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SPECIFICATION FOR RADIO LINKING SYSTEM:

STUDIO TO TRANSMITTER LINKING SYSTEM

USING ANGLE MODULATION WITH
CARRIER FREQUENCY SEPARATION
BETWEEN 75 AND 500 kHz

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CONTENTS

1. SCOPE

This specification covers the minimum performance requirements for angle modulated studio-to-transmitter links (STLs) operating in the 404-420 MHz and 915-921/929-935 MHz Fixed Service bands.

2. BASIC OPERATIONAL REQUIREMENTS

2.1 Class of Emission

Emissions shall be angle modulated. The emission designator as given on the radio apparatus licence shall not be greater than the bandwidth of the assigned channel.

2.2 Method of Operation

The equipment shall operate on a single RF channel only. Two programme channels may be multiplexed on to a single RF carrier, if the equipment is licensed to operate in a 500 kHz channel.

3. STANDARD TEST CONDITIONS

3.1 General

Remote measurements of the transmitting installation shall be performed under the conditions existing at the time of the measurements. It is recognised that this could mean that the measurements are taken under extreme conditions of temperature or power supply voltages. Nevertheless, the installation shall still comply with the requirements of this specification.

The transmitting installation shall be measured while the transmitter is modulated with normal programme material, and operating into the normal antenna, including any filters, combiners or isolators.

3.2 Nominal Tune Frequency

The nominal tune frequency shall be the assigned frequency.

3.3 Spectrum Analyser Requirements

To perform the required measurements, the spectrum analyser shall meet the following parameters:

Frequency range	0.1 MHz to 18 GHz
Resolution bandwidth settings (3 dB)	1, 3,10, 30,100, 300 kHz, 1 MHz
Video bandwidth	As for resolution bandwidth
Display mode	Normal and Peak Hold

The spectrum analyser sideband noise, noise floor, dynamic range, spurious responses and intermodulation performance shall be such that if a normal modulated RF signal is applied to the spectrum analyser, the emission displayed shall not be significantly affected by these parameters.

3.4 Measurement Receiving Antennas

The receiving antennas shall cover the frequencies of all emissions from the transmitting installation under test, up to ten times the assigned frequency. The conversion factor (K), or the gain/frequency characteristics of the antenna over a dipole or isotropic antenna, must be known.

3.5 Measurement Site Requirements

The distance from the transmitting antenna to the measurement site shall be ascertained. The site shall be close to the source and as free as possible from reflections and obstructions. It is essential that the measuring antenna be placed in the far field, in the main beam of the transmitting antenna, and in the same polarity, to ensure maximum accuracy of the measurements.

3.6 Receiving Antenna Height

The receiving antenna height and polarisation shall be varied to give the maximum signal from the wanted source.

4. TRANSMITTER PERFORMANCE

4.1 Equivalent Isotropic Radiated Power (eirp)

4.1.1 Method of Measurement

The transmitter shall be operated under normal working conditions. A spectrum analyser or field strength meter with an appropriate directional antenna (to minimise effects from interfering transmissions) shall be used to measure the total emission from the transmitter, using the bandwidth constraints of Appendix A. The 0 dB reference level shall be established as described in Appendix A. The eirp shall be calculated from the measured field strength and the known distance to the transmitter antenna.

4.1.2 Minimum Standard

The calculated eirp shall not exceed the limit specified on the transmitter licence, after measurement tolerances have been taken into account. Note that the measurement tolerances will be dependent on which measuring authority is making the measurements, their certification/calibration procedures and measurement methods.

4.2 Spurious Emissions

4.2.1 Definition

Spurious emissions are considered to be any emission beyond the channel bandwidth as described in the publication "Fixed Service Bands in New Zealand" (PIB22, which replaces RFS634).

4.2.2 Method of Measurement

The emission shall be monitored with a spectrum analyser as in sub-clause 4.1.1, with a scan width of 1.3 or 2.6 MHz for monophonic or composite signals respectively. The amplitude of any spurious signals shall be measured with respect to the 0 dB reference derived in sub-clause 4.1.1.

