ncee labs
Product Compliance Solutions

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:	**TR-30N**
Test Report No:	**R20190927-20-E2F**
Approved By:	**Nic S. Johnson, NCE** **Technical Manager** **iNARTE Certified EMC Engineer #EMC-003337-NE**
DATE:	**26 May 2020**
Total Pages:	**40**

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ilac-MRA A2LA ACCREDITED TESTING LABORATORY CERTIFICATE NO. 1953.01

REVISION PAGE

Rev. No.	Date	Description
0	27 February 2020	Original – NJohnson Prepared by KVepuri/CFarrington/FLane
A	30 March 2020	Measurements on high channel were updated
B	15 April 2020	Updated Section 2.1
C	15 April 2020	Added EIRP values
D	05 May 2020	1. Radiated emissions details and data was added to the section 4.1 2. Emissions Masks data was added to the section 4.1 3. Modulation Characteristics data was added to the section 4.4 4. Frequency Stability data was updated in section 4.5 5. Includes NCEE Labs report R20190927-20-E2C and its amendment in full
E	21 May 2020	Re-measured low and high channels to show that they stay within the allocated bands.
F	26 May 2020	Added channel frequency measurements to Section 4.5

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 2.1051 Using ANSI C63.26-2015 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/Antenna Port Conducted Emissions	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	TR-30N
EUT Received	17 December 2019
EUT Tested	17 December 2019 – 9 March 2020
Serial No.	075494795900130002 075494695900190002
Operating Band	174MHz-216MHz
Device Type	Licensed Radio
Power Supply	9VDC; 6 AA Batteries

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	174.025 MHz
Middle	198.000 MHz
High	215.975 MHz

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 Hybrid Antenna	JB1	A082918-1	15 Oct 2018	15 Oct 2020
SunAR RF Motion Hybrid Antenna	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 2020*
Trilithic High Pass Filter	6HC330	23042	09 Mar 2018*	09 Mar 2020*
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 2020*
RF Cable (antenna to 10m chamber bulkhead)	FSCM 64639	01E3872	09 Mar 2018*	09 Mar 2020*
RF Cable (10m chamber bulkhead to control room bulkhead)	FSCM 64639	01E3874	09 Mar 2018*	09 Mar 2020*
RF Cable (Control room bulkhead to RF switch)	FSCM 64639	01E3871	09 Mar 2018*	09 Mar 2020*
RF Cable (RF switch to test receiver)	FSCM 64639	01F1206	09 Mar 2018*	09 Mar 2020*
RF switch – Rohde and Schwarz	TS-RSP	1113.5503.14	09 Mar 2018*	09 Mar 2020*
N connector bulkhead (10m chamber)	PE9128	NCEEBH1	09 Mar 2018*	09 Mar 2020*
N connector bulkhead (control room)	PE9128	NCEEBH2	09 Mar 2018*	09 Mar 2020*
HP Modulation Analyzer	8901A	2439A03594	28 May 2019	31 May 2020
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”
2. FCC Part 2.1051 and 2.1053
3. RSS-Gen/ EN 300 422-1 Section 8.3, 8.4, Spurious Emissions

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) Below Peak Output Power

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

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:

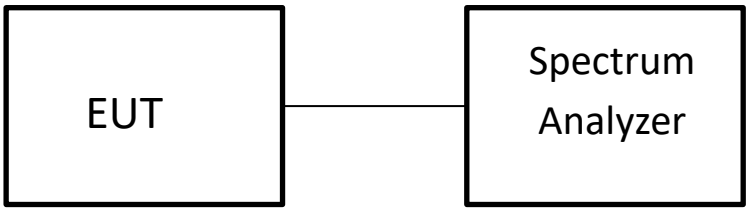


Figure 1 - Conducted Spurious Test Setup

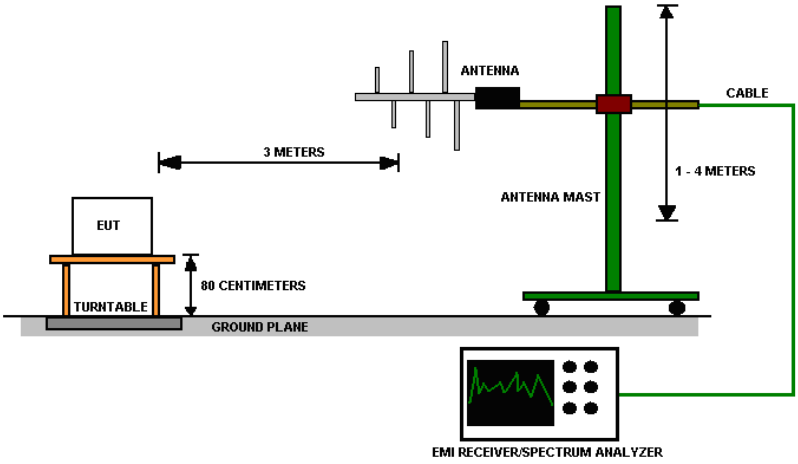


Figure 2 - Radiated Emissions Test Setup

EUT operating conditions

The EUT was powered by 9VDC battery (6 AA batteries) 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:

Low Ch 174 MHz		TR 30 Radiated Emissions Per ETSI EN 300 422-1				
Frequency	Siggen	Cable loss	Gain	corrected Value	Limit	Margin
MHz	dBm	dB		dBm	dBm	dB
522.000000	-7.36	-56.1	4.21	-59.25	-53.98	5.27
696.000000	-6.6	-56.1	6.3	-56.4	-53.98	2.42
All the other measurements were found to be at least 6 dB below the limit.						
Mid Ch 197.975 MHz						
Frequency	Siggen	Cable loss	Gain	corrected Value	Limit	Margin
MHz	dBm	dB		dBm	dBm	dB
593.940000	-10.02	-56.1	5.8	-60.32	-53.98	6.34
791.940000	-19.34	-56.1	6.5	-68.94	-53.98	14.96
All the other measurements were found to be at least 6 dB below the limit.						
High Ch 216 MHz						
Frequency	Siggen	Cable loss	Gain	corrected Value	Limit	Margin
MHz	dBm	dB		dBm	dBm	dB
648.002000	-6.26	-56.1	6.1	-56.26	-53.98	2.28
All the other measurements 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

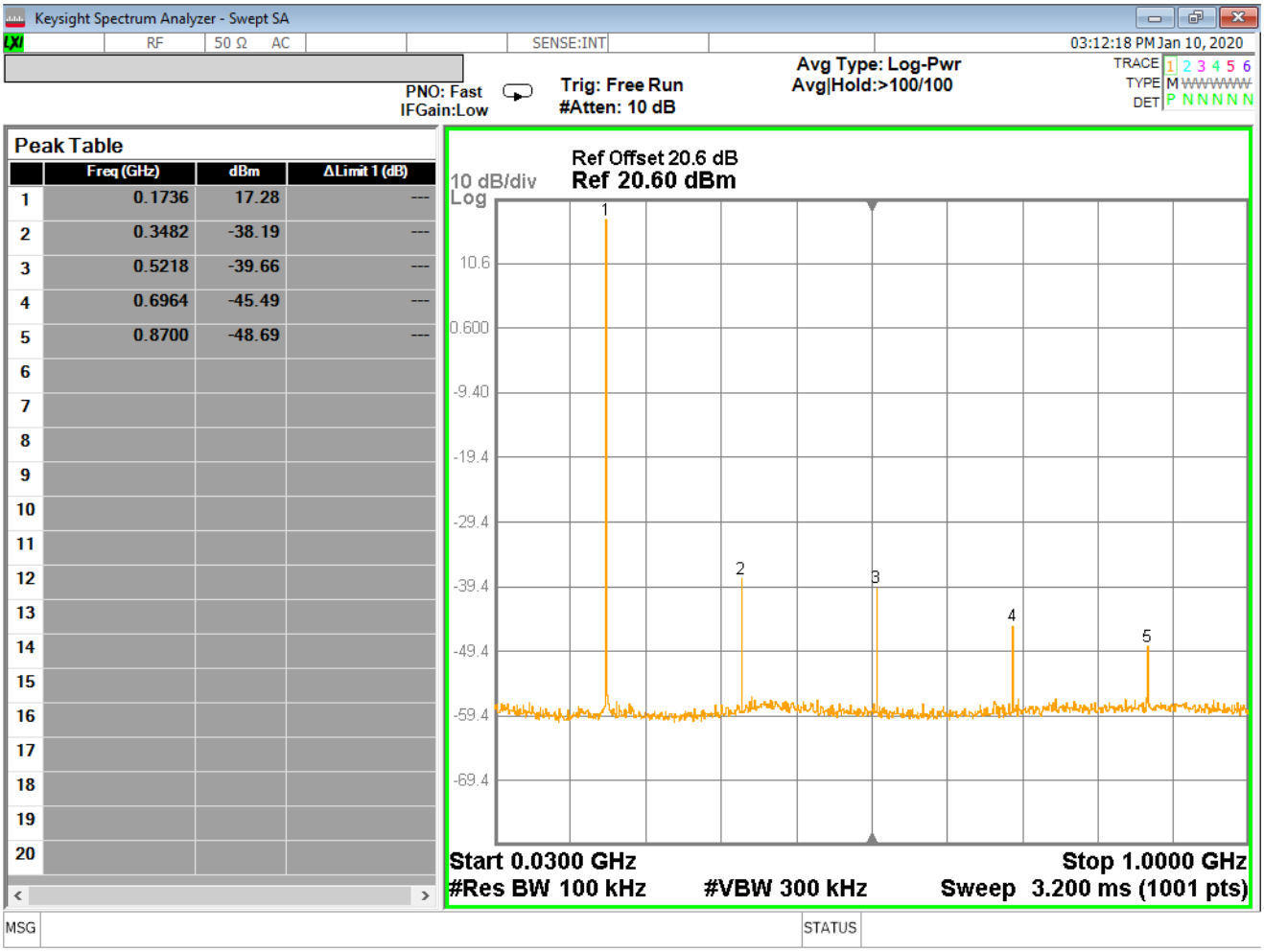


Figure 3 - Conducted Unwanted Emissions Plot, 30-1G

*Limit is -13dB – Pass. Marker 1 is on the fundamental frequency and thus can be disregarded.

