FCC Test Report

FOR:
Sierra Innotek, Inc.

Model Name:
Cell-CAT

Product Description:
Tracking beacon for law enforcement and VHF alarm transmitter

FCC ID: 2AIQACCT

Applied Rules and Standards:
47 CFR: Part 90.217

REPORT #: EMC_INNOT_003_23001_FCC_90.217

DATE: 2023-09-07

A2LA Accredited

IC recognized # 3462B-2

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1 Assessment

The following device was evaluated against the applicable criteria specified in FCC rules Part 90.217 of Title 47 of the Code of Federal Regulations.

Company Name	Product Description	Model #
Sierra Innotek, Inc.	Tracking beacon for law enforcement and VHF alarm transmitter	Cell-CAT

Responsible for Testing Laboratory:

Arndt Stoecker

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Date	Section	Name	Signature
2023-09-07	Compliance	Arndt Stoecker (Director of Regulatory Services)	

Responsible for the Report:

Chin Ming Lui

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Date: 2023.09.07 18:21:31 -07'00'

Date	Section	Name	Signature
2023-09-07	Compliance	Chin Ming Lui (Associate EMC Engineer)	

The test results of this test report relate exclusively to the test item specified in Section3.
CETECOM Inc. USA does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CETECOM Inc. USA.

2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the EMC Test Report

Company Name:	CETECOM Inc.
Department:	Compliance
Street Address:	411 Dixon Landing Road
City/Zip Code	Milpitas, CA 95035
Country	USA
Telephone:	+1 (408) 586 6200
Fax:	+1 (408) 586 6299
EMC Lab Manager:	Arndt Stoecker
Responsible Project Leader:	Rami Saman

2.2 Identification of the Client

Applicant's Name:	Sierra Innotek, Inc.
Street Address:	3013 Alhambra Drive
City/Zip Code:	Cameron Park, CA 95682
Country:	USA

2.3 Identification of the Manufacturer

Manufacturer's Name:	Same as Client
Manufacturers Address:	
City/Zip Code	
Country	

3 Equipment Under Test (EUT)

3.1 EUT Specifications

Product Description:	Tracking beacon for law enforcement and VHF alarm transmitter
Model Name :	Cell-CAT
HW Version :	1
SW Version :	6
FCC-ID :	2AIQACCT
Frequency Range / number of channels:	136 – 173.39 MHz
Bands/Modes Supported	**Cellular Modules** **Model Name** : Telit **Model Number** : ME310G1-WW **FCC ID**: R17ME310G1WW **Wireless Technologies** **LTE Cat-M1 FDD Bands**: 2, 4, 12
	Bluetooth LE – Proprietary Nominal band: 2400 MHz – 2483.5 MHz; Center to center: 2402 MHz (ch 0) – 2480 MHz (ch 39), 40 channels
	VHF Freq Proprietary Tech **Frequency Operation:** 136– 173.39 MHz and 216.0125 – 216.9875 MHz
Modes of Operation:	Analog NBFM Voice
Antenna Information as declared:	Max Gain 2.15 dBi
Max. Peak Output Power:	Conducted: 20.07 dBm / EIRP: 22.22 dBm / ERP: 20.07 dBm
Other Radios included in the device	N/A
Power Supply/ Rated Operating Voltage Range	Battery 3.7VDC
Operating Temperature Range	Low : 0ºC Norm: 25ºC High: 60ºC
Sample Revision	☒Production ☐ Pre-Production
EUT Dimensions	90 mm x 60 mm x 6 mm
Weight	50 grams
EUT Diameter	☒< 60 cm ☐ Other _____

3.2 EUT Sample details

EUT #	Serial Number	HW Version	SW Version	Notes/Comments
1	410	1	6	Conducted and Radiated Measurements

3.3 Support Equipment

SE #	Type	Model	Manufacturer	Serial Number
1	DC Power Supply	3003B	Protek	H 001416

3.4 Test Sample Configuration

EUT Set-up #	Combination of AE used for test set up	Comments
1	EUT#1	The EUT operates in the VHF band, and is capable of transmitting an analog NBFM voice signal with modulation characteristics as used in final application. The emission designator is 11K2F3E.

3.5 Mode of Operation

The EUT can be configured into Analog NBFM Voice modulation, and will transmit on radio carrier frequencies 136 – 173.39 MHz. FM tones from 400 to 2500 Hz can be set.

Testing is performed using the following VHF pulse settings:

- Transmitter Pulse Interval = 1 s
- FM Pulse Duration = 1000 ms
- FM Squelch Open Delay = 0 ms
- FM Tone Frequency = 2500 Hz

The maximum power setting of 100 mW nominal is used for all test cases.

4 Subject of Investigation

The objective of the measurements done by CETECOM Inc. was to assess the performance of the EUT according to the relevant requirements specified in FCC rules Part 90.217 of Title 47 of the Code of Federal Regulations.

Testing procedures are based on ANSI C63.26 – "American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Devices", by the Federal Communications Commission, Office of Engineering and Technology, Laboratory Division.

5 Measurement Results Summary

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	EUT Set-up #	Pass	NA	NP	Result
§2.1046 & §90.217	RF Output Power	Nominal	NBFM	1	■	☐	☐	Complies
§2.1047	Modulation Characteristics	Nominal	NBFM	1	■	☐	☐	Complies
§2.1049 & §90.217	Occupied Bandwidth	Nominal	NBFM	1	■	☐	☐	Complies
§2.1051 & §90.217	Spurious Emissions at Antenna Terminals	Nominal	NBFM	1	■	☐	☐	Complies
§2.1053 & §90.217	Field Strength of Spurious Radiation	Nominal	NBFM	1	■	☐	☐	Complies
§2.1055 & §90.217	Frequency Stability	Nominal & Extreme	NBFM	1	■	☐	☐	Complies

Note 1: NA= Not Applicable; NP= Not Performed.
Note 2: EUT is powered by 3.7VDC battery

6 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus, with 95% confidence interval (in dB delta to result), based on a coverage factor k=2.

Radiated measurement

Measurement System		EMC 1	EMC 2
Conducted emissions (mains port)		1.12 dB	0.46 dB
Radiated emissions	(< 30 MHz)	3.66 dB	3.88 dB
	(30 MHz – 1GHz)	3.17 dB	3.34 dB
	(1 GHz – 3 GHz)	5.01 dB	4.45 dB
	(>3 GHz)	4.0 dB	4.79 dB

RF conducted measurement ±0.5 dB

According to TR 102 273 a multiplicative propagation of error is assumed for RF measurement systems. For this reason the RMS method is applied to dB values and not to linear values as appropriate for additive propagation of error. Also used: http://physics.nist.gov/cuu/Uncertainty/typeb.html. The above calculated uncertainties apply to direct application of the Substitution method. The Substitution method is always used when the EUT comes closer than 3 dB to the limit.

6.1 Environmental Conditions During Testing:

The following environmental conditions were maintained during the course of testing:

- Ambient Temperature: 20-25° C
- Relative humidity: 40-60%

6.2 Dates of Testing:

08/22/2023 – 08/25/2023

6.3 Decision Rule:

Cetecom advanced follows ILAC G8:2019 chapter 4.2.1 (Simple Acceptance Rule).

Only the measured values related to their corresponding limits will be used to decide whether the equipment under test meets the requirements of the test standards listed in chapter 3. The measurement uncertainty is mentioned in this test report, See chapter 9, but is not taken into account – neither to the limits nor to the measurement results. Measurement results with a smaller margin to the corresponding limits than the measurement uncertainty have a potential risk of more than 5% that the decision might be wrong.

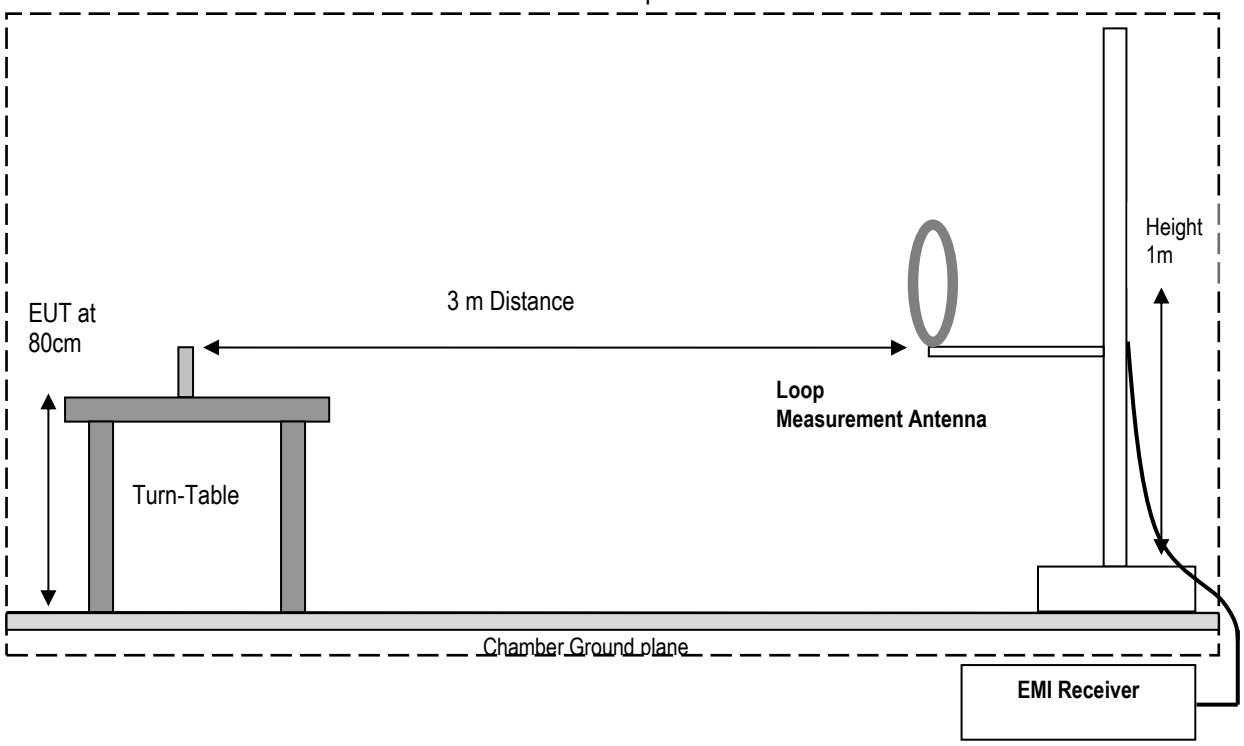
7 Measurement Procedures

7.1 Radiated Measurement

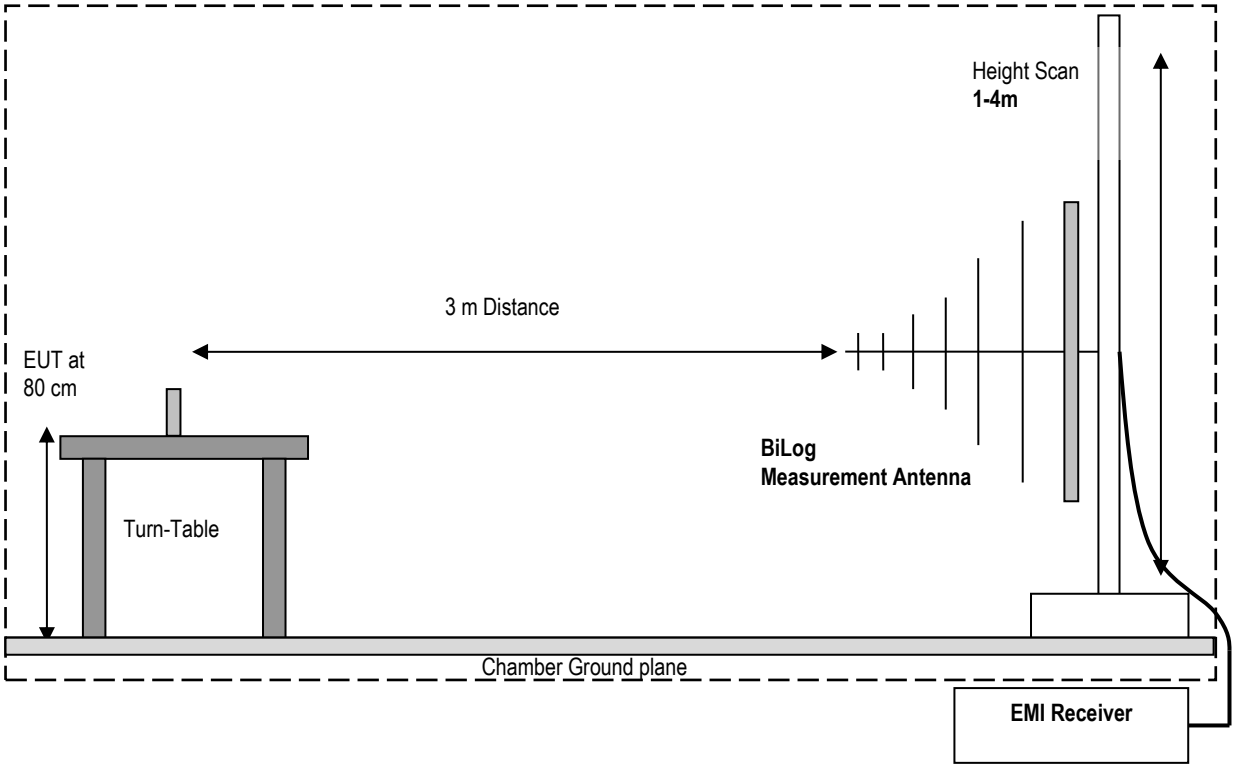
The radiated measurement is performed according to ANSI C63.26 (2015)

- The exploratory measurement is accomplished by running a matrix of 16 sweeps over the required frequency range with R&S Test-SW EMC32 for 4 positions of the turntable, two orthogonal positions of the EUT and both antenna polarizations. This procedure exceeds the requirement of the above standards to cover the 3 orthogonal axis of the EUT. A max peak detector is utilized during the exploratory measurement. The Test-SW creates an overall maximum trace for all 12 sweeps and saves the settings for each point of this trace. The maximum trace is part of the test report.
- The 10 highest emissions are selected with an automatic algorithm of EMC32 searching for peaks in the noise floor and ensuring that broadband signals are not selected multiple times.
- The maxima are then put through the final measurement and again maximized in a 90deg range of the turntable, fine search in frequency domain and height scan between 1m and 4m.
- The above procedure is repeated for all possible ways of power supply to EUT and for all supported modulations.
- In case there are no emissions above noise floor level only the maximum trace is reported as described above.
- The results are split up into up to 4 frequency ranges due to antenna bandwidth restrictions. A magnetic loop is used from 9 kHz to 30 MHz, a Biconilog antenna is used from 30 MHz to 1 GHz, and two different horn antennas are used to cover frequencies up to 40 GHz.

