TELTEST Laboratories
Tait International Ltd
Report Number 4398

LABORATORY TEST REPORT

RADIO PERFORMANCE MEASUREMENTS

for the

TBDK4F Transportable Transceiver
Fitted with the K4 810-870 MHz Reciter

Tested in accordance with:

FCC 47 CFR Parts 22 and 90

RSS-119 Issue 12
RSS-Gen Issue 5

Report Revision:	1	
Issue Date:	6 December 2024	
PREPARED BY:	I. D. Russell	Test Technician
CHECKED & APPROVED BY:	M. C. James	Laboratory Technical Manager

ACCREDITED
TESTING LABORATORY
№ 9, 577

FCC Registration: 838288
ISED Registration: 737A

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REVISION HISTORY

Date	Revision	Comments
6 December 2024	1	Initial test report

INTRODUCTION

Type approval testing of the TBDK4F, 15 Watt, Transportable transceiver in order to demonstrate compliance with FCC 47 Parts 22 & 90, and RSS-119 Issue 12 & RSS-Gen Issue 5. This radio supports analogue, Digital Mobile Radio (DMR), and APCO P25 phase-1 modulations.

REPORT PREPARED FOR
Tait International Limited
245 Wooldridge Road
Harewood
Christchurch 8051
New Zealand

DESCRIPTION OF SAMPLE

Manufacturer	Tait International Limited
Equipment:	Transportable Transceiver
Type:	TBDK4F
Product Code:	TB7304/6-K4K0
Serial Number(s):	18396951 reciter
Frequency range	810 → 870 MHz
Transmit Power	15 Watts

Modulation		Channel Spacing	Speech Channels	Symbol Rate (symbols/sec)	Data Rate (bps)
Analogue FM		12.5 kHz	1	-	-
Digital Mobile Radio (DMR)	4 Level FSK (2 slot TDMA) (ETSI TS102 361-1)	12.5 kHz	2	4800	9600
APCO P25 Phase 1	C4FM (TIA 102)	12.5 kHz	1	4800	9600

HARDWARE & SOFTWARE
Quantity: 1

Unit	Serial Number	Firmware	Hardware Version
Reciter	18396951	dmr-3.45.00.0004	06.02
Reciter	18396951	P25-3.45.00.0004	06.02
Power Amplifier	18396952	-	00.02
Top Panel	-	1.10.04.0004	00.01

Diplexer Type	Serial Number	High Frequency MHz	Low Frequency MHz
DPF 900/6 N (f)	SN200053051	851.025	810.05
DPF 900/6 N (f)	SN200093778	860.025	823.95
DPF 900/6 N (f)	SN200053065	868.975	823.95
Manufacturer: Amphenol Procom			

TEST CONDITIONS
All testing was performed between 21 → 28 November 2024, and under the following conditions:

Ambient temperature:	15°C → 30°C
Relative Humidity:	20% → 75%
Standard Test Voltage	13.8 V_{DC}

A separately tuned Diplexer was used for each RF channel tested, and the PA output power adjusted to provide 15Watts at the common antenna port for high power, and 2Watts for low power.

TEST REQUIREMENTS AND RESULT SUMMARY

Specification Versions: RSS-119 issue 12, RSS Gen issue 5, ANSI C63.26-2015, TIA-603-E

ISED Specification	FCC Specification	Test Name	Test Methods	Result
RSS-119 5.4	FCC 47 CFR 2.1046	Transmitter Output Power (Conducted)	ANSI C63.26 5.2.4.2	P
No specification	FCC 47 CFR 2.1047 (a)	Transmitter Audio Frequency Response – Pre-emphasis	ANSI C63.26 5.3.3.2	P
No specification	FCC 47 CFR 2.1047 (b)	Transmitter Modulation Limiting	ANSI C63.26 5.3.2	P
RSS-119 5.5	FCC 47 CFR 2.1049 (c)	Transmitter Occupied (99%) Bandwidth	ANSI C63.26 5.4.4	P
RSS-119 5.5	FCC 47 CFR 90.210	Transmitter Spectrum Masks	ANSI C63.26.5.7.3	P
RSS-119 5.8.9	FCC 47 CFR 90.543	Adjacent Channel Power Ratio	TIA-603-E 2.2.14 TIA-102.CAAA-E 2.2.8	N/A 2
RSS-119 5.8	FCC 47 CFR 2.1051	Transmitter Spurious Emissions (Conducted)	ANSI C63.26 5.7	P
RSS-119 5.8	FCC 47 CFR 2.1053	Transmitter Spurious Emissions (Radiated)	TIA-603-E 2.2.12	P
No specification	FCC CFR 90.543	Transmitter Radiated Emissions in the GNSS Band	TIA-603-E 2.2.12	N/A 2
RSS-119 5.8.9.2 rad	No specification	Transmitter Conducted Emissions in the GNSS Band	ANSI C63.26 6.5.2.7.4	N/A 2
RSS-119 5.9	FCC 47 CFR 90.214	Transient Frequency Behaviour	ANSI C63.26 6.5.2.2	N/A 3
RSS-119 5.3	FCC 47 CFR 2.1055, FCC 47 CFR 90.213	Transmitter Frequency Stability - Temperature	ANSI C63.26 5.6.4	P
RSS-119 5.3	FCC 47 CFR 2.1055 (d) (1), FCC 47 CFR 90.213	Transmitter Frequency Stability - Voltage	ANSI C63.26 5.6.5	P
RSS-Gen 7.4	FCC 47CFR 15.111	Receiver Spurious Emissions (Conducted)	TIA-603-E 2.1.2	P

Test Case Result Definitions	
No test Performed	N
Test does not apply to the test object	N/A
Test object meets requirements	P (Pass)
Test object does not meet requirements	F (Fail)
Test object is not conclusive	I (Inconclusive)

Comments:
N/A 1: Only required where the EUT is capable of Analogue modulation
N/A 2: Only required where the EUT transmits in the 768-776 or 798-806 MHz band (ISED), or 769-775 or 799-805 MHz band (FCC).
N/A 3: Only required where the EUT transmits in the 138-174 or 406.1-512 MHz band

STATEMENT OF COMPLIANCE

We, TELTEST LABORATORIES of 558 Wairakei Road, Christchurch, New Zealand, declare under our sole responsibility that the product:

Equipment: Transportable Transceiver
Type: TBDK4F

Unit	Serial Number	Firmware	Hardware Version
Reciter	18396951	dmr-3.45.00.0004	06.02
Reciter	18396951	P25-3.45.00.0004	06.02
Power Amplifier	18396952	-	00.02
Top Panel	-	1.10.04.0004	00.01

Diplexer Type	Serial Number	High Frequency MHz	Low Frequency MHz
DPF 900/6 N (f)	SN200053051	851.025	810.05
DPF 900/6 N (f)	SN200093778	860.025	823.95
DPF 900/6 N (f)	SN200053065	868.975	823.95
Manufacturer: Amphenol Procom			

to which this declaration relates, is in conformity with the following standards:

FCC 47 CFR Parts 22 and 90

RSS-119 Issue 12 & RSS-Gen Issue 5

Signature:

Mike James
Technical Manager

Date: 6 December 2024

The results obtained in this test report pertain only to the item(s) tested. Teltest does not make any claims of compliance for samples or variants that were not tested.

95% measurement uncertainties are stated in this report but are not applied in the assessment of results.

LIST OF ANTENNA INTENDED FOR USE WITH THE DEVICE

The equipment tested has a 50 Ω coaxial antenna connection. No antenna was fitted to the EUT during testing the parameters in this report.

Antennas and transmitter power settings are selected with regard to the overall loss of the antenna system, the desired coverage and the EIRP limit of the license.

The radio manufacturer (Tait) does not manufacture specific antennas for this equipment but suggests the following from other suppliers.

Manufacturer	**Part Number**	**Tuning Bandwidth and / or Frequency Range - MHz**	**Gain - dBd (dBi)**
RFI	COL81-870	806-870 MHz	0 (2.1)
RFI	COL84-870	806-870 MHz	5 (7.1)
dBSpectra	DS8A03F36U-D or N	806-869 MHz	3 (5.1)
dBSpectra	DS8A06F36U-D or N	806-869 MHz	6 (8.1)

Other suitable low gain antennas may also be used as appropriate.

CHANNEL TABLE

Channel Number	**Transmit Frequency MHz**	**Receive Frequency MHz**	**Power Watts**	**Channel Spacing kHz**
1	851.025	810.05	15 / 2	12.5 / 25
2	860.025	823.95	15 / 2	12.5 / 25
3	868.975	823.95	15 / 2	12.5 / 25

MODULATION TYPES, NECESSARY BANDWIDTH & EMISSION DESIGNATORS

MODULATION TYPES:

F3E	FM Analogue Voice	-	-
F1E	C4FM	4800 symbols/sec	9600 bps
F1D	C4FM	4800 symbols/sec	9600 bps
FXW	Digital Voice / Data	4800 symbols/sec	9600 bps
FXD	Digital Data	4800 symbols/sec	9600 bps

CHANNEL SPACING: 12.5 kHz

EMISSION DESIGNATORS:

Analogue Voice	11K0F3E
P25 Phase 1 Digital Voice	8K10F1E
P25 Phase 1 Digital Data	8K10F1D
DMR Digital Voice / Data	8K00FXW
DMR Digital Data	8K00FXD

Equation: Bn = 2M + 2Dk
(M is highest modulating frequency; D is peak allowable deviation; k is a constant of 1 for FM)

Analogue Voice 12.5 kHz Channel Spacing

Necessary bandwidth
M = 3.0 kHz
D = 2.5 kHz
Bn = (2x3.0) + (2x2.5) x 1
= 11.0 kHz

Emission Designator
11K0F3E
F3E represents an FM voice transmission

APCO P25 Phase 1 (C4FM): Digital Voice, 12.5 kHz Channel Spacing

99% bandwidth
= 8.1 kHz

Emission Designator
8K10F1E
F1E represents a digital FM voice transmission

APCO P25 Phase 1 (C4FM): Digital Data, 12.5 kHz Channel Spacing

99% bandwidth
= 8.1 kHz

Emission Designator
8K10F1D
F1D represents a digital FM data transmission

DMR: Digital Voice, 12.5 kHz Channel Spacing

99% bandwidth
= 8.0 kHz

Emission Designator
8K00FXW
FXW represents an FM Time Division Multiple Access (TDMA) combination of data and telephony

DMR: Digital Data, 12.5 kHz Channel Spacing

99% bandwidth
= 8.0 kHz

Emission Designator
8K00FXD
FXD represents FM Time Division Multiple Access (TDMA) data only

CHANNEL SPACING: 25 kHz

EMISSION DESIGNATORS:

Analogue Voice 16K0F3E

Equation: Bn = 2M + 2Dk
(M is highest modulating frequency; D is peak allowable deviation; k is a constant of 1 for FM)

Analogue Voice 25 kHz Channel Spacing

Necessary bandwidth	Emission Designator
M = 3.0 kHz	**16K0F3E**
D = 5.0 kHz	F3E represents an FM voice transmission
Bn = (2x3.0) + (2x5) x 1	
= 16.0 kHz	

TEST RESULTS

TRANSMITTER OUTPUT POWER (CONDUCTED)

SPECIFICATION: FCC 47 CFR 2.1046 RSS-119 5.4

GUIDE: ANSI C63.26 5.2.4.2

MEASUREMENT PROCEDURE:
1. Refer Annex A for Equipment set up.
2. The coaxial attenuator has an impedance of 50 Ohms.
3. The unmodulated output power was measured with an RF Power meter.

EXAMPLE CALCULATION:

Example calculation

Power in dBm =	Measured power (dBm) + attenuator and cable loss (dB)
Chan 1 power (dBm) =	9.76 dBm +31.81 dB
=	41.57dBm
(10^(41.57dBm)/10)/1000 =	14.3W

MEASUREMENT UNCERTAINTY: ± 0.6dB

MEASUREMENT RESULTS:
Manufacturer's Rated Output Power: Switchable: 15 W and 2 W

Nominal 15 W	851.025 MHz	860.025 MHz	868.975 MHz
Measured	14.3	13.5	17.0
Variation (%)	-4.4	-10.1	13.0
Variation (dB)	-0.2	-0.5	0.5
Nominal 2 W	851.025 MHz	860.025 MHz	868.975 MHz
Measured	2.3	2.4	2.4
Variation (%)	14.2	19.7	18.6
Variation (dB)	0.6	0.8	0.7

LIMIT CLAUSES:

FCC 47 CFR 90.205 (s)
The output power shall not exceed by more than 20%... the manufacturer's rated output power for the particular transmitter specifically listed on the authorization.

RSS-119 5.4
The output power shall be within ±1.0 dB of the manufacturer's rated power.

TRANSMITTER AUDIO FREQUENCY RESPONSE - PRE-EMPHASIS

SPECIFICATION: FCC 47 CFR 2.1047 (a)

GUIDE: ANSI C63.26 5.3.3.2

MEASUREMENT PROCEDURE:

1. Refer Annex A for Equipment set up.
2. An audio input tone of 1000 Hz was applied with the level set to obtain 20% of maximum deviation. This was used as the 0 dB reference point.
3. The AF was varied while the audio level was held constant.
4. The response in dB relative to 1000 Hz was measured.

MEASUREMENT RESULTS:

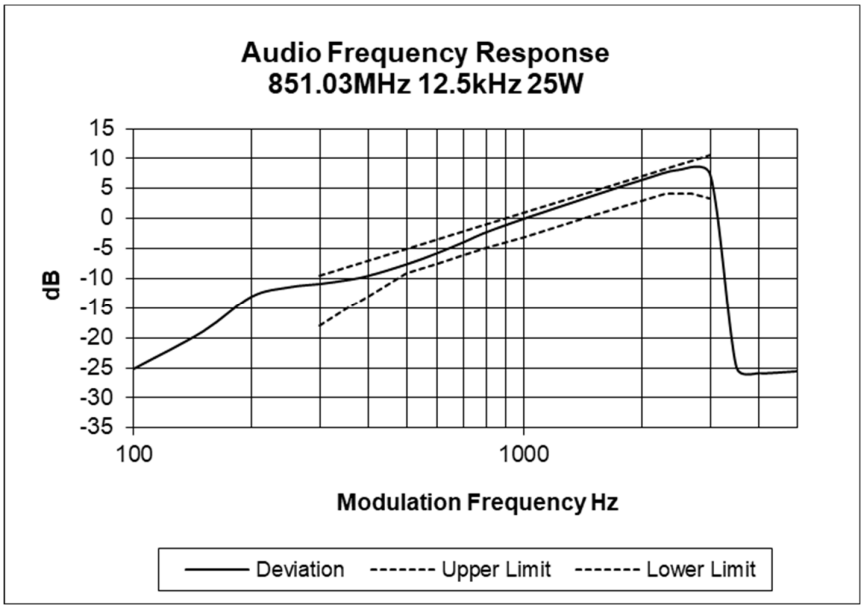
See the plots on the following pages for 12.5 kHz and 25 kHz channel spacing tested at 25 W transmit power (without connection to the diplexer).

