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## Wireless test report – 365560-2TRFWL

Applicant:

**DAMM Cellular Systems A/S**

Product type:

**150 MHz band cellular base station**

Model:

**10520111**

FCC ID:

**Z5W-10520111**

IC Registration number:

**10159A-10520111**

Specifications:

- ◆ **FCC Part 90, Subpart I**  
Private land mobile radio services
- ◆ **FCC Part 22, Subpart E**  
Public mobile services, Paging and Radiotelephone Service
- ◆ **FCC Part 74, Subpart D**  
Experimental radio, auxiliary, special broadcast and other program distributional services  
Remote pickup broadcast stations
- ◆ **RSS-119 Issue 12, May 2015**  
Land Mobile and Fixed Equipment Operating in the Frequency Range 27.41–960 MHz

Date of issue: February 27, 2020

**Yong Huang, Wireless/EMC Specialist**

Tested by

Signature

**Kevin Rose, Wireless/EMC Specialist**

Tested by

Signature

**Tom Tidwell, Director Nemko Direct for Telecom**

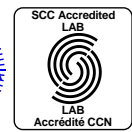
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Signature

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FCC 90 M and RSS-137.docx; Date: May 2014



#### Test location

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Site number:	FCC: CA2041; ISED: 2040G-5 (3 m SAC)

#### Limits of responsibility

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Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

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## Section 1. Report summary

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### 1.1 Applicant/Manufacturer

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Company name:	DAMM Cellular Systems A/S
Address:	Møllegade 68, 6400 Sønderborg, Denmark

### 1.2 Test specifications

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FCC Part 90, Subpart I	Private land mobile radio services
FCC Part 74, Subpart D	Experimental radio, auxiliary, special broadcast and other program distributional services Remote pickup broadcast stations
FCC Part 22, Subpart E	Public mobile services, Paging and Radiotelephone Service
RSS-119 Issue 12, May 2015	Land Mobile and Fixed Equipment Operating in the Frequency Range 27.41-960 MHz

### 1.3 Test methods

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ANSI C63.26-2015	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
FCC Part 2	Frequency Allocations and Radio Treaty Matters; General Rules and Regulations

### 1.4 Statement of compliance

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In the configuration tested, the EUT was found compliant.

Testing was completed against all relevant requirements of the test standard. Results obtained indicate that the product under test complies in full with the requirements tested. The test results relate only to the items tested.

See "Summary of test results" for full details.

### 1.5 Exclusions

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None

### 1.6 Test report revision history

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Revision #	Details of changes made to test report
TRF	Original report issued

## Section 2. Summary of test results

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### 2.1 FCC– Intentional Radiators, test results

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Clause	Test description	Verdict
\$90.205, \$74.461, \$22.565, \$2.1046	Transmitter output power	Pass
\$2.1047	Modulation characteristics	Pass
\$74.462, \$2.1049	Occupied Bandwidth	Pass
\$90.210, \$74.462, \$22.359, \$2.1051	Emission masks and spurious emissions	Pass
\$90.213, \$74.464, \$22.355, \$2.1055	Frequency stability	Pass
\$90.214	Transient frequency behavior	Pass

### 2.2 RSS-119 Issue 12– Intentional Radiators, test results

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Part	Test description	Verdict
5.3	Transmitter Frequency Stability	Pass
5.4	Transmitter Output Power	Pass
5.5	Channel Bandwidth, Authorized Bandwidth, Occupied Bandwidth and Spectrum Masks	Pass
5.8	Transmitter Unwanted Emissions	Pass
5.9	Transient frequency behavior	Pass

## Section 3. Equipment under test (EUT) details

### 3.1 EUT information

Product type	150 MHz band cellular base station
Model	10520111
Serial number	20029265 (low channel) 20025865 (mid channel) 20029266 (high channel)

### 3.2 Technical information

Operating frequencies	150.8–173.4 MHz (USA) 148–174 MHz (Canada)
Channel bandwidths	DMR 2 Slot TDMA data: 15 kHz Analogue Voice: 7.5 kHz, 15 kHz, 30 kHz 0.20TETRA 4 Slot TDMA: 30 kHz 0.35TETRA 4 Slot TDMA: 30 kHz
Modulation type	FM modulation
Emission designator	DMR 2 Slot TDMA data, 7K60FXW 16K0F3E, 11K0F3E, 6K00F3E 0.20TETRA 4 Slot TDMA, ETS 300 392, 20K0D1W
Power requirements	–48 V <sub>DC</sub>
Antenna information	External Antenna with N connector. Antenna type preferred is Omnidirectional with 5.2 dBi max, gain and an electrical down tilt of 6 degrees. Various types can be used.
Firmware/Software version	8.00 2019-05-17

### 3.3 Product description and theory of operation

Outdoor base station featuring multiple technologies in one single core-connected system: TETRA, DMR Tier III and Analog.

During test EUT was set to continuous transmit mode with test software OM, controlled with command provided by client.

Each BS422 can operate up to four different carriers simultaneously, independent of the selected radio technology, inside a defined band. The different carriers may operate in different bandwidths depending of the selected technology.

## Section 4. Engineering considerations

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### 4.1 Modifications incorporated in the EUT

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The following modifications were performed by client: During conducted spurious emissions tests, to reduce harmonic products emissions, the commands below had been applied in test software:

90/FACTORYUNLOCK

93/PA/VOLT/20.0/50.0

### 4.2 Technical judgment

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None

### 4.3 Deviations from laboratory tests procedures

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The following deviations were made: As per customer, EUT can be supplied by battery, the switch on voltage is between 45–47 V, and the switch off voltage is between 40–42 V. The maximum supply voltage is 59.9 V. Hence frequency stability was tested for input voltage –48 Vdc (STV), range from –55.2 Vdc (this is 115%STV) to –42 Vdc (this is 87.5%STV rather than 85%).

## Section 5. Test equipment

### 5.1 Test equipment list

*Table 5.1-1: Equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
3 m EMI test chamber	TDK	SAC-3	FA002532	2 year	January 10, 2021
Flush mount turntable	Sunol	FM2022	FA002550	—	NCR
Controller	Sunol	SC104V	FA002551	—	NCR
Antenna mast	Sunol	TLT2	FA002552	—	NCR
DC Power Supply	Sorensen	SGA80X125C-AAA	FA002738	—	NCR
Receiver/spectrum analyzer	Rohde & Schwarz	ESU 40	FA002071	1 year	December 9, 2020
DFS and Adaptivity system	Aeroflex	PXI 30xx	FA002628	1 year	August 26, 2019
Bilog antenna (20–2000 MHz)	Sunol	JB1	FA002517	1 year	January 3, 2020
Horn antenna (1–18 GHz)	EMCO	3115	FA001451	1 year	April 12, 2020
50 Ω coax cable	C.C.A.	None	FA002603	1 year	February 5, 2020
50 Ω coax cable	C.C.A.	None	FA002605	—	VOU
50 Ω coax cable	C.C.A.	None	FA002831	—	VOU
Tunable notch filter	K&L	3TNF-100/200-N/N	FA001666	—	VOU
Environmental Chamber	Espec	EPX-4H	FA002736	1 year	May 28, 2020
Spectrum analyzer	Rohde & Schwarz	FSV 40	FA002731	1 year	September 17, 2020
Power sensor	Rohde & Schwarz	NRP18S	FA002730	1 year	September 25, 2020

Note: NCR - no calibration required



## Section 6. Testing data

### 6.1 Transmitter power

#### 6.1.1 Definitions and limits

##### FCC Part 90, Subpart I §90.205

(d) 150-174 MHz. (1) The maximum allowable station ERP is dependent upon the station's antenna HAAT and required service area and will be authorized in accordance with table 1. Applicants requesting an ERP in excess of that listed in table 1 must submit an engineering analysis based upon generally accepted engineering practices and standards that includes coverage contours to demonstrate that the requested station parameters will not produce coverage in excess of that which the applicant requires.

(2) Applications for stations where special circumstances exist that make it necessary to deviate from the ERP and antenna heights in Table 1 will be submitted to the frequency coordinator accompanied by a technical analysis, based upon generally accepted engineering practices and standards, that demonstrates that the requested station parameters will not produce a signal strength in excess of 37 dBu at any point along the edge of the requested service area. The coordinator may then recommend any ERP appropriate to meet this condition.

(3) An applicant for a station with a service area radius greater than 40 km (25 mi) must justify the requested service area radius, which will be authorized only in accordance with table 1, note 4. For base stations with service areas greater than 80 km, all operations 80 km or less from the base station will be on a primary basis and all operations outside of 80 km from the base station will be on a secondary basis and will be entitled to no protection from primary operations.

**Table 1—150-174 MHz—Maximum ERP/Reference HAAT for a Specific Service Area Radius**

	Service area radius (km)									
	3	8	13	16	24	32	40	484	64 <sup>4</sup>	80 <sup>4</sup>
Maximum ERP (w) <sup>1</sup>	1	28	178	<sup>2</sup> 500	<sup>2</sup> 500	<sup>2</sup> 500	500	<sup>2</sup> 500	<sup>2</sup> 500	<sup>2</sup> 500
Up to reference HAAT (m) <sup>3</sup>	15	15	15	15	33	65	110	160	380	670

<sup>1</sup>Maximum ERP indicated provides for a 37 dBu signal strength at the edge of the service area per FCC Report R-6602, Fig. 19 (See §73.699, Fig. 10).

<sup>2</sup>Maximum ERP of 500 watts allowed. Signal strength at the service area contour may be less than 37 dBu.

<sup>3</sup>When the actual antenna HAAT is greater than the reference HAAT, the allowable ERP will be reduced in accordance with the following equation:  
 $ERP_{allow} = ERP_{max} \times (HAAT_{ref} / HAAT_{actual})^2$ .

<sup>4</sup>Applications for this service area radius may be granted upon specific request with justification and must include a technical demonstration that the signal strength at the edge of the service area does not exceed 37 dBu.

##### FCC Part 74, §74.461 Transmitting power limits.

(a) Transmitter power is the power at the transmitter output terminals and delivered to the antenna, antenna transmission line, or any other impedance-matched, radio frequency load. For the purpose of this Subpart, the transmitter power is the carrier power.

(b) The authorized transmitter power for a remote pickup broadcast station shall be limited to that necessary for satisfactory service and, in any event, shall not be greater than 100 watts, except that a station to be operated aboard an aircraft shall normally be limited to a maximum authorized power of 15 watts. Specific authorization to operate stations on board aircraft with an output power exceeding 15 watts will be issued only upon an adequate engineering showing of need, and of the procedures that will be taken to avoid harmful interference to other licensees.

##### FCC Part 22, §22.565 Transmitting power limits.

The transmitting power of base, mobile and fixed transmitters operating on the channels listed in §22.561 must not exceed the limits in this section.

(a) *Maximum ERP.* The effective radiated power (ERP) of base and fixed transmitters must not exceed the applicable limits in this paragraph under any circumstances.

Frequency range (MHz)	Maximum ERP (watts)
152-153	1400
157-159	150
454-455	3500
459-460	150

(b) Basic power limit. Except as provided in paragraph (d) of this section, the ERP of base transmitters must not exceed 500 Watts.

**RSS-119, Issue 12**

**5.4 Transmitter Output Power**

The output power shall be within  $\pm 1$  dB of the manufacturer's rated power listed in the equipment specifications.

The transmitter output power limits set forth in Table 2 will come into force upon the publication of Issue 12 of this standard and will apply to newly certified equipment.

Table 2 — Transmitter Output Power		
Frequency Bands (MHz)	Transmitter Output Power (W)	
	Base/Fixed Equipment	Mobile Equipment
138-174	110	60

**6.1.2 Test summary**

Test start date:	June 14, 2019
Test engineer:	Yong Huang

**6.1.3 Observations settings and special notes**

Two Samples were provided by client.  
Sample 1 Tx was configured on low band  
Sample 2 Tx was configured on high band  
Client specified max rated power 50 W and 25 W (for some modulations).  
Tests were performed with power meter.

#### 6.1.4 Test data

**Table 6.1-1: Transmitter power results**

Freq. (MHz)	Modulation	Rated Output Power, W	Conducted Output Power, dBm	Limit, dB	Margin, dB
150.9	7K60FXW	50	47.4	±1	0.6
150.9	16K0F3E	50	47.4	±1	0.6
150.9	0.20TETRA	25	44.5	±1	0.5
163.5	7K60FXW	50	47.1	±1	0.9
163.5	16K0F3E	50	47.1	±1	0.9
163.5	0.20TETRA	25	44.2	±1	0.8
173.3	7K60FXW	50	47.3	±1	0.7
173.3	16K0F3E	50	47.3	±1	0.7
173.3	0.20TETRA	25	44.3	±1	0.7

**Table 6.1-2: Transmitter ERP results**

Freq. (MHz)	Modulation	Conducted Output Power, dBm	Antenna Max Peak Gain, dBd	ERP, dBm
150.9	7K60FXW	47.4	3.05	50.45
150.9	16K0F3E	47.4	3.05	50.45
150.9	0.20TETRA	44.5	3.05	47.55
163.5	7K60FXW	47.1	3.05	50.15
163.5	16K0F3E	47.1	3.05	50.15
163.5	0.20TETRA	44.2	3.05	47.25
173.3	7K60FXW	47.3	3.05	50.35
173.3	16K0F3E	47.3	3.05	50.35
173.3	0.20TETRA	44.3	3.05	47.35

Notes: The output power shall be within ±1 dB of the manufacturer's rated power  
 $ERP = P + GT - LC$   
P = conducted output power, in dBm  
GT = gain of Tx antenna, in dBd (ERP)  
LC = signal loss in the cable connecting EUT and Tx antenna, in dB  
dBd = dBi - 2.15, ERP = EIRP - 2.15, EIRP = ERP + 2.15

## 6.2 FCC 2.1047 Modulation characteristic

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### 6.2.1 Definitions and limits

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FCC §2.1047 Measurements required: Modulation characteristics.

(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

### 6.2.2 Test summary

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Test date	July 11, 2019
Test engineer	Kevin Rose and Yong Huang

### 6.2.3 Observations, settings and special notes

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Receiver setting:

Detector mode	Peak
Demod bandwidth	25 kHz
Trace mode	Max Hold

6.2.4 Test data

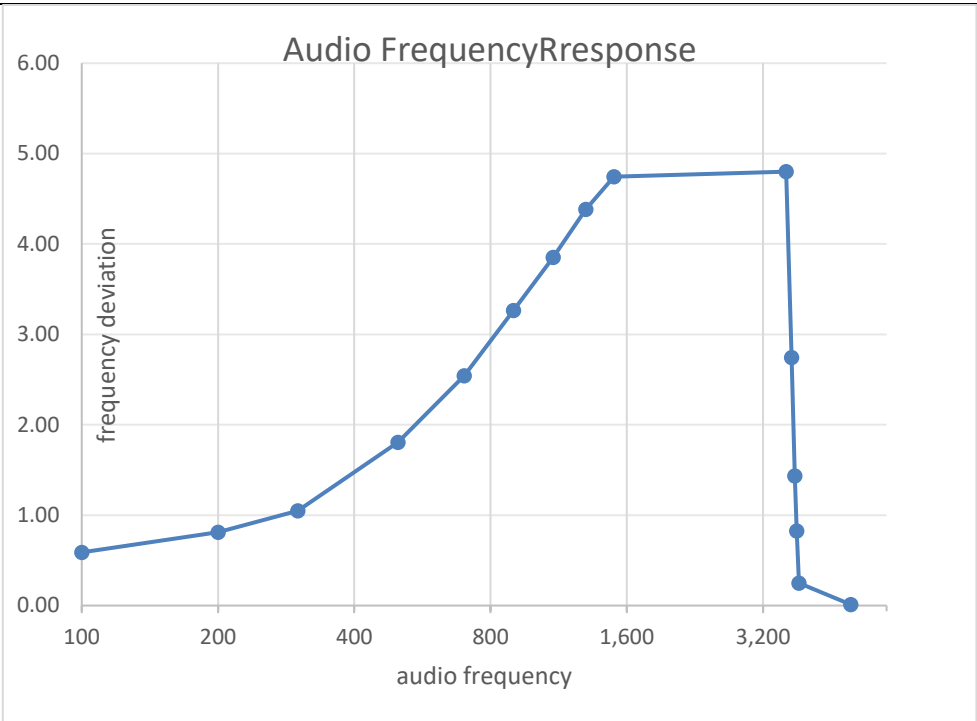


Figure 6.2-1: Audio Frequency Response

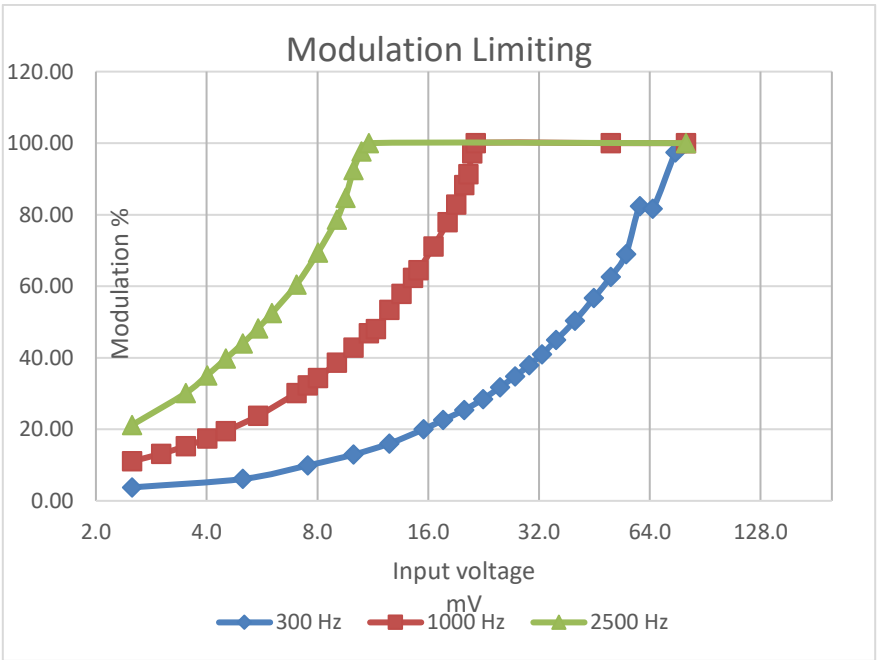


Figure 6.2-2: Modulation Limiting

## 6.3 FCC 74.462 and RSS-119 5.5 Occupied bandwidth

### 6.3.1 Definitions and limits

#### FCC §74.462 Authorized bandwidth and emissions.

(a) Each authorization for a new remote pickup broadcast station or system shall require the use of certificated equipment and such equipment shall be operated in accordance with emission specifications included in the grant of certification and as prescribed in paragraphs (b), (c), and (d) of this section.

(b) The maximum authorized bandwidth of emissions corresponding to the types of emissions specified below, and the maximum authorized frequency deviation in the case of frequency or phase modulated emission, shall be as follows:

Frequencies (MHz)	Authorized bandwidth (kHz)	Maximum frequency deviation <sup>1</sup> (kHz)	Type of emission <sup>2</sup>
25.87 to 26.03	40	10	Frequencies 25.87 to 153.3575 MHz: A3E, F1E, F3E, F9E.
26.07 to 26.47	20	5	
152.8625 to 153.3575 <sup>3</sup>	30/60	5/10	
160.860 to 161.400	60	10	
161.625 to 161.775	30	5	
166.25 and 170.15 <sup>4</sup>	12.5/25	5	

<sup>1</sup>Applies where F1A, F1B, F1D, F1E, F2A, F2B, F2D, F2E, F3E, or F9E emissions are used.

<sup>2</sup>Stations operating above 450 MHz shall show a need for employing A1A, A1B, A1D, A1E, A2A, A2B, A2D, A2E, F1A, F1B, F1D, F1E, F2A, F2B, F2D, or F2E emission.

<sup>3</sup>New or modified licenses for use of the frequencies will not be granted to utilize transmitters on board aircraft, or to use a bandwidth in excess of 30 kHz and maximum deviation exceeding 5 kHz

<sup>4</sup>For stations licensed or applied for before April 16, 2003, the sum of the bandwidth of emission and tolerance on frequencies 166.25 MHz or 170.15 MHz shall not exceed 25 kHz, and such operation may continue until January 1, 2005. For new stations licensed or applied for on or after April 16, 2003, the sum of the bandwidth of emission and tolerance on these frequencies shall not exceed 12.5 kHz. For all remote pickup broadcast stations, the sum of the bandwidth of emission and tolerance on these frequencies shall not exceed 12.5 kHz on or after January 1, 2005.

(c) For emissions on frequencies above 25 MHz with authorized bandwidths up to 30 kHz, the emissions shall comply with the emission mask and transient frequency behavior requirements of §§90.210 and 90.214 of this chapter. For all other emissions, the mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:

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

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

(3) On any frequency removed from the assigned frequency by more than 250 percent on the authorized bandwidth; at least 43 plus 10 log<sub>10</sub> (mean output power, in watts) dB.

(d) In the event a station's emissions outside its authorized channel cause harmful interference, the Commission may, at its discretion, require the licensee to take such further steps as may be necessary to eliminate the interference.

Note: The measurements of emission power can be expressed in peak or mean values provided they are expressed in the same parameters as the unmodulated transmitter carrier power.

## RSS-119

### 5.5 Channel Bandwidth, Authorized Bandwidth, Occupied Bandwidth and Spectrum Masks

For the purpose of this document, channel bandwidth is the channel width in which the equipment is designed to operate.

The maximum permissible occupied bandwidth shall not exceed the authorized bandwidth specified in Table 3 for the equipment's frequency band. The authorized bandwidth is defined as the maximum width of the band of frequencies used to derive spectrum masks and is not necessarily equivalent to the bandwidth found on radio and spectrum licences.

The channel bandwidths, authorized bandwidths and spectrum masks are given in Table 3 for equipment having an output power greater than 120 mW. For equipment with an output power that does not exceed 120 mW, Section 5.10 applies.

**Table 3 — Channel Bandwidths, Authorized Bandwidths and Spectrum Masks**

Frequency Band (MHz)	Related SRSP for Channelling Plan and ERP	Channel Bandwidth (kHz)	Authorized Bandwidth (kHz)	Spectrum Masks for Equipment with Audio Filter	Spectrum Masks for Equipment Without Audio Filter
138-144, 148-149.9 and 150.05-174	SRSP-500	30	20	B	C
		15	11.25	D	D
		7.5	6	E	E

## 6.3.2 Test summary

Test date	June 7, 2019
Test engineer	Yong Huang

## 6.3.3 Observations, settings and special notes

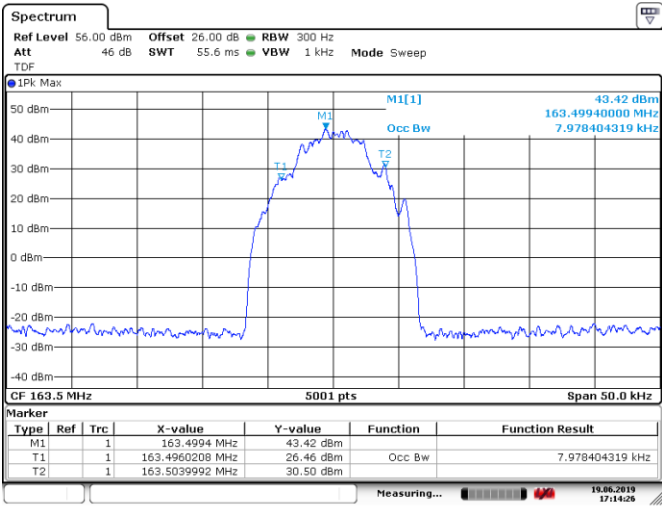
### Spectrum Analyzer setting

Detector mode	Peak
Resolution bandwidth	100 and 300 Hz
Video bandwidth	More than RBW × 3
Trace mode	Max Hold

## 6.3.4 Test data

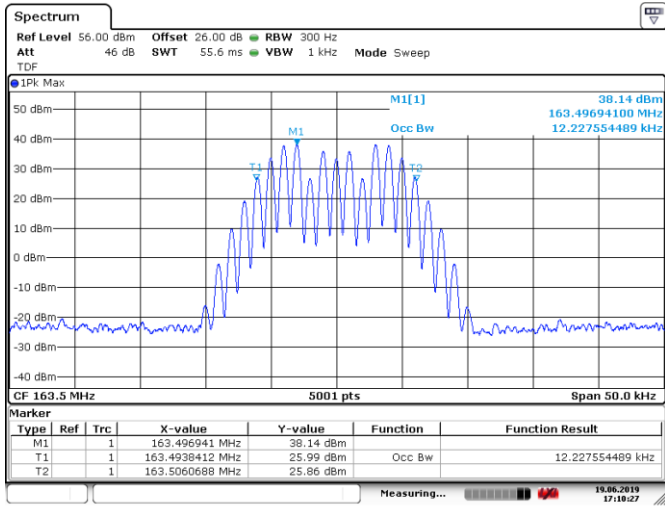
**Table 6.3-1: Occupied Bandwidth test results**

Freq. (MHz)	Modulation	99% Occupied Bandwidth, kHz	Limit, kHz	Margin, kHz
163.5	7K60FXW	7.98	11.25	3.27
163.5	16K0F3E	12.23	20.00	7.77
163.5	11K0F3E	6.60	11.25	4.65
163.5	6K00F3E	4.06	6.00	1.94
163.5	0.20TETRA	19.32	20.00	0.68



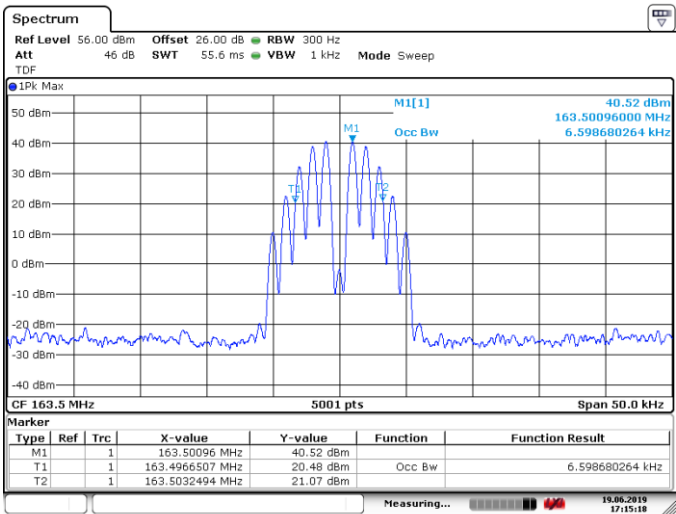
Date: 19 JUN 2019 17:14:26

Figure 6.3-1: Occupied Bandwidth, Tx @mid channel 50 W 7k60FXW modulation



Date: 19 JUN 2019 17:10:27

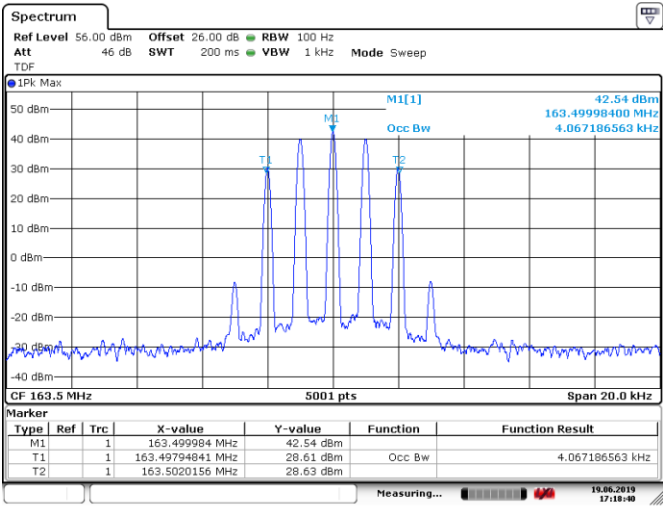
Figure 6.3-2: Occupied Bandwidth, Tx @mid channel 50 W 16k0F3E modulation



Date: 19 JUN 2019 17:15:18

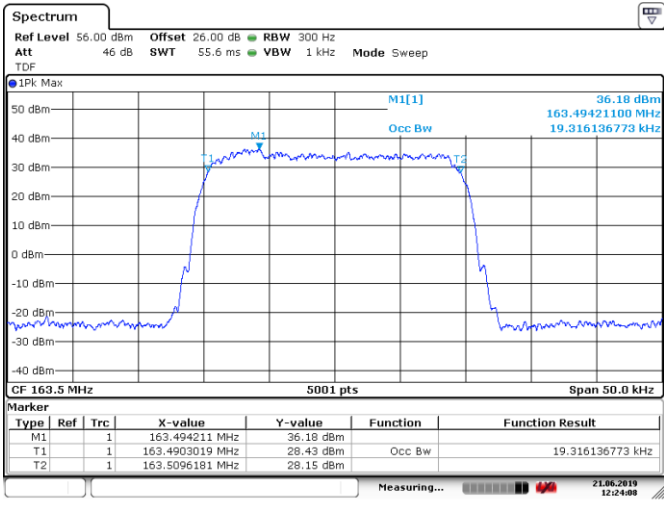
Figure 6.3-3: Occupied Bandwidth, Tx @high channel 50 W 11k0F3E modulation





Date: 19 JUN 2019 17:18:40

Figure 6.3-4: Occupied Bandwidth, Tx @mid channel 50 W 6k00F3E modulation



Date: 21 JUN 2019 12:24:08

Figure 6.3-5: Occupied Bandwidth, Tx @mid channel 25 W o.20TETRA modulation

## 6.4 FCC 90.210, 22.359, 74.462 and RSS-119 5.8 Emission limits, Emission mask

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### 6.4.1 Definitions and limits

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#### FCC §22.359

(a) *Out of band emissions.* The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log (P)$  dB.