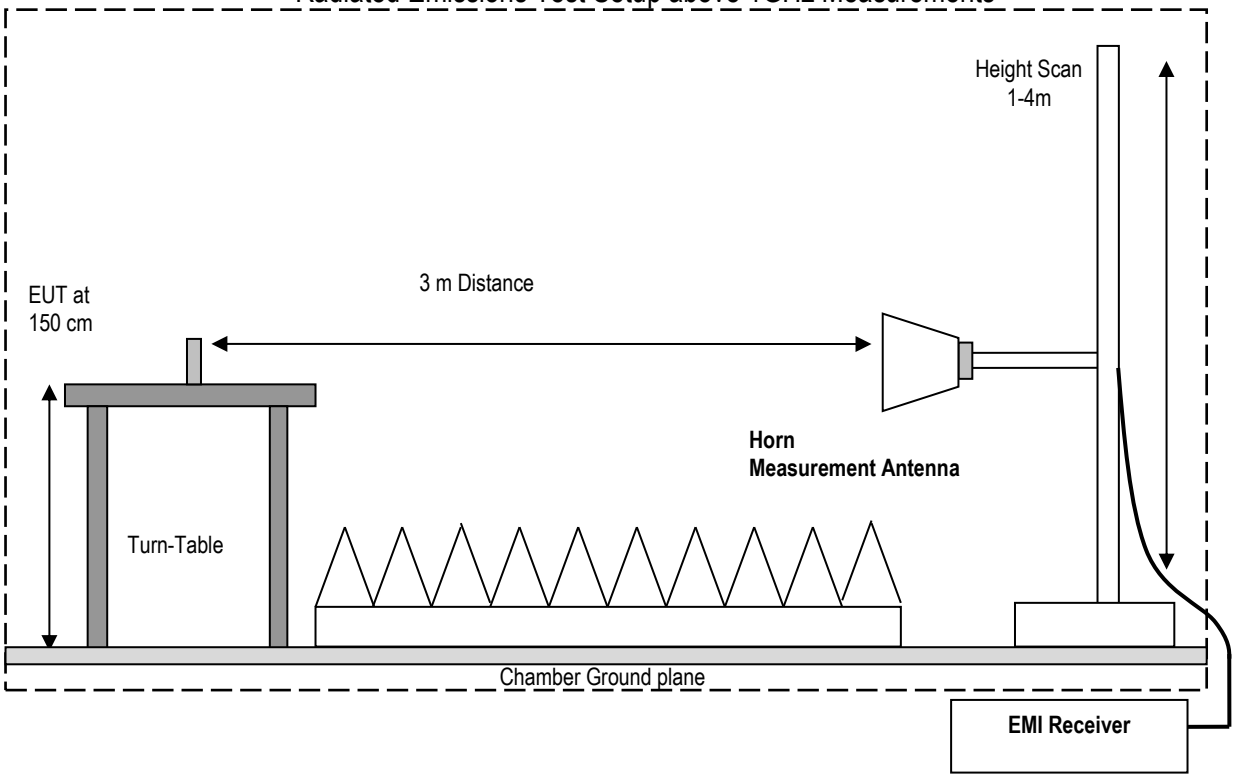
Radiated Emissions Test Setup below 30MHz Measurements



Radiated Emissions Test Setup 30MHz-1GHz Measurements



Radiated Emissions Test Setup above 1GHz Measurements



7.1.1 Sample Calculations for Field Strength Measurements

Field Strength is calculated from the Spectrum Analyzer/ Receiver readings, taking into account the following parameters:

1. Measured reading in dBµV
2. Cable Loss between the receiving antenna and SA in dB and
3. Antenna Factor in dB/m

All radiated measurement plots in this report are taken from a test SW that calculates the Field Strength based on the following equation:

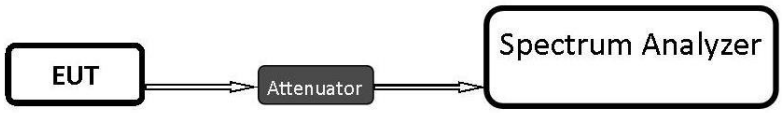
FS (dBµV/m) = Measured Value on SA (dBµV) + Cable Loss (dB)+ Antenna Factor (dB/m)

Example:

Frequency (MHz)	Measured SA (dBµV)	Cable Loss (dB)	Antenna Factor Correction (dB)	Field Strength Result (dBµV/m)
1000	80.5	3.5	14	98.0

7.2 RF Conducted Measurement Procedure

Testing procedures are based on ANSI C63.26 – "American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Devices", by the Federal Communications Commission, Office of Engineering and Technology, Laboratory Division.



- Connect the equipment as shown in the above diagram.
- Adjust the settings of the SA (Rohde-Schwarz Spectrum Analyzer) to connect the EUT at the required mode of test.
- Measurements are to be performed with the EUT set to the low, middle and high channels and for worst case modulation schemes.
- Calculate the conducted power by taking into account attenuation of the cable and the attenuator

8 Test Result Data

8.1 RF Output Power

8.1.1 Measurement according to FCC §2.1046 and ANSI C63.26 (2015)

Refer to Section 5.2 RF output power measurement procedures of ANSI C63.26 (2015) for test procedure. The peak power using a spectrum/signal analyzer or EMI receiver method was used as described in Section 5.2.3.3.

Spectrum Analyzer Settings:

- Set the RBW ≥ OBW
- Set VBW ≥ 3 x RBW
- Set span ≥ 2 x OBW
- Sweep time ≥ 10 x (number of points in sweep) x (transmission symbol period)
- Detector = peak
- Trace mode = max hold
- Allow trace to fully stabilize
- Use the peak marker function to determine the peak amplitude level

8.1.2 Limits:

RF Output Power:
According to FCC §90.217:
Transmitters used at stations licensed below 800 MHz on any frequency listed in subparts B and C of this part or licensed on a business category channel above 800 MHz which have an output power not exceeding 120 milliwatts are exempt from the technical requirements set out in this subpart.

8.1.3 Test conditions and setup:

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input
23° C	1	NBFM	3.7 VDC

8.1.4 Measurement result:

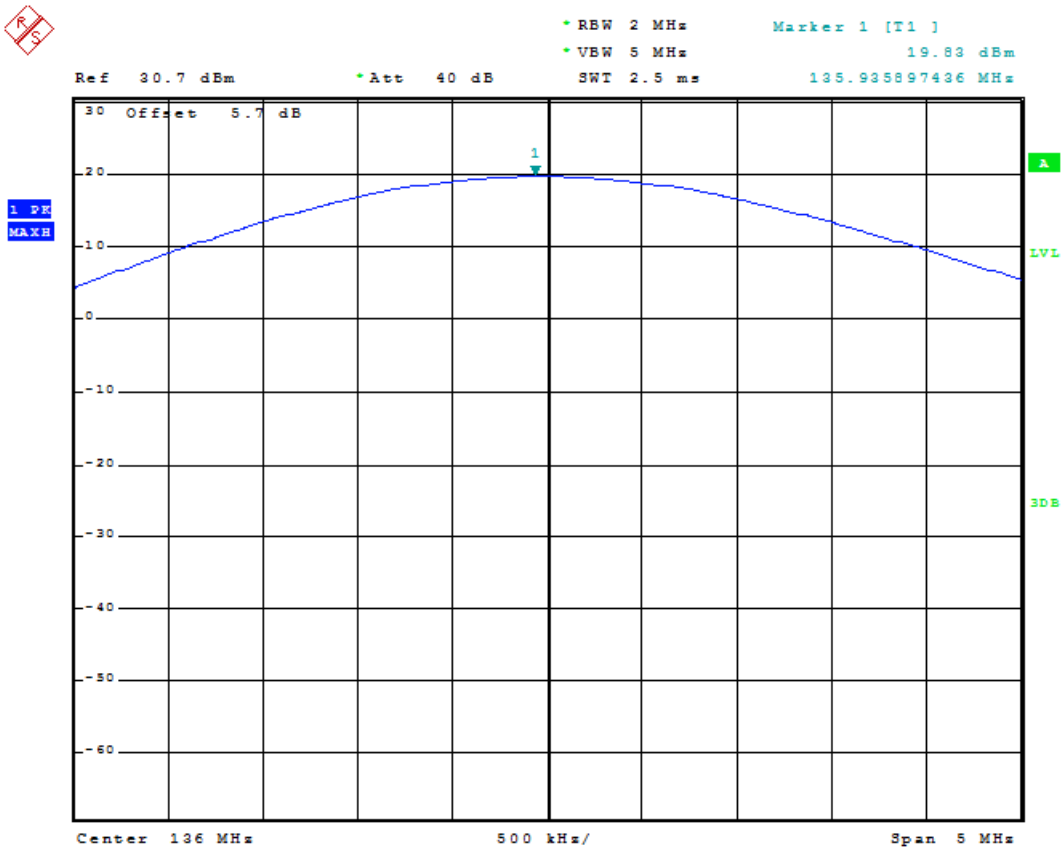
RF Output Power:

Plot #	Frequency (MHz)	Operating Mode	Peak Conducted Output Power (dBm)	Peak Conducted Output Power (mW)	Limit (mW)	Power Setting (mW)	Result
1	136	NBFM	19.83	96.16	120	100	Pass
2	150		20.07	101.62	120	100	Pass
3	162		20.07	101.62	120	100	Pass
4	173.39		19.98	99.54	120	100	Pass

Note: For output power in dBm to mW conversion, use $P_{(mW)} = 1mW \cdot 10^{(P_{(dBm)}/10)}$

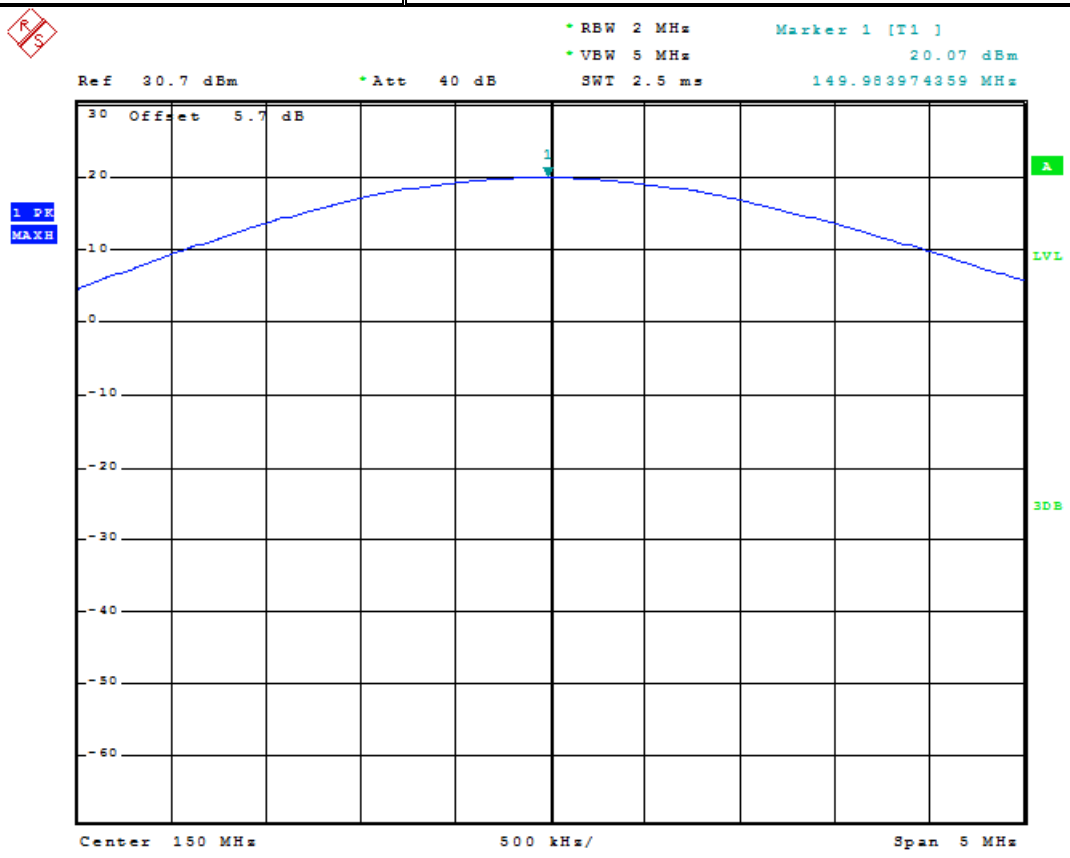
8.1.5 Measurement Plots:

Plot #1 Conducted Peak Output Power	
Channel: 136 MHz	Modulation: NBFM



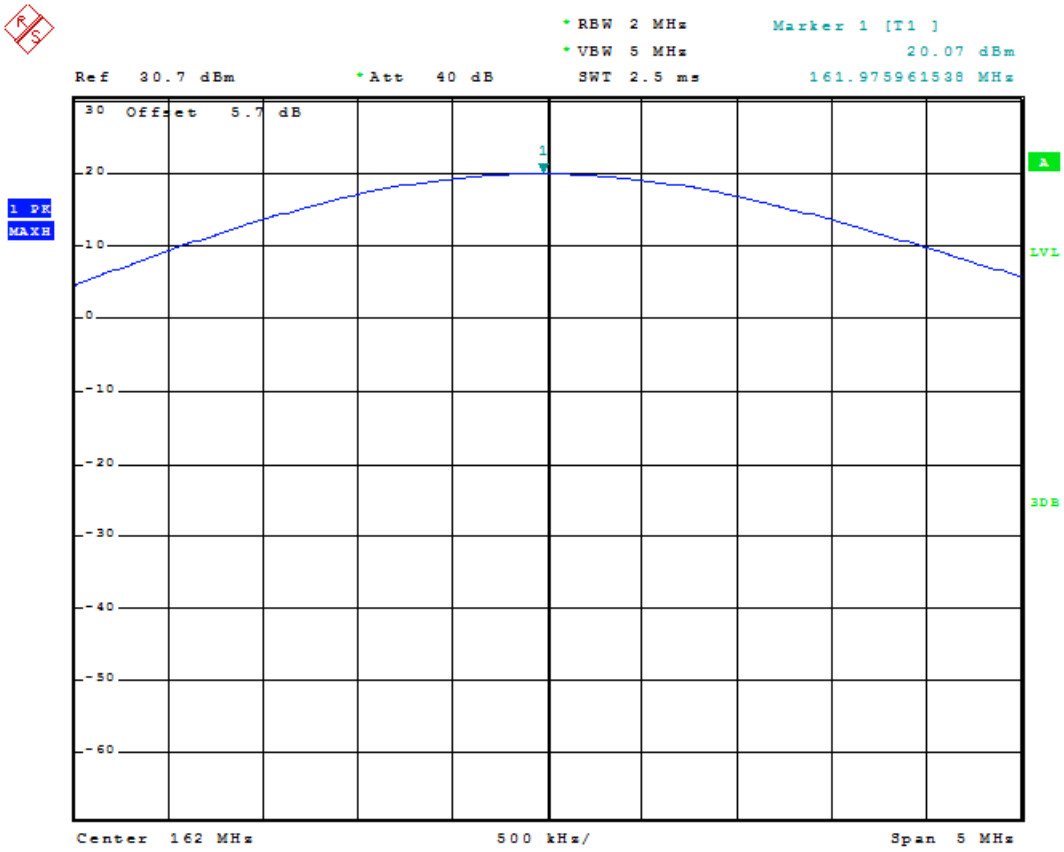
Plot #2 Conducted Peak Output Power

Channel: 150 MHz	Modulation: NBFM

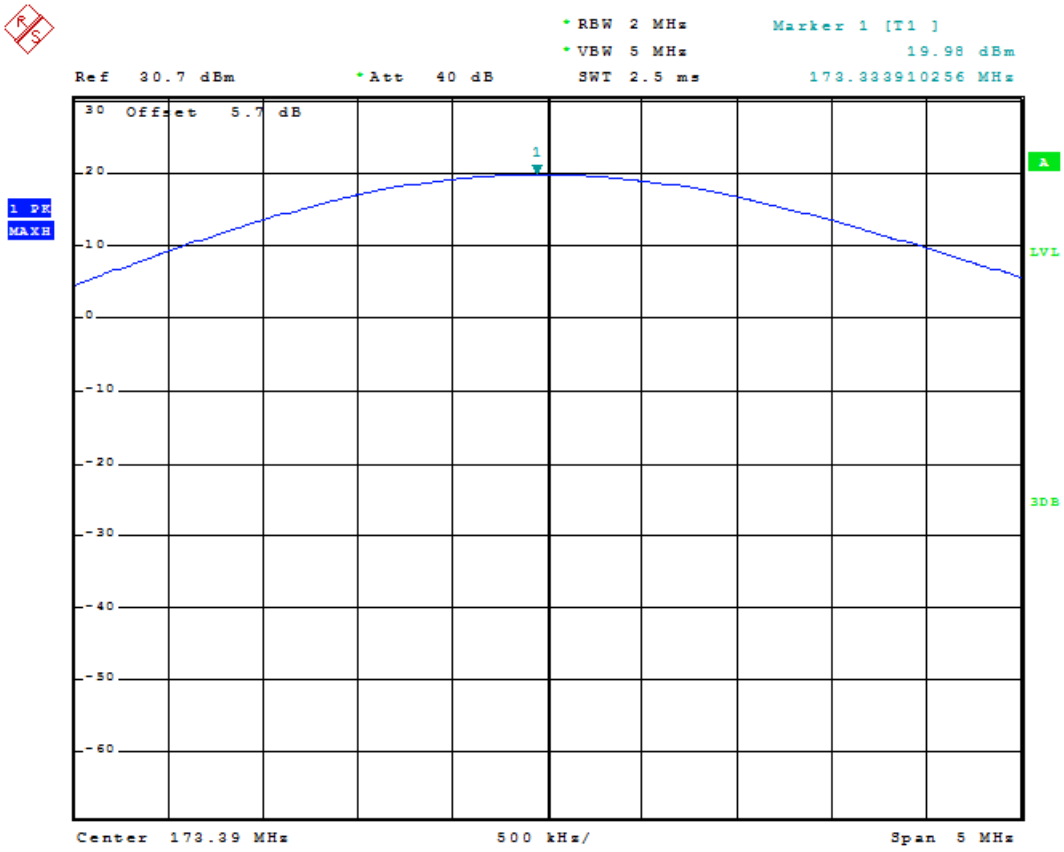


Plot #3 Conducted Peak Output Power

Channel: 162 MHz	Modulation: NBFM



Plot #4 Conducted Peak Output Power	
Channel: 173.39 MHz	**Modulation: NBFM**



8.2 Modulation Characteristics

8.2.1 Measurement according to FCC §2.1047 and ANSI C63.26 (2015)

Refer to Section 5.3 Modulation Characteristics of ANSI C63.26 (2015) for test procedure.

Refer to FCC §2.1047:

(a) ***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.

(b) ***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.

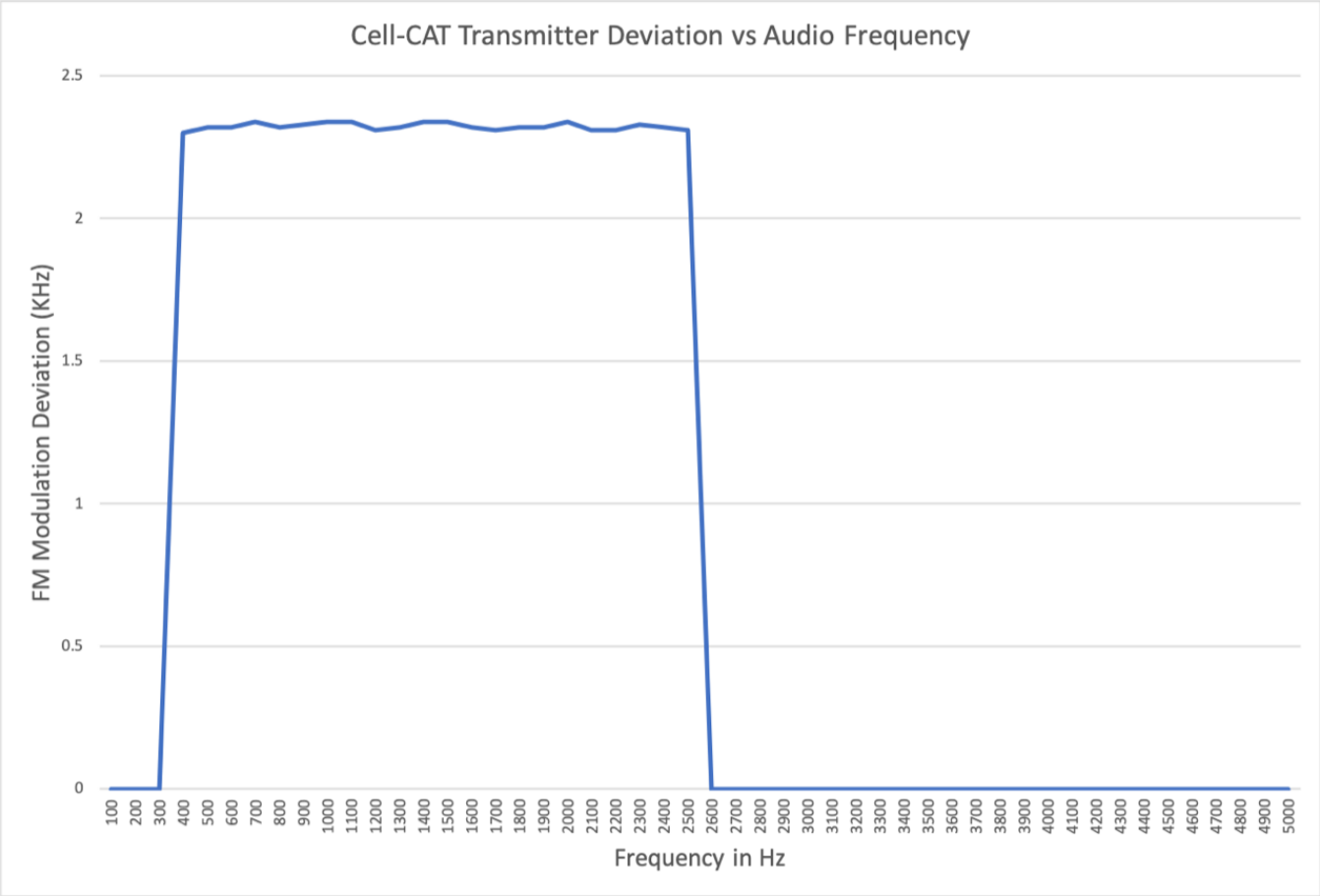
(c) ***Single sideband and independent sideband radiotelephone transmitters which employ a device or circuit to limit peak envelope power.*** A curve showing the peak envelope power output versus the modulation input voltage shall be supplied. The modulating signals shall be the same in frequency as specified in paragraph (c) of § 2.1049 for the occupied bandwidth tests.

(d) ***Other types of equipment.*** A curve or equivalent data which shows that the equipment will meet the modulation requirements of the rules under which the equipment is to be licensed.

8.2.2 Result:

The Cell-CAT is capable of creating an Analog NBFM Voice signal and has no microphone or other traditional audio input. The tones and voice announcements are modulated by directly varying the transmitter frequency. The modulation rate is 48 kHz (the transmit frequency is shifted up to 48,000 times/second) within the 5 kHz bandwidth window (max 2.5 kHz from carrier frequency). The maximum deviation from the center frequency is 2.5 kHz to allow the EUT to work with NBFM radios. The transmitter frequency deviation and rate is limited by the firmware.

The alarm tones can be set by the user and are allowed from 400 to 2,500 Hz. These tones are modulated at nearly 100% (nearly 2.5 kHz deviation). The voice announcements are also limited in the firmware to 2.5 kHz deviation and are pre-recorded and loaded into the firmware. Users cannot add audio.



The Modulation Characteristics description and curve showing the FM Modulation Deviation (kHz) over a range of 100 to 5000 Hz are provided by Sierra Innotek, Inc.

8.3 Occupied Bandwidth

8.3.1 Measurement according to FCC §2.1049 and ANSI C63.26 (2015)

Refer to Section 5.4.4 Occupied bandwidth – Power bandwidth (99%) measurement procedure of ANSI C63.26 (2015) for test procedure.

Spectrum Analyzer settings:

- Set spectrum analyzer center frequency to nominal EUT channel center frequency
- Set frequency span side enough to capture all modulation products (typically 1.5 x OBW is sufficient)
- Filter = 3 dB
- Set RBW = 1% to 5% of anticipated OBW
- Set VBW ≥ 3 x RBW
- Set reference level as required to prevent signal amplitude from exceeding maximum spectrum analyzer input mixer level
- Use 99% OBW function
- Detector = Peak
- Trace mode = Max hold
- Sweep = Auto couple
- Allow the trace to stabilize

8.3.2 Limits:

According to FCC §90.217(a):

(a) For equipment designed to operate with a 25 kHz channel bandwidth, the sum of the bandwidth occupied by the emitted signal plus the bandwidth required for frequency stability shall be adjusted so that any emission appearing on a frequency 40 kHz or more removed from the assigned frequency is attenuated at least 30 dB below the unmodulated carrier.