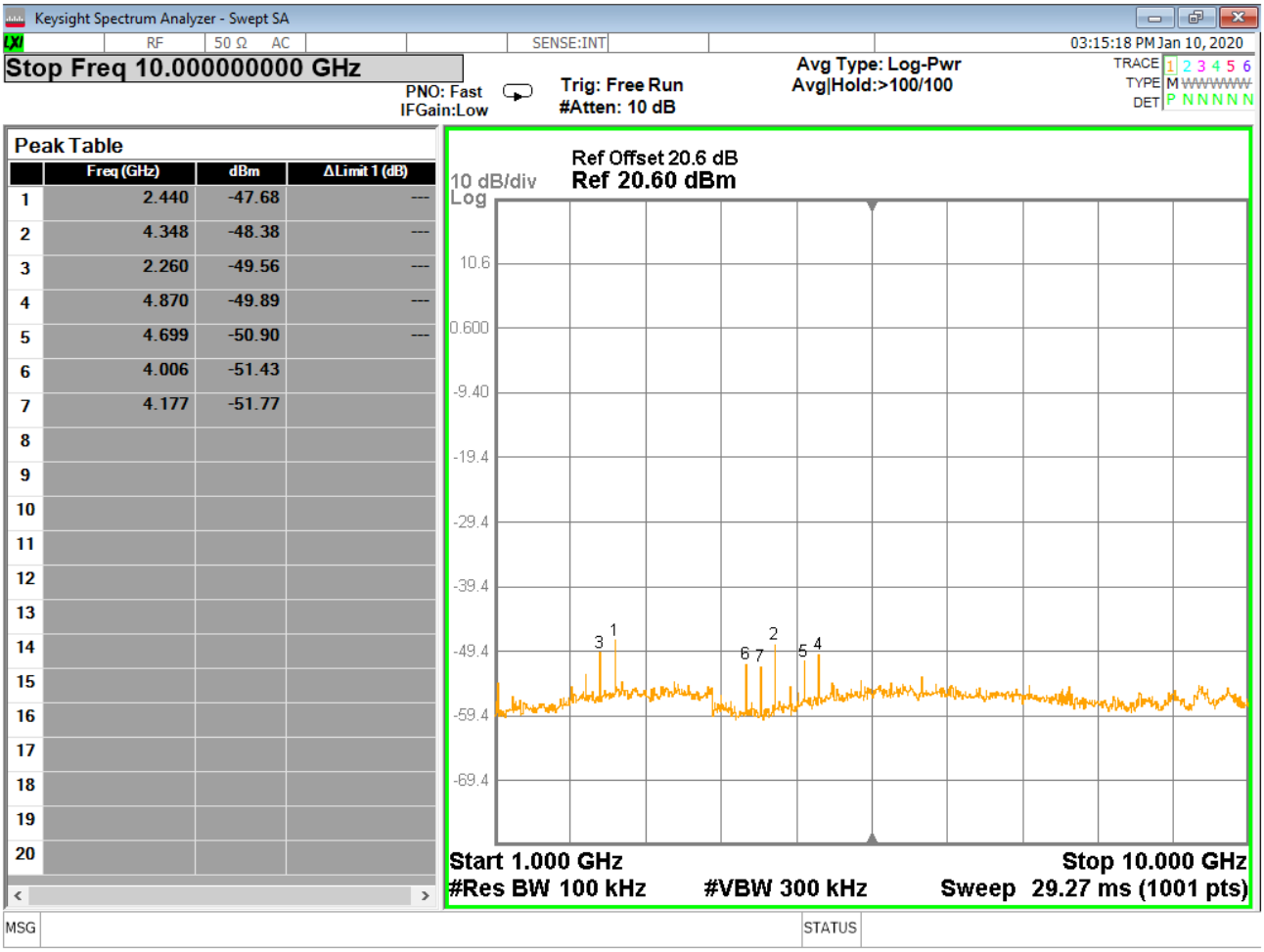
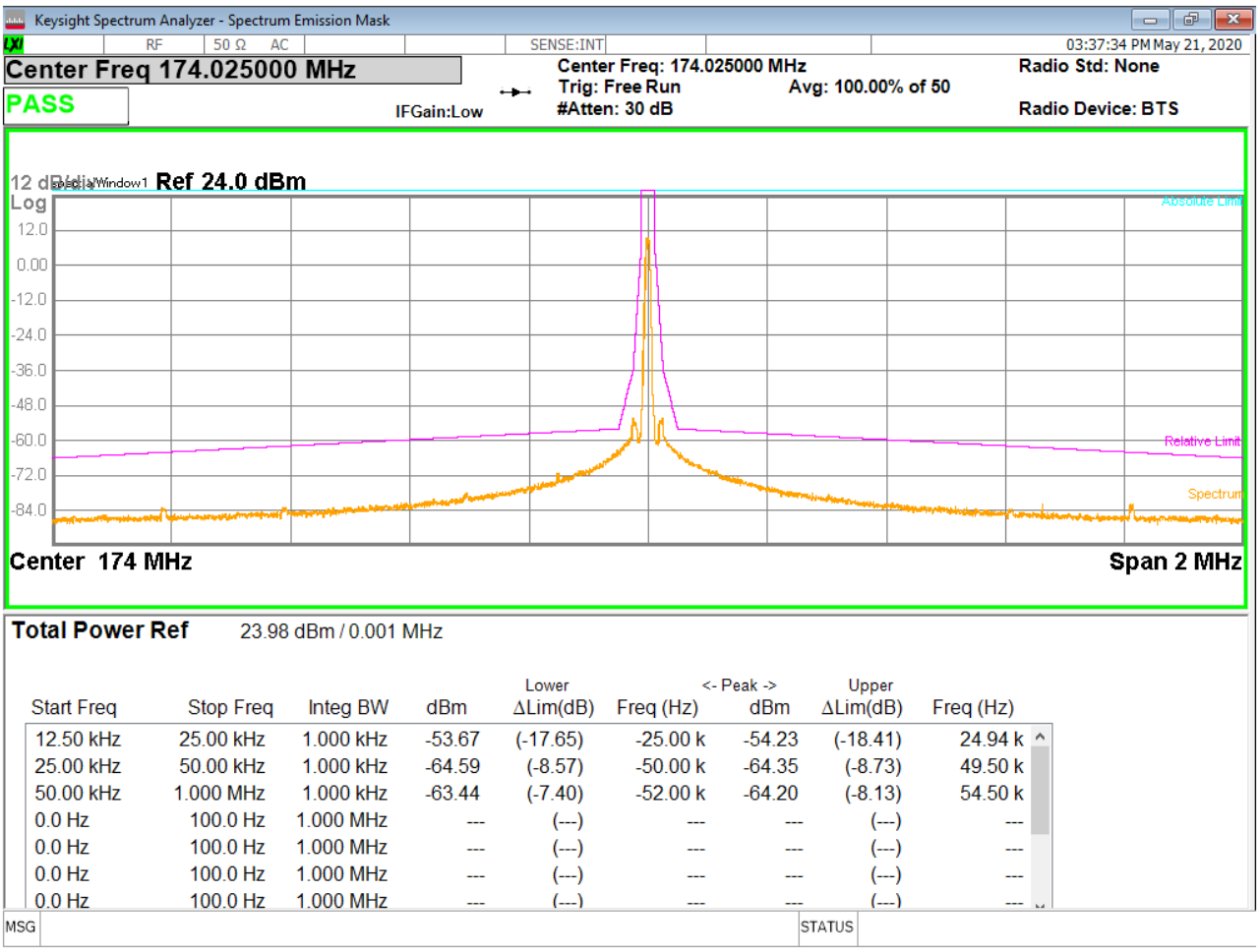


Figure 4 - Conducted Unwanted Emissions Plot, 1-10G

*Limit is -13dB -- Pass



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	-53.67	(-17.65)	-25.00 k	-54.23	(-18.41)	24.94 k
25.00 kHz	50.00 kHz	1.000 kHz	-64.59	(-8.57)	-50.00 k	-64.35	(-8.73)	49.50 k
50.00 kHz	1.000 MHz	1.000 kHz	-63.44	(-7.40)	-52.00 k	-64.20	(-8.13)	54.50 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 5 – Necessary Bandwidth from EN 300 422, Low Channel