LIMIT CLAUSE: TIA/EIA-603E 3.2.6

MEASUREMENT UNCERTAINTY: ± 1.5 %

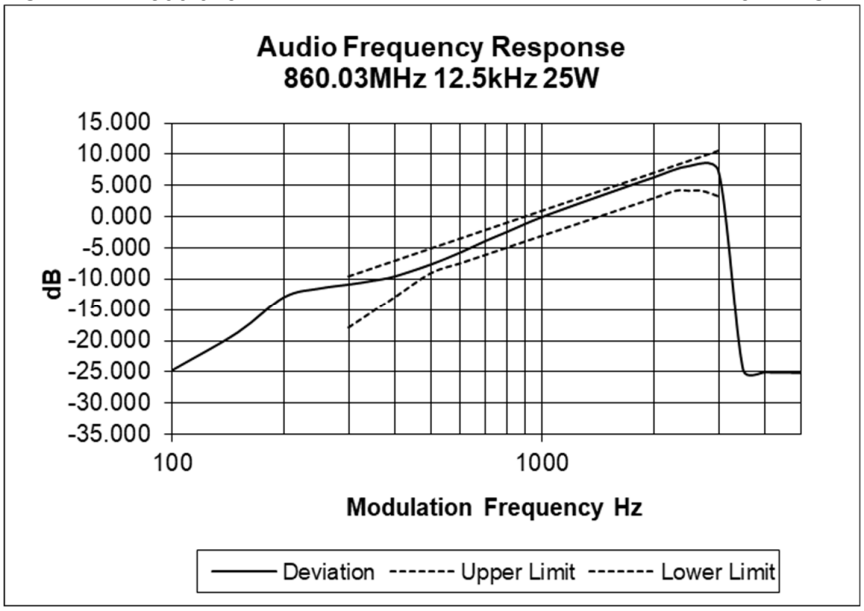
SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 851.025 MHz 12.5 kHz Channel Spacing

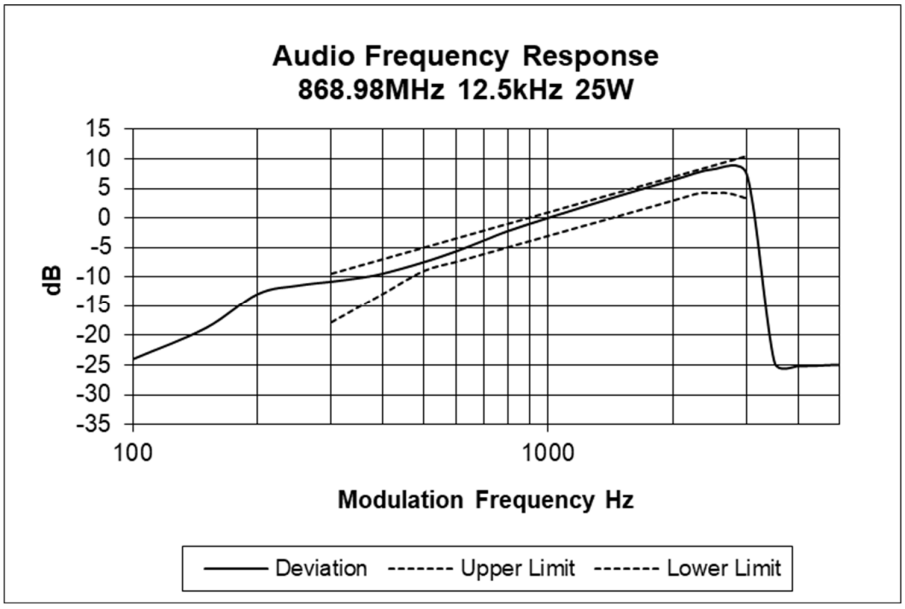


Transmitter Audio Frequency Response – Pre-emphasis

Tx FREQUENCY: 860.025 MHz 12.5 kHz Channel Spacing

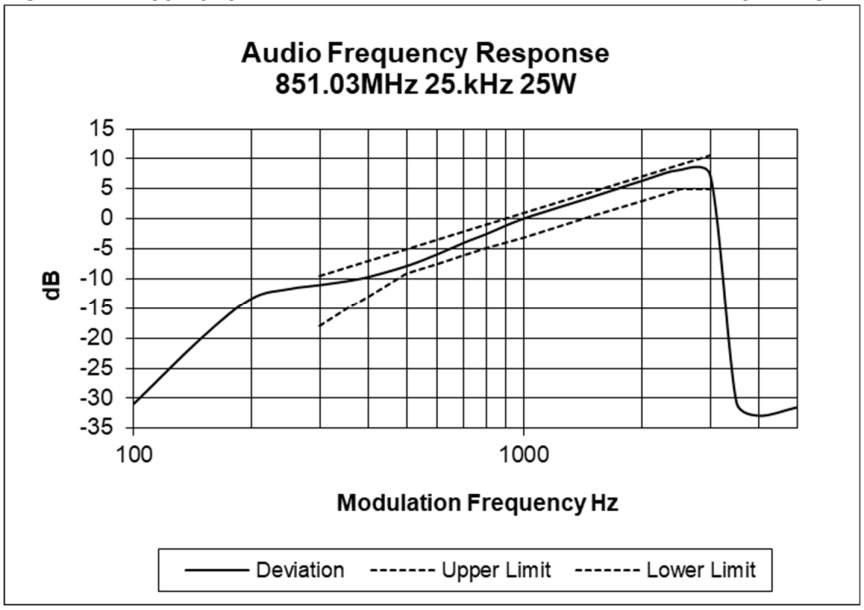


Tx FREQUENCY: 868.975 MHz 12.5 kHz Channel Spacing

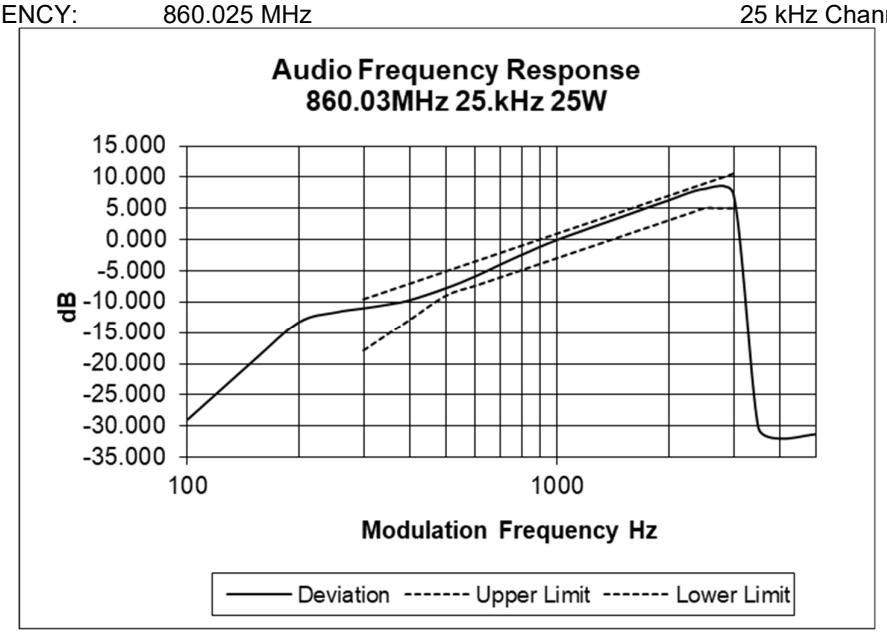


Transmitter Audio Frequency Response – Pre-emphasis

Tx FREQUENCY: 851.025 MHz 25 kHz Channel Spacing

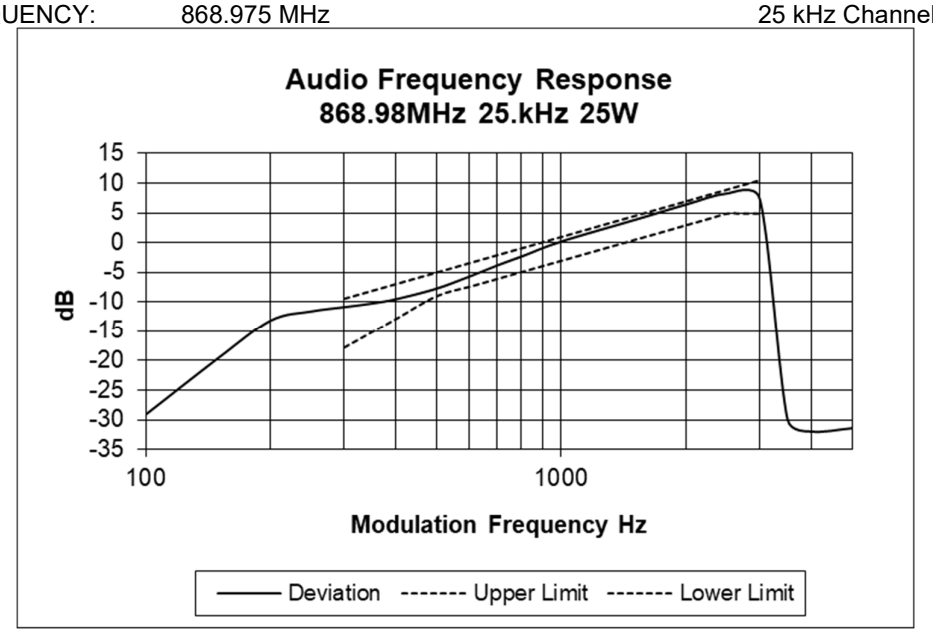


Tx FREQUENCY: 860.025 MHz 25 kHz Channel Spacing



Transmitter Audio Frequency Response – Pre-emphasis

Tx FREQUENCY: 868.975 MHz 25 kHz Channel Spacing



TRANSMITTER MODULATION LIMITING

SPECIFICATION: FCC 47 CFR 2.1047 (b)

GUIDE: ANSI C63.26 5.3.2

MEASUREMENT PROCEDURE:
1. Refer Annex A for Equipment set up.
2. An audio input tone of 1000 Hz was applied with the level set to obtain 60% of maximum deviation. This was used as the 0 dB reference point.
3. The modulation response was measured at four audio frequencies while increasing the input level in 5dB steps.
4. Additionally the level used to measure sideband spectrum (occupied bandwidth) was included in the level sweep.
5. Measurements were made for both Positive and Negative Deviation.

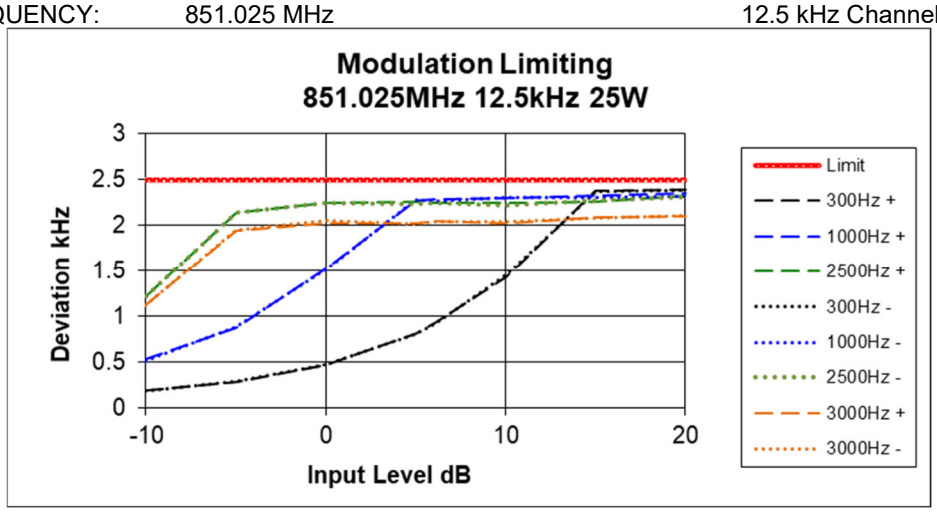
MEASUREMENT RESULTS:
See the plots on the following pages for 12.5 kHz and 25 kHz channel spacing.