8.3.3 Test conditions and setup:

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input
23° C	1	NBFM	3.7 VDC

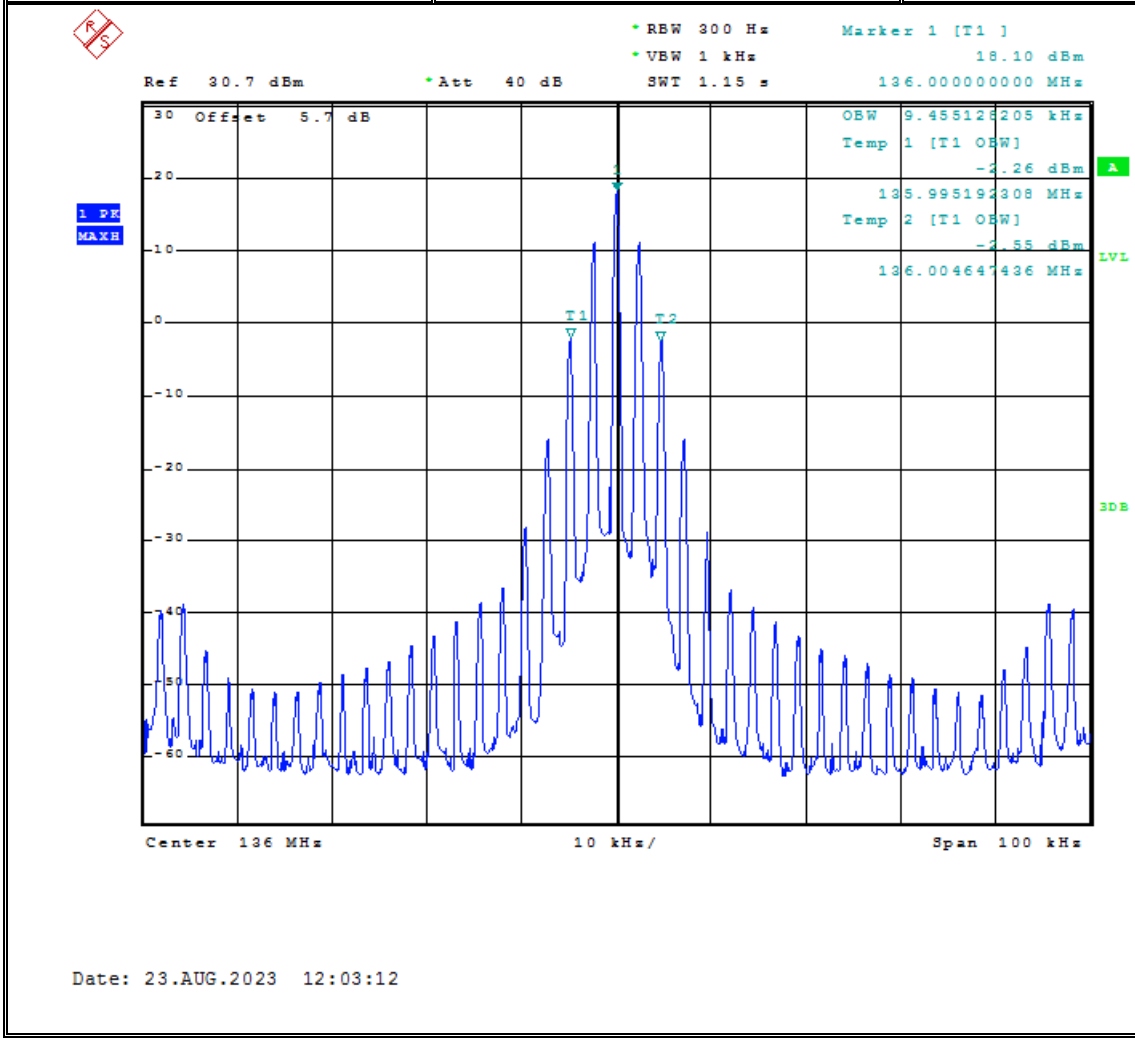
8.3.4 Measurement result:

Plot #	Frequency (MHz)	EUT operating mode	99% Occupied Bandwidth (KHz)	Limit (kHz)	Result
1	136	NBFM	9.455	See Section 8.3.2	Pass
2	150		9.615		Pass
3	162		9.615		Pass
4	173.39		9.776		Pass

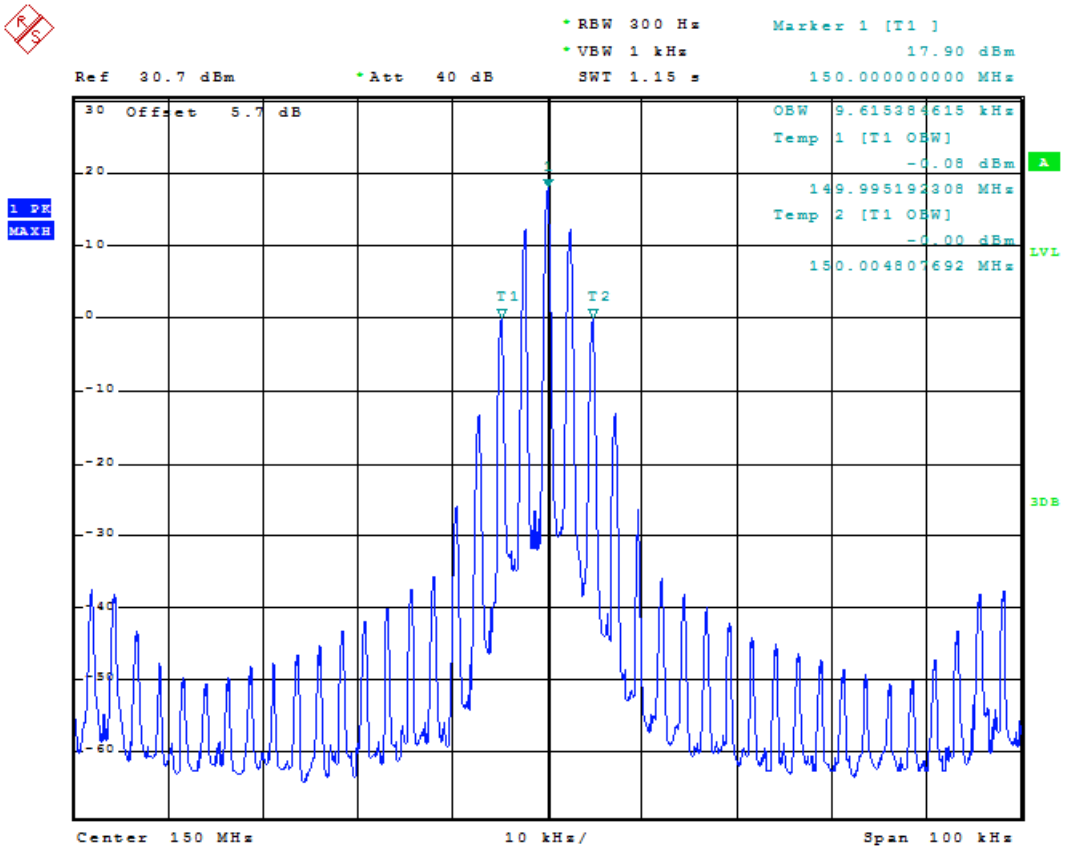
8.3.5 Measurement Plots:

Plot #1

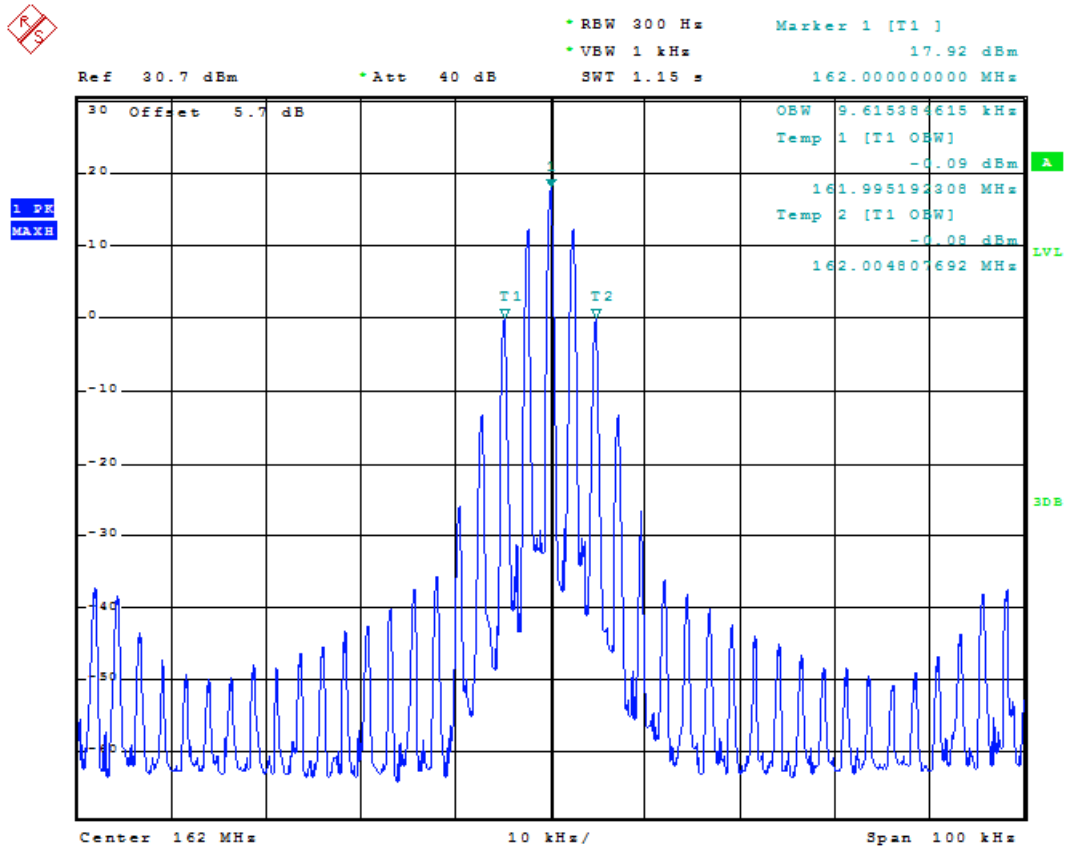
Channel: 136 MHz	Modulation: NBFM	99% OBW



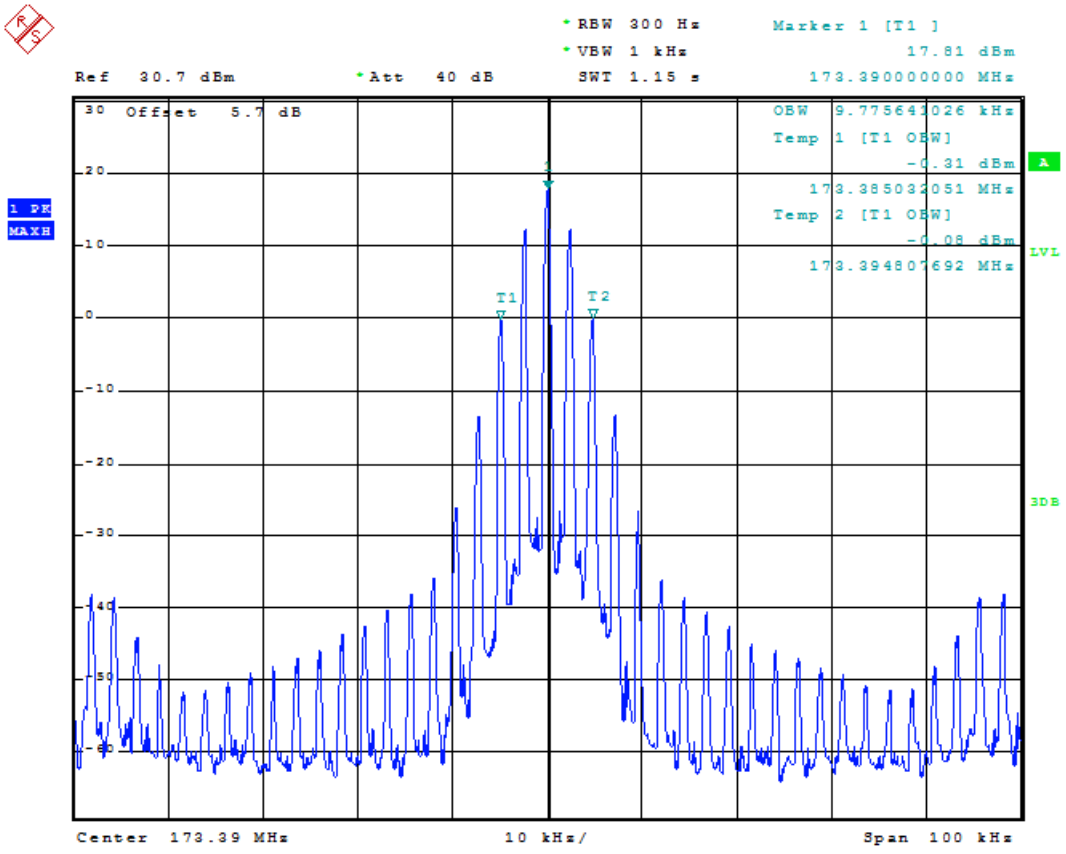
Plot #2		
Channel: 150 MHz	**Modulation: NBFM**	**99% OBW**



Plot #3		
Channel: 162 MHz	**Modulation: NBFM**	**99% OBW**



Plot #4		
Channel: 173.39 MHz	**Modulation: NBFM**	**99% OBW**



8.4 Spurious Emissions at Antenna Terminals

8.4.1 Measurement according to FCC §2.1051 and ANSI C63.26 (2015)

Refer to Section 5.7.3 Out-of-band unwanted emissions measurements and Section 5.7.4 Spurious unwanted emission measurements of ANSI C63.26 for test procedure.