#### FCC §90.210

(b) Emission Mask B. For transmitters that are equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:

- (1) On any frequency removed from the assigned frequency by more than 50 percent, but not more than 100 percent of the authorized bandwidth: At least 25 dB.
- (2) On any frequency removed from the assigned frequency by more than 100 percent, but not more than 250 percent of the authorized bandwidth: At least 35 dB.
- (3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least  $43 + 10 \log (P)$  dB.

(d) *Emission Mask D—12.5 kHz channel bandwidth equipment.* For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

- (1) On any frequency from the center of the authorized bandwidth  $f_0$  to 5.625 kHz removed from  $f_0$ : Zero dB.
- (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least  $7.27(f_d - 2.88 \text{ kHz})$  dB.
- (3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 12.5 kHz: At least  $50 + 10 \log (P)$  dB or 70 dB, whichever is the lesser attenuation.
- (4) The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide (usually two or three times the channel bandwidth) to capture the true peak emission of the equipment under test. In order to show compliance with the emission mask up to and including 50 kHz removed from the edge of the authorized bandwidth, adjust the resolution bandwidth to 100 Hz with the measuring instrument in a peak hold mode. A sufficient number of sweeps must be measured to insure that the emission profile is developed. If video filtering is used, its bandwidth must not be less than the instrument resolution bandwidth. For emissions beyond 50 kHz from the edge of the authorized bandwidth, see paragraph (o) of this section. If it can be shown that use of the above instrumentation settings do not accurately represent the true interference potential of the equipment under test, an alternate procedure may be used provided prior Commission approval is obtained.

(e) *Emission Mask E—6.25 kHz or less channel bandwidth equipment.* For transmitters designed to operate with a 6.25 kHz or less bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

- (1) On any frequency from the center of the authorized bandwidth  $f_0$  to 3.0 kHz removed from  $f_0$ : Zero dB.
- (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 3.0 kHz but no more than 4.6 kHz: At least  $30 + 16.67(f_d - 3 \text{ kHz})$  or  $55 + 10 \log (P)$  or 65 dB, whichever is the lesser attenuation.
- (3) On any frequency removed from the center of the authorized bandwidth by more than 4.6 kHz: At least  $55 + 10 \log (P)$  or 65 dB, whichever is the lesser attenuation.
- (4) The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide (usually two or three times the channel bandwidth) to capture the true peak emission of the equipment under test. In order to show compliance with the emission mask up to and including 50 kHz removed from the edge of the authorized bandwidth, adjust the resolution bandwidth to 100 Hz with the measuring instrument in a peak hold mode. A sufficient number of sweeps must be measured to insure that the emission profile is developed. If video filtering is used, its bandwidth must not be less than the instrument resolution bandwidth. For emissions beyond 50 kHz from the edge of the authorized bandwidth, see paragraph (o) of this section. If it can be shown that use of the above instrumentation settings do not accurately represent the true interference potential of the equipment under test, an alternate procedure may be used provided prior Commission approval is obtained.

**FCC §74.462 Authorized bandwidth and emissions.**

(a) Each authorization for a new remote pickup broadcast station or system shall require the use of certificated equipment and such equipment shall be operated in accordance with emission specifications included in the grant of certification and as prescribed in paragraphs (b), (c), and (d) of this section.

(b) The maximum authorized bandwidth of emissions corresponding to the types of emissions specified below, and the maximum authorized frequency deviation in the case of frequency or phase modulated emission, shall be as follows:

Frequencies (MHz)	Authorized bandwidth (kHz)	Maximum frequency deviation <sup>1</sup> (kHz)	Type of emission <sup>2</sup>
25.87 to 26.03	40	10	Frequencies 25.87 to 153.3575 MHz: A3E, F1E, F3E, F9E.
26.07 to 26.47	20	5	
152.8625 to 153.3575 <sup>3</sup>	30/60	5/10	
160.860 to 161.400	60	10	
161.625 to 161.775	30	5	
166.25 and 170.15 <sup>4</sup>	12.5/25	5	

1Applies where F1A, F1B, F1D, F1E, F2A, F2B, F2D, F2E, F3E, or F9E emissions are used.

2Stations operating above 450 MHz shall show a need for employing A1A, A1B, A1D, A1E, A2A, A2B, A2D, A2E, F1A, F1B, F1D, F1E, F2A, F2B, F2D, or F2E emission.

3New or modified licenses for use of the frequencies will not be granted to utilize transmitters on board aircraft, or to use a bandwidth in excess of 30 kHz and maximum deviation exceeding 5 kHz

4For stations licensed or applied for before April 16, 2003, the sum of the bandwidth of emission and tolerance on frequencies 166.25 MHz or 170.15 MHz shall not exceed 25 kHz, and such operation may continue until January 1, 2005. For new stations licensed or applied for on or after April 16, 2003, the sum of the bandwidth of emission and tolerance on these frequencies shall not exceed 12.5 kHz. For all remote pickup broadcast stations, the sum of the bandwidth of emission and tolerance on these frequencies shall not exceed 12.5 kHz on or after January 1, 2005.

(c) For emissions on frequencies above 25 MHz with authorized bandwidths up to 30 kHz, the emissions shall comply with the emission mask and transient frequency behavior requirements of §§90.210 and 90.214 of this chapter. For all other emissions, the mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:

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

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

(3) On any frequency removed from the assigned frequency by more than 250 percent on the authorized bandwidth; at least 43 plus 10 log<sub>10</sub> (mean output power, in watts) dB.

(d) In the event a station's emissions outside its authorized channel cause harmful interference, the Commission may, at its discretion, require the licensee to take such further steps as may be necessary to eliminate the interference.

Note: The measurements of emission power can be expressed in peak or mean values provided they are expressed in the same parameters as the unmodulated transmitter carrier power.

## RSS-119

### 5.5 Channel Bandwidth, Authorized Bandwidth, Occupied Bandwidth and Spectrum Masks

For the purpose of this document, channel bandwidth is the channel width in which the equipment is designed to operate.

The maximum permissible occupied bandwidth shall not exceed the authorized bandwidth specified in Table 3 for the equipment's frequency band. The authorized bandwidth is defined as the maximum width of the band of frequencies used to derive spectrum masks and is not necessarily equivalent to the bandwidth found on radio and spectrum licences.

The channel bandwidths, authorized bandwidths and spectrum masks are given in Table 3 for equipment having an output power greater than 120 mW. For equipment with an output power that does not exceed 120 mW, Section 5.10 applies.

**Table 3 — Channel Bandwidths, Authorized Bandwidths and Spectrum Masks**

Frequency Band (MHz)	Related SRSP for Channelling Plan and ERP	Channel Bandwidth (kHz)	Authorized Bandwidth (kHz)	Spectrum Masks for Equipment with Audio Filter	Spectrum Masks for Equipment Without Audio Filter
138-144, 148-149.9 and 150.05-174	SRSP-500	30	20	B	C
		15	11.25	D	D
		7.5	6	E	E

### 5.8 Transmitter Unwanted Emissions

The spectrum plots of the unwanted emissions shall comply with the masks specified in Table 3.

Descriptions of these permissible emission masks are given in the sections that follow.

The term displacement frequency,  $f_d$ , used in these sections refers to the difference between the channel frequency and the emission component frequency expressed in kilohertz, and  $p$  is the transmitter output power in Watts.

#### 5.8.1 Emission Mask B for Transmitters Equipped with an Audio Low-Pass Filter

The power of any emission shall be attenuated below the transmitter output power  $P$  (dBW) as specified in Table 5.

**Table 5 — Emission Mask B**

Displacement Frequency, $f_d$ (kHz)	Minimum Attenuation (dB)	Resolution Bandwidth (Hz)
$10 < f_d \leq 20$	25	300
$20 < f_d \leq 50$	35	300
$f_d > 50$	$43 + 10 \log_{10}(p)$	Specified in Section 4.2.1

#### 5.8.3 Emission Mask D for Transmitters Equipped with or Without an Audio Low-Pass Filter

The power of any emission shall be attenuated below the transmitter output power  $P$  (dBW) as specified in Table 7.

**Table 7 — Emission Mask D**

Displacement Frequency, $f_d$ (kHz)	Minimum Attenuation (dB)	Resolution Bandwidth (Hz)
$.625 < f_d \leq 12.5$	$7.27(f_d - 2.88)$	Specified in Section 4.2.2
$f_d > 12.5$	Whichever is the lesser: $70$ or $50 + 10 \log_{10}(p)$	Specified in Section 4.2.2

#### 5.8.4 Emission Mask E for Transmitters Equipped with or Without an Audio Low-Pass Filter

The power of any emission shall be attenuated below the transmitter output power  $P$  (dBW) as specified in Table 8.

**Table 8 — Emission Mask E**

Displacement Frequency, $f_d$ (kHz)	Minimum Attenuation (dB)	Resolution Bandwidth (Hz)
$3 < f_d \leq 4.6$	Whichever is the lesser: $30 + 16.67(f_d - 3)$ or $55 + 10 \log_{10}(p)$	Specified in Section 4.2.2
$f_d > 4.6$	Whichever is the lesser: $57$ or $55 + 10 \log_{10}(p)$	Specified in Section 4.2.2

## 6.4.2 Test summary

Test date	June 7, 2019
Test engineer	Yong Huang

### 6.4.3 Observations, settings and special notes

#### Spectrum Analyzer setting

Detector mode	Peak
Resolution bandwidth	100 Hz
Video bandwidth	More than RBW × 3
Trace mode	Max Hold