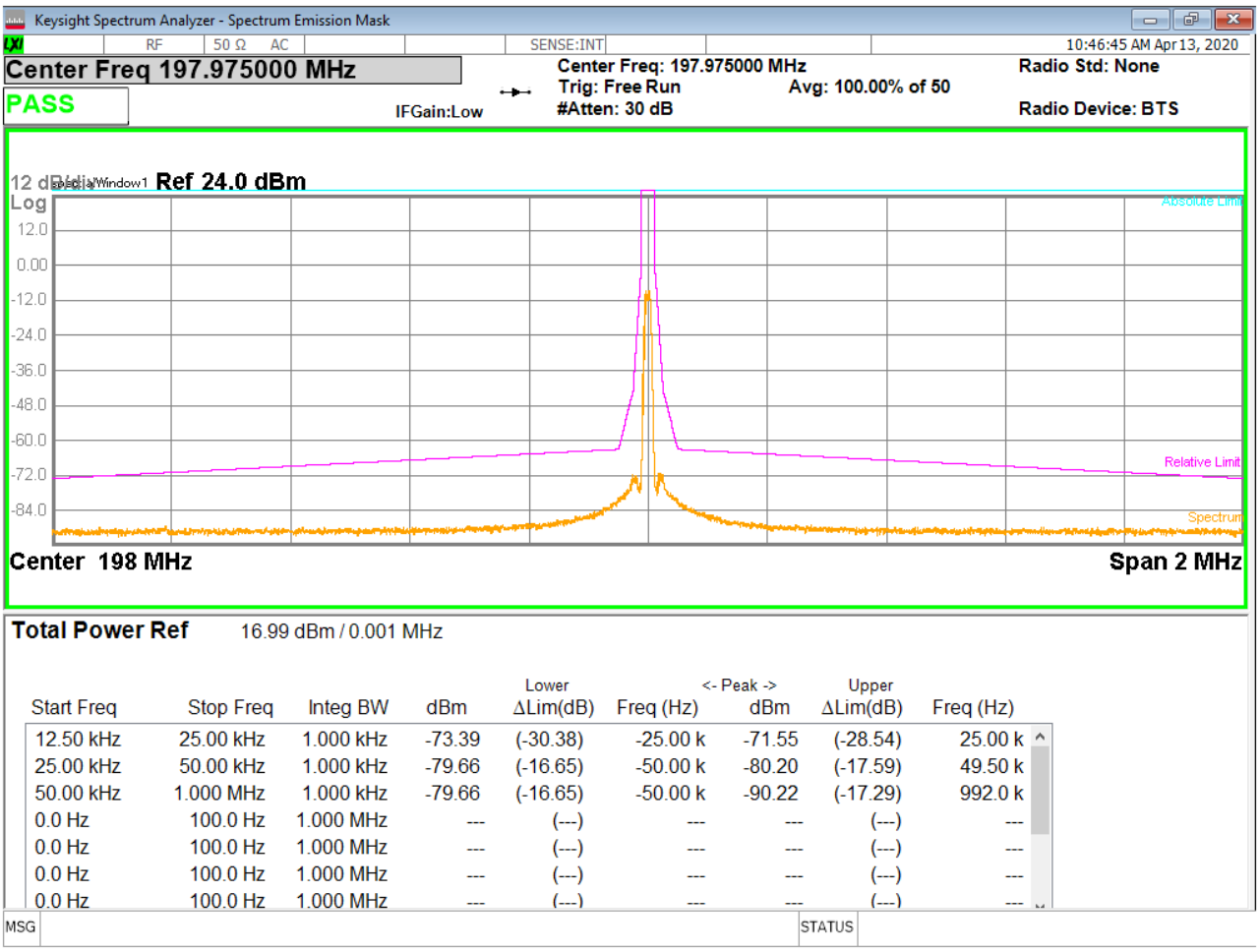
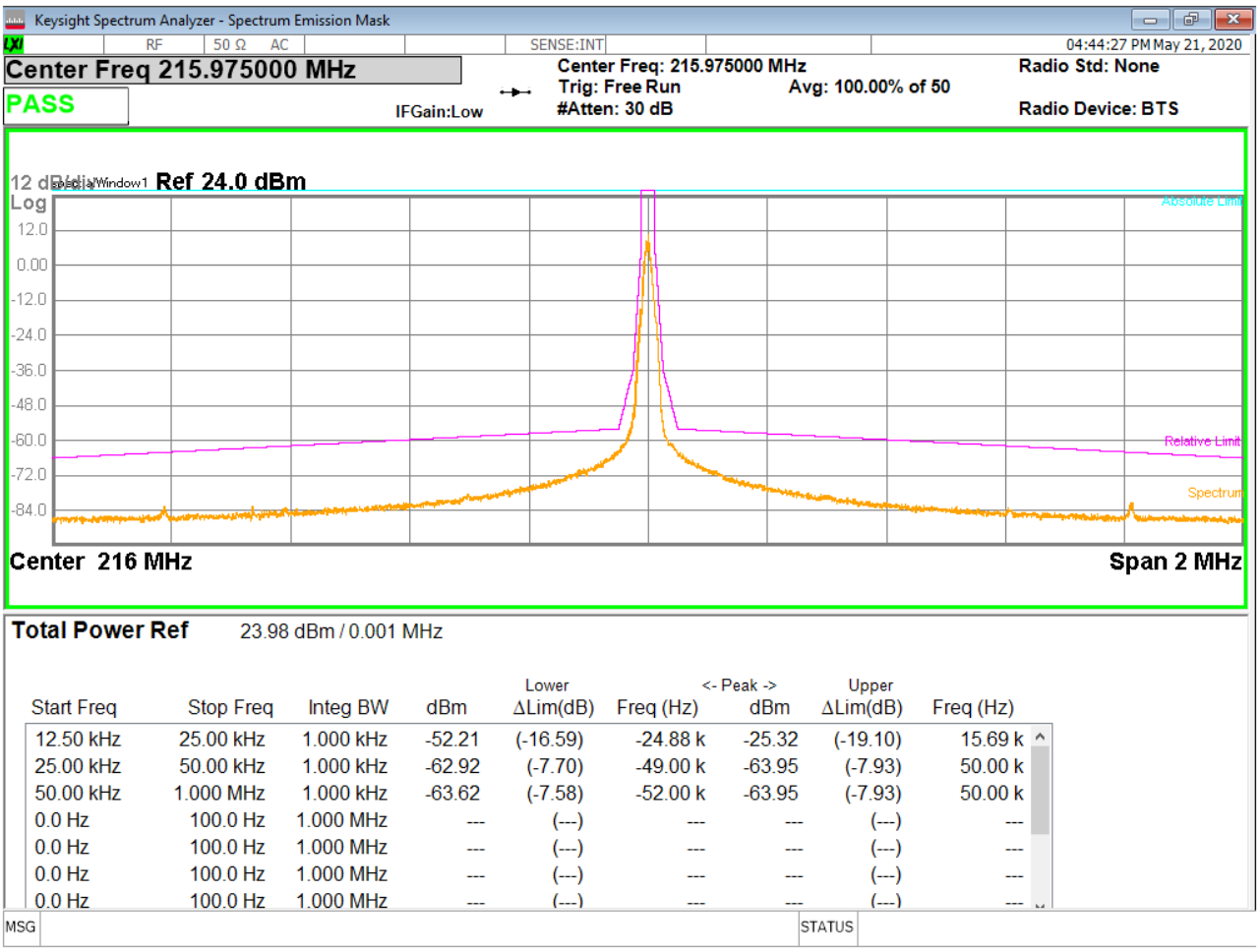


Figure 6 – Necessary Bandwidth from EN 300 422, Mid Channel



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	-52.21	(-16.59)	-24.88 k	-25.32	(-19.10)	15.69 k
25.00 kHz	50.00 kHz	1.000 kHz	-62.92	(-7.70)	-49.00 k	-63.95	(-7.93)	50.00 k
50.00 kHz	1.000 MHz	1.000 kHz	-63.62	(-7.58)	-52.00 k	-63.95	(-7.93)	50.00 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 7 – Necessary Bandwidth from EN 300 422, High Channel

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 8 – Peak Output Power Measurements Test Setup

EUT operating conditions:
The EUT was powered by 9VDC battery (6 AA batteries) 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	174.025	17.321	53.96	26.98	Conducted	PASS
Mid	198.000	16.803	47.90	23.95	Conducted	PASS
High	215.975	16.960	49.66	24.83	Conducted	PASS

*Includes antenna gain of -3.0 dBi (0.50 numeric)

4.3 BANDWIDTH AND EMISSIONS MASK

Test Method: ANSI C63.26,
1. Section(s) 5.4.3, 5.4.4
2. KDB 206256

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:

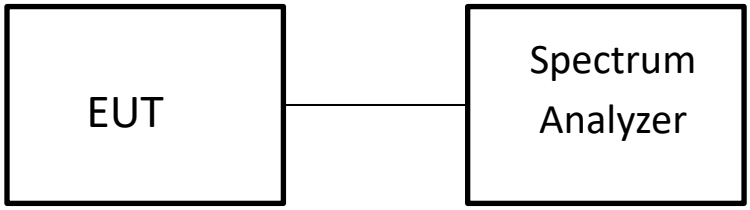


Figure 9 –Measurements Test Setup

EUT operating conditions:
The EUT was powered by 9VDC battery(6 AA batteries) 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:

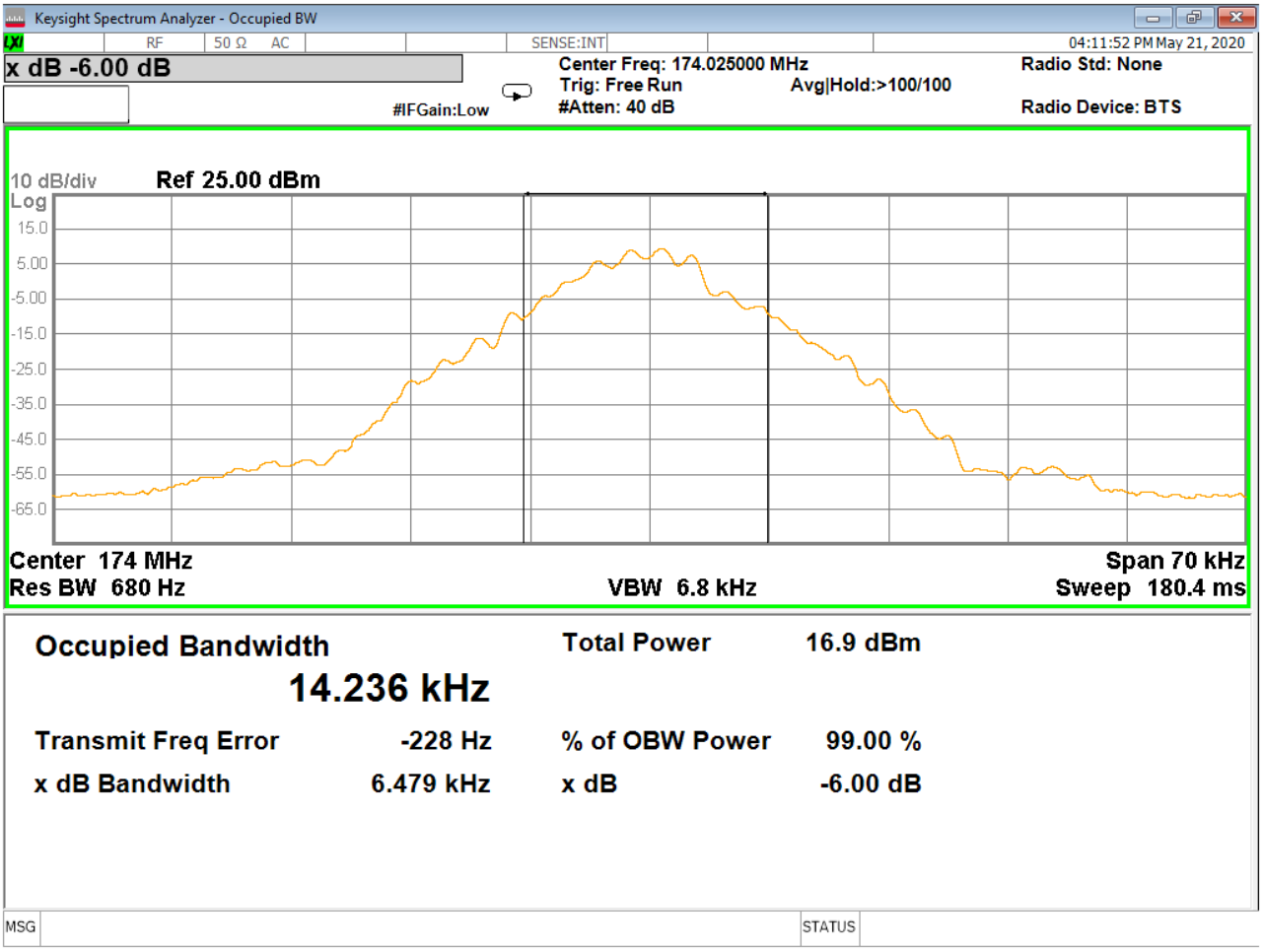


Figure 10 - 99% Occupied Bandwidth, Low Channel with tone

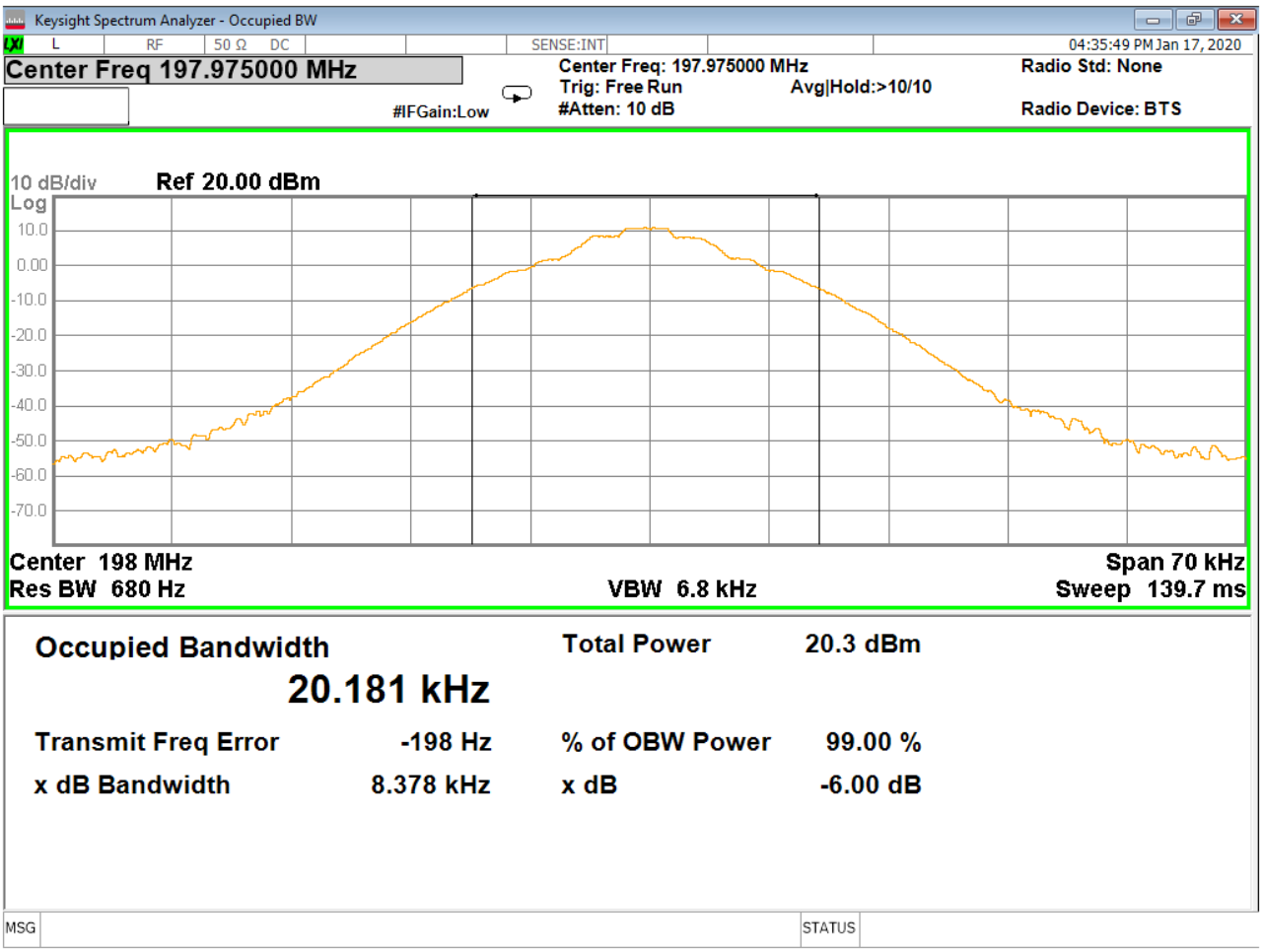


Figure 11 - 99% Occupied Bandwidth, Mid Channel with tone

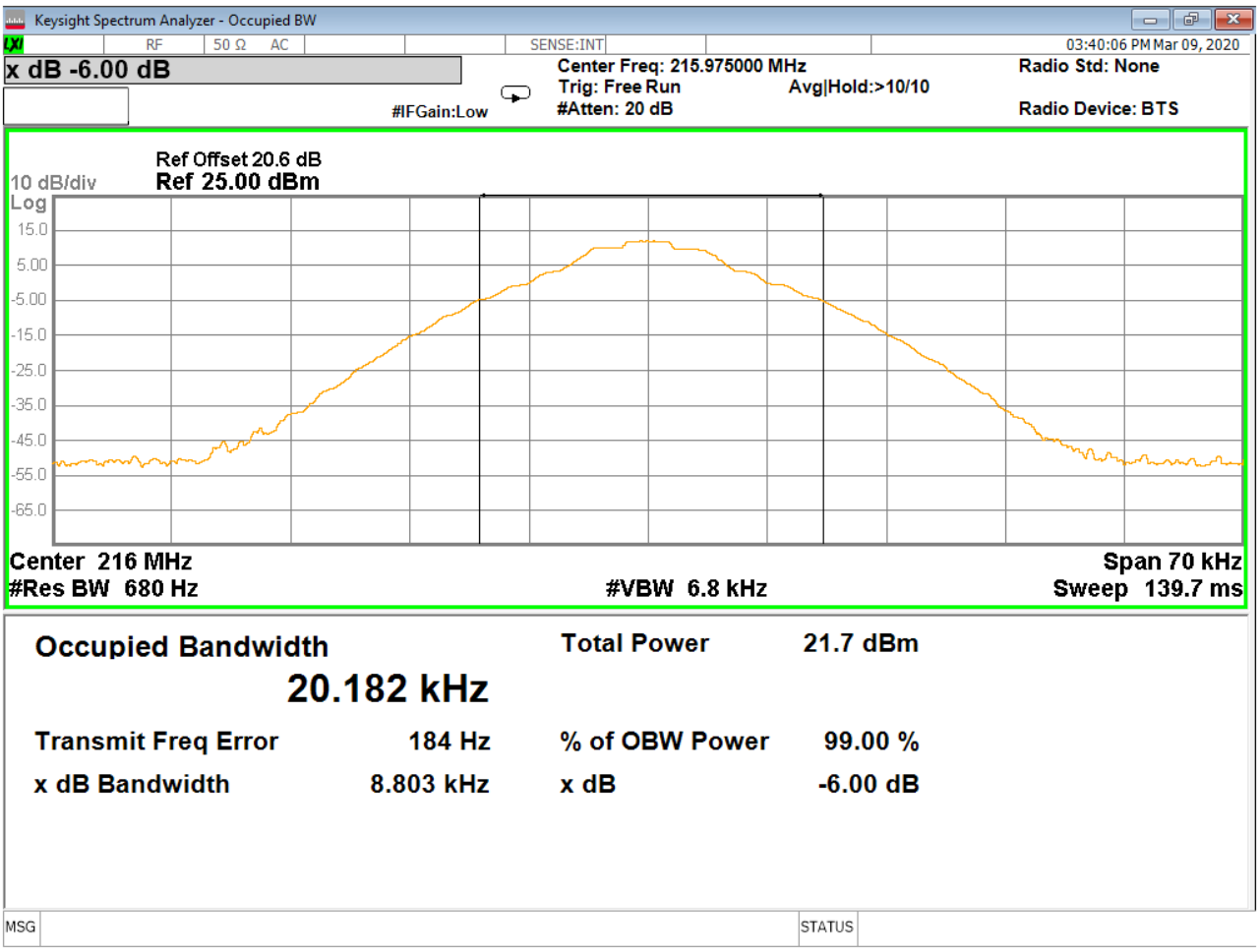


Figure 12 - 99% Occupied Bandwidth, High Channel with tone

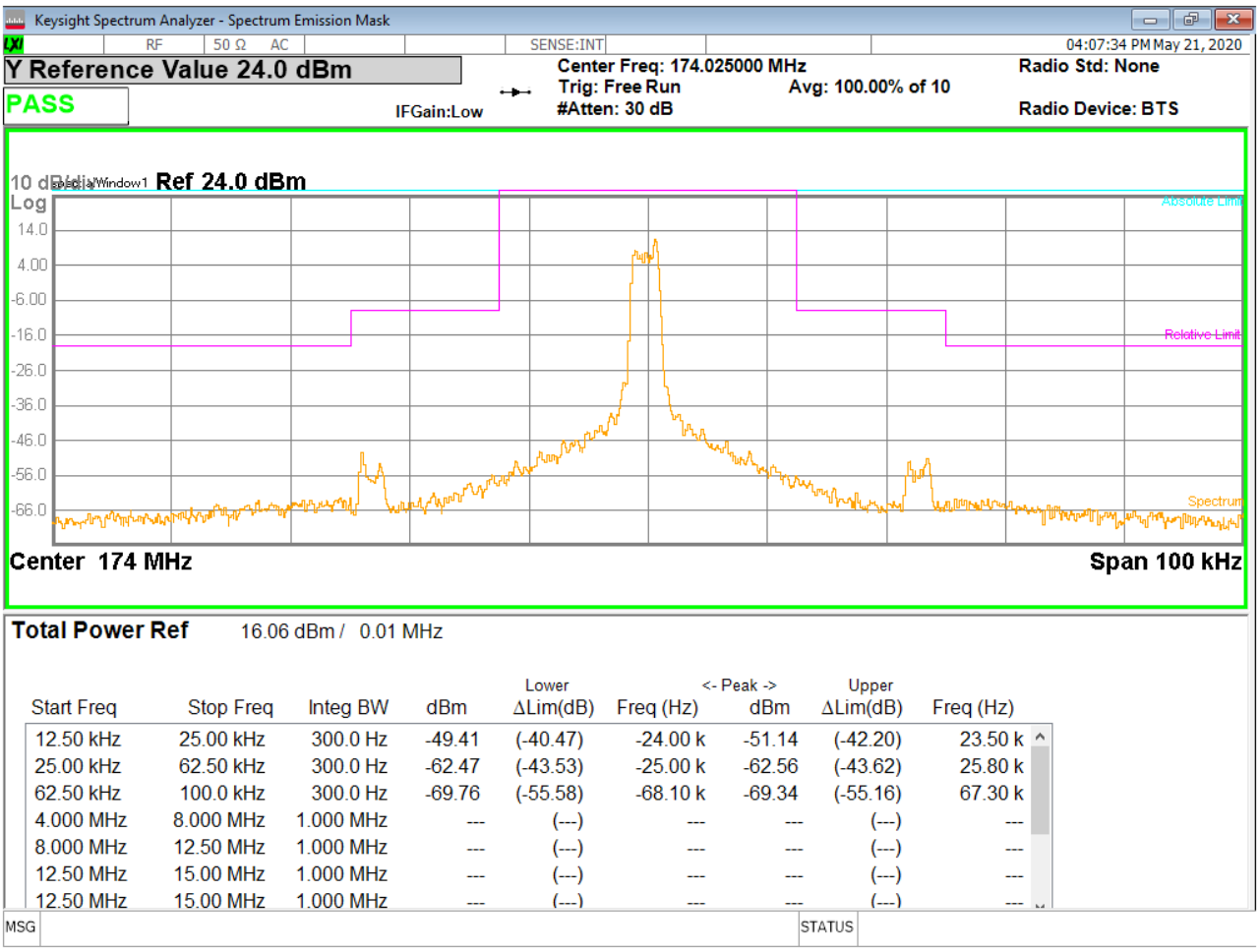
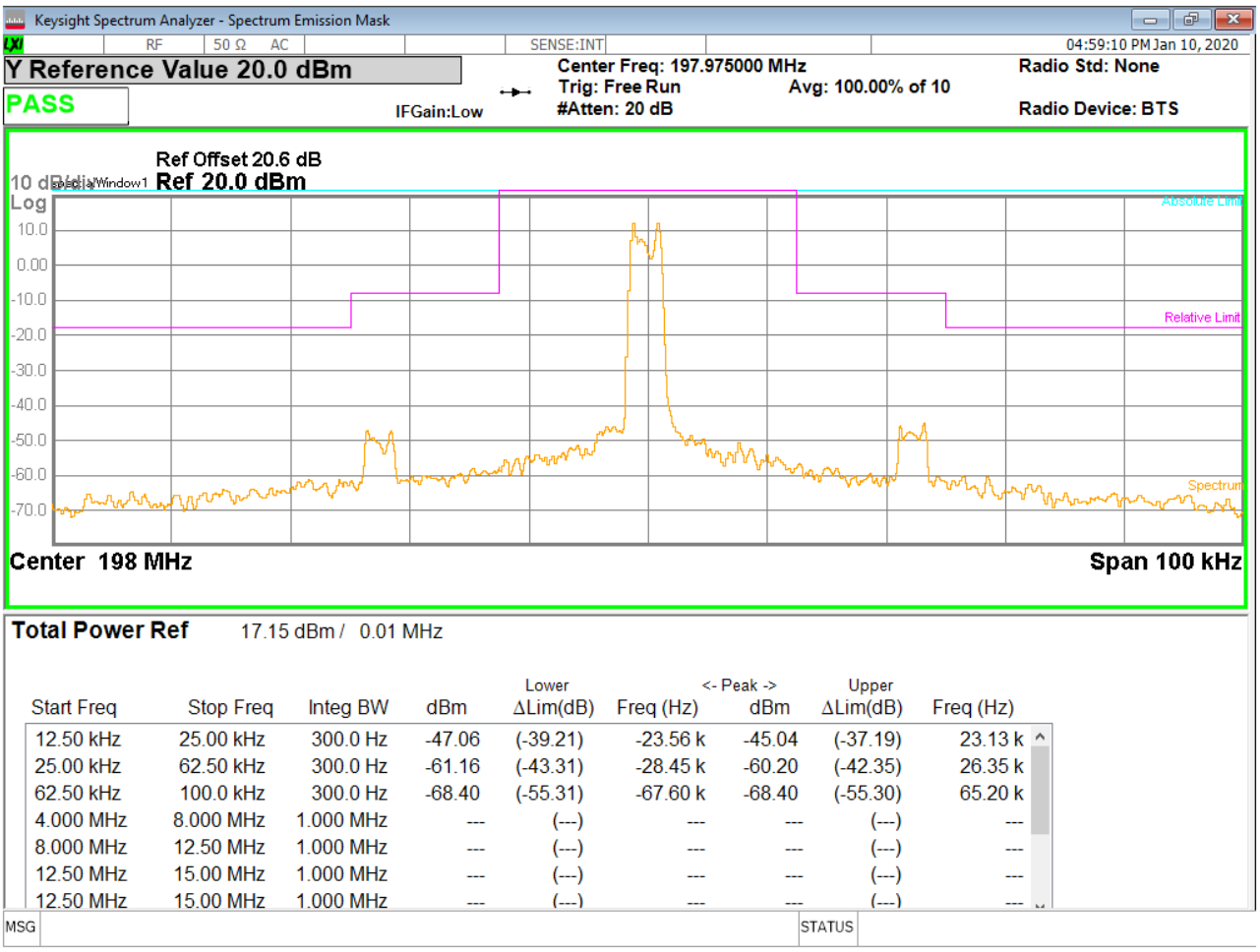


Figure 13 - Emissions Mask, Low Channel



Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Freq (Hz)
12.50 kHz	25.00 kHz	300.0 Hz	-47.06	(-39.21)	-23.56 k	-45.04	(-37.19)	23.13 k
25.00 kHz	62.50 kHz	300.0 Hz	-61.16	(-43.31)	-28.45 k	-60.20	(-42.35)	26.35 k
62.50 kHz	100.0 kHz	300.0 Hz	-68.40	(-55.31)	-67.60 k	-68.40	(-55.30)	65.20 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**

