

Amended

FCC/ISED TEST REPORT

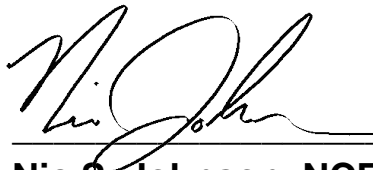
Prepared for: Bosch Security Systems, Inc.

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

Product: TR-32N

Test Report No: R20190927-20-E3G

Approved By:



Nic S. Johnson, NCE


Technical Manager

iNARTE Certified EMC Engineer #EMC-003337-NE

DATE: 1 June 2020


Total Pages: 41

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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 | 14 April 2020 | Updated Section 2.1 |
| C | 15 April 2020 | Added EIRP power |
| D | 05 May 2020 | <ol style="list-style-type: none"> 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-E3C and its amendment in full |
| E | 29 May 2020 | Low and high frequencies were moved within the allocated band. |
| F | 29 May 2020 | Corrected channel frequency on Page 35 |
| G | 1 June 2020 | Corrected channel frequency on Page 35 |

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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 | Carrier Output Power | 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 | Emission Masks And Occupied Bandwidth | Pass |
| FCC Part 2.1047 Using ANSI C63.26-2015 RSS-210 Issue 10, Annex G.5 | 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 | Frequency Stability | Pass |

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

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2.0 EUT DESCRIPTION

2.1 EQUIPMENT UNDER TEST

| | |
|----------------|--|
| Model | TR-32N |
| EUT Received | 17 December 2019 |
| EUT Tested | 17 December 2019 – 9 March 2020 |
| Serial No. | 075497595900130003 075497495900130004 |
| Operating Band | 174 MHz – 216 MHz |
| Device Type | Licensed Radio |
| Power Supply | 9VDC battery (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 (MHz) |
|--------------|-----------------|
| Low (28u) | 174.025 MHz |
| Middle (29u) | 197.975 MHz |
| High (30u) | 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

| | | | | |
|--|----------------|------------------------------|-----|---|
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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 $35 \pm 4\%$
 Temperature of $22 \pm 3^\circ$ 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.

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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 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

| | | | | |
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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) |

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)

| | | | |
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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.

NOTE:

N/A

Deviations from test standard:

No deviation.

Test setup:

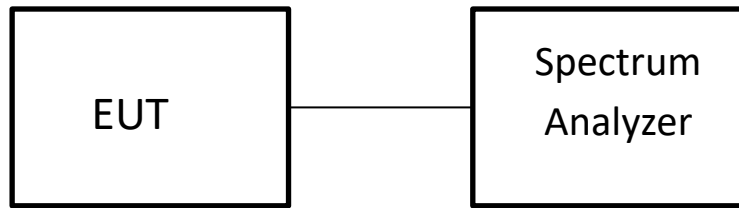


Figure 1 - Conducted Spurious Test Setup

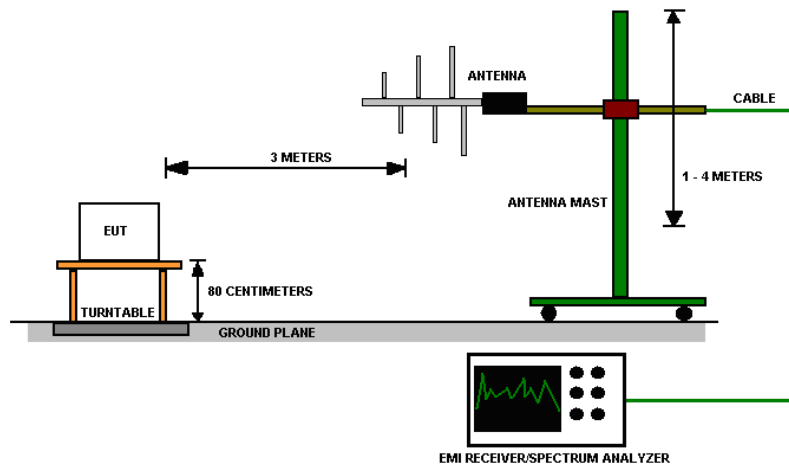



Figure 2 - Radiated Emissions Test Setup

| | | | | |
|--|----------------|------------------------------|-----|---|
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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 174.025 MHz | | TR 32 Radiated Emissions Per ETSI EN 300 422-1 | | | | |
|--|---------|--|------|-----------------|--------|--------|
| Frequency | Sig gen | Cable loss | Gain | Corrected Level | Limit | Margin |
| MHz | dBm | dB | | dBm | dBm | dB |
| 696.000000 | -20 | -56.1 | 6.3 | -69.8 | -53.98 | 15.82 |
| All the other measurements were found to be at least 6 dB below the limit. | | | | | | |
| Mid Ch 197.975 MHz | | | | | | |
| Frequency | Sig gen | Cable loss | Gain | Corrected Level | Limit | Margin |
| MHz | dBm | dB | | dBm | dBm | dB |
| 593.940000 | -11 | -56.1 | 5.8 | -61.3 | -53.98 | 7.32 |
| All the other measurements were found to be at least 6 dB below the limit. | | | | | | |
| High Ch 215.975 MHz | | | | | | |
| Frequency | Sig gen | Cable loss | Gain | Corrected Level | Limit | Margin |
| MHz | dBm | dB | | dBm | dBm | dB |
| 647.940000 | -14.68 | -56.1 | 6.1 | -64.68 | -53.98 | 10.7 |
| 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

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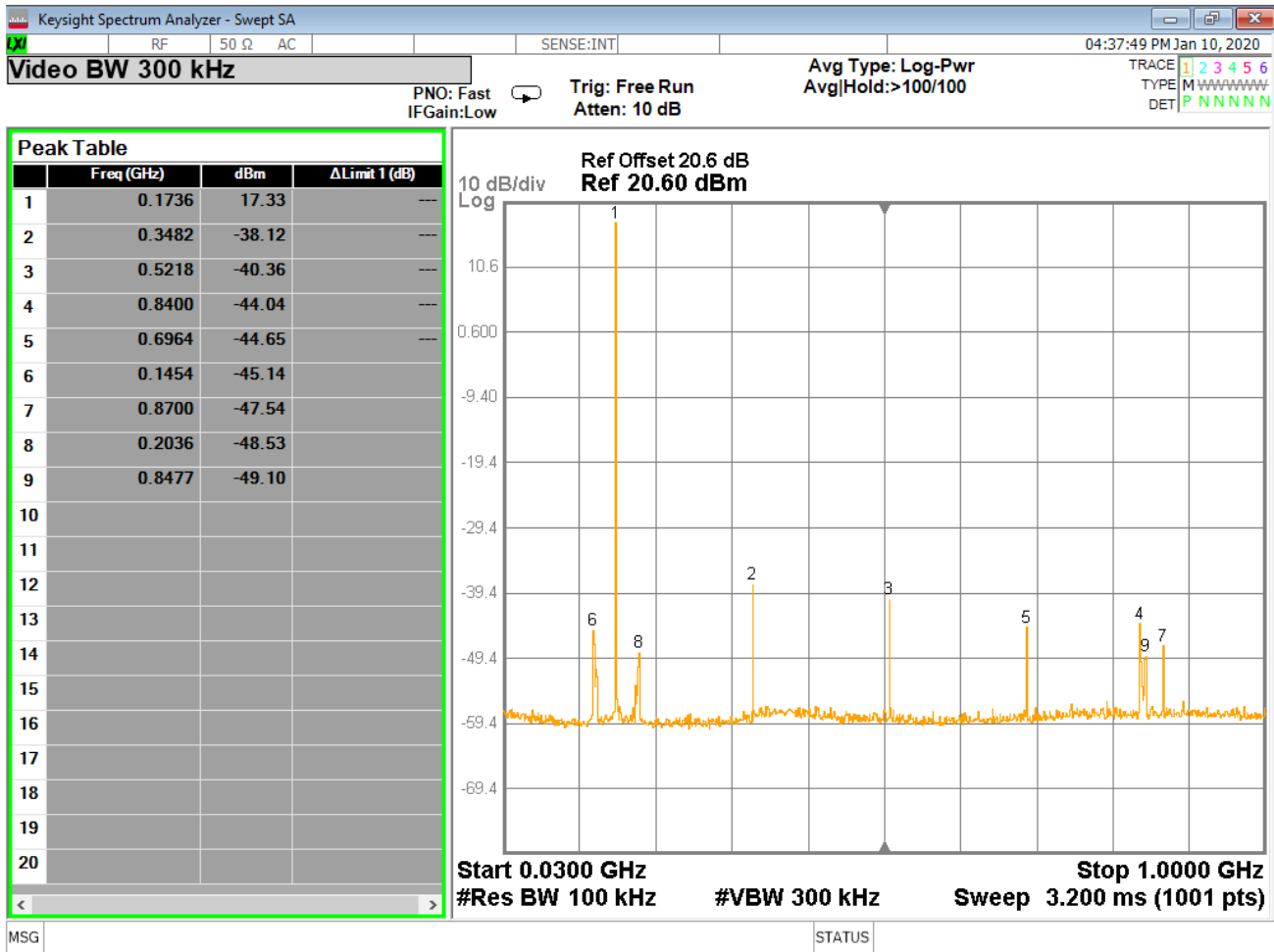



