4740 Discovery Drive | Lincoln, NE 68521
tel- 402.323.6233 | tel -888.657.6860 | fax - 402.323.6238
info@nceelabs.com | http://nceelabs.com

Amended

FCC/ISED TEST REPORT

Prepared for: **Bosch Security Systems, Inc.**

Address: **8601 East Cornhusker Hwy.**
Lincoln, NE 68507
USA

Product: **BTR-30N**

Test Report No: **R20190927-20-E1D**

Approved By:

Nic S. Johnson, NCE
Technical Manager
iNARTE Certified EMC Engineer #EMC-003337-NE

DATE: **1 June 2020**

Total Pages: **46**

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ACCREDITED
TESTING LABORATORY
CERTIFICATE NO. 1953.01

REVISION PAGE

Rev. No.	Date	Description
0	27 February 2020	Original – NJohnson Prepared by KVepuri/CFarrington
A	3 April 2020	Repeated power measurements and made changes requested by the client. Includes NCEE Labs report R20190927-20-E1 and its amendment in full
B	5 May 2020	1. Radiated emissions details and data was added to the section 4.1 2. Emissions Masks data was added to the section 4.3 3. Modulation Characteristics data was added to the section 4.4 4. Includes NCEE Labs report R20190927-20-E1A and its amendment in full
C	22 May 2020	Low and high frequencies were moved within the allocated band. Updated calibration table. Added plots showing center frequency to Section 4.5.
D	1 June 2020	Updated Table in Section 1 and frequencies in Section 4.2.

CONTENTS

1.0 SUMMARY OF TEST RESULTS

The worst-case measurements were reported in this report. The EUT has been tested according to the following specifications:

APPLIED STANDARDS AND REGULATIONS		
Standard Section	**Test Type**	**Result**
FCC Part 74.861(e), 2.1046(a) Using ANSI C63.26-2015 RSS-210 Issue 10, Annex G.1 using ANSI C63.10:2013	Carrier Output Power EIRP	Pass
FCC Part 2.1053(a) Using ANSI C63.26-2015	Unwanted Emissions	Pass
FCC Part 74.861(e)(6), 2.1053(a) Using ANSI C63.26-2015 RSS-210 Issue 10, Annex G.4 using ANSI C63.10:2013	Field Strength of Spurious Radiation	Pass
FCC Part 74.861(e)(7), 2.1053(C) (1) Using ANSI C63.26-2015 RSS-210 Issue 10, Annex G.2 using ANSI C63.10:2013	Emission Masks And Occupied Bandwidth	Pass
FCC Part 2.1047 Using ANSI C63.26-2015 RSS-210 Issue 10, Annex G.5 using ANSI C63.10:2013	Audio Low Pass Filter, Audio Frequency Response and Modulation Limiting	Pass
FCC Part 74.861(e)(4) (5), 2.1055 Using ANSI C63.26-2015 RSS-210 Issue 10, Annex G.3 / RSS-Gen Issue 5, Section 8.11 using ANSI C63.10:2013	Frequency Stability	Pass

See Section 4 for details on the test methods used for each test.

2.0 EUT DESCRIPTION

2.1 EQUIPMENT UNDER TEST

The Equipment Under Test (EUT) was a portable transceiver from Bosch Security Systems.

Model	BTR-30N
EUT Received	17 December 2019
EUT Tested	17 December 2019 - 17 January 2020 25 March 2020
Serial No.	075491495800240001 075491495800240002 115489195800240002
Operating Band	482 MHz - 572 MHz
Power Supply	120 VAC 60 Hz Internal power supply

NOTE: For more detailed features description, please refer to the manufacturer's specifications or user's manual.

2.2 DESCRIPTION OF TEST MODES

The EUT operates on, and was tested at the frequencies below:

Channel	Frequency
Low (28u)	482.025
Middle (29u)	527.000
High (30u)	571.975

These are the only three representative channels tested in the frequency range according to FCC Part 15.31 and RSS-Gen Table A1. See the operational description for a list of all channel frequency and designations.

This EUT was set to transmit in a worse-case scenario with modulation on. The manufacturer modified the unit to transmit continuously on the lowest, highest and one channel in the middle.

2.3 DESCRIPTION OF SUPPORT UNITS

NA

3.0 LABORATORY DESCRIPTION

3.1 LABORATORY DESCRIPTION

All testing was performed at the following Facility:

The Nebraska Center for Excellence in Electronics (NCEE Labs)
4740 Discovery Drive
Lincoln, NE 68521

A2LA Certificate Number:	1953.01
FCC Accredited Test Site Designation No:	US1060
Industry Canada Test Site Registration No:	4294A-1
NCC CAB Identification No:	US0177

Environmental conditions varied slightly throughout the tests:

Relative humidity of 35 ± 4%
Temperature of 22 ± 3° Celsius

3.2 TEST PERSONNEL

All testing was performed by Karthik Vepuri, Fox Lane and Caleb Farrington of NCEE Labs. The results were reviewed by Nic Johnson.

3.3 TEST EQUIPMENT

DESCRIPTION AND MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CALIBRATION DATE	CALIBRATION DUE DATE
Rohde & Schwarz Test Receiver	ES126	100037	30 Jan 2018	30 Jan 2020
Keysight EXA Signal Analyzer	N9010A	MY56070862	14 Dec 2018	14 Dec 2020
Keysight MXE Signal Analyzer	N9038A	MY59050109	23 Apr 2019	23 Apr 2021
SunAR RF Motion	JB1	A082918-1	15 Oct 2018	15 Oct 2020
SunAR RF Motion	JB1	A091418	06 Mar 2020	06 Mar 2022
EMCO Horn Antenna	3115	6416	26 Jan 2018	26 Jan 2020
Rohde & Schwarz Preamplifier	TS-PR18	3545700803	09 Mar 2018*	09 Mar 2021*
Trilithic High Pass Filter	6HC330	23042	09 Mar 2018*	09 Mar 2021*
Rohde & Schwarz LISN	ESH3-Z5	836679/010	25 Jul 2019	25 Jul 2020
Rohde & Schwarz Test Software	ES-K1	12575	NA	NA
RF Cable (preamplifier to antenna)	MFR-57500	01-07-002	09 Mar 2018*	09 Mar 2021*
RF Cable (antenna to 10m chamber bulkhead)	FSCM 64639	01E3872	09 Mar 2018*	09 Mar 2021*
RF Cable (10m chamber bulkhead to control room bulkhead)	FSCM 64639	01E3874	09 Mar 2018*	09 Mar 2021*
RF Cable (Control room bulkhead to RF switch)	FSCM 64639	01E3871	09 Mar 2018*	09 Mar 2021*
RF Cable (RF switch to test receiver)	FSCM 64639	01F1206	09 Mar 2018*	09 Mar 2021*
RF switch – Rohde and Schwarz	TS-RSP	1113.5503.14	09 Mar 2018*	09 Mar 2021*
N connector bulkhead (10m chamber)	PE9128	NCEEBH1	09 Mar 2018*	09 Mar 2021*
N connector bulkhead (control room)	PE9128	NCEEBH2	09 Mar 2018*	09 Mar 2021*
HP Modulation Analyzer	8901A	2439A03594	28 May 2019	31 May 2021
HP Arbitrary Waveform Generator	33120A	US34013155	N/A	N/A
Agilent DC Power Supply	E3631A	KR01128922	N/A	N/A
Tektronix Digital Phosphor Oscilloscope	DPO 2024	C011676	23 Apr 2020	23 Apr 2021

*Internal Characterization

4.0 DETAILED RESULTS

4.1 UNWANTED EMISSIONS & FIELD STRENGTH OF EMISSIONS

Test Method: ANSI C63.26:2015:
1. Section 5.5, “Radiated Emissions Testing”
& also, FCC Part 15B using ANSI C63.4-2014 RSS-Gen, ICES-003, Issue 6

Limits for radiated emissions measurements:

Limits from FCC Part 74.861(e)(6)(iii) shall be applied:

Frequency Band	Limit (dB)
≥250% of authorized bandwidth	43 + 10log(P)

Where P is equal to the output power of the transmitter in Watts.

FCC Limit = -13 dBm

Limit from RSS 210, Annex G.4, and ETSI EN 300 422-1

Table 3: Limits for spurious emissions

State	Frequency		
	47 MHz to 74 MHz 87,5 MHz to 137 MHz 174 MHz to 230 MHz 470 MHz to 862 MHz	Other Frequencies below 1 000 MHz	Frequencies above 1 000 MHz
Operation	4 nW	250 nW	1 µW
Standby	2 nW	2 nW	20 nW

Operation
-53.98 dBm (47-862 MHz Bands) -36.02 dBm (Below – 1 GHz) -30 dBm (above 1 GHz)

Standby
-56.99 dBm (47-862 MHz Bands) -56.99 dBm (Below – 1 GHz) -46.99 dBm (above 1 GHz)

Test procedures:

The EUT was connected directly to a spectrum analyzer. Spurious components with frequency less than 1GHz were recorded and evaluated according to the limit stated above. Analyzer measurement settings can be found in the plots below along with the corresponding power levels.

Deviations from test standard:

No deviation.

Test setup:

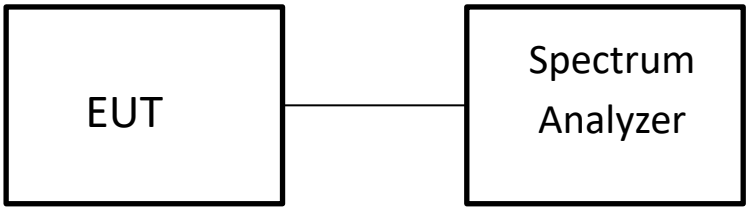


Figure 1 - Conducted Unwanted Emissions Test Setup

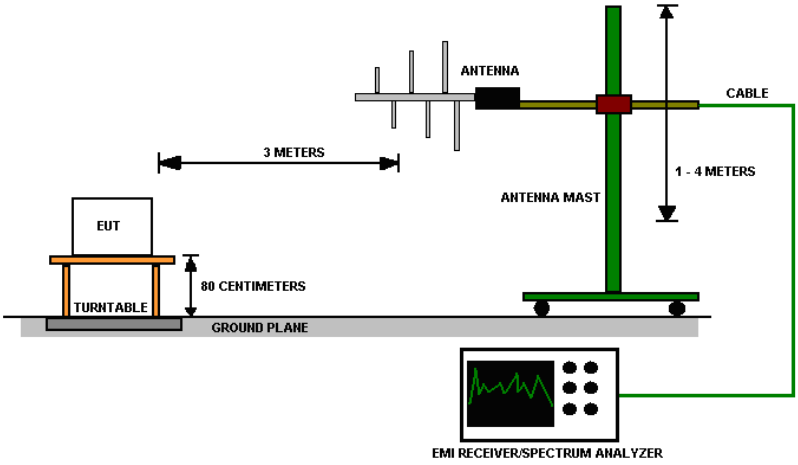


Figure 2 - Radiated Emissions Test Setup

EUT operating conditions

The EUT was powered by 120 VAC 60Hz for all the tests.

Test results:

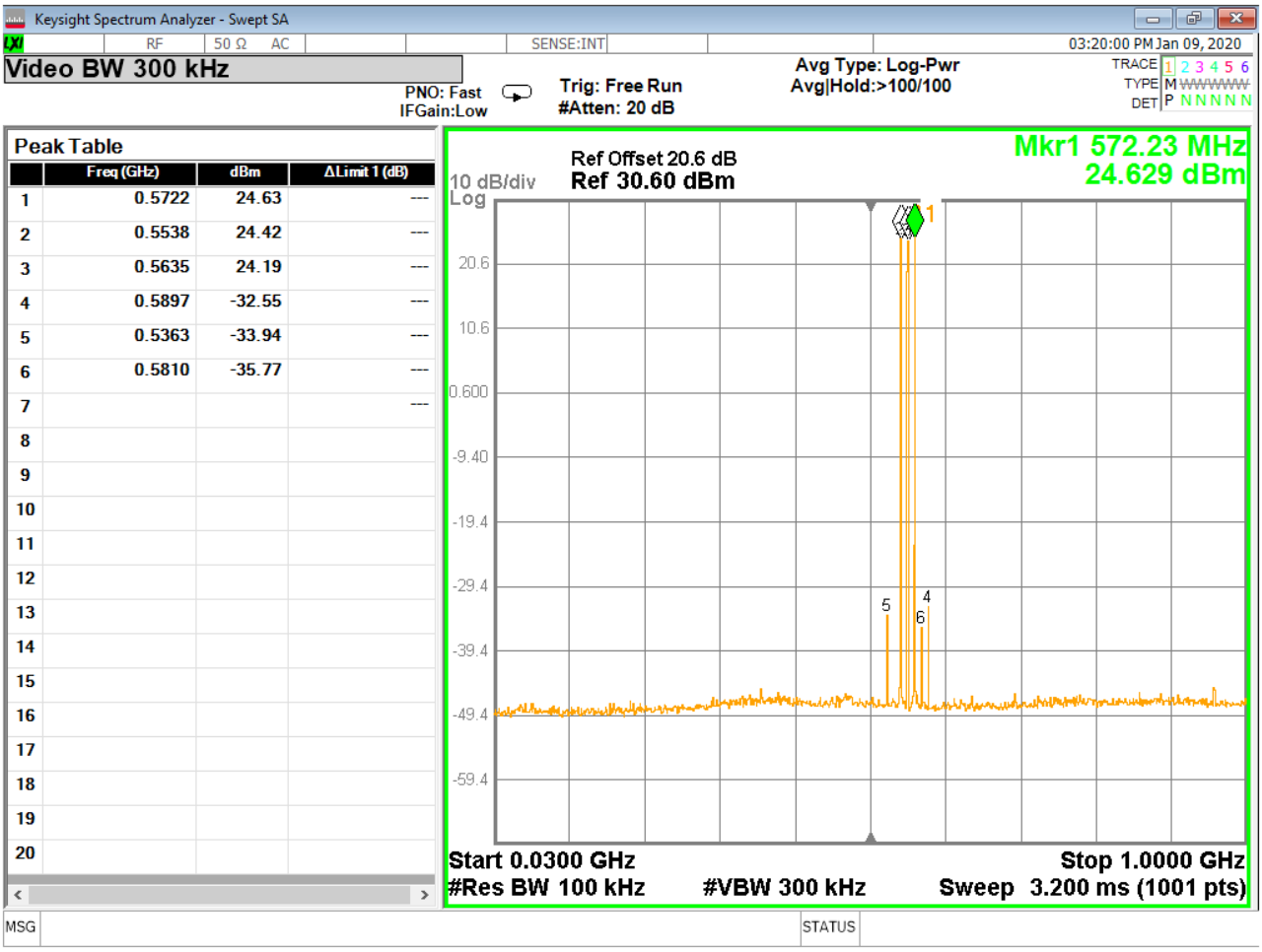


Figure 3 - Conducted Unwanted Emissions Plot

Limit = -13 dBm

Figure 4 - Conducted Unwanted Emissions Plot

Limit = -13 dBm

Low Ch 482 MHz		BTR 30 Radiated Emissions Per ETSI EN 300 422-1				
Frequency	Siggen	Cable loss	Gain	Corrected Level	Limit	Margin
MHz	dBm	dB		dBm	dBm	dB
964.006000	11.2	-56.1	6.6	-38.3	-36.02	2.28

All the other measurements including the harmonics of mid and high channel were found to be at least 6 dB below the limit.

* Note that this table covers FCC requirement too as the limits are higher than that required for EN 300 422-1.
Corrected Level = Sig gen + Cable Loss+ Gain

4.2 OUTPUT POWER

Test Method: ANSI C63.26:
Section(s) 5.2.3.3 “Measurement of peak power in a narrowband signal with a spectrum/signal analyzer or EMI receiver”

Limits of power measurements:

(1) The power may not exceed the following values.

(i) 54-72, 76-88, and 174-216 MHz bands: 50 mW EIRP

(ii) 470-608 and 614-698: 250 mW conducted power

Test procedures:

All the measurements were done with RBW greater than OBW of the signal.

Deviations from test standard:
No deviation.

Test setup:

Figure 5 – Peak Output Power Measurements Test Setup

EUT operating conditions:
The EUT was powered by 120 VAC 60 Hz power unless specified and set to transmit continuously on the lowest frequency channel, highest frequency channel and one in the middle of its operating range.

Test results:

Output Power

CHANNEL	CHANNEL FREQUENCY (MHz)	Peak Output Power (dBm)	Peak Output Power (mW)	EIRP (mW)	Method	RESULT
Low	482.025000	23.863	243.39	243.39	Conducted	PASS
Middle	527.000000	23.575	227.77	227.77	Conducted	PASS
High	571.970000	23.847	242.49	242.49	Conducted	PASS

EIRP = Peak Output Power (mW) x antenna gain (numeric isotropic)

Antenna gain = 0 dBi = 1 (numeric)