8.4.2 Limits

According to FCC §90.217(a):
For equipment designed to operate with a 25 kHz channel bandwidth, the sum of the bandwidth occupied by the emitted signal plus the bandwidth required for frequency stability shall be adjusted so that any emission appearing on a frequency 40 kHz or more removed from the assigned frequency is attenuated at least 30 dB below the unmodulated carrier.

8.4.3 Test conditions and setup:

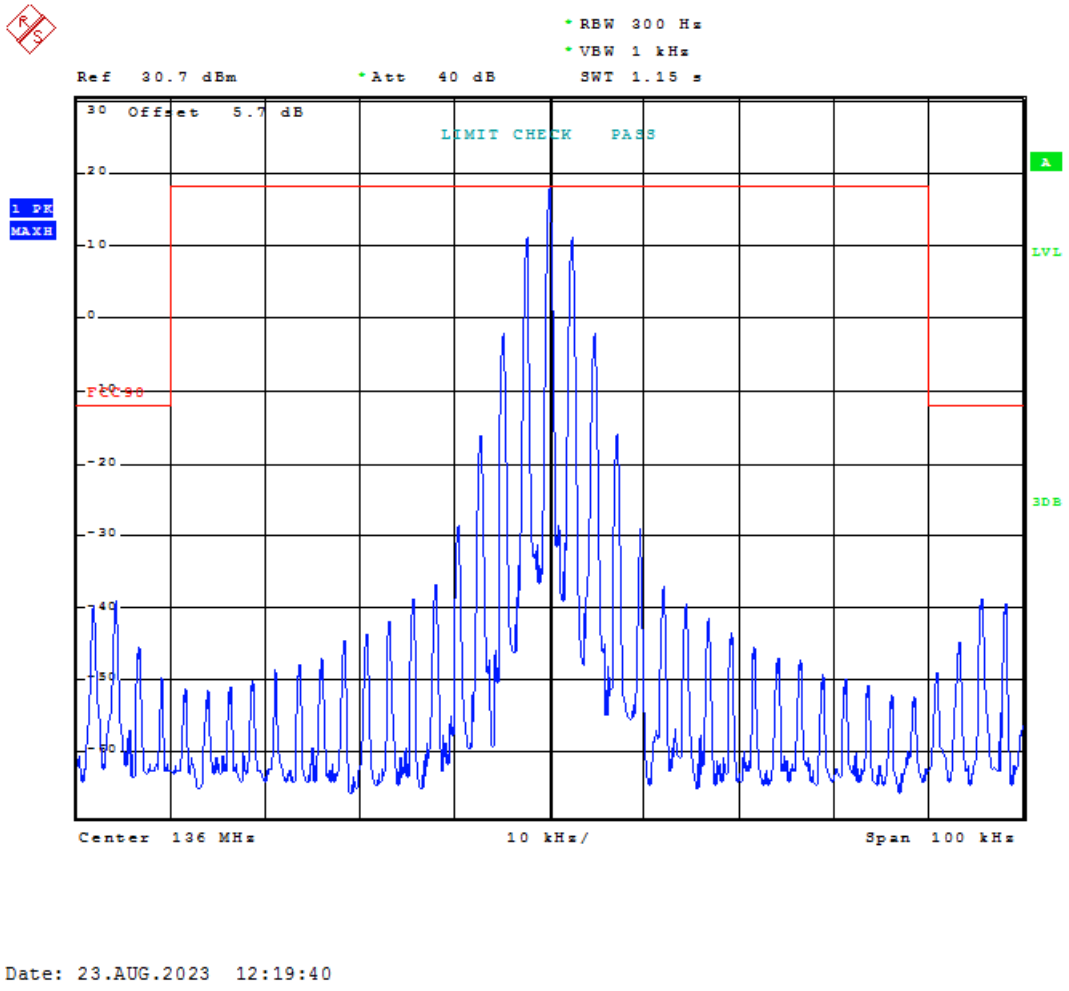
Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input
23° C	1	NBFM	3.7 VDC

8.4.4 Measurement result:

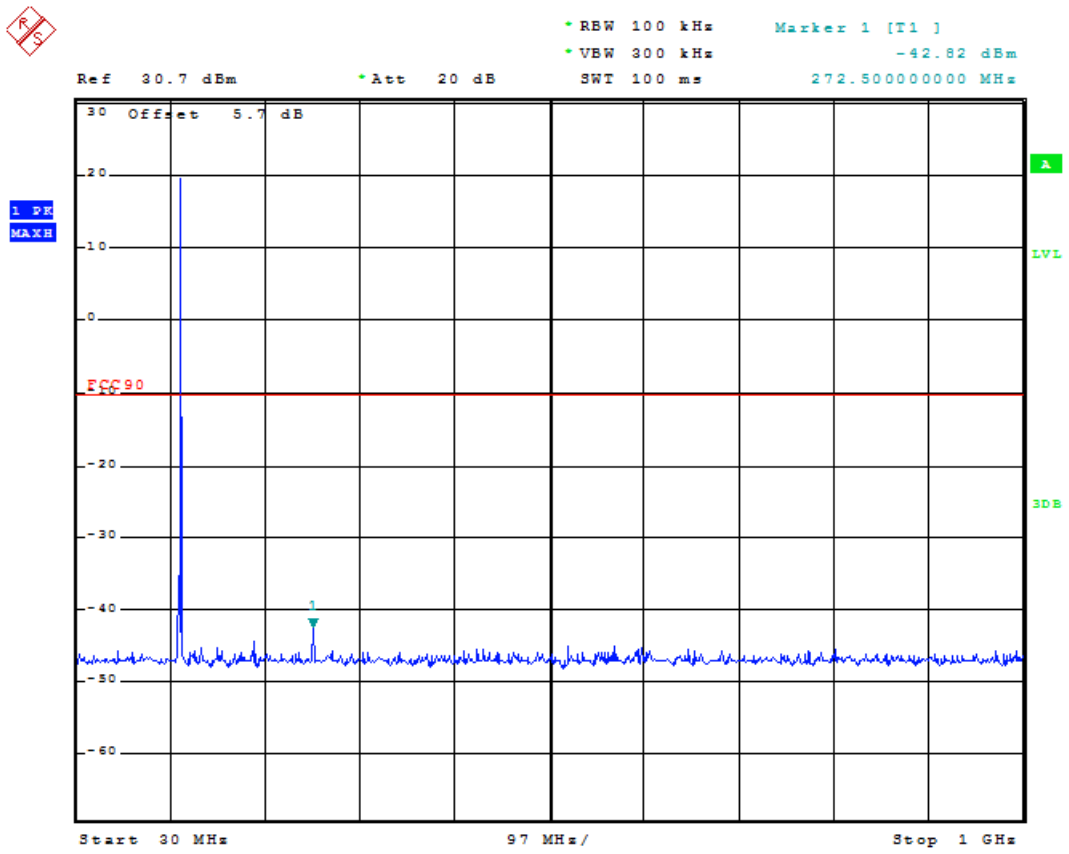
Plot #	Frequency (MHz)	EUT operating mode	Scan Range	Limit	Result
1	136	NBFM	Center Frequency	See Section 8.4.2	Pass
2	136		30 MHz – 1 GHz		Pass
3	136		1 – 3 GHz		Pass
4	150		Center Frequency		Pass
5	150		30 MHz – 1 GHz		Pass
6	150		1 – 3 GHz		Pass
7	162		Center Frequency		Pass
8	162		30 MHz – 1 GHz		Pass
9	162		1 – 3 GHz		Pass
10	173.39		Center Frequency		Pass
11	173.39		30 MHz – 1 GHz		Pass
12	173.39		1 – 3 GHz		Pass

8.4.5 Measurement Plots:

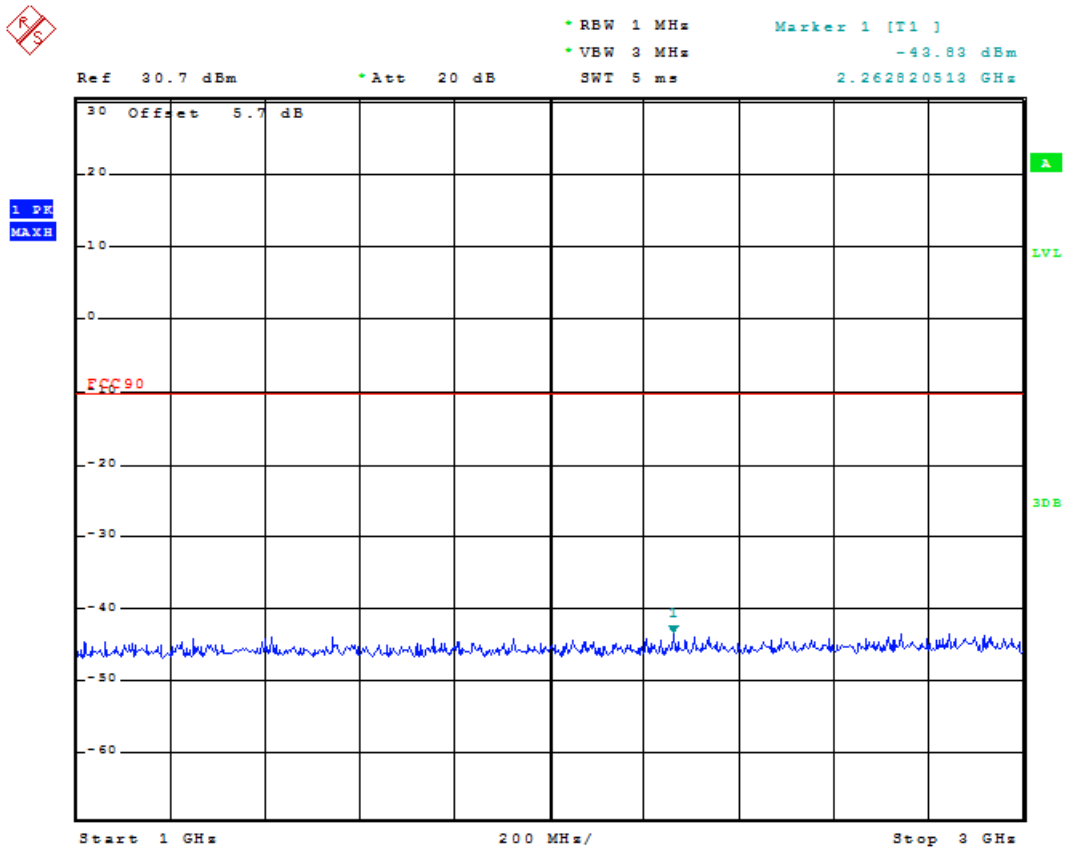
Plot #1	
Channel: 136 MHz	Modulation: NBFM



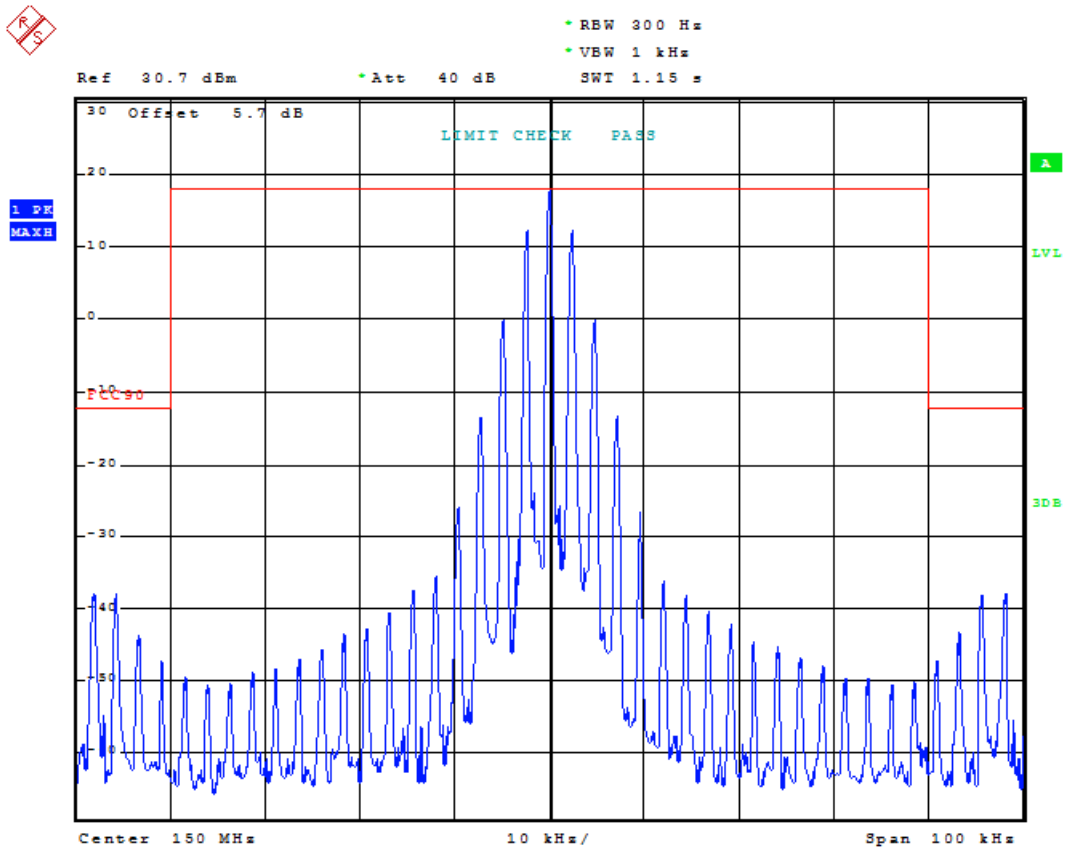
Plot #2	
Channel: 136 MHz	**Modulation: NBFM**