4.2.3 Minimum Standard

The power of any individual spurious signals shall not exceed a level of -70 dBc, but need not be less than -20 dBm eirp.

4.3 Frequency Accuracy of Radiated Emission

4.3.1 Method of measurement

The emission shall be monitored with a spectrum analyser, which shall be set to display the emission in the peak hold mode. The centre frequency of the emission shall be found by using the analyser marker facility. The span of the spectrum analyser shall be reduced to 100 or 150 kHz to allow measurements to be made to an acceptable level of accuracy. The measurement accuracy may be further improved by using the techniques described in Appendix B.

[it is recognised that it is difficult to make remote frequency measurements to the required accuracy, and if indications are that the frequency is outside the permitted tolerance, on-station measurements will be required to resolve the issue.]

4.3.2 Minimum Standard

The difference between the measured centre frequency and the nominal tune frequency shall not exceed ±2.5 kHz for the 404-420 MHz band, or ± 25 ppm for the 915-935 MHz band.

4.4 Occupied Bandwidth

4.4.1 Method of Measurement

The emission shall be monitored as for sub-clause 4.2.2, and the -6 dB and -26 dB bandwidths determined.

4.4.2 Minimum Standard

The measured bandwidths shall not exceed those in the following table:

	Bandwidth (kHz)	
Emission Designator	**-6 dB**	**-26 dB**
<=75K0	42	95
11OK (400 M Hz band)	84	168
11OK - 180K (900 MHz band)	126	290
226K - 256K	126	315

5. RECEIVER PERFORMANCE

It is not practicable to make any remote measurements of receiver performance. Therefore, the responsibility for ensuring that the receiver meets the requirements of the service, and can tolerate the high RF levels imposed upon it by the operating environment, lies with the licensee. An STL receiver must be able to operate without unacceptable blocking or intermodulation effects in a high RF field environment (from adjacent FM and TV broadcast transmitters), and reject signals on adjacent channels adequately while providing a low noise, low distortion output. If the receiver cannot meet these criteria, external filtering shall be added to enable it to do so. Local oscillator and spurious radiation shall be minimised, and shall not exceed -47 dBm eirp.

APPENDIX A

Method for Establishing 0 dB Reference Level

CCIR Report 275-5 para. 7 details a method for establishing a 0 dB reference:

For emissions of F3E and G3E, the Peak Envelope Power, the Unmodulated Carrier Power and the Mean Power are equal. Modulation varies the distribution of power within the frequency spectrum while leaving the total power unchanged. Therefore, by selecting a resolution bandwidth for the spectrum analyser which is adequate to include all significant components of an FM signal, there is no variation with modulation in the amplitude of the total voltage seen by the detector, and the reference 0 dB level can be established. A resolution bandwidth equal to twice the channel spacing is suggested, with a span equal to about five times the channel bandwidth. It must be noted that strong adjacent channel signals would preclude using this method. The presence of intermodulation products and other low-level signals will affect the accuracy of the reference established.

The resolution bandwidth is then reduced to 3 kHz, and the sweep width set to 650 kHz or 1.3 MHz for 110 kHz and 256 kHz emissions respectively. The -6 dB and -26 dB bandwidths can then be determined.

APPENDIX B

Method for Improving Frequency Measurement Accuracy of Spectrum Analyser

The measurement accuracy can be improved significantly if the spectrum analyser has a frequency count facility. To use the spectrum analyser frequency counter, the transmitter must be unmodulated. If the modulation cannot be removed, an unmodulated signal generator can be connected in place of the transmitted signal, and the frequency measured with the spectrum analyser frequency counter. The signal generator can then be used to calibrate the spectrum analyser frequency marker or the displayed centre frequency at the required frequency. With STLs, it is possible that the carrier frequency can be adequately identified and a marker placed on the centre frequency during minor breaks in the programme material.

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