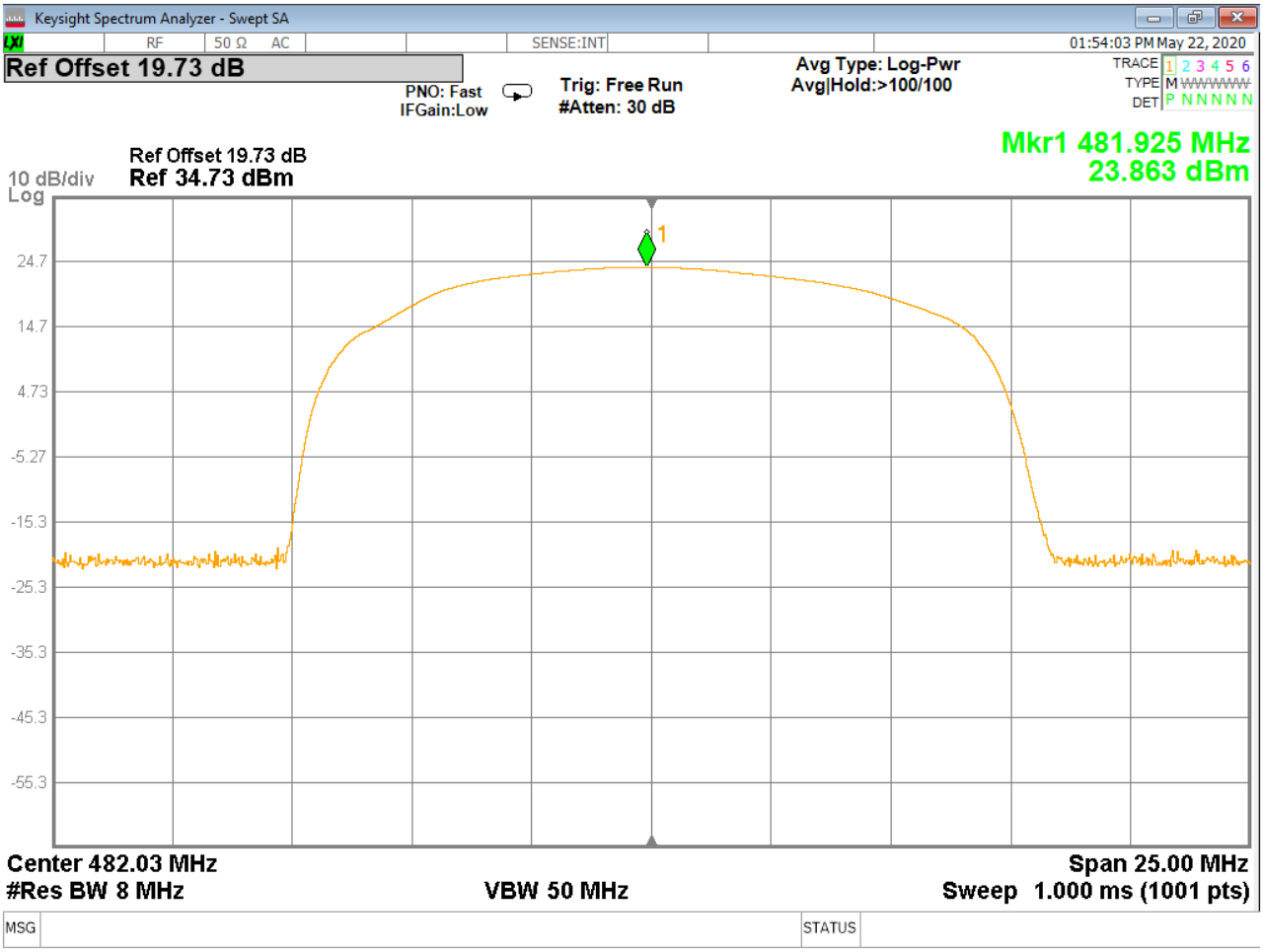


Figure 6 - Output Power, Low Channel

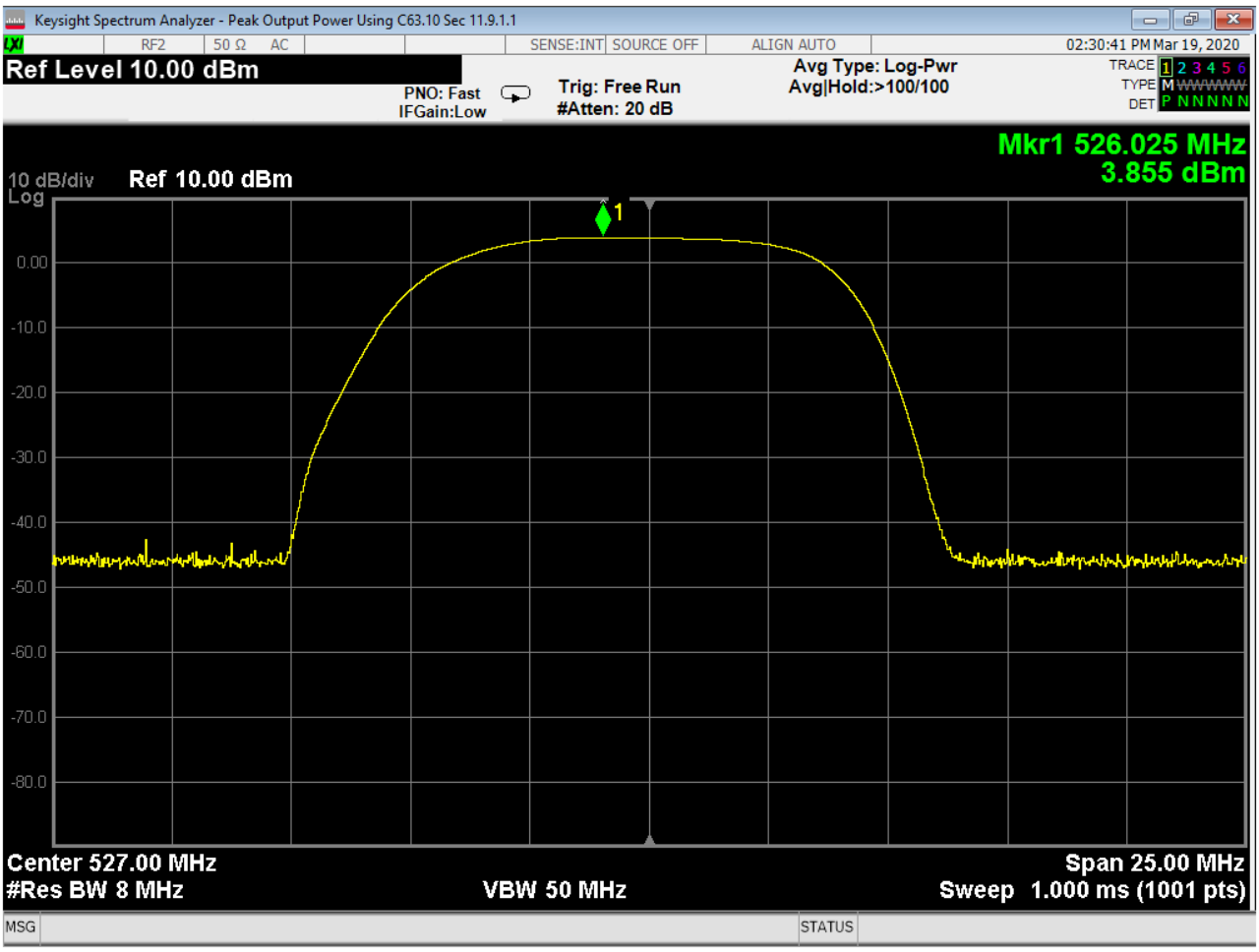


Figure 7 - Output Power, Mid Channel

Attenuator was not accounted for,

23.575dBm = 19.72 + 3.855

Output Power = Attenuation + 3.855

Attenuation = 19.72dBm

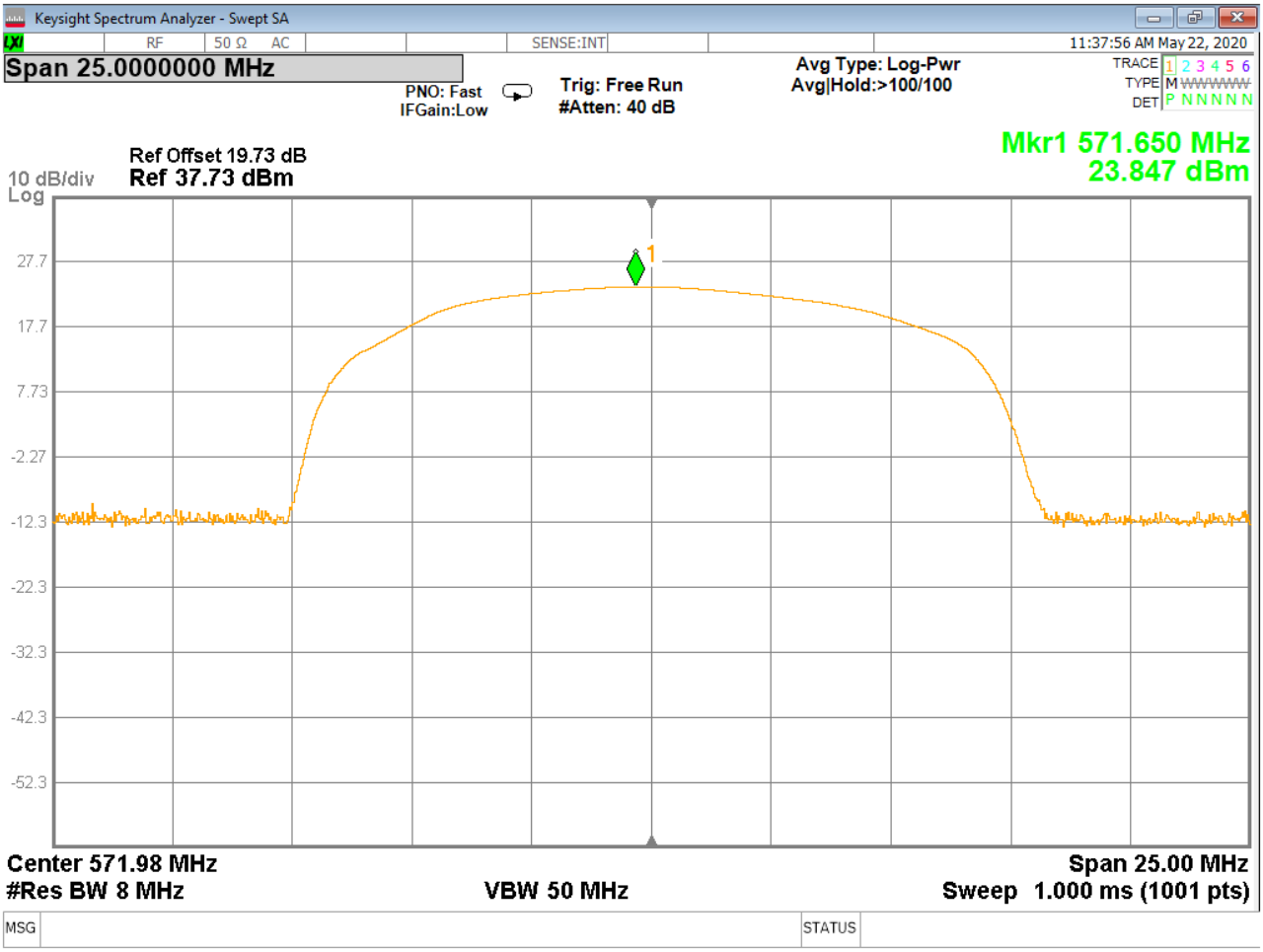


Figure 8 – Output Power, High Channel

4.3 BANDWIDTH AND EMISSIONS MASK

Test Method: ANSI C63.26,
1. Section(s) 5.4.3, 5.4.4

Limits of bandwidth measurements:
The operating bandwidth shall not exceed 200 kHz.

The mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:

(i) On any frequency removed from the operating frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: at least 25 dB;

(ii) On any frequency removed from the operating frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: at least 35 dB;

(iii) On any frequency removed from the operating frequency by more than 250 percent of the authorized bandwidth: at least 43 + 10log10 (mean output power in watts) dB.

Test procedures:
The EUT was connected to the spectrum analyzer directly with a low-loss shielded coaxial cable. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 1 kHz RBW and 3 kHz VBW. The bandwidth measurements were done using the automatic bandwidth measurement. The modulation frequency was 1 kHz.

Deviations from test standard:
No deviation

Test setup:

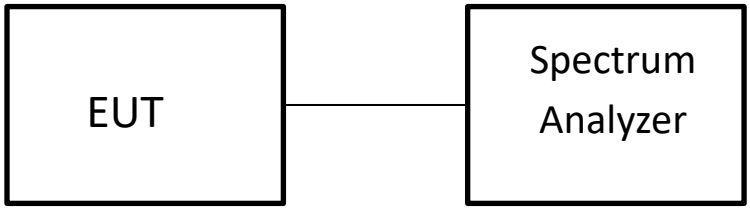


Figure 9 –Measurements Test Setup

EUT operating conditions:
The EUT was powered by 120 VAC 60 Hz power unless specified and set to transmit continuously on the lowest frequency channel, highest frequency channel and one in the middle of its operating range.

Test results:

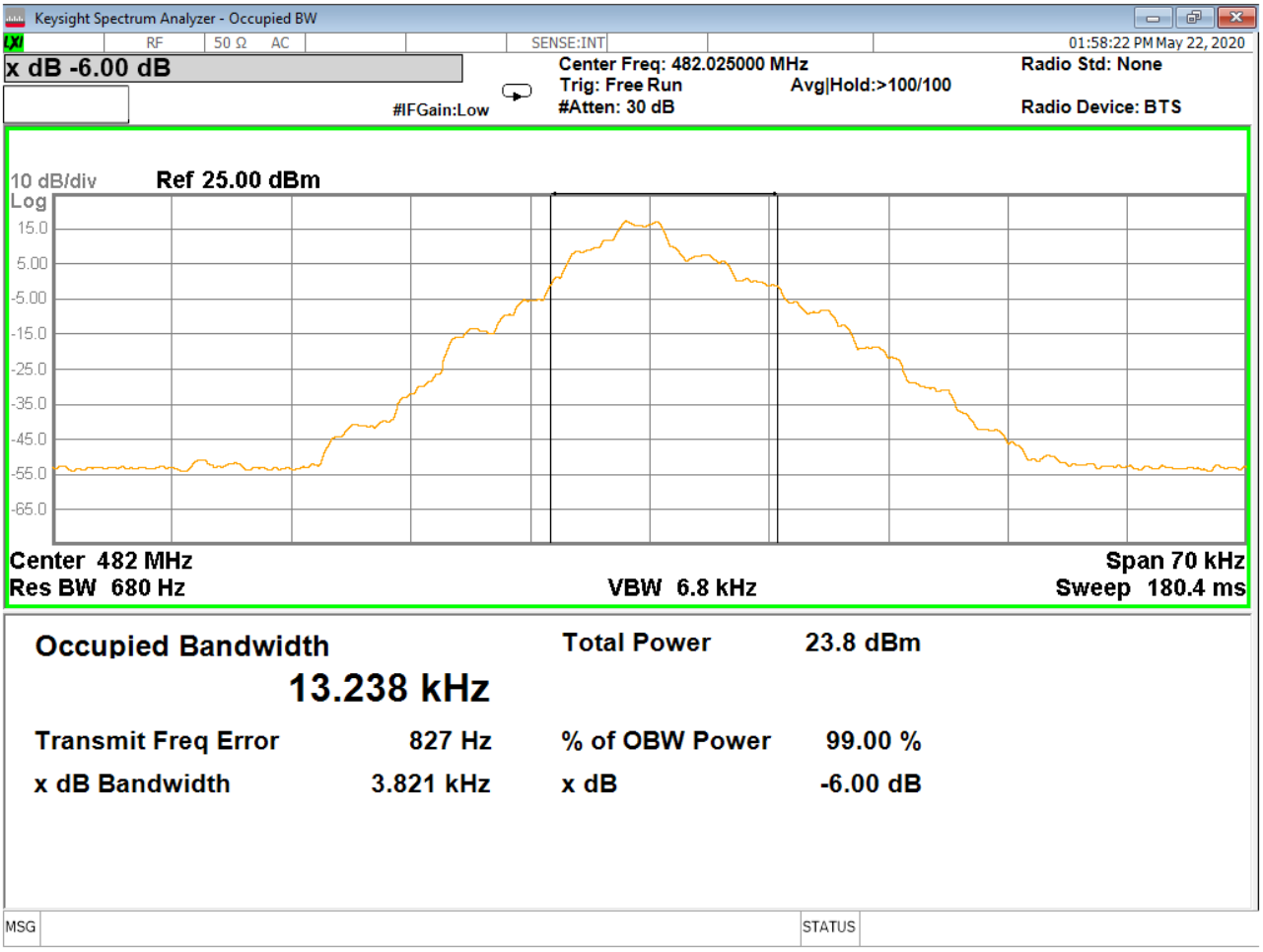


Figure 10 - 99% Occupied Bandwidth, Low Channel, with Tone

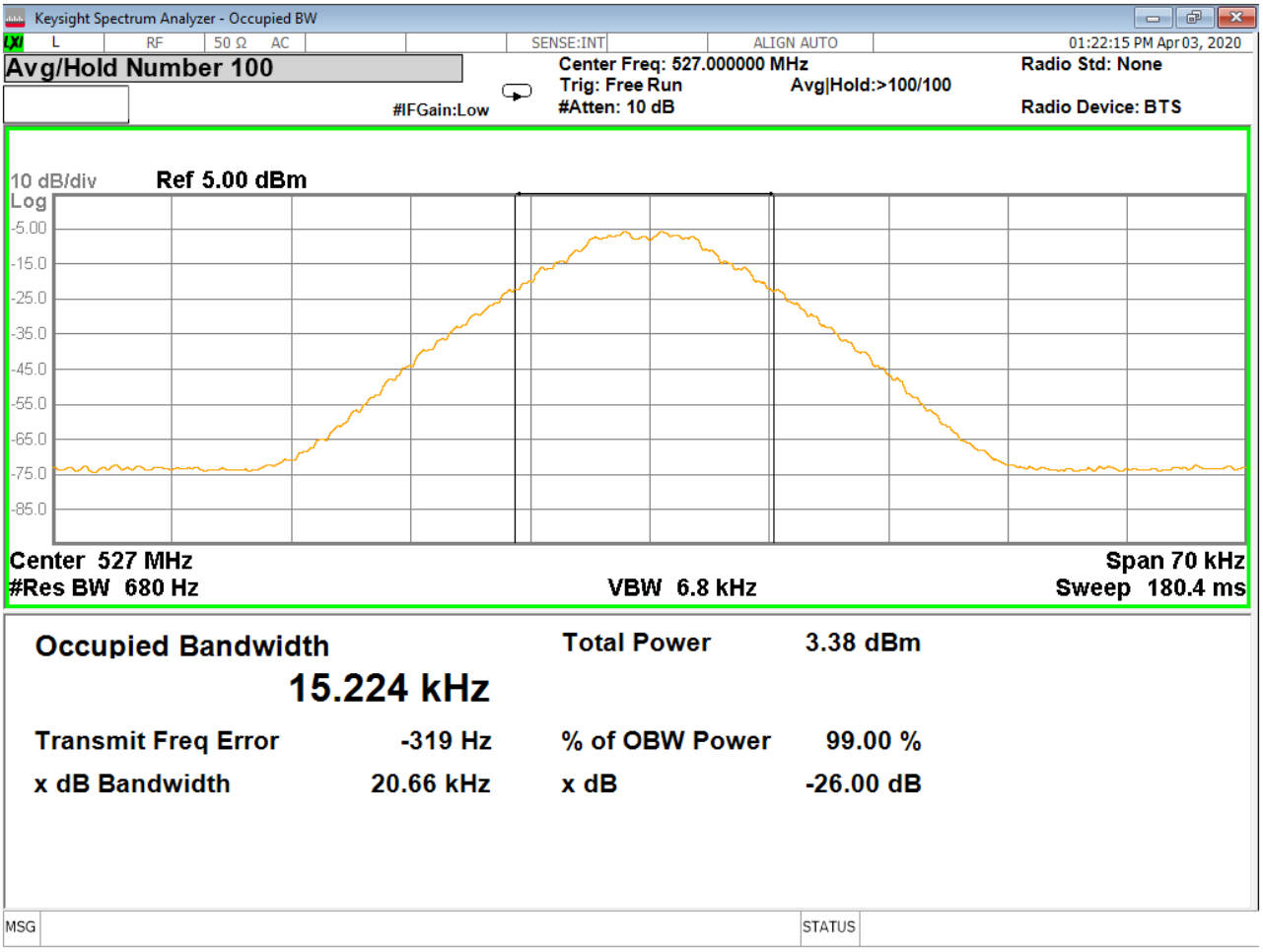


Figure 11 - 99% Occupied Bandwidth, Mid Channel, with Tone

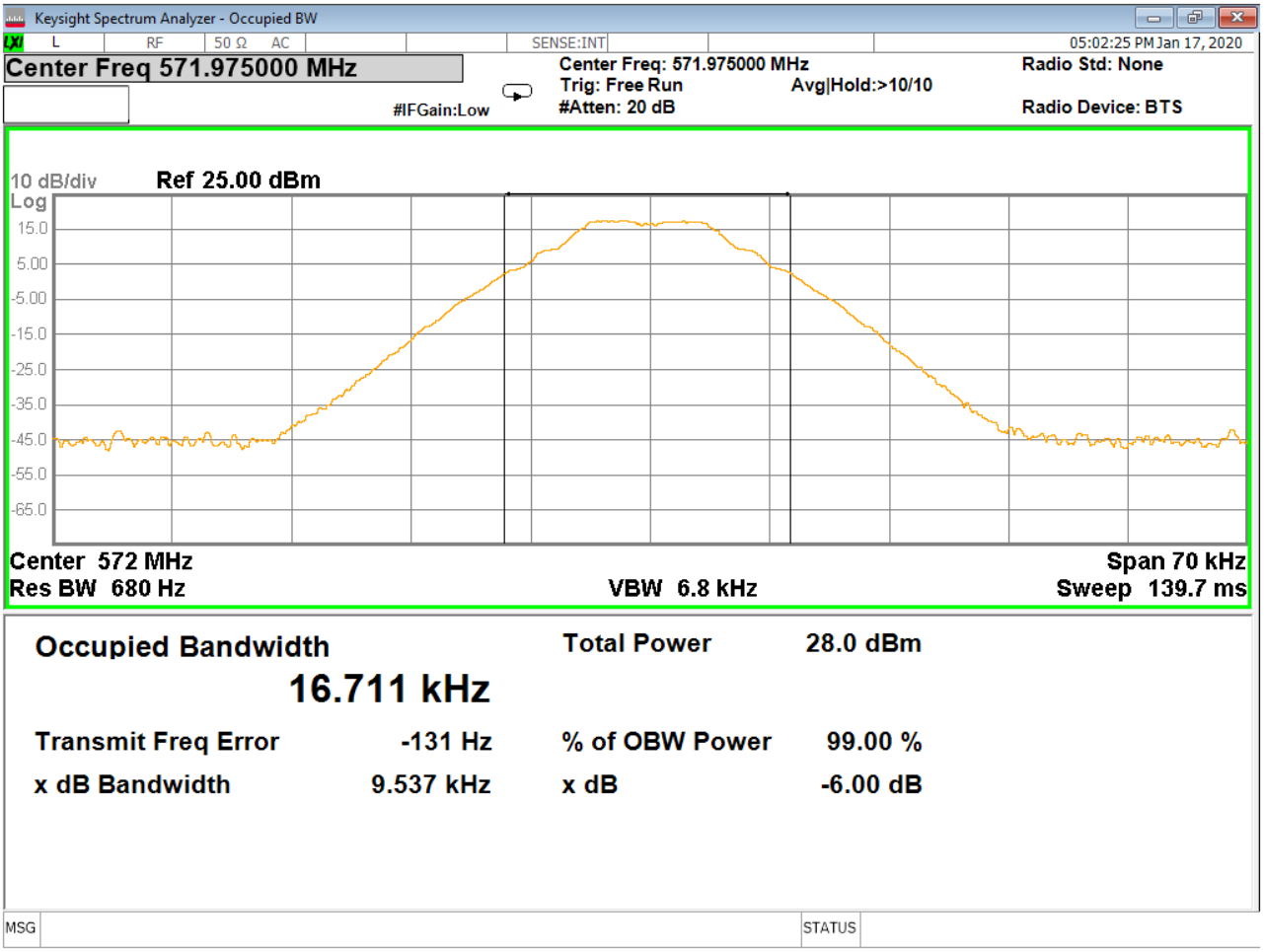
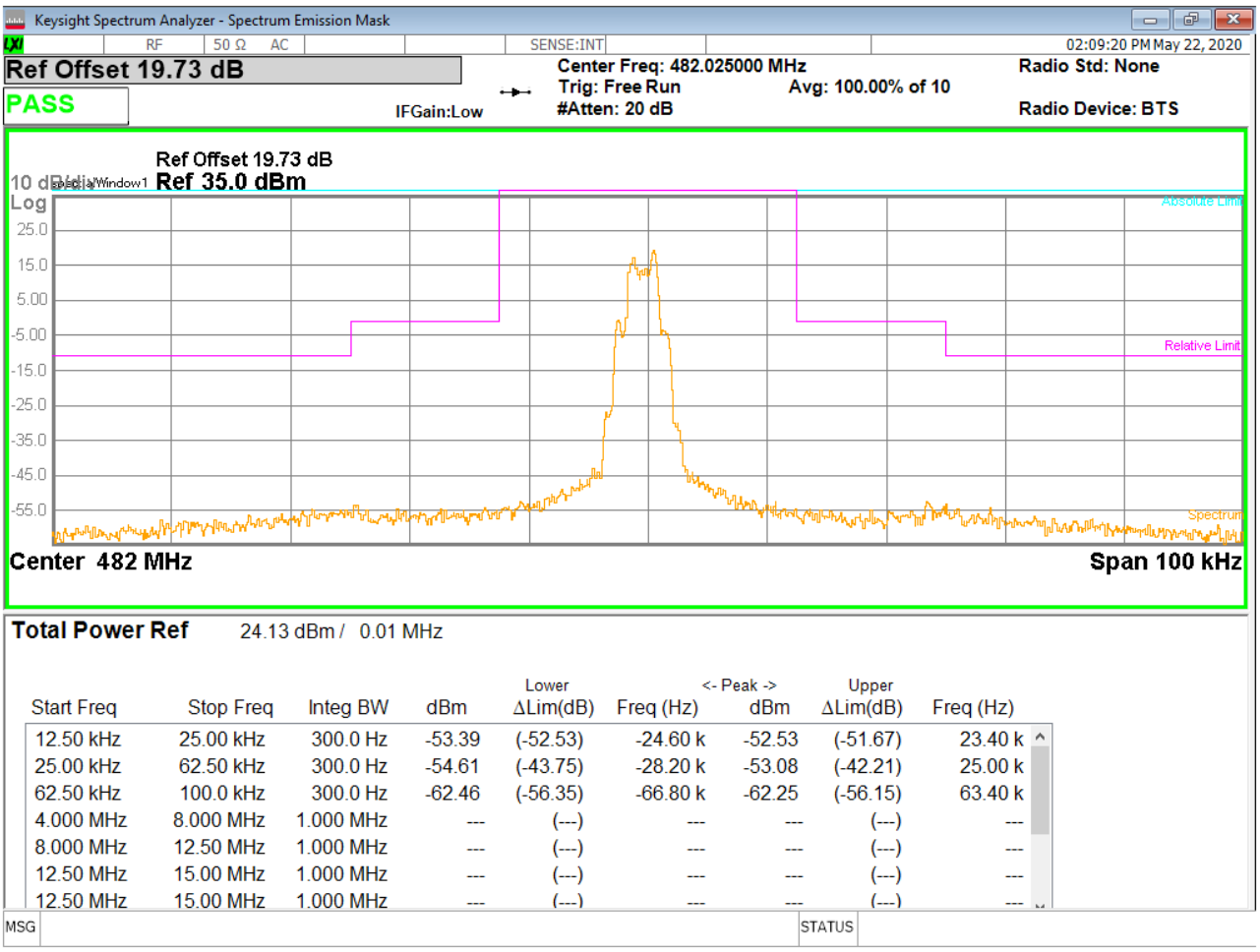
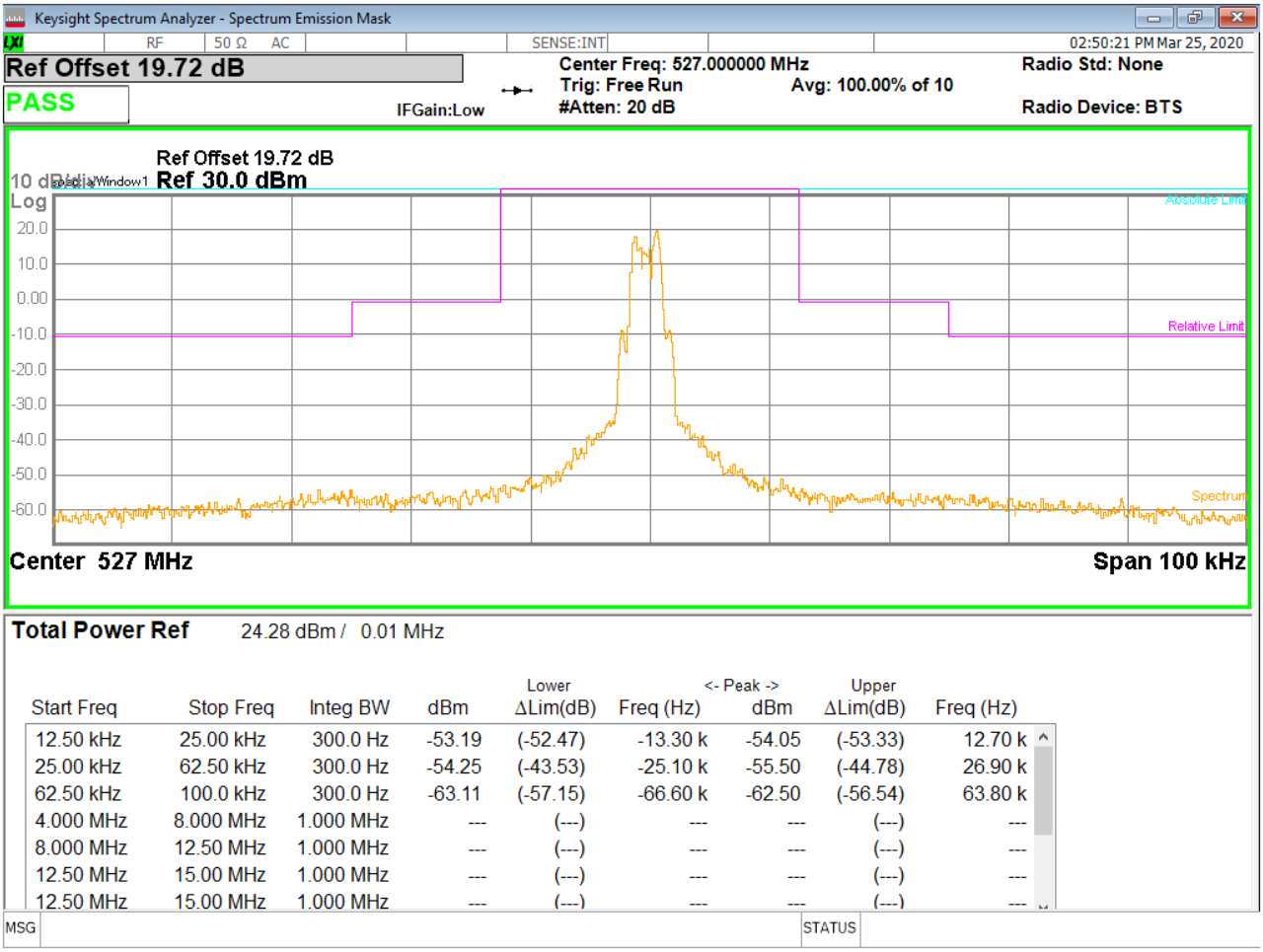


Figure 12 - 99% Occupied Bandwidth, High Channel, with Tone



Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
12.50 kHz	25.00 kHz	300.0 Hz	-53.39	(-52.53)	-24.60 k	-52.53	(-51.67)	23.40 k
25.00 kHz	62.50 kHz	300.0 Hz	-54.61	(-43.75)	-28.20 k	-53.08	(-42.21)	25.00 k
62.50 kHz	100.0 kHz	300.0 Hz	-62.46	(-56.35)	-66.80 k	-62.25	(-56.15)	63.40 k
4.000 MHz	8.000 MHz	1.000 MHz	---	(---)	---	---	(---)	---
8.000 MHz	12.50 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

Figure 13 – Emissions Mask, Low Channel



Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
12.50 kHz	25.00 kHz	300.0 Hz	-53.19	(-52.47)	-13.30 k	-54.05	(-53.33)	12.70 k
25.00 kHz	62.50 kHz	300.0 Hz	-54.25	(-43.53)	-25.10 k	-55.50	(-44.78)	26.90 k
62.50 kHz	100.0 kHz	300.0 Hz	-63.11	(-57.15)	-66.60 k	-62.50	(-56.54)	63.80 k
4.000 MHz	8.000 MHz	1.000 MHz	---	(---)	---	---	(---)	---
8.000 MHz	12.50 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