### 6.4.4 Test data

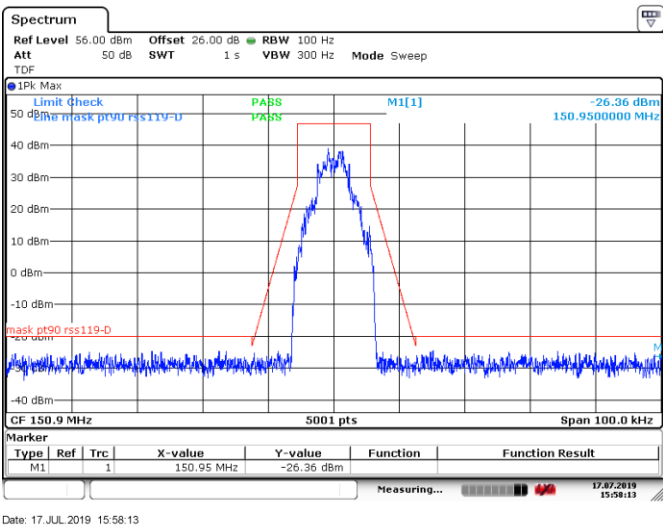


Figure 6.4-1: Mask d, Tx @low channel 50W 7k60FXW modulation

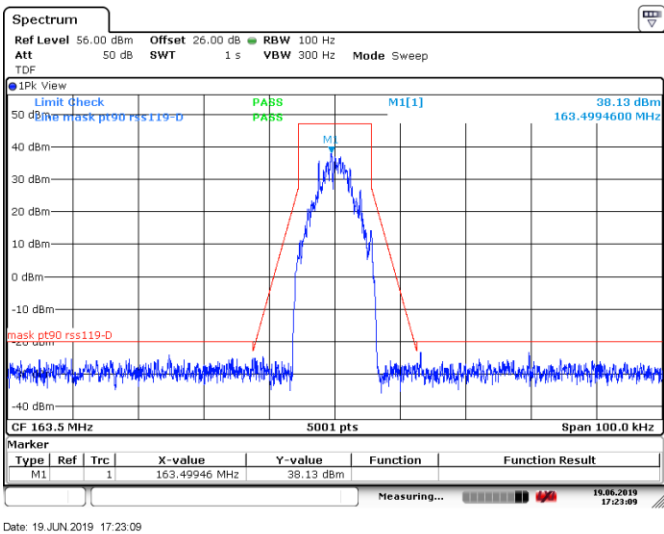


Figure 6.4-2: Mask d, Tx @mid channel 50W 7k60FXW modulation

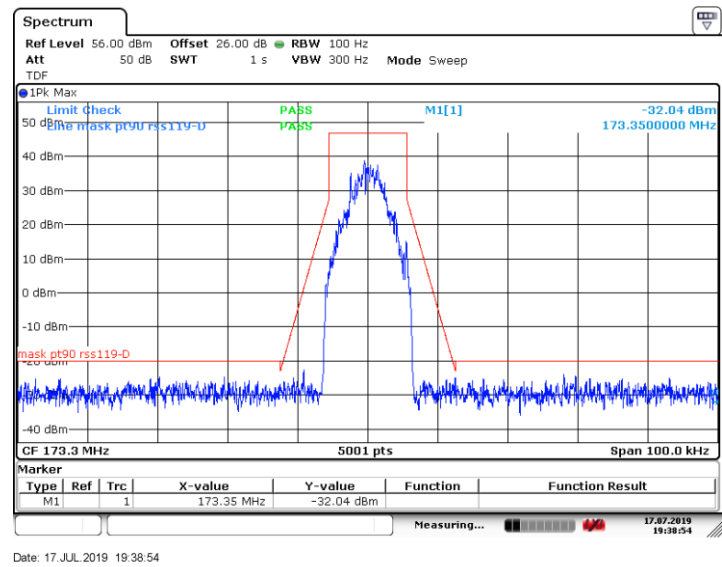


Figure 6.4-3: Mask d, Tx @high channel 50W 7k60FXW modulation

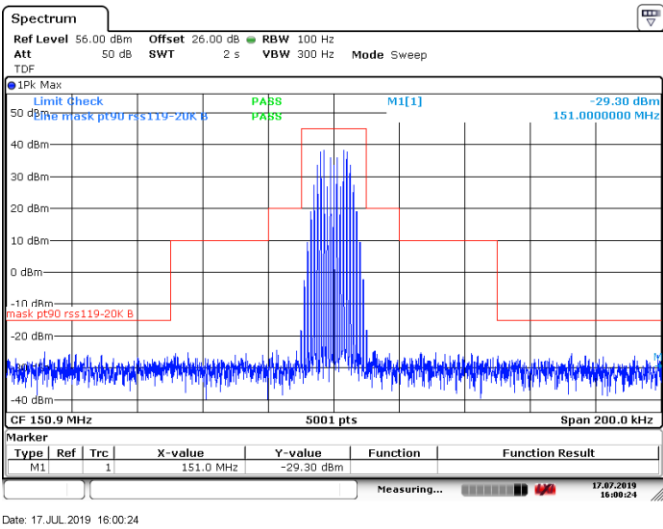


Figure 6.4-4: Mask b, Tx @low channel 50W 16K0F3E modulation

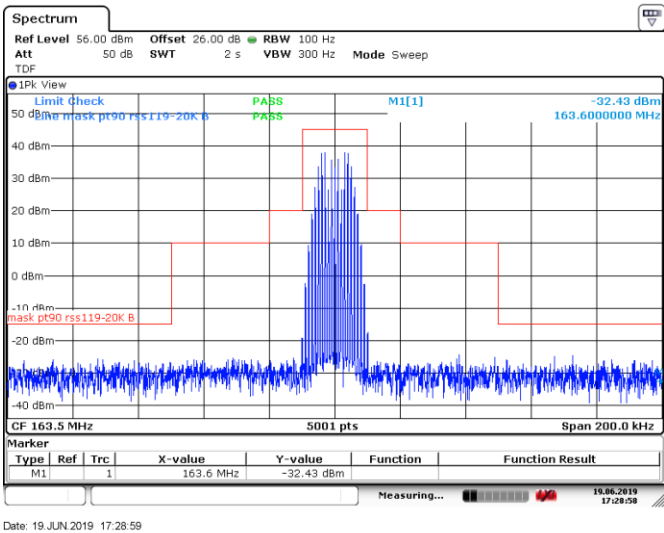


Figure 6.4-5: Mask b, Tx @mid channel 50W 16K0F3E modulation

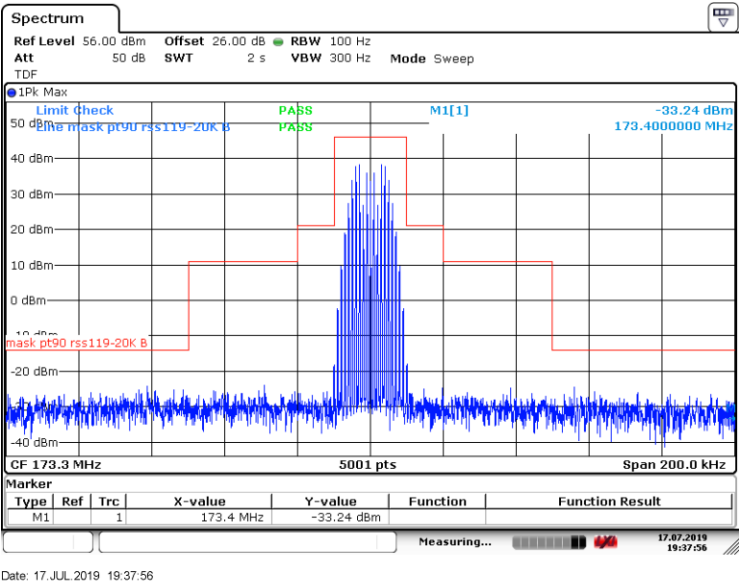


Figure 6.4-6: Mask b, Tx @high channel 50W 16Kof3E modulation

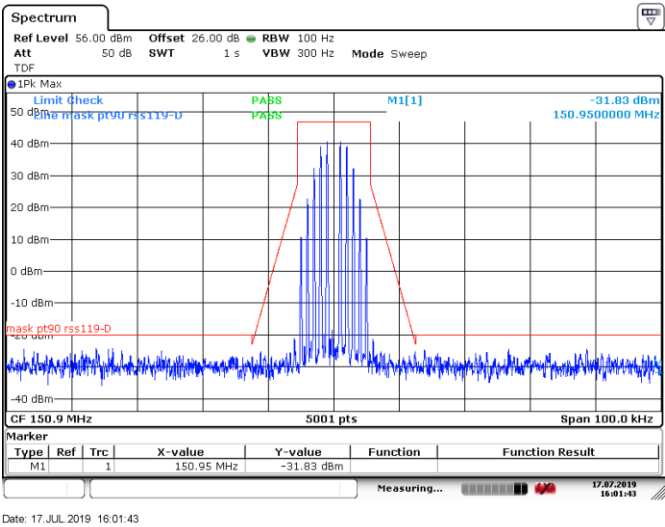


Figure 6.4-7: Mask d, Tx @low channel 50W 11Kof3E modulation

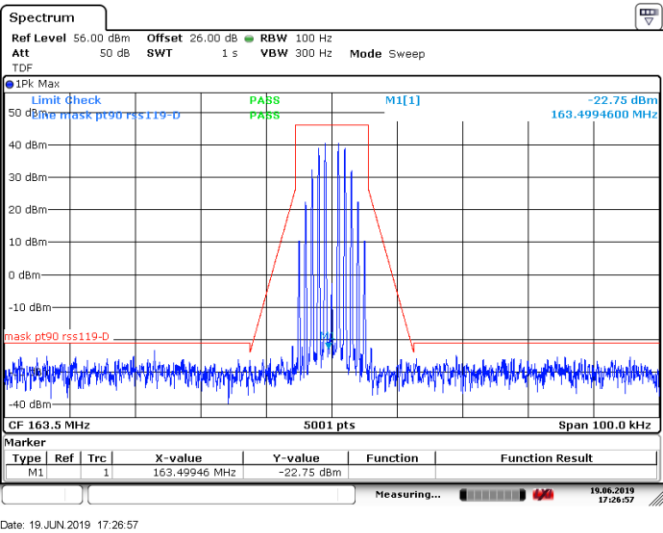


Figure 6.4-8: Mask d, Tx @mid channel 50W 11Kof3E modulation

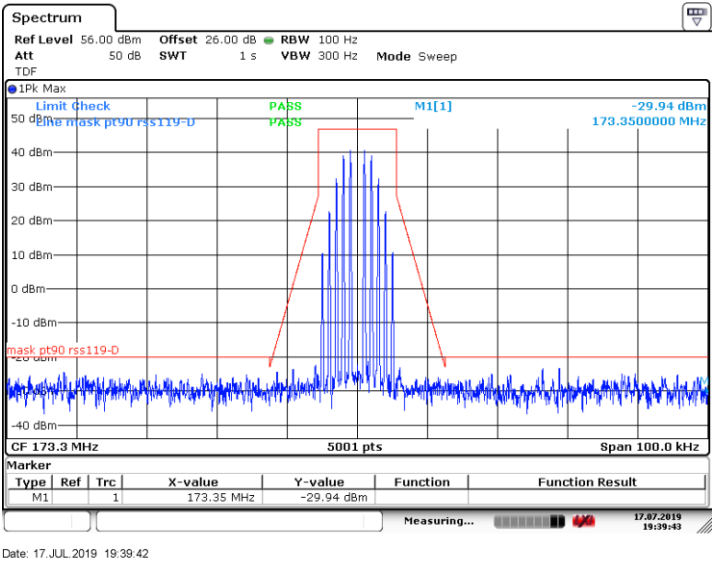


Figure 6.4-9: Mask d, Tx @high channel 50W 11koF3E modulation

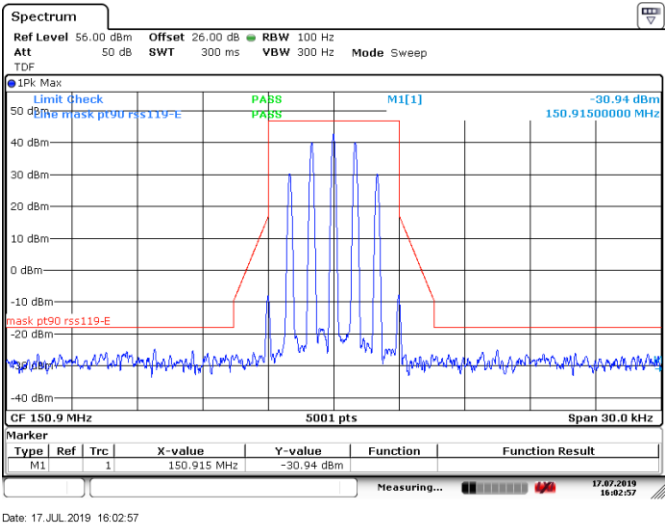


Figure 6.4-10: Mask e, Tx @low channel 50W 6koF3E modulation

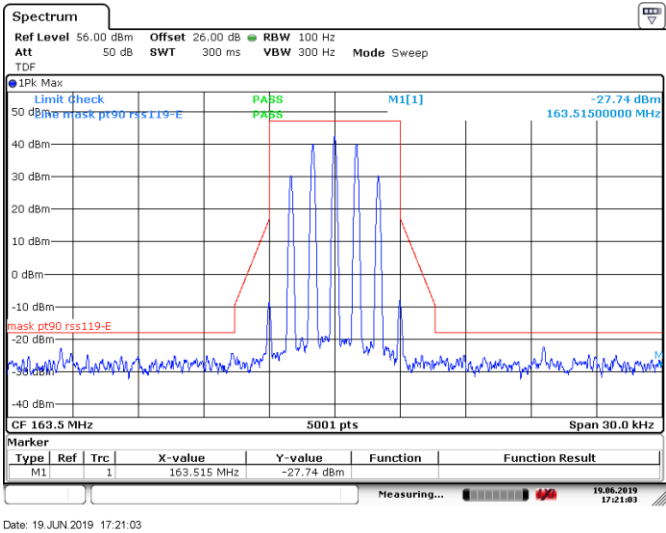


Figure 6.4-11: Mask e, Tx @mid channel 50W 6koF3E modulation



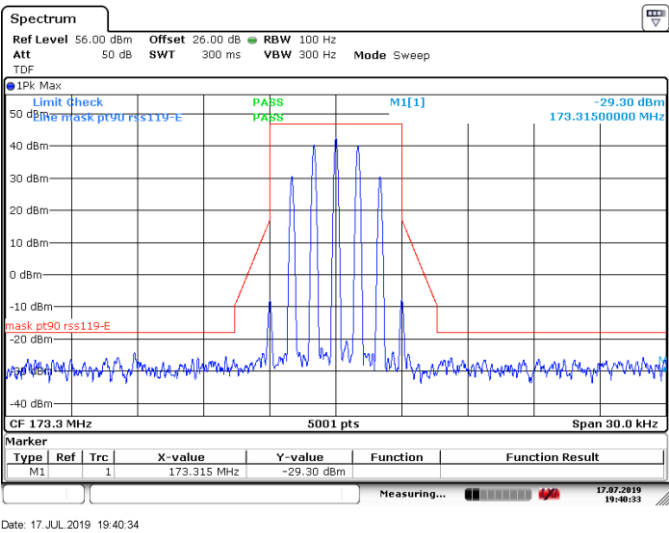


Figure 6.4-12: Mask e, Tx @high channel 50W 6k00F3E modulation

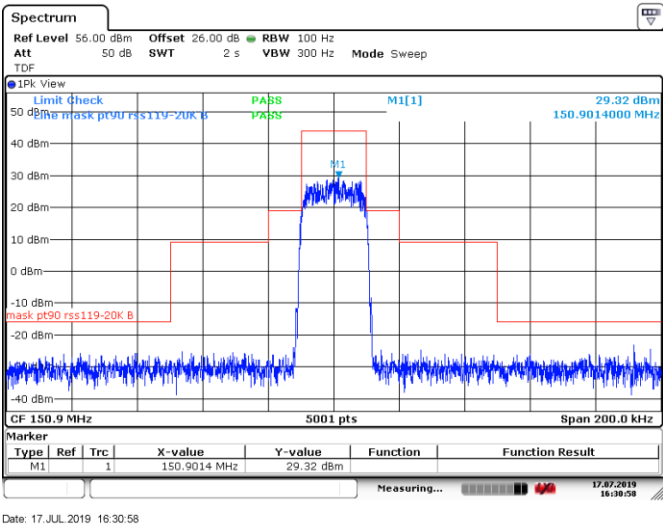


Figure 6.4-13: Mask b, Tx @low channel 25 W 0.20TETRA modulation

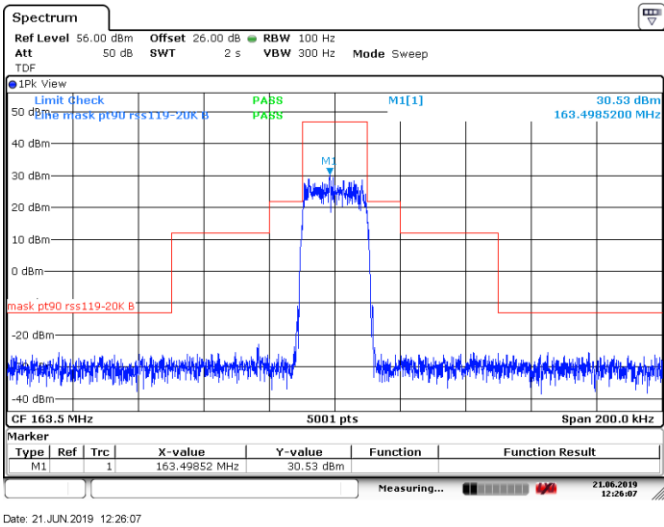


Figure 6.4-14: Mask b, Tx @mid channel 25 W 0.20TETRA modulation

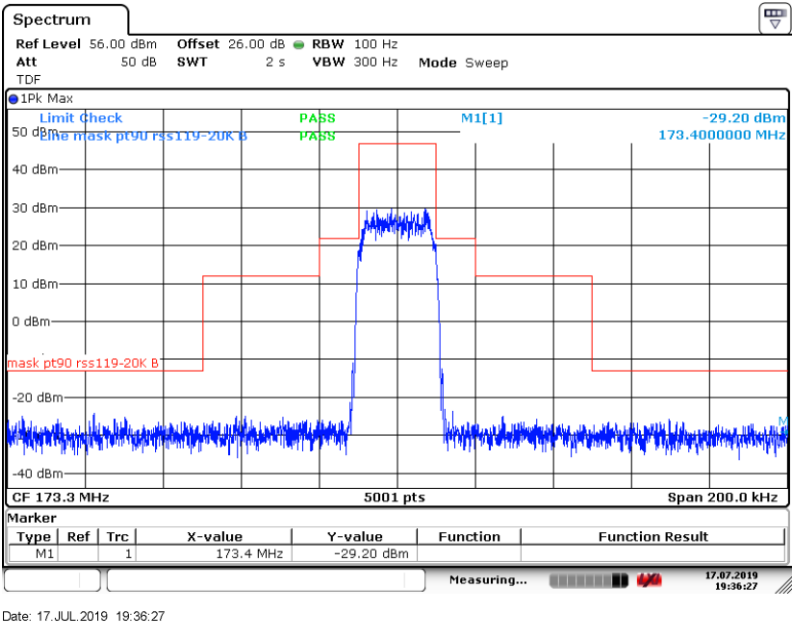


Figure 6.4-15: Mask b, Tx @high channel 25 W o.20TETRA modulation

## 6.5 FCC 90.210, 22.359, 74.462 and RSS-119 5.8 Emission limits, conducted method

### 6.5.1 Definitions and limits

#### FCC §22.359

(a) *Out of band emissions.* The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log (P)$  dB.

#### FCC §90.210

(b) Emission Mask B. For transmitters that are equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:

- (1) On any frequency removed from the assigned frequency by more than 50 percent, but not more than 100 percent of the authorized bandwidth: At least 25 dB.
- (2) On any frequency removed from the assigned frequency by more than 100 percent, but not more than 250 percent of the authorized bandwidth: At least 35 dB.
- (3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least  $43 + 10 \log (P)$  dB.

(d) *Emission Mask D—12.5 kHz channel bandwidth equipment.* For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

- (1) On any frequency from the center of the authorized bandwidth  $f_0$  to 5.625 kHz removed from  $f_0$ : Zero dB.
- (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least  $7.27(f_d - 2.88 \text{ kHz})$  dB.
- (3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 12.5 kHz: At least  $50 + 10 \log (P)$  dB or 70 dB, whichever is the lesser attenuation.
- (4) The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide (usually two or three times the channel bandwidth) to capture the true peak emission of the equipment under test. In order to show compliance with the emission mask up to and including 50 kHz removed from the edge of the authorized bandwidth, adjust the resolution bandwidth to 100 Hz with the measuring instrument in a peak hold mode. A sufficient number of sweeps must be measured to insure that the emission profile is developed. If video filtering is used, its bandwidth must not be less than the instrument resolution bandwidth. For emissions beyond 50 kHz from the edge of the authorized bandwidth, see paragraph (o) of this section. If it can be shown that use of the above instrumentation settings does not accurately represent the true interference potential of the equipment under test, an alternate procedure may be used provided prior Commission approval is obtained.

(e) *Emission Mask E—6.25 kHz or less channel bandwidth equipment.* For transmitters designed to operate with a 6.25 kHz or less bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

- (1) On any frequency from the center of the authorized bandwidth  $f_0$  to 3.0 kHz removed from  $f_0$ : Zero dB.
- (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 3.0 kHz but no more than 4.6 kHz: At least  $30 + 16.67(f_d - 3 \text{ kHz})$  or  $55 + 10 \log (P)$  or 65 dB, whichever is the lesser attenuation.
- (3) On any frequency removed from the center of the authorized bandwidth by more than 4.6 kHz: At least  $55 + 10 \log (P)$  or 65 dB, whichever is the lesser attenuation.
- (4) The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide (usually two or three times the channel bandwidth) to capture the true peak emission of the equipment under test. In order to show compliance with the emission mask up to and including 50 kHz removed from the edge of the authorized bandwidth, adjust the resolution bandwidth to 100 Hz with the measuring instrument in a peak hold mode. A sufficient number of sweeps must be measured to insure that the emission profile is developed. If video filtering is used, its bandwidth must not be less than the instrument resolution bandwidth. For emissions beyond 50 kHz from the edge of the authorized bandwidth, see paragraph (o) of this section. If it can be shown that use of the above instrumentation settings does not accurately represent the true interference potential of the equipment under test, an alternate procedure may be used provided prior Commission approval is obtained.

#### FCC §74.462 Authorized bandwidth and emissions.

(a) Each authorization for a new remote pickup broadcast station or system shall require the use of certificated equipment and such equipment shall be operated in accordance with emission specifications included in the grant of certification and as prescribed in paragraphs (b), (c), and (d) of this section.

(b) The maximum authorized bandwidth of emissions corresponding to the types of emissions specified below, and the maximum authorized frequency deviation in the case of frequency or phase modulated emission, shall be as follows:

Frequencies (MHz)	Authorized bandwidth (kHz)	Maximum frequency deviation <sup>1</sup> (kHz)	Type of emission <sup>2</sup>
25.87 to 26.03	40	10	Frequencies 25.87 to 153.3575 MHz: A3E, F1E, F3E, F9E.
26.07 to 26.47	20	5	
152.8625 to 153.3575 <sup>3</sup>	30/60	5/10	
160.860 to 161.400	60	10	
161.625 to 161.775	30	5	
166.25 and 170.15 <sup>4</sup>	12.5/25	5	

<sup>1</sup>Applies where F1A, F1B, F1D, F1E, F2A, F2B, F2D, F2E, F3E, or F9E emissions are used.

<sup>2</sup>Stations operating above 450 MHz shall show a need for employing A1A, A1B, A1D, A1E, A2A, A2B, A2D, A2E, F1A, F1B, F1D, F1E, F2A, F2B, F2D, or F2E emission.

<sup>3</sup>New or modified licenses for use of the frequencies will not be granted to utilize transmitters on board aircraft, or to use a bandwidth in excess of 30 kHz and maximum deviation exceeding 5 kHz

<sup>4</sup>For stations licensed or applied for before April 16, 2003, the sum of the bandwidth of emission and tolerance on frequencies 166.25 MHz or 170.15 MHz shall not exceed 25 kHz, and such operation may continue until January 1, 2005. For new stations licensed or applied for on or after April 16, 2003, the sum of the bandwidth of emission and tolerance on these frequencies shall not exceed 12.5 kHz. For all remote pickup broadcast stations, the sum of the bandwidth of emission and tolerance on these frequencies shall not exceed 12.5 kHz on or after January 1, 2005.

(c) For emissions on frequencies above 25 MHz with authorized bandwidths up to 30 kHz, the emissions shall comply with the emission mask and transient frequency behavior requirements of §§90.210 and 90.214 of this chapter. For all other emissions, the mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:

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

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

(3) On any frequency removed from the assigned frequency by more than 250 percent on the authorized bandwidth; at least 43 plus 10 log<sub>10</sub> (mean output power, in watts) dB.

(d) In the event a station's emissions outside its authorized channel cause harmful interference, the Commission may, at its discretion, require the licensee to take such further steps as may be necessary to eliminate the interference.

Note: The measurements of emission power can be expressed in peak or mean values provided they are expressed in the same parameters as the unmodulated transmitter carrier power.

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### 5.5 Channel Bandwidth, Authorized Bandwidth, Occupied Bandwidth and Spectrum Masks

For the purpose of this document, channel bandwidth is the channel width in which the equipment is designed to operate.

The maximum permissible occupied bandwidth shall not exceed the authorized bandwidth specified in Table 3 for the equipment's frequency band. The authorized bandwidth is defined as the maximum width of the band of frequencies used to derive spectrum masks and is not necessarily equivalent to the bandwidth found on radio and spectrum licences.

The channel bandwidths, authorized bandwidths and spectrum masks are given in Table 3 for equipment having an output power greater than 120 mW. For equipment with an output power that does not exceed 120 mW, Section 5.10 applies.

**Table 3 — Channel Bandwidths, Authorized Bandwidths and Spectrum Masks**

Frequency Band (MHz)	Related SRSP for Channelling Plan and ERP	Channel Bandwidth (kHz)	Authorized Bandwidth (kHz)	Spectrum Masks for Equipment with Audio Filter	Spectrum Masks for Equipment Without Audio Filter
138-144, 148-149.9 and 150.05-174	SRSP-500	30	20	B	C
		15	11.25	D	D
		7.5	6	E	E

### 5.8 Transmitter Unwanted Emissions

The spectrum plots of the unwanted emissions shall comply with the masks specified in Table 3.

Descriptions of these permissible emission masks are given in the sections that follow.

The term displacement frequency,  $f_d$ , used in these sections refers to the difference between the channel frequency and the emission component frequency expressed in kilohertz, and  $p$  is the transmitter output power in Watts.

#### 5.8.1 Emission Mask B for Transmitters Equipped with an Audio Low-Pass Filter

The power of any emission shall be attenuated below the transmitter output power  $P$  (dBW) as specified in Table 5.

**Table 5 — Emission Mask B**

Displacement Frequency, $f_d$ (kHz)	Minimum Attenuation (dB)	Resolution Bandwidth (Hz)
$10 < f_d \leq 20$	25	300
$20 < f_d \leq 50$	35	300
$f_d > 50$	$43 + 10 \log_{10}(p)$	Specified in Section 4.2.1

#### 5.8.3 Emission Mask D for Transmitters Equipped with or Without an Audio Low-Pass Filter

The power of any emission shall be attenuated below the transmitter output power  $P$  (dBW) as specified in Table 7.

**Table 7 — Emission Mask D**

Displacement Frequency, $f_d$ (kHz)	Minimum Attenuation (dB)	Resolution Bandwidth (Hz)
$.625 < f_d \leq 12.5$	$7.27(f_d - 2.88)$	Specified in Section 4.2.2
$f_d > 12.5$	Whichever is the lesser: 70 or $50 + 10 \log_{10}(p)$	Specified in Section 4.2.2

#### 5.8.4 Emission Mask E for Transmitters Equipped with or Without an Audio Low-Pass Filter

The power of any emission shall be attenuated below the transmitter output power  $P$  (dBW) as specified in Table 8.

**Table 8 — Emission Mask E**

Displacement Frequency, $f_d$ (kHz)	Minimum Attenuation (dB)	Resolution Bandwidth (Hz)
$3 < f_d \leq 4.6$	Whichever is the lesser: $30 + 16.67(f_d - 3)$ or $55 + 10 \log_{10}(p)$	Specified in Section 4.2.2
$f_d > 4.6$	Whichever is the lesser: 57 or $55 + 10 \log_{10}(p)$	Specified in Section 4.2.2

## 6.5.2 Test summary

Test date	June 7, 2019
Test engineer	Yong Huang

### 6.5.3    Observations, settings and special notes

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The spectrum was searched from 30 MHz to the 10th harmonic.

Spectrum Analyzer's setting:

Detector mode	Peak
Resolution bandwidth	100 kHz below 1 GHz/1 MHz above 1 GHz
Video bandwidth	RBW × 3
Trace mode	Max Hold

6.5.4 Test data

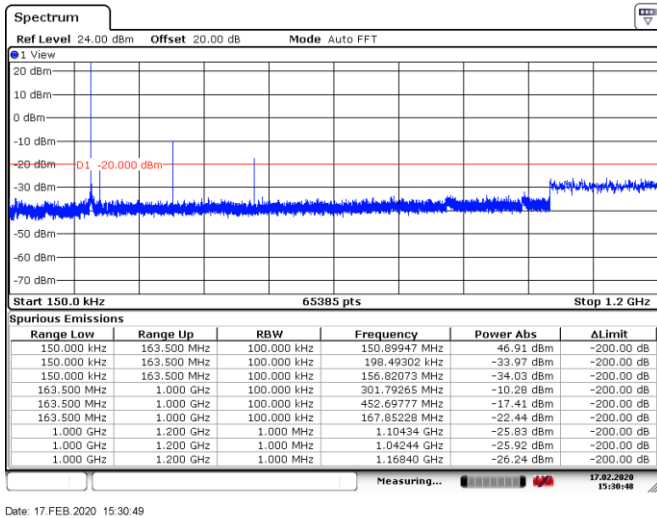


Figure 6.5-1: Conducted Spurious Emissions below 1.2 GHz, Tx @Low channel 50W 7k60FXW modulation

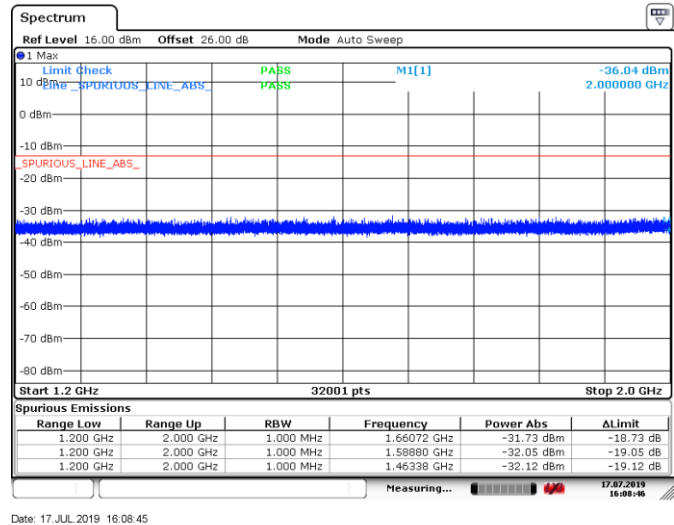


Figure 6.5-2: Conducted Spurious Emissions above 1.2 GHz, Tx @Low channel 50W 7k60FXW modulation

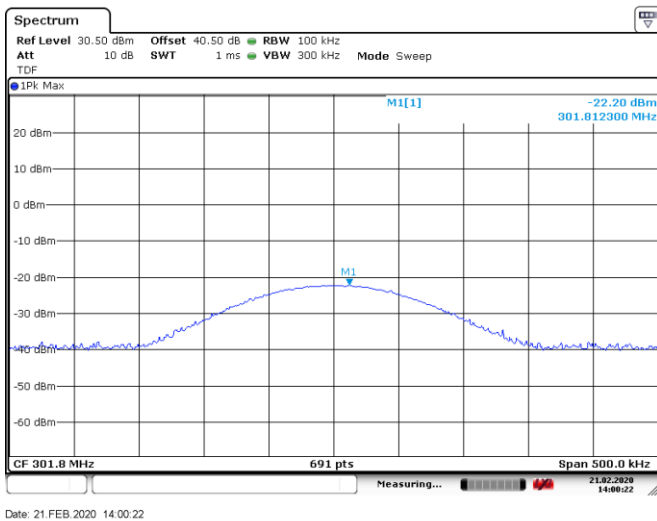


Figure 6.5-3: Conducted Spurious Emissions @301.793 MHz, Tx @Low channel 50W 7k60FXW modulation

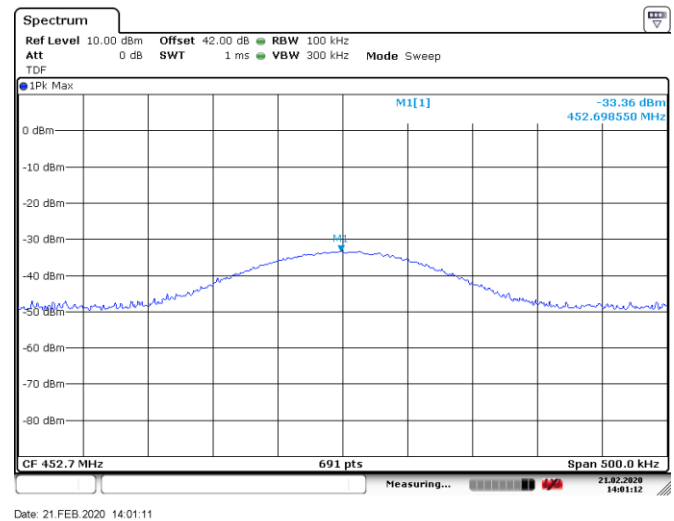
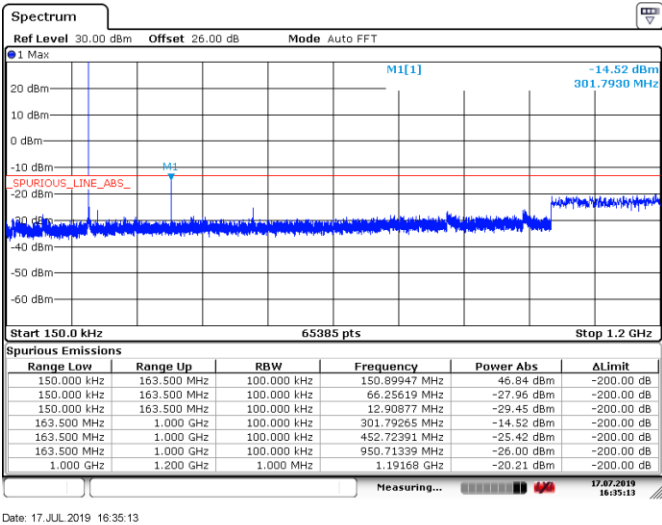


Figure 6.5-4: Conducted Spurious Emissions @452.700 MHz, Tx @Low channel 50W 7k60FXW modulation

Note: the limit line is -20 dBm in plots above, wherever the spurious emissions were over the limit in broad band scan, the emissions are verified with notch filter on fundamental emission, and it's found to be below the limit.

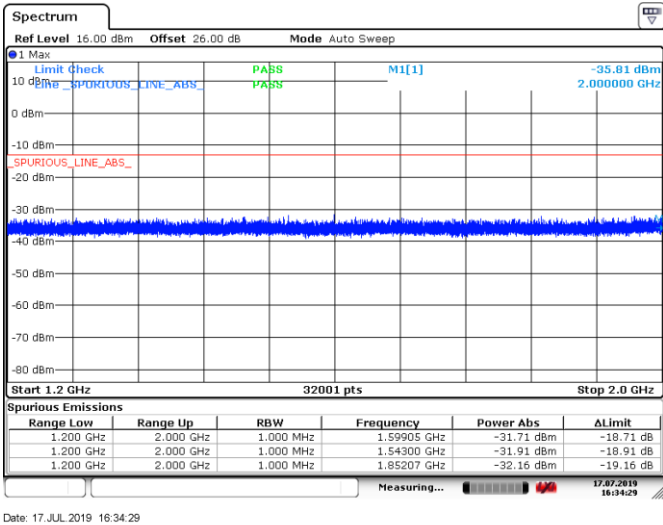
Section 8  
Test name  
Specification

Testing data  
Emission limits, conducted method  
FCC 90.210, 22.359, 74.462 and RSS-119 5.8



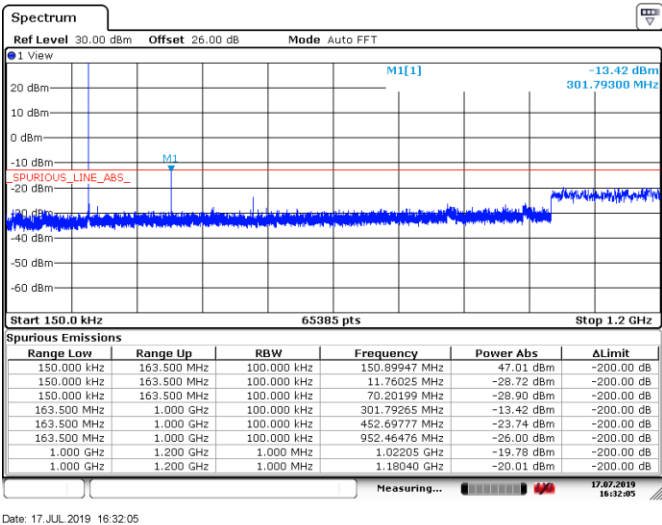
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Figure 6.5-5: Conducted Spurious Emissions below 1.2 GHz, Tx @Low channel 50W 16Kof3E modulation



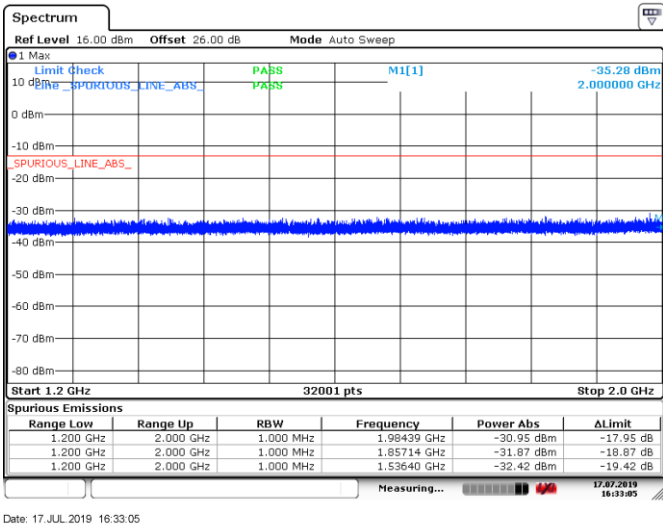
Date: 17 JUL 2019 16:34:29

Figure 6.5-6: Conducted Spurious Emissions above 1.2 GHz, Tx @Low channel 50W 16Kof3E modulation



Date: 17 JUL 2019 16:32:05

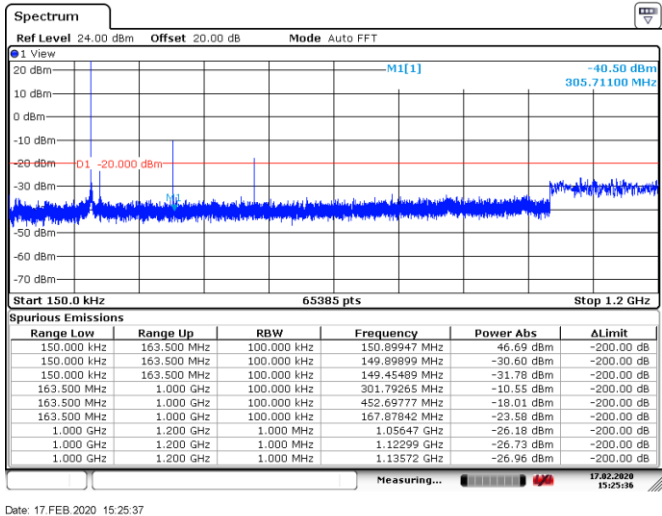
Figure 6.5-7: Conducted Spurious Emissions below 1.2 GHz, Tx @Low channel 25W 0.20TETRA modulation



Date: 17 JUL 2019 16:33:05

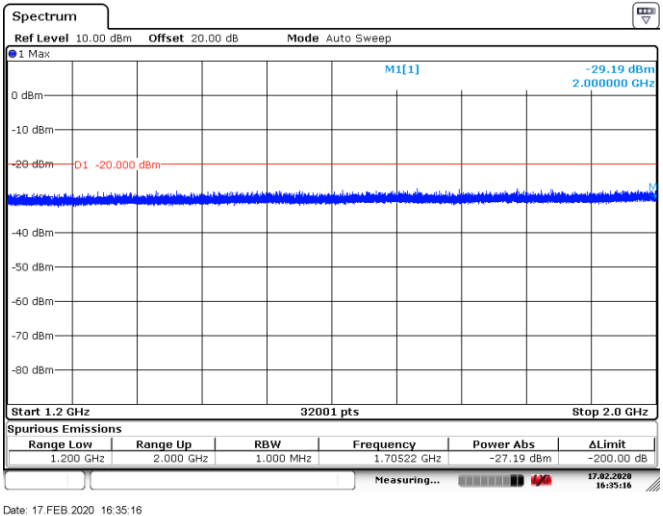
Figure 6.5-8: Conducted Spurious Emissions above 1.2 GHz, Tx @Low channel 25W 0.20TETRA modulation