LIMIT CLAUSE: TIA/EIA-603E 1.3.4.4

MEASUREMENT UNCERTAINTY: ± 1.5 %

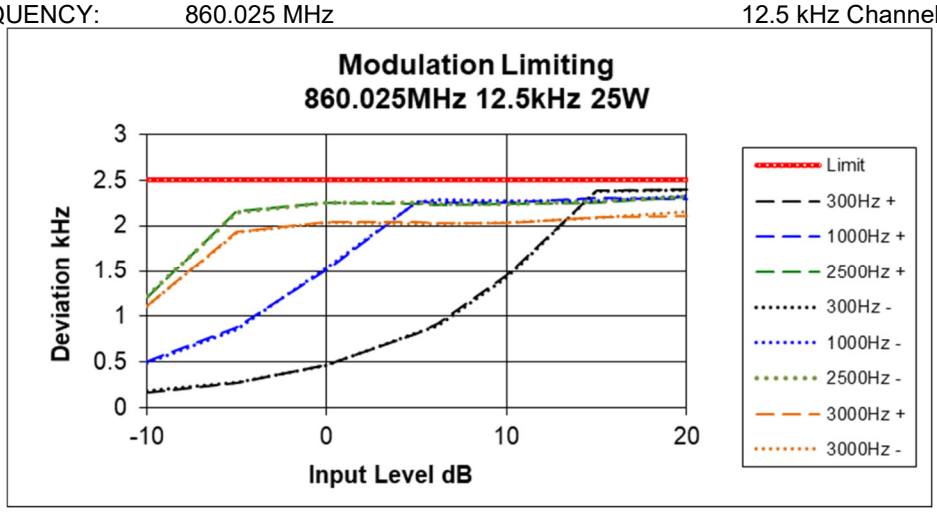
SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 851.025 MHz 12.5 kHz Channel Spacing

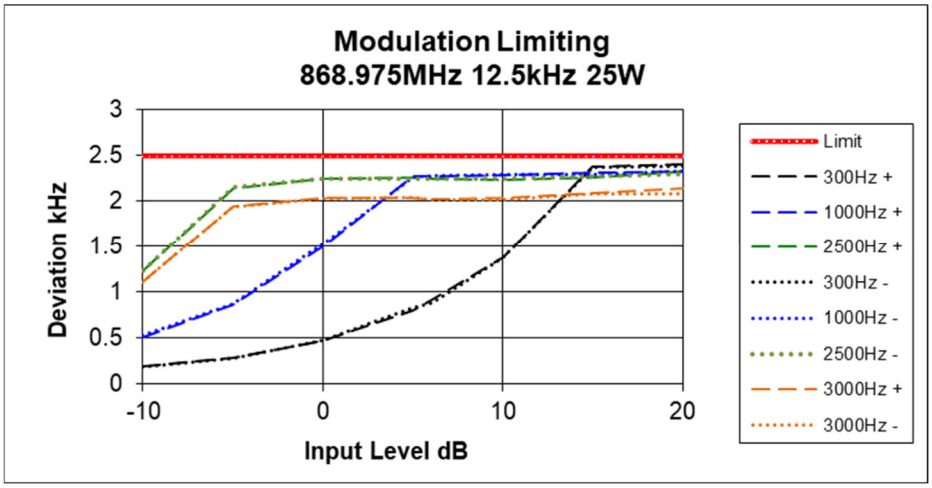


Transmitter Modulation Limiting

Tx FREQUENCY: 860.025 MHz 12.5 kHz Channel Spacing

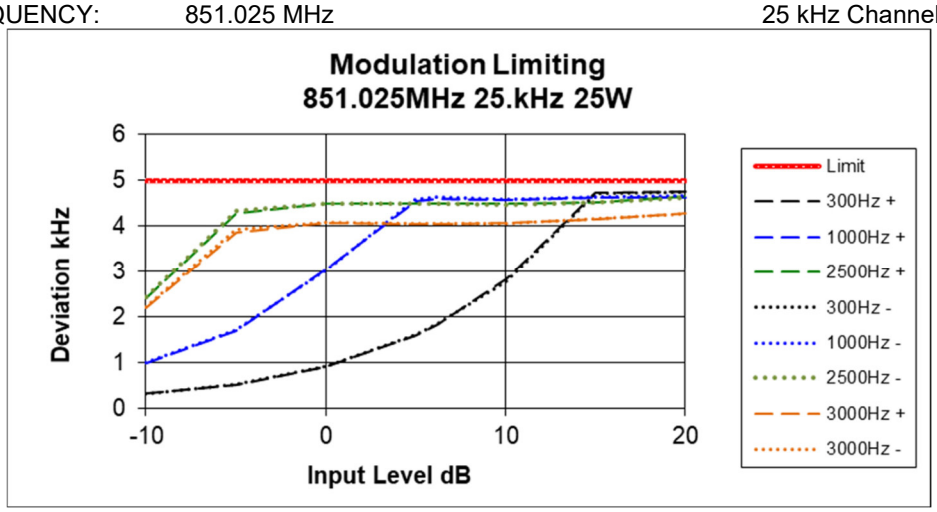


Tx FREQUENCY: 868.975 MHz 12.5 kHz Channel Spacing

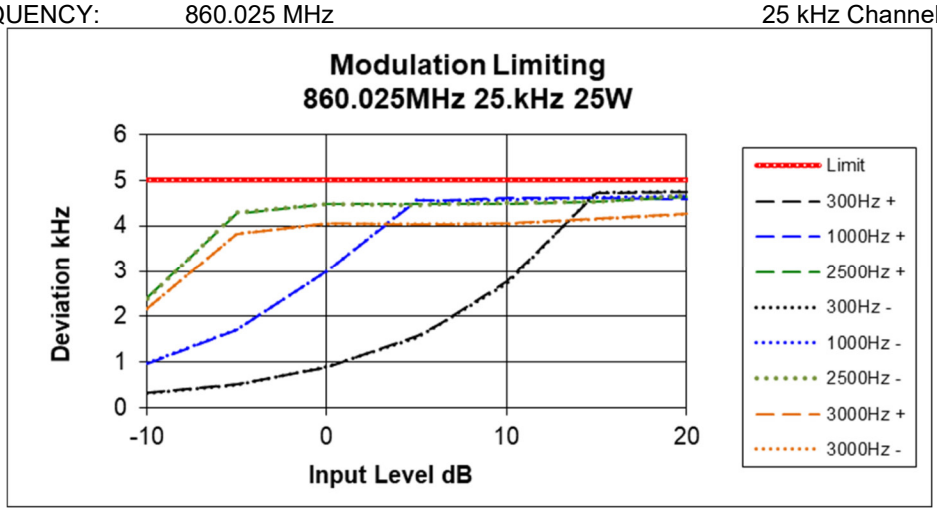


Transmitter Modulation Limiting

Tx FREQUENCY: 851.025 MHz 25 kHz Channel Spacing

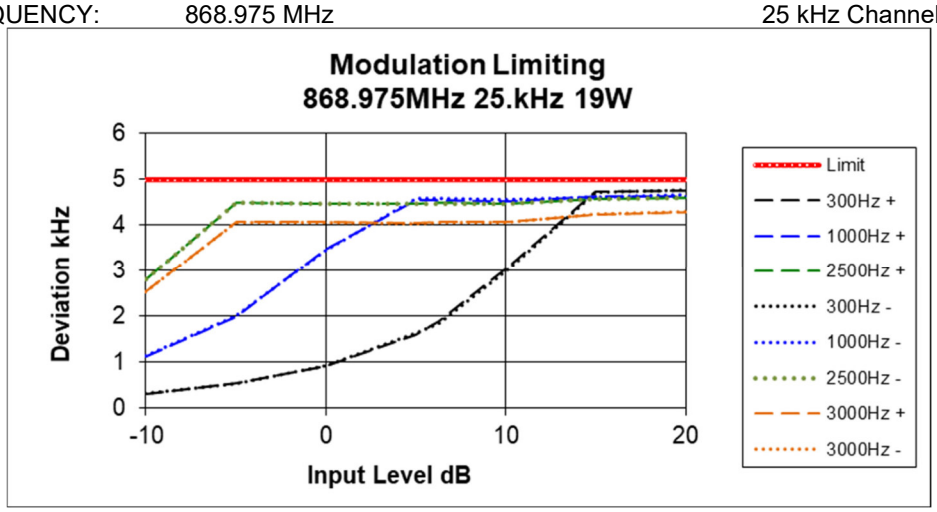


Tx FREQUENCY: 860.025 MHz 25 kHz Channel Spacing



Transmitter Modulation Limiting

Tx FREQUENCY: 868.975 MHz 25 kHz Channel Spacing



TRANSMITTER OCCUPIED (99%) BANDWIDTH

SPECIFICATION: FCC 47 CFR 2.1046
RSS-119 5.5

GUIDE: ANSI C63.26 5.4.4

MEASUREMENT PROCEDURE:

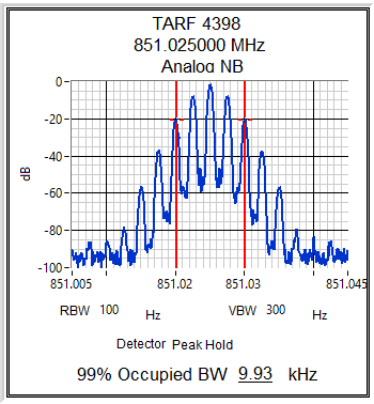
1. Refer Annex A for Equipment Set up.
2. For analogue measurements: The EUT was modulated by a 2500 Hz tone at an input level 16 dB above a level that produced 50% deviation. The input level was established at the frequency of maximum response of the audio modulating circuit.
   For Data measurements: The EUT was modulated with an internally generated pseudo random bit sequence at the appropriate Baud rates.
3. The Occupied Bandwidth was measured on the Spectrum Analyser, with bandwidth settings as follows.
   Resolution Bandwidth = 100 Hz, Video Bandwidth = 300 Hz

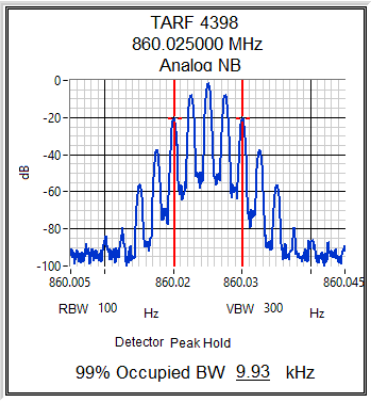
MEASUREMENT RESULTS:

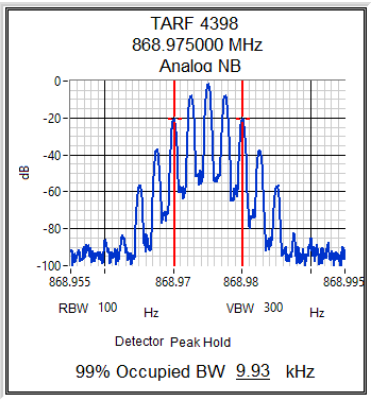
Channel Frequency (MHz)	Channel Spacing (kHz)	Analogue NB	Analogue WB	DMR	APCO P25 phase I C4FM
851.025 MHz	12.5	9.93		7.93	7.8
860.025 MHz	12.5	9.93		7.87	7.8
868.975 MHz	12.5	9.93		7.80	7.93
851.025 MHz	25		15.0		
860.025 MHz	25		15.0		
868.975 MHz	25		15.0		
Limit Authorized Bandwidth 47 CFR 90.209 RSS 119 5.5		11.25	20.0	11.25	11.25
Necessary BW used in emission designator		11.0	16.0	8.0	8.1
Result		Pass	Pass	Pass	Pass

Transmitter Occupied (99%) Bandwidth

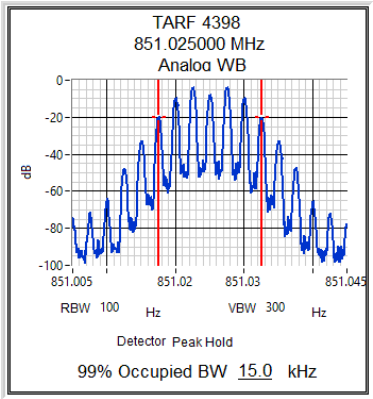
Channel 1-3 15 watts 12.5 kHz ch spacing Analogue Modulation

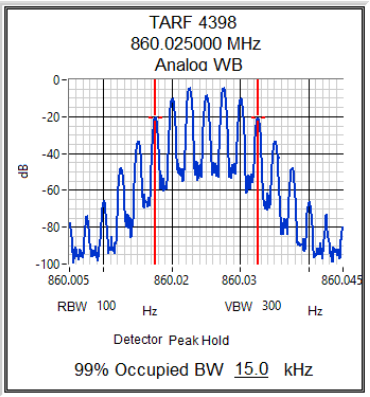


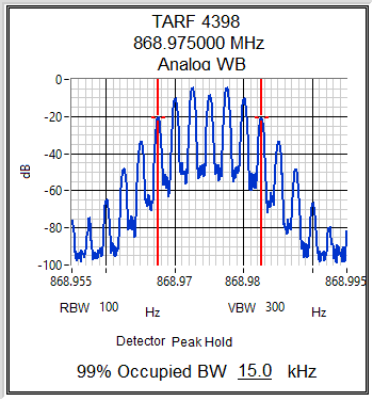




Channel 1-3 15 watts 25 kHz ch spacing Analogue Modulation

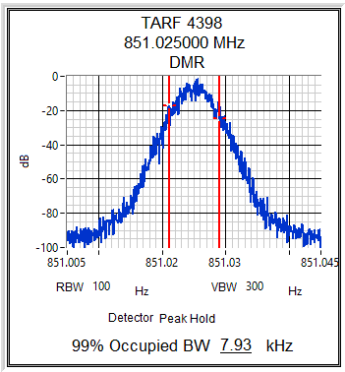


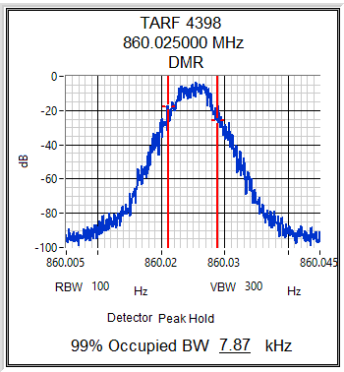


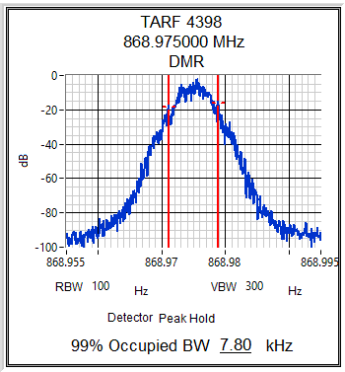


Transmitter Occupied (99%) Bandwidth

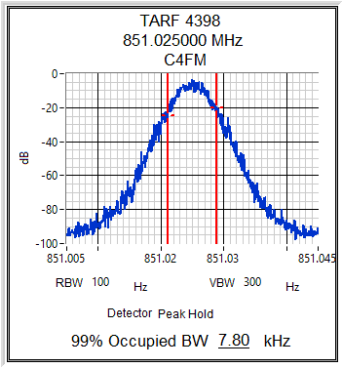
Channel 1-3 15 watts 12.5 kHz ch spacing DMR Modulation

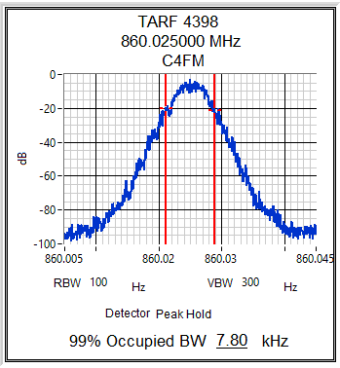


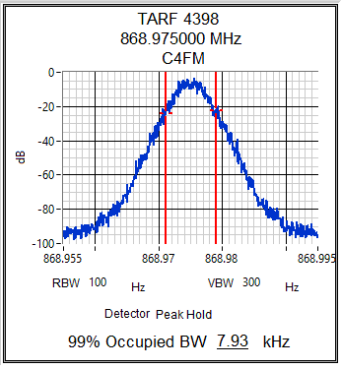




Channel 1-3 15 watts 12.5 kHz ch spacing C4FM Modulation







TRANSMITTER SPECTRUM MASKS

SPECIFICATION:	FCC 47 CFR 2.1049 (c)	RSS-119 5.5
GUIDE:	ANSI C63.26.5.7.3	

MEASUREMENT PROCEDURE:

1. Refer Annex A for Equipment Set up.
2. For Analogue measurements: The EUT was modulated by a 2500 Hz tone at an input level 16 dB above a level that produced 50% deviation. The input level was established at the frequency of maximum response of the audio modulating circuit.
   For Data measurements: The EUT was modulated with an internally generated pseudo random bit sequence at the appropriate Baud rates.
3. The Occupied Bandwidth was measured on the Spectrum Analyser, with bandwidth settings as noted on the recorded plots.