Figure 14 - Emissions Mask, Mid Channel

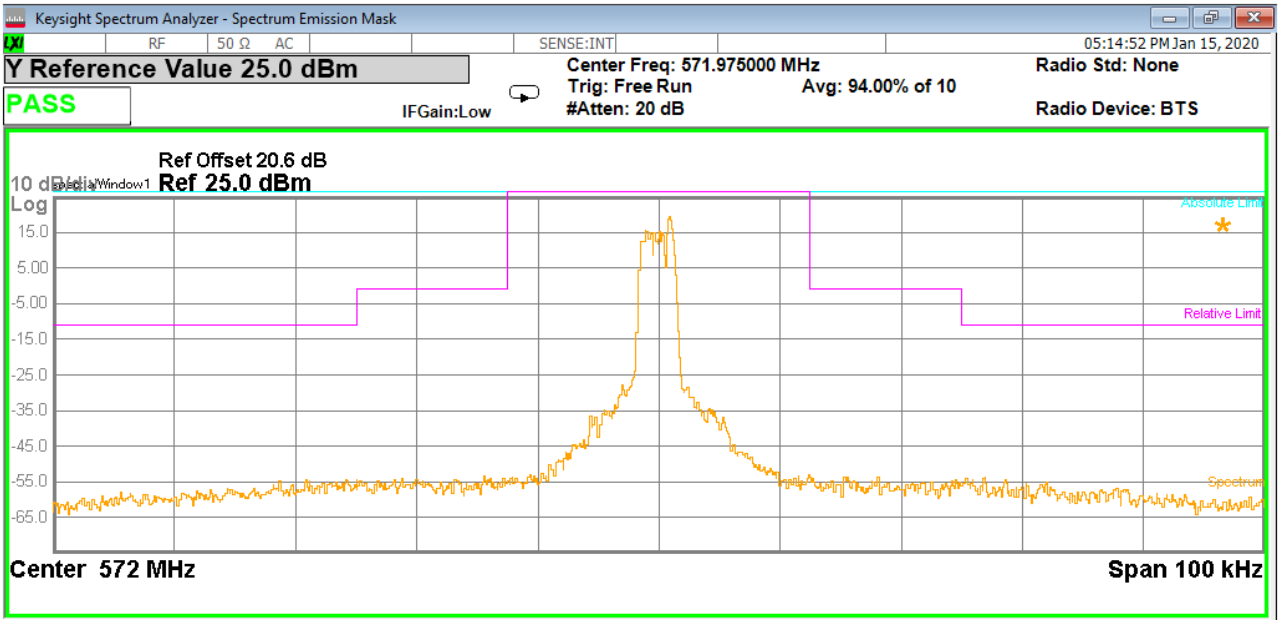


Figure 15 - Emissions Mask, High Channel

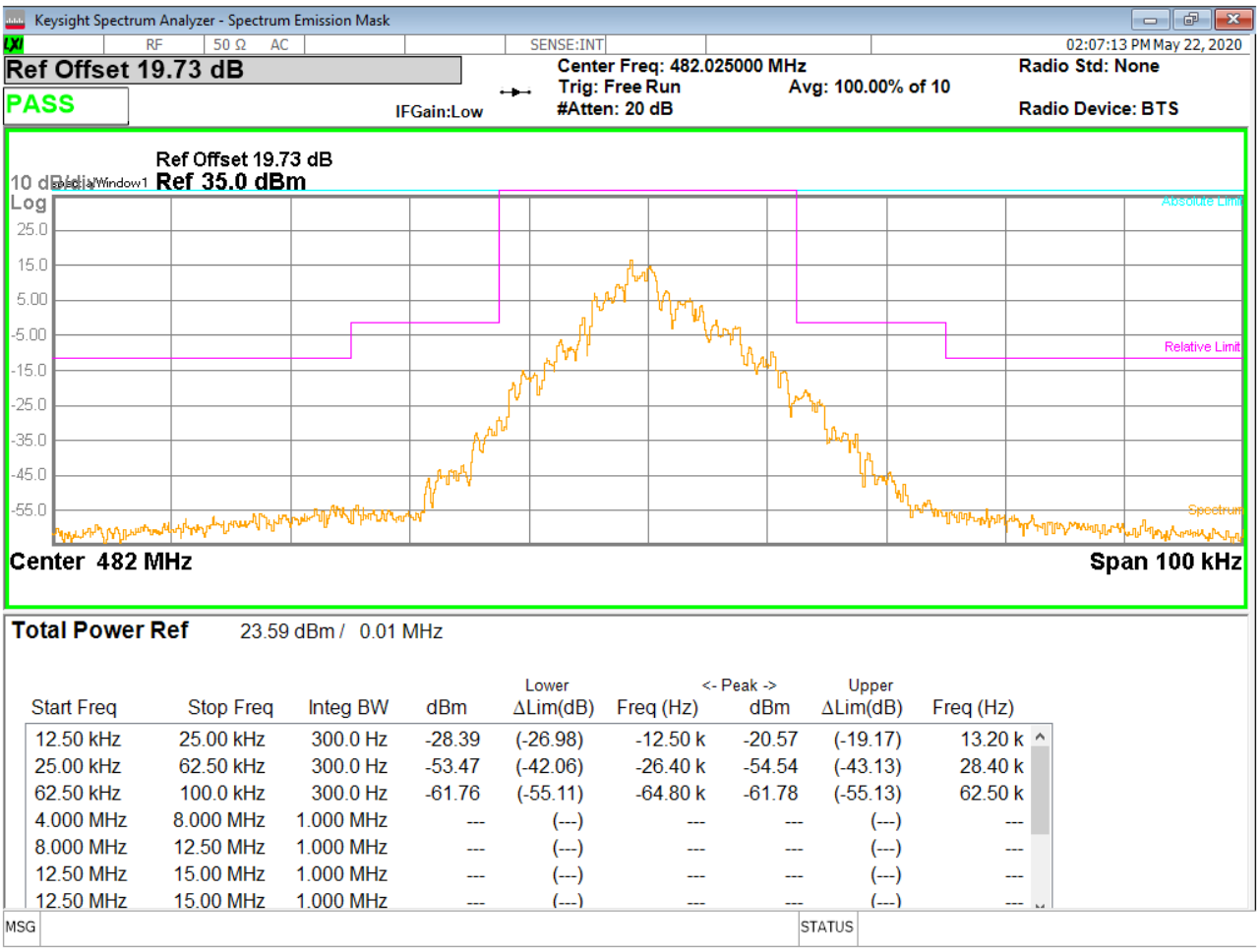


Figure 16 – Emissions Mask, Low Channel, with 1 kHz Tone

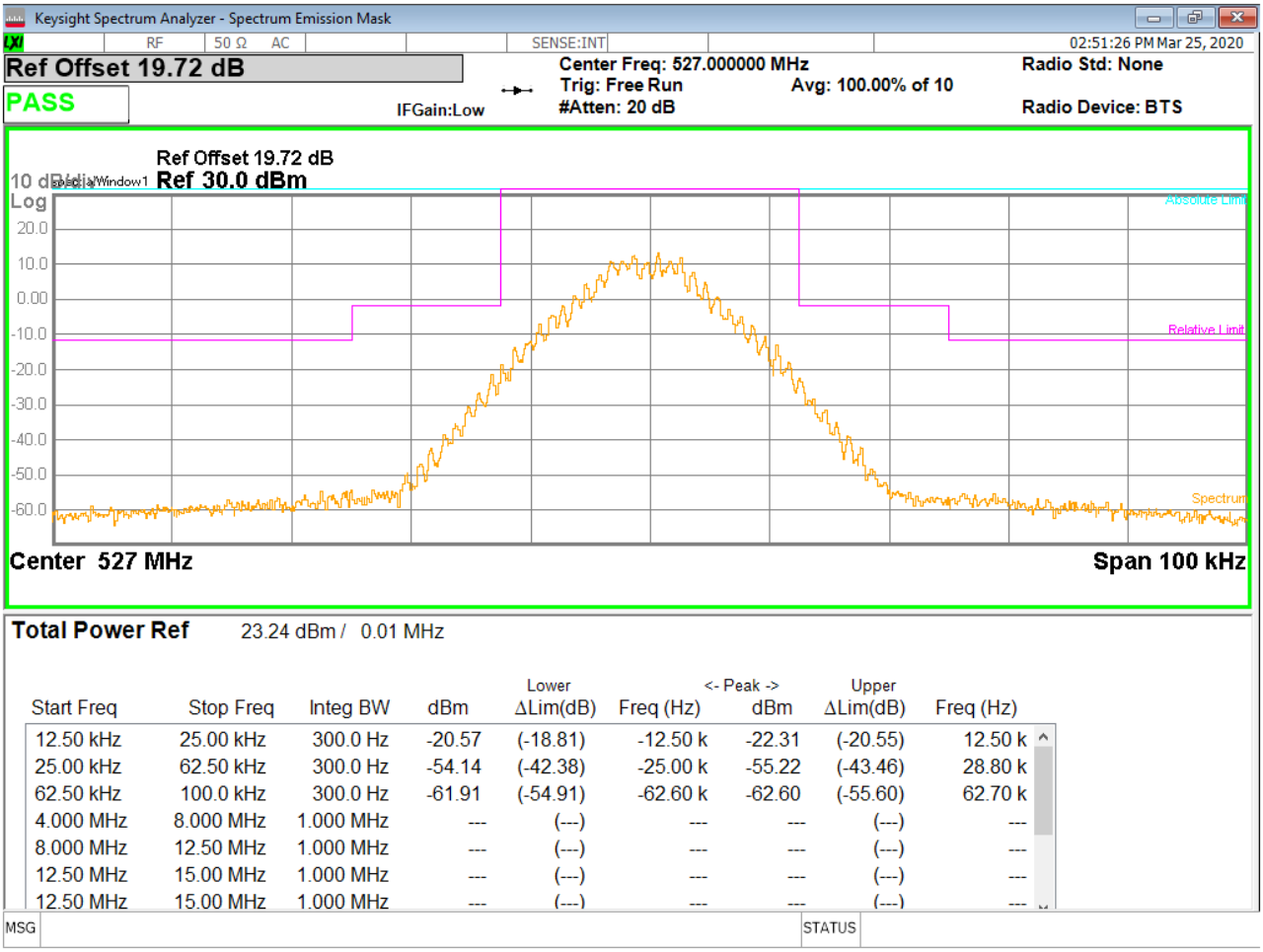


Figure 17 - Emissions Mask, Mid Channel, with 1 kHz Tone

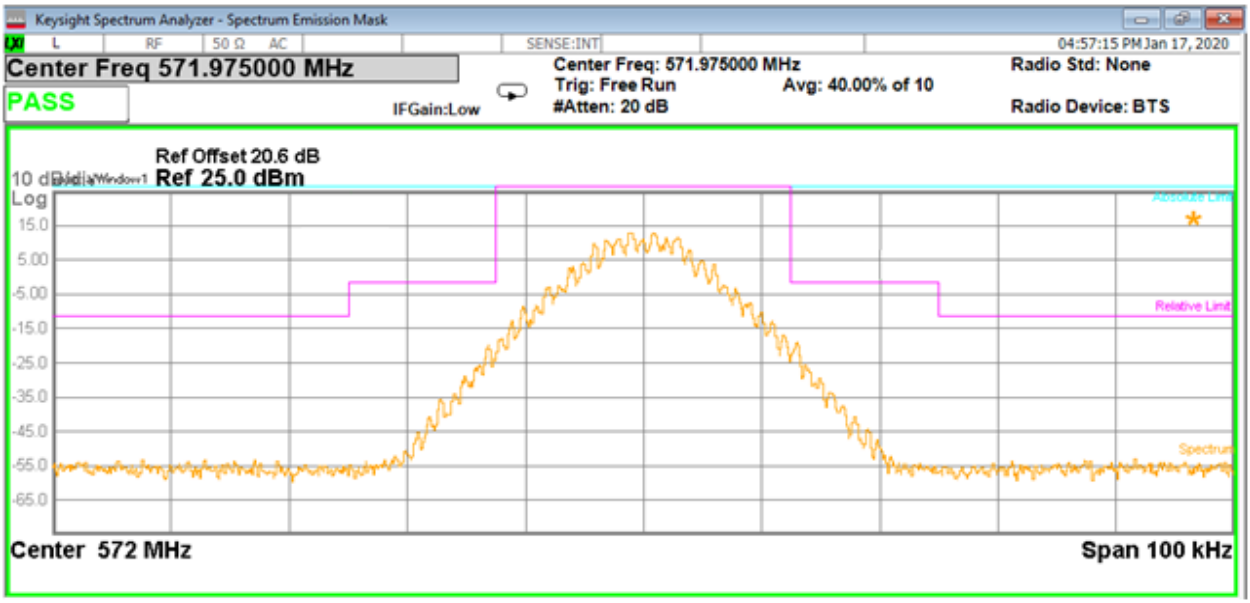


Figure 18 - Emissions Mask, High Channel, with 1kHz Tone

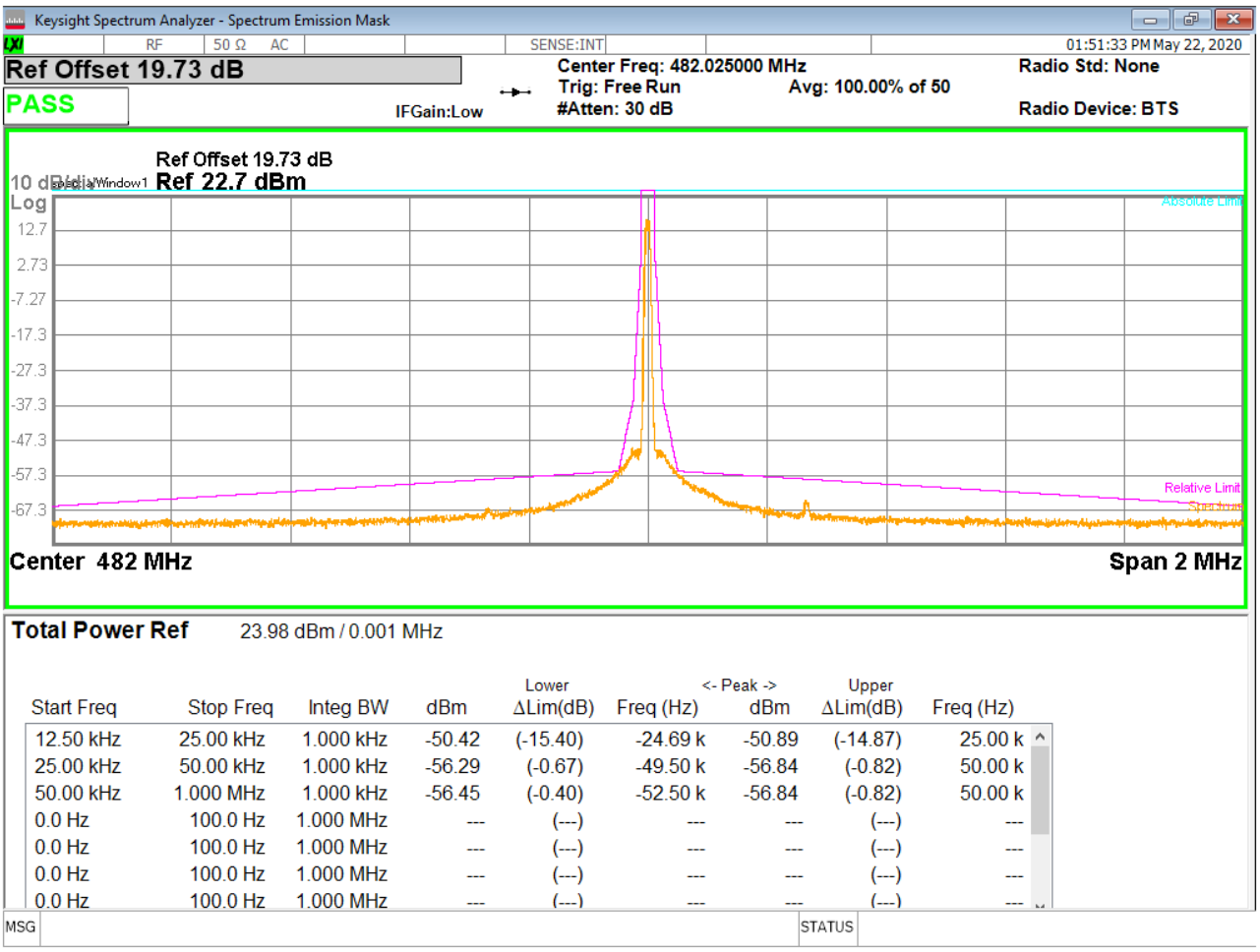
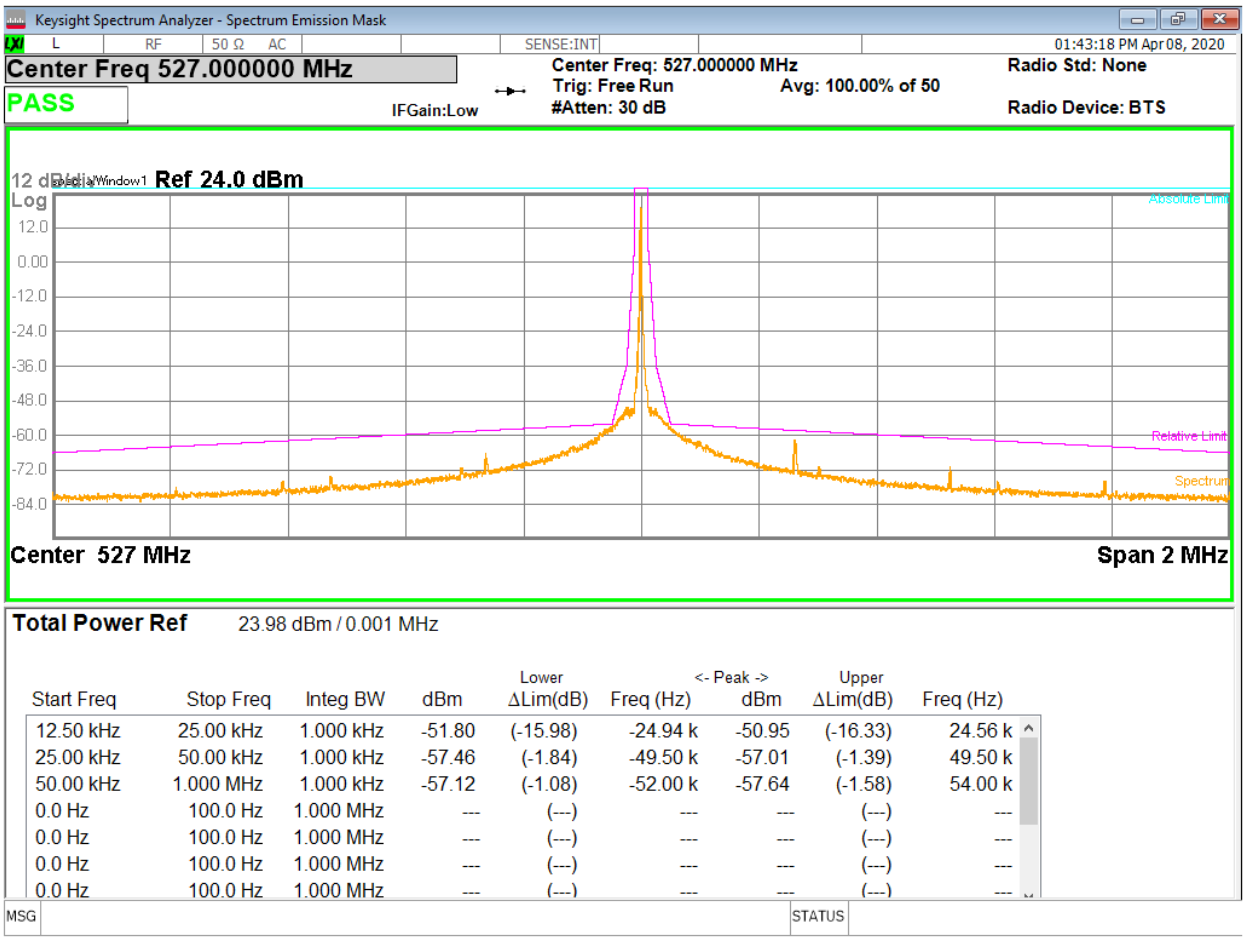
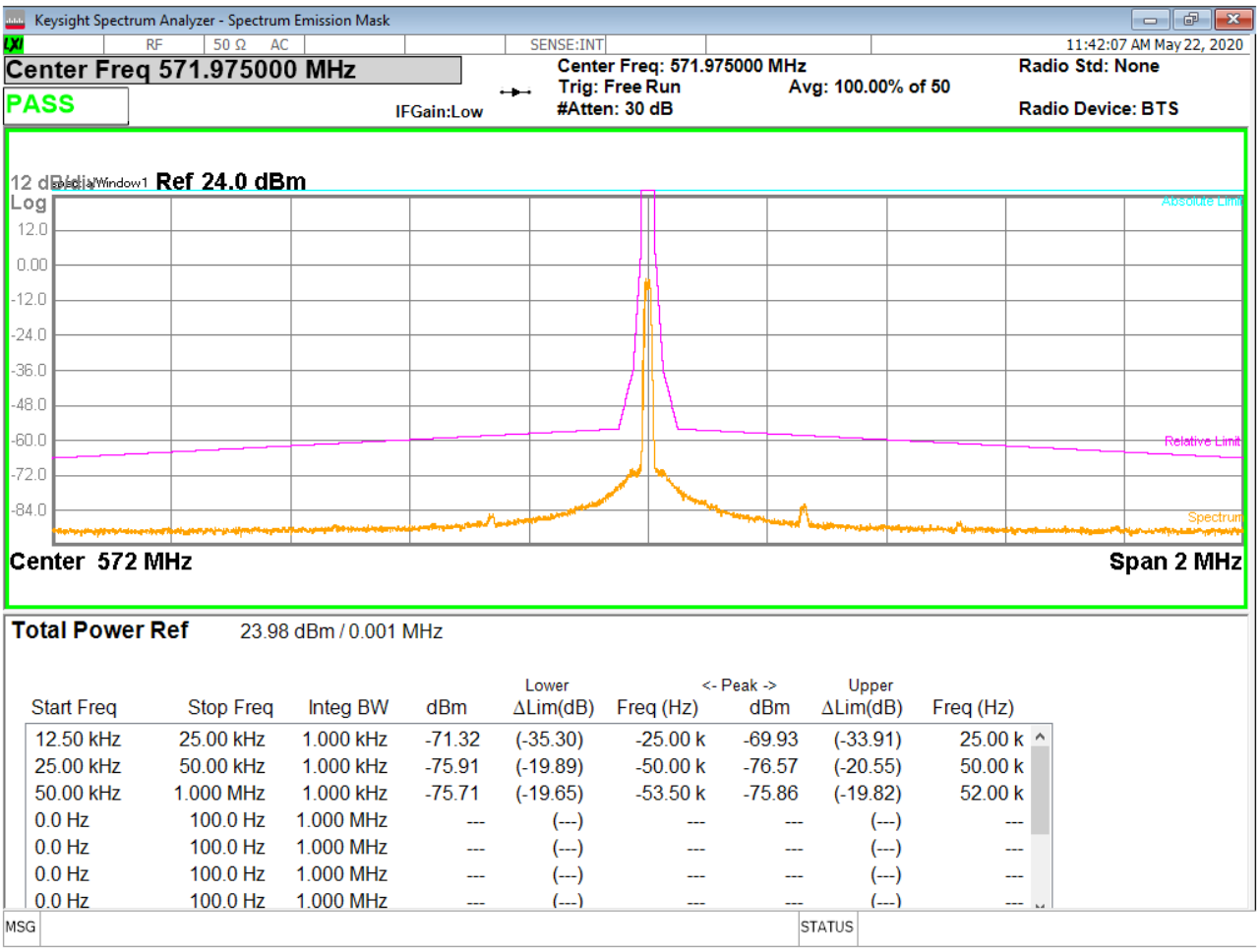


Figure 19 – Necessary Bandwidth, Low Channel



Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
12.50 kHz	25.00 kHz	1.000 kHz	-51.80	(-15.98)	-24.94 k	-50.95	(-16.33)	24.56 k
25.00 kHz	50.00 kHz	1.000 kHz	-57.46	(-1.84)	-49.50 k	-57.01	(-1.39)	49.50 k
50.00 kHz	1.000 MHz	1.000 kHz	-57.12	(-1.08)	-52.00 k	-57.64	(-1.58)	54.00 k
0.0 Hz	100.0 Hz	1.000 MHz	---	(---)	---	---	(---)	---
0.0 Hz	100.0 Hz	1.000 MHz	---	(---)	---	---	(---)	---
0.0 Hz	100.0 Hz	1.000 MHz	---	(---)	---	---	(---)	---
0.0 Hz	100.0 Hz	1.000 MHz	---	(---)	---	---	(---)	---

Figure 20 – Necessary Bandwidth, Mid Channel



Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
12.50 kHz	25.00 kHz	1.000 kHz	-71.32	(-35.30)	-25.00 k	-69.93	(-33.91)	25.00 k
25.00 kHz	50.00 kHz	1.000 kHz	-75.91	(-19.89)	-50.00 k	-76.57	(-20.55)	50.00 k