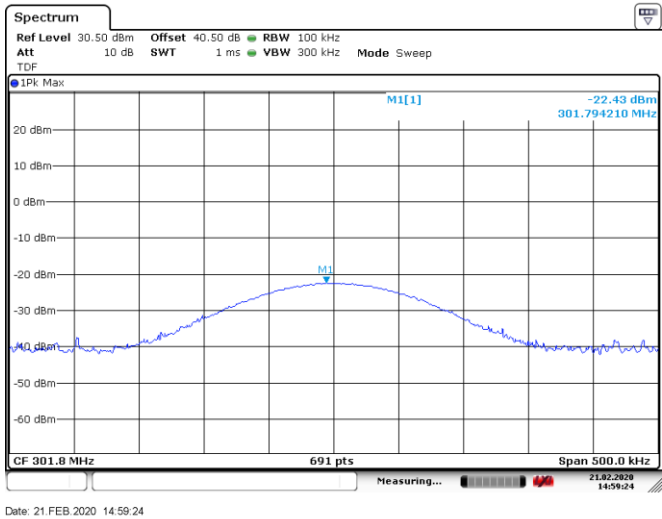
Date: 17.FEB.2020 15:25:37

Figure 6.5-9: Conducted Spurious Emissions below 1.2 GHz, Tx @Low channel 50W 11Kof3E modulation



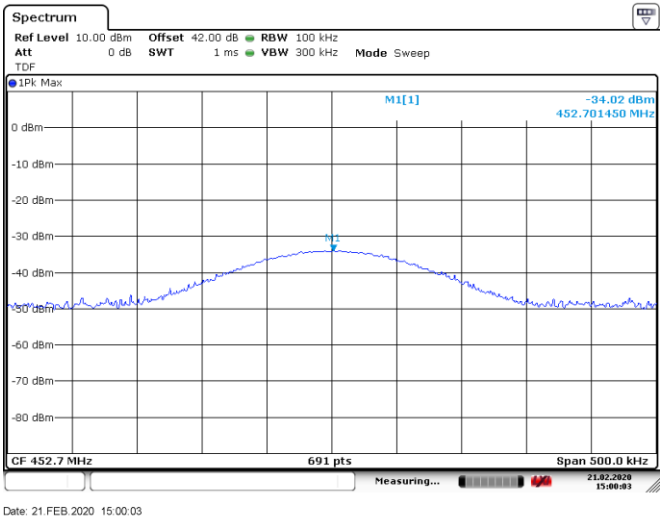
Date: 17.FEB.2020 16:35:16

Figure 6.5-10: Conducted Spurious Emissions above 1.2 GHz, Tx @Low channel 50W 11Kof3E modulation



Date: 21.FEB.2020 14:59:24

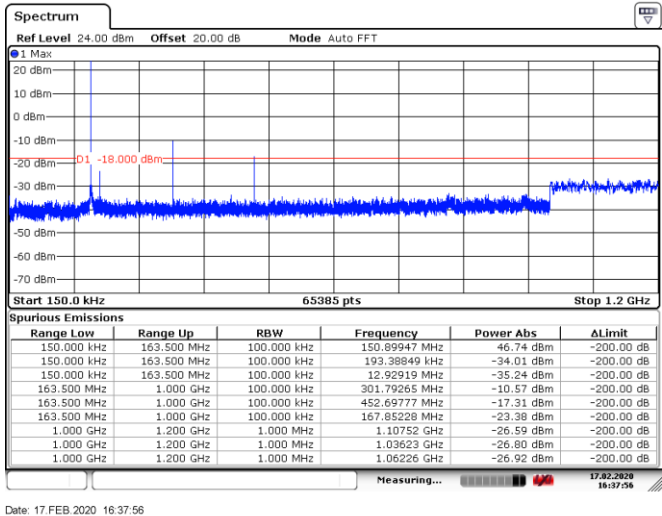
Figure 6.5-11: Conducted Spurious Emissions @301.793 MHz, Tx @Low channel 50W 11Kof3E modulation



Date: 21.FEB.2020 15:00:03

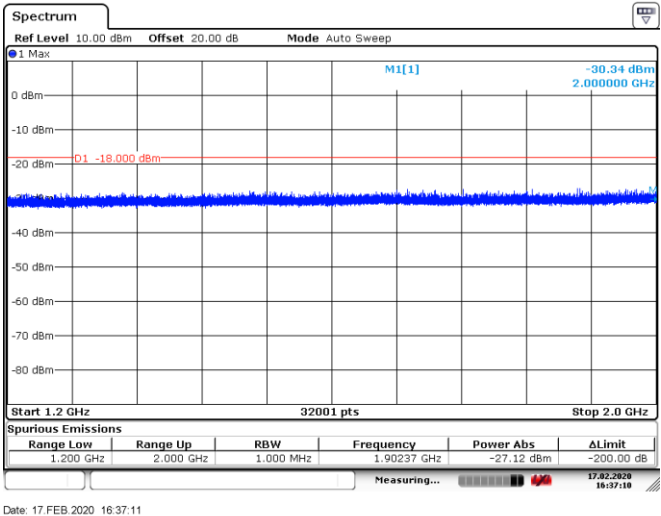
Figure 6.5-12: Conducted Spurious Emissions @452.700 MHz, Tx @Low channel 50W 11Kof3E modulation

Note: the limit line is -20 dBm in plots above, wherever the spurious emissions were over the limit in broad band scan, the emissions are verified with notch filter on fundamental emission, and it's found to be below the limit.



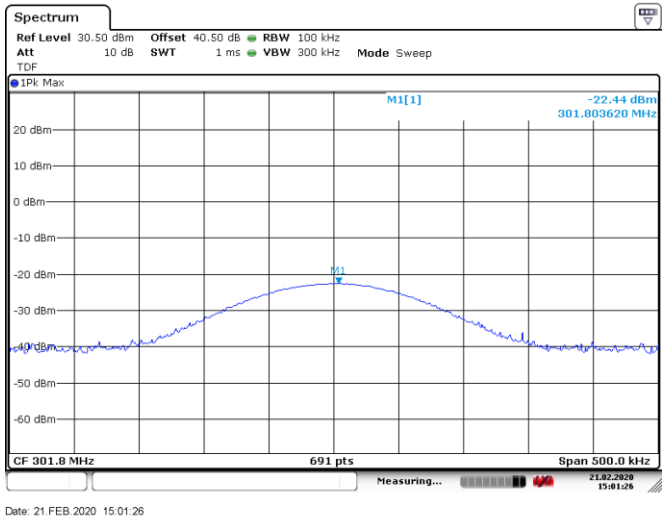
Date: 17.FEB.2020 16:37:56

Figure 6.5-13: Conducted Spurious Emissions below 1.2 GHz, Tx @Low channel 50W 6K00F3E modulation



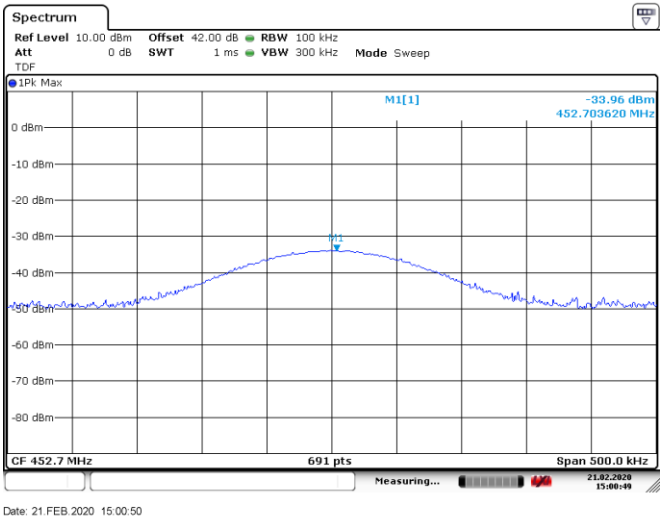
Date: 17.FEB.2020 16:37:11

Figure 6.5-14: Conducted Spurious Emissions above 1.2 GHz, Tx @Low channel 50W 6K00F3E modulation



Date: 21.FEB.2020 15:01:26

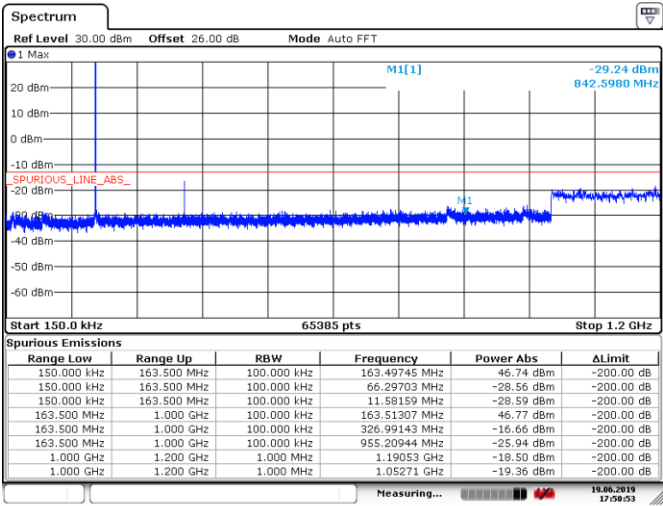
Figure 6.5-15: Conducted Spurious Emissions @301.793 MHz, Tx @Low channel 50W 11K0F3E modulation



Date: 21.FEB.2020 15:00:50

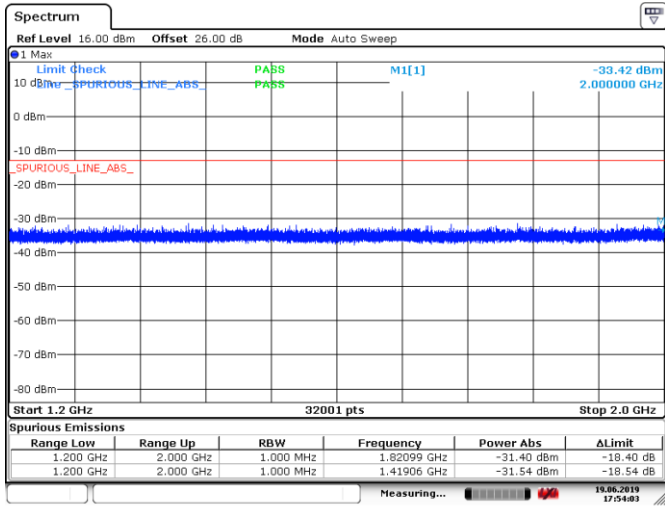
Figure 6.5-16: Conducted Spurious Emissions @452.700 MHz, Tx @Low channel 50W 11K0F3E modulation

Note: the limit line is -18 dBm in plots above, wherever the spurious emissions were over the limit in broad band scan, the emissions are verified with notch filter on fundamental emission, and it's found to be below the limit.



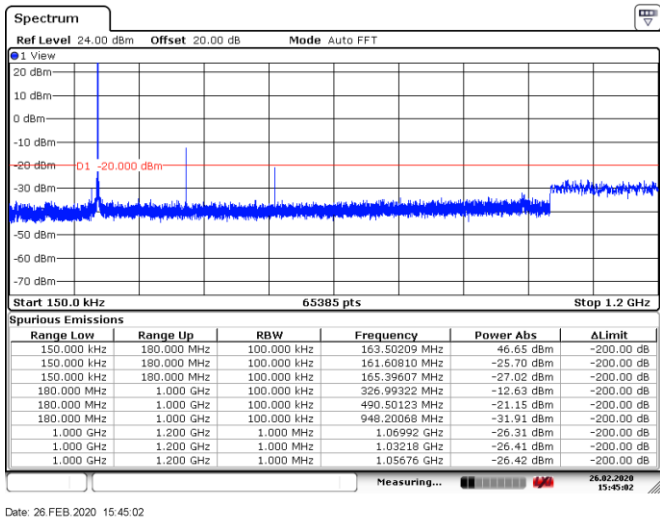
Date: 19 JUN 2019 17:50:52

Figure 6.5-17: Conducted Spurious Emissions below 1.2 GHz, Tx @mid channel 50W 16Kof3E modulation



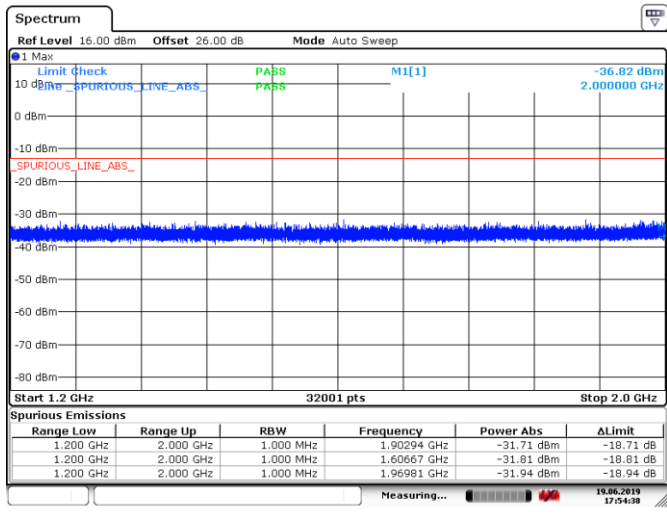
Date: 19 JUN 2019 17:54:03

Figure 6.5-18: Conducted Spurious Emissions above 1.2 GHz, Tx @mid channel 50W 16Kof3E modulation



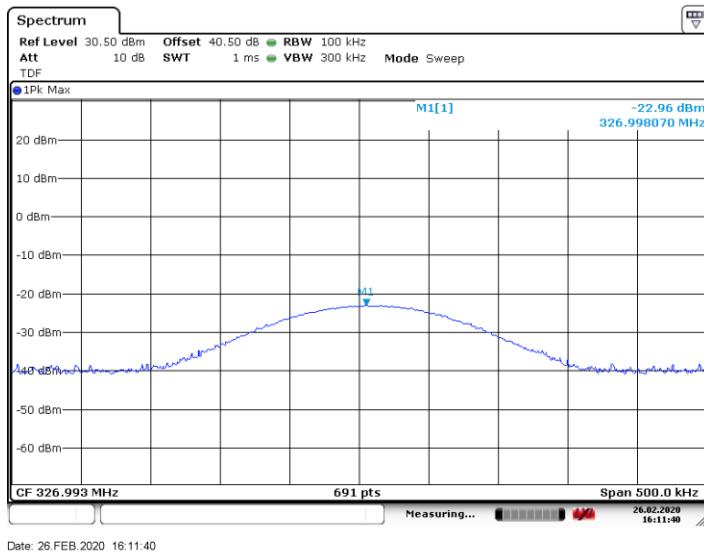
Date: 26.FEB.2020 15:45:02

Figure 6.5-19: Conducted Spurious Emissions below 1.2 GHz, Tx @mid channel 50W 7k60FXW modulation



Date: 19.JUN.2019 17:54:37

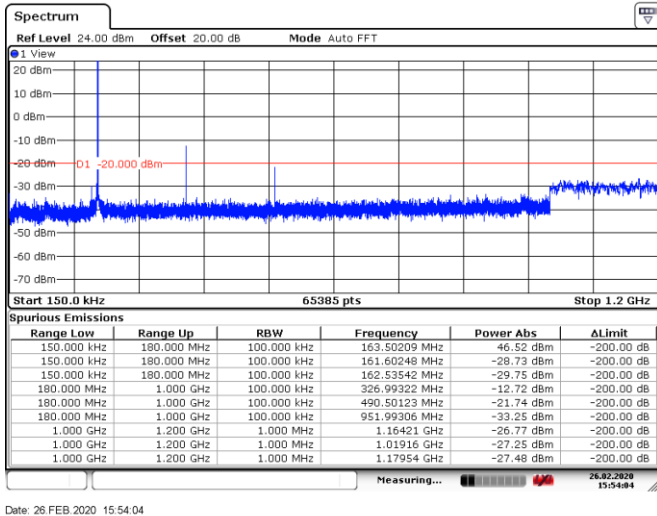
Figure 6.5-20: Conducted Spurious Emissions above 1.2 GHz, Tx @mid channel 50W 7k60FXW modulation



Date: 26.FEB.2020 16:11:40

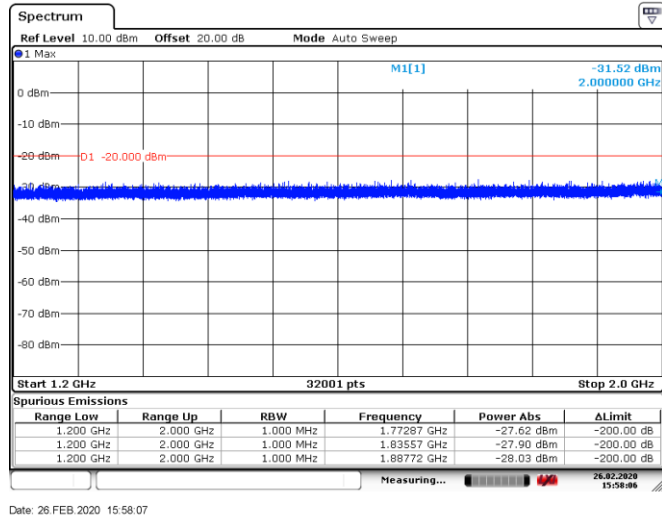
Figure 6.5-21: Conducted Spurious Emissions @326.993 MHz, Tx @mid channel 50W 7k60FXW modulation

Note: the limit line is -20 dBm in plots above, wherever the spurious emissions were over the limit in broad band scan, the emissions are verified with notch filter on fundamental emission, and it's found to be below the limit.



Date: 26 FEB. 2020 15:54:04

Figure 6.5-22: Conducted Spurious Emissions below 1.2 GHz, Tx @mid channel 50W 11Kof3E modulation



Date: 26 FEB. 2020 15:58:07

Figure 6.5-23: Conducted Spurious Emissions above 1.2 GHz, Tx @mid channel 50W 11Kof3E modulation

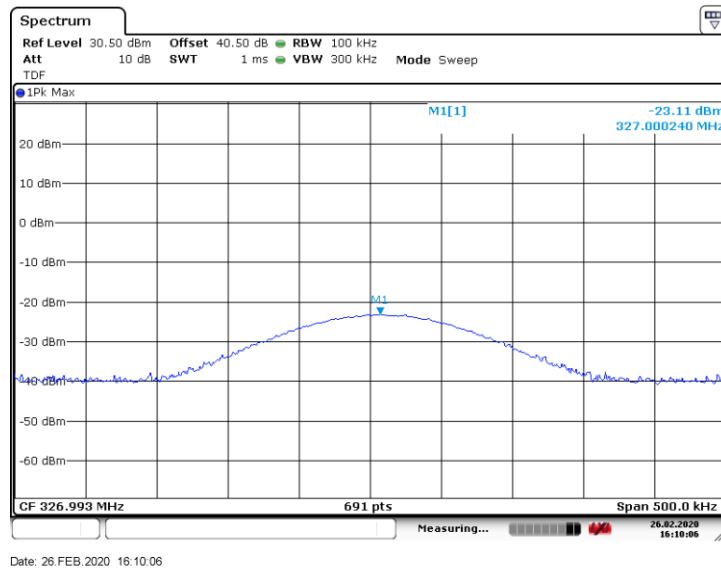


Figure 6.5-24: Conducted Spurious Emissions @326.993 MHz, Tx @mid channel 50W 11Kof3E modulation

Note: the limit line is -20 dBm in plots above, wherever the spurious emissions were over the limit in broad band scan, the emissions are verified with notch filter on fundamental emission, and it's found to be below the limit.

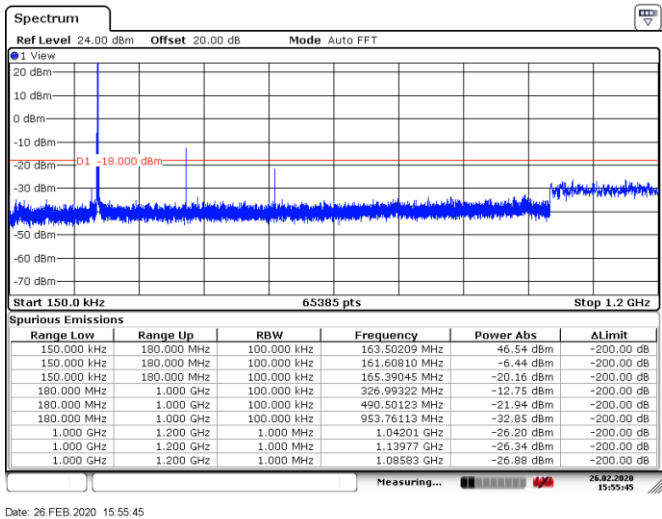


Figure 6.5-25: Conducted Spurious Emissions below 1.2 GHz, Tx @ mid channel 50W 6K00F3E modulation

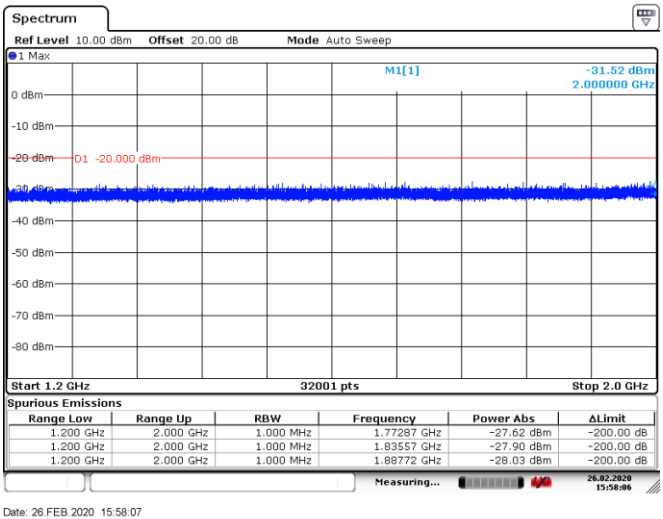


Figure 6.5-26: Conducted Spurious Emissions above 1.2 GHz, Tx @ mid channel 50W 6K00F3E modulation

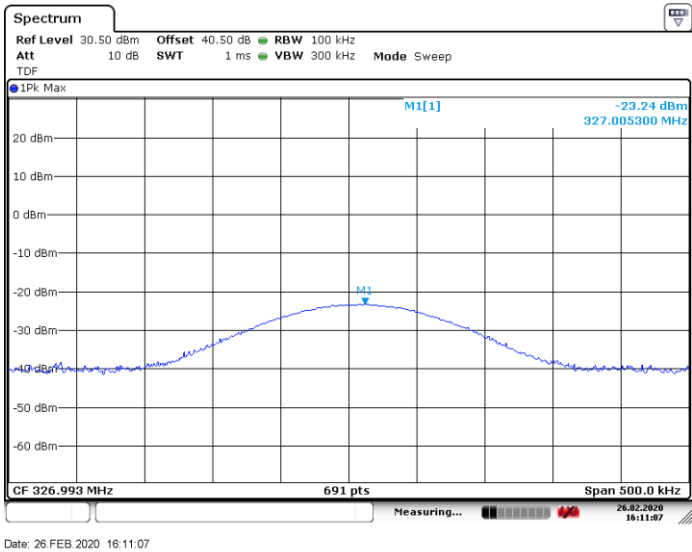


Figure 6.5-27: Conducted Spurious Emissions @326.993 MHz, Tx @mid channel 50W 6k00F3E modulation

Note: the limit line is -18 dBm in plots above, wherever the spurious emissions were over the limit in broad band scan, the emissions are verified with notch filter on fundamental emission, and it's found to be below the limit.