Figure 3 - Conducted Unwanted Emissions Plot, 30 MHz -1 GHz

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

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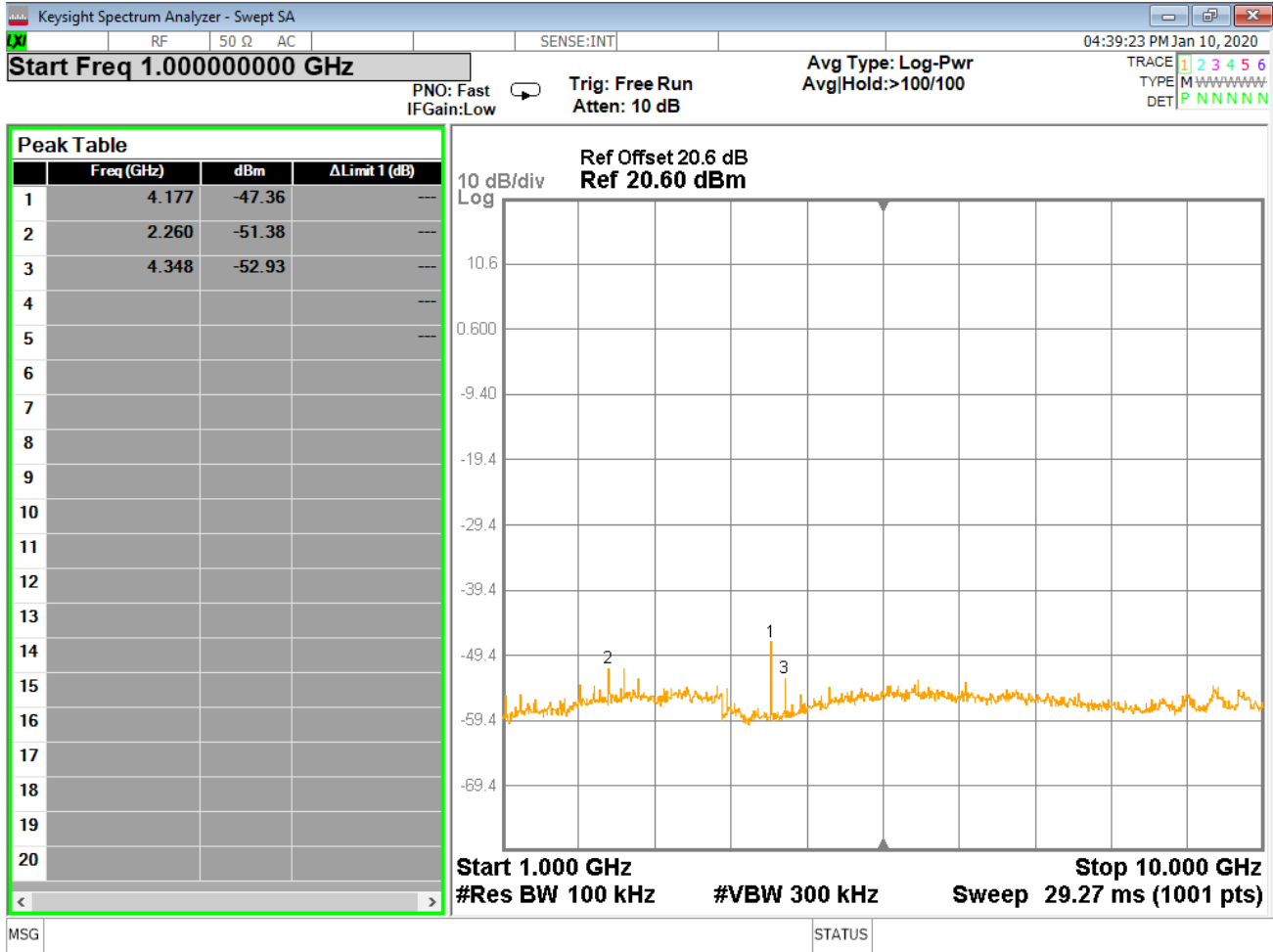



Figure 4 - Conducted Unwanted Emissions Plot, 1 GHz-10 GHz

*Limit is -13dB – Pass

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|--|----------------|------------------------------|-----|---|
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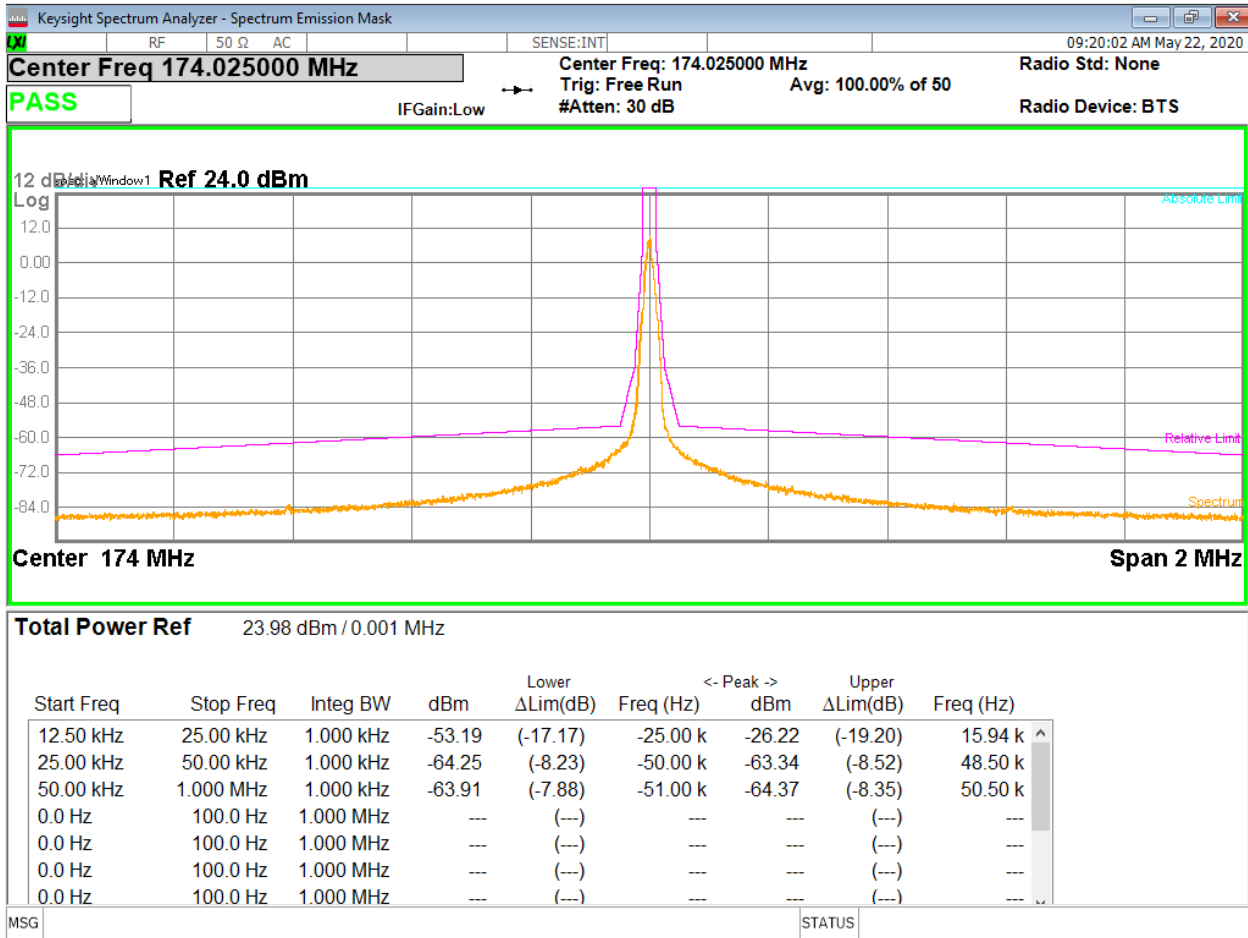



Figure 5 – Necessary Bandwidth from EN 300 422, Low Channel

| | | | | |
|--|----------------|------------------------------|-----|---|
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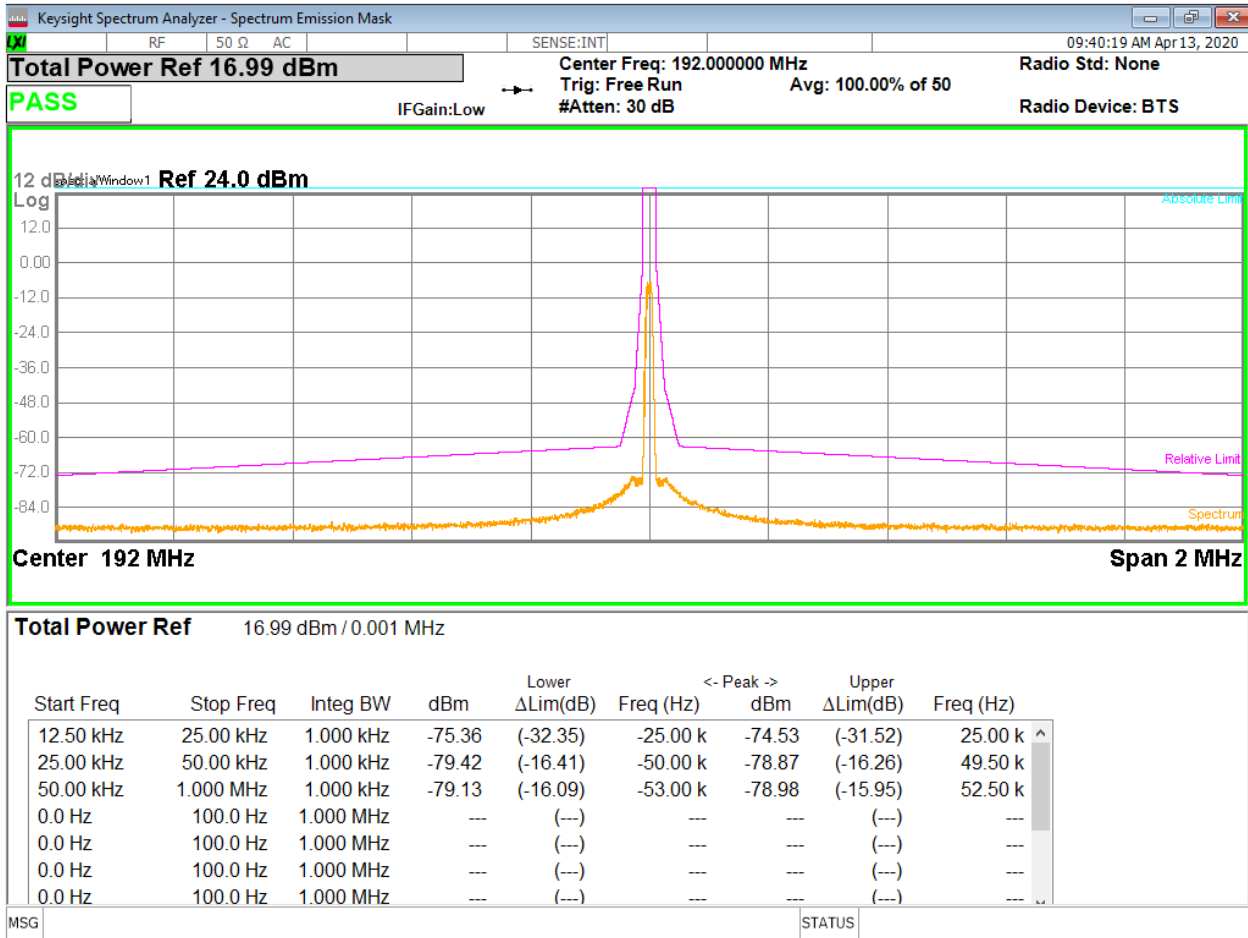