MEASUREMENT RESULTS:
See the plots on the following pages for 12.5 kHz channel spacing.

MEASUREMENT UNCERTAINTY 95% ±0.65dB

LIMIT CLAUSE:	FCC 47 CFR 90.210	RSS-119 5.5

EMISSION MASKS

Emission Mask D	12.5 kHz Channel Spacing	Analogue, Digital Voice/Data
Emission Mask B	25 kHz Channel Spacing	Analogue Wideband

DATA SPEED

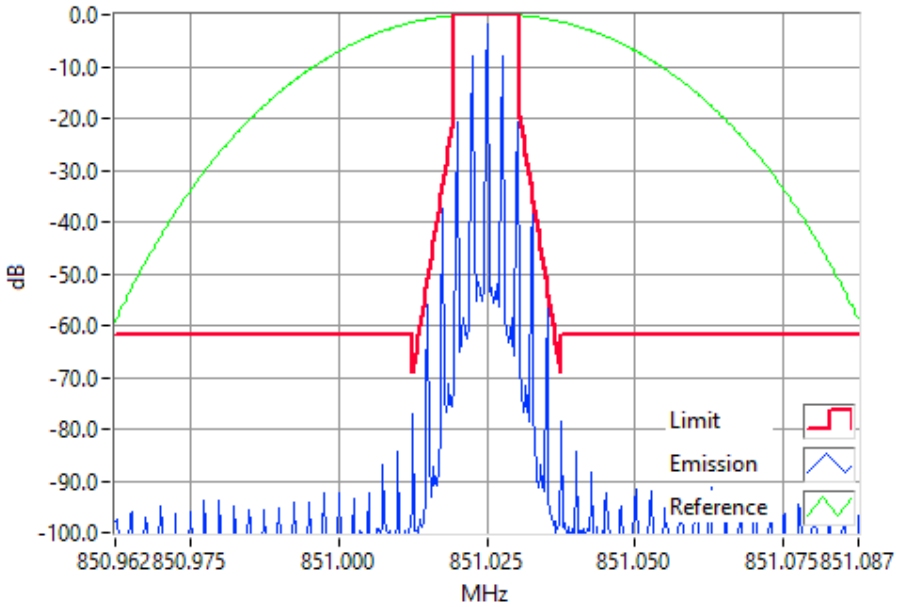
Digital Voice/Data	12.5 kHz Channel Spacing	9600 bps (DMR, P25 Phase I)

Transmitter Spectrum Masks

ANALOGUE VOICE

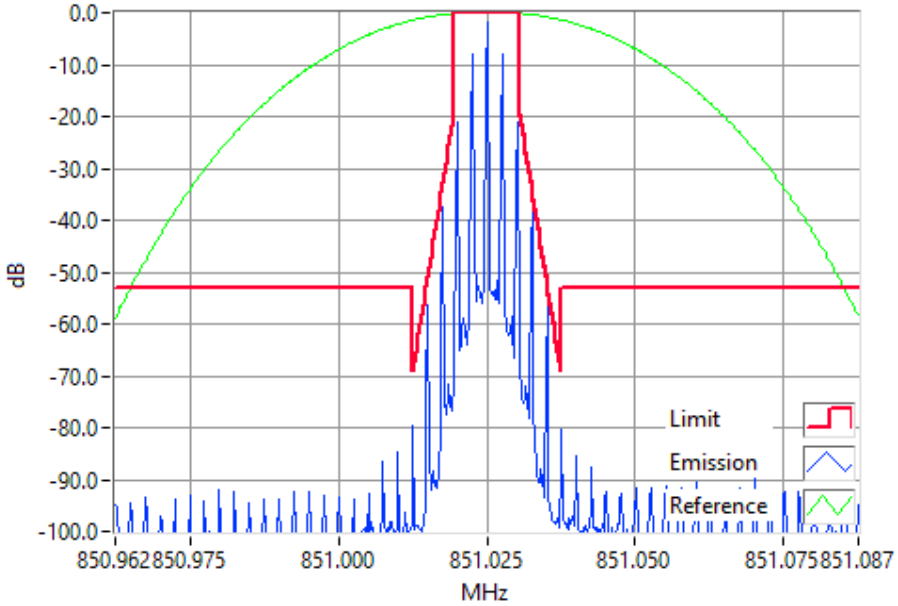
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 851.025 MHz 15 W 12.5 kHz Channel Spacing



Analogue Modulation 851.0250MHz Mask D 15W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 851.025 MHz 2 W 12.5 kHz Channel Spacing



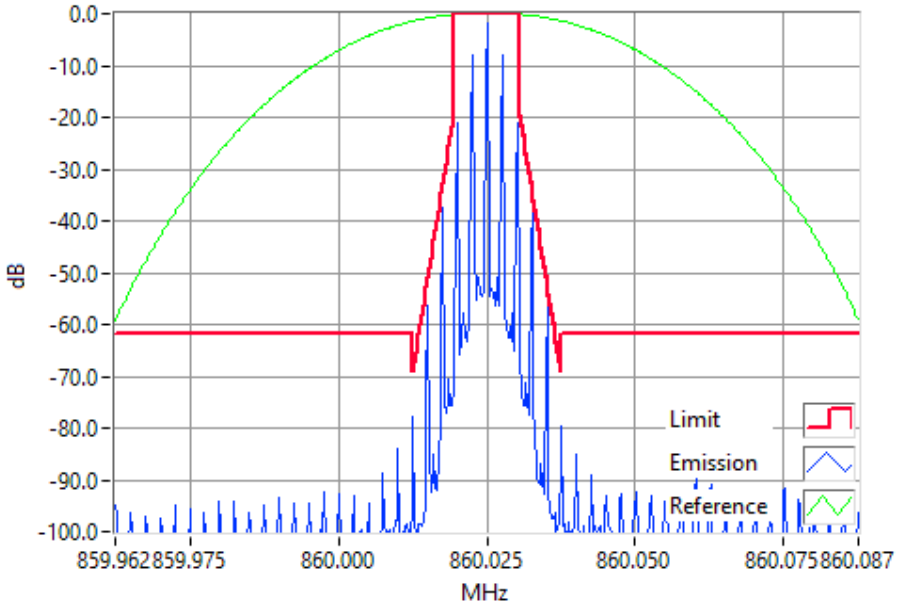
Analogue Modulation 851.0250MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

ANALOGUE VOICE

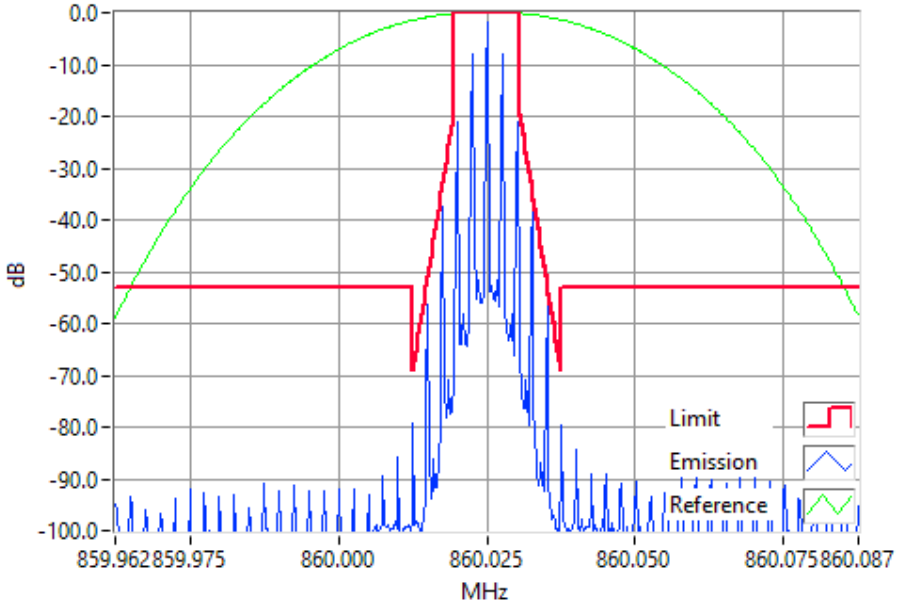
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 860.025 MHz 15 W 12.5 kHz Channel Spacing



Analogue Modulation 860.0250MHz Mask D 15W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 860.025 MHz 2 W 12.5 kHz Channel Spacing



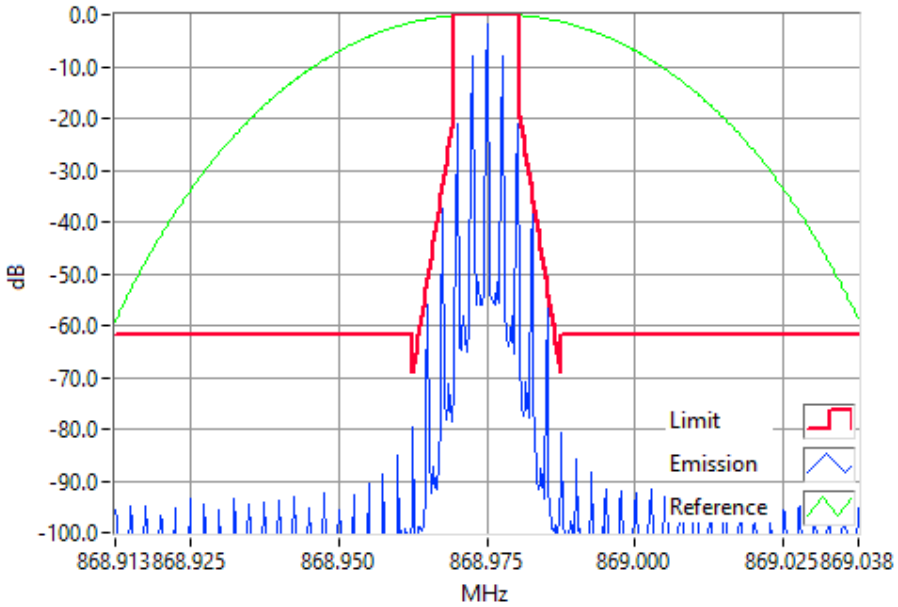
Analogue Modulation 860.0250MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

ANALOGUE VOICE

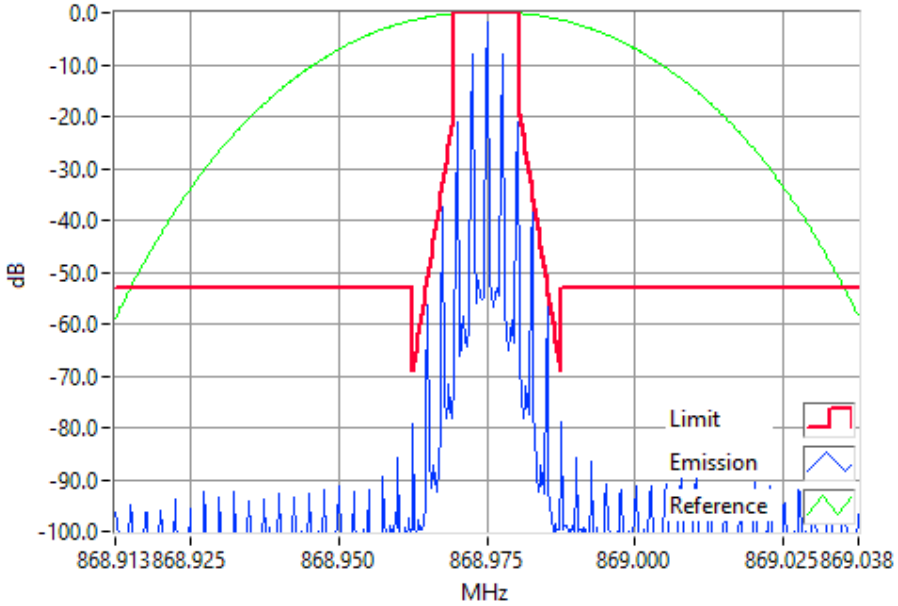
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 868.975 MHz 15 W 12.5 kHz Channel Spacing



Analogue Modulation 868.9750MHz Mask D 15W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 868.975 MHz 2 W 12.5 kHz Channel Spacing