50.00 kHz	1.000 MHz	1.000 kHz	-75.71	(-19.65)	-53.50 k	-75.86	(-19.82)	52.00 k
0.0 Hz	100.0 Hz	1.000 MHz	---	(---)	---	---	(---)	---
0.0 Hz	100.0 Hz	1.000 MHz	---	(---)	---	---	(---)	---
0.0 Hz	100.0 Hz	1.000 MHz	---	(---)	---	---	(---)	---
0.0 Hz	100.0 Hz	1.000 MHz	---	(---)	---	---	(---)	---

Figure 21 – Necessary Bandwidth, High Channel

4.4 MODULATION CHARECTERISTICS

Test Method: ANSI C63.26:
Section(s) 5.3.2 “Modulation limiting test methodology” and 5.3.3” Audio frequency response”

Limits: A maximum deviation of ±75 kHz is permitted when frequency modulation is employed.

-Voice modulated communication equipment. A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted. For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter or of all circuitry installed between the modulation limiter and the modulated stage shall be submitted.

- Equipment which employs modulation limiting. A curve or family of curves showing the percentage of modulation versus the modulation input voltage shall be supplied. The information submitted shall be sufficient to show modulation limiting capability throughout the range of modulating frequencies and input modulating signal levels employed.

Test procedures:

Refer to Section 5.3.3 of C63.26, 2015.

Deviations from test standard:
No deviation.

