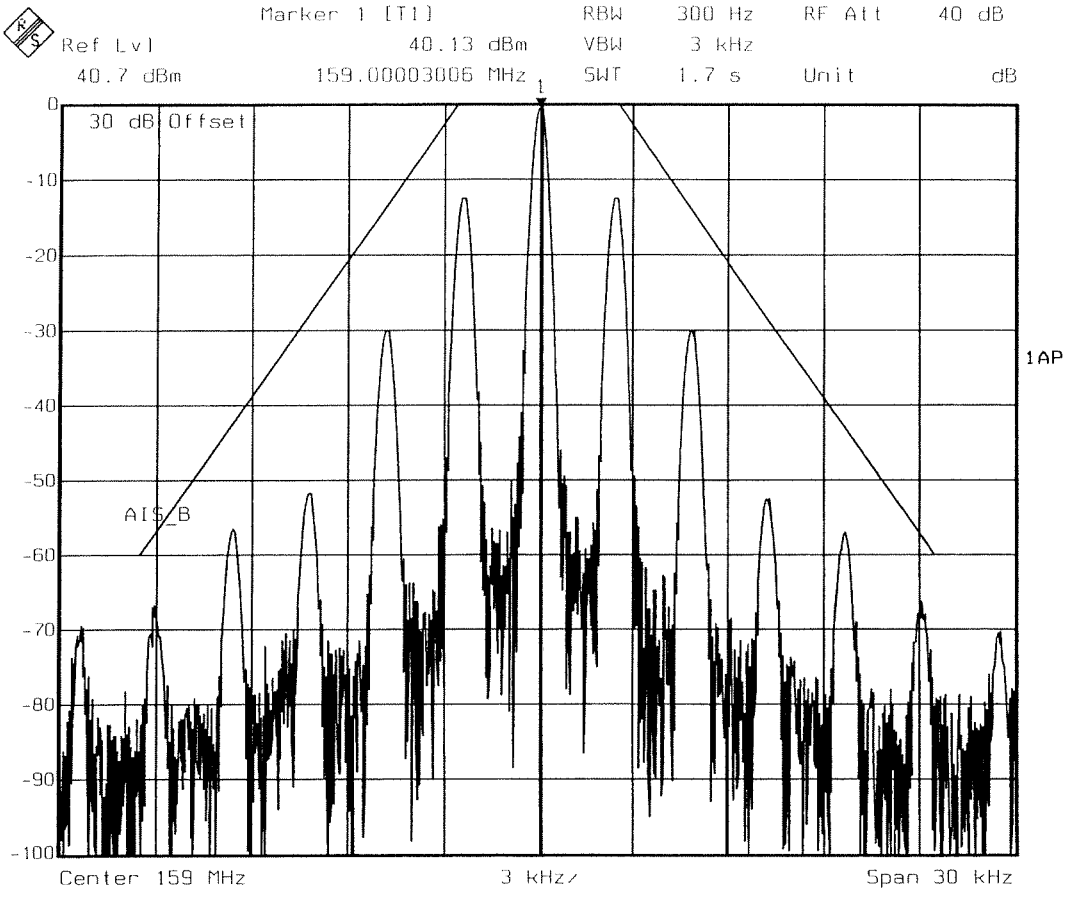
Modulation Spectrum 12.5 kHz channel mode

TX freq.: 159.000 MHz Carrier power: H. P.