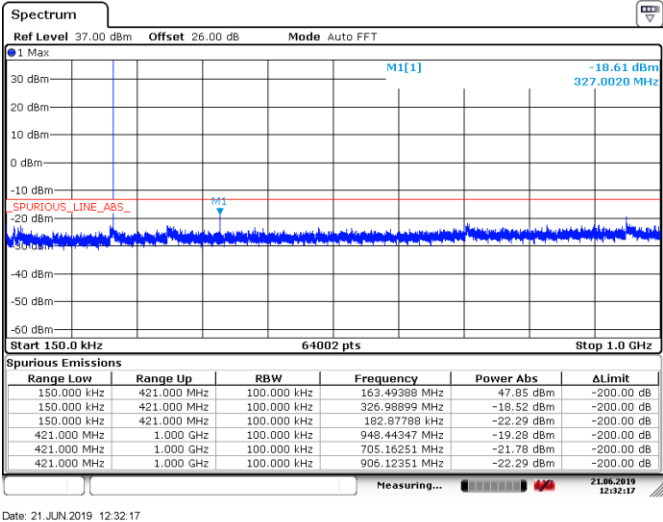


Figure 6.5-28: Conducted Spurious Emissions below 1 GHz, Tx @mid channel 25W 0.20TETRA modulation

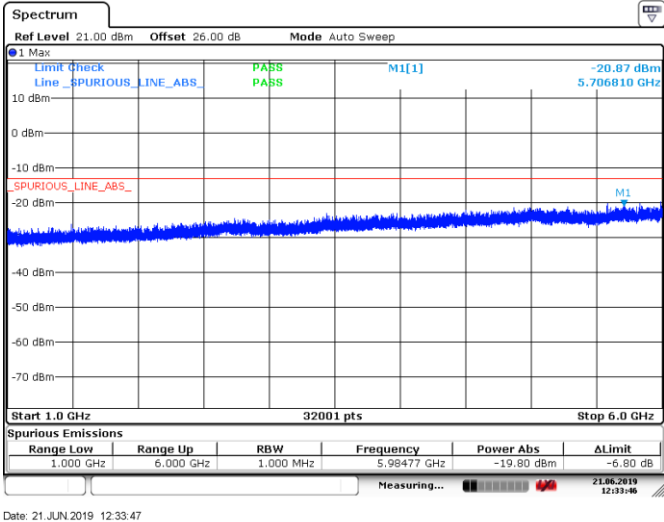
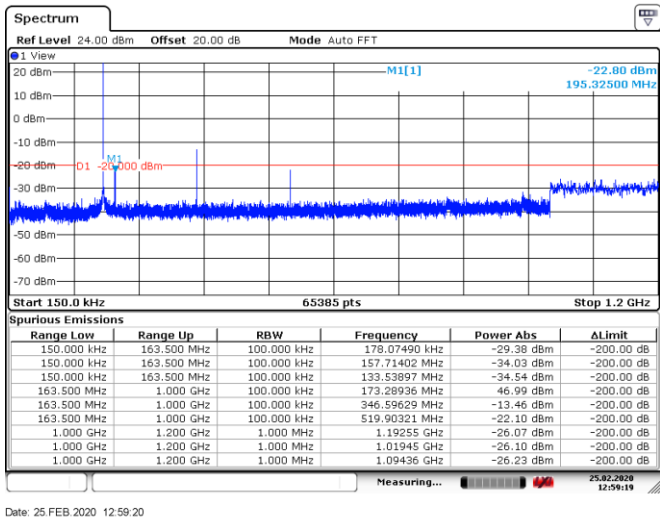
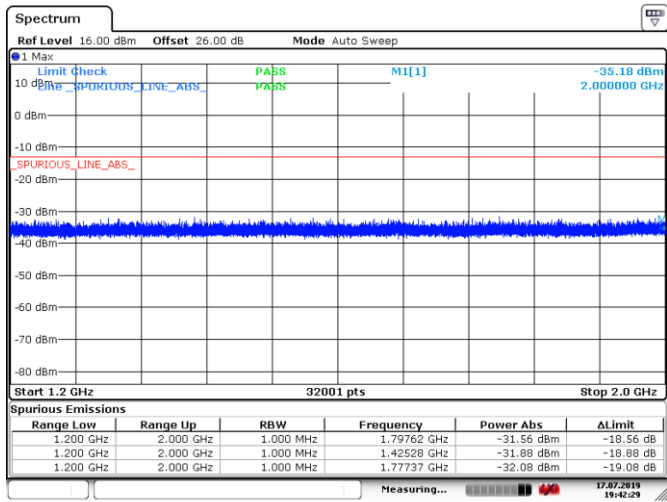


Figure 6.5-29: Conducted Spurious Emissions above 1 GHz, Tx @mid channel 25W 0.20TETRA modulation



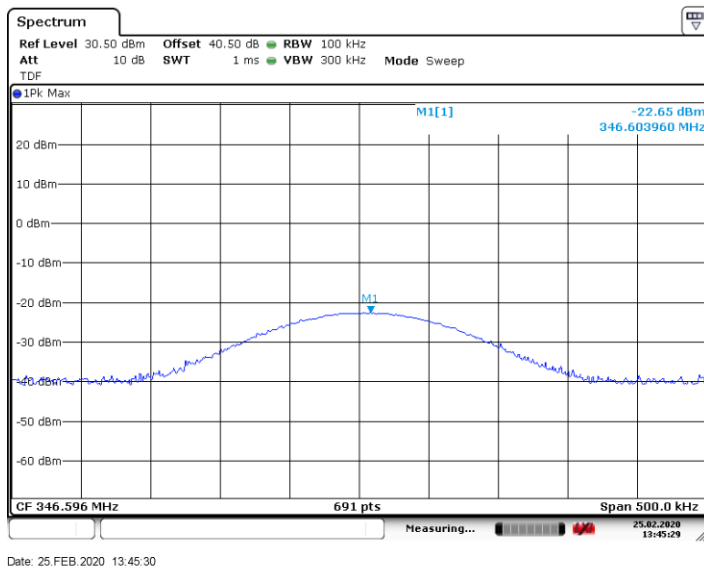
Date: 25.FEB.2020 12:59:20



Date: 17.JUL.2019 19:42:29

Figure 6.5-30: Conducted Spurious Emissions below 1.2 GHz, Tx @high channel 50W 7k60FXW modulation

Figure 6.5-31: Conducted Spurious Emissions above 1.2 GHz, Tx @high channel 50W 7k60FXW modulation



Date: 25.FEB.2020 13:45:30

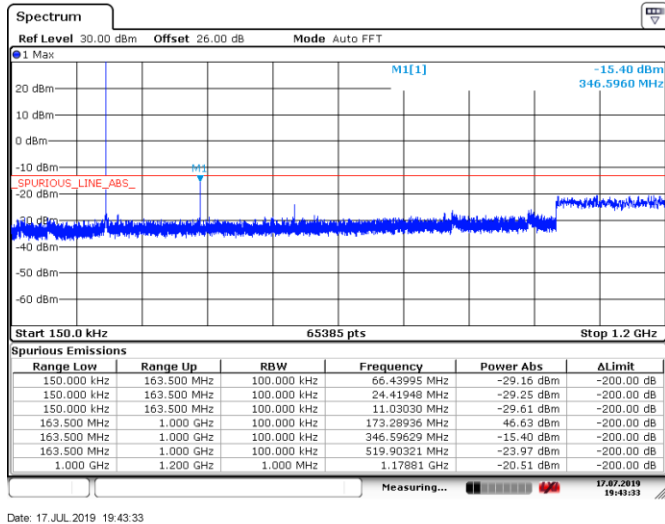
Figure 6.5-32: Conducted Spurious Emissions @346.596 MHz, Tx @high channel 50W 7k60FXW modulation

Note: the limit line is -20 dBm in plots above, wherever the spurious emissions were over the limit in broad band scan, the emissions are verified with notch filter on fundamental emission, and it's found to be below the limit.

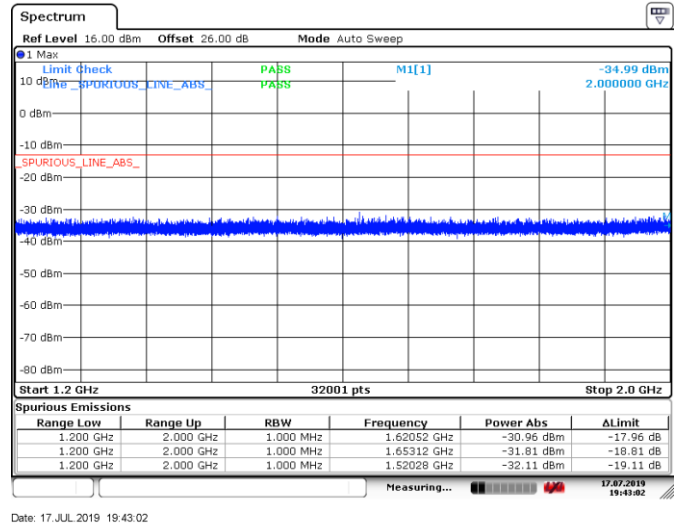


**Section 8**  
**Test name**  
**Specification**

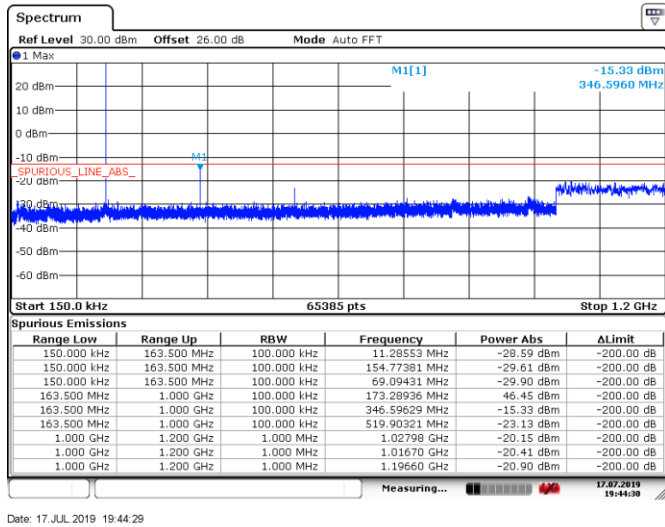
Testing data  
Emission limits, conducted method  
FCC 90.210, 22.359, 74.462 and RSS-119 5.8



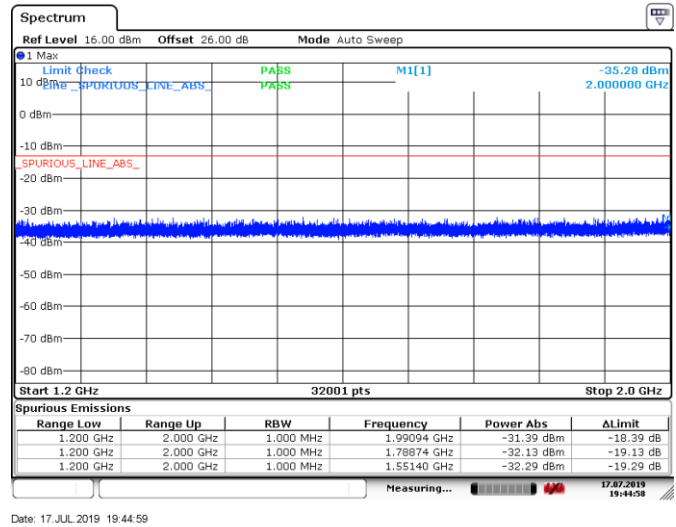
**Figure 6.5-33:** Conducted Spurious Emissions below 1.2 GHz, Tx @ high channel 50W 16Kof3E modulation



**Figure 6.5-34:** Conducted Spurious Emissions above 1.2 GHz, Tx @ high channel 50W 16Kof3E modulation



**Figure 6.5-35:** Conducted Spurious Emissions below 1 GHz, Tx @ high channel 25W 0.20TETRA modulation



**Figure 6.5-36:** Conducted Spurious Emissions above 1 GHz, Tx @ high channel 25W 0.20TETRA modulation

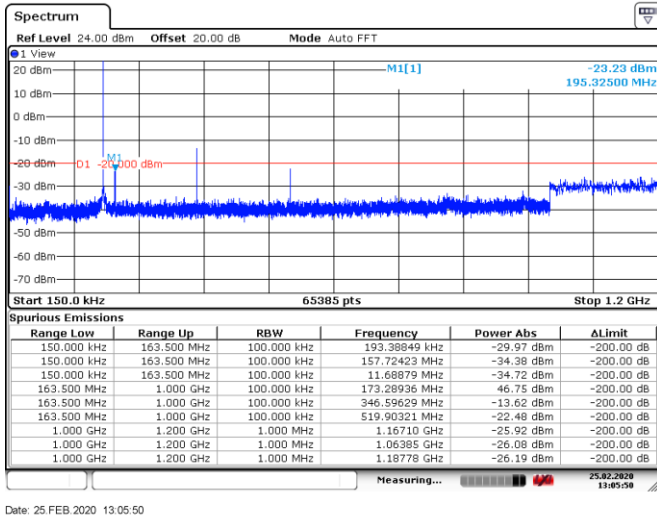


Figure 6.5-37: Conducted Spurious Emissions below 1.2 GHz, Tx @ high channel 50W 11Kof3E modulation

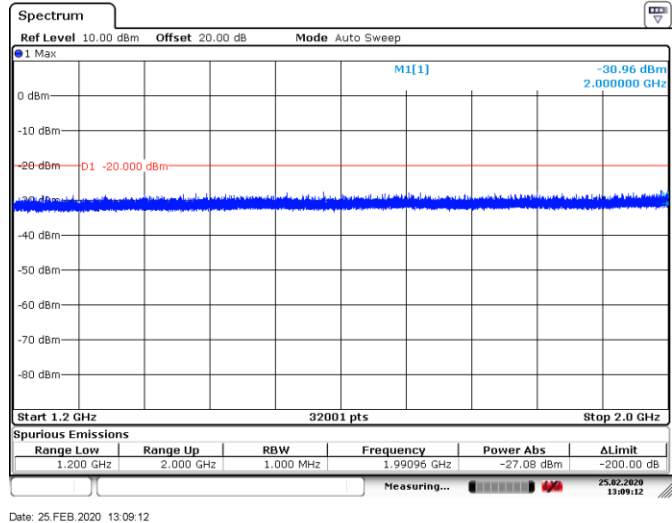


Figure 6.5-38: Conducted Spurious Emissions above 1.2 GHz, Tx @ high channel 50W 11Kof3E modulation

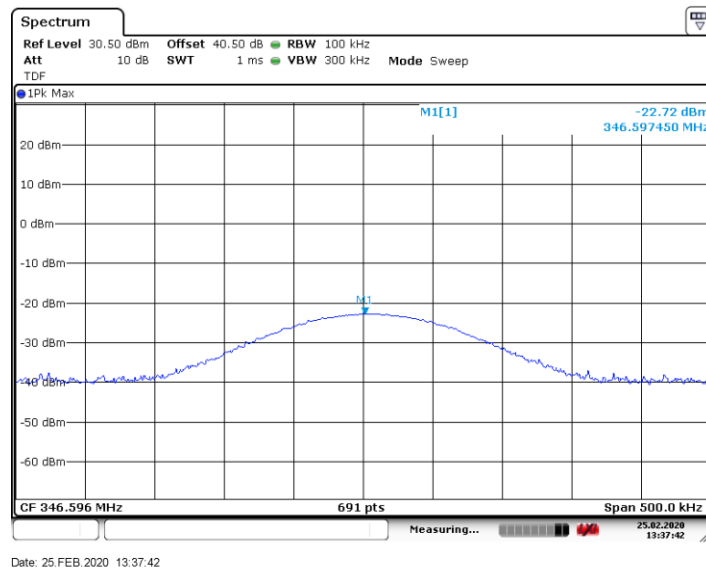
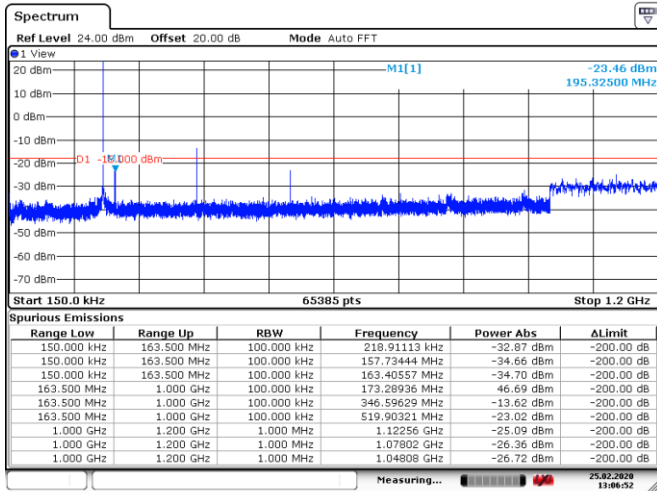


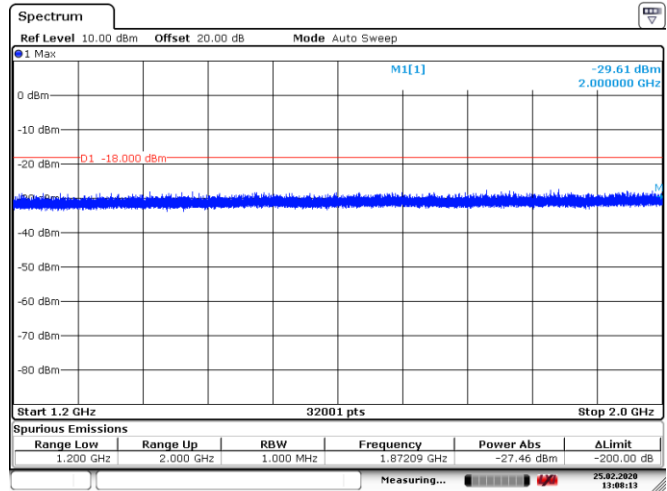
Figure 6.5-39: Conducted Spurious Emissions @346.596 MHz, Tx @high channel 50W 11Kof3E modulation

Note: the limit line is -20 dBm in plots above, wherever the spurious emissions were over the limit in broad band scan, the emissions are verified with notch filter on fundamental emission, and it's found to be below the limit.



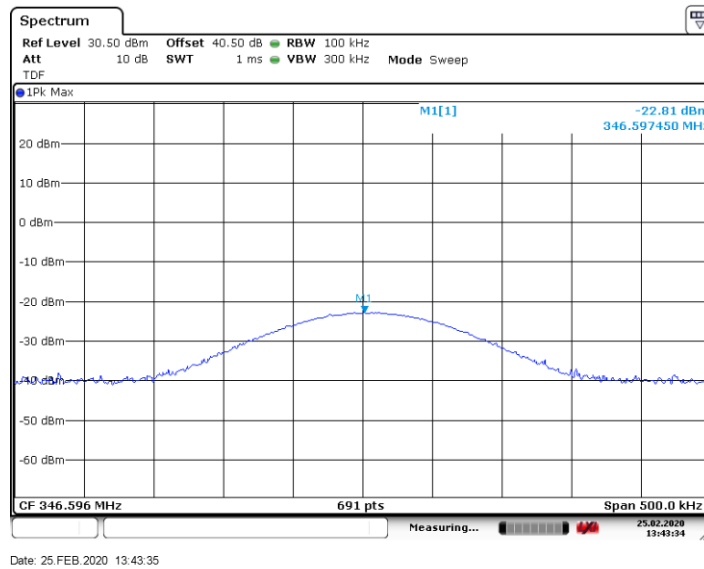
Date: 25 FEB. 2020 13:06:52

Figure 6.5-40: Conducted Spurious Emissions below 1.2 GHz, Tx @ high channel 50W 6K00F3E modulation



Date: 25 FEB. 2020 13:08:13

Figure 6.5-41: Conducted Spurious Emissions above 1.2 GHz, Tx @ high channel 50W 6K00F3E modulation



Date: 25 FEB. 2020 13:43:35

Figure 6.5-42: Conducted Spurious Emissions @346.596 MHz, Tx @high channel 50W 6k00F3E modulation

Note: the limit line is -18 dBm in plots above, wherever the spurious emissions were over the limit in broad band scan, the emissions are verified with notch filter on fundamental emission, and it's found to be below the limit.

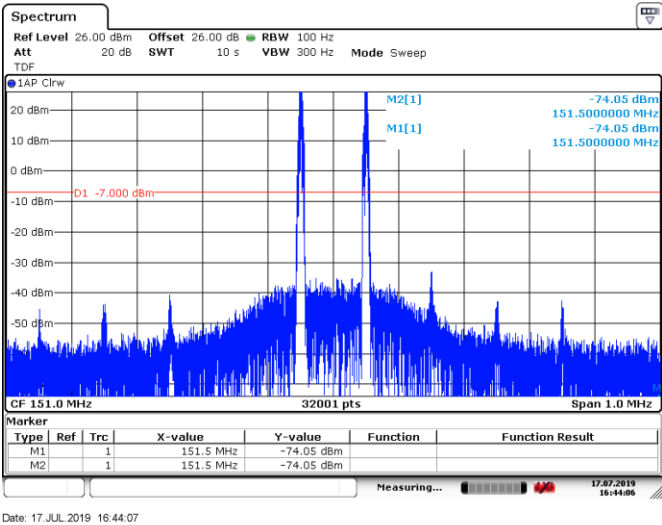


Figure 6.5-43: Conducted Spurious Emissions from inter-modulation products, Tx @low channel 2X15W 7k60FXW modulation

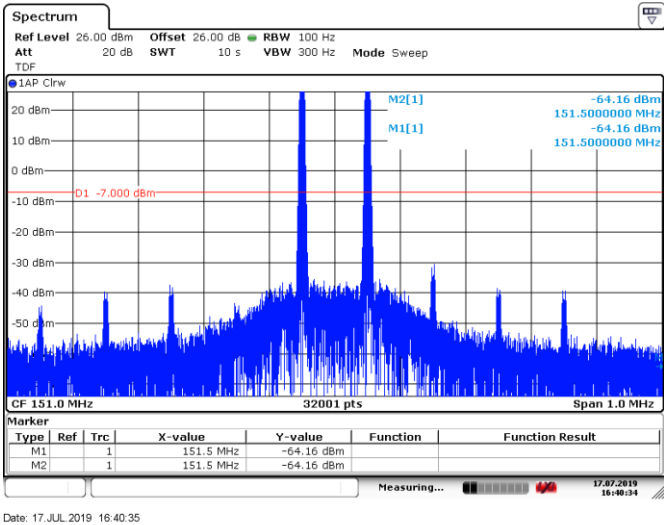


Figure 6.5-44: Conducted Spurious Emissions from inter-modulation products, Tx @low channel 2X15W 16K0F3E modulation

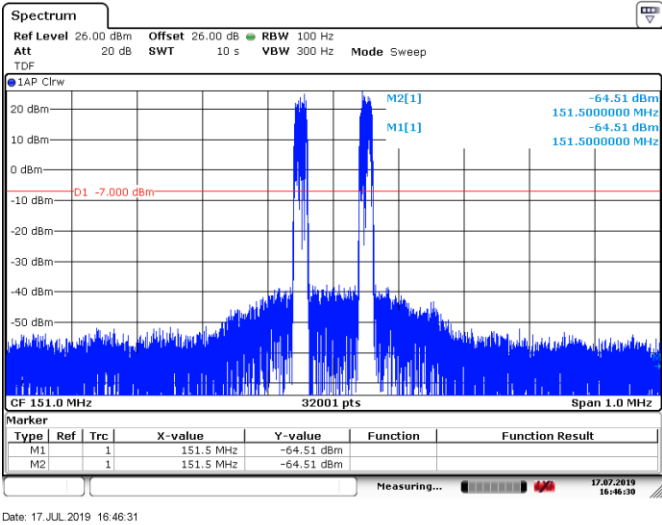


Figure 6.5-45: Conducted Spurious Emissions from inter-modulation products, Tx @low channel 2X10W 0.20TETRA modulation

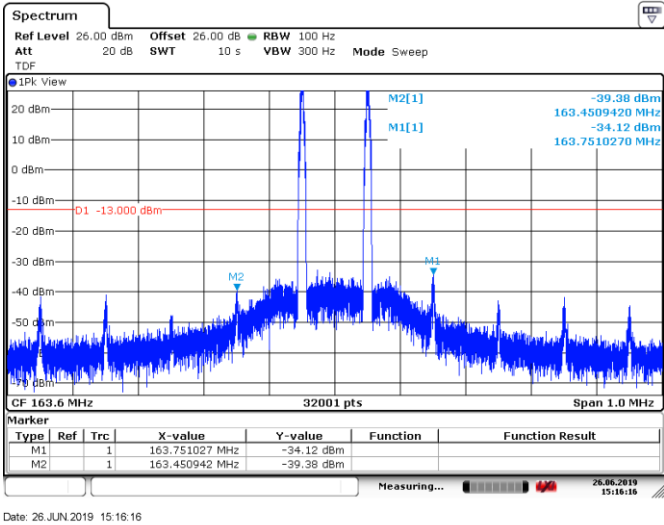


Figure 6.5-46: Conducted Spurious Emissions from inter-modulation products, Tx @mid channel 2X15W 7k60FXW modulation

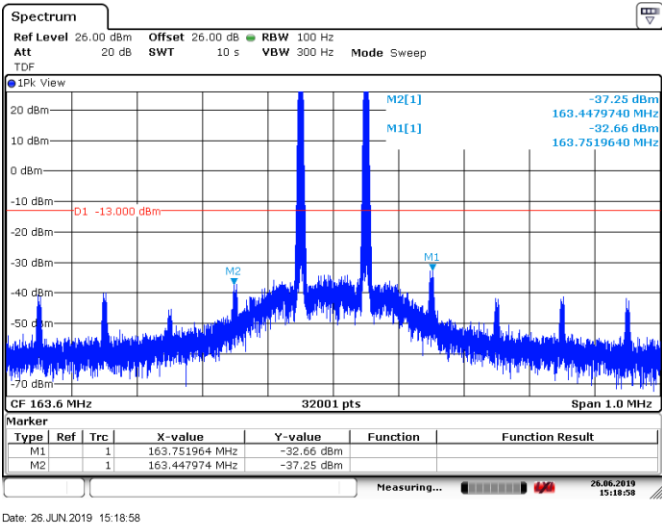


Figure 6.5-47: Conducted Spurious Emissions from inter-modulation products, Tx @mid channel 2X15W 16Kof3E modulation

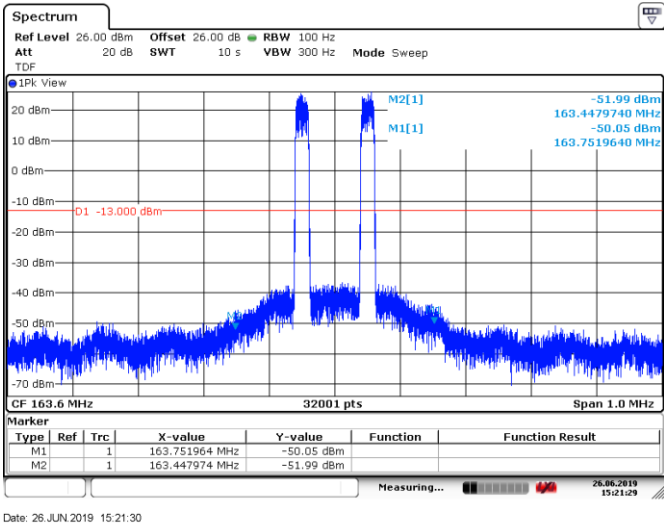


Figure 6.5-48: Conducted Spurious Emissions from inter-modulation products, Tx @mid channel 2X10W 0.20TETRA modulation

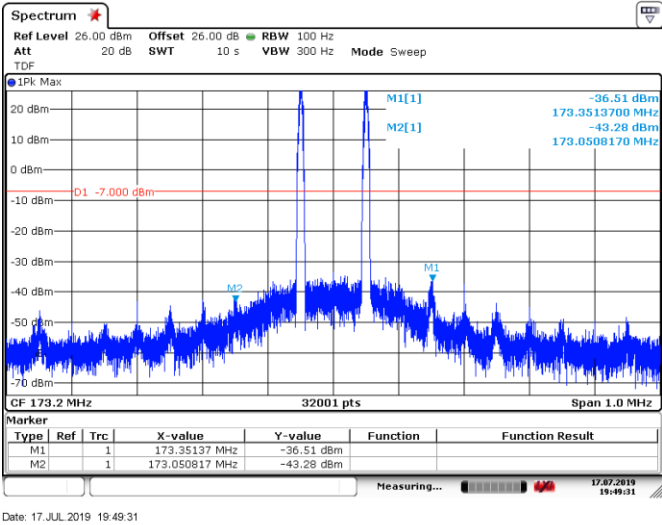


Figure 6.5-49: Conducted Spurious Emissions from inter-modulation products, Tx @high channel 2X15W 7k60FXW modulation

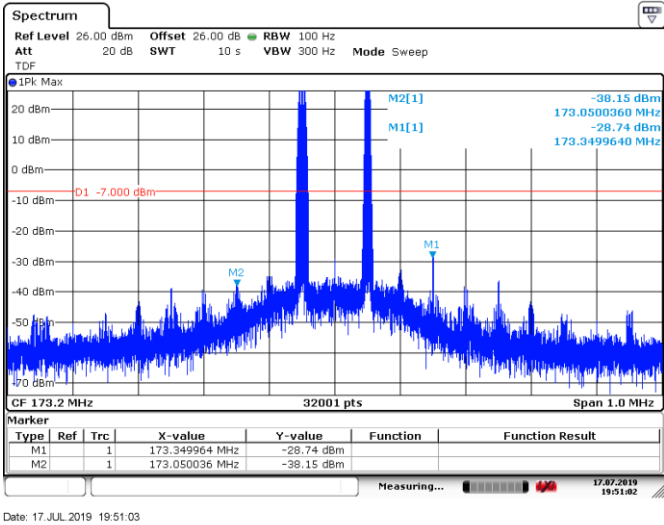


Figure 6.5-50: Conducted Spurious Emissions from inter-modulation products, Tx @mid channel 2X15W 16Kof3E modulation

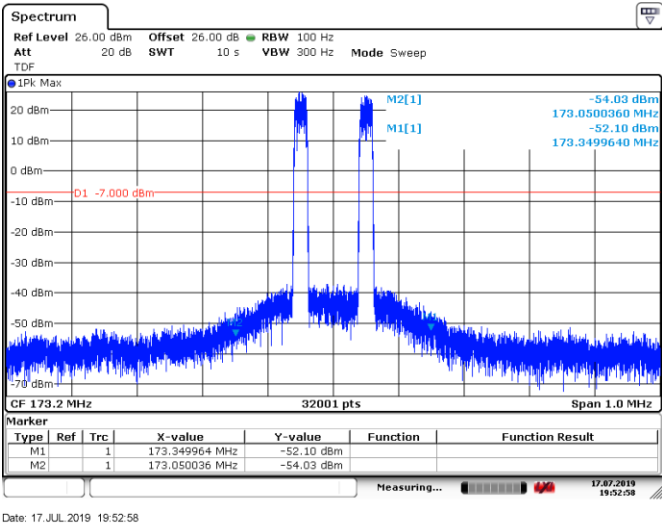


Figure 6.5-51: Conducted Spurious Emissions from inter-modulation products, Tx @high channel 2X10W 0.20TETRA modulation

## 6.6 FCC 90.210, 22.359, 74.462 and RSS-119 5.8 Emission limits, radiated method

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### 6.6.1 Definitions and limits

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#### FCC §22.359

(a) *Out of band emissions.* The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log (P)$  dB.