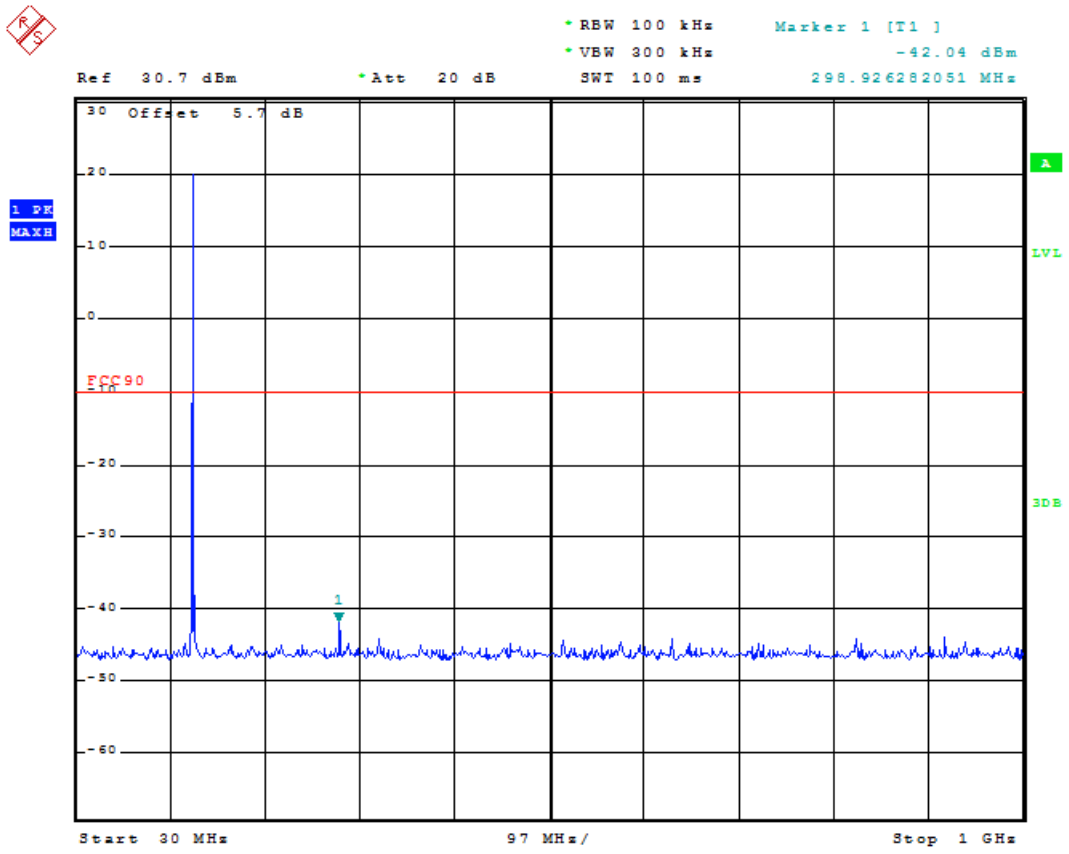
Plot #3	
Channel: 136 MHz	**Modulation: NBFM**



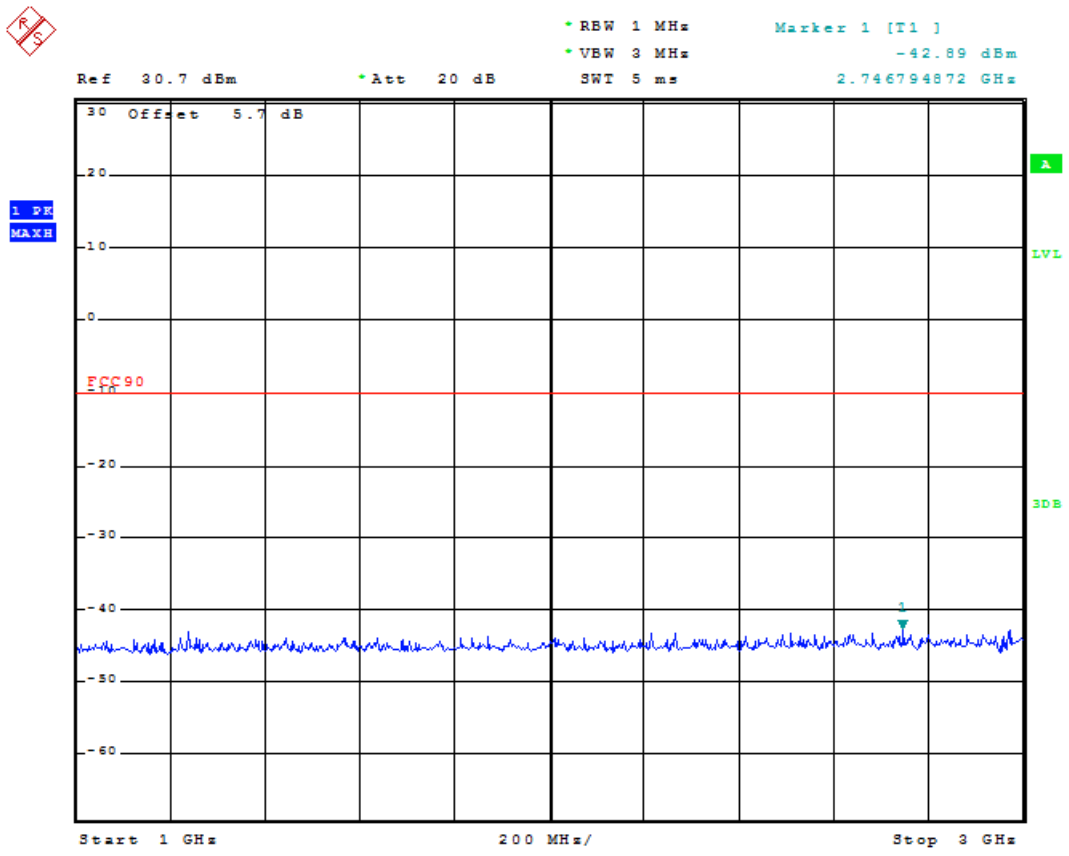
Plot #4	
Channel: 150 MHz	**Modulation: NBFM**