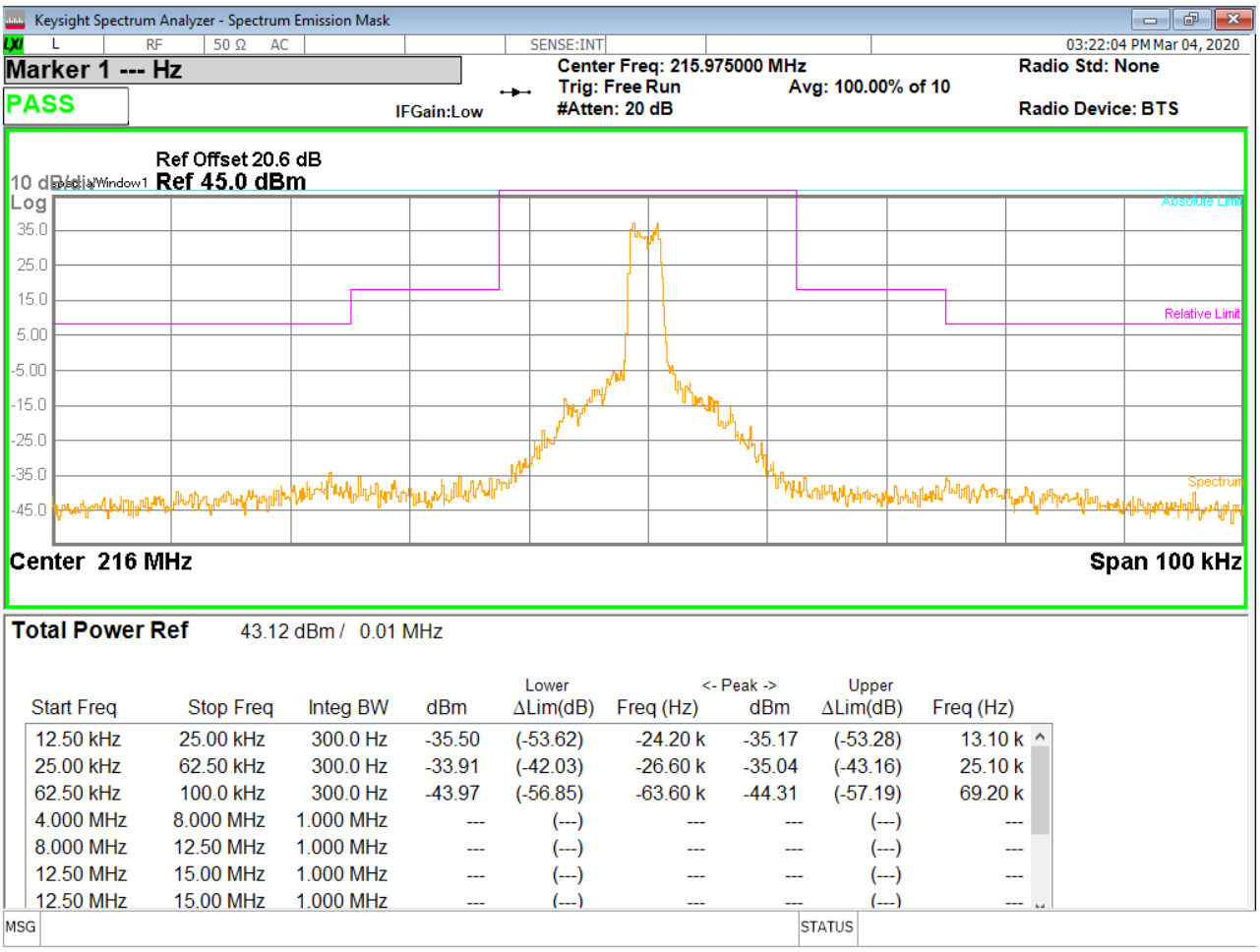


Figure 15 - Emissions Mask, High Channel

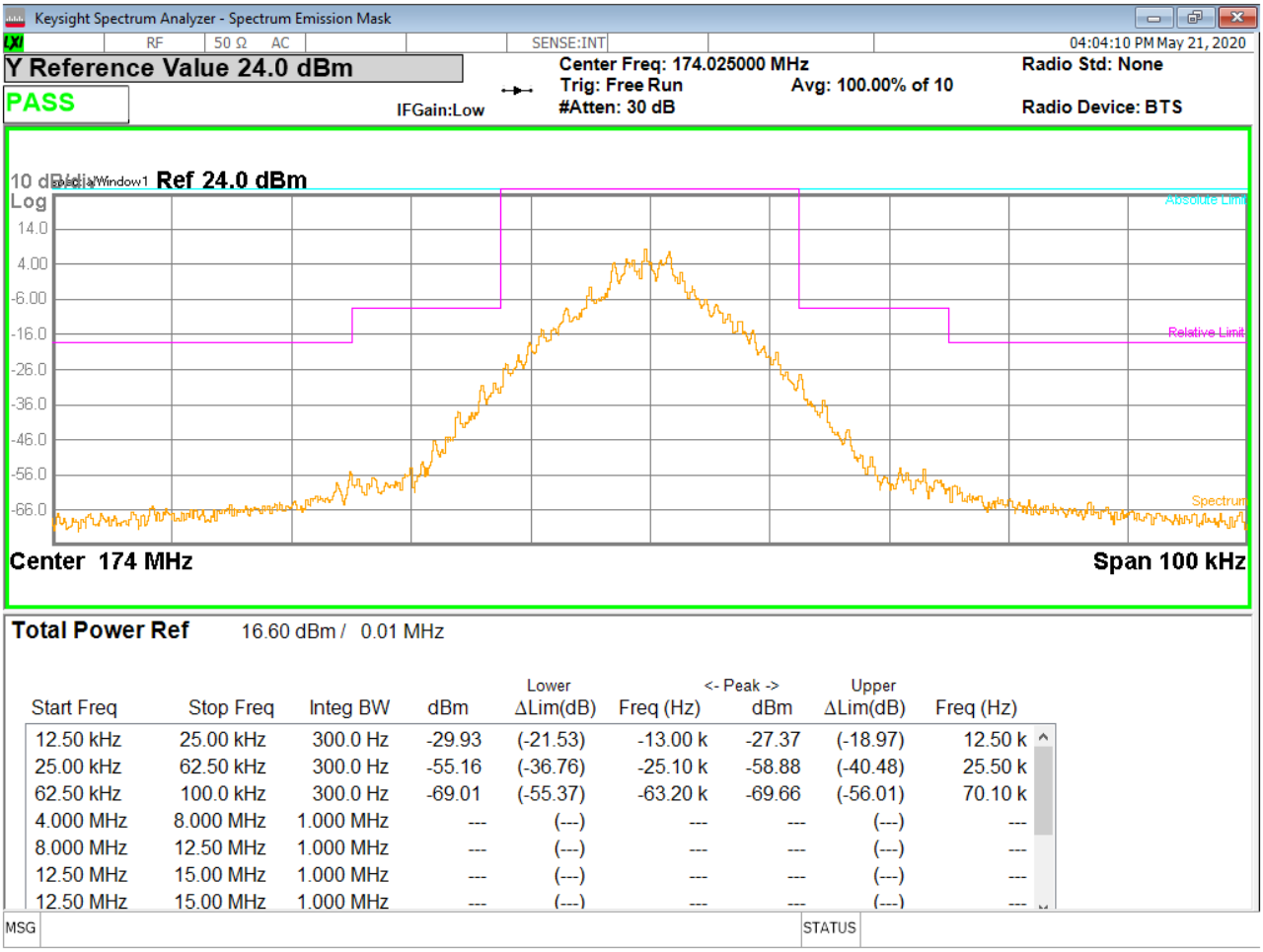


Figure 16 – Emissions Mask, Low Channel with 1 kHz tone

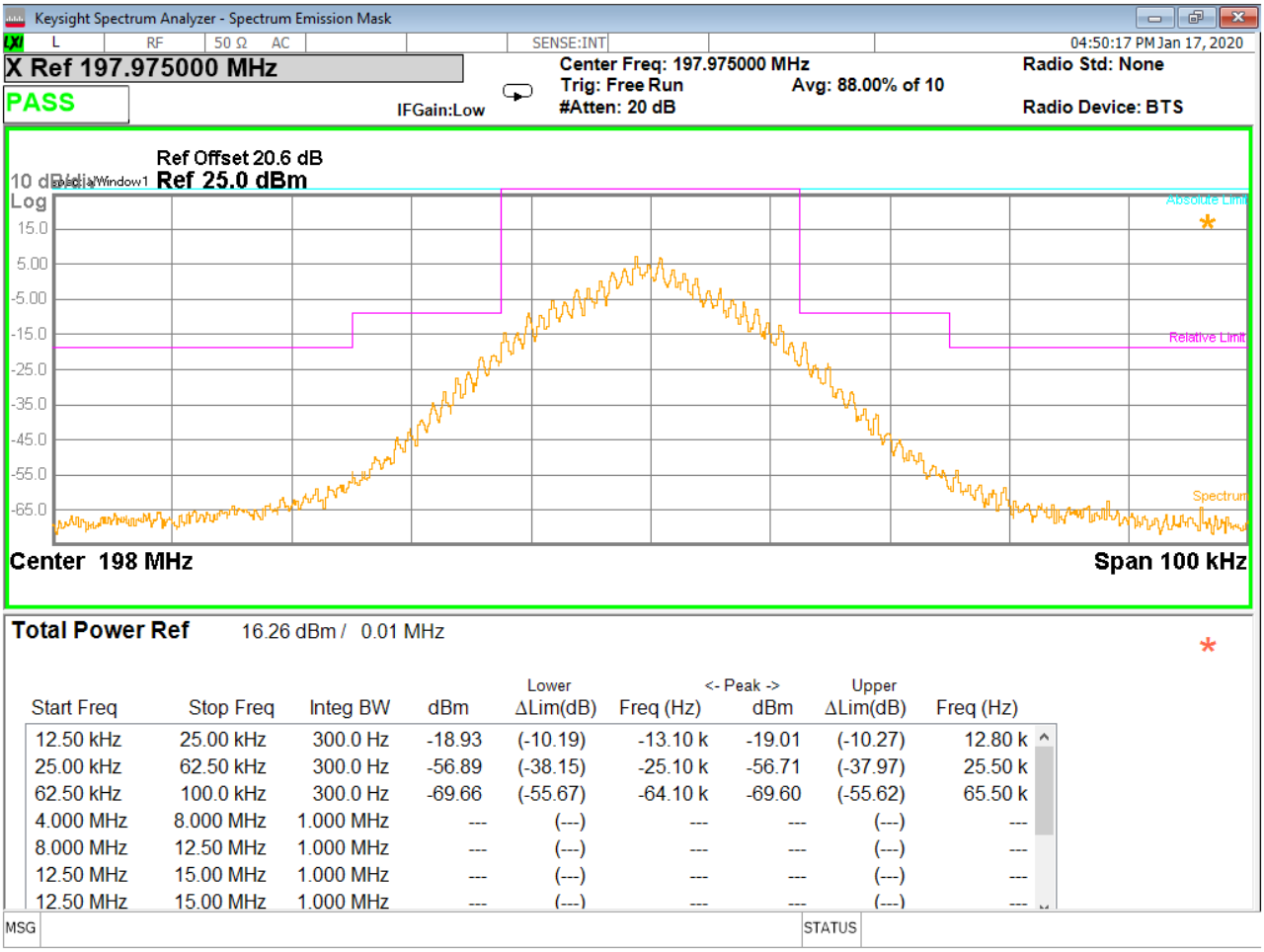
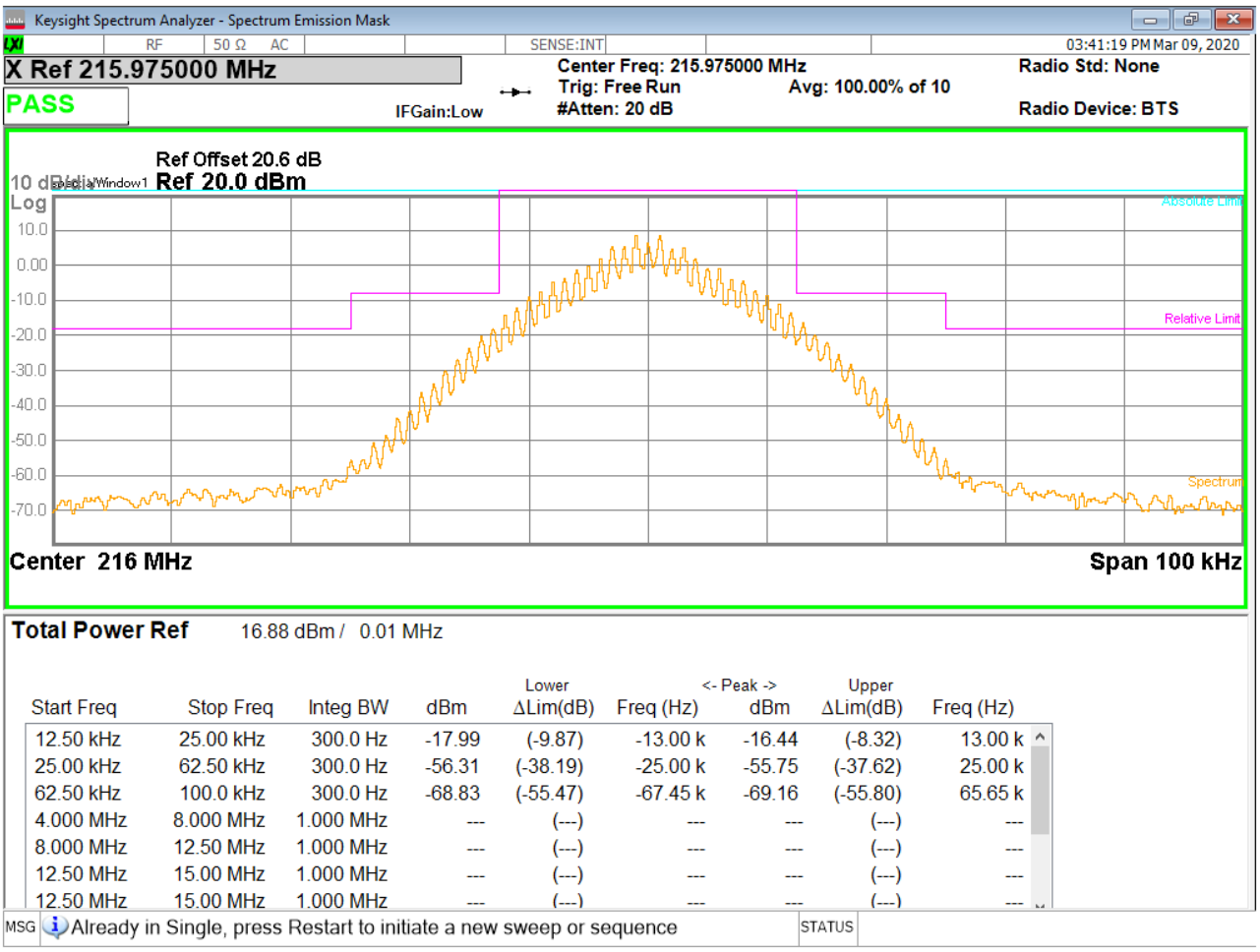


Figure 17 - Emissions Mask, Mid Channel with 1kHz tone



Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Freq (Hz)
12.50 kHz	25.00 kHz	300.0 Hz	-17.99	(-9.87)	-13.00 k	-16.44	(-8.32)	13.00 k
25.00 kHz	62.50 kHz	300.0 Hz	-56.31	(-38.19)	-25.00 k	-55.75	(-37.62)	25.00 k
62.50 kHz	100.0 kHz	300.0 Hz	-68.83	(-55.47)	-67.45 k	-69.16	(-55.80)	65.65 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 18 - Emissions Mask, High Channel with 1 kHz tone

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. The equipment is required to have an audio filter and the test was performed on the audio filter and all circuitry.

Deviations from test standard:
No deviation.

Test setup:

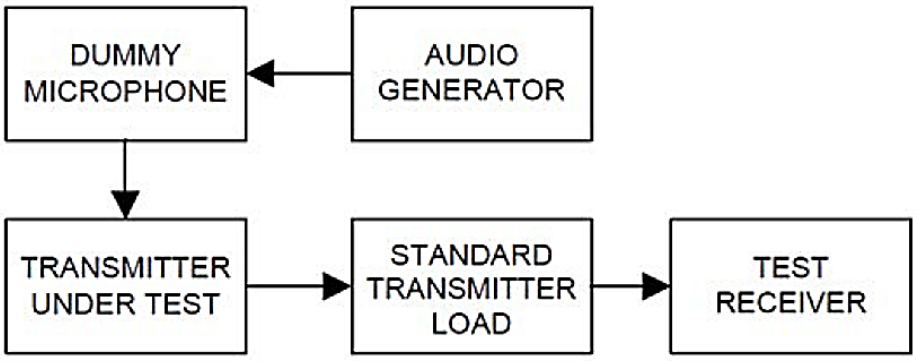


Figure 19 – Modulation Limiting and Audio Frequency Response Test Setup

EUT operating conditions:
The EUT was powered by 9VDC battery(6 AA batteries) 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:

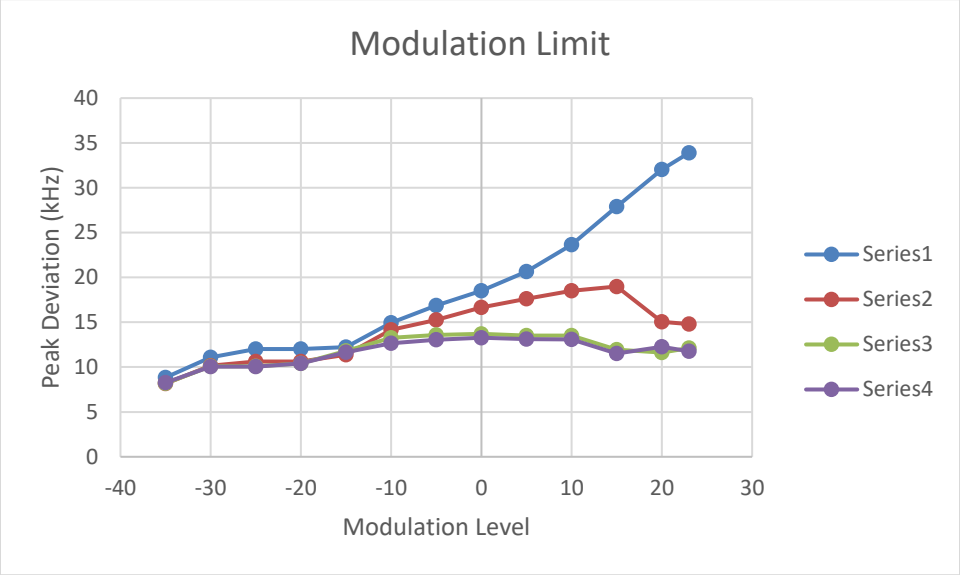


Figure 20 – Modulation Limiting, Mid Channel