#### FCC §90.210

(b) Emission Mask B. For transmitters that are equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:

- (1) On any frequency removed from the assigned frequency by more than 50 percent, but not more than 100 percent of the authorized bandwidth: At least 25 dB.
- (2) On any frequency removed from the assigned frequency by more than 100 percent, but not more than 250 percent of the authorized bandwidth: At least 35 dB.
- (3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least  $43 + 10 \log (P)$  dB.

(d) *Emission Mask D—12.5 kHz channel bandwidth equipment.* For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

- (1) On any frequency from the center of the authorized bandwidth  $f_0$  to 5.625 kHz removed from  $f_0$ : Zero dB.
- (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least  $7.27(f_d - 2.88 \text{ kHz})$  dB.
- (3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 12.5 kHz: At least  $50 + 10 \log (P)$  dB or 70 dB, whichever is the lesser attenuation.
- (4) The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide (usually two or three times the channel bandwidth) to capture the true peak emission of the equipment under test. In order to show compliance with the emission mask up to and including 50 kHz removed from the edge of the authorized bandwidth, adjust the resolution bandwidth to 100 Hz with the measuring instrument in a peak hold mode. A sufficient number of sweeps must be measured to insure that the emission profile is developed. If video filtering is used, its bandwidth must not be less than the instrument resolution bandwidth. For emissions beyond 50 kHz from the edge of the authorized bandwidth, see paragraph (o) of this section. If it can be shown that use of the above instrumentation settings does not accurately represent the true interference potential of the equipment under test, an alternate procedure may be used provided prior Commission approval is obtained.

(e) *Emission Mask E—6.25 kHz or less channel bandwidth equipment.* For transmitters designed to operate with a 6.25 kHz or less bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

- (1) On any frequency from the center of the authorized bandwidth  $f_0$  to 3.0 kHz removed from  $f_0$ : Zero dB.
- (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 3.0 kHz but no more than 4.6 kHz: At least  $30 + 16.67(f_d - 3 \text{ kHz})$  or  $55 + 10 \log (P)$  or 65 dB, whichever is the lesser attenuation.
- (3) On any frequency removed from the center of the authorized bandwidth by more than 4.6 kHz: At least  $55 + 10 \log (P)$  or 65 dB, whichever is the lesser attenuation.
- (4) The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide (usually two or three times the channel bandwidth) to capture the true peak emission of the equipment under test. In order to show compliance with the emission mask up to and including 50 kHz removed from the edge of the authorized bandwidth, adjust the resolution bandwidth to 100 Hz with the measuring instrument in a peak hold mode. A sufficient number of sweeps must be measured to insure that the emission profile is developed. If video filtering is used, its bandwidth must not be less than the instrument resolution bandwidth. For emissions beyond 50 kHz from the edge of the authorized bandwidth, see paragraph (o) of this section. If it can be shown that use of the above instrumentation settings does not accurately represent the true interference potential of the equipment under test, an alternate procedure may be used provided prior Commission approval is obtained.

#### FCC §74.462 Authorized bandwidth and emissions.

(a) Each authorization for a new remote pickup broadcast station or system shall require the use of certificated equipment and such equipment shall be operated in accordance with emission specifications included in the grant of certification and as prescribed in paragraphs (b), (c), and (d) of this section.

(b) The maximum authorized bandwidth of emissions corresponding to the types of emissions specified below, and the maximum authorized frequency deviation in the case of frequency or phase modulated emission, shall be as follows:

Frequencies (MHz)	Authorized bandwidth (kHz)	Maximum frequency deviation <sup>1</sup> (kHz)	Type of emission <sup>2</sup>
25.87 to 26.03	40	10	Frequencies 25.87 to 153.3575 MHz: A3E, F1E, F3E, F9E.
26.07 to 26.47	20	5	
152.8625 to 153.3575 <sup>3</sup>	30/60	5/10	
160.860 to 161.400	60	10	
161.625 to 161.775	30	5	
166.25 and 170.15 <sup>4</sup>	12.5/25	5	

<sup>1</sup>Applies where F1A, F1B, F1D, F1E, F2A, F2B, F2D, F2E, F3E, or F9E emissions are used.

<sup>2</sup>Stations operating above 450 MHz shall show a need for employing A1A, A1B, A1D, A1E, A2A, A2B, A2D, A2E, F1A, F1B, F1D, F1E, F2A, F2B, F2D, or F2E emission.

<sup>3</sup>New or modified licenses for use of the frequencies will not be granted to utilize transmitters on board aircraft, or to use a bandwidth in excess of 30 kHz and maximum deviation exceeding 5 kHz

<sup>4</sup>For stations licensed or applied for before April 16, 2003, the sum of the bandwidth of emission and tolerance on frequencies 166.25 MHz or 170.15 MHz shall not exceed 25 kHz, and such operation may continue until January 1, 2005. For new stations licensed or applied for on or after April 16, 2003, the sum of the bandwidth of emission and tolerance on these frequencies shall not exceed 12.5 kHz. For all remote pickup broadcast stations, the sum of the bandwidth of emission and tolerance on these frequencies shall not exceed 12.5 kHz on or after January 1, 2005.

(c) For emissions on frequencies above 25 MHz with authorized bandwidths up to 30 kHz, the emissions shall comply with the emission mask and transient frequency behavior requirements of §§90.210 and 90.214 of this chapter. For all other emissions, the mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:

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

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

(3) On any frequency removed from the assigned frequency by more than 250 percent on the authorized bandwidth; at least 43 plus 10 log<sub>10</sub> (mean output power, in watts) dB.

(d) In the event a station's emissions outside its authorized channel cause harmful interference, the Commission may, at its discretion, require the licensee to take such further steps as may be necessary to eliminate the interference.

Note: The measurements of emission power can be expressed in peak or mean values provided they are expressed in the same parameters as the unmodulated transmitter carrier power.



## RSS-119

### 5.5 Channel Bandwidth, Authorized Bandwidth, Occupied Bandwidth and Spectrum Masks

For the purpose of this document, channel bandwidth is the channel width in which the equipment is designed to operate.

The maximum permissible occupied bandwidth shall not exceed the authorized bandwidth specified in Table 3 for the equipment's frequency band. The authorized bandwidth is defined as the maximum width of the band of frequencies used to derive spectrum masks and is not necessarily equivalent to the bandwidth found on radio and spectrum licences.

The channel bandwidths, authorized bandwidths and spectrum masks are given in Table 3 for equipment having an output power greater than 120 mW. For equipment with an output power that does not exceed 120 mW, Section 5.10 applies.

**Table 3 — Channel Bandwidths, Authorized Bandwidths and Spectrum Masks**

Frequency Band (MHz)	Related SRSP for Channelling Plan and ERP	Channel Bandwidth (kHz)	Authorized Bandwidth (kHz)	Spectrum Masks for Equipment with Audio Filter	Spectrum Masks for Equipment Without Audio Filter
138-144, 148-149.9 and 150.05-174	SRSP-500	30	20	B	C
		15	11.25	D	D
		7.5	6	E	E

### 5.8 Transmitter Unwanted Emissions

The spectrum plots of the unwanted emissions shall comply with the masks specified in Table 3.

Descriptions of these permissible emission masks are given in the sections that follow.

The term displacement frequency,  $f_d$ , used in these sections refers to the difference between the channel frequency and the emission component frequency expressed in kilohertz, and  $p$  is the transmitter output power in Watts.

#### 5.8.1 Emission Mask B for Transmitters Equipped with an Audio Low-Pass Filter

The power of any emission shall be attenuated below the transmitter output power  $P$  (dBW) as specified in Table 5.

**Table 5 — Emission Mask B**

Displacement Frequency, $f_d$ (kHz)	Minimum Attenuation (dB)	Resolution Bandwidth (Hz)
$10 < f_d \leq 20$	25	300
$20 < f_d \leq 50$	35	300
$f_d > 50$	$43 + 10 \log_{10}(p)$	Specified in Section 4.2.1

#### 5.8.3 Emission Mask D for Transmitters Equipped with or Without an Audio Low-Pass Filter

The power of any emission shall be attenuated below the transmitter output power  $P$  (dBW) as specified in Table 7.

**Table 7 — Emission Mask D**

Displacement Frequency, $f_d$ (kHz)	Minimum Attenuation (dB)	Resolution Bandwidth (Hz)
$.625 < f_d \leq 12.5$	$7.27(f_d - 2.88)$	Specified in Section 4.2.2
$f_d > 12.5$	Whichever is the lesser: $70$ or $50 + 10 \log_{10}(p)$	Specified in Section 4.2.2

#### 5.8.4 Emission Mask E for Transmitters Equipped with or Without an Audio Low-Pass Filter

The power of any emission shall be attenuated below the transmitter output power  $P$  (dBW) as specified in Table 8.

**Table 8 — Emission Mask E**

Displacement Frequency, $f_d$ (kHz)	Minimum Attenuation (dB)	Resolution Bandwidth (Hz)
$3 < f_d \leq 4.6$	Whichever is the lesser: $30 + 16.67(f_d - 3)$ or $55 + 10 \log_{10}(p)$	Specified in Section 4.2.2
$f_d > 4.6$	Whichever is the lesser: $57$ or $55 + 10 \log_{10}(p)$	Specified in Section 4.2.2

## 6.6.2 Test summary

Test date	June 7, 2019
Test engineer	Yong Huang

6.6.3 Observations, settings and special notes

The spectrum was searched from 30 MHz to the 10th harmonic.  
Spectrum Analyzer's setting:

Detector mode	Peak
Resolution bandwidth	100 kHz below 1 GHz/1 MHz above 1 GHz
Video bandwidth	RBW × 3
Trace mode	Max Hold

6.6.4 Test data

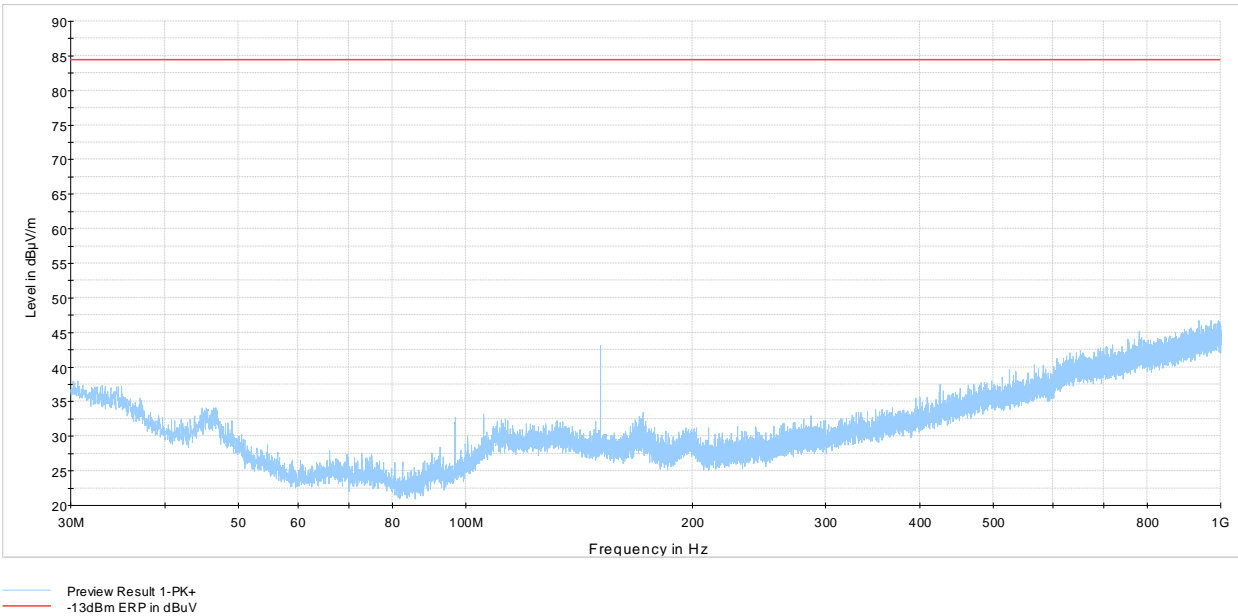


Figure 6.6-1: Cabinet Radiated Spurious Emissions below 1 GHz, Tx @low channel 50W 7k60FXW modulation

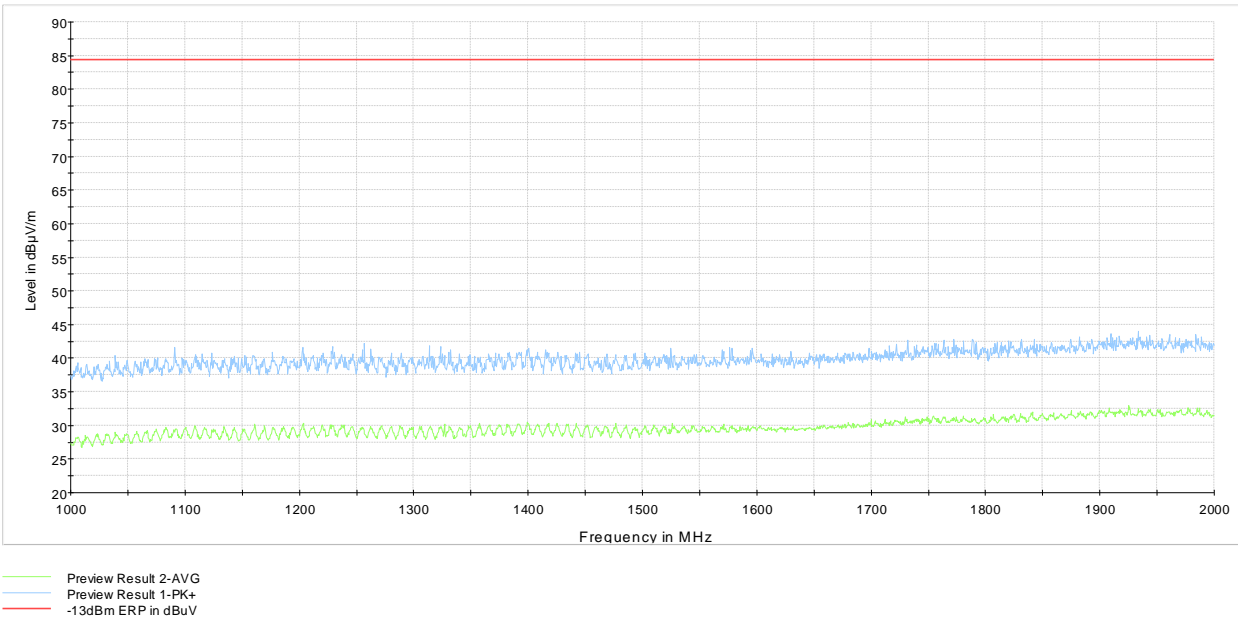


Figure 6.6-2: Cabinet Radiated Spurious Emissions above 1 GHz, Tx @low channel 50W 7k60FXW modulation

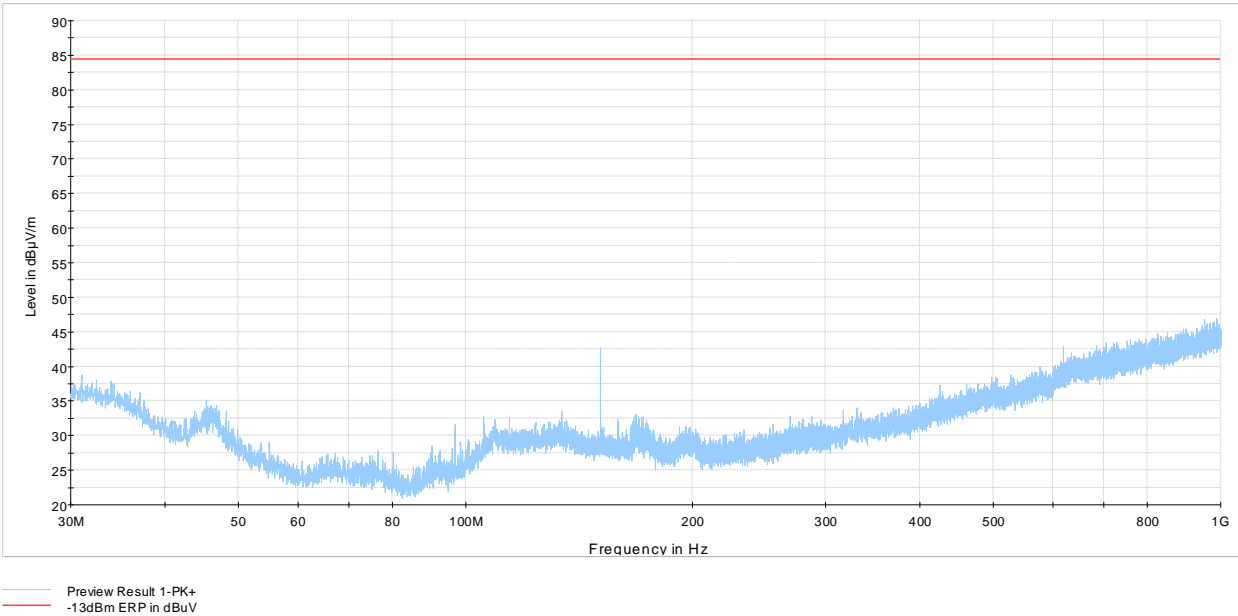


Figure 6.6-3: Cabinet Radiated Spurious Emissions below 1 GHz, Tx @low channel 50W 16K0F3E modulation

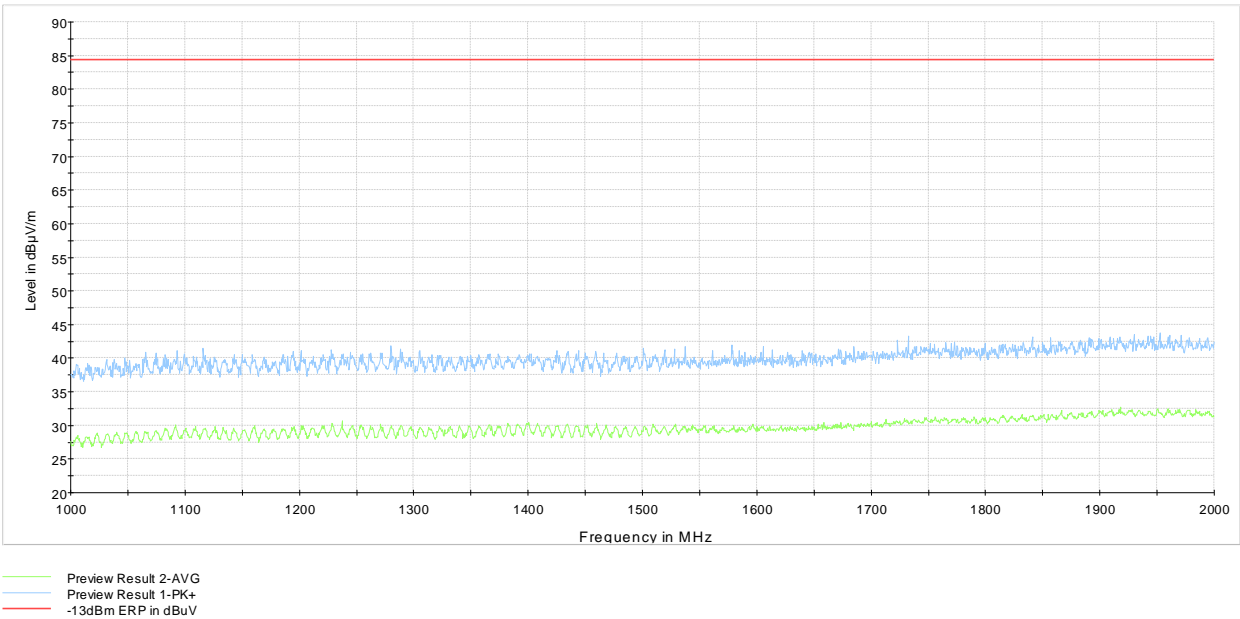


Figure 6.6-4: Cabinet Radiated Spurious Emissions above 1 GHz, Tx @low channel 50W 16KoF3E modulation

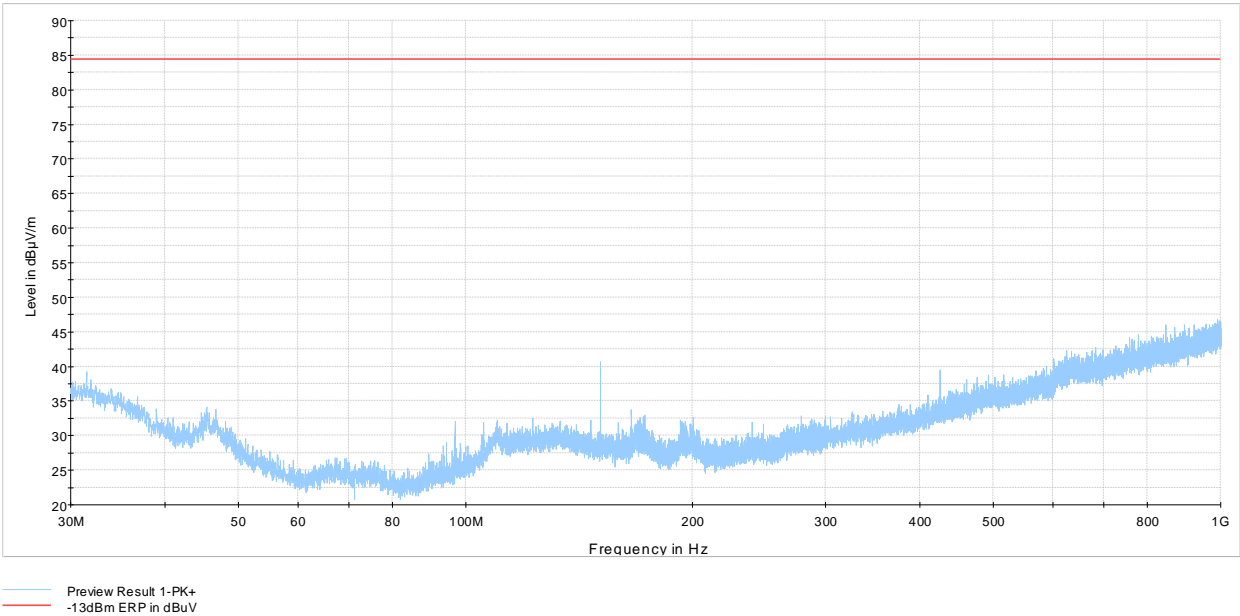


Figure 6.6-5: Cabinet Radiated Spurious Emissions below 1 GHz, Tx @low channel 25W 0.20TETRA modulation

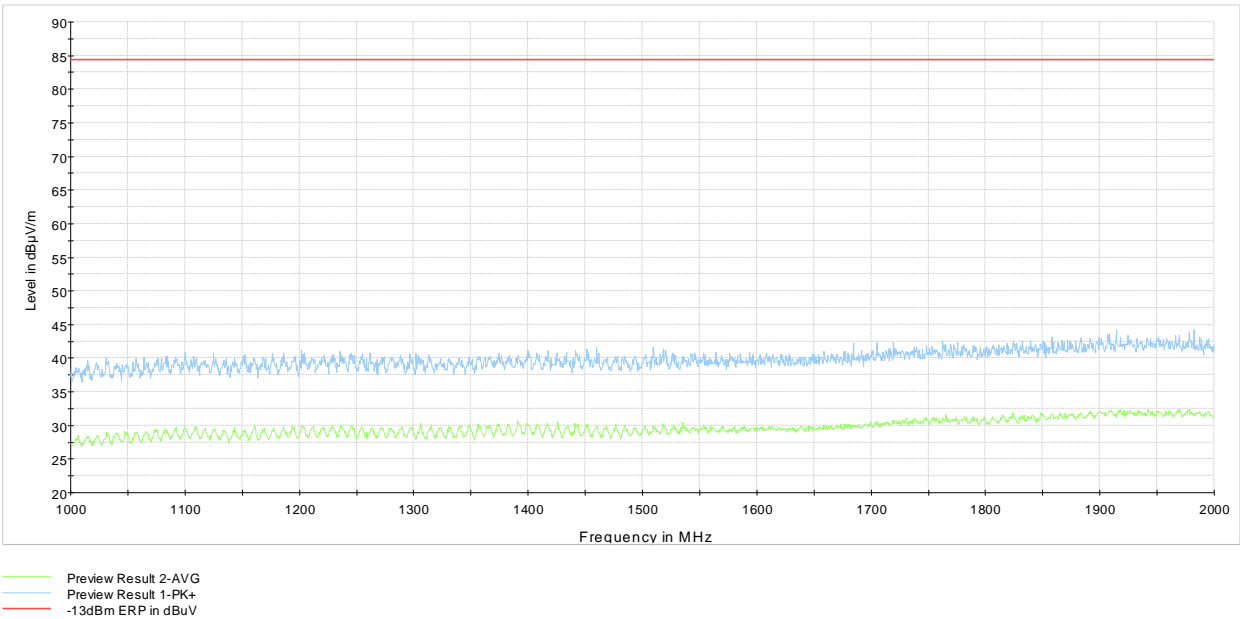


Figure 6.6-6: Cabinet Radiated Spurious Emissions above 1 GHz, Tx @low channel 25W 0.20TETRA modulation