Test setup:

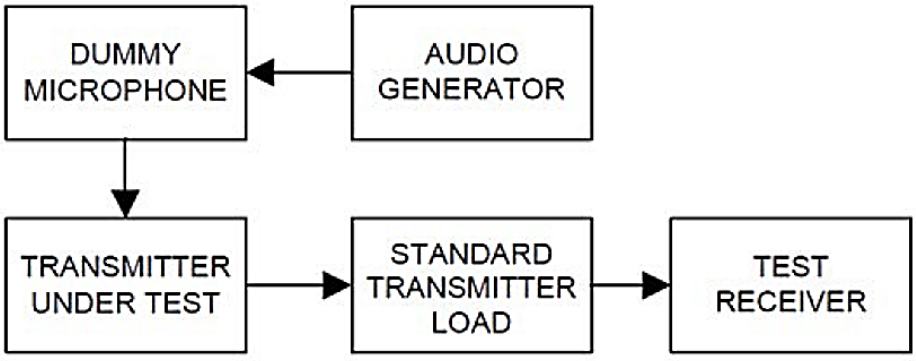


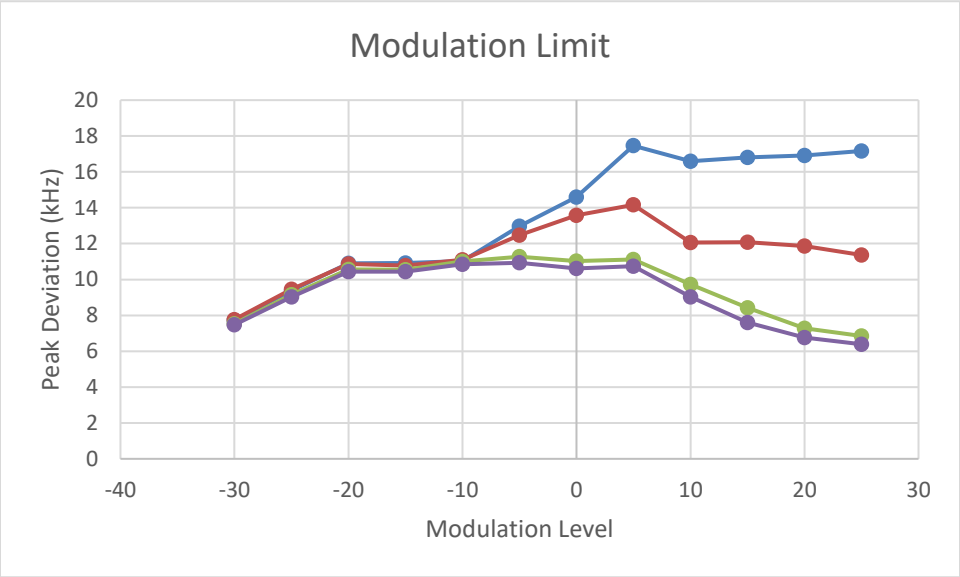
Figure 22 – Modulation Limiting and Audio Frequency Response Test Setup

EUT operating conditions:

The EUT was powered by 120 VAC 60 Hz power unless specified and set to transmit continuously on the lowest frequency channel, highest frequency channel and one in the middle of its operating range.

Test results:

Modulation Limiting:



Modulation Limit					
Modulation Level (dB)	Peak Frequency Deviation (kHz)				Limit (kHz)
	300Hz	1000Hz	2500Hz	3000Hz	
-30	7.73	7.77	7.53	7.47	±75
-25	9.38	9.45	9.15	9.02	±75
-20	10.9	10.86	10.56	10.43	±75
-15	10.92	10.78	10.55	10.44	±75
-10	11.03	11.1	11.01	10.85	±75
-5	12.97	12.48	11.27	10.93	±75
0	14.59	13.58	11.02	10.62	±75
5	17.46	14.16	11.11	10.75	±75
10	16.6	12.06	9.72	9.02	±75
15	16.81	12.08	8.42	7.6	±75
20	16.92	11.87	7.28	6.76	±75
25	17.16	11.36	6.85	6.39	±75

Audio Frequency Response:

Modulation Frequency (kHz)	Max Deviation (kHz)	Audio Frequency Response (dB)
0.30	4.01	-0.02
0.40	4.03	0.02
0.50	4.03	0.02
0.60	4.05	0.06
0.70	4.04	0.04
0.80	4.03	0.02
0.90	4.03	0.02
1.00	4.02	0.00
1.50	3.98	-0.09
2.00	3.95	-0.15
2.50	3.89	-0.29
3.00	3.83	-0.42
3.50	3.79	-0.51
4.00	3.73	-0.65
4.50	3.64	-0.86
5.00	3.56	-1.06
6.00	3.30	-1.71
7.00	3.01	-2.51
8.00	2.73	-3.36
9.00	2.44	-4.34
10.00	2.14	-5.48
11.00	1.94	-6.33
12.00	1.81	-6.93
13.00	1.71	-7.42
14.00	1.65	-7.73
15.00	1.60	-8.00

4.5 FREQUECY STABILITY MEASUREMENTS

Test Method: ANSI C63.26,

1. Section(s) 5.6.3 “Procedures for frequency stability testing”

Limits:
2 PPM

Test procedures:
Radiated power was measured on a spectrum analyzer with resolution bandwidth and video bandwidth set to 500 Hz and 1 kHz respectively. The frequency error functionality on the receiver was used. The temperature was varied from -30°C to -50°C.

Deviations from test standard:
No deviation

Test setup:

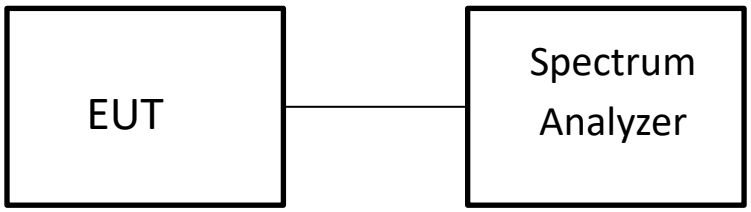


Figure 23 –Measurements Test Setup

EUT operating conditions:
The EUT was powered by 120 VAC 60 Hz power unless specified and set to transmit continuously on the lowest frequency channel, highest frequency channel and one in the middle of its operating range.

Test results:

Frequency Stability, Temperature Variation

Temp in C°	-30	-20	-10	0	10	20	25	30	40	50			
Freq (MHz)	Deviation (Hz)										limit (Hz)	limit (ppm)	Result
482.0000	477	600	386	232	160	124	302	285	487	496	964.000	50	Pass
527.0000	662	828	353	153	71	404	262	277	499	428	1054.000	50	Pass
571.9750	509	405	233	107	82	149	19	60	135	184	1143.950	50	Pass

Frequency Stability, Voltage Variation

Freq (MHz)	102V	120V	138V	limit (Hz)	limit (ppm)	Result
482.0000	388	412	426	1108.000	50	Pass
527.0000	375	354	360	1126.200	50	Pass
571.9750	129	134	129	1143.950	50	Pass

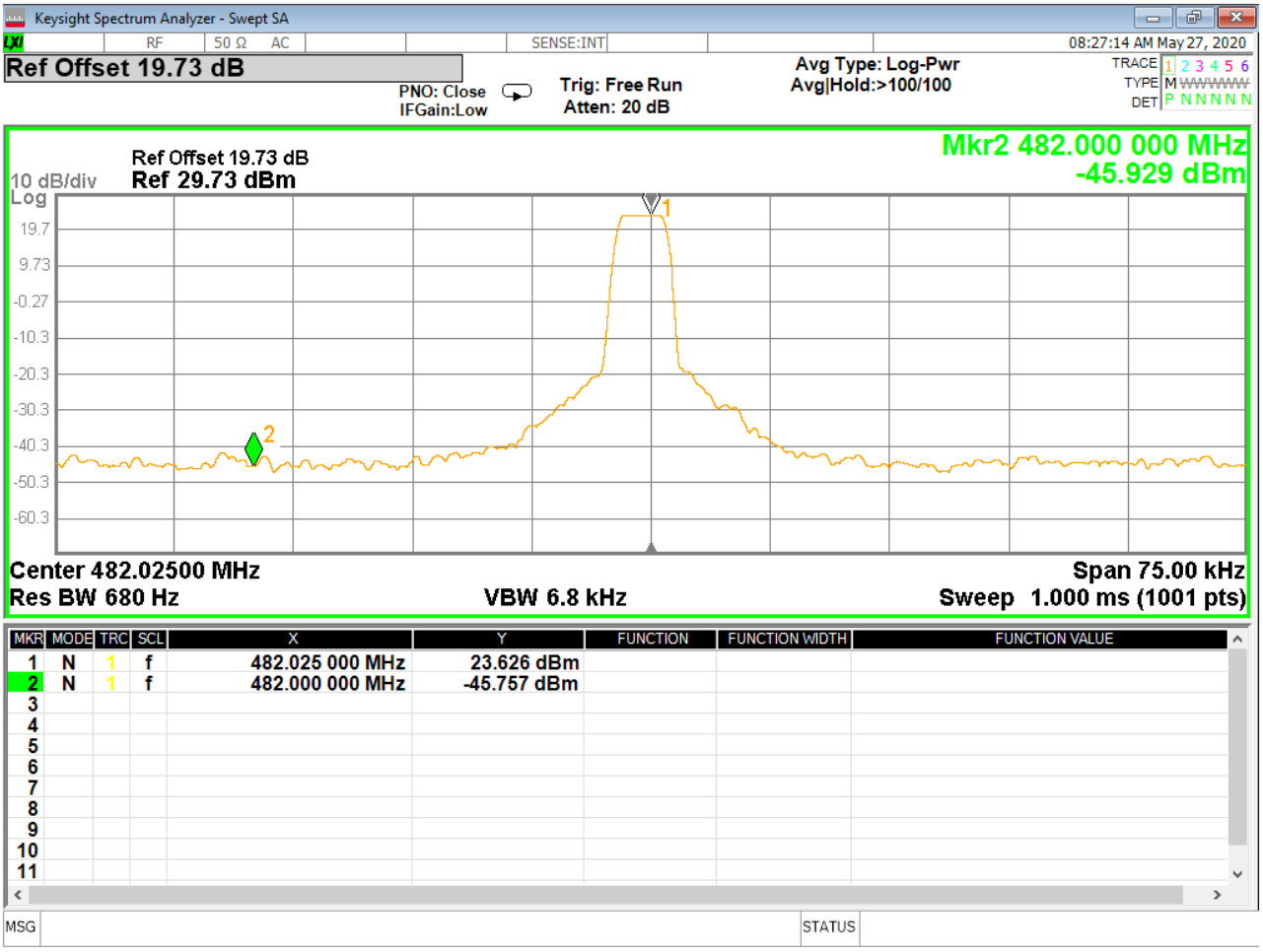


Figure 24 - Lowest channel frequency, 482.025 MHz

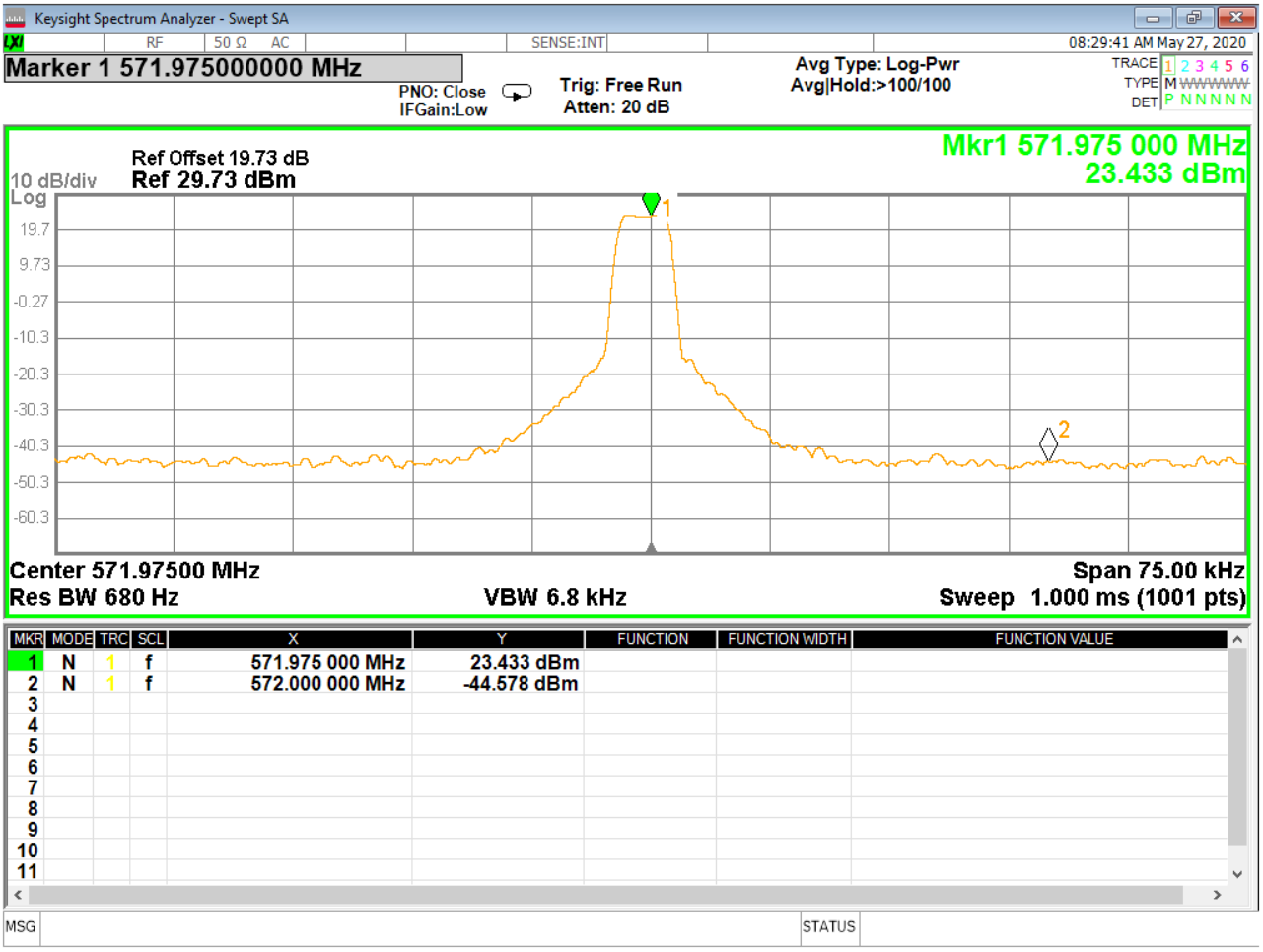


Figure 25 - Highest Channel Frequency, 571.975 MHz

4.6 CONDUCTED AC MAINS EMISSIONS

Test Method: ANSI C63.10-2013, Section(s) 6.2

Limits for conducted emissions measurements:

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

Notes:
1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz
3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

Test Procedures:

a. The EUT was placed 0.8m above a ground reference plane and 0.4 meters from the conducting wall of a shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). The LISN provides 50 ohm/ 50uH of coupling impedance for the measuring instrument.
b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference as well as the ground.
c. The frequency range from 150 kHz to 30 MHz was searched. Emission levels over 10dB under the prescribed limits are not reported.
d. Results were compared to the 15.207 limits.

