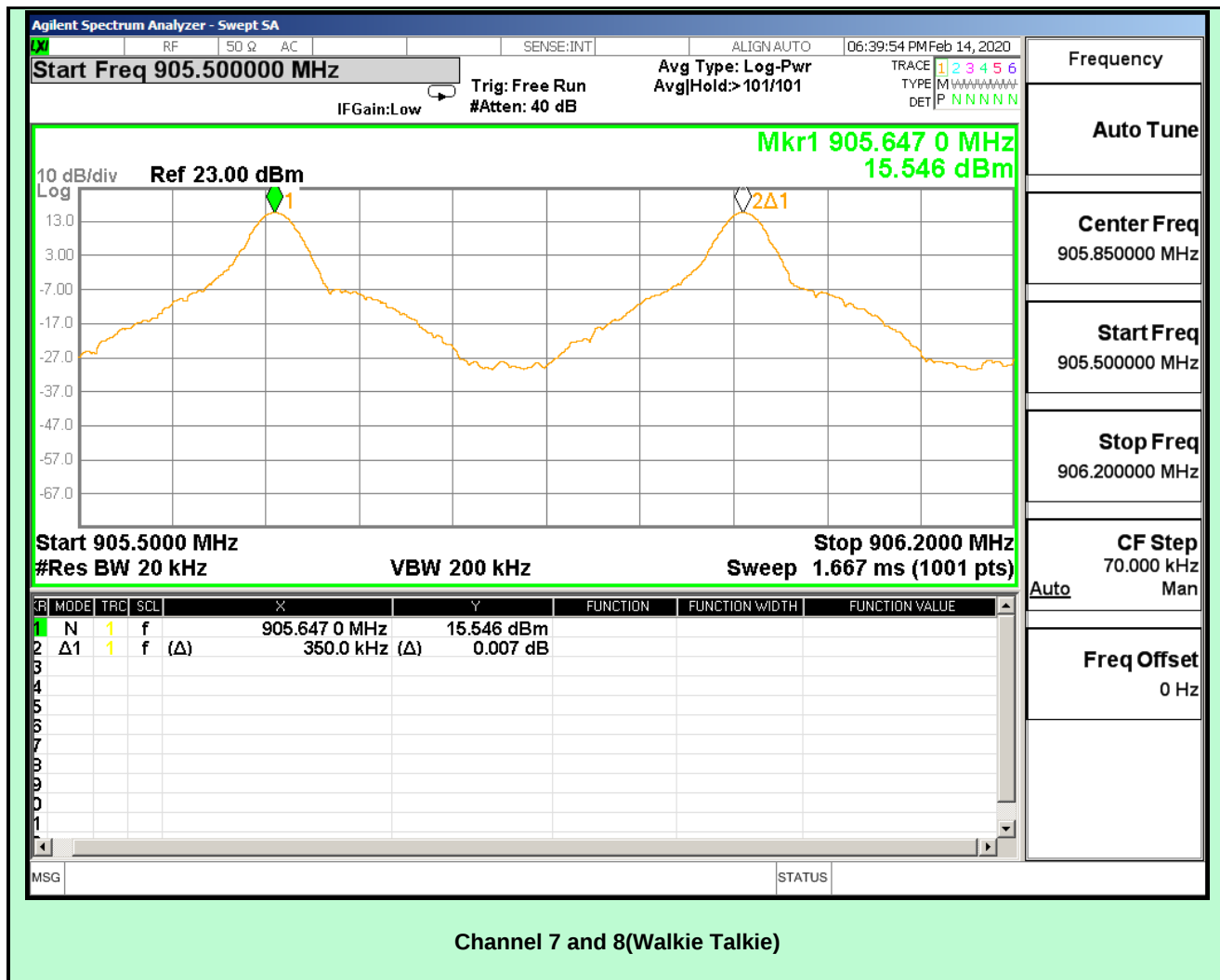


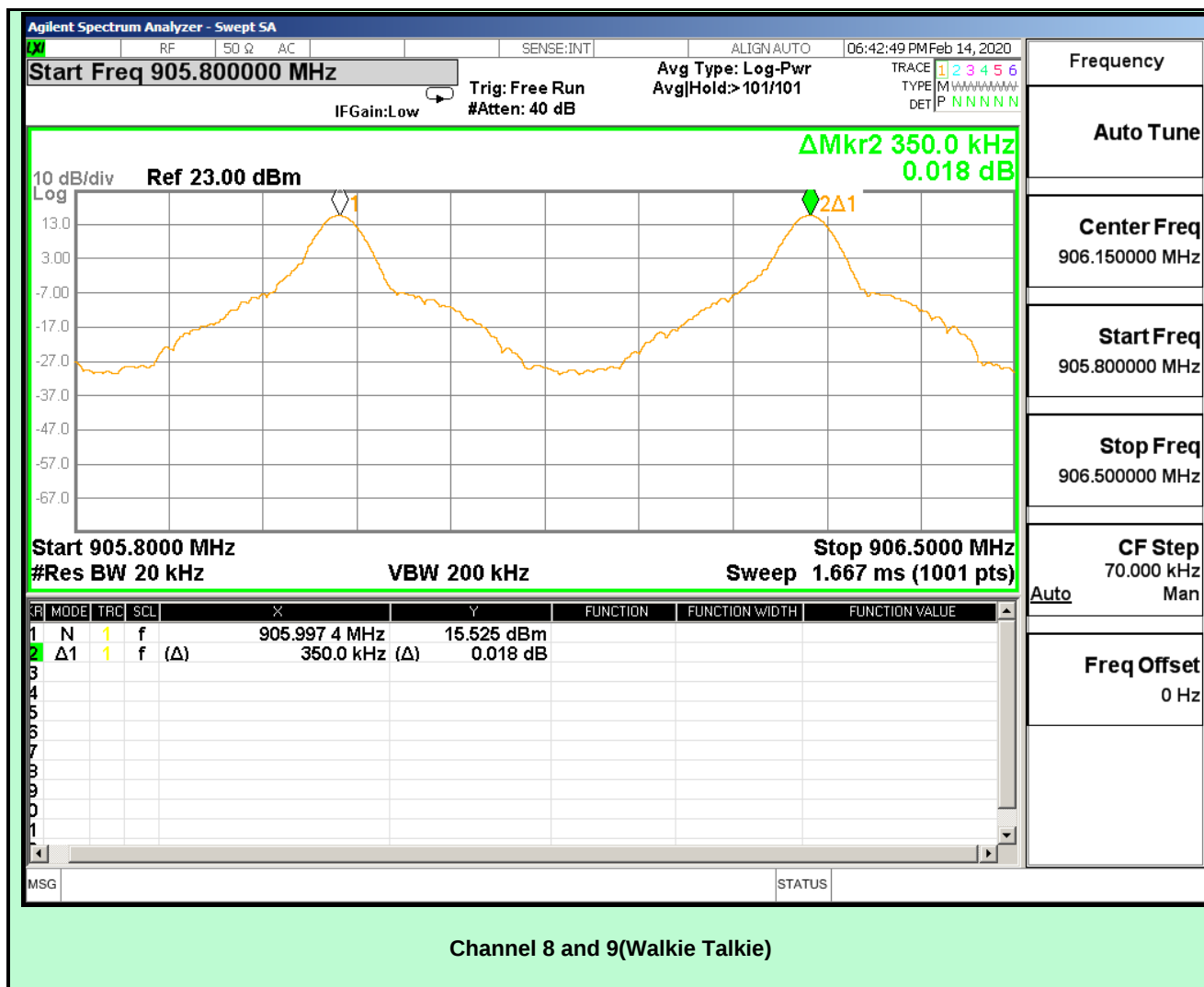


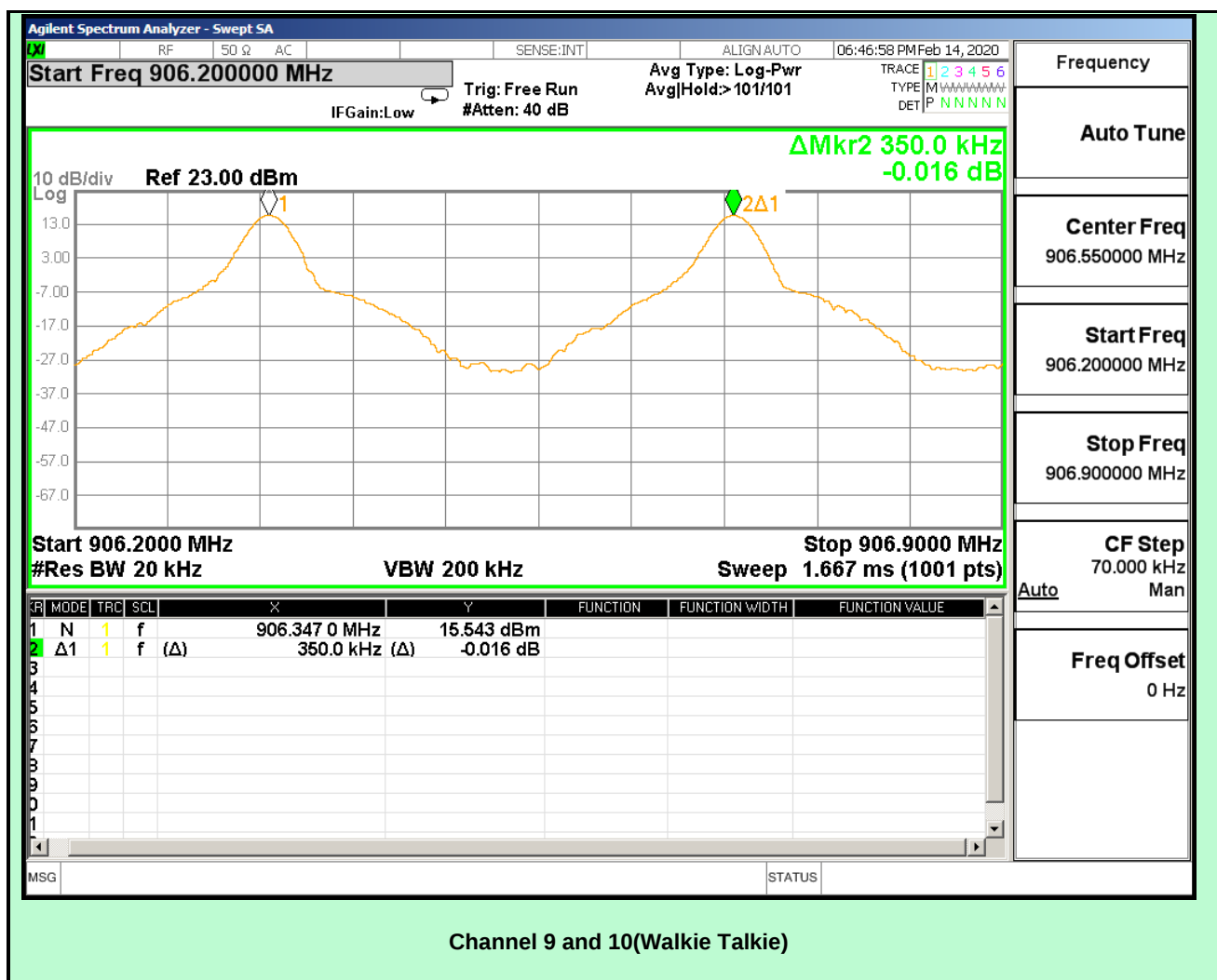


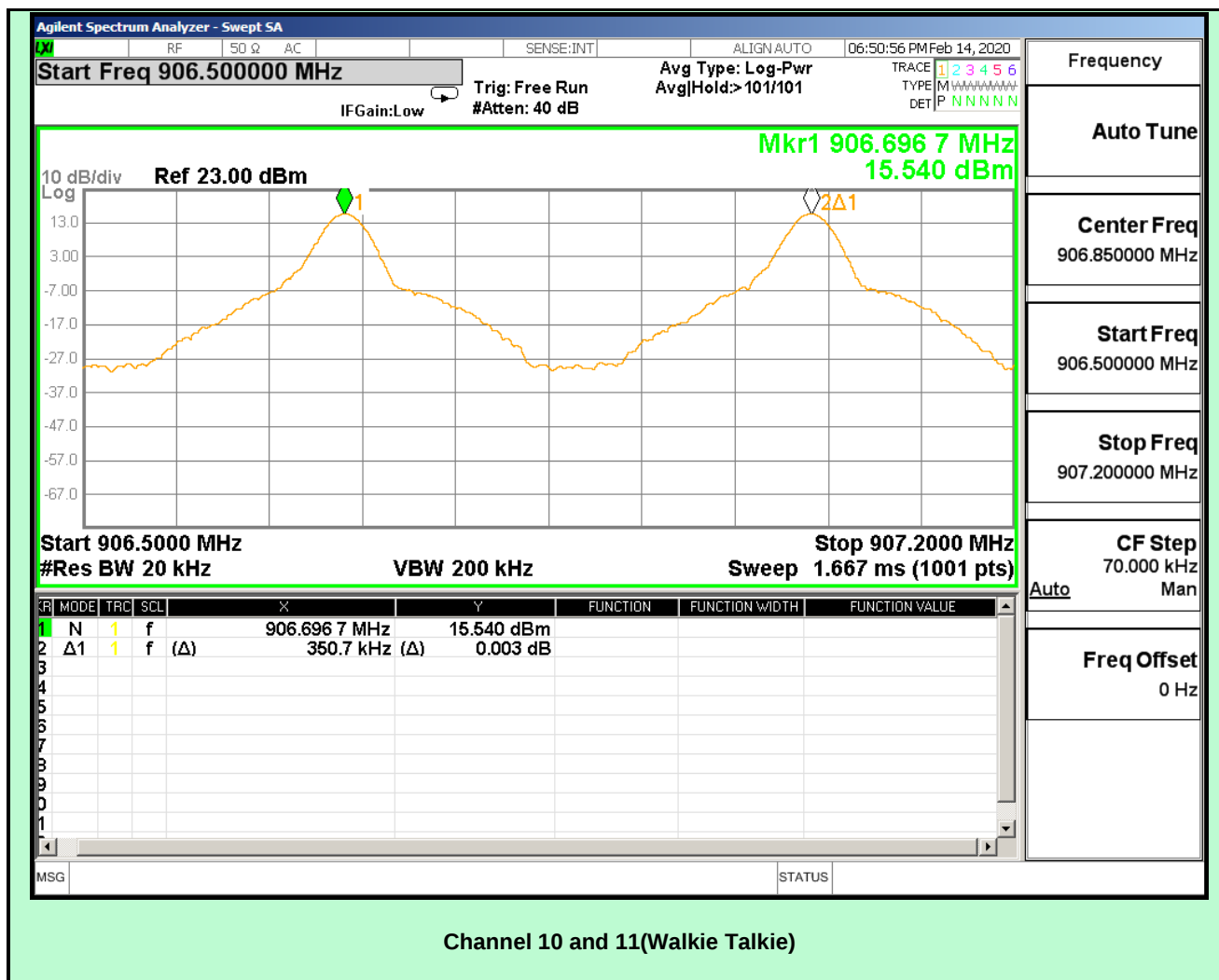


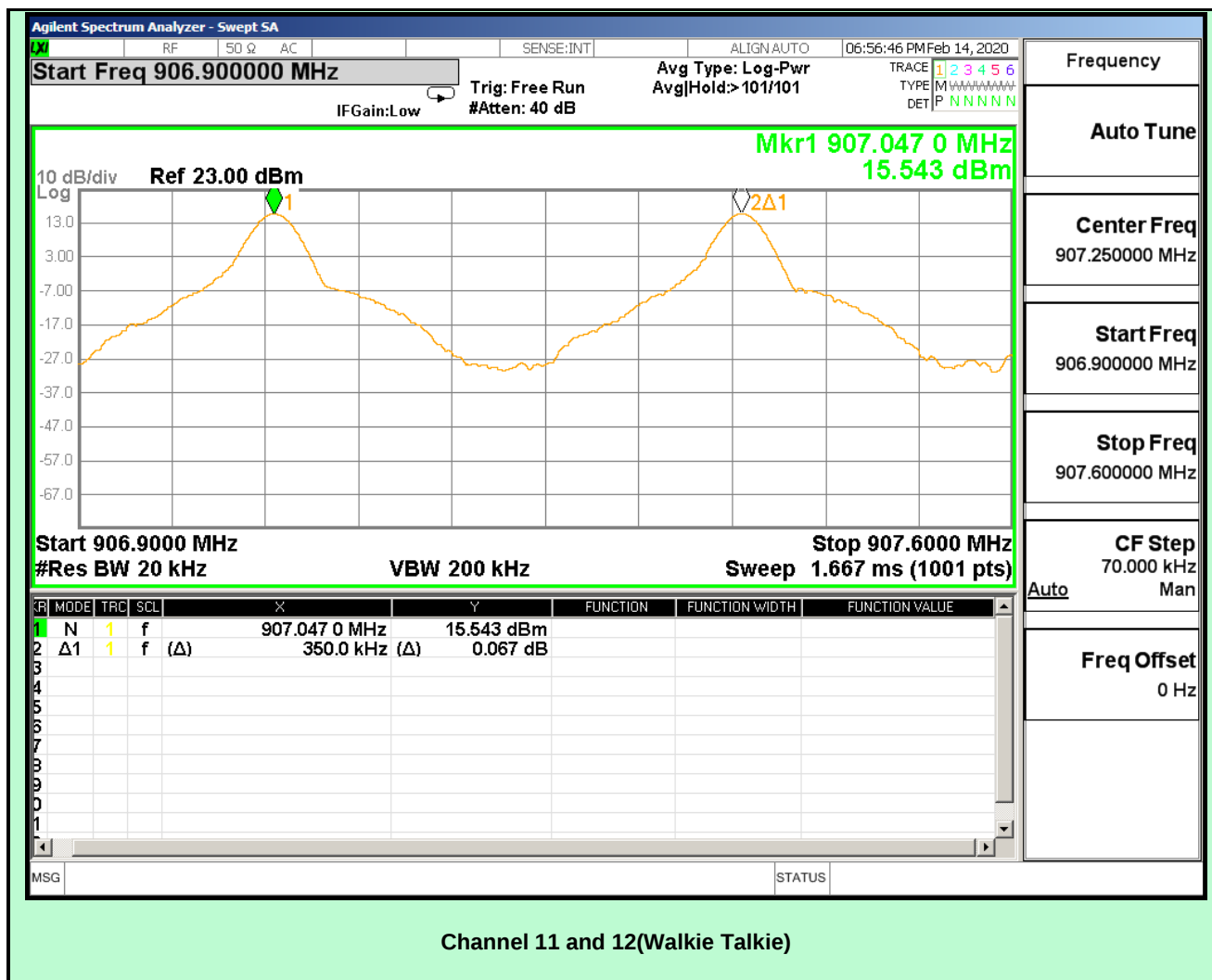


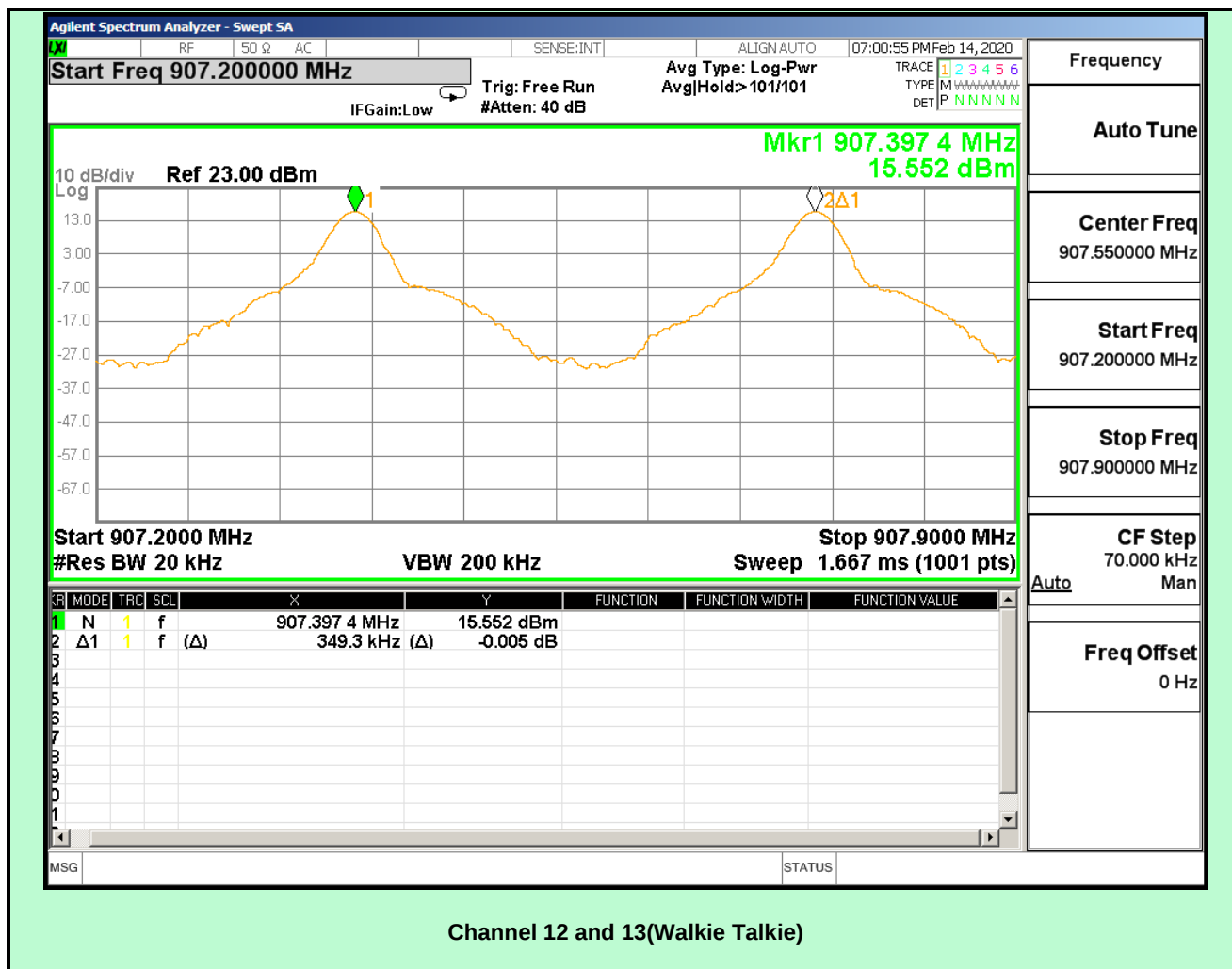


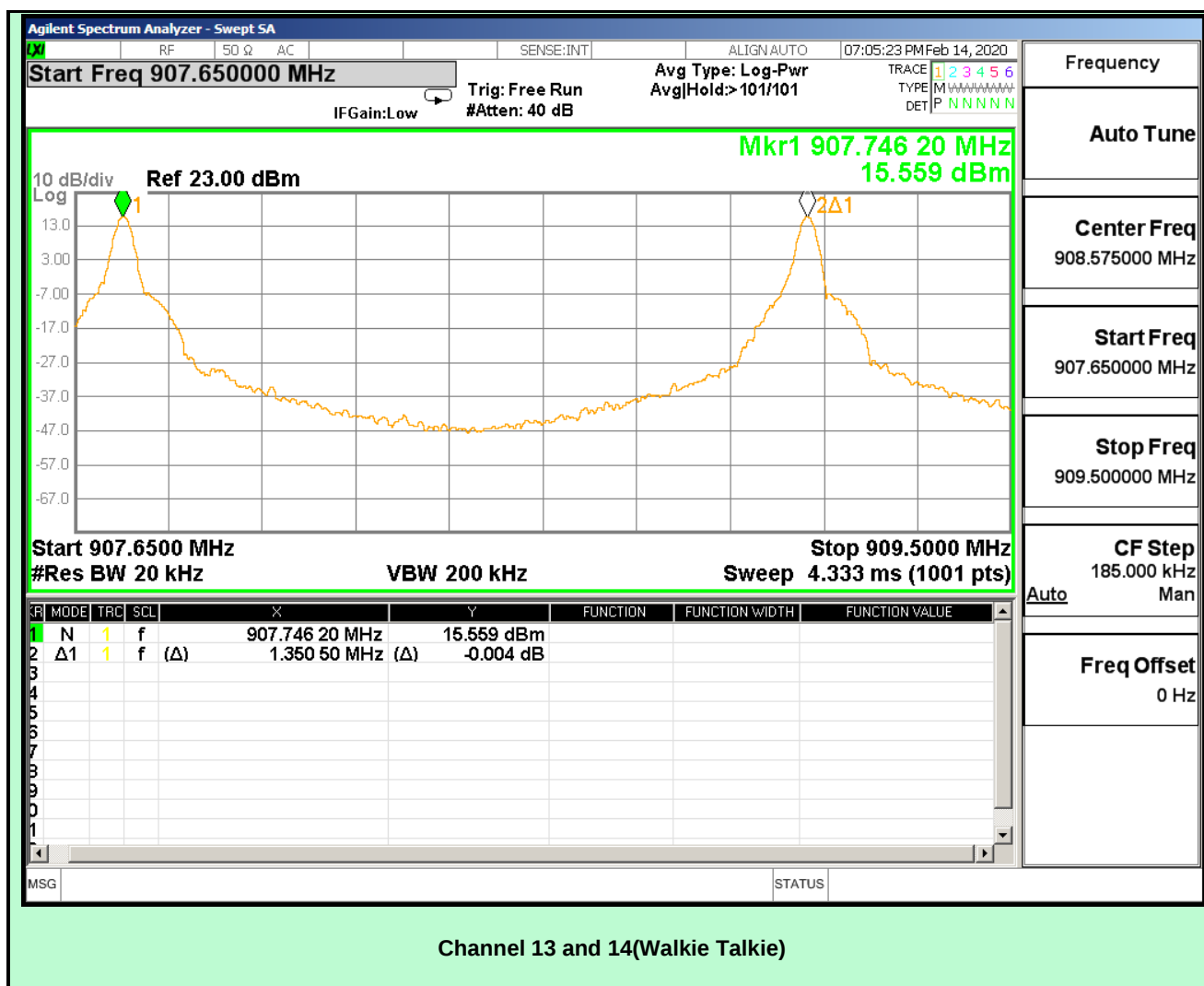


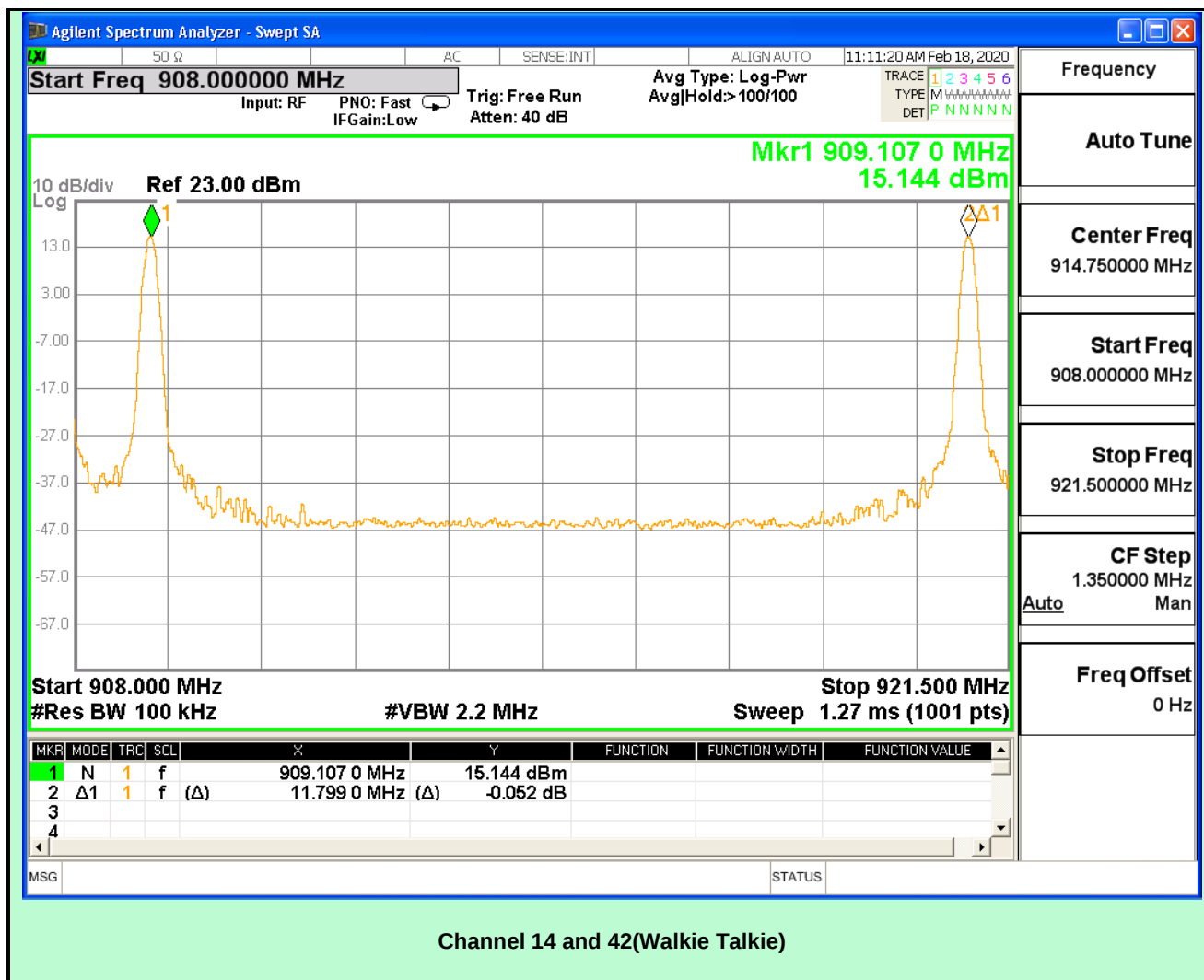


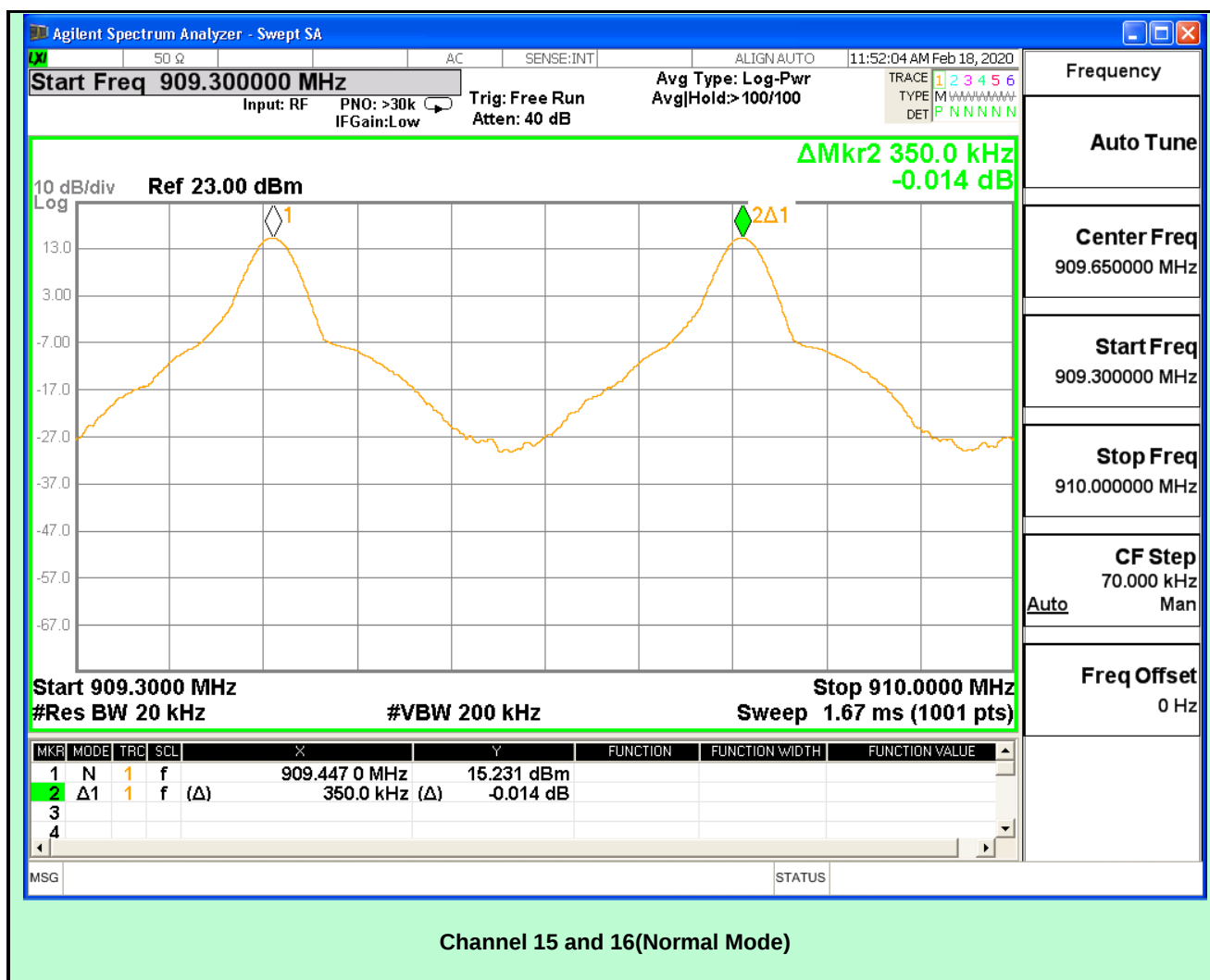


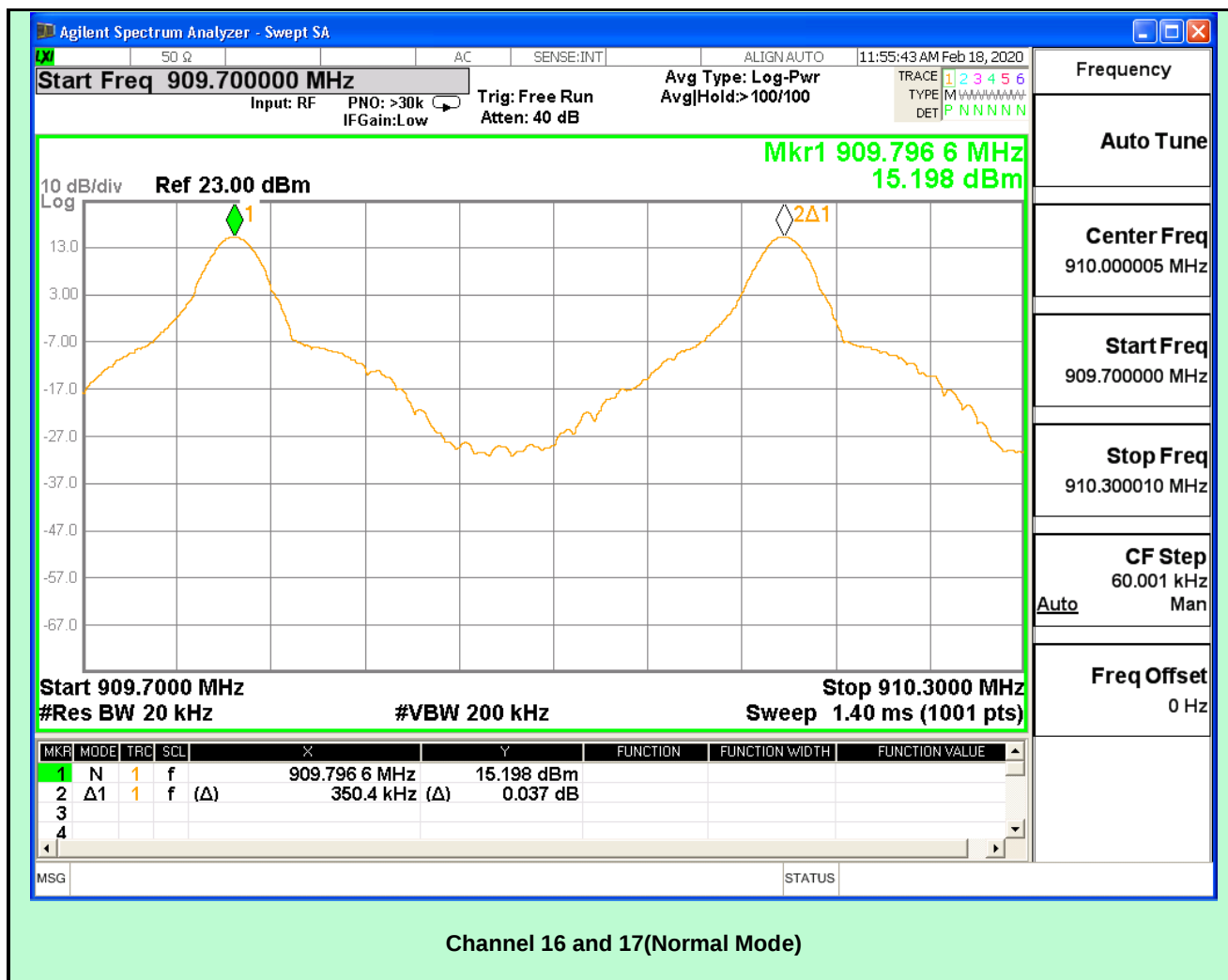


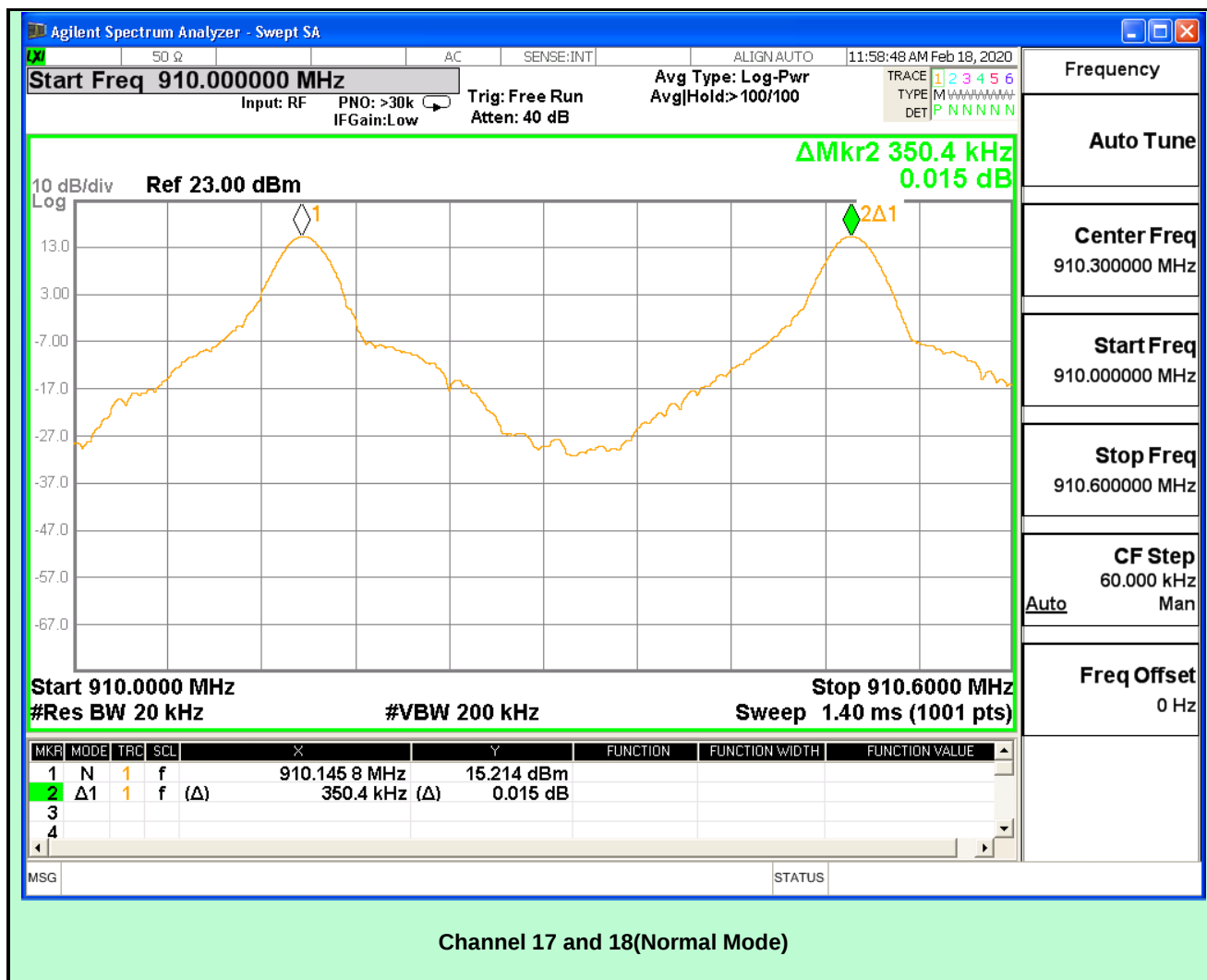


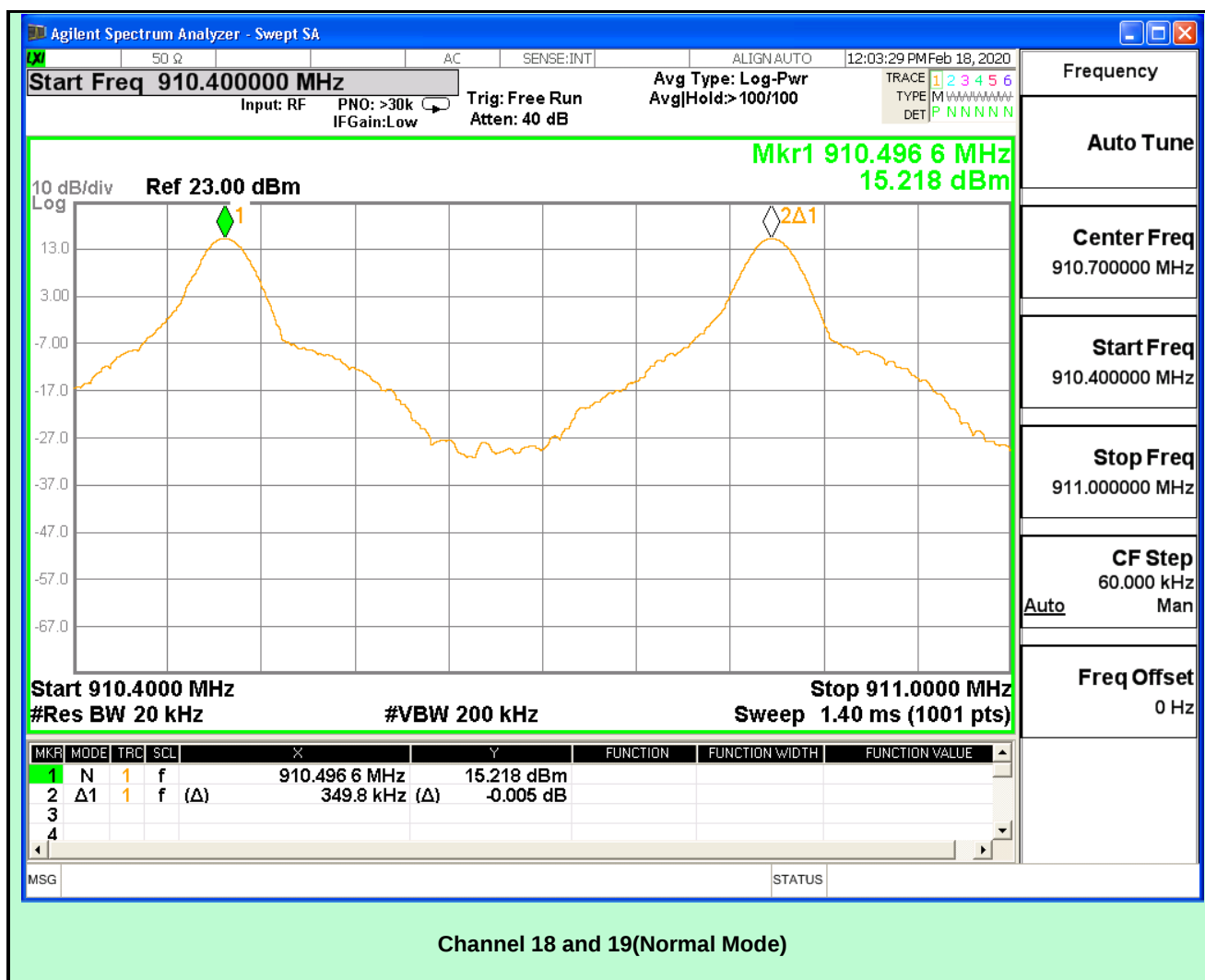


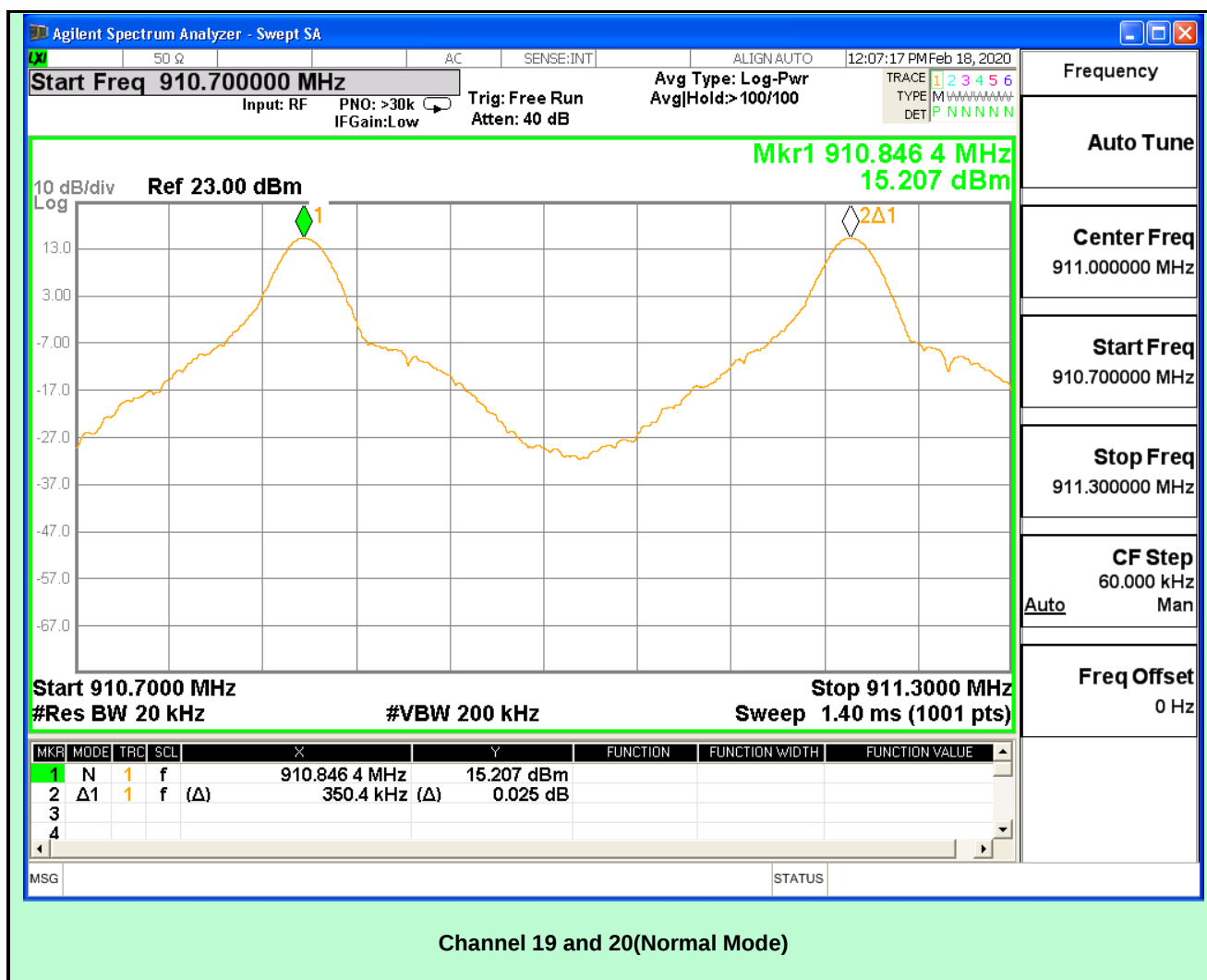


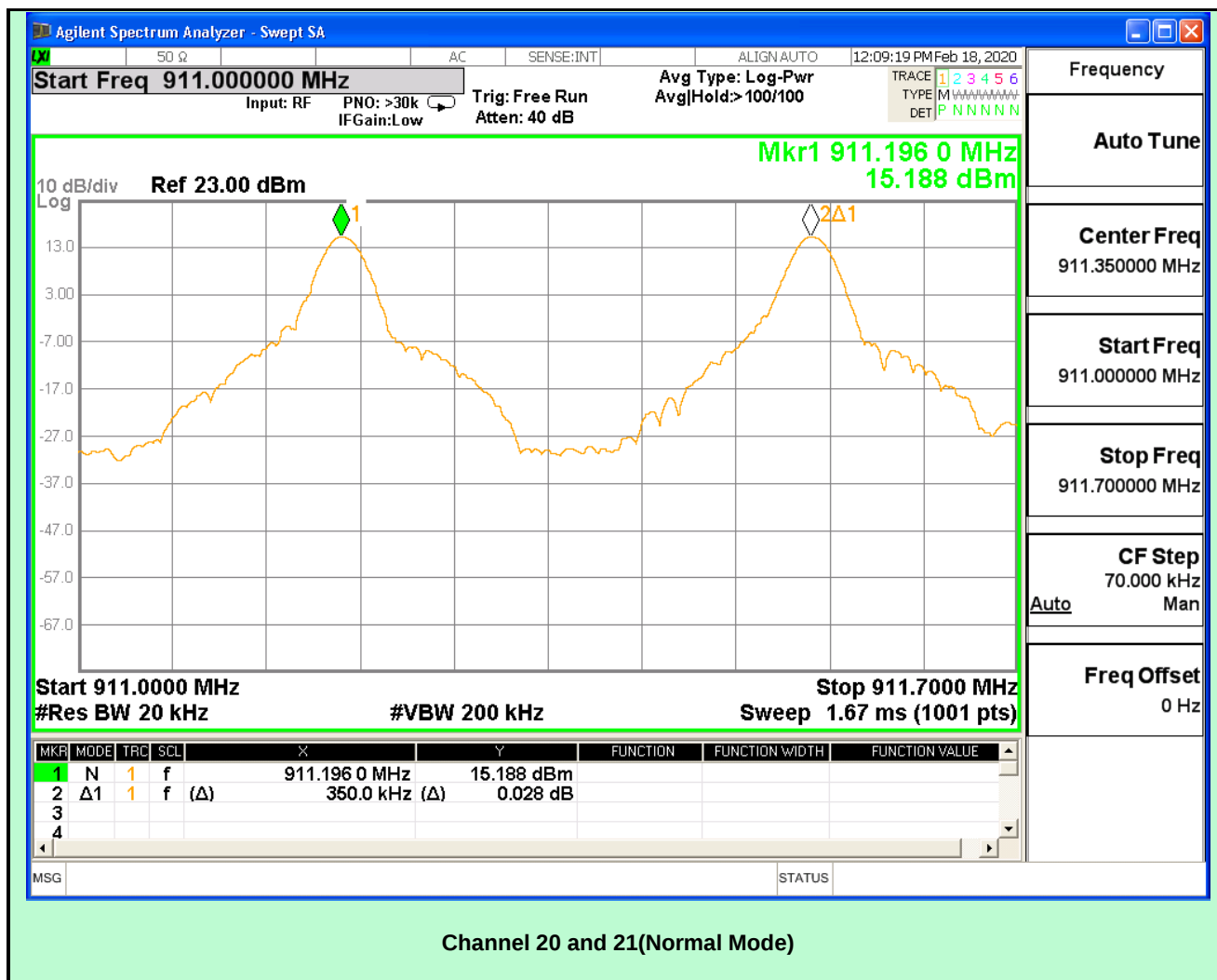


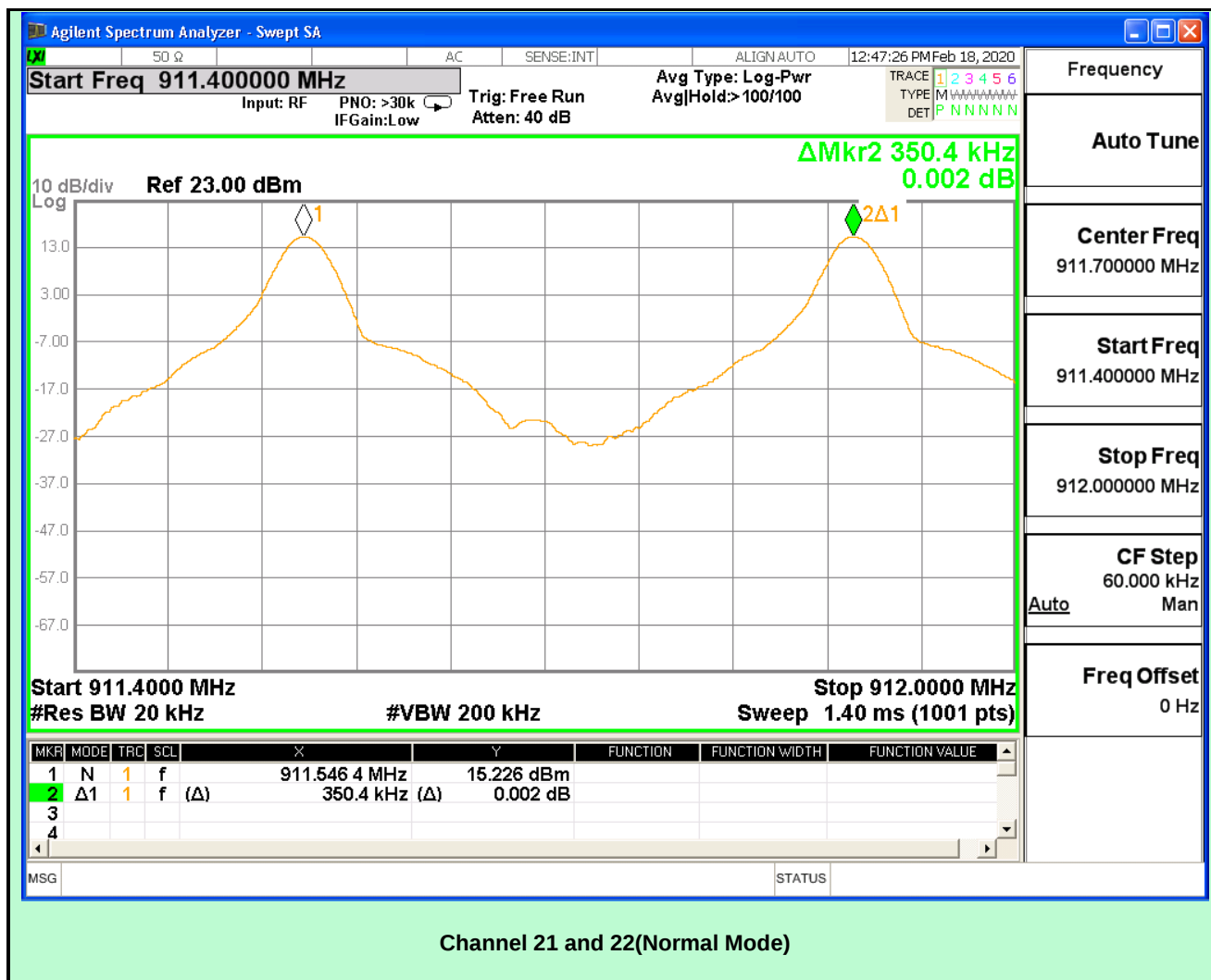


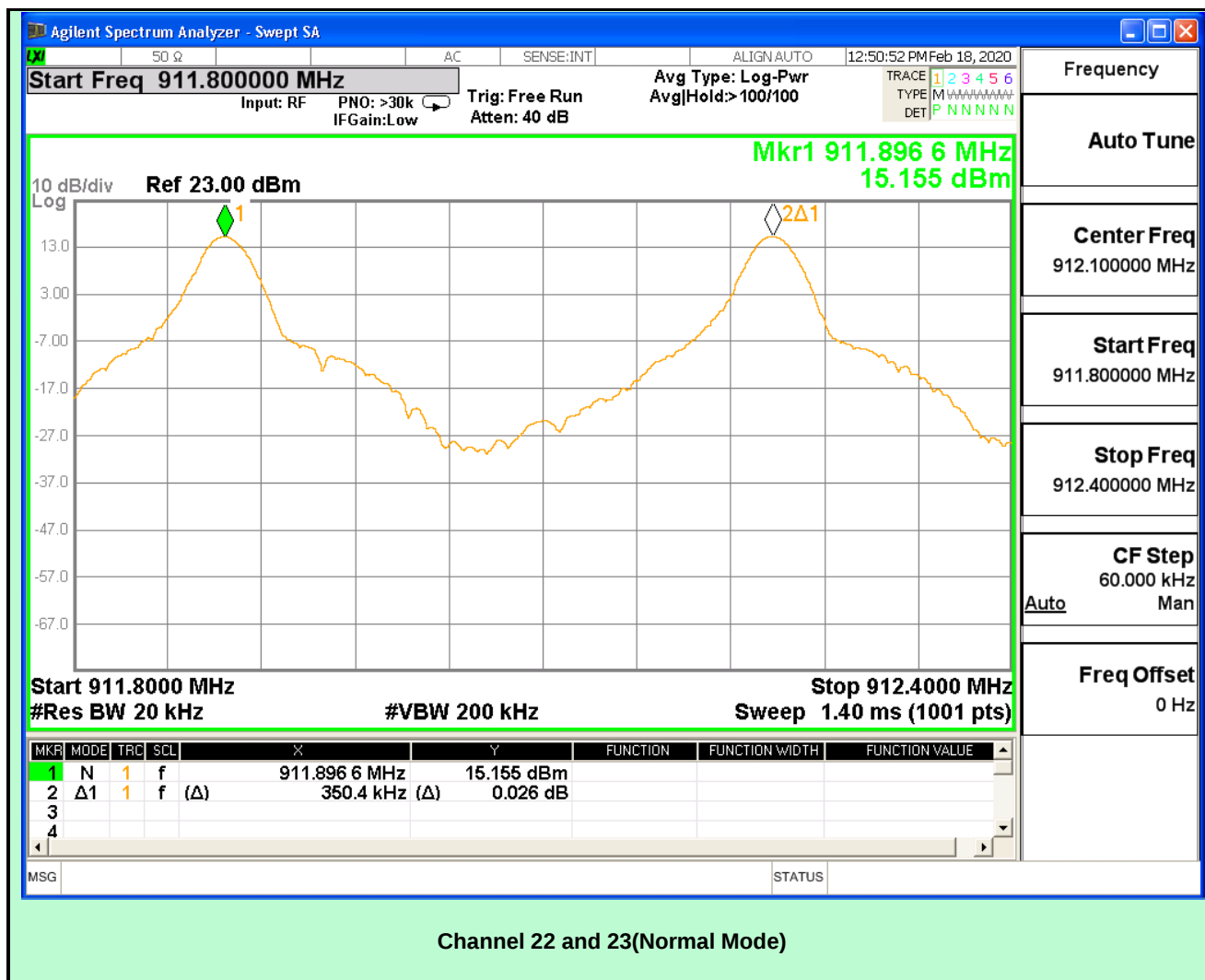


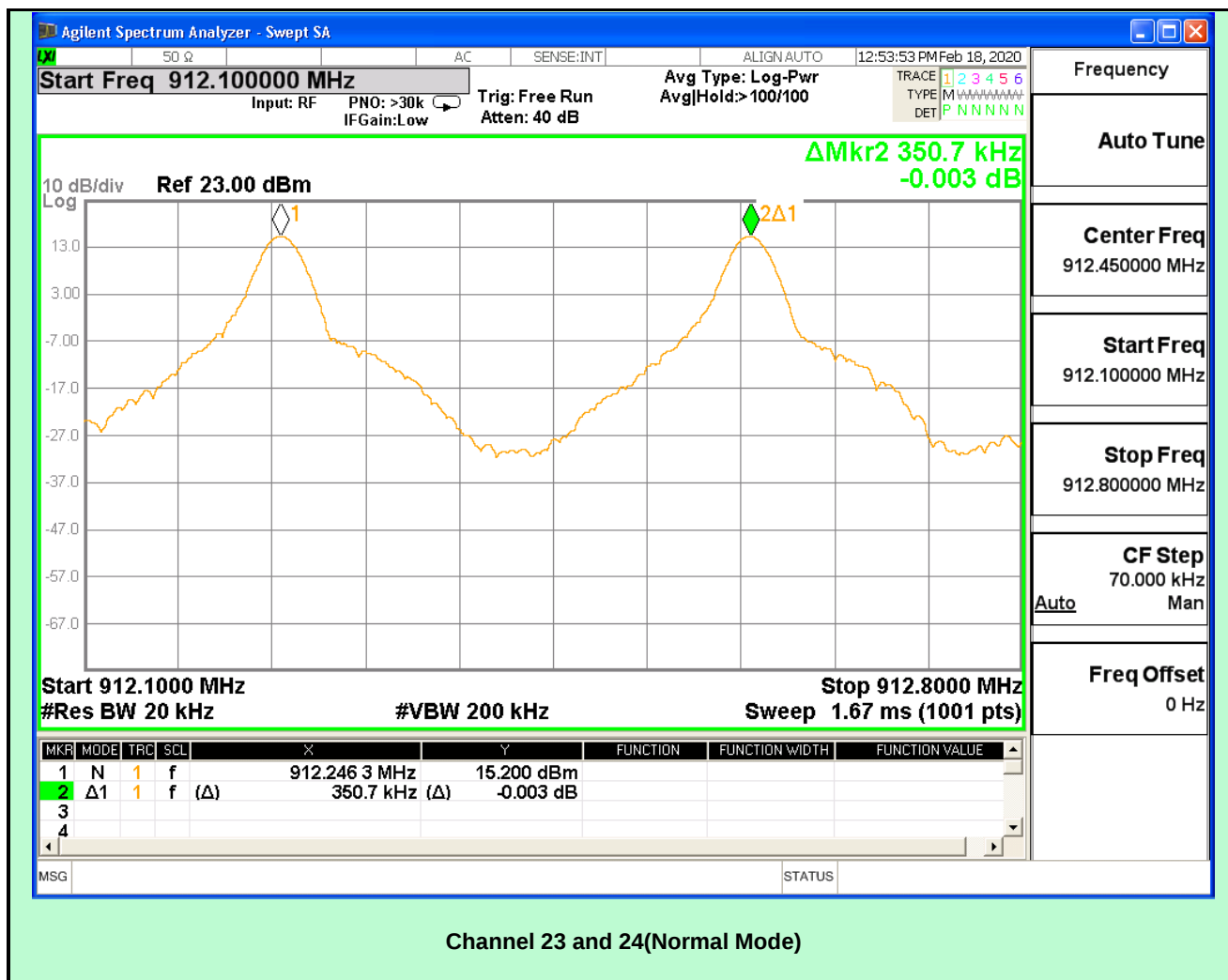


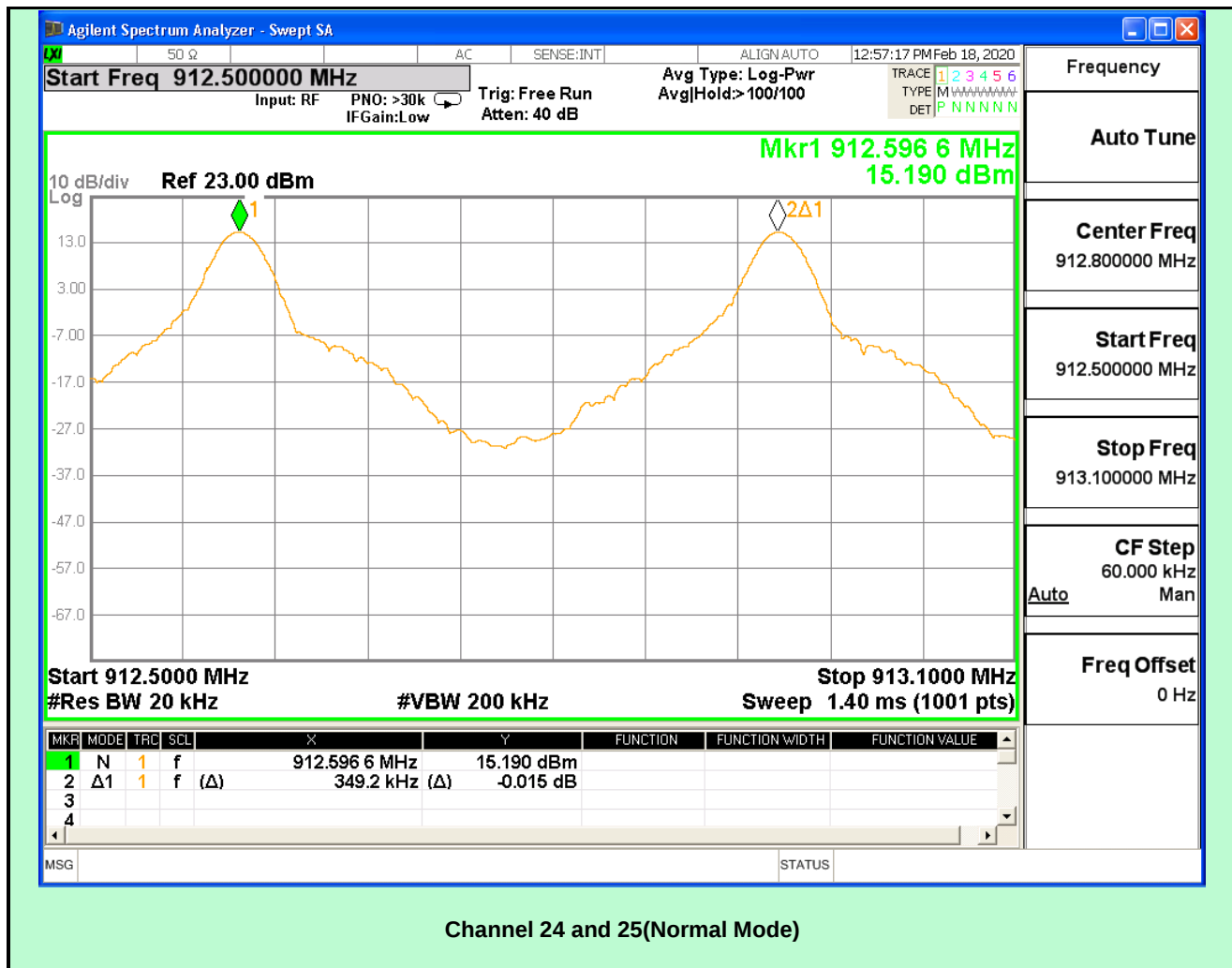


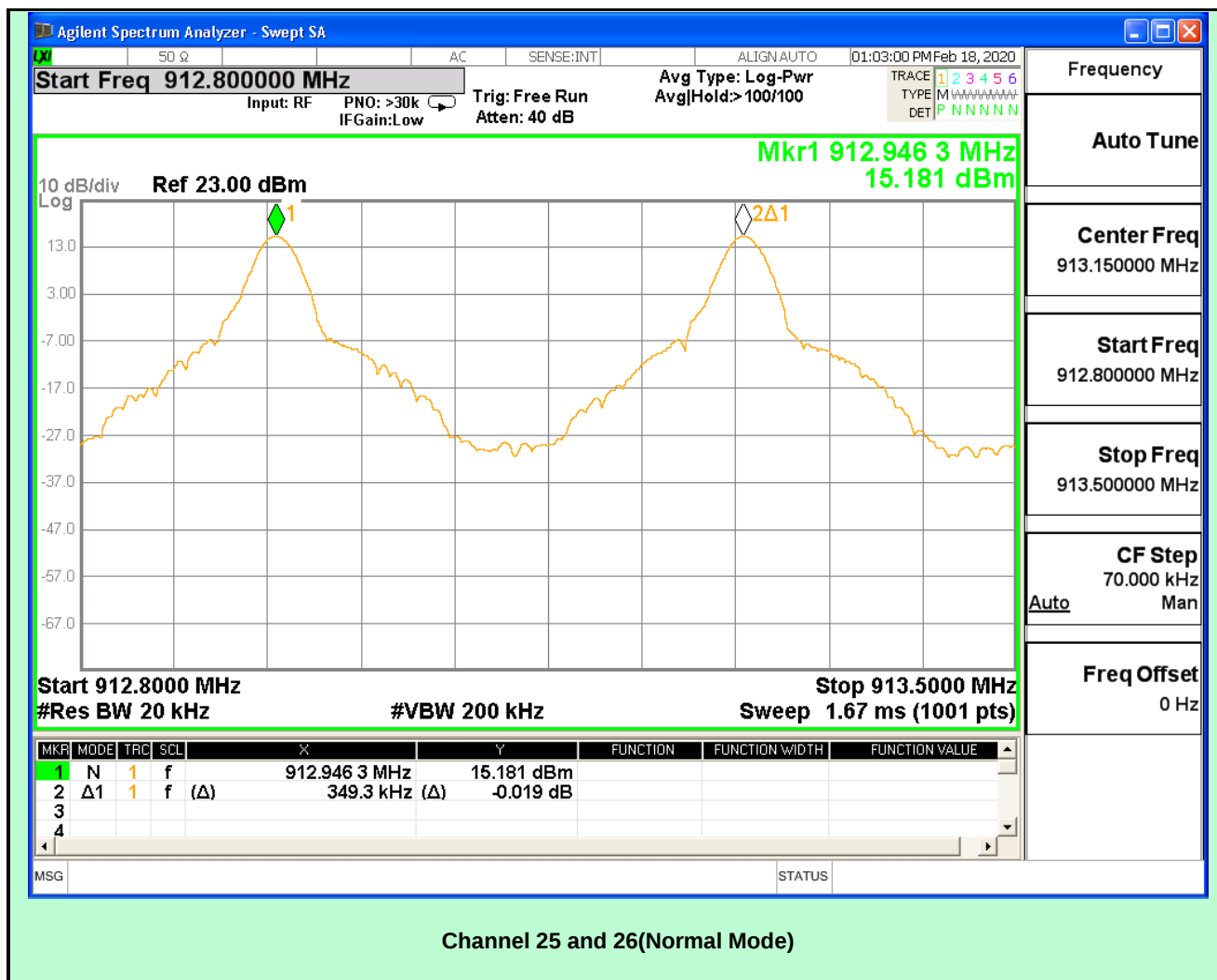


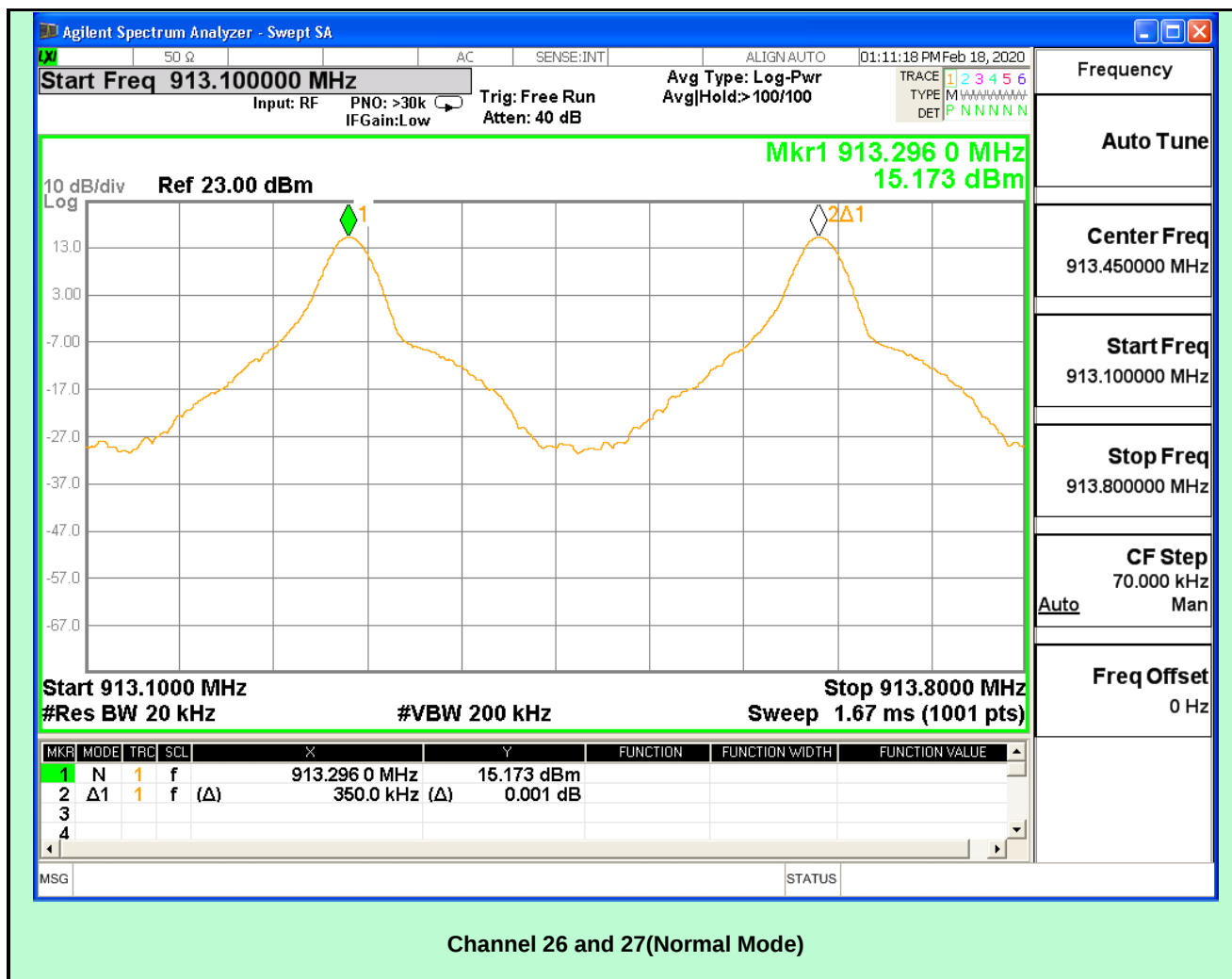


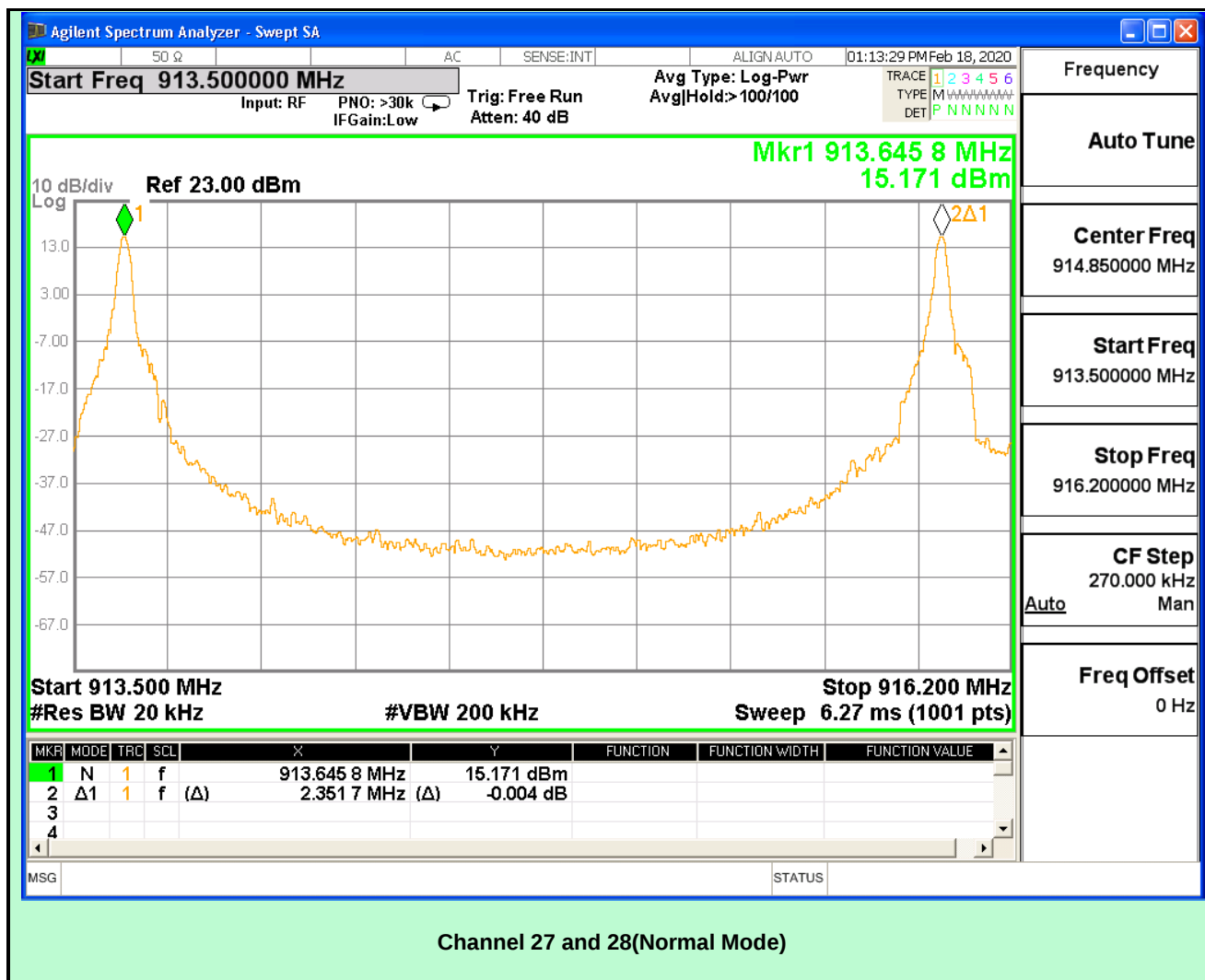


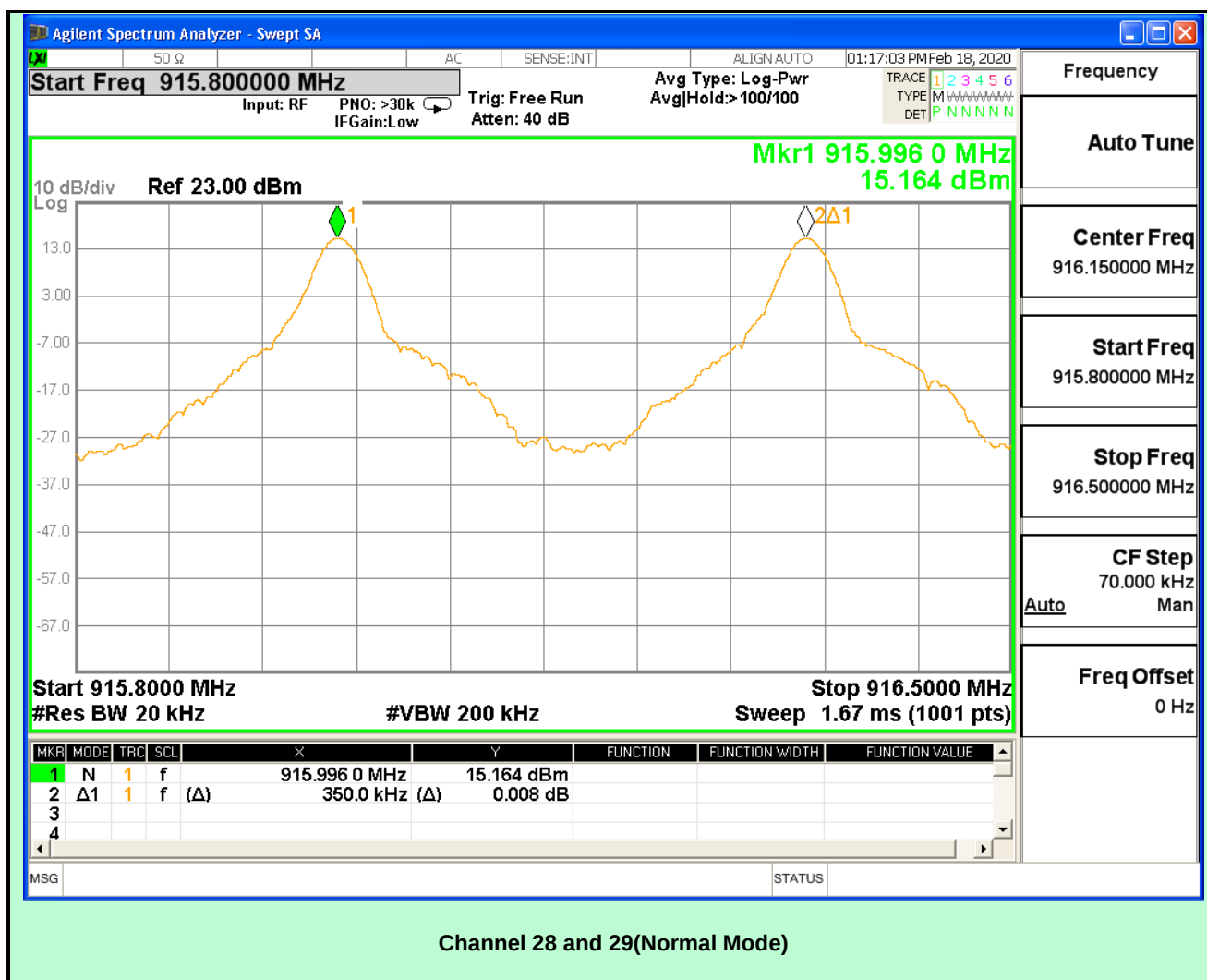


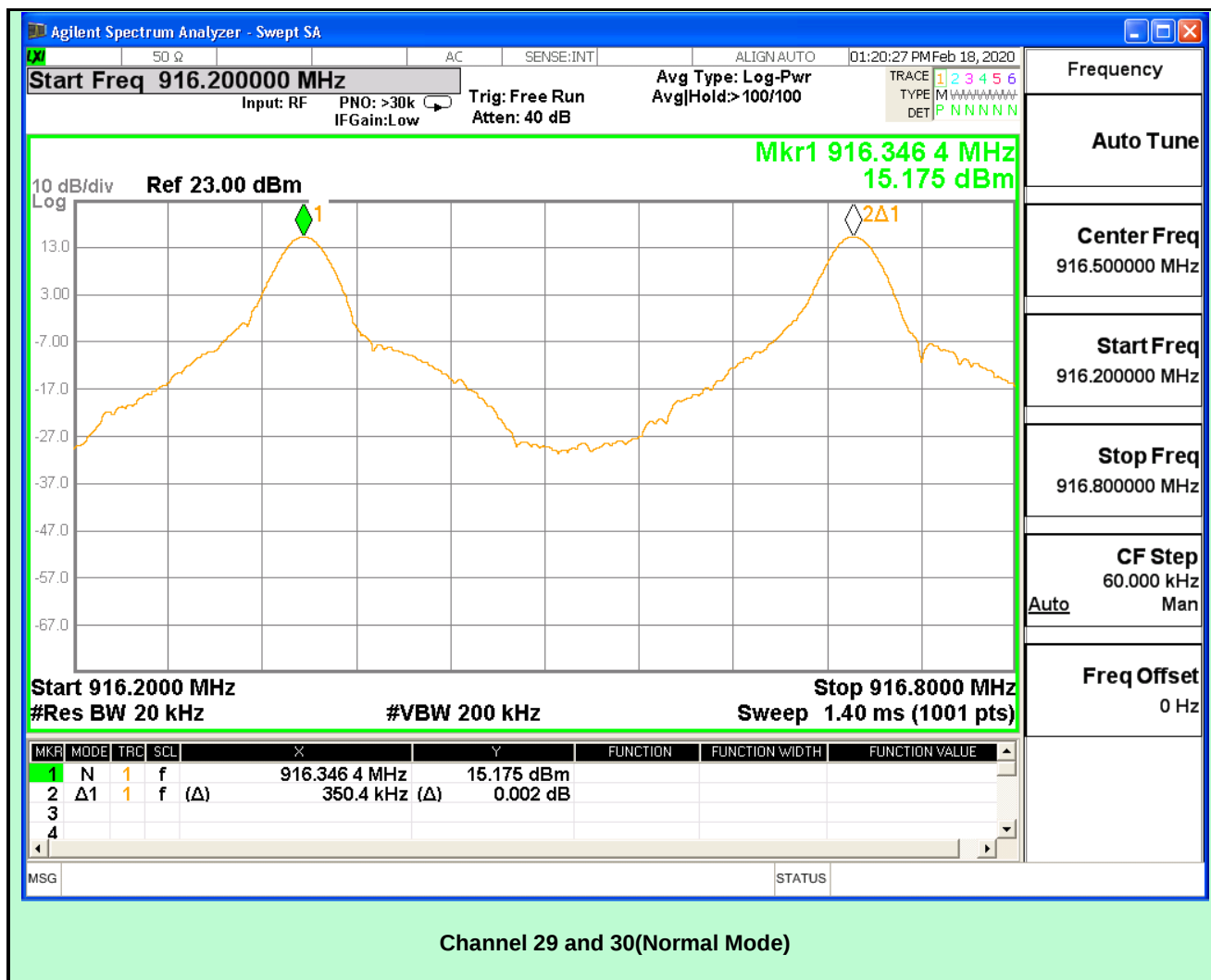


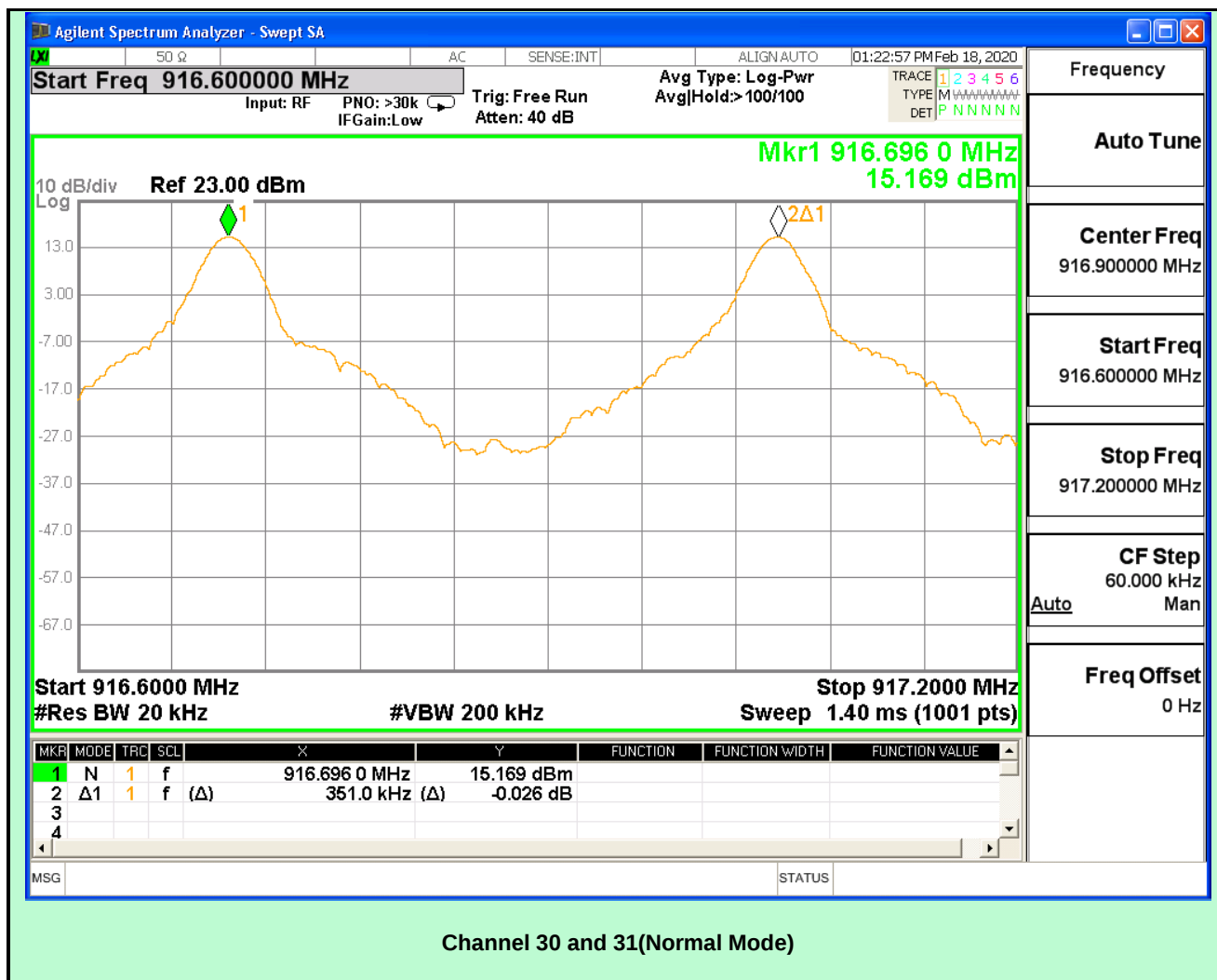


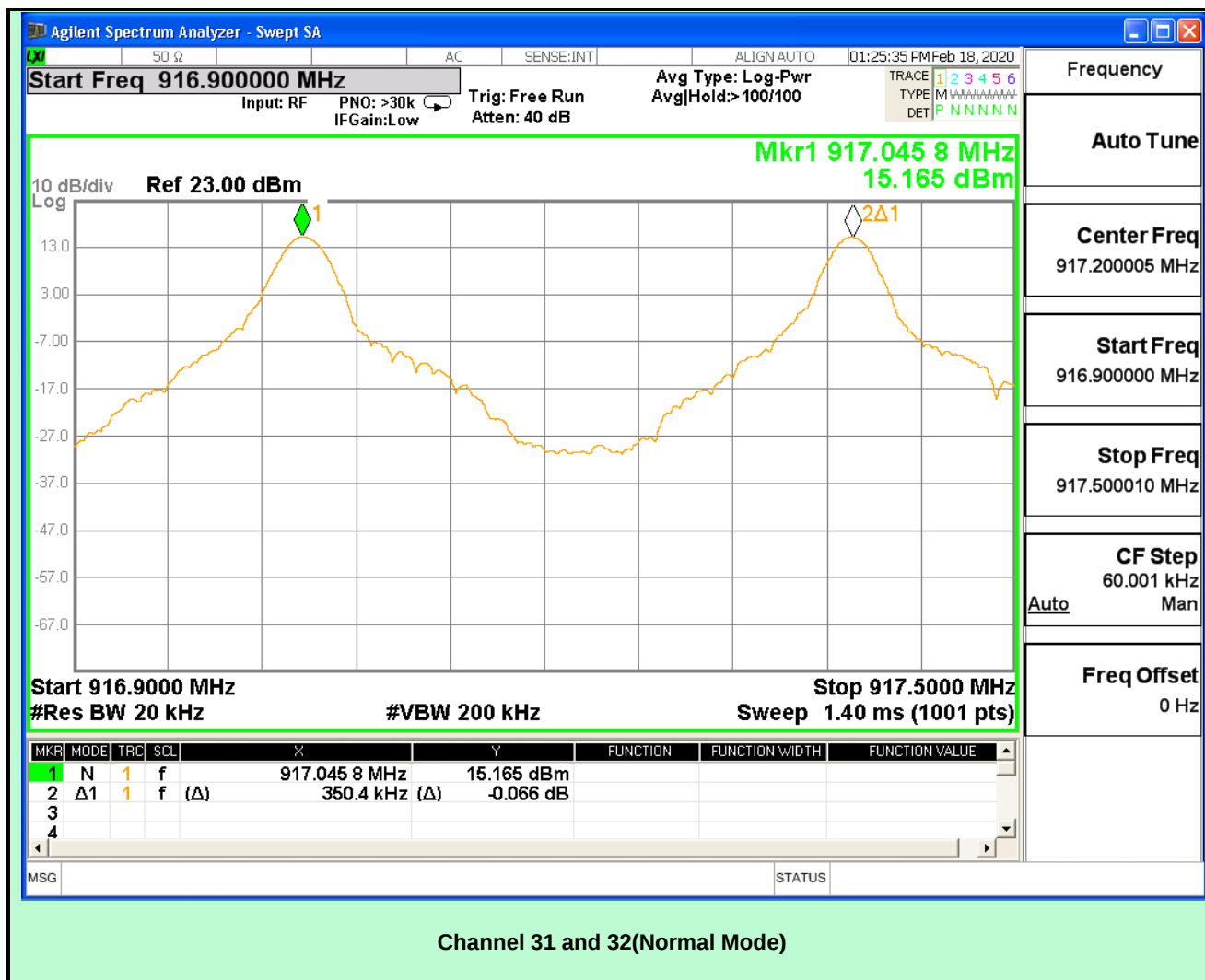


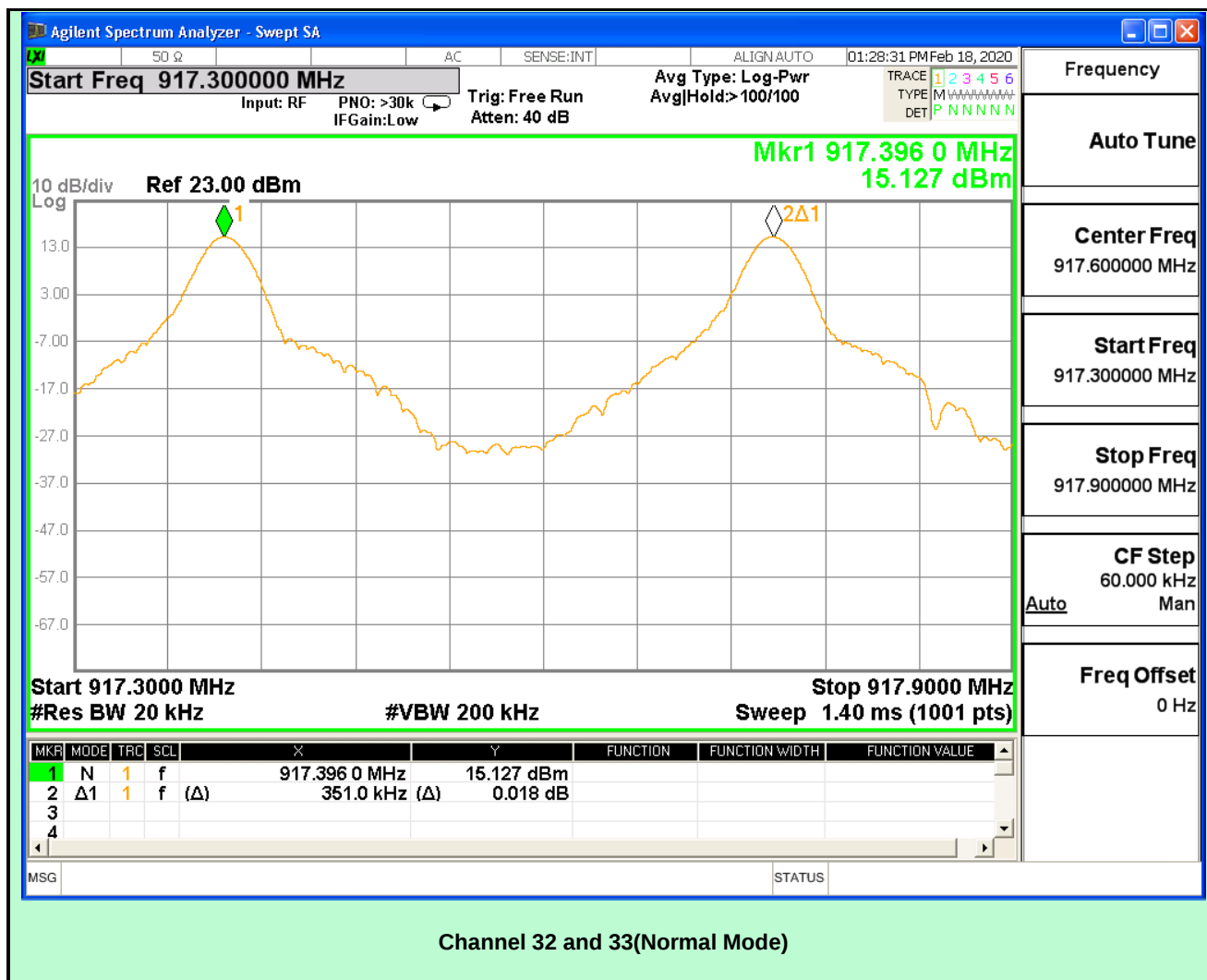