Figure 6 – Necessary Bandwidth from EN 300 422, Mid Channel

| | | | | |
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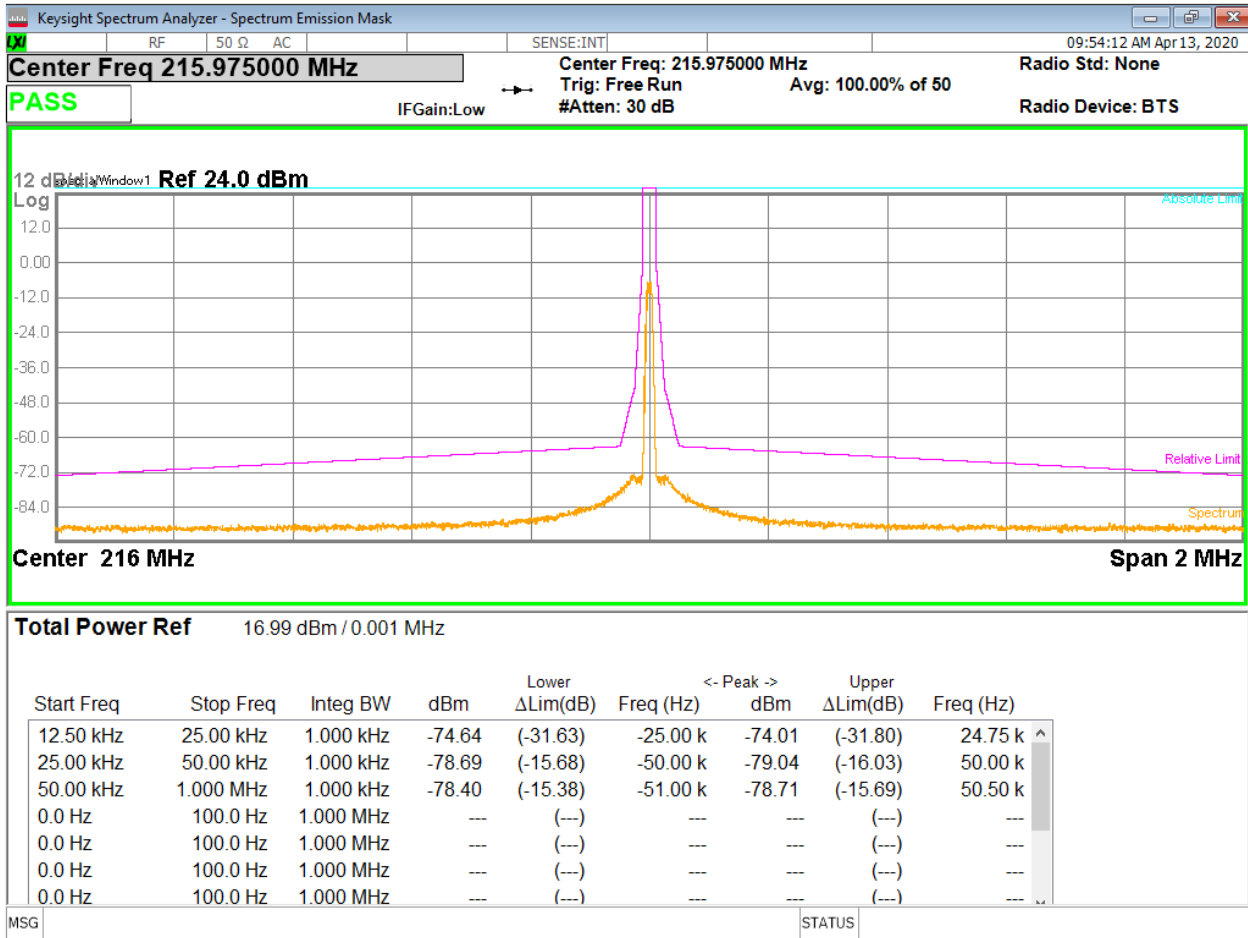



Figure 7 – Necessary Bandwidth from EN 300 422, High Channel

| | | | | |
|--|----------------|------------------------------|-----|---|
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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:

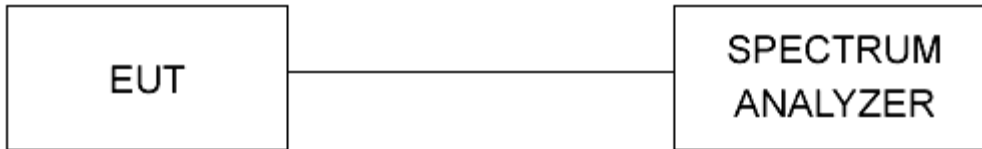


Figure 8 – Peak Output Power Measurements Test Setup

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 | 16.692 | 46.75 | 23.42 | Conducted | PASS |
| Mid | 197.975 | 16.859 | 48.52 | 24.31 | Conducted | PASS |
| High | 215.975 | 16.683 | 46.59 | 23.34 | Conducted | PASS |

*Includes antenna gain of -3 dB (0.501 numeric)

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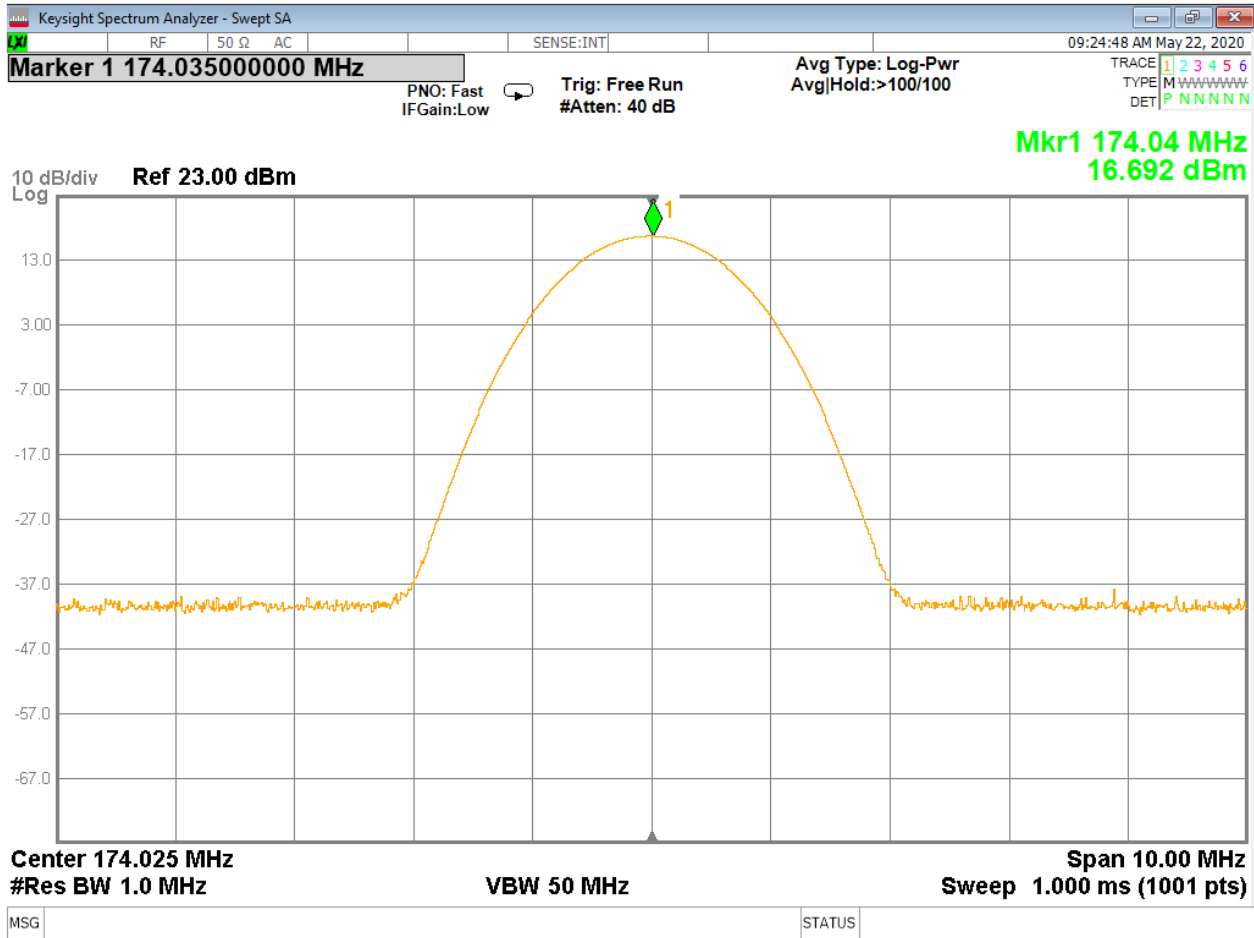



Figure 9 – Peak Output Power, Low Channel,

| | | | | |
|--|----------------|------------------------------|-----|---|
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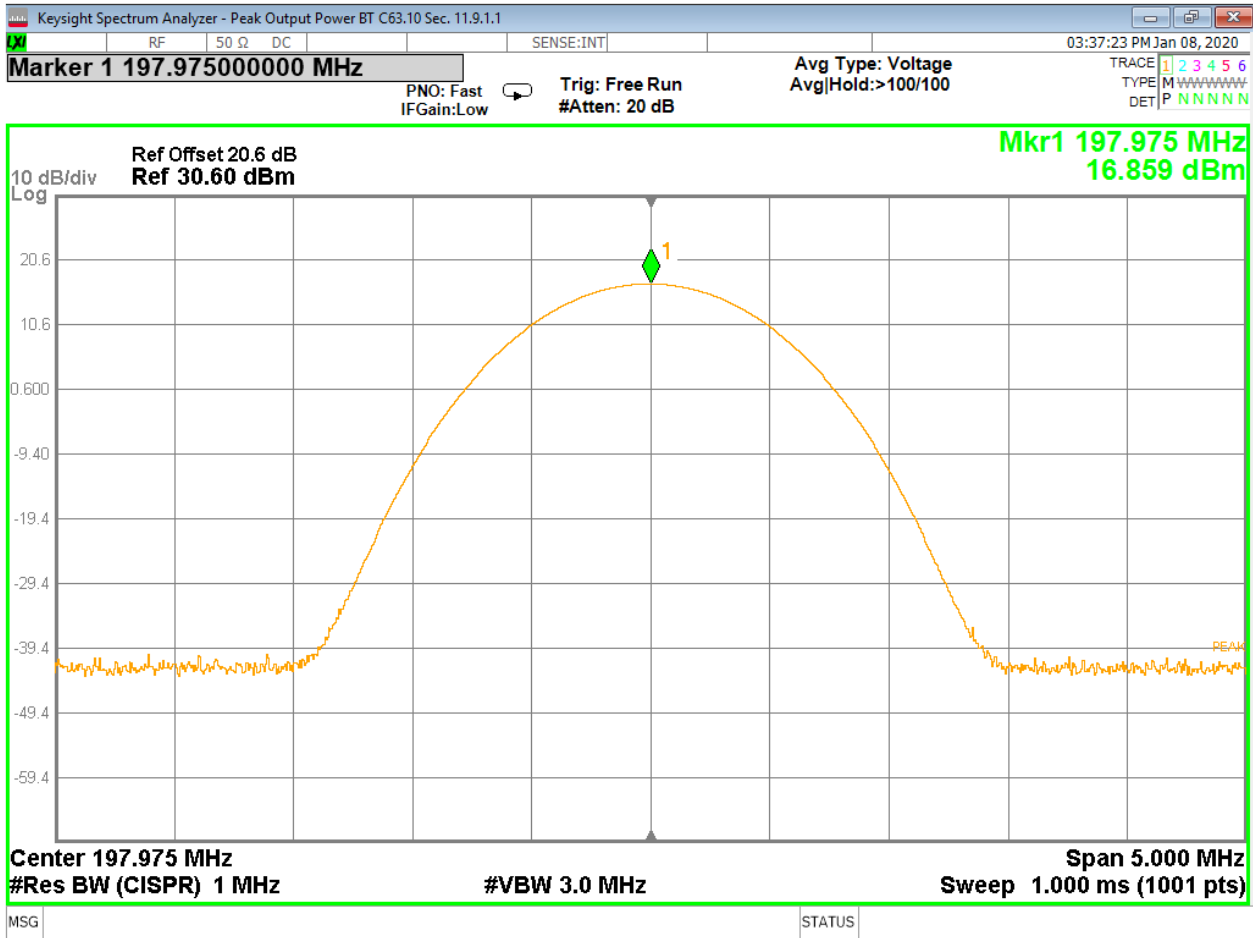