Deviation from the test standard:
No deviation

EUT operating conditions:
The EUT was powered by 120 VAC 60 Hz unless specified and set to transmit continuously on the middle channel.

Test Results:

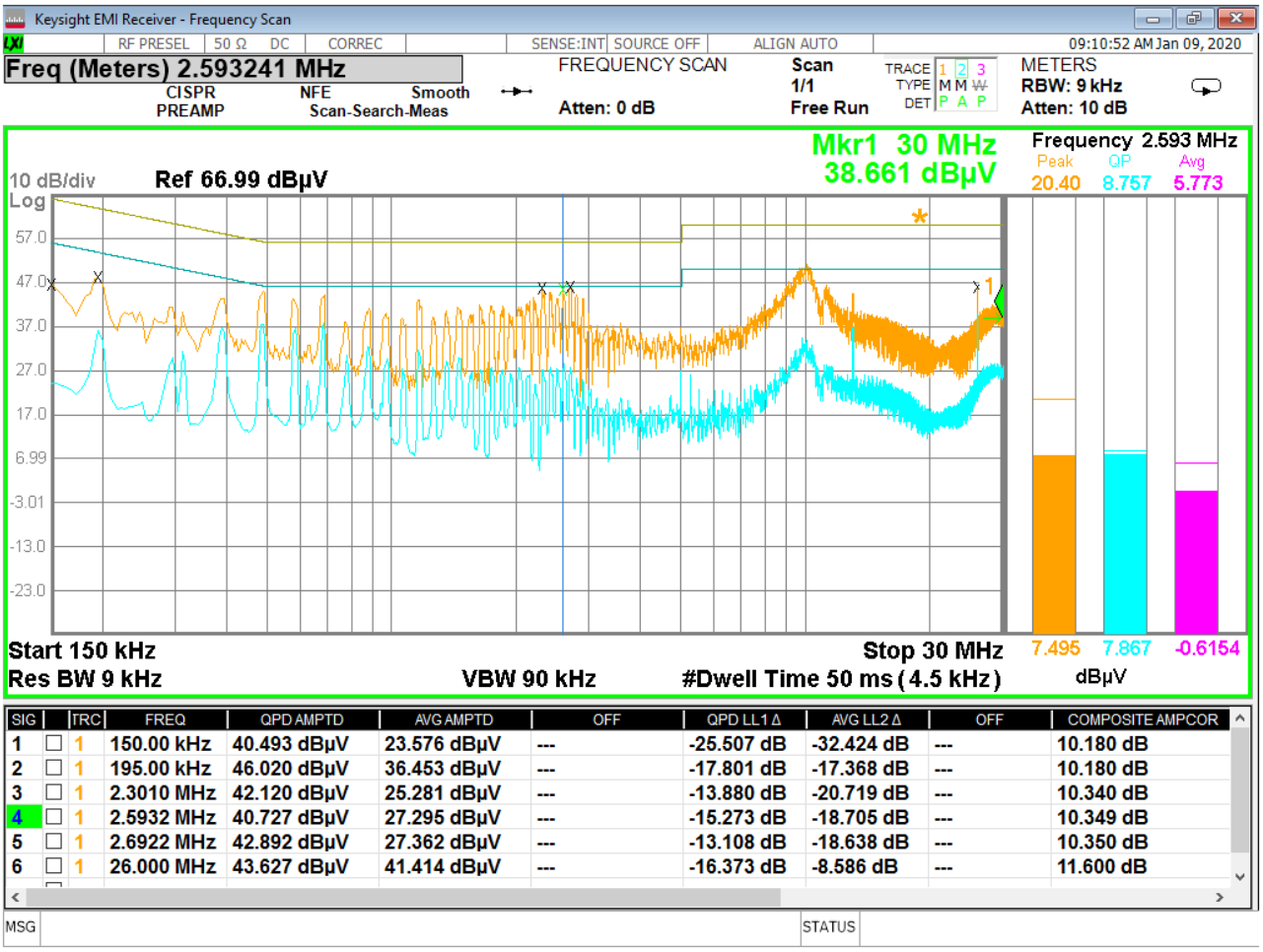
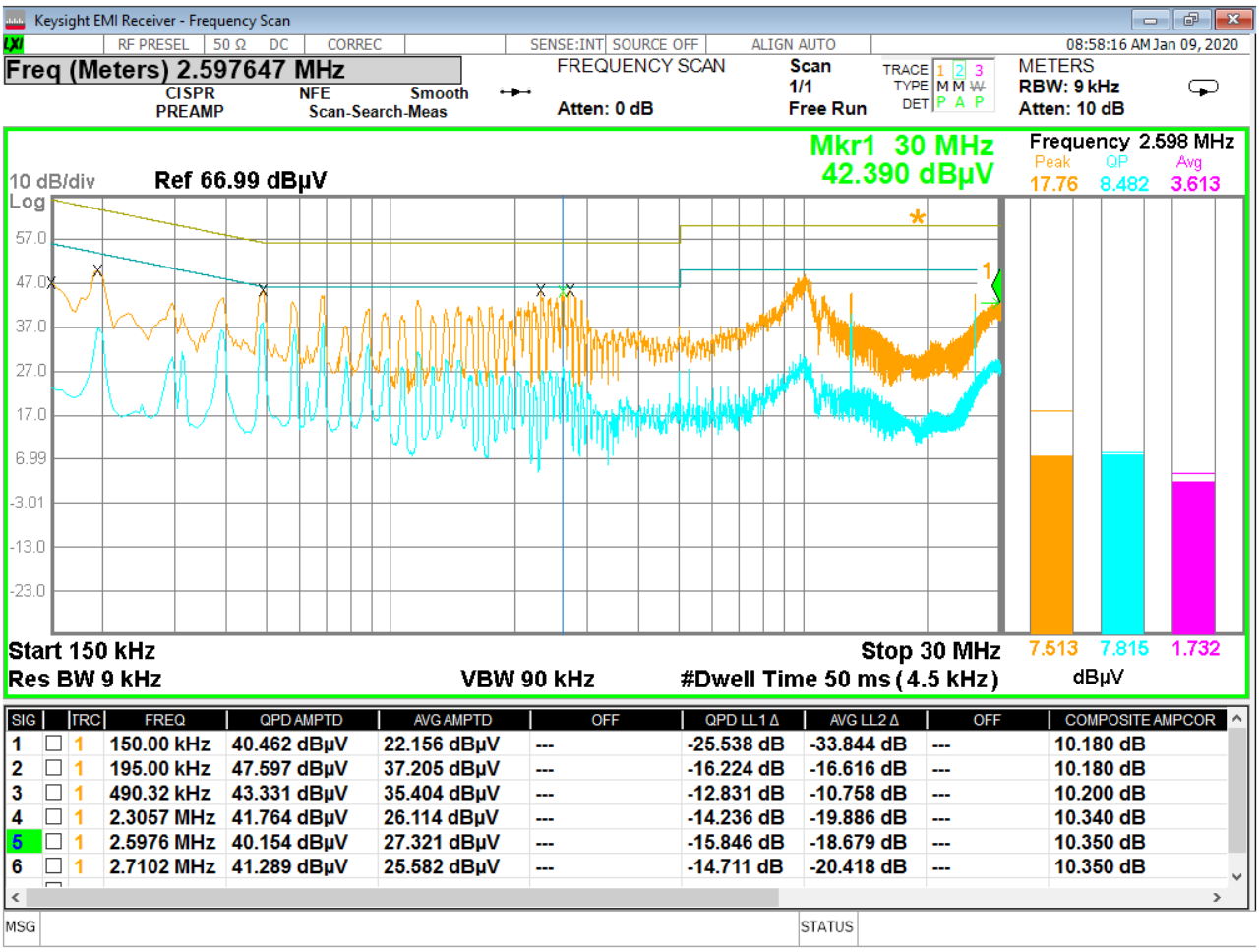


Figure 26 - Conducted Emissions Plot, Line

.



SIG		TRC	FREQ	QPD AMPTD	AVG AMPTD	OFF	QPD LL1 Δ	AVG LL2 Δ	OFF	COMPOSITE AMPCOR
1	☐	1	150.00 kHz	40.462 dBµV	22.156 dBµV	---	-25.538 dB	-33.844 dB	---	10.180 dB
2	☐	1	195.00 kHz	47.597 dBµV	37.205 dBµV	---	-16.224 dB	-16.616 dB	---	10.180 dB
3	☐	1	490.32 kHz	43.331 dBµV	35.404 dBµV	---	-12.831 dB	-10.758 dB	---	10.200 dB
4	☐	1	2.3057 MHz	41.764 dBµV	26.114 dBµV	---	-14.236 dB	-19.886 dB	---	10.340 dB
5	☐	1	2.5976 MHz	40.154 dBµV	27.321 dBµV	---	-15.846 dB	-18.679 dB	---	10.350 dB
6	☐	1	2.7102 MHz	41.289 dBµV	25.582 dBµV	---	-14.711 dB	-20.418 dB	---	10.350 dB

. Figure 27 - Conducted Emissions Plot, Neutral

APPENDIX A: SAMPLE CALCULATION

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:
FS = RA + AF – (-CF + AG) + AV

where FS = Field Strength

RA = Receiver Amplitude

AF = Antenna Factor

CF = Cable Attenuation Factor

AG = Amplifier Gain

AV = Averaging Factor (if applicable)

Assume a receiver reading of 55 dBμV is obtained. The Antenna Factor of 12 and a Cable Factor of 1.1 is added. The Amplifier Gain of 20 dB is subtracted, giving a field strength of 48.1 dBμV/m.

FS = 55 + 12 – (-1.1 + 20) + 0 = 48.1 dBμV/m

The 48.1 dBμV/m value can be mathematically converted to its corresponding level in μV/m.

Level in μV/m = Common Antilogarithm [(48.1 dBμV/m)/20]= 254.1 μV/m

AV is calculated by the taking the 20*log(T_{on}/100) where T_{on} is the maximum transmission time in any 100ms window.

EIRP Calculations

In cases where direct antenna port measurement is not possible or would be inaccurate, output power is measured in EIRP. The maximum field strength is measured at a specified distance and the EIRP is calculated using the following equation;

EIRP (Watts) = [Field Strength (V/m) x antenna distance (m)]^2 / 30

Power (watts) = 10^[Power (dBm)/10] / 1000

Voltage (dBµV) = Power (dBm) + 107 (for 50Ω measurement systems)

Field Strength (V/m) = 10^[Field Strength (dBµV/m) / 20] / 10^6

Gain = 1 (numeric gain for isotropic radiator)

Conversion from 3m field strength to EIRP (d=3):

EIRP = [FS(V/m) x d^2]/30 = FS [0.3] for d = 3

EIRP(dBm) = FS(dBµV/m) – 10(log 10^9)+ 10log[0.3] = FS(dBµV/m) - 95.23

10log(10^9) is the conversion from micro to milli

APPENDIX B – MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been for tests performed in this test report:

Test	Frequency Range	Uncertainty Value (dB)
Radiated Emissions, 3m	30MHz - 1GHz	±3.82 dB
Radiated Emissions, 3m	1GHz - 18GHz	±4.44 dB
Emissions limits, conducted	30MHz – 18GHz	±3.30 dB
Antenna port conducted	9 kHz – 25 GHz	±0.50 dB

Values were calculated per CISPR 16-4-2:2011

Expanded uncertainty values are calculated to a confidence level of 95%.

REPORT END