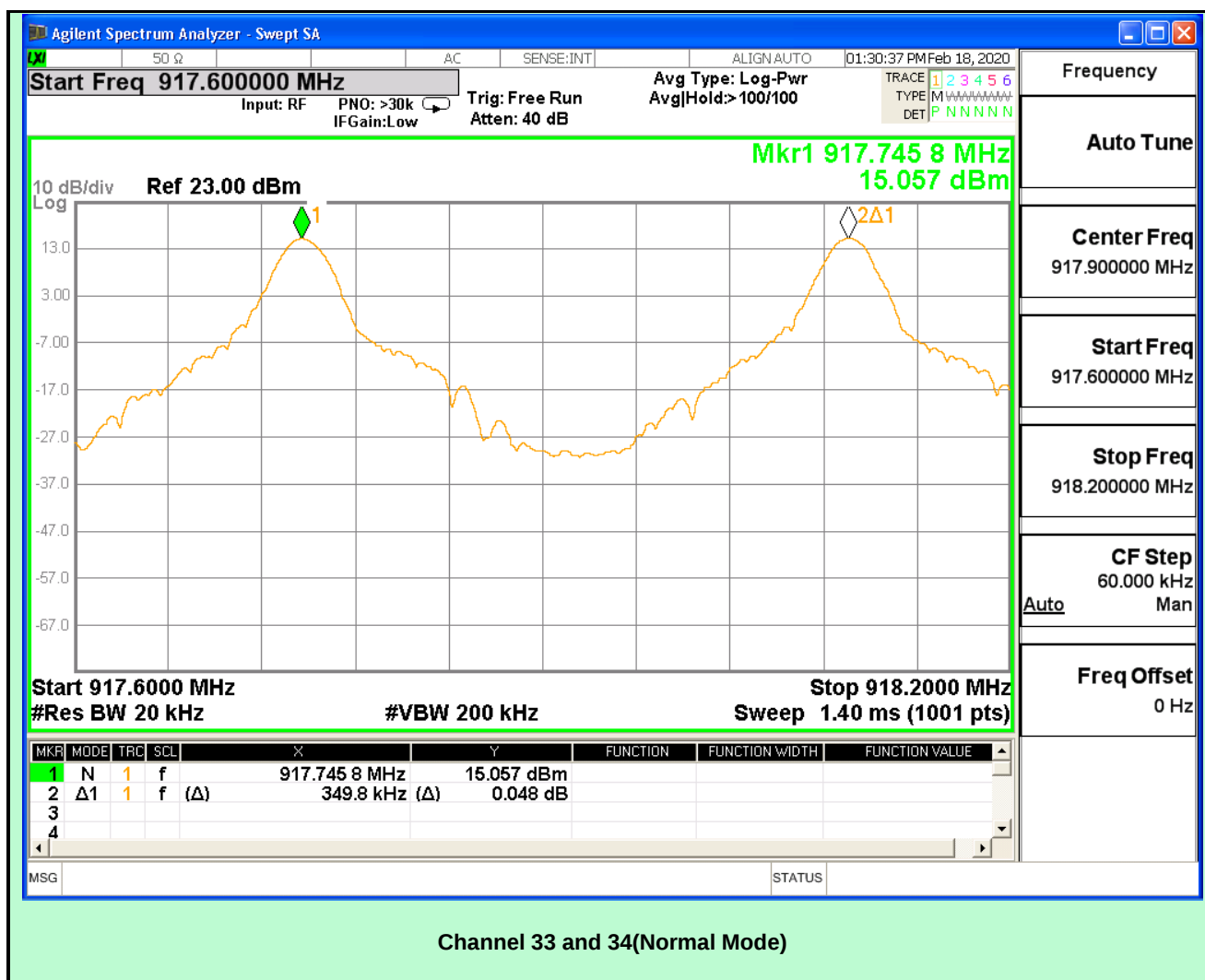


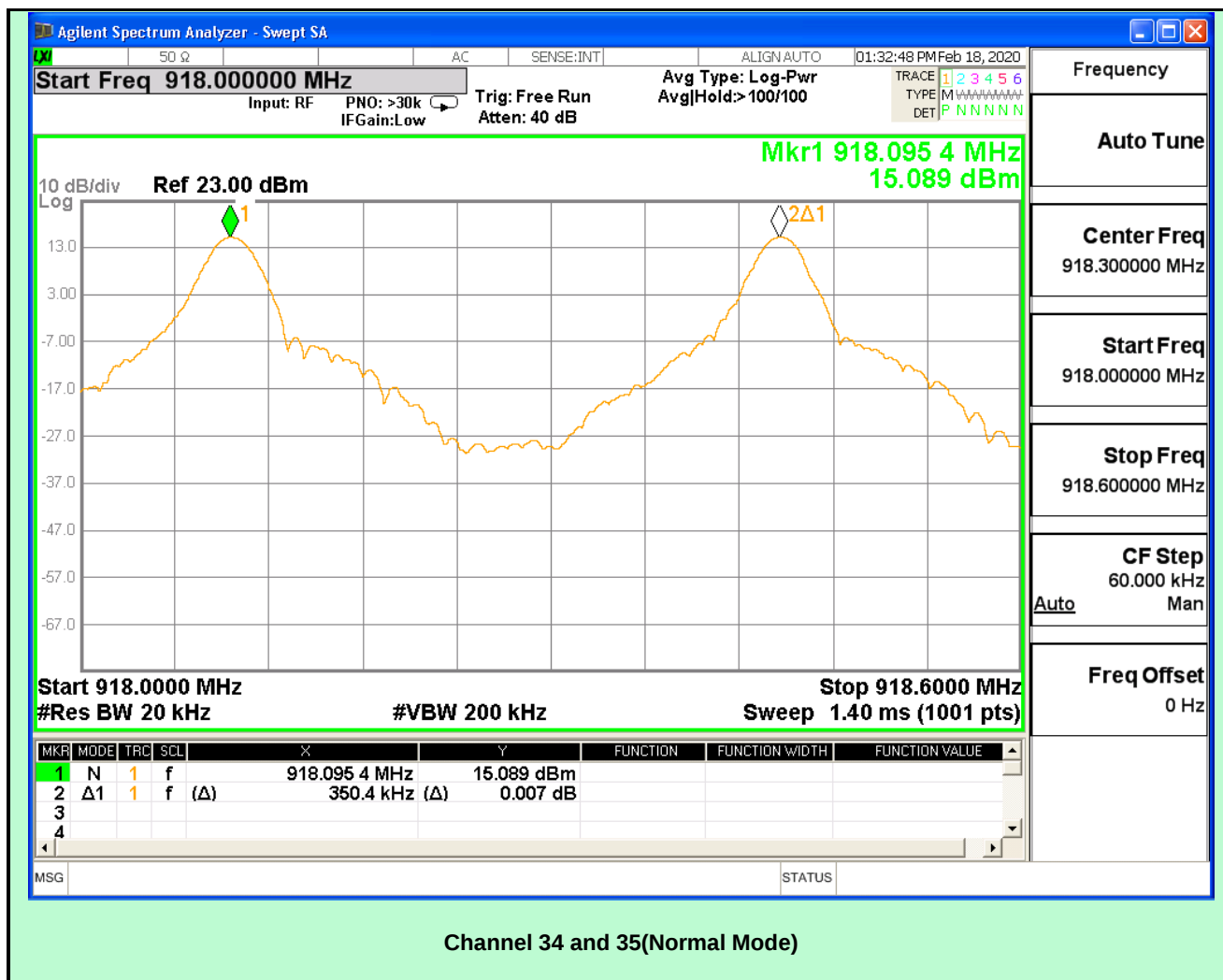


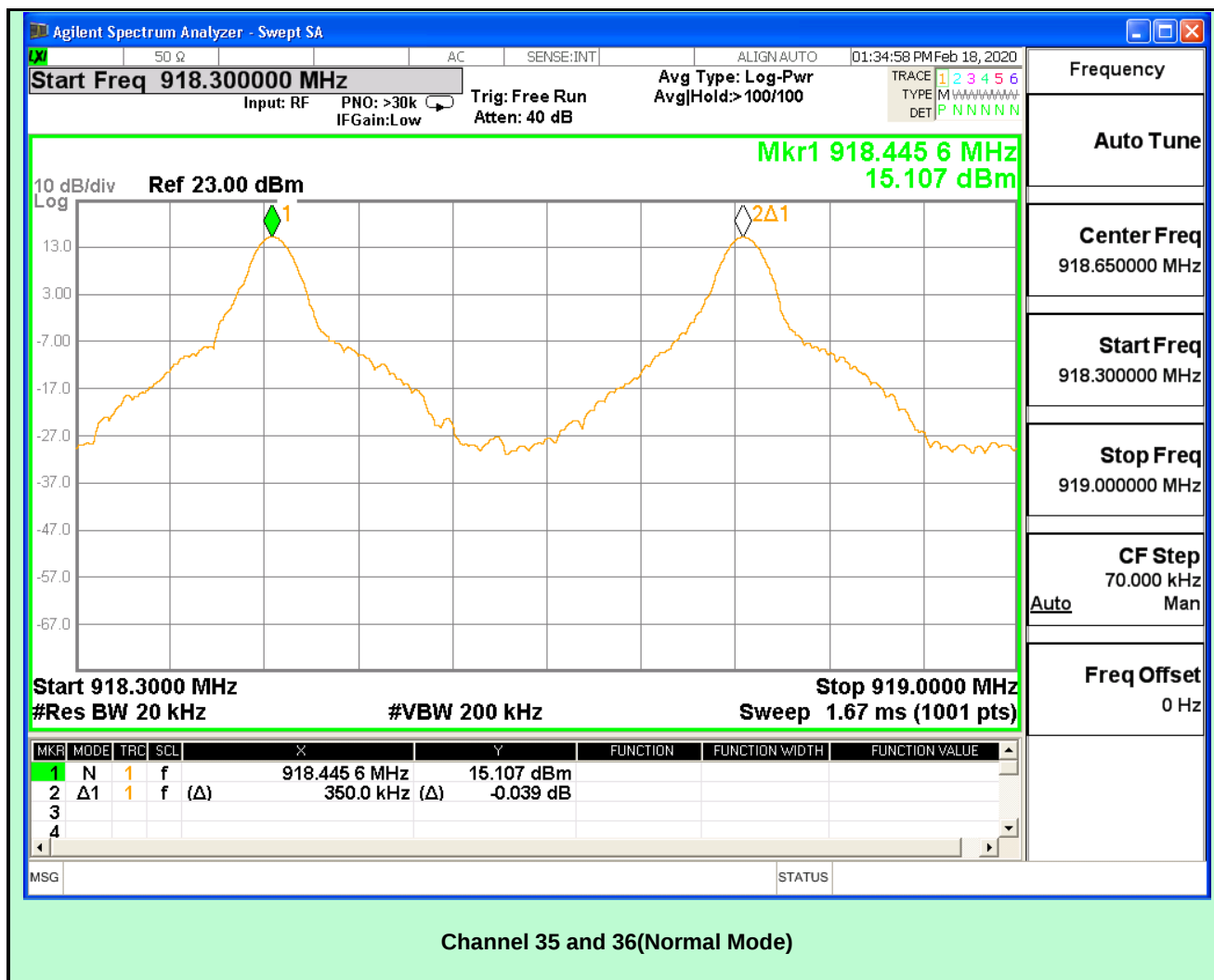


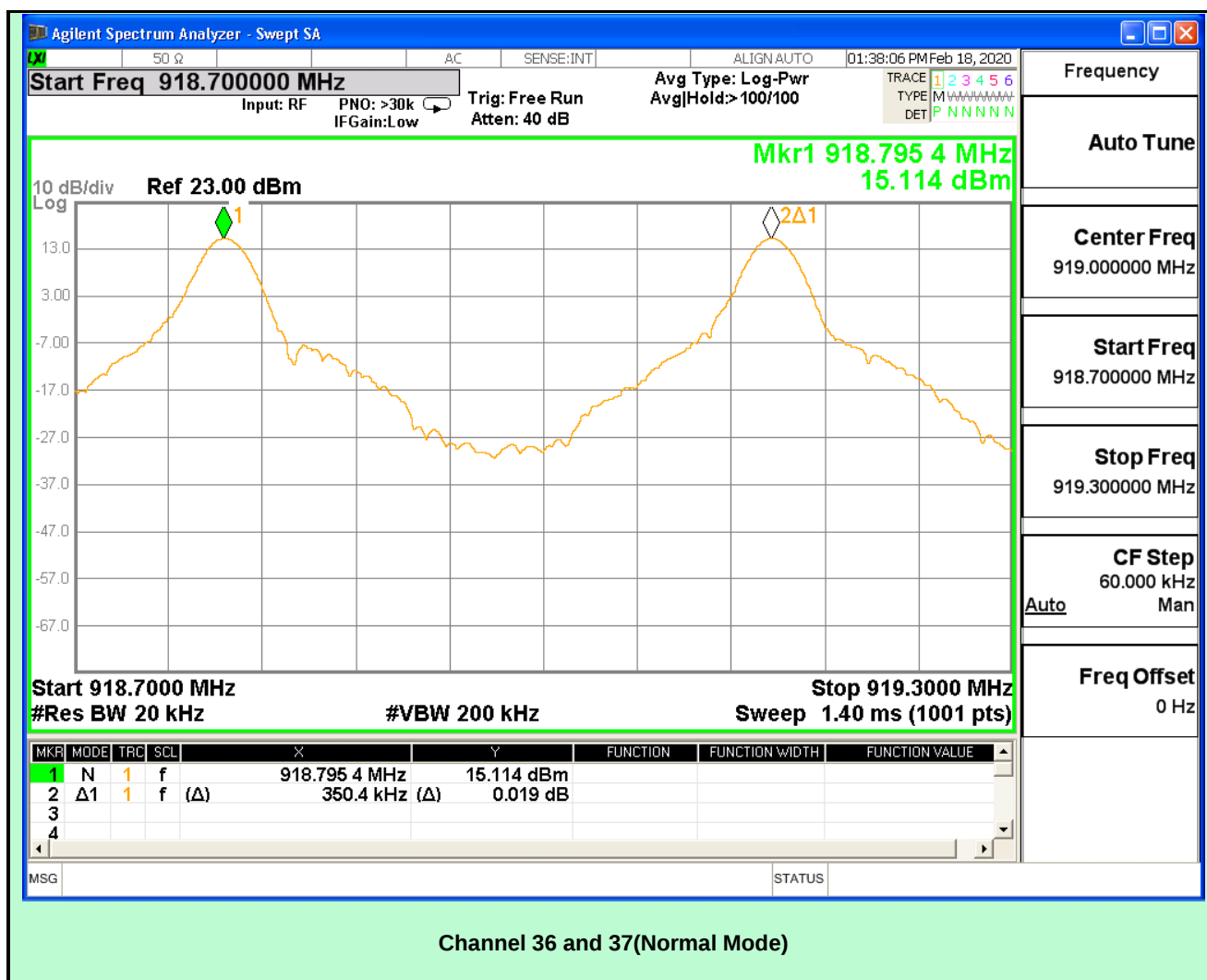


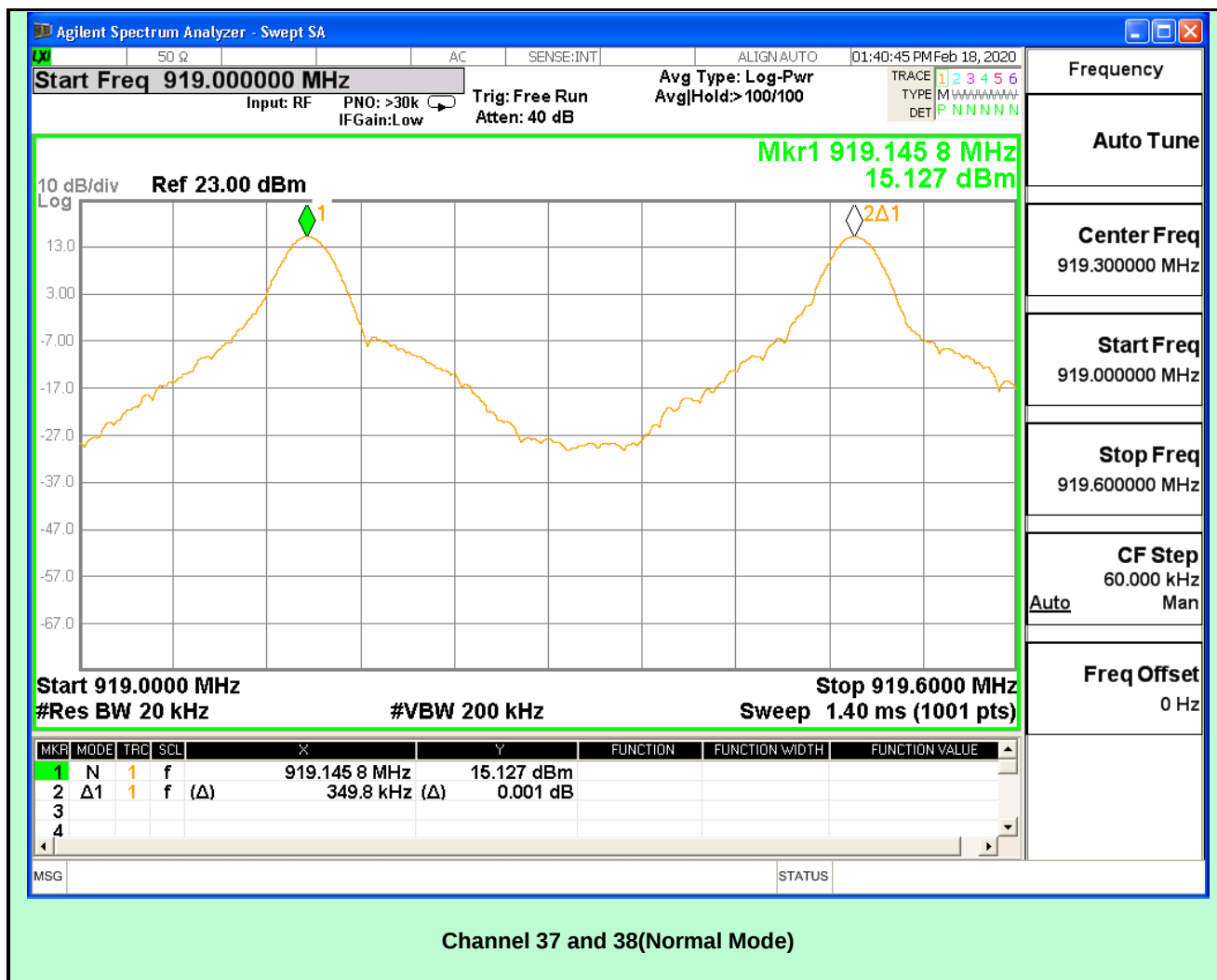


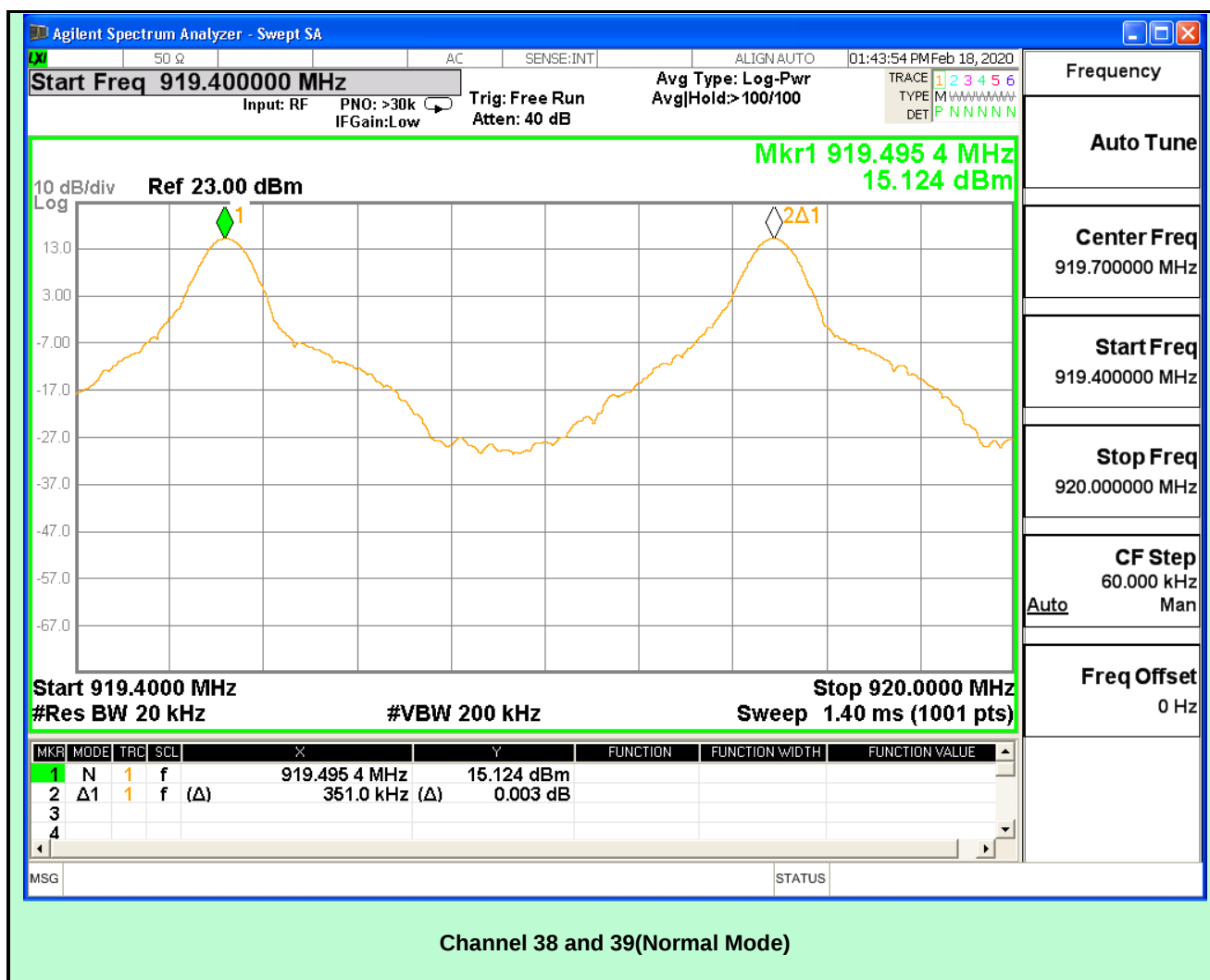


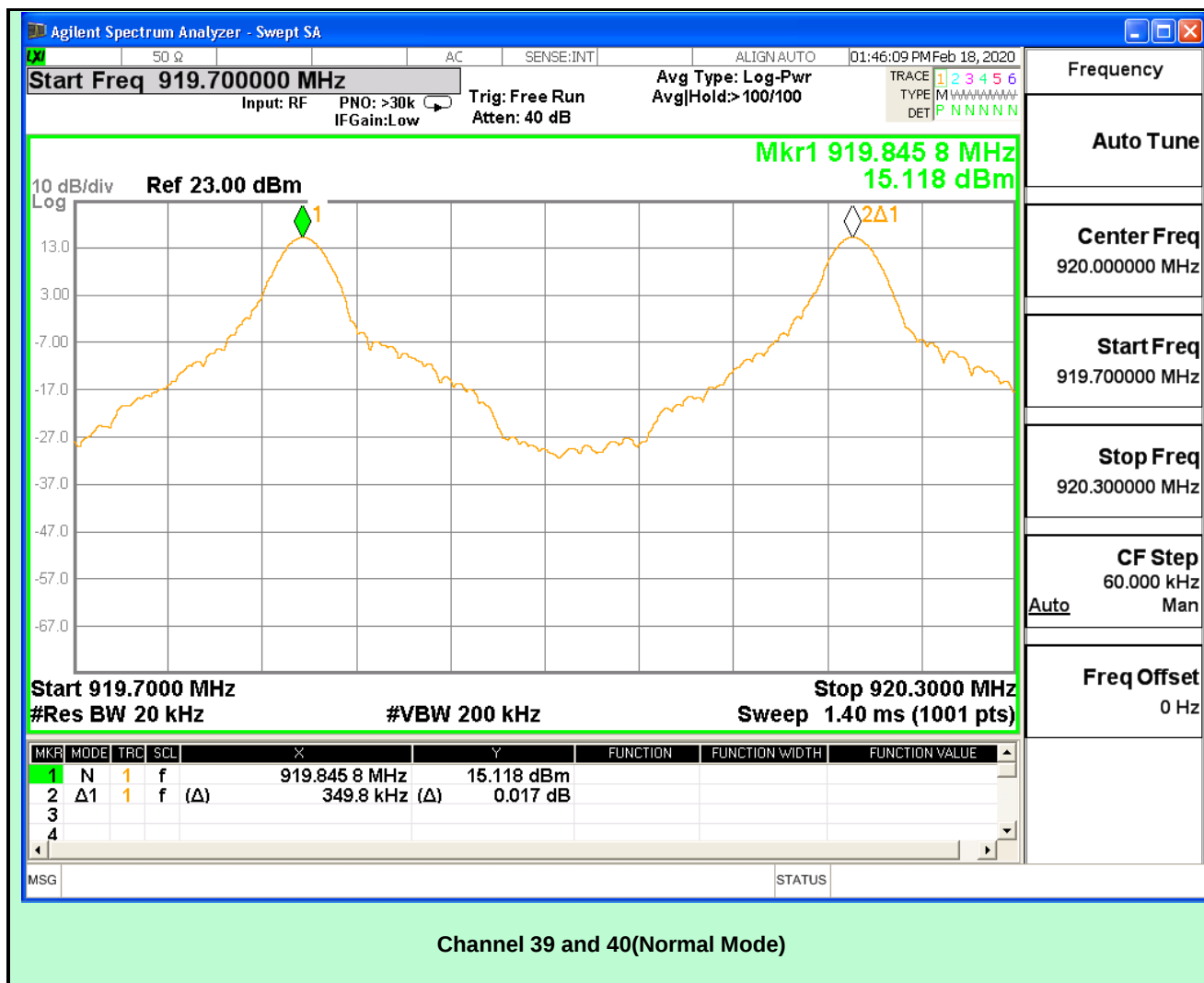


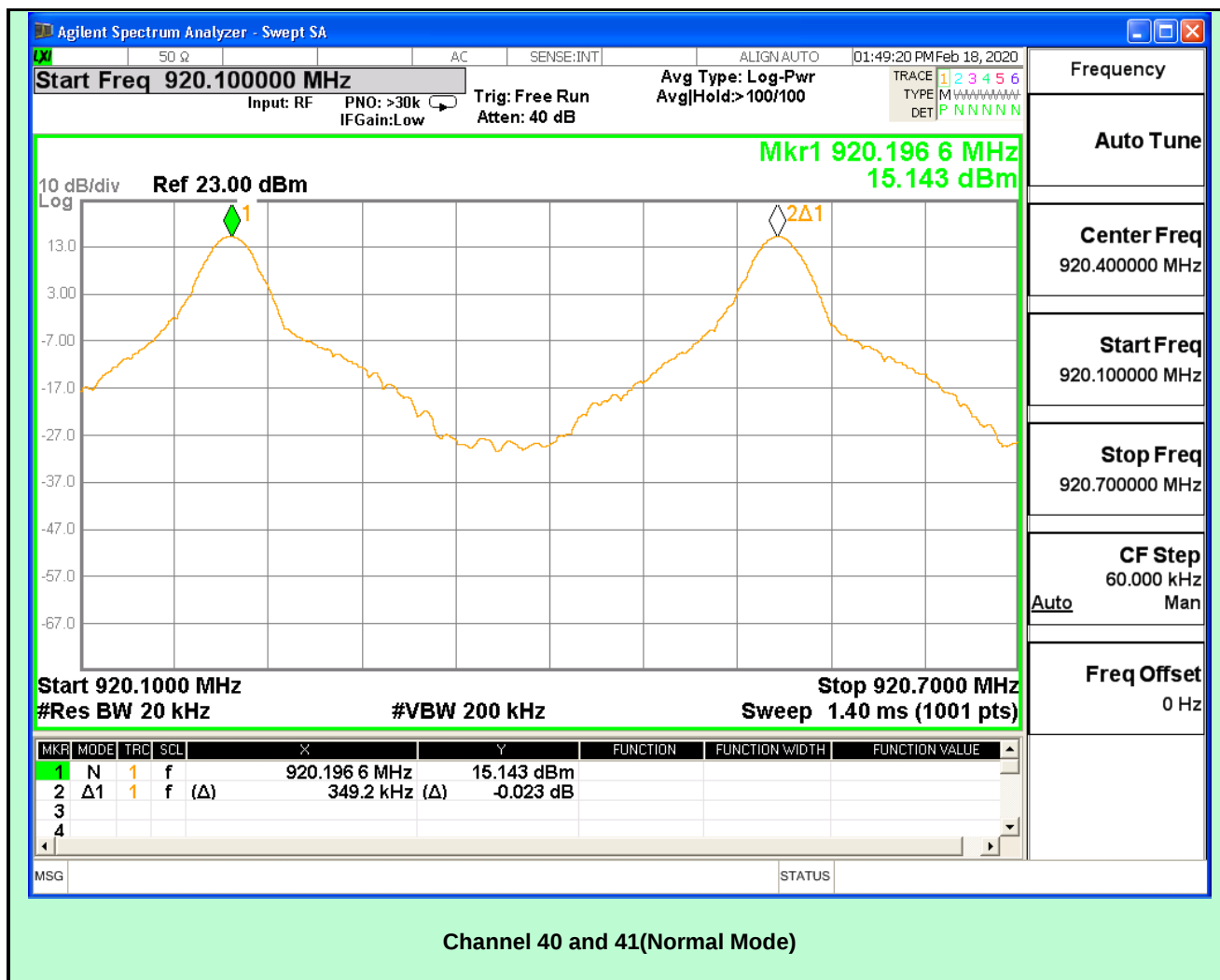


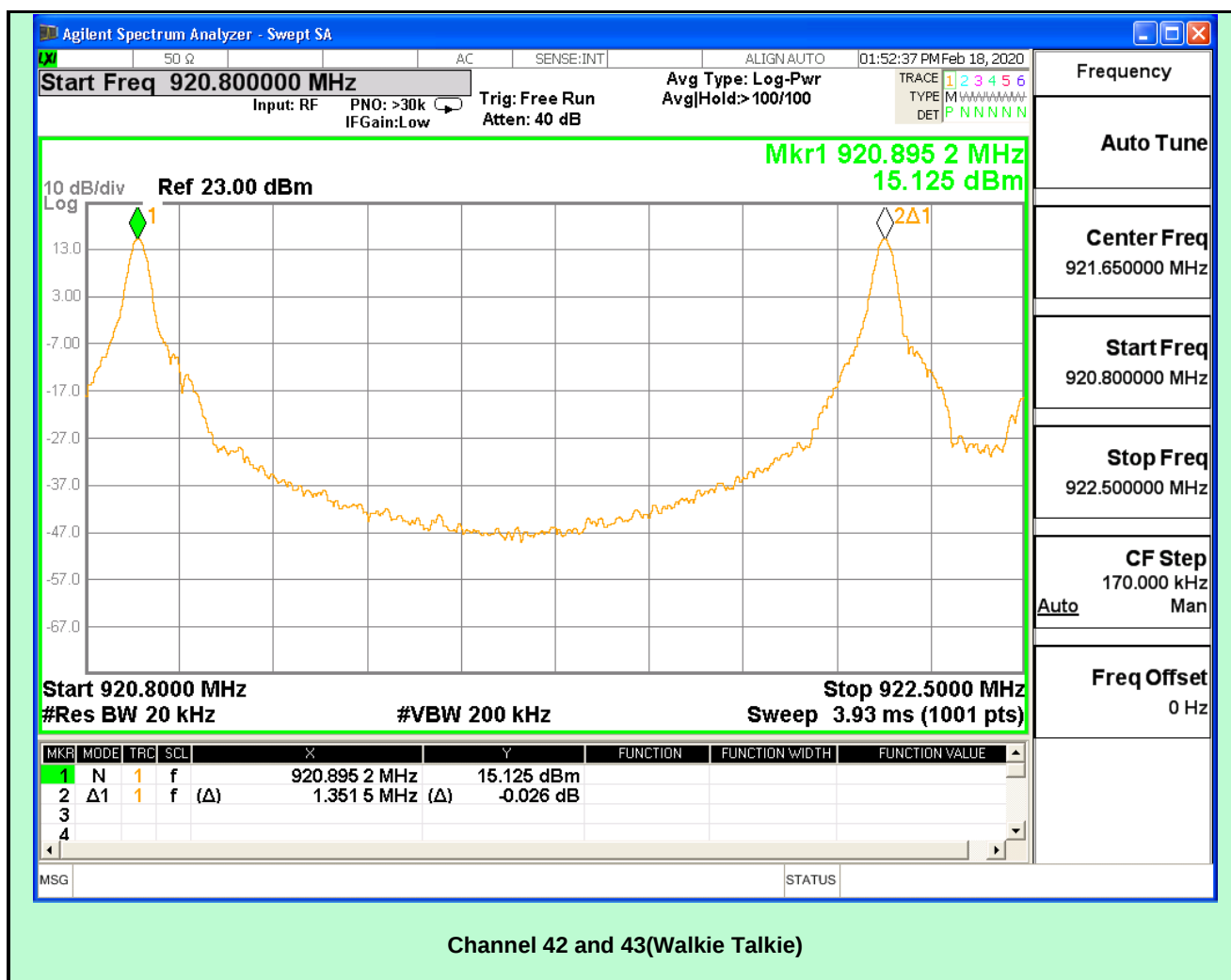


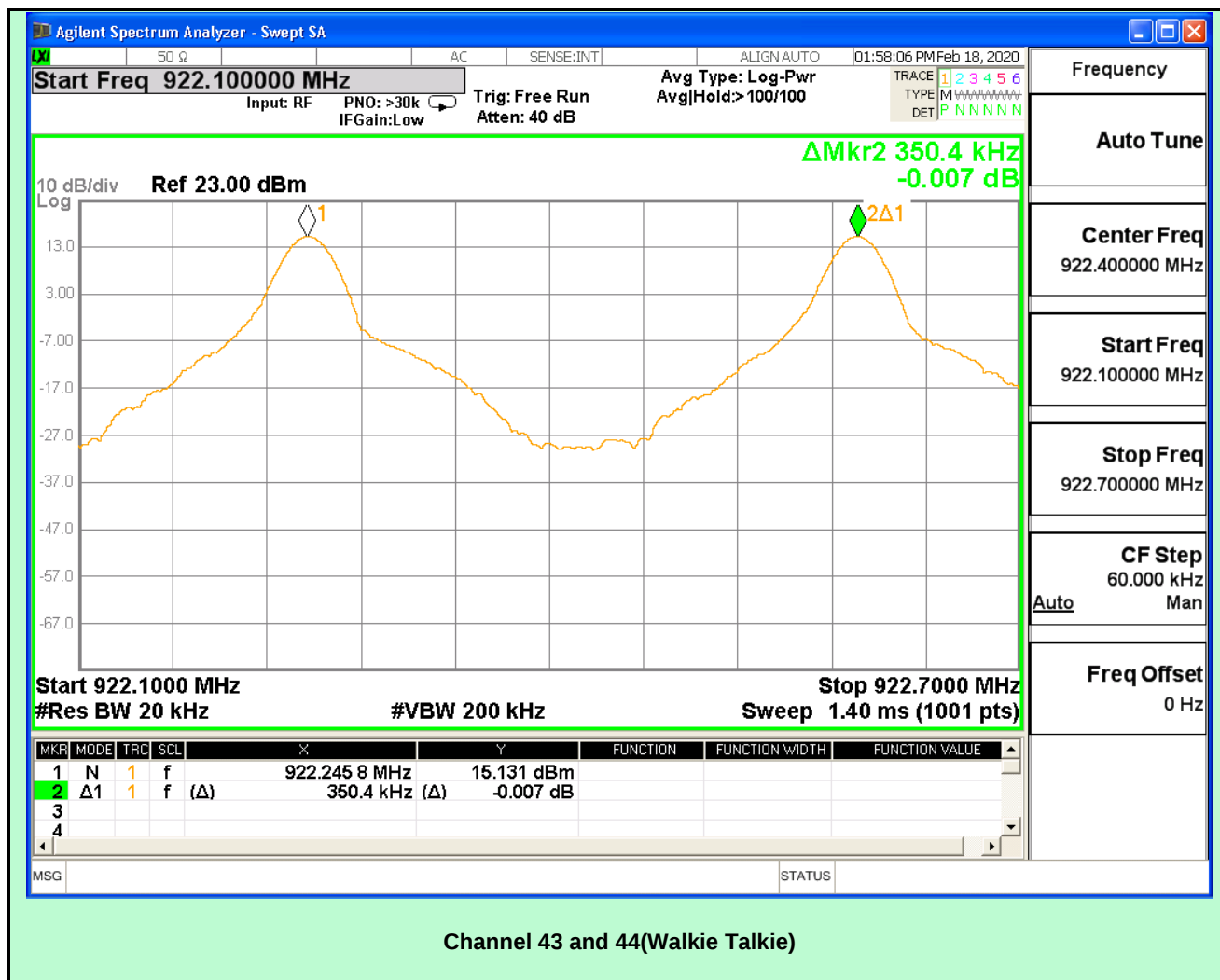


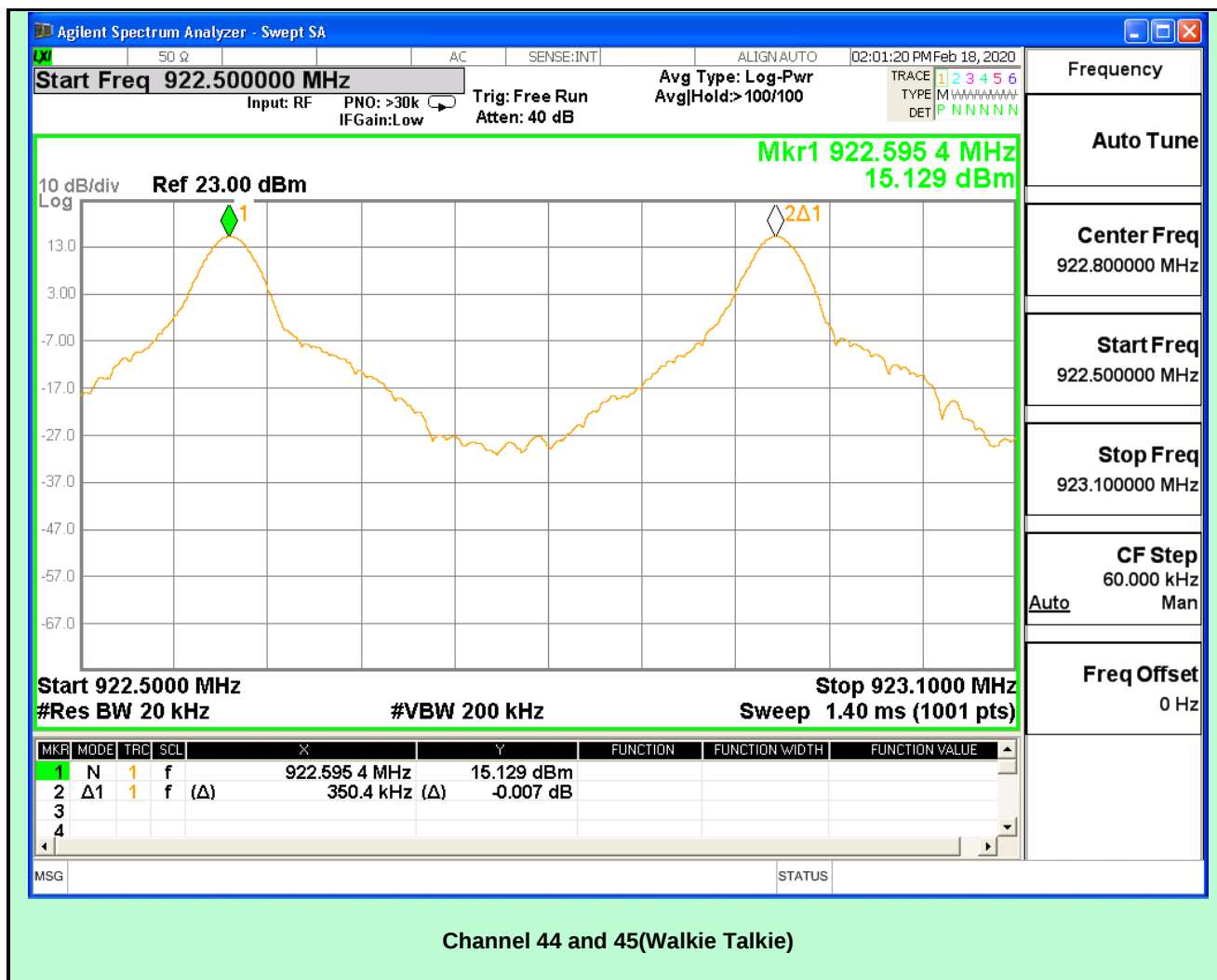


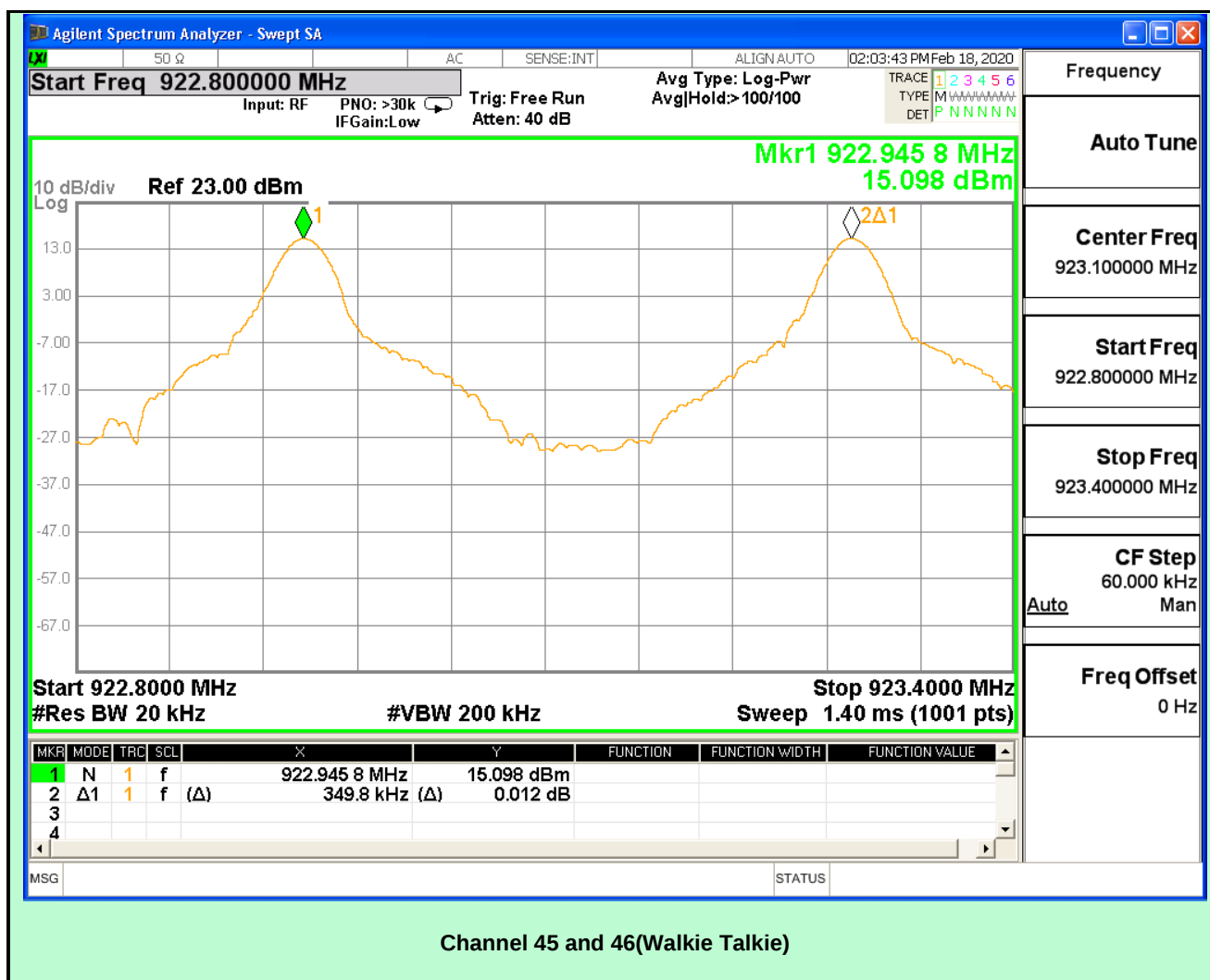


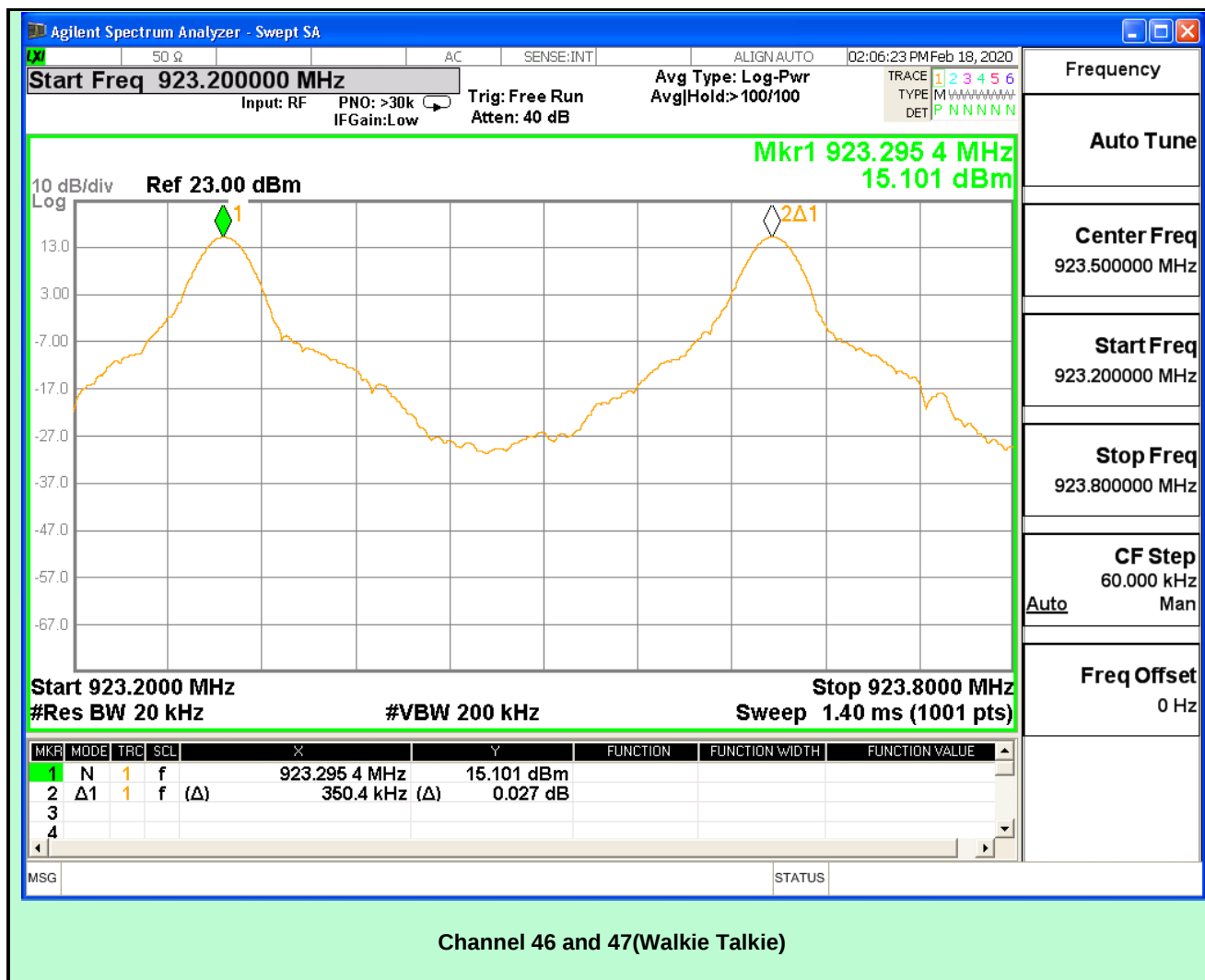


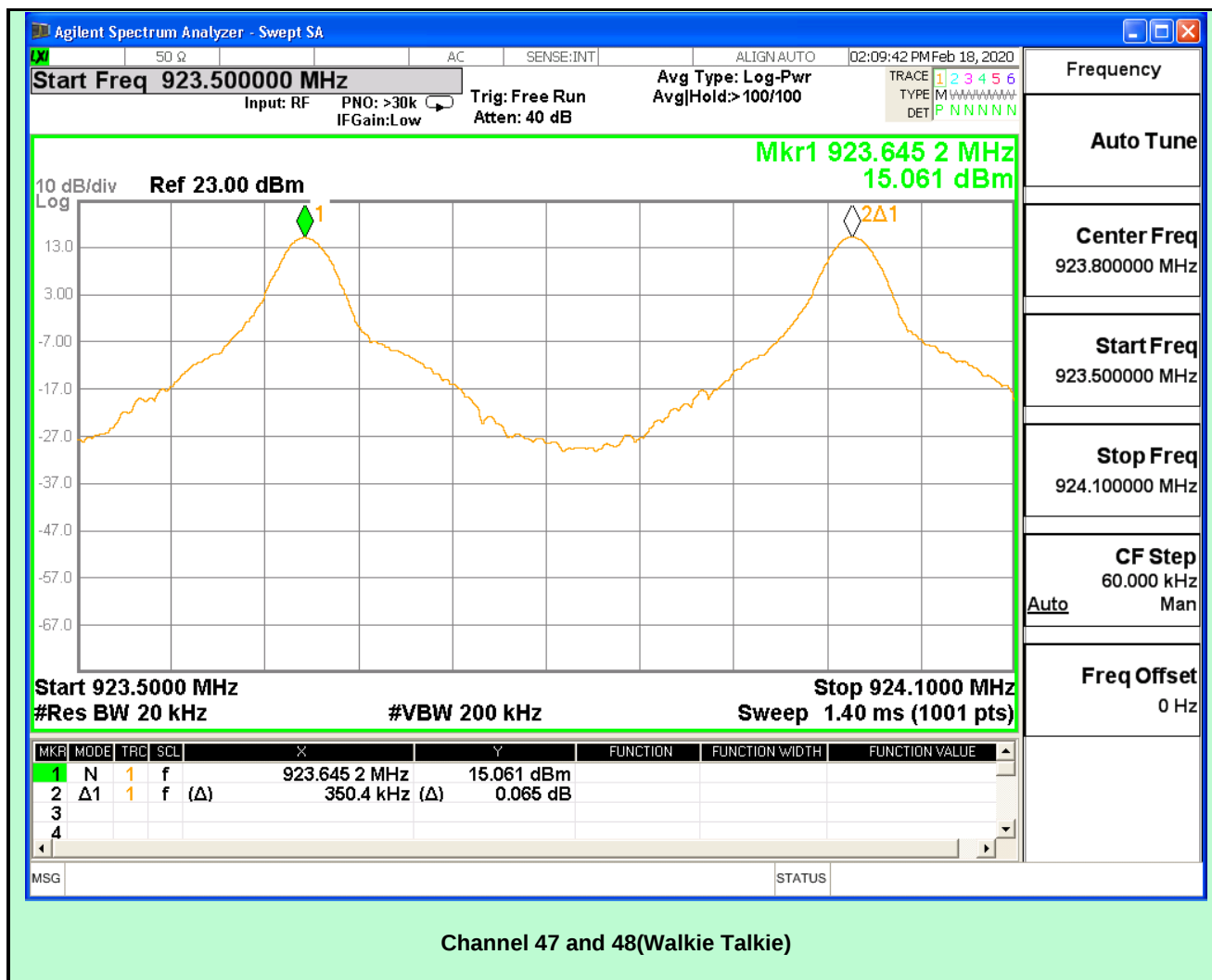


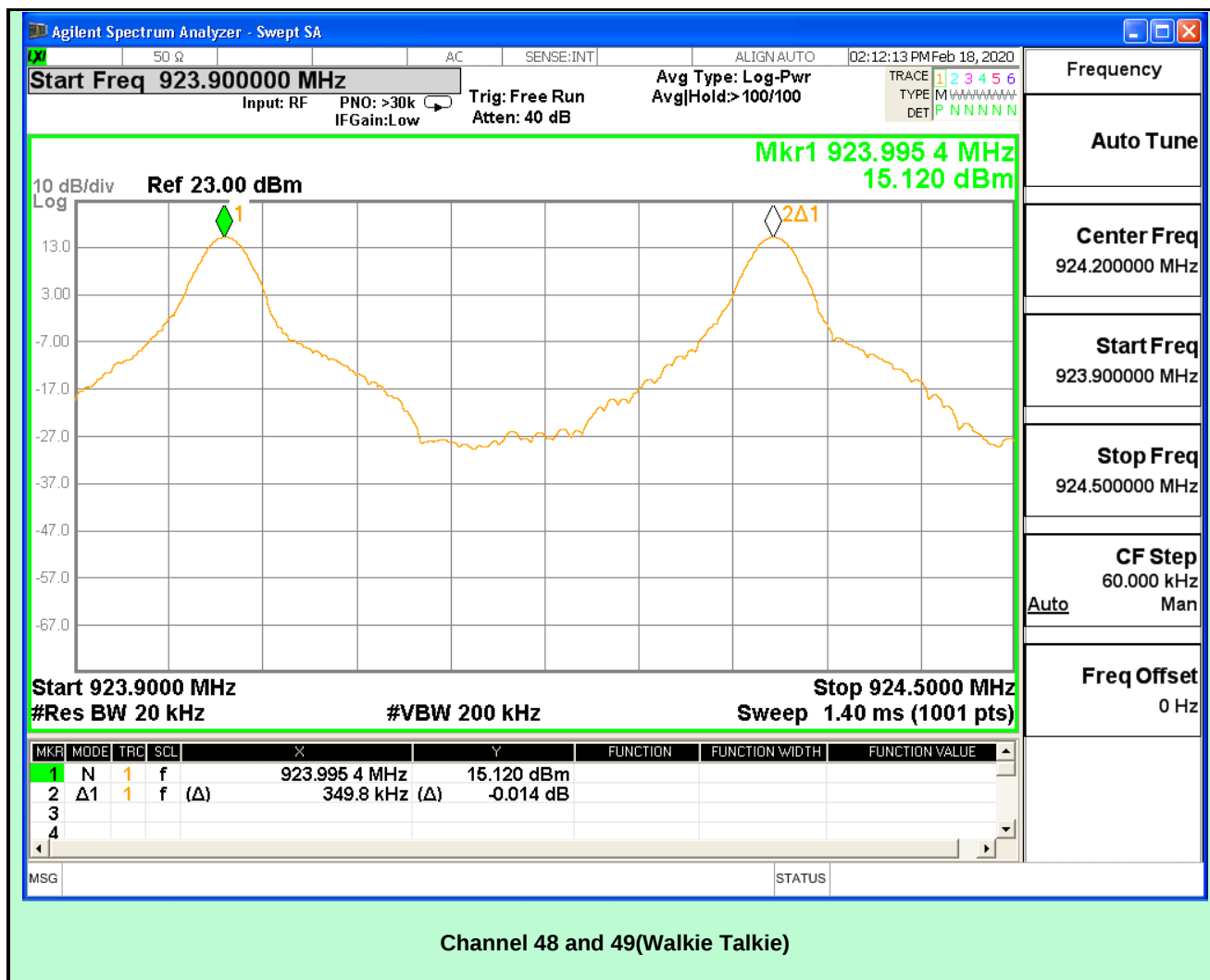


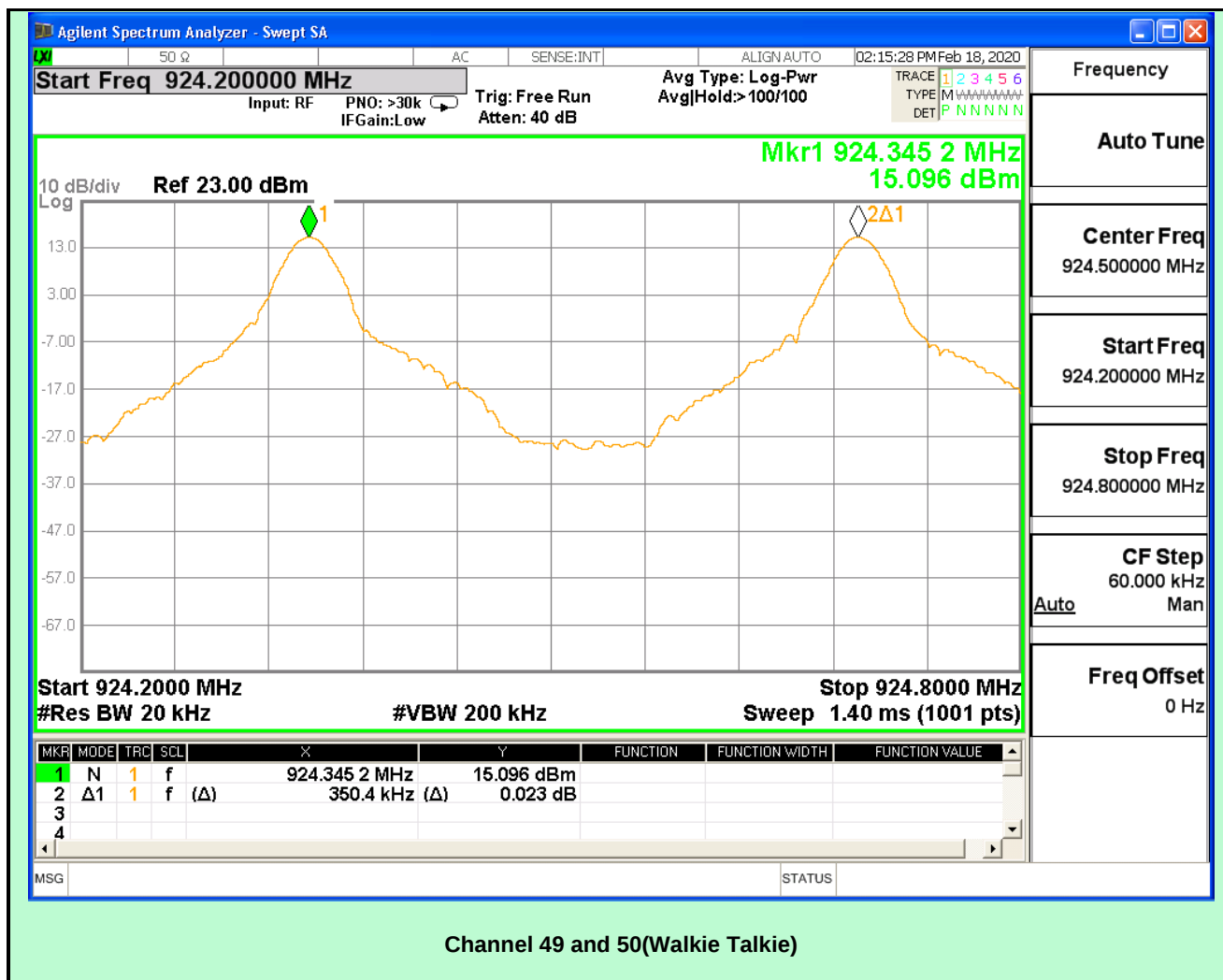


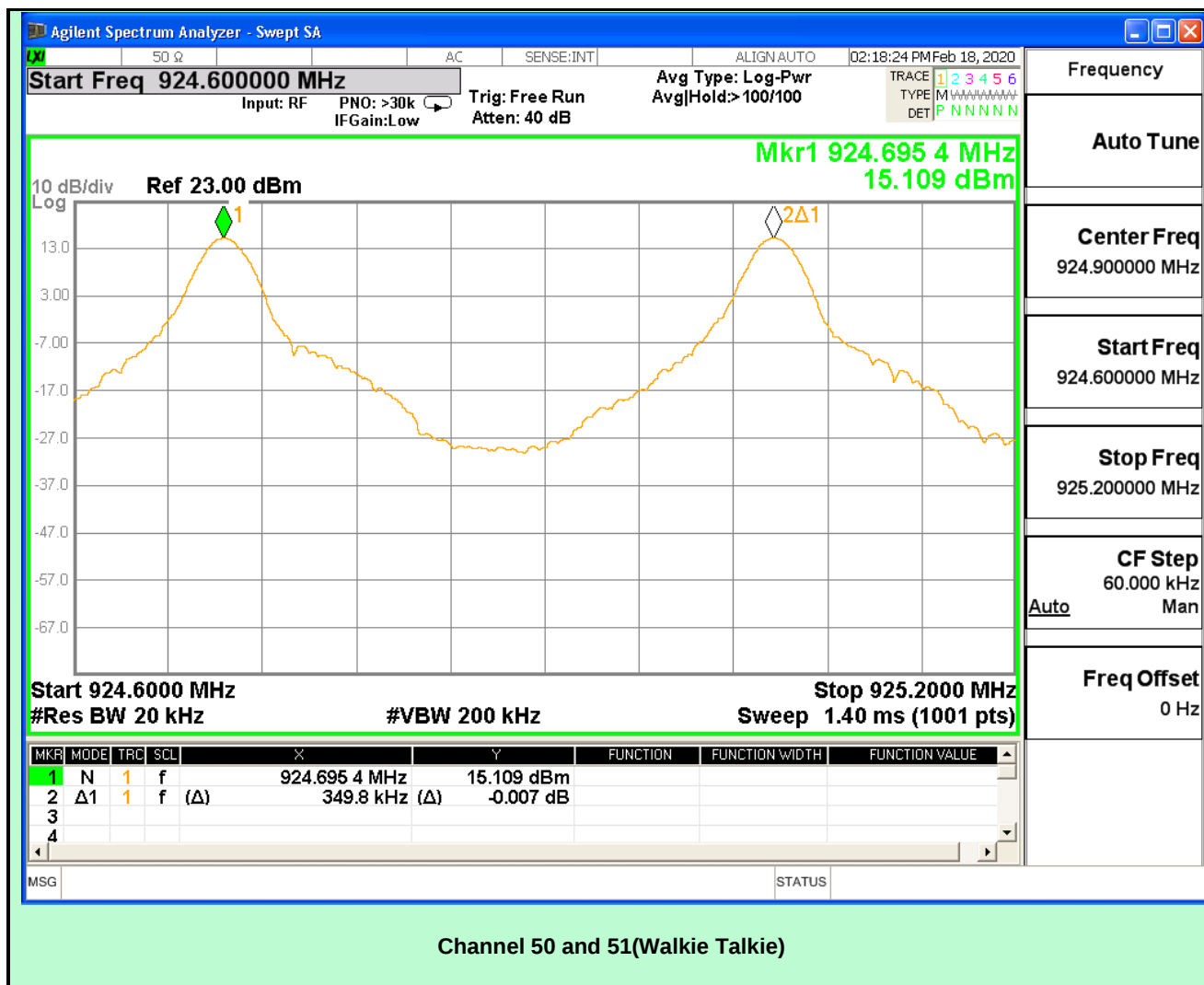


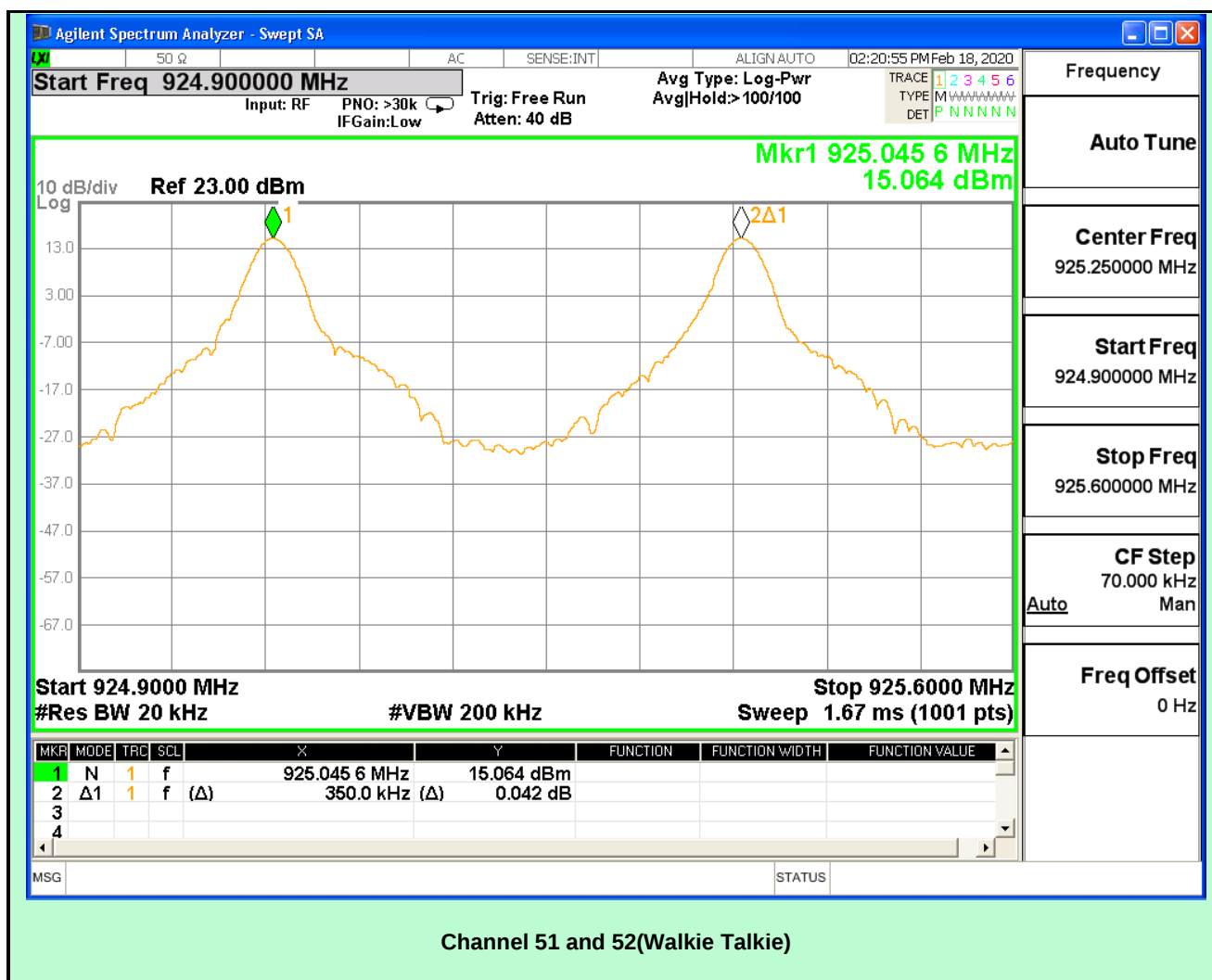


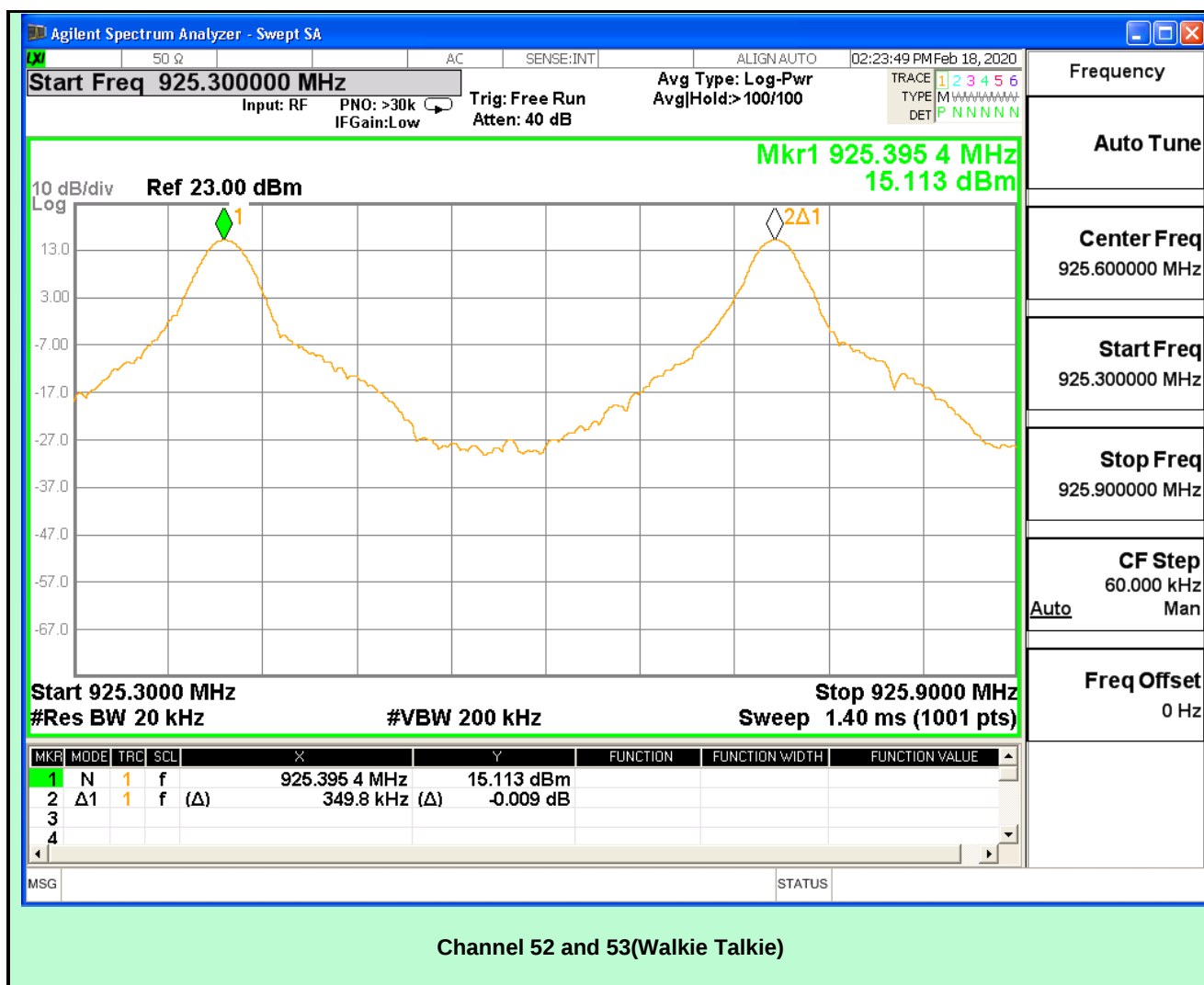


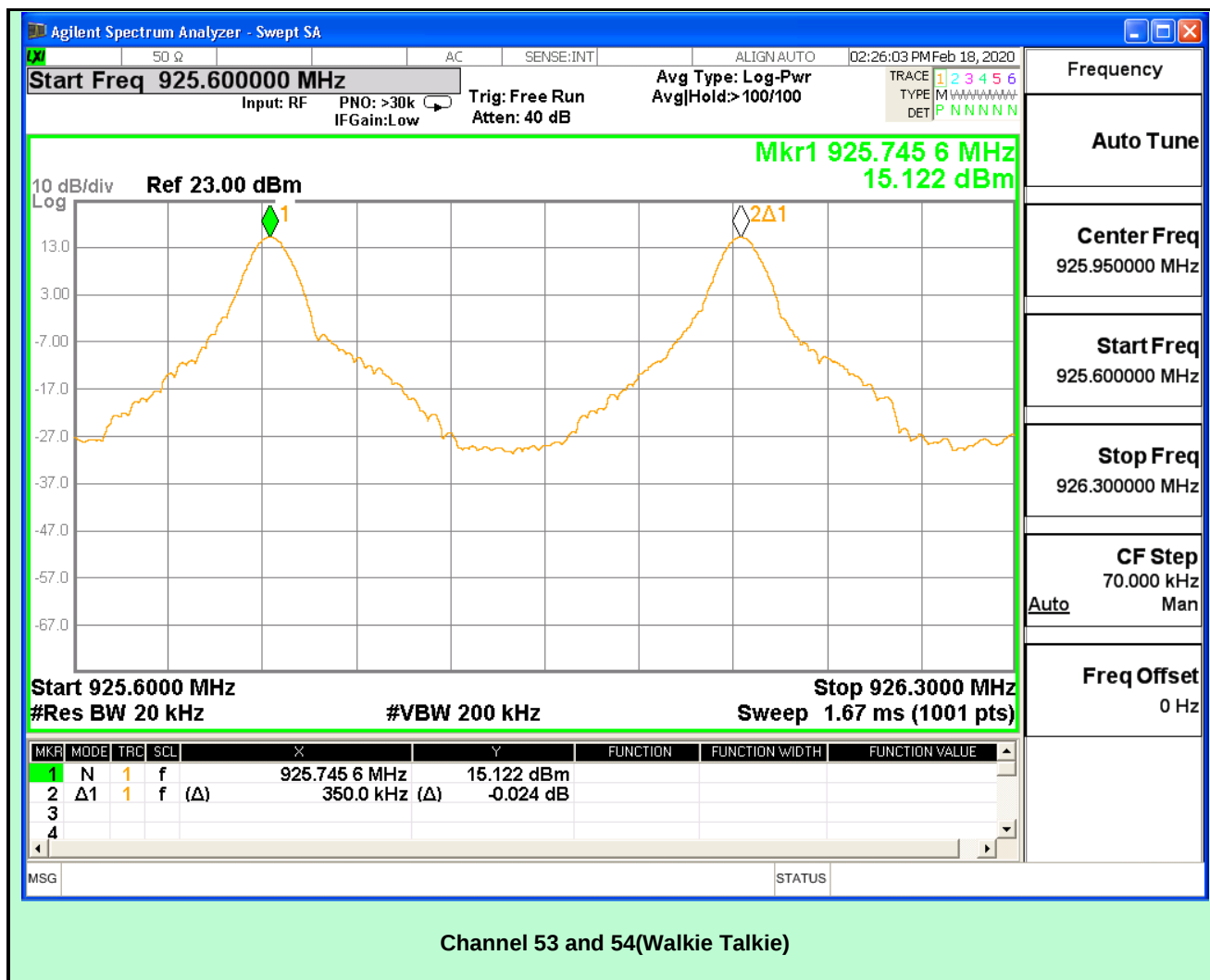


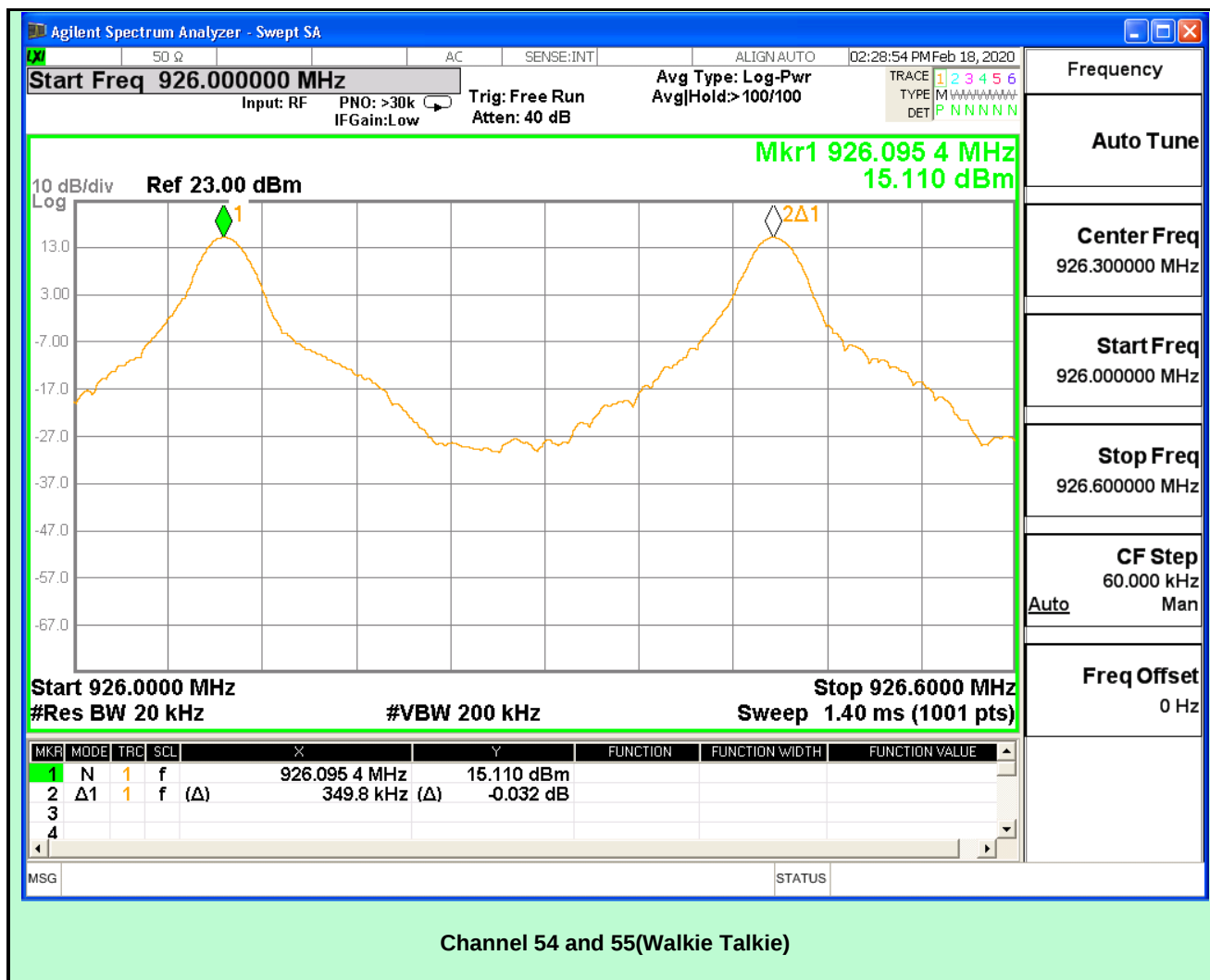












TEST RESULTS			
Channel No	Measured Value	Limit	Test Results
#	KHz		
1 and 2	350	>20dB BW(320KHz)	PASS
2 and 3	350.7	>20dB BW(320KHz)	PASS
3 and 4	350	>20dB BW(320KHz)	PASS