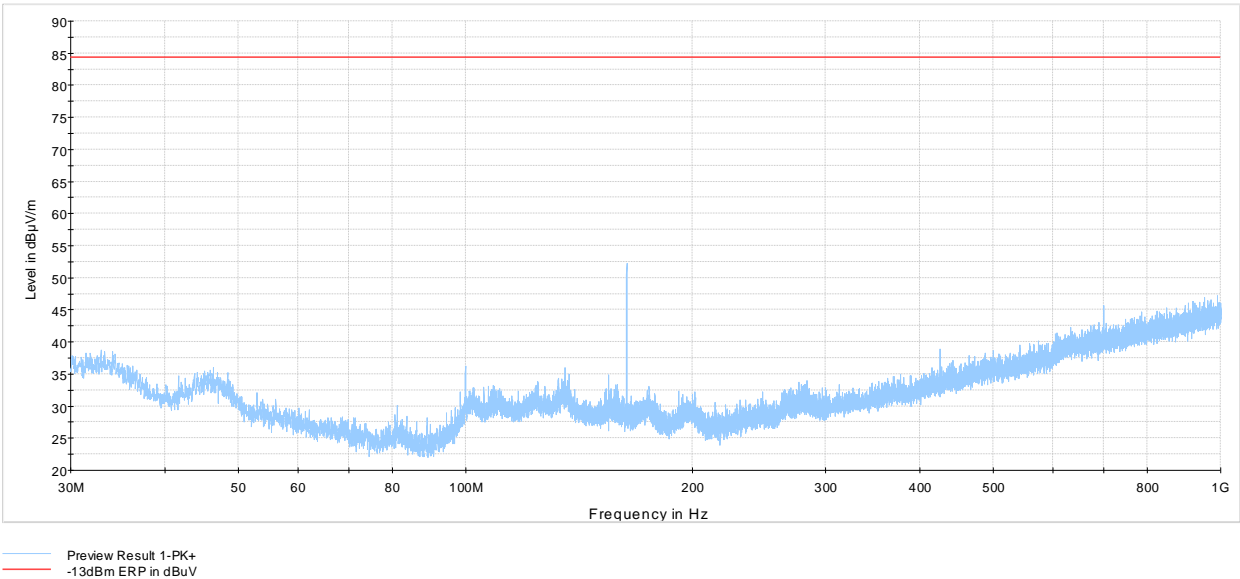


Figure 6.6-7: Cabinet Radiated Spurious Emissions below 1 GHz, Tx @mid channel 50W 7k60F3E modulation

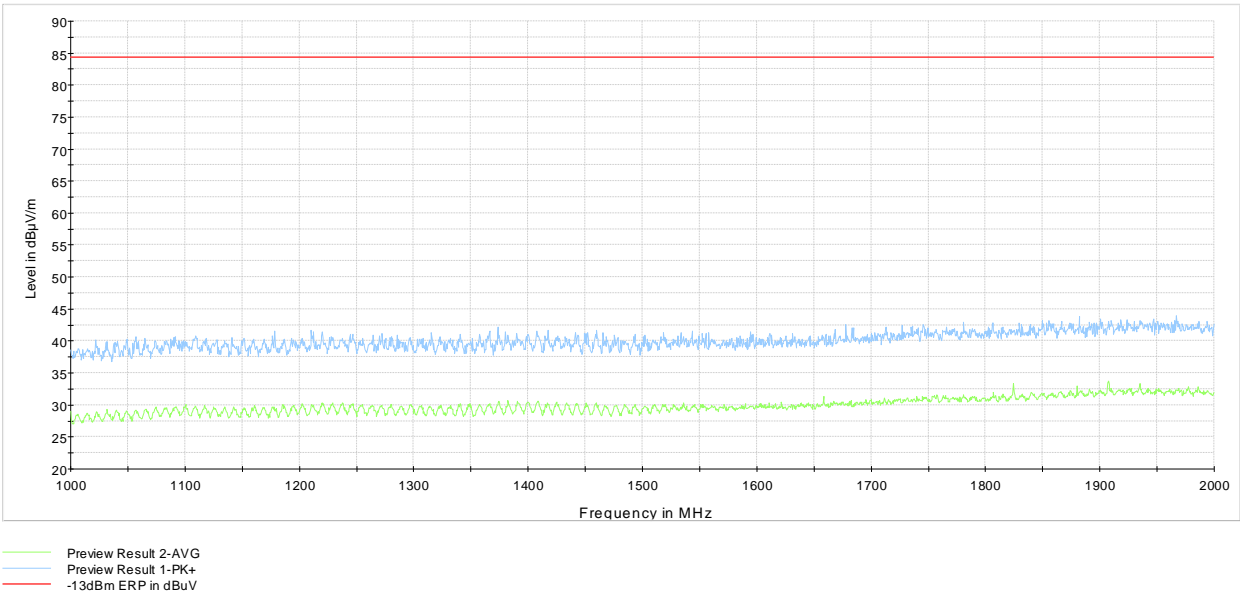


Figure 6.6-8: Cabinet Radiated Spurious Emissions above 1 GHz, Tx @ mid channel 50W 7k60F3E modulation

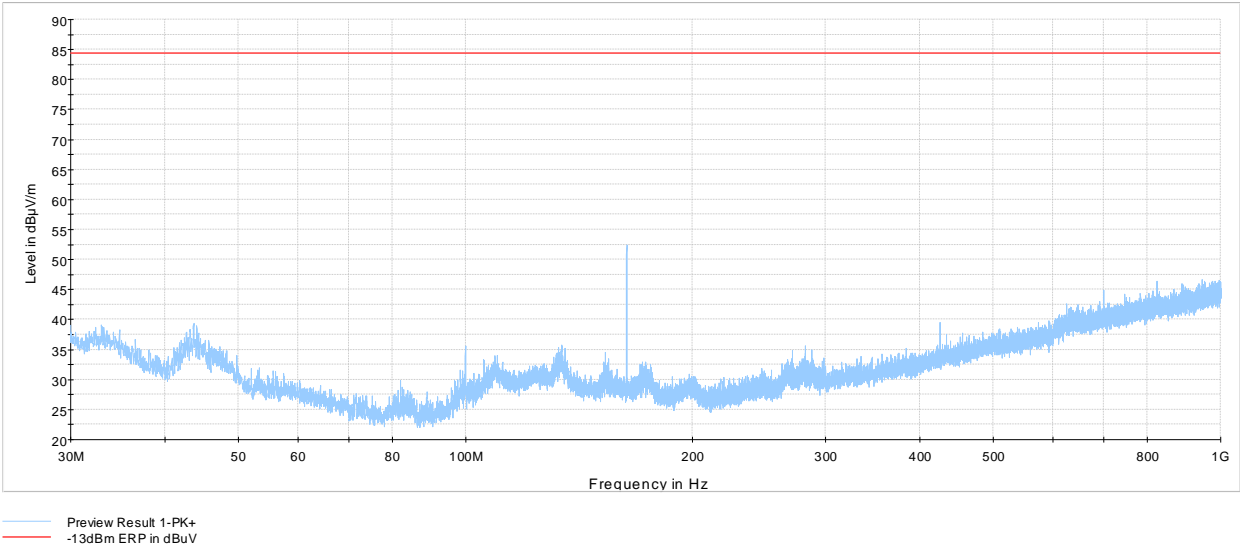


Figure 6.6-9: Cabinet Radiated Spurious Emissions below 1 GHz, Tx @mid channel 50W 16K0F3E modulation

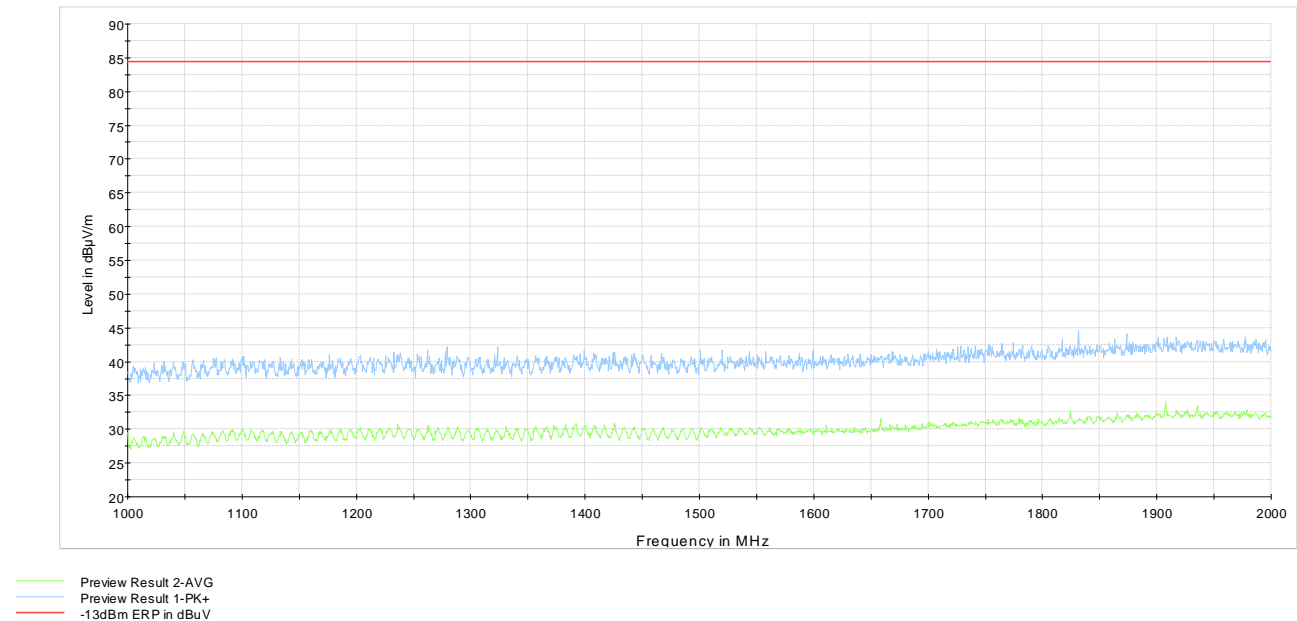


Figure 6.6-10: Cabinet Radiated Spurious Emissions above 1 GHz, Tx @ mid channel 50W 16Kof3E modulation

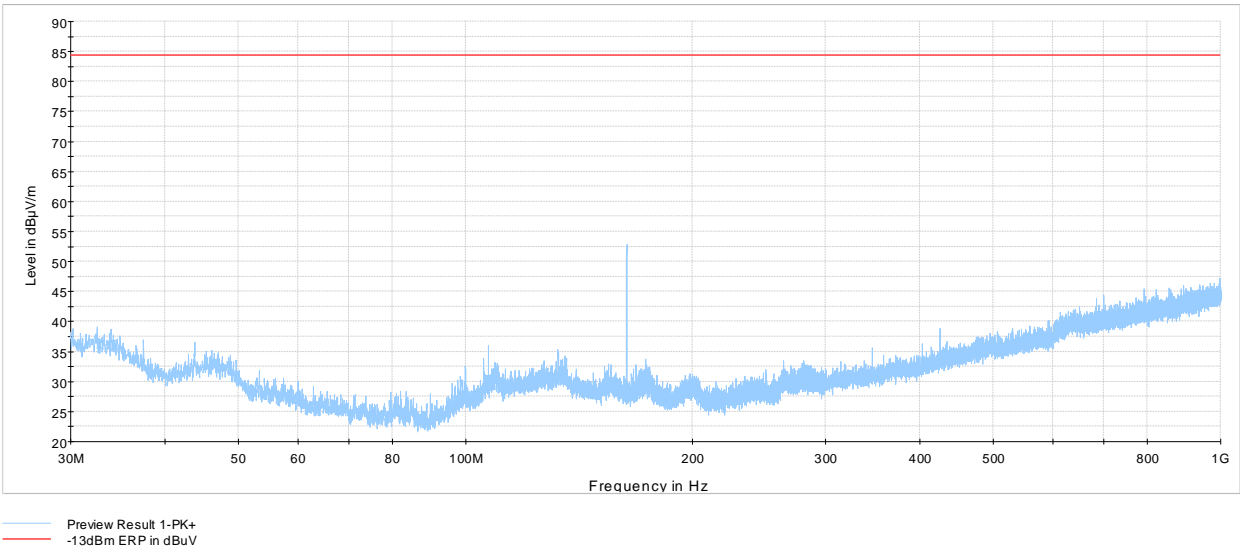


Figure 6.6-11: Cabinet Radiated Spurious Emissions below 1 GHz, Tx @ mid channel 25W 0.20TETRA modulation

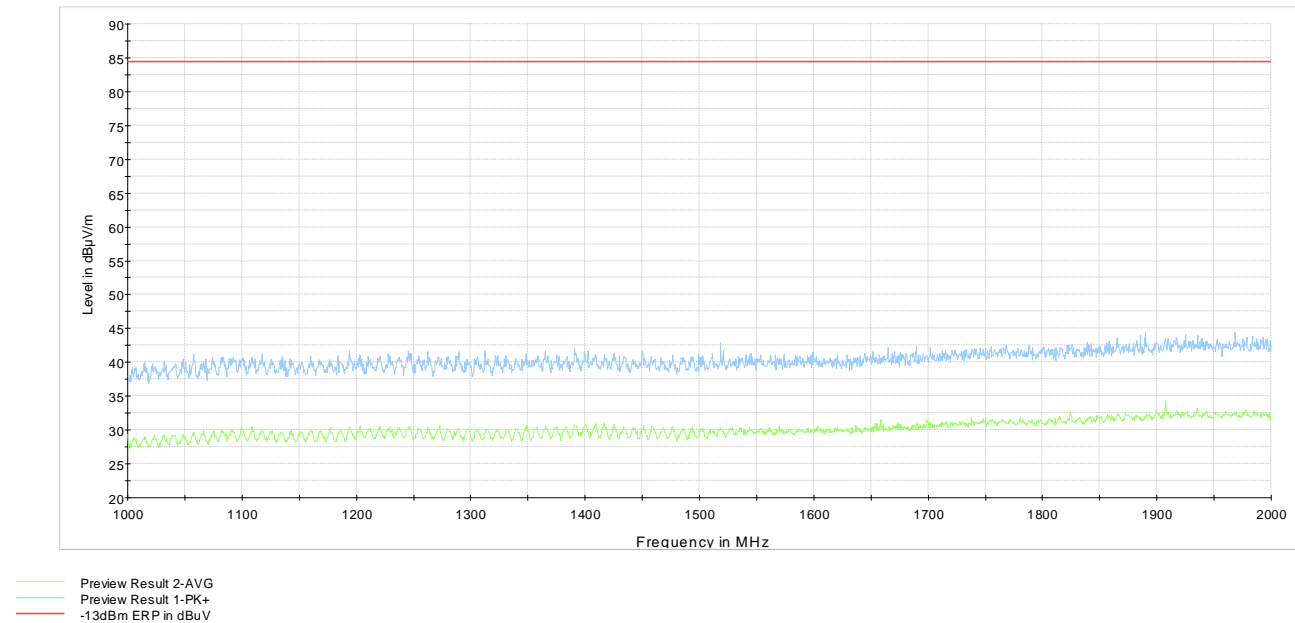


Figure 6.6-12: Cabinet Radiated Spurious Emissions above 1 GHz, Tx @ mid channel 25W 0.20TETRA modulation

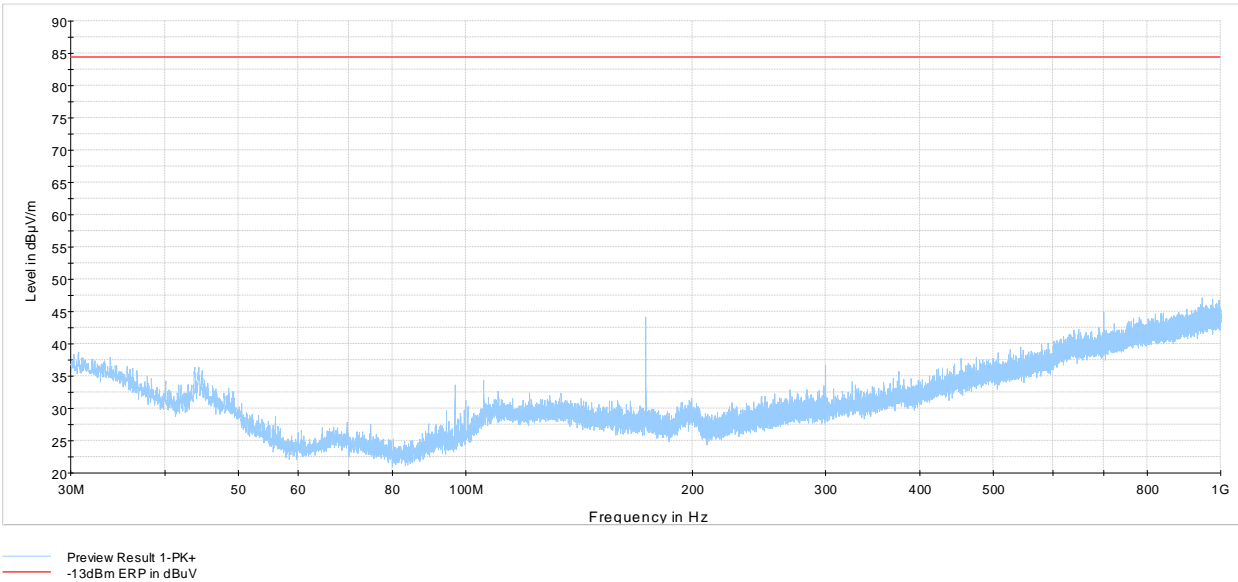


Figure 6.6-13: Cabinet Radiated Spurious Emissions below 1 GHz, Tx @ high channel 50W 7k60F3E modulation



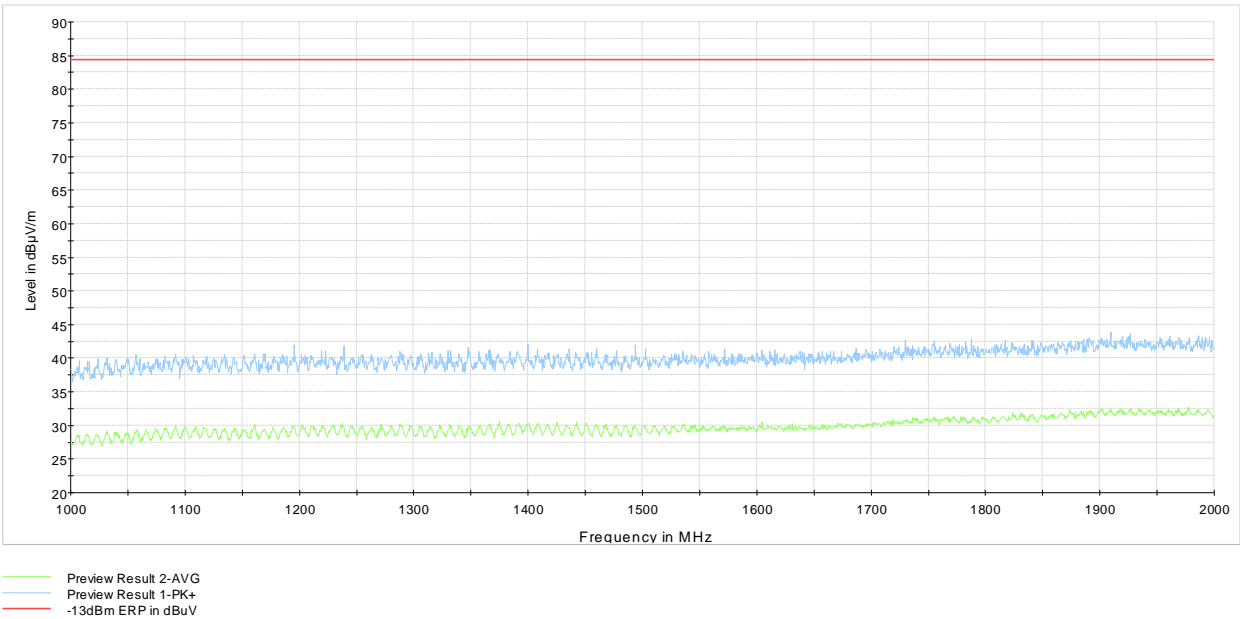


Figure 6.6-14: Cabinet Radiated Spurious Emissions above 1 GHz, Tx @ high channel 50W 7k60F3E modulation

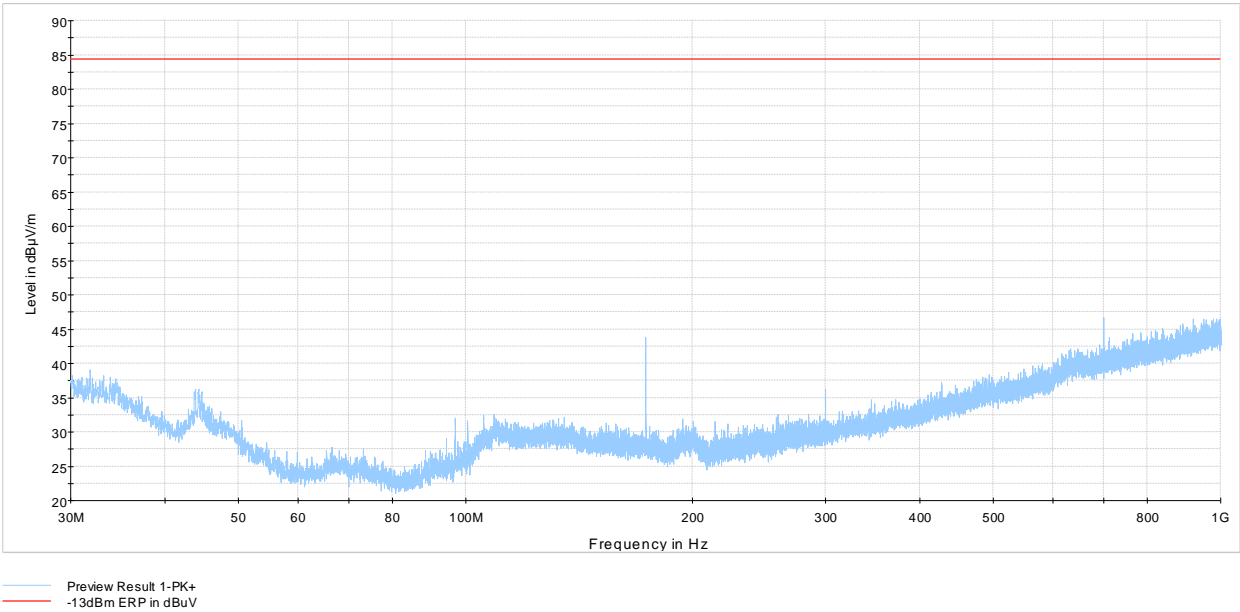


Figure 6.6-15: Cabinet Radiated Spurious Emissions below 1 GHz, Tx @ high channel 50W 16K0F3E modulation

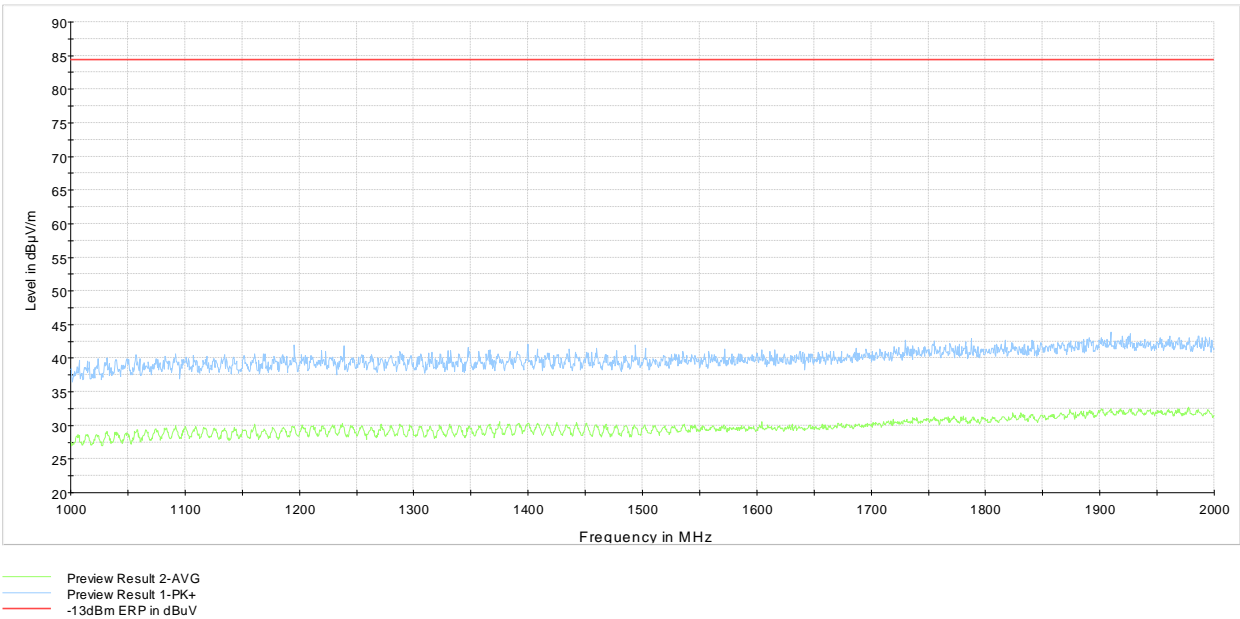


Figure 6.6-16: Cabinet Radiated Spurious Emissions above 1 GHz, Tx @ high channel 50W 16Kof3E modulation

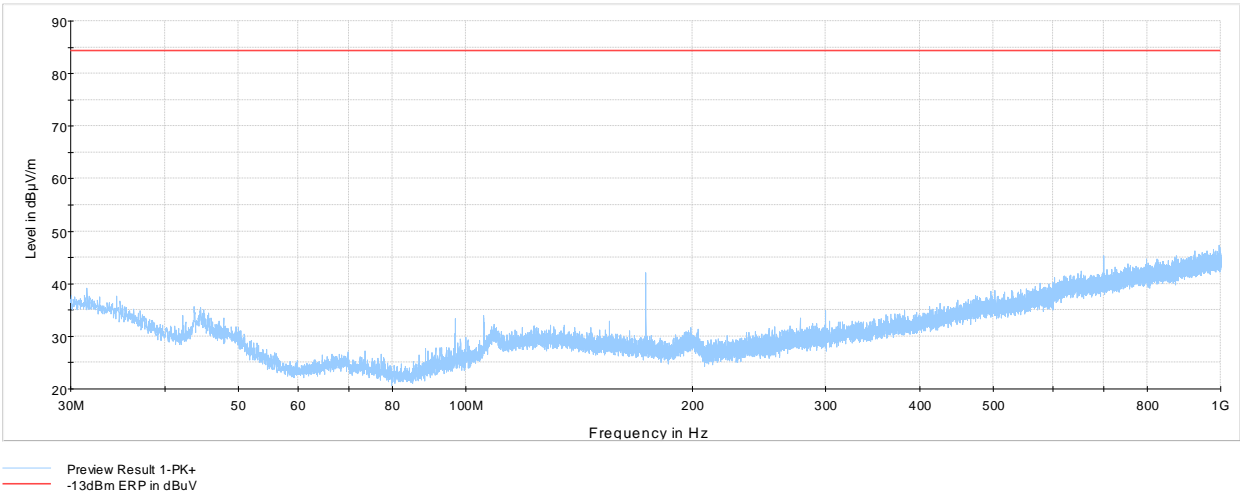


Figure 6.6-17: Cabinet Radiated Spurious Emissions below 1 GHz, Tx @ high channel 25W 0.20TETRA modulation