Plot #5	
Channel: 150 MHz	**Modulation: NBFM**

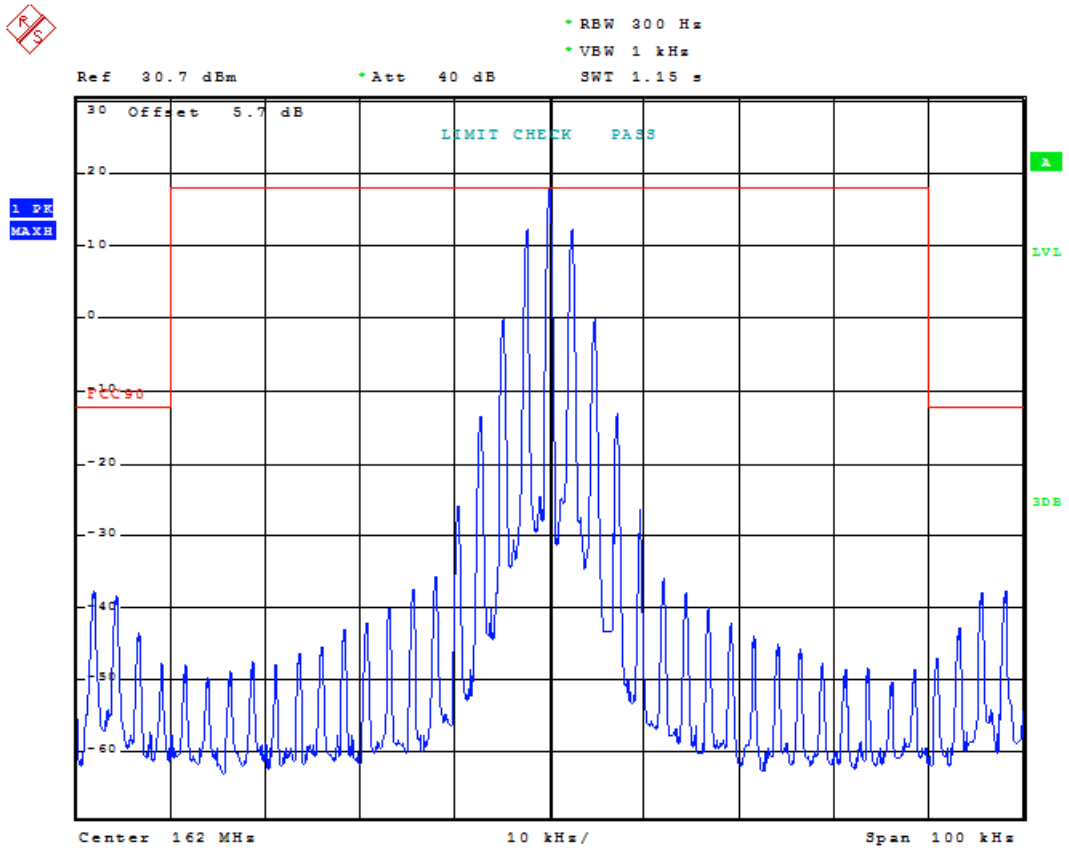


Plot #6	
Channel: 150 MHz	**Modulation: NBFM**



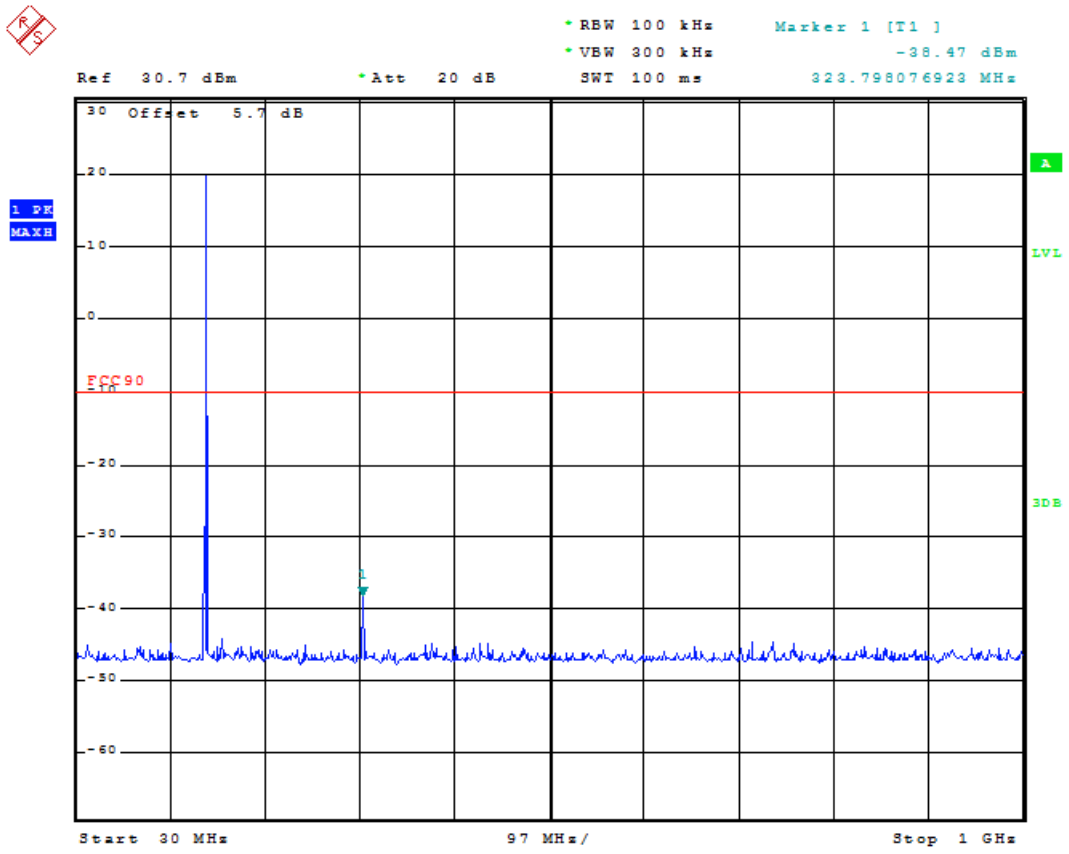
Date: 23.AUG.2023 12:39:02

Plot #7	
Channel: 162 MHz	**Modulation: NBFM**

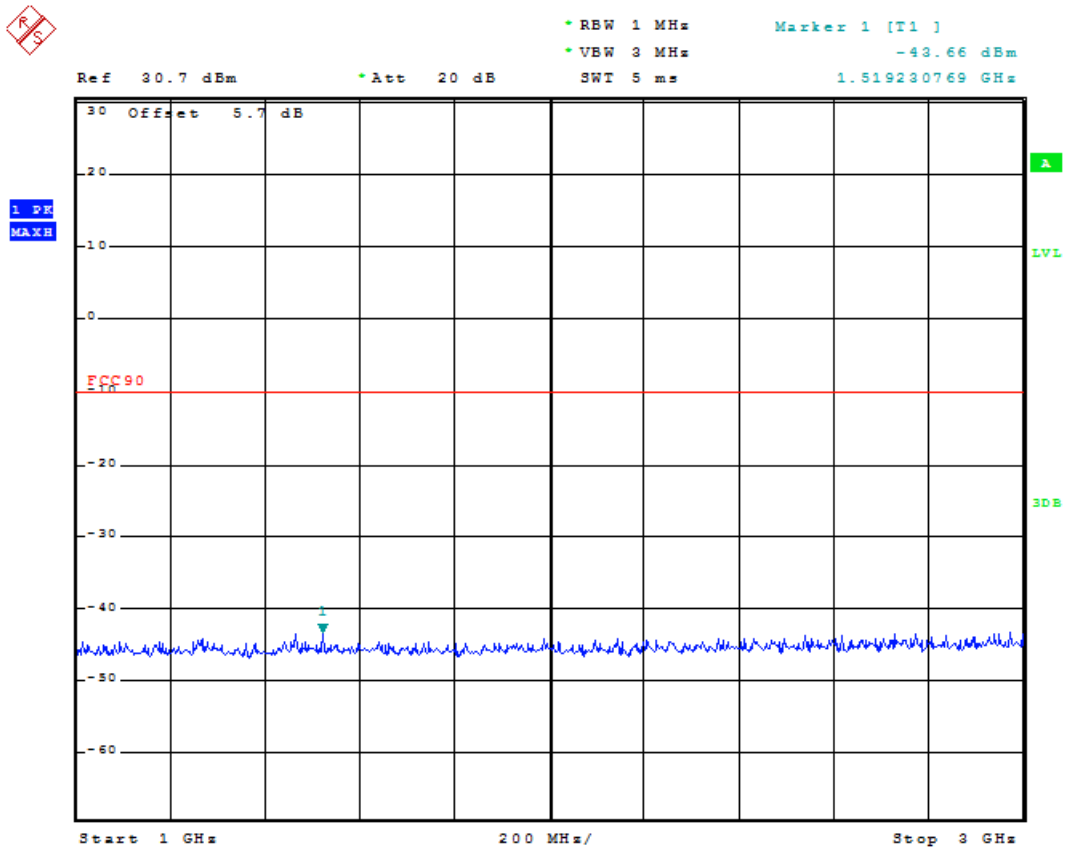


Date: 23.AUG.2023 12:17:30

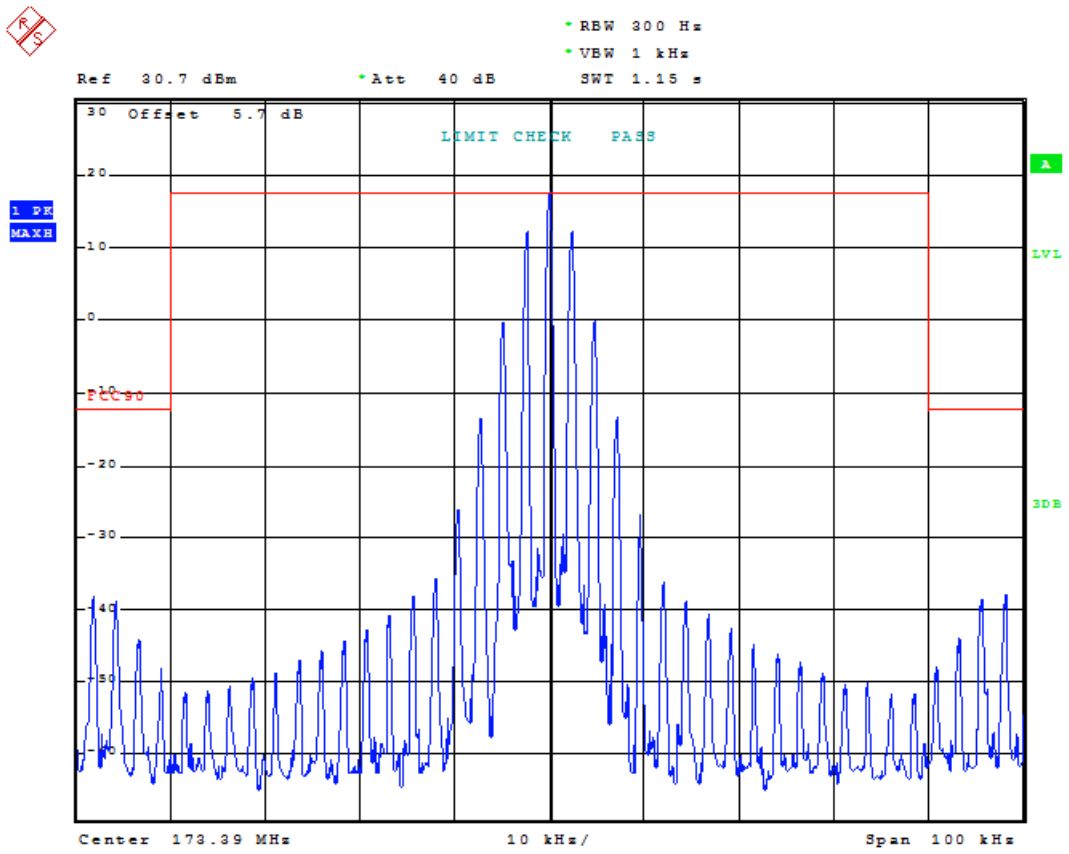
Plot #8	
Channel: 162 MHz	**Modulation: NBFM**



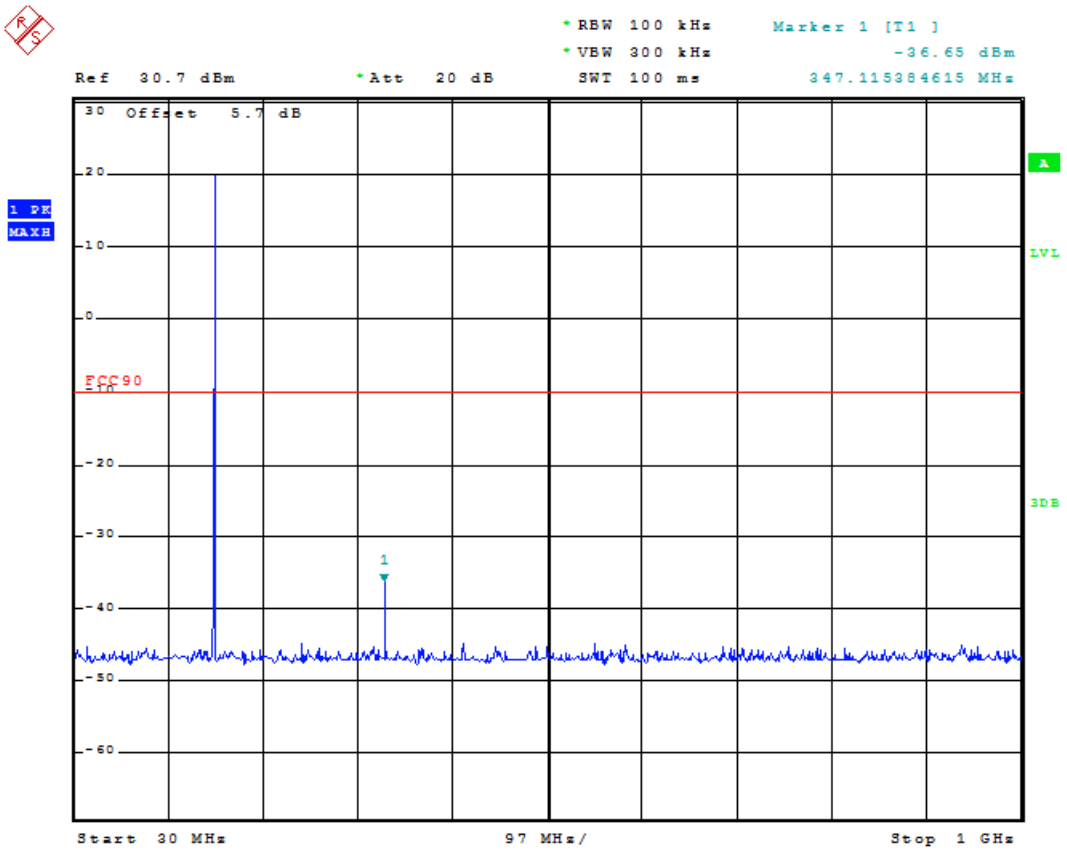
Plot #9	
Channel: 162 MHz	**Modulation: NBFM**



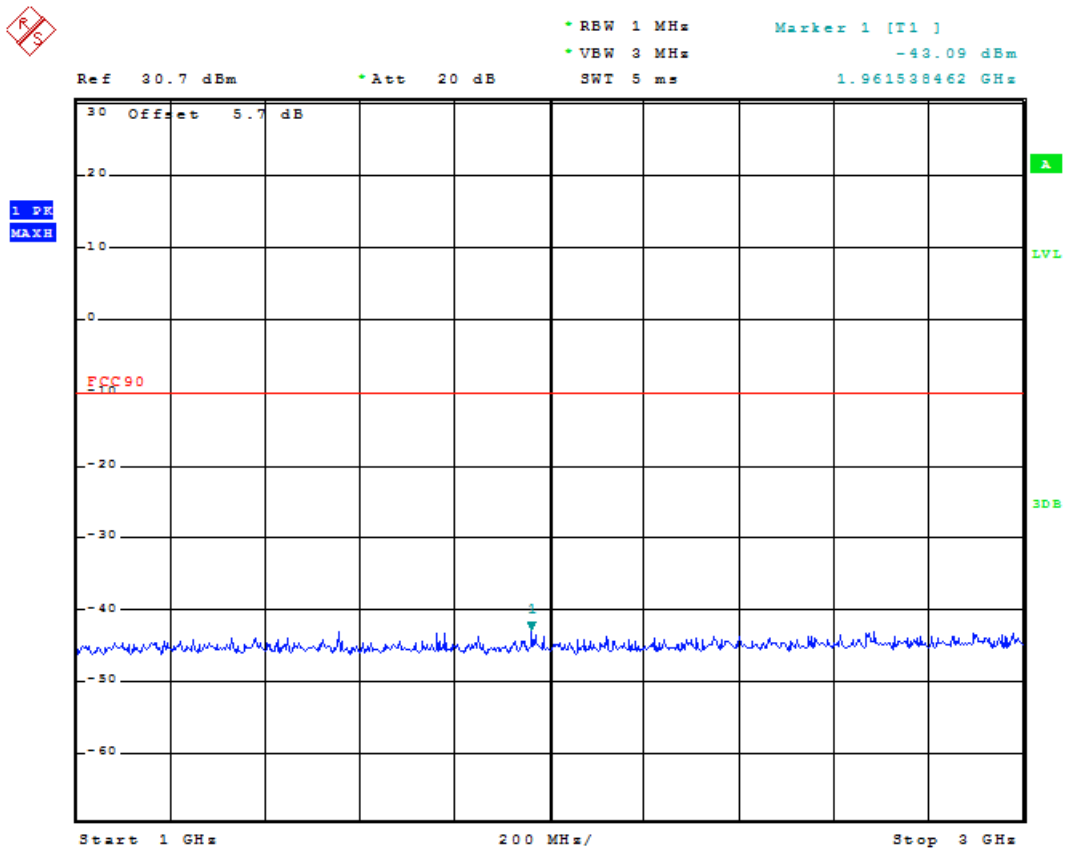
Plot #10	
Channel: 173.390 MHz	**Modulation: NBFM**



Plot #11	
Channel: 173.390 MHz	**Modulation: NBFM**



Plot #12	
Channel: 173.390 MHz	**Modulation: NBFM**



8.5 Field Strength of Spurious Radiation

8.5.1 Measurement according to FCC §2.1053 and ANSI C63.26 (2015)

Refer to Section 5.5.4 Radiated measurements using the field strength method of ANSI C63.26 for test procedure.

8.5.2 Limits

According to FCC §90.217(a):
For equipment designed to operate with a 25 kHz channel bandwidth, the sum of the bandwidth occupied by the emitted signal plus the bandwidth required for frequency stability shall be adjusted so that any emission appearing on a frequency 40 kHz or more removed from the assigned frequency is attenuated at least 30 dB below the unmodulated carrier.