4 and 5	350	>20dB BW(320KHz)	PASS
5 and 6	350	>20dB BW(320KHz)	PASS
6 and 7	350.7	>20dB BW(320KHz)	PASS
7 and 8	350	>20dB BW(320KHz)	PASS
8 and 9	350	>20dB BW(320KHz)	PASS
9 and 10	350	>20dB BW(320KHz)	PASS
10 and 11	350.7	>20dB BW(320KHz)	PASS
11 and 12	350	>20dB BW(320KHz)	PASS
12 and 13	349.3	>20dB BW(320KHz)	PASS
13 and 14	1350	>20dB BW(320KHz)	PASS
14 and 42	11799	>20dB BW(320KHz)	PASS
15 and 16	350	>20dB BW(320KHz)	PASS
16 and 17	350.4	>20dB BW(320KHz)	PASS
17 and 18	350.4	>20dB BW(320KHz)	PASS
18 and 19	349.8	>20dB BW(320KHz)	PASS
19 and 20	350.4	>20dB BW(320KHz)	PASS
20 and 21	350	>20dB BW(320KHz)	PASS
21 and 22	350.4	>20dB BW(320KHz)	PASS
22 and 23	350.4	>20dB BW(320KHz)	PASS
23 and 24	350.7	>20dB BW(320KHz)	PASS
24 and 25	349.2	>20dB BW(320KHz)	PASS
25 and 26	349.3	>20dB BW(320KHz)	PASS
26 and 27	350	>20dB BW(320KHz)	PASS
27 and 28	2351	>20dB BW(320KHz)	PASS
28 and 29	350	>20dB BW(320KHz)	PASS
29 and 30	350.4	>20dB BW(320KHz)	PASS
30 and 31	351	>20dB BW(320KHz)	PASS
31 and 32	350.4	>20dB BW(320KHz)	PASS
32 and 33	351	>20dB BW(320KHz)	PASS
33 and 34	349.8	>20dB BW(320KHz)	PASS