Figure 10 – Peak Output Power, Mid Channel,

| | | | | |
|--|----------------|------------------------------|-----|---|
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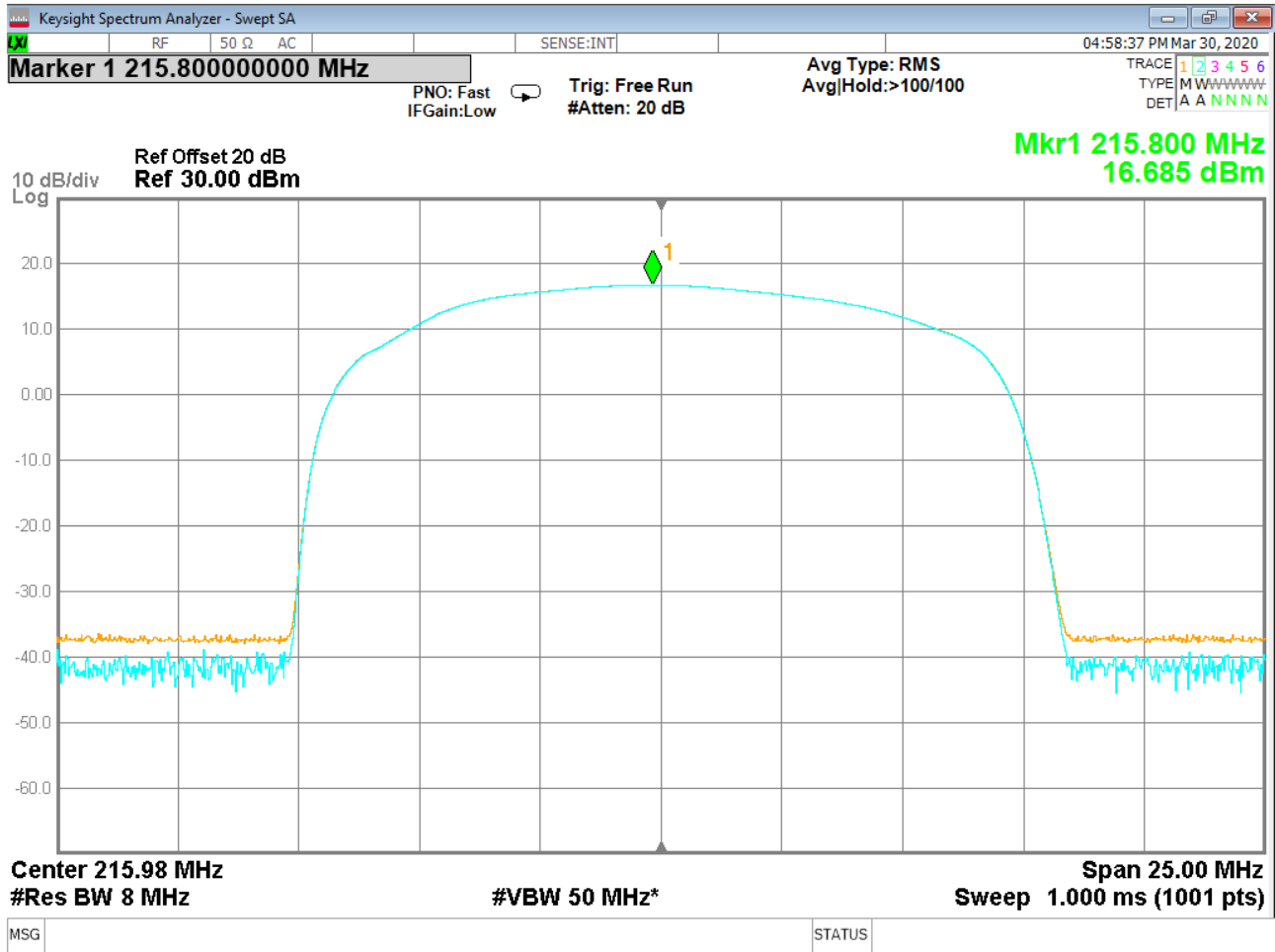



Figure 11 – Peak Output Power, High Channel

| | | | | |
|--|----------------|------------------------------|-----|---|
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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 $43 + 10\log_{10}$ (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

| | | | | |
|--|----------------|------------------------------|-----|---|
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Test setup:

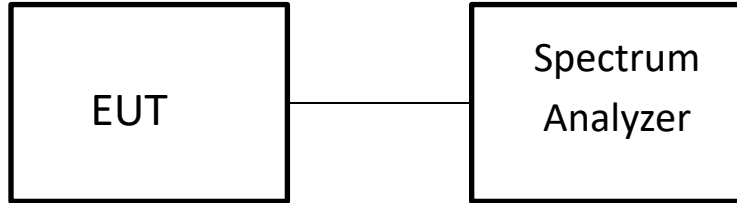



Figure 12 –Measurements Test Setup

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:

| | | | | |
|--|----------------|------------------------------|-----|---|
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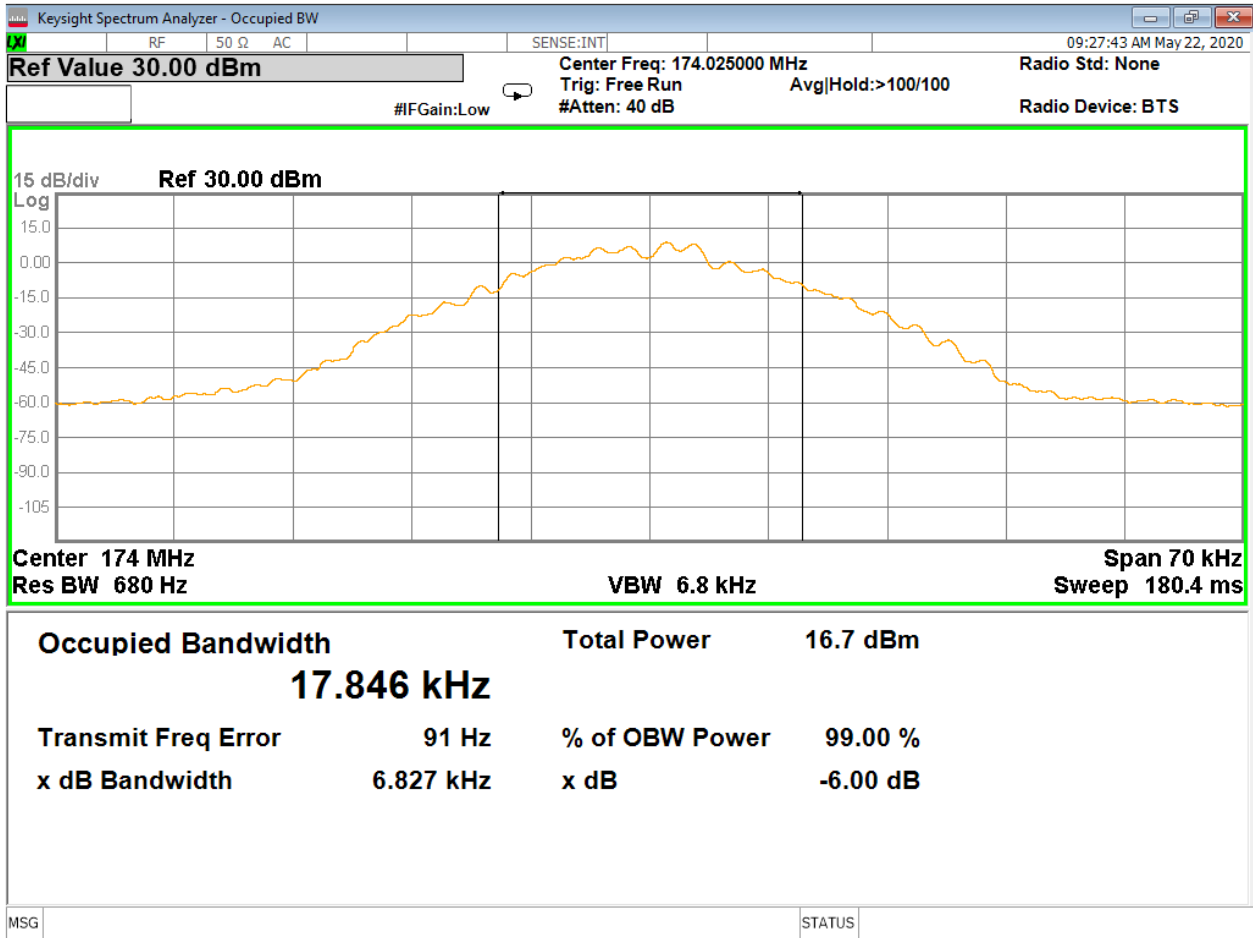