Spectrum obtained during continuous transmission; modulation: 110011 – sequence



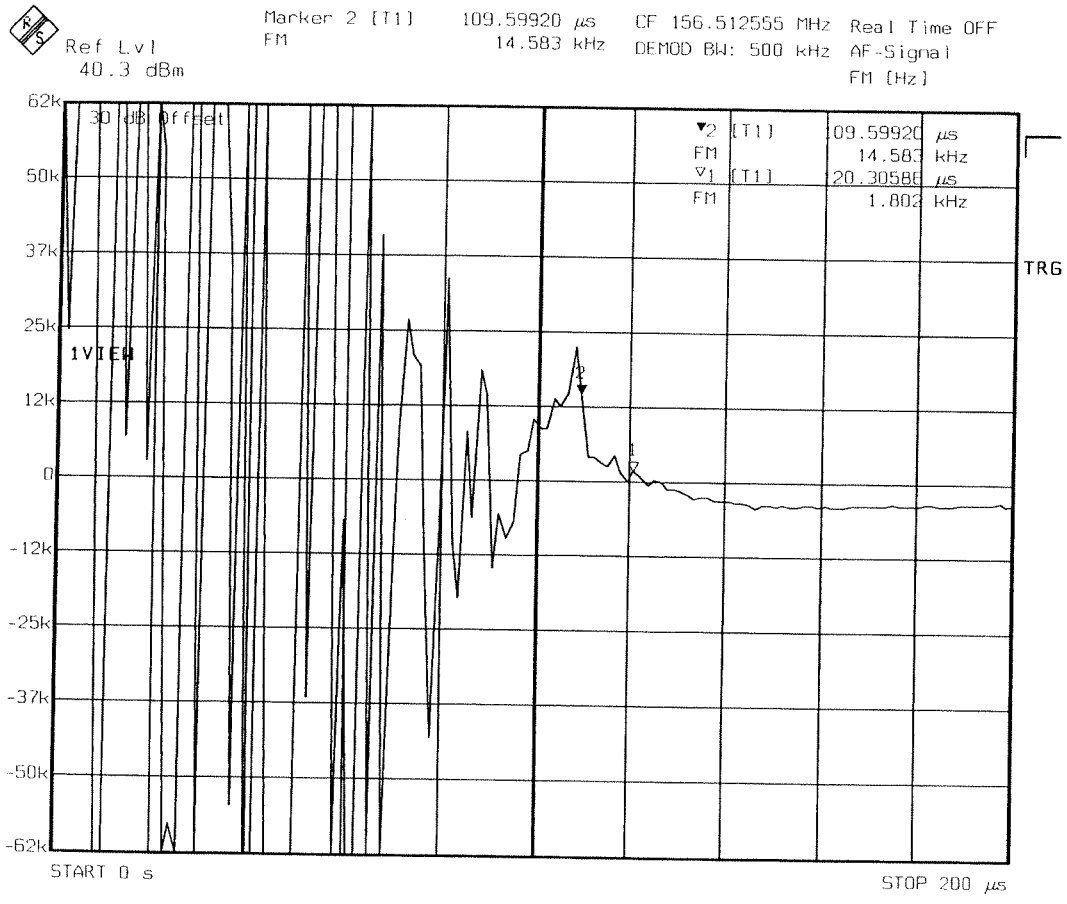
Limit: within the mask specified in figure 5, Clause 15.1.4, IEC 61993-2.
(Emission mask):
At ± 12.5 kHz removed from the carrier, the modulation sidebands is below -60 dBc.
In the region between ± 2.5 kHz and ± 12.5 kHz removed from the carrier, the modulation sidebands is below a line starting at 0 dBc / ± 2.5 kHz and ending at -60 dBc / ± 12.5 kHz without any need to be below 0.25 µW.

Test equipment used: (Item numbers)	10, 25

2.4.5 15.1.5 Transmitter Attack Time

TX freq.: 156.5125 MHz
Carrier power: H. P.

PLOT OF FREQUENCY BEHAVIOUR



Test equipment used: (Item numbers)	10, 25

TX freq.: 156.5125 MHz
Carrier power: H. P.