34 and 35	350.4	>20dB BW(320KHz)	PASS
35 and 36	350	>20dB BW(320KHz)	PASS
36 and 37	350.4	>20dB BW(320KHz)	PASS
37 and 38	349.8	>20dB BW(320KHz)	PASS
38 and 39	351	>20dB BW(320KHz)	PASS
39 and 40	349.8	>20dB BW(320KHz)	PASS
40 and 41	349.2	>20dB BW(320KHz)	PASS
42 and 43	1351	>20dB BW(320KHz)	PASS
43 and 44	350.4	>20dB BW(320KHz)	PASS
44 and 45	350.4	>20dB BW(320KHz)	PASS
45 and 46	349.8	>20dB BW(320KHz)	PASS
46 and 47	350.4	>20dB BW(320KHz)	PASS
47 and 48	350.4	>20dB BW(320KHz)	PASS

48 and 49	349.8	>20dB BW(320KHz)	PASS
49 and 50	350.4	>20dB BW(320KHz)	PASS
50 and 51	349.8	>20dB BW(320KHz)	PASS
51 and 52	350	>20dB BW(320KHz)	PASS
52 and 53	349.8	>20dB BW(320KHz)	PASS
53 and 54	350	>20dB BW(320KHz)	PASS
54 and 55	349.8	>20dB BW(320KHz)	PASS

TEST SETUP PHOTOGRAPH

Refer Annexure -1

Conducted RF Test setup

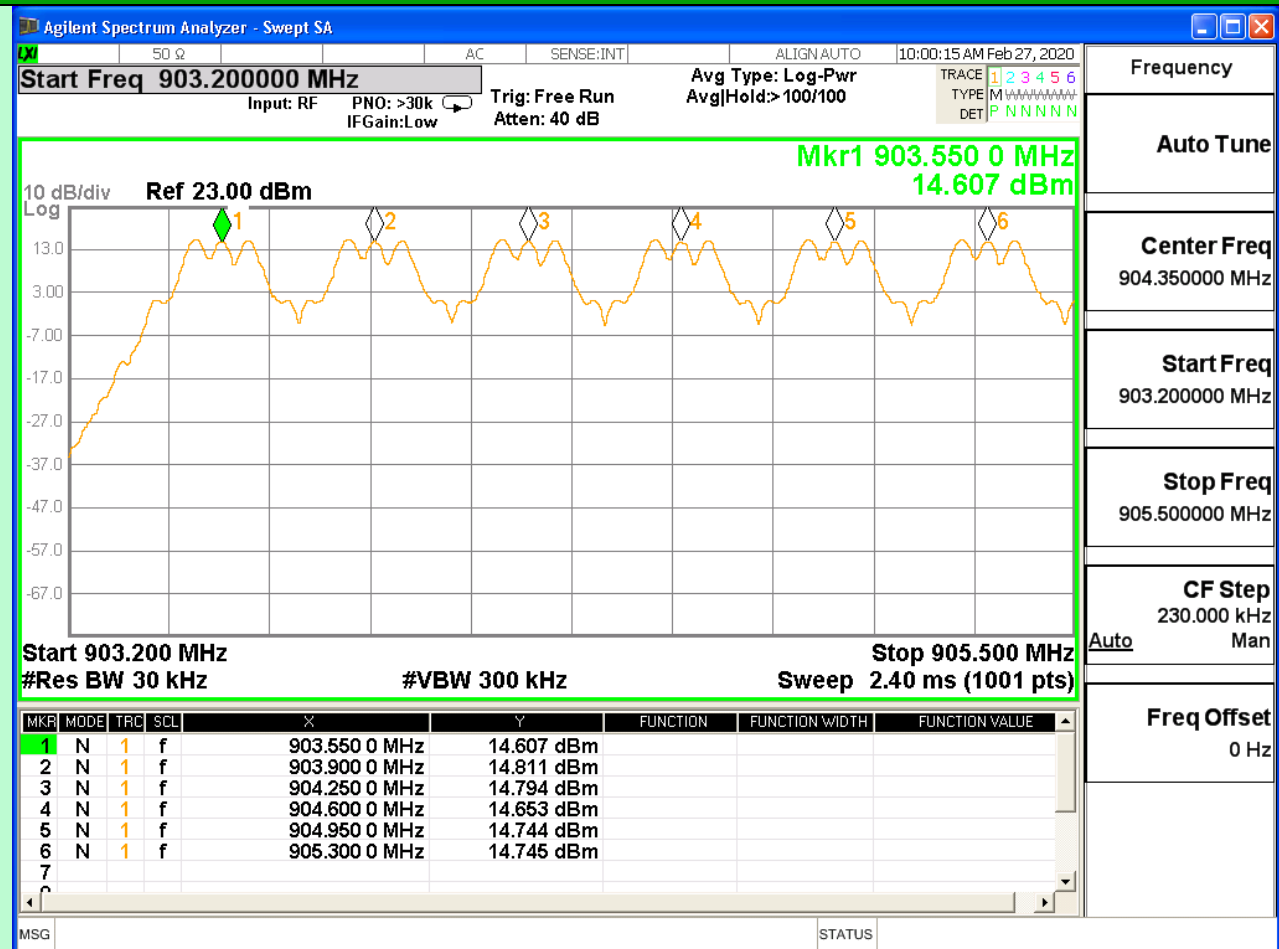
2.4 NUMBER OF HOPPING CHANNELS

EUT Nomenclature	Wireless Monitor Module	Test Request No.	EMC0418-1
Model No.	FW-MM	Serial No.	127
Test Start Date	14-Dec-2019	Temperature (°C)	23.6°C
Test End Date	26-Feb-2020	Humidity RH (%)	51.9%RH