Figure 13 - 99% Occupied Bandwidth, Low Channel

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|--|----------------|------------------------------|-----|---|
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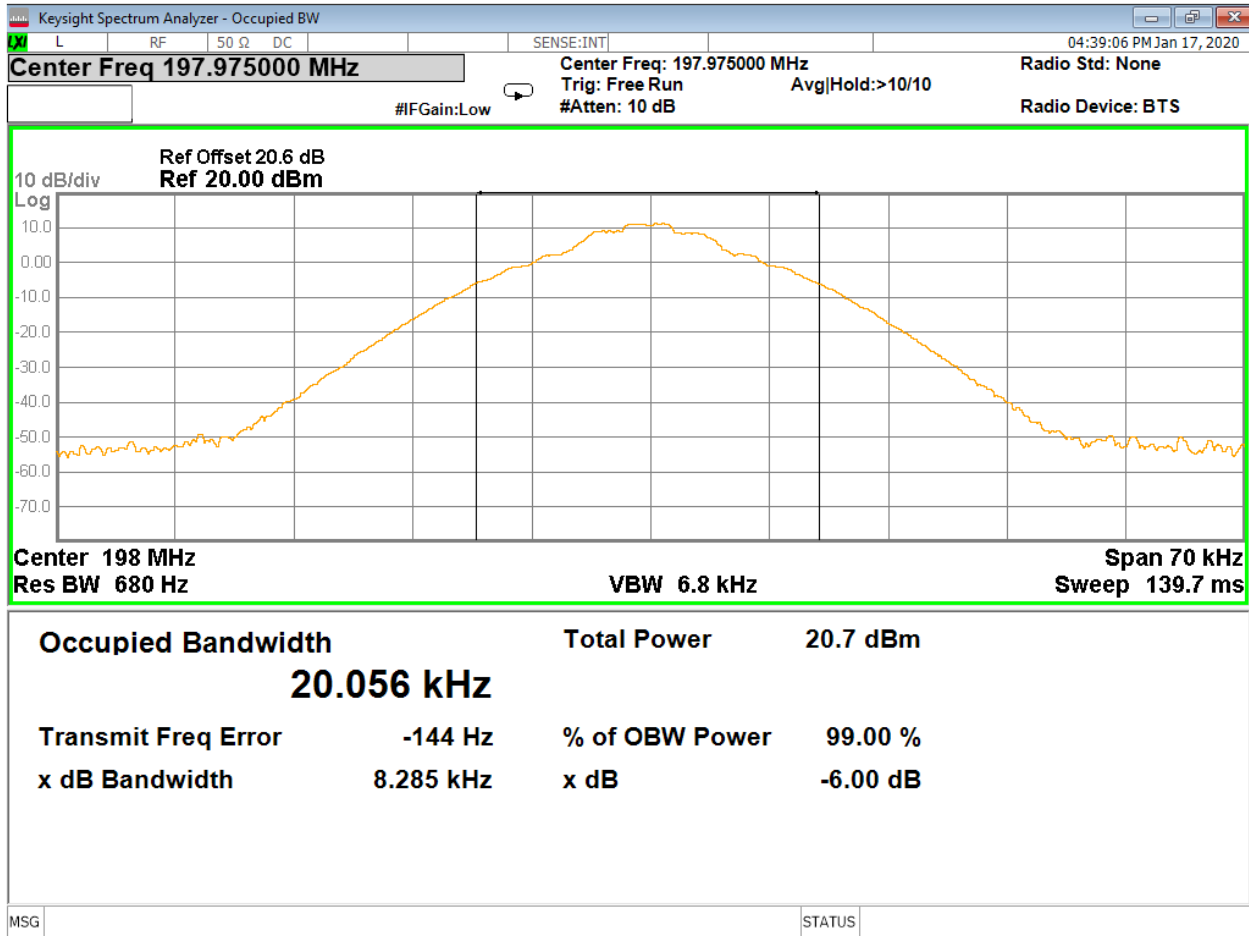



Figure 14 - 99% Occupied Bandwidth, Mid Channel

| | | | |
|--|--|-----|---|
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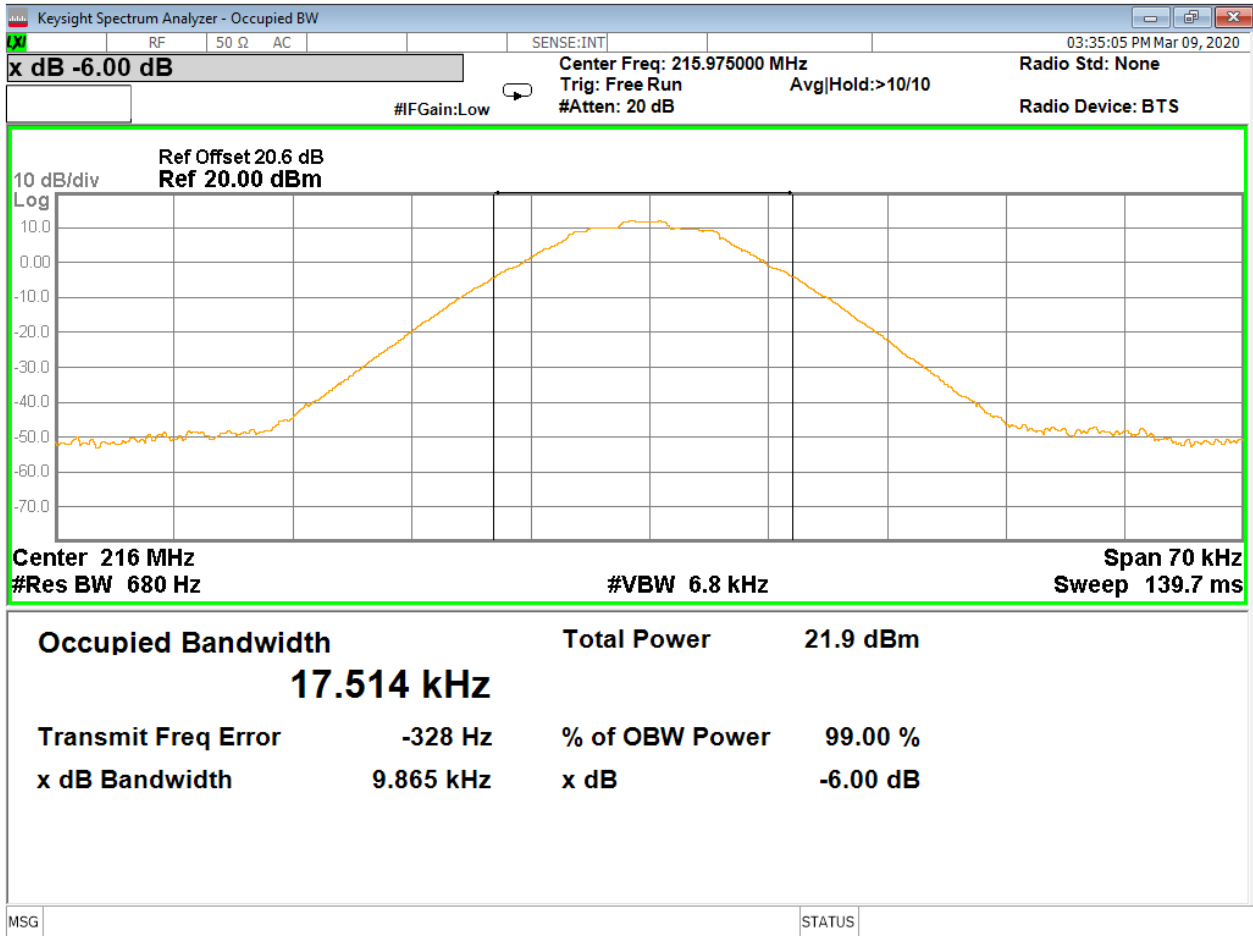



Figure 15 - 99% Occupied Bandwidth, High Channel

| | | | |
|--|--|-----|---|
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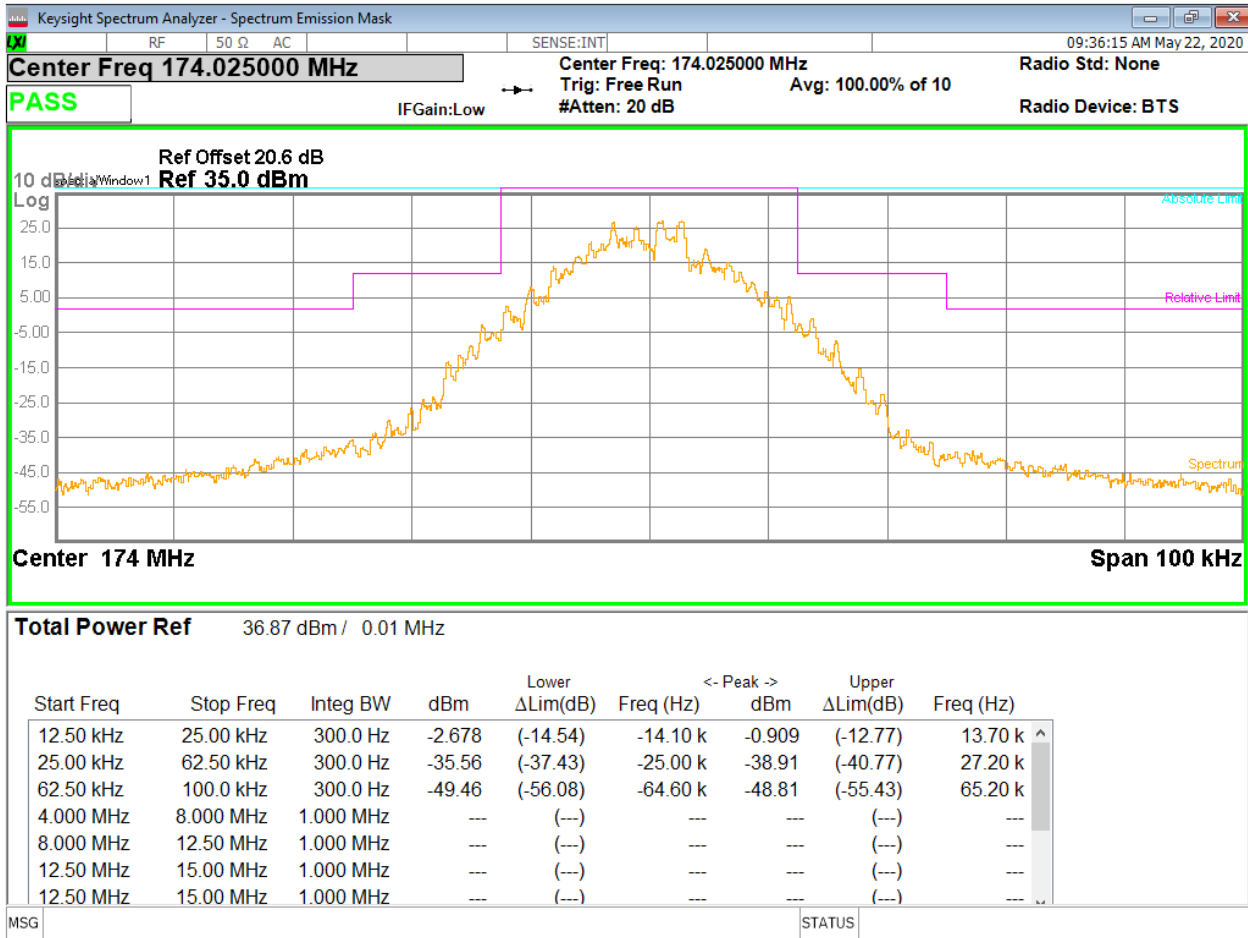