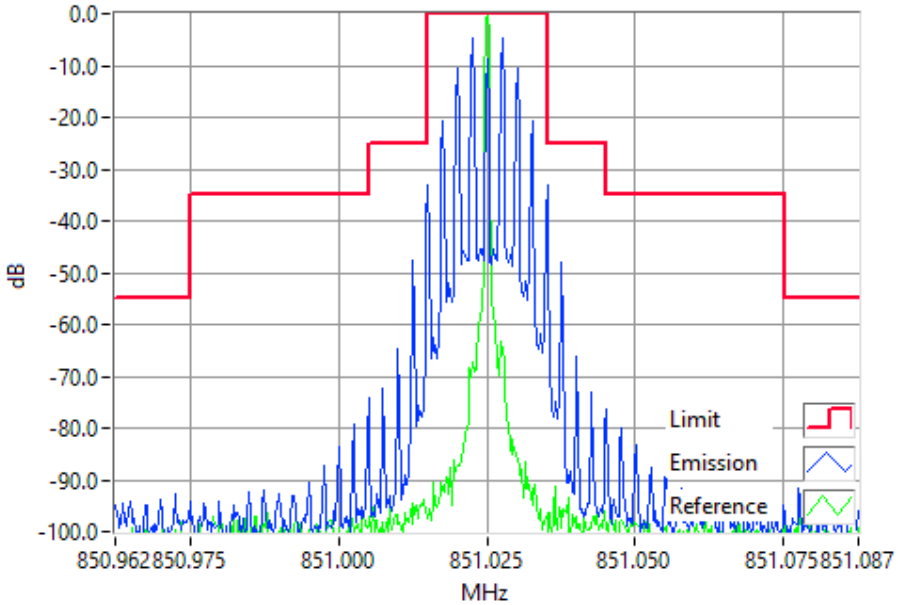
Analogue Modulation 868.9750MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

ANALOGUE VOICE

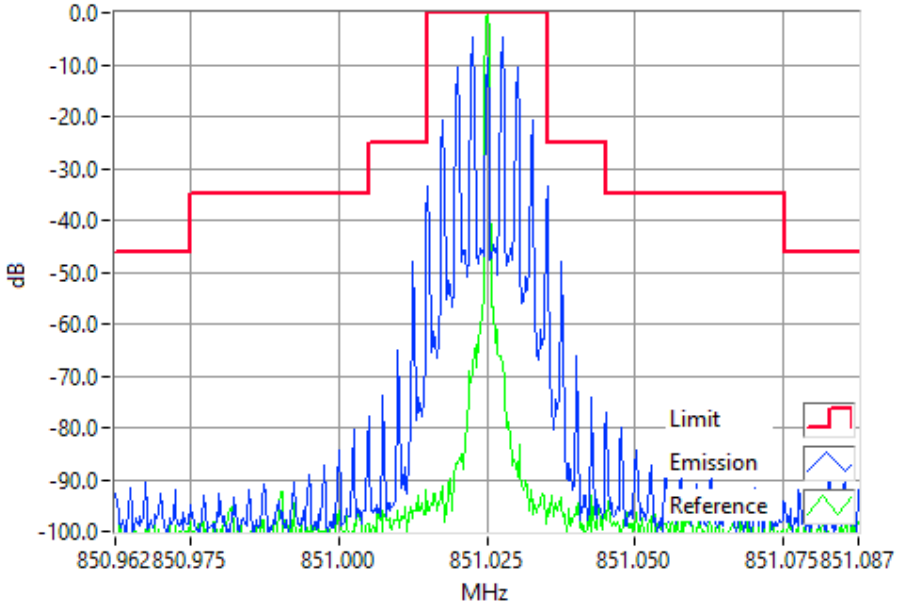
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 851.025 MHz 15 W 25 kHz Channel Spacing



Analogue Modulation 851.0250MHz Mask B 15W
RBW=300Hz, VBW=3000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 851.025 MHz 2 W 25 kHz Channel Spacing



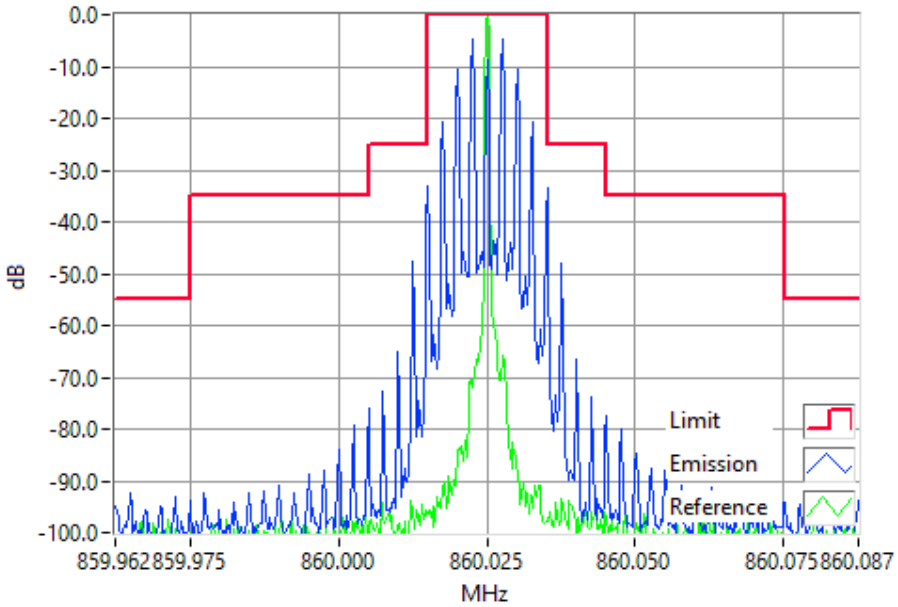
Analogue Modulation 851.0250MHz Mask B 2W
RBW=300Hz, VBW=3000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

ANALOGUE VOICE

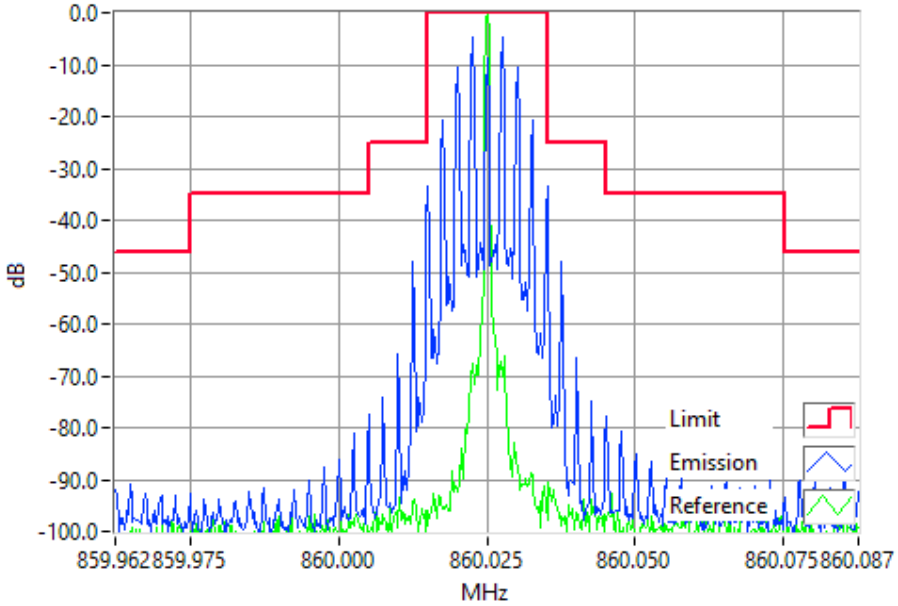
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 860.025 MHz 15 W 25 kHz Channel Spacing



Analogue Modulation 860.0250MHz Mask B 15W
RBW=300Hz, VBW=3000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 860.025 MHz 2 W 25 kHz Channel Spacing



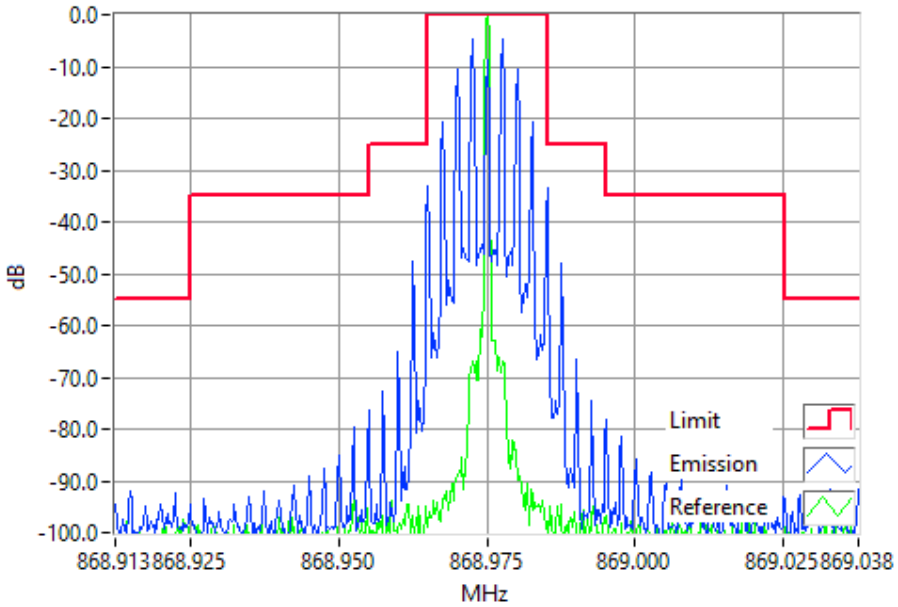
Analogue Modulation 860.0250MHz Mask B 2W
RBW=300Hz, VBW=3000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

ANALOGUE VOICE

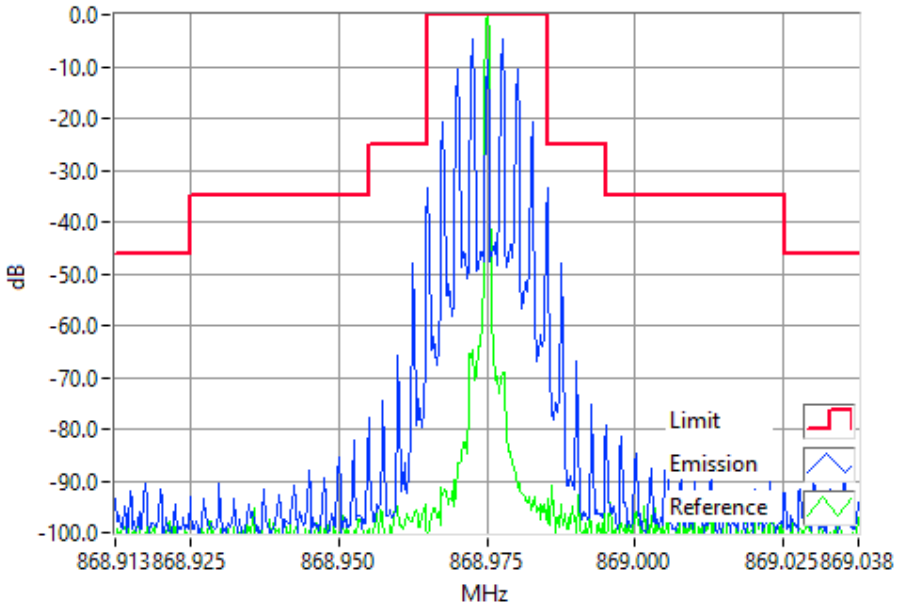
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 868.975 MHz 15 W 25 kHz Channel Spacing



Analogue Modulation 868.9750MHz Mask B 15W
RBW=300Hz, VBW=3000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 868.975MHz 2 W 25 kHz Channel Spacing



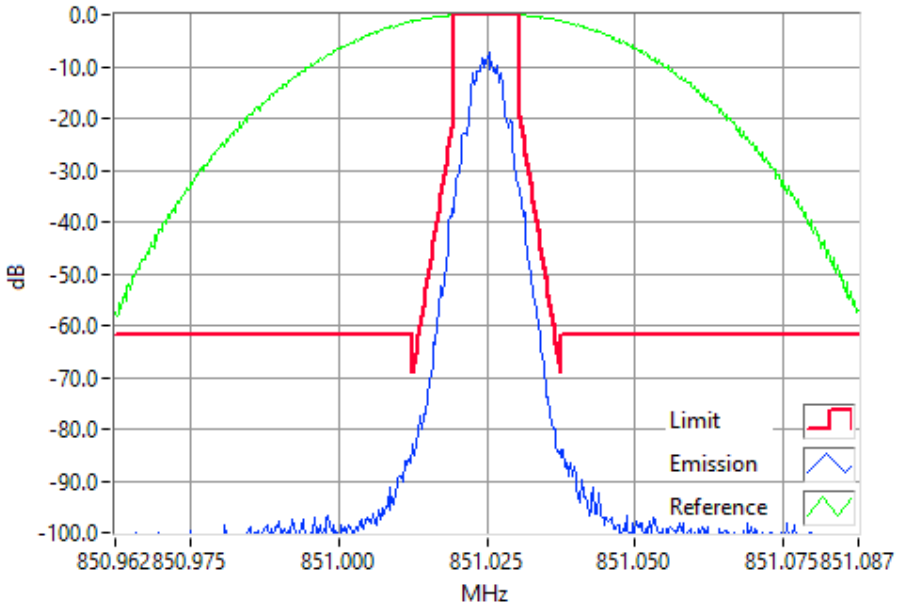
Analogue Modulation 868.9750MHz Mask B 2W
RBW=300Hz, VBW=3000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

DMR

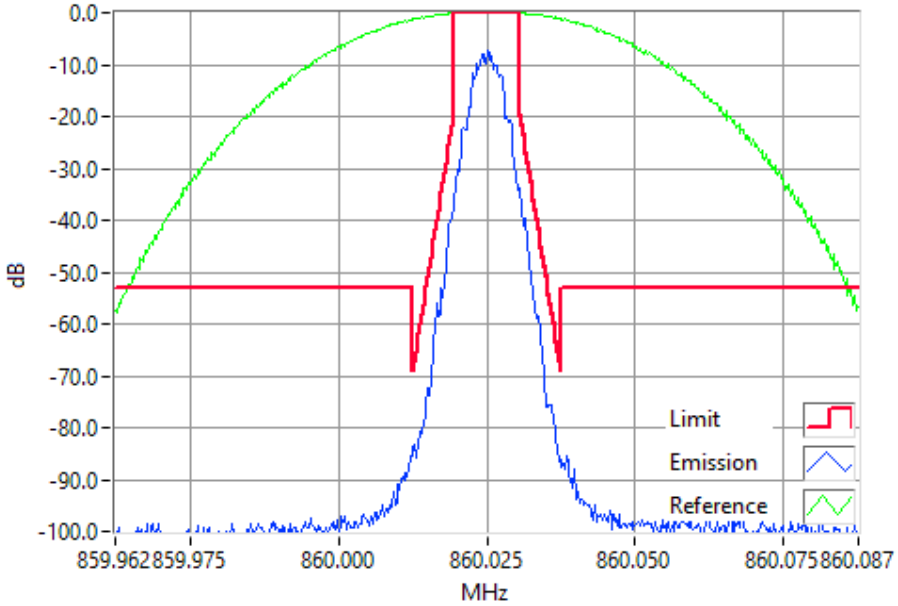
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 851.025 MHz 15 W 12.5 kHz Channel Spacing