Tested By	Vinay Gujjar	Pressure (mbar)	NR
Input Voltage /	3.3Vdc		
Operating Mode	Refer Page 5 for Operating Mode Table		
Test configuration	Refer Page 5 for Test Configuration Table		
Deviation from Std.	NA		
Applicable standard	FCC Part 15.247:2010		
Test Method	DA 00-705		
Comment	NA		
TEST DETAILS			
Method	Radiated ☐	Conducted ☒	
TEST PARAMETERS			
Antenna Height	NA	Turntable Rotation	NA
Equipment Class	NA	Measurement Distance	NA

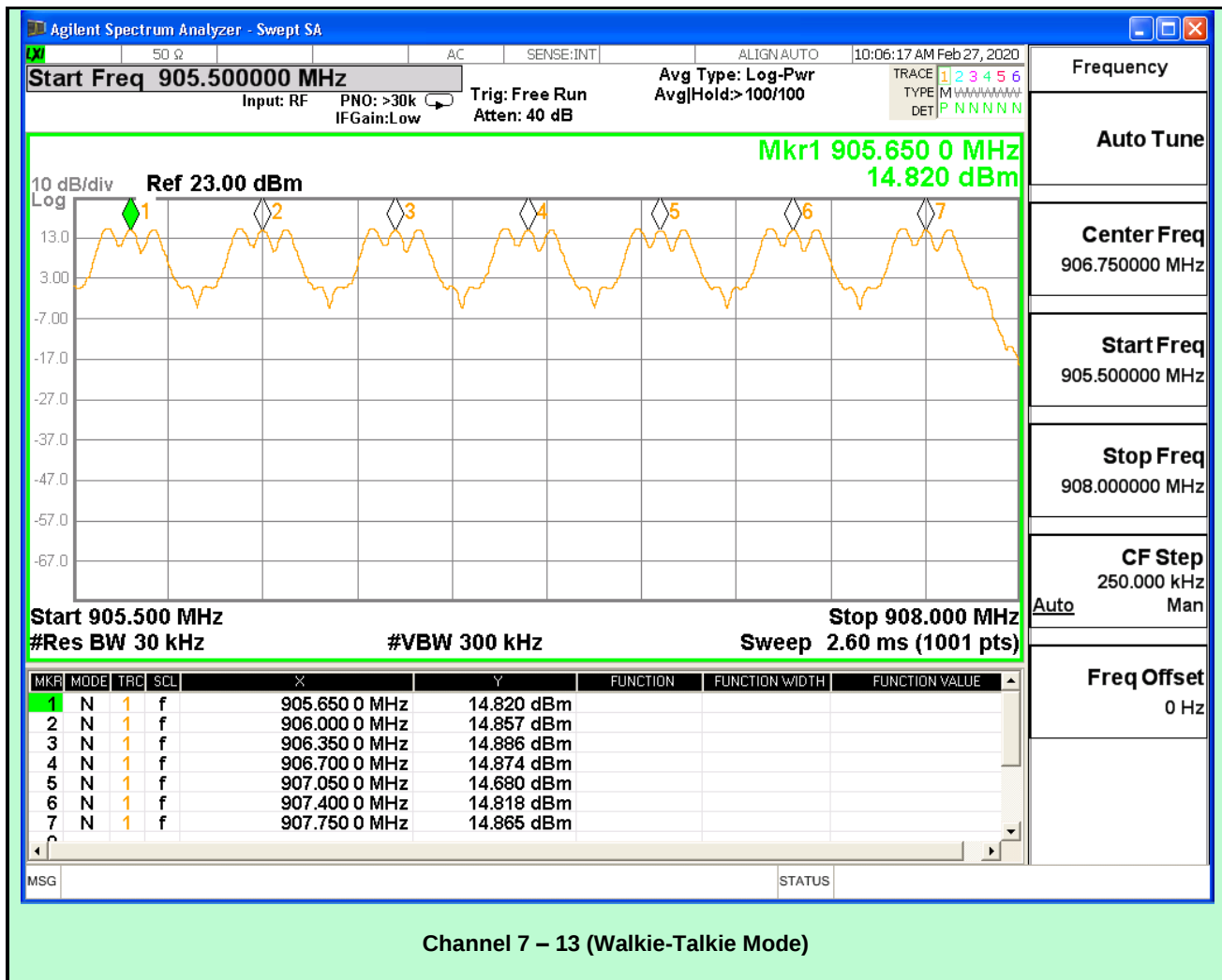
TEST EQUIPMENT

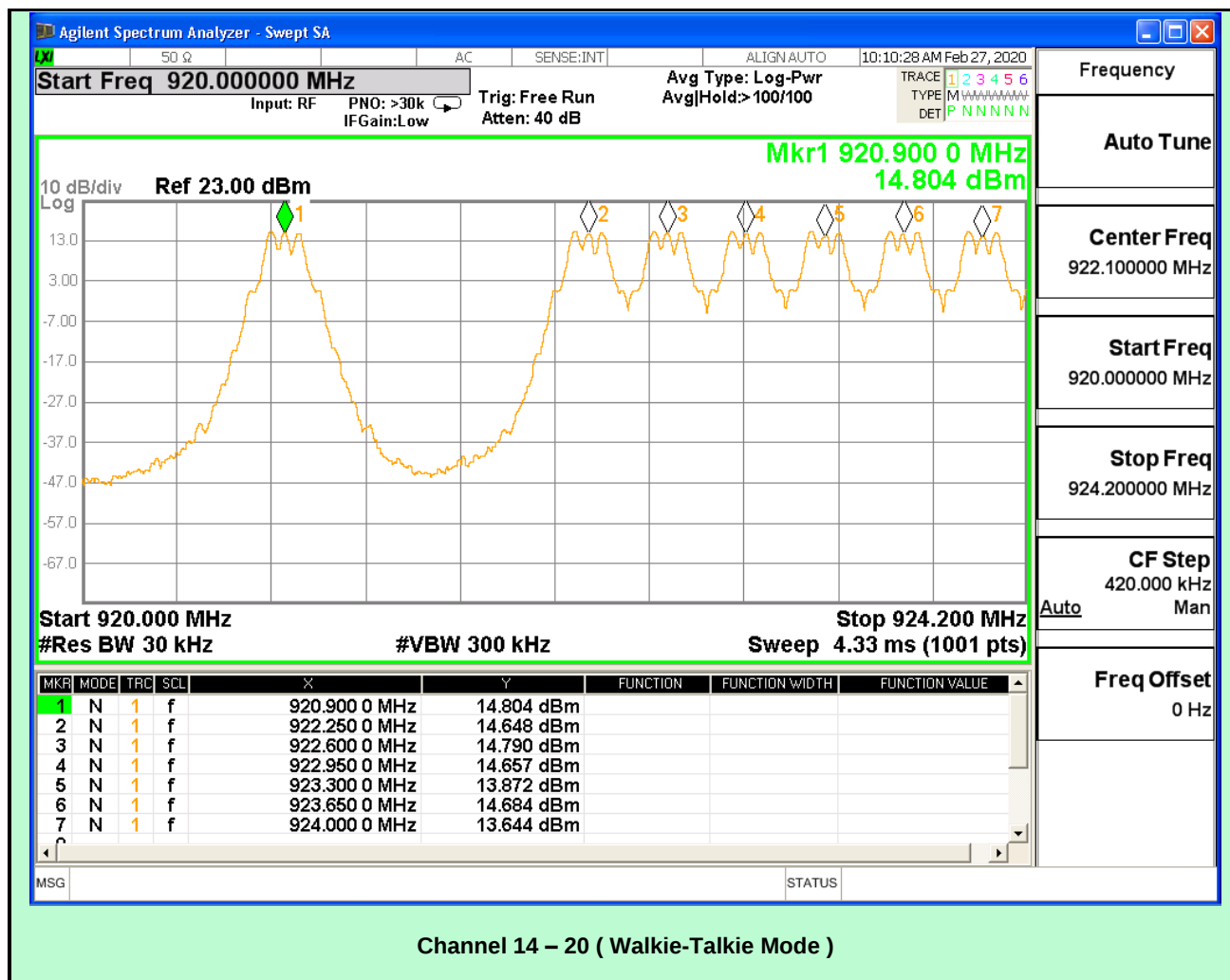
Y/N	Equipment	Make	Model	Sl. No.	Cal Due Date
Y	Spectrum Analyzer	Agilent	N9010A	MY48031005	27-Feb-2021
Y	RF Cable	Huber- Suhner	SF104/2X11PC3542/500	NA	NA

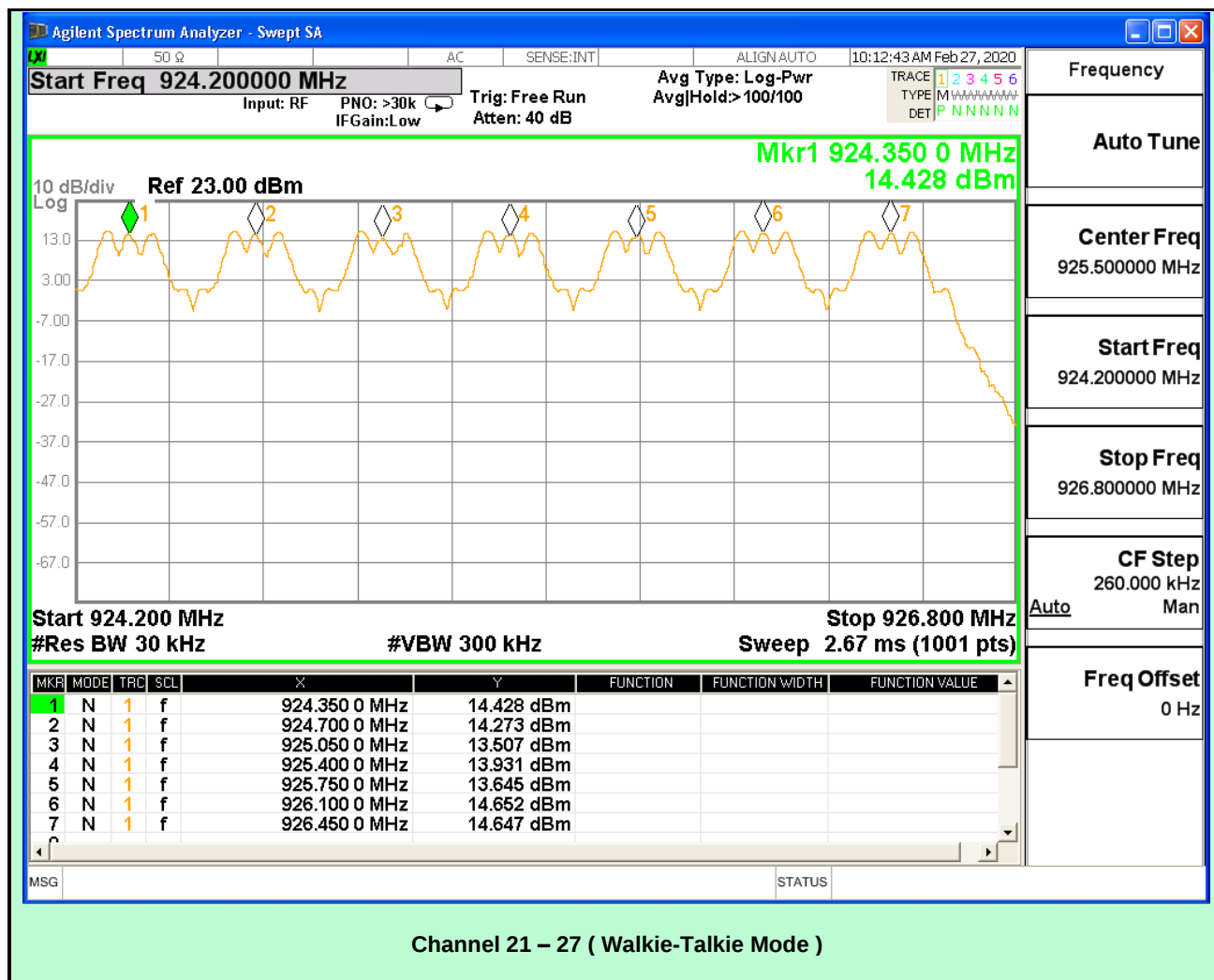
TEST GRAPHS

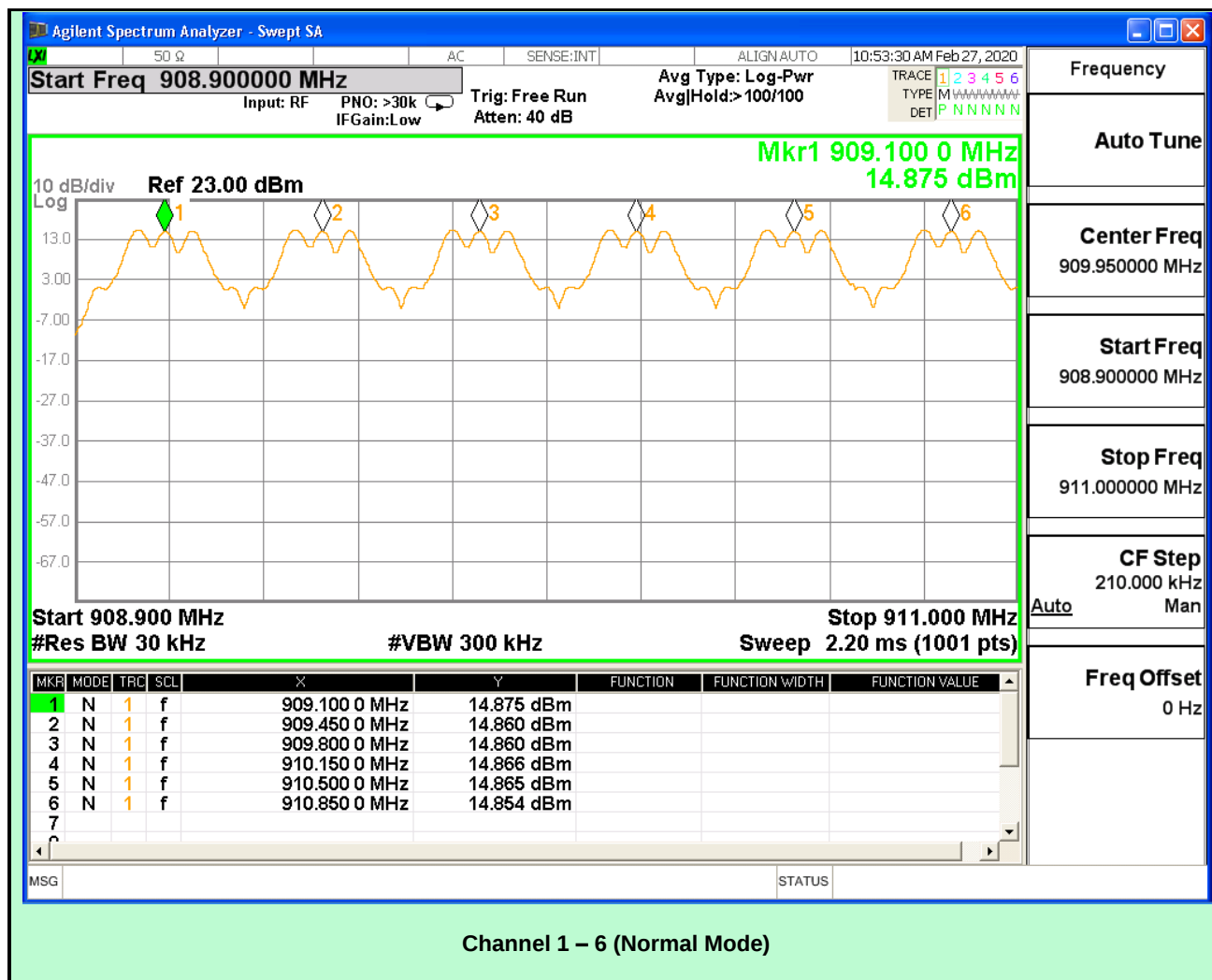


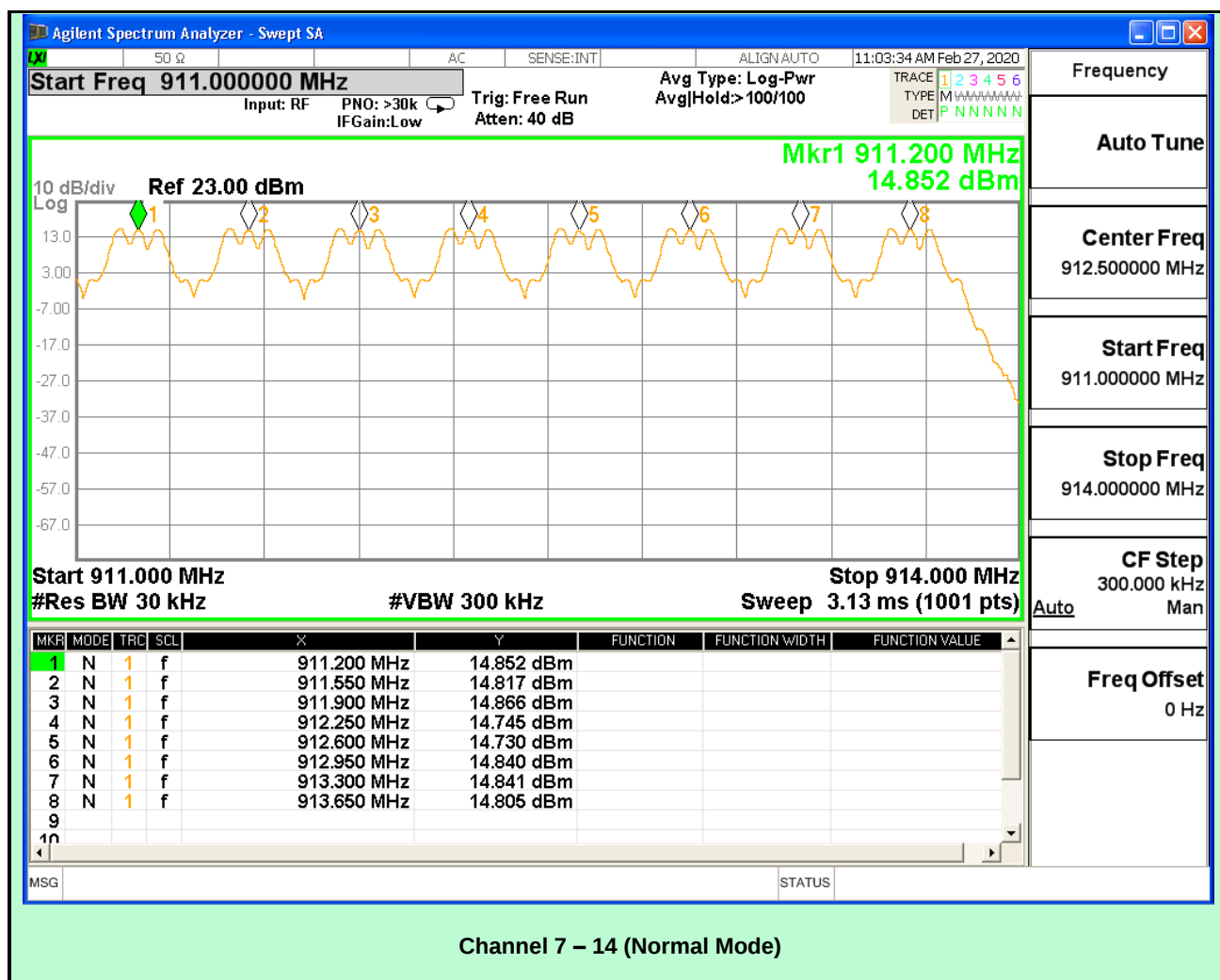
Channel 1 – 6 (Walkie-Talkie Mode)

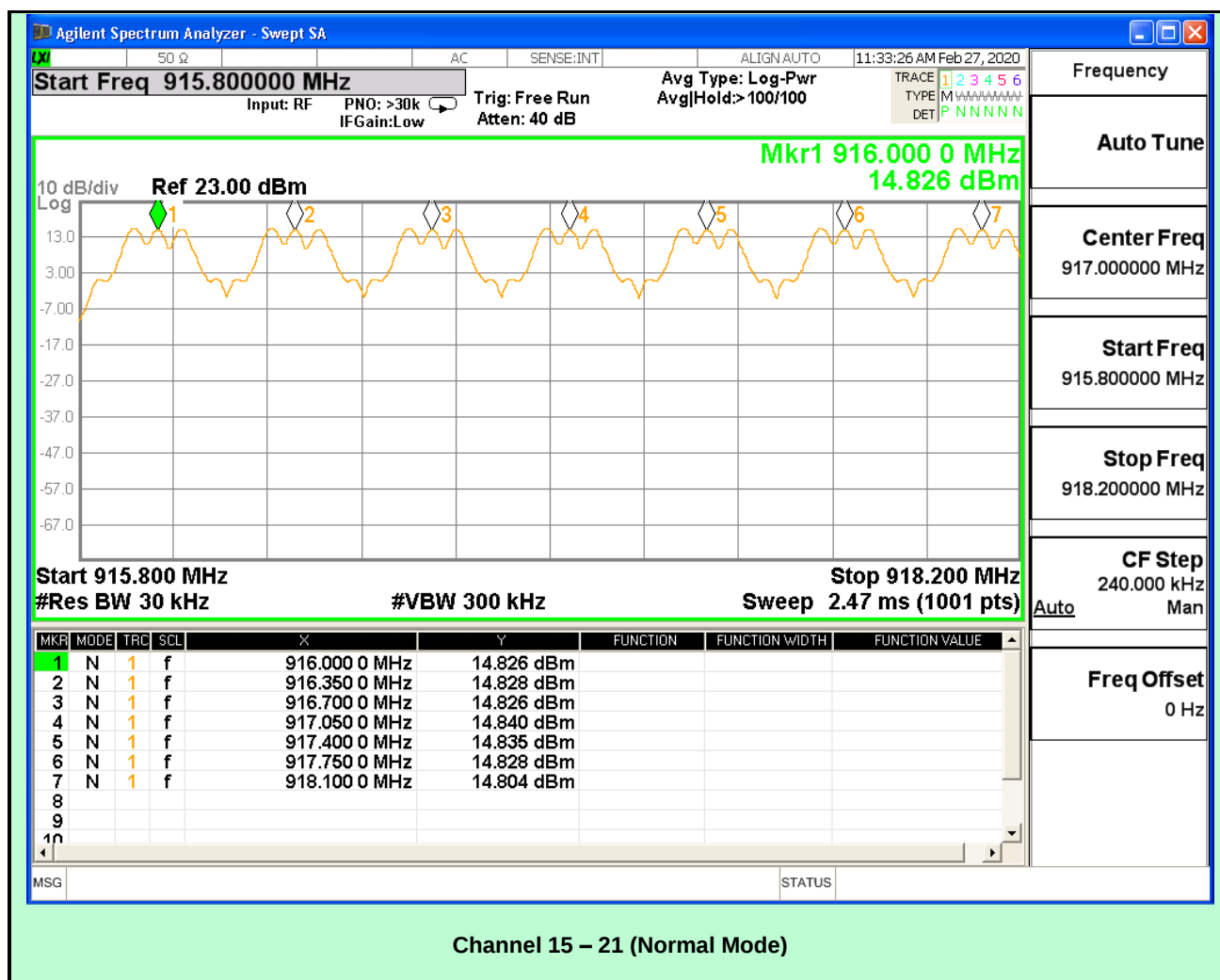


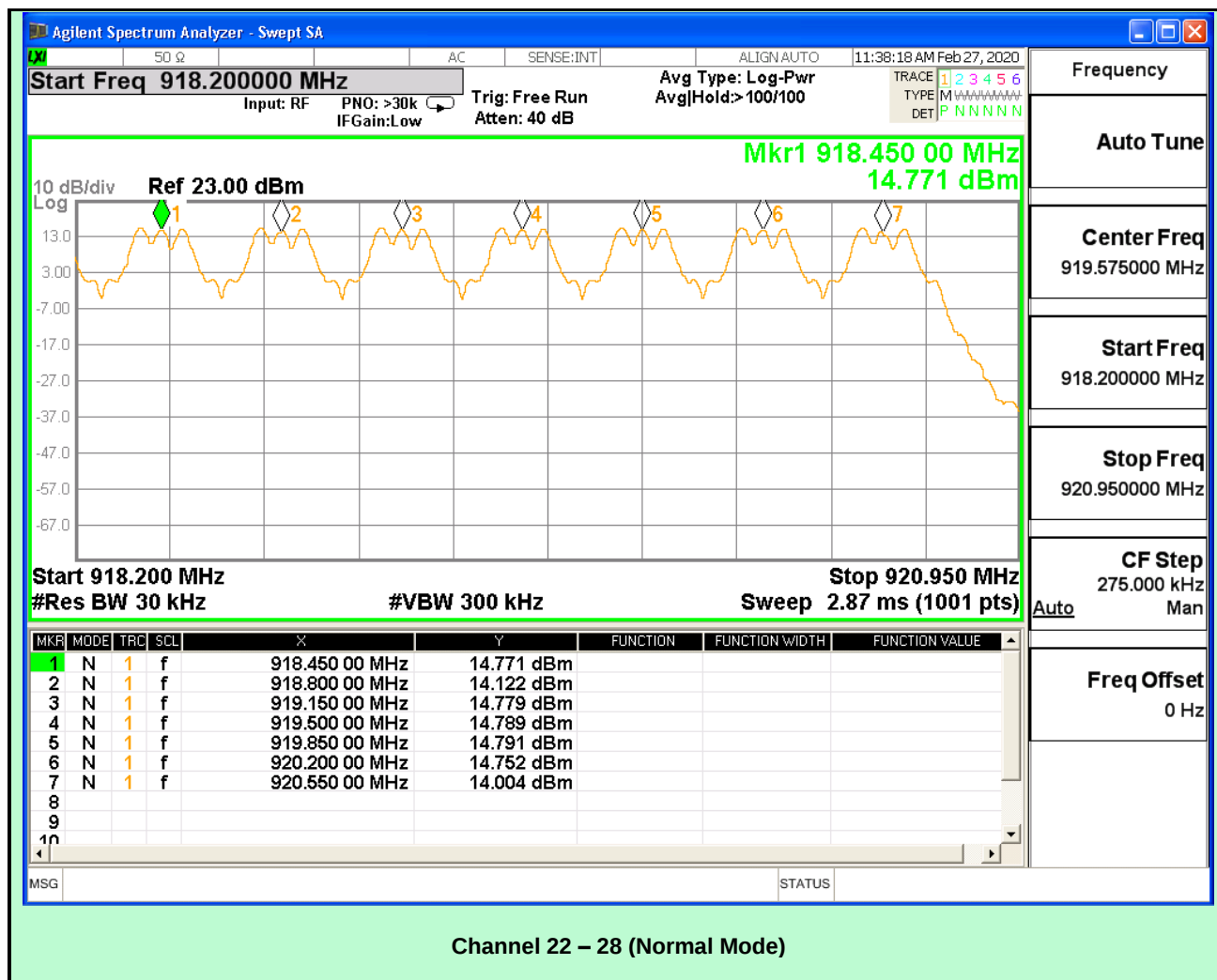












TEST RESULTS

Mode of Operation	No. of Channels Measured	Limit (No. of Channels)	Test Results
#	#	#	
Normal Mode	28	≥25	PASS
Walkie-Talkie Mode	27	≥25	PASS