Figure 16 – Emissions Mask, Low Channel, 1 kHz Tone

| | | | | |
|--|----------------|------------------------------|-----|---|
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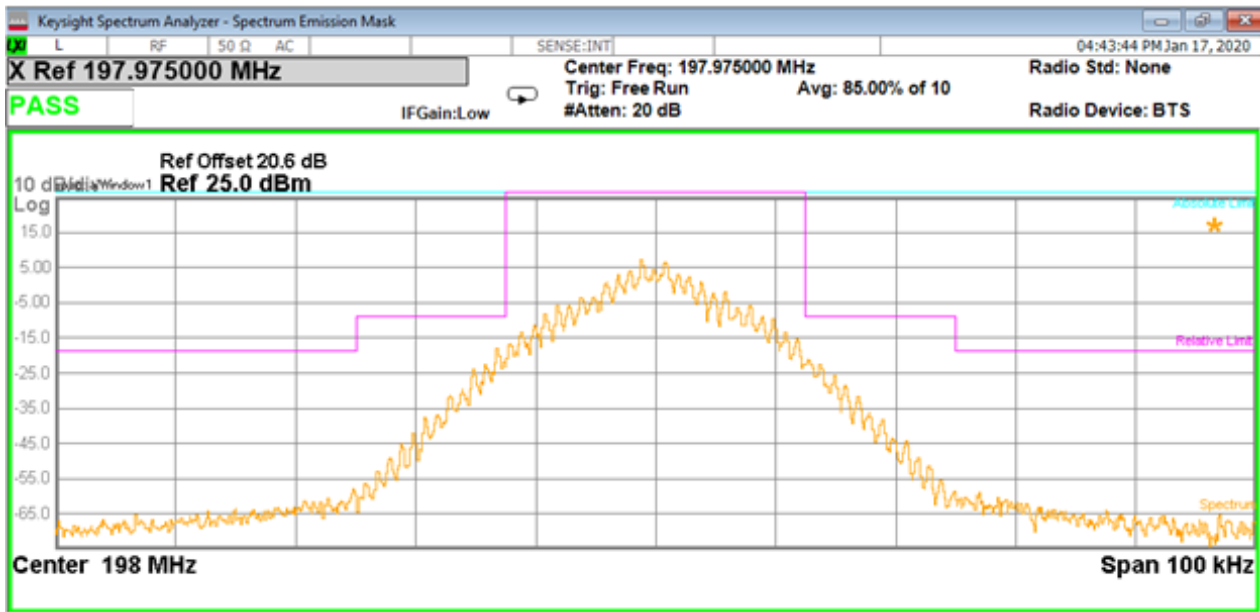



Figure 17 - Emissions Mask, Mid Channel, 1 kHz tone

| | | | | |
|--|----------------|------------------------------|-----|---|
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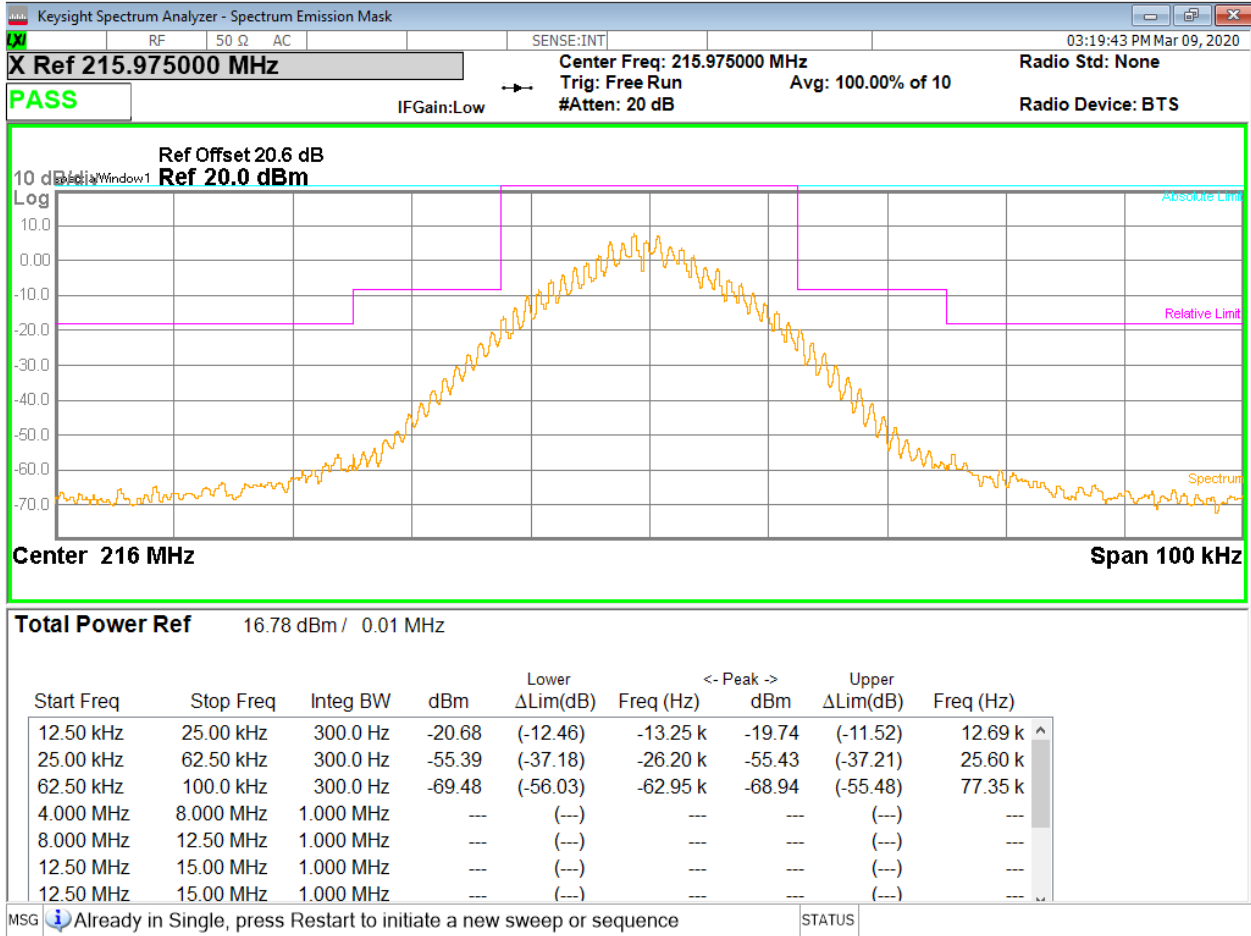



Figure 18 - Emissions Mask, High Channel, 1 kHz tone

| | | | | |
|--|----------------|------------------------------|-----|---|
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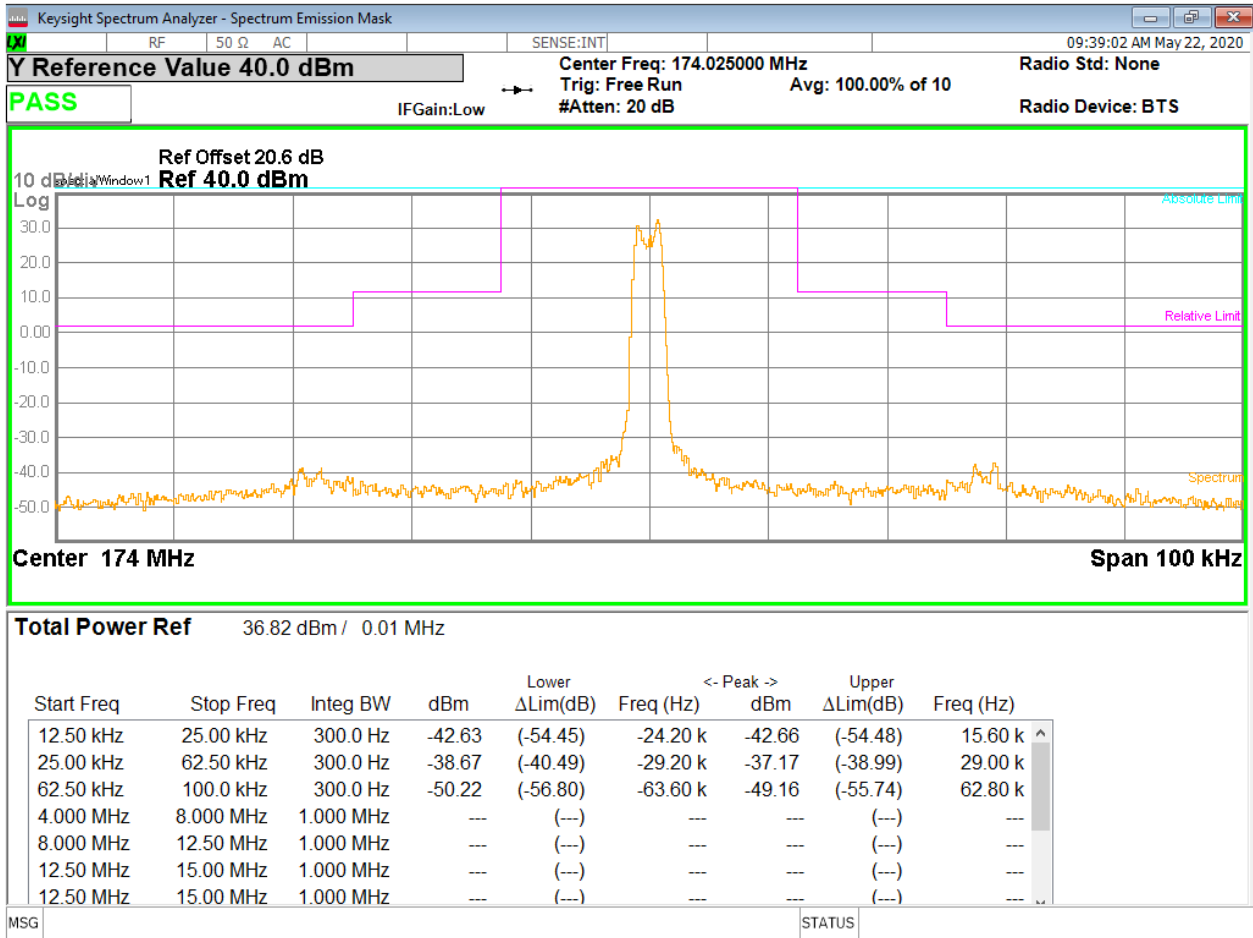



Figure 19 - Emissions Mask, Low Channel

| | | | | |
|--|----------------|------------------------------|-----|---|
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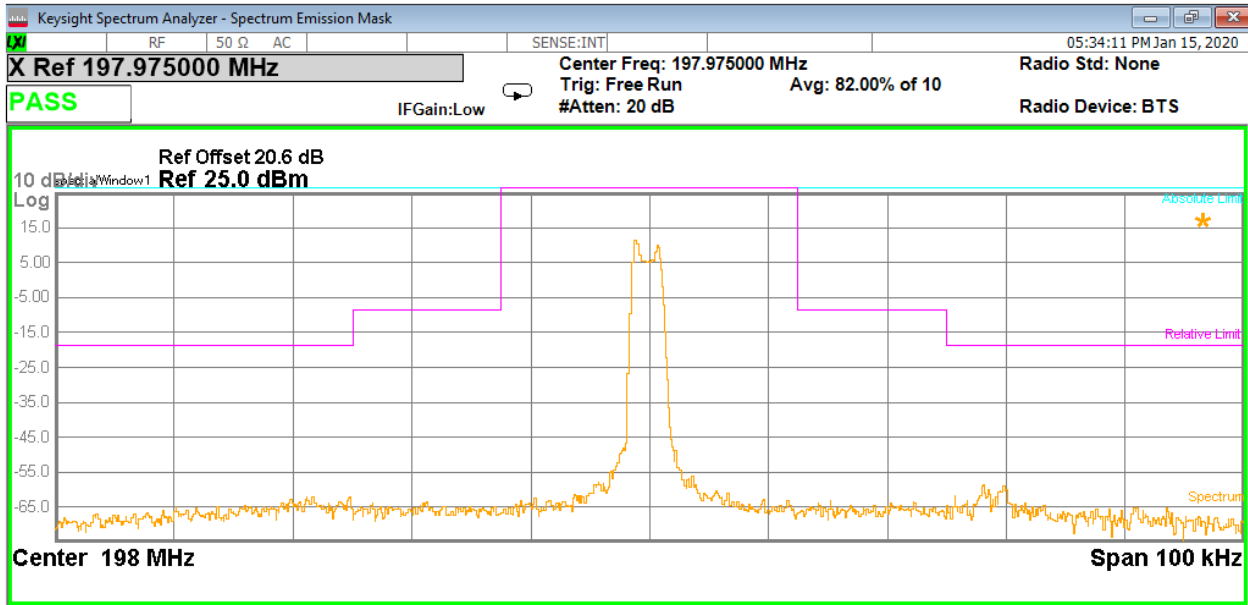