DMR 851.0250MHz Mask D 15W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 851.025 MHz 2 W 12.5 kHz Channel Spacing



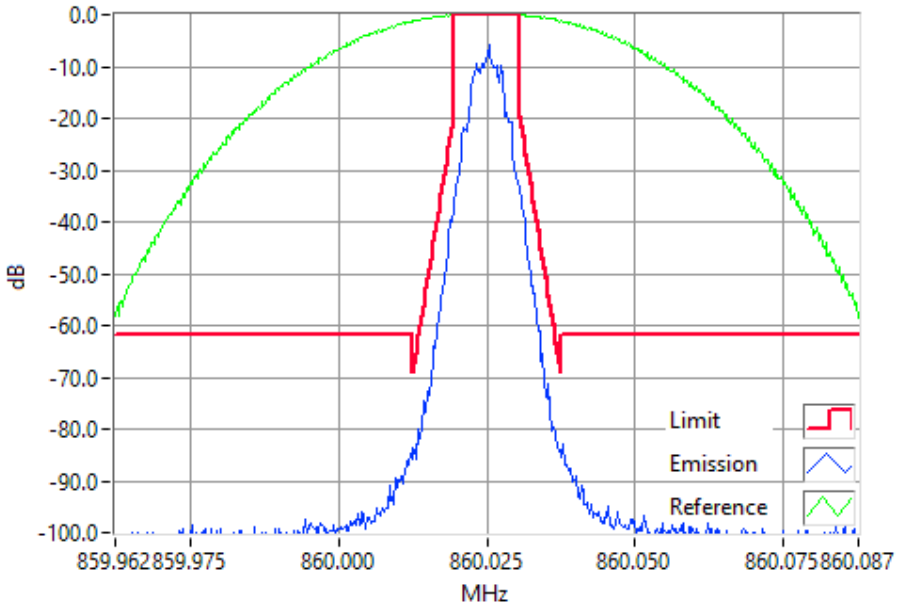
DMR 860.0250MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

DMR

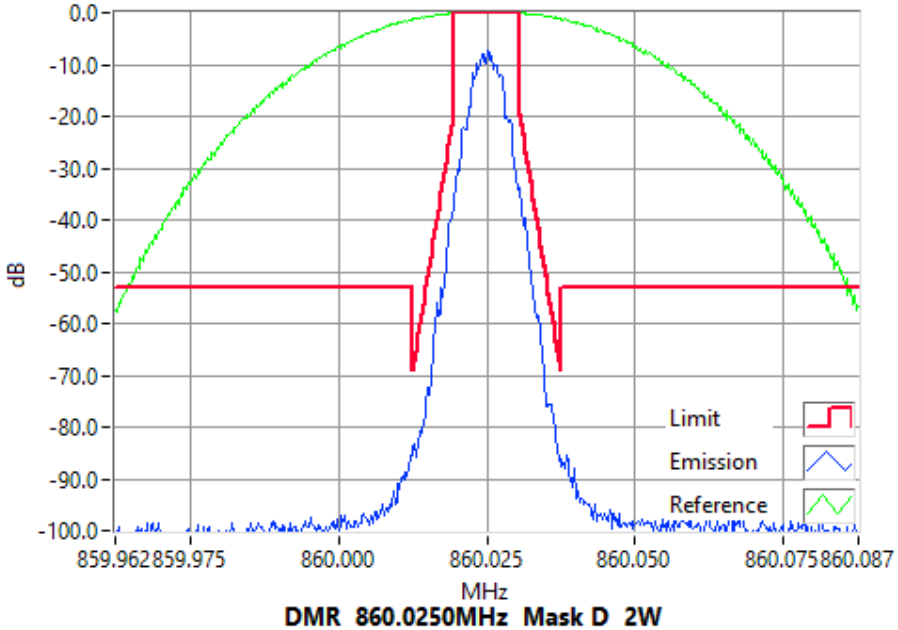
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 860.025 MHz 15 W 12.5 kHz Channel Spacing



DMR 860.0250MHz Mask D 15W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 860.025 MHz 2 W 12.5 kHz Channel Spacing



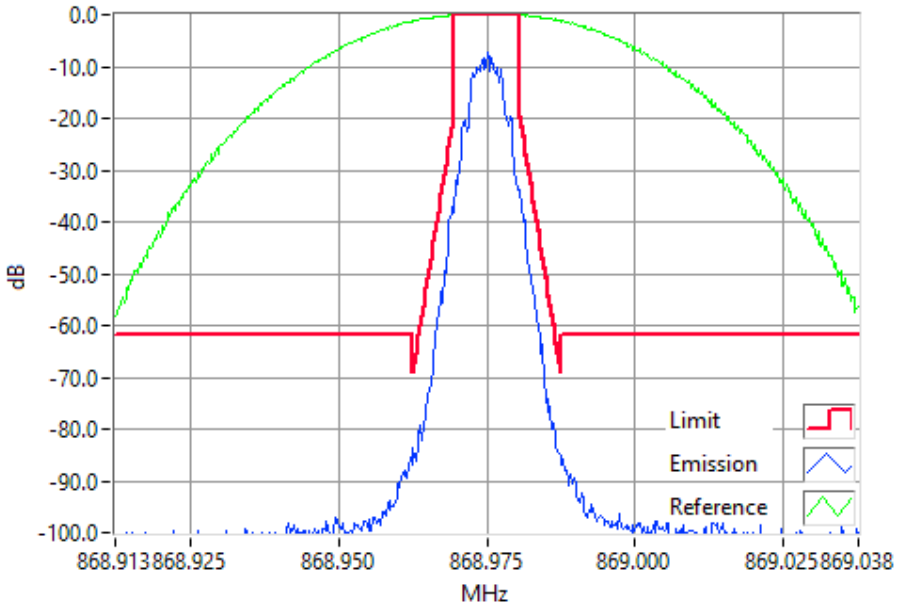
DMR 860.0250MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

DMR

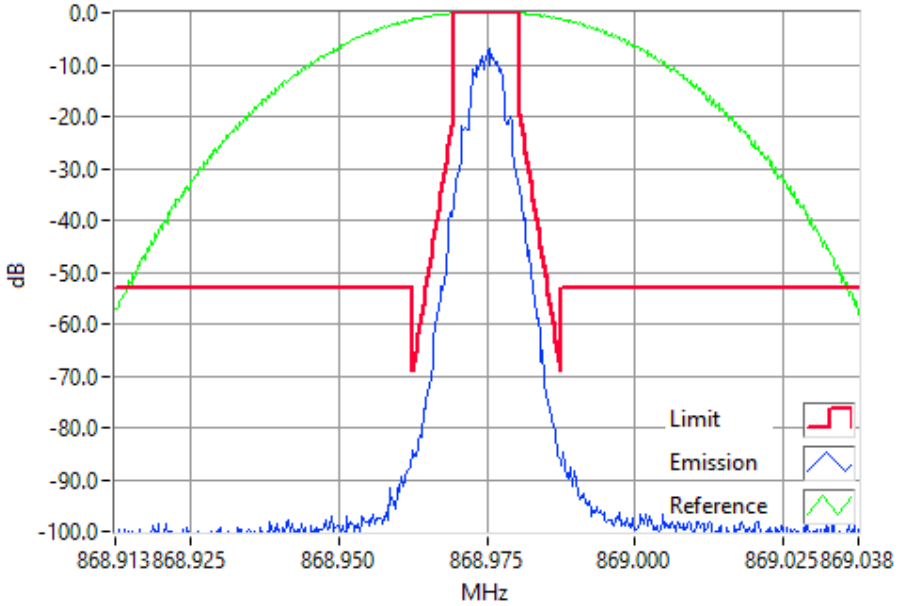
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 868.975 MHz 15 W 12.5 kHz Channel Spacing



DMR 868.9750MHz Mask D 15W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 868.975 MHz 2 W 12.5 kHz Channel Spacing



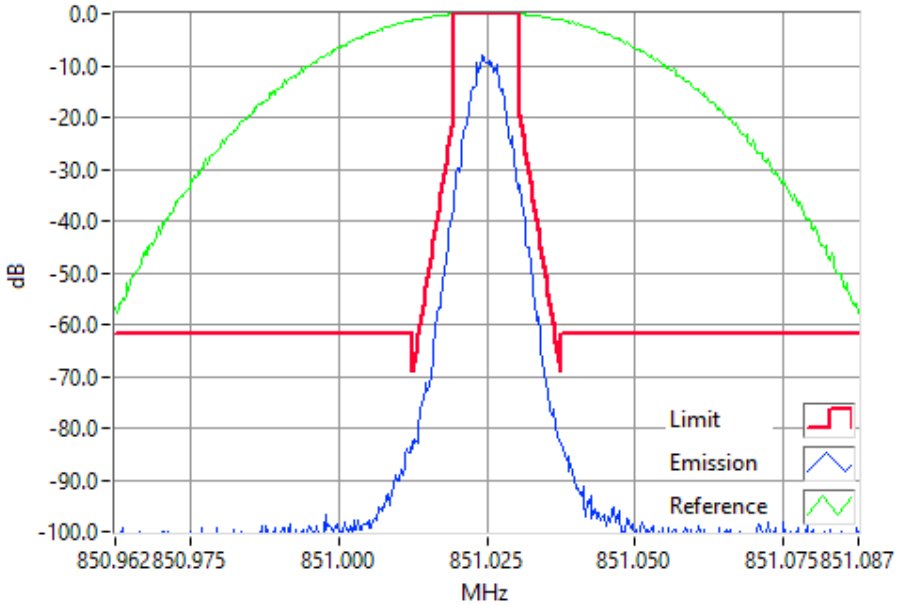
DMR 868.9750MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

P25 PHASE 1, C4FM

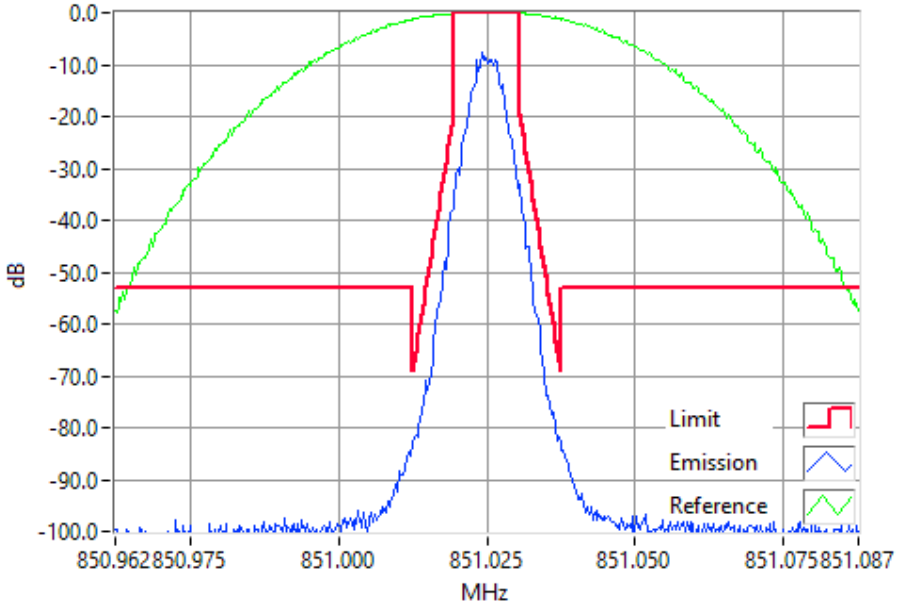
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 851.025 MHz 15 W 12.5 kHz Channel Spacing



C4FM 851.0250MHz Mask D 15W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 851.025 MHz 2 W 12.5 kHz Channel Spacing



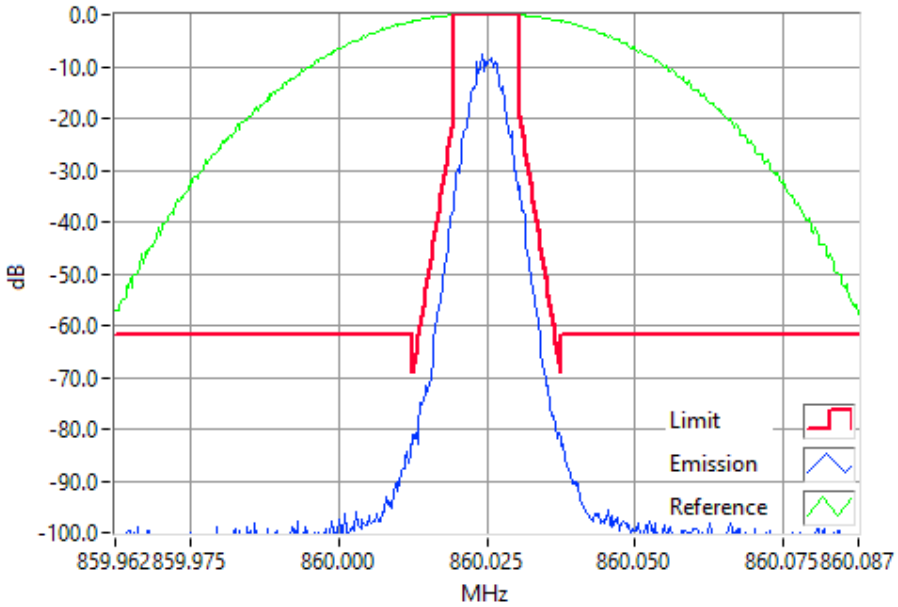
C4FM 851.0250MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