PLOT OF RF POWER BEHAVIOUR

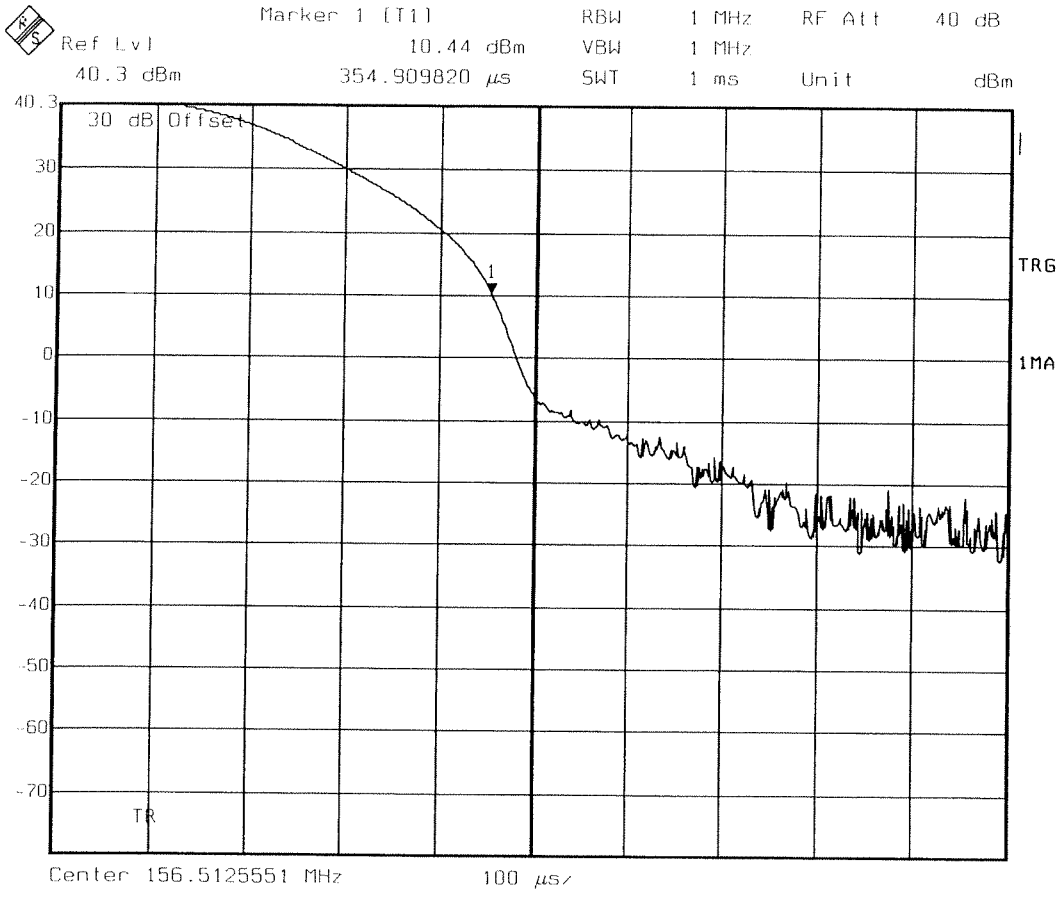
Measurement Uncertainty: ± 0.02 ms
Limit:
- Transmitter attack time T_0: within 1 ms,
- Transient power level: within ±1.5 dB of its final value at any time,
- Carrier frequency Fc: within ± 1 kHz of its required value after 1 ms.

Test equipment used: (Item numbers)	10, 25

2.4.6 15.1.6 Transmitter Release Time

TX freq.: 156.5125 MHz
Carrier power: H. P.

PLOT OF RF POWER BEHAVIOUR



Measurement Uncertainty: ± 0.02 ms
Limit:
Transmitter release time T_r: within 1 ms,

Test equipment used: (Item numbers)	10, 25

2.5 15.2 DSC Transmissions

2.5.1 15.2.1 Frequency error of the DSC Signal

CHANNEL 70 Fn = 156.525 MHz

TEST CONDITIONS		FREQUENCY ERROR (Hz)	
Temperature	Voltage	B-STATE (2100 Hz)	Y-STATE (1300Hz)
Tnom (+20 °C)	*Vnom (24.0 V)*	+ 0.1	+ 0.1
Tmin (-15 °C)	*Vmin (21.6 V)*	+ 0.1	+ 0.1
Tmax (+55 °C)	*Vmax (31.2 V)*	+ 0.1	+ 0.1
Measurement uncertainty		± 0.1 Hz	
Limits		≤ ±1%	

Test equipment used: (Item numbers)	11, 12, 13, 14, 21, 22, 25, 31, 32, 33, 34, 35

2.5.2 15.2.2 Modulation Rate

CHANNEL 70 Fn = 156.525 MHz

TEST CONDITIONS		Modulation Rate Error (ppm)
Temperature	Voltage	
Tnom (+20 °C)	*Vnom (24.0 V)*	- 4.2
Limit		1200 bit/s ± 30 ppm

Test equipment used: (Item numbers)	11, 12, 13, 14, 21, 23, 25, 31, 33, 34, 35

2.6 15.3 TDMA Receivers

2.6.1 15.3.1 Sensitivity - 25 kHz Operation

TEST CONDITIONS		SENSITIVITY LEVEL	
		Fn: 156.025 MHz	Fn: 162.025 MHz
Temperature	Voltage	RF level (dBm)	RF level (dBm)
Tnom (+20 °C)	*Vnom (24.0 V)*	- 109 dBm at 6% PER	- 109 dBm at 7% PER
Tmin (-15 °C)	*Vmin (21.6 V)*	- 108 dBm at 7% PER	- 108 dBm at 7% PER
Tmax (+55 °C)	*Vmax (31.2 V)*	- 107 dBm at 16% PER	- 107 dBm at 17% PER
Measurement uncertainty		± 1.2 dB	
Limits		≤ - 107 dBm with a PER of 20% under normal test conditions, ≤ - 101 dBm with a PER of 20% under extreme test conditions,	