Figure 20 - Emissions Mask, Mid Channel

| | | | | |
|--|----------------|------------------------------|-----|---|
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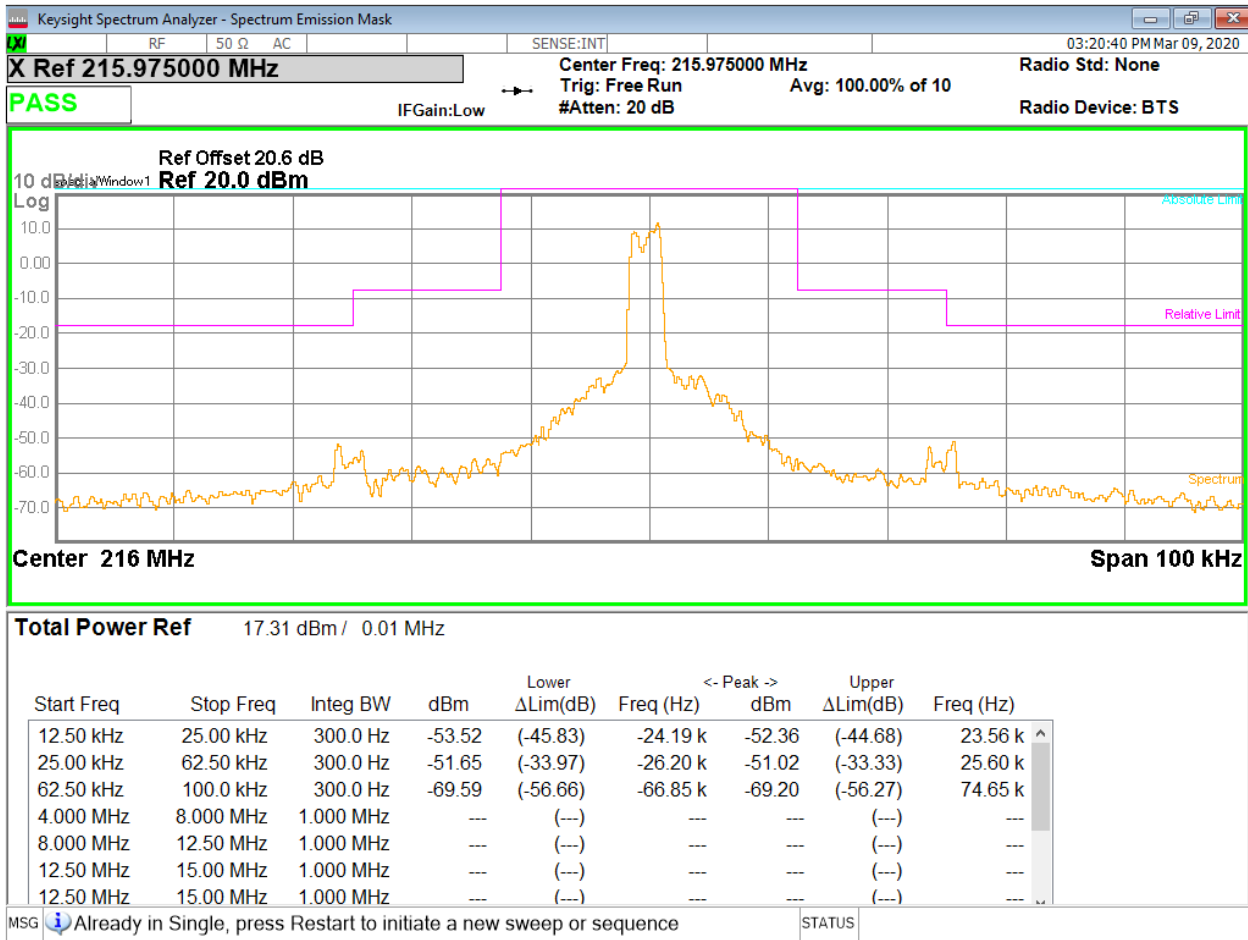



Figure 21 - Emissions Mask, High Channel

| | | | | |
|--|----------------|------------------------------|-----|---|
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4.4 MODULATION CHARACTERISTICS

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:

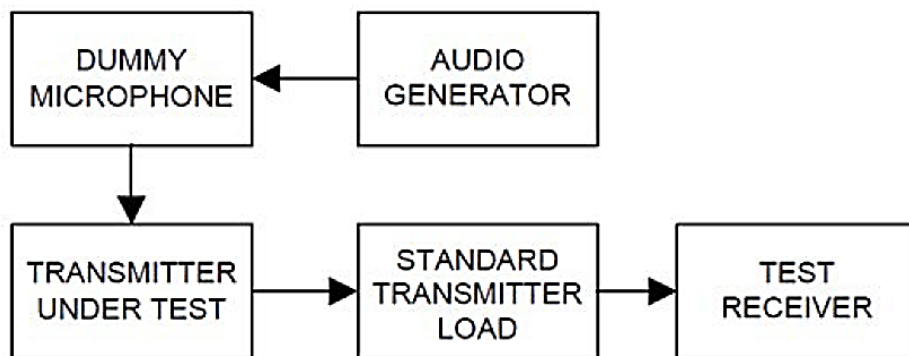



Figure 22 – Modulation Limiting and Audio Frequency Response Test Setup

| | | | | |
|--|----------------|------------------------------|-----|---|
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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:

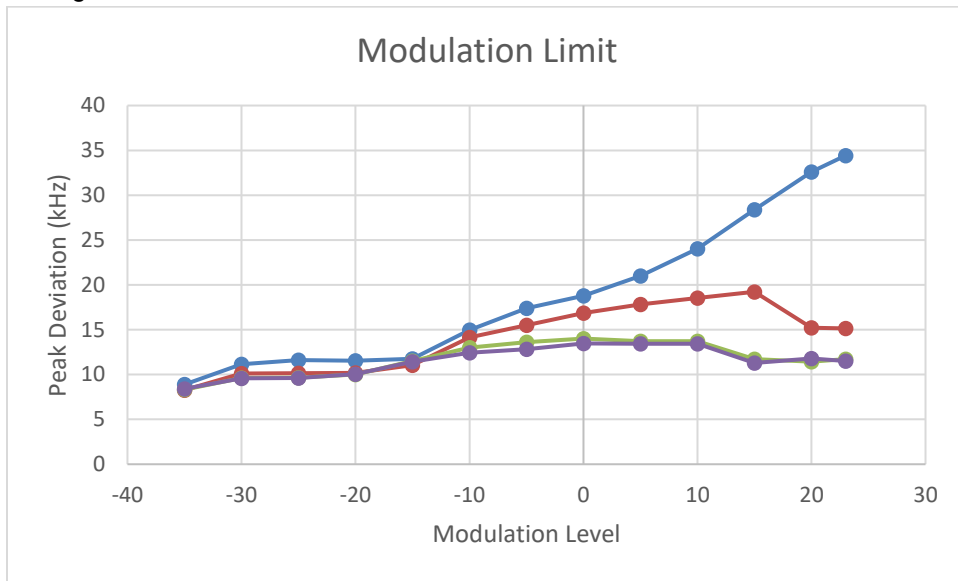




Figure 23 – Modulation Limiting, Mid Channel

| Modulation Limit | | | | | |
|-----------------------|--------------------------------|--------|--------|--------|-------------|
| Modulation Level (dB) | Peak Frequency Deviation (kHz) | | | | Limit (kHz) |
| | 300Hz | 1000Hz | 2500Hz | 3000Hz | |
| -35 | 8.89 | 8.27 | 8.32 | 8.41 | ±75 |
| -30 | 11.14 | 10.13 | 9.63 | 9.58 | ±75 |
| -25 | 11.6 | 10.15 | 9.64 | 9.61 | ±75 |
| -20 | 11.54 | 10.18 | 10 | 10.06 | ±75 |
| -15 | 11.75 | 11.03 | 11.5 | 11.45 | ±75 |
| -10 | 14.96 | 14.15 | 13.02 | 12.44 | ±75 |
| -5 | 17.38 | 15.5 | 13.63 | 12.83 | ±75 |
| 0 | 18.8 | 16.87 | 14.01 | 13.47 | ±75 |
| 5 | 21.008 | 17.82 | 13.72 | 13.43 | ±75 |
| 10 | 24.05 | 18.55 | 13.71 | 13.44 | ±75 |
| 15 | 28.38 | 19.23 | 11.72 | 11.28 | ±75 |
| 20 | 32.61 | 15.23 | 11.43 | 11.8 | ±75 |
| 23 | 34.43 | 15.14 | 11.73 | 11.49 | ±75 |

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Audio Frequency Response:

| Modulation Frequency (kHz) | Max Deviation (kHz) | Audio Frequency Response (dB) |
|----------------------------|---------------------|-------------------------------|
| 0.30 | 4.46 | 0.67 |
| 0.40 | 4.40 | 0.55 |
| 0.50 | 4.33 | 0.41 |
| 0.60 | 4.28 | 0.31 |
| 0.70 | 4.22 | 0.19 |
| 0.80 | 4.18 | 0.10 |
| 0.90 | 4.16 | 0.06 |
| 1.00 | 4.13 | 0.00 |
| 1.50 | 4.10 | -0.06 |
| 2.00 | 4.11 | -0.04 |
| 2.50 | 4.14 | 0.02 |
| 3.00 | 4.19 | 0.13 |
| 3.50 | 4.21 | 0.17 |
| 4.00 | 4.23 | 0.21 |
| 4.50 | 4.19 | 0.13 |
| 5.00 | 4.13 | 0.00 |
| 6.00 | 3.92 | -0.45 |
| 7.00 | 3.61 | -1.17 |
| 8.00 | 3.27 | -2.03 |
| 9.00 | 2.97 | -2.86 |
| 10.00 | 2.72 | -3.63 |
| 11.00 | 2.52 | -4.29 |
| 12.00 | 2.37 | -4.82 |
| 13.00 | 2.24 | -5.31 |
| 14.00 | 2.13 | -5.75 |
| 15.00 | 2.03 | -6.17 |

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4.5 FREQUENCY STABILITY MEASUREMENTS

Test Method: ANSI C63.26,

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

Limits:

50 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.