8.5.3 Test conditions and setup:

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input
23° C	1	NBFM	3.7 VDC

8.5.4 Measurement result:

Plot #	Frequency (MHz)	EUT operating mode	Scan Range	Limit	Result
1	162	NBFM	30 MHz – 1 GHz	See Section 8.5.2	Pass
2			1 – 3 GHz		Pass

Note: The EUT was configured to worst case scenario by selecting channel with the highest output power and using the highest power setting available

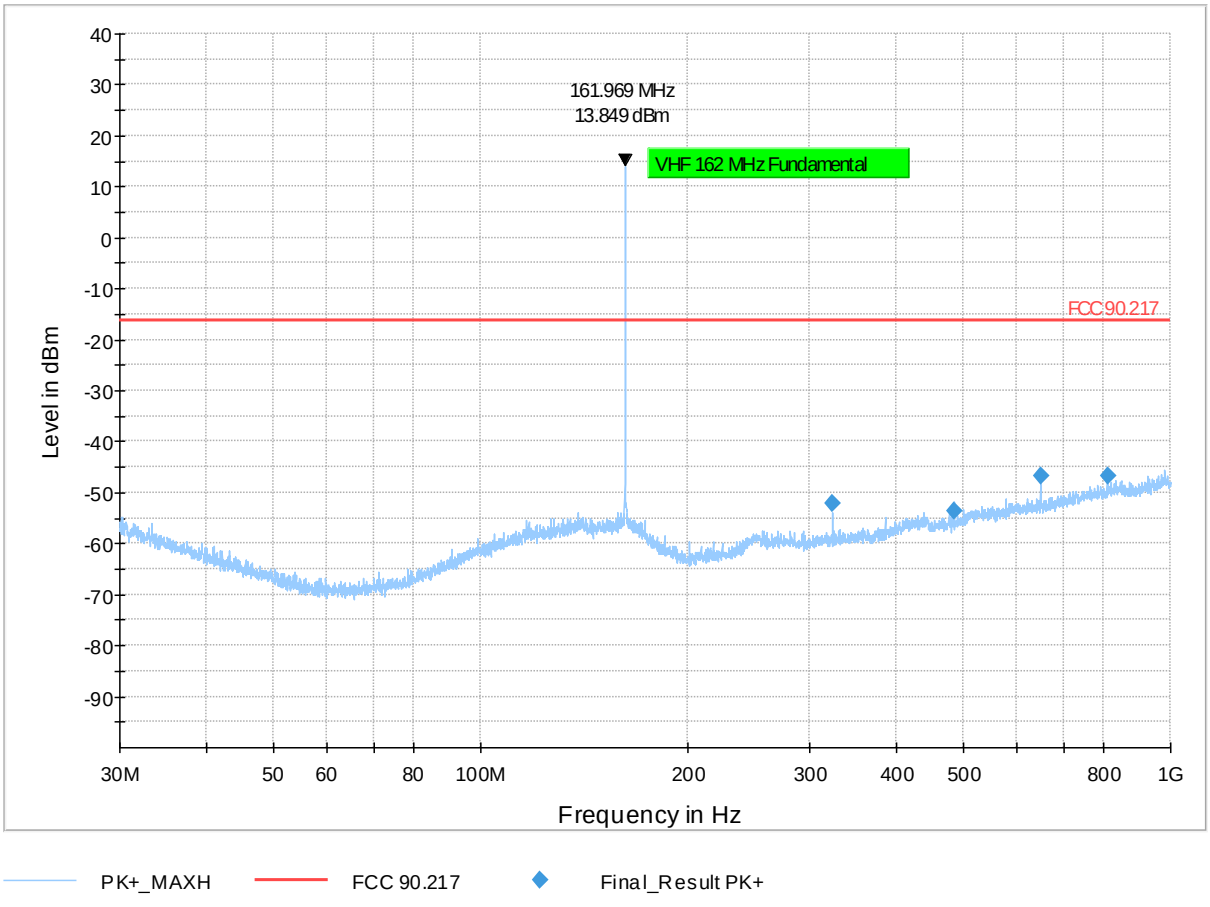
8.5.5 Measurement Plots:

Plot #1

Channel: 162 MHz	Modulation: NBFM

Final_Result

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
323.983	-52.11	-16.15	37.02	500.0	100.000	186.0	V	99.0	-73.5
485.997	-53.71	-16.15	39.28	500.0	100.000	100.0	V	308.0	-69.8
647.987	-46.87	-16.15	32.15	500.0	100.000	254.0	V	168.0	-67.1
810.001	-46.80	-16.15	32.14	500.0	100.000	100.0	H	155.0	-64.2



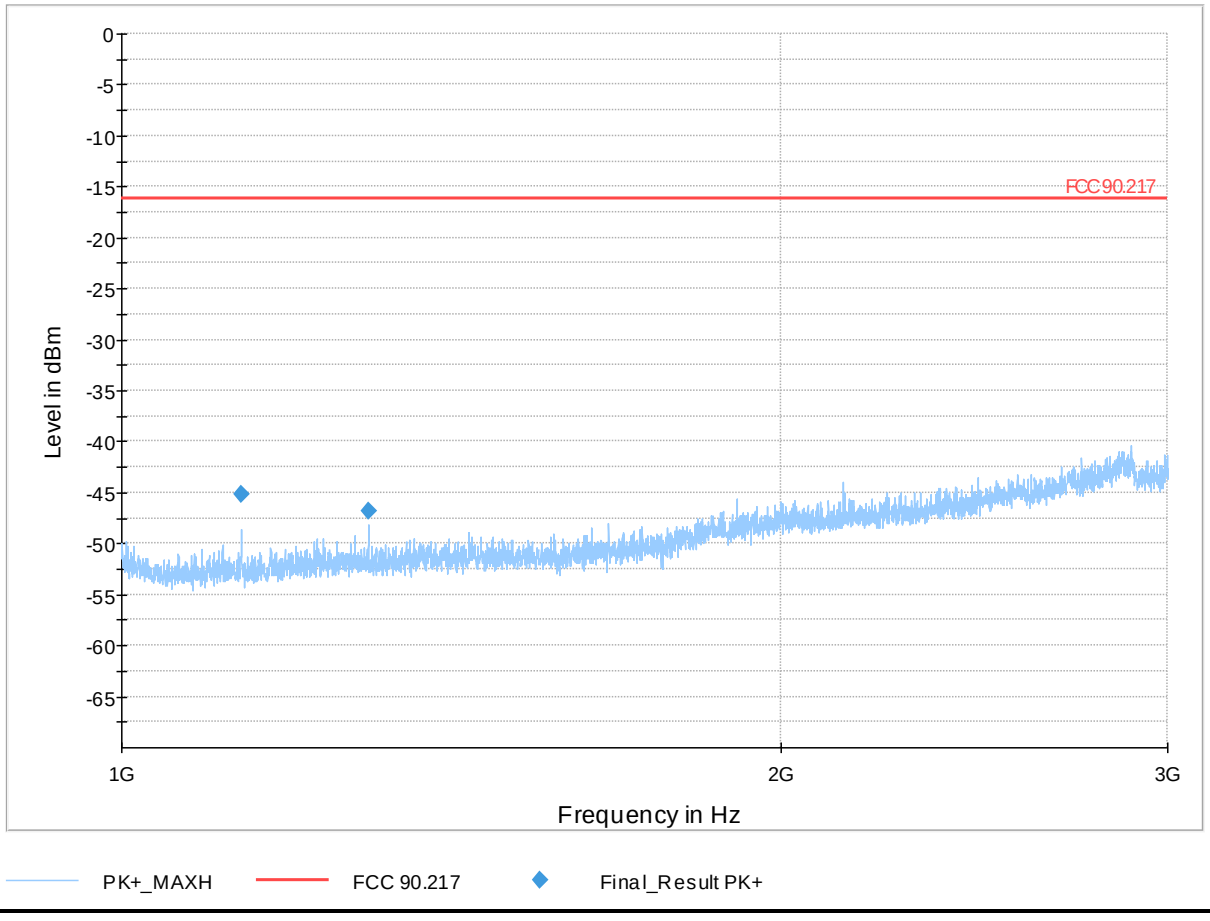
Note: Measured fundamental EIRP = 13.849 dBm. Any emission 40 kHz or more removed from the fundamental frequency is attenuated at least 30 dB below the carrier signal. Thus, the limit is 13.849 – 30 = -16.151 dBm.
The measured field strength levels (in dBµV/m) are converted to equivalent power levels (in dBm) by the following conversion:
EIRP (dBm) = E (dBµV/m) + 20log(D) – 104.8, where D = 3m.
This conversion is accounted for during radiated testing by the test site software.

Plot #2

Channel: 162 MHz	Modulation: NBFM

Final_Result

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1133.750	-45.11	-16.15	28.96	500.0	1000.000	302.0	H	214.0	-67.3
1295.750	-46.87	-16.15	30.72	500.0	1000.000	302.0	H	93.0	-66.7



Note: Measured fundamental EIRP = 13.849 dBm. Any emission 40 kHz or more removed from the fundamental frequency is attenuated at least 30 dB below the carrier signal. Thus, the limit is 13.849 – 30 = -16.151 dBm.
The measured field strength levels (in dBµV/m) are converted to equivalent power levels (in dBm) by the following conversion:
EIRP (dBm) = E (dBµV/m) + 20log(D) – 104.8, where D = 3m.
This conversion is accounted for during radiated testing by the test site software.

8.6 Frequency Stability

8.6.1 Measurement according to FCC §2.1055 and ANSI C63.26 (2015)

Refer to Section 5.6.3 Procedure for frequency stability testing, Section 5.6.4 Frequency stability over variations in temperature, and 5.6.5 Frequency stability when varying supply voltage of ANSI C63.26 for test procedure.

Refer to FCC §2.1055:
(a) The frequency stability shall be measured with variation of ambient temperature as follows:
(1) From −30° to + 50° centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.

(b) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10° centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. The short term transient effects on the frequency of the transmitter due to keying (except for broadcast transmitters) and any heating element cycling normally occurring at each ambient temperature level also shall be shown. Only the portion or portions of the transmitter containing the frequency determining and stabilizing circuitry need be subjected to the temperature variation test.

(d) The frequency stability shall be measured with variation of primary supply voltage as follows:
(2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.

8.6.2 Limits:

According to FCC §90.217(a):
For equipment designed to operate with a 25 kHz channel bandwidth, the sum of the bandwidth occupied by the emitted signal plus the bandwidth required for frequency stability shall be adjusted so that any emission appearing on a frequency 40 kHz or more removed from the assigned frequency is attenuated at least 30 dB below the unmodulated carrier.

8.6.3 Test conditions and setup:

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input
23° C	1	NBFM	3.7 VDC, battery operating end point

8.6.4 Results:

Temperature Variation:

Temperature (°C)	Frequency (MHz)	Measured Frequency (MHz)	Deviation (KHz)	Deviation (ppm)
50	162	161.99980	-0.2	-1.2346
40	162	161.99985	-0.15	-0.9259
30	162	161.99985	-0.15	-0.9259
20	162	161.99985	-0.15	-0.9259
10	162	161.99985	-0.15	-0.9259
0	162	161.99985	-0.15	-0.9259
-10	162	161.99985	-0.15	-0.9259
-20	162	161.99990	-0.1	-0.6173
-30	162	161.99990	-0.1	-0.6173

Note: Test was performed by configuring EUT to FM mode. The peak value of the power envelop was measured. Measurements of –x dBc relative from the peak value were taken for both positive (f1) and negative (f2) frequency increments. The center frequency would then be calculated as $\frac{f1+f2}{2}$. Temperature was varied from -30°C to 50°C during the test according to FCC rule §2.1055(a)(1). The deviation of the measured frequency from the actual frequency would then be calculated from ppm = $\frac{\text{Measured Frequency} - \text{Actual Frequency}}{\text{Actual Frequency}} \times 1{,}000{,}000$.

Supply Voltage Variation:

Voltage (Volts DC)	Frequency (MHz)	Measured Frequency (MHz)	Deviation (KHz)	Deviation (ppm)
2.9	162	161.99990	-0.1	-0.6173
3.7	162	161.99975	-0.25	-1.5432

Note: Test was performed by configuring EUT to FM mode. The peak value of the power envelop was measured. Measurements of –x dBc relative from the peak value were taken for both positive (f1) and negative (f2) frequency increments. The center frequency would then be calculated as $\frac{f1+f2}{2}$. Testing was performed at 20°C and external DC power supply was used to set to the battery operating end point of 2.9 VDC. The deviation of the measured frequency from the actual frequency would then be calculated from ppm = $\frac{\text{Measured Frequency} - \text{Actual Frequency}}{\text{Actual Frequency}} \times 1{,}000{,}000$.

9 Test setup photos

Setup photos are included in supporting file name: “EMC_INNOT_003_23001_FCC_90.217_Setup_Photos.pdf”

10 Test Equipment And Ancillaries Used For Testing

Equipment Type	Manufacturer	Model	Serial #	Calibration Cycle	Last Calibration Date
BILOG ANTENNA	A.H. SYSTEMS	BiLA2G	569	3 YEARS	11/16/2021
HORN ANTENNA	EMCO	3115	00035111	3 YEARS	9/30/2021
ESW.EMI TEST RECEIVER	ROHDE & SCHWARZ	ESW44	101715	3 YEARS	9/14/2021
THERMOMETER HUMIDITY MONITOR	VWR	TRACEABLE	191872028	2 YEARS	10/20/2021
Spectrum Analyzer	Rohde & Schwarz	FSU. Spectrum Analyzer	100189	3 YEARS	5/27/2022
DC Power Supply	Protek	3003B	H 001416	N/A	N/A
TEMPERATURE HUMIDITY CHAMBER	TESTEQUITY	123H	N/A	N/A	N/A

Note: Equipment used meets the measurement uncertainty requirements as required per applicable standards for 95% confidence levels. Calibration due dates, unless defined specifically, falls on the last day of the month. Items indicated “N/A” for cal status either do not specifically require calibration or is internally characterized before use.

11 Revision History

Date	Report Name	Changes to report	Report prepared by
2023-09-07	EMC_INNOT_003_23001_FCC_90.217	Initial version	Chin Ming Lui