Test equipment used: (Item numbers)	4, 5, 9, 13, 14, 21, 22, 25, 31, 32

2.6.2 15.3.2 Sensitivity - 12.5 kHz Operation

TEST CONDITIONS		SENSITIVITY LEVEL	
		Fn: 157.4125 MHz	Fn: 160.6375 MHz
Temperature	Voltage	RF level (dBm)	RF level (dBm)
Tnom *(+20 °C)*	*Vnom* *(24.0 V)*	- 102 dBm at 9% PER	- 102 dBm at 7% PER
Tmin *(-15 °C)*	*Vmin* *(21.6 V)*	- 101 dBm at 18% PER	- 101 dBm at 18% PER
Tmax *(+55 °C)*	*Vmax* *(31.2 V)*	- 100 dBm at 3% PER	- 100 dBm at 19% PER
Measurement uncertainty		± 1.2 dB	
Limits		≤ - 98 dBm with a PER of 20% under normal test conditions, ≤ - 92 dBm with a PER of 20% under extreme test conditions,	

Test equipment used: (Item numbers)	4, 5, 9, 13, 14, 21, 22, 25, 31, 32

2.6.3 15.3.3 Error Behaviour at High Input Levels

TEST CONDITIONS		Packet Error Rate (%)	
		Fn = 156.025 MHz (CH 60)	
Standard Test Signal		as described in clause 15.3.1	
Input signal (dBm)		-77	-7
Temperature	Voltage		
Tnom (+20 °C)	*Vnom (24.0 V)*	0	0
Measurement uncertainty		0.1 %	
Limits		Difference < 1%	

Test equipment used: (Item numbers)	4, 5, 9, 13, 14, 21, 22, 25, 31, 32

2.6.4 15.3.4 Co-channel Rejection - 25 kHz Operation

TEST CONDITIONS		CO-CHANNEL REJECTION RATIO (dB)	
Temperature	Voltage	Fn = 156.025 MHz	
Tnom (+20 °C)	*Vnom (24.0 V)*	Fn +3 kHz	- 9 dB at 18% PER
		Fn	- 9 dB at 11% PER
		Fn –3 kHz	- 9 dB at 18% PER
Measurement uncertainty		± 1.1 dB	
Limits		Between -10.0 dB and 0 dB. Any positive value is also acceptable.	

Remark: Unwanted signal modulated with 400Hz / 3kHz deviation

TEST CONDITIONS		CO-CHANNEL REJECTION RATIO (dB)	
Temperature	Voltage	Fn = 156.025 MHz	
Tnom (+20 °C)	*Vnom (24.0 V)*	Fn +3 kHz	- 9 dB at 16% PER
		Fn	- 9 dB at 7% PER
		Fn –3 kHz	- 9 dB at 15% PER
Measurement uncertainty		± 1.1 dB	
Limits		Between –10.0 dB and 0 dB. Any positive value is also acceptable.	

Remark: Unwanted signal modulated with GMSK test signal #2, 2.4 kHz deviation, BT 0.4

Test equipment used: (Item numbers)	2, 4, 5, 8, 9, 13, 14, 21, 25, 31, 37

2.6.5 15.3.5 Co-channel Rejection - 12.5 kHz Operation

TEST CONDITIONS		CO-CHANNEL REJECTION RATIO (dB)	
Temperature	Voltage	Fn = 157.4125 MHz	
Tnom (+20 °C)	*Vnom (24.0 V)*	Fn +1.5 kHz	- 15 dB at 15% PER
		Fn	- 14 dB at 12% PER
		Fn –1.5 kHz	- 16 dB at 12% PER
Measurement uncertainty		± 1.1 dB	
Limits		Between -18.0 dB and 0 dB. Any positive value is also acceptable.	

Remark: Unwanted signal modulated with 400Hz / 1.5 kHz deviation

TEST CONDITIONS		CO-CHANNEL REJECTION RATIO (dB)	
Temperature	Voltage	Fn = 157.4125 MHz	
Tnom (+20 °C)	*Vnom (24.0 V)*	Fn +1.5 kHz	- 14 dB at 13% PER
		Fn	- 14 dB at 12% PER
		Fn –1.5 kHz	- 16 dB at 16% PER
Measurement uncertainty		± 1.1 dB	
Limits		Between -18.0 dB and 0 dB. Any positive value is also acceptable.	