Modulation Limit					
Modulation Level (dB)	Peak Frequency Deviation (kHz)				Limit (kHz)
	300Hz	1000Hz	2500Hz	3000Hz	
-35	8.84	8.16	8.18	8.27	±75
-30	11.08	10.16	10.09	10.06	±75
-25	12	10.62	10.09	10.05	±75
-20	12.03	10.64	10.4	10.41	±75
-15	12.22	11.39	11.79	11.67	±75
-10	14.93	14.16	13.26	12.67	±75
-5	16.86	15.28	13.59	13.05	±75
0	18.51	16.65	13.71	13.28	±75
5	20.66	17.61	13.53	13.14	±75
10	23.64	18.52	13.53	13.1	±75
15	27.89	18.99	11.93	11.52	±75
20	32.05	15.05	11.63	12.28	±75
23	33.89	14.81	12.13	11.75	±75

Audio Frequency Response:

Modulation Frequency (kHz)	Max Deviation (kHz)	Audio Frequency Response (dB)
0.30	4.43	0.74
0.40	4.34	0.56
0.50	4.25	0.38
0.60	4.22	0.31
0.70	4.16	0.19
0.80	4.12	0.11
0.90	4.10	0.06
1.00	4.07	0.00
1.50	4.05	-0.04
2.00	4.06	-0.02
2.50	4.11	0.08
3.00	4.14	0.15
3.50	4.18	0.23
4.00	4.18	0.23

4.50	4.16	0.19
5.00	4.11	0.08
6.00	3.88	-0.42
7.00	3.56	-1.16
8.00	3.23	-2.01
9.00	2.95	-2.80
10.00	2.72	-3.50
11.00	2.52	-4.16
12.00	2.35	-4.77
13.00	2.23	-5.23
14.00	2.11	-5.71
15.00	2.03	-6.04

4.5 FREQUENCY STABILITY MEASUREMENTS

Test Method: ANSI C63.26,

1. Section(s) 5.6.3 “Procedure for frequency stability testing”
2. FCC Part 2.1055(d)(2)

Limits:
The frequency tolerance of the transmitter shall be 0.005 percent (50ppm).