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

Deviations from test standard:

No deviation

Test setup:

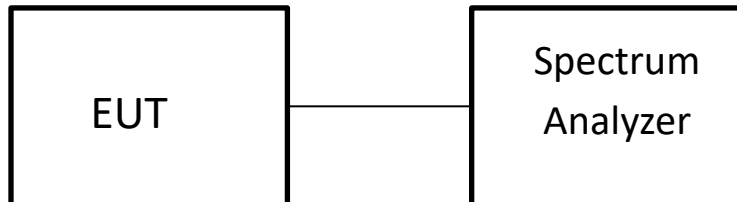



Figure 24 –Measurements Test Setup

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.

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|--|----------------|------------------------------|-----|---|
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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 | 250 | 222 | 173 | 146 | 162 | 184 | 28 | 45 | 66 | 122 | 8700 | 50 | Pass |
| 197.9750 | 115 | 183 | 129 | 172 | 31 | 70 | 166 | 301 | 176 | 152 | 9899 | 50 | Pass |
| 215.9750 | 130 | 368 | 224 | 187 | 202 | 119 | 153 | 180 | 181 | 124 | 10799 | 50 | Pass |

Frequency Stability, Voltage Variation

| Freq (MHz) | 6V | 9V | 10.35V | limit (Hz) | limit (ppm) | Result |
|------------|-----|-----|--------|------------|-------------|--------|
| 174.0250 | 143 | 150 | 142 | 8700 | 50 | Pass |
| 197.9750 | 109 | 262 | 285 | 9899 | 50 | Pass |
| 215.9750 | 129 | 283 | 292 | 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.

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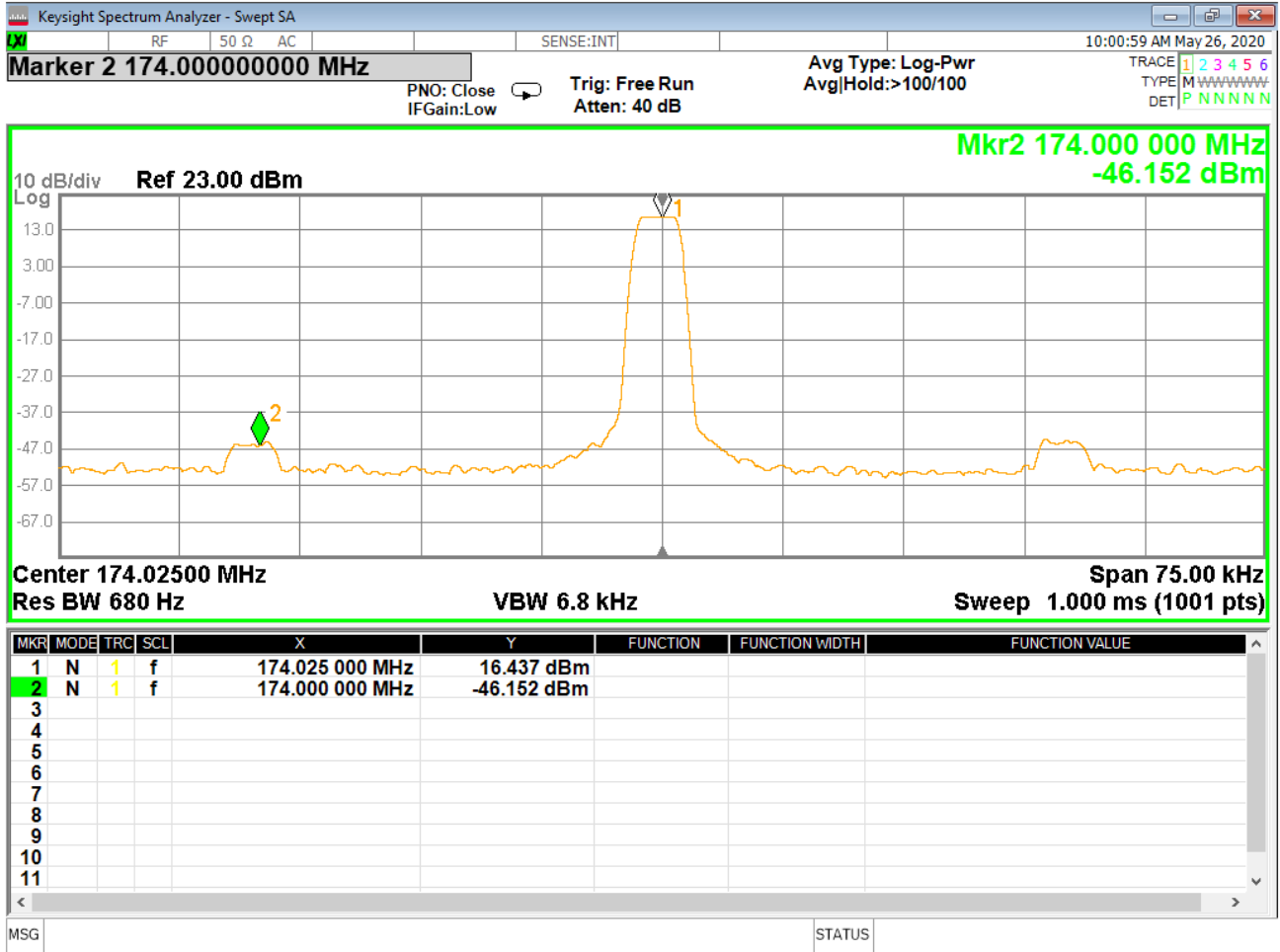



Figure 25 - Lowest channel frequency

| | | | | |
|--|----------------|------------------------------|-----|---|
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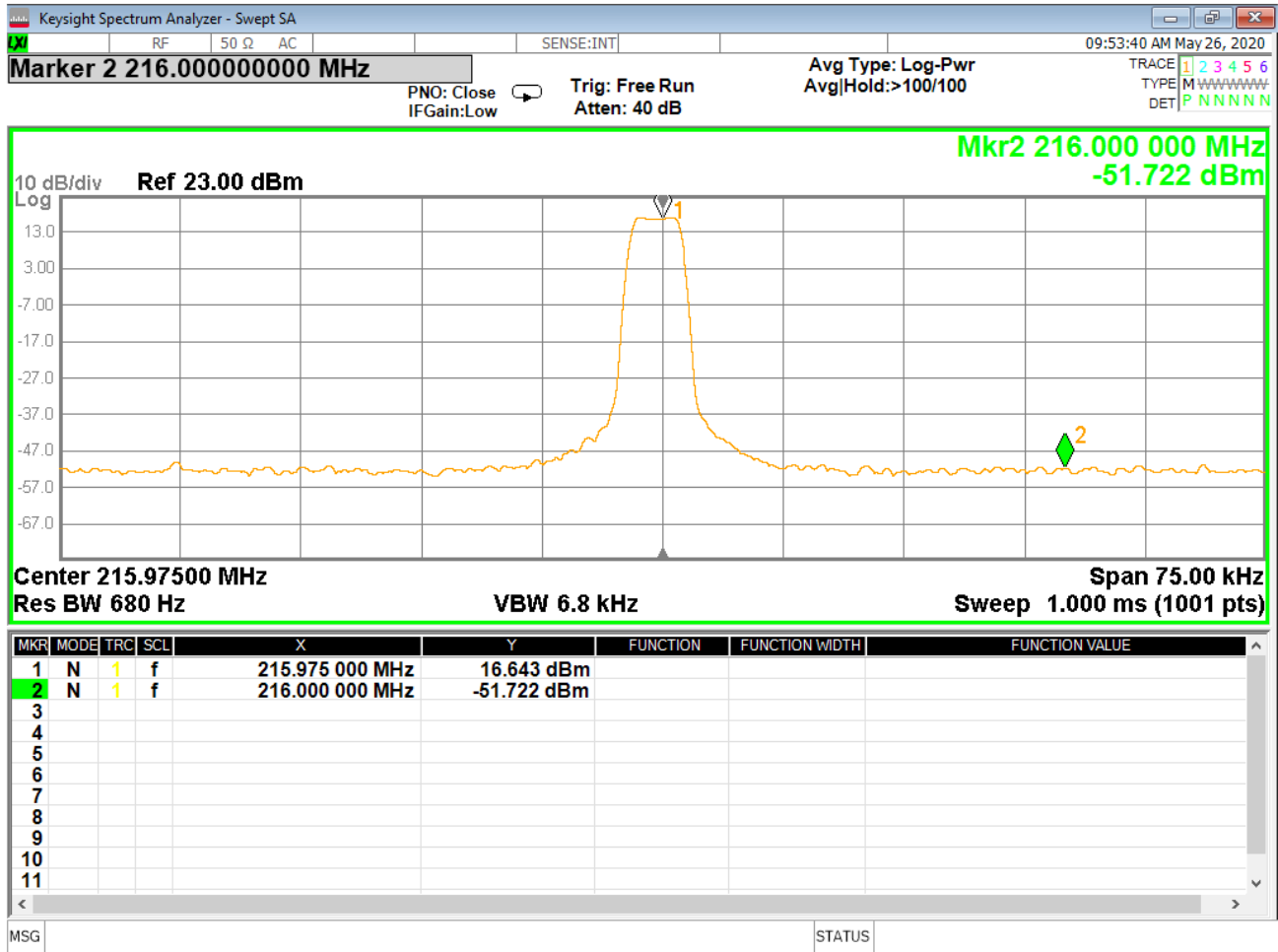



Figure 26 - Highest channel Frequency

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|--|----------------|------------------------------|-----|---|
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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 dB μ V 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 dB μ V/m.

$$FS = 55 + 12 - (-1.1 + 20) + 0 = 48.1 \text{ dB}\mu\text{V/m}$$

The 48.1 dB μ V/m value can be mathematically converted to its corresponding level in μ V/m.

$$\text{Level in } \mu\text{V/m} = \text{Common Antilogarithm} [(48.1 \text{ dB}\mu\text{V/m})/20] = 254.1 \mu\text{V/m}$$

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

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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;

$$EIRP \text{ (Watts)} = [\text{Field Strength (V/m)} \times \text{antenna distance (m)}]^2 / 30$$

$$\text{Power (watts)} = 10^{[\text{Power (dBm)}/10]} / 1000$$

$$\text{Voltage (dB}\mu\text{V)} = \text{Power (dBm)} + 107 \text{ (for } 50\Omega \text{ measurement systems)}$$

$$\text{Field Strength (V/m)} = 10^{[\text{Field Strength (dB}\mu\text{V/m)} / 20]} / 10^6$$


$$\text{Gain} = 1 \text{ (numeric gain for isotropic radiator)}$$

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

$$EIRP = [\text{FS(V/m)} \times d^2] / 30 = \text{FS} [0.3] \quad \text{for } d = 3$$

$$EIRP(\text{dBm}) = \text{FS}(\text{dB}\mu\text{V/m}) - 10(\log 10^9) + 10\log[0.3] = \text{FS}(\text{dB}\mu\text{V/m}) - 95.23$$

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

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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%.

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REPORT END