TEST SETUP PHOTOGRAPH

Refer Annexure -1

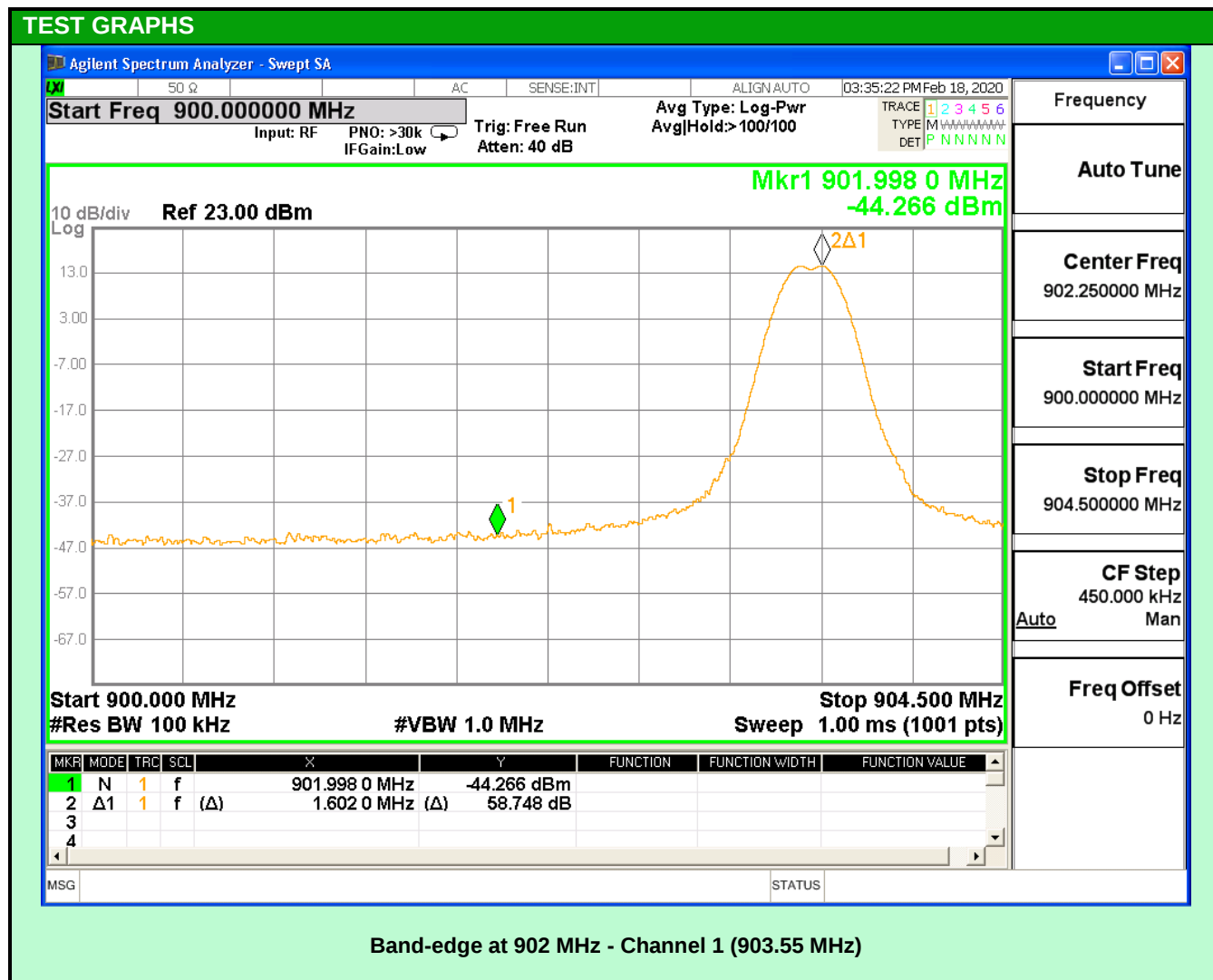
Conducted RF Test setup

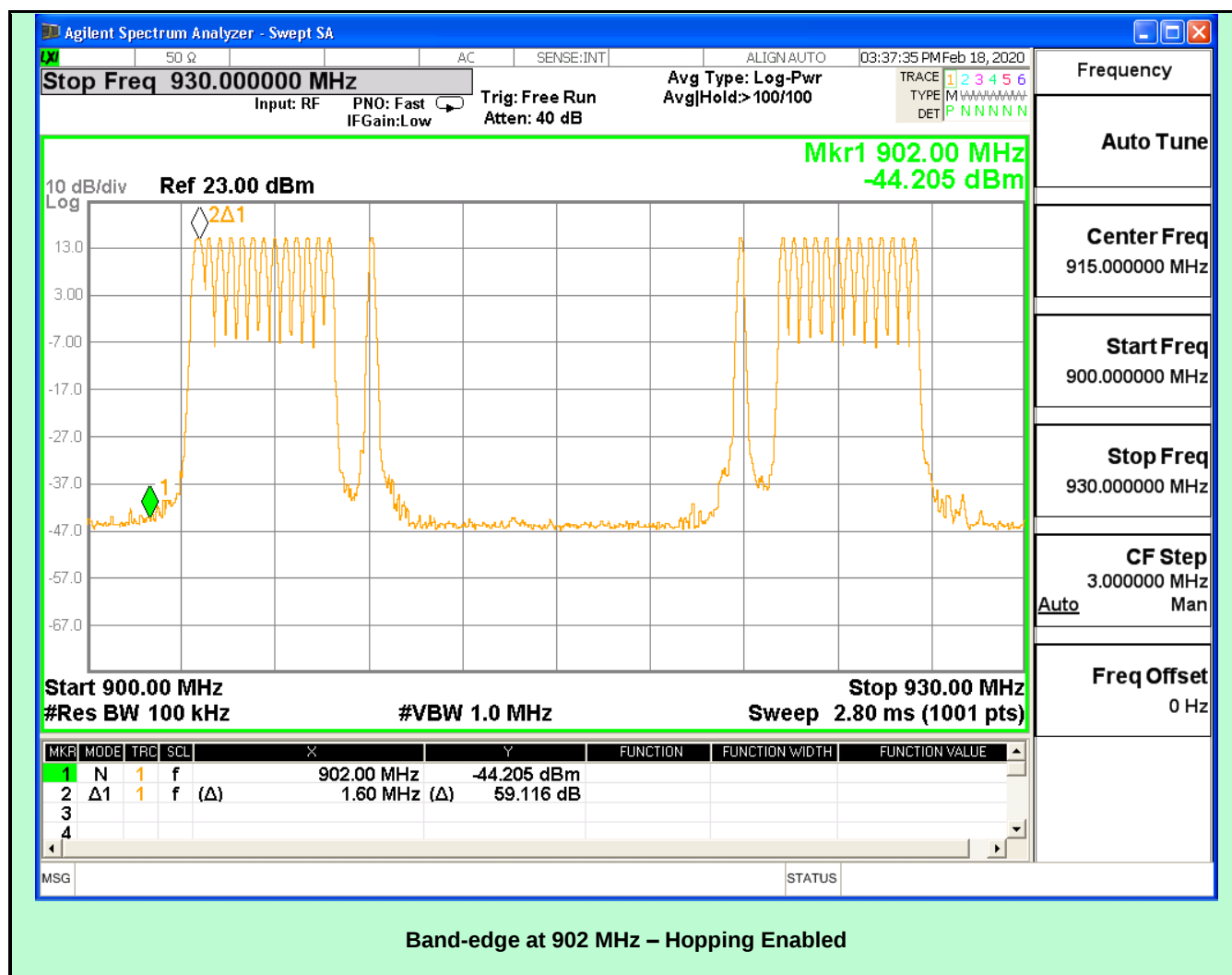
2.5 BAND EDGE COMPLIANCE

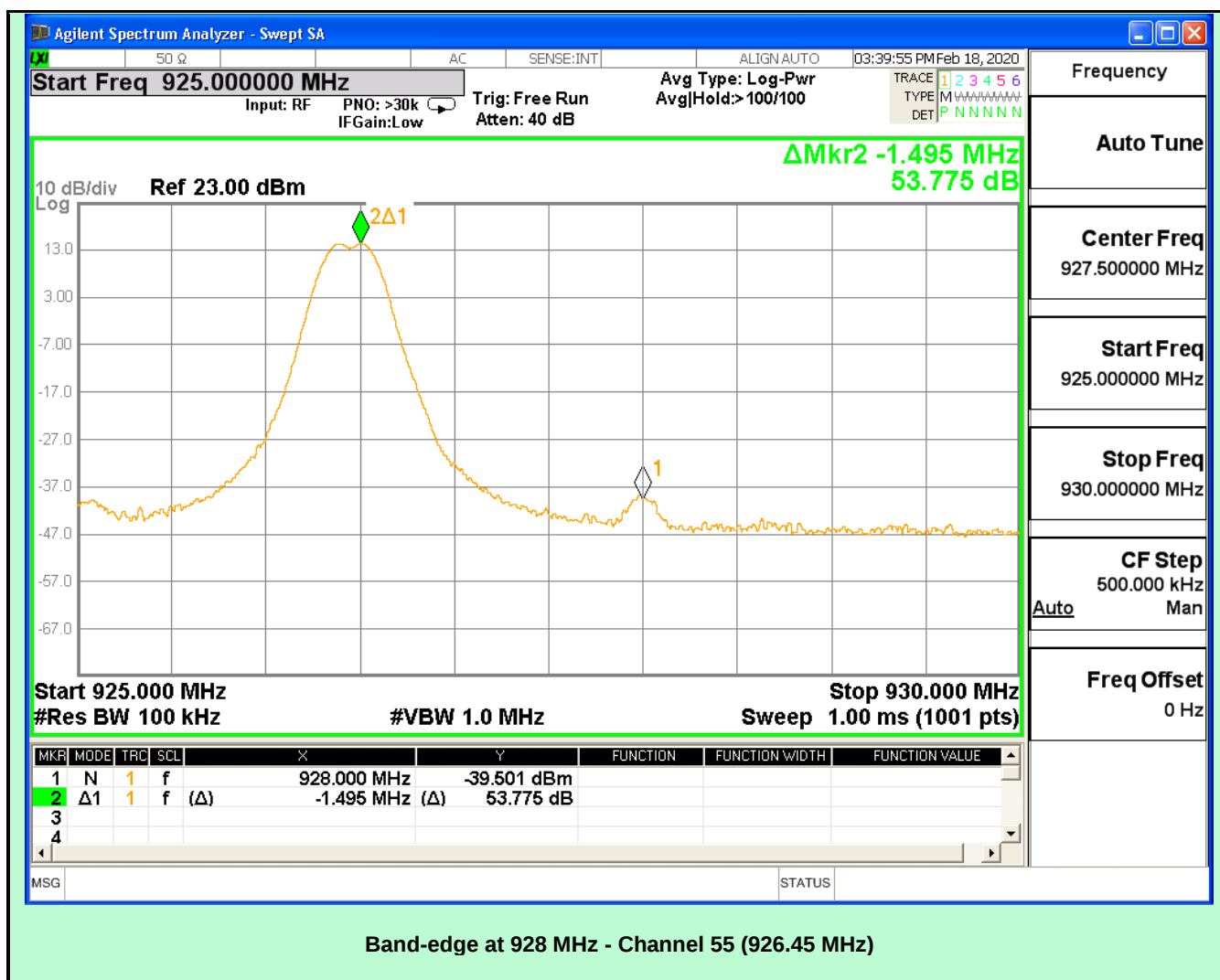
EUT Nomenclature	Wireless Monitor Module	Test Request No.	EMC0418-1
Model No.	FW-MM	Serial No.	127
Test Start Date	14-Dec-2019	Temperature (°C)	24.3°C
Test End Date	26-Feb-2020	Humidity RH (%)	52.8%RH
Tested By	Vinay Gujjar	Pressure (mbar)	NR
Input Voltage /	3.3Vdc		
Operating Mode	Refer Page 5 for Operating Mode Table		
Test configuration	Refer Page 5 for Test Configuration Table		
Deviation from Std.	NA		
Applicable standard	FCC Part 15.247:2010		
Test Method	DA 00-705		
Comment	NA		
TEST DETAILS			
Method	Radiated ☐		Conducted ☒
TEST PARAMETERS			
Antenna Height	NA	Turntable Rotation	NA
Equipment Class	NA	Measurement Distance	NA

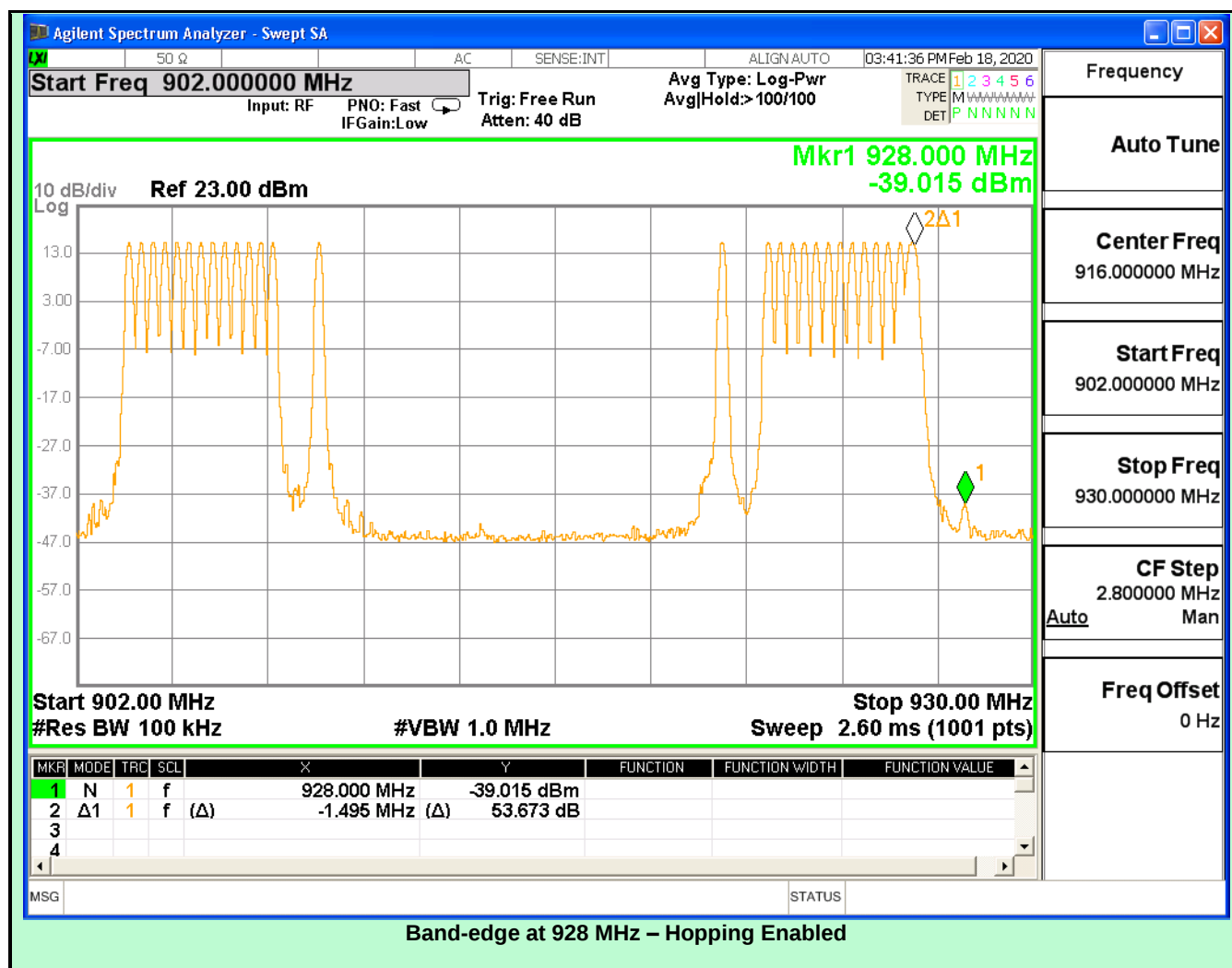
TEST EQUIPMENT

Y/N	Equipment	Make	Model	Sl. No.	Cal Due Date
Y	Spectrum Analyzer	Agilent	N9010A	MY48031005	27-Feb-2021
Y	RF Cable	Huber- Suhner	SF104/2X11PC3542/500	NA	NA









TEST RESULTS

Channel	Frequency	Measured Level- Single Channel	Measured Level – FHSS Enabled	Limit	Test Results
#	MHz	dBc	dBc	dBc	
1	903.55	58.74	59.11	≥20	PASS
55	926.45	53.77	53.67	≥20	PASS

TEST SETUP PHOTOGRAPH

Refer Annexure -1

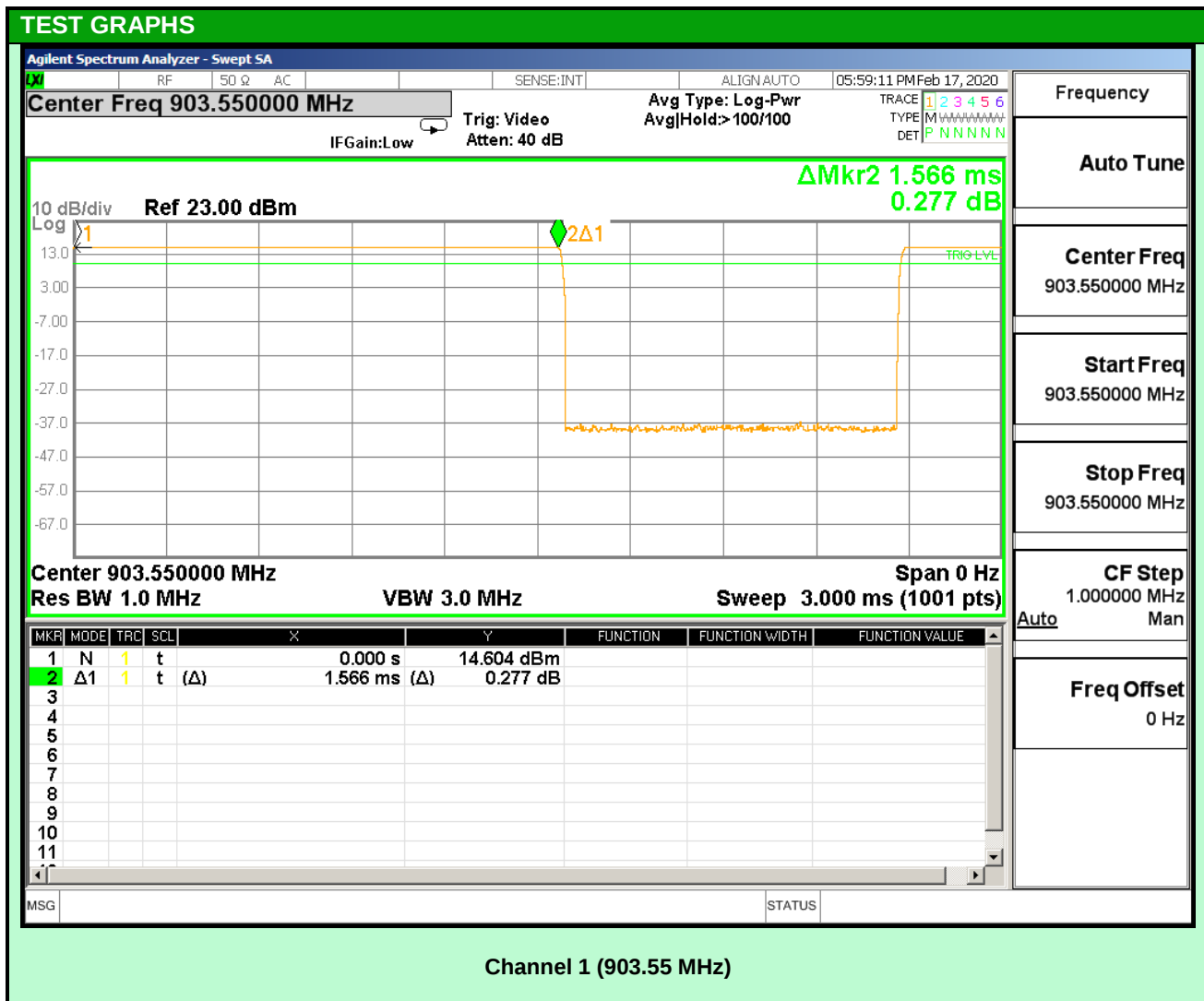
Conducted RF Test setup

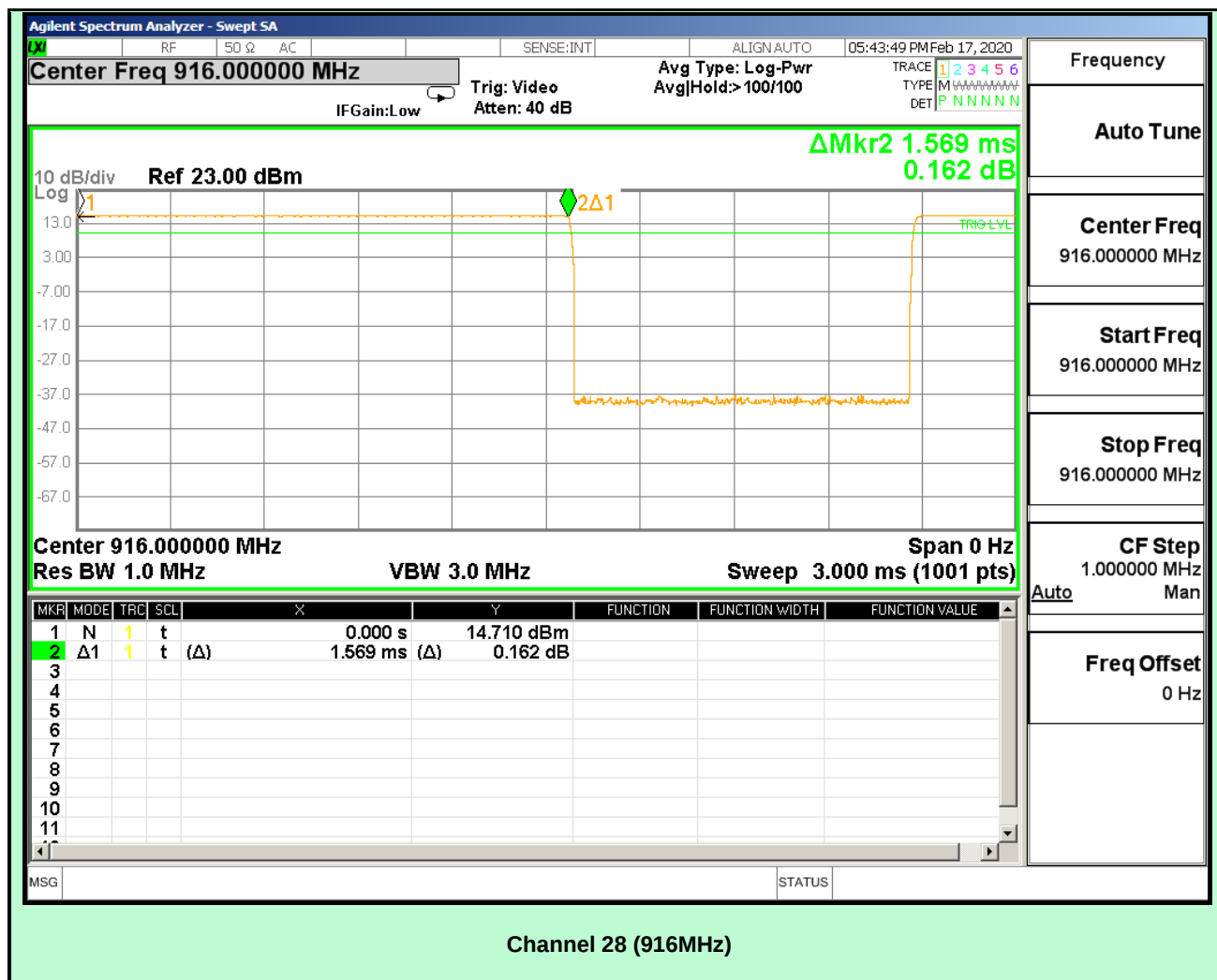
2.6 TIME OF OCCUPANCY (DWELL TIME)

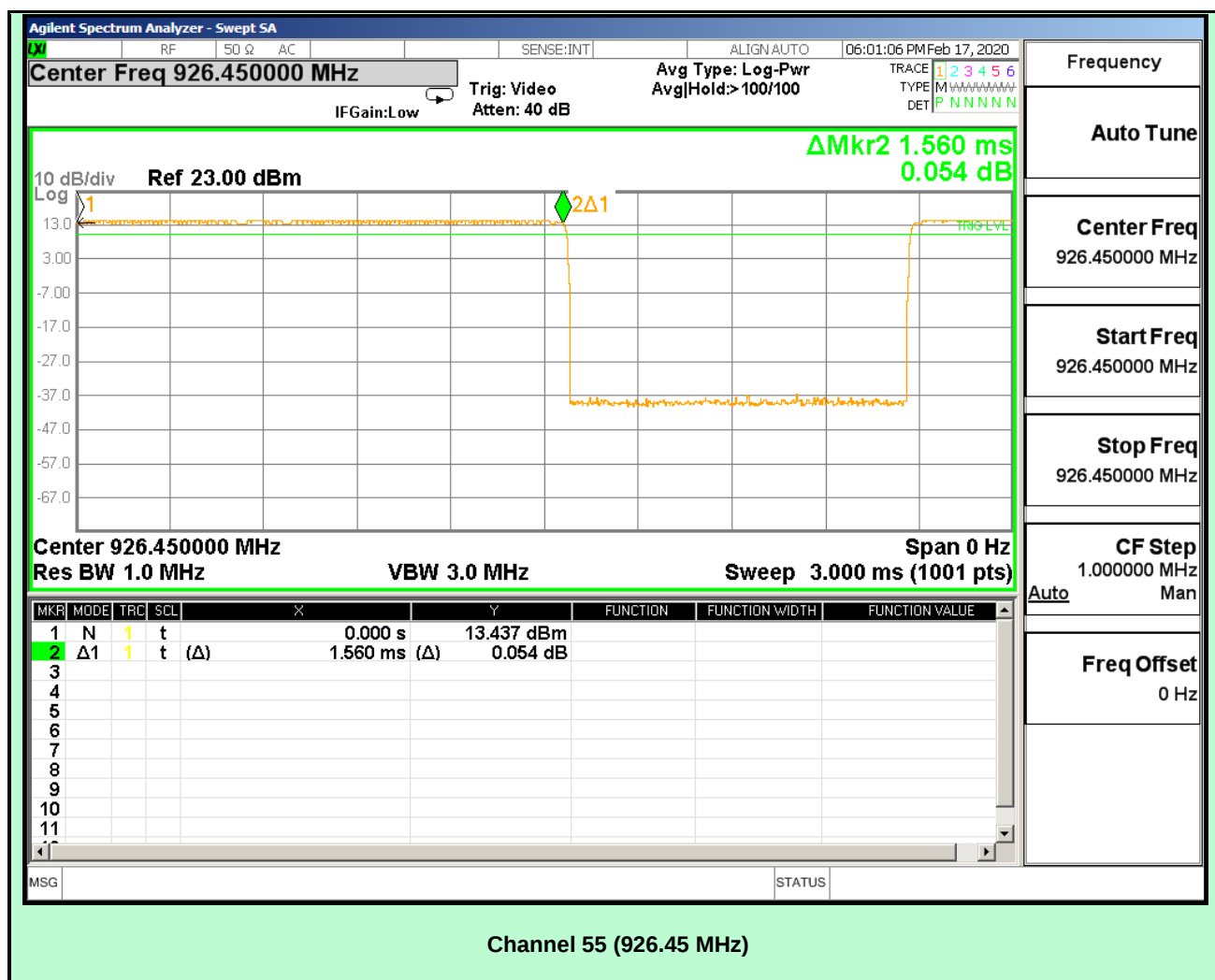
EUT Nomenclature	Wireless Monitor Module	Test Request No.	EMC0418-1
Model No.	FW-MM	Serial No.	127
Test Start Date	14-Dec-2019	Temperature (°C)	23.6°C
Test End Date	26-Feb-2020	Humidity RH (%)	51.9%RH
Tested By	Vinay Gujjar	Pressure (mbar)	NR
Input Voltage /	3.3Vdc		
Operating Mode	Refer Page 5 for Operating Mode Table		
Test configuration	Refer Page 5 for Test Configuration Table		
Deviation from Std.	NA		
Applicable standard	FCC Part 15.247:2010		
Test Method	DA 00-705		
Comment	NA		
TEST DETAILS			
Method	Radiated ☐	Conducted ☒	
TEST PARAMETERS			
Antenna Height	NA	Turntable Rotation	NA
Equipment Class	NA	Measurement Distance	NA

TEST EQUIPMENT

Y/N	Equipment	Make	Model	Sl. No.	Cal Due Date
Y	Spectrum Analyzer	Agilent	N9010A	MY48031005	27-Feb-2021
Y	RF Cable	Huber- Suhner	SF104/2X11PC3542/500	NA	NA







TEST RESULTS

Channel	Frequency	Measured Dwell Time	No. of Bursts	Total Dwell Time in 10Sec	Limit	Test Results
#	MHz	msec	#	msec	msec	
1	903.55	1.566	15	23.49	≤400	PASS
28	916	1.569	15	23.53	≤400	PASS
55	926.45	1.560	15	23.4	≤400	PASS

TEST SETUP PHOTOGRAPH

Refer Annexure -1

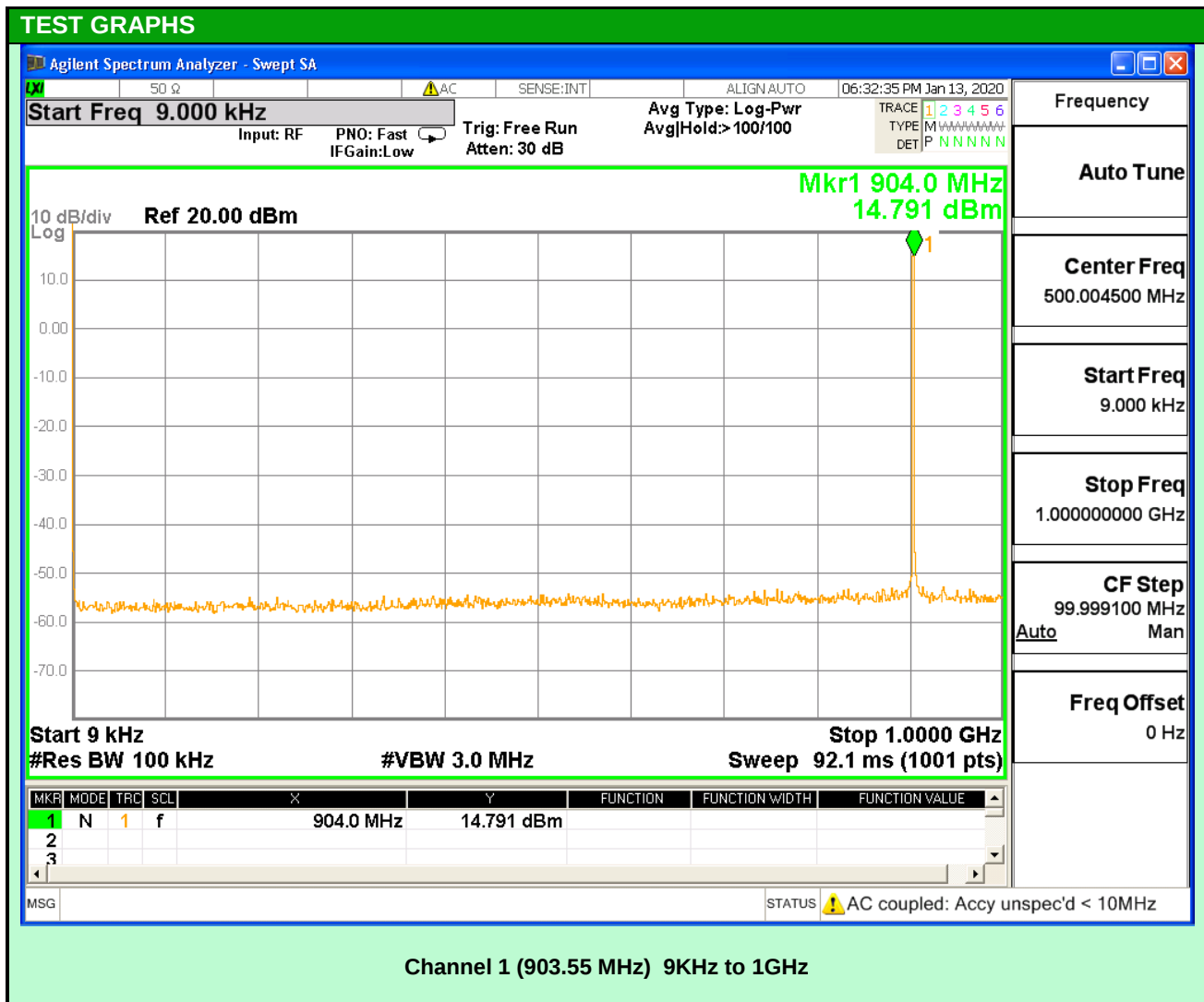
Conducted RF Test setup

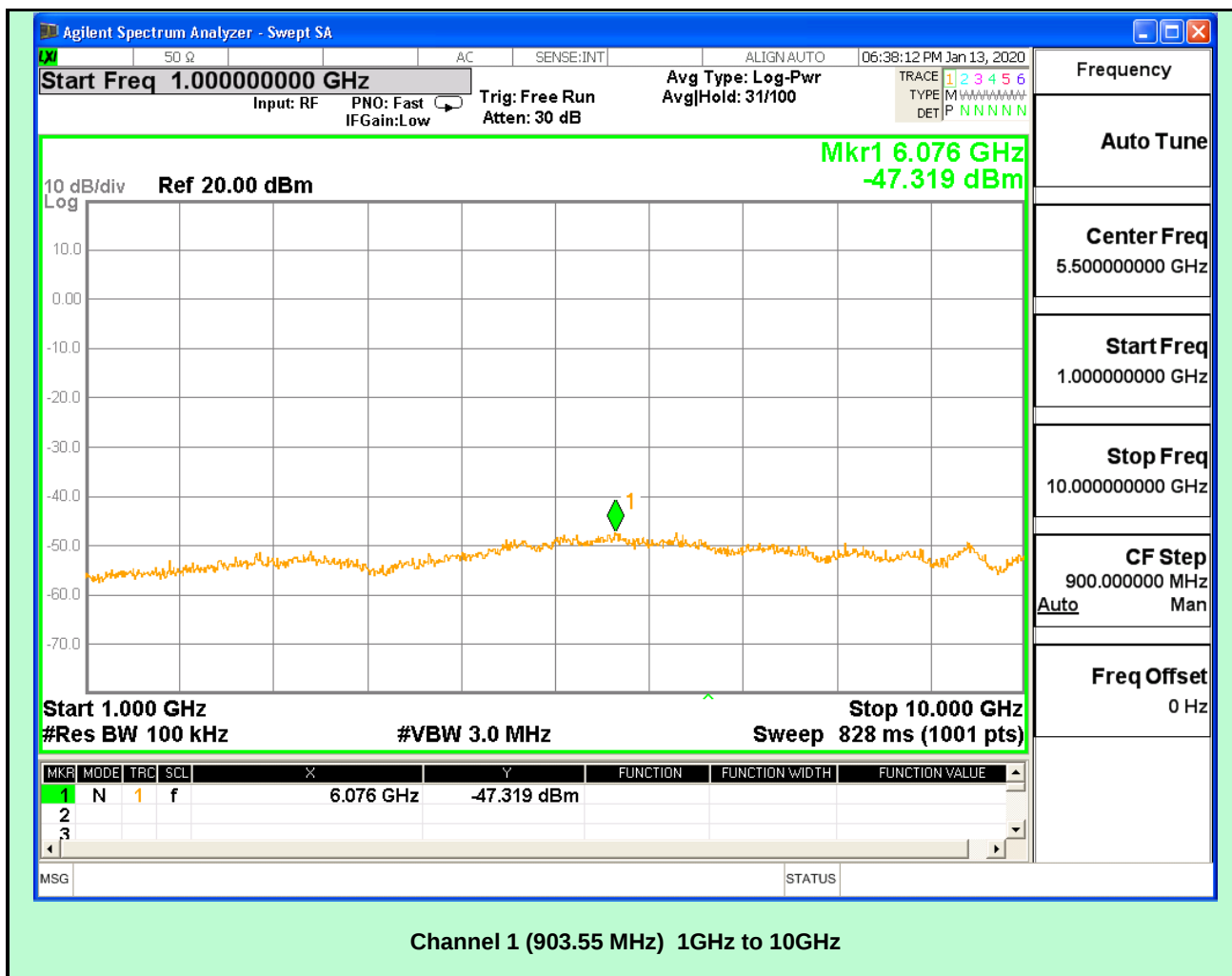
2.7 SPURIOUS RF CONDUCTED EMISSIONS

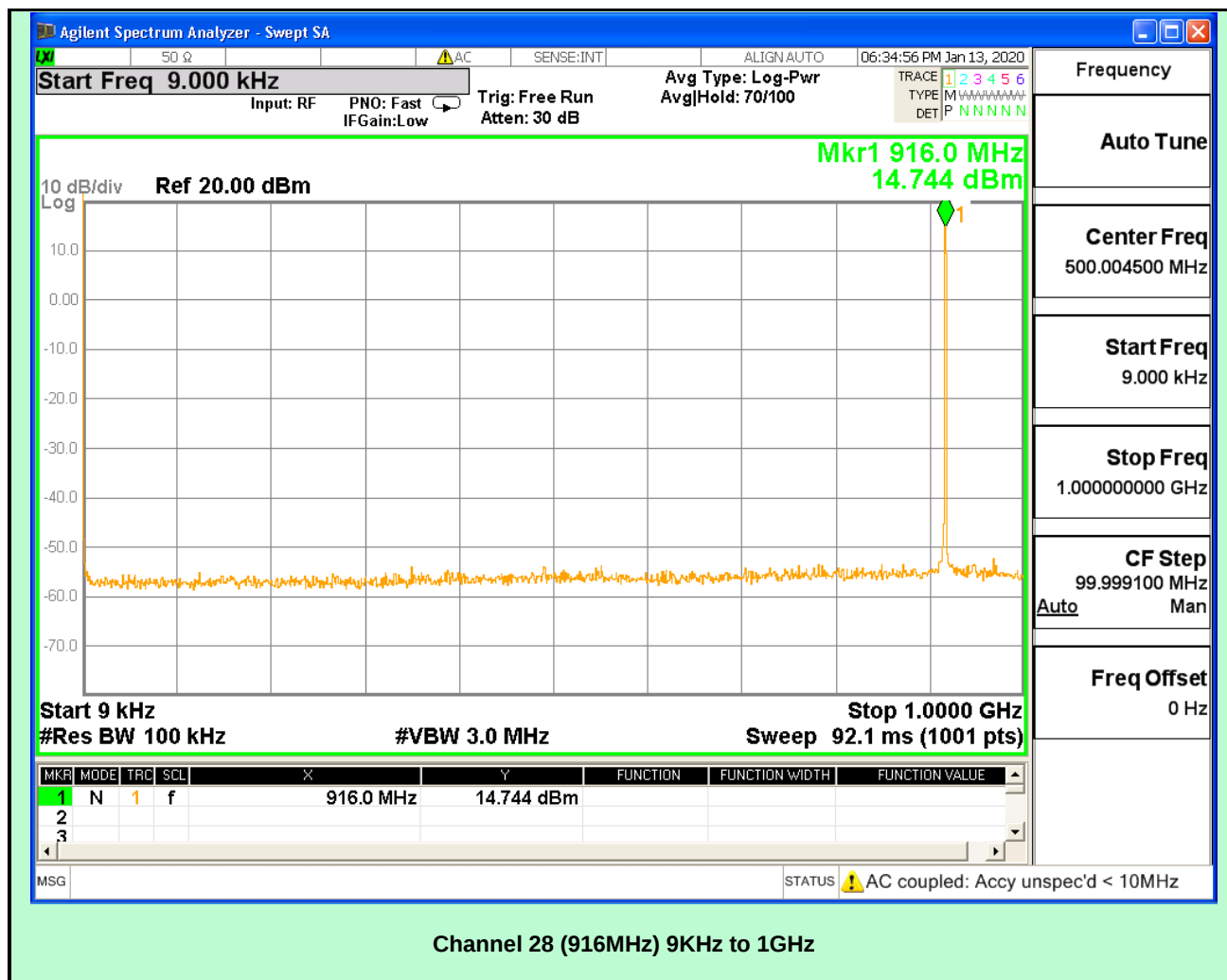
EUT Nomenclature	Wireless Monitor Module	Test Request No.	EMC0418-1
Model No.	FW-MM	Serial No.	127
Test Start Date	14-Dec-2019	Temperature (°C)	23.6°C
Test End Date	26-Feb-2020	Humidity RH (%)	51.9%RH
Tested By	Vinay Gujjar	Pressure (mbar)	NR
Input Voltage /	3.3Vdc		
Operating Mode	Refer Page 5 for Operating Mode Table		
Test configuration	Refer Page 5 for Test Configuration Table		
Deviation from Std.	NA		
Applicable standard	FCC Part 15.247:2010		
Test Method	DA 00-705		
Comment	NA		
TEST DETAILS			
Method	Radiated ☐	Conducted ☒	
TEST PARAMETERS			
Antenna Height	NA	Turntable Rotation	NA
Equipment Class	NA	Measurement Distance	NA