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.

Battery voltage tested from 6V - 10.35V. Operating end point = 5.4V.

Deviations from test standard:
No deviation

Test setup:

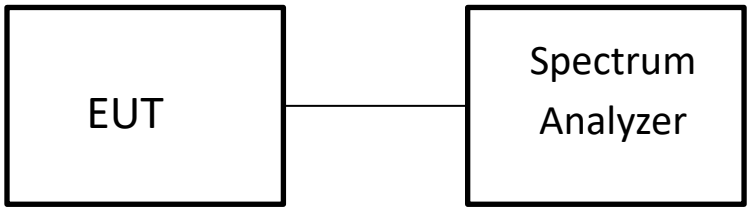


Figure 21 –Measurements Test Setup

EUT operating conditions:
The EUT was powered by 9VDC battery (6 AA batteries) 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
174.0250	303	299	181	170	163	169	30	34	65	110	8700	50	Pass
197.9750	361	138	285	321	108	375	54	156	135	187	9899	50	Pass
215.9750	342	170	108	204	188	220	68	154	118	168	10799	50	Pass

Frequency Stability, Voltage Variation

Freq (MHz)	6V	9V	10.35V	limit (Hz)	limit (ppm)	Result
174.0250	147	171	172	8700	50	Pass
197.9750	155	174	181	9899	50	Pass
215.9750	162	187	191	10799	50	Pass

*Note that the device gives a low battery indication around 6 VDC. So, the manufacturer declares that this is the lowest usable voltage range for this radio.

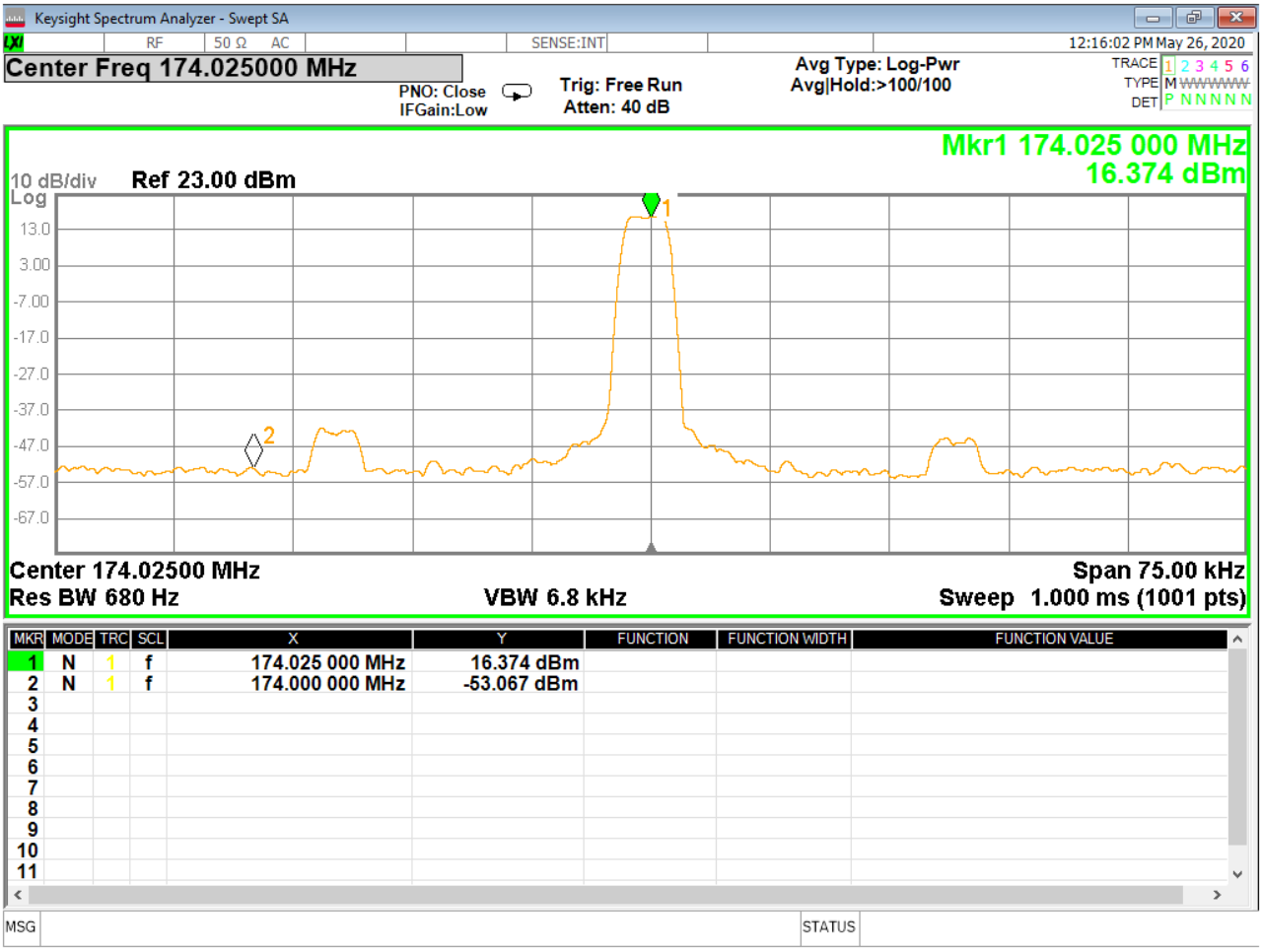


Figure 22 - Channel Frequency, 174.025

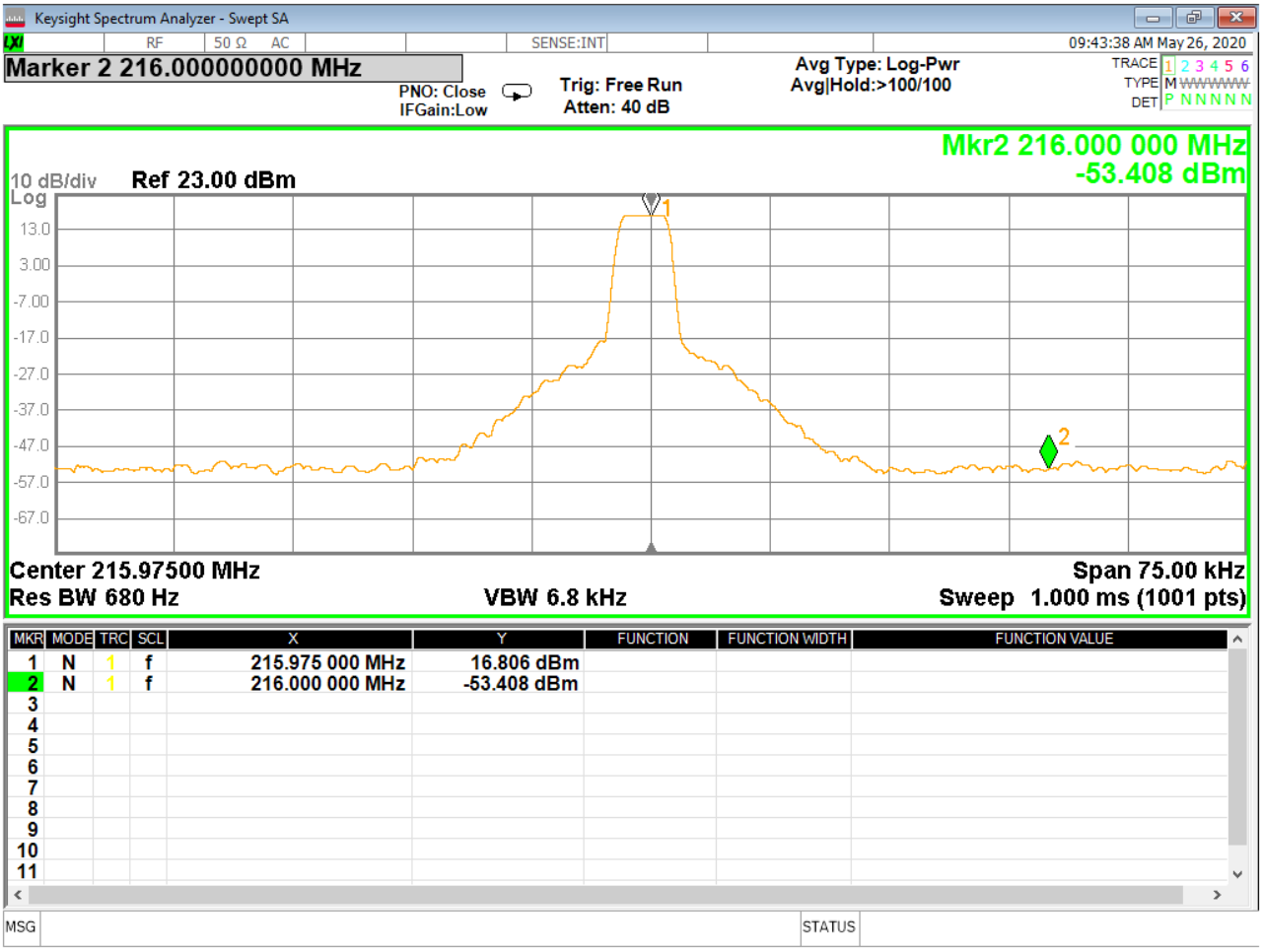


Figure 23 - Channel Frequency - 216.975

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