Remark: Unwanted signal modulated with GFSK, test signal #2, 1.2 kHz deviation, BT 0.3

Test equipment used: (Item numbers)	2, 4, 5, 8, 9, 13, 14, 21, 25, 31, 37

2.6.6 15.3.6 Adjacent Channel selectivity - 25 kHz Operation

TEST CONDITIONS		ADJACENT CHANNEL SELECTIVITY (dB)	
		Fn: 156.025 (MHz)	
Temp.	Voltage	Unwanted signal – 25 kHz	Unwanted signal + 25 kHz
Tnom (+20 °C)	*Vnom (24.0V)*	72 dB at 8% PER	72 dB at 5% PER
Tmin (-15 °C)	*Vmin (21.6 V)*	68 dB at 14% PER	74 dB at 12% PER
Tmax (+55 °C)	*Vmax (31.2 V)*	73 dB at 12% PER	73 dB at 19% PER
Measurement uncertainty		+ 2.3 / - 2.8 dB	
Limits		> 70.0 dB @ ≤20% PER under normal test conditions, > 60.0 dB @ ≤20% PER under extreme test conditions.	

Test equipment used: (Item numbers)	2, 4, 5, 8, 9, 13, 14, 21, 22, 25, 31, 32, 37

2.6.7 15.3.7 Adjacent Channel selectivity - 12.5 kHz Operation

TEST CONDITIONS		ADJACENT CHANNEL SELECTIVITY (dB)	
		Fn = 157.4125 MHz	
Temp.	Voltage	Unwanted signal – 12.5 kHz	Unwanted signal + 12.5 kHz
Tnom (+20 °C)	*Vnom (24.0V)*	58 dB at 5% PER	57 dB at 6% PER
Tmin (-15 °C)	*Vmin (21.6 V)*	57 dB at 15% PER	57 dB at 13% PER
Tmax (+55 °C)	*Vmax (31.2 V)*	58 dB at 16% PER	59 dB at 6% PER
Measurement uncertainty		+ 2.3 / - 2.8 dB	
Limits		> 50.0 dB @ ≤20% PER under normal test conditions, > 50.0 dB @ ≤20% PER under extreme test conditions.	

Test equipment used: (Item numbers)	2, 4, 5, 8, 9, 13, 14, 21, 22, 25, 31, 32, 37

2.6.8 15.3.8 Spurious Response Rejection

Tested frequencies : 156.025 MHz: 162.025 MHz; RX1 and RX2

Funw (MHz)	SPURIOUS RESPONSE REJECTION RATIO (dB)
*	> 80 dB
--	--
Measuring uncertainty	+ 2.4 / - 2.9 dB
Limit	70.0 dB

Funw = unwanted frequency

* : Rejection on all spurious responses is better than 80 dB @ ≤ 20 % PER for RX1 and RX2.

(1) Frequency of the Receiver (f_R): 156.025 MHz; 162.025 MHz
(2) Local oscillator frequency (f_{LO}): RX1: (f_R) + (f_{IF}) MHz; RX2: (f_R) - (f_{IF}) MHz
(3) Intermediate frequency (f_{IF}): RX1: 45.0 MHz; RX2: 45.1 MHz
(4) Switching range of the Receiver (sr): 156.025 to 162.025 MHz

Test equipment used: (Item numbers)	2, 4, 13, 14, 21, 25, 31, 37

2.6.9 15.3.9 Intermodulation response rejection and blocking

TEST CONDITIONS		PACKET ERROR RATE (%)	
		Fn = 156.025 MHz	Fn = 162.025 MHz
Temperature	Voltage	Test #1	Test #2
Tnom (+20 °C)	*Vnom (24.0 V)*	9	9
Measurement uncertainty		+ 2.4 / - 2.8 dB	
Limits		≤20% PER	

Remark: test configuration for above result

	Generator A wanted –101 dBm	Generator B unwanted –27 dBm Mod. 400Hz / 3 kHz	Generator C unwanted –27 dBm unmodulated	Generator D unwanted –15 dBm unmodulated
Test #1	156.025MHz (Fn)	Fn + 1000 kHz	Fn + 500 kHz	Fn + 5.725