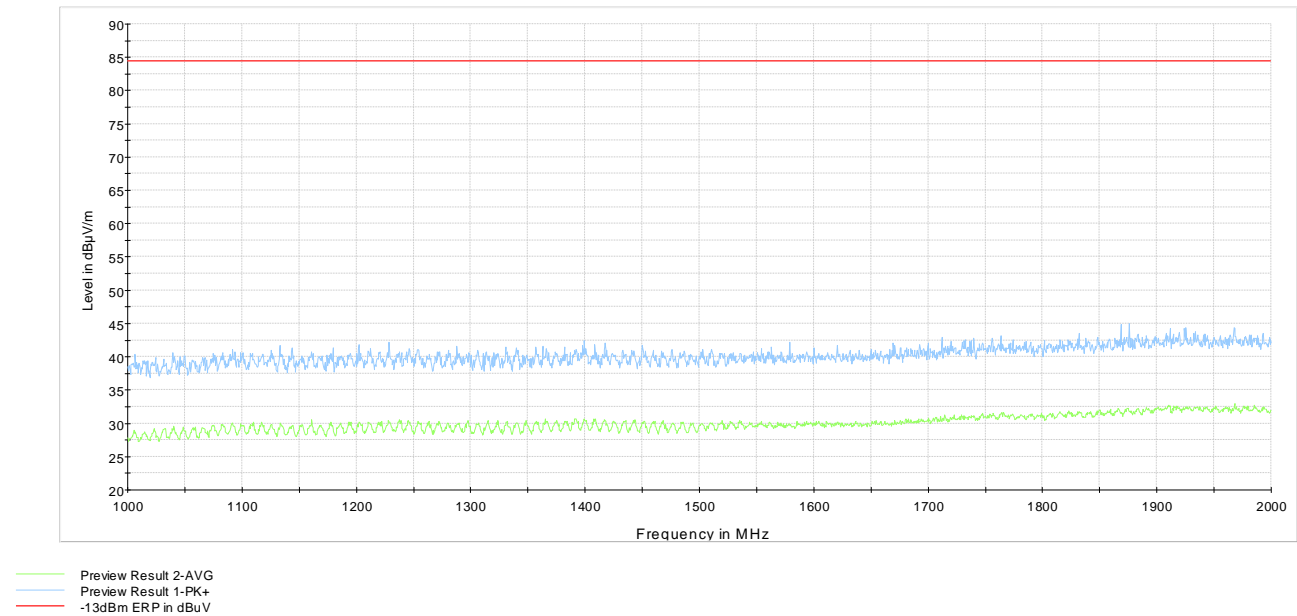


Figure 6.6-18: Cabinet Radiated Spurious Emissions above 1 GHz, Tx @ high channel 25W 0.20TETRA modulation

## 6.7 FCC 90.214 and RSS-119 5.9 Transient frequency behavior

### 6.7.1 Definitions and limits

#### FCC§90.214:

Transmitters designed to operate in the 150-174 MHz and 421-512 MHz frequency bands must maintain transient frequencies within the maximum frequency difference limits during the time intervals indicated:

me intervals <sup>1 2</sup>	Maximum frequency difference <sup>3</sup>	All equipment	
		150 to 174 MHz	421 to 512 MHz
Transient Frequency Behavior for Equipment Designed to Operate on 25 kHz Channels			
t <sub>1</sub> <sup>4</sup>	±25.0 kHz	5.0 ms	10.0 ms
t <sub>2</sub>	±12.5 kHz	20.0 ms	25.0 ms
t <sub>3</sub> <sup>4</sup>	±25.0 kHz	5.0 ms	10.0 ms
Transient Frequency Behavior for Equipment Designed to Operate on 12.5 kHz Channels			
t <sub>1</sub> <sup>4</sup>	±12.5 kHz	5.0 ms	10.0 ms
t <sub>2</sub>	±6.25 kHz	20.0 ms	25.0 ms
t <sub>3</sub> <sup>4</sup>	±12.5 kHz	5.0 ms	10.0 ms
Transient Frequency Behavior for Equipment Designed to Operate on 6.25 kHz Channels			
t <sub>1</sub> <sup>4</sup>	±6.25 kHz	5.0 ms	10.0 ms
t <sub>2</sub>	±3.125 kHz	20.0 ms	25.0 ms
t <sub>3</sub> <sup>4</sup>	±6.25 kHz	5.0 ms	10.0 ms

<sup>1</sup><sub>on</sub> is the instant when a 1 kHz test signal is completely suppressed, including any capture time due to phasing.

t<sub>1</sub> is the time period immediately following t<sub>on</sub>.

t<sub>2</sub> is the time period immediately following t<sub>1</sub>.

t<sub>3</sub> is the time period from the instant when the transmitter is turned off until t<sub>off</sub>.

t<sub>off</sub> is the instant when the 1 kHz test signal starts to rise.

<sup>2</sup> During the time from the end of t<sub>2</sub> to the beginning of t<sub>3</sub>, the frequency difference must not exceed the limits specified in §90.213.

<sup>3</sup> Difference between the actual transmitter frequency and the assigned transmitter frequency.

<sup>4</sup> If the transmitter carrier output power rating is 6 watts or less, the frequency difference during this time period may exceed the maximum frequency difference for this time period.

#### RSS-119, 5.9 Transient Frequency Behaviour

When a transmitter is turned on, the radio frequency may take some time to stabilize. During this initial period, the frequency error or frequency difference (i.e., between the instantaneous and the steady state frequencies) shall not exceed the limits specified in Table 18.

Any suitable method of measurement can be used provided that it is fully described in the test report. A suitable and recommended method is given in TIA Standard 603.

Table 18 — Transient Frequency Behaviour

Channel Bandwidth (kHz)	Time Intervals (Notes <small>Footnote 1, Footnote 2</small> )	Maximum Frequency Difference (kHz)	Transient Duration Limit (ms)	
			138-174 MHz	406.1-512 MHz
25	t <sub>1</sub>	±25	5	10
	t <sub>2</sub>	±12.5	20	25
	t <sub>3</sub>	±25	5	10
12.5	t <sub>1</sub>	±12.5	5	10
	t <sub>2</sub>	±6.25	20	25
	t <sub>3</sub>	±12.5	5	10
6.25	t <sub>1</sub>	±6.25	5	10
	t <sub>2</sub>	±3.125	20	25
	t <sub>3</sub>	±6.25	5	10

Table 18 notes

Table note 1

ton: the instant when a 1 kHz test signal is completely suppressed, including any capture time due to phasing.

t1: the time period immediately following ton.

t2: the time period immediately following t1.

t3: the time period from the instant when the transmitter is turned off until toff.

toff: the instant when the 1 kHz test signal starts to rise.

Return to footnote 1 referrer

Table note 2

If the transmitter carrier output power rating is 6 W or less, the frequency difference during the time periods t1 and t3 may exceed the maximum frequency difference for these time periods. The corresponding plot of frequency versus time during t1 and t3 shall be recorded in the test report.

6.7.2    Test summary

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Test date	July 10, 2019
Test engineer	Kevin Rose and Yong Huang

6.7.3    Observations, settings and special notes

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None

6.7.4 Test data

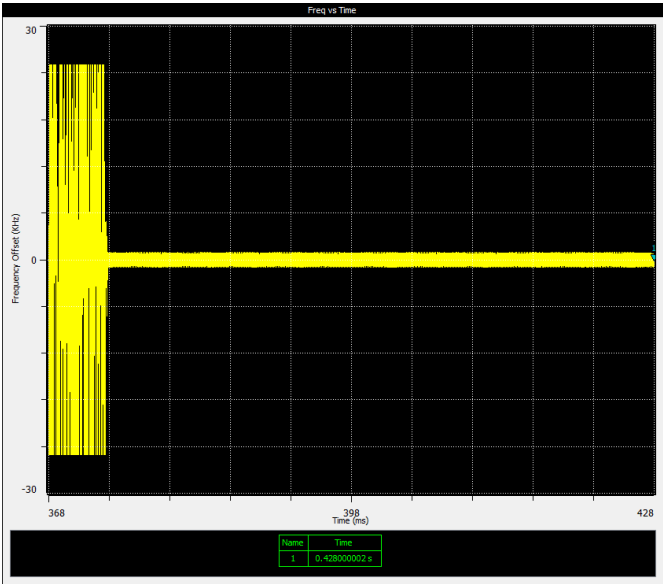


Figure 6.7-1: Transient Frequency behavior, Tx @ mid channel 25 k channel, switch ON

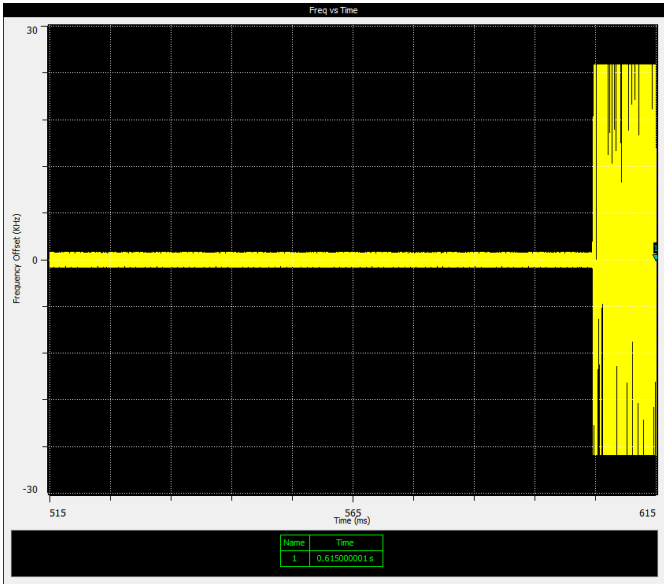


Figure 6.7-2: Transient Frequency behavior, Tx @ mid channel 25 k channel, switch OFF

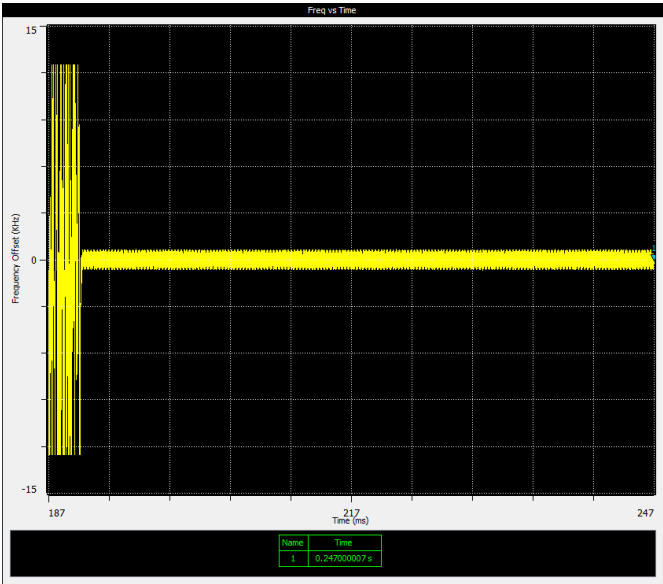


Figure 6.7-3: Transient Frequency behavior, Tx @ mid channel 12.5 k channel, switch ON

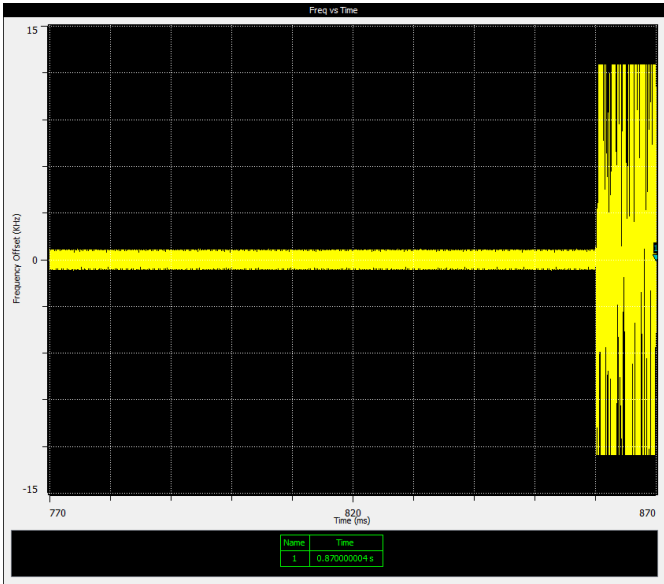
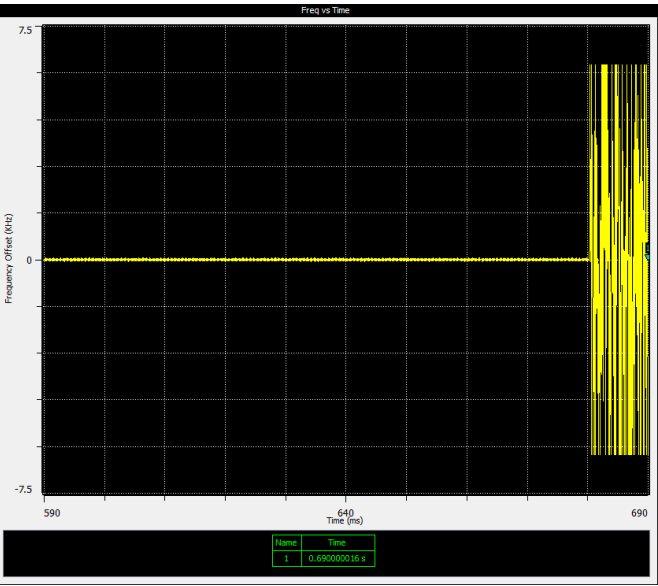
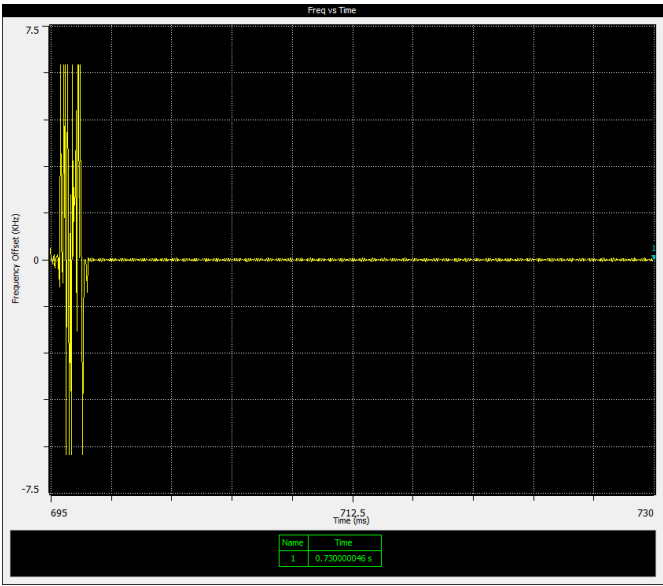


Figure 6.7-4: Transient Frequency behavior, Tx @ mid channel 12.5 k channel, switch OFF



## 6.8 FCC 90.213, 22.355, 74.464 and RSS-119 5.3 Frequency stability

### 6.8.1 Definitions and limits

#### FCC§90.213(a):

(a) Unless noted elsewhere, transmitters used in the services governed by this part must have a minimum frequency stability as specified in the following table:

**Table 6.8-1: Minimum frequency stability**

Frequency range (MHz)	Fixed and base stations (±ppm)	Mobile stations (±ppm)	
		Over 2 watts output power	2 watts or less output power
150-174	<sup>5</sup> 115	<sup>6</sup> 5	<sup>4</sup> <sup>6</sup> 50

<sup>4</sup>Stations operating in the 154.45 to 154.49 MHz or the 173.2 to 173.4 MHz bands must have a frequency stability of 5 ppm.

<sup>5</sup>In the 150-174 MHz band, fixed and base stations with a 12.5 kHz channel bandwidth must have a frequency stability of 2.5 ppm. Fixed and base stations with a 6.25 kHz channel bandwidth must have a frequency stability of 1.0 ppm.

<sup>6</sup>In the 150-174 MHz band, mobile stations designed to operate with a 12.5 kHz channel bandwidth or designed to operate on a frequency specifically designated for itinerant use or designed for low-power operation of two watts or less, must have a frequency stability of 5.0 ppm. Mobile stations designed to operate with a 6.25 kHz channel bandwidth must have a frequency stability of 2.0 ppm.

<sup>11</sup>Paging transmitters operating on paging-only frequencies must operate with frequency stability of 5 ppm in the 150-174 MHz band and 2.5 ppm in the 421-512 MHz band.

#### §22.355 Frequency tolerance.

Except as otherwise provided in this part, the carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances given in Table C-1 of this section.

**Table C-1—Frequency Tolerance for Transmitters in the Public Mobile Services**

Frequency range (MHz)	Base, fixed (ppm)	Mobile >3 watts (ppm)	Mobile ≤3 watts (ppm)
50 to 450	5.0	5.0	50.0

#### §74.464 Frequency tolerance.

For operations on frequencies above 25 MHz using authorized bandwidths up to 30 kHz, the licensee of a remote pickup broadcast station or system shall maintain the operating frequency of each station in compliance with the frequency tolerance requirements of §90.213 of this chapter. For all other operations, the licensee of a remote pickup broadcast station or system shall maintain the operating frequency of each station in accordance with the following:

Frequency range	Tolerance (percent)	
	Base station	Mobile station
30 to 300 MHz:		
3 W or less	.0005	.005
Over 3 W	.0005	.0005
300 to 500 MHz, all powers	.00025	.0005

#### RSS-119, 5.3 Transmitter Frequency Stability

The carrier frequency shall not depart from the reference frequency in excess of the values given in Table 1. For transmitters that have an output power of less than 120 mW, the frequency stability shall comply with the limits listed in Table 1 or, alternatively, with the conditions in Section 5.10.

For fixed and base station equipment, in lieu of meeting the frequency stability limit specified in Table 1, the test report can show that the frequency stability is met by demonstrating that the unwanted emission limits, related to the equipment's nominal carrier frequency measured under normal operation, are met when the equipment is tested at the temperature and supply voltage variations specified for the frequency stability measurement in RSS-Gen.

**Table 1 — Transmitter Frequency Stability**

Frequency Band (MHz)	Channel Bandwidth (kHz)	Frequency Stability (ppm)		
		Base/Fixed	Mobile Station	
			Output Power >2 W	Output Power ≤2 W
138-174	30	5	5	5
	15	2.5	5	5
	7.5	1	2	5



## 6.8.2 Test summary

Test date	June 7, 2019
Test engineer	Yong Huang

## 6.8.3 Observations, settings and special notes

Test was performed on supply voltage variations as per client rated, no frequency deviation was observed.

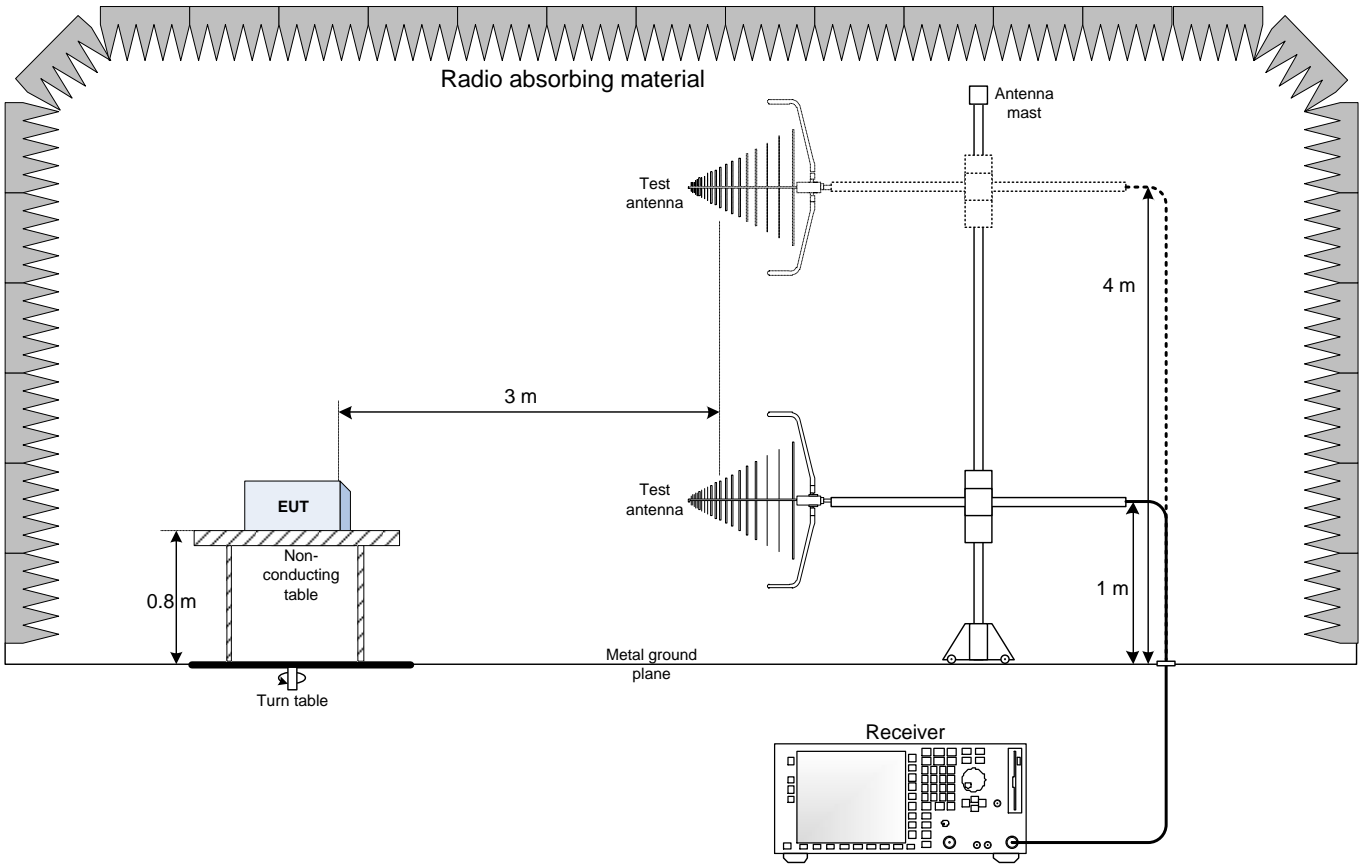
## 6.8.4 Test data

**Table 6.8-2: Frequency drift measurement results**

Test conditions	Frequency, Hz	Drift, Hz	Drift, ppm	Limit ±ppm	Margin, ±ppm
+50 °C, Nominal	163500001.3	17.5	0.11	1	0.89
+40 °C, Nominal	163499998.8	15.0	0.09	1	0.91
+30 °C, Nominal	163499986.3	2.5	0.02	1	0.98
+20 °C, 87.5%	163499983.8	0	0	5	5
+20 °C, Nominal	163499983.8	Reference	Reference	Reference	Reference
+20 °C, 115%	163499983.8	0	0	5	5
+10 °C, Nominal	163499976.3	-7.5	-0.05	1	0.95
0 °C, Nominal	163499966.3	-17.5	-0.11	1	0.89
-10 °C, Nominal	163499948.1	-35.7	-0.22	1	0.78
-20 °C, Nominal	163499944.7	-39.1	-0.24	1	0.76
-30 °C, Nominal	163499954.4	-29.4	-0.18	1	0.82

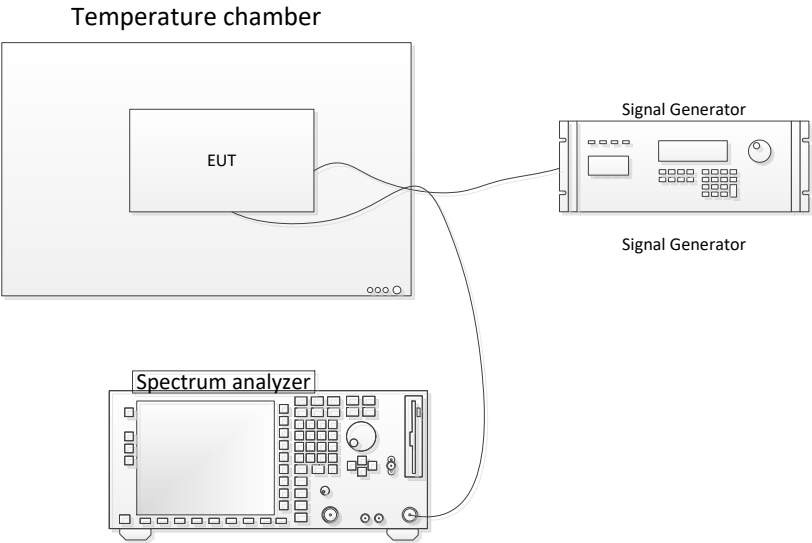
Section 7. Block diagrams of test set-ups

7.1 Radiated emissions set-up



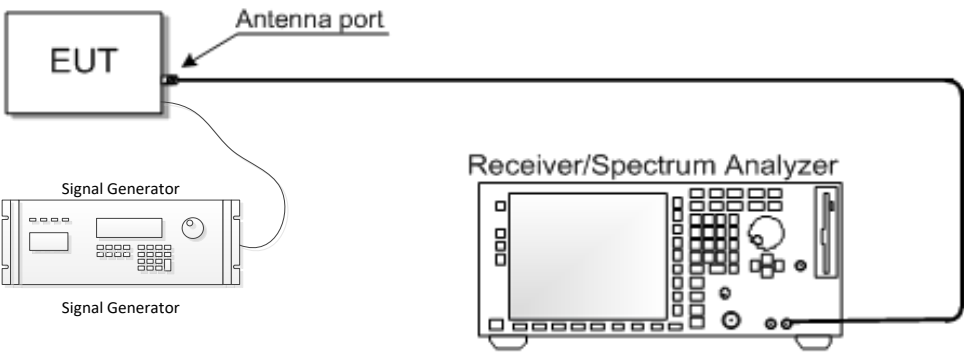
7.2 Frequency stability set-up

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7.3 conducted method set-up

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(End of report)