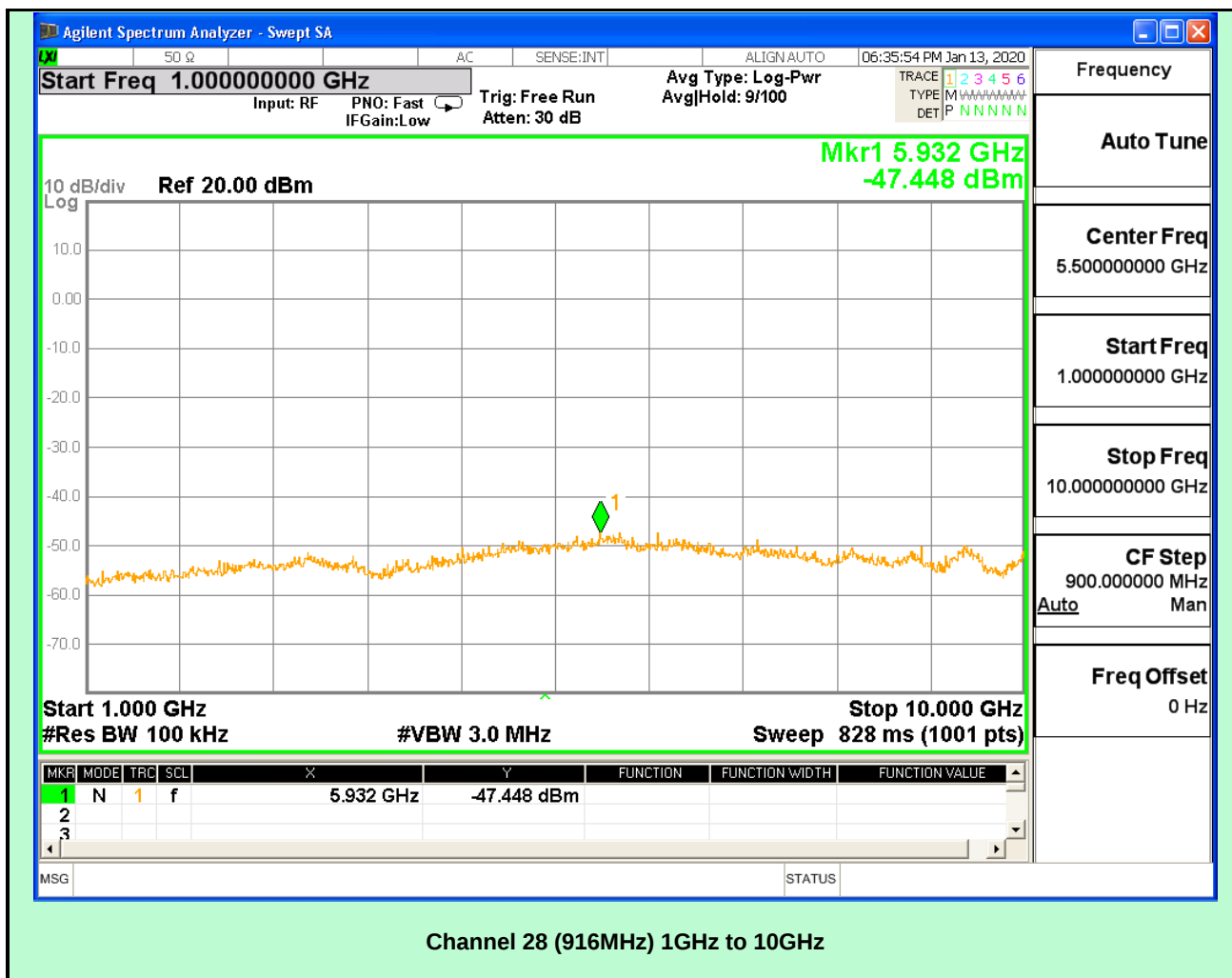
TEST EQUIPMENT

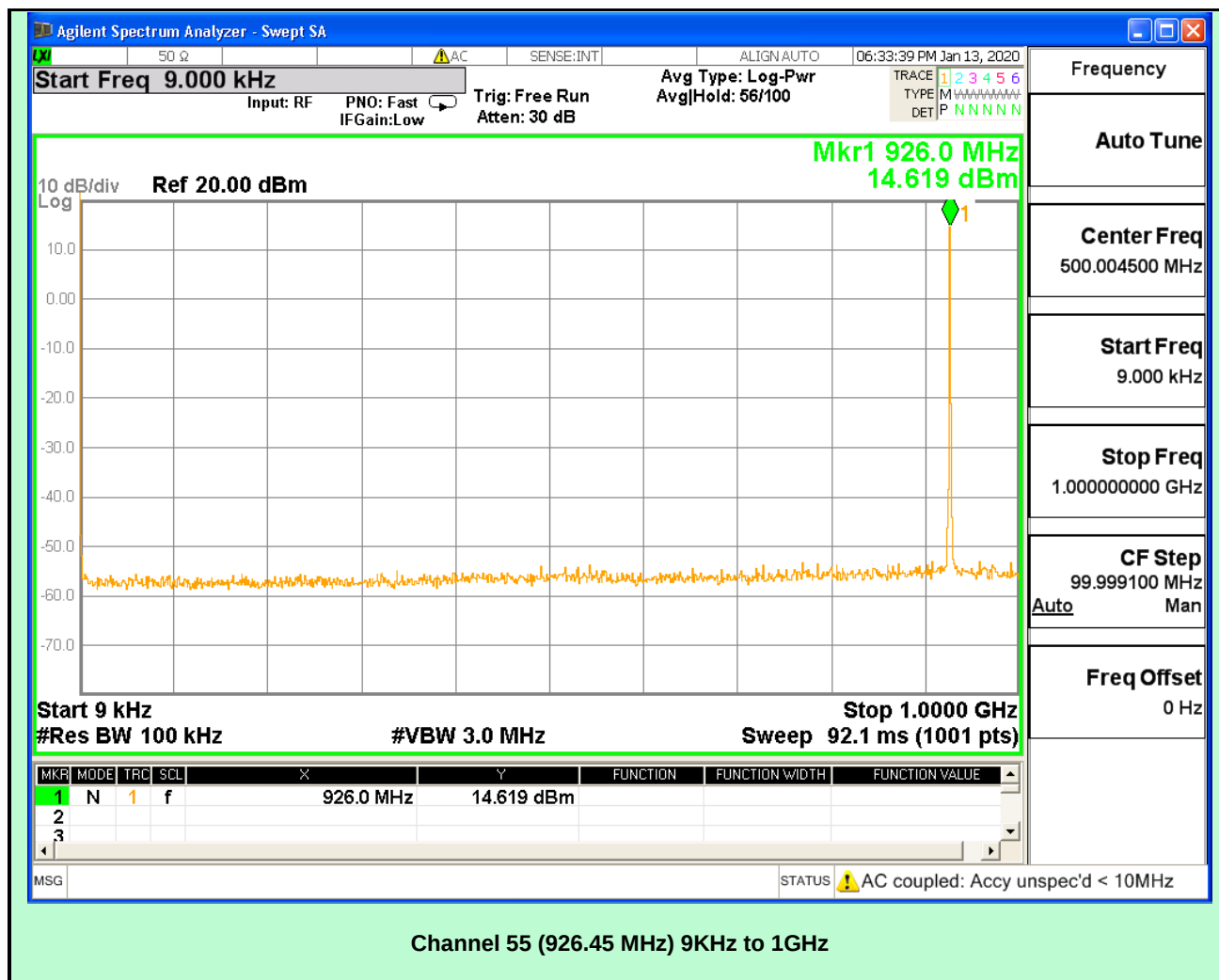
Y/N	Equipment	Make	Model	Sl. No.	Cal Due Date
Y	Spectrum Analyzer	Agilent	N9010A	MY48031005	27-Feb-2021
Y	RF Cable	Huber- Suhner	SF104/2X11PC3542/500	NA	NA

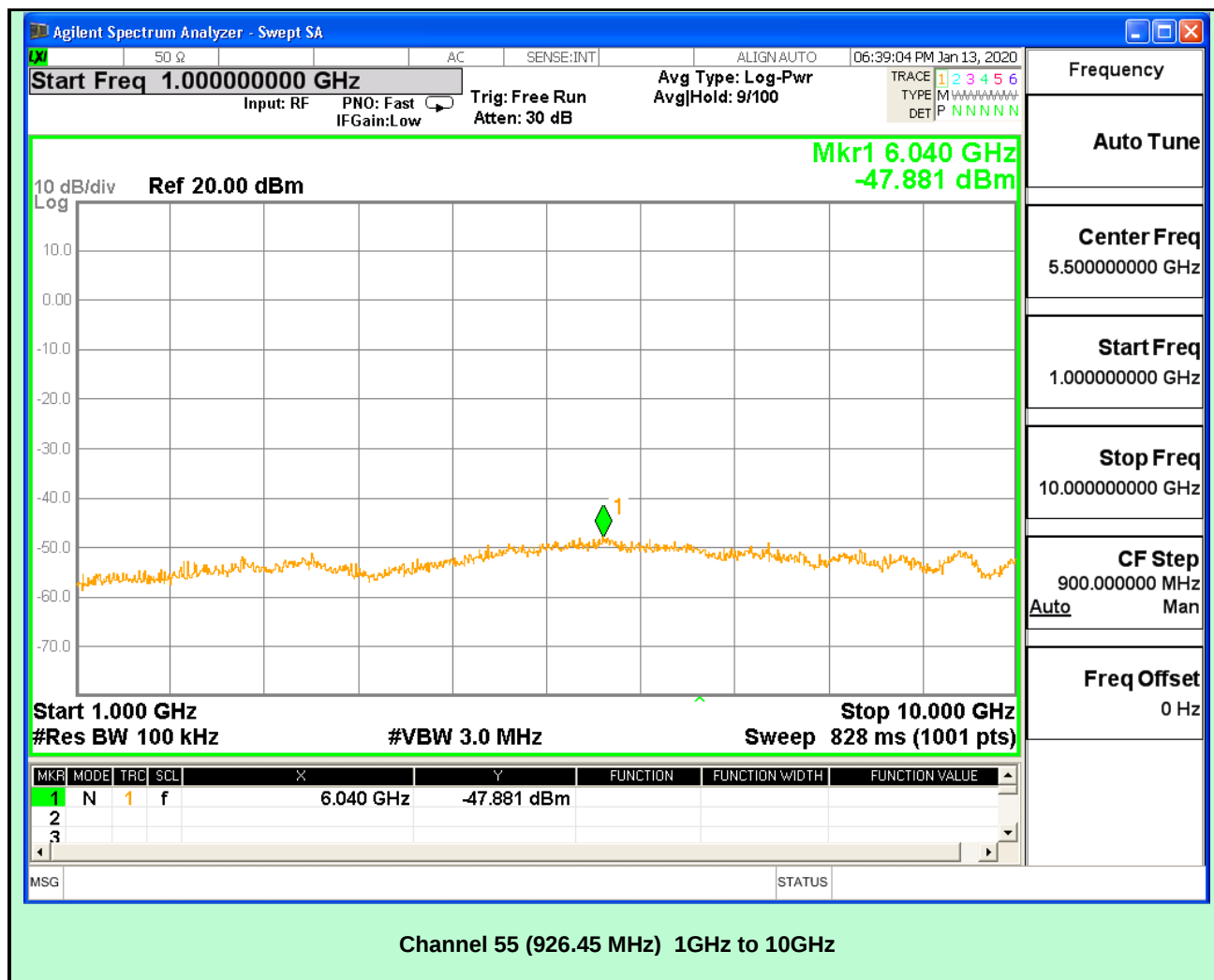












TEST RESULTS

Channel	Frequency	Measured Parameters			Difference (B-A)	Limit	Test Results
#	MHz	Spurious Frequency (GHz)	Spurious Level (dBm)- (A)	Fundamental Level(dBm) - (B)	dBc	dBc	
1	903.55	6.076	-47.319	14.791	62.11	>20	PASS
28	916.00	5.932	-47.448	14.744	62.19	>20	PASS
55	926.45	6.040	-47.881	14.619	62.5	>20	PASS

TEST SETUP PHOTOGRAPH

Refer Annexure -1

Conducted RF Test setup

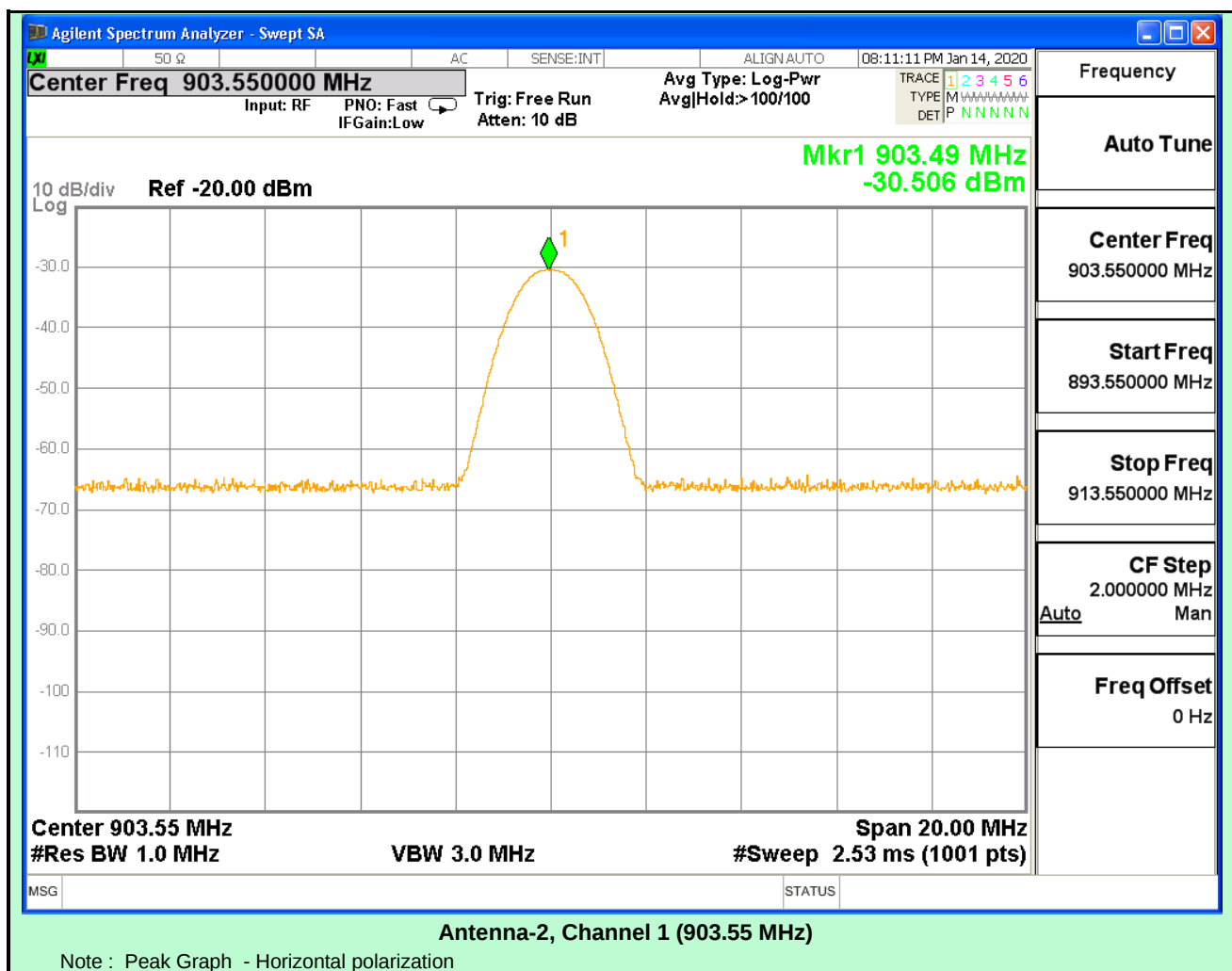
2.8 EFFECTIVE ISOTROPIC RADIATED POWER

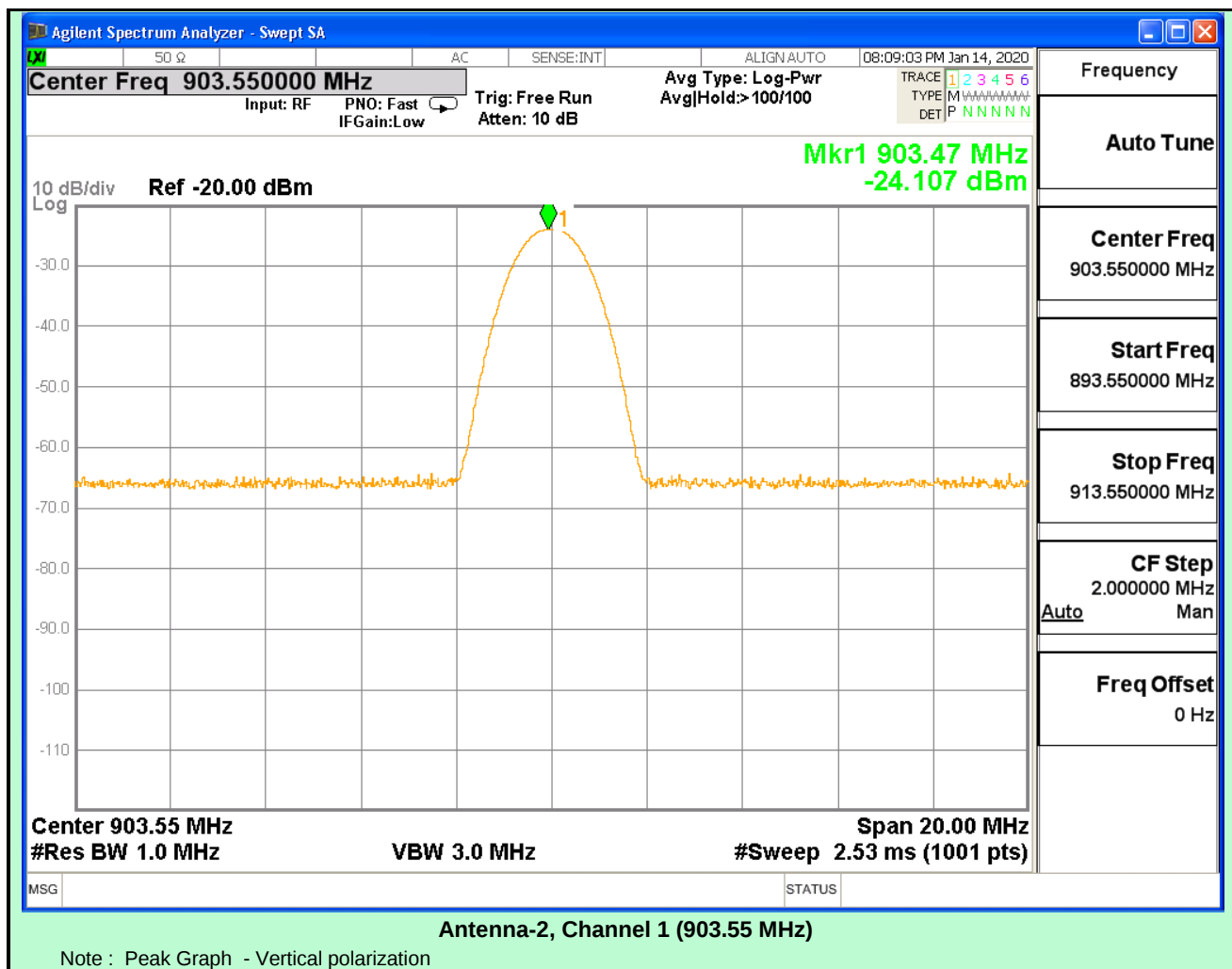
EUT Nomenclature	Wireless Monitor Module	Test Request No.	EMC0418-1
Model No.	FW-MM	Serial No.	127
Test Start Date	14-Dec-2019	Temperature (°C)	24.2°C
Test End Date	26-Feb-2020	Humidity RH (%)	53.8%RH
Tested By	Vinay Gujjar	Pressure (mbar)	NR
Input Voltage / Freq	3.3Vdc		
Operating Mode	Refer Page 5 for Operating Mode Table		
Test configuration	Refer Page 5 for Test Configuration Table		
Deviation from Std	NA		
Applicable standard	FCC Part 15.247 : 2010 & 15.209 :2010		
Test Method	KDB 412172		
Comment	NA		
TEST DETAILS			
Method	☒ Radiated	☐ Conducted	
TEST PARAMETERS			
Antenna Height	NA	Turntable Rotation	NA
Equipment Class	NA	Measurement Distance	NA

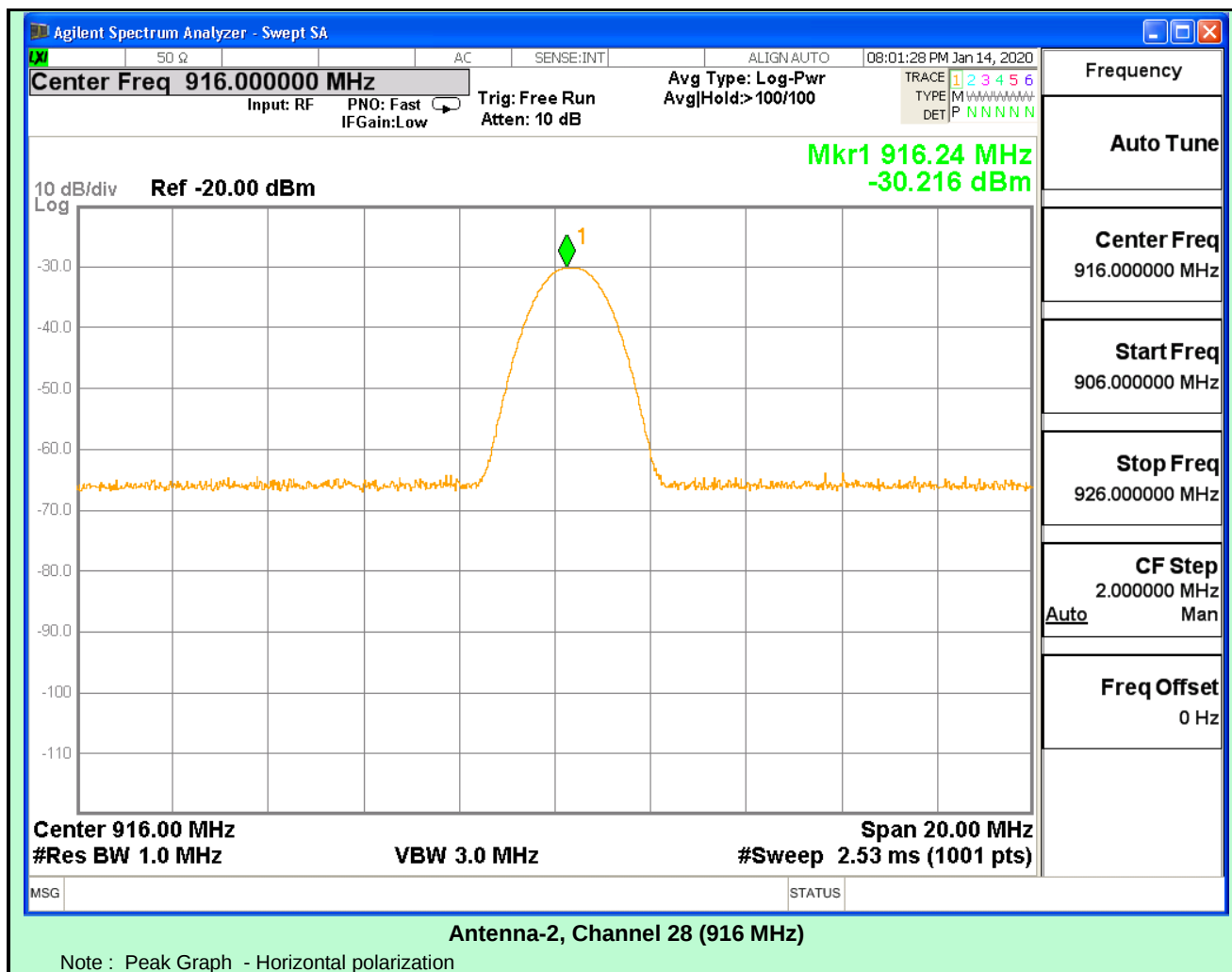
TEST EQUIPMENT

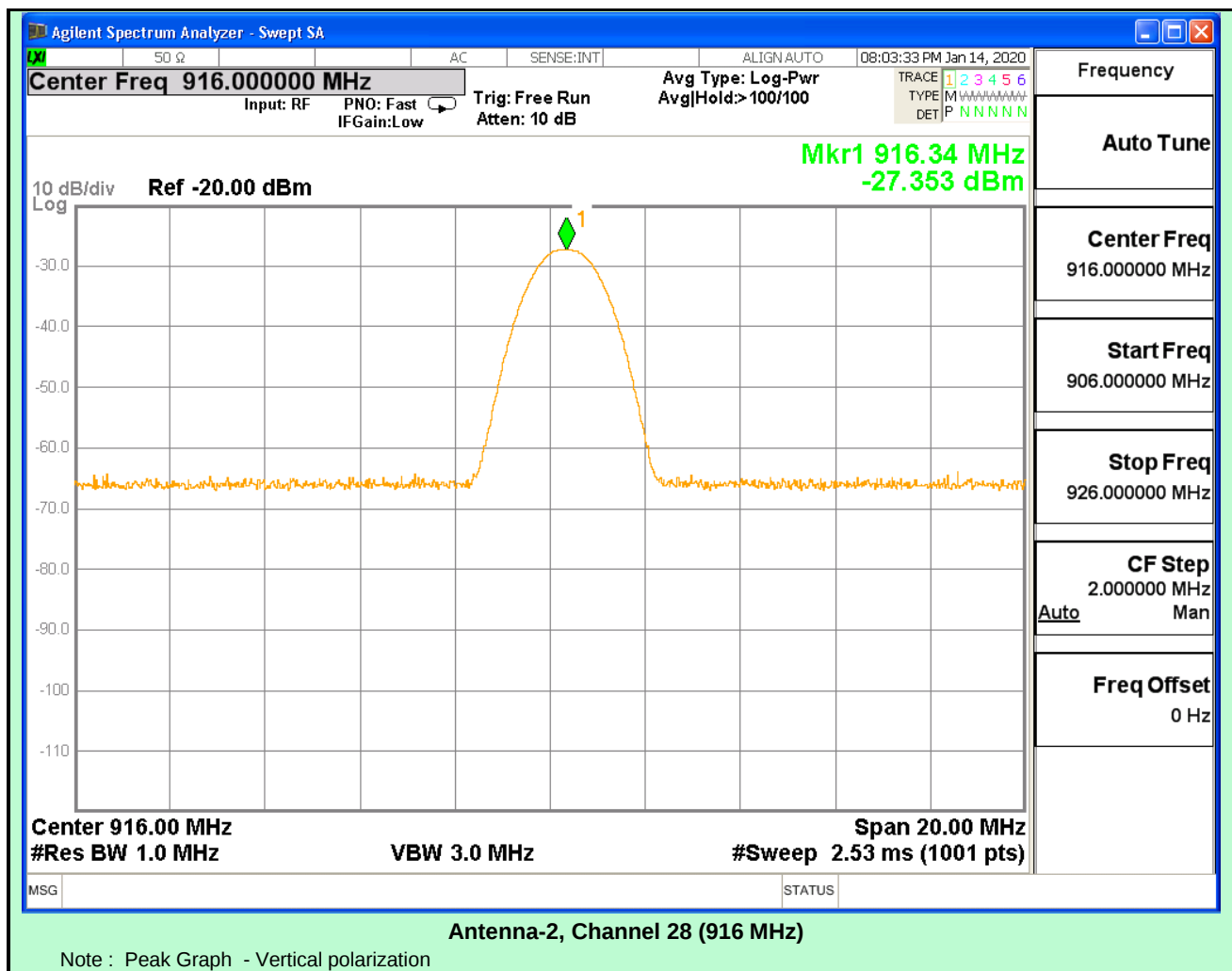
Y/N	Equipment	Make	Model	Sl. No.	Cal Due Date
Y	EMI Test Receiver	R&S	ESU26	100525	7-Aug-20
Y	3m Semi Anechoic Chamber	ETS Lindgren	DKE 6X7 DBL.DR	1625	30-Jul-22
Y	Bilog Antenna	ETS Lindgren	HLP3003C	130525	5-Nov-21
Y	RF cable (9KHz to 18GHz)	Huber + Schuner	Sucoflex100	515518/126E	04-Oct-21

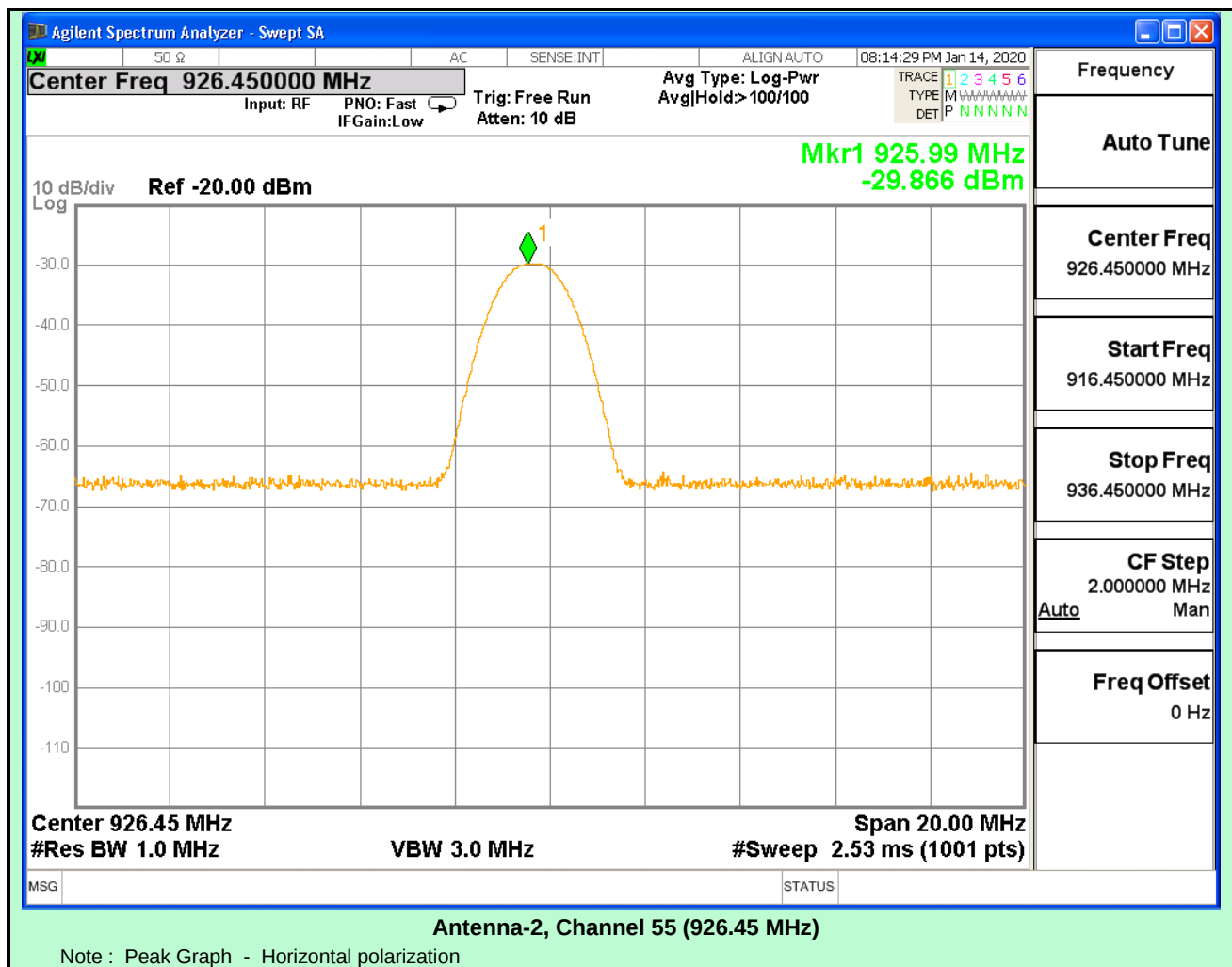
Note: Switch ON /OFF the Internal Preamplifier based on carrier level and or noise floor without overloading the receiver

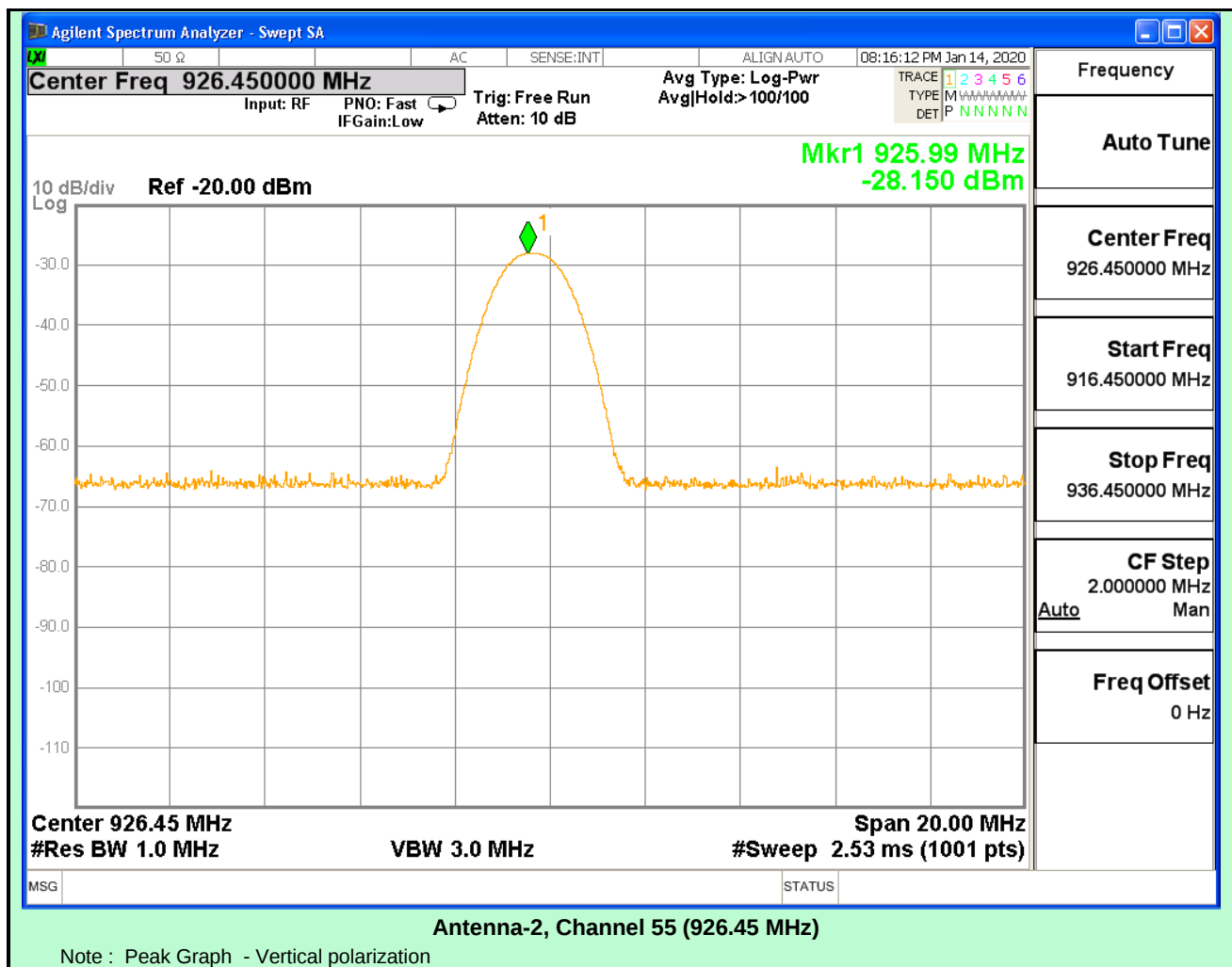












TEST RESULT – EIRP

Channel	Channel Freq	Rx Antenna Height	Rx Ant Pol	Measured Level	Cable Loss	External Att	Path loss @ 3m	Rx Antenna Gain	Calculated Rx Power	Calculated EIRP
#	MHz	cm	H/V	dBm	dB	dB	dB	dBi	dBm	dBm
Antenna – 2 (FHSS Mode)										
CH-1	903.55	125	H	-30.5	2.91	6	41.21	6.3	-27.89	13.32
CH-1	903.55	110	V	-24.10	2.91	6	41.21	6.3	-21.49	19.72
CH-28	916	100	H	-30.21	2.91	6	41.21	6.3	-27.6	13.61
CH-28	916	140	V	-27.53	2.91	6	41.21	6.3	-24.92	16.29
CH-55	926.45	155	H	-29.86	2.91	6	41.21	6.3	-27.25	13.96
CH-55	926.45	160	V	-28.15	2.91	6	41.21	6.3	-25.54	15.67

Note : Effective Isotropic Radiated Power (dBm)= Pr(dBm) +Lp(dB)

$$Pr = P_{meas}(dBm) - Gr(dBi) + Lc(dB) + Latt(dB)$$

$$Lp = 20 \log F + 20 \log D - 27.5$$

Where:

Pr = Calculated Received Power Level(dBm)

Lp= Free Space Path Loss(dB)

Pmeas= Measured Power Level(dBm)

Gr = Receiver Antenna Gain(dBi)

Lc = Cable Loss (dB)

Latt= External Attenuator(dB)