P25 PHASE 1, C4FM

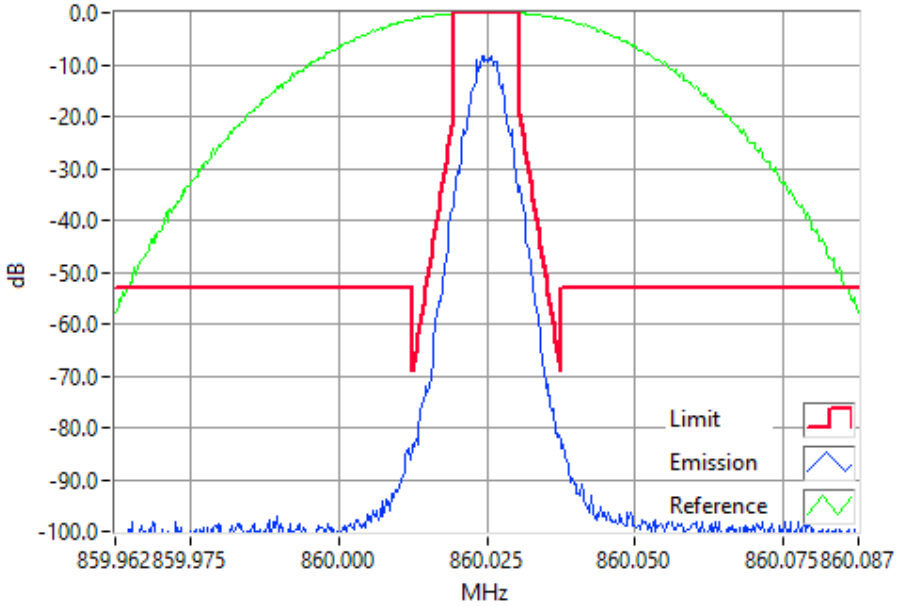
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 860.025 MHz 15 W 12.5 kHz Channel Spacing



C4FM 860.0250MHz Mask D 15W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 860.025 MHz 2 W 12.5 kHz Channel Spacing



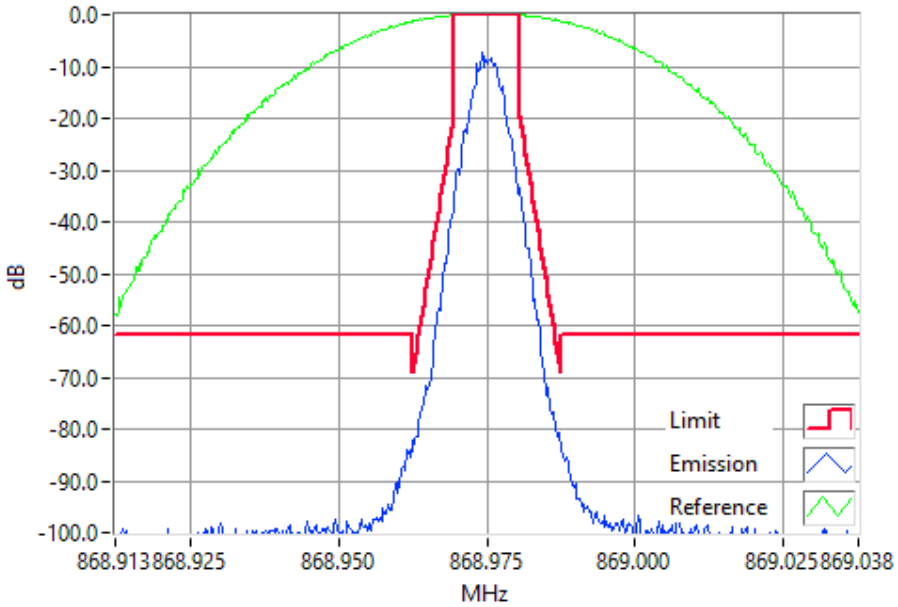
C4FM 860.0250MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

P25 PHASE 1, C4FM

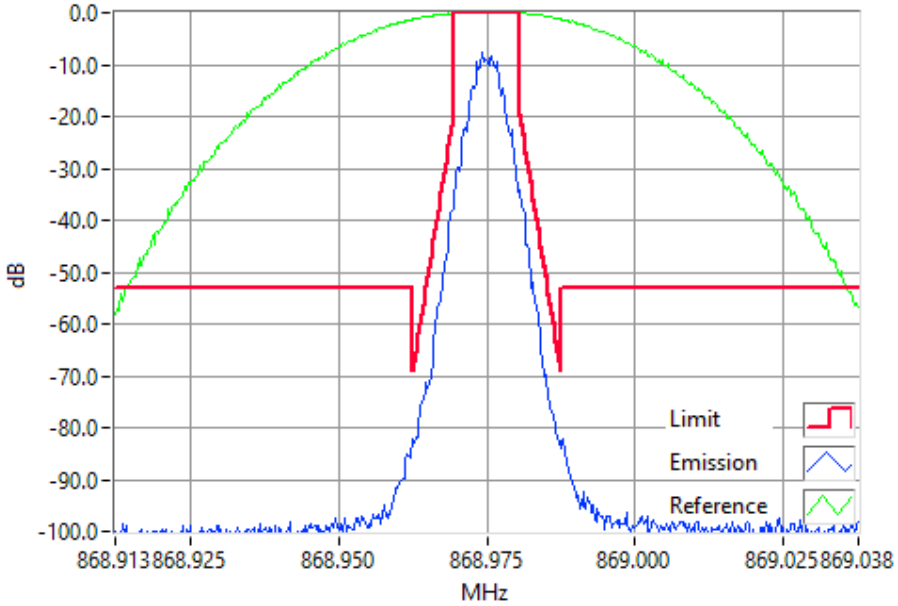
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 868.975 MHz 15 W 12.5 kHz Channel Spacing



C4FM 868.9750MHz Mask D 15W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 868.975 MHz 2 W 12.5 kHz Channel Spacing



C4FM 868.9750MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

TRANSMITTER SPURIOUS EMISSIONS (CONDUCTED)

SPECIFICATIONS: FCC 47 CFR 2.1051 RSS-119 5.8

GUIDE: ANSI C63.26 5.7

MEASUREMENT PROCEDURE:

1. Refer Annex A for equipment set up.
2. The frequency range examined was from the lowest frequency generated within the EUT, to a frequency higher than the 10th Harmonic: 9 kHz to Fc-BW
   Fc+ BW to 10Fc (8.7GHz)
3. The EUT was set to transmit high or low power. A scan is performed with a resolution bandwidth of 100 kHz and a video bandwidth of 300 kHz for frequencies up to 1 GHz, and a resolution bandwidth of 1 MHz and a video bandwidth of 3 MHz for frequencies above 1 GHz.
4. For frequencies close to the carrier the spectrum was measured using a resolution bandwidth of 1kHz, the results were then integrated to give measurements for 100kHz bandwidth.
5. A low-pass filter was used for frequencies from 1GHz to 3.6 GHz.
6. For each frequency range the spectrum analyser was loaded with the appropriate calibration figures to compensate for the cables, attenuator, and filter losses, allowing the emission levels to be read directly with no further calculation.
7. The results of the various sweeps were combined programmatically to give charts for frequencies near the carrier, up to 1GHz and above 1GHz.

   The calibrations are loaded as an overall reference level offset plus a set of correction factors for the required frequency band.

Spurious emissions which were attenuated by more than 20 dB below the limit were not recorded.

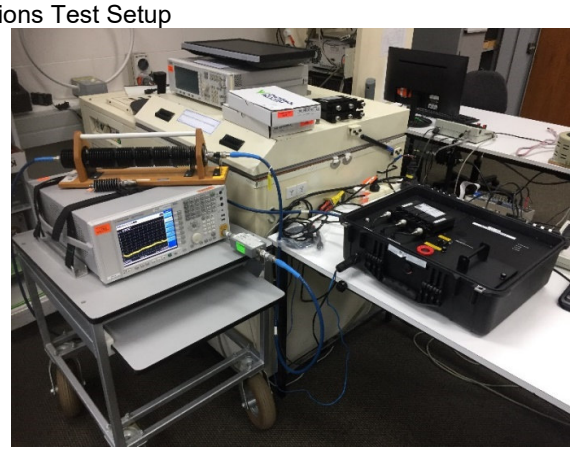
Example of attenuation correction: (dB)

E5023 30dB 350W CK9178	32.21		
E5015 3m Blue	0.86		
E5028 1m5 Blue	0.37		
E3785 550_885MHz HPBRF	45.69		
Total Attenuation @ 851.025 MHz		79.13	Sum of component attenuation (a)
Amplitude offset		44.36	(b)
Correction @ 851.025 MHz		34.77	(a-b)

MEASUREMENT UNCERTAINTY: ≤12.75 GHz ± 3.0 dB

MEASUREMENT RESULTS:
See the tables and plots on the following pages for 12.5 kHz channel spacing.

Photo: Conducted Emissions Test Setup



Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC CFR 2.1051 RSS-119 5.8

12.5 kHz Channel Spacing 851.025 MHz @ 15 W Emission Mask D

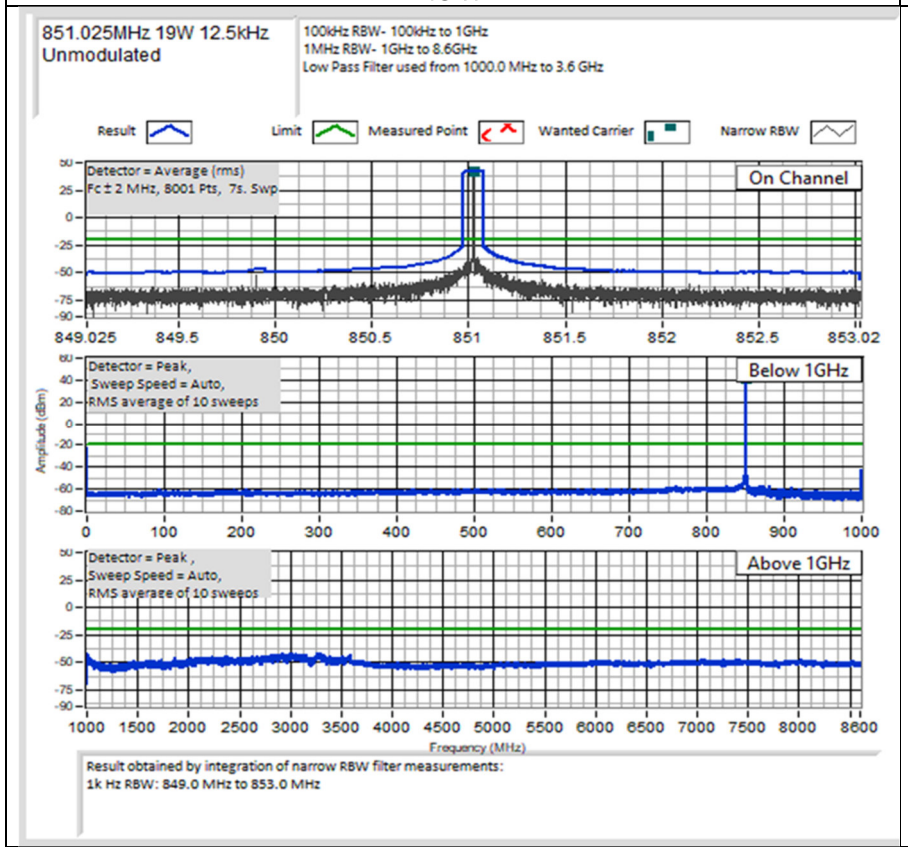
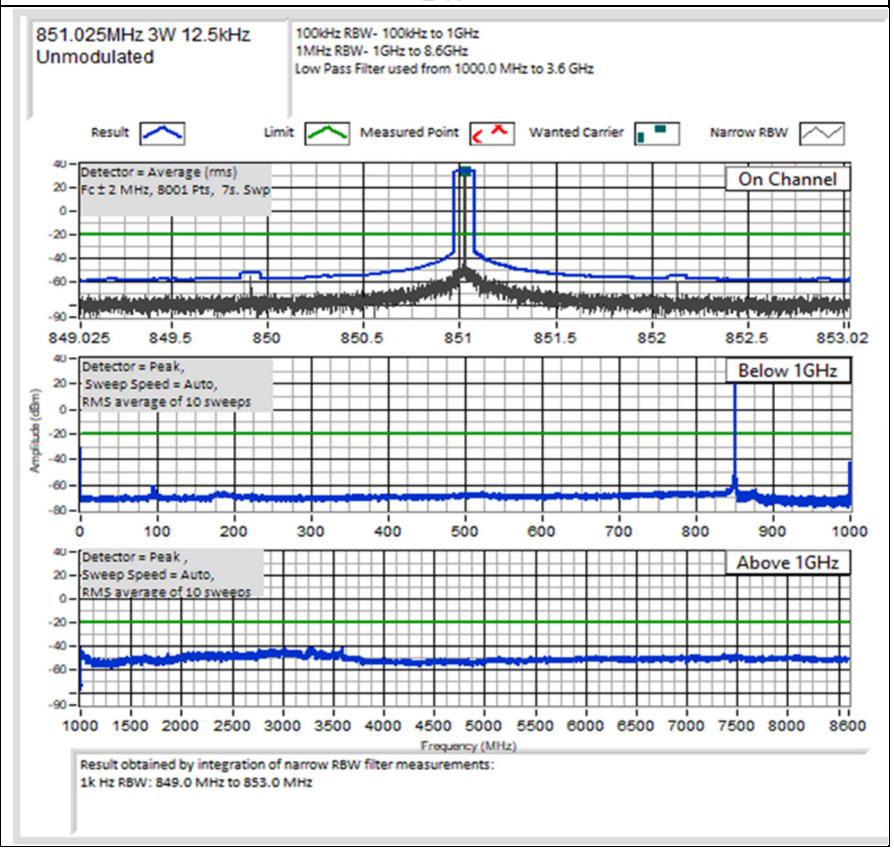
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

12.5 kHz Channel Spacing 851.025 MHz @ 2 W Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
No emissions were detected at a level greater than 20 dB below the limit.		