Remark: test configuration for above result

	Generator A wanted –101 dBm	Generator B unwanted –26 dBm Mod. 400Hz / 3 kHz	Generator C unwanted –26 dBm unmodulated	Generator D unwanted –15 dBm unmodulated
Test #2	162.025MHz (Fn)	Fn - 1000 kHz	Fn - 500 kHz	Fn - 5.725

Test equipment used: (Item numbers)	2, 3, 4, 5, 6, 7, 8, 9, 13, 14, 21, 25, 31, 37, 38

2.6.10 15.3.10 Transmit to receive switching time

TEST CONDITIONS		Sensitivity level (dBm)
Temperature	Voltage	Fn = 156.025 MHz
Tnom (+20 °C)	*Vnom (24.0 V)*	- 107 dBm @ 3 % PER
Measurement uncertainty		±1.2 dB
Limits		≤ -107 dBm @ 20% PER

Test equipment used: (Item numbers)	10

2.7 15.4 DSC Receiver

2.7.1 15.4.1 Maximum sensitivity

TEST CONDITIONS		SENSITIVITY LEVEL (dBm)		
		Fn: 156.525 MHz (CH 70)		
Temperature	Voltage	Fn	Fn - 1.5 kHz	Fn + 1.5 kHz
Tnom (+20 °C)	*Vnom (24.0 V)*	-111 dBm at < 0.5% BER	-111 dBm at < 0.5% BER	-111 dBm at < 0.5% BER
Tmin (-15 °C)	*Vmin (21.6 V)*	-111 dBm at < 0.5% BER	-110 dBm at < 0 5% BER	-111 dBm at < 0.5% BER
Tmax (+55 °C)	*Vmax (31.2 V)*	-109 dBm at < 0.5% BER	-109 dBm at < 0.5% BER	-109 dBm at < 0.5% BER
Measurement uncertainty		±1.2 dB		
Limits		≤ - 107 dBm with a BER of 1% under normal test conditions, ≤ - 101 dBm with a BER of 1% under extreme test conditions,		

Test equipment used: (Item numbers)	4, 13, 14, 21, 22, 25, 31, 32

2.7.2 15.4.2 Error Behaviour at High Input Levels

CHANNEL 70: Fn: 156.525 MHz

TEST CONDITIONS		BIT ERROR RATE (%)
Temperature	Voltage	RF input -7 dBm / Standard Test Signal #1
Tnom (+20 °C)	*Vnom (24.0 V)*	< 0.1
Measurement uncertainty		0.1 %
Limits		BER <1%

Test equipment used: (Item numbers)	4, 13, 14, 21, 25, 31

2.7.3 15.4.3 Co-Channel Rejection

CHANNEL 70: Fn: 156.525 MHz

TEST CONDITIONS		CO-CHANNEL REJECTION RATIO (dB)	
		Standard Test Signal #1/ -104 dBm	
		Unwanted signal (Fn: 156.525 MHz)	
Temperature	Voltage	Unwanted signal	
Tnom (+20 °C)	*Vnom (24.0 V)*	Fn + 3 kHz	- 6 dB at < 0.5 % BER
		Fn	- 6 dB at < 0.5 % BER
		Fn - 3 kHz	- 6 dB at < 0.5 % BER
Measurement uncertainty		±1.1 dB	
Limits		Between -10.0 dB and 0 dB @ BER < 1%	

Test equipment used: (Item numbers)	2, 4, 13, 14, 21, 25, 31, 37

2.7.4 15.4.4 Adjacent Channel selectivity

CHANNEL 70: Fn: 156.525 MHz

TEST CONDITIONS		ADJACENT CHANNEL SELECTIVITY (dB)	
Temp.	Voltage	Upper Channel	Lower Channel
Tnom *(+20 °C)*	Vnom *(24.0V)*	72 dB at < 0.5 % BER	72 dB at < 0.5 % BER
Tmin *(-15 °C)*	Vmin *(21.6 V)*	73 dB at < 0.5 % BER	74 dB at < 0.5 % BER
Tmax *(+55 °C)*	Vmax *(31.2 V)*	69 dB at < 0.5 % BER	69 dB at < 0.5 % BER
Measurement uncertainty		+ 2.3 / - 2.8 dB	
Limits		≥ 70.0 dB @ BER <1% under normal test conditions, ≥ 60.0 dB @ BER <1% under extreme test conditions.	

Test equipment used: (Item numbers)	2, 4, 13, 14, 21, 25, 31, 37