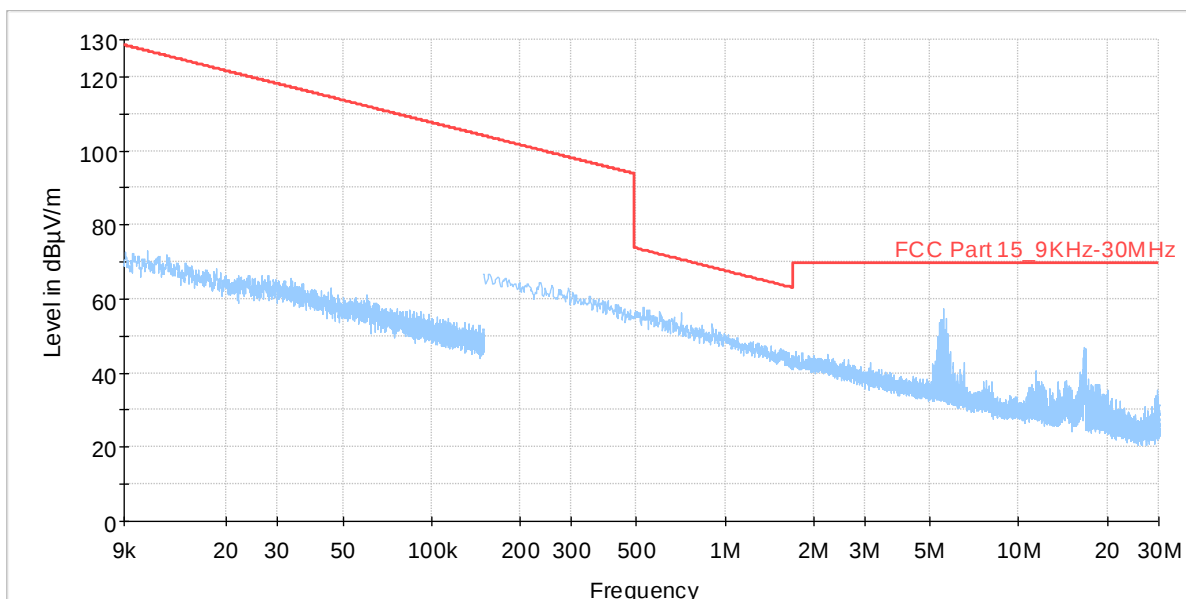
F = Frequency (MHz)

D= Distance (m)

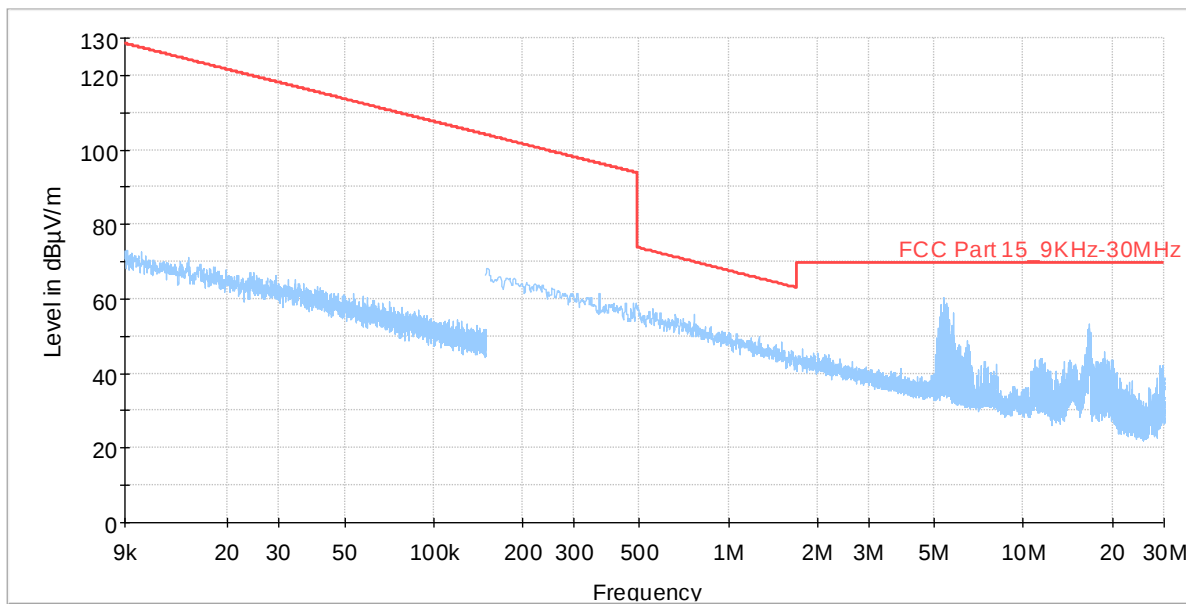
2.4 SPURIOUS RADIATED EMISSIONS

EUT Nomenclature	Wireless Monitor Module	Test Report No.	EMC0418-1
Model No.	FW-MM	Serial No.	127
Test Start Date	14 Dec 2019	Temperature (°C)	24.2 ± 2
Test End Date	26 Feb 2020	Humidity RH (%)	56.2± 2
Tested By	Vinay Gujjar	Pressure (mbar)	NR
Input Voltage / Freq	3.3Vdc		
Operating Mode	Refer Page 5 Operating Modes Table		
Test configuration	Refer Page 5 Test Configuration Table		
Deviation from Std	NA		
Comment	Nil		
TEST FREQUENCY RANGE			
Start Frequency	9 KHz	Stop Frequency	10 GHz
MAXIMUM OPERATING FREQUENCY			
902MHz to 928MHz			
TEST PARAMETERS			
Antenna Height	1m to 4m	Turntable Rotation	0° to 360°
Applicable standard	FCC Part 15.247 & 15.209 :2010	Test Method	ANSI C63.10 - 2013
Equipment Class	NA	Measurement Distance	3m

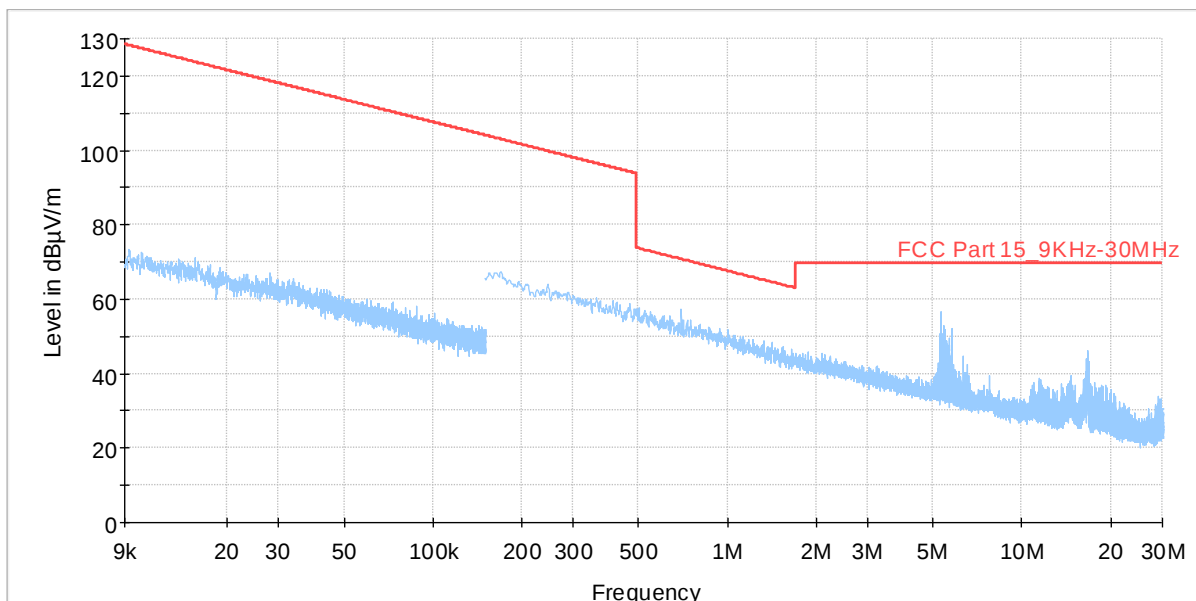
TEST EQUIPMENT					
Y/N	Equipment	Make	Model	Sl. No.	Cal Due Date
Y	EMI Test Receiver	R&S	ESU26	100229	7-Aug-20
Y	3m Semi Anechoic Chamber	ETS Lindgren	DKE 6X7 DBL.DR	1625	30-Jul-22
Y	Double Ridge Guide Horn Antenna	ETS Lindgren	3117	64055	1-Nov-21
Y	Bilog Antenna	ETS Lindgren	HLP3003C	130525	5-Nov-21
Y	Loop Antenna	ETS Lindgren	6507	103694	15-Nov-21
Y	RF cable (9KHz to 18GHz)	Huber + Schuner	Sucoflex100	515518/126E	04-Oct-21
Y	Signal Conditioning unit	R&S	SCU-18	10178	5-Jun-20
Y	High Pass Filter	Wainwright	WHKX1.5/15G-12ST	1	24-Feb-21
Y	EMC32 Software	R&S	8.30.0	820-OT101248	NA
Note: Switch ON /OFF the Internal Preamplifier based on carrier level and or noise floor without overloading the receiver					

**Antenna-2, Channel 1 (903.55 MHz)**

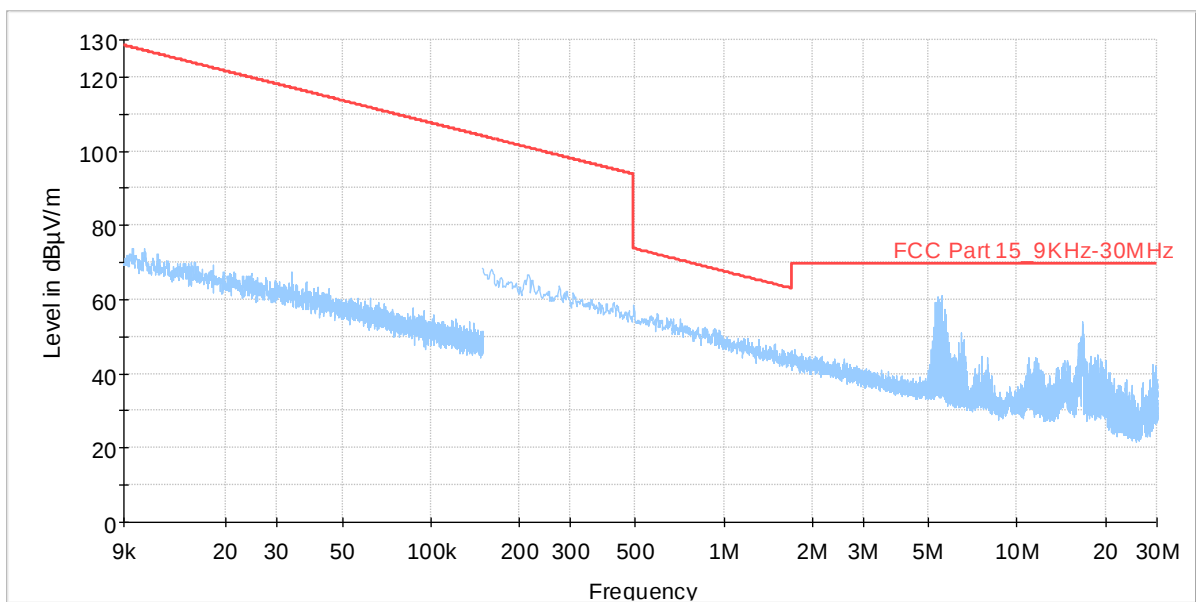
Note : Peak Graph - Parallel

**Antenna-2, Channel 1 (903.55 MHz)**

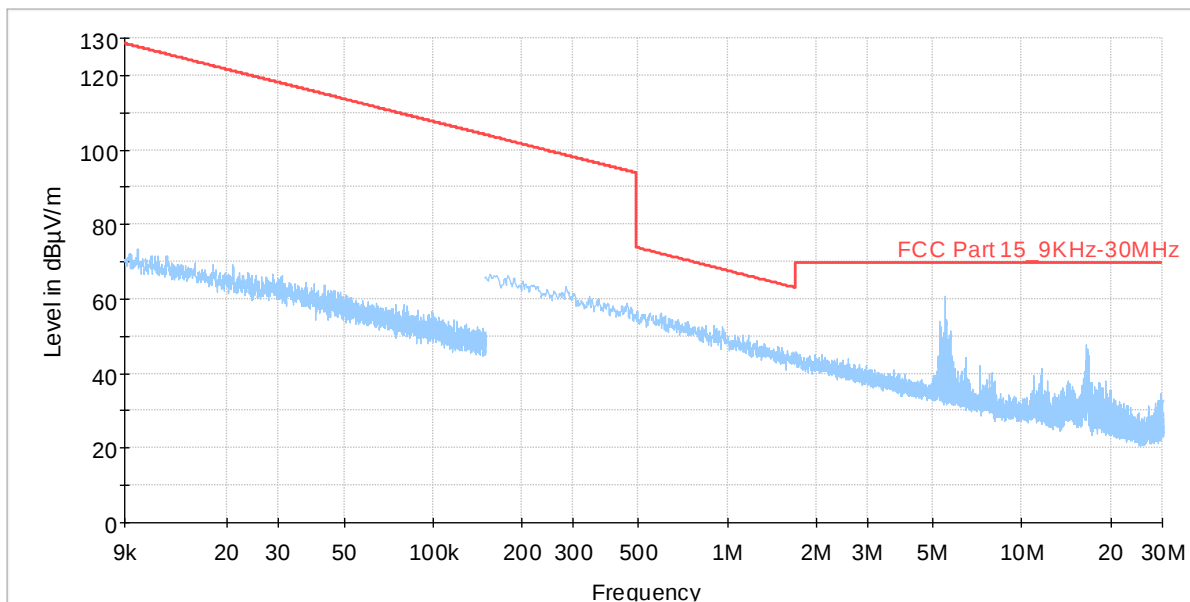
Note : Peak Graph - Perpendicular

**Antenna-2, Channel 28 (916 MHz)**

Note : Peak Graph - Parallel

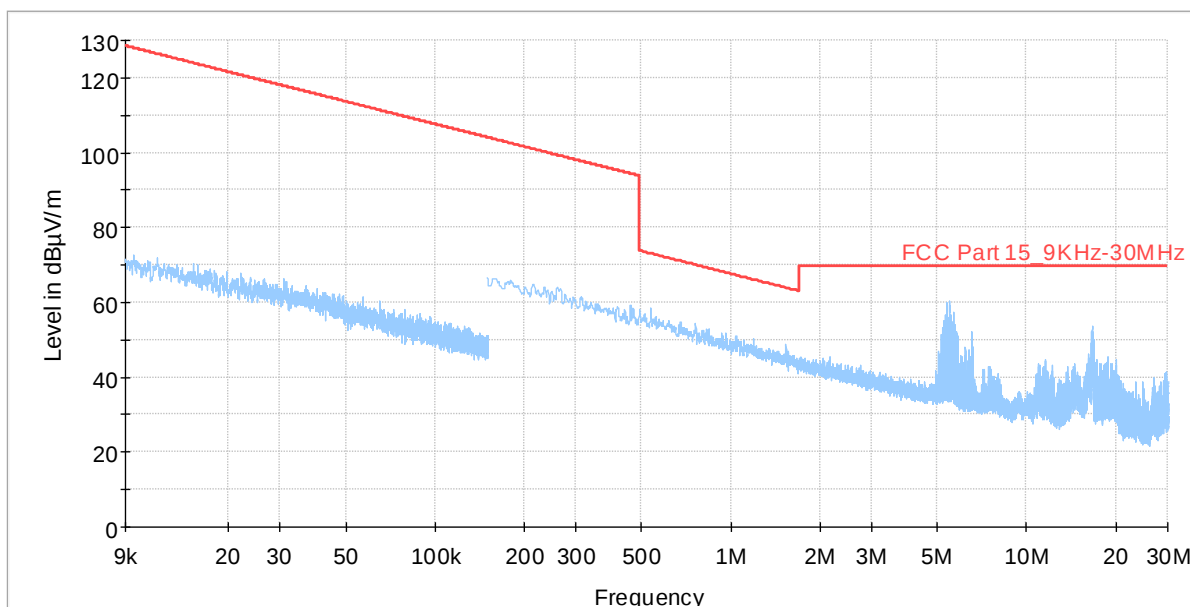
**Antenna-2, Channel 28 (916 MHz)**

Note : Peak Graph - Perpendicular



Antenna-2, Channel 55 (926.45 MHz)

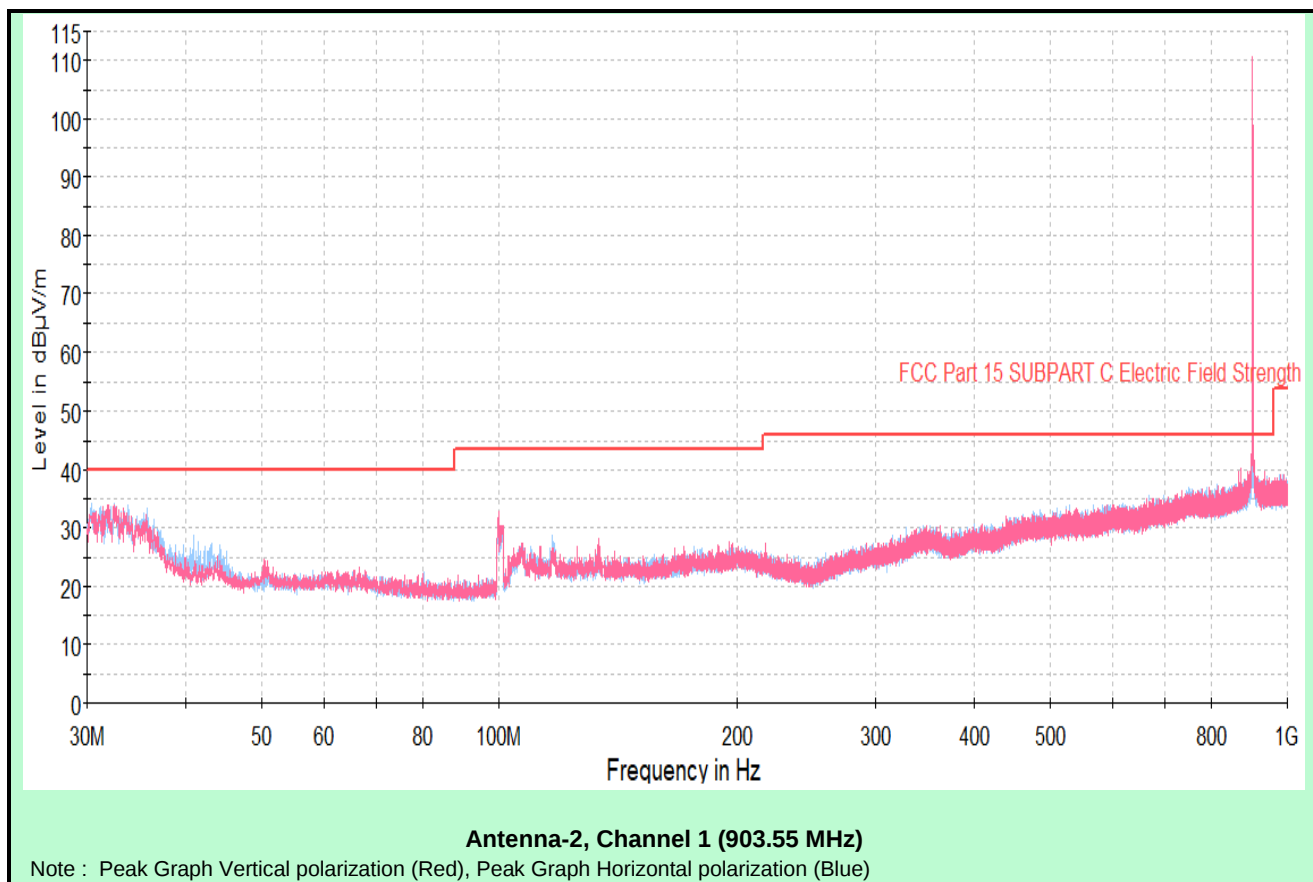
Note : Peak Graph - Parallel

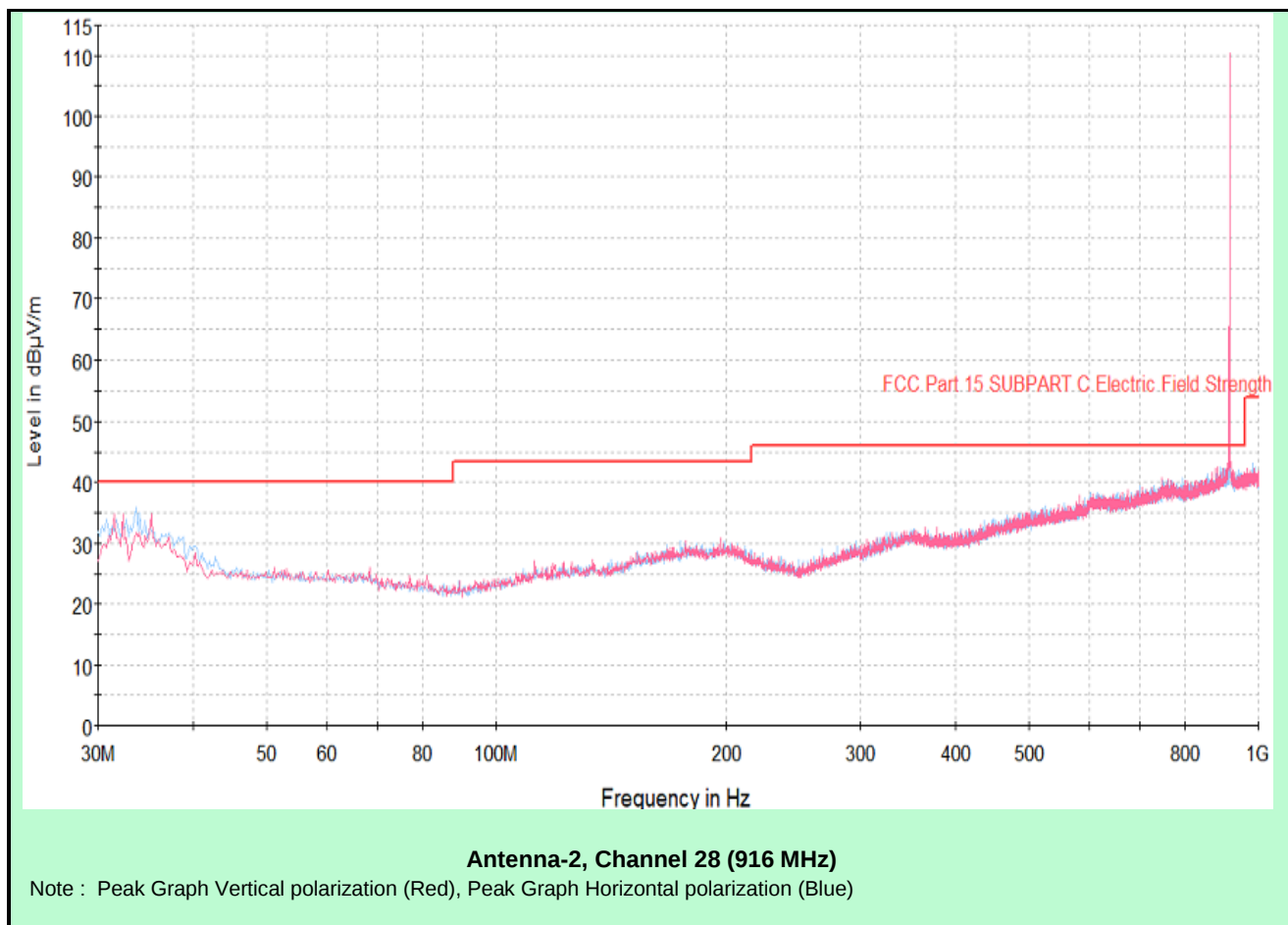


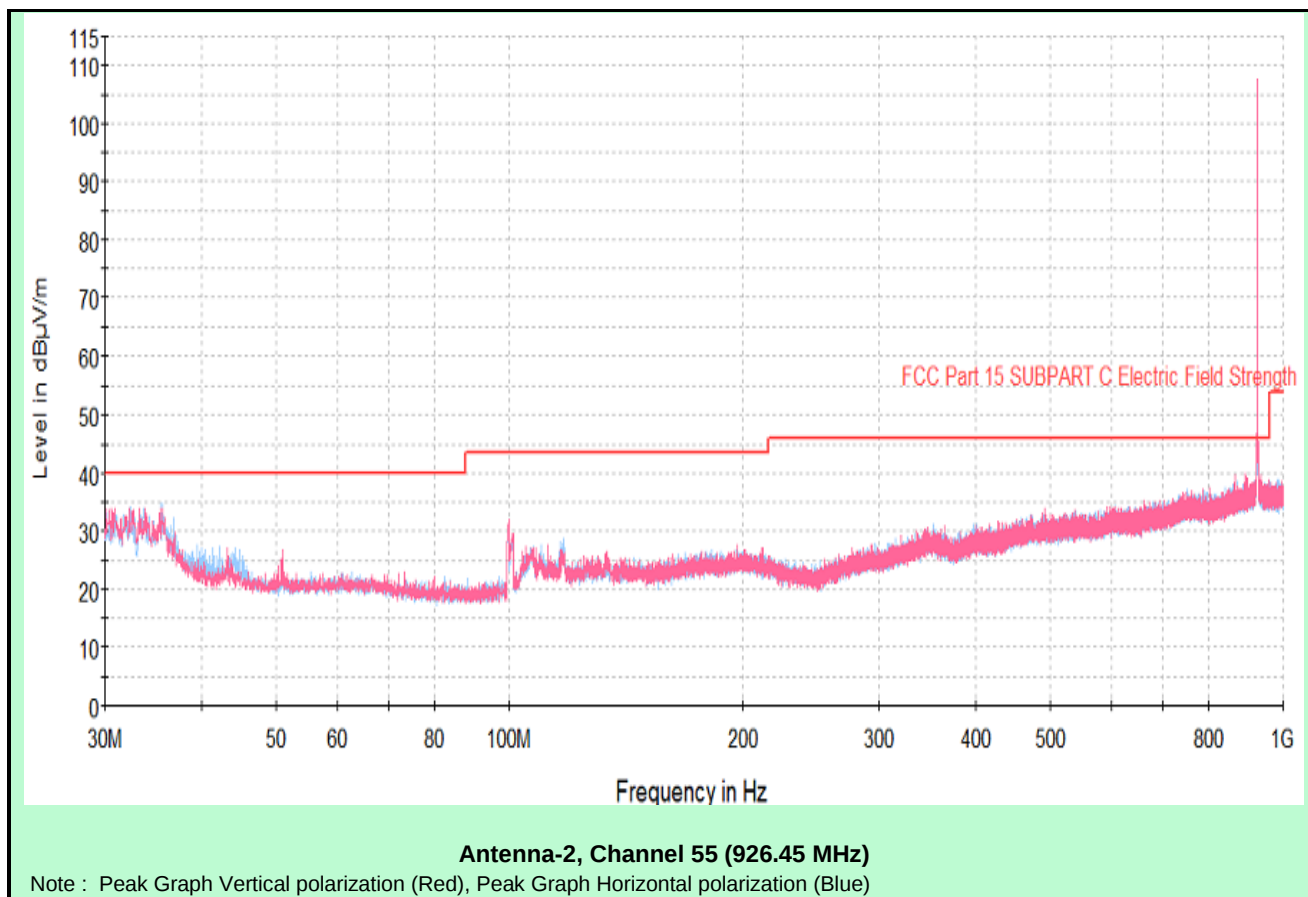
Antenna-2, Channel 55 (926.45 MHz)

Note : Peak Graph - Perpendicular

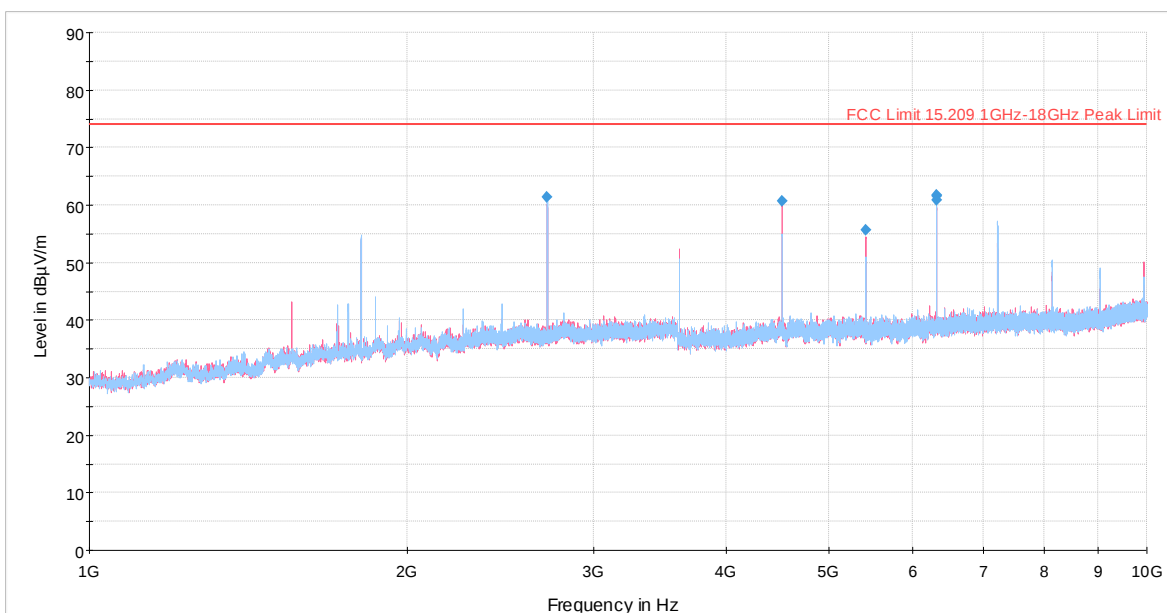
TEST RESULT – 9 KHz to 30 MHz									
Chann el	Channel Freque ncy	Measured Spurious	Quasi Peak	Heigh t	Ant Pol	Azim uth	Margin	Limit @ 3m Distance	Results
#	MHz	MHz	dBµV/m	cm	Parallel / Perpendicular	deg	dB	dBµV/m	
No emissions detected. Emissions shown in the plot are related to the chamber ambient									
Note : Measured Field Strength –dBuV/m = Receiver Readings (dBuV) + Antenna Factor (dB/m) + Cable loss (dB)									



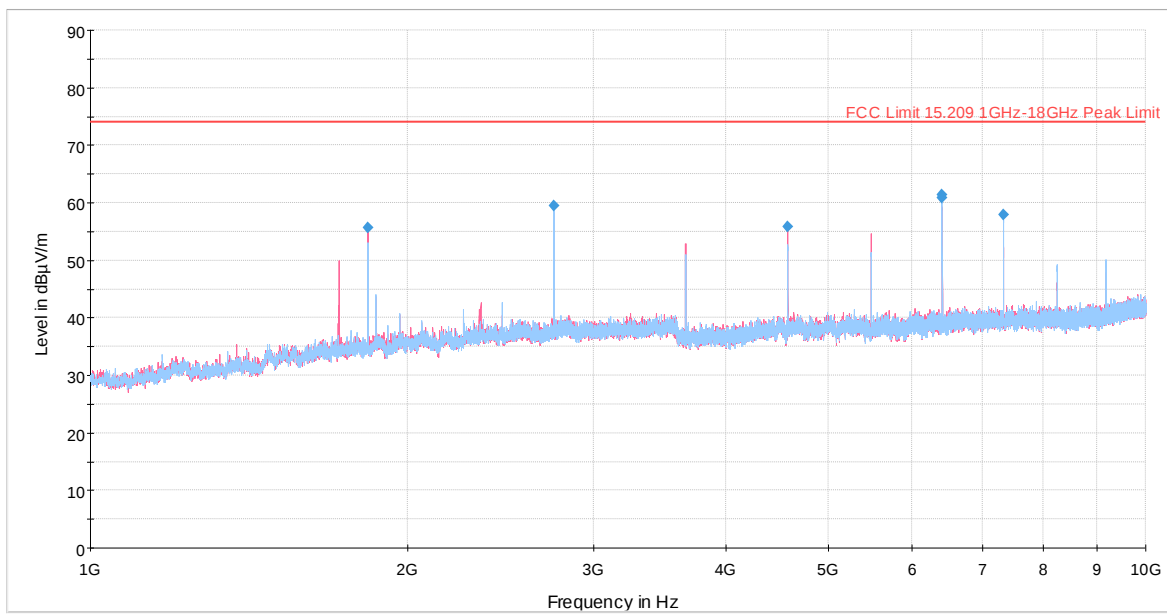




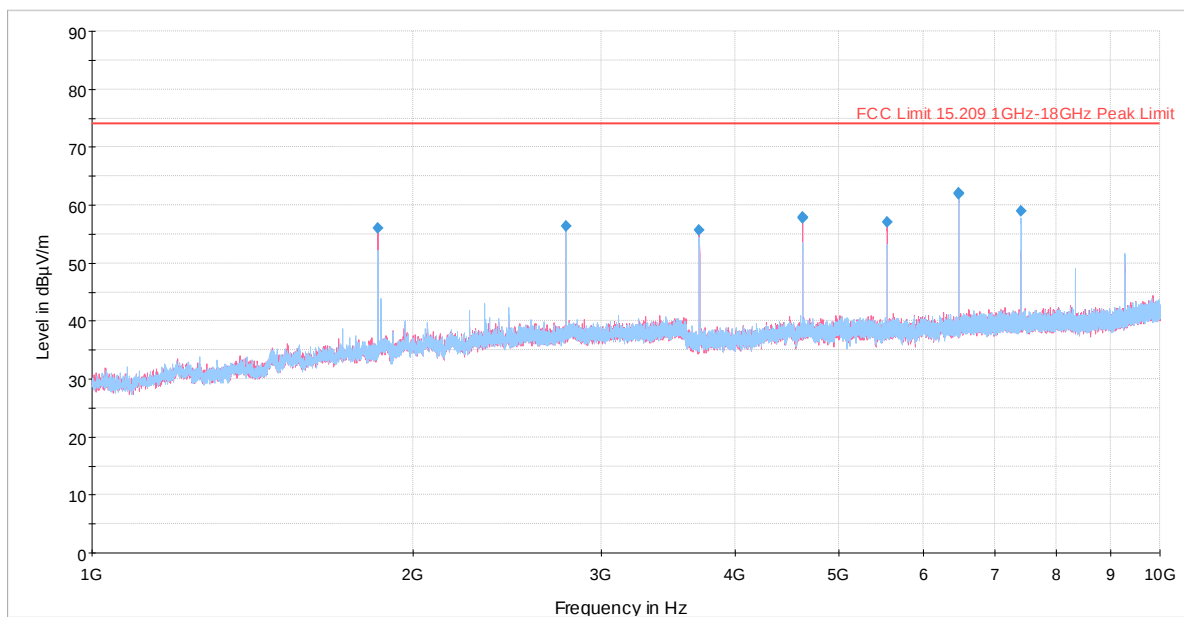
TEST RESULT – 30 MHz to 1 GHz								
Channel	Measured Spurious	Quasi Peak	Height	Ant Pol	Azimuth	Margin	Limit @ 3m Distance	Results
#	MHz	dBµV/m	Cm	H / V	deg	dB	dBµV/m	
Antenna – 2								
CH-1	687.46	32.46	400	H	83	13.54	46	Pass
CH-1	693.48	32.62	100	H	168	13.38	46	Pass
CH-1	766.61	34.09	100	V	7	11.91	46	Pass
CH-1	828.69	34.13	100	H	194	11.87	46	Pass
CH-1	831.6	34.26	200	H	210	11.74	46	Pass
CH-1	903.61	110.51	200	V	211	-	-	Intended Frequency
CH-28	623.83	34.42	400	H	186	11.58	46	Pass
CH-28	687.27	35.24	400	H	110	10.76	46	Pass
CH-28	696.58	35.42	400	V	123	10.58	46	Pass
CH-28	750.12	40.06	300	V	71	5.94	46	Pass
CH-28	838.01	37.48	200	H	180	8.52	46	Pass
CH-28	838.59	37.46	200	H	236	8.54	46	Pass
CH-28	916.386	108.8	100	V	318	-	-	Intended Frequency
CH-55	800.18	33.65	400	V	255	12.35	46	Pass
CH-55	832.19	34.38	400	H	332	11.62	46	Pass
CH-55	849.45	34.57	100	H	312	11.43	46	Pass
CH-55	926.15	107.65	100	V	137	-	-	Intended Frequency
NOTE: Measured Field Strength –dBµV/m (9 KHz to 1 GHz) = Receiver Readings (dBµV) + Antenna Factor (dB/m) + Cable loss (dB)								

**Antenna-2, Channel 1 (903.55 MHz)**

Note : Peak Graph Vertical (Red), Peak Graph Horizontal polarization (Blue)

**Antenna-2, Channel 28 (916 MHz)**

Note : Peak Graph Vertical (Red), Peak Graph Horizontal polarization (Blue)

**Antenna-2, Channel 55 (926.45 MHz)**

Note : Peak Graph Vertical (Red), Peak Graph Horizontal polarization (Blue)

TEST RESULT – 1 GHz to 10 GHz					RESTRICTED BAND – PEAK			
Channel	Frequency	Measured Field Strength	Height	Ant Pol	Azimuth	Margin	Limit	Result
#	(MHz)	(dBμV/m)	(cm)	H / V	(deg)	(dB)	(dBμV/m)	
Antenna – 2								
CH-1	2710.32	61.32	100	H	346	12.68	74	PASS
CH-1	4518.03	60.64	300	V	352	13.36	74	PASS
CH-1	5421.57	55.65	300	V	346	18.35	74	PASS
CH-28	2748.57	59.5	200	H	344	14.5	74	PASS
CH-28	4582.00	55.81	200	V	344	18.19	74	PASS
CH-28	7329.89	57.84	200	H	39	16.16	74	PASS
CH-55	2778.46	56.3	200	H	354	17.7	74	PASS
CH-55	3704.50	55.65	300	V	21	18.35	74	PASS
CH-55	4629.89	57.98	300	V	0	16.02	74	PASS
CH-55	4630.53	57.75	300	V	352	16.25	74	PASS
Note:								
Measured Field Strength (dBuV/m) = Receiver Readings (dBuV) + Antenna Factor (dB/m) + Cable loss (dB) + Filter Insertion loss - Pre- amplifier Gain (dB)								

TEST RESULT – 1 GHz to 10 GHz							RESTRICTED BAND – AVERAGE			
Channel	Frequency	Measured Average	Height	Ant Pol	Azimuth	Duty Cycle	Corrected Reading	Margin	Limit	Result
#	(MHz)	(dBμV/m)	(cm)	H / V	(deg)	(dB)	(dBμV/m)	(dB)	(dBμV/m)	
Antenna – 2										
CH-1	2710.32	57.92	100	H	346	12.53	45.39	8.61	54	PASS
CH-1	3613.86	47.94	200	V	0	12.53	35.41	18.59	54	PASS
CH-1	4517.39	56.33	300	V	352	12.53	43.8	10.2	54	PASS
CH-1	4518.04	55.46	200	V	0	12.53	42.93	11.07	54	PASS
CH-1	5421.25	50.84	300	V	347	12.53	38.31	15.69	54	PASS
CH-28	1720.96	23.24	400	V	148	12.53	10.71	43.29	54	PASS
CH-28	2748.57	54.58	200	H	344	12.53	42.05	11.95	54	PASS
CH-28	3664.96	48.04	100	V	34	12.53	35.51	18.49	54	PASS
CH-28	4581.36	50.9	200	V	346	12.53	38.37	15.63	54	PASS
CH-28	7329.89	48.36	200	H	39	12.53	35.83	18.17	54	PASS
CH-28	8247.89	41.28	200	H	21	12.53	28.75	25.25	54	PASS
CH-28	9162.68	42.48	200	H	344	12.53	29.95	24.05	54	PASS
CH-55	2777.82	51	300	H	346	12.53	38.47	15.53	54	PASS
CH-55	2778.46	54.54	100	H	333	12.53	42.01	11.99	54	PASS
CH-55	3704.50	52.23	300	V	21	12.53	39.7	14.3	54	PASS
CH-55	4630.21	53.27	300	V	0	12.53	40.74	13.26	54	PASS
CH-55	4630.86	52.49	300	V	357	12.53	39.96	14.04	54	PASS
Note: Measured Field Strength (dBμV/m) = Receiver Readings (dBuV) + Antenna Factor (dB/m) + Cable loss (dB) + Filter Insertion loss - Pre- amplifier Gain (dB) Corrected Reading (dBμV/m) = Measured Average (dBuV/m) - Duty Cycle (dB)										

TEST RESULT – 1 GHz to 10 GHz							NON- RESTRICTED BAND - PEAK			
Channel	Measured Fundamental	Spurious Emission	Measured Harmonic	Height	Ant Pol	Azimuth	Limit	Margin	Results	
							[Fundamental – 20 dB]			
#	dBµV/m	MHz	dBµV/m	cm	H / V	deg	dBuV/m	dB		
Antenna – 2										
CH-1	110.51	6324.14	61.74	400	H	259	90.51	28.77		PASS
CH-1	110.51	6324.78	61.51	400	H	259	90.51	29	PASS	
CH-1	110.51	6325.42	60.95	400	H	270	90.51	29.56	PASS	
CH-28	108.8	1832.50	55.74	100	V	0	88.8	33.06	PASS	
CH-28	108.8	6413.82	60.81	400	H	285	88.8	27.99	PASS	
CH-28	108.8	6414.78	61.39	400	H	290	88.8	27.41	PASS	
CH-55	107.65	1852.42	55.94	100	V	352	87.65	31.71	PASS	
CH-55	107.65	5557.21	56.99	300	V	352	87.65	30.66	PASS	
CH-55	107.65	6481.96	62.06	200	H	314	87.65	25.59	PASS	
CH-55	107.65	6483.25	61.95	200	H	314	87.65	25.7	PASS	
CH-55	107.65	7408.32	58.93	200	H	303	87.65	28.72	PASS	
<u>Note:</u>										
Measured Harmonic Field Strength (dBµV/m) = Receiver Readings (dBµV) + Antenna Factor (dB/m) + Cable loss (dB) + Filter Insertion loss - Pre- amplifier Gain (dB)										

TEST SETUP PHOTOGRAPHS
Refer Annexure -1 Radiated Emission Test Setup