Spurious Emissions (Tx Conducted)

851.025 MHz, 9 kHz to 8.6 GHz scan

15 W	2 W
	

851.025MHz 3W 12.5kHz
Unmodulated
100kHz RBW- 100kHz to 1GHz
1MHz RBW- 1GHz to 8.6GHz
Low Pass Filter used from 1000.0 MHz to 3.6 GHz
Result
Limit
Measured Point
Wanted Carrier
Narrow RBW
Detector = Average (rms)
Fc ± 2 MHz, 8001 Pts, 7s. Swp
On Channel
Detector = Peak,
Sweep Speed = Auto,
RMS average of 10 sweeps
Below 1GHz
Detector = Peak ,
Sweep Speed = Auto,
RMS average of 10 sweeps
Above 1GHz
Amplitude (dBm)
Frequency (MHz)
Result obtained by integration of narrow RBW filter measurements:
1k Hz RBW: 849.0 MHz to 853.0 MHz

Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC CFR 2.1051 RSS-119 5.8

12.5 kHz Channel Spacing 860.025 MHz @ 15 W Emission Mask D

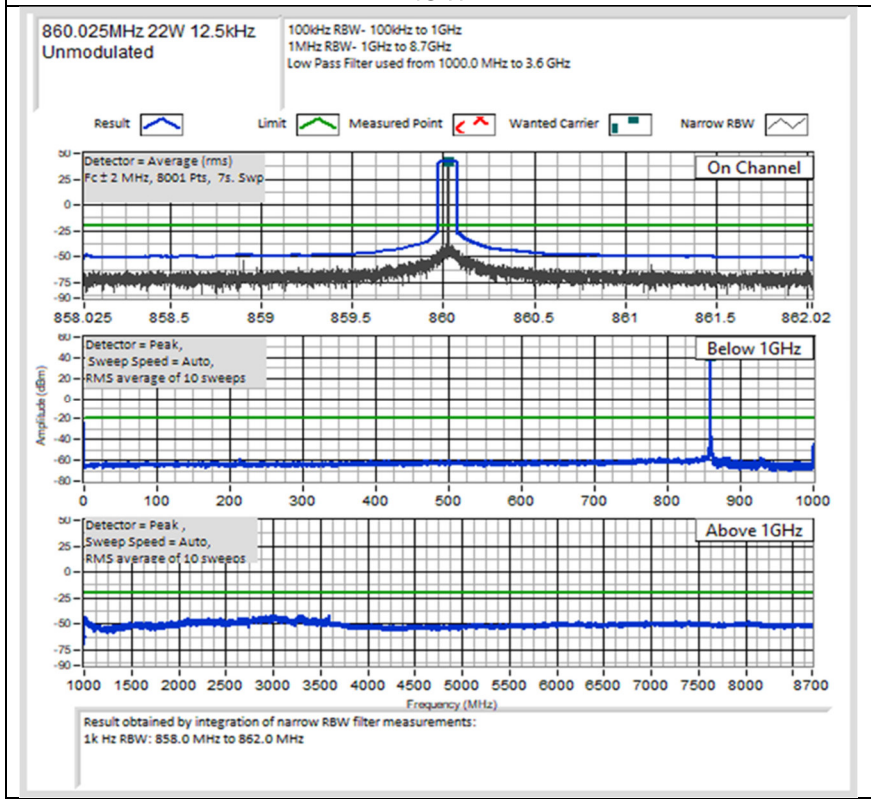
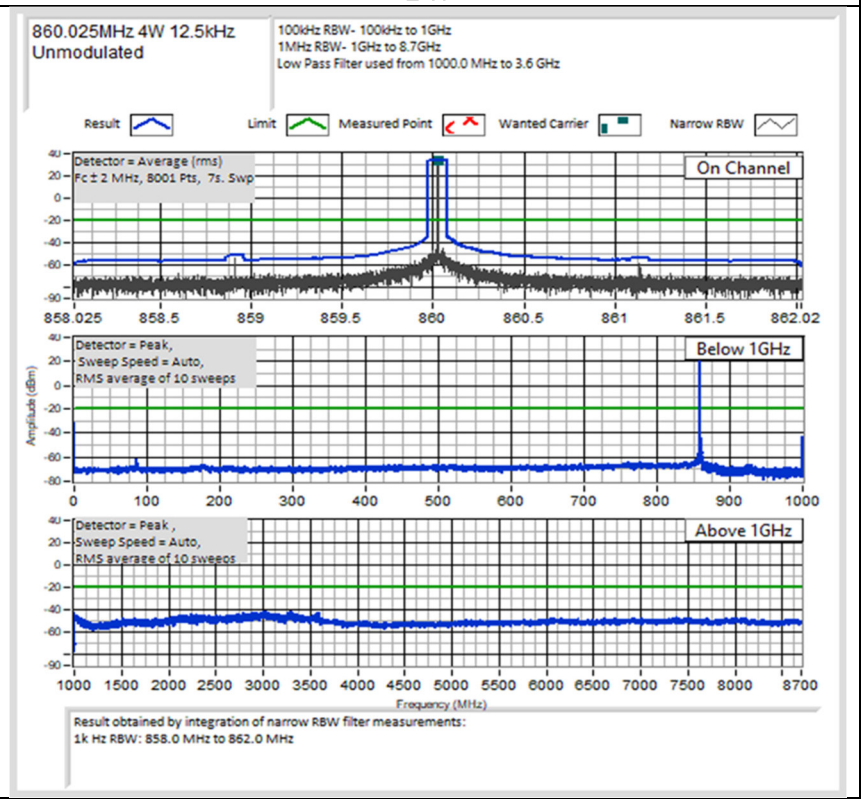
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

12.5 kHz Channel Spacing 860.025 MHz @ 2 W Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
No emissions were detected at a level greater than 20 dB below the limit.		

Spurious Emissions (Tx Conducted)

860.025 MHz, 9 kHz to 8.6 GHz scan

15 W	2 W
	

Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC CFR 2.1051 RSS-119 5.8

12.5 kHz Channel Spacing 868.975 MHz @ 15 W Emission Mask D

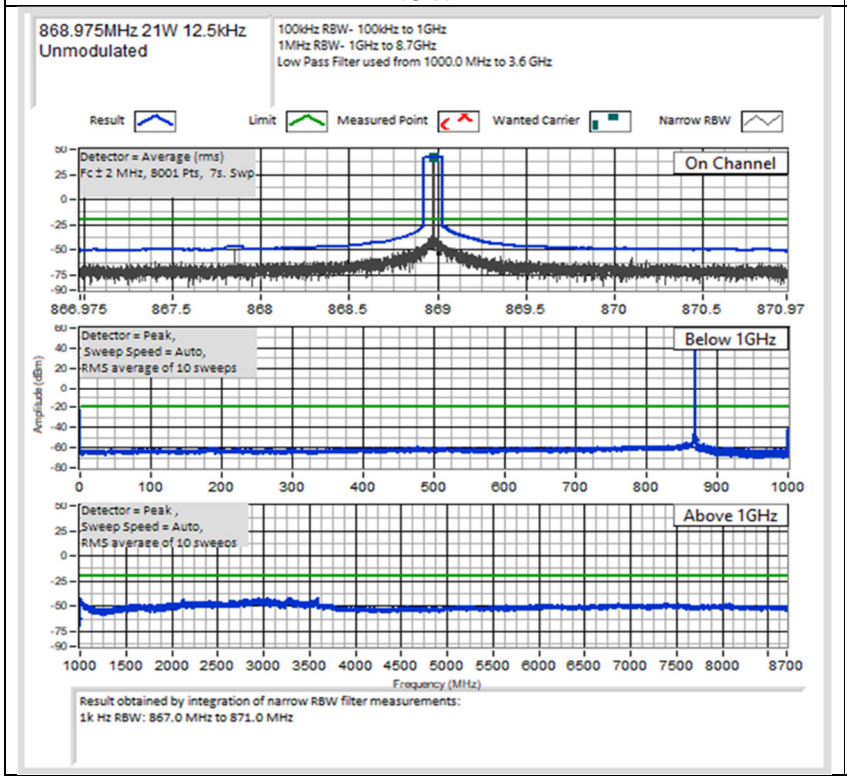
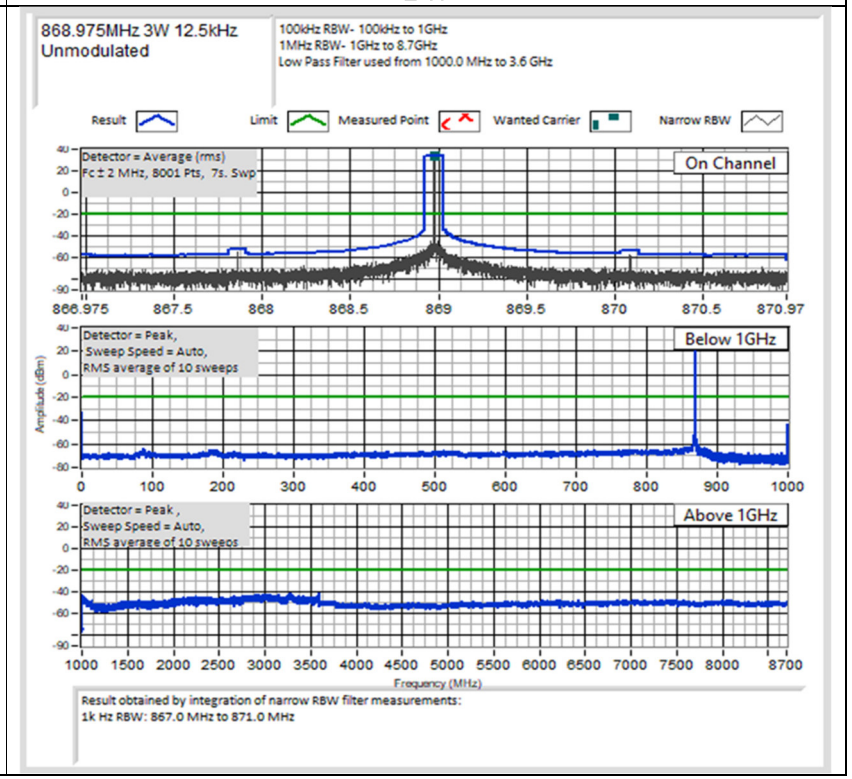
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

12.5 kHz Channel Spacing 868.975 MHz @ 2 W Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
No emissions were detected at a level greater than 20 dB below the limit.		

Spurious Emissions (Tx Conducted)

868.975 MHz, 9 kHz to 8.7 GHz scan

15 W	2 W
	

868.975MHz 3W 12.5kHz
Unmodulated
100kHz RBW- 100kHz to 1GHz
1MHz RBW- 1GHz to 8.7GHz
Low Pass Filter used from 1000.0 MHz to 3.6 GHz
Result
Limit
Measured Point
Wanted Carrier
Narrow RBW
Detector = Average (rms)
Fc ± 2 MHz, 8001 Pts, 7s. Swp
On Channel
Detector = Peak,
Sweep Speed = Auto,
RMS average of 10 sweeps
Below 1GHz
Detector = Peak ,
Sweep Speed = Auto,
RMS average of 10 sweeps
Above 1GHz
Amplitude (dBm)
Frequency (MHz)
Result obtained by integration of narrow RBW filter measurements:
1k Hz RBW: 867.0 MHz to 871.0 MHz

Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC CFR 2.1051 RSS-119 5.8

LIMITS: FCC 47 CFR 90.210 RSS-119 5.8

Carrier Output Power	Emission Mask D 12.5 kHz Channel Spacing $50 + 10 \text{ Log}_{10} (P_{Watts})$	
15 W	-20 dBm	- 61.76 dBc
2 W	-20 dBm	-53 dBc

TRANSMITTER SPURIOUS EMISSIONS (RADIATED)

SPECIFICATION: FCC 47 CFR 2.1053

GUIDE: TIA-603-E 2.2.12

MEASUREMENT PROCEDURE:
Initial Scan:
1. The EUT is placed in the S-Line TEM cell and emissions are measured from 30 MHz to 800 MHz. Any emission within 20 dB of the limit is then re-tested on the OATS.
2. The EUT is placed in the reverberation chamber and emissions are measured from 800 MHz to the upper frequency required (10 x Fc). Any emission within 20 dB of the limit is then re-tested on the OATS.
3. The harmonics emissions up to the 6th harmonic of the fundamental frequency are measured on the OATS

OATS Measurement:
1. The EUT is placed on a wooden turntable at a distance of three metres from the test antenna. The output terminal is connected to an RF dummy load.
2. The test antenna is varied from 1 m to 4 m to obtain a maximum reading and the turntable is rotated through 360° to obtain the maximum response of each spurious emission. Valid emissions are determined by switching the EUT on and off.
3. The EUT is then replaced by a signal generator and substitution antenna to make measurements by the substitution method.

MEASUREMENT UNCERTAINTY: ≤12.75 GHz ± 4.6 dB

MEASUREMENT RESULTS:
See the tables on the following pages

Spurious Emissions (Tx Radiated)

SPECIFICATION: FCC CFR 2.1053

12.5 kHz Channel Spacing 851.025 MHz @ 15 W Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

12.5 kHz Channel Spacing 851.025 MHz @ 2 W Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
No emissions were detected at a level greater than 20 dB below the limit.		

12.5 kHz Channel Spacing 860.025 MHz @ 15 W Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

12.5 kHz Channel Spacing 860.025 MHz @ 2 W Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
No emissions were detected at a level greater than 20 dB below the limit.		

12.5 kHz Channel Spacing 868.975 MHz @ 15 W Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

12.5 kHz Channel Spacing 868.975 MHz @ 2 W Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
No emissions were detected at a level greater than 20 dB below the limit.		

Spurious Emissions (Tx Radiated)

SPECIFICATION: FCC CFR 2.1053

LIMITS: FCC CFR 2.1053

Carrier Output Power	Emission Mask D 12.5 kHz Channel Spacing $50 + 10 \text{ Log}_{10} (P_{Watts})$	
15 W	-20 dBm	- 61.76dBc
2 W	-20 dBm	-53.01 dBc